Hydrogeological Study Report

Osaca Hillstreet Subdivision

County Road 65, Osaca, Ontario

D.M. Wills Project Number 22-11056

D.M. Wills Associates Limited
Partners in Engineering, Planning and Environmental Services
Peterborough

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Prepared for:
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WILLS

Submissions Summary

Submission No.	Submission Title	Date of Release	Submissions Summary
1	Draft Hydrogeological Study Report	December 6, 2022	Draft Submission for Client Review
2	Final Hydrogeological Study Report	December 7, 2022	Final Submission to Client
3	Draft Revised Final Hydrogeological Study Report	April 2, 2024	Draft Submission for Client Review

This report has been formatted considering the requirements of the Accessibility for Ontarians with Disabilities Act.

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1.0 Introduction

D.M. Wills Associates Limited (Wills) was retained by Hillstreet Developments Ltd. c/o Larry MacDonell (Client) to complete a Hydrogeological Study (Study) for the property located at Pt Lot 27 Concession 5, in the village of Osaca, Ontario (Subject Property). Wills understands the Subject Property is approximately 24.6 hectares (ha) and is proposed to be developed as a residential subdivision with 40 individual lots (Proposed Development). The location of the Subject Property is shown on **Figure 1**.

The Study was requested by the Municipality of Port Hope (Pre-Consultation – Planning Review dated May 25, 2022) to confirm sewage servicing capabilities in context of the Proposed Development, and to confirm that adequate water supply is available. Furthermore, infiltration rates of the subsurface soils and shallow groundwater conditions were evaluated as input to the design of proposed stormwater management features and sewage disposal systems on the Subject Property.

Wills' Study was conducted on the basis of:

- the Ministry of Environment Conservation and Parks (MECP) Guidelines D-5-4 Individual On-site Sewage Systems: Water Quality Impact Risk Assessment (Guideline D-5-4) and D-5-5 Private Wells: Water Supply Assessment (Guideline D-5-5).
- Preliminary Draft Plan prepared by D.G. Biddle & Associates Limited, dated October 15, 2023, included in **Appendix A-1**.
- Preliminary Draft Plan prepared by D.G. Biddle & Associates Limited, dated February 21st, 2024, included in **Appendix A-2**.

The Proposed Development is presented on the Preliminary Draft Plan dated February 21st, 2024, and included in **Appendix A-2**.

2.0 Scope of Work

Wills' approved Scope of Work to complete the Study included the following:

- A review of available Ministry of Environment, Conservation, and Parks (MECP) well records within 500 meters (m) of the Subject Property to provide a preliminary characterization of the local hydrogeological conditions.
- Prior to initiating field investigations, public and private utility services locates were obtained and reviewed by Wills staff. A Site-Specific Health and Safety Plan and Field Work plan were prepared to ensure a safe and efficient fieldwork program.
- Steenburgh Sand and Gravel (Steenburgh) excavated 12 test pits on the Subject Property to a depth of 3.0 metres below ground (mbg) between September 23 and September 26, 2022.
- Five drive-point monitor wells were installed in the base of select test pits to monitor groundwater levels above a depth of 3 mbg.

- Eight single ring infiltrometers were installed on the Subject Property to determine representative infiltration rates for stormwater management and sewage disposal system design between September 26 and September 27, 2022.
- Retained soils samples were reviewed by Wills prior to submitting select samples to PRI Engineering (PRI), a Canadian Certified Independent Laboratory (CCIL) for analysis of Particle Size Distribution and percolation time estimation.
- Static groundwater level measurements were recorded on December 5, 2023 in three monitor wells installed by Cambium in 2022 and identified BH101-22, BH-107-22 and BH110-22. Groundwater was found at depths ranging from 2.83 to 2.99 mbg.
- Six groundwater samples were collected and analyzed by SGS to determine background nitrate concentrations:
    - from wells MW22-08, BH107-22 and BH110-22 on October 5th, 2022.
    - from wells BH101-22, BH107-22 and BH110-22 on December 5, 2023.
- Herb Lang Well Drilling Ltd. (HLWD) conducted a 6-hour duration pumping test on three newly installed Ontario Regulation (O. Reg.) 903 Water Supply Wells on the Subject Property on October 31, November 2nd, and November 8th, 2023 respectively.
    - these three wells are referred to individually as "A377795", "A377796" and "A377799". The pumping tests were conducted to determine production yield, maximum pumping rate, well recovery, groundwater quality, the potential for interference with existing neighbouring groundwater taking activities as well as future pumping activities on-site.
- Wills contracted the services of David Ruttan, B.A.Sc., P. Eng., to conduct an evaluation of pumping test data with regards to groundwater availability and potential for interference between pumping activities both on-site and on neighbouring properties through hydrogeological modelling.
- Two groundwater samples were collected from each of the three O. Reg. 903 Water Supply Wells during the pumping tests (at the 1-hour and 6-hour pumping test intervals) and submitted to SGS Canada Inc. (SGS) for analysis of select physical, chemical, and biological parameters for comparison to the Ontario Drinking Water Quality Standards (ODWQS).
- While pumping in one O.Reg. 903 Water Supply Well, real-time data logging technology (Solinst Level Loggers) was employed to record the drawdown and groundwater level fluctuations as well as the response to pumping in the other newly installed O.Reg. 903 Water Supply Wells. The three wells are located approximately 93 m to 150 m away from one another.
- Additionally, groundwater level fluctuations were monitored using a Solinst water level tape in the existing dug well on the neighboring property located 5868 County Road 65, Porpt Hope, ON L1A 3V5. This well is located approximately 208 m, 210 m and 272 m away from wells A377795, A377796 and A377799 respectively.

- Assessment of the Subject Property's capacity to support private on-site sewage disposal systems (Groundwater Impact Assessment) was conducted based on the Preliminary Draft Plan configuration and MECP *Guideline D-5-4 Individual On-site Sewage Systems: Water Quality Impact Risk Assessment (Guideline D-5-4)*.
- Evaluation of Wills' desktop review and field investigations findings, and preparation of this Hydrogeological Study Report.

Boreholes, monitor wells, water supply wells, test pits, and infiltration test locations are shown on **Figure 2**.

3.0 Subsurface Investigation

Test pit and infiltration test locations completed between September 23 and September 27 are shown on **Figure 2**.

Representative soil samples were submitted to PRI for analysis of Particle Size Distribution and percolation time estimation. Laboratory testing results were compared to the Ministry of Municipal Affairs and Housing, Building and Development Branch (MMAH) Supplementary Standard SB-6 – Percolation Time and Soil Descriptions Table 2 & Table 3 values (Ontario Building Code [OBC], 2012) (OBC Table 2 & OBC Table 3). Percolation times are discussed in **Section 4.0**.

Test pit logs detailing the encountered subsurface conditions are included in **Appendix B**. Boreholes advanced for the purpose of installing infiltrometers were completed using an excavator-mounted auger, and were positioned adjacent to existing test pits where possible as a means of confirming the underlying soils. These boreholes were not logged or sampled.

3.1 Soil Profile Summary

The Subject Property is located in the Physiographic Region of the Iroquois Plain (*The Physiography of Southern Ontario, Chapman and Putnam, 1984*), which is characterized by lacustrine deposits including sand plains and beaches associated the former Lake Iroquois. Ontario Geological Survey (OGS) mapping suggests that surficial geology on the Subject Property consists of alluvial deposits.

The results of the test pit program indicate the overburden is generally aligned with published mapping and includes a surficial layer of silty sand topsoil underlain by sand with slight variations in gravel, silt, and clay content. A generally north-south trending band of silt and clay rich soils was observed on the western side of the Subject Property at TP22-10, TP22-08, and TP22-11. This material was encountered at a depth ranging from approximately 1.3 to 1.7 mbg and extended to the test pit termination depths of approximately 3.0 mbg.

Seven laboratory particle size distribution analyses were completed on the collected soil samples. The analytical results are summarized in **Table 1** on the basis of the Unified Soil Classification System (USCS). Certificates of Analysis for the physical soil analysis are included in **Appendix C**.

Table 1– Summary of Particle Size Distribution

Test Pit ID	Sample No.	Sample Depth (mbg)	Soil Unit	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
TP22-01	GS-01	1.4	Sand	3	93	3	1
TP22-02	GS-02	2.9	Sand	3	94	3	0
TP22-03	GS-03	1.0	Sand	0	97	3	0
TP22-05	GS-01	1.7	Sand	2	78	18	2
TP22-08	GS-02	2.0	Silt & Clay	0	4	56	40
TP22-10	GS-02	1.9	Silt & Clay	0	3	62	35
TP22-11	GS-02	2.7	Silt & Clay	0	4	71	25

3.2 Bedrock

Bedrock was not encountered at any of the test pit locations, and a review of nearby MECP well records suggests that bedrock is in excess of 34 mbg in the vicinity of the Subject Property. OGS classifies the underlying bedrock geology to be from the Ottawa and Simcoe group, and may include dolostone, shale, arkose, and sandstone. Nearby MECP well records suggest the underlying bedrock consists of limestone material.

3.3 Groundwater

3.3.1 Groundwater Static Level

Groundwater level monitoring was conducted at the five-drive point monitor well locations, as well as three on-site monitor wells installed by Cambium Inc. and detailed in their November 2022 report titled *Geotechnical Investigation – Proposed Residential Development, 5868 County Road 65, Port Hope, ON* (Geotechnical Report). **Figure 2** shows the locations of the monitor wells included in Wills' Study. **Table 2** summarizes the static water levels measured on the Subject Property by Wills. Groundwater elevations for select monitor wells were inferred using the relative elevations provided in the Geotechnical Report and are referenced to a local (assumed) benchmark.

Table 2– Groundwater Level Summary

Monitor Well ID	Stick-Up (mag)	Date	Static Water Level (mbg)	Groundwater Elevation (masl)
MW22-01	0.73	September 27, 2022	2.71	-
		October 5, 2022	Damaged	-

Monitor Well ID	Stick-Up (mag)	Date	Static Water Level (mbg)	Groundwater Elevation (masl)
MW22-02	0.56	September 27, 2022	Dry	-
		October 5, 2022	Dry	-
MW22-05	0.50	September 27, 2022	2.53	-
		October 5, 2022	2.58	-
MW22-08	0.48	September 27, 2022	2.59	-
		October 5, 2022	2.63	-
MW22-11	0.73	September 27, 2022	2.30	-
		October 5, 2022	2.34	-
BH101-22 (proximal to MW22-01)	0.88	September 27, 2022	-	--
		October 5, 2022	2.66	197.24
		December 5, 2023	2.83	197.07
BH107-22 (proximal to MW22-11)	1.06	September 27, 2022	-	-
		October 5, 2022	2.54	197.86
		December 5, 2023	2.85	197.55
BH110-22 (proximal to MW22-05)	0.92	September 27, 2022	-	-
		October 5, 2022	2.58	196.12
		December 5, 2023	2.99	195.71

*mbg – metres below ground masl – metres above sea level, measured against an assumed datum (local benchmark)

Another round of groundwater level measurements in the three on-site monitor wells installed by Cambium Inc is scheduled for the spring 2024.

3.3.2 Groundwater Flow Direction and Hydraulic Gradients

Shallow groundwater flow direction was calculated using Wills' field measurements and monitor well elevations provided in the Geotechnical Report. Based on this information, Wills infers the shallow groundwater flows direction to be to the southeast on the Subject Property.

The steepest hydraulic gradient was calculated between BH107-22 and BH110-22 at 0.0043 and 0.0046 on October 5, 2022 and December 5, 2023 respectively.

Shallower hydraulic gradients between BH101-22 to BH110-22 and from BH107-22 to BH101-22 were calculated to be:

- 0.0019 and 0.0016 respectively, on October 5, 2022.
- 0.0024 and 0.0012 respectively, on December 5, 2023.

The inferred groundwater flow direction is shown in **Figure 2**.

4.0 In-Situ Infiltration Testing

In-situ Infiltration tests were conducted at select locations on the Subject Property to determine representative shallow infiltration rates for stormwater management and sewage disposal system design. Infiltration testing locations are shown on **Figure 2**.

The tests were conducted at depths ranging from 0.6 to 2.1 mbg and were completed using 51-millimetre open-end single ring infiltrometers. Water levels within the infiltrometer casings were manually monitored using a Solinst water level tape. The infiltration tests were conducted for a maximum of 96 minutes, with water levels measured at 30-second intervals for the first 5-minutes and increasing intervals as the test progressed. Detailed calculations and supporting infiltration graphs are provided in **Appendix D.**

4.1 Permeability and Percolation Time

Table 3 summarizes the permeability and percolation times of the tested soils on the basis of the in-situ testing, and laboratory results compared to OBC Table 2 & Table 3.

Table 3– Permeability and Percolation Time Summary

ID	Sample ID	In-situ Testing	Physical Soil Testing Results	Percolation Range (OBC Table 2 and 3)	Laboratory Estimated Percolation (T)	Permeability (Inferred Soil Envelope)
TP22-01 Proxy for INF-01	GS-01	T= 0.42 min/cm or 1429 mm/hr	SP envelope	T = 2 – 8 min/cm or 75 – 300 mm/hr	T = 6 min/cm	Medium
TP22-02 Proxy for INF-02	GS-02	T= 0.49 min/cm or 1224 mm/hr	SP envelope	T = 2 – 8 min/cm or 75 – 300 mm/hr	T = 7 min/cm	Medium
TP22-03 Proxy for INF-03	GS-01	T=0.35 min/cm or 1714 mm/hr	SP envelope	T = 2 – 8 min/cm or 75 – 300 mm/hr	T = 6 min/cm	Medium
TP22-05 Proxy for INF-05	GS-01	T=0.22 min/cm or 2727 mm/hr	SM envelope	T = 8 – 20 min/cm or 30 – 75 mm/hr	T = 12 min/cm	Medium to Low
INF-06	N/A	T=0.78 min/cm or 769 mm/hr	SM envelope	T = 8 – 20 min/cm or 30 – 75 mm/hr	N/A	Medium to Low
INF-07	N/A	T=0.33 min/cm or 1818 mm/hr	SP envelope	T = 2 – 8 min/cm or 75 – 300 mm/hr	N/A	Medium
INF-08A	N/A	T=1.11 min/cm or 540 mm/hr	SP envelope	T = 2 – 8 min/cm or 75 – 300 mm/hr	N/A	Medium
TP22-08 Proxy for INF-08B	GS-02	T= 0 min/cm or 0 mm/hr	OH envelope	T = > 50 min/cm or >50 mm/hr	T = > 50 min/cm	Unacceptable
INF-11	N/A	T= 0.81 min/cm or 740 mm/hr	SM envelope	T = 8 – 20 min/cm or 30 – 75 mm/hr	N/A	Medium to Low

Notes: 1. SM envelope –silty sands, sand-silt mixtures
SP envelope – poorly graded sands, gravelly sand, little or no fines
OH envelope – Organic clays of medium to high plasticity, organic silts

Wills provides the following considerations as they related for the proposed stormwater management and sewage disposal system designs:

- The encountered soils are anticipated to generally fall within the SP and SM soils envelopes. Sewage disposal system and stormwater management feature design should take into account the silt and clay rich soils identified at TP22-08, TP22-10, and TP22-11 that were encountered between 1.3 to 3.0 mbg. Based on INF-08B, these soils do not have an acceptable permeability on the basis of the OBC.
- A Subsurface Infiltration Plan showing the inferred contact between these two distinct shallow soil units is included as **Figure 3**. Subsurface stratigraphy was inferred from the findings of Wills' test pit program and considers soil properties above a depth of 3.0 mbg.
- Within the sand to silty sand areas identified in red in **Figure 3**, Wills recommends using the mid point of the T-time ranges provided in the OBC for stormwater management and sewage disposal system design on the Subject Property. Although these T-time values (mid range) are slower than that measured in the in-situ tests, Wills considers these conservative for the purpose of design, and should account for any lateral or vertical variation in infiltration rates.
- Within the clayey silt to silt and clay area identified in green in **Figure 3**, Wills recommends that raised tile beds be used for septic systems installed in this area, and minimum setback distances be re-evaluated.

5.0 Groundwater Availability

Wills' preliminary water supply assessment included a review of nearby MECP Well Records and historic hydraulic testing on the neighboring property to the south. Additionally, on-site testing was completed by Wills in three newly installed water supply wells in October and November 2023, to confirm that adequate groundwater supply and quality is available to the Proposed Development.

5.1 MECP Water Well Record Survey

Wills completed a database review and desktop evaluation of MECP Well Records to assist in characterizing the local hydrogeological conditions within 500 m of the Subject Property. The MECP Well Location Plan showing the relative locations of the MECP wells and their respective identifiers is included as **APP- E1** in **Appendix E**. Details for each MECP Well are summarized as **APP-E2** in **Appendix E**.

Nine well records were identified within the 500 m search radius and are summarized below.

- Seven wells were designated as domestic use and two of the wells had an unknown use.
    - One of the unknown uses had incomplete details on the well record, and the other was in relation to a clean-out of sand and gravel from the well bore.

- Five wells were installed in overburden material and four wells were installed in bedrock.
- Well depths ranged from approximately 7.6 to 46 mbg for the wells installed in overburden (25.5 mbg average), and from 34.1 to 44.8 mbg for those installed in bedrock (40.9 mbg average).
- Static water levels ranged from approximately 5.5 to 9.1 mbg for the wells that were installed in overburden (6.9 mbg average), and from 8.5 to 29 mbg for those installed in bedrock (18.3 mbg average).
- The recommended pumping rates ranged from approximately 7.6 to 30.2 litres per minute (L/min) for the overburden wells (19.9 L/min average), and from 3.8 to 37.8 L/min for the bedrock wells (20.2 L/min average).

Based on Wills review, a viable aquifer is present on lands adjacent to the Subject Property. Several wells directly north of the Subject Property and directly west of the 500 m buffer (within the community of Osaca), are dug wells that are screened within a shallow sand layer. These wells are less useful for inferring available water supply as they are non-compliant with Ontario Regulation 903 with respect to the depth of construction.

The most useful information can be inferred from wells to the south and southeast of the Subject Property, which all intercept a productive aquifer directly above, or within the bedrock stratum. Overburden wells in this area are generally screened within a coarse sand and gravel layer, and have recommended pumping rates between approximately 15 and 30 L/min. Adjacent bedrock wells are noted as supplying fresh groundwater with recommended pumps rates that range from approximately 19 to 38 L/min. Based on the short-term pumping test results provided on the Well Records, all of these Wells satisfy the minimum yield requirement of 13.7 L/min (four bedroom dwelling) provided in the MECP *Guideline D-5-5 Private Wells: Water Supply Assessment* (*Guideline D-5-5*).

Based on the proximity of these wells to the Subject Property, it is likely that the hydrogeological/aquifer conditions extend north below the Subject Property, provided that the underlying bedrock structure and overburden deposits are similar in nature.

5.2 Historic Groundwater Supply Evaluation

Three of the water wells included in Wills' MECP records search were subject to long-term pumping tests and detailed in the report titled *Groundwater Supply Assessment Report – Hope Concession 5, Part Lot 27 County Road No. 65*, prepared by Ted Rannie M.Sc., P. Geo in September 2018 (2018 Report). This report was prepared to support the development of a 20-lot subdivision on lands directly south of the Subject Property. The wells included in this assessment were MECP Well ID 7314568 (overburden), 7314570 (bedrock), and 7314569 (overburden).

The 2018 Report concluded the following:

- The wells screened in overburden (coarse gravel layers) were confirmed to have high K (hydraulic conductivity) values ($2x10^{-2}$ m/s to $8x10^{-1}$ m/s), quickly stabilizing

drawdowns, and impressive recovery characteristics (94 – 95% recovery in 75 min and 60 min).

- The well screened in bedrock had a K value 3 orders of magnitude less than the overburden wells ($2x10^{-5}$ m/s), however, also showed impressive recovery (88% recovery in 60 min).
- Groundwater testing results indicated relatively good overall chemical quality, which would require commercial water treatment for several aesthetic parameters.
- Off-site impacts to neighboring water users or surface water resources were not expected in view of the large available drawdown in the tested wells.
- Adequate groundwater supply was inferred for the 20-lot development on the basis of the long duration pumping test results at the three well locations.
- The permeable overburden gravel layers were determined to have the best potential for groundwater source on the property considered.

The results of the 2018 Report speak favorably to the prospect of adequate water supply and quality on the Subject Property. To confirm Wills' preliminary findings, on-site testing was completed by Wills in three newly installed water supply wells in October and November 2023, as presented in the following Section.

5.3 Pumping test

Herb Lang Well Drilling Ltd. (HLWD) installed 3 new O.Reg. 903 water supply wells (MECP Well ID A377795, A377796 and A377799) on the Subject Property on October 17, October 12 and October 6, 2023, respectively. The location of these wells is shown on **Figure 2** and the corresponding MECP Well Records are included in **Appendix F**.

A 6-hour pumping test was conducted in each of the three wells on October 31 (A377795), November 2 (A377796) and November 8 (A377799), 2023. The pumping tests were conducted to confirm the performance of the wells over sustained pumping activity, evaluate the cumulative effect of future on-site pumping activities on groundwater availability, evaluate the potential for interference with onsite and neighboring groundwater taking activities, and to enable the collection of groundwater samples for quality analysis.

During each pumping test, drawdown and groundwater level fluctuations were monitored using:

- Solinst Level Loggers and confirmatory manual measurements in the newly installed water supply wells (A377795, A377796 and A377799)

- Manual measurements using a Solinst water level tape in the existing dug well on the neighbor's property located 5868 County Road 65, Porpt Hope, ON L1A 3V5, shown on **Figure 2**. It is noted that measurements in the neighbor's well were completed through a hole in the concrete casing accessible from the surface and located 0.13 m above ground. Due to lack of better access to the well and

interaction with the pumping equipment present in the well, the well depth could not be properly measured.

5.3.1 A377795 Well Test

Following installation of the level loggers, pumping started at an initial rate of 18.9 L/min (i.e. 5 GPM US). The pumping rate was increased to 37.8 L/min (i.e. 10 GPM US) after 7 minutes of pumping, then to 45.4 L/min (i.e. 12 GPM US) after 14 minutes and was maintained at that rate until completion of the 6-hour long test.

Well details, including static water levels measured prior to the initiation of the pumping test, are summarized in **Table 4**.

Table 4– A377795 Well Pumping Test Details

			Date:	**Oct. 31,2023**
Well ID	**Well Depth (mbtop)**	**Well Depth (mbg)**	**Stick up**	**Static Water Level (mbg)**
Pumping Well				
A377795	11.70	11.19	0.51 mag	3.40
Observation Well				
A377796	12.24	11.64	0.60 mag	3.03
A377799	10.32	9.71	0.61 mag	3.08
Neighbor's well	unknown	unknown	0.13	4.58

mbtop – metres below top of pipe, **mbg** – metres below ground, **mag** – metres above ground

Hydrographs for the Pumping Well and Observation Wells are included in **Appendix G.**

Pumping test details are summarized in **Table 5** below.

Table 5– Pumping Test Summary Well A377795

	Pumping Rate (L/min)	**Time (minutes)**	**Max Drawdown (m)**	**Stabilization Depth (mbg)**	**Cumulated Volume (L)**
Step Test	18.9	7	1.07	4.47	132.3
	37.8	7	1.82	5.22	396.9
Constant Rate	45.4	346	2.33	5.73	16,105.3
Recovery Time			**% Recovery**		
3.5 minutes			90%		

The following observations are provided with regards to the A377795 well pumping test results:

- The pumping rate applied for the majority of the test (346 minutes) represents more than 3 times the peak demand rate considered in MECP Guideline D-5-5 for a residential lot (15 L/min).
- Water levels monitored at Observation Wells A377796 and A377799 showed limited response to the pumping activity, dropping approximately 0.02 m and 0.03 m respectively.
- Water levels monitored at the neighbor's dug well showed limited fluctuations with a maximum measured drawdown of 0.10 m. These limited fluctuations are attributed to the use of the well by its owners during the test.
- 90% recovery was observed in the pumping well within 4 minutes of stopping the pump.

5.3.2 A377796 Well Test

Following installation of the level loggers, pumping started at an initial rate of 18.9 L/min (i.e. 5 GPM US). The pumping rate was increased to 45.4 L/min (i.e. 12 GPM US) after 14 minutes of pumping then decreased to 37.8 L/min (i.e. 10 GPM US) after 16 minutes and was maintained at that rate until completion of the 6-hour long test.

Well details, including static water levels measured prior to the initiation of the pumping test, are summarized in **Table 6**.

Table 6– A377796 Well Pumping Test Details

			Date:	**Nov. 2, 2023**
Well ID	**Well Depth (mbtop)**	**Well Depth (mbg)**	**Stick up**	**Static Water Level (mbg)**
Pumping Well				
A377796	12.24	11.64	0.60 mag	3.04
Observation Well				
A377795	11.70	11.19	0.51 mag	3.26
A377799	10.32	9.71	0.61 mag	3.09
Neighbor's well	unknown	unknown	0.13	4.64

Hydrographs for the Pumping Well and Observation Wells are included in **Appendix G.**

Pumping test details are summarized in **Table 7**.

Table 7– Pumping Test Summary Well A377796

	Pumping Rate (L/min)	Time (minutes)	Max Drawdown (m)	Stabilization Depth (mbg)	Cumulated Volume (L)
Step Test	18.9	14	2.14	5.18	264.6
	45.4	2	4.36	7.40	355.4
Constant Rate	37.8	344	4.17	7.21	13,358.6
Recovery Time			**% Recovery**		
6 minutes			90%		

The following observations are provided with regards to the A377796 well pumping test results:

- The pumping rate applied for the majority of the test (344 minutes) represents more than 2.5 times the peak demand rate considered in MECP Guideline D-5-5 for a residential lot (15 L/min).
- Water levels monitored at Observation Wells A377795 and A377799 showed limited response to the pumping activity, dropping approximately 0.01 m and 0.02 m respectively.
- Water levels monitored at the neighbor's dug well showed limited fluctuations with a maximum measured drawdown of 0.02 m. These limited fluctuations are attributed to the use of the well by its owners during the test.
- 90% recovery was observed in the pumping well within 6 minutes of stopping the pump.

5.3.3 A377799 Well Test

Following installation of the level loggers, pumping started at an initial rate of 18.9 L/min (i.e. 5 GPM US). The pumping rate was increased to 37.8 L/min (i.e. 10 GPM US) after 4 minutes of pumping, then to 45.4 L/min (i.e. 12 GPM US) after 12 minutes and was maintained at that rate until completion of the 6-hour long test.

Well details, including static water levels measured prior to the initiation of the pumping test, are summarized in **Table 8**.

Table 8– A377799 Well Pumping Test Details

				Date: Nov. 8, 2023
Well ID	**Well Depth (mbtop)**	**Well Depth (mbg)**	**Stick up**	**Static Water Level (mbg)**
Pumping Well				
A377799	10.32	9.71	0.61 mag	3.19
Observation Well				
A377795	11.70	11.19	0.51 mag	3.29
A377796	12.24	11.64	0.60 mag	3.08
Neighbor's well	unknown	unknown	0.13	5.21

Hydrographs for the Pumping Well and Observation Wells are included in **Appendix G.**

Pumping test details are summarized in **Table 9**.

Table 9– Pumping Test Summary Well A377799

	Pumping Rate (L/min)	**Time (minutes)**	**Max Drawdown (m)**	**Stabilization Depth (mbg)**	**Cumulated Volume (L)**
Step Test	18.9	4	0.88	3.89	75.6
	37.8	8	1.62	4.81	378
Constant Rate	45.4	348	2.06	5.25	16.177.2
Recovery Time			**% Recovery**		
3 minutes			90%		

The following observations are provided with regards to the A377799 well pumping test results:

- The pumping rate applied for the majority of the test (348 minutes) represents more than 3 times the peak demand rate considered in MECP Guideline D-5-5 for a residential lot (15 L/min).
- Water levels monitored at Observation Wells A377795 and A377796 showed limited response to the pumping activity, dropping approximately 0.03 m and 0.04 m respectively.
- Water levels monitored at the neighbor's dug well showed limited fluctuations with a maximum amplitude of 0.08 m. The lowest groundwater level was measured before pumping started. These limited fluctuations are attributed to the use of the well by its owners during the test.

- 90% recovery was observed in the pumping well within 3 minutes of stopping the pump.

5.3.4 Anticipated Water Taking Needs

The Proposed Development includes 40 residential lots, as shown on the Post-Development Storm Drainage Plan provided by the Client and included in **Appendix A**.

Based on Guideline D-5-5, the drinking water requirement for a residential lot is 1,8 cubic meter per day (m^3/d).

Based on the Peterborough Utilities Commission's Water Subdivision and Development Requirements revised in May 2022, Wills considers in this Study a peak hour factor of 3 for the purpose of evaluating water availability. This corresponds to a daily water demand of 5,4 m^3/d.

During the 6-hour long pumping tests, volumes ranging from 13,358 to 16,177 L were pumped from the wells, with limited drawdowns observed in the pumping wells. These volumes correspond to 7 to 9 times the daily water requirement for a residential lot. These results suggest that one individual well installed in the same aquifer as the three wells tested is more than capable to meet the daily water taking needs of a residential lot, including during peak hour.

However, in order to evaluate the capacity of the aquifer to meet the water taking needs of the 40 residential lots included in the Proposed Development, and the potential for interference between pumping activities both on-site and on neighbouring properties, Wills contracted the services of David Ruttan, P.Eng.

The following section presents D. Ruttan's evaluation and conclusions with regards to the above.

5.3.5 Hydrogeological modelling

It is noted that D. Ruttan's assessment was conducted based on the Preliminary Draft Plan prepared in October 2023, which included 48 residential lots. However, the revised plan prepared in March 2024 includes only 40 residential lots. Therefore, D. Ruttan's assessment with respect to water availability for the development and potential impact on neighbouring pumping activities is deemed conservative.

In order to determine if sufficient water is available for each of the residential lots, three wells were drilled, and pumping tests were carried out to determine aquifer parameters. The water table is relatively shallow (approximately 3 mbg) and the surficial material encountered in the newly installed water supply wells was mainly loose sand. There are some scattered clay lenses as evidenced by a 2.13 m thick 'clay and stones' layer, probably a till, in borehole A377799.

During drilling groundwater was reportedly found ranging from 10.06 to 11.58 mbg. Screens were emplaced ranging from 8.84 to 10.06 mbg in well A377799, 10.36 to 11.58 mbg in well A377796, and 9.75 to 11.20 mbg in well A377795. Groundwater rose in the well casings to between 3.30 and 3.40 mbg, indicating a relatively flat piezometric

surface. The static level being approximately 8 m higher than where water was encountered indicates a confined aquifer.

Drawdown data was analyzed to determine the aquifer parameters transmissivity "T", and Stativity "S". Pumping rates for the three tests ranged from 54.5 to 65.4 m^3/day.

Maximum drawdowns observed during the pumping tests are summarized in **Table 10**.

Table 10– Maximum drawdowns observed during the pumping tests

Well	Oct. 31, 2023 PW = A377795	Nov. 2, 2023 PW = A377796	Nov. 8, 2023 PW = A377799
A377795	2.33 m	0.007 m	0.034 m
A377796	0.025 m	4.17 m	0.040 m
A377799	0.034 m	0.018 m	2.06 m

PW: Pumping well

These drawdowns are minimal and indicate a limited cone of influence, even at relatively elevated pumping rates.

Distances between the wells are shown in **Table 11**.

Table 11– Distances between wells included in the pumping tests

Well	Distance from A377795	Distance from A377796	Distance from A377799
A377795	-	93.2 m	150.3 m
A377796	93.2 m	-	122 m
A377799	150.3 m	122 m	-

Aquifer parameters were derived from curve matching using the Theis method for confined aquifers. The derived parameters are shown in **Table 12**.

Table 12– Derived aquifer parameters

Well	Pumping Rate (m^3/d)	Transmissivity (T) (m^2/d)	Storativity (S) [1]	Maximum drawdown (m)	Test length (min)	Saturated Thickness (m)	Hydraulic Conductivity (K) (m/d)
October 31, 2023 Test - PW = A377795							
A377795	65.41	118.5	3.5E-05	2.33	360	8.62	13.7
A377796		117.3	6.90E-03	0.025	360		13.6
A377799		121.6	2.73E-03	0.034	360		14.1
November 2, 2023 Test - PW = A377796							
A377796	54.5	64.5	1.20E-04	4.172	360	8.62	7.5
A377799		55.8	3.70E-03	0.018	360		6.8
A377795				0.007	360		
November 8, 2023 Test - PW = A377799							
A377799	65.4	149.4	1.30E-04	2.058	360	8.62	17.3
A377795		131.0	9.20E-04	0.034	360		15.2
A377796		122.9	1.20E-03	0.040	360		14.3
Geometric means							
Geometric mean		100.0	6.91E-04				12.2

A relatively simple computer three-dimensional groundwater model was constructed based on the results of subsurface investigations and aquifer testing. Two layers were input spanning the depth from surface to the bottom of the deepest well (i.e. 11.6 m). A 1:10,000 topographic map was used as the basis of the model so that hydraulic boundaries (rivers, swamps) at their respective elevations could be incorporated into the model.

Aquifer parameters were input into the model in layers 1 and 2. Hydraulic conductivity was derived from the geometric mean of transmissivity (i.e.100.0 m^2/day) divided by the saturated thickness from the static water level to the bottom of the deepest well (i.e. 8.62 m). Storativity used in the model was the geometric mean of all storativity values derived from the pumping tests (i.e. $6.91x10^{-4}$). Specific yield was set at 0.25 which is characteristic of the surficial material encountered. Recharge was estimated at 200 mm/yr.

Initially a steady-state model was set up and calibrated to the static water level of wells A377795, A377796 and A377799 in terms of elevations, approximately 157-158 m asl. This model was then converted to a transient (time-based) model with two stress periods (pumping periods). The first period was to run the model for a sufficient time to obtain groundwater elevations similar to the steady-state model. The second stress period was for 0.25 days, the length of the three pumping tests. Each pumping test was simulated in the model and parameters adjusted until a reasonable match of simulated versus observed drawdown was obtain. These drawdowns are shown in **Table 13**.

After many model runs, the simulated pumping test on A377799 on November 8, 2023 was judged as most representative and conservative of aquifer performance.

Table 13– Simulated and observed drawdowns

Well	Simulated Static Water Level (masl)	Simulated pumping level (masl)	Simulated drawdown (m)	Peaceman Corrected drawdown (m)	Observed Drawdown (m)
A377799 PW	157.47	155.44	2.03	3.94	4.17
A377796 OBS	158.12	158.12	0		0.04
A377795 OBS	157.01	157.01	0		0.034

PW: Pumping well; OBS: Observation Welle

The Peaceman correction translates the simulated drawdown in the model cell to the simulated drawdown in the pumping well. The model predictions of simulated drawdowns are considered excellent compared to the observed drawdowns. The hydraulic conductivity used to obtain these results was 3.0 m/day, slightly lower and more conservative than derived from the pumping tests.

This model was converted back to a steady-state model and 48 wells were inserted in it to evaluate the impact of the Proposed Development. The location of the 48 wells used in the simulation are shown in **Figure 4**. The model was run with a well yield of 1.8 m^3/day for each domestic well, which corresponds to the anticipated average daily water taking need for a residential lot. The model was again run with a yield of 5.4 m^3/day for each proposed domestic well, which corresponds to the water taking need

at peak hour. The simulated drawdowns are shown on **Figures 5** and **Figure 6** respectively.

The cumulative drawdown of all domestic wells pumping at 1.8 m^3/day each is approximately 0.4 m. The saturated thickness of the aquifer in the three newly installed wells tested during the field program ranges from 6.87 to 8.5 m. Assuming each pump is a maximum of 1 m above the screen, the available drawdown varies from 4.65 to 6.28 m. Thus, the maximum simulated drawdown at this pumping rate is 9% of the minimum available drawdown.

The cumulative drawdown of all domestic wells pumping at 5.4 m^3/day each is approximately 0.7 m. This is 15% of the minimum available drawdown observed. As pumping at night will be minimal, water levels will likely recover to static levels on a daily basis.

There is minimal effect of pumping at the higher rate on the village of Osaca wells. There is a slightly greater effect on the wells in the subdivision to the south of the site, but even at the higher rate, the effect is minimal. As the higher rate will only apply to a small portion of the day, the drawdowns observed will be closer to those caused by the lower rate.

5.3.6 Groundwater Quality

Two groundwater samples were collected from the pumping well during each pumping test. One sample was collected 1-hour into the pumping test and the second sample was collected at the 6-hour mark, prior to shutting off the pump. Samples were collected in dedicated sample bottles, kept in a cooler with ice and transported to SGS immediately following completion of the field activities. Analytical results were compared to the ODWQS. The Certificates of Analysis provided by SGS are included in **Appendix H**.

The quality of the groundwater samples collected during the pumping tests complies with most ODWQS, except for the following:

A377795 Well

- Turbidity in both the 1-hour and 6-hour samples
- Total Coliform in the 6-hour sample

Exceedances of Aesthetic Objectives or Operational Guidelines were measured for the following non-health related parameters:

- Organic Nitrogen and hardness in both the 1-hour and 6-hour samples.

A377796 Well

- Turbidity in both the 1-hour and 6-hour samples

Exceedances of Aesthetic Objectives or Operational Guidelines were measured for the following non-health related parameters:

- Hardness and iron in both the 1-hour and 6-hour samples.

A377799 Well

- Total Coliform in both the 1-hour and 6-hour samples

Exceedances of Aesthetic Objectives or Operational Guidelines were measured for the following non-health related parameters:

- Hardness in both the 1-hour and 6-hour samples.

Water treatment systems for the Proposed Development should consider the exceedances noted in this section. Commercial filtration and disinfection methods may be used to effectively remove metals and inactivate any harmful protozoa, bacteria and viruses, and commercial water softening may be used to treat elevated levels of hardness.

It is noted that nitrate concentrations for all tested samples collected from wells A377795, A377796 and A377799 met the ODWQS.

6.0 Groundwater Impact Assessment

A Groundwater Impact Assessment was conducted on the basis of the *Guideline D-5-4* to determine the feasibility and potential for impacts to down-gradient water resources arising from the proposed sewage disposal systems. The Groundwater Impact Assessment considered the following:

- Based on the Preliminary Draft Plan prepared by D.G. Biddle & Associates Limited (**Appendix A-2**) the Proposed Development will include 40 residential lots.
    - Wills understands that each lot is proposed to be serviced with a private on-site sewage disposal system.
- At the time of preparing this report, actual dwelling sizes and anticipated sewage flows were not available, however, 1,000 L/day is considered to be an acceptable sewage effluent loading rate.
- Nitrate was used to assess the impact of sewage effluent on the groundwater environment. *Guideline D-5-4* requires that the effluent plume at the boundary of the Subject Property cannot exceed the ODWQS limit of 10 mg/L for nitrate to prevent off-site groundwater impacts.
- Wills' inputs to the mass balance equation used a standard nitrate loading of 40 mg/lot/day (*Guideline D-5-*4) for a conventional sewage disposal system.
- A background nitrate concentration of 2.86 mg/L was used for the Groundwater Impact Assessment. This value corresponds to the average of the concentrations measured in six groundwater samples collected from wells MW22-08, BH101-22, BH107-22 and BH110-22 in 2022 and 2023. Certificates of Analysis for the nitrate samples are included in **Appendix I.**

  - It should be noted that the majority of the Subject Property has been used for agricultural purposes, which may cause elevated levels of nitrate in the shallow soils/topsoil. Therefore, nitrate levels are expected to decrease after development.

- Available post-development dilution/recharge water for the Subject Property was estimated through a water balance analysis. A summary of the water balance calculations, including the Groundwater Impact Assessment, is included in **Appendix J**. The water balance analysis considered the following elements:
  - Historical Climate Normals – Oshawa WPCP (Climate ID 6155878).
  - The total monthly water surplus available for dilution was calculated - accounting for evapotranspiration using the Thornthwaite method.
  - Infiltration factors for topography, soils, and cover were applied based on the MOEE document, *Hydrogeological Technical Information Requirements For Land Development Applications*, April 1995.
  - The additional groundwater recharge that will occur from the low impact development (LID) features within the proposed development.
- The mass balance equation used in Wills' Groundwater Impact Assessment is included in **Appendix K**.

6.1 Water Balance Analysis

In order to determine the average annual infiltration volume that will be available for dilution as part of the proposed development, a water balance analysis has been completed in accordance with the Conservation Authority Guidelines for Hydrological Assessments. The site was divided into catchments for existing and proposed conditions using the same impervious assumptions employed for the stormwater management design, completed by D.G. Biddle & Associates Limited. In the proposed condition, to account for actual drainage area contributing to each proposed LID feature, some catchments were further subdivided. The existing and proposed catchments for the water balance analysis are provided in **Appendix J**.

Without accounting for the additional groundwater recharge that occurs as a result of the proposed LID features, the development would significantly reduce the volume of available for dilution. However, as the LID features have been designed to retain stormwater runoff, the added infiltration potential should be calculated.

The average annual infiltration volume provided by each LID feature was calculated by completing a daily water balance analysis using precipitation and temperature data for the Oshawa Water Pollution Control Plan from 1981 to 2006 (26 years). This date range was selected because it contains the most recent data available for the gauge station and did not have a significant quantity of missing data. A summary of the water balance analysis results is shown in **Table 14** and detailed water balance calculations are provided in **Appendix J**.

Table 14– Water Balance Summary

Catchment Parameters	Existing	Proposed Without LID	Change Without LID	Proposed with LID	Change With LID
Precipitation (mm/year)	872				
Precipitation (m^3/year)	215,471	215,471	0.0%	215,471	0.0%
Evapotranspiration (m^3/year)	150,056	145,518	-3.0%	145,518	-3.0%
Infiltration (m^3/year)	52,561	48,948	-6.9%	57,828	10.0%
Runoff (m^3/year)	12,854	21,828	69.8%	12,948	0.7%

Notes: 1. No infiltration has been calculated for LID features during months with a negative average temperature.

A review of **Table 14** shows that the average annual infiltration volume for the proposed condition will increase from the existing condition when accounting for the additional infiltration provided by the LID features.

6.2 Predictive Assessment

The results from the Predictive Assessment are outlined below:

Table 15– Predictive Assessment of Nitrate Concentration

Parameter	Value
Number of Lots	40
Volume of Effluent (Q_e)	40 lots x 1,000 L/day = 40,000 L/day
Effluent nitrate concentration	40 mg/L
Available dilution water (Natural Infiltration + LID features)	158,432 L/day
Dilution water nitrate concentration	2.86 mg/L
Total Volume	198,432 L/day

Parameter	Value
Total nitrate concentration at property boundary	**10.0 mg/L**

In view of the results presented in **Table 15**, Wills concludes that the current configuration of the Proposed Development would result in acceptable levels of nitrate at the property boundary.

7.0 Conclusions and Recommendations

The following conclusions and recommendations are provided with respect to Wills' Study.

- Shallow subsurface soils were generally consistent across the Subject Property and included a thin layer of silty sand topsoil underlain by sand with slight variations in gravel, silt, and clay content. A north-south trending band of silt and clay rich soils was observed on the western side of the Subject Property at TP22-10, TP22-08, and TP22-11 at a depth of approximately 1.3 to 1.7 mbg and extended to the test pit termination depths of approximately 3.0 mbg.
- Five drivepoint monitor wells were installed in the base of select test pits to monitor groundwater levels above a depth of 3 mbg. Static water levels were also monitored in 3 monitor wells installed by Cambium Inc. to support their geotechnical investigation.
- Static groundwater levels were generally consistent across the Subject Property and ranged from:
    - 2.34 mbg to 2.71 mbg on September 27, 2022
    - 2.34 mbg to 2.66 mbg on October 5, 2022
    - 2.83 mbg to 2.99 mbg on December 5, 2023, in the 3 monitor wells installed by Cambium Inc.
- Groundwater seepage was encountered in all test pits at an approximate depth of 2.9 mbg to 3 mbg, with the exception of TP22-06, TP22-07, and TP22-10, which were found to be dry prior to backfilling.
- Three groundwater samples were submitted for total nitrogen analysis to support the Groundwater Impact Assessment.
- Seven laboratory particle size distribution analyses and laboratory percolation time estimates were completed on representative samples of the shallow subsurface soils.
- Eight in-situ infiltration tests were conducted between September 26 and September 27, 2022. T-Times were calculated to range from 0 min/cm to 0.81 min/cm, with an average of 0.46 min/cm across all eight tests.

- A review of the physical soil characteristics and comparison against OBC Table 2 and Table 3 suggests a percolation time (T-Time) that is generally between 2 to 12 min/cm for the shallow sand to silty sand soils, and > 50 min/cm for the clayey silt to silt material. Laboratory percolation estimates suggest the T-time ranges from 6 min/cm to 12 min/cm for the sand to silty sand material, and > 50 min/cm for the clayey silt to silt material.
    - In view of the in-situ infiltration testing and physical soil testing results, Wills recommends using the middle of the T-time range for the individual soil units/soil envelopes (OBC Table 2 and Table 3) to be conservative. The individual shallow soil types and respective envelopes are shown on **Figure 3.** Within the clayey silt to silt and clay area identified in green in **Figure 3**, Wills recommends that raised tile beds be used for septic systems installed in this area and set-back distances adjusted accordingly.
- Any proposed LID and sewage disposal system design should consider the shallow groundwater depths encountered on the Subject Property, which may impact the respective designs in the areas investigated by Wills.
- Infiltration rates and percolation times may vary across the Subject Property, as topography, moisture content, soil gradation and relative compactness will affect in-situ infiltration rates.
- A Groundwater Impact Assessment was conducted by Wills to determine the suitability of the Subject Property to accommodate private on-site sewage disposal systems.
- The Groundwater Impact Assessment considered 40 residential lots, and anticipated flows to the sewage disposal systems of 1,000 L/day with a nitrate loading of 40 mg/lot/day on the basis of *D-5-4*.
- The Groundwater Impact Assessment concludes that a groundwater nitrate concentration of 10.0 mg/L will be achieved at the property boundary, which meets the ODWS and satisfies the requirements of *D-5-4*.
- The following is provided with respect to Wills' interpretation of the MECP Well Records and historic groundwater investigations on neighboring properties:
    - Viable water supply aquifers have been identified within both coarse grained sand and gravel layers, as well as within the underlying bedrock stratum.
    - The recommended pumping rates ranged from approximately 7.6 to 30.2 litres per minute (L/min) for the nearby overburden wells (19.9 L/min average), and from 3.8 to 37.8 L/min for the bedrock wells (20.2 L/min average).
    - Shallow aquifers were generally more high-producing north of the Subject Property, and deeper wells installed in overburden and bedrock south of the Subject Property were generally more high-performing.
    - Detailed hydraulic assessment (2018 Ted Rannie Report) completed for the property directly south of the Subject Property, concluded that the

underlying aquifer could support a 20 lot residential development without causing off-site impacts to neighbouring water users or surface resources.

- Based on Wills' desktop review of surrounding well performances and understanding of the local geological conditions, it is likely that these aquifer conditions may extend beneath the Subject Property and be available to the Proposed Development.

- Based on the results of Will's field testing and David Ruttan's hydrogeological modelling, Wills anticipates that the aquifer tested can be exploited to meet the Proposed Development water taking needs through 48 individual wells spaced at least 25 meters away from one another. In this configuration, Wills anticipates that the cumulated drawdown when all the wells are pumping simultaneously will be limited to maximum 0.4 m outside of peak hour, and 0.7 m at peak hour, as shown on **Figure 5** and **Figure 6**, with further consideration of the following:
  - The anticipated impact on the village of Osaca to the north is minimal, with modelling showing a cumulated drawdown of 0.1 m or less, including at peak hour.
  - The anticipated impact on the subdivision to the south is slightly higher, with modelling showing a cumulated drawdown ranging from 0.7 m to 0.3 m at peak hour.
  - Based on Wills conservative estimation of the aquifer saturated thickness, and the likely configuration of wells construction and equipment exploiting this aquifer, the maximum cumulative drawdowns obtained through modelling represent only 9% and 15 % of the minimal available drawdown outside peak hour and during peak hour respectively.
  - Interference between wells both within the Proposed Development and on neighbouring properties is anticipated to be limited.
  - The assessment summarized above was conducted based on the Preliminary Draft Plan prepared in October 2023, which included 48 residential lots. Considering that the revised plan prepared in March 2024 includes only 40 residential lots, the assessment is deemed conservative with respect to water availability for the development and potential impact on neighbouring pumping activities.
- Water treatment systems for the Proposed Development should consider the exceedances noted in **Section 5.3.6**.

We trust that the information contained in and attached to this report meets your needs at this time. The following Statement of Limitations should be read carefully and is an integral part of this report. Do not hesitate to contact the undersigned if you have any questions or concerns.

Respectfully submitted,

Prepared by: 

Ralf Bolvin, P. Eng., QPESA
Project Engineer

Reviewed by: 

Ian Ames, M.Sc., P.Geo.
Environmental Monitoring and Management Lead

LT/RB/IA/ck

Statement of Limitations

This report is intended solely for Hillstreet Developments Ltd. c/o Larry MacDonell (Client) for the Proposed Development located on Pt Lot 27Concession 5, in the village of Osaca, Ontario, and is prohibited for use by others without D.M. Wills Associates Limited's (Wills) prior written consent. This report is considered Wills' professional work product and shall remain the sole property of Wills. Any unauthorized reuse, redistribution of or reliance on this report shall be at the Client and recipient's sole risk, without liability to Wills. The Client shall defend, indemnify and hold Wills harmless from any liability arising from or related to the Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include supporting drawings and appendices.

The recommendations made in this report are based on Wills' present understanding of the Project, the current and proposed site use, ground and subsurface conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with the level of care and skill ordinarily exercised by members of geoscience or engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the sole responsibility of such third parties.

The recommendations and comments made in this report are based on Wills' investigations and resulting understanding of the Project, as defined at the time of the assignment. Wills should be retained to review our recommendations when the final or any modified design drawings and specifications are complete. Without this review, Wills shall not be liable for any misunderstanding of our recommendations or their application and adaptation.

Soil, bedrock, and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations. Should any conditions at the Subject Property be encountered which differ from those found at the test locations, Wills must be notified immediately in order to permit a reassessment of our recommendations. If different conditions are identified, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by Wills is completed.

FIGURES

Legend

Subject Property

Subject Property Plan

Hydrogeological Study
County Road 65
Osaca, ON

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

P. 705.742.2297
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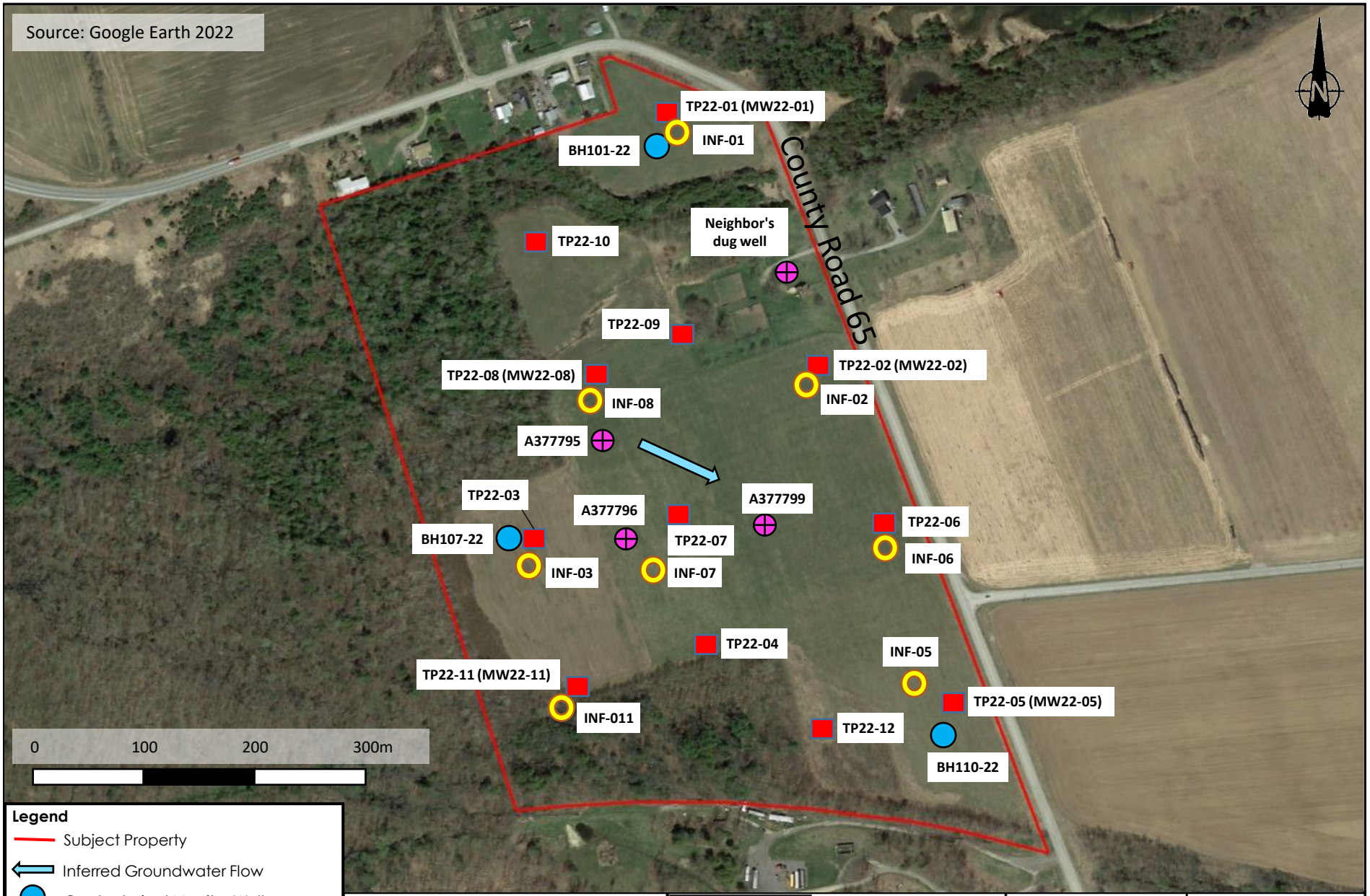
E. wills@dmwills.com

Drawn By	LT	Scale	See Scale Bar
Checked	IA	Date	November 2022
Project No.	22-11056	Drawing File No.	Figure 1



Subsurface Investigation Plan

Hydrogeological Study
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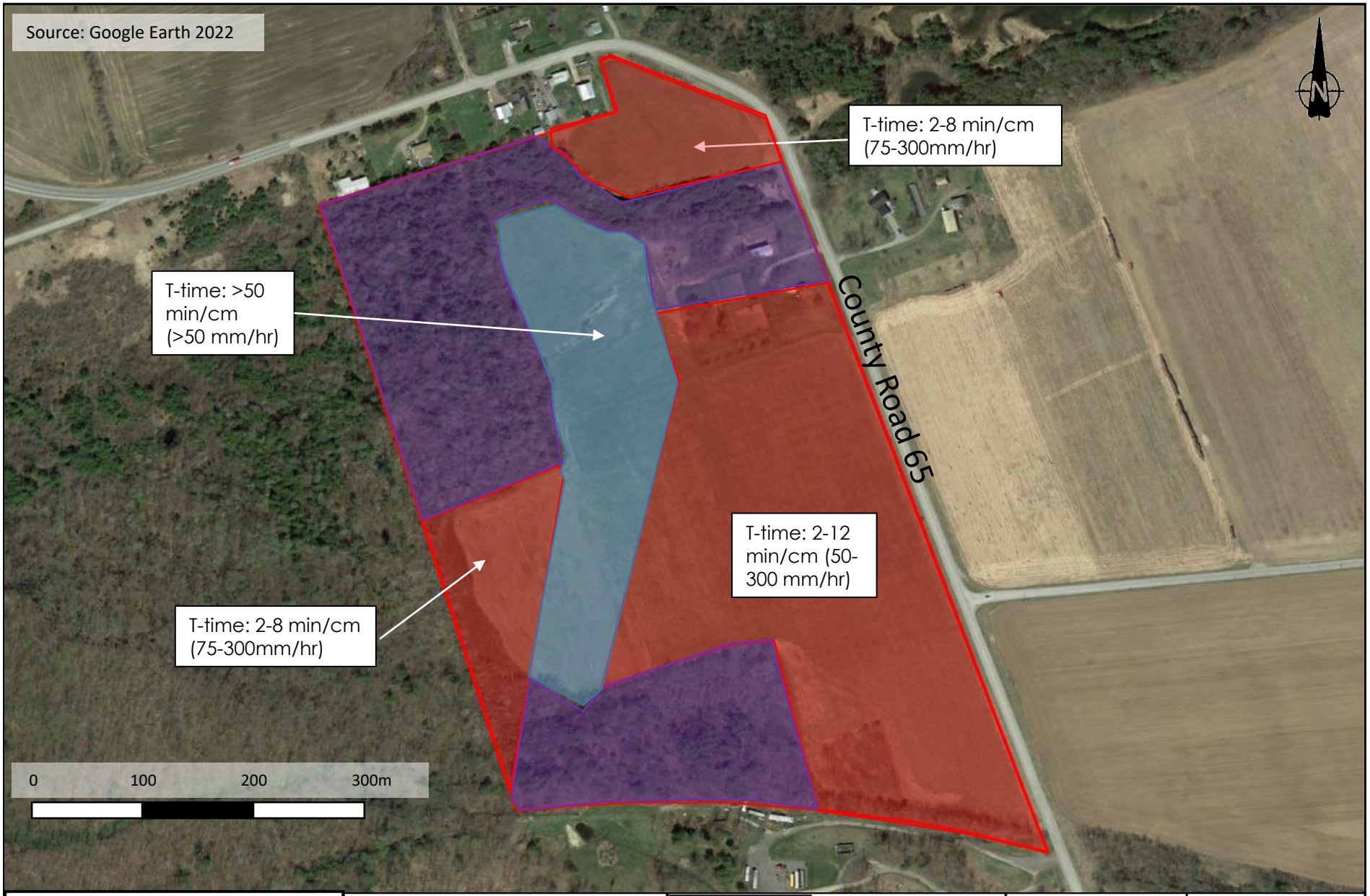
Drawn By	RB	Scale	See Scale Bar
Checked	IA	Date	December 2023
Project No.	22-11056	Drawing File No.	Figure 2



Legend

- Subject Property
- Clayey silt to silt and clay above 3 .0 mbg
- Sand to silty sand above 3.0 mbg
- Uncharacterized

Subsurface Infiltration Plan

Hydrogeological Study
County Road 65
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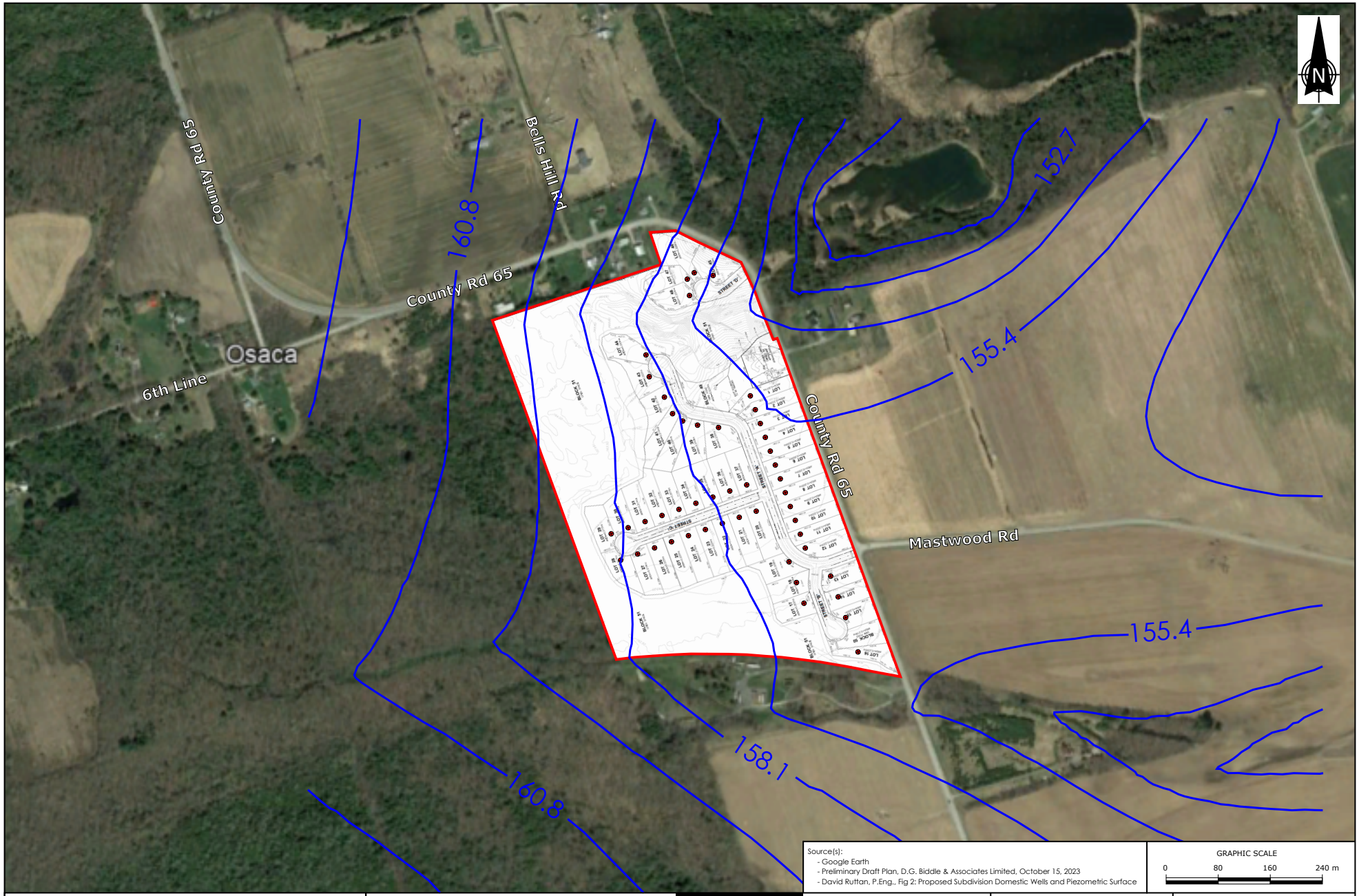
Drawn By	LT	Scale	See Scale Bar
Checked	IA	Date	November 2022
Project No.	22-11056	Drawing File No.	Figure 3



Source(s):
- Google Earth
- Preliminary Draft Plan, D.G. Biddle & Associates Limited, October 15, 2023
- David Ruttan, P.Eng., Fig 2: Proposed Subdivision Domestic Wells and Piezometric Surface

GRAPHIC SCALE
0 80 160 240 m

Legend

- Subject Property
- Domestic Well - Simulated
- 192 Iso-elevation Lines (isopieze - masl)

Proposed Development Domestic Wells and Piezometric Surface

Part of lot 27, Concession 5
Municipality of Port Hope
County of Northumberland

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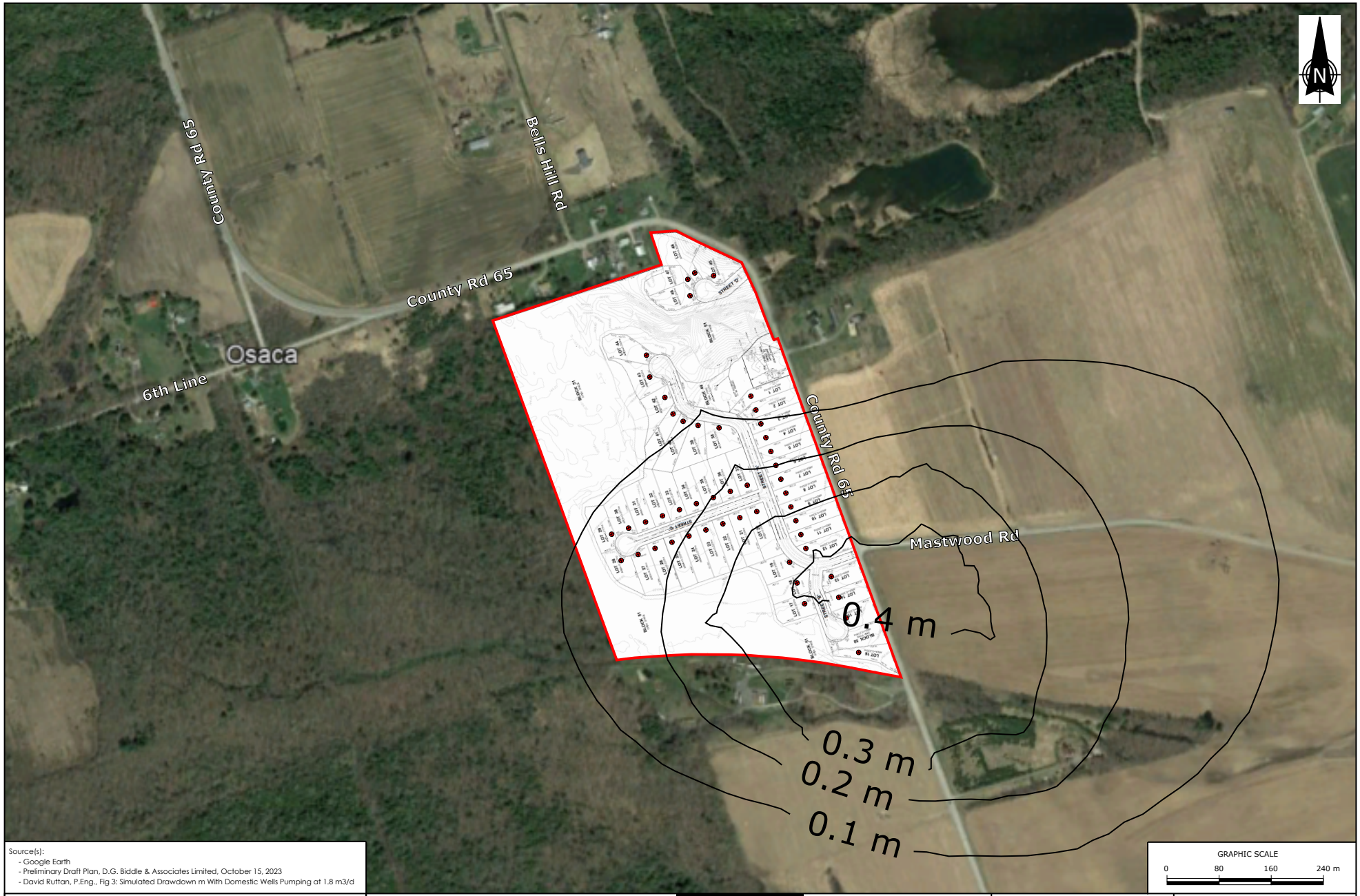
Drawn by: R. BOLVIN	Scale: 1:8 000 on 8.5"x11" (US Letter)
Checked: I. AMES	Date: December 20, 2023
Project No.: 11056	Drawing file No.: Figure 4



Source(s):
- Google Earth
- Preliminary Draft Plan, D.G. Biddle & Associates Limited, October 15, 2023
- David Ruttan, P.Eng., Fig 3: Simulated Drawdown m With Domestic Wells Pumping at 1.8 m3/d

GRAPHIC SCALE
0 80 160 240 m

Legend

- Subject Property
- Domestic Well - Simulated
- 0.4 — Simulated Drawdown (m)

Simulated Drawdown with Domestic Wells Pumping at 1.8 m^3/d

Part of lot 27, Concession 5
Municipality of Port Hope
County of Northumberland

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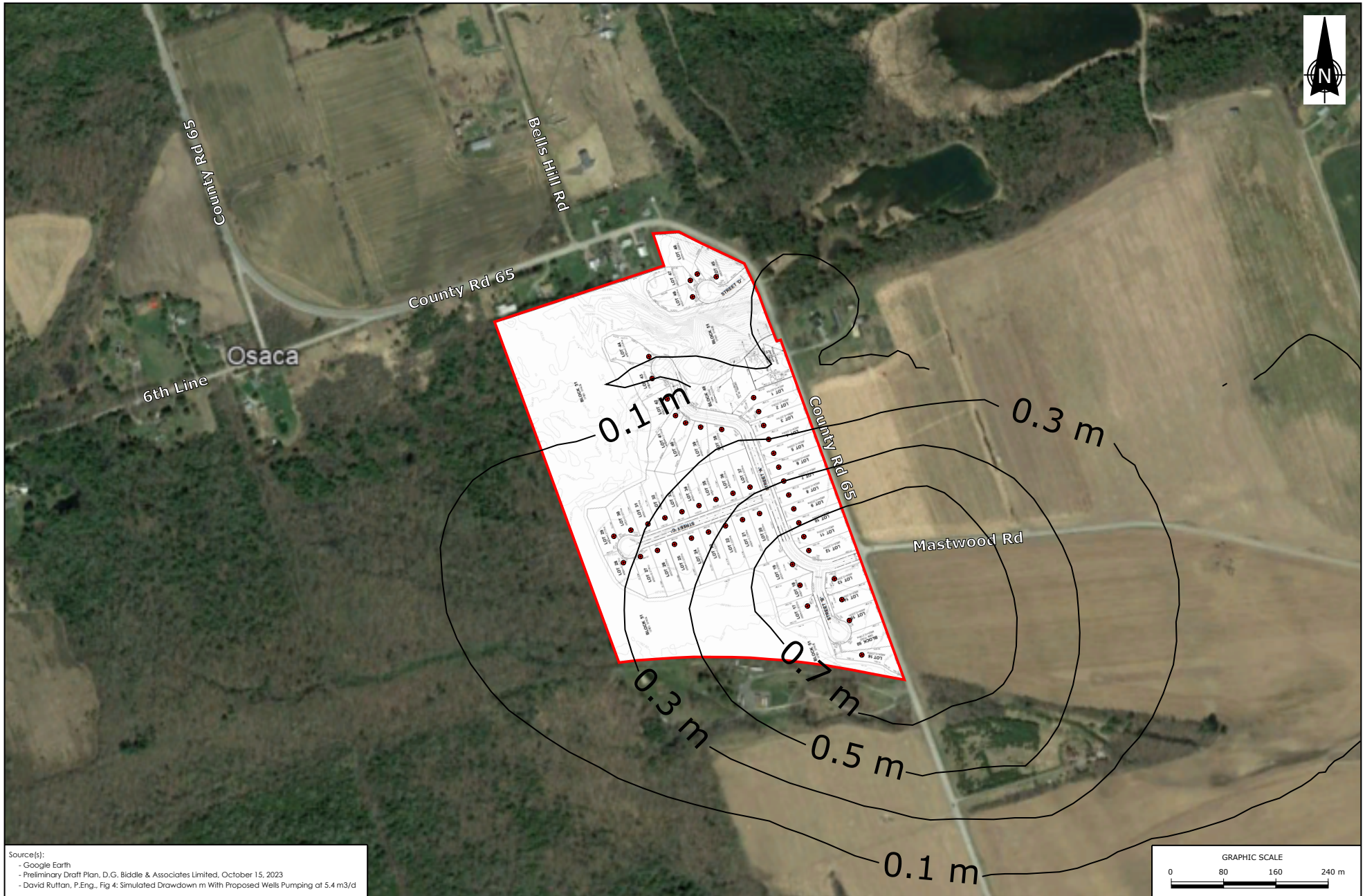
Drawn by: R. BOLVIN	Scale: 1:8 000 on 8.5"x11" (US Letter)
Checked: I. AMES	Date: December 20, 2023
Project No.: 11056	Drawing file No.: Figure 5



Source(s):
- Google Earth
- Preliminary Draft Plan, D.G. Biddle & Associates Limited, October 15, 2023
- David Ruttan, P.Eng., Fig 4: Simulated Drawdown m With Proposed Wells Pumping at 5.4 m3/d

GRAPHIC SCALE
0 80 160 240 m

Legend

- Subject Property
- Domestic Well - Simulated
- 0.4 Simulated Drawdown (m)

Simulated Drawdown with Domestic Wells Pumping at 5.4 m^3/d

Part of lot 27, Concession 5
Municipality of Port Hope
County of Northumberland

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D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
K9J 0B9

P. 705.742.2297
F. 705.748.9944
E. wills@dmwills.com

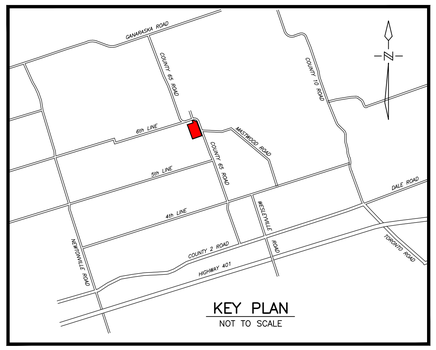
Drawn by: R. BOLVIN	Scale: 1:8 000 on 8.5"x11" (US Letter)
Checked: I. AMES	Date: December 20, 2023
Project No.: 11056	Drawing file No.: Figure 6

Appendix A

Site Plans - D.G. Biddle & Associates Limited

Appendix A-1

Preliminary Draft Plan – D.G. Biddle & Associates Limited – October 2023



AGRICULTURAL

60.20m N21°54'00"W 199.90m N21°54'00"W 104.67m N22°53'30"W 21.95m N21°34'10"W 80.45m N21°30'10"W 88.11m N21°57'20"W

RURAL RESIDENTIAL

RURAL RESIDENTIAL

BLOCK 51
OPEN SPACE

BLOCK 51
OPEN SPACE

BLOCK 51
OPEN SPACE

BLOCK 51
OPEN SPACE

BLOCK 49
SWM POND
AREA=0.502ha

BLOCK 50
SWM POND
AREA=0.218ha

STREET 'A'

STREET 'B'

STREET 'C'

STREET 'D'

LOT 1 AREA=0.201ha
LOT 2 AREA=0.203ha
LOT 3 AREA=0.201ha
LOT 4 AREA=0.200ha
LOT 5 AREA=0.200ha
LOT 6 AREA=0.200ha
LOT 7 AREA=0.200ha
LOT 8 AREA=0.200ha
LOT 9 AREA=0.200ha
LOT 10 AREA=0.200ha
LOT 11 AREA=0.200ha
LOT 12 AREA=0.220ha
LOT 13 AREA=0.200ha
LOT 14 AREA=0.200ha
LOT 15 AREA=0.200ha
LOT 16 AREA=0.230ha
LOT 17 AREA=0.202ha
LOT 18 AREA=0.200ha
LOT 19 AREA=0.208ha
LOT 20 AREA=0.250ha
LOT 21 AREA=0.239ha
LOT 22 AREA=0.222ha
LOT 23 AREA=0.220ha
LOT 24 AREA=0.218ha
LOT 25 AREA=0.220ha
LOT 26 AREA=0.225ha
LOT 27 AREA=0.214ha
LOT 28 AREA=0.217ha
LOT 29 AREA=0.215ha
LOT 30 AREA=0.207ha
LOT 31 AREA=0.214ha
LOT 32 AREA=0.211ha
LOT 33 AREA=0.207ha
LOT 34 AREA=0.203ha
LOT 35 AREA=0.203ha
LOT 36 AREA=0.203ha
LOT 37 AREA=0.203ha
LOT 38 AREA=0.230ha
LOT 39 AREA=0.242ha
LOT 40 AREA=0.224ha
LOT 41 AREA=0.214ha
LOT 42 AREA=0.217ha
LOT 43 AREA=0.222ha
LOT 44 AREA=0.243ha
LOT 45 AREA=0.269ha
LOT 46 AREA=0.329ha
LOT 47 AREA=0.201ha
LOT 48 AREA=0.204ha

OTHER LANDS OWNED BY APPLICANT
AREA=0.388ha

EXIST BUILDINGS TO BE REMOVED

COUNTY ROAD 65

MASTWOOD ROAD

AGRICULTURAL

LAND USE SCHEDULE

PROPOSED USE	LOT/BLK #	# OF LOTS/BLKS	# OF UNITS	AREA (ha)
LOW DENSITY RESIDENTIAL				
SINGLE DETACHED	LOTS 1 – 48	48	48	10.349
NON RESIDENTIAL				
SWM PONDS	BLOCK 49,50	2		0.720
OPEN SPACE	BLOCK 51	1		11.520
ROADS	20.0m ROW			2.034
TOTALS		51	48	24.623

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

a) AS SHOWN ON THE DRAFT PLAN
b) AS SHOWN ON THE DRAFT PLAN
c) AS SHOWN ON THE DRAFT PLAN
d) SEE LAND USE SCHEDULE
e) AS SHOWN ON THE DRAFT PLAN
f) AS SHOWN ON THE DRAFT PLAN
f.1) NOT APPLICABLE
g) AS SHOWN ON THE DRAFT PLAN
h) WELL AND SEPTIC
i) SAND AND SANDY SILT
j) AS SHOWN ON THE DRAFT PLAN
k) PRIVATE WELL
l) AS SHOWN ON THE DRAFT PLAN

No.	REVISION	DATE	BY	APPROVED

REVISIONS

OWNER'S AUTHORIZATION

I/WE
LAND OWNER
BEING THE REGISTERED OWNER OF THE SUBJECT LANDS HEREBY AUTHORIZE
D.G.BIDDLE AND ASSOC. LTD.
TO PREPARE AND SUBMIT A DRAFT PLAN OF SUBDIVISION FOR APPROVAL

SIGNED _____
TITLE

DATE _____

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARY OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN

ONTARIO LAND SURVEYOR
ONTARIO LAND SURVEYORS

SIGNED _____
O.L.S

DATE _____

D.G. Biddle & Associates Limited
consulting engineers and planners
96 KING STREET EAST • OSHAWA,ON L1H 1B6
PHONE (905)576-8500 • FAX (905)576-9730
info@dgbiddle.com

PRELIMINARY

DRAFT PLAN

PART OF LOT 27, CONCESSION 5
FORMERLY IN THE TOWNSHIP OF HOPE
NOW IN THE
MUNICIPALITY OF PORT HOPE
COUNTY OF NORTHUMBERLAND

MICHAEL J. FRY — REGISTERED PROFESSIONAL PLANNER — R.P.P.

SCALE:	1:1000
DRAWN BY:	B.B.
DESIGN BY:	M.F.
CHECKED BY:	M.F.
PLOT DATE:	15/10/2023

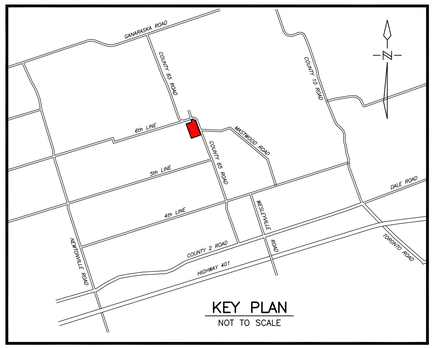
122049

DP-1

X:\STAFF\JOB FILES\122000\122049 DRAWINGS\122049 ENGINEERING DRAWINGS\122049-20231013-DRAFT PLAN.DWG

Appendix A-2

Post-Development Storm Drainage Plan – D.G. Biddle & Associates Limited – March 2024



AGRICULTURAL

60.20m N21°54'00"W 199.90m N21°54'00"W 104.67m N22°53'30"W 21.95m N21°34'10"W 80.45m N21°30'10"W 88.11m N21°57'20"W

RURAL RESIDENTIAL

RURAL RESIDENTIAL

BLOCK 43
OPEN SPACE

BLOCK 43
OPEN SPACE

BLOCK 43
OPEN SPACE

BLOCK 43
OPEN SPACE

BLOCK 42
SWM POND
AREA=0.219ha

BLOCK 41
SWM POND
AREA=0.455ha

BLOCK 44
AREA=1.093ha
OTHER LANDS OWNED BY APPLICANT

OTHER LANDS OWNED BY APPLICANT

STREET 'A'

STREET 'B'

STREET 'C'

LOT 1 AREA=0.201ha
LOT 2 AREA=0.203ha
LOT 3 AREA=0.201ha
LOT 4 AREA=0.200ha
LOT 5 AREA=0.200ha
LOT 6 AREA=0.200ha
LOT 7 AREA=0.200ha
LOT 8 AREA=0.200ha
LOT 9 AREA=0.200ha
LOT 10 AREA=0.200ha
LOT 11 AREA=0.200ha
LOT 12 AREA=0.220ha
LOT 13 AREA=0.200ha
LOT 14 AREA=0.200ha
LOT 15 AREA=0.200ha
LOT 16 AREA=0.216ha
LOT 17 AREA=0.202ha
LOT 18 AREA=0.200ha
LOT 19 AREA=0.208ha
LOT 20 AREA=0.250ha
LOT 21 AREA=0.239ha
LOT 22 AREA=0.222ha
LOT 23 AREA=0.220ha
LOT 24 AREA=0.218ha
LOT 25 AREA=0.339ha
LOT 26 AREA=0.329ha
LOT 27 AREA=0.467ha
LOT 28 AREA=0.357ha
LOT 29 AREA=0.294ha
LOT 30 AREA=0.207ha
LOT 31 AREA=0.203ha
LOT 32 AREA=0.203ha
LOT 33 AREA=0.203ha
LOT 34 AREA=0.203ha
LOT 35 AREA=0.202ha
LOT 36 AREA=0.201ha
LOT 37 AREA=0.217ha
LOT 38 AREA=0.313ha
LOT 39 AREA=0.277ha
LOT 40 AREA=0.248ha

AREA=0.334ha *

EXIST BUILDINGS TO BE REMOVED

OTHER LANDS OWNED BY APPLICANT

COUNTY ROAD 65

MASTWOOD ROAD

AGRICULTURAL

LAND USE SCHEDULE

PROPOSED USE	LOT/BLK #	# OF LOTS/BLKS	# OF UNITS	AREA (ha)
LOW DENSITY RESIDENTIAL				
SINGLE DETACHED	LOTS 1 – 40	40	40	9.450
NON RESIDENTIAL				
SWM PONDS	BLOCK 41,42	2		0.674
OPEN SPACE	BLOCK 43	1		11.354
OTHER LANDS OWNED BY APPLICANT	BLOCK 44	1		1.093
ROADS	20.0m ROW			1.718
TOTALS		44	40	24.289

LEGEND

- WETLANDS (20231024) BOUNDARY
- 30.0m SETBACK FROM WETLANDS (20231024)
- TREELINE (20231024) BOUNDARY
- 5.0m SETBACK FROM WOODLANDS (20231024)

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

a) AS SHOWN ON THE DRAFT PLAN
b) AS SHOWN ON THE DRAFT PLAN
c) AS SHOWN ON THE DRAFT PLAN
d) SEE LAND USE SCHEDULE
e) AS SHOWN ON THE DRAFT PLAN
f) AS SHOWN ON THE DRAFT PLAN
f.1) NOT APPLICABLE
g) AS SHOWN ON THE DRAFT PLAN
h) WELL AND SEPTIC
i) SAND AND SANDY SILT
j) AS SHOWN ON THE DRAFT PLAN
k) PRIVATE WELL
l) AS SHOWN ON THE DRAFT PLAN

OWNER'S AUTHORIZATION

I/WE LAND OWNER

BEING THE REGISTERED OWNER OF THE SUBJECT LANDS HEREBY AUTHORIZE

D.G.BIDDLE AND ASSOC. LTD.

TO PREPARE AND SUBMIT A DRAFT PLAN OF SUBDIVISION FOR APPROVAL

SIGNED _____ TITLE

DATE _____

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARY OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN

ONTARIO LAND SURVEYOR
ONTARIO LAND SURVEYORS

SIGNED _____ O.L.S

DATE _____

No.	REVISION	DATE	BY	APPROVED

REVISIONS

D.G. Biddle & Associates Limited
consulting engineers and planners
96 KING STREET EAST • OSHAWA,ON L1H 1B6
PHONE (905)576-8500 • FAX (905)576-9730
info@dgbiddle.com

MICHAEL J. FRY — CERTIFIED PROFESSIONAL PLANNER — R.P.P.

PRELIMINARY

DRAFT PLAN

PART OF LOT 27, CONCESSION 5
FORMERLY IN THE TOWNSHIP OF HOPE
NOW IN THE
MUNICIPALITY OF PORT HOPE
COUNTY OF NORTHUMBERLAND

SCALE:	1:1000
DRAWN BY:	B.B.
DESIGN BY:	M.F.
CHECKED BY:	M.F.
PLOT DATE:	21/02/2024

122049

DP-1

X:\STAFF\JOB FILES\122000\122049 5868 COUNTY RD 65\122049 DRAWINGS\122049 ENGINEERING DRAWINGS\122049-20240221--DRAFT PLAN.DWG

Appendix B

Test Pit Logs

WILLS

Test Pit Log – TP22-01

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, moist.
0.2 – 3.0	Brown to grey sand, trace gravel, trace silt, moist to saturated.
Grab Sample Summary	
GS-01 collected at approximately 1.4 mbg.	<u>GS-01 GSA:</u> 3% Gravel 93% Sand 3% Silt 1% clay

Groundwater

- Groundwater encountered at 3.0 mbg.

Additional Notes

- Test pit terminated at 3.0 mbg.
- Water pooling at the bottom of test pit upon completion.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.
- MW22-01 installed in test pit prior to backfilling.

Test Pit Photos

TP22-01
September 26, 2022
17T
705479 mE
4875999 mN

WILLS

Test Pit Log – TP22-02

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, rootlets, moist.
0.2 – 3.0	Brown sand, trace gravel, trace silt, moist.
Grab Sample Summary	
GS-02 collected at approximately 2.9 mbg.	<u>GS-02 GSA:</u> 3% Gravel 94% Sand 3% Silt 0% Clay
Groundwater	
• No groundwater encountered.	
Additional Notes	
• Test pit terminated at 3.0 mbg. • Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling. • MW22-02 installed in test pit prior to backfilling.	
Test Pit Photos	

TP22-02
September 23, 2022
17T
705628 mE
4875766 mN

WILLS

Test Pit Log – TP22-03

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, moist.
0.2 – 3.0	Brown to grey sand, trace gravel, moist to saturated.
Grab Sample Summary	
GS-01 collected at approximately 1.0 mbg.	<u>GS-01 GSA:</u> 0% Gravel 97% Sand 3% Silt 0% Clay

Groundwater

- Groundwater encountered at 3.0 mbg.

Additional Notes

- Test pit terminated at 3.0 mbg.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

TP22-03
September 23, 2022
17T
705389 mE
4875605 mN

WILLS

Test Pit Log – TP22-04

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, moist.
0.2 – 0.5	Brown sand, some silt, moist.
0.5 – 3.0	Brown to grey sand, trace gravel, trace silt, moist to saturated.

Groundwater

- Groundwater encountered at 3.0 mbg.

Additional Notes

- Test pit terminated at 3.0 mbg.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

TP22-04
September 23, 2022
17T
705528 mE
4875523 mN

WILLS

Test Pit Log – TP22-05

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, rootlets, moist.
0.2 - 2.4	Brown sand, some silt, trace gravel, trace clay, moist.
2.4 – 3.0	Brown to grey sand, some silt, trace gravel, trace clay, moist to saturated.
Grab Sample Summary	
GS-01 collected at approximately 1.7 mbg.	<u>GS-01 GSA:</u> 2% Gravel 78% Sand 18% Silt 2% Clay

Groundwater

- Groundwater encountered at 2.9 mbg.

Additional Notes

- Test pit terminated at 3.0 mbg.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.
- MW22-05 installed in test pit prior to backfilling.

Test Pit Photos

TP22-05
September 23, 2022
17T
705743 mE
4875493 mN

WILLS

Test Pit Log – TP22-06

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, some rootlets, moist.
0.2 – 3.0	Brown to grey sand, some silt, trace gravel, trace clay, moist.

Groundwater

- No groundwater encountered.

Additional Notes

- Test pit terminated at 3.0 mbg.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

TP22-06
September 23, 2022
17T
705682 mE
4875632 mN

WILLS

Test Pit Log – TP22-07

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, moist.
0.2 - 3.0	Brown to grey sand, some silt, moist to wet.

Groundwater

- Groundwater not encountered.

Additional Notes

- Test pit terminated at 3.0 mbg.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

TP22-07
September 23, 2022
17T
705514 mE
4875641 mN

WILLS

Test Pit Log – TP22-08

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, moist.
0.2 – 1.3	Brown to grey sand, some silt, trace clay, moist.
1.3 – 3.0	Brown to grey silt and clay, trace sand, about plastic limit to much wetter than plastic limit.
Grab Sample Summary	
GS-02 collected at approximately 2.0 mbg.	<u>GS-02 GSA:</u> 0% Gravel 4% Sand 56% Silt 40% Clay

Groundwater

- Groundwater encountered at 3.0 mbg.

Additional Notes

- Test pit terminated at 3.0 mbg.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.
- MW22-08 installed in test pit prior to backfilling.

Test Pit Photos

TP22-08
September 23, 2022
17T
705426 mE
4875745 mN

WILLS

Test Pit Log – TP22-09

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, rootlets, moist.
0.2 - 2.4	Brown sand, trace silt, trace gravel, moist.
2.4 – 3.0	Brown to grey silty sand, some clay, moist to saturated.

Groundwater

- Groundwater encountered at 3.0 mbg.

Additional Notes

- Test pit terminated at 3.0 mbg
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

TP22-09
September 23, 2022
17T
705509 mE
4875797 mN

WILLS

Test Pit Log – TP22-10

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, moist.
0.2 - 1.7	Brown silty sand, trace clay, moist
1.7 – 3.0	Brown to grey silt and clay, trace sand, about plastic limit.
Grab Sample Summary	
GS-02 collected at approximately 1.9 mbg.	<u>GS-02 GSA:</u> 0% Gravel 3% Sand 62% Silt 35% Clay

Groundwater

- Groundwater not encountered.

Additional Notes

- Test pit terminated at 3.0 mbg
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

TP22-10
September 23, 2022
17T
705372 mE
4875876 mN

WILLS

Test Pit Log – TP22-11

Depth (mbg)	Soil Description
0.0 – 0.2	Brown silty sand topsoil, moist.
0.2 - 1.7	Brown silty sand, trace clay, moist.
1.7 – 3.0	Brown to grey silt and clay, trace sand, about plastic limit.
Grab Sample Summary	
GS-03 collected at approximately 2.7 mbg.	<u>GS-03 GSA:</u> 0% Gravel 4% Sand 71% Silt 25% Clay
Groundwater	
• Groundwater encountered at 3.0 mbg.	
Additional Notes	
• Test pit terminated at 3.0 mbg • Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling. • MW22-11 installed in test pit prior to backfilling.	
Test Pit Photos	

TP22-11
September 23, 2022
17T
705435 mE
4875489 mN

WILLS

Test Pit Log – TP22-12

Depth (mbg)	Soil Description
0.0 – 0.1	Brown silty sand topsoil, moist.
0.1 - 0.8	Brown sand, some silt, moist.
0.8 – 2.6	Brown to grey sand, trace silt, trace gravel, moist to wet.
2.6 – 2.8	Grey sand, some gravel, trace silt, saturated.

Groundwater

- Groundwater encountered at 2.6 mbg.

Additional Notes

- Test pit terminated at 2.8 mbg.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

TP22-12
September 23, 2022
17T
705636 mE
4875461 mN

Appendix C

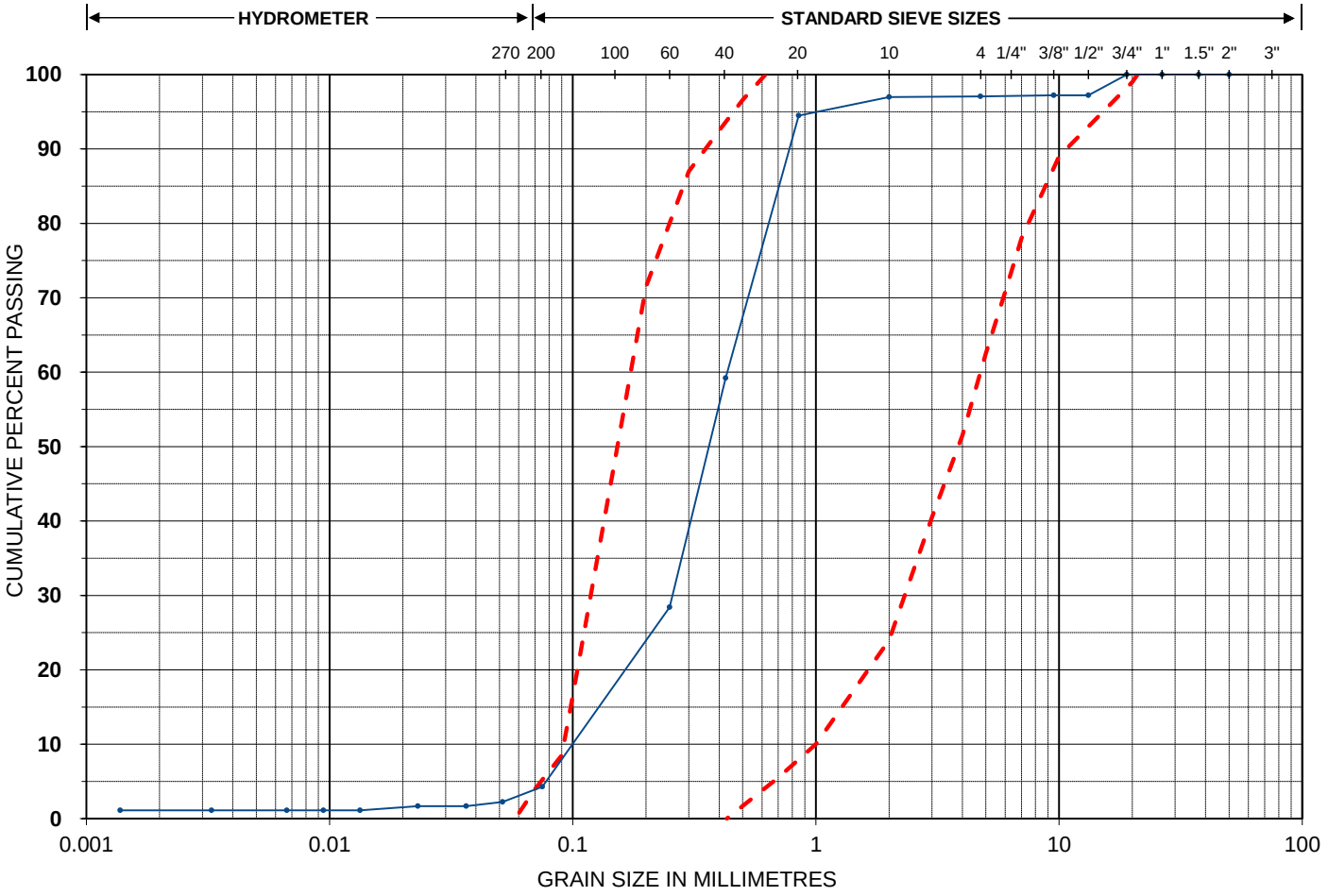
Certificates of Analysis – Physical Soil Testing

PRI ENGINEERING
205 St.George Street, Unit 2, Lindsay, ON, K9V 5Z9
(705) 702-3921
info@priengineering.com
www.priengineering.com

PARTICLE SIZE DISTRIBUTION
LS - 702

Project Name: Osaca (11056) **Project No.:** 22-154 **Sample Date:** 26-Sep-22

Borehole/Test Pit ID.: TP22-01 **Sample No./Depth:** GS1 **LAB ID:** 22HYD-224



Silt or Clay	Sand	Gravel

sp envelope T = 2 - 8 min/cm

Estimated T = 6 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	97.2
9.5	97.2
4.750	97.1
2.000	97.0
0.850	94.5
0.425	59.2
0.250	28.4
0.075	4.3

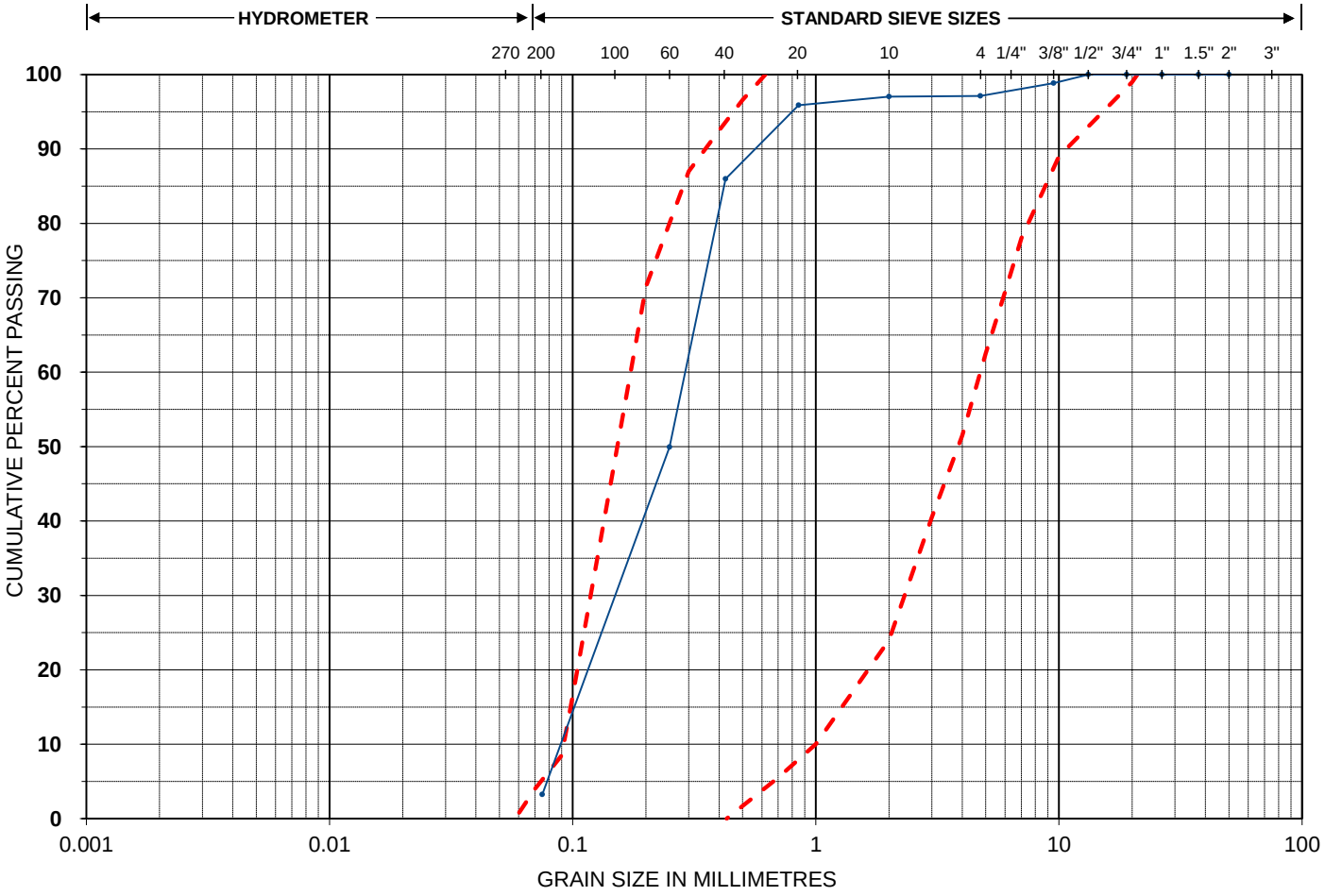
Hydrometer (mm)	% Passing
0.051	2.2
0.036	1.7
0.023	1.7
0.013	1.1
0.009	1.1
0.007	1.1
0.003	1.1
0.001	1.1

PRI ENGINEERING
205 St.George Street, Unit 2, Lindsay, ON, K9V 5Z9
(705) 702-3921
info@priengineering.com
www.priengineering.com

PARTICLE SIZE DISTRIBUTION
LS - 702

Project Name: Osaca (11056) **Project No.:** 22-154 **Sample Date:** 23-Sep-22

Borehole/Test Pit ID.: TP22-02 **Sample No./Depth:** GS2 **LAB ID:** 22HYD-225



Silt or Clay	Sand	Gravel

sp envelope T = 2 - 8 min/cm

Estimated T = 7 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	100.0
9.5	98.8
4.750	97.1
2.000	97.0
0.850	95.9
0.425	86.0
0.250	49.9
0.075	3.2

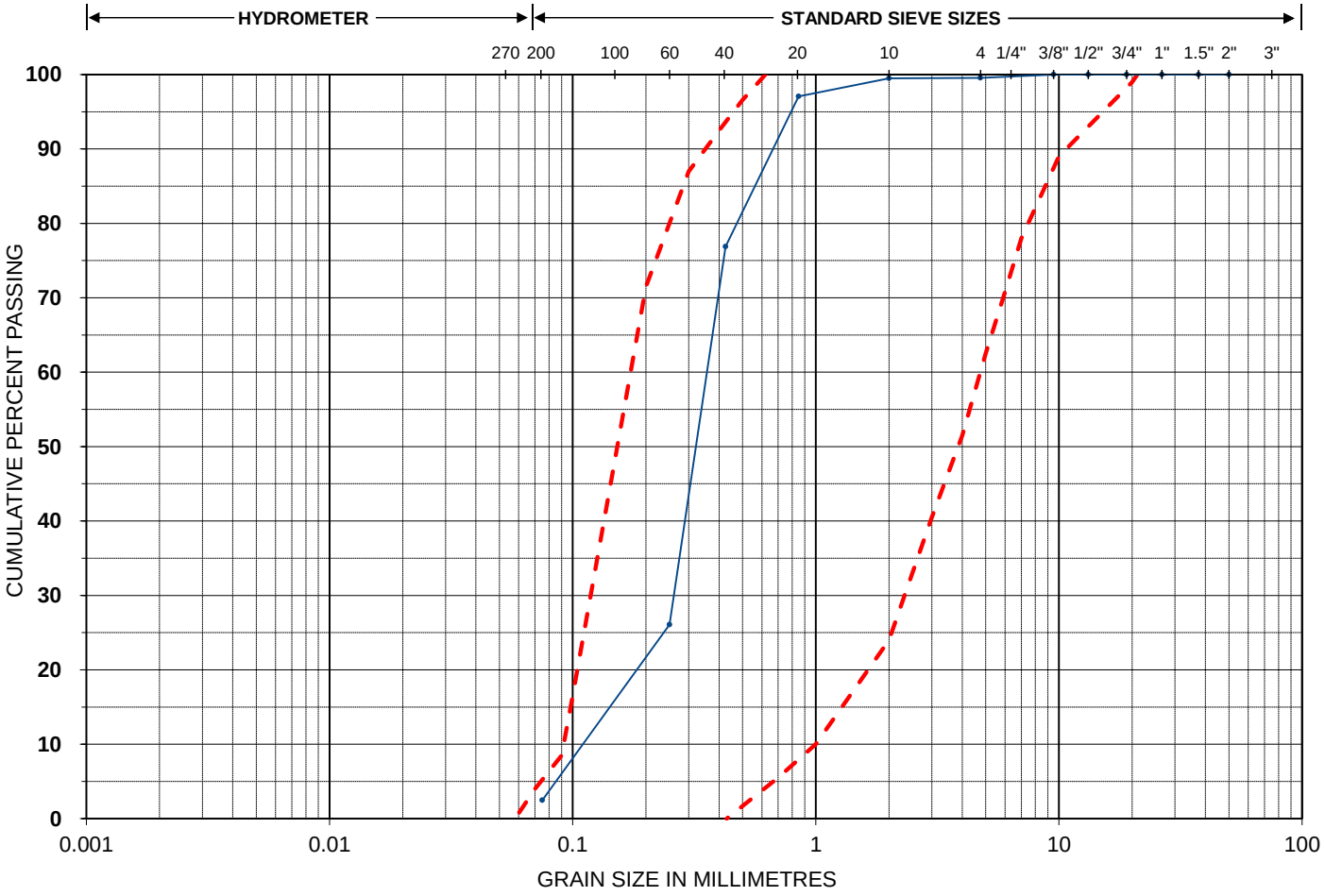
Hydrometer (mm)	% Passing
0.052	0.0
0.036	0.0
0.023	0.0
0.013	0.0
0.009	0.0
0.007	0.0
0.003	0.0
0.001	0.0

PRI ENGINEERING
205 St.George Street, Unit 2, Lindsay, ON, K9V 5Z9
(705) 702-3921
info@priengineering.com
www.priengineering.com

PARTICLE SIZE DISTRIBUTION
LS - 702

Project Name: Osaca (11056) **Project No.:** 22-154 **Sample Date:** 23-Sep-22

Borehole/Test Pit ID.: TP22-03 **Sample No./Depth:** GS1 **LAB ID:** 22HYD-226



Silt or Clay	Sand	Gravel

sp envelope T = 2 - 8 min/cm

Estimated T = 6 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	100.0
9.5	100.0
4.750	99.6
2.000	99.5
0.850	97.1
0.425	76.9
0.250	26.1
0.075	2.5

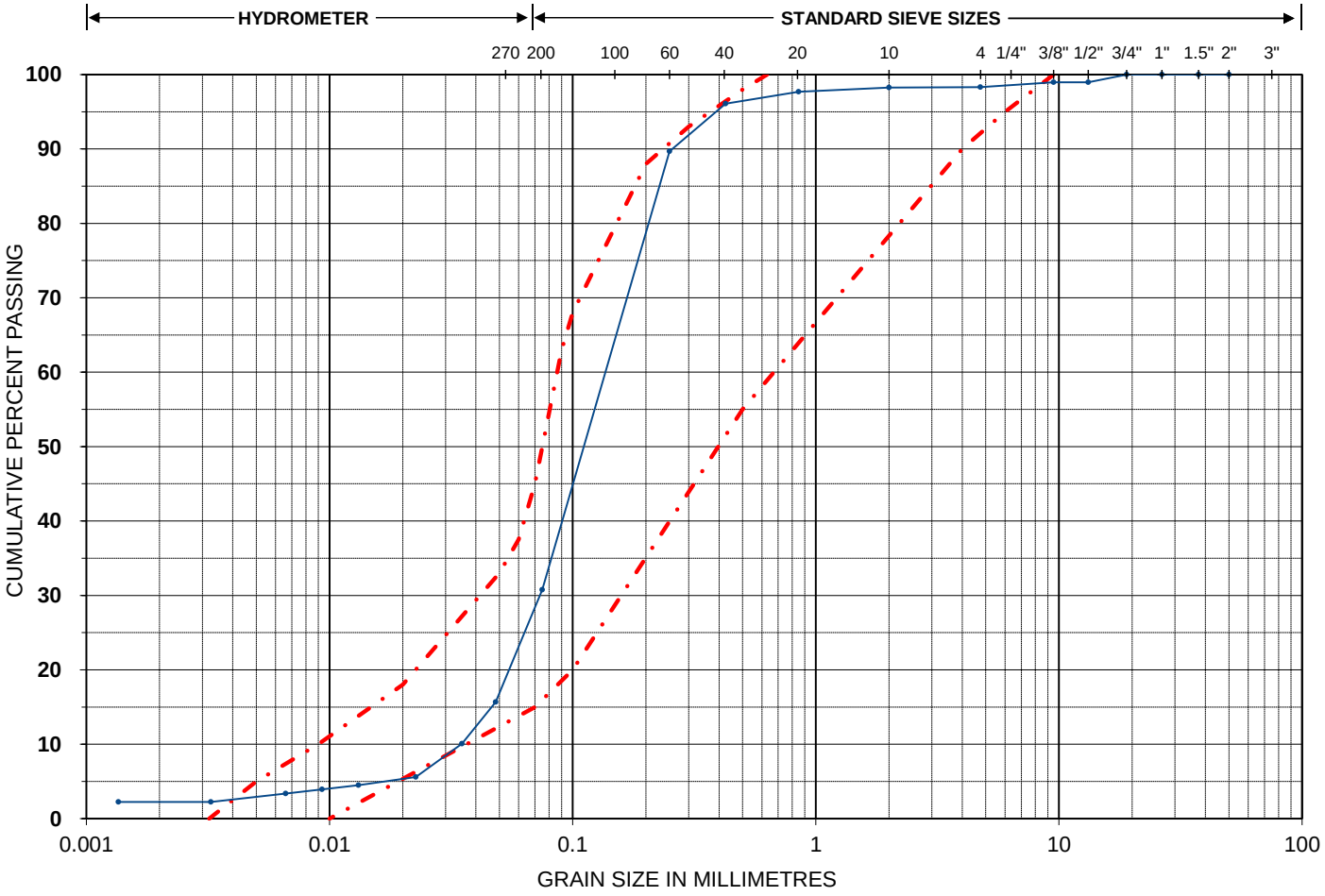
Hydrometer (mm)	% Passing
0.052	0.0
0.037	0.0
0.023	0.0
0.013	0.0
0.009	0.0
0.007	0.0
0.003	0.0
0.001	0.0

PRI ENGINEERING
205 St.George Street, Unit 2, Lindsay, ON, K9V 5Z9
(705) 702-3921
info@priengineering.com
www.priengineering.com

PARTICLE SIZE DISTRIBUTION
LS - 702

Project Name: Osaca (11056) **Project No.:** 22-154 **Sample Date:** 23-Sep-22

Borehole/Test Pit ID.: TP22-05 **Sample No./Depth:** GS1 **LAB ID:** 22HYD-227



Silt or Clay	Sand	Gravel

sm envelope T = 8 - 20 min/cm

Estimated T = 12 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	99.0
9.5	99.0
4.750	98.3
2.000	98.3
0.850	97.7
0.425	96.1
0.250	89.7
0.075	30.8

Hydrometer (mm)	% Passing
0.048	15.7
0.035	10.1
0.023	5.6
0.013	4.5
0.009	3.9
0.007	3.4
0.003	2.2
0.001	2.2

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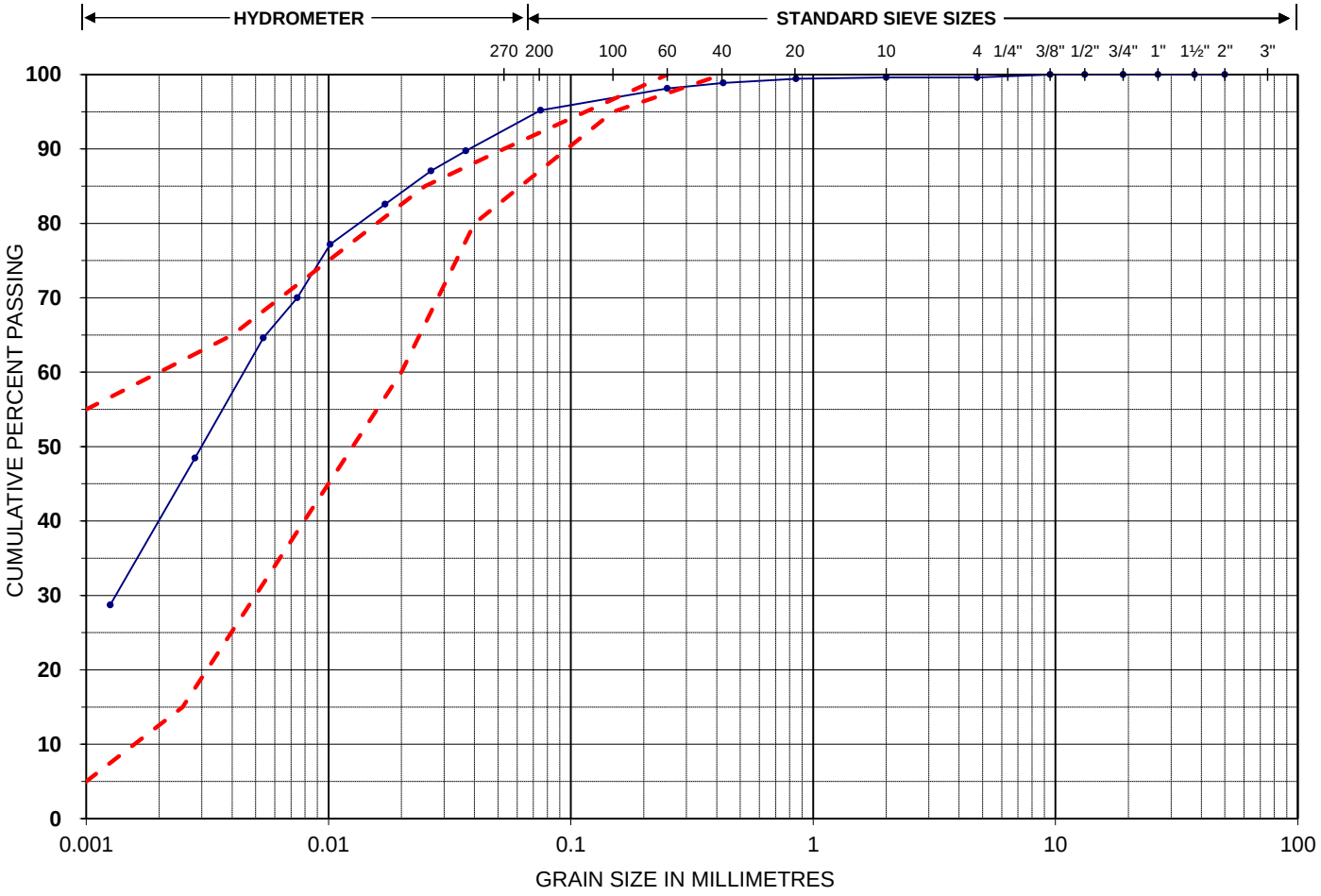
Project Name: Osaca (11056) **Project No.:** 22-154 **Sample Date:** 23-Sep-22

Borehole/Test Pit ID.: TP22-08 **Sample No./Depth:** GS2 **LAB ID:** 22HYD-228



Silt or Clay	Sand	Gravel

OH envelope T > 50 min/cm

Estimated T > 50 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	100.0
9.5	100.0
4.750	99.6
2.000	99.6
0.850	99.4
0.425	98.9
0.250	98.1
0.075	95.2

Hydrometer (mm)	% Passing
0.037	89.7
0.026	87.0
0.017	82.6
0.010	77.2
0.007	70.0
0.005	64.6
0.003	48.5
0.001	28.7

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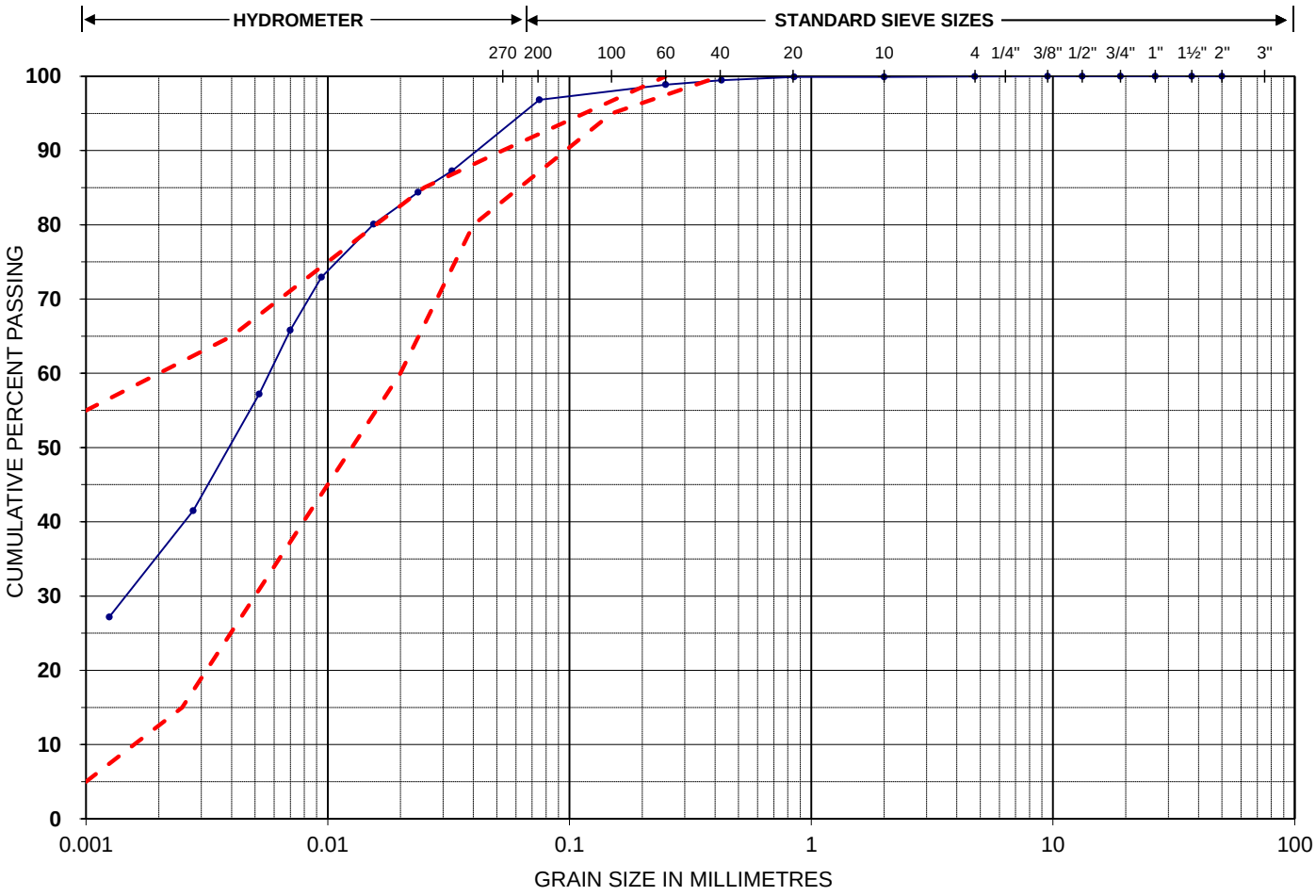
Project Name: Osaca (11056) **Project No.:** 22-154 **Sample Date:** 23-Sep-22

Borehole/Test Pit ID.: TP22-10 **Sample No./Depth:** GS2 **LAB ID:** 22HYD-229



Silt or Clay	Sand	Gravel

OH envelope T > 50 min/cm

Estimated T > 50 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	100.0
9.5	100.0
4.750	100.0
2.000	99.9
0.850	99.9
0.425	99.5
0.250	98.9
0.075	96.8

Hydrometer (mm)	% Passing
0.033	87.2
0.024	84.4
0.015	80.1
0.009	72.9
0.007	65.8
0.005	57.2
0.003	41.5
0.001	27.2

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PARTICLE SIZE DISTRIBUTION
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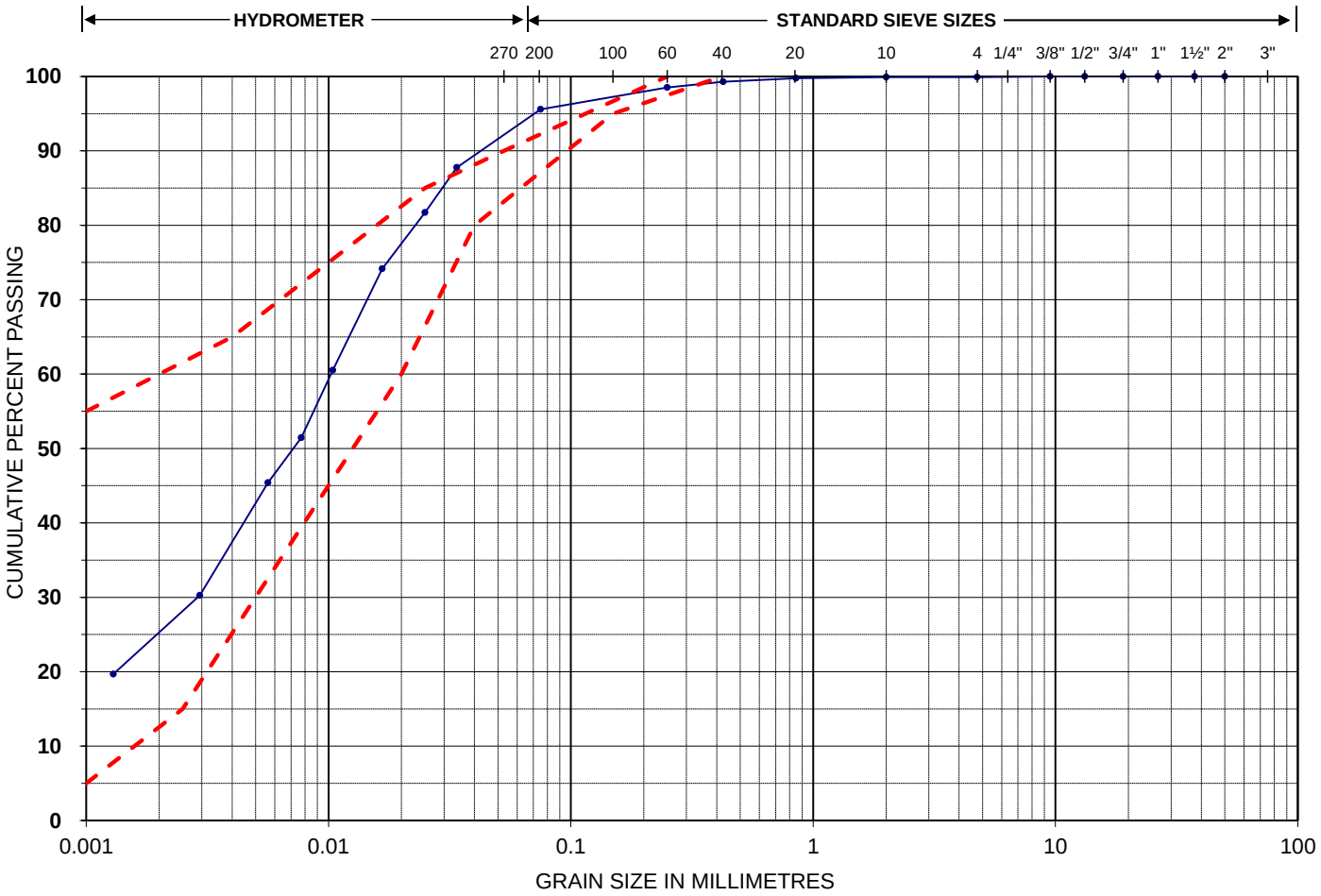
Project Name: Osaca (11056) **Project No.:** 22-154 **Sample Date:** 23-Sep-22

Borehole/Test Pit ID.: TP22-11 **Sample No./Depth:** GS3 **LAB ID:** 22HYD-230



Silt or Clay	Sand	Gravel

OH envelope T > 50 min/cm

Estimated T > 50 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	100.0
9.5	100.0
4.750	99.9
2.000	99.9
0.850	99.8
0.425	99.3
0.250	98.5
0.075	95.6

Hydrometer (mm)	% Passing
0.034	87.8
0.025	81.7
0.017	74.1
0.010	60.5
0.008	51.4
0.006	45.4
0.003	30.3
0.001	19.7

Appendix D

Infiltration Graphs

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	26-Sep-22
Test ID:	INF-01	**Start Time:**	12:30 PM
		Test No.	1

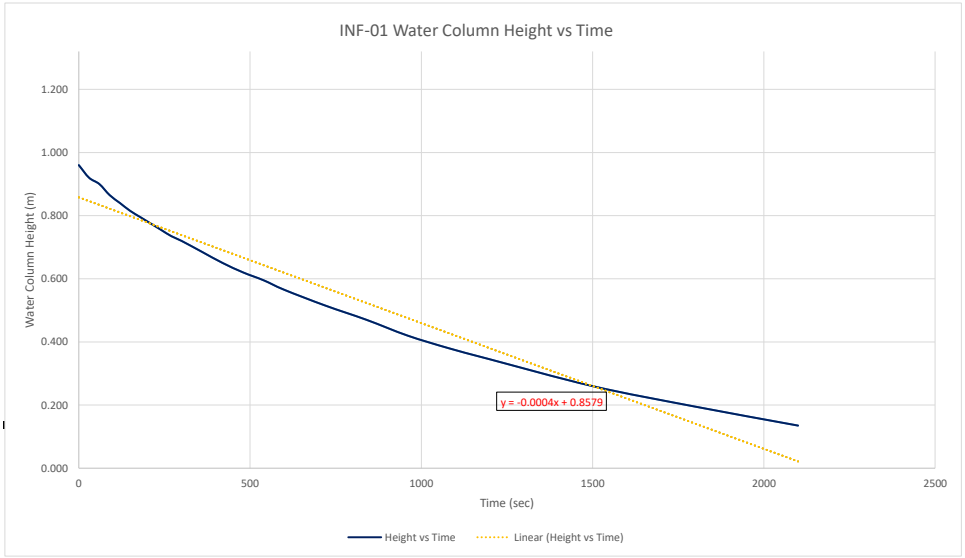
Depth of Test Pit (m):	1.4	**Pipe Stickup (m):**	0.34	**Total Pipe Length(m):**	1.56	

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infiltration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.600	0.960	-	--	--
30	30	0.640	0.92	0.040	1.333E-03	1.333E-03
60	30	0.660	0.90	0.020	6.667E-04	1.000E-03
90	30	0.695	0.87	0.035	1.167E-03	1.056E-03
120	30	0.720	0.84	0.025	8.333E-04	1.000E-03
150	30	0.745	0.82	0.025	8.333E-04	9.667E-04
180	30	0.765	0.80	0.020	6.667E-04	9.167E-04
210	30	0.785	0.78	0.020	6.667E-04	8.810E-04
240	30	0.805	0.76	0.020	6.667E-04	8.542E-04
270	30	0.825	0.74	0.020	6.667E-04	8.333E-04
300	30	0.840	0.72	0.015	5.000E-04	8.000E-04
360	60	0.875	0.69	0.035	5.833E-04	7.639E-04
420	60	0.910	0.65	0.035	5.833E-04	7.381E-04
480	60	0.940	0.62	0.030	5.000E-04	7.083E-04
540	60	0.965	0.60	0.025	4.167E-04	6.759E-04
600	60	0.995	0.57	0.030	5.000E-04	6.583E-04
720	120	1.045	0.52	0.050	4.167E-04	6.181E-04
840	120	1.090	0.47	0.045	3.750E-04	5.833E-04
960	120	1.140	0.42	0.050	4.167E-04	5.625E-04
1,080	120	1.180	0.38	0.040	3.333E-04	5.370E-04
1,200	120	1.215	0.35	0.035	2.917E-04	5.125E-04
1,500	300	1.300	0.26	0.085	2.833E-04	4.667E-04
1,800	300	1.365	0.20	0.065	2.167E-04	4.250E-04
2,100	300	1.425	0.14	0.060	2.000E-04	3.929E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	1.33E-03	1.33E+00	4800
Minimum Infiltration Rate Between Sampling Intervals -	2.00E-04	2.00E-01	720
Median Infiltration Rate Between Sampling Intervals -	5.00E-04	5.00E-01	1800
Average Infiltration Rate Between Sampling Intervals -	**5.70E-04**	**5.70E-01**	**2053**
Cumulative Infiltration Rate for Entire Data Set -	**3.93E-04**	**3.93E-01**	**1414**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.39**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**1414**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.42**



		Test 1 - Observed
Test Duration (seconds)		**2,100**
Total Drop Distance (mm)		**825**
Total Number of Measured Intervals		**24**
Infiltration Rate (mm/sec) - Test Average		**0.39**
Infiltration Rate (mm/hour) - Test Average		**1414**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.42**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-02	**Start Time:**	10:40 AM
		Test No.	1

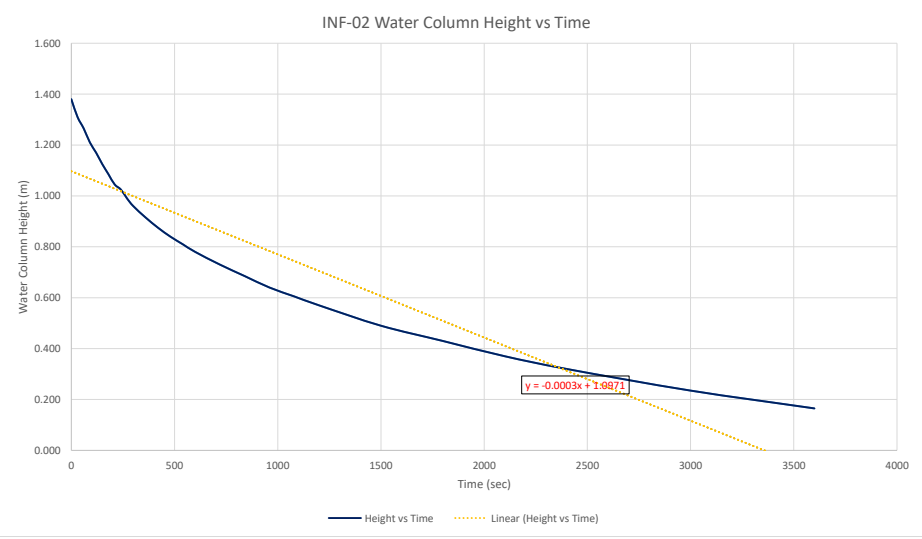
Depth of Test Pit (m):	1	**Pipe Stickup (m):**	1.245	**Total Pipe Length(m):**	2.41	

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	1.025	1.380	-	--	--
30	30	1.095	1.31	0.070	2.333E-03	2.333E-03
60	30	1.140	1.27	0.045	1.500E-03	1.917E-03
90	30	1.195	1.21	0.055	1.833E-03	1.889E-03
120	30	1.235	1.17	0.040	1.333E-03	1.750E-03
150	30	1.280	1.13	0.045	1.500E-03	1.700E-03
180	30	1.320	1.09	0.040	1.333E-03	1.639E-03
210	30	1.360	1.05	0.040	1.333E-03	1.595E-03
240	30	1.380	1.03	0.020	6.667E-04	1.479E-03
270	30	1.415	0.99	0.035	1.167E-03	1.444E-03
300	30	1.445	0.96	0.030	1.000E-03	1.400E-03
360	60	1.490	0.92	0.045	7.500E-04	1.292E-03
420	60	1.530	0.88	0.040	6.667E-04	1.202E-03
480	60	1.565	0.84	0.035	5.833E-04	1.125E-03
540	60	1.595	0.81	0.030	5.000E-04	1.056E-03
600	60	1.625	0.78	0.030	5.000E-04	1.000E-03
720	120	1.675	0.73	0.050	4.167E-04	9.028E-04
840	120	1.720	0.69	0.045	3.750E-04	8.274E-04
960	120	1.765	0.64	0.045	3.750E-04	7.708E-04
1,080	120	1.800	0.61	0.035	2.917E-04	7.176E-04
1,200	120	1.835	0.57	0.035	2.917E-04	6.750E-04
1,500	300	1.915	0.49	0.080	2.667E-04	5.933E-04
1,800	300	1.975	0.43	0.060	2.000E-04	5.278E-04
2,100	300	2.035	0.37	0.060	2.000E-04	4.810E-04
2,400	300	2.085	0.32	0.050	1.667E-04	4.417E-04
3,000	600	2.170	0.24	0.085	1.417E-04	3.817E-04
3,600	600	2.240	0.17	0.070	1.167E-04	3.375E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	2.33E-03	2.33E+00	8400
Minimum Infiltration Rate Between Sampling Intervals -	1.17E-04	1.17E-01	420
Median Infiltration Rate Between Sampling Intervals -	5.42E-04	5.42E-01	1950
Average Infiltration Rate Between Sampling Intervals -	**7.63E-04**	**7.63E-01**	**2747**
Cumulative Infiltration Rate for Entire Data Set -	**3.38E-04**	**3.38E-01**	**1215**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.34**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**1215**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.49**



		Test 1 - Observed
Test Duration (seconds)		**3,600**
Total Drop Distance (mm)		**1215**
Total Number of Measured Intervals		**27**
Infiltration Rate (mm/sec) - Test Average		**0.34**
Infiltration Rate (mm/hour) - Test Average		**1215**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.49**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-03	**Start Time:**	1:44 PM
		Test No.	1

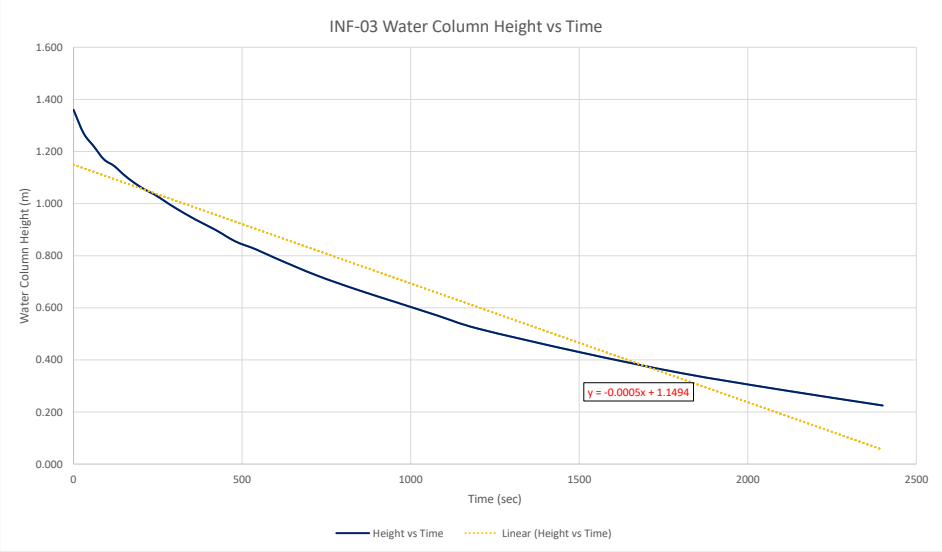
Depth of Test Pit (m):	0.9	**Pipe Stickup (m):**	1.17	**Total Pipe Length(m):**	2.27

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.910	1.360	-	--	--
30	30	1.000	1.27	0.090	3.000E-03	3.000E-03
60	30	1.050	1.22	0.050	1.667E-03	2.333E-03
90	30	1.100	1.17	0.050	1.667E-03	2.111E-03
120	30	1.125	1.15	0.025	8.333E-04	1.792E-03
150	30	1.160	1.11	0.035	1.167E-03	1.667E-03
180	30	1.190	1.08	0.030	1.000E-03	1.556E-03
210	30	1.215	1.06	0.025	8.333E-04	1.452E-03
240	30	1.235	1.04	0.020	6.667E-04	1.354E-03
270	30	1.260	1.01	0.025	8.333E-04	1.296E-03
300	30	1.285	0.99	0.025	8.333E-04	1.250E-03
360	60	1.330	0.94	0.045	7.500E-04	1.167E-03
420	60	1.370	0.90	0.040	6.667E-04	1.095E-03
480	60	1.415	0.86	0.045	7.500E-04	1.052E-03
540	60	1.445	0.83	0.030	5.000E-04	9.907E-04
600	60	1.480	0.79	0.035	5.833E-04	9.500E-04
720	120	1.545	0.73	0.065	5.417E-04	8.819E-04
840	120	1.600	0.67	0.055	4.583E-04	8.214E-04
960	120	1.650	0.62	0.050	4.167E-04	7.708E-04
1,080	120	1.700	0.57	0.050	4.167E-04	7.315E-04
1,200	120	1.750	0.52	0.050	4.167E-04	7.000E-04
1,500	300	1.840	0.43	0.090	3.000E-04	6.200E-04
1,800	300	1.920	0.35	0.080	2.667E-04	5.611E-04
2,100	300	1.985	0.29	0.065	2.167E-04	5.119E-04
2,400	300	2.045	0.23	0.060	2.000E-04	4.729E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	3.00E-03	3.00E+00	10800
Minimum Infiltration Rate Between Sampling Intervals -	2.00E-04	2.00E-01	720
Median Infiltration Rate Between Sampling Intervals -	6.67E-04	6.67E-01	2400
Average Infiltration Rate Between Sampling Intervals -	**7.91E-04**	**7.91E-01**	**2848**
Cumulative Infiltration Rate for Entire Data Set -	**4.73E-04**	**4.73E-01**	**1703**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.47**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**1703**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.35**



		Test 1 - Observed
Test Duration (seconds)		**2,400**
Total Drop Distance (mm)		**1135**
Total Number of Measured Intervals		**25**
Infiltration Rate (mm/sec) - Test Average		**0.47**
Infiltration Rate (mm/hour) - Test Average		**1703**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.35**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-05	**Start Time:**	8:02 AM
		Test No.	1

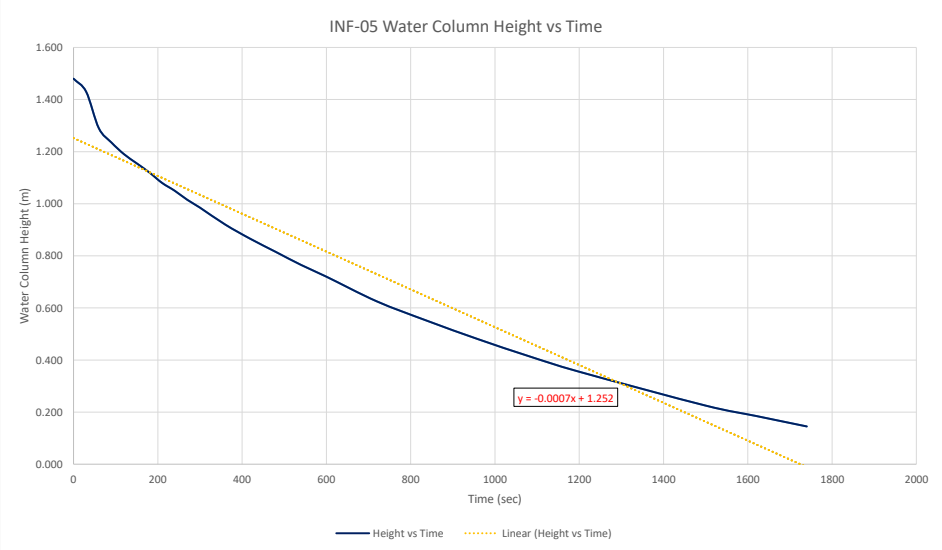
Depth of Test Pit (m):	1.14	**Pipe Stickup (m):**	1.37	**Total Pipe Length(m):**	2.38	

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.900	1.480	-	--	--
30	30	0.950	1.43	0.050	1.667E-03	1.667E-03
60	30	1.090	1.29	0.140	4.667E-03	3.167E-03
90	30	1.145	1.24	0.055	1.833E-03	2.722E-03
120	30	1.190	1.19	0.045	1.500E-03	2.417E-03
150	30	1.225	1.16	0.035	1.167E-03	2.167E-03
180	30	1.260	1.12	0.035	1.167E-03	2.000E-03
210	30	1.300	1.08	0.040	1.333E-03	1.905E-03
240	30	1.330	1.05	0.030	1.000E-03	1.792E-03
270	30	1.365	1.02	0.035	1.167E-03	1.722E-03
300	30	1.395	0.99	0.030	1.000E-03	1.650E-03
360	60	1.460	0.92	0.065	1.083E-03	1.556E-03
420	60	1.515	0.87	0.055	9.167E-04	1.464E-03
480	60	1.565	0.82	0.050	8.333E-04	1.385E-03
540	60	1.615	0.77	0.050	8.333E-04	1.324E-03
600	60	1.660	0.72	0.045	7.500E-04	1.267E-03
720	120	1.755	0.63	0.095	7.917E-04	1.188E-03
840	120	1.830	0.55	0.075	6.250E-04	1.107E-03
960	120	1.900	0.48	0.070	5.833E-04	1.042E-03
1,080	120	1.965	0.42	0.065	5.417E-04	9.861E-04
1,200	120	2.025	0.36	0.060	5.000E-04	9.375E-04
1,500	300	2.155	0.23	0.130	4.333E-04	8.367E-04
1,620	120	2.195	0.19	0.040	3.333E-04	7.994E-04
1,740	120	2.235	0.15	0.040	3.333E-04	7.672E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	4.67E-03	4.67E+00	16800
Minimum Infiltration Rate Between Sampling Intervals -	3.33E-04	3.33E-01	1200
Median Infiltration Rate Between Sampling Intervals -	9.17E-04	9.17E-01	3300
Average Infiltration Rate Between Sampling Intervals -	**1.09E-03**	**1.09E+00**	**3922**
Cumulative Infiltration Rate for Entire Data Set -	**7.67E-04**	**7.67E-01**	**2762**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.77**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**2762**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.22**



		Test 1 - Observed
Test Duration (seconds)		**1,740**
Total Drop Distance (mm)		**1335**
Total Number of Measured Intervals		**24**
Infiltration Rate (mm/sec) - Test Average		**0.77**
Infiltration Rate (mm/hour) - Test Average		**2762**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.22**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-06	**Start Time:**	9:04 AM
		Test No.	1

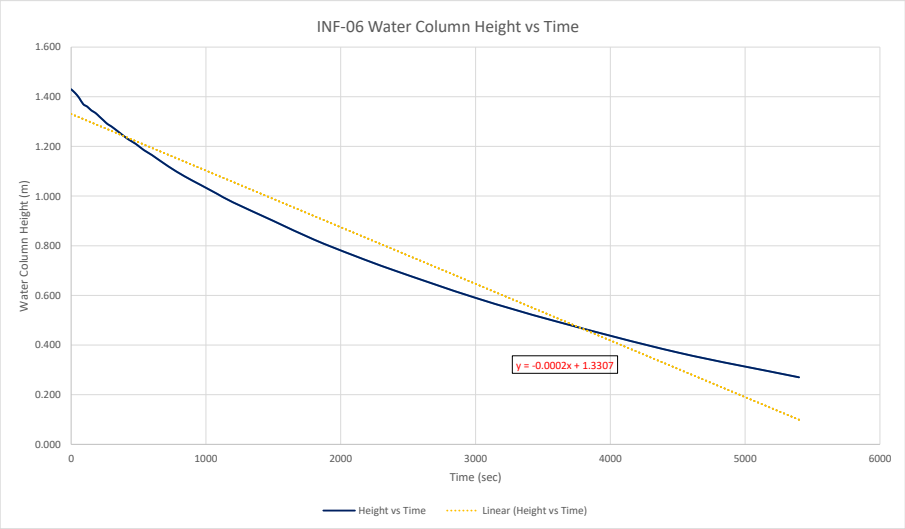
Depth of Test Pit (m):	1.1	**Pipe Stickup (m):**	1.165	**Total Pipe Length(m):**	2.27

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infiltration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.840	1.430	-	--	--
30	30	0.855	1.42	0.015	5.000E-04	5.000E-04
60	30	0.875	1.40	0.020	6.667E-04	5.833E-04
90	30	0.900	1.37	0.025	8.333E-04	6.667E-04
120	30	0.910	1.36	0.010	3.333E-04	5.833E-04
150	30	0.925	1.35	0.015	5.000E-04	5.667E-04
180	30	0.935	1.34	0.010	3.333E-04	5.278E-04
210	30	0.950	1.32	0.015	5.000E-04	5.238E-04
240	30	0.965	1.31	0.015	5.000E-04	5.208E-04
270	30	0.980	1.29	0.015	5.000E-04	5.185E-04
300	30	0.990	1.28	0.010	3.333E-04	5.000E-04
360	60	1.015	1.26	0.025	4.167E-04	4.861E-04
420	60	1.040	1.23	0.025	4.167E-04	4.762E-04
480	60	1.060	1.21	0.020	3.333E-04	4.583E-04
540	60	1.085	1.19	0.025	4.167E-04	4.537E-04
600	60	1.105	1.17	0.020	3.333E-04	4.417E-04
720	120	1.150	1.12	0.045	3.750E-04	4.306E-04
840	120	1.190	1.08	0.040	3.333E-04	4.167E-04
960	120	1.225	1.05	0.035	2.917E-04	4.010E-04
1,080	120	1.260	1.01	0.035	2.917E-04	3.889E-04
1,200	120	1.295	0.98	0.035	2.917E-04	3.792E-04
1,500	300	1.370	0.90	0.075	2.500E-04	3.533E-04
1,800	300	1.445	0.83	0.075	2.500E-04	3.361E-04
2,100	300	1.510	0.76	0.065	2.167E-04	3.190E-04
2,400	300	1.570	0.70	0.060	2.000E-04	3.042E-04
3,000	600	1.680	0.59	0.110	1.833E-04	2.800E-04
3,600	600	1.775	0.50	0.095	1.583E-04	2.597E-04
4,500	900	1.900	0.37	0.125	1.389E-04	2.356E-04
5,400	900	2.000	0.27	0.100	1.111E-04	2.148E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	8.33E-04	8.33E-01	3000
Minimum Infiltration Rate Between Sampling Intervals -	1.11E-04	1.11E-01	400
Median Infiltration Rate Between Sampling Intervals -	3.33E-04	3.33E-01	1200
Average Infiltration Rate Between Sampling Intervals -	**3.57E-04**	**3.57E-01**	**1287**
Cumulative Infiltration Rate for Entire Data Set -	**2.15E-04**	**2.15E-01**	**773**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.21**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**773**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.78**



		Test 1 - Observed
Test Duration (seconds)		**5,400**
Total Drop Distance (mm)		**1160**
Total Number of Measured Intervals		**29**
Infiltration Rate (mm/sec) - Test Average		**0.21**
Infiltration Rate (mm/hour) - Test Average		**773**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.78**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-07	**Start Time:**	4:07 PM
		Test No.	1

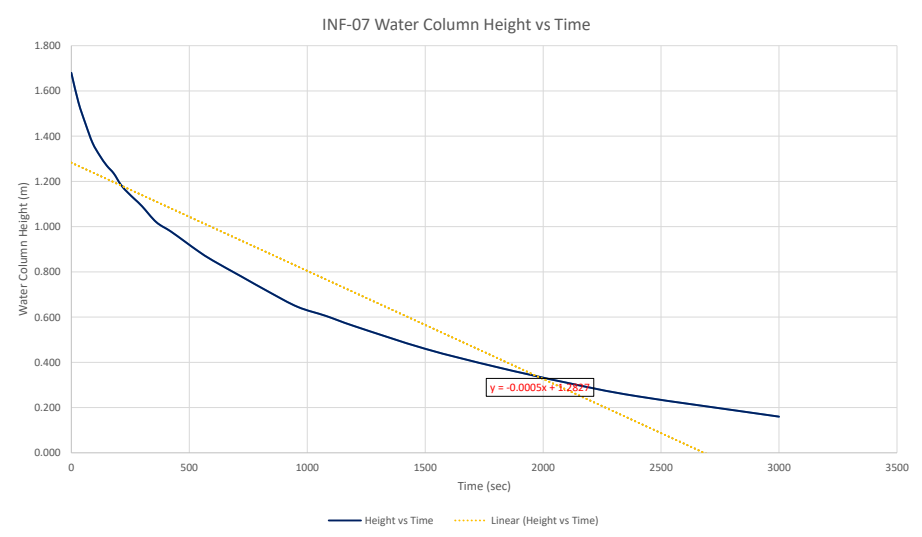
Depth of Test Pit (m):	0.97	**Pipe Stickup (m):**	1.41	**Total Pipe Length(m):**	2.38

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.700	1.680	-	--	--
30	30	0.830	1.55	0.130	4.333E-03	4.333E-03
60	30	0.925	1.46	0.095	3.167E-03	3.750E-03
90	30	1.010	1.37	0.085	2.833E-03	3.444E-03
120	30	1.065	1.32	0.055	1.833E-03	3.042E-03
150	30	1.110	1.27	0.045	1.500E-03	2.733E-03
180	30	1.145	1.24	0.035	1.167E-03	2.472E-03
210	30	1.195	1.19	0.050	1.667E-03	2.357E-03
240	30	1.230	1.15	0.035	1.167E-03	2.208E-03
270	30	1.260	1.12	0.030	1.000E-03	2.074E-03
300	30	1.290	1.09	0.030	1.000E-03	1.967E-03
360	60	1.360	1.02	0.070	1.167E-03	1.833E-03
420	60	1.400	0.98	0.040	6.667E-04	1.667E-03
480	60	1.445	0.94	0.045	7.500E-04	1.552E-03
540	60	1.490	0.89	0.045	7.500E-04	1.463E-03
600	60	1.530	0.85	0.040	6.667E-04	1.383E-03
720	120	1.600	0.78	0.070	5.833E-04	1.250E-03
840	120	1.670	0.71	0.070	5.833E-04	1.155E-03
960	120	1.735	0.65	0.065	5.417E-04	1.078E-03
1,080	120	1.775	0.61	0.040	3.333E-04	9.954E-04
1,200	120	1.820	0.56	0.045	3.750E-04	9.333E-04
1,500	300	1.920	0.46	0.100	3.333E-04	8.133E-04
1,800	300	2.000	0.38	0.080	2.667E-04	7.222E-04
2,100	300	2.070	0.31	0.070	2.333E-04	6.524E-04
2,400	300	2.130	0.25	0.060	2.000E-04	5.958E-04
3,000	600	2.220	0.16	0.090	1.500E-04	5.067E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	4.33E-03	4.33E+00	15600
Minimum Infiltration Rate Between Sampling Intervals -	1.50E-04	1.50E-01	540
Median Infiltration Rate Between Sampling Intervals -	7.50E-04	7.50E-01	2700
Average Infiltration Rate Between Sampling Intervals -	**1.09E-03**	**1.09E+00**	**3926**
Cumulative Infiltration Rate for Entire Data Set -	**5.07E-04**	**5.07E-01**	**1824**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.51**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**1824**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.33**



		Test 1 - Observed
Test Duration (seconds)		**3,000**
Total Drop Distance (mm)		**1520**
Total Number of Measured Intervals		**26**
Infiltration Rate (mm/sec) - Test Average		**0.51**
Infiltration Rate (mm/hour) - Test Average		**1824**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.33**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-08-A	**Start Time:**	12:08 PM
		Test No.	1

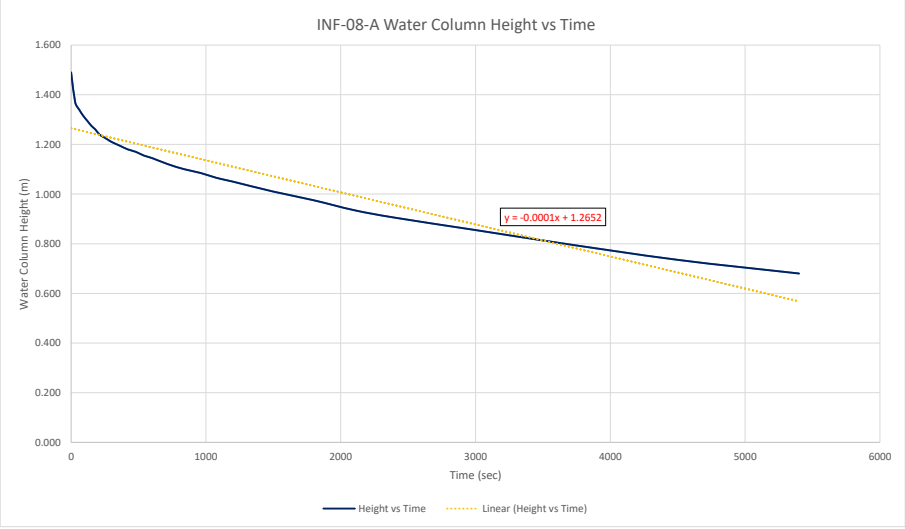
Depth of Test Pit (m):	0.55	**Pipe Stickup (m):**	0.945	**Total Pipe Length(m):**	1.56

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infiltration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.070	1.490	-	--	--
30	30	0.190	1.37	0.120	4.000E-03	4.000E-03
60	30	0.220	1.34	0.030	1.000E-03	2.500E-03
90	30	0.245	1.32	0.025	8.333E-04	1.944E-03
120	30	0.265	1.30	0.020	6.667E-04	1.625E-03
150	30	0.285	1.28	0.020	6.667E-04	1.433E-03
180	30	0.300	1.26	0.015	5.000E-04	1.278E-03
210	30	0.320	1.24	0.020	6.667E-04	1.190E-03
240	30	0.330	1.23	0.010	3.333E-04	1.083E-03
270	30	0.340	1.22	0.010	3.333E-04	1.000E-03
300	30	0.350	1.21	0.010	3.333E-04	9.333E-04
360	60	0.365	1.20	0.015	2.500E-04	8.194E-04
420	60	0.380	1.18	0.015	2.500E-04	7.381E-04
480	60	0.390	1.17	0.010	1.667E-04	6.667E-04
540	60	0.405	1.16	0.015	2.500E-04	6.204E-04
600	60	0.415	1.15	0.010	1.667E-04	5.750E-04
720	120	0.440	1.12	0.025	2.083E-04	5.139E-04
840	120	0.460	1.10	0.020	1.667E-04	4.643E-04
960	120	0.475	1.09	0.015	1.250E-04	4.219E-04
1,080	120	0.495	1.07	0.020	1.667E-04	3.935E-04
1,200	120	0.510	1.05	0.015	1.250E-04	3.667E-04
1,500	300	0.550	1.01	0.040	1.333E-04	3.200E-04
1,800	300	0.585	0.98	0.035	1.167E-04	2.861E-04
2,100	300	0.625	0.94	0.040	1.333E-04	2.643E-04
2,400	300	0.655	0.91	0.030	1.000E-04	2.438E-04
3,000	600	0.705	0.86	0.050	8.333E-05	2.117E-04
3,600	600	0.755	0.81	0.050	8.333E-05	1.903E-04
4,500	900	0.825	0.74	0.070	7.778E-05	1.678E-04
5,400	900	0.880	0.68	0.055	6.111E-05	1.500E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	4.00E-03	4.00E+00	14400
Minimum Infiltration Rate Between Sampling Intervals -	6.11E-05	6.11E-02	220
Median Infiltration Rate Between Sampling Intervals -	1.88E-04	1.88E-01	675
Average Infiltration Rate Between Sampling Intervals -	**4.28E-04**	**4.28E-01**	**1543**
Cumulative Infiltration Rate for Entire Data Set -	**1.50E-04**	**1.50E-01**	**540**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.15**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**540**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**1.11**



		Test 1 - Observed
Test Duration (seconds)		**5,400**
Total Drop Distance (mm)		**810**
Total Number of Measured Intervals		**29**
Infiltration Rate (mm/sec) - Test Average		**0.15**
Infiltration Rate (mm/hour) - Test Average		**540**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**1.11**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-08-B	**Start Time:**	11:48 AM
		Test No.	1

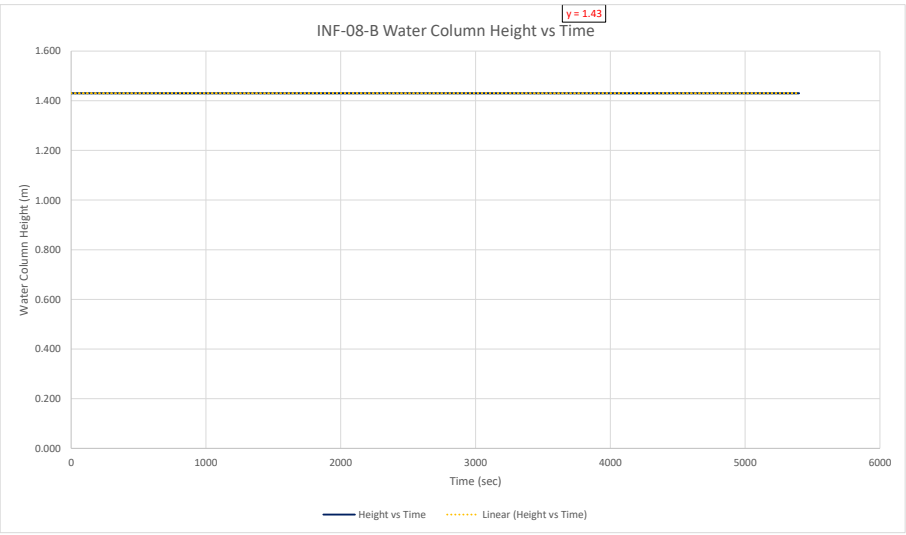
Depth of Test Pit (m):	2.08	**Pipe Stickup (m):**	0.925	**Total Pipe Length(m):**	3.08	

Time* (Seconds)	**Measurement Interval (sec)**	**Depth** (m)**	**Water Column Height (m)**	**Distance dropped per interval (m1)**	**Infiltration Rate per Interval (m/sec)**	**Cumulative Infiltration Rate (m/sec)**
0	-	1.650	1.430	-	--	--
30	30	1.650	1.43	0.000	0.000E+00	0.000E+00
60	30	1.650	1.43	0.000	0.000E+00	0.000E+00
90	30	1.650	1.43	0.000	0.000E+00	0.000E+00
120	30	1.650	1.43	0.000	0.000E+00	0.000E+00
150	30	1.650	1.43	0.000	0.000E+00	0.000E+00
180	30	1.650	1.43	0.000	0.000E+00	0.000E+00
210	30	1.650	1.43	0.000	0.000E+00	0.000E+00
240	30	1.650	1.43	0.000	0.000E+00	0.000E+00
270	30	1.650	1.43	0.000	0.000E+00	0.000E+00
300	30	1.650	1.43	0.000	0.000E+00	0.000E+00
360	60	1.650	1.43	0.000	0.000E+00	0.000E+00
420	60	1.650	1.43	0.000	0.000E+00	0.000E+00
480	60	1.650	1.43	0.000	0.000E+00	0.000E+00
540	60	1.650	1.43	0.000	0.000E+00	0.000E+00
600	60	1.650	1.43	0.000	0.000E+00	0.000E+00
720	120	1.650	1.43	0.000	0.000E+00	0.000E+00
840	120	1.650	1.43	0.000	0.000E+00	0.000E+00
960	120	1.650	1.43	0.000	0.000E+00	0.000E+00
1,080	120	1.650	1.43	0.000	0.000E+00	0.000E+00
1,200	120	1.650	1.43	0.000	0.000E+00	0.000E+00
1,500	300	1.650	1.43	0.000	0.000E+00	0.000E+00
1,800	300	1.650	1.43	0.000	0.000E+00	0.000E+00
2,100	300	1.650	1.43	0.000	0.000E+00	0.000E+00
2,400	300	1.650	1.43	0.000	0.000E+00	0.000E+00
3,000	600	1.650	1.43	0.000	0.000E+00	0.000E+00
3,600	600	1.650	1.43	0.000	0.000E+00	0.000E+00
4,500	900	1.650	1.43	0.000	0.000E+00	0.000E+00
5,400	900	1.650	1.43	0.000	0.000E+00	0.000E+00

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	**(mm/sec)**	**(mm/hour)**
Maximum Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Minimum Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Median Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Average Infiltration Rate Between Sampling Intervals -	**0.00E+00**	**0.00E+00**	**0**
Cumulative Infiltration Rate for Entire Data Set -	**0.00E+00**	**0.00E+00**	**0**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.00**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**0**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**#DIV/0!**



		Test 1 - Observed
Test Duration (seconds)		**5,400**
Total Drop Distance (mm)		**0**
Total Number of Measured Intervals		**29**
Infiltration Rate (mm/sec) - Test Average		**0.00**
Infiltration Rate (mm/hour) - Test Average		**0**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**#DIV/0!**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-11	**Start Time:**	2:53 PM
		Test No.	1

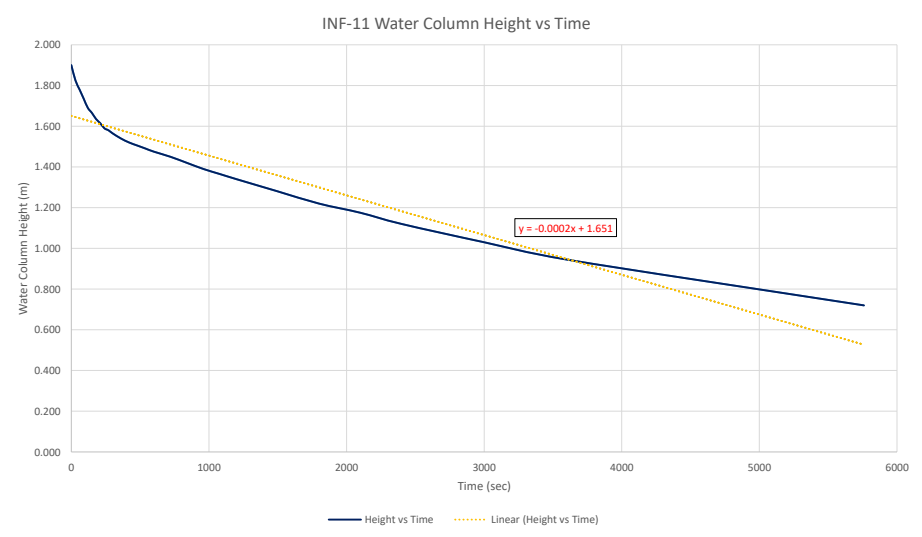
Depth of Test Pit (m):	1.13	**Pipe Stickup (m):**	1.02	**Total Pipe Length(m):**	2.30

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.400	1.900	-	--	--
30	30	0.475	1.83	0.075	2.500E-03	2.500E-03
60	30	0.520	1.78	0.045	1.500E-03	2.000E-03
90	30	0.565	1.74	0.045	1.500E-03	1.833E-03
120	30	0.610	1.69	0.045	1.500E-03	1.750E-03
150	30	0.635	1.67	0.025	8.333E-04	1.567E-03
180	30	0.665	1.64	0.030	1.000E-03	1.472E-03
210	30	0.685	1.62	0.020	6.667E-04	1.357E-03
240	30	0.710	1.59	0.025	8.333E-04	1.292E-03
270	30	0.720	1.58	0.010	3.333E-04	1.185E-03
300	30	0.735	1.57	0.015	5.000E-04	1.117E-03
360	60	0.760	1.54	0.025	4.167E-04	1.000E-03
420	60	0.780	1.52	0.020	3.333E-04	9.048E-04
480	60	0.795	1.51	0.015	2.500E-04	8.229E-04
540	60	0.810	1.49	0.015	2.500E-04	7.593E-04
600	60	0.825	1.48	0.015	2.500E-04	7.083E-04
720	120	0.850	1.45	0.025	2.083E-04	6.250E-04
840	120	0.880	1.42	0.030	2.500E-04	5.714E-04
960	120	0.910	1.39	0.030	2.500E-04	5.313E-04
1,080	120	0.935	1.37	0.025	2.083E-04	4.954E-04
1,200	120	0.960	1.34	0.025	2.083E-04	4.667E-04
1,500	300	1.020	1.28	0.060	2.000E-04	4.133E-04
1,800	300	1.080	1.22	0.060	2.000E-04	3.778E-04
2,100	300	1.125	1.18	0.045	1.500E-04	3.452E-04
2,400	300	1.180	1.12	0.055	1.833E-04	3.250E-04
3,000	600	1.270	1.03	0.090	1.500E-04	2.900E-04
3,600	600	1.355	0.95	0.085	1.417E-04	2.653E-04
5,760	2,160	1.580	0.72	0.225	1.042E-04	2.049E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	2.50E-03	2.50E+00	9000
Minimum Infiltration Rate Between Sampling Intervals -	1.04E-04	1.04E-01	375
Median Infiltration Rate Between Sampling Intervals -	2.50E-04	2.50E-01	900
Average Infiltration Rate Between Sampling Intervals -	**5.53E-04**	**5.53E-01**	**1989**
Cumulative Infiltration Rate for Entire Data Set -	**2.05E-04**	**2.05E-01**	**738**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.20**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**738**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.81**



		Test 1 - Observed
Test Duration (seconds)		**5,760**
Total Drop Distance (mm)		**1180**
Total Number of Measured Intervals		**28**
Infiltration Rate (mm/sec) - Test Average		**0.20**
Infiltration Rate (mm/hour) - Test Average		**738**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.81**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	26-Sep-22
Test ID:	INF-01	**Start Time:**	12:30 PM
		Test No.	1

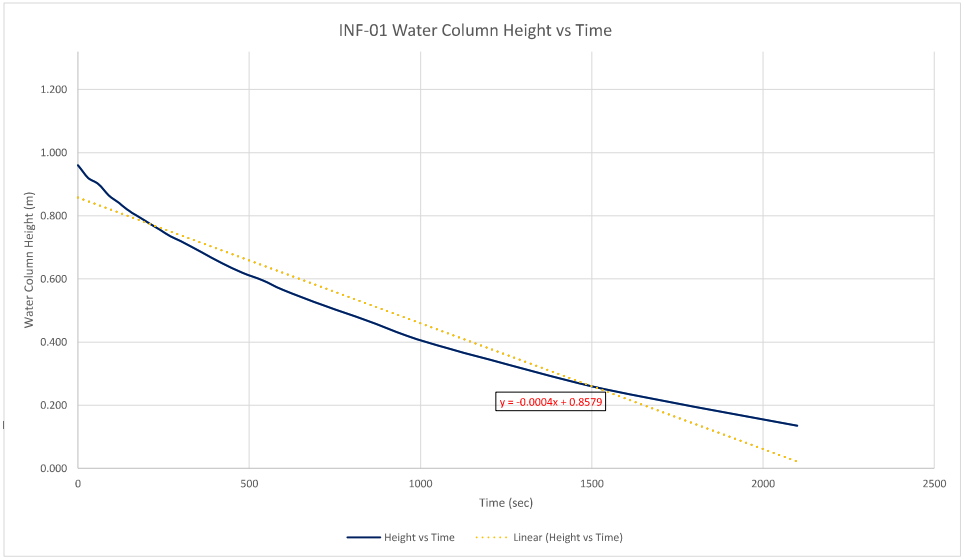
Depth of Test Pit (m):	1.4	**Pipe Stickup (m):**	0.34	**Total Pipe Length(m):**	1.56

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infiltration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.600	0.960	-	--	--
30	30	0.640	0.92	0.040	1.333E-03	1.333E-03
60	30	0.660	0.90	0.020	6.667E-04	1.000E-03
90	30	0.695	0.87	0.035	1.167E-03	1.056E-03
120	30	0.720	0.84	0.025	8.333E-04	1.000E-03
150	30	0.745	0.82	0.025	8.333E-04	9.667E-04
180	30	0.765	0.80	0.020	6.667E-04	9.167E-04
210	30	0.785	0.78	0.020	6.667E-04	8.810E-04
240	30	0.805	0.76	0.020	6.667E-04	8.542E-04
270	30	0.825	0.74	0.020	6.667E-04	8.333E-04
300	30	0.840	0.72	0.015	5.000E-04	8.000E-04
360	60	0.875	0.69	0.035	5.833E-04	7.639E-04
420	60	0.910	0.65	0.035	5.833E-04	7.381E-04
480	60	0.940	0.62	0.030	5.000E-04	7.083E-04
540	60	0.965	0.60	0.025	4.167E-04	6.759E-04
600	60	0.995	0.57	0.030	5.000E-04	6.583E-04
720	120	1.045	0.52	0.050	4.167E-04	6.181E-04
840	120	1.090	0.47	0.045	3.750E-04	5.833E-04
960	120	1.140	0.42	0.050	4.167E-04	5.625E-04
1,080	120	1.180	0.38	0.040	3.333E-04	5.370E-04
1,200	120	1.215	0.35	0.035	2.917E-04	5.125E-04
1,500	300	1.300	0.26	0.085	2.833E-04	4.667E-04
1,800	300	1.365	0.20	0.065	2.167E-04	4.250E-04
2,100	300	1.425	0.14	0.060	2.000E-04	3.929E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	1.33E-03	1.33E+00	4800
Minimum Infiltration Rate Between Sampling Intervals -	2.00E-04	2.00E-01	720
Median Infiltration Rate Between Sampling Intervals -	5.00E-04	5.00E-01	1800
Average Infiltration Rate Between Sampling Intervals -	**5.70E-04**	**5.70E-01**	**2053**
Cumulative Infiltration Rate for Entire Data Set -	**3.93E-04**	**3.93E-01**	**1414**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.39**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**1414**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.42**



		Test 1 - Observed
Test Duration (seconds)		**2,100**
Total Drop Distance (mm)		**825**
Total Number of Measured Intervals		**24**
Infiltration Rate (mm/sec) - Test Average		**0.39**
Infiltration Rate (mm/hour) - Test Average		**1414**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.42**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-02	**Start Time:**	10:40 AM
		Test No.	1

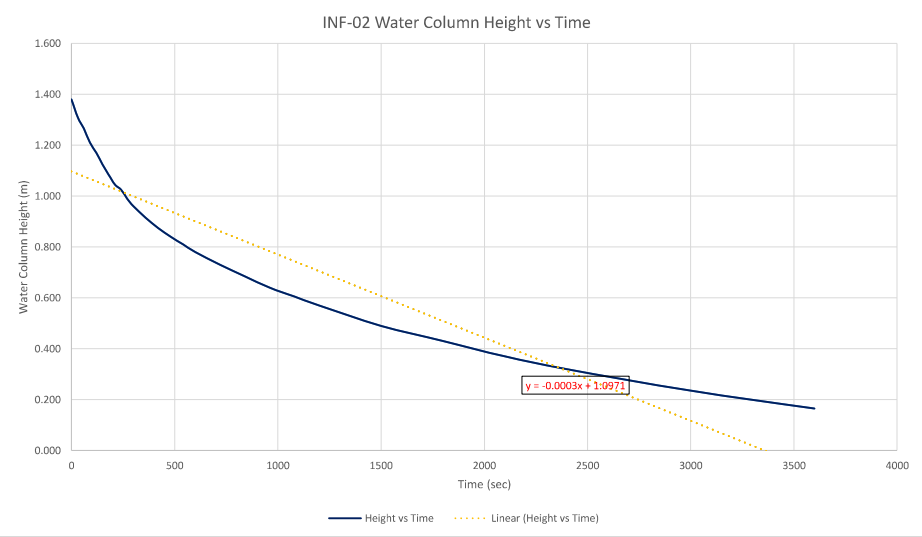
Depth of Test Pit (m):	1	**Pipe Stickup (m):**	1.245	**Total Pipe Length(m):**	2.41	

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	1.025	1.380	-	--	--
30	30	1.095	1.31	0.070	2.333E-03	2.333E-03
60	30	1.140	1.27	0.045	1.500E-03	1.917E-03
90	30	1.195	1.21	0.055	1.833E-03	1.889E-03
120	30	1.235	1.17	0.040	1.333E-03	1.750E-03
150	30	1.280	1.13	0.045	1.500E-03	1.700E-03
180	30	1.320	1.09	0.040	1.333E-03	1.639E-03
210	30	1.360	1.05	0.040	1.333E-03	1.595E-03
240	30	1.380	1.03	0.020	6.667E-04	1.479E-03
270	30	1.415	0.99	0.035	1.167E-03	1.444E-03
300	30	1.445	0.96	0.030	1.000E-03	1.400E-03
360	60	1.490	0.92	0.045	7.500E-04	1.292E-03
420	60	1.530	0.88	0.040	6.667E-04	1.202E-03
480	60	1.565	0.84	0.035	5.833E-04	1.125E-03
540	60	1.595	0.81	0.030	5.000E-04	1.056E-03
600	60	1.625	0.78	0.030	5.000E-04	1.000E-03
720	120	1.675	0.73	0.050	4.167E-04	9.028E-04
840	120	1.720	0.69	0.045	3.750E-04	8.274E-04
960	120	1.765	0.64	0.045	3.750E-04	7.708E-04
1,080	120	1.800	0.61	0.035	2.917E-04	7.176E-04
1,200	120	1.835	0.57	0.035	2.917E-04	6.750E-04
1,500	300	1.915	0.49	0.080	2.667E-04	5.933E-04
1,800	300	1.975	0.43	0.060	2.000E-04	5.278E-04
2,100	300	2.035	0.37	0.060	2.000E-04	4.810E-04
2,400	300	2.085	0.32	0.050	1.667E-04	4.417E-04
3,000	600	2.170	0.24	0.085	1.417E-04	3.817E-04
3,600	600	2.240	0.17	0.070	1.167E-04	3.375E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	2.33E-03	2.33E+00	8400
Minimum Infiltration Rate Between Sampling Intervals -	1.17E-04	1.17E-01	420
Median Infiltration Rate Between Sampling Intervals -	5.42E-04	5.42E-01	1950
Average Infiltration Rate Between Sampling Intervals -	**7.63E-04**	**7.63E-01**	**2747**
Cumulative Infiltration Rate for Entire Data Set -	**3.38E-04**	**3.38E-01**	**1215**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.34**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**1215**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.49**



		Test 1 - Observed
Test Duration (seconds)		**3,600**
Total Drop Distance (mm)		**1215**
Total Number of Measured Intervals		**27**
Infiltration Rate (mm/sec) - Test Average		**0.34**
Infiltration Rate (mm/hour) - Test Average		**1215**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.49**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-03	**Start Time:**	1:44 PM
		Test No.	1

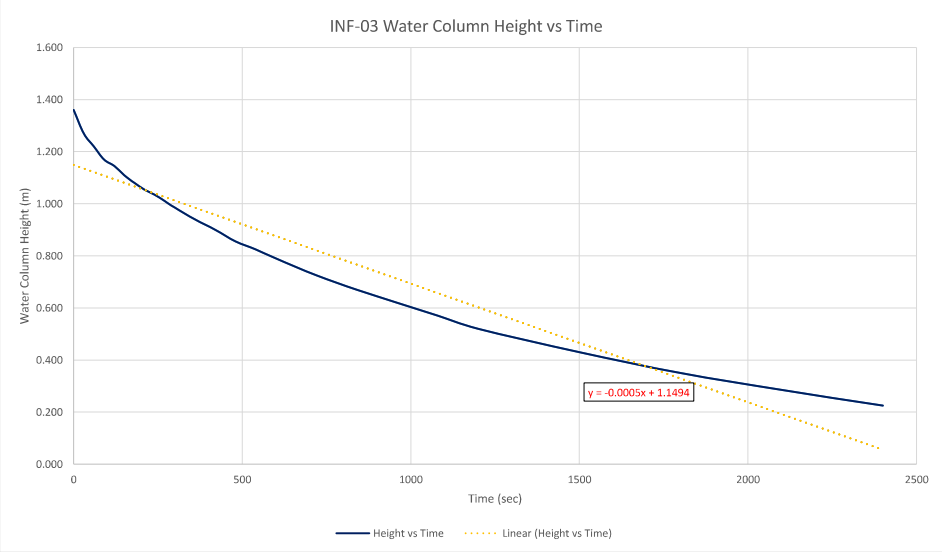
Depth of Test Pit (m):	0.9	**Pipe Stickup (m):**	1.17	**Total Pipe Length(m):**	2.27

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.910	1.360	-	--	--
30	30	1.000	1.27	0.090	3.000E-03	3.000E-03
60	30	1.050	1.22	0.050	1.667E-03	2.333E-03
90	30	1.100	1.17	0.050	1.667E-03	2.111E-03
120	30	1.125	1.15	0.025	8.333E-04	1.792E-03
150	30	1.160	1.11	0.035	1.167E-03	1.667E-03
180	30	1.190	1.08	0.030	1.000E-03	1.556E-03
210	30	1.215	1.06	0.025	8.333E-04	1.452E-03
240	30	1.235	1.04	0.020	6.667E-04	1.354E-03
270	30	1.260	1.01	0.025	8.333E-04	1.296E-03
300	30	1.285	0.99	0.025	8.333E-04	1.250E-03
360	60	1.330	0.94	0.045	7.500E-04	1.167E-03
420	60	1.370	0.90	0.040	6.667E-04	1.095E-03
480	60	1.415	0.86	0.045	7.500E-04	1.052E-03
540	60	1.445	0.83	0.030	5.000E-04	9.907E-04
600	60	1.480	0.79	0.035	5.833E-04	9.500E-04
720	120	1.545	0.73	0.065	5.417E-04	8.819E-04
840	120	1.600	0.67	0.055	4.583E-04	8.214E-04
960	120	1.650	0.62	0.050	4.167E-04	7.708E-04
1,080	120	1.700	0.57	0.050	4.167E-04	7.315E-04
1,200	120	1.750	0.52	0.050	4.167E-04	7.000E-04
1,500	300	1.840	0.43	0.090	3.000E-04	6.200E-04
1,800	300	1.920	0.35	0.080	2.667E-04	5.611E-04
2,100	300	1.985	0.29	0.065	2.167E-04	5.119E-04
2,400	300	2.045	0.23	0.060	2.000E-04	4.729E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	3.00E-03	3.00E+00	10800
Minimum Infiltration Rate Between Sampling Intervals -	2.00E-04	2.00E-01	720
Median Infiltration Rate Between Sampling Intervals -	6.67E-04	6.67E-01	2400
Average Infiltration Rate Between Sampling Intervals -	**7.91E-04**	**7.91E-01**	**2848**
Cumulative Infiltration Rate for Entire Data Set -	**4.73E-04**	**4.73E-01**	**1703**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.47**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**1703**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.35**



		Test 1 - Observed
Test Duration (seconds)		**2,400**
Total Drop Distance (mm)		**1135**
Total Number of Measured Intervals		**25**
Infiltration Rate (mm/sec) - Test Average		**0.47**
Infiltration Rate (mm/hour) - Test Average		**1703**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.35**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-05	**Start Time:**	8:02 AM
		Test No.	1

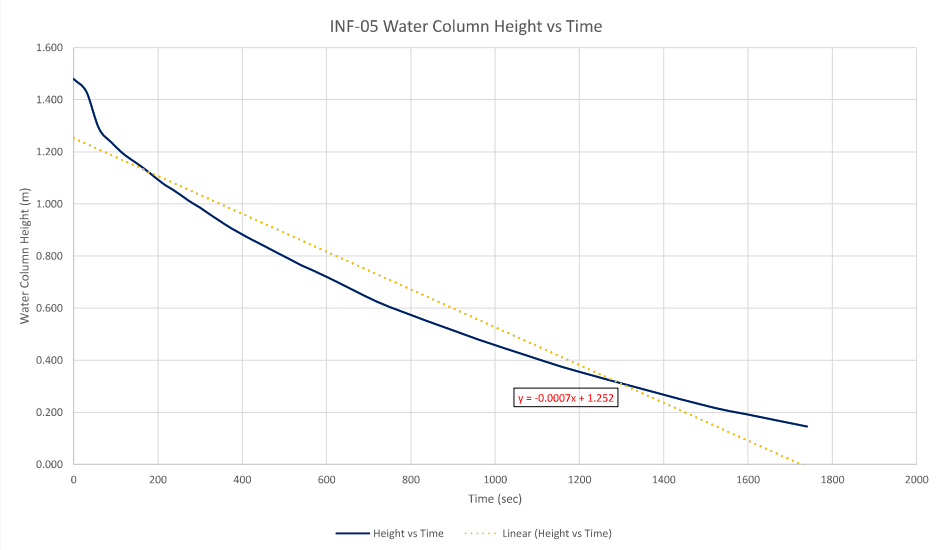
Depth of Test Pit (m):	1.14	**Pipe Stickup (m):**	1.37	**Total Pipe Length(m):**	2.38

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.900	1.480	-	--	--
30	30	0.950	1.43	0.050	1.667E-03	1.667E-03
60	30	1.090	1.29	0.140	4.667E-03	3.167E-03
90	30	1.145	1.24	0.055	1.833E-03	2.722E-03
120	30	1.190	1.19	0.045	1.500E-03	2.417E-03
150	30	1.225	1.16	0.035	1.167E-03	2.167E-03
180	30	1.260	1.12	0.035	1.167E-03	2.000E-03
210	30	1.300	1.08	0.040	1.333E-03	1.905E-03
240	30	1.330	1.05	0.030	1.000E-03	1.792E-03
270	30	1.365	1.02	0.035	1.167E-03	1.722E-03
300	30	1.395	0.99	0.030	1.000E-03	1.650E-03
360	60	1.460	0.92	0.065	1.083E-03	1.556E-03
420	60	1.515	0.87	0.055	9.167E-04	1.464E-03
480	60	1.565	0.82	0.050	8.333E-04	1.385E-03
540	60	1.615	0.77	0.050	8.333E-04	1.324E-03
600	60	1.660	0.72	0.045	7.500E-04	1.267E-03
720	120	1.755	0.63	0.095	7.917E-04	1.188E-03
840	120	1.830	0.55	0.075	6.250E-04	1.107E-03
960	120	1.900	0.48	0.070	5.833E-04	1.042E-03
1,080	120	1.965	0.42	0.065	5.417E-04	9.861E-04
1,200	120	2.025	0.36	0.060	5.000E-04	9.375E-04
1,500	300	2.155	0.23	0.130	4.333E-04	8.367E-04
1,620	120	2.195	0.19	0.040	3.333E-04	7.994E-04
1,740	120	2.235	0.15	0.040	3.333E-04	7.672E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	4.67E-03	4.67E+00	16800
Minimum Infiltration Rate Between Sampling Intervals -	3.33E-04	3.33E-01	1200
Median Infiltration Rate Between Sampling Intervals -	9.17E-04	9.17E-01	3300
Average Infiltration Rate Between Sampling Intervals -	**1.09E-03**	**1.09E+00**	**3922**
Cumulative Infiltration Rate for Entire Data Set -	**7.67E-04**	**7.67E-01**	**2762**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.77**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**2762**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.22**



		Test 1 - Observed
Test Duration (seconds)		**1,740**
Total Drop Distance (mm)		**1335**
Total Number of Measured Intervals		**24**
Infiltration Rate (mm/sec) - Test Average		**0.77**
Infiltration Rate (mm/hour) - Test Average		**2762**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.22**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-06	**Start Time:**	9:04 AM
		Test No.	1

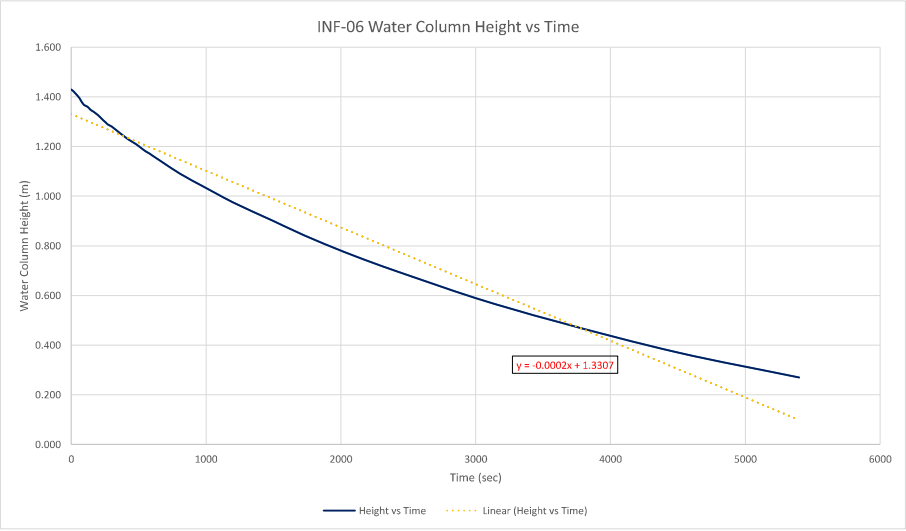
Depth of Test Pit (m):	1.1	**Pipe Stickup (m):**	1.165	**Total Pipe Length(m):**	2.27

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infiltration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.840	1.430	-	--	--
30	30	0.855	1.42	0.015	5.000E-04	5.000E-04
60	30	0.875	1.40	0.020	6.667E-04	5.833E-04
90	30	0.900	1.37	0.025	8.333E-04	6.667E-04
120	30	0.910	1.36	0.010	3.333E-04	5.833E-04
150	30	0.925	1.35	0.015	5.000E-04	5.667E-04
180	30	0.935	1.34	0.010	3.333E-04	5.278E-04
210	30	0.950	1.32	0.015	5.000E-04	5.238E-04
240	30	0.965	1.31	0.015	5.000E-04	5.208E-04
270	30	0.980	1.29	0.015	5.000E-04	5.185E-04
300	30	0.990	1.28	0.010	3.333E-04	5.000E-04
360	60	1.015	1.26	0.025	4.167E-04	4.861E-04
420	60	1.040	1.23	0.025	4.167E-04	4.762E-04
480	60	1.060	1.21	0.020	3.333E-04	4.583E-04
540	60	1.085	1.19	0.025	4.167E-04	4.537E-04
600	60	1.105	1.17	0.020	3.333E-04	4.417E-04
720	120	1.150	1.12	0.045	3.750E-04	4.306E-04
840	120	1.190	1.08	0.040	3.333E-04	4.167E-04
960	120	1.225	1.05	0.035	2.917E-04	4.010E-04
1,080	120	1.260	1.01	0.035	2.917E-04	3.889E-04
1,200	120	1.295	0.98	0.035	2.917E-04	3.792E-04
1,500	300	1.370	0.90	0.075	2.500E-04	3.533E-04
1,800	300	1.445	0.83	0.075	2.500E-04	3.361E-04
2,100	300	1.510	0.76	0.065	2.167E-04	3.190E-04
2,400	300	1.570	0.70	0.060	2.000E-04	3.042E-04
3,000	600	1.680	0.59	0.110	1.833E-04	2.800E-04
3,600	600	1.775	0.50	0.095	1.583E-04	2.597E-04
4,500	900	1.900	0.37	0.125	1.389E-04	2.356E-04
5,400	900	2.000	0.27	0.100	1.111E-04	2.148E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	8.33E-04	8.33E-01	3000
Minimum Infiltration Rate Between Sampling Intervals -	1.11E-04	1.11E-01	400
Median Infiltration Rate Between Sampling Intervals -	3.33E-04	3.33E-01	1200
Average Infiltration Rate Between Sampling Intervals -	**3.57E-04**	**3.57E-01**	**1287**
Cumulative Infiltration Rate for Entire Data Set -	**2.15E-04**	**2.15E-01**	**773**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.21**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**773**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.78**



		Test 1 - Observed
Test Duration (seconds)		**5,400**
Total Drop Distance (mm)		**1160**
Total Number of Measured Intervals		**29**
Infiltration Rate (mm/sec) - Test Average		**0.21**
Infiltration Rate (mm/hour) - Test Average		**773**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.78**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-07	**Start Time:**	4:07 PM
		Test No.	1

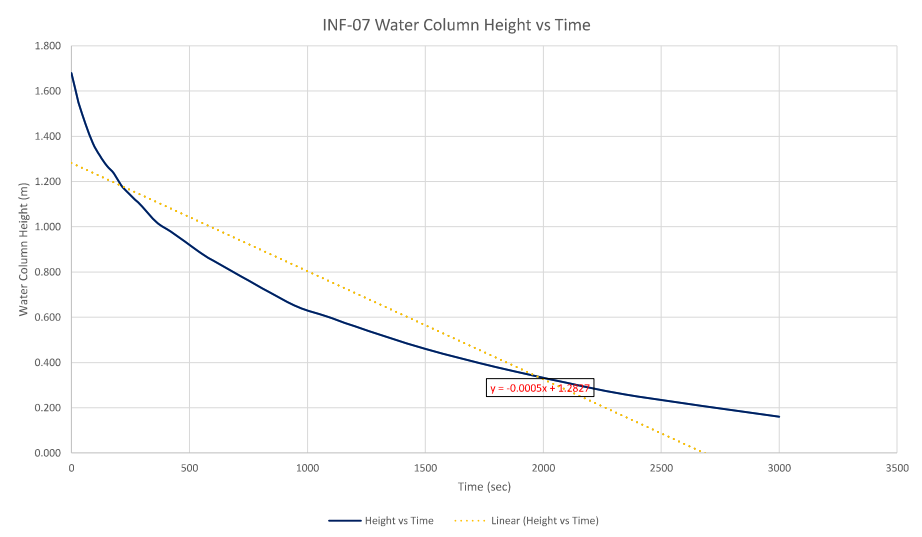
Depth of Test Pit (m):	0.97	**Pipe Stickup (m):**	1.41	**Total Pipe Length(m):**	2.38	

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.700	1.680	-	--	--
30	30	0.830	1.55	0.130	4.333E-03	4.333E-03
60	30	0.925	1.46	0.095	3.167E-03	3.750E-03
90	30	1.010	1.37	0.085	2.833E-03	3.444E-03
120	30	1.065	1.32	0.055	1.833E-03	3.042E-03
150	30	1.110	1.27	0.045	1.500E-03	2.733E-03
180	30	1.145	1.24	0.035	1.167E-03	2.472E-03
210	30	1.195	1.19	0.050	1.667E-03	2.357E-03
240	30	1.230	1.15	0.035	1.167E-03	2.208E-03
270	30	1.260	1.12	0.030	1.000E-03	2.074E-03
300	30	1.290	1.09	0.030	1.000E-03	1.967E-03
360	60	1.360	1.02	0.070	1.167E-03	1.833E-03
420	60	1.400	0.98	0.040	6.667E-04	1.667E-03
480	60	1.445	0.94	0.045	7.500E-04	1.552E-03
540	60	1.490	0.89	0.045	7.500E-04	1.463E-03
600	60	1.530	0.85	0.040	6.667E-04	1.383E-03
720	120	1.600	0.78	0.070	5.833E-04	1.250E-03
840	120	1.670	0.71	0.070	5.833E-04	1.155E-03
960	120	1.735	0.65	0.065	5.417E-04	1.078E-03
1,080	120	1.775	0.61	0.040	3.333E-04	9.954E-04
1,200	120	1.820	0.56	0.045	3.750E-04	9.333E-04
1,500	300	1.920	0.46	0.100	3.333E-04	8.133E-04
1,800	300	2.000	0.38	0.080	2.667E-04	7.222E-04
2,100	300	2.070	0.31	0.070	2.333E-04	6.524E-04
2,400	300	2.130	0.25	0.060	2.000E-04	5.958E-04
3,000	600	2.220	0.16	0.090	1.500E-04	5.067E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	4.33E-03	4.33E+00	15600
Minimum Infiltration Rate Between Sampling Intervals -	1.50E-04	1.50E-01	540
Median Infiltration Rate Between Sampling Intervals -	7.50E-04	7.50E-01	2700
Average Infiltration Rate Between Sampling Intervals -	**1.09E-03**	**1.09E+00**	**3926**
Cumulative Infiltration Rate for Entire Data Set -	**5.07E-04**	**5.07E-01**	**1824**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.51**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**1824**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.33**



		Test 1 - Observed
Test Duration (seconds)		**3,000**
Total Drop Distance (mm)		**1520**
Total Number of Measured Intervals		**26**
Infiltration Rate (mm/sec) - Test Average		**0.51**
Infiltration Rate (mm/hour) - Test Average		**1824**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.33**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-08-A	**Start Time:**	12:08 PM
		Test No.	1

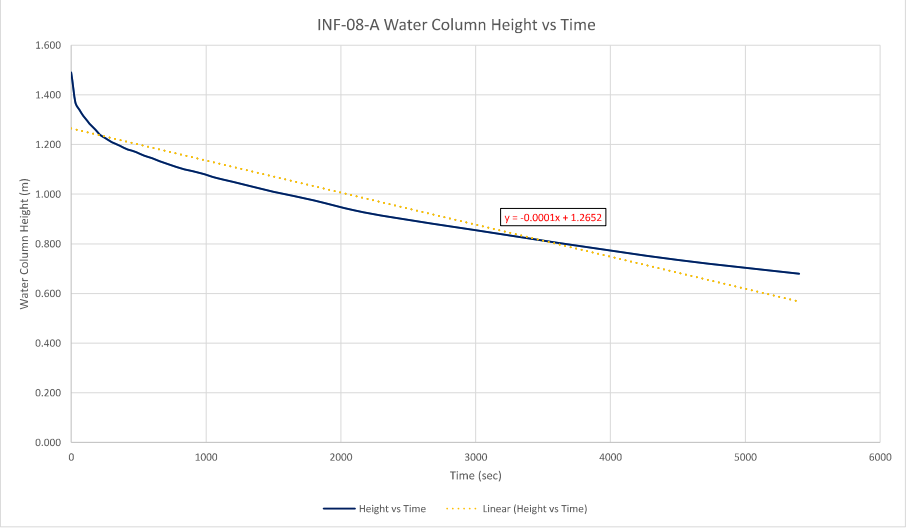
Depth of Test Pit (m):	0.55	**Pipe Stickup (m):**	0.945	**Total Pipe Length(m):**	1.56	

Time* (Seconds)	**Measurement Interval (sec)**	**Depth** (m)**	**Water Column Height (m)**	**Distance dropped per interval (m1)**	**Infiltration Rate per Interval (m/sec)**	**Cumulative Infiltration Rate (m/sec)**
0	-	0.070	1.490	-	--	--
30	30	0.190	1.37	0.120	4.000E-03	4.000E-03
60	30	0.220	1.34	0.030	1.000E-03	2.500E-03
90	30	0.245	1.32	0.025	8.333E-04	1.944E-03
120	30	0.265	1.30	0.020	6.667E-04	1.625E-03
150	30	0.285	1.28	0.020	6.667E-04	1.433E-03
180	30	0.300	1.26	0.015	5.000E-04	1.278E-03
210	30	0.320	1.24	0.020	6.667E-04	1.190E-03
240	30	0.330	1.23	0.010	3.333E-04	1.083E-03
270	30	0.340	1.22	0.010	3.333E-04	1.000E-03
300	30	0.350	1.21	0.010	3.333E-04	9.333E-04
360	60	0.365	1.20	0.015	2.500E-04	8.194E-04
420	60	0.380	1.18	0.015	2.500E-04	7.381E-04
480	60	0.390	1.17	0.010	1.667E-04	6.667E-04
540	60	0.405	1.16	0.015	2.500E-04	6.204E-04
600	60	0.415	1.15	0.010	1.667E-04	5.750E-04
720	120	0.440	1.12	0.025	2.083E-04	5.139E-04
840	120	0.460	1.10	0.020	1.667E-04	4.643E-04
960	120	0.475	1.09	0.015	1.250E-04	4.219E-04
1,080	120	0.495	1.07	0.020	1.667E-04	3.935E-04
1,200	120	0.510	1.05	0.015	1.250E-04	3.667E-04
1,500	300	0.550	1.01	0.040	1.333E-04	3.200E-04
1,800	300	0.585	0.98	0.035	1.167E-04	2.861E-04
2,100	300	0.625	0.94	0.040	1.333E-04	2.643E-04
2,400	300	0.655	0.91	0.030	1.000E-04	2.438E-04
3,000	600	0.705	0.86	0.050	8.333E-05	2.117E-04
3,600	600	0.755	0.81	0.050	8.333E-05	1.903E-04
4,500	900	0.825	0.74	0.070	7.778E-05	1.678E-04
5,400	900	0.880	0.68	0.055	6.111E-05	1.500E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	**(mm/sec)**	**(mm/hour)**
Maximum Infiltration Rate Between Sampling Intervals -	4.00E-03	4.00E+00	14400
Minimum Infiltration Rate Between Sampling Intervals -	6.11E-05	6.11E-02	220
Median Infiltration Rate Between Sampling Intervals -	1.88E-04	1.88E-01	675
Average Infiltration Rate Between Sampling Intervals -	**4.28E-04**	**4.28E-01**	**1543**
Cumulative Infiltration Rate for Entire Data Set -	**1.50E-04**	**1.50E-01**	**540**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.15**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**540**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**1.11**



		Test 1 - Observed
Test Duration (seconds)		**5,400**
Total Drop Distance (mm)		**810**
Total Number of Measured Intervals		**29**
Infiltration Rate (mm/sec) - Test Average		**0.15**
Infiltration Rate (mm/hour) - Test Average		**540**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**1.11**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-08-B	**Start Time:**	11:48 AM
		Test No.	1

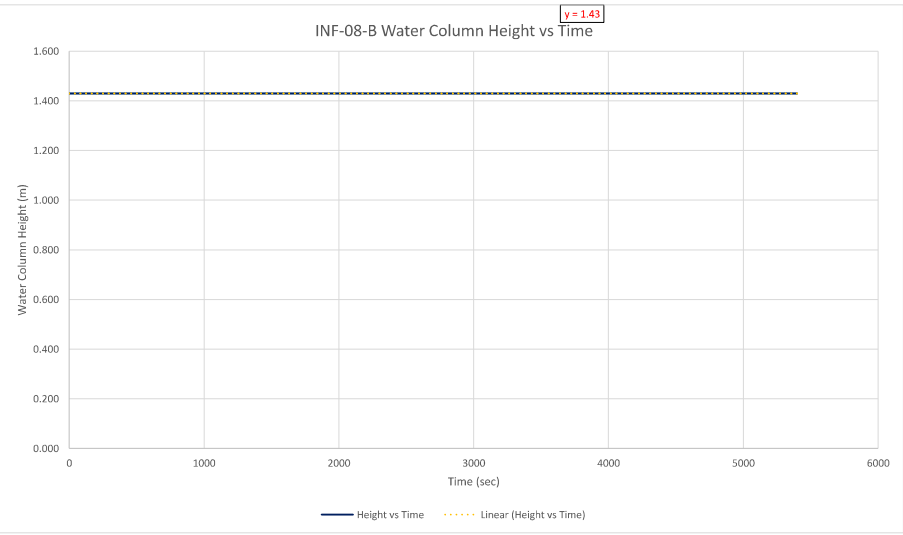
Depth of Test Pit (m):	2.08	**Pipe Stickup (m):**	0.925	**Total Pipe Length(m):**	3.08	

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	1.650	1.430	-	--	--
30	30	1.650	1.43	0.000	0.000E+00	0.000E+00
60	30	1.650	1.43	0.000	0.000E+00	0.000E+00
90	30	1.650	1.43	0.000	0.000E+00	0.000E+00
120	30	1.650	1.43	0.000	0.000E+00	0.000E+00
150	30	1.650	1.43	0.000	0.000E+00	0.000E+00
180	30	1.650	1.43	0.000	0.000E+00	0.000E+00
210	30	1.650	1.43	0.000	0.000E+00	0.000E+00
240	30	1.650	1.43	0.000	0.000E+00	0.000E+00
270	30	1.650	1.43	0.000	0.000E+00	0.000E+00
300	30	1.650	1.43	0.000	0.000E+00	0.000E+00
360	60	1.650	1.43	0.000	0.000E+00	0.000E+00
420	60	1.650	1.43	0.000	0.000E+00	0.000E+00
480	60	1.650	1.43	0.000	0.000E+00	0.000E+00
540	60	1.650	1.43	0.000	0.000E+00	0.000E+00
600	60	1.650	1.43	0.000	0.000E+00	0.000E+00
720	120	1.650	1.43	0.000	0.000E+00	0.000E+00
840	120	1.650	1.43	0.000	0.000E+00	0.000E+00
960	120	1.650	1.43	0.000	0.000E+00	0.000E+00
1,080	120	1.650	1.43	0.000	0.000E+00	0.000E+00
1,200	120	1.650	1.43	0.000	0.000E+00	0.000E+00
1,500	300	1.650	1.43	0.000	0.000E+00	0.000E+00
1,800	300	1.650	1.43	0.000	0.000E+00	0.000E+00
2,100	300	1.650	1.43	0.000	0.000E+00	0.000E+00
2,400	300	1.650	1.43	0.000	0.000E+00	0.000E+00
3,000	600	1.650	1.43	0.000	0.000E+00	0.000E+00
3,600	600	1.650	1.43	0.000	0.000E+00	0.000E+00
4,500	900	1.650	1.43	0.000	0.000E+00	0.000E+00
5,400	900	1.650	1.43	0.000	0.000E+00	0.000E+00

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Minimum Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Median Infiltration Rate Between Sampling Intervals -	0.00E+00	0.00E+00	0
Average Infiltration Rate Between Sampling Intervals -	**0.00E+00**	**0.00E+00**	**0**
Cumulative Infiltration Rate for Entire Data Set -	**0.00E+00**	**0.00E+00**	**0**

In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.00**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**0**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**#DIV/0!**



		Test 1 - Observed
Test Duration (seconds)		**5,400**
Total Drop Distance (mm)		**0**
Total Number of Measured Intervals		**29**
Infiltration Rate (mm/sec) - Test Average		**0.00**
Infiltration Rate (mm/hour) - Test Average		**0**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**#DIV/0!**

IN-SITU INFILTRATION TEST **APPENDIX C**

Project:	Osaca Hillstreet subdivision	**PROJECT NO.:**	11056
Site Location:	5868 County road 65, Osaca, ON	**Date:**	27-Sep-22
Test ID:	INF-11	**Start Time:**	2:53 PM
		Test No.	1

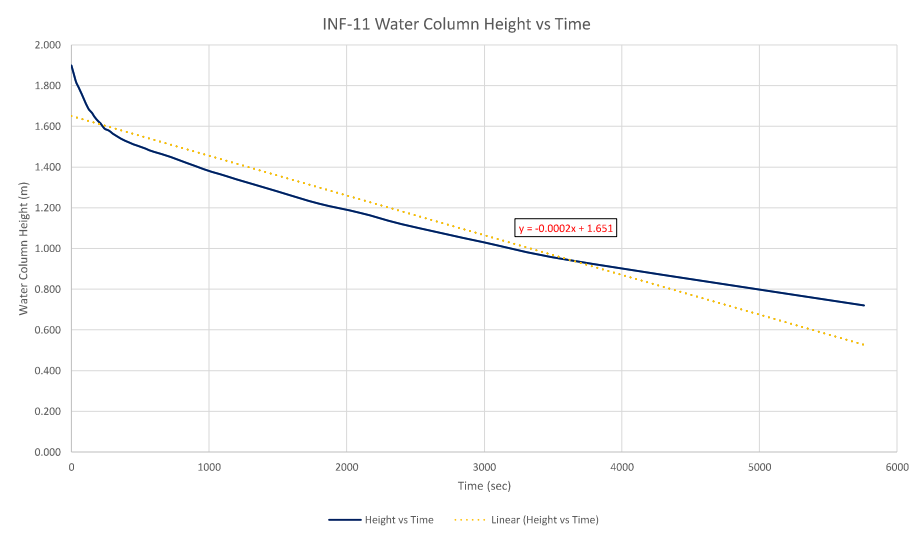
Depth of Test Pit (m):	1.13	**Pipe Stickup (m):**	1.02	**Total Pipe Length(m):**	2.30	

Time* (Seconds)	Measurement Interval (sec)	Depth** (m)	Water Column Height (m)	Distance dropped per interval (m1)	Infilitration Rate per Interval (m/sec)	Cumulative Infiltration Rate (m/sec)
0	-	0.400	1.900	-	--	--
30	30	0.475	1.83	0.075	2.500E-03	2.500E-03
60	30	0.520	1.78	0.045	1.500E-03	2.000E-03
90	30	0.565	1.74	0.045	1.500E-03	1.833E-03
120	30	0.610	1.69	0.045	1.500E-03	1.750E-03
150	30	0.635	1.67	0.025	8.333E-04	1.567E-03
180	30	0.665	1.64	0.030	1.000E-03	1.472E-03
210	30	0.685	1.62	0.020	6.667E-04	1.357E-03
240	30	0.710	1.59	0.025	8.333E-04	1.292E-03
270	30	0.720	1.58	0.010	3.333E-04	1.185E-03
300	30	0.735	1.57	0.015	5.000E-04	1.117E-03
360	60	0.760	1.54	0.025	4.167E-04	1.000E-03
420	60	0.780	1.52	0.020	3.333E-04	9.048E-04
480	60	0.795	1.51	0.015	2.500E-04	8.229E-04
540	60	0.810	1.49	0.015	2.500E-04	7.593E-04
600	60	0.825	1.48	0.015	2.500E-04	7.083E-04
720	120	0.850	1.45	0.025	2.083E-04	6.250E-04
840	120	0.880	1.42	0.030	2.500E-04	5.714E-04
960	120	0.910	1.39	0.030	2.500E-04	5.313E-04
1,080	120	0.935	1.37	0.025	2.083E-04	4.954E-04
1,200	120	0.960	1.34	0.025	2.083E-04	4.667E-04
1,500	300	1.020	1.28	0.060	2.000E-04	4.133E-04
1,800	300	1.080	1.22	0.060	2.000E-04	3.778E-04
2,100	300	1.125	1.18	0.045	1.500E-04	3.452E-04
2,400	300	1.180	1.12	0.055	1.833E-04	3.250E-04
3,000	600	1.270	1.03	0.090	1.500E-04	2.900E-04
3,600	600	1.355	0.95	0.085	1.417E-04	2.653E-04
5,760	2,160	1.580	0.72	0.225	1.042E-04	2.049E-04

** Depth at time 0 indicates measurement below top of measuring pipe at the start of the test.
Not used for statistical analysis

	(m/sec)	(mm/sec)	(mm/hour)
Maximum Infiltration Rate Between Sampling Intervals -	2.50E-03	2.50E+00	9000
Minimum Infiltration Rate Between Sampling Intervals -	1.04E-04	1.04E-01	375
Median Infiltration Rate Between Sampling Intervals -	2.50E-04	2.50E-01	900
Average Infiltration Rate Between Sampling Intervals -	**5.53E-04**	**5.53E-01**	**1989**
Cumulative Infiltration Rate for Entire Data Set -	**2.05E-04**	**2.05E-01**	**738**

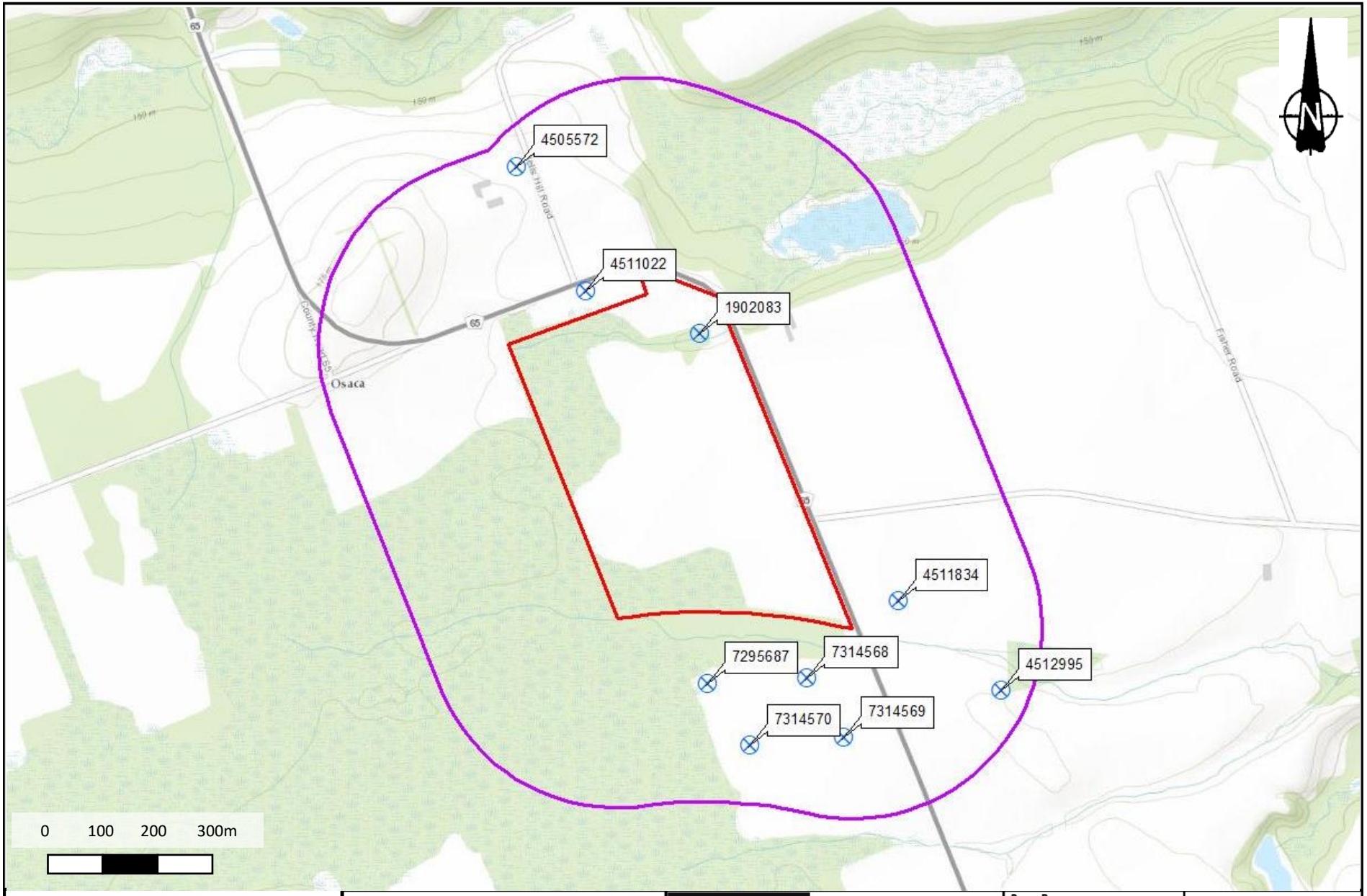
In-situ Infiltration Rate Measured in the Field (mm/sec):	**0.20**
In-situ Infiltration Rate Measured in the Field (mm/hour):	**738**
Calculated Percolation Time (T) based on field infiltration (min/cm):	**0.81**



		Test 1 - Observed
Test Duration (seconds)		**5,760**
Total Drop Distance (mm)		**1180**
Total Number of Measured Intervals		**28**
Infiltration Rate (mm/sec) - Test Average		**0.20**
Infiltration Rate (mm/hour) - Test Average		**738**
Calculated Percolation Time (T) based on Field Infiltration (min/cm)		**0.81**

Appendix E

MECP Well Record Survey



Legend

- MECP Well Survey – 500 m buffer
- Subject Property
- WECP Well Location and ID

MECP Well Location Plan

Hydrogeological Study
Part Lot 27, Concession 5, Village of Osaca, Ontario

WILLS

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

P. 705.742.2297
F. 705.749.9944
E. wills@dmwills.com

Drawn By	LT	Scale	See Scale Bar
Checked	IA	Date	July 2022
Project No.	22-11056	Drawing File No.	APP-E1

APPENDIX E-2 - MECP WELL SUMMARY
Well Record Summary - Bedrock
Project No.: 11056

Lot No.	UTM	M.O.E. Well No.	Well Use	Water Found Feet	Water Found Metres	Static Level Feet	Static Level Metres	REC Pump Rate Igpm	REC Pump Rate L/min	Well Depth Feet	Well Depth Metres	Depth to Bedrock Feet	Depth to Bedrock Metres	Comments
Con. 05														
Lot 27	705556 4875265	7295687	Unknown	-	-	-	-	-	-	-	-	-	-	No information available
Lot 26	Unknown	4512995	Domestic	44	13.4	57	17.4	4.16	18.9	156	47.5	144	43.9	Fresh water observed from 44-156 ft. in limestone bedrock.
Lot 27	705637 4875147	7314570	Domestic	32	9.8	27.9	8.5	8.33	37.8	157	47.9	147	44.8	Fresh water observed at 32 ft. in limestone bedrock.
Con. 6														
Lot 27	Unknown	4505572	Domestic	130	39.6	95	29.0	0.83	3.8	135	41.1	112	34.1	Fresh water observed at 130 ft. in limestone bedrock.

Number of Wells = 4

	Water Found Feet	Water Found Metres	Static Level Feet	Static Level Metres	REC Pump Rate Igpm	REC Pump Rate L/min	Well Depth Feet	Well Depth Metres	Depth to Bedrock Feet	Depth to Bedrock Metres
AVERAGE	68.7	20.9	60.0	18.3	4.4	20.2	149.3	45.5	134.3	40.9
MAXIMUM	130.0	39.6	95.0	29.0	8.3	37.8	157.0	47.9	147.0	44.8
MINIMUM	32.0	9.8	27.9	8.5	0.8	3.8	135.0	41.1	112.0	34.1

APPENDIX E-2 - MECP WELL SUMMARY
Well Record Summary - Overburden
Project No.: 11056

Lot No.	UTM	M.O.E. Well No.	Well Use	Water Found Feet	Water Found Metres	Static Level Feet	Static Level Metres	REC Pump Rate Igpm	REC Pump Rate L/min	Well Depth Feet	Well Depth Metres	Depth to Bedrock Feet	Depth to Bedrock Metres	Comments
Con. 5														
Lot 26	Unknown	4511834	Domestic	58	17.7	30	9.1	3.33	15.1	58	17.7	-	-	Fresh water observed at 58 ft. in brown sand
Lot 27	705815 4875162	7314569	Domestic	32	9.8	21.6	6.6	5.83	26.5	151	46.0	-	-	Fresh water observed at 32 ft. in coarse gravel
Lot 27	705746 4875275	7314568	Domestic	40	12.2	21	6.4	6.66	30.2	101	30.8	-	-	Fresh water observed at 40 ft. in coarse gravel
Lot 27	705527 4875703	1902083	Domestic	17	5.2	18	5.5	1.67	7.6	25	7.6	-	-	Fresh water observed at 17 ft. in clay material
Lot 27	-	4511022	-	-	-	-	-	10	45.4	13	4.0	-	-	No information - well record in relation to well cleanout of sand and gravel

Number of Wells = 5

	Water Found Feet	Water Found Metres	Static Level Feet	Static Level Metres	0 Igpm	0 L/min	Well Depth Feet	Well Depth Metres	Depth to Bedrock Feet	Depth to Bedrock Metres
AVERAGE	36.8	11.2	22.7	6.9	5.5	25.0	69.6	21.2	-	-
MAXIMUM	58.0	17.7	30.0	9.1	10.0	45.4	151.0	46.0	-	-
MINIMUM	17.0	5.2	18.0	5.5	1.7	7.6	13.0	4.0	-	-

Appendix F

MECP Well ID A377795, A377796 and A377799 Well Records

General Instructions and Explanations for completing a Well Record

A completed electronic Well Record Form must be delivered to the well purchaser and the owner of the land on which the well is situated within 14 days after the date on which the well's structural stage is complete. The electronic Well Record must also be forwarded within 30 days after the date on which the well's structural stage is complete to the ministry through email to the following email address: WellRecordSubmission@ontario.ca

False and Misleading Information

Subsection 98(2) of the *Ontario Water Resources Act*, R.S.O. 1990 c. O. 40, states that:

"No person shall orally, in writing or electronically, give or submit false or misleading information in any statement, document or data, to any provincial officer, the Minister, the Ministry or the Agency, any employee in or agent of the Ministry or the Agency, or any person involved in carrying out a program of the Ministry or the Agency in respect of any matter related to this Act or the regulations."

Further, subsection 98(3) of the Act states that:

"No person shall include false or misleading information in any document or data required to be created, stored or submitted under this Act."

Measurements

All measurements must be recorded in the specified unit, metric or imperial by checking off the applicable box on the top of the form. You must use the checked unit consistently throughout the well record. Measurements must be reported to 1/10th of a metre if the unit is a metre. All measurements of depth must be referenced to ground surface.

Well Owner's Information

A "well owner" means the owner of land upon which a well is situated and includes a tenant or lessee of the land and a well purchaser. If the "well owner" is an individual, record the owner's last name and first name or if the "well owner" is a business, government or other organization, record the name in the "organization" area.

Well Location

Street Number/Name and City/town/Village must be provided, if available.

Geographic Township, Concession and Lot must be reported if the well is located in an area where such information exists.

UTM Coordinates must be recorded each time a Well Record is completed. Click the button [Test UTM in Map] to use the UTM Coordinates to plot the location to Google map. This allows verification of the UTM Coordinates. This will also automatically populate the County/District.

Municipal Plan and Sublet Number may be provided, if available.

Overburden and Bedrock Materials

For each formation encountered during construction, choose words from the lists that best describe the formation on the basis of general colour, most common material, other materials, and general description of the formation.

General Colours are White, Yellow, Grey, Brown, Blue, Red, Green and Black.

Examples of Materials are: Fill, Silt, Top Soil, Coarse Sand, Slate, Muck, Gravel, Limestone, Dolomite, Quartzite, Peat, Stones, Fine Sand, Shale, Granite, Clay, Boulders, Medium Sand, Sandstone, and Greenstone.

Some definitions are as follows:

- Clay: Composed of very fine particles. Forms dense hard lumps or clods when dry and a very elastic putty-like mass when wet. It can be rolled between fingers to form a long, flexible ribbon.
- Silt: Grain size, midway between sand and clay. It may form clods which, when broken, feel soft and floury. When moist, it will form a cast that can be handled freely without breaking. Rolled between thumb and finger, it will not "ribbon" but will give a broken appearance.

- Sand: Grains are loose and granular and may be seen and felt readily. Squeezed in the hand when dry, it falls apart when the pressure is released. Squeezed when moist, it will form a cast that will crumble when touched. Should be listed as fine sand, medium sand or coarse sand.
- Gravel: Rock fragments greater than 0.3 cm in diameter.

Examples of General Descriptions are Loose, Cemented, Previously Dug or Bored, Porous, Layered, Previously Drilled, Dense, Soft, Wood Fragments, Packed, Hard.

Abandonment

To report abandonment of a well, check off the applicable box in Type on the top of the form. Details of abandonment must be recorded in the Abandonment and Sealing Section. Additional comments may be entered in the comments box under the Information section.

Annular Space

Record all material placed in the annular space around the single casing or around the permanent outer casing. If the well is a telescoped well [i.e., a well with an outer casing and inner casing(s)] or if the well is a multi-level nested test hole, report the depth from, depth to, material and volume placed for the annular space between two different sized casings or between the inner casing(s) and the side of the well in the “Comments” area of this electronic well record form.

Method of Construction

If the equipment used to construct the well is not on the list, check “Other (specify)” and record the type of equipment, check each equipment that applies.

Well Use

If the well’s use is not provided on the list, check “Other (specify)” and record the use of the well. If the well has multiple uses, check each use that applies.

Status of Well

If the well’s status is not provided on the list, check “Other (specify)” and record the use of the well. If the well has multiple statuses, check each use that applies.

Construction Record – Casing and Open Hole

Use negative values to report the top of casing above ground surface. For example, if the top of the casing is 0.4 metres above the ground surface and the bottom of the casing 6.0 metres below the ground surface, record the casing “Depth From” as -0.4.

If the top of casing is located below the ground surface (e.g., if a test hole is constructed and the top of casing is located below the ground surface in a flush mounted well vault), report the top of the casing from below ground surface. For example, if the top of the casing is 0.1 metres below the ground surface and the bottom of the casing is 6 metres below the ground surface, record the casing “Depth From” as 0.1.

Note: If a drive shoe is used, the shoe is considered casing and it must be reported if the shoe has a different inside diameter thickness.

If a portion of the well was created an open hole, record the location of the open hole on a separate row, including the diameter and the depth (top and bottom of open hole) from the ground surface.

Construction Record – Well Screen

A “well screen” means perforated pipe or tubing, unsealed concrete tiles or other material installed in a well to filter out particulate matter and form the water intake zone. Therefore, the length of a well screen includes any slotted or perforated area and unsealed area of pipe or tiles.

Water Details

- if groundwater was located, record the depth from the ground surface to the location of the groundwater resource, and
- record if the groundwater quality is “Untested,” “Fresh” (i.e., not salty), or “Other (specify).” If “Other (specify)” is recorded, use the “Other (specify)” dropdown list toselect the type of groundwater (e.g., salty, blackish water, yellowish water, mineralized, etc.).

Check off “Gas” if natural gas was encountered during well construction.

Note: Natural gas encounters need to be immediately reported to the ministry at 1-800-268-6060, well purchaser and the owner of the land.

Results of Well Yield Testing

Check off “Pumping Discontinued” if pumping was discontinued before 1 hour of continuous pumping. Explain the reason why pumping was discontinued or in some cases not performed (e.g., the well went dry, impossible to install pump in small diameter well, static water level from test hole or dewatering well was obtained and is reported instead of completing a yield test etc.).

Note: Equipment breakdown is not an acceptable reason for checking off “Pumping Discontinued” on the well record form. If groundwater in the well is flowing out of the well, provide the rate of flow, and check off “Flowing Well” (i.e., static water level above the ground surface).

In the “Results of Well Yield Testing” section of the well record form, record:

- the depth to the intake of the pump,
- the rate of pumping and duration of pumping period during the yield test,
- the final water level when pumping stops,
- water level measurements made during pumping (drawdown) and recovery. All water level measurements must be referenced from below the ground surface for each time interval specified in the drawdown and recovery boxes.

If the water level measurements remain the same over a period of time, continue to measure and report the same water level measurement for the remaining pumping or recovery time intervals.

If pumping continuously for at least 1 hour, but the design of the well does not allow for water level measurements (e.g., driven point well), the person constructing the well is not required to report drawdown or recovery water level measurements.

Map of Well Location

In the “Map of Well Location” section of the well record form, click the map area to attach a map of the well location. The map must show sufficient information to locate the well, including:

- a mark on the map showing the well,
- a scale on the map, and
- where available, the name of the structure, street or surface water body nearest to the well.

Note: More than one map can be added to the well record form by clicking on “Add Map (+)” to add an additional map.

Information

Record any additional information (e.g., observations, tests, additional licensed well technicians who worked on the well, additional annular space details for a telescoped well or a multi-level nested test hole, reasons for not providing a well owner information package) in the comments area.

Declaration

Check the declaration statement to confirm that the person constructing the well agrees with the following statement: “I hereby confirm that I am the person who constructed the well and I hereby confirm that the information on the form is correct and accurate”.

Validate

Click the validate button. If there is no missing information, you will be asked to enter the well tag again to make sure the well tag is entered correctly (only enter the numeric portion of the tag number). The audit number will then be changed from “**incomplete**” to an assigned audit number. The signature field will then be available. Click on “signature” to enter the well technician’s electronic signature. For instructions on how to create an electronic signature, please visit the Adobe Digital IDs website using the following link: https://helpx.adobe.com/acrobat/using/digital-ids.html

Ontario

Ministry of the Environment, Conservation and Parks

Well Record - Regulation 903

Ontario Water Resources Act

Notice of Collection of Personal Information

Personal information contained on this form is collected pursuant to sections 35-50 and 75(2) of the *Ontario Water Resources Act* and section 16.3 of the Wells Regulation. This information will be used for the purpose of maintaining a public record of wells in Ontario. This form and the information contained on the form will be stored in the Ministry's well record database and made publicly available. Questions about this collection should be directed to the Water Well Customer Service Representative at the Wells Help Desk, 125 Resources Road, Toronto Ontario M9P 3V6, at 1-888-396-9355 or wellshelpdesk@ontario.ca.

Fields marked with an asterisk (*) are mandatory.

Well Tag Number *
A 377795

Type *

☑ Construction ☐ Abandonment

Measurement recorded in: *

☐ Metric ☑ Imperial

1. Well Owner's Information

Last Name and First Name, or Organization is mandatory. *

Last Name	First Name
Organization	**Email Address**
Hillstreet Developments Ltd	

Current Address

Unit Number	Street Number *	Street Name *	City/Town/Village	
	524	Rosebank Rd	Pickering	
Country	**Province**	**Postal Code**	**Telephone Number**	
Canada	Ontario	L1W 2N5		

2. Well Location

Address of Well Location

Unit Number	Street Number *	Street Name *	Township
	5688	Concession Rd.65	Hope

Lot	Concession	County/District/Municipality	
27	5	NORTHUMBERLAND	
City/Town		**Province**	**Postal Code**
Osaca		Ontario	

UTM Coordinates	Zone *	Easting *	Northing *		Municipal Plan and Sublot Number
NAD 83	17	705444	4875700	Test UTM in Map	

Other

3. Overburden and Bedrock Material *

Well Depth * 36 (ft)

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To

				(ft)	(ft)
Brown	Sand		Loose	0	28
Brown	Medium Sand		Loose	28	36

4. Annular Space *

Depth From (ft)	Depth To (ft)	Type of Sealant Used (Material and Type)	Volume Placed (cubic feet)
0	20	Bentonite Chips - 175 lbs	2.45
0	20	Bentonite Slurry - 24 gal	3.21

5. Method of Construction *

- [x] Cable Tool
- [ ] Rotary (Conventional)
- [ ] Rotary (Reverse)
- [ ] Boring
- [ ] Air percussion
- [ ] Diamond
- [ ] Jetting
- [ ] Driving
- [ ] Digging
- [ ] Rotary (Air)
- [ ] Augering
- [ ] Direct Push
- [ ] Other (specify) _____

6. Well Use *

- [ ] Public
- [ ] Industrial
- [ ] Cooling & Air Conditioning
- [x] Domestic
- [ ] Commercial
- [ ] Not Used
- [ ] Livestock
- [ ] Municipal
- [ ] Monitoring
- [ ] Irrigation
- [ ] Test Hole
- [ ] Dewatering
- [ ] Other (specify) _____

7. Status of Well *

- [x] Water Supply
- [ ] Replacement Well
- [ ] Test Hole
- [ ] Recharge Well
- [ ] Dewatering Well
- [ ] Observation and/or Monitoring Hole
- [ ] Alteration (Construction)
- [ ] Abandoned, Insufficient Supply
- [ ] Abandoned, Poor Water Quality
- [ ] Abandoned, other (specify) _____
- [ ] Other (specify) _____

8. Construction Record - Casing * (use negative number(s) to indicate depth above ground surface)

Inside Diameter (in)	Open Hole **or** Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness	Depth From (ft)	Depth To (ft)
6.25	Steel	0.188	-2	32
5.25	Steel	0.188	29	32

9. Construction Record - Screen

Outside Diameter (in)	Material (Plastic, Galvanized, Steel)	Slot Number	Depth From (ft)	Depth To (ft)
5.5	Stainless Steel	14	32	36

10. Water Details

Water found at Depth 38 (ft) ☐ Gas Kind of water ☐ Fresh ☑ Untested ☐ Other

11. Hole Diameter

Depth From (ft)	Depth To (ft)	Diameter (in)
0	20	8.75
20	36	6.58

12. Results of Well Yield Testing

☐ Pumping Discontinued

Explain _____

If flowing give rate

☐ Flowing _____ (GPM)

Draw down

Time (min)	Static Level	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)	10	11.2	13.4	15.6	16.1	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4

Recovery

Time (min)	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)	14.1	12.2	10.5	10	10	10	10	10	10	10	10	10	10

After test of well yield, water was

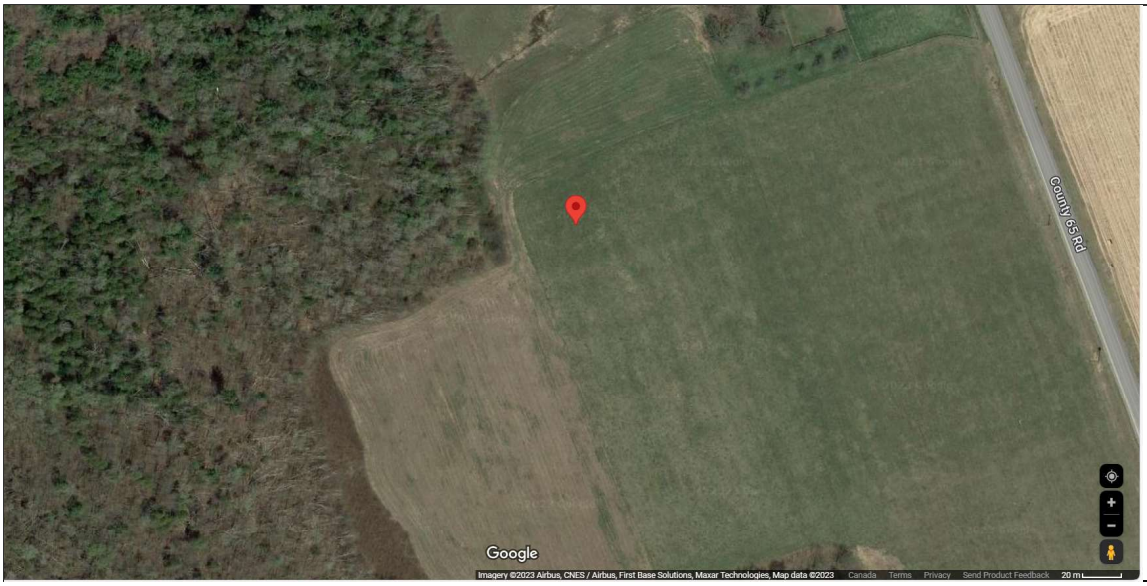
☑ Clear and sand free ☐ Other (specify)

Pump intake set at	Pumping rate	Duration of pumping	Final water level end of pumping	Disinfected? *
33 (ft)	10 (GPM)	1 hrs + 00 min	16.1 (ft)	☑ Yes ☐ No

Recommended pump depth	Recommended pump rate	Well production
33 (ft)	10 (GPM)	10 (GPM)

13. Map of Well Location *

Map 1. Please Click the map area below to import an image file to use as the map. ☐ Make map area bigger



14. Information

Well owner's information package delivered	Date Package Delivered (yyyy/mm/dd)	Date Work Completed (yyyy/mm/dd) *
☑ Yes ☐ No	2023/10/03	2023/10/17

Comments
breakaway guides @ 6' & 16"
K-packer and leader pipe above screen
sand was loose with pressure

15. Well Contractor and Well Technician Information

Business Name of Well Contractor *	Well Contractor's License Number *
Herb Lang Well Drilling Ltd.	7560

Business Address

Unit Number	Street Number	Street Name *
	4852	Highway 7

City/Town/Village *	Province	Postal Code *
Omemee	ON	K0L 2W0

Business Telephone Number	Business Email Address
705-799-7088	hlwelldrilling@gmail.com

Last Name of Well Technician *	First Name of Well Technician *	Well Technician's License Number *
Foster	Nick	3920

16. Declaration *

☑ I hereby confirm that I am the person who constructed the well and I hereby confirm that the information on the form is correct and accurate.

Last Name	First Name	Email Address
Foster	Nick	hlwelldrilling@gmail.com

Signature		Date Submitted (yyyy/mm/dd)
Nick Foster	Digitally signed by Nick Foster Date: 2023.10.25 06:32:28 -04'00'	2023/10/25

17. Ministry Use Only

Audit Number
SDBJ 9K63

General Instructions and Explanations for completing a Well Record

A completed electronic Well Record Form must be delivered to the well purchaser and the owner of the land on which the well is situated within 14 days after the date on which the well's structural stage is complete. The electronic Well Record must also be forwarded within 30 days after the date on which the well's structural stage is complete to the ministry through email to the following email address: WellRecordSubmission@ontario.ca

False and Misleading Information

Subsection 98(2) of the *Ontario Water Resources Act*, R.S.O. 1990 c. O. 40, states that:

"No person shall orally, in writing or electronically, give or submit false or misleading information in any statement, document or data, to any provincial officer, the Minister, the Ministry or the Agency, any employee in or agent of the Ministry or the Agency, or any person involved in carrying out a program of the Ministry or the Agency in respect of any matter related to this Act or the regulations."

Further, subsection 98(3) of the Act states that:

"No person shall include false or misleading information in any document or data required to be created, stored or submitted under this Act."

Measurements

All measurements must be recorded in the specified unit, metric or imperial by checking off the applicable box on the top of the form. You must use the checked unit consistently throughout the well record. Measurements must be reported to 1/10th of a metre if the unit is a metre. All measurements of depth must be referenced to ground surface.

Well Owner's Information

A "well owner" means the owner of land upon which a well is situated and includes a tenant or lessee of the land and a well purchaser. If the "well owner" is an individual, record the owner's last name and first name or if the "well owner" is a business, government or other organization, record the name in the "organization" area.

Well Location

Street Number/Name and City/town/Village must be provided, if available.

Geographic Township, Concession and Lot must be reported if the well is located in an area where such information exists.

UTM Coordinates must be recorded each time a Well Record is completed. Click the button [Test UTM in Map] to use the UTM Coordinates to plot the location to Google map. This allows verification of the UTM Coordinates. This will also automatically populate the County/District.

Municipal Plan and Sublet Number may be provided, if available.

Overburden and Bedrock Materials

For each formation encountered during construction, choose words from the lists that best describe the formation on the basis of general colour, most common material, other materials, and general description of the formation.

General Colours are White, Yellow, Grey, Brown, Blue, Red, Green and Black.

Examples of Materials are: Fill, Silt, Top Soil, Coarse Sand, Slate, Muck, Gravel, Limestone, Dolomite, Quartzite, Peat, Stones, Fine Sand, Shale, Granite, Clay, Boulders, Medium Sand, Sandstone, and Greenstone.

Some definitions are as follows:

- Clay: Composed of very fine particles. Forms dense hard lumps or clods when dry and a very elastic putty-like mass when wet. It can be rolled between fingers to form a long, flexible ribbon.
- Silt: Grain size, midway between sand and clay. It may form clods which, when broken, feel soft and floury. When moist, it will form a cast that can be handled freely without breaking. Rolled between thumb and finger, it will not "ribbon" but will give a broken appearance.

- Sand: Grains are loose and granular and may be seen and felt readily. Squeezed in the hand when dry, it falls apart when the pressure is released. Squeezed when moist, it will form a cast that will crumble when touched. Should be listed as fine sand, medium sand or coarse sand.
- Gravel: Rock fragments greater than 0.3 cm in diameter.

Examples of General Descriptions are Loose, Cemented, Previously Dug or Bored, Porous, Layered, Previously Drilled, Dense, Soft, Wood Fragments, Packed, Hard.

Abandonment

To report abandonment of a well, check off the applicable box in Type on the top of the form. Details of abandonment must be recorded in the Abandonment and Sealing Section. Additional comments may be entered in the comments box under the Information section.

Annular Space

Record all material placed in the annular space around the single casing or around the permanent outer casing. If the well is a telescoped well [i.e., a well with an outer casing and inner casing(s)] or if the well is a multi-level nested test hole, report the depth from, depth to, material and volume placed for the annular space between two different sized casings or between the inner casing(s) and the side of the well in the “Comments” area of this electronic well record form.

Method of Construction

If the equipment used to construct the well is not on the list, check “Other (specify)” and record the type of equipment, check each equipment that applies.

Well Use

If the well’s use is not provided on the list, check “Other (specify)” and record the use of the well. If the well has multiple uses, check each use that applies.

Status of Well

If the well’s status is not provided on the list, check “Other (specify)” and record the use of the well. If the well has multiple statuses, check each use that applies.

Construction Record – Casing and Open Hole

Use negative values to report the top of casing above ground surface. For example, if the top of the casing is 0.4 metres above the ground surface and the bottom of the casing 6.0 metres below the ground surface, record the casing “Depth From” as -0.4.

If the top of casing is located below the ground surface (e.g., if a test hole is constructed and the top of casing is located below the ground surface in a flush mounted well vault), report the top of the casing from below ground surface. For example, if the top of the casing is 0.1 metres below the ground surface and the bottom of the casing is 6 metres below the ground surface, record the casing “Depth From” as 0.1.

Note: If a drive shoe is used, the shoe is considered casing and it must be reported if the shoe has a different inside diameter thickness.

If a portion of the well was created an open hole, record the location of the open hole on a separate row, including the diameter and the depth (top and bottom of open hole) from the ground surface.

Construction Record – Well Screen

A “well screen” means perforated pipe or tubing, unsealed concrete tiles or other material installed in a well to filter out particulate matter and form the water intake zone. Therefore, the length of a well screen includes any slotted or perforated area and unsealed area of pipe or tiles.

Water Details

- if groundwater was located, record the depth from the ground surface to the location of the groundwater resource, and
- record if the groundwater quality is “Untested,” “Fresh” (i.e., not salty), or “Other (specify).” If “Other (specify)” is recorded, use the “Other (specify)” dropdown list toselect the type of groundwater (e.g., salty, blackish water, yellowish water, mineralized, etc.).

Check off “Gas” if natural gas was encountered during well construction.

Note: Natural gas encounters need to be immediately reported to the ministry at 1-800-268-6060, well purchaser and the owner of the land.

Results of Well Yield Testing

Check off “Pumping Discontinued” if pumping was discontinued before 1 hour of continuous pumping. Explain the reason why pumping was discontinued or in some cases not performed (e.g., the well went dry, impossible to install pump in small diameter well, static water level from test hole or dewatering well was obtained and is reported instead of completing a yield test etc.).

Note: Equipment breakdown is not an acceptable reason for checking off “Pumping Discontinued” on the well record form. If groundwater in the well is flowing out of the well, provide the rate of flow, and check off “Flowing Well” (i.e., static water level above the ground surface).

In the “Results of Well Yield Testing” section of the well record form, record:

- the depth to the intake of the pump,
- the rate of pumping and duration of pumping period during the yield test,
- the final water level when pumping stops,
- water level measurements made during pumping (drawdown) and recovery. All water level measurements must be referenced from below the ground surface for each time interval specified in the drawdown and recovery boxes.

If the water level measurements remain the same over a period of time, continue to measure and report the same water level measurement for the remaining pumping or recovery time intervals.

If pumping continuously for at least 1 hour, but the design of the well does not allow for water level measurements (e.g., driven point well), the person constructing the well is not required to report drawdown or recovery water level measurements.

Map of Well Location

In the “Map of Well Location” section of the well record form, click the map area to attach a map of the well location. The map must show sufficient information to locate the well, including:

- a mark on the map showing the well,
- a scale on the map, and
- where available, the name of the structure, street or surface water body nearest to the well.

Note: More than one map can be added to the well record form by clicking on “Add Map (+)” to add an additional map.

Information

Record any additional information (e.g., observations, tests, additional licensed well technicians who worked on the well, additional annular space details for a telescoped well or a multi-level nested test hole, reasons for not providing a well owner information package) in the comments area.

Declaration

Check the declaration statement to confirm that the person constructing the well agrees with the following statement: “I hereby confirm that I am the person who constructed the well and I hereby confirm that the information on the form is correct and accurate”.

Validate

Click the validate button. If there is no missing information, you will be asked to enter the well tag again to make sure the well tag is entered correctly (only enter the numeric portion of the tag number). The audit number will then be changed from “**incomplete**” to an assigned audit number. The signature field will then be available. Click on “signature” to enter the well technician’s electronic signature. For instructions on how to create an electronic signature, please visit the Adobe Digital IDs website using the following link: https://helpx.adobe.com/acrobat/using/digital-ids.html

Notice of Collection of Personal Information

Personal information contained on this form is collected pursuant to sections 35-50 and 75(2) of the *Ontario Water Resources Act* and section 16.3 of the Wells Regulation. This information will be used for the purpose of maintaining a public record of wells in Ontario. This form and the information contained on the form will be stored in the Ministry's well record database and made publicly available. Questions about this collection should be directed to the Water Well Customer Service Representative at the Wells Help Desk, 125 Resources Road, Toronto Ontario M9P 3V6, at 1-888-396-9355 or wellshelpdesk@ontario.ca.

Fields marked with an asterisk (*) are mandatory.

Well Tag Number *
A 377796

Type *

☑ Construction ☐ Abandonment

Measurement recorded in: *

☐ Metric ☑ Imperial

1. Well Owner's Information

Last Name and First Name, or Organization is mandatory. *

Last Name	First Name
Organization	**Email Address**
Hillstreet Developments Ltd	

Current Address

Unit Number	Street Number *	Street Name *	City/Town/Village	
	524	Rosebank Rd	Pickering	
Country	**Province**		**Postal Code**	**Telephone Number**
Canada	Ontario		L1W 2N5	

2. Well Location

Address of Well Location

Unit Number	Street Number *	Street Name *	Township
	5688	Concession Rd. 65	Hope

Lot	Concession	County/District/Municipality	
27	5	NORTHUMBERLAND	
City/Town		**Province**	**Postal Code**
Osaca		Ontario	

UTM Coordinates	Zone *	Easting *	Northing *		Municipal Plan and Sublot Number
NAD 83	17	705464	4875609	Test UTM in Map	

Other

3. Overburden and Bedrock Material *

Well Depth * 38 (ft)

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To

				(ft)	(ft)
Brown	Sand		Loose	0	31
Brown	Medium Sand		Loose	31	38

4. Annular Space *

Depth From (ft)	Depth To (ft)	Type of Sealant Used (Material and Type)	Volume Placed (cubic feet)
0	20	Bentonite Chips - 150lbs	2.1
0	20	Bentonite Slurry - 48 gals	6.42

5. Method of Construction *

- [x] Cable Tool
- [ ] Rotary (Conventional)
- [ ] Rotary (Reverse)
- [ ] Boring
- [ ] Air percussion
- [ ] Diamond
- [ ] Jetting
- [ ] Driving
- [ ] Digging
- [ ] Rotary (Air)
- [ ] Augering
- [ ] Direct Push
- [ ] Other (specify) _____

6. Well Use *

- [ ] Public
- [ ] Industrial
- [ ] Cooling & Air Conditioning
- [x] Domestic
- [ ] Commercial
- [ ] Not Used
- [ ] Livestock
- [ ] Municipal
- [ ] Monitoring
- [ ] Irrigation
- [ ] Test Hole
- [ ] Dewatering
- [ ] Other (specify) _____

7. Status of Well *

- [x] Water Supply
- [ ] Replacement Well
- [ ] Test Hole
- [ ] Recharge Well
- [ ] Dewatering Well
- [ ] Observation and/or Monitoring Hole
- [ ] Alteration (Construction)
- [ ] Abandoned, Insufficient Supply
- [ ] Abandoned, Poor Water Quality
- [ ] Abandoned, other (specify) _____
- [ ] Other (specify) _____

8. Construction Record - Casing * (use negative number(s) to indicate depth above ground surface)

Inside Diameter (in)	Open Hole **or** Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness	Depth From (ft)	Depth To (ft)
6.25	Steel	0.188	-2	34
5.25	Steel	0.188	31	34

9. Construction Record - Screen

Outside Diameter (in)	Material (Plastic, Galvanized, Steel)	Slot Number	Depth From (ft)	Depth To (ft)
5.5	Stainless Steel	14	34	38

10. Water Details

Water found at Depth 38 (ft) ☐ Gas Kind of water ☐ Fresh ☑ Untested ☐ Other

11. Hole Diameter

Depth From (ft)	Depth To (ft)	Diameter (in)
0	20	8.75
20	38	6.58

12. Results of Well Yield Testing

☐ Pumping Discontinued

Explain

If flowing give rate

☐ Flowing (GPM)

Draw down

Time (min)	Static Level	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)	10	17	20.5	20.9	21.7	22.2	23.2	23.4	23.4	23.4	23.5	23.5	23.6	23.6

Recovery

Time (min)	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)	18.6	15.5	13.7	12.4	11.5	10	10	10	10	10	10	10	10

After test of well yield, water was

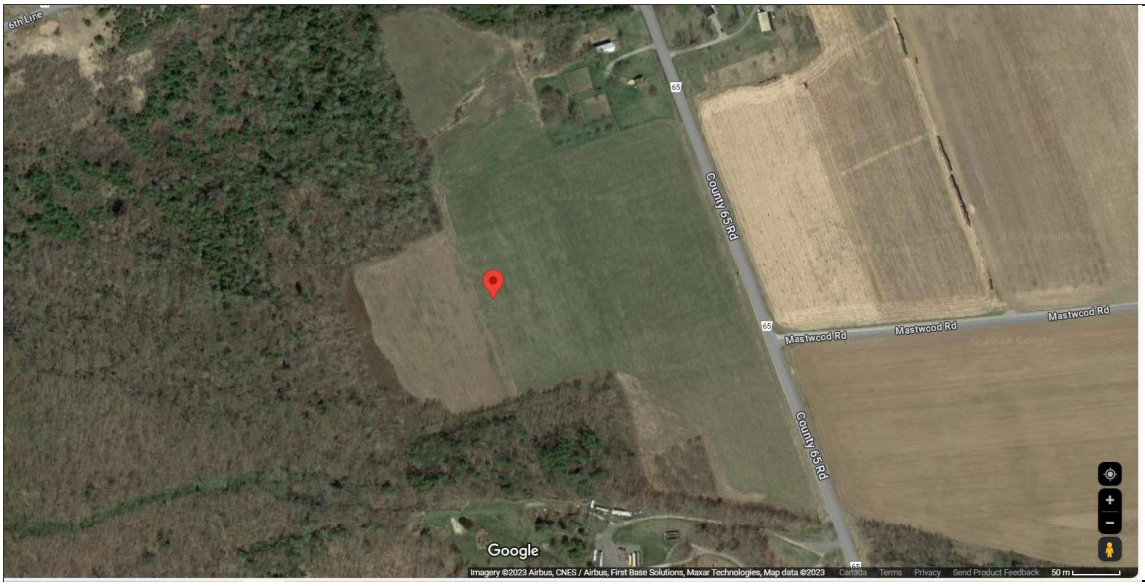
☑ Clear and sand free ☐ Other (specify)

Pump intake set at	Pumping rate	Duration of pumping	Final water level end of pumping	Disinfected? *
35 (ft)	10 (GPM)	1 hrs + 00 min	23.6 (ft)	☑ Yes ☐ No

Recommended pump depth	Recommended pump rate	Well production
35 (ft)	10 (GPM)	10 (GPM)

13. Map of Well Location *

Map 1. Please Click the map area below to import an image file to use as the map. ☐ Make map area bigger



14. Information

Well owner's information package delivered	Date Package Delivered (yyyy/mm/dd)	Date Work Completed (yyyy/mm/dd) *
☑ Yes ☐ No	2023/10/03	2023/10/12

Comments
breakaway guides @ 6' & 16"
K-packer and leader pipe above screen
sand was loose with pressure

15. Well Contractor and Well Technician Information

Business Name of Well Contractor *	Well Contractor's License Number *
Herb Lang Well Drilling Ltd.	7560

Business Address

Unit Number	Street Number	Street Name *
	4852	Highway 7

City/Town/Village *	Province	Postal Code *
Omemee	ON	K0L 2W0

Business Telephone Number	Business Email Address
705-799-7088	hlwelldrilling@gmail.com

Last Name of Well Technician *	First Name of Well Technician *	Well Technician's License Number *
Foster	Nick	3920

16. Declaration *

☑ I hereby confirm that I am the person who constructed the well and I hereby confirm that the information on the form is correct and accurate.

Last Name	First Name	Email Address
Foster	Nick	hlwelldrilling@gmail.com

Signature		Date Submitted (yyyy/mm/dd)
Nick Foster	Digitally signed by Nick Foster Date: 2023.10.25 06:23:49 -04'00'	2023/10/25

17. Ministry Use Only

Audit Number
AXN9 ON2Y

General Instructions and Explanations for completing a Well Record

A completed electronic Well Record Form must be delivered to the well purchaser and the owner of the land on which the well is situated within 14 days after the date on which the well's structural stage is complete. The electronic Well Record must also be forwarded within 30 days after the date on which the well's structural stage is complete to the ministry through email to the following email address: WellRecordSubmission@ontario.ca

False and Misleading Information

Subsection 98(2) of the *Ontario Water Resources Act*, R.S.O. 1990 c. O. 40, states that:

"No person shall orally, in writing or electronically, give or submit false or misleading information in any statement, document or data, to any provincial officer, the Minister, the Ministry or the Agency, any employee in or agent of the Ministry or the Agency, or any person involved in carrying out a program of the Ministry or the Agency in respect of any matter related to this Act or the regulations."

Further, subsection 98(3) of the Act states that:

"No person shall include false or misleading information in any document or data required to be created, stored or submitted under this Act."

Measurements

All measurements must be recorded in the specified unit, metric or imperial by checking off the applicable box on the top of the form. You must use the checked unit consistently throughout the well record. Measurements must be reported to 1/10th of a metre if the unit is a metre. All measurements of depth must be referenced to ground surface.

Well Owner's Information

A "well owner" means the owner of land upon which a well is situated and includes a tenant or lessee of the land and a well purchaser. If the "well owner" is an individual, record the owner's last name and first name or if the "well owner" is a business, government or other organization, record the name in the "organization" area.

Well Location

Street Number/Name and City/town/Village must be provided, if available.

Geographic Township, Concession and Lot must be reported if the well is located in an area where such information exists.

UTM Coordinates must be recorded each time a Well Record is completed. Click the button [Test UTM in Map] to use the UTM Coordinates to plot the location to Google map. This allows verification of the UTM Coordinates. This will also automatically populate the County/District.

Municipal Plan and Sublet Number may be provided, if available.

Overburden and Bedrock Materials

For each formation encountered during construction, choose words from the lists that best describe the formation on the basis of general colour, most common material, other materials, and general description of the formation.

General Colours are White, Yellow, Grey, Brown, Blue, Red, Green and Black.

Examples of Materials are: Fill, Silt, Top Soil, Coarse Sand, Slate, Muck, Gravel, Limestone, Dolomite, Quartzite, Peat, Stones, Fine Sand, Shale, Granite, Clay, Boulders, Medium Sand, Sandstone, and Greenstone.

Some definitions are as follows:

- Clay: Composed of very fine particles. Forms dense hard lumps or clods when dry and a very elastic putty-like mass when wet. It can be rolled between fingers to form a long, flexible ribbon.
- Silt: Grain size, midway between sand and clay. It may form clods which, when broken, feel soft and floury. When moist, it will form a cast that can be handled freely without breaking. Rolled between thumb and finger, it will not "ribbon" but will give a broken appearance.

- Sand: Grains are loose and granular and may be seen and felt readily. Squeezed in the hand when dry, it falls apart when the pressure is released. Squeezed when moist, it will form a cast that will crumble when touched. Should be listed as fine sand, medium sand or coarse sand.
- Gravel: Rock fragments greater than 0.3 cm in diameter.

Examples of General Descriptions are Loose, Cemented, Previously Dug or Bored, Porous, Layered, Previously Drilled, Dense, Soft, Wood Fragments, Packed, Hard.

Abandonment

To report abandonment of a well, check off the applicable box in Type on the top of the form. Details of abandonment must be recorded in the Abandonment and Sealing Section. Additional comments may be entered in the comments box under the Information section.

Annular Space

Record all material placed in the annular space around the single casing or around the permanent outer casing. If the well is a telescoped well [i.e., a well with an outer casing and inner casing(s)] or if the well is a multi-level nested test hole, report the depth from, depth to, material and volume placed for the annular space between two different sized casings or between the inner casing(s) and the side of the well in the “Comments” area of this electronic well record form.

Method of Construction

If the equipment used to construct the well is not on the list, check “Other (specify)” and record the type of equipment, check each equipment that applies.

Well Use

If the well’s use is not provided on the list, check “Other (specify)” and record the use of the well. If the well has multiple uses, check each use that applies.

Status of Well

If the well’s status is not provided on the list, check “Other (specify)” and record the use of the well. If the well has multiple statuses, check each use that applies.

Construction Record – Casing and Open Hole

Use negative values to report the top of casing above ground surface. For example, if the top of the casing is 0.4 metres above the ground surface and the bottom of the casing 6.0 metres below the ground surface, record the casing “Depth From” as -0.4.

If the top of casing is located below the ground surface (e.g., if a test hole is constructed and the top of casing is located below the ground surface in a flush mounted well vault), report the top of the casing from below ground surface. For example, if the top of the casing is 0.1 metres below the ground surface and the bottom of the casing is 6 metres below the ground surface, record the casing “Depth From” as 0.1.

Note: If a drive shoe is used, the shoe is considered casing and it must be reported if the shoe has a different inside diameter thickness.

If a portion of the well was created an open hole, record the location of the open hole on a separate row, including the diameter and the depth (top and bottom of open hole) from the ground surface.

Construction Record – Well Screen

A “well screen” means perforated pipe or tubing, unsealed concrete tiles or other material installed in a well to filter out particulate matter and form the water intake zone. Therefore, the length of a well screen includes any slotted or perforated area and unsealed area of pipe or tiles.

Water Details

- if groundwater was located, record the depth from the ground surface to the location of the groundwater resource, and
- record if the groundwater quality is “Untested,” “Fresh” (i.e., not salty), or “Other (specify).” If “Other (specify)” is recorded, use the “Other (specify)” dropdown list toselect the type of groundwater (e.g., salty, blackish water, yellowish water, mineralized, etc.).

Check off “Gas” if natural gas was encountered during well construction.

Note: Natural gas encounters need to be immediately reported to the ministry at 1-800-268-6060, well purchaser and the owner of the land.

Results of Well Yield Testing

Check off “Pumping Discontinued” if pumping was discontinued before 1 hour of continuous pumping. Explain the reason why pumping was discontinued or in some cases not performed (e.g., the well went dry, impossible to install pump in small diameter well, static water level from test hole or dewatering well was obtained and is reported instead of completing a yield test etc.).

Note: Equipment breakdown is not an acceptable reason for checking off “Pumping Discontinued” on the well record form. If groundwater in the well is flowing out of the well, provide the rate of flow, and check off “Flowing Well” (i.e., static water level above the ground surface).

In the “Results of Well Yield Testing” section of the well record form, record:

- the depth to the intake of the pump,
- the rate of pumping and duration of pumping period during the yield test,
- the final water level when pumping stops,
- water level measurements made during pumping (drawdown) and recovery. All water level measurements must be referenced from below the ground surface for each time interval specified in the drawdown and recovery boxes.

If the water level measurements remain the same over a period of time, continue to measure and report the same water level measurement for the remaining pumping or recovery time intervals.

If pumping continuously for at least 1 hour, but the design of the well does not allow for water level measurements (e.g., driven point well), the person constructing the well is not required to report drawdown or recovery water level measurements.

Map of Well Location

In the “Map of Well Location” section of the well record form, click the map area to attach a map of the well location. The map must show sufficient information to locate the well, including:

- a mark on the map showing the well,
- a scale on the map, and
- where available, the name of the structure, street or surface water body nearest to the well.

Note: More than one map can be added to the well record form by clicking on “Add Map (+)” to add an additional map.

Information

Record any additional information (e.g., observations, tests, additional licensed well technicians who worked on the well, additional annular space details for a telescoped well or a multi-level nested test hole, reasons for not providing a well owner information package) in the comments area.

Declaration

Check the declaration statement to confirm that the person constructing the well agrees with the following statement: “I hereby confirm that I am the person who constructed the well and I hereby confirm that the information on the form is correct and accurate”.

Validate

Click the validate button. If there is no missing information, you will be asked to enter the well tag again to make sure the well tag is entered correctly (only enter the numeric portion of the tag number). The audit number will then be changed from “**incomplete**” to an assigned audit number. The signature field will then be available. Click on “signature” to enter the well technician’s electronic signature. For instructions on how to create an electronic signature, please visit the Adobe Digital IDs website using the following link: https://helpx.adobe.com/acrobat/using/digital-ids.html

Notice of Collection of Personal Information

Personal information contained on this form is collected pursuant to sections 35-50 and 75(2) of the *Ontario Water Resources Act* and section 16.3 of the Wells Regulation. This information will be used for the purpose of maintaining a public record of wells in Ontario. This form and the information contained on the form will be stored in the Ministry's well record database and made publicly available. Questions about this collection should be directed to the Water Well Customer Service Representative at the Wells Help Desk, 125 Resources Road, Toronto Ontario M9P 3V6, at 1-888-396-9355 or wellshelpdesk@ontario.ca.

Fields marked with an asterisk (*) are mandatory.

Well Tag Number *
A 377799

Type *

☑ Construction ☐ Abandonment

Measurement recorded in: *

☐ Metric ☑ Imperial

1. Well Owner's Information

Last Name and First Name, or Organization is mandatory. *

Last Name	First Name
Organization	**Email Address**
Hillstreet Developments Ltd	

Current Address

Unit Number	Street Number *	Street Name *	City/Town/Village	
	524	Rosebank Rd	Pickering	
Country	**Province**	**Postal Code**	**Telephone Number**	
Canada	Ontario	L1W 2N5		

2. Well Location

Address of Well Location

Unit Number	Street Number *	Street Name *	Township
	5868	County Rd. 65	Hope
Lot	**Concession**	**County/District/Municipality**	
27	5	NORTHUMBERLAND	
City/Town	**Province**	**Postal Code**	
Osaca	Ontario		

UTM Coordinates	Zone *	Easting *	Northing *		Municipal Plan and Sublot Number
NAD 83	17	705582	4875640	Test UTM in Map	

Other

3. Overburden and Bedrock Material *

Well Depth * 33 (ft)

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To

				(ft)	(ft)
Brown	Sand		Loose	0	18
Grey	Clay	Stones	Soft	18	25
Brown	Medium Sand		Loose	25	33

4. Annular Space *

Depth From (ft)	Depth To (ft)	Type of Sealant Used (Material and Type)	Volume Placed (cubic feet)
0	20	Bentonite Chips	7.0
0	20	Bentonite Slurry	3.21

5. Method of Construction *

- [x] Cable Tool
- [ ] Rotary (Conventional)
- [ ] Rotary (Reverse)
- [ ] Boring
- [ ] Air percussion
- [ ] Diamond
- [ ] Jetting
- [ ] Driving
- [ ] Digging
- [ ] Rotary (Air)
- [ ] Augering
- [ ] Direct Push
- [ ] Other (specify) _____

6. Well Use *

- [ ] Public
- [ ] Industrial
- [ ] Cooling & Air Conditioning
- [x] Domestic
- [ ] Commercial
- [ ] Not Used
- [ ] Livestock
- [ ] Municipal
- [ ] Monitoring
- [ ] Irrigation
- [ ] Test Hole
- [ ] Dewatering
- [ ] Other (specify) _____

7. Status of Well *

- [x] Water Supply
- [ ] Replacement Well
- [ ] Test Hole
- [ ] Recharge Well
- [ ] Dewatering Well
- [ ] Observation and/or Monitoring Hole
- [ ] Alteration (Construction)
- [ ] Abandoned, Insufficient Supply
- [ ] Abandoned, Poor Water Quality
- [ ] Abandoned, other (specify) _____
- [ ] Other (specify) _____

8. Construction Record - Casing * (use negative number(s) to indicate depth above ground surface)

Inside Diameter (in)	Open Hole **or** Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness	Depth From (ft)	Depth To (ft)
6.25	Steel	0.188	-2	29
5.25	Steel	0.188	26	29

9. Construction Record - Screen

Outside Diameter (in)	Material (Plastic, Galvanized, Steel)	Slot Number	Depth From (ft)	Depth To (ft)
5.5	Stainless Steel	14	29	33

10. Water Details

Water found at Depth 33 (ft) ☐ Gas Kind of water ☐ Fresh ☑ Untested ☐ Other

11. Hole Diameter

Depth From (ft)	Depth To (ft)	Diameter (in)
0	20	8.75
20	33	6.58

12. Results of Well Yield Testing

☐ Pumping Discontinued

Explain _____

If flowing give rate

☐ Flowing _____ (GPM)

Draw down

Time (min)	Static Level	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)	9.5	13.5	14.3	14.8	15.1	15.2	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7

Recovery

Time (min)	1	2	3	4	5	10	15	20	25	30	40	50	60
Water Level (ft)	11.6	10.5	9.7	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5

After test of well yield, water was

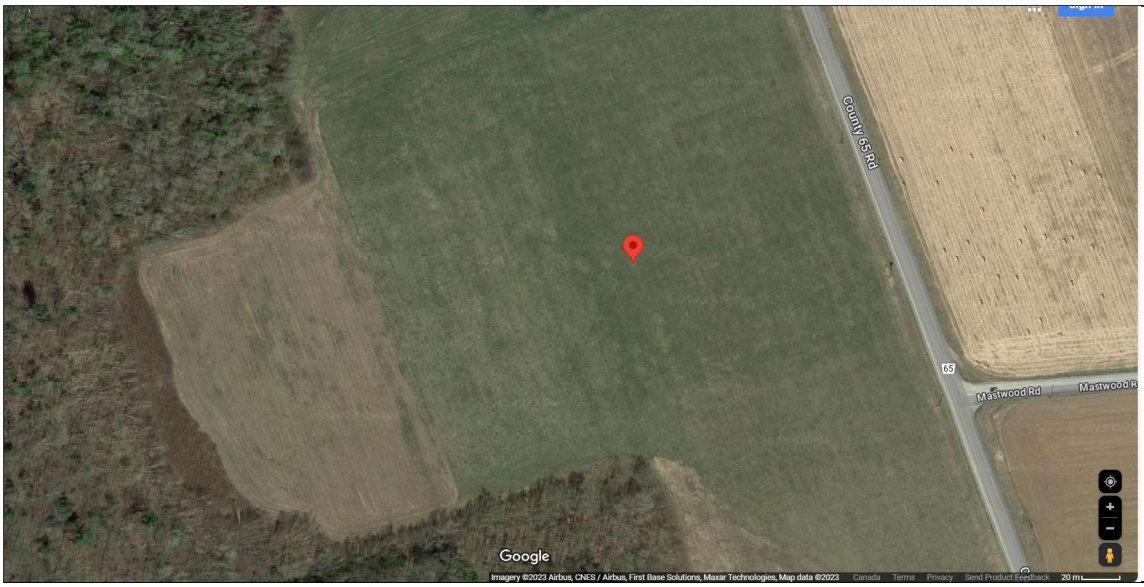
☑ Clear and sand free ☐ Other (specify)

Pump intake set at	Pumping rate	Duration of pumping	Final water level end of pumping	Disinfected? *
31 (ft)	10 (GPM)	1 hrs + 00 min	15.3 (ft)	☑ Yes ☐ No

Recommended pump depth	Recommended pump rate	Well production
31 (ft)	10 (GPM)	10 (GPM)

13. Map of Well Location *

Map 1. Please Click the map area below to import an image file to use as the map. ☐ Make map area bigger



14. Information

Well owner's information package delivered	Date Package Delivered (yyyy/mm/dd)	Date Work Completed (yyyy/mm/dd) *
☑ Yes ☐ No	2023/10/03	2023/10/06

Comments
breakaway guides @ 6' & 16"
K-packer and leader pipe above screen
sand was loose with pressure

15. Well Contractor and Well Technician Information

Business Name of Well Contractor *	Well Contractor's License Number *
Herb Lang Well Drilling Ltd.	7560

Business Address

Unit Number	Street Number	Street Name *
	4852	Highway 7

City/Town/Village *	Province	Postal Code *
Omemee	ON	K0L 2W0

Business Telephone Number	Business Email Address
705-799-7088	hlwelldrilling@gmail.com

Last Name of Well Technician *	First Name of Well Technician *	Well Technician's License Number *
Foster	Nick	3920

16. Declaration *

☑ I hereby confirm that I am the person who constructed the well and I hereby confirm that the information on the form is correct and accurate.

Last Name	First Name	Email Address
Foster	Nick	hlwelldrilling@gmail.com

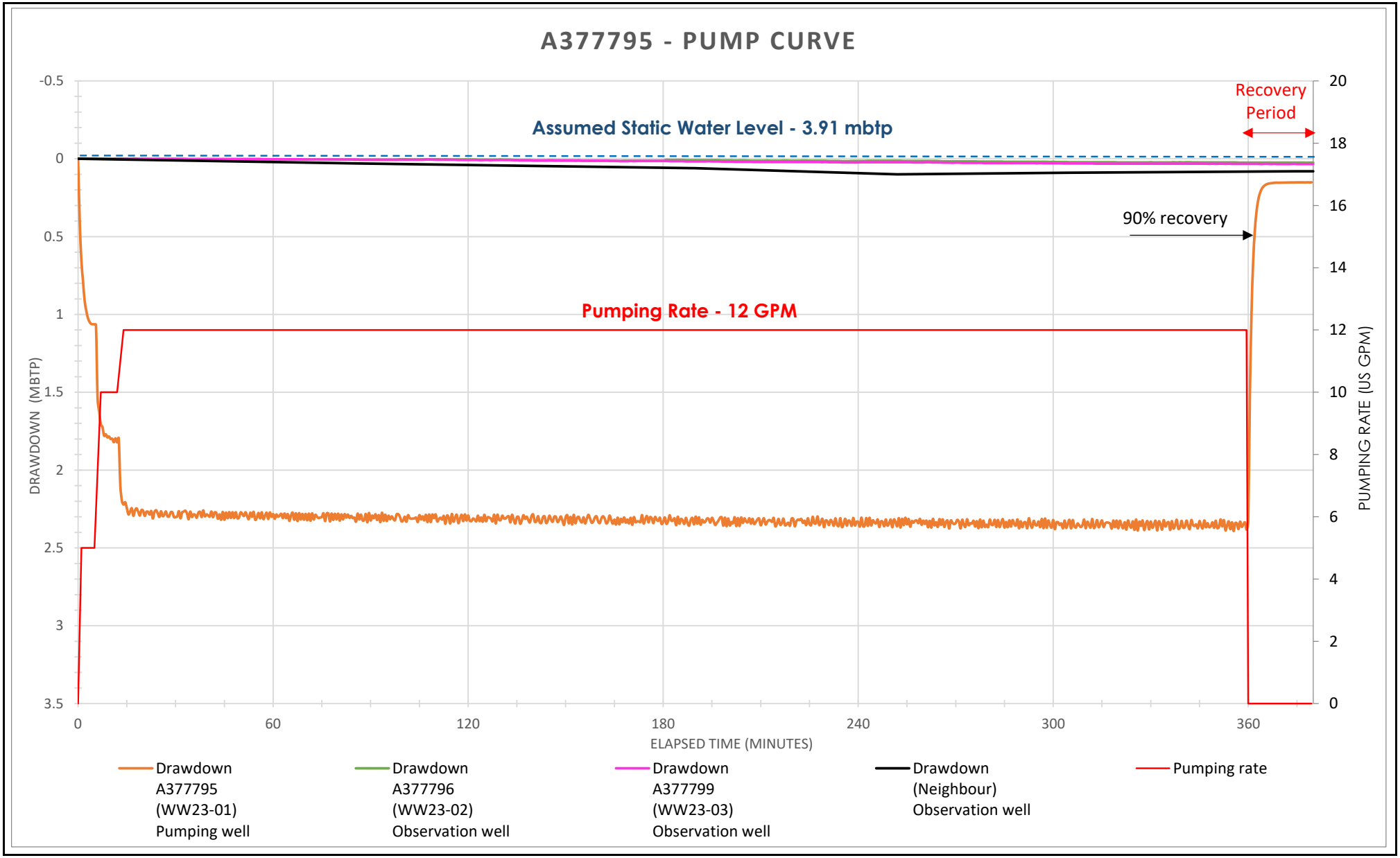
Signature		Date Submitted (yyyy/mm/dd)
Nick Foster	Digitally signed by Nick Foster Date: 2023.10.23 21:57:46 -04'00'	2023/10/23

17. Ministry Use Only

Audit Number
3H6V X9ZB

Appendix G

Pumping Test Hydrographs



Hydrograph

A377795

Pumping Date: October 31, 2023
Pumping Initiation Time: 10:00 am

WILLS

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

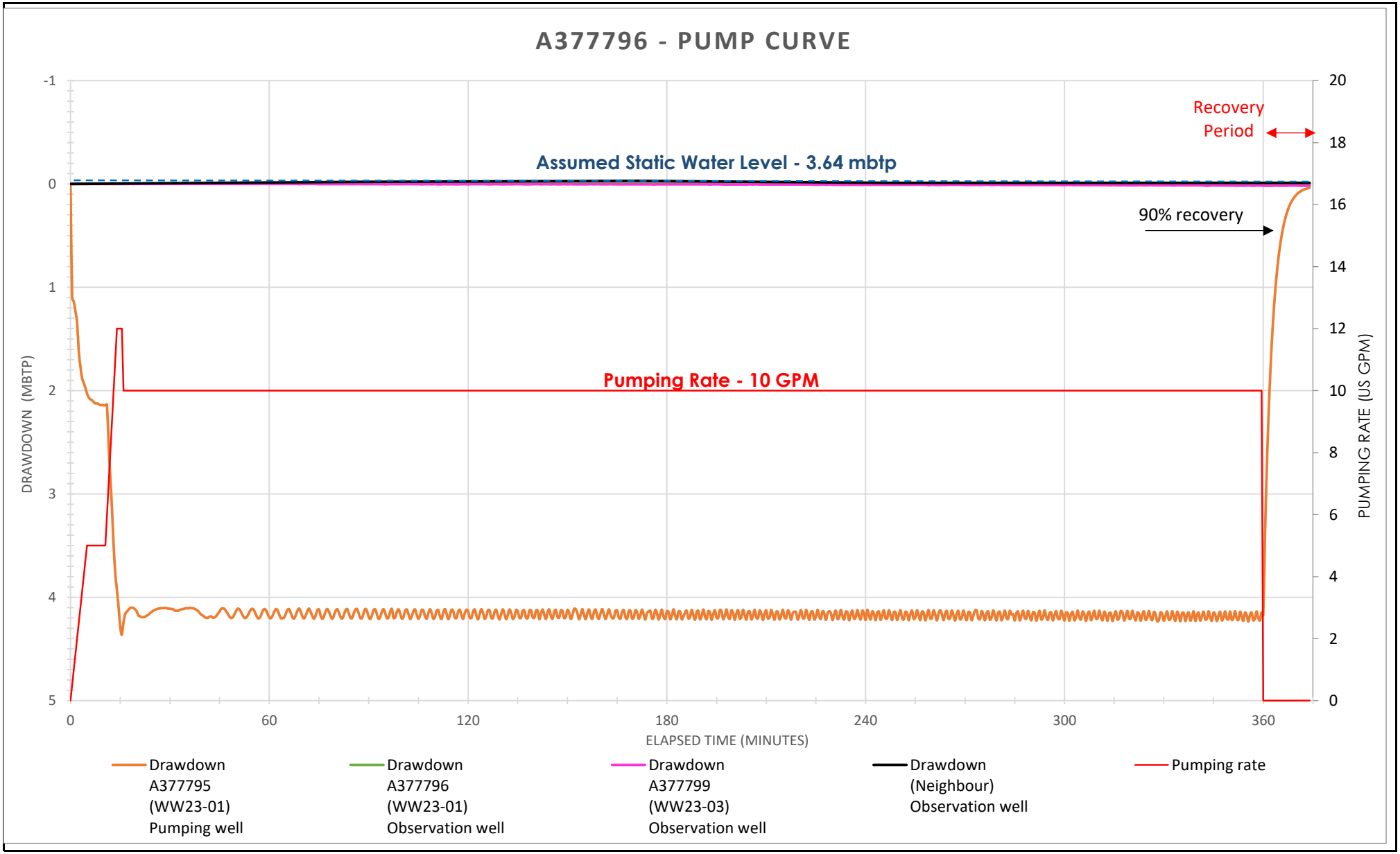
P. 705.742.2297
F. 705.748.9944
E. wills@dmwills.com

Created By: CO

Checked By: IA

Date: November 1, 2023

Project No.: 11056



Hydrograph

A377796

Pumping Date: November 2nd, 2023
Pumping Initiation Time: 9:20 am

WILLS

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

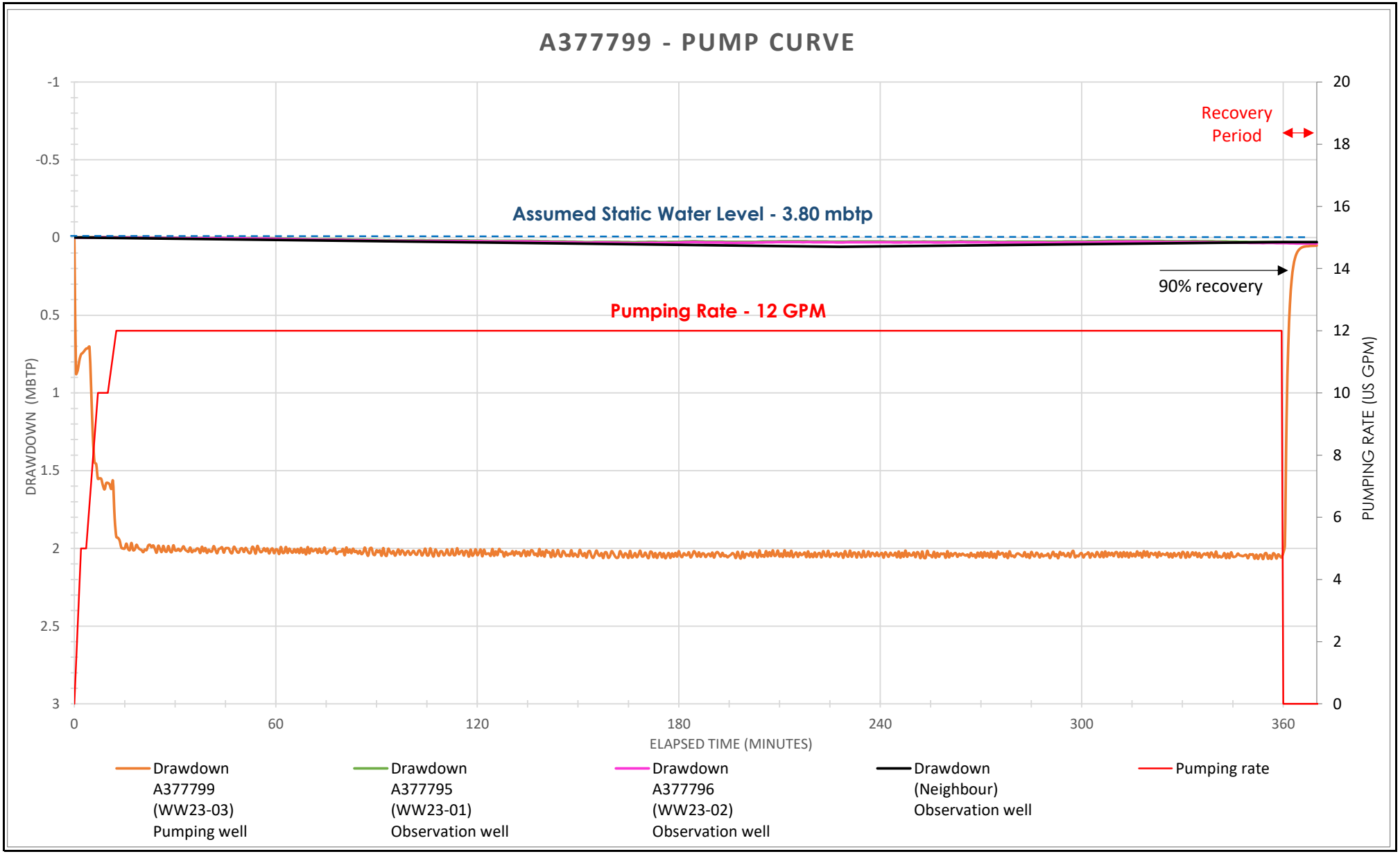
P. 705.742.2297
F. 705.748.9944
E. wills@dmwills.com

Created By: CO

Checked By: IA

Date: November 6, 2023

Project No.: 11056



Hydrograph

A377799

Pumping Date: November 8th, 2023
Pumping Initiation Time: 9:20 am

WILLS

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

P. 705.742.2297
F. 705.748.9944
E. wills@dmwills.com

Created By: CO

Checked By: IA

Date: November 10, 2023

Project No.: 11056

Appendix H

Certificates of Analysis – Groundwater – Water Supply

FINAL REPORT

CA19813-OCT23 R1

11056

Prepared for

D.M. Wills -Peterborough

FINAL REPORT

CA19813-OCT23 R1

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	D.M. Wills -Peterborough	Project Specialist	Jill Campbell, B.Sc.,GISAS
		Laboratory	SGS Canada Inc.
Address	150 Jameson Drive Peterborough, ON K9J 0B9. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Ralf Bolvin	Telephone	2165
Telephone	705-868-1691	Facsimile	705-652-6365
Facsimile	705-741-3568	Email	jill.campbell@sgs.com
Email	rbolvin@dmwills.com	SGS Reference	CA19813-OCT23
Project	11056	Received	10/31/2023
Order Number		Approved	11/07/2023
Samples	Ground Water (2)	Report Number	CA19813-OCT23 R1
		Date Reported	11/07/2023

COMMENTS

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
NR - Not reportable under applicable Provincial drinking water regulations as per client.

Temperature of Sample upon Receipt: 5 degrees C
Cooling Agent Present: Yes
Custody Seal Present: Yes

Chain of Custody Number: 037594

Phenol Spk low due to sample matrix

SIGNATORIES

Jill Campbell, B.Sc.,GISAS

TABLE OF CONTENTS

Client: D.M. Wills -Peterborough
Project: 11056
Project Manager: Ralf Bolvin
Samplers: Chris Ostic

MATRIX: WATER

L1 = ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03

L2 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

				Sample Number	7	8
				Sample Name	11056 Well A377795_1 hr	11056 Well A377795_6 hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	31/10/2023	31/10/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
General Chemistry						
UV Transmittance	%T				94.3	93.4
Alkalinity	mg/L as CaCO3	2	500		221	213
Bicarbonate	mg/L as CaCO3	2			221	213
Carbonate	mg/L as CaCO3	2			< 2	< 2
OH	mg/L as CaCO3	2			< 2	< 2
Colour	TCU	3	5		< 3	3
Conductivity	uS/cm	2			480	479
Total Suspended Solids	mg/L	2			< 2	< 2
Turbidity	NTU	0.10	5	1	1.9	3.1
Organic Nitrogen	mg/L	0.05	0.15		0.76	0.50
Total Kjeldahl Nitrogen (N)	as N mg/L	0.05			0.77	0.51
Ammonia+Ammonium (N)	as N mg/L	0.04			< 0.04	< 0.04
Dissolved Organic Carbon	mg/L	1	5		1	1
Total Organic Carbon	mg/L	1			1	1

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				Sample Name	11056 Well A377795_1 hr	11056 Well A377795_6 hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	31/10/2023	31/10/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics						
Fluoride	mg/L	0.06		1.5	< 0.06	< 0.06
Bromide	mg/L	0.3			< 0.3	< 0.3
Nitrite (as N)	as N mg/L	0.03		1	< 0.03	< 0.03
Nitrate (as N)	as N mg/L	0.06		10	5.16	6.21
Sulphate	mg/L	2	500		11	13
Sulphide	mg/L	0.02			< 0.02	< 0.02
Hardness	mg/L as CaCO3	0.05	100		244	239
Aluminum (total)	mg/L	0.001	0.1		0.007	0.003
Arsenic (total)	mg/L	0.0002		0.01	< 0.0002	< 0.0002
Boron (total)	mg/L	0.002		5	0.010	0.012
Barium (total)	mg/L	0.00008		1	0.00821	0.00903
Beryllium (total)	mg/L	0.000007			< 0.000007	< 0.000007
Bismuth (total)	mg/L	0.00001			< 0.00001	< 0.00001
Cobalt (total)	mg/L	0.000004			0.000135	0.000073
Calcium (total)	mg/L	0.01			90.8	88.8
Cadmium (total)	mg/L	0.000003		0.005	< 0.000003	< 0.000003
Copper (total)	mg/L	0.0002	1		0.0021	0.0019
Chromium (total)	mg/L	0.00008		0.05	0.00029	0.00027
Iron (total)	mg/L	0.007	0.3		0.124	0.032
Potassium (total)	mg/L	0.009			0.442	0.469
Magnesium (total)	mg/L	0.001			4.06	4.16

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					Sample Matrix	Ground Water	Ground Water
					Sample Date	31/10/2023	31/10/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics (continued)						
Manganese (total)	mg/L	0.00001	0.05		0.00666	0.00284
Molybdenum (total)	mg/L	0.00004			0.00036	0.00059
Nickel (total)	mg/L	0.0001			0.0006	0.0004
Sodium (total)	mg/L	0.01	200	20	2.63	2.56
Phosphorus (total)	mg/L	0.003			< 0.003	< 0.003
Lead (total)	mg/L	0.00009		0.01	< 0.00009	< 0.00009
Silicon (total)	mg/L	0.02			3.69	3.66
Silver (total)	mg/L	0.00005			< 0.00005	< 0.00005
Strontium (total)	mg/L	0.00008			0.155	0.155
Thallium (total)	mg/L	0.000005			< 0.000005	< 0.000005
Tin (total)	mg/L	0.00006			0.00011	0.00021
Titanium (total)	mg/L	0.00007			0.00026	0.00010
Antimony (total)	mg/L	0.0009		0.006	< 0.0009	< 0.0009
Selenium (total)	mg/L	0.00004		0.05	0.00004	0.00012
Uranium (total)	mg/L	0.000002		0.02	0.000264	0.000281
Vanadium (total)	mg/L	0.00001			0.00023	0.00020
Zinc (total)	mg/L	0.002	5		0.003	0.002
Cation sum	meq/L	-9999			5.00	4.90
Anion Sum	meq/L	-9999			5.00	4.88
Anion-Cation Balance	% difference	-9999			0.06	0.24
Ion Ratio	none	-9999			1.00	1.00

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				Sample Name	11056 Well A377795_1 hr	11056 Well A377795_6 hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	31/10/2023	31/10/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics (continued)						
Total Dissolved Solids (calculated)	mg/L	-9999			257	252
Conductivity (calculated)	uS/cm	-9999			500	489
Langeliers Index 4° C	@ 4° C	-9999			0.14	0.09
Saturation pH 4°C	pHs @ 4°C	-9999			7.65	7.67
Microbiology						
Total Coliform	cfu/100mL	0		0	0	1
E. Coli	cfu/100mL	0		0	0	0
Heterotrophic Plate Count (HPC)	cfu/1mL	0			740	117
Other (ORP)						
pH	No unit	0.05	8.5		7.79	7.76
Chloride	mg/L	1	250		9	9
Mercury (total)	mg/L	0.00001			< 0.00001	< 0.00001
Phenols						
4AAP-Phenolics	mg/L	0.002			< 0.002	< 0.002

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03 L1	ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03 L2
11056 Well A377795_1 hr					
Organic Nitrogen		mg/L	0.76	0.15	
Turbidity	SM 2130	NTU	1.9		1
Hardness	SM 3030/EPA 200.8	mg/L as CaCO3	244	100	
11056 Well A377795_6 hr					
Organic Nitrogen		mg/L	0.50	0.15	
Total Coliform	OMOE MICROMFDC-E3407A	cfu/100mL	1		0
Turbidity	SM 2130	NTU	3.1		1
Hardness	SM 3030/EPA 200.8	mg/L as CaCO3	239	100	

QC SUMMARY

Alkalinity

Method: SM 2320 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Alkalinity	EWL0113-NOV23	mg/L as CaCO3	2	< 2	1	20	96	80	120	NA		

Ammonia by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENV]SFA-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Ammonia+Ammonium (N)	SKA0040-NOV23	mg/L	0.04	<0.04	ND	10	100	90	110	93	75	125

QC SUMMARY

Anions by discrete analyzer

Method: US EPA 325.2 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-026

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO5006-NOV23	mg/L	1	<1	11	20	104	80	120	106	75	125
Sulphate	DIO5006-NOV23	mg/L	2	<2	ND	20	102	80	120	105	75	125

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bromide	DIO0147-NOV23	mg/L	0.3	<0.3	ND	20	103	90	110	99	75	125
Nitrite (as N)	DIO0147-NOV23	mg/L	0.03	<0.03	19	20	100	90	110	103	75	125
Nitrate (as N)	DIO0147-NOV23	mg/L	0.06	<0.06	0	20	99	90	110	84	75	125

QC SUMMARY

Carbon by SFA

Method: SM 5310 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-009

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Dissolved Organic Carbon	SKA0038-NOV23	mg/L	1	<1	1	20	97	90	110	95	75	125
Total Organic Carbon	SKA0038-NOV23	mg/L	1	<1	1	20	97	90	110	95	75	125

Carbonate/Bicarbonate

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Carbonate	EWL0113-NOV23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0113-NOV23	mg/L as CaCO3	2	< 2	1	10	NA	90	110	NA		
OH	EWL0113-NOV23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		

QC SUMMARY

Colour

Method: SM 2120 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Colour	EWL0037-NOV23	TCU	3	< 3	0	10	105	80	120	NA		

Conductivity

Method: SM 2510 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0113-NOV23	uS/cm	2	< 2	0	20	100	90	110	NA		

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0035-NOV23	mg/L	0.06	<0.06	ND	10	97	90	110	98	75	125
Fluoride	EWL0090-NOV23	mg/L	0.06	<0.06	0	10	96	90	110	96	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0005-NOV23	mg/L	0.00001	< 0.00001	13	20	101	80	120	100	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver (total)	EMS0028-NOV23	mg/L	0.00005	<0.00005	ND	20	102	90	110	73	70	130
Aluminum (total)	EMS0028-NOV23	mg/L	0.001	<0.001	9	20	100	90	110	90	70	130
Arsenic (total)	EMS0028-NOV23	mg/L	0.0002	<0.0002	6	20	97	90	110	100	70	130
Barium (total)	EMS0028-NOV23	mg/L	0.00008	<0.00008	2	20	97	90	110	96	70	130
Beryllium (total)	EMS0028-NOV23	mg/L	0.000007	<0.000007	ND	20	98	90	110	97	70	130
Boron (total)	EMS0028-NOV23	mg/L	0.002	<0.002	5	20	107	90	110	95	70	130
Bismuth (total)	EMS0028-NOV23	mg/L	0.00001	<0.00001	ND	20	91	90	110	97	70	130
Calcium (total)	EMS0028-NOV23	mg/L	0.01	<0.01	2	20	102	90	110	100	70	130
Cadmium (total)	EMS0028-NOV23	mg/L	0.000003	<0.000003	2	20	100	90	110	106	70	130
Cobalt (total)	EMS0028-NOV23	mg/L	0.000004	<0.000004	7	20	101	90	110	99	70	130
Chromium (total)	EMS0028-NOV23	mg/L	0.00008	<0.00008	15	20	101	90	110	85	70	130
Copper (total)	EMS0028-NOV23	mg/L	0.0002	<0.0002	3	20	98	90	110	81	70	130
Iron (total)	EMS0028-NOV23	mg/L	0.007	<0.007	4	20	97	90	110	100	70	130
Potassium (total)	EMS0028-NOV23	mg/L	0.009	<0.009	4	20	101	90	110	99	70	130
Magnesium (total)	EMS0028-NOV23	mg/L	0.001	<0.001	5	20	99	90	110	98	70	130
Manganese (total)	EMS0028-NOV23	mg/L	0.00001	<0.00001	3	20	98	90	110	97	70	130
Molybdenum (total)	EMS0028-NOV23	mg/L	0.00004	<0.00004	1	20	106	90	110	107	70	130
Sodium (total)	EMS0028-NOV23	mg/L	0.01	<0.01	4	20	97	90	110	95	70	130
Nickel (total)	EMS0028-NOV23	mg/L	0.0001	<0.0001	1	20	100	90	110	98	70	130
Lead (total)	EMS0028-NOV23	mg/L	0.00009	<0.00009	ND	20	99	90	110	76	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Phosphorus (total)	EMS0028-NOV23	mg/L	0.003	<0.003	3	20	100	90	110	NV	70	130
Antimony (total)	EMS0028-NOV23	mg/L	0.0009	<0.0009	ND	20	109	90	110	106	70	130
Selenium (total)	EMS0028-NOV23	mg/L	0.00004	<0.00004	ND	20	98	90	110	99	70	130
Silicon (total)	EMS0028-NOV23	mg/L	0.02	<0.02	4	20	105	90	110	NV	70	130
Tin (total)	EMS0028-NOV23	mg/L	0.00006	<0.00006	3	20	106	90	110	NV	70	130
Strontium (total)	EMS0028-NOV23	mg/L	0.00008	<0.00008	4	20	101	90	110	100	70	130
Titanium (total)	EMS0028-NOV23	mg/L	0.00007	<0.00005	9	20	108	90	110	NV	70	130
Thallium (total)	EMS0028-NOV23	mg/L	0.000005	<0.000005	7	20	96	90	110	99	70	130
Uranium (total)	EMS0028-NOV23	mg/L	0.000002	<0.000002	1	20	99	90	110	102	70	130
Vanadium (total)	EMS0028-NOV23	mg/L	0.00001	<0.00001	8	20	97	90	110	96	70	130
Zinc (total)	EMS0028-NOV23	mg/L	0.002	<0.002	3	20	103	90	110	123	70	130

QC SUMMARY

Microbiology

Method: OMOE MICROMFDC-E3407A | Internal ref.: ME-CA-[ENV]MIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
E. Coli	BAC9011-NOV23	cfu/100mL	-	ACCEPTED	ACCEPTED							
Heterotrophic Plate Count (HPC)	BAC9011-NOV23	cfu/1mL	-	ACCEPTED	ACCEPTED							
Total Coliform	BAC9011-NOV23	cfu/100mL	-	ACCEPTED	ACCEPTED							

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0113-NOV23	No unit	0.05	NA	0		100			NA		

QC SUMMARY

Phenols by SFA

Method: SM 5530B-D | Internal ref.: ME-CA-IENVISFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0023-NOV23	mg/L	0.002	<0.002	ND	10	100	80	120	60	75	125

Sulphide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	SKA0030-NOV23	mg/L	0.02	<0.02	ND	20	94	80	120	NA	75	125

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-IENVIEWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0120-NOV23	mg/L	2	< 2	5	10	95	90	110	NA		

QC SUMMARY

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen (N)	SKA0045-NOV23	mg/L	0.05	<0.05	5	10	101	90	110	89	75	125

Turbidity

Method: SM 2130 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Turbidity	EWL0027-NOV23	NTU	0.10	< 0.10	0	10	100	90	110	NA		

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Results relate only to the sample tested.
Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.
"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.
Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated.

SGS Canada Inc. statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

This report supersedes all previous versions.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

No: 037594

SGS Industries & Environment - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

Page _____ of _____

Laboratory Information Section - Lab use only

Received By: _____ Received By (signature): _____

Received Date: 10 / 31 / 23 (mm/dd/yy) Custody Seal Present: Yes ☑ No ☐ Cooling Agent Present: Yes ☑ No ☐ Type: _____

Received Time: 17 : 00 (hr : min) Custody Seal Intact: Yes ☑ No ☐ Temperature Upon Receipt (°C) 5.3 LAB LIMS #: CA19813-OCT23

REPORT INFORMATION

Company: DM WILLS
Contact: RALF BOLVIN
Address: 150 JAMESON DRIVE PETERBOROUGH, ON
Phone: 705-868-1691
Fax: _____
Email: rbolvin@dmwills.com

INVOICE INFORMATION

☑ (same as Report Information)
Company: _____
Contact: _____
Address: _____
Phone: _____
Email: accounts@dmwills.com

Quotation #: _____ P.O. #: 11056
Project #: 11056 Site Location/ID: _____

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days) TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: _____ *NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19

☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium/Fine
☐ Table 3 ☐ Agri/Other
☐ Table _____ Appx. _____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: _____ ☐ MISA ☑ ODWS Not Reportable *See note

Sewer By-Law: ☐ Sanitary ☐ Storm Municipality: _____

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	M&I: Metals & Inorganics (incl CrVI, CN, Hg pH,(B(HWS),EC,SAR-soil) (Cl, Na-water))	M&I: Full Metals Suite (ICP metals plus B(HWS-soil only) Hg, CrVI)	M&I: ICP Metals only (Sb,As,Ba,Be,B,Cd, Cr,Co,Cu,Pb,Mo,Ni,Se,Ag,Ti,U,V,Zn)	SVOC: PAHs only	SVOC: SVOCs (all incl PAHs, ABNs, CPs)	PCB: PCBs (Aroclor / Total)	PHC: F1-F4 + BTEX	PHC: F1-F4 only (no BTEX)	VOC: VOCs (all incl BTEX)	VOC: BTEX only	Pest: Pesticides (Organochlorine or specify other)	Other: Sewer Use: (Specify pkg:)	Other: Water Characterization Pkg (General / Extended)	SPLP: Specify tests (☐ Metals ☐ VOC ☐ 1,4-Dioxane ☐ OCP ☐ ABN)	TCLP: Specify tests (☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit.)	COMMENTS:
1	11056Well A377795-1hr	Oct 31/23	11:00am	13	GW	N													X			
2	11056Well A377795-6hr	Oct 31/23	4:00PM	13	GW	N													X			
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

Observations/Comments/Special Instructions

Sampled By (NAME): CHRIS OSTIC Signature: Chris Ostic Date: 10 / 31 / 23 (mm/dd/yy)

Relinquished by (NAME): CHRIS OSTIC Signature: Chris Ostic Date: 10 / 31 / 23 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

FINAL REPORT

CA14079-NOV23 R1

11056

Prepared for

D.M. Wills -Peterborough

FINAL REPORT

First Page

CLIENT DETAILS

Client	D.M. Wills -Peterborough
Address	150 Jameson Drive Peterborough, ON K9J 0B9. Canada
Contact	Ralf Bolvin
Telephone	705-868-1691
Facsimile	705-741-3568
Email	rbolvin@dmwills.com
Project	11056
Order Number	
Samples	Ground Water (2)

LABORATORY DETAILS

Project Specialist	Jill Campbell, B.Sc.,GISAS
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	2165
Facsimile	705-652-6365
Email	jill.campbell@sgs.com
SGS Reference	CA14079-NOV23
Received	11/02/2023
Approved	11/09/2023
Report Number	CA14079-NOV23 R1
Date Reported	11/09/2023

COMMENTS

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
NR - Not reportable under applicable Provincial drinking water regulations as per client.

Temperature of Sample upon Receipt: 6 degrees C
Cooling Agent Present: Yes
Custody Seal Present: Yes

Chain of Custody Number: 011390

SIGNATORIES

Jill Campbell, B.Sc.,GISAS

TABLE OF CONTENTS

Client: D.M. Wills -Peterborough
Project: 11056
Project Manager: Ralf Bolvin
Samplers: Chris Ostic

MATRIX: WATER

L1 = ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03

L2 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

Sample Number					7	8
Sample Name					11056WellA3777 96_1hr	11056WellA3777 96_6hr
Sample Matrix					Ground Water	Ground Water
Sample Date					02/11/2023	02/11/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
General Chemistry						
UV Transmittance	%T				92.4	91.8
Alkalinity	mg/L as CaCO3	2	500		225	224
Bicarbonate	mg/L as CaCO3	2			225	224
Carbonate	mg/L as CaCO3	2			< 2	< 2
OH	mg/L as CaCO3	2			< 2	< 2
Colour	TCU	3	5		5	4
Conductivity	uS/cm	2			454	461
Total Suspended Solids	mg/L	2			3	3
Turbidity	NTU	0.10	5	1	6.9	2.4
Organic Nitrogen	mg/L	0.05	0.15		< 0.05	< 0.05
Total Kjeldahl Nitrogen (N)	as N mg/L	0.05			< 0.05	< 0.05
Ammonia+Ammonium (N)	as N mg/L	0.04			0.05	< 0.04
Dissolved Organic Carbon	mg/L	1	5		1	1
Total Organic Carbon	mg/L	1			1	1

Client: D.M. Wills -Peterborough
Project: 11056
Project Manager: Ralf Bolvin
Samplers: Chris Ostic

MATRIX: WATER

L1 = ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03

L2 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

				Sample Number	7	8
				Sample Name	11056WellA3777 96_1hr	11056WellA3777 96_6hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	02/11/2023	02/11/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics						
Fluoride	mg/L	0.06		1.5	< 0.06	< 0.06
Bromide	mg/L	0.3			< 0.3	< 0.3
Nitrite (as N)	as N mg/L	0.03		1	< 0.03	< 0.03
Nitrate (as N)	as N mg/L	0.06		10	0.09	0.12
Sulphate	mg/L	2	500		23	21
Sulphide	mg/L	0.02			< 0.02	< 0.02
Hardness	mg/L as CaCO3	0.05	100		260	256
Aluminum (total)	mg/L	0.001	0.1		0.012	0.003
Arsenic (total)	mg/L	0.0002		0.01	0.0002	< 0.0002
Boron (total)	mg/L	0.002		5	0.010	0.008
Barium (total)	mg/L	0.00008		1	0.0285	0.0313
Beryllium (total)	mg/L	0.000007			0.000007	< 0.000007
Bismuth (total)	mg/L	0.00001			< 0.00001	< 0.00001
Cobalt (total)	mg/L	0.000004			0.000113	0.000043
Calcium (total)	mg/L	0.01			96.2	94.7
Cadmium (total)	mg/L	0.000003		0.005	0.000003	< 0.000003
Copper (total)	mg/L	0.0002	1		0.0006	0.0007
Chromium (total)	mg/L	0.00008		0.05	0.00021	0.00015
Iron (total)	mg/L	0.007	0.3		0.804	0.371
Potassium (total)	mg/L	0.009			0.377	0.365
Magnesium (total)	mg/L	0.001			4.83	4.72

Client: D.M. Wills -Peterborough
Project: 11056
Project Manager: Ralf Bolvin
Samplers: Chris Ostic

MATRIX: WATER

L1 = ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03

L2 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

	Sample Number				7	8
	Sample Name				11056WellA3777 96_1hr	11056WellA3777 96_6hr
	Sample Matrix				Ground Water	Ground Water
	Sample Date				02/11/2023	02/11/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics (continued)						
Manganese (total)	mg/L	0.00001	0.05		0.0199	0.0134
Molybdenum (total)	mg/L	0.00004			0.00024	0.00019
Nickel (total)	mg/L	0.0001			0.0006	0.0004
Sodium (total)	mg/L	0.01	200	20	2.37	2.24
Phosphorus (total)	mg/L	0.003			0.003	< 0.003
Lead (total)	mg/L	0.00009		0.01	< 0.00009	< 0.00009
Silicon (total)	mg/L	0.02			4.76	4.72
Silver (total)	mg/L	0.00005			< 0.00005	< 0.00005
Strontium (total)	mg/L	0.00008			0.168	0.165
Thallium (total)	mg/L	0.000005			< 0.000005	< 0.000005
Tin (total)	mg/L	0.00006			0.00007	< 0.00006
Titanium (total)	mg/L	0.00007			0.00049	0.00011
Antimony (total)	mg/L	0.0009		0.006	< 0.0009	< 0.0009
Selenium (total)	mg/L	0.00004		0.05	0.00013	0.00012
Uranium (total)	mg/L	0.000002		0.02	0.000176	0.000202
Vanadium (total)	mg/L	0.00001			0.00015	0.00016
Zinc (total)	mg/L	0.002	5		< 0.002	< 0.002
Cation sum	meq/L	-9999			5.36	5.25
Anion Sum	meq/L	-9999			5.16	5.09
Anion-Cation Balance	% difference	-9999			1.99	1.55
Ion Ratio	none	-9999			1.04	1.03

Client: D.M. Wills -Peterborough
Project: 11056
Project Manager: Ralf Bolvin
Samplers: Chris Ostic

MATRIX: WATER

L1 = ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03

L2 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

				Sample Number	7	8
				Sample Name	11056WellA3777 96_1hr	11056WellA3777 96_6hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	02/11/2023	02/11/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics (continued)						
Total Dissolved Solids (calculated)	mg/L	-9999			268	264
Conductivity (calculated)	uS/cm	-9999			526	517
Langeliers Index 4° C	@ 4° C	-9999			0.38	0.32
Saturation pH 4°C	pHs @ 4°C	-9999			7.61	7.62
Microbiology						
Total Coliform	cfu/100mL	0		0	0	0
E. Coli	cfu/100mL	0		0	0	0
Heterotrophic Plate Count (HPC)	cfu/1mL	0			130	36
Other (ORP)						
pH	No unit	0.05	8.5		7.99	7.94
Chloride	mg/L	1	250		6	6
Mercury (total)	mg/L	0.00001			< 0.00001	< 0.00001
Phenols						
4AAP-Phenolics	mg/L	0.002			< 0.002	< 0.002

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03 L1	ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03 L2
11056WellA377796_1hr					
Turbidity	SM 2130	NTU	6.9	5	1
Hardness	SM 3030/EPA 200.8	mg/L as CaCO3	260	100	
Iron	SM 3030/EPA 200.8	mg/L	0.804	0.3	
11056WellA377796_6hr					
Turbidity	SM 2130	NTU	2.4		1
Hardness	SM 3030/EPA 200.8	mg/L as CaCO3	256	100	
Iron	SM 3030/EPA 200.8	mg/L	0.371	0.3	

QC SUMMARY

Alkalinity

Method: SM 2320 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Alkalinity	EWL0114-NOV23	mg/L as CaCO3	2	< 2	1	20	102	80	120	NA		

Ammonia by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENV]SFA-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Ammonia+Ammonium (N)	SKA0056-NOV23	mg/L	0.04	<0.04	ND	10	97	90	110	92	75	125

QC SUMMARY

Anions by discrete analyzer

Method: US EPA 325.2 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-026

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO5010-NOV23	mg/L	1	<1	ND	20	104	80	120	107	75	125
Sulphate	DIO5010-NOV23	mg/L	2	<2	13	20	102	80	120	105	75	125

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bromide	DIO0191-NOV23	mg/L	0.3	<0.3	ND	20	103	90	110	93	75	125
Nitrite (as N)	DIO0191-NOV23	mg/L	0.03	<0.03	ND	20	99	90	110	103	75	125
Nitrate (as N)	DIO0191-NOV23	mg/L	0.06	<0.06	ND	20	101	90	110	105	75	125

QC SUMMARY

Carbon by SFA

Method: SM 5310 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-009

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Dissolved Organic Carbon	SKA0054-NOV23	mg/L	1	<1	2	20	95	90	110	98	75	125
Total Organic Carbon	SKA0054-NOV23	mg/L	1	<1	2	20	95	90	110	98	75	125

Carbonate/Bicarbonate

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Carbonate	EWL0114-NOV23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0114-NOV23	mg/L as CaCO3	2	< 2	1	10	NA	90	110	NA		
OH	EWL0114-NOV23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		

QC SUMMARY

Colour

Method: SM 2120 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Colour	EWL0166-NOV23	TCU	3	< 3	0	10	105	80	120	NA		

Conductivity

Method: SM 2510 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0114-NOV23	uS/cm	2	< 2	0	20	99	90	110	NA		

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0169-NOV23	mg/L	0.06	<0.06	ND	10	100	90	110	94	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0007-NOV23	mg/L	0.00001	< 0.00001	ND	20	93	80	120	91	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver (total)	EMS0035-NOV23	mg/L	0.00005	<0.00005	ND	20	98	90	110	87	70	130
Aluminum (total)	EMS0035-NOV23	mg/L	0.001	<0.001	7	20	100	90	110	112	70	130
Arsenic (total)	EMS0035-NOV23	mg/L	0.0002	<0.0002	ND	20	98	90	110	97	70	130
Barium (total)	EMS0035-NOV23	mg/L	0.00008	<0.00008	0	20	93	90	110	75	70	130
Beryllium (total)	EMS0035-NOV23	mg/L	0.000007	<0.000007	12	20	98	90	110	88	70	130
Boron (total)	EMS0035-NOV23	mg/L	0.002	<0.002	10	20	107	90	110	96	70	130
Bismuth (total)	EMS0035-NOV23	mg/L	0.00001	<0.00001	ND	20	97	90	110	83	70	130
Calcium (total)	EMS0035-NOV23	mg/L	0.01	<0.01	3	20	105	90	110	127	70	130
Cadmium (total)	EMS0035-NOV23	mg/L	0.000003	<0.000003	0	20	99	90	110	99	70	130
Cobalt (total)	EMS0035-NOV23	mg/L	0.000004	<0.000004	0	20	99	90	110	94	70	130
Chromium (total)	EMS0035-NOV23	mg/L	0.00008	<0.00008	0	20	101	90	110	105	70	130
Copper (total)	EMS0035-NOV23	mg/L	0.0002	<0.0002	2	20	98	90	110	97	70	130
Iron (total)	EMS0035-NOV23	mg/L	0.007	<0.007	0	20	102	90	110	100	70	130
Potassium (total)	EMS0035-NOV23	mg/L	0.009	<0.009	2	20	103	90	110	111	70	130
Magnesium (total)	EMS0035-NOV23	mg/L	0.001	<0.001	1	20	107	90	110	89	70	130
Manganese (total)	EMS0035-NOV23	mg/L	0.00001	<0.00001	1	20	96	90	110	78	70	130
Molybdenum (total)	EMS0035-NOV23	mg/L	0.00004	<0.00004	5	20	96	90	110	96	70	130
Sodium (total)	EMS0035-NOV23	mg/L	0.01	<0.01	1	20	105	90	110	95	70	130
Nickel (total)	EMS0035-NOV23	mg/L	0.0001	<0.0001	7	20	94	90	110	86	70	130
Lead (total)	EMS0035-NOV23	mg/L	0.00009	<0.00009	ND	20	98	90	110	88	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Phosphorus (total)	EMS0035-NOV23	mg/L	0.003	<0.003	ND	20	103	90	110	NV	70	130
Antimony (total)	EMS0035-NOV23	mg/L	0.0009	<0.0009	ND	20	97	90	110	97	70	130
Selenium (total)	EMS0035-NOV23	mg/L	0.00004	<0.00004	ND	20	100	90	110	92	70	130
Silicon (total)	EMS0035-NOV23	mg/L	0.02	<0.02	1	20	102	90	110	NV	70	130
Tin (total)	EMS0035-NOV23	mg/L	0.00006	<0.00006	ND	20	101	90	110	NV	70	130
Strontium (total)	EMS0035-NOV23	mg/L	0.00008	<0.00008	1	20	99	90	110	82	70	130
Titanium (total)	EMS0035-NOV23	mg/L	0.00007	<0.00005	ND	20	98	90	110	NV	70	130
Thallium (total)	EMS0035-NOV23	mg/L	0.000005	<0.000005	0	20	98	90	110	88	70	130
Uranium (total)	EMS0035-NOV23	mg/L	0.000002	2e-006	5	20	98	90	110	89	70	130
Vanadium (total)	EMS0035-NOV23	mg/L	0.00001	<0.00001	16	20	97	90	110	98	70	130
Zinc (total)	EMS0035-NOV23	mg/L	0.002	<0.002	5	20	101	90	110	97	70	130

QC SUMMARY

Microbiology

Method: SM 9215A | Internal ref.: ME-CA-[ENV]MIC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Heterotrophic Plate Count (HPC)	BAC9064-NOV23	cfu/1mL	-	ACCEPTED	ACCEPTED							
E. Coli	BAC9064-NOV23	cfu/100mL	-	ACCEPTED	ACCEPTED							
Total Coliform	BAC9064-NOV23	cfu/100mL	-	ACCEPTED	ACCEPTED							

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0114-NOV23	No unit	0.05	NA	0		100			NA		

QC SUMMARY

Phenols by SFA

Method: SM 5530B-D | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0052-NOV23	mg/L	0.002	<0.002	ND	10	109	80	120	96	75	125

Sulphide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	SKA0090-NOV23	mg/L	0.02	<0.02	ND	20	105	80	120	NA	75	125

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0223-NOV23	mg/L	2	< 2	1	10	95	90	110	NA		

QC SUMMARY

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen (N)	SKA0041-NOV23	mg/L	0.05	<0.05	ND	10	108	90	110	107	75	125

Turbidity

Method: SM 2130 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Turbidity	EWL0102-NOV23	NTU	0.10	< 0.10	0	10	99	90	110	NA		

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Results relate only to the sample tested.
Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.
"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.
Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated.

SGS Canada Inc. statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

This report supersedes all previous versions.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: 011390 Page ____ of ____

Laboratory Information Section - Lab use only

Received By: ne
Received Date: 11/02/23 (mm/dd/yy)
Received Time: 17:10 (hr : min)
Received By (signature): ne
Custody Seal Present: Yes ☐ No ☒
Custody Seal Intact: Yes ☐ No ☒
Cooling Agent Present: Yes ☒ No ☐ Type: ICE
Temperature Upon Receipt (°C): 6.6.6
LAB LIMS #: CA14079-NOV23

REPORT INFORMATION
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Fax:
Email: rbolvin@dmwills.com

INVOICE INFORMATION
☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email: accounts@dmwills.com

Quotation #:
P.O. #: 11056
Project #: 11056
Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED
☑ Regular TAT (5-7days)
TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day
RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION
Specify Due Date:
NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS
Regulation 153/04: ☐ Table 1 ☐ Table 2 ☐ Table 3 ☐ Table ____ ☐ Res/Park ☐ Ind/Com ☐ Agri/Other Soil Texture: ☐ Coarse ☐ Medium ☐ Fine
Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☑ Other: ODWS ☐ MISA
Sewer By-Law: ☐ Sanitary ☐ Storm Municipality:
RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	M&I: Metals & Inorganics (incl CrVI, CN,Hg pH,(B(HWS),EC,SAR-soil) (Cl, Na-water)	M&I: Full Metals Suite (ICP metals plus B(HWS-soil only) Hg, CrVI	M&I: ICP Metals only (Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni, Se,Ag,Tl,U,V,Zn	SVOC: PAHs only	SVOC: SVOCs all incl PAHs, ABNs, CPs	PCB: PCBs Total ☐ Aroclor ☐	PHC: F1-F4 + BTEX	PHC: F1-F4 only no BTEX	VOC: VOCs all incl BTEX	VOC: BTEX only	Pest: Pesticides Organochlorine or specify other	Other (please specify)	Other (please specify)	Other (please specify)	Other (please specify)	Other (please specify)	Other (please specify)	Other (please specify)	TCLP: Specify TCLP tests ☐M&I ☐VOC ☐PCB ☐B(a)P ☐ABN ☐Ignit.	COMMENTS:
																				Sewer Use: Specify pkg:	Water Characterization Pkg ☐ General Extended					
1	11056WellA377796_1hr	Nov 2/23	10:20AM	13	GW	N															X				
2	11056WellA377796_6hr	Nov 2/23	3:20AM	13	GW	N															X				
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									

Observations/Comments/Special Instructions

Sampled By (NAME): CHRIS OSTIC Signature: Chris Ostic Date: 11/02/23 (mm/dd/yy)
Relinquished by (NAME): CHRIS OSTIC Signature: Chris Ostic Date: 11/02/23 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.2
Date of Issue: 09 Sept, 2019

FINAL REPORT

CA14296-NOV23 R1

11056

Prepared for

D.M. Wills -Peterborough

FINAL REPORT

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	D.M. Wills -Peterborough	Project Specialist	Maarit Wolfe, Hon.B.Sc
		Laboratory	SGS Canada Inc.
Address	150 Jameson Drive Peterborough, ON K9J 0B9. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Ralf Bolvin	Telephone	705-652-2000
Telephone	705-868-1691	Facsimile	705-652-6365
Facsimile	705-741-3568	Email	Maarit.Wolfe@sgs.com
Email	rbolvin@dmwills.com	SGS Reference	CA14296-NOV23
Project	11056	Received	11/08/2023
Order Number		Approved	11/15/2023
Samples	Ground Water (2)	Report Number	CA14296-NOV23 R1
		Date Reported	11/15/2023

COMMENTS

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
NR - Not reportable under applicable Provincial drinking water regulations as per client.

Temperature of Sample upon Receipt: 5 degrees C
Cooling Agent Present: Yes
Custody Seal Present: Yes

Chain of Custody Number: 036655

SIGNATORIES

Maarit Wolfe, Hon.B.Sc

TABLE OF CONTENTS

Client: D.M. Wills -Peterborough

Project: 11056

Project Manager: Ralf Bolvin

Samplers: Chris Ostic

MATRIX: WATER

L1 = ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03

L2 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

					Sample Number	7	8
					Sample Name	11056-WellA377 799_1hr	11056-WellA377 799_6hr
					Sample Matrix	Ground Water	Ground Water
					Sample Date	08/11/2023	08/11/2023
Parameter		**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
General Chemistry							
UV Transmittance		%T				96.7	97.1
Alkalinity		mg/L as CaCO3	2	500		198	198
Bicarbonate		mg/L as CaCO3	2			198	198
Carbonate		mg/L as CaCO3	2			< 2	< 2
OH		mg/L as CaCO3	2			< 2	< 2
Colour		TCU	3	5		4	3
Conductivity		uS/cm	2			397	409
Total Suspended Solids		mg/L	2			2	< 2
Turbidity		NTU	0.10	5	1	0.80	0.55
Organic Nitrogen		mg/L	0.05	0.15		< 0.05	< 0.05
Total Kjeldahl Nitrogen (N)		as N mg/L	0.05			< 0.05	< 0.05
Ammonia+Ammonium (N)		as N mg/L	0.04			< 0.04	< 0.04
Dissolved Organic Carbon		mg/L	1	5		1	1
Total Organic Carbon		mg/L	1			< 1	1

Client: D.M. Wills -Peterborough
Project: 11056
Project Manager: Ralf Bolvin
Samplers: Chris Ostic

MATRIX: WATER

L1 = ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03

L2 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

				Sample Number	7	8
				Sample Name	11056-WellA377 799_1hr	11056-WellA377 799_6hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	08/11/2023	08/11/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics						
Fluoride	mg/L	0.06		1.5	< 0.06	< 0.06
Bromide	mg/L	0.3			< 0.3	< 0.3
Nitrite (as N)	as N mg/L	0.03		1	< 0.03	< 0.03
Nitrate (as N)	as N mg/L	0.06		10	1.84	1.62
Sulphate	mg/L	2	500		7	8
Sulphide	mg/L	0.02			< 0.02	< 0.02
Hardness	mg/L as CaCO3	0.05	100		220	225
Aluminum (total)	mg/L	0.001	0.1		0.007	0.003
Arsenic (total)	mg/L	0.0002		0.01	< 0.0002	< 0.0002
Boron (total)	mg/L	0.002		5	0.015	0.015
Barium (total)	mg/L	0.00008		1	0.00993	0.00982
Beryllium (total)	mg/L	0.000007			< 0.000007	< 0.000007
Bismuth (total)	mg/L	0.00001			< 0.00001	< 0.00001
Cobalt (total)	mg/L	0.000004			0.000105	0.000031
Calcium (total)	mg/L	0.01			82.1	83.9
Cadmium (total)	mg/L	0.000003		0.005	< 0.000003	< 0.000003
Copper (total)	mg/L	0.0002	1		0.0009	0.0006
Chromium (total)	mg/L	0.00008		0.05	0.00073	0.00049
Iron (total)	mg/L	0.007	0.3		0.074	0.026
Potassium (total)	mg/L	0.009			0.373	0.361
Magnesium (total)	mg/L	0.001			3.61	3.82

Client: D.M. Wills -Peterborough
Project: 11056
Project Manager: Ralf Bolvin
Samplers: Chris Ostic

MATRIX: WATER

L1 = ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03

L2 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

Sample Number					7	8
Sample Name					11056-WellA377 799_1hr	11056-WellA377 799_6hr
Sample Matrix					Ground Water	Ground Water
Sample Date					08/11/2023	08/11/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics (continued)						
Manganese (total)	mg/L	0.00001	0.05		0.00835	0.00197
Molybdenum (total)	mg/L	0.00004			0.00018	0.00009
Nickel (total)	mg/L	0.0001			0.0005	0.0002
Sodium (total)	mg/L	0.01	200	20	1.54	1.61
Phosphorus (total)	mg/L	0.003			< 0.003	< 0.003
Lead (total)	mg/L	0.00009		0.01	0.00011	< 0.00009
Silicon (total)	mg/L	0.02			4.28	4.34
Silver (total)	mg/L	0.00005			< 0.00005	< 0.00005
Strontium (total)	mg/L	0.00008			0.137	0.140
Thallium (total)	mg/L	0.000005			< 0.000005	< 0.000005
Tin (total)	mg/L	0.00006			< 0.00006	< 0.00006
Titanium (total)	mg/L	0.00007			0.00018	< 0.00007
Antimony (total)	mg/L	0.0009		0.006	< 0.0009	< 0.0009
Selenium (total)	mg/L	0.00004		0.05	0.00015	0.00012
Uranium (total)	mg/L	0.000002		0.02	0.000186	0.000177
Vanadium (total)	mg/L	0.00001			0.00027	0.00027
Zinc (total)	mg/L	0.002	5		< 0.002	< 0.002

Client: D.M. Wills -Peterborough
Project: 11056
Project Manager: Ralf Bolvin
Samplers: Chris Ostic

MATRIX: WATER

L1 = ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03

L2 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

				Sample Number	7	8
				Sample Name	11056-WellA377 799_1hr	11056-WellA377 799_6hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	08/11/2023	08/11/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Microbiology						
Total Coliform	cfu/100mL	0		0	6	2
E. Coli	cfu/100mL	0		0	0	0
Heterotrophic Plate Count (HPC)	cfu/1mL	0			640	115
Other (ORP)						
pH	No unit	0.05	8.5		8.15	8.09
Chloride	mg/L	1	250		2	3
Mercury (total)	mg/L	0.00001			< 0.00001	< 0.00001
Phenols						
4AAP-Phenolics	mg/L	0.002			< 0.002	< 0.002

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	ODWS_AO_OG / WATER / - - Table 4 - Drinking Water - Reg O.169_03 L1	ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03 L2
11056-WellA377799_1hr					
Total Coliform	OMOE MICROMFDC-E3407A	cfu/100mL	6		0
Hardness	SM 3030/EPA 200.8	mg/L as CaCO3	220	100	
11056-WellA377799_6hr					
Total Coliform	OMOE MICROMFDC-E3407A	cfu/100mL	2		0
Hardness	SM 3030/EPA 200.8	mg/L as CaCO3	225	100	

QC SUMMARY

Alkalinity

Method: SM 2320 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Alkalinity	EWL0252-NOV23	mg/L as CaCO3	2	< 2	2	20	94	80	120	NA		

Ammonia by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENV]SFA-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Ammonia+Ammonium (N)	SKA0112-NOV23	mg/L	0.04	<0.04	1	10	96	90	110	97	75	125

QC SUMMARY

Anions by discrete analyzer

Method: US EPA 325.2 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-026

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO5030-NOV23	mg/L	1	<1	ND	20	102	80	120	109	75	125
Sulphate	DIO5030-NOV23	mg/L	2	<2	ND	20	104	80	120	108	75	125

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bromide	DIO0361-NOV23	mg/L	0.3	<0.3	ND	20	97	90	110	91	75	125
Nitrite (as N)	DIO0361-NOV23	mg/L	0.03	<0.03	ND	20	99	90	110	101	75	125
Nitrate (as N)	DIO0361-NOV23	mg/L	0.06	<0.06	ND	20	102	90	110	99	75	125

QC SUMMARY

Carbon by SFA

Method: SM 5310 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-009

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Dissolved Organic Carbon	SKA0113-NOV23	mg/L	1	<1	2	20	103	90	110	96	75	125
Total Organic Carbon	SKA0113-NOV23	mg/L	1	<1	2	20	103	90	110	96	75	125

Carbonate/Bicarbonate

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Carbonate	EWL0252-NOV23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0252-NOV23	mg/L as CaCO3	2	< 2	2	10	NA	90	110	NA		
OH	EWL0252-NOV23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		

QC SUMMARY

Colour

Method: SM 2120 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Colour	EWL0304-NOV23	TCU	3	< 3	0	10	105	80	120	NA		

Conductivity

Method: SM 2510 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0252-NOV23	uS/cm	2	4	0	20	100	90	110	NA		

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0261-NOV23	mg/L	0.06	<0.06	0	10	103	90	110	NV	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0019-NOV23	mg/L	0.00001	< 0.00001	3	20	98	80	120	98	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver (total)	EMS0100-NOV23	mg/L	0.00005	<0.00005	ND	20	106	90	110	78	70	130
Aluminum (total)	EMS0100-NOV23	mg/L	0.001	<0.001	19	20	100	90	110	83	70	130
Arsenic (total)	EMS0100-NOV23	mg/L	0.0002	<0.0002	4	20	107	90	110	103	70	130
Barium (total)	EMS0100-NOV23	mg/L	0.00008	<0.00008	2	20	102	90	110	96	70	130
Beryllium (total)	EMS0100-NOV23	mg/L	0.000007	<0.000007	ND	20	92	90	110	94	70	130
Boron (total)	EMS0100-NOV23	mg/L	0.002	<0.002	1	20	97	90	110	94	70	130
Bismuth (total)	EMS0100-NOV23	mg/L	0.00001	<0.00001	ND	20	106	90	110	86	70	130
Calcium (total)	EMS0100-NOV23	mg/L	0.01	<0.01	4	20	100	90	110	80	70	130
Cadmium (total)	EMS0100-NOV23	mg/L	0.000003	<0.000003	ND	20	108	90	110	94	70	130
Cobalt (total)	EMS0100-NOV23	mg/L	0.000004	<0.000004	10	20	100	90	110	94	70	130
Chromium (total)	EMS0100-NOV23	mg/L	0.00008	<0.00008	ND	20	104	90	110	90	70	130
Copper (total)	EMS0100-NOV23	mg/L	0.0002	<0.0002	1	20	102	90	110	94	70	130
Iron (total)	EMS0100-NOV23	mg/L	0.007	<0.007	1	20	106	90	110	75	70	130
Potassium (total)	EMS0100-NOV23	mg/L	0.009	<0.009	1	20	99	90	110	88	70	130
Magnesium (total)	EMS0100-NOV23	mg/L	0.001	<0.001	1	20	101	90	110	89	70	130
Manganese (total)	EMS0100-NOV23	mg/L	0.00001	<0.00001	2	20	99	90	110	97	70	130
Molybdenum (total)	EMS0100-NOV23	mg/L	0.00004	<0.00004	2	20	100	90	110	90	70	130
Sodium (total)	EMS0100-NOV23	mg/L	0.01	<0.01	1	20	101	90	110	91	70	130
Nickel (total)	EMS0100-NOV23	mg/L	0.0001	<0.0001	12	20	105	90	110	95	70	130
Lead (total)	EMS0100-NOV23	mg/L	0.00009	<0.00009	ND	20	105	90	110	93	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Phosphorus (total)	EMS0100-NOV23	mg/L	0.003	<0.003	2	20	101	90	110	NV	70	130
Antimony (total)	EMS0100-NOV23	mg/L	0.0009	<0.0009	ND	20	103	90	110	94	70	130
Selenium (total)	EMS0100-NOV23	mg/L	0.00004	<0.00004	ND	20	102	90	110	111	70	130
Silicon (total)	EMS0100-NOV23	mg/L	0.02	<0.02	0	20	99	90	110	NV	70	130
Tin (total)	EMS0100-NOV23	mg/L	0.00006	<0.00006	ND	20	97	90	110	NV	70	130
Strontium (total)	EMS0100-NOV23	mg/L	0.00008	<0.00008	2	20	98	90	110	92	70	130
Titanium (total)	EMS0100-NOV23	mg/L	0.00007	<0.00005	3	20	96	90	110	NV	70	130
Thallium (total)	EMS0100-NOV23	mg/L	0.000005	<0.000005	ND	20	105	90	110	93	70	130
Uranium (total)	EMS0100-NOV23	mg/L	0.000002	2e-006	1	20	92	90	110	101	70	130
Vanadium (total)	EMS0100-NOV23	mg/L	0.00001	<0.00001	6	20	102	90	110	105	70	130
Zinc (total)	EMS0100-NOV23	mg/L	0.002	<0.002	ND	20	104	90	110	110	70	130

QC SUMMARY

Microbiology

Method: SM 9215A | Internal ref.: ME-CA-[ENV]MIC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Heterotrophic Plate Count (HPC)	BAC9164-NOV23	cfu/1mL	-	ACCEPTED	ACCEPTED							
E. Coli	BAC9164-NOV23	cfu/100mL	-	ACCEPTED	ACCEPTED							
Total Coliform	BAC9164-NOV23	cfu/100mL	-	ACCEPTED	ACCEPTED							

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0252-NOV23	No unit	0.05	NA	1		100			NA		

QC SUMMARY

Phenols by SFA

Method: SM 5530B-D | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0107-NOV23	mg/L	0.002	<0.002	ND	10	99	80	120	NV	75	125

Sulphide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	SKA0114-NOV23	mg/L	0.02	<0.02	ND	20	116	80	120	NA	75	125

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0346-NOV23	mg/L	2	< 2	0	10	97	90	110	NA		

QC SUMMARY

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen (N)	SKA5051-NOV23	mg/L	0.05	<0.05	3	10	100	90	110	90	75	125

Turbidity

Method: SM 2130 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Turbidity	EWL0243-NOV23	NTU	0.10	< 0.10	0	10	100	90	110	NA		

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Results relate only to the sample tested.
Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.
"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.
Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated.

SGS Canada Inc. statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

This report supersedes all previous versions.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

No: 036655

SGS Industries & Environment - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

Page ____ of ____

Laboratory Information Section - Lab use only

Received By: ____ Received By (signature): ____
Received Date: 11 / 08 / 23 (mm/dd/yy) Custody Seal Present: Yes ☐ No ☒ Cooling Agent Present: Yes ☒ No ☐ Type: ICE
Received Time: 17 : 05 (hr : min) Custody Seal Intact: Yes ☐ No ☒ Temperature Upon Receipt (°C): 5.5.5 LAB LIMS #: CA14296-NOV23

REPORT INFORMATION

Company: DM WILLS
Contact: RALF BOLVIN
Address: 150 JAMESON DRIVE PETERBOROUGH, ON
Phone: 705-868-1691
Fax: ____
Email: rbolvin@dmwills.com

INVOICE INFORMATION

☑ (same as Report Information)
Company: ____
Contact: ____
Address: ____
Phone: ____
Email: accounts@dmwills.com

Quotation #: ____ P.O. #: 11056
Project #: 11056 Site Location/ID: ____

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days) TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: ____

*NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium/Fine
☐ Table 3 ☐ Agri/Other
☐ Table ____ Appx. ____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other: ____
☐ MISA ____
☑ ODWS Not Reportable *See note

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality: ____

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	M&I: Metals & Inorganics (incl CrVI, CN, Hg pH,(B(HWS),EC,SAR–soil) (Cl, Na–water))	M&I: Full Metals Suite (ICP metals plus B(HWS-soil only) Hg, CrVI	M&I: ICP Metals only Sb,As,Ba,Be,B,Cd, Cr,Co,Cu,Pb,Mo,Ni,Se,Ag,Tl,U,V,Zn	SVOC: PAHs only	SVOC: SVOCs all incl PAHs, ABNs, CPs	PCB: PCBs Total ☐ Aroclor ☐	PHC: F1-F4 + BTEX	PHC: F1-F4 only no BTEX	VOC: VOCs all incl BTEX	VOC: BTEX only	Pest: Pesticides Organochlorine or specify other	Other	Other	Other	Other	Other	Sewer Use: Specify pkg:	Water Characterization Pkg ☐ General ☐ Extended	SPLP: Specify tests ☐ Metals ☐ VOC ☐ 1,4-Dioxane ☐ OCP ☐ ABN	TCLP: Specify tests ☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ IgnitL	COMMENTS:
1	11056 Well A377799-1hr	10:20 AM	11/08/23	13	GW	N																X			
2	11056 Well A377799-6hr	3:20 PM	11/08/23	13	GW	N																X			
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									

Observations/Comments/Special Instructions

Sampled By (NAME): CHRIS OSTIC Signature: Chris Ostic Date: 11 / 08 / 23 (mm/dd/yy) Pink Copy - Client

Relinquished by (NAME): CHRIS OSTIC Signature: Chris Ostic Date: 11 / 08 / 23 (mm/dd/yy) Yellow & White Copy - SGS

Appendix I

Certificates of Analysis – Groundwater – Nitrates

FINAL REPORT

CA12213-OCT22 R---

11056 - OSAC.A

Prepared for

D.M. Wills -Peterborough

FINAL REPORT

CA12213-OCT22 R---

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	D.M. Wills -Peterborough	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	150 Jameson Drive Peterborough, ON K9J 0B9. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Lynsey Tuters	Telephone	705-652-2143
Telephone	289-385-6230	Facsimile	705-652-6365
Facsimile	705-741-3568	Email	brad.moore@sgs.com
Email	ltuters@dmwills.com	SGS Reference	CA12213-OCT22
Project	11056 - OSAC.A	Received	10/05/2022
Order Number		Approved	10/18/2022
Samples	Ground Water (3)	Report Number	CA12213-OCT22 R---
		Date Reported	10/18/2022

COMMENTS

Temperature of Sample upon Receipt: 20 degrees C
Cooling Agent Present: Yes
Custody Seal Present: Yes
Chain of Custody Number: 031488

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

FINAL REPORT

CA12213-OCT22 R---

Client: D.M. Wills -Peterborough
Project: 11056 - OSAC.A
Project Manager: Lynsey Tuters
Samplers: L. Tuters

MATRIX: WATER

L1 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

Sample Number				5	6	7
Sample Name				11056 - MW22 - 08	11056 - MW05 - Geotech3	11056 - MW11 - Geotech 2
Sample Matrix				Ground Water	Ground Water	Ground Water
Sample Date				05/10/2022	05/10/2022	05/10/2022
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**
Metals and Inorganics						
Nitrite (as N)	as N mg/L	0.03	1	< 0.03	< 0.03	< 0.03
Nitrate (as N)	as N mg/L	0.06	10	4.35	0.39	0.68
Nitrate + Nitrite (as N)	as N mg/L	0.06		4.35	0.39	0.68

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrate + Nitrite (as N)	DIO0214-OCT22	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0214-OCT22	mg/L	0.03	<0.03	ND	20	93	90	110	95	75	125
Nitrate (as N)	DIO0214-OCT22	mg/L	0.06	<0.06	0	20	99	90	110	NV	75	125
Nitrate + Nitrite (as N)	DIO0229-OCT22	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0229-OCT22	mg/L	0.03	<0.03	0	20	94	90	110	84	75	125
Nitrate (as N)	DIO0229-OCT22	mg/L	0.06	<0.06	0	20	100	90	110	96	75	125

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Results relate only to the sample tested.
Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.
"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.
Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

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This report supersedes all previous versions.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Industries & Environment - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: 031488 Page ____ of ____

Laboratory Information Section - Lab use only

Received By: Sindoori Satheesh
Received Date: OCT 05 2022 (mm/dd/yy)
Received Time: 14 : 40 (hr : min)
Received By (signature):
Custody Seal Present: Yes ☑ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: Ice
Temperature Upon Receipt (°C) 20 x 3
LAB LIMS #: CA12213-OCT22

REPORT INFORMATION	INVOICE INFORMATION
Company: D.M. Wills	☑ (same as Report Information)
Contact: L. Tulers	Company:
Address: 150 Jameson Dr. Peterborough	Contact:
Phone: 289-385-6230	Address:
Fax:	Phone:
Email: ltulers@dmwills.com	Email: accounts@dmwills.com

Quotation #: P.O. #: 11056
Project #: 11056-OSACA Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:

*NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture:
☐ Table 2 ☐ Ind/Com ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ Medium/Fine
☐ Table ____ Appx. ____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA
☑ ODWS Not Reportable *See note

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX
1	11056-MW22-08	oct 5/22	AM	1	GW
2	11056-MW05-Geotech3	oct 5/22	AM	1	GW
3	11056-MW11-Geotech2	oct 5/22	AM	1	GW
4					
5					
6					
7					
8					
9					
10					
11					
12					

M & I: Field Filtered (Y/N); Metals & Inorganics incl CrVI, CN, Hg pH, (B(HWS), EC, SAR-soil) (Cl, Na-water); Full Metals Suite ICP metals plus B(HWS-soil only) Hg, CrVI; ICP Metals only Sb, As, Ba, Be, B, Cd, Cr, Co, Cu, Pb, Mo, Ni, Se, Ag, Tl, U, V, Zn
SVOC: PAHs only; SVOCs all incl PAHs, ABNs, CPs
PCB: PCBs Total ☐ Aroclor ☐
PHC: F1-F4 + BTEX; F1-F4 only no BTEX
VOC: VOCs all incl BTEX; BTEX only
Pest: Pesticides Organochlorine or specify other
Other (please specify): Nitrates ✓ ✓ ✓; Sewer Use: Specify pkg:; Water Characterization Pkg General ☐ Extended ☐
SPLP: Specify tests ☐ Metals ☐ VOC ☐ 1,4-Dioxane ☐ OCP ☐ ABN
TCLP: Specify tests ☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit.

COMMENTS:

Observations/Comments/Special Instructions

Sampled By (NAME): L. Tulers Signature: L Tulers Date: Oct 05 2022 (mm/dd/yy)
Relinquished by (NAME): L. Tulers Signature: L Tulers Date: Oct 05 2022 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.6
Date of Issue: 02 May 2022

FINAL REPORT

CA14187-DEC23 R

11056

Prepared for

D.M. Wills -Peterborough

FINAL REPORT

CA14187-DEC23 R

First Page

CLIENT DETAILS

Client	D.M. Wills -Peterborough
Address	150 Jameson Drive Peterborough, ON K9J 0B9. Canada
Contact	Ralf Bolvin
Telephone	705-868-1691
Facsimile	705-741-3568
Email	rbolvin@dmwills.com
Project	11056
Order Number	
Samples	Ground Water (3)

LABORATORY DETAILS

Project Specialist	Jill Campbell, B.Sc.,GISAS
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	2165
Facsimile	705-652-6365
Email	jill.campbell@sgs.com
SGS Reference	CA14187-DEC23
Received	12/06/2023
Approved	12/11/2023
Report Number	CA14187-DEC23 R
Date Reported	12/11/2023

COMMENTS

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
MDL - SGS Method Detection Limit

Temperature of Sample upon Receipt: 4 degrees C
Cooling Agent Present: Yes
Custody Seal Present: Yes
Chain of Custody Number: 036540

SIGNATORIES

Jill Campbell, B.Sc.,GISAS

TABLE OF CONTENTS

FINAL REPORT

CA14187-DEC23 R

Client: D.M. Wills -Peterborough
Project: 11056
Project Manager: Ralf Bolvin
Samplers: Chris Ostic

MATRIX: WATER

L1 = ODWS_MAC / WATER / - - Table 1,2 and 3 - Drinking Water - Reg O.169_03

Sample Number				8	9	10
Sample Name				BH101-22	BH107-22	BH110-22
Sample Matrix				Ground Water	Ground Water	Ground Water
Sample Date				05/12/2023	05/12/2023	05/12/2023
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**
Metals and Inorganics						
Nitrite (as N)	as N mg/L	0.003	1	0.003#<MDL	0.003#<MDL	0.003#<MDL
Nitrate (as N)	as N mg/L	0.006	10	8.84	0.188	2.72
Nitrate + Nitrite (as N)	as N mg/L	0.006		8.84	0.188	2.72

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrate + Nitrite (as N)	DIO0149-DEC23	mg/L	0.006	<0.006	NA		NA			NA		
Nitrite (as N)	DIO0149-DEC23	mg/L	0.003	<0.003	ND	20	100	90	110	80	75	125
Nitrate (as N)	DIO0149-DEC23	mg/L	0.006	<0.006	1	20	99	90	110	103	75	125

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

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RPD: Relative percent difference

AC: Acceptance criteria

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LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Results relate only to the sample tested.
Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.
"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.
Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

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This report supersedes all previous versions.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

No: 036540

SGS Industries & Environment - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

Page ____ of ____

Laboratory Information Section - Lab use only

Received By: Katelyn Medland
Received Date: 12/06/23 (mm/dd/yy)
Received Time: 15:15 (hr : min)
Received By (signature): Kay
Custody Seal Present: Yes ☐ No ☑
Custody Seal Intact: Yes ☐ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: ice
Temperature Upon Receipt (°C) 3.4.5
LAB LIMS # CA14187-DEC23

REPORT INFORMATION	INVOICE INFORMATION
Company: DM WILLS	☑ (same as Report Information)
Contact: RALF BOLVIN	Company:
Address: 150 JAMESON DRIVE PETERBOROUGH, ON	Contact:
Phone: 705-868-1691	Address:
Fax:	Phone:
Email: rbolvin@dmwills.com	Email: accounts@dmwills.com

Quotation #: ____ P.O. #: 11056
Project #: 11056 Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days) — TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: ____ *NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium/Fine
☐ Table 3 ☐ Agri/Other
☐ Table ____ Appx. ____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ____ ☐ MISA ☑ ODWS Not Reportable *See note

Sewer By-Law: ☐ Sanitary ☐ Storm Municipality: ____

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	M&I: Metals & Inorganics (incl CrVI, CN, Hg pH,(B(HWS),EC,SAR–soil) (Cl, Na–water)	M&I: Full Metals Suite (ICP metals plus B(HWS-soil only) Hg, CrVI	M&I: ICP Metals only Sb,As,Ba,Be,B,Cd, Cr,Co,Cu,Pb,Mo,Ni,Se,Ag,Ti,U,V,Zn	SVOC: PAHs only	SVOC: SVOCs all incl PAHs, ABNs, CPs	PCB: PCBs Total ☐ Aroclor ☐	PHC: F1-F4 + BTEX	PHC: F1-F4 only no BTEX	VOC: VOCs all incl BTEX	VOC: BTEX only	Pest: Pesticides Organochlorine or specify other	Other (please specify): NITRATES	Other	Other	Other	Other: Sewer Use: Specify pkg:	Other: Water Characterization Pkg General ☐ Extended ☐	SPLP: Specify tests ☐ Metals ☐ VOC ☐ 1,4-Dioxane ☐ OCP ☐ ABN	TCLP: Specify tests ☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit.	COMMENTS:
1	BH101-22	DEC 5/23	AM	2	GW	N												X							
2	BH107-22	↓	↓	↓	↓	N												X							
3	BH 110-22	↓	↓	↓	↓	N												X							
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									

Observations/Comments/Special Instructions

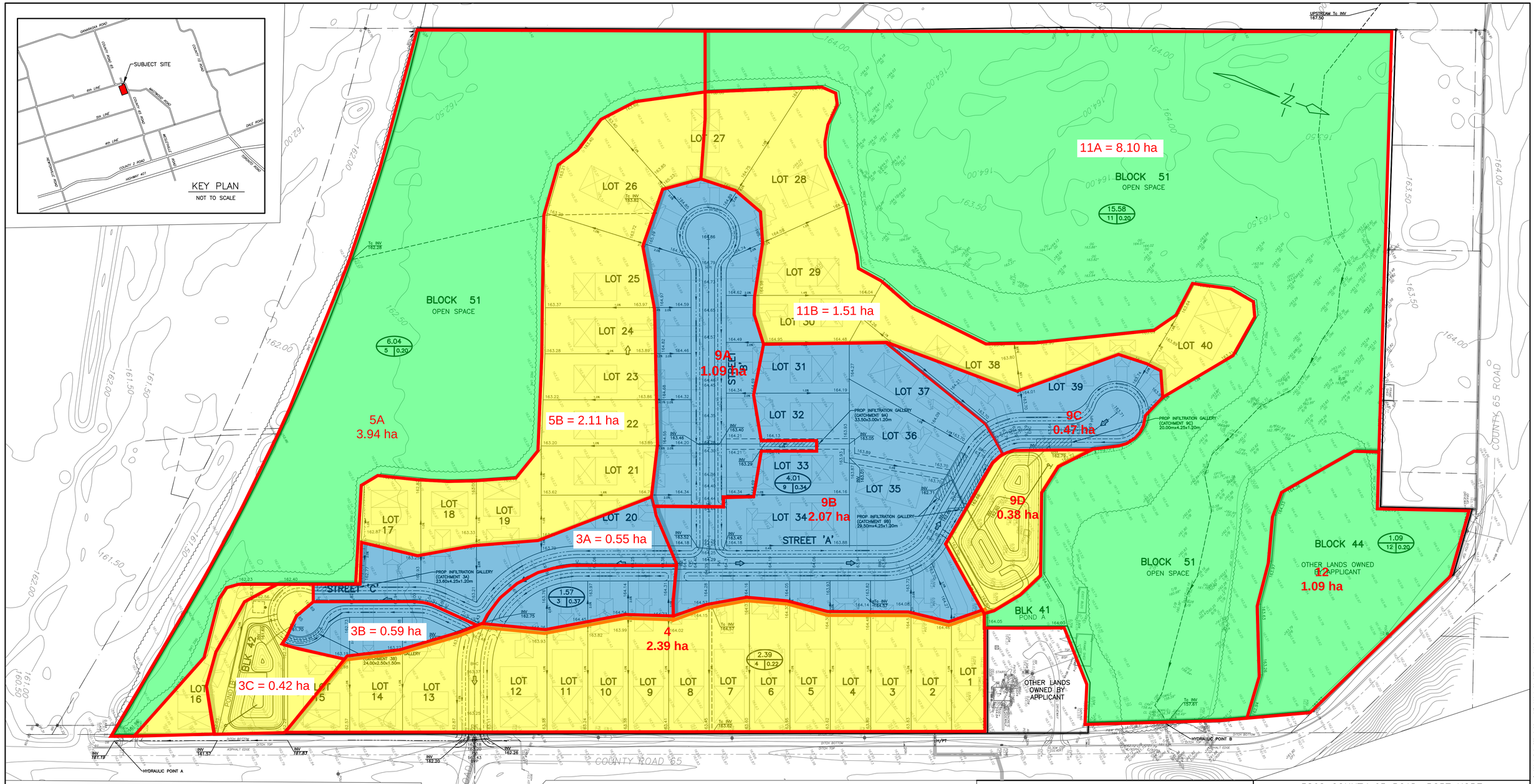
Sampled By (NAME): CHRIS OSTIC Signature: Chris Ostic Date: 12/05/23 (mm/dd/yy)
Relinquished by (NAME): CHRIS OSTIC Signature: Chris Ostic Date: 12/06/23 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.7
Date of Issue: 07 JUNE 2023

Appendix J

Water Balance



DEVELOPED CATCHMENT DIRECTED TO INFILTRATION FACILITY

DEVELOPED CATCHMENT NOT DIRECTED TO INFILTRATION FACILITY

UNDISTURBED CATCHMENT

LEGEND

DRAINAGE BOUNDARY

0.25 / 1 | 90 — DRAINAGE AREA / ID/RUN-OFF COEFFICIENT

OVERLAND FLOW DIRECTION

NOTE: THIS PLAN IS FOR STORM DRAINAGE AREAS ONLY

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION OBTAINED FROM TOPOGRAPHIC BASE PLAN OF 5868 COUNTY ROAD 65 MUNICIPALITY OF PORT HOPE BY IBW SURVEYORS DATED JULY 22, 2022

PRELIMINARY NOT FOR CONSTRUCTION

NO.	DATE	REVISION	BY
2.	01 03/2024	REVISED AS PER UPDATED LOT LAYOUT	MH
1.	10 11/2023	REVISED AS PER 1ST SUBMISSION COMMENTS	MH

REVISIONS

5868 COUNTY 65 ROAD, PORT HOPE

POST-DEVELOPMENT STORM DRAINAGE PLAN

D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
96 King Street East
Oshawa, Ontario, L1H 1B6
Phone: 905-576-8500
info@dgbiddle.com
dgbiddle.com

LICENSED PROFESSIONAL ENGINEER
D.D.J MCNAULL
100174891
MAR 18, '24
PROVINCE OF ONTARIO

SCALE:	1:1000
DRAWN BY:	M.J.H.
DESIGN BY:	M.J.H.
CHECKED BY:	D.D.M.
DATE:	JAN 2023

PROJECT NO. 122049

DRAWING NO. SD-2

K:\STAFF\JOB FILES\122000\122049 5868 COUNTY RD 65\122049 DRAWINGS\122049 DRAWINGS CIVIL\122049 ENGINEERING DRAWINGS\122049-SD-SITE PLAN-1000.DWG

Monthly Water Budget Calculations

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

CANADIAN CLIMATE NORMALS FOR 'OSHAWA WPCP (4996)' (1981-2010)

Climate ID = 6155878
Latitude = 43.87
Longitude = -78.83

Thornthwaite (1948) Inputs				Monthly Water Budget Analysis				
Month	Mean Temperature (°C)[1]	Total Precipitation (mm)[1]	Heat Index	PET (mm)	Daylight Correction Factor	Adjusted PET (mm)	Surplus (mm)	Deficit (mm)
January	-4.8	65.6	0.00	0.0	0.78	0.0	65.6	0.0
February	-3.6	56.6	0.00	0.0	0.88	0.0	56.6	0.0
March	0.4	54.2	0.02	1.4	1.00	1.4	52.8	0.0
April	6.6	72.7	1.52	29.3	1.12	32.9	43.4	0.0
May	12.3	78.9	3.91	60.1	1.23	73.9	18.8	0.0
June	17.6	73.9	6.72	86.2	1.28	110.7	0.0	36.8
July	20.6	73.1	8.53	106.0	1.26	133.1	0.0	60.0
August	20.0	77.4	8.16	102.6	1.16	119.1	0.0	41.7
September	15.9	94.0	5.76	77.1	1.04	80.3	16.9	0.0
October	9.5	70.1	2.64	45.2	0.92	41.4	24.9	0.0
November	4.2	84.8	0.77	17.8	0.80	14.4	67.0	0.0
December	-1.2	70.7	0.00	0.0	0.75	0.0	70.7	0.0
Totals		**872.0**	38.03			**607.3**	**416.6**	**138.6**
	Thornthwaite Coefficient (α)		**1.100**			Total Water Surplus (mm)		**264.7**

Notes:

1. Temperature and Precipitation are taken from Canadian Climate Normals 1981-2010
2. Water budget adjusted for latitude and length of daylight
3. Potential Evapotranspiration (PET) is calculated based on the Thornthwaite 1948 equation
4. Total Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted evapotranspiration

Water Balance Calculations for Existing Conditions

WILLS

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Catchment Parameters	EX-1	EX-2									**Total**
Drainage Area (m^2)	108400	138700									**247100**
Pervious Area (m^2)	108400	138700									**247100**
Impervious Area (m^2)	0	0									**0**
Evapotranspiration Factors											
Pervious PET Ratio	0.70	0.70									**0.70**
Impervious Evapotranspiration[3]	0.20	0.20									**0.00**
Infiltration Factors											
Topography Infiltration Factor	0.30	0.25									**0.27**
Soil Infiltration Factor	0.40	0.40									**0.40**
Land Cover Infiltration Factor	0.14	0.12									**0.13**
MOE Infiltration Factor	0.84	0.77									**0.80**
Actual Infiltration Factor	0.84	0.77									**0.80**
Run-Off Coefficient	0.16	0.23									**0.20**
Runoff from Impervious Surfaces	0.80	0.80									
Inputs (mm/yr)											
Precipitation	872.0	872.0									**872.0**
Run-On	0.0	0.0									**0.0**
Other Inputs	0.0	0.0									**0.0**
Total Inputs	872.0	872.0									**872.0**
Outputs (mm/yr)											
Precipitation Surplus	264.7	264.7									**264.7**
Net Surplus	264.7	264.7									**264.7**
Evapotranspiration	607.3	607.3									**607.3**
Infiltration	223.5	204.3									**212.7**
Infiltration Features[4]	0.0	0.0									**0.0**
Total Infiltration	**223.5**	**204.3**									**212.7**
Runoff Pervious Areas	41.2	60.5									**52.0**
Runoff Impervious Areas	0.0	0.0									**0.0**
Total Unadjusted Runoff	41.2	60.5									**52.0**
Total Adjusted Runoff[5]	**41.2**	**60.5**									**52.0**
Total Outputs	**872.0**	**872.0**									**872.0**
Inputs (m^3/yr)											
Precipitation	94,525	120,946									**215,471**
Run-On	0	0									**0**
Other Inputs	0	0									**0**
Total Inputs	**94,525**	**120,946**									**215,471**
Outputs (m^3/yr)											
Precipitation Surplus	28,697	36,718									**65,415**
Net Surplus	28,697	36,718									**65,415**
Evapotranspiration	65,828	84,228									**150,056**
Infiltration	24,228	28,333									**52,561**
Infiltration Features[4]	0	0									**0**
Total Infiltration	24,228	28,333									**52,561**
Runoff Pervious Areas	4,469	8,385									**12,854**
Runoff Impervious Areas	0	0									**0**
Total Unadjusted Runoff	4,469	8,385									**12,854**
Total Adjusted Runoff[5]	4,469	8,385									**12,854**
Total Outputs	**94,525**	**120,946**									**215,471**

Notes:

1. Water Balance Calculations area in based on methodology described in the Conservation Authority Guidelines for Hydrogeological Assessments (June 2013)
2. Annual Precipitation and Evapotranspiration values were determined using the Thornthwaite (1948) method for monthly water budget calculations
3. Evaporation from impervious areas was assumed to be 0% of Precipitation
4. Infiltration Features are calculated using daily Precipitation data and averaged over the number of years of available data. The entire Catchment is assumed to contribute with no infiltration occuring during months with a negative average temperature.
5. Total Adjusted Runoff is calculated as (Pervious Runoff + Impervious Runoff) - (Infiltration Features)

Water Balance Calculations for Proposed Conditions (40 Lots)

WILLS

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Catchment Parameters	PR-3A	PR-3B	PR-3C	PR-4	PR-5A	PR-5B	PR-9A	PR-9B	PR-9C	PR-9D	PR-11A	PR-11B	PR-12	Total
Drainage Area (m^2)	5500	5900	4200	23900	39400	21100	10900	20700	4700	3800	81000	15100	10900	**247100**
Pervious Area (m^2)	4400	4100	3900	23200	39400	21100	8175	16560	3525	3800	81000	15100	10900	**235160**
Impervious Area (m^2)	1100	1800.0	300	700	0	0	2725	4140	1175	0	0	0	0	**11940**
Evapotranspiration Factors														
Pervious PET Ratio	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	**0.70**
Impervious Evapotranspiration[3]	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	**0.20**
Infiltration Factors														
Topography Infiltration Factor	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	**0.25**
Soil Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	**0.40**
Land Cover Infiltration Factor	0.10	0.10	0.10	0.10	0.18	0.10	0.10	0.10	0.10	0.10	0.16	0.10	0.10	**0.13**
MOE Infiltration Factor	0.75	0.75	0.75	0.75	0.83	0.75	0.75	0.75	0.75	0.75	0.81	0.75	0.75	**0.78**
Actual Infiltration Factor	0.75	0.75	0.75	0.75	0.83	0.75	0.75	0.75	0.75	0.75	0.81	0.75	0.75	**0.78**
Run-Off Coefficient	0.25	0.25	0.25	0.25	0.17	0.25	0.25	0.25	0.25	0.25	0.19	0.25	0.25	**0.22**
Runoff from Impervious Surfaces	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	**0.80**
Inputs (mm/yr)														
Precipitation	872.0	872.0	872.0	872.0	872.0	872.0	872.0	872.0	872.0	872.0	872.0	872.0	872.0	**872.0**
Run-On	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	0.0	0.0	0.0	0.0	0.0	**4.3**
Other Inputs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Total Inputs	872.0	872.0	872.0	872.0	872.0	872.0	872.0	923.0	872.0	872.0	872.0	872.0	872.0	**876.3**
Outputs (mm/yr)														
Precipitation Surplus	351.3	396.8	295.6	277.4	264.7	264.7	372.9	351.3	372.9	264.7	264.7	264.7	264.7	**285.6**
Net Surplus	351.3	396.8	295.6	277.4	264.7	264.7	372.9	371.9	372.9	264.7	264.7	264.7	264.7	**287.4**
Evapotranspiration	520.7	475.2	576.4	594.6	607.3	607.3	499.1	551.1	499.1	607.3	607.3	607.3	607.3	**588.9**
Infiltration	158.8	138.0	184.4	192.7	218.7	198.5	148.9	168.1	148.9	198.5	214.2	198.5	198.5	**198.1**
Infiltration Features[4]	192.5	209.3	0.0	0.0	0.0	0.0	172.9	178.9	212.4	0.0	0.0	0.0	0.0	**35.9**
Total Infiltration	**351.3**	**347.3**	**184.4**	**192.7**	**218.7**	**198.5**	**321.8**	**347.0**	**361.3**	**198.5**	**214.2**	**198.5**	**198.5**	**234.0**
Runoff Pervious Areas	66.2	66.2	66.2	66.2	46.0	66.2	66.2	66.2	66.2	66.2	50.5	66.2	66.2	**57.4**
Runoff Impervious Areas	697.6	697.6	697.6	697.6	0.0	0.0	697.6	697.6	697.6	0.0	0.0	0.0	0.0	**697.6**
Total Unadjusted Runoff	192.5	258.8	111.3	84.7	46.0	66.2	224.0	192.5	224.0	66.2	50.5	66.2	66.2	**88.3**
Total Adjusted Runoff[5]	0.0	49.5	111.3	84.7	46.0	66.2	51.1	13.6	11.7	66.2	50.5	66.2	66.2	**52.4**
Total Outputs	**872.0**	**872.0**	**872.0**	**872.0**	**872.0**	**872.0**	**872.0**	**911.7**	**872.0**	**872.0**	**872.0**	**872.0**	**872.0**	**875.3**
Inputs (m^3/yr)														
Precipitation	4,796	5,145	3,662	20,841	34,357	18,399	9,505	18,050	4,098	3,314	70,632	13,167	9,505	**215,471**
Run-On	0	0	0	0	0	0	0	1,056	0	0	0	0	0	**1,056**
Other Inputs	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total Inputs	**4,796**	**5,145**	**3,662**	**20,841**	**34,357**	**18,399**	**9,505**	**19,106**	**4,098**	**3,314**	**70,632**	**13,167**	**9,505**	**216,527**
Outputs (m^3/yr)														
Precipitation Surplus	1,932	2,341	1,242	6,630	10,430	5,586	4,065	7,272	1,753	1,006	21,443	3,997	2,886	**70,583**
Net Surplus	1,932	2,341	1,242	6,630	10,430	5,586	4,065	7,697	1,753	1,006	21,443	3,997	2,886	**71,009**
Evapotranspiration	2,864	2,804	2,421	14,211	23,926	12,813	5,440	11,409	2,346	2,308	49,189	9,170	6,619	**145,518**
Infiltration	874	814	774	4,606	8,617	4,189	1,623	3,480	700	754	17,353	2,998	2,164	**48,948**
Infiltration Features[4]	1,059	1,235	0	0	0	0	1,885	3,703	998	0	0	0	0	**8,880**
Total Infiltration	1,932	2,049	774	4,606	8,617	4,189	3,508	7,184	1,698	754	17,353	2,998	2,164	**57,828**
Runoff Pervious Areas	291	271	258	1,535	1,813	1,396	541	1,096	233	251	4,090	999	721	**13,499**
Runoff Impervious Areas	767	1,256	209	488	0	0	1,901	2,888	820	0	0	0	0	**8,329**
Total Unadjusted Runoff	1,059	1,527	467	2,024	1,813	1,396	2,442	3,984	1,053	251	4,090	999	721	**21,828**
Total Adjusted Runoff[5]	0	292	467	2,024	1,813	1,396	557	281	55	251	4,090	999	721	**12,948**
Total Outputs	**4,796**	**5,145**	**3,662**	**20,841**	**34,357**	**18,399**	**9,505**	**18,873**	**4,098**	**3,314**	**70,632**	**13,167**	**9,505**	**216,294**

Notes:

1. Water Balance Calculations area in based on methodology described in the Conservation Authority Guidelines for Hydrogeological Assessments (June 2013)
2. Annual Precipitation and Evapotranspiration values were determined using the Thornthwaite (1948) method for monthly water budget calculations
3. Evaporation from impervious areas was assumed to be 20% of Precipitation
4. Infiltration Features are calculated using daily Precipitation data and averaged over the number of years of available data. The entire Catchment is assumed to contribute with no infiltration occuring during months with a negative average temperature.
5. Total Adjusted Runoff is calculated as (Pervious Runoff + Impervious Runoff) - (Infiltration Features)

Water Balance Assessment (40 Lots)

WILLS

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Characteristic	Existing	Proposed No Mitigation	Change	Proposed With Mitigation	Change
Inputs (m^3/yr)					
Precipitation	215,471	215,471	0.0%	215,471	0.0%
Run-On	0	1,056	0.0%	1,056	0.0%
Other Inputs	0	0	0.0%	0	0.0%
Total Inputs	215,471	216,527	0.5%	216,527	0.5%
Outputs (m^3/yr)					
Precipitation Surplus	65,415	70,583	7.9%	70,583	7.9%
Net Surplus	65,415	71,009	8.6%	71,009	8.6%
Evapotranspiration	150,056	145,518	-3.0%	145,518	-3.0%
Infiltration	52,561	48,948	-6.9%	48,948	-6.9%
Infiltration Features	0	0	0.0%	8,880	0.0%
Total Infiltration	**52,561**	**48,948**	**-6.9%**	**57,828**	**10.0%**
Runoff Pervious Areas	12,854	13,499	5.0%	13,499	5.0%
Runoff Impervious Areas	0	8,329	0.0%	8,329	0.0%
Total Runoff	**12,854**	**21,828**	**69.8%**	**12,948**	**0.7%**
Total Outputs	215,471	216,294	0.4%	216,294	0.4%

Nitrate Dilution Calculations

Total Dilution Area	24.71	ha
No. of Lots	40	
Sewage Flow per Lot	1000	L/day
Total Daily Sewage Loading	40,000	L/day
Nitrate in Septic Effluent	40	mg/L
Background Nitrates	2.86	mg/L
Stormwater Effluent Nitrates	0	mg/L
Infiltration Rates		
Infiltration Rate (Clean Water)	138.0	mm/year
Infiltration Rate (Clean Water)	134,103	L/day
Infiltration Rate (Stormwater)	35.9	mm/year
Infiltration Rate (Stormwater)	24,329	L/day
Nitrate Concentrations		
Nitrate Loading - Development	1,600,000	mg/day
Nitrate Loading - Rainfall	383,534	mg/day
Nitrate Loading - Runoff	0	mg/day
Total Nitrate Loading	1,983,534	mg/day
Dilution - Development	40,000	L/day
Dilution - Groundwater Recharge	158,432	L/day
Total Dilution	198,432	L/day
Boundary Nitrate Concentration	**10.00**	**mg/L**

Infiltration Factor Calculations for EX-1

Sheet 1 of 1

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	0.48%
Slope Description	Flat Land
Topography Infiltration Factor	**0.30**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	10.84	10.84
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture	6.04	0.10
Range		
Grass		
Woods		
Wetland	4.80	0.20
Bare Earth (>70% Rock)		
Impervious		
Total[3]	10.84	**0.14**

MOE Infiltration Factor	**0.84**
Actual Infiltration Factor	**0.84**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for EX-2

Sheet 1 of 1

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	2.22%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	13.87	13.87
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture	10.87	0.10
Range		
Grass		
Woods	3.00	0.20
Wetland		
Bare Earth (>70% Rock)		
Impervious		
Total[3]	13.87	**0.12**

MOE Infiltration Factor	**0.77**
Actual Infiltration Factor	**0.77**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-3A

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	2.00%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	0.55	0.55
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	0.44	0.10
Impervious	0.11	
Total[3]	0.44	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-3A

Sheet 2 of 2

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Infiltration Features Summary		
Total Storage Volume[1]	48.6	m^3
Contributing Area[2]	5500	m^2
Pervious Area	4400	m^2
Impervious Area	1100	m^2
Maximum Drawdown	24	hrs
Average Infiltration Volume[3]	**1079**	**m^3/yr**
	196.2	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features
3. Average Infiltration Volume is calculated using daily climate data and averaged over the number of years of available data. No benefit is assumed for Infiltration Features during months with a negative average temperature.
4. Daily climate data is taken from Environment Canada Station 'OSHAWA WPCP' from 1981-2006

Infiltration Factor Calculations for PR-3B

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	2.00%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	0.59	0.59
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	0.41	0.10
Impervious	0.18	
Total[3]	0.41	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-3B	Sheet 2 of 2

WILLS

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Infiltration Features Summary		
Total Storage Volume[1]	36.0	m^3
Contributing Area[2]	5900	m^2
Pervious Area	4100	m^2
Impervious Area	1800	m^2
Maximum Drawdown	24	hrs
Average Infiltration Volume[3]	**1235**	**m^3/yr**
	209.3	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features
3. Average Infiltration Volume is calculated using daily climate data and averaged over the number of years of available data. No benefit is assumed for Infiltration Features during months with a negative average temperature.
4. Daily climate data is taken from Environment Canada Station 'OSHAWA WPCP' from 1981-2006

Infiltration Factor Calculations for PR-3C

Sheet 1 of 1

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	0.99%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	0.42	0.42
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	0.39	0.10
Impervious	0.03	
Total[3]	0.39	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-4

Sheet 1 of 1

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	1.55%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	2.39	2.39
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range		
Grass	2.32	0.10
Woods		
Wetland		
Bare Earth (>70% Rock)		
Impervious	0.07	
Total[3]	2.32	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-5A

Sheet 1 of 1

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	0.70%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	3.94	3.94
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture		
Range	0.94	0.10
Grass		
Woods	3.00	0.20
Wetland		
Bare Earth (>70% Rock)		
Impervious		
Total[3]	3.94	**0.18**

MOE Infiltration Factor	**0.83**
Actual Infiltration Factor	**0.83**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-5B

Sheet 1 of 1

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	1.00%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	2.11	2.11
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock) Impervious	2.11	0.10
Total[3]	2.11	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-9A

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	2.00%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	1.09	1.09
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	0.82	0.10
Impervious	0.27	
Total[3]	0.82	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-9A

Sheet 2 of 2

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Infiltration Features Summary		
Total Storage Volume[1]	48.0	m^3
Contributing Area[2]	10900	m^2
Pervious Area	8175	m^2
Impervious Area	2725	m^2
Maximum Drawdown	24	hrs
Average Infiltration Volume[3]	**1885**	**m^3/yr**
	172.9	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features
3. Average Infiltration Volume is calculated using daily climate data and averaged over the number of years of available data. No benefit is assumed for Infiltration Features during months with a negative average temperature.
4. Daily climate data is taken from Environment Canada Station 'OSHAWA WPCP' from 1981-2006

Infiltration Factor Calculations for PR-9B

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	2.00%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils			
Hydrologic Soil Group[2]	A	A	Total
Soil Type	Brighton Sand	Brighton Sand	
Area (ha)	1.52	0.55	2.07
Soil Infiltration Factor	0.40	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	1.66	0.10
Impervious	0.41	
Total[3]	1.66	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-9B

Sheet 2 of 2

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Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Infiltration Features Summary		
Total Storage Volume[1]	120.4	m^3
Contributing Area[2]	20700	m^2
Pervious Area	16560	m^2
Impervious Area	4140	m^2
Maximum Drawdown	24	hrs
Average Infiltration Volume[3]	**3703**	**m^3/yr**
	178.9	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features
3. Average Infiltration Volume is calculated using daily climate data and averaged over the number of years of available data. No benefit is assumed for Infiltration Features during months with a negative average temperature.
4. Daily climate data is taken from Environment Canada Station 'OSHAWA WPCP' from 1981-2006

Infiltration Factor Calculations for PR-9C

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	2.00%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	0.47	0.47
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock)	0.35	0.10
Impervious	0.12	
Total[3]	0.35	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Features for PR-9C

Sheet 2 of 2

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Infiltration Features Summary		
Total Storage Volume[1]	40.8	m^3
Contributing Area[2]	4700	m^2
Pervious Area	3525	m^2
Impervious Area	1175	m^2
Maximum Drawdown	24	hrs
Average Infiltration Volume[3]	**998**	**m^3/yr**
	212.4	**mm/yr**

Notes:

1. Total Storage Volume from all Infiltration Features in the catchment
2. The entire catchment contributes flow to the Infiltration Features
3. Average Infiltration Volume is calculated using daily climate data and averaged over the number of years of available data. No benefit is assumed for Infiltration Features during months with a negative average temperature.
4. Daily climate data is taken from Environment Canada Station 'OSHAWA WPCP' from 1981-2006

Infiltration Factor Calculations for PR-9D

Sheet 1 of 1

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	2.00%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	0.38	0.38
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock) Impervious	0.38	0.10
Total[3]	0.38	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-11A

Sheet 1 of 1

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	0.77%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	8.10	8.10
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture	3.30	0.10
Range		
Grass		
Woods		
Wetland	4.80	0.20
Bare Earth (>70% Rock)		
Impervious		
Total[3]	8.10	**0.16**

MOE Infiltration Factor	**0.81**
Actual Infiltration Factor	**0.81**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-11B

Sheet 1 of 1

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	0.87%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	1.51	1.51
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock) Impervious	1.51	0.10
Total[3]	1.51	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Infiltration Factor Calculations for PR-12

Sheet 1 of 1

Project No: 11056
Project Name: Osaca Whitepine Subdivision
Designed/Checked By: NN / CP
Date: 22-Mar-24

Topography	
Average Slope	1.00%
Slope Description	Flat/Rolling Land
Topography Infiltration Factor	**0.25**

Soils		
Hydrologic Soil Group[2]	A	Total
Soil Type	Brighton Sand	
Area (ha)	1.09	1.09
Soil Infiltration Factor	0.40	**0.40**

Cover		
Land Use	Area (ha)	**Cover Infiltration Factor**
Agriculture Range Grass Woods Wetland Bare Earth (>70% Rock) Impervious	1.09	0.10
Total[3]	1.09	**0.10**

MOE Infiltration Factor	**0.75**
Actual Infiltration Factor	**0.75**

Notes:

1. Infiltration Factors are derived from Table 3.1, MOE SWM Design Manual 2003
2. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
3. Composite Infiltration Factors are calculated using pervious areas only

Appendix K

Mass Balance Equation

WILLS

Appendix K – D-5-4 Groundwater Impact Assessment: Mass Balance Equation

$$\mathbf{Q_tC_t = Q_eC_e + Q_iC_i}$$

Where Q_t = Total Volume (Q_e + Q_i)

Note: As per the requirements of D-5-4, the maximum volume of effluent allowed to be used as dilution water is 1000L/day/lot.

C_t = Total Concetration of nitrate at property boundary

Q_e = volume of septic effluent

C_e = Concentration of nitrate in effluent (40 mg/L)

Q_i = Volume of available dilution water

C_i = Concentration of nitrate in dilution water

In order to determine the concertation of the nitrate at the property boundary (C_t), the mass balance equation is rearranged to the following:

$$\boldsymbol{Ct = \frac{QeCe + QiCi}{Qt}}$$