

Hydrogeological and Nitrate Loading Assessment
Graham Property (corner of Highway 9 and Mount Pleasant Road)
Caledon, Ontario

Prepared For:

Rob Russell Planning Consultants Inc.

Project #: 18-577-30
Date: January 17, 2020



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18-577-30

January 17, 2020

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Via email: rob.russell@russellplanning.com

RE: Hydrogeological and Nitrate Loading Assessment- Graham Property (Corner of Highway 9 and Mount Pleasant Road)

1.0 INTRODUCTION

DS Consultants Ltd. (DS) was retained by Rob Russell Planning Consultants Inc. to carry out a hydrogeological assessment and nitrate loading assessment to address the Town's Peer Reviewer (Golder) with regards to the comments received in a letter dated February 14, 2018 with respect to the City of Caledon's Official Plan (OP) and in support of design and approvals for the future development at the southeast corner of Highway nine (9) and Mount Pleasant Road in Palgrave, Ontario (Site). The Site will be developed as a residential subdivision that has an approximate area of 30,174 m² (30.174 ha) and is proposed to consist of twenty-two (22) estate-style lots. **Figure 1** shows the site location.

1.1 Previous and Current Investigations

Fifteen (15) boreholes were advanced across the subject site during the previous geotechnical investigation by Shaheen & Peaker Consulting Engineers (S&P) in May 2007. No monitoring wells were installed during the geotechnical investigation. Five (5) monitoring wells were installed across the subject site as part of a hydrogeological investigation by V.A. Wood in July 2016. All wells were screened in a shallow unsaturated silt to sand unit and found dry during subsequent groundwater monitoring events that were carried out at the site.

In June 2018, three (3) additional boreholes were drilled by DS as part of this hydrogeological assessment to specifically address the peer review comments made by Golder on behalf of the Town of Caledon. These boreholes were converted into monitoring wells to identify the primary aquifer at the site and to enable groundwater monitoring and groundwater quality sampling to assess nitrate loading as a result of the proposed private individual septic system for the development. The borehole/monitoring well locations are shown on **Figure 3** and the borehole logs are presented in **Appendix A**. All monitoring wells screened in the saturated sandy silt/silty sand unit extending to depths between 21 to 28 meters below the existing ground surface (mbgs). The well screen detail was based on the first saturated soil samples noted during drilling and in line with groundwater elevations noted in the MECP water well records of the area.

Three (3) groundwater monitoring rounds were obtained for nitrate (NO₃⁻) and nitrite (NO₂⁻) on the site from wells (MW 1, MW 2 and MW 3) on July 9, July 26, and September 26, 2018. Two (2) additional groundwater samples for the noted parameters above were obtained from off-site residential wells on

July 26, 2018. Analytical results were compared against the Ontario Drinking Water Standard (ODWS) of 10 mg/L to assess the background groundwater quality on and off the Site.

1.2 Purpose

The purpose of this investigation was to, estimate nitrate loading, investigate potential impacts as it relates to the future residential development at the Site, propose mitigation measures and address the Town's Peer Review (Golder) with regards to the comments received on February 14, 2018,

1.3 Scope of Work

The scope of work for this investigation included:

- (i) Site visits;
- (ii) Collecting and interpreting available reports and data including the previously conducted hydrogeological assessments and geotechnical, hydrogeological and environmental studies completed at the Site;
- (iii) Drill three (3) monitoring wells strategically positioned across the site;
- (iv) Develop, purge and monitor groundwater levels to assess existing groundwater elevations and the predicted groundwater flow direction at the site;
- (v) In-situ hydraulic conductivity testing of existing monitoring wells;
- (vi) Groundwater quality monitoring;
- (vii) Door to door well survey;
- (viii) Estimation of nitrate loading extending to the property boundary and off-site/down gradient nitrate impact assessment and mitigation measures;
- (ix) Propose monitoring and contingency plan;
- (x) Data analyses and report preparation.

2.0 PHYSICAL SETTING

Available topographic maps, environmental, geotechnical and hydrogeological reports were used to develop an understanding of the physical setting of the study area. Additionally, borehole logs from this investigation conducted by DS at the Site and the Ministry of the Environment Conservation and Parks Water Wells Records (MECP WWRs) were used to interpret the geological and hydrogeological conditions at the Site.

The study area is characterized by hummocky topography. Based on available topography mapping, the topography at the site is undulating with the ground surface elevations varying from 295-311 metres above sea level (masl), sloping towards the west to about 287 masl and sloping towards the east to about 306 masl towards from the high ridge (about 311 masl). The subject Site is entirely located within the Nottawasaga River Watershed (Beeton Creek Sub watershed). There are no water bodies located at the Site. Water supply in the study area primarily depends on groundwater sources (municipal water supply wells or domestic water wells), protected under the Source Water Protection Plan. A small portion at northeast side of the Site falls within the 25 year Well Head Protection Area (WHPA) in the Town of

Caledon and is mapped under Palgrave municipal well 3, WHPA-D (25-year travel time). The Site is within agricultural land and is surrounded by an existing subdivision located to the west, an under-construction subdivision to the south, and rural homes and agricultural land to the north of the Site. The study area is not serviced by municipal sewages. Septic systems are presumed to be used at all residential dwellings.

2.1 Geology

2.1.1 Quaternary Geology

The study area is within the Kame Moraine physiographic region of Southern Ontario (Chapman and Putnam, 1984) and characterised by Bevelled till Plains physiographic landform. The study area generally consists of glaciofluvial deposits of sand and glacial till deposits. The surficial geology map is shown in **Figure 2**.

2.1.2 Bedrock Geology

Based on the review of local boreholes and well record information, the depth to bedrock in the study area is estimated to be approximately at 55 mbgs. Available published mapping indicates that the bedrock consists of shale with seams of limestone. Surficial deposits consist mostly of sand with seams of silt and clay (MNDM Map 2544 Bedrock Geology of Ontario).

2.1.3 Site Geology

Subsurface soils were interpreted from the boreholes drilled at the site as part of previous and current investigations. The locations of the BHs/MWs are shown in **Figure 3** and detailed subsurface conditions are presented on the borehole logs in **Appendix A**. The subsurface conditions in the boreholes are summarized in the following paragraphs.

Topsoil and clayey silt to silty clay (Possible fill/ disturbed native):

All boreholes encountered about 150 mm of topsoil consisting of silt, clay with traces of sand, gravel and grassroots. Cohesive fine-textured fill consisting of clayey silt to silty clay with traces of sand and gravel extending to depths 0.15 m to 1.2 m were found beneath the topsoil.

Silty Sand to Sandy Silt:

Below the topsoil, native Silty Sand to Sandy Silt layers were encountered in all the borehole ranging to depths from 2.4-6.1 mbgs to termination depths (22-28 mbgs).

Bedrock:

Bedrock was not encountered during the drilling at the site or at the termination depth in any borehole.

3.0 HYDROGEOLOGY

The hydrogeology at the Site was evaluated using the on-site monitoring wells, local domestic wells and existing hydrogeological reports for the area.

3.1 Local Groundwater Use

As part of the hydrogeological study, DS completed a search of the Ministry of the Environment Conservation and Parks (MECP) Water Well Record (WWR) database. Based on the MECP water well records search, there are 29 water wells records within 500 meters of the Site. A water well record summary is provided in **Appendix B**. All water well usage is noted as a domestic water wells or unknown. **Figure 1** shows the MECP water well record locations. The study area is not serviced with municipal water.

To verify the results of the MECP WWR search, a door to door well survey was completed in July 2018. Door to door surveys are voluntary and rely on well owner's consent to provide any relevant information. Completed surveys are provided in **Appendix B**. A total of 18 properties were visited during the door-to-door survey, resulting in two (2) properties (17381 Mount Pleasant Road and 10305 Hwy 9, Caledon) providing permission to collect groundwater samples. On July 20, 2018, two (2) water samples were collected from these wells and analyzed for nitrate and nitrite.

3.2 Groundwater Conditions and Flow Direction

Groundwater levels were measured on several occasions in all available monitoring wells by DS hydrogeologists. Groundwater levels are presented in **Table 1**. Groundwater levels at the Site range from 19 to 25 mbgs. Based on groundwater levels recorded, DS identified the primary aquifer at an approximate elevation of 281 masl. The MECP WWRs indicate the wells are screened within the sand/sand & gravel aquifer. Based on monitored groundwater levels and the local topography, the local groundwater flow direction within the site is inferred to be north-northeast. The estimated groundwater flow direction is presented on **Figure 4**.

Table 1: Groundwater Levels in Monitoring Wells

Well ID	Ground Elevation (Approx. masl)	Well Depth (mbgs)	Screened Interval (mbgs)	Date of Measurement	Depth to Water (mbgs)	Groundwater Elevation (masl)
MW18-1	305.7	27.3	25.9-27.3	June 22, 2018	24.3	281.4
				July 9, 2018	24.3	281.4
				July 26, 2018	24.3	281.4
				September 27, 2018	24.2	281.5
MW18-2	297.5	22.2	20.7-22.2	June 22, 2018	18.9	278.6
				July 9, 2018	18.8	278.7
				July 26, 2018	18.8	278.7
				September 27, 2018	18.8	278.7
MW18-3	297.7	21.2	19.7-21.2	June 22, 2018	18.2	279.5
				July 9, 2018	18.1	279.6
				July 26, 2018	18.1	279.6
				September 27, 2018	18.2	279.5
Domestic well(on-site)	304.5	N/A	N/A	June 22, 2018	23.20	281.3

3.3 Hydraulic Conductivity

Single Well Response Tests (SWRT) were conducted using the rising head test method by a DS hydrogeologist in all wells on July 9, 2018 to estimate hydraulic conductivity (k) for the representative geological units in which the wells were screened. Hydraulic conductivity (k) values were calculated using the Bouwer & Rice method. **Table 2** presents a summary of the hydraulic conductivity (k) values for the representative geological units. The value of calculated hydraulic conductivity (k) varies 6.8×10^{-5} m/s for silty sand layer to 6.8×10^{-7} m/s for sandy silt deposits. The hydraulic conductivity analyses are provided in **Appendix C**.

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

Well ID	Screened Lithology	Well Depth (mbgs)	K (m/s)	Geomean K (m/s)
BH/MW 18-1	Silty Sand to Sandy Silt	28.3	6.8×10^{-7}	1.24×10^{-7}
BH/MW 18-2	Silty Sand	23	4.2×10^{-5}	
BH/MW 18-3	Silty Sand	21	6.8×10^{-5}	

3.4 Background Groundwater Quality- Nitrate Concentrations

Three (3) groundwater monitoring rounds were completed from onsite wells (MW 18-1, MW 18-22 and MW 18-3) on July 9, July 26, and September 27, 2018. Additionally, two (2) groundwater samples were collected from domestic wells off-site on July 26, 2018. Samples were submitted under chain of custody to a CALA accredited laboratory (ALS Laboratories). The analytical results were compared to the Ontario Drinking Water Standards (ODWS). The reported analytical results indicated that the nitrate concentrations were exceeded the ODWS from the on-site wells but met the ODWS at the two (2) off-site wells. **Table 3** presents a summary of nitrate concentrations from the three (3) sampling events from the on-site wells (BH/MW18-1 to BH/MW18-3). The certificates of analysis are provided in **Appendix D**.

Table 3: Nitrate Concentrations in Groundwater

Parameter	Unit	ODWS	BH/MW 18-1	BH/MW 18-2	BH/MW 18-3	Off Site Well (Upgradient) 17381 Mount Pleasant Rd.	Off Site Well (Downgradient) 10305 Hwy 9
July 9, 2018							
Nitrate (NO ₃ ⁻)	mg/L	10	12.2	15.9	9.1	-	-
July 26, 2018							
Nitrate (NO ₃ ⁻)	mg/L	10	12.3	12.5	12.0	< 0.02	4.60
September 27, 2018							
Nitrate (NO ₃ ⁻)	mg/L	10	10.1	14.5	8.4	-	-
Average	mg/L	10	11.5	14.3	9.8	< 0.02	4.60

4.0 NITRATE IMPACT ASSESSMENT

It is our understanding that the proposed subdivision will utilize private on-site sewage treatment and disposal facilities for each of the proposed 22 lots. As a result, a groundwater impact assessment must be completed to assess the ability of the lands to treat sewage effluent to meet acceptable limits. A guide for assessing whether on-site sewage systems are appropriate for new developments is provided in the MECP guideline “D-5-4 Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment”. The guideline provides an evaluation process including lot size, system isolation and contaminant attenuation considerations. Developments consisting of lots which average less than 1 hectare in size generally require a groundwater impact assessment when proposing private on-site sewage treatment. At the site, the size of proposed lots ranges from 0.54 to 1.18 ha with an average size of 0.77 ha. Based on the D-5-4 guideline, it can not be assumed that attenuative processes within the lots will be sufficient to reduce the nitrate-nitrogen to an acceptable concentration in groundwater below adjacent properties.

Based on the analytical results presented in **Table 3**, background nitrate concentrations ranging from 8.4 to 15.9 mg/L (11.9 mg/L average) were reported for onsite wells MW18-1 through MW18-3 in July and September monitoring periods. In late July, the analytical results for the upgradient domestic well was reported below the detection limit at 0.02 mg/L nitrate, while results for the downgradient domestic well was reported at 4.6 mg/L nitrate. The data suggests elevated nitrate levels on site are likely the result of current farming practices and the application of nitrates in the form of fertilizers to enhance crop growth. Section 5.1 of the D-5-4 guideline recognizes the impact agricultural practices can have on nitrate-nitrogen concentrations in groundwater. The guideline suggests that if it can be demonstrated that existing levels of nitrates are the result of historical agricultural practices on the site (farming, feedlot, etc.), nitrate levels will decline following the change in land use. For this site, the change from agricultural to residential land use is expected to decrease on-site nitrate-nitrogen loading to groundwater.

Additional sampling of the upgradient nitrate-nitrogen concentrations in groundwater is recommended to provide seasonal comparisons and to further validate that the on-site nitrate-nitrogen concentrations in groundwater are the result of historical agricultural practices.

4.1 Nitrate Loading- On and Off-Site Impacts

The potential impacts of constructing a twenty-two (22) lot subdivision in the 301,740 m² (30.174 ha) site were assessed using the methodology presented in **Appendix E**. An increase in the downgradient nitrate concentration as a result of development is estimated to be approximately 4.87 mg/L. Though the onsite nitrate concentration is higher, this is expected to be the result of current agricultural practices at the site. Considering the change in land use and the future discontinued application of fertilizers, the background nitrate concentration is expected to be more representative of up-gradient nitrate concentrations (< 0.02 mg/L). Using this up-gradient concentrations as background nitrate concentrations at the site, inclusive nitrate concentrations at the site and property boundary would be

4.89 mg/L, which meets the Ontario Drinking Water Standard (ODWS) of 10 mg/L for nitrate. The calculated nitrate loading assumes that the recharged water will contribute directly to the sand aquifer and that there will be no dilution or attenuation between septic system and aquifer.

5.0 MITIGATION AND MONITORING PLAN

Even though downgradient wells are not expected to be affected by the proposed development and considering higher background nitrate concentration at the Site, a tertiary aeration treatment system is recommended to minimize nitrate loading at the Site and to reduce or limit the offsite nitrate concentrations in the future. Assuming a 50% reduction of nitrate loading with a tertiary treatment and taking into account the background concentrations the resulting nitrate concentration is 2.44 mg/L.

A post-development groundwater sampling program should be implemented at registered wells to confirm any adverse effects on water quality due to any increase in nitrate concentrations. The program will include nitrate monitoring on a quarterly basis for the duration of one (1) year after the installation of the tertiary treatment system or will continue as per Town of Caledon requirement.

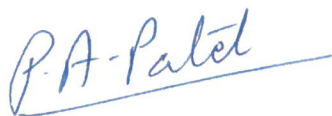
6.0 CONTINGENCY PLAN

In the event that any homeowners within the 500 m zone of the development site file a complaint about their well water quantity or quality, the owner of the site will provide a potable source of water. Additionally, the owner will immediately investigate the complaint. As part of the investigation, samples will be collected from the affected wells and analyzed for nitrate and nitrite. If the investigation determines that water quality has been negatively impacted as a direct result of the development at the Site, remedial action will be taken immediately. If possible, water will be treated directly at the well. Alternatively, a local company will be retained to provide a temporary potable water supply (i.e. cistern). This service shall be maintained until quality in the affected well is restored, or it is determined a long-term solution is required. If an affected well is determined to have been permanently degraded, deepening the existing well, drilling a new well, or connection to municipal supply (if available) will be considered.

We trust that this report satisfies your needs. Should you have any questions or need more information, please do not hesitate to contact our office.

DS Consultants Ltd.

Prepared By:



Pradeep Patel, M.Sc., P.Geo.
Project Manager



Reviewed By:



Martin Gedeon, M.Sc., P.Geo.
Senior Hydrogeologist

7.0 REFERENCES

Chapman, L.J., and D.F. Putnam; The Physiography of Southern Ontario, Third Edition, Ontario Geological Survey Special Volume 2; 1984, & 2007.

Freeze, R.A. and J.A. Cherry. "Groundwater". Prentice-Hall, Inc. Englewood Cliffs, NJ. 1979.

Guideline-D-5-4 Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment, the MECP, Ontario.

Hydrogeological Investigation, Proposed Residential Development, Highway 9/Mount Pleasant Road, Palgrave, Ontario by V.A Wood Associated Limited, July 2016.

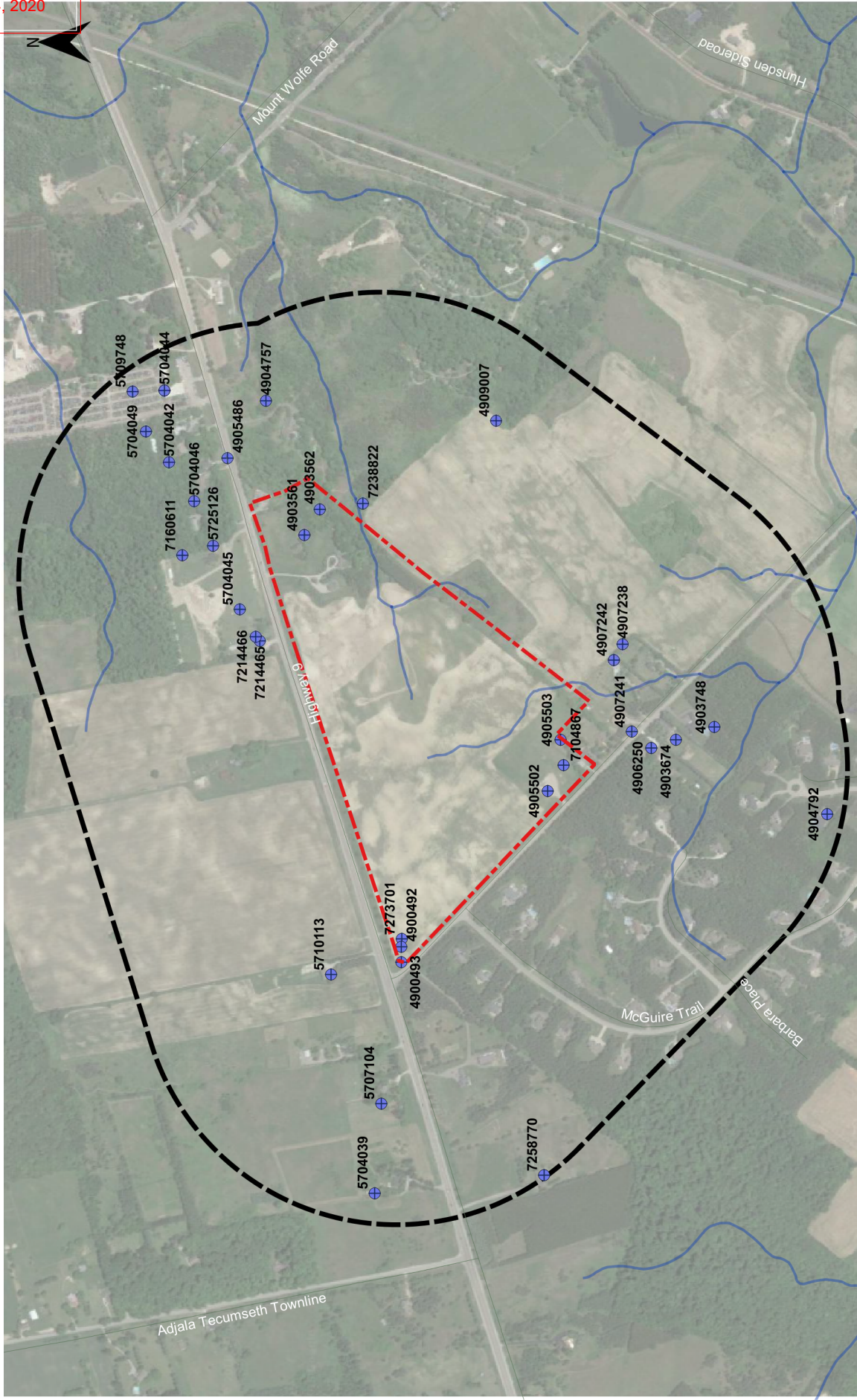
Ontario Regulation 153/04 made under the Environmental Protection Act, July 1, 2011.

Summary of Comments- Town of Caledon, 23 APR 2018: Proposed Draft Plan of Subdivision and Zoning By-law Amendment-2nd Submission Graham (1685078 Ontario Inc.).

Town of Caledon Official Plan, April 2018

FIGURES

J:\GIS\18-577-30 Hydrogeological Services - Graham Property\1-QGIS\Hydrogeology\Figure 1 - Site Location and MECF Wells.qgs



Legend

- Approx. Site Boundary
 - 500m Buffer
 - Registered Water Wells (MECF WWR)
- 0 200 400 m

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Client: ROB RUSSELL PLANNING INC.

Project: HYDROGEOLOGICAL INVESTIGATION

Graham Property, Palgrave

Title: SITE LOCATION AND MECF WELL RECORDS

Approved By:

p.p

Drawn By:

S.Y

Date:

December 2018

Scale:

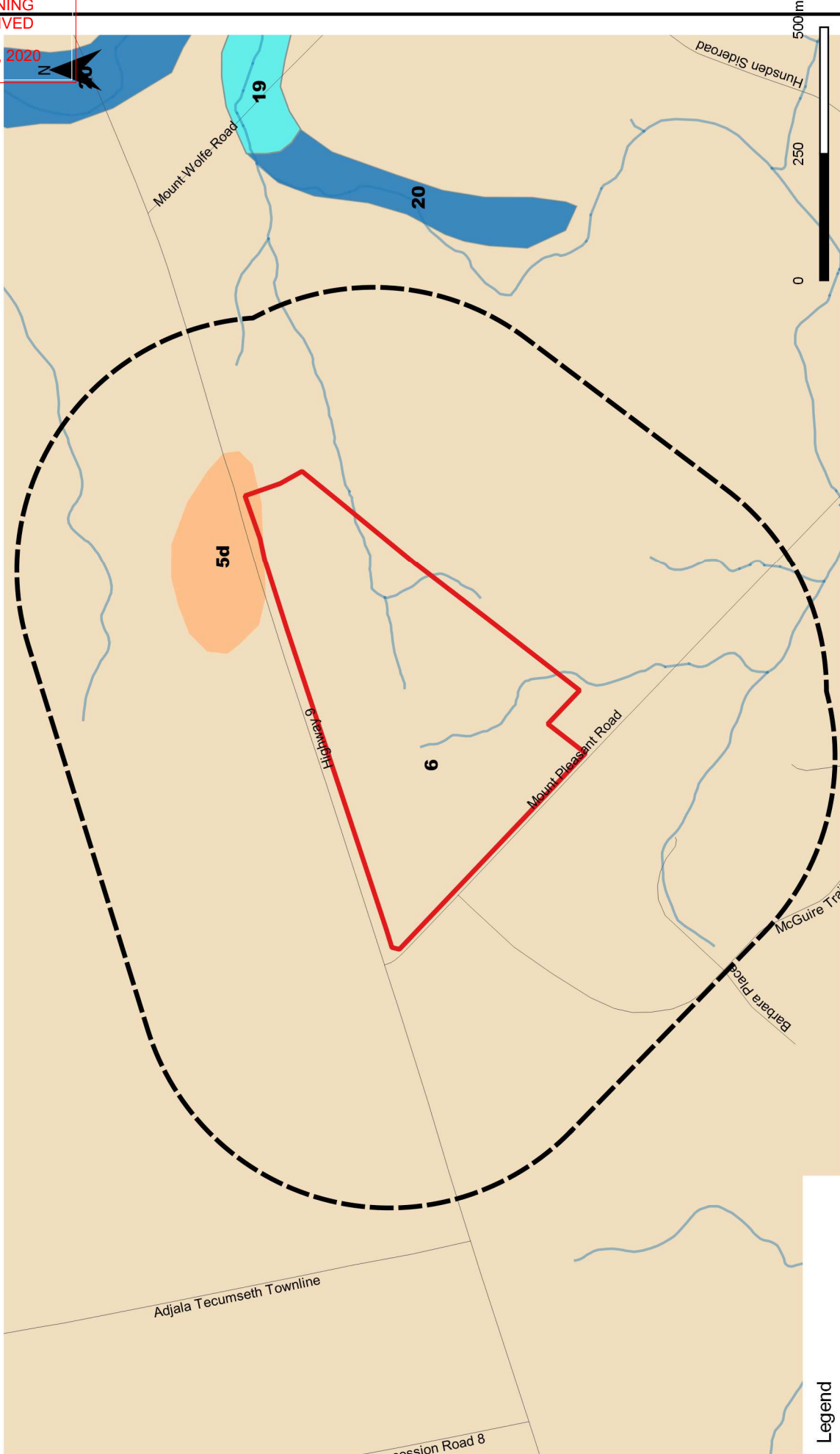
As Shown

Project No.:

18-577-30


Figure No.:

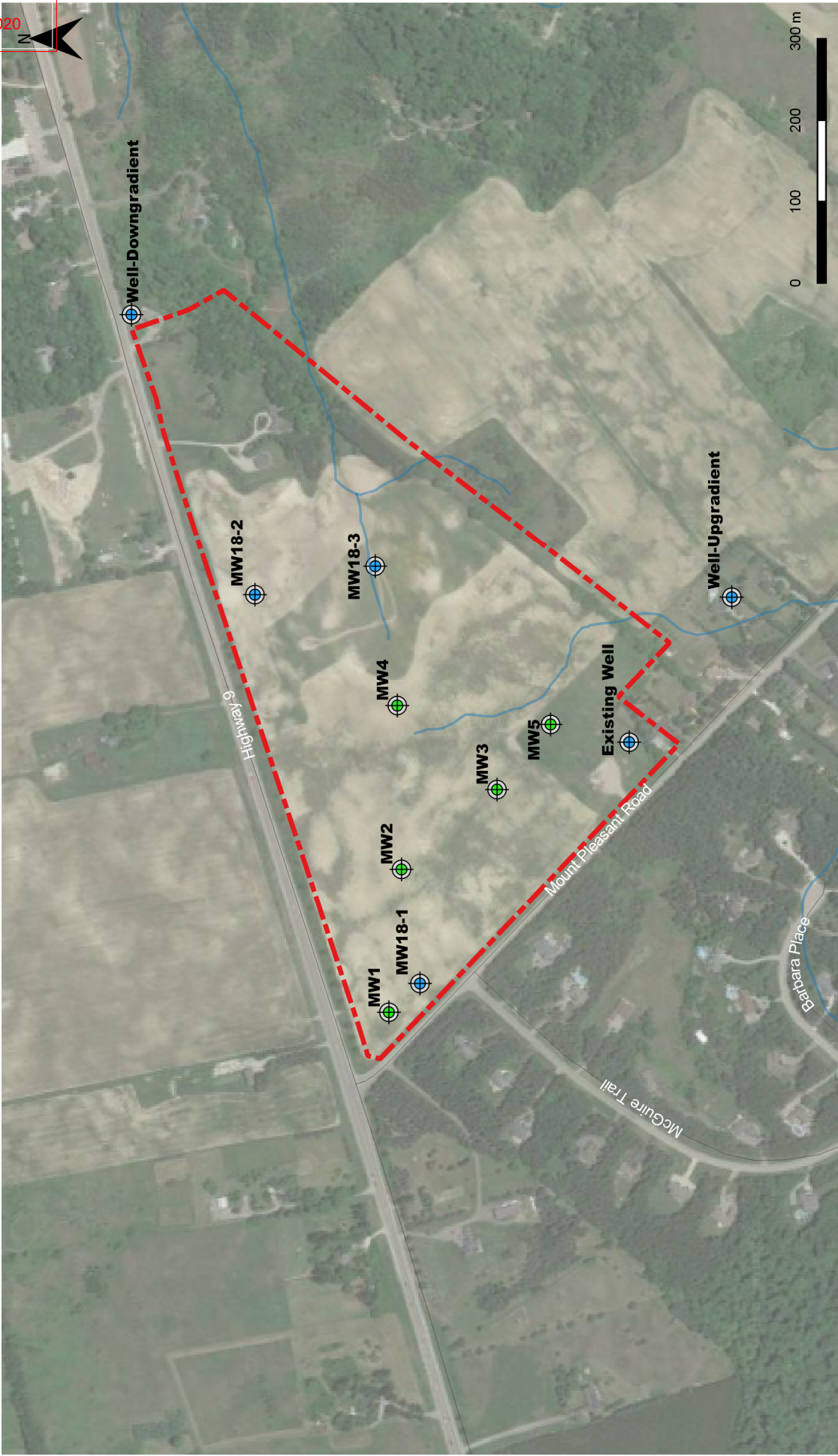
1



Legend

- Approx. Site Boundary
- 500m Buffer
- 19 - Modern Alluvium
- 20 - Wetland organic deposits
- 5d - Till
- 6 - Glaciofluvial sand

 DS CONSULTANTS LTD. 6221 Highway 7, UNIT 16 Vaughan, Ontario L4H 0K8 Telephone: (905) 264-9393 www.dsconsultants.ca	Project: HYDROGEOLOGICAL INVESTIGATION Graham Property, Palgrave		
	Title: SURFICIAL GEOLOGY MAP		
Client: ROB RUSSELL PLANNING INC.	Approved By:	Drawn By:	Date:
	P.P	S.Y	December 2018
	Scale:	Project No.:	Figure No.:
	As Shown	18-577-30	2



Legend



Approx. Site Boundary



Monitoring Well Location (DS)



Monitoring Well Location (V.A Wood)

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Project: HYDROGEOLOGICAL INVESTIGATION

Graham Property, Palgrave

Title: **BOREHOLE AND MONITORING WELL LOCATIONS**

Client:

ROB RUSSELL PLANNING INC.

Approved By:

P.P

Drawn By:

S.Y

Date:

December 2018

Scale:

As Shown

Project No.: 18-577-30

Figure No.:

3

J:\GIS\18-577-30 Hydrogeological Services - Graham Property\1-QGIS\Hydrogeology\Figure 4 - GW Contour Map.ggs



Legend

- Approx. Site Boundary
- Monitoring Well Location
- Groundwater Flow Direction
- 0-5m Groundwater Contour

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Project: HYDROGEOLOGICAL INVESTIGATION

Graham Property, Palgrave

Title: **GROUNDWATER CONTOUR MAP**

Client:

ROB RUSSELL PLANNING INC.

Approved By: P.P

Drawn By:

S.Y

Date: December 2018

Scale: As Shown

Project No.: 18-577-30

Figure No.:

4

Appendix A: Borehole Logs

1 OF 2

DRILLING DATA

Method: Hollow Stem Auger

Diameter: 200 mm

Date: Jun-13-2018

REF. NO.: 18-577-30

ENCL NO.: 2

W. L. 276.8 m
Jun 22, 2018

1st 2nd 3rd 4th

$+^3, \times^3$: Numbers refer to Sensitivity

○ **$\epsilon=3\%$** Strain at Failure

PROJECT: Geotechnical Investigation - Proposed Subdivision										DRILLING DATA											
CLIENT: Rob Russell Planning Consultants Inc										Method: Hollow Stem Auger											
PROJECT LOCATION: Hwy 9 and Mount Pleasant Road, Palgrave, ON										Diameter: 200 mm					REF. NO.: 18-577-30						
DATUM: Geodetic										Date: Jun-13-2018					ENCL NO.: 2						
BOREHOLE LOCATION: See Drawing 1																					
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)					W _p W W _L					GR SA SI CL			
								○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)								
26	SILTY SAND TO SANDY SILT: trace gravel, brown, moist(Continued)						274														
28 272.8																					
28.3	END OF BOREHOLE Notes: 1)Monitoring well installed upon completion of borehole																				

DS SOIL LOG 18-577-30- HWY 9 AND MOUNT PLEASANT ROAD, PALGRAVE, ON.GPJ DS.GDT 18-12-12

GROUNDWATER ELEVATIONS
1st 2nd 3rd 4th
Measurement

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

PROJECT: Geotechnical Investigation - Proposed Subdivision
CLIENT: Rob Russell Planning Consultants Inc
PROJECT LOCATION: Hwy 9 and Mount Pleasant Road, Palgrave, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200 mm
Date: Jun-13-2018
REF. NO.: 18-577-30
ENCL NO.: 3

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				W _p W W _L					GR	SA	SI	CL
								20 40 60 80 100	FIELD VANE & Sensitivity		LAB VANE		WATER CONTENT (%)							
295.2	0.0	: Augered straight down to 6.1 m without spoon sampling. Spoon Sampling started at 6.1 m		1	SS															
				2	SS															
				3	SS															
				4	SS															
				5	SS															
				6	SS															
289.1	6.1	SILTY SAND: trace gravel, brown, moist		7	SS	25														
				8	SS	39														
				9	SS	86														
				10	SS	52														
		saturated below 18.3 m																		
			11	SS	63															
273.4																				
22 21.8																				
	END OF BOREHOLE																			
	Notes: 1)Monitoring well installed upon completion of borehole																			

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ s=3% Strain at Failure

DS SOIL LOG 18-577-30-HWY 9 AND MOUNT PLEASANT ROAD, PALGRAVE, ON GPJ DS.GDT 18-12-12

W. L. 276.3 m
Jun 22, 2018

saturated below 18.3 m

LOG OF BOREHOLE BH18-3

1 OF 1

PROJECT: Geotechnical Investigation - Proposed Subdivision
CLIENT: Rob Russell Planning Consultants Inc
PROJECT LOCATION: Hwy 9 and Mount Pleasant Road, Palgrave, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200 mm
Date: Jun-13-2018
REF. NO.: 18-577-30
ENCL NO.: 4

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	METHANE AND GRAIN SIZE DISTRIBUTION (%)					
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)				WATER CONTENT (%)					GR SA SI CL					
												20 40 60 80 100	20 40 60 80 100	20 40 60 80 100			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100
296.3	0.0	: Augered straight down to 6.1 m without spoon sampling. Spoon Sampling started at 6.1 m		1	SS		296															
				2	SS																	
				3	SS																	
				4	SS		294															
				5	SS																	
				6	SS		292															
290.2	6.1	SILTY SAND: trace gravel, brown, moist		7	SS	26	290															
							288															
				8	SS	45																
							286															
				9	SS	56	284															
							282															
				10	SS	45																
							280															
277.5	18.8	saturated below 18.3 m		11	SS	37	W. L. 278.1 m Jun 22, 2018															
							276															
		END OF BOREHOLE Notes: 1)Monitoring well installed upon completion of borehole																				

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH
NOTES

+ 3 , × 3 : Numbers refer to Sensitivity

○ s=3% Strain at Failure

Appendix B: MECP Water Well Record & Door to Door Well Survey

Table: MECP Water Wells Records

Project: 18-577-30

Hydrogeological Investigation - Graham Property

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
CALEDON TOWN (ALBION	17 594160 4870134 W	1957/10 3414	4	FR 0172	92/170/2/2:0	DO	0172 4	4900492 ()	MSND CLAY 0056 MSND 0092 FSND 0176
CALEDON TOWN (ALBION	17 594130 4870134 W	1957/10 3414	4	FR 0092	92/170/2/2:0	DO	0172 4	4900493 ()	MSND 0092 FSND 0176
CALEDON TOWN (ALBION	17 594964 4870323 W	1970/10 4610	5	FR 0075	69/85/4/8:0	DO	0090 4	4903561 ()	BRWN LOAM MSND 0001 BRWN MSND CLAY SILT 0075 BRWN MSND SILT 0094 BLUE FSND SILT 0096
CALEDON TOWN (ALBION CON 08 027	17 595014 4870293 W	1970/10 4610	5					4903562 () A	BRWN LOAM 0002 BRWN MSND SILT 0035 BRWN CLAY 0100 BLUE MSND SILT 0154
CALEDON TOWN (ALBION CON 08 027	17 594564 4869598 W	1971/04 5206	5	FR 0094	14/16/8/6:0	DO		4903674 ()	BRWN SAND 0069 GREY SAND 0170 MSND 0181
CALEDON TOWN (ALBION CON 08 027	17 594590 4869523 W	1971/12 1315	6 5	FR 0190	70/150/5/5:0	DO	0185 5	4903748 ()	OBDN 0018 FSND QSND 0180 CSND 0190
CALEDON TOWN (ALBION CON 08 028	17 595226 4870398 W	1975/06 3108	7	UK 0087	63/82/10/2:0	DO	0094 3	4904757 ()	BRWN CLAY SAND 0029 BRWN SAND 0057 BRWN CLAY SAND 0086 BRWN MSND FSND 0097
CALEDON TOWN (ALBION CON 09 027	17 594419 4869303 W	1975/09 5459			75/141/12/3:0	DO	0131 6	4904792 ()	BRWN SAND 0008 BRWN CLAY 0061 BRWN FSND 0114 BLUE SAND 0120 BLUE FSND 0130 BLUE SAND 0141
CALEDON TOWN (ALBION CON 09 027	17 595114 4870473 W	1978/05 4778	7	FR 0095	63//7/3:0	DO	0107 3	4905486 ()	BRWN SAND CLAY BLDR 0063 BRWN SAND CLAY 0095 BRWN FSND MSND 0110
CALEDON TOWN (ALBION CON 09 027	17 594464 4869848 W	1979/05 5459	6	FR 0114	75/108/10/:	DO	0111 3	4905502 ()	BRWN GRVL CLAY 0022 BRWN SAND CLAY SOFT 0092 BRWN CLAY 0100 BRWN FSND 0114
CALEDON TOWN (ALBION CON 09 027	17 594564 4869823 W	1979/05 5459	6	FR	75/150/7/:	DO	0154 3	4905503 ()	BRWN GRVL 0003 BRWN SAND CLAY SOFT 0021 BRWN SAND CLAY LYRD 0108 BLUE CLAY 0152 BLUE FSND 0157
CALEDON TOWN (ALBION CON 09 027	17 594548 4869646 W	1985/03 3108	5	UK 0170	67/110/12/1:30	DO	0175 6	4906250 ()	PRDR 0099 BRWN SAND 0168 BLUE SAND 0182
CALEDON TOWN (ALBION CON 09 027	17 594752 4869702 W	1989/06 4778	6	FR 0177	77/110/12/3:0	DO	0183 4	4907238 (55236)	BRWN CLAY SAND 0005 BRWN SAND GRVL 0090 BRWN SAND SILT 0105 BLUE SILT CLAY 0155 BLUE SILT SAND CLAY 0177 BRWN MSND 0187
CALEDON TOWN (ALBION CON 09 027	17 594580 4869684 W	1989/06 4778	6	FR 0184	88/120/12/3:0	DO	0185 4	4907241 (55237)	BRWN SAND GRVL 0012 BRWN SAND CLAY 0035 BRWN SAND SILT 0120 BLUE SILT CLAY 0157 BLUE FSND SILT CLAY 0184 FSND CLN 0189
CALEDON TOWN (ALBION CON 09 027	17 594720 4869719 W	1989/06 4778	6	FR 0170	78/115/10/3:0	DO	0173 4	4907242 (55235)	BRWN CLAY SAND 0005 BRWN SAND GRVL 0090 BRWN SAND SILT 0118 BLUE SILT 0142 BLUE FSND SILT 0170 FSND CLN 0177
CALEDON TOWN (ALBION CON 09 028	17 595188 4869949 L	2002/05 4645				DO		4909007 (241987) A	
CALEDON TOWN (ALBION CON 09 028	17 593680 4870186 W	1967/05 3414	6	FR 0205	98/106/5/3:0	DO	0202 3	5704039 ()	LOAM 0002 CLAY MSND 0020 BRWN MSND 0118 GREY SILT 0193 GREY MSND CLAY 0200 GREY CSND 0205
CALEDON TOWN (ALBION CON 09 028	17 595106 4870587 W	1956/04 3414	5					5704042 () A	BRWN MSND CLAY 0075 HPAN 0078 MSND 0117 HPAN 0184 GREY MSND 0235 GRVL 0248 CLAY BLDR 0285
CALEDON TOWN (ALBION CON 09 028	17 595246 4870596 W	1956/05 3414	4	FR 0086	49/72/6/6:0	DO		5704043 ()	MSND 0086
CALEDON TOWN (ALBION CON 10 027	17 595246 4870596 W	1957/07 3414	4	FR 0068	68/88/10/4:0	DO	0105 4	5704044 ()	MSND 0068 FSND 0100 MSND 0109
TECUMSETH TOWNSHIP CON 01 001	17 595166 4870632 W	1966/01 3414	5	FR 0075	38/44/10/2:0	DO	0071 4	5704049 ()	PRDG 0040 FSND 0070 BRWN CSND 0075
TECUMSETH TOWNSHIP CON 01 003	17 593854 4870173 W	1970/04 3414	6	FR 0125	95/97/7/2:0	DO	0122 3	5707104 ()	BRWN MSND 0020 BRWN CLAY 0046 MSND 0100 FSND 0120 MSND 0125

TECUMSETH TOWNSHIP CON 01 003	17 595244 4870658 W	1973/04 3414	6	FR 0095	60/75/5/2:0	DO	0092 4	5709748 ()	LOAM 0001 BRWN SAND 0070 BRWN MSND 0095
TECUMSETH TOWNSHIP CON 01 003	17 594106 4870271 W	1973/07 3108	7		87/135/6/3:0	DO	0145 3	5710113 ()	BLCK LOAM 0003 BRWN CLAY SAND 0034 BRWN CLAY SAND GRVL 0067 BRWN CLAY SAND 0142 BRWN MSND 0148
TECUMSETH TOWNSHIP CON 01 003	17 594944 4870501 W	1988/05 5206	6	FR 0072	72/95/6/4:0	DO	0107 3	5725126 (26322)	BRWN SAND 0034 GREY SAND 0110
TECUMSETH TOWNSHIP CON 01 003	17 594925 4870561 W	2010/06 6915	2.46		161/184/3/1:0	DO	0361 30	7160611 (Z42886) A038480	BRWN SAND SILT 0390
TECUMSETH TOWNSHIP CON 01 003	17 594758 4870410 W	6915	6.25		70/83/15/1:		0120 5	(Z150111) A130465	BRWN SAND CLAY 0126
TECUMSETH TOWNSHIP CON 01 003	17 594766 4870418 W	6915				NU		7214466 (Z150125) A	
TECUMSETH TOWNSHIP CON 01 004	17 593715 4869855 W	2016/01 5459	6	UT 0216	114/118/12/1:	DO	0210 6	7258770 (Z225818) A032778	BRWN CLAY SILT HARD 0006 BRWN FSND SILT PCKD 0200 BRWN FSND MSND LOOS 0216

Project : 18-577-30 Water Well Survey Results- Graham Property

Address	MECP ID	Comment
Mt. Pleasant Road:		
17390	496250	No Answer
17374	490364	Has Well, busy at the moment/day (Left Phone #, Call to return at another time to take sample)
17366	4903748	On Municipal (Says he was the only one to get hooked up to Municipal Water)
17345	4907238	No Answer
17381	4907242	Survey Completed, Water Level and Sample taken
17385	4907241	Not home owner, gave email to send survey too + arrange for sampling another time
17409	4905503	No Answer
17419	7104867	No Answer
Hwy. 9:		
10261	4903562	No Answer
10305	4903561	Survey Completed, Sample Taken, Unable to access well for water level
8726	5704049	No Answer
8738	5704042	No Answer
8770	4905486	Gate closed
8750	5725126	No Answer
8800	7214465	No Answer, contact Larry Hall: 905-951-1462
8870	5710113	Gate closed
8964	5707104	Not home owner, gave email to send survey too + arrange for sampling another time
8986	5704039	No Answer



WATER WELL SURVEY

LOCATION: 17381 Mt. Pleasant
OWNER: Brad Hayhoe
TELEPHONE #: (647)-326-2045

DATE: July 26/18
PROJECT #: 18-577-30
WELL #: _____

WELL INFORMATION

Drilled ☒ Dug or bored _____ Combination _____
Date Completed Unknown Depth ~190'/60m
Casing Diameter 8" Seal _____
Aquifer: _____ Overburden _____ Bedrock _____
Static Level: Original _____ Present _____
Has well ever been dry? No
Owner when well drilled No

SL = 0.39m WL = 22.98mb top
WATER QUALITY (if previously tested)

PUMP INFORMATION

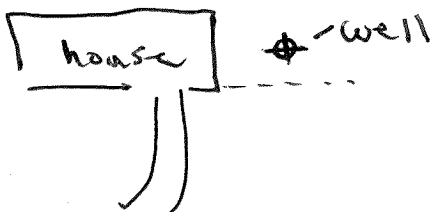
Make _____ Age _____ HP _____
Type: Jet _____ Submersible _____
Shallow well _____ Deep Well _____ Other _____
Depth to intake _____
Centre of pump mbgs _____
Pump capacity _____
Condition: good ☒ fair _____ poor _____

WATER CONSUMPTION

pH _____ Temp: _____ Conductivity _____
Chloride _____ Iron _____
Hardness _____ Alkalinity _____
Bacterial _____
Clear: Yes _____ No _____ Sand-free: Yes _____ No _____
Sulfurous: Yes _____ No _____ Odour: Yes _____ No _____
Any water treatment: Yes, iron-uv-softener

Domestic: # of persons 4
Livestock: (specify) _____
Other uses: Watering, Pool, etc...
Estimated daily requirement: _____

SKETCH (Location – use back if necessary)



ANNUAL SAMPLING PROGRAM

Is Well Water Supplemented? Yes _____ No ☒
Accessible for Water Levels? Yes ☒ No _____
Permission to obtain water levels and samples? Yes ☒ No _____

OWNERS ACKNOWLEDGEMENT:

The Above information is correct to the best of my knowledge.

Signed [Signature]

(Owner/tenant)

Date: July 26/18

22-22-18



WATER WELL SURVEY

LOCATION: 16305 Hwy. 9
OWNER: Pargan Singh
TELEPHONE #: 416 435-5662

DATE: July 26/18
PROJECT #: 18-577-30
WELL #: _____

WELL INFORMATION * couldn't access, sealed

Drilled ☒ Dug or bored _____ Combination _____
Date Completed ? Depth ~100'
Casing Diameter 8" Seal _____
Aquifer: Overburden _____ Bedrock _____
Static Level: Original _____ Present _____
Has well ever been dry? No
Owner when well drilled No

PUMP INFORMATION

Make _____ Age _____ HP _____
Type: Jet Submersible
Shallow well Deep Well Other
Depth to intake _____
Centre of pump mbgs _____
Pump capacity _____
Condition: good ☒ fair _____ poor _____

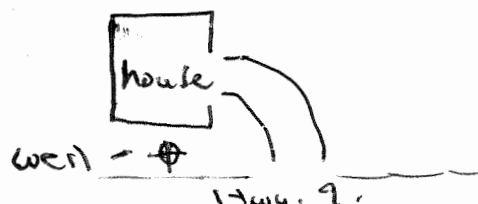
WATER QUALITY (if previously tested)

pH _____ Temp: _____ Conductivity _____
Chloride _____ Iron _____
Hardness _____ Alkalinity _____
Bacterial _____
Clear: Yes _____ No _____ Sand-free: Yes _____ No _____
Sulfurous: Yes _____ No _____ Odour: Yes _____ No _____
Any water treatment: Yes

WATER CONSUMPTION

Domestic: # of persons 2
Livestock: (specify) _____
Other uses: _____
Estimated daily requirement: _____

SKETCH (Location – use back if necessary)



OWNERS ACKNOWLEDGEMENT:

The Above information is correct to the best of my knowledge.

Signed [Signature]
(Owner/tenant)

ANNUAL SAMPLING PROGRAM

Is Well Water Supplemented? Yes _____ No ☒
Accessible for Water Levels? Yes _____ No ☒
Permission to obtain water levels and samples? Yes ☒ No _____

Date: July 26/18



WATER WELL SURVEY

* busy at the moment/day, call to return another time for sample

LOCATION: 17374 Mt. Pleasant
OWNER: Patrick Cleary
TELEPHONE #: (905)-880-4599

DATE: July 26/18
PROJECT #: 18-577-30
WELL #: _____

WELL INFORMATION

Drilled ☒ Dug or bored ☐ Combination ☐
Date Completed _____ Depth ~60.9 m
Casing Diameter _____ Seal _____
Aquifer: Overburden _____ Bedrock _____
Static Level: Original _____ Present _____
Has well ever been dry? No
Owner when well drilled _____

Static WL = ~21.3 m

WATER QUALITY (if previously tested)

pH _____ Temp: _____ Conductivity _____
Chloride _____ Iron _____
Hardness _____ Alkalinity _____
Bacterial _____
Clear: Yes ☐ No ☐ Sand-free: Yes ☐ No ☐
Sulfurous: Yes ☐ No ☐ Odour: Yes ☐ No ☐
Any water treatment: _____

PUMP INFORMATION

Make _____ Age _____ HP _____
Type: Jet Submersible
Shallow well Deep Well Other
Depth to intake _____
Centre of pump mbgs _____
Pump capacity _____
Condition: good ☐ fair ☐ poor ☐

WATER CONSUMPTION

Domestic: # of persons _____
Livestock: (specify) _____
Other uses: _____
Estimated daily requirement: _____

SKETCH (Location – use back if necessary)

ANNUAL SAMPLING PROGRAM

Is Well Water Supplemented? Yes ☐ No ☐
Accessible for Water Levels? Yes ☐ No ☐
Permission to obtain water levels and samples? Yes ☐ No ☐

OWNERS ACKNOWLEDGEMENT:

The Above information is correct to the best of my knowledge.

Signed _____

Date: _____

(Owner/tenant)



WATER WELL SURVEY

**Not owner, email Survey + arrange for Sampling another time*

LOCATION: 8964 Hwy. 9

DATE: July 26/18

OWNER: Stephanie

PROJECT #: 18-577-30

TELEPHONE #: _____

WELL #: _____

Email: S1barrett95@gmail.com

WELL INFORMATION

PUMP INFORMATION

Drilled ☐ Dug or bored ☐ Combination ☐

Make _____ Age _____ HP _____

Date Completed _____ Depth _____

Type: Jet Submersible

Casing Diameter _____ Seal _____

Shallow well Deep Well Other

Aquifer: Overburden _____ Bedrock _____

Depth to intake _____

Static Level: Original _____ Present _____

Centre of pump mbgs _____

Has well ever been dry? _____

Pump capacity _____

Owner when well drilled _____

Condition: good ☐ fair ☐ poor ☐

WATER QUALITY (if previously tested)

WATER CONSUMPTION

pH _____ Temp: _____ Conductivity _____

Domestic: # of persons _____

Chloride _____ Iron _____

Livestock: (specify) _____

Hardness _____ Alkalinity _____

Other uses: _____

Bacterial _____

Estimated daily requirement: _____

Clear: Yes ☐ No ☐ Sand-free: Yes ☐ No ☐

Sulfurous: Yes ☐ No ☐ Odour: Yes ☐ No ☐

Any water treatment: _____

SKETCH (Location – use back if necessary)

ANNUAL SAMPLING PROGRAM

Is Well Water Supplemented? Yes ☐ No ☐

Accessible for Water Levels? Yes ☐ No ☐

Permission to obtain water levels and samples? Yes ☐ No ☐

OWNERS ACKNOWLEDGEMENT:

The Above information is correct to the best of my knowledge.

Signed _____

Date: _____

(Owner/tenant)



WATER WELL SURVEY

- Sonia
* Not home owner, email Rpurge@rcutcom.com

LOCATION: 17385 Mt. Pleasant
OWNER: _____
TELEPHONE #: _____

DATE: July 26/18
PROJECT #: 18-577-30
WELL #: _____

WELL INFORMATION

Drilled _____ Dug or bored _____ Combination _____
Date Completed _____ Depth _____
Casing Diameter _____ Seal _____
Aquifer: _____ Overburden _____ Bedrock _____
Static Level: Original _____ Present _____
Has well ever been dry? _____
Owner when well drilled _____

PUMP INFORMATION

Make _____ Age _____ HP _____
Type: Jet _____ Submersible _____
Shallow well _____ Deep Well _____ Other _____
Depth to intake _____
Centre of pump mbgs _____
Pump capacity _____
Condition: good _____ fair _____ poor _____

WATER QUALITY (if previously tested)

pH _____ Temp: _____ Conductivity _____
Chloride _____ Iron _____
Hardness _____ Alkalinity _____
Bacterial _____
Clear: Yes _____ No _____ Sand-free: Yes _____ No _____
Sulfurous: Yes _____ No _____ Odour: Yes _____ No _____
Any water treatment: _____

WATER CONSUMPTION

Domestic: # of persons _____
Livestock: (specify) _____
Other uses: _____
Estimated daily requirement: _____

SKETCH (Location – use back if necessary)

ANNUAL SAMPLING PROGRAM

Is Well Water Supplemented? Yes _____ No _____
Accessible for Water Levels? Yes _____ No _____
Permission to obtain water levels and samples? Yes _____ No _____

OWNERS ACKNOWLEDGEMENT:

The Above information is correct to the best of my knowledge.

Signed _____

Date: _____

(Owner/tenant)

Appendix C: Hydraulic Conductivity Analysis



Slug Test Analysis Report

Project: Hydrogeological Investigation

Number: 18-577-30

Client: Rob Russell Planning Consultants Inc.

Location: Caledon, ON

Slug Test: MW18-1

Test Well: MW18-1

Test Conducted by: SE

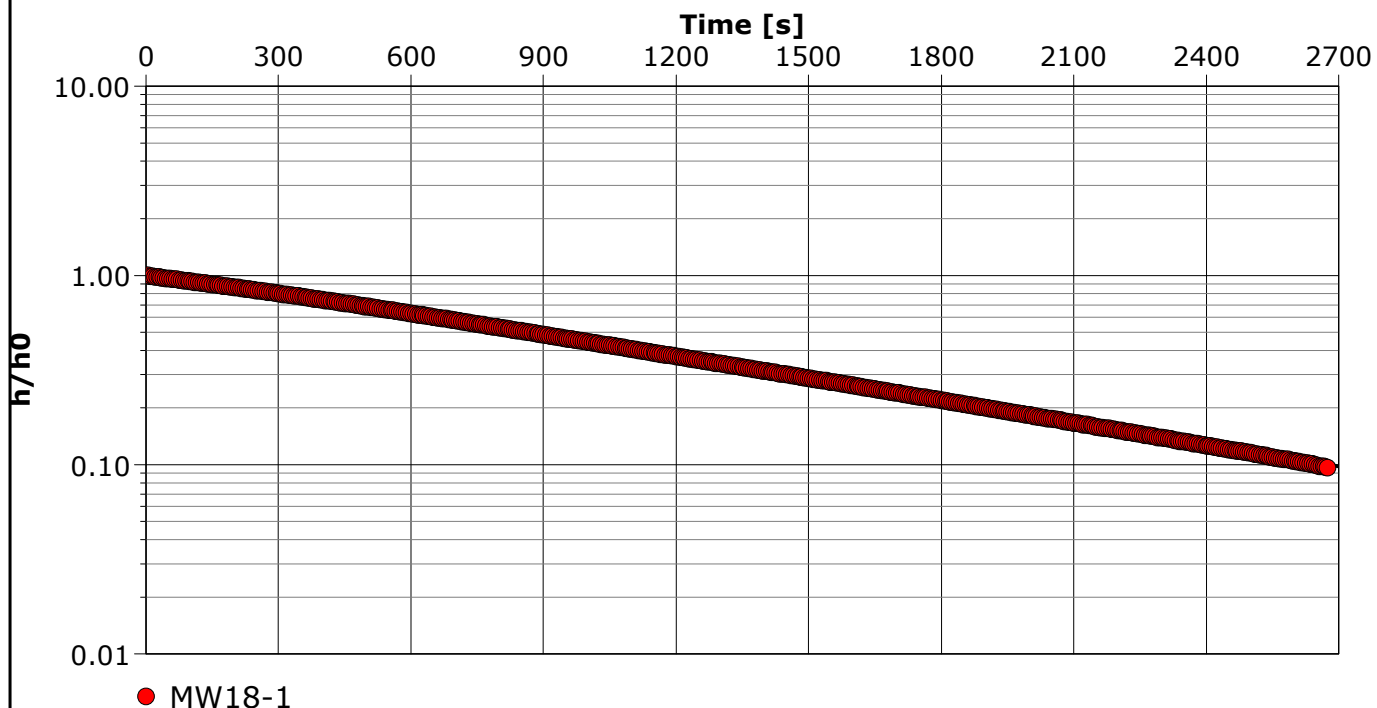
Test Date: 2018-07-09

Analysis Performed by: SE

MW18-1

Analysis Date: 2018-07-18

Aquifer Thickness: 2.95 m



Calculation using Bouwer & Rice

Observation Well

Hydraulic Conductivity
[m/s]

MW18-1

6.75×10^{-7}



Slug Test Analysis Report

Project: Hydrogeological Investigation

Number: 18-577-30

Client: Rob Russell Planning Consultants Inc.

Location: Caledon, ON

Slug Test: MW18-2

Test Well: MW18-2

Test Conducted by: SE

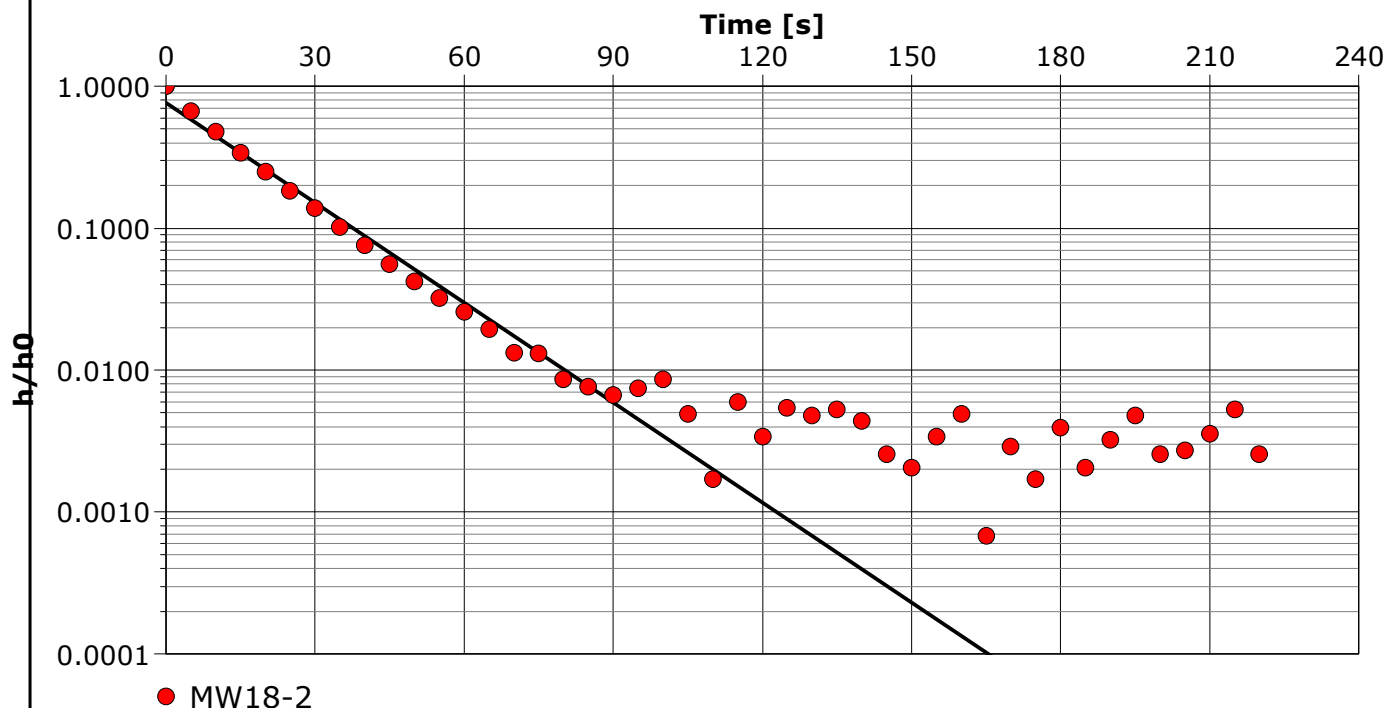
Test Date: 2018-07-09

Analysis Performed by: SE

MW18-2

Analysis Date: 2018-07-18

Aquifer Thickness: 3.22 m



Calculation using Bouwer & Rice

Observation Well

Hydraulic Conductivity
[m/s]

MW18-2

4.21×10^{-5}



Slug Test Analysis Report

Project: Hydrogeological Investigation

Number: 18-577-30

Client: Rob Russell Planning Consultants Inc.

Location: Caledon, ON

Slug Test: MW18-3

Test Well: MW18-3

Test Conducted by: SE

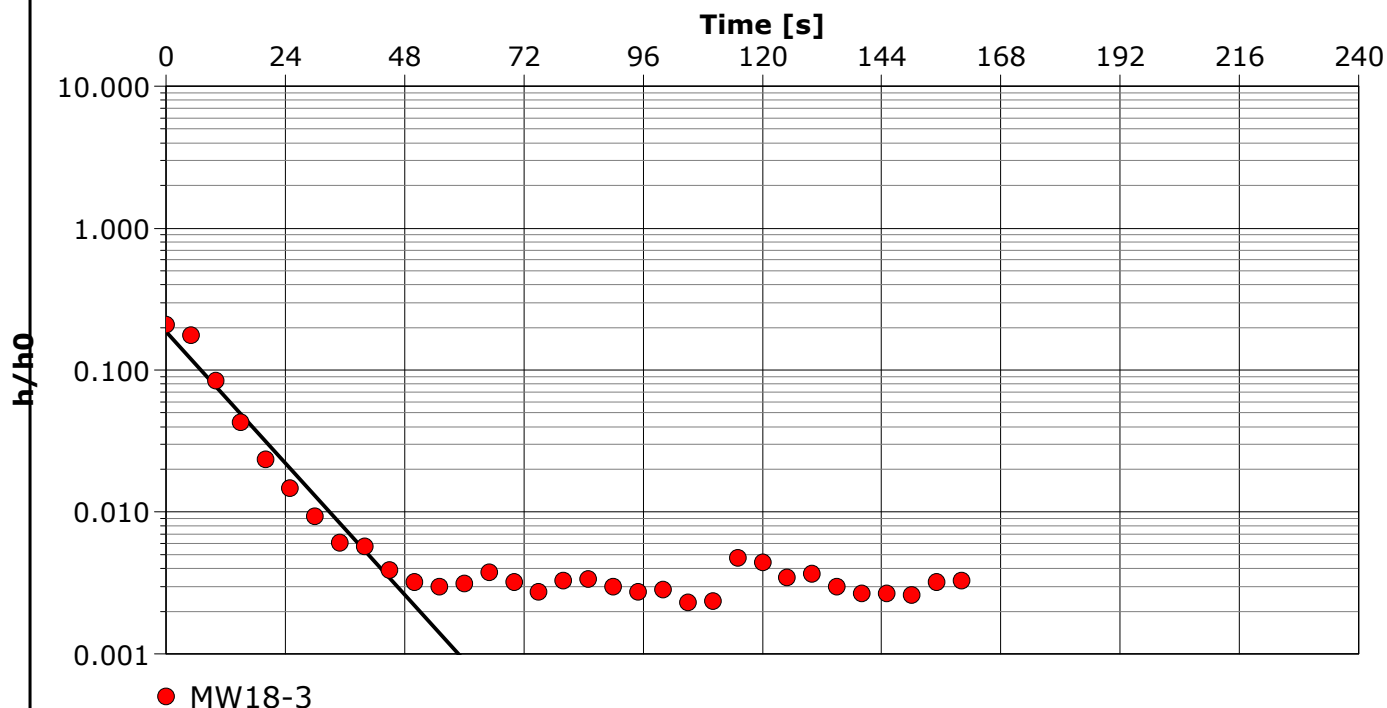
Test Date: 2018-07-09

Analysis Performed by: SE

MW18-3

Analysis Date: 2018-07-18

Aquifer Thickness: 2.97 m



Calculation using Bouwer & Rice

Observation Well

Hydraulic Conductivity
[m/s]

MW18-3

6.83×10^{-5}

Appendix D: Groundwater Quality Certificate of Analysis



DS Consultants (Vaughan)

ATTN: Scott Watson

6221 Highway 7

Unit 16

Vaughan ON L4H 0K8

Date Received: 09-JUL-18

Report Date: 13-JUL-18 11:19 (MT)

Version: FINAL

Client Phone: 647-237-5110

Certificate of Analysis

Lab Work Order #: L2125942

Project P.O. #: NOT SUBMITTED

Job Reference: 18-577-30

C of C Numbers: 17-615312

Legal Site Desc:

Amanda Fazekas
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 5730 Coopers Avenue, Unit #26, Mississauga, ON L4Z 2E9 Canada | Phone: +1 905 507 6910 | Fax: +1 905 507 6927

ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2125942-1	MW18-1							
Sampled By: CLIENT on 09-JUL-18 @ 08:00								
Matrix: WATER								
Anions and Nutrients								
Nitrate and Nitrite as N		12.2		0.022	mg/L		12-JUL-18	
Nitrate (as N)		12.2		0.020	mg/L		11-JUL-18	R4123607
Nitrite (as N)		<0.010		0.010	mg/L		11-JUL-18	R4123607
L2125942-2	MW18-2							
Sampled By: CLIENT on 09-JUL-18 @ 08:00								
Matrix: WATER								
Anions and Nutrients								
Nitrate and Nitrite as N		15.9		0.022	mg/L		12-JUL-18	
Nitrate (as N)		15.9		0.020	mg/L		11-JUL-18	R4123607
Nitrite (as N)		<0.010		0.010	mg/L		11-JUL-18	R4123607
L2125942-3	MW18-3							
Sampled By: CLIENT on 09-JUL-18 @ 08:00								
Matrix: WATER								
Anions and Nutrients								
Nitrate and Nitrite as N		9.09		0.022	mg/L		12-JUL-18	
Nitrate (as N)		9.09		0.020	mg/L		11-JUL-18	R4123607
Nitrite (as N)		<0.010		0.010	mg/L		11-JUL-18	R4123607

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Nitrate (as N)	MS-B	L2125942-1, -2, -3

Sample Parameter Qualifier key listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ETL-N2N3-WT	Water	Calculate from NO2 + NO3	APHA 4110 B
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.			

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

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

Chain of Custody Numbers:

17-615312

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 ww - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

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.



Environmental

Quality Control Report

Workorder: L2125942

Report Date: 13-JUL-18

Page 1 of 2

Client: DS Consultants (Vaughan)
6221 Highway 7 Unit 16
Vaughan ON L4H 0K8

Contact: Scott Watson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-WT		Water						
Batch	R4123607							
WG2819395-14	DUP	WG2819395-13						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	25	11-JUL-18
WG2819395-12	LCS							
Nitrite (as N)			102.1		%		70-130	11-JUL-18
WG2819395-11	MB							
Nitrite (as N)			<0.010		mg/L		0.01	11-JUL-18
WG2819395-15	MS	WG2819395-13						
Nitrite (as N)			99.5		%		70-130	11-JUL-18
NO3-IC-WT		Water						
Batch	R4123607							
WG2819395-14	DUP	WG2819395-13						
Nitrate (as N)		8.16	8.15		mg/L	0.2	25	11-JUL-18
WG2819395-12	LCS							
Nitrate (as N)			101.7		%		70-130	11-JUL-18
WG2819395-11	MB							
Nitrate (as N)			<0.020		mg/L		0.02	11-JUL-18
WG2819395-15	MS	WG2819395-13						
Nitrate (as N)			N/A	MS-B	%		-	11-JUL-18

Quality Control Report

Workorder: L2125942

Report Date: 13-JUL-18

Client: DS Consultants (Vaughan)
6221 Highway 7 Unit 16
Vaughan ON L4H 0K8

Contact: Scott Watson

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
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.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



COC Number: 17-615312
Page 1 of 1

www.alsglobal.com

TOWN OF CALEDON

Report To		Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Company:	DI Consultants Ltd.	Select Report Format:	<input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EBD (Digital)	Regular (R)	<input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply	Emergency	1 Business day [E-100%] Same Day, Weekend or Statutory holiday [E2-200%] (Laboratory opening fees may apply)
Contact:	Scott Watkinson	Quality Control (QC) Report with Report	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	4 day [P4-20%]	<input type="checkbox"/>	3 day [P3-25%]	<input type="checkbox"/>
Phone:	905-264-9393	Compare Results to Criteria on Report - provide details below if box checked	<input type="checkbox"/>	2 day [P2-50%]	<input type="checkbox"/>		
	Company address below will appear on the final report	Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Date and Time Required for all E&P TATs: For tests that can not be performed according to the service level selected, you will be contacted.			
Street:	622 Hwy 7 Unit 16	Email 1 or Fax	Scott.Watson@di-consultants.com	Analysis Request			
City/Province:	Vaughan, ON	Email 2	Sean.Elson@di-consultants.com				
Postal Code:		Email 3					
Invoice To	Same as Report To	Invoice Distribution	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX				
Copy of Invoice with Report	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	Select Invoice Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX				
Company:		Email 1 or Fax					
Contact:		Email 2					
Project Information		Oil and Gas Required Fields (client use)					
ALS Account # / Quote #:		AF/Coast Center:	PO#				
Job #:	18-577-30	Major/Minor Code:	Routing Code:				
PO / AFE:		Requisitioner:					
LSD:		Location:					
ALS Lab Work Order # (lab use only):	201805942	ALS Contact:	AF				
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type			
	MW18-1	09-July-18	AM	GW	XX		
	MW18-2						
	MW18-3						
Drinking Water (DW) Samples (client use)					SAMPLE CONDITION AS RECEIVED (lab use only)		
Are samples taken from a Regulated DW System?					Frozen <input checked="" type="checkbox"/> Ice Packs <input checked="" type="checkbox"/> Ice Cubes <input checked="" type="checkbox"/> Custom seal intact <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>		
Are samples for human consumption/ use?					Cobling Initiated <input type="checkbox"/>		
Are samples for human consumption/ use?					INITIAL COOLER TEMPERATURES °C 0.9		
SHIPMENT RELEASE (client use)					FINAL SHIPMENT RECEPTION (lab use only)		
Shipped by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:
2018-07-22	2018-07-22	15:00	2018-07-22	15:00	2018-07-22	15:00	2018-07-22
INITIAL SHIPMENT RECEPTION (lab use only)					FINAL SHIPMENT RECEPTION (lab use only)		
WHITE - LABORATORY COPY					YELLOW - CLIENT COPY		



DS Consultants (Vaughan)
ATTN: Pradeep Patel
6221 Highway 7
Unit 16
Vaughan ON L4H 0K8

Date Received: 26-JUL-18
Report Date: 03-AUG-18 14:17 (MT)
Version: FINAL

Client Phone: 647-237-5110

Certificate of Analysis

Lab Work Order #: L2136473
Project P.O. #: NOT SUBMITTED
Job Reference: 18-577-30
C of C Numbers: 17-615381
Legal Site Desc:

Amanda Fazekas
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 5730 Coopers Avenue, Unit #26, Mississauga, ON L4Z 2E9 Canada | Phone: +1 905 507 6910 | Fax: +1 905 507 6927
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

03-AUG-18 14:17 (MT)

ANALYTICAL REPORT

Anions and Nutrients - WATER

Analyte	Unit	Guide Limits		Lab ID	L2136473-1	L2136473-2	L2136473-3	L2136473-4	L2136473-5
		#1	#2	Sample Date	26-JUL-18	26-JUL-18	26-JUL-18	26-JUL-18	26-JUL-18
				Sample ID	MW18-1	MW18-2	MW18-3	17381	10305
Nitrate and Nitrite as N	mg/L	10.0	-	12.3	12.5	12	<0.022	4.64	
Nitrate (as N)	mg/L	10	-	12.3	12.5	12.0	<0.020	4.64	
Nitrite (as N)	mg/L	1	-	<0.010	<0.010	<0.010	<0.010	<0.010	

Guide Limit #1: Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2018)

Guide Limit #2: Ontario DW Aesthetic and Operational Guidelines

 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.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
ETL-N2N3-WT	Water	Calculate from NO2 + NO3	APHA 4110 B
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.			

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

Chain of Custody Numbers:

17-615381

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.



Environmental

Quality Control Report

Workorder: L2136473

Report Date: 03-AUG-18

Page 1 of 2

Client: DS Consultants (Vaughan)
6221 Highway 7 Unit 16
Vaughan ON L4H 0K8

Contact: Pradeep Patel

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-WT		Water						
Batch	R4157969							
WG2839808-9	DUP	WG2839808-8						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	25	02-AUG-18
WG2839808-7	LCS							
Nitrite (as N)			102.8		%		70-130	02-AUG-18
WG2839808-6	MB							
Nitrite (as N)			<0.010		mg/L		0.01	02-AUG-18
WG2839808-10	MS	WG2839808-8						
Nitrite (as N)			94.7		%		70-130	02-AUG-18
NO3-IC-WT		Water						
Batch	R4157969							
WG2839808-9	DUP	WG2839808-8						
Nitrate (as N)		12.9	12.0		mg/L	7.4	25	02-AUG-18
WG2839808-7	LCS							
Nitrate (as N)			102.7		%		70-130	02-AUG-18
WG2839808-6	MB							
Nitrate (as N)			<0.020		mg/L		0.02	02-AUG-18
WG2839808-10	MS	WG2839808-8						
Nitrate (as N)			N/A	MS-B	%		-	02-AUG-18

Quality Control Report

Workorder: L2136473

Report Date: 03-AUG-18

Client: DS Consultants (Vaughan)
6221 Highway 7 Unit 16
Vaughan ON L4H 0K8

Contact: Pradeep Patel

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JULY 2017 FRONT

Certificate of Analysis

Client: DS Consultants Limited
6221 Highway 7
Vaughn, Ontario
L4H 0K8
Attention: Mr. Pradeep Patel
PO#:
Invoice to: DS Consultants Limited

Report Number: 1817591
Date Submitted: 2018-09-27
Date Reported: 2018-10-04
Project: 18-577-30
COC #: 198743

Page 1 of 3

Dear Pradeep Patel:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

Addrine
Thomas
2018.10.04
12:23:27
-04'00'

APPROVAL:

Addrine Thomas, Inorganics Supervisor

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Eurofins Ottawa is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on our CALA scope of accreditation. It can be found at <http://www.cala.ca/scopes/2602.pdf>.

Eurofins(Ottawa) is certified and accredited for specific parameters by OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils). Licensed by Ontario MOE for specific tests in drinking water.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required.

Certificate of Analysis

Client: DS Consultants Limited
6221 Highway 7
Vaughn, Ontario
L4H 0K8
Attention: Mr. Pradeep Patel
PO#:
Invoice to: DS Consultants Limited

Report Number: 1817591
Date Submitted: 2018-09-27
Date Reported: 2018-10-04
Project: 18-577-30
COC #: 198743

					Lab I.D.	1390097	1390098	1390099
					Sample Matrix	GW	GW	GW
					Sample Type			
					Sampling Date	2018-09-26	2018-09-26	2018-09-26
					Sample I.D.	MW 18-1	MW 18-2	MW 18-3
Group	Analyte	MRL	Units	Guideline				
Anions	N-NO2	0.10	mg/L	MAC 1.0	<0.10	<0.10	<0.10	
	N-NO3	0.10	mg/L	MAC 10.0	10.1*	14.5*	8.40	
General Chemistry	pH	1.00		6.5-8.5	7.94	7.97	7.94	
Nutrients	N-NH3 (unionized)	0.02	mg/L		<0.02	<0.02	<0.02	
	N-NH4	0.02	mg/L		<0.02	<0.02	0.03	
Subcontract-Inorg	N-NH3	0.02	mg/L		<0.02	<0.02	0.03	

Guideline = ODWSOG

* = Guideline Exceedence

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: DS Consultants Limited
6221 Highway 7
Vaughn, Ontario
L4H 0K8
Attention: Mr. Pradeep Patel
PO#:
Invoice to: DS Consultants Limited

Report Number: 1817591
Date Submitted: 2018-09-27
Date Reported: 2018-10-04
Project: 18-577-30
COC #: 198743

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 353715 Analysis/Extraction Date 2018-10-01 Analyst Z S Method C SM4500-NO3-F			
N-NO2	<0.10 mg/L	100	80-120
N-NO3	<0.10 mg/L	90	80-120
Run No 353762 Analysis/Extraction Date 2018-09-28 Analyst AET Method SM2320,2510,4500H/F			
pH		99	90-110
Run No 353911 Analysis/Extraction Date 2018-10-01 Analyst AET Method POINTECLAIRE			
N-NH3	<0.02 mg/L	98	
Run No 353960 Analysis/Extraction Date 2018-10-04 Analyst AET Method C SM4500-NH3D			
N-NH3 (unionized)			
Run No 353962 Analysis/Extraction Date 2018-10-04 Analyst AET Method C SM4500-NH3D			
N-NH4			

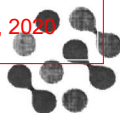
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May 04, 2020



eurofins

CHAIN OF CUSTODY

- ☐ 146 Colonnade Rd., Unit 8, Ottawa, ON K2E 7Y1 Ph: (613) 727-5692 Fax: (613) 727-5222
- ☐ 608 Norris Court, Kingston, ON K7P 2R9 Ph: (613) 634-9307 Fax: (613) 634-9308
- ☐ 380 Vansickle Rd., Unit 630, St. Catharines, ON L2S 0B5 Ph: (905) 680-8887 Fax: (905) 680-4256
- ☐ 2395 Speakman Drive, Mississauga, ON, L5K 1B3 Phone: (905) 822-4111 Fax : (905) 823-1446

198743

LABORATORY USE ONLY

Report #: 181759

Report Information*: Client: <u>DS Consultants</u> Contact: <u>Pradeep Patel</u> Address: <u>6221 Highway 7 unit 16</u> <u>Vaughan, ON</u> Email: <u>pradeep.patel@ds</u> Phone: <u>(416) 332-3812</u> Project: <u>consultants.ca</u> Invoice Information*: Invoice to the same as above? <input checked="" type="checkbox"/> Yes / No, or: Client: _____ Contact: _____ Address: _____ Email: _____ Phone: _____ Purchase Order #: _____ Quote #*: _____		Criteria Required*: <input checked="" type="checkbox"/> ODWSOG <input type="checkbox"/> Other, Specify: _____ <input type="checkbox"/> PWQO <input type="checkbox"/> Ont. Reg. 558 <input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer, City: _____ <input type="checkbox"/> Storm Sewer, City: _____ <input checked="" type="checkbox"/> Ont. Reg 153/04 Table # _____, Coarse/Fine, Surface/Subsurface Type: Com-Ind / Res-Park / Agri / GW / Other The sample results from this submission will form part of a formal Record of Site Condition (RSC) under O.Reg. 153/04 *: <div style="text-align: center;">YES / NO</div> Is this a drinking water sample? YES / <input checked="" type="checkbox"/> NO If yes, complete the drinking water COC		Additional Email/Fax: 1. Email: <u>pradeep.patel@dsconsultants.ca</u> 2. Email: _____ 3. Email: _____ Fax: _____ Report Format: <input type="checkbox"/> PDF <input checked="" type="checkbox"/> Excel <input type="checkbox"/> Other, Specify: _____ Turnaround Time (rush surcharges may apply)*: <input type="checkbox"/> 5 Business Days (Standard) <input type="checkbox"/> 3 Business Days (Rush) <input type="checkbox"/> 2 Business Days (Rush) <input type="checkbox"/> 1 Business Day (Rush) <input type="checkbox"/> Other (specify date): _____ Notes: _____	
---	--	--	--	--	--

* Indicates a required field

* Indicates a required field

Please note that incomplete information may result in turnaround time delays. Samples should be kept cool (4-10°C) from receipt to analysis.

Samples should be kept cool (4-10°C) from sampling time through drop-off at the laboratory.

[illegible]

Appendix E: Nitrate Loading Assessment

Nitrate Loading Assessment

Detail	Without Treatment	With Tertiary Treatment
Subdivision Area (A)	30.174 ha	30.174
Proposed number of lots (P)	22	22
Number of bedrooms	4/lot	4/lot
Sewage volume per bedroom	250 L/day	250 L/day
Sewage nitrate concentration (C)	40 mg/L	20 mg/L
Sewage loading (SL)	1000L/day/lot	1000L/day/lot
Nitrate loading (N)	40 gm/day/lot	20 gm/day/lot
Impervious Surface Area (S)	0.1263	0.1263
Infiltration (I)	0.25 m/year	0.25 m/year
Average On-site Background Nitrate Concentration (B)-max.	11.9	-
Off-site Background Nitrate Concentration (B)-max.	<0.2 - 4.64 mg/L	-
Ontario Drinking Water Standard (O)	10 mg/L	-

On-site Nitrate Calculations- Without Treatment

Property Recharge (R)

$$R = A * (1 - S) * I$$

$$= 31 * 10,000 \text{ m}^2 * (1 - 0.1263) * 0.25 \text{ m/year} = 180.55 \text{ m}^3/\text{day}$$

Nitrate Loading (L)

$$L = N * P$$

$$= 40 \text{ gm/day} * 22 \text{ mg/day} = 880 \text{ gm/day}$$

Resulting Downgradient Nitrate Concentration (RNC)

$$RNC = L / H$$

$$= (840 \text{ gm/day}) / (191 \text{ m}^3/\text{day}) = 4.87 \text{ mg/L}$$

On-site Nitrate Calculations- With Treatment

Property Recharge (R)

$$R = A * (1 - S) * I$$

$$= 31 * 10,000 \text{ m}^2 * (1 - 0.1) * 0.25 \text{ m/year} = 180.55 \text{ m}^3/\text{day}$$

Nitrate Loading (L)

$$L = N * P$$

$$= 20 \text{ gm/day} * 22 \text{ mg/day} = 440 \text{ gm/day}$$

Resulting Downgradient Nitrate Concentration (RNC)

$$RNC = L / H$$

$$= (420 \text{ gm/day}) / (191 \text{ m}^3/\text{day}) = 2.44 \text{ mg/L}$$