INTERIM HYDROGEOLOGICAL ASSESSMENT

10249 HUNSDEN SIDEROAD

ESTATE RESIDENTIAL DEVELOPMENT

TOWN OF CALEDON
REGION OF PEEL

PREPARED FOR:

CARRINGWOOD HOMES

PREPARED BY:

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CROZIER
CONSULTING ENGINEERS

Revision Number	Date	Comments
Rev. 0	June 2022	Issued for First Submission (ZBA)
Rev. 1	May 2024	Revised to address comments on 1st submission provided by the Region of Peel, Town of Caledon and the TRCA.

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1.0 Introduction

C.F. Crozier & Associates Inc. (Crozier) was retained by Carringwood Homes to prepare a Hydrogeological Assessment Report in support of the planning applications for the proposed estate residential development located at 10249 Hunsden Sideroad in the Town of Caledon, Region of Peel. The scope of the following report was designed to meet the relevant Town of Caledon (Town), Region of Peel (Region) and Nottawasaga Valley Conservation Authority (NVCA) guidelines for hydrogeological assessments. Please note that this report has been revised to address the comments provided by the review agencies in March 2024. It is recommended that this report be read in conjunction with the Revised Geotechnical Investigation prepared by Soil Engineers Ltd. (Soil Eng) dated May 2024 and the revised Functional Servicing and Stormwater Management Report prepared by Crozier, dated November 2023.

1.1 Existing Site Description

The subject property (herein referred to as the Site) is located at 10249 Hunsden Sideroad in the Town of Caledon, Region of Peel. The Site covers an area of approximately 21.60 ha and currently consists of an existing detached single-residential dwelling, agricultural lands, and forested areas. The Site is located in a rural area and is bounded by Hunsden Sideroad to the north, a natural heritage woodlot and agricultural lands to the south and east and detached residential dwellings to the west (**see Figure 1**). A tributary of Beeton Creek is mapped on the north end of the property, south of the existing dwelling. It is interpreted to flow from south to north/northwest towards the main branch of Beeton Creek.

1.2 Proposed Development

According to the Draft Plan of Subdivision prepared by Mackitecture Inc. dated July 6, 2023, the key elements envisioned for the proposed development include:

- Fourteen (14) single detached residential lots with individual, privately owned septic systems (7.85 ha).
- Designated Natural Heritage System Lands and a Natural Heritage System Buffer (8.81 ha).
- An internal municipal roadway with access to Hunsden Sideroad and the proposed residential development (Stinson Street) located west of the site (1.04 ha).
- An open space area (0.64 ha).
- Site access from Hunsden Sideroad and Stinson Street.

The existing residential dwelling on Site is to remain unchanged.

2.0 Geology

2.1 Physiography, Drainage, & Topography

As shown in **Figure 2**, the Site is located in the Oak Ridges Moraine physiographic region according to Chapman and Putnam (1984). The Oak Ridges Moraine extends from the Niagara Escarpment in the west to the Trent River in the East. The Oak Ridges Moraine is bounded by the South Slope in the south and covers an area of approximately 1295 km^2. The Oak Ridges Moraine is characterized as a hilly terrain that predominantly consists of sand and gravel soils. Kame moraines, till moraines and rough, hummocky relief is observed near the Site.

The Site Area is situated in the Innisfil Creek Subwatershed within the regional Nottawasaga Valley Conservation Authority Watershed (NVCA, 2006). As noted in section 1, a tributary of Beeton Creek runs through the northern corner of the property, which flows northwest toward Beeton Creek. Surface drainage is interpreted to follow topography and drain roughly in the northern direction. The Site's highest elevation point is found in the southeast/south corner of the property at approximately 305 metres above sea level (masl) and the lowest elevation towards the north of the property at approximately 285 masl.

2.2 Regional Geology

The Site sits atop a bedrock basement of the Georgian Bay Formation. The Georgian Bay Formation primarily consists of grey shale with thin interbeds of crystalline limestone and is generally overlain by thick glacial tills, gravel, sand, and clay (Hewitt, 1972). According to Ontario Geological Survey (OGS) Mapping, the depth to bedrock is estimated to range from approximately 21.24 metres below ground surface (mbgs) to 42.38 mbgs. The surficial geology of the general study area predominantly consists of ice contact stratified deposits of sand and gravel, minor silt, clay and till.

The bedrock and surficial geology of the Site and the general study area are displayed in **Figures 3** and **4**, respectively.

2.3 Local Geology

A Geotechnical Investigation was completed on Site to characterize the existing geological conditions and determine design constraints. In March of 2022, six (6) boreholes were advanced, and converted into monitoring wells by Soil Engineers Ltd. (Soil Eng.) In general, the following stratigraphy was encountered:

- Brown, loose topsoil extending to depths of 0.30 m below ground surface (mbgs).
- Brown, compact sand with some silt extending to depths ranging from 0.15 mbgs to 7.1 mbgs.
- Brown, dense silt with some sand extending to depths ranging from 0.18 mbgs to 9.6 mbgs.

Additional geotechnical drilling was completed by Soil Eng. as part of the detailed site investigation in April of 2024. An additional five (5) monitoring wells were advanced. The primary materials encountered were sand, silt and clay layers, similar to the previous investigation conducted and nearby well records.

For further details, please refer to the geotechnical report prepared by Soil Eng., submitted under separate cover.

2.4 Source Water Protection Information

Based on the MECP Source Protection Information Atlas, the Site is located within the Nottawasaga Valley Source Protection Area and is governed by the policies and procedures outlined in the South Georgian Bay Lake Simcoe Source Protection Plan as per Section 31 of the Clean Water Act (2006). According to Source Protection Mapping, the Site is located within a Significant Groundwater Recharge Area (SGRA) with a vulnerability index score that ranges from 4 – 6, and atop a Highly Vulnerable Aquifer (HVA) with a vulnerability index score of 6.

Under the Clean Water Act (2006), there are a total of 22 prescribed threats that can be considered a drinking water threat. Based on the MECP Source Protection Mapping, there are no significant drinking water threats identified for the Site. However, the following low/moderate drinking water threats should be considered:

- The handling and storage of a dense non-aqueous phase liquid and/or fuel during construction.
- The handling, storage, and application of an organic solvent, road salt, and/or pesticide to land, if applicable.
- The storage of snow.

Best management practices should be employed such that any on site activity does not pose a significant threat to drinking water.

3.0 Hydrogeology

The following sections below detail the existing hydrogeological conditions of the Site based on regional studies, local studies, and relevant background information.

3.1 MECP Well Records

A review of the MECP Well Records Database was completed for wells within 500 m of the Site Area boundary (**Figure 5**). There are forty-four (44) identified well records within 500 m of the Site and the records can be summarized below:

- Of the forty-four (44) well records identified, thirty (30) wells are domestic supply wells, three (3) are monitoring wells, and eight (8) wells have been abandoned. The remaining three (3) wells do not have a specified use identified.
- Thirty-one (31) wells are screened within the overburden aquifer and the remaining thirteen (13) wells are unidentified.
- The wells in the area have an average static water level of 17.4 m and an average depth of 32.6 m.
- The well records in the area indicate the surficial material of the study area is primarily brown silty clay covering grey silty clay.

A summary table of the well records has been appended to this report as Appendix A.

3.2 Hydrostratigraphy

The hydrostratigraphic framework of the Innisfil Creek Subwatershed has been outlined in the NVCA Groundwater Monitoring Network Review and Assessment (2019). The hydrostratigraphic units are summarized in Table 1 below.

Table 1: Regional Hydrostratigraphy of the NVCA Watershed (NVCA, 2019)

Layer	Name	Function	Material	Thickness
Youngest - 1	Upper Confining Layer	Aquitard	Till	
A1	Oak Ridges Moraine	Unconfined shallow aquifer	Coarse-grained glacial and interglacial sediments (contact stratified drift)	10 - 50 m
C1	Confining Layer	Aquitard	Clay and silt	
A2	Upper Thorncliffe Formation	Confined aquifer: private water / small municipal water supply	Surficial ice-contact sand deposits	25 - 100 m
C2	Confining Layer	Aquitard	Silt sand to sandy silt till	
A3	Lower Thorncliffe Formation	Confined aquifer: supply source for several municipalities	Medium-coarse sand with gravel and silty layers	40 - 50 m
C3	Confining Layer	Aquitard	Silt and clay	
A4[1]	Tunnel channels and Laurentian Channel	Aquifer: Deepest municipal water supply wells	Fine-medium sand with minor gravel areas; medium-coarse sand with gravel	3 - 30 m
Oldest - 9	Top of Bedrock	Aquifer/Aquitard		

1. Aquifer not continuous throughout watershed.

The Regional A1 Aquifer Unit is a shallow aquifer which overlays three (3) thicker aquifer units (A2, A3, and A4) that act as water supply for both the private and municipal levels. The deep Regional A3 Aquifer Unit is the major supply source for many municipal wells in the area, followed by the Regional A1 Aquifer Unit and the Regional A2 Aquifer Unit.

3.3 Groundwater Levels

Regional shallow and deep groundwater flow direction is interpreted to follow surface and bedrock topography and flow in the northern direction towards the tributary of Beeton Creek, flow into the Nottawasaga River, and ultimately reach Georgian Bay. According to the Oak Ridges Moraine

Groundwater Program Mapping, groundwater elevations range from approximately 278 metres above sea level (masl) at Site to 180 masl at Georgian Bay.

3.4 Groundwater Quality

Groundwater quality within the NVCA Watershed is obtained from monitoring wells within the Provincial Groundwater Monitoring Network (PGMN) and municipal data. Groundwater sampling results are compared to the Ontario Drinking Water Quality Standards (ODWQS) and any exceedances are flagged and investigated to determine the potential source and impact of the exceedance. According to the NVCA Groundwater Quality Overview Report (2002-2013), elevated concentrations of sodium, aluminium, iron, and manganese have been previously recorded in the watershed.

Elevated concentrations of metals in groundwater are interpreted to be naturally occurring due to mineral deposits in the area. Elevated hardness in groundwater is interpreted to be naturally occurring due to the high presence of marine carbonate rocks in the area. Exceedance of the guideline for sodium is noted in areas where public land use contains salt storage and application near areas of ample groundwater recharge.

4.0 Field Work

4.1 Monitoring Well Installation

Soil Eng. and Crozier supervised the drilling and installation of six (6) monitoring wells on Site on March 9th and 10th, 2022. An additional five (5) monitoring wells were installed on Site to extend the monitoring network for both Geotechnical and Hydrogeological purposes on April 18th and 19th, 2024. The monitoring well network (**Figure 6**) was established to capture subsurface and groundwater conditions for use in preliminary engineering design. Table 2 and 3 below provides a summary of the construction details of each well.

Table 2: 2022 Monitoring Well Details (Soil Eng., 2022)

Monitoring Well	Total Depth (m)	Screened Interval (m)	Screened Material
MW1	9.1	6.1 – 9.1	Brown, dense, sandy silt with trace gravel and brown, compact silty sand.
MW2	6.1	3.1 – 6.1	Brown, dense, sandy silt with trace gravel.
MW3	7.6	4.6 – 7.6	Brown, dense, sandy silt with trace gravel.
MW4	6.1	3.1 – 6.1	Brown, dense, sandy silt and brown, dense, fine sand with some silt.
MW5	6.1	3.1 – 6.1	Brown, dense, sandy silt with trace clay layers.
MW6	6.1	3.1 – 6.1	Brown, very dense, fine grained, silty sand with trace clay.

Table 3: 2024 Monitoring Well Details (Soil Eng., 2024)

Monitoring Well	Total Depth (m)	Screened Interval (m)	Screened Material
MW101	9.6	6.1 – 9.1	Brown, very dense to compact sand, fined grained, some silt.
MW102	11.1	7.7 – 10.7	Brown, very loose to very dense silt, some sand, occurrence of sand seams and clay layers.
MW103	9.6	6.1 – 9.1	Brown, very loose to dense silt, some sand, occurrence of sand seams and clay layers.
MW104	8.1	4.6 – 7.6	Brown, very loose to dense silt, some sand, occurrence of sand seams and clay layers.
MW105	8.1	4.6 – 7.6	Brown, very loose to compact silt, some sand, occurrence of sand seams and clay layers.

All monitoring wells were completed as monument, 51 mm PVC wells. Each was completed with a 3.00 m No.18 well screen and were installed to depths between 3.1 mbgs to 10.7 mbgs. For detailed borehole logs, please refer to the geotechnical report prepared by Soil Eng. submitted under separate cover.

4.2 Groundwater Monitoring

Manual groundwater measurements were collected using an electronic water level meter and automatic level loggers were deployed in select wells across the Site. The water level loggers were set to measure water levels on an hourly basis to collect a more comprehensive dataset for a greater understanding of the shallow groundwater system. Results of groundwater monitoring to date is covered in Section 5 below.

4.3 Groundwater Quality Sampling

In May 2024, a groundwater quality sample was collected from the Site. The sample was collected from an indoor tap located at the house on the property. The homeowner advised that there is no water softener or treatment system for use on the property.

The sample was submitted to a licensed, third-party laboratory for analysis. Note that at the time of preparation of this report, the results are pending.

4.4 Door-to-Door Survey

As per the Region of Peel guidelines, a door-to-door well survey was conducted to evaluate the condition of and location of water supply wells nearby the Site. The survey was conducted in May 2024 via hand delivery to properties within 500 m of the Site boundary. The questionnaire was used to address the following about the wells on adjacent properties:

- Property address
- Existence of a well on the property
- Well use, age, depth
- History of water quantity and quality

A copy of the questionnaire and obtained responses thus far are included in Appendix B. A total of twenty (20) properties were visited and two (2) responses have been received.

5.0 Results

5.1 Groundwater Levels

Groundwater monitoring has been ongoing on the Site since April 2022 in monitoring wells MW1 – MW6 and from MW101 – MW105 since April 2024. Manual groundwater readings were collected on five (5) occasions since installation and the readings are presented in Table 4 below.

Table 4: Groundwater Level Measurements

Monitoring Well	*April 6, 2022*	*October 11, 2022*	*April 28, 2023*	*April 26, 2024*	*May 22, 2024*
	Water Level (mbgs)	**Water Level (mbgs)**	**Water Level (mbgs)**	**Water Level (mbgs)**	**Water Level (mbgs)**
MW1	DRY	DRY	DRY	DRY	DRY
MW2	DRY	DRY	DRY	DRY	DRY
MW3	DRY	DRY	DRY	DRY	DRY
MW4	5.85	5.97	5.85	DRY	DRY
MW5	DRY	DRY	DRY	DRY	DRY
MW6	DRY	DRY	6.01	DRY	DRY
MW101	-	-	-	DRY	DRY
MW102	-	-	-	DRY	DRY
MW103	-	-	-	DRY	DRY
MW104	-	-	-	DRY	DRY
MW105	-	-	-	DRY	DRY

Automatic level loggers were deployed in monitoring wells MW4, MW101, MW105 and MW106 to monitor any short-term changes in water levels and capture the measured unit's response to precipitation. Please refer to Appendix D for detailed hydrographs of the water levels in MW4. Note that the data shown in MW101, MW105 and MW106 consistently read levels equal to ambient air pressure. All the loggers were deployed within 5 cm of the bottom of each monitoring well such that the logger would be submerged if water levels exceeded 15 cm from the base of the well. Since the loggers in MW101, MW105 and MW106 consistently read levels equal to ambient air pressure, it can be assumed that the wells remained dry from the period of April 2024 to May 2024.

The hydrograph for MW4 shows water levels rising only a few centimetres from the base of the well over the course of monitoring period. Note that the data has been adjusted to remove periods where the well was dry, shown as gaps in the graph.

All monitoring wells on the property were dry upon completion of the hole and have remained dry since installation in 2022 and 2024. The deepest monitoring well extends to 279.8 masl at MW101 in the northern portion of the property. Monitoring has been conducted at this location in April and May 2024, within the range of the spring freshet. Therefore, since no water at this location during the wettest time of the year, it can be reasonably assumed that the groundwater table is below 11.1 mbgs or below 279.8 masl.

The Site is located at the edge of the Oak Ridges Moraine, a well drained, complex landform that stretches from Region of Peel in the west to south of Rice Lake in the east. The Oak Ridges Moraine (or ORM) is divided in four (4) wedges from west to east: the Albion Hills wedge, the Uxbridge wedge, the Pontypool wedge and the Rice Lake wedge. The Site is located within the wide, Albion Hills wedge, that is representative of a fan, deltaic sequence. Surficial soils are characterized as silty and sandy in nature and are generally well drained and have good groundwater recharge capabilities (NVCA, 2006).

According to the Oak Ridges Moraine Groundwater Mapping program, the groundwater table is modelled at an elevation of 278 masl. Based on the MECP well records, the maximum static water levels within domestic water wells in the area is 17 mbgs or around 272 to 276 masl. Based on the well drained nature of the soils, it can be reasonably assumed that a seasonally high groundwater elevation of 278 masl is expected in the area of the Site. The lowest extent of Site infrastructure is approximately 285.5 masl for the proposed bioswales (Crozier, 2024), approximately 7.5 m above the groundwater table. Therefore, it is interpreted that the proposed bioswales will not intercept the groundwater table.

5.2 Door-to-Door Survey Results

At the time of this report, only two (2) responses have been received. Note that the collection period for the survey responses is ongoing. The responses shared thus far have been appended to this report as Appendix C.

Both residents indicated that they have drilled, onsite water supply wells, installed at a depth of over 15 mbgs. The wells are between 48 years and 57 years old and have both experienced water quality issues in the past. In speaking with the resident at 10249 Hunsden Road—the resident that occupies the home on the subject Site—their water supply well is not used for drinking water as they have experienced bacterial issues with their water. Neither homeowner has a treatment system in place.

Given the age of both water supply wells, there is potential that the bacteriological issues present in the groundwater could be a product of the well condition. Both wells were installed prior to the Ontario Regulation 903 coming into effect and the wells were not required to have proper isolation from surface water prior to the regulation. Elevated bacteriological concentrations in groundwater often suggest that groundwater has mixed with surface water.

Results of the door-to-door survey will be compared to the pending water quality results from the onsite well.

6.0 Design Considerations

The following section outlines potential design constraints and considerations that should be considered in the design of the proposed development.

6.1 Water Balance

A water balance assessment was conducted to assess potential impacts of the proposed development on the local groundwater conditions. The water balance was conducted under existing (pre-development) and proposed (post-development) conditions. The water balance assessment was conducted in accordance with accepted site condition values from Table 6.3 of the Urban Storm Drainage Criteria Manual: Volume 1 (Urban Drainage and Flood Control District,

2016) and Table 3.1 of the MECP Stormwater Management Planning and Design Manual (MECP, 2003). The appropriate reference tables are provided in Appendix D.

The results of the water balance assessment are presented in Table 5 below.

Table 5: Summary of Water Balance

Pre-Development Infiltration (mm/yr)	**Post-Development Infiltration without Mitigation** (mm/yr)	**Infiltration Deficit** (mm/yr)
122.07	107.54	14.52

6.1.1 Methodology

The water balance on a site can be estimated from the following equation described in Thornthwaite and Mather 1957:

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

Where: P = precipitation

S = change in groundwater storage

R = surface water runoff

I = infiltration

ET = evapotranspiration/evaporation

The components of the water balance equation can be estimated using field observations of drainage conditions, land cover, soil types, groundwater conditions and local climate records.

6.1.2 Precipitation (P)

The nearest climate station to the Site is located approximately 6.21 km southwest of the Site and is known as Albion Field Centre Climate Station Number 6150103 (43°55'00.000" N, 79°50'00.000" W, elevation of 281.90 masl). Monthly average precipitation and climate data from 1981 – 2010 was used to complete the water balance calculations for the Site. The long-term monthly average for precipitation and climate is shown in Table 6 below.

Table 6: Climate Data (1981 – 2010) for Albion Field Centre Climate Station

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Precipitation (mm)	60.4	50.2	50.3	67	76.1	75.5	81.8	77.4	75.0	68.3	81.7	57.7	**821.4**[1]
Temperature (°C)	-7.0	-5.9	-1.4	6.1	12.4	17.3	19.9	19.1	14.3	8.1	2.1	-3.9	**6.7**[2]

1. Total average annual precipitation from 1981-2010
2. Average annual temperature from 1981-2010

Therefore, based on the data above, the long-term annual average precipitation for the area is 821.4 mm/year and the long-term average temperature for the Site area is 6.7 °C.

6.1.1 Storage (S)

Long-term groundwater storage (S) is assumed to be negligible as no evidence of groundwater impact on significant groundwater pumping or withdrawal is noted in regional studies of the area. The seasonal changes in water levels are expected to balance annually.

6.1.2 Evapotranspiration (ET)

The rate of evapotranspiration is a function of the water holding capacity of the soil, soil and vegetation type and land cover. Through the Thornthwaite and Mather method or a soil moisture balance approach and local climate data, the Potential Evapotranspiration (PET) and the Actual Evapotranspiration (AET) can be calculated (see Appendix D) using the following equations:

$$PET = 16 \times \left(\frac{10Ta}{H_i}\right)^{a}$$

Where: Ta = average daily temperature, 0 degrees for negative temperature months

Hi = heat index value, assuming 12 hours per day, 30 days a month of daylight

The average heat index value is estimated using the following equation:

$$Hi = \sum_{i=1}^{12} \left(\frac{10Ta}{5}\right)^{1.514}$$

The evapotranspiration factor (α) is determined using the following equation:

$$\alpha = 0.49 + (0.0179 \times H_i) - (0.0000771 \times H_i^2) + (0.000000675 \times H_i^3)$$

PET is adjusted to account for the average number of hours of daylight per month for a given location. The adjustment factor is dependent on the subject property's latitude and is presented in Appendix D (Thornthwaite and Mather, 1957). The PET is multiplied by the adjustment factor per month to determine the Adjusted Potential Evapotranspiration (PET_{adj}).

The Actual Evapotranspiration (AET) is determined using the following equation:

$$AET = PET_{adj} - \Delta S$$

The Change in Soil Storage (ΔS) is depended on the types of soil on the property and the Accumulated Potential Water Loss (APWL) per month. The Change in Soil Storage and Accumulated Potential Water Loss can be calculated using the following equations:

$$\Delta S = S_{mc} \text{ x}$$

Where: S_{mc} = soil moisture capacity

APWL = accumulated potential water loss

For ΔP < 0: $APWL = -\Sigma_{i=0}^{12} PET_i$

For ΔP < 0: $APWL = \frac{ln\left(\frac{|AET - PET|}{S_{mc}}\right)}{S_{mc}}$

According to the Ministry of Agricultural, Food and Rural Affairs (OMAFRA), AgMaps mapping tool, the soil type on the property was identified as Type B, fine sandy loam. Using the Ministry Environment, Conservation and Parks (MECP) Stormwater Management and Design Manual Table 3.1. (2003), the soil moisture capacity was estimated to be 150 mm for fine sand soils for moderately rooted crop environments and 250 for sandy loam soils in mature forest.

Therefore, based on local climate conditions the Actual Evapotranspiration (AET) is calculated to be 581 mm/year.

6.1.3 Water Surplus (R+I)

The difference between mean annual P and mean annual ET outputs the amount of water surplus for the Site. The water surplus either infiltrates (I) into the soil or travels across the site as runoff I.

The distribution of water that infiltrates into the soil is a function of an infiltration factor as described in Table 3.1 of the MECP Stormwater Management Planning and Design Manual (MECP, 2003). The infiltration factor for the Site is assumed to be 0.6 based on topographic factor of 0.1 for hilly land, a soils factor of 0.3 for silty/sandy loam and a land cover factor of 0.1 for open area. The calculated water surplus available for infiltration or runoff is 240 mm/year. Using MECP methodology, the water balance components, independent of temperature, infiltration and runoff are calculated to be 120 mm/year and 120 mm/year respectively for the majority of the Site. Infiltration is increased in a mature forest environment due to the enhanced void space created by roots; therefore, an infiltration factor of 0.6 was assigned to the forested area.

The water balance components were used to estimate the pre-development and post-development water balance scenarios. Detailed water balance calculations for the subject property can be seen in Appendix D.

6.1.4 Pre-Development Infiltration

The pre-development water balance calculations are presented in Appendix D. Under existing conditions, the infiltration for the Site is calculated to be 118.63 mm/yr.

6.1.5 Post-Development Infiltration

To complete the post-development infiltration calculation, the proposed development was separated by land use and assigned a percent imperviousness. Based on the water balance components, the calculated post-development infiltration volumes are estimated to be 87.89 mm/yr. In comparing the pre and post development infiltration volumes, the proposed development has the potential to decrease by 12%.

6.1.6 Water Balance Impact Assessment

Based on the results of the water balance, the proposed development has the potential to decrease infiltration by 14.53 mm/yr.

According to the Functional Servicing and Stormwater Management Report, bioswale systems are proposed to provide stormwater quantity and quality control on the Site. The bioswale system is proposed to infiltrate a total of 155 m^3 of runoff from the road and the front of each lot under post development conditions. Assuming a contributing area of approximately 45,000 m^2 (area for the front lots and roads) and that there are approximately 40 events per year that produce runoff (MECP, 2003), a total infiltration volume of 10.79 m3 is required to mitigate the deficit. Based on a theoretical infiltration volume of 155 m^3, the proposed bioswales can accommodate the infiltration required to achieve water balance on the Site.

6.2 Infiltration Analysis

As mentioned previously, the Site is well-drained and all the monitoring wells have been dry since 2023. Therefore, in-situ hydraulic conductivity testing was unable to be completed at the elevation of the proposed base of the bioswales. According to the sections provided in the Functional Servicing and Stormwater Management Report, the lowest bioswale elevation extends to a depth of approximately 285.5 masl or 6 mbgs. At this depth, in-situ testing without a measurable amount of water in the monitoring wells is difficult and a Guelph permeameter test at this elevation is nearly impossible without significant excavation.

Hydraulic conductivity testing was completed by Soil Eng as part of the Geotechnical Investigation. Based on the sample collected at MW4 at an elevation of 288.5 masl, the soil was identified as being primarily fine-grained sand, some silt with an estimated permeability of 10^{-2} cm/s. Referring to Appendix C of the CVC Low Impact Development Stormwater Management Planning and Design Guide, a hydraulic conductivity rate of 10^{-2} cm/s equates to an infiltration rate of 150 mm/hr. Using a safety factor of 2.5, a conservative infiltration rate of 60 mm/hr may be used to describe the soils. It is recommended that prior to installation the infiltration rate be confirmed by the onsite contractor.

6.3 Long & Short-Term Dewatering

If proposed building footings are to be extended below the reported seasonally high groundwater conditions, it can be expected that short-term and/or long-term groundwater dewatering will be required. Discharge of any dewatering flows should be analyzed against the local sewer use by-law or against provincial standards to ensure that they are within the allowable tolerance. It should also be noted that dependent on the required discharge volumes during and post-construction, additional permitting requirements may apply. If construction volumes are expected to fall between 50,000 L/day and 400,000 L/day registration with the MECP Environmental Activity Sector Register is required. If construction dewatering volumes are to exceed 400,000 L/day, a Permit to Take Water will be required. Similarly, if daily permanent dewatering volumes are to exceed 50,000 L/day post-construction, an additional Permit to Take Water will be required for the groundwater discharge. Local permitting will also likely be required prior to any groundwater discharge.

It is presumed that groundwater dewatering volumes will be low is due to the deep groundwater conditions found on Site. However, groundwater dewatering volumes should be evaluated once final footings for the proposed buildings are determined.

6.4 Contingency Plan for Well Complaints

In the event of any well complaints from private and/or observation wells within 500 m of the Site, the following steps will be implemented to ensure a continued oversight of groundwater quantity and quality in the area during and following construction.

Based on the Hydrogeological Study requirements outlined in the Public Works Design, Specifications & Procedures Manual prepared by the Region of Peel (Region of Peel, 2009), Crozier recommends the Owner to conduct monitoring throughout construction, and one (1) year after the completion of construction. Given the assumption that groundwater flows in the northern direction, Crozier suggests the Owner to monitor MW 101, as it is the most down gradient monitoring well on Site and has the highest potential of being impacted by future On-Site activities.

As mentioned in Section 5.3 a raw groundwater sample was taken to establish baseline conditions for groundwater quality within the Site Area. Within the monitoring period, yearly groundwater samples should be taken to ensure no interference with groundwater quality and that no exceedances of the Region of Peel Sewer Use By-Law/Provincial Water Quality Objectives have occurred.

Residences within 500 m of the Site Area will be provided contact information (by the Owner) to address any well complaints. On site activities must be stopped and immediate Site investigation will be launched to address and resolve any negatively influencing factors on neighboring properties.

7.0 Conclusions and Recommendations

Based on the information presented above, Crozier is prepared to make the following conclusions and recommendations:

- The Site is characterized by silty sand and sandy silt with traces of clay as identified by geological mapping, MECP well records, and on site investigation.

- A well records search identified forty-four (44) wells within 500 m of the Site area. The wells are mainly used for domestic supply and there have been no reported concerns of water quality or quantity.

- Locally, the shallow groundwater flow is interpreted to flow in the northerly direction towards a tributary of Beeton Creek and ultimately flowing into the Nottawasaga River and Georgian Bay.

- According to the MECP Source Protection Information Atlas, the Site is located in a SGRA and HVA. However, there are no specific source protection policies outlined for the area.

- Seasonally high groundwater elevations across the Site are anticipated to be encountered at a depth of approximately 278 masl. The identified soils at the site are conducive to infiltration and Crozier does not anticipate any significant water will be encountered during construction based on the proposed elevations of the bioswales.

- A site wide water balance was completed for the Site. Using the Thornthwaite and Mather method pre-development infiltration was determined to be 122.07 mm/yr and post-development infiltration was determined to be 107.54 mm/yr. Therefore, the infiltration deficit is calculated to be 14.53 mm/yr.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.

Caitlyn MacPhee, EIT, GIT
Hydrogeology Intern

C.F. CROZIER & ASSOCIATES INC.

Chris Gerrits, M.Sc., P.Eng.
Manager, Hydrogeology

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APPENDIX A

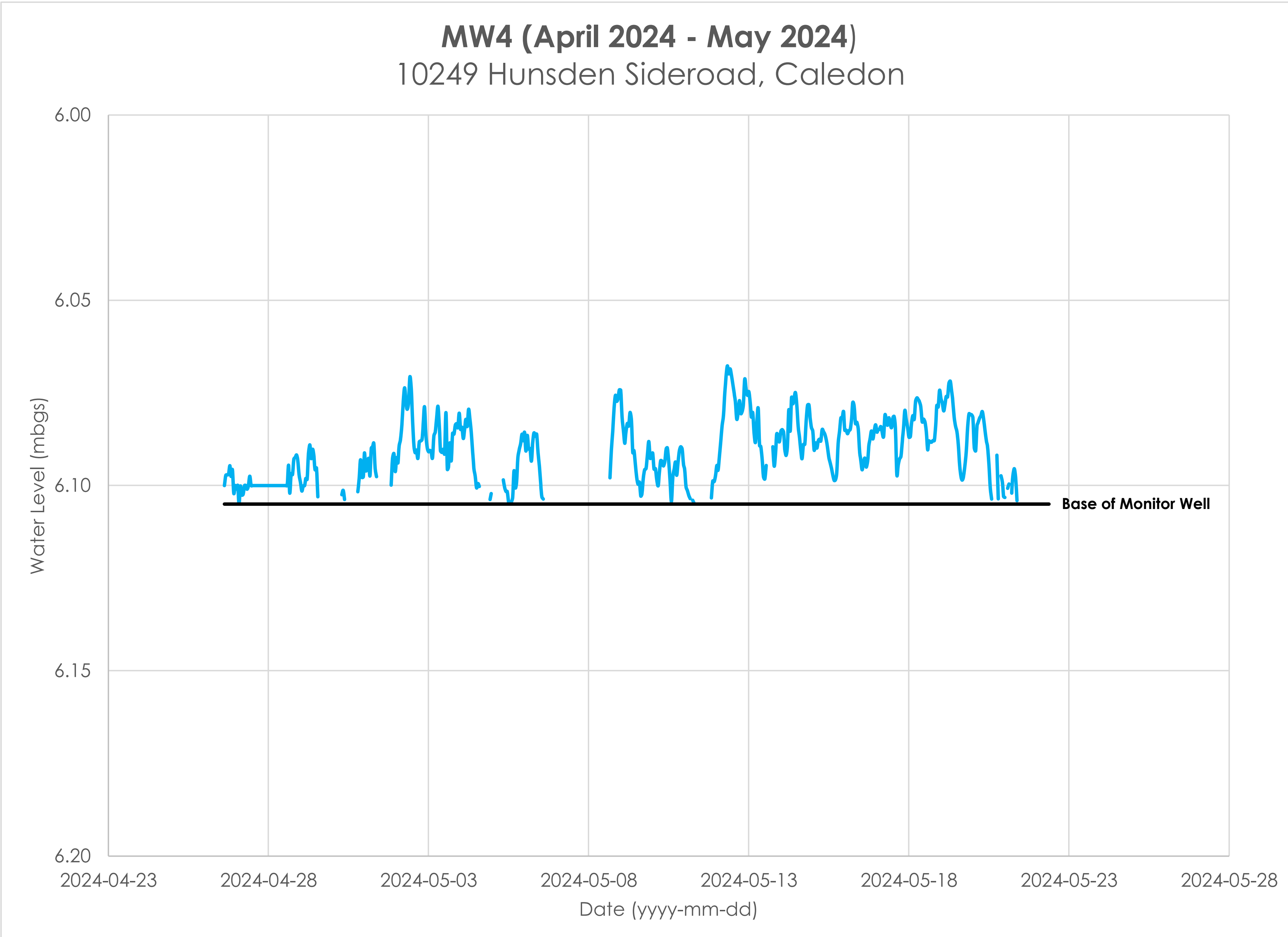
MECP Well Record Summary Table

MECP WATER WELL RECORDS							
Project Number:	0952-6305			Address:	10249 Hunsden Sideroad, Caledon		
Prepared by:	MD			Date completed:	2022.06.27		
Well ID	**Diameter** (cm)	**Depth** (m)	**Static Level** (m)	**Materials**	**Aquifer**[1]	**Use**	**Date Completed**
4900485	76.2	19.8	16.76	fine sand	OB	domestic	10/18/1959
4900487	10.2	21.9	6.71	sand and boulders, sand	OB	domestic	10/14/1964
4900488	16.5	20.7	7.92	sandy clay, sand	OB	domestic	05/18/1967
4904466	12.7	22.9	10.67	sand	OB	domestic	04/30/1974
4904876	12.7	38.1	9.14	sand, clay	OB	domestic	05/13/1976
4904877	12.7	38.1	8.23	sand, clay	OB	domestic	05/14/1976
4904953	12.7	38.7	12.80	sand	OB	domestic	08/23/1976
4905294	76.2	14.6	8.23	sand, clay	OB	livestock/domestic	06/23/1976
4907137	15.2	29.3	22.86	gravelly sand, sand	OB	domestic	07/18/1989
4908537	15.2	24.7	6.40	clay, gravelly sand, sand	OB	domestic	11/27/1999
4908984	16.5	36.0	2.74	sand, sandy clay	OB	domestic	03/20/2001
4909008	91.4	-	-	-	-	abandoned	05/02/2002
4909009	106.7	-	-	-	-	abandoned	05/02/2002
7175042	15.9	38.1	-	silty sand	OB	domestic	12/02/2011
7268505	12.7	-	-	-	-	abandoned	06/24/2016
7362013	-	-	-	-	-	abandoned	06/01/2020
7362014	-	-	-	-	-	abandoned	06/01/2020
4900471	12.7	26.50	10.67	silty sand, sand	OB	livestock/domestic	07/25/1964
4902958	12.7	30.50	23.16	sand	OB	domestic	05/21/1968
4903027	16.5	44.8	13.72	sand, clayey sand	OB	domestic	04/11/1968
4903459	12.7	56.40	18.29	clay, sand	OB	domestic	06/03/1970
4904040	12.7	39.0	21.95	sand	OB	domestic	02/03/1972
4904049	15.2	41.1	27.43	sand, gravel, clay	OB	domestic	03/02/1973
4904166	76.2	10.10	5.49	sand	OB	domestic	08/10/1973
4904186	15.2	37.8	27.43	sand, clay	OB	domestic	06/26/1973
4904187	15.2	34.70	25.91	sand, clay	OB	domestic	06/27/1973
4905307	12.7	36.90	28.04	clay, sand	OB	domestic	09/08/1977
4905471	12.7	29.60	23.77	sand, gravel, sandy clay	OB	domestic	04/10/1979
4905519	15.2	44.2	27.43	sandy clay, sand, silty sand	OB	domestic	08/14/1979
4905699	15.2	34.7	29.26	sand, gravelly sand, clay	OB	domestic	11/14/1980
4907028	15.9	47.2	27.43	gravelly sand, sandy clay, sand	OB	domestic	04/18/1988
4907237	15.2	37.5	6.10	silty sand, silty clay, sand	OB	livestock/domestic	11/10/1989
4907251	15.2	34.1	8.53	silty sand, clay, sand	OB	livestock/domestic	02/23/1990
4907754	15.9	23.2	2.44	gravelly sand, clay, sand	OB	domestic	05/18/1993
4908075	15.9	34.10	65.53	silty clay, gravel, silt, silty sand	OB	domestic	10/04/1995
4909207	76.2	-	-	-	-	abandoned	07/01/2003
7145135	15.2	-	-	-	-	updated well	01/01/2009
7276774	-	-	-	-	-	-	08/26/2016
7279646	5.1	25.9	-	silty clay, silty sand	OB	monitoring	11/22/2016
7282272	-	-	-	-	-	-	04/18/2016
7344608	-	-	-	-	-	monitoring	09/19/2019
7344609	-	-	-	-	-	monitoring	09/19/2019
7344610	-	-	-	-	-	abandoned	09/19/2019
7344611	-	-	-	-	-	abandoned	09/19/2019

Data Source: Ministry of the Environment, Conservation, and Parks, retrieved June 27, 2022.
1. OB = Overburden Aquifer, BR = Bedrock Aquifer

APPENDIX B

Hydrograph: MW4



MW4 (April 2024 - May 2024)
10249 Hunsden Sideroad, Caledon
Water Level (mbgs)
6.00
6.05
6.10
6.15
6.20
2024-04-23
2024-04-28
2024-05-03
2024-05-08
2024-05-13
2024-05-18
2024-05-23
2024-05-28
Date (yyyy-mm-dd)
Base of Monitor Well

APPENDIX C

Door-to-Door Survey Results

MAY 17, 2024

PROJECT NO: 0952-6305

Door to Door Well & Septic Survey Questionnaire

1. What is your address?

   10249 Hunsden Sideroad, Bolton, ON

The following questions 2 – 8 pertain to private water supply wells. If you do not have a well on your property, you may skip to question 9.

2. Do you have a private well on your property?

   Yes

3. Does your well supply your drinking water?

   No

4. What is the age of your well?

   48 years

5. Is it a dug or drilled well?

   Dug

6. How deep is your well?

   47.5 ft

7. Have you had any quantity or quality issues with your well? Briefly describe any issues.

   Yes, bacteria.

8. Would you be willing to allow us to collect a sample of your water for laboratory analysis at no cost to you? All results will be provided to you for your records.

   Yes

9. Do you have a surface water intake on your property?

   No

10. Do you have any water treatment systems (e.g., water softener, chlorinator etc.)?

    No

11. Do you have a septic system on your property?

    Yes

12. Where is your sewage system located (i.e., front of your home, side yard etc.)?

    Front

13. What type of sewage system is it (i.e., septic tan with a leaching bed or holding tank)?

    Holding Tank

14. What is the age of your septic system?

    48 years

MAY 21, 2024

PROJECT NO: 0952-6305

Door to Door Well & Septic Survey Questionnaire

1. What is your address?

   10243 Hunsden Sideroad, Bolton, ON

The following questions 2 – 8 pertain to private water supply wells. If you do not have a well on your property, you may skip to question 9.

2. Do you have a private well on your property?

   Yes

3. Does your well supply your drinking water?

   Yes

4. What is the age of your well?

   57 years

5. Is it a dug or drilled well?

   Drilled

6. How deep is your well?

   68 ft

7. Do you have any records for the well? Do you have a well tag? If so, what is the number?

   Original well record

8. Have you had any quantity or quality issues with your well? Briefly describe any issues.

   Yes, quality issues.

9. Would you be willing to allow us to collect a sample of your water for laboratory analysis at no cost to you? All results will be provided to you for your records.

   Yes

2800 High Point Dr., Suite 100
Milton, ON L9T 6P4
T. 905.875.0026
F. 905.875.4915
cfcrozier.ca

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10. Do you have a surface water intake on your property?

    No

11. Do you have any water treatment systems (e.g., water softener, chlorinator etc.)?

    No response

12. Do you have a septic system on your property?

    Yes

13. Where is your sewage system located (i.e., front of your home, side yard etc.)?

    Backyard

14. What type of sewage system is it (i.e., septic tan with a leaching bed or holding tank)?

    Septic tank with a leaching bed or drain field

15. What is the age of your septic system?

    57 years

APPENDIX D

Water Balance

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Water Balance Parameters

Thornthwaite & Mather Method

Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: VM
Checked By: CM
Date: 2024-05-23

Project Name: **10249 Hunsden Sideroad**
Location: **Region of Peel**

Climate Station: *ALBION FIELD CENTRE*
Longitude: *79°50'00.000" W*
Latitude: *43°55'00.000" N*
Elevation: *281.9 m*
Station ID: *6150103*

LATITUDE — *DEGREES* **43**

Month	Mean Temperature (C°)[1]	Heat Index [i =(t/5)$^{1.514}$]	α	Potential Evapotranspiration (PET) (mm)	Correction Factor[2]	Adjusted Potential Evapotranspiration (APET) (mm)	Total Precipitation (P) (mm)[1]	P - APET (mm)	APET- P (mm)
January	-7	0.0000	0.4924	0.0000	0.81	0	60.4	60.4	0.0
February	-5.9	0.0000	0.4924	0.0000	0.82	0	50.2	50.2	0.0
March	-1.4	0.0000	0.4924	0.0000	1.02	0	50.3	50.3	0.0
April	6.1	1.3513	0.5165	28.8545	1.12	32	67	34.7	0.0
May	12.4	3.9555	0.5621	60.8270	1.26	77	76.1	0.0	0.5
June	17.3	6.5488	0.6066	86.3244	1.28	110	75.5	0.0	35.0
July	19.9	8.0951	0.6328	100.0131	1.29	129	81.8	0.0	47.2
August	19.1	7.6075	0.6246	95.7908	1.2	115	77.4	0.0	37.5
September	14.3	4.9084	0.5786	70.6617	1.04	73	75	1.5	0.0
October	8.1	2.0759	0.5293	38.8760	0.95	37	68.3	31.4	0.0
November	2.1	0.2689	0.4972	9.4052	0.81	8	81.7	74.1	0.0
December	-3.9	0.0000	0.4924	0.0000	0.77	0	57.7	57.7	0.0
TOTAL		**34.8**	**1.1**			**581.5**	**821.4**	**360.24**	**120.30**

TOTAL WATER DEFICIT = 120.30 mm
TOTAL WATER SURPLUS (SURPLUS - DEFICIT) = 239.94 mm

NOTES: 1. Precipitation and Temperature data from the ALBION FIELD CENTRE (Station No.6150103) Environment Canada Station Data
2. Latitude adjustment factors determined based on site latitude assuming 12 hours of sunlight per day for 30 days

CROZIER CONSULTING ENGINEERS

Pre-Development Water Balance

Thornthwaite & Mather Method

Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: VM
Checked By: CM
Date: 2024-05-23

Project Name: **10249 Hunsden Sideroad**
Location: **Region of Peel**

Pre-Development Site Summary

TOTAL SITE AREA (m^2)	225,200

Catchment ID	**101**	**102**	**103**	**Ext-1**
Topography - flat/rolling/hilly	0.10	0.10	0.10	0.10
Soils	0.30	0.30	0.30	0.30
Cover - cultivated/woodland	0.10	0.10	0.10	0.20
Sum (Infiltration Factor)	0.50	0.50	0.50	0.60
Soil Moisture Capacity (mm)	150	150	150	300
Catchment Area (m^2)	109,700	48,300	45,700	21,500
Percent Imperviousness (%)	0%	0%	0%	0%

Catchment ID	**101**	**102**	**103**	**Ext-1**
Total Impervious Area (m^2)	351.04	0	0	0
Percentage of Impervious Area (%)	0%	0%	0%	0%
Total Pervious Area (m^2)	109,349	48,300	45,700	21,500
Percentage of Pervious Area (%)	100%	100%	100%	100%

Catchment ID	**101**											
Evapotranspiration/Evaporation Analysis												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	120
Storage (S) (mm)	150	150	150	150	149	114	67	30	31	63	137	150	
Pervious Area Infiltration/Runoff Analysis													
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Potential Direct Surface Water Runoff (R) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Impervious Area Evapotranspiration/Evaporation/Runoff Analysis													
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	3534	8381	12083	14108	12570	8036	4038	833	0	**63582**
Impervious ET (m^3)	0	0	0	4	4	4	4	4	4	4	4	0	**32**
Pervious Runoff (m^3)	3302	2745	2750	1896	0	0	0	0	0	0	0	2425	**13119**
Impervious Runoff (m^3)	21	18	18	20	23	23	24	23	22	20	24	20	**257**
Pervious Infiltration (m^3)	3302	2745	2750	1896	0	0	0	0	0	0	0	2425	**13119**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Catchment ID	**102**												
Evapotranspiration/Evaporation Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	120
Storage (S) (mm)	150	150	150	150	149	114	67	30	31	63	137	150	
Pervious Area Infiltration/Runoff Analysis													
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Potential Direct Surface Water Runoff (R) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Impervious Area Evapotranspiration/Evaporation/Runoff Analysis													
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	1561	3702	5337	6232	5552	3549	1784	368	0	**28084**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	1459	1212	1215	838	0	0	0	0	0	0	0	1071	**5795**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	1459	1212	1215	838	0	0	0	0	0	0	0	1071	**5795**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Catchment ID	103												
					Evapotranspiration/Evaporation Analysis								
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	120
Storage (S) (mm)	150	150	150	150	149	114	67	30	31	63	137	150	
					Pervious Area Infiltration/Runoff Analysis								
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Potential Direct Surface Water Runoff (R) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
					Impervious Area Evapotranspiration/Evaporation/Runoff Analysis								
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
					Combined Water Balance								
Pervious ET (m^3)	0	0	0	1477	3503	5050	5896	5253	3358	1688	348	0	**26573**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	1380	1147	1149	793	0	0	0	0	0	0	0	1014	**5483**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	1380	1147	1149	793	0	0	0	0	0	0	0	1014	**5483**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Catchment ID	Ext-1												
					Evapotranspiration/Evaporation Analysis								
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	120
Storage (S) (mm)	300	300	300	300	299	264	217	180	181	213	287	300	
					Pervious Area Infiltration/Runoff Analysis								
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	36	30	30	21	0	0	0	0	0	0	0	27	144
Potential Direct Surface Water Runoff (R) (mm)	24	20	20	14	0	0	0	0	0	0	0	18	96
					Impervious Area Evapotranspiration/Evaporation/Runoff Analysis								
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
					Combined Water Balance								
Pervious ET (m^3)	0	0	0	695	1648	2376	2774	2471	1580	794	164	0	**12501**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	519	432	433	298	0	0	0	0	0	0	0	381	**2063**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	779	648	649	447	0	0	0	0	0	0	0	572	**3095**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Pre-Development Water Balance Summary							
Pre-Development Infiltration	27491.1	m^3/yr	122.1	mm/yr			
Pre-Development Runoff	26716.0	m^3/yr	118.6	mm/yr			

NOTES: 1.Areas and percent imperviousness determined using Draft Plan of Subdivision dated June 2022 prepared by Mackitecture Inc..
2.The infiltration factor is determined using the MECP Methodology outlined in Stormwater Drainage Manual 2003.
3. Additional assumptions:
> Surplus water is unavailable for runoff and recharge in months where water losses from AET exceed precipitation inputs.
> Runoff, infiltration and evapotranspiration do not occur when average temperature is below zero.
> Precipitation during winter months (Dec. through Mar. is assumed to be accumulated as snow.
> Soil Moisture Capacity is at a maximum in April.

CROZIER CONSULTING ENGINEERS

Post-Development Water Balance

Thornthwaite & Mather Method

Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: VM
Checked By: CM
Date: 2024-05-23

Project Name: **10249 Hunsden Sideroad**
Location: **Region of Peel**

Post-Development Site Summary

TOTAL SITE AREA (m^2)	225,200						
Catchment ID	**201A**	**202**	**203**	**204**	**205**	**201B**	**Ext-1**
Topography - flat/rolling/hilly	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Soils	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Cover - cultivated/woodland	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Sum (Infiltration Factor)	0.5	0.5	0.5	0.5	0.5	0.5	0.6
Soil Moisture Capacity (mm)	150	150	150	150	150	150	250
Catchment Area (m^2)	70,500	29,600	21,450	10,600	21,900	49,650	21,500
Percent Imperviousness (%)	25%	15%	19%	14%	0%	0%	0%
Catchment ID	**201A**	**202**	**203**	**204**	**205**	**201B**	**Ext-1**
Total Impervious Area (m^2)	17625	4440	4075.5	1484	0	0	0
Percentage of Impervious Area (%)	25%	15%	19%	14%	0%	0%	0%
Total Pervious Area (m^2)	52,875	25,160	17,375	9,116	21,900	49,650	21,500
Percentage of Pervious Area (%)	75%	85%	81%	86%	100%	100%	100%

Catchment ID	**201A**												
Evapotranspiration/Evaporation Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	
Storage (S) (mm)	150	150	150	150	149	114	67	30	31	63	137	150	
Pervious Area Infiltration/Runoff Analysis													
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Potential Direct Surface Water Runoff (R) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Impervious Area Evapotranspiration/Evaporation/Runoff Analysis													
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	1709	4052	5842	6822	6078	3886	1953	403	0	**30745**
Impervious ET (m^3)	0	0	0	177	201	200	216	205	198	181	216	0	**1594**
Pervious Runoff (m^3)	1597	1327	1330	917	0	0	0	0	0	0	0	1173	**6343**
Impervious Runoff (m^3)	1065	885	887	1004	1140	1131	1225	1160	1124	1023	1224	1017	**12884**
Pervious Infiltration (m^3)	1597	1327	1330	917	0	0	0	0	0	0	0	1173	**6343**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Catchment ID	**202**												
Evapotranspiration/Evaporation Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	
Storage (S) (mm)	150	150	150	150	149	114	67	30	31	63	137	150	
Pervious Area Infiltration/Runoff Analysis													
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Potential Direct Surface Water Runoff (R) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Impervious Area Evapotranspiration/Evaporation/Runoff Analysis													
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	813	1928	2780	3246	2892	1849	929	192	0	**14630**
Impervious ET (m^3)	0	0	0	45	51	50	54	52	50	45	54	0	**401**
Pervious Runoff (m^3)	760	632	633	436	0	0	0	0	0	0	0	558	**3018**
Impervious Runoff (m^3)	268	223	223	253	287	285	309	292	283	258	308	256	**3246**
Pervious Infiltration (m^3)	760	632	633	436	0	0	0	0	0	0	0	558	**3018**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Catchment ID	**203**												
					Evapotranspiration/Evaporation Analysis								
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	
Storage (S) (mm)	150	150	150	150	149	114	67	30	31	63	137	150	
					Pervious Area Infiltration/Runoff Analysis								
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Potential Direct Surface Water Runoff (R) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
					Impervious Area Evapotranspiration/Evaporation/Runoff Analysis								
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
					Combined Water Balance								
Pervious ET (m^3)	0	0	0	561	1332	1920	2242	1997	1277	642	132	0	**10103**
Impervious ET (m^3)	0	0	0	41	47	46	50	47	46	42	50	0	**369**
Pervious Runoff (m^3)	525	436	437	301	0	0	0	0	0	0	0	385	**2084**
Impervious Runoff (m^3)	246	205	205	232	264	262	283	268	260	237	283	235	**2979**
Pervious Infiltration (m^3)	525	436	437	301	0	0	0	0	0	0	0	385	**2084**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Catchment ID	**204**												
					Evapotranspiration/Evaporation Analysis								
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	
Storage (S) (mm)	150	150	150	150	149	114	67	30	31	63	137	150	
					Pervious Area Infiltration/Runoff Analysis								
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Potential Direct Surface Water Runoff (R) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
					Impervious Area Evapotranspiration/Evaporation/Runoff Analysis								
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
					Combined Water Balance								
Pervious ET (m^3)	0	0	0	295	699	1007	1176	1048	670	337	69	0	**5301**
Impervious ET (m^3)	0	0	0	15	17	17	18	17	17	15	18	0	**134**
Pervious Runoff (m^3)	275	229	229	158	0	0	0	0	0	0	0	202	**1094**
Impervious Runoff (m^3)	90	74	75	85	96	95	103	98	95	86	103	86	**1085**
Pervious Infiltration (m^3)	275	229	229	158	0	0	0	0	0	0	0	202	**1094**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Catchment ID	**205**												
					Evapotranspiration/Evaporation Analysis								
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	
Storage (S) (mm)	150	150	150	150	149	114	67	30	31	63	137	150	
					Pervious Area Infiltration/Runoff Analysis								
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Potential Direct Surface Water Runoff (R) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
					Impervious Area Evapotranspiration/Evaporation/Runoff Analysis								
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
					Combined Water Balance								
Pervious ET (m^3)	0	0	0	708	1678	2420	2825	2517	1609	809	167	0	**12734**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	661	550	551	380	0	0	0	0	0	0	0	486	**2627**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	661	550	551	380	0	0	0	0	0	0	0	486	**2627**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Catchment ID	201B												
Evapotranspiration/Evaporation Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	
Storage (S) (mm)	150	150	150	150	149	114	67	30	31	63	137	150	
Pervious Area Infiltration/Runoff Analysis													
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Potential Direct Surface Water Runoff (R) (mm)	30	25	25	17	0	0	0	0	0	0	0	22	120
Impervious Area Evapotranspiration/Evaporation/Runoff Analysis													
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	1605	3805	5486	6406	5707	3649	1834	378	0	**28869**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	1499	1246	1249	861	0	0	0	0	0	0	0	1101	**5957**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	1499	1246	1249	861	0	0	0	0	0	0	0	1101	**5957**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Catchment ID	Ext-1												
Evapotranspiration/Evaporation Analysis													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (P)	60	50	50	67	76	76	82	77	75	68	82	58	**821**
Adjusted Potential Evapotranspiration (APET)	0	0	0	32	77	110	129	115	73	37	8	0	581
P-APET	60	50	50	35	-1	-35	-47	-38	2	31	74	58	240
Change in Storage	0	0	0	0	-1	-35	-47	-38	2	31	74	13	
Storage (S) (mm)	250	250	250	250	249	214	167	130	131	163	237	250	
Pervious Area Infiltration/Runoff Analysis													
Water Surplus (mm)	60	50	50	35	0	0	0	0	0	0	0	44	240
Potential Infiltration (I) (mm)	36	30	30	21	0	0	0	0	0	0	0	27	144
Potential Direct Surface Water Runoff (R) (mm)	24	20	20	14	0	0	0	0	0	0	0	18	96
Impervious Area Evapotranspiration/Evaporation/Runoff Analysis													
Impervious Evapotranspiration/Evaporation (mm)	0	0	0	10	11	11	12	12	11	10	12	0	90
Impervious Runoff (mm)	60	50	50	57	65	64	70	66	64	58	69	58	**731**
Combined Water Balance													
Pervious ET (m^3)	0	0	0	695	1648	2376	2774	2471	1580	794	164	0	**12501**
Impervious ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Runoff (m^3)	519	432	433	298	0	0	0	0	0	0	0	381	**2063**
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Pervious Infiltration (m^3)	779	648	649	447	0	0	0	0	0	0	0	572	**3095**
Impervious Infiltration (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Post-Development Water Balance Summary							
Post-Development Infiltration	24219.1	m^3/yr	107.5	mm/yr	0.0034	L/s	
Post-Development Runoff	43380.3	m^3/yr	192.6	mm/yr	0.0061	L/s	

NOTES: 1.Areas and percent imperviousness determined using Draft Plan of Subdivision dated June 2022 prepared by Mackitecture Inc..
2.The infiltration factor is determined using the MECP Methodology outlined in SWM 2003 Manual.
3. Additional assumptions:
> Surplus water is unavailable for runoff and recharge in months where water losses from AET exceed precipitation inputs.
> Runoff, infiltration and evapotranspiration do not occur when average temperature is below zero.
> Precipitation during winter months (Dec. through Mar. is assumed to be accumulated as snow.
> Soil Moisture Capacity is at a maximum in April.

CROZIER CONSULTING ENGINEERS

Water Balance Summary

Thornthwaite & Mather Method

Project Name: 10249 Hunsden Sideroad
Project Number: 0952-6305
Created By: VM
Checked By: CM
Date: 2024-05-23

Project Name: **10249 Hunsden Sideroad**
Location: **Region of Peel**

Characteristic	Pre-Development	Post-Development	% Change (Pre to Post)
Precipitation (mm/yr)	821.40	821.40	0%
Water Surplus (mm/yr)	239.94	239.94	0%
Evapotranspiration (mm/yr)	581.46	581.46	0%
Natural Infiltration (mm/yr)	122.07	107.54	-12%
Infiltration through LID Measures (mm/yr)	0.00	0.00	-
Total Infiltration (mm/yr)	122.07	107.54	-12%
Total Runoff (mm/yr)	118.63	192.63	62%

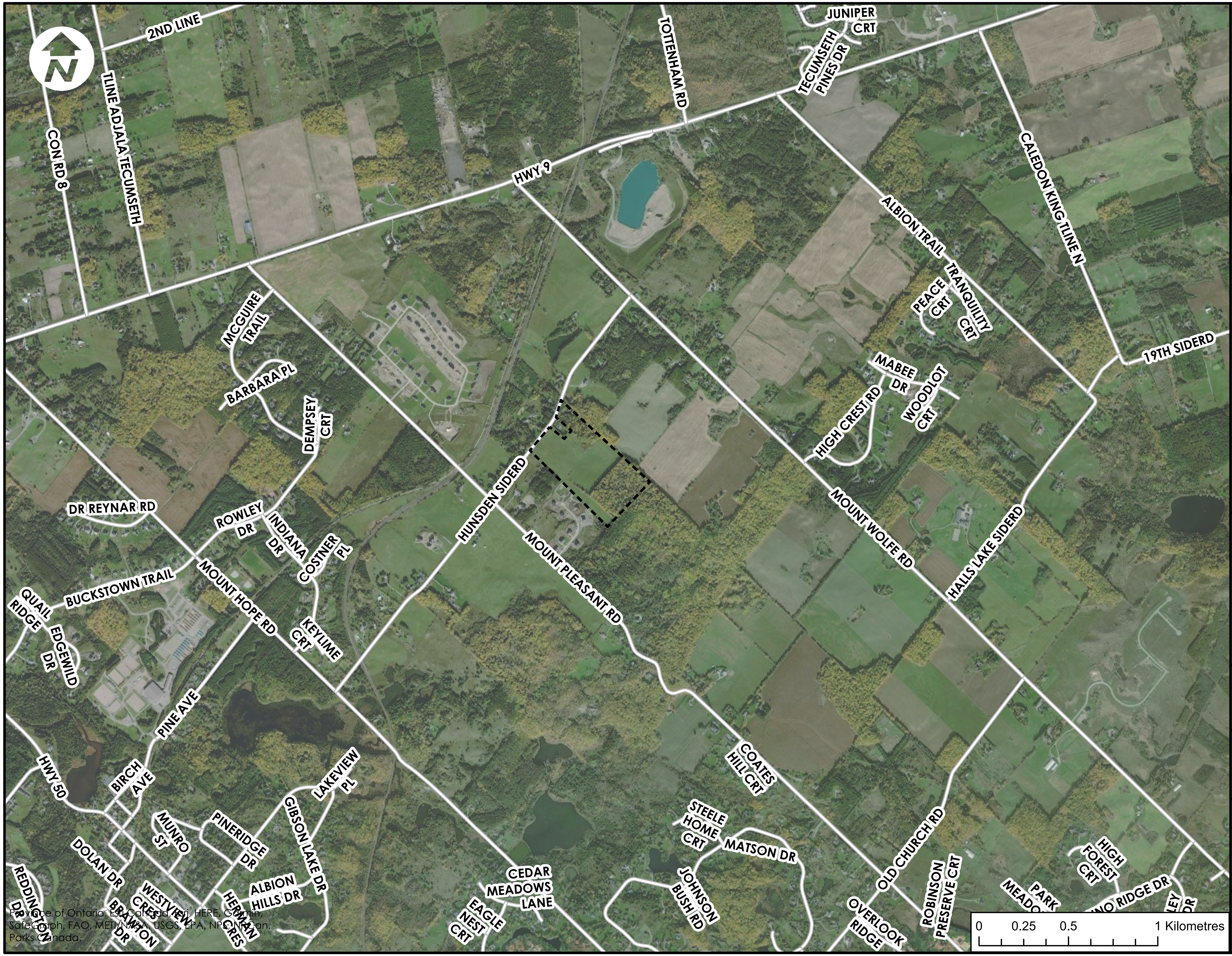
Infiltration Deficit (mm/yr)	14.53

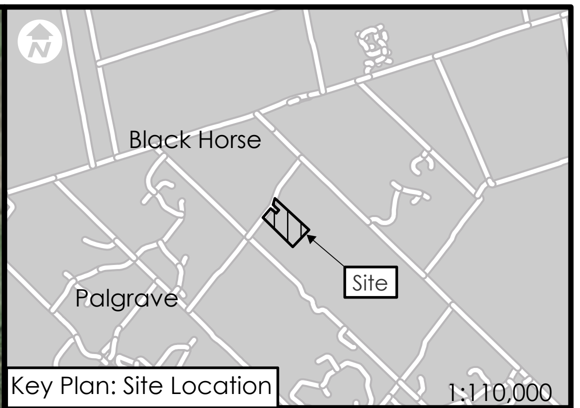
Adjustment Factors Based on Site Latitude Based on 12 hours of Sunlight per day for 30 days

Latitude °C	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50	0.74	0.78	1.02	1.15	1.33	1.36	1.37	1.25	1.06	0.92	0.76	0.70
49	0.75	0.79	1.02	1.14	1.32	1.34	1.35	1.24	1.05	0.93	0.76	0.71
48	0.76	0.80	1.02	1.14	1.31	1.33	1.34	1.23	1.05	0.93	0.77	0.72
47	0.77	0.80	1.02	1.14	1.30	1.32	1.33	1.22	1.04	0.93	0.78	0.73
46	0.79	0.81	1.02	1.13	1.29	1.31	1.32	1.22	1.04	0.94	0.79	0.74
45	0.80	0.81	1.02	1.13	1.28	1.29	1.31	1.21	1.04	0.94	0.79	0.75
44	0.81	0.82	1.02	1.13	1.27	1.29	1.30	1.20	1.04	0.95	0.80	0.76
43	0.81	0.82	1.02	1.12	1.26	1.28	1.29	1.20	1.04	0.95	0.81	0.77
42	0.82	0.83	1.03	1.12	1.26	1.27	1.28	1.19	1.04	0.95	0.82	0.79
41	0.83	0.83	1.03	1.11	1.25	1.26	1.27	1.19	1.04	0.96	0.82	0.80
40	0.84	0.83	1.03	1.11	1.24	1.25	1.27	1.18	1.04	0.96	0.83	0.81
39	0.85	0.84	1.03	1.11	1.23	1.24	1.26	1.18	1.04	0.96	0.84	0.82
38	0.85	0.84	1.03	1.10	1.23	1.24	1.25	1.17	1.04	0.96	0.84	0.83
37	0.86	0.84	1.03	1.10	1.22	1.23	1.25	1.17	1.03	0.97	0.85	0.83
36	0.87	0.85	1.03	1.10	1.21	1.22	1.24	1.16	1.03	0.97	0.86	0.84
35	0.87	0.85	1.03	1.09	1.21	1.21	1.23	1.16	1.03	0.97	0.86	0.85
34	0.88	0.85	1.03	1.09	1.20	1.20	1.22	1.16	1.03	0.97	0.87	0.86
33	0.88	0.86	1.03	1.09	1.19	1.20	1.22	1.15	1.03	0.97	0.88	0.86
32	0.89	0.86	1.03	1.08	1.19	1.19	1.21	1.15	1.03	0.98	0.88	0.87
31	0.90	0.87	1.03	1.08	1.18	1.18	1.20	1.14	1.03	0.98	0.89	0.88
30	0.90	0.87	1.03	1.08	1.18	1.17	1.20	1.14	1.03	0.98	0.89	0.88
29	0.91	0.87	1.03	1.07	1.17	1.16	1.19	1.13	1.03	0.98	0.90	0.89
28	0.91	0.88	1.03	1.07	1.16	1.16	1.18	1.13	1.02	0.98	0.90	0.90
27	0.92	0.88	1.03	1.07	1.16	1.15	1.18	1.13	1.02	0.99	0.90	0.90
26	0.92	0.88	1.03	1.06	1.15	1.15	1.17	1.12	1.02	0.99	0.91	0.91
25	0.93	0.89	1.03	1.06	1.15	1.14	1.17	1.12	1.02	0.99	0.91	0.91
20	0.95	0.90	1.03	1.05	1.13	1.11	1.14	1.11	1.02	1.00	0.93	0.94
15	0.97	0.91	1.03	1.04	1.11	1.08	1.12	1.08	1.02	1.01	0.95	0.97
10	1.00	0.91	1.03	1.03	1.08	1.06	1.08	1.07	1.02	1.02	0.98	0.99
5	1.02	0.93	1.03	1.02	1.06	1.03	1.06	1.05	1.01	1.03	0.99	1.02
0	1.04	0.94	1.04	1.01	1.04	1.01	1.04	1.04	1.01	1.04	1.01	1.04
-5	1.06	0.91	1.04	1.00	1.02	0.99	1.02	1.03	1.00	1.05	1.03	1.06
-10	1.08	0.97	1.05	0.99	1.01	0.96	1.00	1.01	1.00	1.06	1.05	1.10
-15	1.12	0.98	1.05	0.98	0.98	0.94	0.97	1.00	1.00	1.07	1.07	1.12
-20	1.14	1.00	1.05	0.97	0.96	0.91	0.95	0.99	1.00	1.08	1.09	1.15
-25	1.17	1.01	1.05	0.96	0.94	0.88	0.93	0.98	1.00	1.10	1.11	1.18
-30	1.20	1.03	1.06	0.95	0.92	0.85	0.90	0.96	1.00	1.12	1.14	1.21
-35	1.23	1.04	1.06	0.94	0.89	0.82	0.87	0.94	1.00	1.13	1.17	1.25
-45	1.27	1.06	1.07	0.93	0.86	0.78	0.84	0.92	1.00	1.15	1.20	1.29
-42	1.28	1.07	1.07	0.92	0.85	0.76	0.82	0.92	1.00	1.16	1.22	1.31
-44	1.30	1.08	1.07	0.92	0.83	0.74	0.81	0.91	0.99	1.17	1.23	1.33
-46	1.32	1.10	1.07	0.91	0.82	0.72	0.79	0.90	0.99	1.17	1.25	1.35
-48	1.34	1.11	1.08	0.90	0.80	0.70	0.76	0.89	0.99	1.18	1.27	1.37
-50	1.37	1.12	1.08	0.89	0.77	0.67	0.74	0.88	0.99	1.19	1.29	1.41

Source: Dunne, T. and Leopold, L.B., 1978. Water in environmental planning, Freeman Publishers.

FIGURES





Key Plan: Site Location

1:110,000

Legend

Property Limits

Roads

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ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Project:

10249 Hunsden Sideroad

Drawing:

Site Plan Location

CROZIER CONSULTING ENGINEERS

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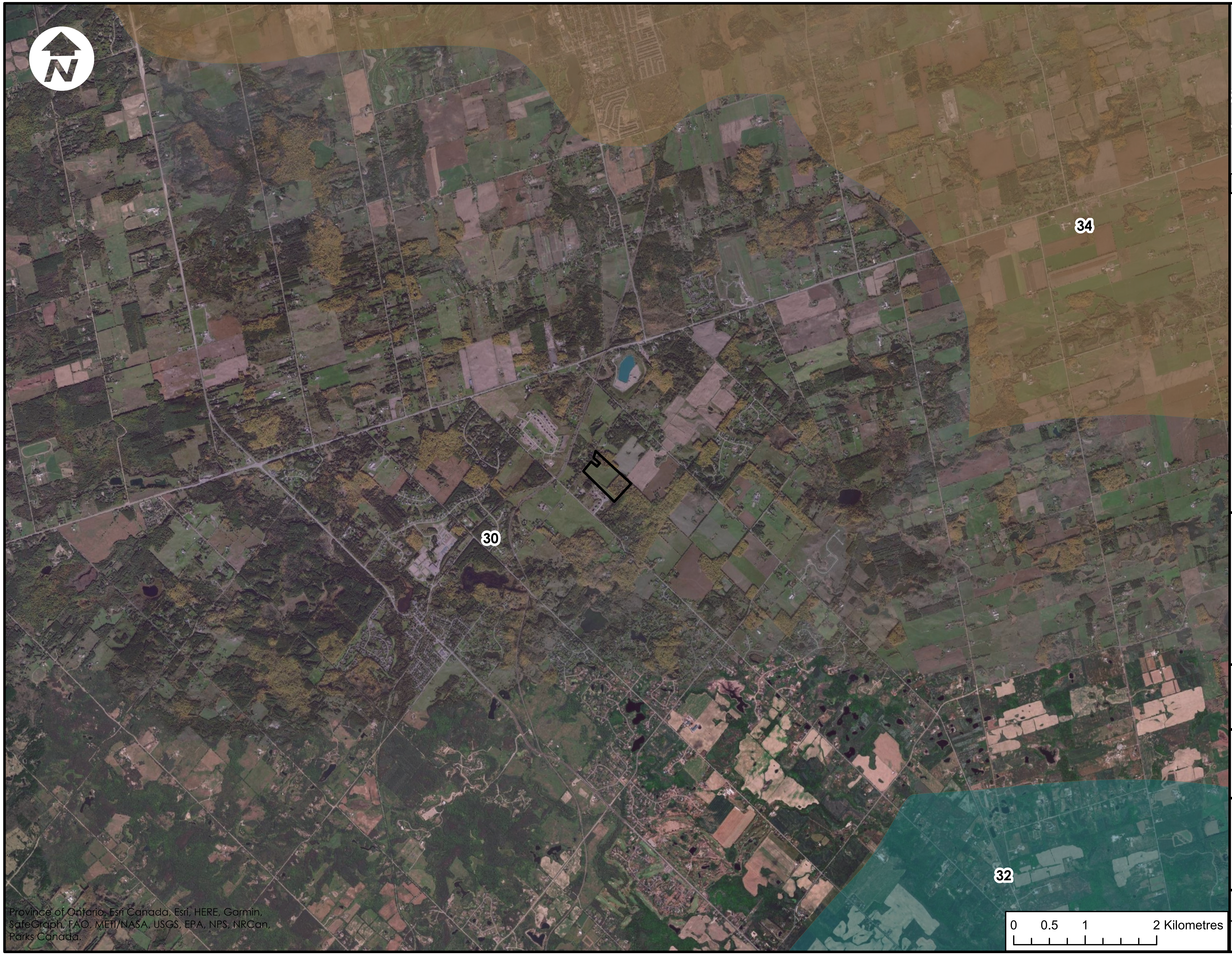
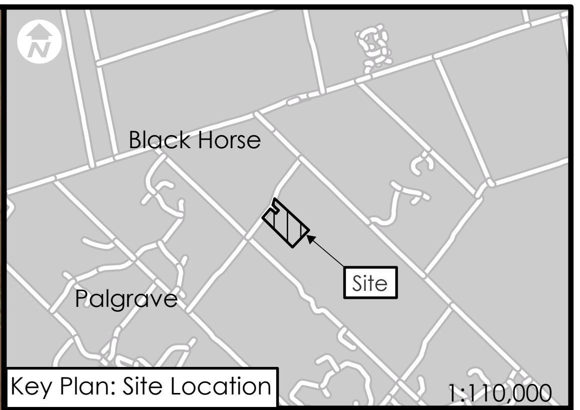
J.M	J.M	6305 - 10249	
Date:	GCS:	Scale:	Dwg.
2022-06-30	WGS 1984	1:20,000	FIG. 1

I:\900\952 - Harwood\6305- 10249 Hunsden Sdrd\Design\GIS\6305 - Hunsden Sideroad\APRXs\10249_Hunsden_Sideroad\10249_Hunsden_Sideroad.aprx





Key Plan: Site Location 1:110,000

Legend

Property Limits

Physiographic Region

30: Oak Ridges Moraine

32: South Slope

34: Schomberg Clay Plains

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Project:

10249 Hunsden Sideroad

Drawing:

Physiography

CROZIER CONSULTING ENGINEERS

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Date:	GCS:	Scale:	Dwg.
2022-06-30	WGS 1984	1:20,000	FIG. 2

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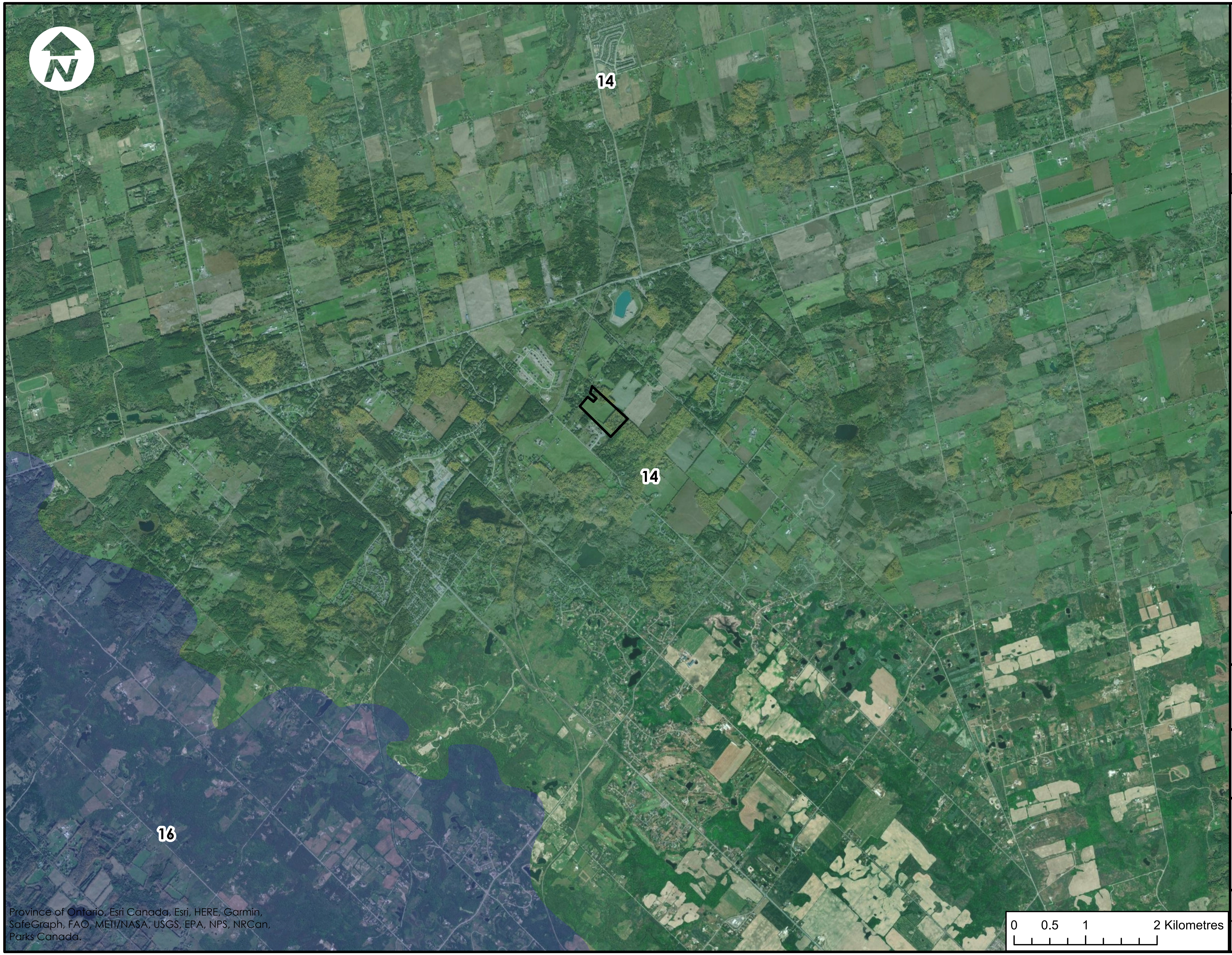

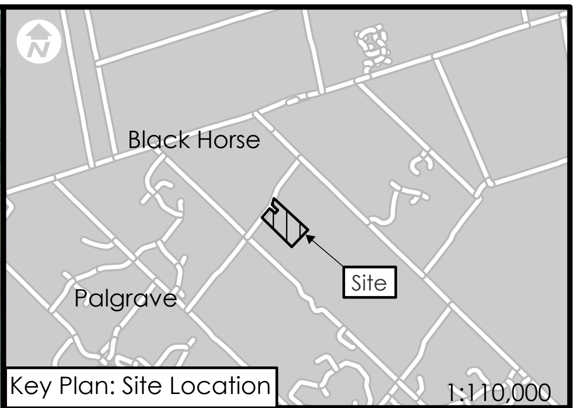

Legend

Property Limits

Bedrock Geology

16: Queenston Formation
shale, siltstone, minor limestone and sandstone

14: Georgian Bay Formation
blue gray shale with thin limestone interbeds

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Project:
10249 Hunsden Sideroad

Drawing:
Bedrock Geology

CROZIER
CONSULTING ENGINEERS

Drawn:	Design:	Project No.	
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Date:	GCS:	Scale:	Dwg.
2022-06-30	WGS 1984	1:20,000	FIG. 3

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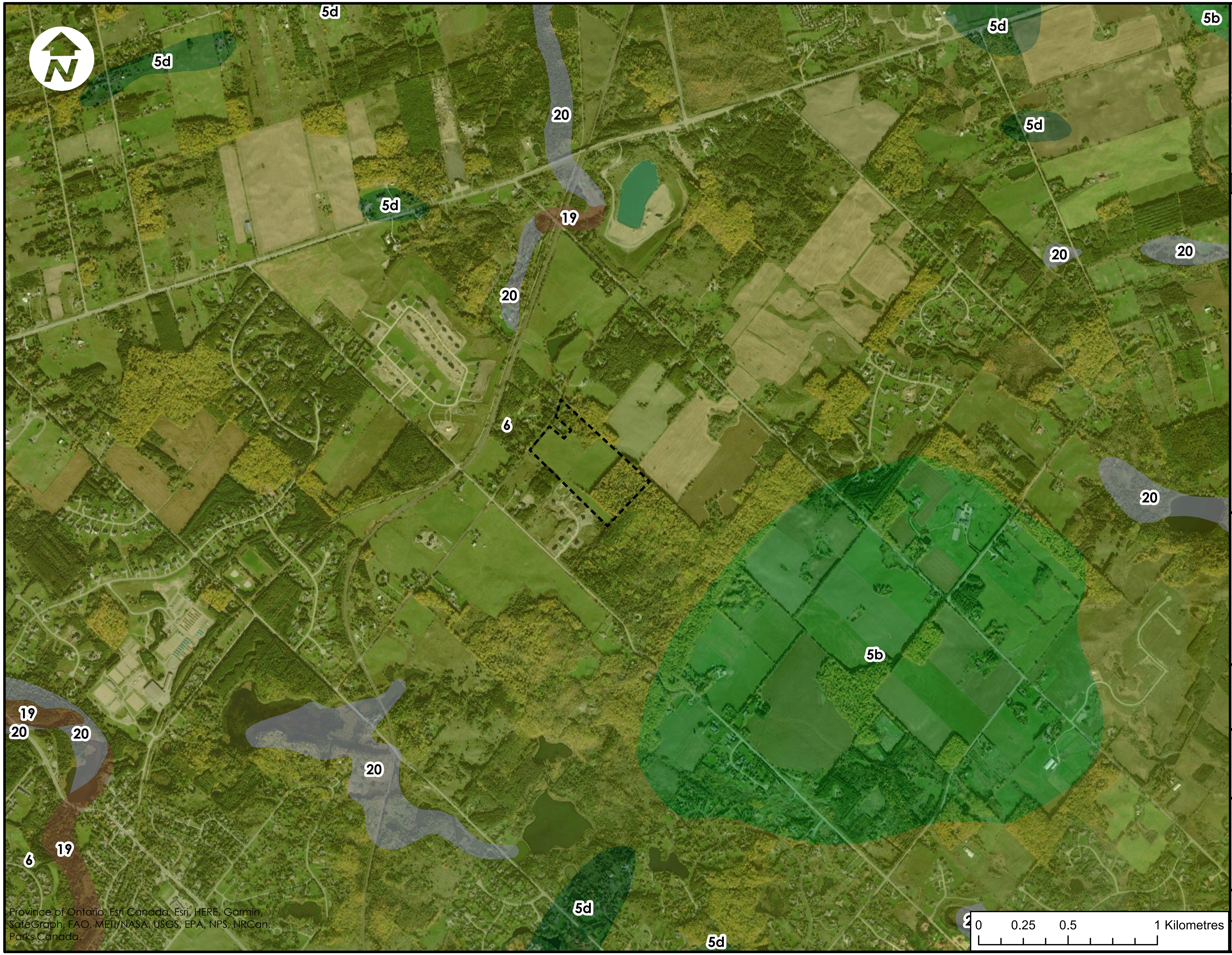

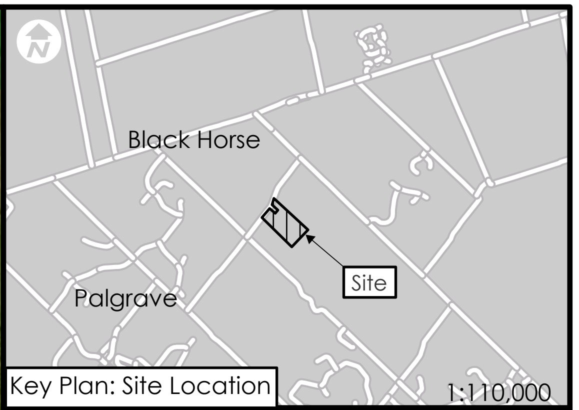

Key Plan: Site Location

Legend

- Property Limits
- Surficial Geology
  - 5b: Stone-poor, carbonate-derived silty to sandy till
  - 5d: Glaciolacustrine-derived silty to clayey till
  - 6: Ice-contact stratified deposits
  - 19: Modern alluvial deposits
  - 20: Organic deposits

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Project:

10249 Hunsden Sideroad

Drawing:

Surficial Geology

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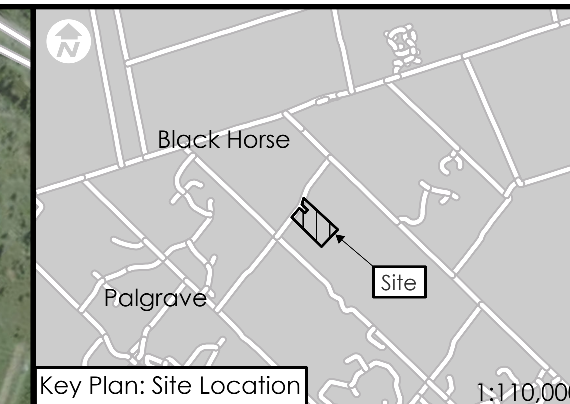
Date:	GCS:	Scale:	Dwg.
2022-06-30	WGS 1984	1:20,000	FIG. 4



Key Plan: Site Location 1:110,000

Legend

- Property Limits
- Roads
- MECP Well

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Project:

10249 Hunsden Sideroad

Drawing:

MECP Well Plan

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Date:	GCS:	Scale:	Dwg.
2022-06-30	WGS 1984	1: 8,500	FIG. 5

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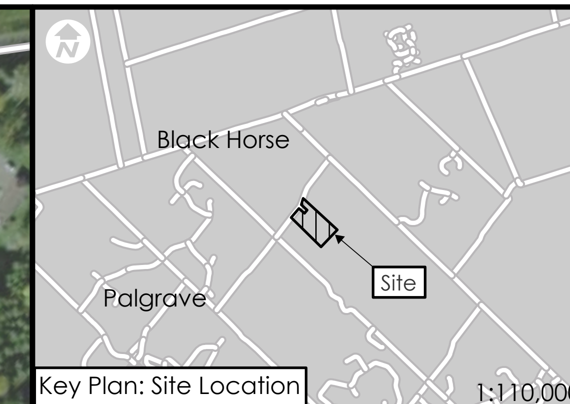

Legend

- Property Limits
- Roads
- Monitoring Well

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Project:

10249 Hunsden Sideroad

Drawing:

Monitoring Well Plan

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Drawn:	Design:	Project No.	
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Date:	GCS:	Scale:	Dwg.
2022-06-30	WGS 1984	1: 3,500	FIG. 6

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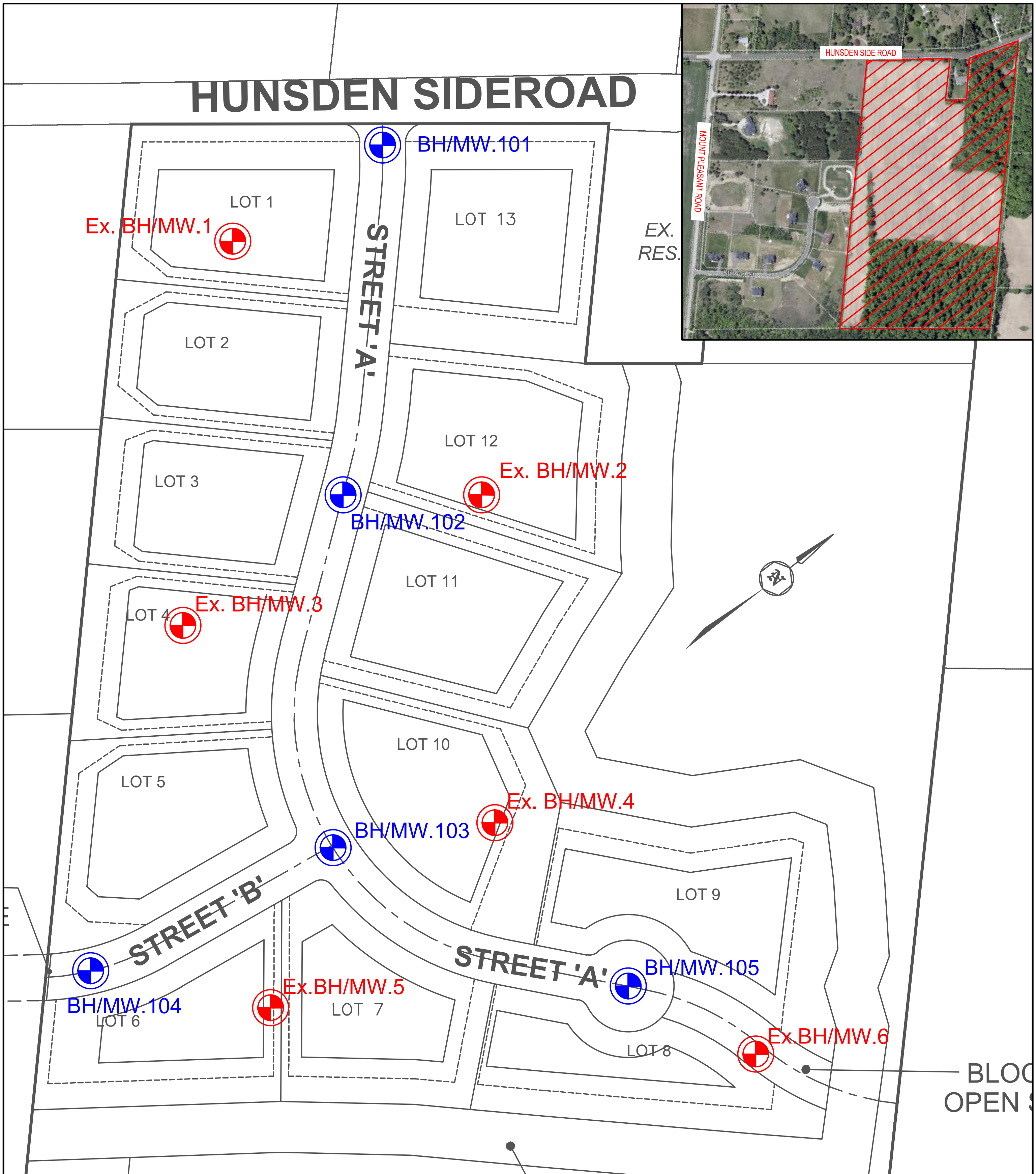

LEGEND

- Borehole with monitoring well

- Ex. Borehole with monitoring well

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BOREHOLE AND MONITORING WELL LOCATION PLAN

SITE: Hunsden Sideroad, Town of Caledon (Bolton)

DESIGNED BY: –	**CHECKED BY:** –	**DWG NO.:** 1
SCALE: 1:2000	**REF. NO.:** 2202-S079 Sup	**DATE:** May 2024

REV –