Hydrogeologic Assessment Report

Laurelpark Subdivision

Part of Lot 19, Concession 6, Town of Caledon (Albion)

Prepared for:
Harbour View Investments, Ltd.

Prepared by:
Azimuth Environmental
Consulting, Inc.

December 2020

AEC 08-019

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

December 8, 2020 AEC 08-019

Harbour View Investments, Ltd.
2458 Dundas Street West
Mississauga, Ontario L5K 1R8

Attention: Mr. Mark Crowe

Re: **Hydrogeological Assessment Report**
Part of Lot 19, Concession 6, Town of Caledon (Albion)

Dear Mr. Crowe:

Azimuth Environmental Consulting (Azimuth) is pleased to submit our Hydrogeological Assessment Report for the property located in Part of Lot 19, Concession 6, Town of Caledon, Region of Peel. To comply with the requirements of the ORMCP, this hydrogeological assessment has been prepared to determine and describe the hydrogeologic and hydrologic function of sensitive features identified on the subject property. The evaluation focused on the nature of the interaction between the ground and surface water systems and the potential effect of the proposed development on these features.

Based upon our interpretation of the available data, it is concluded that the present hydrological and hydrogeological conditions upon the subject property will not experience a significant change due to do the proposed development.

If you require further information or have any questions do not hesitate to contact us.

Yours truly,
AZIMUTH ENVIRONMENTAL CONSULTING, INC.

PROFESSIONAL GEOSCIENTIST
MICHAEL G. JONES
PRACTISING MEMBER
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Mike Jones, M.Sc., P.Geo.
President

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1.0 INTRODUCTION

Azimuth Environmental Consulting (Azimuth) has been retained by Harbour View Investments Limited to conduct a Hydrogeological Assessment Report for the proposed estate residential development to be located on Part of Lot 19, Concession 6, Town of Caledon, Region of Peel (Figure 1). The subject property is located within the within the limits of the Oak Ridges Moraine (Oak Ridges Moraine Conservation Plan [ORMCP], 2002). Since the proposed estate residential development site occurs within the Oak Ridges Moraine Conservation Plan (ORMCP) Area the Hydrogeologic Assessment Report incorporates a Hydrological Evaluation (HE) which is a requirement of both the ORMCP and the Town of Caledon Official Plan (TCOP, 2016).

The primary objective of this report is to identify all Hydrologically Sensitive Features (HSF) as per the ORMCP (i.e. streams, wetlands, kettle lakes, seeps and/or springs) and ensure that the proposed development plan adheres to the requirements of the ORMCP. This includes, maintaining, improving or restoring all the elements that contribute to the hydrological and hydrogeological functions of the Oak Ridges Moraine.

2.0 PLANNING CONTEXT

2.1 Provincial Policy Statement

Section 2.2 – Water

Subsection 2.2.2: Development and site alteration shall be restricted in or near sensitive surface water features and sensitive ground water features such that these features and their related hydrologic functions will be protected, improved or restored. Mitigative measures and/or alternative development approaches may be required in order to protect, improve or restore sensitive surface water features, sensitive ground water features or on the their hydrologic functions.

Each of the six wetlands on the subject property will be protected with a 30 metre buffer (vegetation protection zone) surrounding the outer edge of each feature, which will preserve the existing vegetation and natural slope within each buffer area. Grading within each wetland catchment area will also be minimal in an attempt to replicate existing drainage conditions within the subject property. The subject property is not considered a significant ground water recharge area and given the proposed form of development, the proposed development is not anticipated to have a significant impact on local ground water quality/quantity.

2.2 Oak Ridges Moraine Conservation Plan

The property is located within the limits of the Oak Ridges Moraine (ORMCP, 2017). Within the Oak Ridges Moraine Conservation Plan (ORMCP), the property is within the Palgrave Estates Residential Community.

Subsection 13 (2): Maintains and protects Countryside Areas by:

b) Maintaining, and where possible improving or restoring the health, diversity, size and connectivity of key natural features, hydrogeologically sensitive features and the related ecological functions.
c) Maintaining the quality and quantity of ground water and surface water.
d) Maintaining ground water recharge.
e) Maintaining natural stream form and flow characteristics.
f) Protecting landform features.

Subsection 16 (2)a): For every Subdivision and Site Plan approval, with respect to land in the Countryside Areas, the approval authority shall ensure that a condition requiring the applicant to ensure that natural self-sustaining vegetation is maintained or restored for the long-term protection of any key natural heritage feature or hydrologically sensitive feature on the lot or lots created is imposed.

Subsection 26 (1): Identifies Key Hydrologically Sensitive Features (KHSF) as:

1) Permanent or intermittent streams
2) Wetlands
3) Kettle lakes
4) Seepage areas and springs

Subsection 26 (2): States that all development and site alteration with respect to land within a hydrologically sensitive feature or the related minimum vegetation protection zone is prohibited, except the following:

1) Forest, fish and wildlife management
2) Conservation and flood or erosion control projects, but only if they are determined to be necessary in the public interest after all alternatives have been considered.
3) Development of infrastructure in accordance with the requirements set out in section 41.
4) Low-intensity recreational uses as described in Section 37.
5) Agricultural uses other than uses associated with on-farm buildings and structures, but only with respect to land in the minimum vegetation protection zone related to a key hydrologic feature and not in the key hydrologic feature itself.

No development is planned to occur within the boundaries of any hydrologically sensitive feature located on the subject property or within any related minimum vegetation protection zone. The maintenance of hydrologically sensitive features, wetlands, streams, aquifers, ground water recharge areas and landform features will be done through minimum protection zones, ground water infiltration balancing and minimal site grading.

<u>Subsection 26 (3)</u>: States that an application for development or site alteration with respect to land within the minimum area of influence that relates to a hydrologically sensitive feature, but outside the hydrologically sensitive feature itself and the related minimum vegetation protection zone, shall be accompanied by a hydrological evaluation under subsection (4).

Please consider this report as the required hydrogeological evaluation to satisfy Subsection 26 (3) of the ORMCP.

<u>Subsection 26 (4)</u>: States that a hydrological evaluation shall,

a) Demonstrate that the development or site alternation will have no adverse effects on the hydrologically sensitive feature or on the related hydrological functions;
b) Identify planning, design and construction practices that will maintain, and where possible, improve or restore, the health, diversity and size of the hydrologically sensitive feature;
c) Determine whether the minimum vegetated protection zone, and if it is not sufficient, specify the dimensions of the required minimum vegetation protection zone and provide for the maintenance and, where possible, improvement or restoration or natural self-sustaining vegetation within it; and
d) In the case of an application relating to land in a Natural Core Area, Natural Linkage Area or Countryside Area, demonstrate how connectivity within and between key natural heritage features and key hydrologic features will be maintained and, where possible, improved or restored before, during and after construction.

This report satisfies the requirements of subsection 26 (4) of the ORMCP.

<u>Subsection 29 (5)</u>: States that the following uses are prohibited with respect to land in areas of high aquifer vulnerability:

1) Generation and storage of hazardous waste or liquid industrial waste.
2) Waste disposal sites and facilities, organic soil conditioning sites, and snow storage and disposal facilities.

3) Underground and above-ground storage tanks that are not equipped with an approved secondary contaminant device.
4) Storage of a contaminant listed in Schedule 3 (Severely Toxic Contaminants) to Regulation 347 of the Revised Regulations of Ontario, 1990.

Only a small area of land within the northeastern corner of the subject property is considered an area of high aquifer vulnerability under the ORMCP. None of the prohibited uses listed in subsection 29 (5) will be associated with the proposed development.

Region of Peel Official Plan

<u>Section 2.2.5: Ground Water</u>

2.2.5.1: It is policy of Regional Council to:

2.2.5.1.1: Protect, maintain and enhance the integrity of ecosystems through the proper planning and management of ground water resources and related natural systems in Peel.

2.2.5.1.2: Work with area municipalities, conservation authorities and other provincial agencies to protect, maintain and enhance ground water resources.

It is intended that the proposed development be serviced municipally by an existing watermain which is located along Mount Pleasant Road, which would lessen the impact on ground water resources within the local area. Section 9.0 of this report summarizes the predicted impacts on the local ground water regime from the construction and usage of eight individual septic systems to service the sewage disposal needs of the proposed development.

<u>Section 2.2.9: Oak Ridges Moraine</u>

2.2.9.3.8: Define key natural heritage features and hydrologically sensitive features in accordance with Policy 2.2.9.3.69 and Policy 2.2.9.3.10 of this Plan. Where key natural heritage features and hydrologically sensitive features coincide with components of the Greenlands System in Peel, the policies of Section 2.3 of this Plan shall also apply.

This report (specifically Sections 5.0 and 8.0) defines and describes in detail each hydrogeolocally sensitive feature found on the subject property.

2.2.9.3.10: As outlined in the ORMCP, the Peel Region OP defines hydrologically sensitive features as:

a) Permanent and intermittent stream;
b) Wetlands;
c) Kettle Lakes; and
d) Seepage areas and springs.

2.2.9.3.13: Direct the Town of Caledon to prohibit development and site alteration within key natural heritage features and/or a hydrologically sensitive feature and within the associated minimum vegetation protection zone, in accordance with the Table in Part III of the ORMCP, except as permitted by the ORMCP (e.g. existing uses and existing lots of record).

2.2.9.3.14: Direct the Town of Caledon to require that an application for new development or site alteration within the minimum area of influence of a key natural heritage feature or a hydrologically sensitive feature be accompanied by a natural heritage evaluation and/or a hydrological evaluation, as detailed in the ORMCP. The evaluation shall be prepared to the satisfaction of the Town of Caledon, in consultation with the Region of Peel and the applicable conservation authority, as appropriate. The Town of Caledon may develop guidelines to assist in the interpretation of this policy including appropriate mechanisms for refining and scoping evaluation requirements. These guidelines are to be developed in consultation with the Region of Peel and the applicable conservation authorities.

This report has been completed in accordance with Region of Peel OP policy 2.2.9.3.14

2.2.9.3.15: Direct the Town of Caledon to include, in its Official Plan, the appropriate policies that support connectivity. These policies should also include that applications for development or site alteration identify planning, design, and construction practices that ensure no buildings or other site alterations impede the movement of plants and animals along key natural heritage features, hydrologically sensitive features, and adjacent land within Natural Core Areas and Natural Linkage Areas.

Town of Caledon Official Plan

<u>Section 7.1.9: Environmental Policies</u>

7.1.9.5: No part of a Structure Envelope will be permitted in EZ 2 zones except for short sections of driveways which may cross short sections of EZ 2 if necessary to obtain reasonable access to a lot. Individual lot services will not be permitted to cross Policy Area 4 or EZ 1 and EZ 2 unless included within the driveway portion of a structural envelope crossing EZ 2.

No part of a structure envelope is proposed within EZ 2 zones.

7.1.9.28: The existing natural flow patterns into and from existing ponds should not be disturbed.

All wetlands on the subject property (with the exceptions of Wetland 5 and 6) are hydraulically isolated (offline) features. Wetland 5 outlets surface water into Wetland 6 during times of high water levels, and Wetland 6 outlets to an intermittent watercourse located off-site. Both of these surface flow pathways will be maintained within the 30 metre vegetation protection zones. All wetland catchment areas will also be maintained as much as possible in an attempt to replicated natural flow patterns.

7.1.9.39: Plans of subdivision shall be designated so as to minimize road crossings and extensions into EZ 2. Short sections of roads and associated subdivision services will be permitted to cross or extend into EZ 2 if necessary to allow economically efficient road or subdivision design, provided such road crossing is located in Policy Areas 1, 2 or 3.

A short section of Street A is proposed to cross an ephemeral swale between the pond at Mt. Pleasant and the neighbours dugout pond to the south. This swale directs storm runoff in both directions, With the site grading and road construction, this area would not be considered EZ 2 however, the same drainage function would continue. Significant impacts to the EZ 2 are not anticipated. The site is located within a Policy Area 1, which permits short sections of road to cross or extend into EZ 2.

7.1.9.45: If existing domestic wells are abandoned as a result of estate residential plans of subdivision the applicant must seal the abandoned well in accordance with the regulations of the Ministry of the Environment and Climate Change. Boreholes drilled for the geotechnical investigations detailed in Section 7.1.18.3 also must have piezometers removed and sealed prior to construction unless the borehole is approved by the Town for future environmental monitoring purposes.

No domestic wells exist on the property, and all monitoring wells will be decommissioned in accordance with the regulations of the Ministry of the Environment prior to development, unless a well(s) is approved by the Town for future environmental monitoring purposes.

<u>Section 7.1.18.5: Hydrogeology Report</u>

A Hydrogeology Report will be prepared which summarizes available domestic water well and borehole records and the characteristics and quality of the existing water table and deeper confined aquifers. This report will characterize the hydrogeology of the site and assess the risk of contamination from the proposed development to adjacent domestic and communal ground water supplies. Nitrate modeling will be undertaken as applicable for sand to water table soils. This report may form part of the environmental reporting. The Hydrogeology Report should take into consideration applicable provincial guidelines, such as the Guideline on Planning for Sewage and Water Servicing, and related Technical Appendices.

Sections 4.0, 6.0 and 9.0 of this report satisfy the requirements of Section 7.1.18.5 of the Town of Caledon Official Plan.

Section 7.10.5.1: Key Natural Heritage and Hydrologically Sensitive Features

Hydrologically sensitive features within the ORMCPA are permanent and intermittent streams, wetlands, kettle lakes and seepage areas and spring.

All hydrologically sensitive features on-site have been identified and will be protected with minimum 30-metre vegetation protection zones, as per Table 7.5 of the Town of Caledon Official Plan.

3.0 EXISTING CONDITIONS

3.1 Land Use

The property is approximately 11 hectares (ha) in size and located on the western side of Mount Pleasant Road just south of Oak Knoll Drive (Figure 1). The majority of the property is composed of active and idle agricultural production. A total of six wetlands have been identified on the property, which are scattered throughout the extent of the site (Figure 2). There is also an additional wetland (Wetland 10) located offsite that has the potential to be impacted, as a portion of its catchment area is located on the subject property. It is our understanding that some of the wetlands on-site were created by anthropogenic activities (Wetland 4 and Wetland 7) such as soil/gravel excavation and damming.

To the best of our knowledge, no residential structures have ever been located on the subject property. Lands surrounding the property are dominated by estate residential development and agricultural fields.

3.2 Physiography

The subject property is located within the physiographic region referred to as the Oak Ridges Moraine (ORM) (Chapman and Putnam, 1984). The ORM is a prominent physiographic feature in south-central Ontario forming a west to east trending ridge that is approximately 160 km long and 2 to 11 km wide. Extending from the Niagara Escarpment to the Trent Talbot River, the ORM consists of several distinct sections. The subject property is located within the Albion Hills area of the Town of Caledon, where the hills consist of deep beds of evenly graded fine sand. However, in the vicinity of the subject property, the physiographic setting consists of a Till Moraine.

Locally, the subject property is situated on the southern flanks of Mount Wolfe, an isolated remnant of Northern Till/Newmarket Till. This outlier protrudes through the younger sediments of ORM and rises to approximately 365 masl, 65 metres above the surrounding moraine deposits. The topographic relief on the subject property is approximately 15 metres, ranging between 270 masl in the southwest corner of the property to 285 masl at the peak of a hill located within the central portion of the property.

3.3 Hydrology and Drainage

The subject property is located within the Humber River watershed. The drainage divide between the Humber and the Holland catchment areas is located approximately 1.5 km to the north-northeast, while the drainage divide between the Humber and Nottawasaga catchment areas is located approximately 2.5 km to the north.

Although there are no watercourses located on the subject property, a small tributary of the Humber River named Cold Creek is located just west of the site. It is presumed that the majority of surface and shallow ground water from the subject property drains to this watercourse. The on-site wetlands have also been found to receive a portion of the local surface runoff and shallow ground water contribution at certain periods (ground water contribution primarily during spring and fall).

MNRF classified these wetlands as “Kettle Wetlands” in the Mount Wolfe Wetland Complex Evaluation document dated July, 2012. Based on the geologic history of the area and the isolated (hydraulically) nature of the wetlands, Azimuth agrees that some of these wetlands are kettle features, but as previously mentioned, a portion of the wetlands were established by anthropogenic activities. Kettle features, particularly small features such as these, are abundant throughout sections of the Oak Ridges Moraine. However, they are not identified as kettle lakes. Of note, storm drainage is not being directed to any of the kettle features. Overland runoff from areas of the property (other than roadways) will continue to flow as in the pre-development condition to maintain hydroperiods.

4.0 GEOLOGY

4.1 Regional Geology

The key geological units found within the study area are the Thorncliffe Formation, the Northern Till, the ORM sediments, and the Halton Till. The subject property is located on the southern flanks of Mount Wolfe, which is an inlier of the Northern Till, which extends up through the younger deposits of the ORM. This physiographic / geological feature makes the study area somewhat unique with respect to the general geological characteristics of the ORM.

There is a general consensus that the base of the ORM is defined by a regional unconformity (erosional surface) that forms the top of the Northern Till (mapped as Newmarket Till; Gwyn, 1972; Sharpe *et al*., 1996). The Northern Till was deposited by the Laurentide Ice Sheet as it expanded southwards during the Nissourris Stadial (between 22,000 and 18,000 years ago; Karrow and Ochietti, 1989; Boyce *et al*., 1995) to cover all of Canada and adjacent parts of the United States. The origin of the erosional surface is contentious. Proposed models include sub-glacial outburst floods (Shaw and Sharpe, 1987), or from sub-glacial deformation (Boyce and Eyles, 1991). Regardless of the origin of the regional unconformity, the Northern Till is characterized by an undulating surface both beneath and north of the ORM (Peterborough Drumlin Field).

The Northern Till is a light grey, sandy till, which ranges in texture from a loam to a sandy loam and may contain appreciable percentages of gravel, cobble and boulders. The till is widely recognized as a very dense till, and often referred to as “hardpan” by water well drillers. Within the Till unit, lateral sand and gravel interbeds and boulder pavements marking erosional surfaces have been identified (Boyce *et al*., 1995; Boyce *et al*., 1997).

In most areas east of the Escarpment, the Till is mostly covered by younger deposits but it is also well exposed at the surface in several localities, such as Mono Mills and at Mt. Wolfe. The till is continuous beneath the discontinuous cover of the ORM sediments. The subject lands are mapped by Chapman and Putman (1984) to be located on the Till Moraine, while earlier mapping by White and Karrow (1975) has ORM deposits beneath the subject property. However, based on a site specific geological data, the sediments are found to have been deposited in a moraine environment.

Warming trends approximately 13,800 years ago resulted in the retreat of the Laurentide Ice Sheet and the separation into the Simcoe and Ontario Lobes. The first ice-free period (Mackinaw Interstadial Period) resulted in interbedded outwash sands and gravels were deposited by meltwater draining from the ice margin. After a brief ice-free period, the Laurentide Ice Sheet re-advanced to form an interlobate lake between the ice margins (13,300 years ago). The interlobate lake was confined between the Simcoe Lobe in the north, northeast; the Ontario Lobe in the south, southeast; and the Niagara Escarpment to the west. As ice margins receded, deltaic and glaciofluvial outwash sediments were deposited in the expanding glacial lake basin between the ice margins.

The glaciolacustrine and sub-aqueous deposits that formed the core of the ORM are approximately 95 metres thick and are interfingered and overlain by the Halton Till deposits as a result of several minor ice margin advances and retreats. Although absent along the crest of the moraine, the Halton Till drapes the southern flanks of the ORM, where it forms the uppermost stratigraphic unit. The Till consists of predominantly sandy silt to clayey silt and is typically massive.

The limit of the final ice advance is marked by the narrow zone of hummocky topography and numerous kettle features (lakes, wetlands, or dry depressions).

4.2 Local Geology

To ensure that the surficial geology is consistent with the regional mapping, a review of borehole data was completed. Terraprobe (2013) completed a geotechnical evaluation of the subject property and drilled a total of 12 boreholes ranging between 6.4 and 6.6 metres in depth. The borehole records which show detailed geologic descriptions (stratigraphy) across the extent of the subject property are provided in Appendix B.

The surficial geology is quite consistent across the subject property. The underlying deposits within the upper 6.6 metres of overburden are primarily silty in nature, with some sand and trace clay (Terraprobe, 2013) found in sporadic deposits across the subject property. Terraprobe (2017) completed additional geotechnical work, and excavated 12 test pits as part of that work, which assist in defining the shallow soils and the water table configuration.

Azimuth also supervised the drilling of seven monitoring wells on the subject site for the purpose of long term ground water level monitoring. Please see Figure 3 for monitoring well locations and Appendix B for borehole logs. To summarize, Azimuth encountered very similar shallow geological conditions as Terraprobe, as the silty deposit found across the subject is believed to be regional in expanse.

White (1975) reported that the localized areas of silt within the ice-contact stratified sands and gravels were deposited in fairly deep waters impounded in the moraine area. Deposition over buried ice masses is suggested by the common occurrences of disturbed structures of the stratified silts (wetland areas / depression). In the areas shown as ice contact stratified drift in the moraine zone, numerous exposures of till are seen either overlain by or underlying stratified sediments.

5.0 HYDROGEOLOGY

The ORM is widely recognized as an important aquifer system, which is referred to as the Oak Ridges Aquifer Complex (ORAC). The ORAC is generally unconfined, except where the Halton Till drapes the moraine on the southern flanks. The primarily coarse-grained nature of the outwash gravels that form the complex is reflected by the high values of hydraulic conductivity (Gerber and Howard, 2000). Consequently, the aquifer system has become a major source of potable water for domestic wells and communities in south-central Ontario. Yields are typically as high as 4 L/s (Sibul *et al*., 1997). The base of the aquifer system rests on the Northern Till. The aquifers thickness is largely a function of the thickness of the ORM deposits.

The outwash deposits of the ORM are in direct communication with, and stratigraphically equivalent to the sands (and gravels) of the Mackinaw Interstadial deposits. Based on the local domestic water wells, the majority of the water supplies in the area are obtained from the Mackinaw Interstadial deposits.

There are four domestic water wells on record with the Groundwater Information Network (GIN) for Lot 19, Concession 6, Town of Caledon (former Township of Albion). Table 1 provides a summary of these records. The digital print out of the information is provided in Appendix C.

Table 1: Summary of Local Water Well Records

Water Well No.	Geologic Unit	Approximate Elevation (masl)	Static Water Level (masl)
4903021	Mackinaw Interstadial Sands	**275 - 270**	271
	Underlying Clay Deposits	270 - 263	
4903059	Mackinaw Interstadial Sands	**278 - 272**	270
	Underlying Clay Deposit	272 - 266	
4903634	ORM Deep Water Deposits	285 - 276	275
	Mackinaw Interstadial Sands	**276 - 274**	
	Underlying Clay Deposit	274 - 265	
4904873	ORM Deep Water Deposits	277 – 248	272
	Deeper Sand Deposit	**248 - 245**	

Bold = Zone of target aquifer source

Typically, wells within the vicinity of the subject property target the sandy zone between 270 and 278 masl. The wells that target this upper aquifer zone are dug wells and are not able to target deeper aquifer zones. Well #4904873 is a drilled well, which explains the deeper aquifer zone targeted. The well yields are variable yet sufficient for the requirements of domestic wells (between 5 and 6 IGPM).

5.1 Ground Water Flow – ORAC

To advance the understanding and management of the ground water system across a large part of southern Ontario, a partnership was developed between four municipal governments (Regional Municipalities of York, Peel, and Durham, and the City of Toronto (YPDT)) and the associated Conservation Authorities, including the Toronto and Region (TRCA). This study is known as the YPDT-CAMC Groundwater Management Strategy Study (Kassenaar and Wexler, 2006).

This report included an Aquifer Characterization Study for the TRCA Watersheds. Although it is recognized that this is a broad based regional study, the results provided a general understanding of the ground water flow conditions within the ORAC. Figure 97 and 98 of this report depict calibrated heads in the underlying Thorncliffe and Scarborough Aquifer Complexes (shown below). Both aquifer systems are shown to flow towards the Humber River valley to the southeast.

The Thorncliffe and Scarborough Aquifer Complexes are the major ground water systems within the Oak Ridges Moraine which exist below the upper Oak Ridges Aquifer Complex.

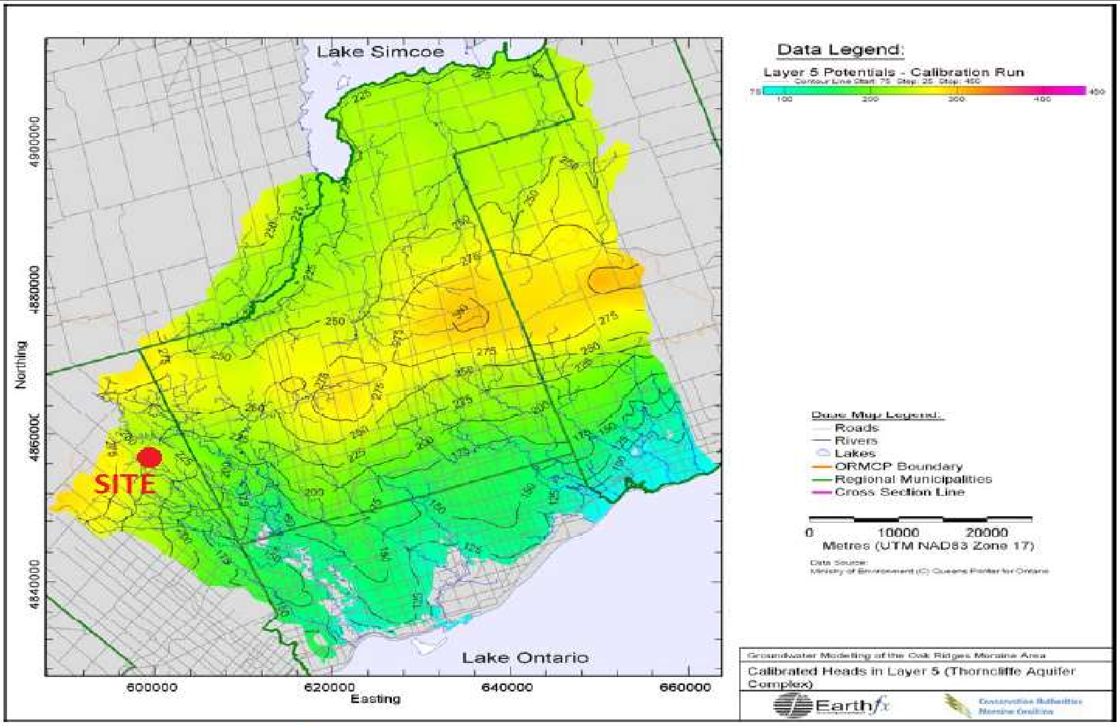


Figure 97: Calibrated heads in the Thorncliffe Aquifer Complex

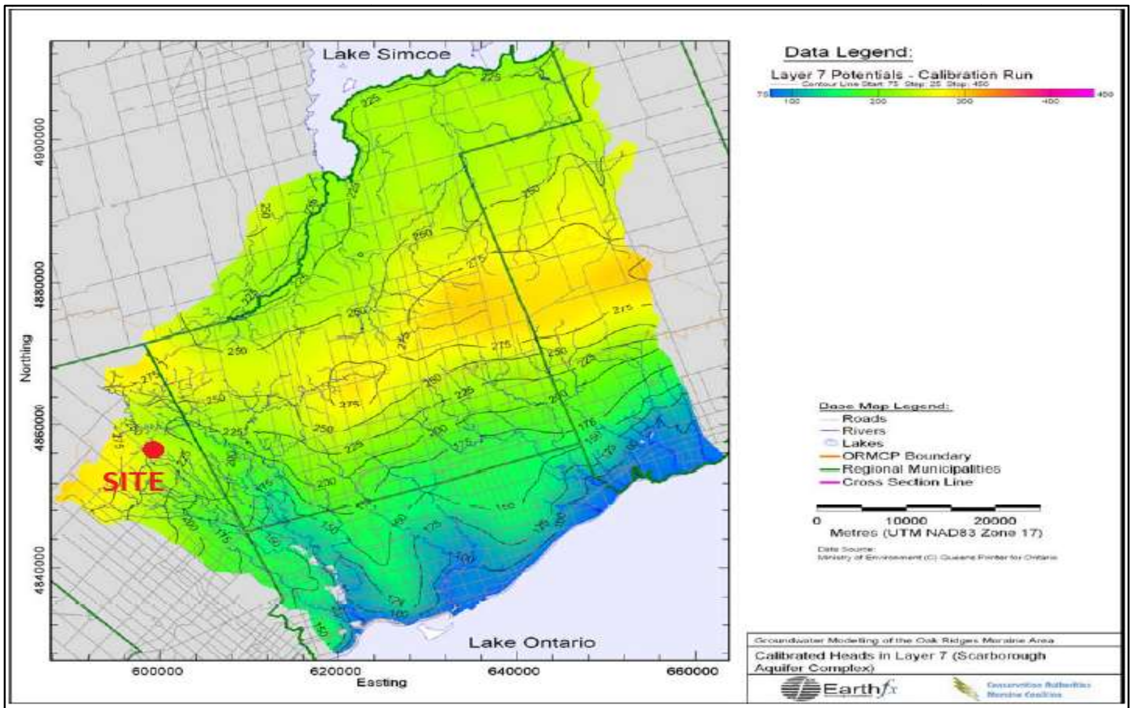


Figure 98: Calibrated heads in the Scarborough Aquifer Complex

Based on these two figures, the calibrated hydraulic heads in the Thorncliffe and Scarborough Aquifer Complex's (deeper aquifers) heads within the vicinity of the subject property fall in the approximate range of 225 - 250 masl. Deeper ground water flow is shown to flow in a southeasterly direction toward Lake Ontario.

Site specific ground water elevations (measured in March 2013) of the shallow upper aquifer monitored on the property, and ground water flow directions are presented in Figure 4. It has been determined that shallow ground water flows in a general south to southeasterly direction.

5.2 Local Hydrogeology

In order to observe the fluctuation of the underlying upper aquifer, automatic water levels were collected using hydrostatic pressure dataloggers installed in the 12 on-site monitoring wells (Figures 7 - 13). Azimuth's long term ground water monitoring program (2012 – 2017) has shown that seasonal ground water level fluctuation within the subject property were in the range of 1.85 (MW-5II) to 5.10 (MW-2) metres. Considering the varying climatic conditions experienced within the monitoring period, this fluctuation range should be considered normal and expected to continue in the future.

Ground water elevations across the subject property ranged between a high of approximately 280.5 masl in the northern portion of the site to approximately 267.8 masl in the southeastern corner of the site. This difference in ground water elevation across the site suggests that the shallow ground water flow is controlled locally by topography, as anticipated.

The Town of Caledon Official Plan (2016) identifies areas of high ground water table (where the water table is usually within 1.5 metres or less below the ground surface), areas of seasonal flooding, dry swale lowlands and natural depressions which perform natural run-off, detention and ground water recharge functions, and smaller hedgerows and strips of native vegetation. These areas are termed EZ 2 (Environmental Zone 2). Figure 6 includes mapping of existing EZ 2 areas within the subject site, based on hydrogeological investigations completed by Azimuth and Terraprobe Inc. in 2013 and 2017.

The Official Plan does not permit any part of a structure envelope within EZ 2 areas, with the exceptions of short sections of driveways and roads. As shown in Figure 6, no development feature will cross an EZ 2 area within the subject property.

6.0 GROUND WATER / SURFACE WATER INTERACTION

Nearly all surface water features (streams, wetlands) interact with ground water in some form or another. In many situations, surface water bodies receive ground water which maintain surface water levels throughout the year, and in others situations the surface water body provides a source of ground water recharge.

To understand the hydraulic significance of the ground water regime on the on-site surface water features, a detailed assessment was completed. This included a long term water level monitoring program for five of the six on-site wetlands (Wetland 4 not included in the assessment as no data was collected) and twelve on-site monitoring wells.

When Azimuth initiated the wetland monitoring program, it was understood that the Wetland 4 was created due to drainage issues from a collapsed culvert beneath Mount Pleasant Road. Due to the collapsed culvert, water could not drain from this feature and eventually turned into a wetland. Azimuth assumed that following the repair of the culvert the feature would have been drained, although the Region of Peel installed a culvert on the north side of the municipal ditch which controls/ maintains water levels (culvert bottom is higher than wetland bottom) in this feature. It should be noted that the on-site catchment area of Wetland 4 will not be altered and that the majority of its catchment area is not part of the subject site, so no impacts to water levels within this feature are anticipated as a result of the proposed development.

Wetland 10 was also not included in the monitoring program is this feature is wholly located offsite and landowner permission was not pursued for access to the adjacent property to the southeast. Visual inspections of this feature throughout the monitoring program verify that surface water level fluctuations during spring, summer and fall are minimal in Wetland 10. This is likely due to the feature being connected to the shallow ground water table which maintains the presence of surface water throughout the year. This wetland has been historically modified as a farm pond with wetland fringe around its shore, likely through dredging.

Based on the surface and ground water level data collected in and around the vicinity of each monitored wetland, it was found that all wetlands receive ground water contribution to some degree during the year, although the amount of ground water contribution varies on a feature-specific basis. Surface water levels within each wetland could not be collected during the winter month due to each feature freezing over, so the comparison of ground and surface water levels was limited to spring, summer and fall. The elevation of the bottom of each wetland feature is known (surveyed by OLS), which allowed for the measurement of ground water levels above or below these elevations during the winter months.

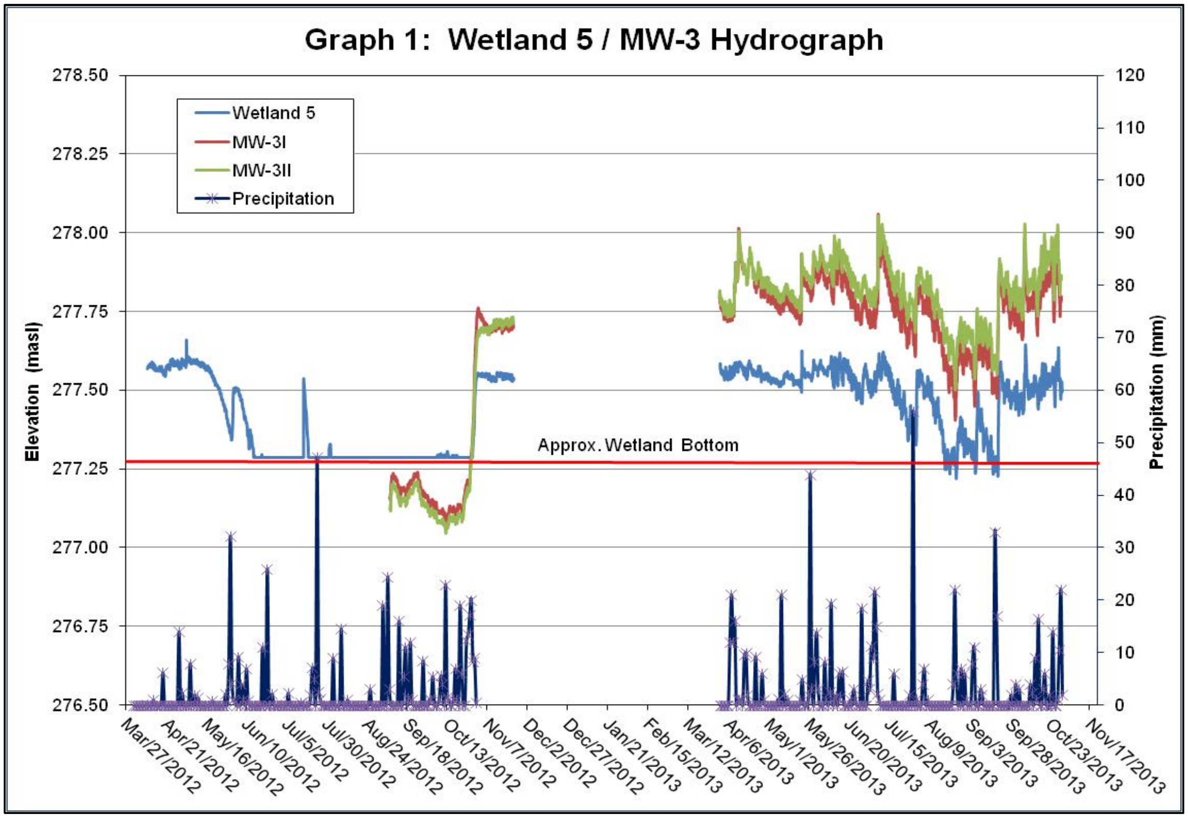
The following sections present the data collected for the purpose of assessing ground and surface water level interactions at five monitored wetland locations.

6.1 Wetland 5 / Monitoring Well 3

Wetland 5 is a small, oval-shaped feature located within the central portion of the subject property, which generally (based on monitoring data between 2012 and 2013, along with periodic visual inspections since 2008) contains surface water between the months of October and June. This feature has been found to dry out for extended periods of time between June and October each year, with the exception of significant storm events/extended periods of precipitation within this time span. This should be considered evidence that ground water contribution generally does not occur within Wetland 5 during the summer months. Further evidence to this belief is shown below in Graph 1.

Monitoring Well 3 is a nested well location containing two separate wells (MW-3I and MW3-II) and is constructed just east (upgradient) of Wetland 5. MW-3I is approximately 3.0 metres deep and MW-3II is approximately 6.7 metres deep. This well nest was installed to identify the degree of ground water contribution to Wetland 5.

Graph 1: Wetland 5 / MW-3 Hydrograph (2012 – 2013)



As can be seen in Graph 1, ground water levels between early September and late October 2012 were below the bottom of Wetland 1, which tells us that ground water contribution was not occurring during this period. An increase in rainfall occurred within October 2012 which raised both surface and ground water levels above the bottom of the wetland. This interaction is evidence that there is a correlation between surface and ground water levels at Wetland 5, and that ground water contribution is a factor in the maintenance of surface water levels within this wetland feature. Throughout the 2013 monitoring period, ground water levels were also above the bottom of the wetland which maintained surface water levels within the Wetland 5. This is evidence that the hydroperiod for Wetland 5 can change on an annual basis due to climatic conditions.

6.2 Wetland 6 / Monitoring Well 4

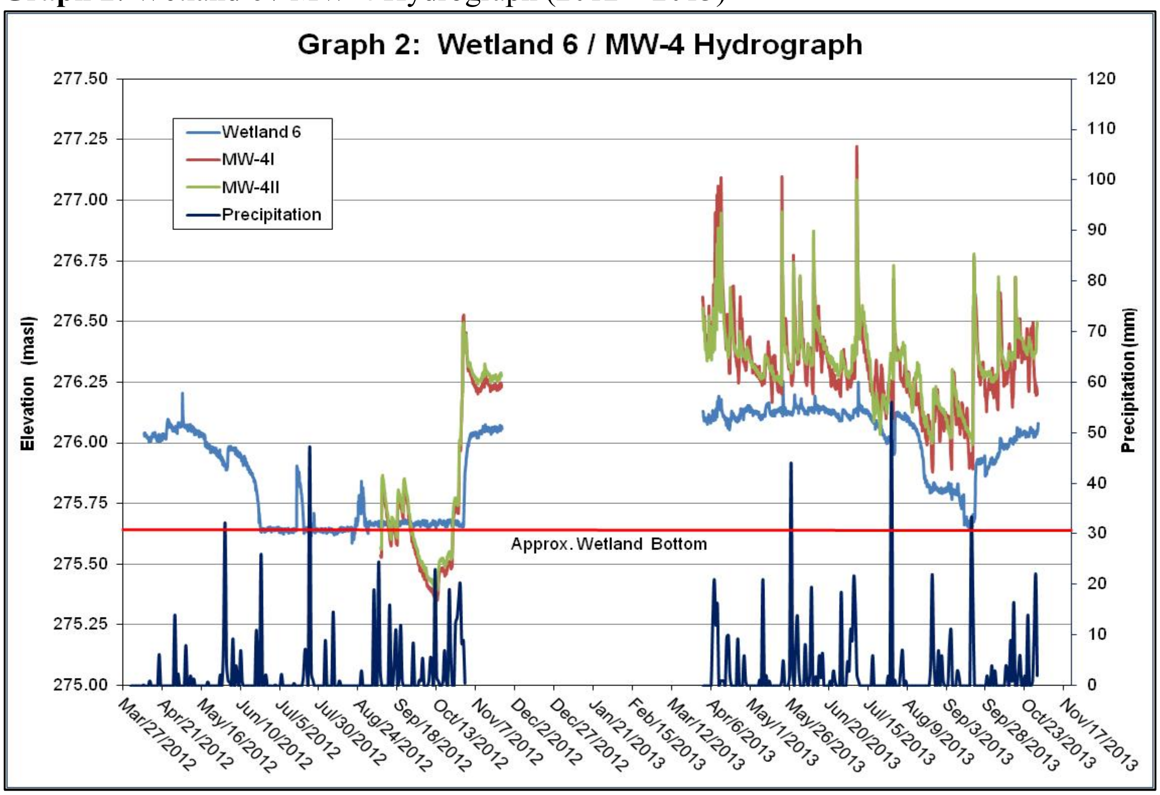
Wetland 6 is a small, kidney-shaped feature located within the central portion of the subject property, which generally (based on monitoring data from 2008, 2011, 2012 and 2013) contains surface water between the months of October and June. Wetland 6 is hydraulically connected to Wetland 5 during periods of high water conditions, as

Wetland 5 drains into Wetland 6 when at capacity. Wetland 6 then drains in an easterly direction via an outlet channel which flows through the adjacent property.

This feature has been found to dry out for extended periods of time between June and October each year, with the exception of significant storm events/extended periods of precipitation within this time span. Historically, significant storm events have been found to restore surface water within the feature for short periods of time until it is evaporated by hot, dry weather and/or infiltrated into the ground water regime. This should be considered evidence that ground water contribution generally does not occur within Wetland 6 during the summer months. Further evidence to this notion is illustrated below in Graph 2.

Monitoring Well 4 is a nested well location containing two separate wells (MW-4I and MW4-II) and is constructed just north (upgradient) of Wetland 6. MW-4I is approximately 3.0 metres deep and MW-4II is approximately 7.6 metres deep. This well nest was installed to identify the degree of ground water contribution to Wetland 6.

Graph 2: Wetland 6 / MW-4 Hydrograph (2012 – 2013)



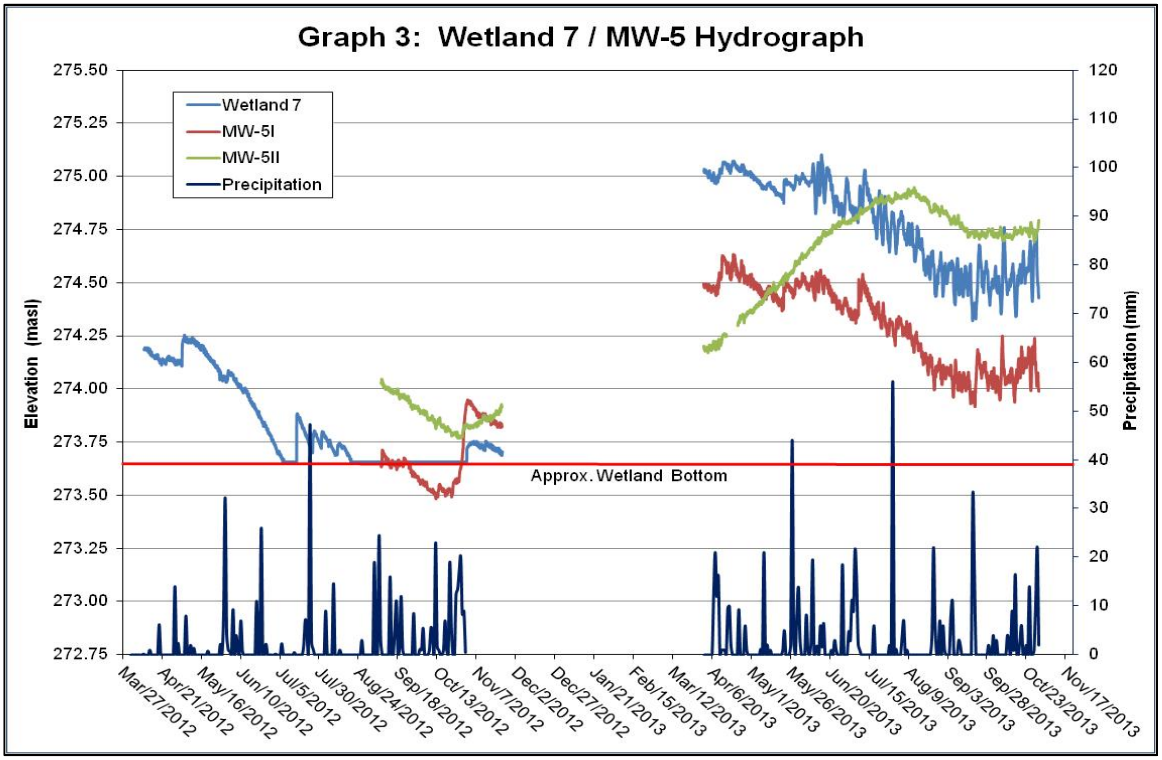
As can be seen in Graph 2, ground water levels between early September and late October 2012 were generally below the bottom on Wetland 6, which tells us that little to no ground water contribution to this feature was occurring during this period. An increase in rainfall occurred in October 2012 which raised both surface and ground water levels above the bottom of the wetland. This interaction is evidence that there is a correlation between surface and ground water levels at Wetland 6, and that ground water contribution is a factor in the maintenance of surface water levels within this wetland feature. Throughout the 2013 monitoring period, ground water levels were also above the bottom of the wetland which maintained surface water levels within the Wetland 6. This is evidence that the hydroperiod for Wetland 6 can change on an annual basis due to climatic conditions.

6.3 Wetland 7 / Monitoring Well 5

Wetland 7 is a small but deep, circular-shaped feature located within the southern central portion of the subject property, which (based on monitoring data from 2008, 2011, 2012 and 2013 and visual observations in 2015 and 2016) contains surface water throughout the entire year of a wet summer, although completely dries out during a dry summer. This feature has been found to contain water levels up to approximately 2 metres in depth at its deepest point. Although Wetland 7 has been found to contain surface water longer into the year, the degree of ground water contribution has been found to be less than other wetlands on-site.

As can be seen in Graph 7, MW-5I and MW-5II respond differently to precipitation events, which is the opposite of what has been observed in the other nested monitoring well sites. MW-5I (3.9 metres deep) shows distinct responses as the water level rises quickly when infiltration occurs from precipitation. MW-5II (7.6 metres deep) shows a slowly decreasing and increasing water level as the seasons change, and does not show quick responses to precipitation events. These varying trends are evidence that a local confining layer may exist within the shallow overburden in the vicinity of Wetland 7 and MW-5 which impedes ground water contribution to the wetland feature. As shown in Graph 3, the Wetland 7 surface water level in April 2013 is either at or above the ground water levels in MW-5I and MW-5II, which shows that ground water contribution is minimal at a time when it should be significant. Other evidence that water levels within Wetland 7 are primarily controlled by surface water is the water chemistry data analyzed for this feature (see Section 7.1).

Graph 3: Wetland 7 / MW-5 Hydrograph (2012 – 2013)

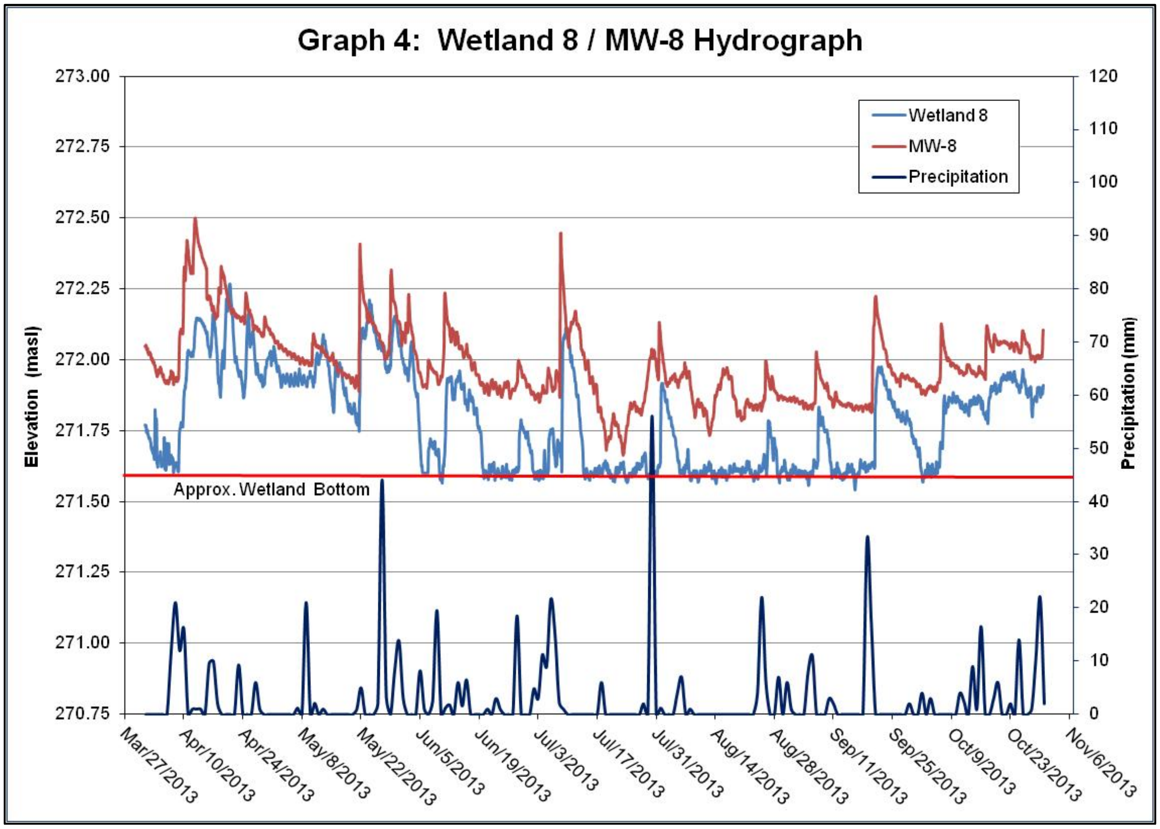


6.4 Wetland 8 / Monitoring Well 8

Wetland 8 is a small, oval-shaped feature located within the southeastern portion of the subject property. Only 2013 data was collected for this feature, although it is known to dry out fairly quickly after spring precipitation ceases each year (based on visual observations since 2008). As can be seen in Graph 4, ground water levels in MW-8 were above surface water levels in Wetland 8 throughout the monitoring period, which is evidence that this feature does receive ground water contribution.

Monitoring Well 8 is a single shallow well (approximately 2.1 metres deep) constructed just north (upgradient) of Wetland 8. This well was installed to identify the degree of ground water contribution to Wetland 8.

Graph 4: Wetland 8 / MW-8 Hydrograph (2013)

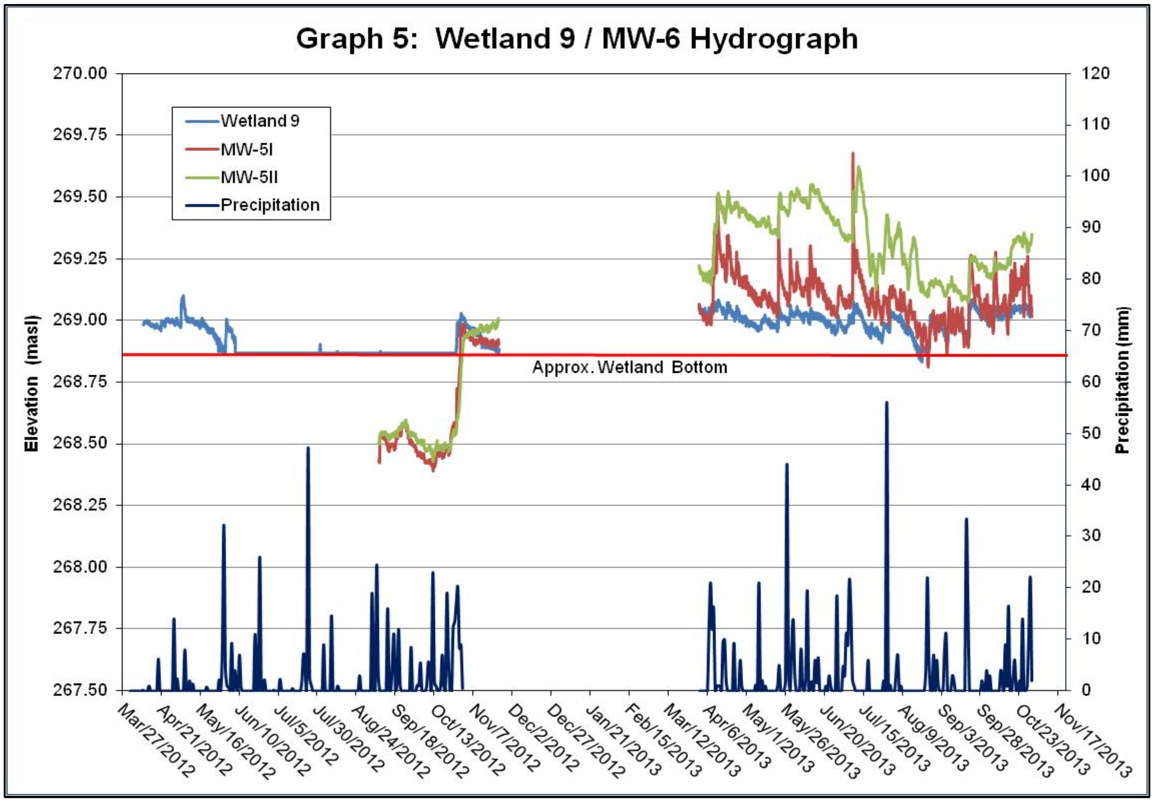


6.5 Wetland 9 / Monitoring Well 6

Wetland 9 is a small and shallow feature located at the southeastern corner of the subject property, and is part of a larger wetland feature primarily located on the adjacent property to the south. Approximately 15-20% of the feature is located on the subject property, with this portion generally drying out much faster than the deeper portion located on the adjacent lands. On the subject property, Wetland 9 generally (based on monitoring data from 2012 and 2013, along with periodic visual inspections since 2008) contains surface water between the months of October and May. This feature has been found to dry out for extended periods of time between May and October each year. Historically, significant storm events have been found to restore surface water within the feature for short periods of time. This should be considered evidence that ground water contribution generally does not occur within this feature during the summer months.

Monitoring Well 6 is a nested well location containing two separate wells (MW-6I and MW6-II) and is constructed just north (upgradient) of Wetland 4. MW-6I is approximately 3.0 metres deep and MW-6II is approximately 6.1 metres deep.

Graph 5: Wetland 9 / MW-6 Hydrograph (2012 – 2013)



As can be seen in Graph 5, ground water levels between early September and late October 2012 were generally below the bottom on Wetland 9, which tells us that ground water contribution was not occurring during this period. An increase in rainfall occurred within October 2012 which raised both surface and ground water levels above the bottom of the wetland. This interaction is evidence that there is a correlation between surface and ground water levels at Wetland 9, and that ground water contribution plays some factor in the maintenance of surface water levels within this wetland feature. For the majority of the 2013 monitoring period, ground water levels were above the bottom of the wetland which maintained surface water levels within the Wetland 9. This is evidence that the hydroperiod for Wetland 9 can change on an annual basis due to climatic conditions.

6.6 Wetland 10

Wetland 10 has not been monitored, as it is fully located off-site of the subject property. Through visual inspections of the wetland throughout the monitoring period (2008 – 2013) it has been determined that it is a permanent pond / wetland feature that does not dry out in the summer months. The elevation of the pond / wetland, along with the permanent nature of the feature leads Azimuth to believe that it is hydraulically connected to the shallow ground water table, which maintains the presence of surface water throughout the year.

It is recommended that surface water levels within Wetland 10 be monitored for baseline water level data, along with during and post-construction monitoring. The specific monitoring plan for the site is presented in Appendix E (also presented in Table 4.1 of Calder Engineering Ltd. Functional Servicing Report for the subject property). It should be noted that landowner permission must be granted for any monitoring to occur for Wetland 10, as it is not located on the subject property.

6.7 Historical Wetland Water Levels

Further to the graphs shown above, the table below presents historical manual water levels taken seasonally between 2008 and 2013. As can be observed from this data, Wetland 3 is the only feature that did not dry out completely during this monitoring period, although as stated in subsection 6.3, it has dried out during extended drought periods (summers of 2015 and 2016).

This historical manual data was not included in the above graphs, as the focus of Graphs 1 - 5 were the 2012 – 2013 monitoring periods. Extending the graphs back to 2008 would decrease the visibility of the data, and the purpose of the graphs was to compare continuous surface water level data to continuous ground water level data. Continuous surface water level data was only collected for the years of 2012 and 2013. The manual measurements shown in the table below are presented to show the variability in hydroperiod between monitoring years. Unfortunately only monitoring of Wetland 6 and Wetland 7 occurred prior to 2012, and the measurements were sporadic.

Table 2: Manual Wetland Water Level Measurements

	Wetland Water Levels (m)				
Date	**Wetland 5**	**Wetland 6**	**Wetland 7**	**Wetland 8**	**Wetland 9**
11-Jun-08	Not Measured	0.21	0.82	Not Measured	Not Measured
3-Jul-08	Not Measured	0.14	0.75	Not Measured	Not Measured
13-Aug-08	Not Measured	0.19	0.69	Not Measured	Not Measured
15-Sep-08	Not Measured	0.14	0.57	Not Measured	Not Measured
21-Oct-08	Not Measured	Dry	0.55*	Not Measured	Not Measured
26-Mar-09	Not Measured	0.33	1.06	Not Measured	Not Measured
13-Apr-09	Not Measured	0.35	1.14	Not Measured	Not Measured
17-Jun-11	Not Measured	0.29	0.88	Not Measured	Not Measured
4-Nov-11	Not Measured	Dry	0.7	Not Measured	Not Measured
7-Mar-12	0.36	0.36	Not Measured	Not Measured	0.13
21-Mar-12	0.29	0.36	1.15	Not Measured	0.15
9-Apr-12	0.28	0.29	1.15	Not Measured	0.13
18-Apr-12	0.28	0.30	1.05	Not Measured	0.10
3-May-12	0.28	0.35	0.98	Not Measured	0.11
31-May-12	0.06	0.21	0.90	Not Measured	0.00
3-Jul-12	Dry	Dry	0.59	Not Measured	Dry
7-Aug-12	Dry	Dry	0.55*	Not Measured	Dry
7-Sep-12	Dry	Dry	0.55*	Not Measured	Dry
21-Oct-12	Dry	Dry	0.55*	Not Measured	Dry
23-Nov-12	0.24	0.31	0.61	Not Measured	0.01
31-Mar-13	0.29	0.38	1.37	0.17	0.18
15-Apr-13	0.29	0.34	1.40	0.48	0.18
7-May-13	0.28	0.30	1.34	0.35	0.14
8-Jun-13	0.28	0.30	1.31	0.09	0.15
8-Jul-13	0.28	0.31	1.16	0.04	0.14
21-Aug-13	Dry	Dry	0.35	Dry	Dry

*Wetland dry at stilling well but measurement is approximate at the deepest part of the feature.

7.0 DOOR-TO-DOOR WELL SURVEY

A door-to-door well survey was initiated in November 2018 to collect baseline data pertaining to neighbouring domestic wells within 500 metres of the subject property. An initial site visit was performed to drop off letters at the properties located within the 500 metre radius, to inform them of the survey program. The program consisted of a well inspection (inspection of type and condition, static ground water level and total depth measurement), survey questionnaire (questions pertaining to general well use, well details, past issues with water quality/quantity, water treatment system and septic location and past issues) and a water quality sample.

A total of three (3) local residents chose to participate in the survey. The properties included 15535 Mount Pleasant Road, 15586 Mount Pleasant Road (direct neighbour to southeast) and 15609 Mount Pleasant Road (direct neighbour to northeast). A map showing the well survey limits, domestic wells within the area limits and participants in the well survey program is included below. It should be noted that only properties along

Mount Pleasant Road are serviced by private wells. All other properties within 500 metres of the subject site are serviced by municipal water.

Map 1: Area of Well Survey

A summary of the basic information collected from the well survey participants is provided below in Table 3.

Table 3: Domestic Well Survey Summary

Well Location	Well Type	Well Depth	Water Level	Condition	Past Issues
15535 Mt. Pleasant Rd.	Dug	19.80	2.82	Poor/Not Sealed	-Well dries out if pumped for long periods. -Bacteria contamination issues.
15586 Mt. Pleasant Rd.	Dug	11.10	4.30	Good/Not Sealed	-No past issues.
15609 Mt. Pleasant Rd.	Dug	15.30	5.86	Fair/Some Casing Damage	-No past issues.

Based on the information collected during the well survey, all wells are older dug wells with typical issues associated with contamination risk. None of the well lids were fully sealed which provides openings for insects/vermin and runoff from the top of the casing to enter the well. Water quality results for the samples taken from these wells are presented in Appendix D and Ontario Drinking Water Quality Standards exceedances are summarized in Section 8.5 of this report.

It should be noted that sampling from all wells resulted in bacterial contamination. This is likely due to the condition of each well and potential pathways for bacterial contamination to enter. All residents were informed by telephone of the health-related water quality exceedances within 24 hours of Azimuth receiving the results from the laboratory.

It should be noted that a Well Contingency Plan has also been prepared by Azimuth and presented in Appendix I. The Contingency Plan would be enacted if nearby well owners complained of possible impacts to their wells during or after construction.

8.0 WATER QUALITY ANALYSIS

On April 21, 2013 Azimuth staff collected surface (5) and ground water (2) samples from the subject property for water quality analysis. Ground water samples were taken from MW-3I and MW-5II, which provided samples from shallow (MW-3I) and deep (MW-5II) well locations.

Surface water samples were taken from the five on-site wetlands included in this investigation (Wetlands 5 – 9). All samples were obtained in adherence with accepted industry protocols and analyzed for a wide array of inorganic, metals, and nutrient parameters. The samples from the on-site monitoring wells were also analyzed for microbiological parameters.

Subsequently, in 2018 Azimuth collected a total of three (3) ground water quality samples from neighbouring domestic dug wells as part of a door-to-door well survey (as described in Section 7.0).

All samples were couriered to AGAT Laboratories in Mississauga, Ontario, the morning after the samples were taken from the subject site. Surface water results were compared to the Provincial Water Quality Objectives (PWQO) and ground water samples were compared to the Ontario Drinking Water Quality Standards (ODWQS). Analytical results including PWQO and ODWQS exceedences are outlined below in subsections 6.1 and 6.2. Complete water quality results can be found in Appendix D.

8.1 Surface Water Quality

Surface water quality results for the five on-site wetlands were fairly consistent, with the exception of Wetland 3. As can be seen in Table 4, major ion parameters for Wetland 7 exhibited consistently lower levels than Wetlands 5, 6, 8 and 9.

Table 4: Major Ion Chemistry Results For Wetlands

Wetland I.D.	Bicarbonate (mg/L)	Sulphate (mg/L)	Calcium (mg/L)	Silica (mg/L)	Sodium (mg/L)
Wetland 5	343	6.60	138	11.7	31.8
Wetland 6	271	5.86	105	5.73	11.4
Wetland 7	**93**	**0.88**	**36.9**	**0.51**	**0.81**
Wetland 8	242	2.04	93.4	9.94	1.47
Wetland 9	265	11.3	113	5.29	2.21

These low levels in Wetland 7 reflect that of a primary surface water source. Ground water chemistry results for MW-3I and MW-5II are much different than those reported for Wetland 7, but are similar to the Wetland 5, 6, 8 and 9 results. This also provides evidence that Wetland 7 does not receive significant ground water contribution from the local regime.

The surface water chemistry results were compared to the PWQO. Parameters which exceeded the PWQO guideline/standard included Total Phosphorus (Wetland 5 and

Wetland 8), Iron (Wetland 9) and Zinc (Wetland 9). These exceedences are presented below in Table 5.

Table 5: PWQO Surface Water Exceedences

Parameter	PWQO Objective	Exceedences		
		Units	Concentration	Location
Total Phosphorus	0.03	mg/L	**0.05 – 0.06**	Wetlands 5 & 8
Iron	0.3	mg/L	**0.682**	Wetland 9
Zinc	0.03	mg/L	**0.034**	Wetland 9

8.2 Parameters Which Exceeded PWQO

8.2.1 Total Phosphorus

Total Phosphorus is an essential nutrient for plants and animals. It is naturally limited in most fresh water systems because it is not as abundant as carbon and nitrogen. Primary sources of phosphorus include soil and rocks, runoff from fertilized lawns and cropland, runoff from animal manure storage areas and decomposition of organic matter.

The exceedences of Total Phosphorus levels found in Wetland 5 and Wetland 8 can be explained primarily by the high amount of vegetation found within each wetland and runoff from agricultural fields. Wetland 5 is heavily treed causing the decomposition of leaf matter to occur within the wetland basin. Wetland 8 is heavily vegetated with cattails throughout the wetland basin, which decompose on an annual basis. Both exceedences should be considered negligible.

8.2.2 Iron

Iron is the fourth most abundant element in the earth's crust and the most abundant heavy metal. The presence of iron in natural waters can be attributed to the weathering of rocks and minerals, landfill leachates, sewage effluents and iron-related industries.

The exceedence found in Wetland 9 can be attributed to natural sources (geological).

8.2.3 Zinc

Zinc is an element commonly found in the Earth's crust, which is released to the environment from both natural and anthropogenic sources; however, releases from anthropogenic sources are greater than those from natural sources. Common small-scale anthropogenic sources of Zinc are primarily from commercial products such as fertilizers, fungicides, insecticides and wood preservative products which contain the element.

The negligible exceedence of Zinc found in Wetland 9 can be attributed to natural sources (geological), or from agricultural runoff from surrounding lands which may have been applied with fungicides/insecticides.

8.3 Ground Water Quality (On-site Monitoring Wells)

The two ground water sampling locations (MW-3I and MW-5II) exhibited very similar concentrations of water quality parameters, which is expected due to the wells extending into the same upper aquifer, although at different depths. A summary of the exceedences of the ODWQS guidelines/standards are presented below in Table 6.

Table 6: Summary of ODWQS Exceedences (On-site Monitoring Wells)

Parameter	ODWQS Objective	Exceedences		
		Units	Concentration	Location
Nitrate	10	mg/L	**14.2 – 15.4**	MW-3I & MW5II
Hardness (as calcium carbonate)	80 - 100	mg/L	**326 - 358**	MW-3I & MW5II
Manganese	0.05	mg/L	**0.084**	MW-5II

8.4 Parameters Which Exceeded ODWQS

8.4.1 Nitrate

Nitrate is present in water (particularly ground water) due to contamination by decaying plant or animal material, agricultural fertilizers, domestic sewage, or geological formations containing soluble nitrogen compounds. Nitrate poisoning, in terms of methaemoglobinaemia, from drinking water appears to be restricted to susceptible infants. Older children and adults drinking the same water are unaffected. Most water-related cases of have been associated with the use of water containing more than 10 mg/L nitrate. Although this guideline is based principally on effects in the most sensitive subgroup (i.e., infants), it would be prudent to minimize exposure of the entire population, owing to the weak evidence of an association between gastric cancer and high levels of nitrate in drinking water. This statement was prompted following a review of recent information on nitrate by the Federal-Provincial Subcommittee on Drinking Water.

These monitoring wells are shallow and reflect shallow water table conditions within an active agricultural area. Based on this information, the upper aquifer below the subject property would not be a suitable drinking water source due to the exceedence of the 10 mg/L Nitrate guideline/standard. Of note, the observed nitrate levels in local bored private wells are much lower, reflecting conditions in the shallow aquifer.

8.4.2 Hardness

Hard water can reduce the effectiveness of laundry soaps, cause scaling deposits when the water is heated (i.e., kettles / hot water heaters) and in extreme conditions restrict or clog water lines because of scaling. Hardness in excess of 500 mg/L is unacceptable for most domestic purposes. For example, the ODWQS (2006) notes that soft water (< 80 mg/L) may result in accelerated corrosion of water pipes.

The ground water in the upper aquifer below the subject property can be considered "hard", and would require treatment (water softener) to soften the water prior to domestic use.

8.4.3 Manganese

Manganese is objectionable in water supplies because it stains laundry, and at excessive concentrations causes undesirable tastes in beverages. Manganese may also encourage the build up of a slimy coating in piping, which can slough off as black precipitate.

The Manganese exceedence found in MW-5II is not necessarily large enough to create issues with a domestic water distribution system. No exceedence was found in the MW-3I sample, which is evidence that Manganese levels vary across the subject property and should not be considered a significant ODWQS exceedence.

8.5 Ground Water Quality (Neighbouring Wells)

The two ground water sampling locations (MW-3I and MW-5II) exhibited very similar concentrations of water quality parameters, which is expected due to the wells extending into the same upper aquifer, although at different depths. A summary of the exceedences of the ODWQS guidelines/standards are presented below in Table 7.

Table 7: Summary of ODWQS Exceedences (Neighbouring Wells)

Parameter	ODWQS Objective	Exceedences		
		Units	Concentration	Location
Escherichia coli	0	CFU/100 mL	**NGODT**	All Wells
Total Coliforms	0	CFU/100 mL	**NGODT**	All Wells
Sodium	20	mg/L	**23.6 – 37.3**	15609 Mt. Pleasant Rd. 15535 Mt. Pleasant Rd.

8.6 Parameters Which Exceeded ODWQS

8.6.1 Escherichia coli

Escherichia coli is a fecal coliform and should not be detected in any drinking water. It is related to the feces of warm-blooded animals. Since Escherichia coli is present in fecal matter and prevalent in sewage, it is a good indicator of recent fecal pollution.

8.6.2 Total Coliforms

The coliform group of microorganisms has been the most commonly used bacteriological indicator of water quality. The coliform group consists of several types of bacteria and their presence in drinking water is indicative of inadequate disinfection. In general, health units interpret the detection of total coliform based on a single sample as unsatisfactory for human consumption. However, most health units indicate the detection of total coliform below 6 CFU/100 mL on three successive samples taken one to three weeks apart as satisfactory for private use.

8.6.3 Sodium

The aesthetic objective for sodium in drinking water is 200 mg/L. Sodium occurs naturally in the earth's crust and is not considered to be toxic. Consumption of sodium in excess of 10 g/day by normal adults does not result in any apparent adverse health effects. Persons suffering from hypertension or congestive heart failure may require a sodium-restricted diet, in which case, the intake of sodium from drinking water could become significant. Thus, the ODWQS criteria for sodium is set at 20 mg/L for these types of individuals.

9.0 WATER BALANCE (ENTIRE SITE)

The proposed development plan consists of eight large estate lots with an average area of approximately 0.57 hectares (1.4 acres). The lots have been placed around the existing natural features which require a 30 metre buffer from all development lands. For the purposes of water budget calculations, the estate dwellings are assumed to have an average rooftop area of 350 m^2, and associated driveways of between approximately 25 – 150 metres in length. A road is also proposed for the estate housing development which will join Mt Pleasant Road and cul-de-sac within the central portion of the property. The lots will be serviced by municipal water and individual private septic systems, and stormwater runoff will be managed by a bioretention area constructed near Mr Pleasant Road. The bioretention area is not designed to infiltrate stormwater and will outlet to the existing municipal ditching system when necessary.

In order to determine the potential changes to the natural ground water recharge conditions, a pre- and post-development water balance assessment has been completed using the Thornthwaite and Mather method (1957). This method evaluates evapotranspiration based on precipitation and temperature. Residual soil saturation is a function of topography and soil type. Monthly data are tabulated from daily average temperature and precipitation, and the water budget is a continuous calculation over the period of record. To clarify, the method and the approach used by many individuals in examining infiltration resets annual conditions (moisture deficit, snow storage, etc) over the winter months because of the general lack of infiltration during the frost period. However, we maintain those records and carry them forward from month to month during the entire period of record.

Values were determined on a monthly basis, compiled from daily Environment Canada meteorological data station located in Orangeville between 1969 – 2019. The calculations are based on the average conditions during this period; the average precipitation was 895 mm, rainfall was 671 mm, evapotranspiration was 502 mm and the surplus was 393 mm. Each parameter falls within a broad range that represents approximately 100% of the lowest values. For example, the observed precipitation falls between 682 and 1,227 mm. The monthly water budget values are tabulated and presented in Appendix I, along with summary tables and graphs.

The approach described in Table 2 of the MOEE Hydrogeological Technical Information Requirements For Land Development Applications (1995) was used to estimate soil infiltration rate. The following factors from Table 2 were used:

Topography: Hilly land – topography relief across the property is approximately 15 meters. *Value infiltration factor of 0.10.*

Soil: Medium combination of clay and loam (silt dominates surficial geology). *Value infiltration factor of 0.20*.

Cover: Cultivated lands. Majority of site currently cultivated.
Value infiltration factor of 0.10.

Adding up the three factors, an soil infiltration factor of **0.40** is estimated.

By multiplying the annual average surplus amount (393 mm) by the soil infiltration rate (40%), infiltration is estimated to be approximately 157 mm/year for the subject site. Post-development infiltration rates will be affected by the presence of impervious surfaces (i.e., roads, dwelling rooftops), which based on the proposed development plan will comprise approximately 10% of the development property.

The table below provides a breakdown of pervious and impervious surfaces for the proposed development:

Table 8: Pervious/Impervious Surfaces Summary

Land Use	Area (m^2)
Total On-site Infiltration Area (excluding wetlands)	106,000
Roads	4,000 (3.8%)
Driveways (approx.)	3,500 (3.3%)
Rooftops	2,800 (2.6%)
Other (pervious areas)	95,700

It is assumed that rainfall from the proposed dwelling rooftops will be directed to grassy side/back yards to promote ground water infiltration. This is a safe assumption based on the large size of the estate lots to provide appropriate length of flow path (>5 metres based on CVC guidelines) to promote ground water infiltration, especially in rear yards.

Using the climate model data mentioned above, the following pre and post-development infiltration values have been determined:

Table 9: Water Balance Summary

Parameter	Pre-Development	Post-Development-(No Mitigation)	Post-Development-(With Mitigation)
Average Annual Rainfall	671 mm	671 mm	671 mm
Average Annual Surplus	393 mm	393 mm	393 mm
Infiltration Factor	0.4	0.4	0.4
Runoff Factor	0.6	0.6	0.6
Site Area of Potential Infiltration	106,000 m^2	95,700 m^2	95,700 m^2
Annual Infiltration – No Mitigation	16,663 m^3	15,044 m^3	--
Infiltration Gain From Rooftop Mitigation	--	--	559 m^3
Annual Infiltration – With Mitigation	--	--	15,603 m^3
Infiltration Change	0% 0 mm/m^2	**-9.7%** **-15 mm/m^2**	**-6%** **-10 mm/m^2**
Pre/Post-Development Infiltration	157 mm/year	142 mm/year	147 mm/year

Upon completion of the site development, it is estimated that there will be a slight loss (~6%) in ground water infiltration between the pre-development and post-development conditions. This is assuming the site will be comprised of approximately 10% impervious surfaces (e.g., rooftops, driveways and roads), and mitigative controls are employed (described below). These controls will provide an increase in the ground water infiltration potential, some of which would otherwise be lost due to the presence of imperious surfaces as part of the proposed development. As pre- and post-development infiltration conditions are not expected to change significantly, runoff/infiltration coefficients are also not expected to experience a significant change.

Recovery of infiltration from rooftop drainage directed to back and side yards is determined from 8 (total rooftops) x 350 (average m^2 rooftop area) x 671 (mm rainfall) x 35% infiltration factor reduced by 5%) x 85% (to reflect losses to evaporation) = ~559 m^3/year. This calculation is based on TRCA's recommended approach for estimating the availability of rooftop runoff for recharge.

With the addition of 559 m^3/year of ground water infiltration from rooftop downspouts, there would still be an overall net infiltration loss of approximately 1,060 m^3/year. In this scenario, further mitigative measures would be required to create a balance of pre- and post-development infiltration conditions. Although the TRCA does not accept the addition of septic system discharge in water balance calculations, it should be noted that approximately 2,920 m^3/year (365 m^3/year multiplied by 8 septic systems) of treated effluent will be discharged to the shallow aquifer. As the proposed development will be serviced municipally for drinking water, the addition of septic discharge to the shallow aquifer should not be dismissed. As there will not be on-site wells drawing from the underlying aquifer(s), the contribution of treated septic effluent should be considered a net infiltration gain for the upper aquifer (which contributes to the on-site wetland features.

Although the development site is not considered a significant recharge area, pre-development ground water infiltration conditions can be effectively balanced by the rooftop mitigation (and septic effluent discharge). As a result, it is not anticipated that the development will have any negative impact on ground/surface water contribution to on-site/adjacent wetland features.

10.0 FEATURES-BASED WATER BALANCES

A Wetland Water Balance Risk Evaluation (Azimuth April 2020) was completed and is appended as Appendix H. Wetlands 4 and the MNR Identified wetland were not analysed further as their catchments were increasing. Wetlands 5, 6, 7 and 8 are Low Magnitude for hydrological change, and Wetland 10 is Medium Magnitude for hydrological change. As such, Wetland 10 warrants additional evaluation as described below.

In order to determine the potential changes to runoff and the natural ground water recharge conditions, a pre- and post- development feature-based water balance assessment has been completed. The features-based water balance is based on similar methodology as the Thornthwaite and Mather method (1957), using long term average data.

Post-development infiltration and runoff rates will be affected by the presence of impervious surfaces (e.g., rooftops, driveways and roads), which, based on the proposed development plan will comprise approximately 3 - 5% of the individual catchments, and on changes in the sub-catchment areas based on proposed grading. Runoff from houses will be directed to side yards where the majority of it will infiltrate. Runoff from driveways and roadways for Lots 4-8 are directed to the biorentention facility and will outlet to the Mount Pleasant Road ditching so is removed from the feature water balances. Runoff from Lots 1-3 are directed primarily to lot areas and a small amount of driveway will drain to the cul-de-sac on the property to the north (i.e. out of the system).

The following metric from the TRCA Wetland Water Balance Monitoring Protocol (2016) forms the basis for comparing pre-construction conditions to post-construction conditions. The Change in Storage reflects the change in the availability of water to each wetland.

Change in Storage = Inputs – Outputs

$$\Delta S = P + S_i + G_i - ET - S_o - G_o$$

S = Storage
P = Precipitation
S_i = Surface water inflows
G_i = Groundwater inflows
ET = Evapotranspiration
S_o = Surface water outflows
G_o = Groundwater outflows

The calculations are based on a number of assumptions or conclusions including:

- The ground water inflow and outflow are essentially unchanged by the development because the water table configuration is not altered as it is primarily controlled by the more regional setting,
- There is limited surface water outflow as evidenced by the absence of, or dry swales that may only flow for a brief period associated with springmelt or very high precipitation events. However, Wetland 5 has a component of surface water outflow that would be an inflow to Wetland 6. Given that these two features are small in area and have finite internal storage, the inflow and outflow are considered a constant that do not materially affect the feature water balance.
- The ground water inflow and outflow are quantified in the table below. The table is a quantitative approach based on Darcy flux. Given the low permeability (from Sharpe, *et al*., 2003), and given the magnitude of the values,, this approach portrays precision not warranted by the analysis. An appropriate conclusion is that the flux values are very small compared to surface runoff and that the discharge and infiltration essentially offset each other.

Table 10: Summary of Feature Based Water Balances (Annual Average Data)

Wetland	**5**	**6**	**7**	**8**	**10**
Area (m2)	1200	1800	800	200	1300
spring/fall gradient (m/m)	0.25	0.3	1.25	0.3	1
weeks discharging into pond	42	42	42	36	52
summer gradient (m/m)	-0.3	-0.5	-1	-1	-1
weeks infiltrating from pond	10	10	10	16	0
K of basal soils (m/s)	1.00E-09	1.00E-09	1.00E-09	1.00E-09	1.00E-08
volume discharging into pond (m3/year)	7.6	13.7	25.4	1.3	408.8
volume infiltrating from pond into ground water (m3/year)	- 2.2	- 5.4	- 4.8	- 1.9	-
net annual infiltration (m3/year)	5.4	8.3	20.6	- 0.6	408.8

(negative means a net infiltration from the pond into ground water, positive means a net discharge from ground water into the pond)

The summer and winter gradients are estimated from the difference between the free-standing water level in the wetland to the water table elevation of the surrounding lands, as estimated from nearest water level monitoring wells.

- The ground water inflow and outflow of Wetland 10 are based on an estimate of hydraulic conductivity of the shallow aquifer. An estimate of $1x10^{-8}$m/s has been used, compared to an estimate of $1x10^{-9}$m/s for the shallow till soils. The use of a low K estimate high-biases the estimate of wetland storage deficit. Changing the K by one order of magnitude reduces the deficit by about 25% and changing it by two orders of magnitude means that the pond would have a surplus instead of a deficit. Thus, the selection of this value controls the outcome of the FBWB. However, we know that the K is higher than the shallow till, because the pond of Wetland 10 remains at a consistent level, and the surface water outlet from Wetland 10 flows sparsely. Thus, the K of the intermediate soils is bounded by 10^{-8} to 10^{-6}m/s.

- Other than Wetland 10, the ground water inflow reflects interflow discharged into each wetland from the adjacent shallow ground water system. Given the low permeability soils, interflow is minimal compared to precipitation.

- Wetland 10 has the better defined outflow channel of all of the features. However, the outlet is a piped flow that is lower in elevation than the high water table elevation, so this outlet is controlled and seasonally limits the pond elevation.

As can be seen in the table below, Wetlands 5, 6 and 8 have small reductions in the water available to the wetland and Wetland 7 has a small increase. The changes are primarily due to small changes in the wetland catchment and each wetland has a small area of hard surface that will drain externally to the catchment. These small changes will have negligible effect on the characteristics of each wetland.

The surface runoff catchment for wetland 10 will be reduced from 3.53ha to 2.16ha. Approximately 1ha of the catchment is on the adjacent privately owned property to the south, including the pond / wetland itself. The change in the catchment onsite is a result of the cul-de-sac that will have ditches and direct runoff from the asphalt and from the lot areas of Lots 4, 5 and part of Lot 6 to the bioretention facility, and out of the Wetland 10 catchment. This will primarily affect the surface water inflow to Wetland 10.

Table 11: Feature Based Water Balance Summary

		Wetlands					
		5	6	7	8	10	Notes
Pre-Construction	Catchment Area (ha)	1.79	2.6	1.6	1.92	3.53	
	Area of Wetland	1200	2500	2200	600	2400	wetted footprint, not including fringe
	Precipitation in Catchment	895	895	895	895	895	annual average
	Rainfall	671	671	671	671	671	annual average
	Evapotranspiration	502	502	502	502	502	annual average
	Surplus	393	393	393	393	393	annual average
	Runoff	236	236	236	236	236	runoff rate = 60% of surplus
	Precipitation to Wetland	1074	2238	1969	537	2148	
	Surface Water In-Flow(runoff) to Wetland	3938	5541	3254	4386	7758	runoff from adjacent catchment
	Surface Water Outflow	0	0	0	0	0	channelized flow leaving
	Ground water inflow	7.62	13.72	25.40	1.31	40.88	low K soils except Wetland 10 that has been deepened
	Ground water outflow	- 2.18	- 5.44	- 4.84	- 1.94	-	
	ET from wetland	602.4	1255	1104.4	301.2	1204.8	
	change in storage	4419	6543	4149	4625	8742	
Pre-Construction	Catchment Area (ha)	1.69	2.51	1.69	1.93	2.16	
	Area of Wetland (m2)	1200	2500	2200	600	2400	wetted footprint, not including fringe
	Hard surface area - flows in catchment	400	400	700	500	1400	
	Hard surface area - flows out of catchment	0	100	0	500	2700	
	Precipitation in Catchment	895	895	895	895	895	annual average
	Rainfall	671	671	671	671	671	annual average
	Evapotranspiration	502	502	502	502	502	annual average
	Surplus	393	393	393	393	393	annual average
	Runoff	235.8	235.8	235.8	235.8	235.8	runoff rate = 60% of surplus
	Precipitation to Wetland	1074	2238	1969	537	2148	
	Surface Water In-Flow(runoff) to Wetland	3756	5359	3561	4359	4080	
	Surface Water Outflow	0	0	0	0	0	
	Ground water inflow	7.62	13.72	25.40	1.31	40.88	low K soils except Wetland 10 that has been deepened
	Ground water outflow	- 2.18	- 5.44	- 4.84	- 1.94	-	
	ET from wetland	602.4	1255	1104.4	301.2	1204.8	
	change in storage	4237	6361	4456	4598	5064	
Change in storage	pre versus post storage	-181.8	-181.8	306.7	-26.9	-3678.2	
	percent change	-4.1%	-2.8%	7.4%	-0.6%	-42.1%	

* Negative indicates that there is a reduction in water available to the wetland, or for ground water, represents a downward hydraulic gradient

A more detailed balance based on daily climate records to determine weekly surplus characteristics has been completed for Wetland 10. Daily data are tabulated from daily average temperature and precipitation to calculate weekly statistics. The water budget is a continuous calculation over the period of record.

Values were determined on a weekly basis, compiled from daily Environment Canada meteorological data station located in Orangeville between 1983 - 2015. This period was selected as it is the period when daily records are available. Weekly data were determined for infiltration, runoff and runoff to the stormwater management controls for both the pre- and post-development scenarios for each catchment. To make data presentation more straightforward, we have generated summary tables that consider the weekly data on a seasonal basis. Winter is considered to include December of the preceding year plus January and February. Spring is considered to include March, April and May. Summer includes June, July and August and Fall includes September, October and November.

The purpose of the calculations is to estimate the potential changes that might be experienced by Wetland 10 on a local scale. In the tables below, the runoff values are overland flow directed into each wetland feature. The infiltration values are infiltration that occurs within the catchment but outside of the wetland footprint. All of the values do not include water from the wetland that is either shallow ground water that has discharged (increases water to the wetland) nor the water from the wetland that re-infiltrates into the ground water regime each summer (dries out the wetland).

Table A (presented in Appendix F) is the summary tables for Wetland 10. The tables show that there is an annual reduction in overland runoff to the Wetland 10 by approximately 45%. This amount is offset by infiltration and runoff within the P8 sub-catchment and increased runoff that is directed to the bioretention facility.

The calculations assume post-development runoff from roadway and driveways are re-directed to the bioretention area. These runoff values are included as a separate line item in the feature-based water balances and represent a net loss to the individual catchment, but a net increase in the runoff from the site.

Wetland 10 has the form of a pond with wetland fringe, and is not expected to change because of the ground water contribution into the pond. A monitoring plan for wetland 10 is proposed, and is contingent upon permission from the neighbouring landowner.

11.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS

To comply with Section 7.1.18.5 of the Palgrave Secondary Plan, an assessment of potential nitrate impacts to local domestic and communal ground water supplies was completed.

Potential impacts to both the local ground water regime are dependent upon the local hydrogeology / hydrology and the contaminant concentrations contained within the effluent (i.e., nitrate). For ground water purposes, the assessment has been examined within the scope of the MECP Reasonable Use Policy (RUP).

11.1 Nitrate Modeling

The MECP RUP describes acceptable levels of parameters (i.e., nitrate) that are permitted to reach the downgradient property boundary in the ground water regime. The policy forms the basis for natural attenuation site designs since it defines a minimum dilution or attenuation that should be observed at a given facility. The dilution calculation under RUP is based on an assessment of source concentrations, identification of key parameters, water budget assessment, and comparison to the Ontario Drinking Water Quality Standards (ODWQS).

In general, the Reasonable Use Policy is only applicable to large sewage works (i.e., individual septic systems that generate in excess of 10,000 Lpd). The sewage volumes for each lot are significantly less than 10,000 Lpd, and subsequently regulated under OBC (1997 and updates). Thus RUP does not apply under the proposed development concepts (i.e., individual private servicing) but can be used as a guide to determine the number of lots that could potentially be developed within the lot fabric and/ or determine concentrations levels at the downgradient property boundary to evaluate any undesirable environment impacts from the individual sewage systems.

Historical use of the RUP concept in municipal planning has accepted the maximum compliance criteria for nitrate at the downgradient property boundary as 10 mg/L (ODWQS for nitrate) for individual residential lot development.

The proposed individual tertiary treatment systems will discharge the effluent to a standard Class IV leaching bed system located on the individual lots. For the purposes of this assessment, a value of 10 mg/L will be used as the maximum RUP compliance criteria (as discussed above). Reasonable Use Policy considers dilution only, and therefore it is highly conservative.

11.1.1 Water Budget

As previously determined in Section 8.0 of this report, the average annual water surplus is 393 mm representing the amount of water available annually to infiltrate into the ground water or run off as surface water. During this period, the average annual precipitation was 895 mm, the average annual rainfall was 671 mm, and the average annual evapotranspiration was 502 mm.

The majority of the recharge area is medium to fine-grained, which has a moderate to low infiltration rate of about 40% of surplus. Pre-development infiltration rates on the site were estimated as being low (0.4 x 393 mm/a = 157 mm/a). The RUP approach was updated by the MECP in 2008; the new methodology uses a standard infiltration rate of 250 mm/a over the lot and area of the septic plume. Thus the older methodology for calculating contamination attenuation is conservative.

11.2 Nitrate Dilution - Entire Subject Property

For the purposes of this evaluation, a RUP assessment was completed for the smallest proposed lot size (i.e., approx. 0.45ha) and for the entire development area using 60% of the subject property (i.e., 60% of 11ha).

The nitrate concentration at the property boundary for the entire parcel of land can be estimated using the RUP nitrate dilution equation (below). The dilution calculation considers the land between each residential lot and the downgradient property boundary.

In 2018, water quality samples were collected and analysed from three neighbouring wells along Mount Pleasant Road (water quality results provided in Appendix D). The nitrate levels in these three private wells was observed at 0.38 mg/L, 3.36mg/L and 3.82mg/L. The RUP calculations have been completed using 3.82 mg/L as the background value. Of note, the nitrate concentrations in shallow standpipe monitors on-site have elevated concentrations that are not considered representative of aquifer conditions. In particular, these monitors only penetrate a short distance into the water table and are situated in localized lows associated with the on-site wetlands that collect local runoff from the adjacent farm fields, which are actively fertilized. The shallow values do not represent septic contamination from neighbouring residential properties, as the monitoring of the shallow wells was completed prior to the development and occupation of those houses.

The RUP calculation is outlined below:

$$C_{rup} = \frac{Q_1 C_1 + Q_2 C_2}{Q_T}$$

, where,

Q1 = (contribution from 60% of property) = total area (m^2) x infiltration (m/a) (10,000 m^2 *0.159 m/a infiltration =10,494 m^3/a),

C1 = (background nitrate concentration) 3.82 mg/L,

Q2 = (contribution from the leaching beds) =8 dwellings * 8,000 Lpd = 8,000 Lpd (2,929 m^3/a),

C2 = (septic effluent nitrate concentration) = 40 mg/L (conservative for tertiary treatment),

QT = (total offsite discharge) = Q1+Q2,

CRUP = nitrate concentration at downgradient property boundary (mg/L) = 10 mg/L

Using the above assumptions, the predicted concentration in the shallow ground water system at the downgradient property boundary is 11.7 mg/L, which is above the RUP criteria of 10 mg/L. The calculations are conservative since they assume an effluent nitrate of 40 mg/L (whereas tertiary treatment systems typically achieve at least 30-50% denitrification) and a site-specific infiltration rate of 159 mm/a was utilized (compared to the value of 250 mm/a recommended by MECP). If the average nitrate of treated effluent is 34 mg/L or an infiltration of 215 mm/a was utilized, the RUP value would match the criteria of 10 mg/L.

11.3 Nitrate Dilution– Individual Lots

The nitrate dilution calculation was also completed for the smallest proposed lot(s) (0.45 ha) for this development to estimate the nitrate concentration as the property boundary.

Under the new MECP methodology (MECP, 2008), the predicted concentration in the shallow ground water system at the downgradient property boundary is ~9.8 mg/L which is slightly below the RUP criteria for small systems.

The results of the RUP assessment are considered to be conservative since they would not typically be advocated for small sewage systems. RUP does not consider biodegradation or denitrification in the subsurface and does not allow for plant uptake within the lot fabric or within the remaining lands downgradient of the property. The calculation considers dilution only and inherently assumes that the units are directly connected in a hydraulic sense. Thus, the RUP is conservative in terms of the overall site conditions and should only be used as a guideline.

As indicated previously, Reasonable Use is a provincial policy that is used by the MECP to evaluate point source contaminant sources; it was not intended to be used to evaluate potential impacts from small septic system but was subsequently modified to provide a rapid evaluation methodology. The results of the RUP evaluation support the proposed 8-lot development such that off site impacts are expected to be negligible in nature. All RUP calculations are presented in Appendix G.

11.4 Potential Wetland Receivers

As an impact assessment for on-site wetlands that may be potential receivers of septic effluent discharge, the following table presents the distance between proposed septic beds and downgradient wetlands.

Table 12: Potential Wetland Effluent Receivers

Wetland ID	Distance From Nearest Septic Bed	Potential for Impacts
Wetland 5	N/A	No upgradient septic system
Wetland 6	100 metres – Lot 6	Wetland 6 is southwest of Lot 6 septic. Not in direct ground water flow path
Wetland 7	75 metres – Lot 3	Wetland 7 is southwest of Lot 3 septic. Not in direct ground water flow path
Wetland 8	75 metres – Lot 2	Wetland 8 in direct ground water flow path of Lot 2 septic, but sufficient distance away
Wetland 9	100 metres – Lot 1	Wetland 9 is southeast of Lot 1 septic. Not in direct ground water flow path
Wetland 10	75 metres – Lot 7	Wetland 10 is southwest of Lot 7 septic. Not in direct ground water flow path

Although all wetlands (with the exception of Wetland 5) will be between 75 – 100 metres downgradient of septic systems, it should be noted that tertiary treatment septic systems will be installed for each lot which creates a very low risk scenario for wetland contamination due to leaching beds. Typical wastewater has TKN of approximately 80mg/L total N (TKN, nitrate, nitrite, ammonia). Tertiary treatment systems are highly adept at nitrifying wastewater, and typically provide at least 50% denitrification. As an example, the BNQ testing for the Waterloo Biofilter system shows 65% removal of Total N and essentially complete nitrification of the remaining nitrogen. Median effluent ammonia concentration is 0.5mg/L (Waterloo Biofilter Systems Inc. 2004).

Total ammonia of 0.5 mg/L incorporates approximately 6.5µg/L unionized ammonia compared to the PWQO of 20µg/L. This is followed by further nitrification and denitrification within the leaching bed and dilution and attenuation during migration in the ground water regime. Ammonia impacts to a surface water feature 75m - 100m downgradient of a tertiary treatment bed is likely only possible if the system malfunctions and/or has surface breakout. One of their requirements for tertiary treatment system approvals is an annual maintenance contract with the supplier / manufacturer that should address the issue of gross malfunction. For these reasons, we do not believe that ammonium monitoring will provide cost-effective results.

12.0 SUMMARY AND CONCLUSIONS

To comply with the requirements of the ORMCP and Palgrave Secondary Plan, this hydrogeologic assessment has been prepared to determine and describe the hydrogeologic and hydrologic functions of sensitive features. The evaluation focused on the nature of the interaction between the ground water system and the surface water system. The evaluation examined the effect of the proposed development and site alteration on the ground and surface water regimes through the completion of pre and post water balance assessments and RUP evaluation.

Data compiled during the long-term monitoring program provides sufficient evidence that impacts to surface/ground water quality and quantity will be minimal following construction of the proposed estate subdivision. Therefore no changes to the current proposed plan are recommended (i.e. lot density). It is also recommended that the proposed monitoring plan (Appendix E) be employed to continue the collection hydrogeological/hydrological data for the on-site/off-site environmental features.

It is concluded that the present hydrologic and hydrogeologic conditions upon the subject property will not experience a significant change due to do the proposed development. The proposed development adheres to the requirements of the ORMCP. No negative post-construction impacts are predicted to occur to the quality / quantity of surface and ground water, ground water recharge, or natural sensitive features.

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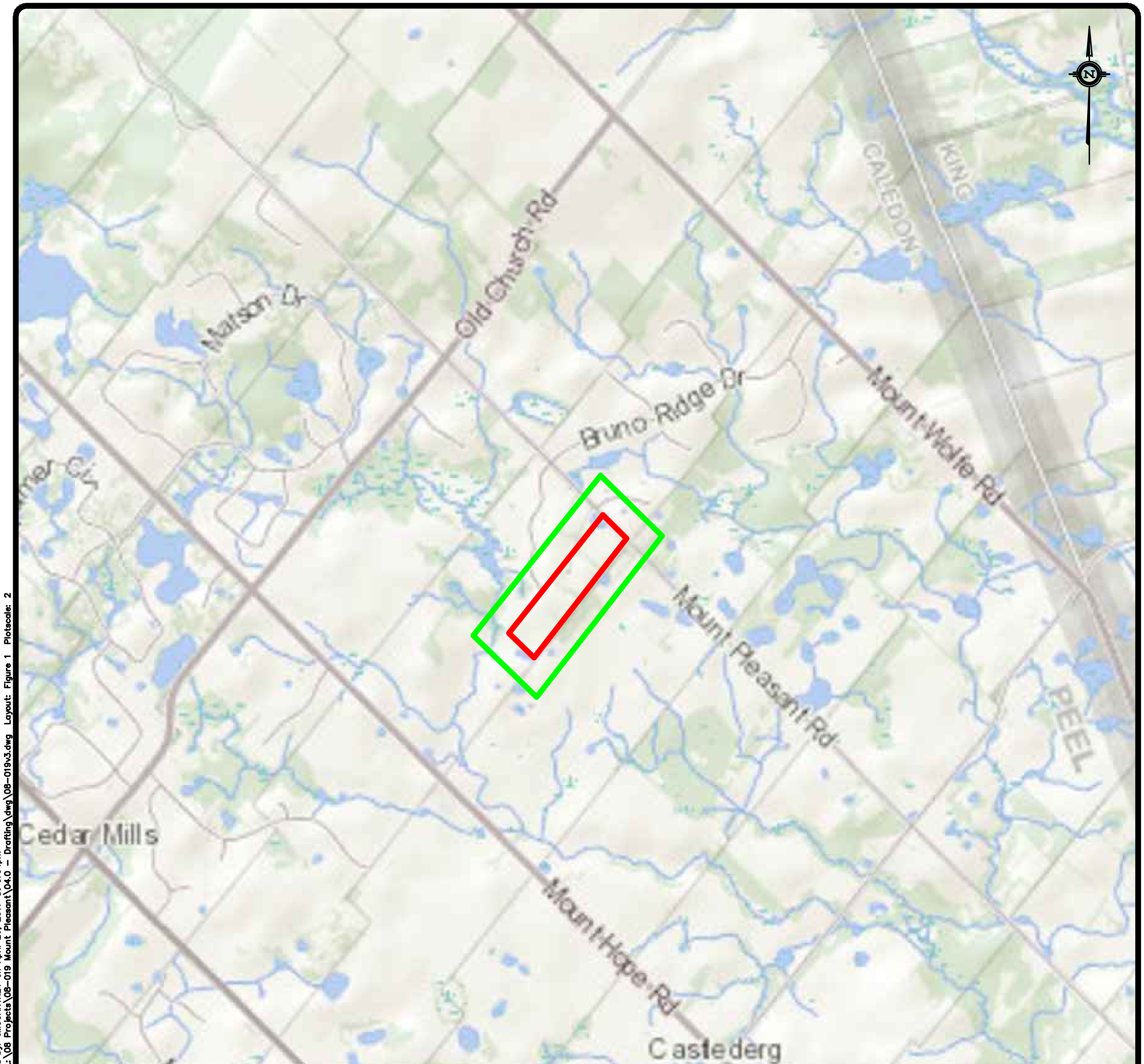
APPENDICES

Appendix A: Figures
Appendix B: Borehole Logs
Appendix C: MECP Water Well Records
Appendix D: Water Quality Laboratory Results
Appendix E: Proposed Monitoring Program
Appendix F: Water Balance Tables
Appendix G: Reasonable Use Policy Calculations
Appendix H: Wetland Water Balance Risk Evaluation (WWBRE)
Appendix I: Well Contingency Plan

APPENDIX A

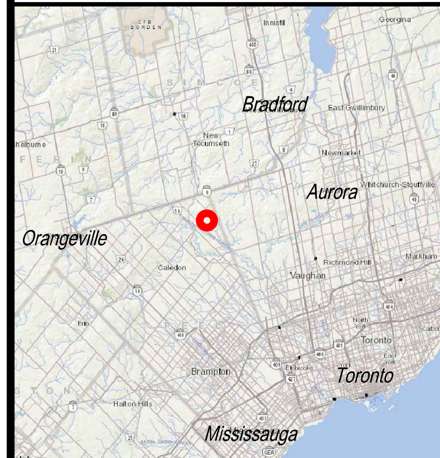
Figures



LEGEND:

Approx. Property Boundary

Approx. Study Area



REG MAP

250m 0 750m

HORIZONTAL SCALE 1:25,000

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Study Area Location

Pt. Lot 19, Concession 8,
Town of Caledon, ON

DATE ISSUED: February 2017	Figure No.
CREATED BY: JLM	1
PROJECT NO.: 08-019	
REFERENCE: MNRF	

DAYSTAMP: L:\08-019 Mount Pleasant\04.0 - Drafting\Drafting\dwg\08-019v3.dwg

Plotted by: JMCCARTNEY on April 26, 2017 at 3:34pm Layout: Figure 1 Plotscale: 2
File: L:\08 Projects\08-019 Mount Pleasant\04.0 – Drafting\dwg\08-019v3.dwg

LEGEND:

- Approx. Property Boundary
- Permanent Stream
- Intermittent Stream
- Drainage Feature
- 30m Minimum Vegetation Protection Zone
- Wetlands

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Protection Components: Wetland

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	March 2017	Figure No.
Created By:	JLM	2
Project No.	08-019	
Reference:	First Base Solutions	

DAYSTAMP: P:\08-019 Mount Pleasant\Drafting\dwg\08-019 FiguresV2.dwg 10/3/2008

LEGEND:

- Approx. Property Boundary
- Permanent Stream
- Wetlands
- Monitoring Well Locations
- Stilling Well Locations

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Monitoring Locations

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	November 2020	Figure No.
Created By:	JLM	3
Project No.	08-019	
Reference:	First Base Solutions	

DAYSTAMP: P:\08-019 Mount Pleasant\Drafting\dwg\08-019 FiguresV2.dwg 10/3/2008

LEGEND:

- Property Boundary
- ⊕ Monitoring Well Locations
- Ground Water Flow Direction
- (277.0) Ground Water Elevation (masl) (March 2013)

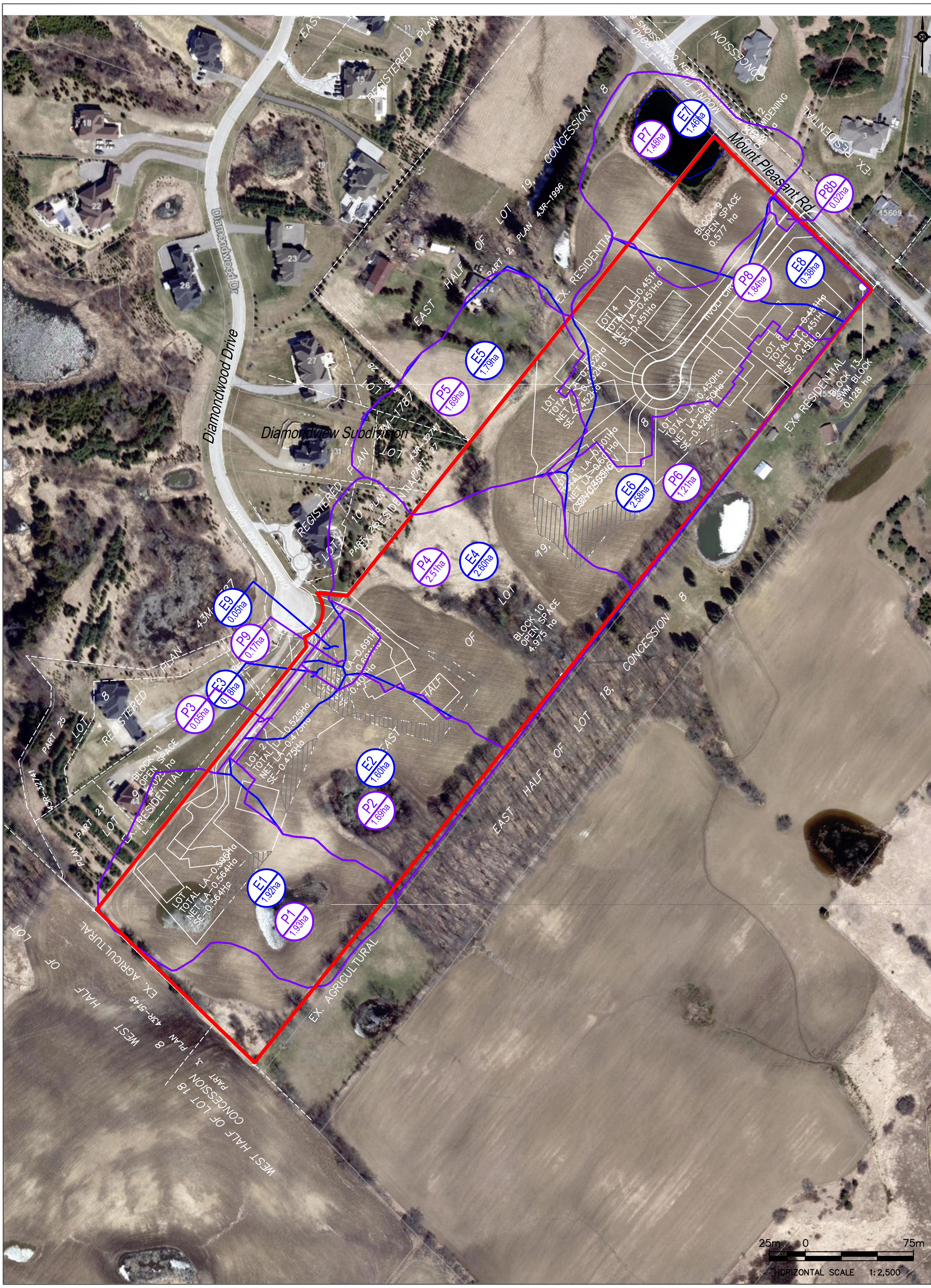
AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Shallow Ground Water Flow

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	May 2017	Figure No.
Created By:	JLM	4
Project No.	08-019	
Reference:	First Base Solutions	

DAYSTAMP: P:\08-019 Mount Pleasant\Drafting\dwg\08-019 Figures.dwg 10/3/2008 8:37:41 AM EDT



LEGEND:

- Approx. Property Boundary
- Existing Drainage Catchment Areas
- Proposed Drainage Catchment Areas

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Drainage Catchment Analysis

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	November 2020	Figure No.
Created By:	JLM	5
Project No.	08-019	
Reference:	First Base Solutions	

DAYSTAMP: P:\08-019 Mount Pleasant\Drafting\dwg\08-019 FiguresV2.dwg 10/3/2008

LEGEND:

- Approx. Property Boundary
- Permanent Stream
- Intermittent Stream
- Ephemeral Drainage
- Environmental Policy Area/Palgrave Estates Environmental Zone 1 (Outermost limits of Minimum Vegetation Protection Zone)
- Environmental Zone 2 (High Ground Water)
- Environmental Zone 2 (2020)
- Proposed Encroachment into MVPZ
- Proposed Addition to MVPZ
- Policy Area 4

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AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Recommended Environmental Policy Areas

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	December 2018	Figure No.
Created By:	JLM	6
Project No.	08-019	
Reference:	First Base Solutions	

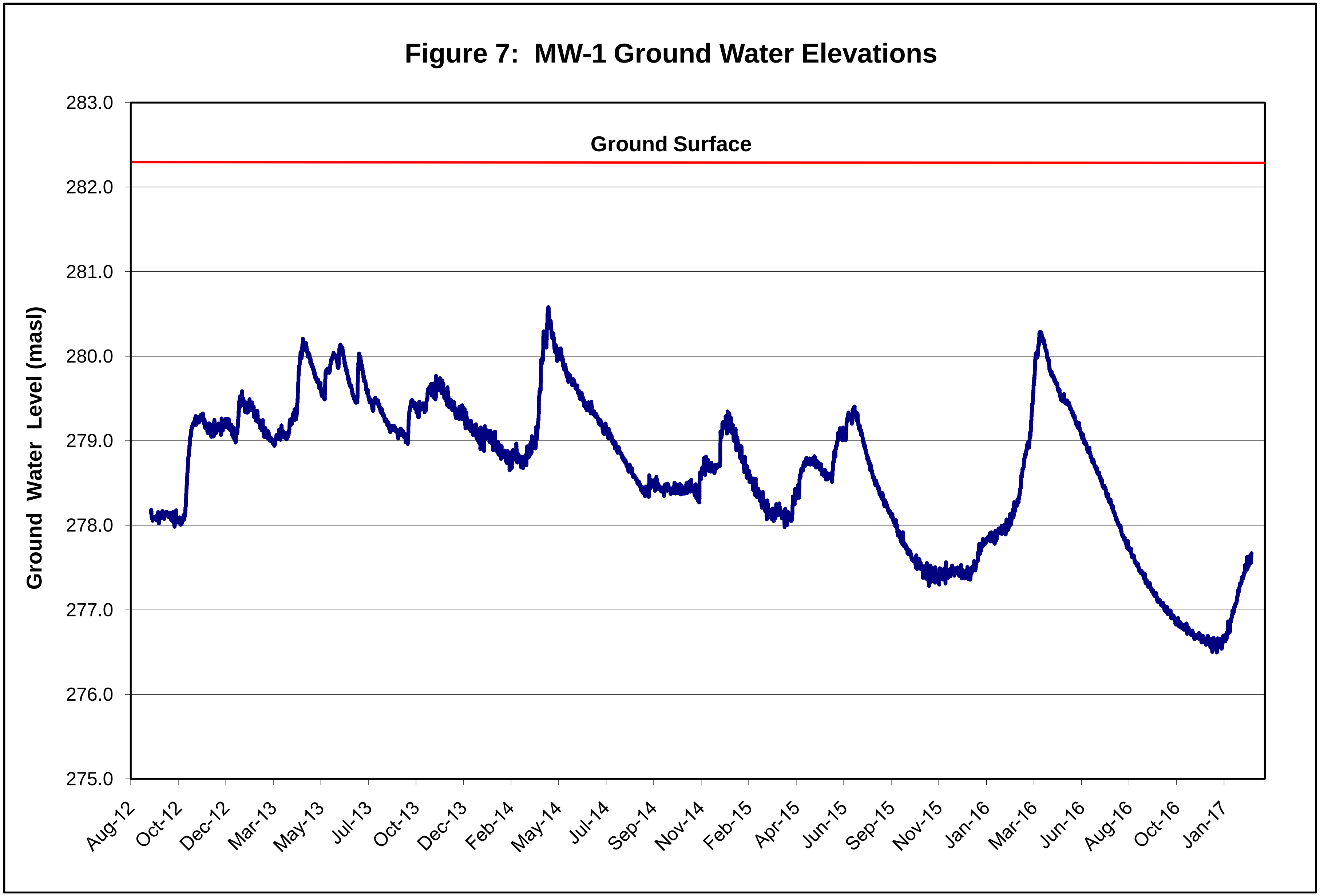

Figure 7: MW-1 Ground Water Elevations
Ground Surface
Ground Water Level (masl)
283.0
282.0
281.0
280.0
279.0
278.0
277.0
276.0
275.0
Aug-12
Oct-12
Dec-12
Mar-13
May-13
Jul-13
Oct-13
Dec-13
Feb-14
May-14
Jul-14
Sep-14
Nov-14
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Mar-16
Jun-16
Aug-16
Oct-16
Jan-17

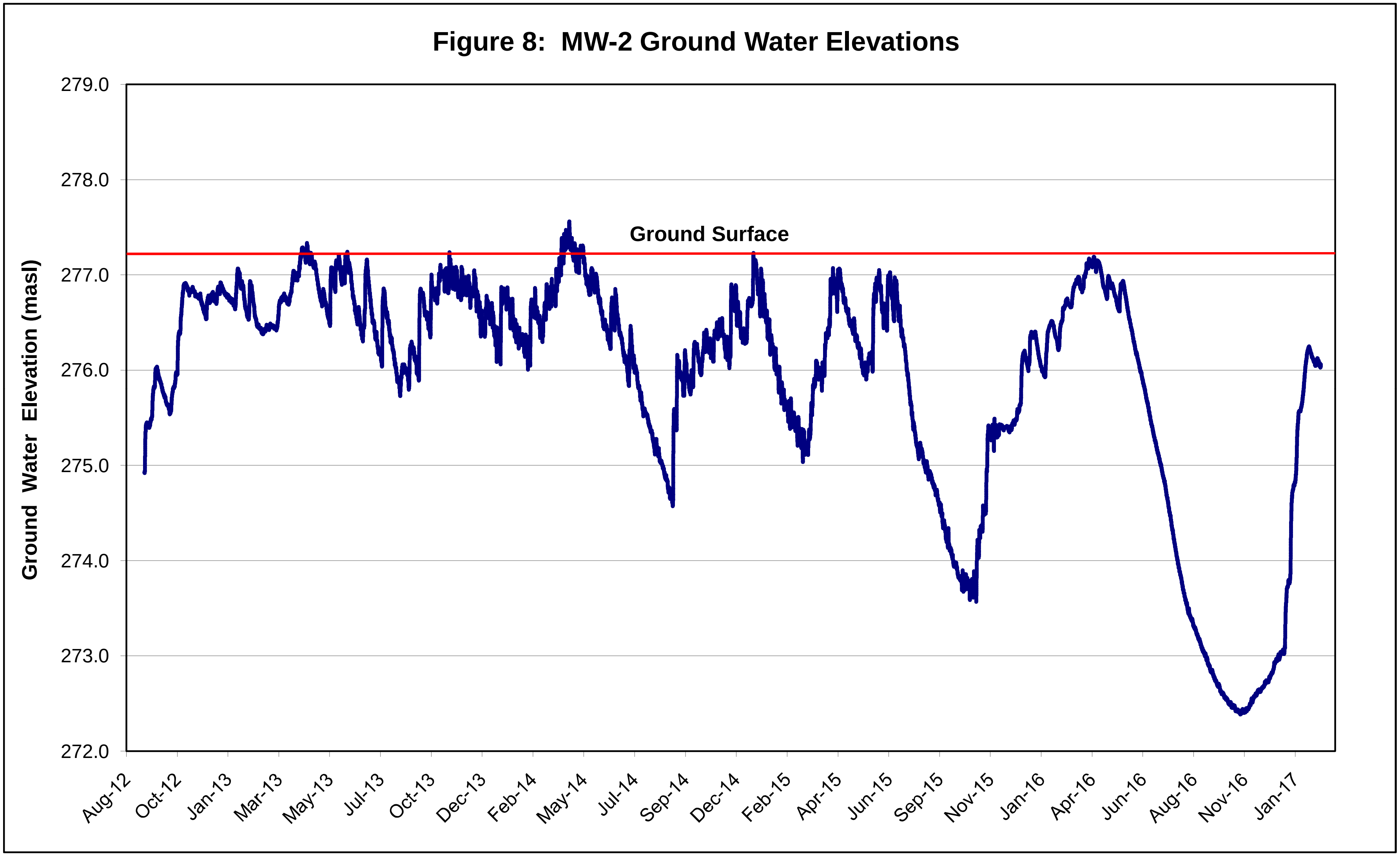
Figure 8: MW-2 Ground Water Elevations
Ground Surface
Ground Water Elevation (masl)
279.0
278.0
277.0
276.0
275.0
274.0
273.0
272.0
Aug-12
Oct-12
Jan-13
Mar-13
May-13
Jul-13
Oct-13
Dec-13
Feb-14
May-14
Jul-14
Sep-14
Dec-14
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Nov-15
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Apr-16
Jun-16
Aug-16
Nov-16
Jan-17

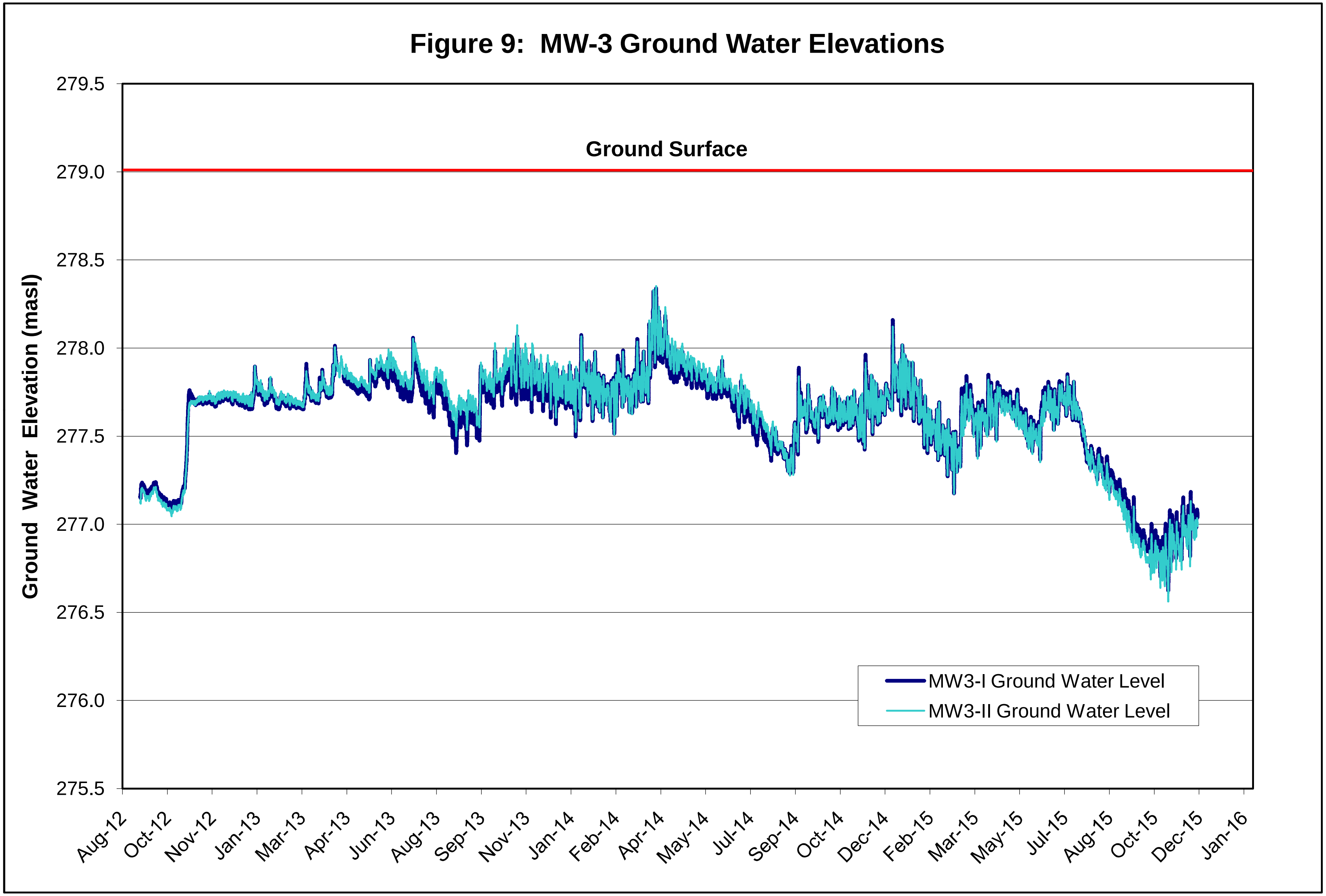
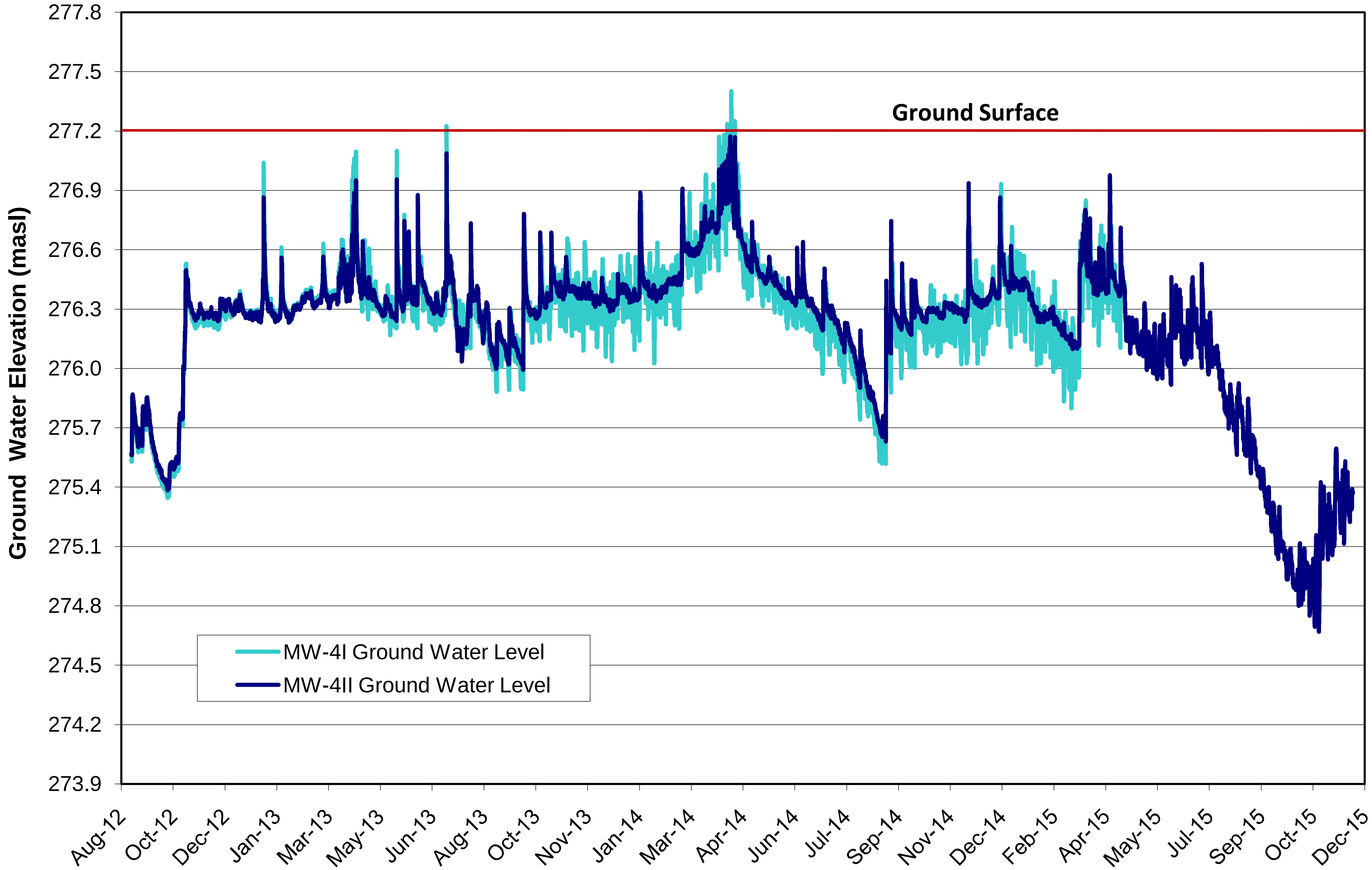


Figure 9: MW-3 Ground Water Elevations
Ground Surface
Ground Water Elevation (masl)
279.5
279.0
278.5
278.0
277.5
277.0
276.5
276.0
275.5
Aug-12
Oct-12
Nov-12
Jan-13
Mar-13
Apr-13
Jun-13
Aug-13
Sep-13
Nov-13
Jan-14
Feb-14
Apr-14
May-14
Jul-14
Sep-14
Oct-14
Dec-14
Feb-15
Mar-15
May-15
Jul-15
Aug-15
Oct-15
Dec-15
Jan-16
MW3-I Ground Water Level
MW3-II Ground Water Level

Figure 10: MW-4 Ground Water Elevations



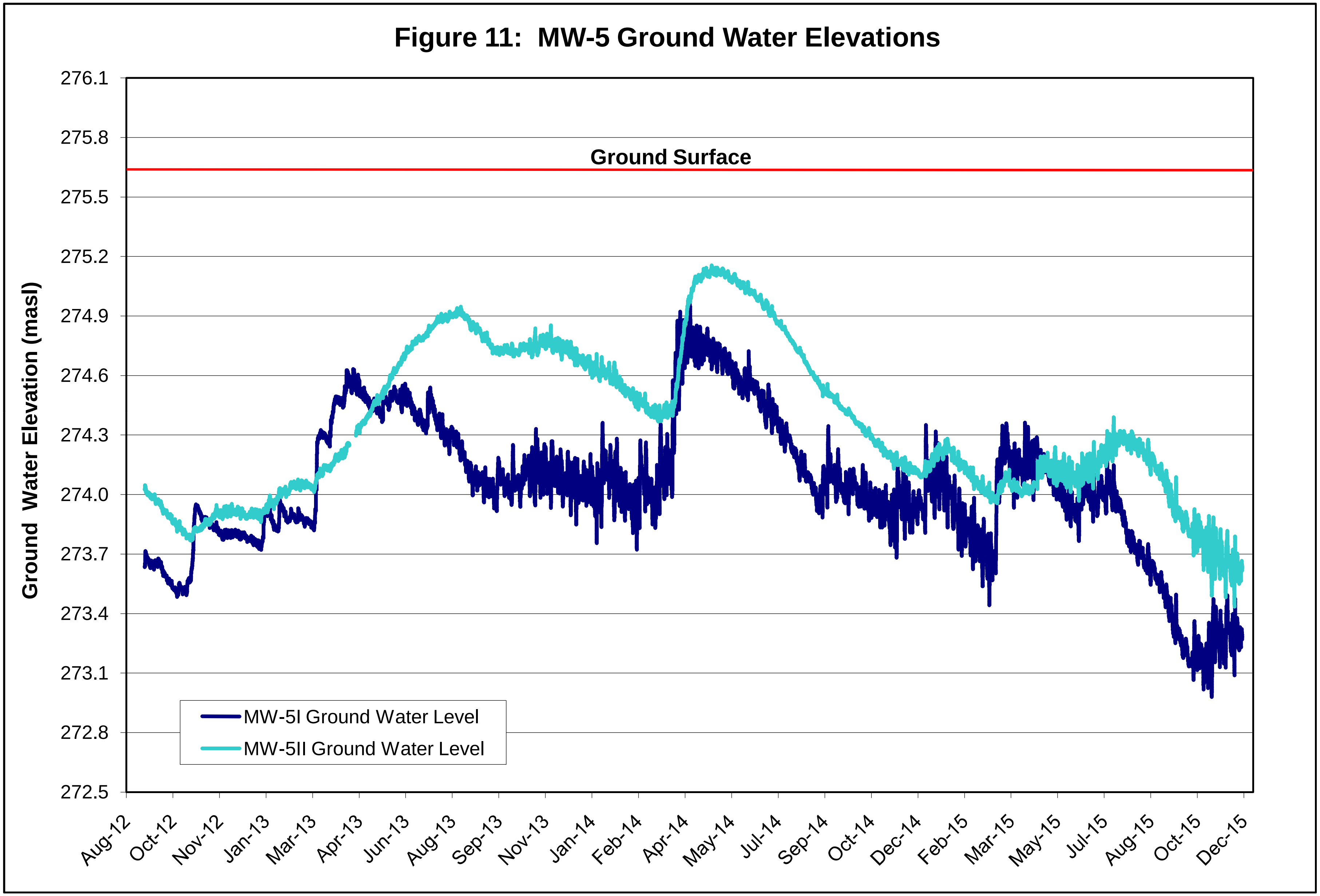


Figure 11: MW-5 Ground Water Elevations
Ground Surface
Ground Water Elevation (masl)
276.1
275.8
275.5
275.2
274.9
274.6
274.3
274.0
273.7
273.4
273.1
272.8
272.5
Aug-12
Oct-12
Nov-12
Jan-13
Mar-13
Apr-13
Jun-13
Aug-13
Sep-13
Nov-13
Jan-14
Feb-14
Apr-14
May-14
Jul-14
Sep-14
Oct-14
Dec-14
Feb-15
Mar-15
May-15
Jul-15
Aug-15
Oct-15
Dec-15
MW-5I Ground Water Level
MW-5II Ground Water Level

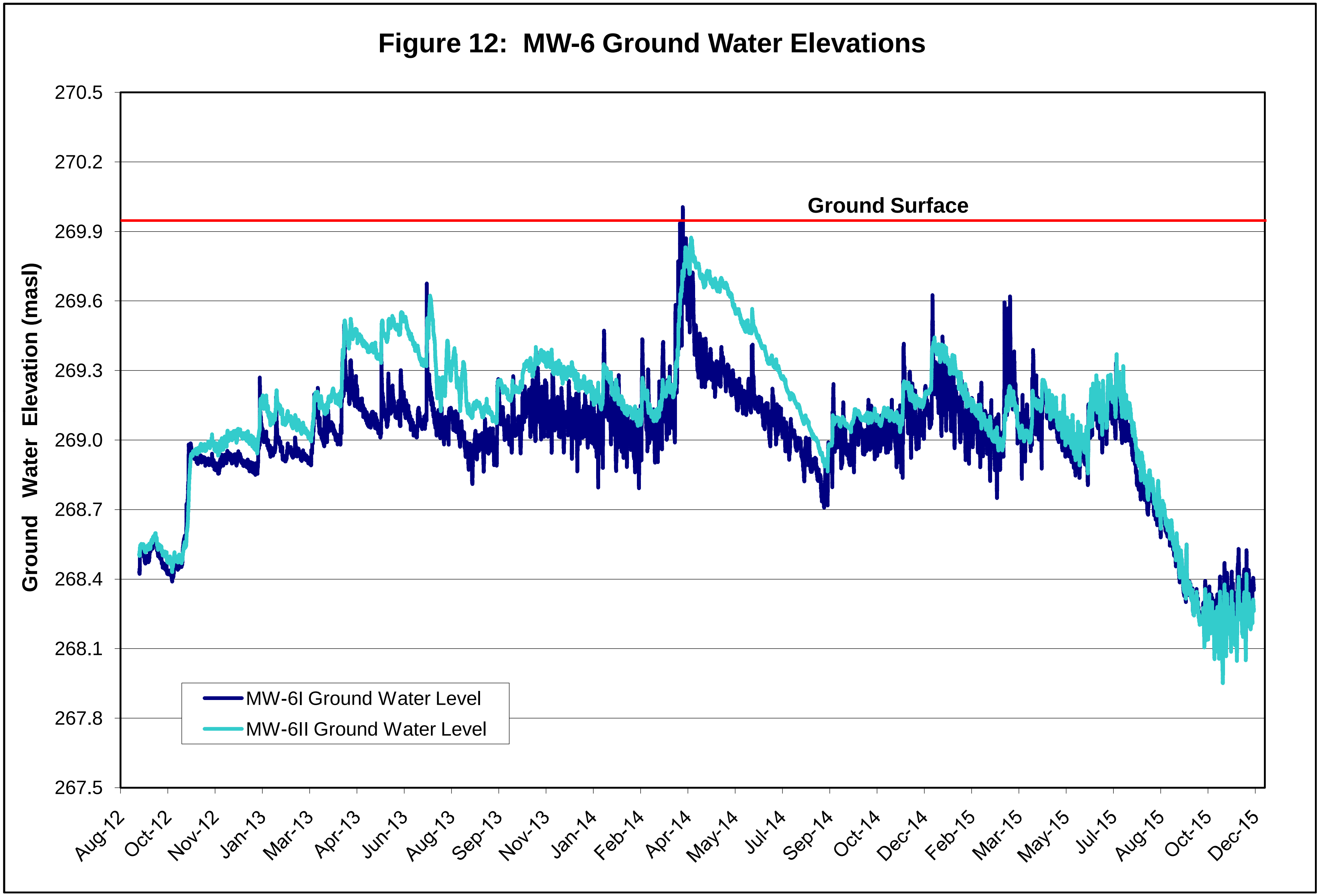


Figure 12: MW-6 Ground Water Elevations
Ground Water Elevation (masl)
270.5
270.2
269.9
269.6
269.3
269.0
268.7
268.4
268.1
267.8
267.5
Ground Surface
MW-6I Ground Water Level
MW-6II Ground Water Level
Aug-12
Oct-12
Nov-12
Jan-13
Mar-13
Apr-13
Jun-13
Aug-13
Sep-13
Nov-13
Jan-14
Feb-14
Apr-14
May-14
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Jul-15
Aug-15
Oct-15
Dec-15

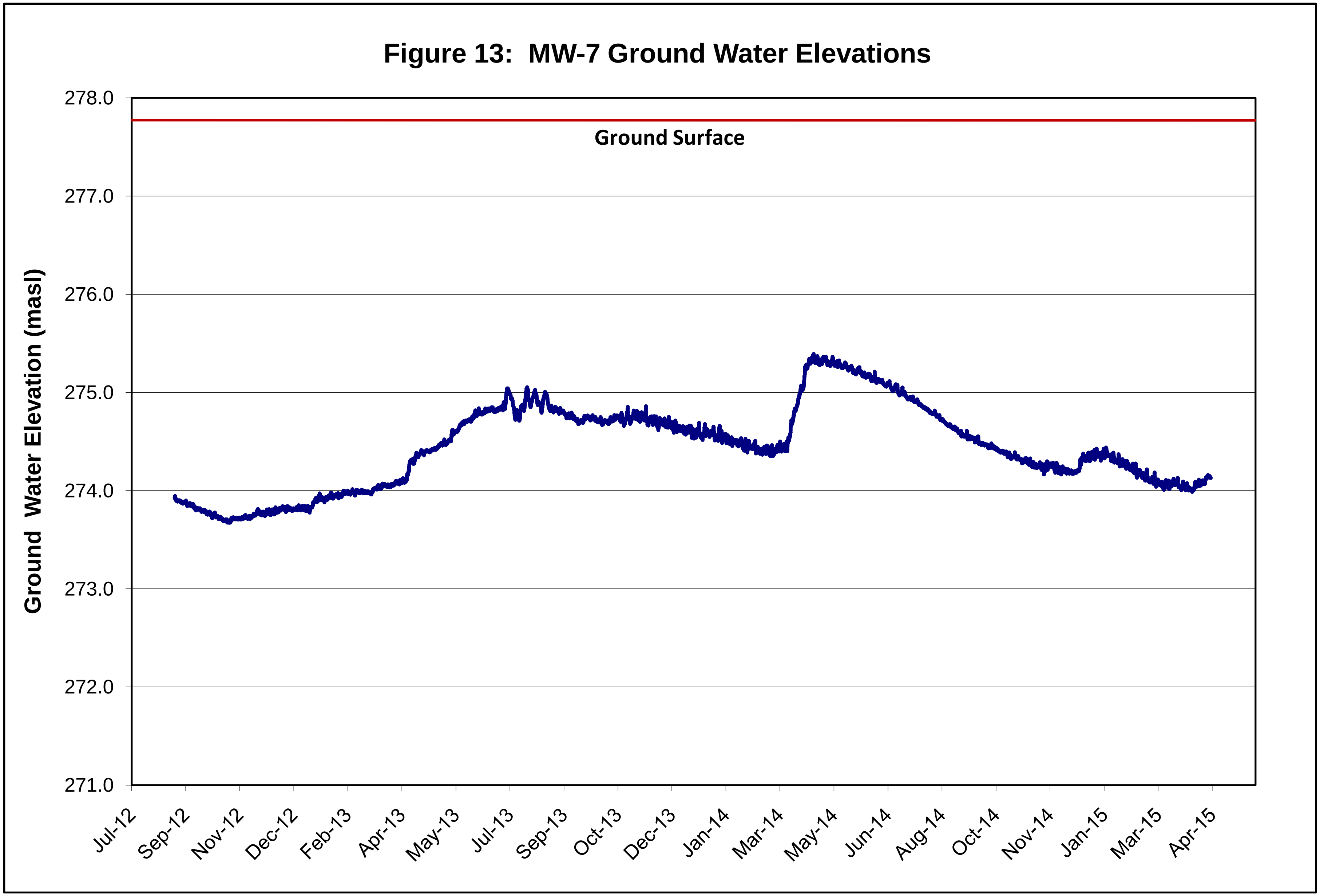
Figure 13: MW-7 Ground Water Elevations
Ground Surface
Ground Water Elevation (masl)
278.0
277.0
276.0
275.0
274.0
273.0
272.0
271.0
Jul-12
Sep-12
Nov-12
Dec-12
Feb-13
Apr-13
May-13
Jul-13
Sep-13
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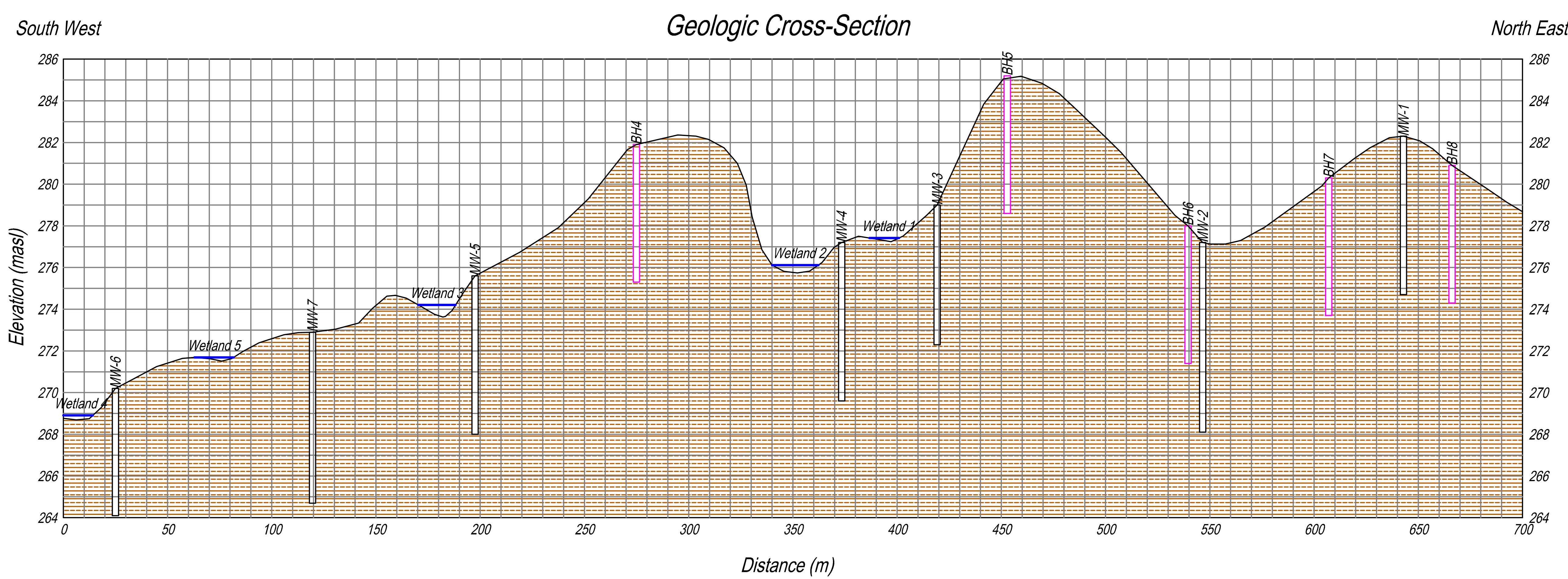
Jan-15
Mar-15
Apr-15



LEGEND:

- Silt (Sandy to Clayey Silt)
- Terraprobe Wells
- Azimuth Wells

10x Vertical Exaggeration

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Geologic Cross-Section

Pt. Lot 19, Con. 8
Town of Caledon

DATE ISSUED:	December 2018	Figure No.
CREATED BY:	JLM	14
PROJECT NO.:	08-019	
REFERENCE:		

DAYSTAMP: L:\08 Projects\08-019 Mount Pleasant\04.0 - Drafting\dwg\08-019v3.dwg

Plotted by: JMCCARTNEY on November 9, 2020 at 11:21am Layout: Section Plotscale: 1
File: O:\08 Projects\08-019 Mount Pleasant\04.0 - Drafting\dwg\08-019v3.dwg

APPENDIX B

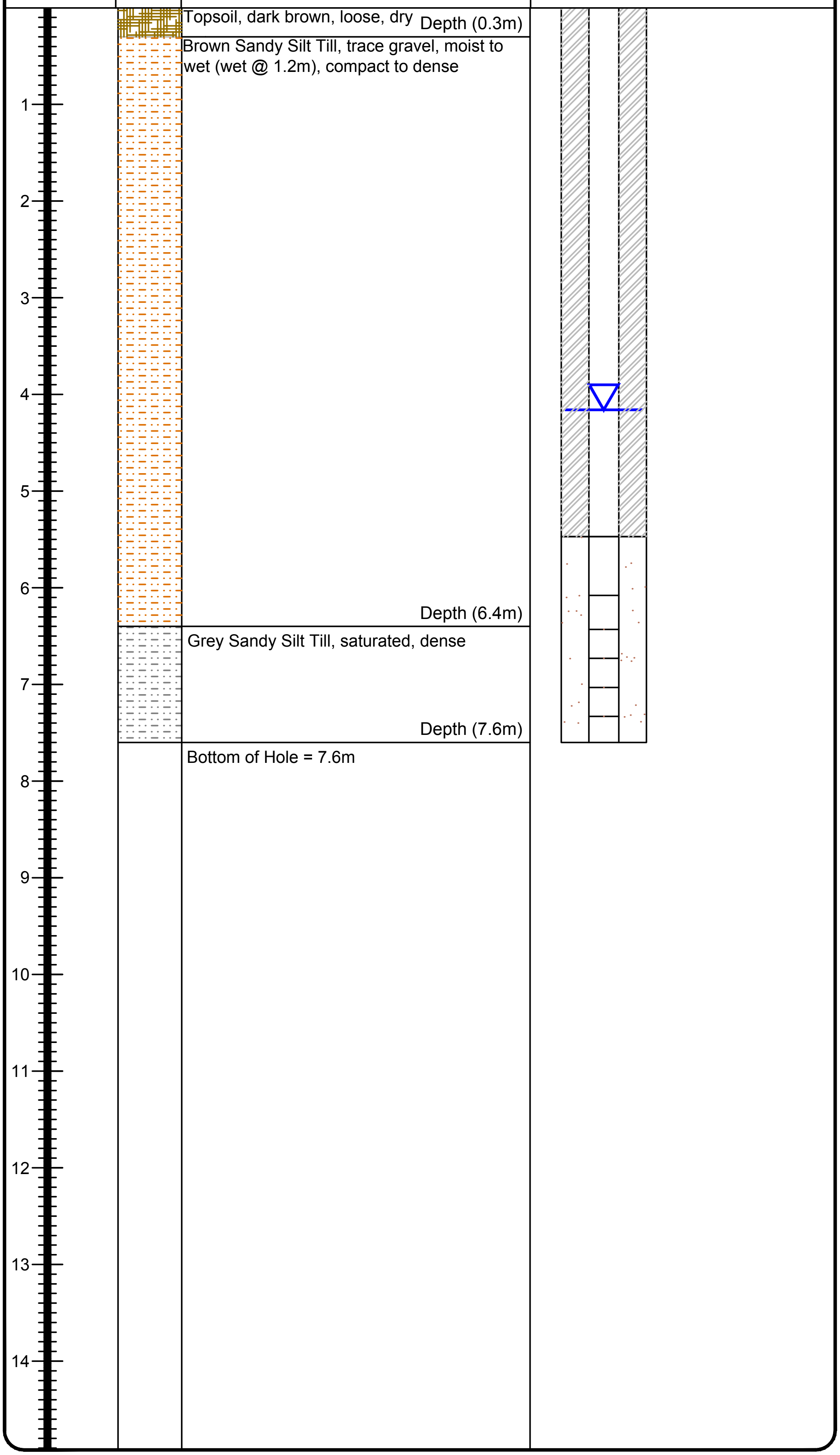
Borehole Logs

Monitoring Well MW1

Laurelpark Development

Mount Pleasant Rd., Caledon, ON

Depth (m)	Lithology	Lithologic Description	Well Construction Details (MW1)
0–0.3		Topsoil, dark brown, loose, dry — Depth (0.3m)	
0.3–6.4		Brown Sandy Silt Till, trace gravel, moist to wet (wet @ 1.2m), compact to dense — Depth (6.4m)	
6.4–7.6		Grey Sandy Silt Till, saturated, dense — Depth (7.6m)	
7.6		Bottom of Hole = 7.6m	



DRILLING DETAILS

Drill Date: August 7, 2012
Drilling Method: Direct Push
Driller: Lantech Drilling
Geologist: Drew West

MONITORING WELL INFORMATION

NAD 83 Zone 17 — Easting: 598434 — Northing: 4865885

Monitoring Well	MW1		
Ground Elev.	282.3masl		
Top of Casing Elev.	283.3masl		
Stick Up (m)	1.00		
Well Depth (m)	7.6mbgs		
High Water Level (date of water level)	4.16mbgs Aug 7, 2012		

All units expressed as metres above sea level unless otherwise noted

LEGEND

Water Level Elevation
Perched Water Table Elevation
Bentonite
Silica Sand
Schedule 40 (2") PVC Riser Pipe
Schedule 40 (2") 10-slot PVC Screen
Steel Casing (6")

Geologic materials recovered and evaluated by: Drew West

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Date Issued:	May 2017
Created By:	JLM
Project No.	08-019
File Name:	08-019bh

Plotted by: JMCCARTNEY on May 17, 2017 at 11:58am
File: C:\Users\jmccartney\appdata\local\temp\AcPublish_6784\08-019bh.dwg Layout: MW1 Plotscale: 40

Monitoring Well

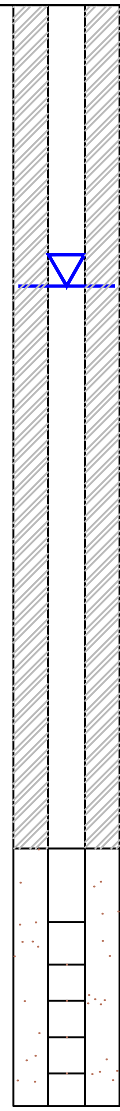
MW2

Laurelpark Development

Mount Pleasant Rd.,
Caledon, ON

Depth (m)	Lithology	Lithologic Description	Well Construction Details MW2
0–0.3		Topsoil, dark brown, loose, dry Depth (0.3m)	
0.3–3.0		Brown Sandy Silt Till, trace gravel, moist, dense Depth (3.0m)	
3.0–9.1		Grey Sandy Silt Till, moist to wet (wet @ 5.0m), compact to dense Depth (9.1m)	
9.1		Bottom of Hole = 9.1m	

Depth scale (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14



DRILLING DETAILS

Drill Date: August 7, 2012
Drilling Method: Direct Push
Driller: Lantech Drilling
Geologist: Drew West

MONITORING WELL INFORMATION

NAD 83 Zone 17 Easting: 598417
Northing: 4865777

Monitoring Well	MW2		
Ground Elev.	277.25masl		
Top of Casing Elev.	278.25masl		
Stick Up (m)	1.00		
Well Depth (m)	9.1mbgs		
High Water Level (date of water level)	2.32mbgs Aug 7, 2012		

All units expressed as metres above sea level unless otherwise noted

LEGEND

- Water Level Elevation
- Perched Water Table Elevation
- Bentonite
- Silica Sand
- Schedule 40 (2") PVC Riser Pipe
- Schedule 40 (2") 10-slot PVC Screen
- Steel Casing (6")

Geologic materials recovered and evaluated by: Drew West

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Date Issued:	May 2017
Created By:	JLM
Project No.	08-019
File Name:	08-019bh

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Monitoring Well

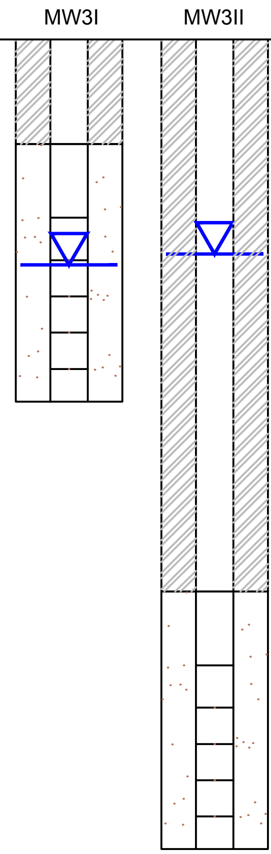
MW3

Laurelpark Development

Mount Pleasant Rd.,
Caledon, ON

Depth (m)	Lithology	Lithologic Description	Well Construction Details
0–0.3		Topsoil, dark brown, loose, dry — Depth (0.3m)	
0.3–6.7		Brown Fine Sandy Silt Till, trace gravel, moist to saturated (wet @ 1.8m), loose to compact — Depth (6.7m)	
6.7		Bottom of Hole = 6.7m	

Depth scale (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14



DRILLING DETAILS

Drill Date: August 7, 2012
Drilling Method: Direct Push
Driller: Lantech Drilling
Geologist: Drew West

MONITORING WELL INFORMATION

NAD 83 Zone 17 Easting: 598269
Northing: 4865725

Monitoring Well	MW3I	MW3II	
Ground Elev.	279.0masl	279.0masl	
Top of Casing Elev.	280.05masl	279.95masl	
Stick Up (m)	1.05	0.95	
Well Depth (m)	3.0mbgs	6.7mbgs	
High Water Level (date of water level)	1.87mbgs Aug 7, 2012	1.78mbgs Aug 7, 2012	

All units expressed as metres above sea level unless otherwise noted

LEGEND

- Water Level Elevation
- Perched Water Table Elevation
- Bentonite
- Silica Sand
- Schedule 40 (2") PVC Riser Pipe
- Schedule 40 (2") 10-slot PVC Screen
- Steel Casing (6")

Geologic materials recovered and evaluated by: Drew West

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Date Issued:	May 2017
Created By:	JLM
Project No.	08-019
File Name:	08-019bh

Page 1 of 1

Plotted by: JMCCARTNEY on May 17, 2017 at 11:58am
File: C:\Users\jmccartney\appdata\local\temp\AcPublish_6784\08-019bh.dwg Layout: MW3 Plotscale: 40

Monitoring Well

MW4

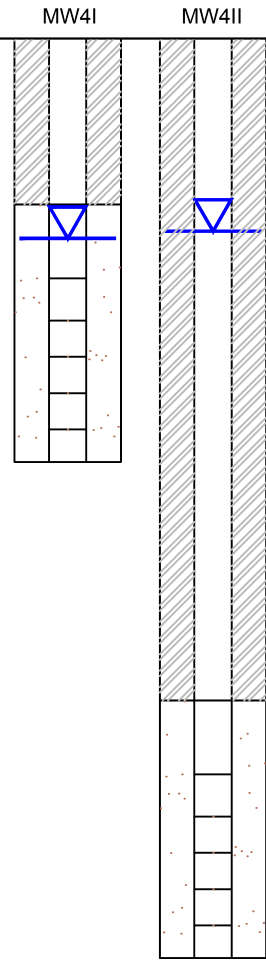
Laurelpark Development

Mount Pleasant Rd.,
Caledon, ON

Depth (m) | Lithology | Lithologic Description | Well Construction Details

Depth (m)	Lithologic Description
0 – 0.15	Topsoil, dark brown, loose, dry — Depth (0.15m)
0.15 – 2.8	Brown Silty Sand, moist to wet (wet @ 1.0m), loose to compact — Depth (2.8m)
2.8 – 5.9	Brown Fine Sandy Silt Till, wet to saturated, compact — Depth (5.9m)
5.9 – 7.6	Grey Fine Sandy Silt Till, saturated, compact — Depth (7.6m)
7.6	Bottom of Hole = 7.6m

Well Construction Details



DRILLING DETAILS

Drill Date: August 7, 2012
Drilling Method: Direct Push
Driller: Lantech Drilling
Geologist: Drew West

MONITORING WELL INFORMATION

NAD 83 Zone 17 — Easting: 598309, Northing: 4865642

Monitoring Well	MW4I	MW4II	
Ground Elev.	277.15masl	277.15masl	
Top of Casing Elev.	278.1masl	278.05masl	
Stick Up (m)	0.95	0.90	
Well Depth (m)	3.5mbgs	3.5mbgs	
High Water Level (date of water level)	1.65mbgs Aug 7, 2012	1.59mbgs Aug 7, 2012	

All units expressed as metres above sea level unless otherwise noted

LEGEND

- Water Level Elevation
- Perched Water Table Elevation
- Bentonite
- Silica Sand
- Schedule 40 (2") PVC Riser Pipe
- Schedule 40 (2") 10-slot PVC Screen
- Steel Casing (6")

Geologic materials recovered and evaluated by: Drew West

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Date Issued:	May 2017	Page
Created By:	JLM	1 of 1
Project No.	08-019	
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Monitoring Well

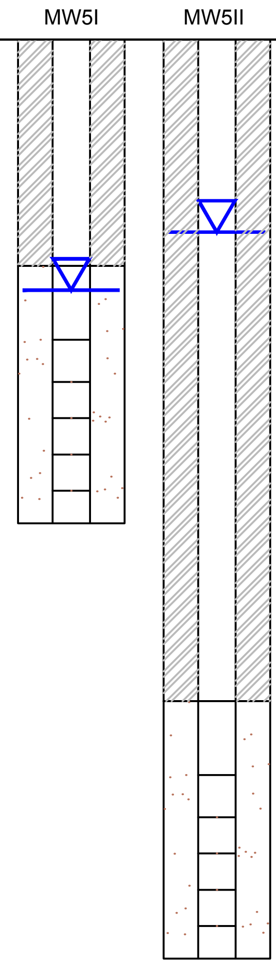
MW5

Laurelpark Development

Mount Pleasant Rd.,
Caledon, ON

Depth (m)	Lithologic Description
0 – 0.3	Topsoil, dark brown, loose, dry. Depth (0.3m)
0.3 – 2.6	Brown Sandy Silt Till, trace gravel, dry to wet (wet @ 2.0m), loose to compact. Depth (2.6m)
2.6 – 2.9	Brown Coarse Sand, wet, loose. Depth (2.9m)
2.9 – 4.6	Brown Silt, wet, compact. Depth (4.6m)
4.6 – 7.6	Grey Silt, wet to saturated, compact. Depth (7.6m)
7.6	Bottom of Hole = 7.6m

Well Construction Details



DRILLING DETAILS

Drill Date: August 8, 2012
Drilling Method: Direct Push
Driller: Lantech Drilling
Geologist: Drew West

MONITORING WELL INFORMATION

NAD 83 Zone 17 — Easting: 598156 — Northing: 4865527

Monitoring Well	MW5I	MW5II	
Ground Elev.	275.60masl	275.6masl	
Top of Casing Elev.	276.60masl	276.6masl	
Stick Up (m)	1.00	1.0	
Well Depth (m)	4.0mbgs	7.6mbgs	
High Water Level (date of water level)	2.07mbgs Aug 8, 2012	1.58mbgs Aug 8, 2012	

All units expressed as metres above sea level unless otherwise noted

LEGEND

- Water Level Elevation
- Perched Water Table Elevation
- Bentonite
- Silica Sand
- Schedule 40 (2") PVC Riser Pipe
- Schedule 40 (2") 10-slot PVC Screen
- Steel Casing (6")

Geologic materials recovered and evaluated by: Drew West

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Date Issued:	May 2017
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Project No.	08-019
File Name:	08-019bh

Page 1 of 1

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File: L:\08 Projects\08-019 Mount Pleasant\04.0 – Drafting\dwg\08-019bh.dwg Layout: MW5 Plotscale: 40

Monitoring Well

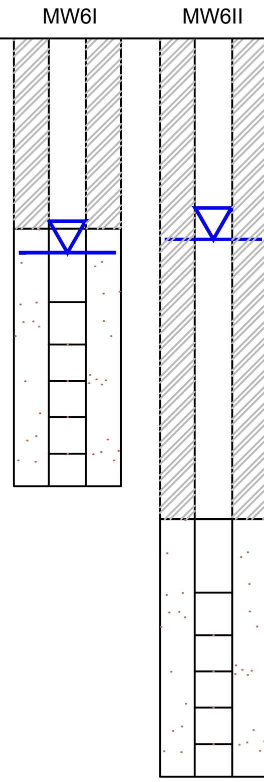
MW6

Laurelpark Development

Mount Pleasant Rd.,
Caledon, ON

Depth (m)	Lithology	Lithologic Description
0 – 0.3		Topsoil, dark brown, loose, dry Depth (0.3m)
0.3 – 2.7		Brown Silt and Sand, moist to wet (wet @ 1.5m), loose to compact Depth (2.7m)
2.7 – 6.1		Grey Silt and Sand, wet to saturated, compact to dense Depth (6.1m)
6.1		Bottom of Hole = 6.1m

Well Construction Details



Depth scale (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

DRILLING DETAILS

Drill Date: August 9, 2012
Drilling Method: Direct Push
Driller: Lantech Drilling
Geologist: Drew West

MONITORING WELL INFORMATION

NAD 83 Zone 17 Easting: 598099
Northing: 4865362

Monitoring Well	MW6I	MW6II	
Ground Elev.	270.18masl	270.18masl	
Top of Casing Elev.	270.98masl	270.98masl	
Stick Up (m)	0.8	0.8	
Well Depth (m)	3.7mbgs	6.1mbgs	
High Water Level (date of water level)	1.77mbgs Aug 9, 2012	1.66mbgs Aug 9, 2012	

All units expressed as metres above sea level unless otherwise noted

LEGEND

- Water Level Elevation
- Perched Water Table Elevation
- Bentonite
- Silica Sand
- Schedule 40 (2") PVC Riser Pipe
- Schedule 40 (2") 10-slot PVC Screen
- Steel Casing (6")

Geologic materials recovered and evaluated by: Drew West

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

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File Name:	08-019bh

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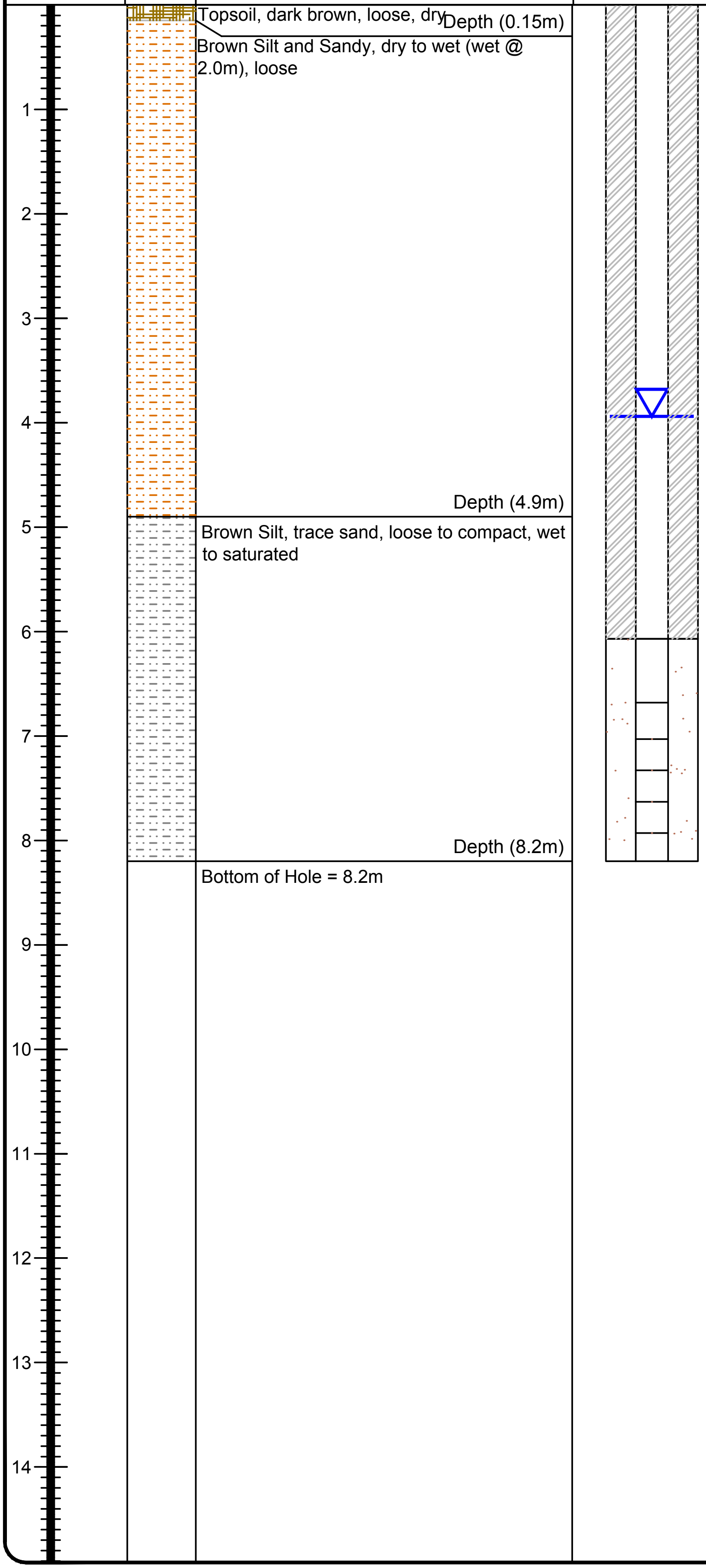
Monitoring Well

MW7

Laurelpark Development

Mount Pleasant Rd.,
Caledon, ON

Depth (m)	Lithology	Lithologic Description	Well Construction Details
0–0.15		Topsoil, dark brown, loose, dry Depth (0.15m)	MW7
0.15–4.9		Brown Silt and Sandy, dry to wet (wet @ 2.0m), loose Depth (4.9m)	
4.9–8.2		Brown Silt, trace sand, loose to compact, wet to saturated Depth (8.2m)	
8.2		Bottom of Hole = 8.2m	



DRILLING DETAILS

Drill Date: August 9, 2012
Drilling Method: Direct Push
Driller: Lantech Drilling
Geologist: Drew West

MONITORING WELL INFORMATION

NAD 83 Zone 17 Easting: 598096
Northing: 4865489

Monitoring Well	MW7		
Ground Elev.	272.94masl		
Top of Casing Elev.	274.04masl		
Stick Up (m)	1.10		
Well Depth (m)	8.2mbgs		
High Water Level (date of water level)	3.94mbgs Aug 9, 2012		

All units expressed as metres above sea level unless otherwise noted

LEGEND

Water Level Elevation
Perched Water Table Elevation
Bentonite
Silica Sand
Schedule 40 (2") PVC Riser Pipe
Schedule 40 (2") 10-slot PVC Screen
Steel Casing (6")

Geologic materials recovered and evaluated by: Drew West

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Date Issued:	May 2017	Page
Created By:	JLM	
Project No.	08-019	1 of 1
File Name:	08-019bh	

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File: C:\Users\jmccartney\appdata\local\temp\AcPublish_6784\08-019bh.dwg Layout: MW7 Plotscale: 40

Terraprobe

BOREHOLE LOG 1

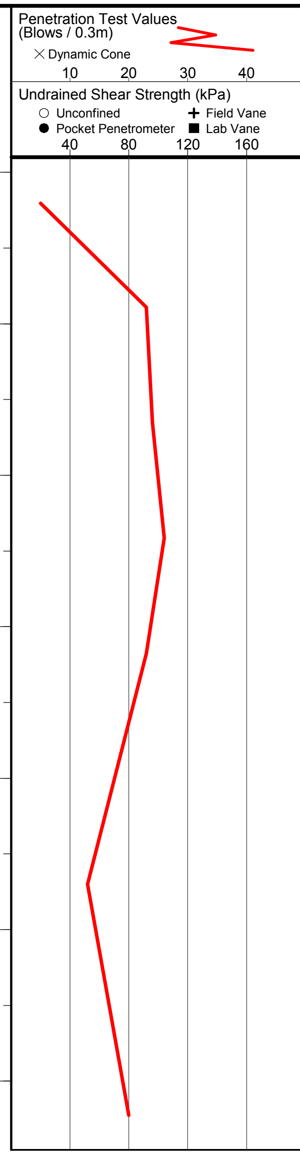
DRAFT

Client	: Laurelpark Inc.	Project No.:	11-13-3052
Project	: Palgrave Estates II	Date started :	May 16, 2013
Location	: Caledon, Ontario	Sheet No. :	1 of 1

Position : E: 598025, N: 4865443 (UTM 17T) — Elevation Datum : Geodetic (NAD83)

Rig type : track-mounted — Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	SOIL PROFILE Description	Graphic Log	SAMPLES Number	Type	SPT 'N' Value	Elevation Scale (m)
0	273.1	**GROUND SURFACE**					273
	272.8 0.3	250mm **TOPSOIL**					
		Trace organics (WEATHERED/DISTURBED)		1	SS	5	
1	272.3 0.8	**SILT**, some sand to sandy, trace to some clay, trace gravel, compact, brown, moist		2	SS	23	272
2				3	SS	24	271
				4	SS	26	
3				5	SS	23	270
4							269
	268.5 4.6	**SILT AND CLAY**, trace sand, trace gravel, stiff to very stiff, grey, moist (GLACIAL TILL)		6	SS	13	
5							268
6				7	SS	20	267
	266.5 6.6						



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

Headspace Vapour | Instrument Details | Unstabilized Water Level | Lab Data and Comments — GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
May 24, 2013	0.4	272.7

BOREHOLE LOG 2

Terraprobe

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

Position : E: 598111, N: 4865495 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

SOIL PROFILE

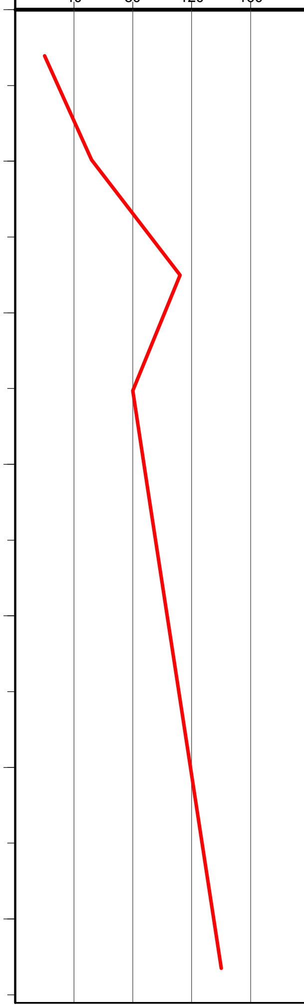
Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log
0	280.0	**GROUND SURFACE**	
	279.7 / 0.3	300mm **TOPSOIL**	
	279.2 / 0.8	Trace organics (WEATHERED/DISTURBED)	
1–6	273.9 / 6.1	**SANDY SILT to SAND AND SILT**, trace clay, trace gravel, compact, brown, moist ...clayey (at approx. 4.5 m)	
6	273.4 / 6.6	**SAND**, trace silt, trace gravel, dense, brown, wet	

SAMPLES

Number	Type	SPT 'N' Value
1	SS	5
2	SS	13
3	SS	28
4	SS	20
5	SS	23
6	SS	29
7	SS	35

Elevation Scale (m): 280, 279, 278, 277, 276, 275, 274

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10, 20, 30, 40
Undrained Shear Strength (kPa): ○ Unconfined, + Field Vane, ● Pocket Penetrometer, ■ Lab Vane; 40, 80, 120, 160



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

Headspace Vapour | Instrument Details | Unstabilized Water Level (∇ at 6.0 m) | Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

END OF BOREHOLE

Unstabilized water level measured at 6.0m below ground surface; borehole was open upon completion of drilling.

BOREHOLE LOG 3

Terraprobe

DRAFT

Client	: Laurelpark Inc.	Project No.:	11-13-3052
Project	: Palgrave Estates II	Date started :	May 16, 2013
Location	: Caledon, Ontario	Sheet No. :	1 of 1

Position	: E: 295137, N: 4865588 (UTM 17T)	Elevation Datum	: Geodetic (NAD83)
Rig type	: track-mounted	Drilling Method	: Solid stem augers

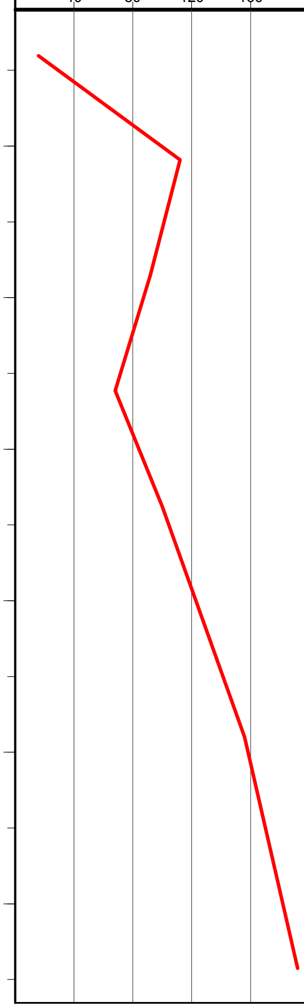
Elev Depth (m)	SOIL PROFILE Description	SAMPLES Number	Type	SPT 'N' Value
281.9	**GROUND SURFACE**			
	400mm **TOPSOIL**	1	SS	4
281.5 0.4	Trace organics (WEATHERED/DISTURBED)			
281.1 0.8	**SANDY SILT to SAND AND SILT**, trace clay, trace gravel, compact to dense, brown, moist	2	SS	28
		3	SS	23
279.6 2.3	**SAND**, trace silt, trace gravel, compact, brown, moist	4	SS	17
278.9 3.1		5	SS	25
	...silty sand	6	SS	39
	...some clay	7	SS	48
275.3 6.6	**END OF BOREHOLE**			

Depth Scale (m): 0, 1, 2, 3, 4, 5, 6

Elevation Scale (m): 281, 280, 279, 278, 277, 276

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

Undrained Shear Strength (kPa): ○ Unconfined; + Field Vane; ● Pocket Penetrometer; ■ Lab Vane; 40, 80, 120, 160



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

Headspace Vapour | Instrument Details | Unstabilized Water Level | Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and caved to 5.9m below ground surface upon completion of drilling.

Terraprobe

BOREHOLE LOG 4

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

Position : E: 598223, N: 4865593 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

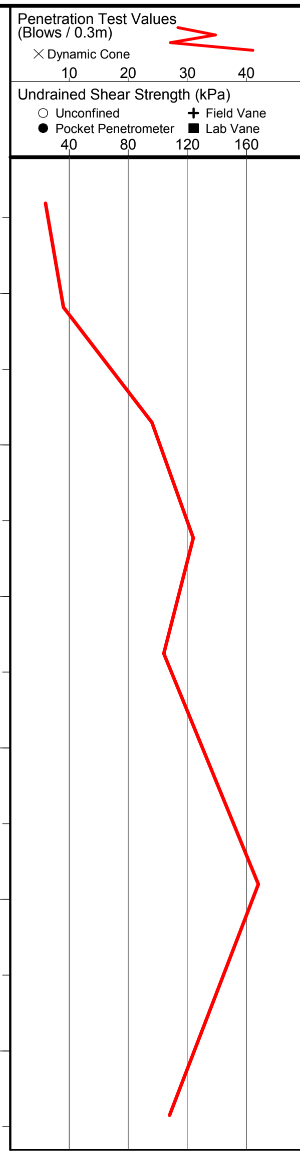
SOIL PROFILE

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log
0	281.9	**GROUND SURFACE**	
	281.6 / 0.3	300mm **TOPSOIL**	
	281.1 / 0.8	Trace organics (WEATHERED/DISTURBED)	
1–6		**SILT**, some clay to clayey silt, trace sand, trace gravel, stiff to hard, brown, moist (GLACIAL TILL)	
		...grey below	
	275.3 / 6.6	**END OF BOREHOLE**	

SAMPLES

Number	Type	SPT 'N' Value
1	SS	6
2	SS	9
3	SS	24
4	SS	31
5	SS	26
6	SS	42
7	SS	27

Elevation Scale (m): 281, 280, 279, 278, 277, 276



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

Headspace Vapour | Instrument Details | Unstabilized Water Level | Lab Data and Comments — GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and open upon completion of drilling.

Terraprobe

BOREHOLE LOG 5

DRAFT

Client	: Laurelpark Inc.		Project No.:	11-13-3052
Project	: Palgrave Estates II		Date started :	May 16, 2013
Location	: Caledon, Ontario		Sheet No. :	1 of 1

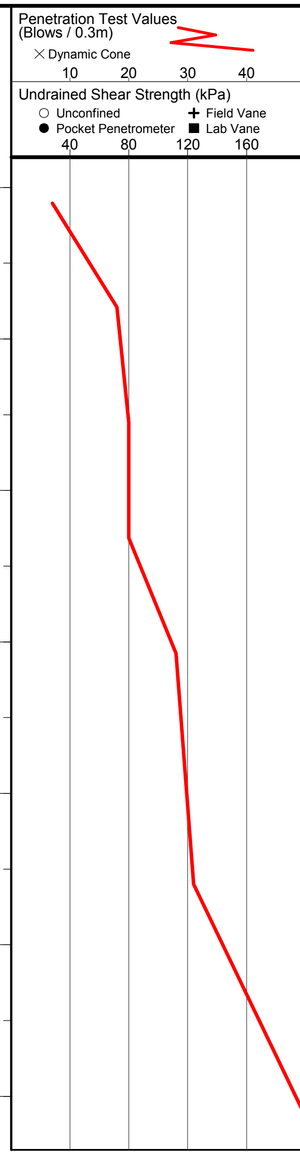
Position : E: 598309, N: 4865735 (UTM 17T) — Elevation Datum : Geodetic (NAD83)

Rig type : track-mounted — Drilling Method : Solid stem augers

Elev (m)	Depth (m)	Description (SOIL PROFILE)	Sample Number	Type	SPT 'N' Value
285.2		**GROUND SURFACE**			
284.9	0.3	300mm **TOPSOIL**	1	SS	7
284.4	0.8	Trace organics (WEATHERED/DISTURBED)			
		SANDY SILT to SAND AND SILT, trace clay, trace gravel, compact to very dense, brown, moist	2	SS	18
			3	SS	20
			4	SS	20
		...sand, some silt	5	SS	28
			6	SS	31
278.6	6.6		7	SS	76

Depth Scale (m): 0, 1, 2, 3, 4, 5, 6

Elevation Scale (m): 285, 284, 283, 282, 281, 280, 279



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

Headspace Vapour | Instrument Details | Unstabilized Water Level

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

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
May 24, 2013	dry	n/a

Terraprobe

BOREHOLE LOG 6

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 15, 2013
Sheet No. : 1 of 1

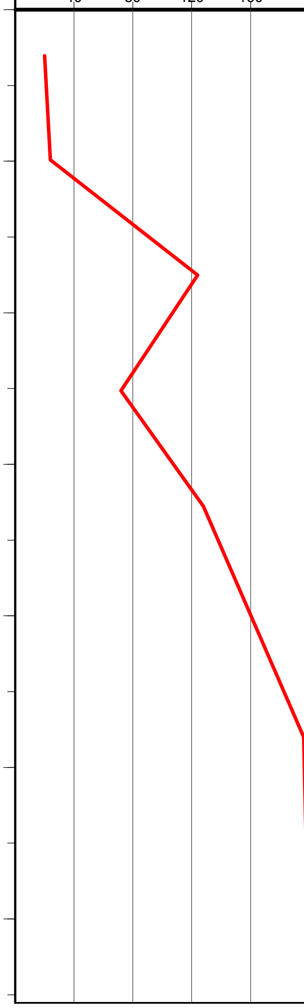
Position : E: 598386, N: 4865796 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

SOIL PROFILE / SAMPLES

Elev (m)	Depth (m)	Description	Number	Type	SPT 'N' Value	Lab Data and Comments
278.0	0.0	**GROUND SURFACE**				
		300mm **TOPSOIL**	1	SS	5	
277.7	0.3	**FILL**, clayey silt, trace to some sand, trace gravel, trace organics, topsoil, firm, brown / grey, moist ...(REWORKED/DISTURBED)	2	SS	6	∇ (unstabilized water level)
276.5	1.5	**SILT**, some sand to sandy, trace to some clay, trace gravel, compact to very dense, brown, moist	3	SS	31	spoon wet
			4	SS	18	
		...grey below	5	SS	32	
			6	SS	49	
			7	SS	70	
271.4	6.6	**END OF BOREHOLE**				

Depth Scale (m): 0, 1, 2, 3, 4, 5, 6
Elevation Scale (m): 278, 277, 276, 275, 274, 273, 272

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10, 20, 30, 40
Undrained Shear Strength (kPa): ○ Unconfined; + Field Vane; ● Pocket Penetrometer; ■ Lab Vane; 40, 80, 120, 160



Moisture / Plasticity: Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL); 10, 20, 30
Headspace Vapour
Instrument Details
Unstabilized Water Level
Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Unstabilized water level measured at 1.2m below ground surface; borehole was open upon completion of drilling.

BOREHOLE LOG 7

Terraprobe

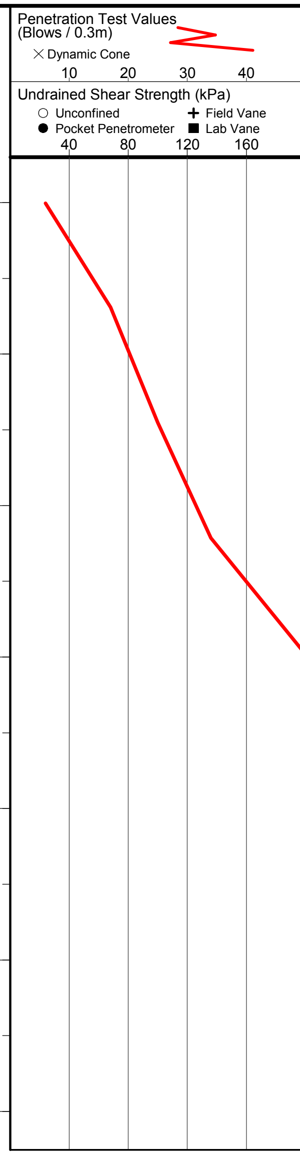
Client	: Laurelpark Inc.	Project No.:	11-13-3052
Project	: Palgrave Estates II	Date started :	May 15, 2013
Location	: Caledon, Ontario	Sheet No. :	1 of 1

Position : E: 598421, N: 4865843 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : track-mounted Drilling Method : Solid stem augers

Elev Depth (m)	Description (SOIL PROFILE)	Sample Number	Type	SPT 'N' Value	Lab Data and Comments
280.3	**GROUND SURFACE**				
	350mm **TOPSOIL**	1	SS	6	
279.9 / 0.4	Trace organics (WEATHERED/DISTURBED)				
279.5 / 0.8	**SILT**, some sand to sandy, trace to some clay, trace gravel, compact to very dense, brown, moist	2	SS	17	
		3	SS	25	
		4	SS	34	
		5	SS	55	spoon wet
	...grey below	6	SS	67	
		7	SS	68	
273.7 / 6.6	**END OF BOREHOLE**				

Unstabilized water level measured at 5.9m below ground surface; borehole was open upon completion of drilling.



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

Headspace Vapour | Instrument Details | Unstabilized Water Level | Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Depth Scale (m): 0 – 6; Elevation Scale (m): 280 – 274

Terraprobe

BOREHOLE LOG 8

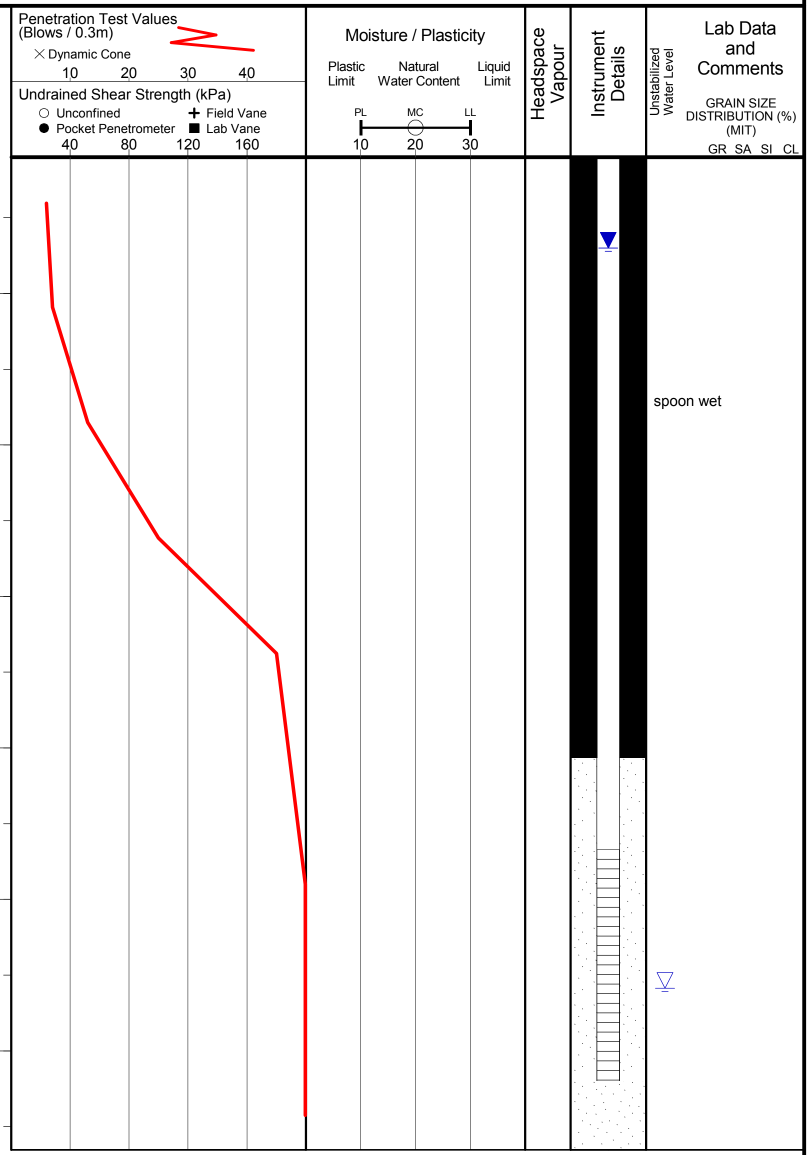
DRAFT

Client	: Laurelpark Inc.	Project No.:	11-13-3052
Project	: Palgrave Estates II	Date started :	May 15, 2013
Location	: Caledon, Ontario	Sheet No. :	1 of 1

Position : E: 598465, N: 4865898 (UTM 17T) — Elevation Datum : Geodetic (NAD83)

Rig type : track-mounted — Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description (SOIL PROFILE)	Sample Number	Type	SPT 'N' Value	Elevation Scale (m)	Lab Data and Comments
0	280.9	GROUND SURFACE					
		300mm **TOPSOIL**	1	SS	6		
	280.6 / 0.3	**FILL**, clayey silt, trace to some sand, trace gravel, trace organics, topsoil, firm, brown / grey, moist ...(REWORKED/DISTURBED)					
1			2	SS	7	280	
	279.4 / 1.5	**SANDY SILT to SAND AND SILT**, trace clay, trace gravel, compact to very dense, brown, moist	3	SS	13		spoon wet
2		...wet, dilatant				279	
			4	SS	25		
3						278	
			5	SS	45		
4						277	
5			6	SS	73	276	
6		...grey below				275	
			7	SS	56		
	274.3 / 6.6	**END OF BOREHOLE**					



Unstabilized water level measured at 5.5m below ground surface; borehole was open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
May 24, 2013	0.6	280.3

BOREHOLE LOG 9

Terraprobe

Client	: Laurelpark Inc.	Project No.:	11-13-3052
Project	: Palgrave Estates II	Date started :	May 16, 2013
Location	: Caledon, Ontario	Sheet No. :	1 of 1

Position : E: 598343, N: 4865854 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : track-mounted Drilling Method : Solid stem augers

DRAFT

Elev Depth (m)	Description	Sample Number	Type	SPT 'N' Value
282.7	**GROUND SURFACE**			
	300mm **TOPSOIL**			
282.4 / 0.3	Trace organics (WEATHERED/DISTURBED)	1	SS	6
281.9 / 0.8	**SILT**, some sand to sandy, trace to some clay, trace gravel, compact to dense, brown, moist	2	SS	10
		3	SS	12
		4	SS	30
		5	SS	34
		6	SS	45
		7	SS	41
276.1 / 6.6	**END OF BOREHOLE**			

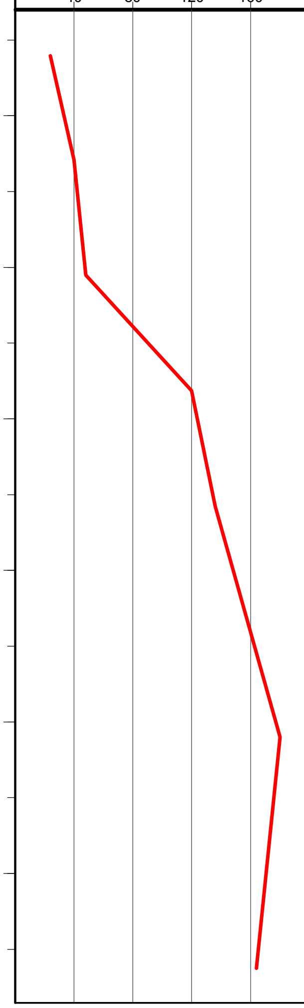
Borehole was dry and open upon completion of drilling.

Depth Scale (m): 0, 1, 2, 3, 4, 5, 6

Elevation Scale (m): 282, 281, 280, 279, 278, 277

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

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



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

Headspace Vapour | Instrument Details | Unstabilized Water Level | Lab Data and Comments — GRAIN SIZE DISTRIBUTION (%) (MIT): GR SA SI CL

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
May 24, 2013	2.5	280.2

BOREHOLE LOG 10

Terraprobe

Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 15, 2013
Sheet No. : 1 of 1

Position : E: 598480, N: 4865808 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

Elev Depth (m)	Description (SOIL PROFILE)	Sample Number	Type	SPT 'N' Value	Lab Data and Comments
279.1	**GROUND SURFACE**				
	350mm **TOPSOIL**	1	SS	8	
278.7 / 0.4	**FILL**, silt, some sand, trace to some clay, trace organics, topsoil presence, firm, brown / grey, moist ...(REWORKED/DISTURBED)	2	SS	7	
277.6 / 1.5	**SANDY SILT to SAND AND SILT**, trace clay, trace gravel, compact to dense, brown, moist	3	SS	14	
		4	SS	20	spoon wet
		5	SS	38	
	...grey below	6	SS	39	
273.0 / 6.1	**SILT**, some clay to clayey silt, trace sand, trace gravel, hard, grey, moist (GLACIAL TILL)	7	SS	58	
272.5 / 6.6	**END OF BOREHOLE**				

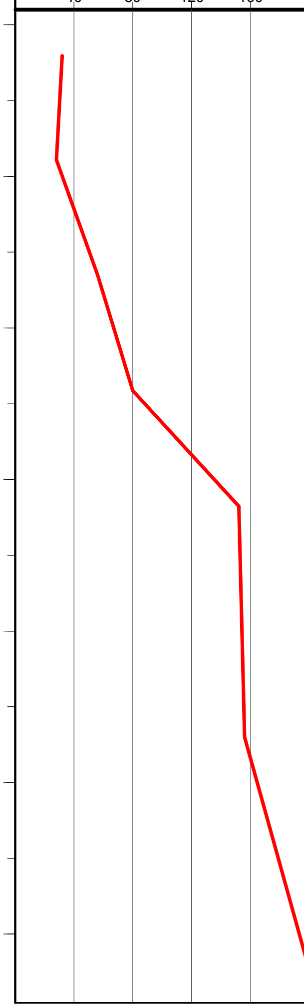
Depth Scale (m): 0–6; Elevation Scale (m): 279–273

Penetration Test Values (Blows / 0.3m): × Dynamic Cone 10 20 30 40
Undrained Shear Strength (kPa): ○ Unconfined, + Field Vane, ● Pocket Penetrometer, ■ Lab Vane 40 80 120 160

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

Headspace Vapour | Instrument Details | Unstabilized Water Level

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



Unstabilized water level measured at 5.4m below ground surface; borehole was open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
May 24, 2013	0.5	278.6

BOREHOLE LOG 11

Terraprobe

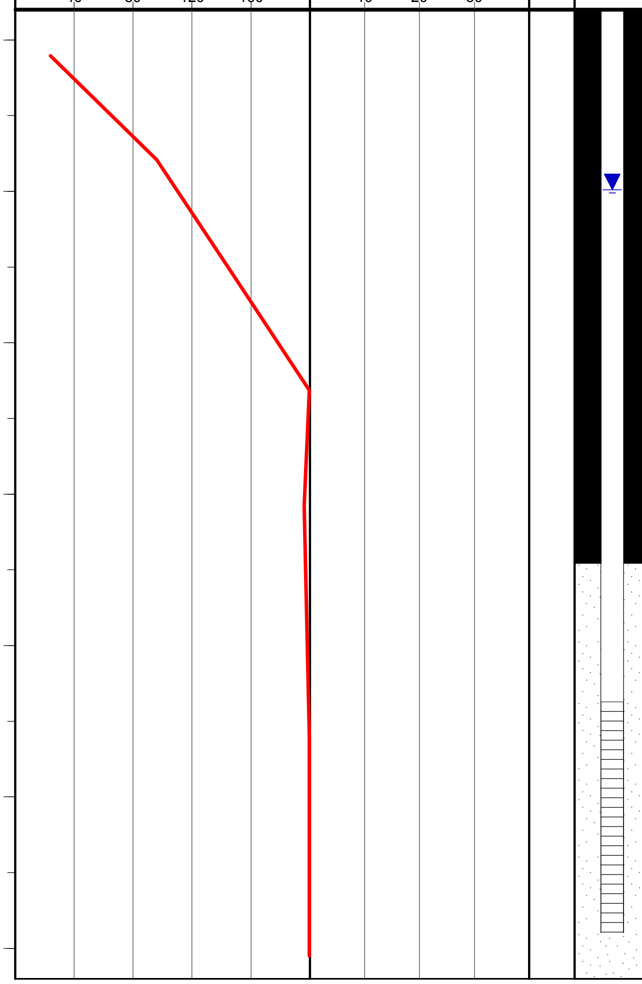
DRAFT

Client : Laurelpark Inc.	Project No.: 11-13-3052
Project : Palgrave Estates II	Date started : May 16, 2013
Location : Caledon, Ontario	Sheet No. : 1 of 1

Position : E: 598392, N: 4865760 (UTM 17T)
Elevation Datum : Geodetic (NAD83)
Rig type : track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Type	SPT 'N' Value	Elevation Scale (m)
0	280.2	**GROUND SURFACE**					
		300mm **TOPSOIL**					280
	279.9 / 0.3	Trace organics (WEATHERED/DISTURBED)		1	SS	6	
	279.4 / 0.8	**SANDY SILT to SAND AND SILT**, trace clay, trace gravel, compact to very dense, brown, moist					
1				2	SS	24	279
				3	SS	37	
2							278
				4	SS	62	
3		...grey below		5	SS	49	277
4							276
				6	SS	62	
5							275
6							274
	273.8 / 6.4			7	SS	50 / 150mm	

Penetration Test Values (Blows / 0.3m) — × Dynamic Cone: 10, 20, 30, 40
Undrained Shear Strength (kPa) — ○ Unconfined, + Field Vane, ● Pocket Penetrometer, ■ Lab Vane: 40, 80, 120, 160
Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30
Headspace Vapour | Instrument Details | Unstabilized Water Level | Lab Data and Comments — GRAIN SIZE DISTRIBUTION (%) (MIT): GR SA SI CL



END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
May 24, 2013	1.2	279.0

Terraprobe

BOREHOLE LOG 12

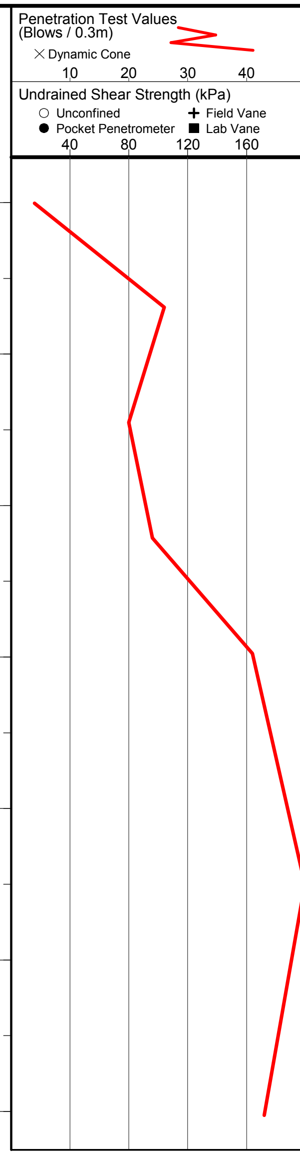
Client : Laurelpark Inc.
Project : Palgrave Estates II
Location : Caledon, Ontario

Project No.: 11-13-3052
Date started : May 16, 2013
Sheet No. : 1 of 1

Position : E: 598168, N: 4865581 (UTM 17T)
Rig type : track-mounted
Elevation Datum : Geodetic (NAD83)
Drilling Method : Solid stem augers

Elev / Depth (m)	Description	Sample Number	Type	SPT 'N' Value
285.3	GROUND SURFACE			
0.0	350mm **TOPSOIL**	1	SS	4
284.9 / 0.4	Trace organics (WEATHERED/DISTURBED)			
284.5 / 0.8	**SANDY SILT to SAND AND SILT**, trace clay, trace gravel, compact to very dense, brown, moist	2	SS	26
		3	SS	20
		4	SS	24
		5	SS	41
		6	SS	67
		7	SS	43
278.7 / 6.6	**END OF BOREHOLE**			

Depth Scale (m): 0, 1, 2, 3, 4, 5, 6
Elevation Scale (m): 285, 284, 283, 282, 281, 280, 279



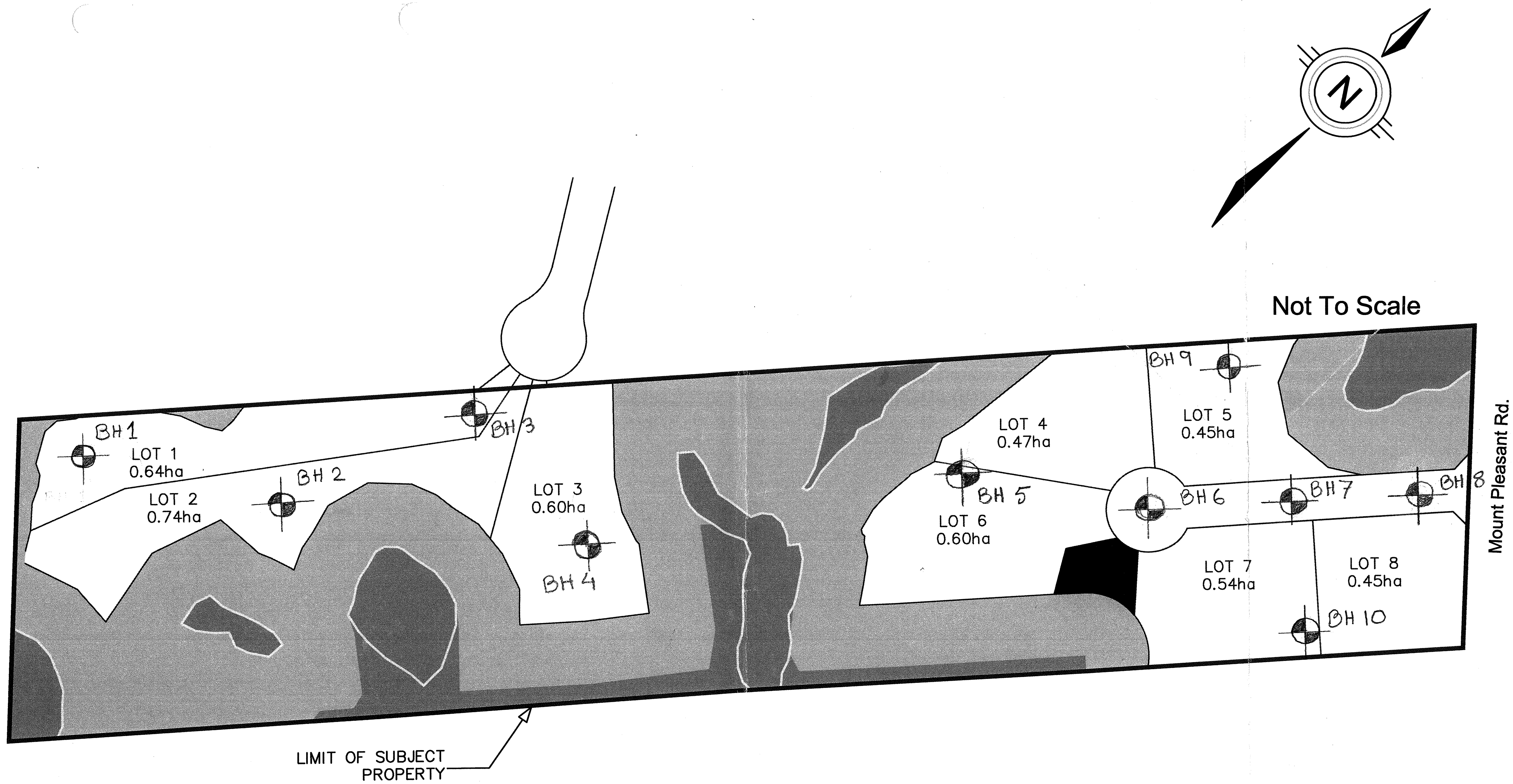
Moisture / Plasticity: Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL) — 10, 20, 30

Headspace Vapour | Instrument Details | Unstabilized Water Level | Lab Data and Comments — GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
May 24, 2013	dry	n/a



PROPOSED BOREHOLE LOCATIONS

FIGURE 1

JOB No. 11-13-3052

FIGURE 8
PROPOSED LOTTING

PALGRAVE ESTATES II
CALEDON, ONTARIO

SCALE	NTS
DATE	2013 02 11
PROJECT No.	30477

LEGEND

- EZ 1
- EZ 2
- S.W.M.

IBI GROUP

SUITE 308
30 EGLINTON AVENUE WEST
MISSISSAUGA, ONTARIO
L5R 3E7
(905) 890-3550
www.ibigroup.com

APPENDIX C

MECP Water Well Records

Well ID Number: 4903021

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	*Township*	*Lot*	*Concession*
not available	Caledon Town (Albion)	019	CON 08
County/District/Municipality	*City/Town/Village*	*Province*	*Postal Code*
PEEL		ON	n/a
UTM Coordinates	*Municipal Plan and Sublot Number*	*Other*	
NAD83 — Zone 17 Easting: 598474.5 Northing: 4865673			

Overburden and Bedrock Materials Interval

General Colour	*Most Common Material*	*Other Materials*	*General Description*	*Depth From*	*To*
	CLAY	MSND		0 ft	12 ft
	CSND			12 ft	16 ft
BLUE	CLAY			16 ft	40 ft

Annular Space/Abandonment Sealing Record

Depth From	*To*	*Type of Sealant Used (Material and Type)*	*Volume Placed*

Method of Construction	**Well Use**
Boring	Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	*Open Hole OR material*	*Depth From*	*To*
30 inch	CONCRETE		40 ft

Construction Record - Screen

Outside Diameter	*Material*X	*Depth From*	*To*

Well Contractor and Well Technician Information

Well Contractor's Licence Number	4102

Results of Well Yield Testing

	Draw Down Time (min)	*Draw Down Water level*	*Recovery Time (min)*	*Recovery Water level*
After test of well yield, water was CLEAR	SWL	15 ft		
	1			
If pumping discontinued, give reason	2			
Pump intake set at	3			
	4			
Pumping Rate 5 GPM	5			
Duration of Pumping	10			
Final water level	15			
If flowing give rate	20			
	25			
Recommended pump depth 38 ft	30			
Recommended pump rate 4 GPM	40			
	45			
Well Production PUMP	50			
Disinfected?	60			

Well ID Number: 4903634

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	*Township*	*Lot*	*Concession*
not available	Caledon Town (Albion)	019	CON 08
County/District/Municipality	*City/Town/Village*	*Province*	*Postal Code*
PEEL		ON	n/a
UTM Coordinates	*Municipal Plan and Sublot Number*	*Other*	
NAD83 — Zone 17 Easting: 598239.5 Northing: 4865873			

Overburden and Bedrock Materials Interval

General Colour	*Most Common Material*	*Other Materials*	*General Description*	*Depth From*	*To*
BRWN	OBDN			0 ft	30 ft
BRWN	CSND			30 ft	36 ft
GREY	CLAY			36 ft	66 ft

Annular Space/Abandonment Sealing Record

Depth From	*To*	*Type of Sealant Used (Material and Type)*	*Volume Placed*

Method of Construction

Boring

Well Use

Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	*Open Hole OR material*	*Depth From*	*To*
30 inch	CONCRETE		66 ft

Construction Record - Screen

Outside Diameter	*MaterialX*	*Depth From*	*To*

Well Contractor and Well Technician Information

Well Contractor's Licence Number	1307

Results of Well Yield Testing

	Draw Down Time (min)	*Draw Down Water level*	*Recovery Time (min)*	*Recovery Water level*
After test of well yield, water was CLEAR	SWL	30 ft		
	1			
If pumping discontinued, give reason	2			
Pump intake set at	3			
	4			
Pumping Rate 6 GPM	5			
Duration of Pumping 1 h:0 m	10			
Final water level 56 ft	15		15	53 ft
If flowing give rate	20			
	25			
Recommended pump depth 64 ft	30		30	50 ft
Recommended pump rate 6 GPM	40			
	45		45	47 ft
Well Production BAILER	50			
Disinfected?	60		60	44 ft

Well ID Number: 4904873

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	*Township*	*Lot*	*Concession*
not available	Caledon Town (Albion)	019	CON 09
County/District/Municipality	*City/Town/Village*	*Province*	*Postal Code*
PEEL		ON	n/a
UTM Coordinates	*Municipal Plan and Sublot Number*	*Other*	
NAD83 — Zone 17 Easting: 598295.5 Northing: 4866057			

Overburden and Bedrock Materials Interval

General Colour	*Most Common Material*	*Other Materials*	*General Description*	*Depth From*	*To*
BLCK	LOAM			0 ft	3 ft
BRWN	CLAY	SAND		3 ft	26 ft
BLUE	CLAY			26 ft	71 ft
GREY	CLAY	SAND		71 ft	95 ft
	SAND	GRVL		95 ft	105 ft

Annular Space/Abandonment Sealing Record

Depth From	*To*	*Type of Sealant Used (Material and Type)*	*Volume Placed*

Method of Construction

Cable Tool

Well Use

Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	*Open Hole OR material*	*Depth From*	*To*
7 inch	STEEL		95 ft

Construction Record - Screen

Outside Diameter	*MaterialX*	*Depth From*	*To*
6 inch		95 ft	101 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number 3108

Results of Well Yield Testing

	Draw Down Time (min)	*Draw Down Water level*	*Recovery Time (min)*	*Recovery Water level*
After test of well yield, water was CLEAR	SWL	18 ft		
	1			
If pumping discontinued, give reason	2			
Pump intake set at	3			
	4			
Pumping Rate 5 GPM	5			
Duration of Pumping 6 h:0 m	10			
Final water level 100 ft	15			
If flowing give rate	20			
Recommended pump depth 104 ft	25			
	30			
Recommended pump rate 5 GPM	40			
	45			
Well Production PUMP	50			
Disinfected?	60			

Well ID Number: 4903059

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	*Township*	*Lot*	*Concession*
not available	Caledon Town (Albion)	019	CON 08
County/District/Municipality	*City/Town/Village*	*Province*	*Postal Code*
PEEL		ON	n/a
UTM Coordinates	*Municipal Plan and Sublot Number*	*Other*	
NAD83 — Zone 17 Easting: 598564.5 Northing: 4865773			

Overburden and Bedrock Materials Interval

General Colour	*Most Common Material*	*Other Materials*	*General Description*	*Depth From*	*To*
	LOAM			0 ft	2 ft
BRWN	CSND	CLAY		2 ft	21 ft
GREY	CLAY	STNS		21 ft	27 ft
BLUE	CLAY			27 ft	40 ft

Annular Space/Abandonment Sealing Record

Depth From	*To*	*Type of Sealant Used (Material and Type)*	*Volume Placed*

Method of Construction

Boring

Well Use

Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	*Open Hole OR material*	*Depth From*	*To*
36 inch	CONCRETE		40 ft

Construction Record - Screen

Outside Diameter	*MaterialX*	*Depth From*	*To*

Well Contractor and Well Technician Information

Well Contractor's Licence Number	3612

Results of Well Yield Testing

	Draw Down *Time (min)*	Draw Down *Water level*	Recovery *Time (min)*	Recovery *Water level*
After test of well yield, water was CLOUDY	SWL	28 ft		
	1			
If pumping discontinued, give reason	2			
Pump intake set at	3			
	4			
Pumping Rate 0 GPM	5			
Duration of Pumping 1 h:0 m	10			
Final water level 38 ft	15			
If flowing give rate	20			
	25			
Recommended pump depth 38 ft	30			
Recommended pump rate 0 GPM	40			
	45			
Well Production PUMP	50			
Disinfected?	60			

APPENDIX D

Water Quality Laboratory Results

5835 COOPERS AVENUE
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TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: **AZIMUTH ENVIRONMENTAL CONSULTING,**
85 BAYFIELD STREET, SUITE 400
BARRIE, ON L4M3A7
(705) 721-8451

ATTENTION TO: **Drew West**

PROJECT NO: **08-019c**

AGAT WORK ORDER: **13T707868**

MICROBIOLOGY ANALYSIS REVIEWED BY: **Anthony Dapaah, PhD (Chem), Inorganic Lab Manager**

WATER ANALYSIS REVIEWED BY: **Elizabeth Polakowska, MSc (Animal Sci), PhD (Agri Sci), Inorganic Lab Supervisor**

DATE REPORTED: **Apr 26, 2013**

PAGES (INCLUDING COVER): **13**

VERSION*: **1**

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

5835 COOPERS AVENUE
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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 13T707868

PROJECT NO: 08-019c

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

ATTENTION TO: Drew West

Microbiological Analysis (water)

DATE RECEIVED: 2013-04-22

DATE REPORTED: 2013-04-26

			SAMPLE DESCRIPTION:	MW-5 II	MW-3 I
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	4/21/2013	4/21/2013
Parameter	**Unit**	**G / S**	**RDL**	**4282874**	**4282984**
Escherichia coli	CFU/100mL	0	1	ND	ND
Total Coliforms	CFU/100mL	0	1	ND	ND
Fecal Coliform	CFU/100mL		1	ND	ND
Heterotrophic Plate Count	CFU/1mL		10	ND	ND

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to SDWA - Microbiology
4282874-4282984 ND - Not Detected.

Certified By:

Certificate of Analysis

AGAT WORK ORDER: 13T707868

PROJECT NO: 08-019c

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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http://www.agatlabs.com

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING, **ATTENTION TO: Drew West**

Water Quality Assessment (excl. Hg)

DATE RECEIVED: 2013-04-22 **DATE REPORTED: 2013-04-26**

			SAMPLE DESCRIPTION:	Wetland 1		Wetland 2		Wetland 3	Wetland 4	Wetland 5
			SAMPLE TYPE:	Water		Water		Water	Water	Water
			DATE SAMPLED:	4/21/2013		4/21/2013		4/21/2013	4/21/2013	4/21/2013
Parameter	**Unit**	**G / S**	**RDL**	**4282731**	**RDL**	**4282799**	**RDL**	**4282822**	**4282851**	**4282853**
Saturation pH				6.75		6.94		7.80	6.93	7.04
pH	pH Units	6.5-8.5	NA	8.13	NA	7.97	NA	7.84	7.61	7.95
Langlier Index				1.38		1.03		0.04	0.68	0.91
Alkalinity (as CaCO3)	mg/L		5	343	5	271	5	93	265	242
Bicarbonate (as CaCO3)	mg/L		5	343	5	271	5	93	265	242
Carbonate (as CaCO3)	mg/L		5	<5	5	<5	5	<5	<5	<5
Hydroxide (as CaCO3)	mg/L		5	<5	5	<5	5	<5	<5	<5
Electrical Conductivity	uS/cm		2	788	2	564	2	192	522	457
Fluoride	mg/L		0.25	<0.25	0.10	<0.10	0.05	<0.05	<0.05	<0.05
Chloride	mg/L		0.50	56.9	0.20	24.2	0.10	2.35	4.74	3.70
Nitrate as N	mg/L		0.25	<0.25	0.10	<0.10	0.05	<0.05	<0.05	<0.05
Nitrite as N	mg/L		0.25	<0.25	0.10	<0.10	0.05	<0.05	<0.05	<0.05
Bromide	mg/L		0.25	<0.25	0.10	<0.10	0.05	<0.05	<0.05	<0.05
Sulphate	mg/L		0.50	6.60	0.20	5.86	0.10	0.88	11.3	2.04
Calcium	mg/L		0.05	138	0.05	105	0.05	36.9	113	93.4
Magnesium	mg/L		0.05	7.89	0.05	6.47	0.05	2.12	4.06	5.15
Sodium	mg/L		0.05	31.8	0.05	11.4	0.05	0.81	2.21	1.47
Potassium	mg/L		0.05	2.14	0.05	1.74	0.05	2.29	1.00	4.39
Ammonia as N	mg/L		0.02	<0.02	0.02	0.03	0.02	<0.02	0.06	0.02
Phosphate as P	mg/L		0.50	<0.50	0.20	<0.20	0.10	<0.10	<0.10	<0.10
Total Phosphorus	mg/L	0.03	0.02	**0.06**	0.02	0.02	0.02	0.02	0.03	**0.05**
Reactive Silica	mg/L		0.05	11.7	0.05	5.73	0.05	0.51	5.29	9.94
Total Organic Carbon	mg/L		0.5	10.0	0.5	8.7	0.5	7.4	12.7	8.2
Colour	TCU		5	38	5	30	5	41	57	31
Turbidity	NTU		0.5	2.1	0.5	0.8	0.5	0.9	1.4	1.9
Aluminum	mg/L		0.004	0.027	0.004	0.030	0.004	0.028	0.055	0.035
Arsenic	mg/L	0.1	0.003	<0.003	0.003	<0.003	0.003	<0.003	<0.003	<0.003
Barium	mg/L		0.002	0.012	0.002	0.017	0.002	0.010	0.024	0.017
Boron	mg/L	0.20	0.010	0.029	0.010	0.015	0.010	0.013	<0.010	0.011
Cadmium	mg/L	0.0002	0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L		0.003	<0.003	0.003	<0.003	0.003	<0.003	<0.003	<0.003

Certified By: Elizabeth Rolakowska

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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 13T707868

PROJECT NO: 08-019c

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

ATTENTION TO: Drew West

Water Quality Assessment (excl. Hg)

DATE RECEIVED: 2013-04-22

DATE REPORTED: 2013-04-26

			SAMPLE DESCRIPTION:	Wetland 1		Wetland 2		Wetland 3	Wetland 4	Wetland 5
			SAMPLE TYPE:	Water		Water		Water	Water	Water
			DATE SAMPLED:	4/21/2013		4/21/2013		4/21/2013	4/21/2013	4/21/2013
Parameter	**Unit**	**G / S**	**RDL**	**4282731**	**RDL**	**4282799**	**RDL**	**4282822**	**4282851**	**4282853**
Copper	mg/L	0.005	0.003	<0.003	0.003	<0.003	0.003	<0.003	<0.003	<0.003
Iron	mg/L	0.3	0.010	0.197	0.010	0.096	0.010	0.179	**0.682**	0.202
Lead	mg/L	0.005	0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001
Manganese	mg/L		0.002	0.336	0.002	0.042	0.002	0.032	0.394	0.103
Molybdenum	mg/L	0.04	0.002	<0.002	0.002	<0.002	0.002	<0.002	<0.002	<0.002
Nickel	mg/L	0.025	0.003	<0.003	0.003	<0.003	0.003	<0.003	<0.003	<0.003
Selenium	mg/L	0.1	0.004	<0.004	0.004	<0.004	0.004	<0.004	<0.004	<0.004
Silver	mg/L	0.0001	0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001
Strontium	mg/L		0.005	0.224	0.005	0.175	0.005	0.057	0.172	0.134
Thallium	mg/L	0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	<0.0003	<0.0003
Tin	mg/L		0.002	<0.002	0.002	<0.002	0.002	<0.002	<0.002	<0.002
Titanium	mg/L		0.002	<0.002	0.002	<0.002	0.002	<0.002	<0.002	<0.002
Uranium	mg/L	0.005	0.002	<0.002	0.002	<0.002	0.002	<0.002	<0.002	<0.002
Vanadium	mg/L	0.005	0.002	<0.002	0.002	<0.002	0.002	<0.002	<0.002	<0.002
Zinc	mg/L	0.03	0.005	<0.005	0.005	<0.005	0.005	<0.005	**0.034**	<0.005
Total Dissolved Solids	mg/L		20	410	20	292	20	82	268	242
Total Hardness (as CaCO3)	mg/L		0.5	377	0.5	289	0.5	101	299	254
% Difference/ Ion Balance			0.1	2.2	0.1	0.8	0.1	4.1	3.7	2.8

Certified By: Elizabeth Rolakowska

Results relate only to the items tested and to all the items tested

Certificate of Analysis

AGAT WORK ORDER: 13T707868
PROJECT NO: 08-019c

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CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING, **ATTENTION TO: Drew West**

Water Quality Assessment (excl. Hg)

DATE RECEIVED: 2013-04-22 **DATE REPORTED: 2013-04-26**

Parameter	Unit	G / S	RDL	MW-5 II	MW-3 I
			SAMPLE DESCRIPTION:	MW-5 II	MW-3 I
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	4/21/2013	4/21/2013
				4282874	4282984
Saturation pH				6.97	6.85
pH	pH Units	6.5-8.5	NA	8.08	8.07
Langlier Index				1.11	1.22
Alkalinity (as CaCO3)	mg/L		5	238	286
Bicarbonate (as CaCO3)	mg/L		5	238	286
Carbonate (as CaCO3)	mg/L		5	<5	<5
Hydroxide (as CaCO3)	mg/L		5	<5	<5
Electrical Conductivity	uS/cm		2	613	654
Fluoride	mg/L		0.10	<0.10	<0.10
Chloride	mg/L		0.20	8.44	5.85
Nitrate as N	mg/L		0.10	15.4	14.2
Nitrite as N	mg/L		0.10	<0.10	<0.10
Bromide	mg/L		0.10	<0.10	<0.10
Sulphate	mg/L		0.20	26.8	13.5
Calcium	mg/L		0.05	104	117
Magnesium	mg/L		0.05	16.2	16.1
Sodium	mg/L		0.05	3.95	4.96
Potassium	mg/L		0.05	1.57	0.52
Ammonia as N	mg/L		0.02	0.06	<0.02
Phosphate as P	mg/L		0.20	<0.20	<0.20
Total Phosphorus	mg/L	0.03	0.02	0.03	0.02
Reactive Silica	mg/L		0.05	16.4	15.5
Total Organic Carbon	mg/L		0.5	5.0	1.7
Colour	TCU		5	<5	<5
Turbidity	NTU		0.5	<0.5	<0.5
Aluminum	mg/L		0.004	0.026	0.027
Arsenic	mg/L	0.1	0.003	<0.003	<0.003
Barium	mg/L		0.002	0.026	0.023
Boron	mg/L	0.20	0.010	<0.010	<0.010
Cadmium	mg/L	0.0002	0.0001	<0.0001	<0.0001
Chromium	mg/L		0.003	<0.003	<0.003

Certified By: Elizabeth Rolakowska

Certificate of Analysis

AGAT WORK ORDER: 13T707868

PROJECT NO: 08-019c

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CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING, **ATTENTION TO: Drew West**

Water Quality Assessment (excl. Hg)

DATE RECEIVED: 2013-04-22 **DATE REPORTED: 2013-04-26**

			SAMPLE DESCRIPTION:	MW-5 II	MW-3 I
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	4/21/2013	4/21/2013
Parameter	**Unit**	**G / S**	**RDL**	**4282874**	**4282984**
Copper	mg/L	0.005	0.003	<0.003	<0.003
Iron	mg/L	0.3	0.010	<0.010	<0.010
Lead	mg/L	0.005	0.001	<0.001	<0.001
Manganese	mg/L		0.002	0.084	<0.002
Molybdenum	mg/L	0.04	0.002	0.005	<0.002
Nickel	mg/L	0.025	0.003	<0.003	<0.003
Selenium	mg/L	0.1	0.004	<0.004	<0.004
Silver	mg/L	0.0001	0.0001	<0.0001	<0.0001
Strontium	mg/L		0.005	0.198	0.203
Thallium	mg/L	0.0003	0.0003	<0.0003	<0.0003
Tin	mg/L		0.002	<0.002	<0.002
Titanium	mg/L		0.002	<0.002	<0.002
Uranium	mg/L	0.005	0.002	<0.002	<0.002
Vanadium	mg/L	0.005	0.002	<0.002	<0.002
Zinc	mg/L	0.03	0.005	<0.005	<0.005
Total Dissolved Solids	mg/L		20	336	360
Total Hardness (as CaCO3)	mg/L		0.5	326	358
% Difference/ Ion Balance			0.1	0.7	1.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO (mg/L)

4282731-4282799 The RDLs were increased for anions to reflect a dilution of the samples prior to analysis.

4282874-4282984 The RDLs were increased for anions to reflect a dilution of the samples prior to analysis.

Certified By: Elizabeth Rolakowska

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AGAT WORK ORDER: 13T707868

PROJECT NO: 08-019c

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING, **ATTENTION TO: Drew West**

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
4282731	Wetland 1	PWQO (mg/L)	Water Quality Assessment (excl. Hg)	Total Phosphorus	0.03	0.06
4282851	Wetland 4	PWQO (mg/L)	Water Quality Assessment (excl. Hg)	Iron	0.3	0.682
4282851	Wetland 4	PWQO (mg/L)	Water Quality Assessment (excl. Hg)	Zinc	0.03	0.034
4282853	Wetland 5	PWQO (mg/L)	Water Quality Assessment (excl. Hg)	Total Phosphorus	0.03	0.05

AGAT Laboratories

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Quality Assurance

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING, **AGAT WORK ORDER: 13T707868**

PROJECT NO: 08-019c **ATTENTION TO: Drew West**

Microbiology Analysis

RPT Date: Apr 26, 2013			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Microbiological Analysis (water)															
Escherichia coli	1		ND	ND	NA	< 1	NA			NA			NA		
Total Coliforms	1		180	162	10.5%	< 1	NA			NA			NA		
Fecal Coliform	1		4	2	NA	< 1	NA			NA			NA		
Heterotrophic Plate Count	1	4282874	ND	ND	NA	< 10	NA			NA			NA		

Comments: ND - Not Detected, ; NA - % RPD Not Applicable
NA - % RPD Not Reportable based on the number of colonies count acceptable for RPD calculation
NA - Not Applicable

Certified By: [signature]

AGAT Laboratories

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Quality Assurance

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING, **AGAT WORK ORDER: 13T707868**

PROJECT NO: 08-019c **ATTENTION TO: Drew West**

Water Analysis

RPT Date: Apr 26, 2013			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Water Quality Assessment (excl. Hg)															
pH	4280718		7.97	8.07	1.2%	NA	100%	90%	110%	NA			NA		
Alkalinity (as CaCO3)	4280718		223	225	0.8%	< 5	97%	80%	120%	NA			NA		
Bicarbonate (as CaCO3)	4280718		223	225	0.8%	< 5	NA	80%	120%	NA			NA		
Carbonate (as CaCO3)	4280718		<5	<5	0.0%	< 5	NA	80%	120%	NA			NA		
Hydroxide (as CaCO3)	4280718		<5	<5	0.0%	< 5	NA	80%	120%	NA			NA		
Electrical Conductivity	4280718		526	524	0.4%	< 2	97%	80%	120%	NA			NA		
Fluoride	4282731	4282731	<0.05	<0.05	0.0%	< 0.05	98%	90%	110%	95%	90%	110%	100%	80%	120%
Chloride	4282731	4282731	56.9	55.8	1.9%	< 0.10	101%	90%	110%	97%	90%	110%	97%	80%	120%
Nitrate as N	4282731	4282731	<0.05	<0.05	0.0%	< 0.05	95%	90%	110%	110%	90%	110%	110%	80%	120%
Nitrite as N	4282731	4282731	<0.05	<0.05	0.0%	< 0.05	NA	90%	110%	107%	90%	110%	108%	80%	120%
Bromide	4282731	4282731	<0.05	<0.05	0.0%	< 0.05	110%	90%	110%	108%	90%	110%	95%	80%	120%
Sulphate	4282731	4282731	6.60	6.51	1.3%	< 0.10	108%	90%	110%	97%	90%	110%	99%	80%	120%
Calcium	1	4282799	105	108	2.8%	< 0.05	100%	90%	110%	101%	90%	110%	108%	70%	130%
Magnesium	1	4282799	6.47	6.48	0.2%	< 0.05	101%	90%	110%	102%	90%	110%	108%	70%	130%
Sodium	1	4282799	11.4	11.7	2.6%	< 0.05	96%	90%	110%	97%	90%	110%	101%	70%	130%
Potassium	1	4282799	1.74	1.74	0.0%	< 0.05	98%	90%	110%	98%	90%	110%	103%	70%	130%
Ammonia as N	1	4282731	< 0.02	< 0.02	0.0%	< 0.02	100%	90%	110%	105%	90%	110%	99%	80%	120%
Phosphate as P	4282731	4282731	<0.10	<0.10	0.0%	< 0.10	106%	90%	110%	107%	90%	110%	103%	80%	120%
Total Phosphorus	1		0.06	0.06	0.0%	< 0.02	94%	90%	110%	102%	90%	110%	96%	80%	120%
Reactive Silica	1	4282874	16.4	16.4	0.0%	< 0.05	105%	90%	110%	106%	90%	110%	82%	80%	120%
Total Organic Carbon	1		1.0	1.1	9.5%	< 0.5	99%	90%	110%	105%	90%	110%	104%	80%	120%
Colour	1	4282731	38	38	0.0%	< 5	103%	90%	110%	NA			NA		
Turbidity	1		16.3	16.2	0.6%	< 0.5	97%	90%	110%	NA			NA		
Aluminum	1	4282984	0.027	0.024	11.8%	< 0.004	99%	90%	110%	100%	90%	110%	109%	70%	130%
Arsenic	1	4282984	< 0.003	< 0.003	0.0%	< 0.003	102%	90%	110%	103%	90%	110%	109%	70%	130%
Barium	1	4282984	0.023	0.022	4.4%	< 0.002	102%	90%	110%	101%	90%	110%	108%	70%	130%
Boron	1	4282984	< 0.010	< 0.010	0.0%	< 0.010	107%	90%	110%	104%	90%	110%	107%	70%	130%
Cadmium	1	4282984	< 0.0001	< 0.0001	0.0%	< 0.0001	102%	90%	110%	101%	90%	110%	110%	70%	130%
Chromium	1	4282984	< 0.003	< 0.003	0.0%	< 0.003	93%	90%	110%	92%	90%	110%	112%	70%	130%
Copper	1	4282984	< 0.003	< 0.003	0.0%	< 0.003	96%	90%	110%	95%	90%	110%	99%	70%	130%
Iron	1	4282984	< 0.010	< 0.010	0.0%	< 0.010	100%	90%	110%	93%	90%	110%	90%	70%	130%
Lead	1	4282984	< 0.001	< 0.001	0.0%	< 0.001	93%	90%	110%	92%	90%	110%	100%	70%	130%
Manganese	1	4282984	< 0.002	< 0.002	0.0%	< 0.002	91%	90%	110%	92%	90%	110%	100%	70%	130%
Molybdenum	1	4282984	< 0.002	< 0.002	0.0%	< 0.002	100%	90%	110%	98%	90%	110%	105%	70%	130%
Nickel	1	4282984	< 0.003	< 0.003	0.0%	< 0.003	105%	90%	110%	106%	90%	110%	114%	70%	130%
Selenium	1	4282984	< 0.004	< 0.004	0.0%	< 0.004	101%	90%	110%	94%	90%	110%	103%	70%	130%
Silver	1	4282984	< 0.0001	< 0.0001	0.0%	< 0.0001	105%	90%	110%	114%	90%	110%	128%	70%	130%
Strontium	1	4282984	0.203	0.187	8.2%	< 0.005	94%	90%	110%	93%	90%	110%	103%	70%	130%
Thallium	1	4282984	< 0.0003	< 0.0003	0.0%	< 0.0003	102%	90%	110%	106%	90%	110%	113%	70%	130%

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Quality Assurance

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING, **AGAT WORK ORDER: 13T707868**

PROJECT NO: 08-019c **ATTENTION TO: Drew West**

Water Analysis (Continued)

RPT Date: Apr 26, 2013			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Tin	1	4282984	< 0.002	< 0.002	0.0%	< 0.002	95%	90%	110%	97%	90%	110%	92%	70%	130%
Titanium	1	4282984	< 0.002	< 0.002	0.0%	< 0.002	102%	90%	110%	97%	90%	110%	104%	70%	130%
Uranium	1	4282984	< 0.002	< 0.002	0.0%	< 0.002	102%	90%	110%	104%	90%	110%	88%	70%	130%
Vanadium	1	4282984	< 0.002	< 0.002	0.0%	< 0.002	102%	90%	110%	98%	90%	110%	107%	70%	130%
Zinc	1	4282984	< 0.005	< 0.005	0.0%	< 0.005	95%	90%	110%	95%	90%	110%	100%	70%	130%
Total Dissolved Solids	1	4282874	336	326	3.0%	< 20	92%	80%	120%	NA			NA		

Comments: QA Qualifier for metals (Ag): In a multielement scan for lab control standards and matrix spikes, up to 10% of analytes may exceed the quoted limits by up to 10% absolute and it is considered acceptable.

Certified By: Elizabeth Polakowska

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QA Violation

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

AGAT WORK ORDER: 13T707868

PROJECT NO: 08-019c

ATTENTION TO: Drew West

RPT Date: Apr 26, 2013			REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Sample Id	Sample Description	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
				Lower	Upper		Lower	Upper		Lower	Upper
Water Quality Assessment (excl. Hg)											
Silver	4282984	Wetland 1	105%	90%	110%	114%	90%	110%	128%	70%	130%

Comments: QA Qualifier for metals (Ag): In a multielement scan for lab control standards and matrix spikes, up to 10% of analytes may exceed the quoted limits by up to 10% absolute and it is considered acceptable.

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Method Summary

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING, **AGAT WORK ORDER: 13T707868**

PROJECT NO: 08-019c **ATTENTION TO: Drew West**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration
Total Coliforms	MIC-93-7010	EPA 1604	Membrane Filtration
Fecal Coliform	MIC-93-7000	SM 9222 D	MF/INCUBATOR
Heterotrophic Plate Count	MIC-93-7020	SM 9215C	Spread Plate

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Method Summary

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

AGAT WORK ORDER: 13T707868

PROJECT NO: 08-019c

ATTENTION TO: Drew West

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Saturation pH		SM 2320 B	CALCULATION
pH	INOR-93-6000	SM 4500-H+ B	PC TITRATE
Langlier Index			CALCULATION
Alkalinity (as CaCO3)	INOR-93-6000	SM 2320 B	PC TITRATE
Bicarbonate (as CaCO3)	INOR-93-6000	SM 2320 B	PC TITRATE
Carbonate (as CaCO3)	INOR-93-6000	SM 2320 B	PC TITRATE
Hydroxide (as CaCO3)	INOR-93-6000	SM 2320 B	PC TITRATE
Electrical Conductivity	INOR-93-6000	SM 2510 B	PC TITRATE
Fluoride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Calcium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Magnesium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Sodium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Potassium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Ammonia as N	INOR-93-6002	AQ2 EPA-103A & SM 4500 NH3-F	AQ-2 DISCRETE ANALYZER
Phosphate as P	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Total Phosphorus	INOR-93-6022	SM 4500-P B&E	SPECTROPHOTOMETER
Reactive Silica	INOR-93-6047	AQ2 EPA-122A & SM 4500 SiO2 D	AQ2 DISCRETE ANALYSER
Total Organic Carbon	INOR-93-6049	EPA 415.1 & SM 5310	SHIMADZU CARBON ANALYZER
Colour	INOR-93-6046	SM 2120 B	SPECTROPHOTOMETER
Turbidity	INOR-93-6044	SM 2130 B	NEPHELOMETER
Aluminum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Barium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Iron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Manganese	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Selenium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Silver	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Strontium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Thallium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Tin	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Titanium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Uranium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Total Dissolved Solids	INOR-93-6028	SM 2540 C	BALANCE
Total Hardness (as CaCO3)	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
% Difference/ Ion Balance		SM 1030 E	CALCULATION

AGAT Laboratories

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Chain of Custody Record

Laboratory Use Only
Arrival Temperature: 7.0 . 7.2 . 7.4
AGAT WO #:
Lab Temperature: 5.0 5.2 5.4
Notes: 13T707868

Client Information
Company: Azimuth Environmental
Contact: Drew West
Address: 85 Bayfield Street, Suite 400, Barrie, ON L4M 3A7
Phone: (705) 721-8451 Fax: (705) 721-8926
Project: 08-019c PO:
AGAT Quotation #:

Please note, if quotation number is not provided, client will be billed full price for analysis.

Regulatory Requirements
☐ Regulation 153/04 (reg. 511 Amend.)
Table ____ *Indicate one*
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(check one)* ☐ Coarse ☐ Fine

☐ Sewer Use
Region ____ *Indicate one*
☐ Sanitary
☐ Storm

☐ Regulation 558
☐ CCME
☐ Other *(specify)*
☑ Prov. Water Quality Objectives (PWQO)
☐ None

Turnaround Time Required (TAT) Required*
Regular TAT
☐ 5 to 7 Working Days
Rush TAT (please provide prior notification)
Rush Surcharges Apply
☑ 3 Working Days
☐ 2 Working Days
☐ 1 Working Day
OR
Date Required (Rush surcharges may apply):

**TAT is exclusive of weekends and statutory holidays*

Invoice To Same: Yes ☑ No ☐
Company:
Contact: Lorna Salgado
Address:

Is this a drinking water sample? (potable water intended for human consumption) ☐ Yes ☑ No
If "Yes", please use the *Drinking Water Chain of Custody Form*

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Legend Matrix
GW Ground Water **O** Oil
SW Surface Water **P** Paint
SD Sediment **S** Soil

Report Information – reports to be sent to:
1. Name: Drew West
Email: drew@azimuthenvironmental.com
2. Name:
Email:

Analysis columns: Metals and Inorganics; Metal Scan; Hydride Forming Metals; Client Custom Metals; ORPs: ☐ B-HWS ☐ Cl- ☐ CN- ☐ EC ☐ FOC ☐ Cr+6- ☐ SAR ☐ NO_3/NO_2 ☐ N- Total ☐ Hg ☐ pH; Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3/NO_2; VOC: ☐ VOC ☐ THM ☐ BTEX; CCME Fractions 1 to 4; ABNs; PAHs; Chlorophenols; PCBs; Organochlorine Pesticides; TCLP Metals/Inorganics; Sewer Use; 94-085; 94-086; 94-088 (microbiology)

Sample Identification	Date Sampled	Time Sampled	Sample Matrix	# of Containers	Comments Site/Sample Information	94-085	94-086	94-088 (microbiology)
Wetland 1	Apr 21	12:00pm	SW	3		X	X	
Wetland 2	↓	↓	SW	3		X	X	
Wetland 3	↓	↓	SW	3		X	X	
Wetland 4	↓	↓	SW	3		X	X	
Wetland 5	↓	↓	SW	3		X	X	
MW-5 II	↓	1:00pm	GW	4		X	X	X
MW-3 I	↓	1:30pm	GW	4		X	X	X

Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time	
Drew West [signature]	Apr. 22/13	H. Gilmour [signature] 22 Apr 13	10.20	Pink Copy - Client
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time	Yellow Copy - AGAT
			12.30	White Copy - AGAT

Page 1 of 1
Nº: 185966

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BARRIE, ON L4N9A1
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ATTENTION TO: Drew West

PROJECT: 08-019

AGAT WORK ORDER: 18T411590

MICROBIOLOGY ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer

WATER ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer

DATE REPORTED: Nov 26, 2018

PAGES (INCLUDING COVER): 10

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Certificate of Analysis

AGAT WORK ORDER: 18T411590
PROJECT: 08-019

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,
ATTENTION TO: Drew West
SAMPLING SITE:
SAMPLED BY:

Microbiological Analysis (water)

DATE RECEIVED: 2018-11-20
DATE REPORTED: 2018-11-26

			SAMPLE DESCRIPTION:	15535
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2018-11-19
Parameter	Unit	G / S	RDL	9721443
Escherichia coli	CFU/100mL		1	NDOGT
Total Coliforms	CFU/100mL		1	NDOGT

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
9721443 NDOGT - No Data; Overgrown with Target, refers to over-crowding microbial growth;
Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Nivine Basily

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 18T411590

PROJECT: 08-019

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CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

ATTENTION TO: Drew West

SAMPLING SITE:

SAMPLED BY:

Water Quality Assessment - Drinking Water Samples

DATE RECEIVED: 2018-11-20

DATE REPORTED: 2018-11-26

			SAMPLE DESCRIPTION:	15535
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2018-11-19
Parameter	Unit	G / S	RDL	9721443
pH	pH Units		NA	7.91
Alkalinity (as CaCO3)	mg/L		5	383
Electrical Conductivity	µS/cm		2	998
Fluoride	mg/L	1.5	0.25	<0.25
Chloride	mg/L		0.50	44.6
Nitrate as N	mg/L	10.0	0.25	0.38
Nitrite as N	mg/L	1.0	0.25	<0.25
Bromide	mg/L		0.25	<0.25
Sulphate	mg/L		0.50	83.3
Calcium	mg/L		0.10	92.8
Magnesium	mg/L		0.10	25.2
Sodium	mg/L	20	0.10	23.6
Potassium	mg/L		0.10	76.5
Ammonia + Ammonium as N	mg/L		0.02	<0.02
Ortho Phosphate as P	mg/L		0.50	<0.50
Total Phosphorus	mg/L		0.02	<0.02
Reactive Silica	mg/L		0.10	16.3
Total Organic Carbon	mg/L		0.5	6.1
Colour	Apparent CU		5	19
Turbidity	NTU		0.5	5.6
Aluminum	mg/L		0.004	<0.004
Arsenic	mg/L	0.010	0.003	<0.003
Barium	mg/L	1	0.002	0.065
Boron	mg/L	5	0.010	0.020
Cadmium	mg/L	0.005	0.001	<0.001
Chromium	mg/L	0.05	0.003	<0.003
Copper	mg/L		0.003	<0.003
Iron	mg/L		0.010	0.558
Lead	mg/L	0.01	0.001	<0.001
Manganese	mg/L		0.002	0.046

Certified By: Nivine Basily

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Certificate of Analysis

AGAT WORK ORDER: 18T411590
PROJECT: 08-019

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,
ATTENTION TO: Drew West
SAMPLING SITE:
SAMPLED BY:

Water Quality Assessment - Drinking Water Samples

DATE RECEIVED: 2018-11-20
DATE REPORTED: 2018-11-26

			SAMPLE DESCRIPTION:	15535
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2018-11-19
Parameter	Unit	G / S	RDL	9721443
Molybdenum	mg/L		0.002	<0.002
Nickel	mg/L		0.003	<0.003
Selenium	mg/L	0.05	0.004	<0.004
Silver	mg/L		0.002	<0.002
Strontium	mg/L		0.005	0.357
Thallium	mg/L		0.006	<0.006
Tin	mg/L		0.002	<0.002
Titanium	mg/L		0.002	<0.002
Uranium	mg/L	0.02	0.002	<0.002
Vanadium	mg/L		0.002	<0.002
Zinc	mg/L		0.005	0.250
Total Dissolved Solids	mg/L		20	652
Total Hardness (as CaCO3)	mg/L		0.5	335

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Ontario Drinking Water Quality Standards. Na value is derived from O. Reg. 248
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9721443 Elevated RDLs indicate the degree of sample dilutions prior to the analysis to keep analytes within the calibration range, reduce matrix interference and/or to avoid contaminating the instrument.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Nivine Basily

Guideline Violation

AGAT WORK ORDER: 18T411590

PROJECT: 08-019

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CANADA L4Z 1Y2
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FAX (905)712-5122
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CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

ATTENTION TO: Drew West

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
9721443	15535	O.Reg.169/03(mg/L)	Water Quality Assessment - Drinking Water Samples	Sodium	mg/L	20	23.6

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Quality Assurance

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,
PROJECT: 08-019
SAMPLING SITE:

AGAT WORK ORDER: 18T411590
ATTENTION TO: Drew West
SAMPLED BY:

Microbiology Analysis

RPT Date: Nov 26, 2018			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Microbiological Analysis (water)															
Escherichia coli	9721365		NDOGT	NDOGT	NA	< 1									
Total Coliforms	9721365		NDOGT	NDOGT	NA	< 1									

Comments: NDOGT - No Data; Overgrown with Target, refers to over-crowding microbial growth; NA - % RPD Not Applicable

Certified By: Nivine Basily

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Quality Assurance

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

AGAT WORK ORDER: 18T411590

PROJECT: 08-019

ATTENTION TO: Drew West

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Nov 26, 2018			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Water Quality Assessment - Drinking Water Samples															
pH	9717152		7.58	7.56	0.3%	NA	100%	90%	110%						
Alkalinity (as CaCO3)	9717152		95	96	0.5%	< 5	101%	80%	120%						
Electrical Conductivity	9708047		415	417	0.5%	< 2	101%	80%	120%						
Fluoride	9724612		<0.25	<0.25	NA	< 0.05	99%	90%	110%	107%	90%	110%	96%	80%	120%
Chloride	9724612		114	113	0.4%	< 0.10	92%	90%	110%	102%	90%	110%	103%	80%	120%
Nitrate as N	9724612		<0.25	<0.25	NA	< 0.05	94%	90%	110%	104%	90%	110%	105%	80%	120%
Nitrite as N	9724612		<0.25	<0.25	NA	< 0.05	NA	90%	110%	105%	90%	110%	99%	80%	120%
Bromide	9724612		<0.25	<0.25	NA	< 0.05	97%	90%	110%	103%	90%	110%	100%	80%	120%
Sulphate	9724612		28.1	28.1	0.0%	< 0.10	92%	90%	110%	99%	90%	110%	102%	80%	120%
Calcium	9710533		75.1	75.7	0.8%	< 0.05	94%	90%	110%	95%	90%	110%	93%	70%	130%
Magnesium	9710533		29.4	30.0	2.0%	< 0.05	94%	90%	110%	94%	90%	110%	95%	70%	130%
Sodium	9710533		10.7	10.9	1.3%	< 0.05	94%	90%	110%	94%	90%	110%	96%	70%	130%
Potassium	9710533		1.53	1.62	5.5%	< 0.05	98%	90%	110%	98%	90%	110%	98%	70%	130%
Ammonia + Ammonium as N	9723978		0.03	0.03	NA	< 0.02	105%	90%	110%	97%	90%	110%	100%	80%	120%
Ortho Phosphate as P	9724612		<0.50	<0.50	NA	< 0.10	103%	90%	110%	96%	90%	110%	103%	80%	120%
Total Phosphorus	9722590		0.04	0.04	NA	< 0.02	102%	80%	120%	103%	90%	110%	104%	70%	130%
Reactive Silica	9715653		10.3	10.3	0.4%	< 0.05	101%	90%	110%	102%	90%	110%	105%	80%	120%
Total Organic Carbon	9721443	9721443	6.1	5.8	6.1%	< 0.5	98%	90%	110%	98%	90%	110%	99%	80%	120%
Colour	9721443	9721443	19	19	NA	< 5	108%	90%	110%						
Turbidity	9721443	9721443	5.6	5.7	0.9%	< 0.5	101%	90%	110%						
Aluminum	9715602		0.006	0.007	NA	< 0.004	108%	90%	110%	94%	90%	110%	97%	70%	130%
Arsenic	9715602		0.005	0.005	NA	< 0.003	101%	90%	110%	105%	90%	110%	102%	70%	130%
Barium	9715602		0.159	0.158	0.6%	< 0.002	106%	90%	110%	101%	90%	110%	112%	70%	130%
Boron	9715602		0.035	0.040	NA	< 0.010	99%	90%	110%	92%	90%	110%	90%	70%	130%
Cadmium	9715602		<0.001	<0.001	NA	< 0.001	103%	90%	110%	103%	90%	110%	104%	70%	130%
Chromium	9715602		<0.003	<0.003	NA	< 0.003	97%	90%	110%	97%	90%	110%	92%	70%	130%
Copper	9715602		<0.003	<0.003	NA	< 0.003	91%	90%	110%	108%	90%	110%	96%	70%	130%
Iron	9715602		0.649	0.662	2.0%	< 0.010	92%	90%	110%	95%	90%	110%	107%	70%	130%
Lead	9715602		<0.001	<0.001	NA	< 0.001	102%	90%	110%	99%	90%	110%	98%	70%	130%
Manganese	9715602		0.149	0.161	7.4%	< 0.002	101%	90%	110%	101%	90%	110%	96%	70%	130%
Molybdenum	9715602		<0.002	<0.002	NA	< 0.002	108%	90%	110%	93%	90%	110%	100%	70%	130%
Nickel	9715602		<0.003	<0.003	NA	< 0.003	93%	90%	110%	103%	90%	110%	100%	70%	130%
Selenium	9715602		<0.004	<0.004	NA	< 0.004	105%	90%	110%	101%	90%	110%	100%	70%	130%
Silver	9715602		<0.002	<0.002	NA	< 0.002	107%	90%	110%	103%	90%	110%	97%	70%	130%
Strontium	9715602		0.226	0.236	4.2%	< 0.005	108%	90%	110%	99%	90%	110%	100%	70%	130%
Thallium	9715602		<0.006	<0.006	NA	< 0.006	106%	90%	110%	101%	90%	110%	99%	70%	130%
Tin	9715602		<0.002	<0.002	NA	< 0.002	101%	90%	110%	107%	90%	110%	107%	70%	130%
Titanium	9715602		<0.002	<0.002	NA	< 0.002	105%	90%	110%	100%	90%	110%	98%	70%	130%
Uranium	9715602		<0.002	<0.002	NA	< 0.002	106%	90%	110%	101%	90%	110%	106%	70%	130%

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Quality Assurance

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,
PROJECT: 08-019
SAMPLING SITE:

AGAT WORK ORDER: 18T411590
ATTENTION TO: Drew West
SAMPLED BY:

Water Analysis (Continued)

RPT Date: Nov 26, 2018			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Vanadium	9715602		<0.002	<0.002	NA	< 0.002	103%	90%	110%	103%	90%	110%	102%	70%	130%
Zinc	9715602		<0.005	0.006	NA	< 0.005	92%	90%	110%	110%	90%	110%	107%	70%	130%
Total Dissolved Solids	9724612		534	530	0.8%	< 20	102%	80%	120%						

Comments: NA signifies Not Applicable.
Duplicate Qualifier: 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.

Certified By: Nivine Basily

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Method Summary

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,
AGAT WORK ORDER: 18T411590
PROJECT: 08-019
ATTENTION TO: Drew West
SAMPLING SITE:
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration
Total Coliforms	MIC-93-7010	EPA 1604	Membrane Filtration
Water Analysis			
pH	INOR-93-6000	SM 4500-H+ B	PC TITRATE
Alkalinity (as CaCO3)	INOR-93-6000	SM 2320 B	PC TITRATE
Electrical Conductivity	INOR-93-6016	SM 2510 B	EC METER
Fluoride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Calcium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Magnesium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Sodium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Potassium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Ammonia + Ammonium as N	INOR-93-6059	QuikChem 10-107-06-1-J & SM 4500 NH3-F	LACHAT FIA
Ortho Phosphate as P	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Total Phosphorus	INOR-93-6057	QuikChem 10-115-01-3-A & SM 4500-P I	LACHAT FIA
Reactive Silica	INOR-93-6047	SmartChem Method SIL-001-A & SM 4500 Si-F 18 &19th	DISCRETE ANALYZER
Total Organic Carbon	INOR-93-6049	EPA 415.1 & SM 5310	SHIMADZU CARBON ANALYZER
Colour	INOR-93-6046	SM 2120 C	SPECTROPHOTOMETER
Turbidity	INOR-93-6044	SM 2130 B	NEPHELOMETER
Aluminum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Barium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Iron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Manganese	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Selenium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Silver	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Strontium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Thallium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Tin	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Titanium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Uranium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Total Dissolved Solids	INOR-93-6028	SM 2540 C	BALANCE
Total Hardness (as CaCO3)	MET-93-6105	EPA SW-846 6010C & 200.7	CALCULATION

4.3 6-3 4

AGAT Laboratories

Miki

5835 Coopers Avenue
Mississauga, ON
L4Z 1Y2
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Drinking Water Chain of Custody Record

P: 905.712.5100 • F: 905.712.5122 • TF: 1.800.856.6261

Laboratory Use Only

Arrival Condition: ☐ Good ☐ Poor (complete notes)
Arrival Temperature: 3.4 3.2 2.9
AGAT Job Number: 18T411590
Notes:

Client Information

Company: Azimuth Environmental
Contact: Drew West
Address: 642 Welham Road, Barrie, ON
Phone: 705-721-8451 Fax:
PO #:
Client Project #: 08-019
AGAT Quotation #:

Report Information

1. Name: Drew West
Email: drew@azimuthenvironmental.com
2. Name:
Email:

Report Format

☑ Single Sample per page
☐ Multiple Samples per page

Turnaround Time Required (TAT) *

Regular TAT 7 to 14 business days ☑

Rush TAT (Please provide prior notification)
5 to 7 business days ☐
3 to 5 business days ☐
1 to 3 business days ☐
Rush surcharges apply

Date Required (Rush surcharges may apply):

Facility Type (Check all that are applicable)

☐ Large OR ☐ Small
☑ Residential OR ☐ Non-Residential
☐ Municipal OR ☐ Non-Municipal

+ Water Type (Specify in column below)
Raw (R), Treated (TR), Distribution (D), Tap (TP) Private Well (P)

Requirements (Check one)

☐ O. Regulation 170
☐ O. Regulation 243
☐ O. Regulation 318/319
☑ Not Applicable
☐ Other (Please Specify)

IS THIS WATER BEING CONSUMED BY HUMANS? ☑ Yes ☐ No
DO THE RESULTS REQUIRE REPORTING TO THE MOECC'S DWIS OR MOH'S LRMA? ☐ Yes ☑ No

CLIENT IS RESPONSIBLE TO COMPELTE AND SUBMIT LAB SERVICE NOTIFICATION (LSN) FORM TO THE MOECC/PHU. FAILURE TO DO SO MAY DELAY REPORTING.

"NOTIFICATION INFORMATION" MUST BE COMPLETE BELOW UPON SUBMISSION OF SAMPLES. LABORATORY ANALYSIS WILL NOT COMMENCE UNTIL ALL INFORMATION HAS BEEN PROVIDED.

SAMPLE IDENTIFICATION/LOCATION	DATE SAMPLED	TIME SAMPLED	WATER TYPE +	# OF CONTAINERS	CHLORINE RESIDUAL (incl. Units)	STANDING	FLUSHED	COMMENTS/STANDING TIME (IN MINUTES)	Inorganics (Sch. 23)	Organics (Sch. 24)	Lead	Fluoride	Sodium	Turbidity	Nitrate, Nitrite	Trihalomethanes	E.coli, Total Coliforms	WQA (no mercury)	
15535	Nov 19	14:15	R	5													X	X	

Samples Taken By (Print Name and Sign): Drew West [signature]

* TAT is exclusive of weekends and statutory holidays. Prior arrangements must be made with the laboratory in order to submit Microbiology samples on Fridays

NOTIFICATION INFORMATION - (required to report adverse results as per the *Safe Drinking Water Act*) - **Laboratory analysis will not commence until all information is received.**

INFORMATION FOR ADVERSE REPORTING			MEDICAL OFFICER OF HEALTH (MOH)	
Waterworks Name:	Phone:	Fax:	Region:	
MOECC# (ie: Waterworks #):	After Hours Phone:		PHU Contact:	
Contact: See Above	Address/Location (if different from client above)		Phone:	Fax:
Email:			Email:	

Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time
Drew West [signature]	Nov 20/18	[signature]	Nov. 20/18 9:35
[signature]	Nov. 20/18 4:27		

Pink Copy - Client
Yellow/Golden Copy - AGAT
White Copy- AGAT

Page 1 of 1

Nº: DW 52629

Document #: DIV-78-1512.008

Date Revised: December 31, 2015

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CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,
642 WELHAM ROAD
BARRIE, ON L4N9A1
(705) 721-8451

ATTENTION TO: Drew West

PROJECT: 08-019

AGAT WORK ORDER: 18T413981

MICROBIOLOGY ANALYSIS REVIEWED BY: Rocio Morales, Inorganics Lab Supervisor

WATER ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer

DATE REPORTED: Dec 10, 2018

PAGES (INCLUDING COVER): 10

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

AGAT Laboratories

AGAT WORK ORDER: 18T413981

PROJECT: 08-019

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CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

ATTENTION TO: Drew West

SAMPLING SITE:

SAMPLED BY:

Microbiological Analysis (water)

DATE RECEIVED: 2018-11-27

DATE REPORTED: 2018-12-10

			SAMPLE DESCRIPTION:	15586	15609
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2018-11-26	2018-11-26
Parameter	Unit	G / S	RDL	9741763	9741772
Escherichia coli	CFU/100mL		1	NDOGT	NDOGT
Total Coliforms	CFU/100mL		1	NDOGT	NDOGT

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9741763-9741772 NDOGT - No Data; Overgrown with Target, refers to over-crowding microbial growth;

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

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CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

ATTENTION TO: Drew West

SAMPLING SITE:

SAMPLED BY:

Water Quality Assessment - Drinking Water Samples

DATE RECEIVED: 2018-11-27

DATE REPORTED: 2018-12-10

			SAMPLE DESCRIPTION:	15586		15609
			SAMPLE TYPE:	Water		Water
			DATE SAMPLED:	2018-11-26		2018-11-26
Parameter	Unit	G / S	RDL	9741763	RDL	9741772
pH	pH Units		NA	7.78	NA	7.65
Alkalinity (as CaCO3)	mg/L		5	381	5	247
Electrical Conductivity	µS/cm		2	771	2	983
Fluoride	mg/L	1.5	0.10	<0.10	0.25	<0.25
Chloride	mg/L		0.20	10.4	0.50	132
Nitrate as N	mg/L	10.0	0.10	3.36	0.25	3.82
Nitrite as N	mg/L	1.0	0.10	<0.10	0.25	<0.25
Bromide	mg/L		0.10	<0.10	0.25	<0.25
Sulphate	mg/L		0.20	28.7	0.50	48.1
Calcium	mg/L		0.05	126	0.10	101
Magnesium	mg/L		0.05	17.8	0.10	24.7
Sodium	mg/L	20	0.05	4.57	0.10	37.3
Potassium	mg/L		0.05	1.43	0.10	1.05
Ammonia + Ammonium as N	mg/L		0.02	0.05	0.02	0.10
Ortho Phosphate as P	mg/L		0.20	<0.20	0.50	<0.50
Total Phosphorus	mg/L		0.02	<0.02	0.02	<0.02
Reactive Silica	mg/L		0.25	14.4	0.05	14.7
Total Organic Carbon	mg/L		0.5	3.5	0.5	2.7
Colour	Apparent CU		5	6	5	<5
Turbidity	NTU		0.5	1.6	0.5	1.3
Aluminum	mg/L		0.004	0.005	0.004	0.006
Arsenic	mg/L	0.010	0.003	<0.003	0.003	<0.003
Barium	mg/L	1	0.002	0.039	0.002	0.037
Boron	mg/L	5	0.010	<0.010	0.010	0.022
Cadmium	mg/L	0.005	0.001	<0.001	0.001	<0.001
Chromium	mg/L	0.05	0.003	<0.003	0.003	<0.003
Copper	mg/L		0.003	<0.003	0.003	<0.003
Iron	mg/L		0.010	<0.010	0.010	<0.010
Lead	mg/L	0.01	0.001	<0.001	0.001	<0.001
Manganese	mg/L		0.002	0.003	0.002	<0.002

Certified By: Nivine Basily

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 18T413981

PROJECT: 08-019

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CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

ATTENTION TO: Drew West

SAMPLING SITE:

SAMPLED BY:

Water Quality Assessment - Drinking Water Samples

DATE RECEIVED: 2018-11-27

DATE REPORTED: 2018-12-10

			SAMPLE DESCRIPTION:	15586		15609
			SAMPLE TYPE:	Water		Water
			DATE SAMPLED:	2018-11-26		2018-11-26
Parameter	Unit	G / S	RDL	9741763	RDL	9741772
Molybdenum	mg/L		0.002	<0.002	0.002	<0.002
Nickel	mg/L		0.003	<0.003	0.003	<0.003
Selenium	mg/L	0.05	0.004	<0.004	0.004	<0.004
Silver	mg/L		0.002	<0.002	0.002	<0.002
Strontium	mg/L		0.005	0.263	0.005	0.210
Thallium	mg/L		0.006	<0.006	0.006	<0.006
Tin	mg/L		0.002	<0.002	0.002	<0.002
Titanium	mg/L		0.002	<0.002	0.002	<0.002
Uranium	mg/L	0.02	0.002	<0.002	0.002	<0.002
Vanadium	mg/L		0.002	<0.002	0.002	<0.002
Zinc	mg/L		0.005	0.182	0.005	<0.005
Total Dissolved Solids	mg/L		20	398	20	464
Total Hardness (as CaCO3)	mg/L		0.5	388	0.5	354

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Ontario Drinking Water Quality Standards. Na value is derived from O. Reg. 248
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9741763-9741772 Elevated RDLs indicate the degree of sample dilutions prior to the analysis to keep analytes within the calibration range, reduce matrix interference and/or to avoid contaminating the instrument.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Nivine Basily

Guideline Violation

AGAT WORK ORDER: 18T413981

PROJECT: 08-019

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ATTENTION TO: Drew West

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
9741772	15609	O.Reg.169/03(mg/L)	Water Quality Assessment - Drinking Water Samples	Sodium	mg/L	20	37.3

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Quality Assurance

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,

AGAT WORK ORDER: 18T413981

PROJECT: 08-019

ATTENTION TO: Drew West

SAMPLING SITE:

SAMPLED BY:

Microbiology Analysis

RPT Date: Dec 10, 2018			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Microbiological Analysis (water)															
Escherichia coli	9741763	9741763	NDOGT	NDOGT	NA	< 1									
Total Coliforms	9741763	9741763	NDOGT	NDOGT	NA	< 1									

Comments: NDOGT - No Data; Overgrown with Target, refers to over-crowding microbial growth; NA - % RPD Not Applicable

Certified By:

AGAT Laboratories

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Quality Assurance

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING, | AGAT WORK ORDER: 18T413981

PROJECT: 08-019 | ATTENTION TO: Drew West

SAMPLING SITE: | SAMPLED BY:

Water Analysis

RPT Date: Dec 10, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Water Quality Assessment - Drinking Water Samples															
pH	9746084		5.75	5.72	0.5%	NA	99%	90%	110%						
Alkalinity (as CaCO3)	9746084		<5	<5	NA	< 5	103%	80%	120%						
Electrical Conductivity	9745152		1219	1224	0.4%	< 2	103%	80%	120%						
Fluoride	9741772	9741772	<0.25	<0.25	NA	< 0.05	100%	90%	110%	103%	90%	110%	106%	80%	120%
Chloride	9741772	9741772	132	132	0.0%	< 0.10	95%	90%	110%	100%	90%	110%	101%	80%	120%
Nitrate as N	9741772	9741772	3.82	3.80	0.6%	< 0.05	93%	90%	110%	103%	90%	110%	108%	80%	120%
Nitrite as N	9741772	9741772	<0.25	<0.25	NA	< 0.05	NA	90%	110%	99%	90%	110%	103%	80%	120%
Bromide	9741772	9741772	<0.25	<0.25	NA	< 0.05	107%	90%	110%	98%	90%	110%	106%	80%	120%
Sulphate	9741772	9741772	48.1	47.9	0.4%	< 0.10	95%	90%	110%	99%	90%	110%	105%	80%	120%
Calcium	9742750		98.4	99.1	0.7%	< 0.05	99%	90%	110%	99%	90%	110%	94%	70%	130%
Magnesium	9742750		12.0	11.9	0.7%	< 0.05	93%	90%	110%	94%	90%	110%	93%	70%	130%
Sodium	9742750		4.51	4.50	0.2%	< 0.05	93%	90%	110%	93%	90%	110%	93%	70%	130%
Potassium	9742750		2.81	2.75	2.1%	< 0.05	92%	90%	110%	92%	90%	110%	94%	70%	130%
Ammonia + Ammonium as N	9739178		0.09	0.09	NA	< 0.02	102%	90%	110%	106%	90%	110%	96%	80%	120%
Ortho Phosphate as P	9741772	9741772	<0.50	<0.50	NA	< 0.10	109%	90%	110%	100%	90%	110%	100%	80%	120%
Total Phosphorus	9741763	9741763	<0.02	<0.02	NA	< 0.02	101%	80%	120%	95%	90%	110%	100%	70%	130%
Reactive Silica	9741763	9741763	14.4	14.6	1.5%	< 0.05	99%	90%	110%	101%	90%	110%	108%	80%	120%
Total Organic Carbon	9741763	9741763	3.5	3.3	5.6%	< 0.5	98%	90%	110%	96%	90%	110%	91%	80%	120%
Colour	9741763	9741763	6	6	NA	< 5	107%	90%	110%						
Turbidity	9737324		3180	3240	1.9%	< 0.5	98%	90%	110%						
Aluminum	9741763	9741763	0.005	0.005	NA	< 0.004	103%	90%	110%	95%	90%	110%	90%	70%	130%
Arsenic	9741763	9741763	<0.003	<0.003	NA	< 0.003	97%	90%	110%	94%	90%	110%	112%	70%	130%
Barium	9741763	9741763	0.039	0.035	10.8%	< 0.002	105%	90%	110%	100%	90%	110%	99%	70%	130%
Boron	9741763	9741763	<0.010	<0.010	NA	< 0.010	103%	90%	110%	100%	90%	110%	83%	70%	130%
Cadmium	9741763	9741763	<0.001	<0.001	NA	< 0.001	102%	90%	110%	99%	90%	110%	103%	70%	130%
Chromium	9741763	9741763	<0.003	<0.003	NA	< 0.003	100%	90%	110%	101%	90%	110%	88%	70%	130%
Copper	9741763	9741763	<0.003	<0.003	NA	< 0.003	99%	90%	110%	104%	90%	110%	91%	70%	130%
Iron	9741763	9741763	<0.010	<0.010	NA	< 0.010	90%	90%	110%	97%	90%	110%	97%	70%	130%
Lead	9741763	9741763	<0.001	<0.001	NA	< 0.001	103%	90%	110%	104%	90%	110%	95%	70%	130%
Manganese	9741763	9741763	0.003	0.003	NA	< 0.002	97%	90%	110%	96%	90%	110%	88%	70%	130%
Molybdenum	9741763	9741763	<0.002	<0.002	NA	< 0.002	98%	90%	110%	93%	90%	110%	110%	70%	130%
Nickel	9741763	9741763	<0.003	<0.003	NA	< 0.003	93%	90%	110%	94%	90%	110%	83%	70%	130%
Selenium	9741763	9741763	<0.004	<0.004	NA	< 0.004	107%	90%	110%	97%	90%	110%	115%	70%	130%
Silver	9741763	9741763	<0.002	<0.002	NA	< 0.002	100%	90%	110%	104%	90%	110%	98%	70%	130%
Strontium	9741763	9741763	0.263	0.247	6.3%	< 0.005	96%	90%	110%	92%	90%	110%	93%	70%	130%
Thallium	9741763	9741763	<0.006	<0.006	NA	< 0.006	102%	90%	110%	100%	90%	110%	93%	70%	130%
Tin	9741763	9741763	<0.002	<0.002	NA	< 0.002	104%	90%	110%	105%	90%	110%	103%	70%	130%
Titanium	9741763	9741763	<0.002	<0.002	NA	< 0.002	96%	90%	110%	96%	90%	110%	96%	70%	130%
Uranium	9741763	9741763	<0.002	<0.002	NA	< 0.002	93%	90%	110%	94%	90%	110%	94%	70%	130%

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Quality Assurance

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,
PROJECT: 08-019
SAMPLING SITE:

AGAT WORK ORDER: 18T413981
ATTENTION TO: Drew West
SAMPLED BY:

Water Analysis (Continued)

RPT Date: Dec 10, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Vanadium	9741763	9741763	<0.002	<0.002	NA	< 0.002	98%	90%	110%	97%	90%	110%	96%	70%	130%
Zinc	9741763	9741763	0.182	0.186	1.9%	< 0.005	99%	90%	110%	99%	90%	110%	95%	70%	130%
Total Dissolved Solids	9747778		348	356	2.3%	< 20	98%	80%	120%						

Comments: NA signifies Not Applicable.
Duplicate Qualifier: 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.

Certified By: Nivine Basily

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Method Summary

CLIENT NAME: AZIMUTH ENVIRONMENTAL CONSULTING,
PROJECT: 08-019
SAMPLING SITE:

AGAT WORK ORDER: 18T413981
ATTENTION TO: Drew West
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration
Total Coliforms	MIC-93-7010	EPA 1604	Membrane Filtration
Water Analysis			
pH	INOR-93-6000	SM 4500-H+ B	PC TITRATE
Alkalinity (as CaCO3)	INOR-93-6000	SM 2320 B	PC TITRATE
Electrical Conductivity	INOR-93-6016	SM 2510 B	EC METER
Fluoride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Calcium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Magnesium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Sodium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Potassium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Ammonia + Ammonium as N	INOR-93-6059	QuikChem 10-107-06-1-J & SM 4500 NH3-F	LACHAT FIA
Ortho Phosphate as P	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Total Phosphorus	INOR-93-6057	QuikChem 10-115-01-3-A & SM 4500-P I	LACHAT FIA
Reactive Silica	INOR-93-6047	SmartChem Method SIL-001-A & SM 4500 Si-F 18 &19th	DISCRETE ANALYZER
Total Organic Carbon	INOR-93-6049	EPA 415.1 & SM 5310	SHIMADZU CARBON ANALYZER
Colour	INOR-93-6046	SM 2120 C	SPECTROPHOTOMETER
Turbidity	INOR-93-6044	SM 2130 B	NEPHELOMETER
Aluminum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Barium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Iron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Manganese	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Selenium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Silver	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Strontium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Thallium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Tin	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Titanium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Uranium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Total Dissolved Solids	INOR-93-6028	SM 2540 C	BALANCE
Total Hardness (as CaCO3)	MET-93-6105	EPA SW-846 6010C & 200.7	CALCULATION

42. 4. 38

AGAT Laboratories

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Drinking Water Chain of Custody Record

Laboratory Use Only

Arrival Condition: ☐ Good ☐ Poor (complete notes)
Arrival Temperature: 3.5 . 3.1 . 2.8
AGAT Job Number: 18T413981
Notes:

Client Information

Company: Azimuth Environmental
Contact: Drew West
Address: 642 Welham Road, Barrie, ON
Phone: 705-721-8451 Fax:
PO #:
Client Project #: 08-019
AGAT Quotation #:

Report Information

1. Name: Drew West
   Email: drew@azimuthenvironmental.com
2. Name:
   Email:

Report Format

☐ Single Sample per page
☑ Multiple Samples per page

Turnaround Time Required (TAT) *

Regular TAT 7 to 14 business days ☑

Rush TAT (Please provide prior notification)
- 5 to 7 business days ☐
- 3 to 5 business days ☐
- 1 to 3 business days ☐

Rush surcharges apply

Date Required (Rush surcharges may apply):

Facility Type *(Check all that are applicable)*

☐ Large OR ☐ Small
☑ Residential OR ☐ Non-Residential
☐ Municipal OR ☐ Non-Municipal

+ Water Type *(Specify in column below)*
Raw (R), Treated (TR), Distribution (D), Tap (TP), Private Well (P)

Requirements *(Check one)*

☐ O. Regulation 170 ☑ Not Applicable
☐ O. Regulation 243 ☐ Other *(Please Specify)*
☐ O. Regulation 318/319

IS THIS WATER BEING CONSUMED BY HUMANS? ☑ Yes ☐ No
DO THE RESULTS REQUIRE REPORTING TO THE MOECC'S DWIS OR MOH'S LRMA? ☐ Yes ☑ No
CLIENT IS RESPONSIBLE TO COMPELTE AND SUBMIT LAB SERVICE NOTIFICATION (LSN) FORM TO THE MOECC/PHU. FAILURE TO DO SO MAY DELAY REPORTING.
NOTIFICATION INFORMATION MUST BE COMPLETE BELOW UPON SUBMISSION OF SAMPLES. LABORATORY ANALYSIS WILL NOT COMMENCE UNTIL ALL INFORMATION HAS BEEN PROVIDED.

SAMPLE IDENTIFICATION/LOCATION	DATE SAMPLED	TIME SAMPLED	WATER TYPE +	# OF CONTAINERS	CHLORINE RESIDUAL (incl. Units)	STANDING	FLUSHED	COMMENTS/STANDING TIME (IN MINUTES)	Inorganics (Sch. 23)	Organics (Sch. 24)	Lead	Fluoride	Sodium	Turbidity	Nitrate, Nitrite	Trihalomethanes	E.coli, Total Coliforms	WQA (no mercury)
15586	Nov 26	12:00	R	5													X	X
15609	Nov 26	12:30	R	5													X	X

Samples Taken By (Print Name and Sign): Drew West [signature]

* TAT is exclusive of weekends and statutory holidays. Prior arrangements must be made with the laboratory in order to submit Microbiology samples on Fridays

NOTIFICATION INFORMATION - (required to report adverse results as per the *Safe Drinking Water Act*) - **Laboratory analysis will not commence until all information is received.**

INFORMATION FOR ADVERSE REPORTING

Waterworks Name: Phone: Fax:
MOECC# (ie: Waterworks #): After Hours Phone:
Contact: See Above Address/Location (if different from client above)
Email:

MEDICAL OFFICER OF HEALTH (MOH)

Region:
PHU Contact:
Phone: Fax:
Email:

Samples Relinquished By (Print Name and Sign)	Date/Time	Samples Received By (Print Name and Sign)	Date/Time
Drew West [signature]	Nov 27/18	[signature]	Nov.27/18 9:27
[signature]	Nov. 27/18 4:48		

Pink Copy - Client
Yellow/Golden Copy - AGAT
White Copy- AGAT

Page 1 of 1

Nº: DW 52630

APPENDIX E

Proposed Monitoring Program

Category and Type of Monitoring	Description	Location	Parameters	Threshold	Mitigation
Design Phase					
Surface Water - Baseline Water Quality Sampling	1 year semi annual sampling (spring/fall)	Wetlands 6, 7 & 8	Nitrate, Nitrite, Total Ammonia, Total Phosphorus	N/A	N/A
Surface Water - Wetland Water Level Monitoring	Continuous Monitoring (Apr - Oct)	Wetlands 5, 6, 7, 8 &10	N/A	N/A	N/A
Ground Water - Baseline Water Quality Sampling	1 year semi annual sampling (spring/fall)	MW3-I, MW5-I	Nitrate, Nitrite, Total Ammonia, Total Phosphorus	N/A	N/A
Ground Water - Ground Water Level Monitoring - Onsite	Continuous Monitoring	All Existing MW's	N/A	N/A	N/A
Ground Water - Ground Water Level Monitoring - Residential Wells	Continuous Monitoring	15609 Mount Pleasant Road 15586 Mount Pleasant Road	N/A	N/A	N/A
Construction Phase					
Surface Water - Wetland Water Level Monitoring	Continuous Monitoring (Apr - Oct)	Wetlands 5, 6, 7, 8 & 10	N/A	N/A	N/A
Ground Water - Ground Water Level Monitoring - Onsite	Continuous Monitoring	All Existing MW's	N/A	N/A	N/A
Ground Water - Ground Water Level Monitoring - Residential Wells	Continuous Monitoring	15609 Mount Pleasant Road 15586 Mount Pleasant Road	N/A	N/A	If well complaint is received a field inspection will be completed by Azimuth staff.
Post Construction Following Assumption					
Surface Water - Water Quality Sampling	Semi Annual (spring/fall) for 4 years	Wetlands 6, 7 & 8	Nitrate, Nitrite, Total Ammonia, Total Phosphorus	Three consecutive concentrations above highest level in pre-construction results	Field inspection of upgradient septic bed(s) and overland pathways
Surface Water - Wetland Water Level Monitoring	Continuous (1 year - Apr to Oct)	Wetlands 5, 6, 7, 8 & 10	N/A	N/A	N/A
Ground Water - Water Quality Sampling	Semi Annual (spring/fall) for 4 years	MW3-I, MW5-I	Nitrate, Nitrite, Total Ammonia, Total Phosphorus	Three consecutive concentrations above highest level in pre-construction results	Field inspection of upgradient septic bed(s) and overland pathways
Ground Water - Ground Water Level Monitoring - Onsite	Continuous (1 year)	All Existing MW's	N/A	N/A	N/A
Ground Water - Ground Water Level Monitoring - Residential Wells	Continuous (1 year)	15609 Mount Pleasant Road 15586 Mount Pleasant Road	N/A	N/A	If well complaint is received a field inspection will be completed by Azimuth staff.

APPENDIX F

Water Balance Tables

TABLE A: Wetland 10 - Features Based Water Balance Summary

Pre-development Runoff & Infiltration

		1983	1984	1985	1986	1987	1988	1989	1990	1991
runoff	spring	4417.3	3172.3	3158.5	2805.1	2743.7	1733.8	2867.6	3885.0	1490.6
	summer	980.4	521.4	2005.0	3392.6	378.8	155.0	2053.5	960.7	35.1
	fall	2490.3	2480.2	4291.5	4916.0	3398.0	4604.2	3769.6	4606.4	2091.4
	winter	3984.0	4029.1	4979.4	3263.8	2927.4	3822.9	3210.9	4595.4	2715.5
	annual	11871.9	10203.0	14434.3	14377.5	9447.9	10316.0	11901.5	14047.5	6332.7
infiltration	spring	2944.8	2114.9	2105.6	1870.1	1829.1	1155.9	1911.7	2590.0	993.7
	summer	653.6	347.6	1336.6	2261.7	252.5	103.4	1369.0	640.5	23.4
	fall	1660.2	1653.5	2861.0	3277.3	2265.3	3069.5	2513.0	3070.9	1394.3
	winter	2656.0	2686.1	3319.6	2175.9	1951.6	2548.6	2140.6	3063.6	1810.4
	annual	7914.6	6802.0	9622.9	9585.0	6298.6	6877.3	7934.3	9365.0	4221.8
	total	19786.5	17005.0	24057.2	23962.5	15746.5	17193.3	19835.8	23412.5	10554.5

		1992	1993	1994	1995	1996	1997	1998	1999	2000
runoff	spring	3392.5	1992.1	3109.4	3123.3	4077.1	3246.3	3374.8	1968.9	3955.3
	summer	3229.3	1351.9	105.1	40.3	2960.2	1096.0	1139.9	1014.7	3655.7
	fall	4998.3	1957.0	2149.8	4860.2	3514.7	2470.2	754.7	2923.9	2222.7
	winter	3331.6	3599.1	2956.2	4051.6	4560.1	4051.5	3422.5	4615.3	3944.8
	annual	14951.7	8900.1	8320.4	12075.4	15112.1	10864.0	8692.0	10522.8	13778.6
infiltration	spring	2261.7	1328.0	2072.9	2082.2	2718.1	2164.2	2249.9	1312.6	2636.9
	summer	2152.9	901.3	70.0	26.8	1973.5	730.7	760.0	676.5	2437.1
	fall	3332.2	1304.7	1433.2	3240.2	2343.1	1646.8	503.1	1949.3	1481.8
	winter	2221.1	2399.4	1970.8	2701.0	3040.0	2701.0	2281.7	3076.9	2629.9
	annual	9967.8	5933.4	5546.9	8050.3	10074.7	7242.7	5794.7	7015.2	9185.7
	total	24919.5	14833.4	13867.3	20125.7	25186.8	18106.7	14486.7	17538.1	22964.3

All values in cubic meters

		2001	2002	2003	2004	2005	2006	2007	2008	2009
runoff	spring	2269.0	4486.0	2048.9	4344.3	2905.1	3999.3	2790.6	4324.2	3388.5
	summer	1120.5	1039.7	1217.8	924.9	2974.1	982.1	0.0	699.5	1865.3
	fall	4293.8	2418.0	4591.0	2061.2	3356.5	4080.5	1920.8	2396.4	2428.0
	winter	3187.9	2130.4	3995.4	4508.5	5427.8	6676.8	6032.2	10877.1	5169.9
	annual	10871.2	10074.1	11853.0	11838.9	14663.5	15738.7	10743.5	18297.1	12851.8
infiltration	spring	1512.6	2990.7	1365.9	2896.2	1936.7	2666.2	1860.4	2882.8	2259.0
	summer	747.0	693.1	811.9	616.6	1982.7	654.7	0.0	466.3	1243.6
	fall	2862.6	1612.0	3060.7	1374.1	2237.7	2720.3	1280.5	1597.6	1618.7
	winter	2125.3	1420.3	2663.6	3005.7	3618.5	4451.2	4021.4	7251.4	3446.6
	annual	7247.5	6716.1	7902.0	7892.6	9775.7	10492.5	7162.3	12198.1	8567.9
	total	18118.7	16790.2	19755.1	19731.4	24439.2	26231.2	17905.9	30495.2	21419.7

All values in cubic meters

		2010	2011	2012	2013	2014	2015	Average
runoff	spring	3791.5	5155.7	1513.2	3935.4	1934.8	1819.3	3127.9
	summer	3387.2	755.0	1292.8	2069.2	2339.0	1458.4	1430.3
	fall	3200.0	3048.7	3998.1	3144.2	2625.2	2781.9	3177.1
	winter	4094.1	6023.9	3191.6	4832.5	3674.7	3635.9	4288.5
	annual	14472.9	14983.3	9995.8	13981.3	10573.7	9695.5	12023.7
infiltration	spring	2527.7	3437.1	1008.8	2623.6	1289.8	1212.9	2085.2
	summer	2258.2	503.3	861.9	1379.5	1559.3	972.2	953.6
	fall	2133.4	2032.5	2665.4	2096.1	1750.1	1854.6	2118.0
	winter	2729.4	4015.9	2127.8	3221.7	2449.8	2423.9	2859.0
	annual	9648.6	9988.9	6663.8	9320.9	7049.1	6463.6	8015.8
	total	24121.5	24972.1	16659.6	23302.2	17622.8	16159.1	20039.6

All values in cubic meters

TABLE B: Wetland 10 - Features Based Water Balance Summary

Post-Development Runoff & Infiltration

		1983	1984	1985	1986	1987	1988	1989	1990	1991
runoff to wetland	spring	2408.9	1729.9	1722.4	1529.7	1496.2	945.5	1563.7	2118.6	812.8
	summer	534.6	284.3	1093.4	1850.1	206.6	84.5	1119.8	523.9	19.2
	fall	1358.0	1352.5	2340.3	2680.8	1853.0	2510.8	2055.6	2512.0	1140.5
	winter	2172.6	2197.2	2715.4	1779.9	1596.4	2084.7	1751.0	2506.0	1480.9
	annual to bioretention facility	1317.2	1132.1	1601.5	1595.2	1048.3	1144.6	1320.5	1558.6	702.6
	annual to wetland	6474.1	5563.9	7871.4	7840.4	5152.2	5625.6	6490.2	7660.5	3453.4
	annual total	7791.3	6696.0	9472.9	9435.7	6200.5	6770.2	7810.7	9219.1	4156.0
infiltration	spring	1605.9	1153.3	1148.3	1019.8	997.5	630.3	1042.5	1412.4	541.9
	summer	356.4	189.5	728.9	1233.4	137.7	56.4	746.5	349.3	12.8
	fall	905.4	901.7	1560.2	1787.2	1235.3	1673.9	1370.4	1674.7	760.3
	winter	1448.4	1464.8	1810.3	1186.6	1064.3	1389.8	1167.3	1670.7	987.2
	annual	4316.0	3709.3	5247.6	5226.9	3434.8	3750.4	4326.8	5107.0	2302.3
	total	10790.1	9273.2	13119.0	13067.4	8587.0	9376.0	10817.0	12767.4	5755.6

		1992	1993	1994	1995	1996	1997	1998	1999	2000
runoff to wetland	spring	1850.0	1086.3	1695.6	1703.2	2223.4	1770.3	1840.4	1073.7	2156.9
	summer	1761.0	737.2	57.3	22.0	1614.3	597.7	621.6	553.4	1993.5
	fall	2725.7	1067.2	1172.3	2650.4	1916.6	1347.0	411.5	1594.5	1212.1
	winter	1816.8	1962.7	1612.1	2209.4	2486.7	2209.4	1866.4	2516.9	2151.2
	annual to bioretention facility	1658.9	987.5	923.2	1339.8	1676.7	1205.4	964.4	1167.5	1528.8
	annual to wetland	8153.6	4853.4	4537.3	6585.0	8241.0	5924.4	4740.0	5738.4	7513.8
	annual total	9812.5	5840.9	5460.5	7924.8	9917.8	7129.8	5704.4	6905.9	9042.6
infiltration	spring	1233.3	724.2	1130.4	1135.5	1482.2	1180.2	1226.9	715.8	1438.0
	summer	1174.0	491.5	38.2	14.6	1076.2	398.5	414.4	368.9	1329.0
	fall	1817.1	711.5	781.6	1766.9	1277.8	898.0	274.4	1063.0	808.1
	winter	1211.2	1308.4	1074.7	1473.0	1657.8	1472.9	1244.3	1677.9	1434.1
	annual	5435.7	3235.6	3024.9	4390.0	5494.0	3949.6	3160.0	3825.6	5009.2
	total	13589.3	8089.1	7562.2	10975.0	13735.0	9874.0	7900.0	9564.0	12523.0

All values in cubic meters

		2001	2002	2003	2004	2005	2006	2007	2008	2009
runoff to wetland	spring	1237.3	2446.3	1117.3	2369.1	1584.2	2180.9	1521.8	2358.1	1847.9
	summer	611.0	567.0	664.1	504.4	1621.9	535.6	0.0	381.4	1017.2
	fall	2341.5	1318.6	2503.6	1124.0	1830.4	2225.2	1047.4	1306.8	1324.1
	winter	1738.4	1161.8	2178.8	2458.6	2959.9	3641.0	3289.5	5931.5	2819.3
	annual to bioretention facility	1206.2	1117.8	1315.1	1313.6	1627.0	1746.3	1192.0	2030.1	1426.0
	annual to wetland	5928.3	5493.7	6463.8	6456.0	7996.4	8582.7	5858.7	9977.9	7008.4
	annual total	7134.5	6611.4	7778.9	7769.6	9623.4	10329.0	7050.7	12008.0	8434.4
infiltration	spring	824.9	1630.9	744.9	1579.4	1056.1	1453.9	1014.5	1572.1	1231.9
	summer	407.4	378.0	442.7	336.3	1081.2	357.1	0.0	254.3	678.1
	fall	1561.0	879.1	1669.1	749.3	1220.3	1483.5	698.3	871.2	882.7
	winter	1159.0	774.5	1452.5	1639.1	1973.3	2427.3	2193.0	3954.4	1879.5
	annual	3952.2	3662.4	4309.2	4304.0	5330.9	5721.8	3905.8	6651.9	4672.3
	total	9880.6	9156.1	10773.0	10760.1	13327.3	14304.5	9764.5	16629.8	11680.7

		2010	2011	2012	2013	2014	2015	Average
runoff to wetland	spring	2067.6	2811.5	825.2	2146.1	1055.1	992.1	1584.6
	summer	1847.2	411.7	705.0	1128.4	1275.5	795.3	739.2
	fall	1745.1	1662.5	2180.3	1714.6	1431.6	1517.0	1585.1
	winter	2232.6	3285.0	1740.5	2635.3	2003.9	1982.8	2136.4
	annual to bioretention facility	1605.8	1662.5	1109.1	1551.3	1173.2	1075.7	1941.6
	annual to wetland	7892.4	8170.8	5451.0	7624.4	5766.1	5287.2	7385.4
	annual total	9498.3	9833.2	6560.0	9175.7	6939.3	6362.9	7890.9
infiltration	spring	1378.4	1874.4	550.1	1430.7	703.4	661.4	1323.1
	summer	1231.4	274.5	470.0	752.3	850.3	530.2	805.3
	fall	1163.4	1108.3	1453.5	1143.1	954.4	1011.3	1048.1
	winter	1488.4	2190.0	1160.3	1756.9	1336.0	1321.8	1582.6
	annual	5261.6	5447.2	3634.0	5082.9	3844.1	3524.8	4057.9
	total	13154.1	13617.9	9084.9	12707.3	9610.2	8812.0	8895.3

All values in cubic meters

TABLE C: Wetland 10 - Features Based Water Balance Summary

Change in Runoff to the Wetland and Infiltration (Negative = loss from pre-development)

		1983	1984	1985	1986	1987	1988	1989	1990	1991
runoff	spring	-2,008	-1,442	-1,436	-1,275	-1,247	-788	-1,304	-1,766	-678
	summer	-446	-237	-912	-1,543	-172	-70	-934	-437	-16
	fall	-1,132	-1,128	-1,951	-2,235	-1,545	-2,093	-1,714	-2,094	-951
	winter	-1,811	-1,832	-2,264	-1,484	-1,331	-1,738	-1,460	-2,089	-1,235
	annual to wetland	-5,398	-4,639	-6,563	-6,537	-4,296	-4,690	-5,411	-6,387	-2,879
	percent change to wetland	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%
	annual to bioretention facility	1,317	1,132	1,602	1,595	1,048	1,145	1,321	1,559	703
infiltration	spring	-1,339	-962	-957	-850	-832	-526	-869	-1,178	-452
	summer	-297	-158	-608	-1,028	-115	-47	-622	-291	-11
	fall	-755	-752	-1,301	-1,490	-1,030	-1,396	-1,143	-1,396	-634
	winter	-1,208	-1,221	-1,509	-989	-887	-1,159	-973	-1,393	-823
	annual	-3,599	-3,093	-4,375	-4,358	-2,864	-3,127	-3,608	-4,258	-1,920
	annual mitigation	254	199	305	358	210	209	280	305	117
	percent change	-42.3%	-42.5%	-42.3%	-41.7%	-42.1%	-42.4%	-41.9%	-42.2%	-42.7%

All values in cubic meters

		1992	1993	1994	1995	1996	1997	1998	1999	2000
runoff	spring	-1,542	-906	-1,414	-1,420	-1,854	-1,476	-1,534	-895	-1,798
	summer	-1,468	-615	-48	-18	-1,346	-498	-518	-461	-1,662
	fall	-2,273	-890	-977	-2,210	-1,598	-1,123	-343	-1,329	-1,011
	winter	-1,515	-1,636	-1,344	-1,842	-2,073	-1,842	-1,556	-2,098	-1,794
	annual to wetland	-6,798	-4,047	-3,783	-5,490	-6,871	-4,940	-3,952	-4,784	-6,265
	percent change to wetland	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%
	annual to bioretention facility	1,659	987	923	1,340	1,677	1,205	964	1,168	1,529
infiltration	spring	-1,028	-604	-942	-947	-1,236	-984	-1,023	-597	-1,199
	summer	-979	-410	-32	-12	-897	-332	-346	-308	-1,108
	fall	-1,515	-593	-652	-1,473	-1,065	-749	-229	-886	-674
	winter	-1,010	-1,091	-896	-1,228	-1,382	-1,228	-1,037	-1,399	-1,196
	annual	-4,532	-2,698	-2,522	-3,660	-4,581	-3,293	-2,635	-3,190	-4,177
	annual mitigation	374	171	173	259	340	220	170	190	317
	percent change	-41.7%	-42.6%	-42.4%	-42.3%	-42.1%	-42.4%	-42.5%	-42.8%	-42.0%

		2001	2002	2003	2004	2005	2006	2007	2008	2009
runoff	spring	-1,032	-2,040	-932	-1,975	-1,321	-1,818	-1,269	-1,966	-1,541
	summer	-509	-473	-554	-421	-1,352	-447	0	-318	-848
	fall	-1,952	-1,099	-2,087	-937	-1,526	-1,855	-873	-1,090	-1,104
	winter	-1,449	-969	-1,817	-2,050	-2,468	-3,036	-2,743	-4,946	-2,351
	annual to wetland	-4,943	-4,580	-5,389	-5,383	-6,667	-7,156	-4,885	-8,319	-5,843
	percent change to wetland	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%
	annual to bioretention facility	1,206	1,118	1,315	1,314	1,627	1,746	1,192	2,030	1,426
infiltration	spring	-688	-1,360	-621	-1,317	-881	-1,212	-846	-1,311	-1,027
	summer	-340	-315	-369	-280	-901	-298	0	-212	-565
	fall	-1,302	-733	-1,392	-625	-1,017	-1,237	-582	-726	-736
	winter	-966	-646	-1,211	-1,367	-1,645	-2,024	-1,828	-3,297	-1,567
	annual	-3,295	-3,054	-3,593	-3,589	-4,445	-4,771	-3,257	-5,546	-3,896
	annual mitigation	248	256	253	236	298	292	152	239	248
	percent change	-42.1%	-41.7%	-42.3%	-42.5%	-42.4%	-42.7%	-43.3%	-43.5%	-42.6%

		2010	2011	2012	2013	2014	2015	Average
runoff	spring	-1,724	-2,344	-688	-1,789	-880	-827	-1,422
	summer	-1,540	-343	-588	-941	-1,063	-663	-650
	fall	-1,455	-1,386	-1,818	-1,430	-1,194	-1,265	-1,445
	winter	-1,861	-2,739	-1,451	-2,197	-1,671	-1,653	-1,950
	annual to wetland	-6,580	-6,813	-4,545	-6,357	-4,808	-4,408	-5,467
	percent change to wetland	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%	-45.5%
	annual to bioretention facility	1,606	1,662	1,109	1,551	1,173	1,076	1,334
infiltration	spring	-1,149	-1,563	-459	-1,193	-586	-551	-948
	summer	-1,027	-229	-392	-627	-709	-442	-434
	fall	-970	-924	-1,212	-953	-796	-843	-963
	winter	-1,241	-1,826	-967	-1,465	-1,114	-1,102	-1,300
	annual	-4,387	-4,542	-3,030	-4,238	-3,205	-2,939	-3,645
	annual mitigation	334	289	219	295	222	195	249
	percent change	-42.0%	-42.6%	-42.2%	-42.3%	-42.3%	-42.4%	-42.4%

All values in cubic meters (except where shown as percentages)

winter= Dec, Jan, Feb

spring= Mar, Apr, May

summer= Jun, Jul, Aug

fall = Sep, Oct Nov

TABLE D: Orangeville MET
Period of Record (1983-2015)
Weekly Surplus - Determined from Daily Thornthwaite-Mather method

Year	Day	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Jan	1	5.0	13.8	5.8	11.0	19.0	6.0	18.6	14.4	10.0	5.0	41.4	25.0	27.0	1.0	27.0	60.2	39.0	20.1	7.5	1.0	14.0
Jan	8	23.8	6.2	1.0	2.0	15.4	0.0	6.4	7.0	20.0	20.0	19.5	0.0	34.2	4.0	20.0	29.0	42.5	14.5	0.0	7.5	7.0
Jan	15	1.0	1.0	42.5	10.8	17.4	24.2	6.0	20.6	0.2	9.5	7.0	13.0	52.9	33.8	11.5	14.5	14.0	6.0	0.0	8.0	1.5
Jan	22	4.0	19.5	10.5	4.8	6.6	7.6	10.0	15.2	10.0	8.0	6.0	31.0	2.0	23.0	23.0	13.5	30.0	2.5	4.0	-1.2	6.5
Feb	29	25.6	4.0	4.5	22.2	16.0	45.0	8.0	14.0	4.0	1.0	12.0	2.0	0.0	5.0	13.0	12.0	6.5	7.0	4.0	18.0	15.0
Feb	36	5.0	7.2	19.0	29.0	8.0	28.0	18.0	3.0	2.0	2.0	3.0	2.0	11.0	15.8	1.0	2.0	7.5	7.0	41.0	0.0	8.0
Feb	43	1.0	31.8	52.0	10.6	0.0	9.0	4.0	17.2	16.5	24.2	9.0	3.0	4.0	2.0	16.0	24.8	9.6	15.7	5.0	5.0	5.5
Feb	50	4.4	6.2	36.4	3.9	0.0	18.2	15.6	25.0	11.0	17.0	22.0	11.0	4.2	19.0	44.8	0.0	3.0	26.4	20.0	24.6	22.0
Mar	57	12.2	26.5	20.5	2.8	25.3	6.8	6.0	4.0	6.0	2.0	17.0	0.0	5.0	17.0	11.8	15.2	22.0	-0.2	8.0	25.1	11.0
Mar	64	3.9	16.5	12.6	27.0	0.0	2.0	0.0	33.0	2.0	37.2	3.0	9.0	1.0	18.0	27.0	36.0	7.5	-2.4	17.0	23.0	1.3
Mar	71	9.9	31.6	11.6	28.4	0.0	5.0	44.0	-7.3	11.8	1.0	10.0	6.0	-7.2	0.0	14.0	39.0	0.0	4.0	6.0	-0.3	0.0
Mar	78	23.5	23.2	7.0	1.1	7.1	11.2	2.0	22.4	8.4	2.0	3.0	11.5	-1.2	28.0	27.0	29.0	0.0	10.0	0.0	5.0	2.5
Mar	85	10.0	0.5	44.0	-9.6	40.4	8.0	2.1	6.2	3.8	7.1	-1.3	8.0	-1.6	6.8	9.6	-2.1	-2.8	14.1	0.0	13.1	17.1
Apr	92	18.2	12.5	17.6	3.7	51.1	13.2	25.1	9.9	5.3	-1.0	1.9	8.0	7.6	16.0	-3.1	2.9	6.9	5.1	13.8	37.0	14.5
Apr	99	45.4	5.1	1.3	17.1	3.3	-0.6	7.3	20.2	7.9	27.6	10.1	8.1	1.1	14.6	9.0	-6.7	-3.6	10.1	6.9	10.3	-7.6
Apr	106	-0.4	5.9	-3.9	18.8	-16.1	9.5	-0.1	4.8	11.8	43.0	17.2	-6.7	51.0	12.7	-1.1	16.8	26.9	36.9	-1.8	-6.1	-3.2
Apr	113	-5.8	-6.9	-12.0	-14.4	-0.7	6.6	-3.0	-23.6	1.6	9.3	14.4	31.3	17.8	25.2	-0.3	-8.1	-10.3	-8.9	-10.1	35.5	-8.0
May	120	51.7	-2.6	1.0	-8.0	-7.3	-5.4	6.1	13.8	5.5	17.0	-10.6	13.1	-10.4	11.4	38.0	-8.7	-8.8	-10.1	-15.3	7.0	33.4
May	127	6.9	6.0	-13.8	-12.1	-11.2	-2.6	28.4	1.2	4.3	-6.9	-15.8	12.0	10.5	15.5	4.2	20.5	-9.1	63.7	-6.1	38.7	7.6
May	134	26.2	-13.9	-9.7	33.5	2.4	19.6	-9.8	67.9	1.8	6.8	-1.8	-1.9	7.0	-4.3	12.7	-22.3	13.0	38.6	-4.6	17.2	0.1
May	141	0.7	14.2	24.8	-6.8	-6.1	-15.4	0.2	-15.1	-8.1	-13.6	14.1	39.8	-10.7	27.3	-11.4	-10.5	16.7	4.4	34.8	-10.2	9.2
May	148	-1.4	7.7	8.7	-17.6	-13.7	-20.7	14.2	-6.1	-8.3	7.2	3.3	-10.1	46.4	-11.9	-7.9	-11.6	-2.0	-14.9	20.6	-1.8	-15.1
Jun	155	-2.0	-25.4	-16.2	9.9	-3.7	0.5	-1.8	9.1	-3.9	-5.3	27.7	-14.5	-1.6	30.2	-12.2	-6.5	-19.0	-7.4	0.5	-13.1	33.4
Jun	162	-23.0	-12.8	1.6	11.4	-5.6	-14.4	-9.0	-6.5	-6.3	-18.7	-16.8	-17.2	-19.3	-16.8	-9.7	2.0	-1.9	79.3	-19.0	25.5	-9.8
Jun	169	-17.5	1.1	-13.8	11.7	1.8	0.3	57.9	6.4	1.7	10.2	21.7	5.0	-21.6	40.5	32.2	-13.5	-6.4	-3.3	6.8	-7.4	-18.2
Jun	176	-5.2	-2.4	-12.2	-8.3	-8.7	-9.0	-23.3	-5.0	-9.2	-10.0	-10.3	-9.4	-7.7	-6.2	-29.7	-0.4	15.9	55.1	-15.8	-22.2	-14.3
July	183	-6.0	0.4	-5.7	-21.7	6.1	-9.8	-19.6	-16.5	-8.8	-2.9	-20.0	-9.2	-3.8	-16.5	6.2	14.0	-8.6	-19.0	-5.3	-17.4	-8.3
July	190	-11.3	-8.2	12.8	13.8	0.5	-8.6	-13.1	-1.7	-3.3	34.3	-4.2	-9.8	-8.0	46.0	-15.2	-18.7	-15.4	-1.7	-15.0	-12.2	-5.8
July	197	-7.8	-6.2	-17.4	35.0	-5.1	-3.2	-8.7	17.7	-4.9	-6.7	-1.5	-0.6	1.9	-2.6	-4.7	-8.4	-14.4	0.5	34.3	-5.7	-6.5
July	204	-6.0	-10.4	-6.9	-12.2	-6.4	-0.2	-2.5	-22.8	-3.6	-6.6	3.0	-3.3	-7.4	-20.4	-7.8	-2.9	-10.8	-13.7	-24.5	23.6	-7.6
Aug	211	33.1	-4.8	-6.5	-19.2	-0.3	-2.0	36.8	-4.9	-0.7	32.8	-6.6	-0.8	-0.3	-7.6	-8.5	-3.4	32.0	37.7	-14.4	-25.5	-0.5
Aug	218	-7.5	-6.6	-3.8	-1.0	9.5	2.5	-21.3	2.0	-0.7	35.6	-9.9	-4.6	-0.1	-16.2	-1.2	37.8	-4.0	-3.8	-10.8	-6.8	24.1
Aug	225	-5.7	-2.0	18.4	29.4	-7.3	-4.4	-0.8	1.5	-3.2	-5.3	-4.6	-4.5	-6.6	-9.4	2.8	-18.0	-5.7	-14.9	11.4	-1.4	-22.4
Aug	232	11.7	-2.8	54.7	48.9	-4.2	3.9	-6.8	-11.4	-2.4	-11.0	-9.0	-3.1	-5.0	-8.6	10.6	-1.1	-3.7	-1.4	-11.6	-1.8	-1.9
Aug	239	1.5	23.2	7.2	-13.8	-0.2	-6.0	2.2	8.5	-3.1	39.5	11.5	-0.3	-3.6	23.1	-15.2	-2.9	-6.9	-15.7	-5.7	-4.1	-4.0
Sep	246	-14.6	7.9	67.2	-11.2	-3.0	42.3	-6.0	-10.4	0.0	9.0	-8.4	-1.9	1.6	49.7	-2.1	-0.8	-1.2	7.2	-3.1	-3.7	-4.4
Sep	253	14.3	23.8	-11.0	85.9	-1.6	-12.4	-1.2	2.8	1.4	-6.5	2.0	17.5	-1.9	10.4	-1.7	-1.3	-2.4	34.7	-3.1	12.1	-1.8
Sep	260	-5.5	-13.4	-13.4	42.1	11.2	16.9	-0.6	7.6	8.1	29.2	-4.9	-16.1	3.6	-4.4	4.3	-2.3	-2.0	15.2	29.1	-12.3	53.5
Sep	267	-2.8	-0.5	3.9	43.3	14.7	-2.2	-2.5	33.2	16.3	-5.1	13.0	10.2	-4.8	34.2	10.3	3.4	25.0	-8.8	18.8	1.5	19.1
Oct	274	-0.7	-2.2	3.5	26.8	11.7	21.4	-0.4	11.3	4.3	-9.1	2.6	-3.0	54.7	-7.9	-7.0	-0.1	11.3	0.7	39.5	4.7	15.5
Oct	281	32.5	3.3	11.9	12.4	-3.2	3.5	31.5	71.6	14.0	4.4	5.4	1.2	4.4	0.5	-2.7	-0.7	22.8	1.1	27.9	-1.3	23.8
Oct	288	-4.9	12.9	10.3	-2.2	5.7	14.1	24.6	22.2	13.1	30.0	38.7	12.5	22.3	22.4	-0.9	-0.8	-3.5	-9.5	17.0	22.1	4.2
Oct	295	25.0	4.5	3.4	-3.0	41.4	31.6	-10.0	-1.3	7.8	-3.8	-5.2	0.3	12.1	0.7	17.6	-1.0	5.0	-1.6	32.3	24.5	26.2
Nov	302	6.8	5.4	36.4	3.5	-1.8	0.7	0.8	-1.3	16.1	45.7	11.5	26.3	44.2	16.7	41.8	-0.3	57.7	-3.5	14.9	4.0	32.1
Nov	309	10.2	48.5	9.3	1.5	10.7	44.2	33.9	49.1	1.0	14.8	0.7	12.0	65.5	25.2	-2.8	18.4	2.1	27.0	4.6	33.3	2.0
Nov	316	16.8	10.8	42.8	1.0	8.7	21.4	77.4	5.1	16.6	68.0	9.3	-3.8	17.0	4.0	33.5	7.0	-0.3	10.0	-3.8	12.0	32.6
Nov	323	12.0	0.0	13.8	15.6	56.2	21.3	9.8	14.6	0.0	35.1	9.0	21.5	4.0	2.0	9.2	6.9	14.1	9.0	18.6	-0.6	7.7
Dec	330	23.2	3.9	18.0	26.0	11.0	5.5	26.0	3.6	14.0	-0.3	34.2	14.6	22.0	12.0	4.4	5.6	13.2	12.4	32.2	6.0	42.0
Dec	337	38.4	10.0	4.0	11.8	10.0	0.8	2.0	29.0	13.0	8.0	5.6	14.7	7.0	22.0	11.0	0.0	21.4	16.0	-2.1	1.0	1.0
Dec	344	24.2	18.8	20.6	2.0	17.5	3.0	12.0	16.0	8.0	33.0	1.2	18.0	16.0	8.0	5.0	0.0	16.8	35.7	12.8	8.5	33.2
Dec	351	20.0	25.7	13.2	9.0	12.3	13.4	0.0	18.0	18.0	5.6	4.5	0.7	6.0	28.2	5.6	0.0	7.9	3.0	14.0	10.0	21.4
Dec	358	12.5	42.2	7.6	11.0	5.0	19.8	25.0	34.0	1.5	24.0	4.5	4.6	5.0	41.5	9.0	0.0	6.5	20.0	10.0	11.0	11.5
total		398.4	466.2	637.2	415.8	360.9	409.2	415.9	434.5	288.3	414.5	378.7	277.6	248.5	483.4	328.9	352.6	297.6	314.1	348.9	190.5	330.2

TABLE D: Orangeville M
Period of Record (1983
Weekly Surplus - Deter

Year	Day	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Jan	1	18.7	16.0	15.5	7.7	29.2	21.4	10.0	14.5	4.0	9.0	7.0	8.0
Jan	8	15.0	19.0	9.2	7.1	58.1	12.0	7.3	17.6	7.4	31.6	30.0	9.0
Jan	15	13.0	8.0	37.2	16.0	25.2	15.0	1.0	9.0	22.0	2.0	11.0	7.0
Jan	22	22.0	21.0	15.0	12.0	37.8	12.5	32.1	6.0	24.3	21.3	5.0	12.0
Feb	29	8.0	0.0	68.3	11.0	42.4	14.0	16.0	62.0	10.0	17.0	30.0	30.5
Feb	36	5.0	14.2	23.0	13.0	64.0	7.3	8.0	21.0	3.5	26.0	3.0	16.0
Feb	43	1.0	38.0	43.0	23.0	56.9	7.6	9.5	3.0	7.0	22.0	10.0	30.0
Feb	50	10.0	21.3	28.0	13.0	6.0	42.0	26.0	9.0	10.2	31.0	28.5	11.0
Mar	57	10.2	20.0	11.0	41.0	23.1	12.0	13.0	49.0	24.4	17.0	9.0	7.0
Mar	64	32.0	18.8	27.3	4.6	61.5	44.7	0.2	38.5	3.6	20.4	10.0	0.0
Mar	71	3.0	8.5	27.6	8.5	4.0	0.0	51.6	6.9	-1.9	9.0	0.0	3.0
Mar	78	16.8	13.0	4.0	13.3	20.6	1.9	3.8	15.0	-5.4	7.0	4.0	6.0
Mar	85	39.5	7.6	5.3	2.3	43.4	15.8	11.3	0.0	1.1	1.8	5.0	7.0
Apr	92	16.4	24.4	28.0	27.2	3.4	29.4	14.4	14.1	-3.9	30.7	10.1	28.1
Apr	99	1.5	-6.2	5.7	13.0	22.2	-4.1	-7.1	16.1	-4.5	27.3	26.4	-1.4
Apr	106	20.7	0.0	4.3	-6.4	-15.3	9.8	-8.7	31.4	-2.6	14.0	-1.1	19.1
Apr	113	3.7	41.3	18.1	11.6	-2.2	11.5	-0.8	22.4	8.5	5.2	25.9	-7.3
May	120	27.1	0.0	-14.0	-9.9	25.7	-7.5	20.8	-0.8	4.6	-18.4	-2.1	-13.6
May	127	-4.9	3.7	16.1	-1.0	-1.0	14.6	38.6	25.4	-5.3	13.0	1.0	-10.8
May	134	-8.4	-6.4	21.9	10.3	0.2	-0.4	-16.7	13.7	-14.1	-16.9	-3.3	-11.3
May	141	34.3	-5.4	-11.0	-13.1	-11.8	14.5	-12.7	11.0	-16.1	36.8	-20.0	-1.0
May	148	-2.8	-7.3	19.6	-3.4	-3.9	5.9	25.4	-19.6	29.2	3.6	-7.4	15.7
Jun	155	-19.0	-20.9	-12.2	-10.8	10.6	3.5	13.4	4.7	-5.7	11.7	-1.9	34.2
Jun	162	8.1	-1.7	-17.1	-17.3	-4.0	-4.8	0.4	-16.8	-11.3	-5.5	-2.0	-0.3
Jun	169	-9.2	-11.0	-15.9	-10.4	11.0	-13.1	47.3	8.8	7.4	-19.5	-9.6	-3.3
Jun	176	-10.1	-12.9	4.0	-10.7	-0.3	0.5	52.2	-13.6	-17.0	-6.2	-9.6	34.6
July	183	20.3	22.6	-13.7	-5.8	-20.9	-15.4	-0.1	-14.9	-13.4	37.5	26.9	-5.6
July	190	-4.8	-24.1	32.3	-4.6	-6.7	-6.2	-12.4	-11.7	-10.3	-25.1	-2.0	-17.9
July	197	-6.5	38.7	-8.7	-2.7	-9.7	-8.8	42.3	-9.9	-6.0	-16.8	-13.2	-13.7
July	204	-8.1	-10.7	-8.1	-1.9	-8.0	43.1	-18.5	1.8	28.5	-9.9	50.0	-16.0
Aug	211	3.6	-4.3	-3.1	-3.6	-4.4	-19.4	-13.6	2.0	-10.6	40.5	-12.5	-1.6
Aug	218	-5.6	-6.3	-10.2	-3.3	11.4	41.1	-1.4	-6.3	25.2	-13.6	6.2	-2.2
Aug	225	-9.0	76.5	-6.4	-2.3	-4.0	-24.2	4.2	10.9	-19.8	-12.3	27.3	-7.6
Aug	232	-8.4	-17.3	2.3	-0.4	-10.7	-1.0	-8.1	7.5	-6.4	7.9	-23.5	-4.5
Aug	239	11.6	2.5	7.8	-1.5	-4.7	-11.4	-14.8	-9.1	-4.9	-9.1	-12.2	-3.1
Sep	246	14.9	-8.6	4.3	5.3	-3.6	-11.6	8.5	-2.7	27.2	2.3	30.2	-4.2
Sep	253	-15.3	-3.9	0.2	7.1	53.8	-8.5	16.4	-2.8	-0.7	-6.3	-3.1	-2.5
Sep	260	-7.6	-5.0	36.4	-12.7	-13.7	-2.7	-7.4	22.8	18.7	36.6	2.7	-2.6
Sep	267	-6.4	35.8	39.1	-0.6	-0.9	27.5	44.9	-1.2	-1.8	-12.4	-4.9	-2.6
Oct	274	-2.0	-16.7	10.9	-0.5	0.3	19.9	-5.1	1.3	0.3	-3.3	20.5	18.5
Oct	281	-1.9	-0.7	16.0	2.4	1.1	16.7	11.9	31.9	30.5	5.2	3.2	-4.8
Oct	288	23.2	4.5	32.7	-2.5	3.2	-0.9	2.4	42.7	2.1	19.4	4.8	0.6
Oct	295	-1.4	25.2	31.6	14.1	8.9	17.2	21.3	22.2	60.8	15.7	-1.1	39.2
Nov	302	26.0	-1.5	0.8	-1.4	-2.1	17.2	4.6	-2.9	35.4	30.5	11.0	7.7
Nov	309	28.7	26.0	8.3	18.9	12.2	-2.2	7.2	2.7	1.6	16.3	7.3	26.0
Nov	316	-0.6	42.9	12.4	5.1	20.6	-0.9	16.7	9.8	11.2	13.6	6.5	16.6
Nov	323	4.5	24.0	-0.9	37.8	13.0	16.1	17.3	10.4	1.2	9.0	37.8	22.7
Dec	330	18.5	37.4	32.7	67.0	9.0	35.4	27.9	69.6	14.8	2.0	2.0	1.6
Dec	337	22.8	22.0	20.0	18.5	33.0	19.0	4.5	21.5	14.5	4.0	3.0	1.7
Dec	344	23.4	16.0	11.3	37.7	32.0	33.6	41.0	19.8	11.0	23.0	22.0	14.9
Dec	351	16.0	11.5	1.0	32.6	54.0	4.5	5.0	8.6	10.0	30.3	21.0	13.2
Dec	358	39.5	31.9	11.1	26.2	66.0	19.8	5.0	22.8	12.0	9.0	1.0	16.8
total		264.7	644.6	3524.2	410.1	886.2	436.1	574.7	425.6	227.6	484.8	369.6	320.0

TABLE E: Wetland 10 Existing Condition Runoff

		area (m2)	runoff coeff
Areas:	roads	0	1
	building	0	0.5
	driveway	0	1
	natural	35300	0.6
	discharge (w	0	1

Year	Day	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Jan	1	105.9	292.3	122.8	233.0	402.4	127.1	393.9	305.0	211.8	105.9	876.9	529.5	571.9	21.2	571.9	1275.0	826.0	425.7	158.9	21.2	296.5	396.1	338.9	328.3	163.2	618.5	453.3
Jan	8	504.1	131.3	21.2	42.4	326.2	0.0	135.6	148.3	423.6	423.6	413.0	0.0	724.4	84.7	423.6	614.2	900.2	307.1	0.0	158.9	148.3	317.7	402.4	194.5	150.4	1229.6	254.2
Jan	15	21.2	21.2	900.2	228.7	368.5	512.6	127.1	436.3	4.2	201.2	148.3	275.3	1120.3	715.9	243.6	307.1	296.5	127.1	0.0	169.4	31.8	275.3	169.4	787.9	338.9	533.7	317.7
Jan	22	84.7	413.0	222.4	101.7	139.8	161.0	211.8	321.9	211.8	169.4	127.1	656.6	42.4	487.1	487.1	285.9	635.4	53.0	84.7	0.0	137.7	466.0	444.8	317.7	254.2	800.6	264.8
Feb	29	542.2	84.7	95.3	470.2	338.9	953.1	169.4	296.5	84.7	21.2	254.2	42.4	0.0	105.9	275.3	254.2	137.7	148.3	84.7	381.2	317.7	169.4	0.0	1446.3	233.0	898.0	296.5
Feb	36	105.9	152.5	402.4	614.2	169.4	593.0	381.2	63.5	42.4	42.4	63.5	42.4	233.0	334.6	21.2	42.4	158.9	148.3	868.4	0.0	169.4	105.9	300.8	487.1	275.3	1355.5	154.6
Feb	43	21.2	672.8	1101.4	224.5	0.0	190.6	84.7	364.3	349.5	512.6	190.6	63.5	84.7	42.4	338.9	525.3	203.3	332.5	105.9	105.9	116.5	21.2	804.8	910.7	487.1	1205.1	161.0
Feb	50	93.2	130.6	771.0	82.6	0.0	385.5	330.4	529.5	233.0	360.1	466.0	233.0	89.0	402.4	948.9	0.0	63.5	558.1	423.6	520.8	466.0	211.8	451.1	593.0	275.3	127.1	889.6
Mar	57	258.4	561.3	434.2	59.3	535.9	144.0	127.1	84.7	127.1	42.4	360.1	0.0	105.9	360.1	249.9	321.0	466.0	0.0	169.4	531.6	233.0	216.0	423.6	233.0	868.4	489.3	254.2
Mar	64	82.9	349.5	266.9	571.9	0.0	42.4	0.0	698.9	42.4	788.1	63.5	190.6	21.2	381.2	571.9	762.5	158.9	0.0	360.1	487.1	27.5	677.8	398.2	578.2	97.4	1302.6	946.7
Mar	71	210.7	669.3	245.7	602.2	0.0	105.9	931.9	0.0	250.3	21.2	211.8	127.1	0.0	0.0	296.5	826.0	0.0	84.7	127.1	0.0	0.0	63.5	180.0	584.6	180.0	84.7	0.0
Mar	78	497.7	491.4	148.3	23.3	150.4	237.2	42.4	474.4	176.9	42.4	63.5	242.6	0.0	593.0	571.9	614.2	0.0	211.8	0.0	105.9	53.1	355.8	275.3	84.7	282.0	436.3	40.2
Mar	85	211.8	10.6	932.7	0.0	855.4	169.9	44.9	131.3	81.2	149.9	0.0	169.4	0.0	144.0	203.7	0.0	0.0	298.3	0.0	276.9	363.1	835.9	159.9	111.5	48.3	919.2	333.9
Apr	92	384.5	264.8	372.3	78.8	1081.4	278.6	531.6	210.7	113.3	0.0	40.6	170.4	161.0	338.9	0.0	60.9	145.2	108.4	293.3	783.7	307.1	346.9	516.7	592.1	576.1	72.3	623.3
Apr	99	961.6	109.1	28.2	362.0	69.6	0.0	154.6	427.6	168.2	583.7	214.4	171.4	24.2	309.5	190.6	0.0	0.0	213.8	146.4	218.3	0.0	31.0	0.0	121.5	275.3	470.6	0.0
Apr	106	0.0	125.1	0.0	398.3	0.0	200.7	0.0	102.3	250.0	910.6	364.7	0.0	1079.7	269.3	0.0	355.5	569.3	780.9	0.0	0.0	0.0	438.7	0.0	90.5	0.0	0.0	207.3
Apr	113	0.0	0.0	0.0	0.0	0.0	139.9	0.0	0.0	34.7	196.7	304.7	662.5	377.2	533.3	0.0	0.0	0.0	0.0	0.0	750.9	0.0	78.2	873.9	382.9	245.9	0.0	244.1
May	120	1094.4	0.0	21.7	0.0	0.0	0.0	128.3	291.9	117.5	360.0	0.0	278.0	0.0	240.6	804.3	0.0	0.0	0.0	0.0	147.5	707.0	574.0	0.0	0.0	0.0	545.0	0.0
May	127	145.8	127.1	0.0	0.0	0.0	0.0	601.5	25.2	90.6	0.0	0.0	254.8	221.6	328.9	89.2	434.8	0.0	1348.5	0.0	820.2	160.4	0.0	77.4	340.8	0.0	0.0	308.2
May	134	553.9	0.0	0.0	709.3	51.1	415.3	0.0	1437.9	38.6	145.0	0.0	0.0	149.0	0.0	268.3	0.0	275.8	816.6	0.0	363.8	2.6	0.0	0.0	464.4	217.1	4.3	0.0
May	141	15.6	301.3	525.2	0.0	0.0	0.0	5.0	0.0	0.0	0.0	298.1	842.5	0.0	578.4	0.0	0.0	353.8	92.3	736.9	0.0	195.1	726.5	0.0	0.0	0.0	0.0	306.3
May	148	0.0	162.9	183.4	0.0	0.0	0.0	300.3	0.0	0.0	152.5	70.6	0.0	983.6	0.0	0.0	0.0	0.0	0.0	435.8	0.0	0.0	0.0	0.0	415.1	0.0	0.0	124.3
Jun	155	0.0	0.0	0.0	209.5	0.0	11.3	0.0	193.7	0.0	0.0	587.3	0.0	0.0	638.6	0.0	0.0	0.0	0.0	9.6	0.0	707.0	0.0	0.0	0.0	0.0	224.5	73.4
Jun	162	0.0	0.0	33.5	242.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.4	0.0	1679.0	0.0	539.8	0.0	171.5	0.0	0.0	0.0	0.0	0.0
Jun	169	0.0	22.5	0.0	247.1	38.2	6.6	1226.3	136.6	35.1	216.5	458.6	105.1	0.0	858.7	682.0	0.0	0.0	0.0	143.4	0.0	0.0	0.0	0.0	0.0	0.0	234.0	0.0
Jun	176	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	336.0	1166.3	0.0	0.0	0.0	0.0	0.0	83.7	0.0	0.0	10.0
July	183	0.0	7.6	0.0	0.0	128.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	130.6	296.9	0.0	0.0	0.0	0.0	0.0	430.2	478.9	0.0	0.0	0.0	0.0
July	190	0.0	0.0	270.1	291.3	10.7	0.0	0.0	0.0	0.0	726.2	0.0	0.0	0.0	974.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	684.2	0.0	0.0	0.0
July	197	0.0	0.0	0.0	742.2	0.0	0.0	0.0	375.7	0.0	0.0	0.0	0.0	40.3	0.0	0.0	0.0	0.0	11.3	726.8	0.0	0.0	0.0	820.4	0.0	0.0	0.0	0.0
July	204	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	499.9	0.0	0.0	0.0	0.0	0.0	0.0	912.0
Aug	211	701.2	0.0	0.0	0.0	0.0	0.0	779.9	0.0	0.0	695.5	0.0	0.0	0.0	0.0	0.0	0.0	678.7	799.0	0.0	0.0	0.0	76.9	0.0	0.0	0.0	0.0	0.0
Aug	218	0.0	0.0	0.0	0.0	201.6	53.8	0.0	43.0	0.0	754.6	0.0	0.0	0.0	0.0	0.0	801.6	0.0	0.0	0.0	0.0	510.8	0.0	0.0	0.0	0.0	241.0	869.9
Aug	225	0.0	0.0	390.0	623.3	0.0	0.0	0.0	30.7	0.0	0.0	0.0	0.0	0.0	0.0	59.6	0.0	0.0	0.0	240.7	0.0	0.0	0.0	1621.3	0.0	0.0	0.0	0.0
Aug	232	247.5	0.0	1159.1	1036.6	0.0	83.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	223.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.2	0.0	0.0	0.0
Aug	239	31.7	491.3	152.3	0.0	0.0	0.0	47.3	181.0	0.0	836.6	243.0	0.0	0.0	488.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	246.3	53.5	165.0	0.0	0.0	0.0
Sep	246	0.0	167.3	1424.2	0.0	0.0	896.3	0.0	0.0	0.0	189.9	0.0	0.0	34.9	1052.1	0.0	0.0	0.0	152.5	0.0	0.0	0.0	315.6	0.0	91.2	112.2	0.0	0.0
Sep	253	303.5	504.6	0.0	1820.3	0.0	0.0	0.0	58.7	29.3	0.0	43.3	370.7	0.0	221.3	0.0	0.0	0.0	734.7	0.0	255.7	0.0	0.0	0.0	3.4	150.2	1140.1	0.0
Sep	260	0.0	0.0	0.0	892.1	238.3	359.0	0.0	160.5	172.2	617.6	0.0	0.0	77.2	0.0	91.6	0.0	0.0	321.5	617.2	0.0	1134.0	0.0	0.0	772.0	0.0	0.0	0.0
Sep	267	0.0	0.0	81.7	917.4	311.1	0.0	0.0	703.1	344.4	0.0	275.2	217.0	0.0	724.1	217.7	71.3	529.3	0.0	398.5	31.9	404.7	0.0	759.1	828.8	0.0	0.0	581.5
Oct	274	0.0	0.0	74.3	566.8	248.8	452.8	0.0	238.5	91.6	0.0	56.0	0.0	1158.1	0.0	0.0	0.0	239.5	15.5	836.4	99.1	327.3	0.0	0.0	230.3	0.0	5.6	422.4
Oct	281	687.5	70.4	252.1	261.6	0.0	74.2	666.9	1517.2	296.4	93.1	114.6	25.1	93.0	10.9	0.0	0.0	482.4	23.6	591.1	0.0	503.9	0.0	0.0	339.4	50.3	23.7	354.6
Oct	288	0.0	273.1	219.1	0.0	119.9	298.4	520.2	470.6	277.7	634.7	819.4	263.8	472.7	475.0	0.0	0.0	0.0	0.0	359.7	468.1	89.7	491.6	95.3	692.5	0.0	68.3	0.0
Oct	295	528.8	94.3	71.4	0.0	877.8	669.4	0.0	0.0	165.5	0.0	0.0	5.6	255.5	15.2	372.0	0.0	105.6	0.0	684.9	518.0	554.0	0.0	534.2	668.3	298.5	188.1	364.1
Nov	302	144.8	115.1	771.5	74.3	0.0	15.4	17.1	0.0	341.5	967.1	244.4	558.1	937.1	354.5	884.5	0.0	1223.0	0.0	316.2	84.7	680.4	549.9	0.0	16.6	0.0	0.0	363.7
Nov	309	216.5	1026.8	198.0	31.9	227.5	935.9	718.6	1039.7	21.2	312.4	15.8	254.2	1387.1	534.5	0.0	389.9	44.7	572.2	97.0	706.3	42.6	608.7	551.2	175.7	400.3	258.9	0.0
Nov	316	355.8	228.4	906.9	21.2	184.4	452.7	1639.2	109.0	351.1	1439.8	197.8	0.0	360.1	84.7	709.5	148.3	0.0	212.1	0.0	254.2	690.9	0.0	908.4	262.3	108.7	436.4	0.0
Nov	323	253.4	0.0	292.3	330.4	1190.3	450.3	207.6	309.0	0.5	743.8	190.6	455.4	84.7	42.4	194.9	145.2	299.4	190.6	393.0	0.0	163.4	95.4	508.3	0.0	800.6	275.3	341.7
Dec	330	491.4	82.6	381.2	550.7	233.0	116.4	550.7	75.6	296.8	0.0	724.4	309.2	466.0	254.2	92.9	118.5	279.6	262.6	682.8	127.1	889.6	391.1	791.5	693.1	1419.1	190.6	749.7
Dec	337	813.3	211.8	84.7	249.9	211.8	16.9	42.4	614.2	275.3	169.4	119.2	311.7	148.3	466.0	233.0	0.0	453.5	338.9	0.0	21.2	21.2	482.9	466.0	423.6	391.8	698.9	402.4
Dec	344	512.6	398.2	436.3	42.4	371.0	63.5	254.2	338.9	169.4	698.9	25.4	381.2	338.9	169.4	105.9	0.0	355.8	756.1	270.6	180.0	703.2	495.6	338.9	238.5	798.5	677.8	711.6
Dec	351	423.6	544.3	279.6	190.6	260.5	283.8	0.0	381.2	381.2	118.6	95.3	13.9	127.1	597.3	118.6	0.0	167.3	63.5	296.5	211.8	453.3	338.9	243.6	21.8	690.5	1143.7	95.3
Dec	358	264.8	893.8	161.0	233.0	105.9	419.4	529.5	720.1	31.8	508.3	95.3	97.4	105.9	879.0	190.6	0.0	137.7	423.6	211.8	233.0	244.4	836.6	675.6	234.2	554.9	1397.9	419.4
annual total		11871.9	10203.0	14434.3	14377.5	9447.9	10316.0	11901.5	14047.5	6332.7	14951.7	8900.1	8320.4	12075.4	15112.1	10864.0	8692.0	10522.8	13778.6	10871.2	10074.1	11853.0	11838.9	14663.5	15738.7	10743.5	18297.1	12851.8

TABLE E: Wetland 10 Existing Condition Runoff

Year	Day	2010	2011	2012	2013	2014	2015
Jan	1	211.8	307.1	84.7	190.6	148.3	169.4
Jan	8	154.6	372.8	156.7	668.5	635.4	190.6
Jan	15	21.2	190.6	466.0	42.4	233.0	148.3
Jan	22	679.9	127.1	514.7	451.1	105.9	254.2
Feb	29	338.9	1313.2	211.8	360.1	635.4	646.0
Feb	36	169.4	444.8	74.1	550.7	63.5	338.9
Feb	43	201.2	63.5	148.3	466.0	211.8	635.4
Feb	50	550.7	190.6	216.0	656.6	603.6	233.0
Mar	57	275.3	1037.8	516.8	360.1	190.6	148.3
Mar	64	4.6	815.4	76.2	431.8	211.8	0.0
Mar	71	1092.7	146.1	0.0	190.6	0.0	63.5
Mar	78	79.8	317.7	0.0	148.3	84.7	127.1
Mar	85	240.4	0.0	23.3	37.5	105.2	148.3
Apr	92	305.4	298.6	0.0	650.3	213.6	594.4
Apr	99	0.0	341.0	0.0	578.3	559.6	0.0
Apr	106	0.0	665.9	0.0	296.5	0.0	405.6
Apr	113	0.0	473.8	180.5	110.5	548.4	0.0
May	120	439.6	0.0	97.7	0.0	0.0	0.0
May	127	816.8	537.5	0.0	275.9	20.8	0.0
May	134	0.0	289.7	0.0	0.0	0.0	0.0
May	141	0.0	232.1	0.0	778.9	0.0	0.0
May	148	536.9	0.0	618.7	76.8	0.0	332.2
Jun	155	284.4	99.6	0.0	248.8	0.0	724.5
Jun	162	8.9	0.0	0.0	0.0	0.0	0.0
Jun	169	1002.7	185.3	156.0	0.0	0.0	0.0
Jun	176	1106.0	0.0	0.0	0.0	0.0	733.9
July	183	0.0	0.0	0.0	794.9	570.1	0.0
July	190	0.0	0.0	0.0	0.0	0.0	0.0
July	197	896.8	0.0	0.0	0.0	0.0	0.0
July	204	0.0	38.1	603.4	0.0	1059.6	0.0
Aug	211	0.0	42.5	0.0	858.0	0.0	0.0
Aug	218	0.0	0.0	533.5	0.0	130.5	0.0
Aug	225	88.5	230.5	0.0	0.0	578.8	0.0
Aug	232	0.0	158.9	0.0	167.5	0.0	0.0
Aug	239	0.0	0.0	0.0	0.0	0.0	0.0
Sep	246	180.9	0.0	575.4	47.9	640.4	0.0
Sep	253	347.1	0.0	0.0	0.0	0.0	0.0
Sep	260	0.0	483.7	396.6	776.2	56.3	0.0
Sep	267	950.6	0.0	0.0	0.0	0.0	0.0
Oct	274	0.0	28.2	6.8	0.0	434.1	390.9
Oct	281	252.9	676.7	645.1	109.7	67.3	0.0
Oct	288	51.6	905.4	43.5	411.0	100.6	13.7
Oct	295	450.2	469.3	1287.2	331.7	0.0	830.8
Nov	302	96.8	0.0	749.4	645.0	233.6	162.5
Nov	309	151.4	57.7	32.8	344.9	154.7	551.6
Nov	316	352.9	207.4	236.9	287.3	137.7	351.6
Nov	323	365.6	220.3	24.4	190.6	800.6	480.8
Dec	330	590.9	1474.4	313.5	42.4	42.4	33.0
Dec	337	95.3	455.4	307.9	84.7	63.5	35.6
Dec	344	868.4	419.4	233.0	487.1	466.0	316.5
Dec	351	105.9	182.1	210.9	641.8	444.8	279.4
Dec	358	105.9	482.9	254.2	190.6	21.2	355.8
annual total		14472.9	14983.3	9995.8	13981.3	10573.7	9695.5

TABLE F: Wetland 10 Existing Condition Infiltration

		area (m2)	runoff coeff
Areas:	roads	0	1
	building	0	0.5
	driveway	0	1
	natural	35300	0.6
	discharge (w	0	1

Year	Day	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Jan	1	70.6	194.9	81.9	155.3	268.3	84.7	262.6	203.3	141.2	70.6	584.6	353.0	381.2
Jan	8	336.1	87.5	14.1	28.2	217.4	0.0	90.4	98.8	282.4	282.4	275.3	0.0	482.9
Jan	15	14.1	14.1	600.1	152.5	245.7	341.7	84.7	290.9	2.8	134.1	98.8	183.6	746.8
Jan	22	56.5	275.3	148.3	67.8	93.2	107.3	141.2	214.6	141.2	113.0	84.7	437.7	28.2
Feb	29	361.5	56.5	63.5	313.5	225.9	635.4	113.0	197.7	56.5	14.1	169.4	28.2	0.0
Feb	36	70.6	101.7	268.3	409.5	113.0	395.4	254.2	42.4	28.2	28.2	42.4	28.2	155.3
Feb	43	14.1	448.5	734.2	149.7	0.0	127.1	56.5	242.9	233.0	341.7	127.1	42.4	56.5
Feb	50	62.1	87.1	514.0	55.1	0.0	257.0	220.3	353.0	155.3	240.0	310.6	155.3	59.3
Mar	57	172.2	374.2	289.5	39.5	357.2	96.0	84.7	56.5	84.7	28.2	240.0	0.0	70.6
Mar	64	55.2	233.0	177.9	381.2	0.0	28.2	0.0	466.0	28.2	525.4	42.4	127.1	14.1
Mar	71	140.5	446.2	163.8	401.4	0.0	70.6	621.3	0.0	166.9	14.1	141.2	84.7	0.0
Mar	78	331.8	327.6	98.8	15.5	100.2	158.1	28.2	316.3	118.0	28.2	42.4	161.7	0.0
Mar	85	141.2	7.1	621.8	0.0	570.3	113.2	29.9	87.5	54.1	99.9	0.0	113.0	0.0
Apr	92	256.3	176.5	248.2	52.5	720.9	185.8	354.4	140.5	75.5	0.0	27.0	113.6	107.3
Apr	99	641.1	72.7	18.8	241.3	46.4	0.0	103.1	285.1	112.1	389.1	142.9	114.3	16.1
Apr	106	0.0	83.4	0.0	265.6	0.0	133.8	0.0	68.2	166.6	607.1	243.1	0.0	719.8
Apr	113	0.0	0.0	0.0	0.0	0.0	93.2	0.0	0.0	23.1	131.1	203.1	441.7	251.5
May	120	729.6	0.0	14.5	0.0	0.0	0.0	85.5	194.6	78.3	240.0	0.0	185.3	0.0
May	127	97.2	84.7	0.0	0.0	0.0	0.0	401.0	16.8	60.4	0.0	0.0	169.9	147.7
May	134	369.3	0.0	0.0	472.9	34.0	276.8	0.0	958.6	25.7	96.7	0.0	0.0	99.3
May	141	10.4	200.9	350.1	0.0	0.0	0.0	3.3	0.0	0.0	0.0	198.8	561.6	0.0
May	148	0.0	108.6	122.3	0.0	0.0	0.0	200.2	0.0	0.0	101.7	47.1	0.0	655.7
Jun	155	0.0	0.0	0.0	139.7	0.0	7.5	0.0	129.2	0.0	0.0	391.6	0.0	0.0
Jun	162	0.0	0.0	22.3	161.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jun	169	0.0	15.0	0.0	164.8	25.5	4.4	817.5	91.1	23.4	144.3	305.8	70.0	0.0
Jun	176	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
July	183	0.0	5.1	0.0	0.0	85.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
July	190	0.0	0.0	180.0	194.2	7.2	0.0	0.0	0.0	0.0	484.2	0.0	0.0	0.0
July	197	0.0	0.0	0.0	494.8	0.0	0.0	0.0	250.5	0.0	0.0	0.0	0.0	26.8
July	204	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.9	0.0	0.0
Aug	211	467.4	0.0	0.0	0.0	0.0	0.0	519.9	0.0	0.0	463.6	0.0	0.0	0.0
Aug	218	0.0	0.0	0.0	0.0	134.4	35.9	0.0	28.7	0.0	503.0	0.0	0.0	0.0
Aug	225	0.0	0.0	260.0	415.5	0.0	0.0	0.0	20.5	0.0	0.0	0.0	0.0	0.0
Aug	232	165.0	0.0	772.7	691.1	0.0	55.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aug	239	21.2	327.5	101.5	0.0	0.0	0.0	31.5	120.6	0.0	557.7	162.0	0.0	0.0
Sep	246	0.0	111.6	949.5	0.0	0.0	597.6	0.0	0.0	0.0	126.6	0.0	0.0	23.2
Sep	253	202.3	336.4	0.0	1213.5	0.0	0.0	0.0	39.2	19.5	0.0	28.9	247.1	0.0
Sep	260	0.0	0.0	0.0	594.7	158.8	239.3	0.0	107.0	114.8	411.7	0.0	0.0	51.4
Sep	267	0.0	0.0	54.5	611.6	207.4	0.0	0.0	468.7	229.6	0.0	183.5	144.6	0.0
Oct	274	0.0	0.0	49.6	377.9	165.9	301.8	0.0	159.0	61.1	0.0	37.3	0.0	772.1
Oct	281	458.4	47.0	168.0	174.4	0.0	49.4	444.6	1011.5	197.6	62.1	76.4	16.7	62.0
Oct	288	0.0	182.1	146.0	0.0	79.9	198.9	346.8	313.7	185.1	423.1	546.2	175.8	315.1
Oct	295	352.5	62.9	47.6	0.0	585.2	446.3	0.0	0.0	110.4	0.0	0.0	3.7	170.4
Nov	302	96.5	76.8	514.3	49.5	0.0	10.2	11.4	0.0	227.6	644.7	162.9	372.0	624.7
Nov	309	144.3	684.6	132.0	21.3	151.7	623.9	479.1	693.1	14.1	208.3	10.5	169.4	924.7
Nov	316	237.2	152.3	604.6	14.1	122.9	301.8	1092.8	72.7	234.0	959.8	131.9	0.0	240.0
Nov	323	168.9	0.0	194.9	220.3	793.5	300.2	138.4	206.0	0.4	495.9	127.1	303.6	56.5
Dec	330	327.6	55.1	254.2	367.1	155.3	77.6	367.1	50.4	197.9	0.0	482.9	206.2	310.6
Dec	337	542.2	141.2	56.5	166.6	141.2	11.3	28.2	409.5	183.6	113.0	79.5	207.8	98.8
Dec	344	341.7	265.5	290.9	28.2	247.3	42.4	169.4	225.9	113.0	466.0	16.9	254.2	225.9
Dec	351	282.4	362.9	186.4	127.1	173.7	189.2	0.0	254.2	254.2	79.1	63.5	9.2	84.7
Dec	358	176.5	595.9	107.3	155.3	70.6	279.6	353.0	480.1	21.2	338.9	63.5	65.0	70.6
annual total		7914.6	6802.0	9622.9	9585.0	6298.6	6877.3	7934.3	9365.0	4221.8	9967.8	5933.4	5546.9	8050.3

Year	Day	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Jan	1	14.1	381.2	850.0	550.7	283.8	105.9	14.1	197.7	264.0	225.9	218.9	108.8	412.3	302.2
Jan	8	56.5	282.4	409.5	600.1	204.7	0.0	105.9	98.8	211.8	268.3	129.7	100.3	819.7	169.4
Jan	15	477.3	162.4	204.7	197.7	84.7	0.0	113.0	21.2	183.6	113.0	525.3	225.9	355.8	211.8
Jan	22	324.8	324.8	190.6	423.6	35.3	56.5	0.0	91.8	310.6	296.5	211.8	169.4	533.7	176.5
Feb	29	70.6	183.6	169.4	91.8	98.8	56.5	254.2	211.8	113.0	0.0	964.2	155.3	598.7	197.7
Feb	36	223.1	14.1	28.2	105.9	98.8	578.9	0.0	113.0	70.6	200.5	324.8	183.6	903.7	103.1
Feb	43	28.2	225.9	350.2	135.6	221.7	70.6	70.6	77.7	14.1	536.6	607.2	324.8	803.4	107.3
Feb	50	268.3	632.6	0.0	42.4	372.1	282.4	347.2	310.6	141.2	300.8	395.4	183.6	84.7	593.0
Mar	57	240.0	166.6	214.0	310.6	0.0	113.0	354.4	155.3	144.0	282.4	155.3	578.9	326.2	169.4
Mar	64	254.2	381.2	508.3	105.9	0.0	240.0	324.8	18.4	451.8	265.5	385.5	65.0	868.4	631.1
Mar	71	0.0	197.7	550.7	0.0	56.5	84.7	0.0	0.0	42.4	120.0	389.7	120.0	56.5	0.0
Mar	78	395.4	381.2	409.5	0.0	141.2	0.0	70.6	35.4	237.2	183.6	56.5	188.0	290.9	26.8
Mar	85	96.0	135.8	0.0	0.0	198.8	0.0	184.6	242.1	557.2	106.6	74.3	32.2	612.8	222.6
Apr	92	225.9	0.0	40.6	96.8	72.3	195.5	522.4	204.7	231.3	344.4	394.7	384.1	48.2	415.5
Apr	99	206.3	127.1	0.0	0.0	142.6	97.6	145.5	0.0	20.6	0.0	81.0	183.6	313.7	0.0
Apr	106	179.5	0.0	237.0	379.6	520.6	0.0	0.0	0.0	292.5	0.0	60.3	0.0	0.0	138.2
Apr	113	355.5	0.0	0.0	0.0	0.0	0.0	500.6	0.0	52.1	582.6	255.3	163.9	0.0	162.8
May	120	160.4	536.2	0.0	0.0	0.0	0.0	98.4	471.3	382.7	0.0	0.0	0.0	363.3	0.0
May	127	219.3	59.5	289.9	0.0	899.0	0.0	546.8	106.9	0.0	51.6	227.2	0.0	0.0	205.5
May	134	0.0	178.9	0.0	183.9	544.4	0.0	242.6	1.7	0.0	0.0	309.6	144.8	2.9	0.0
May	141	385.6	0.0	0.0	235.9	61.5	491.3	0.0	130.1	484.3	0.0	0.0	0.0	0.0	204.2
May	148	0.0	0.0	0.0	0.0	0.0	290.5	0.0	0.0	0.0	0.0	276.8	0.0	0.0	82.9
Jun	155	425.8	0.0	0.0	0.0	0.0	6.4	0.0	471.4	0.0	0.0	0.0	0.0	149.7	48.9
Jun	162	0.0	0.0	27.6	0.0	1119.3	0.0	359.9	0.0	114.3	0.0	0.0	0.0	0.0	0.0
Jun	169	572.5	454.6	0.0	0.0	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	156.0	0.0
Jun	176	0.0	0.0	0.0	224.0	777.5	0.0	0.0	0.0	0.0	0.0	55.8	0.0	0.0	6.6
July	183	0.0	87.1	197.9	0.0	0.0	0.0	0.0	0.0	286.8	319.3	0.0	0.0	0.0	0.0
July	190	649.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	456.1	0.0	0.0	0.0
July	197	0.0	0.0	0.0	0.0	7.6	484.5	0.0	0.0	0.0	546.9	0.0	0.0	0.0	0.0
July	204	0.0	0.0	0.0	0.0	0.0	0.0	333.2	0.0	0.0	0.0	0.0	0.0	0.0	608.0
Aug	211	0.0	0.0	0.0	452.5	532.7	0.0	0.0	0.0	51.3	0.0	0.0	0.0	0.0	0.0
Aug	218	0.0	0.0	534.4	0.0	0.0	0.0	0.0	340.5	0.0	0.0	0.0	0.0	160.6	580.0
Aug	225	0.0	39.7	0.0	0.0	0.0	160.5	0.0	0.0	0.0	1080.9	0.0	0.0	0.0	0.0
Aug	232	0.0	149.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.8	0.0	0.0	0.0
Aug	239	325.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	164.2	35.7	110.0	0.0	0.0	0.0
Sep	246	701.4	0.0	0.0	0.0	101.7	0.0	0.0	0.0	210.4	0.0	60.8	74.8	0.0	0.0
Sep	253	147.5	0.0	0.0	0.0	489.8	0.0	170.5	0.0	0.0	0.0	2.3	100.1	760.1	0.0
Sep	260	0.0	61.1	0.0	0.0	214.4	411.4	0.0	756.0	0.0	0.0	514.6	0.0	0.0	0.0
Sep	267	482.7	145.1	47.5	352.8	0.0	265.7	21.3	269.8	0.0	506.1	552.5	0.0	0.0	387.7
Oct	274	0.0	0.0	0.0	159.7	10.3	557.6	66.0	218.2	0.0	0.0	153.5	0.0	3.7	281.6
Oct	281	7.3	0.0	0.0	321.6	15.7	394.1	0.0	335.9	0.0	0.0	226.3	33.5	15.8	236.4
Oct	288	316.7	0.0	0.0	0.0	0.0	239.8	312.1	59.8	327.7	63.5	461.7	0.0	45.5	0.0
Oct	295	10.1	248.0	0.0	70.4	0.0	456.6	345.3	369.3	0.0	356.1	445.5	199.0	125.4	242.8
Nov	302	236.3	589.7	0.0	815.3	0.0	210.8	56.5	453.6	366.6	0.0	11.1	0.0	0.0	242.5
Nov	309	356.3	0.0	259.9	29.8	381.5	64.6	470.8	28.4	405.8	367.4	117.1	266.9	172.6	0.0
Nov	316	56.5	473.0	98.9	0.0	141.4	0.0	169.4	460.6	0.0	605.6	174.9	72.5	290.9	0.0
Nov	323	28.2	129.9	96.8	199.6	127.1	262.0	0.0	109.0	63.6	338.9	0.0	533.7	183.6	227.8
Dec	330	169.4	62.0	79.0	186.4	175.1	455.2	84.7	593.0	260.7	527.7	462.1	946.0	127.1	499.8
Dec	337	310.6	155.3	0.0	302.3	225.9	0.0	14.1	14.1	321.9	310.6	282.4	261.2	466.0	268.3
Dec	344	113.0	70.6	0.0	237.2	504.1	180.4	120.0	468.8	330.4	225.9	159.0	532.3	451.8	474.4
Dec	351	398.2	79.1	0.0	111.5	42.4	197.7	141.2	302.2	225.9	162.4	14.5	460.3	762.5	63.5
Dec	358	586.0	127.1	0.0	91.8	282.4	141.2	155.3	162.9	557.7	450.4	156.1	369.9	931.9	279.6
annual total		10074.7	7242.7	5794.7	7015.2	9185.7	7247.5	6716.1	7902.0	7892.6	9775.7	10492.5	7162.3	12198.1	8567.9

All values in cubic meters

TABLE F: Wetland 10 Existing Condition Infiltration

Year	Day	2010	2011	2012	2013	2014	2015
Jan	1	141.2	204.7	56.5	127.1	98.8	113.0
Jan	8	103.1	248.5	104.5	445.7	423.6	127.1
Jan	15	14.1	127.1	310.6	28.2	155.3	98.8
Jan	22	453.3	84.7	343.1	300.8	70.6	169.4
Feb	29	225.9	875.4	141.2	240.0	423.6	430.7
Feb	36	113.0	296.5	49.4	367.1	42.4	225.9
Feb	43	134.1	42.4	98.8	310.6	141.2	423.6
Feb	50	367.1	127.1	144.0	437.7	402.4	155.3
Mar	57	183.6	691.9	344.5	240.0	127.1	98.8
Mar	64	3.1	543.6	50.8	287.9	141.2	0.0
Mar	71	728.5	97.4	0.0	127.1	0.0	42.4
Mar	78	53.2	211.8	0.0	98.8	56.5	84.7
Mar	85	160.3	0.0	15.5	25.0	70.1	98.8
Apr	92	203.6	199.1	0.0	433.5	142.4	396.3
Apr	99	0.0	227.4	0.0	385.5	373.1	0.0
Apr	106	0.0	443.9	0.0	197.7	0.0	270.4
Apr	113	0.0	315.9	120.3	73.7	365.6	0.0
May	120	293.0	0.0	65.1	0.0	0.0	0.0
May	127	544.5	358.3	0.0	183.9	13.9	0.0
May	134	0.0	193.1	0.0	0.0	0.0	0.0
May	141	0.0	154.7	0.0	519.3	0.0	0.0
May	148	357.9	0.0	412.5	51.2	0.0	221.5
Jun	155	189.6	66.4	0.0	165.9	0.0	483.0
Jun	162	5.9	0.0	0.0	0.0	0.0	0.0
Jun	169	668.5	123.6	104.0	0.0	0.0	0.0
Jun	176	737.3	0.0	0.0	0.0	0.0	489.3
July	183	0.0	0.0	0.0	530.0	380.1	0.0
July	190	0.0	0.0	0.0	0.0	0.0	0.0
July	197	597.8	0.0	0.0	0.0	0.0	0.0
July	204	0.0	25.4	402.3	0.0	706.4	0.0
Aug	211	0.0	28.3	0.0	572.0	0.0	0.0
Aug	218	0.0	0.0	355.6	0.0	87.0	0.0
Aug	225	59.0	153.7	0.0	0.0	385.9	0.0
Aug	232	0.0	106.0	0.0	111.7	0.0	0.0
Aug	239	0.0	0.0	0.0	0.0	0.0	0.0
Sep	246	120.6	0.0	383.6	32.0	426.9	0.0
Sep	253	231.4	0.0	0.0	0.0	0.0	0.0
Sep	260	0.0	322.5	264.4	517.5	37.5	0.0
Sep	267	633.7	0.0	0.0	0.0	0.0	0.0
Oct	274	0.0	18.8	4.5	0.0	289.4	260.6
Oct	281	168.6	451.1	430.0	73.2	44.9	0.0
Oct	288	34.4	603.6	29.0	274.0	67.1	9.1
Oct	295	300.2	312.8	858.2	221.1	0.0	553.9
Nov	302	64.5	0.0	499.6	430.0	155.7	108.3
Nov	309	101.0	38.5	21.9	229.9	103.1	367.7
Nov	316	235.3	138.3	157.9	191.5	91.8	234.4
Nov	323	243.8	146.8	16.3	127.1	533.7	320.5
Dec	330	393.9	983.0	209.0	28.2	28.2	22.0
Dec	337	63.5	303.6	205.3	56.5	42.4	23.7
Dec	344	578.9	279.6	155.3	324.8	310.6	211.0
Dec	351	70.6	121.4	140.6	427.8	296.5	186.3
Dec	358	70.6	321.9	169.4	127.1	14.1	237.2
annual total		9648.6	9988.9	6663.8	9320.9	7049.1	6463.6

All values in cubic mete

TABLE G: Wetland 10 Post Development Runoff Conditions to the Wetland

		area (m2)	runoff coeff	
Areas:	roads	1150	1	assumes road and driveway runoff is directed to bioretention facility and removed from system
	building	1750	0.6	assumes five homes for Lot 4-8
	driveway	1200	1	assumes 40m long driveway 8m wide
	natural	17500	0.6	assumes no discharge area since all discharge either evaporates or re-infiltrates
	discharge (w	0	1	

Year	Day	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Jan	1	57.8	159.4	67.0	127.1	219.5	69.3	214.8	166.3	115.5	57.8	478.2	288.8	311.9	11.6	311.9	695.3	450.5	232.2	86.6	11.6	161.7	216.0	184.8	179.0	89.0	337.3	247.2
Jan	8	274.9	71.6	11.6	23.1	177.9	0.0	73.9	80.9	231.0	231.0	225.2	0.0	395.0	46.2	231.0	335.0	490.9	167.5	0.0	86.6	80.9	173.3	219.5	106.1	82.0	670.5	138.6
Jan	15	11.6	11.6	490.9	124.7	201.0	279.5	69.3	237.9	2.3	109.7	80.9	150.2	610.9	390.4	132.8	167.5	161.7	69.3	0.0	92.4	17.3	150.2	92.4	429.7	184.8	291.1	173.3
Jan	22	46.2	225.2	121.3	55.4	76.2	87.8	115.5	175.6	115.5	92.4	69.3	358.1	23.1	265.7	265.7	155.9	346.5	28.9	46.2	0.0	75.1	254.1	242.6	173.3	138.6	436.6	144.4
Feb	29	295.7	46.2	52.0	256.4	184.8	519.8	92.4	161.7	46.2	11.6	138.6	23.1	0.0	57.8	150.2	138.6	75.1	80.9	46.2	207.9	173.3	92.4	0.0	788.7	127.1	489.7	161.7
Feb	36	57.8	83.2	219.5	335.0	92.4	323.4	207.9	34.7	23.1	23.1	34.7	23.1	127.1	182.5	11.6	23.1	86.6	80.9	473.6	0.0	92.4	57.8	164.0	265.7	150.2	739.2	84.3
Feb	43	11.6	366.9	600.6	122.4	0.0	104.0	46.2	198.7	190.6	279.5	104.0	34.7	46.2	23.1	184.8	286.4	110.9	181.3	57.8	57.8	63.5	11.6	438.9	496.7	265.7	657.2	87.8
Feb	50	50.8	71.2	420.4	45.0	0.0	210.2	180.2	288.8	127.1	196.4	254.1	127.1	48.5	219.5	517.4	0.0	34.7	304.4	231.0	284.0	254.1	115.5	246.0	323.4	150.2	69.3	485.1
Mar	57	140.9	306.1	236.8	32.3	292.2	78.5	69.3	46.2	69.3	23.1	196.4	0.0	57.8	196.4	136.3	175.0	254.1	0.0	92.4	289.9	127.1	117.8	231.0	127.1	473.6	266.8	138.6
Mar	64	45.2	190.6	145.5	311.9	0.0	23.1	0.0	381.2	23.1	429.8	34.7	104.0	11.6	207.9	311.9	415.8	86.6	0.0	196.4	265.7	15.0	369.6	217.1	315.3	53.1	710.3	516.3
Mar	71	114.9	365.0	134.0	328.4	0.0	57.8	508.2	0.0	136.5	11.6	115.5	69.3	0.0	0.0	161.7	450.5	0.0	46.2	69.3	0.0	0.0	34.7	98.2	318.8	98.2	46.2	0.0
Mar	78	271.4	268.0	80.9	12.7	82.0	129.4	23.1	258.7	96.5	23.1	34.7	132.3	0.0	323.4	311.9	335.0	0.0	115.5	0.0	57.8	28.9	194.0	150.2	46.2	153.8	237.9	21.9
Mar	85	115.5	5.8	508.6	0.0	466.5	92.6	24.5	71.6	44.3	81.7	0.0	92.4	0.0	78.5	111.1	0.0	0.0	162.6	0.0	151.0	198.0	455.8	87.2	60.8	26.4	501.3	182.1
Apr	92	209.7	144.4	203.0	43.0	589.7	152.0	289.9	114.9	61.8	0.0	22.1	92.9	87.8	184.8	0.0	33.2	79.2	59.1	159.9	427.4	167.5	189.2	281.7	322.9	314.2	39.4	339.9
Apr	99	524.4	59.5	15.4	197.4	37.9	0.0	84.3	233.2	91.7	318.3	116.9	93.5	13.2	168.8	104.0	0.0	0.0	116.6	79.8	119.0	0.0	16.9	0.0	66.3	150.2	256.6	0.0
Apr	106	0.0	68.2	0.0	217.2	0.0	109.4	0.0	55.8	136.3	496.6	198.9	0.0	588.8	146.8	0.0	193.9	310.5	425.8	0.0	0.0	0.0	239.3	0.0	49.3	0.0	0.0	113.0
Apr	113	0.0	0.0	0.0	0.0	0.0	76.3	0.0	0.0	18.9	107.3	166.1	361.3	205.7	290.8	0.0	0.0	0.0	0.0	0.0	409.5	0.0	42.6	476.6	208.8	134.1	0.0	133.1
May	120	596.8	0.0	11.8	0.0	0.0	0.0	70.0	159.2	64.1	196.3	0.0	151.6	0.0	131.2	438.6	0.0	0.0	0.0	0.0	80.5	385.5	313.0	0.0	0.0	0.0	297.2	0.0
May	127	79.5	69.3	0.0	0.0	0.0	0.0	328.0	13.7	49.4	0.0	0.0	139.0	120.9	179.4	48.6	237.1	0.0	735.4	0.0	447.3	87.5	0.0	42.2	185.9	0.0	0.0	168.1
May	134	302.1	0.0	0.0	386.8	27.8	226.5	0.0	784.1	21.0	79.1	0.0	0.0	81.3	0.0	146.3	0.0	150.4	445.3	0.0	198.4	1.4	0.0	0.0	253.2	118.4	2.3	0.0
May	141	8.5	164.3	286.4	0.0	0.0	0.0	2.7	0.0	0.0	0.0	162.6	459.4	0.0	315.4	0.0	0.0	192.9	50.3	401.9	0.0	106.4	396.2	0.0	0.0	0.0	0.0	167.0
May	148	0.0	88.8	100.0	0.0	0.0	0.0	163.7	0.0	0.0	83.2	38.5	0.0	536.4	0.0	0.0	0.0	0.0	0.0	237.6	0.0	0.0	0.0	0.0	226.4	0.0	0.0	67.8
Jun	155	0.0	0.0	0.0	114.2	0.0	6.1	0.0	105.6	0.0	0.0	320.3	0.0	0.0	348.3	0.0	0.0	0.0	0.0	5.2	0.0	385.6	0.0	0.0	0.0	0.0	122.4	40.0
Jun	162	0.0	0.0	18.3	132.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.6	0.0	915.6	0.0	294.4	0.0	93.5	0.0	0.0	0.0	0.0	0.0
Jun	169	0.0	12.2	0.0	134.8	20.9	3.6	668.7	74.5	19.2	118.0	250.1	57.3	0.0	468.3	371.9	0.0	0.0	0.0	78.2	0.0	0.0	0.0	0.0	0.0	0.0	127.6	0.0
Jun	176	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	183.2	636.0	0.0	0.0	0.0	0.0	0.0	45.7	0.0	0.0	5.4
July	183	0.0	4.2	0.0	0.0	69.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.2	161.9	0.0	0.0	0.0	0.0	0.0	234.6	261.2	0.0	0.0	0.0	0.0
July	190	0.0	0.0	147.3	158.9	5.9	0.0	0.0	0.0	0.0	396.0	0.0	0.0	0.0	531.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	373.1	0.0	0.0	0.0
July	197	0.0	0.0	0.0	404.8	0.0	0.0	0.0	204.9	0.0	0.0	0.0	0.0	22.0	0.0	0.0	0.0	0.0	6.2	396.4	0.0	0.0	0.0	447.4	0.0	0.0	0.0	0.0
July	204	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	272.6	0.0	0.0	0.0	0.0	0.0	0.0	497.4
Aug	211	382.4	0.0	0.0	0.0	0.0	0.0	425.3	0.0	0.0	379.3	0.0	0.0	0.0	0.0	0.0	0.0	370.1	435.7	0.0	0.0	0.0	41.9	0.0	0.0	0.0	0.0	0.0
Aug	218	0.0	0.0	0.0	0.0	109.9	29.4	0.0	23.4	0.0	411.5	0.0	0.0	0.0	0.0	0.0	437.1	0.0	0.0	0.0	0.0	278.5	0.0	0.0	0.0	0.0	131.4	474.4
Aug	225	0.0	0.0	212.7	339.9	0.0	0.0	0.0	16.8	0.0	0.0	0.0	0.0	0.0	0.0	32.5	0.0	0.0	0.0	131.3	0.0	0.0	0.0	884.1	0.0	0.0	0.0	0.0
Aug	232	135.0	0.0	632.1	565.3	0.0	45.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	122.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.8	0.0	0.0	0.0
Aug	239	17.3	267.9	83.0	0.0	0.0	0.0	25.8	98.7	0.0	456.2	132.5	0.0	0.0	266.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	134.3	29.2	90.0	0.0	0.0	0.0
Sep	246	0.0	91.3	776.7	0.0	0.0	488.8	0.0	0.0	0.0	103.5	0.0	0.0	19.0	573.8	0.0	0.0	0.0	83.2	0.0	0.0	0.0	172.1	0.0	49.7	61.2	0.0	0.0
Sep	253	165.5	275.2	0.0	992.6	0.0	0.0	0.0	32.0	16.0	0.0	23.6	202.2	0.0	120.7	0.0	0.0	0.0	400.6	0.0	139.5	0.0	0.0	0.0	1.9	81.9	621.7	0.0
Sep	260	0.0	0.0	0.0	486.5	129.9	195.8	0.0	87.5	93.9	336.8	0.0	0.0	42.1	0.0	50.0	0.0	0.0	175.3	336.6	0.0	618.4	0.0	0.0	421.0	0.0	0.0	0.0
Sep	267	0.0	0.0	44.6	500.3	169.6	0.0	0.0	383.4	187.8	0.0	150.1	118.3	0.0	394.8	118.7	38.9	288.6	0.0	217.3	17.4	220.7	0.0	414.0	452.0	0.0	0.0	317.1
Oct	274	0.0	0.0	40.5	309.1	135.7	246.9	0.0	130.1	50.0	0.0	30.5	0.0	631.5	0.0	0.0	0.0	130.6	8.5	456.1	54.0	178.5	0.0	0.0	125.6	0.0	3.0	230.4
Oct	281	374.9	38.4	137.5	142.6	0.0	40.4	363.7	827.4	161.7	50.8	62.5	13.7	50.7	6.0	0.0	0.0	263.1	12.9	322.3	0.0	274.8	0.0	0.0	185.1	27.4	12.9	193.4
Oct	288	0.0	148.9	119.5	0.0	65.4	162.7	283.7	256.6	151.4	346.1	446.8	143.8	257.8	259.0	0.0	0.0	0.0	0.0	196.1	255.3	48.9	268.1	52.0	377.7	0.0	37.2	0.0
Oct	295	288.3	51.4	38.9	0.0	478.7	365.0	0.0	0.0	90.3	0.0	0.0	3.0	139.4	8.3	202.8	0.0	57.6	0.0	373.5	282.5	302.1	0.0	291.3	364.5	162.8	102.6	198.6
Nov	302	79.0	62.8	420.7	40.5	0.0	8.4	9.3	0.0	186.2	527.4	133.3	304.3	511.0	193.3	482.3	0.0	666.9	0.0	172.4	46.2	371.0	299.9	0.0	9.1	0.0	0.0	198.3
Nov	309	118.1	560.0	108.0	17.4	124.1	510.4	391.9	567.0	11.6	170.4	8.6	138.6	756.4	291.5	0.0	212.6	24.4	312.0	52.9	385.1	23.2	331.9	300.6	95.8	218.3	141.2	0.0
Nov	316	194.0	124.6	494.5	11.6	100.5	246.9	893.9	59.5	191.4	785.1	107.9	0.0	196.4	46.2	386.9	80.9	0.0	115.6	0.0	138.6	376.8	0.0	495.4	143.0	59.3	238.0	0.0
Nov	323	138.2	0.0	159.4	180.2	649.1	245.5	113.2	168.5	0.3	405.6	104.0	248.4	46.2	23.1	106.3	79.2	163.3	104.0	214.3	0.0	89.1	52.0	277.2	0.0	436.6	150.2	186.3
Dec	330	268.0	45.1	207.9	300.3	127.1	63.5	300.3	41.2	161.8	0.0	395.0	168.6	254.1	138.6	50.7	64.6	152.5	143.2	372.3	69.3	485.1	213.3	431.6	378.0	773.9	104.0	408.8
Dec	337	443.5	115.5	46.2	136.3	115.5	9.2	23.1	335.0	150.2	92.4	65.0	170.0	80.9	254.1	127.1	0.0	247.3	184.8	0.0	11.6	11.6	263.3	254.1	231.0	213.7	381.2	219.5
Dec	344	279.5	217.1	237.9	23.1	202.3	34.7	138.6	184.8	92.4	381.2	13.9	207.9	184.8	92.4	57.8	0.0	194.0	412.3	147.6	98.2	383.5	270.3	184.8	130.1	435.4	369.6	388.1
Dec	351	231.0	296.8	152.5	104.0	142.1	154.8	0.0	207.9	207.9	64.7	52.0	7.6	69.3	325.7	64.7	0.0	91.2	34.7	161.7	115.5	247.2	184.8	132.8	11.9	376.5	623.7	52.0
Dec	358	144.4	487.4	87.8	127.1	57.8	228.7	288.8	392.7	17.3	277.2	52.0	53.1	57.8	479.3	104.0	0.0	75.1	231.0	115.5	127.1	133.3	456.2	368.4	127.7	302.6	762.3	228.7
annual total		6474.1	5563.9	7871.4	7840.4	5152.2	5625.6	6490.2	7660.5	3453.4	8153.6	4853.4	4537.3	6585.0	8241.0	5924.4	4740.0	5738.4	7513.8	5928.3	5493.7	6463.8	6456.0	7996.4	8582.7	5858.7	9977.9	7008.4

All values in cubic meters

TABLE G: Wetland 10 Post Development Runoff Conditions to the W

Year	Day	2010	2011	2012	2013	2014	2015
Jan	1	115.5	167.5	46.2	104.0	80.9	92.4
Jan	8	84.3	203.3	85.5	364.5	346.5	104.0
Jan	15	11.6	104.0	254.1	23.1	127.1	80.9
Jan	22	370.8	69.3	280.7	246.0	57.8	138.6
Feb	29	184.8	716.1	115.5	196.4	346.5	352.3
Feb	36	92.4	242.6	40.4	300.3	34.7	184.8
Feb	43	109.7	34.7	80.9	254.1	115.5	346.5
Feb	50	300.3	104.0	117.8	358.1	329.2	127.1
Mar	57	150.2	566.0	281.8	196.4	104.0	80.9
Mar	64	2.5	444.7	41.6	235.5	115.5	0.0
Mar	71	595.9	79.7	0.0	104.0	0.0	34.7
Mar	78	43.5	173.3	0.0	80.9	46.2	69.3
Mar	85	131.1	0.0	12.7	20.4	57.4	80.9
Apr	92	166.5	162.8	0.0	354.6	116.5	324.1
Apr	99	0.0	186.0	0.0	315.4	305.2	0.0
Apr	106	0.0	363.1	0.0	161.7	0.0	221.2
Apr	113	0.0	258.4	98.4	60.3	299.1	0.0
May	120	239.7	0.0	53.3	0.0	0.0	0.0
May	127	445.4	293.1	0.0	150.4	11.4	0.0
May	134	0.0	158.0	0.0	0.0	0.0	0.0
May	141	0.0	126.6	0.0	424.8	0.0	0.0
May	148	292.8	0.0	337.4	41.9	0.0	181.2
Jun	155	155.1	54.3	0.0	135.7	0.0	395.1
Jun	162	4.9	0.0	0.0	0.0	0.0	0.0
Jun	169	546.8	101.1	85.1	0.0	0.0	0.0
Jun	176	603.1	0.0	0.0	0.0	0.0	400.2
July	183	0.0	0.0	0.0	433.5	310.9	0.0
July	190	0.0	0.0	0.0	0.0	0.0	0.0
July	197	489.0	0.0	0.0	0.0	0.0	0.0
July	204	0.0	20.8	329.0	0.0	577.8	0.0
Aug	211	0.0	23.2	0.0	467.9	0.0	0.0
Aug	218	0.0	0.0	290.9	0.0	71.1	0.0
Aug	225	48.3	125.7	0.0	0.0	315.6	0.0
Aug	232	0.0	86.7	0.0	91.3	0.0	0.0
Aug	239	0.0	0.0	0.0	0.0	0.0	0.0
Sep	246	98.7	0.0	313.8	26.1	349.2	0.0
Sep	253	189.3	0.0	0.0	0.0	0.0	0.0
Sep	260	0.0	263.8	216.3	423.3	30.7	0.0
Sep	267	518.4	0.0	0.0	0.0	0.0	0.0
Oct	274	0.0	15.4	3.7	0.0	236.7	213.2
Oct	281	137.9	369.0	351.8	59.8	36.7	0.0
Oct	288	28.1	493.8	23.7	224.1	54.9	7.5
Oct	295	245.5	255.9	702.0	180.9	0.0	453.1
Nov	302	52.8	0.0	408.7	351.7	127.4	88.6
Nov	309	82.6	31.5	17.9	188.1	84.3	300.8
Nov	316	192.4	113.1	129.2	156.7	75.1	191.7
Nov	323	199.4	120.1	13.3	104.0	436.6	262.2
Dec	330	322.2	804.1	170.9	23.1	23.1	18.0
Dec	337	52.0	248.3	167.9	46.2	34.7	19.4
Dec	344	473.6	228.7	127.1	265.7	254.1	172.6
Dec	351	57.8	99.3	115.0	350.0	242.6	152.4
Dec	358	57.8	263.3	138.6	104.0	11.6	194.0
annual total		7892.4	8170.8	5451.0	7624.4	5766.1	5287.2

All values in cubic meters

Table H: Wetland 10 Post Development Infiltration

		area (m2)	runoff coeff	
Areas:	roads	1150	1	
	building	1750	0.6	assumes five homes for Lot 4-8
	driveway	1200	1	assumes 40m long driveway 8m wide
	natural	17500	0.6	assumes no discharge area since all discharge either evaporates or re-infiltrates
	discharge (w	0	1	

Year	Day	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Jan	1	38.5	106.3	44.7	84.7	146.3	46.2	143.2	110.9	77.0	38.5	318.8	192.5	207.9	7.7	207.9	463.5	300.3	154.8	57.8	7.7	107.8	144.0	123.2	119.4	59.3	224.8	164.8
Jan	8	183.3	47.7	7.7	15.4	118.6	0.0	49.3	53.9	154.0	154.0	150.2	0.0	263.3	30.8	154.0	223.3	327.3	111.7	0.0	57.8	53.9	115.5	146.3	70.7	54.7	447.0	92.4
Jan	15	7.7	7.7	327.3	83.2	134.0	186.3	46.2	158.6	1.5	73.2	53.9	100.1	407.3	260.3	88.6	111.7	107.8	46.2	0.0	61.6	11.6	100.1	61.6	286.4	123.2	194.0	115.5
Jan	22	30.8	150.2	80.9	37.0	50.8	58.5	77.0	117.0	77.0	61.6	46.2	238.7	15.4	177.1	177.1	104.0	231.0	19.3	30.8	0.0	50.1	169.4	161.7	115.5	92.4	291.1	96.3
Feb	29	197.1	30.8	34.7	170.9	123.2	346.5	61.6	107.8	30.8	7.7	92.4	15.4	0.0	38.5	100.1	92.4	50.1	53.9	30.8	138.6	115.5	61.6	0.0	525.8	84.7	326.5	107.8
Feb	36	38.5	55.4	146.3	223.3	61.6	215.6	138.6	23.1	15.4	15.4	23.1	15.4	84.7	121.7	7.7	15.4	57.8	53.9	315.7	0.0	61.6	38.5	109.3	177.1	100.1	492.8	56.2
Feb	43	7.7	244.6	400.4	81.6	0.0	69.3	30.8	132.4	127.1	186.3	69.3	23.1	30.8	15.4	123.2	191.0	73.9	120.9	38.5	38.5	42.4	7.7	292.6	331.1	177.1	438.1	58.5
Feb	50	33.9	47.5	280.3	30.0	0.0	140.1	120.1	192.5	84.7	130.9	169.4	84.7	32.3	146.3	345.0	0.0	23.1	202.9	154.0	189.3	169.4	77.0	164.0	215.6	100.1	46.2	323.4
Mar	57	93.9	204.1	157.9	21.6	194.8	52.4	46.2	30.8	46.2	15.4	130.9	0.0	38.5	130.9	90.9	116.7	169.4	0.0	61.6	193.3	84.7	78.5	154.0	84.7	315.7	177.9	92.4
Mar	64	30.1	127.1	97.0	207.9	0.0	15.4	0.0	254.1	15.4	286.5	23.1	69.3	7.7	138.6	207.9	277.2	57.8	0.0	130.9	177.1	10.0	246.4	144.8	210.2	35.4	473.6	344.2
Mar	71	76.6	243.3	89.3	218.9	0.0	38.5	338.8	0.0	91.0	7.7	77.0	46.2	0.0	0.0	107.8	300.3	0.0	30.8	46.2	0.0	0.0	23.1	65.5	212.5	65.5	30.8	0.0
Mar	78	181.0	178.6	53.9	8.5	54.7	86.2	15.4	172.5	64.3	15.4	23.1	88.2	0.0	215.6	207.9	223.3	0.0	77.0	0.0	38.5	19.3	129.4	100.1	30.8	102.5	158.6	14.6
Mar	85	77.0	3.9	339.1	0.0	311.0	61.8	16.3	47.7	29.5	54.5	0.0	61.6	0.0	52.4	74.1	0.0	0.0	108.4	0.0	100.7	132.0	303.9	58.1	40.5	17.6	334.2	121.4
Apr	92	139.8	96.3	135.3	28.7	393.1	101.3	193.3	76.6	41.2	0.0	14.8	62.0	58.5	123.2	0.0	22.1	52.8	39.4	106.6	284.9	111.7	126.1	187.8	215.3	209.4	26.3	226.6
Apr	99	349.6	39.7	10.2	131.6	25.3	0.0	56.2	155.5	61.1	212.2	77.9	62.3	8.8	112.5	69.3	0.0	0.0	77.7	53.2	79.4	0.0	11.3	0.0	44.2	100.1	171.1	0.0
Apr	106	0.0	45.5	0.0	144.8	0.0	73.0	0.0	37.2	90.9	331.1	132.6	0.0	392.5	97.9	0.0	129.2	207.0	283.9	0.0	0.0	0.0	159.5	0.0	32.9	0.0	0.0	75.4
Apr	113	0.0	0.0	0.0	0.0	0.0	50.8	0.0	0.0	12.6	71.5	110.8	240.9	137.1	193.9	0.0	0.0	0.0	0.0	0.0	273.0	0.0	28.4	317.7	139.2	89.4	0.0	88.8
May	120	397.9	0.0	7.9	0.0	0.0	0.0	46.6	106.1	42.7	130.9	0.0	101.1	0.0	87.5	292.4	0.0	0.0	0.0	0.0	53.6	257.0	208.7	0.0	0.0	0.0	198.1	0.0
May	127	53.0	46.2	0.0	0.0	0.0	0.0	218.7	9.2	32.9	0.0	0.0	92.7	80.6	119.6	32.4	158.1	0.0	490.3	0.0	298.2	58.3	0.0	28.1	123.9	0.0	0.0	112.1
May	134	201.4	0.0	0.0	257.9	18.6	151.0	0.0	522.7	14.0	52.7	0.0	0.0	54.2	0.0	97.5	0.0	100.3	296.9	0.0	132.3	0.9	0.0	0.0	168.8	78.9	1.6	0.0
May	141	5.7	109.6	190.9	0.0	0.0	0.0	1.8	0.0	0.0	0.0	108.4	306.3	0.0	210.3	0.0	0.0	128.6	33.6	267.9	0.0	70.9	264.1	0.0	0.0	0.0	0.0	111.3
May	148	0.0	59.2	66.7	0.0	0.0	0.0	109.2	0.0	0.0	55.5	25.7	0.0	357.6	0.0	0.0	0.0	0.0	0.0	158.4	0.0	0.0	0.0	0.0	150.9	0.0	0.0	45.2
Jun	155	0.0	0.0	0.0	76.2	0.0	4.1	0.0	70.4	0.0	0.0	213.5	0.0	0.0	232.2	0.0	0.0	0.0	0.0	3.5	0.0	257.0	0.0	0.0	0.0	0.0	81.6	26.7
Jun	162	0.0	0.0	12.2	88.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.1	0.0	610.4	0.0	196.3	0.0	62.3	0.0	0.0	0.0	0.0	0.0
Jun	169	0.0	8.2	0.0	89.9	13.9	2.4	445.8	49.7	12.8	78.7	166.7	38.2	0.0	312.2	247.9	0.0	0.0	0.0	52.1	0.0	0.0	0.0	0.0	0.0	0.0	85.1	0.0
Jun	176	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	122.2	424.0	0.0	0.0	0.0	0.0	0.0	30.4	0.0	0.0	3.6
July	183	0.0	2.8	0.0	0.0	46.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.5	107.9	0.0	0.0	0.0	0.0	0.0	156.4	174.1	0.0	0.0	0.0	0.0
July	190	0.0	0.0	98.2	105.9	3.9	0.0	0.0	0.0	0.0	264.0	0.0	0.0	0.0	354.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	248.7	0.0	0.0	0.0
July	197	0.0	0.0	0.0	269.8	0.0	0.0	0.0	136.6	0.0	0.0	0.0	0.0	14.6	0.0	0.0	0.0	0.0	4.1	264.2	0.0	0.0	0.0	298.2	0.0	0.0	0.0	0.0
July	204	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	181.7	0.0	0.0	0.0	0.0	0.0	0.0	331.6
Aug	211	254.9	0.0	0.0	0.0	0.0	0.0	283.5	0.0	0.0	252.8	0.0	0.0	0.0	0.0	0.0	0.0	246.8	290.5	0.0	0.0	0.0	28.0	0.0	0.0	0.0	0.0	0.0
Aug	218	0.0	0.0	0.0	0.0	73.3	19.6	0.0	15.6	0.0	274.3	0.0	0.0	0.0	0.0	0.0	291.4	0.0	0.0	0.0	0.0	185.7	0.0	0.0	0.0	0.0	87.6	316.3
Aug	225	0.0	0.0	141.8	226.6	0.0	0.0	0.0	11.2	0.0	0.0	0.0	0.0	0.0	0.0	21.7	0.0	0.0	0.0	87.5	0.0	0.0	0.0	589.4	0.0	0.0	0.0	0.0
Aug	232	90.0	0.0	421.4	376.9	0.0	30.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.9	0.0	0.0	0.0
Aug	239	11.5	178.6	55.4	0.0	0.0	0.0	17.2	65.8	0.0	304.1	88.4	0.0	0.0	177.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.5	19.4	60.0	0.0	0.0	0.0
Sep	246	0.0	60.8	517.8	0.0	0.0	325.9	0.0	0.0	0.0	69.0	0.0	0.0	12.7	382.5	0.0	0.0	0.0	55.5	0.0	0.0	0.0	114.7	0.0	33.1	40.8	0.0	0.0
Sep	253	110.3	183.5	0.0	661.8	0.0	0.0	0.0	21.4	10.6	0.0	15.7	134.8	0.0	80.5	0.0	0.0	0.0	267.1	0.0	93.0	0.0	0.0	0.0	1.3	54.6	414.5	0.0
Sep	260	0.0	0.0	0.0	324.3	86.6	130.5	0.0	58.3	62.6	224.5	0.0	0.0	28.1	0.0	33.3	0.0	0.0	116.9	224.4	0.0	412.3	0.0	0.0	280.6	0.0	0.0	0.0
Sep	267	0.0	0.0	29.7	333.5	113.1	0.0	0.0	255.6	125.2	0.0	100.0	78.9	0.0	263.2	79.1	25.9	192.4	0.0	144.9	11.6	147.1	0.0	276.0	301.3	0.0	0.0	211.4
Oct	274	0.0	0.0	27.0	206.1	90.5	164.6	0.0	86.7	33.3	0.0	20.4	0.0	421.0	0.0	0.0	0.0	87.1	5.6	304.1	36.0	119.0	0.0	0.0	83.7	0.0	2.0	153.6
Oct	281	250.0	25.6	91.6	95.1	0.0	27.0	242.5	551.6	107.8	33.8	41.7	9.1	33.8	4.0	0.0	0.0	175.4	8.6	214.9	0.0	183.2	0.0	0.0	123.4	18.3	8.6	128.9
Oct	288	0.0	99.3	79.6	0.0	43.6	108.5	189.1	171.1	100.9	230.7	297.9	95.9	171.9	172.7	0.0	0.0	0.0	0.0	130.8	170.2	32.6	178.7	34.7	251.8	0.0	24.8	0.0
Oct	295	192.2	34.3	26.0	0.0	319.1	243.4	0.0	0.0	60.2	0.0	0.0	2.0	92.9	5.5	135.2	0.0	38.4	0.0	249.0	188.3	201.4	0.0	194.2	243.0	108.5	68.4	132.4
Nov	302	52.6	41.9	280.5	27.0	0.0	5.6	6.2	0.0	124.1	351.6	88.8	202.9	340.7	128.9	321.6	0.0	444.6	0.0	114.9	30.8	247.3	199.9	0.0	6.0	0.0	0.0	132.2
Nov	309	78.7	373.3	72.0	11.6	82.7	340.2	261.3	378.0	7.7	113.6	5.7	92.4	504.3	194.3	0.0	141.7	16.3	208.0	35.3	256.8	15.5	221.3	200.4	63.9	145.5	94.1	0.0
Nov	316	129.4	83.0	329.7	7.7	67.0	164.6	595.9	39.6	127.6	523.4	71.9	0.0	130.9	30.8	258.0	53.9	0.0	77.1	0.0	92.4	251.2	0.0	330.3	95.4	39.5	158.6	0.0
Nov	323	92.1	0.0	106.3	120.1	432.7	163.7	75.5	112.3	0.2	270.4	69.3	165.6	30.8	15.4	70.8	52.8	108.8	69.3	142.9	0.0	59.4	34.7	184.8	0.0	291.1	100.1	124.2
Dec	330	178.6	30.0	138.6	200.2	84.7	42.3	200.2	27.5	107.9	0.0	263.3	112.4	169.4	92.4	33.8	43.1	101.6	95.5	248.2	46.2	323.4	142.2	287.8	252.0	515.9	69.3	272.5
Dec	337	295.7	77.0	30.8	90.9	77.0	6.2	15.4	223.3	100.1	61.6	43.3	113.3	53.9	169.4	84.7	0.0	164.9	123.2	0.0	7.7	7.7	175.6	169.4	154.0	142.5	254.1	146.3
Dec	344	186.3	144.8	158.6	15.4	134.9	23.1	92.4	123.2	61.6	254.1	9.2	138.6	123.2	61.6	38.5	0.0	129.4	274.9	98.4	65.5	255.6	180.2	123.2	86.7	290.3	246.4	258.7
Dec	351	154.0	197.9	101.6	69.3	94.7	103.2	0.0	138.6	138.6	43.1	34.7	5.0	46.2	217.1	43.1	0.0	60.8	23.1	107.8	77.0	164.8	123.2	88.6	7.9	251.0	415.8	34.7
Dec	358	96.3	324.9	58.5	84.7	38.5	152.5	192.5	261.8	11.6	184.8	34.7	35.4	38.5	319.6	69.3	0.0	50.1	154.0	77.0	84.7	88.8	304.2	245.6	85.1	201.7	508.2	152.5
annual total		4316.0	3709.3	5247.6	5226.9	3434.8	3750.4	4326.8	5107.0	2302.3	5435.7	3235.6	3024.9	4390.0	5494.0	3949.6	3160.0	3825.6	5009.2	3952.2	3662.4	4309.2	4304.0	5330.9	5721.8	3905.8	6651.9	4672.3

All values in cubic meters

Table H: Wetland 10 Post Development Infiltration

Year	Day	2010	2011	2012	2013	2014	2015
Jan	1	77.0	111.7	30.8	69.3	53.9	61.6
Jan	8	56.2	135.5	57.0	243.0	231.0	69.3
Jan	15	7.7	69.3	169.4	15.4	84.7	53.9
Jan	22	247.2	46.2	187.1	164.0	38.5	92.4
Feb	29	123.2	477.4	77.0	130.9	231.0	234.9
Feb	36	61.6	161.7	27.0	200.2	23.1	123.2
Feb	43	73.2	23.1	53.9	169.4	77.0	231.0
Feb	50	200.2	69.3	78.5	238.7	219.5	84.7
Mar	57	100.1	377.3	187.9	130.9	69.3	53.9
Mar	64	1.7	296.5	27.7	157.0	77.0	0.0
Mar	71	397.3	53.1	0.0	69.3	0.0	23.1
Mar	78	29.0	115.5	0.0	53.9	30.8	46.2
Mar	85	87.4	0.0	8.5	13.6	38.2	53.9
Apr	92	111.0	108.6	0.0	236.4	77.6	216.1
Apr	99	0.0	124.0	0.0	210.2	203.4	0.0
Apr	106	0.0	242.1	0.0	107.8	0.0	147.4
Apr	113	0.0	172.3	65.6	40.2	199.4	0.0
May	120	159.8	0.0	35.5	0.0	0.0	0.0
May	127	296.9	195.4	0.0	100.3	7.6	0.0
May	134	0.0	105.3	0.0	0.0	0.0	0.0
May	141	0.0	84.4	0.0	283.2	0.0	0.0
May	148	195.2	0.0	224.9	27.9	0.0	120.8
Jun	155	103.4	36.2	0.0	90.5	0.0	263.4
Jun	162	3.2	0.0	0.0	0.0	0.0	0.0
Jun	169	364.5	67.4	56.7	0.0	0.0	0.0
Jun	176	402.1	0.0	0.0	0.0	0.0	266.8
July	183	0.0	0.0	0.0	289.0	207.3	0.0
July	190	0.0	0.0	0.0	0.0	0.0	0.0
July	197	326.0	0.0	0.0	0.0	0.0	0.0
July	204	0.0	13.8	219.4	0.0	385.2	0.0
Aug	211	0.0	15.4	0.0	311.9	0.0	0.0
Aug	218	0.0	0.0	193.9	0.0	47.4	0.0
Aug	225	32.2	83.8	0.0	0.0	210.4	0.0
Aug	232	0.0	57.8	0.0	60.9	0.0	0.0
Aug	239	0.0	0.0	0.0	0.0	0.0	0.0
Sep	246	65.8	0.0	209.2	17.4	232.8	0.0
Sep	253	126.2	0.0	0.0	0.0	0.0	0.0
Sep	260	0.0	175.9	144.2	282.2	20.5	0.0
Sep	267	345.6	0.0	0.0	0.0	0.0	0.0
Oct	274	0.0	10.2	2.5	0.0	157.8	142.1
Oct	281	91.9	246.0	234.5	39.9	24.5	0.0
Oct	288	18.8	329.2	15.8	149.4	36.6	5.0
Oct	295	163.7	170.6	468.0	120.6	0.0	302.0
Nov	302	35.2	0.0	272.4	234.5	84.9	59.1
Nov	309	55.1	21.0	11.9	125.4	56.2	200.5
Nov	316	128.3	75.4	86.1	104.4	50.1	127.8
Nov	323	132.9	80.1	8.9	69.3	291.1	174.8
Dec	330	214.8	536.0	114.0	15.4	15.4	12.0
Dec	337	34.7	165.6	111.9	30.8	23.1	12.9
Dec	344	315.7	152.5	84.7	177.1	169.4	115.0
Dec	351	38.5	66.2	76.7	233.3	161.7	101.6
Dec	358	38.5	175.6	92.4	69.3	7.7	129.4
annual total		5261.6	5447.2	3634.0	5082.9	3844.1	3524.8

All values in cubic me

APPENDIX G

Reasonable Use Policy Calculations

TABLE 1 - Reasonable Use Concept Calculation (Individual Systems)

$$C_m = C_b + x*(C_r - C_b)$$

where

C_m = maximum concentration of a particular contaminant
C_r = maximum permissible concentration in the environment (ODWS)
C_b = background concentration of the particular contaminant in the groundwater
x = reduction factor for analysis

C_r = 10 mg/L
C_b = 0.2 MOE Guidelines (2008)
x = 0.25 **(0.25 for health related parameters)**

C_m = 2.65 mg/L

$$C_w = C_m - C_p - C_o$$

where

= maximum concentration of a particular contaminant originating in the disposal site
C_p = present background concentration
C_o = potential contaminant increase from other sources

C_p = 0 mg/L (assumed)
C_o = 0 mg/L (assumed)

C_w = 2.7 mg/L **or 10mg/L for small individual systems**

Detailed Calculation

$$C_e = (C_p*P*A + C_{s*}Q_s + C_b*Q_b)/(P*A + Q_s + Q_b)$$

where

Total Property Area		**0.45**	**ha**	
Downgradient Area	(A)	4,500	m^2	
Annual Infiltration Rate	(P)	250	mm	MOE guideline is 250mm/a
Diluting Volume	(P*A)	1,125	m^3/a	
Aquifer Thickness	(b)	-	m	
Aquifer Velocity	(v)	3.3E-06	m/s	
		0.3	m/day	
Aquifer Cross-sectional Width	(l)	-	m	
Base Flow	(Q_b)	-	m^3/a	
Average Daily Sewage Volume	(Q_s)	1,000	L/day	Input (average Annual Flow)
		365	m^3/a	
Effluent Nitrate Concentration	(C_s)	40.0	mg/L	Class IV
Estimated Site Concentration	(C_e)	**9.8**	mg/L	>10mg/L

TABLE 2 - Reasonable Use Concept Calculation (Entire Development)

$$C_m = C_b + x*(C_r - C_b)$$

where

C_m = maximum concentration of a particular contaminant

C_r = maximum permissible concentration in the environment (ODWS)

C_b = background concentration of the particular contaminant in the groundwater

x = reduction factor for analysis

C_r	=	10	mg/L		
C_b	=	3.82		0	
x	=	0.25			(0.25 for health related parameters)

C_m = 5.365 mg/L

$$C_w = C_m - C_p - C_o$$

where

C_w = maximum concentration of a particular contaminant originating in the disposal site

C_p = present background concentration

C_o = potential contaminant increase from other sources

C_p	=	3.82	mg/L (assumed)
C_o	=	0	mg/L (assumed)

C_w = 1.5 mg/L **or 10mg/L for small individual systems**

Detailed Calculation

$$C_e = (C_p*P*A + C_s*Q_s + C_b*Q_b)/(P*A + Q_s + Q_b)$$

where

Total Property Area		**11.00**	**ha**	
Downgradient Area	(A)	66,000	m^2	
Annual Infiltration Rate	(P)	215	mm	MOE guideline is 250mm/a
Diluting Volume	(P*A)	14,190	m^3/a	
Aquifer Thickness	(b)	-	m	assumed
Aquifer Velocity	(v)	3.3E-06	m/s	assumed
		0.3	m/day	
Aquifer Cross-sectional Width	(l)	-	m	assumed
Base Flow	(Q_b)	-	m^3/a	
Average Daily Sewage Volume	(Q_s)	8,000	L/day	Input (based on MOE guidelines for Average Annual Flow)
		2,922	m^3/a	
Effluent Nitrate Concentration	(C_s)	40.0	mg/L	Class IV standard septic system
Estimated Site Concentration	(C_e)	**10.00**	mg/L	<10 mg/L (meets criteria)

APPENDIX H

Wetland Water Balance Risk Evaluation (WWBRE)

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

April 30, 2020 AEC 08-019

Ventawood Management Inc.
2458 Dundas Street W
Mississauga ON
L5K 1R8

Attention: Carmen Jandu, MCIP RPP

Re: **Wetland Water Balance Risk Evaluation (Updated)**
Laurelpark Subdivision

Dear Ms. Jandu:

Azimuth Environmental Consulting, Inc. (Azimuth) is pleased to submit an updated Wetland Water Balance Risk Evaluation (WWBRE) for the proposed Laurelpark Subdivision located along Mount Pleasant Road on Part of Lot 19, Concession 9, Town of Caledon in the Region of Peel. This WWBRE is required as the proposed residential estate subdivision has the potential to impact the water balance of wetlands that will be protected during and following development.

The Laurelpark Subdivision site currently contains a total of seven wetland features which vary in size and hydrological classification. Azimuth has previously completed a Hydrogeological Assessment Report (2017) and an Environmental Impact Study (2017) for the property, which have provided important hydrogeological and ecological data for completion of this WWBRE.

Magnitude of Potential Hydrological Change

To first determine the magnitude of potential hydrological change within each wetland, information was collected pertaining to catchment areas and proposed changes within these areas. The existing and post-development catchment sizes were included in Azimuth's Hydrogeological Assessment Report (2017) and were originally provided by Calder Engineering. Table 1 provides a summary of this information. Figures 5b – 5f are also appended illustrating each wetland catchment, development, impervious and natural system areas (areas in ha included in figures).

The impervious cover score for each wetland was calculated using the formula provided in Appendix A (Example 1) of the TRCA document "Wetland Water Balance Risk Evaluation" (2017). It should be noted that no water taking is proposed within any of the wetland catchment areas, and no locally significant recharge areas are located on the subject property.

Table 1: Wetland Information Summary

Wetland ID	**Catchment Area (C)**	**Wetland Area**	**Development Area (C_{dev})**	**Impervious Area (IC)**	**Impervious Cover Score (S)**
Wetland 4	wetland catchment size increasing slightly – no assessment needed				
Wetland 5	1.79 ha	0.12 ha	0.36 ha	0.04 ha	**2%**
Wetland 6	2.60 ha	0.25 ha	0.31 ha	0.05 ha	**2%**
Wetland 7	1.60 ha	0.22 ha	0.37 ha	0.07 ha	**5%**
Wetland 8	1.92 ha	0.06 ha	0.57 ha	0.10 ha	**6%**
Wetland 10	3.29 ha	0.24 ha	1.93 ha	0.41 ha	**12%**
MNRF Identified Wetland	wetland catchment size will not change – no assessment needed				

It should be noted that the catchment area for Wetland 4 will increase slightly on a post-development basis, so an assessment was not deemed necessary for this feature. Also, the catchment size for the MNRF Identified Wetland will not change so an assessment was also not required for this feature.

Following TRCA's calculation formula ($S = IC \times C_{dev} / C$), the on-site Wetlands 5, 6, 7, 8 and 10 were given impervious cover scores of between 2% - 12%. These scores for Wetlands 5 – 8 would fall under the "Low Magnitude" (<10%) category for probability of hydrological change. As the Impervious Cover Scores for these wetlands are between 2% -6%, it is unlikely that the proposed development will have a significant impact on wetland hydrology. Wetland 10 was given a score of 12% which would fall under the "Medium Magnitude" (10% – 25%) category for probability for hydrological change.

Please refer to the images below for how each wetland impervious cover score was calculated (TRCA Wetland Water Balance Risk Evaluation – Appendix A "Example 1" figure used). It should be noted that the catchment area used in each calculation was the total catchment area subtracted by the wetland feature area. Also please refer to the attached figures 5b – 5f for further visual aids.

Image 1: Wetland 5 Impervious Cover Score Calculation

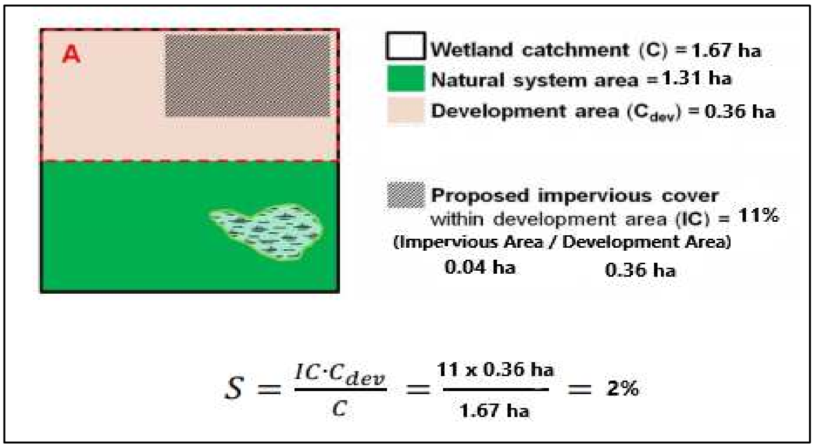


Image 2: Wetland 6 Impervious Cover Score Calculation

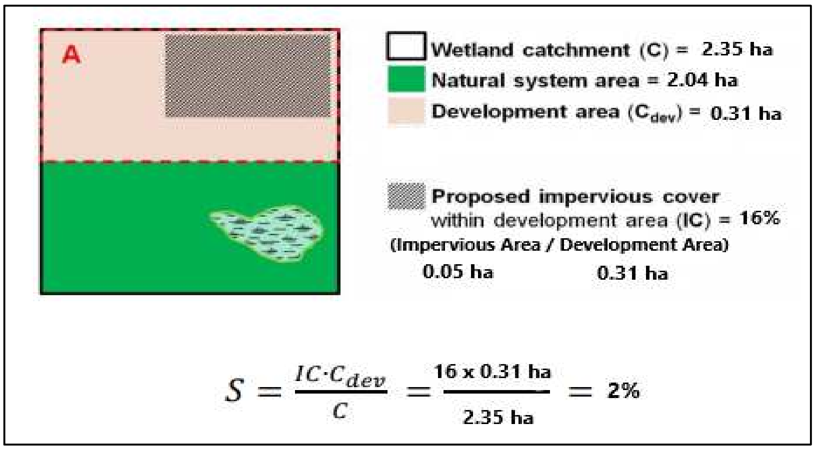


Image 3: Wetland 7 Impervious Cover Score Calculation

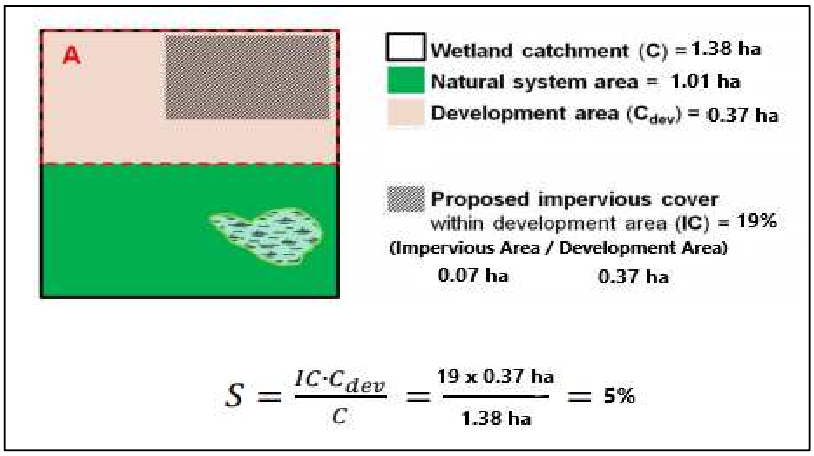


Image 4: Wetland 8 Impervious Cover Score Calculation

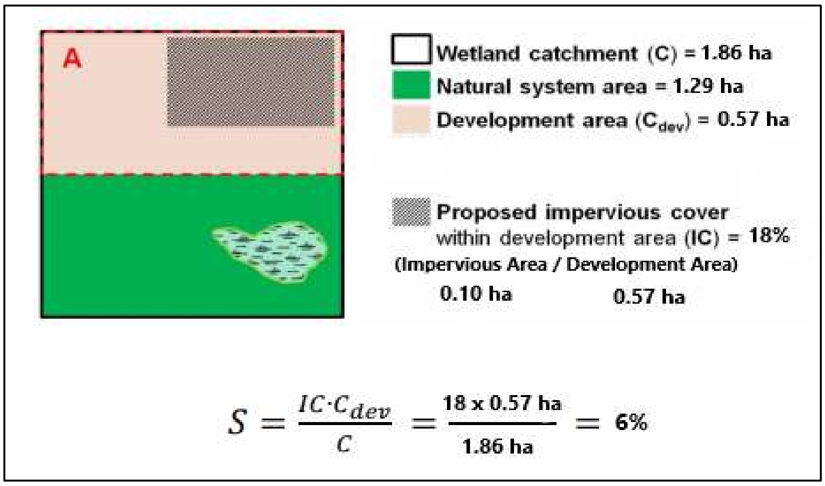
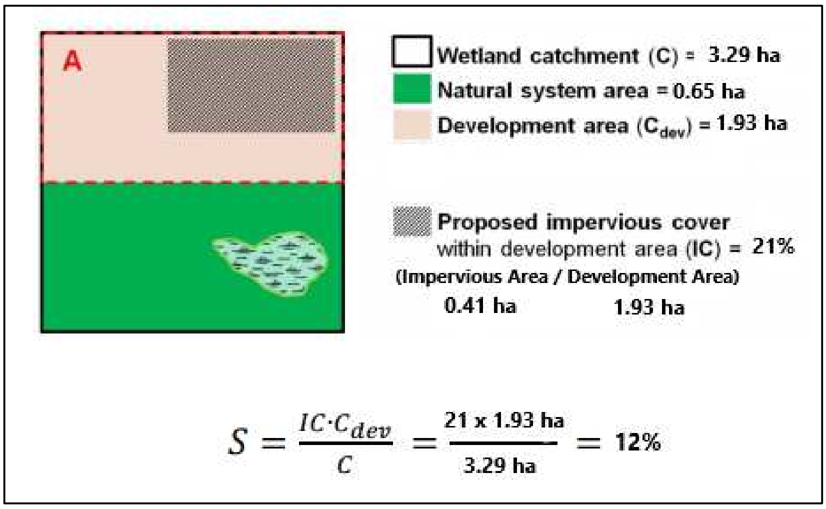


Image 5: Wetland 10 Impervious Cover Score Calculation



Wetland Sensitivity (Ecological)

The sensitivity of a wetland to hydrological change is assessed based on the abiotic and biotic characteristics of the wetland that are directly related to hydrology and/or ecology. Other aspects of wetland ecology not relating directly to hydrology may be evaluated through parallel processes external to this Risk Evaluation. To assess the sensitivity of a wetland to hydrological change five criteria are used:

i) Vegetation community
ii) Fauna species
iii) Flora species
iv) Significant wildlife habitat for hydrologically sensitive species
v) Hydrological classification

The sensitivity of each wetland to hydrological change was assessed using the data listed below. The data tables were compiled using the information collected during the completion of Azimuth's Environmental Impact Study (2017). The compiled data was then used to determine the sensitivity of each wetland. The highest magnitude sensitivity category with one or more criteria satisfied determines the overall sensitivity of the wetland to hydrological change. Please refer to Tables 2 – 7 for all data analysis and rankings.

Vegetation Community

Table 2: Wetland community types represented on the property (and associated sensitivity levels)

ELC Community Type	Sensitivity Level (TRCA 2017)	ELC Type	Wetland #
MAM3-2	Medium	Reed Canary Grass Organic Meadow Marsh	MNRF Identified
MAS2-1	Medium	Cattail Mineral Shallow Marsh	4, 8
SAF1-3	Medium	Duckweed Floating-Leaved Shallow Aquatic	7
SAS1-3	Medium	Stonewort Submerged Shallow Aquatic	4, 10
SWD3-2	Medium	Silver Maple Mineral Deciduous Swamp	5
SWT2-5	Low	Red-osier Mineral Thicket Swamp	6,7

* Figure 2a highlights the vegetation communities present on the property.

Fauna Species

Table 3: Fauna species documented on the property, associated sensitivity level, and wetland community associations

Fauna Species	Sensitivity Level (TRCA 2017)	Wetland Community Association	Wetland #
American Toad	Medium	N/A (General observation)	N/A
Gray Treefrog	High	SAS1-3, SAF1-3, SWT2-5	4, 7, 10
Wood Frog	High	SAS1-3, SAF1-3, SWT2-5, MAS2-1	4, 6, 7, 8, 10
Northern Spring Peeper	High	SAS1-3, SAF1-3, SWT2-5	4, 6, 7, 10
Western Chorus Frog	High	SAS1-3	4
Green Frog	Medium	SAS1-3, SAF1-3	4, 7, 10
Common Snapping Turtle	High	SAF 1-3, SWT2-5	7
Midland Painted Turtle	High	SAS1-3, MAS2-1	4
Wood Duck	Medium	N/A (General observation)	N/A

Mallard	Low	N/A (Flyover)	N/A
Canada Goose	Low	N/A (Flyover)	N/A
Great Blue Heron	Low	N/A (Flyover)	N/A
Common Yellowthroat	Low	SAF1-3, SWT2-5	7
Green Heron	Low	SAF1-3	7
Alder Flycatcher	Low	SWT2-5	7

Flora species

Table 4: Flora species documented on the property, associated sensitivity level, and wetland community associations

Flora Species	Sensitivity Level (TRCA 2017)	SWD 3-2	SWT 2-5	MAM 3-2	MAS 2-1	SAS 1-3	SAF 1-3	Wetland #
Calla palustris	High					X		4
Equisetum pratense	High	X	X					5, 6, 7
Glyceria borealis	High				X			8
Alisma triviale	Low		X		X			6,7,8
Bidens cernua	Low	X						5
Bidens frondosa	Low							N/A
Epilobium coloratum	Low				X			8
Eupatorium perfoliatum	Low		X					6, 7
Eutrochium maculatum	Low	X	X	X				5, 6, 7
Leersia oryzoides	Low							N/A
Salix discolor	Low	X	X	X				6, 7, and MNRF Identified
Salix petiolaris	Low		X	X				6, 7, and

								MNRF Identified
Scirpus atrovirens	Low	X	X					4, 6, 7
Sparganium eurycarpum	Low				X			8
Spiraea alba	Low			X				9
Typha latifolia	Low	X	X		X			5, 6, 7, 8
Acer saccharinum	Medium	X						5
Acer x freemanii	Medium		X					6,7
Alopecurus aequalis	Medium				X			8
Bidens tripartite	Medium							N/A
Carex pseudocyperus	Medium							N/A
Ceratophyllum demersum	Medium					X		10
Cicuta maculata	Medium	X	X					5, 6, 7
Dryopteris carthusiana	Medium							N/A
Eleocharis erythropoda	Medium							N/A
Galium palustre	Medium	X	X					5, 6, 7
Galium tinctorium	Medium		X					6, 7
Glyceria grandis	Medium							N/A
Impatiens capensis	Medium	X	X	X				5, 6, 7
Lycopus americanus	Medium							N/A
Lycopus uniflorus	Medium							N/A
Mimulus ringens	Medium							N/A
Onoclea sensibilis	Medium	X	X					5, 6, 7

Poa palustris	Medium	X	X		X			5, 6, 7, 8
Potamogeton foliosus	Medium					X		10
Potamogeton natans	Medium					X		4
Potamogeton zosteriformis	Medium					X		4
Ribes hirtellum	Medium							N/A
Ribes triste	Medium		X					6, 7
Sagittaria latifolia	Medium							6, 7
Salix amygdaloides	Medium							N/A
Salix bebbiana	Medium		X	X				N/A
Salix eriocephala	Medium		X					6, 7
Salix lucida	Medium		X					6, 7
Schoenoplectus tabernaemonta	Medium		X					6, 7
Scirpus cyperinus	Medium							N/A
Scutellaria galericulata	Medium							N/A
Scutellaria lateriflora	Medium		X					6, 7
Sium suave	Medium		X					6, 7
Spirodela polyrhiza	Medium					X		4
Symphyiotrichum puniceum	Medium							N/A
Thuja occidentalis	Medium				X			8
Viburnum opulus	Medium							N/A

Significant Wildlife Habitat for Hydrologically Sensitive Species

Table 5: Wetland community types represented on the property with Significant Wildlife Habitat function for hydrologically-sensitive species.

ELC Community Type	Significant Wildlife Habitat Function (MNRF 2014)	Wetland #
SWT2-5	Confirmed Habitat for Species of Special Concern or Rare Wildlife Species (presence of Western Chorus Frog)	7
SWD3-2	N/A	
MAM3-2	N/A	
MAS2-1	N/A	
SAF1-3	Confirmed Habitat for Species of Special Concern or Rare Wildlife Species (presence of Western Chorus Frog)	7
SAS1-3	N/A	

Table 6: Hydrological classification considering ecology for wetland community types represented on the property.

Wetland No	Hydrological Classification	Presence of Medium Sensitivity Vegetation Communities or Medium Sensitivity Species	Sensitivity
4	isolated	Yes	High
5	palustrine	Yes	High
6	palustrine	Yes	High
7	palustrine	Yes	High
8	isolated	Yes	High
10	palustrine	Yes	High
MNRF Identified Wetland	isolated	Yes	High

Table 7: Summary of sensitivity criteria for wetland community types represented on the property.

Sensitivity Evaluation Criteria	Community-specific Sensitivity Rank						
	4	**5**	**6**	**7**	**8**	**10**	**MNRF Identified Wetland**
Vegetation Community	Medium	Medium	Low	Medium	Medium	Medium	Medium
Fauna Species	High	Low	High	High	High	High	Low
Flora Species	Medium	Medium	Medium	Medium	Medium	Medium	Low
Significant Wildlife Habitat	Low	Low	Low	High	Low	Low	Low
Hydrological Classification (considering ecology)	High	High	High	High	High	High	Low
Overall Sensitivity (Highest magnitude of sensitivity)	**High**	**High**	**High**	**High**	**High**	**High**	**Medium**

Summary and Conclusions

To summarize, each on-site wetland was assessed from both hydrological and ecological perspectives to determine the degree of change proposed to the wetland catchments, and the level of sensitivity of each feature. Following the assessments the following determinations have been made:

- Wetlands 4 & MNRF Identified Wetland will not experience a loss of wetland catchment area and do not require a WWBRE.
- Wetlands 5, 6, 7 & 8 were given impervious cover scores of between 2% - 6%. These score fall under the “Low Magnitude” (<10%) category for probability of hydrological change. Wetland 10 was given an impervious cover score of 12% which falls under the “Medium Magnitude” (10% - 25%) category for probability of hydrological change.
- Wetlands 4, 5, 6, 7, 8 & 10 were given overall sensitivity ranking of “High”.
- The MNRF Identified Wetland was given an overall sensitivity ranking of “Medium”.

According to Figure 3 of the TRCA Wetland Water Balance Risk Evaluation document (Wetland Risk Evaluation Decision Tree), Wetlands 5, 6, 7 & 8 are ranked as “Low Risk”. Low Risk wetlands do not require monitoring, although a non-continuous hydrological model and mitigation plan to maintain water balance to wetlands are required. As Azimuth has completed a Features Based Water Balance for these wetlands within our Hydrogeologic Assessment Report (2020), this should fulfill the non-continuous hydrological model requirement. Also, the impacts to the wetland catchment areas will be minimal (1% change in most cases), so mitigation strategies should not be necessary.

Wetland 10 is ranked as “High Risk”, as it has a Medium Risk for hydrological change and High Risk for ecological sensitivity. According to Figure 3 of the TRCA WWBRE document, a High Risk wetland requires a monitoring plan, continuous hydrological model and mitigation plan. Azimuth will work with TRCA regarding the specific requirements for monitoring. To date, there has been no baseline hydrological data collected for Wetland 10 as it is located on a neighbouring property. Permission from the landowner must be granted prior to any monitoring taking place.

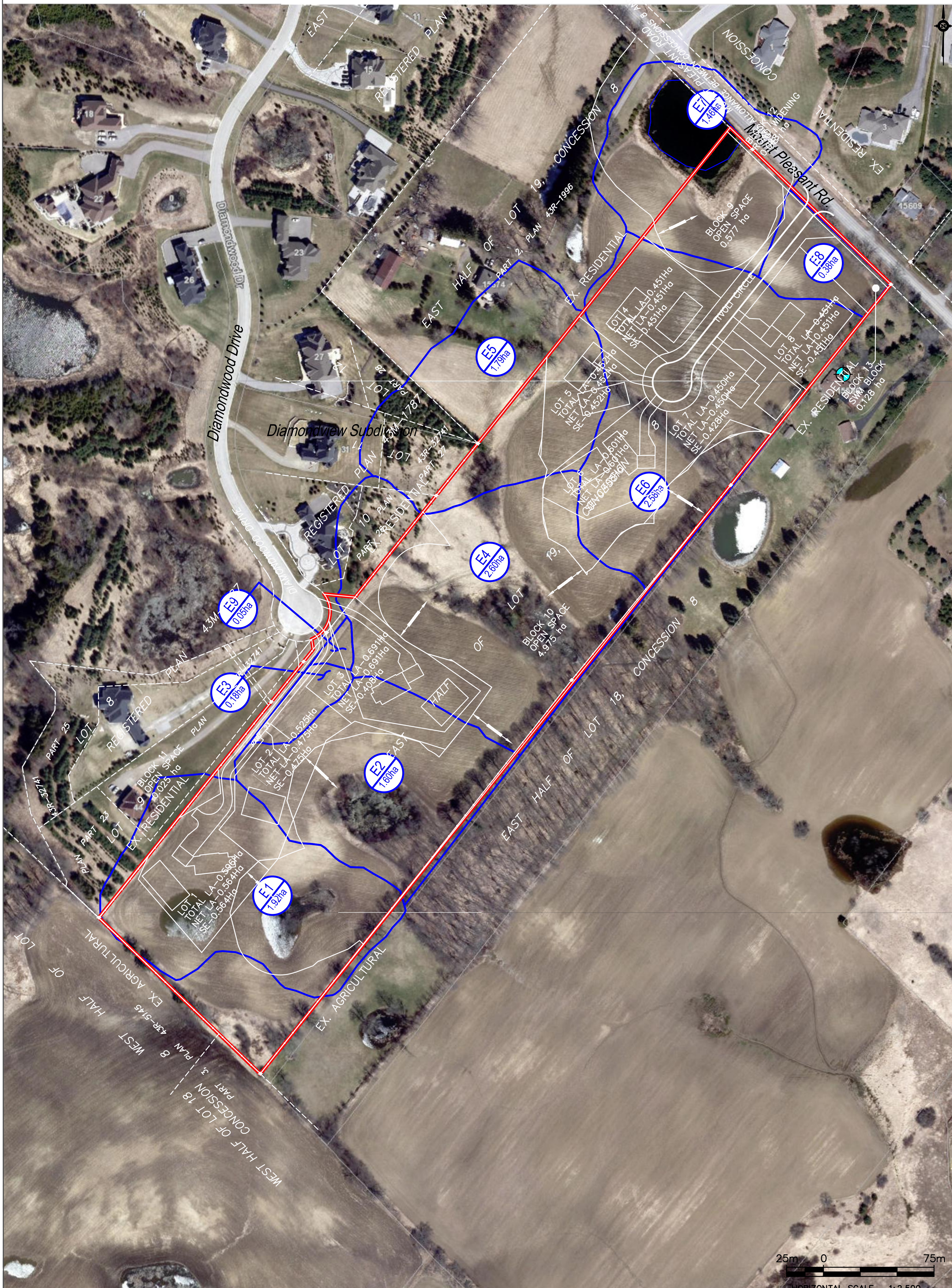
Wetland 4 & the MNRF Identified Wetland are of no risk to hydrological or ecological change and require no action.

If you have any questions or concerns please do not hesitate to contract the undersigned.

Yours truly,
AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Mike Jones, M.Sc., P.Geo.
President

Lisa Moran, B.Sc.Env.
Terrestrial Ecologist



LEGEND:

Approx. Property Boundary

Existing Drainage Catchment Areas

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Drainage Catchment Analysis

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	June 2017	Figure No.	
Created By:	JLM	5	
Project No.	08-019		
Reference:	First Base Solutions		

DAYSTAMP: P:\08-019 Mount Pleasant\Drafting\dwg\08-019 FiguresV2.dwg 10/3/2008

LEGEND:

- *Approx. Property Boundary*
- *Existing Drainage Catchment Areas Wetland 5 = 1.79ha*
  Natural Systems Area = 1.31ha
- *Development Area = 0.36ha*
- *Wetland Area = 0.12ha*
- *Impervious Area = 0.04ha*

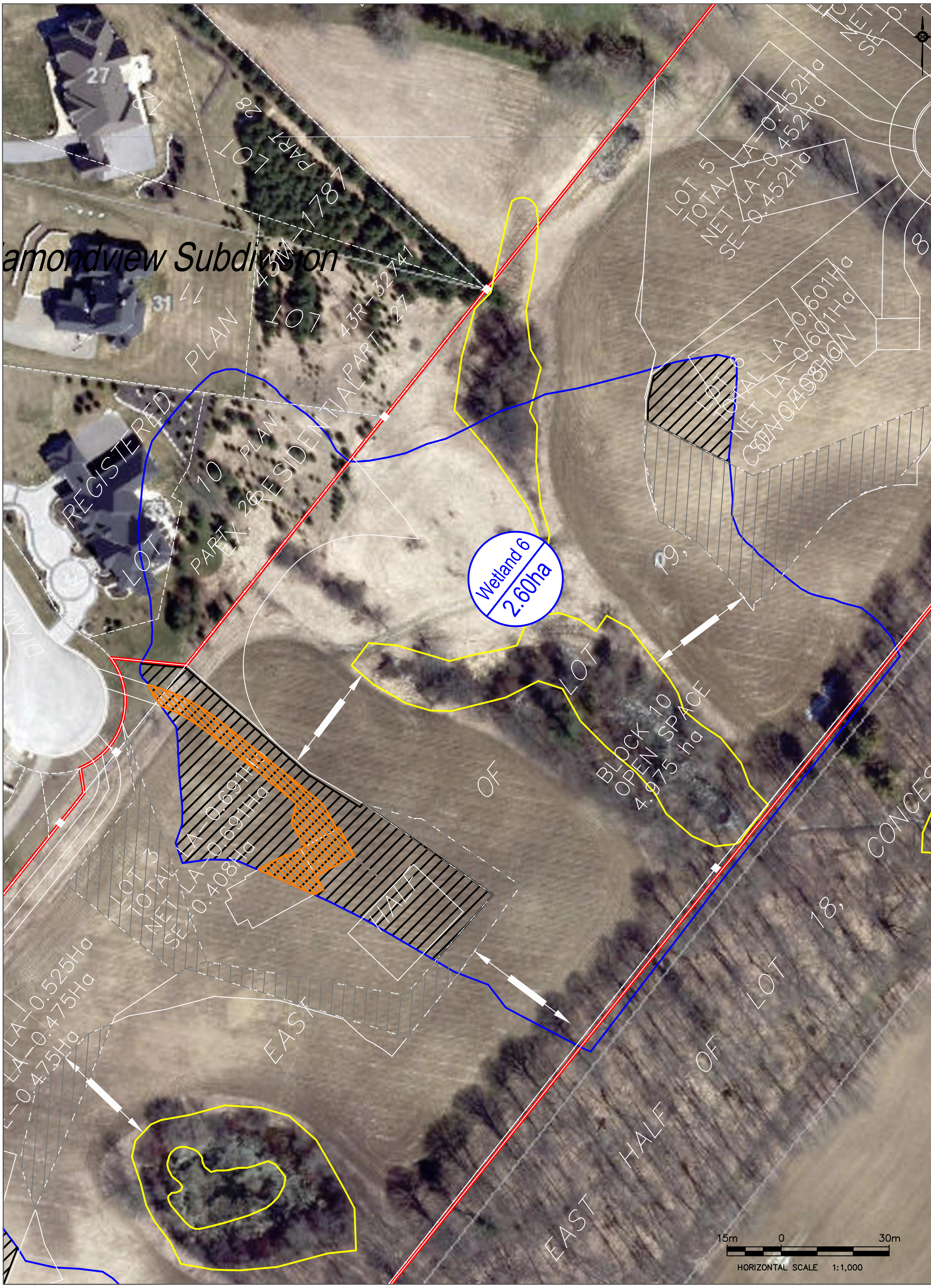
AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Drainage Catchment Analysis
Wetland 5

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	June 2017	Figure No.
Created By:	JLM	5
Project No.	08-019	
Reference:	First Base Solutions	

DAYSTAMP: P:\08-019 Mount Pleasant\Drafting\dwg\08-019 FiguresV2.dwg 10/3/2008



LEGEND:

- Approx. Property Boundary
- Existing Drainage Catchment Areas Wetland 6 Area = 2.60ha
  Natural Systems Area = 2.04ha
- Development Area = 0.31ha
- Wetland Area = 0.25ha
- Impervious Area = 0.05ha

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AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Drainage Catchment Analysis
Wetland 6

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	June 2017	Figure No.
Created By:	JLM	5c
Project No.	08-019	
Reference:	First Base Solutions	

LEGEND:

- *Approx. Property Boundary*
- *Existing Drainage Catchment Areas Wetland 7 Area = 1.60ha*
  Natural Systems Area = 1.01ha
- *Development Area = 0.37ha*
- *Wetland Area = 0.22ha*
- *Impervious Area = 0.07ha*

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Drainage Catchment Analysis
Wetland 7

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	June 2017	Figure No.
Created By:	JLM	5d
Project No.	08-019	
Reference:	First Base Solutions	

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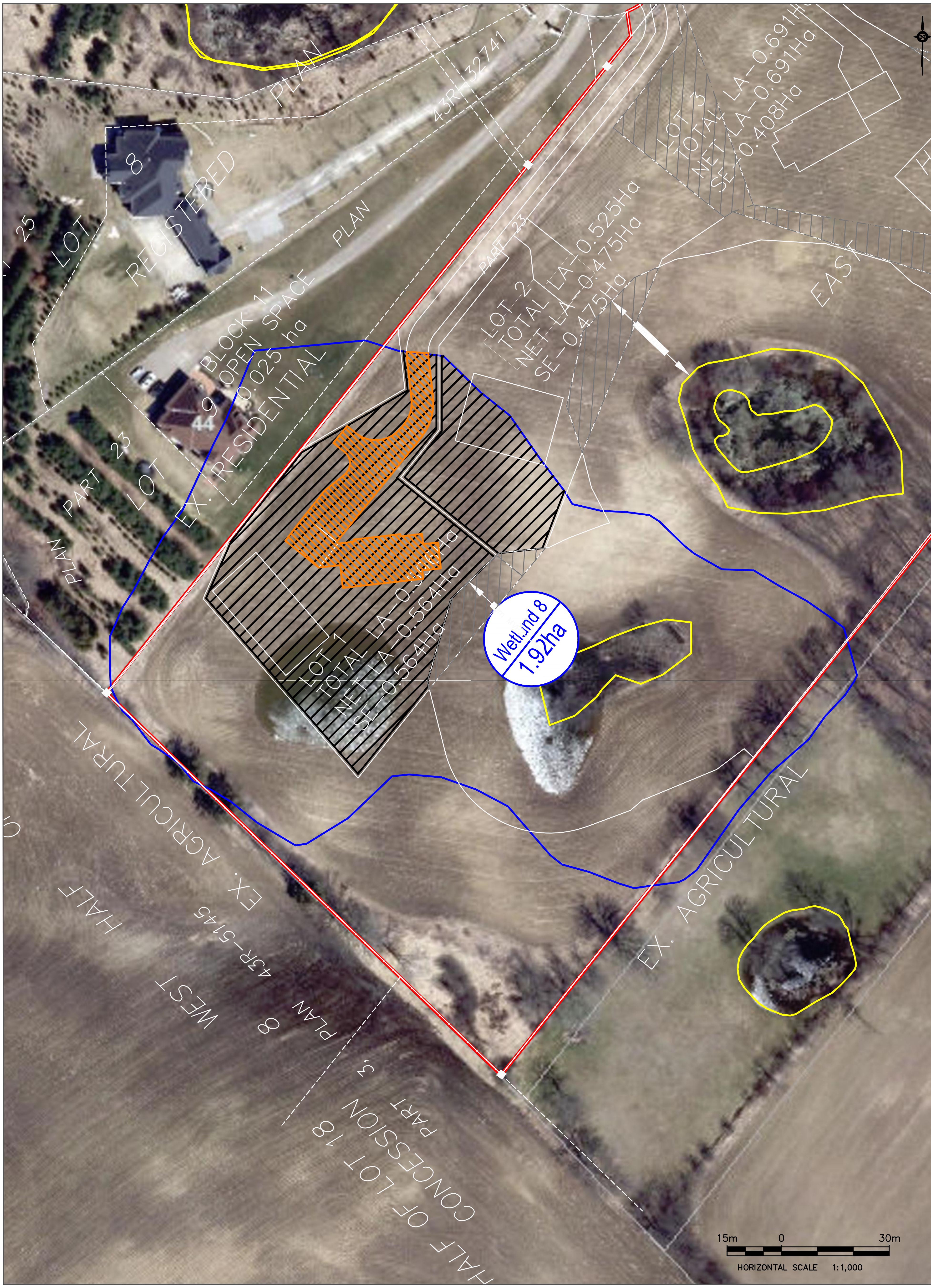

LEGEND:

- Approx. Property Boundary
- Existing Drainage Catchment Areas Wetland Area = 1.92ha
  Natural Systems Area = 1.29ha
- Development Area = 0.57ha
- Wetland Area = 0.06ha
- Impervious Area = 0.10ha

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Drainage Catchment Analysis
Wetland 8

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	June 2017	Figure No.
Created By:	JLM	5e
Project No.	08-019	
Reference:	First Base Solutions	

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LEGEND:

- Approx. Property Boundary
- Existing Drainage Catchment Areas Wetland Area = 3.53ha
  Natural Systems Area = 1.60ha
- Development Area = 1.93ha
- Onsite Wetland Area = 0.24ha
- Impervious Area = 0.41ha

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Drainage Catchment Analysis
Wetland 10

Pt. Lot 19, Con. 8
Town of Caledon

Date Issued:	June 2017	Figure No.
Created By:	JLM	5f
Project No.	08-019	
Reference:	First Base Solutions	

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APPENDIX I

Well Contingency Plan

WELL CONTINCENCY PLAN

RESPONSE PLAN

When a complaint is received, a three-step action plan will be implemented. The initial steps are intended to confirm the veracity of the complaint and determine if the problem is related to site activities. If it is concluded that the problem is due to the site activities, then remedial steps are undertaken to return the facilities to their previous function. Because of the planned site activities and the types of wells used in the area, the focus will be on the reduction of well yields due to lowering of the water table.

Potable water will be immediately supplied to the property owner as an initial step to alleviate immediate issues due to lack of drinking water. This initial supply will consist of two 5 gallon bottles of water plus a case of bottled drinking water.

Post-Complaint Site Inspection

An inspection of the subject property will be undertaken to evaluate the problem, normally within 24 hours. There can be a number of potential causes for water shortage. In some cases, these can be simple physical conditions, such as pump failure or pressure tank malfunction. The initial site inspection will identify:

- Measure water levels in the well,
- Examine the integrity of the well casing and well construction,
- Confirm the pump function by surcharging the well and operating the pump,
- Inspect the plumbing system and water treatment equipment to ensure functionality,
- Evaluate the water use pattern at the property to determine if the use pattern has changed in a manner that would now exceed the well capacity,
- Examine the surrounding property to identify other water users and potential sources for interference,
- Examine activities on the subject property to document the extent of water-taking activities. Inspection should also examine along site water courses to identify ground water discharge areas and look for any unusual discharge amounts.
- Manual measurement of water levels in the monitoring well network, particularly in monitoring wells near the complaintant's property. Wherever possible, wells on adjacent properties should also be evaluated.
- If there is reasonable cause to believe that the development property may be the cause of the water shortage, a replacement supply will be made available immediately at the cost of the developer. Although other options may be available, the short term solution is expected to be the connection of a cistern or

holding tank to the plumbing system, and filled with trucked in water from the local municipal system.

Subsequent Evaluation

Subsequent evaluations are to be undertaken to confirm the cause of the water shortage for the well, and the liability for its replacement / mitigation. These evaluations will include:

- an assessment of natural climate conditions,
- hydraulic testing of the well to determine if its sustainable yield has been modified from that listed on the MECP well log. This will involve pump testing of the well and monitoring water levels during drawdown and recovery phases,
- consideration of water table trends, particularly for ground water monitors that are closest to the complaintant's property. Interpretation of the trends should also include the all uses of ground water within 500m,
- consideration of the construction activities at the subject property and their potential impacts on the ground water table.

A summary report will be prepared for each separate property and provided to the Town for review. Once finalized, the report will also be provided to the property owner. The report will address all information gathered during the evaluation as well as a discussion of responsibility and mitigation.

Remedial Options

If the subsequent evaluation confirms that activities on the subject property are responsible for the water shortage, then the remedial activities will be done under the responsibility of the developer. If the evaluation considers that the responsibility is both the proponent's and the property owner's, then the costs will be considered based on the proportion of responsibility. If the conclusion is reached that the developer activities are not responsible for water shortage, then the responsibility for all remedial works shall be borne by the property owner. The appropriate remedial option needs to be tailored to the specific cause of the water shortage problem. The remedial options could include:

- Drilling of a new well,
- Installation of additional storage or pressure capacity,
- Cessation or modification to the on-site activities to reduce the drawdown, allowing the water table to recover, increasing well yield,
- Installation of water treatment equipment,
- Repairs to the existing well,
- Providing a temporary water tank filled with municipal water,
- Connection to the municipal drinking water system (if appropriate).