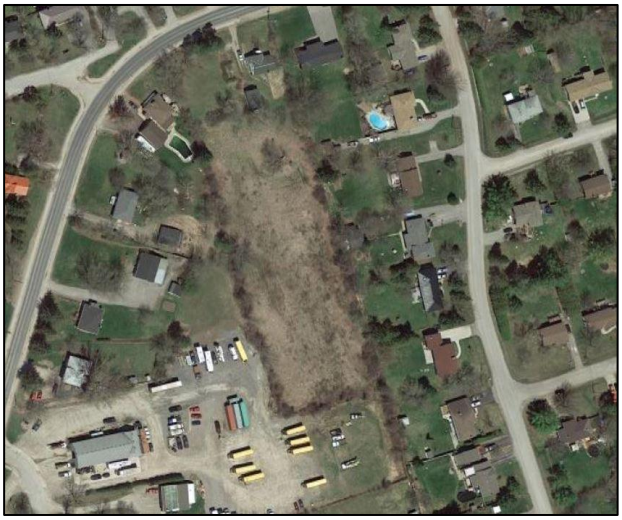
Stormwater Management Report

Bridgenorth Townhouse Development

949 Eighth Line
Bridgenorth, Ontario

D.M. Wills Project No. 22-85260



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Peterborough

December 2025

Prepared for:
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WILLS

Summary of Revisions

Revision No.	Revision Title	Date of Release	Summary of Revisions
1	Stormwater Management Design Brief	April 2024	1st Submission to Peterborough County
2	Stormwater Management Report	August 2025	2nd Submission to Peterborough County
3	Stormwater Management Report	December 2025	3rd Submission to Peterborough County

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

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1.0 Purpose

D.M. Wills Associates Limited (Wills) has been retained by O/A Granite Ridge Estates (1447147 Ontario Inc.) to prepare a Stormwater Management (SWM) Report in support of the Zoning By-Law Amendment (ZBA) and proposed Site Plan Approval (SPA) application for the proposed townhouse development located at 949 Eighth Line, Bridgenorth, Township of Selwyn.

The purpose of this report is to evaluate the existing drainage characteristics of the site and to advance an integrated plan for SWM that will permit the development to proceed with no adverse impacts to the receiving drainage system. This report has been prepared to address the requirements of the Township of Selwyn (Township) and Otonabee Region Conservation Authority (ORCA).

2.0 Site Description

The location of the Site is shown in **Figure 1** and is located at 949 Eighth Line in the Town of Bridgenorth, Ontario (Subject Property). The Subject Property consists of 1.02 ha of land located on the south side of Eighth Line (Peterborough County Road 18), approximately one kilometer north of Bridgenorth. The properties to the east are residential, mainly composed of pervious areas (lawns), with some impervious areas associated with the driveways, rooftops, and accessory buildings. The lands to the west of the Subject Property are composed of similar land uses. A vehicle repair shop is located to the west and south; the area contains a gravel area that drains to the west, away from the proposed development.

The existing site consists of a gravel entrance and parking to support a single-family dwelling, a detached garage, and grassed area in the northern section of the property, around the structures. The remainder of the Subject Property consists of longer, unkept grass, referred to as range. This area of range encompasses the majority of the property. The south area of the Subject property drains toward a low-lying area approximately 32 m south of northwest corner. The north section of the property drains overland westward to the identical low-lying area. Stormwater flows toward the Eighth Line Right of Way (ROW) via a shallow swale where runoff enters the municipal stormwater system via a catch basin.

The proposed development includes the construction of three townhouse buildings, a gravel driveway and additional parking. The existing dwelling detached garage and gravel driveway are to be demolished under proposed conditions.

The topographic survey of the site was completed by JBF Surveyors on September 7, 2022. This data was used to determine elevations and locations of existing site features, determine on-site drainage patterns, and establish the proposed grades.

Surficial soils data for the site was collected and analyzed by Wills and were obtained from multiple site visits. The Final Hydrogeological Report, dated November 2023,

includes relevant information required for SWM analysis and design. This report details that the native soils consist of dark brown silty sand; when coupled with historical soil mapping, the Subject property consists of Otonabee Loam and Lyons Loam, corresponding to Hydrologic Soil Group B and Group C, respectively.

Wills' Hydrogeological Report outlined that infiltration rates varied based on location on the Subject Property. The report also suggests that high groundwater levels were encountered during the spring months; in some cases, groundwater was located at the ground surface. This information will be utilized when designing the appropriate SWM feature(s) for the Subject Property.

Legend

949 Eighth Line, Lakefield, Township of Selwyn

Meters

0 130 260 520

Data Sources
Land Information Ontario 2021
Created In: ArcMap 10.7

NAD 1983 UTM Zone 17N

1:10,000

Figure 1 - Location Plan

Drawn By:	NN
Checked By:	MW
Map Date:	1/26/23
Project Number:	22-85260
Map File Number	Figure 1

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3.0 Methodology

The present hierarchy of watershed planning in Ontario can be described by the following in descending order: Watershed Plans, Sub-watershed Plans and Individual SWM Plans. The subject site is not covered by any Watershed or Sub-watershed Plans; therefore, this report has been prepared as an individual SWM plan.

3.1 Site Specific Stormwater Design Criteria

Based on the typical requirements of the Township of Selwyn and ORCA, the following design criteria have been established for the Site:

- Provide stormwater quantity controls to reduce the proposed peak flow rates to the existing condition for the 2 to 100-year design storms.
- Provide stormwater quality controls to achieve "Enhanced" Level 1 protection as defined in the MECP Stormwater Management Planning and Design Manual (March 2003), with due consideration to the site constraints and available alternatives.
- Provide Low Impact Development features to mitigate the extent to which the development will increase runoff volumes on an average annual basis.

3.2 Catchment Characterization

3.2.1 Existing Catchments

The existing drainage patterns for the site were determined through a combination of aerial photography and available topographic data. The site is represented by one catchment area for the existing condition which is shown in **Figure 2** and described in detail below:

- Catchment **EX-100** consists of the entire subject property including the gravel driveway, single-family dwelling, and detached garage. A small portion of the remaining area is grassed; however, the majority of the site is composed of grassed-like range. The south portion of the Subject Property, consisting of range, drains from southeast to northwest to a low-lying area near the northwest corner of the property. The developed area of the property, consisting of the dwelling and detached garage, drains from east to west toward the low-lying area. This low-lying area directs runoff toward a shallow swale which discharges to the Eighth Line ROW and ultimately the municipal storm sewer (**OUT-1**) at or around Structure P00091A (see **Section 4.1.5** for more details).

3.2.2 Proposed Catchments

For the proposed condition, the Site has been analyzed based on the proposed building envelopes and grading of the site. The proposed catchment areas are shown on **Figure 3** and described in detail below:

- Catchment area **PR-101** encompasses the majority of the Subject Property under proposed conditions. This includes the three townhouse buildings, the gravel driveway, parking areas, grassed landscaping and SWM quality and quantity controls. Runoff generated within this catchment will be captured in either the east or west swale and directed to the SWM facility, prior to discharging into the municipal sewer (**OUT-1**) at or around Structure P0170A (see **Section 4.1.5** for more details).
- Catchment **PR-102** represents a small portion of the Subject Property along the northwestern property boundary. This catchment consists of an undeveloped grassed area which will follow existing drainage patterns and ultimately flow into the municipal sewer (**OUT-1**) at or around Structure P0170A (see **Section 4.1.5** for more details).

3.2.3 External Catchments

The external drainage patterns were determined based on topographic data provided by the County of Peterborough GIS. The external catchment that contributes to the stormwater discharging from the Subject Property is described below:

- Catchment **EXT-101** consists of grassed landscaping and small amounts of impervious area from the dwellings. Under existing conditions, the properties directly east drain from east to west through the Subject Property. The lands to the south drain from south to northeast, also flowing through the Subject Property. Under post-development conditions, runoff generated from the external area will be conveyed to the SWM facility prior to discharging to the municipal storm sewer (**OUT-1**).

EX-100 / 0.22 ha — CATCHMENT ID / CATCHMENT AREA

CATCHMENT BOUNDARY

OVERLAND FLOW DIRECTION

STORM SEWER FLOW DIRECTION

OUT — OUTLET LOCATION

Sketch No.

FIGURE 2

949 EIGHTH LINE

PRE-DEVELOPMENT

DRAINAGE AREA PLAN

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Designed By: NN	Plot Date: DEC. 2023
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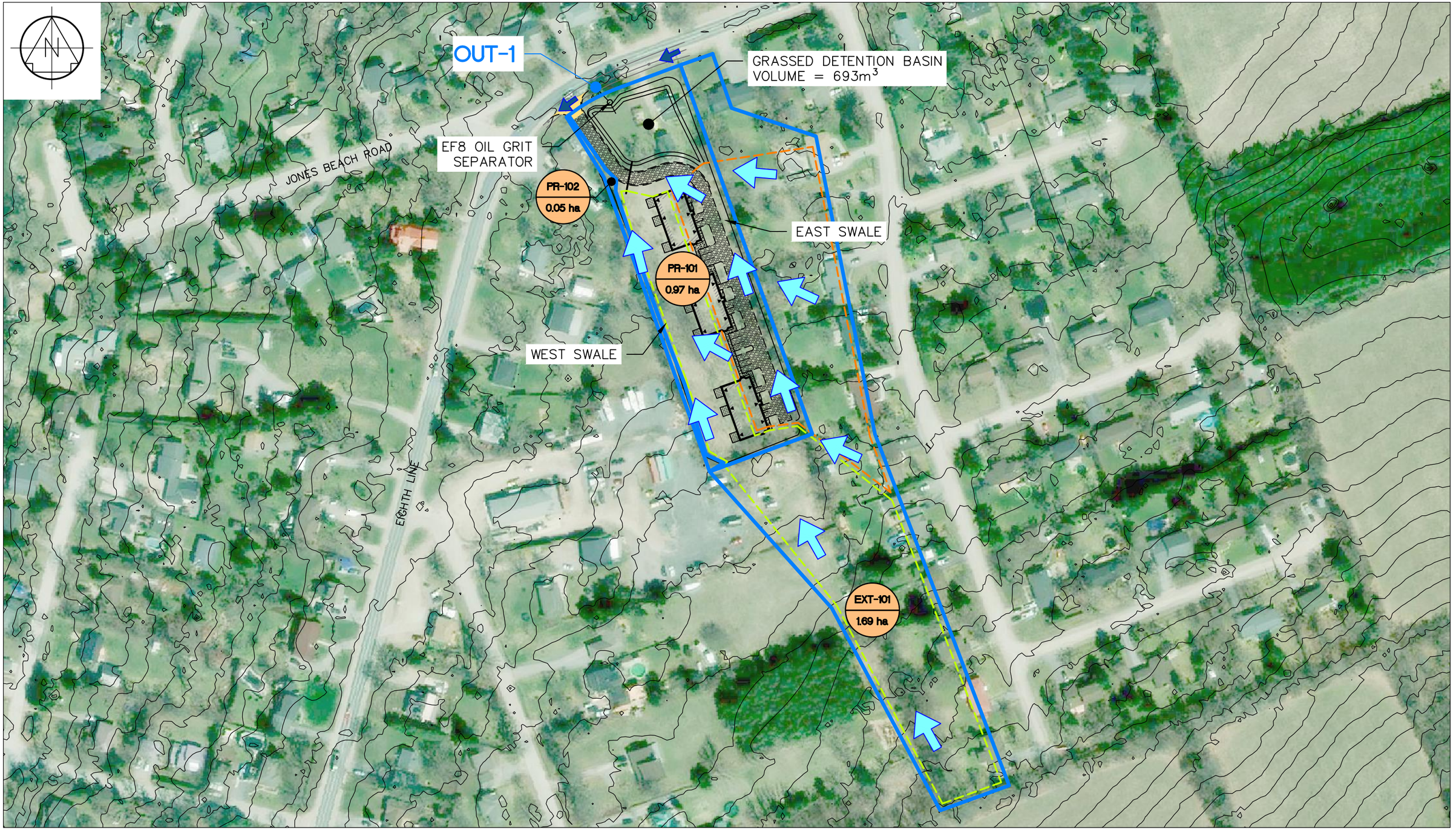
Engineer: KS	Drawing File No.: 85260-DP-NOV 2023



EX-100 / 0.22 ha — CATCHMENT ID / CATCHMENT AREA

CATCHMENT BOUNDARY

OVERLAND FLOW DIRECTION

STORM SEWER FLOW DIRECTION

WEST SWALE DRAINAGE AREA (1.16 ha)

OUT — OUTLET LOCATION

EAST SWALE DRAINAGE AREA (0.94 ha)

Sketch No.

FIGURE 3
949 EIGHTH LINE
POST-DEVELOPMENT DRAINAGE AREA PLAN

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Checked By: KS	Project No.: 85260
Engineer: KS	Drawing File No.: 85260-DP-FEB 2024

3.3 Site Conditions Summary

The existing and proposed site characteristics were analyzed in detail to estimate the key hydrologic parameters. On-site soils were assessed as Otonabee Loam and Lyons Loam classified as Hydrologic Soil Group B and Group C, respectively. The hydrologic parameters are summarized in **Table 1** and documented in **Appendix A**.

Table 1 – Existing and Proposed Hydrologic Parameters

Nashyd[1]					
Catchment ID	**Area (ha)**	**Impervious %**	**CN*[2]**	**Ia[3]**	**Tp[4] (hrs)**
EX-100	1.02	1.5	75.8	7.3	0.29
EXT-101	1.69	12.4	72.8	5.3	0.23
PR-102	0.05	0.0	70.5	5.0	0.13

Standhyd[1]								
Catchment ID	**Area (ha)**	**Impervious %**	**CN*[2]**	**Ia[3]**	**Pervious Length (m)**	**Pervious Slope (%)**	**Impervious Length (m)**	**Impervious Slope (%)**
PR-101	0.97	30	75.9	4.4	149	1.9	13	7.8

Notes:
1. Nashyd and Standhyd refer to the unit hydrograph model used in the Visual Otthymo Version 3(VO3) hydrologic model for the respective catchment area.
2. CN* refers to the modified CN number adjusted to Antecedent Moisture Conditions II. Excludes Impervious Area for Standhyd.
3. Ia refers to Initial Abstraction. Excludes Impervious Area for Standhyd.
4. Tp refers to Time to Peak.

Hydrologic parameters such as soil infiltration properties, land use and runoff responses were determined based on Wills' Hydrogeological Report dated November 2023. Topographic mapping and AutoCAD Civil 3D 2019 software were used to establish catchment areas, land use and slope.

The City of Peterborough (City) requires the 6-hr SCS Type II Peterborough storm distribution to be applied for SWM analysis. Based on the proximity of the Subject Property to the City, this design storm was chosen to complete the hydrologic analysis. Further information pertaining to the storm distributions can be found in **Appendix A**.

3.3.1 Subsurface Conditions

Wills' Environmental Team conducted multiple site visits to investigate the subsurface geology of the Subject Property. This included pertinent information required for SWM design such as soil composition, infiltration rates and groundwater levels.

The Hydrogeological Report was prepared by Wills in November 2023, analyzing the subsurface soil profile, seasonal ground water elevations and infiltration rates of the native soil. These conditions were analyzed through four test pits, three boreholes, which included monitoring wells, and three infiltration tests conducted throughout the site. Groundwater fluctuations were analyzed via monitoring wells throughout the year. The results are summarized in **Table 2**.

Table 2 – Groundwater Level Summary

Monitor Well ID	Measurement Date	Groundwater Level (mbg)	Groundwater Elevation (masl)
MW22-01	January 31, 2023	0.25	265.29
	May 9, 2023	0.13	265.41
	November 9, 2023	0.92	264.62
MW22-02	January 31, 2023	0.47	263.88
	May 9, 2023	0.43	263.91
	November 9, 2023	1.14	263.20
MW22-03	January 31, 2023	0.83	263.49
	May 9, 2023	0.63	263.69
	November 9, 2023	2.40	261.91

A review of **Table 2** shows that high groundwater levels were encountered throughout the entire site during every season, aside from MW22-03 in November. The highest groundwater levels were experienced during the spring (May), as anticipated.

In-situ infiltration testing was completed at three locations within the Subject Property. Shallow groundwater conditions limited the testing completed at the end of April 2022, and no infiltration was observed. During January 2023, the percolation time was recorded to be 12.1 min/cm, equating to an infiltration rate of 50 mm/hr. Further details can be found in the Hydrogeological Report (Wills, 2023) included in **Appendix B**.

All boreholes were advanced to a depth of 6.10 meters below grade (mbg). Sand and silt were encountered beneath the silty sand material at the surface. No bedrock was encountered during drilling. Borehole logs are included in **Appendix B**.

3.3.2 Influence on Stormwater Management

High groundwater levels will have the greatest impact on SWM, specifically on the opportunity to utilize infiltration as a strategy to achieve quality control targets. Based on the observed groundwater elevations, it will not be possible to achieve the required 1.0 m separation from the bottom of an infiltration feature to the high ground water level.

This will restrict the design alternatives to those options that rely on shallow-flow filtration (e.g. enhanced grass swales) and technologies that promote sediment settling and separation (e.g. Oil-Grit Separators) to provide sufficient stormwater quality and quantity.

Furthermore, there is a risk that any excavation stormwater feature or subdrainage system could introduce a flow path for existing groundwater to the surface or into the municipal storm sewer. Therefore, depending on the nature of the stormwater facility, the design may require an impervious liner to prevent groundwater upwelling and discharge. The depth of any proposed excavation may be limited based on the location of the SWM facility, and the potential upwelling pressures that could be developed during the seasonal high groundwater level.

Pre- and post-development conditions will be analyzed based on the hydrologic conditions and stormwater Best Management Practices (BMPs) will be implemented during the design phase.

4.0 Stormwater Management

4.1 Stormwater Quantity Control

4.1.1 Peak Flow Calculations

Peak flow rates from the existing condition have been analyzed at the outlet location based on the hydrologic parameters shown in **Table 1**. Uncontrolled, post-development peak flow rates were also calculated at the same outlet location. A summary of the peak flow rates is shown in **Table 3**.

Peak flows were estimated using VO3 hydrologic modelling software for each of the 2 to 100-year storms. These calculations consider the 6-hour SCS Peterborough storm duration. The flow chart and the VO3 model are presented in **Appendix C.**

Table 3 – Existing and Post-Development Uncontrolled Peak Flow Summary

Return Period	Peak Flow Rates (m^3/s)	
	EX[1]	UNC[2]
2-year	0.065	**0.089**
5-year	0.121	**0.146**
10-year	0.165	**0.189**
25-year	0.225	**0.252**
50-year	0.273	**0.300**
100-year	0.323	**0.358**

Notes:
1. EX refers to the site under existing conditions. Refer to VO3 hydrograph NHYD (1)
2. UNC refers to the site without any quantity controls in place. Refer to VO3 hydrograph NHYD (4)

A review of **Table 3** confirms the increase in proposed peak flow rates from the existing peak flow rates leaving the site, in the absence of stormwater quantity controls.

4.1.2 Grassed Detention Basin

In accordance with the design criteria established in **Section 3.1**, quantity controls are required up to the 100-year storm. A grassed detention basin with an orifice flow control is proposed to attenuate peak stormwater flowrates.

The proposed outlet pipe will be 300 mm in diameter, with an invert positioned at the bottom of the pond (263.40 m) to ensure post development flows are controlled to pre-development levels. The outlet pipe will outflow into an OGS which will discharge into 375 mm diameter sewer, which will be connected to the municipal sewer at a slope of at least 1.0%. The 100-year controlled outflow from the basin will utilize 26% of the capacity of the sewer; and therefore the pipe will not introduce a pressurized backflow on the outlet pipe.

The grassed detention basin is located near the northern property boundary, where high groundwater levels were experienced. Therefore, this facility will contain an impermeable clay liner, preventing groundwater upwelling. Said liner is to be designed by a qualified geotechnical engineer.

Trench plugs are to be incorporated at the outlet pipe location of the SWM facility to ensure no exfiltration into the system and thus into municipal infrastructure.

In order to prevent groundwater movement and upwelling at the outlet location of the grassed detention basin, trench plugs will be implemented. Further details can be found in the Detailed Design Drawings included in **Appendix H**.

The stage-storage-discharge relationship for the grassed detention basin is shown in **Table 4** with detailed calculations are provided in **Appendix D**.

Table 4– Underground Storage Facility Stage Storage Discharge

Elev. (m)	Storage Depth (m)	Peak Flows (m^3/s)	Storage Volume (m^3)	Remarks
263.40	0.00	0.000	0	Bottom of Grassed Detention Basin
263.40	0.00	0.000	0	300 mm Orifice Tube Flow Control
263.54	0.14	0.030	148	2 Year (140 m^3)
263.61	0.21	0.061	225	5 Year (216 m^3)
263.66	0.26	0.083	281	10 Year (274 m^3)
263.73	0.33	0.106	362	25 Year (360 m^3)
263.80	0.40	0.125	445	50 Year (434 m^3)
263.86	0.46	0.139	517	100 Year (515 m^3)
264.00	0.60	0.167	693	Top of Grassed Detention Basin

4.1.3 Emergency Spillway Assessment

The proposed detention basin does not require an additional emergency spillway based on the site grading and hydraulic modelling results. The relatively lowest point on the site is located at elevation 263.13, positioned at the property line where the proposed driveway access is situated. In the event of outlet blockage, stormwater will pond up to this critical elevation.

Under the simulated worst-case condition (100-year storm event with outlet blockage), the emergency spill route modelling (Appendix G) indicates a maximum ponding depth of 0.076 m, resulting in an emergency water surface elevation of 263.21. At this stage, the uncontrolled discharge rate is 0.358 m^3/s, which corresponds to the unchanged (natural) 100-year storm runoff rate. The modelling results confirm that the design can safely convey this flow, with an average velocity of approximately 0.47 m/s along the driveway. The maximum emergency water level (263.21) remains below the secondary driveway high point at 264.25, ensuring no overtopping occurs.

In addition, all proposed building finished floor elevations have been designed with a minimum of 0.30 m freeboard above the critical spill elevation, ensuring adequate protection against extreme rainfall events. This analysis confirms that the site infrastructure and adjacent properties remain safe, with no risk of damage due to overtopping or uncontrolled discharge.

4.1.4 Proposed Release Rates

The proposed peak flow rates for the development are shown in Error! Reference source not found. below. These flow rates include the quantity control provided by the proposed grassed detention basin.

Table 5 – Existing and Proposed Peak Flow Summary

Return Period	Peak Flow Rates (m^3/s)	
	EX[1]	PR[2]
2-year	0.065	0.028
5-year	0.121	0.058
10-year	0.165	0.080
25-year	0.225	0.106
50-year	0.273	0.123
100-year	0.323	0.139

Notes: 1. EX refers to the existing development conditions. (NHYD = 1)
2. PR refers to the proposed conditions with controlled flows from the proposed grassed detention basin. (NYHD = 3)

A review of Error! Reference source not found. demonstrates that the grassed detention facility will control runoff from the site to the allowable discharge rates to **OUT-1**.

4.1.5 Existing Storm Sewer Analysis

Under proposed conditions, the grassed detention basin will discharge into the municipal storm infrastructure north of the Subject Property. Although the post development stormwater flowrates are controlled to pre-development levels, the development necessitates that the discharge must be introduced to the municipal sewer system slightly upstream of existing conditions (proposed flow will discharge to P0170A instead of P00091A).

To ensure the adjustment in the discharge location will not significantly impact the hydraulic performance of the sewer network, the existing storm sewer was analyzed to ensure runoff can be appropriately conveyed without stressing the system or creating / exacerbating impactful hydraulic grade line elevations.

A storm sewer analysis of the existing system was undertaken in order to determine the impact of the proposed development on the system. A Hydraulic Grade Line (HGL) was created for pre-development flows; and compared to the post-development HGL. During the 5-year storm event, the orifice-controlled outflows for the proposed development resulted in a minor and localized increase in the HGL between P0170A and P00091A'. The increase between existing and proposed conditions is attributable to a difference in the calculation approach as the system approached critical flow depth

in the local pipes. Although the proposed conditions show a local increase, the sewers in question are functioning at less than 100% capacity. Elsewhere in the network the HGL was unchanged to improved (lowered). During the 100 year storm event, the performance of the system was improved, with the exception of a very minor increase in the HGL (0.04 m) at P0170A. A detailed breakdown of for the HGLs can be found in **Appendix E**.

4.1.6 Culvert Capacity and Tailwater Considerations

The proposed culvert is a 450 mm diameter HDPE pipe with an actual slope of 0.6%, located to convey flows from the west swale downstream of the stormwater pond outlet. The culvert inlet is set above the basin's outlet to maintain positive drainage. The culvert outlet invert elevation is set at 263.68 m with a slope of 0.6%. The HY-8 modeling was conducted using constant tailwater (100-year HWL=263.86) with free fall conditions. Under these design conditions, the HY-8 analysis (Appendix G) indicates that the culvert can convey flows from the west swale for all analyzed storm events, including the 100-year return period, without overtopping the roadway (crest elevation 264.28 m). The peak 100-year flow of 0.17 m³/s for the west swale is accommodated with headwater levels below the roadway crest, providing adequate freeboard. These results confirm that the proposed culvert has sufficient capacity under the project's design criteria.

4.2 Stormwater Quality Control

The selection and sizing of the water quality measures are based on the procedures set out in the *Stormwater Management Planning and Design Manual* (MOE, March 2003) for Enhanced (Level 1) protection. As such, the goal of SWM is to preserve the natural hydrologic cycle. In addition, SWM measures should be assessed in the following order:

- Stormwater lot level controls
- Stormwater conveyance controls
- End-of-pipe SWM facilities

Stormwater lot level controls represent measures that are implemented on an individual lot basis such as soak-a-way pits, flatter grading, and reduction of the impervious footprint. Currently, the Subject Property has minor grade changes, and the proposed grading will not substantially differ. This will supplement the proposed SWM strategy; however, is not intended to become the primary means for stormwater quality control.

Stormwater conveyance controls represent the conveyance systems used to transport stormwater runoff from the lots to the receiving waters such as pervious pipes, catch basin treatment and grassed swales. Stormwater conveyance controls will be one of the main sources of quality treatment for the proposed development. Enhanced grassed swales will be implemented to promote suspended solids removal. Further details are provided in **Section 4.2.1**.

End-of-pipe SWM facilities represent the common urban SWM measures used to service numerous lots or whole subdivisions including wet ponds, wetlands, dry ponds,

infiltration-based facilities, Oil and Grit Separators (OGS) and filter systems. An OGS is proposed to aid in quality control treatment prior to stormwater discharge into the municipal infrastructure.

4.2.1 Quality Control Summary

As described above, quality control will be achieved via a combination of enhanced grassed swales and an OGS prior to discharging into the municipal storm sewer. East and west enhanced swales, located in catchment **PR-101**, will convey stormwater generated from **PR-101** and **EXT-101** to the grassed detention basin. Outflow from said basin will flow through an OGS before discharging into the municipal storm sewer. The OGS and grassed detention basin are proposed to be located in catchment **PR-101**. When combined, the quality control features will provide quality control treatment to the greatest extent possible, noting that infiltration practices are infeasible the high groundwater levels recorded on the Subject Property.

4.2.1.1 Enhanced Grassed Swales

Similar to a typical swale, an enhanced grassed swale provides a means of stormwater congregation and conveyance. However, enhanced swales contain more gradual slopes to remove any sediment from the stormwater. Given the high groundwater challenges experienced at the Subject Property, infiltration-based strategies could not be used to provide the required quality control, thus, enhanced grassed swales were selected to aid in quality control treatment.

Two enhanced swales are proposed for the Subject Property, on the east and west sides of the property. The east swale will collect any runoff generated from the eastern half of catchment **PR-101** and a portion of **EXT-101**, including half of the roof area of the proposed townhouses, concrete walkways, the gravel driveway and parking areas, and the grassed area adjacent to the eastern property boundary. The west swale will collect stormwater produced from the outstanding half of the proposed townhouses, the large, grassed area in the western portion of catchment **PR-101**, and the remainder of the external area. Both swales will contain clay liners where seasonally high groundwater is at the surface. This liner will also need to be designed by a qualified geotechnical engineer. **Figure 4** and **Figure 5** illustrate the proposed dimensions of the enhanced swales with additional detailed included in **Appendix F**.

Figure 4 – West Swale Design

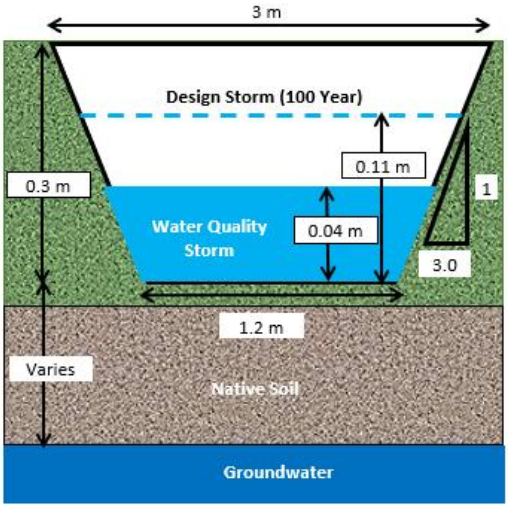
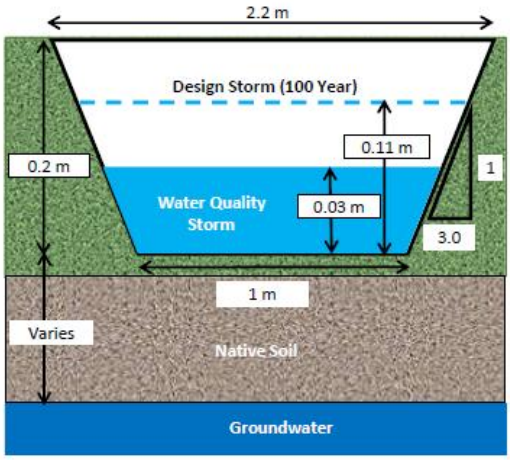


Figure 5 – East Swale Design



4.2.1.2 ETV Tested Oil-Grit Separators

OGS devices have become an increasingly common method of achieving stormwater quality control requirements in the province of Ontario. However, recent studies have cast scrutiny on performance claims and sizing methodologies used for some of these technologies. In an effort to standardize the evaluation of different OGS units, the Canadian Environmental Technology Verification (ETV) Program has published a Procedure for Laboratory Testing of OGS's (ISO 14034). This protocol contains testing specifications for third-party laboratories, sediment removal efficiency, sediment scour, particle size distribution, oil/fuel retention and scaling of various model sizes. ETV Canada publishes technologies that have been verified.

Several municipalities and conservation authorities in Ontario have adopted the following guidelines for the selection of OGS devices:

1. OGS devices must have a current Canadian ETV or ISO 14034 verification.
2. OGS devices that were not tested for oil/fuel retention or do not report the results of this testing, shall not be approved for installation in sites that require oil or fuel capture.
3. OGS model sizes should be scaled according to the surface loading rate and depth as specified in the scaling provisions of ISO 14034.
4. The target Total Suspended Solids (TSS) removal rate for OGS units is 60% of the ETV particle size distribution.
5. For sites that require 80% TSS removal, such as the Subject Property, additional or alternative stormwater best management practices are required, hence the implementation of the enhanced swales.

The pre-treatment option selected is summarized in **Table 6** with sizing calculations included in **Appendix F**.

Table 6 – Oil-Grit Separator

Option	Pre-Treatment	Model[1]	Particle Size Distribution	TSS Removal	Annual Runoff Volume Treated
1	Stormceptor	EF8	CA-ETV	60%	>90%

Notes: 1. Stormceptor supplier to specify the weir elevation and extended base dimensions based on groundwater elevations

4.3 Low Impact Development Design

As the practice of SWM has evolved, increasing emphasis has been placed on utilizing a treatment train approach to manage runoff as close to the source as possible. This design philosophy is often referred to as Low Impact Development (LID), where the goal is to maintain and mimic the natural hydrologic conditions. LID designs accomplish this

by reducing the runoff volume generated by a site and implementing features that infiltrate, filter, evaporate, harvest, and detain runoff, while also preventing pollution. Therefore, opportunities to utilize these features have been investigated.

The net impact of the enhanced grassed swales and grassed detention basin is expected to align with LID principles. Generally, infiltration-based LID features require a minimum 1.0 m separation from the seasonal high groundwater levels and appropriate infiltration rates to facilitate a reasonable drawdown period. Given the high groundwater levels recorded on site, this separation cannot be achieved, therefore infiltration-based quality control cannot be implemented. The proposed design provides the most amount of quality control possible, given the constraints of the Subject Property, while taking measures to prevent groundwater upwelling and discharge to of groundwater to the surface or municipal sewer.

5.0 Erosion and Sediment Control

When soils are exposed during construction, there is a potential for transport of relatively large amounts of sediment off-site to downstream areas. In order to minimize the impacts associated with sediment transfer, the following measures will be completed in the order listed:

- Install silt barrier along the Property limits as shown on Detailed Design Drawings and maintain as required.
- Install storm drain inlet protection on all receiving catch basin grates.
- Remove temporary erosion and sediment control devices/measures and clean out once vegetation is established.

Regular inspection and maintenance of the silt fence will ensure continued protection to the downstream areas for the duration of the construction period. Additional information on the proposed erosion and sediment control measures are listed below.

5.1 Silt Fencing

Silt fencing will be installed in accordance with Ontario Provincial Standard Drawings OPSD 219.110 and 219.130, with the type selected based on site conditions. Light duty silt fencing (OPSD 219.110) will be used in areas with lower flow velocities and less critical sediment control requirements, while heavy duty silt fencing (OPSD 219.130/219.131) will be used in locations subject to higher flow velocities or requiring greater durability. All silt fencing will be inspected after every rainfall to identify failed or damaged sections, which shall be repaired immediately. When sediment accumulation reaches half the height of the geotextile, it will be removed and disposed of in a controlled location to prevent re-entry into the drainage system. A supply of extra silt fence material will be kept on site to allow for quick repairs or installation of additional fencing if required.

5.2 Storm Drain Inlet Protection

Storm drain inlet protection will be provided by catch basin filters placed on all catch basin grates. The location of the catch basin filters can be found on the detailed design drawings. The catch basin filters treat runoff before it is released to the infiltration basin while permanent stabilization is taking place. The catch basin filters will be inspected regularly and removed after the final lift of asphalt has been installed and vegetation is sufficiently established (>80%).

6.0 Conclusion

The proposed townhouse development located at 949 Eighth Line in Lakefield, Ontario will alter the existing drainage patterns, therefore a Stormwater Management Report has been prepared to address the requirements of the Township of Selwyn and the Otonabee Region Conservation Authority.

Water quantity control is provided by a grassed detention basin with a controlled orifice outflow. Water quality control is provided via an oil-grit separator coupled with upstream enhanced grassed swales. Low impact development is achieved via the enhanced swales and the grassed detention basin. Erosion and sediment control measures have been prepared to ensure that off-site transport of sediment is minimized through temporary measures.

The proposed 450 mm diameter smooth HDPE culvert has been evaluated through HY-8 analysis and confirmed to have sufficient capacity to convey the design flows from the west swale for all modeled storm events, including the 100-year return period, without overtopping the roadway.

The proper installation and ongoing maintenance of the erosion and sediment control measures outlined in this report will ensure that the development can proceed without adversely affecting downstream drainage conditions. The Property owner shall carry out the maintenance of the proposed measures.

Respectfully submitted,

Sheng Cai, P.Eng.
Water Resources Engineer

Chris Proctor, P.Eng.
Manager, Land Development Engineering

NN/KS/CP/SC/jh/af

Statement of Limitations

This report has been prepared by D.M. Wills Associates Limited on behalf of O/A Granite Ridge Estates (1447147 Ontario Inc.) address the requirements of the Township of Selwyn of Bancroft and the Otonabee Region Conservation Authority. .

The conclusions and recommendations in this report are based on available background documentation and discussions with applicable agencies at the time of preparation.

The report is intended to demonstrate the means whereby stormwater runoff originating from the site will be managed with respect to quantity and quality control. The report is applicable only to the project described in the text, constructed substantially in accordance with the plans and details accompanying this report.

Any use which a third party makes of this report other than a Stormwater Management Report for the proposed development, is the responsibility of such third parties. D.M. Wills Associates Limited accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or action taken based on using this report for purposes other than a Stormwater Management Report for the 949 Eighth Line, Lakefield, Ontario development.

D.M. Wills Associates Limited is not responsible for any changes made to the SWM measures, which are not in accordance with the design drawings. Any person(s) relying on the "as-constructed" stormwater measures should confirm that the field conditions are in accordance with the design drawings.

Appendix A

Rainfall Data and Hydrologic Parameters

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6 Hour SCS Type II Intensity Hyetographs
2006 Peterborough Airport Weather Station
(mm/hr)

Time (min.)	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
0	0	0	0	0	0	0
15	1.6	2.1	2.5	2.9	3.3	3.6
30	1.6	2.1	2.5	2.9	3.3	3.6
45	2.3	3.2	3.7	4.4	4.9	5.4
60	2.3	3.2	3.7	4.4	4.9	5.4
75	2.3	3.2	3.7	4.4	4.9	5.4
90	2.3	3.2	3.7	4.4	4.9	5.4
105	3.9	5.2	6.2	7.3	8.1	9.0
120	3.9	5.2	6.2	7.3	8.1	9.0
135	4.6	6.3	7.4	8.8	9.8	10.8
150	4.6	6.3	7.4	8.8	9.8	10.8
165	23.2	31.4	36.9	43.7	48.9	53.9
180	60.4	81.78	95.9	113.7	127.0	140.2
195	8.5	11.5	13.5	16.0	17.9	19.8
210	8.5	11.5	13.5	16.0	17.9	19.8
225	3.9	5.2	6.2	7.3	8.1	9.0
240	3.9	5.2	6.2	7.3	8.1	9.0
255	3.1	4.2	4.9	5.8	6.5	7.2
270	3.1	4.2	4.9	5.8	6.5	7.2
285	2.3	3.2	3.7	4.4	4.9	5.4
300	2.3	3.2	3.7	4.4	4.9	5.4
315	1.6	2.1	2.5	2.9	3.3	3.6
330	1.6	2.1	2.5	2.9	3.3	3.6
345	1.6	2.1	2.5	2.9	3.3	3.6
360	1.6	2.1	2.5	2.9	3.3	3.6

Hydrologic Parameters for EX-100

Sheet 1 of 1

Project No: 85260
Project Name: Lakefield Townhouse Development
Designed/Checked By: NN / KS
Date: 4-Mar-24

Land Use

	EX-100	EX-100	
Agriculture	0.00	0.00	ha
Range	0.11	0.69	ha
Grass	0.20	0.00	ha
Woods	0.00	0.00	ha
Wetland	0.00	0.00	ha
Gravel	0.01	0.00	ha
Impervious	0.02	0.00	ha
SUM	**0.33**	**0.69**	
Hydrologic Soil Group[1]	B	C	
Soil Type	Otonabee Loam	Lyons Loam	
C	0.21	0.28	
CN (Nashyd)	64.5	76.0	

Rainfall Data

Gauging Station = Peterborough
12 hr, 100 Yr Rainfall = 90.4 mm

Drainage Area	**1.02**	ha
Impervious Area	**0.02**	ha
Percent Impervious	**1.5%**	
Connected Impervious	1.5%	

	Pervious	Impervious	
Length	160	11	m
US Elev	267.70	268.00	m
DS Elev	263.60	267.00	m
Slope	2.6	9.4	%
	Rolling	Hilly	

Parameter	Soil Group	Land Use: Agriculture	Range	Grass	Woods	Wetland	Gravel	Impervious	Weighted Value: Incl. Imperv. NASHYD	Weighted Value: Not Incl. Imperv. STANDHYD
Runoff Coefficient[2]**, C**	**B**	0.32	0.22	0.13	0.11	0.05	0.76	0.90	0.21	
	C	0.45	0.28	0.17	0.13	0.05	0.84	0.90	0.28	n.a.
SCS Curve No.[3]**, CN**	**B**	74	65	61	58	50	85	98	64.5	62.8
	C	82	76	74	71	50	89	98	76.0	76.0
Initial Abstraction[5]**, mm**		6.0	8.0	5.0	10.0	10.0	2.5	2.0	7.3	7.4

Time of Concentration[6]

Total Length	171	m	
Average Slope	3.0	%	
Airport	**25.1**	min.	
Bransby - Williams	7.8	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Applicable Minimum[7]	10.0	min.	
Time to Peak	16.8	min.	
	0.29	**hr.**	

Composite Parameters

Drainage Area	1.02 ha	
Runoff Coefficient	0.26	
SCS Curve No.	72.3	71.9
Modified Curve No.[4]**, CN***	**75.8**	75.2
Initial Abstraction.	**7.3**	7.4

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
2. Runoff coefficient obtained from M.T.O. Design Chart 1.07, M.T.O. Drainage Management Manual, 1997, Hydrologic Analysis and Design, McCuen 2004 and New Jersey Technical Manual for Stream Encroachment, 1984.
3. SCS Curve No. obtained from M.T.O. Design Chart 1.09, M.T.O. Drainage Management Manual, 1997, and Table 2-2a, TR-55, page 2-5.
4. The modified curve number is adjusted as per Paul Wisner & Associates (1982) and represents anticedent moisture conditions Type II
5. Initial Abstraction values taken from the Environmental and Engineering Services Department, The Corporation of the City of London, Dec 2005
6. Use Airport Equation to calculate time of concentration for C <= 0.4, and Bransby-Williams for C > 0.4.
7. Minimum Time of Concentration for use in the Rational Method and Hydrologic Model has been set to 10 minutes
8. All impervious areas have been assumed to be directly connected.

Hydrologic Parameters for EXT-101

Sheet 1 of 1

Project No: 85260
Project Name: Lakefield Townhouse Development
Designed/Checked By: NN / KS
Date: 4-Mar-24

Land Use

	EXT-101	EXT-101	
Agriculture	0.00	0.00	ha
Range	0.24	0.17	ha
Grass	0.59	0.49	ha
Woods	0.00	0.00	ha
Wetland	0.00	0.00	ha
Gravel	0.00	0.00	ha
Impervious	0.09	0.12	ha
SUM	**0.92**	**0.77**	
Hydrologic Soil Group[1]	B	C	
Soil Type	Otonabee Loam	Lyons Loam	
C	0.23	0.30	
CN (Nashyd)	65.8	78.0	

Rainfall Data

Gauging Station = Peterborough
12 hr, 100 Yr Rainfall = 90.4 mm

Drainage Area	**1.69**	ha
Impervious Area	**0.21**	ha
Percent Impervious	**12.4%**	
Connected Impervious	12.4%	

	Pervious	Impervious	
Length	157	9	m
US Elev	276.00	100.00	m
DS Elev	268.00	99.50	m
Slope	5.1	5.3	%
	Rolling	Rolling	

Parameter	Soil Group	Land Use							Weighted Value	
		Agriculture	Range	Grass	Woods	Wetland	Gravel	Impervious	Incl. Imperv. NASHYD	Not Incl. Imperv. STANDHYD
Runoff Coefficient[2]**, C**	**B**	0.32	0.22	0.13	0.11	0.05	0.76	0.90	0.23	n.a.
	C	0.45	0.28	0.17	0.13	0.05	0.84	0.90	0.30	
SCS Curve No.[3]**, CN**	**B**	74	65	61	58	50	85	98	65.8	62.1
	C	82	76	74	71	50	89	98	78.0	74.5
Initial Abstraction[5]**, mm**		6.0	8.0	5.0	10.0	10.0	2.5	2.0	5.3	5.8

Time of Concentration[6]

Total Length	167	m	
Average Slope	5.1	%	
Airport	**20.5**	min.	
Bransby - Williams	6.5	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Applicable Minimum[7]	10.0	min.	
Time to Peak	13.8	min.	
	0.23	**hr.**	

Composite Parameters

Drainage Area	1.69 ha	
Runoff Coefficient	0.26	
SCS Curve No.	71.4	67.6
Modified Curve No.[4]**, CN***	**72.8**	69.7
Initial Abstraction.	**5.3**	5.8

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
2. Runoff coefficient obtained from M.T.O. Design Chart 1.07, M.T.O. Drainage Management Manual, 1997, Hydrologic Analysis and Design, McCuen 2004 and New Jersey Technical Manual for Stream Encroachment, 1984.
3. SCS Curve No. obtained from M.T.O. Design Chart 1.09, M.T.O. Drainage Management Manual, 1997, and Table 2-2a, TR-55, page 2-5.
4. The modified curve number is adjusted as per Paul Wisner & Associates (1982) and represents anticedent moisture conditions Type II
5. Initial Abstraction values taken from the Environmental and Engineering Services Department, The Corporation of the City of London, Dec 2005
6. Use Airport Equation to calculate time of concentration for C <= 0.4, and Bransby-Williams for C > 0.4.
7. Minimum Time of Concentration for use in the Rational Method and Hydrologic Model has been set to 10 minutes
8. All impervious areas have been assumed to be directly connected.

Hydrologic Parameters for PR-101

Sheet 1 of 1

Project No: 85260
Project Name: Lakefield Townhouse Development
Designed/Checked By: NN / KS
Date: 11-Mar-24

Land Use

	PR-101	PR-101	
Agriculture	0.00	0.00	ha
Range	0.00	0.00	ha
Grass	0.13	0.39	ha
Woods	0.00	0.00	ha
Wetland	0.00	0.00	ha
Gravel	0.05	0.11	ha
Impervious	0.14	0.15	ha
SUM	**0.31**	**0.66**	
Hydrologic Soil Group[1]	B	C	
Soil Type	Otonabee Loam	Lyons Loam	
C	0.55	0.42	
CN (Nashyd)	81.2	82.2	

Rainfall Data

Gauging Station = Peterborough
12 hr, 100 Yr Rainfall = 90.4 mm

Drainage Area	**0.97**	ha
Impervious Area	**0.29**	ha
Percent Impervious	**30.3%**	
Connected Impervious	30.3%	

	Pervious	Impervious	
Length	149	13	m
US Elev	266.80	100.00	m
DS Elev	264.00	99.00	m
Slope	1.9	7.8	%
	Flat	Hilly	

Parameter	Soil Group	Land Use: Agriculture	Range	Grass	Woods	Wetland	Gravel	Impervious	Weighted Value: Incl. Imperv. NASHYD	Weighted Value: Not Incl. Imperv. STANDHYD
Runoff Coefficient[2], C	**B**	0.26	0.14	0.08	0.08	0.05	0.76	0.90	0.55	
	C	0.39	0.20	0.12	0.10	0.05	0.84	0.90	0.42	n.a.
SCS Curve No.[3], CN	**B**	74	65	61	58	50	85	98	81.2	67.5
	C	82	76	74	71	50	89	98	82.2	77.3
Initial Abstraction[5], mm		6.0	8.0	5.0	10.0	10.0	2.5	2.0	3.7	4.4

Time of Concentration[6]

Total Length	162	m	
Average Slope	2.3	%	
Airport	19.9	min.	
Bransby - Williams	7.8	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Applicable Minimum[7]	**10.0**	min.	
Time to Peak	6.7	min.	
	0.12	**hr.**	

Composite Parameters

Drainage Area	0.97 ha	
Runoff Coefficient	0.46	
SCS Curve No.	81.8	74.8
Modified Curve No.[4], CN*	82.5	**75.9**
Initial Abstraction.	3.7	**4.4**

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
2. Runoff coefficient obtained from M.T.O. Design Chart 1.07, M.T.O. Drainage Management Manual, 1997, Hydrologic Analysis and Design, McCuen 2004 and New Jersey Technical Manual for Stream Encroachment, 1984.
3. SCS Curve No. obtained from M.T.O. Design Chart 1.09, M.T.O. Drainage Management Manual, 1997, and Table 2-2a, TR-55, page 2-5.
4. The modified curve number is adjusted as per Paul Wisner & Associates (1982) and represents anticedent moisture conditions Type II
5. Initial Abstraction values taken from the Environmental and Engineering Services Department, The Corporation of the City of London, Dec 2005
6. Use Airport Equation to calculate time of concentration for C <= 0.4, and Bransby-Williams for C > 0.4.
7. Minimum Time of Concentration for use in the Rational Method and Hydrologic Model has been set to 10 minutes
8. All impervious areas have been assumed to be directly connected.

Hydrologic Parameters for PR-102

Sheet 1 of 1

WILLS

Project No: 85260
Project Name: Lakefield Townhouse Development
Designed/Checked By: NN / KS
Date: 11-Mar-24

Land Use

	PR-102	PR-102	
Agriculture	0.00	0.00	ha
Range	0.00	0.00	ha
Grass	0.02	0.03	ha
Woods	0.00	0.00	ha
Wetland	0.00	0.00	ha
Gravel	0.00	0.00	ha
Impervious	0.00	0.00	ha
SUM	**0.02**	**0.03**	
Hydrologic Soil Group[1]	B	C	
Soil Type	Otonabee Loam	Lyons Loam	
C	0.13	0.17	
CN (Nashyd)	61.0	74.0	

Rainfall Data

Gauging Station = Peterborough
12 hr, 100 Yr Rainfall = 90.4 mm

Drainage Area	**0.05**	ha
Impervious Area	**0.00**	ha
Percent Impervious	**0.0%**	
Connected Impervious	0.0%	

	Pervious	Impervious	
Length	31	5	m
US Elev	265.00	100.00	m
DS Elev	264.00	99.50	m
Slope	3.2	10.0	%
	Rolling	Steep	

Parameter	Soil Group	Land Use							Weighted Value	
		Agriculture	Range	Grass	Woods	Wetland	Gravel	Impervious	Incl. Imperv. NASHYD	Not Incl. Imperv. STANDHYD
Runoff Coefficient[2], C	B	0.32	0.22	0.13	0.11	0.05	0.76	0.90	0.13	n.a.
	C	0.45	0.28	0.17	0.13	0.05	0.84	0.90	0.17	
SCS Curve No.[3], CN	B	74	65	61	58	50	85	98	61.0	61.0
	C	82	76	74	71	50	89	98	74.0	74.0
Initial Abstraction[5], mm		6.0	8.0	5.0	10.0	10.0	2.5	2.0	5.0	5.0

Time of Concentration[6]

Total Length	36	m	
Average Slope	4.2	%	
Airport	**11.6**	min.	
Bransby - Williams	2.1	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Applicable Minimum[7]	10.0	min.	
Time to Peak	7.7	min.	
	0.13	**hr.**	

Composite Parameters

Drainage Area	0.05 ha	
Runoff Coefficient	0.15	
SCS Curve No.	68.8	68.8
Modified Curve No.[4], CN*	**70.5**	70.5
Initial Abstraction.	**5.0**	5.0

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.
2. Runoff coefficient obtained from M.T.O. Design Chart 1.07, M.T.O. Drainage Management Manual, 1997, Hydrologic Analysis and Design, McCuen 2004 and New Jersey Technical Manual for Stream Encroachment, 1984.
3. SCS Curve No. obtained from M.T.O. Design Chart 1.09, M.T.O. Drainage Management Manual, 1997, and Table 2-2a, TR-55, page 2-5.
4. The modified curve number is adjusted as per Paul Wisner & Associates (1982) and represents anticedent moisture conditions Type II
5. Initial Abstraction values taken from the Environmental and Engineering Services Department, The Corporation of the City of London, Dec 2005
6. Use Airport Equation to calculate time of concentration for C <= 0.4, and Bransby-Williams for C > 0.4.
7. Minimum Time of Concentration for use in the Rational Method and Hydrologic Model has been set to 10 minutes
8. All impervious areas have been assumed to be directly connected.

Appendix B

Hydrogeological Report

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Hydrogeological Report

Bridgenorth Townhouse Development

949 Eighth Line, Township of Selwyn, Ontario

D.M. Wills Project Number 22-85260

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

November 2023

Prepared for:
Jeff Chesher

Submissions Summary

Submission No.	Submission Title	Date of Release	Submissions Summary
1	Draft Hydrogeological Study Report	June 29, 2023	Draft Submission for Client Review
2	Final Hydrogeological Study Report	July 6, 2023	Final Submission to Client
3	Revised Hydrogeological Study Report	November 29, 2023	Final Submission to Client

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

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Appendix G – Sewage System Calculations Sheet
Appendix H – Pumping Test Hydrographs
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Appendix J – Groundwater Impact Assessment

1.0 Introduction

D.M. Wills Associates Limited (Wills) was retained by Jeff Chesher (Client) to conduct a Hydrogeological Study (Study) for the property located at 949 Eighth Line Township of Selwyn, Ontario (Subject Property). The Study was completed in support of a Zoning By-law Amendment (ZBA) for the proposed Bridgenorth Townhouse Development (Proposed Development) on the Subject Property. The Proposed Development includes two three-unit townhouse buildings that are individually serviced with a water supply well and sewage disposal system.

Wills' Study is required to confirm adequate groundwater supply and quality, sewage servicing capabilities, and to assess the infiltration rates of the subsurface soils as input to proposed Low Impact Development (LID) design on the Subject Property.

The Subject Property is generally rectangular in shape and approximately 1 hectare (ha). The existing conditions on the Subject Property include the following:

- One residential dwelling and detached garage on the northeast corner. The majority of the Subject Property is currently undeveloped.
- The Subject Property is currently serviced with one water supply well and one sewage disposal system located in proximity to the existing dwelling. A Ministry of Environment, Conservation and Parks (MECP) Well Record is not available for the existing water supply well.
- Following completion of the Proposed Development, the existing dwelling, water supply well, and sewage system will remain on the Subject Property.

The Subject Property is bound to the east and west by residential properties, to the south by a commercial property, and to the north by Eighth Line Smith. Residential and commercial properties in proximity to the Subject Property along Eighth Line Smith are privately serviced for water supply and sewage disposal. A Regional Location Plan is included as **Figure 1.**

The anticipated water taking needs for the existing dwelling and the Proposed Development (Post-Development Subject Property) have been calculated to be approximately 6,000 litres per day (L/day).

2.0 Scope of Work

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

- A review of background information provided by the Client and readily available information accessed through public databases, including MECP Well Records within 500 metres (m) of the Subject Property.
- Prior to initiating field investigations, public and private utility services locates were obtained and reviewed by Wills staff. Additionally, a Site-Specific Health

and Safety Plan, Traffic Protection Plan, and Field Work Plan were prepared to ensure a safe and efficient fieldwork program.

- Steenburgh Sand and Gravel excavated four test pits under the direct supervision of Wills Staff to a depth of 3.0 metres below ground (mbg) on the Subject Property on April 28, 2022.
- Canadian Environmental Drilling and Contractors Inc. advanced three boreholes to a depth of 6.0 mbg on May 3, 2022. Each borehole was completed as a monitor well to facilitate static groundwater level measurements and sampling activities.
- Soils samples retained from the boreholes and test pits were reviewed by Wills prior to submitting select samples to WSP Canada (WSP), a Canadian Certified Independent Laboratory (CCIL) for Particle Size Distribution and percolation time estimations.
- Three infiltration testing locations were selected to determine representative infiltration rates for LID design. Due to the high groundwater table (0.15 mbg and less than 1.0 mbg respectively) at two of the locations, infiltration testing was only feasible at one location, as discussed in **Section 4.0**.
- One single ring infiltrometer was installed on April 28, 2022, to determine representative infiltration rates for LID design on the Subject Property. Water levels within the infiltrometer were monitored manually using a Solinst Water Level Meter. A second infiltration test performed using a Guelph Permeameter at this same location on January 31, 2023, to confirm the initial infiltration testing results.
- Two additional infiltration tests were performed using a Guelph Permeameter in the locations of the proposed sewage systems on November 9, 2023:
    - The additional infiltration tests were conducted to address peer review comments provided by Engage Engineering in their letter dated August 21, 2023, regarding inputs to the sewage system calculation sheets.
    - Soil samples were collected from the testing depths at each location and submitted to PRI Engineering (PRI) CCIL, for Particle Size Distribution and percolation time estimations.
    - Depth to groundwater within the footprint of the proposed northern sewage system was recorded; however, subsurface conditions hindered the advanced of the hand auger to groundwater depth within the footprint of the southern sewage system.
    - Shallow groundwater conditions prevented representative in-situ results from being obtained at both testing locations.
- Joe Legge & Sons installed two Ontario Regulation (O. Reg.) 903 water supply wells on the Subject Property to service the Proposed Development. The new wells will be referred to herein as Well 1 (A358381) and Well 2 (A358382).
- Two six-hour pumping tests were conducted – one on Well 1 and one on Well 2, to determine production yield, maximum pumping rate, well recovery, groundwater quality, and the potential for interference with neighbouring groundwater taking activities.

- Two groundwater samples were collected from the pumping well during each pumping test (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).
- During each pumping test, real-time data logging technology (Solinst Level Loggers) was employed to record the drawdown and groundwater level fluctuations in the pumping well, as well as the response to pumping in two Observation Wells (discussed in **Section 5.2**).
- An evaluation of pumping test data was completed with respect to the availability and quality of groundwater on the Subject Property in context of the anticipated water taking needs of the Proposed Development.
- Evaluation of Wills' desktop review and field investigation findings, and preparation of this Hydrogeological Study Report.

3.0 Subsurface Investigation

Borehole/monitor well, test pit, and infiltration test locations are shown on **Figure 2.**

Test pit and borehole logs detailing the encountered subsurface conditions and monitor well construction details are included in **Appendix A – Borehole and Test Pit Logs**.

Analytical results from the representative soil samples submitted to WSP 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 and Table 3 values (Ontario Building Code [OBC], 2012) (OBC Table 2/3). Percolation times are discussed in **Section 4.1**.

3.1 Soil Profile Summary

The Subject Property is situated within the Physiographic Region of the Peterborough Drumlin Field (Chapman and Putnam, 1984) which generally consists of undulating till plains punctuated with predominantly northeast trending drumlin features. Based on Ontario Geological Survey (OGS) mapping, the majority of the Subject Property lies along the flank of a drumlin feature, with the remainder being occupied by drumlinized till plains**.**

OGS surficial geology mapping suggests the Subject Property includes stone-poor, sandy silt to silty sand till on Paleozoic terrain. The underlying bedrock geology consisting of Middle Ordovician-aged limestone bedrock. MECP Well Records for properties adjacent to the Subject Property indicate that the underlying bedrock was encountered at depths ranging from approximately 3.4 to 28.3 mbg. OGS mapping is included in **Appendix B – Ontario Geological Survey Mapping**.

The results of the drilling and test pit program indicate the overburden is generally aligned with the published mapping, and generally includes a surficial layer of silty sand topsoil that is variably underlain by silty sand to silt material with varying amounts of

sand. Based on the MECP Well Records for Well 1 and Well 2, a stratigraphically lower, coarse grained gravel material was encountered at approximately 19.0 mbg to well termination depths of approximately 20.2 mbg.

The following observations are made regarding the subsurface profile at the Subject Property:

- Based on Standard Penetration Test (SPT) N values between 3 to 21 blows per 305 millimetres (mm) of penetration, the shallow silty sand material has a very loose to compact relative compactness.
- Silt and sand were encountered beneath the silty sand material in all borehole and test pit locations to a maximum depth of 6.10 mbg. This material was described as moist to saturated. SPT N values ranged between 8 to greater than 50 blows per 305 mm of penetration, indicating a loose to very dense relative compactness.
- Silt material was encountered at most of the borehole and test pit locations, extending to a maximum depth of 5.05 mbg. Based on SPT N values between 23 to 66 blows per 305 mm of penetration, the silt material has a compact to very dense relative compactness.
- Significant variations in gravel content were noted throughout the investigation areas with high gravel content noted in TP22-01 at 3.0 mbg.
- Shallow groundwater was encountered between 0.4 mbg and 0.5 mbg in all four test pits prior to backfilling.
- Groundwater was observed in open boreholes between 0.9 mbg (MW22-02) to 6.05 mbg (MW22-03) prior to backfilling.

Six laboratory particle size distribution analyses were completed on the collected soil samples. The results are summarized in **Table 1**, based on the Unified Soil Classification System (USCS). Certificates of Analysis for the physical soil testing results are included in **Appendix C – Certificates of Analysis – Physical Soil Testing**.

Table 1 – Summary of Particle Size Distribution

Location ID	Sample Depth (mbg)	Soil Unit	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH22-02 SS3	1.50	Silt and Sand	15	40	33	12
BH22-03 SS2	0.75	Silt and Sand	10	40	35	15
TP22-01 GS3	3.0	Sand & Gravel	30	30	29	11
TP22-03 GS4	2.5	Silt	0	20	67	13
HA23-01	0.2	Silty Sand	2	70	25	3
HA23-02	0.4	Silt and Sand	1	42	44	13

3.2 Groundwater

Three monitor wells were installed on the Subject Property to facilitate groundwater level monitoring and sampling. Well construction details and ground surface elevations are shown on the borehole logs included in **Appendix A. Table 2** summarizes the static groundwater levels measured during the Study.

Table 2 – Monitor Well Construction and Groundwater Level Summary

Monitor Well ID	Screened Material	Stick-Up (mag)	Measurement Date	Groundwater Level (mbg)	Groundwater Elevation (masl)
MW22-01	Silt and Sand	0.89	January 31, 2023	0.25	265.29
			May 9, 2023	0.13	265.41
			November 9, 2023	0.92	264.62
MW22-02	Silt	0.92	January 31, 2023	0.47	263.88
			May 9, 2023	0.43	263.91
			November 9, 2023	1.14	263.20
MW22-03	Silt and Sand	1.12	January 31, 2023	0.83	263.49
			May 9, 2023	0.63	263.69
			November 9, 2023	2.40	261.91

*mag – metres above ground *mbg – metres below ground

3.2.1 Groundwater Flow

Shallow groundwater flow direction was calculated using static water levels collected in 2023. Monitor well top of pipe and ground elevations were measured using a Sokkia GPS unit in May 2023.

The hydraulic gradient between the three monitor wells including magnitude and direction, were calculated using the United States Environmental Protection Agency (EPA) *On-Line Tools for Site Assessment Calculation – Hydraulic Gradient – Magnitude and Direction*. The inputs and outputs of the EPA's model are summarized in **Table 3**.

Table 3 – Subject Property Hydraulic Gradient

Monitor Wells	Date	Hydraulic Gradient	Direction	Azimuth	Coefficient of Determination (R^2)
MW21-01 MW21-02 MW2103	January 31, 2023	0.0268	North-northeast	20.6	1.00
MW21-01 MW21-02 MW2103	May 9, 2023	0.0282	North-northeast	19.3	1.00

Wills' 2023 groundwater flow calculations suggest a north-northeast flow direction. It should be noted that the desired triangular orientation of the monitor wells was not feasible during drilling activities due to challenging site conditions. Very soft ground conditions and standing surface water limited the drilling contractor's ability to safely stabilize the track-mounted drill rig in the original proposed locations. Monitor wells were

sited in a more linear fashion, which may have contributed to the hydraulic gradient bias slightly to the north-northeast, as opposed to distinctly north or northwest, towards Chemong Lake. For the purposes of the Groundwater Impact Assessment, groundwater flow is assumed to flow north through the Subject Property.

4.0 In-Situ Infiltration Testing

Three infiltration test (INF-1 to INF-3) locations were selected on the Subject Property to confirm the infiltration rates of the shallow subsurface soils as input to LID design. Based on very shallow groundwater conditions encountered on April 28, 2022, in-situ infiltration testing was not feasible at locations INF-1 and INF-2.

One infiltration test (INF-3) was conducted at a depth of 1.5 mbg using a 51-millimetre open-end single ring infiltrometer on April 28, 2022. Water levels within the infiltrometer casings were manually monitored using a Solinst water level tape. No infiltration was observed at INF-3 following 45 minutes of monitoring.

The infiltration rate of soils proximal to INF-3 were re-tested on January 31, 2023, using a Guelph Permeameter (INF-3b). The testing was conducted at 0.55 mbg within the silt and sand material. The infiltration rate during this second test was calculated to be 12.1 min/cm (49.6 mm/hr).

Two additional infiltration tests were performed on November 9, 2023, in the locations of the proposed sewage systems (INF-4 and INF-5).

Infiltration test locations are shown on **Figure 2**. Detailed calculations and supporting infiltration graphs are provided in **Appendix D – Infiltration Graphs.**

4.1 Permeability and Percolation Time

Table 4 summarizes the permeability and percolation times of the tested soils based on the in-situ testing, and laboratory results compared to OBC Table 2 & Table 3.

Table 4 – Permeability and Percolation Time Summary

ID	Soil Description	Physical Soil Testing Results	Percolation Range	Laboratory Estimated Percolation (T)	Permeability	In-situ Testing
INF-4	Silty Sand	SM envelope	T = 8 – 20 min/cm or 30 – 75 mm/hr	T = 16 min/cm	Medium to low	Shallow groundwater conditions prevented infiltration testing.
INF-5	Silt and Sand	ML envelope	T = 20 – 50 min/cm or 12 – 30 mm/hr	T = 30 min/cm	Medium to low	236 min/cm 2.56 mm/hr Shallow groundwater/groundwater mounding anticipated to have affected in-situ results
INF-3	Silt and Sand	SM envelope	T = 8 – 20 min/cm or 30 – 75 mm/hr	T = 35 min/cm 17 mm/hr	Medium to low	Water level rising after 45 minutes of testing – test abandoned.
		ML envelope	T = 20 – 50 min/cm or 12 – 30 mm/hr		Medium to low	
INF-3b	Silt and Sand	SM envelope	T = 8 – 20 min/cm or 30 – 75 mm/hr	T = 35 min/cm 17 mm/hr	Medium to low	12.1 min/cm 49.62 mm/hr
		ML envelope	T = 20 – 50 min/cm or 12 – 30 mm/hr		Medium to low	
INF-2	Silt and Sand	SM envelope	T = 8 – 20 min/cm or 30 – 75 mm/hr	T = 25 min/cm 24 mm/hr	Medium to Low	Groundwater present in open borehole – test not completed.
		ML envelope	T = 20 – 50 min/cm or 12 – 30 mm/hr		Medium to low	

ID	Soil Description	Physical Soil Testing Results	Percolation Range	Laboratory Estimated Percolation (T)	Permeability	In-situ Testing
INF-1	Silt	SM envelope	T = 8 – 20 min/cm or 30 – 75 mm/hr	T = 35 min/cm 17 mm/hr	Medium to low	Groundwater present in open borehole – test not completed.
		ML envelope	T = 20 – 50 min/cm or 12 – 30 mm/hr		Medium to low	
TP22-01	Silty Sand and Gravel	SM envelope	T = 8 – 20 min/cm or 30 – 75 mm/hr	T = 25 min/cm 24 mm/hr	Medium to low	N/A
		ML envelope	T = 20 – 50 min/cm or 12 – 30 mm/hr		Medium to low	

Notes: 1. SM envelope –silty sands, sand-silt mixtures
ML envelope – Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, clayey silts with slight plasticity
N/A – Scope did not include infiltration testing at this location.

The following considerations for the proposed LID feature design are provided:

- The encountered soils are anticipated to generally fall within the SM and ML soils envelopes. LID feature design should consider the abundance of silt material identified throughout the Subject Property, encountered between approximately 0.4 to 3.0 mbg.
- LID design should consider the shallow groundwater conditions encountered across the Subject Property. Shallow groundwater was observed in the monitor wells between 0.13 mbg to 0.83 mbg.
- For the purpose of LID design, Wills recommends using the upper end of T-time range for the ML envelope, 50 min/cm or 12 mm/hr. Although this T-time value is slower than that measured during the in-situ infiltration test at INF-3b, this value is considered conservative and should account for any lateral or vertical variation in infiltration rates.

5.0 Groundwater Availability

5.1 MECP Water Well Record Survey and Review

A desktop review of MECP Well Records was conducted to provide a preliminary characterization of the local hydrogeological conditions within 500 m of the Subject Property. The MECP Well Location Plan showing the relative locations and MECP well identifiers of local wells is included as **APP-E1** in **Appendix E – MECP Well Record Search**.

The MECP Well Record search identified 133 wells within 500 m of the Subject Property - 42 installed in bedrock and 91 installed in overburden material. Of the 133 wells identified, 127 were designated for domestic use, three were abandoned, two were public use, and one was commercial use.

Of the 42 wells installed in bedrock, well depths ranged from approximately 7.6 mbg to 48.8 mbg (22.8 mbg average) and static water levels ranged from approximately ground surface to 12.8 mbg (3.7 mbg average). The recommended pumping rates ranged from approximately 2.3 litres per minute (L/min) to 89.3 L/min (26.9 L/min average).

Of the 91 wells installed in overburden material, well depths ranged from approximately 3.7 mbg to 24.4 mbg (14.8 mbg average) and static water levels ranged from approximately ground surface to 10.7 mbg (2.8 mbg average). The recommended pumping rates ranged from approximately 3.8 L/min to 94.5 L/min (31.2 L/min average). As static groundwater levels are comparable between the overburden and bedrock wells, it is plausible a hydrogeological connection exists between the overburden and bedrock aquifers.

Pertinent information including MECP Well ID, well depth, depth to encountered groundwater, static groundwater level, recommended pumping rate, depth to bedrock, and general comments on water quality were summarized and included as **APP-E2** in **Appendix E**.

5.2 Pumping Test

A 6-hour pumping test was conducted on Well 1 on May 10, 2023, and a second 6-hour pumping test was conducted on Well 2 on May 11, 2023. The MECP Well Records for Well 1 and Well 2 are included in **Appendix F – MECP Well Records – Pumping Tests**. The locations and identifications of the wells used for this assessment are shown on **Figure 2**.

The pumping tests were conducted to confirm the performance of the wells over sustained pumping activity and to enable the collection of groundwater samples for quality analysis. The pumping tests were conducted at a constant rate of 19 L/min. The 19 L/min pumping rate is in surplus of that required for the Proposed Development, which was calculated to be approximately 4.3 L/min if pumped constantly over 24 hours (6,000 L/day total). The anticipated water taking needs are considered equivalent to the proposed flows to the sewage systems and are outlined on the Sewage System Calculations Sheet included in **Appendix G – Sewage System Calculations Sheet**.

During each pumping test, Solinst Level Loggers were installed in the Observation Well and the Pumping Well to record the drawdown and groundwater level fluctuations resulting from the pumping test. Confirmatory manual measurements of the groundwater levels in the wells were obtained using a Solinst water level tape.

Well details, including static water levels measured prior to the initiation of each pumping test, are summarized in **Table 5** and **Table 6**.

Table 5 – Well 1 Pumping Test Details

			Date:	**May 10, 2023**
Well ID	**Well Depth (mbtop)**	**Well Depth (mbg)**	**Stick Up (mag)**	**Static Water Level (mbg)**
Pumping Well				
Well 1 (A358381)	20.15	19.30	0.85	0.86
Observation Well				
Well 2 (A358382)	20.15	19.34	0.81	1.55

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

Table 6 – Well 2 Pumping Test Details

			Date:	May 11, 2023
Well ID	**Well Depth (mbtop)**	**Well Depth (mbg)**	**Stick up**	**Static Water Level (mbg)**
Pumping Well				
Well 2 (A358382)	20.15	19.34	0.81 mag	1.69
Observation Well				
Well 1 (A358381)	20.15	19.34	0.85 mag	0.89

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

Hydrographs for the Pumping Well and Observation Well for each pumping test are included in **Appendix H – Pumping Test Hyrdographs.** Pumping test details are summarized in **Table 7** and **Table 8** below.

Table 7 – Pumping Test Summary Well 1 (A358381)

	Pumping Rate (L/min)	**Time (minutes)**	**Max. Drawdown (m)**	**Stabilization Depth (mbg)**	**Volume Pumped (L)**
Constant Rate	19	360	6.04	+/- 7.00	6,840
Recovery Time			**% Recovery**		
120 minutes			90%		

Table 8 – Pumping Test Summary Well 2 (A358382)

	Pumping Rate (L/min)	**Time (minutes)**	**Max. Drawdown (m)**	**Stabilization Depth (mbg)**	**Volume Pumped (L)**
Constant Rate	19	360	3.65	+/- 6.00	6,840
Recovery Time			**% Recovery**		
145 minutes			90%		

The following observations are provided for the results of the pumping tests:

- Observation Well - Well 2 showed a relatively minor response to pumping activities during the Well 1 pumping test, dropping approximately 2.45 m over the duration of the test. There was approximately 18 m of available drawdown (88%) remaining in Well 2 following the 6-hour pumping test on Well 1 at 19 L/min.

- Observation Well – Well 1 showed a relatively minor response to pumping activities during the Well 2 pumping test, dropping approximately 2.58 m. There was 17.50 m of available drawdown (87%) in Well 1 remaining following the 6-hour pumping test on Well 2 at 19 L/min.
- The pumping test results indicate a hydrogeological connection between Well 1 and Well 2; however, this connection is not anticipated to have a negative impact to either well's ability to support the Proposed Development.
    - Interference between each well is considered minor in view of the available drawdown, and the actual water taking rates are expected to be significantly lower than those utilized during the pumping tests.
    - Both pumping tests resulted in total water takings that exceeded the anticipated daily use of water for the Proposed Development.

The pumping test results indicate that both Well 1 and Well 2 can provide a constant water supply at 19 L/min for at least six hours, with reasonable recovery. Furthermore, 31% (Well 1) and 20% (Well 2) of the available drawdown was used in the pumping well during each 6-hour test. This result suggests both wells can perform at a higher pumping rate than that employed during the tests, and greatly exceed the water taking needs of the Proposed Development, as discussed in **Section 5.2.2**.

5.2.1 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 I – Certificates of Analysis – Pumping Tests Groundwater**.

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

Well 1 Pumping Test

- Turbidity, hardness, aluminum, and iron in both the 1-hour and the 6-hour samples
- Manganese in the 1-hour sample
- Total coliform in the 6-hour sample

Further to the laboratory results, it was observed that groundwater discharging from the well was cloudy during the 1-hour sample collection. As the pumping test progressed, the groundwater became increasingly clear, indicating that the elevated concentrations of fines were likely present due to the well installation process and were being flushed from the well. However, turbidity levels were still elevated above the ODWQS in the 6-hour sample and should be considered when designing any proposed water treatment system(s).

The total coliform result in the 6-hour sample may have been unintentionally introduced into the well during construction, or on the sample jar/equipment during sampling activities. This exceedance may not be representative of the aquifer conditions, as this was the only sample (four total collected) where this parameter was identified.

Well 2 Pumping Test

- Turbidity, hardness, and iron in both the 1-hour and the 6-hour samples

The water treatment system(s) for the Proposed Development should consider the exceedances noted above. Commercial filtration and disinfection methods may be used to effectively remove and inactivate any harmful protozoa, bacteria or viruses, and commercial water softening may be used to treat elevated levels of hardness.

5.2.2 Anticipated Water Taking Needs

Anticipated water taking needs for the Proposed Development were estimated based on the Sewage System Calculation Sheet provided by the Client, included in **Appendix G**. The estimated total sewage flows (equivalent to the water taking needs) for the Post-Development Subject Property is estimated to be 6,000 L/day.

During each of the 6-hour duration pumping test, the total water taking was 6,840 L. During the Well 1 pumping test, 31% of the available drawdown was used. During the Well 2 pumping test, 20% of the available drawdown was used. These results suggest that both wells are more than capable of supporting the Proposed Development.

Wills does not expect groundwater availability to be a limiting factor for the Proposed Development, and off-site impact resulting from the proposed water taking activities are not anticipated in view of the observed aquifer conditions.

6.0 Groundwater Impact Assessment

In view of the anticipated flows greater than 4,500 L/day, a procedure derived from the Ontario Water Resources Act (OWRA), 1994, *Guideline B-7, Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities* and *Procedure B-7-1, Determination of Contaminant Limits and Attenuation Zones* (*Reasonable Use Guideline*) was used to confirm that the projected post-development groundwater nitrate concentration meets the reasonable use criteria at the down gradient property boundary. The procedure is referenced in *Section 22.5 – Assessment of Impact on Water Resources* of the Ministry of Environment (MOE, now MECP), guidance document titled Design Guidelines for Sewage Works 2008 (*MOE Design Guidelines)*.

It is generally assumed that the reasonable use of any groundwater is drinking water, therefore the ODWQS was used for this Groundwater impact Assessment (Impact Assessment).

6.1 Groundwater Impact Assessment Guidelines

The Impact Assessment procedure provided in the *MOE Design Guidelines* incorporates concepts presented in the *Reasonable Use Guideline* and is designed to protect groundwater quality in consideration of the current and potential down gradient land uses.

In the case where sewage effluent discharges to groundwater, the critical contaminant is typically nitrate. It should be assumed that all nitrite and ammonia will convert to nitrate and concentrations should be evaluated as "Nitrogen" i.e., nitrate-N.

For this Impact Assessment, groundwater was assumed to flow north on the Subject Property, towards Chemong Lake.

The Maximum Acceptable Concentration (MAC) of nitrate-N at the down gradient property boundary, based on the *MOE Design Guidelines* procedure, is 2.5 milligrams per litre (mg/L). Detailed MAC calculations are included in **Appendix J – Groundwater Impact Assessment**.

6.2 Impact Assessment - Proposed Development

While most critical contaminants in domestic sewage effluent are typically removed within a short travel distance within soil, mobile constituents such as nitrates will require sustained dilution to meet the calculated MAC at the down gradient property boundary.

The dilution model for this Impact Assessment is premised on the contaminant attenuation equation provided in *Section 22.5.8 – Prediction of Contaminant Attenuation* in the *MOE Design Guidelines*. The model assumes that the source of groundwater recharge, which can be anticipated to attenuate (dilute) the sewage effluent, is limited to the infiltration of precipitation over the contaminant plume area.

The *MOE Design Guidelines* recommends using a constant quantity of dilution (250 millimetres [mm]) of precipitation infiltration per year over the contaminant plume area) as a surrogate for all attenuative mechanisms and in consideration of all soil textures.

The following inputs were used in the dilution model equation:

- The Contaminant Attenuation Zone (CAZ) dilution area (A_D) was estimated to be 8,995 m^2.
- The annual sewage volume (V_s) was calculated as a product of the anticipated sewage flows for the Proposed Development (6,000 L/day) over a 365-day period, equal to 2,190 m^3.

Wills concludes that sewage effluent containing 5.1 mg/L nitrate-N would result in an acceptable level of nitrate-N at the down gradient property boundary, and would not degrade shallow groundwater quality beyond the *MOE Design Guidelines* requirements at down gradient properties.

A figure showing the anticipated dilution area (CAZ) is included as **Figure 3**. The detailed calculations for the Impact Assessment are included in **Appendix J**.

7.0 Conclusions and Recommendations

The Study was requested to confirm adequate water supply and water quality, sewage servicing capabilities, and to assess the infiltration capacity of subsurface soils as input to the proposed LID design features on the Subject Property. The following conclusions with respect to the Study are provided:

- Shallow subsurface soils were generally consistent across the Subject Property and included a thin layer of silty sand topsoil underlain by silty sand to silt material with varying amounts of gravel and clay. The encountered soils are anticipated to generally fall within the SM and ML soils envelopes.
- Groundwater seepage was encountered in all open test pits at depths ranging from 0.40 mbg to 0.50 mbg.
- Groundwater was observed in open boreholes between 0.9 mbg (MW22-02) and 6.05 mbg (MW22-03).
- Static groundwater levels in the three monitor wells ranged from 0.13 mbg to 0.83 mbg. Static groundwater levels were measured during both winter and spring conditions.
- Shallow groundwater conditions on the Subject Property permitted infiltration testing at only one location (INF-3). Infiltration was not observed at INF-3, and water levels within the infiltrometer were observed to rise slightly over the 45-minute duration test.
    - This result suggests that the test may have been conducted within the saturated zone at a depth of 1.55 mbg.
- On January 31, 2023, INF-3b was conducted at a testing depth of 0.55 mbg within the silt and sand material. The infiltration rate during this second test was calculated to be 12.1 min/cm (49.62 mm/hr).
- LID feature design should consider the silt-rich soils identified across the Subject Property, from approximately 0.4 to 3.0 mbg. Additionally, LID design should consider the shallow groundwater conditions observed.
- For the purpose of LID design, Wills recommends using the high end of the T-time range provided in the OBC for the ML soil envelope, 50 min/cm or 12 mm/hr.
    - Although this T-time value is slower than that measured during the in-situ test at INF-3b, this value is considered conservative, and should account for any lateral or vertical variation in infiltration rates, particularly those impacted by the silty soils with varying amounts of clay.
- 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.
- The pumping test results indicate that both Well 1 and Well 2 can provide a constant water supply at 19 L/min for at least six hours, with relatively rapid

recovery. Furthermore, 31% (Well 1) and 20% (Well 2) of the available drawdown in the Pumping Wells was utilized during each 6-hour test.

  - This result suggests both wells can likely perform at higher pumping rates than that employed during the tests, and greatly exceed the water taking needs of the Post-Development Subject Property.

- Significant interference with neighbouring water taking activities, including the existing dwelling, are not anticipated based on the pumping test results.
- Wills provides the following input to sewage system design:
  - Laboratory testing results indicate that soils within the footprint of the proposed sewage systems are comprised primarily of sand with varying degrees of silt, gravel, and clay content.
  - In-situ infiltration testing indicated a t-time of approximately 236 min/cm (2.56 mm/hr) in the vicinity of the southern proposed sewage systems (INF-05). This in-situ result is expected to have been impacted by shallow groundwater conditions/groundwater mounding. Laboratory t-time estimates ranged from 16-30 min/cm.
  - Sewage system design should consider the high groundwater table, and soil composition encountered within the footprints of the proposed sewage systems.
  - Wills recommends using the laboratory T-time estimate of 30 min/cm for the design of both sewage systems. This value is considered appropriate based on Wills field observations and textural classification of the encountered shallow soils.
- The Impact Assessment concluded that the Subject Property could support the Proposed Development if sewage effluent contains at a maximum 5.1 mg/L nitrate-N from each sewage disposal system. This nitrate concentration would result in an acceptable level of nitrate-N at the down gradient property boundary and would not degrade downgradient shallow groundwater quality beyond the *MOE Design Guidelines*.

We trust that the information contained in and attached to this report meets your needs at this time. The Statement of Limitations found below 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: _____

Lynsey Tuters, B.A., C.Tech.
Environmental Project Technologist

Reviewed by: _____

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

LT/IA/jh

Statement of Limitations

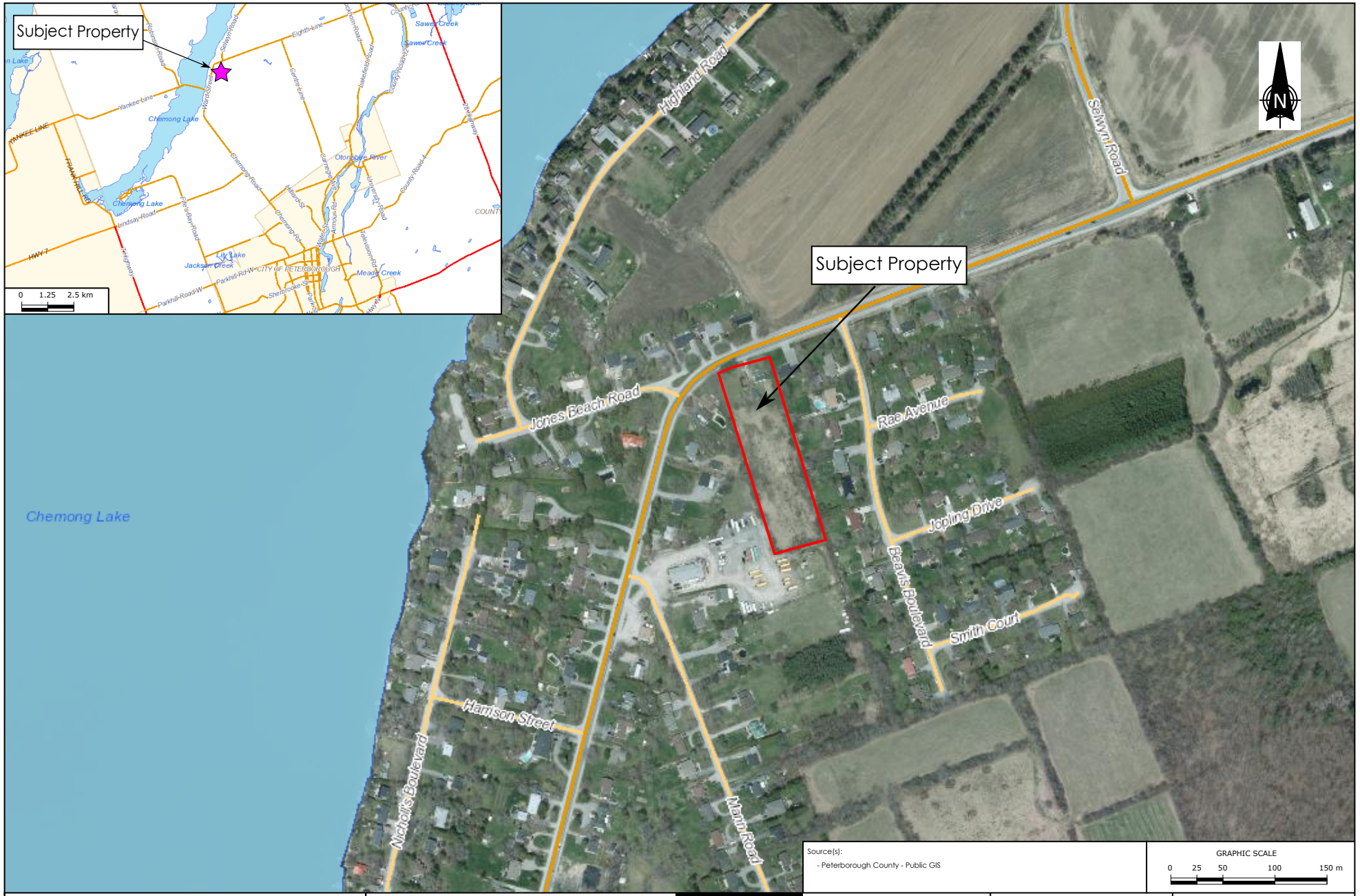
This report is intended solely for Jeff Chesher (Client) for the Proposed Development located at 949 Eighth Line, Township of Selwyn Ontario, and is prohibited for use by others without D.M. Wills Associates Limited's (Wills) prior written consent. This report is considered Wills' professional work product 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 Limits

Regional Location Plan

Hydrogeological Study
949 Eighth Line,Bridgenorth, Township of Selwyn, Ontario

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: C. OSTIC	Scale: 1:5 000 on 8.5"x11" (US Letter)
Checked: L. TUTERS	Date: May 18, 2023
Project No.: 85260	Drawing file No.: Figure 1

Source(s):
- Peterborough County - Public GIS

GRAPHIC SCALE
0 6.25 12.5 25 37.5 m

Legend

- Subject Property
- Monitor Well (MW)
- Test Pit (TP)
- Hand Auger Hole
- Infiltration Test
- Water Supply Well

Subsurface Investigation Plan

Hydrogeological Study
949 Eighth Line, Lakefield Township of Selwyn, Ontario

WILLS

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
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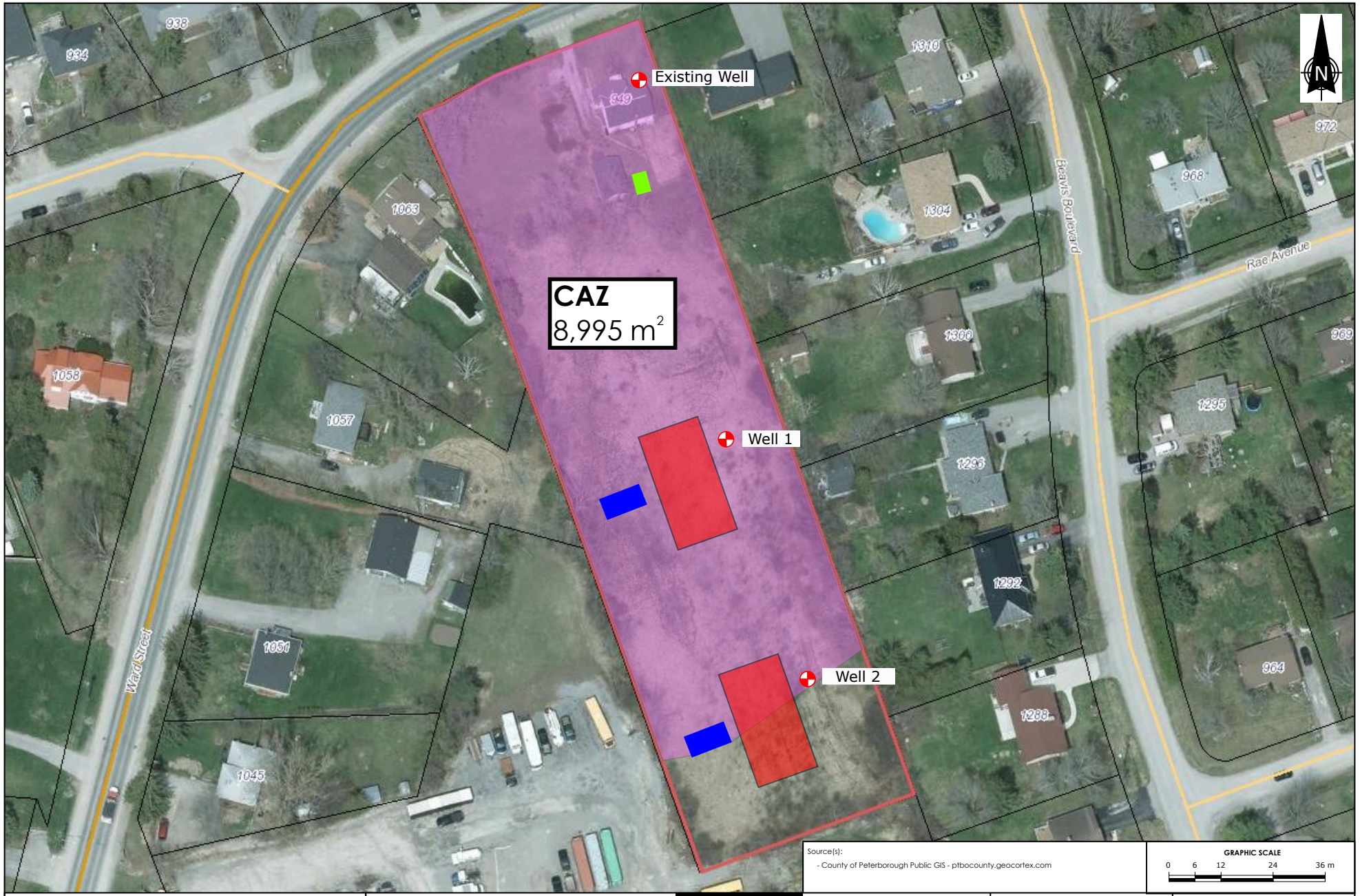
Drawn by: C. OSTIC	Scale: 1:1 250 on 8.5"x11" (US Letter)
Checked: L. TUTERS	Date: May 18, 2023
Project No.: 85260	Drawing file No.: Figure 2



Source(s):
- County of Peterborough Public GIS - ptbocounty.geocortex.com

GRAPHIC SCALE
0 6 12 24 36 m

Legend

- Subject Property
- Proposed Townhouse Buildng
- Contaminant Attenuation Zone (CAZ)
- Proposed Sewage Disposal System
- Existing Sewage Disposal System
- Water Supply Well

Contaminant Attenuation

949 Eighth Line, Lakefield, Ontario

WILLS

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

P. 705.742.2297
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E. wills@dmwills.com

Drawn by: L. Tuters	Scale: 1:1,200 on 8.5"x11" (US Letter)
Checked: I. Ames	Date: May 23, 2023
Project No.: 85260	Drawing file No.: Figure 3

Appendix A

Borehole and Test Pit Logs

WELL NUMBER MW22-01

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

CLIENT Jeff Chesher
PROJECT NAME 949 8th Line, Township of Selwyn
PROJECT NUMBER 22-85260
PROJECT LOCATION Bridgenorth, Ontario
DATE STARTED 5/3/22 **COMPLETED** 5/3/22
UTM ZONE 17T **EASTING** 4919136.994 **NORTHING** 708822.238
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc. **GROUND ELEVATION** 265.536 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING 2.60 m / Elev 262.94 m
NOTES BH22-01
AFTER DRILLING 0.24 m / Elev 265.30 m Date:5/03/22

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
						Casing Top Elev: 0.89 (mag) Casing Type: Monument
	SS-1	67	0-1-2-4 (3)		0.20 TOPSOIL: Dark brown silty sand topsoil, trace clay, organics, moist, very loose 265.34	Cement seal at surface
					SILTY SAND: Light brown silty sand, some gravel, some clay, occasional cobble, orange-brown mottling, moist to wet, loose	
1	SS-2	70	36-12-9-7 (21)		-compact	Bentonite seal from surface to 1.20 mbg
	SS-3	93	8-10-6 (16)		-wet	
2	SS-4	100	5-6-12 (18)			
3					3.05 262.49	Quartz sand from 1.20 to 4.55 mbg. Point 10 slotted screen from 1.52 to 4.55 mbg.
	SS-5	83	5-8-15 (23)		SILT AND SAND: Grey silt and sand, some clay, trace gravel, wet to saturated, compact	
4						
	SS-6	93	6-16-23 (39)		-dense	
5					5.05 260.49	

Borehole terminated at 5.05 mbg in silt and sand material.
Borehole open with groundwater at 2.60 mbg following completion of drilling.

BH LOGS WITH TERMINATION NOTES 85260_BH LOGS_LT.GPJ WILL BH LOGS WITH NVALUE.GDT 5/16/23

WELL NUMBER MW22-02

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

CLIENT Jeff Chesher
PROJECT NAME 949 8th Line, Township of Selwyn
PROJECT NUMBER 22-85260
PROJECT LOCATION Bridgenorth, Ontario
DATE STARTED 5/3/22 **COMPLETED** 5/3/22
UTM ZONE 17T **EASTING** 4919202.444 **NORTHING** 708797.668
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc. **GROUND ELEVATION** 264.344 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING 0.90 m / Elev 263.44 m
NOTES BH22-02
AFTER DRILLING 0.72 m / Elev 263.62 m Date:5/03/22

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
							Casing Top Elev: 0.92 (mag) Casing Type: Monument
	SS-1	52	1-2-1-2 (3)			0.25 TOPSOIL: Dark brown silty sand topsoil, trace clay, organics, moist, very loose 264.09 0.30 SILTY SAND: Light brown silty sand, trace clay, moist, very loose 264.04	Cement seal at surface
						SILT AND SAND: Light brown grey silt and sand, some gravel, some clay, orange-brown mottling, wet, loose	Bentonite seal from surface to 1.20 mbg
1	SS-2	54	3-4-4 (8)				
	SS-3	52	5-6-8 (14)	GSA SS3: Gravel: 15% Sand:40% Silt:33% Clay:12%		-compact	
2						2.30 262.04	
	SS-4	30	7-11-12 (23)			SILT: Light brown silt, some sand, some gravel, trace clay, saturated, compact	
3							Quartz sand from 1.20 to 4.55 mbg. Point 10 slotted screen from 1.52 to 4.55 mbg.
	SS-5	43	8-12-13 (25)			-some clay	
4							
	SS-6	133	30-28-38 (66)			-very dense	
5						5.05 259.29	

Borehole terminated at 5.05 mbg in silt material.
Borehole caved to 3.35 mbg with groundwater at 0.90 mbg following completion of drilling.

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

WELL NUMBER MW22-03

CLIENT Jeff Chesher
PROJECT NAME 949 8th Line, Township of Selwyn
PROJECT NUMBER 22-85260
PROJECT LOCATION Bridgenorth, Ontario
DATE STARTED 5/3/22 **COMPLETED** 5/3/22
UTM ZONE 17T **EASTING** 4919231.861 **NORTHING** 708761.006
DRILLING CONTRACTOR Canadian Environmental Drilling & Contractors Inc. **GROUND ELEVATION** 264.313 masl
DRILLING METHOD 6" Solid Stem Auger with Split Spoons
GROUNDWATER LEVELS:
LOGGED BY LT **CHECKED BY** IA
AT END OF DRILLING 6.05 m / Elev 258.26 m
NOTES BH22-03
AFTER DRILLING 5.55 m / Elev 258.76 m Date:5/03/22

DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	SS-1	59	1-2-2-1 (4)	GSA SS2: Gravel:10% Sand:40% Silt:35% Clay:15%		0.20 TOPSOIL: Dark brown silty sand topsoil, trace clay, organics, moist, loose (264.11)	Casing Top Elev: 1.12 (mag) Casing Type: Monument; Cement seal at surface
						0.40 SILTY SAND: Brown silty sand, trace gravel, trace clay, moist, loose (263.91)	
1	SS-2	56	4-4-3 (7)			SILT AND SAND: Light brown grey silt and sand, some gravel, some clay, moist to wet, loose	
	SS-3	85	4-6-4 (10)			-orange-brown mottling, wet, compact	Bentonite from surface to 2.75 mbg
2							
	SS-4	89	5-8-8 (16)				
3						-occasional cobble	
	SS-5	83	13-13-15 (28)			-grey	
4							
	SS-6	100	9-17-50/0.13			-very dense	Quart sand from 2.75 to 6.10 mbg; Point 10 slotted screen from 3.05 to 6.10 mbg
5							
6						6.10 (258.21) Borehole terminated at 6.10 mbg in silt and sand material. Borehole open with groundwater at 6.05 mbg following completion of drilling.	

BH LOGS WITH TERMINATION NOTES 85260_BH LOGS_LT.GPJ WILL BH LOGS WITH NVALUE.GDT 5/16/23

WILLS

Test Pit Log – TP22-01

Depth (mbg)	Soil Description
0.0 – 0.4	Dark brown silty sand topsoil, trace clay, rootlets, moist, loose.
0.4 - 3.0	Light brown silty sand and gravel, some clay, occasional cobble/boulder, wet to saturated, loose.

Grab Sample Summary

GS3 collected at 3.0 mbg	GSA: Gravel – 30% Sand – 30% Silt – 29% Clay – 11%	Moisture: N/A

Groundwater

- Groundwater encountered at 0.4 mbg, seeping in at varying depths to 3.0 mbg.

Additional Notes

- Test pit terminated at 3.0 mbg.
- Test pit walls caving at varying depths due to groundwater.
- Test pit backfilled and compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

April 28, 2022
17T 0708841 4919104
TP22-01

WILLS

Test Pit Log – TP22-02

Depth (mbg)	Soil Description
0.0 – 0.4	Dark brown silty sand topsoil, trace clay, rootlets, moist
0.4 –1.2	Light brown silty sand, trace gravel, trace clay, occasional cobbles, orange-brown mottling, wet
1.2 – 1.8	Light brown gravelly silt, some sand, trace clay, occasional cobble, wet
1.8 – 2.1	Light brown sand, some gravel, some silt, trace clay, occasional cobble/boulder, wet to saturated
2.1 – 3.0	Light brown silt, some sand, some gravel, some clay, occasional cobble/boulder, wet to saturated

Grab Sample Summary		
N/A	GSA: N/A	Moisture: N/A

Groundwater

- Groundwater seepage encountered at 0.4 mbg.

Additional Notes

- Test pit terminated at 3.0 mbg.
- Test pit walls caving at varying depths due to groundwater.
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

April 28, 2022
17T 0708847 4919093
TP22-02

WILLS

Test Pit Log – TP22-03

Depth (mbg)	Soil Description
0.0 – 0.4	Dark brown silty sand topsoil, trace clay, rootlets, moist
0.4 – 0.6	Light brown silty sand, trace gravel, trace clay, orange-brown mottling, wet
0.6 – 1.8	Light brown silt and sand, some gravel, some clay, occasional cobble, wet
1.8 – 3.0	Light brown silt, some sand, some clay, trace gravel, wet to saturated

Grab Sample Summary

GS4 collected 2.5 mbg	GSA: Gravel – 0% Sand – 20% Silt – 67% Clay – 13%	Moisture: N/A

Groundwater

- Groundwater seepage encountered at 0.4 mbg.

Additional Notes

- Test pit terminated at 3.0 mbg.
- Test pit walls caving at varying depths due to groundwater.
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

April 28, 2022
17 T 0708826 4919169
TP22-03

WILLS

Test Pit Log – TP22-04

Depth (mbg)	Soil Description
0.0 – 0.5	Dark brown silty sand topsoil, trace clay, rootlets, moist
0.5 – 0.8	Brown silty sand, some gravel, trace clay, occasional cobble/boulder, orange-brown mottling, moist
0.8 – 1.5	Brown sand, some silt, some gravel, trace clay, occasional cobble/boulder, wet
1.5 – 1.8	Light brown silt and sand, some clay, trace gravel, occasional cobble/boulder, wet
1.8 – 3.0	Light brown-grey sandy silt, some clay, trace gravel, occasional cobble/boulder, wet to saturated

Grab Sample Summary		
N/A	GSA: N/A	Moisture: N/A

Groundwater

- Groundwater encountered at 0.5 mbg, seeping in at varying depths to 3.0 mbg.

Additional Notes

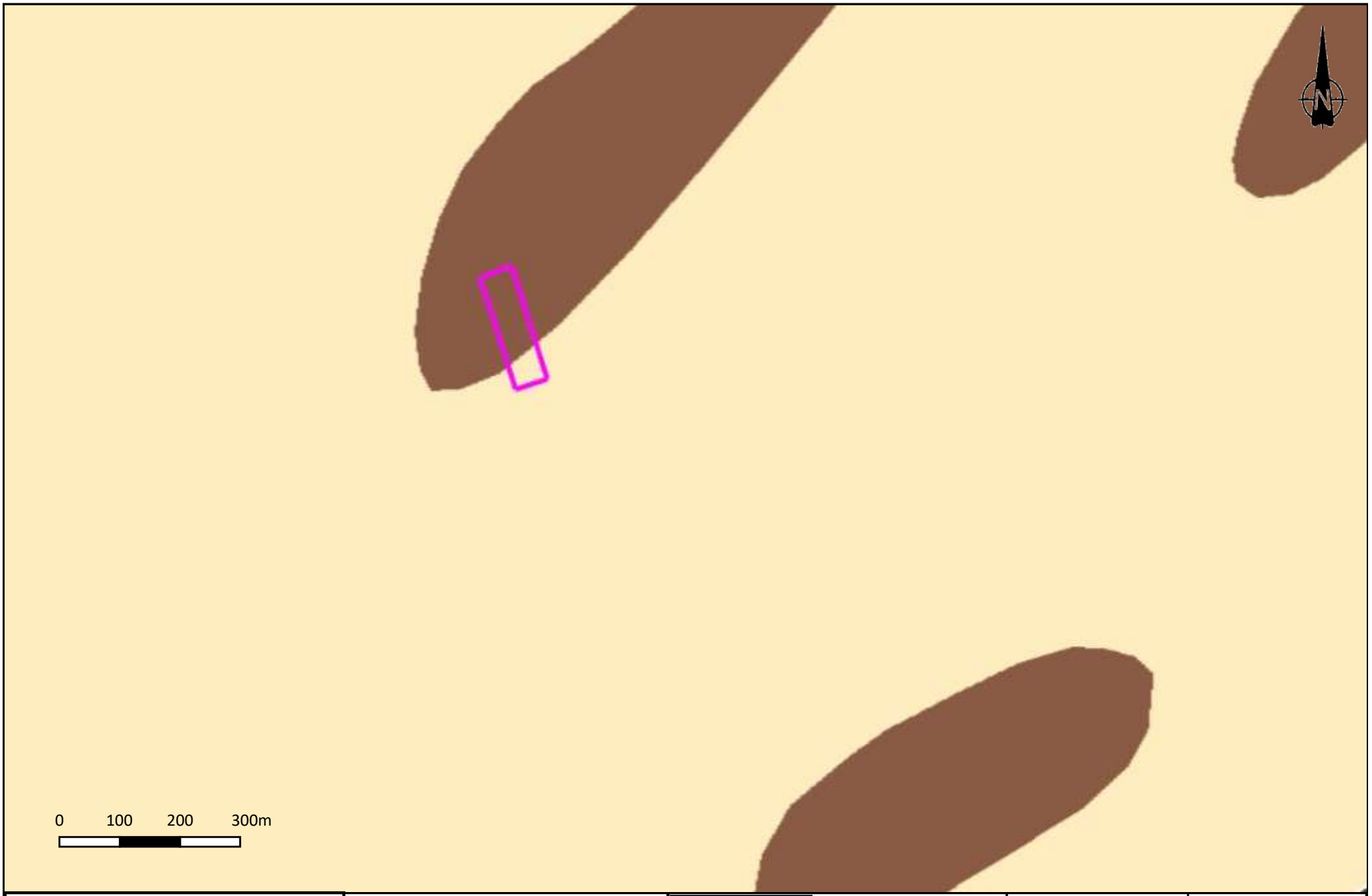
- Test pit terminated at 3.0 mbg.
- Test pit walls caving at varying depths due to groundwater.
- Test pit backfilled and nominally compacted using excavator following completion of stratigraphic logging and sampling.

Test Pit Photos

April 29, 2022
17 T 696929 4907298
TP22-04

Appendix B

Ontario Geological Survey Mapping



Legend

- Till Plains (Drumlinized)
- Drumlins
- Subject Property Boundary

Regional Physiography Map

Hydrogeological Study
949 Eighth Line, Bridgenorth, Township of Selwyn, Ontario

WILLS

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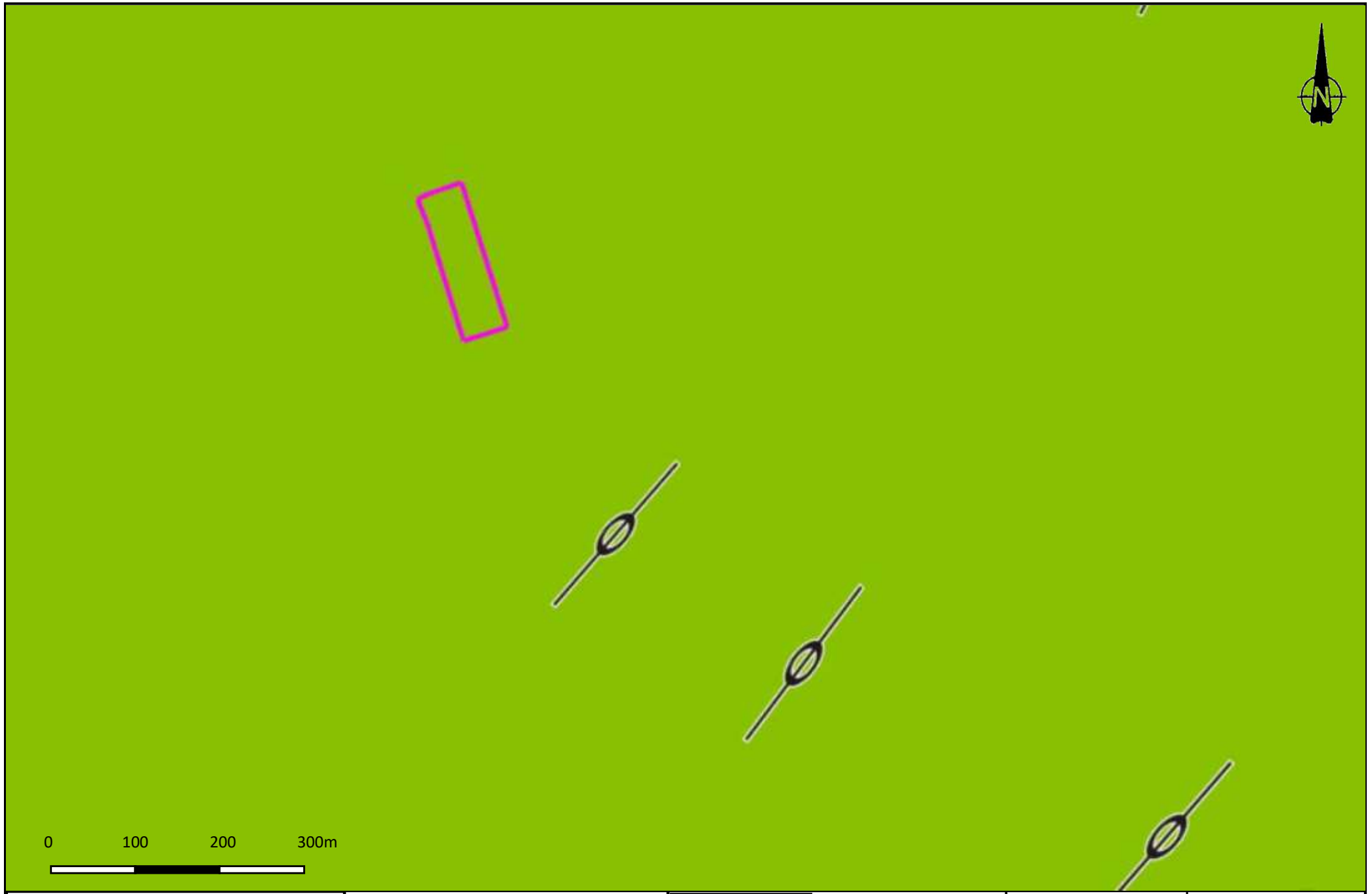
Drawn By	LT	Scale	See Scale Bar
Checked	IA	Date	March 2022
Project No.	22-85260	Drawing File No.	APP-B1



Legend

- Stone-poor, sandy silt to silty sand-textured
- Drumlin, Drumlinoid Ridges
- Subject Property Boundary

Regional Surficial Geology Map

Hydrogeological Study
949 Eighth Line, Bridgenorth, Township of Selwyn, Ontario

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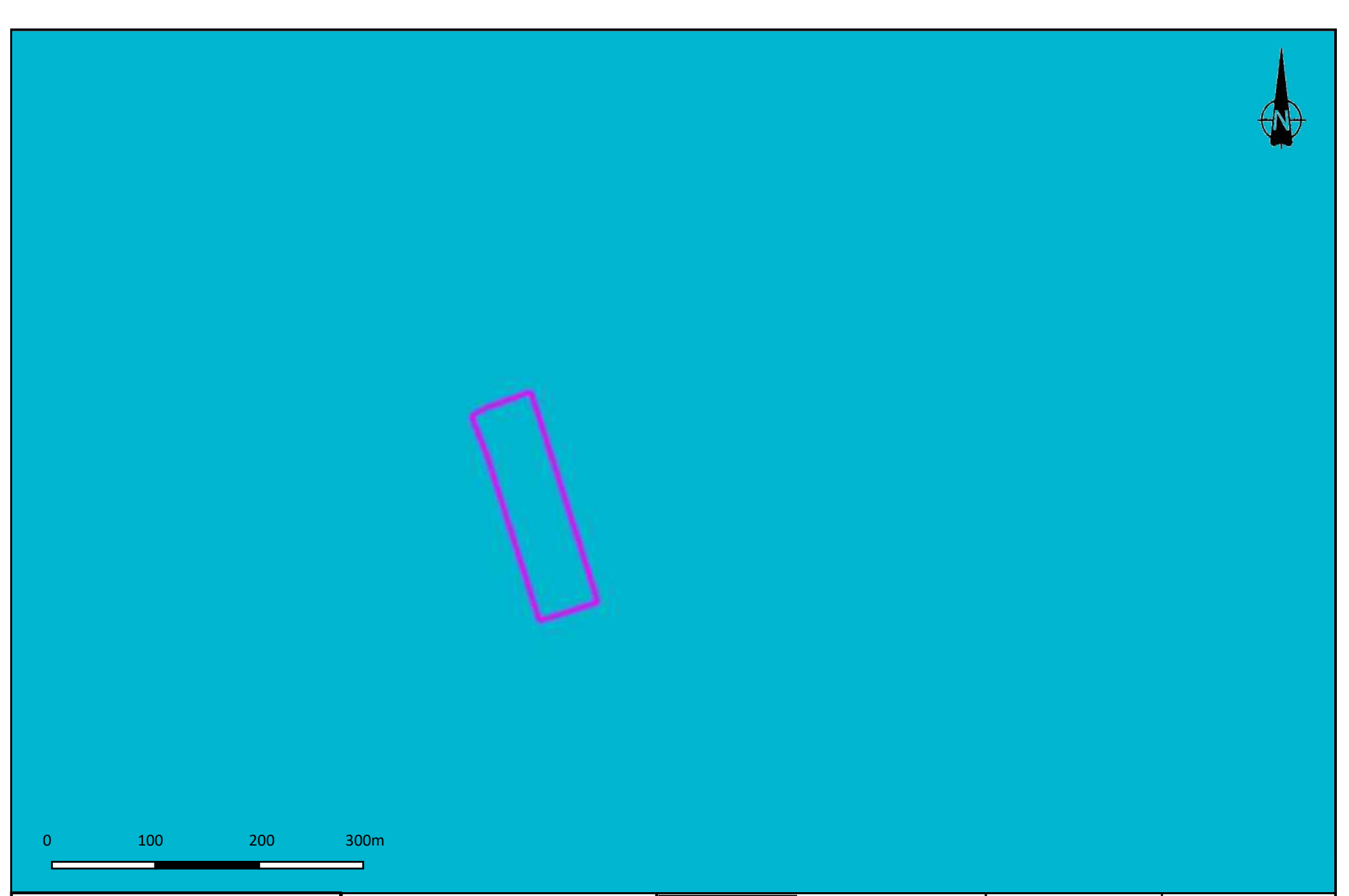
Drawn By	LT	Scale	See Scale Bar
Checked	IA	Date	March 2022
Project No.	22-85260	Drawing File No.	APP-B2



Legend

- Clastic Metasedimentary Rocks
- Subject Property

Regional Bedrock Geology Map

Hydrogeological Study
949 Eighth Line, Bridgenorth, Township of Selwyn, Ontario

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Drawn By	LT	Scale	See Scale Bar
Checked	IA	Date	March 2022
Project No.	22-85260	Drawing File No.	APP-B3

Appendix C

Certificates of Analysis – Physical Soil Testing

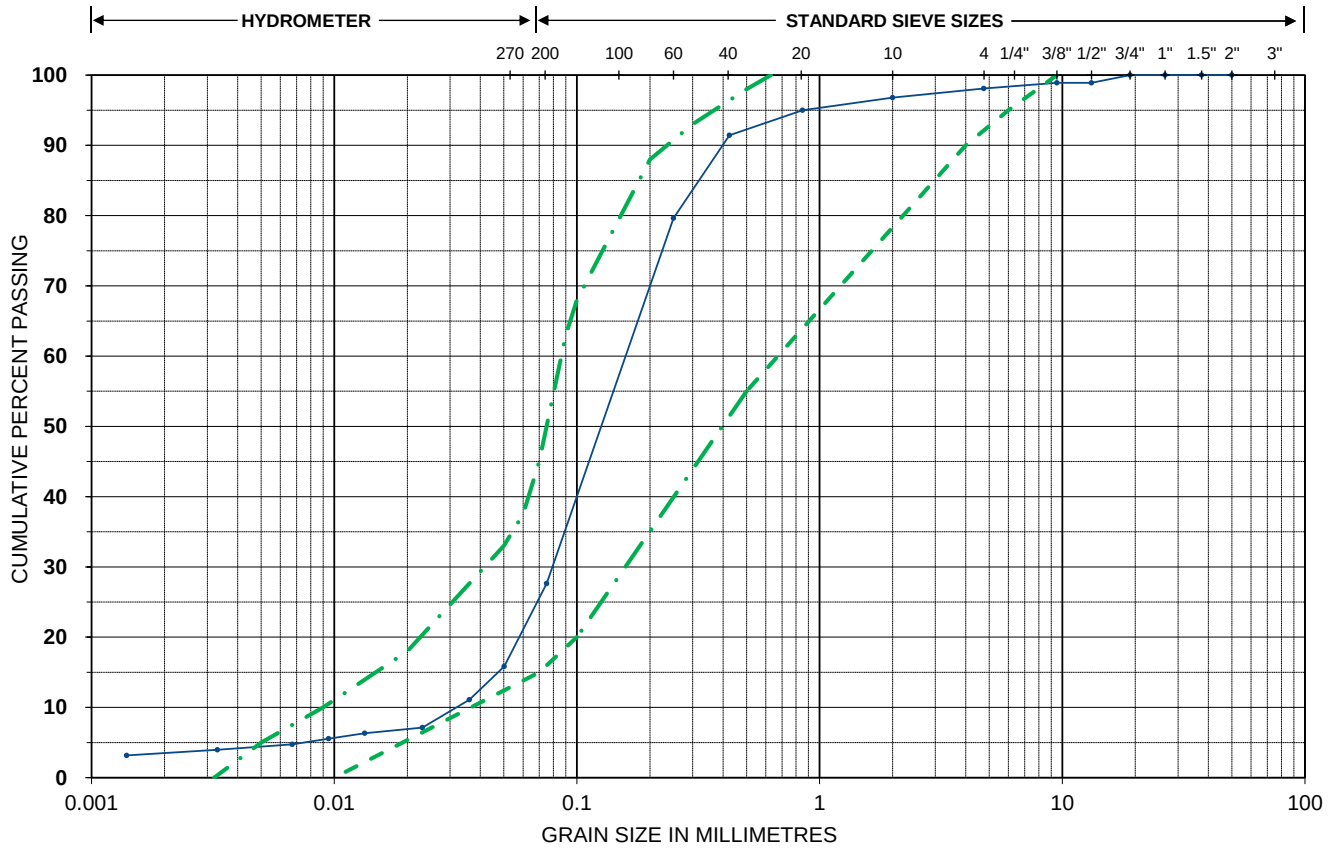
PRI ENGINEERING
205 St.George Street, Unit 2, Lindsay, ON, K9V 5Z9
(705) 702-3921
info@priengineering.com
www.priengineering.com

PARTICLE SIZE DISTRIBUTION

LS - 702
T-Time Analysis
MMAH Supplementary Standard SB-6

Project Name: Bridgenorth Development (85260) **Project No.:** 22-154 **Sample Date:** 9-Nov-23

Borehole/Test Pit ID.: INF4 **Sample No./Depth:** HA1 / 0 - 0.2 m **LAB ID:** 23HYD-333



Estimated T = 16 min/cm

Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	98.9
9.5	98.9
4.750	98.1
2.000	96.8
0.850	95.0
0.425	91.4
0.250	79.6
0.075	27.6

Hydrometer (mm)	% Passing
0.050	15.8
0.036	11.1
0.023	7.1
0.013	6.3
0.009	5.5
0.007	4.8
0.003	4.0
0.001	3.2

NOTES

Percolation rates are based on the Supplementary Standard to the Ontario Building Code 2012 document *Percolation Time and Soil Descriptions (* SB-5). It should be noted, PRI did not conduct field investigations in conjunction with the sample collection, or witness the collection of the sample tested. PRI assumes no responsibility for the application of the above-noted percoliation rate ("T"-Time) for use in design of an on-site sewage dispsal system. The design of an on-site sewage system must be conduction by a qualified professional with due regard for a number of site-specific conditions in addition to the percolation rate of the soil. The client or any third party using this informaiton as a basis for design assumes all risk associated with their evaluation of this report and all other criteria used in the design of any private sewage disposal system. This report is based entirely on the grain size distribution curve of the soil sample submitted for analysis. Additional analyses may be required following any future processing of the subject material or following supply of the material to individual sites for use in any tile bed construction.

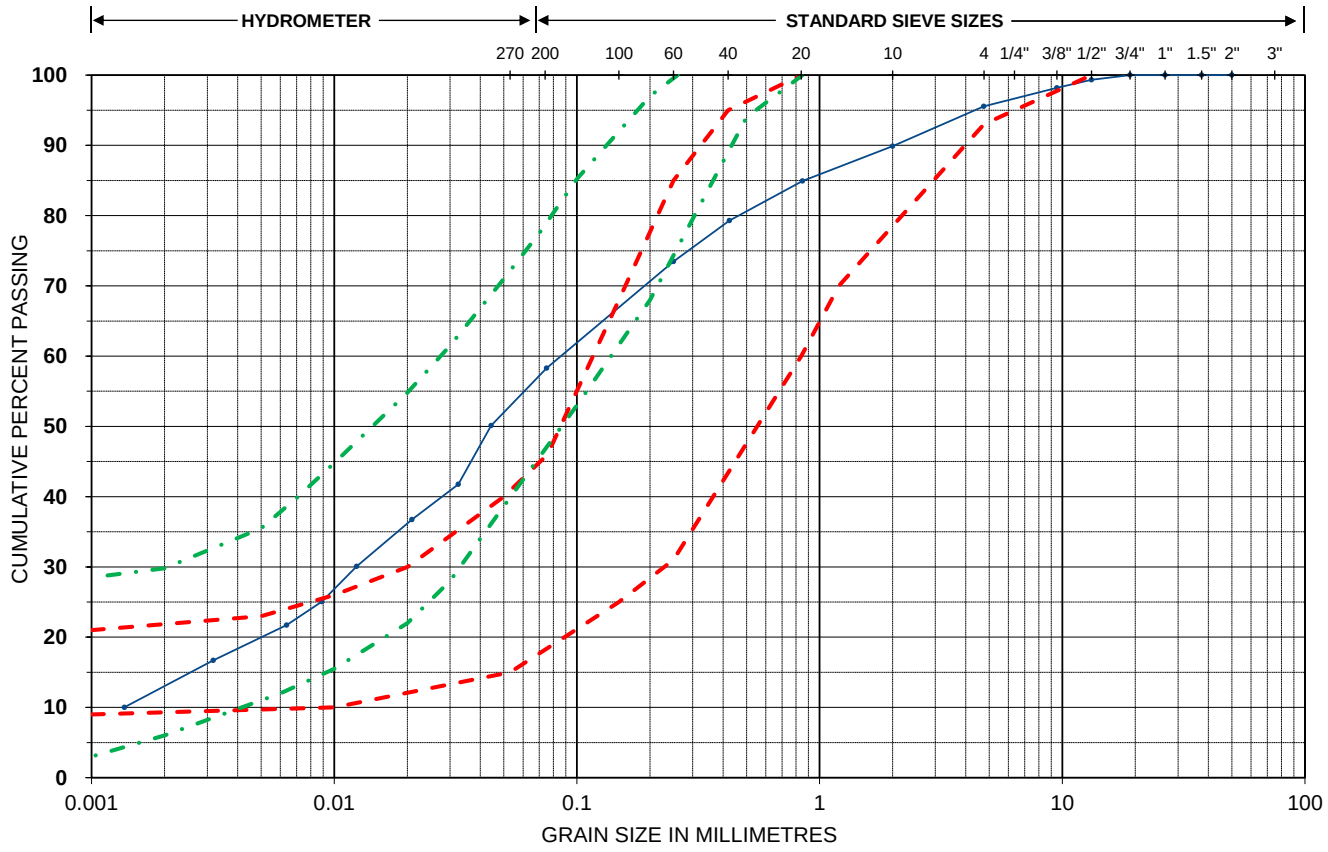
PRI ENGINEERING
205 St.George Street, Unit 2, Lindsay, ON, K9V 5Z9
(705) 702-3921
info@priengineering.com
www.priengineering.com

PARTICLE SIZE DISTRIBUTION

LS - 702
T-Time Analysis
MMAH Supplementary Standard SB-6

Project Name: Bridgenorth Development (85260) **Project No.:** 22-154 **Sample Date:** 9-Nov-23

Borehole/Test Pit ID.: INF5 **Sample No./Depth:** HA2 / 0.25 - 0.4 m **LAB ID:** 23HYD-334



Silt or Clay	Sand	Gravel

ML envelope T = 20 - 50 min/cm
SC envelope T = 12 - 50 min/cm

Estimated T = 30 min/cm

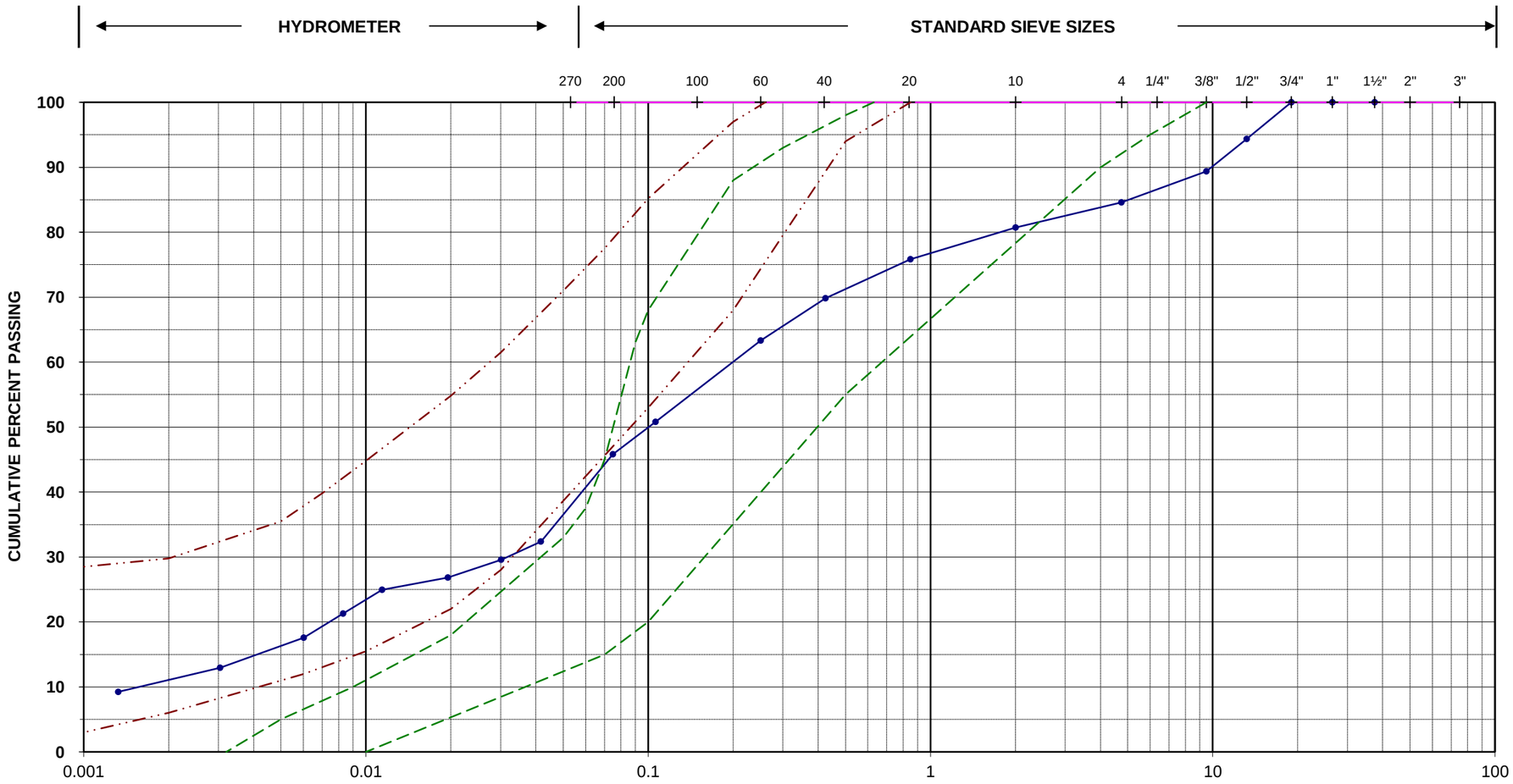
Sieve Size (mm)	% Passing
37.5	100.0
26.5	100.0
19.0	100.0
13.2	99.3
9.5	98.2
4.750	95.5
2.000	89.9
0.850	84.9
0.425	79.3
0.250	73.5
0.075	58.3

Hydrometer (mm)	% Passing
0.044	50.1
0.032	41.8
0.021	36.8
0.012	30.1
0.009	25.1
0.006	21.7
0.003	16.7
0.001	10.0

NOTES

Percolation rates are based on the Supplementary Standard to the Ontario Building Code 2012 document *Percolation Time and Soil Descriptions (* SB-5). It should be noted, PRI did not conduct field investigations in conjunction with the sample collection, or witness the collection of the sample tested. PRI assumes no responsibility for the application of the above-noted percoliation rate ("T"-Time) for use in design of an on-site sewage dispsal system. The design of an on-site sewage system must be conduction by a qualified professional with due regard for a number of site-specific conditions in addition to the percolation rate of the soil. The client or any third party using this informaiton as a basis for design assumes all risk associated with their evaluation of this report and all other criteria used in the design of any private sewage disposal system. This report is based entirely on the grain size distribution curve of the soil sample submitted for analysis. Additional analyses may be required following any future processing of the subject material or following supply of the material to individual sites for use in any tile bed construction.

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	15	%
SAND	40	%
SILT	33	%
CLAY	12	%

---------- sm envelope T = 8 - 20 min/cm

– - - – - - – - - – - sm envelope T = 20 - 50 min/cm

Estimated T = 25 min/cm

Project Name: DM Wills - 85260 **Project No.:** 201-07253-00

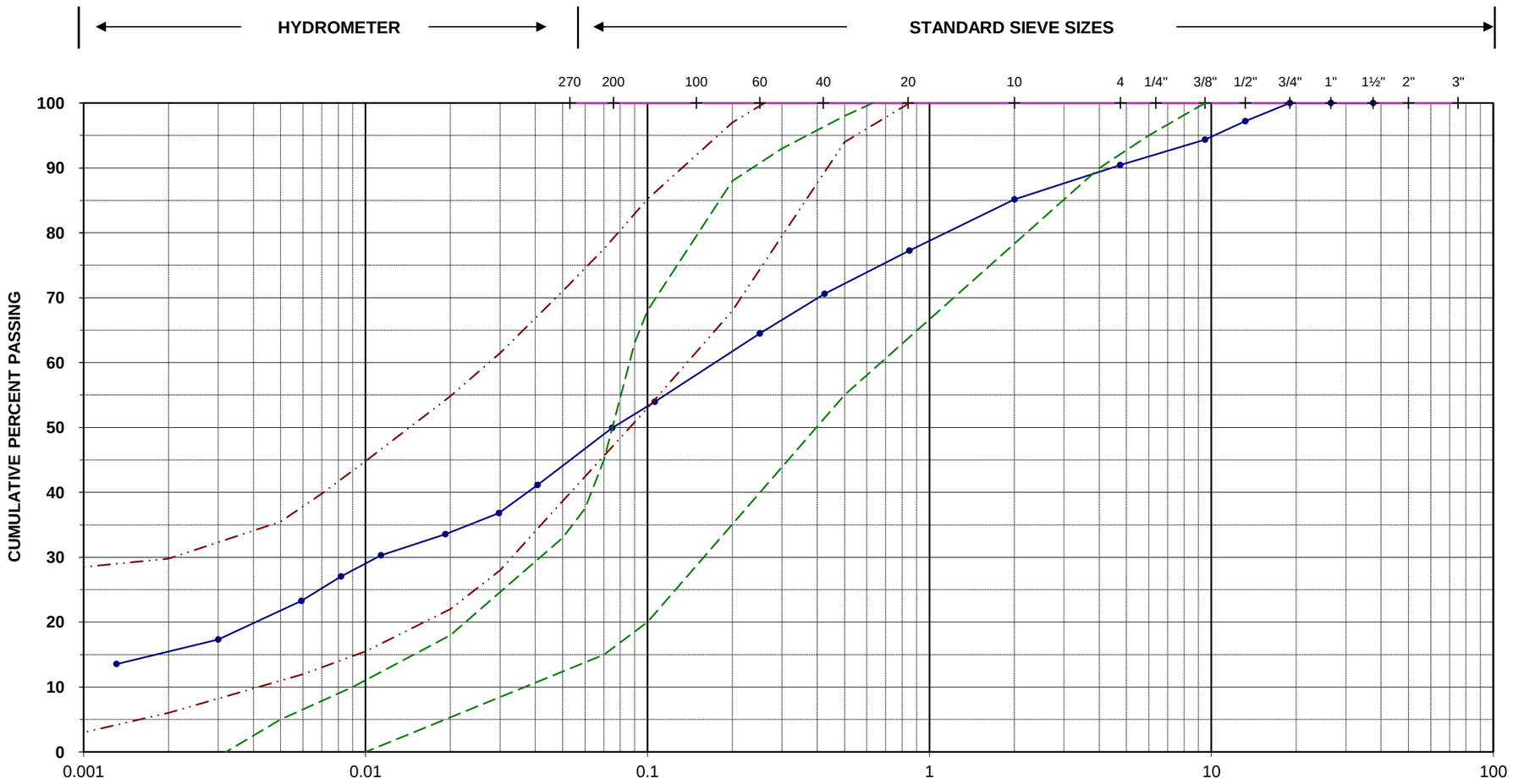
Location ID.: BH22-02 **Sample No./Depth:** SS3

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	80.70	**0.042**	32.4
26.5 mm	100.0	**0.850 mm**	75.8	**0.019**	26.8
19.0 mm	100.0	**0.425 mm**	69.9	**0.008**	21.3
13.2 mm	94.3	**0.250 mm**	63.3	**0.003**	12.9
9.50 mm	89.4	**0.106 mm**	50.8	**0.001**	9.2
4.75 mm	84.6	**0.075 mm**	45.8		

Note: More information is available upon request.

Tested by: WGH Reviewed by: Date: 11-May-22

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	**10**	**%**
SAND	**40**	**%**
SILT	**35**	**%**
CLAY	**15**	**%**

---------- sm envelope T = 8 - 20 min/cm

– - - – - – - – - – ml envelope T = 20 - 50 min/cm

Estimated T = 35 min/cm

Project Name: DM Wills - 85260 **Project No.:** 201-07253-00

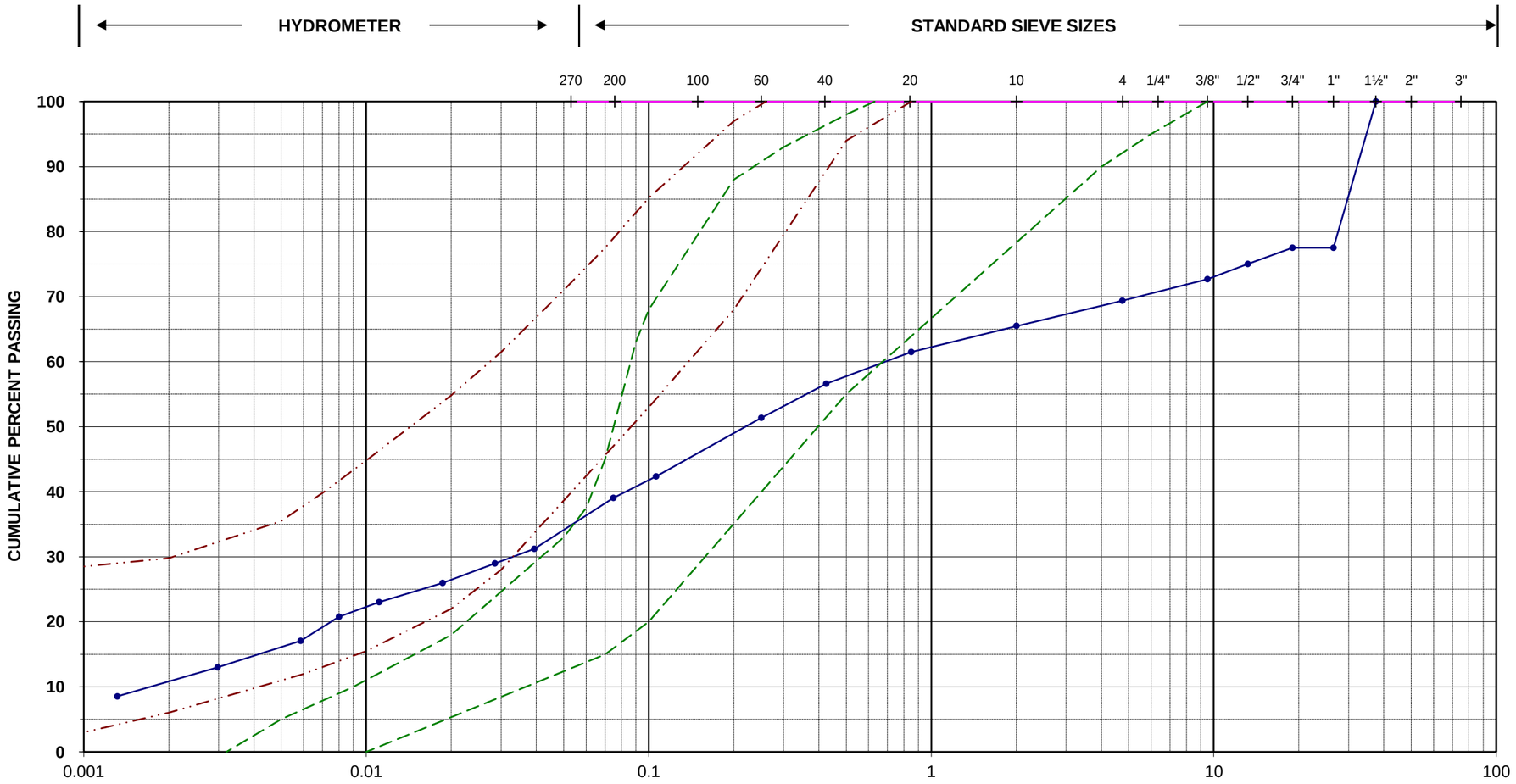
Location ID.: BH22-03 **Sample No./Depth:** SS2

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	85.15	**0.041**	41.1
26.5 mm	100.0	**0.850 mm**	77.3	**0.019**	33.6
19.0 mm	100.0	**0.425 mm**	70.6	**0.008**	27.1
13.2 mm	97.2	**0.250 mm**	64.5	**0.003**	17.3
9.50 mm	94.4	**0.106 mm**	54.0	**0.001**	13.5
4.75 mm	90.4	**0.075 mm**	49.9		

Note: More information is available upon request.

Tested by: WGH Reviewed by: Date: 11-May-22

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	**30**	**%**
SAND	**30**	**%**
SILT	**29**	**%**
CLAY	**11**	**%**

---------- sm envelope T = 8 - 20 min/cm

– – – — – – — – – — – – ml envelope T = 20 - 50 min/cm

Estimated T = 25 min/cm

Project Name: DM Wills - 85260 **Project No.:** 201-07253-00

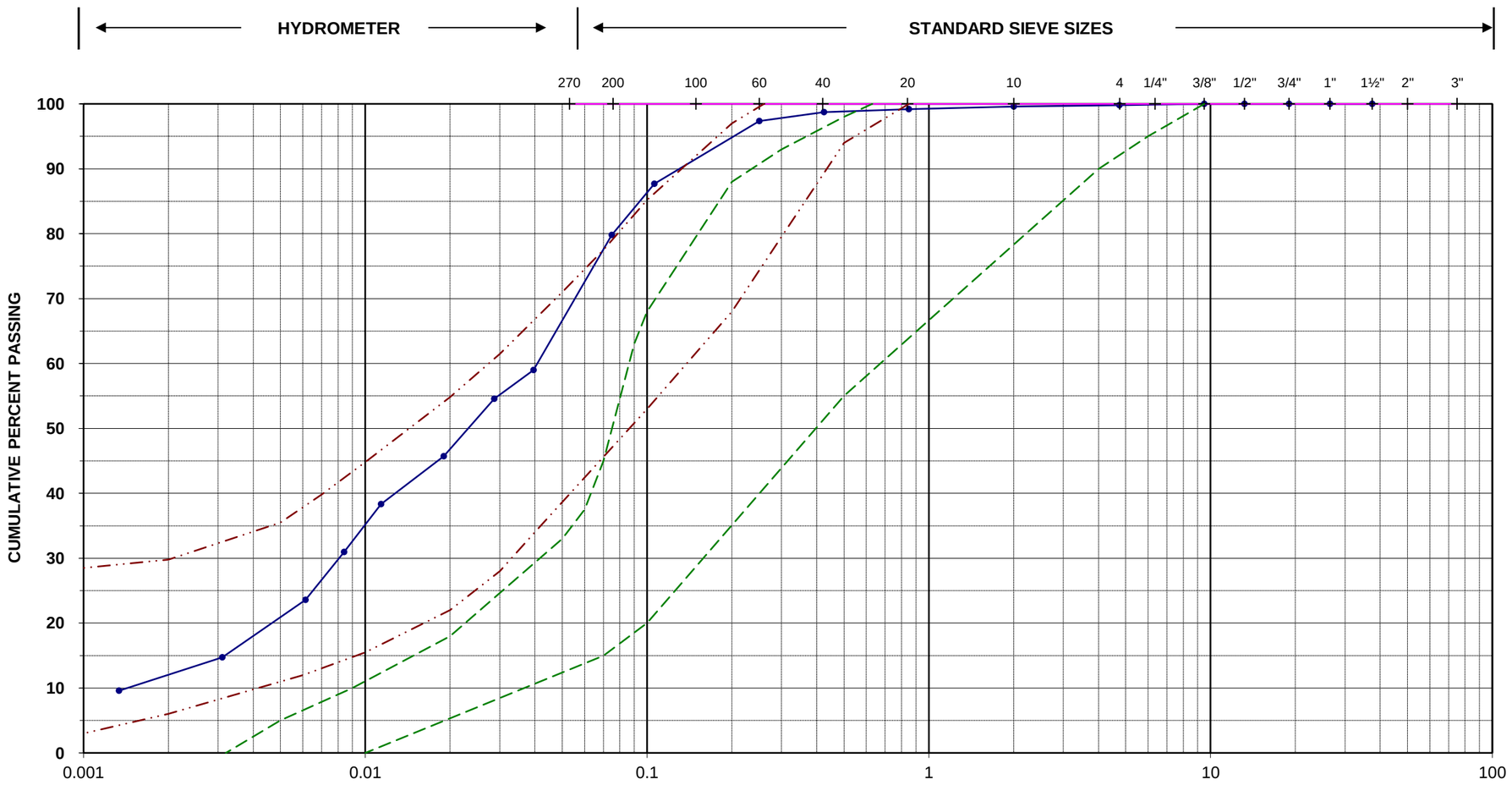
Location ID.: TP22-01 **Sample No./Depth:** GS3

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	65.48	**0.039**	31.2
26.5 mm	77.5	**0.850 mm**	61.5	**0.019**	26.0
19.0 mm	77.5	**0.425 mm**	56.6	**0.008**	20.8
13.2 mm	75.0	**0.250 mm**	51.4	**0.003**	13.0
9.50 mm	72.7	**0.106 mm**	42.3	**0.001**	8.5
4.75 mm	69.4	**0.075 mm**	39.0		

Note: More information is available upon request.

Tested by: WGH Reviewed by: Date: 11-May-22

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	**0**	**%**
SAND	**20**	**%**
SILT	**67**	**%**
CLAY	**13**	**%**

---------- sm envelope T = 8 - 20 min/cm

– - - – - – - – - – - – ml envelope T = 20 - 50 min/cm

Estimated T = 35 min/cm

Project Name: DM Wills - 85260 **Project No.:** 201-07253-00

Location ID.: TP22-03 **Sample No./Depth:** GS-04

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	99.61	**0.040**	59.0
26.5 mm	100.0	**0.850 mm**	99.2	**0.019**	45.7
19.0 mm	100.0	**0.425 mm**	98.7	**0.008**	31.0
13.2 mm	100.0	**0.250 mm**	97.4	**0.003**	14.7
9.50 mm	100.0	**0.106 mm**	87.7	**0.001**	9.6
4.75 mm	99.8	**0.075 mm**	79.8		

Note: More information is available upon request.

Tested by: WGH Reviewed by: Date: 11-May-22

Appendix D

Infiltration Graphs

Guelph Permeameter Calculations

WILLS

Single Head Method

Project Name Bridgenorth Townhouse Development
Project Number 85260

Date 1/31/23
Infiltration Test Number: INF-1

Reservoir Cross-sectional area in cm^2 ("35.22" for Combined or "2.16" for Inner reservoir):	**35.22**
Water Head Height ("H" in cm):	**15**
Borehole Radius ("a" in cm):	**3**
Soil texture-structure category:	**2**

Soil Texture Categories

1 - Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.

2- Soils which are both fine textured (clayey or silty) and unstructured, may also include some fine sands.

3 - Most structured soils from clay through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils

4- Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macroports, etc.

USCS Soil Classification:
Sand and silt, some clay, some gravel, moist

Steady State Rate of Water Level Change ("R" in cm/min): **5.5000**

Calculations:

Res Type	35.22
H	15
a	3
H/a	5
a*	0.04
C0.01	1.518269
C0.04	1.629144
C0.12	1.666893
C0.36	1.666893
C	1.629144
R	5.500
Q	3.2285
pi	3.1415

Infiltration Rates:

49.62 mm/hr
12.1 min/cm

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

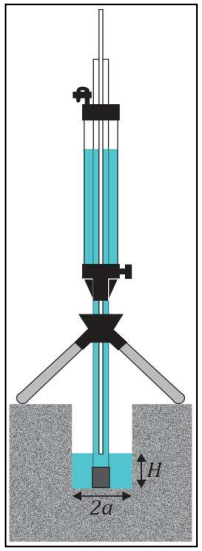
α^*= **0.04** cm^{-1}

C = **1.62914414**
Q = **3.2285**

K_{fs} =

0.00	**cm/sec**
0.08	**cm/min**
0.00	**m/sec**
0.03	**inch/min**
0.00	**inch/sec**

Φ_m = **0.03** **cm^2/min**



Definitions:

H - Water Head Height
a - Borehole radius
R - Steady-state rate of fall
α^* - ratio of gravity to capillary forces during infiltration or drainage
C - Shape Factor
Q - Rate of discharge
Kfs - Soil saturated hydraulic conductivity
Φm - Soil matrix flux potential

Guelph Permeameter Calculations

WILLS

Single Head Method

Project Name Bridgenorth Townhouse Development
Project Number 85260

Date 11/09/23
Infiltration Test Number: INF-5 (Test 1)

Reservoir Cross-sectional area in cm^2 ("35.22" for Combined or "2.16" for Inner reservoir):	35.22
Water Head Height ("H" in cm):	10
Borehole Radius ("a" in cm):	3
Soil texture-structure category:	3

Soil Texture Categories

1 - Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.

2- Soils which are both fine textured (clayey or silty) and unstructured, may also include some fine sands.

3 - Most structured soils from clay through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils

4- Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macroports, etc.

USCS Soil Classification:
Sand and silt, some clay, trace gravel, moist

Steady State Rate of Water Level Change ("R" in cm/min): 0.1250

Calculations:

Res Type	35.22
H	10
a	3
H/a	3.333333
α*	0.12
C0.01	1.21841
C0.04	1.290234
C0.12	1.287543
C0.36	1.287543
C	1.287543
R	0.125
Q	0.073375
pi	3.1415

Infiltration Rates:

2.862 mm/hr
209.6 min/cm

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

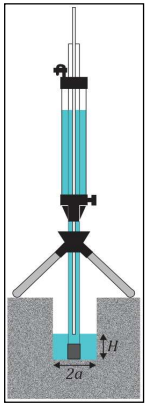
α*= 0.12 cm^{-1}

C = 1.2875428
Q = 0.073375

K_{fs} =

0.00	cm/sec
0.00	cm/min
0.00	m/sec
0.00	inch/min
0.00	inch/sec

Φ_m = 0.00 cm^2/min



Definitions:

H - Water Head Height
a - Borehole radius
R - Steady-state rate of fall
α* - ratio of gravity to capillary forces during infiltration or drainage
C - Shape Factor
Q - Rate of discharge
Kfs - Soil saturated hydraulic conductivity
Φm - Soil matrix flux potential

Calculations: 209.6 min/cm
2.9

Guelph Permeameter Calculations

WILLS

Single Head Method

Project Name Bridgenorth Townhouse Development
Project Number 85260

Date 11/09/23
Infiltration Test Number: INF-5 (Test 2)

Reservoir Cross-sectional area in cm^2 ("35.22" for Combined or "2.16" for Inner reservoir):	35.22
Water Head Height ("H" in cm):	10
Borehole Radius ("a" in cm):	3
Soil texture-structure category:	3

Soil Texture Categories

1 - Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.

2- Soils which are both fine textured (clayey or silty) and unstructured, may also include some fine sands.

3 - Most structured soils from clay through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils

4- Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macroports, etc.

USCS Soil Classification:

Sand and silt, some clay, trace gravel, moist

Steady State Rate of Water Level Change ("R" in cm/min): 0.1000

Calculations:

Res Type	35.22
H	10
a	3
H/a	3.333333
α*	0.12
C0.01	1.21841
C0.04	1.290234
C0.12	1.287543
C0.36	1.287543
C	1.287543
R	0.100
Q	0.0587
pi	3.1415

Infiltration Rates:

2.29 mm/hr
262.0 min/cm

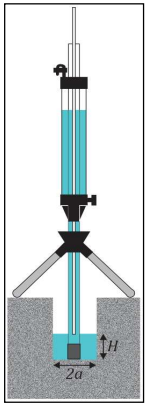
Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only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

α^*= 0.12 cm^{-1}

C = 1.2875428
Q = 0.0587

K_{fs} = 0.00 cm/sec
0.00 cm/min
0.00 m/sec
0.00 inch/min
0.00 inch/sec

Φ_m = 0.00 cm^2/min



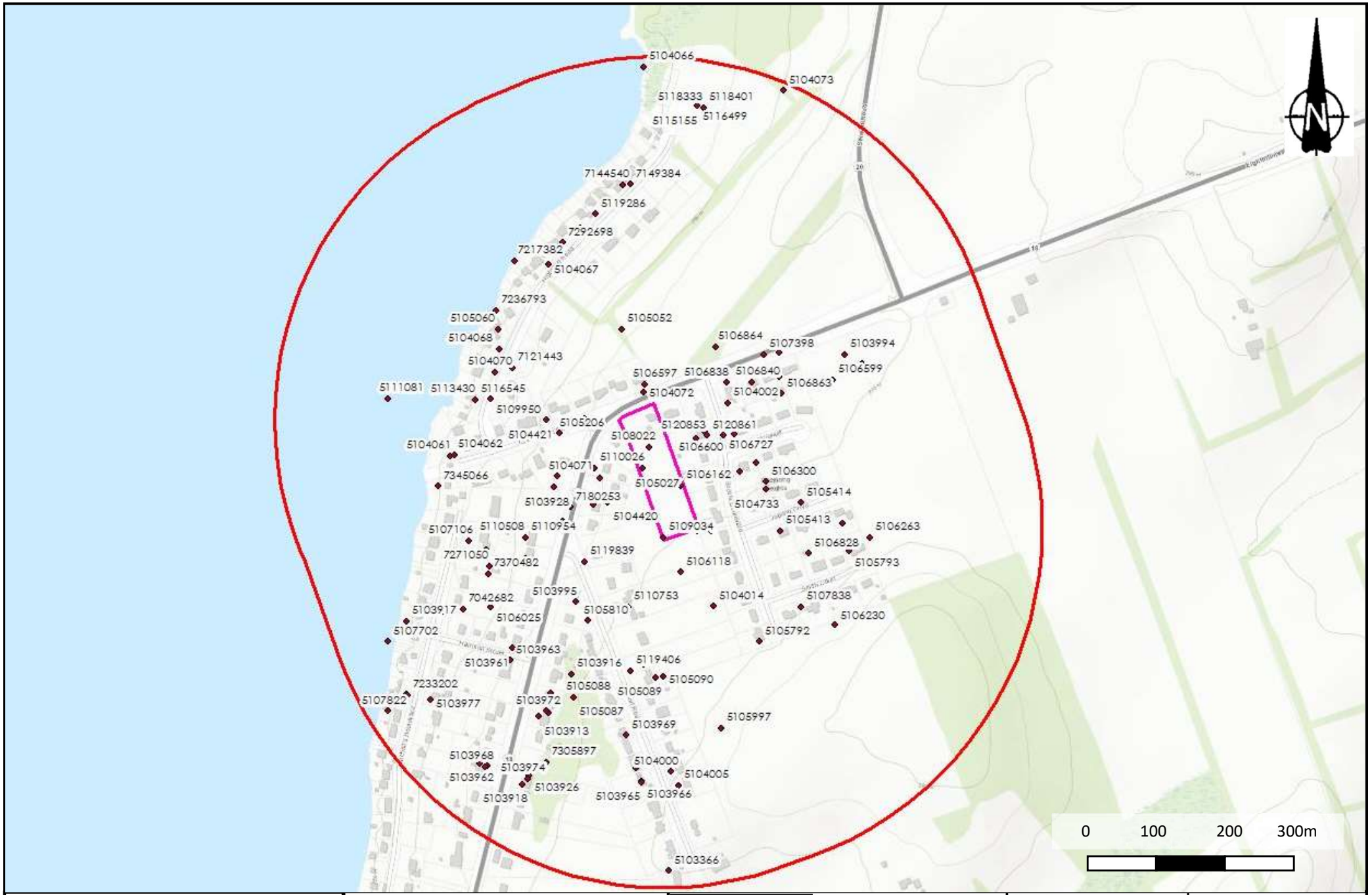
Definitions:

H - Water Head Height
a - Borehole radius
R - Steady-state rate of fall
α* - ratio of gravity to capillary forces during infiltration or drainage
C - Shape Factor
Q - Rate of discharge
Kfs - Soil saturated hydraulic conductivity
Φm - Soil matrix flux potential

Calculations: 262.0 min/cm
2.3

Appendix E

MECP Well Record Search



Legend

- Subject Property
- 500 m Well Search Area
- WECP Well Location and ID

MECP Well Location Plan

Hydrogeological Study
949 Eighth Line, Bridgenorth, Township of Selwyn, 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	March 2022
Project No.	22-85260	Drawing File No.	APP-E1

MECP WELL SUMMARY

Well Record Summary - Bedrock

Project No.: 85260

Lot No.	UTM	MECP Well No.	Well Use	Water Found		Static Level		REC Pump Rate		Well Depth		Depth to Bedrock		Comments
				Feet	Metres	Feet	Metres	Igpm	L/min	Feet	Metres	Feet	Metres	
Concession Unknown														
Unknown	708572 4919400	7236793	Domestic	70	21.3	7.1	2.2			70	21.3	67.0	20.4	Fresh water observed at 70 ft. in limestone bedrock.
Concession 7														
Lot 003	708701 4919038	5119839	Domestic	84	25.6	23.1	7.0	7.5	34.1	84	25.6	68.0	20.7	Fresh water observed at 84 ft. in limestone bedrock.
Lot 012	708705 4918953	5105810	Domestic	71	21.6	10	3.0	8.33	37.8	71	21.6	69.0	21.0	Fresh water observed at 71 ft. in shale bedrock.
Lot 012	708563 4919032	7271050	Domestic	24	7.3	4	1.2	5.83	26.5	133	40.5	59.0	18.0	Fresh water observed at 24 ft. in clay.
Lot 012	708559 4919056	7121530	Domestic	65	19.8	9.2	2.8	3.33	15.1	100	30.5	64.0	19.5	Fresh water observed at 65 ft. in limestone bedrock.
Lot 012	708442 4918952	5103917	Domestic	60	18.3	4	1.2	4.16	18.9	60	18.3	52.0	15.8	Fresh water observed at 60 ft. in limestone bedrock.
Lot 012	708484 4918865	5103959	Domestic	58	17.7	20	6.1	8.33	37.8	58	17.7	57.0	17.4	Fresh water observed at 58 ft. in limestone bedrock.
Lot 012	708645 4918749	7305897	Domestic	66	20.1	7	2.1	14.98	68.0	92	28.0	71.0	21.6	Fresh water observed at 66 ft. in gravel.
Lot 012	708435 4918673	5104631	Domestic	20	6.1	9	2.7	6.66	30.2	27	8.2	22.0	6.7	Fresh water observed at 20 ft. in gravel.
Lot 012	708615 4919073	5110954	Domestic	54	16.5	3	0.9	8.33	37.8	64	19.5	56.0	17.1	Fresh water observed at 54 ft. in clay.
Lot 012	708669 4919096	5106879	Domestic	54	16.5	10	3.0	4.16	18.9	58	17.7	54.0	16.5	Fresh water observed at 54 ft. in limestone bedrock.
Lot 012	708532 4919068	5107106	Domestic	69	21.0	15	4.6	12.49	56.7	69	21.0	64.0	19.5	Fresh water observed at 69 ft. in limestone bedrock.
Lot 013	708525 4918970	7042682	Domestic	57.74	17.6	0	0.0	2.51	11.4	86.94	26.5	58.1	17.7	Fresh water observed at 57.74 ft. in limestone bedrock.
Lot 013	708765 4918973	5110753	Domestic	77	23.5	12	3.7	5	22.7	86	26.2	80.0	24.4	Fresh water observed at 77 ft. in gravel.
Lot 013	709015 4918973	5107838	Domestic	61	18.6	31	9.4	9.99	45.4	72	21.9	67.0	20.4	Fresh water observed at 61 ft. in gravel.
Lot 013	708480 4918651	7308882	Domestic	26	7.9	0	0.0	3.33	15.1	36	11.0	27.0	8.2	Fresh water observed at 26 ft. in gravel.
Lot 013	708662 4919161	5104071	Domestic	80	24.4	18	5.5	5.82	26.4	80	24.4	76.0	23.2	Fresh water observed at 80 ft. in limestone bedrock.
Lot 013	708715 4919173	5110026	Domestic	50	15.2	25	7.6	6.66	30.2	52	15.8	42.0	12.8	Fresh water observed at 50 ft. in limestone bedrock.
Lot 013	708879 4919220	5120853	Domestic	55	16.8	4.3	1.3	4.16	18.9	60	18.3	55.0	16.8	Fresh water observed at 55 ft. in limestone bedrock.
Lot 013	708903 4919220	5106727	Domestic	53	16.2			2.5	11.4	65	19.8	52.0	15.8	Fresh water observed at 52 ft. in limestone bedrock.
Lot 013	708909 4919267	5104002	Domestic	60	18.3	10	3.0	11.66	52.9	66	20.1	64.0	19.5	Fresh water observed at 60 ft. in sand.
Lot 013	708907 4919296	5106838	Domestic	50	15.2	4	1.2	19.68	89.3	54	16.5	50.0	15.2	Fresh water observed at 50 ft. in limestone bedrock.
Lot 013	708961 4919337	5107398	Domestic	38	11.6	14	4.3	4.5	20.4	40	12.2	36.0	11.0	Fresh water observed at 38 ft. in limestone bedrock.
Lot 013	709105 4919324	5106598	Domestic	42	12.8	0	0.0	4.16	18.9	49	14.9	42.0	12.8	Fresh water observed at 42 ft. in limestone bedrock.
Lot 014	709298 4919403	5104008	Domestic	87	26.5	6	1.8	2.5	11.4	120	36.6	87.0	26.5	Fresh water observed at 87 ft. in limestone bedrock.
Concession 8														
Lot 012	708597 4919318	7121443	Public	84.97	25.90	41.99	12.80	0.5	2.27	134.97	41.1	72.99	22.2	Fresh water observed at 84.97 ft. in limestone bedrock.
Lot 012	708543 4919271	5113430	Domestic	24	7.32	7	2.13	2.5	11.35	25	7.6	11	3.4	Fresh water observed at 24 ft. in limestone bedrock.
Lot 012	708543 4919271	5116545	Domestic	48	14.63	6	1.83	4.16	18.89	50	15.2	48	14.6	Fresh water observed at 48 ft. in shale bedrock.
Lot 012	708415 4919273	5111081	Domestic	64	19.51	5	1.52	4	18.16	67	20.4	65	19.8	Fresh water observed at 64 ft. in limestone bedrock.
Lot 012	708512 4919192	5104062	Domestic	155	47.24	15	4.57	1.66	7.54	160	48.8	52	15.8	Fresh water observed at 155 ft. in limestone bedrock.
Lot 013	708865 4919695	5111975	Domestic	84	25.60	11	3.35	2.5	11.35	115	35.1	85	25.9	Fresh water observed at 84 ft. in gravel.
Lot 013	708865 4919695	5115155	Domestic	58	17.68	20	6.10	4.16	18.89	72	21.9	58	17.7	Fresh water observed at 58 ft. in gravel.
Lot 013	708865 4919695	5116499	Domestic	81	24.69	21	6.40	4.16	18.89	81	24.7	80	24.4	Fresh water observed at 81 ft. in limestone bedrock.
Lot 013	708874 4919692	5118401	Domestic	93	28.35	18	5.49	2.5	11.35	93	28.3	93	28.3	Fresh water observed at 93 ft. in limestone bedrock.
Lot 013	708599 4919472	7217382	Domestic	80	24.38	5.4	1.65	4.16	18.89	85	25.9	80	24.4	Fresh water observed at 80 ft. in shale bedrock.
Lot 013	708575 4919373	5105060	Domestic	80	24.38	2	0.61	8.33	37.82	80	24.4	74	22.6	Fresh water observed at 80 ft. in shale bedrock.
Lot 013	708645 4919243	5104421	Domestic	105	32.0	42	12.8	2.49	11.3	105	32.0	58.0	17.7	Fresh water observed at 105 ft. in limestone bedrock.
Lot 013	708787 4919282	5104072	Domestic	62	18.9	18	5.5	8.33	37.8	62	18.9	60.0	18.3	Fresh water observed at 62 ft. in limestone bedrock.
Lot 013	708755 4919373	5105052	Domestic	64	19.5	26	7.9	4.16	18.9	84	25.6	64.0	19.5	Fresh water observed at 64 ft. in limestone bedrock.
Lot 013	708892 4919348	5106864	Domestic	32	9.8	2	0.6	11.66	52.9	34	10.4	60.0	18.3	Fresh water observed at 32 ft. in granite boulders.
Lot 018	708717 4919539	5119286	Domestic	57	17.37	10	3.05	4.16	18.89	57	17.4	55	16.8	Fresh water observed at 57 ft. in shale bedrock.
Concession 6														
Lot 012	708615 4919073	5110508	Domestic			0.83	0.25	7	31.78	86	26.2	52	15.8	

Number of Wells: 42

	Water Found		Static Level		REC Pump Rate		Well Depth		Depth to Bedrock	
	Feet	Metres	Feet	Metres	Igpm	L/min	Feet	Metres	Feet	Metres
TOTALS	2603.7	793.6	496.9	151.5	243.0	1103.2	3143.9	958.3	2507.1	764.2
AVERAGE	63.5	19.4	12.1	3.7	5.9	26.9	74.9	22.8	59.7	18.2
MAXIMUM	155.0	47.2	42.0	12.8	19.7	89.3	160.0	48.8	93.0	28.3
MINIMUM	20.0	6.1	0.0	0.0	0.5	2.3	25.0	7.6	11.0	3.4

MECP WELL SUMMARY
Well Record Summary - Overburden
Project No.: 85260

Lot No.	UTM	MECP 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	Comments
(CR E)												
Lot 012	708823 491593	5103366	Domestic	62	18.9	30	9.1	2.5	11.4	62	18.9	Fresh water observed at 62 ft. in gravel.
Concession 7												
Lot 012	708615 4919043	5104536	Domestic	69	21.0	12	3.7	6.66	30.2	69	21.0	Fresh water observed at 69 ft. in gravel.
Lot 012	708415 4918923	5107702	Domestic	25	7.6	16	4.9	4.16	18.9	25	7.6	Fresh water observed at 25 ft. in gravel.
Lot 012	708565 4918973	5106025	Domestic	52	15.8	8	2.4	5.83	26.5	54	16.5	Fresh water observed at 52 ft. in gravel.
Lot 012	708443 4918848	5103970	Domestic	40	12.2	5	1.5	2.5	11.4	45	13.7	Fresh water observed at 40 ft. in gravel.
Lot 012	708444 4918846	7233202	Abandoned - Other	12	3.7	9	2.7			12	3.7	Well abandonment.
Lot 012	708477 4918839	5103977	Domestic	57	17.4	4	1.2	1.66	7.5	57	17.4	Fresh water observed at 57 ft. in clay.
Lot 012	708495 4918966	5103929	Domestic	52	15.8			1.67	7.6	52	15.8	Fresh water observed at 52 ft. in gravel.
Lot 012	708762 4918788	5103969	Domestic	75	22.9	12	3.7	8.33	37.8	75	22.9	Fresh water observed at 75 ft. in gravel.
Lot 012	708620 4918730	5103926	Domestic	60	18.3	8	2.4			60	18.3	Fresh water observed at 60 ft. in gravel.
Lot 012	708618 4918725	5103974	Domestic	49	14.9	6	1.8	8.33	37.8	49	14.9	Fresh water observed at 49 ft. in gravel.
Lot 012	708611 4918718	5103918	Domestic	26	7.9					26	7.9	Fresh water observed at 26 ft. in gravel.
Lot 012	708775 4918741	5103964	Domestic	78	23.8	18	5.5	12.49	56.7	78	23.8	Fresh water observed at 78 ft. in gravel.
Lot 012	708784 4918722	5103965	Domestic	71	21.6	12	3.7	5	22.7	71	21.6	Fresh water observed at 71 ft. in gravel.
Lot 012	708783 4918720	5103966	Domestic	80	24.4	24	7.3	4	18.2	80	24.4	Fresh water observed at 80 ft. in gravel.
Lot 012	708656 4918908	5103914	Domestic	64	19.5	2	0.6	6.66	30.2	64	19.5	Fresh water observed at 64 ft. in gravel.
Lot 012	708682 4918876	5103916	Domestic	39	11.9	0	0.0			40	12.2	Fresh water observed at 40 ft. in gravel.
Lot 012	708651 4918849	5103967	Domestic	65	19.8	8	2.4	8.33	37.8	65	19.8	Fresh water observed at 65 ft. in gravel.
Lot 012	708685 4918843	5105087	Domestic	41	12.5	6	1.8	4.16	18.9	41	12.5	Fresh water observed at 41 ft. in gravel.
Lot 012	708685 4918843	5105088	Domestic	56	17.1	8	2.4	5.83	26.5	56	17.1	Fresh water observed at 56 ft. in gravel.
Lot 012	708648 4918820	5103386	Domestic	36	11.0	2	0.6	8.33	37.8	36	11.0	Fresh water observed at 36 ft. in gravel.
Lot 012	708645 4978823	5103972	Domestic	52	15.8	8	2.4	8.32	37.8	54	16.5	Fresh water observed at 52 ft. in gravel.
Lot 012	708635 4918815	5103913	Domestic	49	14.9	0	0.0	6.66	30.2	49	14.9	Fresh water observed at 49 ft. in gravel.
Lot 012	708656 4919146	5103928	Commercial	63	19.2	2	0.6			63	19.2	Fresh water observed at 63 ft. in gravel.
Lot 012	708415 4918723	5108839	Domestic	20	6.1	18	5.5	9.16	41.6	30	9.1	Fresh water observed at 20 ft. in clay.
Lot 012	708548 4918748	5103962	Domestic	44	13.4			11.09	50.3	47	14.3	Fresh water observed at 44 ft. in gravel.
Lot 012	708556 4918743	5103968	Domestic	32	9.8	0	0.0	4	18.2	36	11.0	Fresh water observed at 32 ft. in gravel.
Lot 012	708560 4918744	5103912	Doemstic	25	7.6	0.33	0.1	5	22.7	28	8.5	Fresh water observed from 25 to 28 ft. in gravel.
Lot 012	708615 4919073	5104630	Domestic	26	7.9	5	1.5	4	18.2	68	20.7	Fresh water observed at 26 ft. in clay.
Lot 012	708489 4919147	7345066	Public	40	12.2	6.67	2.0	1.66	7.5	45	13.7	Fresh water observed at 40 ft. in sand.
Lot 012	708435 4918833	5105209	Domestic	58	17.7	3	0.9	5.8	26.3	60	18.3	Fresh water observed at 58 ft. in gravel.
Lot 012	708596 4918914	5103961	Domestic	60	18.3			8	36.3	60	18.3	Fresh water observed at 66 ft. in gravel.
Lot 013	708827 4918736	5104000	Domestic	50	15.2	20	6.1	8.33	37.8	50	15.2	Fresh water observed at 50 ft. in gravel.
Lot 013	708838 4918716	5104005	Domestic	54	16.5	20	6.1	6.66	30.2	54	16.5	Fresh water observed at 54 ft. in gravel.
Lot 013	708888 4918974	5104014	Domestic	51	15.5	5	1.5	7.49	34.0	56	17.1	Fresh water observed at 51 ft. in gravel.
Lot 013	709065 4918948	5106230	Domestic	55	16.8	35	10.7	16.65	75.6	55	16.8	Fresh water observed at 55 ft. in gravel.
Lot 013	708955 4918923	5105792	Doemstic	45	13.7	12	3.7	4.99	22.7	45	13.7	Fresh water observed at 45 ft. in gravel.
Lot 013	708786 4918890	5103999	Domestic	64	19.5	12	3.7	16.65	75.6	64	19.5	Fresh water observed at 64 ft. in gravel.
Lot 013	708767 4918881	5119406	Domestic	54	16.5	28	8.5	4.99	22.7	54	16.5	Fresh water observed at 54 ft. in sand and gravel.
Lot 013	708804 4918872	5103996	Domestic	74	22.6	12	3.7	10.83	49.2	74	22.6	Fresh water observed at 74 ft. in sand and gravel.
Lot 013	708815 4918873	5105089	Domestic	39	11.9	3	0.9	4.99	22.7	39	11.9	Fresh water observed at 39 ft. in gravel.
Lot 013	708815 4918873	5105090	Domestic	39	11.9	5	1.5	4.16	18.9	39	11.9	Fresh water observed at 39 ft. in gravel.
Lot 013	708803 4918856	5103998	Domestic	58	17.7	12	3.7	9.99	45.4	62	18.9	Fresh water observed at 58 ft. in gravel.
Lot 013	708688 4918980	5103995	Domestic	71	21.6	6	1.8	6.66	30.2	71	21.6	Fresh water observed at 71 ft. in clay and gravel.
Lot 013	708714 4919121	5104001	Domestic	45	13.7	10	3.0	5.83	26.5	45	13.7	Fresh water observed at 45 ft. in sandy gravel.
Lot 013	708735 4919123	5104420	Domestic	45	13.7	6	1.8	4	18.2	46	14.0	Fresh water observed at 45 ft. in gravel.
Lot 013	708926 4919168	5104004	Domestic	25	7.6	0	0.0	8.32	37.8	30	9.1	Fresh water observed at 25 ft. in gravel.
Lot 013	708951 4919180	5104003	Domestic	25	7.6	4	1.2	8.33	37.8	28	8.5	Fresh water observed at 25 ft. in gravel.
Lot 013	708965 4919153	5106300	Domestic	40	12.2	0	0.0	8.33	37.8	42	12.8	Fresh water observed at 40 ft. in gravel.
Lot 013	708965 4919143	5104733	Domestic	36	11.0	4	1.2	4	18.2	36	11.0	
Lot 013	709075 4919133	5104539	Domestic	45	13.7	18	5.5	6.66	30.2	49	14.9	Fresh water observed at 45 ft. in gravel.
Lot 013	709015 4919123	5105414	Domestic	46	14.0	12	3.7	6.66	30.2	46	14.0	Fresh water observed at 46 ft. in gravel.
Lot 013	709075 4919093	5104538	Domestic	41	12.5	18	5.5	5.83	26.5	41	12.5	Fresh water observed at 41 ft. in gravel.
Lot 013	709026 4919050	5106828	Domestic	35	10.7	15	4.6	8.33	37.8	35	10.7	Fresh water observed at 35 ft. in gravel.
Lot 013	709115 4919073	5106263	Doemstic	40	12.2	8	2.4	5.83	26.5	42	12.8	Fresh water observed at 40 ft. in gravel.
Lot 013	709085 4919053	5105793	Domestic	40	12.2	28	8.5	4.16	18.9	40	12.2	Fresh water observed at 40 ft. in gravel.
Lot 013	708885 4919083	5104540	Domestic	39	11.9	12	3.7	5.83	26.5	39	11.9	Fresh water observed at 39 ft. in gravel.
Lot 013	708865 4919083	5104734	Domestic	43	13.1	2	0.6	4.16	18.9	44	13.4	Fresh water observed at 43 ft. in gravel.
Lot 013	708815 4919073	5109034	Domestic	48	14.6	0	0.0	4.16	18.9	48	14.6	Fresh water observed at 48 ft. in gravel.
Lot 013	708680 4919117	7180253	Domestic		15.7	5.97	1.8	4.84	22.0	51.18	15.6	
Lot 013	708665 4919223	5105206	Doemstic	57	17.4	0	0.0	4	18.2	59	18.0	Fresh water observed at 57 ft. in gravel.
Lot 013	708723 4919159	5103997	Domestic	42	12.8	3	0.9	8.33	37.8	45	13.7	Fresh water observed at 42 ft. in sand and gravel.
Lot 013	708785 4919173	5105027	Domestic	60	18.3	10	3.0	20.82	94.5	62	18.9	Fresh water observed at 60 ft. in sand.
Lot 013	708795 4919203	5108022	Domestic	34	10.4	2	0.6	3.33	15.1	35	10.7	Fresh water observed at 34 ft. in gravel.
Lot 013	708840 4919148	5106162	Domestic	61	18.6	8	2.4	8.33	37.8	61	18.6	Fresh water observed at 61 ft. in gravel.
Lot 013	708863 4919215	5103992	Domestic	51	15.5					51	15.5	Fresh water observed at 51 ft. in gravel.
Lot 013	708875 4919225	5106600	Domestic	38	11.6	1	0.3	11.66	52.9	41	12.5	Fresh water observed at 38 ft. in gravel.
Lot 013	708919 4919222	5106862	Domestic	42	12.8	2	0.6	5.83	26.5	46	14.0	Fresh water observed at 42 ft. in gravel.
Lot 013	708944 4919297	5106840	Domestic	35	10.7	3	0.9	5.83	26.5	38	11.6	Fresh water observed at 35 ft. in sand.
Lot 013	708986 4919280	5106863	Domestic	34	10.4	2	0.6	5.83	26.5	37	11.3	Fresh water observed at 34 ft. in gravel.
Lot 013	708983 4919305	5103993	Domestic	53	16.2	33	10.1	6.66	30.2	53	16.2	Fresh water observed at 53 ft. in gravel.
Lot 013	708984 4919339	5106839	Domestic	30	9.1	2	0.6	8.33	37.8	31	9.4	Fresh water observed at 30 ft. in gravel.
Lot 013	709061 4919300	5106599	Domestic	28	8.5	0	0.0	5.83	26.5	32	9.8	Fresh water observed at 28 ft. in gravel.
Lot 013	709079 4919337	5103994	Domestic	65	19.8	8	2.4	8.32	37.8	65	19.8	Fresh water observed at 65 ft. in gravel.
Lot 017	708593 4918896	5103963	Domestic	66	20.1	8	2.4	16.65	75.6	66	20.1	Fresh water observed at 66 ft. in gravel.
Lot 022	708900 4918798	5105997	Domestic	42	12.8	25	7.6	8.33	37.8	44	13.4	Fresh water observed at 42 ft. in gravel.
Concession 8												
Lot 012	708695 4919519	7126130	Domestic	60	18.29	10.75	3.28	4.99	22.65	60	18.3	Fresh water observed at 60 ft. in gravel.
Lot 012	708565 4919273	5109950	Domestic	44	13.41	4	1.22			45	13.7	Fresh water observed at 44 ft. in gravel.
Lot 012	708505 4919191	5104061	Abandoned - Supply									
Lot 013	708786 4919751	5104066	Domestic	31	9.45					31	9.4	Fresh water observed at 31 ft. in gravel.
Lot 013	708865 4919695	5112008	Domestic	48	14.63	8	2.44	8.33	37.82	50	15.2	Fresh water observed at 48 ft. in gravel.
Lot 013	708874 4919692	5118333	Domestic	62	18.90	10	3.05	6.66	30.24	62	18.9	Fresh water observed at 62 ft. in gravel.
Lot 013	708767 4919582	7149384	Abandoned - Other									
Lot 013	708757 4919581	7144540	Domestic	57	17.37	3	0.91	4.16	18.89	57	17.4	Fresh water observed at 57 ft. in gravel.
Lot 013	708670 4919498	7292698										Wellhead was raised to meet regulation.
Lot 013	708649 4919466	5104067	Domestic	31	9.45			4.99	22.65	31	9.4	Fresh water observed at 31 ft. in gravel.
Lot 013	708577 4919345	5104068	Domestic	21	6.40	7	2.13	0.83	3.77	23	7.0	Fresh water observed at 21 ft. in gravel.
Lot 013	708571 4919311	5104070	Domestic	32	9.75	12	3.66	8.33	37.82	33	10.1	Fresh water observed at 32 ft. in gravel.
Lot 013	708789 4919294	5106597	Domestic	46	14.0	1	0.3	6.66	30.2	52	15.8	Fresh water observed at 46 ft. in gravel.
Lot 013	708701 4919244	5104006	Domestic	48	14.6	18	5.5	6.66	30.2	48	14.6	Fresh water observed at 48 ft. in gravel.
Lot 014	708990 4919717	5104073	Domestic	32	9.75	18	5.49	11.66	52.94	34	10.4	Fresh water observed at 32 ft. in gravel.

Number of Wells: 91 90

	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
TOTALS	4075.0	1257.8	744.7	227.0	549.1	2493.1	4274.2	1302.8
AVERAGE	46.8	14.3	9.2	2.8	6.9	31.2	48.6	14.8
MAXIMUM	80.0	24.4	35.0	10.7	20.8	94.5	80.0	24.4
MINIMUM	12.0	3.7	0.0	0.0	0.8	3.8	12.0	3.7

Appendix F

MECP Well Records – Pumping Tests

Ontario — Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. (Place Sticker and/or Print Below) A358382

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
GRANITE	RIDGE BUILDERS		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
BOX 100	BUCKHORN	ONT	K0L1J0	7057579311

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
	SMITH		

County/District/Municipality	City/Town/Village	Province	Postal Code
PETERBOROUGH	BRIDGENORTH	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	708328	4911731		

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
BROWN	SANDY	CLAY	DENSE	0	4
GREY	CLAY		DENSE	4	49
GREY	CLAY	STONES	HARDPAN	49	63
GREY	GRAVEL		COARSE	63	66

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0	63	BENTONITE SLURRY	18 ft^3

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4	STEEL	.188	+2	66

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☒ 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

Water Details

Water found at Depth (m/ft)	☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify
66		

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	63	9"
63	66	6"

Results of Well Yield Testing

After test of well yield, water was:
☒ Clear and sand free
☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft): 61.4

Pumping rate (l/min / GPM): 15

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 61.4

If flowing give rate (l/min/GPM):

Recommended pump depth (m/ft): 55

Recommended pump rate (l/min/GPM): 6

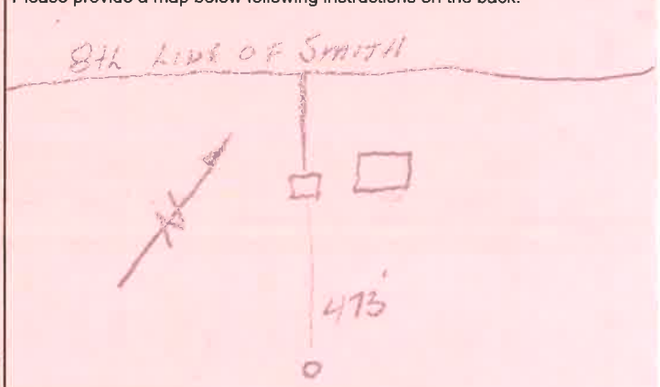
Well production (l/min/GPM): 9.6

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	7.7		61.4
1	17.1	1	52.7
2	23.2	2	46.4
3	29.0	3	41.2
4	34.1	4	37.3
5	38.6	5	33.2
10	53.1	10	18.7
15	61.4	15	12.7
20		20	10.2
25		25	8.6
30		30	7.9
40		40	7.8
50		50	7.8
60	61.4	60	7.7

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
JOE LEGGE & SONS	7052

Business Address (Street Number/Name)	Municipality
RR#3	BANCROFT

Province	Postal Code	Business E-mail Address
ONT	K0L1C0	

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6133349254	LEGGE JOE

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
1819	Joe Legge	

Well owner's information package delivered: ☐ Yes ☒ No

Date Package Delivered: ____

Date Work Completed: 2023/04/28

Ministry Use Only

Audit No. Z398468

Received

0506E (2020/06) © Queen's Printer for Ontario, 2020

Well Owner's Copy

Ontario — Ministry of the Environment, Conservation and Parks

Well Tag No. (Place Sticker and/or Print Below): A358381

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
GRANITE	RIDGE BUILDERS		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
BOX 100	BUCKHORN	ONT	K0L 1C0	705 657 9311

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
	SMITH		

County/District/Municipality	City/Town/Village	Province	Postal Code
PETERBOROUGH	BRIDGENORTH	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	708294	4919161		

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
BROWN	SANDY	CLAY	DENSE	0	4
GREY	CLAY		DENSE	4	46
GREY	CLAY	STONES	HARD ROCK	46	64
GREY	GRAVEL		COARSE	64	67

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0	64	BENTONITE SLURRY	19 ft^3

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6¼	STEEL	.188	+2	67

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☒ 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

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water	Other, specify
67	☐	☐ Fresh ☒ Untested	
	☐	☐ Fresh ☐ Untested	
	☐	☐ Fresh ☐ Untested	

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	64	9"
64	67	6"

Results of Well Yield Testing

After test of well yield, water was:
☒ Clear and sand free
☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft): 60.1

Pumping rate (l/min / GPM): 15

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 60.1

If flowing give rate (l/min/GPM)

Recommended pump depth (m/ft): 55

Recommended pump rate (l/min/GPM): 4

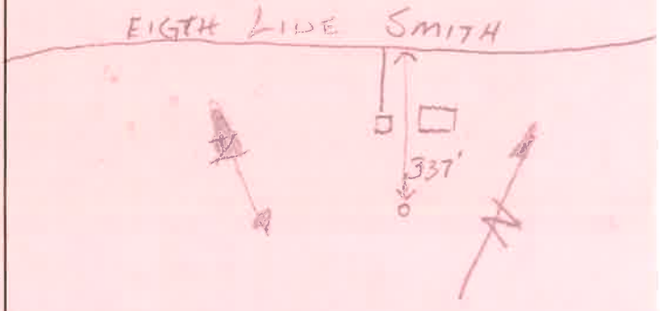
Well production (l/min/GPM): 5

Disinfected? ☒ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		5.3		60.1
1		15.1	1	50.0
2		22.1	2	48.1
3		29.6	3	44.2
4		36.7	4	40.4
5		43.5	5	36.7
10		60.1	10	20.1
15			15	15.6
20			20	11.2
25			25	10.1
30			30	9.3
40			40	7.6
50		↓	50	6.4
60		60.1	60	5.9

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
JOE LEGGE & SONS	7052

Business Address (Street Number/Name)	Municipality
RR#3	BANCROFT

Province	Postal Code	Business E-mail Address
ONT	K0L 1C0	

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
613 334 9254	LEGGE JOE

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
1879	Joe Legge	

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☐ Yes ☒ No		2023 05 01

Ministry Use Only

Audit No. Z398469

Received

Well Owner's Copy

Appendix G

Sewage System Calculations Sheet

* These numbers are for the property as a whole *

SEWAGE SYSTEM CALCULATION SHEET

Date: 12/7/2022

Name: Proposed Tri-Plexes & Rental House **Location:** Bridgenorth

1. SEWAGE FLOW

a) Number of bedrooms 5 = 2500 Litres (1) (max. 2500 litres)

(1 bed = 750 2 bed = 1100 3 bed = 1600 4 bed = 2000 5 bed = 2500)

(If over 5 bedrooms, use 2,500 & add extra bedrooms below.)

Total of all bedrooms

Extra bedrooms 7 x 500 = 3500 Litres (1-a) 6000 litres

b) Living Space 6500 Sq. Ft. = 605 m2

(Each 10 m2 between 200 - 400 m2) 20 x 100 = 2000 Litres

(Each 10 m2 over 400 m2) 21 x 75 = 1575 Litres

Total 3575 Litres (2)

c) Total Fixture Units 78

Each fixture over 20 58 x 50 = 2900 Litres (3)

Add 1a plus the higher of 1b or 1c (except as noted below)

* As of 2013, if over 5 bedrooms use 2500 plus extra bedrooms (at 500 each) or total living space (2) or total fixtures (3) which ever is higher.

Total Sewage Flow: (Q) **6000 Litres**

2. SEPTIC TANK SIZE

Residential Occupancy:	Sewage Flow	6000	x 2	12000 Litres
Commercial Occupancy:	Sewage Flow		x 3	0 Litres
Holding Tank:	Sewage Flow		x 7	0 Litres
				Gallons

3. LOADING RATE

Percolation Time	Loading Rate
2 - 20	10
20 - 35	8
35 - 50	6
>50	4

6000 Sewage Flow / 10 Loading Rate = Loading Area 600.0 m2 / 6458.4 Sq. Ft.

4. FILTER BED SIZE

Sewage Flow <3000 Litres/day		/ 75 =	0.0 m2 of filter bed	0.0 Sq. Ft.
Sewage Flow >3000 Litres/day	6000	/ 50 =	120.0 m2 of filter bed	1291.7 Sq. Ft.

5. FILTER BED CONTACT AREA

Sewage Flow 6000

Percolation Rate

0.0 m2 of contact area 0.0 Sq. Ft.

(Formula = Sewage flow x Perc. Rate / 850)

Bedrooms

Rental House	4 bedrooms	2000
Unit # 1	4 bedrooms	2,000
Unit # 2	4 bedrooms	2,000
		6,000

Living Space

Rental House		900 ft²	6500 ft² = 605 m²
Unit # 1	A)	800	each 10m² between 200-400 =
	B)	800	20 x 100 = 2000
	C)	1200	each 10 m² over 400
Unit # 2	A)	800	21 x 75 = 1575
	B)	800	
	C)	1200	3575

6,500 ft²

Fixtures

Rental House			18
Unit 1	1 3pc bath	6	
	1 kitchen sink	1.5	
	1 DW	1	
	1 washer	1.5	
		10 x 6 units	60
			78

fixtures

SEWAGE SYSTEM CALCULATION SHEET

Date: 12/7/2022

Name: Proposed Triplex #2 **Location:** 949 8th Line

1. SEWAGE FLOW

a) Number of bedrooms 4 = 2000 Litres (1) (max. 2500 litres)

(1 bed = 750 2 bed = 1100 3 bed = 1600 4 bed = 2000 5 bed = 2500)

(If over 5 bedrooms, use 2,500 & add extra bedrooms below.)

Total of all bedrooms: 2000 litres

Extra bedrooms _____ x 500 = 0 Litres (1-a)

b) Living Space 2800 Sq. Ft. = 260 m2

(Each 10 m2 between 200 - 400 m2) 6 x 100 = 600 Litres

(Each 10 m2 over 400 m2) _____ x 75 = 0 Litres

Total 600 Litres (2)

c) Total Fixture Units 30

Each fixture over 20 10 x 50 = 500 Litres (3)

Add 1a plus the higher of 1b or 1c (except as noted below) 2600

* As of 2013, if over 5 bedrooms use 2500 plus extra bedrooms (at 500 each) or total living space (2) or total fixtures (3) which ever is higher.

Total Sewage Flow: (Q) 2600 Litres

2. SEPTIC TANK SIZE

Residential Occupancy:	Sewage Flow	2600	x 2	5200 Litres
Commercial Occupancy:	Sewage Flow	_____	x 3	0 Litres
Holding Tank:	Sewage Flow	_____	x 7	0 Litres
				_____ Gallons

3. LOADING RATE

Percolation Time	Loading Rate
2 - 20	10
20 - 35	8
35 - 50	6
>50	4

2600 Sewage Flow / 10 Loading Rate

Loading Area: 260.0 m2 = 2798.6 Sq. Ft.

4. FILTER BED SIZE

Sewage Flow <3000 Litres/day: 2600 / 75 = 34.7 m2 of filter bed = 373.2 Sq. Ft.

Sewage Flow >3000 Litres/day: _____ / 50 = 0.0 m2 of filter bed = 0.0 Sq. Ft.

5. FILTER BED CONTACT AREA

Sewage Flow 2600

Percolation Rate 15

45.9 m2 of contact area = 493.9 Sq. Ft.

(Formula = Sewage flow x Perc. Rate / 850)

Township of Selwyn
PO Box 270
Bridgenorth ON K0L 1H0
Tel 705-292-9507 Fax 705-292-8964

TAX BILL

REPRINT-2019 Final (FTX0083)

Billing Date Oct. 22, 2019

Roll No. 1516 020 202 22300 0000

Group Code

.gage Company

Mortgage Account #

Mailing Information

1447147 ONTARIO INC
PO BOX 100
BUCKHORN ON K0L 1J0

Legal Owner and Legal Description

1447147 ONTARIO INC

949 8TH LINE
CON 7 PT LOT 13 BLK NO 17617
REG
2.51AC 200.00FR 601.90D

Assessments		Municipal			Education	
Tax Class	Value	Municipal Levies	Tax Rate %	Amount	Tax Rate %	Amount
RTEP	246,500	MUNICIPAL	.217340	535.74	.161000	396.87
RTEP	246,500	POLICE S-E/D-D AREA	.074838	184.48		
RTEP	246,500	Conservation Levy	.006701	16.52		
RTEP	246,500	COUNTY	.342050	843.15		

Sub Totals		Municipal Levy	1,579.89	Education Levy	396.87

SPECIAL CHARGES / CREDITS

SUMMARY

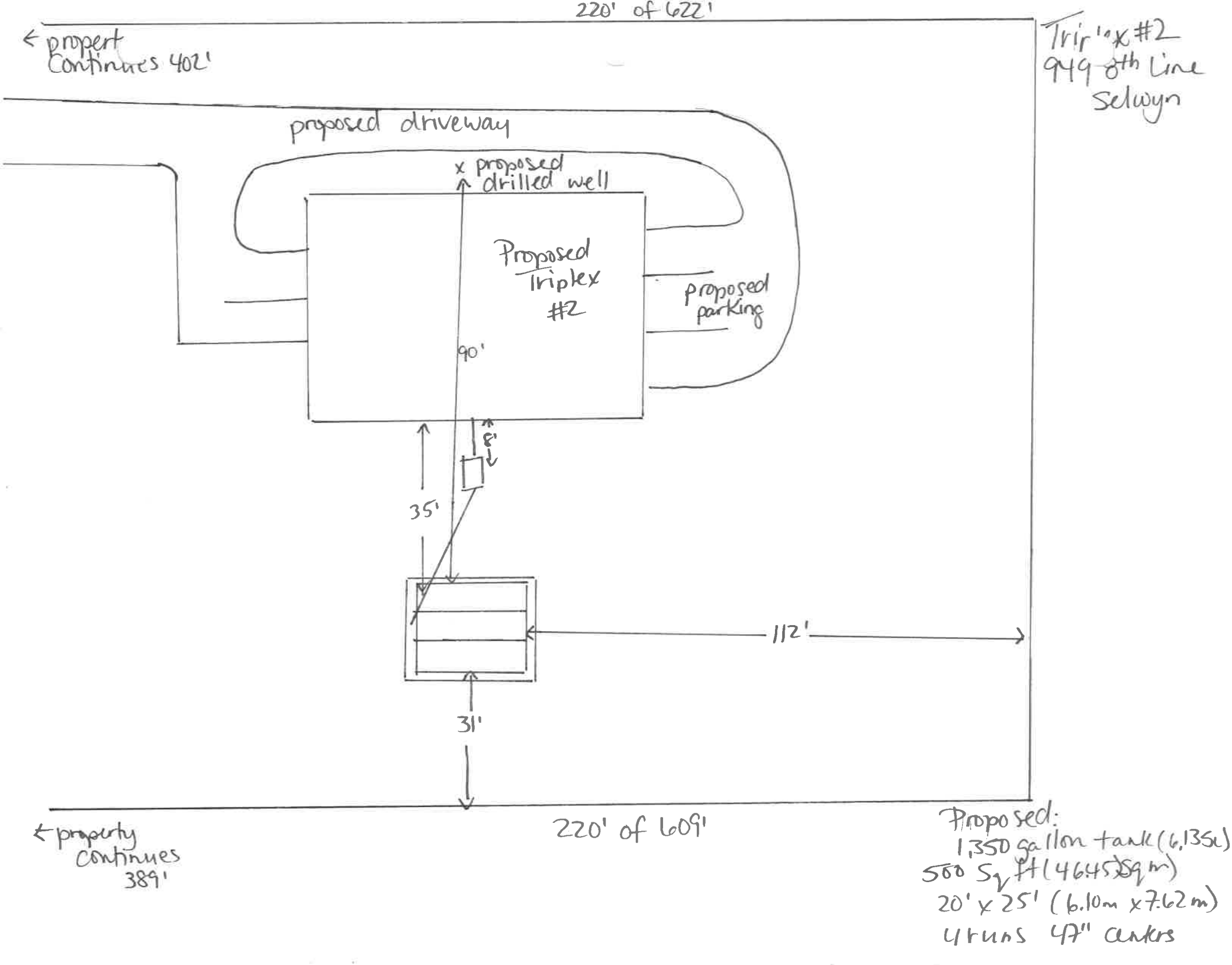
Tax Levy Sub-total (Municipal + Education)	1,976.76
Special Charges/Credits	.00
	.00
2019 Tax Cap Adjustment	.00
Final 2019 Taxes	1,976.76
Less Interim Billing	941.37
Past Due / Credit (as of Oct. 22,2019)	-1,035.39
Total Amount Due	0.00

Total 0.00

1st INSTALLMENT Aug. 12, 2019 518.00

2nd INSTALLMENT Oct. 07, 2019 517.39

If a mortgage company name appears under Roll No. this bill is for information only - do not pay
if are paying by pre-authorized payment (PAP) this bill is for information only - do not pay.
Penalty and/or interest are fixed at a rate of 1.25%. Penalty and/or interest will accrue on
unpaid taxes commencing the first day of default and the first day of each calendar month thereafter.


220' of 622'
← propert
Continues 402'
Trip'ex #2
949 8th Line
Selwyn
proposed driveway
x proposed
drilled well
Proposed
Triplex
#2
proposed
parking
90'
8'
35'
112'
31'
220' of 609'
← property
Continues
389'
Proposed:
1,350 gallon tank (6,135L)
500 Sq ft (46.45Sq m)
20' x 25' (6.10m x 7.62m)
4 runs 47" centers

Peterborough Public Health

Application for a Permit to Construct or Demolish

This form is authorized under subsection 8(1.1) of the Building Code Act.

For use by Principal Authority	
Application number	Permit number
Date received:	Roll number:

Application submitted to: PETERBOROUGH PUBLIC HEALTH

A. Project information

Building number, street name		Unit number	Lot	Con.
949 8th Line Selwyn		Triplex #2		
Municipality/Ward	**Postal Code**	**Plan number/other description**		
Selwyn	K9J 6X5	Roll #1516 020 202 22300		
Project value est. $		Project Dimensions (m2)		

B. Purpose of application

X New construction ___ Addition to an existing building ____ Alteration/repair ____ Demolition ____ Conditional Permit

Proposed use of building	Current use of building
Single Family Dwelling	Single Family Dwelling

Description of proposed work (reason for sewage system installation)

New system for a new build (triplex)

C. Applicant

Applicant is: ☐ Owner or X Authorized agent of owner

Last name	First name	Corporation or partnership	
BUCKHORN SAND & GRAVEL		CORPORATION	
Street Address		Unit number	Lot/con.
P. O. Box 100			
Municipality	**Postal Code**	**Province**	**E-mail**
Buckhorn	K0L 1J0	Ontario	
Telephone number	**Fax**		**Cell number**
(705) 657-9311	(705) 657-9627		( )

E-Mail Address: info@buckhornsandgravel.com

D. Owner (if different from applicant)

Last Name	First name	Corporation or partnership	
1447147 Ontario Inc	o/a Granite Ridge Estates		
Street address		Unit number	Lot/con.
P.O. Box 100			
Municipality	**Postal Code**		**E-mail**
Buckhorn	K0L 1J0		
Telephone number	**Email**		**Cell number**
705 657-9311	info@buckhornsandgravel.com		

E. Builder (optional)

Last Name	First name	Corporation or partnership	
Street address		Unit number	Lot/con.
Municipality	Postal Code	Province	E-mail
Telephone number	Fax ( )		Cell number ( )

F. Tarion Warranty Corporation (Ontario New Home Warranty Program)

i. Is proposed construction for a new home as defined in the *Ontario New Home Warranties Plan Act*? If no, go to section G. ☐ Yes **X** No

ii. Is registration required under the *Ontario New Home Warranties Plan Act*? ☐ Yes **X** No

iii. If yes to (ii) provide registration number(s): _____

G. Required Schedules

i) Attach Schedule 1 for each individual who reviews and takes responsibility for design activities.

ii) Attach Schedule 2 where application is to construct on-site, install or repair a sewage system.

H. Completeness and compliance with applicable law

i) This application meets all the requirements of clauses 1.3.1.3 (5) (a) to (d) Division C of the Building code (the application is made in the correct form and by the owner or authorized agent, all applicable fields have been completed on the application and required schedules, and all required schedules are submitted).	**X** Yes	____ NO
Payment has been made of all fees that are required, under the applicable by-law, resolution or regulation made under clase 7(1)(c) of the *Building Code Act, 1992*, to be paid when the applicaiton nade.	**X** Yes	____ NO
ii) This application is accompanied by the plans and specifications prescribed by the applicable by-law, resolution or regulation made under clause 7(1)(b) of the *Building Code Act, 1992.*	**X** Yes	____ NO
iii) This application is accompanied by the information and documents prescribed by the applicable by-law, resolution or regulation made under clause 7(1)(b) of the BuildingCode Act, 1992 which enable the chief building official to determine whether the proposed buildign, construction or demolition will contravene any applicable law.	**X** Yes	____ NO
iv) The proposed building, construction or demolition will not contravene any applicable law.	**X** Yes	____NO

H. Declaration of applicant.

I, **JEFF CHESHER** declare that:

(print name)

1. The information contained in this application, attached schedules, attached pans and specification, and other attached documentation is true to the best of my knowledge.
2. I have authority to bind the corporation or partnership (if applicable).

December 8, 2022
Date

Signature of applicant

Personal information contained in this form and schedules is collected under the authority of subsection 8(1.1) of the Building Code Act, 1992, and will be used in the administration and enforcement of the *Building Code Act, 1992*. Questions about the collection of personal information may be addressed to: a) the Chief Building Official of the municipality or upper-tier municipality to which this application is being made, or, b) the inspector having the powers and duties of a chief building official in relation to sewage systems or plumbing for an upper-tier municipality, board of health or conservation authority to whom this application is made, or, 2) Director, Building and Development Branch, Ministry of Municipal Affairs and Housing 777 Bay St., 2nd Floor, Toronto. M5G 2E5. (416) 585-6666.

Schedule 1: Designer Information

Use one form for each individual who reviews and take responsibility for design activities with respect to the project.

A. Project information

Building number, street name	Unit number	Lot.	Con.
94[illegible]th Line Selwyn		0	0

Municipality	Postal Code	Plan number/other description
Selwyn	K9J 6X5	Roll #1516 020 202 22300

B. Individual who reviews and takes responsibility for desing activites

Name	Firm
Jeff Chesher	BUCKHORN SAND & GRAVEL

Street address	Unit no	Lot/con.
P. O. Box 100		

Municipality	Postal Code	Province	E-Mail
Buckhorn	K0L 1J0	Ontario	info@buckhornsandgravel.com

Telephone number	Fax number	Cell number
(705) 657-9311	(705) 657-9627	

C. Designe activities undertaken by individual identified in Section B. (Building Code Table 2.20.2.1)

☐ House	☐ HVAC -House	☐ Building Structual
☐ Small Buildings	☐ Building Services	☐ Plumbing -House
☐ Large Buildings	☐ Detection,Lighting & Power	☐ Plumbing - All Buildings
☐ Comple Buildings	☐ Fire Protection	X On-Site Sewage Systems

Description of designer's work

Sewage system design & installation.

D. Declaration of designer

I, Jeff Chesher declare that (choose one as appropriate) :

☑ I review and take responsibilty for the design work on behal of a firm registers under subsection 2.17.4 of the Building code. I am qualified, and firm is registered, in the appropriate classes/categories.

Indivdual BCIN: 11330

Firm BCIN: 16113 BUCKHORN SAND & GRAVEL

☐ I review and take responsibilty for the design work and am qualified in the appropriate category as an "other designer" under subsection 2.17.5. of the Building Code

Indivdual BCIN: _____

Basis for exemption from registration: _____

☐ The design work is exempt from the registration and qualification requirements of the Building Code.

Basis for exemption from registration and qualification: _____

I certify that:

1. The information contained in this schedule is true to the best of my knowledge.
2. I have submitted this application with the knowledge and consent of the firm.

Dec 9 2022
Date

Signature of applicant

NOTE:

1. For the purposes of this form, "individual" means the "person" referred to in Clause 3.2.4.7(1) d). Of Division C, Article 3.2.5.1. of Division C, and all other persons who are exempt from qualification under Subsections 3.2.4. and 3.2.5. of Division C.
2. Schedul 1 is not required to be completed by a holder of a license, temporary license, or a certificate of practice, issued by the Ontario Association of [illegible]itects. Schedule 1 is also not required to be completed by a holder of license to practise, a limited license to practise, or a certificate of [illegible]orization, issued by theAssociation of Professional Engineers of Ontario.

Schedule 2: Sewage System Installer Information

A. Project information

Building number, street name	Unit number	Lot	Con.
94[illegible] 8th Line Selwyn		0	0

Municipality	Postal Code	Plan number/other description
Selwyn	K9J 6X5	Roll #1516 020 202 22300

B. Sewage system installer

Is the installer of the sewage system engaged in the business of construction on-site, installing, repairing, servicing, cleaning or emptying sewage systems, in accordance with Building Code Article 2.18.1.1?

X Yes (Continue to Section c) ☐ No (Continued to Section E) ☐ Installer unknown at time of application (Continue to Section E)

C. Registered installer information (where answer to B is "Yes")

Name		BCIN	
BUCKHORN SAND & GRAVEL		16113	
Street Address		**Unit number**	**Lot/con.**
P. O. Box 100			
Municipality	**Postal Code**	**Province**	**E-mail**
Buckhorn	K0L 1J0	Ontario	
Telephone number	**Fax**		**Cell number**
(705) 657-9311	(705) 657-9627		( )

D. Qualified supervisor information (where answer to section B is "Yes")

Name of qualified supervisor(s)	Building Code Identification Number (BCIN)
JEFF CHESHER	11330

E [illegible]eclaration of Applicant:

I, JEFF CHESHER (print name) declare that:

X I am the applicant for the permit to construct the sewage sytem. If the installer is unknown at the time of application, I shall submit a new Schedule 2 prior to construction when the installer is known;

OR

☐ I am the holder of the permit to construct the sewage system, and am submitting a new Schedule 2 now that the installer is known.

I certify that:

1. The information contained in this schedule is true to the best of my knowledge.
2. If the owner is a corporation or partnership, I have the authority to bind the corporation or partnership.

December 8, 2022
Date

Signature of applicant

A. Directions to the property:

From Chemong Rd, head to Bridgenorth. Follow Ward St through Bridgenorth, staying straight at lights. Follow past Jones Beach Rd (on left), around bend where Ward St. turns into 8th line. #949 will be just past the bend on the right hand side.

B. Site and Design Information:

Water Supply: Proposed (x) or Existing ( ) Municipal ( ) Drilled Well (x) or Dug Well ( ) Other: _____

Depth of Water-Tight Well Casing: _____

State number of Fixture Units:

Toilets		x 4		
Kitchen Sink	3	x 1.5	4.5	
Wash Basin		x 1.5		
Bathtub and/or Shower		x 1.5		
Dishwasher	3	x 1.0	3	
Clothes Washing Machine	3	x 1.5	4.5	
Single or Double Laundry Tub		x 1.5		
Floor Drain - 2 in. trap		x 2.0		
Floor Drain - 3 in. trap		x 3.0		

"Bathroom Group means: a group of plumbing fixtures installed in the same room consisting of 1 toilet 1 wash basin, and 1 tub, shower or tub/shower combo.

3 x 6.0 = 18

List any additional toilets, wash basin or tubs and/or showers below

Other - list details _____ Total 30

Total number of Bedrooms on the property:	A)	4
Total Floor Area of Buildings:	B)	2800
Total Fixture Units:	C)	30
Total Daily Design Flow Rate	L/Day	2600

Soils: Depth to bedrock: _____ Depth to high ground water table: _____

Percolation Rate: _____ Date of assessment: _____

Will more than one sewage system be used? Yes ( ) No (**X**)

H. Proposed Sewage System Design:

Class of Sewage System applied for:

( ) **Class 2:** Dimensions _____ Depth of Excavation: _____

( ) **Class 3:** Dimensions _____ Depth of Excavation: _____

(x) **Class 4:** Treatment Unit (x) Septic Tank: Capacity - 1,350 gallon (6135 L)

( ) Other (State manufacturer, model, size etc.) _____

_____

Leaching Bed:

(x) Filter bed Filter bed area: 500 sq ft (46.45 sq m) Expanded Contact Area:

Depth of excavation:

( ) Absorption trench

Total length of distribution pipe Maximum depth of trench excavation

( ) Other: List type and details of System:

( ) **Class 5:** Size of Holding Tank:

Attached Pump out Agreement ( ) Yes No ( )

Attention Applicant or Agent

- I agree to comply with the provisions of the Ontario Building Code, as amended. I further agree that neither the granting of a permit, nor the approval of plans, nor inspections made by the Inspector shall in any way relieve me from my responsibility for carrying out the work in accordance with the legislation mentioned above. I also understand that it is my responsibility to arrange for the necessary inspections as specified in writing by the Inspector at the time of permit issuance.

- Applicants are responsible for ensuring that the information provided is true and accurate. I also understand that, once a Permit has been issued, there shall be no change in the plans, specifications, documents or other information on which the Permit was issued unless, written authorization is first received from the Public Health Inspector. The Peterborough County-City Health Unit will not be held responsible for incorrect information provided herein by the applicant.

Owner's Signature

Dec. 9/22

Date

Agent's Signature

Dec. 9/22

Date

- The Inspector will return all applications, which are incomplete or unsigned. This application does not constitute a permit.

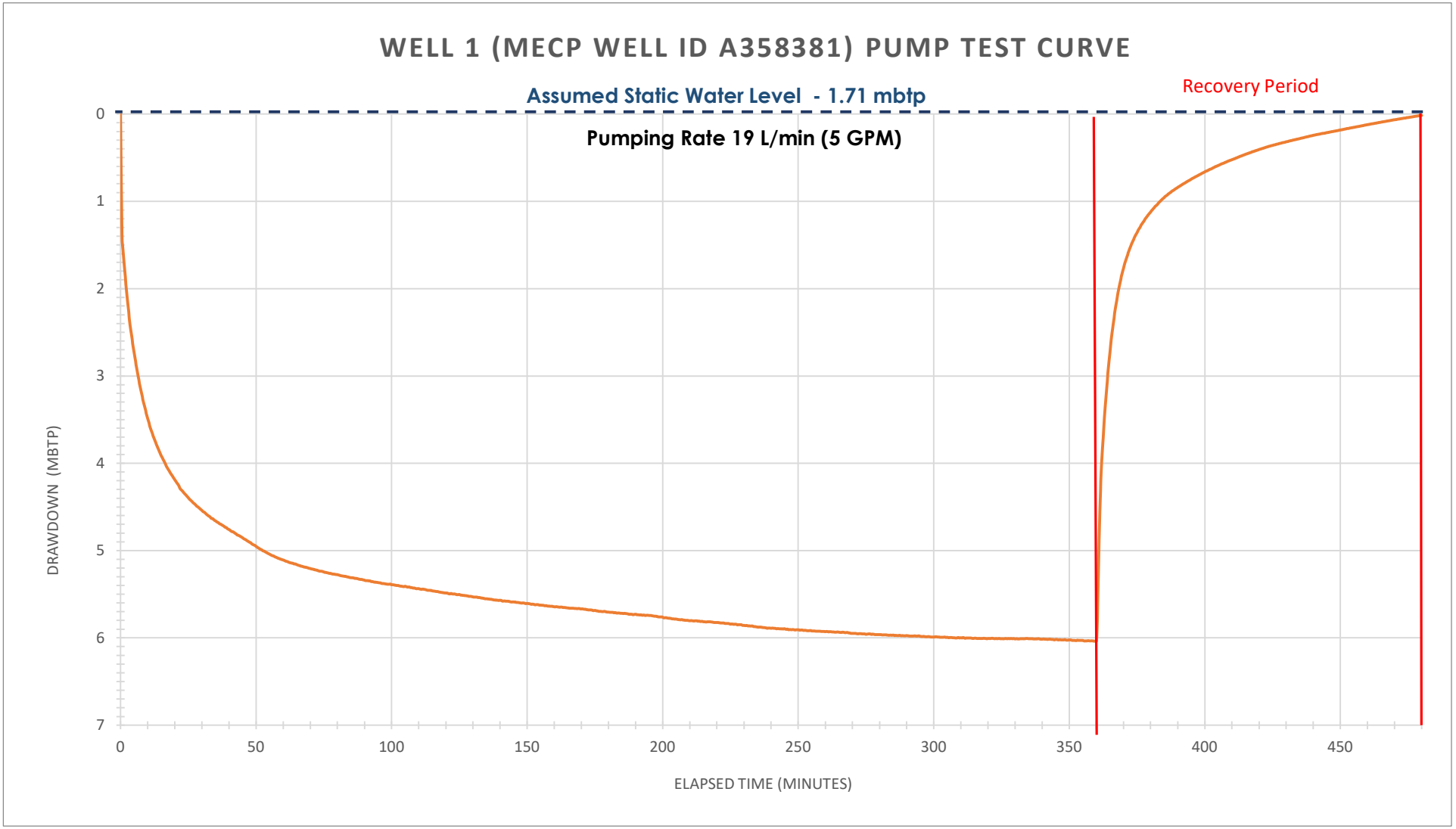
- **No work shall commence until a permit has been issued.**

Public Health

peterboroughpublichealth.ca
Jackson Square, 185 King Street
Peterborough, ON K9J 2R8
Phone: 705-743-1000 or Toll Free 1-877-743-0101
Fax: 705-743-2897

Appendix H

Pumping Test Hydrographs



Hydrograph

Well 1 (MECP ID A358381)

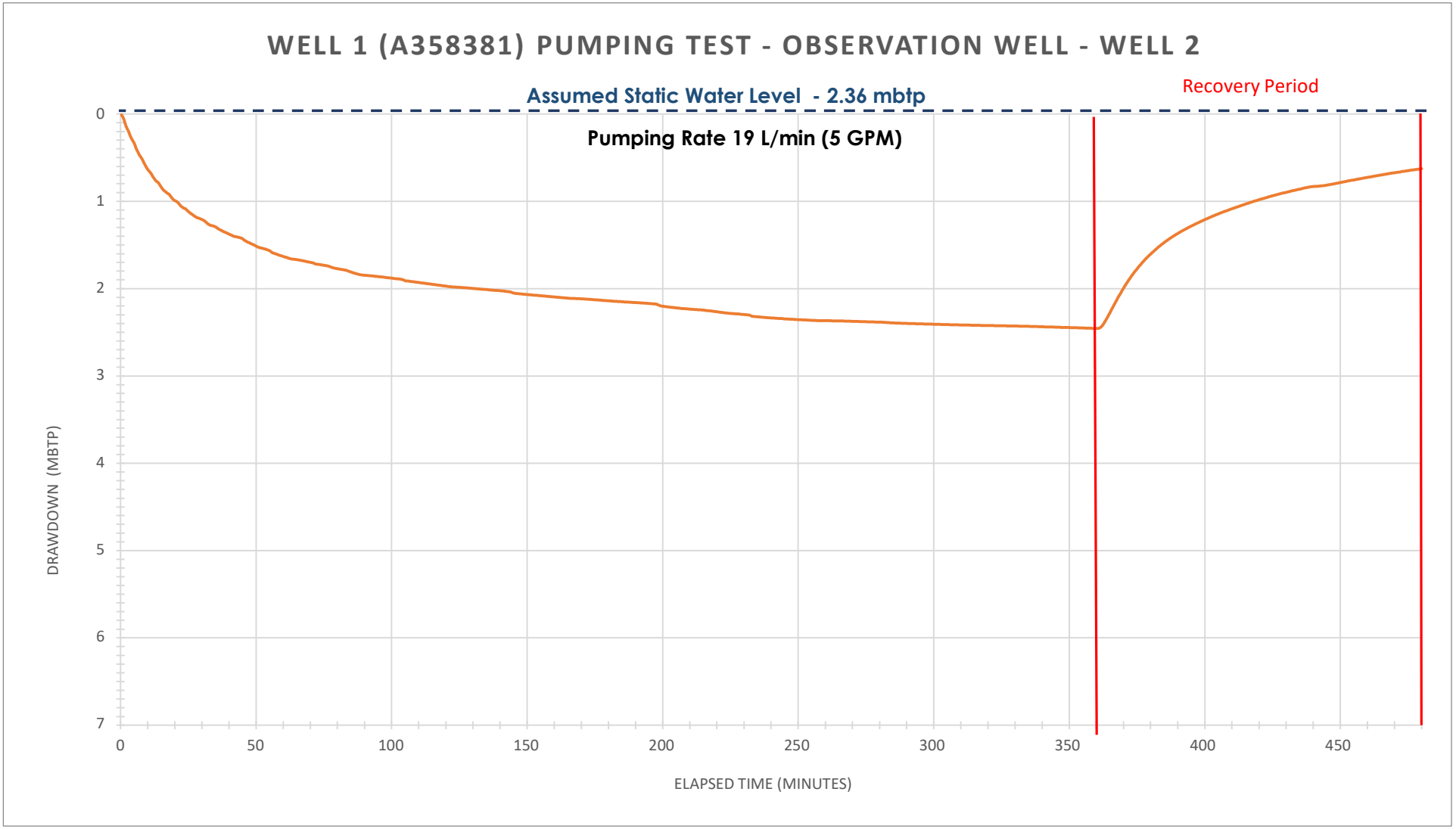
Pumping Date: May 10, 2023
Pumping Initiation Time: 8:32 am

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: LT
Checked By: IA
Date: May 12, 2023
Project No.: 85260



Hydrograph

Observation Well: Well 2 (MECP ID A358382)

Pumping Date: May 10, 2023

Pumping Initiation Time: 8:32 am

WILLS

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

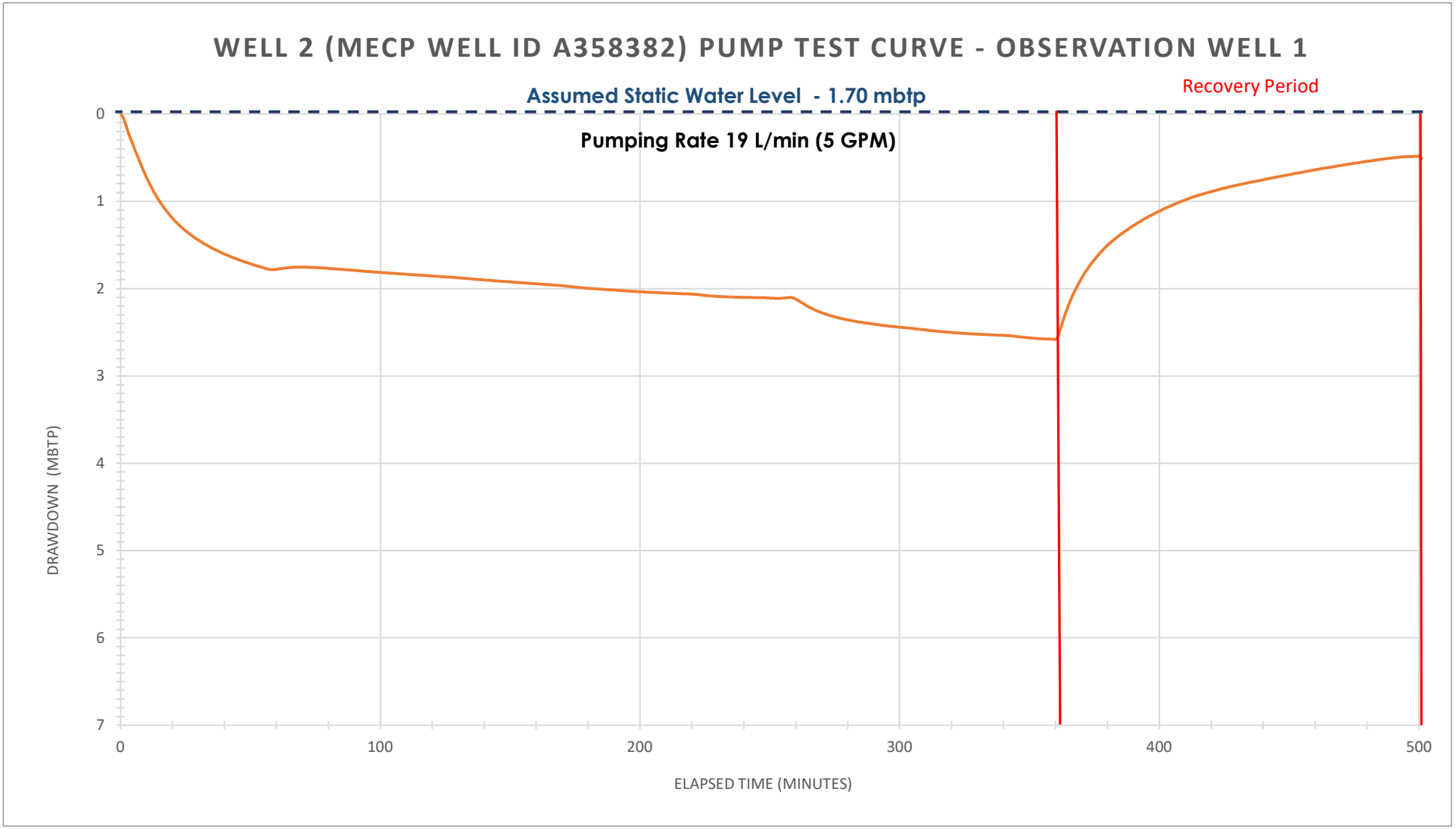
P. 705.742.2297
F. 705.748.9944
E. wills@dmwills.com

Created By: LT

Checked By: IA

Date: May 12, 2023

Project No.: 85260



Hydrograph

Observation Well - Well 1 (MECP ID A358381)

Pumping Date: May 11, 2023

Pumping Initiation Time: 8:10 am

WILLS

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

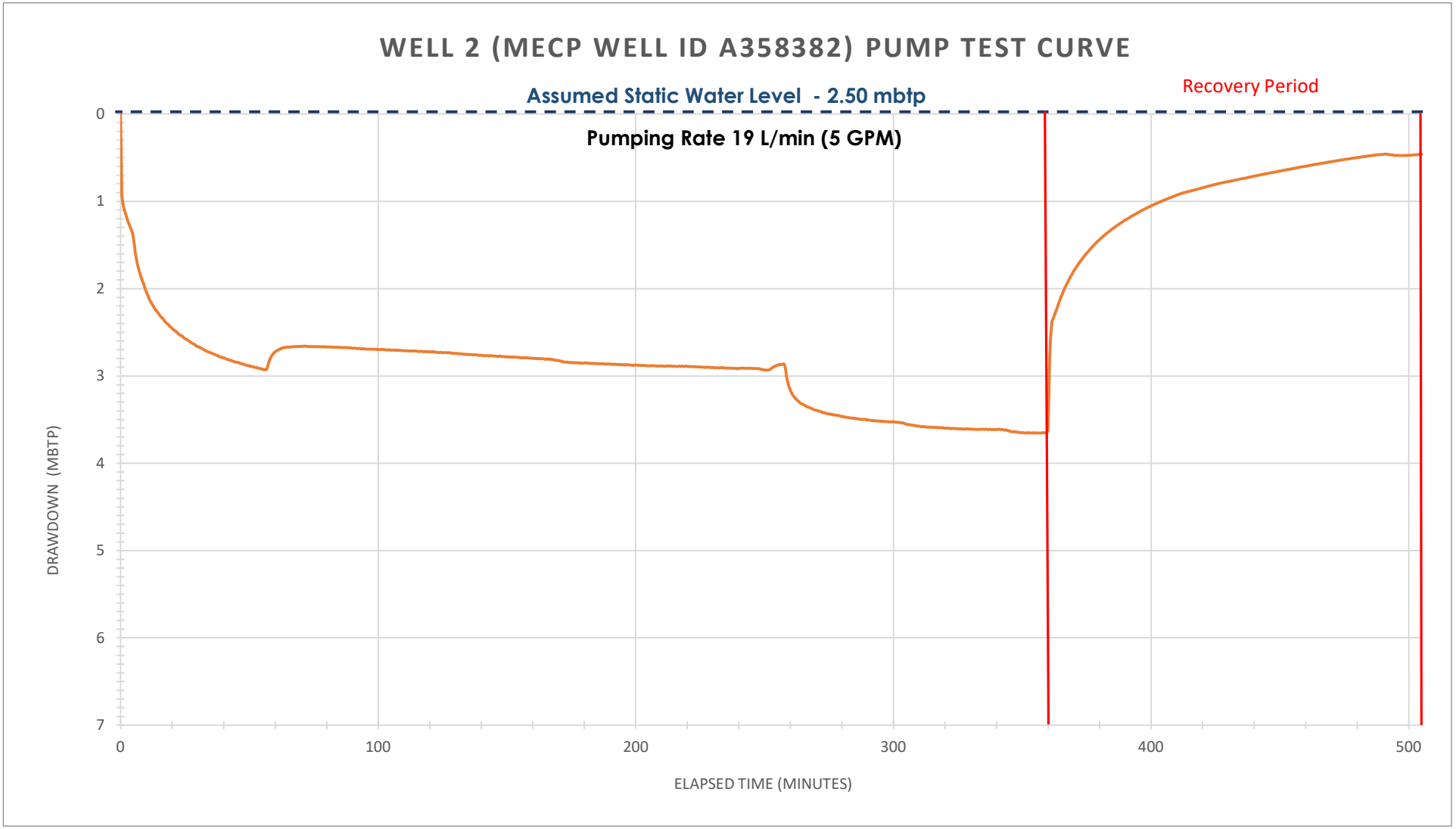
P. 705.742.2297
F. 705.748.9944
E. wills@dmwills.com

Created By: LT

Checked By: IA

Date: May 15, 2023

Project No.: 85260



Hydrograph

Well 2 - MECP ID A358382

Pumping Date: May 11, 2023
Pumping Initiation Time: 8:10 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: LT

Checked By: IA

Date: May 15, 2023

Project No.: 85260

Appendix I

Certificates of Analysis – Groundwater Pumping Tests

FINAL REPORT

CA14421-MAY23 R1

85260

Prepared for

D.M. Wills -Peterborough

FINAL REPORT

CA14421-MAY23 R1

First Page

CLIENT DETAILS

Client	D.M. Wills -Peterborough
Address	150 Jameson Drive Peterborough, ON K9J 0B9. Canada
Contact	Lynsey Tuters
Telephone	289-385-6230
Facsimile	705-741-3568
Email	ltuters@dmwills.com
Project	85260
Order Number	
Samples	Ground Water (2)

LABORATORY DETAILS

Project Specialist	Maarit Wolfe, Hon.B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2000
Facsimile	705-652-6365
Email	Maarit.Wolfe@sgs.com
SGS Reference	CA14421-MAY23
Received	05/10/2023
Approved	05/17/2023
Report Number	CA14421-MAY23 R1
Date Reported	05/17/2023

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: 8 degrees C
Cooling Agent Present: YES
Custody Seal Present: YES

Chain of Custody Number:031755

SIGNATORIES

Maarit Wolfe, Hon.B.Sc

TABLE OF CONTENTS

Client: D.M. Wills -Peterborough
Project: 85260
Project Manager: Lynsey Tuters
Samplers: L. Tuters/J. Gorman

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	85260 Well 1 - 1 hr	85260 Well 1 - 6 hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	10/05/2023	10/05/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
General Chemistry						
UV Transmittance	%T				75.8	94.4
Alkalinity	mg/L as CaCO3	2	500		258	253
Bicarbonate	mg/L as CaCO3	2			258	253
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			650	653
Total Suspended Solids	mg/L	2			95	9
Turbidity	NTU	0.10	5	1	75	14
Organic Nitrogen	mg/L	0.05	0.15		< 0.05	0.06
Total Kjeldahl Nitrogen (N)	as N mg/L	0.05			< 0.05	0.07
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
Ion Ratio	-	-9999			1.23	1.03
Total Dissolved Solids (calculated)	mg/L	-9999			410	377
Conductivity (calculated)	uS/cm	-9999			816	732
Langeliers Index 4° C	@ 4° C	-9999			0.58	0.46
Saturation pH 4°C	pHs @ 4°C	-9999			7.45	7.56

FINAL REPORT

CA14421-MAY23 R1

Client: D.M. Wills -Peterborough
Project: 85260
Project Manager: Lynsey Tuters
Samplers: L. Tuters/J. Gorman

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	85260 Well 1 - 1 hr	85260 Well 1 - 6 hr
					Sample Matrix	Ground Water	Ground Water
					Sample Date	10/05/2023	10/05/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics						
Fluoride	mg/L	0.06		1.5	0.18	0.18
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	< 0.06	< 0.06
Sulphate	mg/L	2	500		43	41
Sulphide	mg/L	0.02			< 0.02	< 0.02
Hardness	mg/L as CaCO3	0.05	100		404	332
Aluminum (total)	mg/L	0.001	0.1		0.313	0.044
Arsenic (total)	mg/L	0.0002		0.01	0.0007	0.0004
Boron (total)	mg/L	0.002		5	0.028	0.028
Barium (total)	mg/L	0.00008		1	0.184	0.169
Beryllium (total)	mg/L	0.000007			0.000025	< 0.000007
Bismuth (total)	mg/L	0.00001			< 0.00001	< 0.00001
Cobalt (total)	mg/L	0.000004			0.000221	0.000037
Calcium (total)	mg/L	0.01			129	101
Cadmium (total)	mg/L	0.000003		0.005	0.000004	< 0.000003
Copper (total)	mg/L	0.0002	1		0.0030	0.0007
Chromium (total)	mg/L	0.00008		0.05	0.00098	0.00029
Iron (total)	mg/L	0.007	0.3		1.92	0.868
Potassium (total)	mg/L	0.009			2.82	2.54
Magnesium (total)	mg/L	0.001			19.9	19.7

Client: D.M. Wills -Peterborough
Project: 85260
Project Manager: Lynsey Tuters
Samplers: L. Tuters/J. Gorman

MATRIX: WATER

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

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					Sample Number	7	8
					Sample Name	85260 Well 1 - 1 hr	85260 Well 1 - 6 hr
					Sample Matrix	Ground Water	Ground Water
					Sample Date	10/05/2023	10/05/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics (continued)						
Manganese (total)	mg/L	0.00001	0.05		0.0785	0.0275
Molybdenum (total)	mg/L	0.00004			0.00112	0.00099
Nickel (total)	mg/L	0.0001			0.0010	0.0006
Sodium (total)	mg/L	0.01	200	20	16.1	15.5
Phosphorus (total)	mg/L	0.003			0.083	0.009
Lead (total)	mg/L	0.00009		0.01	0.00063	0.00013
Silicon (total)	mg/L	0.02			9.40	8.68
Silver (total)	mg/L	0.00005			< 0.00005	< 0.00005
Strontium (total)	mg/L	0.00008			0.435	0.393
Thallium (total)	mg/L	0.000005			0.000007	< 0.000005
Tin (total)	mg/L	0.00006			0.00007	0.00008
Titanium (total)	mg/L	0.00005			0.02280	0.00439
Antimony (total)	mg/L	0.0009		0.006	< 0.0009	< 0.0009
Selenium (total)	mg/L	0.00004		0.05	< 0.00004	< 0.00004
Uranium (total)	mg/L	0.000002		0.02	0.00232	0.00134
Vanadium (total)	mg/L	0.00001			0.00070	0.00016
Zinc (total)	mg/L	0.002	5		0.005	0.004
Cation sum	meq/L	-9999			9.01	7.44
Anion Sum	meq/L	-9999			7.31	7.20
Anion-Cation Balance	% difference	-9999			10.45	1.66

Client: D.M. Wills -Peterborough
Project: 85260
Project Manager: Lynsey Tuters
Samplers: L. Tuters/J. Gorman

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	85260 Well 1 - 1 hr	85260 Well 1 - 6 hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	10/05/2023	10/05/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Microbiology						
Total Coliform	cfu/100mL	0		0	0	1
E. Coli	cfu/100mL	0		0	0	0
Heterotrophic Plate Count (HPC)	cfu/1mL	0			85	49
Other (ORP)						
pH	No unit	0.05	8.5		8.03	8.02
Chloride	mg/L	1	250		45	46
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
85260 Well 1 - 1 hr					
Turbidity	SM 2130	NTU	75	5	1
Aluminum	SM 3030/EPA 200.8	mg/L	0.313	0.1	
Hardness	SM 3030/EPA 200.8	mg/L as CaCO3	404	100	
Iron	SM 3030/EPA 200.8	mg/L	1.92	0.3	
Manganese	SM 3030/EPA 200.8	mg/L	0.0785	0.05	
85260 Well 1 - 6 hr					
Total Coliform	OMOE MICROMFDC-E3407A	cfu/100mL	1		0
Turbidity	SM 2130	NTU	14	5	1
Hardness	SM 3030/EPA 200.8	mg/L as CaCO3	332	100	
Iron	SM 3030/EPA 200.8	mg/L	0.868	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	EWL0306-MAY23	mg/L as CaCO3	2	< 2	ND	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)	SKA0128-MAY23	mg/L	0.04	<0.04	ND	10	101	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	DIO5066-MAY23	mg/L	1	<1	ND	20	108	80	120	116	75	125
Sulphate	DIO5066-MAY23	mg/L	2	<2	2	20	106	80	120	96	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	DIO0326-MAY23	mg/L	0.3	<0.3	ND	20	98	90	110	88	75	125
Nitrite (as N)	DIO0326-MAY23	mg/L	0.03	<0.03	ND	20	98	90	110	105	75	125
Nitrate (as N)	DIO0326-MAY23	mg/L	0.06	<0.06	2	20	102	90	110	106	75	125
Bromide	DIO0328-MAY23	mg/L	0.3	<0.3	ND	20	100	90	110	86	75	125
Nitrite (as N)	DIO0328-MAY23	mg/L	0.03	<0.03	ND	20	99	90	110	99	75	125
Nitrate (as N)	DIO0328-MAY23	mg/L	0.06	<0.06	ND	20	98	90	110	94	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	SKA0129-MAY23	mg/L	1	<1	1	20	100	90	110	98	75	125
Total Organic Carbon	SKA0129-MAY23	mg/L	1	<1	1	20	100	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	EWL0306-MAY23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0306-MAY23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
OH	EWL0306-MAY23	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	EWL0293-MAY23	TCU	3	< 3	ND	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	EWL0306-MAY23	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	EWL0336-MAY23	mg/L	0.06	<0.06	ND	10	101	90	110	95	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)	EHG0026-MAY23	mg/L	0.00001	< 0.00001	0	20	103	80	120	99	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)	EMS0093-MAY23	mg/L	0.00005	<0.00005	ND	20	105	90	110	94	70	130
Aluminum (total)	EMS0093-MAY23	mg/L	0.001	<0.001	1	20	104	90	110	121	70	130
Arsenic (total)	EMS0093-MAY23	mg/L	0.0002	<0.0002	2	20	103	90	110	102	70	130
Barium (total)	EMS0093-MAY23	mg/L	0.00008	<0.00008	0	20	95	90	110	100	70	130
Beryllium (total)	EMS0093-MAY23	mg/L	0.000007	<0.000007	ND	20	96	90	110	93	70	130
Boron (total)	EMS0093-MAY23	mg/L	0.002	<0.002	ND	20	101	90	110	98	70	130
Bismuth (total)	EMS0093-MAY23	mg/L	0.00001	<0.00001	ND	20	96	90	110	79	70	130
Calcium (total)	EMS0093-MAY23	mg/L	0.01	<0.01	1	20	101	90	110	92	70	130
Cadmium (total)	EMS0093-MAY23	mg/L	0.000003	<0.000003	ND	20	103	90	110	111	70	130
Cobalt (total)	EMS0093-MAY23	mg/L	0.000004	<0.000004	12	20	103	90	110	101	70	130
Chromium (total)	EMS0093-MAY23	mg/L	0.00008	<0.00008	ND	20	104	90	110	101	70	130
Copper (total)	EMS0093-MAY23	mg/L	0.0002	<0.0002	ND	20	104	90	110	105	70	130
Iron (total)	EMS0093-MAY23	mg/L	0.007	<0.007	ND	20	105	90	110	125	70	130
Potassium (total)	EMS0093-MAY23	mg/L	0.009	<0.009	1	20	105	90	110	83	70	130
Magnesium (total)	EMS0093-MAY23	mg/L	0.001	<0.001	0	20	98	90	110	95	70	130
Manganese (total)	EMS0093-MAY23	mg/L	0.00001	<0.00001	1	20	105	90	110	85	70	130
Molybdenum (total)	EMS0093-MAY23	mg/L	0.00004	<0.00004	0	20	107	90	110	105	70	130
Sodium (total)	EMS0093-MAY23	mg/L	0.01	<0.01	1	20	100	90	110	98	70	130
Nickel (total)	EMS0093-MAY23	mg/L	0.0001	<0.0001	ND	20	105	90	110	100	70	130
Lead (total)	EMS0093-MAY23	mg/L	0.00009	<0.00009	ND	20	98	90	110	98	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)	EMS0093-MAY23	mg/L	0.003	<0.003	ND	20	102	90	110	NV	70	130
Antimony (total)	EMS0093-MAY23	mg/L	0.0009	<0.0009	ND	20	101	90	110	95	70	130
Selenium (total)	EMS0093-MAY23	mg/L	0.00004	<0.00004	ND	20	100	90	110	126	70	130
Silicon (total)	EMS0093-MAY23	mg/L	0.02	<0.02	1	20	104	90	110	NV	70	130
Tin (total)	EMS0093-MAY23	mg/L	0.00006	<0.00006	ND	20	100	90	110	NV	70	130
Strontium (total)	EMS0093-MAY23	mg/L	0.00008	<0.00008	1	20	100	90	110	105	70	130
Titanium (total)	EMS0093-MAY23	mg/L	0.00005	<0.00005	19	20	105	90	110	NV	70	130
Thallium (total)	EMS0093-MAY23	mg/L	0.000005	<0.000005	ND	20	96	90	110	90	70	130
Uranium (total)	EMS0093-MAY23	mg/L	0.000002	<0.000002	2	20	94	90	110	80	70	130
Vanadium (total)	EMS0093-MAY23	mg/L	0.00001	<0.00001	1	20	105	90	110	105	70	130
Zinc (total)	EMS0093-MAY23	mg/L	0.002	<0.002	ND	20	102	90	110	108	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	BAC9211-MAY23	cfu/100mL	-	ACCEPTED	ACCEPTED							
Heterotrophic Plate Count (HPC)	BAC9211-MAY23	cfu/1mL	-	ACCEPTED	ACCEPTED							
Total Coliform	BAC9211-MAY23	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	EWL0306-MAY23	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	SKA0145-MAY23	mg/L	0.002	<0.002	ND	10	98	80	120	96	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	SKA0126-MAY23	mg/L	0.02	<0.02	ND	20	100	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	EWL0425-MAY23	mg/L	2	< 2	3	10	104	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)	SKA0131-MAY23	mg/L	0.05	<0.05	ND	10	104	90	110	105	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	EWL0300-MAY23	NTU	0.10	< 0.10	1	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 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: 031755 Page ____ of ____

Laboratory Information Section - Lab use only

Received By: Katelyn Medad
Received Date: 05/10/23 (mm/dd/yy)
Received Time: 17:30 (hr : min)
Received By (signature): Kmedad
Custody Seal Present: Yes ☑ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: ____
Temperature Upon Receipt (°C) 8 . 8 . 8
LAB LIMS #: CA1442I-May23

REPORT INFORMATION

Company: P.M. Wills
Contact: Lynsey Tulers
Address: 150 Jameson Dr. Peterborough
Phone: 289-385-6230
Fax: ____
Email: ltulers@pmwills.com

INVOICE INFORMATION

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

Quotation #: ____ P.O. #: 85260
Project #: ~~656~~ 85260 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	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: Sewer Use: Specify pkg:	Other: Water Characterization Pkg ☑ Extended ☐ General	SPLP: Specify tests ☐ Metals ☐ VOC ☐ 1,4-Dioxane ☐ OCP ☐ ABN	TCLP: Specify tests ☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit.	COMMENTS:
1	85260 well 1 - 1hr	May 10/23	9:30am	14	GW	N													✓			
2	85260 well 1 - 6hr	May 10/23	2:15pm	14	GW	N													✓			
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

Observations/Comments/Special Instructions

Sampled By (NAME): L. Tulers / J. Gorman Signature: L Tulers / Jaala Gorman Date: 05/10/2023 (mm/dd/yy)
Relinquished by (NAME): ~~L. Tulers~~ J. Gorman Signature: Jaala Gorman Date: 05/10/2023 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.6
Date of Issue: 02 May 2022

FINAL REPORT

CA14319-MAY23 R1

85260

Prepared for

D.M. Wills -Peterborough

FINAL REPORT

CA14319-MAY23 R1

First Page

CLIENT DETAILS

Client	D.M. Wills -Peterborough
Address	150 Jameson Drive Peterborough, ON K9J 0B9. Canada
Contact	Lynsey Tuters
Telephone	289-385-6230
Facsimile	705-741-3568
Email	ltuters@dmwills.com
Project	85260
Order Number	
Samples	Ground Water (2)

LABORATORY DETAILS

Project Specialist	Maarit Wolfe, Hon.B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2000
Facsimile	705-652-6365
Email	Maarit.Wolfe@sgs.com
SGS Reference	CA14319-MAY23
Received	05/11/2023
Approved	05/18/2023
Report Number	CA14319-MAY23 R1
Date Reported	05/19/2023

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: 16 degrees C
Cooling Agent Present: Yes
Custody Seal Present: Yes

Chain of Custody Number: 024682

SIGNATORIES

Maarit Wolfe, Hon.B.Sc

TABLE OF CONTENTS

FINAL REPORT

CA14319-MAY23 R1

Client: D.M. Wills -Peterborough
Project: 85260
Project Manager: Lynsey Tuters
Samplers: J.Gorman

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	85260 Well 2 - 1hr	85260 Well 2 - 6hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	11/05/2023	11/05/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
General Chemistry						
UV Transmittance	%T				92.5	93.5
Alkalinity	mg/L as CaCO3	2	500		272	254
Bicarbonate	mg/L as CaCO3	2			272	254
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			641	639
Total Suspended Solids	mg/L	2			3	3
Turbidity	NTU	0.10	5	1	13	11
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
Ion Ratio	-	-9999			0.85	0.90
Total Dissolved Solids (calculated)	mg/L	-9999			372	354
Conductivity (calculated)	uS/cm	-9999			706	678
Langeliers Index 4° C	@ 4° C	-9999			0.19	0.21
Saturation pH 4°C	pHs @ 4°C	-9999			7.61	7.64

Client: D.M. Wills -Peterborough
Project: 85260
Project Manager: Lynsey Tuters
Samplers: J.Gorman

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	85260 Well 2 - 1hr	85260 Well 2 - 6hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	11/05/2023	11/05/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics						
Fluoride	mg/L	0.06		1.5	0.22	0.19
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	< 0.06	< 0.06
Sulphate	mg/L	2	500		44	41
Sulphide	mg/L	0.02			< 0.02	< 0.02
Hardness	mg/L as CaCO3	0.05	100		286	285
Aluminum (total)	mg/L	0.001	0.1		0.002	< 0.001
Arsenic (total)	mg/L	0.0002		0.01	0.0002	< 0.0002
Boron (total)	mg/L	0.002		5	0.022	0.034
Barium (total)	mg/L	0.00008		1	0.149	0.141
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			0.000020	0.000012
Calcium (total)	mg/L	0.01			83.7	83.4
Cadmium (total)	mg/L	0.000003		0.005	< 0.000003	< 0.000003
Copper (total)	mg/L	0.0002	1		0.0008	0.0002
Chromium (total)	mg/L	0.00008		0.05	< 0.00008	< 0.00008
Iron (total)	mg/L	0.007	0.3		0.945	0.815
Potassium (total)	mg/L	0.009			2.20	2.15
Magnesium (total)	mg/L	0.001			18.7	18.7

Client: D.M. Wills -Peterborough
Project: 85260
Project Manager: Lynsey Tuters
Samplers: J.Gorman

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	85260 Well 2 - 1hr	85260 Well 2 - 6hr
					Sample Matrix	Ground Water	Ground Water
					Sample Date	11/05/2023	11/05/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics (continued)						
Manganese (total)	mg/L	0.00001	0.05		0.0229	0.0208
Molybdenum (total)	mg/L	0.00004			0.00139	0.00104
Nickel (total)	mg/L	0.0001			0.0004	0.0004
Sodium (total)	mg/L	0.01	200	20	15.1	14.3
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			7.61	7.32
Silver (total)	mg/L	0.00005			< 0.00005	< 0.00005
Strontium (total)	mg/L	0.00008			0.388	0.389
Thallium (total)	mg/L	0.000005			< 0.000005	< 0.000005
Tin (total)	mg/L	0.00006			0.00032	0.00011
Titanium (total)	mg/L	0.00005			0.00016	0.00011
Antimony (total)	mg/L	0.0009		0.006	< 0.0009	< 0.0009
Selenium (total)	mg/L	0.00004		0.05	0.00006	< 0.00004
Uranium (total)	mg/L	0.000002		0.02	0.000432	0.000441
Vanadium (total)	mg/L	0.00001			0.00005	0.00004
Zinc (total)	mg/L	0.002	5		0.004	0.003
Cation sum	meq/L	-9999			6.49	6.44
Anion Sum	meq/L	-9999			7.63	7.11
Anion-Cation Balance	% difference	-9999			-8.06	-5.01

Client: D.M. Wills -Peterborough
Project: 85260
Project Manager: Lynsey Tuters
Samplers: J.Gorman

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	85260 Well 2 - 1hr	85260 Well 2 - 6hr
				Sample Matrix	Ground Water	Ground Water
				Sample Date	11/05/2023	11/05/2023
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Microbiology						
Total Coliform	cfu/100mL	0		0	0	0
E. Coli	cfu/100mL	0		0	0	0
Heterotrophic Plate Count (HPC)	cfu/1mL	0			74	26
Other (ORP)						
pH	No unit	0.05	8.5		7.80	7.85
Chloride	mg/L	1	250		45	42
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
85260 Well 2 - 1hr					
Turbidity	SM 2130	NTU	13	5	1
Hardness	SM 3030/EPA 200.8	mg/L as CaCO3	286	100	
Iron	SM 3030/EPA 200.8	mg/L	0.945	0.3	
85260 Well 2 - 6hr					
Turbidity	SM 2130	NTU	11	5	1
Hardness	SM 3030/EPA 200.8	mg/L as CaCO3	285	100	
Iron	SM 3030/EPA 200.8	mg/L	0.815	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	EWL0342-MAY23	mg/L as CaCO3	2	< 2	2	20	98	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)	SKA0142-MAY23	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	DIO5076-MAY23	mg/L	1	<1	2	20	111	80	120	78	75	125
Sulphate	DIO5076-MAY23	mg/L	2	<2	3	20	110	80	120	103	75	125
Chloride	DIO5077-MAY23	mg/L	1	<1	6	20	104	80	120	99	75	125
Sulphate	DIO5077-MAY23	mg/L	2	<2	9	20	107	80	120	101	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	DIO0357-MAY23	mg/L	0.3	<0.3	ND	20	99	90	110	94	75	125
Nitrite (as N)	DIO0357-MAY23	mg/L	0.03	<0.03	ND	20	99	90	110	99	75	125
Nitrate (as N)	DIO0357-MAY23	mg/L	0.06	<0.06	1	20	103	90	110	105	75	125
Bromide	DIO0358-MAY23	mg/L	0.3	<0.3	ND	20	101	90	110	95	75	125
Nitrite (as N)	DIO0358-MAY23	mg/L	0.03	<0.03	ND	20	99	90	110	97	75	125
Nitrate (as N)	DIO0358-MAY23	mg/L	0.06	<0.06	ND	20	100	90	110	101	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	SKA0144-MAY23	mg/L	1	<1	ND	20	96	90	110	100	75	125
Total Organic Carbon	SKA0144-MAY23	mg/L	1	<1	ND	20	96	90	110	100	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	EWL0342-MAY23	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0342-MAY23	mg/L as CaCO3	2	2	ND	10	NA	90	110	NA		
OH	EWL0342-MAY23	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	EWL0328-MAY23	TCU	3	< 3	4	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	EWL0342-MAY23	uS/cm	2	5	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	EWL0336-MAY23	mg/L	0.06	<0.06	ND	10	101	90	110	95	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)	EHG0027-MAY23	mg/L	0.00001	< 0.00001	0	20	116	80	120	115	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)	EMS0108-MAY23	mg/L	0.00005	<0.00005	ND	20	100	90	110	91	70	130
Aluminum (total)	EMS0108-MAY23	mg/L	0.001	<0.001	5	20	101	90	110	106	70	130
Arsenic (total)	EMS0108-MAY23	mg/L	0.0002	<0.0002	2	20	99	90	110	110	70	130
Barium (total)	EMS0108-MAY23	mg/L	0.00008	<0.00008	3	20	97	90	110	108	70	130
Beryllium (total)	EMS0108-MAY23	mg/L	0.000007	<0.000007	ND	20	104	90	110	109	70	130
Boron (total)	EMS0108-MAY23	mg/L	0.002	<0.002	4	20	106	90	110	99	70	130
Bismuth (total)	EMS0108-MAY23	mg/L	0.00001	<0.00001	ND	20	97	90	110	88	70	130
Calcium (total)	EMS0108-MAY23	mg/L	0.01	<0.01	1	20	98	90	110	97	70	130
Cadmium (total)	EMS0108-MAY23	mg/L	0.000003	<0.000003	ND	20	99	90	110	114	70	130
Cobalt (total)	EMS0108-MAY23	mg/L	0.000004	<0.000004	1	20	97	90	110	97	70	130
Chromium (total)	EMS0108-MAY23	mg/L	0.00008	<0.00008	ND	20	97	90	110	121	70	130
Copper (total)	EMS0108-MAY23	mg/L	0.0002	<0.0002	0	20	99	90	110	103	70	130
Iron (total)	EMS0108-MAY23	mg/L	0.007	<0.007	0	20	100	90	110	NV	70	130
Potassium (total)	EMS0108-MAY23	mg/L	0.009	<0.009	2	20	105	90	110	98	70	130
Magnesium (total)	EMS0108-MAY23	mg/L	0.001	<0.001	1	20	104	90	110	100	70	130
Manganese (total)	EMS0108-MAY23	mg/L	0.00001	<0.00001	2	20	100	90	110	107	70	130
Molybdenum (total)	EMS0108-MAY23	mg/L	0.00004	<0.00004	ND	20	98	90	110	99	70	130
Sodium (total)	EMS0108-MAY23	mg/L	0.01	<0.01	1	20	100	90	110	95	70	130
Nickel (total)	EMS0108-MAY23	mg/L	0.0001	<0.0001	2	20	99	90	110	98	70	130
Lead (total)	EMS0108-MAY23	mg/L	0.00009	<0.00009	ND	20	101	90	110	90	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)	EMS0108-MAY23	mg/L	0.003	<0.003	12	20	99	90	110	NV	70	130
Antimony (total)	EMS0108-MAY23	mg/L	0.0009	<0.0009	ND	20	103	90	110	109	70	130
Selenium (total)	EMS0108-MAY23	mg/L	0.00004	<0.00004	ND	20	92	90	110	110	70	130
Silicon (total)	EMS0108-MAY23	mg/L	0.02	<0.02	1	20	100	90	110	NV	70	130
Tin (total)	EMS0108-MAY23	mg/L	0.00006	<0.00006	3	20	105	90	110	NV	70	130
Strontium (total)	EMS0108-MAY23	mg/L	0.00008	<0.00008	1	20	100	90	110	80	70	130
Titanium (total)	EMS0108-MAY23	mg/L	0.00005	<0.00005	ND	20	108	90	110	NV	70	130
Thallium (total)	EMS0108-MAY23	mg/L	0.000005	<0.000005	ND	20	101	90	110	96	70	130
Uranium (total)	EMS0108-MAY23	mg/L	0.000002	<0.000002	7	20	98	90	110	95	70	130
Vanadium (total)	EMS0108-MAY23	mg/L	0.00001	<0.00001	4	20	98	90	110	98	70	130
Zinc (total)	EMS0108-MAY23	mg/L	0.002	<0.002	ND	20	100	90	110	111	70	130
Boron (total)	EMS0139-MAY23	mg/L	0.002	<0.002	4	20	106	90	110	104	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	BAC9233-MAY23	cfu/100mL	-	ACCEPTED	ACCEPTED							
Heterotrophic Plate Count (HPC)	BAC9233-MAY23	cfu/1mL	-	ACCEPTED	ACCEPTED							
Total Coliform	BAC9233-MAY23	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	EWL0342-MAY23	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	SKA0145-MAY23	mg/L	0.002	<0.002	ND	10	98	80	120	96	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	SKA0149-MAY23	mg/L	0.02	<0.02	ND	20	96	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	EWL0320-MAY23	mg/L	2	< 2	1	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)	SKA0148-MAY23	mg/L	0.05	<0.05	0	10	105	90	110	106	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	EWL0319-MAY23	NTU	0.10	< 0.10	ND	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: 024682 Page ____ of ____

Laboratory Information Section - Lab use only

Received By: Katelyn Medland
Received Date: 05 / 11 / 23 (mm/dd/yy)
Received Time: 13 : 00 (hr : min)
Received By (signature): KM
Custody Seal Present: Yes ☑ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: ice
Temperature Upon Receipt (°C) 16, 16, 16
LAB LIMS #: CA14319-May23

REPORT INFORMATION

Company: DM Wills
Contact: Lynsey Tuters
Address: 150 Jameson Dr
Peterborough
Phone: 289-385-6230
Fax:
Email: ltuters@dmwills.com

INVOICE INFORMATION

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

Quotation #:
P.O. #: 85260
Project #: 85260
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	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,)	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)	Sewer Use: (Specify pkg:)	Water Characterization Pkg ☑ Extended ☐ General	SPLP: Specify tests ☐ Metals ☐ VOC ☐ 1,4-Dioxane ☐ OCP ☐ ABN	TCLP: Specify tests ☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit.	COMMENTS:
1	85260 well2 -1hr	May 11/23	9:15am	14	GW	N																	✓			
2	85260 well2 -6hr	May 11/23	2:00pm	14	GW	N																	✓			
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										
11																										
12																										

Observations/Comments/Special Instructions

Sampled By (NAME): J. Gorman Signature: Jade Gorman Date: 05 / 11 / 2023 (mm/dd/yy)
Relinquished by (NAME): J. Gorman Signature: Jade Gorman Date: 05 / 11 / 2023 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.5
Date of Issue: 11 June 2021

Appendix J

Groundwater Impact Assessment

Reasonable Use Guideline - Maximum Acceptable Concentration Equation

$C_m = f(Cr)$

Where: Cm = Acceptable concentration at property boundary
f = constant equal to 0.25 (health related parameter) or 0.5 (non-health related parameter)
Cr = ODWQS Nitrate Concentration

Therefore,

$C_M = 0.25(10)$

C_M = 2.50 mg/L

Contaminant Attenuation Calculations

$V_A = A_D \times K$
$V_T = V_A + V_S$
$C_M = (C_S \times V_S)/V_T$

Where: V_A = annual dilution volume (m^3)
A_D = dilution area (m^2) = 8,995.00 m^2
V_T = total volume of water (m^3)
V_S = annual sewage volume (m^3) = 365 days x 6 m^3/day = 2,190 m^3
C_M = concentration at property boundary (mg/L)
C_{PB} = allowable concentration in sewage (mg/L)
K = 0.25 m - constant: 250 mm annual dilution precipitation rate

Therefore,

$V_A = 8{,}995 \times 0.25$
$V_A = 2{,}249\ m^3$

$V_T = 2{,}249 + 2{,}190$
$V_T = 4{,}439$

$C_{PB} = (C_M \times V_T) / V_S$
$= (2.5 \times 4{,}439) / 2{,}190$

C_{PB} = 5.1 mg/L

Therefore, the allowable nitrate concentration in the sewage may not exceed 5.1 mg/L in order to achieve a nitrate (as N) concentration BELOW the RUC acceptable concentration (2.50 mg/L) at the property boundary.

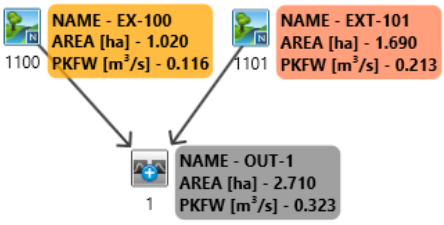
Appendix C

VO3 Modelling Results

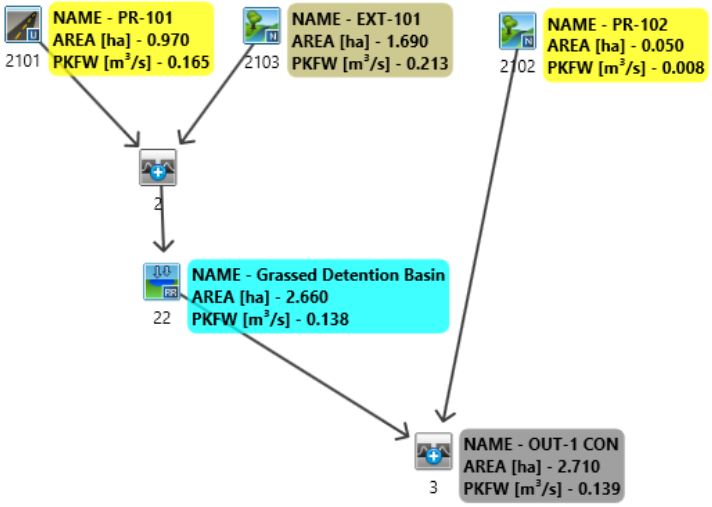
`

Visual Otthymo Model Configuration

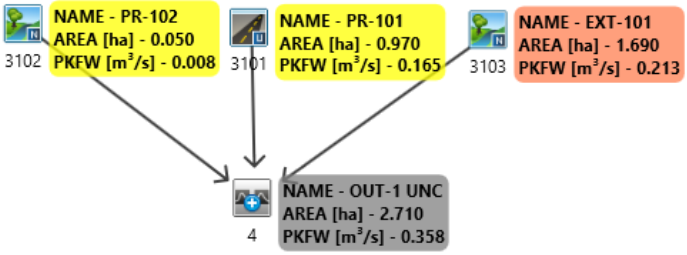
Existing Condition



Proposed Condition



Uncontrolled Condition



```
================================================================================
============================

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\VO Suite 3.0\VO2\voin.dat

  Output  filename:
C:\Users\nnapper\AppData\Local\Temp\72ae4afb-68be-4265-bb2a-d08d33636251\Scena
rio.out
  Summary filename:
C:\Users\nnapper\AppData\Local\Temp\72ae4afb-68be-4265-bb2a-d08d33636251\Scena
rio.sum


DATE: 04/10/2024                          TIME: 11:39:54

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
----------------------------
  ***************************
  ** SIMULATION NUMBER:   1 **
  ***************************


--------------------
|    READ STORM    |    Filename: C:\Users\nnapper\AppD

|                  |              ata\Local\Temp\
```

```
|                  |
72ae4afb-68be-4265-bb2a-d08d33636251\a67b0caa
| Ptotal= 38.75 mm |    Comments: 2-Year, 6 hour SCS Type II - Peterboroug
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    1.60 |  1.75    3.90 |  3.25    8.50 |  4.75    2.30
                0.50    1.60 |  2.00    3.90 |  3.50    8.50 |  5.00    2.30
                0.75    2.30 |  2.25    4.60 |  3.75    3.90 |  5.25    1.60
                1.00    2.30 |  2.50    4.60 |  4.00    3.90 |  5.50    1.60
                1.25    2.30 |  2.75   23.20 |  4.25    3.10 |  5.75    1.60
                1.50    2.30 |  3.00   60.40 |  4.50    3.10 |  6.00    1.60

--------------------------------------------------------------------------------
-


--------------------
| CALIB            |
| NASHYD    (1100) |   Area    (ha)=   1.02   Curve Number   (CN)= 75.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.29

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    1.60 | 1.583    3.90 | 3.083    8.50 |  4.58    2.30
               0.167    1.60 | 1.667    3.90 | 3.167    8.50 |  4.67    2.30
               0.250    1.60 | 1.750    3.90 | 3.250    8.50 |  4.75    2.30
               0.333    1.60 | 1.833    3.90 | 3.333    8.50 |  4.83    2.30
               0.417    1.60 | 1.917    3.90 | 3.417    8.50 |  4.92    2.30
               0.500    1.60 | 2.000    3.90 | 3.500    8.50 |  5.00    2.30
               0.583    2.30 | 2.083    4.60 | 3.583    3.90 |  5.08    1.60
               0.667    2.30 | 2.167    4.60 | 3.667    3.90 |  5.17    1.60
               0.750    2.30 | 2.250    4.60 | 3.750    3.90 |  5.25    1.60
               0.833    2.30 | 2.333    4.60 | 3.833    3.90 |  5.33    1.60
               0.917    2.30 | 2.417    4.60 | 3.917    3.90 |  5.42    1.60
               1.000    2.30 | 2.500    4.60 | 4.000    3.90 |  5.50    1.60
               1.083    2.30 | 2.583   23.20 | 4.083    3.10 |  5.58    1.60
               1.167    2.30 | 2.667   23.20 | 4.167    3.10 |  5.67    1.60
               1.250    2.30 | 2.750   23.20 | 4.250    3.10 |  5.75    1.60
               1.333    2.30 | 2.833   60.40 | 4.333    3.10 |  5.83    1.60
               1.417    2.30 | 2.917   60.40 | 4.417    3.10 |  5.92    1.60
               1.500    2.30 | 3.000   60.40 | 4.500    3.10 |  6.00    1.60

    Unit Hyd Qpeak  (cms)=   0.134

    PEAK FLOW       (cms)=   0.023 (i)
    TIME TO PEAK    (hrs)=   3.167
    RUNOFF VOLUME    (mm)=   8.784
```

```
     TOTAL RAINFALL   (mm)=  38.750
     RUNOFF COEFFICIENT   =   0.227

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
--------------------
| CALIB            |
| NASHYD    (1101) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.044 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=   8.708
     TOTAL RAINFALL   (mm)=  38.750
     RUNOFF COEFFICIENT   =   0.225

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (1100):     1.02   0.023     3.17     8.78
       + ID2= 2 (1101):     1.69   0.044     3.08     8.71
         ================================================
         ID = 3 (0001):     2.71   0.065     3.17     8.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
--------------------
| CALIB            |
| NASHYD    (2102) |   Area    (ha)=   0.05   Curve Number   (CN)= 70.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

     Unit Hyd Qpeak  (cms)=   0.015

     PEAK FLOW       (cms)=   0.002 (i)
     TIME TO PEAK    (hrs)=   3.000
     RUNOFF VOLUME    (mm)=   8.046
     TOTAL RAINFALL   (mm)=  38.750
     RUNOFF COEFFICIENT   =   0.208

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
--------------------
| CALIB            |
| NASHYD    (2103) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.044 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=   8.708
     TOTAL RAINFALL   (mm)=  38.750
     RUNOFF COEFFICIENT   =   0.225

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
--------------------
| CALIB            |
| STANDHYD  (2101) |   Area    (ha)=   0.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  30.00
--------------------

                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.68
     Dep. Storage     (mm)=       1.00         4.40
     Average Slope     (%)=       7.75         1.88
     Length            (m)=      80.42       149.30
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      60.40         8.55
               over (min)        5.00        45.00
     Storage Coeff.  (min)=       1.48 (ii)   43.86 (ii)
     Unit Hyd. Tpeak (min)=       5.00        45.00
     Unit Hyd. peak  (cms)=       0.33         0.03
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.01          0.051 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.67           3.00
     RUNOFF VOLUME    (mm)=      37.75        10.26          18.48
     TOTAL RAINFALL   (mm)=      38.75        38.75          38.75
     RUNOFF COEFFICIENT   =       0.97         0.26           0.48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
```

THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0002)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (2101):	0.97	0.051	3.00	18.48
	+ ID2= 2 (2103):	1.69	0.044	3.08	8.71
	ID = 3 (0002):	2.66	0.088	3.00	12.27

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0022)					
IN= 2---> OUT= 1					
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1142	0.0397
	0.0062	0.0062	0.1294	0.0469
	0.0229	0.0126	0.1430	0.0542
	0.0470	0.0191	0.1555	0.0617
	0.0742	0.0258	0.1670	0.0693
	0.0965	0.0327	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0002)	2.660	0.088	3.00	12.27
OUTFLOW: ID= 1 (0022)	2.660	0.028	3.67	12.18

PEAK FLOW REDUCTION [Qout/Qin](%)= 31.80
TIME SHIFT OF PEAK FLOW (min)= 40.00
MAXIMUM STORAGE USED (ha.m.)= 0.0140

ADD HYD (0003)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (2102):	0.05	0.002	3.00	8.05
	+ ID2= 2 (0022):	2.66	0.028	3.67	12.18
	ID = 3 (0003):	2.71	0.028	3.67	12.10

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB				
NASHYD (3102)	Area (ha)= 0.05	Curve Number (CN)= 70.5		
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.13			

Unit Hyd Qpeak (cms)= 0.015

PEAK FLOW (cms)= 0.002 (i)
TIME TO PEAK (hrs)= 3.000
RUNOFF VOLUME (mm)= 8.046
TOTAL RAINFALL (mm)= 38.750
RUNOFF COEFFICIENT = 0.208

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB				
NASHYD (3103)	Area (ha)= 1.69	Curve Number (CN)= 72.8		
ID= 1 DT= 5.0 min	Ia (mm)= 5.30	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.23			

Unit Hyd Qpeak (cms)= 0.281

PEAK FLOW (cms)= 0.044 (i)
TIME TO PEAK (hrs)= 3.083
RUNOFF VOLUME (mm)= 8.708
TOTAL RAINFALL (mm)= 38.750
RUNOFF COEFFICIENT = 0.225

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB				
STANDHYD (3101)	Area (ha)= 0.97			
ID= 1 DT= 5.0 min	Total Imp(%)= 30.00	Dir. Conn.(%)= 30.00		

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.29	0.68
Dep. Storage	(mm)=	1.00	4.40
Average Slope	(%)=	7.75	1.88
Length	(m)=	80.42	149.30
Mannings n	=	0.013	0.250

```
     Max.Eff.Inten.(mm/hr)=      60.40         8.55
                over (min)        5.00        45.00
     Storage Coeff.  (min)=       1.48 (ii)   43.86 (ii)
     Unit Hyd. Tpeak (min)=       5.00        45.00
     Unit Hyd. peak  (cms)=       0.33         0.03
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.01          0.051 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.67           3.00
     RUNOFF VOLUME    (mm)=      37.75        10.26          18.48
     TOTAL RAINFALL   (mm)=      38.75        38.75          38.75
     RUNOFF COEFFICIENT   =       0.97         0.26           0.48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-

--------------------
| ADD HYD   (0004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (3101):     0.97   0.051     3.00    18.48
        + ID2= 2 (3102):     0.05   0.002     3.00     8.05
          ================================================
          ID = 3 (0004):     1.02   0.053     3.00    17.97

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
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--------------------
| ADD HYD   (0004) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (0004):     1.02   0.053     3.00    17.97
        + ID2= 2 (3103):     1.69   0.044     3.08     8.71
          ================================================
          ID = 1 (0004):     2.71   0.089     3.00    12.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ***************************
  ** SIMULATION NUMBER:   2 **
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|    READ STORM    |    Filename: C:\Users\nnapper\AppD

|                  |              ata\Local\Temp\

|                  |
72ae4afb-68be-4265-bb2a-d08d33636251\e297e7ce
| Ptotal= 52.45 mm |    Comments: 5-Year, 6 hour SCS Type II - Peterboroug
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    2.10 |  1.75    5.20 |  3.25   11.50 |  4.75    3.20
                0.50    2.10 |  2.00    5.20 |  3.50   11.50 |  5.00    3.20
                0.75    3.20 |  2.25    6.30 |  3.75    5.20 |  5.25    2.10
                1.00    3.20 |  2.50    6.30 |  4.00    5.20 |  5.50    2.10
                1.25    3.20 |  2.75   31.40 |  4.25    4.20 |  5.75    2.10
                1.50    3.20 |  3.00   81.80 |  4.50    4.20 |  6.00    2.10

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--------------------
| CALIB            |
| NASHYD    (1100) |   Area    (ha)=   1.02   Curve Number   (CN)= 75.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.29

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.10 | 1.583    5.20 | 3.083   11.50 |  4.58    3.20
               0.167    2.10 | 1.667    5.20 | 3.167   11.50 |  4.67    3.20
               0.250    2.10 | 1.750    5.20 | 3.250   11.50 |  4.75    3.20
               0.333    2.10 | 1.833    5.20 | 3.333   11.50 |  4.83    3.20
               0.417    2.10 | 1.917    5.20 | 3.417   11.50 |  4.92    3.20
               0.500    2.10 | 2.000    5.20 | 3.500   11.50 |  5.00    3.20
               0.583    3.20 | 2.083    6.30 | 3.583    5.20 |  5.08    2.10
               0.667    3.20 | 2.167    6.30 | 3.667    5.20 |  5.17    2.10
               0.750    3.20 | 2.250    6.30 | 3.750    5.20 |  5.25    2.10
               0.833    3.20 | 2.333    6.30 | 3.833    5.20 |  5.33    2.10
               0.917    3.20 | 2.417    6.30 | 3.917    5.20 |  5.42    2.10
               1.000    3.20 | 2.500    6.30 | 4.000    5.20 |  5.50    2.10
               1.083    3.20 | 2.583   31.40 | 4.083    4.20 |  5.58    2.10
               1.167    3.20 | 2.667   31.40 | 4.167    4.20 |  5.67    2.10
               1.250    3.20 | 2.750   31.40 | 4.250    4.20 |  5.75    2.10
               1.333    3.20 | 2.833   81.80 | 4.333    4.20 |  5.83    2.10
```

```
                1.417    3.20 | 2.917   81.80 | 4.417    4.20 |  5.92    2.10
                1.500    3.20 | 3.000   81.80 | 4.500    4.20 |  6.00    2.10

     Unit Hyd Qpeak  (cms)=   0.134

     PEAK FLOW       (cms)=   0.043 (i)
     TIME TO PEAK    (hrs)=   3.167
     RUNOFF VOLUME    (mm)=  16.140
     TOTAL RAINFALL   (mm)=  52.450
     RUNOFF COEFFICIENT   =   0.308

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (1101) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.081 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  15.633
     TOTAL RAINFALL   (mm)=  52.450
     RUNOFF COEFFICIENT   =   0.298

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (1100):     1.02   0.043     3.17    16.14
        + ID2= 2 (1101):     1.69   0.081     3.08    15.63
          ================================================
          ID = 3 (0001):     2.71   0.121     3.08    15.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-
--------------------
| CALIB            |
| NASHYD    (2102) |   Area    (ha)=   0.05   Curve Number   (CN)= 70.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

     Unit Hyd Qpeak  (cms)=   0.015

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   3.000
     RUNOFF VOLUME    (mm)=  14.496
     TOTAL RAINFALL   (mm)=  52.450
     RUNOFF COEFFICIENT   =   0.276

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (2103) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.081 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  15.633
     TOTAL RAINFALL   (mm)=  52.450
     RUNOFF COEFFICIENT   =   0.298

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2101) |   Area    (ha)=   0.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  30.00
--------------------

                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.68
     Dep. Storage     (mm)=       1.00         4.40
     Average Slope     (%)=       7.75         1.88
     Length            (m)=      80.42       149.30
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      81.80        17.58
               over (min)        5.00        35.00
     Storage Coeff.  (min)=       1.31 (ii)   33.08 (ii)
     Unit Hyd. Tpeak (min)=       5.00        35.00
     Unit Hyd. peak  (cms)=       0.33         0.03
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.02          0.074 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.50           3.00
     RUNOFF VOLUME    (mm)=      51.45        17.94          27.97
```

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     TOTAL RAINFALL   (mm)=      52.45        52.45          52.45
     RUNOFF COEFFICIENT   =       0.98         0.34           0.53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (2101):     0.97   0.074     3.00    27.97
       + ID2= 2 (2103):     1.69   0.081     3.08    15.63
         ================================================
         ID = 3 (0002):     2.66   0.142     3.00    20.13

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (0022) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1142      0.0397
                          0.0062     0.0062   |   0.1294      0.0469
                          0.0229     0.0126   |   0.1430      0.0542
                          0.0470     0.0191   |   0.1555      0.0617
                          0.0742     0.0258   |   0.1670      0.0693
                          0.0965     0.0327   |   0.0000      0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0002)     2.660      0.142      3.00      20.13
     OUTFLOW: ID= 1 (0022)     2.660      0.057      3.58      20.04

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 40.12
                    TIME SHIFT OF PEAK FLOW         (min)= 35.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0216

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| ADD HYD   (0003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (2102):     0.05   0.003     3.00    14.50
       + ID2= 2 (0022):     2.66   0.057     3.58    20.04
         ================================================
         ID = 3 (0003):     2.71   0.058     3.58    19.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-
--------------------
| CALIB            |
| NASHYD    (3102) |   Area    (ha)=   0.05   Curve Number   (CN)= 70.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

     Unit Hyd Qpeak  (cms)=   0.015

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   3.000
     RUNOFF VOLUME    (mm)=  14.496
     TOTAL RAINFALL   (mm)=  52.450
     RUNOFF COEFFICIENT   =   0.276

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (3103) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.081 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  15.633
     TOTAL RAINFALL   (mm)=  52.450
     RUNOFF COEFFICIENT   =   0.298

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
--------------------
| CALIB            |
| STANDHYD  (3101) |   Area    (ha)=   0.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  30.00
```

```
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.29         0.68
     Dep. Storage     (mm)=      1.00         4.40
     Average Slope     (%)=      7.75         1.88
     Length            (m)=     80.42       149.30
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     81.80        17.58
                over (min)       5.00        35.00
     Storage Coeff.  (min)=      1.31 (ii)   33.08 (ii)
     Unit Hyd. Tpeak (min)=      5.00        35.00
     Unit Hyd. peak  (cms)=      0.33         0.03
                                                      *TOTALS*
     PEAK FLOW       (cms)=      0.07         0.02          0.074 (iii)
     TIME TO PEAK    (hrs)=      3.00         3.50           3.00
     RUNOFF VOLUME    (mm)=     51.45        17.94          27.97
     TOTAL RAINFALL   (mm)=     52.45        52.45          52.45
     RUNOFF COEFFICIENT   =      0.98         0.34           0.53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (3101):     0.97   0.074     3.00    27.97
        + ID2= 2 (3102):     0.05   0.003     3.00    14.50
          ================================================
          ID = 3 (0004):     1.02   0.077     3.00    27.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0004) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (0004):     1.02   0.077     3.00    27.31
        + ID2= 2 (3103):     1.69   0.081     3.08    15.63
          ================================================
```

```
          ID = 1 (0004):     2.71   0.146     3.00    20.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-
  ***************************
  ** SIMULATION NUMBER:   3 **
  ***************************


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|    READ STORM    |    Filename: C:\Users\nnapper\AppD

|                  |              ata\Local\Temp\

|                  |
72ae4afb-68be-4265-bb2a-d08d33636251\86484080
| Ptotal= 61.60 mm |    Comments: 10-Year, 6 hour SCS Type II - Peterborou
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    2.50 |  1.75    6.20 |  3.25   13.50 |  4.75    3.70
                0.50    2.50 |  2.00    6.20 |  3.50   13.50 |  5.00    3.70
                0.75    3.70 |  2.25    7.40 |  3.75    6.20 |  5.25    2.50
                1.00    3.70 |  2.50    7.40 |  4.00    6.20 |  5.50    2.50
                1.25    3.70 |  2.75   36.90 |  4.25    4.90 |  5.75    2.50
                1.50    3.70 |  3.00   95.90 |  4.50    4.90 |  6.00    2.50

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--------------------
| CALIB            |
| NASHYD    (1100) |   Area    (ha)=   1.02   Curve Number   (CN)= 75.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.29

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.50 | 1.583    6.20 | 3.083   13.50 |  4.58    3.70
               0.167    2.50 | 1.667    6.20 | 3.167   13.50 |  4.67    3.70
               0.250    2.50 | 1.750    6.20 | 3.250   13.50 |  4.75    3.70
               0.333    2.50 | 1.833    6.20 | 3.333   13.50 |  4.83    3.70
               0.417    2.50 | 1.917    6.20 | 3.417   13.50 |  4.92    3.70
               0.500    2.50 | 2.000    6.20 | 3.500   13.50 |  5.00    3.70
               0.583    3.70 | 2.083    7.40 | 3.583    6.20 |  5.08    2.50
               0.667    3.70 | 2.167    7.40 | 3.667    6.20 |  5.17    2.50
```

```
                0.750    3.70 | 2.250    7.40 | 3.750    6.20 |  5.25    2.50
                0.833    3.70 | 2.333    7.40 | 3.833    6.20 |  5.33    2.50
                0.917    3.70 | 2.417    7.40 | 3.917    6.20 |  5.42    2.50
                1.000    3.70 | 2.500    7.40 | 4.000    6.20 |  5.50    2.50
                1.083    3.70 | 2.583   36.90 | 4.083    4.90 |  5.58    2.50
                1.167    3.70 | 2.667   36.90 | 4.167    4.90 |  5.67    2.50
                1.250    3.70 | 2.750   36.90 | 4.250    4.90 |  5.75    2.50
                1.333    3.70 | 2.833   95.90 | 4.333    4.90 |  5.83    2.50
                1.417    3.70 | 2.917   95.90 | 4.417    4.90 |  5.92    2.50
                1.500    3.70 | 3.000   95.90 | 4.500    4.90 |  6.00    2.50

     Unit Hyd Qpeak  (cms)=   0.134

     PEAK FLOW       (cms)=   0.059 (i)
     TIME TO PEAK    (hrs)=   3.167
     RUNOFF VOLUME    (mm)=  21.767
     TOTAL RAINFALL   (mm)=  61.600
     RUNOFF COEFFICIENT   =   0.353

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
--------------------
| CALIB            |
| NASHYD    (1101) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.110 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  20.940
     TOTAL RAINFALL   (mm)=  61.600
     RUNOFF COEFFICIENT   =   0.340

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (1100):     1.02   0.059     3.17    21.77
       + ID2= 2 (1101):     1.69   0.110     3.08    20.94
         ================================================
         ID = 3 (0001):     2.71   0.165     3.08    21.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| CALIB            |
| NASHYD    (2102) |   Area    (ha)=   0.05   Curve Number   (CN)= 70.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

     Unit Hyd Qpeak  (cms)=   0.015

     PEAK FLOW       (cms)=   0.004 (i)
     TIME TO PEAK    (hrs)=   3.000
     RUNOFF VOLUME    (mm)=  19.467
     TOTAL RAINFALL   (mm)=  61.600
     RUNOFF COEFFICIENT   =   0.316

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (2103) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.110 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  20.940
     TOTAL RAINFALL   (mm)=  61.600
     RUNOFF COEFFICIENT   =   0.340

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2101) |   Area    (ha)=   0.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  30.00
--------------------

                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.68
     Dep. Storage     (mm)=       1.00         4.40
     Average Slope     (%)=       7.75         1.88
     Length            (m)=      80.42       149.30
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      95.90        26.01
```

```
              over (min)        5.00        30.00
     Storage Coeff.  (min)=     1.23 (ii)   28.39 (ii)
     Unit Hyd. Tpeak (min)=     5.00        30.00
     Unit Hyd. peak  (cms)=     0.33         0.04
                                                      *TOTALS*
     PEAK FLOW       (cms)=     0.08         0.03        0.092 (iii)
     TIME TO PEAK    (hrs)=     3.00         3.42         3.00
     RUNOFF VOLUME    (mm)=    60.60        23.73        34.78
     TOTAL RAINFALL   (mm)=    61.60        61.60        61.60
     RUNOFF COEFFICIENT   =     0.98         0.39         0.56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (2101):     0.97   0.092     3.00    34.78
       + ID2= 2 (2103):     1.69   0.110     3.08    20.94
         ================================================
         ID = 3 (0002):     2.66   0.185     3.00    25.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (0022) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1142      0.0397
                          0.0062     0.0062   |   0.1294      0.0469
                          0.0229     0.0126   |   0.1430      0.0542
                          0.0470     0.0191   |   0.1555      0.0617
                          0.0742     0.0258   |   0.1670      0.0693
                          0.0965     0.0327   |   0.0000      0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0002)     2.660      0.185      3.00      25.99
     OUTFLOW: ID= 1 (0022)     2.660      0.079      3.58      25.89

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 42.80
                    TIME SHIFT OF PEAK FLOW         (min)= 35.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0274

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| ADD HYD   (0003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (2102):     0.05   0.004     3.00    19.47
       + ID2= 2 (0022):     2.66   0.079     3.58    25.89
         ================================================
         ID = 3 (0003):     2.71   0.080     3.58    25.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| CALIB            |
| NASHYD    (3102) |   Area    (ha)=   0.05   Curve Number   (CN)= 70.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

     Unit Hyd Qpeak  (cms)=   0.015

     PEAK FLOW       (cms)=   0.004 (i)
     TIME TO PEAK    (hrs)=   3.000
     RUNOFF VOLUME    (mm)=  19.467
     TOTAL RAINFALL   (mm)=  61.600
     RUNOFF COEFFICIENT   =   0.316

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| NASHYD    (3103) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.110 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  20.940
     TOTAL RAINFALL   (mm)=  61.600
     RUNOFF COEFFICIENT   =   0.340
```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD  (3101) |   Area    (ha)=   0.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  30.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.68
     Dep. Storage     (mm)=       1.00         4.40
     Average Slope     (%)=       7.75         1.88
     Length            (m)=      80.42       149.30
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      95.90        26.01
               over (min)        5.00        30.00
     Storage Coeff.  (min)=       1.23 (ii)   28.39 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=       0.33         0.04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.03          0.092 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.42           3.00
     RUNOFF VOLUME    (mm)=      60.60        23.73          34.78
     TOTAL RAINFALL   (mm)=      61.60        61.60          61.60
     RUNOFF COEFFICIENT   =       0.98         0.39           0.56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (3101):     0.97   0.092     3.00    34.78
        + ID2= 2 (3102):     0.05   0.004     3.00    19.47
          ================================================
          ID = 3 (0004):     1.02   0.096     3.00    34.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0004) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (0004):     1.02   0.096     3.00    34.03
        + ID2= 2 (3103):     1.69   0.110     3.08    20.94
          ================================================
          ID = 1 (0004):     2.71   0.189     3.00    25.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ***************************
  ** SIMULATION NUMBER:   4 **
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|    READ STORM    |    Filename: C:\Users\nnapper\AppD

|                  |              ata\Local\Temp\

|                  |
72ae4afb-68be-4265-bb2a-d08d33636251\5b0ebe46
| Ptotal= 72.90 mm |    Comments: 25-Year, 6 hour SCS Type II - Peterborou
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    2.90 |  1.75    7.30 |  3.25   16.00 |  4.75    4.40
                0.50    2.90 |  2.00    7.30 |  3.50   16.00 |  5.00    4.40
                0.75    4.40 |  2.25    8.80 |  3.75    7.30 |  5.25    2.90
                1.00    4.40 |  2.50    8.80 |  4.00    7.30 |  5.50    2.90
                1.25    4.40 |  2.75   43.70 |  4.25    5.80 |  5.75    2.90
                1.50    4.40 |  3.00  113.70 |  4.50    5.80 |  6.00    2.90

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--------------------
| CALIB            |
| NASHYD    (1100) |   Area    (ha)=   1.02   Curve Number   (CN)= 75.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.29

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
```

0.083	2.90	1.583	7.30	3.083	16.00	4.58	4.40
0.167	2.90	1.667	7.30	3.167	16.00	4.67	4.40
0.250	2.90	1.750	7.30	3.250	16.00	4.75	4.40
0.333	2.90	1.833	7.30	3.333	16.00	4.83	4.40
0.417	2.90	1.917	7.30	3.417	16.00	4.92	4.40
0.500	2.90	2.000	7.30	3.500	16.00	5.00	4.40
0.583	4.40	2.083	8.80	3.583	7.30	5.08	2.90
0.667	4.40	2.167	8.80	3.667	7.30	5.17	2.90
0.750	4.40	2.250	8.80	3.750	7.30	5.25	2.90
0.833	4.40	2.333	8.80	3.833	7.30	5.33	2.90
0.917	4.40	2.417	8.80	3.917	7.30	5.42	2.90
1.000	4.40	2.500	8.80	4.000	7.30	5.50	2.90
1.083	4.40	2.583	43.70	4.083	5.80	5.58	2.90
1.167	4.40	2.667	43.70	4.167	5.80	5.67	2.90
1.250	4.40	2.750	43.70	4.250	5.80	5.75	2.90
1.333	4.40	2.833	113.70	4.333	5.80	5.83	2.90
1.417	4.40	2.917	113.70	4.417	5.80	5.92	2.90
1.500	4.40	3.000	113.70	4.500	5.80	6.00	2.90

Unit Hyd Qpeak (cms)= 0.134

PEAK FLOW (cms)= 0.081 (i)
TIME TO PEAK (hrs)= 3.167
RUNOFF VOLUME (mm)= 29.322
TOTAL RAINFALL (mm)= 72.900
RUNOFF COEFFICIENT = 0.402

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
NASHYD (1101)	Area (ha)= 1.69 Curve Number (CN)= 72.8
ID= 1 DT= 5.0 min	Ia (mm)= 5.30 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.23

Unit Hyd Qpeak (cms)= 0.281

PEAK FLOW (cms)= 0.149 (i)
TIME TO PEAK (hrs)= 3.083
RUNOFF VOLUME (mm)= 28.090
TOTAL RAINFALL (mm)= 72.900
RUNOFF COEFFICIENT = 0.385

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0001)

1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (1100):	1.02	0.081	3.17	29.32
+ ID2= 2 (1101):	1.69	0.149	3.08	28.09
ID = 3 (0001):	2.71	0.225	3.08	28.55

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB	
NASHYD (2102)	Area (ha)= 0.05 Curve Number (CN)= 70.5
ID= 1 DT= 5.0 min	Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.13

Unit Hyd Qpeak (cms)= 0.015

PEAK FLOW (cms)= 0.006 (i)
TIME TO PEAK (hrs)= 3.000
RUNOFF VOLUME (mm)= 26.199
TOTAL RAINFALL (mm)= 72.900
RUNOFF COEFFICIENT = 0.359

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
NASHYD (2103)	Area (ha)= 1.69 Curve Number (CN)= 72.8
ID= 1 DT= 5.0 min	Ia (mm)= 5.30 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.23

Unit Hyd Qpeak (cms)= 0.281

PEAK FLOW (cms)= 0.149 (i)
TIME TO PEAK (hrs)= 3.083
RUNOFF VOLUME (mm)= 28.090
TOTAL RAINFALL (mm)= 72.900
RUNOFF COEFFICIENT = 0.385

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (2101)	Area (ha)= 0.97
ID= 1 DT= 5.0 min	Total Imp(%)= 30.00 Dir. Conn.(%)= 30.00

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.68
     Dep. Storage     (mm)=       1.00         4.40
     Average Slope     (%)=       7.75         1.88
     Length            (m)=      80.42       149.30
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     113.70        39.81
               over (min)        5.00        25.00
     Storage Coeff.  (min)=       1.15 (ii)   24.06 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=       0.34         0.05
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.05          0.118 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.25           3.00
     RUNOFF VOLUME    (mm)=      71.90        31.46          43.58
     TOTAL RAINFALL   (mm)=      72.90        72.90          72.90
     RUNOFF COEFFICIENT   =       0.99         0.43           0.60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| ADD HYD   (0002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (2101):     0.97   0.118     3.00    43.58
       + ID2= 2 (2103):     1.69   0.149     3.08    28.09
         ================================================
         ID = 3 (0002):     2.66   0.246     3.00    33.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (0022) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1142     0.0397
                          0.0062     0.0062   |   0.1294     0.0469
                          0.0229     0.0126   |   0.1430     0.0542
                          0.0470     0.0191   |   0.1555     0.0617
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                          0.0742     0.0258   |   0.1670     0.0693
                          0.0965     0.0327   |   0.0000     0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0002)      2.660      0.246      3.00      33.74
     OUTFLOW: ID= 1 (0022)      2.660      0.105      3.58      33.64

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 42.57
                TIME SHIFT OF PEAK FLOW         (min)= 35.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0360

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| ADD HYD   (0003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (2102):     0.05   0.006     3.00    26.20
       + ID2= 2 (0022):     2.66   0.105     3.58    33.64
         ================================================
         ID = 3 (0003):     2.71   0.106     3.58    33.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| NASHYD    (3102) |   Area    (ha)=   0.05   Curve Number   (CN)= 70.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

     Unit Hyd Qpeak  (cms)=   0.015

     PEAK FLOW       (cms)=   0.006 (i)
     TIME TO PEAK    (hrs)=   3.000
     RUNOFF VOLUME    (mm)=  26.199
     TOTAL RAINFALL   (mm)=  72.900
     RUNOFF COEFFICIENT   =   0.359

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| NASHYD    (3103) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23
```

```
     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.149 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  28.090
     TOTAL RAINFALL   (mm)=  72.900
     RUNOFF COEFFICIENT   =   0.385

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (3101) |   Area    (ha)=   0.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  30.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.68
     Dep. Storage     (mm)=       1.00         4.40
     Average Slope     (%)=       7.75         1.88
     Length            (m)=      80.42       149.30
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     113.70        39.81
               over (min)        5.00        25.00
     Storage Coeff.  (min)=       1.15 (ii)   24.06 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=       0.34         0.05
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.05          0.118 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.25           3.00
     RUNOFF VOLUME    (mm)=      71.90        31.46          43.58
     TOTAL RAINFALL   (mm)=      72.90        72.90          72.90
     RUNOFF COEFFICIENT   =       0.99         0.43           0.60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0004) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (3101):     0.97   0.118     3.00    43.58
         + ID2= 2 (3102):     0.05   0.006     3.00    26.20
           ================================================
           ID = 3 (0004):     1.02   0.124     3.00    42.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0004) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (0004):     1.02   0.124     3.00    42.73
         + ID2= 2 (3103):     1.69   0.149     3.08    28.09
           ================================================
           ID = 1 (0004):     2.71   0.252     3.00    33.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ***************************
  ** SIMULATION NUMBER:   5 **
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--------------------
|    READ STORM    |    Filename: C:\Users\nnapper\AppD

|                  |              ata\Local\Temp\

|                  |
72ae4afb-68be-4265-bb2a-d08d33636251\7d964e3a
| Ptotal= 81.47 mm |    Comments: 50-Year, 6 hour SCS Type II - Peterborou
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    3.30 |  1.75    8.10 |  3.25   17.90 |  4.75    4.90
                0.50    3.30 |  2.00    8.10 |  3.50   17.90 |  5.00    4.90
                0.75    4.90 |  2.25    9.80 |  3.75    8.10 |  5.25    3.30
                1.00    4.90 |  2.50    9.80 |  4.00    8.10 |  5.50    3.30
                1.25    4.90 |  2.75   48.90 |  4.25    6.50 |  5.75    3.30
                1.50    4.90 |  3.00  127.00 |  4.50    6.50 |  6.00    3.30

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| CALIB            |
| NASHYD    (1100) |   Area    (ha)=   1.02   Curve Number   (CN)= 75.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
```

-------------------- U.H. Tp(hrs)= 0.29

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.30	1.583	8.10	3.083	17.90	4.58	4.90
0.167	3.30	1.667	8.10	3.167	17.90	4.67	4.90
0.250	3.30	1.750	8.10	3.250	17.90	4.75	4.90
0.333	3.30	1.833	8.10	3.333	17.90	4.83	4.90
0.417	3.30	1.917	8.10	3.417	17.90	4.92	4.90
0.500	3.30	2.000	8.10	3.500	17.90	5.00	4.90
0.583	4.90	2.083	9.80	3.583	8.10	5.08	3.30
0.667	4.90	2.167	9.80	3.667	8.10	5.17	3.30
0.750	4.90	2.250	9.80	3.750	8.10	5.25	3.30
0.833	4.90	2.333	9.80	3.833	8.10	5.33	3.30
0.917	4.90	2.417	9.80	3.917	8.10	5.42	3.30
1.000	4.90	2.500	9.80	4.000	8.10	5.50	3.30
1.083	4.90	2.583	48.90	4.083	6.50	5.58	3.30
1.167	4.90	2.667	48.90	4.167	6.50	5.67	3.30
1.250	4.90	2.750	48.90	4.250	6.50	5.75	3.30
1.333	4.90	2.833	127.00	4.333	6.50	5.83	3.30
1.417	4.90	2.917	127.00	4.417	6.50	5.92	3.30
1.500	4.90	3.000	127.00	4.500	6.50	6.00	3.30

Unit Hyd Qpeak (cms)= 0.134

PEAK FLOW (cms)= 0.098 (i)
TIME TO PEAK (hrs)= 3.167
RUNOFF VOLUME (mm)= 35.419
TOTAL RAINFALL (mm)= 81.475
RUNOFF COEFFICIENT = 0.435

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD	(1101)	Area	(ha)= 1.69	Curve Number	(CN)= 72.8
ID= 1 DT= 5.0 min		Ia	(mm)= 5.30	# of Linear Res.(N)= 3.00	
		U.H. Tp(hrs)=	0.23		

Unit Hyd Qpeak (cms)= 0.281

PEAK FLOW (cms)= 0.180 (i)
TIME TO PEAK (hrs)= 3.083
RUNOFF VOLUME (mm)= 33.881
TOTAL RAINFALL (mm)= 81.475
RUNOFF COEFFICIENT = 0.416

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0001)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (1100):	1.02	0.098	3.17	35.42
	+ ID2= 2 (1101):	1.69	0.180	3.08	33.88
	ID = 3 (0001):	2.71	0.273	3.08	34.46

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB					
NASHYD	(2102)	Area	(ha)= 0.05	Curve Number	(CN)= 70.5
ID= 1 DT= 5.0 min		Ia	(mm)= 5.00	# of Linear Res.(N)= 3.00	
		U.H. Tp(hrs)=	0.13		

Unit Hyd Qpeak (cms)= 0.015

PEAK FLOW (cms)= 0.007 (i)
TIME TO PEAK (hrs)= 3.000
RUNOFF VOLUME (mm)= 31.675
TOTAL RAINFALL (mm)= 81.475
RUNOFF COEFFICIENT = 0.389

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD	(2103)	Area	(ha)= 1.69	Curve Number	(CN)= 72.8
ID= 1 DT= 5.0 min		Ia	(mm)= 5.30	# of Linear Res.(N)= 3.00	
		U.H. Tp(hrs)=	0.23		

Unit Hyd Qpeak (cms)= 0.281

PEAK FLOW (cms)= 0.180 (i)
TIME TO PEAK (hrs)= 3.083
RUNOFF VOLUME (mm)= 33.881
TOTAL RAINFALL (mm)= 81.475
RUNOFF COEFFICIENT = 0.416

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (2101) |   Area    (ha)=   0.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  30.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.68
     Dep. Storage     (mm)=       1.00         4.40
     Average Slope     (%)=       7.75         1.88
     Length            (m)=      80.42       149.30
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     127.00        55.92
               over (min)        5.00        25.00
     Storage Coeff.  (min)=       1.10 (ii)   21.10 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=       0.34         0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.10         0.06          0.137 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.25           3.00
     RUNOFF VOLUME    (mm)=      80.48        37.66          50.49
     TOTAL RAINFALL   (mm)=      81.48        81.48          81.48
     RUNOFF COEFFICIENT   =       0.99         0.46           0.62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-

--------------------
| ADD HYD   (0002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (2101):     0.97   0.137     3.00    50.49
       + ID2= 2 (2103):     1.69   0.180     3.08    33.88
         ================================================
         ID = 3 (0002):     2.66   0.293     3.00    39.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| RESERVOIR (0022) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1142      0.0397
                          0.0062     0.0062   |   0.1294      0.0469
                          0.0229     0.0126   |   0.1430      0.0542
                          0.0470     0.0191   |   0.1555      0.0617
                          0.0742     0.0258   |   0.1670      0.0693
                          0.0965     0.0327   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0002)      2.660      0.293      3.00      39.94
     OUTFLOW: ID= 1 (0022)      2.660      0.122      3.58      39.84

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 41.59
                   TIME SHIFT OF PEAK FLOW         (min)= 35.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0434

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--------------------
| ADD HYD   (0003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (2102):     0.05   0.007     3.00    31.67
       + ID2= 2 (0022):     2.66   0.122     3.58    39.84
         ================================================
         ID = 3 (0003):     2.71   0.123     3.58    39.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
--------------------
| CALIB            |
| NASHYD    (3102) |   Area    (ha)=   0.05   Curve Number   (CN)= 70.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

     Unit Hyd Qpeak  (cms)=   0.015

     PEAK FLOW       (cms)=   0.007 (i)
     TIME TO PEAK    (hrs)=   3.000
     RUNOFF VOLUME    (mm)=  31.675
     TOTAL RAINFALL   (mm)=  81.475
     RUNOFF COEFFICIENT   =   0.389

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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| CALIB            |
| NASHYD    (3103) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.180 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  33.881
     TOTAL RAINFALL   (mm)=  81.475
     RUNOFF COEFFICIENT   =   0.416

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (3101) |   Area    (ha)=   0.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  30.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.29         0.68
     Dep. Storage     (mm)=      1.00         4.40
     Average Slope     (%)=      7.75         1.88
     Length            (m)=     80.42       149.30
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=    127.00        55.92
               over (min)        5.00        25.00
     Storage Coeff.  (min)=      1.10 (ii)   21.10 (ii)
     Unit Hyd. Tpeak (min)=      5.00        25.00
     Unit Hyd. peak  (cms)=      0.34         0.05
                                                        *TOTALS*
     PEAK FLOW       (cms)=      0.10         0.06          0.137 (iii)
     TIME TO PEAK    (hrs)=      3.00         3.25           3.00
     RUNOFF VOLUME    (mm)=     80.48        37.66          50.49
     TOTAL RAINFALL   (mm)=     81.48        81.48          81.48
     RUNOFF COEFFICIENT   =      0.99         0.46           0.62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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--------------------
| ADD HYD   (0004) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (3101):     0.97   0.137     3.00    50.49
        + ID2= 2 (3102):     0.05   0.007     3.00    31.67
          ================================================
          ID = 3 (0004):     1.02   0.144     3.00    49.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0004) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0004):     1.02   0.144     3.00    49.57
        + ID2= 2 (3103):     1.69   0.180     3.08    33.88
          ================================================
          ID = 1 (0004):     2.71   0.300     3.00    39.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ***************************
  ** SIMULATION NUMBER:   6 **
  ***************************


--------------------
|    READ STORM    |    Filename: C:\Users\nnapper\AppD

|                  |              ata\Local\Temp\

|                  |
72ae4afb-68be-4265-bb2a-d08d33636251\166f370f
| Ptotal= 89.93 mm |    Comments: 100-Year, 6 hour SCS Type II - Peterboro
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.25    3.60 |  1.75    9.00 |  3.25   19.80 |  4.75    5.40
                0.50    3.60 |  2.00    9.00 |  3.50   19.80 |  5.00    5.40
                0.75    5.40 |  2.25   10.80 |  3.75    9.00 |  5.25    3.60
                1.00    5.40 |  2.50   10.80 |  4.00    9.00 |  5.50    3.60
                1.25    5.40 |  2.75   53.90 |  4.25    7.20 |  5.75    3.60
                1.50    5.40 |  3.00  140.20 |  4.50    7.20 |  6.00    3.60
```

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--------------------
| CALIB            |
| NASHYD    (1100) |   Area    (ha)=   1.02   Curve Number   (CN)= 75.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.29

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.60 | 1.583    9.00 | 3.083   19.80 |  4.58    5.40
                0.167    3.60 | 1.667    9.00 | 3.167   19.80 |  4.67    5.40
                0.250    3.60 | 1.750    9.00 | 3.250   19.80 |  4.75    5.40
                0.333    3.60 | 1.833    9.00 | 3.333   19.80 |  4.83    5.40
                0.417    3.60 | 1.917    9.00 | 3.417   19.80 |  4.92    5.40
                0.500    3.60 | 2.000    9.00 | 3.500   19.80 |  5.00    5.40
                0.583    5.40 | 2.083   10.80 | 3.583    9.00 |  5.08    3.60
                0.667    5.40 | 2.167   10.80 | 3.667    9.00 |  5.17    3.60
                0.750    5.40 | 2.250   10.80 | 3.750    9.00 |  5.25    3.60
                0.833    5.40 | 2.333   10.80 | 3.833    9.00 |  5.33    3.60
                0.917    5.40 | 2.417   10.80 | 3.917    9.00 |  5.42    3.60
                1.000    5.40 | 2.500   10.80 | 4.000    9.00 |  5.50    3.60
                1.083    5.40 | 2.583   53.90 | 4.083    7.20 |  5.58    3.60
                1.167    5.40 | 2.667   53.90 | 4.167    7.20 |  5.67    3.60
                1.250    5.40 | 2.750   53.90 | 4.250    7.20 |  5.75    3.60
                1.333    5.40 | 2.833  140.20 | 4.333    7.20 |  5.83    3.60
                1.417    5.40 | 2.917  140.20 | 4.417    7.20 |  5.92    3.60
                1.500    5.40 | 3.000  140.20 | 4.500    7.20 |  6.00    3.60

     Unit Hyd Qpeak  (cms)=   0.134

     PEAK FLOW       (cms)=   0.116 (i)
     TIME TO PEAK    (hrs)=   3.167
     RUNOFF VOLUME    (mm)=  41.680
     TOTAL RAINFALL   (mm)=  89.925
     RUNOFF COEFFICIENT   =   0.464

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
--------------------
| CALIB            |
| NASHYD    (1101) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.213 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  39.846
     TOTAL RAINFALL   (mm)=  89.925
     RUNOFF COEFFICIENT   =   0.443

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (1100):     1.02   0.116     3.17    41.68
       + ID2= 2 (1101):     1.69   0.213     3.08    39.85
         ================================================
         ID = 3 (0001):     2.71   0.323     3.08    40.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| NASHYD    (2102) |   Area    (ha)=   0.05   Curve Number   (CN)= 70.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

     Unit Hyd Qpeak  (cms)=   0.015

     PEAK FLOW       (cms)=   0.008 (i)
     TIME TO PEAK    (hrs)=   3.000
     RUNOFF VOLUME    (mm)=  37.335
     TOTAL RAINFALL   (mm)=  89.925
     RUNOFF COEFFICIENT   =   0.415

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
--------------------
| CALIB            |
| NASHYD    (2103) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281
```

```
     PEAK FLOW       (cms)=   0.213 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  39.846
     TOTAL RAINFALL   (mm)=  89.925
     RUNOFF COEFFICIENT   =   0.443

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
--------------------
| CALIB            |
| STANDHYD  (2101) |   Area    (ha)=   0.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  30.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.68
     Dep. Storage     (mm)=       1.00         4.40
     Average Slope     (%)=       7.75         1.88
     Length            (m)=      80.42       149.30
     Mannings n             =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     140.20        65.48
               over (min)        5.00        20.00
     Storage Coeff.  (min)=       1.06 (ii)   19.83 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.34         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.08          0.165 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.17           3.00
     RUNOFF VOLUME    (mm)=      88.92        44.02          57.48
     TOTAL RAINFALL   (mm)=      89.93        89.93          89.93
     RUNOFF COEFFICIENT   =       0.99         0.49           0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0002) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2101):     0.97   0.165     3.00    57.48
        + ID2= 2 (2103):     1.69   0.213     3.08    39.85
          ================================================
          ID = 3 (0002):     2.66   0.350     3.00    46.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| RESERVOIR (0022) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1142      0.0397
                          0.0062     0.0062   |   0.1294      0.0469
                          0.0229     0.0126   |   0.1430      0.0542
                          0.0470     0.0191   |   0.1555      0.0617
                          0.0742     0.0258   |   0.1670      0.0693
                          0.0965     0.0327   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0002)      2.660      0.350      3.00      46.28
     OUTFLOW: ID= 1 (0022)      2.660      0.138      3.58      46.18

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 39.43
                    TIME SHIFT OF PEAK FLOW         (min)= 35.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0515

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--------------------
| ADD HYD   (0003) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (2102):     0.05   0.008     3.00    37.34
        + ID2= 2 (0022):     2.66   0.138     3.58    46.18
          ================================================
          ID = 3 (0003):     2.71   0.139     3.58    46.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| NASHYD    (3102) |   Area    (ha)=   0.05   Curve Number   (CN)= 70.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.13

     Unit Hyd Qpeak  (cms)=   0.015
```

```
     PEAK FLOW       (cms)=   0.008 (i)
     TIME TO PEAK    (hrs)=   3.000
     RUNOFF VOLUME    (mm)=  37.335
     TOTAL RAINFALL   (mm)=  89.925
     RUNOFF COEFFICIENT   =   0.415

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (3103) |   Area    (ha)=   1.69   Curve Number   (CN)= 72.8
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.281

     PEAK FLOW       (cms)=   0.213 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  39.846
     TOTAL RAINFALL   (mm)=  89.925
     RUNOFF COEFFICIENT   =   0.443

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
--------------------
| CALIB            |
| STANDHYD  (3101) |   Area    (ha)=   0.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  30.00
--------------------

                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.68
     Dep. Storage     (mm)=       1.00         4.40
     Average Slope     (%)=       7.75         1.88
     Length            (m)=      80.42       149.30
     Mannings n             =    0.013        0.250

     Max.Eff.Inten.(mm/hr)=     140.20        65.48
               over (min)        5.00        20.00
     Storage Coeff.  (min)=       1.06 (ii)   19.83 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.34         0.06
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.08          0.165 (iii)
     TIME TO PEAK    (hrs)=       3.00         3.17           3.00
     RUNOFF VOLUME    (mm)=      88.92        44.02          57.48
     TOTAL RAINFALL   (mm)=      89.93        89.93          89.93
     RUNOFF COEFFICIENT   =       0.99         0.49           0.64
```

```
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  75.9    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0004) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (3101):     0.97   0.165     3.00    57.48
        + ID2= 2 (3102):     0.05   0.008     3.00    37.34
          ================================================
          ID = 3 (0004):     1.02   0.173     3.00    56.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0004) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0004):     1.02   0.173     3.00    56.49
        + ID2= 2 (3103):     1.69   0.213     3.08    39.85
          ================================================
          ID = 1 (0004):     2.71   0.358     3.00    46.11

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 FINISH
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Appendix D

Quantity Control

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Stage-Storage-Discharge: Grassed Detention Basin

Project No: 85260
Project Name: Lakefield Townhouse Development
Designed/Checked By: NN / KS
Date: March 9, 2024

Storage Summary		
Top of Permanent Pool:	263.40	m
Permanent Pool Volume:	0.0	m^3
Active Storage Volume:	693.3	m^3

Outlet Capacity Summary				
Type	Diameter	Slope	Peak Flow	% Full
PVC	375	0.056	0.139	25.8

Discharge Summary				
Stage	Type	Invert Elev (m)	Diameter / Width (mm)	(m)
1	Orifice Tube: Vertical	263.40	299	

Stage-Storage-Discharge Summary Table

Elevation	Stage	Stage 1 Orifice Tube						Active Storage	Total Discharge	Notes
m	m	m^3/s						ha*m	m^3/s	
263.40	0.00	0.000						**0.0000**	**0.000**	
263.41	0.01	**0.000**						**0.0010**	**0.000**	
263.42	0.02	**0.001**						**0.0021**	**0.001**	
263.43	0.03	**0.002**						**0.0031**	**0.002**	
263.44	0.04	**0.003**						**0.0041**	**0.003**	
263.45	0.05	**0.004**						**0.0052**	**0.004**	
263.46	0.06	**0.006**						**0.0062**	**0.006**	
263.47	0.07	**0.008**						**0.0073**	**0.008**	
263.48	0.08	**0.011**						**0.0083**	**0.011**	
263.49	0.09	**0.013**						**0.0094**	**0.013**	
263.50	0.10	**0.016**						**0.0105**	**0.016**	
263.51	0.11	**0.019**						**0.0115**	**0.019**	
263.52	0.12	**0.023**						**0.0126**	**0.023**	
263.53	0.13	**0.026**						**0.0137**	**0.026**	
263.54	0.14	**0.030**						**0.0148**	**0.030**	<= 2 Yr: 140 m³ (263.54m)
263.55	0.15	**0.034**						**0.0159**	**0.034**	
263.56	0.16	**0.038**						**0.0169**	**0.038**	
263.57	0.17	**0.043**						**0.0180**	**0.043**	
263.58	0.18	**0.047**						**0.0191**	**0.047**	
263.59	0.19	**0.051**						**0.0202**	**0.051**	
263.60	0.20	**0.056**						**0.0214**	**0.056**	
263.61	0.21	**0.061**						**0.0225**	**0.061**	<= 5 Yr: 216.1 m³ (263.61m)
263.62	0.22	**0.065**						**0.0236**	**0.065**	
263.63	0.23	**0.070**						**0.0247**	**0.070**	
263.64	0.24	**0.074**						**0.0258**	**0.074**	
263.65	0.25	**0.079**						**0.0270**	**0.079**	
263.66	0.26	**0.083**						**0.0281**	**0.083**	<= 10 Yr: 274 m³ (263.66m)
263.67	0.27	**0.087**						**0.0292**	**0.087**	
263.68	0.28	**0.091**						**0.0304**	**0.091**	
263.69	0.29	**0.094**						**0.0315**	**0.094**	
263.70	0.30	**0.097**						**0.0327**	**0.097**	
263.71	0.31	**0.100**						**0.0338**	**0.100**	
263.72	0.32	**0.103**						**0.0350**	**0.103**	
263.73	0.33	**0.106**						**0.0362**	**0.106**	<= 25 Yr: 360 m³ (263.73m)
263.74	0.34	**0.109**						**0.0373**	**0.109**	
263.75	0.35	**0.111**						**0.0385**	**0.111**	
263.76	0.36	**0.114**						**0.0397**	**0.114**	
263.77	0.37	**0.117**						**0.0409**	**0.117**	
263.78	0.38	**0.119**						**0.0421**	**0.119**	
263.79	0.39	**0.122**						**0.0433**	**0.122**	
263.80	0.40	**0.125**						**0.0445**	**0.125**	<= 50 Yr: 434 m³ (263.8m)
263.81	0.41	**0.127**						**0.0457**	**0.127**	
263.82	0.42	**0.129**						**0.0469**	**0.129**	
263.83	0.43	**0.132**						**0.0481**	**0.132**	
263.84	0.44	**0.134**						**0.0493**	**0.134**	
263.85	0.45	**0.136**						**0.0505**	**0.136**	
263.86	0.46	**0.139**						**0.0517**	**0.139**	<= 100 Yr: 515 m³ (263.86m)
263.87	0.47	**0.141**						**0.0530**	**0.141**	
263.88	0.48	**0.143**						**0.0542**	**0.143**	
263.89	0.49	**0.145**						**0.0554**	**0.145**	
263.90	0.50	**0.147**						**0.0567**	**0.147**	
263.91	0.51	**0.149**						**0.0579**	**0.149**	
263.92	0.52	**0.151**						**0.0592**	**0.151**	
263.93	0.53	**0.153**						**0.0604**	**0.153**	
263.94	0.54	**0.155**						**0.0617**	**0.155**	
263.95	0.55	**0.157**						**0.0629**	**0.157**	
263.96	0.56	**0.159**						**0.0642**	**0.159**	
263.97	0.57	**0.161**						**0.0655**	**0.161**	
263.98	0.58	**0.163**						**0.0668**	**0.163**	
263.99	0.59	**0.165**						**0.0680**	**0.165**	
264.00	0.60	**0.167**						**0.0693**	**0.167**	

Appendix E

Storm Sewer Analysis

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STORM SEWER HYDRAULIC GRADE LINE DESIGN SHEET - EXISTING CONDITIONS

Rain Station:	Peterborough Airport
Design Storm:	5 Year
Intensity-Duration-Frequency Parameters	a = 1098.0
	b = 10.100
	c = 0.83
Minimum Time of Concentration:	10 min

Design Consideration: Overland Flow Route

Project Information			
Project Name	8th Line Bridgenorth Townhouses	**Project No.**	85260
Project Location	Bridgenorth	**Designed by**	JTF
Municipality	Selwyn Township	**Checked by**	KS
Design Standards		**Date**	07/12/2023

D.M. Wills Associates Ltd.
150 Jameson Drive
Peterborough, ON · K9J 0B9
Tel: (705) 742-2297 ext. 250
Fax: (705) 741-3568

LOCATION					TIME OF CONCENTRATION (MIN)		INTENSITY (mm/hr)	CATCHMENT (Multiplation Factor for 5 Year Storm: 1.00)			STRUCTURE INLET PROPERTIES								PIPE PROPERTIES								FLOW REGIME				LOSSES			HGL					NOTES
STREET	CATCHMENT ID	FROM	TO	TO (OVERLAND FLOW ROUTE)	TO UPPER END	IN REACH		AREA (ha)	5 YR RUNOFF COEFFICIENT, C	AC (x FACTOR)	EXTRANEOUS **SURFACE** FLOWS (m^3/s)	CUMULATIVE AC TO STRUCTURE	CUMULATIVE EXTRANEOUS FLOWS TO STRUCTURE (m^3/s)	CATCH BASIN GRATE TYPE	CATCHBASIN ON GRADE OR IN SAG	GRADE OF ROAD (%)	MAX PONDING DEPTH (m)	% FLOW CAPTURED	EXTRANEOUS **SEWER** FLOWS (m^3/s)	PIPE FLOW (m^3/s)	PIPE MATERIAL	LENGTH (m)	GRADE (%)	PIPE DIA. (mm)	BEND AT D/S STRUCTURE (0-90°)	UPSTREAM INVERT (m)	CAPACITY (m^3/s)	% FULL	PARTIAL FLOW VELOCITY (m/s)	FLOW REGIME	FRICTION LOSS (m)	STRUCTURE LOSSES (m)	CONFLUENCE LOSSES (m)	U/S HGL ELEVATION (m)	D/S HGL ELEVATION (m)	D/S HGL OVERRIDE	TOP OF GRATE ELEVATION (m)	SURFACE PONDING DEPTH (m)	
Ward St	P0651	P0651	P0237	P0169	10.0	0.0	91.0	0.05	0.80	0.04	0.000	0.04	0.00	Single	On Grade	1.41	0.00	100	0.000	0.010	Concrete	7.6	5.46	300	90	263.93	0.226	4.5%	1.64	Spr-Crit	0.42	0.18	0.18	264.01	263.79		265.25	-1.24	
Ward St	P0237	P0237	P0238	P0238	10.0	0.9	91.0	0.99	0.15	0.15	0.000	0.15	0.00	Single	On Grade	1.41	0.00	90	0.000	0.044	Concrete	65.7	0.82	300	0	263.44	0.088	50.3%	1.24	Spr-Crit	0.54	0.00	0.00	263.61	263.05		265.24	-1.64	
Ward St	P0169	P0169	P0238	P0653	10.0	0.0	91.0	0.05	0.80	0.04	0.000	0.04	0.00	Single	On Grade	1.43	0.00	100	0.000	0.010	Concrete	7.6	5.50	300	90	263.10	0.227	4.5%	1.64	Spr-Crit	0.42	0.00	0.18	263.18	262.87		264.65	-1.47	
Ward St	P0652	P0652	P0238	P0238	10.0	0.0	91.0	0.24	0.15	0.04	0.000	0.04	0.00	Single	On Grade	1.43	0.00	100	0.000	0.009	Concrete	5.8	4.51	300	50	263.16	0.205	4.4%	1.48	Spr-Crit	0.26	0.00	0.05	263.23	262.95		264.82	-1.59	
Ward St	P0238	P0238	P0239	P0239	10.9	0.8	87.7	0.40	0.15	0.06	0.000	0.07	0.00	Single	On Grade	1.60	0.00	100	0.000	0.079	Concrete	83.9	1.71	300	0	262.64	0.127	62.5%	1.89	Spr-Crit	1.44	0.01	0.01	262.86	261.49		264.49	-1.63	
Ward St	P0653	P0653	P0239	P0264	10.0	0.0	91.0	0.09	0.80	0.07	0.000	0.07	0.00	Single	On Grade	1.60	0.00	100	0.000	0.018	Concrete	7.6	9.67	300	90	262.07	0.301	6.1%	2.36	Spr-Crit	0.73	0.01	0.38	262.17	261.49		263.19	-1.02	
Ward St	P0239	P0239	P0239A	P0239A	11.7	0.5	85.1	0.59	0.40	0.24	0.000	0.24	0.00	Single	On Grade	1.53	0.00	81	0.000	0.139	Concrete	61.3	1.69	375	0	261.20	0.228	61.0%	2.17	Spr-Crit	1.04	0.01	0.01	261.48	261.22		263.13	-1.66	
Ward St	P0264	P0264	P0239A	P0239A	10.0	0.1	91.0	0.05	0.80	0.04	0.000	0.04	0.00	Single	On Grade	1.53	0.00	100	0.000	0.010	Concrete	7.6	2.35	300	90	260.42	0.148	6.8%	1.20	Spr-Crit	0.00	0.01	0.00	261.22	261.22		262.22	-0.99	
Mann Rd	P0643A	P0643A	P0643	P0471	10.0	0.2	91.0	0.85	0.15	0.13	0.000	0.13	0.00	Single	In Sag	5.58	0.15	100	0.000	0.032	Concrete	15.0	0.84	300	90	263.00	0.089	36.4%	1.16	Spr-Crit	0.02	0.01	0.01	263.46	263.44		263.90	-0.44	
Mann Rd	P0643	P0643	P0172	P0643A	33.2	0.1	48.1	5.46	0.25	1.37	0.000	1.37	0.00	Single	In Sag	5.56	0.30	100	0.000	0.200	Concrete	21.9	5.79	300	15	262.38	0.233	85.8%	3.30	Sub-Crit	0.94	0.03	0.03	263.42	262.49		264.25	-0.83	
Mann Rd	P0172	P0172	P0239A	P0239A	33.3	0.1	48.0	0.73	0.40	0.29	0.000	0.29	0.00	Single	In Sag	4.85	0.30	100	0.000	0.238	Concrete	20.3	4.68	300	70	261.11	0.209	113.9%	2.97	Sub-Crit	1.23	0.01	0.50	262.46	261.22		262.78	-0.32	
Mann Rd	P0471	P0471	P0239A	P0239A	10.0	0.1	91.0	0.21	0.80	0.17	0.000	0.17	0.00	Single	On Grade	4.85	0.00	98	0.000	0.042	HDPE	19.4	4.67	300	90	261.06	0.272	15.3%	2.79	Spr-Crit	0.91	0.01	0.52	261.22	261.22		262.39	-1.17	
Ward St	P0239A	P0239A	P0070	P0070	33.4	0.6	47.9	0.21	0.80	0.17	0.000	0.22	0.00	Single	On Grade	4.85	0.00	100	0.000	0.372	Concrete	63.5	0.88	450	0	260.05	0.268	138.8%	1.69	Sub-Crit	1.08	0.01	0.01	261.21	260.13		262.18	-0.97	
Ward St	P0168	P0168	P0070	P0070	10.0	0.1	91.0	0.11	0.80	0.09	0.000	0.09	0.00	Single	In Sag	1.00	0.15	100	0.000	0.022	Concrete	7.5	2.34	300	90	259.93	0.148	15.1%	1.51	Spr-Crit	0.17	0.01	0.15	260.13	260.13		261.62	-1.49	
Ward St	P0644	P0644	P0070	P0070	10.0	0.1	91.0	1.00	0.80	0.80	0.000	0.80	0.00	Single	In Sag	1.00	0.30	100	0.000	0.202	Concrete	5.4	2.00	250	90	260.79	0.084	240.2%	1.72	Sub-Crit	0.62	0.01	1.14	261.56	260.94		261.86	-0.31	
Ward St	P0757	P0757	P0070	P0070	10.0	0.0	91.0	0.49	0.45	0.22	0.000	0.22	0.00	Single	In Sag	1.00	0.15	100	0.000	0.056	Concrete	4.6	2.00	250	90	260.95	0.084	66.3%	1.83	Spr-Crit	0.09	0.01	0.23	261.14	261.00		262.02	-0.88	
Ward St	P0070	P0070	P0234	OUT	34.0	0.8	47.4	0.10	0.45	0.05	0.000	0.05	0.00	Single	In Sag	1.10	0.30	100	0.000	0.520	Concrete	79.1	0.57	600	5	259.39	0.462	112.5%	1.64	Sub-Crit	0.57	0.01	0.01	260.11	259.55		261.68	-1.57	
Ward St	P0265A	P0265A	P0234	P0168	10.0	0.1	91.0	0.02	0.80	0.02	0.000	0.02	0.00	Single	On Grade	1.24	0.00	100	0.000	0.004	Concrete	7.6	0.50	300	90	261.25	0.068	5.9%	0.56	Sub-Crit	0.04	0.01	0.30	261.30	261.26		262.45	-1.15	
Ward St	P0234	P0234	P0091	P0070	34.8	0.3	46.7	0.04	0.80	0.03	0.000	0.03	0.00	Single	On Grade	1.24	0.00	100	0.000	0.518	Concrete	44.3	1.16	600	90	258.93	0.662	78.3%	2.59	Spr-Crit	0.51	0.28	0.45	259.42	259.42		262.44	-3.02	
Ward St	P0091A	P0091A	P0091	P0234	38.8	0.0	43.5	3.36	0.25	0.84	0.000	0.84	0.00	Single	In Sag	1.24	0.15	100	0.000	0.102	Concrete	8.9	8.91	250	45	261.17	0.178	57.2%	3.74	Spr-Crit	0.80	0.28	0.28	261.40	260.51		262.35	-0.94	
8th Line	P0263	P0263	P0236	P0236	34.1	0.1	47.3	19.10	0.31	5.92	0.000	5.92	0.00	Open	In Sag	0.38	0.30	100	0.000	0.779	Concrete	25.9	6.72	600	15	263.96	1.591	48.9%	5.60	Spr-Crit	1.74	0.12	0.12	264.51	262.82		264.96	-0.45	
8th Line	P0236	P0236	P0170A	P0170A	34.2	0.2	47.2	0.03	0.80	0.02	0.000	0.02	0.00	Single	On Grade	2.31	0.00	100	0.000	0.780	Concrete	33.1	1.88	600	15	262.19	0.841	92.7%	2.98	Sub-Crit	0.53	0.03	0.03	262.70	262.17		264.35	-1.65	
8th Line	P0170A	P0170A	P0235	P0235	34.4	0.2	47.0	0.06	0.80	0.05	0.000	0.05	0.00	Single	On Grade	2.31	0.00	100	0.000	0.784	Concrete	27.3	1.89	600	15	261.54	0.843	93.0%	2.99	Sub-Crit	0.45	0.03	0.03	262.07	261.63		264.50	-2.43	
8th Line	P0235	P0235	P0091	P0091	34.6	0.1	46.9	0.12	0.45	0.05	0.000	0.05	0.00	Single	On Grade	2.88	0.00	100	0.000	0.788	Concrete	25.4	2.42	600	90	260.99	0.955	82.5%	3.77	Sub-Crit	0.61	0.28	0.96	261.40	260.79		263.66	-2.25	
8th Line	P0091	P0091	P0295	P0234	38.8	0.2	43.5	0.07	0.80	0.06	0.000	0.06	0.00	Single	On Grade	1.24	0.00	100	0.000	1.323	Concrete	28.8	1.34	750	60	258.37	1.287	102.8%	2.92	Sub-Crit	0.41	0.29	0.29	259.14	258.74		262.95	-3.81	

Rain Station:	Peterborough Airport
Design Storm:	5 Year
Intensity-Duration-Frequency Parameters	a = 1098.0 b = 10.100 c = 0.83
Minimum Time of Concentration:	10 min

Design Consideration:	Overland Flow Route

Project Information			
Project Name	8th Line Bridgenorth Townhouses	**Project No.**	85260
Project Location	Bridgenorth	**Designed by**	JTF
Municipality	Selwyn Township	**Checked by**	KS
Design Standards		**Date**	07/12/2023

D.M. Wills Associates Ltd.
150 Jameson Drive
Peterborough, ON · K9J 0B9
Tel: (705) 742-2297 ext. 250
Fax: (705) 741-3568

LOCATION					TIME OF CONCENTRATION (MIN)		INTENSITY (mm/hr)	CATCHMENT			STRUCTURE INLET PROPERTIES								PIPE PROPERTIES								FLOW REGIME				LOSSES			HGL					NOTES
								Multiplation Factor for 5 Year Storm: 1.00																															
STREET	CATCHMENT ID	FROM	TO	TO (OVERLAND FLOW ROUTE)	TO UPPER END	IN REACH		AREA (ha)	5 YR RUNOFF COEFFICIENT, C	AC (x FACTOR)	EXTRANEOUS **SURFACE** FLOWS (m^3/s)	CUMULATIVE AC TO STRUCTURE	CUMULATIVE EXTRANEOUS FLOWS TO STRUCTURE (m^3/s)	CATCH BASIN GRATE TYPE	CATCHBASIN ON GRADE OR IN SAG	GRADE OF ROAD (%)	MAX PONDING DEPTH (m)	% FLOW CAPTURED	EXTRANEOUS **SEWER** FLOWS (m^3/s)	PIPE FLOW (m^3/s)	PIPE MATERIAL	LENGTH (m)	GRADE (%)	PIPE DIA. (mm)	BEND AT D/S STRUCTURE (0-90°)	UPSTREAM INVERT (m)	CAPACITY (m^3/s)	% FULL	PARTIAL FLOW VELOCITY (m/s)	FLOW REGIME	FRICTION LOSS (m)	STRUCTURE LOSSES (m)	CONFLUENCE LOSSES (m)	U/S HGL ELEVATION (m)	D/S HGL ELEVATION (m)	D/S HGL OVERRIDE	TOP OF GRATE ELEVATION (m)	SURFACE PONDING DEPTH (m)	
Jones Beach Rd	P0295	P0295	S0169	S0169	39.0	0.2	43.4	0.02	0.80	0.02	0.000	0.02	0.00	Single	On Grade	7.14	0.00	100	0.000	1.320	Concrete	51.2	1.91	750	0	257.95	1.539	85.8%	3.49	Sub-Crit	0.72	0.02	0.02	258.44	257.72		262.42	-3.98	
Jones Beach Rd	S0169A	S0169A	S0169	S0173	10.0	0.1	91.0	0.39	0.45	0.18	0.000	0.18	0.00	Single	On Grade	8.65	0.00	98	0.000	0.044	PVC	11.1	4.00	300	90	257.00	0.193	22.5%	2.22	Spr-Crit	0.03	0.02	0.45	257.61	257.58		258.00	-0.39	
Jones Beach Rd	S0169	S0169	S0170	S0170	39.2	0.1	43.2	0.16	0.15	0.02	0.000	0.02	0.00	Single	On Grade	8.65	0.00	100	0.000	1.339	Concrete	34.0	7.70	750	0	256.87	3.088	43.4%	6.74	Spr-Crit	2.62	0.12	0.12	257.55	254.60		258.49	-0.93	
Jones Beach Rd	S0170	S0170	S0171	S0171	39.3	0.1	43.1	0.35	0.40	0.14	0.000	0.14	0.00	Single	On Grade	5.50	0.00	100	0.000	1.354	Concrete	23.8	4.21	750	0	253.74	2.284	59.3%	5.39	Spr-Crit	1.00	0.07	0.07	254.43	253.16		256.47	-2.04	
Jones Beach Rd	S0171	S0171	S0172	S0172	39.4	0.0	43.1	0.14	0.40	0.06	0.000	0.06	0.00	Single	On Grade	7.51	0.00	100	0.000	1.358	Concrete	14.7	6.23	750	0	252.22	2.780	48.9%	6.26	Spr-Crit	0.92	0.10	0.10	252.91	251.67		254.70	-1.79	
Jones Beach Rd	S0173	S0173	S0172	OUT	10.0	0.0	91.0	0.21	0.40	0.08	0.000	0.09	0.00	Single	On Grade	8.33	0.00	100	0.000	0.022	Concrete	11.3	3.92	750	75	251.67	2.204	1.0%	1.62	Spr-Crit	0.44	0.10	0.13	251.76	251.53		253.27	-1.51	
Jones Beach Rd	S0172	S0172	S0174	S0174	39.4	0.2	43.1	0.10	0.40	0.04	0.000	0.04	0.00	Single	On Grade	8.33	0.00	100	0.000	1.373	Concrete	59.1	5.51	750	0	250.74	2.614	52.5%	5.99	Spr-Crit	3.26	0.09	0.09	251.43	248.12		253.71	-2.28	
Jones Beach Rd	S0174	S0174	OUT	OUT	39.6	0.1	42.9	0.30	0.40	0.12	0.000	0.12	0.00	Single	On Grade	6.10	0.00	100	0.000	1.383	Concrete	19.2	2.00	900	0	247.33	2.560	54.0%	4.10	Spr-Crit	0.38	0.04	0.04	248.03	247.42		249.13	-1.10	

Input Column

Formulated Column

U/S End of Pipe Run

D/S End of Pipe Run

Manual Entry

Equivalent Circular Pipe Diameter

Manning's n Values

HDPE	0.010
PVC	0.013
Concrete	0.013
Clay	0.014
Brick	0.015

Surface Ponding

1.00 Surface Ponding Exceeds Max Allowable Ponding Depth

STORM SEWER HYDRAULIC GRADE LINE DESIGN SHEET

Rain Station:	Peterborough Airport
Design Storm:	100 Year
Intensity-Duration-Frequency Parameters	a = 2507.0
	b = 14.800
	c = 0.88
Minimum Time of Concentration:	10 min

Design Consideration: Overland Flow Route

Project Information			
Project Name	8th Line Bridgenorth Townhouses	**Project No.**	85260
Project Location	Bridgenorth	**Designed by**	JTF
Municipality	Selwyn Township	**Checked by**	KS
Design Standards		**Date**	07/12/2023

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LOCATION					TIME OF CONCENTRATION (MIN)		INTENSITY (mm/hr)	CATCHMENT			STRUCTURE INLET PROPERTIES								PIPE PROPERTIES								FLOW REGIME				LOSSES			HGL					NOTES
								Multiplation Factor for 100 Year Storm: 1.25																															
STREET	CATCHMENT ID	FROM	TO	TO (OVERLAND FLOW ROUTE)	TO UPPER END	IN REACH		AREA (ha)	5 YR RUNOFF COEFFICIENT, C	AC (x FACTOR)	EXTRANEOUS **SURFACE** FLOWS (m^3/s)	CUMULATIVE AC TO STRUCTURE	CUMULATIVE EXTRANEOUS FLOWS TO STRUCTURE (m^3/s)	CATCH BASIN GRATE TYPE	CATCHBASIN ON GRADE OR IN SAG	GRADE OF ROAD (%)	MAX PONDING DEPTH (m)	% FLOW CAPTURED	EXTRANEOUS **SEWER** FLOWS (m^3/s)	PIPE FLOW (m^3/s)	PIPE MATERIAL	LENGTH (m)	GRADE (%)	PIPE DIA. (mm)	BEND AT D/S STRUCTURE (0-90°)	UPSTREAM INVERT (m)	CAPACITY (m^3/s)	% FULL	PARTIAL FLOW VELOCITY (m/s)	FLOW REGIME	FRICTION LOSS (m)	STRUCTURE LOSSES (m)	CONFLUENCE LOSSES (m)	U/S HGL ELEVATION (m)	D/S HGL ELEVATION (m)	D/S HGL OVERRIDE	TOP OF GRATE ELEVATION (m)	SURFACE PONDING DEPTH (m)	
Ward St	P0651	P0651	P0237	P0169	10.0	0.0	148.6	0.05	0.80	0.05	0.000	0.05	0.00	Single	On Grade	1.41	0.00	98	0.000	0.019	Concrete	7.6	5.46	300	90	263.93	0.226	8.5%	1.95	Spr-Crit	0.01	0.00	0.00	265.25	265.24	265.24	265.25	0.00	
Ward St	P0237	P0237	P0238	P0238	10.0	0.9	148.6	0.99	0.15	0.19	0.000	0.19	0.00	Single	On Grade	1.41	0.00	74	0.000	0.076	Concrete	65.7	0.82	300	0	263.44	0.088	86.3%	1.24	Sub-Crit	0.40	0.00	0.00	264.90	264.49	264.49	265.24	-0.35	
Ward St	P0169	P0169	P0238	P0653	10.0	0.0	148.6	0.05	0.80	0.05	0.000	0.05	0.00	Single	On Grade	1.43	0.00	98	0.000	0.020	Concrete	7.6	5.50	300	90	263.10	0.227	8.6%	1.97	Spr-Crit	0.01	0.00	0.01	264.50	264.49	264.49	264.65	-0.15	
Ward St	P0652	P0652	P0238	P0238	10.0	0.0	148.6	0.24	0.15	0.05	0.000	0.05	0.00	Single	On Grade	1.43	0.00	98	0.000	0.018	Concrete	5.8	4.51	300	50	263.16	0.205	8.9%	1.80	Spr-Crit	0.01	0.00	0.00	264.50	264.49	264.49	264.82	-0.32	
Ward St	P0238	P0238	P0239	P0239	10.9	0.8	144.0	0.40	0.15	0.08	0.000	0.12	0.00	Single	On Grade	1.60	0.00	85	0.000	0.152	Concrete	83.9	1.71	300	0	262.64	0.127	120.4%	1.80	Sub-Crit	2.08	0.01	0.01	265.22	263.13	263.13	264.49	0.73	
Ward St	P0653	P0653	P0239	P0264	10.0	0.0	148.6	0.09	0.80	0.09	0.000	0.09	0.00	Single	On Grade	1.60	0.00	92	0.000	0.033	Concrete	7.6	9.67	300	90	262.07	0.301	11.0%	2.80	Spr-Crit	0.02	0.01	0.08	263.15	263.13	263.13	263.19	-0.03	
Ward St	P0239	P0239	P0239A	P0239A	11.7	0.5	140.2	0.59	0.40	0.30	0.000	0.31	0.00	Single	On Grade	1.53	0.00	61	0.000	0.255	Concrete	61.3	1.69	375	0	261.20	0.228	111.6%	2.07	Sub-Crit	1.29	0.01	0.01	263.47	262.18	262.18	263.13	0.33	
Ward St	P0264	P0264	P0239A	P0239A	10.0	0.1	148.6	0.05	0.80	0.05	0.000	0.05	0.00	Single	On Grade	1.53	0.00	98	0.000	0.022	Concrete	7.6	2.35	300	90	260.42	0.148	14.8%	1.51	Spr-Crit	0.01	0.01	0.01	262.18	262.18	262.18	262.22	-0.03	
Mann Rd	P0643A	P0643A	P0643	P0471	10.0	0.2	148.6	0.85	0.15	0.16	0.000	0.99	0.00	Single	In Sag	5.58	0.15	29	0.000	0.120	Concrete	15.0	0.84	300	90	263.00	0.089	135.4%	1.26	Sub-Crit	0.23	0.19	0.19	264.48	264.25	264.25	263.90	0.58	
Mann Rd	P0643	P0643	P0172	P0643A	33.2	0.1	83.1	5.46	0.25	1.71	0.000	1.71	0.00	Single	In Sag	5.56	0.30	51	0.000	0.269	Concrete	21.9	5.79	300	15	262.38	0.233	115.7%	3.30	Sub-Crit	1.70	0.05	0.05	264.48	262.78	262.78	264.25	0.23	
Mann Rd	P0172	P0172	P0239A	P0239A	33.3	0.1	83.0	0.73	0.40	0.37	0.000	0.37	0.00	Single	In Sag	4.85	0.30	100	0.000	0.353	Concrete	20.3	4.68	300	70	261.11	0.209	168.6%	2.97	Sub-Crit	2.71	0.01	1.09	264.88	262.18	262.18	262.78	2.10	
Mann Rd	P0471	P0471	P0239A	P0239A	10.0	0.1	148.6	0.21	0.80	0.20	0.000	0.90	0.00	Single	On Grade	4.85	0.00	48	0.000	0.179	HDPE	19.4	4.67	300	90	261.06	0.272	66.0%	4.11	Spr-Crit	0.35	0.01	0.43	262.52	262.18	262.18	262.39	0.13	
Ward St	P0239A	P0239A	P0070	P0070	33.4	0.6	82.8	0.21	0.80	0.20	0.000	0.79	0.00	Single	On Grade	4.85	0.00	64	0.000	0.731	Concrete	63.5	0.88	450	0	260.05	0.268	272.5%	1.69	Sub-Crit	4.17	0.05	0.05	265.86	261.68	261.68	262.18	3.68	
Ward St	P0168	P0168	P0070	P0070	10.0	0.1	148.6	0.11	0.80	0.10	0.000	0.10	0.00	Single	In Sag	1.00	0.15	100	0.000	0.043	Concrete	7.5	2.34	300	90	259.93	0.148	29.2%	1.82	Spr-Crit	0.02	0.05	0.03	261.70	261.68	261.68	261.62	0.08	
Ward St	P0644	P0644	P0070	P0070	10.0	0.1	148.6	1.00	0.80	0.95	0.000	0.95	0.00	Single	In Sag	1.00	0.30	51	0.000	0.202	Concrete	5.4	2.00	250	90	260.79	0.084	240.2%	1.72	Sub-Crit	0.62	0.05	1.14	262.30	261.68	261.68	261.86	0.44	
Ward St	P0757	P0757	P0070	P0070	10.0	0.0	148.6	0.49	0.45	0.28	0.000	0.28	0.00	Single	In Sag	1.00	0.15	100	0.000	0.114	Concrete	4.6	2.00	250	90	260.95	0.084	135.4%	1.72	Sub-Crit	0.17	0.05	0.36	261.85	261.68	261.68	262.02	-0.16	
Ward St	P0070	P0070	P0234	OUT	34.0	0.8	81.9	0.10	0.45	0.06	0.000	1.17	0.00	Single	In Sag	1.10	0.30	76	0.000	1.123	Concrete	79.1	0.57	600	5	259.39	0.462	243.0%	1.64	Sub-Crit	2.64	0.04	0.04	265.08	262.44	262.44	261.68	3.40	
Ward St	P0265A	P0265A	P0234	P0168	10.0	0.1	148.6	0.02	0.80	0.02	0.000	0.02	0.00	Single	On Grade	1.24	0.00	100	0.000	0.008	Concrete	7.6	0.50	300	90	261.25	0.068	11.5%	0.65	Sub-Crit	0.00	0.04	0.30	262.44	262.44	262.44	262.45	-0.01	
Ward St	P0234	P0234	P0091	P0070	34.8	0.3	80.7	0.04	0.80	0.04	0.000	0.78	0.00	Single	On Grade	1.24	0.00	53	0.000	1.204	Concrete	44.3	1.16	600	90	258.93	0.662	181.7%	2.35	Sub-Crit	1.70	0.12	1.22	264.65	262.95	262.95	262.44	2.22	
Ward St	P0091A	P0091A	P0091	P0234	38.8	0.0	75.4	3.36	0.25	1.05	0.000	1.05	0.00	Single	In Sag	1.24	0.15	55	0.000	0.120	Concrete	8.9	8.91	250	45	261.17	0.178	67.6%	3.88	Spr-Crit	0.31	0.12	0.12	263.27	262.95	262.95	262.35	0.92	
8th Line	P0263	P0263	P0236	P0236	34.1	0.1	81.8	19.10	0.31	7.40	0.000	7.40	0.00	Open	In Sag	0.38	0.30	56	0.000	0.942	Concrete	25.9	6.72	600	15	263.96	1.591	59.2%	5.86	Spr-Crit	1.74	0.13	0.13	264.54	264.35	264.35	264.96	-0.42	
8th Line	P0236	P0236	P0170A	P0170A	34.2	0.2	81.6	0.03	0.80	0.03	0.000	3.29	0.00	Single	On Grade	2.31	0.00	44	0.000	1.268	Concrete	33.1	1.88	600	15	262.19	0.841	150.7%	2.98	Sub-Crit	1.41	0.08	0.08	265.91	264.50	264.50	264.35	1.56	
8th Line	P0170A	P0170A	P0235	P0235	34.4	0.2	81.3	0.06	0.80	0.06	0.000	1.90	0.00	Single	On Grade	2.31	0.00	44	0.000	1.453	Concrete	27.3	1.89	600	15	261.54	0.843	172.3%	2.99	Sub-Crit	1.53	0.10	0.10	265.18	263.66	263.66	264.50	0.68	
8th Line	P0235	P0235	P0091	P0091	34.6	0.1	81.0	0.12	0.45	0.07	0.000	1.13	0.00	Single	On Grade	2.88	0.00	51	0.000	1.578	Concrete	25.4	2.42	600	90	260.99	0.955	165.2%	3.38	Sub-Crit	1.68	0.12	2.10	264.63	262.95	262.95	263.66	0.97	
8th Line	P0091	P0091	P0295	P0234	38.8	0.2	75.4	0.07	0.80	0.07	0.000	0.61	0.00	Single	On Grade	1.24	0.00	58	0.000	2.787	Concrete	28.8	1.34	750	60	258.37	1.287	216.7%	2.92	Sub-Crit	1.81	1.28	1.28	264.22	262.42	262.42	262.95	1.27	
Jones Beach Rd	P0295	P0295	S0169	S0169	39.0	0.2	75.2	0.02	0.80	0.02	0.000	0.02	0.00	Single	On Grade	7.14	0.00	100	0.000	2.782	Concrete	51.2	1.91	750	0	257.95	1.539	180.8%	3.49	Sub-Crit	3.20	0.10	0.10	260.91	257.72		262.42	-1.50	
Jones Beach Rd	S0169A	S0169A	S0169	S0173	10.0	0.1	148.6	0.39	0.45	0.22	0.000	0.22	0.00	Single	On Grade	8.65	0.00	89	0.000	0.081	PVC	11.1	4.00	300	90	257.00	0.193	41.7%	2.61	Spr-Crit	0.08	0.10	0.45	257.68	257.60		258.00	-0.32	
Jones Beach Rd	S0169	S0169	S0170	S0170	39.2	0.1	74.9	0.16	0.15	0.03	0.000	0.03	0.00	Single	On Grade	8.65	0.00	100	0.000	2.820	Concrete	34.0	7.70	750	0	256.87	3.088	91.3%	7.00	Sub-Crit	2.18	0.10	0.10	257.50	255.32		258.49	-0.99	
Jones Beach Rd	S0170	S0170	S0171	S0171	39.3	0.1	74.8	0.35	0.40	0.18	0.000	0.18	0.00	Single	On Grade	5.50	0.00	98	0.000	2.851	Concrete	23.8	4.21	750	0	253.74	2.284	124.8%	5.18	Sub-Crit	1.56	0.11	0.11	255.21	253.65		256.47	-1.26	
Jones Beach Rd	S0171	S0171	S0172	S0172	39.4	0.0	74.7	0.14	0.40	0.07	0.000	0.07	0.00	Single	On Grade	7.51	0.00	100	0.000	2.862	Concrete	14.7	6.23	750	0	252.22	2.780	102.9%	6.30	Sub-Crit	0.97	0.11	0.11	253.54	252.57		254.70	-1.16	
Jones Beach Rd	S0173	S0173	S0172	OUT	10.0	0.0	148.6	0.21	0.40	0.11	0.000	0.13	0.00	Single	On Grade	8.33	0.00	98	0.000	0.052	Concrete	11.3	3.92	750	75	251.67	2.204	2.4%	2.08	Spr-Crit	0.00	0.11	0.00	252.57	252.57		253.27	-0.70	
Jones Beach Rd	S0172	S0172	S0174	S0174	39.4	0.2	74.7	0.10	0.40	0.05	0.000	0.05	0.00	Single	On Grade	8.33	0.00	100	0.000	2.898	Concrete	59.1	5.51	750	0	250.74	2.614	110.9%	5.93	Sub-Crit	4.01	0.11	0.11	252.46	248.46		253.71	-1.25	
Jones Beach Rd	S0174	S0174	OUT	OUT	39.6	0.1	74.4	0.30	0.40	0.15	0.000	0.15	0.00	Single	On Grade	6.10	0.00	100	0.000	2.920	Concrete	19.2	2.00	900	0	247.33	2.560	114.1%	4.03	Sub-Crit	0.50	0.05	0.05	248.35	247.85		249.13	-0.78	

Rain Station:	Peterborough Airport
Design Storm:	100 Year
Intensity-Duration-Frequency Parameters	a = 2507.0 b = 14.800 c = 0.88
Minimum Time of Concentration:	10 min

Design Consideration:	Overland Flow Route

Project Information			
Project Name	8th Line Bridgenorth Townhouses	**Project No.**	85260
Project Location	Bridgenorth	**Designed by**	JTF
Municipality	Selwyn Township	**Checked by**	KS
Design Standards		**Date**	07/12/2023

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LOCATION					TIME OF CONCENTRATION (MIN)		INTENSITY (mm/hr)	CATCHMENT			STRUCTURE INLET PROPERTIES									PIPE PROPERTIES									FLOW REGIME				LOSSES			HGL					NOTES
STREET	CATCHMENT ID	FROM	TO	TO (OVERLAND FLOW ROUTE)	TO UPPER END	IN REACH		Multiplation Factor for 100 Year Storm: 1.25			EXTRANEOUS **SURFACE** FLOWS (m^3/s)	CUMULATIVE AC TO STRUCTURE	CUMULATIVE EXTRANEOUS FLOWS TO STRUCTURE (m^3/s)	CATCH BASIN GRATE TYPE	CATCHBASIN ON GRADE OR IN SAG	GRADE OF ROAD (%)	MAX PONDING DEPTH (m)	% FLOW CAPTURED	EXTRANEOUS **SEWER** FLOWS (m^3/s)	PIPE FLOW (m^3/s)	PIPE MATERIAL	LENGTH (m)	GRADE (%)	PIPE DIA. (mm)	BEND AT D/S STRUCTURE (0-90°)	UPSTREAM INVERT (m)	CAPACITY (m^3/s)	% FULL	PARTIAL FLOW VELOCITY (m/s)	FLOW REGIME	FRICTION LOSS (m)	STRUCTURE LOSSES (m)	CONFLUENCE LOSSES (m)	U/S HGL ELEVATION (m)	D/S HGL ELEVATION (m)	D/S HGL OVERRIDE	TOP OF GRATE ELEVATION (m)	SURFACE PONDING DEPTH (m)	
								AREA (ha)	5 YR RUNOFF COEFFICIENT, C	AC (x FACTOR)																														

	Input Column
	Formulated Column
	U/S End of Pipe Run
	D/S End of Pipe Run
	Manual Entry
	Equivalent Circular Pipe Diameter

Manning's n Values

HDPE	0.010
PVC	0.013
Concrete	0.013
Clay	0.014
Brick	0.015

	Surface Ponding
1.00	Surface Ponding Exceeds Max Allowable Ponding Depth

STORM SEWER HYDRAULIC GRADE LINE DESIGN SHEET - PROPOSED CONDITIONS

Rain Station:	Peterborough Airport
Design Storm:	5 Year
Intensity-Duration-Frequency Parameters	a = 1098.0
	b = 10.100
	c = 0.83
Minimum Time of Concentration:	10 min

Design Consideration: Overland Flow Route

Project Information			
Project Name	8th Line Bridgenorth Townhouses	**Project No.**	85260
Project Location	Bridgenorth	**Designed by**	JTF
Municipality	Selwyn Township	**Checked by**	KS
Design Standards		**Date**	07/12/2023

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LOCATION					TIME OF CONCENTRATION (MIN)		INTENSITY (mm/hr)	CATCHMENT (Multiplation Factor for 5 Year Storm: 1.00)			STRUCTURE INLET PROPERTIES								PIPE PROPERTIES								FLOW REGIME				LOSSES			HGL					NOTES
STREET	CATCHMENT ID	FROM	TO	TO (OVERLAND FLOW ROUTE)	TO UPPER END	IN REACH		AREA (ha)	5 YR RUNOFF COEFFICIENT, C	AC (x FACTOR)	EXTRANEOUS **SURFACE** FLOWS (m^3/s)	CUMULATIVE AC TO STRUCTURE	CUMULATIVE EXTRANEOUS FLOWS TO STRUCTURE (m^3/s)	CATCH BASIN GRATE TYPE	CATCHBASIN ON GRADE OR IN SAG	GRADE OF ROAD (%)	MAX PONDING DEPTH (m)	% FLOW CAPTURED	EXTRANEOUS **SEWER** FLOWS (m^3/s)	PIPE FLOW (m^3/s)	PIPE MATERIAL	LENGTH (m)	GRADE (%)	PIPE DIA. (mm)	BEND AT D/S STRUCTURE (0-90°)	UPSTREAM INVERT (m)	CAPACITY (m^3/s)	% FULL	PARTIAL FLOW VELOCITY (m/s)	FLOW REGIME	FRICTION LOSS (m)	STRUCTURE LOSSES (m)	CONFLUENCE LOSSES (m)	U/S HGL ELEVATION (m)	D/S HGL ELEVATION (m)	D/S HGL OVERRIDE	TOP OF GRATE ELEVATION (m)	SURFACE PONDING DEPTH (m)	
Ward St	P0651	P0651	P0237	P0169	10.0	0.0	91.0	0.05	0.80	0.04	0.000	0.04	0.00	Single	On Grade	1.41	0.00	100	0.000	0.010	Concrete	7.6	5.46	300	90	263.93	0.226	4.5%	1.64	Spr-Crit	0.42	0.18	0.18	264.01	263.79		265.25	-1.24	
Ward St	P0237	P0237	P0238	P0238	10.0	0.9	91.0	0.99	0.15	0.15	0.000	0.15	0.00	Single	On Grade	1.41	0.00	90	0.000	0.044	Concrete	65.7	0.82	300	0	263.44	0.088	50.3%	1.24	Spr-Crit	0.54	0.00	0.00	263.61	263.05		265.24	-1.64	
Ward St	P0169	P0169	P0238	P0653	10.0	0.0	91.0	0.05	0.80	0.04	0.000	0.04	0.00	Single	On Grade	1.43	0.00	100	0.000	0.010	Concrete	7.6	5.50	300	90	263.10	0.227	4.5%	1.64	Spr-Crit	0.42	0.00	0.18	263.18	262.87		264.65	-1.47	
Ward St	P0652	P0652	P0238	P0238	10.0	0.0	91.0	0.24	0.15	0.04	0.000	0.04	0.00	Single	On Grade	1.43	0.00	100	0.000	0.009	Concrete	5.8	4.51	300	50	263.16	0.205	4.4%	1.48	Spr-Crit	0.26	0.00	0.05	263.23	262.95		264.82	-1.59	
Ward St	P0238	P0238	P0239	P0239	10.9	0.8	87.7	0.40	0.15	0.06	0.000	0.07	0.00	Single	On Grade	1.60	0.00	100	0.000	0.079	Concrete	83.9	1.71	300	0	262.64	0.127	62.5%	1.89	Spr-Crit	1.44	0.01	0.01	262.86	261.49		264.49	-1.63	
Ward St	P0653	P0653	P0239	P0264	10.0	0.0	91.0	0.09	0.80	0.07	0.000	0.07	0.00	Single	On Grade	1.60	0.00	100	0.000	0.018	Concrete	7.6	9.67	300	90	262.07	0.301	6.1%	2.36	Spr-Crit	0.73	0.01	0.38	262.17	261.49		263.19	-1.02	
Ward St	P0239	P0239	P0239A	P0239A	11.7	0.5	85.1	0.59	0.40	0.24	0.000	0.24	0.00	Single	On Grade	1.53	0.00	81	0.000	0.139	Concrete	61.3	1.69	375	0	261.20	0.228	61.0%	2.17	Spr-Crit	1.04	0.01	0.01	261.48	261.22		263.13	-1.66	
Ward St	P0264	P0264	P0239A	P0239A	10.0	0.1	91.0	0.05	0.80	0.04	0.000	0.04	0.00	Single	On Grade	1.53	0.00	100	0.000	0.010	Concrete	7.6	2.35	300	90	260.42	0.148	6.8%	1.20	Spr-Crit	0.00	0.01	0.00	261.22	261.22		262.22	-0.99	
Mann Rd	P0643A	P0643A	P0643	P0471	10.0	0.2	91.0	0.85	0.15	0.13	0.000	0.13	0.00	Single	In Sag	5.58	0.15	100	0.000	0.032	Concrete	15.0	0.84	300	90	263.00	0.089	36.4%	1.16	Spr-Crit	0.02	0.01	0.01	263.46	263.44		263.90	-0.44	
Mann Rd	P0643	P0643	P0172	P0643A	33.2	0.1	48.1	5.46	0.25	1.37	0.000	1.37	0.00	Single	In Sag	5.56	0.30	100	0.000	0.200	Concrete	21.9	5.79	300	15	262.38	0.233	85.8%	3.30	Sub-Crit	0.94	0.03	0.03	263.42	262.49		264.25	-0.83	
Mann Rd	P0172	P0172	P0239A	P0239A	33.3	0.1	48.0	0.73	0.40	0.29	0.000	0.29	0.00	Single	In Sag	4.85	0.30	100	0.000	0.238	Concrete	20.3	4.68	300	70	261.11	0.209	113.9%	2.97	Sub-Crit	1.23	0.01	0.50	262.46	261.22		262.78	-0.32	
Mann Rd	P0471	P0471	P0239A	P0239A	10.0	0.1	91.0	0.21	0.80	0.17	0.000	0.17	0.00	Single	On Grade	4.85	0.00	98	0.000	0.042	HDPE	19.4	4.67	300	90	261.06	0.272	15.3%	2.79	Spr-Crit	0.91	0.01	0.52	261.22	261.22		262.39	-1.17	
Ward St	P0239A	P0239A	P0070	P0070	33.4	0.6	47.9	0.21	0.80	0.17	0.000	0.22	0.00	Single	On Grade	4.85	0.00	100	0.000	0.372	Concrete	63.5	0.88	450	0	260.05	0.268	138.8%	1.69	Sub-Crit	1.08	0.01	0.01	261.21	260.13		262.18	-0.97	
Ward St	P0168	P0168	P0070	P0070	10.0	0.1	91.0	0.11	0.80	0.09	0.000	0.09	0.00	Single	In Sag	1.00	0.15	100	0.000	0.022	Concrete	7.5	2.34	300	90	259.93	0.148	15.1%	1.51	Spr-Crit	0.17	0.01	0.15	260.13	260.13		261.62	-1.49	
Ward St	P0644	P0644	P0070	P0070	10.0	0.1	91.0	1.00	0.80	0.80	0.000	0.80	0.00	Single	In Sag	1.00	0.30	100	0.000	0.202	Concrete	5.4	2.00	250	90	260.79	0.084	240.2%	1.72	Sub-Crit	0.62	0.01	1.14	261.56	260.94		261.86	-0.31	
Ward St	P0757	P0757	P0070	P0070	10.0	0.0	91.0	0.49	0.45	0.22	0.000	0.22	0.00	Single	In Sag	1.00	0.15	100	0.000	0.056	Concrete	4.6	2.00	250	90	260.95	0.084	66.3%	1.83	Spr-Crit	0.09	0.01	0.23	261.14	261.00		262.02	-0.88	
Ward St	P0070	P0070	P0234	OUT	34.0	0.8	47.4	0.10	0.45	0.05	0.000	0.05	0.00	Single	In Sag	1.10	0.30	100	0.000	0.520	Concrete	79.1	0.57	600	5	259.39	0.462	112.5%	1.64	Sub-Crit	0.57	0.01	0.01	260.11	259.55		261.68	-1.57	
Ward St	P0265A	P0265A	P0234	P0168	10.0	0.1	91.0	0.02	0.80	0.02	0.000	0.02	0.00	Single	On Grade	1.24	0.00	100	0.000	0.004	Concrete	7.6	0.50	300	90	261.25	0.068	5.9%	0.56	Sub-Crit	0.04	0.01	0.30	261.30	261.26		262.45	-1.15	
Ward St	P0234	P0234	P0091	P0070	34.8	0.3	46.7	0.04	0.80	0.03	0.000	0.03	0.00	Single	On Grade	1.24	0.00	100	0.000	0.518	Concrete	44.3	1.16	600	90	258.93	0.662	78.3%	2.59	Spr-Crit	0.51	0.12	0.45	259.40	259.39		262.44	-3.04	
Ward St	P0091A	P0091A	P0091	P0234	33.1	0.0	48.2	0.63	0.25	0.16	0.000	0.16	0.00	Single	In Sag	1.24	0.15	100	0.000	0.021	Concrete	8.9	8.91	250	45	261.17	0.178	11.9%	2.45	Spr-Crit	0.80	0.12	0.12	261.28	260.43		262.35	-1.06	
8th Line	P0263	P0263	P0236	P0236	34.1	0.1	47.3	19.10	0.31	5.92	0.000	5.92	0.00	Open	In Sag	0.38	0.30	100	0.000	0.779	Concrete	25.9	6.72	600	15	263.96	1.591	48.9%	5.60	Spr-Crit	1.74	0.12	0.12	264.51	262.82		264.96	-0.45	
8th Line	P0236	P0236	P0170A	P0170A	34.2	0.2	47.2	0.02	0.80	0.02	0.000	0.02	0.00	Single	On Grade	2.31	0.00	100	0.000	0.779	Concrete	33.1	1.88	600	15	262.19	0.841	92.6%	2.98	Sub-Crit	0.53	0.03	0.03	262.70	262.17		264.35	-1.65	
8th Line	P0170A	P0170A	P0235	P0235	39.3	0.2	43.1	2.84	0.00	0.00	0.000	0.00	0.00	Open	On Grade	2.31	0.00	100	0.058	0.770	Concrete	27.3	1.89	600	15	261.54	0.843	91.3%	2.99	Sub-Crit	0.43	0.03	0.03	262.05	261.63		264.50	-2.45	Site
8th Line	P0235	P0235	P0091	P0091	39.5	0.1	43.0	0.09	0.45	0.04	0.000	0.04	0.00	Single	On Grade	2.88	0.00	100	0.000	0.772	Concrete	25.4	2.42	600	90	260.99	0.955	80.9%	3.76	Spr-Crit	0.61	0.12	0.95	261.54	260.78		263.66	-2.12	
8th Line	P0091	P0091	P0295	P0234	39.6	0.2	42.9	0.07	0.80	0.06	0.000	0.06	0.00	Single	On Grade	1.24	0.00	100	0.000	1.273	Concrete	28.8	1.34	750	60	258.37	1.287	99.0%	2.92	Sub-Crit	0.38	0.27	0.27	259.27	258.89		262.95	-3.69	

Rain Station:	Peterborough Airport
Design Storm:	5 Year
Intensity-Duration-Frequency Parameters	a = 1098.0 b = 10.100 c = 0.83
Minimum Time of Concentration:	10 min

Design Consideration:	Overland Flow Route

Project Information			
Project Name	8th Line Bridgenorth Townhouses	**Project No.**	85260
Project Location	Bridgenorth	**Designed by**	JTF
Municipality	Selwyn Township	**Checked by**	KS
Design Standards		**Date**	07/12/2023

D.M. Wills Associates Ltd.
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LOCATION					TIME OF CONCENTRATION (MIN)		INTENSITY (mm/hr)	CATCHMENT			STRUCTURE INLET PROPERTIES								PIPE PROPERTIES								FLOW REGIME				LOSSES			HGL					NOTES
								Multiplation Factor for 5 Year Storm: 1.00																															
STREET	CATCHMENT ID	FROM	TO	TO (OVERLAND FLOW ROUTE)	TO UPPER END	IN REACH		AREA (ha)	5 YR RUNOFF COEFFICIENT, C	AC (x FACTOR)	EXTRANEOUS **SURFACE** FLOWS (m^3/s)	CUMULATIVE AC TO STRUCTURE	CUMULATIVE EXTRANEOUS FLOWS TO STRUCTURE (m^3/s)	CATCH BASIN GRATE TYPE	CATCHBASIN ON GRADE OR IN SAG	GRADE OF ROAD (%)	MAX PONDING DEPTH (m)	% FLOW CAPTURED	EXTRANEOUS **SEWER** FLOWS (m^3/s)	PIPE FLOW (m^3/s)	PIPE MATERIAL	LENGTH (m)	GRADE (%)	PIPE DIA. (mm)	BEND AT D/S STRUCTURE (0-90°)	UPSTREAM INVERT (m)	CAPACITY (m^3/s)	% FULL	PARTIAL FLOW VELOCITY (m/s)	FLOW REGIME	FRICTION LOSS (m)	STRUCTURE LOSSES (m)	CONFLUENCE LOSSES (m)	U/S HGL ELEVATION (m)	D/S HGL ELEVATION (m)	D/S HGL OVERRIDE	TOP OF GRATE ELEVATION (m)	SURFACE PONDING DEPTH (m)	
Jones Beach Rd	P0295	P0295	S0169	S0169	39.8	0.2	42.8	0.02	0.80	0.02	0.000	0.02	0.00	Single	On Grade	7.14	0.00	100	0.000	1.271	Concrete	51.2	1.91	750	0	257.95	1.539	82.6%	3.89	Spr-Crit	0.98	0.04	0.04	258.62	257.59		262.42	-3.79	
Jones Beach Rd	S0169A	S0169A	S0169	S0173	10.0	0.1	91.0	0.39	0.45	0.18	0.000	0.18	0.00	Single	On Grade	8.65	0.00	98	0.000	0.044	PVC	11.1	4.00	300	90	257.00	0.193	22.5%	2.22	Spr-Crit	0.03	0.04	0.45	257.62	257.59		258.00	-0.38	
Jones Beach Rd	S0169	S0169	S0170	S0170	40.0	0.1	42.6	0.16	0.15	0.02	0.000	0.02	0.00	Single	On Grade	8.65	0.00	100	0.000	1.290	Concrete	34.0	7.70	750	0	256.87	3.088	41.8%	6.68	Spr-Crit	2.62	0.11	0.11	257.55	254.59		258.49	-0.94	
Jones Beach Rd	S0170	S0170	S0171	S0171	40.1	0.1	42.6	0.35	0.40	0.14	0.000	0.14	0.00	Single	On Grade	5.50	0.00	100	0.000	1.305	Concrete	23.8	4.21	750	0	253.74	2.284	57.1%	5.34	Spr-Crit	1.00	0.07	0.07	254.42	253.15		256.47	-2.05	
Jones Beach Rd	S0171	S0171	S0172	S0172	40.2	0.0	42.5	0.14	0.40	0.06	0.000	0.06	0.00	Single	On Grade	7.51	0.00	100	0.000	1.309	Concrete	14.7	6.23	750	0	252.22	2.780	47.1%	6.20	Spr-Crit	0.92	0.10	0.10	252.90	251.66		254.70	-1.80	
Jones Beach Rd	S0173	S0173	S0172	OUT	10.0	0.0	91.0	0.21	0.40	0.08	0.000	0.09	0.00	Single	On Grade	8.33	0.00	100	0.000	0.022	Concrete	11.3	3.92	750	75	251.67	2.204	1.0%	1.62	Spr-Crit	0.44	0.10	0.13	251.76	251.52		253.27	-1.51	
Jones Beach Rd	S0172	S0172	S0174	S0174	40.2	0.2	42.5	0.10	0.40	0.04	0.000	0.04	0.00	Single	On Grade	8.33	0.00	100	0.000	1.324	Concrete	59.1	5.51	750	0	250.74	2.614	50.7%	5.94	Spr-Crit	3.26	0.09	0.09	251.43	248.10		253.71	-2.29	
Jones Beach Rd	S0174	S0174	OUT	OUT	40.4	0.1	42.4	0.30	0.40	0.12	0.000	0.12	0.00	Single	On Grade	6.10	0.00	100	0.000	1.334	Concrete	19.2	2.00	900	0	247.33	2.560	52.1%	4.07	Spr-Crit	0.38	0.04	0.04	248.01	247.41		249.13	-1.12	

Input Column
Formulated Column

U/S End of Pipe Run
D/S End of Pipe Run

Manual Entry
Equivalent Circular Pipe Diameter

Manning's n Values

HDPE	0.010
PVC	0.013
Concrete	0.013
Clay	0.014
Brick	0.015

Surface Ponding
1.00 Surface Ponding Exceeds Max Allowable Ponding Depth

STORM SEWER HYDRAULIC GRADE LINE DESIGN SHEET

Rain Station:	Peterborough Airport
Design Storm:	100 Year
Intensity-Duration-Frequency Parameters	a = 2507.0
	b = 14.800
	c = 0.88
Minimum Time of Concentration:	10 min

Design Consideration: Overland Flow Route

Project Information			
Project Name	8th Line Bridgenorth Townhouses	**Project No.**	85260
Project Location	Bridgenorth	**Designed by**	JTF
Municipality	Selwyn Township	**Checked by**	KS
Design Standards		**Date**	07/12/2023

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LOCATION					TIME OF CONCENTRATION (MIN)		INTENSITY (mm/hr)	CATCHMENT			STRUCTURE INLET PROPERTIES								PIPE PROPERTIES								FLOW REGIME				LOSSES			HGL					NOTES
								Multiplation Factor for 100 Year Storm: 1.25																															
STREET	CATCHMENT ID	FROM	TO	TO (OVERLAND FLOW ROUTE)	TO UPPER END	IN REACH		AREA (ha)	5 YR RUNOFF COEFFICIENT, C	AC (x FACTOR)	EXTRANEOUS **SURFACE** FLOWS (m^3/s)	CUMULATIVE AC TO STRUCTURE	CUMULATIVE EXTRANEOUS FLOWS TO STRUCTURE (m^3/s)	CATCH BASIN GRATE TYPE	CATCHBASIN ON GRADE OR IN SAG	GRADE OF ROAD (%)	MAX PONDING DEPTH (m)	% FLOW CAPTURED	EXTRANEOUS **SEWER** FLOWS (m^3/s)	PIPE FLOW (m^3/s)	PIPE MATERIAL	LENGTH (m)	GRADE (%)	PIPE DIA. (mm)	BEND AT D/S STRUCTURE (0-90°)	UPSTREAM INVERT (m)	CAPACITY (m^3/s)	% FULL	PARTIAL FLOW VELOCITY (m/s)	FLOW REGIME	FRICTION LOSS (m)	STRUCTURE LOSSES (m)	CONFLUENCE LOSSES (m)	U/S HGL ELEVATION (m)	D/S HGL ELEVATION (m)	D/S HGL OVERRIDE	TOP OF GRATE ELEVATION (m)	SURFACE PONDING DEPTH (m)	
Ward St	P0651	P0651	P0237	P0169	10.0	0.0	148.6	0.05	0.80	0.05	0.000	0.05	0.00	Single	On Grade	1.41	0.00	98	0.000	0.019	Concrete	7.6	5.46	300	90	263.93	0.226	8.5%	1.95	Spr-Crit	0.01	0.00	0.00	265.25	265.24	265.24	265.25	0.00	
Ward St	P0237	P0237	P0238	P0238	10.0	0.9	148.6	0.99	0.15	0.19	0.000	0.19	0.00	Single	On Grade	1.41	0.00	74	0.000	0.076	Concrete	65.7	0.82	300	0	263.44	0.088	86.3%	1.24	Sub-Crit	0.40	0.00	0.00	264.90	264.49	264.49	265.24	-0.35	
Ward St	P0169	P0169	P0238	P0653	10.0	0.0	148.6	0.05	0.80	0.05	0.000	0.05	0.00	Single	On Grade	1.43	0.00	98	0.000	0.020	Concrete	7.6	5.50	300	90	263.10	0.227	8.6%	1.97	Spr-Crit	0.01	0.00	0.01	264.50	264.49	264.49	264.65	-0.15	
Ward St	P0652	P0652	P0238	P0238	10.0	0.0	148.6	0.24	0.15	0.05	0.000	0.05	0.00	Single	On Grade	1.43	0.00	98	0.000	0.018	Concrete	5.8	4.51	300	50	263.16	0.205	8.9%	1.80	Spr-Crit	0.01	0.00	0.00	264.50	264.49	264.49	264.82	-0.32	
Ward St	P0238	P0238	P0239	P0239	10.9	0.8	144.0	0.40	0.15	0.08	0.000	0.12	0.00	Single	On Grade	1.60	0.00	85	0.000	0.152	Concrete	83.9	1.71	300	0	262.64	0.127	120.4%	1.80	Sub-Crit	2.08	0.01	0.01	265.22	263.13	263.13	264.49	**0.73**	
Ward St	P0653	P0653	P0239	P0264	10.0	0.0	148.6	0.09	0.80	0.09	0.000	0.09	0.00	Single	On Grade	1.60	0.00	92	0.000	0.033	Concrete	7.6	9.67	300	90	262.07	0.301	11.0%	2.80	Spr-Crit	0.02	0.01	0.08	263.15	263.13	263.13	263.19	-0.03	
Ward St	P0239	P0239	P0239A	P0239A	11.7	0.5	140.2	0.59	0.40	0.30	0.000	0.31	0.00	Single	On Grade	1.53	0.00	61	0.000	0.255	Concrete	61.3	1.69	375	0	261.20	0.228	111.6%	2.07	Sub-Crit	1.29	0.01	0.01	263.47	262.18	262.18	263.13	**0.33**	
Ward St	P0264	P0264	P0239A	P0239A	10.0	0.1	148.6	0.05	0.80	0.05	0.000	0.05	0.00	Single	On Grade	1.53	0.00	98	0.000	0.022	Concrete	7.6	2.35	300	90	260.42	0.148	14.8%	1.51	Spr-Crit	0.01	0.01	0.01	262.18	262.18	262.18	262.22	-0.03	
Mann Rd	P0643A	P0643A	P0643	P0471	10.0	0.2	148.6	0.85	0.15	0.16	0.000	0.99	0.00	Single	In Sag	5.58	0.15	29	0.000	0.120	Concrete	15.0	0.84	300	90	263.00	0.089	135.4%	1.26	Sub-Crit	0.23	0.19	0.19	264.48	264.25	264.25	263.90	**0.58**	
Mann Rd	P0643	P0643	P0172	P0643A	33.2	0.1	83.1	5.46	0.25	1.71	0.000	1.71	0.00	Single	In Sag	5.56	0.30	51	0.000	0.269	Concrete	21.9	5.79	300	15	262.38	0.233	115.7%	3.30	Sub-Crit	1.70	0.05	0.05	264.48	262.78	262.78	264.25	0.23	
Mann Rd	P0172	P0172	P0239A	P0239A	33.3	0.1	83.0	0.73	0.40	0.37	0.000	0.37	0.00	Single	In Sag	4.85	0.30	100	0.000	0.353	Concrete	20.3	4.68	300	70	261.11	0.209	168.6%	2.97	Sub-Crit	2.71	0.01	1.09	264.88	262.18	262.18	262.78	**2.10**	
Mann Rd	P0471	P0471	P0239A	P0239A	10.0	0.1	148.6	0.21	0.80	0.20	0.000	0.90	0.00	Single	On Grade	4.85	0.00	48	0.000	0.179	HDPE	19.4	4.67	300	90	261.06	0.272	66.0%	4.11	Spr-Crit	0.35	0.01	0.43	262.52	262.18	262.18	262.39	**0.13**	
Ward St	P0239A	P0239A	P0070	P0070	33.4	0.6	82.8	0.21	0.80	0.20	0.000	0.79	0.00	Single	On Grade	4.85	0.00	64	0.000	0.731	Concrete	63.5	0.88	450	0	260.05	0.268	272.5%	1.69	Sub-Crit	4.17	0.05	0.05	265.86	261.68	261.68	262.18	**3.68**	
Ward St	P0168	P0168	P0070	P0070	10.0	0.1	148.6	0.11	0.80	0.10	0.000	0.10	0.00	Single	In Sag	1.00	0.15	100	0.000	0.043	Concrete	7.5	2.34	300	90	259.93	0.148	29.2%	1.82	Spr-Crit	0.02	0.05	0.03	261.70	261.68	261.68	261.62	0.08	
Ward St	P0644	P0644	P0070	P0070	10.0	0.1	148.6	1.00	0.80	0.95	0.000	0.95	0.00	Single	In Sag	1.00	0.30	51	0.000	0.202	Concrete	5.4	2.00	250	90	260.79	0.084	240.2%	1.72	Sub-Crit	0.62	0.05	1.14	262.30	261.68	261.68	261.86	**0.44**	
Ward St	P0757	P0757	P0070	P0070	10.0	0.0	148.6	0.49	0.45	0.28	0.000	0.28	0.00	Single	In Sag	1.00	0.15	100	0.000	0.114	Concrete	4.6	2.00	250	90	260.95	0.084	135.4%	1.72	Sub-Crit	0.17	0.05	0.36	261.85	261.68	261.68	262.02	-0.16	
Ward St	P0070	P0070	P0234	OUT	34.0	0.8	81.9	0.10	0.45	0.06	0.000	0.86	0.00	Single	In Sag	1.10	0.30	100	0.000	1.116	Concrete	79.1	0.57	600	5	259.39	0.462	241.5%	1.64	Sub-Crit	2.61	0.04	0.04	265.05	262.44	262.44	261.68	**3.37**	
Ward St	P0265A	P0265A	P0234	P0168	10.0	0.1	148.6	0.02	0.80	0.02	0.000	0.02	0.00	Single	On Grade	1.24	0.00	100	0.000	0.008	Concrete	7.6	0.50	300	90	261.25	0.068	11.5%	0.65	Sub-Crit	0.00	0.04	0.30	262.44	262.44	262.44	262.45	-0.01	
Ward St	P0234	P0234	P0091	P0070	34.8	0.3	80.7	0.04	0.80	0.04	0.000	0.25	0.00	Single	On Grade	1.24	0.00	78	0.000	1.149	Concrete	44.3	1.16	600	90	258.93	0.662	173.5%	2.35	Sub-Crit	1.55	0.02	1.11	264.50	262.95	262.95	262.44	**2.06**	
Ward St	P0091A	P0091A	P0091	P0234	33.1	0.0	83.3	0.63	0.25	0.20	0.000	0.20	0.00	Single	In Sag	1.24	0.15	100	0.000	0.046	Concrete	8.9	8.91	250	45	261.17	0.178	25.7%	3.03	Spr-Crit	0.07	0.02	0.02	263.03	262.95	262.95	262.35	**0.68**	
8th Line	P0263	P0263	P0236	P0236	34.1	0.1	81.8	19.10	0.31	7.40	0.000	7.40	0.00	Open	In Sag	1.00	0.30	56	0.000	0.942	Concrete	25.9	6.72	600	15	263.96	1.591	59.2%	5.86	Spr-Crit	1.74	0.13	0.13	264.54	264.35	264.35	264.96	-0.42	
8th Line	P0236	P0236	P0170A	P0170A	34.2	0.2	81.6	0.02	0.80	0.02	0.000	3.28	0.00	Single	On Grade	2.31	0.00	44	0.000	1.267	Concrete	33.1	1.88	600	15	262.19	0.841	150.6%	2.98	Sub-Crit	1.41	0.08	0.08	265.91	264.50	264.50	264.35	**1.56**	
8th Line	P0170A	P0170A	P0235	P0235	39.3	0.2	74.8	2.84	0.00	0.00	0.000	1.83	0.00	Single	On Grade	2.31	0.00	44	0.139	1.469	Concrete	27.3	1.89	600	15	261.54	0.843	174.2%	2.99	Sub-Crit	1.56	0.10	0.10	265.22	263.66	263.66	264.50	**0.72**	
8th Line	P0235	P0235	P0091	P0091	39.5	0.1	74.6	0.09	0.45	0.05	0.000	1.08	0.00	Single	On Grade	2.88	0.00	54	0.000	1.584	Concrete	25.4	2.42	600	90	260.99	0.955	165.9%	3.38	Sub-Crit	1.69	0.02	2.11	264.64	262.95	262.95	263.66	**0.98**	
8th Line	P0091	P0091	P0295	P0234	39.6	0.2	74.4	0.07	0.80	0.07	0.000	0.57	0.00	Single	On Grade	1.24	0.00	62	0.000	2.754	Concrete	28.8	1.34	750	60	258.37	1.287	214.1%	2.92	Sub-Crit	1.76	1.25	1.25	264.18	262.42	262.42	262.95	**1.23**	
Jones Beach Rd	P0295	P0295	S0169	S0169	39.8	0.2	74.2	0.02	0.80	0.02	0.000	0.02	0.00	Single	On Grade	7.14	0.00	100	0.000	2.750	Concrete	51.2	1.91	750	0	257.95	1.539	178.7%	3.49	Sub-Crit	3.12	0.10	0.10	260.84	257.72		262.42	-1.58	
Jones Beach Rd	S0169A	S0169A	S0169	S0173	10.0	0.1	148.6	0.39	0.45	0.22	0.000	0.22	0.00	Single	On Grade	8.65	0.00	89	0.000	0.081	PVC	11.1	4.00	300	90	257.00	0.193	41.7%	2.61	Spr-Crit	0.08	0.10	0.45	257.46	257.38		258.00	-0.54	
Jones Beach Rd	S0169	S0169	S0170	S0170	40.0	0.1	74.0	0.16	0.15	0.03	0.000	0.03	0.00	Single	On Grade	8.65	0.00	100	0.000	2.787	Concrete	34.0	7.70	750	0	256.87	3.088	90.3%	7.00	Sub-Crit	2.13	0.10	0.10	257.28	255.15		258.49	-1.21	
Jones Beach Rd	S0170	S0170	S0171	S0171	40.1	0.1	73.8	0.35	0.40	0.18	0.000	0.18	0.00	Single	On Grade	5.50	0.00	98	0.000	2.818	Concrete	23.8	4.21	750	0	253.74	2.284	123.4%	5.18	Sub-Crit	1.53	0.10	0.10	255.05	253.52		256.47	-1.43	
Jones Beach Rd	S0171	S0171	S0172	S0172	40.2	0.0	73.7	0.14	0.40	0.07	0.000	0.07	0.00	Single	On Grade	7.51	0.00	100	0.000	2.829	Concrete	14.7	6.23	750	0	252.22	2.780	101.8%	6.30	Sub-Crit	0.95	0.10	0.10	253.42	252.46		254.70	-1.28	
Jones Beach Rd	S0173	S0173	S0172	OUT	10.0	0.0	148.6	0.21	0.40	0.11	0.000	0.13	0.00	Single	On Grade	8.33	0.00	98	0.000	0.052	Concrete	11.3	3.92	750	75	251.67	2.204	2.4%	2.08	Spr-Crit	0.00	0.10	0.00	252.46	252.46		253.27	-0.81	
Jones Beach Rd	S0172	S0172	S0174	S0174	40.2	0.2	73.7	0.10	0.40	0.05	0.000	0.05	0.00	Single	On Grade	8.33	0.00	100	0.000	2.865	Concrete	59.1	5.51	750	0	250.74	2.614	109.6%	5.93	Sub-Crit	3.92	0.11	0.11	252.36	248.44		253.71	-1.35	
Jones Beach Rd	S0174	S0174	OUT	OUT	40.4	0.1	73.5	0.30	0.40	0.15	0.000	0.15	0.00	Single	On Grade	6.10	0.00	100	0.000	2.887	Concrete	19.2	2.00	900	0	247.33	2.560	112.8%	4.03	Sub-Crit	0.49	0.05	0.05	248.34	247.85		249.13	-0.80	

Rain Station:	Peterborough Airport
Design Storm:	100 Year
Intensity-Duration-Frequency Parameters	a = 2507.0 b = 14.800 c = 0.88
Minimum Time of Concentration:	10 min

Design Consideration:	Overland Flow Route

Project Information			
Project Name	8th Line Bridgenorth Townhouses	**Project No.**	85260
Project Location	Bridgenorth	**Designed by**	JTF
Municipality	Selwyn Township	**Checked by**	KS
Design Standards		**Date**	07/12/2023

D.M. Wills Associates Ltd.
150 Jameson Drive
Peterborough, ON · K9J 0B9
Tel: (705) 742-2297 ext. 250
Fax: (705) 741-3568

LOCATION					TIME OF CONCENTRATION (MIN)		INTENSITY (mm/hr)	CATCHMENT			STRUCTURE INLET PROPERTIES									PIPE PROPERTIES									FLOW REGIME				LOSSES			HGL					NOTES
STREET	CATCHMENT ID	FROM	TO	TO (OVERLAND FLOW ROUTE)	TO UPPER END	IN REACH		Multiplation Factor for 100 Year Storm: 1.25			EXTRANEOUS **SURFACE** FLOWS (m^3/s)	CUMULATIVE AC TO STRUCTURE	CUMULATIVE EXTRANEOUS FLOWS TO STRUCTURE (m^3/s)	CATCH BASIN GRATE TYPE	CATCHBASIN ON GRADE OR IN SAG	GRADE OF ROAD (%)	MAX PONDING DEPTH (m)	% FLOW CAPTURED	EXTRANEOUS **SEWER** FLOWS (m^3/s)	PIPE FLOW (m^3/s)	PIPE MATERIAL	LENGTH (m)	GRADE (%)	PIPE DIA. (mm)	BEND AT D/S STRUCTURE (0-90°)	UPSTREAM INVERT (m)	CAPACITY (m^3/s)	% FULL	PARTIAL FLOW VELOCITY (m/s)	FLOW REGIME	FRICTION LOSS (m)	STRUCTURE LOSSES (m)	CONFLUENCE LOSSES (m)	U/S HGL ELEVATION (m)	D/S HGL ELEVATION (m)	D/S HGL OVERRIDE	TOP OF GRATE ELEVATION (m)	SURFACE PONDING DEPTH (m)	
								AREA (ha)	5 YR RUNOFF COEFFICIENT, C	AC (x FACTOR)																														

	Input Column
	Formulated Column
	U/S End of Pipe Run
	D/S End of Pipe Run
	Manual Entry
	Equivalent Circular Pipe Diameter

Manning's n Values

HDPE	0.010
PVC	0.013
Concrete	0.013
Clay	0.014
Brick	0.015

	Surface Ponding
1.00	Surface Ponding Exceeds Max Allowable Ponding Depth

Appendix F

Quality Control

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Enhanced Grass Swale Sizing for East Swale

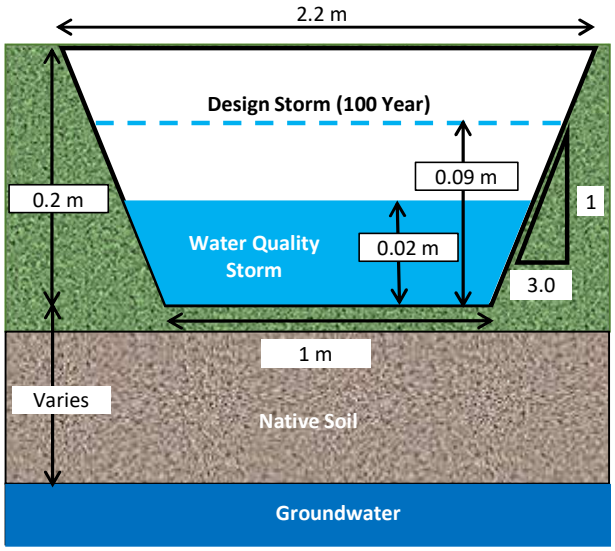
Project No: 85260
Project Name: Bridgenorth Townhouse Dev.
Designed/Checked By: NN / KS
Date: March 1, 2024

Site Characteristics		
Catchment Area	0.94	ha
Water Quality Storm	25	mm
Runoff Coefficient	0.50	
Water Quality Control Volume	117.5	m^3
Water Quality Peak Flow Rate	0.010	m^3/s
100 Year Storm Peak Flow Rate	0.127	m^3/s
Proposed Surface Elevation	Varies	
Groundwater Elevation	At / Near Surface	

Design Constraints		
Check Dams Required	Yes	
Max Water Quality Flow Depth	0.10	m
Max Water Quality Velocity	0.5	m/s
Max Design Storm Velocity	1.5	m/s
Min Depth to Groundwater	1.0	m

Design Calculations		
Pretreatment Utilized	None	
Check Dams Included	No	
Longitudinal Slope	3.50	%
Manning's n	0.027	
Maximum Swale Capacity	0.60	m^3/s
Water Quality Depth	0.019	m
Water Quality Velocity	0.48	m/s
Design Storm Velocity	1.18	m/s

Enhanced Grassed Swale
Proposed Cross-Section



Notes:

1. Flow Depth and Velocity were determined using Manning's Equation for the proposed swale cross-section.
2. Design Constraints were determined from CVC/TRCA Low Impact Development Stormwater Management Planning and Design Guide (2010)

Stormceptor®

Rinker MATERIALS™

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

03/04/2024

Province:	Ontario
City:	Bridgenorth
Nearest Rainfall Station:	PETERBOROUGH
Climate Station Id:	6166456
Years of Rainfall Data:	15

Site Name:	

Drainage Area (ha):	2.66
% Imperviousness:	18.20

Runoff Coefficient 'c': 0.40

Particle Size Distribution:	CA ETV
Target TSS Removal (%):	60.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	39.28
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	160.00
Influent TSS Concentration (mg/L):	100
Estimated Average Annual Sediment Load (kg/yr):	196
Estimated Average Annual Sediment Volume (L/yr):	159

Project Name:	Lakefield Townhouse Development
Project Number:	85260
Designer Name:	Nate Napper
Designer Company:	D.M. Wills Associates Limited
Designer Email:	nnapper@dmwills.com
Designer Phone:	705-742-2297
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	48
EF6	56
EF8	60
EF10	63
EF12	65

Recommended Stormceptor EF Model: EF8

Estimated Net Annual Sediment (TSS) Load Reduction (%): 60

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterwavs.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

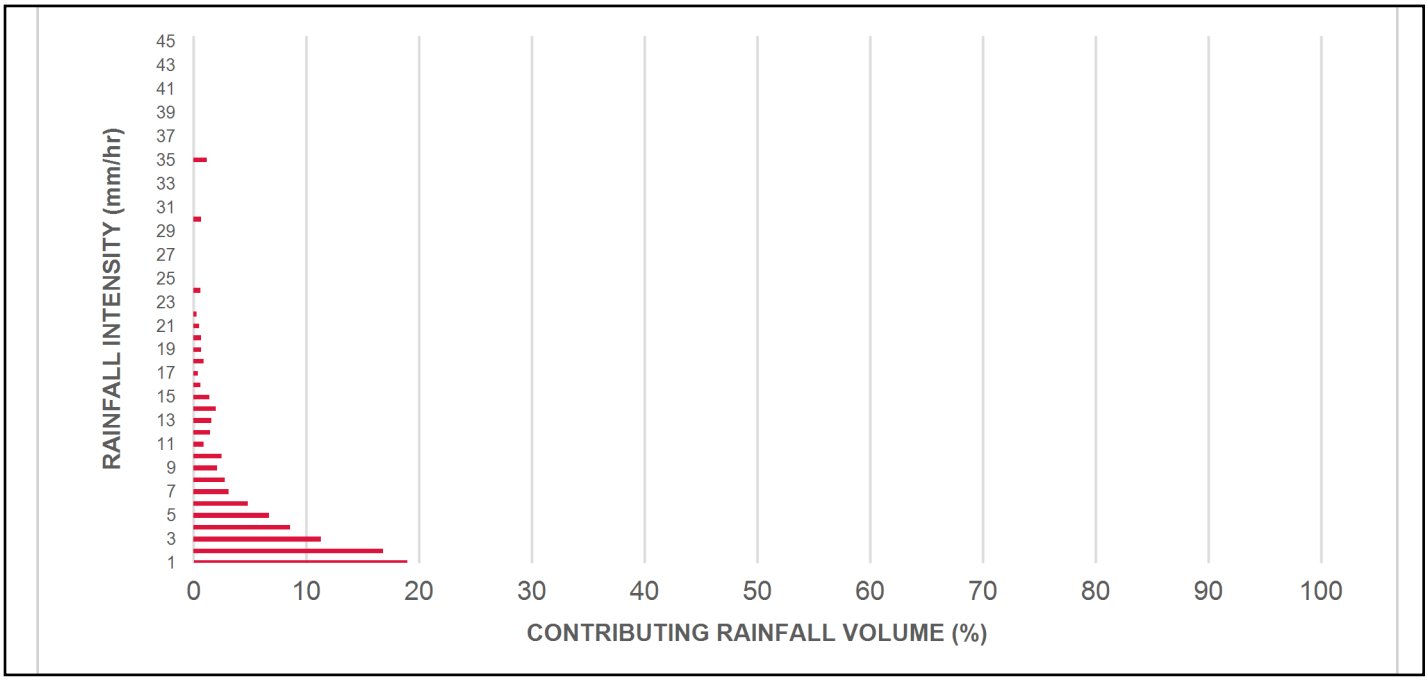
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

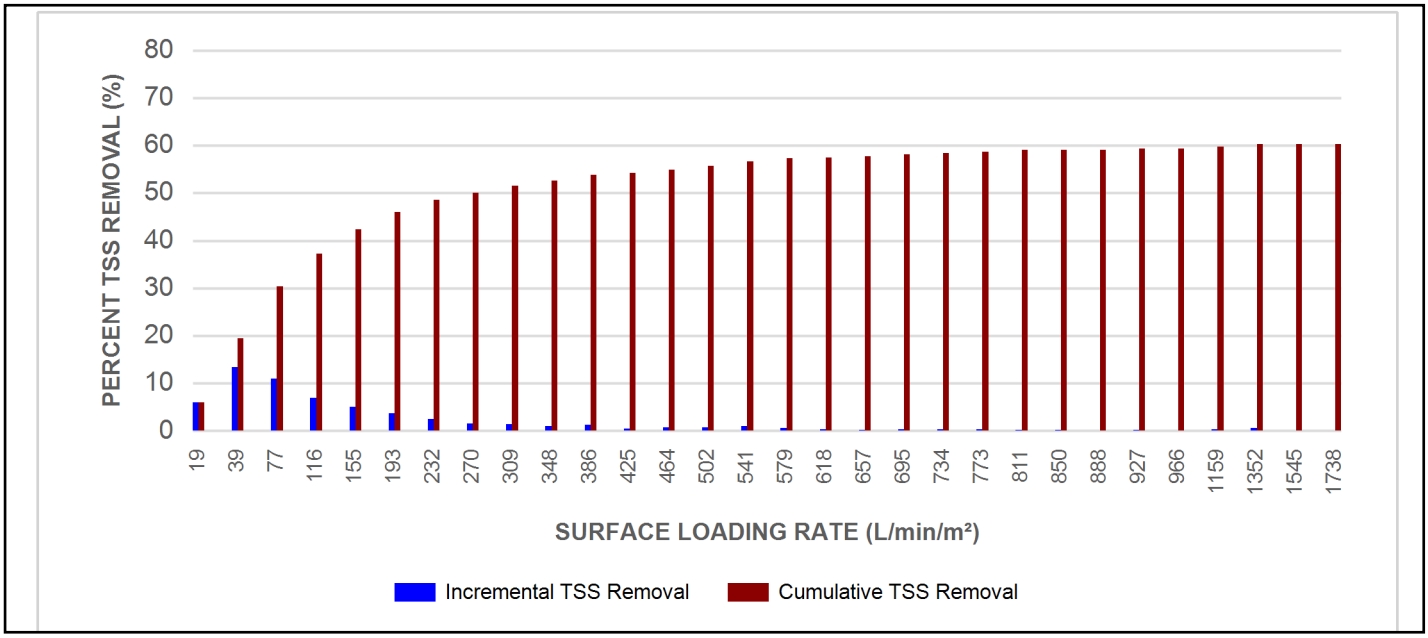
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.5	8.5	1.51	91.0	19.0	70	6.0	6.0
1.00	19.0	27.5	3.03	182.0	39.0	70	13.4	19.4
2.00	16.8	44.3	6.05	363.0	77.0	66	11.0	30.4
3.00	11.3	55.6	9.08	545.0	116.0	62	6.9	37.3
4.00	8.6	64.2	12.10	726.0	155.0	58	5.0	42.3
5.00	6.7	70.9	15.13	908.0	193.0	55	3.7	46.0
6.00	4.8	75.6	18.16	1089.0	232.0	53	2.5	48.5
7.00	3.1	78.7	21.18	1271.0	270.0	52	1.6	50.1
8.00	2.8	81.5	24.21	1452.0	309.0	51	1.4	51.5
9.00	2.1	83.6	27.23	1634.0	348.0	50	1.0	52.6
10.00	2.5	86.1	30.26	1816.0	386.0	49	1.2	53.8
11.00	0.9	87.0	33.29	1997.0	425.0	48	0.4	54.2
12.00	1.5	88.5	36.31	2179.0	464.0	47	0.7	54.9
13.00	1.6	90.0	39.34	2360.0	502.0	47	0.7	55.7
14.00	2.0	92.0	42.36	2542.0	541.0	47	0.9	56.6
15.00	1.4	93.5	45.39	2723.0	579.0	46	0.7	57.3
16.00	0.6	94.1	48.42	2905.0	618.0	46	0.3	57.5
17.00	0.4	94.5	51.44	3086.0	657.0	46	0.2	57.7
18.00	0.9	95.3	54.47	3268.0	695.0	46	0.4	58.1
19.00	0.7	96.0	57.49	3450.0	734.0	45	0.3	58.4
20.00	0.7	96.7	60.52	3631.0	773.0	45	0.3	58.7
21.00	0.5	97.2	63.54	3813.0	811.0	45	0.2	59.0
22.00	0.3	97.5	66.57	3994.0	850.0	45	0.1	59.1
23.00	0.0	97.5	69.60	4176.0	888.0	45	0.0	59.1
24.00	0.6	98.1	72.62	4357.0	927.0	44	0.3	59.3
25.00	0.0	98.1	75.65	4539.0	966.0	44	0.0	59.3
30.00	0.7	98.8	90.78	5447.0	1159.0	46	0.3	59.7
35.00	1.2	100.0	105.91	6354.0	1352.0	48	0.6	60.3
40.00	0.0	100.0	121.04	7262.0	1545.0	45	0.0	60.3
45.00	0.0	100.0	136.17	8170.0	1738.0	40	0.0	60.3
Estimated Net Annual Sediment (TSS) Load Reduction =								**60 %**

Climate Station ID: 6166456 *Years of Rainfall Data*: 15

RAINFALL DATA FROM PETERBOROUGH RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

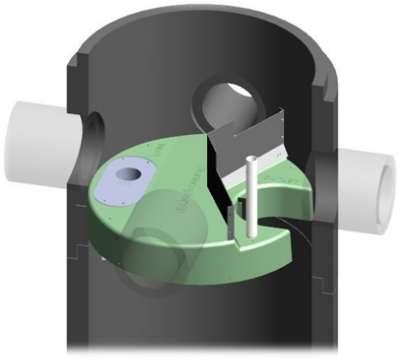
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

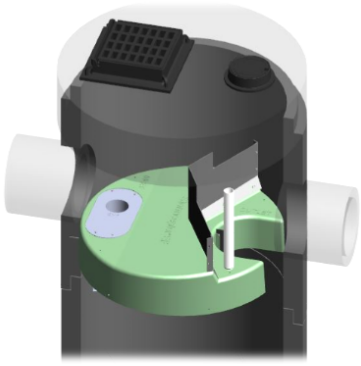
DESIGN FLEXIBILITY

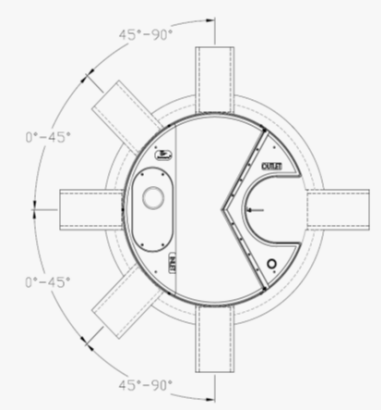
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results
Stormceptor® EF

SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL
1	70	660	46	1320	48	1980	35
30	70	690	46	1350	48	2010	34
60	67	720	45	1380	49	2040	34
90	63	750	45	1410	49	2070	33
120	61	780	45	1440	48	2100	33
150	58	810	45	1470	47	2130	32
180	56	840	45	1500	46	2160	32
210	54	870	45	1530	45	2190	31
240	53	900	45	1560	44	2220	31
270	52	930	44	1590	43	2250	30
300	51	960	44	1620	42	2280	30
330	50	990	44	1650	42	2310	30
360	49	1020	44	1680	41	2340	29
390	48	1050	45	1710	40	2370	29
420	48	1080	45	1740	39	2400	29
450	48	1110	45	1770	39	2430	28
480	47	1140	46	1800	38	2460	28
510	47	1170	46	1830	37	2490	28
540	47	1200	47	1860	37	2520	27
570	46	1230	47	1890	36	2550	27
600	46	1260	47	1920	36	2580	27
630	46	1290	48	1950	35	2600	26

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The **minimum** sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

Enhanced Grass Swale Sizing for West Swale

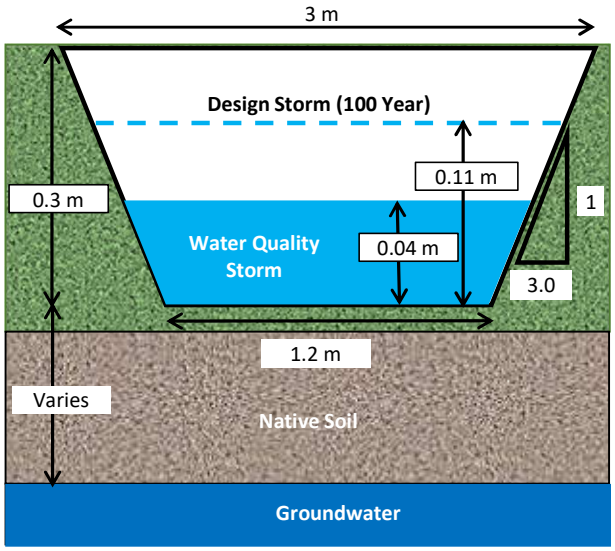
Project No: 85260
Project Name: Bridgenorth Townhouse Dev.
Designed/Checked By: NN / KS
Date: March 1, 2024

Site Characteristics		
Catchment Area	1.16	ha
Water Quality Storm	25	mm
Runoff Coefficient	0.19	
Water Quality Control Volume	55.1	m^3
Water Quality Peak Flow Rate	0.030	m^3/s
100 Year Storm Peak Flow Rate	0.166	m^3/s
Proposed Surface Elevation	Varies	
Groundwater Elevation	At / Near Surface	

Design Constraints		
Check Dams Required	No	
Max Water Quality Flow Depth	0.10	m
Max Water Quality Velocity	0.5	m/s
Max Design Storm Velocity	1.5	m/s
Min Depth to Groundwater	1.0	m

Design Calculations		
Pretreatment Utilized	None	
Check Dams Included	No	
Longitudinal Slope	2.00	%
Manning's n	0.03	
Maximum Swale Capacity	1.03	m^3/s
Water Quality Depth	0.042	m
Water Quality Velocity	0.54	m/s
Design Storm Velocity	0.95	m/s

Enhanced Grassed Swale
Proposed Cross-Section



Notes:

1. Flow Depth and Velocity were determined using Manning's Equation for the proposed swale cross-section.
2. Design Constraints were determined from CVC/TRCA Low Impact Development Stormwater Management Planning and Design Guide (2010)

Appendix G

HY8 & Emergency Spillway Modelling Results

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Weir Report

Emergency Spill Route

Trapezoidal Weir

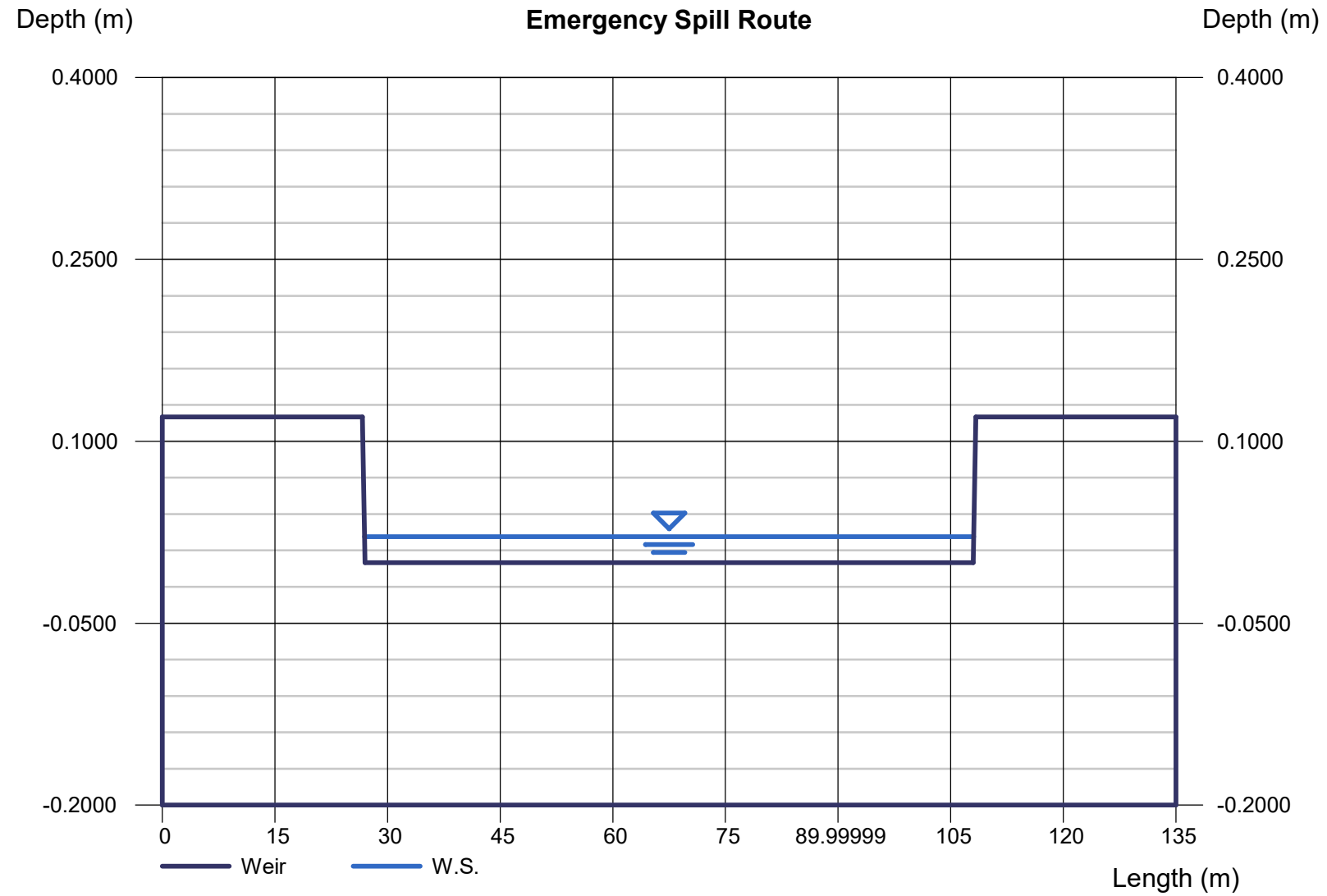
Crest	= Sharp
Bottom Length (m)	= 81.0000
Total Depth (m)	= 0.1200
Side Slope (z:1)	= 3.0000

Calculations

Weir Coeff. Cw	= 3.1000
Compute by:	Known Q
Known Q (cms)	= 0.3580

Highlighted

Depth (m)	= 0.0213
Q (cms)	= 0.3580
Area (sqm)	= 1.7296
Velocity (m/s)	= 0.2070
Top Width (m)	= 81.1280



LOT

ON SHEET 101 FOR SWALE CROSS SECTION

LIMIT OF GRADING MATCH EXISTING GRADE AT 3:1

301 / 101

BEGIN MATCHING GRADE AT 2:1 MAX

LIMIT OF GRADING MATCH EXISTING GRADE AT 2:1 MAX

3:1

2:1 MAX

EDGE OF ASPHALT

HP

O/H

3.05

32.7

265.37

266.0

264.89

264.68

264.66

264.75

264.00

263.40

263.80

264.03

263.99

264.19

264.15

264.16

264.30

264.10

264.31

264.32

0.7%

0.9%

2.0%

EMERGENCY FIRE-ROUTE

264.30

264.38

264.41

264.44

264.64

264.28

PROPOSED WELL

3.6%

2.3%

1.8%

264.46

264.52

264.49

264.50

264.51

CB

265.25

TOP OF SWM FACILITY DESIGN (ELEV. 264.00)

STORMCEPTOR EF8
T/G: 264.52
S INV: 263.40
N INV: 263.39
(SUPPLIER TO SPECIFY THE WEIR ELEVATION AND EXTENDED BASE DIMENSIONS BASED ON GROUNDWATER ELEVATIONS)

265.0

LIMIT OF GRADING MATCH EXISTING GRADE AT 3:1

EMERGENCY SPILLWAY AT 264.13
TOTAL LENGTH=81.0m

RODENT GRATE

304 / 101

PROPOSED SWM FACILITY

BELL EASEMENT

264.5

264.25

264.26

264.38

2.0%

PROPOSED BUILDING
FFE: 264.92

2R

264.52

264.44

LOT 13

0.9%

2.8%

1.0%

2.1%

EIGHTH LINE

STORMCEPTOR EF8

OUTLET
INV: 263.40

300mmø 7.1m
PVC @ 0.0%

INV=263.70

COVER:
11.75mm

PROPOSED
450mmø
HDPE 16.0m
@ 0.5%

PROPOSED 450mm HDPE CULVERT 16.0m @ 0.5%

4.0%

2.9%

300 / 101

375mmø 10.2m
PVC @ 5.6%

264.39

264.33

264.40

264.85

264.97

264.96

264.08

263.78

264.11

264.18

264.27

264.31

263.81

263.96

0.5%

264.0

A=26.3

3.05

EMERGENCY FIRE-ROUTE

GRAVEL DRIVEWAY

264.13

264.37

264.49

264.48

263.56

263.85

264.22

34.3

263.98

263.96

264.04

263.67

LIMIT OF GRADING MATCH EXISTING GRADE AT 3:1

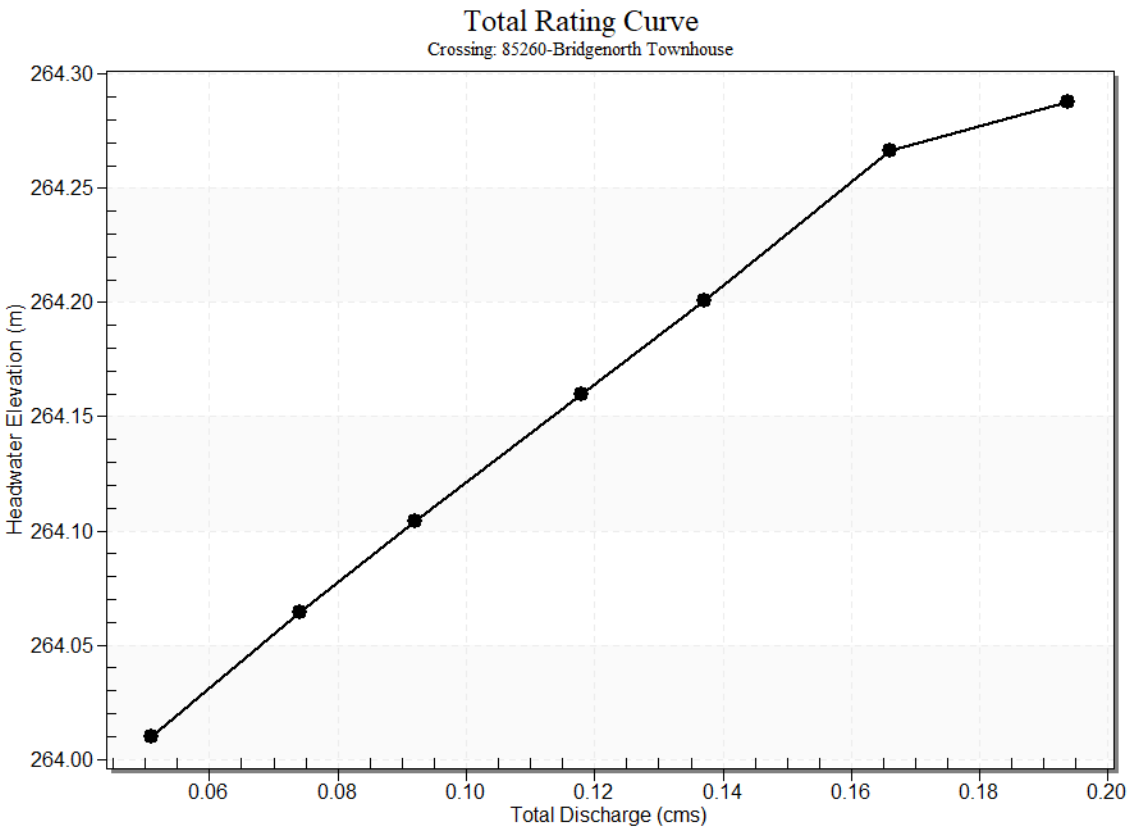
301 / 101

LIMIT OF GRADING MATCH EXISTING GRADE AT 3:1

+/- 45m OF DRAINAGE SWALE TO BE CLAY LINED AS SPECIFIED BY GEOTECHNICAL ENGINEER

Discharge Selection Method: User Defined

Headwater Elevation (m)	Discharge Names	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Iterations
264.01	2-YR	0.05	0.05	0.00	1
264.06	5-YR	0.07	0.07	0.00	1
264.10	10-YR	0.09	0.09	0.00	1
264.16	25-YR	0.12	0.12	0.00	1
264.20	50-YR	0.14	0.14	0.00	1
264.27	100 YR	0.17	0.17	0.00	1
264.28	Overtopping	0.17	0.17	0.00	Overtopping



Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
2-YR	0.05 cms	0.05 cms	264.01	0.23	0.094	1-S2n	0.14	0.15	0.14	0.46	1.22	0.00
5-YR	0.07 cms	0.07 cms	264.06	0.28	0.118	1-S2n	0.17	0.19	0.17	0.46	1.35	0.00
10-YR	0.09 cms	0.09 cms	264.10	0.32	0.157	1-S2n	0.19	0.21	0.19	0.46	1.43	0.00
25-YR	0.12 cms	0.12 cms	264.16	0.38	0.216	1-S2n	0.22	0.24	0.22	0.46	1.52	0.00
50-YR	0.14 cms	0.14 cms	264.20	0.42	0.262	1-S2n	0.24	0.26	0.24	0.46	1.58	0.00
100 YR	0.17 cms	0.17 cms	264.27	0.49	0.338	5-S2n	0.27	0.29	0.27	0.46	1.65	0.00

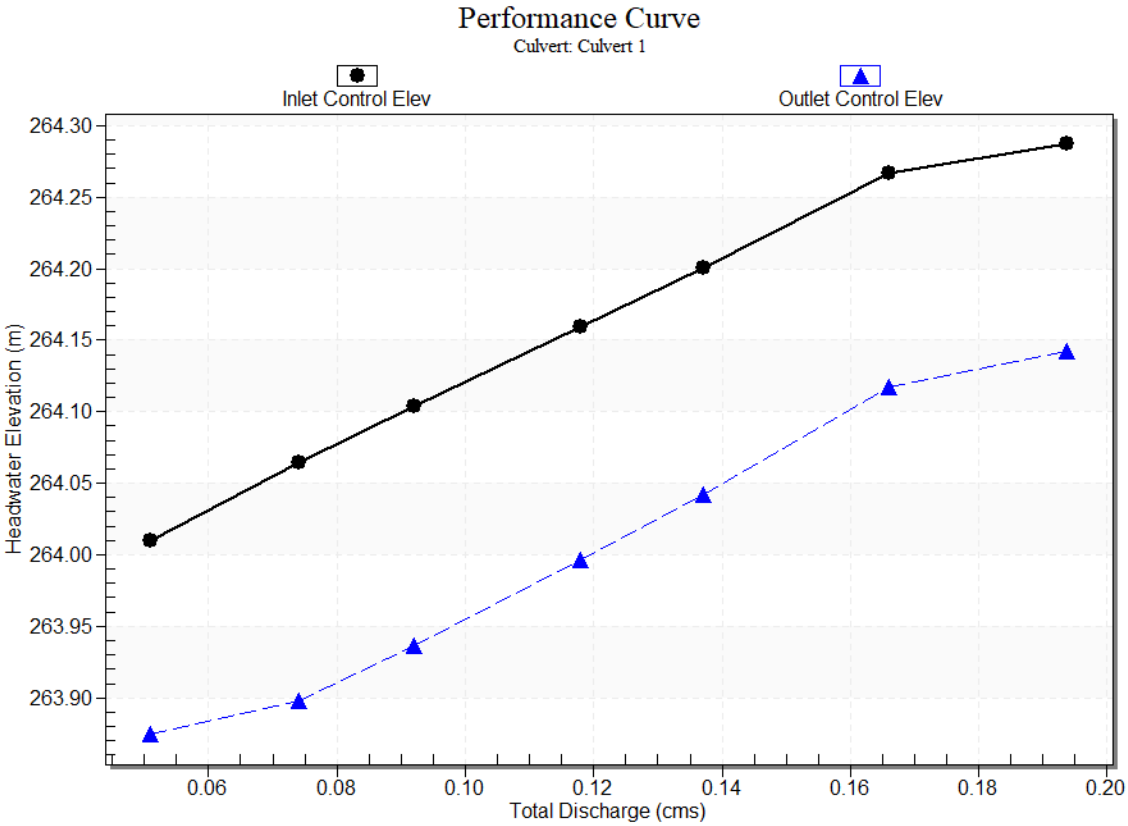
Culvert Barrel Type Straight Culvert

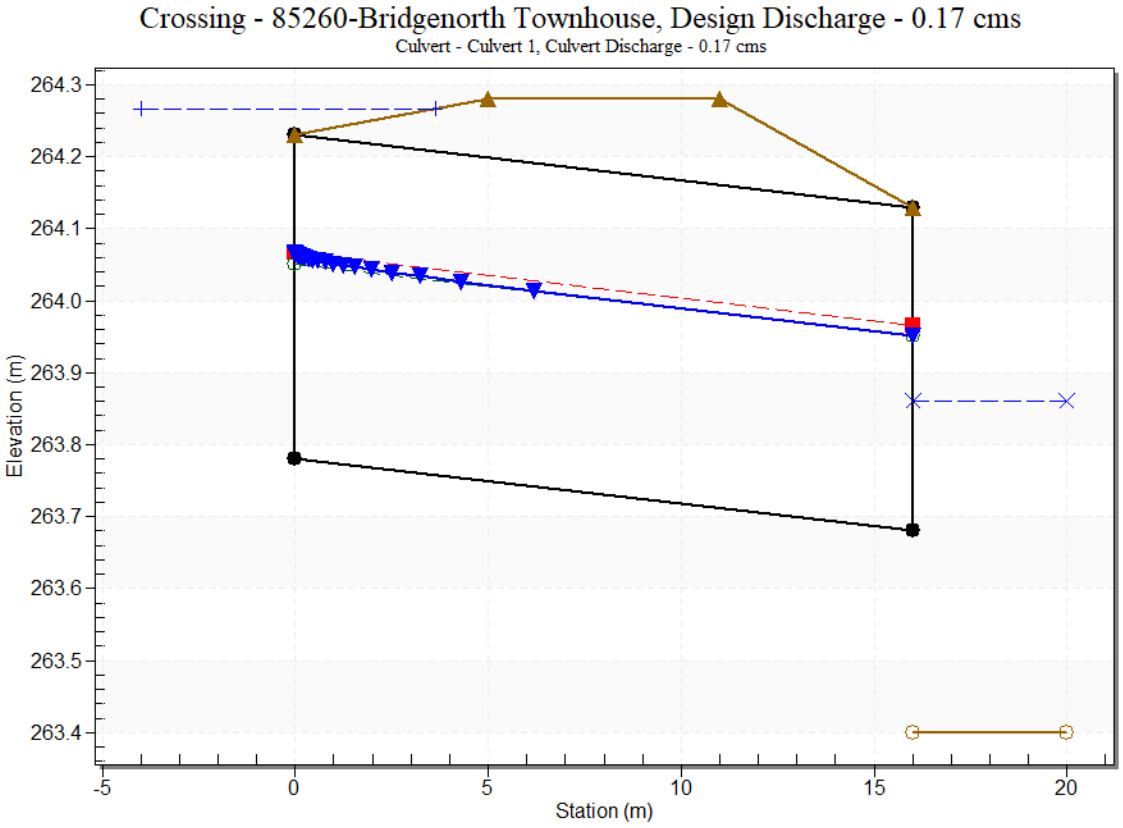
Inlet Elevation (invert): 263.78 m,

Outlet Elevation (invert): 263.68 m

Culvert Length: 16.00 m,

Culvert Slope: 0.0063


Performance Curve
Culvert: Culvert 1
Inlet Control Elev
Outlet Control Elev
Headwater Elevation (m)
264.30
264.25
264.20
264.15
264.10
264.05
264.00
263.95
263.90
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
Total Discharge (cms)



Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 263.78 m

Outlet Station: 16.00 m

Outlet Elevation: 263.68 m

Number of Barrels: 1

Barrel Shape: Circular

Barrel Diameter: 450.00 mm

Barrel Material: Smooth HDPE

Embedment: 0.00 mm

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting (Ke=0.9)

Inlet Depression: None

Flow (cms)	Water Surface Elev (m)	Depth (m)
0.05	263.86	0.46
0.07	263.86	0.46
0.09	263.86	0.46
0.12	263.86	0.46
0.14	263.86	0.46
0.17	263.86	0.46

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 263.86 m

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 23.40 m

Crest Elevation: 264.28 m

Roadway Surface: Gravel

Roadway Top Width: 6.00 m

Appendix H

Detailed Design Drawings

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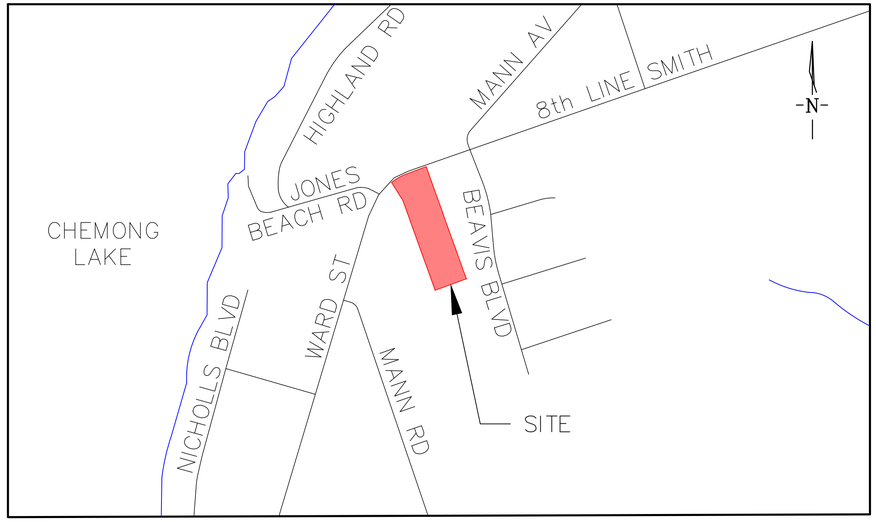
BRIDGENORTH TOWNHOUSE DEVELOPMENT

SELWYN
BRIDGENORTH, ONTARIO
WILLS PROJECT No. 22-85260



DRAWING INDEX

SHEET No.	DRAWING	REVISION No.	REVISION DATE
000	COVER SHEET	1	12/16/2025
100	GENERAL NOTES AND SPECIFICATIONS	1	12/16/2025
101	DETAILS	1	12/16/2025
102	EXISTING CONDITIONS PLAN	1	12/16/2025
200	REMOVALS, EROSION AND SEDIMENT CONTROL	1	12/16/2025
400	SITE PLAN	1	12/16/2025
500	GRADING AND SERVICING PLAN	1	12/16/2025

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

2ND SUBMISSION – DECEMBER 16, 2025

BRIDGENORTH TOWNHOUSE DEVELOPMENT
TOWNSHIP OF SELWYN, ONTARIO
WILLS PROJECT No. 22-85260
2ND SUBMISSION - DECEMBER 16, 2025

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

NOTES

1.0 SOURCE DATA

1.01 THE ENGINEERING DESIGN RELIES ON THE SURVEY PLAN DATED SEPTEMBER 7, 2022, PROJECT NUMBER 8529TOPO, PREPARED BY JBF SURVEYORS.

1.02 THE ENGINEERING DESIGN RELIES ON THE HYDROGEOTECHNICAL REPORT DATED NOVEMBER 2023, PROJECT NUMBER 22-85260, PREPARED BY DM WILLS ASSOCIATES LIMITED.

1.03 THE LOCATION OF EXISTING UNDERGROUND ELECTRIC, GAS, DATA TRANSMISSION, TELEPHONE AND CABLE TELEVISION IDENTIFIED ON THE CONTRACT DRAWINGS ARE FOR REFERENCE ONLY. THE CONTRACTOR SHALL LOCATE ALL UTILITIES HORIZONTALLY AND VERTICALLY PRIOR TO COMMENCEMENT OF CONSTRUCTION IN ACCORDANCE WITH OPSS 100 GC 7.01.09.

2.0 GENERAL CONSTRUCTION

2.01 REFERENCES WITHIN THESE CONTRACT DOCUMENTS TO AN OPSS SHALL BE DEEMED TO MEAN OPSS.MUNI, UNLESS USE OF A PROVINCIAL-ORIENTED SPECIFICATION IS SPECIFIED IN THE CONTRACT DOCUMENTS. WHEN THERE IS NOT A CORRESPONDING MUNICIPAL ORIENTED SPECIFICATION, THE REFERENCES BELOW SHALL BE CONSIDERED TO BE THE OPSS.COMM.

2.02 THE WORK IS TO BE COMPLETED IN ACCORDANCE WITH OPSS MUNI 100 GENERAL CONDITIONS OF CONTRACT.

2.03 THE ENGINEERING DESIGN REFERENCES THE FOLLOWING BENCHMARK, PROVIDED BY JBF SURVEYORS:

BENCHMARK TABLE

BM#	ELEVATION	NORTHING	EASTING	DESCRIPTION
BM#1	264.03	4919241.65m	708746.11m	TOP OF IRON BAR IN NORTHWEST CORNER OF SITE

2.04 THE CONTRACTOR SHALL VERIFY ALL BENCHMARKS WITH THE CONTRACT ADMINISTRATOR IN A FORMAT AS PRESCRIBED BY THE CONTRACT ADMINISTRATOR PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.

2.05 THE CONTRACTOR SHALL UNDERTAKE ALL LAYOUT REQUIRED TO FACILITATE THE CONSTRUCTION OF THIS CONTRACT.

2.06 WITH THE EXCEPTION OF THE REFERENCED LOCAL CONTROL POINTS SPECIFICALLY PROVIDED IN THE CONTRACT DRAWINGS, NO ELEVATION WITHIN THE CONTRACT DRAWINGS ARE TO BE USED AS A REFERENCE FOR LAYOUT.

2.07 LOCAL CONTROL POINTS, MONUMENTS, PROPERTY MONUMENTS, AND BENCHMARKS SHALL BE INVENTORIED IN THE FORM PROVIDED IN IN A FORMAT AS PRESCRIBED BY THE CONTRACT ADMINISTRATOR.

2.08 DISTURBED OR OTHERWISE DAMAGED CONTROL POINTS SHALL BE REINSTATED BY AN OLS SURVEYOR AT THE SOLE EXPENSE OF THE CONTRACTOR.

2.09 THE CONTRACTOR SHALL USE THE LOCAL CONTROL POINTS AS SPECIFIED ON THE CONTRACT DRAWINGS. THE USE OF AN INCORRECT CONTROL POINT BY THE CONTRACTOR, THAT RESULTS IN DEFICIENT WORK, EITHER IN VERTICAL OR HORIZONTAL ALIGNMENT, SHALL BE CORRECTED BY THE CONTRACTOR AT THE SOLE EXPENSE OF THE CONTRACTOR.

2.10 ANY DISCREPANCY BETWEEN THE SITE CONDITIONS AND THE CONTRACT DRAWINGS SHALL IMMEDIATELY BE REPORTED TO THE CONTRACT ADMINISTRATOR.

2.11 THE CONTRACTOR SHALL OBTAIN AND MAINTAIN COPIES OF ALL REFERENCED STANDARD DOCUMENTS AND DRAWINGS ON SITE FOR THE DURATION OF THE WORK.

2.12 THE CONTRACTOR SHALL KEEP RECORDS AND SUPPLY THE CONTRACT ADMINISTRATOR WITH RED-LINED AS CONSTRUCTED DRAWINGS NOTING THAT ALL SITE SERVICE INSTALLATION WORKS WERE INSTALLED AS PER THE CONTRACT DOCUMENTS, OR OTHERWISE NOTING THE ACTUAL STRUCTURE LOCATIONS, PIPE DETAILS (LENGTH, SIZE AND / OR MATERIAL), AND INVERTS AND ANY OTHER DEVIATION FROM THE CONTRACT DOCUMENTS.

2.13 NO ADDITIONAL PAYMENT WILL BE MADE FOR COSTS ASSOCIATED WITH THE SUPPORT, PRESERVATION AND / OR RELOCATION OF EXISTING UTILITIES IDENTIFIED IN THE CONTRACT DOCUMENTS, UNLESS SPECIFICALLY NOTED OTHERWISE.

3.0 EROSION AND SEDIMENT CONTROL

3.01 EROSION AND SEDIMENT CONTROL AND TREE PROTECTION MEASURES SHALL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING CONSTRUCTION TO PREVENT ENTRY OF SEDIMENT LADEN WATER INTO EXISTING INFRASTRUCTURE, WATERBODIES OR ONTO ADJACENT LANDS. ALL DAMAGED EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REPAIRED OR REPLACED WITHIN 48 HOURS OF INSPECTION.

3.02 DISTURBANCE TO EXISTING VEGETATED AREAS WITHIN THE WORK AREA SHALL BE MINIMIZED TO THE EXTENT POSSIBLE. NO ADDITIONAL PAYMENT WILL BE MADE FOR RESTORATION OF AREAS DISTURBED BY CONSTRUCTION UNLESS NOTED IN THE CONTRACT DOCUMENTS.

3.03 THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED / AMENDED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREA. ADDITIONAL OR ALTERNATIVE CONTROL MEASURES SHALL BE IMPLEMENTED IMMEDIATELY UPON DIRECTION FROM THE CONTRACT ADMINISTRATOR. ADDITIONAL MATERIALS SHALL BE KEPT ON SITE TO BE USED AS NECESSARY.

3.04 ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, SHALL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES ONTO ROADS OR ADJACENT PROPERTIES, OR INTO SEWERS OR ADJACENT WATERBODIES.

3.05 SILT SACKS SHALL BE PLACED UNDER GRATES ON ALL CATCHBASINS TO TRAP SEDIMENT. SILT SACKS ARE TO BE CLEANED REGULARLY, REPLACED AS NECESSARY AND ARE NOT TO BE SEALED IN PLACE DURING PAVING OPERATIONS.

3.06 ALL EROSION AND SEDIMENT CONTROL AND TREE PROTECTION SHALL REMAIN IN PLACE UNTIL REMOVAL IS AUTHORIZED BY THE CONTRACT ADMINISTRATOR.

3.07 CONTRACTOR EQUIPMENT AND VEHICLES ARE NOT PERMITTED WITHIN THE DRIPLINE OF TREES NOT DESIGNATED FOR REMOVAL.

3.08 ALL COSTS ASSOCIATED WITH THE MAINTENANCE OF EROSION AND SEDIMENT CONTROLS, INCLUDING REMOVAL OF ACCUMULATED SEDIMENT AND REPAIR / REPLACEMENT OF DAMAGED MEASURES SHALL BE INCLUDED IN THE CONTRACT PRICE. NO ADDITIONAL PAYMENT WILL BE MADE.

3.09 SEED SHALL BE LOWLAND MIX.

4.0 GRADING / EARTHWORKS

4.01 MANAGEMENT OF EXCESS MATERIAL BY OPEN BURNING IS NOT PERMITTED.

5.0 REMOVALS

5.01 NATURAL WOOD SHALL BE MANAGED AS EXCESS MATERIAL AND MAY NOT BE MANAGED AS DISPOSABLE FILL WITHIN THE CONTRACT LIMITS.

6.0 STRIPPING, COMPACTION, AND DEWATERING

6.01 EXCAVATION OF THE SWM FACILITY AREA TO OCCUR TO THE ELEVATION OF THE BOTTOM OF THE CLAY LINER. THIS ELEVATION WOULD CORRESPOND TO 263.40 M PLUS THE THICKNESS OF CLAY LINER, WHICH IS TO BE SPECIFIED BY A QUALIFIED GEOTECHNICAL ENGINEER.

6.02 ANY WATER PRESENT WITHIN THE EXCAVATED FOOTPRINT OF THE SWM FACILITY FOLLOWING STRIPPING SHALL BE DEWATERED PRIOR TO THE INSTALLATION OF THE CLAY LINER. THE CONTRACTOR SHALL DIRECT WATER TO A FILTER BAG (TERRAFIX ENVIROBAG OR SIMILAR) PRIOR TO OVERLAND DISCHARGE.

6.03 THE CLAY LINER SHALL BE INSTALLED IN DRY CONDITIONS AND AS PER THE SPECIFICATIONS SHOWN IN THE DRAWINGS. THE CLAY LINER SHALL BE COMPACTED TO A DENSITY RECOMMENDED BY A QUALIFIED GEOTECHNICAL ENGINEER.

6.04 RESTORE THE SWM FACILITY INSIDE AND OUTSIDE WITH 150 MM OF TOPSOIL AND SEED (LOWLAND MIX). WATER SEEDED AREAS AS REQUIRED TO ENSURE GERMINATION AND CONTINUOUS GROWTH.

6.05 THE IDENTICAL PROCESS IS TO BE FOLLOWED WHEN CONSTRUCTING THE ENHANCED GRASSED SWALES, HOWEVER ELEVATIONS WILL DIFFER. A QUALIFIED GEOTECHNICAL ENGINEER SHALL SPECIFY THE LENGTH AND DEPTH OF CLAY LINER REQUIRED FOR SWALE CONSTRUCTION.

7.0 SEWERS

7.01 ALL NEW STORM SEWERS SHALL BE CCTV INSPECTED. IN ADDITION WHERE THE NEW SEWERS TIE INTO EXISTING STRUCTURES ONE ADDITIONAL LENGTH, TO THE NEXT STRUCTURE DOWNSTREAM, OF EXISTING SEWER SHALL BE CCTV INSPECTED. CCTV INSPECTION SHALL BE CONDUCTED AFTER ALL MATERIAL HAS BEEN POWER CLEANED FROM DOWNSTREAM MANHOLE AND PRIOR TO THE PLACEMENT OF ASPHALT, CURB OR CONCRETE SIDEWALK. CCTV CONTRACTOR SHALL BE PACP 6.0, OR ABOVE, CERTIFIED PER OPSS 409 AND PROVIDE THREE (3) COPIES OF THE VIDEOS AND REPORTS IN DIGITAL VIDEO AND PDF FORMATS TO THE ENGINEER FOR THEIR REVIEW AND APPROVAL PRIOR TO THE RELEASE OF SITE SECURITIES. ALL TIPPING FEES SHALL BE CARRIED BY THE CONTRACTOR.

7.02 A RESILIENT CONNECTOR (I.E. A FLEXIBLE, WATERTIGHT CONNECTOR) SHALL BE INSTALLED IN THE STRUCTURE OPENING FOR FLEXIBLE AND RIGID PIPE.

7.03 THERE SHALL BE NO CHANGES TO THE DESIGN ALIGNMENT AND GRADE OF SEWERS WITHOUT THE WRITTEN AUTHORIZATION OF THE CONTRACT ADMINISTRATOR.

7.04 LOW PRESSURE AIR TESTING IS PERMITTED FOR PIPE.

7.05 AIR TEST (WATER TEST) RESULTS SHALL BE SUBMITTED PRIOR TO ACCEPTANCE OF THE SEWERS. THE TEST(S) SHALL BE DONE AFTER FINAL BACKFILL IS PLACED IN THE TRENCH AND BEFORE ASPHALT HAS BEEN PLACED. GENERAL SEQUENCE OF TESTING FOR SEWER SYSTEMS IS AS FOLLOWS (BUT NOT LIMITED TO):

- 7.05.01 CLEANING AND FLUSHING WITH HIGH-PRESSURE WATER BLASTING
- 7.05.02 WATER-TIGHTNESS (LEAKAGE) TESTING
- 7.05.03 CCTV (PHOTOGRAPHIC RECORD & INSPECTION FORM FOR MAINTENANCE HOLES) AFTER TESTING
- 7.05.04 DEFLECTION OR OUT OF ROUND TESTING (FOR THERMO-PLASTIC PIPES ONLY) IN ACCORDANCE WITH OPSS 410 MAY BE REQUIRED FOLLOWING THE REVIEW OF THE CCTV AS DIRECTED BY THE CONTRACT ADMINISTRATOR.

8.0 ROADWORKS / BOULEVARDS

8.01 THE CONTRACT ADMINISTRATOR MUST AUTHORIZE THE STOCKPILE LOCATIONS PROPOSED BY THE CONTRACTOR, PRIOR TO THE IMPORT OF ANY MATERIAL TO BE STOCKPILED.

8.02 ALL FORMWORK SHALL BE REVIEWED BY THE CONTRACT ADMINISTRATOR PRIOR TO PLACEMENT OF CONCRETE. THE CONTRACTOR SHALL NOTIFY THE CONTRACT ADMINISTRATOR A MINIMUM OF 2 BUSINESS DAYS PRIOR TO THE SCHEDULED CONCRETE POUR TO ALLOW TIME TO COORDINATE FORMWORK REVIEW. CONCRETE PLACED PRIOR TO THE REVIEW OF THE CONTRACT ADMINISTRATOR MAY BE REQUIRED TO BE REMOVED, DISPOSED OFF-SITE AND REPLACED AT THE SOLE EXPENSE OF THE CONTRACTOR.

8.03 DUMMY JOINTS SHALL BE CONSTRUCTED AT A MAXIMUM SPACING OF 1.5 M BETWEEN CONTRACTION / EXPANSION JOINTS.

8.04 SEED SHALL BE LOWLAND MIX.

8.05 GEOTECHNICAL ENGINEER TO PROVIDE PAVEMENT STRUCTURE. ENTRANCE PAVEMENT TO CONSIST OF, AT A MINIMUM, 50mm HL4 FROM CURB TO PROPERTY LINE AS PER THE COUNTY BY-LAW.

9.0 INSPECTION AND DOCUMENTATION REQUIREMENTS

9.01 SUBMIT SHOP DRAWINGS TO THE CONTRACT ADMINISTRATOR PROMPTLY AND IN ORDERLY SEQUENCE TO NOT CAUSE DELAY IN WORK. FAILURE TO SUBMIT IN AMPLE TIME IS NOT CONSIDERED SUFFICIENT REASON FOR EXTENSION OF CONTRACT TIME AND NO CLAIM FOR EXTENSION BY REASON OF SUCH DEFAULT WILL BE ALLOWED. DO NOT PROCEED WITH WORK AFFECTED BY SUBMITTAL UNTIL REVIEW IS COMPLETE. REVIEW SHOP DRAWINGS PRIOR TO SUBMISSION. THIS REVIEW REPRESENTS THAT NECESSARY REQUIREMENTS HAVE BEEN DETERMINED AND VERIFIED, OR WILL BE, AND THAT EACH SUBMITTAL HAS BEEN CHECKED AND CO-ORDINATED WITH REQUIREMENTS OF WORK AND CONTRACT DOCUMENTS. SUBMITTALS NOT STAMPED, SIGNED, DATED AND IDENTIFIED AS TO SPECIFIC PROJECT WILL BE RETURNED WITHOUT BEING EXAMINED AND CONSIDERED REJECTED. ALLOW 5 BUSINESS DAYS FOR THE FIRST, AND 3 BUSINESS DAYS FOR RESUBMITTED SHOP DRAWING REVIEW.

9.02 THE CONTRACTOR SHALL CONTACT THE CONTRACT ADMINISTRATOR A MINIMUM OF 2 BUSINESS DAYS IN ADVANCE OF THE FOLLOWING ACTIVITIES IN ORDER FOR THE CONTRACT ADMINISTRATOR TO ARRANGE FOR THE PROPER INSPECTION OF THE RELATED CONSTRUCTION ACTIVITIES. IF THE REQUIRED NOTICE IS NOT PROVIDED, THE CONTRACTOR MAY BE REQUIRED TO UNDERTAKE ADDITIONAL WORKS, AT THE SOLE EXPENSE OF THE CONTRACTOR, TO PERMIT THE CONTRACT ADMINISTRATOR TO INSPECT AND / OR VERIFY THAT THE WORKS HAVE CONSTRUCTED IN CONFORMANCE WITH THE CONTRACT DOCUMENTS.

- 9.02.01 MOBILIZATION DATE, PROPOSED CONSTRUCTION SCHEDULE AND CONTRACTOR CONTACT INFORMATION.
- 9.02.02 VERIFY SITE CONTROL POINTS PRIOR TO LAYOUT.
- 9.02.03 UPON COMPLETION OF ALL EROSION AND SEDIMENT CONTROL WORKS.
- 9.02.04 PRIOR TO THE PLACEMENT OF THE FIRST STORM AND SANITARY MANHOLES
- 9.02.05 PRIOR TO THE CONNECTION OF NEW WORKS TO EXISTING WORKS (STORM).
- 9.02.06 PRIOR TO AIR TESTING THE STORM SEWERS.
- 9.02.07 PRIOR TO THE PLACEMENT OF ANY GRANULAR ROAD OR PARKING LOT GRANULAR BASE.
- 9.02.08 PRIOR TO ASPHALT PLACEMENT.
- 9.02.09 PRIOR TO ANY CONCRETE POUR.
- 9.02.10 PRIOR TO THE DEMOBILIZATION OF THE SERVICING CONTRACTOR FROM THE SITE.

8.03 THE CONTRACTOR SHALL SUPPLY THE CONTRACT ADMINISTRATOR WITH COPIES OF ALL TESTING AND INSPECTION REPORTS RELATED TO THE WORK WITHIN 4 BUSINESS DAYS OF THE REPORTING.

OPSS INDEX

NUMBER	REV.	DATE	DESCRIPTION
180		NOV-21	GENERAL SPECIFICATION FOR THE MANAGEMENT OF EXCESS MATERIALS
201		APR-19	CLEARING, CLOST CUT CLEARING, GRUBBING AND REMOVAL OF SURFACE AND PILED BOULDERS
206		APR-19	GRADING
310		NOV-17	HOT MIX ASPHALT
314		NOV-19	UNTREATED SUB BASE, BASE, SURFACE, SHOULDER, SELECTED SUBGRADE, AND STOCKPILING
351		NOV-21	CONCRETE SIDEWALK
353		NOV-21	CONCRETE CURB AND GUTTER SYSTEMS
401		NOV-21	TRENCHING BACKFILL AND COMPACTING
402		NOV-16	EXCAVATING, BACKFILLING AND COMPACTING FOR MAINTENANCE HOLES, CATCH BASINS, DITCH INLETS AND VALVE CHAMBERS
404		NOV-17	SUPPORT SYSTEMS
407		NOV-21	NEW MAINTENANCE HOLE, CATCH BASIN, DITCH INLET, AND VALVE CHAMBER INSTALLATION
409		NOV-17	CLOSED-CIRCUIT TELEVISION (CCTV) INSPECTION OF PIPELINES
410		NOV-18	PIPE SEWER INSTALLATION IN OPEN CUT
411		NOV-21	CLEANING AND FLUSHING OF PIPE SEWERS, CATCH BASINS, MAINTENANCE HOLES, DITCH INLETS, AND OIL-GRIT SEPARATORS
421		NOV-18	PIPE CULVERT INSTALLATION IN OPEN CUT
490		NOV-20	SITE PREPARATION FOR PIPELINES, UTILITIES, AND ASSOCIATED STRUCTURES
491		NOV-17	PRESERVATION, PROTECTION, AND RECONSTRUCTION OF EXISTING FACILITIES
492		NOV-20	SITE RESTORATION FOLLOWING INSTALLATION OF PIPELINES, UTILITIES, AND ASSOCIATED STRUCTURES
501		NOV-17	COMPACTING
510		NOV-18	REMOVAL
802		NOV-19	TOPSOIL
804		NOV-14	SEED AND COVER
805		NOV-21	TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES
811		NOV-22	LARGE WOODY DEBRIS
1205		APR-15	MATERIAL SPECIFICATION FOR CLAY SEAL

OPSD INDEX

NUMBER	REV.	DATE	DESCRIPTION
102.010	1	NOV-06	REMOVALS, LEGEND
200.010	2	NOV-09	EARTH/SHALE GRADING - UNDIVIDED RURAL
205.010	3	NOV-16	TRANSITION TREATMENT - EARTH CUT TO EARTH FILL
219.110	3	NOV-21	LIGHT DUTY SILT FENCE BARRIER
219.130	3	NOV-21	HEAVY DUTY SILT FENCE BARRIER
220.010	1	NOV-19	BARRIER FOR TREE PROTECTION
310.010	3	NOV-19	CONCRETE SIDEWALKS
350.010	2	NOV-18	URBAN INDUSTRIAL, COMMERCIAL, AND APARTMENT ENTRANCES
401.010	4	NOV-18	CAST IRON, SQUARE FRAME WITH CIRCULAR CLOSED OR OPEN COVER FOR MAINTENANCE HOLES.
600.010	0	NOV-19	CONCRETE BARRIER CURB WITH WIDE GUTTER
701.010	5	NOV-21	PRECAST CONCRETE MAINTENANCE HOLE - 1200mm DIAMETER
708.020	4	NOV-16	SUPPORT FOR PIPE AT CATCH BASIN OR MAINTENANCE HOLE
802.010	3	NOV-14	FLEXIBLE PIPE EMBEDMENT AND BACKFILL, EARTH EXCAVATION
802.095	3	NOV-21	TRENCH PLUG
803.030	3	NOV-15	FROST TREATMENT - PIPE CULVERTS FROST PENETRATION LINE BELOW GRADE
1003.032	0	NOV-21	INTERNAL DROP STRUCTURE FOR EXISTING MAINTENANCE HOLES WITH TOP CLEANOUT

BM1 - ELEV. 264.03
TOP OF IRON BAR IN NORTHWEST CORNER OF SITE.

TRUE NORTH

KEY PLAN

REVISIONS

No.	Description	Date
2	ISSUED FOR ZONING BY-LAW AMENDMENT - 2ND SUBMISSION	12/16/25
1	ISSUED FOR ZONING BY-LAW AMENDMENT - 1ST SUBMISSION	04/04/24

METRIC Dimensions are in METRES and/or MILLIMETRES unless otherwise shown

LEGEND TO BE READ IN CONJUNCTION WITH OPSD 100 SERIES

LICENSED PROFESSIONAL ENGINEER
Dec. 16, 2025
E.R. ST PIERRE
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Project Name/Location

BRIDGENORTH TOWNHOUSE DEVELOPMENT

BRIDGENORTH, ONTARIO

Drawing Title

GENERAL NOTES

Drawn By: M.G.	SCALE: Horz. - Vert. -	
Designed By: M.G.	Plot Date: DECEMBER 16, 2025	
Checked By: J.D.F./J.R.	Project No.: 22-85260	Sht. No.:
Engineer: E.S.P.	Dwg File No.: 85260 - GNDT	100

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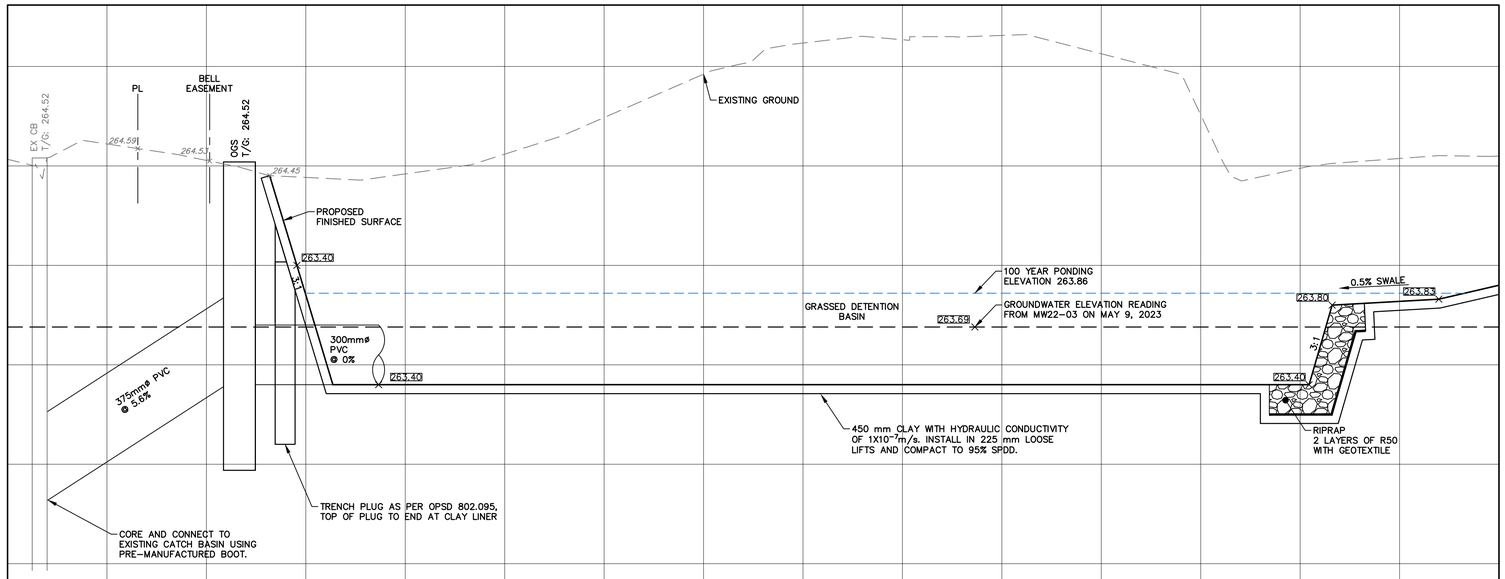
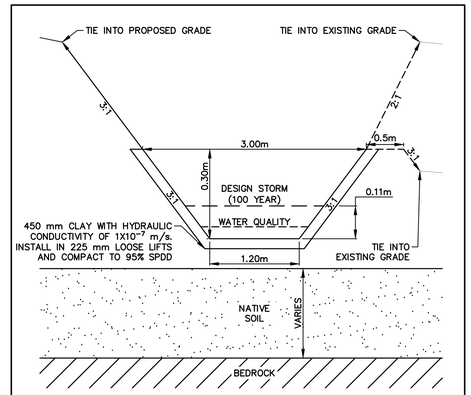


300 STORMWATER MANAGEMENT FACILITY

SCALE = VERT 1:150, HOR 1:15

DATE MAR 2024

REV 0

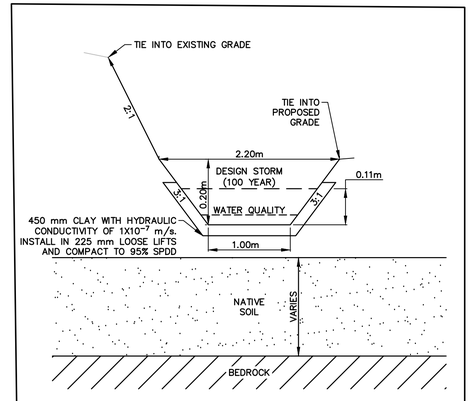


302 WEST SWALE

SCALE = N.T.S

DATE MAR 2024

REV 0

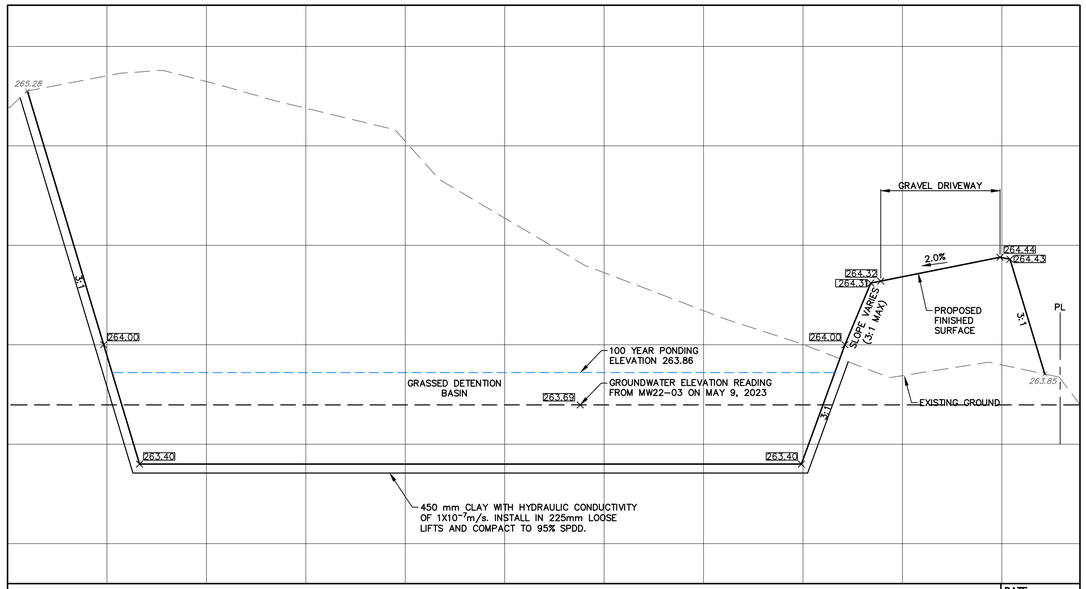


303 EAST SWALE

SCALE = N.T.S

DATE MAR 2024

REV 0

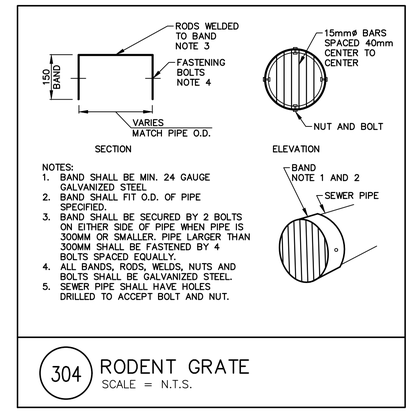


301 STORMWATER MANAGEMENT FACILITY

SCALE = VERT 1:150, HOR 1:15

DATE MAR 2024

REV 0



NOTES:
1. BAND SHALL BE MIN. 24 GAUGE GALVANIZED STEEL
2. BAND SHALL FIT O.D. OF PIPE SPECIFIED.
3. BAND SHALL BE SECURED BY 2 BOLTS ON EITHER SIDE OF PIPE WHEN PIPE IS 300MM OR SMALLER. PIPE LARGER THAN 300MM SHALL BE FASTENED BY 4 BOLTS SPACED EQUALLY.
4. ALL BANDS, RODS, WELDS, NUTS AND BOLTS SHALL BE GALVANIZED STEEL.
5. SEWER PIPE SHALL HAVE HOLES DRILLED TO ACCEPT BOLT AND NUT.

304 RODENT GRATE

SCALE = N.T.S.

BM1 – ELEV. 264.03
TOP OF IRON BAR IN NORTHWEST CORNER OF SITE.

TRUE NORTH

KEY PLAN

REVISIONS

No.	Description	Date
2	ISSUED FOR ZONING BY-LAW AMENDMENT – 2ND SUBMISSION	12/16/25
1	ISSUED FOR ZONING BY-LAW AMENDMENT – 1ST SUBMISSION	04/04/24

METRIC Dimensions are in METRES and/or MILLIMETRES unless otherwise shown

LEGEND TO BE READ IN CONJUNCTION WITH OPSD 100 SERIES

LICENCE OF PROFESSIONAL ENGINEER
100513163
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Project Name/Location

BRIDGENORTH TOWNHOUSE DEVELOPMENT

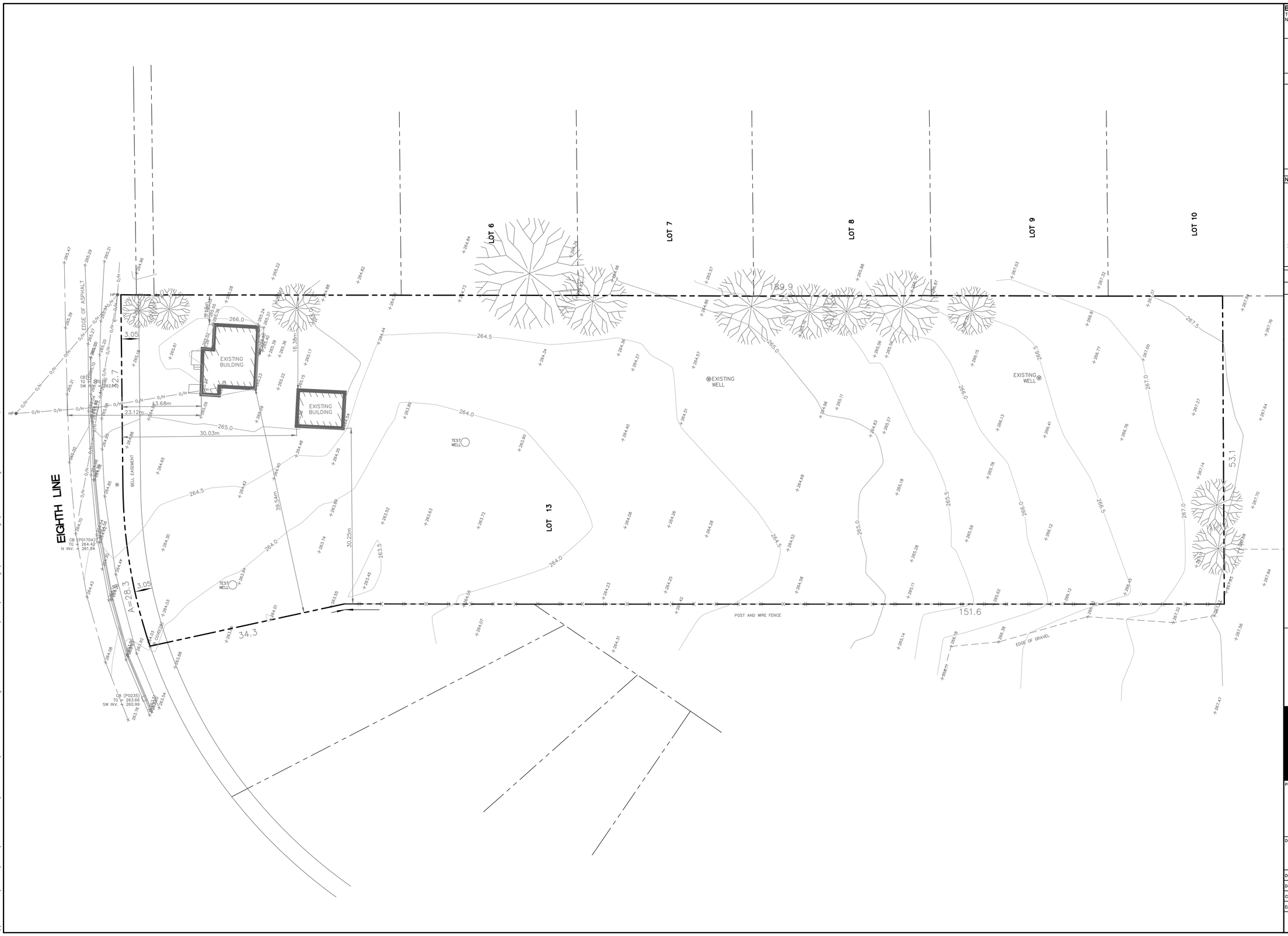
BRIDGENORTH, ONTARIO

Drawing Title

DETAILS

Drawn By: M.G.	SCALE: Horz. –	Vert. –	
Designed By: M.G.	Plot Date: DECEMBER 16, 2025		
Checked By: J.D.F./J.R.	Project No.: 22-85260	Sht. No.:	
Engineer: K.S.	Dwg File No.: 85260 – GNDT	101	

NOT FOR CONSTRUCTION



Printed By: jryan Printed On: December 16, 2025
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BM1 – ELEV. 264.03
TOP OF IRON BAR IN NORTHWEST CORNER OF SITE.

TRUE NORTH

KEY PLAN

REVISIONS

No.	Description	Date
2	ISSUED FOR ZONING BY-LAW AMENDMENT – 2ND SUBMISSION	12/16/25
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Project Name/Location

BRIDGENORTH TOWNHOUSE DEVELOPMENT

BRIDGENORTH, ONTARIO

Drawing Title

EXISTING CONDITIONS PLAN

Drawn By: M.G./C.M.	SCALE: Horz. 1:300	Vert. –	
Designed By: M.G.	Plot Date: December 16, 2025		
Checked By: J.D.F./J.R.	Project No.: 22-85260	Sht. No.:	
Engineer: E.S.P.	Dwg File No.: 85260 – TP	102	

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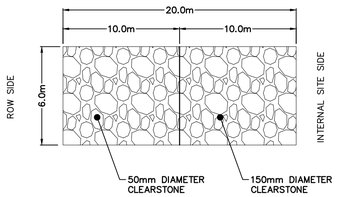


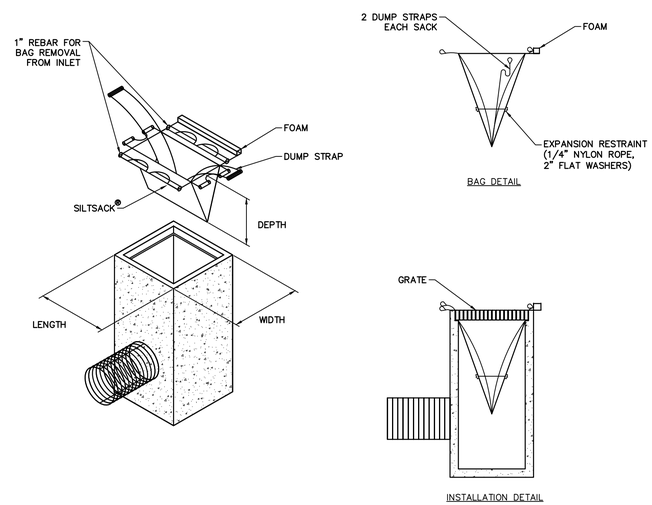
NOTE 1. TO BE INSTALLED PRIOR TO CONSTRUCTION AND MAINTAINED DURING CONSTRUCTION, REMOVE PRIOR TO PLACEMENT OF GRANULAR MATERIAL.
2. PAD SHALL BE 300mm THICK, UNDERLAIN WITH TERRAFIX 270R GEOTEXTILE OR APPROVED EQUIVALENT. PAD SHALL CONSIST OF 50mm DIA. CLEAR STONE FOR FIRST 10m FROM STREET. REMAINDER OF LENGTH TO CONSIST OF 150mm DIA. CLEAR STONE.

105 MUD MAT

SCALE = N.T.S

DATE DEC 2023

REV 2



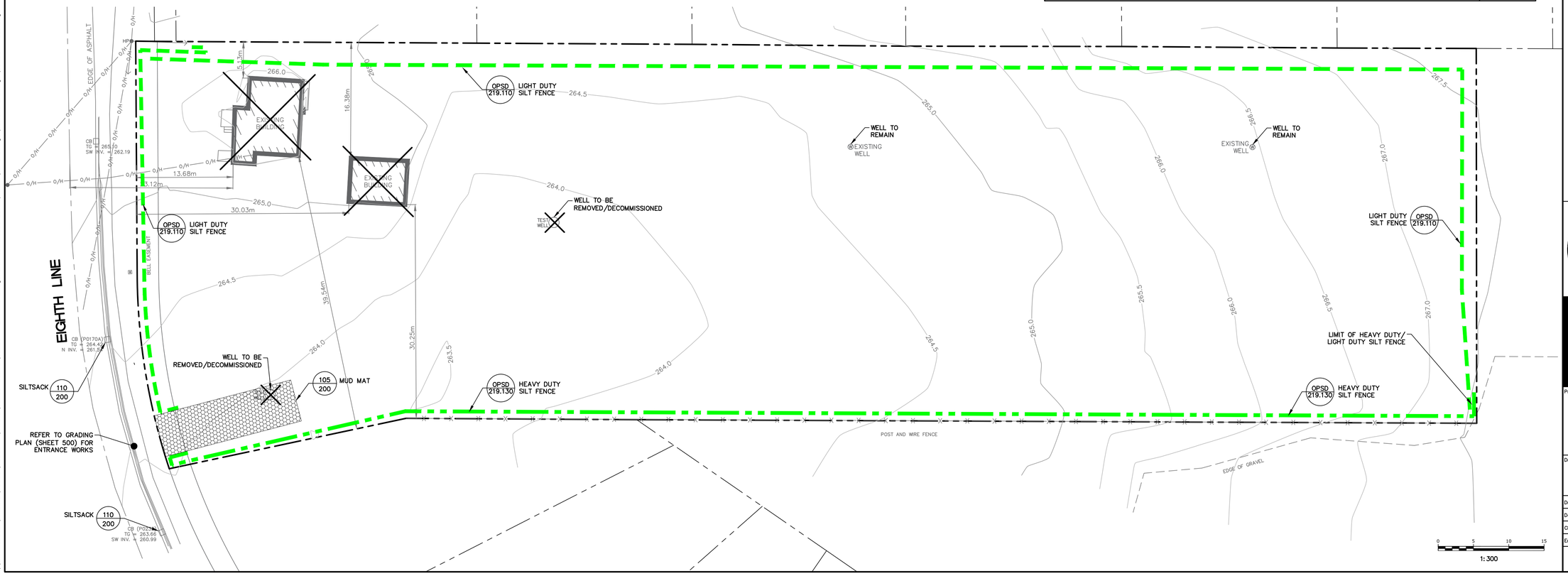
NOTES:
1. SILTSACK MANUFACTURED BY ACF ENVIRONMENTAL AND SI GEOSOLUTIONS. CONTRACTOR MAY SUBSTITUTE APPROVED EQUAL.
2. CONTRACTOR TO FOLLOW MANUFACTURERS INSTRUCTION FOR INSTALLATION AND MAINTENANCE.
3. CONTRACTOR TO INSTALL SILTSACK IN ALL CATCH BASINS OR CATCH BASIN MANHOLES IDENTIFIED ON THE SITE SERVICING OR SITE GRADING PLANS OR AS DIRECTED BY THE CONTRACT ADMINISTRATOR.

110 TYPICAL SILTSACK® CONSTRUCTION

SCALE = N.T.S

DATE MAR 2020

REV 1



BM1 – ELEV. 264.03
TOP OF IRON BAR IN NORTHWEST CORNER OF SITE.

TRUE NORTH

KEY PLAN

REVISIONS

No.	Description	Date
2	ISSUED FOR ZONING BY-LAW AMENDMENT – 2ND SUBMISSION	12/16/25
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LEGEND TO BE READ IN CONJUNCTION WITH OPSD 100 SERIES

- TYPICAL ILLUSTRATION FOR REMOVAL
- TYPICAL ILLUSTRATION FOR REMOVAL
- EX. BUILDING
- EX. EDGE OF PAVEMENT
- EX. CURB
- EX. ROAD CENTERLINE
- EX./PR. CATCH BASIN
- EXISTING FENCE
- PROPERTY LINE
- EXISTING SIGN
- LIGHT DUTY SILT FENCE
- HEAVY DUTY SILT FENCE

LICENSED PROFESSIONAL ENGINEER
Dec. 16, 2025
E.R. ST PIERRE
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Project Name/Location

BRIDGENORTH TOWNHOUSE DEVELOPMENT

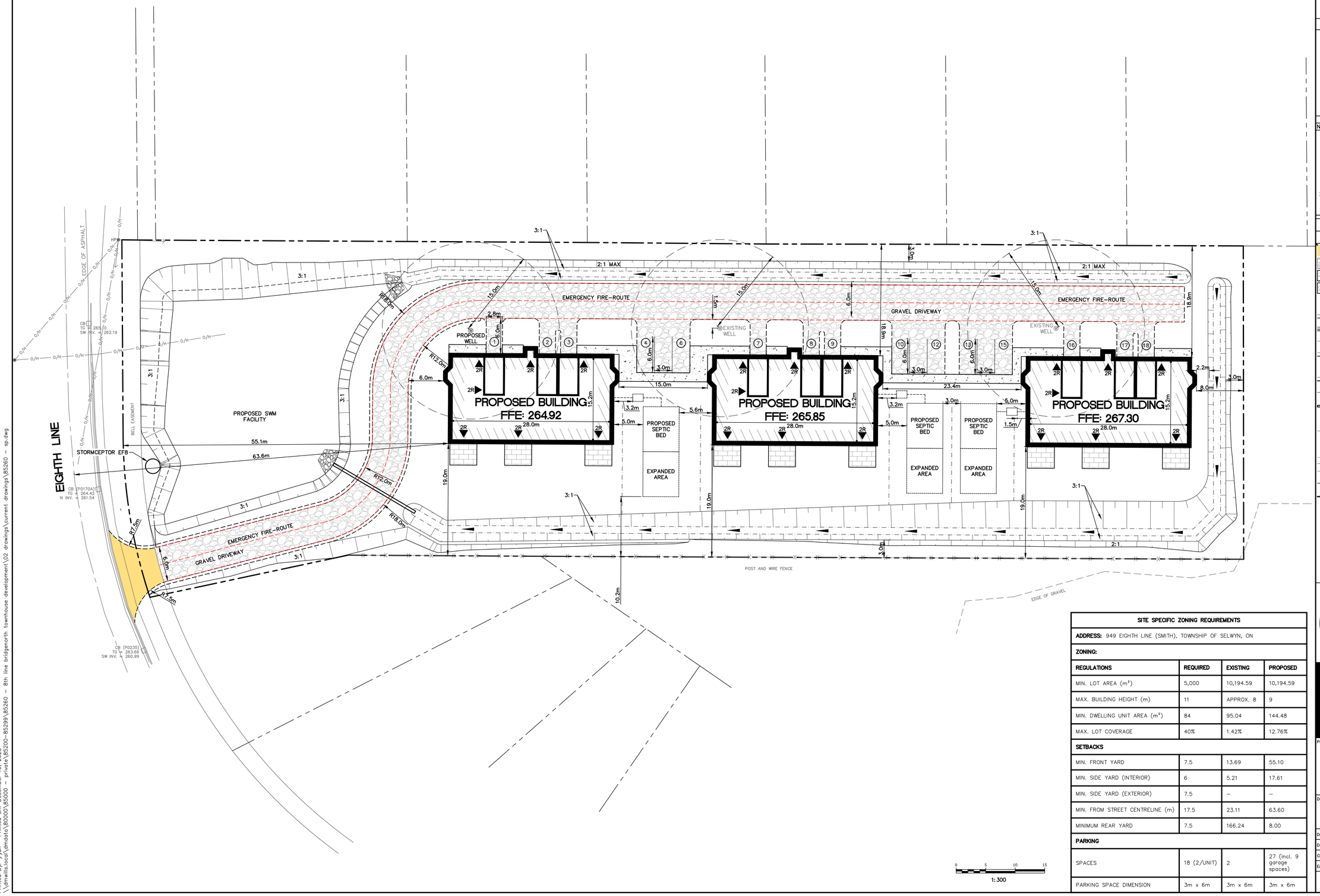
BRIDGENORTH, ONTARIO

Drawing Title

EROSION AND SEDIMENT CONTROL

Drawn By: M.G.	SCALE: Horz. 1:300 Vert. –		
Designed By: M.G./S.R.	Plot Date: DECEMBER 16, 2025		
Checked By: J.F.	Project No.: 22-85260	Sht. No.:	
Engineer: K.S.	Dwg File No.: 85260 – ESC	200	

NOT FOR CONSTRUCTION



BM1 – ELEV. 264.03
TOP OF IRON BAR IN NORTHWEST CORNER OF SITE.

TRUE NORTH

KEY PLAN

REVISIONS

No.	Description	Date
2	ISSUED FOR ZONING BY-LAW AMENDMENT – 2ND SUBMISSION	12/16/25
1	ISSUED FOR ZONING BY-LAW AMENDMENT – 1ST SUBMISSION	04/04/24

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LEGEND TO BE READ IN CONJUNCTION WITH OPSD 100 SERIES

- PR. ASPHALT
- PR. GRAVEL
- PR. CONCRETE
- PR. INTERLOCK
- EX./PR. BUILDING
- EX./PR. EDGE OF PAVEMENT
- EX./PR. CURB
- EX. ROAD CENTERLINE
- EX. EDGE OF SHOULDER
- EX. CATCH BASIN
- EX. STORM SEWER
- PR. DITCH
- PR. CULVERT
- HP EX. HYDRO POLE
- O/H EX. OVERHEAD HYDRO
- EX. BELL PEDESTAL
- 100.0 EX./PR. CONTOUR
- X EX. FENCE
- R.O.W.
- PROPERTY LINE

SITE SPECIFIC ZONING REQUIREMENTS

ADDRESS: 949 EIGHTH LINE (SMITH), TOWNSHIP OF SELWYN, ON

ZONING:

REGULATIONS	REQUIRED	EXISTING	PROPOSED
MIN. LOT AREA (m^2)	5,000	10,194.59	10,194.59
MAX. BUILDING HEIGHT (m)	11	APPROX. 8	9
MIN. DWELLING UNIT AREA (m^2)	84	95.04	144.48
MAX. LOT COVERAGE	40%	1.42%	12.76%
SETBACKS			
MIN. FRONT YARD	7.5	13.69	55.10
MIN. SIDE YARD (INTERIOR)	6	5.21	17.61
MIN. SIDE YARD (EXTERIOR)	7.5	–	–
MIN. FROM STREET CENTRELINE (m)	17.5	23.11	63.60
MINIMUM REAR YARD	7.5	166.24	8.00
PARKING			
SPACES	18 (2/UNIT)	2	27 (incl. 9 garage spaces)
PARKING SPACE DIMENSION	3m x 6m	3m x 6m	3m x 6m

LICENSED PROFESSIONAL ENGINEER
Dec. 16, 2025
E.R ST PIERRE
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Project Name/Location

BRIDGENORTH TOWNHOUSE DEVELOPMENT

BRIDGENORTH, ONTARIO

Drawing Title

SITE PLAN

Drawn By: M.G.	SCALE: Horz. 1: 300 Vert. –	
Designed By: M.G.	Plot Date: DECEMBER 16, 2025	
Checked By: J.F./J.R	Project No.: 22-85260	Sht. No.:
Engineer: E.S.P.	Dwg File No.: 85260 – SP	400

NOT FOR CONSTRUCTION

Printed By: jryon Printed On: December 16, 2025
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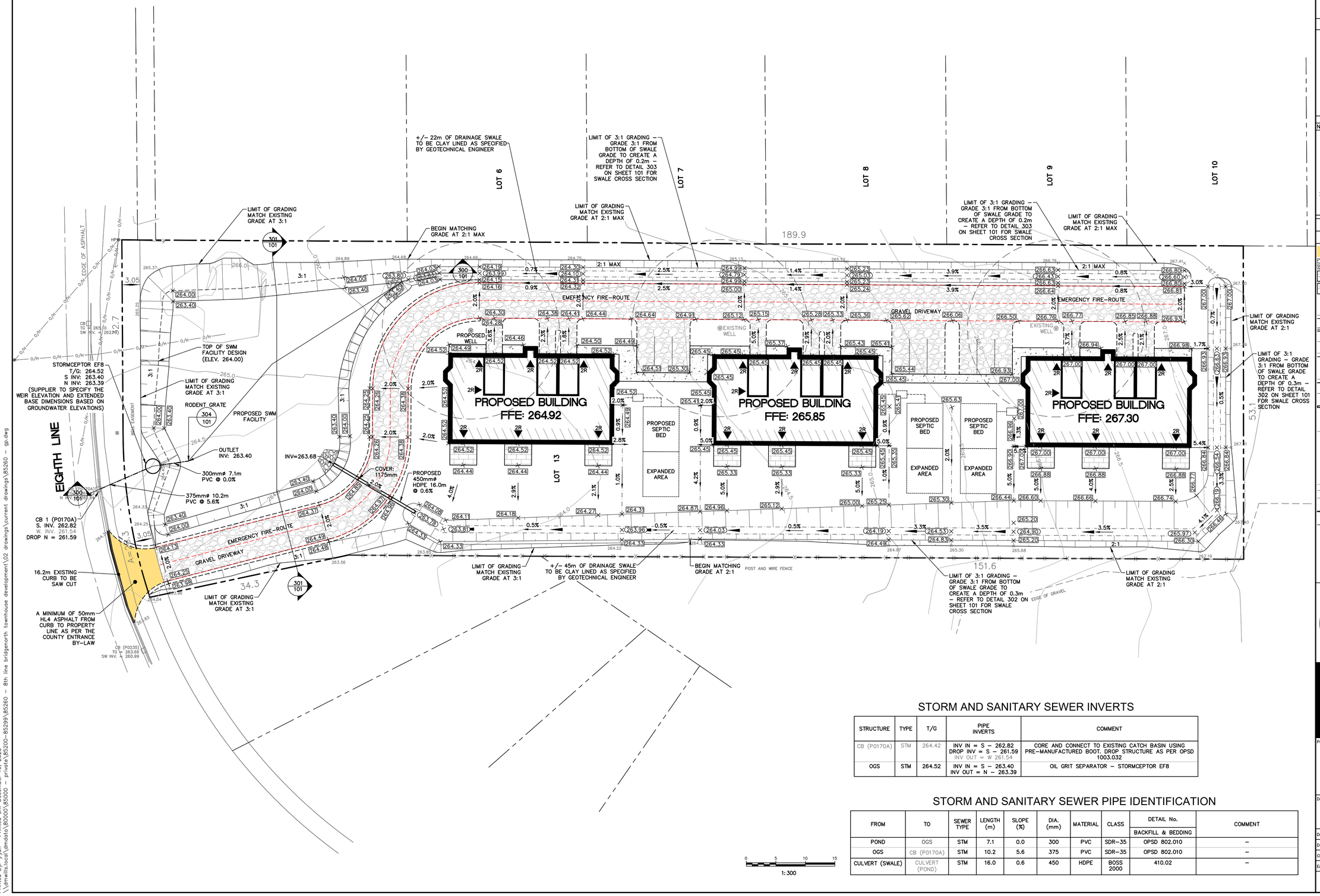

STORM AND SANITARY SEWER INVERTS

STRUCTURE	TYPE	T/G	PIPE INVERTS	COMMENT
CB (P0170A)	STM	264.42	INV IN = S – 262.82 DROP INV = S – 261.59 INV OUT = W 261.54	CORE AND CONNECT TO EXISTING CATCH BASIN USING PRE–MANUFACTURED BOOT. DROP STRUCTURE AS PER OPSD 1003.032
OGS	STM	264.52	INV IN = S – 263.40 INV OUT = N – 263.39	OIL GRIT SEPARATOR – STORMCEPTOR EF8

STORM AND SANITARY SEWER PIPE IDENTIFICATION

FROM	TO	SEWER TYPE	LENGTH (m)	SLOPE (%)	DIA. (mm)	MATERIAL	CLASS	DETAIL No.	COMMENT
								BACKFILL & BEDDING	
POND	OGS	STM	7.1	0.0	300	PVC	SDR–35	OPSD 802.010	–
OGS	CB (P0170A)	STM	10.2	5.6	375	PVC	SDR–35	OPSD 802.010	–
CULVERT (SWALE)	CULVERT (POND)	STM	16.0	0.6	450	HDPE	BOSS 2000	410.02	–

BM1 – ELEV. 264.03
TOP OF IRON BAR IN NORTHWEST CORNER OF SITE.

TRUE NORTH

KEY PLAN

REVISIONS

No.	Description	Date
2	ISSUED FOR ZONING BY–LAW AMENDMENT – 2ND SUBMISSION	12/16/25
1	ISSUED FOR ZONING BY–LAW AMENDMENT – 1ST SUBMISSION	04/04/24

METRIC — Dimensions are in METRES and/or MILLIMETRES unless otherwise shown

LEGEND — TO BE READ IN CONJUNCTION WITH OPSD 100 SERIES

- PR. ASPHALT
- PR. GRAVEL
- PR. CONCRETE
- PR. INTERLOCK
- EX./PR. BUILDING
- EX./PR. EDGE OF PAVEMENT
- EX./PR. CURB
- EX. ROAD CENTERLINE
- EX. EDGE OF SHOULDER
- EX. CATCH BASIN
- EX. STORM SEWER
- PR. DITCH
- PR. CULVERT
- HP EX. HYDRO POLE
- O/H EX. OVERHEAD HYDRO
- EX. BELL PEDESTAL
- x215.00 x214.00 EX./PR. ELEVATION
- 1.0% PR. GRADE
- 100.0 100.0 EX./PR. CONTOUR
- X X EX. FENCE
- R.O.W.
- PROPERTY LINE

LICENSED PROFESSIONAL ENGINEER
Dec. 16, 2025
E.R. ST PIERRE
100500092
PROVINCE OF ONTARIO

WILLS
D.M. Wills Associates Limited
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Project Name/Location

BRIDGENORTH TOWNHOUSE DEVELOPMENT

BRIDGENORTH, ONTARIO

Drawing Title

GRADING AND SERVICING PLAN

Drawn By: M.G./C.M.	SCALE: Horz. 1:300	Vert. –	
Designed By: M.G.	Plot Date: DECEMBER 16, 2025		
Checked By: J.D.F./J.R.	Project No.: 22–85260	Sht. No.:	
Engineer: E.S.P.	Dwg File No.: 85260 – GP	500	

NOT FOR CONSTRUCTION