REPORT ON
PRELIMINARY HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
MACVILLE COMMUNITY
IN CONNECTION WITH LOPA APPLICATION TO
ESTABLISH THE MACVILLE COMMUNITY
SECONDARY PLAN AREA
BOLTON, ONTARIO

PREPARED FOR:
Bolton Option 3 Landowners Group

Project No: 20-169-100
Date: February 3, 2021

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20-169-100 **Feb 3rd, 2021**

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RE: Hydrogeological Investigation – Macville Community, Caledon (Bolton), ON

DS Consultants Limited (DS) was retained by Option 3 Landowners Group to complete a hydrogeological investigation in support of a proposed Secondary Plan for the Macville Community in Bolton, Ontario (Site). The Site includes approximate 182.1 hectares of land bounded by King Street to the south, The Gore Road to the west and Humber Station Road and the CP Rail to the east. The area is primarily agricultural with some single detached residential lots. The Secondary Plan involves development of these lands for residential and mixed-use land uses, open spaces, parks, trails, commercial uses, the Bolton GO Station, Environmental Policy Area (EPA) and areas designated for stormwater management (SWM Ponds). The development will also include the construction of roadways including storm and sanitary sewer and water distribution infrastructure.

This Hydrogeological Investigation is undertaken in support of the Local Official Plan Amendment (LOPA) application to establish the Macville Community Secondary Plan Area. It includes an overview of the existing geological and hydrogeological conditions at the Site and surrounding area and provides an assessment of hydrogeological constraints and potential impacts of the proposed development on local groundwater resources. A significant aim of the study is to provide mitigation measures to reduce or eliminate the impacts of development on local water resources, groundwater users, and the natural environment. It also includes an estimation of construction dewatering requirements and groundwater permanent drainage conditions.

If needed, the results of this investigation can be used in support of an application for a Category 3 Permit to Take Water (PTTW) or an Environmental Activity Sector Registry (EASR) for construction dewatering from the Ministry of the Environment, Conservation and Parks (MECP) and discharge permitting from the Town of Caledon.

Based on the results of our investigation, the following conclusions and recommendations are presented:

1. The Site is located within the Main Humber subwatershed part of the larger Humber River watershed. The surface water and drainage setting at the Site comprises a total of eight (8) wetlands, which are incorporated into the tributaries of the Humber River and ultimately flow into Lake Ontario. Relief across the Site ranges from approximately 281 masl in the northwest corner of the Site to 262.0 masl in the southwest corner of the Site. The study area is characterized as having moderate drainage, which is directed overland into various streams on the Site.

2. The Site is situated within the South Slope Physiographic Region of Southern Ontario (Chapman and Putnam, 1984), and lies within a Drumlinized Till Plain Physiographic Landform. Surficial geology mapping made available by the Ontario Geological Survey (2010) indicates that the study area is covered entirely by Halton till. There are some glacial deposits of sand and gravel to the west of the site and modern alluvial deposits of silt, sand, and gravel to the east along tributaries to the Humber River. The overburden in the vicinity of the site is clayey silt to sandy silt till deposits (Halton till).

3. Based on the MECP water well records search, there are seventy-three (73) water wells within 500 meters of the Site. Forty-seven (47) water wells are noted as domestic supply wells and six (6) wells are noted as commercial or industrial supply wells. Eight (8) wells are noted as test holes or monitoring wells. The remaining twenty-three (23) wells are either abandoned or unknown use. Private domestic and commercial water supply wells are drilled into sandy aquifers confined under clay till. The depths of these wells range from 5.5 m to 65.2 mbgs. It is recommended that a private door-to-door water well survey be completed within a 500 m radius of the Site to confirm private use of groundwater in the study area.

4. To assess groundwater conditions at the Site, DS carried out a drilling program in July 2020 to advance a total of sixteen (16) exploratory boreholes and installing monitoring wells (MW) in thirteen (13) strategic locations across the study area as shown in **Figure 4**. MWs were constructed with two (2) inch PVC casing and a 1.5 m length of screen installed at varying depths ranging from 3.0 to 9.1 meters below ground surface (mbgs).

5. Based on the subsurface investigation, the stratigraphic setting of the Site comprises of topsoil/fill /disturbed native materials underlain by native soil deposits. The native soil deposits at the Site includes clayey silt till to silty clay till (Halton till) to depths ranging from 1.5 m to 11.3 mbgs, which in turn is underlain by silt/sandy silt/silty sand (Newmarket till) extending to the maximum depth of investigation. Modern alluvium deposits consisting of sand and gravel were encountered in the southeast corner of the Site in Borehole/Monitoring Well BH20-16. Bedrock was encountered during the subsurface investigation.

6. **DS** implemented a manual groundwater monitoring program at the site in May 2018 on a monthly basis to assess long-term groundwater fluctuations for a one (1) year. Groundwater was found in monitoring wells at depths ranging from 254.11 to 274.76 mbgs. The The groundwater flow direction within the Site area is inferred to be in a southeasterly direction with some flow in the southwestern quadrant of the Site to be directed in a southwesterly direction. Continuous groundwater monitoring at the Site indicated that the groundwater levels at the Site had a gradual decline during the August to October ongoing monitoring period.

7. Single Well Response Tests (SWRTs) were completed by **DS** in all monitoring wells on August 6th and 7th, 2020 to estimate hydraulic conductivity (K) for the representative geological units in which the wells were completed. The hydraulic conductivity values ranged from 7.4x 10^{-9} m/sec to 3.2 x 10^{-6} m/sec for clayey silt till and sandy silt till / silt unit.

8. Non-filtered groundwater samples were collected from Monitoring Well BH20-4 on Oct September 4, 2020 to assess the groundwater quality. Groundwater quality results were compared to parameters listed in the Provincial Water Quality Objectives (PWQO) for surface water to assess the suitability of discharge to nearby surface water features as part of the hydrogeological investigation. Based on the results of the analytical testing, the sample quality met the permissible limit of all analyzed parameters, however exceeded for Total Cobalt against the PWQO standards. Pre-treatment of the pumped water will be required prior to discharging into a natural surface water feature.

9. Non-filtered surface water samples were collected from surface stations SG W2-1 and SG W8-1 to compare the baseline water quality against the PWQO. Based on the results of the analytical testing, the water quality exceeded the PWQO criteria for various metal parameters.

10. **DS** commenced continuous pre-construction monitoring at the Site including the onsite wetlands to determine the interaction between surface and groundwater. The monitoring program is currently ongoing and will commence for a period of 1-year. Based on the preliminary results of the monitoring during the August to October period in 2020, all wetlands at the Site appear to be ephemeral features. The monitoring program to-date indicated upward shallow groundwater gradient in two (2) surface water monitoring stations, including for Wetland 3 (SG-W3, W3-PZS and W3-PZD) and Wetland 8 (SG-W8, W8-PZS and W8-PZD). Based on the preliminary data collected during the current monitoring period, there is a potential for the baseflow of Wetland 8 to be maintained by groundwater following precipitation events and/or during the wet season; however further monitoring will be required to confirm the surface and groundwater dynamic at the location of Wetland 8 and the remainder of the Site.

11. In-situ infiltration testing was conducted by **DS** field personnel on September 2nd, 2020. The testing was completed at a depth of 0.5m and 1.5 m bgs at ten monitoring well locations (BH20-1, BH20-2 and BH20-5 through BH20-16). Based on the test results, the site primarily consists of a low permeable silty clay till with a measured infiltration rate ranging from about 16 to 38 mm/hr with an average of 26 mm/hr. One test location at (BH20-16 - southeast corner of the Site) with sand and gravel deposits, produced an infiltration rate of 108 mm/hr. Soils with infiltration rates over 15 mm/hr are considered suitable for Soakaways, infiltration trenches and chambers (TRCA, 2010). Continued water level monitoring at all locations is recommended to ensure a minimum of 1 m clearance between the top of the seasonally high water table and the bottom of any infiltration measure.

12. The Site-specific water balance indicates a reduction in the annual infiltration rates at the Site following the proposed plans for development due to an increase in the impervious area. Designing of Low Impact Development (LID) measures to mitigate this post-development infiltration deficit will be required to ensure that pre-development infiltration rates are maintained.

13. Changes to wetland catchment size directly effects the volume and timing of stormwater contributions to downgradient features. A Wetland Water Balance Risk Evaluation following TRCA guidelines (TRCA, Nov 2017) showed there is high risk to wetlands W1 to W6 as a result of reduced catchment size. In order to understand the effects of the reduced catchment area and evaluate the

magnitude of actual hydrological changes, a wetland water balance is currently being completed by Urbantech using a continuous model. The results of the ongoing pre-construction wetland monitoring program undertaken by **DS** will be used in conjunction with the continuous model to assess the actual risks to the wetlands. Based on the findings of the water balance results, a wetland mitigation plan will be developed.

14. It is understood that the provided site grading plan and the design of the two (2) storm water management plans are currently preliminary and the proposed site servicing plan and the architectural drawings with the final basement floor slab elevations of all structures to be constructed below grade have not been finalized at this stage. **DS** made numerous assumptions, as outlined in Section 6.0 of this report, in support of the groundwater seepage assessment during the construction period. The requirements for dewatering/control during the construction period is as follows:

    14.0 Low-Rise Residential Block – 62,000 L/day (incl. 50% safety factor on anticipated seepage rates and contribution from a 2-year storm) **per unit block**;

    14.1 Mid-Rise Residential Block – 102,500 L/day (incl. 50% safety factor on anticipated seepage rates and contribution from a 2-year storm) **per unit block;**

    14.2 Site Servicing (Developmental Site area / Newmarket Till) – 15,500 L/day (incl. 50% safety factor on anticipated seepage rate and contribution from a 2-year storm) **per unit trench segment**;

    14.3 Storm Water Management Pond 1 – 205,000 L/day (incl. 50% safety factor on anticipated rate; does not include contribution from a 2-year storm);

    14.4 Storm Water Management Pond 2 (Anticipated Case/Halton Till) – 230,500 L/day (incl. 50% safety factor on anticipated rate; does not include contribution from a 2-year storm); and

15. It is expected that permanent drainage control will be required for the proposed mid-rise residential blocks should detailed designs corroborate assumptions made during this assessment. The total permanent drainage rates for one (1) block of a mid-rise residential is estimated to be on the order of 55,000 L/day. Control of permanent private water drainage in the low-rise residential blocks, institutional and commercial zones is not anticipated.

16. During the construction period, the requirements to obtain any water taking permits (EASR/PTTW) will depend on the ownership structure of the Site and the staging for development. During the post-construction period, PTTW registration with the MECP will be required for the permanent drainage anticipated for proposed mid-rise residential blocks.

17. A discharge permit may be required from the Toronto and Region Conservation Authority (TRCA), Region of Peel and/or Town of Caledon if the water is to be discharged to a nearby/on-site surface water body as a result of construction dewatering. A discharge and monitoring plan will need to be prepared prior to obtaining a discharge approval from the TRCA, Peel Region and/or Town of Caledon.

Based on the results of the groundwater analytical testing, the quality of the groundwater exceeded the PWQO for Total Cobalt. Pre-treatment of the pumped water will be required to ensure compliance with the PWQO criteria prior to discharging into a natural surface water feature.

18. During the post-construction period, a sewer discharge agreement with the local upper and/or lower tier municipality may be required prior to any discharging operations into the municipal sewer system.

19. Dewatering activities adjacent to the on-site wetland features has the potential to lower the groundwater and/or surface water levels in the wetlands. Once a groundwater dewatering system is set up at the Site, daily and weekly monitoring should be implemented to assess the groundwater conditions such as water levels, measurement of discharge flow, discharge water quality and any adverse impacts as a result of dewatering, if any. At this stage, pre-construction monitoring for a period of 1-year has not been completed and baseline conditions in the wetlands have yet to be established. On the onset of completing the pre-construction monitoring, DS will prepare a monitoring, mitigation and contingency plan, which will outline a pre-defined "*review*" and "*response*" levels for all surface water stations in the wetlands to ensure a mitigation plan is in place should impacts to the wetland features be noted.

20. In conformance with Regulation 903 of the Ontario Water Resources Act, the decommissioning of any dewatering system and monitoring wells should be carried out by a licensed contractor under the supervision of a licensed water well technician.

Should you have any questions regarding these findings, please do not hesitate to contact the undersigned.

DS Consultants Ltd.

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1.0 INTRODUCTION

DS Consultants Limited (DS) was retained by Option 3 Landowners Group to complete a Hydrogeological Investigation in support of a proposed Secondary Plan for the Macville Community in Bolton, Ontario (Plan). The investigation was completed as part of the Comprehensive Environmental Impact Study and Management Plan (CEISMP) in collaboration with Beacon Environmental Limited (Beacon) and Urbantech Consulting (Urbantech).

The Macville Community Secondary Plan includes the development of approximate 182.1 hectares of land bounded by King Street to the south, The Gore Road to the west and Humber Station Road and the CP Rail to the east (Site). The Site location is shown in **Figure 1**. The area is primarily agricultural with some single detached residential lots. The proposed development of these lands includes residential and mixed-use land uses, open spaces, parks, trails, commercial uses, the Bolton GO Station, natural heritage features and areas designated for stormwater management (SWM Ponds). The development will also include the construction of roadways including storm and sanitary sewer and water distribution infrastructure.

This hydrogeological investigation includes characterization of existing geological, hydrogeological and hydrologic conditions of the Site and local features including 8 wetland units. The investigation provides an assessment of opportunities and constraints including potential impacts on local groundwater resources. A significant aim of the study is to provide mitigation measures to reduce or eliminate the impacts of development on local water resources, groundwater users, and the natural environment. The study also provides an estimation of construction dewatering requirements and groundwater permanent drainage conditions.

1.1 Purpose

The purpose of this investigation is to characterize groundwater conditions over the study area and provide construction dewatering estimates and recommendations for design and mitigation measures to reduce or eliminate impacts of development on local water resources. The investigation will inform a water balance study to help define potential risks to the wetlands features within the Site. This investigation also includes an asassessment of dewatering requirements and provides recommendations for the obtaining the necessary permits prior to construction such as a Permit to Take Water (PTTW) or registry on the Environmental Activity Sector Registry (EASR) from the Ministry of Environment and Conservation and Parks (MECP).

1.2 Scope of Work

The scope of work for this investigation includes:

(i) Drilling and installation of monitoring wells, piezometers, and stream flow monitoring instrumentation;
(ii) Collecting and interpreting available reports and data including the MECP Water Well Records (WWR), geotechnical, hydrogeological and environmental studies completed at the Site;
(iii) In-situ hydraulic conductivity testing
(iv) Stream water level and flow monitoring including seasonal fluctuation;

(v) Water quality assessment for surface water and groundwater;
(vi) Site water balance assessment;
(vii) Data analyses and report preparation, and;
(viii) Review and response to agency comments.

2.0 PREVIOUS STUDIES

DS reviewed the following previous studies during our background review:

- *"Headwater Drainage Feature Assessment: In Support of the Bolton Residential Expansion Study"*, by Aquafor Beech Ltd., dated June 16. 2013, File No.: 65473
- *"Preliminary Geotechnical Investigation, Proposed Residential Subdivision, Bolton Option 3 Lands, Bolton, Ontario"*, by DS Consultants Ltd., dated September 4, 2020, File No.: 20-169-100

A brief summary of the findings from each investigation/report is provided in the following sections.

2.1 Headwater Drainage Feature Assessment: In Support of the Bolton Residential Expansion Study (Aquafor Beech Ltd., 2014)

Aquafor Beech Limited (Aquafor) completed a *Headwater Drainage Feature Assessment* (2014) in support of the BRES Study being carried out by the Town of Caledon. The objectives of the investigation included delineation of Headwater Drainage Features (HDF) within the Option 3 Lands (Site). The study identified and classified a total of four (4) HDFs as summarized below:

- Headwater Drainage Feature-1 (HDF-1) is located in the eastern portion of the Site and consists of fifteen (15) stream reaches (1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1l, 1m, 1n and 1-o);
- Headwater Drainage Feature-2 (HDF-2) is located along the eastern boundary of the Site and consists of two (2) stream reaches (2a and 2b);
- Headwater Drainage Feature-3 (HDF-3) is located in the western portion of the Site and consists of seven (7) stream reaches (3a, 3b, 3c, 3d, 3e, 3f and 3g) ; and,
- Headwater Drainage Feature-4 (HDF-4) is located along the western property boundary of the Site and consists of three (3) stream reaches (4a, 4b and 4c). Stream reach 4b is noted to be an existing pond.

The Headwater Drainage Map by Aquafor (2014) is provided in **Appendix A**.

2.2 Preliminary Geotechnical Investigation, Proposed Residential Subdivision, Bolton Option 3 Lands, Bolton, Ontario (DS Consultants Limited, 2020)

A Preliminary Geotechnical Investigation was completed by DS Consultants Ltd., for the Site. The investigation involved advancing a total of sixteen (16) boreholes to depths ranging from 6.7 m to 11.3 m bgs. Groundwater monitoring wells were installed in thirteen (13) borehole locations (BH20-1, BH20-2,

BH20-3, BH20-4, BH20-5, BH20-6, BH20-7, BH20-9, BH20-11, BH20-12, BH20-14, BH20-15 and BH20-16) to permit monitoring of groundwater levels at the Site.

Based on the subsurface investigation completed at the Site, the Site was underlain by a surficial layer of topsoil, fill and/or disturbed native materials to depths of 0.8 m bgs, which in turn was underlain by native soils extending to the full depth of investigation. The native soils at the Site comprised of clayey silt/silty clay till material underlain by a lower cohesionless silt to sandy silt and silty sand deposits. Bedrock was not encountered to the full depth of investigation.

The clayey silt till was encountered under the fill layer in all borehole locations except BH20-4 and extended to depths ranging from 1.5 m to 7.7 m bgs and to the termination depth in Boreholes BH20-6, BH20-7, BH20-10, BH20-14 and BH20-15. The clayey silt to silty clay layer contained sand seams and trace to some amounts of sand, gravel and cobbles. The unit was noted to be moist to very moist and wet at the bottom of some borehole locations. The soil was generally found to be brown to grey in colour.

The lower cohesionless silt to sandy silt and silty sand deposits was found underlying the clayey silt to silty clay deposits in Boreholes BH20-1 to BH20-3, BH20-5, BH20-8, BH20-9, BH20-11 to BH20-13 and BH20-16 and extended to the full depth of investigation. This unit contained layers of sand and gravel/gravelly sand materials in the location of Borehole BH20-16 at various depths ranging from 1.5 m to 6.2 m bgs. The unit was noted to be moist to wet and brown to grey in colour.

The investigation involved equipping thirteen (13) borehole locations with 51 mm diameter monitoring wells to permit the monitoring of groundwater levels at the Site. On-completion groundwater levels were collected and noted to range from 2.3 m to 9.1 m bgs. Groundwater levels in the monitoring wells were measured in August 2020 and ranged from 0.2 m to 6.8 m bgs (Elev. 260.4 masl to 275.7 masl). Monitoring Well BH20-7 was found to be dry.

3.0 FIELD INVESTIGATION

To assess soil and groundwater conditions at the Site, DS used monitoring wells installed during the geotechnical investigation carried out in July 2020 which included thirteen (13) monitoring wells (MWs) installed in at borehole locations BH20-1 through BH20-7, BH20-9, BH20-11, BH20-12 and BH20-14 to BH20-16. The borehole and monitoring well locations are as shown in **Figure 4**. The detailed subsurface conditions are provided in the boreholes logs in **Appendix B**. MWs were constructed in accordance with O.Reg. 903, with 2-inch PVC casing and a 3.0 m length of screen (10 slot) in BHs 20-2, 20-3, and 20-4 and 1.5m length screen in the remainder of BHs. Screens were installed at varying depths ranging from 3.0 to 9.1 meters below ground surface (mbgs).

Monitoring wells were developed before use to allow for groundwater level monitoring, hydraulic conductivity testing, and to assess groundwater quality. Nine (9) single well response tests (SWRTs) were completed by performing a rising head test to estimate hydraulic conductivity values of the overburden at the Site.

Two (2) unfiltered groundwater samples were collected and analyzed against parameters listed in the Provincial Water Quality Objectives (PWQO) for surface water to assess the suitability of discharge to nearby surface water features as part of the hydrogeological investigation.

Water quality testing at the Site consisted of collecting one (1) non-filtered groundwater sample and two (2) non-filtered surface water samples for comparison of water quality against the Provincial Water Quality Objectives (PWQO) to assess baseline water quality conditions at the Site prior to commencing construction activities.

4.0 PHYSICAL SETTING

Available topographic maps, environmental, geotechnical, and hydrogeological reports were used to develop an understanding of the physical setting of the study area. The borehole logs from all investigations at the site as well as the Ministry of the Environment, Conservation and Parks Water Wells Records (MECP WWRs) used to interpret the geological and hydrogeological conditions at the Site.

4.1 Physiography and Drainage

The Site is located within a physiographic region of southern Ontario known as the South Slope and within a physiographic landform feature known as the Drumlinized Till Plain (Chapman and Putnam, 1984). The South Slope physiographic region lies between the Oak Ridges Moraine in the north and the Peel Plain in the south. Much of the land surface topography and geology in southern Ontario was formed during the most recent glaciation period, known as the Wisconsin Glaciation, which was accompanied by various meltwater lakes and channels. The Pleistocene deposits present in the Caledon and Brampton area are associated with the advancing and retreating of this ice sheet. The South Slope consists of low-lying till plains, with undulating to gently rolling terrain and incised valleys around larger creeks and rivers. The South Slope has a gently, but steady slope to the southeast towards Lake Ontario, which results in overall good drainage. A regional physiography map for the Site and surrounding area is provided in **Figure 2A**.

The Site is located within the Main Humber subwatershed, part of the larger Humber River Watershed. There are numerous headwater drainage features located within the Site (Section 4.3.5). The closest surface watercourse to the Site is the Humber River, located approximately 1 km east of the Site. The topography within the Site is gently rolling with a general slope towards the south/southeast. The study area is characterized as having a moderate drainage and is directed overland into various streams on the Site.

4.2 Geology

The following presents a brief description of regional and site geology based on the review of available information and site-specific soil investigations.

4.2.1 Quaternary Geology

The surficial geology at the Site and in the surrounding area is predominantly comprised of clay to silt-textured silt (Ontario Geological Survey, 2010). A pocket of surficial ice-contact stratified deposits consisting of sand and gravel with minor amounts of clay, silt and till are present west of the Site. There are modern alluvial deposits

consisting of clay, silt, sand and gravel deposits present along the Humber River and its tributaries in the east. An illustration of surficial geology for the Site and surrounding area is provided in **Figure 2B.**

4.2.2 Bedrock Geology

Available published mapping indicates that bedrock in the area predominantly comprises of shale and minor limestone part of the Queenston Formation (MNDM Map 2544 Bedrock Geology of Ontario). As part of the borehole drilling program within the Macville Community Site area, bedrock was not encountered to 11.3 mbgs (Elev. 250.4 masl), which was the maximum depth of investigation. Based on the MECP water well records, there are ten (10) water well records which were reportedly completed into bedrock. The thickness of the overburden generally ranged from 29.9 mbgs to 76.2 mbgs, based on nine (9) well records (MECP WWR No. 4908193, 1908194, 1907399, 1906470, 4905615, 7275497, 4903854, 7267796 and 4904216). There is one (1) well record (MECP WWR No. 4905839) located approximately 490 northeast of the Site with a reported depth to bedrock of 11.6 mbgs. This well record is located within the valley lands of the Humber River, and for this reason the ground surface elevation of the well is likely significantly lower than surface elevations across the Site.

A bedrock geology map for the Site and the surrounding area is provided in **Figure 2C**.

4.2.3 Site Geology

The stratigraphic setting of the Site was interpreted from the soil encountered during the current subsurface investigation. In summary, the Site is underlain by a surficial layer of topsoil / fill / disturbed native material, which in turn was underlain by native soil deposits extending to the full depth of investigation. The native soil deposits at the Site comprised of clayey silt till to silty clay till (Halton Till), which in turn was underlain by silt to sandy silt/sandy silt deposits. Sand and gravel alluvium deposits were encountered in the southeast corner of the Site (BH20-16). Bedrock was not encountered during the subsurface investigation.

The stratigraphic conditions encountered at the Site during the current subsurface investigations were generally consistent with the findings from the previously completed Preliminary Geotechnical Investigations at the 14275 The Gore Road and the Cook Property by SPL Consultants Ltd (Sections 2.4 and 2.5).

The stratigraphic conditions encountered in the boreholes are in detail summarized below.

Topsoil/Fill/Disturbed Native:

Topsoil was encountered at grade in all borehole locations with the exception of Borehole BH20-05. The depths of the topsoil varied from 200 mm to 550 mm, with an average thickness of 340 mm. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative of the Site and should not be relied on to estimate the quantity of topsoil at the Site.

A layer of earth fill / disturbed native material was encountered at all borehole locations and extended to a maximum depth of 0.8 m below the ground surface. The fill / disturbed native material generally consisted of sandy silt to clayey silt with trace gravel and trace amounts of topsoil/organics.

Halton Till Deposits (Clayey Silt Till to Silty Clay Till):

Glacial till deposits consisting of clayey silt to silty clay with trace amounts of sand and gravel was predominantly encountered underlying the surficial topsoil / fill / disturbed native soils in all borehole locations except for Borehole BH20-4. The till deposits consisted of occasional wet silt or sand seams/layers. The glacial till layer extended to depths ranging from 1.5 m to 11.3 mbgs and to the borehole termination depth in BH20-6, BH20-7, BH20-10, BH20-14 and BH20-15. The Standard Penetration Test ("N") counts ranged from 8 to 72 blows for a penetration of 300 mm.

Newmarket Till (Silt / Sandy Silt / Silty Sand):

Silt/sandy silt/silty sand was encountered in all BHs but BH20-6, 20-7, 20-10, 20-14, and 20-15 extending to the limits of excavation wherever it is present. A massive layer of silty sand to sandy silt Newmarket till likely underlies the Halton till and modern alluvial deposits throughout the site, even where clayey silt is found to the extent of boreholes. "N" values ranged from 7 to greater than 100 blows for 300mm penetration.

Modern Alluvium (Sand and Gravel):

Sand and gravel deposits are not common throughout the site however they are present at the southeast corner of the site near the watercourse in BH 20-16. The sand and gravel layer extends from 1.5 to 6.2mbgs and is split by a sandy silt layer from 3.3 to 4.5mbgs

The location of the boreholes and monitoring wells is provided in **Figure 4**. The borehole logs are provided in **Appendix B**. Geological Cross-Sections A-A' to F-F', which depict the stratigraphic setting at the Site are provided in **Figure 5A to 5F**.

4.3 Hydrogeology

The hydrogeology at the Site was evaluated using the on-site monitoring wells, piezometers, and staff gauges installed by DS, local domestic wells and existing hydrogeological and environmental reports for the area.

4.3.1 Local Groundwater Use

As part of the hydrogeological study, DS completed a search of the Ministry of the Environment, Conservation and Parks (MECP) Water Well Record (WWR) database. Based on the MECP water well records search, there are seventy-three (73) water wells within 500 meters of the Site. Forty-seven (47) water wells are noted as domestic supply wells and six (6) wells are noted as commercial or industrial supply wells. Eight (8) wells are noted as test holes or monitoring wells. The remaining twenty-three (23) wells are either abandoned or unknown use. Private domestic and commercial water supply wells are drilled into sandy aquifers confined under clay till. The depths of these wells range from 5.5 to 65.2 mbgs. Domestic water supply records exist for wells drilled between the dates of January 15th, 1957 to June 13th, 2016. The water well

record summary is included **in Appendix C. Figure 3** shows the MECP water well location plan.

It is recommended that a door-to-door private water well survey be completed within a 500 m radius of the Site to confirm the use of groundwater for private servicing in the study area.

There are zero (0) records of permit to take water (PTTW) within 500m of the site.

4.3.2 Groundwater Conditions

DS implemented a groundwater monitoring program at the Site in August 2020, with a Site visit to collect groundwater levels on a monthly basis for one (1) year to assess long-term groundwater fluctuations. Currently, the monitoring has been conducted from August 2020 to October 2020, and will ongoing until August 2021. **Figure 4** shows the monitoring well locations. **Table 1** presents a summary of the measured groundwater level elevations in all monitoring wells and piezometers.

Throughout the study area, groundwater levels were found to range between 255.2 masl (BH20-7) and 275.7 masl (BH20-1) in the proposed developmental area, which represent the groundwater levels within the overburden at the Site. Based on the groundwater elevation contours, the direction of groundwater flow is generally expected to be in a southeasterly direction with some flow in the southwestern quadrant of the Site to be directed in a southwesterly direction towards Monitoring Well BH20-7. The average hydraulic gradient in the northern portion of the Site is estimated to be 0.009 m/m from the west to the east. The average hydraulic gradient from the north to the south in the northern portion of the Site is estimated to be approximately 0.001 m/m. The average hydraulic gradient from the north to south in the southern portion of the Site is estimated to be approximately 0.008 m/m. Groundwater outlets to surface streams at the southwest and southeast limits of the site. A groundwater elevation contour and flow map is provided in **Figure 6**.

Continuous water level monitoring was conducted on four (4) select monitoring wells at BH20-5, BH20-7, BH20-12 and BH-20-16. Continuous monitoring was completed using a fixed interval pressure and temperature data recording device (Levelogger™) which was corrected for atmospheric pressure from a central location on the site. Based on the findings of the continuous monitoring to-date (August to October), the following is summarized:

- **Monitoring Well BH20-5 –** There was a decline in the groundwater level from 270.2 m to 269.7 m above sea level;
- **Monitoring Well BH20-7 –** The recovery in this monitoring well is noted to be significantly slow following development of the monitoring well. The water level has gradually risen to the currently measured level of 258.3 m above sea level, which is considered to not have been stabilized yet;
- **Monitoring Well BH20-12 –** The water level has stagnated at an approximate elevation of 264.8 m above sea level; and
- **Monitoring Well BH20-16 –** The water level has fluctuated between 263.0 m to 263.5 m above sea level.

Based on the above, the water levels in the monitoring wells have not varied significantly during the current

monitoring period. The groundwater levels in the monitoring wells, with the exception of Monitoring Well BH20-7, have gradually declined during the late summer to the fall monitoring period. The water level recovery in Monitoring Well BH20-7 is noted to be significantly slow and has yet to stabilize at its static water level. For this reason, the water level Monitoring Well BH20-7 is not considered representative of actual groundwater conditions at this stage.

The hydrographs for the continuous groundwater monitoring are provided in **Appendix F**.

4.3.3 Hydraulic Conductivity

Single Well Response Tests (SWRTs) were completed by DS in nine (9) monitoring wells on August 6th and 7th, 2020 to estimate hydraulic conductivity (K) for the representative geological units in which the wells were screened. SWRTs were completed by performing a rising head test (slug test) using a bailer to remove water from the well. A data logger was placed at the bottom of the wells to monitor recovery. Hydraulic conductivity (k) values were calculated using the Bouwer and Rice method. **Table 2** presents a summary of the hydraulic conductivity (K) results for the representative geological units. The hydraulic conductivity values ranged from 7.4×10^{-9} m/sec to 3.2×10^{-6} m/sec for the clayey silt till and sandy silt till / silt unit. The hydraulic testing results are provided in **Appendix D.**

Table 2: Summary of Hydraulic Conductivity (K) Test Results

Well ID	Screen Interval (masl)	Screened Formation	K- Value(m/s)
BH20-1	272.2 m to 273.7 m	Silt	7.3×10^{-7}
BH20-5	264.0 m to 275.5 m	Silty sand	5.3×10^{-7}
BH20-6	262.5 m to 264.0 m	Clayey silt till, sand seams	1.4×10^{-7}
BH20-9	266.5 m to 268.0 m	Silty clay till, some sand	3.2×10^{-6}
BH20-11	261.0 m to 262.5 m	Silt, some sand	5.2×10^{-8}
BH20-12	257.3 m to 258.8 m	Silt	7.3×10^{-7}
BH20-14	257.1 m to 258.6 m	Silty clay till, some sand	6.0×10^{-7}
BH20-15	255.0 m to 256.5 m	Clayey silt till, some sand	7.4×10^{-9}
BH20-16	251.8 m to 259.4 m	Silty sand, some clay	1.5×10^{-8}

4.3.4 In-Situ Infiltration Testing

In-situ infiltration testing was conducted by DS field personnel on September 2nd, 2020. The testing was completed in the location of monitoring wells (BH20-1, BH20-2 and BH20-5 through BH20-16) as shown below in **Table 3**, to provide a preliminary field assessment of infiltration rates of surficial soils across the Site. Testing was completed following the guidelines outlined in the Low Impact Development (LID) Stormwater Management Planning and Design Guide for Stormwater Infiltration, 2010 (Appendix C Site Evaluation and Soil Testing Protocol).

To estimate the infiltration rate of soils in the test locations, **DS** completed in-situ infiltration testing at a depth of 0.5m and 1.5 m bgs. The testing included the use of a constant head infiltrometer which operates using the Marriott Bottle principal, whereby a shallow ponded head of water is maintained at a constant

depth within an augured borehole. The steady-state flow of water into the subsurface soil following saturated conditions is regarded as the field saturated hydraulic conductivity (K_{fs}) rate respective of the depth of the head utilized. The results of the infiltration testing is summarized below in **Table 3**.

Table 3: Summary of Test Pits and Estimated Soil Infiltration Rates

Test Location	Test Depth (mbgs)	Soil Type	Water Head	Steady State Rate of Water Level Change (cm/min)	K_{fs} (cm/sec)	Infiltration Rate (mm/hr)
BH20-1	0.5	Sandy Silt	0.05 m	0.34	3.20E-05	34.1
	1.5	Silty Clay	0.05 m	0.03	2.82E-06	17.8
BH20-2	0.5	Sandy Silt	0.05 m	0.28	2.63E-05	32.4
	1.5	Silty Clay	0.05 m	0.02	1.88E-06	16.0
BH20-5	0.5	Sandy Silt	0.05 m	0.20	1.88E-05	29.6
	1.5	Silty Clay	0.05 m	0.04	3.76E-06	19.2
BH20-6	0.5	Silty Clay	0.05 m	0.11	1.03E-05	25.2
	1.5	Silty Clay	0.05 m	0.02	1.88E-06	16.0
BH20-9	0.5	Silty Clay	0.05 m	0.08	7.52E-06	23.1
	1.5	Silty Clay	0.05 m	0.03	2.82E-06	17.8
BH20-11	0.5	Silty Clay	0.05 m	0.48	4.51E-05	37.4
	1.5	Silty Clay	0.05 m	0.04	3.76E-06	19.2
BH20-12	0.5	Silty Clay	0.05 m	0.14	1.32E-05	26.9
	1.5	Silty Clay	0.05 m	0	No Infiltration - wet Soil Conditions	
BH20-14	0.5	Silty Clay	0.05 m	0.25	2.35E-05	31.4
	1.5	Silty Clay	0.05 m	0.05	4.70E-06	20.4
BH20-15	0.5	Silty Clay	0.05 m	0.40	3.76E-05	35.6
	1.5	Silty Clay	0.05 m	0.06	5.64E-06	21.4
BH20-16	0.5	Sandy Silt	0.05 m	0.44	4.14E-05	36.5
	1.5	Sand and Gravel	0.05 m	24.94	2.34E-03	107.6

Notes:
-m bgs– meters below ground surface
-Infiltration Rate approximated from Kfs using calculations provided in Figure C1 of Appendix C - Site Evaluation and Soil Testing Protocol (Low Impact Development (LID) Stormwater Management Planning and Design Guide for Stormwater Infiltration, 2010)

Based on the results of the infiltration testing, the site primarily consists of a low permeable silty clay till with a measured infiltration rate ranging from about 16 to 38 mm/hr with an average of 26 mm/hr. Soils with infiltration rates over 15 mm/hr are considered suitable for Soakaways, infiltration trenches and chambers (TRCA, 2010).

One test location at BH20-16 on the southeast corner of the Site contains sand and gravel deposits which extend from 1.5 to 6.2mbgs. The deep test (1.5 mbgs) was completed within the sand and gravel layer and produced an infiltration rate of about 108 mm/hr. The area is in the location of a proposed Storm water Management (SWM) pond. Based on test results there appears to be a good opportunity for infiltration measures in areas surrounding the SWM pond assuming there is a minimum of 1 m clearance between the top of the seasonally high water table and the bottom of any infiltration measure.

For the purpose of calculating design infiltration rates for on-site LID measures, Table C2 in the "Low Impact Development Stormwater Management Planning and Design Guide" (Appendix C), was used to determined safety correction factors for each of the test pit locations. The safety factors are applied to the measured infiltration rates of soils for each location to address heterogeneity of the soils. The calculated safety correction factors and the design infiltration rates for each location was determined to be 2.5. As a result of applying the safety correction factors, an infiltration rate ranging from about 6 to 15 mm/hr (average 10 mm/hr), can be considered for design purposes at the tested locations within the silty clay soils. A design infiltration rate of 43 mm/hr was calculated for the tested location within the sand and gravel deposits. Shallow groundwater levels in the vicinity of BH20-12 interfered with in-situ test results at this location. Buried infiltration facilities in this location are not recommended. Continued water level monitoring at all locations is recommended to ensure a minimum of 1 m clearance between the top of the seasonally high water table and the bottom of any infiltration measure.

4.3.5 Groundwater Quality

Unfiltered groundwater samples were collected from the selected monitoring well location (BH 20-4) on September 4th, 2020 to assess groundwater quality. The collected samples were submitted to SGS Laboratory in Lakefield, Ontario. SGS Laboratory is a Canadian Association of Laboratory Accreditation Inc. (CALA) and Canadian Standard Association (CSA) certified. Groundwater quality results were compared to parameters listed in the Provincial Water Quality Objectives (PWQO) for surface water to assess the suitability of discharge to nearby surface water features as part of the hydrogeological investigation. Analytical results indicate that the concentration of Cobalt exceeded PWQO standards at least at one monitoring well location. **Table 4** presents a summary of exceeded parameters.

Table 4: Parameters in Groundwater Exceeding MECP Guidelines

Parameter Exceeded	Guideline	Unit	Borehole #	Guideline limit	Concentration
Cobalt	MECP O.Reg. 153/04 Table 2	µg/L	20-4	**3.8**	**5.16**

4.3.6 Surface Water Conditions

The surface water and drainage setting at the Site comprises a total of eight (8) wetlands (Wetland 1, 2, 3, 4, 5, 6, 7 and 8), which are incorporated into the tributaries of the Humber River and ultimately flow into Lake Ontario. All accessible wetlands at the Site were instrumented with surface stations consisting of staff gauges and associated nested piezometer set.

A 1-year pre-construction surface water and groundwater monitoring program of the Site is currently underway, and this report includes the findings from the data collected to-date during the August to October of 2020 monitoring period. All staff gauges installed within the wetlands at the Site have been instrumented with a Levelogger™ to allow for continuous monitoring at every 15-minute interval. The monitoring program includes a Site visit on an every 1-month basis to retrieve the water level data from the Levelogger™ and to collect manual readings within all surface stations and monitoring wells at the Site.

As discussed in Section 2.1, Aquafor (2014) completed a *Headwater Drainage Feature Assessment* of the Site and delineated the four (4) Headwater Drainage Features (HDFs) and their associated reaches at the Site. The surface stations are installed within the delineated drainage reaches at the Site.

The location of the wetlands is provided in **Figure 4**.

A discussion on the surface water conditions at all surface stations is provided below.

Wetland 1 and 2

Wetland 1 and 2 are located within the southwestern corner of the Site along The Gore Road and within the Headwater Drainage Feature HDF-4. Due to accessibility constraints, Wetland 1 could not be instrumented with a surface station to permit monitoring within the wetland. Wetland 2 was equipped with a staff gauge, SG W2-1, and a nested piezometer set, W2-PZS and W2-PZD within Reach 4a. The shallow and deep nested piezometers were installed to depths of 1.1 m (Elev. 260.5 masl) and 2.0 m (259.5 masl) below existing ground surface, respectively. Staff gauge SG W2-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W2-1 is approximately 261.3 masl.

During the continuous monitoring of staff gauge SG W2-1 in Wetland 2, the Reach 4a channel has generally remained dry during the August to October monitoring period, with some flow observed following precipitation events. This flow was noted to diminish into dry conditions within 1-2 days after the cessation of the storm event. The manual groundwater monitoring in the nested piezometer indicate that the shallow and deep piezometer water levels are slightly above the base of the Reach 4a channel during the current monitoring period. The water level in the shallow piezometer was found to be approximately 0.1 m to 0.2 m above the base of the Reach 4a channel. The water level in the deep piezometer was found to be approximately 0.08 m to 0.16 m above the base of the Reach 4a channel. The shallow groundwater gradient at the location of Reach 4a was found to be downward during the current monitoring period; with a decline in the gradient from 0.04 m/m to 0.03 m/m between September and October 2020.

The flow observed in the monitoring data for the Reach 4a channel after precipitation events may potentially be as a result of the low permeability surficial silty clay till soils precluding the free infiltration of storm water into the ground. This allows for the saturation of the near surficial soils creating perched groundwater conditions, which in turn further reduces the soil infiltration rates and allows for increased surface runoff along the Reach 4a channel. Nearby Monitoring Well BH20-7 indicates the deep groundwater level to be measured at 4.5 m below existing grade (Elev. 257.2 masl) during highest point in the current monitoring period. For this reason, groundwater is not considered to be recharging the Reach 4a channel. There is also a potential for recharging of the surface water in the Reach 4a channel from the up-gradient Reach 4b (pond) and 4c of HDF-4. Given that the primary source of flow in the Reach 4a channel during the current monitoring period is determined to be from precipitation events, this channel is considered an ephemeral feature. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrographs for Wetland 1 and 2 are provided in **Appendix F**.

Wetland 3

Wetland 3 is located within the southwestern portion of the Site and within the Headwater Drainage Feature HDF-3. The wetland was equipped with a staff gauge, SG W3-1 and a nested piezometer set, W3-PZS and W3-PZD within Reach 3c of HDF-3. The shallow and deep nested piezometers were installed to depths of 1.0 m (Elev. 269.9 masl) and 1.9 m (269.1 masl) below existing ground surface, respectively. Staff gauge SG W3-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland at approximate ground surface elevation of 270.7 masl. Wetland 4 is located downstream of this wetland location with respect to surface water flow.

During the continuous monitoring of staff gauge SG W3-1 in Wetland 3, Reach 3c has generally remained dry during the August to October monitoring period, with very minimal response to precipitation events. Flow in the Reach 3c was rare, however diminished into dry conditions within the same day from appearing in the data. The manual groundwater monitoring in the nested piezometer indicate that the shallow and deep piezometer water levels are below the base of Reach 3c. The water level in the shallow piezometer was found to be approximately 0.25 m to 0.44 m below the base of Reach 3c. The water level in the deep piezometer was found to be approximately 0.33 m to 0.64 m below the base of Reach 3c. The shallow groundwater gradient at the location of Reach 3c was found to be upward during the current monitoring period; with a decline in the gradient from 0.25 m/m to 0.10 m/m between September and October 2020.

Reach 3c is located within tiled agricultural cropland without a discernable channel (Aquafor, 2014). The short-lived flow observed in the monitoring data for Reach 3c following precipitation is not considered to be a prevalent flow due to the absence of a defined channelized morphology at this location. Further, given that the shallow groundwater levels recorded in the nested piezometers during the current monitoring period are below the base of Reach 3c, there is no contributions to the feature from groundwater during the late summer and fall period. Given that Reach 3c had some minor response to precipitation events, the feature is considered ephemeral. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrographs for Wetland 3 is provided in **Appendix F**.

Wetland 4

Wetland 4 is located within the southwestern corner of the Site, east of Wetland 2 within the Headwater Drainage Feature HDF-3. Wetland 4 was equipped with a staff gauge, SG W4-1, and a nested piezometer set, W4-PZS and W4-PZD within the Reach 3a channel. The shallow and deep nested piezometers were installed to depths of 0.6 m (Elev. 260.7 masl) and 1.6 m (259.5 masl) below existing ground surface, respectively. Staff gauge SG W4-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W4-1 is approximately 261.0 masl.

During the continuous monitoring of staff gauge SG W4-1 in Wetland 4, the Reach 3a channel has generally remained dry during the August to October monitoring period, with very minimal response to precipitation events. Flow in the Reach 3a was rare, however diminished into dry conditions within the same day from appearing in the data. The manual groundwater monitoring in the nested piezometer indicate that the

shallow and deep piezometer water levels are below the base of Reach 3a. The water level in the shallow piezometer was found to range from 0.1 m to more than 0.3 m below the base of Reach 3a. The water level in the deep piezometer was found to be approximately 0.3 m to 1.3 m below the base of Reach 3a. The shallow groundwater gradient at the location of Reach 3a was found to be downward during the current monitoring period; with a magnitude of 0.17 m/m.

All up-gradient reaches (3b, 3c, 3d, 3e, 3f and 3g) in HDF-3 are located within tile agricultural cropland without discernible channels (Aquafor, 2014). For this reason, based on the current data, recharge of surface flows for Reach 3a from up-gradient reaches in HDF-3 is not considered to be likely. Given that the shallow groundwater levels recorded in the nested piezometers during the current monitoring period are below the base of Reach 3a, there is no contribution to the feature from groundwater during the late summer and fall period. Given that Reach 3a had some minor response to precipitation events, it is considered an ephemeral feature. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrograph for Wetland 4 is provided in **Appendix F**.

Wetland 5 and 6

Wetland 5 and 6 are located near the southern boundary of the Site along King Street, east of Wetland 4 within the Headwater Drainage Feature HDF-3. Both wetlands are equipped with a single staff gauge, SG W5-1, and a nested piezometer set, W5-PZS and W5-PZD within Reach 3g. The shallow and deep nested piezometers were installed to depths of 0.8 m (Elev. 260.5 masl) and 1.8 m (259.4 masl) below existing ground surface, respectively. Staff gauge SG W5-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W5-1 is approximately 261.1 masl.

During the continuous monitoring of staff gauge SG W5-1, the Reach 3g channel has generally remained dry during the August to October monitoring period, with some flow observed following precipitation events. This flow was noted to diminish into dry conditions within 1-2 days after the cessation of the storm event. The manual groundwater monitoring in the nested piezometers indicate the following:

- The water level in the shallow piezometer was 0.02 m above the base of Reach 3g channel during the September measurement, and 0.013 m below the base of Reach 3g channel during the October measurement

- The water level in the deep piezometer was 0.003 m below the base of the Reach 3g channel during the September measurement, and 1.2 m below the base of the Reach 3g channel during the October measurement.

The shallow groundwater gradient at the location of Reach 3g was found to be downward during the current monitoring period; with a rise in the gradient from 0.019 m/m to 1.1 m/m between September and October 2020.

The flow observed in the monitoring data for the Reach 3g channel after precipitation events may potentially be as a result of the low permeability surficial silty clay till soils precluding the free infiltration of storm water into the ground. This allows for the saturation of the near surficial soils creating perched groundwater conditions, which in turn further reduces the soil infiltration rates and allows for increased surface runoff along the Reach 3g channel. Based on the monitoring of Wetland 5 and 6 during the late summer and fall monitoring period, groundwater was not considered a source for contributions to surface water flow in Reach 3g. Groundwater levels observed in the shallow piezometer at the elevation of the Reach 3g streambed is considered to be perched groundwater conditions. All up-gradient reaches (3f and 3g) in HDF-3 are located within tile agricultural cropland without discernible channels (Aquafor, 2014). For this reason, based on the current data, recharge of surface water flows for Reach 3g from up-gradient reaches in HDF-3 is not considered to be likely. Given that the primary source of flow in the Reach 3g channel during the current monitoring period is determined to be from precipitation events, this channel is considered an ephemeral feature. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrographs for Wetland 5 and 6 are provided in **Appendix F**.

Wetland 7

Wetland 7 is located within the southeastern portion of the Site, north Wetland 8 and within the Headwater Drainage Feature HDF-1. The wetland was equipped with a staff gauge, SG W7-1 and a nested piezometer set, W7-PZS and W7-PZD within Reach 1d of HDF-1. The shallow and deep nested piezometers were installed to depths of 1.1 m (Elev. 269.9 masl) and 1.8 m (269.1 masl) below existing ground surface, respectively. An additional staff gauge SG W7-2 was installed on the upstream end of the wetland within Reach 1e. Staff gauge SG W7-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the local low point of the wetland at its upstream location. The ground surface elevation at the location of staff gauge SG W7-1 is approximately 261.3 masl.

During the continuous monitoring of staff gauge SG W7-1 and manual monitoring of SG W7-2 in Wetland 7, both Reach 1d and Reach 1e have consistently remained dry during the entire August to October monitoring period. Staff gauge SG W7-1 did not display any response to precipitation events. The manual groundwater monitoring in the nested piezometer (W7-PZS and W7-PZD) were noted to be dry during this monitoring period.

All up-gradient reaches (1e, 1f, 1k, 1l, 1m and 1n) are located in tiled agricultural croplands without discernable channels. For this reason, there is likely no surface water recharge from any upstream reaches in HDF-1. Further, the dry conditions indicate that there is no surface water and groundwater interaction during the August to October monitoring period. At this stage, Reach 1d is considered a non-perennial surface water feature. Further monitoring will be required to confirm seasonal fluctuations and to confirm the surface/groundwater dynamics.

The hydrograph for Wetland 7 is provided in **Appendix F**.

Wetland 8

Wetland 8 is located in the southeastern portion of the Site along Humber Station Road and within the Headwater Drainage Feature HDF-1. Wetland 8 was equipped with a staff gauge, SG W8-1, and a nested piezometer set, W8-PZS and W8-PZD within the Reach 1a channel. The shallow and deep nested piezometers were installed to depths of 0.8 m (Elev. 262.8 masl) and 1.7 m (261.9 masl) below existing ground surface, respectively. Staff gauge SG W8-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W8-1 is approximately 263.4 masl.

During the continuous monitoring of staff gauge SG W8-1 in Wetland 8, the Reach 1a channel has sustained flow for the majority of September with increased response to precipitation events during this period. The flow in the Reach 1a channel was noted to become dry at the end of September and transitioning into the October period. During the dry period, the Reach 1a channel did not display any response to any storm events. The manual groundwater monitoring in the nested piezometers indicate the following:

- The water level in the shallow piezometer was 0.02 m above the base of Reach 1a channel during the September measurement, and was found dry during the October measurement
- The water level in the deep piezometer was 0.08 m below the base of the Reach 1a channel during the September measurement, and was found dry during the October measurement.

The shallow groundwater gradient at the location of Reach 1a was found to be upward during the September monitoring period with a magnitude of 0.036 m/m.

Up-gradient Reaches 1d, 1e, 1f, 1g, 1i, 1j, 1k, 1l, 1m and 1n are located within tile agricultural cropland without discernable channels (Aquafor, 2014). Further, upstream Reaches 1b and 1c comprise of a well-defined channel, which may allow for flow of surface water downgradient into Reach 1a. Reach 1h also has a reported well-defined channel, however connectivity with Reach 1a is lost as a result of the absence of a channel along the intermediary Reach 1g (Aquafor, 2014). It is likely that surface water flows carried from Reach 1b and 1c allows for recharge to Reach 1a following precipitation events and/or at times of high groundwater tables. Based on the groundwater elevation contours (**Figure 6**), the deeper groundwater level in the area of Reach 1a during the current monitoring period is expected to be approximately 262.0 masl to 263.0 masl. Given that monitoring from the nested piezometer indicated an upward shallow groundwater gradient, it is possible that surface water flows in Reach 1a may receive contribution from groundwater. For this reason, Reach 8 is likely an intermittent surface water feature, however further monitoring will be required to confirm seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrograph for Wetland 8 is provided in **Appendix F**.

4.3.7 Surface Water Quality

DS collected two (2) surface water samples on October 24, 2020; one (1) from the surface water stream in the southwest corner of the Site (Surface Station: SG W2-1); and one (1) sample from the surface water stream in the southeast corner of the Site (Surface Station: SG W8-1). The collected samples were submitted to ALS Laboratory in Richmond Hill, Ontario. ALS Laboratory is a Canadian Association of Laboratory

Accreditation Inc. (CALA) and Canadian Standard Association (CSA) certified. The samples were analyzed for general chemistry parameters, total suspended solids and dissolve oxygen against the Provincial Water Quality Objectives (PWQO) for surface water to assess suitability of discharge to nearby surface water features as part of the Hydrogeological Investigation. **Table 5** presents a summary of exceeded parameters**.**

Table 5: Parameters in Surface Water Exceeding the PWQO

Parameter Exceeded	Unit	Sample Location	Guideline limit	Concentration (SG W2-1)	Concentration (SG W8-1)
Aluminum	ug/L	Surface stream	**75**	**2,610**	**2,400**
Aluminum	mg/L	Surface stream	**0.015**	**0.034**	**0.096**
Arsenic	ug/L	Surface stream	**5**	**12.0**	1.0
Cobalt	ug/L	Surface stream	**0.9**	**1.86**	**1.87**
Copper	ug/L	Surface stream	**5**	**6.9**	3.2
Iron	ug/L	Surface stream	**300**	**36,800**	**4,300**
Phosphorus	mg/L	Surface stream	**0.01**	**1.93**	**0.358**
Zinc	ug/L	Surface stream	**20**	**24**	**19**

Bold – parameter exceeds the PWQO standards.

Based on the analytical testing results, both surface water samples exceeded the PWQO for various parameters.

The certificate of analysis report is provided in **Appendix E.**

5.0 SITE WATER BALANCE

To understand and compare existing hydrologic conditions, a Thornthwaite site water balance was completed. The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is an accounting type method used to analyze the allocation of water among various components of the hydrologic cycle. Inputs to the model are monthly temperature, Site latitude, precipitation, and stormwater run-on. Outputs include monthly potential and actual evapotranspiration, evaporation, water surplus, total infiltration, and total runoff. For ease of calculation, a spreadsheet model was used for the computation.

When precipitation (P) occurs, it can either runoff (R) through the surface water system, infiltrate (I) to the water table, or evaporate/evapotranspiration (ET) from the earth's surface and vegetation. The sum of R and I is termed as the water surplus (S). When long-term averages of P, R, I and ET are used, there is no net change in groundwater storage (ST). Annually, however, there is a potential for small changes in ST. The annual water budget can be stated as **P = ET + R + I + ST** and the components are discussed below.

Precipitation (P)

Based on the 30-year average for the Toronto Pearson Airport Climate Station in Ontario, the average precipitation for the area is about 786 mm/year for the period between 1981 and 2010. Also, the average monthly temperature from this station has been used. The monthly distribution of precipitation is presented in **Table G-1, Appendix G.**

Storage (St)

Groundwater storage (ST) of native soils for the existing Site was estimated using values of Water Holding Capacity (mm) of respective land use and soil types identified in Table 3.1 of the Storm Water Management (SWM) Planning & Design Manual (MOE, March 2003). The land uses, soil types and respective water holding capacities chosen to represent existing conditions at the Site include the following with their respective water holding capacity applied to March for monthly calculations:

- Pasture/Shrubs, Silty Clay Soils – 200 mm
- Moderately Rooted Crop, Silty Clay Soils – 150 mm
- Urban Lawns, Pervious Development – 75 mm

Using the procedures outlined in the SWM Planning & Design Manual for the above land use and soil type, the annual change in storage is zero (0).

Evapotranspiration (Et)

Monthly Potential Evapotranspiration (PET) is estimated using monthly temperature data and is defined as a water loss from a homogeneous vegetation-covered area that never lacks water (Thornthwaite,1948; Mather, 1978). In the Thornthwaite water balance model, PET is calculated using the Hamon equation (Hamon, 1061);

PET Hamon = 13.97 * d * D2 * Wt

Where:
d = the number of days in the month
D = the mean monthly hours of daylight in units of 12 hours
Wt = a saturated water vapour density term = 4.95 * e0.627/100
T = the monthly mean temperature in degrees Celsius

The calculated Actual Evapotranspiration (AET) is based on PET and changes in ST (Δ ST). Where there is not enough P to satisfy PET, a reduction in ST occurs. As a result, volumes of AET are less than PET. Also, it is assumed that evaporation will occur and will amount to approximately 15% of the total precipitation for an impervious cover.

Precipitation Surplus (S)

Precipitation surplus is calculated as P–ET. For pervious areas, ET is considered AET and for impervious areas, ET is evaporation.

Infiltration (I) and Runoff (R)

For pervious areas, precipitation surplus has two components in the Thornthwaite model: a runoff component (overland flow that occurs when soil moisture capacity is exceeded) and an infiltration component. The accumulation of infiltration factors for topography, soil types and cover as prescribed in Table 3.1 of the SWM Planning & Design Manual give infiltration factors for existing conditions on the Site as shown below in **Table 6**. The runoff component calculated in the pre-development model is the remaining volume of precipitation surplus following AET, ET, and infiltration.

Table 6 - Existing Conditions – Infiltration Factor

Land uses / soil types	Topography	Soil	Cover	Total Infiltration Factor
Pasture & Shrubs / Clay Loam	0.1	0.15	0.15	0.4
Moderately Rooted Crop / Clay Loam	0.1	0.15	0.1	0.35
Urban Lawns / Clay Loam	0.1	0.15	0.05	0.3

5.1 Pre-development Water Balance

The Site has a total area of 181.7 ha and is predominantly comprised of landscaped/vegetated areas with only 1.7% of the total Site area comprising of existing buildings and asphalt/paved hard surfaces. **Figure 7** shows the pre-development conceptual model considered for establishing current hydrologic conditions. To predict outputs of the pre-development water balance, various inputs were entered into the Thornthwaite model including monthly precipitation and temperature, site latitude, water holding capacity values for native soils and factors of infiltration. Various inputs and outputs of the model are summarised below.

The average annual precipitation rate for the area is approximately 786 mm/year. In the pervious area of the Site, the PET is estimated to be 605 mm/year, which is approximately 77% of the total annual precipitation rate. Based on the monthly distribution of soil storage for all pervious areas of the Site characteristic of silty clay soils, the resulting annual AET rate for each pervious area will be as follows:

- Pasture/Shrubs – 551.6 mm/year
- Moderately Rooted Crop – 533.9 mm/year
- Urban Lawn – 501.8 mm/year

There will not be any evapotranspiration from the existing impervious area of the Site however a loss of 15% from all incoming precipitation and surface runoff due to evaporation is accounted for in the water balance model. All water surplus in the existing impervious area of the Site will convert into surface runoff.

Based on the above, the resulting annual evapotranspiration, infiltration and runoff volumes for each area of the Site during the pre-development period is summarized in **Table 7** below.

Table 7 – Summary of Pre-Development Water Balance

Land Uses / Soil Types	ET Volume (m^3/year)	AET Volume (m^3/year)	Infiltration Volume (m^3/year)	Runoff Volume (m^3/year)
Pasture & Shrubs / Clay Loam	NIL	115,750	19,505	29,257
Moderately Rooted Crop / Clay Loam	NIL	789,624	130,527	242,407
Urban Lawns / Clay Loam	NIL	49,398	8,394	19,585
Impervious Areas	3,708	-	-	21,010
Total	***3,708***	***953,773***	***158,426***	***312,260***

The detailed calculations are provided in **Table G-2, Appendix G**.

5.2 Post-development Water Balance

To predict outputs of the post-development water balance, the same elements of the 30-year average weather data and site latitude inputs were used. Various inputs and outputs of the post-development model are described in detail below. **Figure 8** shows the post-development conceptual model considered for establishing current hydrologic conditions. The detailed calculations are presented in **Table G-3, Appendix G**.

PRECIPITATION (P)

Based on the 30-year average for the Toronto Pearson Airport Climate Station, the average precipitation for the area is about 786 mm/year for the period between 1981 and 2010. Also, the average monthly temperature from this station has been used. The monthly distribution of precipitation is presented in **Table 1, Appendix G.**

STORAGE (ST)

Groundwater storage (ST) of native soils for the post-development scenario was estimated using the values of soil moisture holding capacity or respective land use and soil types identified in Table 3.1 of the Storm Water Management (SWM) Planning and Design Manual (MOE, March 2003). The land uses, soil types and respective water holding capacities chosen to represent existing conditions at the Site including the following with their respective water holding capacity applied to March for monthly calculations:

- Pasture/Shrubs, Silty Clay Soils – 200 mm
- Urban Lawns/Landscaped, Previous Development – 75 mm

Similar to the pre-development conditions, using the procedures outlined in the SWM Planning & Design Manual for each land use, the annual change in storage is 0. The monthly distribution of ST for each of the land use/soil types is presented in **Table G-1, Appendix G**.

EVAPORATION / EVAPOTRANSPIRATION (ET)

The proposed plans for development during the post-construction period will result in an increase in the total impervious hard surfaces across the Site. The total area of impervious surfaces following the proposed plans for construction is approximately 1,277,392 m^2. In the impervious areas, it is assumed that only evaporation will occur and will amount to approximately 15% of the total precipitation. Considering a total annual precipitation of 786 mm/year, evaporation is estimated at 118 mm. On this basis, the total annual volume of evaporation is estimated at 150,604 m^3/year. The detailed calculations for evaporation are included in **Table G-3, Appendix G**.

For post-development pervious areas, monthly PET is estimated using the same inputs and calculations described in the pre-development model respective of land use and soil moisture holding capacity. In the post-development scenario, annual AET is 62,780 m^3/year for the pasture/shrubs area and 213,660 m^3/year for the pervious landscape/developmental area of the Site. The monthly distribution of Post-development AET and detailed calculations are presented in **Table G-3, Appendix G**.

PRECIPITATION SURPLUS (S)

For post-development pervious surfaces at the site, precipitation surplus is calculated as the difference between precipitation and actual evapotranspiration (P–AET), which is summarized below for each of the post-development pervious catchment areas:

- Pasture/Shrubs – 234.4 mm/year
- Pervious Landscaped – 284.2 mm/year

For Impervious surfaces at the site, surplus is P-ET where ET is estimated at 15% of P. The resulting precipitation surplus is about 853,426 mm/yr. The more detailed calculations are included in **Table 3, Appendix G**.

INFILTRATION (I)

The same accumulation of infiltration factors for topography, soil types and cover as prescribed in Table 3.1 of the SWM Planning & Design Manual were used give infiltration factors for post-development conditions.

Considering the infiltration factors used, the total volume of Infiltration (I) estimated for post-development conditions of each pervious areas of the Site is summarized below:

- Pasture/Shrubs – 10,671 mm/year
- Previous Landscaped – 36,305 mm/year

The more detailed calculations are presented in **Table G-3, Appendix G**.

RUNOFF (R)

The runoff component calculated in the post-development model is a combination of the remaining volume of precipitation surplus for both pervious and impervious areas. The total volume of runoff (R) estimated for the post-development conditions of the pervious areas is summarized below:

- Pasture/Shrubs – 16,007 m^3/year
- Pervious Landscaped – 84,712 m^3/year

All precipitation water over impervious hard surfaces will convert into surface runoff after accounting for evaporative losses. On this basis, the resulting surface runoff over the impervious lands during the post-construction period is estimated to be 853,426 m^3/year.

The more detailed calculations are presented in **Table G-3, Appendix G**.

5.3 Post-development Water Balance (With Mitigation)

A summary of the results from the pre- and post-development water balance without mitigation is provided in **Table 8** below:

Table 8 – Summary of Pre- and Post-Development Site Water Balance (without Mitigation)

	Pre-Development	Post-Development	Change
ET (m^3/year)	3,708	150,605	-146,897
AET (m^3/year)	953,772	276,441	677,331
Infiltration (m^3/year)	158,426	46,976	111,450
Runoff (m^3/year)	312,260	954,144	-641,884

During the post-construction period, there is an increase in the area of hard surface paving/imperviousness, which in turn resulted in an overall increase in surface runoff. The decrease in the available pervious/landscaped area during the post-construction period resulted in a decreased in the annual AET and infiltration volumes. There has been an increase in the volume of evapotranspiration during the post-construction period as a result of increased volume of surface runoff over impervious surfaces which is subjected to evaporation. A summary of the results of the water balance is provided in **Table G-6 and G-7, Appendix G**.

To minimize the effects of increased impervious area, Low Impact Development (LID) measures which promote onsite infiltration should be incorporated into the development plan. Based on the *"Functional Servicing Report, Macville Secondary Plan, Macville, Town of Caledon, Region of Peel, 1st Submission"*, by Urbantech, Prepared for Bolton Option 3 Landowners Group, dated January 2021, File No.: 15-458, the following LID measures are currently under consideration to meet the water balance deficit:

- Downspout Disconnection
- Additional Topsoil Depth
- Swales
- Infiltration Facilities
- Rain Gardens
- Rainwater Harvesting

Stormwater management practices at the Site following the construction period should involve directing all roof and surface runoff towards the above considered LID facilities to allow for gradual re-infiltration of collected storm water into the ground. It should be noted that if any stormwater is collected from surface runoff over paved impervious lands, then pre-treatment of the collected water will be required prior to permitting infiltration into the ground through any LID facilities.

It should be noted that the detailed design of the LID facilities at the Site during the post-construction period have not been finalized. For this reason, a post-development water balance to account for the effectiveness of the proposed LID mitigation measures to meet the water balance deficit of the post-development Site could not be completed at this time. During the detailed design stage, **DS** should be consulted to estimate the water balance, which accounts for the actual considered mitigation measures.

Please refer to the above-referenced Functional Service Report (FSR) by Urbantech (2021) for further information regarding the LID's under consideration.

6.0 FEATURE BASED WATER BALANCE

6.1 Pre-development Subcatchments

Pre-development catchment mapping showing topographical drainage divides and wetland catchments were provided by Urbantech (2021) to document existing drainage patterns across the site and determine which areas are within the catchments of wetlands W1 through W9. The mapping was completed to inform the proposed functional servicing for the development. Wetland and constraints mapping was provided by Beacon. The Pre-Development catchment map is presented in **Figure 9**.

The pre-development mapping shows catchments for 9 wetland units including W1 through W9. Catchments for wetlands W1 to W6 includes west areas of the Site which drain south across King Rd. Each of these catchments are limited to within the Site boundaries with exception to some ditch and road runoff from the east side of The Gore Rd. The largest subcatchment is mapped draining directly into W7 and includes approximately 75.9 ha of upgradient area which runs onto the Site via HDF WHT6-E. The drainage feature appears to be captured within a collector pipe which is observed to transect the Site from the north boundary to somewhere between wetland W7 and W8. The entire catchment area within the Site is currently tile drained. Flow exists the Site at wetland W8 via a culvert across Humber Station Road approximately 30m north of the southeast corner of the Site. Wetland catchment W9 is located east of the Site and the CP Rail. The wetland is not within the Sites boundaries however there is a small portion of the catchment within the proposed development area.

6.2 Post-Development Subcatchments

Post-development wetland catchments were provided by Urbantech to document proposed changes to existing drainage patterns for wetland catchments W1 to W6. The Post-Development Catchment Map is provided in Drawings 501 to 503 in Functional Servicing Report (Urbantech 2021). Based on the post-development wetland catchments provided, changes to catchment boundaries for Wetland 1 to 6 include area reductions of about 48 to 87%. The post development boundaries are limited to the wetland / constraints boundaries with exception to about 90 residential lots which are proposed to drain uncontrolled into the wetland features. The uncontrolled drainage includes runoff from pervious back yards and half of the roof area which includes roof leaders discharging to backyards. A summary of changes to catchment size and imperviousness is provided in **Appendix G, Table G-6**.

Wetlands W7 and W8 are proposed to be relocated and so were not included in the post-development water balance assessment. It should be noted that the external run-on from HDF WHT6-E which is currently conveyed to wetlands W7/W8 via a drainage pipe is proposed it be redirected toward the relocated features to provide runoff contributions as required. Wetland W9 was also not included in the water balance assessment as it is located off Site and was not accounted for in the post-development catchment mapping.

6.3 Wetland Water Balance Risk Evaluation

To aid in determining the level of risk and evaluation requirements for the study, an assessment was completed using the Wetland Water Balance Risk Evaluation guidelines provided by the Toronto and Region Conservation Authority (TRCA, Nov 2017). The guideline provides criteria used to evaluate the magnitude of potential hydrological impact on a wetland. The criteria include:

i) The proportion of impervious cover in the catchment of the wetland that would result from the proposal;
ii) The degree of change in the size of the wetland catchment;
iii) Water taking from, or discharge to, surface water bodies or aquifers directly connected to the wetland, and;
iv) The impact on locally significant recharge areas.

Considering the above criteria, increases to impervious cover and changes to wetland catchment size were evaluated.

6.3.1 Impervious Cover Score

An increase in the percent of impervious cover within a wetland catchment has the effect of reducing infiltration and potentially decreasing baseflow and/or interflow contributions to the wetland. It further increases runoff contributions and risks of flooding and potentially increases stormwater sediment and contaminant loading. To assess the risk of the proposed impervious surfaces on sensitive features including Wetlands 1, 2, 3 and 5/6, the Impervious Cover Score (S) was calculated for each of the catchments. The equation defining S is as follows:

$$S = \frac{IC \cdot Cdev}{C}$$

where,

IC is the proportion of impervious cover proposed within the specific catchment (as a percentage between 0 and 100)
C dev is the total proposed development area within the catchment (in ha)
C is the size of the wetland's catchment (in ha).

Results of the calculation are provided in **Table 9** and show that wetland catchment W1 to W6 are presented with low risk based on the calculated S.

Table 9 –Impervious Cover Score - Probability and Magnitude of Hydrological Change

Subcatchment Area Name	Pre-development Catchment Size (m^2)	Proposed Impervious Cover (m^2)	Impervious Cover Score (S) (%)	Sensitive Feature	magnitude of hydrological change
Wetland 1 (W1)	13,402	85	0. 6	Wetland	Low
Wetland 2 (W2)	50,784	1,615	3.2	Wetland	Low
Wetland 3 (W3)	225,600	1,785	0.8	Wetland	Low
Wetland 4 (W4)	62,040	2,083	3.4	Wetland	Low
Wetland 5 (W5)	74,225	1,062	1.4	Wetland	Low
Wetland 6 (W6)	47,447	1,020	2.1	Wetland	Low

Note: * Impervious Cover Score (S) calculated using equation 1 (TRCA - Wetland Water Balance Risk Evaluation, Nov 2017)

6.3.2 Change in Catchment Size

Changes to catchment size directly effects the volume and timing of stormwater contributions to downgradient features. To evaluate the magnitude of hydrological change these effects can have, pre-development and post-development catchments were compared. **Table 10** provides the area breakdown for pre and post-development conditions. The same magnitude thresholds used for impervious cover (10% and 25 %) are used as thresholds to define catchment size alteration. As a result, changes to catchment size for W1 to W6 is considered high risk.

Table 10 –Changes to Catchment Size - Probability and Magnitude of Hydrological Change

Subcatchment Area Name	Pre-development catchment area (m^2)	Post-Development Catchment Area (m^2)	% Change in Catchment Area	Sensitive Feature	Magnitude of Hydrological Change *
W1	13,402	2,200	84 % decrease	Wetland	High
W2	50,784	26,500	48 % decrease	Wetland	High
W3	225,600	30,399	87 % decrease	Wetland	High
W4	62,040	14,915	76% decrease	Wetland	High
W5	74,225	17,101	77% decrease	Wetland	High
W6	47,447	11,600	76% decrease	Wetland	High

Note: * Based on Table 2: Criteria used to evaluate the probability and magnitude of hydrological change (TRCA - Wetland Water Balance Risk Evaluation, Nov 2017)

6.4 Wetland Water Balance

To estimate potential hydrologic changes to the wetland catchments as a result of the proposed development, a Thornthwaite Water Balance was completed for all retained onsite wetlands with catchments identified as intersecting the site. The model was developed using the same input as the site water balance with the exception of including only those areas which fall within the Wetland catchments.

6.4.1 Existing Conditions

The existing conditions across the wetland catchments W1 to W6 include a silty clay loam soil type on a rolling terrain with pervious cover consisting of cultivated agricultural areas, pasture and shrub (NHS areas) and urban lawn and impervious surfaces associated with existing developed areas of the Site. **Table 11** shows the pre-development catchment breakdown of land uses for each subcatchment.

Table 11 – Pre-Development Conditions

Subcatchment Area Name	Pre-development catchment area (m^2)	Mature Forest (m^2)	Pasture and Shrub (m^2)	Moderately Rooted Crop (m^2)	Landscaped (m^2)	Impervious Surface (m^2)
W1	13,402	0	5,161	4,003	1,881	2,357
W2	50,784	0	26,743	18,870	1,486	3,685

Subcatchment Area Name	Pre-development catchment area (m^2)	Mature Forest (m^2)	Pasture and Shrub (m^2)	Moderately Rooted Crop (m^2)	Landscaped (m^2)	Impervious Surface (m^2)
W3	225,600	0	35,599	163,350	21,470	5,181
W4	62,040	0	8,313	52,371	0	1,356
W5	74,225	0	19,471	50,398	3,331	1,025
W6	47,447	0	16,702	27,448	1,989	1,307

6.4.2 Proposed Development

It is expected that the proposed plans for development will result in a decrease in the total catchment area size for Wetlands 1 to 6 during the post-development conditions. In order to understand the effects of the reduced catchment area and evaluate the magnitude of actual hydrological changes, a wetland water balance is currently being completed by Urbantech, which includes the use of a continuous model. A pre-construction wetland monitoring program by **DS** is currently underway and will be ongoing for a minimum of a 1-year period to establish baseline conditions throughout the hydroperiods for Wetlands 1 to 6. The results of the baseline wetland monitoring will be used in combination with the continuous modeling to assess the actual risk to the wetlands. Based on the findings of the water balance results, a wetland mitigation plan will be developed.

7.0 CONSTRUCTION DEWATERING

Based on the preliminary designs, the proposed plans for development will consist of low-rise and mid-rise residential blocks, commercial and institutional zones, storm water management (SWM) ponds and greenspace. The development will also include the construction of roadways and associated storm, sanitary sewer and water distribution infrastructure. Given that the detailed design of the proposed plans for development is not currently finalized, it is assumed that the proposed residential blocks will comprise of one (1) to two (2) level of underground basement and/or parking. Further, the institutional and mixed commercial use blocks and the GO station block will be constructed slab-on-grade.

Based on the findings of the subsurface drilling investigation, there are significant variations noted in the subsurface stratigraphic and groundwater conditions across the Site. The construction of the low-rise residential blocks and the site servicing will be dispersed across the Site area and therefore will encounter varying subsurface conditions at different locations of the Site. The following preliminary grading plans for the Site were provided to **DS** for review in estimating the requirements for groundwater control and dewatering during the construction period:

- *"Drawing No. 301 - Preliminary Grading Plan (1 of 4), Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)"*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458

- *"Drawing No. 302 - Preliminary Grading Plan (2 of 4), Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)"*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458
- *"Drawing No. 303 - Preliminary Grading Plan (3 of 4), Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)"*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458
- *"Drawing No. 304 - Preliminary Grading Plan (4 of 4), Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)"*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458
- *"Drawing No. 601 – Preliminary SWM Pond 1 Plan View and Sections, Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)"*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458
- *"Drawing No. 602 – Preliminary SWM Pond 2 Plan View and Sections, Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)"*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458

Based on the review of the proposed preliminary grading plans, it is understood that the site grades will generally range from approximately 280.0 masl in the northwestern corner to an approximate elevation of 262.2 masl in the southwest and 265.1 masl in the southeastern corner of the Site. For the purpose of assessing the requirements for groundwater control and dewatering during the construction period, a conceptual model of the Site has been prepared based on the proposed site grading and the worst-case subsurface conditions, which can be encountered during the trenching/excavation for the low-rise residential blocks and site servicing. Conceptual models for the mid-rise residential development and the two (2) storm water management ponds are prepared based on inference from nearby boreholes and monitoring wells in the locality of these proposed structures.

It is expected that the trenching and excavation earthwork during the construction period will extend below the groundwater table in certain areas of the Site and groundwater control and dewatering will be required to ensure the excavation area remains dry and safe. Generally, the excavations will be completed into the cohesive clayey silt till, however will extend into the underlying silty sand till / silt unit in certain locations. The site services trenching and the excavation for the storm water management pond in the southeastern corner of the Site has the potential to encounter modern alluvium deposits, which may provide higher flows of groundwater seepage. The geometric mean hydraulic conductivity for the overburden at the Site is estimated to be 2.0×10^{-7} m/sec.

The dewatering estimates also includes provision for controlling storm water in the excavation area from an incidental 2-year storm event. As per the Ministry of Transportation (MTO) Intensity-Distribution-Frequency (IDF) curves for the Town of Caledon, a 2-Year storm that is 2-hours in duration would result in a 13.5 mm/hr of rainfall intensity.

This section calculates the estimated dewatering required during the construction of the proposed residential buildings, private services, and SWM ponds.

7.1 Estimation of Flow Rate – Residential Blocks, Low-Rise Development

It is understood that the architectural designs for the proposed structures at the Site are not finalized at this time. For the purpose of assessing groundwater seepage rates during the construction period, the following assumptions were made:

- An excavation for one (1) residential block within the larger Site development will comprise of six (6) low-rise units. This will result in an excavation that will be approximately 60 m x 20 m in area for one block.

- The low-rise residential development will comprise of one (1) level of underground basement extending to approximately 2 m below ground surface. The excavation will extend an additional 0.5 m below the finished floor basement slab for the foundation. On this basis, the base of excavation for each low-rise residential block will be advanced to 2.5 m below ground surface.

As previously indicated, the excavations for the proposed residential blocks will be dispersed across the Site area and therefore will encounter varying subsurface conditions at different locations of the Site. Generally, it is expected that the excavations for the low-rise residential blocks will be completed above the groundwater table and construction dewatering/control will be minimal for the majority of the Site, and particularly during the summer period. To assess the requirements for groundwater control and dewatering during the construction period, a conceptual site model was prepared assuming the worst-case scenario with respect to the depth of excavation below the ground water table at the Site. Based on the proposed preliminary grading plan, it is anticipated that these conditions will likely be present in the central portion of the Site. For the purpose of estimating the requirements for groundwater control and dewatering during the construction period, the groundwater table in the conceptual site model was set to Elev. 269.7 masl (BH20-9, August 6, 2020). The elevation at the base of excavation will be Elev. 267.8 masl. On this basis, the excavation will be advanced to a depth of 1.9 m below the ground surface. There will be a requirement to lower the groundwater table to an elevation of 0.5 m below the base of excavation.

The groundwater seepage volume in the excavation is estimated using the Dupuit-Forcheimer analytical model for flow into a linear trench from a system of wells of equivalent radius under unconfined groundwater conditions. The anticipated groundwater seepage rates are estimated to be on the order of 19,702 L/day. An incidental 2-year storm event will result in a total of 32,400 L of water to be removed from the excavation. The total **unit** dewatering rate during the construction period for **one (1) residential low-rise block** development at the Site is estimated to be **62,000 L per day**, which includes a 50% safety factor on the anticipated rates and the contribution from an incidental precipitation event.

The maximum predicted theoretical radius of influence is estimated to be 1.2 m from the edge of the excavation.

It is understood that the provided site grading plans are currently preliminary and are subject to changes in the future. Should there be any changes to the proposed site grading and/or deviation from any assumptions made above, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

7.2 Estimation of Flow Rate – Residential Blocks, Mid-Rise Development

The proposed development will envisage the construction of mid-rise residential blocks in the east-central portion of the Site adjacent to the GO Station block. For the purpose of assessing groundwater seepage rates during the construction period, the following assumptions were made:

- An excavation for one (1) mid-rise residential block within the larger Site development will be approximately 60 m x 20 m in area for one block; and,

- The mid-rise residential development will comprise of two (2) levels of underground basements extending to approximately 6 m below ground surface. The excavation will extend an additional 1.2 m below the lowest finished floor basement slab for the foundation. On this basis, the base of excavation for each mid-rise residential block will be advanced to 7.2 m (Elev. 262.3 masl) below ground surface.

Monitoring Wells BH20-10, BH20-11, BH20-14 and BH20-15 are located in close proximity to the proposed mid-rise residential blocks and are considered for estimating the requirements for construction dewatering/control. The highest groundwater level measured in the east-central portion of the Site is at Elev. 264.8 masl (BH20-11). On this basis, the excavation for the mid-rise residential development will extend approximately 2.5 m below the groundwater table. For this reason, groundwater control and dewatering during the construction period will be required to maintain a dry and safe excavation. There will be a requirement to lower the groundwater table to an elevation of 0.5 m below the base of excavation.

The groundwater seepage volume in the excavation is estimated using the Dupuit-Forcheimer analytical model for flow into a linear trench from a system of wells of an equivalent radius under unconfined groundwater conditions. The anticipated groundwater seepage rate is estimated to be on the order of 46,703 L/day. An incidental 2-year storm event will result in a total of 32,400 L of water to be removed from the excavation. The total **unit** dewatering rate during the construction period for **one (1) residential mid-rise block** is estimated to be on the order of **102,500 L per day**, which includes a 50% safety factor on the anticipated rates and contribution from an incidental 2-year precipitation event.

The predicted theoretical radius of influence is estimated to range from 2.5 m from the edge of the excavation.

It is understood that the provided site grading plans are currently preliminary and are subject to changes in the future. Should there be any changes to the proposed site grading and/or deviation from any assumptions made above, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

7.3 Estimation of Flow Rate – Site Servicing

It is understood that the site servicing plans for the proposed development at the Site are not finalized at this stage. For the purpose of assessing groundwater seepage rates during the construction period, the following assumptions were made:

- The trenching for the site servicing will be completed in segments of 30 m x 2 m per day; and
- The lowest invert level of the proposed trunk sewer and local servicing infrastructure will be limited to a depth of 4 m bgs.

As previously indicated, the trenching for the proposed site servicing will be dispersed across the Site area and therefore will encounter varying subsurface conditions at different locations of the Site. Generally, it is expected that the excavations for the site servicing will be completed above the groundwater table and construction dewatering/control will typically be minimal for the majority of the Site, and particularly during the summer period. To assess the requirements for groundwater control and dewatering during the construction period, a conceptual site model was prepared assuming the worst-case scenario with respect to the depth of excavation below the ground water table at the Site. Based on the proposed preliminary grading plan, it is anticipated that these conditions will likely be present in the central portion of the Site. For the purpose of estimating the requirements for groundwater control and dewatering during the construction period, the groundwater table in the conceptual site model was set to Elev. 269.7 masl (BH20-9, August 6, 2020). The elevation at the base of excavation will be Elev. 266.3 masl. On this basis, the excavation will be advanced to a depth of 3.4 m below the ground surface. There will be a requirement to lower the groundwater table to an elevation of 0.5 m below the base of the trench.

The groundwater seepage volume in the excavation is estimated using the Dupuit-Forcheimer analytical model for flow into a linear trench from a system of wells of an equivalent radius under unconfined groundwater conditions. The anticipated groundwater seepage rates are estimated to be on the order of 9,006 L/day. An incidental 2-year storm event will result in a total of 1,620 L of water to be removed from the trench. The total **unit** dewatering rate during the construction period for **one (1) trench segment** at the Site is estimated to be **15,500 L per day**, which includes a 50% safety factor on the anticipated rates and contributions from an incidental precipitation event.

The maximum predicted theoretical radius of influence is estimated to be 2 m from the edge of the excavation.

It should be noted that the presence of modern alluvium deposits present in the southeastern corner of the Site has the potential to provide higher than anticipated groundwater flows into the trenching/excavation for the site servicing. It is understood that the provided site grading plans are currently preliminary and are subject to changes in the future. Furthermore, the detailed design of the proposed site servicing has not been finalized at this stage. During the detailed design stage, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

7.4 Estimation of Flow Rate – Storm Water Management Ponds

The proposed plans for development will include two storm water management (SWM) ponds; one in the south-central portion of the Site (SWM Pond 1) and one in the southeast corner (SWM Pond 2). A discussion on the hydrogeological conditions and potential requirements for construction dewatering/control for each SWM pond is discussed below:

Storm Water Management (SWM) Pond 1

Monitoring Well BH20-12 is located within the footprint of the proposed SWM Pond 1. Based on the preliminary grading and storm water management plans provided to **DS** for review, it is understood that the lowest point of the excavation for the proposed SWM Pond 1 will be advanced to an elevation of Elev. 260.5 masl into the silty sand till / silt unit. Monitoring of BH20-12 indicates that the silty sand till / silt unit in this area of the Site is under pressurized hydrostatic conditions with potentiometric levels during the late summer and fall of 2020 to range from 0.1 m (Elev. 264.8 masl) to 0.2 m (Elev. 264.7 masl) below the existing ground surface.

It is expected that during the spring wet season, the potentiometric level of the underlying silty sand till / silt may observe a further rise. Assuming a 0.5 m rise in the potentiometric levels, the groundwater level at the location of SWM Pond 1 could be as high as 0.4 m (265.3 masl) above the existing ground surface. On this basis, the base of excavation would extend approximately 4.8 m below the highest assumed potentiometric surface of the underlying silty sand till / silt unit. There will be a requirement to lower the potentiometric level to an elevation of 0.5 m below the base of excavation during the construction period to maintain a stable and dry excavation. During periods of high groundwater tables, the total volume of groundwater into the excavation is estimated to be on the order of **205,000 L/day**. During periods of low groundwater tables, the total volume of groundwater into the excavation is estimated to be reduced to **202,000 L/day**. The above estimates both include a 50% safety factor on the anticipated volumes.

The maximum predicted theoretical radius of influence is estimated to be 16 m from the edge of the excavation or 126 m from the center of excavation.

It should be noted that the above calculations do not include provisions for controlling storm water from an incidental precipitation event during the construction period. Assuming an incidental 2-year storm event, 904,203 L of water could pool within the area of the proposed SWM Pond 1. It is understood that the pooled storm water would be pumped at a controlled rate over a period of a few weeks to ensure that the daily dewatering rates are within the limits of the approved water taking and discharging permits. Furthermore, the high potentiometric surface of 0.4 m (265.3 masl) above the existing ground surface was estimated at this stage for the purpose of assessing the approximate requirements for construction dewatering and control for the proposed SWM Pond 1. It should be noted that groundwater monitoring data for the spring period is not yet available and will need to be confirmed as part of the ongoing long-term groundwater monitoring program at the Site. The above estimates may need to be revised if the seasonal high groundwater levels or the final design of the storm water management pond differ from the assumptions made above.

The SWM pond must be constructed with a clay liner to prevent seepage of stormwater into the underlying groundwater regime. The existing silty clay till layer at the location of SWM Pond 1 extends to an approximate depth of 3.0 m (Elev. 261.9 masl) below existing grade or 1.4 m above the proposed base of the SWM Pond 1. The existing silty clay till must be tested for acceptability as a clay liner during construction. The safe excavation depth (SED) for the SWM Pond is estimated to be 2.5 m to 4 m.

It is understood that the provided site grading and storm water management plans are currently preliminary and are subject to changes in the future. Should there be any changes to the proposed plans and/or any deviations to the assumptions made above, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

It is recommended that further subsurface investigation be completed within the footprint of the proposed SWM Pond to characterize the local soil and groundwater conditions and to confirm the above dewatering estimates.

Storm Water Management (SWM) Pond 2

Monitoring Well BH20-14, BH20-16 and Borehole BH20-13 are located in close proximity of the proposed SWM Pond 2 footprint. Based on the preliminary grading and storm water management plans provided to **DS** for review, it is understood that the lowest point of the excavation for the proposed SWM Pond 2 will be advanced to an elevation of Elev. 260.5 masl into the silty clay till. Based on monitoring of groundwater levels from BH20-14 and BH20-16, the highest groundwater levels in the silty clay till during the late summer and fall of 2020 was measured at elevation Elev. 264.3 masl.

It is expected that during the spring wet season, the groundwater level in the silty clay till may rise further. Assuming a 0.5 m fluctuation, the groundwater level at the location of SWM Pond 2 could be as high as elevation Elev. 264.8 masl. On this basis, the base of excavation would extend approximately 4.3 m below the assumed seasonal high groundwater level of silty clay till. There will be a requirement to lower the groundwater level to an elevation of 0.5 m below the base of excavation during the construction period to maintain a safe and dry excavation. During periods of high groundwater tables, the total volume of groundwater into the excavation is estimated to be on the order of **230,500 L/day**. During periods of low groundwater tables, the total volume of groundwater into the excavation is estimated to be reduced to **218,000 L/day**. The above estimates both include a 50% safety factor on the anticipated volumes.

The maximum predicted theoretical radius of influence is estimated to be 16 m from the edge of the excavation.

It should be noted that the above calculations do not include provisions for controlling storm water from an incidental precipitation event during the construction period. Assuming an incidental 2-year storm event, 1,112,643 L of water could pool within the area of the proposed SWM Pond 2. It is understood that the pooled storm water would be pumped at a controlled rate over a period of a few weeks to ensure that the daily dewatering rates are within the limits of the approved water taking permit. Furthermore, the assumed high groundwater table of elevation Elev. 264.8 masl was estimated at this stage for the purpose of assessing the approximate requirements for construction dewatering and control for the proposed SWM Pond 2. It should be noted that groundwater monitoring data for the spring period is not yet available and will need to be confirmed as part of the ongoing long-term groundwater monitoring program at the Site.

The SWM pond must be constructed with a clay liner to prevent seepage of stormwater into the underlying groundwater regime. The existing silty clay till layer at the location of SWM Pond 2 extends to an approximate depth of 7.5 m (Elev. 260.6 masl) below existing grade or 0.1 m above the proposed base of

the SWM Pond 2. The existing silty clay till must be tested for acceptability as a clay liner during construction. The safe excavation depth (SED) for the SWM Pond is estimated to be 3.0 m to 4.5 m.

It should be noted that the provided site grading and storm water management plan are preliminary and subject to changes in the future. For this reason, the above requirements for groundwater control and dewatering during the construction period will need to be revisited if the finalized site grading and stormwater management pond design are revised during the detailed design stage or if the seasonal high groundwater level differs from the assumptions made above.

It is recommended that further subsurface investigation be completed within the footprint of the proposed SWM Pond to characterize the local soil and groundwater conditions and to confirm the above dewatering estimates.

7.5 Permanent Drainage (Long-term Discharge)

It is expected that the proposed mid-rise residential structures will comprise of underground basements/parking levels that will extend below the groundwater table at the Site. For this reason, control of permanent drainage within these structures will likely be required. It is understood that the proposed architectural and mechanical engineering design for the proposed mid-rise residential structures has not been finalized at this stage.

For the purpose of assessing permanent flows into the private water drainage system, the following design considerations relative to each type of structure and groundwater conditions are assumed:

- Monitoring Wells BH20-11, BH20-14, BH20-15 and Borehole BH20-10 are located in close proximity to the mid-rise residential blocks and are considered for estimating the construction dewatering/control requirements. The highest groundwater level measured in the east-central portion of the Site is at Elev. 264.8 masl (BH20-11).

- The mid-rise residential structures will comprise of two (2) levels of underground basement/parking (P2). The finished floor elevation (FFE) of the P2 level will extend to a depth of approximately 6 m (Elev. 263.5 masl) below ground surface. The sub-drains will be installed to a depth of approximately 0.3 m (~ 1 ft.) below P2 FFE slab to an approximate elevation of 263.2 masl. On this basis, the sub-drains will be situated approximately 1.6 m below the groundwater table and will be completed into the clayey silt till, however may extend into the silty sand till / silt unit in some areas.

The total flows into the permanent drainage system of the mid-rise residential structure during the long-term is estimated to be on the order of **55,000 L** of water to be removed over a 1-day period and includes a 50% safety factor on the anticipated permanent drainage flows.

It is understood that the low-rise residential block will include one (1) level of underground basement, which will likely be constructed above the water table and with a water-proofing membrane. A perimeter drainage system will be installed, however all collected percolating stormwater will be discharged to landscaped/vegetated areas of individual residential lots. Further, the institutional and commercial zones

will be constructed slab-on-grade. For this reason, all low-rise residential blocks, institutional and commercial zones are not anticipated to require any permanent groundwater drainage control.

Given that the detailed design for the proposed plans for development were not finalized at this stage, various assumptions were made to assess the requirements for groundwater control and dewatering during the post-construction period. During the detailed design stage, if the assumptions made therein Section 6.0 of this report deviate from the finalized developmental designs, then **DS** should be consulted to revise the estimated groundwater seepage rates and permitting requirements.

7.6 Permit Requirements

7.6.1 Environmental Activity and Sector Registry (EASR) /Permit to Take Water (PTTW) Application

An Environmental Activity Sector Registration (EASR) Posting is required to be submitted to the Ministry of the Environment, Conservation and Parks (MECP) if the taking of groundwater and stormwater for a temporary construction project is between 50,000 L/day and 400,000 L/ day. The EASR application is an online registry and should be submitted to the MECP before commencing any construction dewatering operations. A PTTW is required to be submitted to the MECP if the taking of groundwater and stormwater for a temporary construction project is greater than 400,000 L/ day.

During the construction period, the requirements to obtain any water taking permitting (EASR/PTTW) will depend on the ownership structure of the Site and the staging for development. The estimates for groundwater control and dewatering provided in Section 7.1 through 7.4 of this report should be made use of each individual land parcel that comprise of the larger subject Site. It is anticipated that an EASR Posting will likely be required, however if the construction dewatering rates exceed 400 m^3 on any given day, a PTTW Registration with the MECP will be required.

During the post-construction period, the anticipated permanent drainage flows are anticipated to be about 55,000 L/day for a mid-rise residential block. Given that the estimated permanent drainage flows are expected to be greater than the MECP threshold of 50,000 L/day, a long-term PTTW will be required in support of permanent groundwater control for the mid-rise residential blocks should design details corroborate the assumptions made in this assessment.

7.6.2 Discharge Permits (Construction Dewatering and Permanent Drainage)

The Site is located within the Humber River watershed, which is located within the regulatory jurisdiction of the Toronto and Region Conservation Authority (TRCA). A discharge permit may be required from the TRCA, Peel Region and/or Town of Caledon if the water is to be discharged to a nearby/on-site surface water feature during the construction period. A discharge and monitoring plan will need to be prepared prior to obtaining a discharge approval from the TRCA, Peel Region and/or Town of Caledon.

If the private water during the post-construction period is anticipated to be discharged into the proposed municipal sewer system, a sewer discharge agreement with the Town of Caledon and/or Regional Municipality of Peel will be required prior to any discharging operations.

8.0 POTENTIAL IMPACTS

The following are the predicted potential impacts as a result of construction dewatering:

8.1 Local Groundwater Use

Based on the MECP WWRs, there are numerous well records listed within the boundary of the Site and the immediately adjacent area. The wells located within the Site boundary are expected to be decommissioned prior to commencing construction works for the proposed development. The predicted radius of influence from the dewatering activities is estimated to range from 1.2 m to 16.0 m from the edge of excavation. The majority of water supply wells in the area are noted to be installed at deeper depths. Given that the proposed construction is anticipated to extend to approximately 2.5 m to 7.6 m below existing ground surface, and the resulting radius of influence from the dewatering activities will be kept minimal, short and long-term impacts to private wells in the area during the construction period is not considered to be likely.

It is understood that the detailed design of the proposed plans for development have not been finalized at this stage. These specific details include, among other items, the maximum depth of excavation/trenching required in support of the proposed development, servicing and storm water management ponds. At this stage, the above-defined assumptions were considered in this assessment with regards to the deepest anticipated depth of excavation. It should be noted that if at the detailed design stage, the above assumptions do not hold true, then this assessment will need to be revisited based on the finalized design details.

8.2 Surface Water Features

Based on the proposed plans for development at the Site, the following may have the potential for impacts to natural surface water features:

(i) Groundwater control and dewatering operations during the construction period;
(ii) Reduction of groundwater recharge and possibly groundwater contributions to surface water features as a result of impervious surfaces following construction; and,
(iii) Reduction of runoff available to natural features as a result of changes to Site drainage.

A discussion on the potential for impacts (i to iii above) are provided below.

Groundwater Control and Dewatering:

All dewatering activities for the proposed development adjacent to the existing onsite wetlands have the potential to interfere and lower the groundwater table within the wetland features. During the construction period, monitoring of the wetlands must be continued to ensure the groundwater levels and surface water flows in the headwater drainage features are not being lowered. At this stage, pre-construction monitoring for a period of 1-year has not been completed and baseline conditions in the wetlands have yet to be established. On the onset of completing the pre-construction monitoring, **DS** will prepare a contingency

plan, which will outline pre-defined *"review"* and "*response*" levels for all surface water stations in the wetlands, where impacts to the surface water features will have become apparent and mitigative measures as well as more frequent monitoring will need to be initiated promptly. Further preliminary details on the contingency plan are discussed in Section 8.0.

Pumped water from temporary construction dewatering activities should be managed to avoid direct discharge of potentially impacted water into sensitive features such as the wetland. To manage the potential risks to surface water quality, a discharge plan should be developed for proper discharge of private water during the construction period.

Reduction in Groundwater Recharge:

As discussed in Section 4.3.5, there are eight (8) wetlands at the Site. Wetlands W7 and W8 are being relocated with existing upgradient (offsite) contributions proposed to be redirected toward the new features. An adaptive management program for the newly constructed features will be required to ensure there is adequate contribution. For wetlands W1 to W6, a long-term pre-construction surface water and groundwater monitoring program is currently underway. Monitoring during the current period indicates that most wetlands are ephemeral surface water features, with minimal to some to response to precipitation events. Upward shallow groundwater gradient at wetland W3 is noted, however further monitoring will be required to establish seasonal baseline conditions and to confirm surface water and groundwater interaction dynamics for each of the wetlands.

There is a potential that groundwater levels may rise during the spring period and provide contribution to seasonal baseflow of the wetlands. A reduction in recharge over the Site as a result of the development may result in a lowering of the water table and thus a reduction in groundwater contribution. The water balance completed for the Site shows there is a total Site infiltration deficit of 111,450 m^3/yr. To prevent risk to the wetlands which may rely on contribution from groundwater, the post-development infiltration deficit should be reduced / eliminated through the designing and implementation of appropriate Low Impact Development (LID) servicing for storm water management at the Site. LID's which target areas surrounding upgradient portions of wetlands W1 through W6 would help maintain groundwater gradients toward the features without necessarily requiring a complete elimination of the infiltration deficit over the entire Site.

Reduction in Runoff Contribution:

Results of the wetland water balance shows there is reduced runoff within upgradient wetland catchments which is considered contribution for each of the wetlands W1 to W6. It is anticipated that the runoff deficits can be managed by introducing LIDs which collect and convey clean sources of runoff from residential lots. The system can outlet to infiltration trenches constructed around the wetland buffer to maintain groundwater gradients toward each of the wetland units. Runoff contribution can be maintained by sizing the trenches to allow larger precipitation/melt events to overflow to constructed outlets along the natural wetland inlets. Infiltration and runoff targets should be assessed using a continuous surface water model to compare changes in wetland storage for pre-development, post-development and post-development

with mitigation conditions. It is anticipated that there is enough surplus and sufficient infiltration potential available in native soils based on in-situ infiltration testing results.

Discharged water from storm sewer outfalls should be designed to avoid direct discharge into the wetland where possible. Results of the wetland risk assessment (TRCA, Nov 2017) indicates that since the impervious cover was calculated to be under 15% of the total wetland catchment, that stormwater generated over the proposed development currently contributing to wetlands presently includes a low risk. should an outfall be considered with a direct discharge to the wetland, the risk to the wetland should be revaluated.

8.3 Point of Discharge and Groundwater Quality

A discharge plan will be required for the discharge of pumped groundwater from construction dewatering activities. The plan must identify the discharge location and ensure the discharge will not result in any adverse impacts by identifying the discharge measures to be installed and control measures to limit the turbidity of the discharge water.

Discharged water from temporary construction dewatering activities should be managed to avoid direct discharge of potentially impacted water into sensitive features such as the wetland. To manage the potential risks to surface water quality, a discharge plan should be developed for the discharge of pumped groundwater from the construction dewatering.

The results of the groundwater analytical testing indicate the quality of groundwater exceeded the Provincial Water Quality Objective (PWQO) for total cobalt. Therefore, pre-treatment of the pumped construction water will be required prior to discharging into any surface water bodies. Exceedances of metals can generally be treated through the use of a primarily filtration. The design and effectiveness of the pre-treatment system will be the responsibility of the pre-treatment system contractor. The quality of the discharge water must meet the guideline limits of the PWQO prior to discharging into any surface water features. If the pumped water is to be discharged into a surface water body, a monitoring plan will need to be prepared and submitted to the Toronto and Region Conservation Authority (TRCA), Peel Region and/or the Town of Caledon to obtain approval for a discharge permit.

8.4 Well Decommissioning

Following the completion of construction activities, all dewatering wells, well points, eductors, and monitoring wells installed at various stages of this project must be decommissioned. The installation and eventual decommissioning of the wells and the dewatering system must be carried out by a licenced water well contractor in accordance with Regulation 903 of the Ontario Water Resources Act.

9.0 MONITORING AND MITIGATION

Based on the hydrogeological investigation, **Table 13** below provides a recommended monitoring program, triggers for mitigation and recommended mitigation measures for groundwater levels and the discharge of water during construction.

Table 13: Monitoring and Mitigation Plan

PERIOD	MONITORING LOCATION	MONITORING FREQUENCY	METHOD	TRIGGERS FOR MITIGATION	COMMENTS / RECOMENDATIONS
WATER LEVELS					
Pre-Construction	Groundwater level monitoring (available on-site monitoring wells)	Continuously for one week	Dataloggers within the existing wells	None	Complete hydrographs to document baseline water levels
	Existing surface water stations (including staff gauages and nested piezometers)	Continuously for one week	Dataloggers within the existing staff gauges and manual measurements in nested piezometer	None	Complete hydrograph to document baseline water levels
During construction	Existing monitoring wells or replacements adjacent to dewatering area	Daily until target water level is reached	Dataloggers with weekly downloads	Target drawdown not reached or exceeded	Increased / reduced pumping; if pumping is approaching 400 m^3/day, a PTTW will be required
	Discharge volume	Daily at discharge location	Manual with totalizing flow meter in-line	Flow exceeds predicted volumes	Reduce to maximum allowed or obtain a PTTW
	Existing surface water stations (including staff gauages and nested piezometers)	Continuously until pre-defined *review* and/or *response* trigger levels are reached	Dataloggers and manual monitoring with weekly downloads	Drawdown of groundwater levels in wetlands to pre-defined *review* and/or *response* levels	The *review* and *response* levels will be finalized upon completion of the 1-year pre-construction monitoring
	Groundwater Contribution to Wetland (if any)	Continuously until pre-defined *review* and/or *response* trigger levels are reached	Dataloggers and manual monitoring with weekly downloads	Drawdown of surface water flows in wetlands below pre-defined *review* and/or *response* levels	The *review* and *response* levels will be finalized upon completion of the 1-year pre-construction monitoring
Post-Construction	Existing monitoring wells or replacements adjacent to dewatering area	Weekly for one month or until water levels reach 90% of original static level	Datalogger water level monitoring with weekly downloads	NA	NA
	Existing surface water stations (including staff gauages and nested piezometers)	Weekly for one month or until water levels reach 90% of original static level	Datalogger water level monitoring with weekly downloads	N/A	N/A

PERIOD	MONITORING LOCATION	MONITORING FREQUENCY	METHOD	TRIGGERS FOR MITIGATION	COMMENTS / RECOMENDATIONS
WATER QUALITY					
During construction (discharge to surface water feature)	Groundwater Discharge from dewatering	Sample for parameters against the PWQO criteria Field monitoring for turbidity and correlation with lab results	Once the start of dewatering at the point of discharge Weekly from the dewatering system for the first month of active dewatering Assuming water quality is compliant, monthly for the remainder of the dewatering period.	Discharge quality exceeds the PWQO criteria Field TSS/Turbidity exceed the PWQO criteria	More frequent monitoring will be considered Enhanced treatment of the discharge water will be considered, if needed
During Construction (surface water quality in wetlands)	Surface water flows at each surface water station	Sample for parameters against the PWQO criteria Field monitoring for turbidity and correlation with lab results	Sampling to be completed during construction monitoring on a monthly basis, until trigger level is reached	Exceedance in background turbidity concentration in water quality by more than 20 NTU or total suspended solids concentration above 25 mg/L	Conduct a site visit with the contractor; revisit the effectiveness of the pre-treatment system with the contractor and property owner to potentially alter construction phasing/methodology plan; revisit surface runoff at the Site and sediment and erosion control measures; and assess the need for clean up of the HDFs to minimize sediment transport

10.0 LIMITATIONS

This report was prepared for the sole use of the addressee to provide an assessment of the hydrogeological conditions on the property. The information presented in this report is based on information collected during the completion of the hydrogeological investigation. DS Consultants Limited was required to use and rely upon various information sources produced by other parties. The information provided in this report reflects DS' judgment in light of the information available at the time of report preparation. This report may not be relied upon by any other person or entity without the written authorization of DS Consultants Ltd. The scope of services performed in the execution of this investigation may not be appropriate to satisfy the needs of other users, and any use or reuse of this document or findings,

conclusions, and recommendations represented herein, is at the sole risk of said users. The conclusions drawn from the Hydrogeological report were based on information at selected observation and sampling locations. Different conditions between and beyond these locations may become apparent during future investigations or on-site work, which could not be detected or anticipated at the time of this investigation. DS Consultants Ltd. cannot be held responsible for hydrogeological conditions at the site that was not apparent from the available information.

Should you have any questions regarding these findings, please do not hesitate to contact the undersigned.

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Tables

Macville Community (Option 3) Secondary Plan, Bolton ON
Hydrogoelogical Investigation
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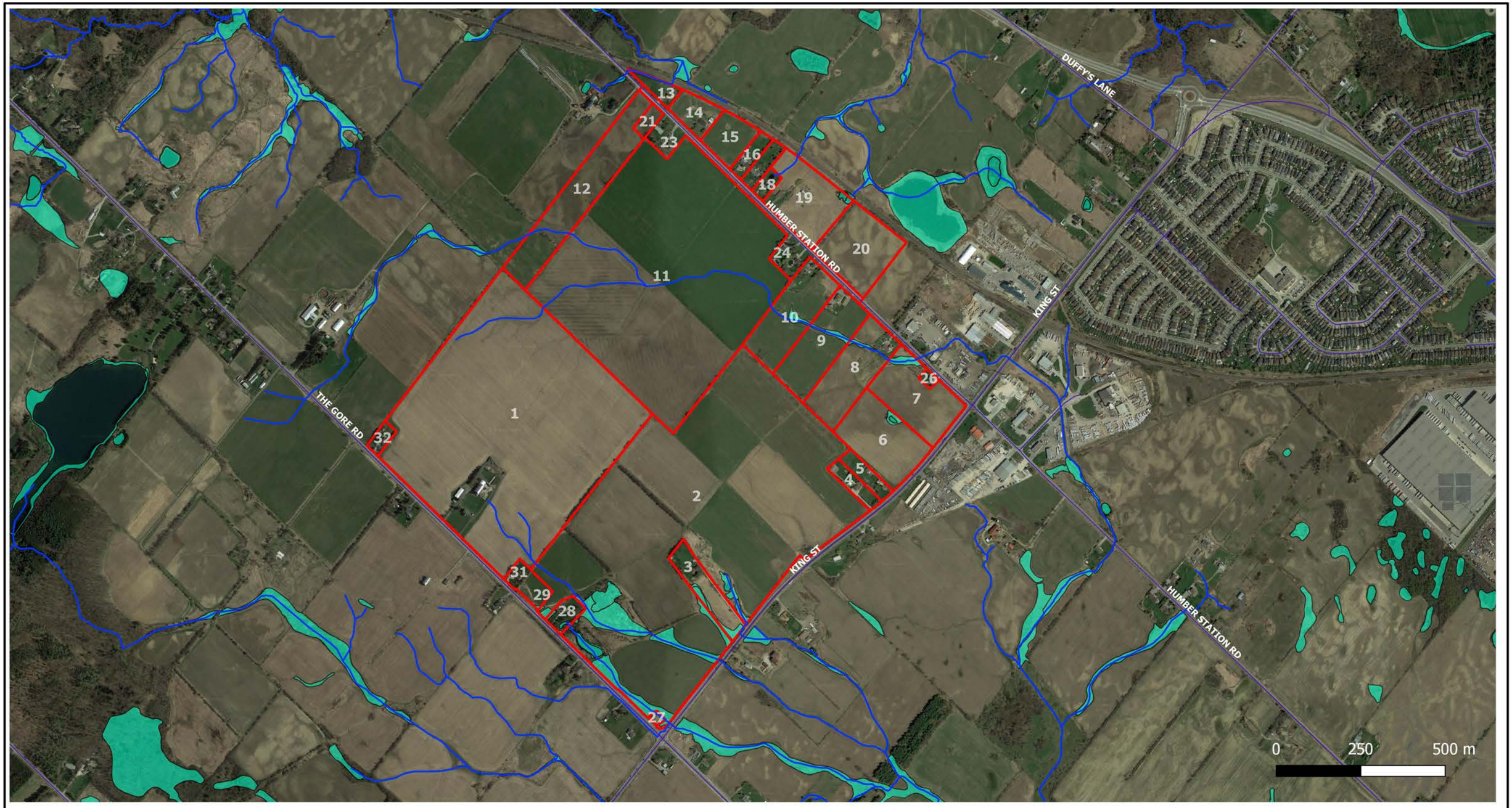
Staff Gauges (SGs)							
SG ID	Top of Pipe Elevation (masl)	Depth (mbtop)	Ground Elev. (masl)	September 8, 2020		October 22, 2020	
				Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)
SG W2-1	262.62	1.35	261.27	1.25	261.37	1.35	261.27
SG W3-1	271.937	1.23	270.707	DRY		DRY	
SG W4-1	262.408	1.41	260.998	DRY		DRY	
SG W5-1	262.383	1.29	261.093	DRY		1.29	261.093
SG-W7-1	261.3	1.13	-	DRY		DRY	
SG W7-2	270.853	1.445	269.408	DRY		DRY	
SG W8-1	264.784	1.47	263.314	1.41	263.374	DRY	
Culvert	263.61	-	262.96	1.73	261.88	1.73	261.88

Piezometers (PZs)								
Piezometer Location	Top of Pipe Elevation (masl)	Depth (top of pipe)	Stick-up (m)	Surface Elev. (masl)	September 8, 2020		October 22, 2020	
					Depth to Water (mbtop)	Depth to Water (masl)	Depth to Water (mbtop)	Depth to Water (masl)
W2-PZS	262.22	1.73	0.68	261.54	0.75	261.47	0.84	261.38
W2-PZD	262.38	2.92	0.90	261.48	0.95	261.43	1.03	261.35
W3-PZ2S	271.68	1.77	0.81	270.87	1.62	270.06	1.31	270.37
W3-PZ2D	271.77	2.65	0.78	270.99	1.51	270.26	1.32	270.45
W4-PZ1S	262.17	1.49	0.86	261.31	1.27	260.90	DRY	
W4-PZ1D	261.89	2.35	0.74	261.15	1.19	260.70	2.18	259.71
W5-PZS	262.17	1.71	0.90	261.27	1.06	261.11	1.09	261.08
W5-PZD	261.89	2.51	0.67	261.22	0.80	261.09	1.97	259.92
W7-PZS	271.50	1.63	0.53	-	DRY		DRY	
W7-PZD	271.50	2.37	0.56	-	DRY		2.23	269.27
W8-PZS	264.34	1.59	0.75	263.59	0.98	263.36	DRY	
W8-PZD	264.39	2.48	0.83	263.56	1.00	263.39	2.21	262.18
HD-F2 PZS	270.21	1.82	0.65	269.56	DRY		DRY	
HD-F2 PZD	270.25	3.29	0.75	269.50	2.18	268.07	2.11	268.14

Monitoring Wells (MWs)									
MW ID	Surface Elevation (masl)	Depth (mbgs)	Stick-Up (m)	August 6, 2020		September 8, 2020		October 22, 2020	
				Depth to Water (mbtop)	Depth to Water (masl)	Depth to Water (mbtop)	Depth to Water (masl)	Depth to Water (mbtop)	Depth to Water (masl)
BH20-1	279.83	6.92	0.96	5.07	275.72	5.20	275.59	5.47	275.32
BH20-2	278.80	7.20	0.94	7.06	272.68	7.30	272.44	7.42	272.32
BH20-3	278.55	6.20	0.95	6.94	272.56	DRY		DRY	
BH20-4	277.07	5.54	0.85	4.62	273.30	4.75	273.17	NOT ACCESSIBLE	
BH20-5	273.07	9.33	0.97	3.75	270.29	4.06	269.98	4.35	269.69
BH20-6	270.95	7.64	0.86	7.63	264.18	2.01	269.80	NOT ACCESSIBLE	
BH20-7	261.71	7.65	1.08	DRY		7.60	255.19	4.48	258.31
BH20-9	274.11	7.37	0.88	5.31	269.68	5.60	269.39	5.85	269.14
BH20-11	270.10	9.07	1.00	6.42	264.68	6.37	264.73	6.33	264.77
BH20-12	264.94	4.60	0.77	0.97	264.74	0.87	264.84	0.91	264.80
BH20-14	267.65	11.04	0.88	4.20	264.33	4.31	264.22	4.47	264.06
BH20-15	264.14	9.38	0.95	3.36	261.73	3.28	261.81	3.36	261.73
BH20-16	265.54	7.79	0.88	3.00	263.42	3.15	263.27	3.37	263.05

Figures



Legend

- Watercourse
- Wetland Areas
- Site Boundary
- Owner Parcels

Numbering Indicates Owners

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **Site Location Plan**

Client: Option 3 Landowners Group

Size:	Approved By:	S.W	Drawn By:	M.Z	Date:	December 2020
11x17	Scale:	As Shown	Project No.:	20-169-100	Figure No.:	1
Rev. 0	Image/Map Source: *Google Satellite Image*					

F:\August 27,2020\Site Location Plan.qgs

Guelph Drumlin Field

Oak Ridges Moraine

South Slope

Niagara Escarpment

Peel Plain

0 2.5 5 km

orseshoe Moraines

Legend

- Roads
- Site Boundary
- Guelph Drumlin Field
- Niagara Escarpment
- Oak Ridges Moraine
- Peel Plain
- South Slope

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

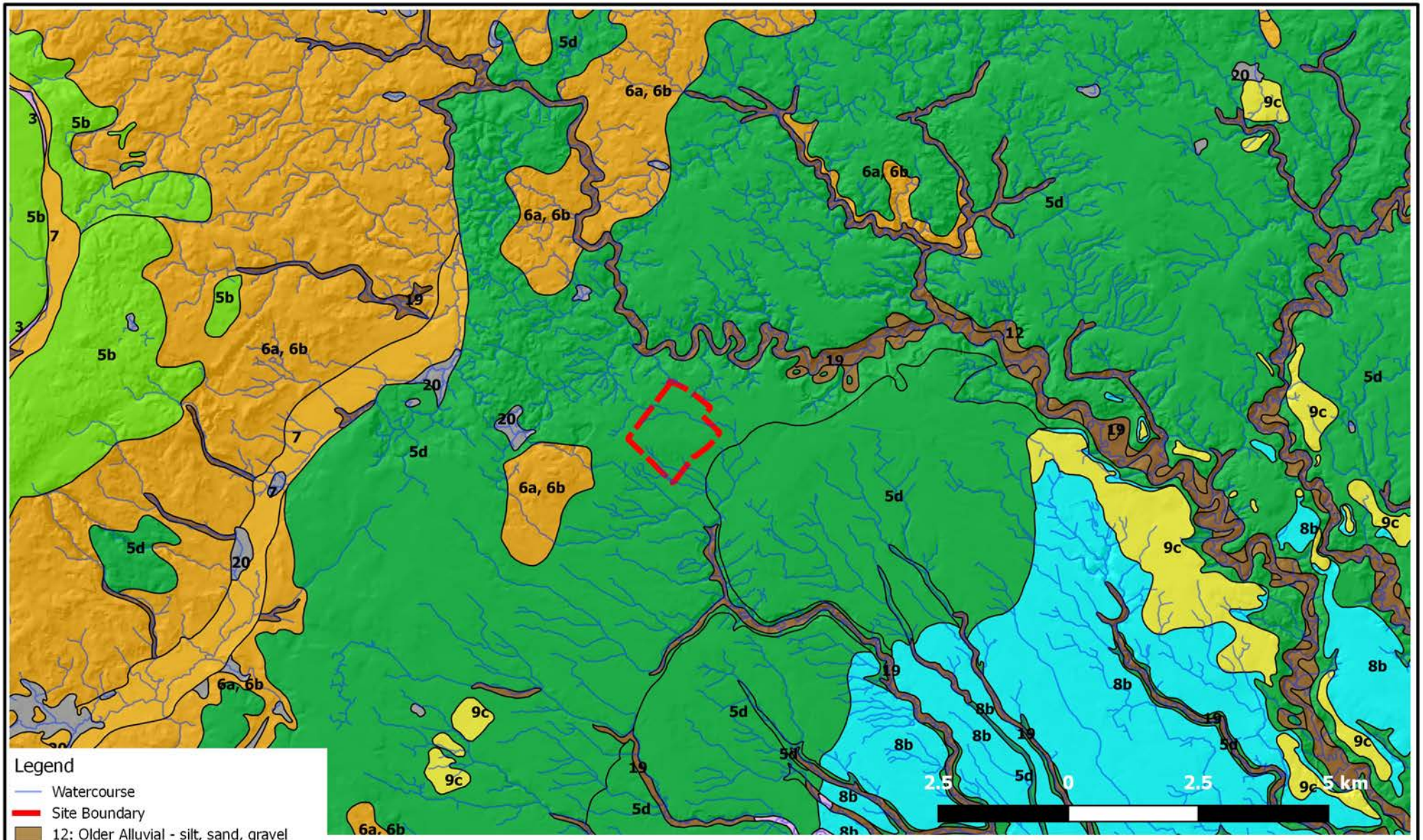
Title: **Regional Physiography Map**

Client: Option 3 Landowners Group

Size:	Approved By: S.W	Drawn By: M.Z	Date: December 2020
11x17	Scale: As Shown	Project No.: 20-169-100	Figure No.: **2A**
Rev. 0	Image/Map Source: *Google Satellite Image*		

F:\August 27,2020\Regional Physiography Map.qgs

F:\August 27,2020\surfgeo map.qgs



Legend

- Watercourse
- Site Boundary
- 12: Older Alluvial - silt, sand, gravel
- 19: Modern Alluvial - silt, sand, gravel
- 20: Organic - peat, muck, marl
- 3: Paleozoic Bedrock
- 5b: Till - sandy silt to silty sand
- 5d: Till - clayey silt to sandy silt
- 6a, 6b: Glacial Deposit - sand and gravel
- 7: Glaciofluvial - sand, gravel
- 8b: Fine Glaciolacustrine - clay, silt
- 9c: Coarse Glaciolacustrine - sand

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

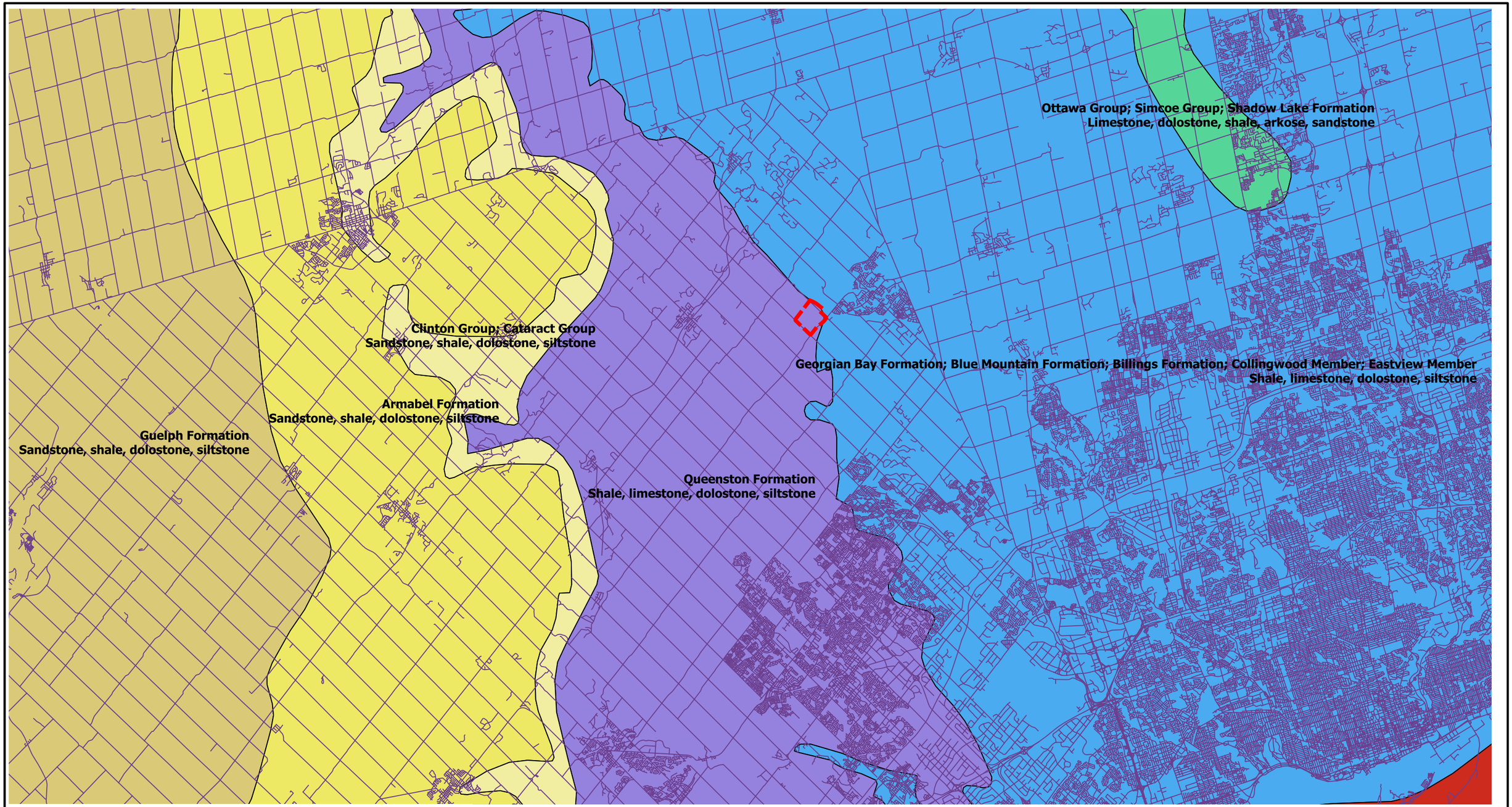
Title: **Surficial Geology Map**

N

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	August 2020
Rev: 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: **2B**

Image/Map Source: *Google Satellite Image*



Legend

- Site Boundary
- Roads
- Ottawa Group, Simcoe Group
- Queenston Formation
- Georgian Bay Formation
- Guelph Formation
- Amabel Formation
- Clinton-Cataract Group
- LIMIT

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **Bedrock Geology Map**

N

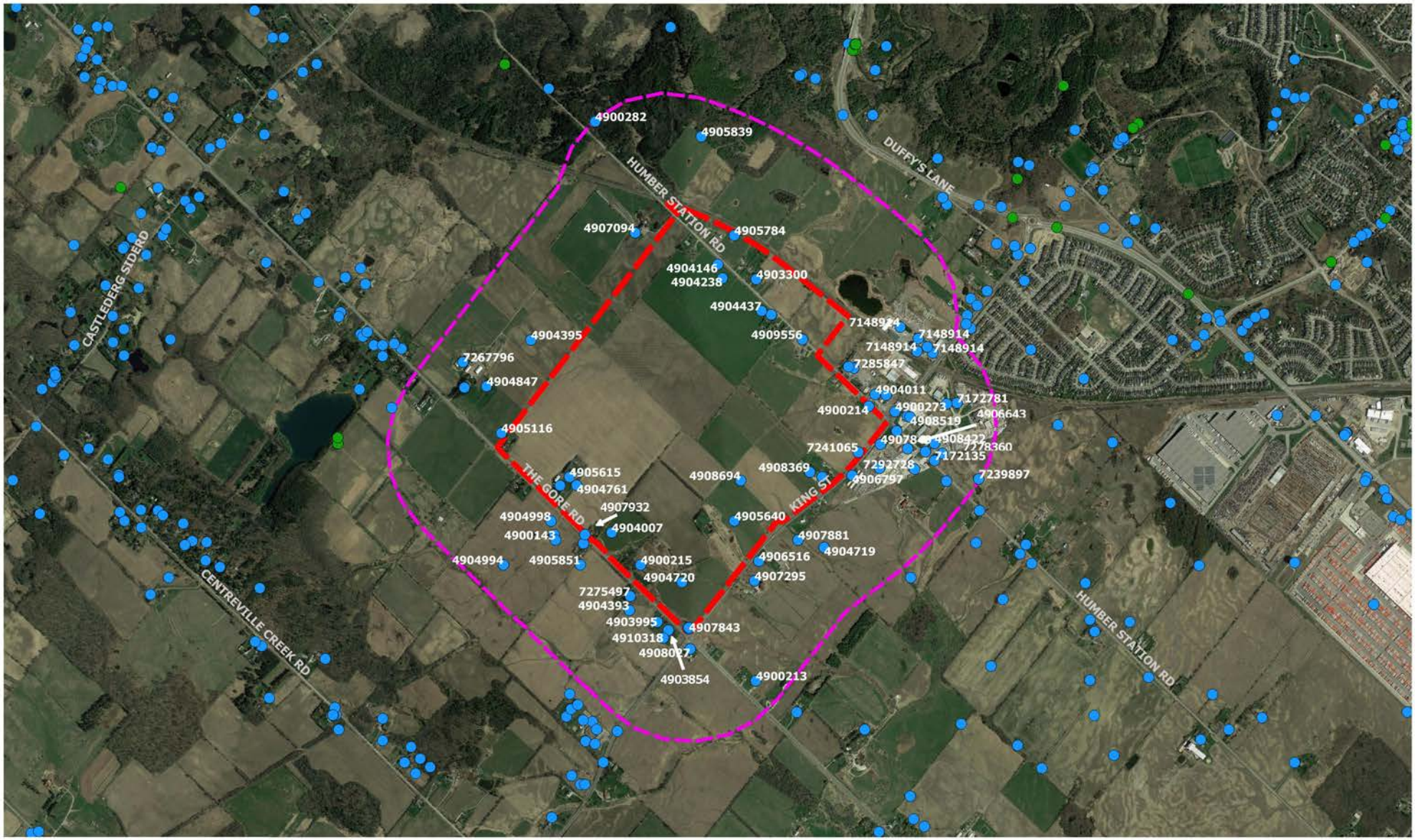
Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
11x17	S.W.	M.Z	December 2020
Rev. 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: **2C**

Image/Map Source: *Google Satellite Image*

F:\August 27,2020\Bedrock Geology map.qgs

F:\August 27,2020\MECP WWR and PTTW map.qgs



Legend

- Site Boundary
- 500m Buffer
- Permit To Take Water
- MECP Water Well Record

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Client: Option 3 Landowners Group

Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **MECP WWR and PTTW Map**

N

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	December 2020
Rev:	Scale:	Project No.:	Figure No.:
0	As Shown	20-169-100	3

Image/Map Source: *Google Satellite Image*

BH20-15
BH20-11
PZ-WHT6-E (S)
SG-WHT6-E
PZ-WHT6-E (D)
BH20-10
BH20-5
BH20-14
W7-PZD
SG-W7-1
W7-PZS
SG-W8-1
W8-PZS
W8-PZD
BH20-13
BH20-9
BH20-16
BH20-1
BH20-4
BH20-8
BH20-2
BH20-3
SG-W3-1
W3-PZD
W3-PZS
BH20-6
BH20-12
W5-PZD
W5-PZS
SG-W5-1
W4-PZS
SG-W4-1
W4-PZD
W2-PZD
BH20-7
SG W2-1
W2-PZS
A
A'
B
B'
C
C'
D
D'
E
E'
F
F'

Legend

- Site Boundary
- Parcels
- Wetland Areas
- Watercourse
- A cross sections
- Borehole
- Monitoring Well
- Staff Guage
- Groundwater Piezometer

250 0 250 500 m

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Project: HYDROGEOLOGICAL INVESTIGATION - BOLTON OPTION 3 LANDS

Title: **BOREHOLE AND INSTRUMENTATION LOCATION MAP**

Client: Bolton Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
11x17	S.W	M.Z	December 2020
Rev. 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: 4

Image/Map Source: *Google Satellite Image*

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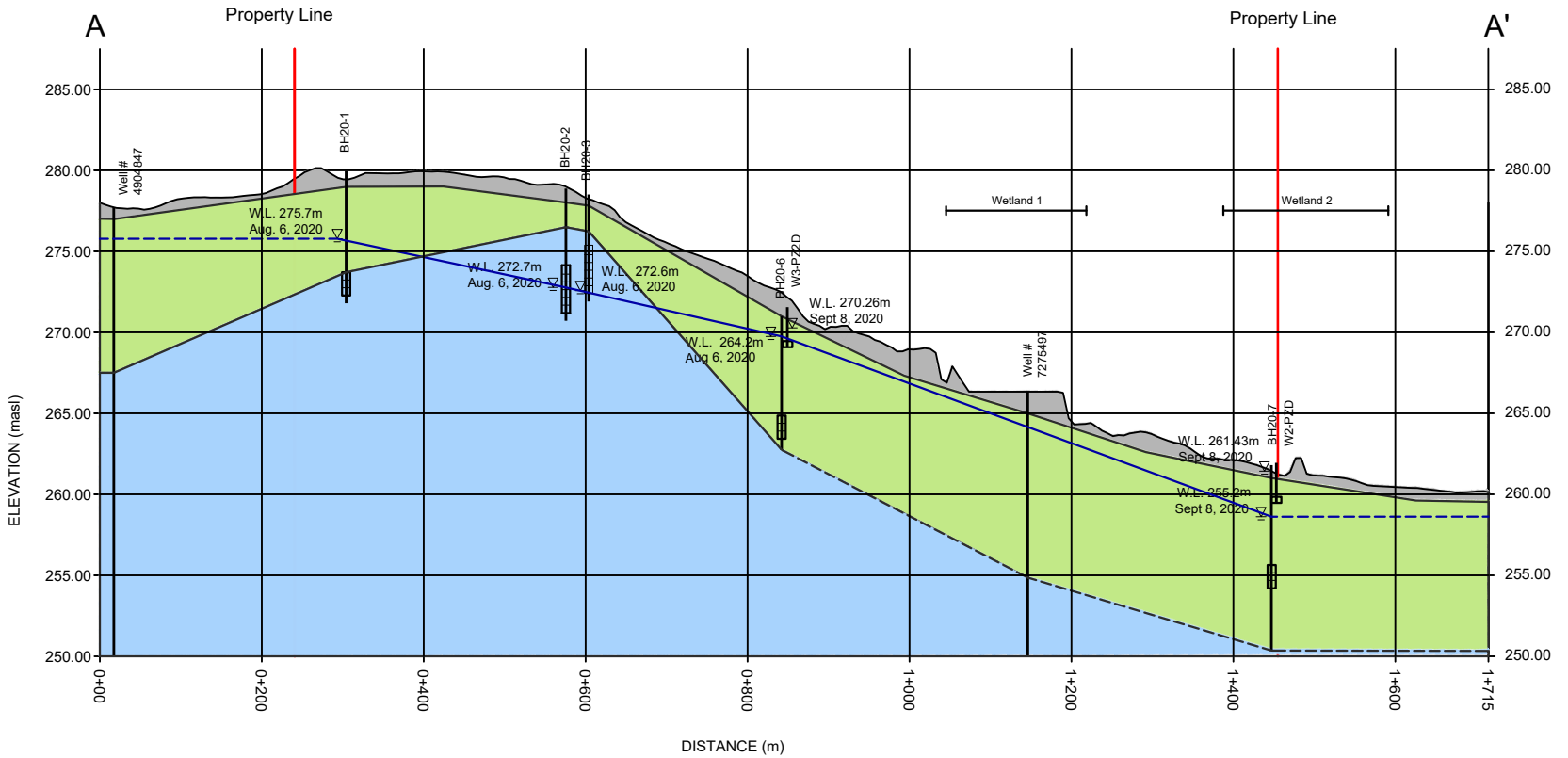

Horizontal Scale: 1:10,000
Vertical Scale: 1:400

Groundwater Level
Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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Client: Option 3 Landowners Group

Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **GEOLOGICAL CROSS SECTION A-A'**

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	December 2020
Rev.	Scale:	Project No:	Figure No.
	As Shown	20-169-100	**5A**

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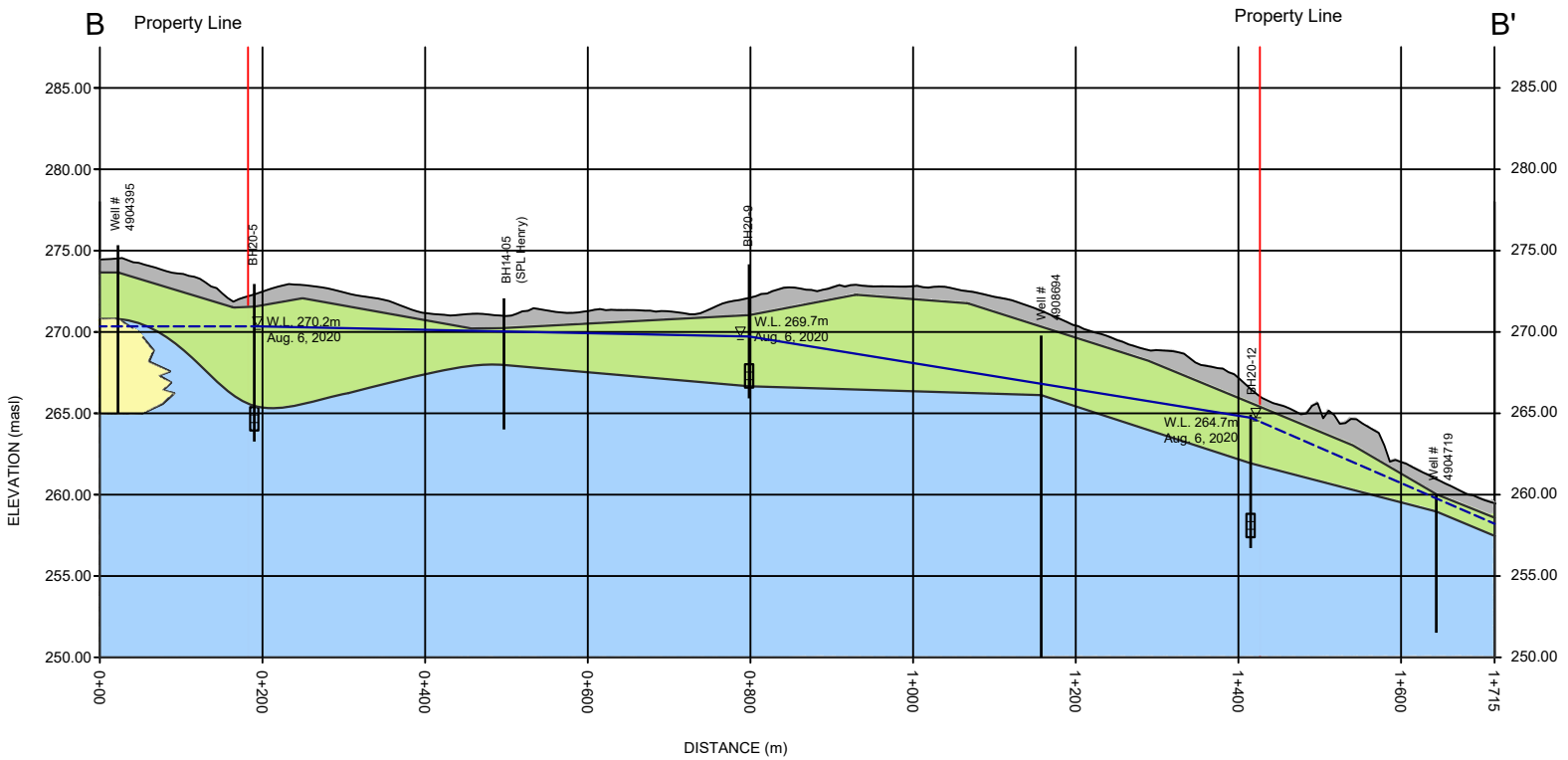

Horizontal Scale: 1:10,000
Vertical Scale: 1:400

Groundwater Level
Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **GEOLOGICAL CROSS SECTION B-B'**

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	December 2020
Rev.	Scale:	Project No:	Figure No.
	As Shown	20-169-100	**5B**

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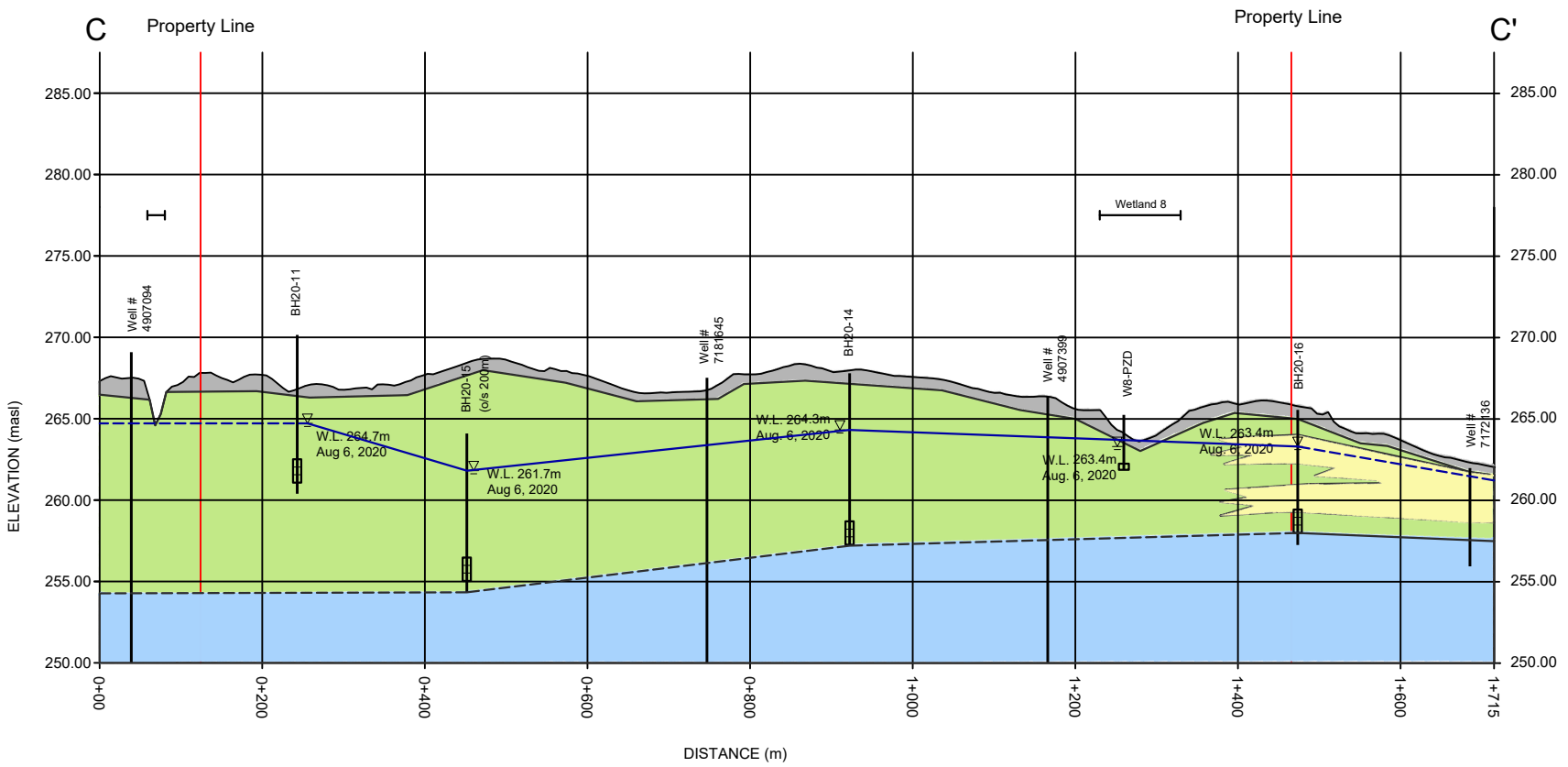

Horizontal Scale: 1:10,000
Vertical Scale: 1:400

Groundwater Level
Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **GEOLOGICAL CROSS SECTION C-C'**

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	December 2020
Rev.	**Scale:**	**Project No:**	**Figure No.**
	As Shown	20-169-100	**5C**

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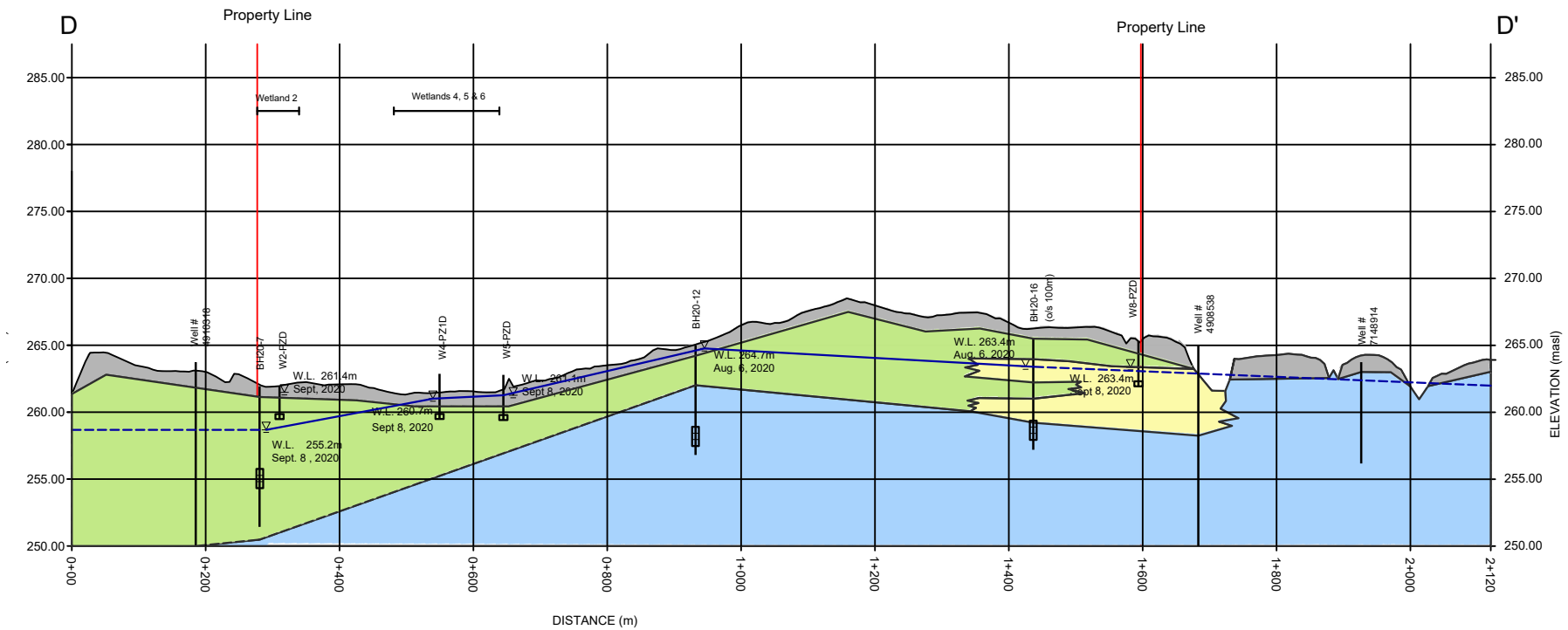

Horizontal Scale: 1:2000
Vertical Scale: 1:200

Groundwater Level
Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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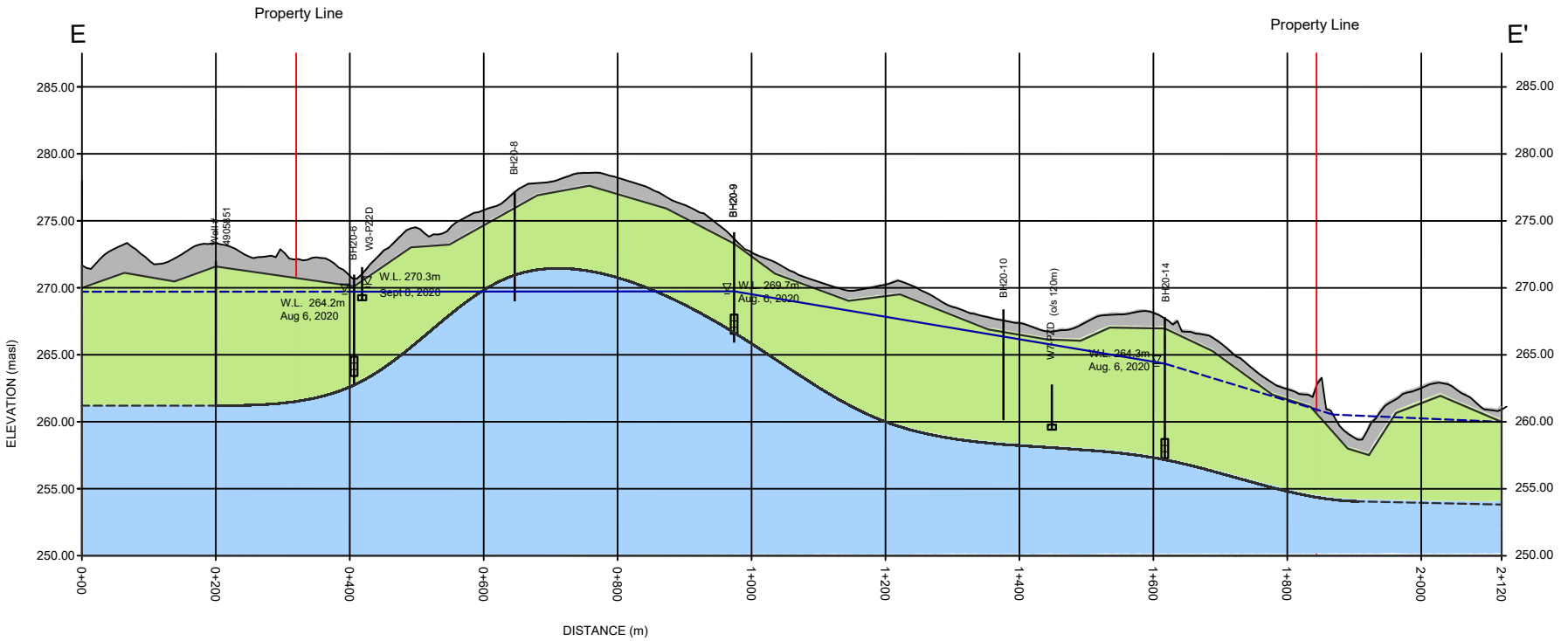
Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **GEOLOGICAL CROSS SECTION D-D'**

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	December 2020
Rev.	Scale:	Project No:	Figure No.
	As Shown	20-169-100	**5D**

Path:192.168.2.252\projects\2020 projects\20-169-100 geo and hydro investigations bolton option 3 lands_argo development corp bolton option 3 landowners group\drawings\geo cross sections\working css.dwg



Horizontal Scale: 1:2000
Vertical Scale: 1:200

Groundwater Level
Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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Project: Hydrogeological Investigation and Water Balance Study- Macville Community

Title: **GEOLOGICAL CROSS SECTION E-E'**

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	December 2020
Rev.	Scale:	Project No:	Figure No.
	As Shown	20-169-100	**5E**

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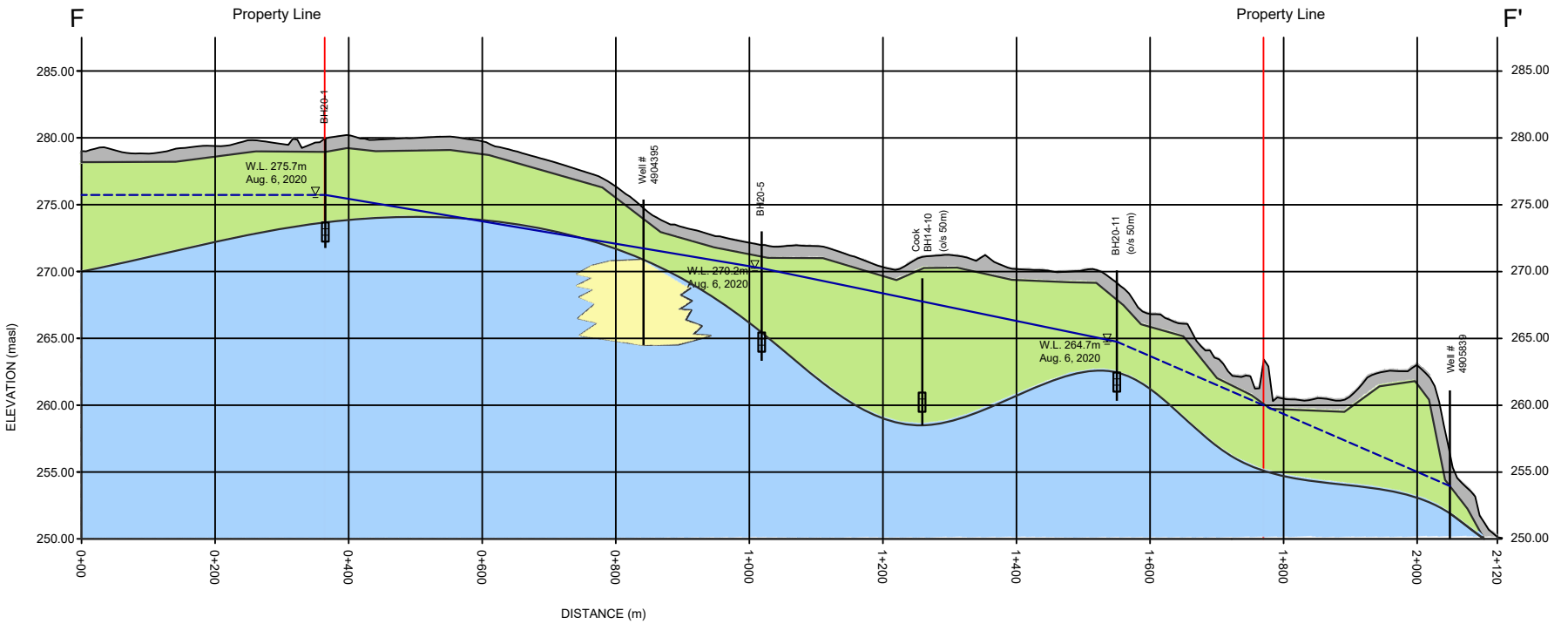

Horizontal Scale: 1:2000
Vertical Scale: 1:200

Groundwater Level
Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **GEOLOGICAL CROSS SECTION F-F'**

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	December 2020
Rev.	Scale:	Project No:	Figure No.
	As Shown	20-169-100	**5F**

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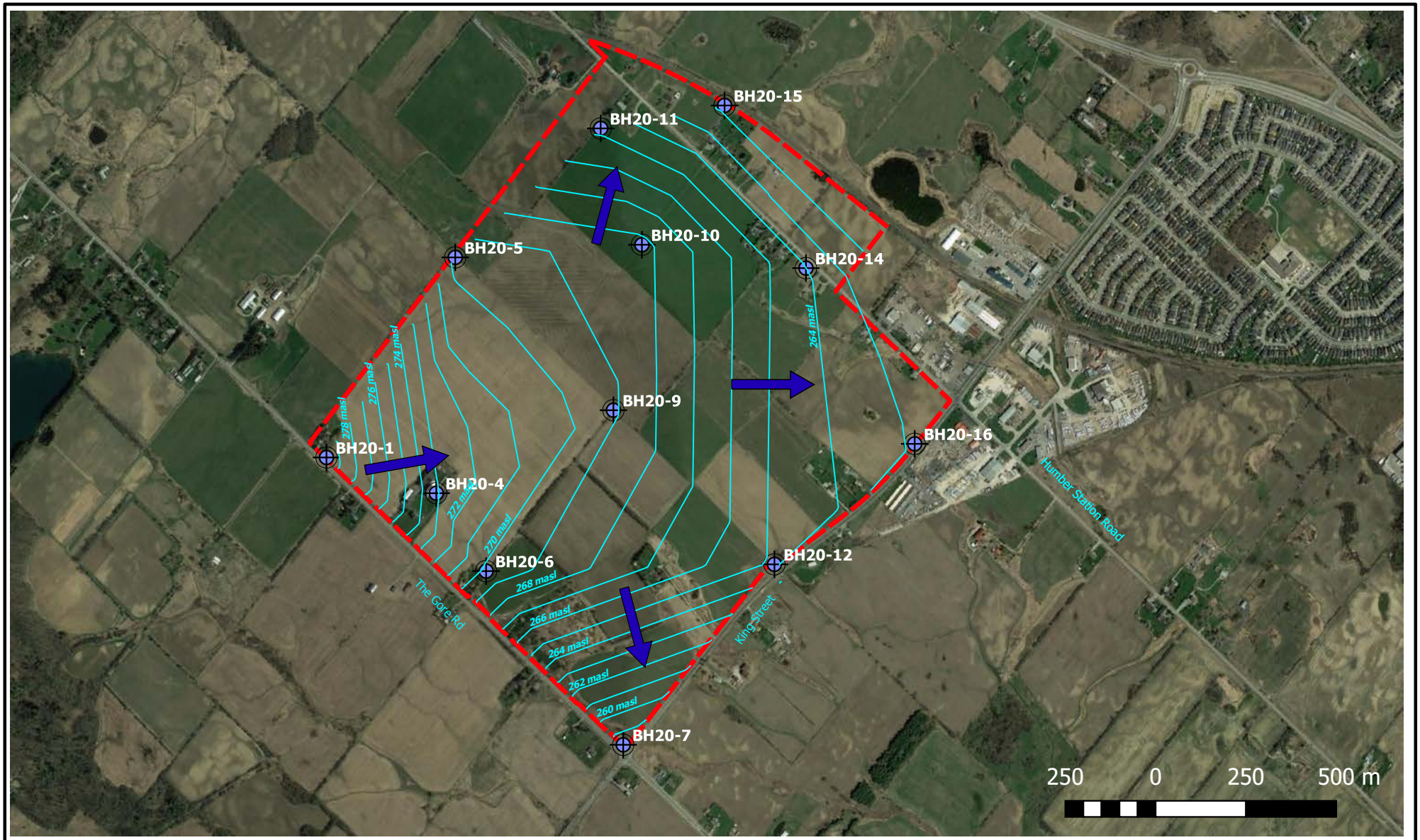

Legend

- Site Boundary
- Monitoring Well Location
- Groundwater Contour (1m)
- Groundwater Flow

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **Groundwater Flow Map**

N

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	December 2020
Rev: 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: 6

Image/Map Source: *Google Satellite Image*

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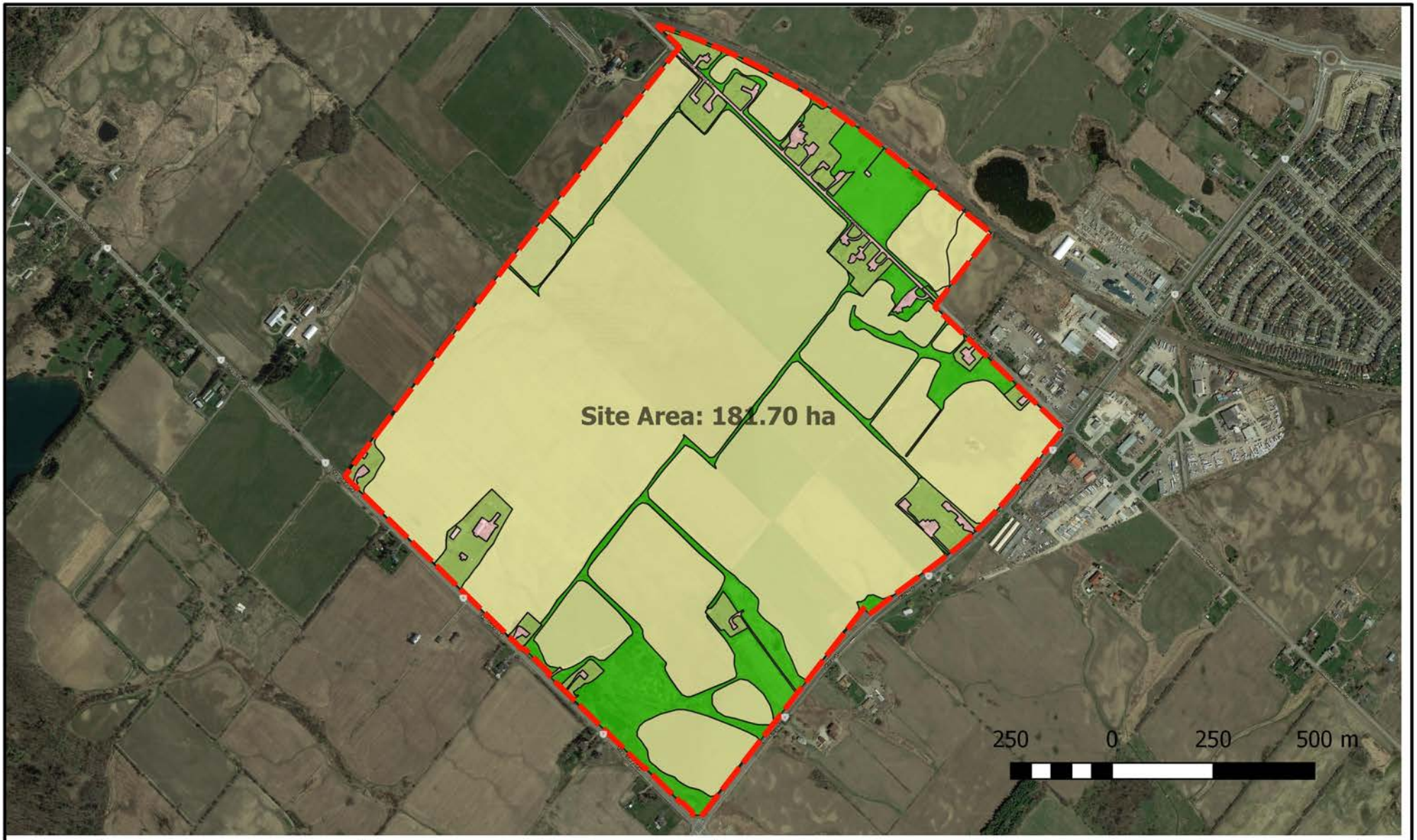

Legend

- Site Boundary

Hydrologic Cover Types

- Cultivated
- Impervious
- Landscaped
- Shrub

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Project: HYDROGEOLOGICAL INVESTIGATION & WATER BALANCE STUDY - MACKVILLE COMMUNITY

Title: **PRE-DEVELOPMENT CONCEPTUAL MODEL -SITE WATER BALANCE**

N

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	M.G	S.W	December 2020
Rev: 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: 7

Image/Map Source: *Google Satellite Image*

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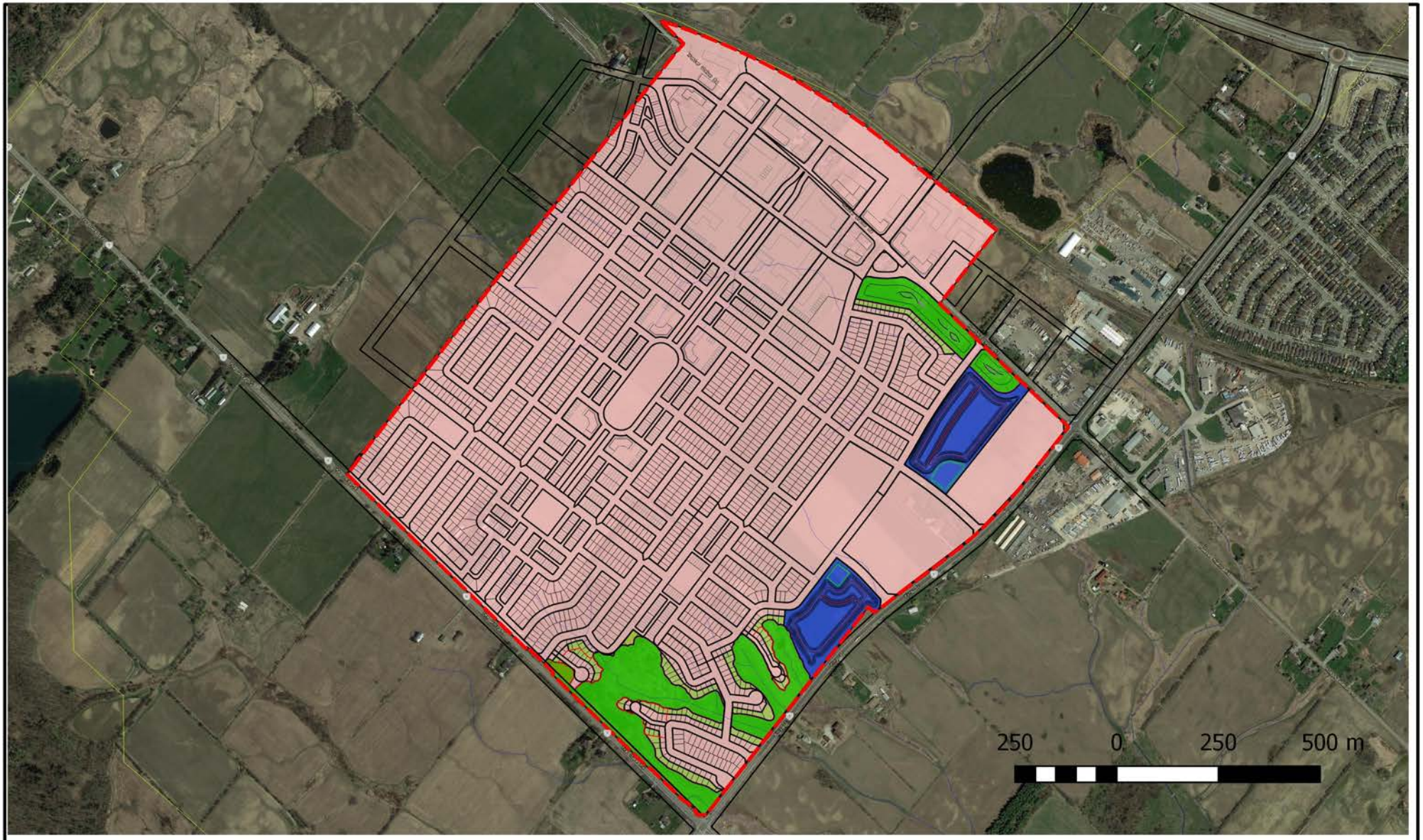

Legend

- Site Boundary

Hydrologic Cover Types

- Dev
- Landscaped
- NHS/Shrub
- SWM Pond

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Project: HYDROGEOLOGICAL INVESTIGATION & WATER BALANCE STUDY - MACKVILLE COMMUNITY

Title: **POST-DEVELOPMENT CONCEPTUAL MODEL -SITE WATER BALANCE**

N

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	M.G	S.W	December 2020
Rev: 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: 8

Image/Map Source: *Google Satellite Image*

Catchment W9 (16.90 ha)

Catchment W7 (145.30 ha)

Catchment W8 (18.32 ha)

Catchment W3 (22.56 ha)

Catchment W1 (1.34 ha)

Catchment W2 (5.08 ha)

Catchment W6 (4.74 ha)

Catchment W5 (7.42 ha)

Catchment W4 (6.20 ha)

250 0 250 500 m

Legend

- Site Boundary
- Wetlands
- Watercourse
- Pre-development Wetland Catchments

Hydrologic Cover Types

- Cultivated
- Forest
- Impervious
- Landscaped
- Shrub

C:\Projects\Bolton LOPA\Pre-Dev Wetland WB.qgs Jan-06 12:06

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Project: HYDROGEOLOGICAL INVESTIGATION & WATER BALANCE STUDY - MACKVILLE COMMUNITY

Title: **PRE-DEVELOPMENT LAND USE & WETLAND CATCHMENT MAP**

N

Client: Option 3 Landowners Group

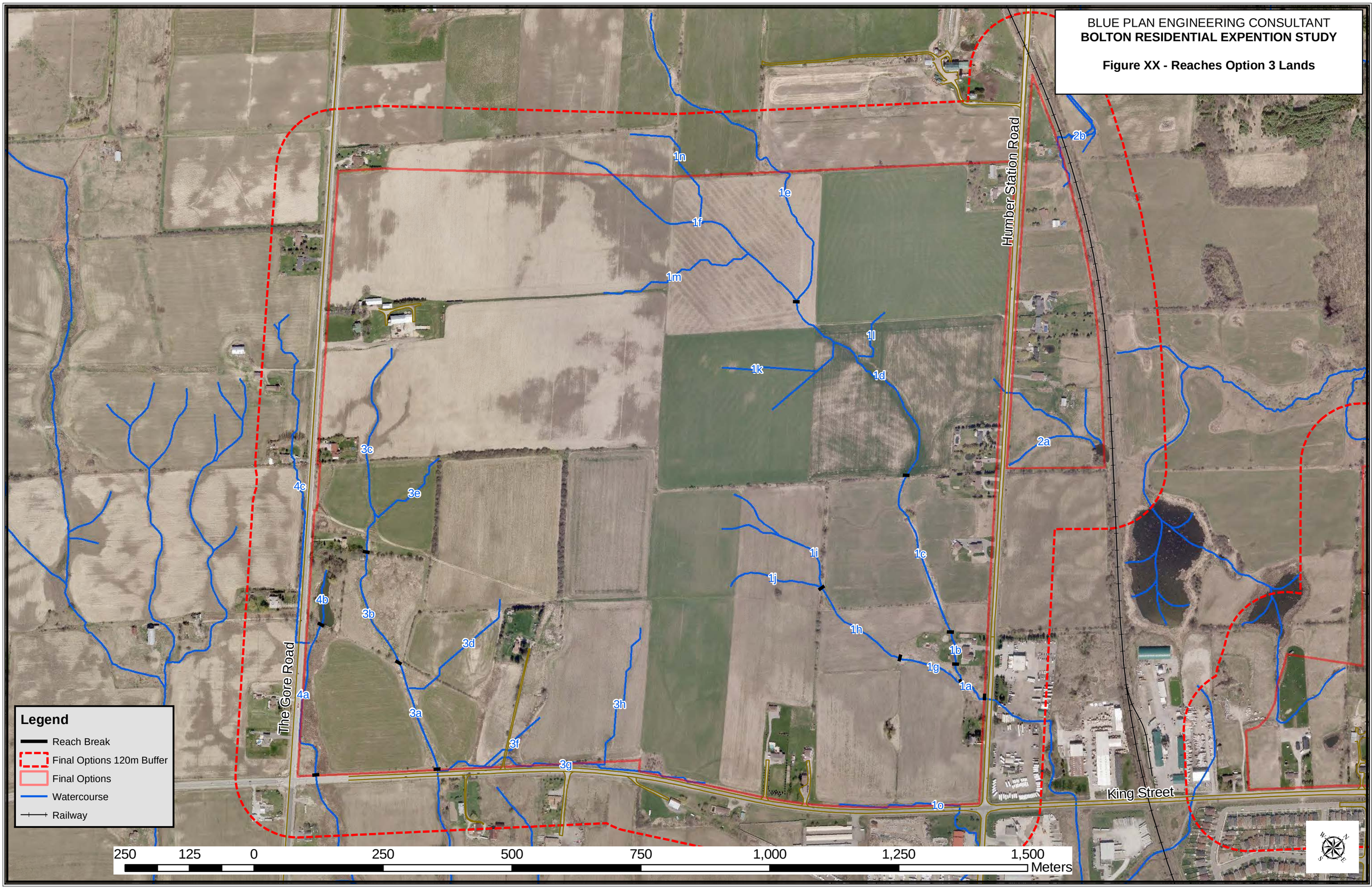
Size:	Approved By:	Drawn By:	Date:
11x17	SW	S.Y	December, 2020
Rev. 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: 9

Image/Map Source: *Google Satellite Image*

Appendix A

BLUE PLAN ENGINEERING CONSULTANT
BOLTON RESIDENTIAL EXPENTION STUDY

Figure XX - Reaches Option 3 Lands



Appendix B

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LOG OF BOREHOLE BH20-1

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857815.92 E 597082.44

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
279.8						
0.0 / 279.5	**TOPSOIL:** 300mm					
0.3 / 279.0	**FILL:** sandy silt, trace gravel, dark brown, moist, loose	1	SS	6		
0.8	**CLAYEY SILT TILL:** sandy, trace gravel, sand seams, brown, moist, very stiff to hard	2	SS	19		279
		3	SS	36		278
	trace cobble below 2.3m	4	SS	55		
		5	SS	32		276
275.3					W. L. 275.7 m Aug 06, 2020[1] W. L. 275.3 m Oct 22, 2020	
4.5 / 273.8	**SILTY CLAY:** trace sand, grey, very moist, very stiff	6	SS	17		274
6.0	**SILT:** trace clay, grey, wet, compact	7	SS	12	Filter Pack / Slotted Pipe	
271.6		8	SS	20		272
8.2	**END OF BOREHOLE:**					

Notes:
1) Water level at 4.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	4.11
Sept 8, 2020	4.24
Oct 22, 2020	4.51

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

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

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE 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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

DS CONSULTANTS LTD.

LOG OF BOREHOLE BH20-2

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857663.29 E 597311.06

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
278.8					
278.6	**TOPSOIL:** 200mm				
0.2	**FILL:** sandy silt, trace gravel, brown, moist, loose	1	SS	8	
278.0					278
1 0.8	**CLAYEY SILT TILL:** sandy, trace gravel, sand seams, brown, moist, very stiff	2	SS	16	
		3	SS	19	277
2 276.5					
2.3	**SANDY SILT:** trace clay, brown, moist to very moist, very dense	4	SS	58	
3					276
		5	SS	58	
4					275
5		6	SS	66	274
6	wet below 6m	7	SS	51	
7					
		8	SS	52	271
8 270.6					
8.2	**END OF BOREHOLE:**				

Notes:
1) Water level at 6.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	6.12
Sept 8, 2020	6.36
Oct 22, 2020	6.48

Bentonite
Filter Pack
Slotted Pipe
W. L. 272.7 m Aug 06, 2020
W. L. 272.3 m Oct 22, 2020

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE 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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-3

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857648.82 E 597335.94

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"
278.6				
0.0 / 278.3	**TOPSOIL:** 300mm			
0.3 / 277.8	**FILL:** sandy silt, trace gravel, brown, moist, compact	1	SS	10
1 0.8	**SILTY CLAY TILL:** sandy, trace gravel, sand seams, brown, moist, stiff	2	SS	13
2		3	SS	10
276.3				
2.3	**SILTY SAND:** trace clay, grey, moist, compact to very dense	4	SS	15
3		5	SS	35
4				
	wet below 4.5m	6	SS	65
5				
6		7	SS	49
271.9				
6.7	**END OF BOREHOLE:**			

Notes:
1) Water level at 4.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	6.0
Sept 8, 2020	dry
Oct 22, 2020	dry

ELEVATION: 278, 277, 276, 275, 273, 272

Bentonite
Filter Pack
Slotted Pipe
W. L. 272.6 m
Aug 06, 2020

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

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

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

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE 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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-4

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857717.02 E 597386.34

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
277.1							
0.0 / 276.8	**CONCRETE:** 300mm						
0.3 / 276.3	**FILL:** clayey silt, trace gravel, grey to brown, moist, stiff		1	SS	8		
0.8	**SANDY SILT:** trace clay, brown, moist, compact to very dense		2	SS	21		276
			3	SS	42		275
			4	SS	62		274
			5	SS	56		
	wet below 4.5m		6	SS	46		272
271.1 / 6.0	**SANDY SILT:** trace silt, brown, wet, compact		7	SS	28		271
270.4 / 6.7	**END OF BOREHOLE:**						

Bentonite
W. L. 273.3 m Aug 06, 2020[1]
Sep 08, 2020
Slotted Pipe

Notes:
1) Water level at 4.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	3.77
Sept 8, 2020	3.90
Oct 22, 2020	inaccessible

DYNAMIC CONE PENETRATION RESISTANCE PLOT — 20 40 60 80 100

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

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

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE 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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-5

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858369.55 E 597438.77

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/29/2020

REF. NO.: 20-169-100
ENCL NO.: 6

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
273.0					
272.9 0.0	**TOPSOIL:** 250mm				
0.3 272.2	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, compact	1	SS	15	
0.8	**SILTY CLAY TILL:** sandy, trace gravel, frequent sand seams, brown, moist, hard	2	SS	35	272
		3	SS	31	271
270.0		4	SS	39	
3.0	**CLAYEY SILT TILL:** sandy, trace gravel, interbed of sandy silt layers, greyish brown, moist to very moist, hard	5	SS	35	
	grey below 4.5m	6	SS	37	269 / 268
	sand seams below 6m	7	SS	46	267 / 266
265.5					
7.5	**SILTY SAND:** trace clay, grey, moist, very dense	8	SS	74/ 280mm	
	very moist at 9m	9	SS	59	264
263.3					
9.7	**END OF BOREHOLE:**				

Notes:
1) Water level at 9.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	2.78
Sept 8, 2020	3.09
Oct 22, 2020	3.38

W. L. 270.2 m Aug 06, 2020
W. L. 269.6 m Oct 22, 2020
Filter Pack
Slotted Pipe

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30

METHANE AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	0	51	47	2

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

DS CONSULTANTS LTD.

LOG OF BOREHOLE BH20-6

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857501.44 E 597524.2

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/28/2020

REF. NO.: 20-169-100
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
271.0 / 0.0	**TOPSOIL:** 250mm				
270.7 / 0.3	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, dark brown, moist, loose	1	SS	8	
270.2 / 0.8	**CLAYEY SILT TILL:** sandy, trace gravel, sand seams, brown, moist, stiff to hard	2	SS	12	270
		3	SS	21	269
	hard below 2.3m	4	SS	59	
					268
		5	SS	58	
					267
	grey below 4.5m	6	SS	31	266
					265
		7	SS	39	
262.8 / 8.2	**END OF BOREHOLE:**	8	SS	25	263

Notes:
1) Borehole dry during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	6.77
Sept 8, 2020	1.15

Bentonite
Filter Pack
W. L. 269.8 m Sep 08, 2020
W. L. 264.2 m Aug 06, 2020

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-7

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857020.81 E 597903.58

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/31/2020

REF. NO.: 20-169-100
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
261.7 / 0.0	**TOPSOIL:** 500mm	1	SS	8	
261.2 / 0.5	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace rootlets, dark brown, moist, stiff	2	SS	10	261
260.9 / 0.8	**CLAYEY SILT TILL:** some sand, trace gravel, brownish grey, very moist, stiff with silt and sand seams at 1.5m	3	SS	13	260
259.4 / 2.3	**SILTY CLAY TILL:** some sand, some gravel, greyish brown, moist, very stiff to hard	4	SS	39	
	grey, very moist to wet below 3m	5	SS	28	
		6	SS	21	257
		7	SS	19	256
		8	SS	25	254
		9	SS	16	253
		10	SS	24	252
250.4 / 11.3	**END OF BOREHOLE:**				251

Bentonite
W. L. 258.3 m Oct 22, 2020
Filter Pack
W. L. 255.2 m Sep 08, 2020
Bentonite: Bottom of hole

Notes:
1) Borehole dry during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	dry
Sept 8, 2020	6.52
Oct 22, 2020	3.40

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

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

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
15	18	38	29

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-8

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857701.02 E 597673.81

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/28/2020

REF. NO.: 20-169-100
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
277.2								
0.0 / 276.8	**TOPSOIL:** 340mm		1	SS	8		277	
0.4 / 276.4	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, brown, moist, loose							
1 0.8 / 275.7	**CLAYEY SILT TILL:** sandy, trace gravel, brown, moist, compact		2	SS	10		276	
1.5	**SILT:** some clay, trace sand, trace gravel, brown, very moist, compact to very dense		3	SS	19			
2			4	SS	58		275	2 2 85 11
3			5	SS	92/ 255mm		274	
4							273	
5			6	SS	74		272	
6 271.2								
6.0	**SANDY SILT:** trace clay, brown, wet, very dense		7	SS	62		271	0 27 67 6
7							270	
8 269.0			8	SS	54		269	
8.2	**END OF BOREHOLE:** Notes: 1) Water at depth of 6.1m during drilling.							

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

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

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

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-9

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857946.64 E 597876.44

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/28/2020

REF. NO.: 20-169-100
ENCL NO.: 10

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
274.1 / 0.0	**TOPSOIL:** 550mm	1	SS	5	274
273.6 / 0.5	**FILL:** sandy silt, trace topsoil/ organics, trace clay, trace gravel, trace organics, trace rootlets, dark brown, moist, loose	2	SS	16	
273.3 / 0.8	**SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff to hard	3	SS	25	273
	sand seams below 2.3m	4	SS	38	272
		5	SS	72	271
	grey below 4.5m	6	SS	45	270
	trace cobble, very moist below 6m	7	SS	24	268
266.6 / 7.5	**SANDY SILT:** trace clay, grey, wet, compact	8	SS	29	267
265.9 / 8.2	**END OF BOREHOLE:**				266

Notes:
1) Water level at 7.6m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	4.43
Sept 8, 2020	4.72
Oct 22, 2020	4.97

Bentonite
W. L. 269.7 m Aug 06, 2020
W. L. 269.1 m Oct 22, 2020
Filter Pack
Slotted Pipe

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE 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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-10

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858404.6 E 597955.26

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/29/2020

REF. NO.: 20-169-100
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
268.3							
0.0 / 268.0	**TOPSOIL:** 300mm						
0.3 / 267.5	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, compact		1	SS	15		268
0.8	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brown, moist to very moist, very stiff		2	SS	21		267
			3	SS	25		
			4	SS	25		266
	grey below 3m		5	SS	16		265
			6	SS	20		264
			7	SS	17		263
			8	SS	15		262
260.1							261
8.2	**END OF BOREHOLE:** Notes: 1) Borehole dry and open upon completion.						

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

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

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH20-11

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858726.5 E 597841.19

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/29/2020

REF. NO.: 20-169-100
ENCL NO.: 12

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
270.1 / 0.0	**TOPSOIL:** 300mm				
269.8 / 0.3	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, compact	1	SS	12	270
269.3 / 0.8	**SILTY CLAY TILL:** sandy, trace gravel, sand seams, brown, moist, very stiff to hard	2	SS	19	269
		3	SS	22	
		4	SS	28	268
		5	SS	44	267
	grey below 4.5m	6	SS	24	266
		7	SS	21	265
262.4 / 7.7	**SILT:** some sand, trace clay, trace gravel, grey, wet, compact	8	SS	28	264
		9	SS	27	263
260.4 / 9.7	**END OF BOREHOLE:**				262
					261

Notes:
1) Water level at 9.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	5.42
Sept 8, 2020	5.37
Oct 22, 2020	5.33

Bentonite
W. L. 264.7 m Aug 06, 2020
Filter Pack
Slotted Pipe

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

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

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
1	11	80	8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-12

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857520.15 E 598321.99

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/31/2020

REF. NO.: 20-169-100
ENCL NO.: 13

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
264.9							
0.0 / 264.5	**TOPSOIL:** 400mm		1	SS	8		
0.4 / 264.1	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, sand seams, trace rootlets, dark brown, moist, stiff						
0.8	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brown, moist to very moist, stiff		2	SS	8		
			3	SS	9		
	grey below 2.3m		4	SS	10		
261.9							
3.0	**SANDY SILT TO SILT:** trace clay, grey, very moist, dense		5	SS	32		
	wet below 4.5m		6	SS	36		
258.9							
6.0	**SILT:** trace clay, trace sand, grey, very moist, compact to loose		7	SS	25		
			8	SS	7		
256.7							
8.2	**END OF BOREHOLE:**						

W. L. 264.7 m
Aug 06, 2020

Bentonite
Filter Pack
Slotted Pipe

Notes:
1) Water level at 3.1m below grade during drilling
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	0.2
Sept 8, 2020	0.1
Oct 22, 2020	0.14

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

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

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

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	1	94	5

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-13

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857981.07 E 598332.09

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/30/2020

REF. NO.: 20-169-100
ENCL NO.: 14

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
268.1 / 0.0	**TOPSOIL:** 200mm				268
0.2	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace rootlets, dark brown, moist, stiff	1	SS	12	
267.3 / 0.8	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brownish grey, moist, stiff to very stiff	2	SS	19	267
		3	SS	20	
		4	SS	26	266
		5	SS	14	265
	grey below 4.5m	6	SS	9	264
		7	SS	19	263
260.6 / 7.5	**SANDY SILT TO SILT:** trace clay, trace gravel, grey, wet, very dense	8	SS	94/ 255mm	262
259.9 / 8.2	**END OF BOREHOLE:** Notes: 1) Water at 7.6m below grade during drilling				261
					260

GROUND WATER CONDITIONS

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

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

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

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE 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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-14

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858339.89 E 598409.18

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/30/2020

REF. NO.: 20-169-100
ENCL NO.: 15

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
267.7					
0.0 / 267.3	**TOPSOIL:** 400mm	1	SS	7	267
0.4 / 266.9	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace sand, trace rootlets, brown, moist, firm				
0.8	**SILTY CLAY TILL:** some sand, trace gravel, frequent sand seams, brown, moist, stiff to hard	2	SS	14	
		3	SS	13	266
		4	SS	27	265
		5	SS	28	
					263
		6	SS	24	
	grey below 6m	7	SS	18	262
					261
		8	SS	29	260
					259
		9	SS	22	
	interbed of clayey silt and sany silt layers, wet below 10.5m	10	SS	35	257
256.4					
11.3	**END OF BOREHOLE:**				

W. L. 264.3 m Aug 06, 2020
Oct 22, 2020
Bentonite
Filter Pack
Slotted Pipe

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	3.32
Sept 8, 2020	3.43
Oct 22, 2020	3.59

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE 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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-15

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858789.95 E 598183.97

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/30/2020

REF. NO.: 20-169-100
ENCL NO.: 16

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
264.1					
0.0 / 263.8	**TOPSOIL:** 350mm	1	SS	12	264
0.4 / 263.3	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace sand, trace rootlets, brown, moist, stiff				
0.8	**CLAYEY SILT TILL:** some sand, trace gravel, sand seams, brown, moist, stiff to very stiff	2	SS	18	263
		3	SS	22	
		4	SS	27	262
		5	SS	27	261
	grey below 4.5m	6	SS	17	260
		7	SS	14	259
		8	SS	16	258
	wet below 9m	9	SS	12	257
254.4					255
9.7	**END OF BOREHOLE:**				

Notes:
1) Water level at 9.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	2.41
Sept 8, 2020	2.33
Oct 22, 2020	2.41

W. L. 261.7 m
Aug 06, 2020
Bentonite
Filter Pack
Slotted Pipe

DYNAMIC CONE PENETRATION RESISTANCE PLOT
SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE 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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-16

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857848.7 E 598703.75

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/31/2020

REF. NO.: 20-169-100
ENCL NO.: 17

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
265.5					
0.0 / 265.1	**TOPSOIL:** 400mm	1	SS	9	265
0.4 / 264.7	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, stiff				
0.8 / 264.0	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brown, moist, stiff to hard	2	SS	33	264
1.5	**GRAVELLY SAND:** some silt, trace clay, brown, very moist to wet, compact to dense	3	SS	30	
262.2		4	SS	24	262
3.3 / 261.0	**SANDY SILT:** trace clay, brown, wet, compact	5	SS	20	
4.5 / 259.3	**SAND AND GRAVEI:** some silt, trace clay, brownish grey, wet, very dense	6	SS	66	260
6.2 / 258.0	**SILTY SAND:** some clay, trace gravel, greyish brown, wet, dense	7	SS	38	258
7.5 / 257.3	**SANDY SILT:** trace clay, grey, wet, dense	8	SS	41	
8.2	**END OF BOREHOLE:**				

Notes:
1) Water level at 2.3m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	2.12
Sept 8, 2020	2.27
Oct 22, 2020	2.49

GROUND WATER CONDITIONS: W. L. 263.4 m Aug 06, 2020[1]; W. L. 263.1 m Oct 22, 2020

Filter Pack
Slotted Pipe

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

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

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

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
4	22	64	10	4
6	42	37	15	6
10	3	61	26	10

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

Appendix C

Table: MECP Water Wells Records (500 m Radius)

Project: 20-169-100

Location: North Bolton, King Rd and The Gore

MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
4908650	597296	4857460	2	0.6	2	0.6	Brown	Loam	-	-	74	22.6	19	5.8	Fresh	6/Oct/00	Water Supply	Domestic
			12	3.7	10	3.0	Brown	Sand	Clay	-								
			68	20.7	56	17.1	Grey	Clay	Silt	-								
			74	22.6	6	1.8	Grey	MSND	-	-								
7292728	598935	4857759	-	-	-	-	-	-	-	-	-	-	-	-	-	3/Aug/17	Abandoned	-
4904998	597281	4857522	1	0.3	1	0.3	Brown	Loam	-	-	34	10.4	25	7.6	not stated	4/Dec/75	Water Supply	Domestic
			10	3.0	9	2.7	Brown	Clay	-	-								
			34	10.4	24	7.3	Grey	Sand	-	-								
			40	12.2	6	1.8	Grey	Sand	-	-								
4900215	597688	4857323	15	4.6	15	4.6	Brown	Loam	-	-	65	19.8	15	4.6	Fresh	9/Sep/67	Water Supply	Domestic
			63	19.2	48	14.6	Grey	Clay	-	-								
			65	19.8	2	0.6	-	MSND	-	-								
7239897	599227	4857714	-	-	-	-	-	-	-	-	-	-	-	-	-	26/Mar/15	Abandoned	not used
4908538	598806	4858096	1	0.3	1	0.3	-	Loam	-	-	80	24.4	12	3.7	Fresh	1/Oct/99	Water Supply	Domestic
			8	2.4	7	2.1	Brown	Clay	-	-								
			22	6.7	14	4.3	Brown	Sand	-	-								
			61	18.6	39	11.9	Brown	Clay	-	-								
			80	24.4	19	5.8	Blue	Clay	-	-								
			93	28.3	13	4.0	Blue	FSND	-	-								
4906797	598651	4857730	-	-	-	-	-	-	-	-	-	-	-	-	-	10/Nov/87	Water Supply	Domestic
4900213	598212	4856795	20	6.1	20	6.1	Brown	Clay	-	-	45 & 115	14 & 35	Flowing		Fresh	14/Jun/66	Water Supply	Domestic
			45	13.7	25	7.6	Blue	Clay	-	-								
			55	16.8	10	3.0	-	MSND	Gravel	Clay								
			115	35.1	60	18.3	Blue	Clay	-	-								
			136	41.5	21	6.4	-	FSND	-	-								
			138	42.1	2	0.6	Blue	Clay	-	-								
4903995	597764	4857063	22	6.7	22	6.7	Brown	Clay	-	-	120	36.6	Flowing		Fresh	24-Nov-72	Water Supply	Domestic
			35	10.7	13	4.0	Blue	Clay	-	-								
			78	23.8	78	23.8	-	HPAN	-	-								
			120	36.6	42	12.8	Blue	Clay	-	-								
			140	42.7	140	42.7	-	Sand	Silt	-								
			146	44.5	6	1.8	-	Sand	-	-								
			150	45.7	4	1.2	-	FSND	-	-								
4908193	597907	4857031	2	0.6	2	0.6	Brown	Peat	Loose	-	-	-	-	-	-	10-Jan-97	Test Hole	Municipal
			40	12.2	38	11.6	Grey	Clay	Till	Silty								
			108	32.9	68	20.7	Grey	Silt	Stones	LYRD								
			130	39.63	22	6.7	Grey	Clay	Sand	LYRD								
			164	50.0	34	10.4	Grey	Clay	Sand	Silt								
			184	56.1	20	6.1	Grey	Silt	Stones	Sandy								
			201	61.3	17	5.2	Grey	FSND	Silt	Dense								
			218	66.4	17	5.2	Grey	Sand	Gravel	LYRD								
			246	75.0	28	8.5	Grey	Sand	Silt	LYRD								
			250	76.2	4	1.2	Grey	Shale	LYRD	WTHD								
4907295	598206	4857250	2	0.6	2	0.6	-	Loam	-	-	134	40.9	-	-	Fresh	18-Apr-91	Water Supply	Domestic
			37	11.3	35	10.7	-	Clay	-	-								
			39	11.9	2	0.6	-	Sand	GRVL	-								
			95	29.0	56	17.1	Blue	Clay	GRVL	-								
			98	29.9	3	0.9	-	Sand	GRVL	-								
			134	40.8	36	11.0	Blue	Clay	-	-								
			140	42.7	6	1.8	Blue	Sand	-	-								
			7	2.1	7	2.1	Brown	Silt	Clay	Soft								

MEOCC WWR ID	Easting UTM N17	Northing UTM N17	Depth (ft)	Depth (m)	Thickness (ft)	Thickness (m)	Stratigraphy Color	Primary	Secondary	Tertiary	Water Found (ft)	Water Found (m)	Static Level (ft)	Static Level (m)	Water Kind	Date Completed	Status	Water Use
7148914	598946	4858295	16	4.9	9	2.7	Brown	Silt	Clay	Dense	-	-	-	-	Fresh	14-Jul-10	Test Hole	Test Hole
			25	7.6	9	2.7	Grey	Clay	Silt	-								
4908194	597904	4857073	2	0.6	2	0.6	Brown	Peat	Loose	-	-	-	-	-	-	3-Jan-97	Test Hole	Municipal
			40	12.2	38	11.6	Grey	Clay	Silt	LYRD								
			108	32.9	68	20.7	Grey	Silt	Stones	LYRD								
			130	39.6	22	6.7	Grey	Silt	Sand	LYRD								
			164	50.0	34	10.4	Grey	Silt	Clay	Sand								
			184	56.1	20	6.1	Grey	Silt	Stones	Sandy								
			201	61.3	17	5.2	Grey	FSND	Silt	LYRD								
			218	66.5	17	5.2	Grey	Clay	Sand	LYRD								
			246	75.0	28	8.5	Grey	Clay	Sand	Dense								
			250	76.2	4	1.2	Grey	SHLE	WTHD	PCKD								
4904238	598060	4858628	20	6.1	20	6.1	Brown	Clay	Stones	-	177	54.0	23	7.0	Fresh	30-Nov-73	Water Supply	Domestic
			67	20.4	47	14.3	Blue	Clay	Gravel	-								
			78	23.8	11	3.4	Blue	Clay	Gravel	Sand								
			120	36.6	42	12.8	Blue	Clay	-	-								
			177	54.0	57	17.4	Blue	Clay	-	-								
			190	57.9	13	4.0	-	FSND	MSND	Clay								
4906470	598853	4857932	1	0.3	1	0.3	Black	Loam	-	-	80	24.4	4	1.22	Fresh	1-Nov-85	Water supply	Commerical
			6	1.8	5	1.5	Brown	Clay	Gravel	-								
			11	3.4	5	1.5	Blue	Clay	-	-								
			83	25.3	72	22.0	Brown	MSND	-	-								
			92	28.0	9	2.7	Grey	MSND	-	-								
			107	32.6	15	4.6	Blue	Clay	Gravel	-								
			125	38.1	18	5.5	Grey	Clay	Shale	-								
4904994	597064	4857323	1	0.3	1	0.3	Brown	Loam	Hard	-	30	9.1	25	7.6	not stated	30-Oct-76	Water Supply	Domestic
			20	6.1	19	5.8	Brown	Clay	Hard	-								
			45	13.7	25	7.6	Grey	Clay	Sand	Loose								
4907844	599080	4857704	-	-	-	-	-	-	-	-	-	-	-	-	-	13-Jul-94	-	-
4900273	598846	4858021	5	1.5	5	1.5	Brown	Clay	-	-	6	1.8	6	1.8	Fresh	7-Nov-60	Water Supply	Domestic
			8	2.4	3	0.9	-	Clay	MSND	-								
			18	5.5	10	3.0	-	MSND	-	-								
7285847	598658	4858218	-	-	-	-	-	-	-	-	-	-	-	-	-	25-Jan-17	-	-
4900282	597481	4859341	12	3.7	12	3.7	Brown	Clay	-	-	59	18.0	Flowing		Fresh	15-Jan-57	Water Supply	Domestic
			59	18.0	47	14.3	Grey	Clay	MSND	Stones								
			60	18.3	1	0.3	-	MSND	-	-								
4907399	598634	4858225	19	5.8	19	5.8	Brown	Clay	Stones	Gravel	88	26.8	22	6.7	Fresh	28-Oct-90	Water Supply	Commerical
			39	11.9	20	6.1	Blue	Clay	Soft	-								
			55	16.8	16	4.9	Blue	Clay	Soft	Hard								
			62	18.9	7	2.1	-	HPAN	-	-								
			82	25.0	20	6.1	Blue	Clay	Hard	-								
			88	26.8	6	1.8	Blue	Clay	Stones	Gravel								
			93	28.4	5	1.5	Blue	CSND	Gravel	-								
			118	36.0	25	7.6	Blue	Shale	-	-								
4900143	597301	4857436	12	3.7	12	3.7	Brown	Clay	MSND	-	64	19.5	31	9.5	Fresh	20-Aug-65	Water Supply	Domestic/Livestock
			40	12.2	28	8.5	White	Clay	-	-								
			64	19.5	24	7.3	-	Clay	MSND	HPAN								
			66	20.1	2	0.6	-	FSND	-	-								
7172781	599128	4858060	4	1.2	4	1.2	Black	-	-	-	73	22.3	Flowing		not tested	7-Jul-11	Water Supply	Industrial
			17	5.2	13	4.0	Brown	Clay	Stones	-								
			50	15.2	33	10.1	Grey	Clay	Stones	-								
			70	21.3	20	6.1	Grey	Clay	Stones	CMTD								
			80	24.4	10	3.0	Grey	Gravel	Clay	MGVL								
7172137	599023	4857883	0.5	0.2	0.5	0.2	Black	-	-	-	-	-	-	-	-	2-Nov-11	Test Hole	Monitoring
			1	0.3	0.5	0.2	Brown	Sand	Gravel	Loose								
			12	3.7	11	3.4	Brown	Silt	Sand	Loose								
			20	6.1	8	2.4	Grey	Silt	Clay	Dense								

MEOCC WWR ID	Easting UTM N17	Northing UTM N17	Depth (ft)	Depth (m)	Thickness (ft)	Thickness (m)	Stratigraphy Color	Primary	Secondary	Tertiary	Water Found (ft)	Water Found (m)	Static Level (ft)	Static Level (m)	Water Kind	Date Completed	Status	Water Use
4905615	597364	4857723	48	14.6	48	14.6	-	Topsoil	-	-	100	30.5	26	7.9	Fresh	27-Apr-79	Water Supply	Livestock
			76	23.2	28	8.5	Brown	Sand	Clay	Silt								
			92	28.0	16	4.9	Blue	Clay	Silt	Gravel								
			100	30.5	8	2.4	Blue	HPAN	-	-								
			103	31.4	3	0.9	Blue	Gravel	Sand	Clay								
			106	32.3	3	0.9	Blue	Shale	-	-								
4907843	597908	4857037	-	-	-	-	-	-	-	-	-	-	-	-	-	13-Jul-94	-	-
4908534	597428	4857420	25	7.6	25	7.6	Brown	Sand	MSND	-	34	10.4	34	10.4	Fresh	27-Jan-00	Water Supply	Domestic
			66	20.1	41	12.5	Grey	Sand	MSND	-								
7292729	598776	4857763	-	-	-	-	-	-	-	-	-	-	-	-	-	3/Aug/17	Abandoned	-
4904393	597637	4857116	1	0.3	1	0.3	Brown	Loam	-	-	38	11.6	20	6.1	Not stated	01-Aug-74	Water Supply	Domestic
			10	3.0	9	2.7	Brown	Clay	-	-								
			38	11.6	28	8.5	Grey	Clay	-	-								
			42	12.8	4	1.2	Grey	Sand	-	-								
7275497	597641	4857180	16	4.9	16	4.9	Brown	Clay	-	-	-	-	-	-	-	6-May-16	Water Supply	Domestic
			38	11.6	22	6.7	Grey	Clay	Stones	-								
			98	29.9	60	18.3	Grey	Silt	Sand	-								
			110	33.5	12	3.7	Grey	Silt	-	-								
			113	34.5	3	0.9	Grey	Clay	Silt	-								
			125	38.1	12	3.7	Grey	Sand	Clay	-								
			133	40.5	8	2.4	Grey	Sand	Gravel	-								
			143	43.6	10	3.0	Grey	Shale	-	-								
4908694	598144	4857707	1	0.3	1	0.3	Brown	Loam	-	-	75	22.9	7	2.1	Fresh	18-May-00	Water Supply	Domestic
			10	3.0	9	2.7	Brown	Clay	-	-								
			12	3.7	2	0.6	Blue	Clay	-	-								
			75	22.9	63	19.2	Grey	FSND	-	-								
			84	25.6	9	2.7	Grey	MSND	-	-								
			91	27.7	7	2.1	Grey	FSND	-	-								
			93	28.4	2	0.6	Grey	Sand	Silt	Clay								
4903854	597814	4857025	12	3.7	12	3.7	Brown	Clay	-	-	85	25.9	90	27.4	Salty	12-Jun-72	Water Supply	Domestic
			81	24.7	69	21.0	Grey	Clay	-	-								
			120	36.6	39	11.9	Grey	Shale	-	-								
4905640	598114	4857523	2	0.6	2	0.6	Black	Topsoil	-	-	14	4.3	8	2.4	not tested	30-Apr-80	Water Supply	Domestic
			14	4.3	12	3.7	Blue	Clay	-	Hard								
			25	7.6	11	3.4	Brown	Sand	Pebbles	Coarse								
4910378	597322	4857684	-	-	-	-	-	-	-	-	-	-	-	-	-	30/Sep/06	Abandoned	-
4910318	597792	4856990	12	3.7	12	3.7	Brown	Clay	-	-	170	51.8	Flowing		Fresh	20-Aug-06	Water Supply	Domestic
			93	28.4	81	24.7	Grey	Clay	-	-								
			123	37.5	30	9.1	Grey	Silt	Clay	-								
			167	50.9	44	13.4	Grey	Clay	Stones	-								
			180	54.9	13	4.0	Grey	FSND	-	-								
4900214	598726	4858045	2	0.6	2	0.6	-	Loam	-	-	21	6.4	5	1.5	Fresh	13-Apr-66	Water Supply	Domestic
			5	1.5	3	0.9	Brown	Clay	-	-								
			20	6.1	15	4.6	Brown	Clay	BLDR	-								
			21	6.4	1	0.3	Blue	Clay	-	-								
			22	6.7	1	0.3	-	CSND	-	-								
4905851	597414	4857323	1	0.3	1	0.3	Brown	Loam	Hard	-	30	9.1	15	4.6	not stated	15-Dec-81	Water Supply	Domestic
			20	6.1	19	5.8	Brown	Clay	Hard	-								
			30	9.1	10	3.0	Grey	Clay	Hard	-								
			35	10.7	5	1.5	Grey	Sand	Loose	-								
4905839	597964	4859273	1	0.3	1	0.3	Brown	Loam	-	-	22	6.7	17.0	5.2	Fresh	20-May-81	Water Supply	Domestic
			10	3.0	9	2.7	Brown	Clay	Stones	-								
			29	8.8	19	5.8	Grey	Clay	Stones	Sand								
			35	10.7	6	1.8	Grey	Stones	Clay	-								
			36	11.0	1	0.3	Grey	Clay	Shale	-								
			38	11.6	2	0.6	Grey	Shale	Very Hard	-								
			12	3.7	12	3.7	Brown	Loam	-	-							Water	

MEOCC WWR ID	Easting UTM N17	Northing UTM N17	Depth (ft)	Depth (m)	Thickness (ft)	Thickness (m)	Stratigraphy Color	Primary	Secondary	Tertiary	Water Found (ft)	Water Found (m)	Static Level (ft)	Static Level (m)	Water Kind	Date Completed	Status	Water Use
4905116	597054	4857923	42	12.8	30	9.1	Grey	Clay	-	-	42	12.8	35	10.7	Fresh	10-May-77	Water supply	Domestic
			48	14.6	6	1.8	-	Sand	Gravel	WBRG								
4904011	598755	4858099	34	10.4	34	10.4	-	PRDG	-	-	110	33.54	Flowing		Fresh	26-Aug-72	Water supply	Domestic
			65	19.8	31	9.5	Blue	Clay	Sand	-								
			110	33.5	45	13.7	Blue	FSND	Clay	-								
			115	35.1	5	1.5	-	FSND	-	-								
4907849	598780	4857872	-	-	-	-	-	-	-	-	-	-	-	-	-	13-Jul-94	-	-
4906516	598226	4857340	18	5.5	18	5.5	Brown	Clay	-	-	23	7.0	Flowing		Fresh	11-Oct-86	Water Supply	Domestic
			23	7.0	5	1.5	Blue	Clay	-	-								
			35	10.7	12	3.7	Brown	MSND	-	-								
			45	13.7	10	3.0	Blue	Clay	-	-								
7220334	598903	4858000	3	0.9	3	0.9	Brown	Fill	Sand	Loose	-	-	-	-	-	1-May-14	Observe.	Monitoring
			14.5	4.4	11.5	3.5	Brown	Clay	Silt	Hard								
			18	5.5	3.5	1.1	Grey	Clay	Silt	Hard								
			25.5	7.8	7.5	2.3	Grey	Sand	Silt	Dense								
7292795	598776	4857763	-	-	-	-	-	-	-	-	-	-	-	-	-	3-Aug-17	Abandoned	-
7267796	596880	4858246	2	0.6	2	0.6	Brown	Loam	-	Soft	8	2.4	13	4.0	Fresh	13-Jun-16	Water Supply	Livestock / Domestic
			13	4.0	11	3.4	Brown	Clay	-	Hard								
			27	8.2	14	4.3	Grey	Clay	Stones	Hard								
			29	8.8	2	0.6	Brown	Sand	-	Loose								
			65	19.8	36	11.0	Grey	Clay	-	Hard								
			75	22.9	10	3.0	Brown	Sand	Gravel	LYRD								
			85	25.9	10	3.0	Grey	Gravel	Sand	Loose								
			98	29.9	13	4.0	Gray	Sand	Silt	DRTY								
			98	29.9	0	0.0	Grey	Shale	-	Hard								
4908369	598459	4857745	25	7.6	25	7.6	Brown	Clay	Stones	Dense	99	30.2	36	11.0	Fresh	25-Aug-97	Water Supply	Domestic
			28	8.5	3	0.9	Blue	CSND	Loose	-								
			33	10.1	5	1.5	Blue	FSND	Silt	Soft								
			48	14.6	15	4.6	Blue	Clay	Soft	-								
			53	16.2	5	1.5	Blue	FSND	Loose	-								
			86	26.2	33	10.1	Blue	FSND	Silt	Loose								
			97	29.6	11	3.4	Blue	Clay	Stones	PCKD								
			107	32.6	10	3.0	Blue	CSND	WBRG	Loose								
7181645	598283	4858462	1	0.3	1	0.3	Black	Loam	-	Soft	117	35.7	25	7.6	Fresh	20-Feb-12	Water Supply	Domestic
			17	5.2	16	4.9	Brown	Clay	-	Hard								
			92	28.0	75	22.9	Grey	Clay	Silt	Layered								
			98	29.9	6	1.8	Grey	Gravel	-	Loose								
			113	34.5	15	4.6	Grey	Clay	-	Hard								
			117	35.7	4	1.2	Grey	Sand	-	Loose								
4904720	597876	4857244	7	2.1	7	2.1	-	Clay	-	-	28	8.5	4	1.2	Fresh	26-Aug-74	Water Supply	Domestic
			10	3.0	3	0.9	-	Clay	Stones	-								
			12	3.7	2	0.6	-	Sand	-	-								
			16	4.9	4	1.2	-	Stones	-	-								
			18	5.5	2	0.6	-	Clay	-	-								
			30	9.1	12	3.7	-	Sand	Stones	-								
4908519	598914	4857996	4	1.2	4	1.2	Brown	Clay	-	-	-	-	3	0.9	Fresh	18-Oct-99	Water Supply	Commercial / Industrial
			16	4.9	12	3.7	Brown	Clay	Gravel	-								
			34	10.4	18	5.5	Brown	Sand	FSND	-								
			42	12.8	8	2.4	Blue	Clay	-	-								
			68	20.7	26	7.9	-	Sand	-	-								
			71	21.6	3	0.9	Blue	Clay	-	-								
7172136	598984	4857838	0.5	0.2	0.5	0.2	Brown	Loam	-	Loose	-	-	-	-	-	2-Nov-11	Test Hole	Monitoring
			12	3.7	11.5	3.5	Brown	Sand	Silt	Loose								
			20	6.1	8	2.4	Grey	Silt	Sand	Dense								
4906643	598903	4857852	19	5.8	19	5.8	Brown	Clay	-	-	84	25.6	Flowing		Fresh	30-Aug-86	Water Supply	Commercial
			46	14.0	27	8.2	Blue	Clay	-	-								
			84	25.6	38	11.6	Blue	Clay	Silt	Sand								

MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
			91	27.7	7	2.1	Brown	MSND	-	-								
4904007	597556	4857470	2	0.6	2	0.6	Brown	Loam	-	-	23	7.0	Flowing		Fresh	15-Jun-72	Water Supply	Domestic
			9	2.7	7	2.1	Brown	Clay	-	-								
			23	7.0	14	4.3	Blue	Clay	Stones	-								
			25	7.6	2	0.6	Blue	Gravel	-	-								
4904847	596987	4858136	32	9.8	32	9.8	-	Topsoil	-	-	90	27.4	22	6.7	Fresh	4-Feb-76	Water Supply	Livestock / Domestic
			35	10.7	3	0.9	Blue	Clay	-	-								
			90	27.4	55	16.8	-	FSND	-	-								
			95	29.0	5	1.5	-	Gravel	-	-								
4907932	597435	4857461	1	0.3	1	0.3	Brown	Loam	Hard	-	60	18.3	5	1.5	not stated	10-Sep-94	Water Supply	Domestic
			30	9.1	29	8.8	Brown	Clay	Hard	-								
			60	18.3	30	9.1	Grey	Clay	Hard	-								
			72	22.0	12	3.7	Grey	Sand	Loose	-								
4904395	597189	4858347	1	0.3	1	0.3	Brown	Loam	-	-	20	6.1	15	4.6	not stated	1-Aug-74	Water Supply	Domestic
			15	4.6	14	4.3	Brown	Clay	-	-								
			34	10.4	19	5.8	Brown	Sand	Gravel	-								
4900216	596886	4858130	2	0.6	2	0.6	-	Loam	-	-	132	40.2	25	7.6	Fresh	13-Nov-64	Water Supply	Domestic
			15	4.6	13	4.0	-	Clay	-	-								
			45	13.7	30	9.1	-	HPAN	-	-								
			110	33.5	65	19.8	-	Clay	MSND	-								
			130	39.6	20	6.1	-	QSND	-	-								
			132	40.2	2	0.6	-	GRVL	-	-								
4904146	598039	4858691	2	0.6	2	0.6	Black	Loam	-	-	33	10.1	57	17.4	Fresh	6-Jul-73	Water Supply	Domestic
			35	10.7	33	10.1	Brown	Clay	Stones	-								
			57	17.4	22	6.7	Blue	Clay	Stones	-								
			67	20.4	10	3.0	Grey	Sand	-	-								
			75	22.9	8	2.4	Blue	Clay	-	-								
4907881	598405	4857436	-	-	-	-	-	-	-	-	-	-	-	-	-	2-Sep-94	-	-
4904437	598238	4858479	23	7.0	23	7.0	Brown	Clay	-	-	100	30.5	23	7.0	Fresh	30-Jul-73	Water Supply	Domestic
			100	30.5	77	23.5	Blue	Clay	Stones	-								
			112	34.1	12	3.7	Blue	Sand	Gravel	Clay								

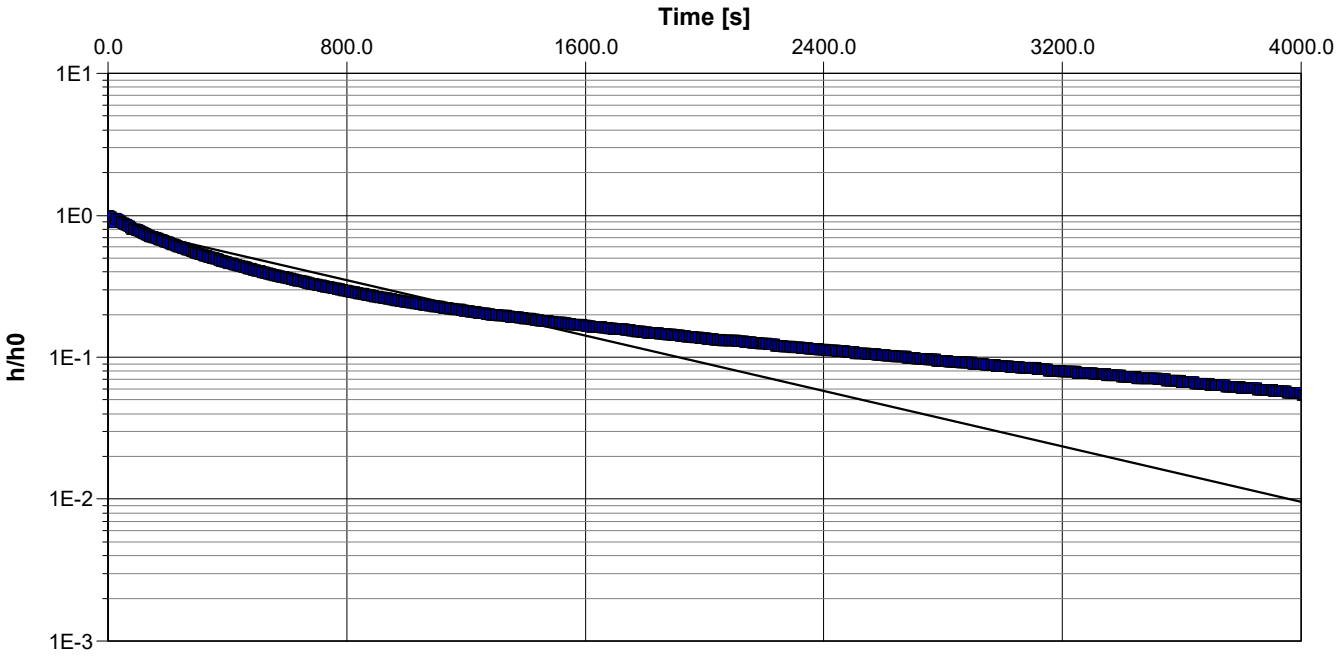
MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
			127	38.7	15	4.6	Blue	Shale	Clay	-							Supply	
			180	54.9	53	16.2	Blue	Shale	-	-								
4903300	598214	4858623	12	3.7	12	3.7	Brown	Clay	-	-	175	53.4	35	10.7	Fresh	11-Aug-69	Water Supply	Domestic
			122	37.2	110	33.5	Blue	Clay	-	-								
			175	53.4	53	16.2	Grey	Silt	-	-								
4908027	597914	4856940	2	0.6	2	0.6	-	Loam	-	-	124	37.8	1	0.3	Fresh	16-Aug-95	Water supply	Domestic
			12	3.7	10	3.0	Brown	Clay	-	-								
			27	8.2	15	4.6	Blue	Clay	-	-								
			78	23.8	51	15.5	Blue	Clay	Gravel	-								
			124	37.8	46	14.0	Blue	Clay	Soft	-								
			130	39.6	6	1.8	Brown	Sand	-	-								
4907094	597663	4858835	22	6.7	22	6.7	Brown	Clay	Stones	-	199	60.7	26	7.9	Fresh	20-Jan-89	Water Supply	Livestock / Domestic
			65	19.8	43	13.1	Blue	Clay	Stones	-								
			72	22.0	7	2.1	Blue	Clay	Soft	-								
			85	25.9	13	4.0	Blue	Clay	Gravel	Sand								
			190	57.9	105	32.0	Blue	Clay	Silt	-								
			199	60.7	9	2.7	Blue	Clay	Silt	Sand								
			214	65.2	15	4.6	-	FSND	-	-								
7241065	598679	4857836	1.5	0.5	1.5	0.5	Brown	Loam	-	Loose	7	2.1	-	-	not tested	24-Mar-15	Test Hole	Monitoring
			7	2.1	5.5	1.7	Brown	Clay	-	Silty								
			16	4.9	9	2.7	Brown	Sand	Clay	Gravel								
			20	6.1	4	1.2	Brown	Silt	Clay	Soft								
			35	10.7	15	4.6	Grey	Silt	-	Loose								
4904719	598523	4857402	9	2.7	9	2.7	-	Clay	-	-	10	3.0	6	1.8	Fresh	29-Aug-74	Water Supply	Domestic
			12	3.7	3	0.9	-	Sand	-	-								
			18	5.5	6	1.8	-	Sand	-	-								
			28	8.5	10	3.0	-	Clay	-	-								
7172135	599026	4857798	0.5	0.2	0.5	0.2	Brown	Loam	-	Loose	-	-	-	-	-	2-Nov-11	Test Hole	Monitoring
			12	3.7	11.5	3.5	Brown	Silt	Sand	Loose								
			20	6.1	8	2.4	Grey	Silt	Clay	Dense								
4905545	598514	4857723	1	0.3	1	0.3	Brown	Loam	-	-	16	4.9	15	4.6	not stated	31-Jul-79	Water Supply	Domestic
			9	2.7	8	2.4	Brown	Clay	-	-								
			16	4.9	7	2.1	Brown	Clay	Sand	-								
			24	7.3	8	2.4	Brown	Sand	-	-								
			32	9.8	8	2.4	Brown	Clay	Sand	-								
			35	10.7	3	0.9	Grey	Sand	-	-								
4909556	598425	4858349	15	4.6	15	4.6	Brown	Clay	-	Hard	75	22.9	17	5.2	Fresh	24-Oct-04	Water Supply	Domestic
			25	7.6	10	3.0	Grey	Clay	-	Hard								
			64	19.5	39	11.9	Grey	Clay	Stones	Hard								
			70	21.3	6	1.8	Grey	Clay	-	Loose								
			77	23.5	7	2.2	Grey	Gravel	-	Loose								
4909415	599081	4858056	20	6.1	20	6.1	Brown	Fill	-	-	-	-	2	0.6	Fresh	13-Apr-04	Water Supply	Domestic
			38	11.6	18	5.5	Grey	Clay	-	-								
			41	12.5	3	0.9	Brown	Sand	-	-								
			50	15.2	9	2.8	Grey	Sand	Soft	Clean								
			60	18.3	10	3.0	Grey	Clay	Hard	-								
7278360	599062	4857830	-	-	-	-	-	-	-	-	-	-	-	-	-	10-Jun-16	-	-
4908422	599026	4857876	4	1.2	4	1.2	Brown	Clay	Stones	Fill	71	21.6	0	0	Fresh	26-Oct-91	Water Supply	Commercial
			12	3.7	8	2.4	Brown	Clay	Sand	-								
			34	10.4	22	6.7	Brown	Clay	Gravel	-								
			71	21.6	37	11.3	Grey	FSND	-	-								
			114	34.8	43	13.1	Grey	FSND	-	-								
			118	36.0	4	1.2	Blue	Clay	Gravel	Sand								
4904761	597397	4857685	2	0.6	2	0.6	Brown	Loam	-	-	24	7.3	23	7.0	not stated	23-Sep-75	Water Supply	Domestic
			24	7.3	22	6.7	Brown	Sand	Clay	-								
			38	11.6	14	4.3	Grey	Sand	-	-								
			43	13.1	5	1.5	Brown	Sand	-	-								

MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
7221650	598993	4858315	-	-	-	-	-	-	-	-	4	1.2	-	-	Fresh	14-May-14	-	-
4905784	598114	4858823	100	30.5	100	30.5	-	PRDG	-	-	208		22		Fresh	12-Dec-80	Water Supply	Domestic
			160	48.8	60	18.3	Blue	Clay	-	-								
			208	63.4	48	14.6	Blue	Clay	Silt	FSND								
			212	64.6	4	1.2	-	Gravel	CSND	Clay								

Appendix D

	Slug Test Analysis Report	C
	Project: Hydrogeological Investigation	
	Number: 20-169-100	
	Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-1	Test Well: BH20-1
Test Conducted by:		Test Date: 7/6/2020
Analysis Performed by: AS	BH2-01	Analysis Date: 12/7/2020
Aquifer Thickness: 3.80 m		

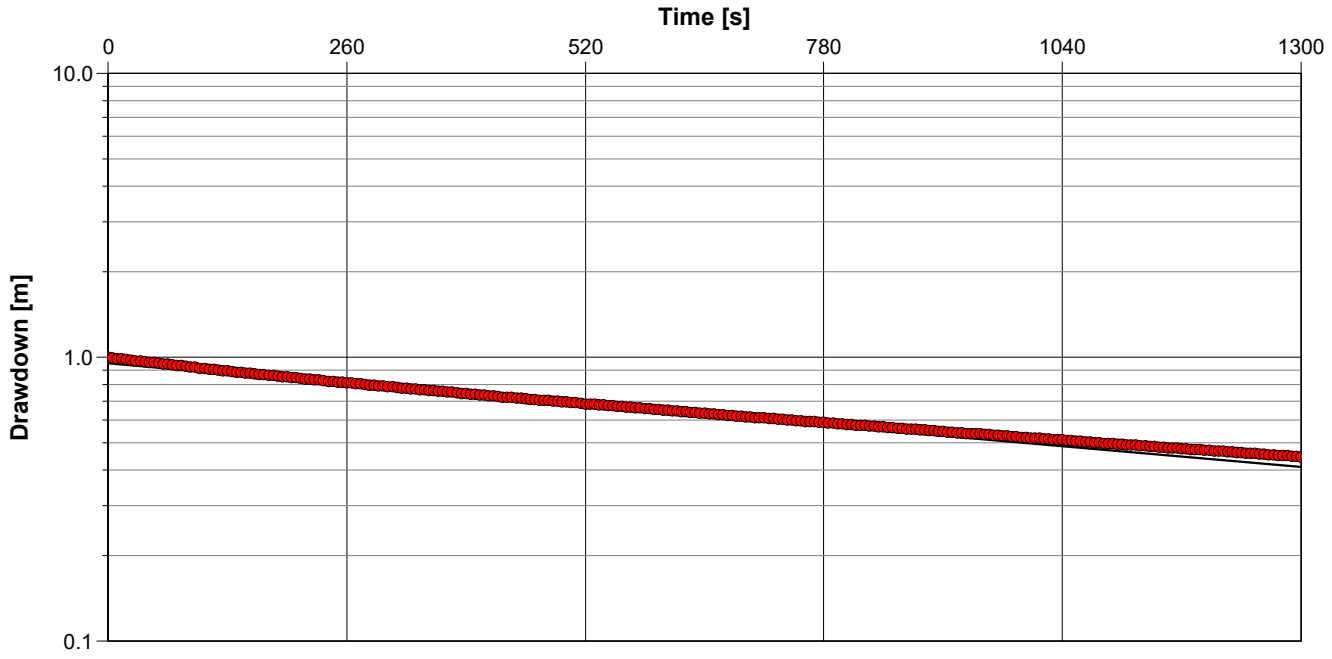


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-1	7.34×10^{-7}	

	Slug Test Analysis Report	C
	Project: Hydrogeological Investigation	
	Number: 20-169-100	
	Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-5	Test Well: BH20-5
Test Conducted by:		Test Date: 12/7/2020
Analysis Performed by: AS	BH20-5	Analysis Date: 12/7/2020
Aquifer Thickness: 7.00 m		

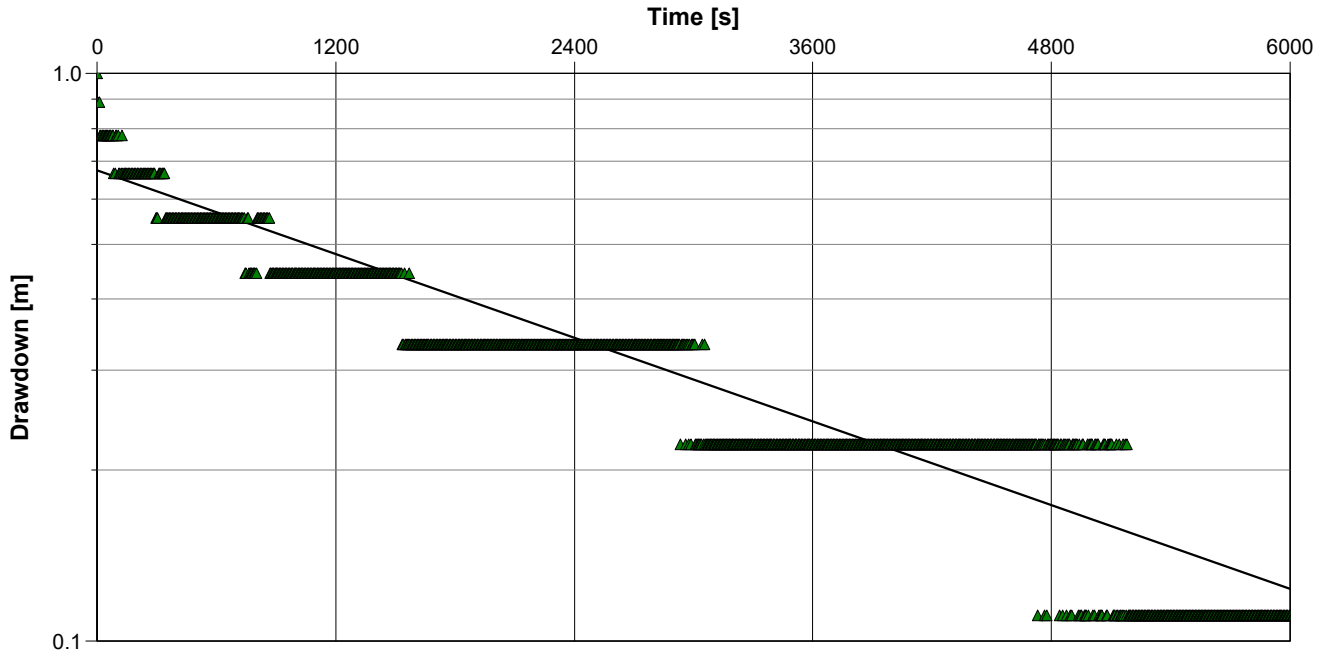


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-5	5.34×10^{-7}	

	Slug Test Analysis Report	C
	Project: Hydrogeological Investigation	
	Number: 20-169-100	
	Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-6	Test Well: BH20-6
Test Conducted by:		Test Date: 12/7/2020
Analysis Performed by: AS	BH20-6	Analysis Date: 12/7/2020
Aquifer Thickness: 1.08 m		

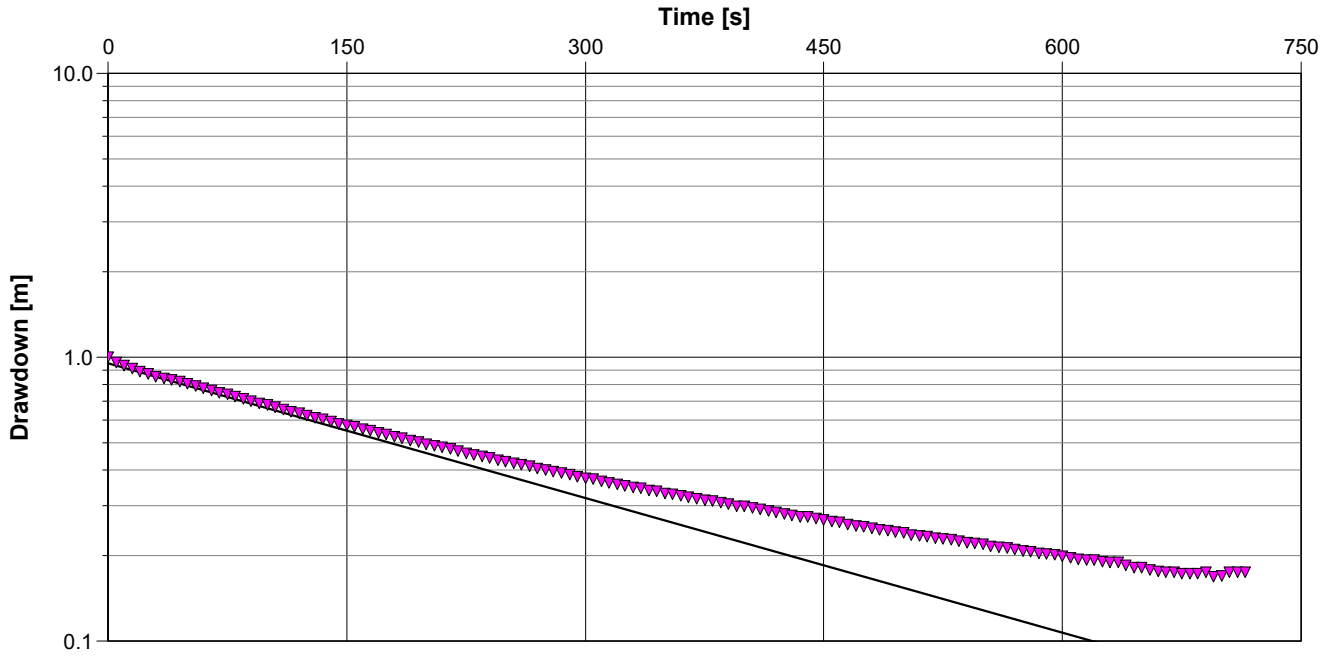


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-6	1.42×10^{-7}	

	Slug Test Analysis Report	C
	Project: Hydrogeological Investigation	
	Number: 20-169-100	
	Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-9	Test Well: BH20-9
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-9	Analysis Date: 12/8/2020
Aquifer Thickness: 3.08 m		

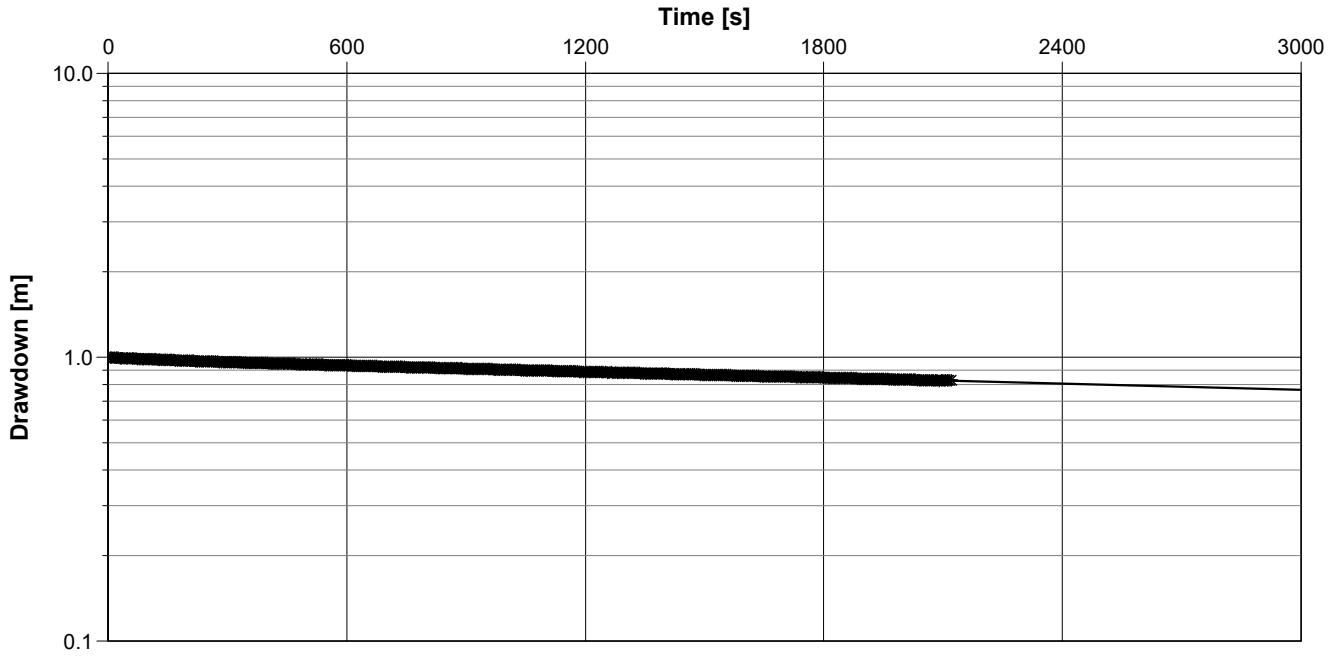


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH20-9	3.21×10^{-6}	

	Slug Test Analysis Report	C
	Project: Hydrogeological Investigation	
	Number: 20-169-100	
	Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-11	Test Well: BH20-11
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-11	Analysis Date: 12/8/2020
Aquifer Thickness: 2.00 m		

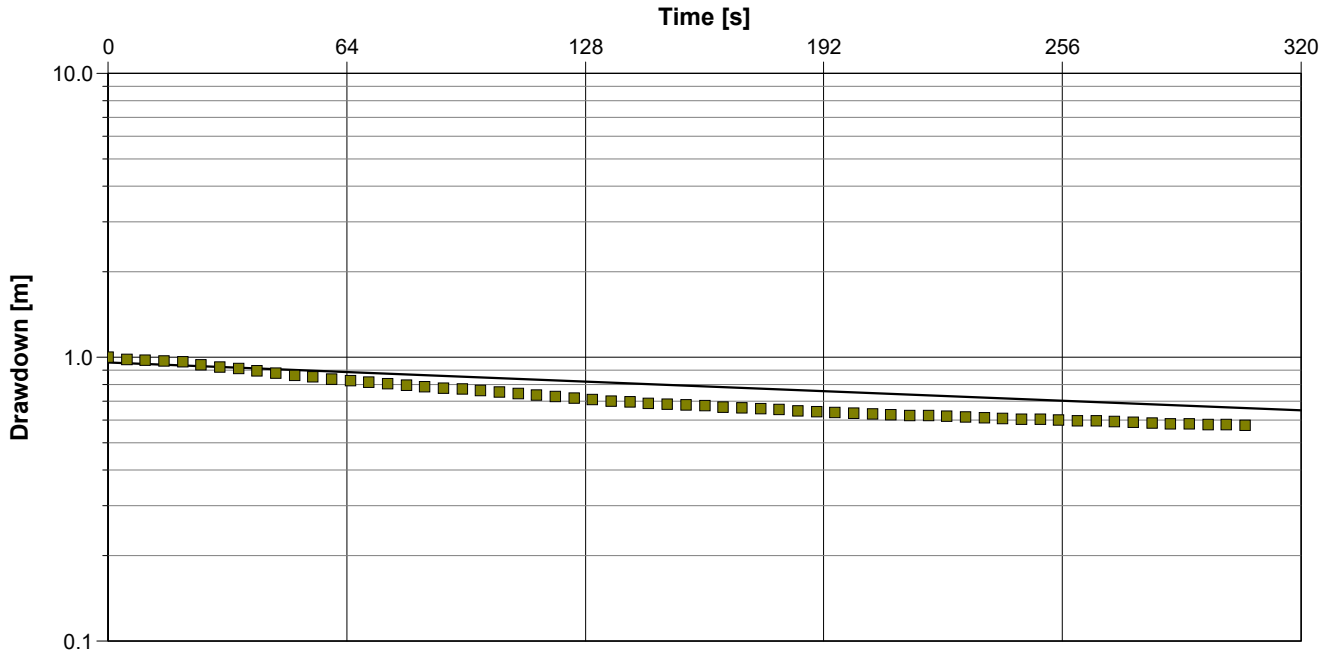


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-11	5.22×10^{-8}	

	Slug Test Analysis Report	C
	Project: Hydrogeological Investigation	
	Number: 20-169-100	
	Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-12	Test Well: BH20-12
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-12	Analysis Date: 12/8/2020
Aquifer Thickness: 2.20 m		

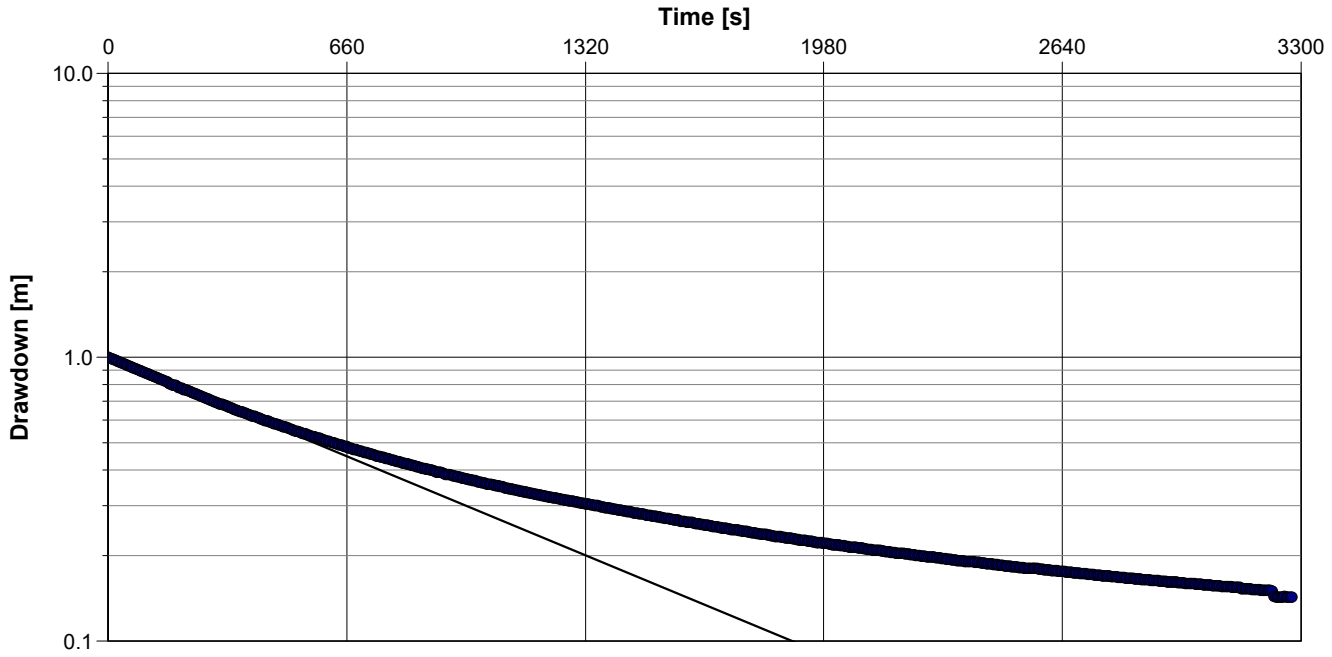


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-12	7.33×10^{-7}	

	Slug Test Analysis Report	C
	Project: Hydrogeological Investigation	
	Number: 20-169-100	
	Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-14	Test Well: BH20-14
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-14	Analysis Date: 12/8/2020
Aquifer Thickness: 0.80 m		

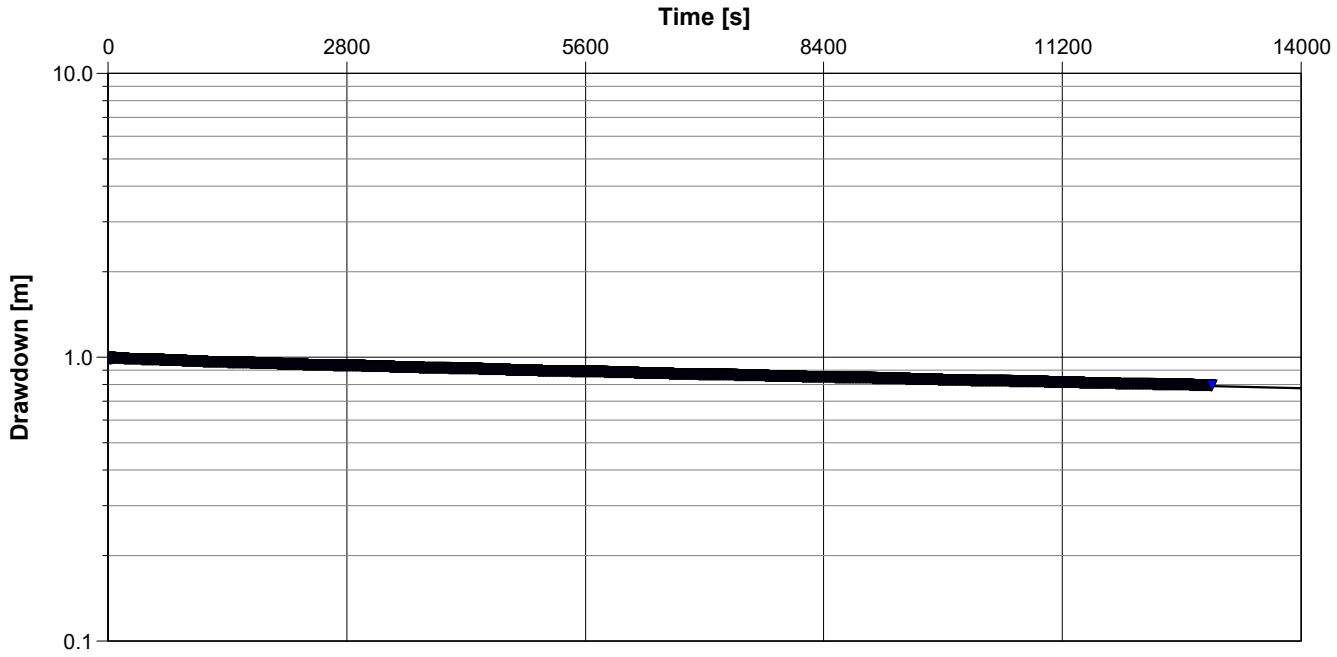


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-14	6.01×10^{-7}	

	Slug Test Analysis Report	C
	Project: Hydrogeological Investigation	
	Number: 20-169-100	
	Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-15	Test Well: Well 9
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-15	Analysis Date: 12/8/2020
Aquifer Thickness: 0.70 m		

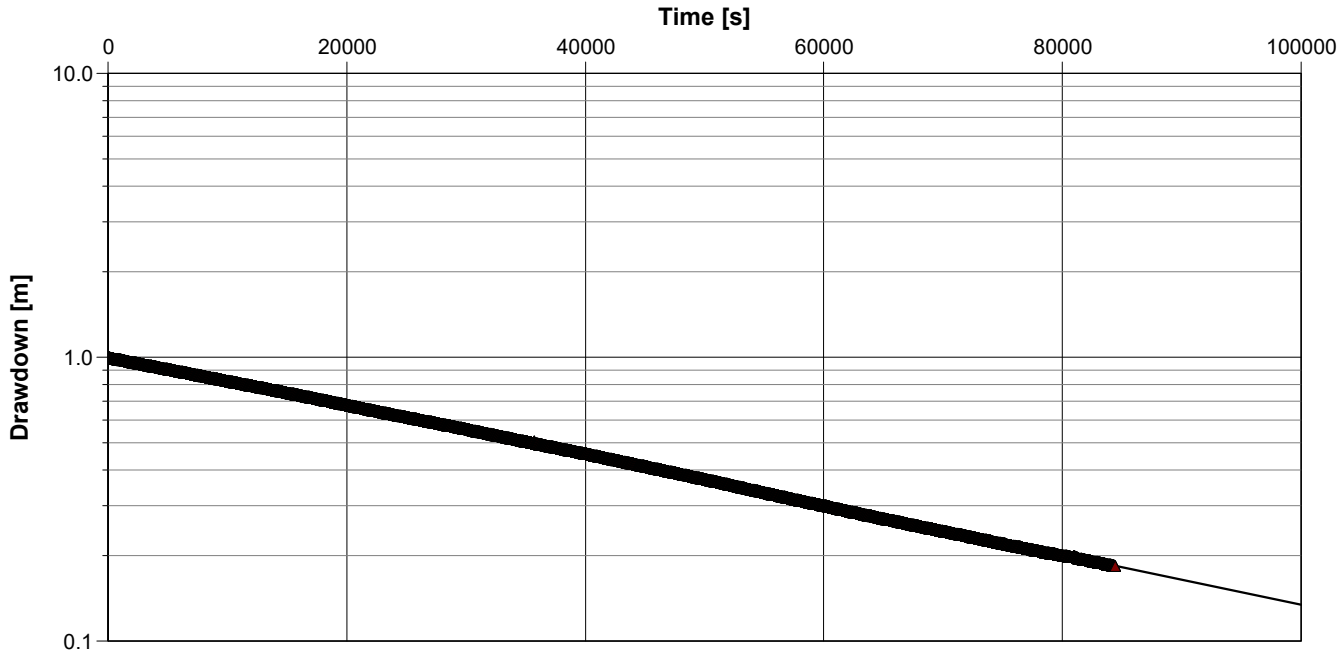


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
Well 9	7.38×10^{-9}	

	Slug Test Analysis Report	C
	Project: Hydrogeological Investigation	
	Number: 20-169-100	
	Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-16	Test Well: BH20-16
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-16	Analysis Date: 12/8/2020
Aquifer Thickness: 6.12 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-16	1.50×10^{-8}	

Appendix E

FINAL REPORT

CA15868-OCT20 R1

20-169-100

Prepared for

DS Consultants

FINAL REPORT

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	DS Consultants	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	6221 Highway 7 Unit 16 Vaughan, Ontario L4H 0K8. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Dorothy Garda	Telephone	705-652-2143
Telephone	905-264-9393	Facsimile	705-652-6365
Facsimile	905-264-2685	Email	brad.moore@sgs.com
Email	dorothy.garda@dsconsultants.ca	SGS Reference	CA15868-OCT20
Project	20-169-100	Received	10/29/2020
Order Number		Approved	10/30/2020
Samples	Surface Water (2)	Report Number	CA15868-OCT20 R1
		Date Reported	10/30/2020

COMMENTS

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
NR - Not reportable under applicable Provincial drinking water regulations as per client.

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:018069

Hg spike reported as NV due to technician error. No spike used for the replicate sample. Data accepted as the spike blank met tolerance as well as secondary QC

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

Client: DS Consultants
Project: 20-169-100
Project Manager: Dorothy Garda
Samplers: Dorothy Grada

PACKAGE: **PWQO_L - General Chemistry**
(WATER)

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

			Sample Number	7	8
			Sample Name	SGW1	SGW6
			Sample Matrix	Surface Water	Surface Water
			Sample Date	29/10/2020	29/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
General Chemistry					
Dissolved Oxygen	mg/L	1		8.8	9.1
Total Suspended Solids	mg/L	2		103	33
Alkalinity	mg/L as CaCO3	2		247	375
Bicarbonate	mg/L as CaCO3	2		247	375
Carbonate	mg/L as CaCO3	2		< 2	< 2
OH	mg/L as CaCO3	2		< 2	< 2
Colour	TCU	3		9	13
Conductivity	uS/cm	2		889	2190
Turbidity	NTU	0.10		56.7	50.1
Ammonia+Ammonium (N)	as N mg/L	0.04		0.04	0.32
Phosphorus (total reactive)	mg/L	0.03		0.09	0.10
Total Organic Carbon	mg/L	1		4	8
Ion Ratio	-	-9999		1.58	1
Total Dissolved Solids (calculated)	mg/L	-9999		460	1155
Conductivity (calculated)	uS/cm	-9999		1020	2135
Langeliers Index 4° C	@ 4° C	-9999		0.46	0.77
Saturation pH 4°C	pHs @ 4°C	-9999		7.61	7.25

Client: DS Consultants
Project: 20-169-100
Project Manager: Dorothy Garda
Samplers: Dorothy Grada

PACKAGE: **PWQO_L - Metals and Inorganics**
(WATER)

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

			Sample Number	7	8
			Sample Name	SGW1	SGW6
			Sample Matrix	Surface Water	Surface Water
			Sample Date	29/10/2020	29/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Metals and Inorganics					
Fluoride	mg/L	0.06		0.12	0.67
Bromide	mg/L	0.05		<0.05	0.15
Nitrite (as N)	as N mg/L	0.003		<0.003	<0.003
Nitrate (as N)	as N mg/L	0.006		0.058	0.042
Sulphate	mg/L	0.04		20	14
Mercury	µg/L	0.01	0.2	< 0.01	< 0.01
Hardness	mg/L as CaCO3	0.05		311	467
Aluminum	µg/L	1	75	2610	2400
Aluminum (0.2µm)	mg/L	0.001	0.015	0.034	0.096
Arsenic	µg/L	0.2	5	12.0	1.0
Boron	µg/L	2	200	17	32
Barium	µg/L	0.02		178	82.0
Beryllium	µg/L	0.007	1100	0.139	0.109
Cobalt	µg/L	0.004	0.9	1.86	1.87
Calcium	mg/L	0.01		93.0	153
Cadmium	µg/L	0.003	0.5	0.059	0.036
Copper	µg/L	0.2	5	5.9	3.2
Chromium	µg/L	0.08	100	3.82	2.80
Iron	ug/L	7	300	36800	4300
Potassium	mg/L	0.009		2.69	7.23
Magnesium	mg/L	0.001		19.1	20.8
Manganese	µg/L	0.01		1910	3270
Molybdenum	µg/L	0.04	40	1.34	1.53

Client: DS Consultants
Project: 20-169-100
Project Manager: Dorothy Garda
Samplers: Dorothy Grada

PACKAGE: **PWQO_L - Metals and Inorganics**
(WATER)

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

			Sample Number	7	8
			Sample Name	SGW1	SGW6
			Sample Matrix	Surface Water	Surface Water
			Sample Date	29/10/2020	29/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Metals and Inorganics (continued)					
Nickel	µg/L	0.1	25	1.8	2.8
Sodium	mg/L	0.01		87.3	254
Phosphorus	mg/L	0.003	0.01	1.93	0.358
Lead	µg/L	0.01	25	5.68	1.72
Silicon	ug/L	20		12800	9560
Silver	µg/L	0.05	0.1	< 0.05	< 0.05
Strontium	µg/L	0.02		306	466
Thallium	µg/L	0.005	0.3	0.034	0.026
Tin	µg/L	0.06		0.20	0.19
Titanium	ug/L	0.05		87.3	75.4
Antimony	µg/L	0.09	20	0.19	0.19
Selenium	µg/L	0.04	100	0.22	0.28
Uranium	µg/L	0.002	5	0.220	1.30
Vanadium	µg/L	0.01	6	5.20	3.92
Zinc	µg/L	2	20	24	19
Cation sum	meq/L	-9999		12.5	21.35
Anion Sum	meq/L	-9999		7.89	21.36
Anion-Cation Balance	% difference	-9999		22.58	-0.03

Client: DS Consultants
Project: 20-169-100
Project Manager: Dorothy Garda
Samplers: Dorothy Grada

PACKAGE: **PWQO_L - Other (ORP)** (WATER)

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

Sample Number	7	8
Sample Name	SGW1	SGW6
Sample Matrix	Surface Water	Surface Water
Sample Date	29/10/2020	29/10/2020

Parameter	Units	RL	L1	Result	Result
Other (ORP)					
pH	No unit	0.05	8.6	8.07	8.02
Chloride	mg/L	0.04		90	480

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E L1
SGW1				
Aluminum	SM 3030/EPA 200.8	µg/L	2610	75
Aluminum (dissolved)	SM 3030/EPA 200.8	µg/L	0.034	0.015
Arsenic	SM 3030/EPA 200.8	µg/L	12.0	5
Cobalt	SM 3030/EPA 200.8	µg/L	1.86	0.9
Copper	SM 3030/EPA 200.8	µg/L	5.9	5
Iron	SM 3030/EPA 200.8	µg/L	36800	300
Phosphorus	SM 3030/EPA 200.8	µg/L	1.93	0.01
Zinc	SM 3030/EPA 200.8	µg/L	24	20
SGW6				
Aluminum	SM 3030/EPA 200.8	µg/L	2400	75
Aluminum (dissolved)	SM 3030/EPA 200.8	µg/L	0.096	0.015
Cobalt	SM 3030/EPA 200.8	µg/L	1.87	0.9
Iron	SM 3030/EPA 200.8	µg/L	4300	300
Phosphorus	SM 3030/EPA 200.8	µg/L	0.358	0.01

QC SUMMARY

Alkalinity

Method: SM 2320 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Alkalinity	EWL0551-OCT20	mg/L as CaCO3	2	< 2	1	20	102	80	120	NA		

Ammonia by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENV]SFA-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Ammonia+Ammonium (N)	SKA0324-OCT20	mg/L	0.04	<0.04	0	10	100	90	110	99	75	125

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bromide	DIO0586-OCT20	mg/L	0.05	<0.05	ND	20	102	80	120	98	75	125
Chloride	DIO0586-OCT20	mg/L	0.04	<0.04	8	20	100	80	120	94	75	125
Nitrite (as N)	DIO0586-OCT20	mg/L	0.003	<0.003	ND	20	101	80	120	98	75	125
Nitrate (as N)	DIO0586-OCT20	mg/L	0.006	<0.006	20	20	103	80	120	102	75	125
Sulphate	DIO0586-OCT20	mg/L	0.04	<0.04	NV	20	98	80	120	91	75	125
Chloride	DIO0590-OCT20	mg/L	0.04	<0.04	2	20	98	80	120	100	75	125

Carbon by SFA

Method: SM 5310 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-009

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Organic Carbon	SKA0327-OCT20	mg/L	1	<1	2	10	103	90	110	109	75	125

QC SUMMARY

Carbonate/Bicarbonate

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Carbonate	EWL0551-OCT20	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0551-OCT20	mg/L as CaCO3	2	< 2	1	10	NA	90	110	NA		
OH	EWL0551-OCT20	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		

Colour

Method: SM 2120 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Colour	EWL0563-OCT20	TCU	3	< 3	ND	10	100	80	120	NA		

QC SUMMARY

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0551-OCT20	uS/cm	2	< 2	0	20	99	90	110	NA		

Fluoride by Specific Ion Electrode

Method: SM 4500 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0560-OCT20	mg/L	0.06	<0.06	ND	10	98	90	110	111	75	125

Mercury by CVAAS

Method: SM3112/EPA 245 | Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0029-OCT20	ug/L	0.01	-0.020	ND	20	90	80	120	NV	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0179-OCT20	ug/L	0.05	<0.00005	ND	20	101	90	110	98	70	130
Aluminum	EMS0179-OCT20	ug/L	1	<0.001	ND	20	99	90	110	115	70	130
Aluminum (0.2µm)	EMS0179-OCT20	mg/L	0.001	<0.001	ND	20	99	90	110	115	70	130
Arsenic	EMS0179-OCT20	ug/L	0.2	<0.0002	4	20	102	90	110	101	70	130
Barium	EMS0179-OCT20	ug/L	0.02	<0.00002	4	20	98	90	110	109	70	130
Beryllium	EMS0179-OCT20	ug/L	0.007	<0.000007	0	20	95	90	110	94	70	130
Boron	EMS0179-OCT20	ug/L	2	<0.002	6	20	91	90	110	NV	70	130
Calcium	EMS0179-OCT20	mg/L	0.01	<0.01	3	20	96	90	110	103	70	130
Cadmium	EMS0179-OCT20	ug/L	0.003	<0.000003	7	20	99	90	110	100	70	130
Cobalt	EMS0179-OCT20	ug/L	0.004	<0.000004	3	20	100	90	110	98	70	130
Chromium	EMS0179-OCT20	ug/L	0.08	<0.00008	ND	20	102	90	110	104	70	130
Copper	EMS0179-OCT20	ug/L	0.2	<0.0002	14	20	101	90	110	105	70	130
Iron	EMS0179-OCT20	ug/L	7	<0.007	18	20	97	90	110	NV	70	130
Potassium	EMS0179-OCT20	mg/L	0.009	<0.009	2	20	100	90	110	100	70	130
Magnesium	EMS0179-OCT20	mg/L	0.001	<0.001	4	20	95	90	110	97	70	130
Manganese	EMS0179-OCT20	ug/L	0.01	<0.00001	1	20	101	90	110	104	70	130
Molybdenum	EMS0179-OCT20	ug/L	0.04	<0.00004	ND	20	102	90	110	106	70	130
Sodium	EMS0179-OCT20	mg/L	0.01	<0.01	6	20	91	90	110	94	70	130
Nickel	EMS0179-OCT20	ug/L	0.1	<0.0001	18	20	101	90	110	83	70	130
Lead	EMS0179-OCT20	ug/L	0.01	<0.00001	2	20	96	90	110	105	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Phosphorus	EMS0179-OCT20	mg/L	0.003	<0.003	ND	20	96	90	110	NV	70	130
Antimony	EMS0179-OCT20	ug/L	0.09	<0.0009	ND	20	98	90	110	110	70	130
Selenium	EMS0179-OCT20	ug/L	0.04	<0.00004	ND	20	100	90	110	110	70	130
Silicon	EMS0179-OCT20	ug/L	20	<0.02	5	20	99	90	110	NV	70	130
Tin	EMS0179-OCT20	ug/L	0.06	<0.00006	ND	20	98	90	110	NV	70	130
Strontium	EMS0179-OCT20	ug/L	0.02	< 0.02	3	20	102	90	110	103	70	130
Titanium	EMS0179-OCT20	ug/L	0.05	<0.00005	ND	20	98	90	110	NV	70	130
Thallium	EMS0179-OCT20	ug/L	0.005	<0.000005	13	20	99	90	110	104	70	130
Uranium	EMS0179-OCT20	ug/L	0.002	<0.000002	4	20	97	90	110	102	70	130
Vanadium	EMS0179-OCT20	ug/L	0.01	<0.00001	8	20	99	90	110	87	70	130
Zinc	EMS0179-OCT20	ug/L	2	<0.002	ND	20	97	90	110	126	70	130

QC SUMMARY

Metals in aqueous samples - ICP-OES

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Hardness	EMS0179-OCT20	mg/L as CaCO3	0.05		3	20						

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0551-OCT20	No unit	0.05	NA	0		101			NA		

Reactive Phosphorus by SFA

Method: SM 4500-P F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Phosphorus (total reactive)	SKA0319-OCT20	mg/L	0.03	<0.03	ND	10	97	90	110	NV	75	125

QC SUMMARY

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0555-OCT20	mg/L	2	< 2	0	10	96	90	110	NA		

Turbidity

Method: SM 2130 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Turbidity	EWL0554-OCT20	NTU	0.10	< 0.10	1	10	99	90	110	NA		

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: 018069 Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Scott
Received Date: 10/29/2020 (mm/dd/yy)
Received Time: 16 20 (hr : min)
Received By (signature):
Custody Seal Present: Yes ☑ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: Ice
Temperature Upon Receipt (°C) 9°c. 9°c 9°c
LAB LIMS #: CA15868-OCT20

REPORT INFORMATION	INVOICE INFORMATION
Company: DS	☒ (same as Report Information)
Contact: Dorothy Gorda	Company: accounting
Address: 16-6221 HWY 7 Vaughn, ON	Contact:
Phone: (905) 324-2735	Address:
Fax:	Phone:
Email: dorothy.gorda@dsconsultants.ca	Email: accounting@dsconsultants.ca

Quotation #:
Project #: 20-169-100
P.O. #:
Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED

☐ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☒ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:

*NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium/Fine
☐ Table 3 ☐ Agri/Other
☐ Table ____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☒ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA
☐ ODWS Not Reportable *See note

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	M&I: Metals & Inorganics (incl CrVI, CN, Hg, pH,(B(HWS),EC,SAR–soil) (Cl, Na–water)	M&I: Full Metals Suite (ICP metals plus B(HWS–soil only) Hg, CrVI	M&I: ICP Metals only Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni,	SVOC: PAHs only	SVOC: SVOCs all incl PAHs, ABNs, CPs	PCB: PCBs ☐ Total ☐ Aroclor	PHC: F1-F4 + BTEX	PHC: F1-F4 only no BTEX	VOC: VOCs all incl BTEX	VOC: BTEX only	Pest: Pesticides Organochlorine or specify other	Other: DO	Other: TSS	Other: Gen Chem (Characterization)	Other: Nitrate	Other: Appendix 2: 406/19 Leachate Screening Levels Table:	Other: Sewer Use: Specify pkg:	Other: Water Characterization Pkg ☐ Extended ☐ General	TCLP: Specify TCLP tests ☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit.	COMMENTS:
1	SGW9	10/29/20	8:30am	8	SW													X	X	X					
2	SGW6	10/29/20	9.am	8	SW													X	X	X					
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									

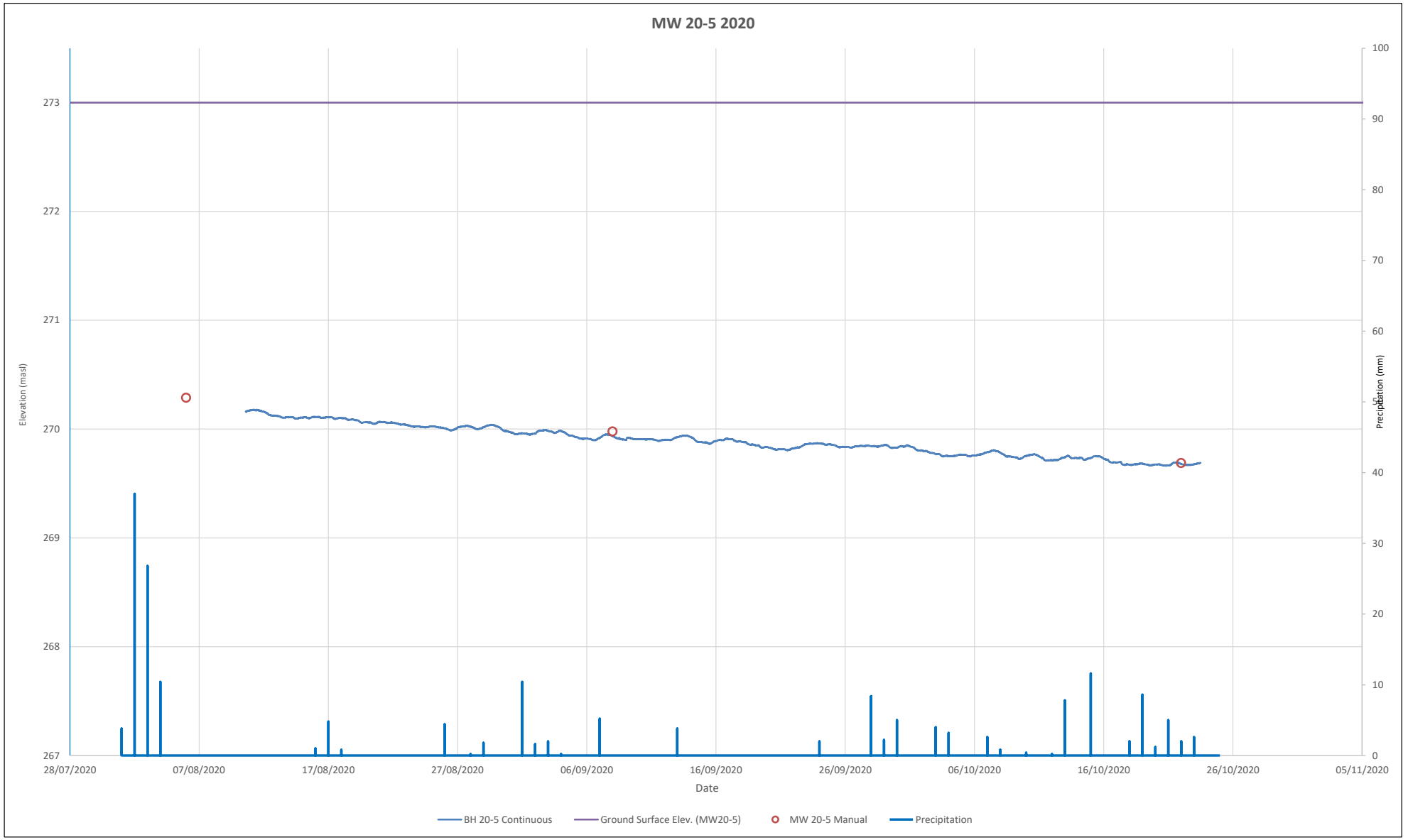
Observations/Comments/Special Instructions

Sampled By (NAME): Dorothy Gorda	Signature:	Date: 10/29/20 (mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Dorothy Gorda	Signature:	Date: 10/29/20 (mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.4
Date of Issue: 22 May. 2020

Appendix F

WATER LEVEL HYDROGRAPH



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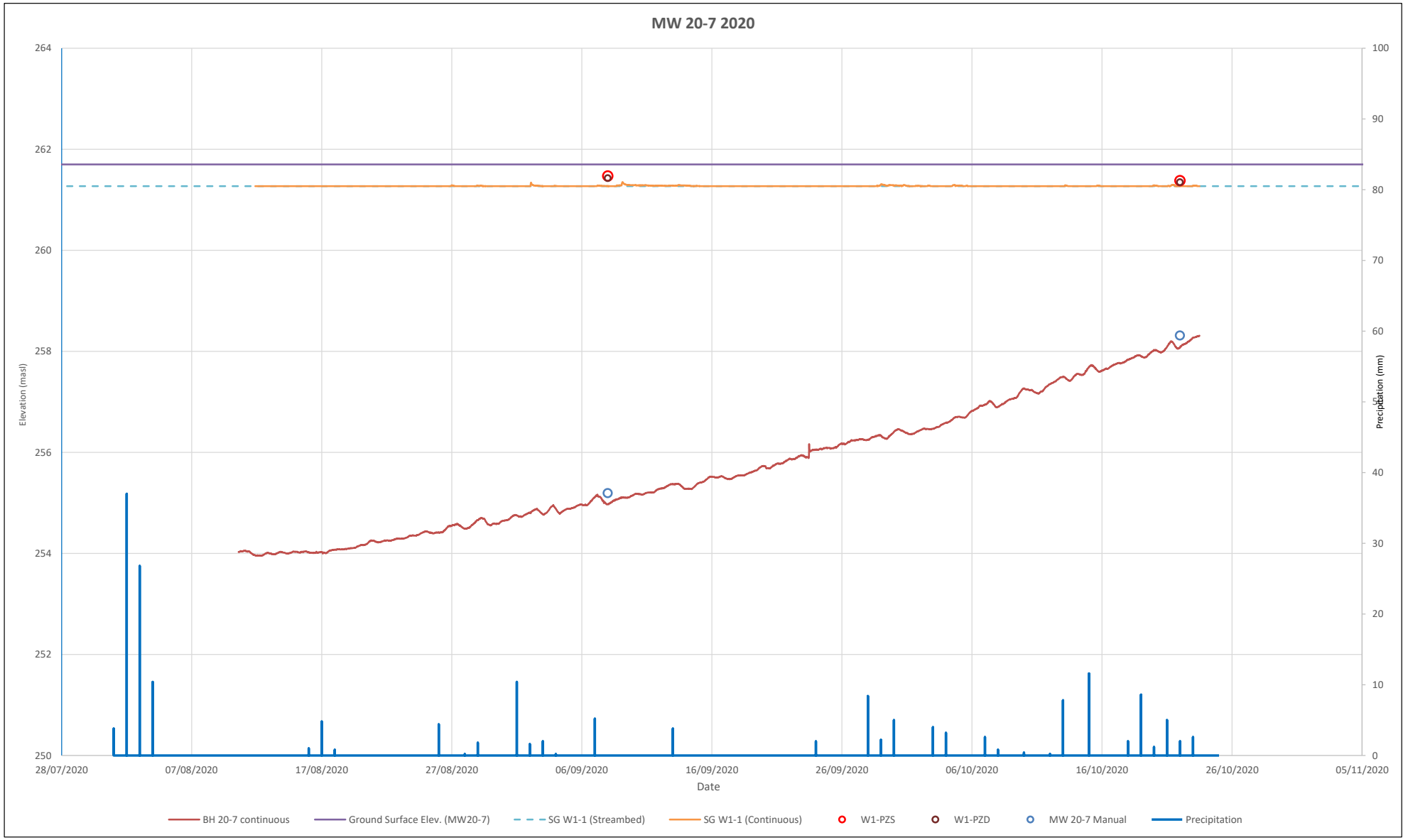
Geotechnical • Environmental • Materials • Hydrogeology

Macville Community
MW 20-5 HYDROGRAPH

August 2020 - 2021
F-7

WATER LEVEL HYDROGRAPH



DS CONSULTANTS LTD.
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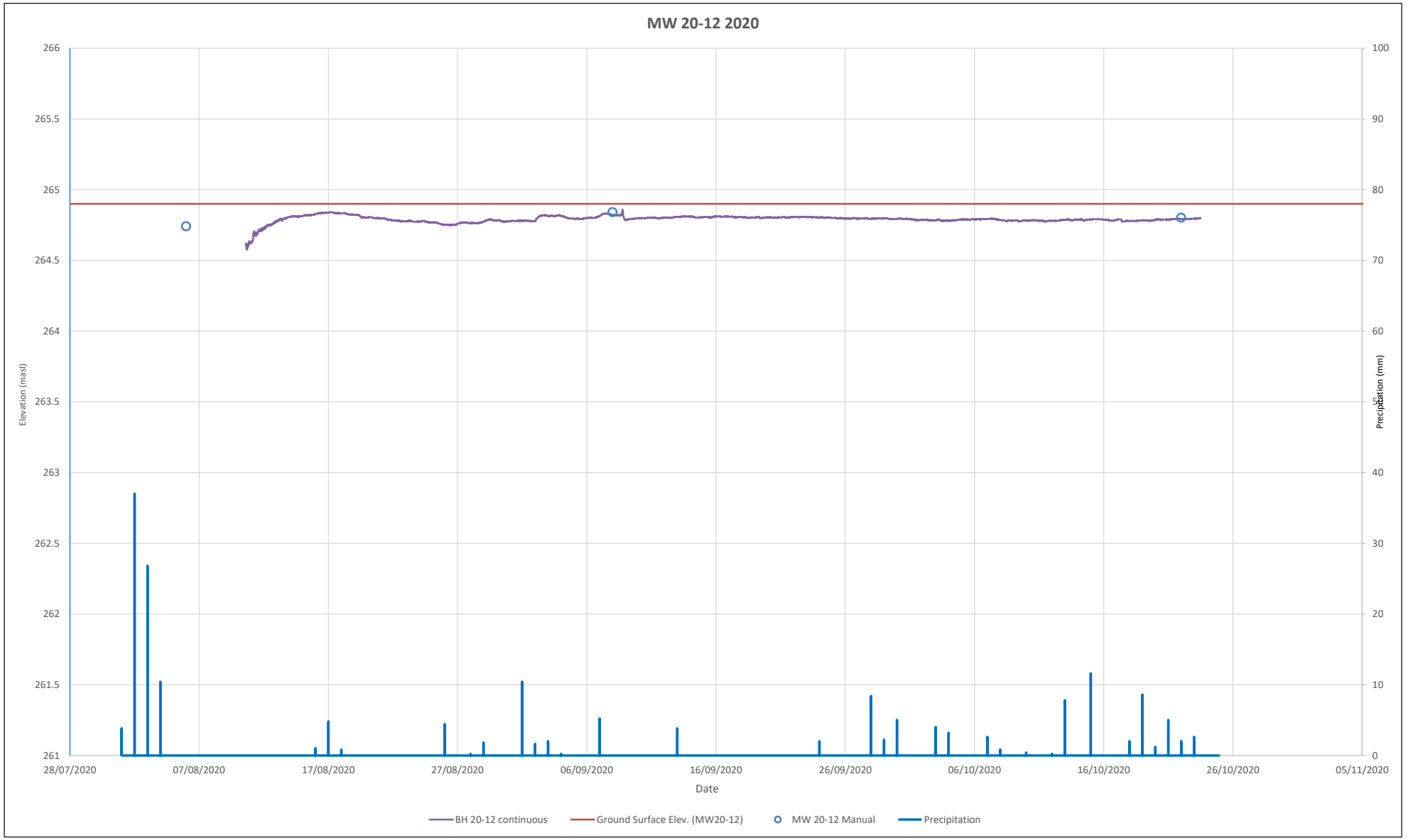
Macville Community
MW 20-7 HYDROGRAPH

August 2020 - 2021
F-7

WATER LEVEL HYDROGRAPH



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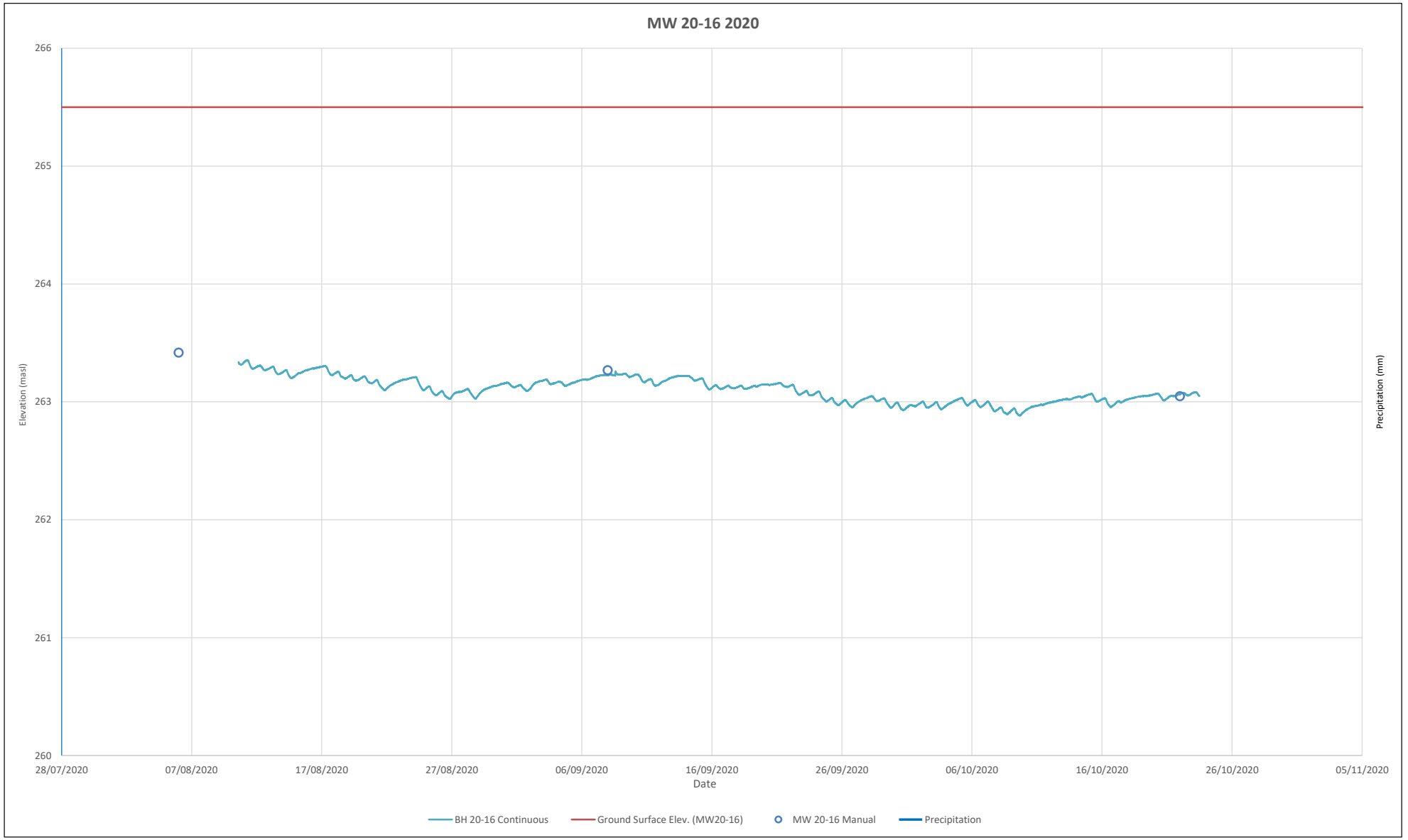
Macville Community
MW 20-12 HYDROGRAPH

August 2020 - 2021
F-7

WATER LEVEL HYDROGRAPH



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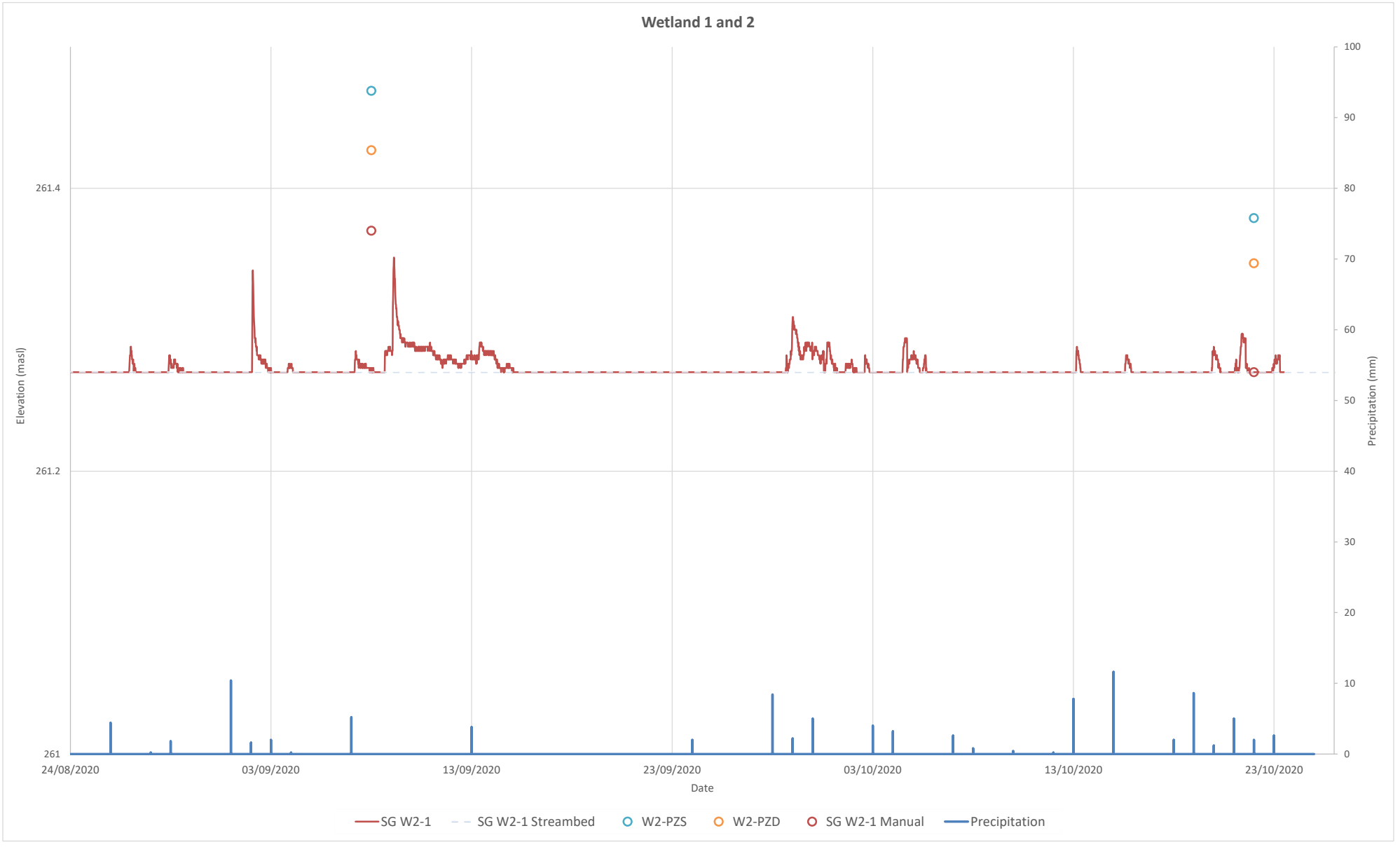
Macville Community
MW 20-16 HYDROGRAPH

August 2020 - 2021
F-7

WATER LEVEL HYDROGRAPH



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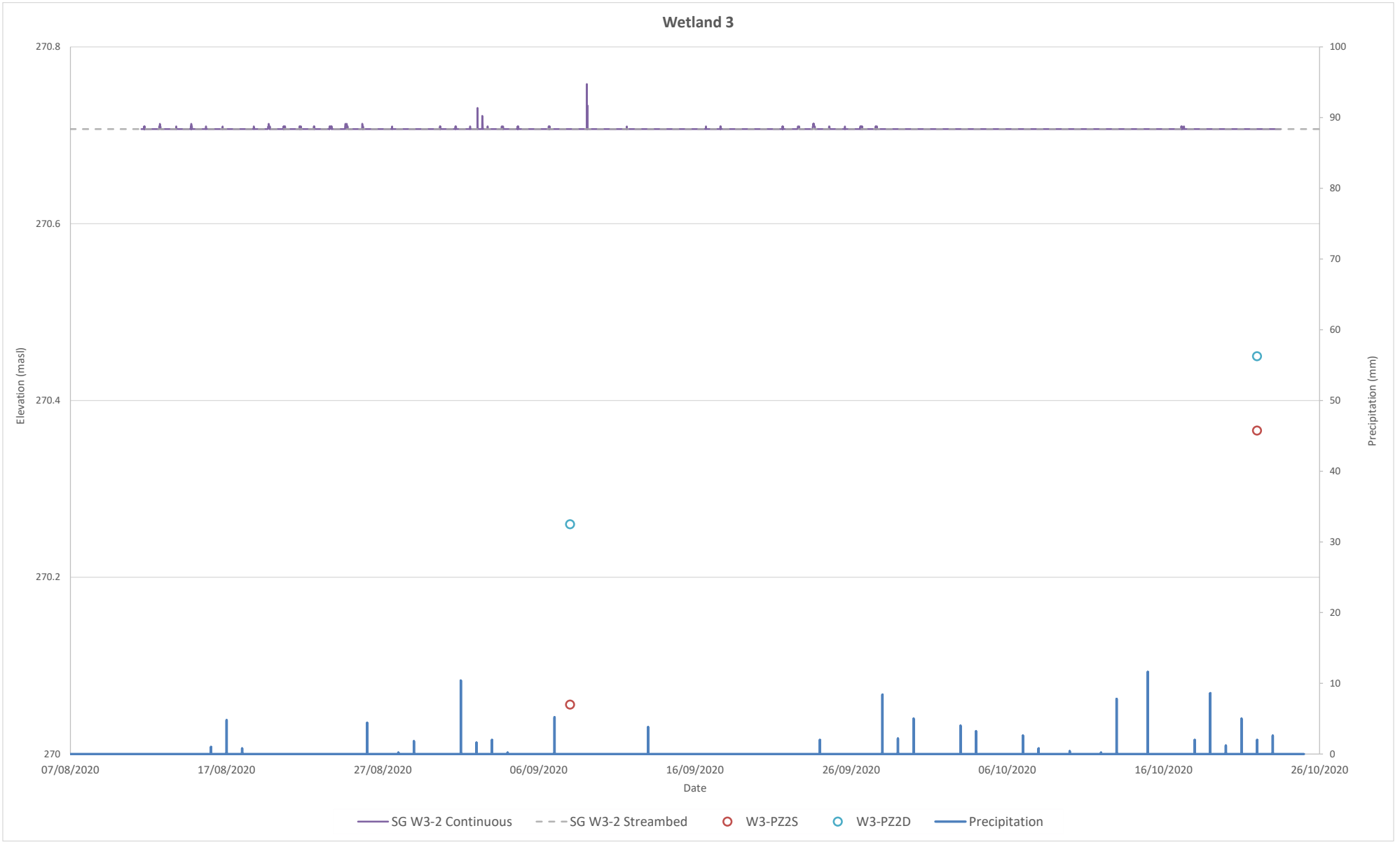
Macville Community
WETLAND 1 & 2 HYDROGRAPH

August 2020 - 2021
D-2

WATER LEVEL HYDROGRAPH



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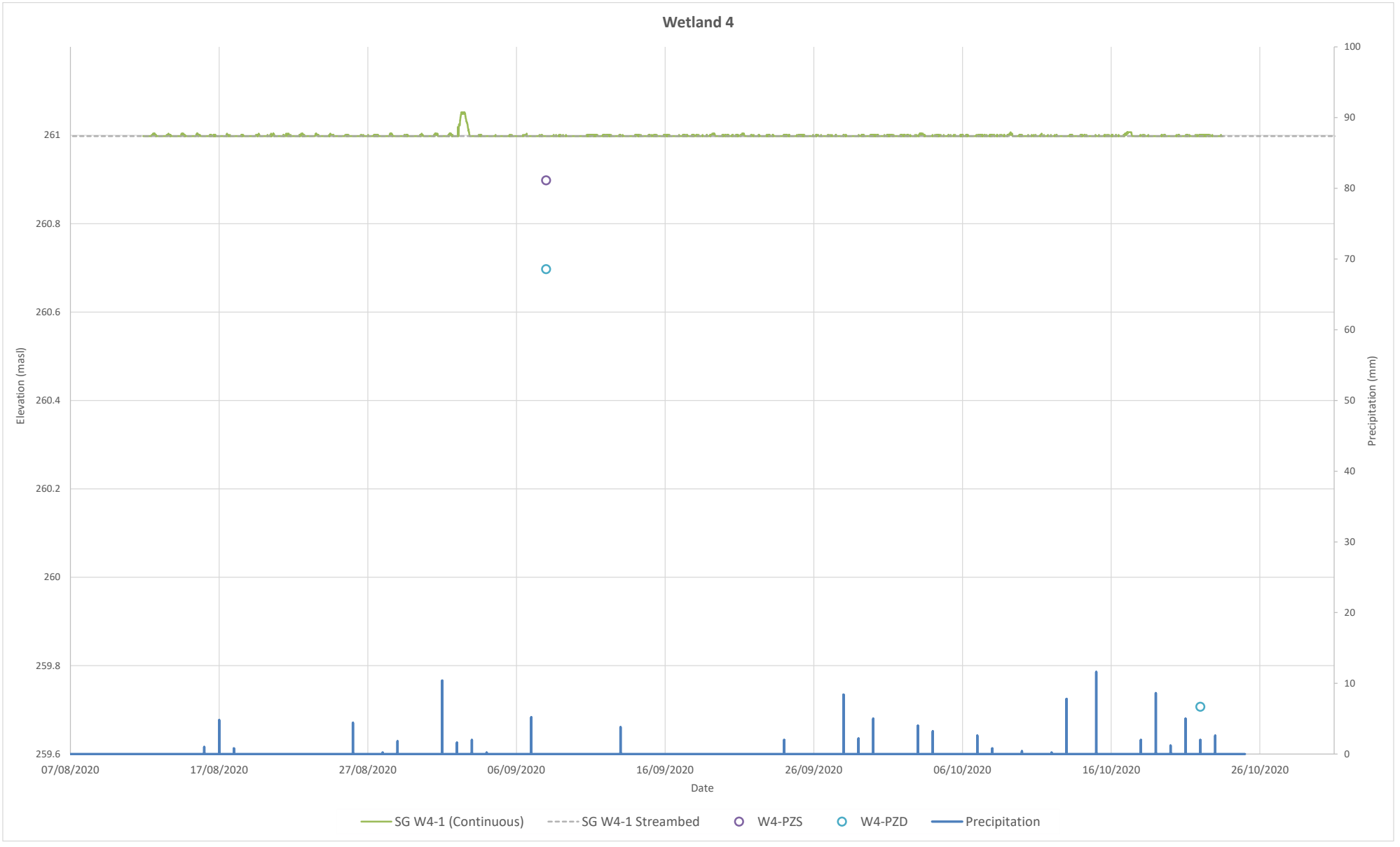
Macville Community
WETLAND 3 HYDROGRAPH

August 2020 - 2021
D-2

WATER LEVEL HYDROGRAPH



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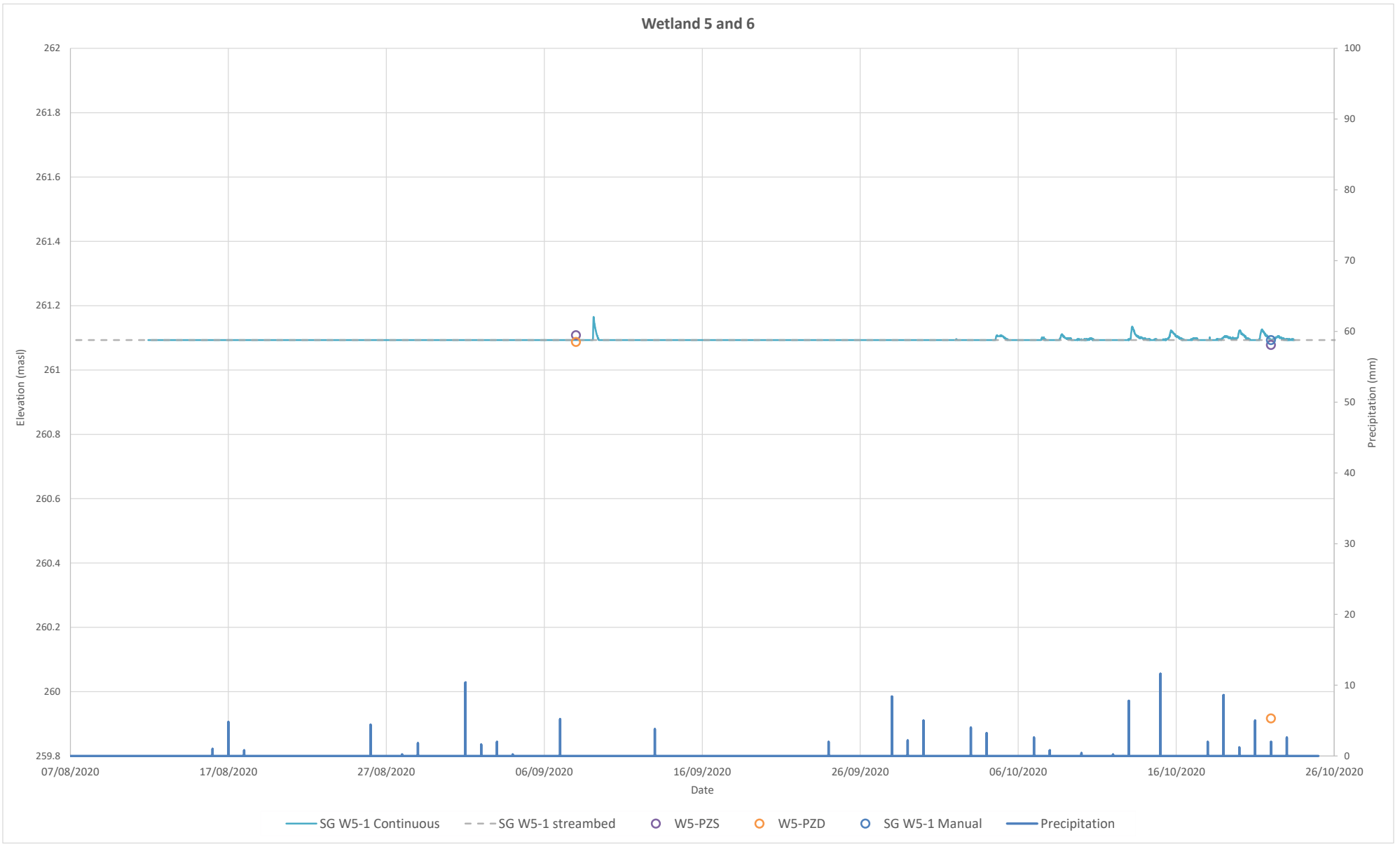
Macville Community
WETLAND 4 HYDROGRAPH

August 2020 - 2021
D-2

WATER LEVEL HYDROGRAPH



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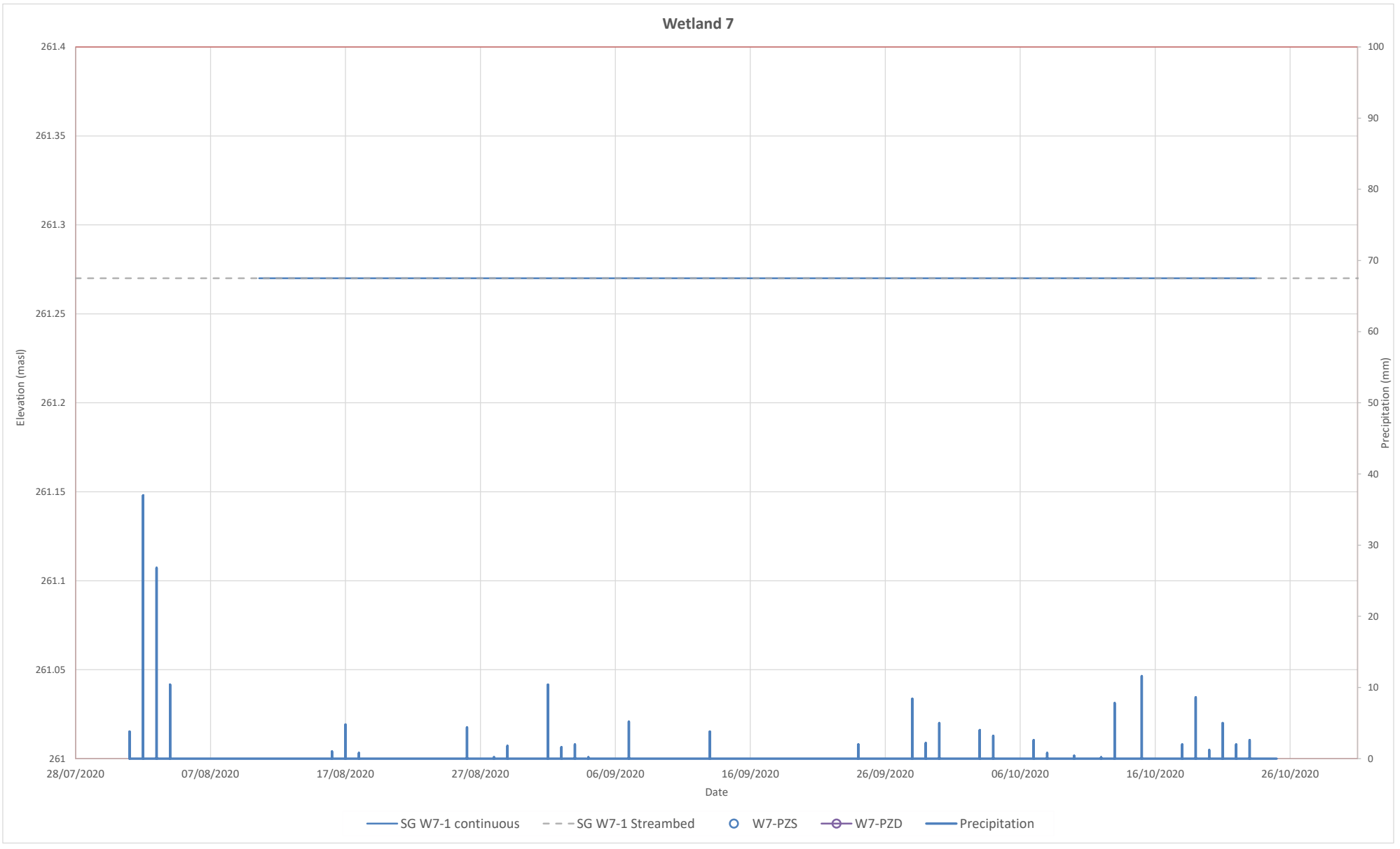
WETLANDS 5 & 6 HYDROGRAPH

August 2020 - 2021
D-2

WATER LEVEL HYDROGRAPH



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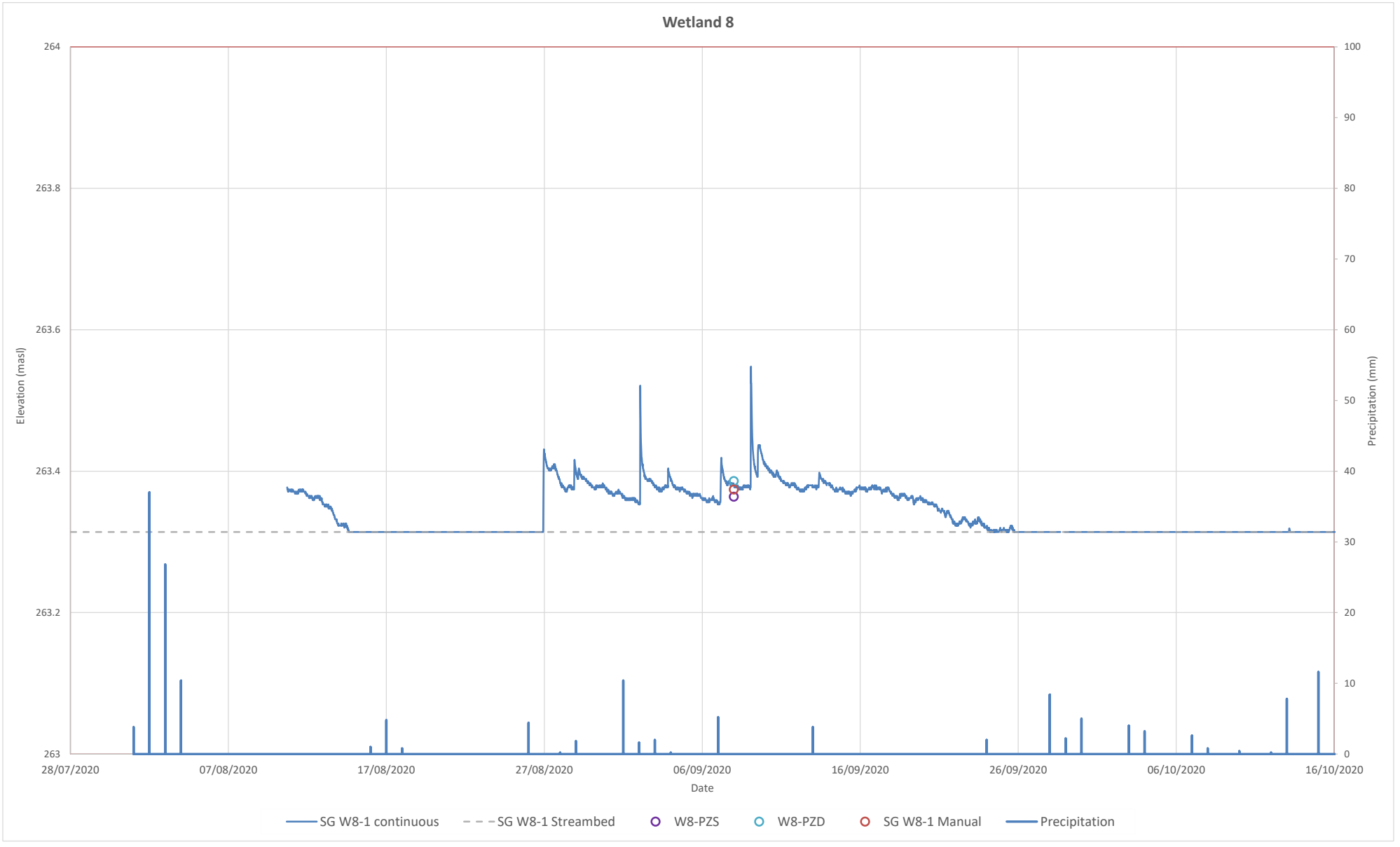
Macville Community
WETLAND 7 HYDROGRAPH

August 2020 - 2021
D-2

WATER LEVEL HYDROGRAPH



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Macville Community
WETLAND 8 HYDROGRAPH

August 2020 - 2021
D-2

Appendix G

TABLE 1
Pre-development Water Balance
Bolton LOPA Submission for Option 3 Lands

Month	Thornthwaite (1948)					
	Mean Temperature (°C)	Heat Index	Unadjusted Potential Evapotranspiration (mm)	Daylight Correction Value	Adjusted Potential Evapotranspiration (mm)	Total Precipitation (mm)
January	-5.5	0.0	0.0	0.78	0.0	51.8
February	-4.5	0.0	0.0	0.88	0.0	47.7
March	0.1	0.0	0.2	0.99	0.2	49.8
April	7.1	1.7	30.4	1.12	34.1	68.5
May	13.1	4.3	60.7	1.22	74.1	74.3
June	18.6	7.3	90.2	1.28	115.4	71.5
July	21.5	9.1	106.2	1.25	132.7	75.7
August	20.6	8.5	101.2	1.16	117.4	78.1
September	16.2	5.9	77.2	1.04	80.2	74.5
October	9.5	2.6	42.3	0.92	38.9	61.1
November	3.7	0.6	14.6	0.81	11.8	75.1
December	-2.2	0.0	0.0	0.75	0.0	57.9
TOTALS		**40.1**	**522.9**		**604.8**	**786.0**

Notes: Daylight Correction values obtained from Instruction and Tables For Computing Potential Evapotranspiration and The Water Balance (Thornthwaite & Mather, 1957)

TABLE 2
Pre-development Site Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Site	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **208030.47**	**Monthly Volumes**												
		AET (m^3)	51.22	7090.97	15410.94	23005.67	23313.47	19491.50	15838.43	8088.91	2459.07	0.00	0.00	0.00	114750.18
		Infiltration (m^3)	4123.48	2863.65	18.29	0.00	0.00	0.00	0.00	0.00	0.00	4219.68	4310.39	3969.22	19504.71
		Run-Off (m^3)	6185.22	4295.47	27.43	0.00	0.00	0.00	0.00	0.00	0.00	6329.52	6465.59	5953.83	29257.06
	Moderately Rooted Crop, Silty Clay Soils	Soil Moisture Storage (mm)	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = **1479082.32**	**Monthly Volumes**												
		AET (m^3)	364.19	50416.29	109570.75	161192.49	155581.05	126918.48	110585.62	57511.56	17483.80	0.00	0.00	0.00	789624.23
		Infiltration (m^3)	25652.94	17815.30	113.77	0.00	0.00	0.00	0.00	0.00	5462.41	29973.60	26815.76	24693.28	130527.06
		Run-Off (m^3)	47641.17	33085.55	211.30	0.00	0.00	0.00	0.00	0.00	10144.48	55665.26	49800.70	45858.95	242407.40
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) **98444.53**	**Monthly Volumes**												
		AET (m^3)	24.24	3355.60	7292.79	10095.99	8615.54	7688.52	7334.12	3827.85	1163.68	0.00	0.00	0.00	49398.33
		Infiltration (m^3)	1463.49	1016.36	6.49	0.00	0.00	0.00	0.00	0.00	1258.84	1709.98	1529.83	1408.74	8393.72
		Run-Off (m^3)	3414.81	2371.50	15.15	0.00	0.00	0.00	0.00	0.00	2937.29	3989.96	3569.60	3287.06	19585.36
	Impervious Development	Catchment Area (m^2) = **31447.95**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	234.92	323.13	350.49	337.28	357.09	368.41	351.43	288.22	354.26	273.13	244.35	225.01	**3707.71**
		Run-Off from Imperv. (m^3) - with 15% evap.	1331.19	1831.06	1986.10	1911.25	2023.52	2087.67	1991.44	1633.25	2007.48	1547.71	1384.65	1275.06	**21010.38**
			Total Catchment Volumes												
		Total ET (m^3)	234.92	323.13	350.49	337.28	357.09	368.41	351.43	288.22	354.26	273.13	244.35	225.01	**3707.71**
		Total AET (m^3)	439.65	60862.86	132274.48	194294.15	187510.05	154098.50	133758.16	69428.31	21106.55	0.00	0.00	0.00	**953772.73**
		Total Infiltration (m^3)	31239.90	21695.30	138.55	0.00	0.00	0.00	0.00	0.00	6721.25	35903.27	32655.98	30071.24	**158425.50**
		Total Runoff (m^3)	58572.39	41583.58	2239.97	1911.25	2023.52	2087.67	1991.44	1633.25	15089.24	67532.46	61220.54	56374.90	**312260.20**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 3
Post-development Site Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Site	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **113814.56**	**Monthly Volumes**												
		AET (m^3)	28.02	3879.51	8431.41	12586.52	12754.92	10663.90	8665.29	4425.48	1345.37	0.00	0.00	0.00	62780.42
		Infiltration (m^3)	2255.98	1566.72	10.01	0.00	0.00	0.00	0.00	0.00	0.00	2308.61	2358.24	2171.58	10671.13
		Run-Off (m^3)	3383.96	2350.08	15.01	0.00	0.00	0.00	0.00	0.00	0.00	3462.92	3537.36	3257.37	16006.69
	Development - Pervious Landscape	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) **425797.60**	Imperv coeff. 0.75				**Monthly Volumes**								
		AET (m^3)	104.84	14513.82	31543.18	43667.73	37264.38	33254.79	31721.92	16556.40	5033.23	0.00	0.00	0.00	213660.30
		Infiltration (m^3)	6329.96	4395.99	28.07	0.00	0.00	0.00	0.00	0.00	5444.79	7396.10	6616.89	6093.16	36304.99
		Run-Off (m^3)	14769.91	10257.32	65.51	0.00	0.00	0.00	0.00	0.00	12704.51	17257.58	15439.42	14217.38	84711.63
	Development - Impervious Area	Catchment Area (m^2) = **1277392.80**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	9542.12	13125.21	14236.54	13700.04	14504.80	14964.66	14274.86	11707.31	14389.83	11094.16	9925.34	9139.75	**150604.61**
		Run-Off from Imperv. (m^3) - with 15% evap.	54072.04	74376.20	80673.74	77633.55	82193.84	84799.72	80890.90	66341.40	81542.37	62866.89	56243.60	51791.89	**853426.13**
		Total Catchment Volumes													
		Total ET (m^3)	9542.12	13125.21	14236.54	13700.04	14504.80	14964.66	14274.86	11707.31	14389.83	11094.16	9925.34	9139.75	**150604.61**
		Total AET (m^3)	132.87	18393.33	39974.59	56254.25	50019.30	43918.69	40387.21	20981.89	6378.60	0.00	0.00	0.00	**276440.72**
		Total Infiltration (m^3)	8585.94	5962.71	38.08	0.00	0.00	0.00	0.00	0.00	5444.79	9704.71	8975.13	8264.75	**46976.11**
		Total Runoff (m^3)	72225.92	86983.59	80754.26	77633.55	82193.84	84799.72	80890.90	66341.40	94246.88	83587.38	75220.38	69266.65	**954144.45**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 4
Pre-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W1	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **5160.60**	**Monthly Volumes**												
		AET (m^3)	1.27	175.91	382.30	570.70	578.34	483.52	392.90	200.66	61.00	0.00	0.00	0.00	2846.60
		Infiltration (m^3)	102.29	71.04	0.45	0.00	0.00	0.00	0.00	0.00	0.00	104.68	106.93	98.46	483.85
		Run-Off (m^3)	153.44	106.56	0.68	0.00	0.00	0.00	0.00	0.00	0.00	157.02	160.39	147.70	725.78
	Moderately Rooted Crop, Silty Clay Soils	Soil Moisture Storage (mm)	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = **4002.93**	**Monthly Volumes**												
		AET (m^3)	0.99	136.44	296.54	436.24	421.06	343.49	299.28	155.65	47.32	0.00	0.00	0.00	2137.01
		Infiltration (m^3)	69.43	48.21	0.31	0.00	0.00	0.00	0.00	0.00	14.78	81.12	72.57	66.83	353.25
		Run-Off (m^3)	128.93	89.54	0.57	0.00	0.00	0.00	0.00	0.00	27.45	150.65	134.78	124.11	656.04
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) **1881.07**	**Monthly Volumes**												
		AET (m^3)	0.46	64.12	139.35	192.91	164.62	146.91	140.14	73.14	22.24	0.00	0.00	0.00	943.90
		Infiltration (m^3)	27.96	19.42	0.12	0.00	0.00	0.00	0.00	0.00	24.05	32.67	29.23	26.92	160.39
		Run-Off (m^3)	65.25	45.31	0.29	0.00	0.00	0.00	0.00	0.00	56.13	76.24	68.21	62.81	374.23
	Impervious Development	Catchment Area (m^2) = **2357.31**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	17.61	24.22	26.27	25.28	26.77	27.62	26.34	21.60	26.56	20.47	18.32	16.87	**277.93**
		Run-Off from Imperv. (m^3) - with 15% evap.	99.79	137.25	148.88	143.27	151.68	156.49	149.28	122.43	150.48	116.02	103.79	95.58	**1574.92**
			Total Catchment Volumes												
		Total ET (m^3)	17.61	24.22	26.27	25.28	26.77	27.62	26.34	21.60	26.56	20.47	18.32	16.87	**277.93**
		Total AET (m^3)	2.72	376.47	818.19	1199.86	1164.02	973.92	832.33	429.45	130.55	0.00	0.00	0.00	**5927.50**
		Total Infiltration (m^3)	199.68	138.67	0.89	0.00	0.00	0.00	0.00	0.00	38.84	218.47	208.73	192.21	**997.49**
		Total Runoff to W1 (m^3)	447.41	378.67	150.42	143.27	151.68	156.49	149.28	122.43	234.06	499.92	467.17	430.19	**3330.98**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 4
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Catchments and Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W2	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **31904.05**	**Monthly Volumes**												
		AET (m^3)	7.86	1087.49	2363.46	3528.20	3575.41	2989.26	2429.02	1240.53	377.13	0.00	0.00	0.00	17598.36
		Infiltration (m^3)	632.39	439.18	2.80	0.00	0.00	0.00	0.00	0.00	0.00	647.14	661.05	608.73	2991.29
		Run-Off (m^3)	948.58	658.76	4.21	0.00	0.00	0.00	0.00	0.00	0.00	970.71	991.58	913.09	4486.93
	Moderately Rooted Crop, Silty Clay Soils	Soil Moisture Storage (mm)	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = **22855.93**	**Monthly Volumes**												
		AET (m^3)	5.63	779.07	1693.17	2490.87	2404.16	1961.24	1708.86	888.71	270.17	0.00	0.00	0.00	12201.89
		Infiltration (m^3)	396.41	275.30	1.76	0.00	0.00	0.00	0.00	0.00	84.41	463.18	414.38	381.58	2017.01
		Run-Off (m^3)	736.19	511.26	3.27	0.00	0.00	0.00	0.00	0.00	156.76	860.18	769.56	708.65	3745.87
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) **3366.60**	**Monthly Volumes**												
		AET (m^3)	0.83	114.75	249.40	345.26	294.63	262.93	250.81	130.90	39.80	0.00	0.00	0.00	1689.32
		Infiltration (m^3)	50.05	34.76	0.22	0.00	0.00	0.00	0.00	0.00	43.05	58.48	52.32	48.18	287.05
		Run-Off (m^3)	116.78	81.10	0.52	0.00	0.00	0.00	0.00	0.00	100.45	136.45	122.07	112.41	669.78
	Impervious Development	Catchment Area (m^2) = **6143.56**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	45.89	63.13	68.47	65.89	69.76	71.97	68.65	56.31	69.21	53.36	47.74	43.96	**724.33**
		Run-Off from Imperv. (m^3) - with 15% evap.	260.06	357.71	388.00	373.38	395.31	407.84	389.04	319.07	392.17	302.36	270.50	249.09	**4104.52**
			Total Catchment Volumes												
	Total ET (m^3)		45.89	63.13	68.47	65.89	69.76	71.97	68.65	56.31	69.21	53.36	47.74	43.96	**724.33**
	Total AET (m^3)		14.31	1981.31	4306.03	6364.34	6274.20	5213.44	4388.69	2260.15	687.10	0.00	0.00	0.00	**31489.57**
	Total Infiltration (m^3)		1078.84	749.23	4.78	0.00	0.00	0.00	0.00	0.00	127.46	1168.79	1127.75	1038.49	**5295.34**
	Total Runoff to W2 (m^3)		2061.60	1608.84	395.99	373.38	395.31	407.84	389.04	319.07	649.38	2269.70	2153.71	1983.24	**13007.10**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 4
Pre-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W3	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **35599.24**	**Monthly Volumes**												
		AET (m^3)	8.77	1213.44	2637.20	3936.85	3989.52	3335.49	2710.35	1384.22	420.81	0.00	0.00	0.00	19636.64
		Infiltration (m^3)	705.63	490.04	3.13	0.00	0.00	0.00	0.00	0.00	0.00	722.09	737.62	679.23	3337.75
		Run-Off (m^3)	1058.45	735.06	4.69	0.00	0.00	0.00	0.00	0.00	0.00	1083.14	1106.42	1018.85	5006.62
	Moderately Rooted Crop, Silty Clay Soils	Soil Moisture Storage (mm)	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = **163349.82**	**Monthly Volumes**												
		AET (m^3)	40.22	5567.97	12100.99	17802.10	17182.37	14016.87	12213.07	6351.58	1930.91	0.00	0.00	0.00	87206.08
		Infiltration (m^3)	2833.11	1967.52	12.57	0.00	0.00	0.00	0.00	0.00	603.27	3310.28	2961.53	2727.13	14415.41
		Run-Off (m^3)	5261.49	3653.97	23.34	0.00	0.00	0.00	0.00	0.00	1120.36	6147.67	5499.99	5064.66	26771.47
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) **21469.99**	**Monthly Volumes**												
		AET (m^3)	5.29	731.83	1590.50	2201.86	1878.98	1676.81	1599.51	834.82	253.79	0.00	0.00	0.00	10773.39
		Infiltration (m^3)	319.18	221.66	1.42	0.00	0.00	0.00	0.00	0.00	274.54	372.93	333.64	307.24	1830.61
		Run-Off (m^3)	744.74	517.20	3.30	0.00	0.00	0.00	0.00	0.00	640.60	870.18	778.50	716.88	4271.41
	Impervious Development	Catchment Area (m^2) = **5181.01**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	38.70	53.23	57.74	55.57	58.83	60.70	57.90	47.48	58.36	45.00	40.26	37.07	**610.84**
		Run-Off from Imperv. (m^3) - with 15% evap.	219.31	301.66	327.21	314.88	333.37	343.94	328.09	269.08	330.73	254.98	228.12	210.06	**3461.43**
	Total Catchment Volumes														
	Total ET (m^3)		38.70	53.23	57.74	55.57	58.83	60.70	57.90	47.48	58.36	45.00	40.26	37.07	**610.84**
	Total AET (m^3)		54.27	7513.25	16328.69	23940.80	23050.87	19029.17	16522.94	8570.61	2605.51	0.00	0.00	0.00	**117616.12**
	Total Infiltration (m^3)		3857.92	2679.22	17.11	0.00	0.00	0.00	0.00	0.00	877.81	4405.31	4032.79	3713.59	**19583.76**
	Total Runoff to W3 (m^3)		7283.99	5207.90	358.54	314.88	333.37	343.94	328.09	269.08	2091.69	8355.97	7613.03	7010.46	**39510.93**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

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Catchments and Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W4	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **8313.13**	**Monthly Volumes**												
		AET (m^3)	2.05	283.36	615.84	919.33	931.63	778.90	632.92	323.24	98.27	0.00	0.00	0.00	4585.54
		Infiltration (m^3)	164.78	114.43	0.73	0.00	0.00	0.00	0.00	0.00	0.00	168.62	172.25	158.61	779.43
		Run-Off (m^3)	247.17	171.65	1.10	0.00	0.00	0.00	0.00	0.00	0.00	252.93	258.37	237.92	1169.14
	Moderately Rooted Crop, Silty Clay Soils	Soil Moisture Storage (mm)	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = **52370.92**	**Monthly Volumes**												
		AET (m^3)	12.90	1785.13	3879.65	5707.46	5508.77	4493.89	3915.58	2036.35	619.06	0.00	0.00	0.00	27958.78
		Infiltration (m^3)	908.31	630.80	4.03	0.00	0.00	0.00	0.00	0.00	193.41	1061.30	949.48	874.33	4621.66
		Run-Off (m^3)	1686.86	1171.48	7.48	0.00	0.00	0.00	0.00	0.00	359.19	1970.98	1763.33	1623.76	8583.09
	Impervious Development	Catchment Area (m^2) = **1355.74**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	10.13	13.93	15.11	14.54	15.39	15.88	15.15	12.43	15.27	11.77	10.53	9.70	**159.84**
		Run-Off from Imperv. (m^3) - with 15% evap.	57.39	78.94	85.62	82.40	87.24	90.00	85.85	70.41	86.54	66.72	59.69	54.97	**905.77**
	Total Catchment Volumes														
	Total ET (m^3)		10.13	13.93	15.11	14.54	15.39	15.88	15.15	12.43	15.27	11.77	10.53	9.70	**159.84**
	Total AET (m^3)		14.94	2068.49	4495.49	6626.79	6440.40	5272.79	4548.50	2359.59	717.33	0.00	0.00	0.00	**32544.33**
	Total Infiltration (m^3)		1073.09	745.23	4.76	0.00	0.00	0.00	0.00	0.00	193.41	1229.92	1121.73	1032.95	**5401.09**
	Total Runoff to W4 (m^3)		1991.42	1422.07	94.20	82.40	87.24	90.00	85.85	70.41	445.74	2290.64	2081.39	1916.65	**10658.01**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
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P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W5	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **19470.82**	**Monthly Volumes**												
		AET (m^3)	4.79	663.69	1442.40	2153.24	2182.05	1824.33	1482.41	757.09	230.16	0.00	0.00	0.00	10740.16
		Infiltration (m^3)	385.94	268.03	1.71	0.00	0.00	0.00	0.00	0.00	0.00	394.95	403.44	371.50	1825.56
		Run-Off (m^3)	578.91	402.04	2.57	0.00	0.00	0.00	0.00	0.00	0.00	592.42	605.15	557.25	2738.34
	Moderately Rooted Crop, Silty Clay Soils	Soil Moisture Storage (mm)	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = **50497.92**	**Monthly Volumes**												
		AET (m^3)	12.43	1721.28	3740.90	5503.33	5311.75	4333.17	3775.55	1963.52	596.92	0.00	0.00	0.00	26958.86
		Infiltration (m^3)	875.83	608.24	3.88	0.00	0.00	0.00	0.00	0.00	186.49	1023.34	915.53	843.06	4456.37
		Run-Off (m^3)	1626.54	1129.59	7.21	0.00	0.00	0.00	0.00	0.00	346.35	1900.49	1700.26	1565.69	8276.12
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) **3330.87**	**Monthly Volumes**												
		AET (m^3)	0.82	113.54	246.75	341.60	291.51	260.14	248.15	129.52	39.37	0.00	0.00	0.00	1671.39
		Infiltration (m^3)	49.52	34.39	0.22	0.00	0.00	0.00	0.00	0.00	42.59	57.86	51.76	47.66	284.00
		Run-Off (m^3)	115.54	80.24	0.51	0.00	0.00	0.00	0.00	0.00	99.38	135.00	120.78	111.22	662.67
	Impervious Development	Catchment Area (m^2) = **1025.45**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	7.66	10.54	11.43	11.00	11.64	12.01	11.46	9.40	11.55	8.91	7.97	7.34	**120.90**
		Run-Off from Imperv. (m^3) - with 15% evap.	43.41	59.71	64.76	62.32	65.98	68.07	64.94	53.26	65.46	50.47	45.15	41.58	**685.11**
	Total Catchment Volumes														
	Total ET (m^3)		7.66	10.54	11.43	11.00	11.64	12.01	11.46	9.40	11.55	8.91	7.97	7.34	**120.90**
	Total AET (m^3)		18.05	2498.50	5430.05	7998.17	7785.31	6417.64	5506.11	2850.13	866.45	0.00	0.00	0.00	**39370.41**
	Total Infiltration (m^3)		1311.28	910.65	5.82	0.00	0.00	0.00	0.00	0.00	229.09	1476.14	1370.72	1262.23	**6565.94**
	Total Runoff to W5 (m^3)		2364.39	1671.57	75.06	62.32	65.98	68.07	64.94	53.26	511.19	2678.37	2471.35	2275.74	**12362.24**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 4
Pre-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W6	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **16702.36**	**Monthly Volumes**												
		AET (m^3)	4.11	569.32	1237.31	1847.08	1871.79	1564.93	1271.64	649.44	197.43	0.00	0.00	0.00	9213.07
		Infiltration (m^3)	331.07	229.92	1.47	0.00	0.00	0.00	0.00	0.00	0.00	338.79	346.07	318.68	1565.99
		Run-Off (m^3)	496.60	344.88	2.20	0.00	0.00	0.00	0.00	0.00	0.00	508.19	519.11	478.02	2348.99
	Moderately Rooted Crop, Silty Clay Soils	Soil Moisture Storage (mm)	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = **27498.16**	**Monthly Volumes**												
		AET (m^3)	6.77	937.31	2037.07	2996.79	2892.46	2359.59	2055.94	1069.22	325.05	0.00	0.00	0.00	14680.20
		Infiltration (m^3)	476.92	331.21	2.12	0.00	0.00	0.00	0.00	0.00	101.55	557.25	498.54	459.08	2426.68
		Run-Off (m^3)	885.71	615.11	3.93	0.00	0.00	0.00	0.00	0.00	188.60	1034.89	925.86	852.58	4506.69
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) **1988.73**	**Monthly Volumes**												
		AET (m^3)	0.49	67.79	147.33	203.95	174.05	155.32	148.16	77.33	23.51	0.00	0.00	0.00	997.92
		Infiltration (m^3)	29.56	20.53	0.13	0.00	0.00	0.00	0.00	0.00	25.43	34.54	30.90	28.46	169.57
		Run-Off (m^3)	68.98	47.91	0.31	0.00	0.00	0.00	0.00	0.00	59.34	80.60	72.11	66.40	395.65
	Impervious Development	Catchment Area (m^2) = **1307.38**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	9.77	13.43	14.57	14.02	14.85	15.32	14.61	11.98	14.73	11.35	10.16	9.35	**154.14**
		Run-Off from Imperv. (m^3) - with 15% evap.	55.34	76.12	82.57	79.46	84.12	86.79	82.79	67.90	83.46	64.34	57.56	53.01	**873.46**
			Total Catchment Volumes												
		Total ET (m^3)	9.77	13.43	14.57	14.02	14.85	15.32	14.61	11.98	14.73	11.35	10.16	9.35	**154.14**
		Total AET (m^3)	11.37	1574.42	3421.71	5047.82	4938.30	4079.84	3475.73	1795.99	545.99	0.00	0.00	0.00	**24891.19**
		Total Infiltration (m^3)	837.55	581.66	3.71	0.00	0.00	0.00	0.00	0.00	126.98	930.58	875.52	806.22	**4162.24**
		Total Runoff to W6 (m^3)	1506.64	1084.01	89.00	79.46	84.12	86.79	82.79	67.90	331.39	1688.02	1574.65	1450.01	**8124.79**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
Post-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W1	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 4253.00	Monthly Volumes												
		AET (m^3)	1.05	144.97	315.06	470.33	476.62	398.49	323.80	165.37	50.27	0.00	0.00	0.00	2345.97
		Infiltration (m^3)	84.30	58.54	0.37	0.00	0.00	0.00	0.00	0.00	0.00	86.27	88.12	81.15	398.76
		Run-Off (m^3)	126.45	87.82	0.56	0.00	0.00	0.00	0.00	0.00	0.00	129.40	132.18	121.72	598.13
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 819.00	Monthly Volumes												
		AET (m^3)	0.20	27.92	60.67	83.99	71.68	63.96	61.02	31.85	9.68	0.00	0.00	0.00	410.96
		Infiltration (m^3)	12.18	8.46	0.05	0.00	0.00	0.00	0.00	0.00	10.47	14.23	12.73	11.72	69.83
		Run-Off (m^3)	28.41	19.73	0.13	0.00	0.00	0.00	0.00	0.00	24.44	33.19	29.70	27.35	162.94
	Impervious Development (existing road)	Catchment Area (m^2) = 1184.00	Monthly Volumes												
		Evaporation from Imperv. (m^3) - 15% of P.	8.84	12.17	13.20	12.70	13.44	13.87	13.23	10.85	13.34	10.28	9.20	8.47	**139.59**
		Run-Off from Imperv. (m^3) - with 15% evap.	50.12	68.94	74.78	71.96	76.18	78.60	74.98	61.49	75.58	58.27	52.13	48.01	**791.03**
	Total Catchment Volumes														
	Total ET (m^3)		8.84	12.17	13.20	12.70	13.44	13.87	13.23	10.85	13.34	10.28	9.20	8.47	**139.59**
	Total AET (m^3)		1.25	172.89	375.73	554.32	548.30	462.45	384.82	197.22	59.95	0.00	0.00	0.00	**2756.93**
	Total Infiltration (m^3)		96.48	67.00	0.43	0.00	0.00	0.00	0.00	0.00	10.47	100.49	100.85	92.87	**468.59**
	Total Runoff to W1 (m^3)		204.98	176.48	75.46	71.96	76.18	78.60	74.98	61.49	100.02	220.87	214.01	197.07	**1552.10**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
Post-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W2	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **28376.00**	**Monthly Volumes**												
		AET (m^3)	6.99	967.23	2102.10	3138.04	3180.03	2658.70	2160.41	1103.35	335.42	0.00	0.00	0.00	15652.28
		Infiltration (m^3)	562.46	390.61	2.49	0.00	0.00	0.00	0.00	0.00	0.00	575.58	587.95	541.41	2660.50
		Run-Off (m^3)	843.68	585.92	3.74	0.00	0.00	0.00	0.00	0.00	0.00	863.37	881.93	812.12	3990.75
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) **5463.00**	**Monthly Volumes**												
		AET (m^3)	1.35	186.21	404.70	560.26	478.10	426.66	406.99	212.42	64.58	0.00	0.00	0.00	2741.27
		Infiltration (m^3)	81.21	56.40	0.36	0.00	0.00	0.00	0.00	0.00	69.86	94.89	84.90	78.18	465.79
		Run-Off (m^3)	189.50	131.60	0.84	0.00	0.00	0.00	0.00	0.00	163.00	221.42	198.09	182.41	1086.85
	Impervious Development (existing road)	Catchment Area (m^2) = **3307.00**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	24.70	33.98	36.86	35.47	37.55	38.74	36.96	30.31	37.25	28.72	25.70	23.66	**389.90**
		Run-Off from Imperv. (m^3) - with 15% evap.	139.99	192.55	208.85	200.98	212.79	219.54	209.42	171.75	211.10	162.75	145.61	134.08	**2209.41**
		Total Catchment Volumes													
		Total ET (m^3)	24.70	33.98	36.86	35.47	37.55	38.74	36.96	30.31	37.25	28.72	25.70	23.66	**389.90**
		Total AET (m^3)	8.33	1153.44	2506.80	3698.30	3658.13	3085.36	2567.40	1315.77	400.00	0.00	0.00	0.00	**18393.55**
		Total Infiltration (m^3)	643.67	447.01	2.85	0.00	0.00	0.00	0.00	0.00	69.86	670.47	672.85	619.59	**3126.30**
		Total Runoff to W2 (m^3)	1173.17	910.07	213.44	200.98	212.79	219.54	209.42	171.75	374.10	1247.54	1225.62	1128.61	**7287.01**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
Post-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W3	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **23518.00**	**Monthly Volumes**												
		AET (m^3)	5.79	801.64	1742.22	2600.81	2635.60	2203.53	1790.55	914.46	278.00	0.00	0.00	0.00	12972.59
		Infiltration (m^3)	466.16	323.74	2.07	0.00	0.00	0.00	0.00	0.00	0.00	477.04	487.29	448.72	2205.02
		Run-Off (m^3)	699.24	485.61	3.10	0.00	0.00	0.00	0.00	0.00	0.00	715.56	730.94	673.09	3307.53
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) **7354.00**	**Monthly Volumes**												
		AET (m^3)	1.81	250.67	544.79	754.19	643.60	574.35	547.87	285.95	86.93	0.00	0.00	0.00	3690.15
		Infiltration (m^3)	109.33	75.92	0.48	0.00	0.00	0.00	0.00	0.00	94.04	127.74	114.28	105.24	627.03
		Run-Off (m^3)	255.09	177.16	1.13	0.00	0.00	0.00	0.00	0.00	219.42	298.06	266.66	245.55	1463.06
	Impervious Development	Catchment Area (m^2) = **0.00**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
		Run-Off from Imperv. (m^3) - with 15% evap.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	Total Catchment Volumes														
	Total ET (m^3)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	Total AET (m^3)		7.60	1052.31	2287.00	3355.00	3279.20	2777.88	2338.42	1200.40	364.93	0.00	0.00	0.00	**16662.75**
	Total Infiltration (m^3)		575.49	399.66	2.55	0.00	0.00	0.00	0.00	0.00	94.04	604.78	601.57	553.96	**2832.05**
	Total Runoff to W3 (m^3)		954.34	662.76	4.23	0.00	0.00	0.00	0.00	0.00	219.42	1013.62	997.60	918.64	**4770.60**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

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Catchments and Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W4	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 10099.00	Monthly Volumes												
		AET (m^3)	2.49	344.24	748.14	1116.83	1131.77	946.23	768.89	392.68	119.38	0.00	0.00	0.00	5570.64
		Infiltration (m^3)	200.18	139.02	0.89	0.00	0.00	0.00	0.00	0.00	0.00	204.85	209.25	192.69	946.87
		Run-Off (m^3)	300.27	208.53	1.33	0.00	0.00	0.00	0.00	0.00	0.00	307.27	313.88	289.03	1420.31
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 6378.00	Monthly Volumes												
		AET (m^3)	1.57	217.40	472.48	654.10	558.18	498.12	475.16	248.00	75.39	0.00	0.00	0.00	3200.41
		Infiltration (m^3)	94.82	65.85	0.42	0.00	0.00	0.00	0.00	0.00	81.56	110.79	99.11	91.27	543.81
		Run-Off (m^3)	221.24	153.64	0.98	0.00	0.00	0.00	0.00	0.00	190.30	258.50	231.27	212.96	1268.89
	Impervious Development	Catchment Area (m^2) = 785.00	Monthly Volumes												
		Evaporation from Imperv. (m^3) - 15% of P.	5.86	8.07	8.75	8.42	8.91	9.20	8.77	7.19	8.84	6.82	6.10	5.62	**92.55**
		Run-Off from Imperv. (m^3) - with 15% evap.	33.23	45.71	49.58	47.71	50.51	52.11	49.71	40.77	50.11	38.63	34.56	31.83	**524.46**
			Total Catchment Volumes												
		Total ET (m^3)	5.86	8.07	8.75	8.42	8.91	9.20	8.77	7.19	8.84	6.82	6.10	5.62	**92.55**
		Total AET (m^3)	4.06	561.64	1220.62	1770.92	1689.95	1444.35	1244.05	640.68	194.77	0.00	0.00	0.00	**8771.04**
		Total Infiltration (m^3)	294.99	204.87	1.31	0.00	0.00	0.00	0.00	0.00	81.56	315.63	308.37	283.96	**1490.68**
		Total Runoff to W4 (m^3)	554.73	407.88	51.89	47.71	50.51	52.11	49.71	40.77	240.41	604.41	579.71	533.82	**3213.66**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
Post-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W5	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = **13883.00**	**Monthly Volumes**												
		AET (m^3)	3.42	473.22	1028.46	1535.29	1555.83	1300.77	1056.98	539.82	164.11	0.00	0.00	0.00	7657.90
		Infiltration (m^3)	275.18	191.11	1.22	0.00	0.00	0.00	0.00	0.00	0.00	281.60	287.66	264.89	1301.65
		Run-Off (m^3)	412.77	286.66	1.83	0.00	0.00	0.00	0.00	0.00	0.00	422.40	431.48	397.33	1952.48
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) **2947.00**	**Monthly Volumes**												
		AET (m^3)	0.73	100.45	218.31	302.23	257.91	230.16	219.55	114.59	34.84	0.00	0.00	0.00	1478.77
		Infiltration (m^3)	43.81	30.43	0.19	0.00	0.00	0.00	0.00	0.00	37.68	51.19	45.80	42.17	251.27
		Run-Off (m^3)	102.22	70.99	0.45	0.00	0.00	0.00	0.00	0.00	87.93	119.44	106.86	98.40	586.30
	Impervious Development	Catchment Area (m^2) = **592.00**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	4.42	6.08	6.60	6.35	6.72	6.94	6.62	5.43	6.67	5.14	4.60	4.24	**69.80**
		Run-Off from Imperv. (m^3) - with 15% evap.	25.06	34.47	37.39	35.98	38.09	39.30	37.49	30.75	37.79	29.14	26.07	24.00	**395.52**
			Total Catchment Volumes												
		Total ET (m^3)	4.42	6.08	6.60	6.35	6.72	6.94	6.62	5.43	6.67	5.14	4.60	4.24	**69.80**
		Total AET (m^3)	4.14	573.67	1246.77	1837.52	1813.75	1530.93	1276.54	654.41	198.94	0.00	0.00	0.00	**9136.67**
		Total Infiltration (m^3)	318.99	221.53	1.41	0.00	0.00	0.00	0.00	0.00	37.68	332.79	333.45	307.06	**1552.93**
		Total Runoff to W5 (m^3)	540.06	392.12	39.67	35.98	38.09	39.30	37.49	30.75	125.72	570.98	564.41	519.73	**2934.30**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
Post-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W6	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 8731.00	Monthly Volumes												
		AET (m^3)	2.15	297.61	646.79	965.54	978.46	818.05	664.74	339.49	103.21	0.00	0.00	0.00	4816.04
		Infiltration (m^3)	173.06	120.19	0.77	0.00	0.00	0.00	0.00	0.00	0.00	177.10	180.91	166.59	818.61
		Run-Off (m^3)	259.59	180.28	1.15	0.00	0.00	0.00	0.00	0.00	0.00	265.65	271.36	249.88	1227.91
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 2803.00	Monthly Volumes												
		AET (m^3)	0.69	95.54	207.65	287.46	245.31	218.91	208.82	108.99	33.13	0.00	0.00	0.00	1406.51
		Infiltration (m^3)	41.67	28.94	0.18	0.00	0.00	0.00	0.00	0.00	35.84	48.69	43.56	40.11	238.99
		Run-Off (m^3)	97.23	67.52	0.43	0.00	0.00	0.00	0.00	0.00	83.63	113.61	101.64	93.59	557.65
	Impervious Development	Catchment Area (m^2) = 427.00	Monthly Volumes												
		Evaporation from Imperv. (m^3) - 15% of P.	3.19	4.39	4.76	4.58	4.85	5.00	4.77	3.91	4.81	3.71	3.32	3.06	**50.34**
		Run-Off from Imperv. (m^3) - with 15% evap.	18.07	24.86	26.97	25.95	27.48	28.35	27.04	22.18	27.26	21.01	18.80	17.31	**285.28**
			Total Catchment Volumes												
		Total ET (m^3)	3.19	4.39	4.76	4.58	4.85	5.00	4.77	3.91	4.81	3.71	3.32	3.06	**50.34**
		Total AET (m^3)	2.84	393.15	854.44	1253.01	1223.77	1036.97	873.56	448.48	136.34	0.00	0.00	0.00	**6222.56**
		Total Infiltration (m^3)	214.73	149.13	0.95	0.00	0.00	0.00	0.00	0.00	35.84	225.79	224.46	206.70	**1057.60**
		Total Runoff to W6 (m^3)	374.90	272.67	28.55	25.95	27.48	28.35	27.04	22.18	110.89	400.27	391.80	360.79	**2070.84**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 6
Water Balance Summary
Bolton LOPA Submission for Option 3 Lands

Total Runoff (m^3)	March	April	May	June	July	August	September	October	November	December	January	February	Annual Total
W1													
Pre-development	447	379	150	143	152	156	149	122	234	500	467	430	3331
Post-development no Mitigation	205	176	75	72	76	79	75	61	100	221	214	197	1552
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	242	202	75	71	75	78	74	61	134	279	253	233	1779
W2													
Pre-development	2062	1609	396	373	395	408	389	319	649	2270	2154	1983	13007
Post-development no Mitigation	1173	910	213	201	213	220	209	172	374	1248	1226	1129	7287
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	888	699	183	172	183	188	180	147	275	1022	928	855	5720
W3													
Pre-development	7284	5208	359	315	333	344	328	269	2092	8356	7613	7010	39511
Post-development no mitigation	954	663	4	0	0	0	0	0	219	1014	998	919	4771
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	6330	4545	354	315	333	344	328	269	1872	7342	6615	6092	34740
W4													
Pre-development	1991	1422	94	82	87	90	86	70	446	2291	2081	1917	10658
Post-development no Mitigation	555	408	52	48	51	52	50	41	240	604	580	534	3214
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	1437	1014	42	35	37	38	36	30	205	1686	1502	1383	7444
W5													
Pre-development	2364	1672	75	62	66	68	65	53	511	2678	2471	2276	12362
Post-development no Mitigation	540	392	40	36	38	39	37	31	126	571	564	520	2934
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	1824	1279	35	26	28	29	27	23	385	2107	1907	1756	9428
W6													
Pre-development	1507	1084	89	79	84	87	83	68	331	1688	1575	1450	8125
Post-development no Mitigation	375	273	29	26	27	28	27	22	111	400	392	361	2071
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	1132	811	60	54	57	58	56	46	221	1288	1183	1089	6054
Total Study Area													
Pre-development	58572	41584	2240	1911	2024	2088	1991	1633	15089	67532	61221	56375	312260
Post-development no Mitigation	72226	86984	80754	77634	82194	84800	80891	66341	94247	83587	75220	69267	954144
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	-13654	-45400	-78514	-75722	-80170	-82712	-78899	-64708	-79158	-16055	-14000	-12892	-641884

NOTES:
1) - ve implies net gain

TABLE 6
Water Balance Summary
Bolton LOPA Submission for Option 3 Lands

Total Infiltration (m^3)	March	April	May	June	July	August	September	October	November	December	January	February	Annual Total
W1													
Pre-development	200	139	1	0	0	0	0	0	39	218	209	192	997
Post-development no Mitigation	96	67	0	0	0	0	0	0	10	100	101	93	469
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	103	72	0	0	0	0	0	0	28	118	108	99	529
W2													
Pre-development	1079	749	5	0	0	0	0	0	127	1169	1128	1038	5295
Post-development no Mitigation	644	447	3	0	0	0	0	0	70	670	673	620	3126
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	435	302	2	0	0	0	0	0	58	498	455	419	2169
W3													
Pre-development	3858	2679	17	0	0	0	0	0	878	4405	4033	3714	19584
Post-development no mitigation	575	400	3	0	0	0	0	0	94	605	602	554	2832
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	3282	2280	15	0	0	0	0	0	784	3801	3431	3160	16752
W4													
Pre-development	1073	745	5	0	0	0	0	0	193	1230	1122	1033	5401
Post-development no Mitigation	295	205	1	0	0	0	0	0	82	316	308	284	1491
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	778	540	3	0	0	0	0	0	112	914	813	749	3910
W5													
Pre-development	1311	911	6	0	0	0	0	0	229	1476	1371	1262	6566
Post-development no Mitigation	319	222	1	0	0	0	0	0	38	333	333	307	1553
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	992	689	4	0	0	0	0	0	191	1143	1037	955	5013
W6													
Pre-development	838	582	4	0	0	0	0	0	127	931	876	806	4162
Post-development no Mitigation	215	149	1	0	0	0	0	0	36	226	224	207	1058
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	623	433	3	0	0	0	0	0	91	705	651	600	3105
Total Study Area													
Pre-development	31240	21695	139	0	0	0	0	0	6721	35903	32656	30071	158425
Post-development no Mitigation	8586	5963	38	0	0	0	0	0	5445	9705	8975	8265	46976
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	22654	15733	100	0	0	0	0	0	1276	26199	23681	21806	111449

Catchment Area Name	Pre-development Catchment Area (m^2)	Post-development Catchment Area (m^2)	% Reduction in Catchment Area	Pre-development Impervious Area	Post-development Impervious Area (m^2)	% Increase in Impervious Area
W1	13402	6256	53.3	2357.31	1184.00	-49.8
W2	64270	37146	42.2	6143.56	3307.00	-46.2
W3	225600	30872	86.3	5181	0	-100.0
W4	62040	17262	72.2	1356	785	-42.1
W5	74325	17422	76.6	1025.45	592.00	-42.3
W6	47497	11961	74.8	1307.38	427.00	-67.3

NOTES:
* - ve implies net reduction