United Property Resource Corporation

Dunbarton – Fairport United Church, City of Pickering

Stormwater Management Report

October 18, 2022

DUNBARTON – FAIRPORT UNITED CHURCH, CITY OF PICKERING

Stormwater Management Report

United Property Resource Corporation

Rezoning Application

Project No.: 221-05497-00
Date: October 18, 2022

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2022-10-18
Date

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Project Engineer, Water Resources

2022-10-18
Date

[1] Approval of this document is an administrative function indicating readiness for release and does not impart legal liability on to the Approver for any technical content contained herein. Technical accuracy and fit-for-purpose of this content is obtained through the review process. The Approver shall ensure the applicable review process has occurred prior to signing the document.

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United Property Resource Corporation

WSP

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TABLE OF CONTENTS

Tables

Figures

Appendices

1 INTRODUCTION

1.1 Scope

WSP Canada Inc. (WSP) has been retained by United Property Resource Corporation (the 'Client') to prepare a stormwater management (S.W.M.) report to support the rezoning application for the proposed development located north of Dunbarton road in the City of Pickering in the Regional Municipality of Durham (the 'Site'). This SWM report will examine the potential water balance, erosion control, water quality and water quantity impacts of the proposed development and summarizes how each parameter will be addressed in accordance with the City of Pickering Stormwater Management Design Guidelines dated July 2019.

1.2 Site Location

The Site is bounded by Dunbarton road to the south and east, and Rambleberry Avenue to the north. There is an existing retaining wall along the south corner of the site, adjacent to Dunbarton Road and the existing church which will be maintained through the development of the site. The location of the proposed development is shown in **Figure 1**.

The Site is located within Toronto and Region Conservation Authority (TRC.A) jurisdiction and falls within their regulated area. The Site is located within the Frenchman's Bay Watershed. Therefore, the TRCA guidelines shall be adhered to and consultation and approval may be required.

1.3 Stormwater Management Plan Objectives

The objectives of the stormwater management plan are as follows:

- Determine site specific stormwater management requirements to ensure that the proposals are in conformance with the City of Pickering Stormwater Management Design Guidelines and TRCA Stormwater Management Criteria.
- Evaluate various stormwater management practices that meet the requirements of the City and recommend a preferred strategy.
- Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and preliminary sizing of the proposed stormwater management facilities.

CLIENT

UNITED PROPERTY RESOURCE CORPORATION

TITLE

DUNBARTON FAIRPORT

1066 Dunbarton Rd

Pickering, ON L1V 1G8

SITE LOCATION

Checked A.M.B.	Drawn M.S.L.	
Date OCTOBER 2022	Proj. No. 221-05497	
Scale N.T.S.	Figure No. 1	Gr.No. 00

FIGURE 1-DUNBARTON.dwg Fig 1 C:\Users\stlouism\ACCDocs\WSP Canada projects (AMER)\LDOFiles\221-05497 - Dunbarton\SWM\FIGURES\ Oct 18, 2022 - 10:24am

1.4 Design Criteria

The City of Pickering issued the Stormwater Management Design Guidelines in July 2019 to provide direction on the management of rainfall and runoff inside the City's Jurisdiction. Similarly, the TRCA issued the Stormwater Management Criteria in August 2012 to provide guidance regarding the planning and design of stormwater management facilities located within their jurisdiction. A summary of the stormwater management criteria applicable to this project are as follows:

1.4.1 Erosion Control

The City's guideline states that for small sites (< 5 ha), the minimum erosion control requirements are:

- Runoff reduction from the site through infiltration, evapotranspiration, and reuse of a minimum 5 mm of rainfall depth across all impervious surfaces.

In addition, appropriate erosion and sediment controls shall be implemented and maintained during construction.

1.4.2 Water Balance

The Site is located within a Low Volume Groundwater Recharge Area (L.G.R.A.). Due to its location, the City's and TRCA's guidelines do not explicitly state the requirements regarding water balance. It is expected that best efforts will be taken to maintain the natural water balance of the site and to use SWM BMPs that reduce runoff volumes, which will result in reduced loading of pollutants.

1.4.3 Water Quality

Both the City's and TRCA's guidelines require the development to provide water quality measures that are designed to provide Enhanced (Level 1) level of protection as defined in the 2003 Stormwater Management Planning and Design Manual prepared by the Ontario's Ministry of the Environment, now Ministry of the Environment, Conservation and Parks (MECP).

1.4.4 Water Quantity

The City's guideline requires the development to attenuate post-development flows for all storms up to and including the 100-year storm event to pre-development levels. The existing church will be kept unchanged along the southwestern limits of the Site. It is assumed that storm sewers will be designed to handle the 5-year design storm in accordance with the City of Pickering design guidelines. Therefore, the post-development discharge rates shall be attenuated to either the pre-development flow to the creek or the 5-year design flow, whichever is lower, for all storms up to and including the 100-year storm event.

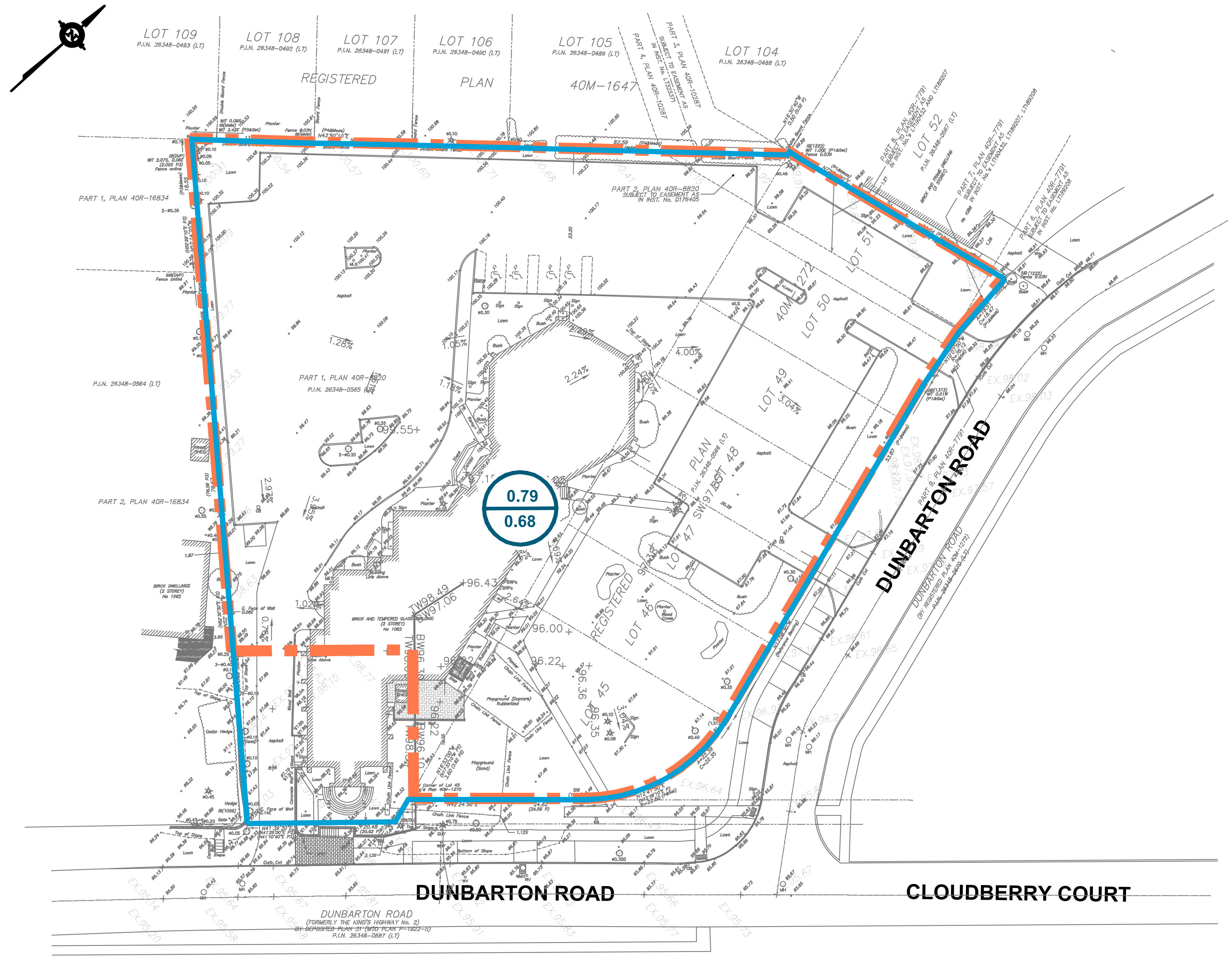
As mentioned previously, the Site is located within the Frenchman's Bay Watershed. According to the TRCA's guideline, since the Site's runoff will not discharged directly to Frenchman's Bay, the post-development flows shall be attenuated to pre-development levels for all storms up to and including the 100-year storm event.

2 EXISTING CONDITIONS

2.1 General

Based on the topographic survey, the site area is approximately 0.799 ha. However, the existing church area (565 m^2) will be excluded from proposed development area Moreover, the 0.74 ha will be defined as the project area boundary for the proposed development and will be used for the hydrologic analysis.

Currently, the 0.74 ha area is comprised of pervious landscaping, walkways, and few building areas. Therefore, the pre-development runoff coefficient can be estimated as 0.68. Under pre-development conditions, the existing overland flow route is split to the southeast towards Dunbarton Road and to the south also towards Dunbarton Road and drains to an existing 300 mm storm sewer. The existing condition of the Site is shown in **Figure 2**.



LEGEND

PROJECT BOUNDARY

SUB-CATCHMENT BOUNDARY

100 — DRAINAGE AREA (ha)

1.77 — AVERAGE RUNOFF COEFFICIENT

5 0 10 20 30m

CLIENT

UNITED PROPERTY RESOURCE CORPORATION

TITLE

DUNBARTON FAIRPORT
1066 Dunbarton Rd
Pickering, ON L1V 1G8

EXISTING CONDITIONS

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Scale AS SHOWN	Figure No. 2

FIGURE 2-DUNBARTON.dwg Fig 2 C:\Users\stlouism\ACCDocs\WSP Canada projects (AMER)\LDO\Files\221-05497 - Dunbarton\SWM\FIGURES\ Oct 18, 2022 - 10:15am

2.2 Rainfall Information

The rainfall intensity of the site was calculated using the following equation as stated in Section 6.2.4 of the City of Pickering Stormwater Management Design Guidelines:

$$I = \frac{A}{(t_c + B)^C}$$

Where:

I = Rainfall intensity in mm/hr

T_c = Time of concentration in minutes

A, B and C = Constant parameters as stated in "Table 12 – Pickering IDF Parameters: in the City of Pickering Stormwater Management Design Guidelines".

The parameters are summarized in **Table 2-1**.

Table 2-1: Intensity Duration Frequency (IDF) Parameters used by the City of Pickering

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
A	715.076	1082.901	1313.979	1581.718	1828.009	2096.425
B	5.262	6.007	6.026	6.007	6.193	6.485
C	0.815	0.837	0.845	0.848	0.856	0.863

Source: City of Pickering Stormwater Management Design Guidelines (July 2019)

An initial time of concentration, T_C, of 10 minutes was assumed for the calculation for rainfall intensity.

2.3 Allowable Flow Rates

As noted in Section 1.4.4., from the City of Pickering Stormwater Management Design Guidelines, the discharge rate from the Site in the post-development condition shall be controlled to the allowable release rate which is defined as the lower of the pre-development discharge rate from the Site for all storm events up to and including the 100-year storm event or the 5-year design flow for the future storm sewer.

The calculated pre-development peak flow rates for the existing site for 2-year to 100-year storm events are summarized in **Table 2-2**. Detailed calculations are provided in **Appendix A**. It is important to note that the City of Pickering Stormwater Management Design Guidelines has an Antecedent Precipitation Factor (Ca) that should be used for less frequent storms. The factors are included in **Table 2-2**, in the detailed calculations for both pre- and post-development conditions in **Appendix A**, and in the hydraulic model.

Table 2-2: Pre-Development Peak Flow Rate and Maximum Allowable Site Discharge Rate

Return Period (Years)	Rainfall Intensity, I (mm/hr)	Existing Peak Runoff Rates, Q (L/s)**	Uncontrolled Discharge Rate(L/s)	5yr Allowable Release Rate, Q_P (L/s)***
2	77.6	109.4	4.5	**127.2**
5	106.3	150.0	6.1	
10	126.0	177.8	7.2	
25	150.6	224.7	9.2	
50	168.6	254.0	10.4	
100	186.7	282.6	11.5	

Notes:
*Runoff Coefficient Adjust Factor are required for storms greater than the 25-year storm event when calculating the peak flows using the Rational Method, as stated in Section 6.2.3 of the City of Pickering Stormwater Management Design Guidelines. Note the product of C and the adjustment factor cannot be larger than 1.00
**C = 0.68, catchment area = 0.74 ha, and a time of concentration of 10 minutes
***C = 0.65, catchment area = 0.74 ha, and a time of concentration of 10 minutes

2.4 Groundwater and Hydrogeology Characterization

Hydrogeological investigations were conducted by Grounded Engineering inc. in August 29, 2022 which addresses the groundwater conditions, and dewatering requirements for the Site. In terms of groundwater quality, no parameter exceedances were reported for discharge to both the storm and sanitary / combined sewer system in accordance with the Regional Municipality of Durham By-Law. Under post-development condition, it is proposed to discharge to the future storm sewer network.

The long term (permanent) groundwater flow rate is 33,000 L/day (safety Factor of 2.0) which is equivalent to 0.38 L/s. The groundwater will be piped to the proposed cistern; as such, 0.38 L/s has been accounted as a base flow to the SWM cistern node in the HydroCAD model. Note that a groundwater treatment system will be required, designed

by others, should exceed the City's water quality requirements. The hydrogeological investigation report will be submitted under separate cover.

3 POST-DEVELOPMENT CONDITIONS

3.1 General

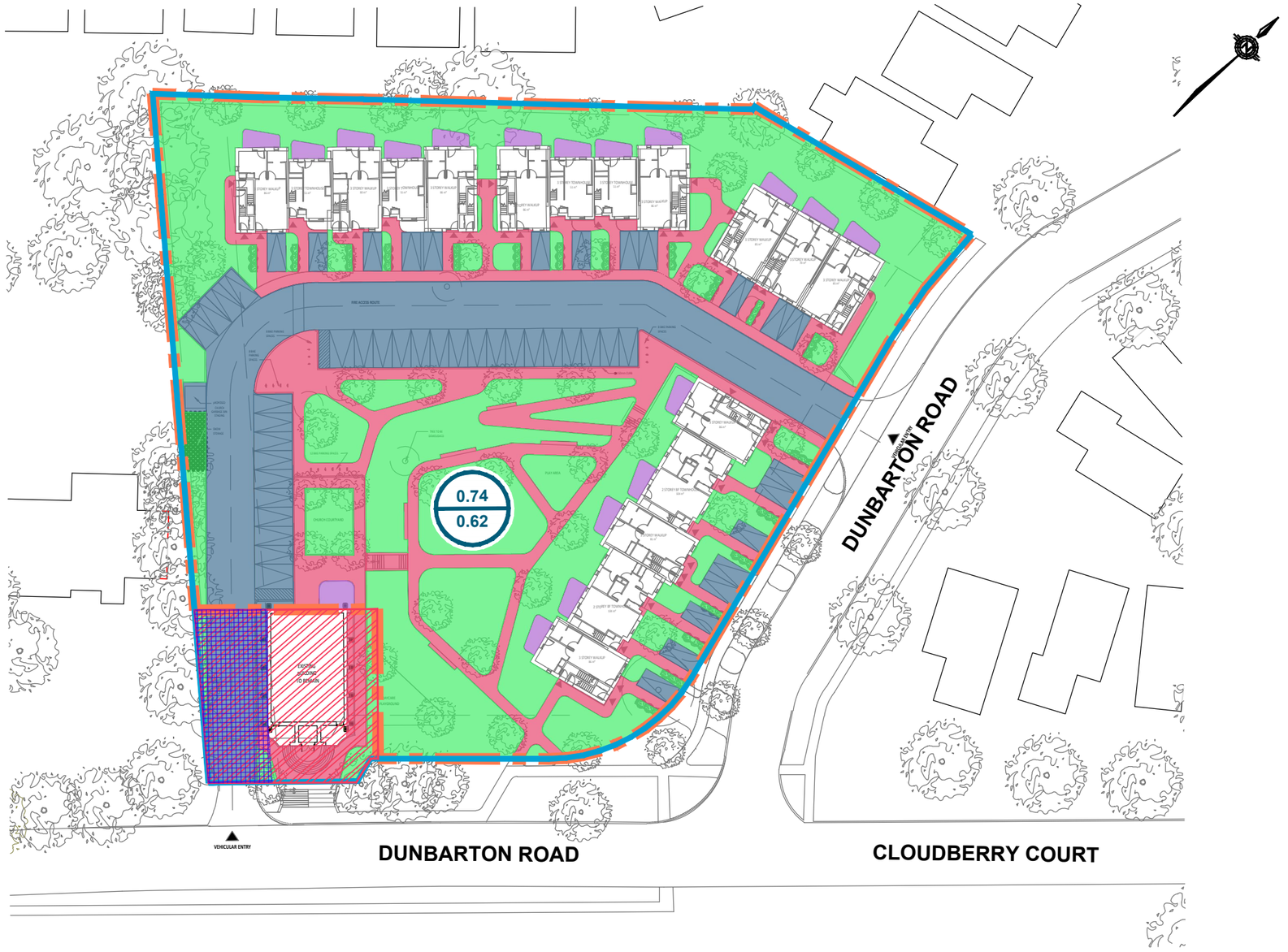
The 0.74 ha proposed development will consist of few townhouse blocks, landscaping, playground, walkways, parking lots, and driveways. One of the proposed townhouse blocks will be located on the east property lines and front the existing Dunbarton Road. The remaining three townhouse blocks will be located along the north and northeast property line and will front a proposed private internal roadway. The townhouse blocks will contain between seven and ten units, for a total of 41 residential townhouse units. The end units of each townhouse block will be three storey walk-ups consisting of three individual flats.

Parking for the proposed development will be handled by a mix of individual driveways for each townhouse unit. An additional 28 parking spaces will be provided along the private internal roadway which will provide visitor parking for the townhouse units and the existing church which will be remained unchanged.

An area breakdown for the proposed development under proposed condition is provided below in **Table 3-1**. Please refer to **Figures 3** for details of the post-development conditions. Detailed calculations can be found in **Appendix A.**

Table 3-1: Proposed Land-Use Area Breakdown

Land-Use	Area (m^2)	Runoff Coeff. (2-10 year)	Runoff Coeff. (25-year)	Runoff Coeff. (50-year)	Runoff Coeff. (100-year)	% Coverage
At Grade Impervious / Roof Area	1,402	0.95	0.99	1.00	1.00	19%
Parking / Vehicular Surfaces	1,961	0.95	0.99	1.00	1.00	26%
Soft Landscaping	2,993	0.20	0.22	0.24	0.25	40%
Pedestrian Walkway	772	0.95	0.99	1.00	1.00	10%
Uncontrolled At-Grade	303	0.95	0.99	1.00	1.00	4%
Total	**7,432**	**0.65**	**0.69**	**0.69**	**0.70**	**100%**



LEGEND

- PROJECT AREA: 0.743 ha
- SITE AREA: 0.799 ha
- 100 / 1.77 — DRAINAGE AREA (ha) / AVERAGE RUNOFF COEFFICIENT
- UNCONTROLLED AREA
- AT GRADE IMPERVIOUS
- LANDSCAPING
- EXCLUDED CHURCH AREA
- ASPHALT
- PEDESTRIAN WALKWAY

5 0 10 20 30m

CLIENT
UNITED PROPERTY RESOURCE CORPORATION

TITLE
DUNBARTON FAIRPORT
1066 Dunbarton Rd
Pickering, ON L1V 1G8

PROPOSED CONDITIONS

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Date OCTOBER 2022	Proj. No. 221-05497	
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FIGURE 3-DUNBARTON.dwg Fig 3 C:\Users\stouism\ACCDocs\WSP Canada projects (AMER)\LDO\Files\221-05497 - Dunbarton\SWM\FIGURES\ Oct 18, 2022 - 10:09am

3.2 Erosion Control

As noted in **Section 1.4.1**, for sites smaller than 5 ha, there are minimum requirements that the development must meet. The site has been designed to meet the second requirement in the City of Pickering Stormwater Management Design Guidelines which states, "*runoff reduction from the site through infiltration, evapotranspiration and reuse of a minimum of 5 mm of rainfall depth across all impervious surfaces*". Temporary erosion and sediment control measures will be implemented on Site during construction. Refer to the Erosion and Sediment Control Plan provided under a separate cover for more information.

3.3 Water Balance

Allowing for an initial abstraction of 1 mm for impervious surfaces and 5 mm for pervious surfaces, a water balance volume for post-development conditions is calculated. The proposed development will affect the water balance since it will be introducing approximately 0.41 ha of impervious surface, which will result in more runoff and less infiltration and evapotranspiration volume. The development will be designed to capture and retain a minimum 5 mm of rainfall for reuse on Site for the post-development condition. This will help reduce a minimum of 17.76 m^3 from leaving the site as runoff during a rainfall event. The details of water balance calculations are summarized in **Table 3-2.**

Table 3-2: Water Balance Calculations

Surface Type	Area (m2)	Initial Abstraction (m)	Volume Abstracted (m3)	5 mm Volume (m3)	Water Balance (m3)
At Grade Impervious / Roof Area	1,402	0.001	1.40	7.01	5.61
Parking / Vehicular Surfaces	1,961	0.001	1.96	9.81	7.84
Soft Landscaping	2,993	0.005	14.97	14.97	0.00
Pedestrian Walkway	772	0.001	0.77	3.86	3.09
Uncontrolled At-Grade	303	0.001	0.30	1.52	1.21
Total	**7,432**	**-**	**19.40**	**37.16**	**17.76**

3.4 Water Quality

As mentioned in **Section 1.4.3**, Enhanced Level of protection is required for the proposed development. The target is to treat 90% of the annual runoff volume and remove 80% of the total suspended solids (TSS.). Therefore, a filtration unit is proposed.

A SFPD0814 filtration unit is proposed to be installed upstream of the proposed stormwater cistern to provide the required quality treatment for the controlled at-grade areas which consists primarily of the driveway, at-grade impervious areas and landscaping. Please refer to **Appendix C** for the sizing report.

3.5 Water Quantity

As stated in **Section 1.4.4**, the post-development flows from the site shall be attenuated to the pre-development flow or the 5-year design flow to the storm sewer network, for all storms up to and including the 100-year storm event. As mentioned in **Section 2.4**, The allowable release rate shall be the pre-development flows for all storms up to and including the 100-year storm event (127.2 L/s based on an area of 0.74 ha) plus the 0.38 L/s base flow rate.

A HydroCAD model was used to iteratively determine the storage volume of the tank. The model was used to calculate the discharge rates achieved by the proposed flow controls under all storm events using the City of Pickering IDF curves. As mentioned before, the City of Pickering's required adjustment factors have been applied for storms greater than the 25-year storm event. The modified rational method (an inherent subroutine of the HydroCAD software) has been used for the modelling exercise.

The Brentwood storm tank with a storage of 84.1 m^3 has been modelled to have an overall footprint of 110.5 m^2 and a height of 1.14 m. The tank will be discharged to the control manhole and to the storm sewer at Dunbarton Road when it fills 0.305 m above the base of the system, providing a sump storage volume of 25.5 m^3 to meet the water balance requirement.

A summary of the modelling results for storm tank in the proposed condition is provided in **Table 3-3**. The HydroCAD modelling output is provided in **Appendix D**.

Table 3-3: Summary of Modelling Results

Return Period	Utilized Tank Storage (m^3/ 364.8 m^3)	Peak Water Elevation in Tank (m)	Uncontrolled Area Release Rate (L/s)	Site Post-Development Release Rate (L/s)	Allowable Release Rate* (L/s)
2	22.3	0.35	4.8	59.7	127.2
5	34.4	0.46	6.4	72.8	
10	46.3	0.59	7.9	83.7	
25	59.9	0.73	9.2	94.8	
50	71.2	0.85	10.3	103.1	
100	82.1	1.1	11.1	118.6	

Notes:
*Allowable Release Rate is calculated by taking the pre-development flows stated in **Table 2-2** and the flows by 0.38 L/s to account for the flow from the dewatering system which will also discharge to the storm sewers.

Therefore, the modelling results demonstrate that the overall peak flow rate from the entire site will be below the allowable release rates for all storms up to and including the 100-year storm event. The rainfall intensity and the critical storm duration resulting in the maximum flow during the 100-year storm event is 17 minutes, according to the Modified Rational Method process.

4 CONCLUSIONS

A stormwater management report has been prepared to support the Rezoning application for the proposed development located at the northwest corner of 1066 Dunbarton Road in the City of Pickering. The key points are summarized below.

Erosion Control

The site is below the 2.0 ha erosion control guideline and the on-site minimum retention of the 5 mm rainfall event is achieved under the water balance criteria; therefore, no further measures are recommended.

Water Balance

A 25.5 m^3 sump storage will be provided at the base of a storm tank system to ensure the Water Balance criteria are satisfied. The stormwater stored in the sump of the Brentwood storm tank will be utilized to satisfy the water balance requirement. The Site will be designed to capture and retain the runoff volume of a 5 mm rainfall event for reuse on site, in order to meet the erosion control requirement.

Water Quality

A filtration treatment unit, SFPD0814, is proposed upstream of the proposed storm tank and is designed to capture and treat the runoff from the controlled at-grade areas. All uncontrolled areas are not in contact with vehicular traffic or sediment generating activates, therefore are considered inherently clean and no water quality controls are provided for those areas as well.

Water Quantity

For the Site, a storm tank with a footprint of 110.5 m^2 and a height of 1.14 m is proposed on the northern of the site. The stormwater cistern has a total available storage of 84.1 m^3 and will be controlled by a 200 mm orifice tube will be installed downstream of the chamber system to control flow to the allowable release rate of 127.2 L/s.

For the tank, the attenuated runoff will discharge to a storm control manhole prior to discharging to the storm sewer network to the south of the site. Post-development flows, including the expected flows from the dewatering systems, have been controlled to below the allowable release rate for the site for proposed conditions.

This report has demonstrated that the proposed SWM strategy will address the stormwater management related impacts from this project and meet the intent of the City of Pickering Stormwater Management Design Guidelines and the Toronto and Region Conservation Authority (TRCA) Stormwater Management Criteria.

5 BIBLIOGRAPHY

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- Toronto and Region Conservation Authority. (2012, August). Stormwater Management Criteria Version 1.0. Retrieved March 18, 2021, from Toronto and Region Conservation Authority Procedural Manual & Technical Guidelines: https://trca.ca/planning-permits/procedural-manual-and-technical-guidelines/
- Toronto and Region Conservation Authority. (N.d). T.R.C.A. Regulation Mapping. Retrieved March 18, 2021, from Toronto and Region Conservation Authority Annual Regulation Mapping Update: https://trca.ca/regulation-mapping-update/

APPENDIX

A

Stormwater Management Calculations

	Stormwater Management Calculations	Project: 1066 Dunbarton Rd	No.: 221-05497-00	
	Pre-Development Discharge Rate - Site Area	By: RJ Checked: AMB	Date: 2022-10-18	Page: 1

Calculation of existing runoff rate is undertaken using the Rational Method: Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)

Ca = Runoff coefficient adjustment factor (-)

C = Runoff coefficient (-)

I = Rainfall intensity (mm/hour)

A = Catchment area (hectares)

Project Area, A **0.743** hectares

Runoff Coef, C 0.68

$$I = \frac{A}{(t+B)^c}$$

Where: A, B and C = Parameters defined in Table 12 of City of Pickering Stormwater Management Design Guidelines (July 2019)

I = Rainfall intensity (mm/hour)

t = Time of concentration (minutes)

Return Period (Years)	2	5	10	25	50	100
A	715.076	1082.901	1313.979	1581.718	1828.009	2096.425
B	5.262	6.007	6.026	6.007	6.193	6.485
C	0.815	0.837	0.845	0.848	0.856	0.863
T (mins) *	10	10	10	10	10	10
I (mm/hr)	77.6	106.3	126.0	150.6	168.6	186.7
Adjusted C** (-)	0.68	0.68	0.68	0.72	0.73	0.73
Q (litres/sec)	109.4	150.0	177.8	224.7	254.0	282.6
Q (m3/sec)	0.109	0.150	0.178	0.225	0.254	0.283

*Note: For a small site (<2.0ha), a time of concentration of 10 minutes was assumed for the calculations

**Note: Please refer to the "Runoff Coefficient Adjustment Calculations" calculation page for more details

	Stormwater Management Calculations	**Project:** 1066 Dunbarton Rd	**No.:** 221-05497-00	
	Pre-Development Discharge Rate - Site Area	**By:** RJ **Checked:** AMB	**Date:** 2022-10-18	**Page:** 1

Calculation of existing runoff rate is undertaken using the Rational Method: Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)

Ca = Runoff coefficient adjustment factor (-)

C = Runoff coefficient (-)

I = Rainfall intensity (mm/hour)

A = Catchment area (hectares)

Project Area, A **0.03** hectares

Runoff Coef, C 0.62

$$I = \frac{A}{(t+B)^c}$$

Where: A, B and C = Parameters defined in Table 12 of City of Pickering Stormwater Management Design Guidelines (July 2019)

I = Rainfall intensity (mm/hour)

t = Time of concentration (minutes)

Return Period (Years)	2	5	10	25	50	100
A	715.076	1082.901	1313.979	1581.718	1828.009	2096.425
B	5.262	6.007	6.026	6.007	6.193	6.485
C	0.815	0.837	0.845	0.848	0.856	0.863
T (mins) *	10	10	10	10	10	10
I (mm/hr)	77.6	106.3	126.0	150.6	168.6	186.7
Adjusted C** (-)	0.68	0.68	0.68	0.72	0.73	0.73
Q (litres/sec)	4.5	6.1	7.2	9.2	10.4	11.5
Q (m3/sec)	0.004	0.006	0.007	0.009	0.010	0.012

*Note: For a small site (<2.0ha), a time of concentration of 10 minutes was assumed for the calculations

**Note: Please refer to the "Runoff Coefficient Adjustment Calculations" calculation page for more details

Calculation of existing runoff rate is undertaken using the Rational Method: Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)
Ca = Runoff coefficient adjustment factor (-)
C = Runoff coefficient (-)
I = Rainfall intensity (mm/hour)
A = Catchment area (hectares)

Project Area, A **0.74** hectares
Runoff Coef, C 0.63

$$I = \frac{A}{(t+B)^c}$$

Where: A, B and C = Parameters defined in Table 12 of City of Pickering Stormwater Management Design Guidelines (July 2019)
I = Rainfall intensity (mm/hour)
t = Time of concentration (minutes)

Return Period (Years)	5
A	1082.901
B	6.007
C	0.837
T (mins) *	10
I (mm/hr)	106.3
Adjusted C** (-)	0.63
Q (litres/sec)	138.7
Q (m3/sec)	0.139

*Note: For a small site (<2.0ha), a time of concentration of 10 minutes was assumed for the calculations

**Note: Please refer to the "Runoff Coefficient Adjustment Calculations" calculation page for more details

Therefore, the allowable release rate to the future storm sewer on Dunbarton RD is 138.72 L/s.

For less frequent storms an Antecedent Precipiation Factor (Ca) should be used and Rational Formula to be modified accordingly to: Q (Flow) = A (Area) x C (Runoff Coefficient) x Ca (Antecedent Precipiation Factor) x I (Rainfall Intensity)

Storm	Ca
1 to 10 year storm	1.00
25 year storm	1.10
50 year storm	1.20
100 year storm	1.25
Product of 'Ca x C' should not exceed 1.00	

As per City of Pickering Stormwater Management Design Guidelines (July 2019) Section 6.2.3.

Existing Conditions		Runoff Coefficients C, Return Period (Years)					
Land Use	Area (m^2)	2	5	10	25	50	100
Soft Landscaping	2850	0.20	0.20	0.20	0.22	0.24	0.25
Impervious At-Grade	5147	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**7997**	**0.68**	**0.68**	**0.68**	**0.72**	**0.73**	**0.73**

Proposed CONDITION

Proposed Conditions		Runoff Coefficients C, Return Period (Years)					
Land Use	Area (m^2)	2	5	10	25	50	100
Site Area + Existing Curch Area							
At Grade Impervious / Roof Area	1402	0.95	0.95	0.95	1.00	1.00	1.00
Parking / Vehicular Surfaces	1961	0.95	0.95	0.95	1.00	1.00	1.00
Soft Landscaping	2993	0.20	0.20	0.20	0.22	0.24	0.25
Pedestrain Walkway	772	0.95	0.95	0.95	1.00	1.00	1.00
Uncontrolled At-Grade	303	0.95	0.95	0.95	1.00	1.00	1.00
Exluded Church Area	565	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**7997**	**0.67**	**0.67**	**0.67**	**0.71**	**0.72**	**0.72**

Proposed Conditions		Runoff Coefficients C, Return Period (Years)					
Land Use	Area (m^2)	2	5	10	25	50	100
Site Area Excluding Curch Area							
At Grade Impervious / Roof Area	1402	0.95	0.95	0.95	1.00	1.00	1.00
Parking / Vehicular Surfaces	1961	0.95	0.95	0.95	1.00	1.00	1.00
Soft Landscaping	2993	0.20	0.20	0.20	0.22	0.24	0.25
Pedestrain Walkway	772	0.95	0.95	0.95	1.00	1.00	1.00
Uncontrolled At-Grade	303	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**7432**	**0.65**	**0.65**	**0.65**	**0.69**	**0.69**	**0.70**

The City of Pickering Stormwater Management Guidelines requires runoff reduction from the site through infiltration, evapotranspiration and reuse of a minimum 5 mm of rainfall depth across all impervious surfaces - Section 4.2. In this case, the minimum on-site runoff retention will require the site to retain all runoff from a 5 mm storm event through evapotranspiration, infiltration or rainwater reuse.

The interim area measurements and land use types for the site are as follows:

Land Use	Area (m^2)	Runoff C	Impervious
At Grade Impervious / Roof Area	1,402	0.95	100%
Parking / Vehicular Surfaces	1,961	0.95	100%
Soft Landscaping	2,993	0.20	0%
Pedestrain Walkway	772	0.95	100%
Uncontrolled At-Grade	303	0.95	100%
Total Controlled Site Area	**7,432**	**0.65**	**60%**

Surface Type	Area (m^2)	Initial Abstraction (m)	Volume Abstracted (m^3)	5 mm Volume (m^3)	Water Balance (m^3)
At Grade Impervious / Roof A	1,402	0.001	1.40	7.01	5.61
Parking / Vehicular Surfaces	1,961	0.001	1.96	9.81	7.84
Soft Landscaping	2,993	0.005	14.97	14.97	0.00
Pedestrain Walkway	772	0.001	0.77	3.86	3.09
Uncontrolled At-Grade	303	0.001	0.30	1.52	1.21
Total	**7,432**	-	**19.40**	**37.16**	**17.76**

For the purposes of the water balance calculation it is assumed that green roofs can accept 5 mm of rainfall without producing any runoff.

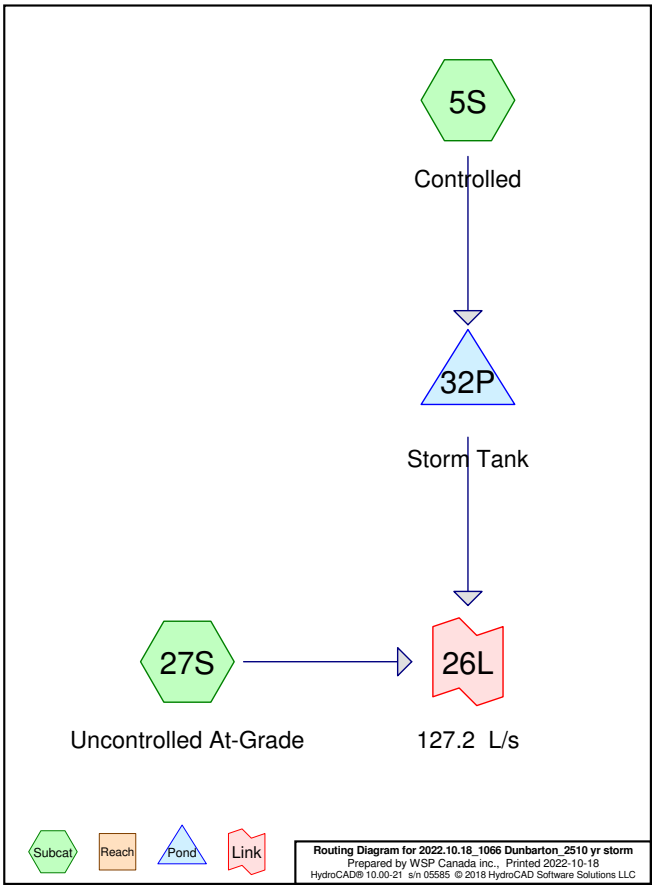
It is assumed that the remaining hard surfaces on the site can abstract 1 mm of rainfall, and that all soft landscaped areas can absorb 5 mm

Therefore, volume of runoff during a 5 mm storm event for the Site is: **17.76** m^3

APPENDIX

B

Hydrologic Model Output (HydroCAD)



Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.1402	0.95	At Grade Impervious / Roofs (5S)
0.0303	0.95	At Grade-Uncontrolled (27S)
0.1961	0.95	Parking / Vehicular Surface (5S)
0.0772	0.95	Pedestrain Walkway (5S)
0.2994	0.20	Soft Landscaping (5S)
0.7432	**0.65**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
0.7432	Other	5S, 27S
0.7432		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchm Numbers
0.0000	0.0000	0.0000	0.0000	0.1402	0.1402	At Grade Impervious / Roofs	
0.0000	0.0000	0.0000	0.0000	0.0303	0.0303	At Grade-Uncontrolled	
0.0000	0.0000	0.0000	0.0000	0.1961	0.1961	Parking / Vehicular Surface	
0.0000	0.0000	0.0000	0.0000	0.0772	0.0772	Pedestrain Walkway	
0.0000	0.0000	0.0000	0.0000	0.2994	0.2994	Soft Landscaping	
0.0000	**0.0000**	**0.0000**	**0.0000**	**0.7432**	**0.7432**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: Controlled Runoff Area=7,129.0 m² 58.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.64 Runoff=0.0759 m³/s 0.068 Ml

Subcatchment 27S: Uncontrolled Runoff Area=303.0 m² 100.00% Impervious Runoff Depth=14 mm
Tc=10.0 min C=0.95 Runoff=0.0048 m³/s 0.004 Ml

Pond 32P: Storm Tank Peak Elev=0.352 m Storage=22.3 m³ Inflow=0.0763 m³/s 0.077 Ml
Outflow=0.0559 m³/s 0.076 Ml

Link 26L: 127.2 L/s Inflow=0.0597 m³/s 0.081 Ml
Primary=0.0597 m³/s 0.081 Ml

Total Runoff Area = 0.7432 ha Runoff Volume = 0.073 Ml Average Runoff Depth = 10 mm
40.29% Pervious = 0.2994 ha 59.71% Impervious = 0.4438 ha

Summary for Subcatchment 5S: Controlled

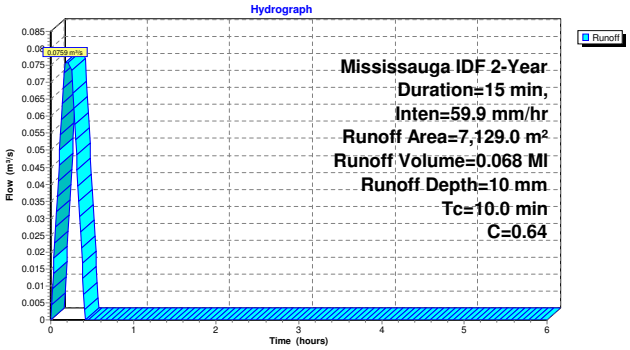
Runoff = 0.0759 m³/s @ 0.17 hrs, Volume= 0.068 Ml, Depth= 10 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 2-Year Duration=15 min, Inten=59.9 mm/hr

Area (m²)	C	Description
1,402.0	0.95	At Grade Impervious / Roofs
1,961.0	0.95	Parking / Vehicular Surface
2,994.0	0.20	Soft Landscaping
772.0	0.95	Pedestrain Walkway
7,129.0	0.64	Weighted Average
2,994.0		42.00% Pervious Area
4,135.0		58.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 5S: Controlled



Summary for Subcatchment 27S: Uncontrolled At-Grade

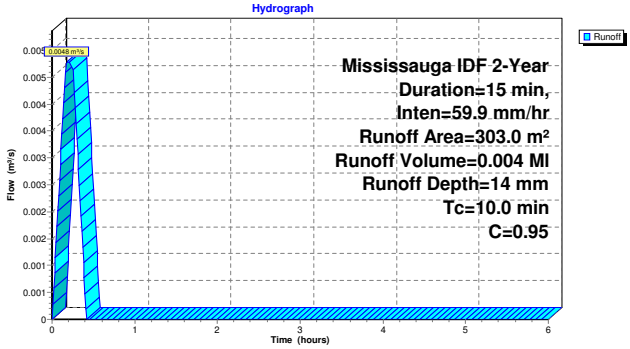
Runoff = 0.0048 m³/s @ 0.17 hrs, Volume= 0.004 Ml, Depth= 14 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 2-Year Duration=15 min, Inten=59.9 mm/hr

Area (m²)	C	Description
303.0	0.95	At Grade-Uncontrolled
303.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 27S: Uncontrolled At-Grade



Summary for Pond 32P: Storm Tank

Inflow Area = 0.7129 ha, 58.00% Impervious, Inflow Depth > 11 mm for 2-Year event
Inflow = 0.0763 m³/s @ 0.17 hrs, Volume= 0.077 Ml, Incl. 0.0004 m³/s Base Flow
Outflow = 0.0559 m³/s @ 0.29 hrs, Volume= 0.076 Ml, Atten= 27%, Lag= 7.5 min
Primary = 0.0559 m³/s @ 0.29 hrs, Volume= 0.076 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 0.352 m @ 0.29 hrs Surf.Area= 110.5 m² Storage= 22.3 m³

Plug-Flow detention time= 8.1 min calculated for 0.076 Ml (99% of inflow)
Center-of-Mass det. time= 5.2 min (36.5 - 31.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	26.7 m³	**12.50 mW x 8.84 mL x 1.14 mH Field A** 126.4 m³ Overall - 59.6 m³ Embedded = 66.8 m³ x 40.0% Voids
#2A	0.230 m	57.4 m³	**Brentwood StormTank 24"** x 234 Inside #1 Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³ Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³ 26 Rows of 9 Chambers
		84.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.0559 m³/s @ 0.29 hrs HW=0.352 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0559 m³/s @ 1.78 m/s)

Pond 32P: Storm Tank - Chamber Wizard Field A

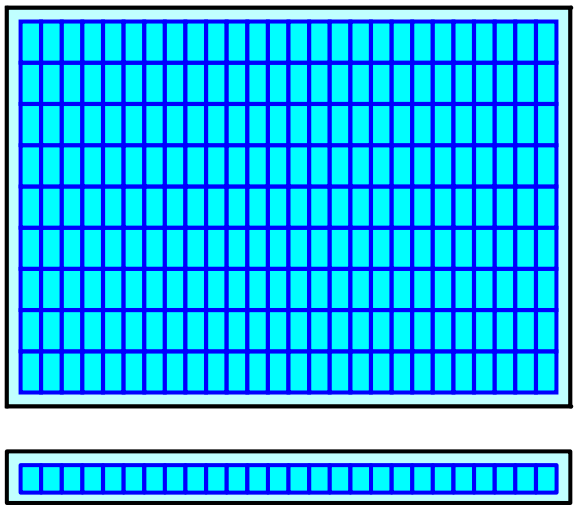
Chamber Model = Brentwood StormTank 24" (Brentwood Industries StormTank)
Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³
Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³

9 Chambers/Row x 0.91 m Long = 8.23 m Row Length +305 mm End Stone x 2 = 8.84 m Base Length
26 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 12.50 m Base Width
230 mm Base + 610 mm Chamber Height + 305 mm Cover = 1.14 m Field Height

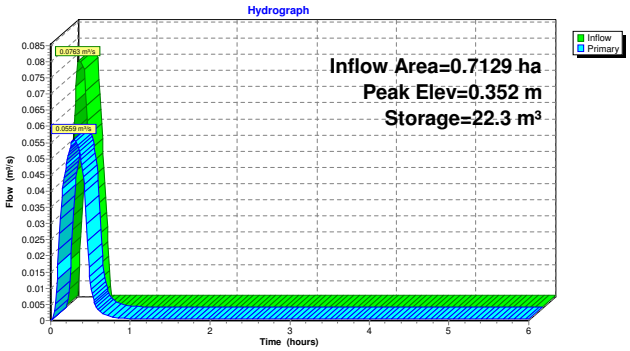
234 Chambers x 0.25 m³ = 57.36 m³ Chamber Storage
234 Chambers x 0.25 m³ = 59.64 m³ Displacement

126.44 m³ Field - 59.64 m³ Chambers = 66.81 m³ Stone x 40.0% Voids = 26.72 m³ Stone Storage

Chamber Storage + Stone Storage = 84.08 m³ = 0.084 Ml
Overall Storage Efficiency = 66.5%
Overall System Size = 8.84 m x 12.50 m x 1.14 m



Pond 32P: Storm Tank

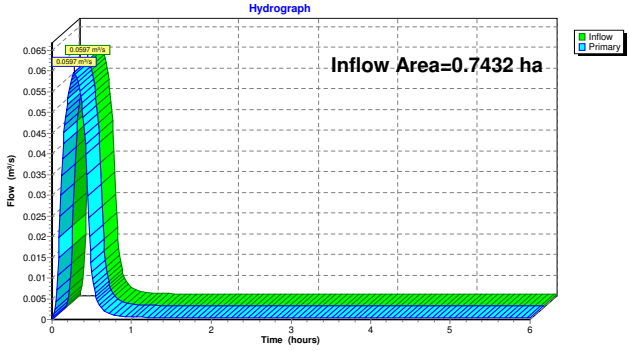


Summary for Link 26L: 127.2 L/s

Inflow Area = 0.7432 ha, 59.71% Impervious, Inflow Depth > 11 mm for 2-Year event
Inflow = 0.0597 m³/s @ 0.28 hrs, Volume= 0.081 Ml
Primary = 0.0597 m³/s @ 0.28 hrs, Volume= 0.081 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 26L: 127.2 L/s



Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: Controlled Runoff Area=7,129.0 m² 58.00% Impervious Runoff Depth=13 mm
Tc=10.0 min C=0.64 Runoff=0.1020 m³/s 0.092 Ml

Subcatchment 27S: Uncontrolled Runoff Area=303.0 m² 100.00% Impervious Runoff Depth=19 mm
Tc=10.0 min C=0.95 Runoff=0.0064 m³/s 0.006 Ml

Pond 32P: Storm Tank Peak Elev=0.475 m Storage=34.4 m³ Inflow=0.1024 m³/s 0.100 Ml
Outflow=0.0681 m³/s 0.100 Ml

Link 26L: 127.2 L/s Inflow=0.0728 m³/s 0.106 Ml
Primary=0.0728 m³/s 0.106 Ml

Total Runoff Area = 0.7432 ha Runoff Volume = 0.098 Ml Average Runoff Depth = 13 mm
40.29% Pervious = 0.2994 ha 59.71% Impervious = 0.4438 ha

Summary for Subcatchment 5S: Controlled

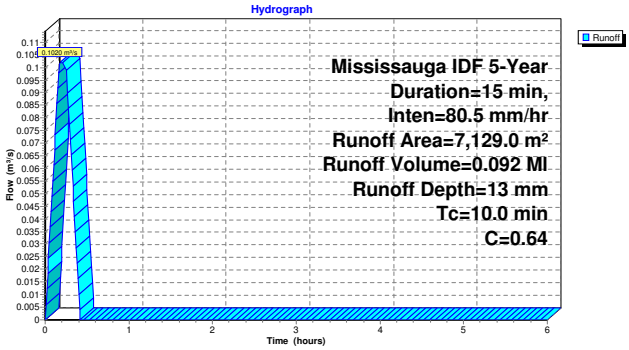
Runoff = 0.1020 m³/s @ 0.17 hrs, Volume= 0.092 Ml, Depth= 13 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 5-Year Duration=15 min, Inten=80.5 mm/hr

Area (m²)	C	Description
1,402.0	0.95	At Grade Impervious / Roofs
1,961.0	0.95	Parking / Vehicular Surface
2,994.0	0.20	Soft Landscaping
772.0	0.95	Pedestrain Walkway
7,129.0	0.64	Weighted Average
2,994.0		42.00% Pervious Area
4,135.0		58.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 5S: Controlled



Summary for Subcatchment 27S: Uncontrolled At-Grade

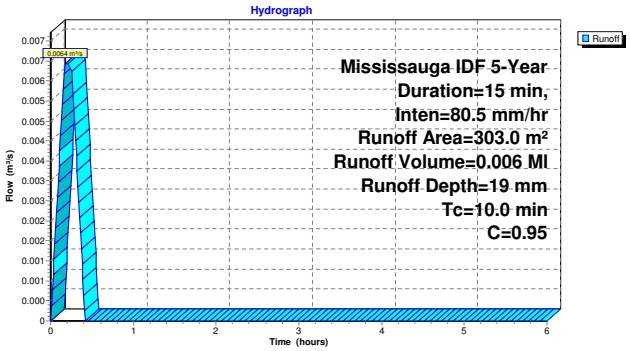
Runoff = 0.0064 m³/s @ 0.17 hrs, Volume= 0.006 Ml, Depth= 19 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 5-Year Duration=15 min, Inten=80.5 mm/hr

Area (m²)	C	Description
303.0	0.95	At Grade-Uncontrolled
303.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 27S: Uncontrolled At-Grade



Summary for Pond 32P: Storm Tank

Inflow Area = 0.7129 ha, 58.00% Impervious, Inflow Depth > 14 mm for 5-Year event
Inflow = 0.1024 m³/s @ 0.17 hrs, Volume= 0.100 Ml, Incl. 0.0004 m³/s Base Flow
Outflow = 0.0681 m³/s @ 0.31 hrs, Volume= 0.100 Ml, Atten= 33%, Lag= 8.2 min
Primary = 0.0681 m³/s @ 0.31 hrs, Volume= 0.100 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 0.475 m @ 0.31 hrs Surf.Area= 110.5 m² Storage= 34.4 m³

Plug-Flow detention time= 8.5 min calculated for 0.100 Ml (99% of inflow)
Center-of-Mass det. time= 6.3 min (33.2 - 26.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	26.7 m³	**12.50 mW x 8.84 mL x 1.14 mH Field A** 126.4 m³ Overall - 59.6 m³ Embedded = 66.8 m³ x 40.0% Voids
#2A	0.230 m	57.4 m³	**Brentwood StormTank 24"** x 234 Inside #1 Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³ Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³ 26 Rows of 9 Chambers
		84.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.0681 m³/s @ 0.31 hrs HW=0.474 m (Free Discharge)
↳**1=Orifice/Grate** (Orifice Controls 0.0681 m³/s @ 2.17 m/s)

Pond 32P: Storm Tank - Chamber Wizard Field A

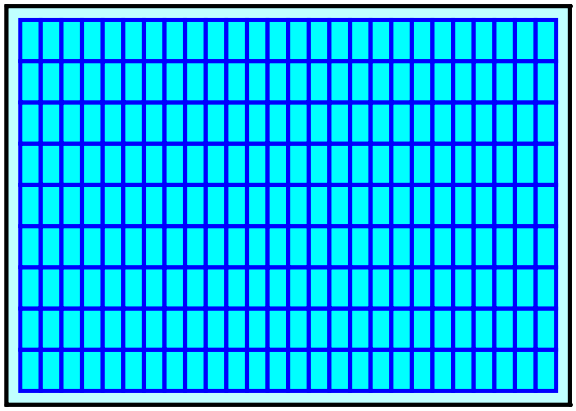
Chamber Model = Brentwood StormTank 24" (Brentwood Industries StormTank)
Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³
Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³

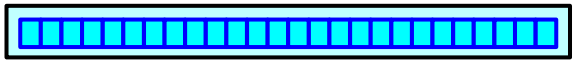
9 Chambers/Row x 0.91 m Long = 8.23 m Row Length +305 mm End Stone x 2 = 8.84 m Base Length
26 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 12.50 m Base Width
230 mm Base + 610 mm Chamber Height + 305 mm Cover = 1.14 m Field Height

234 Chambers x 0.25 m³ = 57.36 m³ Chamber Storage
234 Chambers x 0.25 m³ = 59.64 m³ Displacement

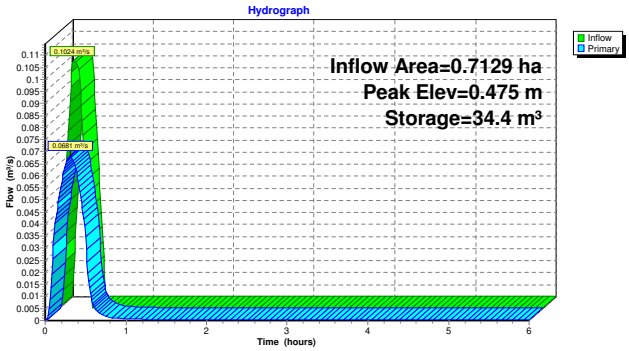
126.44 m³ Field - 59.64 m³ Chambers = 66.81 m³ Stone x 40.0% Voids = 26.72 m³ Stone Storage

Chamber Storage + Stone Storage = 84.08 m³ = 0.084 Ml
Overall Storage Efficiency = 66.5%
Overall System Size = 8.84 m x 12.50 m x 1.14 m





Pond 32P: Storm Tank

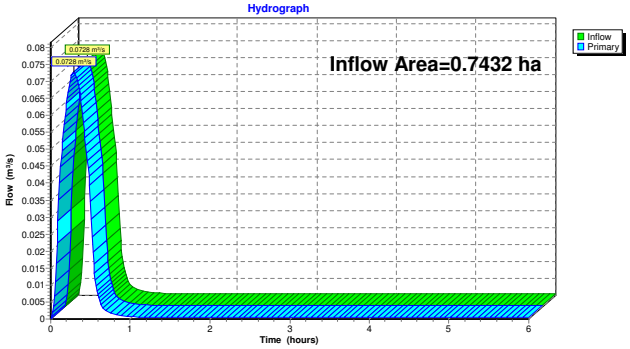


Summary for Link 26L: 127.2 L/s

Inflow Area = 0.7432 ha, 59.71% Impervious, Inflow Depth > 14 mm for 5-Year event
Inflow = 0.0728 m³/s @ 0.29 hrs, Volume= 0.106 Ml
Primary = 0.0728 m³/s @ 0.29 hrs, Volume= 0.106 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 26L: 127.2 L/s



Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: Controlled Runoff Area=7,129.0 m² 58.00% Impervious Runoff Depth=16 mm
Tc=10.0 min C=0.64 Runoff=0.1257 m³/s 0.113 Ml

Subcatchment 27S: Uncontrolled Runoff Area=303.0 m² 100.00% Impervious Runoff Depth=24 mm
Tc=10.0 min C=0.95 Runoff=0.0079 m³/s 0.007 Ml

Pond 32P: Storm Tank Peak Elev=0.595 m Storage=46.3 m³ Inflow=0.1261 m³/s 0.122 Ml
Outflow=0.0783 m³/s 0.121 Ml

Link 26L: 127.2 L/s Inflow=0.0837 m³/s 0.128 Ml
Primary=0.0837 m³/s 0.128 Ml

Total Runoff Area = 0.7432 ha Runoff Volume = 0.120 Ml Average Runoff Depth = 16 mm
40.29% Pervious = 0.2994 ha 59.71% Impervious = 0.4438 ha

Summary for Subcatchment 5S: Controlled

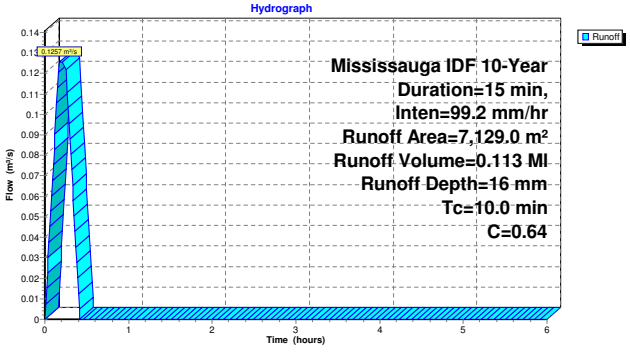
Runoff = 0.1257 m³/s @ 0.17 hrs, Volume= 0.113 Ml, Depth= 16 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 10-Year Duration=15 min, Inten=99.2 mm/hr

Area (m²)	C	Description
1,402.0	0.95	At Grade Impervious / Roofs
1,961.0	0.95	Parking / Vehicular Surface
2,994.0	0.20	Soft Landscaping
772.0	0.95	Pedestrain Walkway
7,129.0	0.64	Weighted Average
2,994.0		42.00% Pervious Area
4,135.0		58.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 5S: Controlled



Summary for Subcatchment 27S: Uncontrolled At-Grade

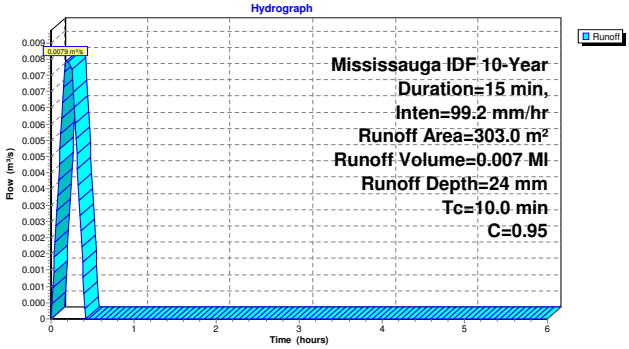
Runoff = 0.0079 m³/s @ 0.17 hrs, Volume= 0.007 Ml, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 10-Year Duration=15 min, Inten=99.2 mm/hr

Area (m²)	C	Description
303.0	0.95	At Grade-Uncontrolled
303.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 27S: Uncontrolled At-Grade



Summary for Pond 32P: Storm Tank

Inflow Area = 0.7129 ha, 58.00% Impervious, Inflow Depth > 17 mm for 10-Year event
Inflow = 0.1261 m³/s @ 0.17 hrs, Volume= 0.122 Ml, Incl. 0.0004 m³/s Base Flow
Outflow = 0.0783 m³/s @ 0.31 hrs, Volume= 0.121 Ml, Atten= 38%, Lag= 8.6 min
Primary = 0.0783 m³/s @ 0.31 hrs, Volume= 0.121 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 0.595 m @ 0.31 hrs Surf.Area= 110.5 m² Storage= 46.3 m³

Plug-Flow detention time= 9.0 min calculated for 0.121 Ml (99% of inflow)
Center-of-Mass det. time= 7.2 min (31.6 - 24.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	26.7 m³	**12.50 mW x 8.84 mL x 1.14 mH Field A** 126.4 m³ Overall - 59.6 m³ Embedded = 66.8 m³ x 40.0% Voids
#2A	0.230 m	57.4 m³	**Brentwood StormTank 24"** x 234 Inside #1 Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³ Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³ 26 Rows of 9 Chambers
		84.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.0783 m³/s @ 0.31 hrs HW=0.594 m (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.0783 m³/s @ 2.49 m/s)

Pond 32P: Storm Tank - Chamber Wizard Field A

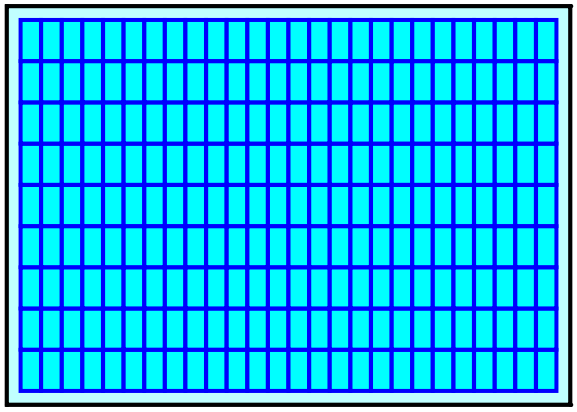
Chamber Model = Brentwood StormTank 24" (Brentwood Industries StormTank)
Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³
Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³

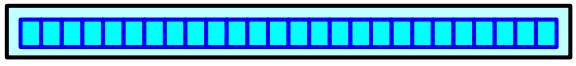
9 Chambers/Row x 0.91 m Long = 8.23 m Row Length +305 mm End Stone x 2 = 8.84 m Base Length
26 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 12.50 m Base Width
230 mm Base + 610 mm Chamber Height + 305 mm Cover = 1.14 m Field Height

234 Chambers x 0.25 m³ = 57.36 m³ Chamber Storage
234 Chambers x 0.25 m³ = 59.64 m³ Displacement

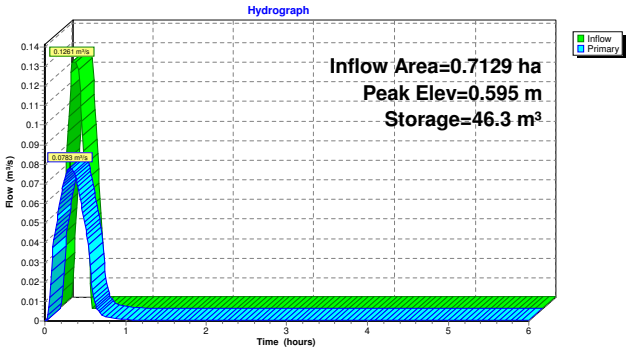
126.44 m³ Field - 59.64 m³ Chambers = 66.81 m³ Stone x 40.0% Voids = 26.72 m³ Stone Storage

Chamber Storage + Stone Storage = 84.08 m³ = 0.084 Ml
Overall Storage Efficiency = 66.5%
Overall System Size = 8.84 m x 12.50 m x 1.14 m





Pond 32P: Storm Tank

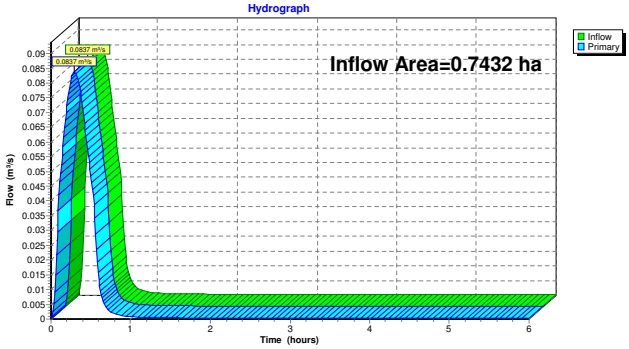


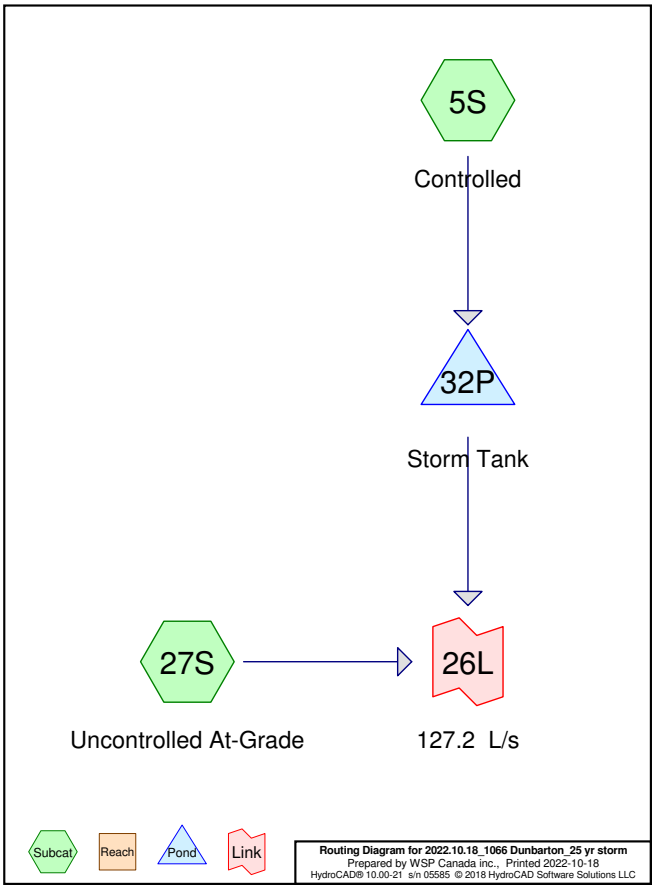
Summary for Link 26L: 127.2 L/s

Inflow Area = 0.7432 ha, 59.71% Impervious, Inflow Depth > 17 mm for 10-Year event
Inflow = 0.0837 m³/s @ 0.29 hrs, Volume= 0.128 Ml
Primary = 0.0837 m³/s @ 0.29 hrs, Volume= 0.128 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 26L: 127.2 L/s





Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.1402	1.00	At Grade Impervious / Roofs (5S)
0.0303	1.00	At Grade-Uncontrolled (27S)
0.1961	1.00	Parking / Vehicular Surface (5S)
0.0772	1.00	Pedestrain Walkway (5S)
0.2994	0.22	Soft Landscaping (5S)
0.7432	**0.69**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
0.7432	Other	5S, 27S
0.7432		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchm Numbers
0.0000	0.0000	0.0000	0.0000	0.1402	0.1402	At Grade Impervious / Roofs	
0.0000	0.0000	0.0000	0.0000	0.0303	0.0303	At Grade-Uncontrolled	
0.0000	0.0000	0.0000	0.0000	0.1961	0.1961	Parking / Vehicular Surface	
0.0000	0.0000	0.0000	0.0000	0.0772	0.0772	Pedestrain Walkway	
0.0000	0.0000	0.0000	0.0000	0.2994	0.2994	Soft Landscaping	
0.0000	**0.0000**	**0.0000**	**0.0000**	**0.7432**	**0.7432**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: Controlled Runoff Area=7,129.0 m² 58.00% Impervious Runoff Depth=20 mm
Tc=10.0 min C=0.67 Runoff=0.1454 m³/s 0.140 Ml

Subcatchment 27S: Uncontrolled Runoff Area=303.0 m² 100.00% Impervious Runoff Depth=29 mm
Tc=10.0 min C=1.00 Runoff=0.0092 m³/s 0.009 Ml

Pond 32P: Storm Tank Peak Elev=0.732 m Storage=59.9 m³ Inflow=0.1458 m³/s 0.148 Ml
Outflow=0.0885 m³/s 0.147 Ml

Link 26L: 127.2 L/s Inflow=0.0948 m³/s 0.156 Ml
Primary=0.0948 m³/s 0.156 Ml

Total Runoff Area = 0.7432 ha Runoff Volume = 0.148 Ml Average Runoff Depth = 20 mm
40.29% Pervious = 0.2994 ha 59.71% Impervious = 0.4438 ha

Summary for Subcatchment 5S: Controlled

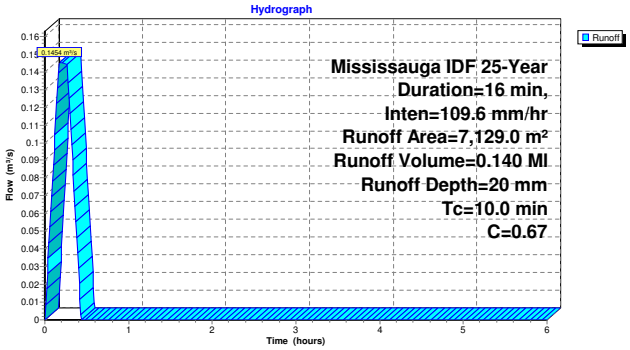
Runoff = 0.1454 m³/s @ 0.17 hrs, Volume= 0.140 Ml, Depth= 20 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 25-Year Duration=16 min, Inten=109.6 mm/hr

Area (m²)	C	Description
1,402.0	1.00	At Grade Impervious / Roofs
1,961.0	1.00	Parking / Vehicular Surface
2,994.0	0.22	Soft Landscaping
772.0	1.00	Pedestrain Walkway
7,129.0	0.67	Weighted Average
2,994.0		42.00% Pervious Area
4,135.0		58.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 5S: Controlled



Summary for Subcatchment 27S: Uncontrolled At-Grade

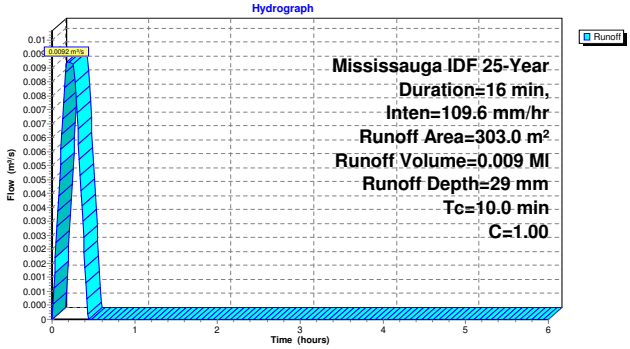
Runoff = 0.0092 m³/s @ 0.17 hrs, Volume= 0.009 Ml, Depth= 29 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 25-Year Duration=16 min, Inten=109.6 mm/hr

Area (m²)	C	Description
303.0	1.00	At Grade-Uncontrolled
303.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 27S: Uncontrolled At-Grade



Summary for Pond 32P: Storm Tank

Inflow Area = 0.7129 ha, 58.00% Impervious, Inflow Depth > 21 mm for 25-Year event
Inflow = 0.1458 m³/s @ 0.17 hrs, Volume= 0.148 Ml, Incl. 0.0004 m³/s Base Flow
Outflow = 0.0885 m³/s @ 0.33 hrs, Volume= 0.147 Ml, Atten= 39%, Lag= 9.7 min
Primary = 0.0885 m³/s @ 0.33 hrs, Volume= 0.147 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 0.732 m @ 0.33 hrs Surf.Area= 110.5 m² Storage= 59.9 m³

Plug-Flow detention time= 9.7 min calculated for 0.147 Ml (100% of inflow)
Center-of-Mass det. time= 8.2 min (30.9 - 22.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	26.7 m³	**12.50 mW x 8.84 mL x 1.14 mH Field A** 126.4 m³ Overall - 59.6 m³ Embedded = 66.8 m³ x 40.0% Voids
#2A	0.230 m	57.4 m³	**Brentwood StormTank 24"** x 234 Inside #1 Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³ Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³ 26 Rows of 9 Chambers
		84.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.0885 m³/s @ 0.33 hrs HW=0.732 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0885 m³/s @ 2.82 m/s)

Pond 32P: Storm Tank - Chamber Wizard Field A

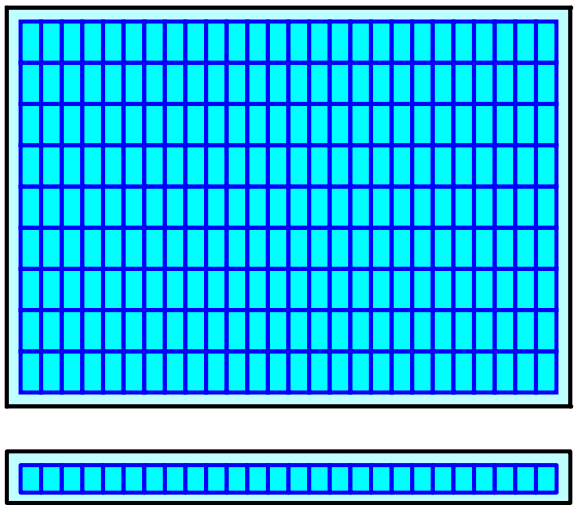
Chamber Model = Brentwood StormTank 24" (Brentwood Industries StormTank)
Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³
Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³

9 Chambers/Row x 0.91 m Long = 8.23 m Row Length +305 mm End Stone x 2 = 8.84 m Base Length
26 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 12.50 m Base Width
230 mm Base + 610 mm Chamber Height + 305 mm Cover = 1.14 m Field Height

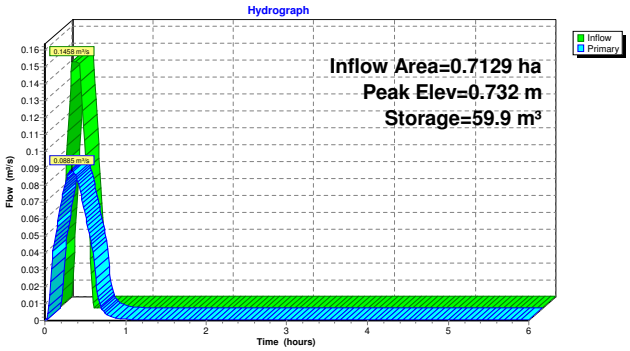
234 Chambers x 0.25 m³ = 57.36 m³ Chamber Storage
234 Chambers x 0.25 m³ = 59.64 m³ Displacement

126.44 m³ Field - 59.64 m³ Chambers = 66.81 m³ Stone x 40.0% Voids = 26.72 m³ Stone Storage

Chamber Storage + Stone Storage = 84.08 m³ = 0.084 Ml
Overall Storage Efficiency = 66.5%
Overall System Size = 8.84 m x 12.50 m x 1.14 m



Pond 32P: Storm Tank

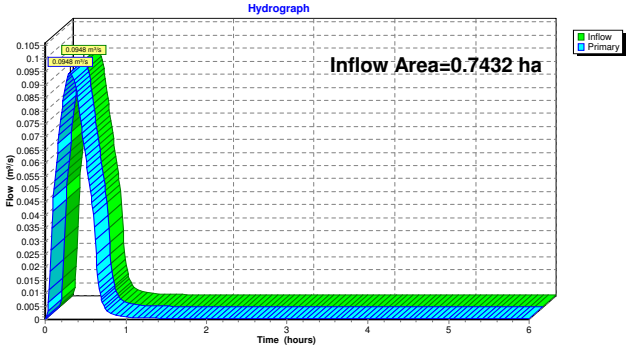


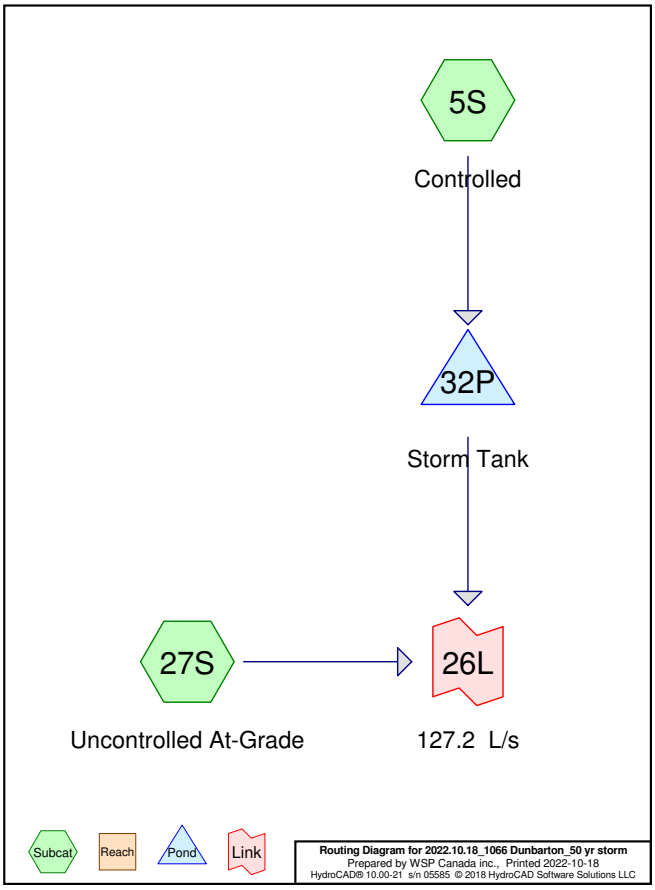
Summary for Link 26L: 127.2 L/s

Inflow Area = 0.7432 ha, 59.71% Impervious, Inflow Depth > 21 mm for 25-Year event
Inflow = 0.0948 m³/s @ 0.31 hrs, Volume= 0.156 Ml
Primary = 0.0948 m³/s @ 0.31 hrs, Volume= 0.156 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 26L: 127.2 L/s





Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.1402	1.00	At Grade Impervious / Roofs (5S)
0.0303	1.00	At Grade-Uncontrolled (27S)
0.1961	1.00	Parking / Vehicular Surface (5S)
0.0772	1.00	Pedestrain Walkway (5S)
0.2994	0.24	Soft Landscaping (5S)
0.7432	**0.69**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
0.7432	Other	5S, 27S
0.7432		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchm Numbers
0.0000	0.0000	0.0000	0.0000	0.1402	0.1402	At Grade Impervious / Roofs	
0.0000	0.0000	0.0000	0.0000	0.0303	0.0303	At Grade-Uncontrolled	
0.0000	0.0000	0.0000	0.0000	0.1961	0.1961	Parking / Vehicular Surface	
0.0000	0.0000	0.0000	0.0000	0.0772	0.0772	Pedestrain Walkway	
0.0000	0.0000	0.0000	0.0000	0.2994	0.2994	Soft Landscaping	
0.0000	**0.0000**	**0.0000**	**0.0000**	**0.7432**	**0.7432**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: Controlled Runoff Area=7,129.0 m² 58.00% Impervious Runoff Depth=23 mm
Tc=10.0 min C=0.68 Runoff=0.1588 m³/s 0.162 Ml

Subcatchment 27S: Uncontrolled Runoff Area=303.0 m² 100.00% Impervious Runoff Depth=33 mm
Tc=10.0 min C=1.00 Runoff=0.0099 m³/s 0.010 Ml

Pond 32P: Storm Tank Peak Elev=0.854 m Storage=71.2 m³ Inflow=0.1592 m³/s 0.171 Ml
Outflow=0.0967 m³/s 0.170 Ml

Link 26L: 127.2 L/s Inflow=0.1030 m³/s 0.180 Ml
Primary=0.1030 m³/s 0.180 Ml

Total Runoff Area = 0.7432 ha Runoff Volume = 0.172 Ml Average Runoff Depth = 23 mm
40.29% Pervious = 0.2994 ha 59.71% Impervious = 0.4438 ha

Summary for Subcatchment 5S: Controlled

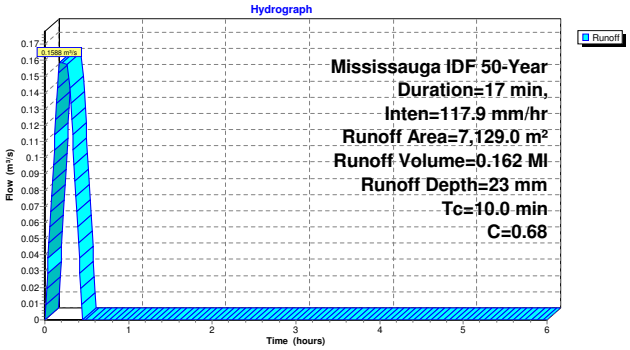
Runoff = 0.1588 m³/s @ 0.17 hrs, Volume= 0.162 Ml, Depth= 23 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 50-Year Duration=17 min, Inten=117.9 mm/hr

Area (m²)	C	Description
1,402.0	1.00	At Grade Impervious / Roofs
1,961.0	1.00	Parking / Vehicular Surface
2,994.0	0.24	Soft Landscaping
772.0	1.00	Pedestrain Walkway
7,129.0	0.68	Weighted Average
2,994.0		42.00% Pervious Area
4,135.0		58.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 5S: Controlled



Summary for Subcatchment 27S: Uncontrolled At-Grade

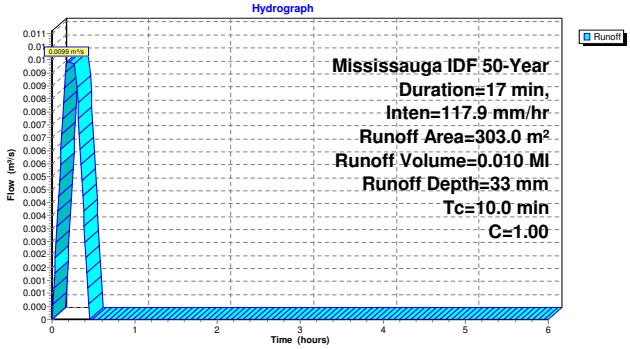
Runoff = 0.0099 m³/s @ 0.17 hrs, Volume= 0.010 Ml, Depth= 33 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 50-Year Duration=17 min, Inten=117.9 mm/hr

Area (m²)	C	Description
303.0	1.00	At Grade-Uncontrolled
303.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 27S: Uncontrolled At-Grade



Summary for Pond 32P: Storm Tank

Inflow Area = 0.7129 ha, 58.00% Impervious, Inflow Depth > 24 mm for 50-Year event
Inflow = 0.1592 m³/s @ 0.17 hrs, Volume= 0.171 Ml, Incl. 0.0004 m³/s Base Flow
Outflow = 0.0967 m³/s @ 0.35 hrs, Volume= 0.170 Ml, Atten= 39%, Lag= 10.7 min
Primary = 0.0967 m³/s @ 0.35 hrs, Volume= 0.170 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 0.854 m @ 0.35 hrs Surf.Area= 110.5 m² Storage= 71.2 m³

Plug-Flow detention time= 10.2 min calculated for 0.170 Ml (100% of inflow)
Center-of-Mass det. time= 8.9 min (30.9 - 22.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	26.7 m³	**12.50 mW x 8.84 mL x 1.14 mH Field A** 126.4 m³ Overall - 59.6 m³ Embedded = 66.8 m³ x 40.0% Voids
#2A	0.230 m	57.4 m³	**Brentwood StormTank 24"** x 234 Inside #1 Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³ Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³ 26 Rows of 9 Chambers
		84.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.0966 m³/s @ 0.35 hrs HW=0.854 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0966 m³/s @ 3.08 m/s)

Pond 32P: Storm Tank - Chamber Wizard Field A

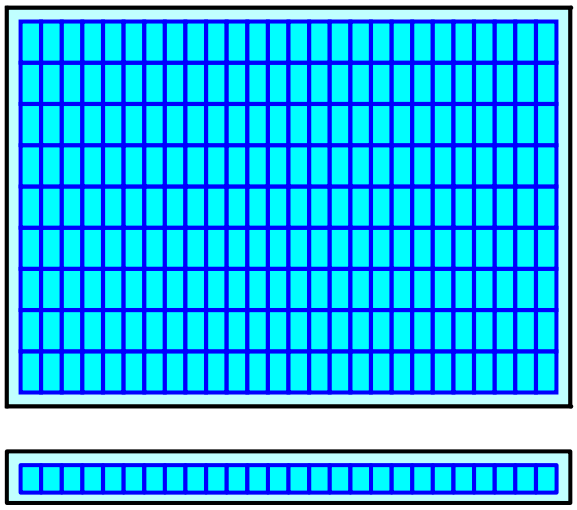
Chamber Model = Brentwood StormTank 24" (Brentwood Industries StormTank)
Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³
Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³

9 Chambers/Row x 0.91 m Long = 8.23 m Row Length +305 mm End Stone x 2 = 8.84 m Base Length
26 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 12.50 m Base Width
230 mm Base + 610 mm Chamber Height + 305 mm Cover = 1.14 m Field Height

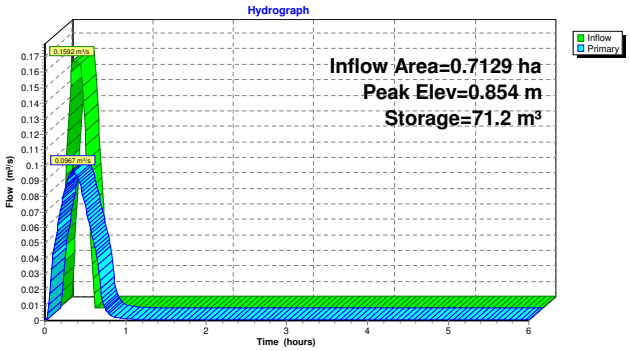
234 Chambers x 0.25 m³ = 57.36 m³ Chamber Storage
234 Chambers x 0.25 m³ = 59.64 m³ Displacement

126.44 m³ Field - 59.64 m³ Chambers = 66.81 m³ Stone x 40.0% Voids = 26.72 m³ Stone Storage

Chamber Storage + Stone Storage = 84.08 m³ = 0.084 Ml
Overall Storage Efficiency = 66.5%
Overall System Size = 8.84 m x 12.50 m x 1.14 m



Pond 32P: Storm Tank

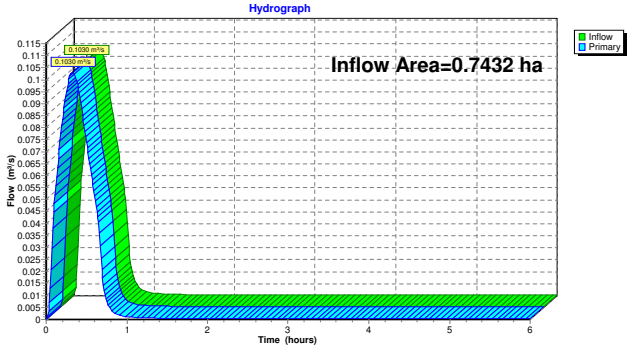


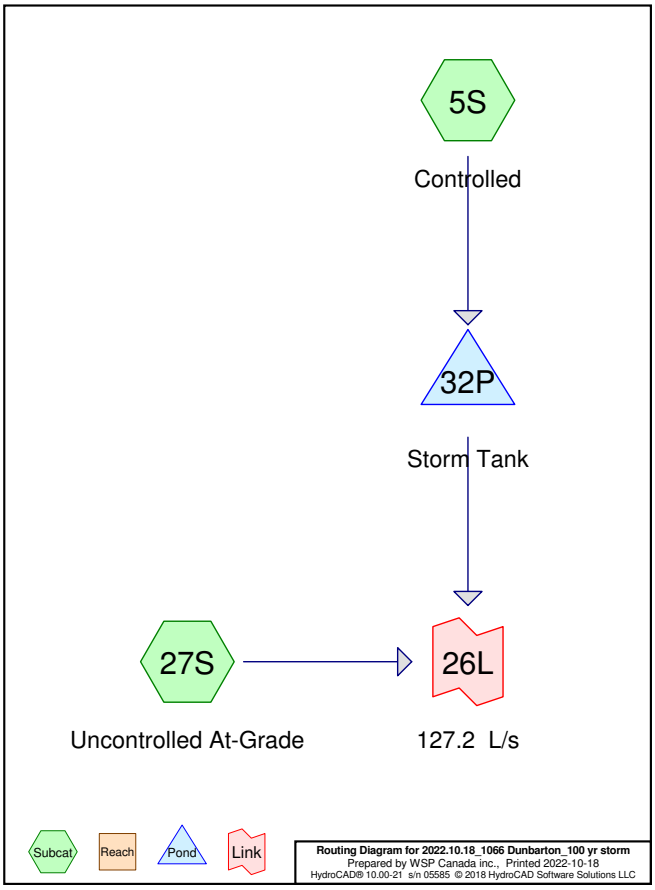
Summary for Link 26L: 127.2 L/s

Inflow Area = 0.7432 ha, 59.71% Impervious, Inflow Depth > 24 mm for 50-Year event
Inflow = 0.1030 m³/s @ 0.34 hrs, Volume= 0.180 Ml
Primary = 0.1030 m³/s @ 0.34 hrs, Volume= 0.180 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 26L: 127.2 L/s





Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.1402	1.00	At Grade Impervious / Roofs (5S)
0.0303	1.00	At Grade-Uncontrolled (27S)
0.1961	1.00	Parking / Vehicular Surface (5S)
0.0772	1.00	Pedestrain Walkway (5S)
0.2994	0.25	Soft Landscaping (5S)
0.7432	**0.70**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
0.7432	Other	5S, 27S
0.7432		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchm Numbers
0.0000	0.0000	0.0000	0.0000	0.1402	0.1402	At Grade Impervious / Roofs	
0.0000	0.0000	0.0000	0.0000	0.0303	0.0303	At Grade-Uncontrolled	
0.0000	0.0000	0.0000	0.0000	0.1961	0.1961	Parking / Vehicular Surface	
0.0000	0.0000	0.0000	0.0000	0.0772	0.0772	Pedestrain Walkway	
0.0000	0.0000	0.0000	0.0000	0.2994	0.2994	Soft Landscaping	
0.0000	**0.0000**	**0.0000**	**0.0000**	**0.7432**	**0.7432**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 5S: Controlled Runoff Area=7,129.0 m² 58.00% Impervious Runoff Depth=26 mm
Tc=10.0 min C=0.69 Runoff=0.1723 m³/s 0.186 Ml

Subcatchment 27S: Uncontrolled Runoff Area=303.0 m² 100.00% Impervious Runoff Depth=38 mm
Tc=10.0 min C=1.00 Runoff=0.0106 m³/s 0.011 Ml

Pond 32P: Storm Tank Peak Elev=1.100 m Storage=82.1 m³ Inflow=0.1727 m³/s 0.195 Ml
Outflow=0.1113 m³/s 0.194 Ml

Link 26L: 127.2 L/s Inflow=0.1186 m³/s 0.206 Ml
Primary=0.1186 m³/s 0.206 Ml

Total Runoff Area = 0.7432 ha Runoff Volume = 0.198 Ml Average Runoff Depth = 27 mm
40.29% Pervious = 0.2994 ha 59.71% Impervious = 0.4438 ha

Summary for Subcatchment 5S: Controlled

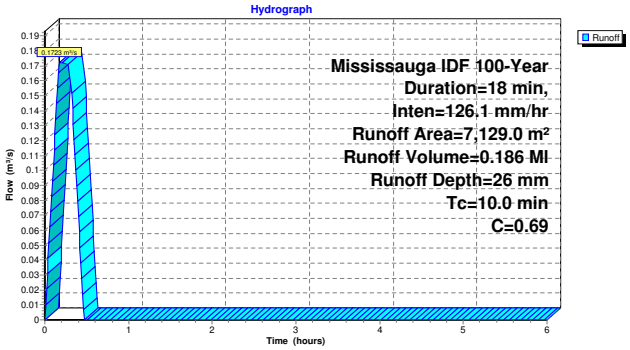
Runoff = 0.1723 m³/s @ 0.17 hrs, Volume= 0.186 Ml, Depth= 26 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 100-Year Duration=18 min, Inten=126.1 mm/hr

Area (m²)	C	Description
1,402.0	1.00	At Grade Impervious / Roofs
1,961.0	1.00	Parking / Vehicular Surface
2,994.0	0.25	Soft Landscaping
772.0	1.00	Pedestrain Walkway
7,129.0	0.69	Weighted Average
2,994.0		42.00% Pervious Area
4,135.0		58.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 5S: Controlled



Summary for Subcatchment 27S: Uncontrolled At-Grade

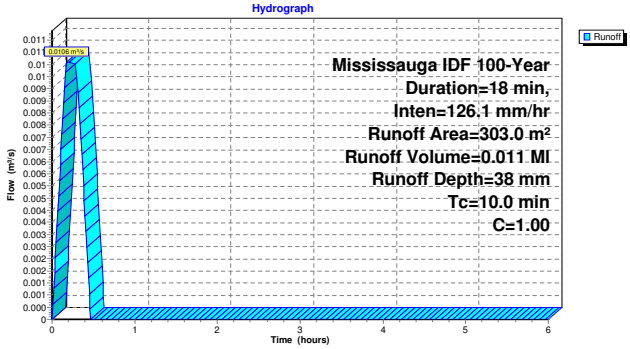
Runoff = 0.0106 m³/s @ 0.17 hrs, Volume= 0.011 Ml, Depth= 38 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 100-Year Duration=18 min, Inten=126.1 mm/hr

Area (m²)	C	Description
303.0	1.00	At Grade-Uncontrolled
303.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 27S: Uncontrolled At-Grade



Summary for Pond 32P: Storm Tank

Inflow Area = 0.7129 ha, 58.00% Impervious, Inflow Depth > 27 mm for 100-Year event
Inflow = 0.1727 m³/s @ 0.17 hrs, Volume= 0.195 Ml, Incl. 0.0004 m³/s Base Flow
Outflow = 0.1113 m³/s @ 0.36 hrs, Volume= 0.194 Ml, Atten= 36%, Lag= 11.4 min
Primary = 0.1113 m³/s @ 0.36 hrs, Volume= 0.194 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 1.100 m @ 0.36 hrs Surf.Area= 110.5 m² Storage= 82.1 m³

Plug-Flow detention time= 10.6 min calculated for 0.194 Ml (100% of inflow)
Center-of-Mass det. time= 9.4 min (30.8 - 21.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	26.7 m³	**12.50 mW x 8.84 mL x 1.14 mH Field A** 126.4 m³ Overall - 59.6 m³ Embedded = 66.8 m³ x 40.0% Voids
#2A	0.230 m	57.4 m³	**Brentwood StormTank 24"** x 234 Inside #1 Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³ Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³ 26 Rows of 9 Chambers
		84.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.1113 m³/s @ 0.36 hrs HW=1.100 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.1113 m³/s @ 3.54 m/s)

Pond 32P: Storm Tank - Chamber Wizard Field A

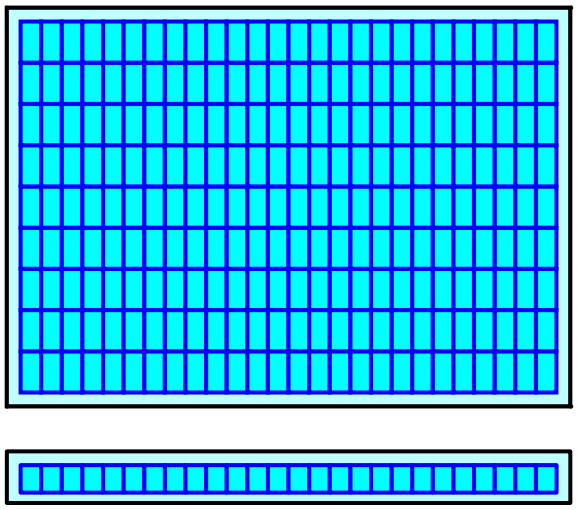
Chamber Model = Brentwood StormTank 24" (Brentwood Industries StormTank)
Inside= 457 mmW x 610 mmH => 0.268 m² x 0.91 mL = 0.25 m³
Outside= 457 mmW x 610 mmH => 0.279 m² x 0.91 mL = 0.25 m³

9 Chambers/Row x 0.91 m Long = 8.23 m Row Length +305 mm End Stone x 2 = 8.84 m Base Length
26 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 12.50 m Base Width
230 mm Base + 610 mm Chamber Height + 305 mm Cover = 1.14 m Field Height

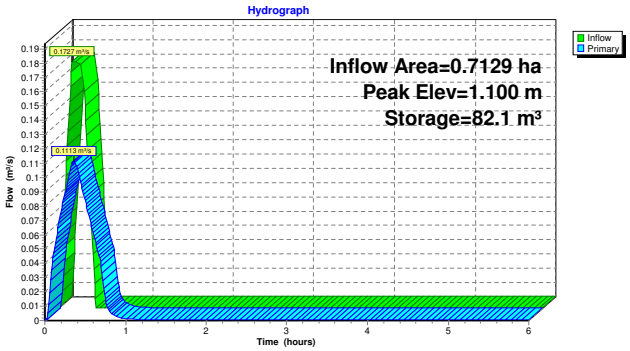
234 Chambers x 0.25 m³ = 57.36 m³ Chamber Storage
234 Chambers x 0.25 m³ = 59.64 m³ Displacement

126.44 m³ Field - 59.64 m³ Chambers = 66.81 m³ Stone x 40.0% Voids = 26.72 m³ Stone Storage

Chamber Storage + Stone Storage = 84.08 m³ = 0.084 Ml
Overall Storage Efficiency = 66.5%
Overall System Size = 8.84 m x 12.50 m x 1.14 m



Pond 32P: Storm Tank

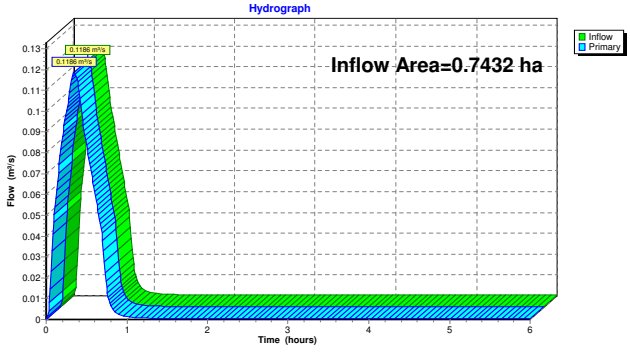


Summary for Link 26L: 127.2 L/s

Inflow Area = 0.7432 ha, 59.71% Impervious, Inflow Depth > 28 mm for 100-Year event
Inflow = 0.1186 m³/s @ 0.35 hrs, Volume= 0.206 Ml
Primary = 0.1186 m³/s @ 0.35 hrs, Volume= 0.206 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 26L: 127.2 L/s



APPENDIX

C

Water Quality Unit Sizing Report

Determining Number of Cartridges for Flow Based Systems

Date	**17/10/2011**	**Black Cells =**	**Calculation**

Site Information

Project Name	**1066 Dunbarton Road**		
Project Location	**Pickering, ON**		
OGS ID	**OGS**		
Drainage Area, Ad	**1.73**	ac	(0.7 ha)
Impervious Area, Ai	**0.98**	ac	
Pervious Area, Ap	**0.74**		
% Impervious	**57%**		
Runoff Coefficient, Rc	**0.62**		
Treatment storm flow rate, Q_{treat}	**0.55**	cfs	(15.7 L/s)
Peak storm flow rate, Q_{peak}	**TBD**	cfs	

Filter System

Filtration brand	**StormFilter**	
Cartridge height	**18**	in
Specific Flow Rate	**1.67**	gpm/ft²
Flow rate per cartridge	**12.53**	gpm

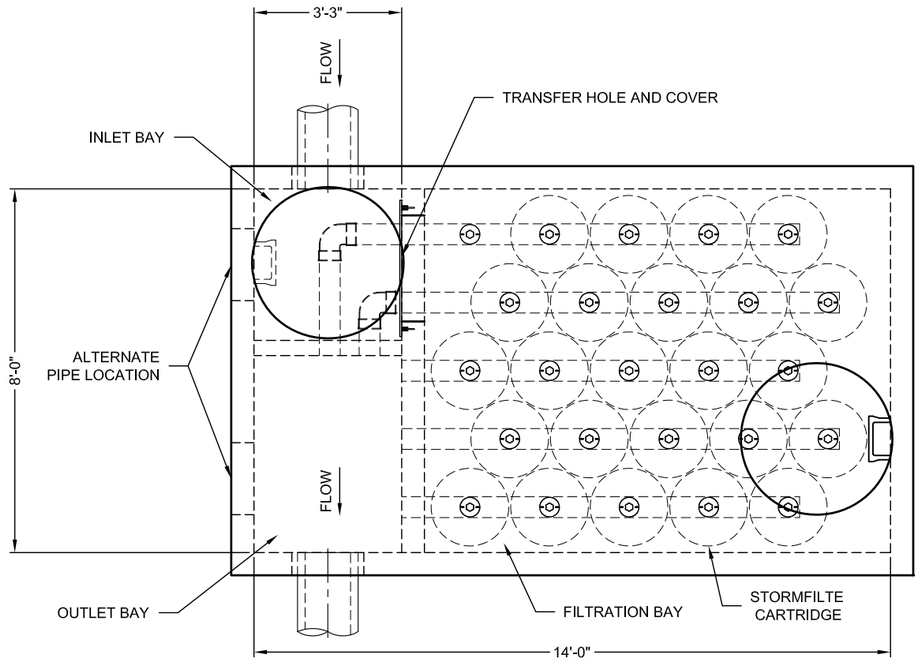
SUMMARY

Number of Cartridges	21
Media Type	Perlite

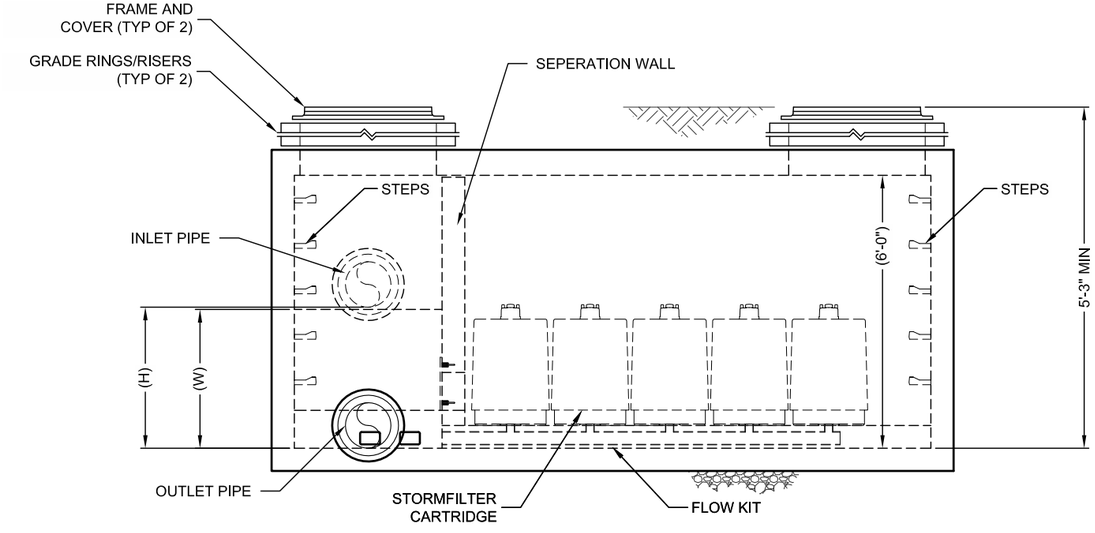
Event Mean Concentration (EMC)	**150**	mg/L
Annual TSS Removal	**80%**	
Percent Runoff Capture	**90%**	

Recommend SFPD0814 vault or CIP

200 Enterprise Drive
Scarborough, ME 04074
Phone 877-907-8676
Fax 207-885-9825



PLAN

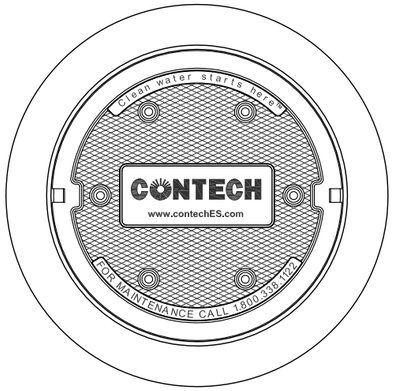


ELEVATION

STORMFILTER DESIGN TABLE

- THE 8' x 14' PEAK DIVERSION STORMFILTER TREATMENT CAPACITY VARIES BY CARTRIDGE COUNT AND LOCALLY APPROVED SURFACE AREA SPECIFIC FLOW RATE. PEAK CONVEYANCE CAPACITY TO BE DETERMINED BY ENGINEER OF RECORD.
- THE PEAK DIVERSION STORMFILTER IS AVAILABLE IN A LEFT INLET (AS SHOWN) OR RIGHT INLET CONFIGURATION.
- ALL PARTS AND INTERNAL ASSEMBLY PROVIDED BY CONTECH UNLESS OTHERWISE NOTED.

CARTRIDGE HEIGHT	27"		18"		LOW DROP	
SYSTEM HYDRAULIC DROP (H - REQ'D. MIN.)	3.05'		2.3'		1.8'	
HEIGHT OF WEIR (W)	3.00'		2.25'		1.75'	
TREATMENT BY MEDIA SURFACE AREA	2 gpm/ft²	1 gpm/ft²	2 gpm/ft²	1 gpm/ft²	2 gpm/ft²	1 gpm/ft²
CARTRIDGE FLOW RATE (gpm)	22.5	11.25	15	7.5	10	5



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	*
WATER QUALITY FLOW RATE (cfs)	*
PEAK FLOW RATE (cfs)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
# OF CARTRIDGES REQUIRED	*
CARTRIDGE FLOW RATE	*
MEDIA TYPE (CSF, PERLITE, ZPG)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE	*	*	*
OUTLET PIPE	*	*	*

INLET BAY RIM ELEVATION	*
FILTER BAY RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

PERFORMANCE SPECIFICATION

FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. **RADIAL MEDIA DEPTH SHALL BE 7-INCHES**. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST **37 SECONDS**. SPECIFIC FLOW RATE SHALL BE **2 GPM/SF (MAXIMUM)**. SPECIFIC FLOW RATE IS THE MEASURE OF THE FLOW (GPM) DIVIDED BY THE MEDIA SURFACE CONTACT AREA (SF). MEDIA VOLUMETRIC FLOW RATE SHALL BE **6 GPM/CF OF MEDIA (MAXIMUM).**

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.ContechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
F. CONTRACTOR TO REMOVE THE TRANSFER HOLE COVER WHEN THE SYSTEM IS BROUGHT ONLINE.

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

THE STORMWATER MANAGEMENT STORMFILTER 8' x 14' PEAK DIVERSION STORMFILTER STANDARD DETAIL