74 Berkeley Street, Toronto, ON M5A 2W7
Tel: 647-795-8153 | www.pecg.ca

Hydrogeological Investigation

0 Nicholas Street, Alton Village, Town of Caledon, ON

Palmer Project #

1904308

Prepared For

Goodman, Solomon & Gold

January 24, 2022

74 Berkeley Street, Toronto, ON M5A 2W7
Tel: 647-795-8153 | www.pecg.ca

January 24, 2022

David Goodman
Goodman, Solomon & Gold
1500-439 University Avenue, Toronto ON
M3G 1Y8

Dear David Goodman:

Re: Hydrogeological Investigation

Project #: 1904308

Palmer Environmental Consulting Group (Palmer) is pleased to submit the attached report describing the results of our hydrogeological investigation for the property at 0 Nicholas Street, Village of Alton (hereafter referred to as the "site") in the Town of Caledon, Ontario. It is understood that the proposed residential subdivision consists of 15 single residential lots with lot areas ranging from 0.14 ha to 0.20 ha. The residential subdivision will have private septic systems and municipal water service.

The focus of the hydrogeological investigation was to define groundwater conditions and soil permeability to assess stormwater infiltration potential for Low Impact Development (LID) design, soil percolation rates, groundwater levels, groundwater supported vs. surface water supported natural features, and to complete a nitrate loading assessment for individual septic servicing.

The overburden on-site consists of ice-contact stratified deposits underlain by the Halton Till. However, stratigraphy/hydrostratigraphy is highly variable on a local scale. Measured groundwater elevations on June 23, 2021 ranged from 401.97 mASL to 415.44 mASL, or 1.97 mbgs to 3.63 mbgs. Shallow horizontal groundwater flow is directed east-northeastwards reflecting the influences of local surface water features and topography.

Alton Village is serviced by a municipal water supply drawn from groundwater, but residents previously relied on private wells. Based on the review of the MECP WWR database, 99 WWRs are on record for land within 500 m of the project boundary. Of the 99 WWRs, 54 are for domestic wells, 10 are for monitoring wells/test holes, three are for commercial use, two are not used, two are associated with the public water supply system, 23 are abandonment records (all types of wells) and five are for wells of unknown use. The site is situated within the Credit Valley Source Protection Area and is subject to the CTC Source Protection Plan (SPP). A small area in the eastern portion of the site is within a Wellhead Protection Area (WHPA)-B (Score = 6). The remainder of the site is within a WHPA-C (Score = 6 except in the northern portion of the site were Score = 8). The site is part of a Significant Groundwater Recharge Area (Score = 6) and is also the location of a Highly Vulnerable Aquifer (Score = 6). The site and its vicinity are located within a Significant DNAPL (dense non-aqueous phase liquids) Threat Area. It is also required that the pre-development infiltration is maintained on-site post-development, to the extent practical.

Both shallow groundwater samples collected during this investigation exceeded the ODWSOG Aesthetic Objectives (AOs) for colour and turbidity and the ODWSOG Operational Guideline (OG) for hardness. Sample BH6 exceeded the ODWQS for sodium but not its ODWSOG AO. Sample BH7 exceeded the ODWSOG AO for manganese. With the possible exception of sodium at BH6, these findings are attributed to background conditions.

Based on the results of in situ hydraulic conductivity testing, the calculated hydraulic conductivity of the shallow soils ranges from $2.0x10^{-7}$ m/s to $6.4x10^{-6}$ m/s with a geometric mean of $2.0x10^{-6}$ m/s. Based on this testing and grain size distribution data obtained during the geotechnical investigation, the shallow soils appear to be suitable to allow for the construction of in-ground leaching beds. The percolation rate of the tested soils ranged from 30.1 to 76.0 mm/hr (T-time of 19.9 to 7.9 min/cm) with a mean of 51.9 mm/hr (T-time of 11.6 min/cm). When applying a default safety factor of 2.5, the geometric mean infiltration rate is 20.7 mm/hr (T-time of 29.9 min/cm). It is recommended that this rate be used for preliminary design purposes until future site-specific percolation rate testing is completed.

Based on MECP Procedure D-5-4 and Guideline B7 (required by Credit Valley Conservation), a background concentration of nitrate of 1.56 mg/L (this is based on two of four wells and may be affected by a nearby large-scale septic system) and if the development consists of 167.3 m^2/1,800 sq ft single-storey homes, the maximum allowable concentration of nitrate in groundwater at the site boundary is 3.67 mg/L. The septic systems will require tertiary treatment system to reduce the concentration of nitrate in the septic effluent to 8.05 mg/L.

A Thornthwaite and Mather water balance was completed for the site. It is estimated that approximately 70% (240 mm/year) of the surplus infiltrates, and the remaining 30% (112.8 mm/year) runs off. Based on a site area of 5.91 ha, it is estimated that 14,181.4 m^3/year infiltrates and 6,077.8 m^3/year runs off. If the development consists of 167.3 m^2/1,800 sq ft homes, the proposed development will increase the area of impermeable surfaces, currently none, to approximately 0.45 ha. It is estimated that, post-development, 12,705.7 m^3/year (215 mm/year) of precipitation will infiltrate. Through the use of Low Impact Development (LID) measures, such as infiltration galleries which capture 1,475.7 m^3 of precipitation per year, the post-development infiltration may be increased to 14,181.4 m^3/year to maintain pre-development conditions.

A simplistic dewatering rate estimate indicates that a groundwater level lowering of 1.7 m in the southeastern portion of the site (perimeter foundation trench only, no basements unless the grade is raised due to high water table), the total dewatering rate is estimated to be approximately 21,130 L/day. For a groundwater level lowering of 1 m elsewhere (square basement excavation), the total dewatering rate is estimated to be approximately 15,600 L/day. The radius of influence is estimated at 157 m. One private well may be located within this radius, which will be confirmed during later design stages and mitigation proposed as necessary.

Thank you for the opportunity to work with your team on this project. Please let us know if you have questions or comments on this submission.

Yours truly,

Jason Cole, M.Sc., P.Geo
Vice President, Principal Hydrogeologist

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1. Introduction

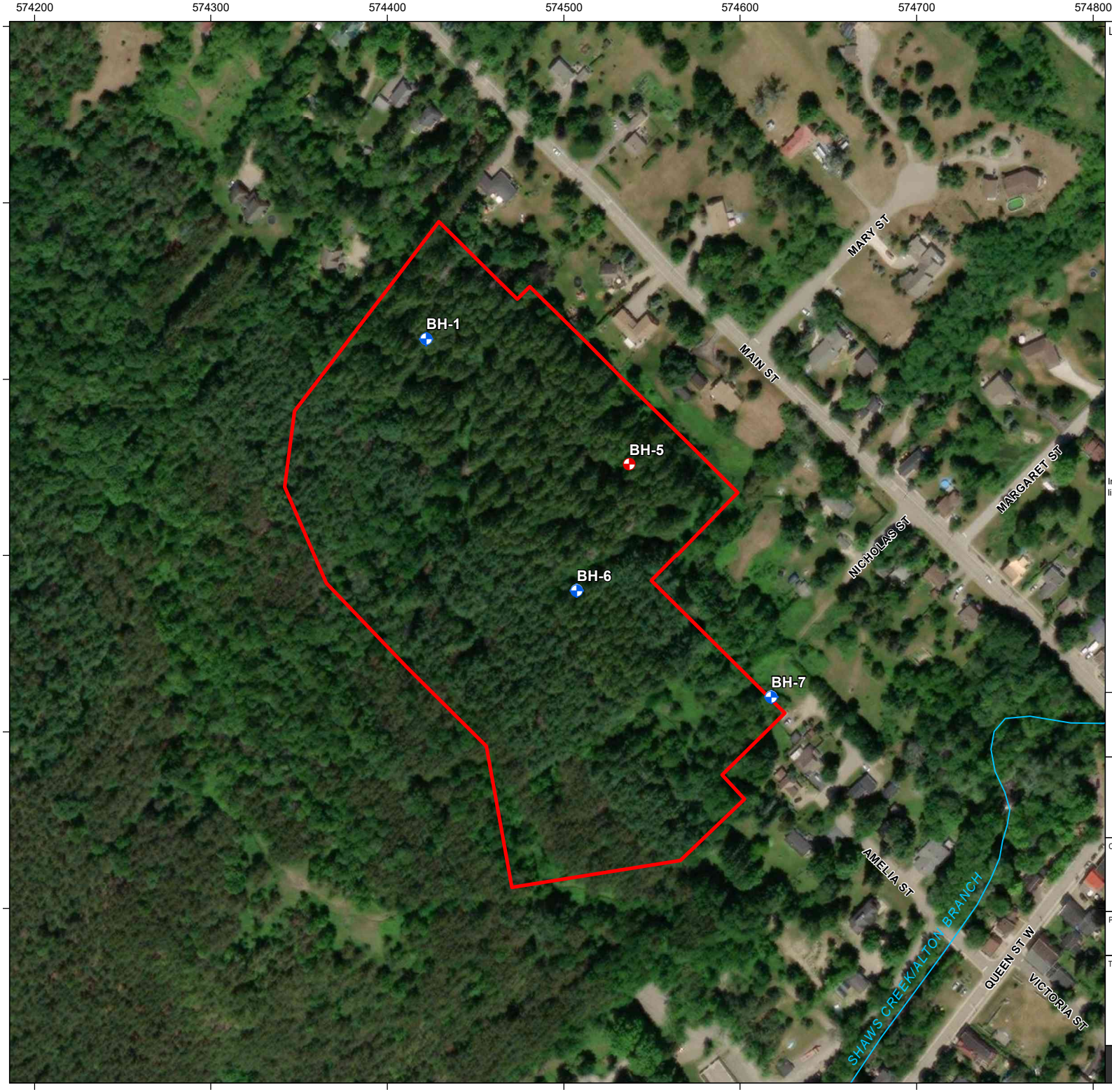
Palmer Environmental Consulting Group (Palmer) is pleased to submit the attached report describing the results of our hydrogeological investigation for the property at 0 Nicholas Street, Village of Alton (hereafter referred to as the "site") (**Figure 1**) in the Town of Caledon, Ontario, completed as part of development approvals. Approvals are required from the Town of Caledon, Peel Region and Credit Valley Conservation (CVC).

At this stage, it is understood that the proposed residential subdivision will consist of 15 single residential lots with lot areas ranging from 0.14 ha to 0.20 ha (**Appendix A**), a conservation easement, road allowance(s), and will have private septic systems and municipal water service. The focus of this hydrogeological investigation was to define groundwater conditions and soil permeability to assess stormwater infiltration potential for Low Impact Development (LID) design, soil percolation rates, groundwater levels, groundwater supported vs. surface water supported natural features, and to complete a nitrate loading assessment for individual septic servicing.

The property is currently a wooded area approximately 5.91 ha in area featuring a walking trail. Surrounding land uses are residential (north, east, south) and woodland area (west). Grade slopes downwards from a topographic high located along the western property boundary towards the eastern property boundary with total relief of approximately 25 m. There are no structures or surface water features on-site. A Provincially Significant Wetland (Mill Pond) and the Credit River/Shaw Creek – Alton River Branch are located approximately 175 m southeast and south, respectively, of the site. The surface waterbodies are regulated by Credit Valley Conservation. There are two (2) active Permits to Take Water (PTTWs) for the municipal water supply within 1 km of the site. This site is located within a Wellhead Protection Area-C (WHPA-C).

In addition, this study was carried out to assist the preparation of the engineering design and EIS report being completed for the project. To characterize the hydrogeological conditions at the site, the following scope of work was conducted by Palmer:

- Literature review of background geology and hydrogeology data from published maps and reports, the Ministry of Environment (MOE) water well database, and previous environmental studies in the area;
- Site visit to measure water levels, develop the wells and complete hydraulic testing of wells at four (4) existing monitoring wells;
- Collect groundwater samples from two (2) monitoring wells;
- Field screening to identify active wells and potential risks to water supply wells from site development;
- Long-term monitoring of hourly groundwater measurements at one (1) monitoring well (ongoing);
- Assessment of the geological and hydrogeological conditions at the site to determine hydraulic conductivity, stormwater infiltration potential, soil percolation rates for LID design, and groundwater chemistry;
- Completion of nitrate loading calculations for the proposed development;
- Completion of a water balance assessment for the site under pre- and post-development; and
- Completion of a Hydrogeological Investigation Report.



LEGEND:

- Borehole Location
- Monitoring Well Location
- Watercourse
- Subject Site

Imagery (2018) provided by Esri basemap service. Contains information licensed under the Open Government Licence – Ontario

0 50 100

metres

N

PROJECT NO.	1904308	REVISION:	1-1
DATE:	Jun 22, 2021	SCALE:	1:3000
DRAWN:	CV	DATUM:	NAD 1983
CHECKED:	SH	PROJECTION:	UTM zone 17

CLIENT: The Biglieri Group

PREPARED BY: Palmer

PROJECT: Alton Village

TITLE:

Site Location

FIGURE 1

Document Path: G:\Shared drives\Projects 2019\19043 - The Biglieri Group\1904308 - Alton Village\Mapping\Figures\5_ArcGIS\HydroG\1904308_1-1_Site Location.mxd

2. Regional Conditions

2.1 Climate and Precipitation

Data for the duration of the groundwater level monitoring period (May 2021 to April 2022) will be compared against 1981 – 2010 Climate Normals for the Orangeville MOE station (ID #6155790, the closest station), upon completion of monitoring, to determine if the monitoring period occurring during a representative or average meteorological year.

2.2 Geological and Hydrogeological Setting

2.2.1 Physiography

This site is located within two physiographic regions: the majority of the site is located within the Hillsburgh Sandhills (locally, a kame moraine), and a small area in the southern portion of the site is located within the Guelph Drumlin Field physiographic region (**Figure 2**) (Chapman and Putnam, 1984).

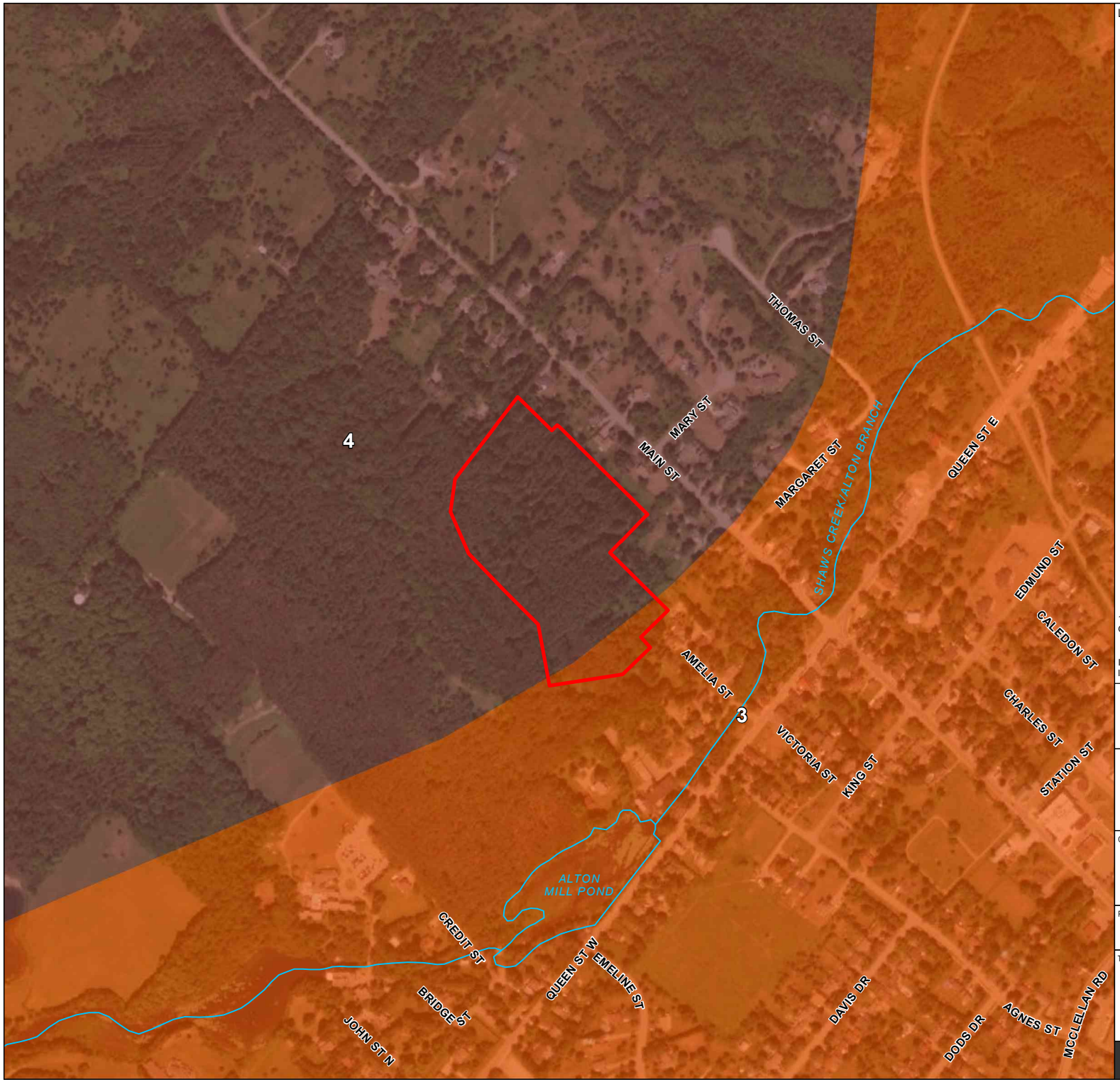
The Hillsburgh Sandhills are characterized by rough topography, sandy materials, knobby hills, and a flat-bottomed swampy valley running through the moraine. These sandhills contain fine sands which is not typical of kames. The Guelph Drumlin Field, including parts of the regional municipalities of Hamilton-Wentworth, Waterloo, Halton, and part of Wellington country is characterized by approximately 300 drumlins of all sizes. These drumlins are composed of loamy and calcareous till with fragments of red shale. This unit is defined by stony till drumlins and deep gravel terraces. Locally, this unit is present as a spillway.

2.2.2 Overburden Geology

Based on Ontario Geological Survey (OGS) surficial geology mapping, this site is underlain by ice-contact stratified deposits containing layers of sand and gravel; minor silt; and silt and clay (**Figure 3**). According to ORMGP, 2021, this sequence is underlain by the Halton Till/equivalent till at depths of 8 m in the western portion of the site and increasingly less towards the east.

The Halton Till represents the latest glacial ice advance of the Lake Ontario ice lobe approximately 13,000 years ago (Eyles, 2002). It is an extensive diamicton with varying texture ranging from sandy silt till to silty clay till interbedded with silt, clay, sand and gravel (Earthfx, 2013). In areas where ice has overridden glaciolacustrine deposits, the till tends to be more clay rich. The thickness of the unit is typically between 10 to 20 m; however, it can reach up to 40 m. Locally, its thickness is estimated at 5 to 7 m (ORMGP, 2021). Regionally, this unit acts as a confining aquitard, and plays a significant role in inhibiting groundwater recharge to the underlying Oak Ridges Moraine Aquifer Complex (ORMAC)/equivalent aquifer (Earthfx, 2013). The thickness of the ORMAC/equivalent aquifer (e.g., spillway) is estimated at approximately 8 m (ORMGP, 2021).

The Newmarket Till was deposited, initially into standing water, by a Late Wisconsinan advance of the Laurentide Ice Sheet. It is laterally extensive within the Greater Toronto Area. The Newmarket Till has a distinct and consistent lithology (Sharpe, Barnett, Russel, Brennand, & Gorrell, 1999). Locally, the thickness of the till can exceed 100 m; however, it is typically between approximately 20 – 30 m thick (Earthfx, 2013). Locally, it is estimated at approximately 7 to 8 m in thickness (ORMGP, 2021). This till is reported to include thin interbeds of sands and silts, boulder pavements, fractures, and joints, as well as discontinuous sand seams on the order of 1 to 2 m in thickness. Infrequently, the till may also contain



LEGEND:

- Watercourse
- Subject Site

Physiographic Landforms[1]

- 4 Kame Moraines
- 3 Spillways

1. Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 228.

Imagery (2018) provided by Esri basemap service. Contains information licensed under the Open Government Licence – Ontario

0 50 100
metres

N

PROJECT NO.	1904308	REVISION:	1-1
DATE:	Jun 22, 2021	SCALE:	1:7000
DRAWN:	CV	DATUM:	NAD 1983
CHECKED:	SH	PROJECTION:	UTM zone 17

CLIENT: The Biglieri Group

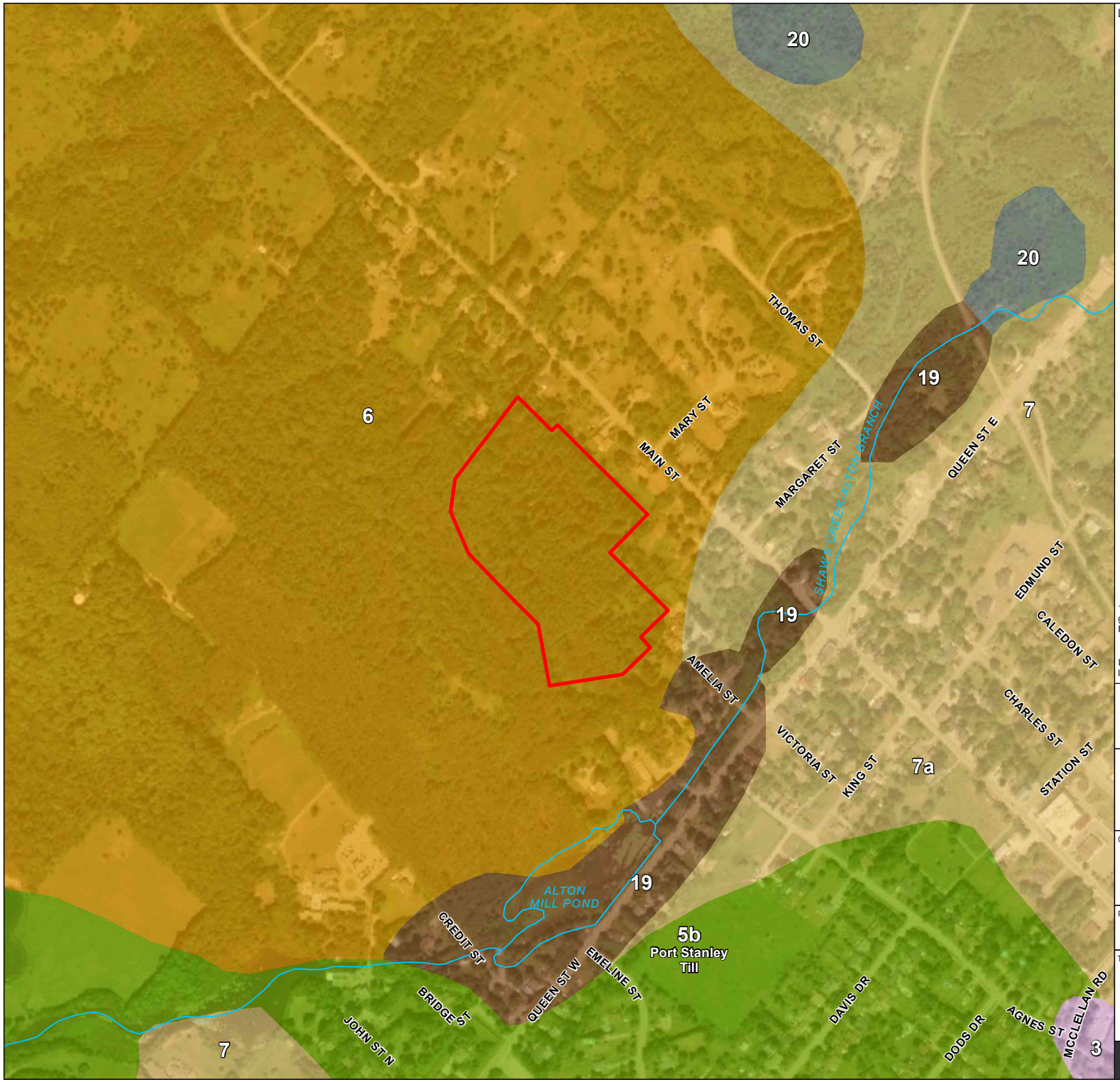
PREPARED BY: Palmer

PROJECT: Alton Village

TITLE: **Physiographic Landforms**

FIGURE 2

Document Path: G:\Shared drives\Projects 2019\19043 - The Biglieri Group\1904308 - Alton Village\Mapping\Figures\5_ArcGIS\Hydro\G\1904308_2-1_Physiographic Landforms.mxd



LEGEND:

Watercourse

Subject Site

Surficial Geology[1]

PHANEROZOIC

CENOZOIC

QUATERNARY

RECENT

20 **Organic Deposits:** peat, muck, marl

19 **Modern alluvial deposits:** clay, silt, sand, gravel, may contain organic remains

PLEISTOCENE

7 **Glaciofluvial deposits:** river deposits and delta topset facies
7a Sandy deposits

6 **Ice-contact stratified deposits:** sand and gravel, minor silt, clay and till

5b **Till:**
5b Stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain

PALEOZOIC

3 **Paleozoic bedrock**

1. Ontario Geological Survey 2010 (Mapped at 1:50,000).Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release- Data 128 - Revised

0 50 100
metres

N

PROJECT NO.	1904308	REVISION:	1-1
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DRAWN:	CV	DATUM:	NAD 1983
CHECKED:	SH	PROJECTION:	UTM zone 17

CLIENT: The Biglieri Group

PREPARED BY: Palmer

PROJECT: Alton Village

TITLE: **Surficial Geology**

FIGURE 3

Document Path: G:\Shared drives\Projects 2019\19043 - The Biglieri Group\1904308 - Alton Village\Mapping\Figures\5_ArcGIS\Hydro\G\1904308_3-1_Surficial Geology.mxd

rhythmites or isolated clay laminations. It should be noted that this overall sequence is less applicable on a regional scale than is more commonly the case due to the presence of glacial spillways, bedrock valleys and, to the east, the Niagara Escarpment.

2.2.3 Bedrock Geology

Regional bedrock underlying the site consists of two Lower Silurian aged units, the Clinton-Cataract Group, and the Amabel Formation (Armstrong and Dodge, 2007) (**Figure 4**). The Clinton-Cataract group consists of shale, sandstone and carbonate units that occur along the base of the Niagara Escarpment. The Amabel formation is characterized by white to blue-grey, thick to massive-bedded dolostone. Bedrock was not encountered during the geotechnical drilling program by Sirati & Partners Consultants Limited. Based on the Ministry of Environment (MOE) WWR database information (**Appendix B**), the depth to bedrock within 500 m of the site ranges from 1.8 to 45.7 m (geometric mean 9.3 m). The most commonly encountered type of bedrock was limestone, frequently underlain by shale or sandstone, although shale was the first type of bedrock encountered at nine locations.

2.2.4 Hydrostratigraphy

Hydrostratigraphic units can be subdivided into two distinct groups based on their capacity to permit groundwater movement, an aquifer or an aquitard. An aquifer is classically defined as a layer of soil permeable enough to permit a usable supply of water to be extracted. Conversely, an aquitard is a layer of soil that inhibits groundwater movement due to its low permeability.

As noted previously (Section 2.2.2), the stratigraphy/hydrostratigraphy is highly variable on a local scale with one, two or no coarse-textured units present above bedrock and with up to three (or no) fine-textured units present above bedrock. The upper contact of bedrock/overburden thickness is also highly variable with valleys incised into bedrock in the vicinity of the site/to the east and, separately, to the northwest. As a result, outside the major valley features, any consistent flow regime in the overburden and, at least locally, shallow bedrock, is expected to be localized in nature. However, this is not significant with respect to the proposed development due to the existence and intended use of a municipal water service.

2.3 MECP Well Records

Alton Village is serviced by a municipal water supply drawn from groundwater, but residents previously relied on private wells. Based on the review of the MECP Water Well Record (WWR) database, 99 WWRs are on record for land within 500 m of the project boundary. The locations of wells are shown on **Figure 5**. Of the 99 WWRs, 54 are for domestic wells, 10 are for monitoring wells/test holes, three are for commercial use, two are not used, two are associated with the public water supply system, 23 are abandonment records (all types of wells) and five are for wells of unknown use. **Appendix B** contains a summary table of the WWRs.

Due to COVID-related issues, a drive-by well survey was undertaken in the vicinity of the site on June 13, 2021 to assess if any private wells may remain. An apparent concrete well tile was observed in front of 19969 Main Street, located near the northeast corner of the site on the east side of Main Street. This may correspond to either WWR 4900901 or WWR 4900903 (**Figure 5**) as both wells are located in the vicinity of 19969 Main Street and both WWRs are for tiled dug wells that were deepened by drilling inside the concrete casing. The current status of the apparent well is unknown.

A second possible dug well was inferred as potential present at 29 Amelia Street, south of the southeastern corner of the site, where a wooden structure approximately 1 m in diameter was observed at the end of the driveway. No WWRs correlate with this location.

LEGEND:

Watercourse

Subject Site

Paleozoic Bedrock Geology[1]

Lower Silurian

19 Amabel: *dolostone; thick-bedded, crinoidal, locally biohermal*

17 Clinton-Cataract Group: *shale, sandstone, dolostone, limestone units*

1. Armstrong, D.K. and Dodge, J.E.P. Paleozoic Geology Map of Southern Ontario; Ontario Geological Survey, Miscellaneous Release --Data 219

0 50 100
metres

N

PROJECT NO.	1904308	REVISION:	1-1
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DRAWN:	CV	DATUM:	NAD 1983
CHECKED:	SH	PROJECTION:	UTM zone 17

CLIENT: The Biglieri Group

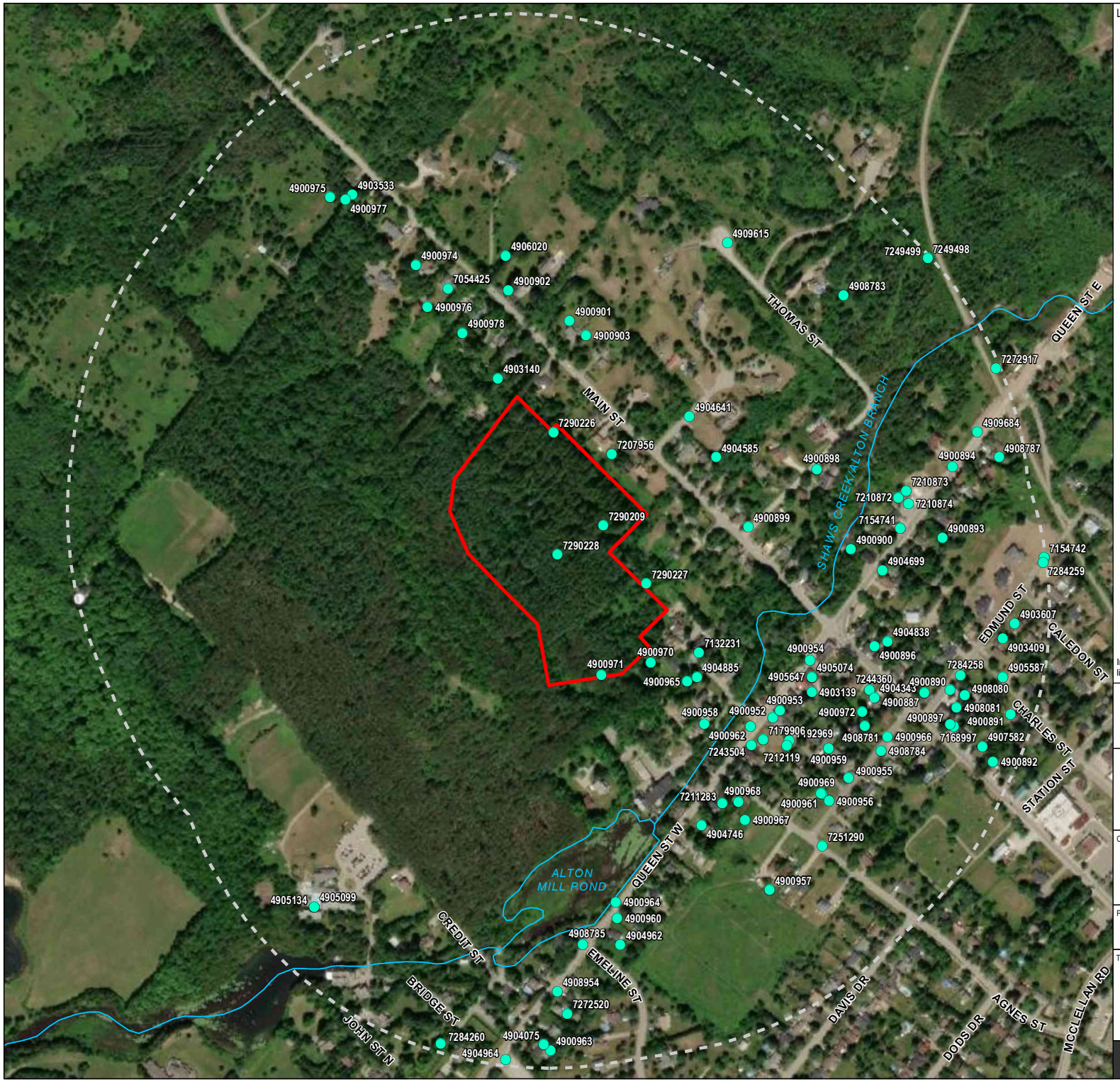
PREPARED BY: Palmer

PROJECT: Alton Village

TITLE: **Bedrock Geology**

FIGURE 4

Document Path: G:\Shared drives\Projects 2019\19043 - The Biglieri Group\1904308 - Alton Village\Mapping\Figures\5_ArcGIS\HydroG\1904308_4-1_Bedrock Geology.mxd



LEGEND:

- MECP Water Wells within 500m
- Watercourse
- 500m Site Buffer
- Subject Site

0 50 100
metres

N

PROJECT NO.	1904308	REVISION:	1-1
DATE:	Jul 20, 2021	SCALE:	1:7000
DRAWN:	CV	DATUM:	NAD 1983
CHECKED:	SH	PROJECTION:	UTM zone 17

CLIENT: The Biglieri Group

PREPARED BY: Palmer

PROJECT: Alton Village

TITLE:

MECP Water Wells within 500m of Site

FIGURE 5

Document Path: G:\Shared drives\Projects 2019\19043 - The Biglieri Group\1904308 - Alton Village\Mapping\Figures\5_ArcGIS\HydroG\1904308_5-1_MECP Water Wells.mxd

3. Site-Specific Conditions

3.1 Borehole Drilling Program

As part of the geotechnical investigation of the site (Sirati & Partners Consultants Limited [SPCL], 2017), SPCL drilled eight (8) boreholes on the site on June 06 and 07, 2017, four (4) of which were completed as monitoring wells. Monitoring well (MW) locations are illustrated on **Figure 1** (borehole locations are not included as they were not surveyed in at the time of drilling and the reader is referred to the geotechnical report for further information on these boreholes). The boreholes were drilled using hollow stem continuous flight augers and split spoon samplers. The boreholes were drilled to depths ranging from 6.4 to 12.7 mbgs. Monitoring wells were installed in boreholes BH1 and BH5 through BH7. Well construction details are provided in **Table 1**, below, and on the monitoring well logs in **Appendix C1**.

Table 1. Borehole and Monitoring Well Installation Details

BH/MW ID	Date Installed	Grade Elevation (mASL)	Total Depth (mbgs)	Stick Up (m)	Screened Interval (mbgs)	Screened Geology
MW1	Jun. 06, 2017	418.91	6.4	0.73	2.4 – 6.4	sandy silt
BH2	Jun. 07, 2017	-	7.6	-	-	-
BH3	Jun. 05, 2017	-	8.2	-	-	-
BH4	Jun. 06, 2017	-	9.7	-	-	-
MW5	Jun. 07, 2017	Weak signal (tree cover)	7.6	0.67	4.6 – 7.6	sandy silt till, sand and gravel
MW6	Jun. 06, 2017	415.85	10.4	0.72	7.4 – 10.4	sandy silt
MW7	Jun. 07, 2017	403.93	12.7	0.585	9.7 – 12.7	silty clay
BH8	Jun. 07, 2017	-	9.7	-	-	-

3.2 Local Stratigraphy

Based on the results of drilling completed onsite during Sirati & Partners Consultants Limited's geotechnical investigation (SPCL, 2017), shallow soils were found to be cohesionless soils of sand, sandy silt to silty sands, silt and sand and gravel in BH1 through BH5 and BH8. In BH4 and BH6, the cohesionless soils are underlain by glacial till deposits comprising of sandy silt to silt sand soils. A stiffer and more cohesive silt to clay sequence was found in BH7 underlying the sandy silt to silt sand soils.

As discussed in Section 2.2.2, OGS mapping indicates the site is underlain by Ice-contact stratified deposits containing layers of sand and gravel; minor silt; and silt and clay. Borehole drilling results indicated that much of the site is underlain by ice stratified layers containing cohesionless soils of sand, sandy silt to silty sand, silt, and sand and gravel. Grain size distribution analysis of four (4) samples (BH1, BH2, BH3, BH7) were conducted and the results have been provided in **Appendix C.2**. The percentage ranges of the four main soil groups are 0 – 9% for gravel, 57 – 81% for sand, 7 – 30% for silt and 8 – 13% for clay

Site stratigraphy is summarized as follows:

Topsoil and Fill Material.

A 220 mm to 330 mm thick surficial layer of topsoil was found at all borehole locations. Fill material was encountered at all borehole locations except for BH6. The fill ranges from 0.8 m to 2.3 m and consists of mainly sand and silty sand with trace clay and topsoil.

Cohesionless Silty and Sandy Deposits

The native soil underlying the fill material in all boreholes consists of cohesionless material of sand, sandy silt to silty sand, silt and some sand and gravel. This layer was not fully penetrated in BH1, BH5 and BH8.

Sandy Silt to Silty Sand Till

The silty and sandy deposits in BH6 was underlain by glacial till deposits comprising of sandy silt to silt sand soils. The layer was observed to extend from 6.1 m to the bottom of the borehole. The sand was found to be in a loose to dense state and was not fully penetrated. This layer was also observed at depth in BH4.

Clayey Silt to Silt Clay Till

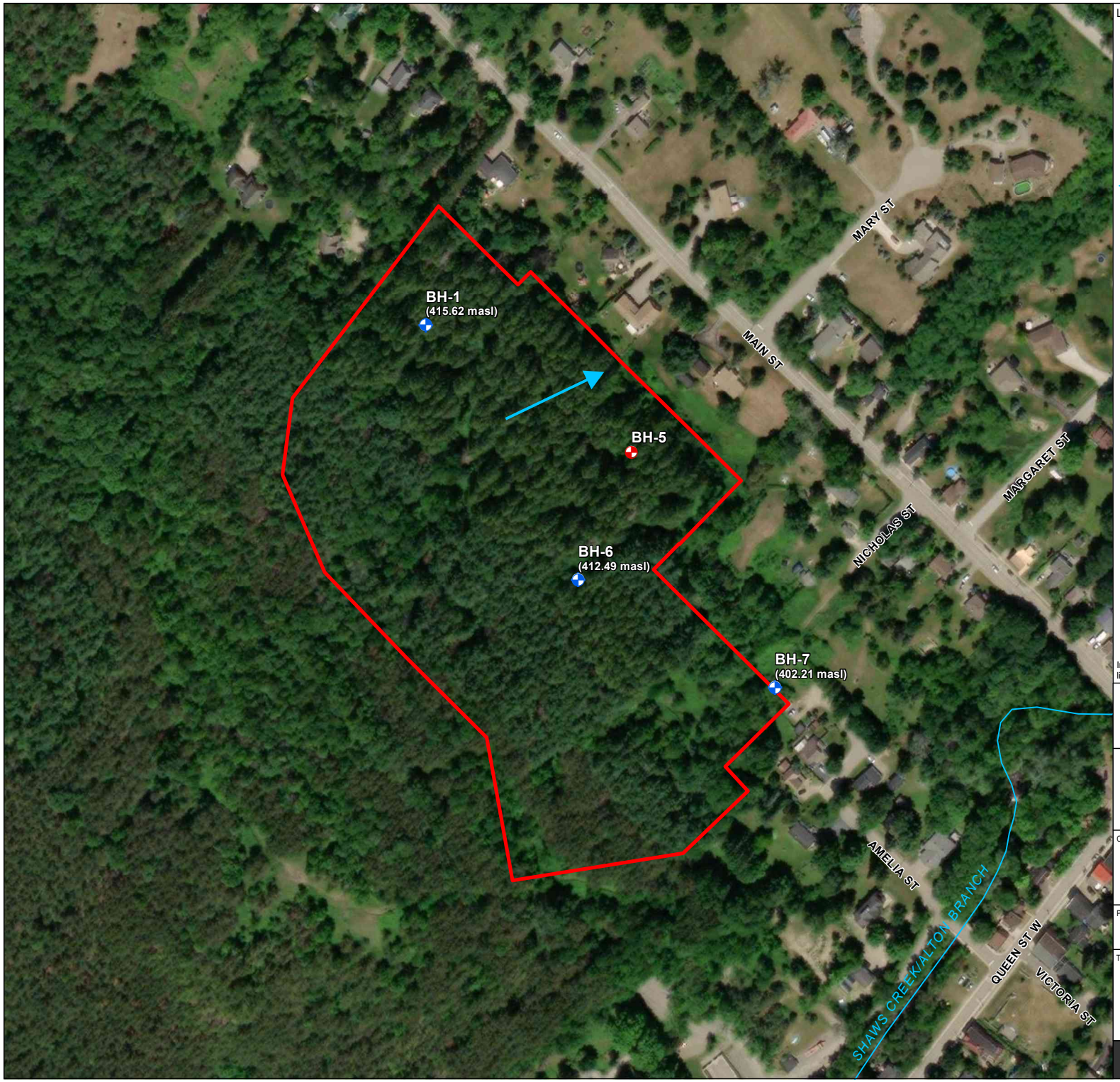
A cohesive layer of clayey silt to silty clay was observed in BH7 underlying the sand to silty sand layer. This layer extended from 10.7 m to the bottom of the borehole. The later was found to be in a stiff and hard state and was not fully penetrated.

3.3 Water Level Monitoring and Groundwater Flow

Groundwater levels were measured manually at installed MWs at the site by SPCL on July 13, 2017 and by Palmer on May 05, May 18, and June 23, 2021. Measurements were made using a water level tape and recorded to the nearest centimeters. In addition, a datalogger, programmed to record data at intervals of one hour, was installed in BH6 to continuously record water levels on-site before, during and following site grading and construction. Manual groundwater level results are summarized in **Table 2**, below. During Palmer's monitoring program to date, the depth to water table ranged from 1.73 to 3.73 mbgs, corresponding to an elevation range of 401.97 to 415.72 metres above sea level (mASL). As indicated on Figure 6, shallow horizontal groundwater flow is directed east-northeastwards reflecting the influences of local surface water features and topography on the hydraulic regime. It is important to consider that groundwater levels are subject to fluctuations due to seasonal trends and precipitation input

Table 2. Groundwater Level Monitoring Results

MW ID	Grade Elevation (mASL)	Depth (mbgs)	Unit	Water Level			
				July 13, 2017	May 05, 2021	May 18, 2021	June 23, 2021
BH1	418.91	6.02	mbgs	2.9	3.29	3.19	3.47
			mASL	416.0	415.62	415.72	415.44
BH5	Not available	6.80	mbgs	2.7	3.05	3.06	3.39
			mASL	-	-	-	-
BH6	415.85	10.50	mbgs	2.9	3.36	-	3.63
			mASL	414.95	412.49	-	412.22
BH7	403.93	12.56	mbgs	1.3	1.73	1.75	1.97
			mASL	403.6	402.20	402.18	401.97



LEGEND:

- Borehole Location
- Monitoring Well Location
- Watercourse
- Subject Site
- Groundwater Flow

0 50 100

metres

N

PROJECT NO.	1904308	REVISION:	1-1
DATE:	Jul 20, 2021	SCALE:	1:3000
DRAWN:	CV	DATUM:	NAD 1983
CHECKED:	SH	PROJECTION:	UTM zone 17

CLIENT: The Biglieri Group

PREPARED BY: Palmer

PROJECT: Alton Village

TITLE:

Groundwater Elevations and Flow (May 05, 2021)

FIGURE 6

Document Path: G:\Shared drives\Projects 2019\19043 - The Biglieri Group\1904308 - Alton Village\Mapping\Figures\5_ArcGIS\HydroG\1904308_6-1_Groundwater Elevations and Flow.mxd

3.3.1 Hydraulic Conductivity Testing and Infiltration Rate Estimates

Single Well Response Tests (SWRT) were performed by Palmer at all monitoring wells to estimate the hydraulic conductivity of the soil materials surrounding the well screen at each location. Tests were completed by lowering a 1 L slug into each well and then rapidly removing it to create a change in hydraulic head. Hydraulic conductivity values were estimated by measuring the rate of change in recovery of the water level (also known as a Rising Head Test). Water levels in each well were recorded using a datalogger set to record either every one or two seconds. The tests were terminated once either 80% recovery had been attained, or 30 minutes had elapsed.

Hydraulic conductivity values were calculated from the displacement-time data using the Bouwer & Rice (1976, 1989) Method for an unconfined aquifer as implemented in a spreadsheet distributed by the United States Geological Survey. The results are presented in **Appendix D.1** and included in **Table 3,** below. The calculated hydraulic conductivities range from $2.0x10^{-7}$ m/s to $6.4x10^{-6}$ m/s with a geometric mean of $2.0x10^{-6}$ m/s. The results assume fully penetrating conditions. Hydraulic conductivity decreases slightly if a thicker aquifer/partial penetration is assumed.

In addition, the hydraulic conductivity of the soil samples collected during SPCL's 2017 geotechnical investigation were estimated from grain size distribution data using the spreadsheet HydrogeoSieveXL ver 2.2. (Devlin, 2016). This spreadsheet contains 15 different methods of estimating hydraulic conductivity; however, only the results of those methods for which the sample met acceptance criteria are used. The HydrogeoSieveXL output sheets are provided in **Appendix D.2** and the results are included in **Table 3**, below. The calculated hydraulic conductivities range from $3.8x10^{-7}$ m/s to $2.3x10^{-6}$ m/s with a geometric mean of $1.2x10^{-6}$ m/s.

An estimation of the percolation rate of the soils within the site was produced empirically using the method developed by Toronto and Region Conservation Authority (TRCA) (2012) and Credit Valley Conservation (CVC) (2010). The results of the calculations are also provided in **Table 3,** below. The estimated percolation rate of the tested soils ranged from 30.1 to 76.0 mm/hr (T-time of 19.9 to 7.9 min/cm) with a geometric mean of 51.9 mm/hr (T-time of 11.6 min/cm). When applying a default safety factor of 2.5, the geometric mean infiltration rate is 20.7 mm/hr (T-time of 29.9 min/cm). It is recommended that this rate be used for preliminary design purposes until future site-specific percolation rate testing is completed.

3.3.2 Groundwater Chemistry

Groundwater samples were collected on May 04, 2021 from BH6 and BH7. The samples were submitted to ALS Canada Ltd. (ALS) for analysis for a suite of general potability parameters including turbidity, TSS, TDS, pH, metals, and cations and anions. ALS is accredited by the Canadian Association for Laboratory Accreditation (CALA). A copy of the Certificate of Analysis is provided in **Appendix E**.

The results were compared against the 2006 Ontario Drinking Water Standards, Objectives and Guidelines (ODWSOG), 2006 and the Ontario Drinking Water Quality Standards (ODWQS), 2020.

A summary of the groundwater analytical results is presented in **Table 4**, below, with the Certificate of Analysis provided in **Appendix E**. Both samples exceeded the ODWSOG Aesthetic Objectives (AOs) for colour and turbidity and the ODWSOG Operational Guideline (OG) for hardness. Sample BH6 exceeded the ODWQS for sodium but not its ODWSOG AO. Sample BH7 exceeded the ODWSOG AO for manganese.

Table 3. Summary of Hydraulic Conductivity Values and Infiltration Rates

Location	Test Used	Depth (m)	Soil Description	K (m/s)	Infiltration Rate (mm/hour)	Infiltration Rate (min/cm)
BH1	Slug Test	3.3 - 6.4	Sandy silt to sand	$2.0x10^{-07}$	30.1	19.9
BH5	Slug Test	4.5 - 7.6	Sandy silt/sand and gravel	$6.4x10^{-06}$	76.0	7.9
BH6	Slug Test	7.3 - 10.4	Silty sand	$3.2x10^{-06}$	63.2	9.5
BH7	Slug Test	9.6 - 12.7	Silt to silty clay	$3.7x10^{-06}$	65.7	9.1
BH1	Grain size – SS4	2.3 - 2.9	Sandy silt/silty sand, trace clay	$3.8x10^{-07}$	35.7	16.8
BH2	Grain size distribution – SS3	1.5 - 2.1	Sand and gravel ,trace silt	$2.1x10^{-06}$	56.4	10.6
BH3	Grain size distribution – SS6	4.4 - 5.0	Sand, trace silt	$1.1x10^{-06}$	47.5	12.6
BH7	Grain size distribution – SS3	1.5 - 2.1	Silty sand, trace clay	$2.3x10^{-06}$	57.8	10.4

Table 4. Groundwater Chemistry Results

Parameter	ODWQS/ODWSOG where no ODWQS established	Detection Limit	Units	BH6 May 05, 2021	BH7 May 05, 2021
Physical Tests (Water)					
Colour, Apparent	- / 5	2.0	CU	**36.7**	**24.6**
Conductivity	- / -	3.0	umhos/cm	731	492
pH	- / 6.5 -> 8.5	0.10	pH units	7.91	8.00
Redox Potentials	- / -	-1000	mV	3.08	295
Total Dissolved Solids	- / 500	20	mg/L	411	304
Turbidity	- / 5	0.10	NTU	**784**	**19.1**
Anions and Nutrients (Water)					
Alkalinity, Bicarbonate (as CaCO3)	- / -	2.0	mg/L	292	233
Alkalinity, Carbonate (as CaCO3)	- / -	2.0	mg/L	<2.0	<2.0
Alkalinity, Hydroxide (as CaCO3)	- / -	2.0	mg/L	<2.0	<2.0
Alkalinity, Total (as CaCO3)	- / 30 -> 500	2.0	mg/L	292	223
Ammonia, Total (as N)	- / -	0.010	mg/L	<0.010	<0.010
Bromide (Br)	- / -	0.10	mg/L	<0.10	<0.10
Chloride (Cl)	- / 250	0.50	mg/L	61.2	3.10
Computed Conductivity	- / -		µS/cm	711	454
Conductivity % Difference	- / -		%	-3	-8
Fluoride (F)	1.5 / -	0.20	mg/L	0.040	0.050
Hardness (as CaCO3)	- / 80 -> 100		mg/L	**327**	**264**
Ion Balance	- / -		%	110	119
Langelier Index	- / -		-	1	1
Nitrate (as N)	10 / -	0.020	mg/L	3.10	<0.020
Nitrite (as N)	1 / -	0.010	mg/L	<0.010	<0.010
Saturation pH	- / -		pH	7.09	7.26
Orthophosphate-Dissolved (as P)	- / -	0.0030	mg/L	<0.0030	<0.0030
TDS (Calculated)	- / -		mg/L	437	269

Parameter	ODWQS/ODWSOG where no ODWQS established	Detection Limit	Units	BH6 May 05, 2021	BH7 May 05, 2021
Sulfate (SO4)	- / 500	0.30	mg/L	36.0	38.2
Anion Sum	- / -		me/L	7.52	4.57
Cation Sum	- / -		me/L	8.25	5.43
Cation - Anion Balance	- / -		%	5	9
Inorganic Parameters (Water)					
Silica	- / -	0.21	mg/L	15.2	13.5
Bacteriological Tests (Water)					
E. Coli	0 / -		CFU/100mL	0	0
Total Coliform Background	- / -	10	CFU/100mL	780	3
Total Coliforms	0 / -		CFU/100mL	0	0
Metals (Water)					
Sodium Adsorption Ratio	**- / -**	0.10	SAR	0.94	<0.10
Total Metals (Water)					
Aluminum (Al)-Total	0.1 / -	0.010	mg/L	0.074	<0.010
Antimony (Sb)-Total	- / 0.006	0.00010	mg/L	<0.00010	<0.00010
Arsenic (As)-Total	- / 0.01	0.00010	mg/L	0.00025	0.00040
Barium (Ba)-Total	- / 1	0.00020	mg/L	0.0778	0.0561
Beryllium (Be)-Total	- / -	0.00010	mg/L	<0.00010	<0.00010
Bismuth (Bi)-Total	- / -	0.000050	mg/L	<0.000050	<0.000050
Boron (B)-Total	- / 5	0.010	mg/L	<0.010	0.011
Cadmium (Cd)-Total	- / 0.005	0.000010	mg/L	<0.000010	<0.000010
Calcium (Ca)-Total	- / -	0.50	mg/L	81.3	66.1
Cesium (Cs)-Total	- / -	0.000010	mg/L	<0.000010	<0.000010
Chromium (Cr)-Total	- / 0.05	0.00050	mg/L	0.00159	<0.00050
Cobalt (Co)-Total	- / -	0.00010	mg/L	<0.00010	0.00011
Copper (Cu)-Total	1 / -	0.0010	mg/L	0.0030	0.0075
Iron (Fe)-Total	0.3 / -	0.050	mg/L	0.117	<0.050
Lead (Pb)-Total	- / 0.01	0.00010	mg/L	0.00017	<0.00010

Parameter	ODWQS/ODWSOG where no ODWQS established	Detection Limit	Units	BH6 May 05, 2021	BH7 May 05, 2021
Magnesium (Mg)-Total	- / -	0.050	mg/L	30.1	24.0
Manganese (Mn)-Total	0.05 / -	0.00050	mg/L	0.00585	**0.0517**
Molybdenum (Mo)-Total	- / -	0.000050	mg/L	0.000236	0.000822
Nickel (Ni)-Total	- / -	0.00050	mg/L	0.00072	0.00064
Phosphorus (P)-Total	- / -	0.050	mg/L	<0.050	<0.050
Potassium (K)-Total	- / -	0.050	mg/L	1.13	1.31
Rubidium (Rb)-Total	- / -	0.00020	mg/L	0.00066	0.00042
Selenium (Se)-Total	- / 0.05	0.000050	mg/L	0.000057	<0.000050
Silicon (Si)-Total	- / -	0.10	mg/L	7.10	6.31
Silver (Ag)-Total	- / -	0.000050	mg/L	<0.000050	<0.000050
Sodium (Na)-Total	200 / 20	0.50	mg/L	**38.9**	2.96
Strontium (Sr)-Total	- / -	0.0010	mg/L	0.135	0.143
Sulfur (S)-Total	- / -	0.50	mg/L	12.9	10.9
Tellurium (Te)-Total	- / -	0.00020	mg/L	<0.00020	<0.00020
Thallium (Tl)-Total	- / -	0.000010	mg/L	<0.000010	<0.000010
Thorium (Th)-Total	- / -	0.00010	mg/L	<0.00010	<0.00010
Tin (Sn)-Total	- / -	0.00010	mg/L	0.00014	0.00018
Titanium (Ti)-Total	- / -	0.00030	mg/L	0.00282	<0.00030
Tungsten (W)-Total	- / -	0.00010	mg/L	<0.00010	<0.00010
Uranium (U)-Total	- / 0.02	0.000010	mg/L	0.000354	0.000484
Vanadium (V)-Total	- / -	0.00050	mg/L	<0.00050	<0.00050
Zinc (Zn)-Total	5 / -	0.0030	mg/L	0.0036	0.0034
Zirconium (Zr)-Total	- / -	0.00030	mg/L	<0.00030	<0.00030

***bold** = Exceeds Standard

4. Water Balance

4.1 Water Budget Methodology

4.1.1 Water Surplus

The water surplus described the difference between precipitation and evapotranspiration (ET) to estimate the amount of water or surplus that is available to contribute to infiltration and runoff. The surplus was calculated using the monthly soil-moisture balance approach as described in Thornthwaite and Mather (1957). Surplus on impermeable surfaces is assumed to be 90% of the precipitation. A soil moisture storage value of 200 mm was used, which is appropriate for silt loam and moderately – deep rooted crops. Data for average monthly precipitation and temperature was derived from the 1981 – 2010 climate normals from the Orangeville climate station (ID 6155790). Actual evapotranspiration is calculated based on a potential ET (or PET) and soil-moisture storage withdrawal. Monthly PET is estimated using monthly temperature data and is defined as a water loss from a homogeneous vegetation-covered area that never lacks water (Thornthwaite, An Approach Toward a Rational Classification of Climate, 1948).

4.1.2 Infiltration Factors

The partitioning of the water surplus between runoff and infiltration depends on soil type, topography and vegetation cover. Water will infiltrate more easily through sands compared to clays, on flat slopes compared to steep sloped, and through natural vegetated soils compared to agricultural crops or urban areas. The method developed by Bernard (1932) and described by the Ministry of the Environment and Energy (MOEE) (1995) was used to estimate infiltration for the site. The infiltration factor is calculated by adding the individual sub-factors at the site. The water surplus is then multiplied by the total infiltration factor to determine the partitioning between the amount of runoff and the amount of infiltration that occurs annually. The runoff is the total amount of surplus remaining after taking into account infiltration (1 – infiltration factor = runoff factor).

4.2 Water Budget Results

4.2.1 Pre-Development Conditions

For reference, the CVC Water Balance Tool (CVC, 2021) reports precipitation of 897 mm/yr, infiltration of 370 to 381 mm/yr (lower values are on the plateau to the west), evapotranspiration of approximately 402 mm/yr and runoff of approximately 114 mm/yr. However, it should be noted that the eastern flank of the most prominent hill in the area comprises the western portion of the site.

The total yearly precipitation recorded by the Orangeville Meteorological Station was 901.5 mm/year (**Table 5.**). The calculated actual ET (or AET) based on the Thornthwaite and Mather monthly water balance model is approximately 559 mm/year (**Table 5**). The estimated water surplus for the site area is approximately 343 mm/year (38% of the total precipitation). The surplus values are given below in **Table 5.**

Based on OGS surficial geology mapping and borehole data, the site is underlain by sand to silty sand, treated as “open sandy loam” under MOE, 1995 (infiltration factor of 0.4), the site has hilly topography (infiltration factor 0.1), and the land use on-site is woodland (infiltration factor of 0.2). **Table 6.** presents the soil infiltration factors used for the site-wide water budget.

Using the method in the MOE stormwater management (SWM) manual and MOEE (1995) for guidance, it is estimated that approximately 70% (240 mm/year) of the surplus infiltrates, and the remaining 30% (102.8

mm/year) runs off. Based on a site area of 5.91 ha, it is estimated that 14,181.4 m^3/year infiltrates and 6,077.8 m^3/year runs off under existing conditions. The results are summarized in **Table 7.**.

Table 5. Water Surplus

Water Balance	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (mm)	64.3	54.5	60.9	70.1	86.6	81.3	80.8	88.2	87	76.6	87.1	64.2	901.6
Temperature (°C)	-7.5	-6.5	-2.1	5.3	11.7	16.9	19.4	18.4	14.3	7.8	2.0	-4.1	6.3
Potential Evapotranspiration (PET) (mm)	0.0	0.0	0.0	29.5	75.1	110.3	129.1	113.1	75.4	36.8	7.7	0.0	577.0
P – PET	64.3	54.5	60.9	40.6	11.5	-29.0	-48.3	-24.9	11.6	39.8	79.4	64.2	325.0
Change in Soil Moisture Storage	0.0	0.0	0.0	0.0	0.0	-29.0	-48.0	-25.0	102.0	0.0	0.0	0.0	0.0
Soil Moisture Storage	200.0	200.0	200.0	200.0	200.0	171.0	123.0	98.0	200.0	200.0	200.0	200.0	200.0
Actual Evapotranspiration (AET)	0.0	0.0	0.0	29.5	75.1	108.3	118.8	107.2	75.4	36.8	7.7	0.0	558.8
Soil Moisture Deficit (mm)	0.0	0.0	0.0	0.0	0.0	-29.0	-48.0	-25.0	0.0	0.0	0.0	0.0	0.0
Surplus (P – AET)	64.3	54.5	60.9	40.6	11.5	-27.0	-38.0	-19.0	11.6	39.8	79.4	64.2	342.8

Table 6. MOEE (1995) Infiltration Factors

Description of the Area	Value of the Infiltration Factor
TOPOGRAPHY	
- Hilly topography	0.10
SOIL	
- Sand to silty sand	0.4 (treated as “Open sandy loam”)
COVER	
- Agricultural	0.10
- Woodland	0.20

4.2.2 Post-Development Conditions

It is intended to develop the site with 15 residences and a roadway (refer to Site Plan by The Biglieri Group Ltd., (**Appendix A**). The portion of the site that is not reserved as a Conservation Easement is approximately 2.61 ha. Details of the planned residences are not available. As a temporary measure, it is assumed that the homes will have a first floor footprint of 1,800 ft^2 (167.3 m^2) each and that the standard driveway will be, on average, 4.5 x 10 m. The roadway is approximately 188 m long with an assumed paved

width of 25 ft/7.6 m. This results in 4,615 m^2 of impervious surfaces (rooftops and paved areas). It is also assumed that the remaining portion of the developed area will be divided evenly between new lawns/open space and existing woodlands. An infiltration factor of 0.15 (average of agricultural and woodland) is applied to this 2.15 ha.

It is estimated that, post-development, 12,705.7 m^3/year (215 mm/year) of precipitation will infiltrate (a decrease of 10.4%), and 9,534.6 m^3/year (161 mm/year) will run off (an increase of 56.8%). Through the use of Low Impact Development (LID) measures which are designed to re-infiltrate 1,475.7 m^3 of precipitation per year across the entire site area, the post-development infiltration will be maintained at pre-development conditions.

Based on the soil and groundwater conditions at the site, infiltration based LIDs such as infiltration trenches, galleries, or swales would be effective in promoting groundwater recharge to balance the pre-to-post development water balance. LIDs should be installed 1 m above the high water table and designed based a percolation rate of 20.7 mm/hr, which includes a 2.5x factor of safety from the percolation rates provided in **Table 3**.

Table 7. Pre- and Post Development Water Balances

Pre-Development

Land Use	Area (ha)	Impervious Factor	Impervious Area (ha)	Water Surplus on Impervious Area (m/yr)	Runoff from Impervious Area (m^3/yr)	Pervious Area (ha)	Water Surplus on Pervious Area (m/yr)	Runoff Coefficient	Runoff Volume from Pervious Area (m^3/yr)	Infiltration Coefficient	Infiltration Volume from Pervious Area (m^3/yr)	Total Runoff Volume (m^3/yr)	Total Infiltration Volume (m^3/yr)
Woodland	5.91	0.00	0.00	0.772	0	5.91	0.3428	0.30	6,077.8	0.70	14,181.4	6,077.8	14,181.4
Development – Building/Paved Areas	0.00	1.00	0.00	0.772	0	0.00	0.3428	1.00	0	0.00	0	0	0
Total	**5.91**		**0.00**		**0**	**5.91**			**6,077.8**		**14,181.4**	**6,077.8**	**14,181.4**

Post-Development (No Mitigation)

Land Use	Area (ha)	Impervious Factor	Impervious Area (ha)	Water Surplus on Impervious Area (m/yr)	Runoff from Impervious Area (m^3/yr)	Pervious Area (ha)	Water Surplus on Pervious Area (m/yr)	Runoff Coefficient	Runoff Volume from Pervious Area (m^3/yr)	Infiltration Coefficient	Infiltration Volume from Pervious Area (m^3/yr)	Total Runoff Volume (m^3/yr)	Total Infiltration Volume (m^3/yr)
Woodland (Conservation Reserve)	3.2985	0.00	0.00	0.772	0.00	3.2985	0.3428	0.3	3,392.2	0.70	7,915.1	3,392.2	7,915.1
Lawn/Woodland	2.15	0.00	0.00	0.772	0.00	2.15	0.3428	0.35	2,579.6	0.65	4,790.6	2,579.6	4,790.6
Development – Building/Paved Areas	0.4615	1.00	0.4615	0.772	3,562.8	0.00	0.3428	1.00	0	0.00	0	3,562.8	0
Total	**5.91**		**0.4615**		**3,562.8**	**5.4485**			**5,971.8**		**12,705.7**	**9,534.6**	**12,705.7**

Post-Development (With Mitigation)

Land Use	Area (ha)	Impervious Factor	Impervious Area (ha)	Water Surplus on Impervious Area (m/yr)	Runoff from Impervious Area (m^3/yr)	Pervious Area (ha)	Water Surplus on Pervious Area (m/yr)	Runoff Coefficient	Runoff Volume from Pervious Area (m^3/yr)	Infiltration Coefficient	Infiltration Volume from Pervious Area (m^3/yr)	Total Runoff Volume (m^3/yr)	Total Infiltration Volume (m^3/yr)
Woodland (Conservation Reserve)	3.2985	0.00	0.00	0.772	0.00	3.2985	0.3428	0.3	3,392.2	0.70	7,915.1	3,392.2	7,915.1
Lawn/Woodland	2.15	0.00	0.00	0.772	0.00	2.15	0.3428	0.35	2,579.6	0.65	4,790.6	2,579.6	4,790.6

Land Use	Area (ha)	Impervious Factor	Impervious Area (ha)	Water Surplus on Impervious Area (m/yr)	Runoff from Impervious Area (m^3/yr)	Pervious Area (ha)	Water Surplus on Pervious Area (m/yr)	Runoff Coefficient	Runoff Volume from Pervious Area (m^3/yr)	Infiltration Coefficient	Infiltration Volume from Pervious Area (m^3/yr)	Total Runoff Volume (m^3/yr)	Total Infiltration Volume (m^3/yr)
Development – Building/Paved Areas	0.4615	1.00	0.4615	0.772	3,562.8	0.00	0.3428	1.00	0	0.00	0	3,562.8	0
Infiltration Based LID (assumed)												-1,475.7	+1,475.7
Total	**5.91**		**0.4615**		**3,562.8**	**5.4485**			**5,971.8**		**12,705.7**	**8,058.9**	**14,181.4**

No Mitigation	**Pre-to-Post Difference (%)**	**+56.8**	**-10.4%**
	Pre-to-Post Difference (m^3)	**+3,456.8**	**-1,475.7**
With Mitigation	**Pre-to-Post Difference (%)**	**+32.6%**	**0%**
	Pre-to-Post Difference (m^3)	**+1,981.1**	**0%**

5. Septic System Servicing Assessment

5.1 Suitability of Site Soils for Leaching Beds

Based on the SWRTs completed as part of this investigation and grain size distribution data obtained during the geotechnical investigation, the shallow soils appear to be suitable to allow for the construction of in-ground leaching beds. The average percolation rate of the subsurface soils is expected to be approximately 20.7 mm/hr when adjusted for a default safety factor of 2.5.

In order to use in-ground systems, a water table separation of approximately 1.2 to 1.5 m is required to meet the requirements under the Ontario Building Code (OBC, Ontario Regulation 332/12). Based on the depths to water table measured across the site on May 18, 2021, in the range of 1.75 to 3.19 mbgs, the use of partially raised beds in the extreme southeastern portion of the site near BH7 (i.e., vicinity of Lots 14 and 15 on the Site Plan, (**Appendix A**) should be considered due to the possibility of a higher water table under seasonal conditions. Additional soil and groundwater testing at later design stages is recommended.

5.2 Site Capacity Effects Assessment

In its comments on an earlier submission regarding the site, the CVC stated that it required (i) a septic impact assessment undertaken in accordance with the MOE's Design Guidelines for Sewage Works 2008 - Chapter 22. Large Subsurface Sewage Disposal Systems and (ii) that the concentration of nitrate in shallow groundwater entering nearby surface water/environmentally sensitive areas meet the CCME, 2012 standard of 3 mg/L nitrate-as-N for the protection of aquatic life. The CVC's first requirement leads to a need to develop a site-specific criterion at the site boundary to a value derived under the MECP's Guideline B7 ("Reasonable Use").

The background nitrate-as-N concentration was found to range from <0.020 to 3.10 mg/L with an average of 1.56 mg/L. The ODWQS for nitrate, applicable to daily flows less than 10,000 L/day, is 10 mg/L. Guideline B7 permits the concentration of a health-related parameter to increase by one-quarter of the difference between background and its ODWQS. This equates to 1.56 + 0.25 * (10 – 1.56) = 3.67 mg/L. It should be noted that only two of the four wells on-site were sampled and that the well with 3.10 mg/L of nitrate is BH6, located in the central portion of the site. The detected nitrate may originate at the septic tile field serving a large commercial development located west of the site (the septic tile field in question is located northwest of the site).

The specific plans for the development in terms of house sizes are unknown at present. It is assumed that each of the 15 lots will be occupied by a 3 bedroom house less than 200 m^2 in area. Under Table 8.2.1.3.a of the Ontario Building Code, the daily flow from each such home is 1,600 L/day or 24,000 L/day for the proposed development in its entirety. Given the uncertainty regarding specifics of the development and that the site-specific criterion of 3.67 mg/L nitrate-as-N at the site boundary is close to the CCME, 2012 standard of 3 mg/L nitrate-as-N, only an on-site assessment has been carried out. Off-site conditions will be assessed when more specific information regarding the proposed development is available.

The post-development infiltration is expected to be 14,181.4 m^3/year (38,853 L/day) once LID measures are put in place to maintain the pre-to-post development water balance as outlined in **Section 4.2.2,** above.

A MECP Procedure D-5-4 discharge assessment and Guideline B7 assessment have been completed to determine the loading that will result from the proposed system. Based on the septic systems outlined previously, the following nitrate loading calculation is provided:

Calculation of Nitrate (NO_3) Concentration in Groundwater:

$$[NO_3] = 3.67\ \frac{mg}{L} = \frac{Septic\ System\ Input + Supply\ Aquifer\ Input}{Available\ Dilution + Volume\ of\ Septic\ Effluent}$$

Where:

- *Septic System Input NO_3 [g/day] = Effluent [NO_3] x [Effluent Volume]*
  - *Allowable Effluent [NO_3] = the unknown being solved for*
  - *Effluent Volume per Day = 24,000 L/day*
- *Supply Aquifer Input NO_3 [g/day] = Background [NO_3] x Effluent Volume*
  - *Background [NO_3] = 1.56 mg/L*
  - *Effluent Volume per Day = 24,000 L/day*
- *Available Dilution [m^3/day] = 38,853 L/day*
  - *Daily infiltration over the site determined using a Thornthwaite & Mather Water Balance (1957) (**Table 8)***

The resulting allowable concentration of nitrate-as-N in the septic effluent is 8.05 mg/L, which will require the use of tertiary treatment in the septic systems.

6. Wellhead Protection Area Assessment

The site is situated within the Credit Valley Source Protection Area and is subject to the CTC Source Protection Plan. The objectives of the SPP, as established under the *Clean Water Act, 2006* are as follows:

- To protect existing and future drinking water sources in the protection region; and,
- To ensure that, for every area identified in the assessment report as an area where an activity is or would be a significant drinking water threat:
  - The activity never becomes a significant drinking water threat; or
  - If the activity is occurring when the SPP took effect, the activity ceases to be a significant drinking water threat.

The SPP designates the site and its vicinity as a Significant DNAPL (dense, non-aqueous phase liquid, e.g., PCBs and several common chlorinated solvents) Threat Area.

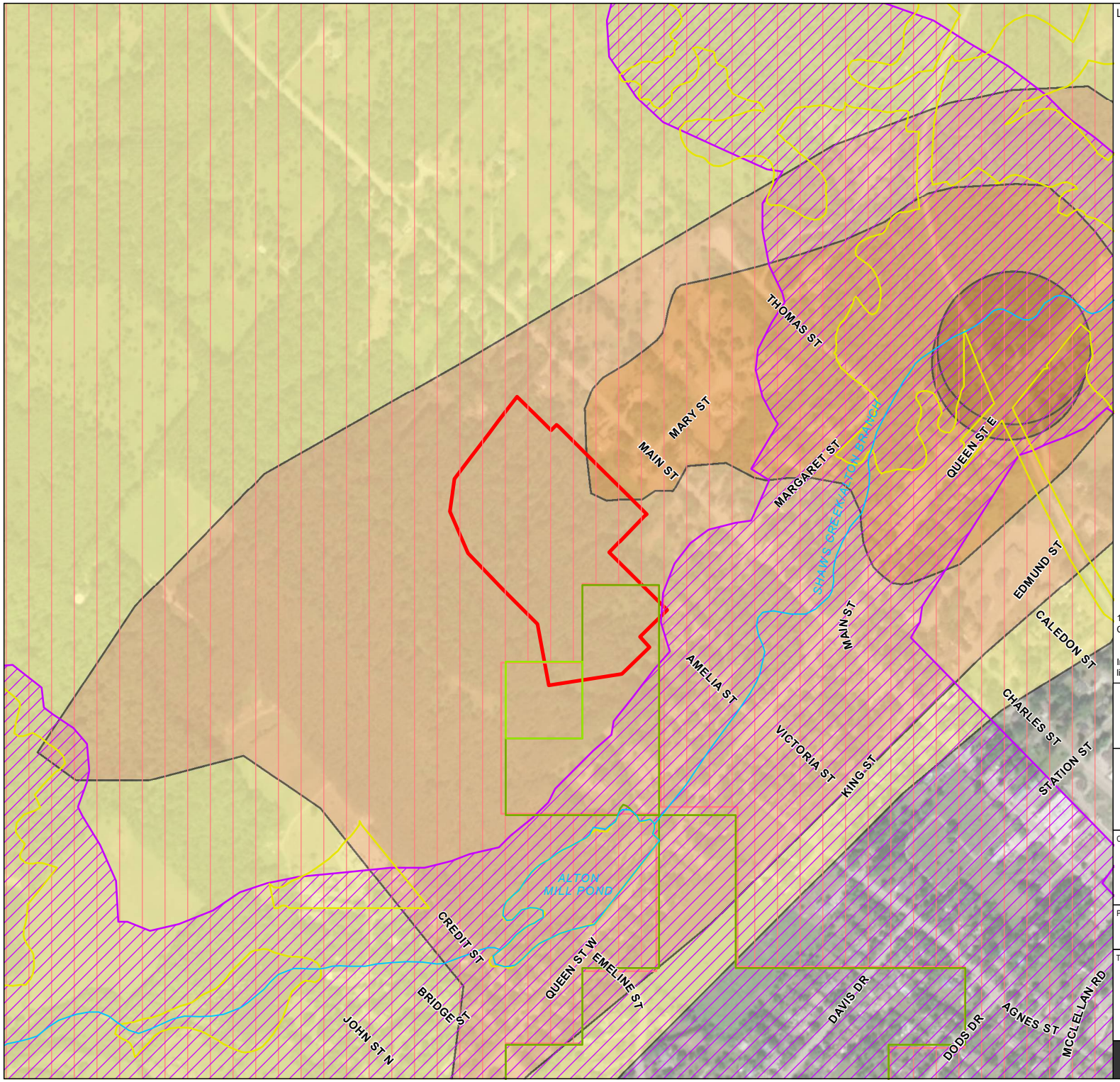
The SPP identifies four vulnerable areas: Wellhead Protection Areas (WHPA), Intake Protection Zones (IPZ), Highly Vulnerable Aquifers (HVA), and Significant Groundwater Recharge Areas (SGRA). An intrinsic vulnerability of the underlying aquifer of an area is also assigned as low, medium or high. A Wellhead Protection Area (WHPA) is the area around the wellhead where land use activities have the potential to affect the quality or quantity of water that flows into the well. These areas are delineated into zones of vulnerability (A, B, C, and D) based on the time of travel of water into the well, and zones around a surface water body influencing a Groundwater Under Direct Influence (GUDI) well (E, F). Other zones (Q1 and Q2) are defined as the areas where new water takings or reduced recharge could impact the quantity of water to municipal supply wells. The delineation requirements for each WHPA are outlined in **Table 8.** WHPA Zone Delineation Requirements.

A small area in the eastern portion of the site is within a WHPA-B (Score = 6). The remainder of the site is within a WHPA-C (Score = 6 except in the northern portion of the site where Score = 8). The site is part of an SGRA (Score = 6) and is also the location of an HVA (Score = 6). The site and its vicinity are located within a Significant DNAPL Threat Area. It is also required that the pre-development infiltration is maintained on-site post-development, to the extent pracctical. The regulated areas of the site, in addition to the CVC's requirements for nitrate in groundwater (**Section 5.2**), are shown on **Figure 7.**

Table 8. WHPA Zone Delineation Requirements

WHPA Zone	Area of Vulnerability	Delineation Requirement
WHPA-A	Quality	100 m radius from wellhead
WHPA-B	Quality	2 years travel time
WHPA-C	Quality	5 years travel time
WHPA-D	Quality	25 years travel time
WHPA-E	Quality	From point of interaction between aquifer and surface water body influencing a GUDI well

WHPA Zone	Area of Vulnerability	Delineation Requirement
WHPA-Q1	Quantity	Area affected by groundwater use
WHPA-Q2	Quantity	Area affected by recharge reduction



LEGEND:

- Watercourse
- Subject Site

Source Water Protection[1]

Significant Groundwater Recharge Area

- 2
- 4
- 6

Wellhead Protection Area (WHPA)

- WHPA A (100m Buffer Zone)
- WHPA B (2 Year Time of Travel)
- WHPA C (5 Year Time of Travel)
- WHPA D (25 Year Time of Travel)
- WHPA Groundwater Under Direct Influence (WHPA-E)
- Highly Vulnerable Aquifer (HVA)

1. Source Protection Information Atlas, Ministry of the Environment, Conservation and Parks © Queen's Printer for Ontario, 2021

0 50 100
metres

N

PROJECT NO.	1904308	REVISION:	1-1
DATE:	Jul 20, 2021	SCALE:	1:7000
DRAWN:	CV	DATUM:	NAD 1983
CHECKED:	SH	PROJECTION:	UTM zone 17

CLIENT: The Biglieri Group

PREPARED BY: Palmer

PROJECT: Alton Village

TITLE: **Source Water Protection**

FIGURE 7

Document Path: G:\Shared drives\Projects 2019\19043 - The Biglieri Group\1904308 - Alton Village\Mapping\Figures\5_ArcGIS\HydroG\1904308_7-1_Source Water Protection.mxd

7. Dewatering Considerations

It is Palmer's understanding that open cut excavation methods are expected to be used for installation of the footings of the proposed homes. Given the shallow water table in the southeastern portion of the site, it is assumed that there will not be basements in this portion of the site (unless grade is raised in this area) and the foundations will extend to a depth of at least 1.2 mbgs with dewatering required 1 m below this depth. In addition, Palmer has assumed that the spring high water level will be 1 m higher than the highest level measured in this area (i.e., 0.3 mbgs after seasonal allowance; 1.9 m of dewatering required) and that an open cut trench will have a daily working footprint of the perimeter of the house (12.9 x 12.9 m for a square 1,800 ft^2/167 m^2 home). Elsewhere, the corresponding adjusted high water level is 1.7 m and it is assumed that the basements will extend 1.2 mbgs with foundations extending another 0.5 m with dewatering 1 m below that depth (i.e., dewatering of 1 m below the water table).

It should be noted that the highest dewatering flows are anticipated at the beginning of the dewatering process to achieve the target drawdown levels. After groundwater levels have been lowered to the target elevation, the dewatering flows are anticipated to be lower when maintaining the groundwater level at the target elevation during steady-state dewatering flow conditions.

A dewatering rate estimate (Q) for the proposed square excavations was calculated using the following equations from Powers et. al (2007) for excavation in an unconfined aquifer:

Unconfined Aquifer, $$Q_{open\ cut} = \frac{\pi K(H^2 - h^2)}{ln\left(\frac{Ro}{r_e}\right)} \quad m^3/s$$

Where K = hydraulic conductivity (m/s)

H = initial saturated thickness (m)

h = saturated thickness after dewatering (m)

R_O = radius of influence usually estimated using the Sichardt Approximation:

R_O = 3000 * (H-h) * $\sqrt{K}$ (m) (only valid if ln[Ro/r_e] > 1.5; not applicable)

or University of Washington, 2009:

R_O = H * $\sqrt{\frac{K}{2} * W}$ (m) (ln[Ro/r_e] > 1.5; used)

W = annual infiltration rate = 240 mm/yr (6.6×10^{-4} m/yr)

r_e = equivalent well radius estimated by:

$r_e = \sqrt{\frac{a^2}{\pi}}$ (m)

Where a = excavation length/width (m)

Table 9 presents a summary of Palmer's findings and the estimated dewatering rates for the proposed excavations.

Table 9. Dewatering Rate Estimate

Dewatering Parameter	Symbol	Unit	Values
Excavation length	x	[m]	12.9
Excavation width	a	[m]	12.9
Hydraulic Conductivity	K	[m/s]	$5.6x10^{-6}$ (90^{th} percentile of all in situ tests)
Saturated thickness	H	[m]	8.2 (based on depth of silty clay at BH7)
Dewatered saturated thickness	h	[m]	6.5 in the southeast, 7.2 elsewhere
Radius of influence	R_0	[m]	157.3
Equivalent Well Radius	r_e	[m]	7.3
Dewatering rate	Q_{dw}	[m^3/s]	$1.43x10^{-4}$ (southeast), $8.82x10^{-5}$ (elsewhere)
Dewatering rate	Q_{dw}	[L/day]	12,365 (southeast); 7,620 (elsewhere)
Total Dewatering Rate (With 1.5x Safety Factor and Precipitation Allowance, ***see below***)	Q	[L/day]	21,130 (southeast) 15,600 (elsewhere)

For a groundwater level lowering of 1.7 m in the southeast (perimeter foundation trench only, no basements unless grade is raised), the total dewatering rate is estimated to be approximately 21,130 L/day. For a groundwater level lowering of 1 m elsewhere (square basement excavation), the total dewatering rate is estimated to be approximately 15,600 L/day. These estimates are based on two factors that result in a higher flow rate than that calculated above, namely:

- A safety factor of 1.5 is recommended for use with the flow calculation as a contingency measure and to allow for dewatering in advance of the upcoming (i.e., the next day's) work area; and
- An allowance must be made for precipitation. The volume of water obtained from a nominal two year storm (25 mm in 24 hours) over the footprint of the excavation (assumed trench width in the southeast is 2 m) will be approximately 2,580 L/day (southeast) and 4,160 L/day elsewhere.

Registration on the Environmental and Site Activity Registry (EASR) is not required for pumping rates below 50,000 L/day but registration would be required if multiple excavations were being dewatered simultaneously at a combined rate in excess of 50,000 L/day.

The estimated steady state radius of influence is approximately 157 m, although it is unlikely that this will be reached over the course of the construction period. The status of the possible well observed at 29 Amelia Street should be resolved prior to dewatering in its vicinity.

Dewatering discharge is expected to be managed on-site using temporary sediment ponds, filter bags and/or other best management practices to avoid erosion and sedimentation.

8. Summary and Conclusions

This Hydrogeology and Water Balance Study has been prepared to support development applications for the property known as 0 Nicholas Street, Village of Alton in the Town of Caledon, Ontario (the "site"). The focus of this hydrogeological investigation was to define groundwater conditions and soil permeability to assess stormwater infiltration potential for Low Impact Development (LID) design, soil percolation rates, groundwater levels, groundwater supported vs. surface water supported natural features, and to complete a nitrate loading assessment for individual septic servicing. The following provides a summary of the results of and conclusions of Palmer's Hydrogeological Investigation:

- The overburden on-site consists of ice-contact stratified deposits underlain by the Halton Till. However, stratigraphy/hydrostratigraphy is highly variable on a local scale with one, two or no coarse-textured units present above bedrock and with up to three (or no) fine-textured units present above bedrock. The upper contact of bedrock/overburden thickness is also highly variable with valleys incised into bedrock in the vicinity of the site/to the east and, separately, to the northwest. As a result, outside the major valley features, any consistent flow regime in the overburden and, at least locally, shallow bedrock, is expected to be localized in nature.
- The site is situated within the Credit Valley Source Protection Area and is subject to the CTC Source Protection Plan (SPP). A small area in the eastern portion of the site is within a WHPA-B (Score = 6). The remainder of the site is within a WHPA-C (Score = 6 except in the northern portion of the site were Score = 8). The site is part of an SGRA (Score = 6) and is also the location of an HVA (Score = 6). The site and its vicinity are located within a Significant DNAPL (dense non-aqueous phase liquids) Threat Area. It is also required that the pre-development infiltration is maintained on-site post-development.
- Alton Village is serviced by a municipal water supply drawn from groundwater but residents previously relied on private wells. Based on the review of the MECP WWR database, 99 WWRs are on record for land within 500 m of the project boundary. Of the 99 WWRs, 54 are for domestic wells, 10 are for monitoring wells/test holes, three are for commercial use, two are not used, two are associated with the public water supply system, 23 are abandonment records (all types of wells) and five are for wells of unknown use.
- Measured groundwater elevations on June 23, 2021 ranged from 401.97 mASL to 415.44 mASL, or 1.97 mbgs to 3.63 mbgs. Shallow horizontal groundwater flow is directed east-northeastwards reflecting the influences of local surface water features.
- Single Well Response Tests (SWRT) were performed by Palmer at all monitoring wells to measure the hydraulic conductivity of the soil materials surrounding the well screen at each location. Hydraulic conductivity values were calculated from the displacement-time data using the Bouwer & Rice (1976, 1989) method for confined aquifers. Based on the results of these analyses, the calculated hydraulic conductivity of the shallow soils ranges from 2.0×10^{-7} m/s to 6.4×10^{-6} m/s with a geometric mean of 2.0×10^{-6} m/s.
- Based on the SWRTs completed as part of this investigation and grain size distribution data obtained during the geotechnical investigation, the shallow soils appear to be suitable to allow for the construction of in-ground leaching beds. The average percolation rate of the subsurface soils is expected to be approximately 20.7 mm/hr when adjusted for a default safety factor of 2.5. It is recommended that this rate be used for preliminary design purposes until future site-specific percolation rate testing is completed.

- Both shallow groundwater samples collected during this investigation exceeded the ODWSOG Aesthetic Objectives (AOs) for colour and turbidity and the ODWSOG Operational Guideline (OG) for hardness. Sample BH6 exceeded the ODWQS for sodium but not its ODWSOG AO. Sample BH7 exceeded the ODWSOG AO for manganese. With the possible exception of sodium at BH6, these findings are attributed to background conditions.
- Based on MECP Procedure D-5-4 and Guideline B7, a background concentration of nitrate of 1.56 mg/L (this is based on two of four wells and may be affected by a nearby large scale septic system) and if the development consists of 167.3 m^2/1,800 sq ft single-storey homes, the maximum allowable concentration of nitrate in groundwater at the site boundary is 3.67 mg/L. The septic systems will require tertiary treatment system to reduce the concentration of nitrate in the septic effluent to 8.05 mg/L.
- A Thornthwaite and Mather water balance was completed for the site. It is estimated that approximately 70% (240 mm/year) of the surplus infiltrates, and the remaining 30% (112.8 mm/year) runs off. Based on a site area of 5.91 ha, it is estimated that 14,181.4 m^3/year infiltrates and 6,077.8 m^3/year runs off. If the development consists of 167.3 m^2/1,800 sq ft homes, the proposed development will increase the area of impermeable surfaces, currently none, to approximately 0.45 ha. It is estimated that, post-development, 12,705.7 m^3/year (215 mm/year) of precipitation will infiltrate. Through the use of Low Impact Development (LID) measures, such as infiltration galleries which capture 1,475.7 m^3 of precipitation per year, the post-development infiltration may be increased to 14,181.4 m^3/year to maintain pre-development conditions.
- A simplistic dewatering rate estimate indicates that a groundwater level lowering of 1.7 m in the southeastern portion of the site (perimeter foundation trench only, no basements due to high water table unless grade is raised), the total dewatering rate is estimated to be approximately 21,130 L/day. For a groundwater level lowering of 1 m elsewhere (square basement excavation), the total dewatering rate is estimated to be approximately 15,600 L/day. The radius of influence is estimated at 157 m. A possible private well is located south of the site and potentially within this radius of influence. The status of the well is unknown.

9. Statement of Limitations

The extent of this study was limited to the specific scope of work for which we were retained and that is described in this report. Palmer has assumed that the information provided by the client or any secondary sources of information are factual and accurate. Palmer accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report, as a result, of omissions, misinterpretations or negligent acts from relied upon data. Judgment has been used by Palmer in the interpretation of the information provided but subsurface physical and chemical characteristics may differ from regional scale geology mapping and vary between or beyond well/borehole locations given the inherent variability in geological conditions.

Palmer is not a guarantor of the geological or groundwater conditions at the subject site but warrants only that its work was undertaken and its report prepared in a manner consistent with the level of skill and diligence normally exercised by competent geoscience professionals practicing in the Province of Ontario. Our findings, conclusions and recommendations should be evaluated in light of the limited scope of our work.

The information and opinions expressed in the Report are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT PALMER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS PALMER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belongs to Palmer. Any use which a third party makes of the Report is the sole responsibility of such third party. Palmer accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Palmer's express written permission. Should the project design change following issuance of the Report, Palmer must be provided the opportunity to review and revise the Report in light of such alteration or variation.

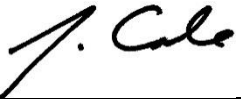
10. Certification

This report was prepared, reviewed and approved by the undersigned. In recognition of the practice of Geoscience in Ontario, this report was originally prepared by Mr. Stephen Hodgson, P.Geo. Mr. Hodgson is no longer with Palmer.

Prepared by:

Tanvi Patel, M.Env.Sc., G.I.T.
Environmental Scientist

Reviewed and Approved by:



Jason Cole, M.Sc., P.Geo.
Vice President, Principal Hydrogeologist

11. References

Armstrong, D. K., & Dodge, J. P. (2007). *Paleozoic Geology of Southern Ontario.* Ontario Geological Survey, Miscellaneous Release - Data 219.

Chapman, L. J., & Putnam, D. F. (1984). *Physiography of Southern Ontario* (Vol. Sepcial Volume 2). Ontario Geological Survey.

CVC and TCRA. (2010). *Low Impact Development Stormwater Management Planning and Design Guide.*

Gerber, R. E., Sharpe, D. R., Hazen, R. A., Holysh, S., & Khazaei, E. (2018). Conceptual Hydrogeological Modele of the Yonge Street Aquifer, South-Central Ontario: a Glaciofluvial Channel-Fan Setting.

LSRCA. (2010). *East Holland River Subwatershed Plan.*

Meriano, M. (1999). *Hydrogeology of a Complex Glacial System, Rouge River-Highland Creek Watershed, Scarborough, Ontario.* University of Toronto.

Ministry of the Environment, Conservation and Parks. (2017). *Drinking Water Threats and Circumstances Tables.* Government of Ontario.

MOEE. (1995). *Technical Information Requirements of Land Development Applications.*

Puckett, W. E., Dane, J. H., & Hajek, B. F. (1985). Physical and Mineralogical Data to Determine Soil Hydraulic Properties. *Soil Science Society of America Journal, 49*, 831-836.

Sharpe, D. R., Barnett, P. J., Russel, H. J., Brennand, T. A., & Gorrell, G. (1999). *Regional Geological Mapping of the Oak Ridges Moraine, Greater Toronto Area, Southern Ontario.* Geological Survey of Canada.

The Biglieri Group Ltd. (2020). *Site Plan.*

Thornthwaite, C. W. (1948). An Approach Toward a Rational Classification of Climate. *Geographical Review, 38*(1), 55-94.

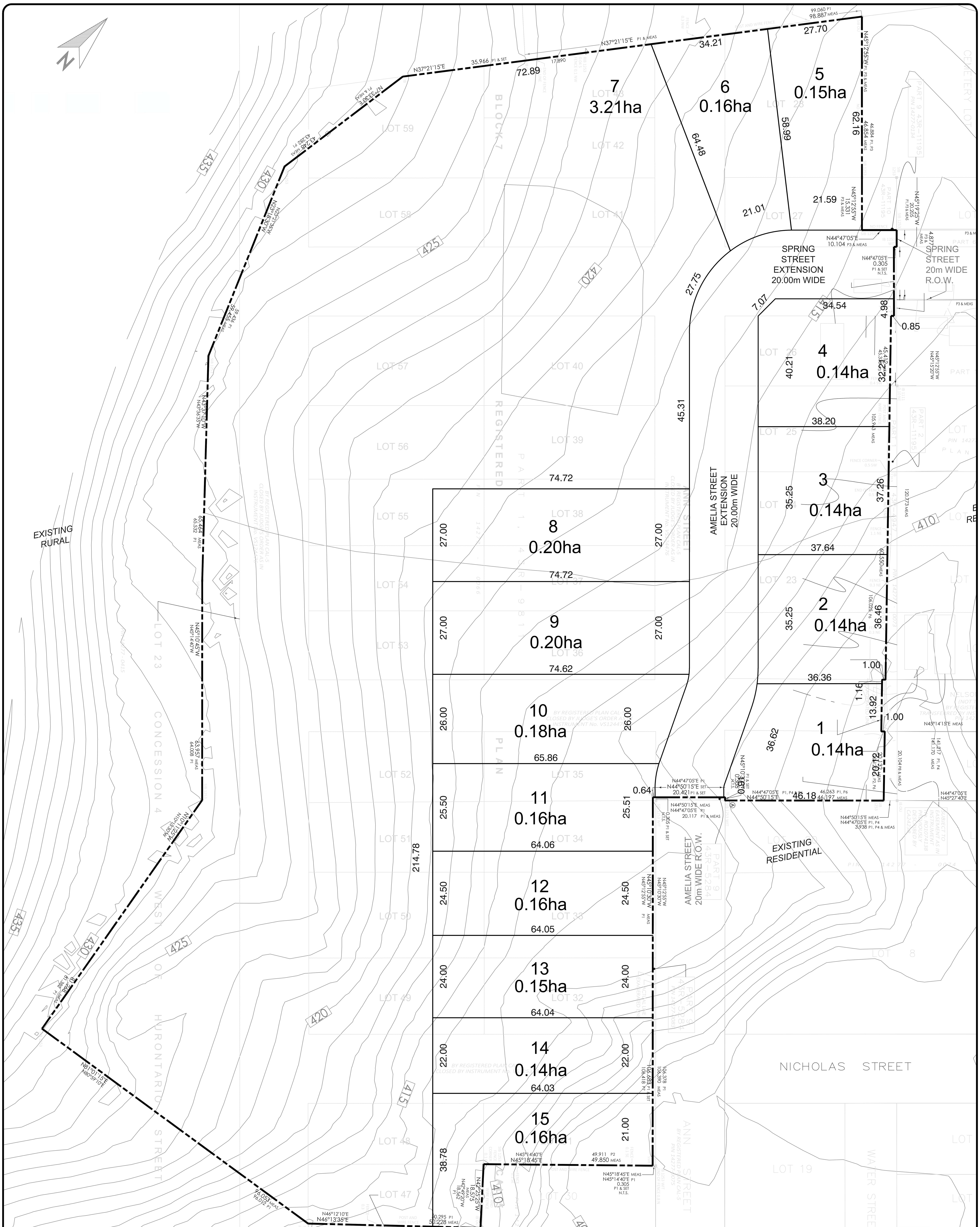
Thornthwaite, C. W., & Mather, J. R. (1957). Instructions and tables for computing potential evapotranspiration and water balance. *Publications in Climatology*, 311.

University of Washington. (2009). Course Notes, ENVH 440/545: Water, Wastewater and Environmental Health.

WHO (2007). Nitrate and nitrite in drinking-water. Background document for development of WHO Guidelines for Drinking-Water Quality. World Health Organization, Geneva (WHO/SDE/WSH/07.01/16).

Appendix A

Concept Plan



SURVEYOR'S CERTIFICATE:

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATE AND CORRECTLY SHOWN IN ACCORDANCE WITH A PLAN OF SURVEY PREPARED BY VAN HARTEN SURVEYING INC.

LUKE G. WILCOX
VAN HARTEN SURVEYING INC.

DATE

OWNER'S CERTIFICATE:

I HEREBY AUTHORIZE **THE BIGLIERI GROUP LTD.** TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE MUNICIPALITY

2496815 Ontario Inc.

DATE

TITLE:

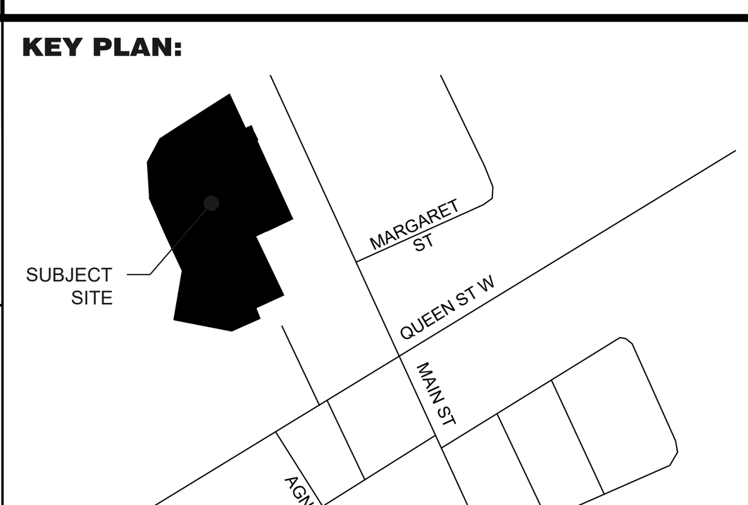
DRAFT PLAN OF SUBDIVISION

LEGAL DESCRIPTION:

PLAN OF SURVEY OF
PART LOT 23, CONCESSION 4,
WEST OF HURONTARIO STREET,
(GEOGRAPHIC TOWNSHIP OF CALEDON)
AND
PART OF LOTS 21, 22, 23, 24, 25, 26, 27 31, 32, 33, 34, 35, 47 & 59,
ALL OF LOTS 28, 36, 37, 38, 39, 40, 41, 42, 43, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57 & 58, AND
PARTS OF SPRING STREET,
NELSON STREET,
NICHOLAS STREET,
ALFRED STREET AND
ANN STREET
BLOCK 7,
REGISTERED PLAN CAL-5
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL

ALTON VILLAGE
CALEDON, ONTARIO

KEY PLAN:



REQUIRED INFORMATION:

AS REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT R.S.O. 1990.

(a) SEE PLAN
(b) SEE PLAN
(c) SEE KEY MAP
(d) SEE SCHEDULE OF LAND USE
(e) SEE PLAN
(f) SEE PLAN
(g) SEE PLAN
(h) MUNICIPAL WATER AND SEWAGE AVAILABLE
(i) TOPSOIL, FILL, SAND, SANDY SILT, SILTY SAND, SILT, SAND AND GRAVEL
(j) SEE PLAN
(k) MUNICIPAL WATER AND SEWAGE AVAILABLE
(l) SEE PLAN
NOTE: CONTOURS RELATE TO CANADIAN GEODETIC DATUM

Schedule of Land Use

Description	Lot / Block No.	Residential Units	Area (ha)
Single Detached Residential			
Min, Lot Are 0.14ha	1-15	15	5.44
ROW	AMELIA STREET EXTENSION		0.39
Total		15	5.84

NOTE:
DISTANCES AND/OR COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

APPROVAL STAMP

REVISIONS

No.	Description	Date	Int.
3			
2			
1			

PROJECT No.:	16420
DATE:	September 29, 2021
SCALE:	1:500
DRAFTED BY: JS	CHECKED BY:
DRAWING No.:	**DP-01**

THE BIGLIERI GROUP LTD.
Planning | Development | Project Management | Urban Design
20 Leslie Street, Suite 121, Toronto
126 Catharine Street North, Hamilton
(416) 693-9155
thebiglierigroup.com

Appendix B

Summary of MECP Well Records

Well ID	TWP LOT CON	Zone	Easting	Northing	Elev. (mASL)	Depth (m)	Depth to Bedrock (m)	Water Found (m)	Static Level (m)	Date and Contractor No.	Casing Diameter (in)	Rate (Lpm)	Pumping Test (ft/ft/lgpm/hr:min)	Use	Screen (top depth and length in ft)	Stratigraphy (ft)
4900887	Lot 3 WHS Con 022 Caledon Twp	17	574961.3	4856702	406.06	24.4	5.2	21.3	5.2	1962/11 4703		45.5	17/20/10/2:0	DO		CLAY STNS 0017 LMSN 0060 RED SHLE 0080
4900890	Lot 3 WHS Con 023 Caledon Twp	17	574995.3	4856706	405.32	15.2	6.1	8.5, 13.7	5.5	1956/05 4703		36.4	18/25/8/2:0	DO		CLAY 0006 CLAY STNS 0020 LMSN 0050
4900891	Lot 3 WHS Con 023 Caledon Twp	17	575074.3	4856674	404.31	19.2	4	17.7	10.1	1956/12 4728		22.75	33/38/5/12:0	DO		CLAY 0006 CLAY MSND STNS 0013 LMSN 0036 BLUE SHLE 0042 RED SHLE 0063
4900892	Lot 3 WHS Con 023 Caledon Twp	17	575051.3	4856612	411.02	18	5.2	15.2	5.2	1957/04 4728		18.2	17/17/4/:	PS		CLAY STNS 0017 LMSN 0029 BLUE SHLE 0035 RED SHLE 0059
4900893	Lot 3 WHS Con 023 Caledon Twp	17	574985.3	4856905	401.38	44.5	25.6	31.7	9.8	1959/09 2909		9.1	32/146/2/4:0	DO		BRWN MSND BLDR 0038 BRWN MSND SILT GRVL 0046 BRWN CLAY MSND BLDR 0060 GREY CLAY 0084 BRWN LMSN 0105 SNDS 0128 GREY SHLE 0146
4900894	Lot 3 WHS Con 023 Caledon Twp	17	574998.3	4856998	398.04	32.6		32.0	4.6	1959/12 4703	4	45.5	15/32/10/2:0	DO		LOAM 0005 CLAY GRVL 0032 FSND 0105 GRVL 0107
4900896	Lot 3 WHS Con 023 Caledon Twp	17	574896.3	4856763	406.13	43.6	26.2	35.4, 38.1, 42.1	12.2	1960/11 2904		22.75	40/140/5/6:0	CO		PRDG 0019 HPAN BLDR 0046 BRWN CLAY STNS 0056 BRWN CLAY 0067 BLCK CLAY MUCK 0071 GREY CLAY 0078 YLLW CLAY 0086 CLAY SHLE LMSN 0099 BRWN LMSN 0126 RED SHLE 0143
4900897	Lot 3 WHS Con 023 Caledon Twp	17	574995.3	4856661	407.46	24.4	5.5	19.8	6.1	1960/09 4703		27.3	20/54/6/3:0	DO		BLDR CLAY 0018 BRWN LMSN 0060 RED SHLE 0080
4900898	Lot 3 WHS Con 023 Caledon Twp	17	574821.3	4856994	396.62	31.4		31.1	2.4	1962/08 5416	4	18.2	8/60/4/8:0	DO		LOAM STNS 0006 MSND 0072 MSND BLDR 0103
4900899	Lot 3 WHS Con 023 Caledon Twp	17	574731.3	4856919	400.46	22.6		21.0	5.5	1966/09 3316	4	27.3	18/28/6/2:0	DO		CLAY 0069 GRVL 0074
4900900	Lot 3 WHS Con 023 Caledon Twp	17	574865.3	4856890	398.42	76.2	45.7	71.6	14	1967/06 3316		18.2	46/180/4/2:0	PS		MSND 0040 CLAY 0150 RED SHLE 0250
4900901	Lot 3 WHS Con 024 Caledon Twp	17	574498.3	4857188	416.48	38.7	13.7	29.0	9.8	1960/03 4703		36.4	32/60/8/2:0	DO		PRDG 0020 MSND 0032 CLAY STNS 0045 LMSN 0084 RED SHLE 0127
4900902	Lot 3 WHS Con 024 Caledon Twp	17	574418.3	4857228	418.55	38.4	12.8	31.7	9.1	1962/01 4703		27.3	30/75/6/5:0	DO		LOAM 0001 CLAY GRVL 0042 LMSN 0074 BLUE SHLE 0126
4900903	Lot 3 WHS Con 024 Caledon Twp	17	574519.3	4857169	416.26	39.6	18.3	27.4	11.6	1962/12 4703		27.3	38/80/6/2:0	DO		PRDG 0050 CLAY STNS 0060 GREY LMSN 0080 BLUE SHLE 0130
4900952	Lot 4 WHS Con 023 Caledon Twp	17	574763.3	4856670	407.34	39.6	9.1	24.4, 38.1	13.7	1950/08 4703		136.5	45/50/30/3:0	DO		CLAY MSND STNS 0030 LMSN 0060 BLUE SHLE 0120 RED SHLE 0130
4900953	Lot 4 WHS Con 023 Caledon Twp	17	574773.3	4856679	406.90	39	15.2	19.8, 36.6	9.1	1951/05 4703		18.2	30/70/4/5:0	DO		BLDR CLAY 0050 RED SHLE 0065 BLUE SHLE 0128
4900954	Lot 4 WHS Con 023 Caledon Twp	17	574812.3	4856745	407.06	12.8	1.8	7.6, 12.2	4.9	1952/04 4703			16/22//2:0	DO		YLLW CLAY 0006 LMSN 0042
4900955	Lot 4 WHS Con 023 Caledon Twp	17	574862.3	4856591	411.98	14.3	9.1	13.7	4.9	1953/04 4703		45.5	16/20/10/2:0	DO		CLAY 0010 CLAY STNS 0030 BRWN LMSN 0047
4900956	Lot 4 WHS Con 023 Caledon Twp	17	574837.3	4856561	415.17	8.5	5.2		4.6	1954/09 4728		22.75	15/15/5/15:0	DO		PRDG 0009 CLAY MSND BLDR 0017 LMSN 0028
4900957	Lot 4 WHS Con 023 Caledon Twp	17	574759.3	4856445	418.55	12.8	5.5		7.6	1954/10 4728		13.65	25/35/3/12:0	DO		LOAM 0002 GRVL STNS 0018 LMSN 0023 GRVL 0024 LMSN 0042
4900958	Lot 4 WHS Con 023 Caledon Twp	17	574674.3	4856662	408.86	86.3	3	6.1, 64.0	12.2	1956/07 1705		27.3	40/94/6/8:0	DO		CLAY MSND STNS 0010 BRWN SHLE 0046 WHIT LMSN 0060 BRWN LMSN 0093 GREY LMSN 0110 BLUE SHLE 0115 RED SHLE 0132 BLUE SHLE 0201 RED SHLE 0210 BLUE SHLE 0213 RED SHLE 0283
4900959	Lot 4 WHS Con 023 Caledon Twp	17	574836.3	4856630	409.57	10.1	3.7	9.1	4.9	1956/12 4728		18.2	16/16/4/6:0	DO		PRDG 0005 CLAY STNS 0012 WHIT LMSN 0033
4900960	Lot 4 WHS Con 023 Caledon Twp	17	574560.3	4856408	414.15	17.1	5.5	6.7	5.2	1957/03 4728		9.1	17/50/2/:	DO		CLAY 0018 LMSN 0056
4900961	Lot 4 WHS Con 023 Caledon Twp	17	574828.3	4856570	414.61	10.1	7.3	9.1	6.1	1957/03 4728		18.2	20/25/4/:	DO		CLAY STNS 0024 LMSN 0033
4900962	Lot 4 WHS Con 023 Caledon Twp	17	574734.3	4856658	408.32	10.7	3.7	7.6, 9.8	4.6	1957/11 4703		68.25	15/18/15/2:0	DO		CLAY MSND STNS 0012 GREY LMSN 0035
4900963	Lot 4 WHS Con 023 Caledon Twp	17	574473.3	4856235	421.93	12.2		10.7	4.6	1957/12 4703		31.85	15/20/7/2:0	DO		CLAY LMSN 0014 GREY LMSN 0040
4900964	Lot 4 WHS Con 023 Caledon Twp	17	574558.3	4856429	413.67	12.2	4.9	6.1	0.9	1959/05 4703		54.6	3/15/12/3:0	DO		CLAY STNS 0016 LMSN 0040
4900965	Lot 4 WHS Con 023 Caledon Twp	17	574651.3	4856717	408.66	10.7		10.7	4.6	1959/06 4703	5	45.5	15/20/10/5:0	DO		CLAY BLDR 0025 CLAY GRVL 0030 GRVL MSND CLAY 0035
4900966	Lot 4 WHS Con 023 Caledon Twp	17	574913.3	4856645	408.17	11.6	6.1	9.1	3	1959/06 4703		36.4	10/16/8/2:0	DO		CLAY STNS 0012 CLAY MSND 0020 CLAY GRVL LMSN 0028 LMSN 0038
4900967	Lot 4 WHS Con 023 Caledon Twp	17	574727.3	4856536	413.93	23.8	8.5	17.7, 22.3	4.3	1960/11 2904		45.5	14/24/10/24:0	DO		LOAM 0002 CLAY MSND STNS 0015 BLDR GRVL 0022 BLDR CLAY MSND 0028 LMSN 0034 LMSN MSND 0038 LMSN 0062 RED SHLE 0074 GREY LMSN 0078
4900968	Lot 4 WHS Con 023 Caledon Twp	17	574718.3	4856560	412.33	12.8	6.4	10.4	2.4	1962/03 4703		54.6	8/14/12/3:0	DO		LOAM 0002 BRWN CLAY STNS 0021 BRWN LMSN 0042
4900969	Lot 4 WHS Con 023 Caledon Twp	17	574826.3	4856571	414.54	17.4	7.6	13.7	4.3	1962/05 4703		45.5	14/20/10/3:0	DO		LOAM 0001 CLAY BLDR LMSN 0025 LMSN 0057
4900970	Lot 4 WHS Con 023 Caledon Twp	17	574604.3	4856742	410.15	33.5	21.3	32.9	3.7	1962/07 5416		22.75	12/60/5/4:0	DO		LOAM 0002 CLAY 0025 MSND 0045 MSND BLDR 0060 GRVL 0070 BRWN LMSN 0110
4900971	Lot 4 WHS Con 023 Caledon Twp	17	574539.3	4856726	420.52	18.9	3.7	18.6	8.2	1963/01 3316		27.3	27/35/6/1:30	DO		CLAY GRVL 0012 LMSN 0017 CLAY LMSN 0032 GREY LMSN 0062
4900972	Lot 4 WHS Con 023 Caledon Twp	17	574880.3	4856677	407.99	33.5	6.7	32.9	6.1	1967/02 1315		13.65	20/30/3/3:0	DO		CLAY BLDR 0022 GRVL LMSN 0033 LMSN 0070 BLUE SHLE 0110
4900974	Lot 4 WHS Con 024 Caledon Twp	17	574297.3	4857261	424.85	39.6	15.2	36.6	5.2	1956/06 4703		13.65	17/50/3/2:0	DO		PRDG 0018 MSND 0025 CLAY MSND STNS 0050 LMSN SNDS 0070 RED SHLE 0130
4900975	Lot 4 WHS Con 024 Caledon Twp	17	574185.3	4857350	423.20	27.4	13.7	21.3	7.9	1960/03 4703		36.4	26/32/8/3:0	DO		PRDG 0025 CLAY STNS 0045 LMSN 0090

Well ID	TWP LOT CON	Zone	Easting	Northing	Elev. (mASL)	Depth (m)	Depth to Bedrock (m)	Water Found (m)	Static Level (m)	Date and Contractor No.	Casing Diameter (in)	Rate (Lpm)	Pumping Test (ft/ft/lgpm/hr: min)	Use	Screen (top depth and length in ft)	Stratigraphy (ft)
4900976	Lot 4 WHS Con 024 Caledon Twp	17	574312.3	4857206	423.17	15.2	10.7	14.3	7.6	1965/12 3316		27.3	25/32/6/3:0	DO		CLAY GRVL 0020 MSND 0030 GRVL 0035 LMSN 0050
4900977	Lot 4 WHS Con 024 Caledon Twp	17	574205.3	4857346	422.78	61	38.1	59.1	22.9	1960/04 3512		22.75	75/75/5/2:0	DO		BRWN MSND 0083 HPAN 0093 BRWN MSND 0112 BLUE CLAY 0125 BLUE SHLE 0137 RED SHLE 0148 BLUE SHLE 0184 LMSN 0200
4900978	Lot 4 WHS Con 024 Caledon Twp	17	574358.3	4857172	421.07	29	11	25.9	10.7	1966/09 3316		9.1	35/60/2/1:0	DO		CLAY LMSN 0036 LMSN 0095
4903139	Lot 4 WHS Con 023 Caledon Twp	17	574814.3	4856703	407.12	30.5	4.3	15.2	3	1968/09 3316		27.3	10/40/6/1:0	DO		CLAY BLDR 0014 GREY LMSN 0055 RED SHLE 0100
4903140	Lot 4 WHS Con 024 Caledon Twp	17	574404.3	4857113	416.51	39.6	14	37.8	13.7	1968/09 3316		18.2	45/75/4/2:0	DO		MSND 0035 CLAY STNS 0046 GREY LMSN 0104 RED SHLE 0130
4903409	Lot 3 WHS Con 023 Caledon Twp	17	575064.3	4856773	402.74	42.7	17.1	29.0, 36.6, 41.2	7.3	1969/11 3316		13.65	24/90/3/1:0	DO		MSND GRVL 0016 FSND CLAY 0056 BLUE SHLE 0085 BRWN SHLE SNDS 0126 RED SHLE 0140
4903533	Lot 4 WHS Con 024 Caledon Twp	17	574214.3	4857353	422.34	36.6	14	22.9, 31.7, 35.1		1970/09 3316		22.75	/80/5/4:0	DO		CLAY MSND 0020 CLAY STNS 0046 GREY LMSN 0105 BLUE SHLE 0120
4903607	Lot 3 WHS Con 022 Caledon Twp	17	575079.3	4856793	401.51	29.6	26.2	28.7	7.6	1971/05 2406	5	45.5	25/68/10/2:0	DO		BRWN GRVL CLAY 0019 BRWN CLAY GRVL 0057 BLDR 0058 GREY CLAY GRVL 0086 GREY SHLE 0097
4904075	Lot 4 WHS Con 023 Caledon Twp	17	574464.3	4856243	421.54	36.9	2.4	32.3, 36.0	6.1	1973/04 4320	4	36.4	20/50/8/2:0	DO		BRWN CLAY STNS 0008 GREY DLMT 0121
4904343	Lot 3 WHS Con 023 Caledon Twp	17	574896.3	4856696	407.38	59.4	19.2	23.2, 58.5	12.2	1974/05 4856		27.3	40/105/6/5:0	DO		BLCK LOAM 0001 GREY CLAY GRVL BLDR 0063 BLUE LMSN SHLE LYRD 0074 BLUE SHLE HARD SOFT 0150 RED SHLE HARD SOFT 0195
4904585	Lot 3 WHS Con 023 Caledon Twp	17	574689.3	4857010	405.81	44.2	27.4		10.7	1974/10 1315	5	45.5	35/78/10/3:0	DO		CLAY GRVL STNS 0030 YLLW BLDR GRVL CLAY 0090 LMSN MUCK 0120 RED SHLE 0145
4904641	Lot 3 WHS Con 023 Caledon Twp	17	574654.3	4857063	410.17	39	29.6	39.0	7.6	1975/05 3406		18.2	25/100/4/1:0	DO		BRWN GRVL 0073 GREY CLAY GRVL 0097 GREN SHLE LMSN 0120 GREN LMSN 0128
4904699	Lot 3 WHS Con 023 Caledon Twp	17	574907.3	4856862	401.95	68.6	39.9	54.9, 66.5	12.2	1974/10 3316		27.3	40/100/6/1:0	DO		CLAY STNS 0131 RED SHLE 0225
4904746	Lot 4 WHS Con 023 Caledon Twp	17	574670.3	4856529	413.64	27.7	4.3	27.4	3	1975/06 4320	5	45.5	10/40/10/20:0	DO		BRWN LOAM 0002 BRWN GRVL CLAY STNS 0014 LMSN 0022 GREY LMSN SHLE 0091
4904838	Lot 3 WHS Con 023 Caledon Twp	17	574913.3	4856769	405.82	43.9	7.3	39.6	14	1975/11 3317		13.65	46/105/3/2:0	DO		BRWN CLAY STNS GRVL 0024 LMSN 0046 BLUE SHLE 0105 DLMT 0129 SNDS 0144
4904885	Lot 4 WHS Con 023 Caledon Twp	17	574664.3	4856723	408.08	100.6	12.8	15.2, 44.5	12.5	1975/09 2332	2	22.75	41/65/4/5:0	DO		BLCK LOAM 0002 BRWN GRVL STNS FSND 0016 BRWN GRVL STNS FSND 0042 WHIT LMSN 0050 BRWN MSND STNS 0064 GREY SHLE 0105 GREY ROCK SHLE 0146 RED SHLE 0330
4904962	Lot 4 WHS Con 022 Caledon Twp	17	574564.3	4856373	415.07	76.2	6.7	10.7, 51.5		1976/07 1737		31.85	//7/:	NU		LOAM 0001 BRWN CLAY STNS SNDY 0003 SAND GRVL BLDR 0011 SAND SOFT 0017 BRWN CLAY SAND GRVL 0022 BRWN LMSN HARD 0047 BRWN LMSN HARD 0064 GREY LMSN HARD 0073 BRWN LMSN HARD 0077 GREY LMSN HARD 0082 BRWN LMSN 0084 GREY LMSN HARD 0088 BRWN LMSN 0089 BLUE SHLE
4904964	Lot 4 WHS Con 022 Caledon Twp	17	574414.3	4856223	421.53	48.8	4.3	17.7, 21.0, 29.3	7.9	1976/07 1737		91	26//20/:	NU		LOAM 0001 BRWN CLAY STNS SOFT 0014 BRWN LMSN HARD 0016 BRWN LMSN HARD 0032 BRWN LMSN HARD 0058 BRWN LMSN SOFT 0060 BRWN LMSN HARD 0068 BRWN LMSN SHLE SOFT 0069 BRWN LMSN SOFT 0078 BRWN LMSN SOFT 0080 BRWN LMSN HARD 0084 BRWN LMSN SOFT 0085 BRWN LMSN HARD
4905074	Lot 4 WHS Con 023 Caledon Twp	17	574814.3	4856723	407.05	55.5	30.5	55.5	13.7	1976/09 3406		18.2	45/80/4/5:0	DO		BRWN CLAY GRVL 0042 BRWN CLAY 0100 RED SHLE LMSN 0182
4905099	Lot 4 WHS Con 023 Caledon Twp	17	574164.3	4856423	422.86	64.3	2.4	25.9	5.2	1977/04 2336		18.2	17/90/4/3:0	CO		LOAM 0001 BRWN CLAY STNS FCRD 0008 BRWN ROCK 0110 GREY ROCK 0120 BLUE SHLE 0175 BRWN ROCK 0211
4905134	Lot 4 WHS Con 023 Caledon Twp	17	574164.3	4856423	422.86	68.3	3	33.5	4.9	1977/04 2336		4.55	16//5/1:0	DO		BRWN LOAM 0001 BRWN CLAY STNS 0010 BRWN ROCK 0100 GREY ROCK 0123 BLUE SHLE 0136 RED SHLE 0151 BLUE SHLE 0186 BRWN ROCK 0220 RED SHLE 0224
4905587	Lot 3 WHS Con 022 Caledon Twp	17	575064.3	4856723	403.75	31.4	18	29.0	10.7	1979/11 3317		22.75	35/52/5/3:0	DO		GRVL SAND 0040 CLAY STNS 0059 SHLE STNS 0103
4905647	Lot 4 WHS Con 023 Caledon Twp	17	574814.3	4856723	407.05	61.6	16.2	61.0	6.1	1979/11 3406		27.3	20/200/6/1:30	CO		LOAM 0001 BRWN SAND 0011 GRVL 0017 GRVL STNS CLAY 0053 BRWN LMSN 0072 RED SHLE 0202
4906020	Lot 3 WHS Con 024 Caledon Twp	17	574414.3	4857273	417.89	57	33.8	51.8	15.5	1982/11 3317		22.75	51/170/5/2:0	DO		SAND CLAY LYRD 0102 CLAY STNS 0111 BLUE SHLE SOFT 0128 DLMT SHLE LYRD 0160 SNDS 0180 BLUE SHLE 0183 RED SHLE 0187

Well ID	TWP LOT CON	Zone	Easting	Northing	Elev. (mASL)	Depth (m)	Depth to Bedrock (m)	Water Found (m)	Static Level (m)	Date and Contractor No.	Casing Diameter (in)	Rate (Lpm)	Pumping Test (ft/ft/lgpm/hr: min)	Use	Screen (top depth and length in ft)	Stratigraphy (ft)
4907582 (103357) A	Lot 3 WHS Con 022 Caledon Twp	17	575037.3	4856632	409.93	40.5				1991/11 4011				A		PRDR 0133
4908080 (168902) A	Lot 3 WHS Con 022 Caledon Twp	17	575014.3	4856699	405.15	7.9	7.6	6.7		1995/11 9999	30			A DO		BRWN CSND STNS LOOS 0025 YLLW LMSN 0026
4908081 (168901) A	Lot 3 WHS Con 022 Caledon Twp	17	575003.3	4856683	405.99	24.4	6.1	16.5		1995/11 9999	4			A DO		BRWN CSND STNS LOOS 0020 YLLW LMSN LYRD SOFT 0080
4908781 (229058) A	Lot 04 WHS Con Caledon Twp	17	574884	4856659	408.32					2001/04 4011				A		
4908783 (229065) A	Lot 03 WHS Con Caledon Twp	17	574856	4857221	395.44					2001/04 4011				A		
4908784 (229075) A	Lot 04 WHS Con Caledon Twp	17	574905	4856626	408.87					2001/04 4011				A		
4908785 (229061) A	Lot WHS Con Caledon Twp	17	574515	4856374	415.26	0.6				2001/04 4011				A		UNKN CMTD 0001 UNKN 0001 STNS GRVL 0002
4908787 (229057) A	Lot WHS Con Caledon Twp	17	575059	4857010	396.55					2001/04 4011				A		
4908954 (243993) A	Lot WHS Con Caledon Twp	17	574482	4856312	418.25					2002/03 4011				A		
4909615 (Z11183) A011071	Lot 3 WHS Con 024 Caledon Twp	17	574704	4857290	402.82	25				2004/10 6809	2			UN	0072 10	BRWN SAND GRVL 0015 BRWN SAND SILT 0030 BRWN SAND CLAY SILT 0034 BRWN SAND STNS SILT 0082
4909684 (Z17481) A025741	Lot WHS Con Caledon Twp	17	575031	4857043	395.10	7.3		4.3		2004/06 1129	2.48			UN	0014 10	BRWN FILL SNDY LOOS 0014 BRWN CSND LOOS 0024
7054425 (Z75375) A	Lot 4 WHS Con 024 Caledon Twp	17	574339	4857230	420.95					2007/12 4011	0.4			A		
7132231 (Z098414) A085719 A	Lot 4 WHS Con 023 Caledon Twp	17	574667	4856755	406.86	6.1			5.2	2009/09 7219	28		17///:	A		SAND 0016 0017 SAND 0020
7154741 (Z110180) A095429	Lot WHS Con Caledon Twp	17	574930	4856917	400.75	10.7				2010/03 6809	2.5			MT	0030 5	BLCK LOAM 0002 BRWN FSND 0026 GREY CSND WBRG 0035
7154742 (Z110184) A095466	Lot WHS Con Caledon Twp	17	575118	4856879	398.98	9.1				2010/03 6809	2.5			MT	0025 5	BLCK 0000 BRWN CSND GRVL 0003 GREY 0004 BRWN FILL 0008 BRWN CLAY 0012 BRWN SAND GRVL 0023 GREY CSND WBRG 0030
7168997 (Z134781) A	Lot 3 WHS Con 022 Caledon Twp	17	575000	4856658	407.68	0				2011/08 4011				A OT		
7179906 (Z143123) A126374	Lot WHS Con Caledon Twp	17	574751	4856641	409.20	4.6				2012/01 7215	2			TH	0015 10	BRWN FILL LOOS 0005 RED SAND CLAY WBRG 0015
7192969 (C18004) A126133 P	Lot WHS Con Caledon Twp	17	574785	4856640	409.14	0				2012/06 6607				UN		
7207956 (Z171588) A	Lot 4 WHS Con 023 Caledon Twp	17	574553	4857014	409.49	0		2.7		2013/08 7147	35.4			A		

Well ID	TWP LOT CON	Zone	Easting	Northing	Elev. (mASL)	Depth (m)	Depth to Bedrock (m)	Water Found (m)	Static Level (m)	Date and Contractor No.	Casing Diameter (in)	Rate (Lpm)	Pumping Test (ft/ft/lgpm/hr: min)	Use	Screen (top depth and length in ft)	Stratigraphy (ft)
7210872 (Z179317) A152743	Lot WHS Con Caledon Twp	17	574928	4856957	398.27	6.7				2013/10 7241	2			MT	0012 10	BRWN FILL 0015 BRWN SILT SAND WBRG 0020 BRWN SAND SILT 0022
7210873 (Z179316) A155770	Lot WHS Con Caledon Twp	17	574938	4856966	398.17	8.2				2013/10 7241	2			MT	0017 10	BRWN FILL 0013 BRWN SAND 0023 BRWN SAND WBRG 0027
7210874 (Z179315) A155771	Lot WHS Con Caledon Twp	17	574941	4856949	399.36	8.2				2013/10 7241	2			MT	0017 10	BRWN FILL 0013 BRWN SAND 0024 BRWN SAND WBRG 0027
7211283 (Z180493) A	Lot 4 WHS Con 023 Caledon Twp	17	574698	4856558	411.95			2.7		2013/11 7147	3.94			A		
7212119 (C22128) A146726 P	Lot WHS Con Caledon Twp	17	574782	4856633	409.53					2013/08 6607				UN		
7243504 (C28782) A118007 P	Lot WHS Con Caledon Twp	17	574736	4856634	409.56					2015/06 7147				UN		
7244360 (Z203321) A	Lot 4 WHS Con 023 Caledon Twp	17	574890	4856706	407.31			0.9		2015/06 7147	90			A		
7249498 (Z221469) A	Lot WHS Con Caledon Twp	17	574966	4857270	393.53					2015/09 7221	1.5			A MO		
7249499 (Z221468) A	Lot WHS Con Caledon Twp	17	574966	4857270	393.53					2015/09 7221	1.5			A MO		
7251290 (Z221705) A	Lot WHS Con Caledon Twp	17	574828	4856502	417.02					2015/10 7221	2.5			A MO		
7272520 (Z227961) A	Lot 4 WHS Con 023 Caledon Twp	17	574495	4856283	419.37			5.2		2016/09 7147	5.9			A		
7272917 (Z243333) A	Lot 3 WHS Con 023 Caledon Twp	17	575055	4857126	395.06	25.5		7.0	4.8	2016/09 7221	6.3		16///:	A TH	0045 10	BRWN CLAY SNDY 0003 BRWN GRVL SAND 0020 BRWN SAND SLTY 0031 BRWN GRVL SAND 0056 BRWN SAND GRVL SILT 0060 BRWN SAND SLTY FSND 0084
7284258 (Z249203) A	Lot WHS Con Caledon Twp	17	575009	4856725	405.03					2017/03 7221	2.51			A MO		
7284259 (Z249205) A	Lot WHS Con Caledon Twp	17	575117	4856873	399.01					2017/03 7221	2.51			A MO		
7284260 (Z249204) A	Lot WHS Con Caledon Twp	17	574330	4856244	421.39					2017/03 7221	6.4			A MO		
7290209 (Z259982) A224028	Lot WHS Con Caledon Twp	17	574542	4856921	411.37	7.6		3.7	3	2017/06 7190	2.09		10///:	MO	0015 10	BRWN LOAM LOAM DRY 0001 BRWN SAND GRVL SILT 0012 BRWN SAND SILT WBRG 0015 BRWN SILT SAND ---- 0025

Well ID	TWP LOT CON	Zone	Easting	Northing	Elev. (mASL)	Depth (m)	Depth to Bedrock (m)	Water Found (m)	Static Level (m)	Date and Contractor No.	Casing Diameter (in)	Rate (Lpm)	Pumping Test (ft/ft/lgpm/hr: min)	Use	Screen (top depth and length in ft)	Stratigraphy (ft)
7290226 (Z262896) A224037	Lot WHS Con Caledon Twp	17	574477	4857042	413.58	6.1		4.6	4.6	2017/06 7190	2.09		15///:	MO	0010 10	BRWN SAND SILT DRY 0012 BRWN SAND SILT WBRG 0015 BRWN SAND SILT ---- 0020
7290227 (Z259981) A224099	Lot 4 WHS Con 023 Caledon Twp	17	574598	4856845	408.93	12.2		1.5	1.5	2017/06 7190	2.09		5///:	MO	0028 10	BLCK LOAM SAND DRY 0001 BRWN SAND GRVL DRY 0005 BRWN SAND SILT GRVL 0015 GREY SILT SAND ---- 0030 GREY CLAY TILL SILT 0035 GREY SAND SILT LOOS 0040
7290228 (Z262897) A224029	Lot WHS Con Caledon Twp	17	574482	4856883	418.00	10.7		1.5	1.5	2017/06 7190	2.09		5///:	MO	0025 10	BRWN SAND SILT GRVL 0005 BRWN SAND SILT ---- 0035

Appendix C

Geotechnical Data

C1. Borehole/Monitoring Well Logs (Sirati & Partners, DRAFT)

C2. Grain Size Analyses (Sirati & Partners, DRAFT)

Appendix C1

Borehole/Monitoring Well Logs (Sirati & Partners, DRAFT)

Sirati & Partners Consultants Ltd.
Geotechnical & Environmental Services
Engineering Solutions

LOG OF BOREHOLE BH1

PROJECT: Geotechnical and Hydrogeological Services
CLIENT: Derrick Libawski
PROJECT LOCATION: New Alton Subdivision Queen Street, Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200mm
Date: Jun/06/2017

REF. NO.: SP17-213-10
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 220mm											
0.2	**FILL:** silty sand, trace clay, trace gravel, dark brown, very moist, very loose		1	SS	3				○			
0.8	**SANDY SILT TO SILY SAND:** trace clay, trace gravel, brown, moist, very loose		2	SS	3				○			
1.5	**SILT:** trace to some sand, trace clay, brown, wet, very loose		3	SS	2				○			
2.3	**SANDY SILT TO SILY SAND:** trace clay, trace gravel, brown, wet, very loose to loose		4	SS	4				○			0 57 30 13
			5	SS	2	▽	W. L. 2.9 mBGL Jul 13, 2017		○			
4.6	**SAND:** trace silt, grey, wet, loose		6	SS	9				○			
5.1	**SANDY SILT TO SILY SAND:** trace clay, trace gravel, brown, wet, loose											
6.1	**SAND AND GRAVEL:** trace silt, some cobbles, brown, wet, very dense		7	SS	50/ 120mm				○			
6.4	**END OF BOREHOLE**											

Notes:
1) Monitoring well installed in the borehole upon completion.
2) Water level in the well was measured to be at 2.9 m depth on July 13, 2017.

SPCL SOIL LOG SP17-213-10 - ALTON SUBDIVISION.GPJ SPCL.GDT 8/29/17

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

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

Sirati & Partners Consultants Ltd.
Geotechnical & Environmental Services
Engineering Solutions

LOG OF BOREHOLE BH2

PROJECT: Geotechnical and Hydrogeological Services
CLIENT: Derrick Libawski
PROJECT LOCATION: New Alton Subdivision Queen Street, Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200mm
Date: Jun/07/2017

REF. NO.: SP17-213-10
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 250mm											
0.3	**FILL:** silty sand, trace topsoil, trace gravel, brown, moist, very loose		1	SS	3							
			2	SS	4							
1.5	**SAND AND GRAVEL:** trace silt, brown to dark brown, wet, very loose		3	SS	4							9 72 7 12
	dense at 2.3m		4	SS	34							
3.0	**FINE SAND:** trace to some silt, some gravel, occasional cobble/boulder, brown, wet, compact to very dense		5	SS	11							
			6	SS	45							
			7	SS	51							
7.6	**END OF BOREHOLE** Notes: 1) Auger refusal and terminated. 2) Water level at 1.8 m during drilling.		8	SS	50/ 25mm							

SPCL SOIL LOG SP17-213-10 - ALTON SUBDIVISION.GPJ SPCL.GDT 8/29/17

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

Sirati & Partners Consultants Ltd.
Geotechnical & Environmental Services
Engineering Solutions

LOG OF BOREHOLE BH3

PROJECT: Geotechnical and Hydrogeological Services
CLIENT: Derrick Libawski
PROJECT LOCATION: New Alton Subdivision Queen Street, Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200mm
Date: Jun/05/2017

REF. NO.: SP17-213-10
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 250mm											
0.3	**FILL:** sandy silt, trace clay, brown, moist, very loose to loose		1	SS	2				○			
			2	SS	5				○			
1.5	**SANDY SILT:** trace clay, greyish brown, wet, very loose to loose		3	SS	4				○			
			4	SS	2				○			
			5	SS	9				○			
3.7	**SAND:** trace silt, brown, wet, loose to compact											
			6	SS	24				○			0 81 7 12
6.1	**SANDY SILT TO SILTY SAND:** trace clay, trace gravel,brown, wet, compact		7	SS	12				○			
	very dense below 7.6m		8	SS	23							
8.2	**END OF BOREHOLE** Notes: 1) Auger refusal and terminated. 2) Water level at 2.4 m during drilling.											

SPCL SOIL LOG SP17-213-10 - ALTON SUBDIVISION.GPJ SPCL.GDT 8/29/17

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

Sirati & Partners Consultants Ltd.
Geotechnical & Environmental Services
Engineering Solutions

LOG OF BOREHOLE BH4

PROJECT: Geotechnical and Hydrogeological Services
CLIENT: Derrick Libawski
PROJECT LOCATION: New Alton Subdivision Queen Street, Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200mm
Date: Jun/06/2017

REF. NO.: SP17-213-10
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** 330mm		1	SS	2							
0.3	**FILL:** silty sand, trace clay, brown, moist, very loose		2	SS	2							
1.5	**FILL:** sand, some silt, trace topsoil, trace gravel, brown, moist, very loose		3	SS	1							
2.3	**SANDY SILT:** trace clay, trace gravel, greyish brown, very moist, very loose		4	SS	4							
3.0	**SILT:** trace to some clay, trace sand, greyish brown, wet, compact		5	SS	14							
			6	SS	16							
4.6	**SAND:** trace to some silt, trace clay, brown, wet, compact		7	SS	14							
7.6	**SILT:** trace to some clay, trace sand, grey, wet, compact		8	SS	23							
	very dense below 9.1m		9	SS	53							
9.7	**END OF BOREHOLE** Notes: 1) Water level at 2.4 m during drilling.											

SPCL SOIL LOG SP17-213-10 - ALTON SUBDIVISION.GPJ SPCL.GDT 8/29/17

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ε_{50}=3% Strain at Failure

Sirati & Partners Consultants Ltd.
Geotechnical & Environmental Services
Engineering Solutions

LOG OF BOREHOLE BH5

PROJECT: Geotechnical and Hydrogeological Services
CLIENT: Derrick Libawski
PROJECT LOCATION: New Alton Subdivision Queen Street, Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200mm
Date: Jun/07/2017

REF. NO.: SP17-213-10
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:**250mm											
0.3	**FILL:** sand, some crusher limestone, brown to grey, moist, very loose		1	SS	2							
			2	SS	4							
1.6	**SANDY SILT TO SILTY SAND:** trace clay, brown, moist, compact		3	SS	10							
2.3	**SILTY SAND TO SAND:** trace gravel, brown, wet, compact		4	SS	14	▽	W. L. 2.7 mBGL Jul 13, 2017					
3.0	**SANDY SILT TO SILTY SAND:** trace clay, brown, wet, compact to dense		5	SS	13							
4.6	**SANDY SILT TILL:** trace to some clay, occasional cobble/boulder, brown, wet, dense		6	SS	40							
6.1	**SAND AND GRAVEL:** some cobble/boulder, greyish brown, wet, dense to very dense		7	SS	30							
7.6	**END OF BOREHOLE** Notes: 1) Auger refusal and terminated. 2) Water level in the well was measured to be at 2.7 m depth on July 13, 2017.		8	SS	50/ 25mm							

SPCL SOIL LOG SP17-213-10 - ALTON SUBDIVISION.GPJ SPCL.GDT 8/29/17

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

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ε_{50}=3% Strain at Failure

Sirati & Partners Consultants Ltd.
Geotechnical & Environmental Services
Engineering Solutions

LOG OF BOREHOLE BH6

PROJECT: Geotechnical and Hydrogeological Services
CLIENT: Derrick Libawski
PROJECT LOCATION: New Alton Subdivision Queen Street, Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200mm
Date: Jun/06/2017

REF. NO.: SP17-213-10
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:**280mm							
0.3	**SAND:** trace to some gravel, trace silt, greyish brown, moist, very loose to loose		1	SS	2			
			2	SS	9			
1.5	**GRAVELLY SAND:** trace silt, greyish brown, moist, dense		3	SS	31			
2.3	**SILTY SAND:** trace clay, brown, wet, compact		4	SS	13			
3.0	**SILT TO SANDY SILT:** trace clay, trace gravel, brown, wet, compact		5	SS	26	W. L. 2.9 mBGL Jul 13, 2017		
			6	SS	16			
4.6	**SAND:** trace silt, grey, wet, compact							
6.1	**SANDY SILT TILL:** trace to some clay, trace gravel, layer of crusher limestone, brown, wet, very dense		7	SS	55			
7.6	**SILTY SAND TILL:** trace clay, trace gravel, brown, wet, loose		8	SS	8			
	dense to very dense below 9.1m		9	SS	40			
10.4	**END OF BOREHOLE** Notes: 1) Monitoring well installed in the borehole upon completion. 2) Water level in the well was measured to be at 2.9 m depth on July 13, 2017.		10	SS	50/ 25mm			

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

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

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

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8=3% Strain at Failure

SPCL SOIL LOG SP17-213-10 - ALTON SUBDIVISION.GPJ SPCL.GDT 8/29/17

Sirati & Partners Consultants Ltd.
Geotechnical & Environmental Services
Engineering Solutions

LOG OF BOREHOLE BH7

PROJECT: Geotechnical and Hydrogeological Services
CLIENT: Derrick Libawski
PROJECT LOCATION: New Alton Subdivision Queen Street, Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200mm
Date: Jun/07/2017

REF. NO.: SP17-213-10
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:**280mm											
0.3	**FILL:** silty sand, trace topsoil, trace rootlets, brown, moist, loose		1	SS	6							
0.8	**FILL:** sand mixed with limestone, trace cobble, brown, moist, compact		2	SS	22							
1.5	**SILTY SAND:** trace sand, trace clay, brown, wet, loose to compact		3	SS	8		W. L. 1.3 mBGL Jul 13, 2017					0 79 13 8
			4	SS	13							
			5	SS	14							
			6	SS	19							
			7	SS	22							
			8	SS	8							
9.1	**SILTY CLAY:** trace sand, trace gravel, grey, wet, stiff		9	SS	8							
10.7	**CLAYEY SILT TILL:** some sand, trace gravel, grey, moist, hard		10	SS	36							
12.2	**INTERBEDDED SILT AND CLAYEY SILT:** trace sand, trace gravel, brown, moist, stiff		11	SS	13							
12.7	**END OF BOREHOLE** Notes: 1) Monitoring well installed in the borehole upon completion. 2) Water level in the well was measured to be at 1.3 m depth on July 13, 2017.											

SPCL SOIL LOG SP17-213-10 - ALTON SUBDIVISION.GPJ SPCL.GDT 8/29/17

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

Sirati & Partners Consultants Ltd.
Geotechnical & Environmental Services
Engineering Solutions

LOG OF BOREHOLE BH8

PROJECT: Geotechnical and Hydrogeological Services
CLIENT: Derrick Libawski
PROJECT LOCATION: New Alton Subdivision Queen Street, Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Augers
Diameter: 200mm
Date: Jun/07/2017

REF. NO.: SP17-213-10
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:**280mm											
0.3	**FILL:** silty sand, trace topsoil, brown, moist, very loose		1	SS	3							
0.8	**SILTY SAND:** trace clay, brown, moist, very loose		2	SS	2							
1.5	**SAND:** trace to some silt, brown, moist, very loose		3	SS	4							
2.3	**SILTY SAND:** trace clay, trace gravel, brown, wet, compact		4	SS	10							
			5	SS	11							
4.6	**SANDY SILT:** trace clay, grey, wet, compact		6	SS	10							
			7	SS	12							
6.7	**SAND:** trace silt, grey, wet, compact											
7.6	**SAND AND GRAVEL WITH COBBLES:** some silt, brown, wet, compact to dense		8	SS	18							
			9	SS	38							
9.7	**END OF BOREHOLE** Notes: 1) Water level at 2.6 m during drilling.											

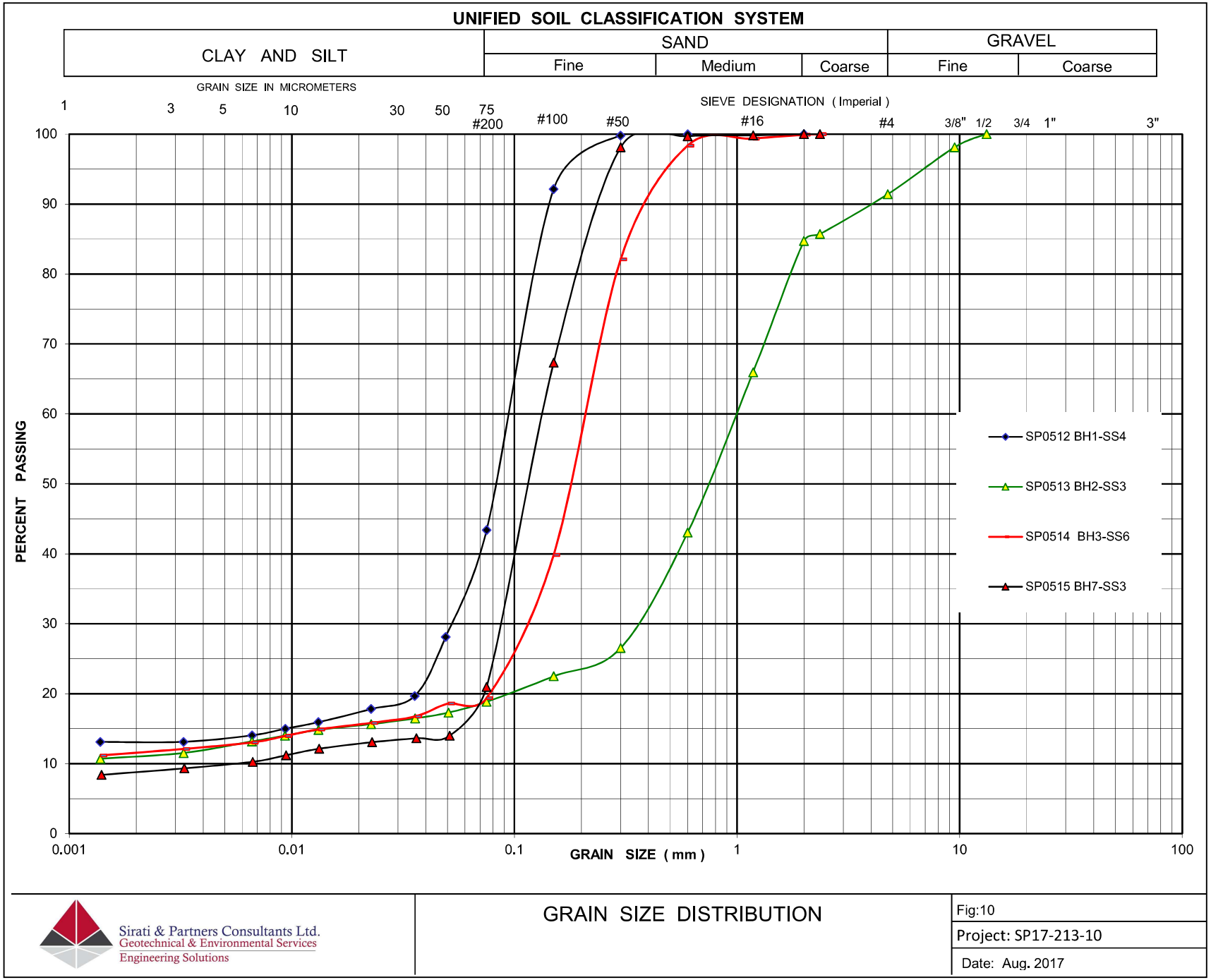
SPCL SOIL LOG SP17-213-10 - ALTON SUBDIVISION.GPJ SPCL.GDT 8/29/17

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

Appendix C2

Grain Size Analyses (Sirati & Partners, DRAFT)



Sirati & Partners Consultants Ltd.
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Engineering Solutions

GRAIN SIZE DISTRIBUTION

Fig:10

Project: SP17-213-10

Date: Aug. 2017

Appendix D

Hydraulic Conductivity Testing

Appendix D1

SWRTs

WELL ID: BH1

Local ID:
Date:
Time:

INPUT

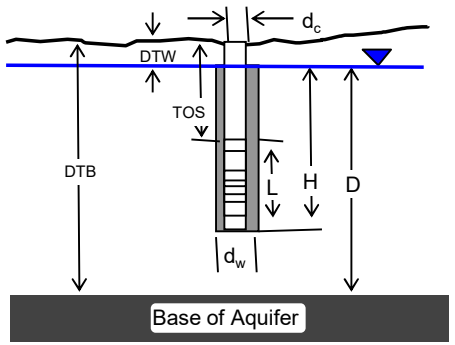
Construction:		
Casing dia. (d_c)	0.05	Meter
Annulus dia. (d_w)	0.203	Meter
Screen Length (L)	3.05	Meter
Depths to:		
water level (DTW)	3.19	Meter
top of screen (TOS)	3.35	Meter
Base of Aquifer (DTB)	6.4	Meter
Annular Fill:		
across screen --	Coarse Sand	
above screen --	Bentonite	
Aquifer Material --	Till	

COMPUTED

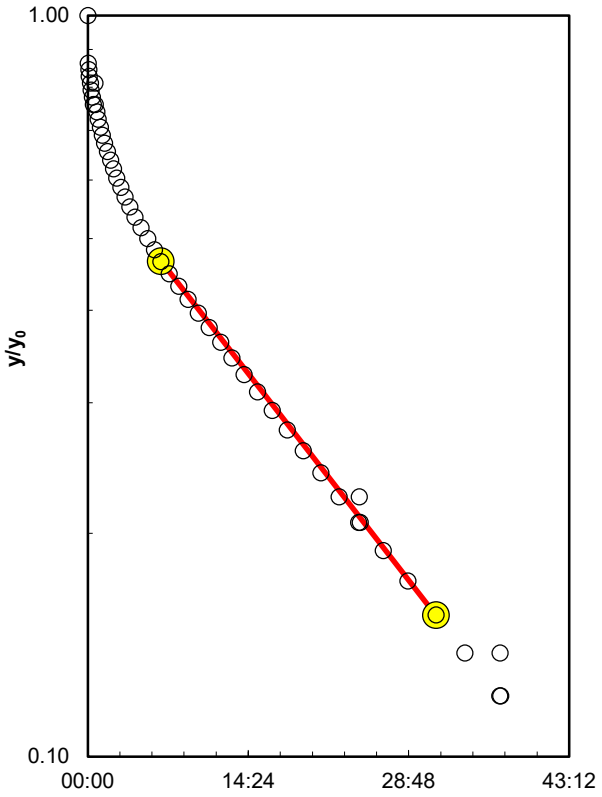
L_{wetted}	3.05	Meter
D =	3.21	Meter
H =	3.21	Meter
L/r_w =	30.05	
$y_{0\text{-DISPLACEMENT}}$ =	0.58	Meter
$y_{0\text{-SLUG}}$ =	0.51	Meter
From look-up table using L/r_w		
Fully penetrate C =	2.082	
ln(Re/rw) =	2.579	
Re =	4.39	Meter
Slope =	0.000323	log_{10}/sec
$t_{90\%}$ recovery =	3096	sec

Input is consistent.

K = 2E-07 Meter/Second



Adjust slope of line to estimate K



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	3.77
2	0:00:02.0	3.69
3	0:00:06.0	3.68
4	0:00:08.0	3.67
5	0:00:14.0	3.66
6	0:00:18.0	3.65
7	0:00:24.0	3.64
8	0:00:30.0	3.63
9	0:00:38.0	3.66
10	0:00:40.0	3.63
11	0:00:48.0	3.62
12	0:00:56.0	3.61
13	0:01:08.0	3.60
14	0:01:18.0	3.59
15	0:01:30.0	3.58
16	0:01:46.0	3.57
17	0:02:02.0	3.56
18	0:02:18.0	3.55
19	0:02:36.0	3.54
20	0:02:58.0	3.53
21	0:03:20.0	3.52
22	0:03:46.0	3.51
23	0:04:14.0	3.50
24	0:04:46.0	3.49
25	0:05:22.0	3.48
26	0:05:58.0	3.47
27	0:06:34.0	3.46
28	0:07:18.0	3.45
29	0:08:10.0	3.44
30	0:09:00.0	3.43
31	0:09:54.0	3.42
32	0:10:54.0	3.41
33	0:11:56.0	3.40
34	0:12:56.0	3.39
35	0:14:02.0	3.38
36	0:15:14.0	3.37

TIME, Minute:Second

REMARKS: Bouwer and Rice analysis of slug test, WRR 1976

37	0:16:32.0	3.36
38	0:17:54.0	3.35
39	0:19:20.0	3.34
40	0:20:54.0	3.33
41	0:22:32.0	3.32
42	0:24:18.0	3.31
43	0:24:22.0	3.32
44	0:24:26.0	3.31
45	0:26:30.0	3.30

WELL ID: BH5

Local ID:
Date:
Time:

INPUT

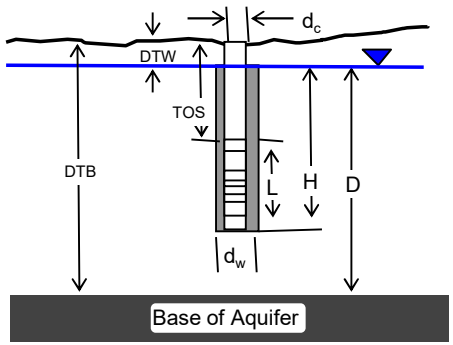
Construction:		
Casing dia. (d_c)	0.05	Meter
Annulus dia. (d_w)	0.203	Meter
Screen Length (L)	3.05	Meter
Depths to:		
water level (DTW)	3.06	Meter
top of screen (TOS)	4.55	Meter
Base of Aquifer (DTB)	7.6	Meter
Annular Fill:		
across screen --	Coarse Sand	
above screen --	Bentonite	
Aquifer Material --	Fine Sand	

COMPUTED

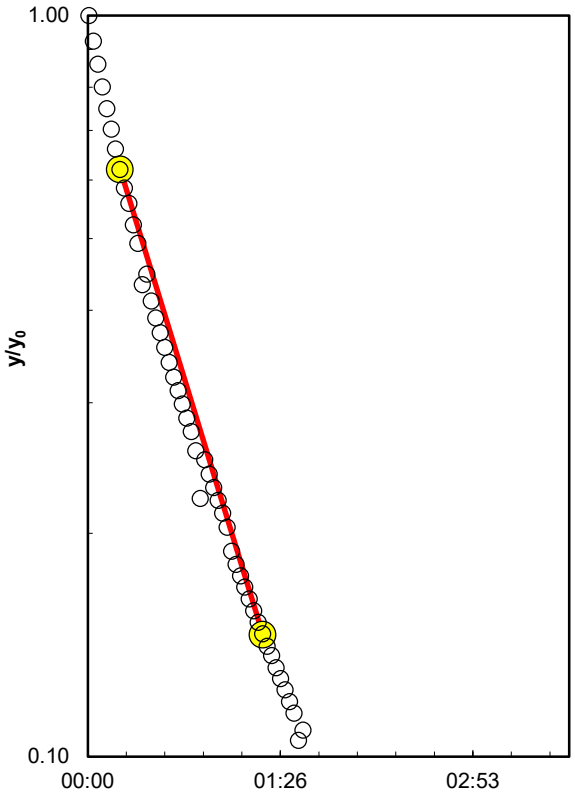
L_{wetted}	3.05	Meter
D =	4.54	Meter
H =	4.54	Meter
L/r_w =	30.05	
$y_{0\text{-DISPLACEMENT}}$ =	0.59	Meter
$y_{0\text{-SLUG}}$ =	0.51	Meter
From look-up table using L/r_w		
Fully penetrate C =	2.082	
ln(Re/rw) =	2.788	
Re =	5.41	Meter
Slope =	0.009813	$\log_{10}$/sec
$t_{90\%}$ recovery =	102	sec

Input is consistent.

K = 6.4E-06 Meter/Second



Adjust slope of line to estimate K



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	3.65
2	0:00:02.0	3.61
3	0:00:04.0	3.57
4	0:00:06.0	3.54
5	0:00:08.0	3.51
6	0:00:10.0	3.48
7	0:00:12.0	3.45
8	0:00:14.0	3.43
9	0:00:16.0	3.41
10	0:00:18.0	3.39
11	0:00:20.0	3.37
12	0:00:22.0	3.35
13	0:00:24.0	3.32
14	0:00:26.0	3.33
15	0:00:28.0	3.30
16	0:00:30.0	3.29
17	0:00:32.0	3.28
18	0:00:34.0	3.27
19	0:00:36.0	3.26
20	0:00:38.0	3.25
21	0:00:40.0	3.25
22	0:00:42.0	3.24
23	0:00:44.0	3.23
24	0:00:46.0	3.22
25	0:00:48.0	3.21
26	0:00:50.0	3.19
27	0:00:52.0	3.21
28	0:00:54.0	3.20
29	0:00:56.0	3.20
30	0:00:58.0	3.19
31	0:01:00.0	3.19
32	0:01:02.0	3.18
33	0:01:04.0	3.17
34	0:01:06.0	3.17
35	0:01:08.0	3.16
36	0:01:10.0	3.16

TIME, Minute:Second

K= 0.0000064 is less than likely minimum of 0.0000106 for Fine Sand

REMARKS: Bouwer and Rice analysis of slug test, WRR 1976

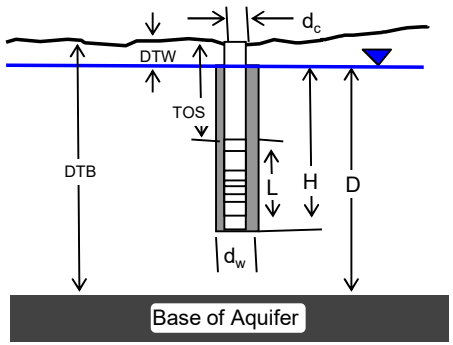
37	0:01:12.0	3.16
38	0:01:14.0	3.15
39	0:01:16.0	3.15
40	0:01:18.0	3.15
41	0:01:20.0	3.14
42	0:01:22.0	3.14
43	0:01:24.0	3.14
44	0:01:26.0	3.14
45	0:01:28.0	3.13

WELL ID: BH6

Local ID:
Date:
Time:

INPUT

Construction:		
Casing dia. (d_c)	0.05	Meter
Annulus dia. (d_w)	0.203	Meter
Screen Length (L)	3.05	Meter
Depths to:		
water level (DTW)	3.36	Meter
top of screen (TOS)	7.35	Meter
Base of Aquifer (DTB)	10.4	Meter
Annular Fill:		
across screen --	Coarse Sand	
above screen --	Bentonite	
Aquifer Material --	Fine-Grained Sandstone	



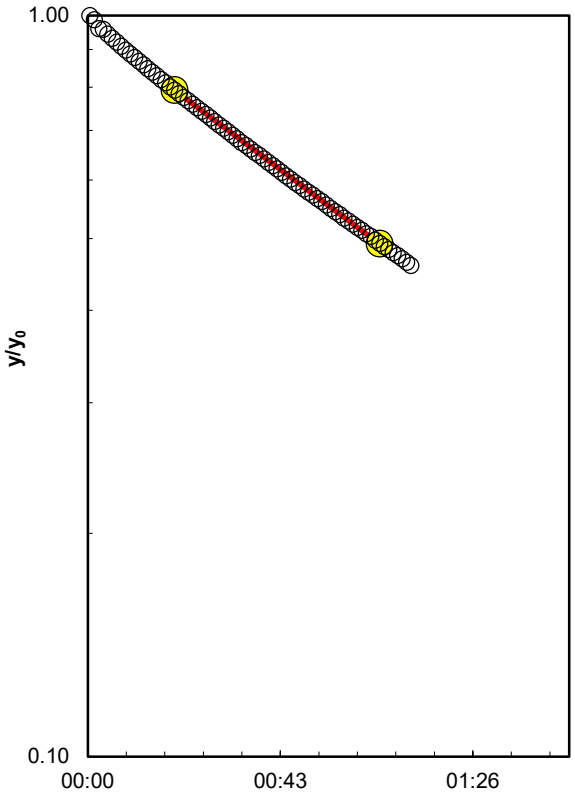
COMPUTED

L_{wetted}	3.05	Meter
D =	7.04	Meter
H =	7.04	Meter
L/r_w =	30.05	
$y_{0\text{-DISPLACEMENT}}$ =	0.59	Meter
$y_{0\text{-SLUG}}$ =	0.51	Meter
From look-up table using L/r_w		
Fully penetrate C =	2.082	
ln(Re/rw) =	3.042	
Re =	6.98	Meter
Slope =	0.004507	$\log_{10}$/sec
$t_{90\%}$ recovery =	222	sec

Input is consistent.

K = 3.2E-06 Meter/Second

Adjust slope of line to estimate K



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	2.77
2	0:00:01.0	2.77
3	0:00:02.0	2.79
4	0:00:03.0	2.79
5	0:00:04.0	2.80
6	0:00:05.0	2.81
7	0:00:06.0	2.81
8	0:00:07.0	2.82
9	0:00:08.0	2.83
10	0:00:09.0	2.83
11	0:00:10.0	2.84
12	0:00:11.0	2.85
13	0:00:12.0	2.85
14	0:00:13.0	2.86
15	0:00:14.0	2.86
16	0:00:15.0	2.87
17	0:00:16.0	2.87
18	0:00:17.0	2.88
19	0:00:18.0	2.88
20	0:00:19.0	2.89
21	0:00:20.0	2.89
22	0:00:21.0	2.90
23	0:00:22.0	2.90
24	0:00:23.0	2.91
25	0:00:24.0	2.91
26	0:00:25.0	2.92
27	0:00:26.0	2.92
28	0:00:27.0	2.93
29	0:00:28.0	2.93
30	0:00:29.0	2.94
31	0:00:30.0	2.94
32	0:00:31.0	2.95
33	0:00:32.0	2.95
34	0:00:33.0	2.96
35	0:00:34.0	2.96
36	0:00:35.0	2.96

TIME, Minute:Second

REMARKS: Bouwer and Rice analysis of slug test, WRR 1976

37	0:00:36.0	2.97
38	0:00:37.0	2.97
39	0:00:38.0	2.98
40	0:00:39.0	2.98
41	0:00:40.0	2.98
42	0:00:41.0	2.99
43	0:00:42.0	2.99
44	0:00:43.0	3.00
45	0:00:44.0	3.00

WELL ID: BH7

Local ID:
Date:
Time:

INPUT

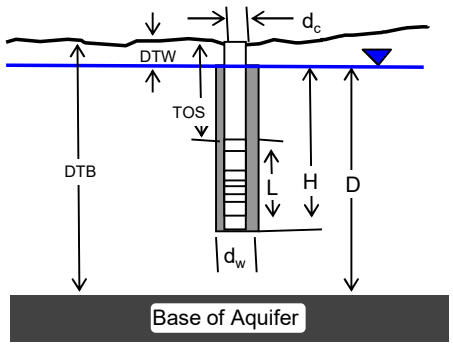
Construction:		
Casing dia. (d_c)	0.05	Meter
Annulus dia. (d_w)	0.203	Meter
Screen Length (L)	3.05	Meter
Depths to:		
water level (DTW)	1.745	Meter
top of screen (TOS)	9.65	Meter
Base of Aquifer (DTB)	12.7	Meter
Annular Fill:		
across screen --	Coarse Sand	
above screen --	Bentonite	
Aquifer Material --	Medium-Grained Sandstone	

COMPUTED

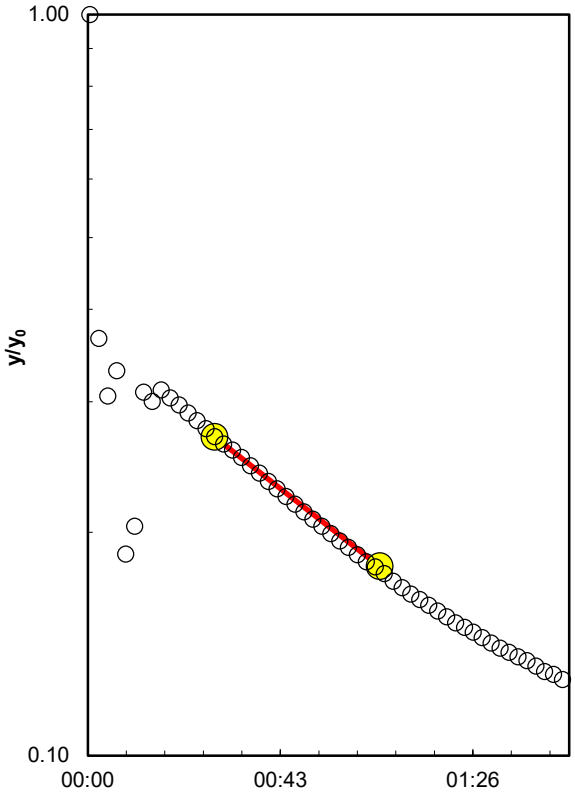
L_{wetted}	3.05	Meter
D =	10.955	Meter
H =	10.955	Meter
L/r_w =	30.05	
$y_{0\text{-DISPLACEMENT}}$ =	0.59	Meter
$y_{0\text{-SLUG}}$ =	0.51	Meter
From look-up table using L/r_w		
Fully penetrate C =	2.082	
ln(Re/rw) =	3.287	
Re =	8.92	Meter
Slope =	0.004716	$\log_{10}$/sec
$t_{90\%}$ recovery =	212	sec

Input is consistent.

K = 3.7E-06 Meter/Second



Adjust slope of line to estimate K



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	2.34
2	0:00:04.0	1.93
3	0:00:08.0	1.86
4	0:00:12.0	1.93
5	0:00:16.0	1.93
6	0:00:20.0	1.92
7	0:00:24.0	1.91
8	0:00:28.0	1.90
9	0:00:32.0	1.90
10	0:00:36.0	1.89
11	0:00:40.0	1.88
12	0:00:44.0	1.88
13	0:00:48.0	1.87
14	0:00:52.0	1.87
15	0:00:56.0	1.86
16	0:01:00.0	1.86
17	0:01:04.0	1.85
18	0:01:08.0	1.85
19	0:01:12.0	1.84
20	0:01:16.0	1.84
21	0:01:20.0	1.84
22	0:01:24.0	1.83
23	0:01:28.0	1.83
24	0:01:32.0	1.83
25	0:01:36.0	1.83
26	0:01:40.0	1.82
27	0:01:44.0	1.82
28	0:01:48.0	1.82
29	0:01:52.0	1.82
30	0:01:56.0	1.82
31	0:02:00.0	1.81
32	0:02:04.0	1.81
33	0:02:08.0	1.81
34	0:02:12.0	1.81
35	0:02:16.0	1.81
36	0:02:20.0	1.81

TIME, Minute:Second

REMARKS: Bouwer and Rice analysis of slug test, WRR 1976

37	0:02:24.0	1.81
38	0:02:28.0	1.80
39	0:02:32.0	1.80
40	0:02:36.0	1.80
41	0:02:40.0	1.80
42	0:02:44.0	1.80
43	0:02:48.0	1.80
44	0:02:52.0	1.80
45	0:02:56.0	1.80

Palmer™

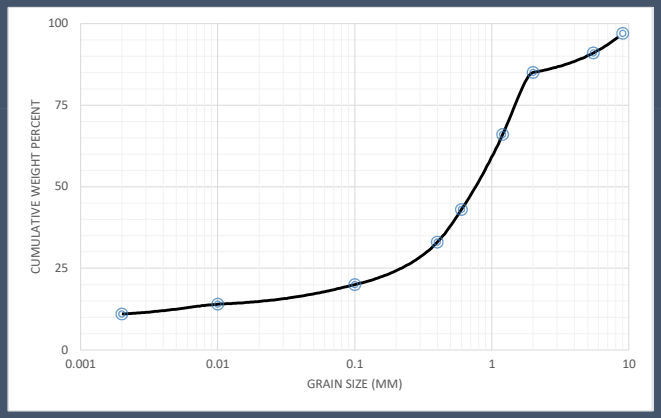
Appendix D2

Grain Size Distribution Analyses

BH2 SS3

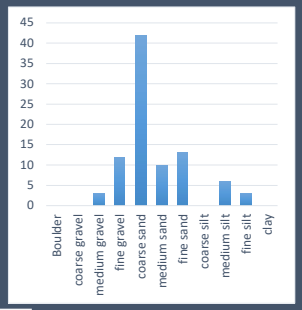
Sand and gravel, trace silt

	Mass Sample (g):			T (°C)
		100		20
Sieve opening d_i (ϕ)	Sieve opening (ps) d_i (mm)	Mass of retained (mr) (g)	mass fraction (mf)	Percent Passing (pp)
3.167417	9	3	0.03	97
2.457486	5.5	6	0.06	91
0.999209	2	6	0.06	85
0.262826	1.2	19	0.19	66
-0.736383	0.6	23	0.23	43
-1.320882	0.4	10	0.1	33
-3.3193	0.1	13	0.13	20
-6.6386	0.01	6	0.06	14
-8.958691	0.002	3	0.03	11



	Estimation of Hydraulic Conductivity	cm/s	m/s	m/d
	Hazen	.187E-05	.187E-07	0.002
	Hazen K (cm/s) = d_{10}^2 (mm^2)	.331E-05	.331E-07	0.003
	Slichter	.368E-06	.368E-08	0.000
✓	Terzaghi	.524E-06	.524E-08	0.000
	Beyer	-.102E-06	-.102E-08	0.000
✓	Sauerbrei	.354E-03	.354E-05	0.306
	Kruger	.382E-02	.382E-04	3.300
✓	Kozeny-Carmen	.387E-04	.387E-06	0.033
	Zunker	.303E-04	.303E-06	0.026
✓	Zamarin	.366E-04	.366E-06	0.032
	USBR	.239E-02	.239E-04	2.065
✓	Barr	.394E-06	.394E-08	0.000
✓	Alyamani and Sen	.455E-01	.455E-03	39.295
	Chapuis	.119E-07	.119E-09	0.000
✓	Krumbein and Monk	.385E-02	.385E-04	3.329
	geometric mean	.784E-04	.784E-06	.677E-01
	arithmetic mean	.711E-02	.711E-04	.614E+01

Effective Grain Diameters (mm)		Other Useful Parameters	
d10	0.002	Uniformity Coef.	573.91
d17	0.055	n computed	0.255000
d20	0.100	g (cm/s^2)	980.00
d50	0.783	ρ (g/cm^3)	0.9981
d60	1.043	μ (g/cm s)	0.0098
$d_{geometric\ mean}$	0.660	ρg/μ (1/cm s)	9.9327E+04
de (Kruger)	0.139	tau (Sauerbrei)	1.053
de (Kozeny)	0.013	$d5_\phi$	-10.103
de (Zunker)	0.013	$d16_\phi$	-4.644
de (Zamarin)	0.013	$d50_\phi$	-0.353
Io (Alyameni)	-0.193	$d84_\phi$	0.969
		$d95_\phi$	2.970
		σ_ϕ	3.384

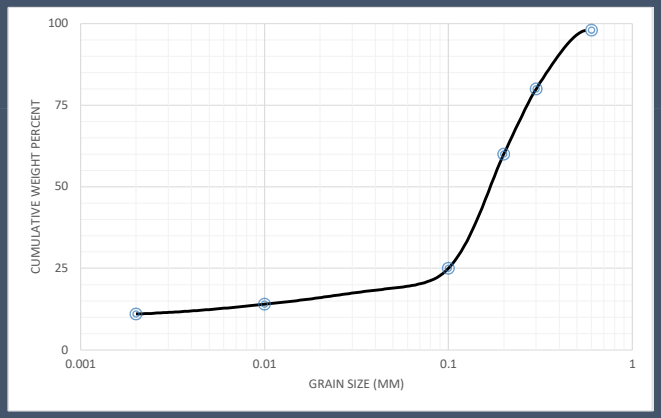


mm		% in sample
>64	Boulder	
16 - 64	coarse gravel	
8 - 16	medium gravel	3.000
2 - 8	fine gravel	12.000
0.5 - 2	coarse sand	42.000
0.25 - 0.5	medium sand	10.000
0.063 - 0.25	fine sand	13.000
0.016 - 0.063	coarse silt	
0.008 - 0.016	medium silt	6
0.002 - 0.008	fine silt	3
<0.002	clay	

BH3 SS6

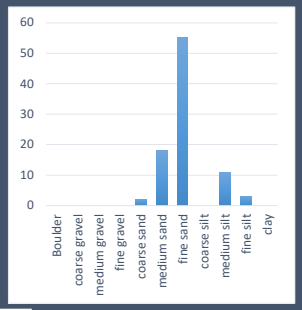
Sand, trace silt

	Mass Sample (g):			T (°C)
		100		20
Sieve opening d_i (ϕ)	Sieve opening (ps) d_i (mm)	Mass of retained (mr) (g)	mass fraction (mf)	Percent Passing (pp)
-0.736383	0.6	2	0.02	98
-1.735591	0.3	18	0.18	80
-2.320091	0.2	20	0.2	60
-3.3193	0.1	35	0.35	25
-6.6386	0.01	11	0.11	14
-8.958691	0.002	3	0.03	11



	Estimation of Hydraulic Conductivity	cm/s	m/s	m/d
	Hazen	.187E-05	.187E-07	0.002
	Hazen K (cm/s) = d_{10}^2 (mm^2)	.331E-05	.331E-07	0.003
	Slichter	.368E-06	.368E-08	0.000
	Terzaghi	.524E-06	.524E-08	0.000
	Beyer	.112E-05	.112E-07	0.001
✓	Sauerbrei	.140E-03	.140E-05	0.121
	Kruger	.179E-02	.179E-04	1.546
	Kozeny-Carmen	.341E-04	.341E-06	0.029
	Zunker	.271E-04	.271E-06	0.023
	Zamarin	.332E-04	.332E-06	0.029
	USBR	.713E-03	.713E-05	0.616
✓	Barr	.394E-06	.394E-08	0.000
✓	Alyamani and Sen	.199E-02	.199E-04	1.717
	Chapuis	.119E-07	.119E-09	0.000
✓	Krumbein and Monk	.123E-02	.123E-04	1.066
	geometric mean	.108E-03	.108E-05	.932E-01
	arithmetic mean	.840E-03	.840E-05	.726E+00

Effective Grain Diameters (mm)		Other Useful Parameters	
d10	0.002	Uniformity Coef.	110.00
d17	0.035	n computed	0.255000
d20	0.059	g (cm/s^2)	980.00
d50	0.171	ρ (g/cm^3)	0.9981
d60	0.200	μ (g/cm s)	0.0098
$d_{geometric\ mean}$	0.190	ρg/μ (1/cm s)	9.9327E+04
de (Kruger)	0.095	tau (Sauerbrei)	1.053
de (Kozeny)	0.012	$d5_\phi$	-10.103
de (Zunker)	0.012	$d16_\phi$	-5.245
de (Zamarin)	0.013	$d50_\phi$	-2.542
Io (Alyameni)	-0.041	$d84_\phi$	-1.447
		$d95_\phi$	-0.862
		σ_ϕ	2.350

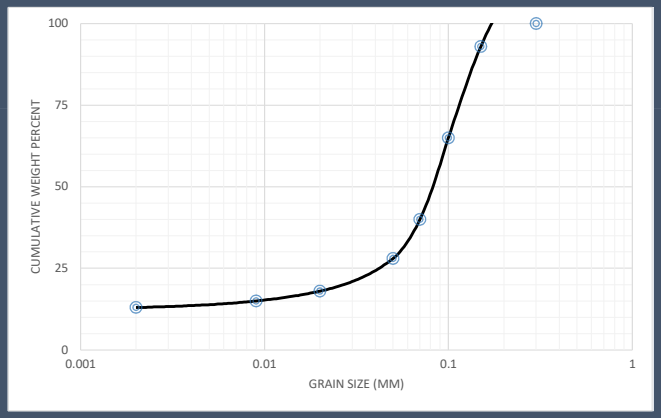


mm		% in sample
>64	Boulder	
16 - 64	coarse gravel	
8 - 16	medium gravel	
2 - 8	fine gravel	
0.5 - 2	coarse sand	2.000
0.25 - 0.5	medium sand	18.000
0.063 - 0.25	fine sand	55.000
0.016 - 0.063	coarse silt	
0.008 - 0.016	medium silt	11
0.002 - 0.008	fine silt	3
<0.002	clay	

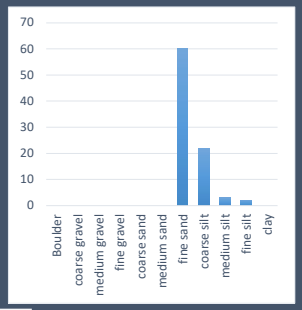
BH1 SS4

Sandy silt to silty sand, trace clay

	Mass Sample (g):			T (°C)
	100			20
Sieve opening d_i (ϕ)	Sieve opening (ps) d_i (mm)	Mass of retained (mr) (g)	mass fraction (mf)	Percent Passing (pp)
-1.735591	0.3	0	0	100
-2.7348	0.15	7	0.07	93
-3.3193	0.1	28	0.28	65
-3.833466	0.07	25	0.25	40
-4.318509	0.05	12	0.12	28
-5.639391	0.02	10	0.1	18
-6.790483	0.009	3	0.03	15
-8.958691	0.002	2	0.02	13



	Estimation of Hydraulic Conductivity	cm/s	m/s	m/d
	Hazen	.134E-05	.134E-07	0.001
	Hazen K (cm/s) = d_{10}^2 (mm^2)	.237E-05	.237E-07	0.002
	Slichter	.263E-06	.263E-08	0.000
	Terzaghi	.375E-06	.375E-08	0.000
	Beyer	.112E-05	.112E-07	0.001
✓	Sauerbrei	.313E-04	.313E-06	0.027
	Kruger	.770E-03	.770E-05	0.665
	Kozeny-Carmen	.257E-04	.257E-06	0.022
	Zunker	.194E-04	.194E-06	0.017
	Zamarin	.226E-04	.226E-06	0.020
	USBR	.108E-03	.108E-05	0.093
✓	Barr	.282E-06	.282E-08	0.000
✓	Alyamani and Sen	.413E-03	.413E-05	0.357
	Chapuis	.746E-08	.746E-10	0.000
✓	Krumbein and Monk	.570E-03	.570E-05	0.492
	geometric mean	.380E-04	.380E-06	.328E-01
	arithmetic mean	.254E-03	.254E-05	.219E+00



Effective Grain Diameters (mm)		Other Useful Parameters	
d10	0.002	Uniformity Coef.	61.10
d17	0.016	n computed	0.255003
d20	0.026	g (cm/s^2)	980.00
d50	0.082	ρ (g/cm^3)	0.9981
d60	0.094	μ (g/cm s)	0.0098
$d_{geometric\ mean}$	0.106	ρg/μ (1/cm s)	9.9327E+04
de (Kruger)	0.062	tau (Sauerbrei)	1.053
de (Kozeny)	0.010	$d5_\phi$	-10.344
de (Zunker)	0.010	$d16_\phi$	-6.303
de (Zamarin)	0.011	$d50_\phi$	-3.605
Io (Alyameni)	-0.019	$d84_\phi$	-2.900
		$d95_\phi$	-2.374
		σ_ϕ	2.058

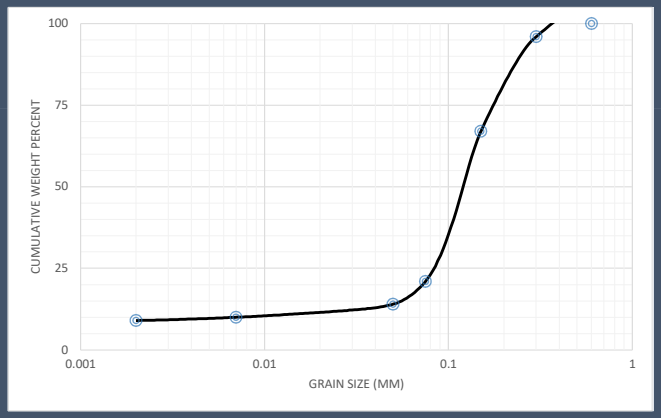
mm		% in sample
>64	Boulder	
16 - 64	coarse gravel	
8 - 16	medium gravel	
2 - 8	fine gravel	
0.5 - 2	coarse sand	
0.25 - 0.5	medium sand	0.000
0.063 - 0.25	fine sand	60.000
0.016 - 0.063	coarse silt	22
0.008 - 0.016	medium silt	3
0.002 - 0.008	fine silt	2
<0.002	clay	

BH7 SS3

Silty sand, trace clay

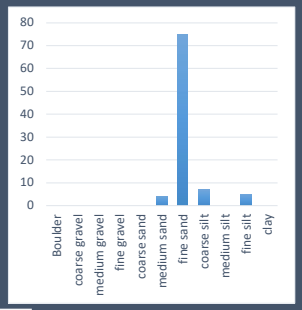
	Mass Sample (g):	T (°C)
	100	20

Sieve opening d_i (ϕ)	Sieve opening (ps) d_i (mm)	Mass of retained (mr) (g)	mass fraction (mf)	Percent Passing (pp)
-0.736383	0.6	0	0	100
-1.735591	0.3	4	0.04	96
-2.7348	0.15	29	0.29	67
-3.734009	0.075	46	0.46	21
-4.318509	0.05	7	0.07	14
-7.152766	0.007	4	0.04	10
-8.958691	0.002	1	0.01	9



	Estimation of Hydraulic Conductivity	cm/s	m/s	m/d
	Hazen	.296E-04	.296E-06	0.026
	Hazen K (cm/s) = d_{10}^2 (mm^2)	.490E-04	.490E-06	0.042
	Slichter	.591E-05	.591E-07	0.005
	Terzaghi	.864E-05	.864E-07	0.007
	Beyer	.355E-04	.355E-06	0.031
✓	Sauerbrei	.473E-03	.473E-05	0.409
	Kruger	.198E-02	.198E-04	1.715
	Kozeny-Carmen	.587E-04	.587E-06	0.051
	Zunker	.437E-04	.437E-06	0.038
	Zamarin	.516E-04	.516E-06	0.045
	USBR	.110E-02	.110E-04	0.952
✓	Barr	.640E-05	.640E-07	0.006
✓	Alyamani and Sen	.540E-03	.540E-05	0.466
	Chapuis	.615E-06	.615E-08	0.001
✓	Krumbein and Monk	.163E-02	.163E-04	1.408
	geometric mean	.227E-03	.227E-05	.196E+00
	arithmetic mean	.662E-03	.662E-05	.572E+00

Effective Grain Diameters (mm)		Other Useful Parameters	
d10	0.007	Uniformity Coef.	19.80
d17	0.061	n computed	0.261374
d20	0.071	g (cm/s^2)	980.00
d50	0.122	ρ (g/cm^3)	0.9981
d60	0.139	μ (g/cm s)	0.0098
$d_{geometric\ mean}$	0.146	ρg/μ (1/cm s)	9.9327E+04
de (Kruger)	0.098	tau (Sauerbrei)	1.053
de (Kozeny)	0.015	$d5_\phi$	-9.814
de (Zunker)	0.015	$d16_\phi$	-4.129
de (Zamarin)	0.015	$d50_\phi$	-3.029
Io (Alyameni)	-0.022	$d84_\phi$	-2.071
		$d95_\phi$	-1.762
		σ_ϕ	1.734



mm		% in sample
>64	Boulder	
16 - 64	coarse gravel	
8 - 16	medium gravel	
2 - 8	fine gravel	
0.5 - 2	coarse sand	0.000
0.25 - 0.5	medium sand	4.000
0.063 - 0.25	fine sand	75.000
0.016 - 0.063	coarse silt	7
0.008 - 0.016	medium silt	
0.002 - 0.008	fine silt	5
<0.002	clay	

Appendix E

Certificate of Analysis (ALS, 2021)

PALMER ENVIRONMENTAL CONSULTING
GROUP INC. (Richmond Hill)
ATTN: TANVI PATEL
74 Berkeley Street
Toronto ON M5V 1E3

Date Received: 05-MAY-21
Report Date: 13-MAY-21 09:22 (MT)
Version: FINAL

Client Phone: 647-795-8153

Certificate of Analysis

Lab Work Order #: L2584415

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 20-891465
Legal Site Desc:

Jennifer Barkshire-Paterson
Account Manager

ANALYTICAL REPORT

Summary of Guideline Exceedances

ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Ontario Drinking Water Regulation (ODWQS) JAN.1,2020 - Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2020)						
L2584415-1	BH 6	Bacteriological Tests	Total Coliforms	<2	0	CFU/100mL
		Total Metals	Sodium (Na)-Total	38.9	20	mg/L
Ontario Drinking Water Regulation (ODWQS) JAN.1,2020 - Ontario DW Aesthetic and Operational Guidelines (June, 2006)						
L2584415-1	BH 6	Physical Tests	Colour, Apparent	36.7	5	CU
			Turbidity	784	5	NTU
		Anions and Nutrients	Hardness (as CaCO3)	327	80-100	mg/L
L2584415-2	BH 7	Physical Tests	Colour, Apparent	24.6	5	CU
			Turbidity	19.1	5	NTU
		Anions and Nutrients	Hardness (as CaCO3)	264	80-100	mg/L
		Total Metals	Manganese (Mn)-Total	0.0517	0.05	mg/L

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Physical Tests - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2584415-1, Sample Date: 05-MAY-21, Sample ID: BH 6	Lab ID: L2584415-2, Sample Date: 05-MAY-21, Sample ID: BH 7
Colour, Apparent	CU	-	5	36.7	24.6
Conductivity	umhos/cm	-	-	731	492
pH	pH units	-	6.5-8.5	7.91	8.00
Redox Potential	mV	-	-	308 PEHR	295 PEHR
Total Dissolved Solids	mg/L	-	500	411 DLDS	304 DLDS
Turbidity	NTU	-	5	784	19.1

Guide Limit #1: Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2020)
Guide Limit #2: Ontario DW Aesthetic and Operational Guidelines (June, 2006)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Anions and Nutrients - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID L2584415-1 / Sample Date 05-MAY-21 / Sample ID BH 6	Lab ID L2584415-2 / Sample Date 05-MAY-21 / Sample ID BH 7
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	292	223
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	<2.0	<2.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	<2.0	<2.0
Alkalinity, Total (as CaCO3)	mg/L	-	30-500	292	223
Ammonia, Total (as N)	mg/L	-	-	<0.010	<0.010
Bromide (Br)	mg/L	-	-	<0.10	<0.10
Chloride (Cl)	mg/L	-	250	61.2	3.10
Computed Conductivity	uS/cm	-	-	711	454
Conductivity % Difference	%	-	-	-3	-8
Fluoride (F)	mg/L	1.5	-	0.040	0.050
Hardness (as CaCO3)	mg/L	-	80-100	327	264
Ion Balance	%	-	-	110	119
Langelier Index		-	-	1	1
Nitrate (as N)	mg/L	10	-	3.10	<0.020
Nitrite (as N)	mg/L	1	-	<0.010	<0.010
Saturation pH	pH	-	-	7.09	7.26
Orthophosphate-Dissolved (as P)	mg/L	-	-	<0.0030	<0.0030
TDS (Calculated)	mg/L	-	-	437	269
Sulfate (SO4)	mg/L	-	500	36.0	38.2
Anion Sum	me/L	-	-	7.52	4.57
Cation Sum	me/L	-	-	8.25	5.43
Cation - Anion Balance	%	-	-	5	9

Guide Limit #1: Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2020)
Guide Limit #2: Ontario DW Aesthetic and Operational Guidelines (June, 2006)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Inorganic Parameters - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2584415-1 / Sample Date: 05-MAY-21 / Sample ID: BH 6	Lab ID: L2584415-2 / Sample Date: 05-MAY-21 / Sample ID: BH 7
Silica	mg/L	-	-	15.2	13.5

Guide Limit #1: Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2020)
Guide Limit #2: Ontario DW Aesthetic and Operational Guidelines (June, 2006)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Bacteriological Tests - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2584415-1 Sample Date: 05-MAY-21 Sample ID: BH 6	Lab ID: L2584415-2 Sample Date: 05-MAY-21 Sample ID: BH 7
E. Coli	CFU/100mL	0	-	0	0
Total Coliform Background	CFU/100mL	-	-	780 DLM	3
Total Coliforms	CFU/100mL	0	-	<2 DLM	0

Guide Limit #1: Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2020)
Guide Limit #2: Ontario DW Aesthetic and Operational Guidelines (June, 2006)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Metals - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	Sample Date	Sample ID
				L2584415-1	05-MAY-21	BH 6
				L2584415-2	05-MAY-21	BH 7
Sodium Adsorption Ratio	SAR	-	-	0.94		<0.10

Guide Limit #1: Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2020)
Guide Limit #2: Ontario DW Aesthetic and Operational Guidelines (June, 2006)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Total Metals - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2584415-1 Sample Date: 05-MAY-21 Sample ID: BH 6	Lab ID: L2584415-2 Sample Date: 05-MAY-21 Sample ID: BH 7
Aluminum (Al)-Total	mg/L	-	0.1	0.074	<0.010
Antimony (Sb)-Total	mg/L	0.006	-	<0.00010	<0.00010
Arsenic (As)-Total	mg/L	0.0100	-	0.00025	0.00040
Barium (Ba)-Total	mg/L	1	-	0.0778	0.0561
Beryllium (Be)-Total	mg/L	-	-	<0.00010	<0.00010
Bismuth (Bi)-Total	mg/L	-	-	<0.000050	<0.000050
Boron (B)-Total	mg/L	5	-	<0.010	0.011
Cadmium (Cd)-Total	mg/L	0.005	-	<0.000010	<0.000010
Calcium (Ca)-Total	mg/L	-	-	81.3	66.1
Cesium (Cs)-Total	mg/L	-	-	<0.000010	<0.000010
Chromium (Cr)-Total	mg/L	0.05	-	0.00159	<0.00050
Cobalt (Co)-Total	mg/L	-	-	<0.00010	0.00011
Copper (Cu)-Total	mg/L	-	1	0.0030	0.0075
Iron (Fe)-Total	mg/L	-	0.3	0.117	<0.050
Lead (Pb)-Total	mg/L	0.01	-	0.00017	<0.00010
Magnesium (Mg)-Total	mg/L	-	-	30.1	24.0
Manganese (Mn)-Total	mg/L	-	0.05	0.00585	0.0517
Molybdenum (Mo)-Total	mg/L	-	-	0.000236	0.000822
Nickel (Ni)-Total	mg/L	-	-	0.00072	0.00064
Phosphorus (P)-Total	mg/L	-	-	<0.050	<0.050
Potassium (K)-Total	mg/L	-	-	1.13	1.31
Rubidium (Rb)-Total	mg/L	-	-	0.00066	0.00042
Selenium (Se)-Total	mg/L	0.05	-	0.000057	<0.000050
Silicon (Si)-Total	mg/L	-	-	7.10	6.31
Silver (Ag)-Total	mg/L	-	-	<0.000050	<0.000050
Sodium (Na)-Total	mg/L	20	200	38.9	2.96
Strontium (Sr)-Total	mg/L	-	-	0.135	0.143
Sulfur (S)-Total	mg/L	-	-	12.9	10.9
Tellurium (Te)-Total	mg/L	-	-	<0.00020	<0.00020
Thallium (Tl)-Total	mg/L	-	-	<0.000010	<0.000010

Guide Limit #1: Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2020)
Guide Limit #2: Ontario DW Aesthetic and Operational Guidelines (June, 2006)

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Total Metals - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2584415-1 Sample Date: 05-MAY-21 Sample ID: BH 6	Lab ID: L2584415-2 Sample Date: 05-MAY-21 Sample ID: BH 7
Thorium (Th)-Total	mg/L	-	-	<0.00010	<0.00010
Tin (Sn)-Total	mg/L	-	-	0.00014	0.00018
Titanium (Ti)-Total	mg/L	-	-	0.00282	<0.00030
Tungsten (W)-Total	mg/L	-	-	<0.00010	<0.00010
Uranium (U)-Total	mg/L	0.02	-	0.000354	0.000484
Vanadium (V)-Total	mg/L	-	-	<0.00050	<0.00050
Zinc (Zn)-Total	mg/L	-	5	0.0036	0.0034
Zirconium (Zr)-Total	mg/L	-	-	<0.00030	<0.00030

Guide Limit #1: Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2020)
Guide Limit #2: Ontario DW Aesthetic and Operational Guidelines (June, 2006)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SPEC-PCT-WT	Water	Automated Speciated Alkalinity	APHA 2320B

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BR-IC-N-WT	Water	Bromide in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CL-IC-N-WT	Water	Chloride by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

COLOUR-APPARENT-WT	Water	Colour	APHA 2120

Apparent Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method after sample decanting. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

EC-MF-WT	Water	E. coli	SM 9222D

A 100 mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h. Method ID: WT-TM-1200

EC-SCREEN-WT	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

EC-WT	Water	Conductivity	APHA 2510 B

Water samples can be measured directly by immersing the conductivity cell into the sample.

ETL-SAR-CALC-WT	Water	Sodium Adsorption Ratio	Calculation
ETL-SILICA-CALC-WT	Water	Calculate from SI-TOT-WT	EPA 200.8
F-IC-N-WT	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
MET-T-CCMS-WT	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

NH3-F-WT	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

PH-WT	Water	pH	APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days

PO4-DO-COL-WT	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

REDOX-POTENTIAL-WT	Water	Redox Potential	APHA 2580

This analysis is carried out in accordance with the procedure described in the "APHA" method 2580 "Oxidation-Reduction Potential" 2012. Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

It is recommended that this analysis be conducted in the field.

SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TC-MF-WT	Water	Total Coliforms	SM 9222B

A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200

TCB-MF-WT	Water	Total Coliform Background	SM 9222B

A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200.

TURBIDITY-WT	Water	Turbidity	APHA 2130 B

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

20-891465

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Quality Control Report

Workorder: L2584415 Report Date: 13-MAY-21

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-SPEC-PCT-WT	**Water**							
Batch R5455716								
WG3531442-4 DUP		**WG3531442-3**						
Alkalinity, Total (as CaCO3)		138	137		mg/L	0.8	20	08-MAY-21
Alkalinity, Bicarbonate (as CaCO3)		138	135		mg/L	2.2	20	08-MAY-21
Alkalinity, Carbonate (as CaCO3)		<2.0	<2.0	RPD-NA	mg/L	N/A	20	08-MAY-21
Alkalinity, Hydroxide (as CaCO3)		<2.0	<2.0	RPD-NA	mg/L	N/A	20	08-MAY-21
WG3531442-2 LCS								
Alkalinity, Total (as CaCO3)			100.6		%		85-115	08-MAY-21
WG3531442-1 MB								
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	08-MAY-21
Alkalinity, Bicarbonate (as CaCO3)			<2.0		mg/L		2	08-MAY-21
Alkalinity, Carbonate (as CaCO3)			<2.0		mg/L		2	08-MAY-21
Alkalinity, Hydroxide (as CaCO3)			<2.0		mg/L		2	08-MAY-21
BR-IC-N-WT	**Water**							
Batch R5456507								
WG3532979-10 DUP		**WG3532979-8**						
Bromide (Br)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	11-MAY-21
WG3532979-7 LCS								
Bromide (Br)			101.5		%		85-115	11-MAY-21
WG3532979-6 MB								
Bromide (Br)			<0.10		mg/L		0.1	11-MAY-21
WG3532979-9 MS		**WG3532979-8**						
Bromide (Br)			100.6		%		75-125	11-MAY-21
CL-IC-N-WT	**Water**							
Batch R5456507								
WG3532979-10 DUP		**WG3532979-8**						
Chloride (Cl)		3.09	3.08		mg/L	0.3	20	11-MAY-21
WG3532979-7 LCS								
Chloride (Cl)			102.5		%		90-110	11-MAY-21
WG3532979-6 MB								
Chloride (Cl)			<0.50		mg/L		0.5	11-MAY-21
WG3532979-9 MS		**WG3532979-8**						
Chloride (Cl)			101.5		%		75-125	11-MAY-21
COLOUR-APPARENT-WT	**Water**							
Batch R5454620								
WG3531234-3 DUP		**WG3531234-4**						
Colour, Apparent		24.6	24.9		CU	1.5	20	07-MAY-21
WG3531234-2 LCS								

Quality Control Report

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
COLOUR-APPARENT-WT	**Water**							
Batch R5454620								
WG3531234-2 LCS								
Colour, Apparent			103.0		%		85-115	07-MAY-21
WG3531234-1 MB								
Colour, Apparent			<2.0		CU		2	07-MAY-21
EC-MF-WT	**Water**							
Batch R5454699								
WG3530284-1 MB								
E. Coli			0		CFU/100mL		1	06-MAY-21
EC-WT	**Water**							
Batch R5455716								
WG3531442-4 DUP		**WG3531442-3**						
Conductivity		382	380		umhos/cm	0.5	10	08-MAY-21
WG3531442-2 LCS								
Conductivity			104.0		%		90-110	08-MAY-21
WG3531442-1 MB								
Conductivity			<3.0		umhos/cm		3	08-MAY-21
F-IC-N-WT	**Water**							
Batch R5456507								
WG3532979-10 DUP		**WG3532979-8**						
Fluoride (F)		0.049	0.049		mg/L	0.3	20	11-MAY-21
WG3532979-7 LCS								
Fluoride (F)			102.4		%		90-110	11-MAY-21
WG3532979-6 MB								
Fluoride (F)			<0.020		mg/L		0.02	11-MAY-21
WG3532979-9 MS		**WG3532979-8**						
Fluoride (F)			99.5		%		75-125	11-MAY-21
MET-T-CCMS-WT	**Water**							
Batch R5454175								
WG3530591-4 DUP		**WG3530591-3**						
Aluminum (Al)-Total		0.0468	0.0470		mg/L	0.6	20	10-MAY-21
Antimony (Sb)-Total		0.00016	0.00016		mg/L	3.4	20	10-MAY-21
Arsenic (As)-Total		0.00089	0.00089		mg/L	0.6	20	10-MAY-21
Barium (Ba)-Total		0.0221	0.0224		mg/L	1.4	20	10-MAY-21
Beryllium (Be)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	10-MAY-21
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	10-MAY-21

Quality Control Report

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5454175								
WG3530591-4 DUP		**WG3530591-3**						
Boron (B)-Total		0.023	0.023		mg/L	0.0	20	10-MAY-21
Cadmium (Cd)-Total		0.000104	0.000109		mg/L	4.4	20	10-MAY-21
Calcium (Ca)-Total		33.9	34.1		mg/L	0.6	20	10-MAY-21
Chromium (Cr)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	10-MAY-21
Cesium (Cs)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	10-MAY-21
Cobalt (Co)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	10-MAY-21
Copper (Cu)-Total		0.0123	0.0124		mg/L	0.7	20	10-MAY-21
Iron (Fe)-Total		0.024	0.025		mg/L	4.2	20	10-MAY-21
Lead (Pb)-Total		0.00127	0.00127		mg/L	0.2	20	10-MAY-21
Magnesium (Mg)-Total		9.08	9.20		mg/L	1.3	20	10-MAY-21
Manganese (Mn)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	10-MAY-21
Molybdenum (Mo)-Total		0.00119	0.00121		mg/L	2.2	20	10-MAY-21
Nickel (Ni)-Total		0.00064	0.00071		mg/L	10	20	10-MAY-21
Phosphorus (P)-Total		0.549	0.521		mg/L	5.3	20	10-MAY-21
Potassium (K)-Total		1.63	1.63		mg/L	0.0	20	10-MAY-21
Rubidium (Rb)-Total		0.00095	0.00093		mg/L	1.8	20	10-MAY-21
Selenium (Se)-Total		0.000157	0.000146		mg/L	7.0	20	10-MAY-21
Silicon (Si)-Total		0.69	0.70		mg/L	0.7	20	10-MAY-21
Silver (Ag)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	10-MAY-21
Sodium (Na)-Total		14.7	14.8		mg/L	0.6	20	10-MAY-21
Strontium (Sr)-Total		0.184	0.185		mg/L	0.6	20	10-MAY-21
Sulfur (S)-Total		8.30	8.38		mg/L	1.0	20	10-MAY-21
Thallium (Tl)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	10-MAY-21
Tellurium (Te)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	10-MAY-21
Thorium (Th)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	10-MAY-21
Tin (Sn)-Total		0.00133	0.00200	DUP-H	mg/L	40	20	10-MAY-21
Titanium (Ti)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	10-MAY-21
Tungsten (W)-Total		0.00010	<0.00010	RPD-NA	mg/L	N/A	20	10-MAY-21
Uranium (U)-Total		0.000401	0.000396		mg/L	1.2	20	10-MAY-21
Vanadium (V)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	10-MAY-21
Zinc (Zn)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	10-MAY-21
Zirconium (Zr)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	10-MAY-21
WG3530591-2 LCS								

Quality Control Report

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5454175								
WG3530591-2 LCS								
Aluminum (Al)-Total			105.1		%		80-120	07-MAY-21
Antimony (Sb)-Total			113.6		%		80-120	07-MAY-21
Arsenic (As)-Total			104.2		%		80-120	07-MAY-21
Barium (Ba)-Total			104.8		%		80-120	07-MAY-21
Beryllium (Be)-Total			108.7		%		80-120	07-MAY-21
Bismuth (Bi)-Total			111.9		%		80-120	07-MAY-21
Boron (B)-Total			107.1		%		80-120	07-MAY-21
Cadmium (Cd)-Total			106.9		%		80-120	07-MAY-21
Calcium (Ca)-Total			107.4		%		80-120	07-MAY-21
Chromium (Cr)-Total			104.2		%		80-120	07-MAY-21
Cesium (Cs)-Total			112.3		%		80-120	07-MAY-21
Cobalt (Co)-Total			105.6		%		80-120	07-MAY-21
Copper (Cu)-Total			103.7		%		80-120	07-MAY-21
Iron (Fe)-Total			105.2		%		80-120	07-MAY-21
Lead (Pb)-Total			113.1		%		80-120	07-MAY-21
Magnesium (Mg)-Total			106.0		%		80-120	07-MAY-21
Manganese (Mn)-Total			103.2		%		80-120	07-MAY-21
Molybdenum (Mo)-Total			107.9		%		80-120	07-MAY-21
Nickel (Ni)-Total			103.8		%		80-120	07-MAY-21
Phosphorus (P)-Total			108.9		%		70-130	07-MAY-21
Potassium (K)-Total			103.4		%		80-120	07-MAY-21
Rubidium (Rb)-Total			109.6		%		80-120	07-MAY-21
Selenium (Se)-Total			103.4		%		80-120	07-MAY-21
Silicon (Si)-Total			106.5		%		60-140	07-MAY-21
Silver (Ag)-Total			115.0		%		80-120	07-MAY-21
Sodium (Na)-Total			105.2		%		80-120	07-MAY-21
Strontium (Sr)-Total			111.0		%		80-120	07-MAY-21
Sulfur (S)-Total			100.8		%		80-120	07-MAY-21
Thallium (Tl)-Total			112.6		%		80-120	07-MAY-21
Tellurium (Te)-Total			105.9		%		80-120	07-MAY-21
Thorium (Th)-Total			111.4		%		80-120	07-MAY-21
Tin (Sn)-Total			106.0		%		80-120	07-MAY-21
Titanium (Ti)-Total			100.2		%		80-120	07-MAY-21

Quality Control Report

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5454175								
WG3530591-2 LCS								
Tungsten (W)-Total			113.5		%		80-120	07-MAY-21
Uranium (U)-Total			114.4		%		80-120	07-MAY-21
Vanadium (V)-Total			105.3		%		80-120	07-MAY-21
Zinc (Zn)-Total			102.4		%		80-120	07-MAY-21
Zirconium (Zr)-Total			109.7		%		80-120	07-MAY-21
WG3530591-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	07-MAY-21
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	07-MAY-21
Arsenic (As)-Total			<0.00010		mg/L		0.0001	07-MAY-21
Barium (Ba)-Total			<0.00010		mg/L		0.0001	07-MAY-21
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	07-MAY-21
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	07-MAY-21
Boron (B)-Total			<0.010		mg/L		0.01	07-MAY-21
Cadmium (Cd)-Total			<0.000005(		mg/L		0.000005	07-MAY-21
Calcium (Ca)-Total			<0.050		mg/L		0.05	07-MAY-21
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	07-MAY-21
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	07-MAY-21
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	07-MAY-21
Copper (Cu)-Total			<0.00050		mg/L		0.0005	07-MAY-21
Iron (Fe)-Total			<0.010		mg/L		0.01	07-MAY-21
Lead (Pb)-Total			<0.000050		mg/L		0.00005	07-MAY-21
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	07-MAY-21
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	07-MAY-21
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	07-MAY-21
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	07-MAY-21
Phosphorus (P)-Total			<0.050		mg/L		0.05	07-MAY-21
Potassium (K)-Total			<0.050		mg/L		0.05	07-MAY-21
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	07-MAY-21
Selenium (Se)-Total			<0.000050		mg/L		0.00005	07-MAY-21
Silicon (Si)-Total			<0.10		mg/L		0.1	07-MAY-21
Silver (Ag)-Total			<0.000050		mg/L		0.00005	07-MAY-21
Sodium (Na)-Total			<0.050		mg/L		0.05	07-MAY-21
Strontium (Sr)-Total			<0.0010		mg/L		0.001	07-MAY-21
Sulfur (S)-Total			<0.50		mg/L		0.5	07-MAY-21

Quality Control Report

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5454175								
WG3530591-1 MB								
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	07-MAY-21
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	07-MAY-21
Thorium (Th)-Total			<0.00010		mg/L		0.0001	07-MAY-21
Tin (Sn)-Total			<0.00010		mg/L		0.0001	07-MAY-21
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	07-MAY-21
Tungsten (W)-Total			<0.00010		mg/L		0.0001	07-MAY-21
Uranium (U)-Total			<0.000010		mg/L		0.00001	07-MAY-21
Vanadium (V)-Total			<0.00050		mg/L		0.0005	07-MAY-21
Zinc (Zn)-Total			<0.0030		mg/L		0.003	07-MAY-21
Zirconium (Zr)-Total			<0.00020		mg/L		0.0002	07-MAY-21
WG3530591-5 MS		**WG3530591-3**						
Aluminum (Al)-Total			99.1		%		70-130	10-MAY-21
Antimony (Sb)-Total			103.8		%		70-130	10-MAY-21
Arsenic (As)-Total			102.5		%		70-130	10-MAY-21
Barium (Ba)-Total			N/A	MS-B	%		-	10-MAY-21
Beryllium (Be)-Total			101.8		%		70-130	10-MAY-21
Bismuth (Bi)-Total			97.5		%		70-130	10-MAY-21
Boron (B)-Total			99.8		%		70-130	10-MAY-21
Cadmium (Cd)-Total			102.5		%		70-130	10-MAY-21
Calcium (Ca)-Total			N/A	MS-B	%		-	10-MAY-21
Chromium (Cr)-Total			102.9		%		70-130	10-MAY-21
Cesium (Cs)-Total			104.5		%		70-130	10-MAY-21
Cobalt (Co)-Total			102.8		%		70-130	10-MAY-21
Copper (Cu)-Total			93.9		%		70-130	10-MAY-21
Iron (Fe)-Total			101.1		%		70-130	10-MAY-21
Lead (Pb)-Total			99.6		%		70-130	10-MAY-21
Magnesium (Mg)-Total			N/A	MS-B	%		-	10-MAY-21
Manganese (Mn)-Total			101.9		%		70-130	10-MAY-21
Molybdenum (Mo)-Total			101.3		%		70-130	10-MAY-21
Nickel (Ni)-Total			98.6		%		70-130	10-MAY-21
Phosphorus (P)-Total			N/A	MS-B	%		-	10-MAY-21
Potassium (K)-Total			99.4		%		70-130	10-MAY-21
Rubidium (Rb)-Total			103.8		%		70-130	10-MAY-21
Selenium (Se)-Total			101.6		%		70-130	10-MAY-21

Quality Control Report

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5454175								
WG3530591-5 MS		**WG3530591-3**						
Silicon (Si)-Total			N/A	MS-B	%		-	10-MAY-21
Silver (Ag)-Total			101.2		%		70-130	10-MAY-21
Sodium (Na)-Total			N/A	MS-B	%		-	10-MAY-21
Strontium (Sr)-Total			N/A	MS-B	%		-	10-MAY-21
Sulfur (S)-Total			N/A	MS-B	%		-	10-MAY-21
Thallium (Tl)-Total			100.5		%		70-130	10-MAY-21
Tellurium (Te)-Total			95.0		%		70-130	10-MAY-21
Thorium (Th)-Total			103.7		%		70-130	10-MAY-21
Tin (Sn)-Total			98.9		%		70-130	10-MAY-21
Titanium (Ti)-Total			100.5		%		70-130	10-MAY-21
Tungsten (W)-Total			100.0		%		70-130	10-MAY-21
Uranium (U)-Total			N/A	MS-B	%		-	10-MAY-21
Vanadium (V)-Total			104.2		%		70-130	10-MAY-21
Zinc (Zn)-Total			96.0		%		70-130	10-MAY-21
Zirconium (Zr)-Total			102.2		%		70-130	10-MAY-21
NH3-F-WT	**Water**							
Batch R5456489								
WG3533458-2 LCS								
Ammonia, Total (as N)			110.6		%		85-115	12-MAY-21
WG3533458-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	12-MAY-21
NO2-IC-WT	**Water**							
Batch R5456507								
WG3532979-10 DUP		**WG3532979-8**						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	20	11-MAY-21
WG3532979-7 LCS								
Nitrite (as N)			101.4		%		90-110	11-MAY-21
WG3532979-6 MB								
Nitrite (as N)			<0.010		mg/L		0.01	11-MAY-21
WG3532979-9 MS		**WG3532979-8**						
Nitrite (as N)			100.2		%		75-125	11-MAY-21
NO3-IC-WT	**Water**							

Quality Control Report

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-WT	**Water**							
Batch R5456507								
WG3532979-10 DUP		**WG3532979-8**						
Nitrate (as N)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	11-MAY-21
WG3532979-7 LCS								
Nitrate (as N)			101.0		%		90-110	11-MAY-21
WG3532979-6 MB								
Nitrate (as N)			<0.020		mg/L		0.02	11-MAY-21
WG3532979-9 MS		**WG3532979-8**						
Nitrate (as N)			96.8		%		75-125	11-MAY-21
PH-WT	**Water**							
Batch R5455716								
WG3531442-4 DUP		**WG3531442-3**						
pH		8.29	8.35	J	pH units	0.06	0.2	08-MAY-21
WG3531442-2 LCS								
pH			7.01		pH units		6.9-7.1	08-MAY-21
PO4-DO-COL-WT	**Water**							
Batch R5455088								
WG3531617-7 DUP		**L2583556-1**						
Orthophosphate-Dissolved (as P)		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	10-MAY-21
WG3531617-6 LCS								
Orthophosphate-Dissolved (as P)			103.4		%		80-120	10-MAY-21
WG3531617-5 MB								
Orthophosphate-Dissolved (as P)			<0.0030		mg/L		0.003	10-MAY-21
WG3531617-8 MS		**L2583556-1**						
Orthophosphate-Dissolved (as P)			98.3		%		70-130	10-MAY-21
REDOX-POTENTIAL-WT	**Water**							
Batch R5454240								
WG3530797-1 CRM		**WT-REDOX**						
Redox Potential			101.3		%		80-120	07-MAY-21
WG3530797-2 DUP		**L2583394-1**						
Redox Potential		370	354		mV	4.4	25	07-MAY-21
SO4-IC-N-WT	**Water**							
Batch R5456507								
WG3532979-10 DUP		**WG3532979-8**						
Sulfate (SO4)		38.3	38.3		mg/L	0.1	20	11-MAY-21
WG3532979-7 LCS								
Sulfate (SO4)			102.4		%		90-110	11-MAY-21
WG3532979-6 MB								

Quality Control Report

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-WT	**Water**							
Batch R5456507								
WG3532979-6 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	11-MAY-21
WG3532979-9 MS		**WG3532979-8**						
Sulfate (SO4)			102.5		%		75-125	11-MAY-21
SOLIDS-TDS-WT	**Water**							
Batch R5455580								
WG3531721-3 DUP		**L2584372-1**						
Total Dissolved Solids		318	317		mg/L	0.5	20	10-MAY-21
WG3531721-2 LCS								
Total Dissolved Solids			103.2		%		85-115	10-MAY-21
WG3531721-1 MB								
Total Dissolved Solids			<10		mg/L		10	10-MAY-21
TC-MF-WT	**Water**							
Batch R5454697								
WG3530278-1 MB								
Total Coliforms			0		CFU/100mL		1	06-MAY-21
TCB-MF-WT	**Water**							
Batch R5454697								
WG3530278-1 MB								
Total Coliform Background			0		CFU/100mL		1	06-MAY-21
TURBIDITY-WT	**Water**							
Batch R5454245								
WG3530623-3 DUP		**L2584415-1**						
Turbidity		784	783		NTU	0.1	15	07-MAY-21
WG3530623-2 LCS								
Turbidity			98.0		%		85-115	07-MAY-21
WG3530623-1 MB								
Turbidity			<0.10		NTU		0.1	07-MAY-21

Quality Control Report

Workorder: L2584415 Report Date: 13-MAY-21

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L2584415 Report Date: 13-MAY-21

Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)
74 Berkeley Street
Toronto ON M5V 1E3
Contact: TANVI PATEL

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential							
	1	05-MAY-21 12:00	07-MAY-21 00:00	0.25	36	hours	EHTR-FM
	2	05-MAY-21 14:00	07-MAY-21 00:00	0.25	34	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2584415 were received on 05-MAY-21 16:19.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chai

L2584415-COFC

COC Number: 20 - 891465

Page 1 of 1

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Report To	Contact and company name below will appear on the final report
Company:	Palmer
Contact:	Tanvi Patel
Phone:	647-688-2538
	Company address below will appear on the final report
Street:	74 Berkeley
City/Province:	Toronto, ON
Postal Code:	M1B 1W9
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☐ YES ☒ NO
Company:	Palmer
Contact:	

Reports / Recipients

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☒ YES ☐ NO ☐ N/A

☒ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Jason.cole@pecg.ca

Email 2: stephen.hodgson@pecg.ca

Email 3: tanvi.patel@pecg.ca

Invoice Recipients

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: accounting@pecg.ca

Email 2:

Turnaround Time (TAT) Requested

☒ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum

☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum

☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum

☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum

☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests

Date and Time Required for all E&P TATs:

For all tests with rush TATs requested, please contact your AM to confirm availability.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	AP	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (ALS use only):	L2584415	ALS Contact: Jennifer	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Potability Package	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	BH 6	05-MAY-21	12:00	Water	4	X			
	BH 7	05-MAY-21	02:00	water	4	X			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human consumption/ use? ☐ YES ☒ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

compare to Ontario Drinking Water Standards (ODWS)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☒ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
5.2				2.5			

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
Tanvi Patel	2021-05-05	4:15

INITIAL SHIPMENT RECEPTION (ALS use only)

Received by:	Date:	Time:
Karam	5/5/21	16:19

FINAL SHIPMENT RECEPTION (ALS use only)

Received by:	Date:	Time:
[illegible]	5/6/21	1100

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.