

Edenshaw Elizabeth Developments Limited

# 42 - 46 Park Street East and 23 Elizabeth Street North

## Stormwater Management Report

April 30, 2020







# 42 - 46 Park Street East and 23 Elizabeth Street North

## Stormwater Management Report

Edenshaw Elizabeth Developments Limited

Rezoning Application (RZA)

Project No.: 20M-00430-00

Date: April 30, 2020

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# Revision History

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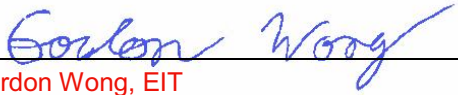
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Prepared by	Reviewed by	Approved By		
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April 30, 2020	Rezoning Application			
Prepared by	Reviewed by	Approved By		
Gordon Wong, EIT	Iain Smith, P.Eng	Iain Smith, P.Eng		
<b>REVISION 2</b>				
<b>FINAL</b>				



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# Signatures

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April 30, 2020  
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Approved<sup>1</sup> by (must be reviewed for technical accuracy prior to approval)



Iain Smith, P.Eng.  
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# 1 INTRODUCTION

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## 1.1 Scope

WSP Canada Group Limited (WSP) has been retained by Edenshaw Elizabeth Developments Limited to prepare a stormwater management (SWM) report to support the Rezoning Application for the proposed development located at 42 - 46 Park Street East and 23 Elizabeth Street North in the City of Mississauga. This SWM report examines the potential water quality, water quantity, erosion control and water balance impacts of the proposed development and summarizes how each parameter will be addressed in accordance with the City of Mississauga Development Requirements Manual dated September 2016.

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## 1.2 Site Location

The site is bounded by Elizabeth Street North to the west and Park Street East to the south. High density residential buildings are located on the north and east side of the site boundary. The site is located within the Norval to Port Credit subwatershed as part of the Credit River watershed. The location of the proposed re-development is illustrated in **Figure 1**.

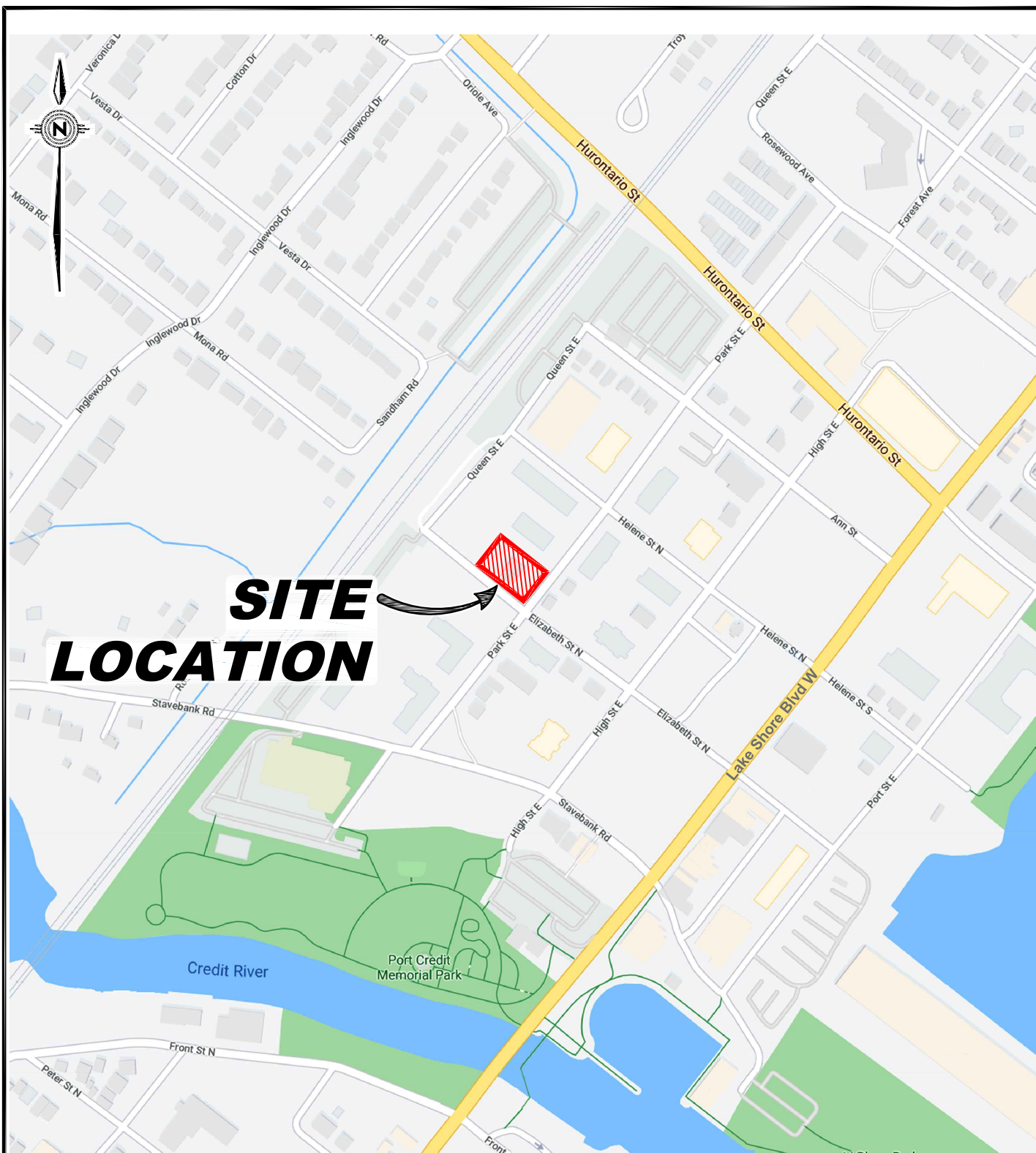
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## 1.3 Stormwater Management Plan Objectives

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 Mississauga Development Requirements Manual.
- 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.

FIGURE 1.dwg - Elizabeth St N & Park St E - Site Location X:\DIV\38\2020\20M-00430-00 Elizabeth Street North and Park Street East\4. CAD\FIGURES\ Apr 08, 2020 - 9:51am



CLIENT

EDENSHAW ELIZABETH DEVELOPMENTS LIMITED

TITLE

42-46 PARK ST. E AND 23 ELIZABETH ST. N

## SITE LOCATION



Checked	I.S.	Drawn	AutoCAD/B.K.B.
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Scale	AS SHOWN	Figure No.	1
		Gr.No.	00

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## **1.4 Design Criteria**

The City of Mississauga Development Requirements Manual (September 2016) and the Ministry of the Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual (March 2003) provides direction on the management of rainfall and runoff inside the city's jurisdiction. A summary of the stormwater management criteria applicable to this project follows:

### **1.4.1 Runoff Volume Reduction**

From Section 2.01.03.02 of the City of Mississauga Development Requirements Manual, it states that "the first 5 mm of runoff shall be retained on-site and managed by a way of infiltration, evapotranspiration or re-use". As such, feasible water balance reuse opportunities will be analyzed and a best practices approach will be applied. Additionally, from prior experience, it was determined that the City of Mississauga does not accept initial abstractions as part of the runoff volume reduction, therefore they will be disregarded.

### **1.4.2 Water Quality**

The development is required to provide water quality measures that are designed to provided Enhanced (Level 1, 80% Total Suspended Solids Removal (TSS)) level of protection as defined in the MECP Stormwater Management Planning and Design Manual.

### **1.4.3 Erosion Control**

As mentioned in Section 2.09.01 of the City of Mississauga Development Requirements Manual, sites under one hectare are not required to provide long term erosion control measures. Temporary erosion and sediment controls will be installed during construction to minimize impacts.

### **1.4.4 Water Quantity and Discharge to Municipal Infrastructure**

From Table 2.01.03.03 of the City of Mississauga Development Requirements Manual, it was determined that no quantity control is required for the site. However, according to Note 1, the storm sewer capacity constraints governs in this case. Through downstream sewer analysis, it was determined that the storm sewers in the area are overcapacity. Therefore, to provide relief to the storm sewer system, post-development peak flows for all storms up to and including the 100-year storm will be attenuated to the peak flow of the 2-year storm event under pre-development conditions.

## 2 PRE-DEVELOPMENT CONDITIONS

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### 2.1 General

The site covers an area of approximately 0.18 ha and is currently occupied by four 2 to 3-storey detached residential homes at 42, 44 and 46 Park Street East and 23 Elizabeth Street North. These properties have individually paved driveways and grassed yards. The pre-development runoff coefficient is estimated to be 0.56 for the site. Under pre-development conditions, a portion of the site drains to Park Street East, a portion drains to Elizabeth Street North and a small section of the site drains northeast into the adjacent property. Approximately 0.10 ha drains to the storm sewers on Park Street East while 0.08 ha of the site drains to the storm sewers on Elizabeth Street North. The area that drains to Park Street East has a runoff coefficient of 0.60 and the area that drains to Elizabeth Street North has a runoff coefficient of 0.53. Ultimately, the majority of the flows from the site are collected by the 300 mm diameter storm sewers along Park Street East and Elizabeth Street North and conveyed downstream by a 600 mm diameter storm sewer on Elizabeth Street North.

Based on the topographic survey, an external area located on the northeast side of the property with a total area of approximately 0.03 ha and a runoff coefficient of 0.27 currently discharges into the site and to Park Street East. The area is predominately landscaped areas. The external area will be accounted for in the post-development conditions to meet the water quantity requirement. The existing condition of the site is shown in **Figure 2**.



PROPERTY BOUNDARY

DRAINAGE AREA BOUNDARY

EXTERNAL DRAINAGE AREA BOUNDARY

DRAINAGE AREA: 0.08

RUNOFF COEFFICIENT: 0.53

APPROXIMATE CENTRELINE OF PAVEMENT: 80.57, 80.84

0 2 4 6 8 10m

CLIENT: EDENSHAW ELIZABETH DEVELOPMENTS LIMITED

TITLE: 42-46 PARK ST. E AND 23 ELIZABETH ST. N

EXISTING CONDITIONS

Checked: I.S., Drawn: AutoCAD/B.K.B.

Date: APRIL 2020, Proj. No.: 20M-00430-00

Scale: AS SHOWN, Figure No.: 2, Gr.No.: 00

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## 2.2 Rainfall Information

The rainfall intensity for the site was calculated using the following equation as stated in the City of Mississauga Development Requirements Manual:

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

Where:

I = Rainfall intensity in mm/hr

t<sub>c</sub> = Time of concentration in minutes

A, B and C = Constant parameters stated in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual. The parameters are summarized in **Table 2-1**.

**Table 2-1: IDF Parameters used by the City of Mississauga**

Return Period (Years)	2	5	10	25	50	100
A	610	820	1,010	1,160	1,300	1,450
B	4.6	4.6	4.6	4.6	4.7	4.9
C	0.78	0.78	0.78	0.78	0.78	0.78

Source: City of Mississauga's Development Requirements Manual (September 2016)

An initial time of concentration, t<sub>c</sub>, of 15 minutes was assumed for the calculations of the rainfall intensity as recommended in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual.

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## 2.3 Allowable Flow Rates

From Section 2.01.01.02 of the manual, the storm sewer was assumed to be designed to accept up to the 10-year storm event. According to Table 2.01.03.03a of the City of Mississauga Development Requirements Manual, "In all cases, the storm sewer capacity constraints or downstream concerns may govern". The downstream analysis of the local storm sewers, provided in the Functional Servicing Report under a separate cover, indicates that the system is surcharged and has no capacity. Therefore, it was determined that the allowable release rate to the municipal storm sewer system from the development will be limited to the 2-year pre-development flow rate based on a runoff coefficient of 0.50. This decision will provide relief to the existing storm sewer system.



As well, in the pre-development condition, the external area discharges to Park Street East. The allowable release rate to Park Street East would be the summation of the 2-year pre-development flow to Park Street East and the flows from the external area for each storm event up to and including the 100-year storm event.

The calculated peak flow rates for the portion of the site discharging to Elizabeth Street North and Park Street East under pre-development conditions are summarized below in **Table 2-2** and **Table 2-3**, respectively. Please note that the adjustment factors to the runoff coefficients as mentioned in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual are used in the calculation of the peak flows. Detailed calculations are contained within **Appendix A**.

**Table 2-2: Pre-Development Peak Discharge Rates and Allowable Release Rate (Elizabeth Street North)**

Return Period (Years)	Rainfall Intensity, I (mm/hr)	Existing Peak Flow Rate, Q* (L/s)	Allowable Release Rate, Q <sub>a</sub> ** (L/s)
2	59.9	7.1	6.6
5	80.5	9.5	
10	99.2	11.7	
25	113.9	14.8	
50	127.1	17.0	
100	140.7	19.1	

\*Runoff coefficient of 0.53 with Adjustment Factor for severe storms, area of 0.08 ha, and a time of concentration of 15 minutes

\*\*Runoff coefficient of 0.50, area of 0.08 ha, and a time of concentration of 15 minutes

**Table 2-3: Pre-Development Peak Discharge Rates and Allowable Release Rate (Park Street East)**

Return Period (Years)	Rainfall Intensity, I (mm/hr)	Existing Peak Flow Rate, Q* (L/s)	2-year Pre-Development Flow with a C of 0.50** (L/s)	External Flow*** (L/s)	Allowable Release Rate, Q <sub>a</sub> (L/s)
2	59.9	9.6	8.0	1.3	9.3
5	80.5	12.9		1.7	9.7
10	99.2	15.8		2.1	10.1
25	113.9	20.0		2.7	10.7
50	127.1	22.9		3.3	11.3
100	140.7	25.6		3.8	11.8

\*Runoff coefficient of 0.60 with Adjustment Factor for severe storms, area of 0.10 ha, and a time of concentration of 15 minutes

\*\*Runoff coefficient of 0.50, area of 0.10 ha, and a time of concentration of 15 minutes

\*\*\*Runoff coefficient of 0.27 with Adjustment Factor for severe storms, area of 0.03 ha, and a time of concentration of 15 minutes

# 3 POST-DEVELOPMENT CONDITIONS

## 3.1 General

The proposed development consists of the construction of a 22-storey residential tower with six townhouse units located at ground level. A 6-level underground parking structure underlies the majority of the site, while vehicular access is provided via Park Street East. Service access is provided via Elizabeth Street North. Landscaping is provided around the perimeter of the building at-grade. In the post-development condition, it was determined that the majority of the site will discharge to the storm sewers on Elizabeth Street North. A small area located on the east corner of the site will flow uncontrolled to the storm sewer on Park Street East.

As mentioned before, an external area of approximately 0.03 ha located at the northeast side of the site drains into the site. Under post-development conditions, flows from the external area will discharge to Elizabeth Street North instead of Park Street East as in pre-development conditions. Flows from the external area will be modelled to ensure the water quantity control requirement is met.

An area breakdown for the proposed development is provided below in **Table 3-1**. Please refer to **Figure 3** for details of the post-development conditions, land-uses and stormwater catchments.

**Table 3-1: Proposed Conditions Area Breakdown**

Land Use	Area (m <sup>2</sup> )	Runoff Coefficient (-)	% Coverage
<b>Controlled Area discharging to Elizabeth Street North</b>			
Impervious Roof Area	1,379	0.90	79%
Soft Landscaping	193	0.25	11%
At-Grade Impervious Area	183	0.90	10%
<b>Total Site Area</b>	<b>1,755</b>	<b>0.83</b>	<b>100%</b>
External Area	285	0.27	-
<b>Total Area</b>	<b>2,039</b>	<b>0.75</b>	<b>-</b>
<b>Uncontrolled Area discharging to Park Street East</b>			
Soft Landscaping	5	0.25	11%
At-Grade Impervious Area	41	0.90	89%
<b>Total Site Area</b>	<b>46</b>	<b>0.83</b>	<b>100%</b>



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## 3.2 Runoff Volume Reduction

As noted in Section 1.4.1, the city's manual requires the proponent to retain all runoff from a 5 mm storm event and to be used for infiltration, evapotranspiration and/or reuse on site. For the proposed development, an underground parking garage underlies the majority of the site's footprint therefore infiltration is not a feasible option to satisfy the volume reduction requirement. A stormwater cistern with a sump volume for reuse purposes on site will be the primary mechanism to ensure the runoff volume reduction requirement is met. Discharge from the roof, at-grade areas and the external area will be directed to the stormwater cistern.

From previous experience, it was determined that the City of Mississauga does not accept initial abstractions when calculating the runoff volume from a 5 mm storm event. This provides a more conservative approach and will be accounted for in the analysis. From the analysis, it was determined that a volume of 9.00 m<sup>3</sup> is required for reuse. The stormwater cistern will provide a sump volume of 9.35 m<sup>3</sup> to meet the volume reduction requirement. Details of the sump and stormwater cistern are further discussed in Section 3.6.

The reuse methods for the captured stormwater are still being assessed in conjunction with the mechanical design of the building's water supply systems. The methods being considered include irrigation supply for the landscaped areas, cleaning and maintenance of the building's facilities, and other non-potable water demand in the communal areas of the building. It is considered that sufficient opportunities exist within the development to reuse the full volume of retained stormwater.

The mechanical design of the rainwater reuse pump system from the cistern will ensure that the cistern is empty prior to switching to the City's water supply. **Table 3-2** outlines the runoff volume reduction requirement for the site. Detailed calculations can be found in **Appendix A** of this report.

**Table 3-2: Runoff Volume Reduction Calculation**

Surface Type	Area (m <sup>2</sup> )	5 mm Volume (m <sup>3</sup> )
Impervious Roof Area	1,379	6.90
Soft Landscaping	198	0.99
At-Grade Impervious	223	1.12
<b>Total</b>	<b>1,800</b>	<b>9.00</b>



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### 3.3 Water Quality Control

As stated in Section 1.4.2, “Enhanced” level of protection is required for the proposed development. The target is to treat at least 90% of the annual runoff volume and remove 80% of the total suspended solids (TSS).

A PMSU2015-4 oil and grit separator will be installed upstream of the cistern to treat 99.6% of the annual runoff volume and provide 88.4% TSS removal for the runoff discharging to Elizabeth Street North. The oil and grit separator has been sized by Echelon Environmental Inc. using the “Fine” particle size distribution. Please refer to **Appendix B** for the sizing report. Due to the grading constraints of the site, the small uncontrolled area discharging to Park Street East will receive no water quality control.

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### 3.4 Erosion Control

The City of Mississauga Development Requirements Manual do not specify long-term in-stream erosion control requirements for sites smaller than 1.0 ha. The area of this development is only 0.18 ha; therefore, no long-term erosion control measures will be implemented. Appropriate temporary erosion and sediment controls will be implemented to minimize impacts during construction. More details can be found in the Erosion and Sediment Control Plan, provided in the Functional Servicing Report under a separate cover.

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### 3.5 Water Quantity Control

As stated in Section 1.4.4 and 2.3, the post-development flows will be attenuated to the 2-year pre-development flows with a maximum runoff coefficient of 0.50 since the municipal sewers of the surrounding streets are surcharged under current conditions. In the post-development condition, the majority of the site along with the external area will be discharging to the storm sewers on Elizabeth Street North. A small portion located on the east corner of the site will discharge uncontrolled to the storm sewers on Park Street East.

### 3.5.1 Discharge to Elizabeth Street North

A stormwater cistern located in the underground parking structure is proposed. All flows from the roof, at-grade and external area discharging to Elizabeth Street North will be collected and controlled by the cistern prior to discharge. Using a HydroCAD model of the project, the storage volume of the cistern was determined iteratively. The model was used to calculate the discharge rates achieved by the proposed flow controls under all storm events using Mississauga's IDF curves. The modified rational method (an inherent subroutine of the HydroCAD software) has been used for the modelling exercise.

The cistern is designed with a footprint of 26.7 m<sup>2</sup> and a height of 4 m, providing a total volume of 106.8 m<sup>3</sup> for quantity control and runoff volume reduction. A pump with a maximum discharge rate of 390 L/min (6.5 L/s) located 0.35 m above the base of the cistern will be provided to control the discharge from the cistern to Elizabeth Street North and to provide a sump volume of 9.35 m<sup>3</sup> to satisfy the runoff volume reduction requirement. The pump will discharge to a discharge manhole prior to discharging to Elizabeth Street North.

A 75 mm orifice tube is proposed in the discharge manhole with the invert the same as the bottom of the manhole to ensure discharge to the sewer cannot exceed the design flow rate. The maximum water level above the orifice invert should be 0.215 m to ensure the discharge to the storm sewer on Elizabeth Street North is below 6.6 L/s. Calculations for the orifice tube can be found in **Appendix A**. It shall be the developer's responsibility to ensure that the proposed pump is sized to meet the 6.6 L/s maximum discharge rate to Elizabeth Street North. A mechanical engineer can provide these assurances regarding pumps.

In the situation where a storm that exceeds the 100-year storm event occurs or the orifice tube is blocked, an emergency overflow will be provided at the cistern and the discharge manhole. Excess stormwater will be discharged to street level and to the adjacent right-of-way. This will prevent flow from backing up into the building's pipework.

It is assumed that runoff from the external area will be collected by onsite measures (i.e. catchbasins and area drains) and conveyed to the cistern. The external area has been modelled to ensure that the total flow released from the site for all storms up to and including the 100-year storm event will be less than the allowable release rate to Elizabeth Street North.

A summary of the modelling results is provided below in **Table 3-3**. Note that the simulated situation includes a full sump storage volume at the beginning of each rainfall event. Full HydroCAD modelling output is provided in **Appendix C**.

**Table 3-3: Summary of Modelling Results (Elizabeth Street North)**

Return Period (Years)	Utilized Cistern Storage (m <sup>3</sup> /106.8 m <sup>3</sup> )	Peak Water Elevation in Cistern (m)*	Post-Development Release Rate (L/s)	Allowable Release Rate (L/s)
2	38.7	1.45	3.3	6.6
5	48.8	1.83	4.5	
10	58.1	2.18	5.1	
25	72.3	2.71	5.5	
50	82.2	3.08	5.8	
100	92.0	3.45	6.1	

*\*Depth is from the internal cistern bottom*

The modelling results demonstrates that the 100-year storm event uses a maximum storage volume of 92.0 m<sup>3</sup> within the cistern, which is below the storage volume provided. While the overall peak flow rate from the cistern and for the area discharging to Elizabeth Street North is 6.1 L/s, which is less than the target release rate of 6.6 L/s.

As majority of the flow are controlled by the proposed cistern, the rainfall intensity and storm duration resulting in the maximum utilized storage produce the largest flows. This has been iteratively determined  $t_d = 111$  minutes (for the 100-year event) according to the Modified Rational Method process.

### 3.5.2 Discharge to Park Street East

In addition, there is an area of approximately 46 m<sup>2</sup> located at the east corner of the site that will discharge uncontrolled to Park Street East. Runoff from that area will discharge uncontrolled via overland flow towards the storm sewer on Park Street East. With the reduced drainage area, it is expected that the flows in the post-development conditions to be less than the flows under pre-development conditions for all storms up to and including the 100-year storm event. A summary of the modelling results from HydroCAD is provided below in **Table 3-4**. Full HydroCAD modelling output is provided in **Appendix C**.

**Table 3-4: Summary of Modelling Results (Park Street East)**

Return Period (Years)	Post-Development Release Rate (L/s)	Allowable Release Rate, Q <sub>a</sub> (L/s)
2	0.6	9.3
5	0.8	9.7
10	1.0	10.1
25	1.3	10.7
50	1.5	11.3
100	1.7	11.8

Therefore, as shown in **Table 3-4**, the post-development release rate to Park Street East is less than the allowable release rate for all storms up to and including the 100-year storm event without any additional water quantity control measures.



## 4 CONCLUSIONS

A stormwater management report has been prepared to support the rezoning application for the proposed development at 42, 44 and 46 Park Street East and 23 Elizabeth Street North in the City of Mississauga. The key points are summarized below:

### **Runoff Volume Reduction**

The site is required to retain the runoff volume from a 5 mm rainfall event, which is equivalent to 9.00 m<sup>3</sup>, for water reuse. A sump volume of 9.35 m<sup>3</sup> is provided in the stormwater cistern. The reuse method of the stored runoff is still to be determined but could include irrigation of the landscaped areas and cleaning and maintenance of the building's facilities.

### **Water Quality**

A PMSU2015-4 oil and grit separator is proposed to provide the required Enhanced level protection by capturing 99.6% of the annual runoff and removing 88.4% of the TSS for the areas discharging to Elizabeth Street North. No quality control is provided for the small uncontrolled area discharging to Park Street East due to grading constraints.

### **Erosion Control**

No long-term erosion control is required for the proposed development. Temporary erosion and sediment controls will be provided to minimize impacts during construction. More details are provided under a separate cover.

### **Water Quantity**

The stormwater cistern has a total available storage of 106.8 m<sup>3</sup> and will be controlled by a pump located 0.35 m above the base of the cistern with a maximum discharge rate of 6.5 L/s. The pump will discharge to a discharge manhole where a 75 mm orifice tube, located at the base of the manhole, further controls the discharge before it flows by gravity to the municipal storm sewer on Elizabeth Street North. A small area of the site will discharge uncontrolled to Park Street East. Post-development flows have been controlled to below the allowable release rate for the site.

The 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 Mississauga Development Requirements Manual.

## 5 BIBLIOGRAPHY

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# APPENDIX

**A**

## Stormwater Management Calculations

**Stormwater Management Calculations****Project:** 42-46 Park Street East and 23 Elizabeth Street North**No.:** 20M-00430-00**Existing Offsite Discharge Rate to Elizabeth Street North****By:** GW**Checked:** IS**Date:** 4/30/2020**Page:**

1

Calculation of existing runoff rate is undertaken using the Rational Method:  $Q = 0.0028 \text{ CIA}$ Where:  $Q$  = Peak flow rate ( $\text{m}^3/\text{seconds}$ ) $C$  = Runoff coefficient $I$  = Rainfall intensity ( $\text{mm}/\text{hour}$ ) $A$  = Catchment area (hectares)Project Area,  $A$  **0.08** hectares

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

Where:  $A$ ,  $B$  and  $C$  = Parameters defined in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual $I$  = Rainfall intensity ( $\text{mm}/\text{hour}$ ) $t_c$  = Time of concentration (hours)

Return Period (Years)	2	5	10	25	50	100
$A$	610.0	820.0	1010.0	1160.0	1300.0	1450.0
$B$	4.6	4.6	4.6	4.6	4.7	4.9
$C$	0.78	0.78	0.78	0.78	0.78	0.78
$T$ (mins) *	15	15	15	15	15	15
$I$ ( $\text{mm}/\text{hr}$ )	59.9	80.5	99.2	113.9	127.1	140.7
$C$ (-)**	0.53	0.53	0.53	0.59	0.60	0.61
$Q$ ( $\text{m}^3/\text{sec}$ )	0.01	0.01	0.01	0.01	0.02	0.02
$Q$ ( $\text{L}/\text{sec}$ )	7.1	9.5	11.7	14.8	17.0	19.1

\*Note: Recommended minimum value for time of concentration is 15 minutes, as stated in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual.

\*\*Note: Please see Page 6 of Appendix A to see the adjusted runoff coefficient using the adjustment factors specified in the City's manual



**Stormwater Management Calculations**

**Project:** 42-46 Park Street East and 23 Elizabeth Street North

**No.:** 20M-00430-00

**Existing Offsite Discharge Rate to Park Street East**

**By:** GW

**Checked:** IS

**Date:** 4/30/2020

**Page:**

2

Calculation of existing runoff rate is undertaken using the Rational Method:  $Q = 0.0028 \text{ CIA}$

Where:  $Q$  = Peak flow rate ( $\text{m}^3/\text{seconds}$ )

$C$  = Runoff coefficient

$I$  = Rainfall intensity ( $\text{mm}/\text{hour}$ )

$A$  = Catchment area (hectares)

Project Area,  $A$  0.10 hectares

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

Where:  $A$ ,  $B$  and  $C$  = Parameters defined in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual

$I$  = Rainfall intensity ( $\text{mm}/\text{hour}$ )

$t_c$  = Time of concentration (hours)

Return Period (Years)	2	5	10	25	50	100
$A$	610.0	820.0	1010.0	1160.0	1300.0	1450.0
$B$	4.6	4.6	4.6	4.6	4.7	4.9
$C$	0.78	0.78	0.78	0.78	0.78	0.78
$T$ (mins) *	15	15	15	15	15	15
$I$ ( $\text{mm}/\text{hr}$ )	59.9	80.5	99.2	113.9	127.1	140.7
$C$ (-)**	0.60	0.60	0.60	0.66	0.67	0.68
$Q$ ( $\text{m}^3/\text{sec}$ )	0.01	0.01	0.02	0.02	0.02	0.03
$Q$ ( $\text{L}/\text{sec}$ )	9.6	12.9	15.8	20.0	22.9	25.6

\*Note: Recommended minimum value for time of concentration is 15 minutes, as stated in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual.

\*\*Note: Please see Page 6 of Appendix A to see the adjusted runoff coefficient using the adjustment factors specified in the City's manual

**Stormwater Management Calculations****Project:** 42-46 Park Street East and 23 Elizabeth Street North**No.:** 20M-00430-00**Allowable Offsite Discharge Rate to Elizabeth Street North****By:** GW**Date:** 4/30/2020**Checked:** IS**Page:**

3

Calculation of existing runoff rate is undertaken using the Rational Method:  $Q = 0.0028 \text{ CIA}$

Where:  $Q$  = Peak flow rate ( $\text{m}^3/\text{seconds}$ )

$C$  = Runoff coefficient

$I$  = Rainfall intensity ( $\text{mm}/\text{hour}$ )

$A$  = Catchment area (hectares)

Project Area,  $A$  **0.08** hectares

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

Where:  $A$ ,  $B$  and  $C$  = Parameters defined in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual

$I$  = Rainfall intensity ( $\text{mm}/\text{hour}$ )

$t_c$  = Time of concentration (hours)

Return Period (Years)	2
A	610.0
B	4.6
C	0.78
T (mins) *	15
I (mm/hr)	59.9
C (-)**	0.50
Q ( $\text{m}^3/\text{sec}$ )	0.01
Q (L/sec)	6.6

\*Note: Recommended minimum value for time of concentration is 15 minutes, as stated in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual.

\*\*Note: From the City of Mississauga Development Requirements Manual, the maximum runoff coefficient to be used to calculate the pre-development flow is 0.50 for a site that may already be developed.

**Stormwater Management Calculations****Project:** 42-46 Park Street East and 23 Elizabeth Street North**No.:** 20M-00430-00**Allowable Offsite Discharge Rate to Park Street East****By:** GW**Checked:** IS**Date:** 4/30/2020**Page:**

4

Calculation of existing runoff rate is undertaken using the Rational Method:  $Q = 0.0028 \text{ CIA}$

Where:  $Q$  = Peak flow rate ( $\text{m}^3/\text{seconds}$ )

$C$  = Runoff coefficient

$I$  = Rainfall intensity ( $\text{mm}/\text{hour}$ )

$A$  = Catchment area (hectares)

Project Area,  $A$   hectares

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

Where:  $A$ ,  $B$  and  $C$  = Parameters defined in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual

$I$  = Rainfall intensity ( $\text{mm}/\text{hour}$ )

$t_c$  = Time of concentration (hours)

Return Period (Years)	2
A	610.0
B	4.6
C	0.78
T (mins) *	15
I (mm/hr)	59.9
C (-)**	0.50
Q ( $\text{m}^3/\text{sec}$ )	0.01
Q (L/sec)	8.0

\*Note: Recommended minimum value for time of concentration is 15 minutes, as stated in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual.

\*\*Note: From the City of Mississauga Development Requirements Manual, the maximum runoff coefficient to be used to calculate the pre-development flow is 0.50 for a site that may already be developed.

**Stormwater Management Calculations****Project:** 42-46 Park Street East and 23 Elizabeth Street North**No.:** 20M-00430-00**External Area Discharge Rate****By:** GW**Checked:** IS**Date:** 4/30/2020**Page:**

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Calculation of existing runoff rate is undertaken using the Rational Method:  $Q = 0.0028 \text{ CIA}$

Where:  $Q$  = Peak flow rate ( $\text{m}^3/\text{seconds}$ )

$C$  = Runoff coefficient

$I$  = Rainfall intensity ( $\text{mm}/\text{hour}$ )

$A$  = Catchment area (hectares)

Project Area,  $A$  0.03 hectares

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

Where:  $A$ ,  $B$  and  $C$  = Parameters defined in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual

$I$  = Rainfall intensity ( $\text{mm}/\text{hour}$ )

$t_c$  = Time of concentration (hours)

Return Period (Years)	2	5	10	25	50	100
$A$	610.0	820.0	1010.0	1160.0	1300.0	1450.0
$B$	4.6	4.6	4.6	4.6	4.7	4.9
$C$	0.78	0.78	0.78	0.78	0.78	0.78
$T$ (mins) *	15	15	15	15	15	15
$I$ (mm/hr)	59.9	80.5	99.2	113.9	127.1	140.7
$C$ (-)**	0.27	0.27	0.27	0.30	0.32	0.33
$Q$ ( $\text{m}^3/\text{sec}$ )	0.00	0.00	0.00	0.00	0.00	0.00
$Q$ (L/sec)	1.3	1.7	2.1	2.7	3.3	3.8

\*Note: Recommended minimum value for time of concentration is 15 minutes, as stated in Section 2.01.01.01 of the City of Mississauga Development Requirements Manual.

\*\*Note: Please see Page 6 of Appendix A to see the adjusted runoff coefficient using the adjustment factors specified in the City's manual



**Stormwater Management Calculations****Project:** 42-46 Park Street East and  
23 Elizabeth Street North**No.:** 20M-00430-00**Weighted Runoff Coefficient  
Calculations****By:** GW**Date:** 4/30/2020**Checked:** IS**Page:**

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For less frequent storms an Adjustment Factor (Ca) should be used and the Rational Formula to be modified accordingly to:  $Q \text{ (Flow)} = A \text{ (Area)} \times C \text{ (Runoff Coefficient)} \times C_a \text{ (Adjustment Factor)} \times I \text{ (Rainfall Intensity)}$

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 the City of Mississauga Development Requirements Manual (September 2016) Section 2.01.01.01

Existing Conditions (Elizabeth Street North)		Adjusted Runoff Coefficients C, Return Period (Years)					
Land Use	Area (m <sup>2</sup> )	2	5	10	25	50	100
Impervious Roof	223	0.90	0.90	0.90	0.99	1.00	1.00
Soft Landscaping	449	0.25	0.25	0.25	0.28	0.30	0.31
Impervious At-Grade	120	0.90	0.90	0.90	0.99	1.00	1.00
<b>Total Area</b>	<b>792</b>	<b>0.53</b>	<b>0.53</b>	<b>0.53</b>	<b>0.59</b>	<b>0.60</b>	<b>0.61</b>

Existing Conditions (Park Street East)		Adjusted Runoff Coefficients C, Return Period (Years)					
Land Use	Area (m <sup>2</sup> )	2	5	10	25	50	100
Impervious Roof	298	0.90	0.90	0.90	0.99	1.00	1.00
Soft Landscaping	444	0.25	0.25	0.25	0.28	0.30	0.31
Impervious At-Grade	212	0.90	0.90	0.90	0.99	1.00	1.00
<b>Total Area</b>	<b>954</b>	<b>0.60</b>	<b>0.60</b>	<b>0.60</b>	<b>0.66</b>	<b>0.67</b>	<b>0.68</b>

External Area		Adjusted Runoff Coefficients C, Return Period (Years)					
Land Use	Area (m <sup>2</sup> )	2	5	10	25	50	100
Soft Landscaping	276	0.25	0.25	0.25	0.28	0.30	0.31
Impervious At-Grade	9	0.90	0.90	0.90	0.99	1.00	1.00
<b>Total Area</b>	<b>285</b>	<b>0.27</b>	<b>0.27</b>	<b>0.27</b>	<b>0.30</b>	<b>0.32</b>	<b>0.33</b>

Proposed Conditions (Controlled to Elizabeth Street North)		Adjusted Runoff Coefficients C, Return Period (Years)					
Land Use	Area (m <sup>2</sup> )	2	5	10	25	50	100
Impervious Roof Area	1379	0.90	0.90	0.90	0.99	1.00	1.00
Soft Landscaping	193	0.25	0.25	0.25	0.28	0.30	0.31
At-Grade Impervious	182	0.90	0.90	0.90	0.99	1.00	1.00
<b>Total Area</b>	<b>1755</b>	<b>0.83</b>	<b>0.83</b>	<b>0.83</b>	<b>0.91</b>	<b>0.92</b>	<b>0.92</b>

Proposed Conditions (Uncontrolled to Park Street East)		Adjusted Runoff Coefficients C, Return Period (Years)					
Land Use	Area (m <sup>2</sup> )	2	5	10	25	50	100
Soft Landscaping	5	0.25	0.25	0.25	0.28	0.30	0.31
At-Grade Impervious	41	0.90	0.90	0.90	0.99	1.00	1.00
<b>Total Area</b>	<b>46</b>	<b>0.83</b>	<b>0.83</b>	<b>0.83</b>	<b>0.92</b>	<b>0.93</b>	<b>0.93</b>

**Stormwater Management Calculations****Project:** 42-46 Park Street East  
and 23 Elizabeth Street  
North**No.:** 20M-00430-00**Runoff Volume Reduction****By:** GW**Date:** 4/30/2020**Checked:** IS**Page:**

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The City of Mississauga Development Requirements Manual requires that "the first 5mm of runoff shall be retained on-site and managed by way of infiltration, evapotranspiration or re-use."

From previous experiences, it was noted that the City of Mississauga does not consider initial abstractions when calculating the 5 mm runoff volume. This is a more conservative approach and has been accounted for in the calculations below.

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

Land Use	Area (m <sup>2</sup> )	Runoff C	Impervious
Impervious Roof Area	1,379	0.90	100%
Soft Landscaping	198	0.25	0%
At-Grade Impervious	223	0.90	100%
<b>Total Site Area:</b>	<b>1,800</b>	<b>0.83</b>	<b>89%</b>

Surface Type	Area (m <sup>2</sup> )	5 mm Volume (m <sup>3</sup> )
Impervious Roof Area	1,379	6.90
Soft Landscaping	198	0.99
At-Grade Impervious	223	1.12
<b>Total:</b>	<b>1,800</b>	<b>9.00</b>

Therefore, volume of runoff during a 5 mm storm event: **9.00** m<sup>3</sup>

**Stormwater Management Calculations****Project:****42-46 Park Street East  
and 23 Elizabeth Street  
North****No.:****20M-00430-00****Orifice Calculation - Peak****By:****CW****Date:****4/30/2020****Page:****8****Elevation****Checked:****IS**

Discharge for a circular orifice is given by the following formula:

$$Q = Ca(2gh)^{0.5}$$

Where: Q = Flow rate ( $\text{m}^3/\text{s}$ )

C = Discharge coefficient (unitless)

a = Submerged area ( $\text{m}^2$ )

g = Gravitational constant ( $\text{m}/\text{s}^2$ )

h = Effective head (m)

For an orifice opening in a vertical plane, the effective head is given by the following formulae:

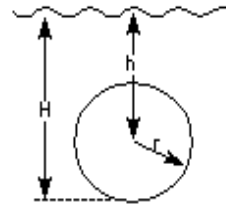
Fully Submerged:

$$h = H - \max(r, TW)$$

Where: H = Head above invert level (m)

r = Radius of orifice (m)

TW = Tailwater depth above invert level (m)

**Variables:**

C = **0.8** - (Orifice Tube, C = 0.8/Orifice Plate, C = 0.6)

Orifice diameter = **75** mm

r = **37.5** mm

r = **0.038** m

a = **0.00442**  $\text{sqm}$

g = **9.81**  $\text{m}/\text{s}^2$

H = **0.215** m

TW = **0.00** m (0.00 = assume free discharge)

h = **0.18** m

**Calculation:**

Q = **0.00660**  $\text{m}^3/\text{s}$

Q = **6.60** l/sec

Therefore, the maximum ponding above the orifice invert is 0.215 m to ensure that the flows release is below the allowable release rate.



# APPENDIX

## B

### Water Quality Unit Sizing Report





**CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION  
BASED ON THE RATIONAL RAINFALL METHOD  
BASED ON A FINE PARTICLE SIZE DISTRIBUTION**



**Project Name:** 42-46 Park St E & 23 Elizabeth St

**Engineer:** WSP

**Location:** Mississauga, ON

**Contact:** G. Wong, EIT

**OGS #:** OGS

**Report Date:** 30-Apr-20

**Area** 0.21 ha

**Rainfall Station #** 206

**Weighted C** 0.75

**Particle Size Distribution** FINE

**CDS Model** 2015-4

**CDS Treatment Capacity** 20 l/s

<u>Rainfall Intensity<sup>1</sup></u> (mm/hr)	<u>Percent Rainfall Volume<sup>1</sup></u>	<u>Cumulative Rainfall Volume</u>	<u>Total Flowrate (l/s)</u>	<u>Treated Flowrate (l/s)</u>	<u>Operating Rate (%)</u>	<u>Removal Efficiency (%)</u>	<u>Incremental Removal (%)</u>
0.5	9.9%	9.9%	0.2	0.2	1.1	98.5	9.8
1.0	10.7%	20.6%	0.4	0.4	2.2	98.2	10.5
1.5	9.8%	30.4%	0.7	0.7	3.3	97.9	9.6
2.0	8.9%	39.3%	0.9	0.9	4.4	97.6	8.7
2.5	7.2%	46.4%	1.1	1.1	5.5	97.3	7.0
3.0	6.1%	52.5%	1.3	1.3	6.6	97.0	5.9
3.5	3.4%	55.9%	1.5	1.5	7.7	96.6	3.3
4.0	5.0%	60.9%	1.8	1.8	8.8	96.3	4.9
4.5	4.2%	65.1%	2.0	2.0	9.9	96.0	4.0
5.0	3.2%	68.3%	2.2	2.2	11.0	95.7	3.1
6.0	5.4%	73.8%	2.6	2.6	13.3	95.1	5.2
7.0	4.2%	77.9%	3.1	3.1	15.5	94.4	3.9
8.0	4.0%	81.9%	3.5	3.5	17.7	93.8	3.7
9.0	2.4%	84.3%	3.9	3.9	19.9	93.2	2.3
10.0	2.7%	87.0%	4.4	4.4	22.1	92.5	2.5
15.0	6.1%	93.0%	6.6	6.6	33.1	89.4	5.4
20.0	2.8%	95.8%	8.8	8.8	44.2	86.2	2.4
25.0	1.8%	97.7%	10.9	10.9	55.2	83.0	1.5
30.0	1.0%	98.7%	13.1	13.1	66.3	79.9	0.8
35.0	0.3%	99.0%	15.3	15.3	77.3	76.7	0.2
40.0	0.6%	99.6%	17.5	17.5	88.3	73.5	0.4
45.0	0.0%	99.6%	19.7	19.7	99.4	70.4	0.0
50.0	0.0%	99.6%	21.9	19.8	100.0	63.6	0.0
							94.9

Removal Efficiency Adjustment<sup>2</sup> = 6.5%

**Predicted Net Annual Load Removal Efficiency = 88.4%**

**Predicted % Annual Rainfall Treated = 99.6%**

1 - Based on 65 years of hourly rainfall data from Canadian Station 6158350, Toronto ON (Bloor)

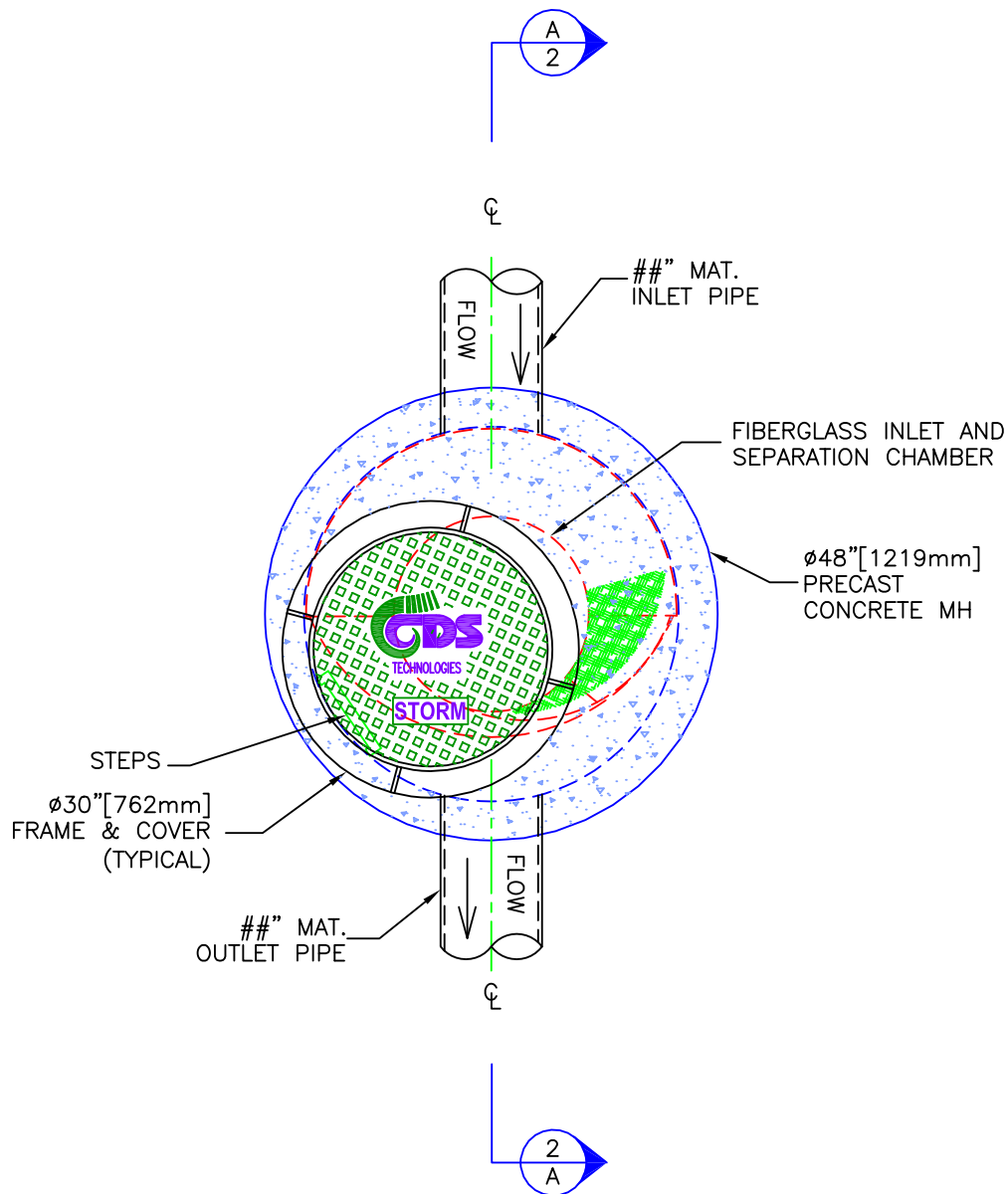
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

3 - CDS Efficiency based on testing conducted at the University of Central Florida

4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications



## PLAN VIEW



### CDS MODEL PMSU20\_15\_4m STORMWATER TREATMENT UNIT



PROJECT NAME  
CITY, STATE

JOB# XX-##-###

DATE ##/##/##

DRAWN INITIALS

APPROV.

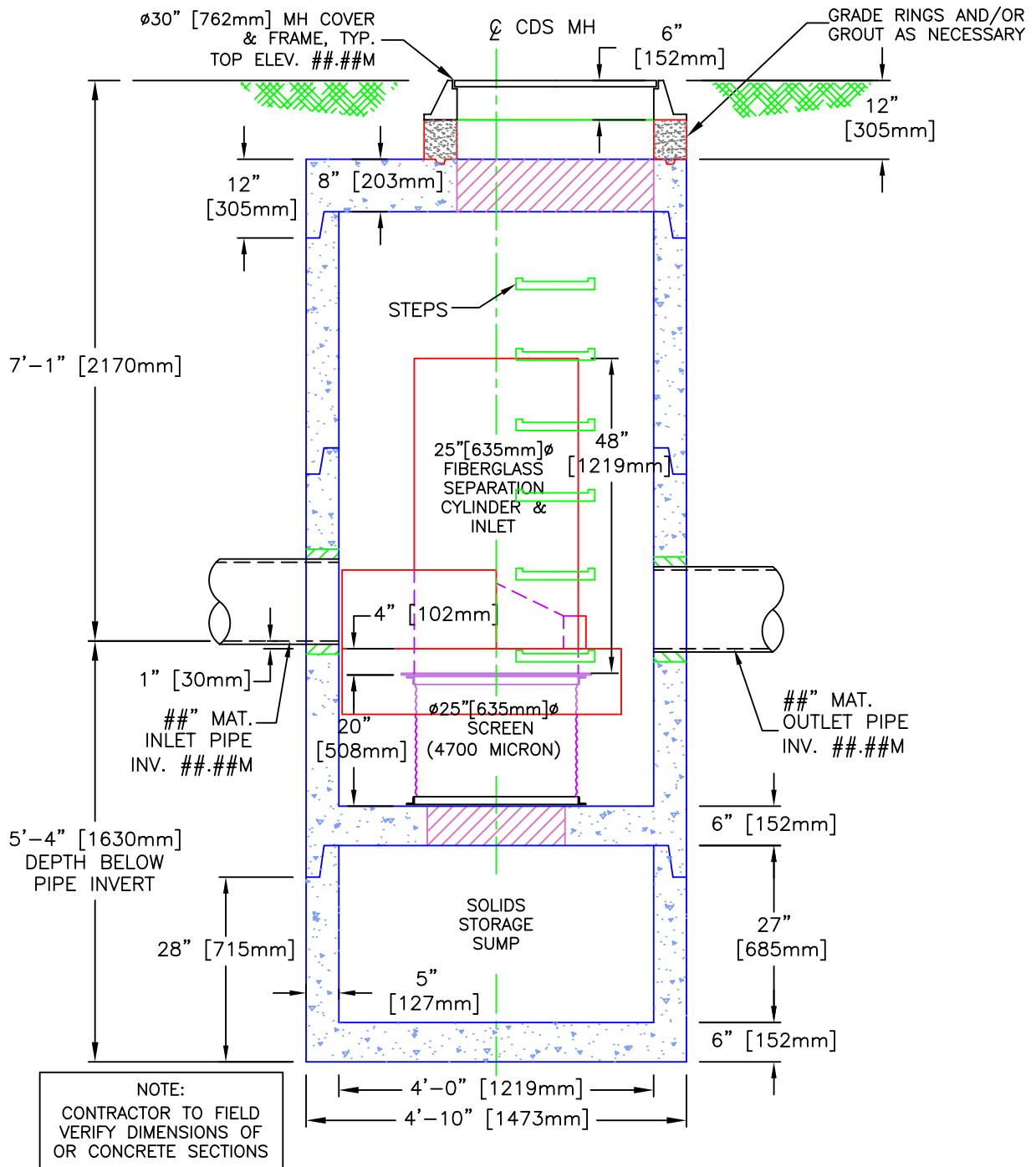
SCALE  
1" = 2'

SHEET

1



## SECTION A-A ELEVATION VIEW



**CDS MODEL PMSU20\_15\_4m  
STORMWATER TREATMENT UNIT**



**PROJECT NAME**  
CITY, STATE

JOB# XX-##-###

DATE ##/##/##

DRAWN INITIALS

APPROV.

SCALE  
1" = 2'

SHEET

2



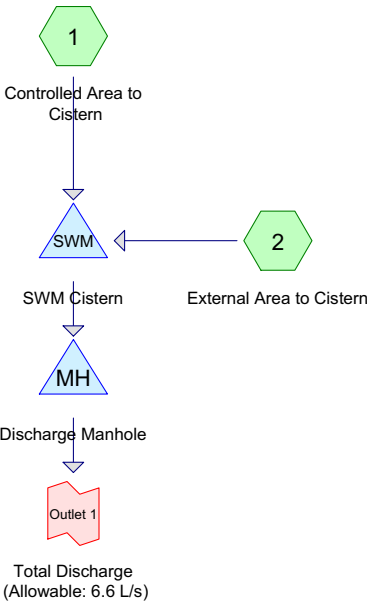


# APPENDIX

# C

Hydrologic Model Output  
(HydroCAD)

Discharging to  
Elizabeth Street North



Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
191.4	0.90	At-grade Impervious (1, 2)
1,379.4	0.90	Impervious Roof (1)
468.7	0.25	Soft Landscaping (1, 2)
2,039.5	0.75	TOTAL AREA

Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
2,039.5	Other	1, 2
2,039.5		TOTAL AREA

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Sub Nur
0.0	0.0	0.0	0.0	191.4	191.4	At-grade Impervious	
0.0	0.0	0.0	0.0	1,379.4	1,379.4	Impervious Roof	
0.0	0.0	0.0	0.0	468.7	468.7	Soft Landscaping	
0.0	0.0	0.0	0.0	2,039.5	2,039.5	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

**Subcatchment1: Controlled Area to** Runoff Area=1,754.6 m<sup>2</sup> 0.00% Impervious Runoff Depth=22 mm  
 Tc=15.0 min C=0.83 Runoff=0.0071 m<sup>3</sup>/s 38.3 m<sup>3</sup>

**Subcatchment2: External Area to Cistern** Runoff Area=284.9 m<sup>2</sup> 0.00% Impervious Runoff Depth=7 mm  
 Tc=15.0 min C=0.27 Runoff=0.0004 m<sup>3</sup>/s 2.0 m<sup>3</sup>

**Pond MH: Discharge Manhole** Peak Elev=0.083 m Storage=0.1 m<sup>3</sup> Inflow=0.0033 m<sup>3</sup>/s 35.3 m<sup>3</sup>  
 Outflow=0.0033 m<sup>3</sup>/s 35.3 m<sup>3</sup>

**Pond SWM: SWM Cistern** Peak Elev=1.449 m Storage=38.7 m<sup>3</sup> Inflow=0.0075 m<sup>3</sup>/s 40.3 m<sup>3</sup>  
 Outflow=0.0033 m<sup>3</sup>/s 35.3 m<sup>3</sup>

**Link Outlet 1: Total Discharge (Allowable: 6.6 L/s)** Inflow=0.0033 m<sup>3</sup>/s 35.3 m<sup>3</sup>  
 Primary=0.0033 m<sup>3</sup>/s 35.3 m<sup>3</sup>

Total Runoff Area = 2,039.5 m<sup>2</sup> Runoff Volume = 40.3 m<sup>3</sup> Average Runoff Depth = 20 mm  
 100.00% Pervious = 2,039.5 m<sup>2</sup> 0.00% Impervious = 0.0 m<sup>2</sup>

### Summary for Subcatchment 1: Controlled Area to Cistern

Runoff = 0.0071 m<sup>3</sup>/s @ 0.25 hrs, Volume= 38.3 m<sup>3</sup>, Depth= 22 mm

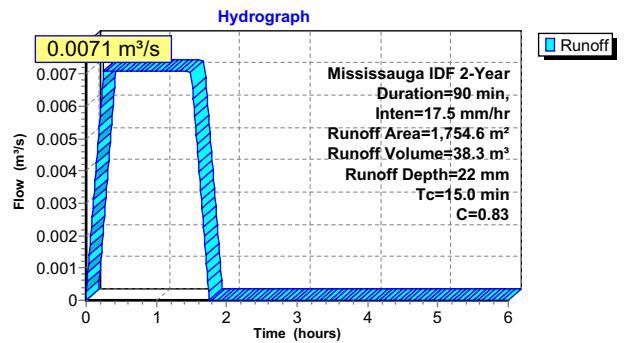
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Mississauga IDF 2-Year Duration=90 min, Inten=17.5 mm/hr

Area (m <sup>2</sup> )	C	Description
1,379.4	0.90	Impervious Roof
192.8	0.25	Soft Landscaping
182.4	0.90	At-grade Impervious
1,754.6	0.83	Weighted Average
1,754.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m <sup>3</sup> /s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 1: Controlled Area to Cistern



### Summary for Subcatchment 2: External Area to Cistern

Runoff = 0.0004 m<sup>3</sup>/s @ 0.25 hrs, Volume= 2.0 m<sup>3</sup>, Depth= 7 mm

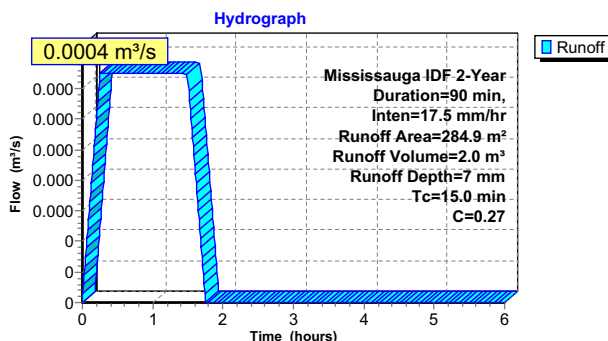
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Mississauga IDF 2-Year Duration=90 min, Inten=17.5 mm/hr

Area (m <sup>2</sup> )	C	Description
275.9	0.25	Soft Landscaping
9.0	0.90	At-grade Impervious
284.9	0.27	Weighted Average
284.9		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m <sup>3</sup> /s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 2: External Area to Cistern



### Summary for Pond MH: Discharge Manhole

Inflow Area = 2,039.5 m<sup>2</sup>, 0.00% Impervious, Inflow Depth > 17 mm for 2-Year event  
 Inflow = 0.0033 m<sup>3</sup>/s @ 1.64 hrs, Volume= 35.3 m<sup>3</sup>  
 Outflow = 0.0033 m<sup>3</sup>/s @ 1.65 hrs, Volume= 35.3 m<sup>3</sup>, Atten= 0%, Lag= 0.6 min  
 Primary = 0.0033 m<sup>3</sup>/s @ 1.65 hrs, Volume= 35.3 m<sup>3</sup>

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Peak Elev= 0.083 m @ 1.65 hrs Surf.Area= 1.1 m<sup>2</sup> Storage= 0.1 m<sup>3</sup>

Plug-Flow detention time= 0.5 min calculated for 35.3 m<sup>3</sup> (100% of inflow)  
 Center-of-Mass det. time= 0.4 min ( 155.8 - 155.4 )

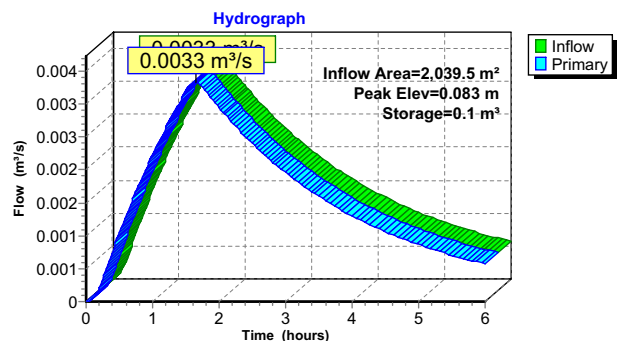
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	2.3 m <sup>3</sup>	1.20 mD x 2.00 mH Vertical Cone/Cylinder

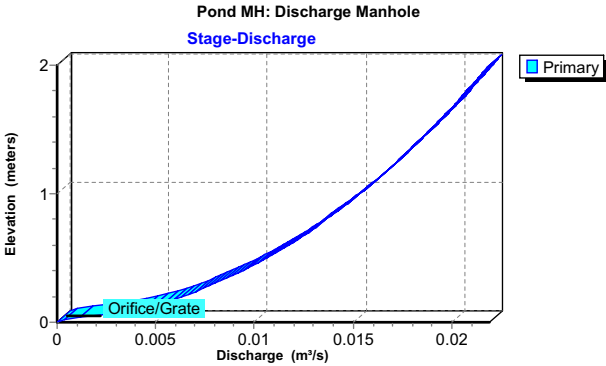
  

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.800

**Primary OutFlow** Max=0.0033 m<sup>3</sup>/s @ 1.65 hrs HW=0.083 m (Free Discharge)  
 1=Orifice/Grate (Orifice Controls 0.0033 m<sup>3</sup>/s @ 0.76 m/s)

### Pond MH: Discharge Manhole





Summary for Pond SWM: SWM Cistern

Located in the underground parking garage

Inflow Area =	2,039.5 m²	0.00% Impervious,	Inflow Depth =	20 mm	for 2-Year event
Inflow =	0.0075 m³/s @	0.25 hrs,	Volume=	40.3 m³	
Outflow =	0.0033 m³/s @	1.64 hrs,	Volume=	35.3 m³	Atten= 55%, Lag= 83.3 min
Primary =	0.0033 m³/s @	1.64 hrs,	Volume=	35.3 m³	

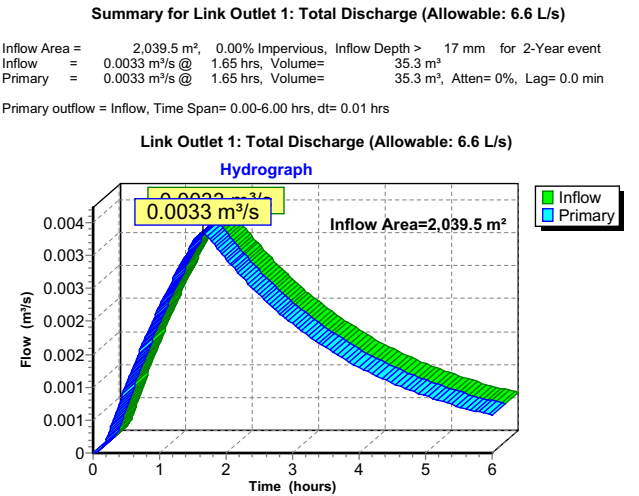
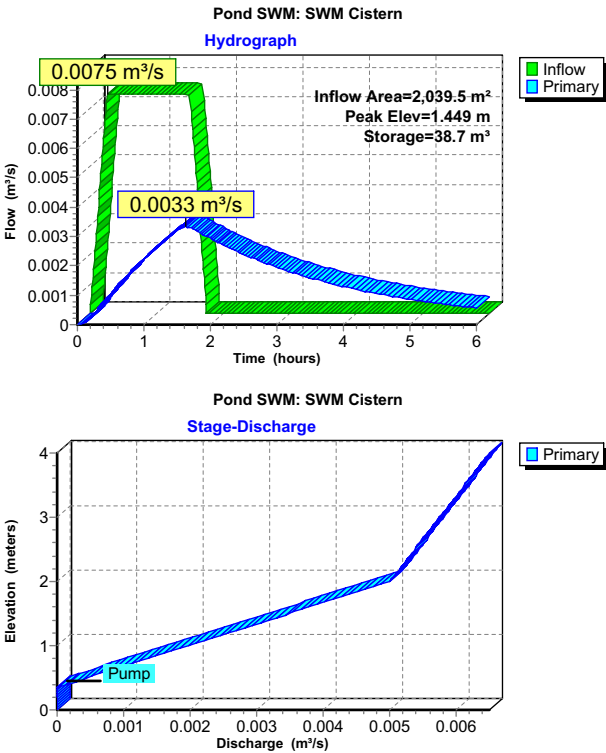
Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3  
Starting Elev= 0.350 m Surf.Area= 26.7 m² Storage= 9.3 m³  
Peak Elev= 1.449 m @ 1.64 hrs Surf.Area= 26.7 m² Storage= 38.7 m³ (29.3 m³ above start)

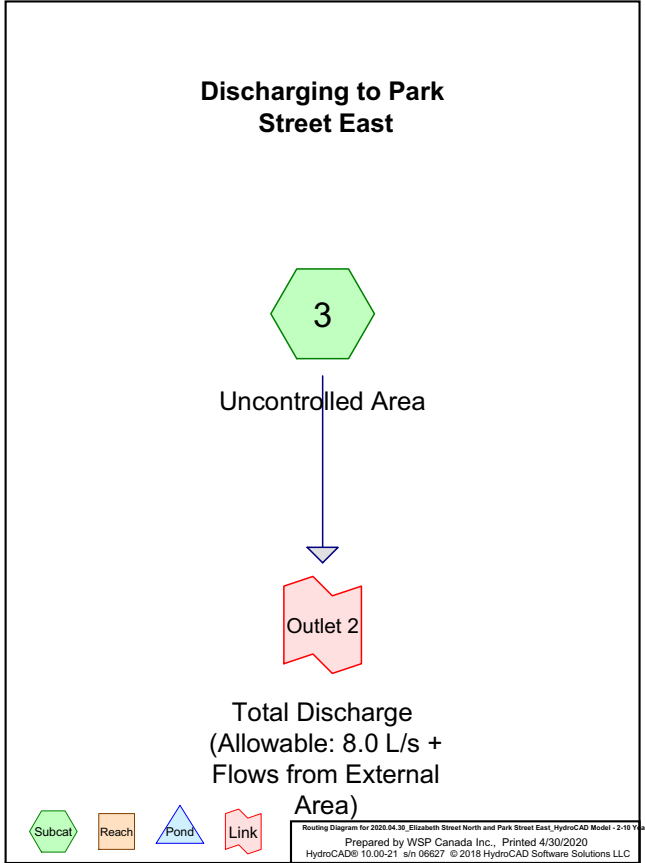
Plug-Flow detention time= 152.3 min calculated for 26.0 m³ (64% of inflow)  
Center-of-Mass det. time= 102.9 min ( 155.4 - 52.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	106.8 m³	1.00 mW x 26.70 mL x 4.00 mH Prismatoid

Device	Routing	Invert	Outlet Devices
#1	Primary	0.350 m	Pump
			Discharges@4.000 m
			Flow (l/min)= 0.0 300.0 390.0
			Head (meters)= 3.650 2.000 0.000

Primary OutFlow Max=0.0033 m³/s @ 1.64 hrs HW=1.449 m (Free Discharge)  
Pump (Pump Controls 0.0033 m³/s)





Area Listing (selected nodes)		
Area (sq-meters)	C	Description (subcatchment-numbers)
40.9	0.90	At-grade Impervious (3)
4.7	0.25	Soft Landscaping (3)
45.6	0.83	TOTAL AREA

Soil Listing (selected nodes)		
Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
45.6	Other	3
45.6		TOTAL AREA

Ground Covers (selected nodes)							Sub Nur
HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	
0.0	0.0	0.0	0.0	40.9	40.9	At-grade Impervious	
0.0	0.0	0.0	0.0	4.7	4.7	Soft Landscaping	
0.0	0.0	0.0	0.0	45.6	45.6	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

Subcatchment3: Uncontrolled Area Runoff Area=45.6 m² 0.00% Impervious Runoff Depth=12 mm  
Tc=15.0 min C=0.83 Runoff=0.0006 m³/s 0.6 m³

Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Inflow=0.0006 m³/s 0.6 m³  
Primary=0.0006 m³/s 0.6 m³

Total Runoff Area = 45.6 m² Runoff Volume = 0.6 m³ Average Runoff Depth = 12 mm  
100.00% Pervious = 45.6 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 3: Uncontrolled Area

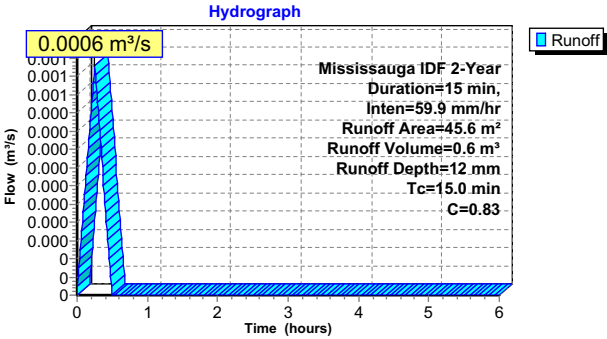
Runoff = 0.0006 m³/s @ 0.25 hrs, Volume= 0.6 m³, Depth= 12 mm

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
4.7	0.25	Soft Landscaping
40.9	0.90	At-grade Impervious
45.6	0.83	Weighted Average
45.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

Subcatchment 3: Uncontrolled Area

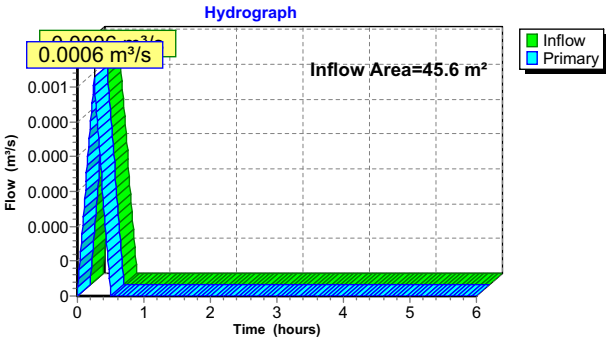


Summary for Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)

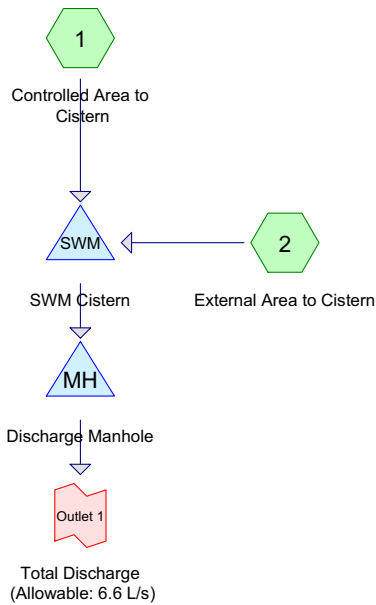
Inflow Area = 45.6 m², 0.00% Impervious, Inflow Depth = 12 mm for 2-Year event  
Inflow = 0.0006 m³/s @ 0.25 hrs, Volume= 0.6 m³  
Primary = 0.0006 m³/s @ 0.25 hrs, Volume= 0.6 m³, Atten= 0%, Lag= 0.0 min

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

Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)



Discharging to  
Elizabeth Street North



Routing Diagram for 2020.04.30\_Elizabeth Street North and Park Street East\_HydroCAD Model - 2-10 Year  
Prepared by WSP Canada Inc., Printed 4/30/2020  
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Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
191.4	0.90	At-grade Impervious (1, 2)
1,379.4	0.90	Impervious Roof (1)
468.7	0.25	Soft Landscaping (1, 2)
2,039.5	0.75	TOTAL AREA

Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
2,039.5	Other	1, 2
2,039.5		TOTAL AREA

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Sub Nur
0.0	0.0	0.0	0.0	191.4	191.4	At-grade Impervious	
0.0	0.0	0.0	0.0	1,379.4	1,379.4	Impervious Roof	
0.0	0.0	0.0	0.0	468.7	468.7	Soft Landscaping	
0.0	0.0	0.0	0.0	2,039.5	2,039.5	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

**Subcatchment1: Controlled Area to** Runoff Area=1,754.6 m<sup>2</sup> 0.00% Impervious Runoff Depth=29 mm  
 Tc=15.0 min C=0.83 Runoff=0.0095 m<sup>3</sup>/s 51.5 m<sup>3</sup>

**Subcatchment2: External Area to Cistern** Runoff Area=284.9 m<sup>2</sup> 0.00% Impervious Runoff Depth=10 mm  
 Tc=15.0 min C=0.27 Runoff=0.0005 m<sup>3</sup>/s 2.7 m<sup>3</sup>

**Pond MH: Discharge Manhole** Peak Elev=0.119 m Storage=0.1 m<sup>3</sup> Inflow=0.0045 m<sup>3</sup>/s 47.5 m<sup>3</sup>  
 Outflow=0.0045 m<sup>3</sup>/s 47.4 m<sup>3</sup>

**Pond SWM: SWM Cistern** Peak Elev=1.827 m Storage=48.8 m<sup>3</sup> Inflow=0.0100 m<sup>3</sup>/s 54.2 m<sup>3</sup>  
 Outflow=0.0045 m<sup>3</sup>/s 47.5 m<sup>3</sup>

**Link Outlet 1: Total Discharge (Allowable: 6.6 L/s)** Inflow=0.0045 m<sup>3</sup>/s 47.4 m<sup>3</sup>  
 Primary=0.0045 m<sup>3</sup>/s 47.4 m<sup>3</sup>

Total Runoff Area = 2,039.5 m<sup>2</sup> Runoff Volume = 54.2 m<sup>3</sup> Average Runoff Depth = 27 mm  
 100.00% Pervious = 2,039.5 m<sup>2</sup> 0.00% Impervious = 0.0 m<sup>2</sup>

### Summary for Subcatchment 1: Controlled Area to Cistern

Runoff = 0.0095 m<sup>3</sup>/s @ 0.25 hrs, Volume= 51.5 m<sup>3</sup>, Depth= 29 mm

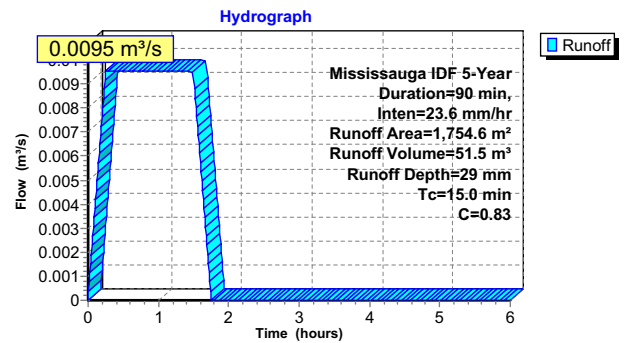
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Mississauga IDF 5-Year Duration=90 min, Inten=23.6 mm/hr

Area (m <sup>2</sup> )	C	Description
1,379.4	0.90	Impervious Roof
192.8	0.25	Soft Landscaping
182.4	0.90	At-grade Impervious
1,754.6	0.83	Weighted Average
1,754.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m <sup>3</sup> /s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 1: Controlled Area to Cistern



### Summary for Subcatchment 2: External Area to Cistern

Runoff = 0.0005 m<sup>3</sup>/s @ 0.25 hrs, Volume= 2.7 m<sup>3</sup>, Depth= 10 mm

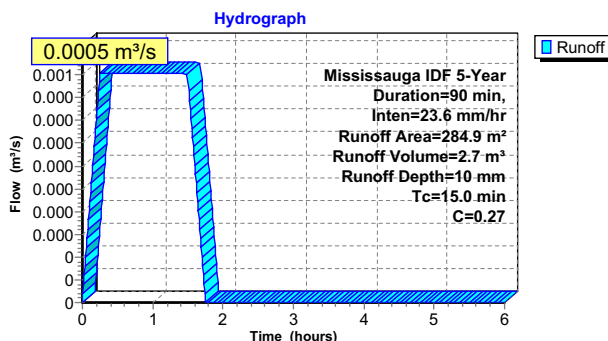
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Mississauga IDF 5-Year Duration=90 min, Inten=23.6 mm/hr

Area (m <sup>2</sup> )	C	Description
275.9	0.25	Soft Landscaping
9.0	0.90	At-grade Impervious
284.9	0.27	Weighted Average
284.9		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m <sup>3</sup> /s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 2: External Area to Cistern



### Summary for Pond MH: Discharge Manhole

Inflow Area = 2,039.5 m<sup>2</sup>, 0.00% Impervious, Inflow Depth > 23 mm for 5-Year event  
 Inflow = 0.0045 m<sup>3</sup>/s @ 1.64 hrs, Volume= 47.5 m<sup>3</sup>  
 Outflow = 0.0045 m<sup>3</sup>/s @ 1.65 hrs, Volume= 47.4 m<sup>3</sup>, Atten= 0%, Lag= 0.6 min  
 Primary = 0.0045 m<sup>3</sup>/s @ 1.65 hrs, Volume= 47.4 m<sup>3</sup>

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Peak Elev= 0.119 m @ 1.65 hrs Surf.Area= 1.1 m<sup>2</sup> Storage= 0.1 m<sup>3</sup>

Plug-Flow detention time= 0.5 min calculated for 47.4 m<sup>3</sup> (100% of inflow)  
 Center-of-Mass det. time= 0.4 min ( 155.8 - 155.4 )

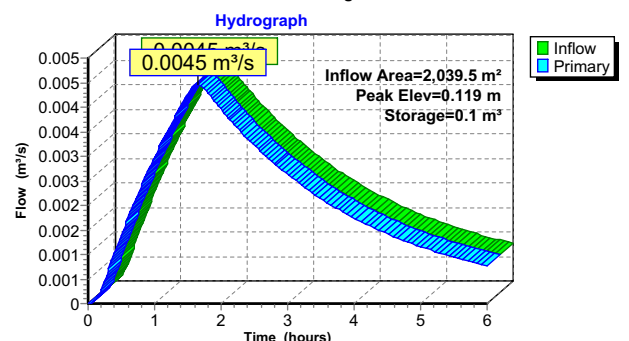
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	2.3 m <sup>3</sup>	1.20 mD x 2.00 mH Vertical Cone/Cylinder

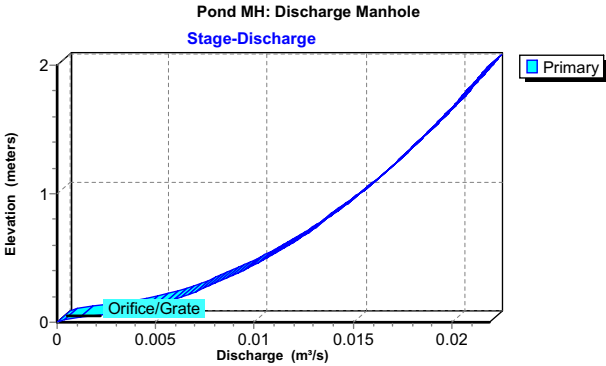
  

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.800

**Primary OutFlow** Max=0.0045 m<sup>3</sup>/s @ 1.65 hrs HW=0.119 m (Free Discharge)  
 1=Orifice/Grate (Orifice Controls 0.0045 m<sup>3</sup>/s @ 1.01 m/s)

### Pond MH: Discharge Manhole





Summary for Pond SWM: SWM Cistern

Located in the underground parking garage

Inflow Area =	2,039.5 m²	0.00% Impervious	Inflow Depth =	27 mm	for 5-Year event
Inflow =	0.0100 m³/s @	0.25 hrs	Volume=	54.2 m³	
Outflow =	0.0045 m³/s @	1.64 hrs	Volume=	47.5 m³	Atten= 55%, Lag= 83.3 min
Primary =	0.0045 m³/s @	1.64 hrs	Volume=	47.5 m³	

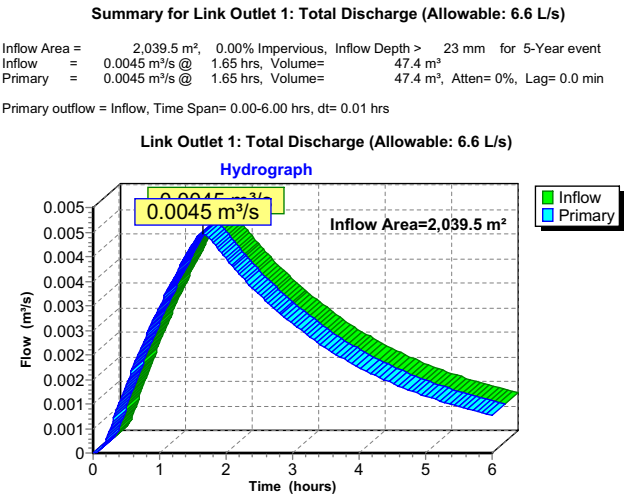
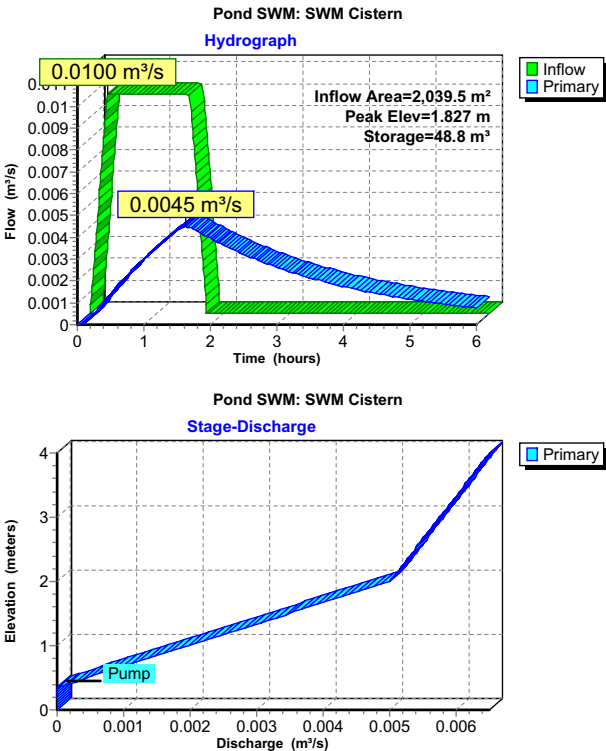
Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3  
Starting Elev= 0.350 m Surf.Area= 26.7 m² Storage= 9.3 m³  
Peak Elev= 1.827 m @ 1.64 hrs Surf.Area= 26.7 m² Storage= 48.8 m³ (39.4 m³ above start)

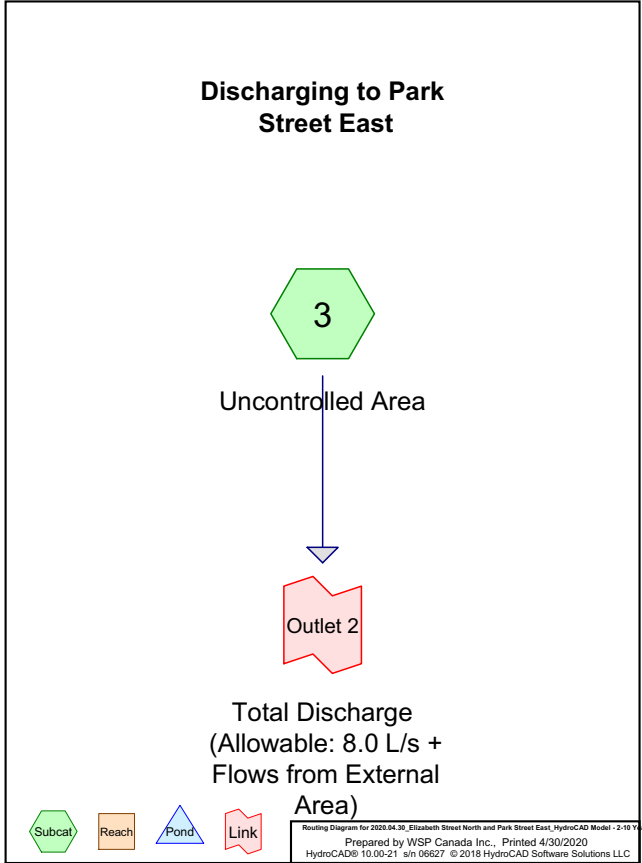
Plug-Flow detention time= 141.0 min calculated for 38.1 m³ (70% of inflow)  
Center-of-Mass det. time= 102.9 min ( 155.4 - 52.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	106.8 m³	1.00 mW x 26.70 mL x 4.00 mH Prismaoid

Device	Routing	Invert	Outlet Devices
#1	Primary	0.350 m	Pump
			Discharges@ 4.000 m
			Flow (l/min)= 0.0 300.0 390.0
			Head (meters)= 3.650 2.000 0.000

Primary OutFlow Max=0.0045 m³/s @ 1.64 hrs HW=1.827 m (Free Discharge)  
←1=Pump (Pump Controls 0.0045 m³/s)





Area Listing (selected nodes)		
Area (sq-meters)	C	Description (subcatchment-numbers)
40.9	0.90	At-grade Impervious (3)
4.7	0.25	Soft Landscaping (3)
45.6	0.83	TOTAL AREA

Soil Listing (selected nodes)		
Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
45.6	Other	3
45.6		TOTAL AREA

Ground Covers (selected nodes)							Sub Nur
HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	
0.0	0.0	0.0	0.0	40.9	40.9	At-grade Impervious	
0.0	0.0	0.0	0.0	4.7	4.7	Soft Landscaping	
0.0	0.0	0.0	0.0	45.6	45.6	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

Subcatchment3: Uncontrolled Area Runoff Area=45.6 m² 0.00% Impervious Runoff Depth=17 mm  
Tc=15.0 min C=0.83 Runoff=0.0008 m³/s 0.8 m³

Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Inflow=0.0008 m³/s 0.8 m³  
Primary=0.0008 m³/s 0.8 m³

Total Runoff Area = 45.6 m² Runoff Volume = 0.8 m³ Average Runoff Depth = 17 mm  
100.00% Pervious = 45.6 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 3: Uncontrolled Area

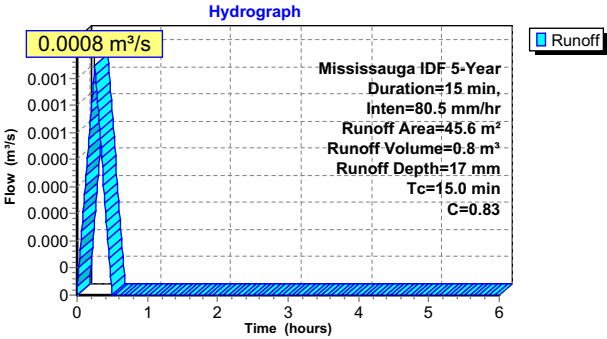
Runoff = 0.0008 m³/s @ 0.25 hrs, Volume= 0.8 m³, Depth= 17 mm

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
4.7	0.25	Soft Landscaping
40.9	0.90	At-grade Impervious
45.6	0.83	Weighted Average
45.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

Subcatchment 3: Uncontrolled Area

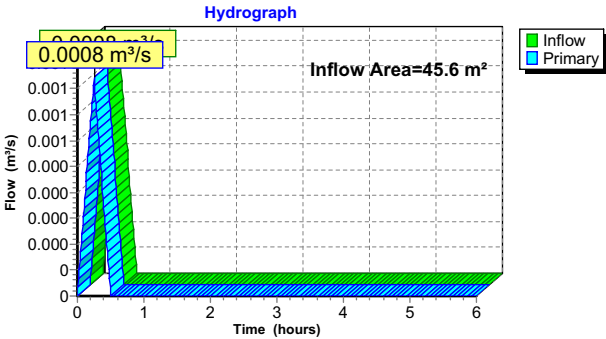


Summary for Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)

Inflow Area = 45.6 m², 0.00% Impervious, Inflow Depth = 17 mm for 5-Year event  
Inflow = 0.0008 m³/s @ 0.25 hrs, Volume= 0.8 m³  
Primary = 0.0008 m³/s @ 0.25 hrs, Volume= 0.8 m³, Atten= 0%, Lag= 0.0 min

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

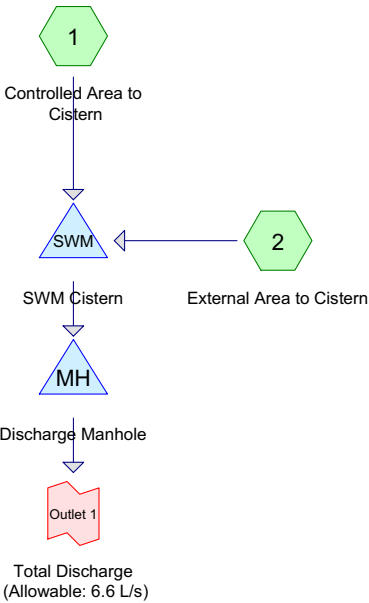
Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)



Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
191.4	0.90	At-grade Impervious (1, 2)
1,379.4	0.90	Impervious Roof (1)
468.7	0.25	Soft Landscaping (1, 2)
2,039.5	0.75	TOTAL AREA

Discharging to  
Elizabeth Street North



Routing Diagram for 2020.04.30\_Elizabeth Street North and Park Street East\_HydroCAD Model - 2-10 Year  
Prepared by WSP Canada Inc., Printed 4/30/2020  
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Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
2,039.5	Other	1, 2
2,039.5		TOTAL AREA

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Sub Nur
0.0	0.0	0.0	0.0	191.4	191.4	At-grade Impervious	
0.0	0.0	0.0	0.0	1,379.4	1,379.4	Impervious Roof	
0.0	0.0	0.0	0.0	468.7	468.7	Soft Landscaping	
0.0	0.0	0.0	0.0	2,039.5	2,039.5	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

**Subcatchment1: Controlled Area to** Runoff Area=1,754.6 m² 0.00% Impervious Runoff Depth=36 mm  
 Tc=15.0 min C=0.83 Runoff=0.0118 m³/s 63.5 m³

**Subcatchment2: External Area to Cistern** Runoff Area=284.9 m² 0.00% Impervious Runoff Depth=12 mm  
 Tc=15.0 min C=0.27 Runoff=0.0006 m³/s 3.4 m³

**Pond MH: Discharge Manhole** Peak Elev=0.145 m Storage=0.2 m³ Inflow=0.0051 m³/s 58.4 m³  
 Outflow=0.0051 m³/s 58.3 m³

**Pond SWM: SWM Cistern** Peak Elev=2.177 m Storage=58.1 m³ Inflow=0.0124 m³/s 66.8 m³  
 Outflow=0.0051 m³/s 58.4 m³

**Link Outlet 1: Total Discharge (Allowable: 6.6 L/s)** Inflow=0.0051 m³/s 58.3 m³  
 Primary=0.0051 m³/s 58.3 m³

Total Runoff Area = 2,039.5 m² Runoff Volume = 66.8 m³ Average Runoff Depth = 33 mm  
 100.00% Pervious = 2,039.5 m² 0.00% Impervious = 0.0 m²

### Summary for Subcatchment 1: Controlled Area to Cistern

Runoff = 0.0118 m³/s @ 0.25 hrs, Volume= 63.5 m³, Depth= 36 mm

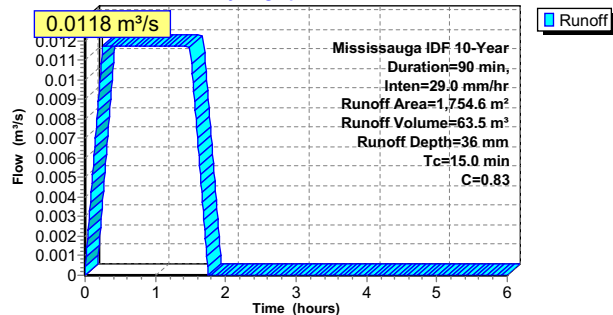
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Mississauga IDF 10-Year Duration=90 min, Inten=29.0 mm/hr

Area (m²)	C	Description
1,379.4	0.90	Impervious Roof
192.8	0.25	Soft Landscaping
182.4	0.90	At-grade Impervious
1,754.6	0.83	Weighted Average
1,754.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 1: Controlled Area to Cistern

#### Hydrograph



### Summary for Subcatchment 2: External Area to Cistern

Runoff = 0.0006 m³/s @ 0.25 hrs, Volume= 3.4 m³, Depth= 12 mm

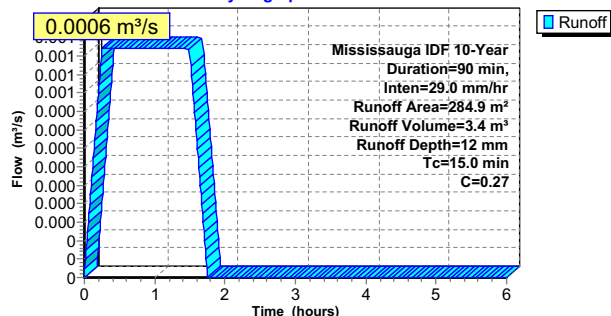
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Mississauga IDF 10-Year Duration=90 min, Inten=29.0 mm/hr

Area (m²)	C	Description
275.9	0.25	Soft Landscaping
9.0	0.90	At-grade Impervious
284.9	0.27	Weighted Average
284.9		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 2: External Area to Cistern

#### Hydrograph



### Summary for Pond MH: Discharge Manhole

Inflow Area = 2,039.5 m², 0.00% Impervious, Inflow Depth > 29 mm for 10-Year event  
 Inflow = 0.0051 m³/s @ 1.66 hrs, Volume= 58.4 m³  
 Outflow = 0.0051 m³/s @ 1.66 hrs, Volume= 58.3 m³, Atten= 0%, Lag= 0.8 min  
 Primary = 0.0051 m³/s @ 1.66 hrs, Volume= 58.3 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Peak Elev= 0.145 m @ 1.66 hrs Surf.Area= 1.1 m² Storage= 0.2 m³

Plug-Flow detention time= 0.5 min calculated for 58.3 m³ (100% of inflow)  
 Center-of-Mass det. time= 0.4 min (156.5 - 156.1)

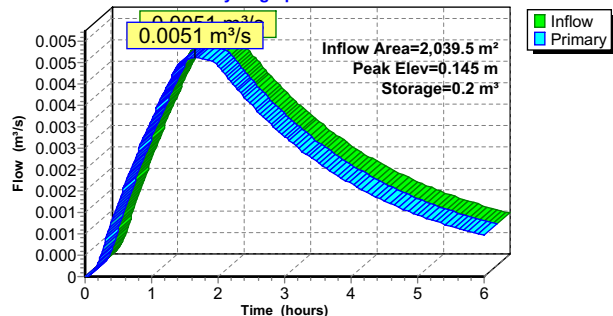
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	2.3 m³	1.20 mD x 2.00 mH Vertical Cone/Cylinder

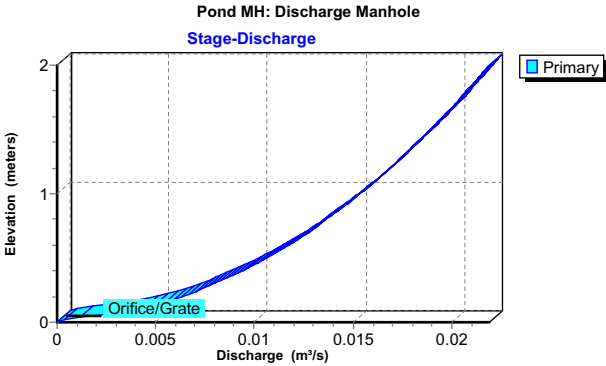
Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.800

**Primary OutFlow** Max=0.0051 m³/s @ 1.66 hrs HW=0.145 m (Free Discharge)  
 1=Orifice/Grate (Orifice Controls 0.0051 m³/s @ 1.16 m/s)

### Pond MH: Discharge Manhole

#### Hydrograph





Summary for Pond SWM: SWM Cistern

Located in the underground parking garage

Inflow Area =	2,039.5 m²	0.00% Impervious	Inflow Depth =	33 mm	for 10-Year event
Inflow =	0.0124 m³/s @	0.25 hrs	Volume=	66.8 m³	
Outflow =	0.0051 m³/s @	1.65 hrs	Volume=	58.4 m³	Atten= 59%, Lag= 83.8 min
Primary =	0.0051 m³/s @	1.65 hrs	Volume=	58.4 m³	

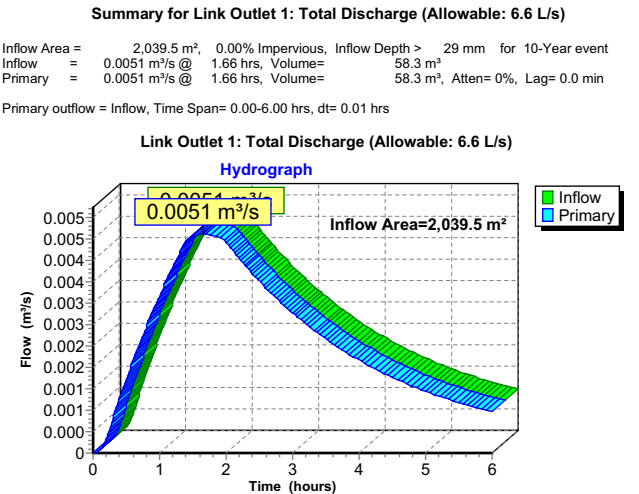
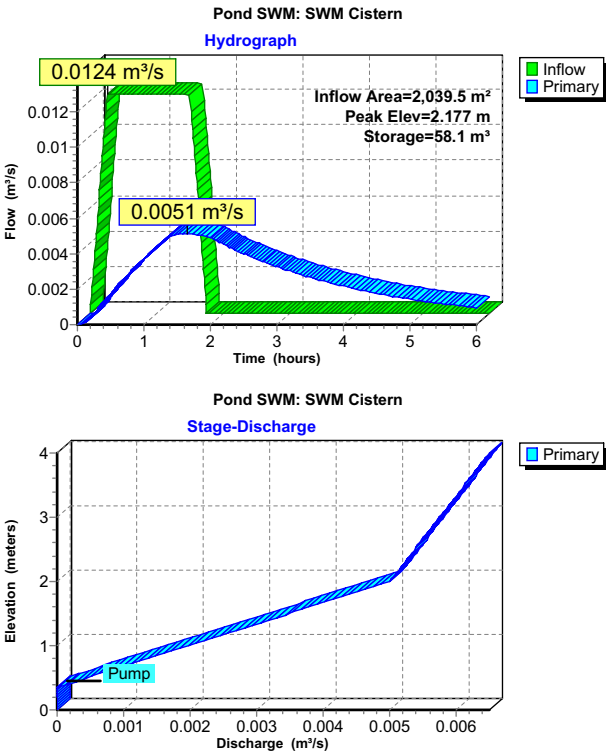
Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3  
Starting Elev= 0.350 m Surf.Area= 26.7 m² Storage= 9.3 m³  
Peak Elev= 2.177 m @ 1.65 hrs Surf.Area= 26.7 m² Storage= 58.1 m³ (48.8 m³ above start)

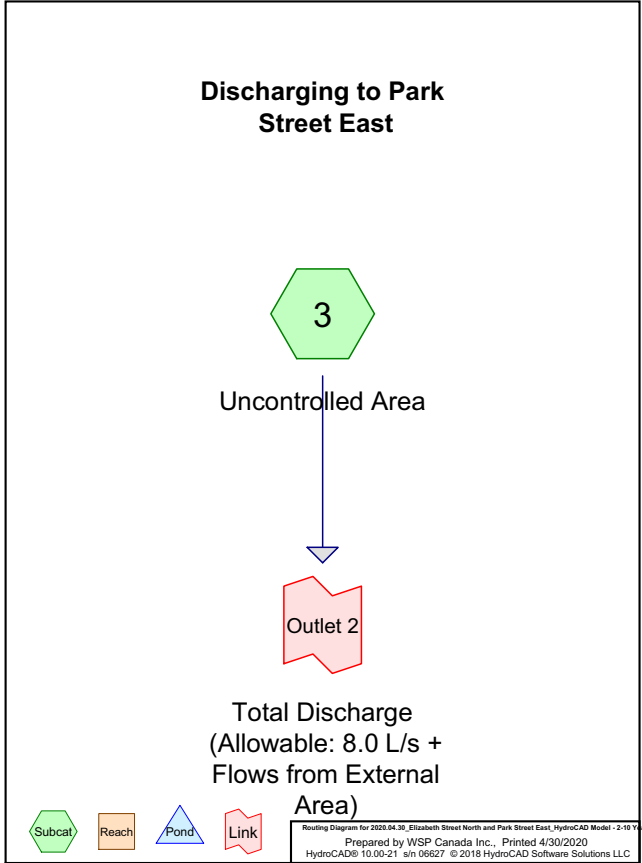
Plug-Flow detention time= 135.7 min calculated for 49.0 m³ (73% of inflow)  
Center-of-Mass det. time= 103.6 min ( 156.1 - 52.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	106.8 m³	1.00 mW x 26.70 mL x 4.00 mH Prismatoid

Device	Routing	Invert	Outlet Devices
#1	Primary	0.350 m	Pump
			Discharges@4.000 m
			Flow (l/min)= 0.0 300.0 390.0
			Head (meters)= 3.650 2.000 0.000

Primary OutFlow Max=0.0051 m³/s @ 1.65 hrs HW=2.177 m (Free Discharge)  
←1=Pump (Pump Controls 0.0051 m³/s)





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
40.9	0.90	At-grade Impervious (3)
4.7	0.25	Soft Landscaping (3)
45.6	0.83	TOTAL AREA

Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
45.6	Other	3
45.6		TOTAL AREA

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Sub Nur
0.0	0.0	0.0	0.0	40.9	40.9	At-grade Impervious	
0.0	0.0	0.0	0.0	4.7	4.7	Soft Landscaping	
0.0	0.0	0.0	0.0	45.6	45.6	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

Subcatchment3: Uncontrolled Area Runoff Area=45.6 m² 0.00% Impervious Runoff Depth=21 mm  
Tc=15.0 min C=0.83 Runoff=0.0010 m³/s 0.9 m³

Link Outlet2: Total Discharge (Allowable: 8.0 L/s + Flows from External Inflow=0.0010 m³/s 0.9 m³  
Primary=0.0010 m³/s 0.9 m³

Total Runoff Area = 45.6 m² Runoff Volume = 0.9 m³ Average Runoff Depth = 21 mm  
100.00% Pervious = 45.6 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 3: Uncontrolled Area

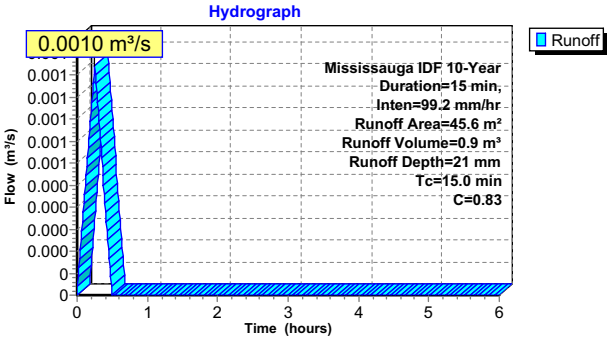
Runoff = 0.0010 m³/s @ 0.25 hrs, Volume= 0.9 m³, Depth= 21 mm

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
4.7	0.25	Soft Landscaping
40.9	0.90	At-grade Impervious
45.6	0.83	Weighted Average
45.6		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

Subcatchment 3: Uncontrolled Area

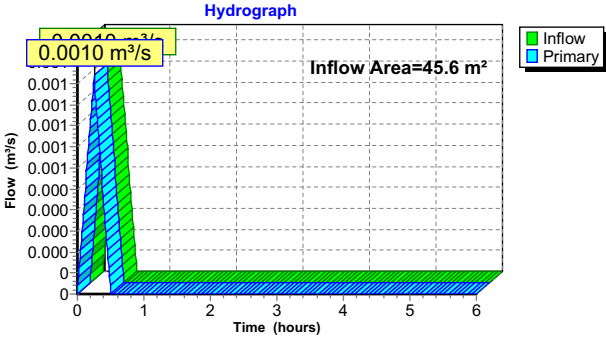


Summary for Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)

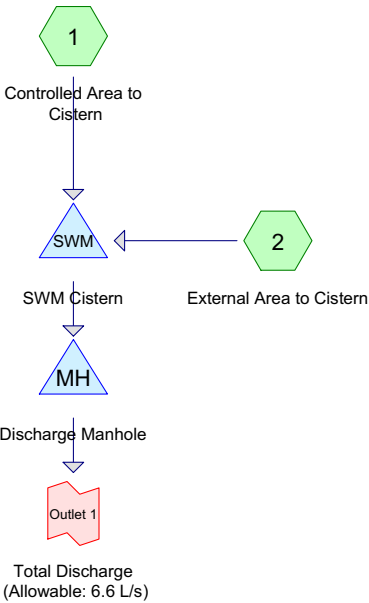
Inflow Area = 45.6 m², 0.00% Impervious, Inflow Depth = 21 mm for 10-Year event  
Inflow = 0.0010 m³/s @ 0.25 hrs, Volume= 0.9 m³  
Primary = 0.0010 m³/s @ 0.25 hrs, Volume= 0.9 m³, Atten= 0%, Lag= 0.0 min

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

Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)



Discharging to  
Elizabeth Street North



Routing Diagram for 2020.04.30\_Elizabeth Street North and Park Street East\_HydroCAD Model - 25 Year  
Prepared by WSP Canada Inc., Printed 4/30/2020  
HydroCAD® 10.00-21 s/n 06627 © 2018 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
191.4	0.99	At-grade Impervious (1, 2)
1,379.4	0.99	Impervious Roof (1)
468.7	0.28	Soft Landscaping (1, 2)
2,039.5	0.83	TOTAL AREA

Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
2,039.5	Other	1, 2
2,039.5		TOTAL AREA

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Sub Nur
0.0	0.0	0.0	0.0	191.4	191.4	At-grade Impervious	
0.0	0.0	0.0	0.0	1,379.4	1,379.4	Impervious Roof	
0.0	0.0	0.0	0.0	468.7	468.7	Soft Landscaping	
0.0	0.0	0.0	0.0	2,039.5	2,039.5	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

**Subcatchment1: Controlled Area to** Runoff Area=1,754.6 m² 89.01% Impervious Runoff Depth=47 mm  
 Tc=15.0 min C=0.91 Runoff=0.0138 m³/s 81.9 m³

**Subcatchment2: External Area to Cistern** Runoff Area=284.9 m² 3.16% Impervious Runoff Depth=15 mm  
 Tc=15.0 min C=0.30 Runoff=0.0007 m³/s 4.4 m³

**Pond MH: Discharge Manhole** Peak Elev=0.162 m Storage=0.2 m³ Inflow=0.0055 m³/s 74.1 m³  
 Outflow=0.0055 m³/s 74.1 m³

**Pond SWM: SWM Cistern** Peak Elev=2.709 m Storage=72.3 m³ Inflow=0.0145 m³/s 86.3 m³  
 Outflow=0.0055 m³/s 74.1 m³

**Link Outlet 1: Total Discharge (Allowable: 6.6 L/s)** Inflow=0.0055 m³/s 74.1 m³  
 Primary=0.0055 m³/s 74.1 m³

**Total Runoff Area = 2,039.5 m² Runoff Volume = 86.3 m³ Average Runoff Depth = 42 mm**  
**22.98% Pervious = 468.7 m² 77.02% Impervious = 1,570.8 m²**

### Summary for Subcatchment 1: Controlled Area to Cistern

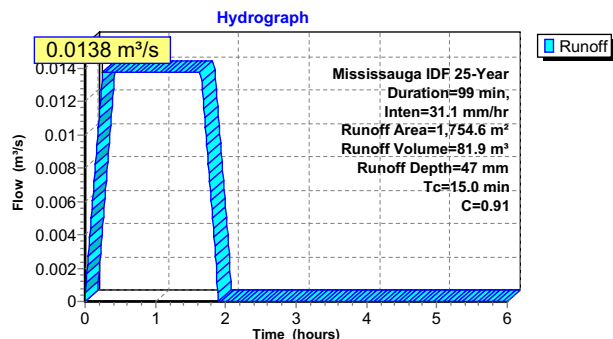
Runoff = 0.0138 m³/s @ 0.25 hrs, Volume= 81.9 m³, Depth= 47 mm

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=99 min, Inten=31.1 mm/hr

Area (m²)	C	Description
1,379.4	0.99	Impervious Roof
192.8	0.28	Soft Landscaping
182.4	0.99	At-grade Impervious
1,754.6	0.91	Weighted Average
192.8		10.99% Pervious Area
1,561.8		89.01% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 1: Controlled Area to Cistern



### Summary for Subcatchment 2: External Area to Cistern

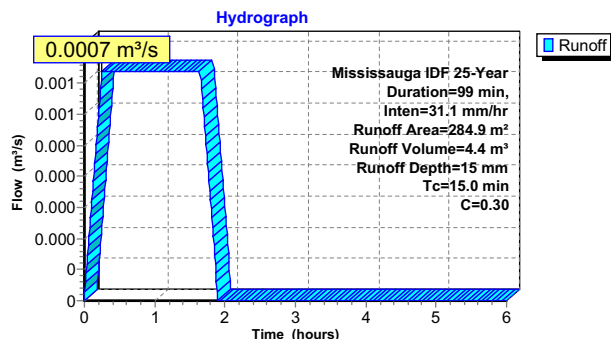
Runoff = 0.0007 m³/s @ 0.25 hrs, Volume= 4.4 m³, Depth= 15 mm

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=99 min, Inten=31.1 mm/hr

Area (m²)	C	Description
275.9	0.28	Soft Landscaping
9.0	0.99	At-grade Impervious
284.9	0.30	Weighted Average
275.9		96.84% Pervious Area
9.0		3.16% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 2: External Area to Cistern



### Summary for Pond MH: Discharge Manhole

Inflow Area = 2,039.5 m², 77.02% Impervious, Inflow Depth > 36 mm for 25-Year event  
 Inflow = 0.0055 m³/s @ 1.80 hrs, Volume= 74.1 m³  
 Outflow = 0.0055 m³/s @ 1.82 hrs, Volume= 74.1 m³, Atten= 0%, Lag= 0.9 min  
 Primary = 0.0055 m³/s @ 1.82 hrs, Volume= 74.1 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Peak Elev= 0.162 m @ 1.82 hrs Surf.Area= 1.1 m² Storage= 0.2 m³

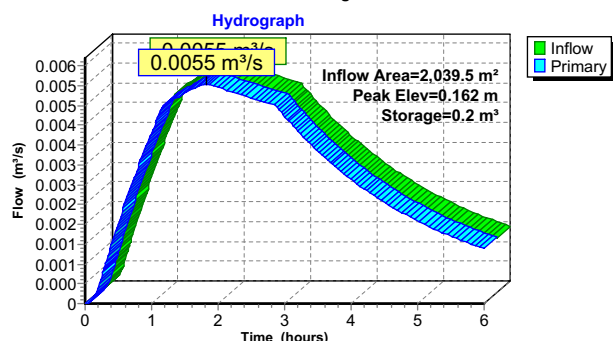
Plug-Flow detention time= 0.5 min calculated for 73.9 m³ (100% of inflow)  
 Center-of-Mass det. time= 0.4 min ( 164.9 - 164.5 )

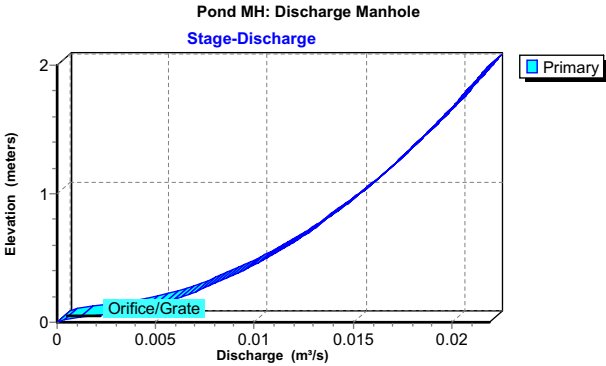
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	2.3 m³	1.20 mD x 2.00 mH Vertical Cone/Cylinder

Device	Routing	Invert	Outlet Devices	C
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate	0.800

**Primary OutFlow** Max=0.0055 m³/s @ 1.82 hrs HW=0.162 m (Free Discharge)  
 1=Orifice/Grate (Orifice Controls 0.0055 m³/s @ 1.25 m/s)

### Pond MH: Discharge Manhole





Summary for Pond SWM: SWM Cistern

Located in the underground parking garage

Inflow Area =	2,039.5 m², 77.02% Impervious,	Inflow Depth =	42 mm	for 25-Year event
Inflow =	0.0145 m³/s @ 0.25 hrs,	Volume =	86.3 m³	
Outflow =	0.0055 m³/s @ 1.80 hrs,	Volume =	74.1 m³,	Atten= 62%, Lag= 93.3 min
Primary =	0.0055 m³/s @ 1.80 hrs,	Volume =	74.1 m³	

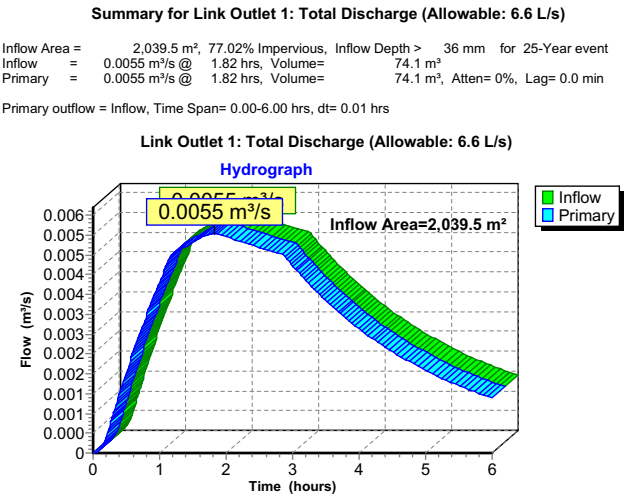
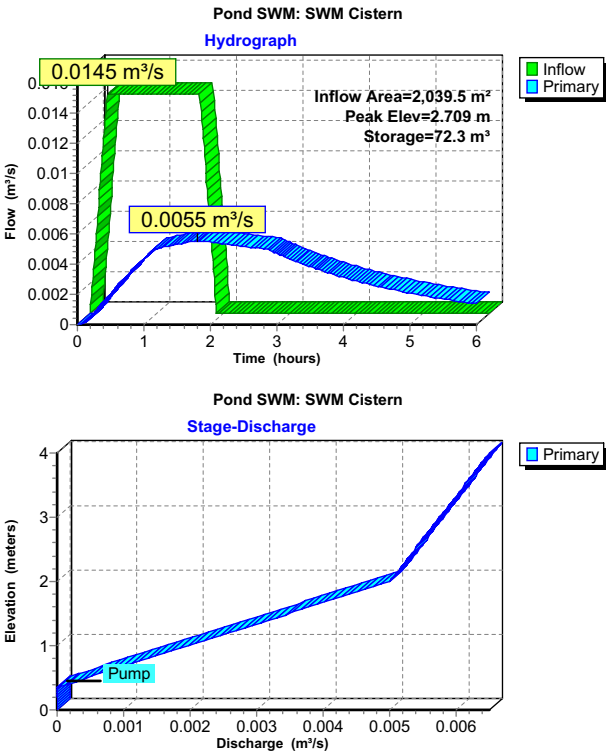
Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3  
Starting Elev= 0.350 m Surf.Area= 26.7 m² Storage= 9.3 m³  
Peak Elev= 2.709 m @ 1.80 hrs Surf.Area= 26.7 m² Storage= 72.3 m³ (63.0 m³ above start)

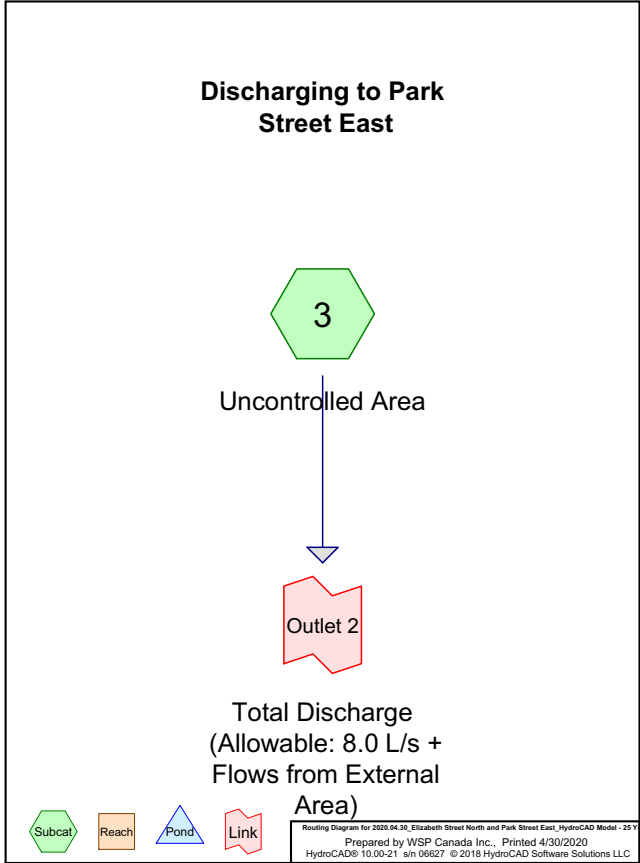
Plug-Flow detention time= 136.8 min calculated for 64.7 m³ (75% of inflow)  
Center-of-Mass det. time= 107.5 min ( 164.5 - 57.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	106.8 m³	1.00 mW x 26.70 mL x 4.00 mH Prismatoid

Device	Routing	Invert	Outlet Devices
#1	Primary	0.350 m	Pump
			Discharges@4.000 m
			Flow (l/min)= 0.0 300.0 390.0
			Head (meters)= 3.650 2.000 0.000

Primary OutFlow Max=0.0055 m³/s @ 1.80 hrs HW=2.709 m (Free Discharge)  
←1=Pump (Pump Controls 0.0055 m³/s)





Area Listing (selected nodes)		
Area (sq-meters)	C	Description (subcatchment-numbers)
40.9	0.99	At-grade Impervious (3)
4.7	0.28	Soft Landscaping (3)
45.6	0.92	TOTAL AREA

Soil Listing (selected nodes)		
Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
45.6	Other	3
45.6		TOTAL AREA

Ground Covers (selected nodes)							Sub Nur
HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	
0.0	0.0	0.0	0.0	40.9	40.9	At-grade Impervious	
0.0	0.0	0.0	0.0	4.7	4.7	Soft Landscaping	
0.0	0.0	0.0	0.0	45.6	45.6	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

Subcatchment3: Uncontrolled Area Runoff Area=45.6 m² 89.69% Impervious Runoff Depth=26 mm  
Tc=15.0 min C=0.92 Runoff=0.0013 m³/s 1.2 m³

Link Outlet2: Total Discharge (Allowable: 8.0 L/s + Flows from External Inflow=0.0013 m³/s 1.2 m³  
Primary=0.0013 m³/s 1.2 m³

Total Runoff Area = 45.6 m² Runoff Volume = 1.2 m³ Average Runoff Depth = 26 mm  
10.31% Pervious = 4.7 m² 89.69% Impervious = 40.9 m²

Summary for Subcatchment 3: Uncontrolled Area

Runoff = 0.0013 m³/s @ 0.25 hrs, Volume= 1.2 m³, Depth= 26 mm

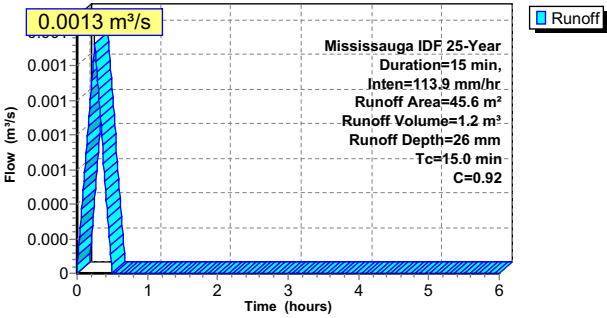
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
Mississauga IDF 25-Year Duration=15 min, Inten=113.9 mm/hr

Area (m²)	C	Description
4.7	0.28	Soft Landscaping
40.9	0.99	At-grade Impervious
45.6	0.92	Weighted Average
4.7		10.31% Pervious Area
40.9		89.69% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

Subcatchment 3: Uncontrolled Area

Hydrograph



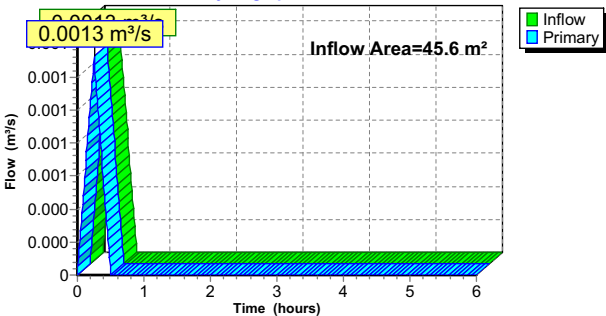
Summary for Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)

Inflow Area = 45.6 m², 89.69% Impervious, Inflow Depth = 26 mm for 25-Year event  
Inflow = 0.0013 m³/s @ 0.25 hrs, Volume= 1.2 m³  
Primary = 0.0013 m³/s @ 0.25 hrs, Volume= 1.2 m³, Atten= 0%, Lag= 0.0 min

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

Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)

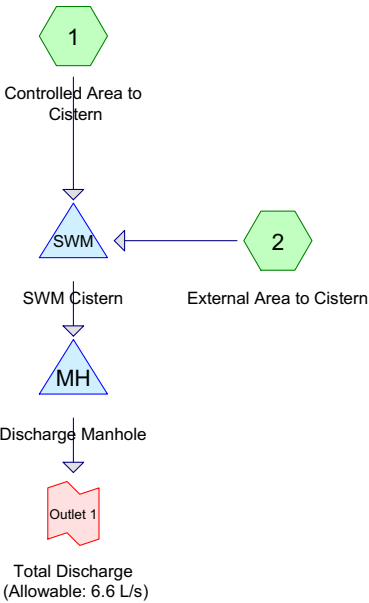
Hydrograph



Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
191.4	1.00	At-grade Impervious (1, 2)
1,379.4	1.00	Impervious Roof (1)
468.7	0.30	Soft Landscaping (1, 2)
2,039.5	0.84	TOTAL AREA

Discharging to  
Elizabeth Street North



Routing Diagram for 2020.04.30\_Elizabeth Street North and Park Street East\_HydroCAD Model - 50 Year  
Prepared by WSP Canada Inc., Printed 4/30/2020  
HydroCAD® 10.00-21 s/n 06627 © 2018 HydroCAD Software Solutions LLC

Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
2,039.5	Other	1, 2
2,039.5		TOTAL AREA

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Sub Nur
0.0	0.0	0.0	0.0	191.4	191.4	At-grade Impervious	
0.0	0.0	0.0	0.0	1,379.4	1,379.4	Roof Impervious	
0.0	0.0	0.0	0.0	468.7	468.7	Soft Landscaping	
0.0	0.0	0.0	0.0	2,039.5	2,039.5	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

**Subcatchment1: Controlled Area to** Runoff Area=1,754.6 m² 89.01% Impervious Runoff Depth=54 mm  
 Tc=15.0 min C=0.92 Runoff=0.0149 m³/s 94.1 m³

**Subcatchment2: External Area to Cistern** Runoff Area=284.9 m² 3.16% Impervious Runoff Depth=19 mm  
 Tc=15.0 min C=0.32 Runoff=0.0008 m³/s 5.3 m³

**Pond MH: Discharge Manhole** Peak Elev=0.175 m Storage=0.2 m³ Inflow=0.0058 m³/s 84.0 m³  
 Outflow=0.0058 m³/s 83.9 m³

**Pond SWM: SWM Cistern** Peak Elev=3.077 m Storage=82.2 m³ Inflow=0.0158 m³/s 99.4 m³  
 Outflow=0.0058 m³/s 84.0 m³

**Link Outlet 1: Total Discharge (Allowable: 6.6 L/s)** Inflow=0.0058 m³/s 83.9 m³  
 Primary=0.0058 m³/s 83.9 m³

Total Runoff Area = 2,039.5 m² Runoff Volume = 99.4 m³ Average Runoff Depth = 49 mm  
 22.98% Pervious = 468.7 m² 77.02% Impervious = 1,570.8 m²

### Summary for Subcatchment 1: Controlled Area to Cistern

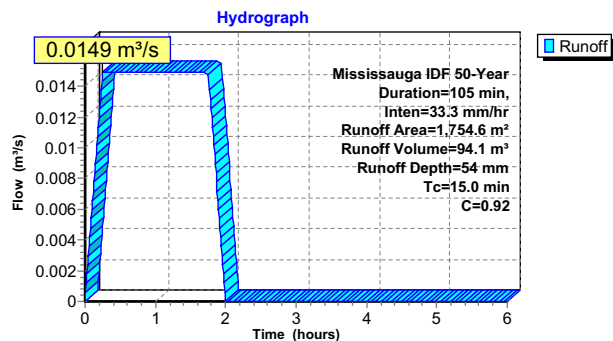
Runoff = 0.0149 m³/s @ 0.25 hrs, Volume= 94.1 m³, Depth= 54 mm

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=105 min, Inten=33.3 mm/hr

Area (m²)	C	Description
1,379.4	1.00	Impervious Roof
192.8	0.30	Soft Landscaping
182.4	1.00	At-grade Impervious
1,754.6	0.92	Weighted Average
192.8		10.99% Pervious Area
1,561.8		89.01% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 1: Controlled Area to Cistern



### Summary for Subcatchment 2: External Area to Cistern

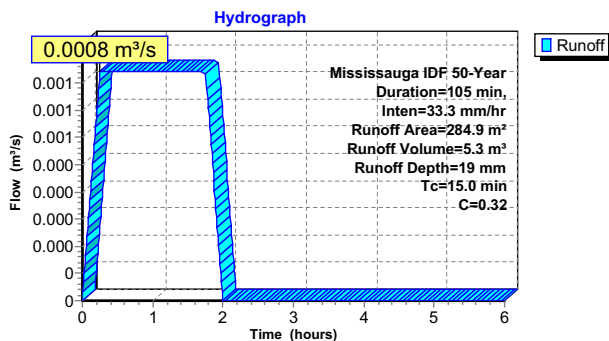
Runoff = 0.0008 m³/s @ 0.25 hrs, Volume= 5.3 m³, Depth= 19 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Mississauga IDF 50-Year Duration=105 min, Inten=33.3 mm/hr

Area (m²)	C	Description
275.9	0.30	Soft Landscaping
9.0	1.00	At-grade Impervious
284.9	0.32	Weighted Average
275.9		96.84% Pervious Area
9.0		3.16% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 2: External Area to Cistern



### Summary for Pond MH: Discharge Manhole

Inflow Area = 2,039.5 m², 77.02% Impervious, Inflow Depth > 41 mm for 50-Year event  
 Inflow = 0.0058 m³/s @ 1.91 hrs, Volume= 84.0 m³  
 Outflow = 0.0058 m³/s @ 1.92 hrs, Volume= 83.9 m³, Atten= 0%, Lag= 0.9 min  
 Primary = 0.0058 m³/s @ 1.92 hrs, Volume= 83.9 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Peak Elev= 0.175 m @ 1.92 hrs Surf.Area= 1.1 m² Storage= 0.2 m³

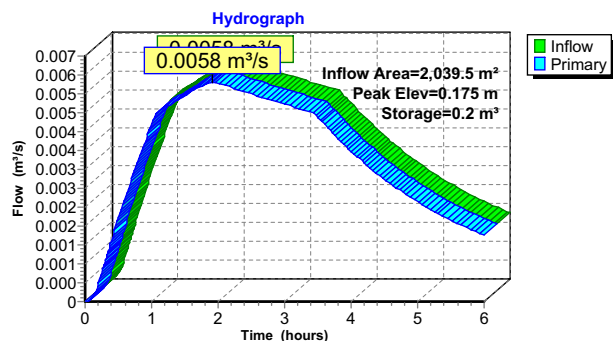
Plug-Flow detention time= 0.5 min calculated for 83.9 m³ (100% of inflow)  
 Center-of-Mass det. time= 0.4 min (171.2 - 170.8)

Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	2.3 m³	1.20 mD x 2.00 mH Vertical Cone/Cylinder

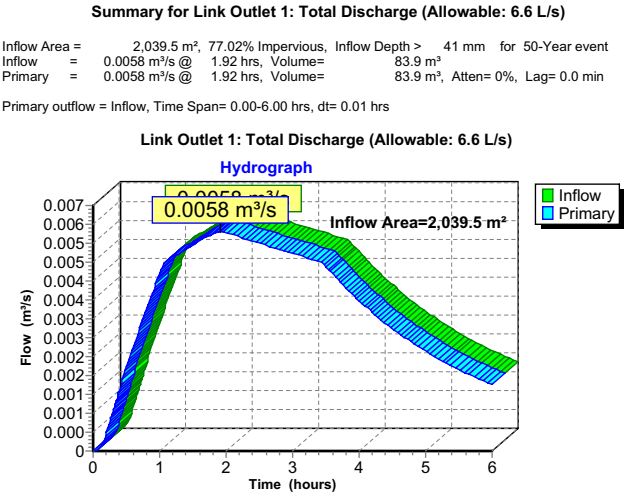
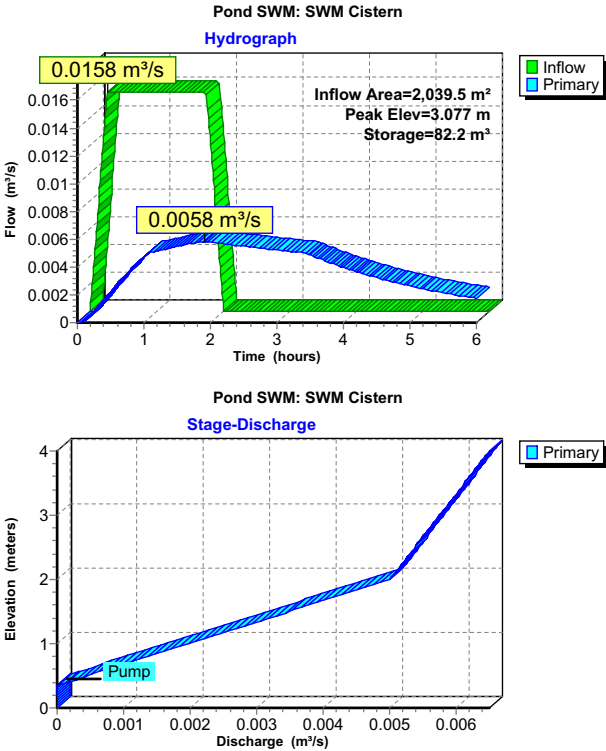
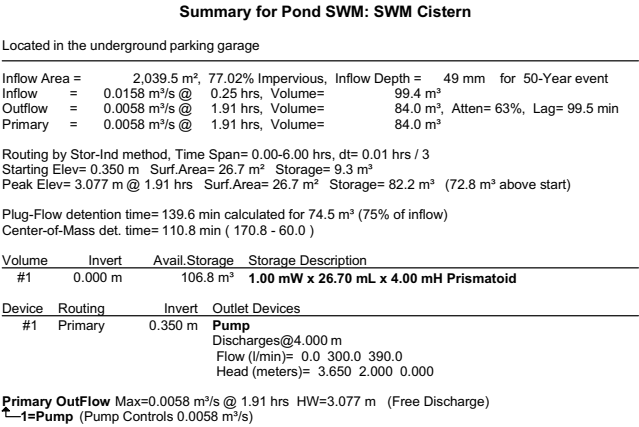
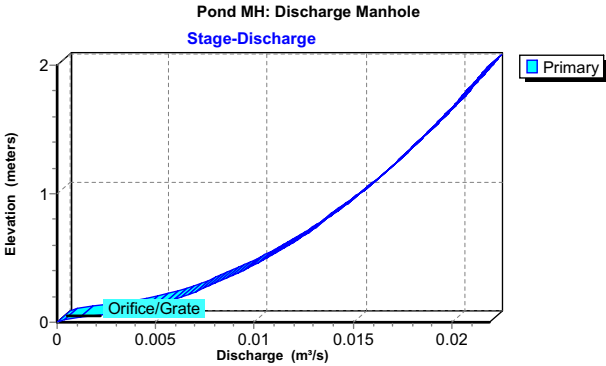
Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.800

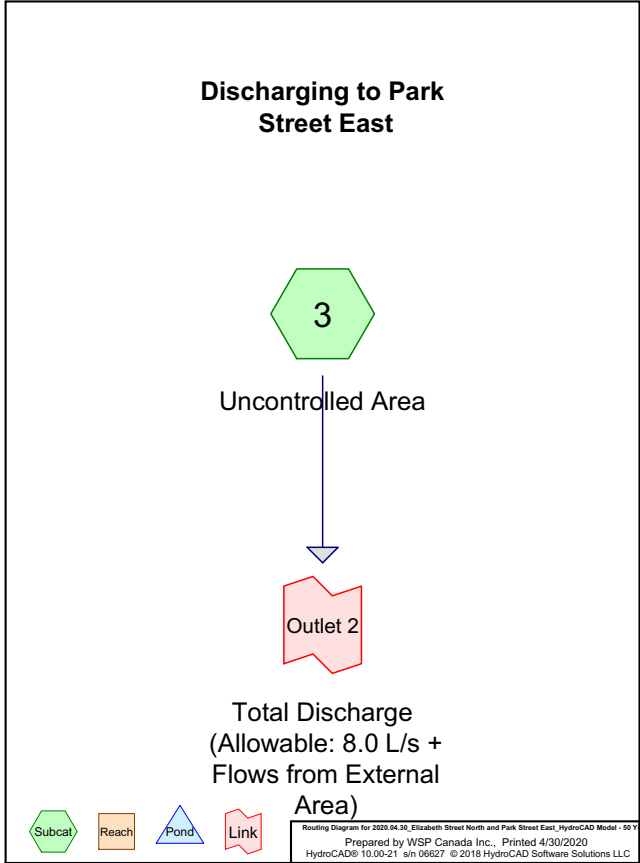
**Primary OutFlow** Max=0.0058 m³/s @ 1.92 hrs HW=0.175 m (Free Discharge)  
 1=Orifice/Grate (Orifice Controls 0.0058 m³/s @ 1.32 m/s)

### Pond MH: Discharge Manhole









Area Listing (selected nodes)		
Area (sq-meters)	C	Description (subcatchment-numbers)
40.9	1.00	At-grade Impervious (3)
4.7	0.30	Soft Landscaping (3)
45.6	0.93	TOTAL AREA

Soil Listing (selected nodes)		
Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
45.6	Other	3
45.6		TOTAL AREA

Ground Covers (selected nodes)							Sub Nur
HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	
0.0	0.0	0.0	0.0	40.9	40.9	At-grade Impervious	
0.0	0.0	0.0	0.0	4.7	4.7	Soft Landscaping	
0.0	0.0	0.0	0.0	45.6	45.6	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

Subcatchment3: Uncontrolled Area Runoff Area=45.6 m² 89.69% Impervious Runoff Depth=30 mm  
Tc=15.0 min C=0.93 Runoff=0.0015 m³/s 1.3 m³

Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Inflow=0.0015 m³/s 1.3 m³  
Primary=0.0015 m³/s 1.3 m³

Total Runoff Area = 45.6 m² Runoff Volume = 1.3 m³ Average Runoff Depth = 30 mm  
10.31% Pervious = 4.7 m² 89.69% Impervious = 40.9 m²

Summary for Subcatchment 3: Uncontrolled Area

Runoff = 0.0015 m³/s @ 0.25 hrs, Volume= 1.3 m³, Depth= 30 mm

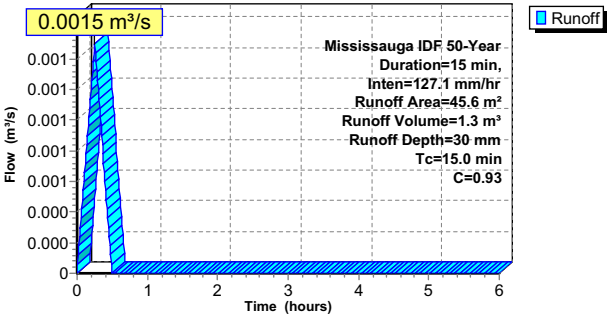
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
Mississauga IDF 50-Year Duration=15 min, Inten=127.1 mm/hr

Area (m²)	C	Description
4.7	0.30	Soft Landscaping
40.9	1.00	At-grade Impervious
45.6	0.93	Weighted Average
4.7		10.31% Pervious Area
40.9		89.69% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

Subcatchment 3: Uncontrolled Area

Hydrograph



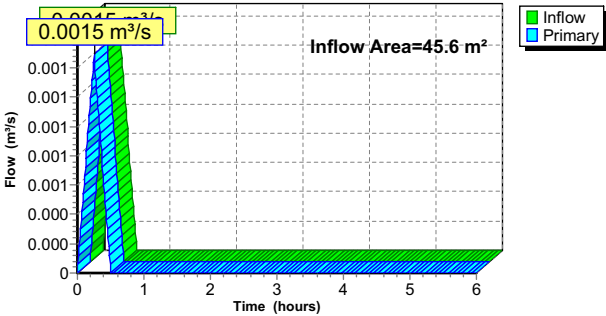
Summary for Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)

Inflow Area = 45.6 m², 89.69% Impervious, Inflow Depth = 30 mm for 50-Year event  
Inflow = 0.0015 m³/s @ 0.25 hrs, Volume= 1.3 m³  
Primary = 0.0015 m³/s @ 0.25 hrs, Volume= 1.3 m³, Atten= 0%, Lag= 0.0 min

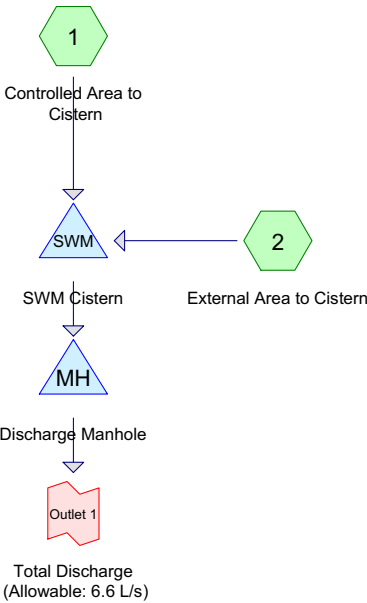
Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)

Hydrograph



Discharging to  
Elizabeth Street North



Routing Diagram for 2020.04.30\_Elizabeth Street North and Park Street East\_HydroCAD Model - 100 Year  
Prepared by WSP Canada Inc., Printed 4/30/2020  
HydroCAD® 10.00-21 s/n 06627 © 2018 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
191.4	1.00	At-grade Impervious (1, 2)
1,379.4	1.00	Impervious Roof (1)
468.7	0.31	Soft Landscaping (1, 2)
2,039.5	0.84	TOTAL AREA

Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
2,039.5	Other	1, 2
2,039.5		TOTAL AREA

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Sub Nur
0.0	0.0	0.0	0.0	191.4	191.4	At-grade Impervious	
0.0	0.0	0.0	0.0	1,379.4	1,379.4	Impervious Roof	
0.0	0.0	0.0	0.0	468.7	468.7	Soft Landscaping	
0.0	0.0	0.0	0.0	2,039.5	2,039.5	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

**Subcatchment1: Controlled Area to** Runoff Area=1,754.6 m² 89.01% Impervious Runoff Depth=61 mm  
 Tc=15.0 min C=0.92 Runoff=0.0160 m³/s 106.3 m³

**Subcatchment2: External Area to Cistern** Runoff Area=284.9 m² 3.16% Impervious Runoff Depth=22 mm  
 Tc=15.0 min C=0.33 Runoff=0.0009 m³/s 6.2 m³

**Pond MH: Discharge Manhole** Peak Elev=0.189 m Storage=0.2 m³ Inflow=0.0061 m³/s 93.1 m³  
 Outflow=0.0061 m³/s 93.0 m³

**Pond SWM: SWM Cistern** Peak Elev=3.445 m Storage=92.0 m³ Inflow=0.0169 m³/s 112.5 m³  
 Outflow=0.0061 m³/s 93.1 m³

**Link Outlet 1: Total Discharge (Allowable: 6.6 L/s)** Inflow=0.0061 m³/s 93.0 m³  
 Primary=0.0061 m³/s 93.0 m³

Total Runoff Area = 2,039.5 m² Runoff Volume = 112.5 m³ Average Runoff Depth = 55 mm  
 22.98% Pervious = 468.7 m² 77.02% Impervious = 1,570.8 m²

### Summary for Subcatchment 1: Controlled Area to Cistern

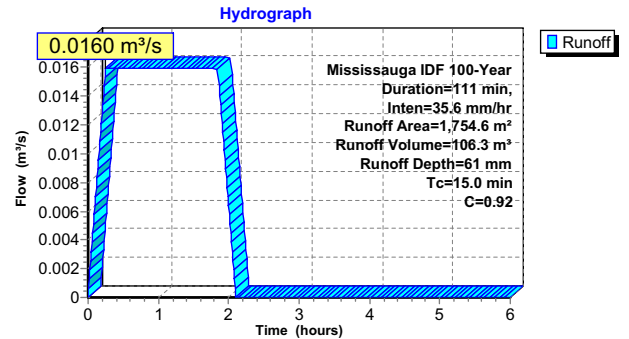
Runoff = 0.0160 m³/s @ 0.25 hrs, Volume= 106.3 m³, Depth= 61 mm

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=111 min, Inten=35.6 mm/hr

Area (m²)	C	Description
1,379.4	1.00	Impervious Roof
192.8	0.31	Soft Landscaping
182.4	1.00	At-grade Impervious
1,754.6	0.92	Weighted Average
192.8		10.99% Pervious Area
1,561.8		89.01% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 1: Controlled Area to Cistern



### Summary for Subcatchment 2: External Area to Cistern

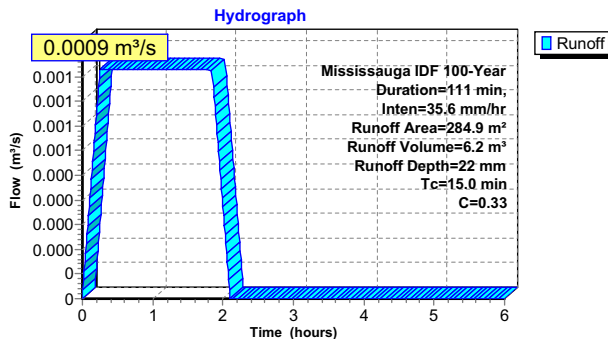
Runoff = 0.0009 m³/s @ 0.25 hrs, Volume= 6.2 m³, Depth= 22 mm

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=111 min, Inten=35.6 mm/hr

Area (m²)	C	Description
275.9	0.31	Soft Landscaping
9.0	1.00	At-grade Impervious
284.9	0.33	Weighted Average
275.9		96.84% Pervious Area
9.0		3.16% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

### Subcatchment 2: External Area to Cistern



### Summary for Pond MH: Discharge Manhole

Inflow Area = 2,039.5 m², 77.02% Impervious, Inflow Depth > 46 mm for 100-Year event  
 Inflow = 0.0061 m³/s @ 2.01 hrs, Volume= 93.1 m³  
 Outflow = 0.0061 m³/s @ 2.03 hrs, Volume= 93.0 m³, Atten= 0%, Lag= 0.9 min  
 Primary = 0.0061 m³/s @ 2.03 hrs, Volume= 93.0 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
 Peak Elev= 0.189 m @ 2.03 hrs Surf.Area= 1.1 m² Storage= 0.2 m³

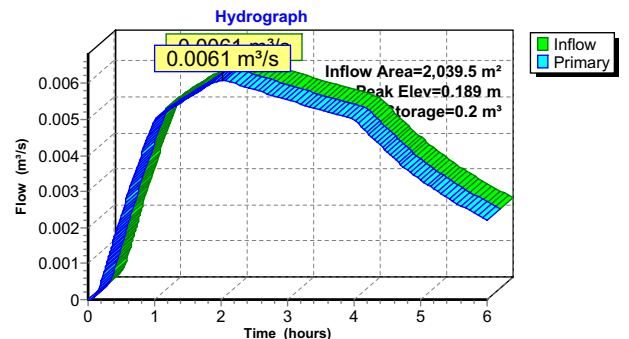
Plug-Flow detention time= 0.5 min calculated for 93.0 m³ (100% of inflow)  
 Center-of-Mass det. time= 0.4 min (177.2 - 176.8)

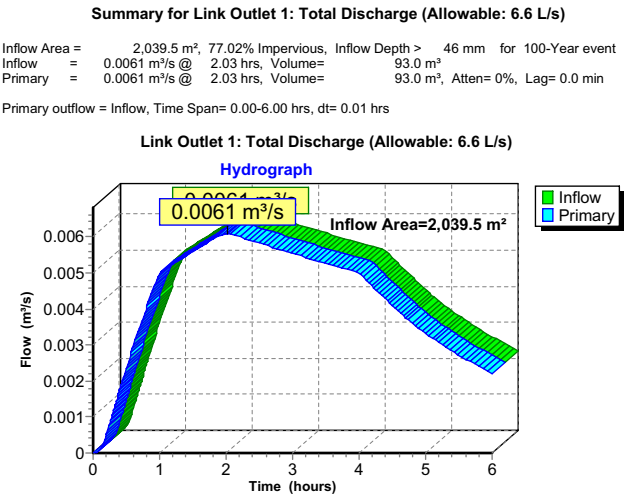
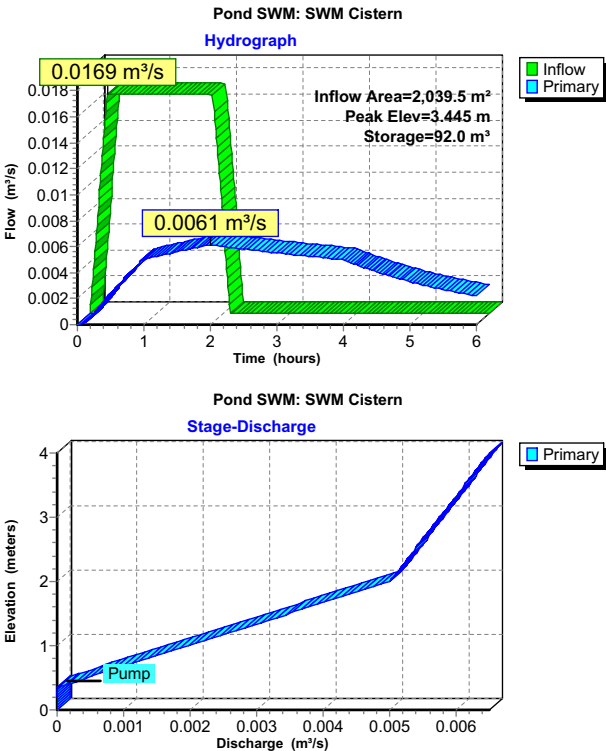
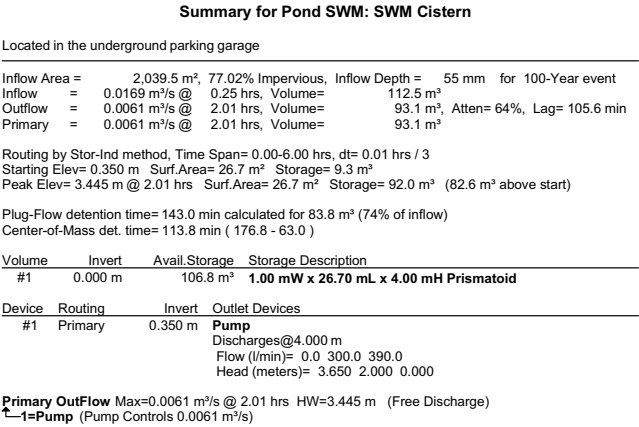
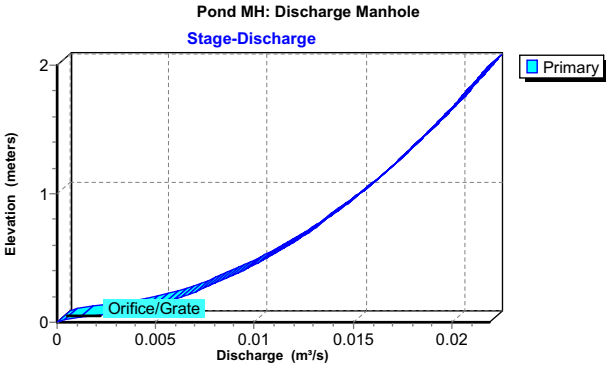
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	2.3 m³	1.20 mD x 2.00 mH Vertical Cone/Cylinder

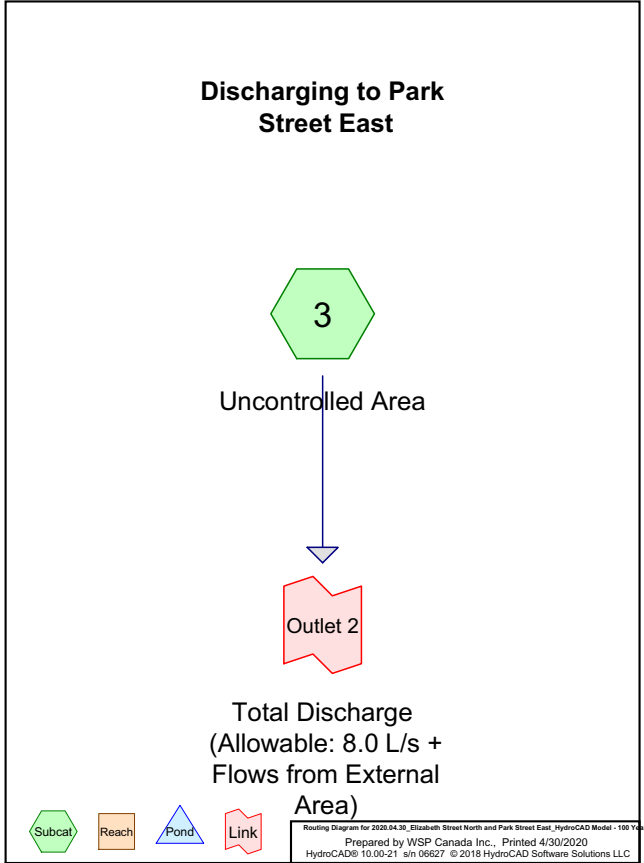
Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.800

**Primary OutFlow** Max=0.0061 m³/s @ 2.03 hrs HW=0.189 m (Free Discharge)  
 1=Orifice/Grate (Orifice Controls 0.0061 m³/s @ 1.38 m/s)

### Pond MH: Discharge Manhole







Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
40.9	1.00	At-grade Impervious (3)
4.7	0.31	Soft Landscaping (3)
45.6	0.93	TOTAL AREA

Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
45.6	Other	3
45.6		TOTAL AREA

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Sub Nur
0.0	0.0	0.0	0.0	40.9	40.9	At-grade Impervious	
0.0	0.0	0.0	0.0	4.7	4.7	Soft Landscaping	
0.0	0.0	0.0	0.0	45.6	45.6	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

Subcatchment3: Uncontrolled Area Runoff Area=45.6 m² 89.69% Impervious Runoff Depth=33 mm  
Tc=15.0 min C=0.93 Runoff=0.0017 m³/s 1.5 m³

Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Inflow=0.0017 m³/s 1.5 m³  
Primary=0.0017 m³/s 1.5 m³

Total Runoff Area = 45.6 m² Runoff Volume = 1.5 m³ Average Runoff Depth = 33 mm  
10.31% Pervious = 4.7 m² 89.69% Impervious = 40.9 m²

Summary for Subcatchment 3: Uncontrolled Area

Runoff = 0.0017 m³/s @ 0.25 hrs, Volume= 1.5 m³, Depth= 33 mm

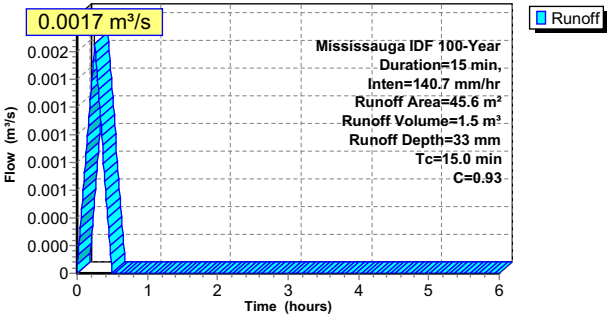
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs  
Mississauga IDF 100-Year Duration=15 min, Inten=140.7 mm/hr

Area (m²)	C	Description
4.7	0.31	Soft Landscaping
40.9	1.00	At-grade Impervious
45.6	0.93	Weighted Average
4.7		10.31% Pervious Area
40.9		89.69% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					Direct Entry, Time of Concentration (Direct Entry)

Subcatchment 3: Uncontrolled Area

Hydrograph



Summary for Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)

Inflow Area = 45.6 m², 89.69% Impervious, Inflow Depth = 33 mm for 100-Year event  
Inflow = 0.0017 m³/s @ 0.25 hrs, Volume= 1.5 m³  
Primary = 0.0017 m³/s @ 0.25 hrs, Volume= 1.5 m³, Atten= 0%, Lag= 0.0 min

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

Link Outlet 2: Total Discharge (Allowable: 8.0 L/s + Flows from External Area)

Hydrograph

