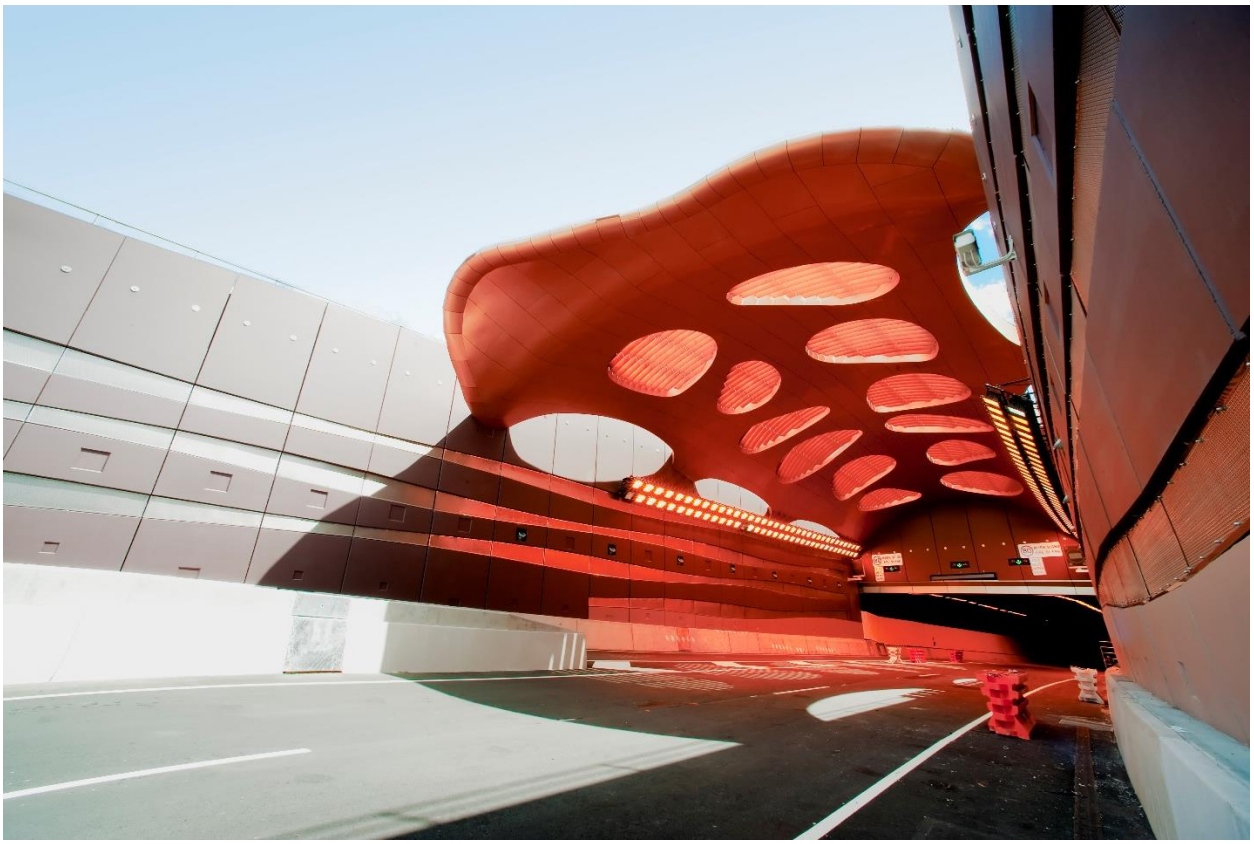
11 YORKVILLE PARTNERSHIP INC.

STORMWATER MANAGEMENT REPORT

11-21 YORKVILLE AVENUE



STORMWATER MANAGEMENT REPORT

11-21 YORKVILLE AVENUE

11 YORKVILLE PARTNERSHIP INC.

REZONING & SITE PLAN APPLICATION

PROJECT NO.: 17M-01494-00
DATE: MARCH 2018

WSP

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QUALITY MANAGEMENT

ISSUE/REVISION	FIRST DRAFT	FIRST ISSUE		
Remarks	RZA & SPA	RZA & SPA		
Date	03/08/2018	03/08/2018		
Prepared by	Brenden Ding	Brenden Ding		
Signature				
Checked by	Thomas Raso	Bhavika Patel		
Signature				
Project number	17M-01494-00	17M-01494-00		

SIGNATURES

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PRODUCTION TEAM

CLIENT

11 Yorkville Partnership Inc.

WSP

Designer (EIT)	Brenden Ding
Project Reviewer	Bhavika Patel

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1 INTRODUCTION

1.1 SCOPE

WSP has been retained by 11 Yorkville Partnership Inc. to prepare a Stormwater Management Report for the proposed development of 11-21 Yorkville Avenue and 16-18 Cumberland Street in the City of Toronto (herein referred to as Building A and B, respectively, or 'site'). This stormwater management report examines the potential water quality, quantity and water balance impacts of the proposed development and summarizes how each will be addressed in accordance with the City of Toronto's Wet Weather Flow Management Guidelines (WWFMG).

1.2 SITE LOCATION

The site is located on the south side of Yorkville Avenue just west of Yonge Street and on the north side of Cumberland Street. The total site area is 0.32 ha. Building A is 0.28 ha and Building B is 0.04 ha. The location of the proposed development is shown in Figure 1.

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 Toronto WWFMG document;
- Evaluate various stormwater management practices that meet the requirements of the City and recommend a preferred strategy; and
- Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and sizing of the proposed stormwater management facilities.

1.4 DESIGN CRITERIA

The City of Toronto issued the WWFMG document in November 2006 to provide 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:

- **Water Balance** – The WWFMG requires a site to 'retain stormwater on-site, to the extent practicable, to achieve the same level of annual volume of overland runoff allowable from the development site under pre-development conditions'. According to the guidelines, if the allowable annual runoff volume from the development site under post-development conditions is less than the pre-development conditions, then the maximum allowable annual runoff is 50% of the total average annual rainfall depth. Typically, the minimum on-site runoff retention will require the site to retain all runoff from 5 mm storm event through infiltration, evapotranspiration or rainwater reuse.
- **Water Quality** – Under the WWFMG, the site is required to target a long-term removal of 80% of total suspended solids (TSS) on an annual loading basis. Depending on land use and site activities, sites under 0.3 ha that have a low potential for spills may not require additional quality controls or BMPs.
- **Erosion Control** –As indicated in WWFMG, 'For small infill/redevelopment sites < 2.0 ha, erosion control in the form of stormwater detention is normally not required, provided the on-site minimum runoff retention from a small design rainfall event (typically 5 mm) is achieved under the Water Balance Criteria.' During construction, appropriate erosion and sediment controls will be implemented.

— **Water Quantity Control and Discharge to Municipal Infrastructure** – Runoff from the 2-year to 100-year design storms must not exceed the allowable release rate as stated in the WWFMG. The allowable release rate to the municipal storm sewer system from the development site is the 2-year pre-development flow rate based on a runoff coefficient of 0.50 or the capacity of the receiving sewer.

2 PRE-DEVELOPMENT CONDITIONS

2.1 GENERAL

Currently, 11 Yorkville is occupied by a 10-storey commercial building with an underground parking structure at its rear. 17 Yorkville Avenue is occupied by a 3-storey commercial building with a small backyard area. 19-21 Yorkville Avenue is occupied by a 4-storey commercial building. 16 Cumberland Street is occupied by a 3-storey commercial building and 18 Cumberland Street is occupied by a 2-storey commercial building. The total site area is 0.32 ha, the majority of which consists of roof area and hard paved surfaces. Under existing conditions, due to the high ratio of impervious surfaces, a runoff coefficient of 0.90 is estimated, however the WWFMG specify a maximum runoff coefficient of 0.50 be used when calculating runoff in existing conditions for the purposes of determining the allowable release rate. Figure 2 illustrates the existing conditions of the subject site.

2.2 RAINFALL INFORMATION

The rainfall intensity for the site was calculated using the following equation: $I = AT^C$

Where;

I = rainfall intensity in mm/hour

T = time of concentration in hours

A and C = constant parameters (see below)

The parameters (A, C) recommended for use by the City of Toronto (per Section 3.1 of the Wet Weather Flow Management Guidelines) are summarized in Table 2.1.

Table 2.1 Rainfall Parameters

RETURN PERIOD (years)	2	5	10	25	50	100
A	21.8	32.0	38.7	45.2	53.5	59.7
C	-0.78	-0.79	-0.80	-0.80	-0.80	-0.80

Source: City of Toronto Wet Weather Flow Management Guidelines (November, 2006)

An initial time of concentration, T_C, of 10 minutes (or 0.167 hours) is recommended in the WWFMG document.

2.3 ALLOWABLE FLOW RATES

It is estimated that runoff from the existing building roof and surrounding at-grade at 11-21 Yorkville Avenue are collected by a combined sewer system on Yorkville Street and runoff at 16-18 Cumberland Street are collect by a combined sewer system on Cumberland Street. According to the WWFMG, Section 2.2.3.8, the allowable release rate to the municipal sewer system from the existing site is 35.2 L/s to Yorkville Avenue and 4.4 L/s to Cumberland Street. This is based on the 2-year pre-development flow rate calculated with a runoff coefficient value of 0.50.

The calculated pre-development peak flow rates for the existing site for 2-year to 100-year storm events are summarized in Table 2.2. Detailed calculations are provided in Appendix A.

Table 2.2 Pre-Development Peak Flow Rate Calculations & Maximum Allowable Site Discharge Rate

RETURN PERIOD (YEARS)	RAINFALL INTENSITY, I (MM/HR)	EXISTING PEAK RUNOFF RATES, Q (L/s)* YORKVILLE AVENUE C=0.9	EXISTING PEAK RUNOFF RATES, Q (L/s)** YORKVILLE AVENUE C=0.5	WWFMG MAXIMUM ALLOWABLE RELEASE RATE, Q_A** (L/s) YORKVILLE AVENUE	EXISTING PEAK RUNOFF RATES, Q (L/s)*** CUMBERLAND STREET C=0.9	EXISTING PEAK RUNOFF RATES, Q (L/s)**** CUMBERLAND STREET C=0.5	WWFMG MAXIMUM ALLOWABLE RELEASE RATE, Q_A**** (L/s) YORKVILLE AVENUE
2	88.2	63.4	35.2	**35.2**	7.9	4.4	**4.4**
5	131.8	94.7	52.6		11.8	6.6	
10	162.3	116.6	64.8		14.5	8.1	
25	189.5	136.2	75.6		17.0	9.4	
50	224.3	161.2	89.5		20.1	11.2	
100	250.3	179.8	99.9		22.4	12.4	

*C=0.90, pre-development sewer drainage catchment area of 0.29 ha and time of concentration of 10 minutes

**C=0.50, pre-development sewer drainage catchment area of 0.29 ha and time of concentration of 10 minutes

***C=0.90, pre-development sewer drainage catchment area of 0.04 ha and time of concentration of 10 minutes

****C=0.50, pre-development sewer drainage catchment area of 0.04 ha and time of concentration of 10 minutes

3 POST-DEVELOPMENT CONDITIONS

3.1 GENERAL

The proposed development consists of one 62-storey mixed use tower (Building A) and one 2-storey retail building (Building B). Building A will have four (4) below-grade parking levels, 716 residential units and approximately 3,107 m^2 of retail space. Building B will have one below-grade concourse level and two above-ground levels with a total of 954 m^2 of retail space. All storm service connections for Building A will be provided to existing infrastructure on Yorkville Avenue and for Building B, storm service connections will be directed to the laneway on the north side, which will ultimately connect to the existing combined sewer on Yorkville Avenue. At-grade impervious area north of Building A (213 m^2) will flow uncontrolled to Yorkville Avenue. Please refer to Figure 3 for the proposed conditions. Tables 3.1 and 3.2 show the land-use breakdown for Building A and Building B, respectively.

Table 3.1 Proposed Land-Use Area Breakdown – Building A

LAND-USE	AREA (m^2)	% COVERAGE	RUNOFF COEFFICIENT, C
Impervious Roof Surfaces	1,336	46%	0.90
Green Roof Area	495	17%	0.45
Landscape Area	50	27%	0.25
At-Grade Impervious	777	2%	0.90
Uncontrolled Drainage	213	7%	0.9
Total Site Area	**2,871**	**100%**	**0.81**

Table 3.2 Proposed Land-Use Area Breakdown – Building B

LAND-USE	AREA (m^2)	% COVERAGE	RUNOFF COEFFICIENT, C
Impervious Roof Surfaces	307	86%	0.90
At-Grade Impervious	50	14%	0.90
Total Site Area	**357**	**100%**	**0.90**

3.2 WATER BALANCE

As noted in section 1.4, the WWFMG states that the proponent should target the retention of 5 mm of stormwater runoff from all surfaces, in order to ensure 50% of the total average annual rainfall volume is retained on site. Due to the underground parking garage occupying the entire site area, infiltration is not feasible for this project. A water reuse sump volume, stored within the stormwater cistern, is the mechanism proposed to achieve water balance requirements. The cistern in Building A will provide all the water balance required for the site.

Given a 5 mm initial abstraction depth over landscape areas and green roof surfaces, (contributing area 546 m^2) and a 1 mm abstraction depth over impervious surfaces, (contributing area 2684 m^2), a water balance volume of 10.74 m^3 will be required to satisfy the water balance criteria. Table 3.3 outlines the water balance requirement for the site. Detailed water balance calculations can be found in Appendix A of this report.

Table 3.3 Water Balance Calculation – Entire Site

SURFACE TYPE	AREA (m^2)	IA (m)	VOLUME ABSTRACTED (m^3)	5 mm VOLUME (m^3)	WATER BALANCE (m^3)
Impervious Roof Area	1,693	0.001	1.64	8.22	6.77
Green Roof Area	495	0.005	2.48	2.48	-
Landscape Area	50	0.005	0.25	0.25	-
At-Grade Impervious	828	0.001	0.83	4.14	3.31
Uncontrolled Drainage	213	0.001	0.21	1.06	0.85
Total Site Area	**3,229**	-	**5.41**	**16.15**	**10.74**

The re-use methods for the captured stormwater is proposed to be a combination of irrigation supply for the proposed green roof and rooftop misters. The proposed options only operate during May to September and not for the entire year. As such, an annual water balance is done to size the cistern sump and to ensure the re-use options is capable of retaining 50% of the total annual average rainfall volume on site.

The annual total average rainfall within the City of Toronto is 714 mm (Government of Canada, Toronto Rainfall Records from 1981 - 2010). Accounting for initial abstractions, the remaining runoff volume to be retained based on capturing 50% of the total average annual rainfall for the site is 774 m^3.

The monthly irrigation demands for the site for the period from May to September have been estimated by Terraplan Landscape Architects. The annual water demand (153 days) for irrigation is 237 m^3. Rooftop misters perform mechanically-driven evapotranspiration, returning water to the atmosphere and counter the heat-island effect of impervious areas. One (1) Koolfog Mojave High-pressure Misting Pump (Model: M88 or approved equivalent) shall be proposed. The pump can mist at a flow rate of 8.3 L/minute (2.2 GMP) or 12 m^3 volume within 24 hours or 8 hours a day for three days. The annual water demand (153 days) for misting is 612 m^3.

The total annual water demand is 849 m^3, which is higher than 50% of the total average annual rainfall less abstractions. It is the developer's responsibility to ensure the selected mechanisms for irrigation and misting meets the water balance criteria. Detailed water demand calculations can be found in Appendix A. Additional water-reuse information can be found in Appendix C.

The cistern sump volume was designed to be large enough to capture runoff from major storm event and thus provide a re-use volume even during extended dry periods. The cistern is designed with a sump storage volume of 40 m^3, capable of capturing runoff from a storm event producing up to 14 mm of rainfall depth, which is equivalent to capturing 81% of the total annual rainfall volume (WWFMG, Figure 1a), from May to September.

For the warmer period of May through September, it is important that the sump be sufficiently full to meet the increased water re-use demand which includes irrigation requirements. In the warmer months, the re-use demands are capable of ensuring the cistern has sufficient capacity to capture minor storm events. The average 72 hour water re-use demand is 17 m^3, which is larger than the runoff volume associated with a 5 mm storm event, 10.74 m^3.

3.3 WATER QUALITY CONTROL

The majority of the site area is new impervious roof or pedestrian walkways, which is consider clean for the purpose of stormwater runoff quality. The TSS loading of this area is relatively low. No additional water quality treatment is recommended at this stage.

3.4 EROSION CONTROL

As mentioned in Section 1.4, this development is an overall small footprint development. According to the WWFMG, *'For small infill/redevelopment sites <2 ha, erosion control in the form of stormwater detention is normally not required, provided the on-site minimum runoff retention from a small design rainfall event (typically 5 mm) is achieved under the Water Balance Criteria.'*

The site area for this application is 0.32 ha, which is well below the 2.0 ha guideline, and the 5 mm water balance requirement has been addressed – therefore additional measures for erosion control are not recommended.

3.5 WATER QUANTITY CONTROL

As noted in section 2.3, the allowable discharge rate to the municipal sewer system on Yorkville Avenue from the site is estimated to be 35.2 L/sec, which is equivalent to the peak runoff rate under pre-development conditions during a 2-year design storm event with a minimum runoff coefficient of 0.50.

Discharge from Building A will be directed to a SWM control tank located in the underground parking garage. The cistern is designed to have a footprint of 16.95 m^2 with a height of 9 m. The cistern volume 171 m^3, including sump volume. A pump will be proposed above the sump outlet to drain runoff from the site for the cistern. The pump will discharge to a control manhole before outletting to the Yorkville Avenue municipal sewer. A 125 mm orifice tube will control the flow from the control manhole. Due to insufficient information regarding pump size and associated discharge, a maximum discharge of 16 L/s is assumed for outlet sizing and cistern storage calculations for Buildings A. This ensures that site meets overall stormwater management criteria. It will be developer's responsibility to ensure that the proposed pumps is sized to meet 16 L/s.

Discharge from Building B will be directed to a SWM control tank located at the concourse level. The cistern is designed to have a footprint of 16 m^2 with a height of 2 m. A 3-inch (76 mm) diameter SXH Hydrobrake valve has been selected to control runoff from the cistern.

For events greater than the 100-year storm or in the event of an obstruction at the cistern outlet, excess volume from the cistern will be discharged onto the nearby grade, ultimately discharging to the north of the site on Yorkville Street.

The 'HydroCAD' software package (Version 9.10) has been used to model the behaviour of the proposed SWM system, and determine its response under various storm events. This software utilises the Modified Rational Method to calculate flow rates and related storage values. Detailed output from the model is included in Appendix B. Based on the City's WWFMG criteria – specifically the 'Discharge to Municipal Infrastructure' section – all stormwater runoff from events up to and including the 100-year storm must be contained on site and released at or below the allowable rate. Summaries of the modelled peak offsite discharge rates for the SWM cisterns in Building A and B are provided in Table 3.4 shows the total off site discharge to the municipal sewer, which is in compliance with the WWFMG discharge rate criteria.

Table 3.4 Water Balance Calculation – Entire Site

RETURN PERIOD (YEARS)	UTILIZED CISTERN STORAGE (m^3) (T_D = 10 MIN) BUILDING B	PEAK WATER ELEVATION IN CISTERN (m) (T_D = 10 MIN) BUILDING B	CISTERN POST-DEVELOPMENT FLOW RATE (L/s) (T_D = 10 MIN) BUILIDNG B	UNCONTROLLED AT-GRADE FLOW RATE (L/S) (T_D = 10 MIN)	PUMPED FLOW RATE (L/S) (T_D = 10 MIN) BUILDING A	TOTAL SITE ALLOWABLE FLOW RATE (L/s)	OFFSITE POST-DEVELOPMENT FLOW RATE (L/s) (T_D = 10 MIN)
2	2.9	0.357	2.4	4.6	16	**35.2**	23.0
5	4.9	0.613	2.6	6.9			25.1
10	6.3	0.790	2.9	8.5			26.8
25	7.6	0.950	3.2	9.9			28.4
50	9.2	1.155	3.5	11.7			30.4
100	10.5/10.5	1.309/1.309	3.8/3.8	13.1			31.9/31.9

**Red values in the table are the modelling results at td 10 mins, which is the time of duration that creates the largest peak flow at the Yorkville Avenue Combined Sewer.*

The table above indicates that the flows and storages in the cistern based on 10 minutes duration time from 2 to 100 year; meanwhile it presents the maximum required values at time of peak for 100 year event. The modelling results demonstrate that the post-development peak flow rates for all events up to the 100-year storm are lower than the target release rate established in accordance with the WWFMG. The time of duration has been iteratively determined at t_d = 10 minutes (for the 100-year event) according to the Modified Rational Method process.

4 CONCLUSIONS

A stormwater management plan has been prepared to support the rezoning application for the proposed redevelopment of 11-21 Yorkville Avenue and 16-18 Cumberland Street in the City of Toronto. The key points are summarized below.

WATER BALANCE

A sump volume of 40 m³ is provided at the base of a stormwater cistern in Building A for reuse purposes ensuring that the WWFMG Water Balance criteria are satisfied.

WATER QUANTITY

Storage provided by stormwater cisterns in Building A and B will ensure that the peak offsite discharge rates to the combined sewer on Yorkville Avenue will be below the allowable maximum rate of 35.2 L/s defined in the WWFMG for all storms up to and including the 100-year event. The release rate from each cistern is controlled through the use of a 100 mm orifice tube from the proposed 165 m^3 cistern in Building A and the use of a 3 inch (76 mm) SXH HydroBrake valve from the proposed 16 m³ stormwater cistern in Building B.

EROSION CONTROL

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

WATER QUALITY

The majority of the site area is new impervious roof or pedestrian walkways, which is consider clean for the purpose of stormwater runoff quality. The TSS loading of this area is relatively low. No additional water quality treatment is recommended at this stage.

The proposed SWM strategy described in this report addresses all stormwater management related impacts from the project and satisfies the intent of the City of Toronto Wet Weather Flow Management Guidelines.

Respectfully submitted,

WSP

Brenden Ding, M.A.Sc.

Designer, Water Resources

Bhavika Patel, P.Eng.,CFM

Project Engineer, Water Resources

5 STANDARD LIMITATIONS

This report was prepared by WSP Group Canada Limited for the client in accordance with the agreement between WSP and the client. This report is based on information provided to WSP which has not been independently verified.

The disclosure of any information contained in this report is the sole responsibility of the client. The material in this report, accompanying spreadsheets and all information relating to this activity reflect WSP's judgment in light of the information available to us at the time of preparation of this report. With the exception of the City of Toronto who can rely on this report, any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report.

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This Standard Limitations statement is considered part of this report.

APPENDIX

A STORMWATER MANAGEMENT CALCULATIONS

	Stormwater Management Calculations	Project: 11-21 Yorkville	No.: 17M-01494	
	Allowable Offsite Discharge Rate - Yorkville Avenue	By: BD	Date: 3/22/2018	Page: 1
		Checked: BP	Checked:	

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

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

Project Area, A **0.29** hectares
Runoff Coef, C* 0.50

* Note - actual site runoff coefficient is approximately 0.75, however City of Toronto WWFMG states maximum runoff coefficient to be used in calculation of pre-development peak flow is 0.50 (section 2.2.3.8).

Rainfall intensity calculated in accordance with City of Toronto WWFMG (section 3.1): $I = AT^C$

Where: A and C = Parameters defined in WWFMG section 3.1.
I = Rainfall intensity (mm/hour)
T = Time of concentration (hours)

Return Period (Years)	2	5	10	25	50	100
A	21.8	32.0	38.7	45.2	53.5	59.7
C	-0.78	-0.79	-0.80	-0.80	-0.80	-0.80
T (mins) **	10	10	10	10	10	10
T (hrs)	0.167	0.167	0.167	0.167	0.167	0.167
I (mm/hr)	88.2	131.8	162.3	189.5	224.3	250.3
Q (litres/sec)	**35.2**	52.6	64.8	75.6	89.5	99.9
Q (m3/sec)	0.035	0.053	0.065	0.076	0.090	0.100

** Note recommended minimum value for time of concentration for small sites (<2.0ha) is 10 minutes.

Allowable release rate to municipal storm sewer system is therefore 35.2 litres/second.

(As per City of Toronto WWFMG section 2.2.3.7)

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

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

Project Area, A **0.04** hectares
Runoff Coef, C* 0.50

* Note - actual site runoff coefficient is approximately 0.75, however City of Toronto WWFMG states maximum runoff coefficient to be used in calculation of pre-development peak flow is 0.50 (section 2.2.3.8).

Rainfall intensity calculated in accordance with City of Toronto WWFMG (section 3.1): $I = AT^C$

Where: A and C = Parameters defined in WWFMG section 3.1.
I = Rainfall intensity (mm/hour)
T = Time of concentration (hours)

Return Period (Years)	2	5	10	25	50	100
A	21.8	32.0	38.7	45.2	53.5	59.7
C	-0.78	-0.79	-0.80	-0.80	-0.80	-0.80
T (mins) **	10	10	10	10	10	10
T (hrs)	0.167	0.167	0.167	0.167	0.167	0.167
I (mm/hr)	88.2	131.8	162.3	189.5	224.3	250.3
Q (litres/sec)	**4.4**	6.6	8.1	9.4	11.2	12.4
Q (m3/sec)	0.004	0.007	0.008	0.009	0.011	0.012

** Note recommended minimum value for time of concentration for small sites (<2.0ha) is 10 minutes.

Allowable release rate to municipal storm sewer system is therefore 4.4 litres/second.

(As per City of Toronto WWFMG section 2.2.3.7)

The City of Toronto Wet Weather Flow Management Guidelines (WWFMG) require a site "to retain water on-site to the extent practicable, to achieve the same level of annual volume of overland runoff allowable from the development site under pre-development conditions".
- Section 2.2.1.1 (a)

In this case, the minimum on-site runoff retention will require the site to retain all runoff from 5 mm storm event through evapotranspiration infiltration, or rainwater reuse. WWFMG Section 2.2.1.1 (d).

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

Land Use	Area (m^2)	Runoff C	Impervious	CN
Impervious Roof Area	1,643	0.90	100%	98
Green Roof Area	495	0.45	0%	81
Landscape	50	0.90	100%	98
At-Grade Impervious	828	0.90	100%	98
Uncontrolled Drainage	213	0.90	100%	98
Total Site Area:	**3,229**	**0.83**	**85%**	**95**

Surface Type	Area (m^2)	IA (m)	Volume Abstracted (m^3)	5 mm Volume (m^3)	Water Balance (m^3)
Impervious Roof Area	1,643	0.001	1.64	8.22	6.57
Green Roof Area	495	0.005	2.48	2.48	0.00
Landscape	50	0.005	0.25	0.25	0.00
At-Grade Impervious	828	0.001	0.83	4.14	3.31
Uncontrolled Drainage	213	0.001	0.21	1.06	0.85
Total Site Area:	**3,229**	**-**	**5.41**	**16.15**	**10.74**

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

This is supported by EPA analysis of green roof manufacturer data sheets (dry unit weights versus saturated unit weights).

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

Therefore, volume of runoff during a 5 mm storm event: **10.74** m^3

Method 1 - Irrigation

	May	June	July	August	Sept	Avg
72 Hour Demand (Litres)	4311	5299	5864	4684	3038	**4639**
Annual Demand - 153 Days (m^3)	220	270	299	239	155	**237**

Method 2 - Misting

Misting Demand (m^3/hour)	0.5
Hours of Operation per day	8
72 Hour Misting Demand (m3)	**12**
Annual Demand -153 days(m^3)	**612**

Total Annual Demand (m^3)	**849**
Total 72 Hour Demand (m^3)	**17**

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Subject **Analysis of the Total Annual Runoff Volume from Block C with Proposed SWM Strategy**

Averaged Annual Rainfall Depth: (mm) 714 Source: Toronto Rainfall Records (1981 - 2010)
http://www.climate.weatheroffice.gc.ca/climate_normals/index_e.htm

Assumptions of the analysis:

1. For Imperviousness Area, the first milimeter rainfall will get the pavement wet and sumps filled; therefore, an initial abstraction depth of 1.0 mm is assumed - this represents 10% of total average annual rainfall volume in Toronto (WWFMG 2.2.1.1 Fig.1a)
2. Green Roofs, the water retention layer supporting plants growing can retain 5 mm rainfall without discharge. That means Green Roofs can retain 48% annual rainfall volume.
3. For soft landscaped area, the surfaces retain 48% of annual average rainfall-runoff volume by soil retention, vegetation evapotranspiration and infiltration

Water Balance Analysis Sheet - Summer Months (May through September)

Landuse		Building Green Roof	Soft Landscaped Surfaces	Impervious Surfaces	Site Total	Runoff (Percentage of Annual Total)
Area (m^2)		495	50	2,684	3,229	
% Area Coverage		15.3%	1.5%	83.1%	100.0%	
5 Month Rainfall (mm) (May - September)		383	383	383	383	54%
Initial Abstraction (mm)		5.0	5.0	1.0	N/A	
Initial Abstraction as % Annual Average Rainfall		48%	48%	10%	N/A	
5 Month Summer Abstraction / Evapotranspiration/Infiltration (mm)		184	184	38	63	8.8%
Annual Water Re-use	Captured Rainfall Depth (mm)	9.0	9.0	13.0	N/A	N/A
	Storage Volume (m^3)	4.5	0.5	34.9	N/A	N/A
	Cistern Storage Required (m^3)	4.5	0.5	34.9	**39.8**	N/A
Total Rainfall Depth Captured (mm)		14.0	14.0	14.0	N/A	
Equivalent % of total average annual rainfall volume in Toronto (from WWFMG 2.2.1.1 Fig.1a)		81%	81%	81%	81%	N/A
Depth Captured for Summer Months (mm)		310	310	310	310	43.4%
Runoff in Summer Months (mm)		**73**	**73**	**73**	**73**	**10.2%**

Month	May	Jun	Jul	Aug	Sep	Total
Rainfall Depth (mm)	82	70.9	63.9	81.1	84.7	383
					Annual %	0.54

	Winter	Summer	
Average Annual Runoff	**38.8%**	**10.2%**	**49.0%**

wsp	Project	11-21 Yorkville	No.	17M-01494	
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Subject Analysis of the Total Annual Runoff Volume from Block C with Proposed SWM Strategy

Averaged Annual Rainfall Depth: (mm) 714 Source: Toronto Rainfall Records (1981 - 2010)
http://www.climate.weatheroffice.gc.ca/climate_normals/index_e.htm

Water Balance Analysis Sheet - Winter Months (October through April)

Landuse		Building Green Roof	Soft Landscaped Surfaces	Impervious Surfaces	Site Total	Runoff (Percentage of Annual Total)
Area (m^2)		495	50	2,684	3,229	
% Area Coverage		15.3%	1.5%	83.1%	100.0%	
6 Month Rainfall (Oct - Mar) (mm)		331	331	331	331	46%
Initial Abstraction (mm)		5.0	5.0	1.0	N/A	
Initial Abstraction as % Annual Average Rainfall		48%	48%	10%	N/A	
6 Month Winter Abstraction / Evapotranspiration/Infiltration (mm)		159	159	33	54	7.6%
Annual Water Re-use	Captured Rainfall Depth (mm)	0.0	0.0	0.0	N/A	N/A
	Storage Volume (m^3)	0.0	0.0	0.0	N/A	N/A
	Cistern Storage Required (m^3)	0.0	0.0	0.0	**0.0**	N/A
Total Rainfall Depth Captured (mm)		5.0	5.0	1.0	N/A	
Equivalent % of total average annual rainfall volume in Toronto (from WWFMG 2.2.1.1 Fig.1a)		48%	48%	10%	16%	N/A
Depth Captured for Winter Months (mm)		159	159	33	54	7.6%
Runoff in Winter Months (mm)		**172**	**172**	**298**	**277**	**38.8%**

Month	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**Total**
Rainfall Depth (mm)	**64.3**	**75.4**	**38.2**	**29.1**	**29.7**	**33.6**	**61**	**331**
							Annual %	**0.46**

	Winter	**Summer**	
Average Annual Runoff	**38.8%**	**10.2%**	**49.0%**

	Project	11-21 Yorkville	No.	17M-01494	
	By	B.D.	Date	3/22/2018	Page
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Subject	Total Annual Water Balance Analysis - Ultimate Condition				

Annual Rainfall Depth: (mm) 714 Source: Toronto Rainfall Records (1981-2010)
http://www.climate.weatheroffice.gc.ca/climate_normals/index_e.htm

Month	Apr	May	Jun	Jul	Aug	Sep
Rainfall Depth (mm)	61.1	82	70.9	63.9	81.1	84.7

Month	Oct	Nov	Dec	Jan	Feb	Mar	Total
Rainfall Depth (mm)	64.3	75.4	38.2	29.1	29.7	33.6	**714**

Assumptions of the analysis:

1. For impervious areas, the first milimeter rainfall will wet the pavement and fill sumps; therefore, an initial abstraction depth of 1.0 mm is assumed - this represents 10% of total average annual rainfall volume in Toronto (WWFMG 2.2.1.1 Fig.1a)

2. For green roofs the water retention layer supporting plant growth can retain 5 mm rainfall without discharge, meaning that 48% annual rainfall volume is retained.

3. For soft landscaped areas, the surfaces retain 48% of annual average rainfall-runoff volume by soil retention, vegetation evapotranspiration and infiltration
4. Annual average rainfall percentages for the City of Toronto are taken from WWFMG 2.2.1.1 Fig.1a

Water Balance Analysis Sheet - Annual

Land Use	*Green Roofs*	*Soft Landscaped Surface*	*Impervious Surface*	*Site Total*	*Runoff (Percentage of Annual Total)*
Area (m^2)	**495**	**50**	**2,684**	**3,229**	
% Area Coverage	15%	2%	83%	100%	
Annual Rainfall (mm)	714	714	714	714	100%
50% to be Retained	357	357	357	357	50%
Initial Abstraction (mm)	5	5	1	N/A	
Initial Abstraction as % Annual Average Rainfall	48%	48%	10%	N/A	
Annual Abstraction/Evapotranspiration/Infiltration (mm)	343	343	71	117	16.4%
Total Retention Required (mm)	14	14	286	240	33.6%
Annual Total Abstraction (mm)	170	17	192	378	
Annual Volume Captured - Less Abstractions (m^3)	7	1	767	**774**	33.6%

Conclusion

The analysis shows that in order to limit the site's annual runoff to 50% of the total annual rainfall depth, the total annual rainfall volume to be captured on site, less initial abstractions, is 774 m^3.

	Stormwater Management Calculations	Project: 11-21 Yorkville	No.: 17M-01494	
	Orifice Calculation	By: BD	Date: 3/22/2018	Page:
		Checked: BP	Checked:	8

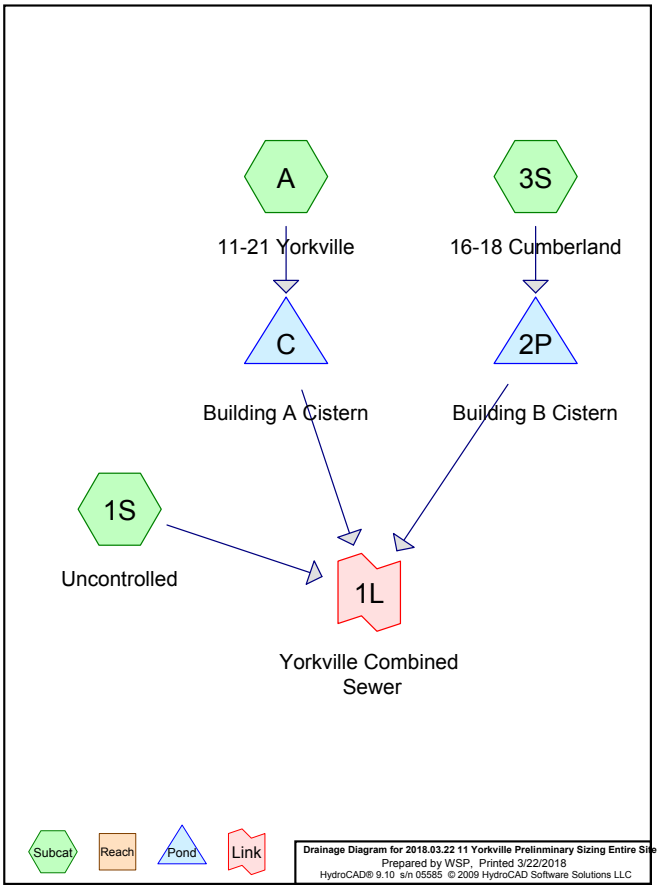
Orifice Tube Size, D (mm)	125
Orifice Coefficient, C	0.8
Orifice Area, A (m^2)	0.012
Orifice invert elevation, h1	0

Orifice Equation: $Q = CA \times \sqrt{2gh}$

Water Elev. in Tank h2 (m)	Head on Outlet* h (m)	Q ($m^3/2$)	Q L/s	Tank Min. Active Vol (m^3)
0.00	-	-	-	-
0.05	-	-	-	-
0.10	-	-	-	-
0.15	-	-	-	-
0.20	0.14	0.016	16.1	4
0.25	0.19	0.019	18.8	5
0.30	0.24	0.021	21.2	6
0.35	0.29	0.023	23.3	7
0.40	0.34	0.025	25.3	8
0.45	0.39	0.027	27.1	9
0.50	0.44	0.029	28.8	10
0.55	0.49	0.030	30.4	11
0.60	0.54	0.032	31.9	12
0.65	0.59	0.033	33.3	13
0.70	0.64	0.035	34.7	14
0.75	0.69	0.036	36.1	15
0.80	0.74	0.037	37.3	16
0.85	0.79	0.039	38.6	17
0.90	0.84	0.040	39.8	18
0.95	0.89	0.041	41.0	19
1.00	0.94	0.042	42.1	20
1.05	0.99	0.043	43.2	21
1.10	1.04	0.044	44.3	22
1.15	1.09	0.045	45.3	23
1.20	1.14	0.046	46.4	24
1.25	1.19	0.047	47.4	25
1.30	1.24	0.048	48.4	26
1.35	1.29	0.049	49.3	27
1.40	1.34	0.050	50.3	28
1.45	1.39	0.051	51.2	29
1.50	1.44	0.052	52.1	30
1.55	1.49	0.053	53.0	31
1.60	1.54	0.054	53.9	32

APPENDIX

B HYDROLOGIC MODEL OUTPUT (HydroCAD)



Area Listing (all nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
50.0	0.25	Landscape (A)
495.0	0.45	Green Roof (A)
777.5	0.90	At-Grade Impervious (A)
50.4	0.90	At-grade Impervious (3S)
1,643.3	0.90	Impervious Roof (3S, A)
212.9	0.90	Uncontrolled (1S)
3,229.1		**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

Subcatchment1S: Uncontrolled Runoff Area=212.9 m² 0.00% Impervious Runoff Depth=13 mm
Tc=10.0 min C=0.90 Runoff=0.0046 m³/s 2.8 m³

Subcatchment3S: 16-18 Cumberland Runoff Area=357.7 m² 0.00% Impervious Runoff Depth=13 mm
Tc=10.0 min C=0.90 Runoff=0.0077 m³/s 4.7 m³

SubcatchmentA: 11-21 Yorkville Runoff Area=2,658.5 m² 0.00% Impervious Runoff Depth=12 mm
Tc=10.0 min C=0.80 Runoff=0.0512 m³/s 31.2 m³

Pond 2P: Building B Cistern Peak Elev=0.357 m Storage=2.9 m³ Inflow=0.0077 m³/s 4.7 m³
Outflow=0.0024 m³/s 4.7 m³

Pond C: Building A Cistern Peak Elev=0.798 m Storage=15.2 m³ Inflow=0.0512 m³/s 31.2 m³
Outflow=0.0160 m³/s 31.2 m³

Link 1L: Yorkville Combined Sewer Inflow=0.0230 m³/s 38.8 m³
Primary=0.0230 m³/s 38.8 m³

Total Runoff Area = 3,229.1 m² Runoff Volume = 38.8 m³ Average Runoff Depth = 12 mm
100.00% Pervious = 3,229.1 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 1S: Uncontrolled

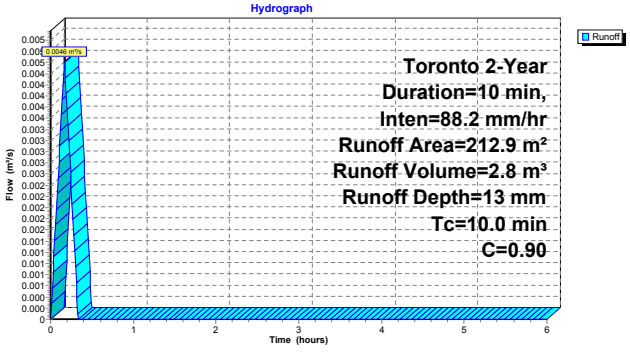
Runoff = 0.0046 m³/s @ 0.17 hrs, Volume= 2.8 m³, Depth= 13 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 2-Year Duration=10 min, Inten=88.2 mm/hr

Area (m²)	C	Description
212.9	0.90	Uncontrolled
212.9		100.00% Pervious Area

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

Subcatchment 1S: Uncontrolled



Summary for Subcatchment 3S: 16-18 Cumberland

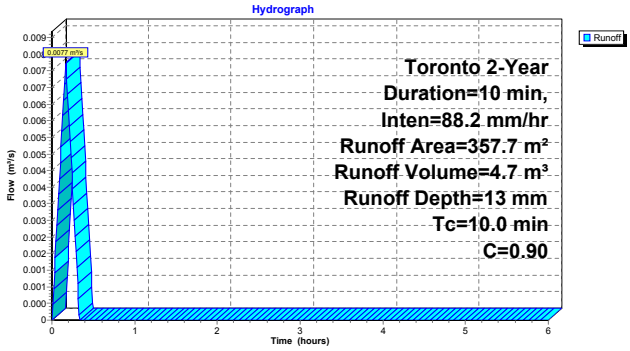
Runoff = 0.0077 m³/s @ 0.17 hrs, Volume= 4.7 m³, Depth= 13 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 2-Year Duration=10 min, Inten=88.2 mm/hr

Area (m²)	C	Description
307.3	0.90	Impervious Roof
50.4	0.90	At-grade Impervious
357.7	0.90	Weighted Average
357.7		100.00% Pervious Area

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

Subcatchment 3S: 16-18 Cumberland



Summary for Subcatchment A: 11-21 Yorkville

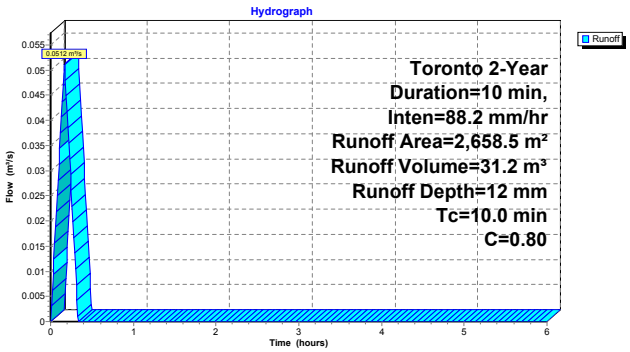
Runoff = 0.0512 m³/s @ 0.17 hrs, Volume= 31.2 m³, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 2-Year Duration=10 min, Inten=88.2 mm/hr

Area (m²)	C	Description
495.0	0.45	Green Roof
1,336.0	0.90	Impervious Roof
777.5	0.90	At-Grade Impervious
50.0	0.25	Landscape
2,658.5	0.80	Weighted Average
2,658.5		100.00% Pervious Area

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

Subcatchment A: 11-21 Yorkville



Summary for Pond 2P: Building B Cistern

Inflow Area = 357.7 m², 0.00% Impervious, Inflow Depth = 13 mm for 2-Year event
Inflow = 0.0077 m³/s @ 0.17 hrs, Volume= 4.7 m³
Outflow = 0.0024 m³/s @ 0.16 hrs, Volume= 4.7 m³, Atten= 69%, Lag= 0.0 min
Primary = 0.0024 m³/s @ 0.16 hrs, Volume= 4.7 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 0.357 m @ 0.29 hrs Surf.Area= 8.0 m² Storage= 2.9 m³

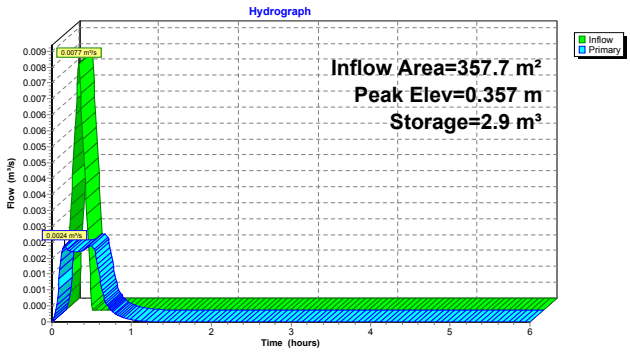
Plug-Flow detention time= 12.8 min calculated for 4.7 m³ (100% of inflow)
Center-of-Mass det. time= 12.9 min (22.9 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	16.0 m³	**8.00 mW x 1.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Reg-U-Flo SXH 3.0-in Metric - Extended**

Primary OutFlow Max=0.0024 m³/s @ 0.16 hrs HW=0.178 m (Free Discharge)
↑1=Reg-U-Flo SXH 3.0-in Metric - Extended (Custom Controls 0.0024 m³/s)

Pond 2P: Building B Cistern



Summary for Pond C: Building A Cistern

Inflow Area = 2,658.5 m², 0.00% Impervious, Inflow Depth = 12 mm for 2-Year event
Inflow = 0.0512 m³/s @ 0.17 hrs, Volume= 31.2 m³
Outflow = 0.0160 m³/s @ 0.06 hrs, Volume= 31.2 m³, Atten= 69%, Lag= 0.0 min
Primary = 0.0160 m³/s @ 0.06 hrs, Volume= 31.2 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 0.798 m @ 0.28 hrs Surf.Area= 19.0 m² Storage= 15.2 m³

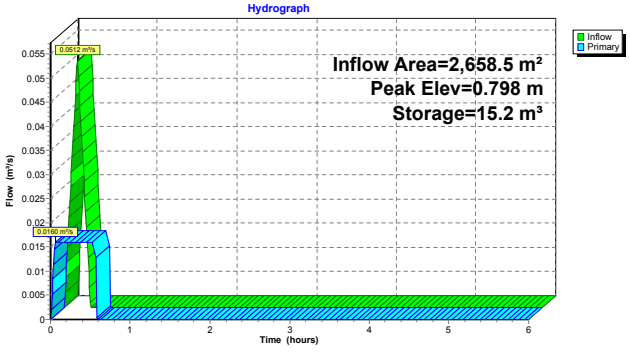
Plug-Flow detention time= 8.0 min calculated for 31.2 m³ (100% of inflow)
Center-of-Mass det. time= 8.0 min (18.0 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	125.4 m³	**19.00 mW x 1.00 mL x 6.60 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Special & User-Defined** Elev. (meters) 0.000 0.010 2.050 10.000 Disch. (m³/s) 0.00000 0.01600 0.01600 0.01600

Primary OutFlow Max=0.0160 m³/s @ 0.06 hrs HW=0.012 m (Free Discharge)
↑1=Special & User-Defined (Custom Controls 0.0160 m³/s)

Pond C: Building A Cistern

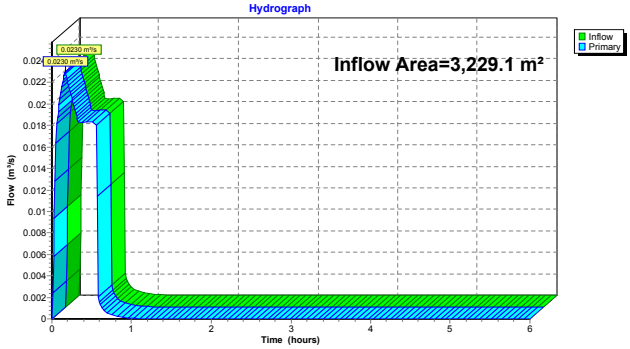


Summary for Link 1L: Yorkville Combined Sewer

Inflow Area = 3,229.1 m², 0.00% Impervious, Inflow Depth = 12 mm for 2-Year event
Inflow = 0.0230 m³/s @ 0.17 hrs, Volume= 38.8 m³
Primary = 0.0230 m³/s @ 0.17 hrs, Volume= 38.8 m³, Atten= 0%, Lag= 0.0 min

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

Link 1L: Yorkville Combined Sewer



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

Subcatchment1S: Uncontrolled Runoff Area=212.9 m² 0.00% Impervious Runoff Depth=20 mm
Tc=10.0 min C=0.90 Runoff=0.0069 m³/s 4.2 m³

Subcatchment3S: 16-18 Cumberland Runoff Area=357.7 m² 0.00% Impervious Runoff Depth=20 mm
Tc=10.0 min C=0.90 Runoff=0.0116 m³/s 7.1 m³

SubcatchmentA: 11-21 Yorkville Runoff Area=2,658.5 m² 0.00% Impervious Runoff Depth=18 mm
Tc=10.0 min C=0.80 Runoff=0.0765 m³/s 46.7 m³

Pond 2P: Building B Cistern Peak Elev=0.613 m Storage=4.9 m³ Inflow=0.0116 m³/s 7.1 m³
Outflow=0.0026 m³/s 7.1 m³

Pond C: Building A Cistern Peak Elev=1.560 m Storage=29.6 m³ Inflow=0.0765 m³/s 46.7 m³
Outflow=0.0160 m³/s 46.7 m³

Link 1L: Yorkville Combined Sewer Inflow=0.0251 m³/s 57.9 m³
Primary=0.0251 m³/s 57.9 m³

Total Runoff Area = 3,229.1 m² Runoff Volume = 58.0 m³ Average Runoff Depth = 18 mm
100.00% Pervious = 3,229.1 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 1S: Uncontrolled

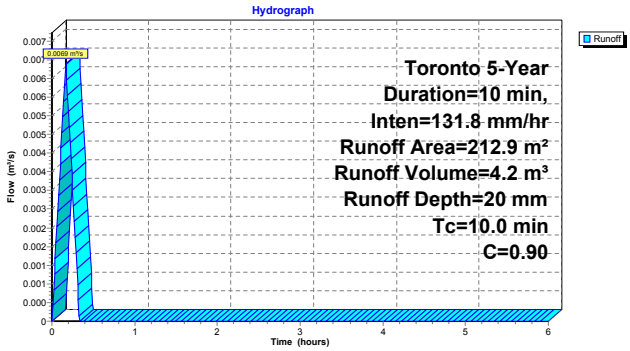
Runoff = 0.0069 m³/s @ 0.17 hrs, Volume= 4.2 m³, Depth= 20 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 5-Year Duration=10 min, Inten=131.8 mm/hr

Area (m²)	C	Description
212.9	0.90	Uncontrolled
212.9		100.00% Pervious Area

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

Subcatchment 1S: Uncontrolled



Summary for Subcatchment 3S: 16-18 Cumberland

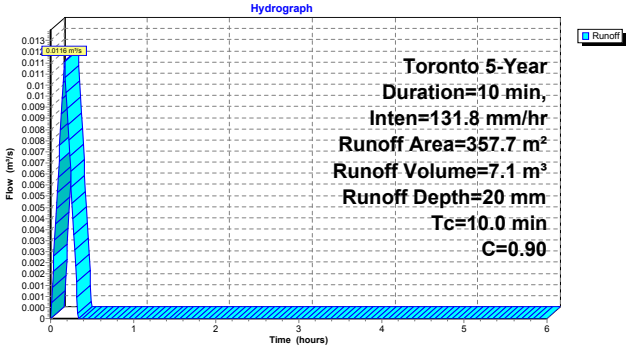
Runoff = 0.0116 m³/s @ 0.17 hrs, Volume= 7.1 m³, Depth= 20 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 5-Year Duration=10 min, Inten=131.8 mm/hr

Area (m²)	C	Description
307.3	0.90	Impervious Roof
50.4	0.90	At-grade Impervious
357.7	0.90	Weighted Average
357.7		100.00% Pervious Area

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

Subcatchment 3S: 16-18 Cumberland



Summary for Subcatchment A: 11-21 Yorkville

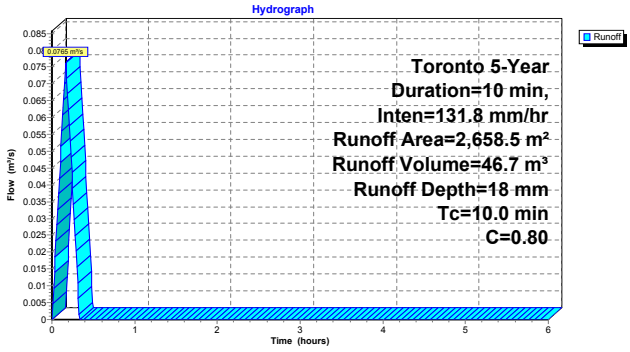
Runoff = 0.0765 m³/s @ 0.17 hrs, Volume= 46.7 m³, Depth= 18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 5-Year Duration=10 min, Inten=131.8 mm/hr

Area (m²)	C	Description
495.0	0.45	Green Roof
1,336.0	0.90	Impervious Roof
777.5	0.90	At-Grade Impervious
50.0	0.25	Landscape
2,658.5	0.80	Weighted Average
2,658.5		100.00% Pervious Area

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

Subcatchment A: 11-21 Yorkville



Summary for Pond 2P: Building B Cistern

Inflow Area = 357.7 m², 0.00% Impervious, Inflow Depth = 20 mm for 5-Year event
Inflow = 0.0116 m³/s @ 0.17 hrs, Volume= 7.1 m³
Outflow = 0.0026 m³/s @ 0.30 hrs, Volume= 7.1 m³, Atten= 78%, Lag= 7.7 min
Primary = 0.0026 m³/s @ 0.30 hrs, Volume= 7.1 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 0.613 m @ 0.30 hrs Surf.Area= 8.0 m² Storage= 4.9 m³

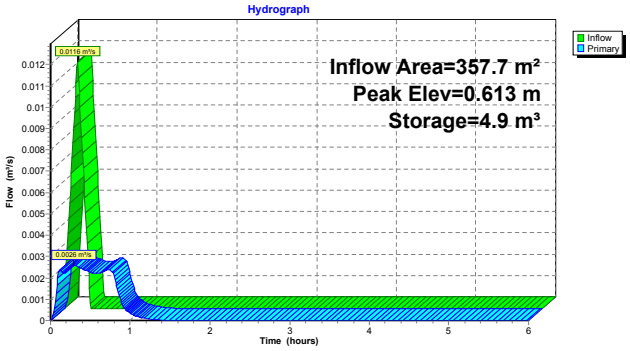
Plug-Flow detention time= 19.2 min calculated for 7.1 m³ (100% of inflow)
Center-of-Mass det. time= 19.3 min (29.3 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	16.0 m³	**8.00 mW x 1.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Reg-U-Flo SXH 3.0-in Metric - Extended**

Primary OutFlow Max=0.0026 m³/s @ 0.30 hrs HW=0.613 m (Free Discharge)
↑**1=Reg-U-Flo SXH 3.0-in Metric - Extended** (Custom Controls 0.0026 m³/s)

Pond 2P: Building B Cistern



Summary for Pond C: Building A Cistern

Inflow Area = 2,658.5 m², 0.00% Impervious, Inflow Depth = 18 mm for 5-Year event
Inflow = 0.0765 m³/s @ 0.17 hrs, Volume= 46.7 m³
Outflow = 0.0160 m³/s @ 0.04 hrs, Volume= 46.7 m³, Atten= 79%, Lag= 0.0 min
Primary = 0.0160 m³/s @ 0.04 hrs, Volume= 46.7 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 1.560 m @ 0.30 hrs Surf.Area= 19.0 m² Storage= 29.6 m³

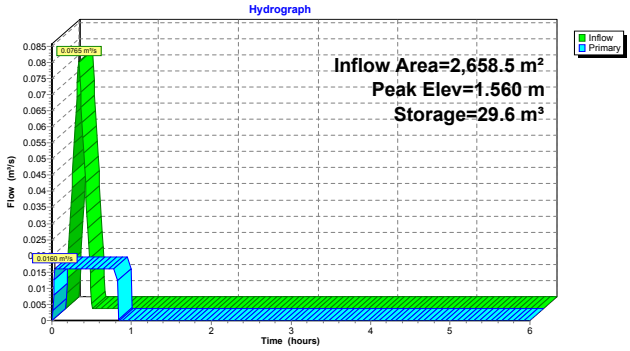
Plug-Flow detention time= 15.5 min calculated for 46.6 m³ (100% of inflow)
Center-of-Mass det. time= 15.5 min (25.5 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	125.4 m³	**19.00 mW x 1.00 mL x 6.60 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Special & User-Defined**
			Elev. (meters) 0.000 0.010 2.050 10.000
			Disch. (m³/s) 0.00000 0.01600 0.01600 0.01600

Primary OutFlow Max=0.0160 m³/s @ 0.04 hrs HW=0.011 m (Free Discharge)
↑**1=Special & User-Defined** (Custom Controls 0.0160 m³/s)

Pond C: Building A Cistern

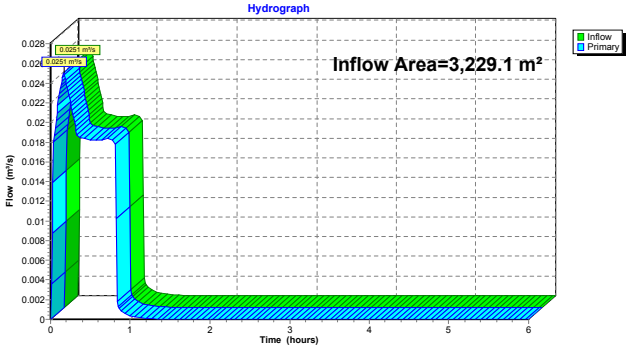


Summary for Link 1L: Yorkville Combined Sewer

Inflow Area = 3,229.1 m², 0.00% Impervious, Inflow Depth = 18 mm for 5-Year event
Inflow = 0.0251 m³/s @ 0.17 hrs, Volume= 57.9 m³
Primary = 0.0251 m³/s @ 0.17 hrs, Volume= 57.9 m³, Atten= 0%, Lag= 0.0 min

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

Link 1L: Yorkville Combined Sewer



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

Subcatchment1S: Uncontrolled Runoff Area=212.9 m² 0.00% Impervious Runoff Depth=24 mm
Tc=10.0 min C=0.90 Runoff=0.0085 m³/s 5.2 m³

Subcatchment3S: 16-18 Cumberland Runoff Area=357.7 m² 0.00% Impervious Runoff Depth=24 mm
Tc=10.0 min C=0.90 Runoff=0.0143 m³/s 8.7 m³

SubcatchmentA: 11-21 Yorkville Runoff Area=2,658.5 m² 0.00% Impervious Runoff Depth=22 mm
Tc=10.0 min C=0.80 Runoff=0.0942 m³/s 57.5 m³

Pond 2P: Building B Cistern Peak Elev=0.790 m Storage=6.3 m³ Inflow=0.0143 m³/s 8.7 m³
Outflow=0.0029 m³/s 8.7 m³

Pond C: Building A Cistern Peak Elev=2.108 m Storage=40.1 m³ Inflow=0.0942 m³/s 57.5 m³
Outflow=0.0160 m³/s 57.5 m³

Link 1L: Yorkville Combined Sewer Inflow=0.0268 m³/s 71.4 m³
Primary=0.0268 m³/s 71.4 m³

Total Runoff Area = 3,229.1 m² Runoff Volume = 71.4 m³ Average Runoff Depth = 22 mm
100.00% Pervious = 3,229.1 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 1S: Uncontrolled

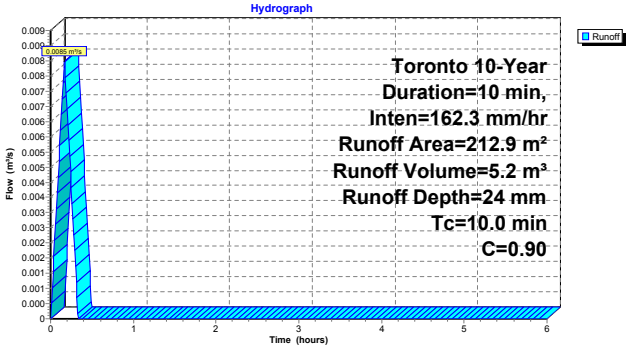
Runoff = 0.0085 m³/s @ 0.17 hrs, Volume= 5.2 m³, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 10-Year Duration=10 min, Inten=162.3 mm/hr

Area (m²)	C	Description
212.9	0.90	Uncontrolled
212.9		100.00% Pervious Area

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

Subcatchment 1S: Uncontrolled



Summary for Subcatchment 3S: 16-18 Cumberland

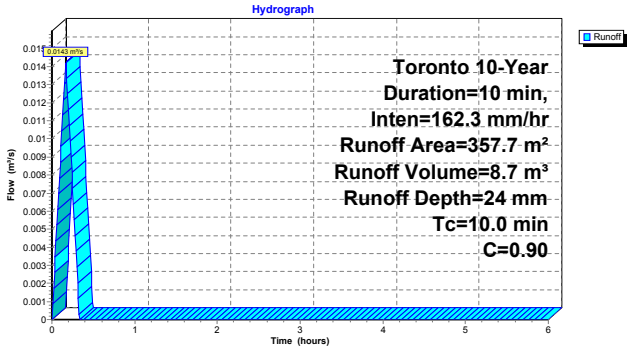
Runoff = 0.0143 m³/s @ 0.17 hrs, Volume= 8.7 m³, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 10-Year Duration=10 min, Inten=162.3 mm/hr

Area (m²)	C	Description
307.3	0.90	Impervious Roof
50.4	0.90	At-grade Impervious
357.7	0.90	Weighted Average
357.7		100.00% Pervious Area

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

Subcatchment 3S: 16-18 Cumberland



Summary for Subcatchment A: 11-21 Yorkville

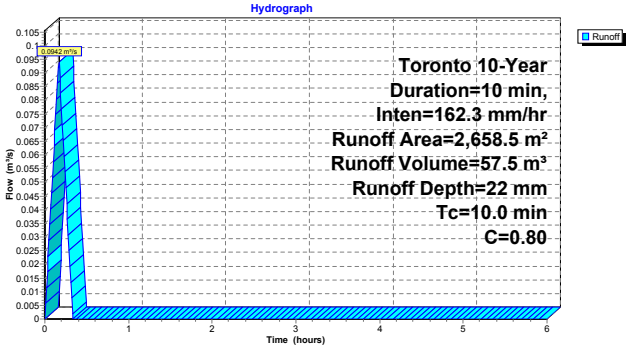
Runoff = 0.0942 m³/s @ 0.17 hrs, Volume= 57.5 m³, Depth= 22 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 10-Year Duration=10 min, Inten=162.3 mm/hr

Area (m²)	C	Description
495.0	0.45	Green Roof
1,336.0	0.90	Impervious Roof
777.5	0.90	At-Grade Impervious
50.0	0.25	Landscape
2,658.5	0.80	Weighted Average
2,658.5		100.00% Pervious Area

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

Subcatchment A: 11-21 Yorkville



Summary for Pond 2P: Building B Cistern

Inflow Area = 357.7 m², 0.00% Impervious, Inflow Depth = 24 mm for 10-Year event
Inflow = 0.0143 m³/s @ 0.17 hrs, Volume= 8.7 m³
Outflow = 0.0029 m³/s @ 0.30 hrs, Volume= 8.7 m³, Atten= 79%, Lag= 7.9 min
Primary = 0.0029 m³/s @ 0.30 hrs, Volume= 8.7 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 0.790 m @ 0.30 hrs Surf.Area= 8.0 m² Storage= 6.3 m³

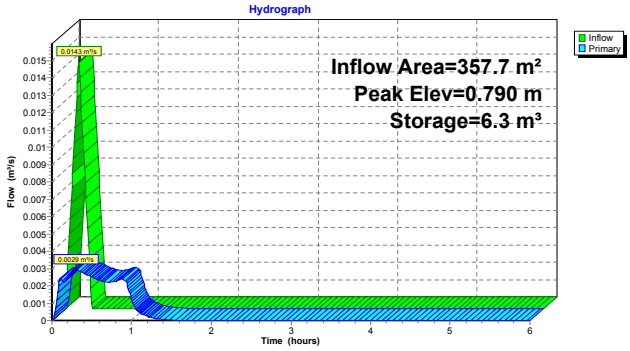
Plug-Flow detention time= 22.6 min calculated for 8.7 m³ (100% of inflow)
Center-of-Mass det. time= 22.7 min (32.7 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	16.0 m³	**8.00 mW x 1.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Reg-U-Flo SXH 3.0-in Metric - Extended**

Primary OutFlow Max=0.0029 m³/s @ 0.30 hrs HW=0.790 m (Free Discharge)
1=Reg-U-Flo SXH 3.0-in Metric - Extended (Custom Controls 0.0029 m³/s)

Pond 2P: Building B Cistern



Summary for Pond C: Building A Cistern

Inflow Area = 2,658.5 m², 0.00% Impervious, Inflow Depth = 22 mm for 10-Year event
Inflow = 0.0942 m³/s @ 0.17 hrs, Volume= 57.5 m³
Outflow = 0.0160 m³/s @ 0.04 hrs, Volume= 57.5 m³, Atten= 83%, Lag= 0.0 min
Primary = 0.0160 m³/s @ 0.04 hrs, Volume= 57.5 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2.108 m @ 0.31 hrs Surf.Area= 19.0 m² Storage= 40.1 m³

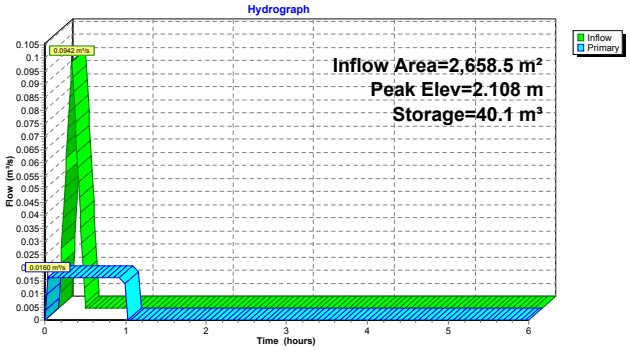
Plug-Flow detention time= 20.9 min calculated for 57.4 m³ (100% of inflow)
Center-of-Mass det. time= 21.0 min (31.0 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	125.4 m³	**19.00 mW x 1.00 mL x 6.60 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Special & User-Defined**
			Elev. (meters) 0.000 0.010 2.050 10.000
			Disch. (m³/s) 0.00000 0.01600 0.01600 0.01600

Primary OutFlow Max=0.0160 m³/s @ 0.04 hrs HW=0.018 m (Free Discharge)
1=Special & User-Defined (Custom Controls 0.0160 m³/s)

Pond C: Building A Cistern

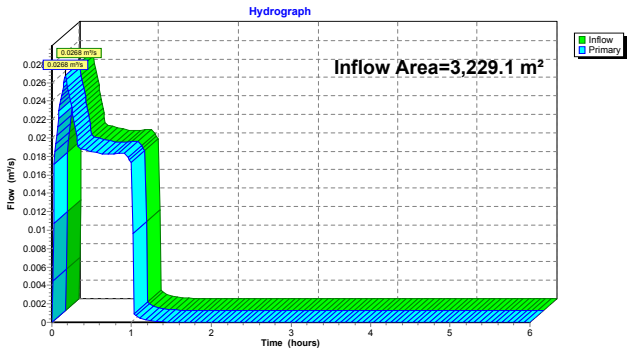


Summary for Link 1L: Yorkville Combined Sewer

Inflow Area = 3,229.1 m², 0.00% Impervious, Inflow Depth = 22 mm for 10-Year event
Inflow = 0.0268 m³/s @ 0.17 hrs, Volume= 71.4 m³
Primary = 0.0268 m³/s @ 0.17 hrs, Volume= 71.4 m³, Atten= 0%, Lag= 0.0 min

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

Link 1L: Yorkville Combined Sewer



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

Subcatchment1S: Uncontrolled Runoff Area=212.9 m² 0.00% Impervious Runoff Depth=28 mm
Tc=10.0 min C=0.90 Runoff=0.0099 m³/s 6.0 m³

Subcatchment3S: 16-18 Cumberland Runoff Area=357.7 m² 0.00% Impervious Runoff Depth=28 mm
Tc=10.0 min C=0.90 Runoff=0.0167 m³/s 10.2 m³

SubcatchmentA: 11-21 Yorkville Runoff Area=2,658.5 m² 0.00% Impervious Runoff Depth=25 mm
Tc=10.0 min C=0.80 Runoff=0.1100 m³/s 67.2 m³

Pond 2P: Building B Cistern Peak Elev=0.950 m Storage=7.6 m³ Inflow=0.0167 m³/s 10.2 m³
Outflow=0.0032 m³/s 10.2 m³

Pond C: Building A Cistern Peak Elev=2.604 m Storage=49.5 m³ Inflow=0.1100 m³/s 67.2 m³
Outflow=0.0160 m³/s 67.1 m³

Link 1L: Yorkville Combined Sewer Inflow=0.0284 m³/s 83.3 m³
Primary=0.0284 m³/s 83.3 m³

Total Runoff Area = 3,229.1 m² Runoff Volume = 83.4 m³ Average Runoff Depth = 26 mm
100.00% Pervious = 3,229.1 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 1S: Uncontrolled

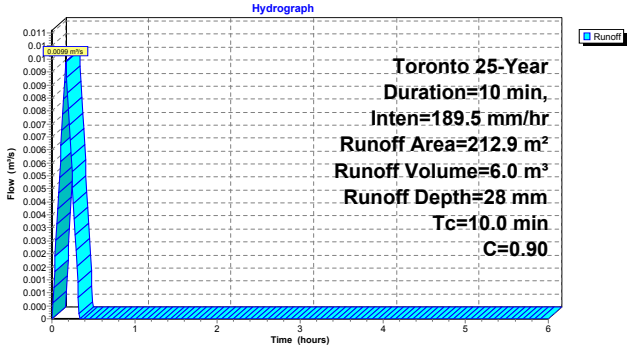
Runoff = 0.0099 m³/s @ 0.17 hrs, Volume= 6.0 m³, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 25-Year Duration=10 min, Inten=189.5 mm/hr

Area (m²)	C	Description
212.9	0.90	Uncontrolled
212.9		100.00% Pervious Area

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

Subcatchment 1S: Uncontrolled



Summary for Subcatchment 3S: 16-18 Cumberland

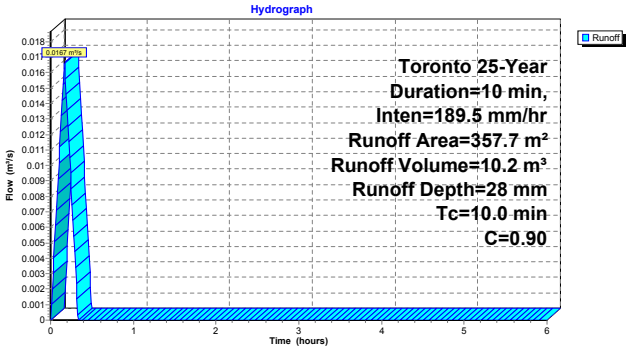
Runoff = 0.0167 m³/s @ 0.17 hrs, Volume= 10.2 m³, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 25-Year Duration=10 min, Inten=189.5 mm/hr

Area (m²)	C	Description
307.3	0.90	Impervious Roof
50.4	0.90	At-grade Impervious
357.7	0.90	Weighted Average
357.7		100.00% Pervious Area

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

Subcatchment 3S: 16-18 Cumberland



Summary for Subcatchment A: 11-21 Yorkville

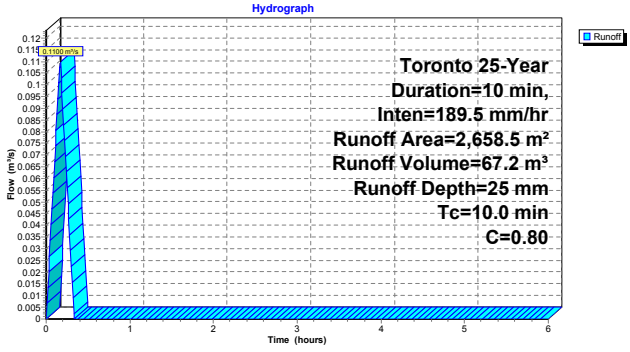
Runoff = 0.1100 m³/s @ 0.17 hrs, Volume= 67.2 m³, Depth= 25 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 25-Year Duration=10 min, Inten=189.5 mm/hr

Area (m²)	C	Description
495.0	0.45	Green Roof
1,336.0	0.90	Impervious Roof
777.5	0.90	At-Grade Impervious
50.0	0.25	Landscape
2,658.5	0.80	Weighted Average
2,658.5		100.00% Pervious Area

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

Subcatchment A: 11-21 Yorkville



Summary for Pond 2P: Building B Cistern

Inflow Area = 357.7 m², 0.00% Impervious, Inflow Depth = 28 mm for 25-Year event
Inflow = 0.0167 m³/s @ 0.17 hrs, Volume= 10.2 m³
Outflow = 0.0032 m³/s @ 0.30 hrs, Volume= 10.2 m³, Atten= 81%, Lag= 8.1 min
Primary = 0.0032 m³/s @ 0.30 hrs, Volume= 10.2 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 0.950 m @ 0.30 hrs Surf.Area= 8.0 m² Storage= 7.6 m³

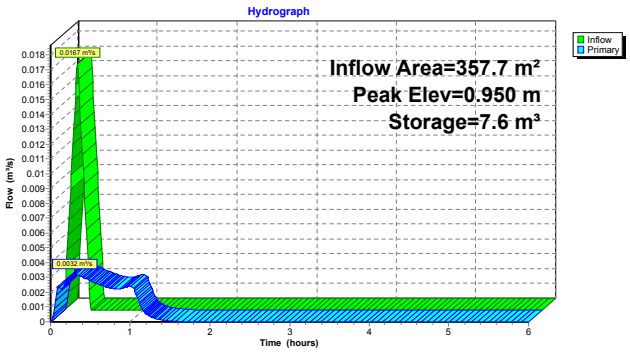
Plug-Flow detention time= 25.3 min calculated for 10.1 m³ (100% of inflow)
Center-of-Mass det. time= 25.4 min (35.4 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	16.0 m³	**8.00 mW x 1.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Reg-U-Flo SXH 3.0-in Metric - Extended**

Primary OutFlow Max=0.0032 m³/s @ 0.30 hrs HW=0.949 m (Free Discharge)
↑1=Reg-U-Flo SXH 3.0-in Metric - Extended(Custom Controls 0.0032 m³/s)

Pond 2P: Building B Cistern



Summary for Pond C: Building A Cistern

Inflow Area = 2,658.5 m², 0.00% Impervious, Inflow Depth = 25 mm for 25-Year event
Inflow = 0.1100 m³/s @ 0.17 hrs, Volume= 67.2 m³
Outflow = 0.0160 m³/s @ 0.03 hrs, Volume= 67.1 m³, Atten= 85%, Lag= 0.0 min
Primary = 0.0160 m³/s @ 0.03 hrs, Volume= 67.1 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2.604 m @ 0.31 hrs Surf.Area= 19.0 m² Storage= 49.5 m³

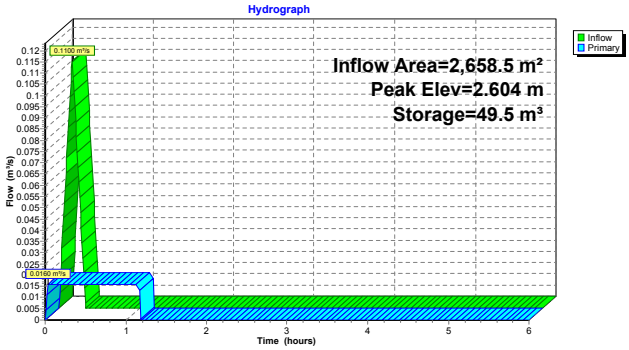
Plug-Flow detention time= 25.8 min calculated for 67.0 m³ (100% of inflow)
Center-of-Mass det. time= 25.9 min (35.9 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	125.4 m³	**19.00 mW x 1.00 mL x 6.60 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Special & User-Defined**
			Elev. (meters) 0.000 0.010 2.050 10.000
			Disch. (m³/s) 0.00000 0.01600 0.01600 0.01600

Primary OutFlow Max=0.0160 m³/s @ 0.03 hrs HW=0.012 m (Free Discharge)
↑**1=Special & User-Defined** (Custom Controls 0.0160 m³/s)

Pond C: Building A Cistern

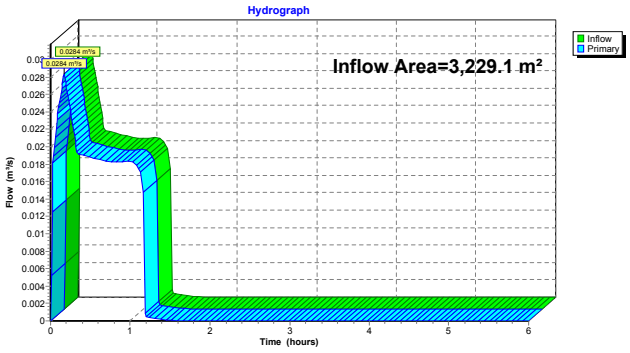


Summary for Link 1L: Yorkville Combined Sewer

Inflow Area = 3,229.1 m², 0.00% Impervious, Inflow Depth = 26 mm for 25-Year event
Inflow = 0.0284 m³/s @ 0.17 hrs, Volume= 83.3 m³
Primary = 0.0284 m³/s @ 0.17 hrs, Volume= 83.3 m³, Atten= 0%, Lag= 0.0 min

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

Link 1L: Yorkville Combined Sewer



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

Subcatchment1S: Uncontrolled Runoff Area=212.9 m² 0.00% Impervious Runoff Depth=34 mm
Tc=10.0 min C=0.90 Runoff=0.0117 m³/s 7.2 m³

Subcatchment3S: 16-18 Cumberland Runoff Area=357.7 m² 0.00% Impervious Runoff Depth=34 mm
Tc=10.0 min C=0.90 Runoff=0.0197 m³/s 12.0 m³

SubcatchmentA: 11-21 Yorkville Runoff Area=2,658.5 m² 0.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=0.80 Runoff=0.1302 m³/s 79.5 m³

Pond 2P: Building B Cistern Peak Elev=1.155 m Storage=9.2 m³ Inflow=0.0197 m³/s 12.0 m³
Outflow=0.0035 m³/s 12.0 m³

Pond C: Building A Cistern Peak Elev=3.241 m Storage=61.6 m³ Inflow=0.1302 m³/s 79.5 m³
Outflow=0.0160 m³/s 79.6 m³

Link 1L: Yorkville Combined Sewer Inflow=0.0304 m³/s 98.8 m³
Primary=0.0304 m³/s 98.8 m³

Total Runoff Area = 3,229.1 m² Runoff Volume = 98.7 m³ Average Runoff Depth = 31 mm
100.00% Pervious = 3,229.1 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 1S: Uncontrolled

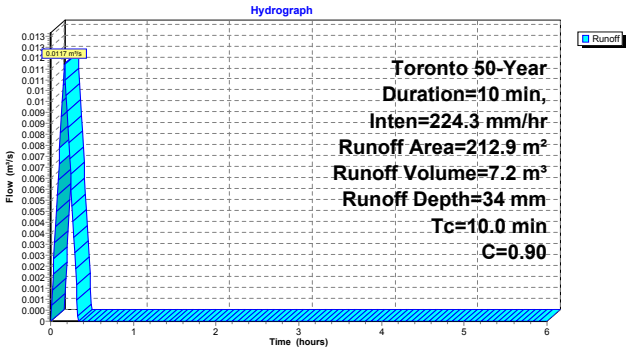
Runoff = 0.0117 m³/s @ 0.17 hrs, Volume= 7.2 m³, Depth= 34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 50-Year Duration=10 min, Inten=224.3 mm/hr

Area (m²)	C	Description
212.9	0.90	Uncontrolled
212.9		100.00% Pervious Area

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

Subcatchment 1S: Uncontrolled



Summary for Subcatchment 3S: 16-18 Cumberland

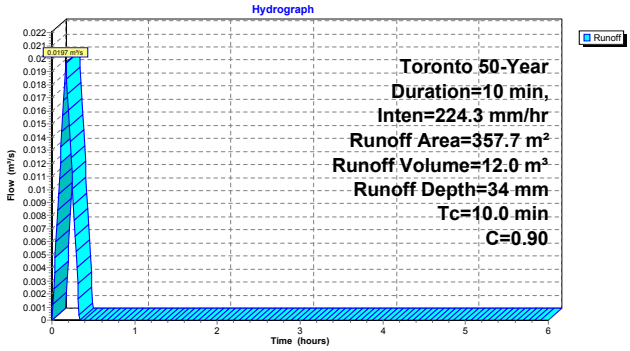
Runoff = 0.0197 m³/s @ 0.17 hrs, Volume= 12.0 m³, Depth= 34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 50-Year Duration=10 min, Inten=224.3 mm/hr

Area (m²)	C	Description
307.3	0.90	Impervious Roof
50.4	0.90	At-grade Impervious
357.7	0.90	Weighted Average
357.7		100.00% Pervious Area

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

Subcatchment 3S: 16-18 Cumberland



Summary for Subcatchment A: 11-21 Yorkville

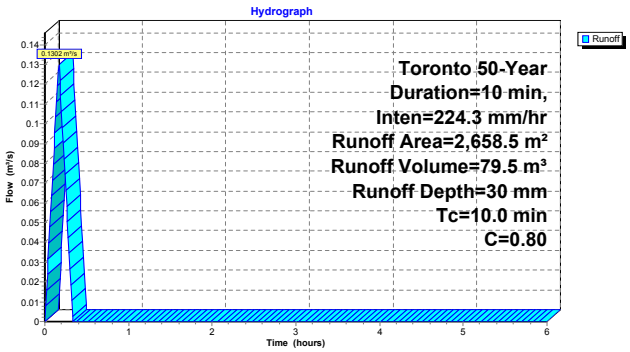
Runoff = 0.1302 m³/s @ 0.17 hrs, Volume= 79.5 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 50-Year Duration=10 min, Inten=224.3 mm/hr

Area (m²)	C	Description
495.0	0.45	Green Roof
1,336.0	0.90	Impervious Roof
777.5	0.90	At-Grade Impervious
50.0	0.25	Landscape
2,658.5	0.80	Weighted Average
2,658.5		100.00% Pervious Area

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

Subcatchment A: 11-21 Yorkville



Summary for Pond 2P: Building B Cistern

Inflow Area = 357.7 m², 0.00% Impervious, Inflow Depth = 34 mm for 50-Year event
Inflow = 0.0197 m³/s @ 0.17 hrs, Volume= 12.0 m³
Outflow = 0.0035 m³/s @ 0.30 hrs, Volume= 12.0 m³, Atten= 82%, Lag= 8.2 min
Primary = 0.0035 m³/s @ 0.30 hrs, Volume= 12.0 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 1.155 m @ 0.30 hrs Surf.Area= 8.0 m² Storage= 9.2 m³

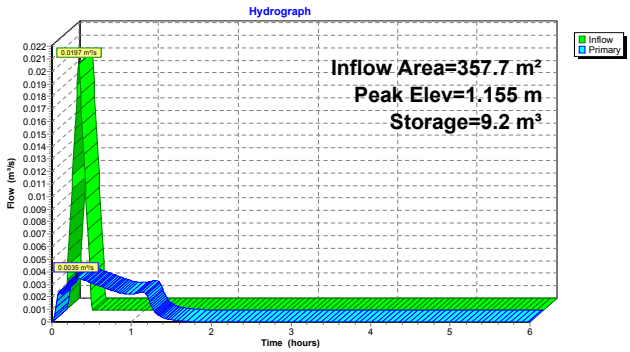
Plug-Flow detention time= 28.4 min calculated for 12.0 m³ (100% of inflow)
Center-of-Mass det. time= 28.5 min (38.5 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	16.0 m³	**8.00 mW x 1.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Reg-U-Flo SXH 3.0-in Metric - Extended**

Primary OutFlow Max=0.0035 m³/s @ 0.30 hrs HW=1.154 m (Free Discharge)
1=Reg-U-Flo SXH 3.0-in Metric - Extended (Custom Controls 0.0035 m³/s)

Pond 2P: Building B Cistern



Summary for Pond C: Building A Cistern

Inflow Area = 2,658.5 m², 0.00% Impervious, Inflow Depth = 30 mm for 50-Year event
Inflow = 0.1302 m³/s @ 0.17 hrs, Volume= 79.5 m³
Outflow = 0.0160 m³/s @ 0.03 hrs, Volume= 79.6 m³, Atten= 88%, Lag= 0.0 min
Primary = 0.0160 m³/s @ 0.03 hrs, Volume= 79.6 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 3.241 m @ 0.31 hrs Surf.Area= 19.0 m² Storage= 61.6 m³

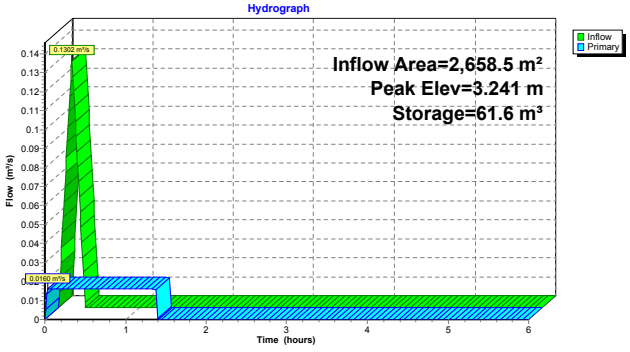
Plug-Flow detention time= 32.2 min calculated for 79.4 m³ (100% of inflow)
Center-of-Mass det. time= 32.2 min (42.2 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	125.4 m³	**19.00 mW x 1.00 mL x 6.60 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Special & User-Defined** Elev. (meters) 0.000 0.010 2.050 10.000 Disch. (m³/s) 0.00000 0.01600 0.01600 0.01600

Primary OutFlow Max=0.0160 m³/s @ 0.03 hrs HW=0.017 m (Free Discharge)
1=Special & User-Defined (Custom Controls 0.0160 m³/s)

Pond C: Building A Cistern

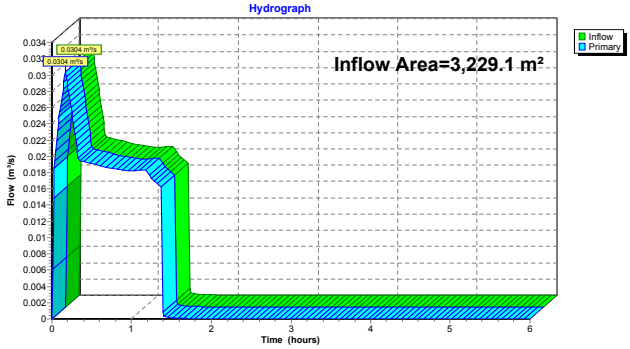


Summary for Link 1L: Yorkville Combined Sewer

Inflow Area = 3,229.1 m², 0.00% Impervious, Inflow Depth = 31 mm for 50-Year event
Inflow = 0.0304 m³/s @ 0.17 hrs, Volume= 98.8 m³
Primary = 0.0304 m³/s @ 0.17 hrs, Volume= 98.8 m³, Atten= 0%, Lag= 0.0 min

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

Link 1L: Yorkville Combined Sewer



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

Subcatchment1S: Uncontrolled Runoff Area=212.9 m² 0.00% Impervious Runoff Depth=38 mm
Tc=10.0 min C=0.90 Runoff=0.0131 m³/s 8.0 m³

Subcatchment3S: 16-18 Cumberland Runoff Area=357.7 m² 0.00% Impervious Runoff Depth=38 mm
Tc=10.0 min C=0.90 Runoff=0.0220 m³/s 13.4 m³

SubcatchmentA: 11-21 Yorkville Runoff Area=2,658.5 m² 0.00% Impervious Runoff Depth=33 mm
Tc=10.0 min C=0.80 Runoff=0.1453 m³/s 88.7 m³

Pond 2P: Building B Cistern Peak Elev=1.309 m Storage=10.5 m³ Inflow=0.0220 m³/s 13.4 m³
Outflow=0.0038 m³/s 13.4 m³

Pond C: Building A Cistern Peak Elev=3.720 m Storage=70.7 m³ Inflow=0.1453 m³/s 88.7 m³
Outflow=0.0160 m³/s 88.7 m³

Link 1L: Yorkville Combined Sewer Inflow=0.0319 m³/s 110.2 m³
Primary=0.0319 m³/s 110.2 m³

Total Runoff Area = 3,229.1 m² Runoff Volume = 110.1 m³ Average Runoff Depth = 34 mm
100.00% Pervious = 3,229.1 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 1S: Uncontrolled

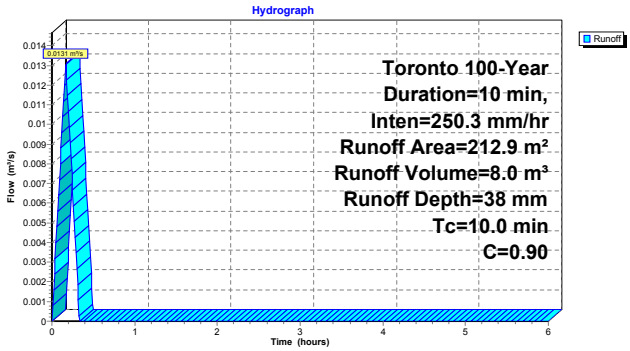
Runoff = 0.0131 m³/s @ 0.17 hrs, Volume= 8.0 m³, Depth= 38 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 100-Year Duration=10 min, Inten=250.3 mm/hr

Area (m²)	C	Description
212.9	0.90	Uncontrolled
212.9		100.00% Pervious Area

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

Subcatchment 1S: Uncontrolled



Summary for Subcatchment 3S: 16-18 Cumberland

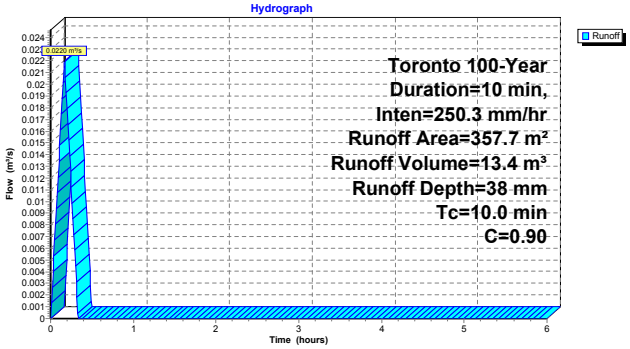
Runoff = 0.0220 m³/s @ 0.17 hrs, Volume= 13.4 m³, Depth= 38 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 100-Year Duration=10 min, Inten=250.3 mm/hr

Area (m²)	C	Description
307.3	0.90	Impervious Roof
50.4	0.90	At-grade Impervious
357.7	0.90	Weighted Average
357.7		100.00% Pervious Area

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

Subcatchment 3S: 16-18 Cumberland



Summary for Subcatchment A: 11-21 Yorkville

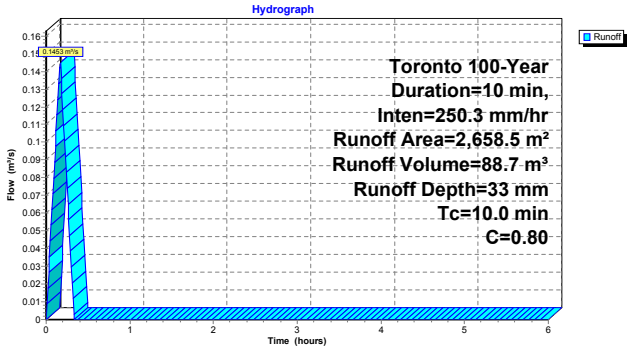
Runoff = 0.1453 m³/s @ 0.17 hrs, Volume= 88.7 m³, Depth= 33 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Toronto 100-Year Duration=10 min, Inten=250.3 mm/hr

Area (m²)	C	Description
495.0	0.45	Green Roof
1,336.0	0.90	Impervious Roof
777.5	0.90	At-Grade Impervious
50.0	0.25	Landscape
2,658.5	0.80	Weighted Average
2,658.5		100.00% Pervious Area

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

Subcatchment A: 11-21 Yorkville



Summary for Pond 2P: Building B Cistern

Inflow Area = 357.7 m², 0.00% Impervious, Inflow Depth = 38 mm for 100-Year event
Inflow = 0.0220 m³/s @ 0.17 hrs, Volume= 13.4 m³
Outflow = 0.0038 m³/s @ 0.31 hrs, Volume= 13.4 m³, Atten= 83%, Lag= 8.3 min
Primary = 0.0038 m³/s @ 0.31 hrs, Volume= 13.4 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 1.309 m @ 0.31 hrs Surf.Area= 8.0 m² Storage= 10.5 m³

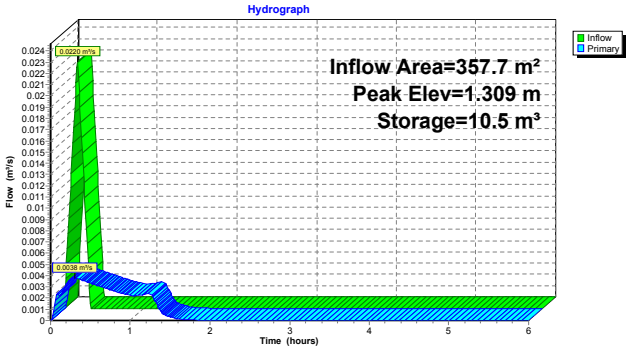
Plug-Flow detention time= 30.5 min calculated for 13.4 m³ (100% of inflow)
Center-of-Mass det. time= 30.6 min (40.6 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	16.0 m³	**8.00 mW x 1.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Reg-U-Flo SXH 3.0-in Metric - Extended**

Primary OutFlow Max=0.0038 m³/s @ 0.31 hrs HW=1.309 m (Free Discharge)
1=Reg-U-Flo SXH 3.0-in Metric - Extended (Custom Controls 0.0038 m³/s)

Pond 2P: Building B Cistern



Summary for Pond C: Building A Cistern

Inflow Area = 2,658.5 m², 0.00% Impervious, Inflow Depth = 33 mm for 100-Year event
Inflow = 0.1453 m³/s @ 0.17 hrs, Volume= 88.7 m³
Outflow = 0.0160 m³/s @ 0.03 hrs, Volume= 88.7 m³, Atten= 89%, Lag= 0.0 min
Primary = 0.0160 m³/s @ 0.03 hrs, Volume= 88.7 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 3.720 m @ 0.32 hrs Surf.Area= 19.0 m² Storage= 70.7 m³

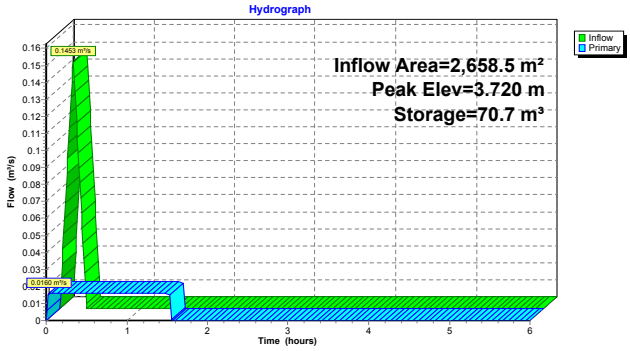
Plug-Flow detention time= 36.9 min calculated for 88.6 m³ (100% of inflow)
Center-of-Mass det. time= 36.9 min (46.9 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	125.4 m³	**19.00 mW x 1.00 mL x 6.60 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**Special & User-Defined**
			Elev. (meters) 0.000 0.010 2.050 10.000
			Disch. (m³/s) 0.00000 0.01600 0.01600 0.01600

Primary OutFlow Max=0.0160 m³/s @ 0.03 hrs HW=0.021 m (Free Discharge)
1=Special & User-Defined (Custom Controls 0.0160 m³/s)

Pond C: Building A Cistern

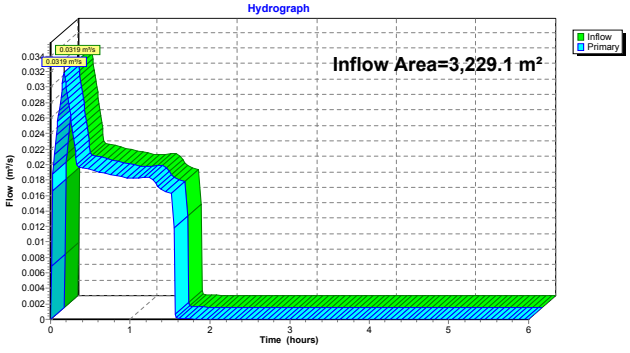


Summary for Link 1L: Yorkville Combined Sewer

Inflow Area = 3,229.1 m², 0.00% Impervious, Inflow Depth = 34 mm for 100-Year event
Inflow = 0.0319 m³/s @ 0.17 hrs, Volume= 110.2 m³
Primary = 0.0319 m³/s @ 0.17 hrs, Volume= 110.2 m³, Atten= 0%, Lag= 0.0 min

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

Link 1L: Yorkville Combined Sewer



APPENDIX

C WATER RE-USE DOCUMENTS

TERRAPLAN LANDSCAPE ARCHITECTS

PROJECT NUMBER	17-177	**PROJECT NAME**	11 Yorkville - green roof	**TERRAPLAN LANDSCAPE ARCHITECTS**	
DATE	19-Mar-18	**COMPLETED BY**	Alex Forbes		

CALCULATIONS FOR WATER COLLECTED vs. WATER NEEDED

GENERAL INFO All measures are in Metric
Refer to the 'Water Efficiency' section of the LEED Canada-NC 2009 Document
Using the chart below please note the below

Species Factor (*Ks*) Species Factor is determined as follows: Water needs: Low for drought plants, Average and High per plant water needs
Shrubs & Grd Cover: Low = .2, Avg=.5, High=.7. Mixed .2, .5, .9. Turfgrass .6, .7, .8

Density Factor (*Kd*) Plant grouping: Sparsely planted: 'Low' (0.5, shrubs, 0.6 mixed, 0.6 turf, and 0.6 Sedum mats)
Densely Planted: 'High' (1.0 shrubs, 1.3 mixed, 1.0 turf, and 1.0 Sedum Plugs)

Microclimate Factor (*Kmc*) Plant grouping exposure to wind, heat, reflected light: NE / shaded: 'Low', see above
SW / hot and gets the summer wind: 'Ave or High'

Kl = *Ks* x *Kd* x *Kmc*
Etl = Kl x 138.2 mm/ mth (5.44 ins/ mth) of July, highest ET rate (for Toronto and region)
IE can be Drip, Sprinkler (Spray) or Efficient Flow Nozzles
TPWA (*L*)= area (m^2) x (*Etl* / *IE*)

WATER COLLECTION (if applicable)

				X
Cistern:	5mm Retention of Storm Water for Irrigation Purposes	3.000	m^3	3000.000

DESIGN CASE

Landscape Type	**Area** m^2	**Species Factor** *Ks*	**Density Factor** *Kd*	**Microclimate** *Kmc*	*Kl*	*Etl July*	*IE* Drip (.9), Low flow (0.75), Spray (.625)	*TPWA Average* (liters)	*TPWA* May	*TPWA* June	*TPWA* July	*TPWA* August	*TPWA* Sept
Trees (Canopy Area)	0.0	0.5	1.0	0.5	0.250	34.550	0.625	0	0	0	0	0	0
Shrubs	0.0	0.4	1.1	1.3	0.572	79.050	0.625	0	0	0	0	0	0
Perennials	0.0	0.3	1.1	1.3	0.429	59.288	0.625	0	0	0	0	0	0
Mixed	0.0	0.2	1.3	0.5	0.130	17.966	0.625	0	0	0	0	0	0
Turfgrass	0.0	0.7	1.0	1.2	0.840	116.088	0.625	0	0	0	0	0	0
Sedum Mats	495.0	0.5	1.0	1.0	0.500	69.100	0.625	43,299	40,234	49,460	54,727	43718	28354
Total m²	**495.0**				**Subtotal (L) per month**			43,299	**40,234**	**49,460**	**54,727**	**43,718**	**28,354**
* Trees require 55 L per week or 220 L/ mth less rainfall, 6.4 sq m per tree					**Net potable water (L) from Design Case per week**			10,825	**10,058**	**12,365**	**13,682**	**10,930**	**7,088**
					Irrigation water use for 72 hours, (subtotal/7days)*3days			4,639	**4,311**	**5,299**	**5,864**	**4,684**	**3,038**
					5mm Retention for Irrigation Purposes (see *X* above)			**3000**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**
					AVERAGE WATER REMAINING IN CISTERN AFTER 72 HR (May-Sept)			**0**	**0**	**0**	**0**	**0**	**0**

APPENDIX D3 – WATER REUSE MISTER DETAILS

Models	M20, M44, M88
Flow Rates	0.5 GPM, 1.1 GPM, 2.2 GPM
Dimensions	Length 35” / 88.9 cm w/ filtration Width 24” / 61 cm Height 15” / 38.1 cm
Weight	109 - 129 lbs 49 - 59 kg
Motor	TEFC .75HP (M20), 2HP (M44 - M88)
Power	110/115 volt standard 50/60Hz
Discharge	1000 psi factory setting 69 bar factory setting
Diagnostics	Inlet and outlet glycerin filled gauges Hour meter showing system usage On/Off/Auto switch
Filtration	Dual filtration, scale inhibiting
Enclosure	Polyethylene enclosure Sound absorption UV protection Superior aesthetics Dual layer protection for electrical control box Integrated oil pan for service

Water Volume: 12,000 L

Re-use Limit: 72 hours

2.2 GPM = 500 L/hour
12,000 L X 0.002 hour/L = 24 hours

8.0 hours of misting application between hours of 10AM to 6:00PM during April through October.