



Hydrogeological Assessment, 31 Patterson Road, Barrie, Ontario

February 13, 2023

Prepared for:
Gerrits Engineering

Cambium Reference: 15863-001

CAMBIUM INC.

866.217.7900

cambium-inc.com

Peterborough | Barrie | Oshawa | Kingston



Table of Contents

1.0	Introduction.....	1
1.1	Scope of Work.....	1
1.2	Site Description and Site Development	2
2.0	Environmental Features	4
3.0	Physical Setting.....	5
3.1	Topography and Drainage.....	5
3.2	Physiography.....	5
3.3	Overburden Geology	5
3.4	Bedrock Geology	5
4.0	MECP Well Records Assessment	7
5.0	Borehole Drilling and Monitoring Well Installation	9
5.1	Borehole Investigation	9
5.1.1	Past Investigation	9
5.1.2	Monitoring Well Installation (Cambium 2022)	9
5.2	Physical Laboratory Testing	10
5.3	Groundwater Level Monitoring	11
5.4	Groundwater Flow Direction	11
5.5	In-Situ Hydraulic Conductivity Tests.....	12
5.6	In-Situ Infiltration Testing.....	12
6.0	Water Balance Assessment	14
6.1	Water Surplus.....	15
6.2	Infiltration Rates	16
6.2.1	Pre-Development Water Balance	16
6.2.2	Post-Development Water Balance	17
6.2.3	Water Balance Comparison.....	17
6.2.4	Requirement of Infiltration from Roof Runoff	18



6.3	Discussions on LID Measures	18
6.3.1	Mitigation Measures.	19
7.0	Source Water Protection and Risk Management	21
7.1	SGRA	21
7.2	ICA	21
7.3	WHPA-C/D	22
7.4	WHPA-Q1/Q2.....	23
8.0	Assessment of Potential Impacts	25
8.1	Natural Features.....	25
8.2	Water Supply Wells near the Site	25
8.3	Considerations on Drinking Water Vulnerability	25
9.0	Conclusions and Recommendations	26
9.1	Respectfully submitted,	27
10.0	References	28
11.0	Standard Limitations.....	29

List of Tables

Table 1	Summary of the Surrounding Water Well Record Information	7
Table 2	Well Construction Details.....	10
Table 3	Particle Size Distribution	11
Table 4	Measured Groundwater Details	11
Table 5	Results of Estimated Hydraulic Conductivity as per Slug Test.....	12
Table 6	Infiltration Rates – Guelph Permeameter Method.....	13
Table 7	Pre- and Post-Development Statistics	15
Table 8	Pre-Development Water Balance	17
Table 9	Post-Development Water Balance	17
Table 10	Water Balance Comparison	17
Table 11	Requirement of Infiltration from Roof Run-off	18



List of Appended Figures

- Figure 1 Regional Site Location Map
- Figure 2 Site Location Plan
- Figure 3 MECP Well Records Map within 500 m Radius
- Figure 4 Borehole Location Plan
- Figure 5 Groundwater Configuration Map
- Figure 6 Pre-Development Plan
- Figure 7 Post-Development Plan

List of Appendices

- Appendix A Site Development Plans
- Appendix B MECP Well Records
- Appendix C Borehole Logs
- Appendix D Grain Size Analysis Data
- Appendix E SWRT Analysis
- Appendix F In-Situ Infiltration Results
- Appendix G Thornthwaite Water Balance



1.0 Introduction

Cambium Inc. (Cambium) was retained by Gerrits Engineering (Client) to complete a hydrogeological assessment of the property located at 31 Patterson Road, Barrie, Ontario (herein referred to as Site).

A hydrogeological assessment is required as part of the application process for a Site Plan Approval (SPA) for the proposed industrial warehouse expansion. The total area of the property is approximately 4.44 hectares (~11.0 acres).

The property is currently developed with an industrial building which is used as a manufacturing and distributing facility for Canplas Industries Ltd., and associated infrastructure such as parking lots, driveways, greenspace, etc. It is understood that the proposed development will include an expansion of approximately 1,572.8 m² to the building in the form of an addition off of the south side of the building.

1.1 Scope of Work

This hydrogeological investigation was carried out with the following tasks:

- **Review of available background information:** a review of available geological and hydrogeological information for the site and surrounding areas and the previous investigation reports completed for the Site, was conducted to provide background information to allow for characterization of the Site's soil and groundwater conditions.
- **Detailed site inspection:** an inspection of the Site was completed to review existing Site conditions including identification of any hydrogeological features such as significant areas of potential groundwater recharge or areas of groundwater discharge.
- **Measurement of groundwater levels:** groundwater levels were measured in the existing monitoring wells to establish and/or confirm the general groundwater flow condition and elevations.
- **In-Situ Hydraulic Conductivity Tests:** single well response tests (SWRT) i.e., in-situ hydraulic conductivity tests in all monitoring wells conducted to estimate the hydraulic

conductivity of the underlying soils and/or bedrock, which will be used for assessing the potential dewatering requirements, if any.

- **In-Situ Infiltration Tests:** surficial infiltration testing completed across the Site and will be utilized to characterize the infiltration rate of the shallow surficial soils (i.e., approximately 1.5 metres below ground surface (mbgs)). The infiltration testing will provide a general characterization of surficial infiltration rates and will help for the design and placement of Low Impact Development (LID) measures, if any, across the Site.
- **Water Balance (Preliminary):** a preliminary water balance study was completed for the proposed development using the Thornthwaite-Mather approach and utilizing the climatic data obtained from Environment Canada.
- **Source Water Impact Assessment:** as the Site is situated within a Significant Groundwater Recharge Area (SGRA), Issues Contributing Area (ICA), Wellhead Protection Area C and D (WHPA-C/D), and Wellhead Protection Area Q1 and Q2 (WHPA-Q1/Q2), an assessment detailing threats to groundwater in terms of water quality and quantity, was discussed.
- **Report Preparation:** a hydrogeological report was prepared presenting the results, findings, and recommendations of this investigation.

It should be noted that a geotechnical investigation has already been completed at the Site by Peto MacCallum Ltd. in June of 2017 (Peto MacCallum, 2017). The results of this investigation will be discussed in Section 5.1.

1.2 Site Description and Site Development

The total area of the Site is approximately 4.44 hectares (~11.0 acres) in size and currently zoned as a Highway Industrial (HI) Zone; and the Site is bordered to the north and south by HI zoning, to the east by Highway 400, and to the west by Patterson Road.

The property is currently developed with an industrial building which is used as a manufacturing and distributing facility for Canplas Industries Ltd., and associated infrastructure such as parking lots, driveways, greenspace, etc.



The proposed development will include an expansion of approximately 1,579 m² to the building in the form of an addition off of the south side of the building. The expansion of the building will replace both paved parking areas and landscaped areas of the current development. Water and wastewater services will be provided for the proposed development by the City of Barrie (City).

The regional location of the Site is outlined on Figure 1, the property and surrounding areas outlined on Figure 2 and the proposed development plan is included in Appendix A.

2.0 Environmental Features

To assess environmental features, databases maintained by the Ministry of Natural Resources and Forestry (MNR), the Ministry of Environment, Conservation and Parks (MECP), and Lake Simcoe Region Conservation Authority (LSRCA) were reviewed.

Based on the data reviewed, the Site is situated within the Barrie Creeks subwatershed under the jurisdiction of the LSRCA Source Protection Area. The local drainage for the majority of the Site is assumed to either infiltrate into the shallow overburden soils or flow off-site to the southeast where it will meet with Hotchkiss Creek, approximately 45 m southeast of the Site.

No significant wetlands or woodlands are situated on the Site. The eastern part of the Site is partially situated in the LSRCA regulated area per Ont. Reg. 179/06. (Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses) and therefore, development restrictions apply to the proposed development.

As per the MNR Natural Heritage System database the Site does not have any Areas of Environmental Significance or Areas of Natural and Scientific Interests (ANSI) (Appendix A).

As shown on the MECP Source Water Protection Atlas map and Lake Simcoe Protection Plan, the Site is within the following areas (Appendix A):

- Significant Groundwater Recharge Area (SGRA) with a vulnerability score of 2
- Issues Contributing Area (ICA) for the contaminant chloride
- Wellhead Protection Area C and D (WHPA-C/D) with a vulnerability score of 4
- Wellhead Protection Area Q1 and Q2 (WHPA-Q1/Q2) with a low stress level

3.0 Physical Setting

3.1 Topography and Drainage

Based on the Site Grading Plan provided by Gerrits Engineering, dated May 10, 2022 (Appendix A), the topographic high of the Site is approximately 236.0 metres above sea level (masl) in the northwest with topography gently sloping to the southeast to a minimum of 234.0 masl.

As discussed in Section 2.0, there are no mapped waterbodies on Site. The surficial drainage from the majority of the Site is to the southeast where it discharges to Hotchkiss Creek, which is flowing from southwest to northeast and is situated at approximately 45 m southeast of the Site.

3.2 Physiography

The Site is located within physiographic region known as Simcoe Lowlands. This region is described as having lower elevations with flat-floored valley features that generally correspond to current river system. The region was formed from flooding by the glacial Lake Algonquin and are bordered by shore cliffs, beaches, and boulder terraces and as a result is floored by sand, silt, and clay. The western shoreline of Lake Simcoe (where Barrie is located) is predominantly comprised of sandy beaches (Chapman, L.J. and D.F. Putnam, 1984).

3.3 Overburden Geology

According to Miscellaneous Release – Data 128 from the Ontario Geological Survey (Ontario Geological Survey, 2010) the predominant overburden soils at the surface of the Site are coarse-grained glaciolacustrine deposits composed of sand, gravel, minor silt, and clay and interpreted to have been deposited in foreshore or basinal environments.

3.4 Bedrock Geology

The bedrock of the area consists of Middle Ordovician rocks of the Simcoe Group (OGS, 2007). The Site is composed of rocks from the Verulam Formation, which is described as a sequence of interbedded limestone and shale. The carbonate lithology of this formation varies



from very fine-crystalline limestone, virtually fossil-free, to coarse-crystalline bioclastic limestones.

4.0 MECP Well Records Assessment

Cambium accessed the Ministry of the Environment Conservation and Parks (MECP) Water Well Information System (WWIS) to review water well records within 500 m of the Site.

There were 140 water well records found within approximately 500 m of the Site (Figure 3). 138 of the well records were for wells that were installed in overburden, only two well records were installed in bedrock (one installed in shale, and one installed in limestone). The boreholes were installed between the years 1952 and 2020. The deepest borehole was the bedrock test hole drilled to a depth of 125.9 mbgs (Well Record No. 5700277). One well record (Well Record No. 5706146) is for City of Barrie water supply use (drilled in 1969). Fifty-two other well records were for supply wells installed in overburden, 51 well records were for monitoring wells or test holes, two well records were for dewatering wells, and 30 well records were for well abandonments; four of the well records were blank.

A summary of the depths, static water levels, and pumping rate are shown in Table 1 and the well records have been included as Appendix B.

Table 1 Summary of the Surrounding Water Well Record Information

Well Type		Depth (mbgs)	Water Found At (mbgs)	Static Water Level (mbgs)	Recommended Pumping Rate (L/min)
Overburden Supply Wells Count: 52	Minimum	4.3	2.1	-1.0	5
	Maximum	71.6	36.0	29.0	68
	Average	22.0	18.6	7.2	23
Overburden Monitoring Wells/Test Holes: 49	Minimum	3.1	2.0	3.0	-
	Maximum	110.3	57.3	14.0	-
	Average	21.5	14.9	6.5	-
Bedrock Test Holes: 2	Minimum	110.3	38.7	4.0	-
	Maximum	125.9	38.7	4.0	-
	Average	118.1	38.7	4.0	-

A summary of the information outlined in the well records is provided below:

- Overburden was reported as interbedded thick sand and clay units. Some well records also recorded isolated gravel horizons or gravel within the sand-dominant or clay-dominant



units. Bedrock was only encountered in two well records and was described as shale and limestone.

- The municipal supply well record (Well Record No. 5706146; not included in Table 1) was drilled in 1969 to a total depth of 71.6 mbgs with a well radius of 16 inches. The recorded static water level is 3.9 mbgs, and the recorded recommended pumping rate was 4,456 L/min, indicating a very productive water supply yield.

5.0 Borehole Drilling and Monitoring Well Installation

5.1 Borehole Investigation

5.1.1 Past Investigation

Peto-MacCallum Limited conducted a geotechnical investigation at the Site in 2017 to support a previous 55.2 m by 28.6 m addition to the southeastern corner of the existing warehouse. Since this report was published on June 7, 2017, this addition has been built (Peto MacCallum, 2017).

The results of the subsurface investigation for this report indicate that the site stratigraphy is comprised of topsoil overlying engineered fill, overlying native sand which grades to silty sand with depth. Groundwater was encountered below 2.3 mbgs during the drilling investigation. Based off the subsurface investigation it was determined that conventional strip and spread footings founded at normal depths on engineered fill and/or native sand should be sufficient for the floor slab-on-grade addition.

The information within this geotechnical investigation is still relevant for the current proposed addition; however, as there were no monitoring wells installed during the Peto-MacCallum 2017 investigation, Cambium conducted their own borehole investigation to install monitoring wells at the Site to determine the local groundwater regime.

5.1.2 Monitoring Well Installation (Cambium 2022)

Cambium completed a borehole investigation at the Site on August 16, 2022, to assess the subsurface conditions at the Site. A total of three boreholes were advanced into the overburden, designated as MW101-22 through MW103-22. Each borehole was advanced to 5.2 mbgs and were outfitted as monitoring wells. These monitoring wells were used for stabilized water level monitoring and to define the local groundwater regime across the Site. Monitoring well locations are appended as Figure 4. Borehole logs are included in Appendix C. A summary of general lithological details is presented below.

Asphalt

Asphalt overlies the overburden material at Site for all boreholes with a thickness of 0.1 m at each borehole.

Silt and Sand to Sandy Silt

Underlying the asphalt for each borehole was a native brown silt and sand to sandy silt unit. This silt and sand/sandy silt unit has some gravel in the upper horizon to approximately 0.8 mbgs. The silt content was found to decrease around 2.5 mbgs in each borehole. The unit becomes brown in colour until approximately 2.1 mbgs; after 2.1 mbgs, the unit becomes grey in colour. This unit continues until borehole termination for each borehole.

Bedrock

Bedrock was not encountered during the geotechnical investigation. Drilling was terminated at a maximum depth of 5.2 mbgs, in native soils.

Monitoring wells construction details including screen elevations are presented in the Table 2.

Table 2 Well Construction Details

Monitoring Well1	Termination Depth (mbgs)	Ground Elevation (masl)	Screen Top (masl)	Screen Bottom (masl)
MW101-22	5.20	234.85	229.65	232.70
MW102-22	5.20	236.15	230.95	234.00
MW103-22	5.20	235.23	230.03	233.08

5.2 Physical Laboratory Testing

Physical laboratory testing was completed for a total of three selected soil samples to confirm textural classification and to estimate percolation rates of the native soils. Results are presented in Appendix D and details of the grain-size analysis are presented in Table 3 below.

Based on sieve analysis data, majority of the samples predominantly consisted of silty to sandy silt with some gravel and some clay.

Table 3 Particle Size Distribution

Borehole	Depth (mbgs)	Description	% Gravel	% Sand	% Silt	% Clay	Percolation Times (min/cm)
BH101-22 GS2	0.9 – 1.5	Silt and Sand trace Clay	0	44	48	8	25
BH102-22 GS2	0.9 – 1.5	Sandy Silt some Clay trace Gravel	1	21	68	10	30
BH103-22 GS3	1.5 – 2.1	Silt and Sand trace Clay	0	37	55	8	25

The soil percolation rates were fairly consistent and ranged from 25 min/cm to 30 min/cm. The geometric mean of the percolation rate was estimated at about 27 min/cm. These results indicate a moderate infiltration capacity of the native soils.

5.3 Groundwater Level Monitoring

Water level monitoring on the newly installed monitoring wells was completed on August 25, 2022. Recorded groundwater levels are presented in Table 4 below.

Table 4 Measured Groundwater Details

Well		MW101-22	MW102-22	MW103-22
Top of Pipe Elevation (masl)		234.79	236.03	235.10
Ground Surface Elevation (masl)		234.85	236.15	235.23
Stick-up (m)		-0.06	-0.12	-0.13
August 25, 2022	Water Level (mbgs)	2.17	2.82	2.85
	Groundwater Elev. (masl)	232.68	233.33	232.38

As presented above, the measured groundwater levels in the monitoring wells ranged in depth from 2.17 mbgs to 2.85 mbgs, and the elevations ranged from 232.38 masl to 233.33 masl. Accordingly, the highest summer water level and elevation could be 2.17 mbgs and 233.33 masl, respectively.

5.4 Groundwater Flow Direction

Based on the groundwater elevation data obtained from the summer monitoring event (August 25, 2022), a site-specific groundwater elevation contour map was prepared to present the groundwater flow direction across the Site. As shown in Figure 5, the groundwater flow direction was found to be northeast towards Hotchkiss Creek.

5.5 In-Situ Hydraulic Conductivity Tests

The hydraulic conductivity (k-value) of the soils were estimated based on the results obtained from the single well response tests (slug tests). Aquifer response test (slug tests/single well response tests) was conducted on August 25, 2022. Either falling head test or rising head tests were performed in the existing monitoring wells MW101-22, MW102-22, and MW103-22. Results of hydraulic conductivity tests are presented below in Table 5 and analytical data is included in Appendix E.

Table 5 Results of Estimated Hydraulic Conductivity as per Slug Test

Monitoring Well	Estimated Hydraulic Conductivity (m/sec)	Tested Soil Type
MW101-22	3.00×10^{-6}	Sand with Silt, trace Clay
MW102-22	2.41×10^{-6}	Sand with Silt, trace Clay & Gravel
MW103-22	1.75×10^{-6}	Sand with Silt, trace Clay

The hydraulic conductivity was estimated utilizing Aquifer Test Pro slug test software using the Hvorslev interpretation method. The estimated hydraulic conductivities showed little variability between the monitoring wells, ranging between 1.75×10^{-6} m/sec and 3.00×10^{-6} m/sec. The estimated hydraulic conductivities were consistent with published values for native sandy silt and silty sand with trace clay and trace gravel. The geometric mean of hydraulic conductivity was calculated at 2.33×10^{-6} m/sec.

5.6 In-Situ Infiltration Testing

In-situ soil infiltration tests were completed at the Site by Cambium personnel using a Guelph Permeameter (GP). The Guelph Permeameter is used to accurately measure in-situ hydraulic conductivity or the field saturated hydraulic conductivity (Kfs) of the native soils. GP infiltration test method is the most sought-after test method to verify native soil infiltration rates for design purposes.

The infiltration tests were carried out on September 22, 2022, at two locations (GP1 and GP2) within the proposed area for the subsurface infiltration feature as identified by the Client, which are shown in Appendix A.

As per the proposed infiltration and storage system design (Appendix A), the proposed bottom elevation of the infiltration system is at 232.81 masl and the proposed bottom elevation of the storage system is at 232.82 masl. The ground surface elevation in the area of the proposed infiltration features ranges between 234.54 and 234.25 masl; accordingly, the infiltration tests were completed at an average depth of 1.75 m.

To carry out the infiltration tests, shallow test holes were excavated to a certain depth prior to using a hand auger to complete a test hole of approximately 0.06 m in diameter. The tested native soils were predominantly consisting of clayey silt and silty clay with trace sand.

The field results of the in-situ infiltration testing were processed using SOILMOISTURE ® excel based calculation models which yield the saturated hydraulic conductivity of the soil (in m/s). The saturated hydraulic conductivity results are then cross-referenced against established relationships between hydraulic conductivity (m/s) and infiltration rate (mm/hr), as outlined in the *Supplementary Guidelines to the Ontario Building Code: SG-6 Percolation Time and Soil Descriptions* (OMMAH, 1997). The details of the test results are presented in Table 6 and Appendix F.

Table 6 Infiltration Rates – Guelph Permeameter Method

Test Location	Test Depth (mbgs)	Tested Soil Type	Head (mm)	Field Saturated Hydraulic Conductivity (m/s)	Infiltration Rate (mm/hr)	Percolation Rate (min/cm)
GP1	1.75	Fine to medium-grained sand, trace silt	50	1.40×10^{-4}	171.04	3.52
GP2	1.75	Fine sand and silt	50	2.14×10^{-5}	104.05	5.79

As shown above, the percolation times ranged from 5.79 min/cm to 3.52 min/cm, while the infiltration rates ranged between 104.05 mm/hour and 171.04 mm/hour. The calculated infiltration rates closely resemble the tested native soils at each location.

The calculated percolation rates and infiltration rates indicates a high drainage potential at the Site due to the sand-dominant native soils in the area.



6.0 Water Balance Assessment

Based on the Thornthwaite and Mather methodology (1957), the water balance is an accounting of water in the hydrologic cycle. Precipitation (P) falls as rain and snow. It can run off towards lakes and streams (R), infiltrate to the groundwater table (I), or evaporate from ground or evapotranspiration by vegetation (ET). When long-term average values of P, R, I, and ET are used, there is minimal or no net change to groundwater storage (ΔS).

The annual water budget can be expressed as:

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

Where:

P = Precipitation (mm/year)

ET = Evapotranspiration (mm/year)

R = Run-off (mm/year)

I = Infiltration (mm/year)

ΔS = Change in groundwater storage (taken as zero) (mm/year)

It is noted that the water balance described herein does not account for catchment areas that extend off-site. The calculations compare the pre- and post-development water balance changes within the Site boundaries.

The property is currently developed with an industrial building which is used as a manufacturing and distributing facility for Canplas Industries Ltd., with associated infrastructure such as parking lots, driveways, greenspace, etc.

The proposed development will include an expansion of approximately 1,572.8 m² to the existing building in the form of an addition off of the south side of the building. The expansion of the building will replace both paved parking areas and landscaped areas of the current development.

Pre- and post development water balance was completed for the entire Site area consisting of 43,990 m².

Based on the available design information, the development area at the Site can be generally categorized into three types as paved area, roof area, and landscape areas. The pre- and post-development plans of the proposed development are shown in Figure 6 and Figure 7, respectively. A summary of the surface areas of the development is listed in Table 7:

Table 7 Pre- and Post-Development Statistics

Type of Land Coverage	Pre-Developments Areas (m ²)	Post Development Areas (m ²)
Paved Area	16,890	16,063
Building Roof Area	14,447	16,406
Landscape/Vegetated Area	12,653	11,521
Total (m ²)	43,990	43,990

Supporting information referenced herein (including detailed water balance calculations) is attached in Appendix G.

6.1 Water Surplus

Water surplus is calculated by determining the difference between precipitation and evapotranspiration (changes in soil water storage was assumed to be negligible over the course of a year). The volume of water surplus is further sub-divided into portions that infiltrate the on-site soils and that are directed off-site as runoff.

The climatic data including monthly average temperature and precipitation were obtained from Environment Canada, for Barrie WPCC (Climate ID: 6110557) located about 1.64 km distance from the Site. Accordingly, the average annual evapotranspiration was estimated to be about 478 mm/annum using the USGS Thornthwaite Monthly Water Balance methodology (Appendix G), and the average annual precipitation was recorded to be 933 mm/annum. The water surplus of the Site was calculated to be 455 mm/yr.

Evapotranspiration does not occur from structures, paved areas, or gravel surfaces. It was assumed that 10% of precipitation falling on these surfaces is lost directly to evaporation. The remaining depth (i.e., 90% of precipitation) was considered surplus and converted to infiltration and/or runoff.

6.2 Infiltration Rates

The volume of surplus water that infiltrates through pervious surfaces on-site was determined by applying an infiltration factor to the surplus depth. The surplus water that does not infiltrate into pervious surfaces will leave the Site as surface water runoff. The infiltration factor varies from 0 to 1 and is estimated based on topography, soils, and vegetation cover as per the *Stormwater Management Planning and Design Manual* (Ministry of the Environment, 2003).

The rate of infiltration at a site is expected to vary, based on a number of factors to be considered in any infiltration model. To partition the available water surpluses into infiltration and surface run-off, the Ministry of Environment, Conservation and Parks (MECP) infiltration factor was used. The MECP Storm Water Management Planning and Design Manual (2003) methodology for calculating total infiltration based on topography, soil type and land cover was used, and a corresponding run-off component was calculated for the soil moisture storage conditions.

The Site has is generally flat-lying and based on the results of the borehole investigation and the grain size analysis, the subsurface conditions at the Site consist of sandy loam with silt. Therefore, an infiltration factor of 0.70 was considered appropriate for the Site.

6.2.1 Pre-Development Water Balance

The water balance for the existing conditions of the Site is summarized in Table 8. The pre-development infiltration rate was calculated to be 4,030 m³/yr and the runoff rate was 28,041 m³/yr.

Table 8 Pre-Development Water Balance

Land Use		Area (m ²)	Precipitation (m ³)	Evapo-transpiration (m ³)	Infiltration (m ³)	Run-off (m ³)
Impervious Areas	Paved Area	16,890	15,758	1,576	0	14,183
	Roof Area	14,447	13,479	1,348	0	12,131
Pervious Areas	Landscape Area	12,653	11,805	6,048	4,030	1,727
		43,990	41,043	8,972	4,030	28,041
Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.						

6.2.2 Post-Development Water Balance

The post-development water balance is summarized in Table 9. The post-development infiltration rate was calculated to be 3,669 m³/yr and the runoff volume was 28,837 m³/yr.

Table 9 Post-Development Water Balance

Land Use		Area (m ²)	Precipitation (m ³)	Evapo-transpiration (m ³)	Infiltration (m ³)	Run-off (m ³)
Impervious Areas	Paved Area	16,063	14,987	1,499	0	13,488
	Roof Area	16,406	15,307	1,531	0	13,776
Pervious Areas	Landscape Area	11,521	10,749	5,507	3,669	1,573
		43,990	41,043	8,536	3,669	28,837
Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.						

6.2.3 Water Balance Comparison

The water balances of the pre-development and post-development scenarios are summarized below in Table 10.

Table 10 Water Balance Comparison

	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-off (m ³)
Pre-Development	41,043	8,972	4,030	28,041
Post-Development	41,043	8,536	3,669	28,837
Change in Volume			361	796
Change in %			9	3

Based on the above, there is a net infiltration deficit of about 361 m³/year compared to the pre-development infiltration, while the runoff rate upon development of the Site will increase by 796 m³/year.

6.2.4 Requirement of Infiltration from Roof Runoff

As shown below in Table 11, approximately 3% of roof runoff is required to compensate the pre-development infiltration.

Table 11 Requirement of Infiltration from Roof Run-off

Volume of Pre-Development Infiltration (m³/annum)	4,030
Volume of Post-Development Infiltration (m³/annum)	3,669
Deficit from Pre to Post Development Infiltration (m³/annum)	361
% of Roof Runoff required to match the pre-development Infiltration	3

Based on the above calculations, a summary of the water balance could be provided as follows:

1. There is a net increase in run-off at the Site of about 796 m³/annum, from 28,041 m³/annum to 28,837 m³/annum. However, in terms of percent change, it is just about 3%. This increase is a result of the development of the Site with more impervious areas such as roof and paved areas and a decrease in pervious areas.
2. Post-development landscape area was decreased by about 1,132 m², when compared to the pre-development landscape, causing less infiltration across the Site.
3. Without implementing any mitigation measures, there is a net deficit of about 361 m³/annum in the post-development infiltration on a yearly basis; in terms of percent change, it is only about 9%.
4. Based on the estimation, a diversion of about 3% of general roof water for infiltration, the proposed development would maintain an enhanced infiltration after the development.

6.3 Discussions on LID Measures

It is known that low impact development (LID) practices have received increasing attention as these strategies attempt to capture the runoff and mimic the natural hydrologic cycle. Infiltration decrease reduces groundwater recharge and soil moisture replenishment and also reduces stream baseflow needed for sustaining aquatic life. Therefore, it is important to maintain the natural hydrologic cycle as much as possible.

In general, there are two primary categories of LIDs. The first promotes the infiltration of stormwater close to the source. These infiltration type LIDs are preferred when hydrogeological and physical conditions are optimal and allow for their emplacement. The proposed development does not include a stormwater management pond to improve the water quality and enhance the lost infiltration due to the Site development with paved and roof areas. Therefore, the second option described below could be considered.

The second option captures and slowly releases the water to the surface water system through the process of storage and filtration by infiltration LIDs. Infiltration targets may be achieved through the incorporation of a variety of stormwater management practices including reduced lot grading, roof downspout disconnection, roof leaders discharging to ponding areas or soak away pits, infiltration trenches, grassed swales etc.

The conceptual water balance indicates that there will be an infiltration deficit of about 361 m³/annum in the post-development infiltration upon development of the Site, compared to the pre-development. Based on the estimation, a diversion of only about 3% of the general roof water for infiltration would allow the proposed development to maintain an enhanced infiltration after the development.

As the water levels at the Site ranged between 2.17 mbgs to 2.85 mbgs, the implementation of LID measures at the Site would be feasible in its present design.

6.3.1 Mitigation Measures.

The proposed Site Plan (Appendix A) includes a Greenstorm Infiltration System and a Greenstorm Storage System; the combined volume of water that the infiltration and storage tanks can store is about 403 m³. The proposed infiltration system can hold a volume of 171 m³, while the total infiltration deficit on a yearly basis of about 361 m³. Based on the in-situ infiltration rates calculated in this area (Section 5.6) and the natural native soils, the proposed infiltration facility would be able to compensate the infiltration deficit. Also, it should be noted that there should be a minimum of 1 m separation distance maintained between the bottom elevation of the infiltration facility and highest spring water level.



It is Cambium's opinion that the infiltration deficit can easily be compensated for the proposed post-development plan if roof runoff is directed towards infiltration and storage tanks that are included in the Site Plan provided by the Client (Appendix A).

7.0 Source Water Protection and Risk Management

As per the Lake Simcoe Source Protection Plan (LSSPP), the Subject Site is located within the following groundwater vulnerable areas (Appendix A):

- Significant Groundwater Recharge Area (SGRA) with a vulnerability score of 2
- Issues Contributing Area (ICA) for the contaminant chloride
- Wellhead Protection Area C and D (WHPA-C/D) with a vulnerability score of 4
- Wellhead Protection Area Q1 and Q2 (WHPA-Q1/Q2) with a low stress level

7.1 SGRA

SGRAs are areas on the landscape, which are characterized by porous soils, such as sand or gravel, which allows water to seep easily into the ground and flow to an aquifer. A recharge area is considered significant when it helps maintain the water level in an aquifer that supplies a community or private residence with drinking water.

Given that the Site is located in an urbanized area, the Site and its neighboring properties would be relying on the City's water supply. The proposed development may reduce the pervious area at the Site, which result in decreased infiltration into subsurface i.e. decrease in groundwater recharge. The infiltration deficit will be negated by LID measures, discussed in Section 6.3.

Considering that City's municipal water wells are dependent on the groundwater recharge to the local aquifers, it is of paramount importance in protecting and restoring the ground water recharge area. In the present development scenario, only about 1,130 m² of landscaped area is being reduced from pre to post development stage and therefore, the impact on the groundwater recharge is considered to be low to negligible.

7.2 ICA

The ICA's specific to chloride were delineated under the Clean Water Act (Government of Ontario, 2006). The issues contributing areas are the land areas where road salt has already affected drinking water supplies and that the elevated level of chloride in the source water are

attributed to the road salt-related activities. Therefore, a reduction in winter salt application is required to mitigate anticipated chloride increases in local watercourses as well as water supply aquifers.

As per the LSSPP, SALT(ICA)-1 is categorized as Threat 13. Salt storage and handling at the Site are considered low to moderate risk, and do not require a risk management plan because the Site is not within a WHPA-A or WHPA-B. This assessment assumes that there will be less than 5 tonnes of salt storage on Site. If salt storage were to be equal to or greater than 5 tonnes, road salt storage would be elevated to a significant drinking water threat and would require a risk management plan.

As per the LSSPP, SNOW(ICA)-1 is categorised as Threat 14: The storage of snow – issues contributing area. In general, the greater the snow storage area (and therefore the volume of snow stored), the greater the inherent risk to drinking water. Based on the Site development plan and land use practices, the snow storage areas were unknown and therefore, any proposed snow storage area and method of disposing of the snow need to be defined at the building permit stage. Cambium assumes based on the land use practices at the Site that the snow storage would be insignificant and not a significant drinking water threat and therefore would not require a risk management plan.

7.3 WHPA-C/D

WHPA-C refers to an area around a municipal well which represents a 5-year travel time for contaminants in the groundwater to reach the municipal supply well. WHPA-D represents a 25-year travel time. The WHPA-C/D are not perfect circles; instead, they are determined via a function of how water travels underground and is influenced by slope of the land, depth of the well, sediment type, etc.

As per the LSSPP, there are 10 municipal water supply wells in the City of Barrie within LSRCA jurisdiction, and 4 municipal water supply wells in the City of Barrie within Nottawasaga Valley Conservation Authority (NVCA) jurisdiction.

Based off of the 5-year travel time assigned to a WHPA-C, dense non-aqueous phase liquids (DNAPLs) were considered a significant threat. As far as the Site use is concerned, Cambium

assumes there will not be any storage or handling of DNAPL's at the Site and therefore, the Restricted Land Use (RLU-1) Policy is not applicable to the Site and a Contaminant Management Plan would not be required.

Based off of the 25-year travel time assigned to a WHPA-D, most chemical threats are considered to be low. This means that the handling or storage of chemical threats at Site such as road salts, snow, fuels, solvents, etc. are considered a low threat to the municipal groundwater supply. The only chemicals that are considered a moderate threat were dense non-aqueous phase liquids (DNAPLs). There are no significant chemical threats identified for a WHPA-D.

There were no pathogen threats (low through significant) identified for a WHPA-C or WHPA-D. Salt, snow, fuels, solvents, etc. risk management plans are not required as they are all designated as low drinking water threats as per the LSSPP. A risk management plan for the storage and handling of DNAPLs will only be required if DNAPLs are stored or handled at the Site.

7.4 WHPA-Q1/Q2

WHPA Q1- refers to the area where activities that take water without returning it to the same source may be a threat; while WHPA Q2- refers to the area where activities that reduce recharge may be a threat. WHPA-Q1 (area affected by groundwater use) and WHPA-Q2 (area affected by recharge reduction) for the municipal wells in Barrie area were delineated through the application of a numerical groundwater flow model that considered all known high volume groundwater users. In other words, WHPA-Q2 delineates an area where there is potential for threats from reductions in groundwater recharge (i.e. new development).

In the present development scenario, the proposed development is located on a property that is already developed commercially/industrially and therefore there will not be a large reduction in pervious areas compared to pre-development statistics. There should not be a significant reduction in groundwater recharge to the municipal aquifer from the proposed development at Site.



There is, however, a net deficit in the infiltration compared to pre-development scenario and therefore, there is a negative impact to the groundwater recharge due to the proposed nature of the development in the study area. The water balance assessment for the proposed development indicated an infiltration deficit of 361 m³/annum.

Therefore, it is required to meet the pre-development water balance by implementing the LID measures such as infiltration facilities where practicable, demonstrating recharge will be maintained across the Site (refer to Section 6.3 for more discussion).

Cambium also recommends using the Best Management Practices (BMPs) so as to avoid overland flow of any contaminants to the natural environment such as the tributary of Hotchkiss Creek which is located in close vicinity to the Site.

The Site will be under municipal sewage service and as such is not expected to cause any groundwater contamination by nitrates.

8.0 Assessment of Potential Impacts

Based on the information available, the proposed development will include an expansion of approximately 1,572.8 m² to the building in the form of an addition off of the south side of the building. The expansion of the building will replace both paved parking and landscaped areas of the current development.

The potential impacts due to the Site development were assessed as below.

8.1 Natural Features

There are no natural features such as wetland or woodlands located on Site; however, Hotchkiss Creek is located to the southeast of the Site, approximately 45 m at its closest proximity. Therefore, as per Ont. Reg. 179/06. (Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses), set-back distances or buffer zones as prescribed by the Conservation Authority should be followed to protect the natural feature.

8.2 Water Supply Wells near the Site

Given that the water services are being provided by the Town and there are no construction dewatering requirements, impacts on the local water wells (private or public) are not anticipated to be associated with the Site development.

Deep drilling for foundation construction can create a transport pathway for contaminant migration to the deep municipal aquifers. The proposed addition will be finished as a slab-on-grade structure with minimal to no drilling activities and therefore, the integrity of the municipal aquifer is not compromised.

8.3 Considerations on Drinking Water Vulnerability

Based on the MECP Source Protection Information Atlas, the Site is situated within a WHPA-C/D and WHPA-Q1/Q2 and therefore, any contaminants from the Site will ultimately end up in the Municipal well drinking supply. Additionally, the Site is within an ICA, so the area has already been designated as being impacted by chloride contamination. Section 7.0 of this report has a detailed discussion on the issue of source water protection and all the land use policies described there-in should be implemented as recommended.

9.0 Conclusions and Recommendations

Cambium Inc. (Cambium) was retained by Gerrits Engineering (the Client) to complete a hydrogeological assessment of the property located at 31 Patterson Road, Barrie, Ontario (the Site).

The Site is partially situated in the LSRCA regulated area per Ont. Reg. 179/06. (Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses) and therefore, development restrictions apply to the proposed development.

The measured groundwater levels in the monitoring wells on August 25, 2022, ranged in depths from 2.17 mbgs to 2.85 mbgs, and the elevations ranged from 232.38 masl to 233.33 masl. Groundwater flow was determined to be northeast.

Estimated hydraulic conductivities ranged between 1.75×10^{-6} m/sec and 3.00×10^{-6} m/sec and the geometric mean of hydraulic conductivity was calculated at 2.33×10^{-6} m/sec.

According to the in-situ infiltration tests completed at the Site, the percolation times ranged from 5.79 min/cm to 3.52 min/cm, while the infiltration rates ranged between 104.05 mm/hour and 171.04 mm/hour. The calculated percolation and infiltration rates should be used for designing the proposed infiltration system on site.

The water balance assessment indicates that there will be an infiltration deficit upon development of the Site in the order of about 361 m³/annum. Based on the estimation, a diversion of 3% of general roof water for infiltration should allow the proposed development to maintain an enhanced infiltration after the development. If roof runoff were to be directed to the proposed infiltration system it is expected that it would be able to re-infiltrate roof runoff to compensate the infiltration deficit.

Since the Site is situated within the SGRA, WHPA-C/D, WHPA-Q1/Q2 and an ICA, Cambium recommends using the BMPs so as to avoid overland flow of any contaminants to the natural environment as well as to Hotchkiss Creek to the southeast of the Site.



9.1 Respectfully submitted,

Cambium Inc.

Nicole Heikoop, M.Sc., GIT
Technologist

Sudhakar Kurli, M.Sc., P.Geo.
Project Manager/Hydrogeologist

P:\15800 to 15899\15863-001 Gerrits Engineering Ltd - Hydrog - 31 Patterson Road Barrie\Deliverables\REPORT - HydroG\Final\2023-02-13 RPT - HydroG Assess - 31 Patterson Rd.docx

10.0 References

- Chapman, L.J. and D.F. Putnam. (1984). *The Physiography of Southern Ontario: Ontario Geological Survey, Special Volume 2.*
- Government of Ontario. (2006). *Clean Water Act.*
- Ministry of the Environment. (2003). *Stormwater Management Planning and Design Manual .*
- OGS. (2007). *Paleozoic Geology of Southern Ontario.* Ontario Geological Survey, Miscellaneous Release - Data 219.
- OMMAH. (1997). SG-6 Percolation Time and Soil Descriptions. In *Supplementary Guidelines to the Ontario Building Code.* Ontario Ministry of Municipal Affairs and Housing.
- Ontario Geological Survey. (2010). *Surficial geology of Southern Ontario; Miscellaneous Release - Data 128 - Revised.*
- Peto MacCallum. (2017). *Geotechnical Investigation, Proposed Building Addition, Canplas Industries, 31 Patterson Road, Barrie, Ontario.* Peto MacCallum Ltd.

11.0 Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

Reliance on Materials and Information

The findings and results presented in reports prepared by Cambium are based on the materials and information provided by the client to Cambium and on the facts, conditions and circumstances encountered by Cambium during the performance of the work requested by the client. In formulating its findings and results into a report, Cambium assumes that the information and materials provided by the client or obtained by Cambium from the client or otherwise are factual, accurate and represent a true depiction of the circumstances that exist. Cambium relies on its client to inform Cambium if there are changes to any such information and materials. Cambium does not review, analyze or attempt to verify the accuracy or completeness of the information or materials provided, or circumstances encountered, other than in accordance with applicable accepted industry practice. Cambium will not be responsible for matters arising from incomplete, incorrect or misleading information or from facts or circumstances that are not fully disclosed to or that are concealed from Cambium during the provision of services, work or reports.

Facts, conditions, information and circumstances may vary with time and locations and Cambium's work is based on a review of such matters as they existed at the particular time and location indicated in its reports. No assurance is made by Cambium that the facts, conditions, information, circumstances or any underlying assumptions made by Cambium in connection with the work performed will not change after the work is completed and a report is submitted. If any such changes occur or additional information is obtained, Cambium should be advised and requested to consider if the changes or additional information affect its findings or results.

When preparing reports, Cambium considers applicable legislation, regulations, governmental guidelines and policies to the extent they are within its knowledge, but Cambium is not qualified to advise with respect to legal matters. The presentation of information regarding applicable legislation, regulations, governmental guidelines and policies is for information only and is not intended to and should not be interpreted as constituting a legal opinion concerning the work completed or conditions outlined in a report. All legal matters should be reviewed and considered by an appropriately qualified legal practitioner.

Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

Only conditions at the site and locations chosen for study by the client are evaluated; no adjacent or other properties are evaluated unless specifically requested by the client. Any physical or other aspects of the site chosen for study by the client, or any other matter not specifically addressed in a report prepared by Cambium, are beyond the scope of the work performed by Cambium and such matters have not been investigated or addressed.

Reliance

Cambium's services, work and reports may be relied on by the client and its corporate directors and officers, employees, and professional advisors. Cambium is not responsible for the use of its work or reports by any other party, or for the reliance on, or for any decision which is made by any party using the services or work performed by or a report prepared by Cambium without Cambium's express written consent. Any party that relies on services or work performed by Cambium or a report prepared by Cambium without Cambium's express written consent, does so at its own risk. No report of Cambium may be disclosed or referred to in any public document without Cambium's express prior written consent. Cambium specifically disclaims any liability or responsibility to any such party for any loss, damage, expense, fine, penalty or other such thing which may arise or result from the use of any information, recommendation or other matter arising from the services, work or reports provided by Cambium.

Limitation of Liability

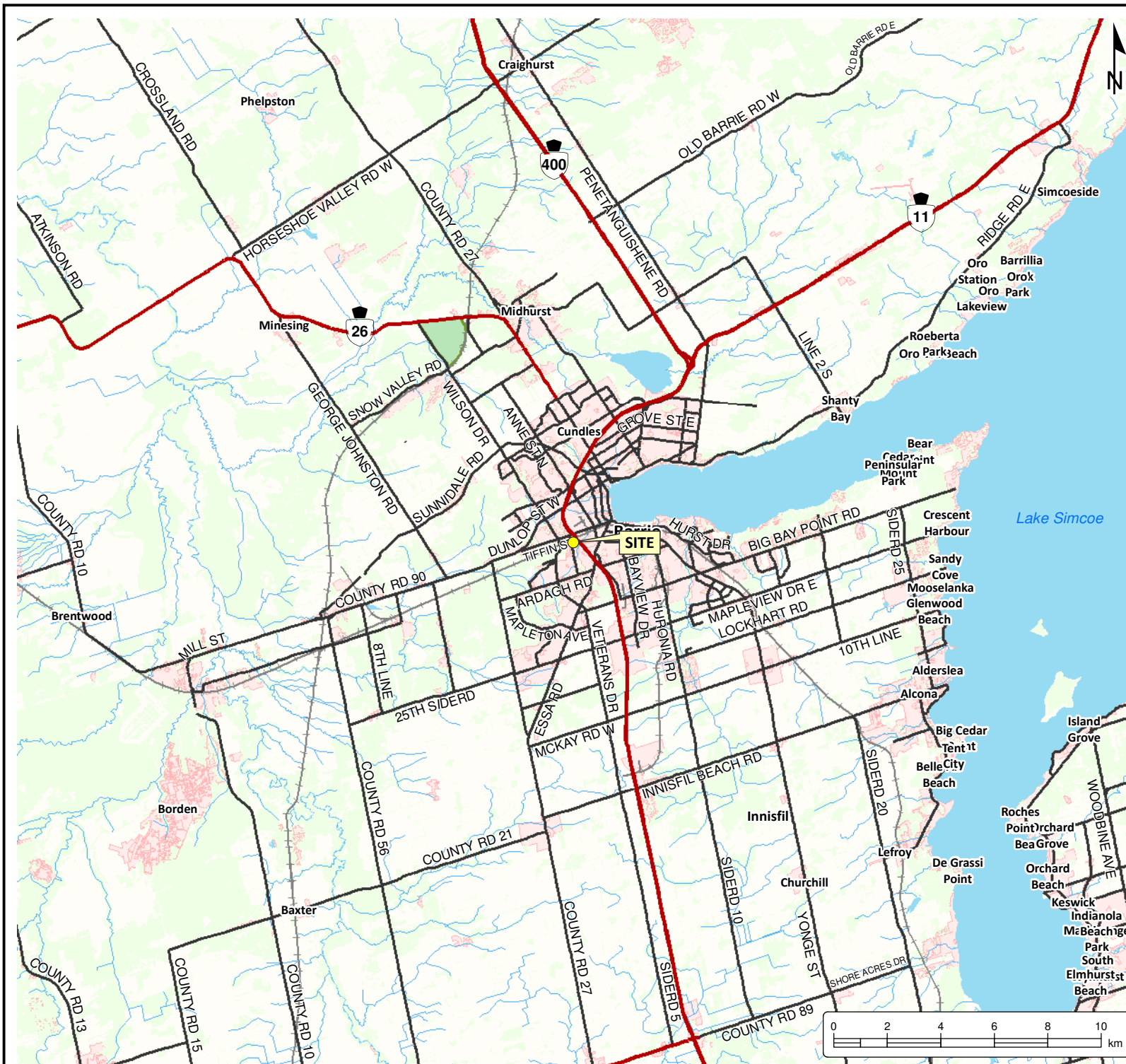
Potential liability to the client arising out of the report is limited to the amount of Cambium's professional liability insurance coverage. Cambium shall only be liable for direct damages to the extent caused by Cambium's negligence and/or breach of contract. Cambium shall not be liable for consequential damages.

Personal Liability

The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.



Appended Figures



HYDROGEOLOGICAL ASSESSMENT

GERRITS ENGINEERING

31 Patterson Road
Barrie, Ontario

LEGEND

-  Highway
-  Major Road
-  Railroad
-  Watercourse
-  Water Area
-  Provincial Park
-  Wooded Area
-  Built Up Area

Notes:

- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 3.048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.



194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

REGIONAL SITE
LOCATION MAP

Project No.: 15863-001		Date: September 2022 Rev.:	
Scale: 1:200,000		Projection: NAD 1983 UTM Zone 17N	
Created by: ACS	Checked by: SK	Figure: 1	



HYDROGEOLOGICAL ASSESSMENT

GERRITS ENGINEERING
31 Patterson Road
Barrie, Ontario

LEGEND

Site (4.4ha) (approximate)

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

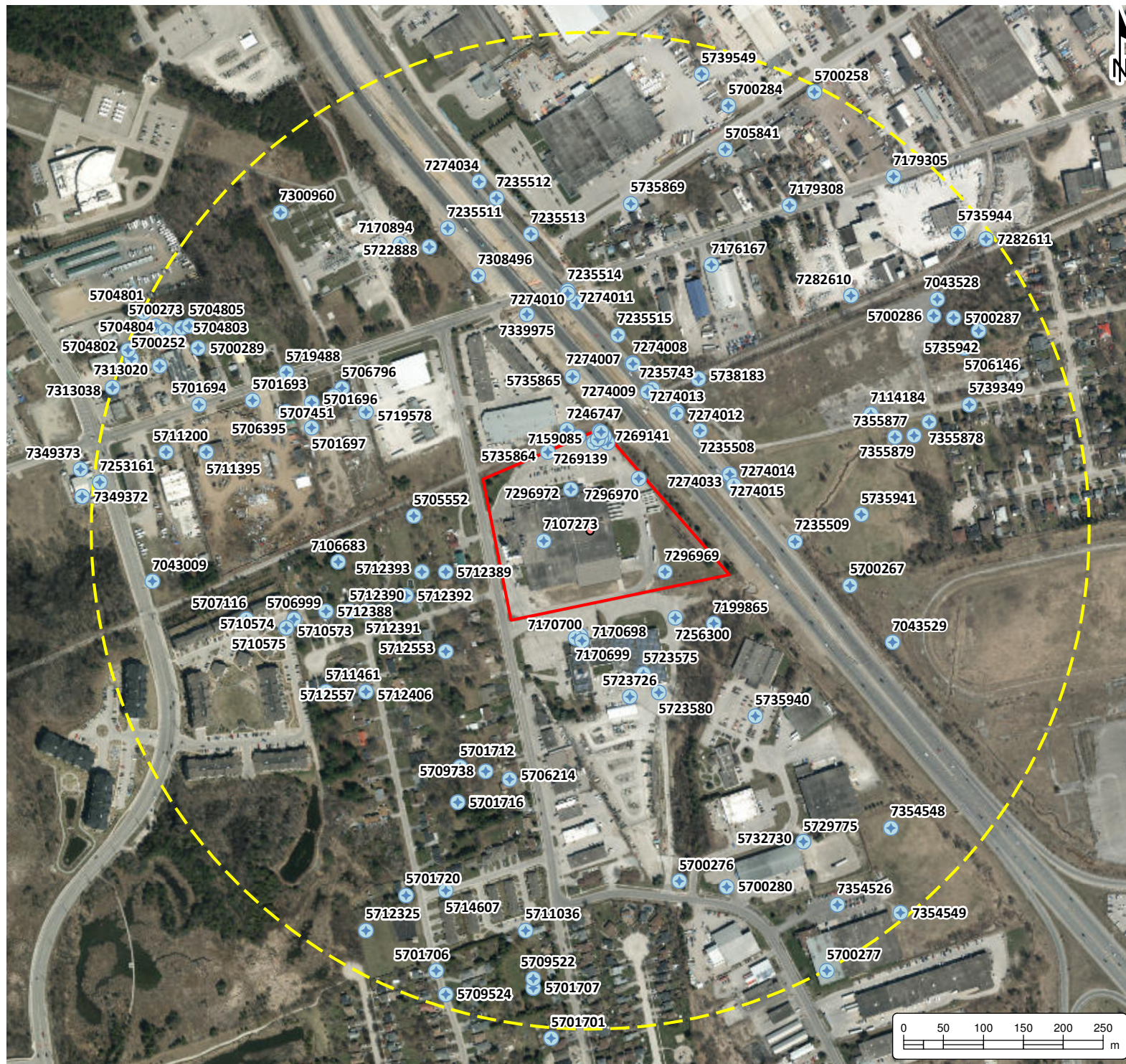


194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

SITE PLAN

Project No.:	15863-001	Date:	September 2022
Scale:	1:3,000	Rev.:	
Created by:	ACS	Checked by:	SK
		Figure:	2

O:\GISMXD\15800-1589\15863-001 Gerrits Engineering Ltd - Hydrog - 31 Patterson Road Barrie 2022-08-31 FIG 3 - MECP Well Records Map.mxd



HYDROGEOLOGICAL ASSESSMENT

GERRITS ENGINEERING
31 Patterson Road
Barrie, Ontario

LEGEND

- Water Well Records
- Site_Centerpoint
- Study Area (~500m)
- Site (approximate)

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.



194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

MECP WELL RECORDS WITHIN 500m

Project No.: 15863-001	Date: Sept 2022
Scale: 1:6,800	Rev.: NAD 1983 UTM Zone 17N
Created by: PAS	Checked by: SK
Figure: 3	



HYDROGEOLOGICAL ASSESSMENT

GERRITS ENGINEERING
31 Patterson Road
Barrie, Ontario

LEGEND

-  Monitoring Well
(Cambium, 2022)
-  Borehole
(Peto MacCallum Ltd., 2017)
-  Test Pit
(Peto MacCallum Ltd., 2017)
-  Guelph Permeameter
-  Site (approximate)

Notes:
 - Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
 - Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
 - Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.



194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

BOREHOLE LOCATION PLAN

Project No.: 15863-001	Date: September 2022
Scale: 1:2,000	Rev.: NAD 1983 UTM Zone 17N
Created by: ACS	Checked by: SK
Figure: 4	

O:\GIS\MXDs\15800-15899\15863-001 Gerrits Engineering Ltd - Hydrog - 31 Patterson Road Barrie\2022-09-31 FIG 4 - Borehole Location Plan.mxd



HYDROGEOLOGICAL ASSESSMENT

GERRITS ENGINEERING
31 Patterson Road
Barrie, Ontario

LEGEND

-  Monitoring Well
(Cambium, 2022)
-  Borehole
(Peto MacCallum Ltd., 2017)
-  Test Pit
(Peto MacCallum Ltd., 2017)
-  Site (approximate)

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.



194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

BOREHOLE LOCATION PLAN

Project No.:	15863-001	Date:	September 2022
Scale:	1:2,000	Rev.:	
Created by:	ACS	Checked by:	SK
Figure:			4



HYDROGEOLOGICAL ASSESSMENT

GERRITS ENGINEERING
31 Patterson Road
Barrie, Ontario

LEGEND

- Monitoring Well
- Groundwater Contours (0.25m intervals)
- Site (approximate)
- (232.68)** Groundwater Elevation (August 25, 2022)
- Groundwater Flow Direction

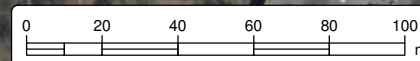
Notes:
 - Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
 - Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
 - Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.



194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

GROUNDWATER CONFIGURATION MAP

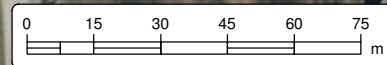
Project No.: 15863-001	Date: September 2022
Scale: 1:2,000	Rev.: Rev.
Created by: MAT	Checked by: SK
Figure: 5	



O:\GIS\MXDs\15800-15899\15863-001 Gerrits Engineering Ltd - Hydrog - 31 Patterson Road Barrie\2022-08-31 FIG 6 - Pre-Development Plan.mxd



	Area (m ²)
Roof Area	14,447
Paved Area	16,890
Landscaped Area	12,653
Total Area	43,990



HYDROGEOLOGICAL ASSESSMENT

GERRITS ENGINEERING
31 Patterson Road
Barrie, Ontario

LEGEND

- Roof Area
- Paved Area
- Landscaped Area
- Site (approximate)

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.



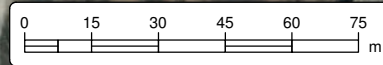
194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

PRE-DEVELOPMENT PLAN

Project No.: 15863-001		Date: September 2022 Rev.:	
Scale: 1:1,700		Projection: NAD 1983 UTM Zone 17N	
Created by: ACS	Checked by: SK	Figure:	6



	Area (m ²)
Roof Area	16,406
Paved Area	16,063
Landscaped Area	11,521
Total Area	43,990



HYDROGEOLOGICAL ASSESSMENT GERRITS ENGINEERING 31 Patterson Road Barrie, Ontario

LEGEND

- Roof Area
- Paved Area
- Landscaped Area
- Site (approximate)

Notes:
 - Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
 - Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
 - Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.



194 Sophia Street
 Peterborough, Ontario, K9H 1E5
 Tel: (705) 742.7900 Fax: (705) 742.7907
 www.cambium-inc.com

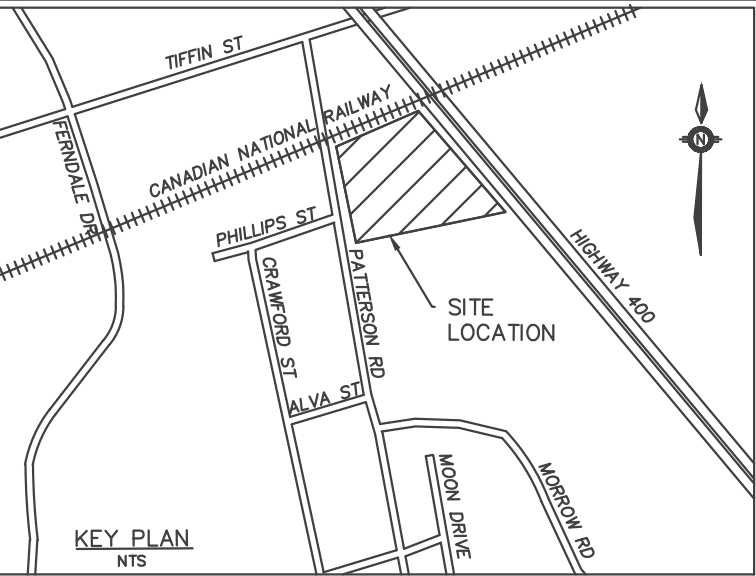
POST-DEVELOPMENT PLAN

Project No.: 15863-001	Date: September 2022
Scale: 1:1,700	Rev.: NAD 1983 UTM Zone 17N
Created by: ACS	Checked by: SK
Figure: 7	



Appendix A

Site Development Plans



LEGEND

- PRIVACY FENCE
- ACOUSTIC FENCE
- CHAIN LINK FENCE
- SILT FENCE
- GAS LINE
- HYDRO LINE
- BELL LINE
- EXISTING SANITARY MAINTENANCE HOLE
- PROPOSED SANITARY MAINTENANCE HOLE
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN
- EXISTING STORM MAINTENANCE HOLE
- PROPOSED STORM MAINTENANCE HOLE
- SERVICE CAP
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT
- EXISTING VALVE BOX
- PROPOSED VALVE BOX
- PROPOSED SIGN
- EXISTING LIGHT POLE
- MANDOOR
- OVERHEAD DOOR
- FIRE DEPT CONNECTION

- LANDSCAPE AREA
- LIGHT DUTY ASPHALT AREA
- HEAVY DUTY ASPHALT AREA
- GRAVEL AREA
- CONCRETE AREA
- INTERLOCK AREA

Gerrits
ENGINEERING

222 Mapleview Drive West, Suite 300
Barrie, ON L4N 9E7 Canada
Tel.: 705.737.3303
Fax.: 705.737.1772
www.gerrits.com

This drawing has been created electronically.
Handwritten or manual revisions to the drawing are only valid when accompanied by the design engineer's initials.

Do not scale drawings.
Check and verify all dimensions and information on the drawings and report all errors or omissions to the Consultant before proceeding with the work.
This drawing shall not be reproduced in any manner, in part or in whole, for any project other than that for which it was prepared.
This drawing, and all design concepts it contains, are an instrument of professional service and remain the property of Gerrits Engineering.

This drawing may have been reduced.
0 5 10 20 30 40 50mm
0" 1/4" 1/2" 1" 1 1/2" 2"

No.	Issuance Description	YYMMDD
1.	SITE PLAN APPROVAL	22/05/10
2.		

Issued For:
SITE PLAN APPROVAL

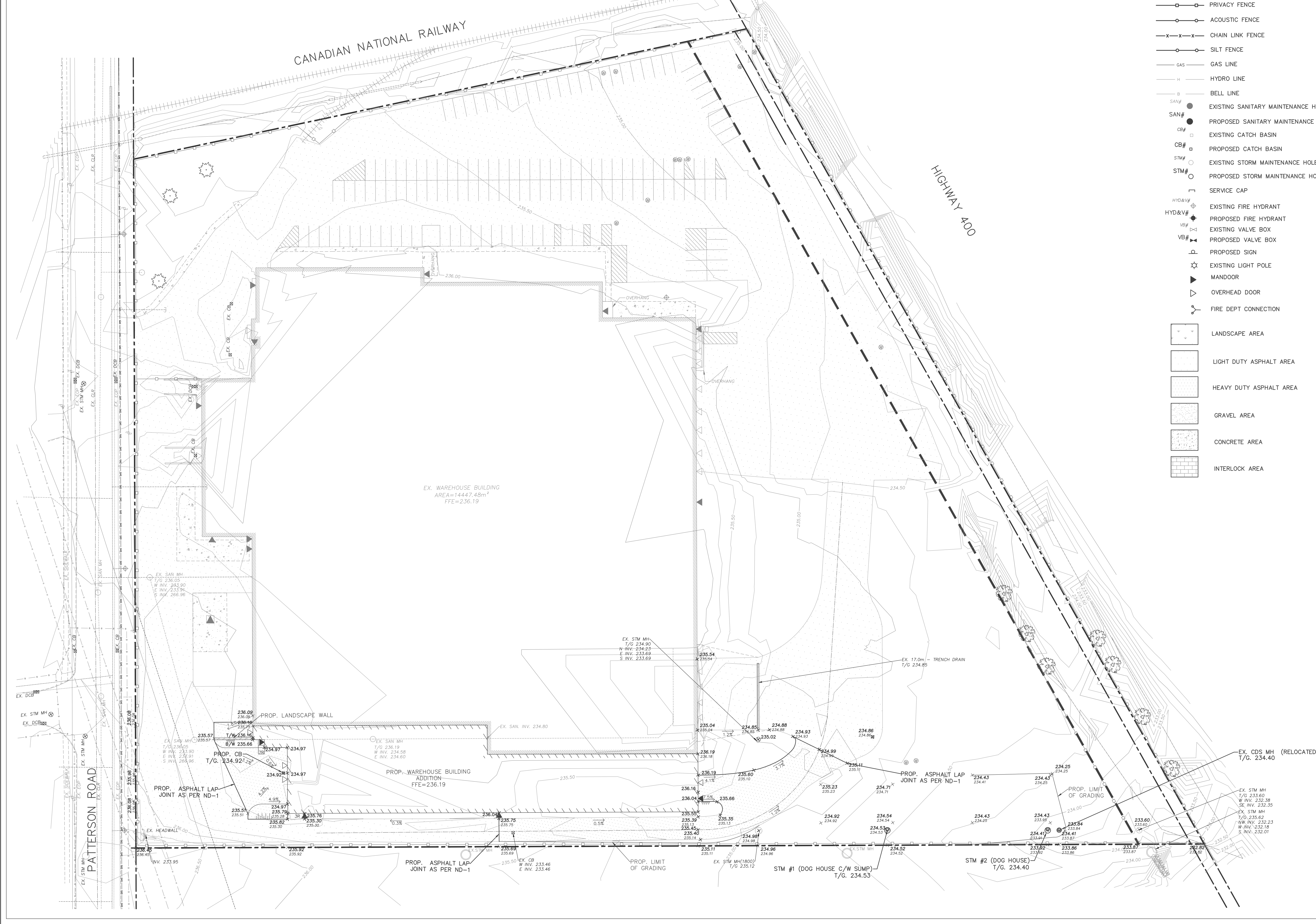
Client
canplas
INDUSTRIES LTD.

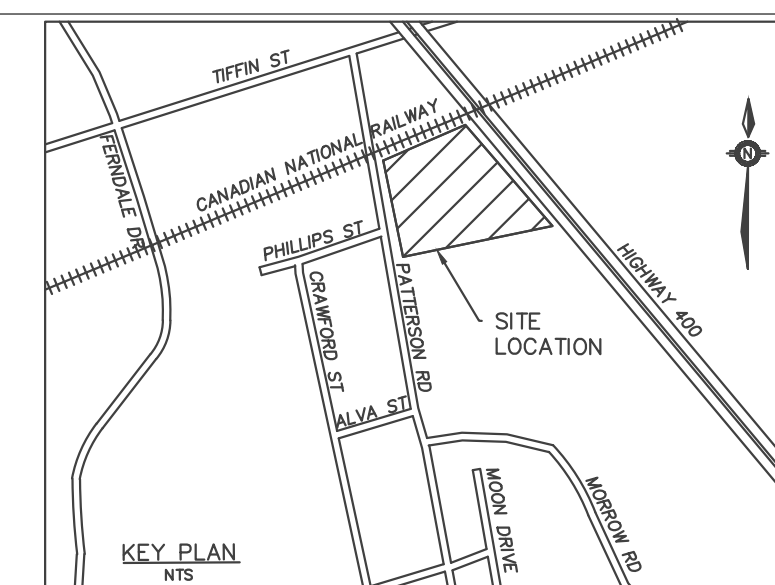
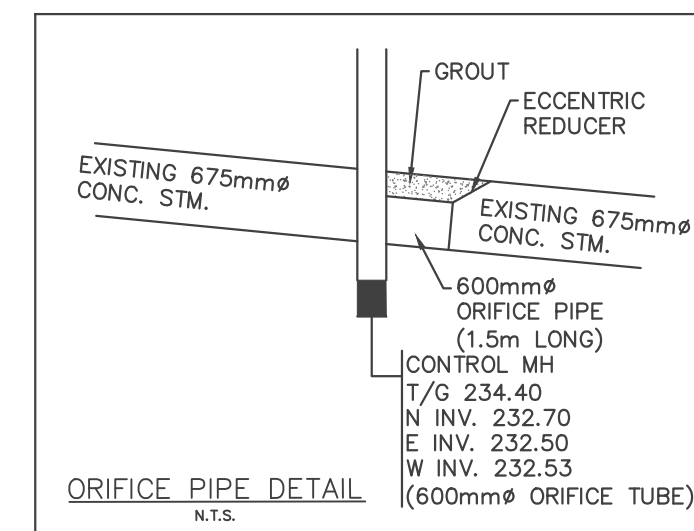
Project
CANPLAS WAREHOUSE ADDITION
31 Patterson Rd., Barrie, ON L4N 3V9

Drawing:
SITE GRADING PLAN

Project No.	873-009	Designed by:	RM	Checked by:	KF
Scale:	1:500	Drawn by:	RM	Approved by:	NI

Orientation
Stamp
Drawing No.
SG-1





	PRIVACY FENCE
	ACOUSTIC FENCE
	CHAIN LINK FENCE
	SILT FENCE
	GAS LINE
	HYDRO LINE
	BELL LINE
	EXISTING SANITARY MAINTENANCE HOLE
	PROPOSED SANITARY MAINTENANCE HOLE
	EXISTING CATCH BASIN
	PROPOSED CATCH BASIN
	EXISTING STORM MAINTENANCE HOLE
	PROPOSED STORM MAINTENANCE HOLE
	SERVICE CAP
	EXISTING FIRE HYDRANT
	PROPOSED FIRE HYDRANT
	EXISTING VALVE BOX
	PROPOSED VALVE BOX
	PROPOSED SIGN
	EXISTING LIGHT POLE
	MANDOOR
	OVERHEAD DOOR
	FIRE DEPT CONNECTION

	LANDSCAPE AREA
	LIGHT DUTY ASPHALT AREA
	HEAVY DUTY ASPHALT AREA
	GRAVEL AREA
	CONCRETE AREA
	INTERLOCK AREA

This drawing has been created electronically.

Handwritten or manual revisions to the drawing are only valid when accompanied by the design engineer's initials.

Do not scale drawings.

Check and verify all dimensions and information on the drawings and report all errors or omissions to the Consultant before proceeding with the work.

This drawing shall not be reproduced in any manner, in part or in whole, for any project other than that for which it was prepared.

This drawing, and all design concepts it contains, are an instrument of professional service and remain the property of Gerrits Engineering.

No.	Issuance Description	YY/MM/DD
1.	SITE PLAN APPROVAL	22/05/10
2		

Issued For:

canplas®
INDUSTRIES LTD.

Project

CANPLAS WAREHOUSE
ADDITION

31 Patterson Rd., Barrie, ON L4N 3V9

Project No.	873-009	Designed by: RM	Checked by: KF
Scale:	1:500	Drawn by: RM	Approved by: NI
Orientation	Stamp		

Drawing No.

SS-1

City of Barrie
North Section

Kempenfelt
Bay



ZONING BY-LAW 2009-141 SOUTH SECTION

Office Consolidation
January 2022

- Central Area Commercial (C1, C1-1, C1-2)
- Transition Centre Commercial (C2, C2-1, C2-2)
- Shopping Centre Commercial (C3)
- General Commercial (C4)
- Convenience Commercial (C5)
- Mixed Use Node (MU1)
- Mixed Use Corridor (MU2)
- Neighbourhood Mixed Use (NMU)
- Residential Hold (RH)
- Residential Single Detached Dwelling First Density (R1)
- Residential Single Detached Dwelling Second Density (R2, R2-WS)
- Residential Single Detached Dwelling Third Density (R3, R3-WS)
- Residential Single Detached Dwelling Fourth Density (R4, R4-WS)
- Neighbourhood Residential (R5)
- Residential Apartment Dwelling First Density (RA1, RA1-1, RA1-2, RA1-3)
- Residential Apartment Dwelling Second Density (RA2, RA2-1, RA2-2)
- Residential Multiple Dwelling First Density (RM1, RM1-SS, RM1-WS)
- Residential Multiple Dwelling Second Density (RM2, RM2-TH, RM2-TH WS)
- RM3, Neighbourhood Multiple Residential
- Institutional (I)
- Educational Institutional (I-E)
- Major Institutional (I-M, I-M-1)
- Open Space (OS)
- Environmental Protection Area (EP)
- Agriculture (A)
- Business Park (BP)
- Highway Industrial (HI)
- Light Industrial (LI)
- General Industrial (GI)
- Restrictive Industrial (RI)
- Municipal Services and Utilities (MSU)
- Refer to Zoning By-law 054-04 Innisfil

- City Centre Revitalization Area
- Application Currently Before the Local Planning Appeal Tribunal (LPAT)
- City Boundary
- Parcels

0 0.25 0.5 1 km



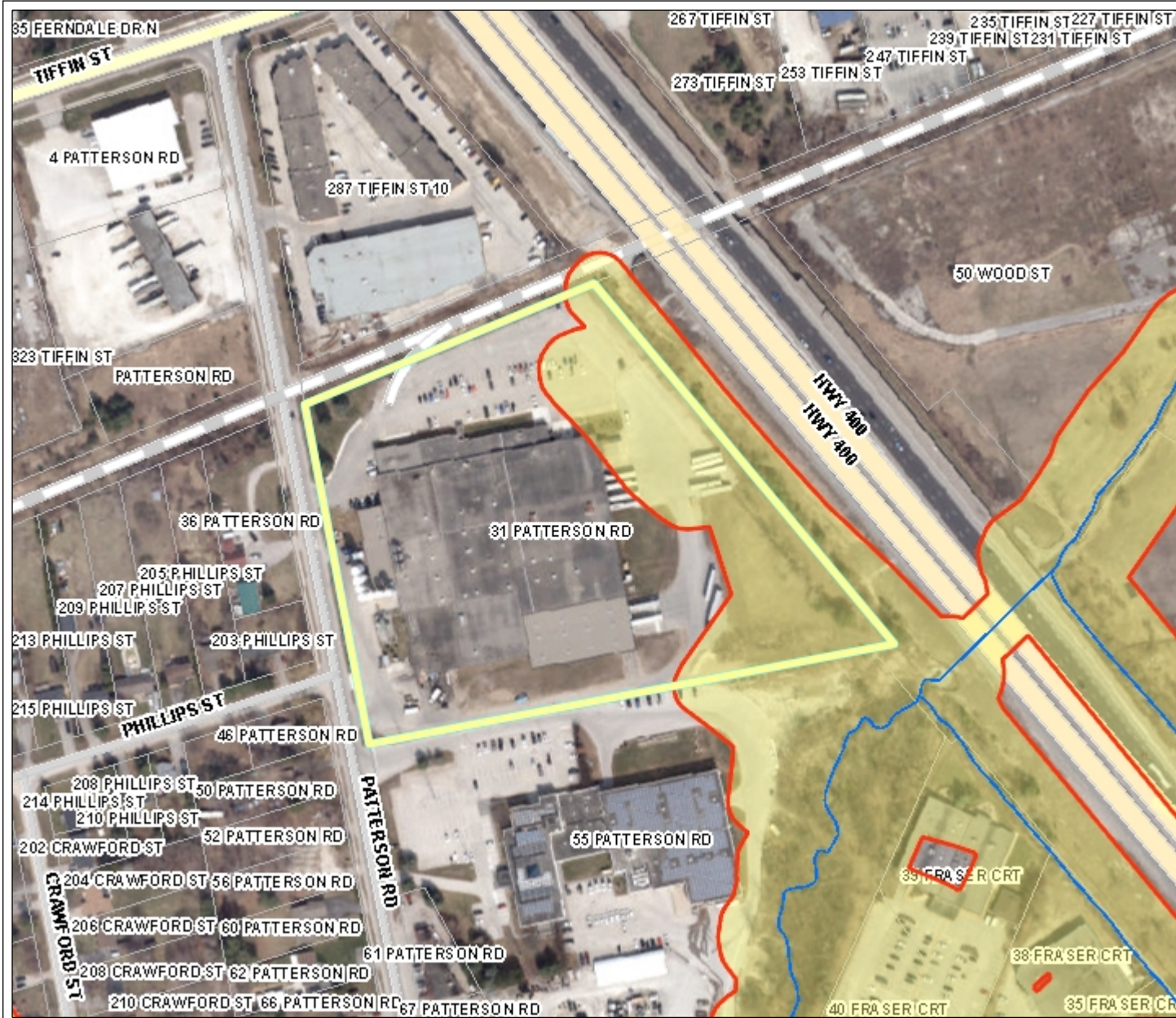
The City of Barrie does not warrant the accuracy, completeness, content, or currency of the information provided.
This is not a legal Plan of Survey.
Copyright © City of Barrie 2022.
Produced (in part) under license from:
© Queens Printer, Ontario Ministry of Natural Resources. All rights reserved;
© Her Majesty the Queen in Right of Canada, Department of Natural Resources. All rights reserved;
© Members of the Ontario Geospatial Data Exchange. All rights reserved.
For information please contact Service Barrie at 705-735-4242 or ServiceBarrie@barrie.ca

Development Services 8/23/2022

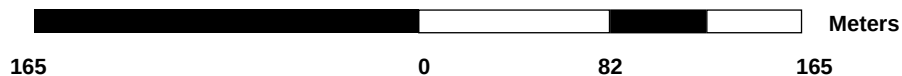


Features

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



Scale 1: 3,246



Printed On:
8/26/2022

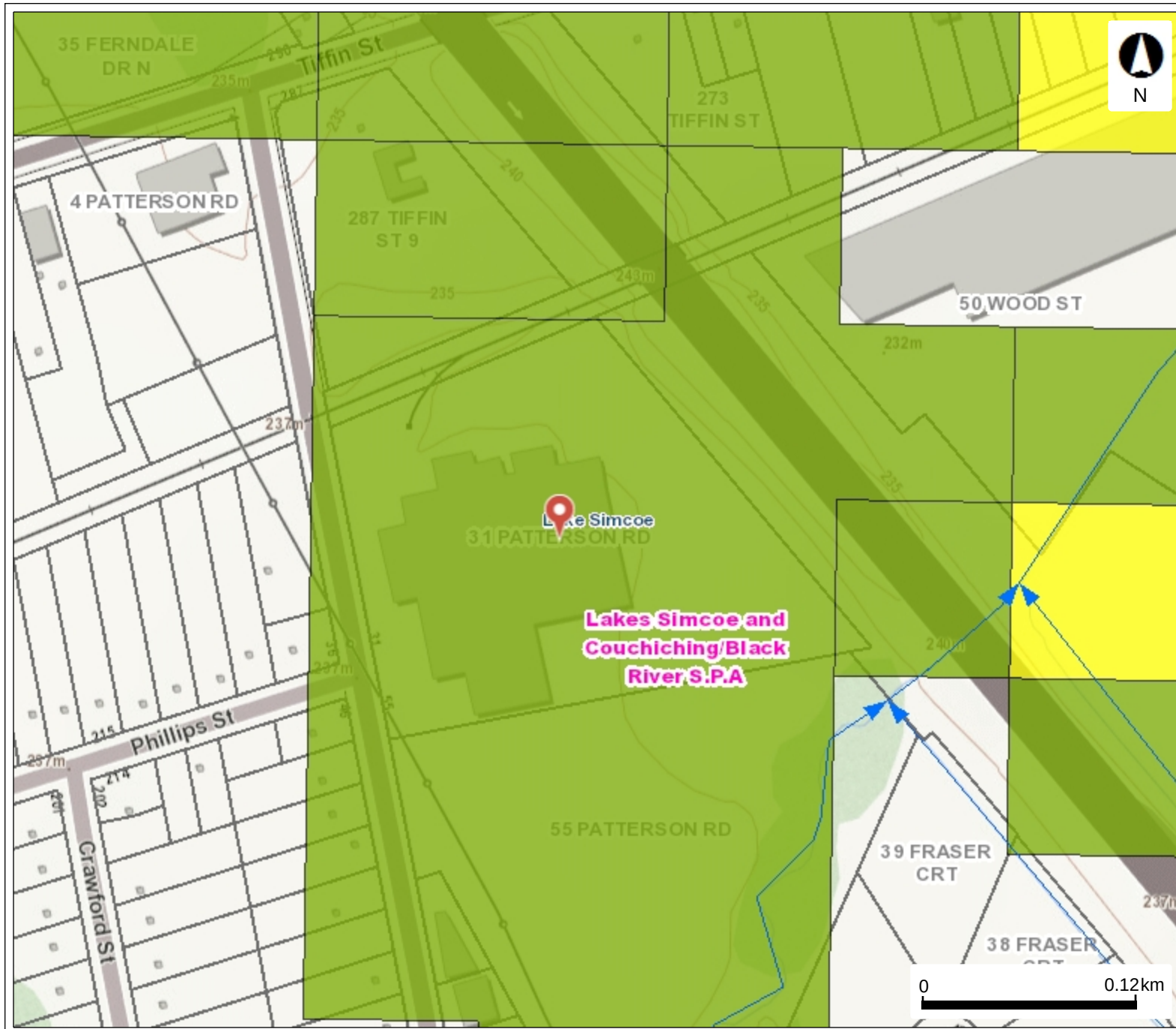


WGS_1984_Web_Mercator_
Auxiliary_Sphere

Mapped By:

This product was produced by the Lake Simcoe Region Conservation Authority and some information depicted on this map may have been compiled from various sources. While every effort has been made to accurately depict the information, data/mapping errors may exist. This map has been produced for illustrative purposes from an interactive web mapping site. LSRCA GIS Services DRAFT printed 2022. © LAKE SIMCOE REGION CONSERVATION AUTHORITY, 2022. All Rights Reserved. The following data sets of Assessment Parcel, Roads, Upper & Lower Tier Municipalities, Wetlands are © Queens Printer for Ontario. Reproduced with Permission, 2022. The Current Regulation Limit and Boundary data sets are derived products from several datasets. Orthophotography 2002, 2005, 2007-2009, 2011-2021, © First Base Solutions, Inc.

SGRA Map

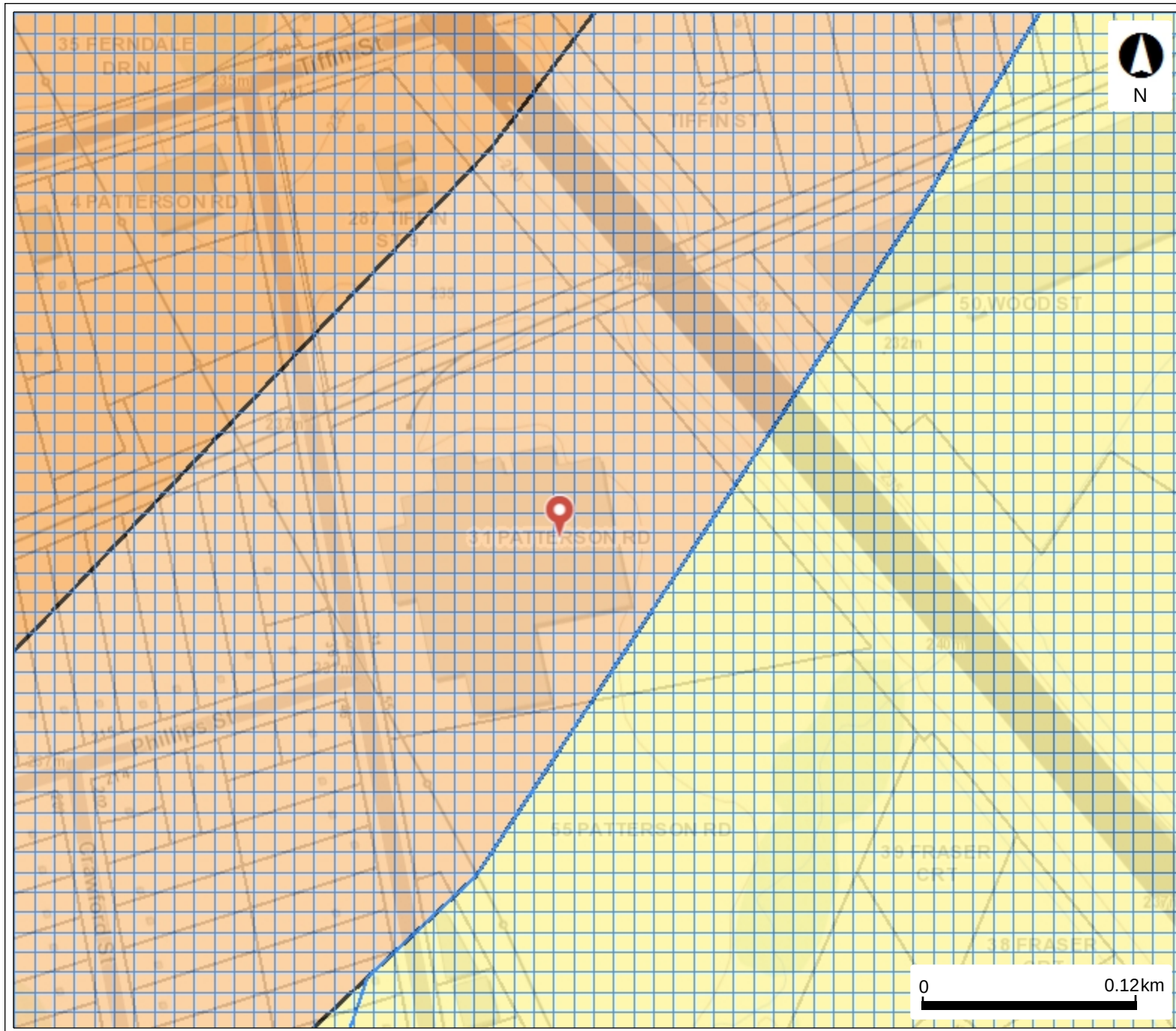


Legend

-  Watercourse Direction
-  Source Protection Areas
-  Quaternary
-  Significant Groundwater Recharge Area
-  0
-  2
-  4
-  6
-  Assessment Parcel with Address

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

WHPA and ICA Map

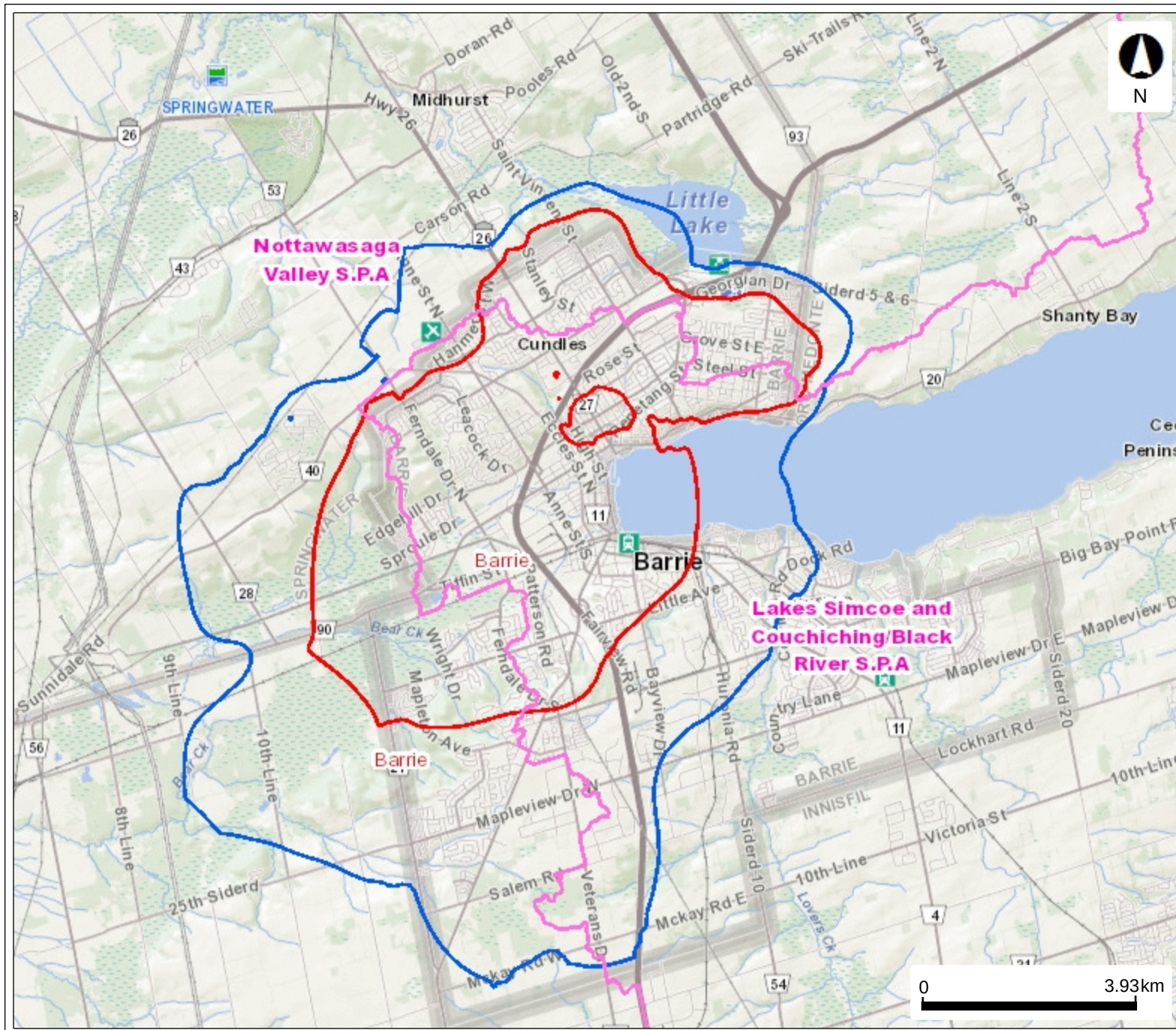


Legend

- Source Protection Areas
- Issue Contributing Areas
- Wellhead Protection Area
 - A
 - B
 - C
 - C1
 - D
 - F
- Event Based Areas
- Assessment Parcel with Addre

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

WHPA-Q1/Q2 Map



Legend

- Source Protection Areas
- Wellhead Protection Area Q1
- Wellhead Protection Area Q2

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



Appendix B

MECP Well Records

Water Well Records Summary Report

Produced by Cambium Inc. using MOECP Water Well Information System (WWIS)

All units in meters unless otherwise specified



Well ID: 5700252	Easting: 602470	UTM Zone 17	
Construction Date: 1960-11-02	Northing: 4913790	Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 26.5	Water Kind FRESH	Pump Rate (LPM): 36	
Water First Found: 25.3	Final Status Water Supply	Recommended Pump Rate:	
Static Level: 2	Primary Water Use: Domestic	Pumping Duration (h:m): 4 : 0	
Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	MEDIUM SAND	0.30	2.13
3	CLAY	2.13	24.4
4	FINE SAND	24.4	26.5

Well ID: 5700258	Easting: 603326	UTM Zone 17	
Construction Date: 1961-06-01	Northing: 4914125	Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 6.1	Water Kind FRESH	Pump Rate (LPM):	
Water First Found: 3.05	Final Status Water Supply	Recommended Pump Rate: 9	
Static Level: 3	Primary Water Use: Industrial	Pumping Duration (h:m): :	
Layer:	Driller's Description:	Top:	Bottom:
1	MEDIUM SAND	0	6.1

Well ID: 5700267	Easting: 603371	UTM Zone 17	
Construction Date: 1963-12-03	Northing: 4913506	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth: 110	Water Kind Not stated	Pump Rate (LPM):	
Water First Found: 40.5	Final Status Observation W	Recommended Pump Rate:	
Static Level: 7	Primary Water Use: Not Used	Pumping Duration (h:m): :	
Layer:	Driller's Description:	Top:	Bottom:
1	FINE SAND	0	12.2
2	CLAY	12.2	12.5
3	FINE SAND	12.5	20.1
4	CLAY	20.1	40.5
5	FINE SAND	40.5	42.7
6	GRAVEL	42.7	45.4
7	BOULDERS	45.4	47.2
8	CLAY	47.2	49.1
9	CLAY	49.1	52.1
10	FINE SAND	52.1	56.4
11	MEDIUM SAND	56.4	64.6
12	MEDIUM SAND	64.6	68.6
13	MEDIUM SAND	68.6	69.2
14	CLAY	69.2	85.9
15	MEDIUM SAND	85.9	96.6

16	CLAY	96.6	100
17	MEDIUM SAND	100	101
18	CLAY	101	110

Well ID: 5700273		Easting: 602501		UTM Zone 17	
Construction Date: 1964-06-03		Northing: 4913831		Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 22.9		Water Kind FRESH		Pump Rate (LPM): 27	
Water First Found: 22.9		Final Status Water Supply		Recommended Pump Rate: 23	
Static Level: 5		Primary Water Use: Domestic		Pumping Duration (h:m): 1 : 30	
Layer:	Driller's Description:	Top:	Bottom:		
1	MEDIUM SAND	0	2.13		
2	CLAY	2.13	20.1		
3	FINE SAND	20.1	21.3		
4	MEDIUM SAND	21.3	22.9		

Well ID: 5700276		Easting: 603157		UTM Zone 17	
Construction Date: 1965-08-23		Northing: 4913135		Positional Accuracy: margin of error : 10 - 30 m	
Well Depth: 72.5		Water Kind Not stated		Pump Rate (LPM):	
Water First Found: 10.4		Final Status Observation W		Recommended Pump Rate:	
Static Level: 6		Primary Water Use: Not Used		Pumping Duration (h:m): :	
Layer:	Driller's Description:	Top:	Bottom:		
1	CLAY	0	10.4		
2	FINE SAND	10.4	20.7		
3	FINE SAND	20.7	22.6		
4	FINE SAND	22.6	26.5		
5	GRAVEL	26.5	26.8		
6	FINE SAND	26.8	29.3		
7	MEDIUM SAND	29.3	32.6		
8	FINE SAND	32.6	42.1		
9	MEDIUM SAND	42.1	56.4		
10	MEDIUM SAND	56.4	57.9		
11	FINE SAND	57.9	62.2		
12	MEDIUM SAND	62.2	63.7		
13	FINE SAND	63.7	72.5		

Well ID: 5700280		Easting: 603216		UTM Zone 17	
Construction Date: 1965-11-29		Northing: 4913128		Positional Accuracy: margin of error : 10 - 30 m	
Well Depth: 102		Water Kind FRESH		Pump Rate (LPM): 173	
Water First Found: 57.3		Final Status Test Hole		Recommended Pump Rate:	
Static Level: 6		Primary Water Use: Not Used		Pumping Duration (h:m): 5 : 0	
Layer:	Driller's Description:	Top:	Bottom:		
1	TOPSOIL	0	1.83		
2	CLAY	1.83	7.01		
3	CLAY	7.01	12.8		
4	FINE SAND	12.8	20.7		
5	MEDIUM SAND	20.7	21.6		

6	MEDIUM SAND	21.6	28.4
7	FINE SAND	28.4	30.2
8	MEDIUM SAND	30.2	33.5
9	CLAY	33.5	42.4
10	CLAY	42.4	54.9
11	CLAY	54.9	56.1
12	MEDIUM SAND	56.1	57.3
13	GRAVEL	57.3	59.1
14	FINE SAND	59.1	61.9
15	MEDIUM SAND	61.9	62.5
16	CLAY	62.5	64.3
17	MEDIUM SAND	64.3	65.8
18	MEDIUM SAND	65.8	72.8
19	CLAY	72.8	76.2
20	CLAY	76.2	88.4
21	CLAY	88.4	90.8
22	CLAY	90.8	102

Well ID: 5700284

Construction Date: 1966-11-15

Easting: 603218

Northing: 4914108

UTM Zone 17

Positional Accuracy: margin of error : 100 m - 300 m

Well Depth: 7.62

Water First Found: 3.96

Static Level: 4

Water Kind

FRESH

Final Status

Water Supply

Primary Water Use: Irrigation

Pump Rate (LPM): 9

Recommended Pump Rate: 9

Pumping Duration (h:m): :

Layer: Driller's Description:

1

MEDIUM SAND

Top:

0

Bottom:

7.62

Well ID: 5700286

Construction Date: 1967-05-24

Easting: 603475

Northing: 4913844

UTM Zone 17

Positional Accuracy: unknown UTM

Well Depth: 62.5

Water First Found: 39.6

Static Level: 4

Water Kind

FRESH

Final Status

Test Hole

Primary Water Use: Not Used

Pump Rate (LPM):

Recommended Pump Rate:

Pumping Duration (h:m): :

Layer: Driller's Description:

1

MEDIUM SAND

0

4.57

2

CLAY

4.57

4.88

3

FINE SAND

4.88

11.6

4

CLAY

11.6

13.4

5

CLAY

13.4

14.3

6

FINE SAND

14.3

22.3

7

CLAY

22.3

33.2

8

CLAY

33.2

34.8

9

MEDIUM SAND

34.8

39.6

10

MEDIUM SAND

39.6

41.5

11

GRAVEL

41.5

59.1

12

MEDIUM SAND

59.1

60.0

Well ID: 5700287**Easting:** 603500**UTM Zone** 17**Construction Date:** 1967-05-24**Northing:** 4913841**Positional Accuracy:** unknown UTM**Well Depth:** 110**Water Kind** FRESH**Pump Rate (LPM):** 114**Water First Found:** 38.7**Final Status** Test Hole**Recommended Pump Rate:****Static Level:** 4**Primary Water Use:** Not Used**Pumping Duration (h:m):** 5 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	MEDIUM SAND	0	4.27
2	CLAY	4.27	4.88
3	FINE SAND	4.88	7.32
4	FINE SAND	7.32	10.7
5	CLAY	10.7	19.2
6	FINE SAND	19.2	32.9
7	CLAY	32.9	35.0
8	MEDIUM SAND	35.0	38.7
9	GRAVEL	38.7	57
10	CLAY	57	58.5
11	GRAVEL	58.5	63.4
12	CLAY	63.4	68
13	GRAVEL	68	71.9
14	CLAY	71.9	75.3
15	CLAY	75.3	91.7
16	MEDIUM SAND	91.7	97.8
17	CLAY	97.8	102
18	CLAY	102	103
19	CLAY	103	105
20	CLAY	105	109
21	LIMESTONE	109	110

Well ID: 5700289**Easting:** 602554**UTM Zone** 17**Construction Date:** 1967-02-27**Northing:** 4913803**Positional Accuracy:** margin of error : 100 m - 300 m**Well Depth:** 25.9**Water Kind** FRESH**Pump Rate (LPM):** 14**Water First Found:** 22.3**Final Status** Water Supply**Recommended Pump Rate:** 14**Static Level:** 8**Primary Water Use:** Domestic**Pumping Duration (h:m):** 2 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	CLAY	0	0.91
2	MEDIUM SAND	0.91	2.44
3	CLAY	2.44	22.3
4	MEDIUM SAND	22.3	22.9
5	CLAY	22.9	25.9

Well ID: 5701693	Easting: 602622	UTM Zone 17		
Construction Date: 1952-09-25	Northing: 4913738	Positional Accuracy: unknown UTM		
Well Depth: 19.8	Water Kind FRESH	Pump Rate (LPM): 36		
Water First Found: 18.3	Final Status Water Supply	Recommended Pump Rate:		
Static Level: 2	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	MUCK	0	2.44	
2	MEDIUM SAND	2.44	8.53	
3	CLAY	8.53	16.8	
4	MEDIUM SAND	16.8	19.8	

Well ID: 5701694	Easting: 602555	UTM Zone 17		
Construction Date: 1952-09-25	Northing: 4913733	Positional Accuracy: unknown UTM		
Well Depth: 19.8	Water Kind FRESH	Pump Rate (LPM): 36		
Water First Found: 18.3	Final Status Water Supply	Recommended Pump Rate:		
Static Level: 2	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	MUCK	0	2.44	
2	MEDIUM SAND	2.44	8.53	
3	CLAY	8.53	16.8	
4	MEDIUM SAND	16.8	19.8	

Well ID: 5701696	Easting: 602696	UTM Zone 17		
Construction Date: 1959-10-28	Northing: 4913735	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 71.6	Water Kind FRESH	Pump Rate (LPM): 114		
Water First Found: 19.8	Final Status Water Supply	Recommended Pump Rate:		
Static Level: 4	Primary Water Use: Irrigation	Pumping Duration (h:m): 6 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	SILT	0	0.30	
2	TOPSOIL	0.30	0.61	
3	SILT	0.61	4.57	
4	CLAY	4.57	8.84	
5	CLAY	8.84	19.8	
6	MEDIUM SAND	19.8	33.2	
7	CLAY	33.2	35.4	
8	SILT	35.4	55.2	
9	MEDIUM SAND	55.2	59.1	
10	CLAY	59.1	60.0	
11	SILT	60.0	61.3	
12	MEDIUM SAND	61.3	64.0	
13	GRAVEL	64.0	65.5	
14	CLAY	65.5	71.6	

Well ID: 5701706 **Easting:** 602852 **UTM Zone** 17
Construction Date: 1961-10-16 **Northing:** 4913022 **Positional Accuracy:** margin of error : 100 m - 300 m

Well Depth: 20.7 **Water Kind** FRESH **Pump Rate (LPM):** 32
Water First Found: 19.8 **Final Status** Water Supply **Recommended Pump Rate:** 14
Static Level: 7 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 2 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	FILL	0	0.30
2	CLAY	0.30	5.49
3	FINE SAND	5.49	11.3
4	CLAY	11.3	16.5
5	FINE SAND	16.5	19.5
6	MEDIUM SAND	19.5	20.7

Well ID: 5701707 **Easting:** 602974 **UTM Zone** 17
Construction Date: 1962-02-05 **Northing:** 4913001 **Positional Accuracy:** margin of error : 100 m - 300 m

Well Depth: 19.8 **Water Kind** FRESH **Pump Rate (LPM):** 23
Water First Found: 18.6 **Final Status** Water Supply **Recommended Pump Rate:** 18
Static Level: 6 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 2 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	CLAY	0.30	3.66
3	FINE SAND	3.66	18.3
4	MEDIUM SAND	18.3	19.8

Well ID: 5701712 **Easting:** 602882 **UTM Zone** 17
Construction Date: 1965-01-19 **Northing:** 4913278 **Positional Accuracy:** margin of error : 100 m - 300 m

Well Depth: 13.7 **Water Kind** FRESH **Pump Rate (LPM):** 18
Water First Found: 12.8 **Final Status** Water Supply **Recommended Pump Rate:** 18
Static Level: 6 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 2 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	PREVIOUSLY DUG	0	2.74
2	CLAY	2.74	10.7
3	CLAY	10.7	12.8
4	MEDIUM SAND	12.8	13.7

Well ID: 5701716 **Easting:** 602879 **UTM Zone** 17
Construction Date: 1967-06-21 **Northing:** 4913234 **Positional Accuracy:** margin of error : 100 m - 300 m

Well Depth: 17.7 **Water Kind** FRESH **Pump Rate (LPM):** 45
Water First Found: 17.7 **Final Status** Water Supply **Recommended Pump Rate:**
Static Level: 7 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 1 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	CLAY	0	6.1
2	HARDPAN	6.1	13.7
3	FINE SAND	13.7	16.5
4	COARSE SAND	16.5	17.7

Well ID: 5701720	Easting: 602814	UTM Zone 17
Construction Date: 1967-11-27	Northing: 4913117	Positional Accuracy: margin of error : 100 m - 300 m
Well Depth: 20.7	Water Kind FRESH	Pump Rate (LPM): 18
Water First Found: 17.4	Final Status Water Supply	Recommended Pump Rate: 18
Static Level: 6	Primary Water Use: Public	Pumping Duration (h:m): 2 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.91
2	MEDIUM SAND	0.91	3.66
3	CLAY	3.66	5.49
4	CLAY	5.49	17.4
5	MEDIUM SAND	17.4	20.7

Well ID: 5704801	Easting: 602486	UTM Zone 17
Construction Date: 1952-07-24	Northing: 4913849	Positional Accuracy: unknown UTM
Well Depth: 7.32	Water Kind FRESH	Pump Rate (LPM): 23
Water First Found: 6.1	Final Status Water Supply	Recommended Pump Rate:
Static Level: 1	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	CLAY	0	3.05
2	FINE SAND	3.05	5.49
3	MEDIUM SAND	5.49	7.32

Well ID: 5704802	Easting: 602466	UTM Zone 17
Construction Date: 1952-09-25	Northing: 4913801	Positional Accuracy: unknown UTM
Well Depth: 19.8	Water Kind FRESH	Pump Rate (LPM): 36
Water First Found: 18.3	Final Status Water Supply	Recommended Pump Rate:
Static Level: 2	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	MUCK	0	2.44
2	MEDIUM SAND	2.44	8.53
3	CLAY	8.53	16.8
4	MEDIUM SAND	16.8	19.8

Well ID: 5704803	Easting: 602533	UTM Zone 17
Construction Date: 1954-01-06	Northing: 4913829	Positional Accuracy: unknown UTM
Well Depth: 20.7	Water Kind FRESH	Pump Rate (LPM): 23
Water First Found: 15.9	Final Status Water Supply	Recommended Pump Rate:
Static Level: 3	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	MEDIUM SAND	0	4.88
2	GRAVEL	4.88	6.71
3	CLAY	6.71	15.9
4	FINE SAND	15.9	18.9
5	COARSE SAND	18.9	20.7

Well ID: 5704804	Easting: 602513	UTM Zone 17		
Construction Date: 1954-10-13	Northing: 4913826	Positional Accuracy: unknown UTM		
Well Depth: 35.4	Water Kind FRESH	Pump Rate (LPM): 36		
Water First Found:	Final Status Water Supply	Recommended Pump Rate:		
Static Level: 3	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	MUCK	0	4.27	
2	CLAY	4.27	18.9	
3	FINE SAND	18.9	20.7	
4	CLAY	20.7	30.8	
5	STONES	30.8	31.4	
6	CLAY	31.4	33.5	
7	MEDIUM SAND	33.5	35.4	

Well ID: 5704805	Easting: 602543	UTM Zone 17		
Construction Date: 1954-12-30	Northing: 4913831	Positional Accuracy: unknown UTM		
Well Depth: 31.4	Water Kind FRESH	Pump Rate (LPM): 27		
Water First Found: 28.0	Final Status Water Supply	Recommended Pump Rate:		
Static Level: 3	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	MUCK	0	2.13	
2	CLAY	2.13	4.27	
3	GRAVEL	4.27	9.14	
4	CLAY	9.14	19.8	
5	CLAY	19.8	28.0	
6	FINE SAND	28.0	29.6	
7	COARSE SAND	29.6	31.4	

Well ID: 5705552	Easting: 602824	UTM Zone 17		
Construction Date: 1969-01-06	Northing: 4913593	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 23.8	Water Kind FRESH	Pump Rate (LPM): 23		
Water First Found: 22	Final Status Water Supply	Recommended Pump Rate: 23		
Static Level: 11	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	FILL	0	0.91	
2	MEDIUM SAND	0.91	4.57	
3	CLAY	4.57	7.01	
4	MEDIUM SAND	7.01	10.7	
5	CLAY	10.7	18.3	
6	CLAY	18.3	22	
7	MEDIUM SAND	22	23.8	

Well ID: 5705841	Easting: 603214	UTM Zone 17		
Construction Date: 1968-11-21	Northing: 4914053	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 5.79	Water Kind FRESH	Pump Rate (LPM):		
Water First Found: 3.05	Final Status Water Supply	Recommended Pump Rate: 9		
Static Level: 29	Primary Water Use: Industrial	Pumping Duration (h:m): :		
Layer:	Driller's Description:	Top:	Bottom:	
1	MEDIUM SAND	0	5.79	

Well ID: 5706146	Easting: 603514	UTM Zone 17		
Construction Date: 1969-02-03	Northing: 4913803	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 71.9	Water Kind FRESH	Pump Rate (LPM): 5001		
Water First Found: 32.3	Final Status Water Supply	Recommended Pump Rate: 5E+		
Static Level: 4	Primary Water Use: Municipal	Pumping Duration (h:m): 24 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	MEDIUM SAND	0	3.35	
2	MEDIUM SAND	3.35	4.57	
3	CLAY	4.57	4.88	
4	CLAY	4.88	20.4	
5	FINE SAND	20.4	25.3	
6	CLAY	25.3	25.9	
7	MEDIUM SAND	25.9	31.7	
8	CLAY	31.7	32.3	
9	FINE SAND	32.3	33.5	
10	MEDIUM SAND	33.5	35.7	
11	COARSE SAND	35.7	38.7	
12	GRAVEL	38.7	57	
13	FINE SAND	57	57.6	
14	MEDIUM SAND	57.6	63.1	
15	MEDIUM SAND	63.1	64.9	
16	MEDIUM SAND	64.9	71.6	
17	CLAY	71.6	71.9	

Well ID: 5706214	Easting: 602944	UTM Zone 17		
Construction Date: 1970-04-21	Northing: 4913263	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 22.9	Water Kind FRESH	Pump Rate (LPM): 23		
Water First Found: 21.6	Final Status Water Supply	Recommended Pump Rate: 23		
Static Level: 9	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	TOPSOIL	0	0.30	
2	CLAY	0.30	13.7	
3	FINE SAND	13.7	21.3	
4	COARSE SAND	21.3	22.9	

Well ID: 5706395 **Easting:** 602664 **UTM Zone** 17
Construction Date: 1969-07-11 **Northing:** 4913723 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 21.6 **Water Kind** FRESH **Pump Rate (LPM):** 27
Water First Found: 18.9 **Final Status** Water Supply **Recommended Pump Rate:** 23
Static Level: 8 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 1 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.61
2	MEDIUM SAND	0.61	3.66
3	CLAY	3.66	5.49
4	MEDIUM SAND	5.49	7.01
5	CLAY	7.01	18.9
6	MEDIUM SAND	18.9	21.6

Well ID: 5706796 **Easting:** 602734 **UTM Zone** 17
Construction Date: 1969-11-04 **Northing:** 4913753 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 22 **Water Kind** FRESH **Pump Rate (LPM):** 9
Water First Found: 18.9 **Final Status** Water Supply **Recommended Pump Rate:** 14
Static Level: 8 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 1 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	PREVIOUSLY DUG	0	2.44
2	CLAY	2.44	4.88
3	CLAY	4.88	17.7
4	SILT	17.7	18.9
5	FINE SAND	18.9	21.0
6	MEDIUM SAND	21.0	22

Well ID: 5706999 **Easting:** 602674 **UTM Zone** 17
Construction Date: 1970-01-28 **Northing:** 4913463 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 6.1 **Water Kind** Not stated **Pump Rate (LPM):**
Water First Found: 3.05 **Final Status** Water Supply **Recommended Pump Rate:** 23
Static Level: 3 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 1 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	MEDIUM SAND	0	2.44
2	CLAY	2.44	6.1

Well ID: 5707116 **Easting:** 602614 **UTM Zone** 17
Construction Date: 1970-05-19 **Northing:** 4913463 **Positional Accuracy:** margin of error : 30 m - 100 m

Well Depth: 5.79 **Water Kind** SALTY **Pump Rate (LPM):**
Water First Found: 5.79 **Final Status** Water Supply **Recommended Pump Rate:** 18
Static Level: 3 **Primary Water Use:** Domestic **Pumping Duration (h:m):** 1 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	MEDIUM SAND	0	5.79
1	MEDIUM SAND	0	5.79
1	MEDIUM SAND	0	5.79
1	MEDIUM SAND	0	5.79

Well ID: 5707451	Easting: 602724	UTM Zone 17		
Construction Date: 1970-09-15	Northing: 4913743	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 22.9	Water Kind FRESH	Pump Rate (LPM): 45		
Water First Found: 21.6	Final Status Water Supply	Recommended Pump Rate: 27		
Static Level: 5	Primary Water Use: Commerical	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	CLAY	0	4.57	
2	CLAY	4.57	19.8	
3	MEDIUM SAND	19.8	22.9	

Well ID: 5709522	Easting: 602974	UTM Zone 17		
Construction Date: 1973-02-16	Northing: 4913013	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 18.9	Water Kind FRESH	Pump Rate (LPM): 18		
Water First Found: 15.9	Final Status Water Supply	Recommended Pump Rate: 18		
Static Level: 9	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	PREVIOUSLY DUG	0	7.62	
1	PREVIOUSLY DUG	0	7.62	
2	SAND	7.62	13.7	
2	SAND	7.62	13.7	
3	SAND	13.7	15.9	
3	SAND	13.7	15.9	
4	SAND	15.9	18.9	
4	SAND	15.9	18.9	

Well ID: 5709524	Easting: 602864	UTM Zone 17		
Construction Date: 1973-02-16	Northing: 4912993	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 21.6	Water Kind FRESH	Pump Rate (LPM): 45		
Water First Found: 17.4	Final Status Water Supply	Recommended Pump Rate: 45		
Static Level: 8	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	4.88	
2	CLAY	4.88	11.6	
3	CLAY	11.6	17.4	
4	SAND	17.4	21.6	

Well ID: 5709738	Easting: 602914	UTM Zone 17		
Construction Date: 1973-04-25	Northing: 4913273	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 19.2	Water Kind FRESH	Pump Rate (LPM): 18		
Water First Found: 12.8	Final Status Water Supply	Recommended Pump Rate: 14		
Static Level: 6	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	PREV. DRILLED	0	12.8	
2	SAND	12.8	19.2	

Well ID: 5710573	Easting: 602664	UTM Zone 17		
Construction Date: 1974-01-14	Northing: 4913453	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 9.45	Water Kind FRESH	Pump Rate (LPM):		
Water First Found: 6.1	Final Status Water Supply	Recommended Pump Rate: 5		
Static Level: 5	Primary Water Use: Domestic	Pumping Duration (h:m): :		
Layer:	Driller's Description:	Top:	Bottom:	
1	TOPSOIL	0	0.61	
2	COARSE SAND	0.61	6.1	
3	CLAY	6.1	9.45	

Well ID: 5710574	Easting: 602664	UTM Zone 17		
Construction Date: 1974-01-14	Northing: 4913453	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 4.27	Water Kind FRESH	Pump Rate (LPM):		
Water First Found: 2.13	Final Status Water Supply	Recommended Pump Rate: 5		
Static Level: 2	Primary Water Use: Domestic	Pumping Duration (h:m): :		
Layer:	Driller's Description:	Top:	Bottom:	
1	TOPSOIL	0	0.30	
2	SAND	0.30	4.27	

Well ID: 5710575	Easting: 602664	UTM Zone 17		
Construction Date: 1974-01-14	Northing: 4913453	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 6.71	Water Kind FRESH	Pump Rate (LPM):		
Water First Found: 4.88	Final Status Water Supply	Recommended Pump Rate: 5		
Static Level: 4	Primary Water Use: Domestic	Pumping Duration (h:m): :		
Layer:	Driller's Description:	Top:	Bottom:	
1	TOPSOIL	0	0.61	
2	SAND	0.61	4.88	
3	CLAY	4.88	6.71	

Well ID: 5711036	Easting: 602964	UTM Zone 17		
Construction Date: 1974-06-05	Northing: 4913073	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 16.8	Water Kind FRESH	Pump Rate (LPM): 14		
Water First Found: 12.2	Final Status Water Supply	Recommended Pump Rate: 14		
Static Level: 9	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	TOPSOIL	0	0.91	
2	SAND	0.91	2.44	
3	HARDPAN	2.44	5.18	
4	CLAY	5.18	15.5	
5	MEDIUM SAND	15.5	16.8	

Well ID: 5711200	Easting: 602514	UTM Zone 17		
Construction Date: 1974-07-24	Northing: 4913673	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 28.0	Water Kind FRESH	Pump Rate (LPM): 45		
Water First Found: 25.9	Final Status Water Supply	Recommended Pump Rate: 45		
Static Level: 8	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	3.35	

2	CLAY	3.35	19.5
3	CLAY	19.5	25.9
4	SAND	25.9	28.0
5	CLAY	28.0	28.0

Well ID: 5711395	Easting: 602564	UTM Zone 17	
Construction Date: 1974-09-24	Northing: 4913673	Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 20.1	Water Kind FRESH	Pump Rate (LPM): 23	
Water First Found: 18.9	Final Status Water Supply	Recommended Pump Rate: 23	
Static Level: 7	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 45	
Layer:	Driller's Description:	Top:	Bottom:
1	MEDIUM SAND	0	6.1
2	CLAY	6.1	18.9
3	FINE SAND	18.9	20.1

Well ID: 5711461	Easting: 602714	UTM Zone 17	
Construction Date: 1974-10-07	Northing: 4913373	Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 25.6	Water Kind FRESH	Pump Rate (LPM): 45	
Water First Found: 22.9	Final Status Water Supply	Recommended Pump Rate: 45	
Static Level: 9	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	1.52
2	CLAY	1.52	7.62
3	CLAY	7.62	14.6
4	CLAY	14.6	20.1
5	SAND	20.1	21.3
6	FINE SAND	21.3	22.9
7	FINE SAND	22.9	25.6

Well ID: 5712325	Easting: 602764	UTM Zone 17	
Construction Date: 1975-08-06	Northing: 4913073	Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 25.9	Water Kind FRESH	Pump Rate (LPM): 45	
Water First Found: 24.4	Final Status Water Supply	Recommended Pump Rate: 45	
Static Level: 11	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	1.83
2	SAND	1.83	3.05
3	CLAY	3.05	18.3
4	CLAY	18.3	24.4
5	SAND	24.4	25.9

Well ID: 5712388	Easting: 602714	UTM Zone 17	
Construction Date: 1975-08-15	Northing: 4913473	Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 24.1	Water Kind FRESH	Pump Rate (LPM): 23	
Water First Found: 22.9	Final Status Water Supply	Recommended Pump Rate: 23	
Static Level: 11	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	2.44

2	SAND	2.44	4.27
3	CLAY	4.27	21.3
4	SAND	21.3	22.9
5	SAND	22.9	24.1

Well ID: 5712389	Easting: 602864	UTM Zone 17		
Construction Date: 1975-08-15	Northing: 4913523	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 22.3	Water Kind FRESH	Pump Rate (LPM): 27		
Water First Found: 20.7	Final Status Water Supply	Recommended Pump Rate: 27		
Static Level: 14	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	1.52	
2	SAND	1.52	6.1	
3	CLAY	6.1	18.3	
4	SAND	18.3	20.7	
5	SAND	20.7	22.3	

Well ID: 5712390	Easting: 602744	UTM Zone 17		
Construction Date: 1975-08-15	Northing: 4913473	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 27.4	Water Kind FRESH	Pump Rate (LPM): 23		
Water First Found: 25.9	Final Status Water Supply	Recommended Pump Rate: 23		
Static Level: 12	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	2.44	
2	SAND	2.44	4.27	
3	CLAY	4.27	25.9	
4	SAND	25.9	27.4	

Well ID: 5712391	Easting: 602764	UTM Zone 17		
Construction Date: 1975-08-15	Northing: 4913473	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 27.4	Water Kind FRESH	Pump Rate (LPM): 32		
Water First Found: 25.3	Final Status Water Supply	Recommended Pump Rate: 32		
Static Level: 10	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	1.52	
2	SAND	1.52	6.71	
3	CLAY	6.71	18.3	
4	SILT	18.3	25.3	
5	SAND	25.3	27.4	

Well ID: 5712392	Easting: 602814	UTM Zone 17		
Construction Date: 1975-08-15	Northing: 4913493	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 29.9	Water Kind FRESH	Pump Rate (LPM): 36		
Water First Found: 28.4	Final Status Water Supply	Recommended Pump Rate: 36		
Static Level: 9	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	1.52	
2	SAND	1.52	9.14	

3	CLAY	9.14	21.3
4	SILT	21.3	28.4
5	SAND	28.4	29.9

Well ID: 5712393	Easting: 602834	UTM Zone 17	
Construction Date: 1975-08-15	Northing: 4913523	Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 26.5	Water Kind FRESH	Pump Rate (LPM): 27	
Water First Found: 24.4	Final Status Water Supply	Recommended Pump Rate: 27	
Static Level: 12	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	1.52
2	CLAY	1.52	6.71
3	CLAY	6.71	18.3
4	FINE SAND	18.3	24.4
5	SAND	24.4	26.5

Well ID: 5712406	Easting: 602764	UTM Zone 17	
Construction Date: 1975-08-22	Northing: 4913373	Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 29.6	Water Kind FRESH	Pump Rate (LPM): 23	
Water First Found: 28.0	Final Status Water Supply	Recommended Pump Rate: 23	
Static Level: 10	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0	
Layer:	Driller's Description:	Top:	Bottom:
1	FILL	0	2.44
2	CLAY	2.44	10.7
3	CLAY	10.7	28.0
4	SAND	28.0	29.6

Well ID: 5712553	Easting: 602864	UTM Zone 17	
Construction Date: 1975-10-20	Northing: 4913423	Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 30.5	Water Kind SALTY	Pump Rate (LPM): 45	
Water First Found: 29.6	Final Status Water Supply	Recommended Pump Rate: 45	
Static Level: 10	Primary Water Use: Domestic	Pumping Duration (h:m): 0 : 45	
Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	1.52
2	CLAY	1.52	29.6
3	SAND	29.6	30.5

Well ID: 5712557	Easting: 602764	UTM Zone 17	
Construction Date: 1975-10-20	Northing: 4913373	Positional Accuracy: margin of error : 100 m - 300 m	
Well Depth: 29.9	Water Kind FRESH	Pump Rate (LPM): 27	
Water First Found: 29	Final Status Water Supply	Recommended Pump Rate: 27	
Static Level: 12	Primary Water Use: Domestic	Pumping Duration (h:m): 0 : 45	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	2.44
2	CLAY	2.44	4.57
3	CLAY	4.57	29
4	SAND	29	29.9

Well ID: 5714607	Easting: 602864	UTM Zone 17		
Construction Date: 1977-09-29	Northing: 4913123	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 27.1	Water Kind FRESH	Pump Rate (LPM): 68		
Water First Found: 25.9	Final Status Water Supply	Recommended Pump Rate: 68		
Static Level: 10	Primary Water Use: Domestic	Pumping Duration (h:m): 10 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	TOPSOIL	0	0.30	
2	CLAY	0.30	7.01	
3	CLAY	7.01	21.3	
4	CLAY	21.3	25.9	
5	SAND	25.9	27.1	

Well ID: 5719488	Easting: 602664	UTM Zone 17		
Construction Date: 1984-12-10	Northing: 4913773	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 21.3	Water Kind FRESH	Pump Rate (LPM): 45		
Water First Found: 20.1	Final Status Water Supply	Recommended Pump Rate: 23		
Static Level: 9	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	TOPSOIL	0	0.61	
2	SAND	0.61	3.66	
3	SAND	3.66	14.6	
4	CLAY	14.6	17.7	
5	FINE SAND	17.7	21.3	

Well ID: 5719578	Easting: 602764	UTM Zone 17		
Construction Date: 1985-02-15	Northing: 4913723	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 22.9	Water Kind FRESH	Pump Rate (LPM): 23		
Water First Found: 21.0	Final Status Water Supply	Recommended Pump Rate: 23		
Static Level: 8	Primary Water Use: Domestic	Pumping Duration (h:m): 1 : 0		
Layer:	Driller's Description:	Top:	Bottom:	
1	PREV. DRILLED	0	21.0	
2	FINE SAND	21.0	22.6	
3	CLAY	22.6	22.9	

Well ID: 5729775	Easting: 603312	UTM Zone 17		
Construction Date: 1992-12-03	Northing: 4913184	Positional Accuracy: unknown UTM		
Well Depth: 32.3	Water Kind FRESH	Pump Rate (LPM): 45		
Water First Found: 28.0	Final Status Water Supply	Recommended Pump Rate: 23		
Static Level: 0	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 30		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	0.30	
2	GRAVEL	0.30	3.96	
3	BOULDERS	3.96	5.18	
4	CLAY	5.18	10.1	
5	CLAY	10.1	28.0	
6	SAND	28.0	32	
7	SAND	32	32.3	

Well ID: 5732730	Easting: 603312	UTM Zone 17
Construction Date: 1997-05-02	Northing: 4913184	Positional Accuracy: unknown UTM
Well Depth: 38.1	Water Kind FRESH	Pump Rate (LPM): 14
Water First Found: 36	Final Status Water Supply	Recommended Pump Rate: 14
Static Level: 10	Primary Water Use: Domestic	Pumping Duration (h:m): 2 : 0

Layer:	Driller's Description:	Top:	Bottom:
1	TOPSOIL	0	0.30
2	SAND	0.30	12.2
3	CLAY	12.2	29
4	CLAY	29	36
5	FINE SAND	36	38.1

Well ID: 7043009	Easting: 602497	UTM Zone 17
Construction Date: 2007-04-25	Northing: 4913511	Positional Accuracy: margin of error : 10 - 30 m
Well Depth: 7	Water Kind FRESH	Pump Rate (LPM):
Water First Found: 1	Final Status Dewatering	Recommended Pump Rate:
Static Level:	Primary Water Use:	Pumping Duration (h:m): :

Layer:	Driller's Description:	Top:	Bottom:
1	FINE SAND	0	2.5
2	SAND	2.5	7

Well ID: 7107273	Easting: 602987	UTM Zone 17
Construction Date: 2008-07-03	Northing: 4913562	Positional Accuracy: margin of error : 10 - 30 m
Well Depth: 7	Water Kind FRESH	Pump Rate (LPM):
Water First Found: 3	Final Status Dewatering	Recommended Pump Rate:
Static Level:	Primary Water Use: Dewatering	Pumping Duration (h:m):

Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	7

Well ID: 7114184	Easting: 603397	UTM Zone 17
Construction Date: 2008-10-30	Northing: 4913721	Positional Accuracy: margin of error : 10 - 30 m
Well Depth: 4.57	Water Kind	Pump Rate (LPM):
Water First Found:	Final Status Observation W	Recommended Pump Rate:
Static Level:	Primary Water Use: Other	Pumping Duration (h:m):

Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	4.57

Well ID: 7159085	Easting: 603050	UTM Zone 17
Construction Date: 2011-02-11	Northing: 4913685	Positional Accuracy: margin of error : 10 - 30 m
Well Depth: 13.7	Water Kind	Pump Rate (LPM):
Water First Found:	Final Status Observation W	Recommended Pump Rate:
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):

Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	1.52
2	SAND	1.52	13.7

Well ID: 7170698	Easting: 603033	UTM Zone 17	
Construction Date: 2011-11-01	Northing: 4913443	Positional Accuracy: margin of error : 10 - 30 m	
Well Depth: 12.2	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	9.14
2	SILT	9.14	12.2

Well ID: 7170699	Easting: 603027	UTM Zone 17	
Construction Date: 2011-11-01	Northing: 4913440	Positional Accuracy: margin of error : 10 - 30 m	
Well Depth: 12.8	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	9.14
2	SILT	9.14	12.8

Well ID: 7170700	Easting: 603035	UTM Zone 17	
Construction Date: 2011-11-01	Northing: 4913436	Positional Accuracy: margin of error : 10 - 30 m	
Well Depth: 12.8	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	9.14
2	SILT	9.14	12.8

Well ID: 7176167	Easting: 603197	UTM Zone 17	
Construction Date: 2012-02-01	Northing: 4913908	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth: 6.1	Water Kind Not stated	Pump Rate (LPM):	
Water First Found: 3.66	Final Status Observation W	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	3.66
2	SAND	3.66	6.1

Well ID: 7235508	Easting: 603183	UTM Zone 17	
Construction Date: 2015-01-16	Northing: 4913700	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth: 5.3	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status Observation W	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:
1	FINE SAND	0	5.30

Well ID: 7235509	Easting: 603302	UTM Zone 17	
Construction Date: 2015-01-16	Northing: 4913561	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth: 3.1	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status Observation W	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7235511
Construction Date: 2015-01-16

Easting: 602867
Northing: 4913954

UTM Zone 17
Positional Accuracy: margin of error : 30 m - 100 m

Well Depth: 7.6
Water First Found:
Static Level:

Water Kind
Final Status
Primary Water Use:

Observation W
Monitoring

Pump Rate (LPM):
Recommended Pump Rate:
Pumping Duration (h:m):

Layer: Driller's Description: Top: Bottom:

1	FINE SAND	0	0.60
2	FINE SAND	0.60	7.6

Well ID: 7235512
Construction Date: 2015-01-16

Easting: 602928
Northing: 4913992

UTM Zone 17
Positional Accuracy: margin of error : 30 m - 100 m

Well Depth: 7.6
Water First Found:
Static Level:

Water Kind
Final Status
Primary Water Use:

Observation W
Monitoring

Pump Rate (LPM):
Recommended Pump Rate:
Pumping Duration (h:m):

Layer: Driller's Description: Top: Bottom:

1	FINE SAND	0	7.6
---	-----------	---	-----

Well ID: 7235513
Construction Date: 2015-01-16

Easting: 602971
Northing: 4913947

UTM Zone 17
Positional Accuracy: margin of error : 30 m - 100 m

Well Depth: 7.6
Water First Found:
Static Level:

Water Kind
Final Status
Primary Water Use:

Observation W
Monitoring

Pump Rate (LPM):
Recommended Pump Rate:
Pumping Duration (h:m):

Layer: Driller's Description: Top: Bottom:

1	FINE SAND	0	7.6
---	-----------	---	-----

Well ID: 7235514
Construction Date: 2015-01-16

Easting: 603017
Northing: 4913875

UTM Zone 17
Positional Accuracy: margin of error : 30 m - 100 m

Well Depth: 6.1
Water First Found:
Static Level:

Water Kind
Final Status
Primary Water Use:

Observation W
Monitoring

Pump Rate (LPM):
Recommended Pump Rate:
Pumping Duration (h:m):

Layer: Driller's Description: Top: Bottom:

1	FINE SAND	0	6.1
---	-----------	---	-----

Well ID: 7235515
Construction Date: 2015-01-16

Easting: 603080
Northing: 4913820

UTM Zone 17
Positional Accuracy: margin of error : 30 m - 100 m

Well Depth: 9.2
Water First Found:
Static Level:

Water Kind
Final Status
Primary Water Use:

Observation W
Monitoring

Pump Rate (LPM):
Recommended Pump Rate:
Pumping Duration (h:m):

Layer: Driller's Description: Top: Bottom:

1	FINE SAND	0	4.6
2	FINE SAND	4.6	9.2

Well ID: 7235743
Construction Date: 2015-01-16

Easting: 603123
Northing: 4913752

UTM Zone 17
Positional Accuracy: margin of error : 30 m - 100 m

Well Depth: 5.9
Water First Found:
Static Level:

Water Kind
Final Status
Primary Water Use:

Observation W
Monitoring

Pump Rate (LPM):
Recommended Pump Rate:
Pumping Duration (h:m):

Layer: Driller's Description: Top: Bottom:

1	FINE SAND	0	5.90
---	-----------	---	------

Well ID: 7246747	Easting: 603016	UTM Zone 17		
Construction Date: 2015-08-18	Northing: 4913701	Positional Accuracy: margin of error : 100 m - 300 m		
Well Depth: 1.83	Water Kind	Pump Rate (LPM):		
Water First Found:	Final Status Abandoned-Qu	Recommended Pump Rate:		
Static Level:	Primary Water Use: Test Hole	Pumping Duration (h:m):		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	1.83	

Well ID: 7260347	Easting: 603535	UTM Zone 17		
Construction Date: 2016-03-31	Northing: 4914099	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 6.1	Water Kind	Pump Rate (LPM):		
Water First Found:	Final Status Monitoring an	Recommended Pump Rate:		
Static Level:	Primary Water Use: Monitoring an	Pumping Duration (h:m):		
Layer:	Driller's Description:	Top:	Bottom:	
1	FINE SAND	0	2.74	
2	FINE SAND	2.74	6.1	

Well ID: 7269139	Easting: 603067	UTM Zone 17		
Construction Date: 2016-08-17	Northing: 4913685	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 42	Water Kind	Pump Rate (LPM):		
Water First Found:	Final Status Monitoring an	Recommended Pump Rate:		
Static Level:	Primary Water Use: Monitoring an	Pumping Duration (h:m):		
Layer:	Driller's Description:	Top:	Bottom:	
1	FILL	0	3	
2	SAND	3	32	
3	SAND	32	42	

Well ID: 7269140	Easting: 603061	UTM Zone 17		
Construction Date: 2016-08-17	Northing: 4913693	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 42	Water Kind	Pump Rate (LPM):		
Water First Found:	Final Status Monitoring an	Recommended Pump Rate:		
Static Level:	Primary Water Use: Monitoring an	Pumping Duration (h:m):		
Layer:	Driller's Description:	Top:	Bottom:	
1	FILL	0	3	
2	SAND	3	32	
3	SAND	32	42	

Well ID: 7269141	Easting: 603062	UTM Zone 17		
Construction Date: 2016-08-17	Northing: 4913689	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 39	Water Kind	Pump Rate (LPM):		
Water First Found:	Final Status Monitoring an	Recommended Pump Rate:		
Static Level:	Primary Water Use: Monitoring an	Pumping Duration (h:m):		
Layer:	Driller's Description:	Top:	Bottom:	
1	GRAVEL	0	3	
2	SAND	3	29	
3	SAND	29	39	

Well ID: 7272177	Easting: 603058	UTM Zone 17
Construction Date: 2016-09-22	Northing: 4913698	Positional Accuracy: margin of error : 30 m - 100 m
Well Depth:	Water Kind	Pump Rate (LPM):
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:
Static Level:	Primary Water Use: Test Hole	Pumping Duration (h:m):
Layer:	Driller's Description:	Top: Bottom:

Well ID: 7272178	Easting: 603057	UTM Zone 17
Construction Date: 2016-09-22	Northing: 4913699	Positional Accuracy: margin of error : 30 m - 100 m
Well Depth:	Water Kind	Pump Rate (LPM):
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:
Static Level:	Primary Water Use: Test Hole	Pumping Duration (h:m):
Layer:	Driller's Description:	Top: Bottom:

Well ID: 7272179	Easting: 603058	UTM Zone 17
Construction Date: 2016-09-22	Northing: 4913695	Positional Accuracy: margin of error : 30 m - 100 m
Well Depth:	Water Kind	Pump Rate (LPM):
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:
Static Level:	Primary Water Use: Test Hole	Pumping Duration (h:m):
Layer:	Driller's Description:	Top: Bottom:

Well ID: 7272180	Easting: 603063	UTM Zone 17
Construction Date: 2016-09-22	Northing: 4913693	Positional Accuracy: margin of error : 30 m - 100 m
Well Depth:	Water Kind	Pump Rate (LPM):
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:
Static Level:	Primary Water Use: Not Used	Pumping Duration (h:m):
Layer:	Driller's Description:	Top: Bottom:

Well ID: 7272181	Easting: 603059	UTM Zone 17
Construction Date: 2016-09-22	Northing: 4913690	Positional Accuracy: margin of error : 30 m - 100 m
Well Depth:	Water Kind	Pump Rate (LPM):
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:
Static Level:	Primary Water Use: Test Hole	Pumping Duration (h:m):
Layer:	Driller's Description:	Top: Bottom:

Well ID: 7272182	Easting: 603055	UTM Zone 17
Construction Date: 2016-09-22	Northing: 4913689	Positional Accuracy: margin of error : 30 m - 100 m
Well Depth:	Water Kind	Pump Rate (LPM):
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:
Static Level:	Primary Water Use: Test Hole	Pumping Duration (h:m):
Layer:	Driller's Description:	Top: Bottom:

Well ID: 7274007	Easting: 603098	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4913785	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7274008	Easting: 603099	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4913784	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7274009	Easting: 603117	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4913749	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7274010	Easting: 603028	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4913860	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7274011	Easting: 603017	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4913872	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7274012	Easting: 603154	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4913724	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7274013	Easting: 603154	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4913722	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7274014	Easting: 603219	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4913645	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7274015	Easting: 603220	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4913645	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7274033	Easting: 603225	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4913632	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7274034	Easting: 602906	UTM Zone 17	
Construction Date: 2016-10-27	Northing: 4914012	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7282610	Easting: 603372	UTM Zone 17	
Construction Date: 2017-03-06	Northing: 4913869	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth: 6.1	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status Monitoring an	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring an	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	6.1

Well ID: 7282611	Easting: 603541	UTM Zone 17	
Construction Date: 2017-03-06	Northing: 4913940	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth: 6.1	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status Monitoring an	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring an	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:
1	SAND	0	3.05
2	SAND	3.05	6.1

Well ID: 7296969	Easting: 603139	UTM Zone 17	
Construction Date: 2017-10-11	Northing: 4913523	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7296970	Easting: 603106	UTM Zone 17	
Construction Date: 2017-10-11	Northing: 4913640	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7296972	Easting: 603021	UTM Zone 17	
Construction Date: 2017-10-11	Northing: 4913626	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7296973	Easting: 603030	UTM Zone 17	
Construction Date: 2017-10-11	Northing: 4913692	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7296974	Easting: 603059	UTM Zone 17	
Construction Date: 2017-10-11	Northing: 4913698	Positional Accuracy: margin of error : 30 m - 100 m	
Well Depth:	Water Kind	Pump Rate (LPM):	
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:	
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):	
Layer:	Driller's Description:	Top:	Bottom:

Well ID: 7300960	Easting: 602657	UTM Zone 17		
Construction Date: 2017-12-08	Northing: 4913974	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 6.1	Water Kind	Pump Rate (LPM):		
Water First Found:	Final Status Observation W	Recommended Pump Rate:		
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m):		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	3.66	
2	SILT	3.66	6.1	

Well ID: 7313020	Easting: 602506	UTM Zone 17		
Construction Date: 2018-06-19	Northing: 4913781	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 4.57	Water Kind	Pump Rate (LPM):		
Water First Found:	Final Status Observation W	Recommended Pump Rate:		
Static Level:	Primary Water Use: Test Hole	Pumping Duration (h:m):		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	1.22	
2	SAND	1.22	2.13	
3	SAND	2.13	4.57	

Well ID: 7339975	Easting: 602966	UTM Zone 17		
Construction Date: 2019-08-21	Northing: 4913846	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth:	Water Kind	Pump Rate (LPM):		
Water First Found:	Final Status Abandoned-Ot	Recommended Pump Rate:		
Static Level:	Primary Water Use:	Pumping Duration (h:m):		
Layer:	Driller's Description:	Top:	Bottom:	

Well ID: 7354526	Easting: 603355	UTM Zone 17		
Construction Date: 2020-02-18	Northing: 4913105	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 3.7	Water Kind Untested	Pump Rate (LPM):		
Water First Found: 2	Final Status Observation W	Recommended Pump Rate:		
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m): :		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	3.70	

Well ID: 7354548	Easting: 603422	UTM Zone 17		
Construction Date: 2020-02-18	Northing: 4913202	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 4.6	Water Kind Untested	Pump Rate (LPM):		
Water First Found: 2	Final Status Observation W	Recommended Pump Rate:		
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m): :		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	4.6	

Well ID: 7354549	Easting: 603434	UTM Zone 17		
Construction Date: 2020-02-18	Northing: 4913095	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 4.3	Water Kind Untested	Pump Rate (LPM):		
Water First Found: 2	Final Status Observation W	Recommended Pump Rate:		
Static Level:	Primary Water Use: Monitoring	Pumping Duration (h:m): :		
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	4.30	

Well ID: 7354550	Easting: 603439	UTM Zone 17		
Construction Date: 2020-02-18	Northing: 4913044	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 3.8	Water Kind	Untested	Pump Rate (LPM):	
Water First Found: 2	Final Status	Observation W	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Monitoring	Pumping Duration (h:m): :	
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	3.8	

Well ID: 7354551	Easting: 603522	UTM Zone 17		
Construction Date: 2020-02-18	Northing: 4913082	Positional Accuracy: margin of error : 30 m - 100 m		
Well Depth: 4.6	Water Kind	Untested	Pump Rate (LPM):	
Water First Found: 2	Final Status	Observation W	Recommended Pump Rate:	
Static Level:	Primary Water Use:	Monitoring	Pumping Duration (h:m): :	
Layer:	Driller's Description:	Top:	Bottom:	
1	SAND	0	4.6	



Appendix C

Borehole Logs



Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole:

MW101-22

Page 1 of 1

Client: Gerrits Engineering
Contractor: Walker Drilling
Location: 31 Patterson Road, Barrie, ON

Project Name: 31 Patterson Road, Barrie, ON
Method: Solid Stem Augers
UTM:

Project No.: 15863-001
Date Completed: August 16, 2022
Elevation: 234.85 mASL

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT				Well Installation	Remarks
								25	50	75	10	20	30	40		
234.8	0	ASPHALT: (100 mm)													Flushmount	Top of Pipe (TOP) elevation: 234.8 mASL
		SAND: Brpwn sand, some gravel, moist [FILL]			GS										Cap	Groundwater measured at 2.17 mbgs (232.7 mASL) on 08, 25, 2022
234.0	1	SILT AND SAND: Brown silt and sand, trace clay, moist													Holeplug	
															PVC Standpipe	GSA GS2: 0% Gravel 44% Sand 48% Silt 8% Clay
233.0	2															
		- wet, decreased silt content														
232.0	3															
					GS										Sand	
231.0	4														PVC Screen	
230.0	5		Borehole terminated at 5.2 m due to target depth achieved												Cap	
229.0	6															

Logged By: Waleed El-Taweel

Input By: Waleed El-Taweel



Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole:

MW102-22

Page 1 of 1

Client: Gerrits Engineering

Project Name: 31 Patterson Road, Barrie, ON

Project No.: 15863-001

Contractor: Walker Drilling

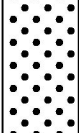
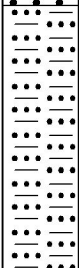
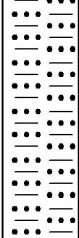
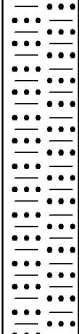
Method: Solid Stem Augers

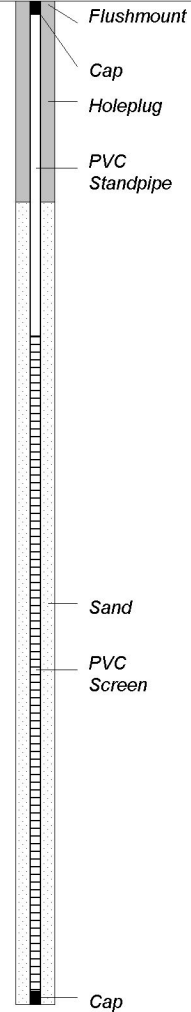
Date Completed: August 16, 2022

Location: 31 Patterson Road, Barrie, ON

UTM:

Elevation: 236.15 mASL

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT				Well Installation	Remarks
								25	50	75	10	20	30	40		
236	0		ASPHALT: (100 mm)												 Flushmount	Top of Pipe (TOP) elevation: 236.03 mASL Groundwater measured at 2.82mbgs (233.3 mASL) on 08, 25, 2022
			SAND: Brpwn sand, some gravel, moist [FILL]		GS										Cap	
			SANDY SILT: Brown sandy silt, some clay, trace gravel, moist		GS										Holeplug	
235	1														PVC Standpipe	
																
234	2		-grey , wet, decreased silt content													
																
233	3				GS											Sand
																PVC Screen
232	4															
																Cap
231	5		Borehole terminated at 5.2 m due to target depth achieved													
	6															



Top of Pipe (TOP) elevation: 236.03 mASL Groundwater measured at 2.82mbgs (233.3 mASL) on 08, 25, 2022

GSA GS2:
1% Gravel
21% Sand
68% Silt
10% Clay

Logged By: Waleed El-Taweel

Input By: Waleed El-Taweel



MW103-22

Project Name: 31 Patterson Road, Barrie, ON
Method: Solid Stem Augers
UTM:

Project No.: 15863-001
Date Completed: August 16, 2022
Elevation: 235.23 mASL

Logged By: Waleed El-Taweel **Input By:** Waleed El-Taweel



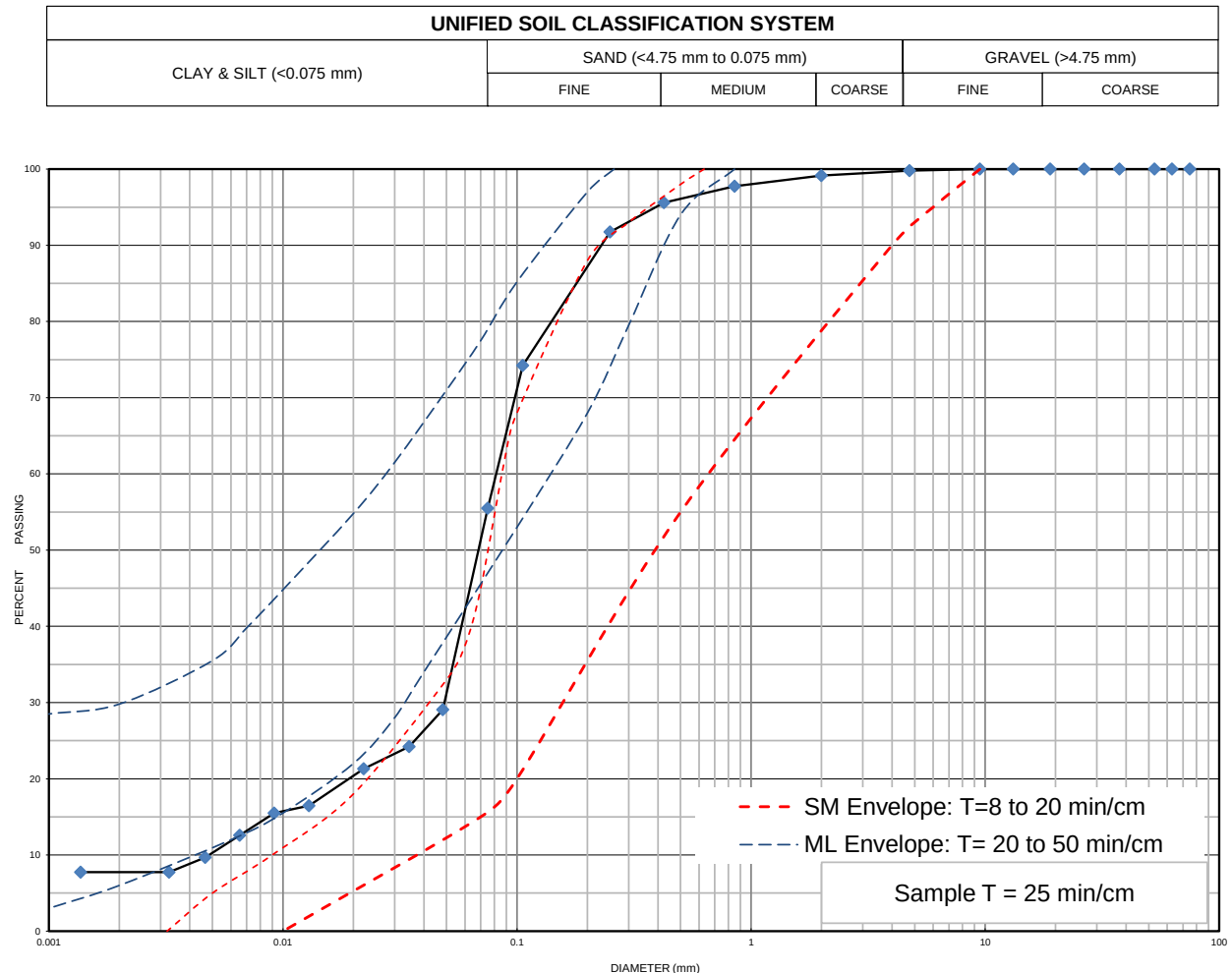
Appendix D

Grain Size Analysis Data



Grain Size Distribution Chart

Project Number: 15863-001 **Client:** Gerrits Engineering Ltd.
Project Name: Hydrogeological Assessment - 31 Patterson Road Barrie
Sample Date: August 16, 2022 **Sampled By:** Waleed El-Taweel - Cambium Inc.
Location: BH 101-22 GS 2 **Depth:** 0.9 m to 1.5 m **Lab Sample No:** S-22-1270



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-22	GS 2		0	44	48	8	20.0
Description	Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c	
Silt and Sand trace Clay	ML	0.0810	0.0490	0.0049	16.53	6.05	

Additional information available upon request

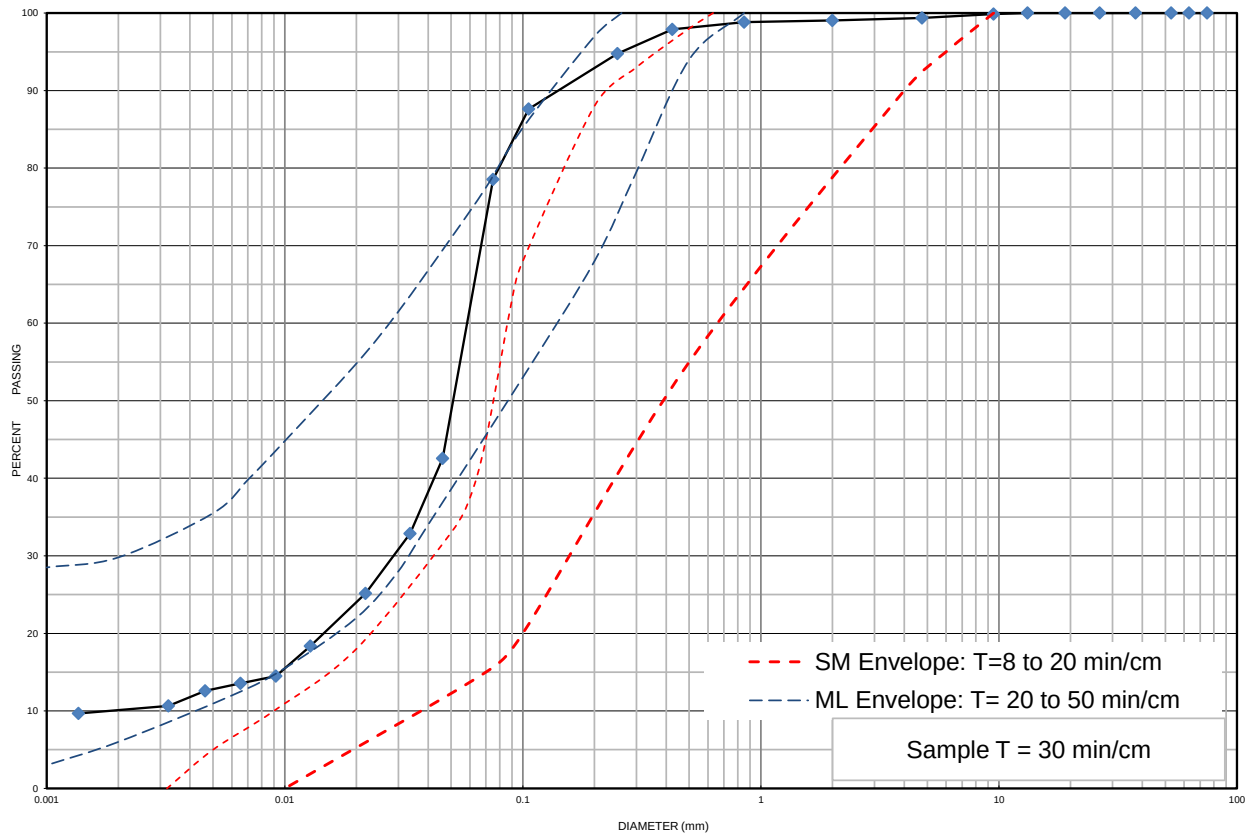
Issued By: _____ **Date Issued:** September 11, 2022
 (Senior Project Manager)



Grain Size Distribution Chart

Project Number: 15863-001 **Client:** Gerrits Engineering Ltd.
Project Name: Hydrogeological Assessment - 31 Patterson Road Barrie
Sample Date: August 16, 2022 **Sampled By:** Waleed El-Taweel - Cambium Inc.
Location: BH 102-22 GS 2 **Depth:** 0.9 m to 1.5 m **Lab Sample No:** S-22-1271

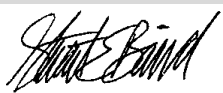
UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT		FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE
			SAND			GRAVEL		
								BOULDERS

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-22	GS 2	0.9 m to 1.5 m	1	21	68	10	18.4
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Sandy Silt some Clay trace Gravel		ML	0.0590	0.0280	0.0017	34.71	7.82

Additional information available upon request

Issued By:  (Senior Project Manager) **Date Issued:** September 11, 2022

Cambium Inc. (Laboratory)
 866.217.7900 | cambium-inc.com
 194 Sophia St. | Peterborough | ON | K9H 1E5

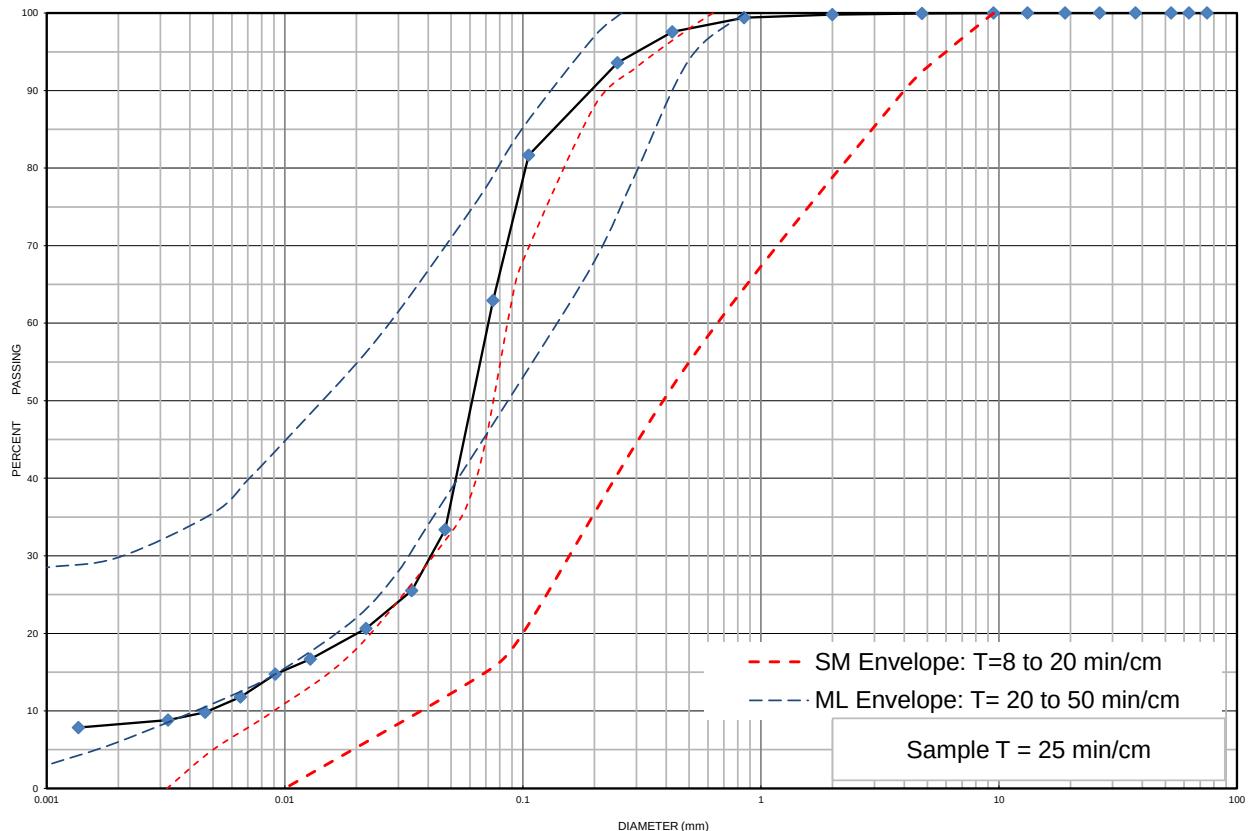
Form: L6V.2 - Grad.Hydo



Grain Size Distribution Chart

Project Number: 15863-001 **Client:** Gerrits Engineering Ltd.
Project Name: Hydrogeological Assessment - 31 Patterson Road Barrie
Sample Date: August 16, 2022 **Sampled By:** Waleed El-Taweel - Cambium Inc.
Location: BH 103-22 GS 3 **Depth:** 1.5 m to 2.1 m **Lab Sample No:** S-22-1272

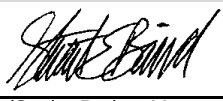
UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDER
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 103-22	GS 3		0	37	55	8	19.7
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Silt and Sand trace Clay		ML	0.0710	0.0410	0.0046	15.43	5.15

Additional information available upon request

Issued By: 
(Senior Project Manager)

Date Issued: September 11, 2022

Cambium Inc. (Laboratory)
866.217.7900 | cambium-inc.com
194 Sophia St. | Peterborough | ON | K9H 1E5

Form: L6V.2 - Grad.Hydo



Appendix E

SWRT Analysis



194 Sophia St.
Peterborough, ON
K9H1E5

Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 15863-001

Client: Gerrits Engineering

Location: 31 Patterson Rd., Barrie

Slug Test: MW101-22 Slug Test

Test Well: MW101-22

Test Conducted by: N. Heikoop

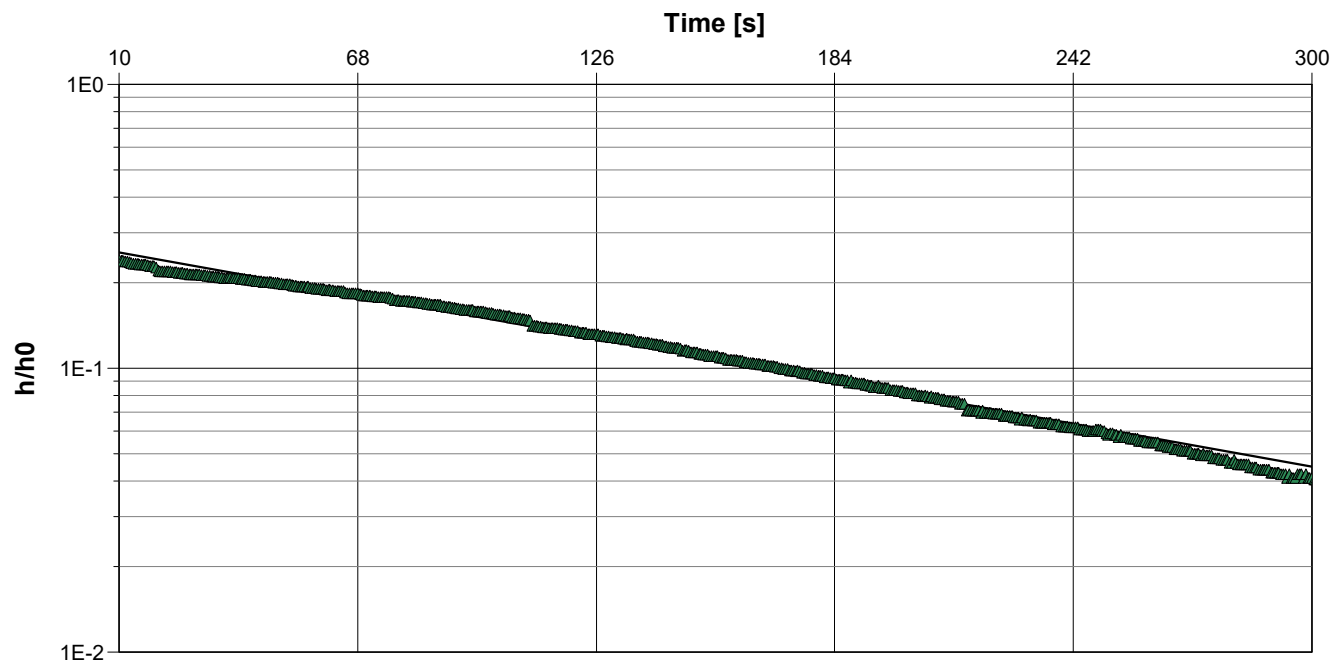
Test Date: 8/25/2022

Analysis Performed by: N. Heikoop

MW101-22 Slug Test

Analysis Date: 8/31/2022

Aquifer Thickness: 2.27 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

MW101-22

3.00×10^{-6}



194 Sophia St.
Peterborough, ON
K9H1E5

Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 15863-001

Client: Gerrits Engineering

Location: 31 Patterson Rd., Barrie

Slug Test: MW102-22 Slug Test

Test Well: MW102-22

Test Conducted by: N. Heikoop

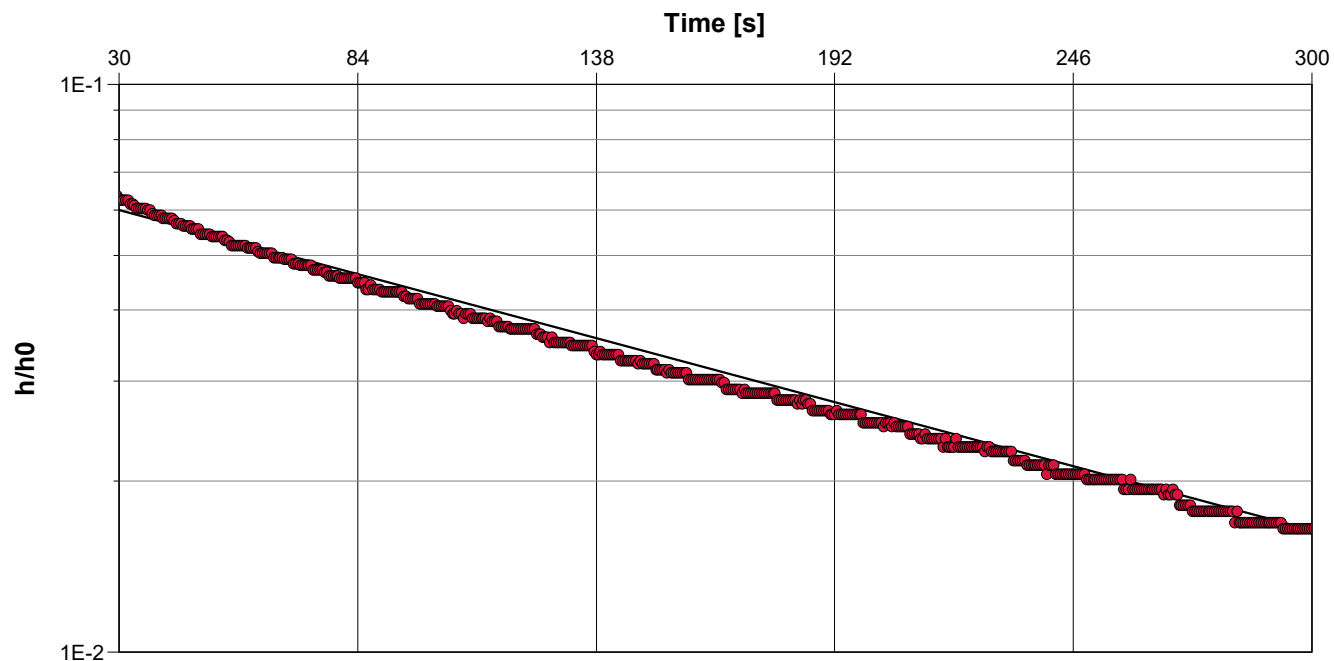
Test Date: 8/25/2022

Analysis Performed by: N. Heikoop

MW102-22 Slug Test

Analysis Date: 8/31/2022

Aquifer Thickness: 1.77 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

MW102-22

2.41×10^{-6}



194 Sophia St.
Peterborough, ON
K9H1E5

Slug Test Analysis Report

Project: Hydrogeological Assessment

Number: 15863-001

Client: Gerrits Engineering

Location: 31 Patterson Rd., Barrie

Slug Test: MW103-22 Slug Test

Test Well: MW103-22

Test Conducted by: N. Heikoop

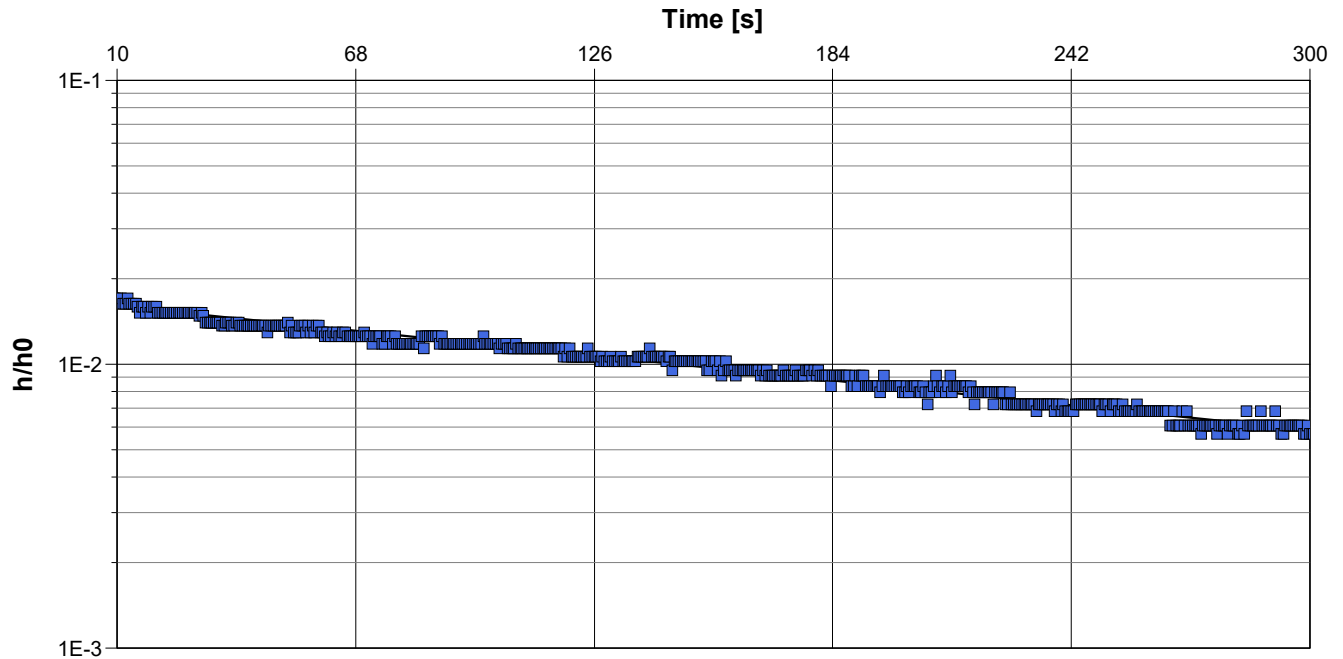
Test Date: 8/25/2022

Analysis Performed by: N. Heikoop

MW103-22 Slug Test

Analysis Date: 8/31/2022

Aquifer Thickness: 1.71 m



Calculation using Hvorslev

Observation Well

Hydraulic Conductivity
[m/s]

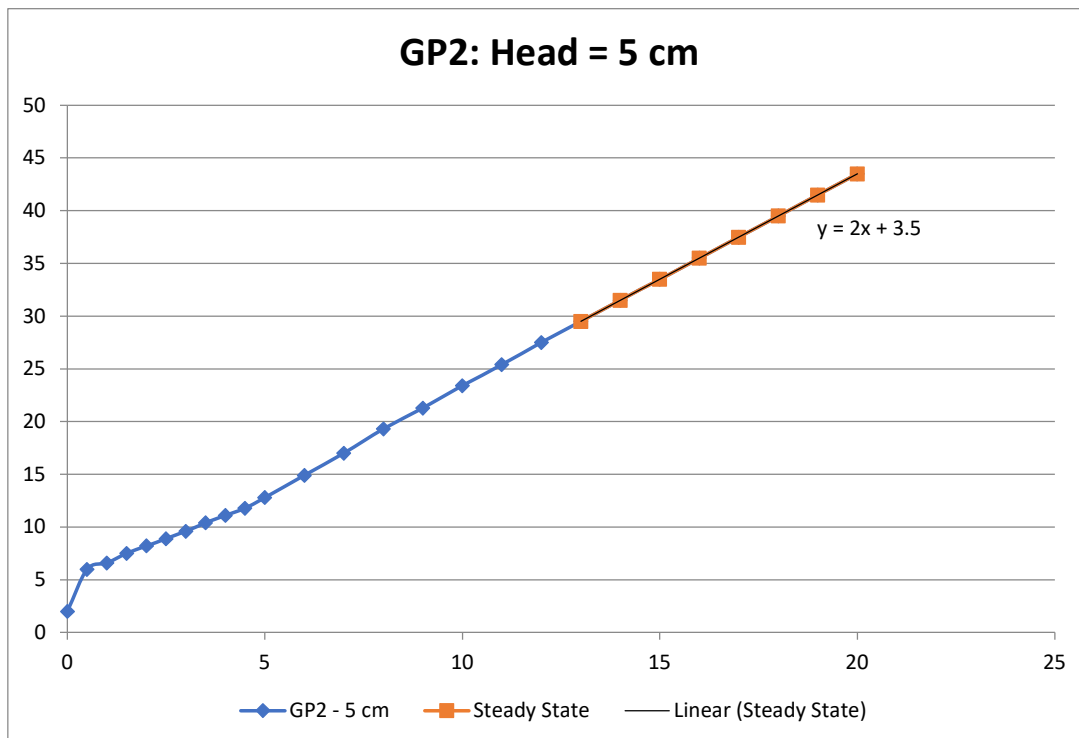
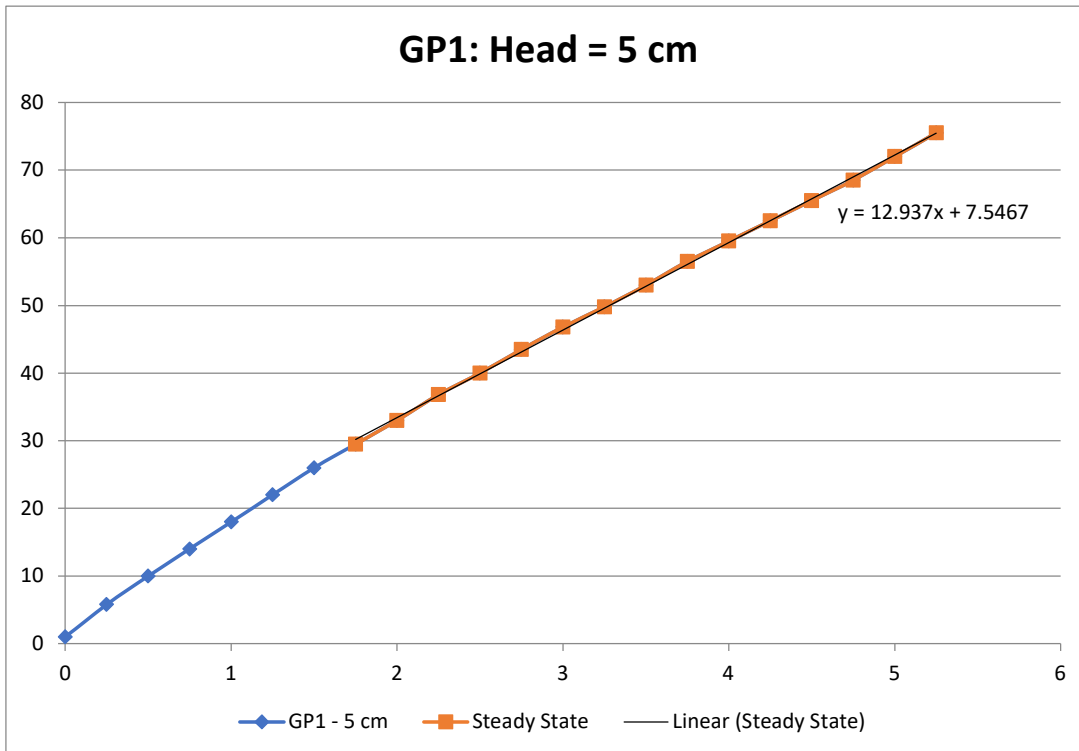
MW103-22

1.75×10^{-6}



Appendix F

In-Situ Infiltration Results





Guelph Permeameter Calculations

Input

Result

Single Head Method (1) - GP1

Reservoir Cross-sectional area in cm²
(enter "35.22" for Combined and "2.16" for Inner reservoir): **35.22**

Enter water Head Height ("H" in cm): **5**

Enter the Borehole Radius ("a" in cm): **3**

Enter the soil texture-structure category (enter one of the below numbers): **3**

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropores, etc

Steady State Rate of Water Level Change ("R" in cm/min): **13.1000**

Res Type 35.22
H 5
a 3
H/a 1.667
a* 0.12
C0.01 0.809
C0.04 0.842
C0.12 0.803
C0.36 0.803
C 0.803
R #####
Q 7.69
pi 3.142

$\alpha^* = 0.12 \text{ cm}^{-1}$

C = 0.803154
Q = 7.6897

$K_{fs} = 1.40E-02 \text{ cm/sec}$
 $8.39E-01 \text{ cm/min}$
 $1.40E-04 \text{ m/sec}$
 $3.30E-01 \text{ inch/min}$
 $5.51E-03 \text{ inch/sec}$

$\Phi_m = 1.17E-01 \text{ cm}^2/\text{min}$

Single Head Method (2) - GP2

Reservoir Cross-sectional area in cm²
(enter "35.22" for Combined and "2.16" for Inner reservoir): **35.22**

Enter water Head Height ("H" in cm): **5**

Enter the Borehole Radius ("a" in cm): **3**

Enter the soil texture-structure category (enter one of the below numbers): **3**

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropores, etc

Steady State Rate of Water Level Change ("R" in cm/min): **2.0000**

Res Type 35.22
H 5
a 3
H/a 1.66667
a* 0.12
C0.01 0.80949
C0.04 0.84206
C0.12 0.80315
C0.36 0.80315
C 0.80315
R 2.000
Q 1.174
pi 3.1415

$\alpha^* = 0.12 \text{ cm}^{-1}$

C = 0.803154
Q = 1.174

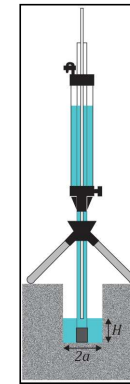
$K_{fs} = 2.14E-03 \text{ cm/sec}$
 $1.28E-01 \text{ cm/min}$
 $2.14E-05 \text{ m/sec}$
 $5.04E-02 \text{ inch/min}$
 $8.41E-04 \text{ inch/sec}$

$\Phi_m = 1.78E-02 \text{ cm}^2/\text{min}$

Average

$K_{fs} = 8.06E-03 \text{ cm/sec}$
 $4.84E-01 \text{ cm/min}$
 $8.06E-05 \text{ m/s}$
 $1.90E-01 \text{ inch/min}$
 $3.17E-03 \text{ inch/sec}$

$\Phi_m = 6.72E-02 \text{ cm}^2/\text{min}$



Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and a^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(\text{cm}^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_2/a}{2.081 + 0.121(H_2/a)} \right)^{0.672}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)} \right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)} \right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)} \right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)} \right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)} \right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)} \right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm²/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm), H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi \left(\frac{H_1}{a} \right)}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	$\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)a^* + 2\pi H_1}$
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1 H_2 (H_2 - H_1) + a^2 (H_1 C_2 - H_2 C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1 H_2 (H_2 - H_1) + a^2 (H_1 C_2 - H_2 C_1))}$ $K_{fs} = G_2 Q_2 - G_1 Q_1$ $G_3 = \frac{(2H_1^2 + a^2 C_1)C_1}{2\pi(2H_1 H_2 (H_2 - H_1) + a^2 (H_1 C_2 - H_2 C_1))}$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$G_4 = \frac{(2H_1^2 + a^2 C_1)C_2}{2\pi(2H_1 H_2 (H_2 - H_1) + a^2 (H_1 C_2 - H_2 C_1))}$ $\Phi_m = G_3 Q_1 - G_4 Q_2$



Infiltration Location	Soil Type	Soil Type Class	Test Depth (m)	Test	Head (mm)	Hydraulic Conductivity K (m/s)	Infiltration Rate (mm/hr)	Percolation Rate T (min/cm)
GP1	Fine to medium-grained sand, trace silt	3	1.75	Dual	50	1.40E-04	171.04	3.52
GP2	Fine sand and silt	3	1.75	Dual	50	2.14E-05	104.05	5.79



Appendix G

Thornthwaite Water Balance

Climate Normals 1981-2010 Station Data

Metadata including Station Name, Province or Territory, Latitude, Longitude, Elevation, Climate ID, WMO ID, TC ID

STATION_ID PROVINCE LATITUDE LONGITUDE ELEVATION CLIMATE_ID WMO_ID TC_ID

BARRIE WI ON 44°22'33.(79°41'23.(221.0 m 6110557

Legend

A = WMO "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation)

B = At least 25 years

C = At least 20 years

D = At least 15 years

1981 to 2010 Canadian Climate Normals station data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Temperature														
Daily Average	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	6.9	C
Standard Dev	3.4	2.6	2.2	1.6	1.9	1.4	1.3	1.5	1.4	1.2	1.6	3	1.4	C
Daily Maximum	-2.9	-1.5	3.2	11	18.1	23.6	26.3	25.1	20.7	13.5	6.5	0.4	12	C
Daily Minimum	-12.4	-11.7	-7.4	0.2	6.5	12.3	15.3	14.3	10	3.9	-1	-7.3	1.9	C
Extreme Minimum	14	14	24	30.5	35	35	36	36.5	34.5	30	21.5	19.5		
Date (yyyy-mm-dd)	1995/14	1984/23	1998/30	2002/16	2006/30	1994/17	Jun-88	Jan-06	Sep-02	May-05	May-78	Mar-82		
Extreme Maximum	-35	-33	-30.5	-15	-4	1	6	0	-1.5	-6.5	-19.5	-33		
Date (yyyy-mm-dd)	Apr-81	1979/18	Aug-84	Jul-03	Jul-06	Sep-80	Aug-84	2004/22	1993/30	1988/31	1989/29	2004/20		
Precipitation														
Rainfall (mm)	16.6	16	29.2	56.6	82.3	84.8	77.2	89.9	94	75.2	66	22.2	709.9	C
Snowfall (cm)	65.9	45.9	29	5.7	0.1	0	0	0	0	2.3	22.8	51.4	223	C
Precipitation	82.5	61.8	58.1	62.2	82.4	84.8	77.2	89.9	94	77.5	88.9	73.6	932.9	C
Average Snow	16	17	8	1	0	0	0	0	0	0	2	9	4	D
Median Snow	17	17	8	0	0	0	0	0	0	0	1	8	4	D
Snow Depth	17	15	1	0	0	0	0	0	0	0	4	11	4	C
Extreme Depth	27	35	43	40	54.4	96	75	79	80	48.8	50	28.6		
Date (yyyy-mm-dd)	May-98	1997/21	Nov-90	1995/21	2004/23	Feb-95	1980/20	1995/31	Nov-86	May-95	Feb-99	1979/24		
Extreme Depth	65	32.4	22	17	2	0	0	0	0	12	27	44		
Date (yyyy-mm-dd)	Sep-78	1984/29	Oct-84	Apr-79	Jul-89	Jan-78	Jan-78	Jan-78	Jan-77	1997/26	2000/21	Oct-95		
Extreme Depth	65	35	43	40	54.4	96	75	79	80	48.8	52	44		
Date (yyyy-mm-dd)	Sep-78	1997/21	Nov-90	1995/21	2004/23	Feb-95	1980/20	1995/31	Nov-86	May-95	Feb-99	Oct-95		
Extreme Snow	57	59	50	21	0	0	0	0	0	8	29	54		
Date (yyyy-mm-dd)	Jul-81	Sep-01	May-03	Jan-87	Jan-81	Jan-81	Jan-81	Jan-81	Jan-81	1997/27	1995/28	Nov-95		
Days with Maximum Temperature														
<= 0 °C	21	16.6	10	0.92	0	0	0	0	0	0	3.5	14.6	66.6	C
> 0 °C	10	11.6	21	29.1	31	30	31	31	30	31	26.5	16.4	298.6	C
> 10 °C	0.36	0.48	3.8	14.9	28.2	29.9	31	31	29.5	21.8	6.4	1	198.2	C
> 20 °C	0	0	0.54	3.1	10.6	22.6	29.1	27.3	15.6	3.6	0.08	0	112.5	C
> 30 °C	0	0	0	0.04	0.4	2.5	4.4	2.4	0.63	0	0	0	10.4	C
> 35 °C	0	0	0	0	0	0	0.04	0.04	0	0	0	0	0.08	C
Days with Minimum Temperature														
> 0 °C	0.84	1	2.9	13.9	29	30	31	31	29.8	24.8	10.6	3	207.8	C
<= 2 °C	30.9	28.1	30.2	21.7	5.2	0.12	0	0.09	0.96	12.3	23.7	29.9	183	C
<= 0 °C	30.2	27.2	28.1	16.1	2	0	0	0.04	0.21	6.3	19.4	28	157.5	C
< -2 °C	27	24.6	22.9	7.1	0.12	0	0	0	0	0.92	10.6	22.6	115.8	C
< -10 °C	17	15.6	9.1	0.52	0	0	0	0	0	0	0.79	9.6	52.6	C
< -20 °C	6	3.9	0.96	0	0	0	0	0	0	0	0	1.3	12.2	C
< -30 °C	0.56	0.13	0.04	0	0	0	0	0	0	0	0	0.04	0.77	C
Days with Rainfall														
>= 0.2 mm	2.8	3	5.4	11.3	12.9	11.4	11.1	11.8	13.3	15.5	11.3	4.6	114.4	C
>= 5 mm	1	1.2	2.2	3.9	5.8	4.4	4.7	5.1	5.4	5.5	4.6	1.9	45.5	C
>= 10 mm	0.64	0.58	0.88	1.6	2.7	2.9	2.5	3.4	3	1.9	2.2	0.46	22.8	C
>= 25 mm	0.04	0.08	0.04	0.27	0.36	0.73	0.62	0.81	0.73	0.15	0.28	0.04	4.2	C
Days With Snowfall														
>= 0.2 cm	12.4	10	6.8	1.5	0.04	0	0	0	0	0.54	4.5	9.6	45.5	C
>= 5 cm	5	3.4	2.2	0.35	0	0	0	0	0	0.19	1.6	3.8	16.5	C
>= 10 cm	1.8	1	0.64	0.12	0	0	0	0	0	0.04	0.46	1.6	5.7	C
>= 25 cm	0.08	0.15	0	0.04	0	0	0	0	0	0	0.08	0.08	0.43	C
Days with Precipitation														
>= 0.2 mm	14.9	12.3	11.6	12.2	12.9	11.4	11.1	11.8	13.3	15.6	15.4	13.8	156.1	C
>= 5 mm	6	4.5	4.3	4.2	5.8	4.4	4.7	5.1	5.4	5.7	6.2	5.8	62	C
>= 10 mm	2.4	1.8	1.6	1.7	2.7	2.9	2.5	3.4	3	2	2.7	2.1	28.9	C
>= 25 mm	0.12	0.23	0.04	0.31	0.36	0.73	0.62	0.81	0.73	0.19	0.44	0.13	4.7	C
Degree Days														
Above 24 °	0	0	0	0	0.1	2.5	8.3	4.2	0.4	0	0	0	15.5	C
Above 18 °	0	0	0	0.8	8	45.5	95.8	71.4	19.6	1	0	0	242	C
Above 15 °	0	0	0	3.4	25.6	103.1	180.5	149.2	56.1	5.1	0	0	523	C
Above 10 °	0	0	1.5	16.8	97.6	239.8	334.6	301.4	165.9	36.1	2.2	0.3	1196.3	C
Above 5 °C	0.4	0.5	10.1	66.1	227.7	389.2	489.6	456.3	310.6	126.9	26.1	3.9	2107.4	C
Above 0 °C	7.7	10.1	44.4	176.1	381.7	539.2	644.6	611.3	460.5	272.9	101.1	25.4	3274.9	C
Below 0 °C	245.7	194.9	110	7.9	0	0	0	0	0	0	21.7	132.5	712.8	C
Below 5 °C	393.4	326.4	230.8	47.9	1.1	0	0	0	0.1	9.1	96.6	266	1371.3	C
Below 10 °	548	466.9	377.1	148.6	25.9	0.6	0	0.1	5.4	73.2	222.8	417.4	2286.2	C
Below 15 °	703	608	530.7	285.3	108.9	14	0.9	2.8	45.6	197.2	370.6	572.1	3439.1	C
Below 18 °	796	692.6	623.7	372.6	184.3	46.3	9.1	18	99	286.2	460.6	665.1	4253.7	C

1981 to 2010 Canadian Climate Normals station data (Frost-Free)

Frost-Free: Code

Average Days: 07-May D

Average Days: 09-Oct D

Average Length of Days: 153 Days D

Probability: 10% 25% 33% 50% 66% 75% 90%

Date: 19-May 16-May 12-May 05-May 03-May 30-Apr 27-Apr

Probability: 10% 25% 33% 50% 66% 75% 90%

Date: 20-Sep 02-Oct 07-Oct 10-Oct 14-Oct 18-Oct 23-Oct

Probability: 10% 25% 33% 50% 66% 75% 90%

Days: 126 147 154 156 159 161 169

Barrie

THORNTHWAITE-TYPE MONTHLY WATER-BALANCE MODEL													
modified from Dingman 2001: ex. 7-13, Box 7-3 using ET model of Hamon (1963)													
Input Data				Computed Values				Surplus	455 mm/yr				
Location: Barrie				Lat. =	44.4 degree			SOILmax =		90 mm			
				0.77 rad									
Declination (deg)	-21.3	-13.3	-2.0	9.8	18.9	23.3	21.3	13.7	3.0	-9.0	-18.6	-23.3	
Declination (rad)	-0.37	-0.23	-0.03	0.17	0.33	0.41	0.37	0.24	0.05	-0.16	-0.32	-0.41	
DayLength (hr)*	9.0	10.2	11.7	13.3	14.6	15.3	15.0	13.8	12.4	10.8	9.4	8.7	
*For lat. > 66.5, replace #NUM! with 24 in summer; 0 in winter.													
MONTHLY WATER BALANCE DATA													
Temperatures in C, water-balance terms in mm.													
Month:	J	F	M	A	M	J	J	A	S	O	N	D	Year
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
P	83	62	58	62	82	85	77	90	94	78	89	74	933
T	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	
F	0.00	0.00	0.00	0.93	1.00	1.00	1.00	1.00	1.00	1.00	0.45	0.00	
RAIN	0	0	0	58	82	85	77	90	94	78	40	0	604
SNOW	83	62	58	4	0	0	0	0	0	0	49	74	329
PACK	183	244	302	20	0	0	0	0	0	0	27	100	
MELT	0	0	0	286	20	0	0	0	0	0	22	0	329
INPUT (W _m)	0	0	0	344	103	85	77	90	94	78	62	0	932
PET	0	0	0	40	68	100	116	100	69	40	23	0	557
W _m - PET	0	0	0	304	35	-15	-39	-11	25	38	39	0	
SOIL	150	150	150	90	90	76	49	44	69	90	90	90	
Δ SOIL	60	0	0	-60	0	-14	-27	-5	25	21	0	0	
ET	-60	0	0	40	68	99	104	95	69	40	23	0	478
SURP=W-ET- Δ SOIL	0	0	0	364	35	0	0	0	0	16	39	0	454
DEFIC=PET-ET	60	0	0	0	0	1	12	5	0	0	0	0	79

DETAILED WATER BALANCE CALCULATIONS
31 Patterson Road, Barrie, ON

1 Climate Information

Precipitation	933 mm/a
Actual Evapotranspiration	478 mm/a
Water Surplus	455 mm/a

2 Infiltration Rates

Table 2 Approach - Infiltration factors

Topography: Flat Land	0.3
Soil Type: Sandy Loam with Silt	0.3
Cover: Open Land	0.1
Total	0.7

Infiltration (0.7 x 455)	319 mm/a
Run-off (455-319)	137 mm/a

Table 3 Approach - Typical Recharge Rates

Coarse Sand and Gravel	>250	mm/a
Fine to medium sand	200-250	mm/a
Silty sand to sandy silt	150-200	mm/a
Silt	125-150	mm/a
Clayey Silt	100- 125	mm/a
Clay	<100	mm/a

Site development area is underlain predominantly by sand with silt

Based on the above, the recharge rate is typically	150-200	mm/a
--	---------	------

3 Pre-Development Property Statistics

	ha	m2
Paved Area	1.69	16,890
Roof Area	1.44	14,447
Landscape Area	1.27	12,653
Total	4.40	43,990

4 Post-Development Property Statistics

	ha	m2
Paved Area	1.61	16,063
Total Building Roof Area	1.64	16,406
Landscape Area	1.15	11,521
Total Land Area	4.40	43,990

5 Pre-Development Water Balance

Land Use		Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-off (m ³)
Impervious Areas	Paved Area	16,890	15,758	1,576	0	14,183
	Roof Area	14,447	13,479	1,348	0	12,131
Pervious Areas	Landscape Area	12,653	11,805	6,048	4,030	1,727
		43,990	41,043	8,972	4,030	28,041
Assuming no infiltration occurring in paved and roof areas, and 10% of precipitation to be evaporated from paved and roof areas.						

6 Post-Development Water Balance

Land Use		Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-off (m ³)
Impervious Areas	Paved Area	16,063	14,987	1,499	0	13,488
	Roof Area	16,406	15,307	1,531	0	13,776
Pervious Areas	Landscape Area	11,521	10,749	5,507	3,669	1,573
		43,990	41,043	8,536	3,669	28,837

7 Comparison of Pre- and Post -Development

	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-off (m ³)
Pre-Development	41,043	8,972	4,030	28,041
Post-Development	41,043	8,536	3,669	28,837
Change in Volume			- 361	796
Change in %			- 9	3

8 Requirement for Infiltration of Roof Run-off

Volume of Pre-Development Infiltration (m ³ /annum)	4,030
Volume of Post-Development Infiltration (m ³ /annum)	3,669
Deficit from Pre to Post Development Infiltration (m ³ /annum)	- 361
Percentage of Roof Runoff required to match the pre-development infiltration (%)	3