Preliminary
Stormwater Management Report

540 King Street Subdivision
Town of Cobourg

Residential Subdivision Development

D.M. Wills Project No. 19-10927

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

February 2022

Prepared for:
Sunnyside Village Inc.

Table of Contents

Figures

Tables

Appendices

1.0 Purpose

D.M. Wills Associates Limited (Wills) has been retained by Restoration Depot Inc. to prepare a Preliminary Stormwater Management Plan and Report for the proposed residential subdivision located at 540 King Street East in the Town of Cobourg.

The purpose of this report is to evaluate the impact of the proposed development on stormwater runoff and to develop a preliminary plan for stormwater management that will permit the development to proceed with no adverse impacts to the receiving drainage systems. This report has been prepared specifically for the Town of Cobourg (Town) and the Ganaraska Region Conservation Authority (GRCA) to address stormwater management for the development and to satisfy the statutory requirements.

2.0 Site Description

The subject property is located at 540 King Street East, approximately 3 kilometers east of the Town of Cobourg. The subject site is legally described as a Part of Lot 10, Concession A in the Town of Cobourg. The property is bound by the Canadian Pacific Railway to the north and private residential / agricultural properties to east, west and south. An unevaluated wetland feature is located in the north-west area of the property, which completely infiltrates without any defined outlet. The location of the site is shown on **Figure 1.**

The proposed residential subdivision consists of detached and semi-detached units. The portion of the site within the wetland buffer is to remain undisturbed in its natural condition. The development of the site will require the removal of vegetated areas and grasslands. A private roadway from King Street is proposed to provide access for the development.

According to the Soil Survey Complex of Ontario, the subject site is primarily composed of two types of surficial soils. The wetland and western portion of the site is composed of Smithfield Clay Loam and the remainder of the site is composed of Tecumseth Sandy Loam. According to the SCS method of classifying soils, these types of surficial soils correspond to Hydrologic Soils Groups C and B respectively.

A topographic survey was completed by DFP Surveyors Ltd. (Job No. P2020-001, February 2020), to determine existing elevations and the location of existing features on the site. This information was used to determine drainage patterns and preliminary catchment area characteristics.

Figure 1 – Location Plan

3.0 Methodology

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

3.1 Site Specific Stormwater Design Criteria

The following criteria have been established by reviewing the Town and GRCA design standards for stormwater management, and in reviewing the Preliminary Design Concepts review document (Town of Cobourg, dated November 21, 2019):

- To provide stormwater quality controls, to achieve "Enhanced" Level 1 protection as defined in the Stormwater Management Planning and Design Manual (March 2003).

- To provide stormwater quantity controls, to reduce the post development peak flow rates to the existing peak flow rates at the outlet locations, for the 2 to 100-year design storms.
- To respect the recommended statutory setback requirements provided by the regulatory agency for the unevaluated wetland located within the property.
- To incorporate Low Impact Development (LID) features within the proposed stormwater management strategy.

3.2 Catchment Area Characterization

For the purpose of the preliminary SWM plan, the site will be analyzed as two (2) catchment areas comprising the subject site, and two (2) external catchment areas flowing into the subject site area. The existing catchment areas are shown on **Figure 2.**

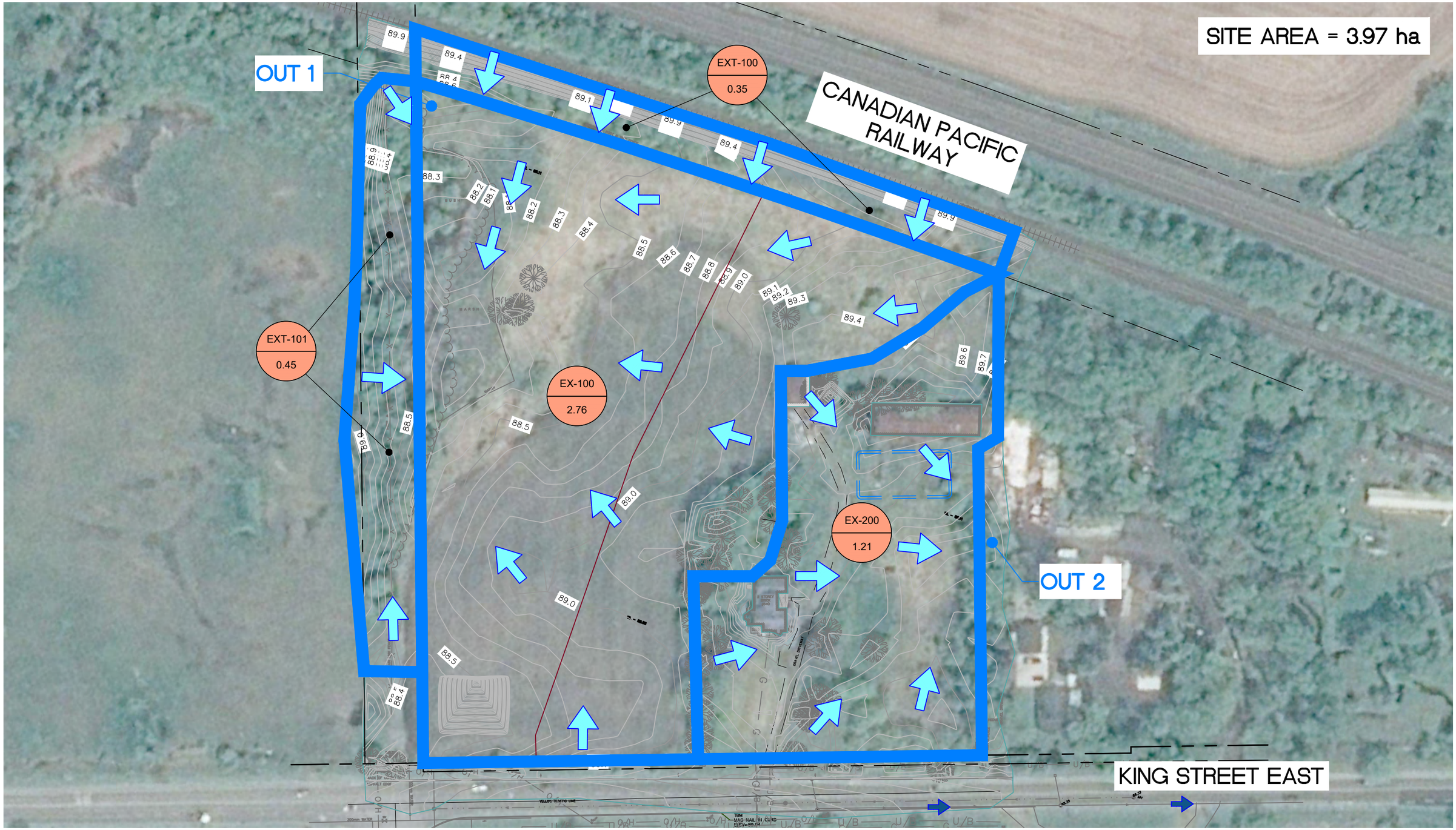
- Catchment area **EX-100** consists of 2.76 ha of land and includes the central and western portion of the site. This catchment is comprised of agricultural field and the identified unevaluated wetland located along the western boundary. The runoff generated within this catchment drains towards the wetland. In general, the wetland captures and infiltrates the runoff generated on the site. Any excess runoff drains northwesterly towards an unnamed watercourse located approximately 120 meters west of the site (**OUT-1**).
- Catchment area **EX-200** consists of 1.21 ha of land and includes the existing heritage home and abandoned barn. This catchment is comprised of grass and range areas with gravel driveways. The runoff generated within this catchment flows overland to the watercourse situated approximately 110 meters east of the site (**OUT-2**).
- Catchment area **EXT-100** consists of 0.35 ha of external lands located along the north boundary of the subject property abutting the Canadian Pacific Railway Line. This catchment is comprised of range type vegetated land. Runoff generated within this catchment drains overland westerly towards the wetland located at the north-west corner of the site (**OUT-1**).
- Catchment area **EXT-101** consists of 0.45 ha of external lands located adjacent to the west property boundary. This catchment is comprised of vegetated range type lands with some wooded areas. The runoff generated within this catchment drains north easterly into the subject property, discharging to the unevaluated wetland (**OUT-1**)

For the proposed condition, the site will be analyzed as four (4) catchment areas comprising the subject site, and two (2) external catchment areas flowing into the subject site area. The external catchment areas (EXT-100 and EXT-101) will not undergo any land use change in the proposed condition. The proposed catchment areas are shown on **Figure 3.**

- Catchment area **PR-100** consists of 0.48 ha of land located in the western portion of the site. This catchment consists of the unevaluated wetland feature and

landscape buffer area. Runoff generated within this catchment will continue to drain towards the wetland. Excess runoff from the wetland will continue to drain to the unnamed watercourse located west of the site (**OUT-1**).

- Catchment area **PR-101** consists of 2.04 ha of land and includes the central region of the site. This catchment is comprised of proposed lots and roadway network. Runoff generated from this catchment will be collected by an internal storm sewer network, and will discharge at a controlled rate to the proposed King Street storm sewer extension. This storm sewer extension will convey stormwater runoff westerly (**OUT-1**).
- Catchment area **PR-200** consists of 1.32 ha of land and includes the eastern portion of the site. This catchment is comprised of the proposed lots, roadway network, heritage home, abandoned barn and the King Street access. Runoff generated within this catchment will be collected by an internal storm sewer network and will discharge at a controlled rate to the watercourse located east of the site (**OUT-2**).
- Catchment area **PR-300** consists of a 0.13 ha strip of land located along the north property boundary of the site. This catchment is comprised of range type vegetated lands and will discharge northerly to the proposed property line abutting external catchment **EXT-100**.



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

CATCHMENT BOUNDARY

OVERLAND FLOW DIRECTION

STORM SEWER FLOW DIRECTION

OUT — OUTLET LOCATION

Sketch No.

FIGURE 2
KING ST RESIDENTIAL PRE-DEVELOPMENT DRAINAGE AREA PLAN

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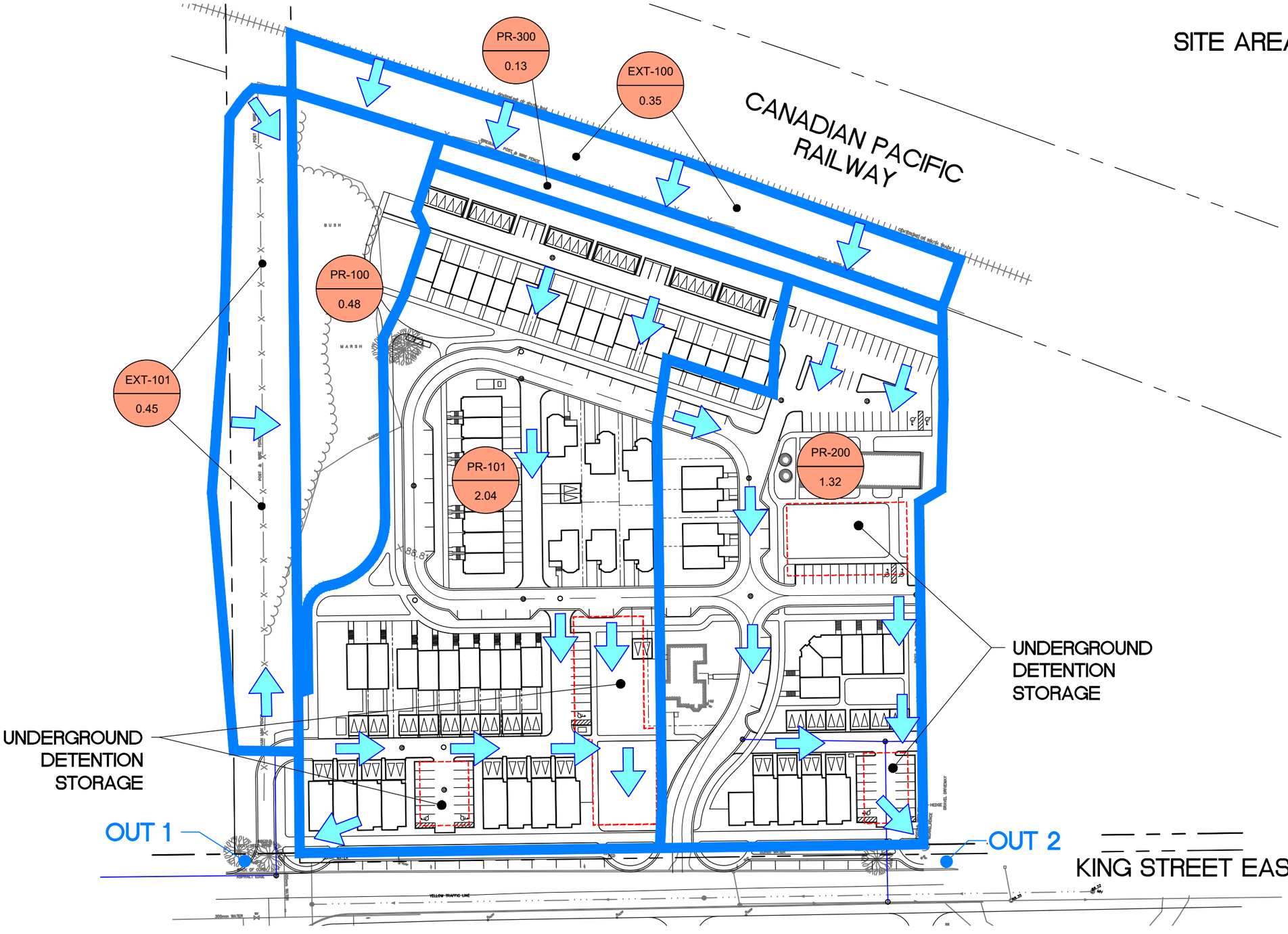
Drawn By: RC	Scale: 1:1250
Designed By: RC	Plot Date: FEB 2022
Checked By: CPB	Project No.: 19-10927
Engineer: RC/CPB	Drawing File No.: SWM Figure 2

SITE AREA = 3.97 ha



EX-100
0.22 ha
CATCHMENT ID
CATCHMENT AREA
CATCHMENT BOUNDARY

OVERLAND FLOW DIRECTION
STORM SEWER FLOW DIRECTION

OUT
OUTLET LOCATION

Sketch No.
FIGURE 3
KING ST RESIDENTIAL
POST-DEVELOPMENT
DRAINAGE AREA PLAN

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Drawn By: RC	Scale: 1:1250
Designed By: RC	Plot Date: FEB 2022
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The hydrologic parameters used for each catchment area, in both existing and proposed conditions, are summarized in **Table 1** and documented in **Appendix A**.

Table 1 – Existing and Proposed Hydrologic Parameters

Standhyd[1]						
Catchment ID	**Area (ha)**	**Impervious %**	**CN*[2]**	**Ia[3]**	**Pervious Slope (%)**	**Impervious Slope (%)**
PR-101	2.04	75	66.5	5.0	2.0	1.0
PR-200	1.32	70	60.5	5.0	2.0	1.0

Nashyd[1]					
Catchment ID	**Area (ha)**	**Impervious %**	**CN*[2]**	**Ia[3]**	**Tp[4] (hrs)**
EX-100	2.76	0.0	73.6	7.5	0.32
EX-200	1.21	6.6	70.2	7.7	0.29
EXT-100	0.35	0.0	75.2	8.0	0.43
EXT-101	0.45	0.0	76.5	8.9	0.68
PR-100	0.48	0.0	71.5	8.8	0.57
PR-300	0.13	0.0	68.4	8.0	0.11

Notes:
1. Command Line refers to the unit hydrograph used in the VO3 hydrologic model for the respective catchment area.
2. CN* refers to the modified CN number adjusted to Antecedent Moisture Conditions II. Excludes Impervious Area for Standhyd.
3. Ia refers to Initial Abstraction. Excludes Impervious Area for Standhyd.
4. Tp refers to Time of Peak.

Hydrologic parameters such as soil infiltration properties, land use and runoff response were determined based on aerial photography, site reconnaissance and literature review. Topographic mapping and AutoCAD Civil 3D 2019 software were used to establish sub-catchment areas, land use and slopes. Rainfall data for the site is taken from the GRCA Technical and Engineering Guidelines for Stormwater Management Submissions (December 2014) and is included in **Appendix A**.

3.3 Peak Flow Calculations

Under proposed conditions, there is a significant change in land use that will increase the impervious area of the Site.

Peak flow rates were estimated using the Visual Otthymo Version 3.0 (VO3) hydrologic model. GRCA guidelines require that a range of storm events and distributions be considered in the analysis, and the 4-hour Chicago storm was selected for the

preliminary calculations. The existing and uncontrolled proposed peak flow rates at the two (2) outlet locations are shown in **Table 2** below. The model schematic and detailed results have been included in **Appendix B**.

Table 2 – Peak Flow Rates

Return Interval (year)	Peak Flow (m^3/s)			
	OUT 1		OUT 2	
	Ex.	Pr.	Ex.	Pr.
2	0.034	**0.326**	0.012	**0.198**
5	0.069	**0.418**	0.024	**0.252**
10	0.094	**0.485**	0.032	**0.292**
25	0.172	**0.644**	0.060	**0.384**
50	0.221	**0.660**	0.077	**0.392**
100	0.274	**0.707**	0.096	**0.418**

Notes:
1. **Ex.** refers to the existing flow rates at each outlet location. VO3 NHYD = 4 and 5
2. **Pr.** refers to the uncontrolled proposed flow rates at each outlet location. VO3 NHYD = 6 and 13

A review of **Table 2** indicates there is an increase in peak flows at each outlet location, and therefore stormwater quantity controls will be required for the development. A storm sewer extension is proposed on King Street East, to provide a discharge location for the western portion of the proposed development. Controlled flows from catchment **PR-101** will connect to the new extension, with flows conveyed westerly via the King Street storm sewer system (**OUT 1**). Controlled flows from catchment **PR-200** will connect to a separate existing storm sewer network on King Street East adjacent to the eastern portion of the site (**OUT 2**). These flows will be conveyed easterly on King Street East via the existing storm sewer system.

4.0 Stormwater Management

4.1 Low Impact Development Design

As the practice of stormwater management has evolved, increasing emphasis has been placed on utilizing a treatment train approach to manage runoff as close to the source as possible. This design philosophy is often referred to as low impact development (LID), where the ultimate goal is to maintain and mimic the natural hydrologic conditions. LID designs accomplish this by reducing the runoff volume generated by a site and implementing features that infiltrate, filter, evaporate, harvest and detain runoff, while also preventing pollution. GRCA encourages the use of LID

features as part of the water quality design for a site and, therefore, opportunities to utilize these features have been investigated at a preliminary level.

4.1.1 Subsurface Soils Investigation

A Geotechnical Investigation Report was completed by GHD (dated May 26, 2020), with ten (10) boreholes advanced on site. Monitoring wells were installed in three (3) boreholes to facilitate monitoring of groundwater levels. The borehole logs indicate groundwater was observed in all boreholes, at depths ranging from 0.61 m to 4.27 meters below existing grade (mbeg). **Table 3** outlines the approximate groundwater elevation at each monitored borehole location. Infiltration rates for the native soils were estimated based on in-situ infiltration testing in six (6) locations on site. The Geotechnical Investigation report recommended using an infiltration rate of 50 mm/hr with an appropriate safety factor applied, for design purposes. However, it was noted that no infiltration was observed in three (3) of the testing locations.

Table 3 – Borehole and Groundwater Elevation Summary

Borehole ID	Existing Ground Elevation (m)	Water Level (m)	Approximate Groundwater Elevation (m)
BH-2	89.00	0.37	88.63
BH-6	87.78	0.02	87.76
BH-9	88.37	0.54	87.83

4.1.2 LID Design Summary

Table 3.4.1 of the Low Impact Development Stormwater Management Planning and Design Manual identifies 12 types of LIDs and their associated design constraints. For all infiltration based LID features, a minimum separation of 1.0 m is required from the bottom of feature to the seasonally high groundwater levels. In considering the proposed grading design for the development with the groundwater elevations as outlined in **Table 3**, the site does not allow for infiltration within underground features. Furthermore, any underground storage features will require an impermeable liner to prevent groundwater influence. As a result, the underground chamber storage facilities include an Isolator Row Plus, which is an LID that does not rely on infiltration. Other LID features such as enhanced grassed swales, surface infiltration and rain barrels will be considered during detailed design. Treatment train calculations will be provided confirming that the water quality features achieve "Enhanced" Level 1 protection as defined in the Stormwater Management Planning and Design Manual (March 2003).

4.2 Stormwater Management Facility Options

The proposed increase in the impervious area is expected to impact both the quantity and quality of stormwater runoff leaving the Site. A SWM strategy for the Site has been evaluated on a preliminary level, to indicate whether stormwater runoff can be managed from a quantity and quality perspective to the standards described in the

Ministry of the Environment (MOE) Stormwater Management Planning and Design Manual (March 2003), and to Town of Cobourg and GRCA standards.

A conservative estimate of the storage volume requirements was determined using a single-stage outlet structure in VO3. During detailed design, a multi-stage outlet design will be considered to optimize the storage volume requirements. Preliminary storage area estimates were completed based on typical design depths, underground chamber manufacturer recommendations, length to width ratios and grading requirements. The SWM methods are summarized for each outlet location in **Error! Reference source not found.** and **Table 5** and detailed calculations are included in **Appendix C.**

Table 4 – SWM Strategy Summary (OUT 1)

Facility Description	Outlet Control	Volume / Area Requirements[1]	Comments and Feasibility
Underground Storage	• 1-stage outlet • Control proposed flows to existing at **OUT-1**	• Approx. total volume required = 1,071 m^3. • Assumed two (2) separate connected underground chamber storage systems (SC-740) below landscape area and parking lot. • Approx. total area required = 1,641 m^2.	• Feasible option for **water quantity** and **water quality** control. • Isolator row plus provides LID credit. • OGS located upstream provides quality pre-treatment. • Can be supplemented with other options such as parking lot / surface storage.
Oil-Grit Separator (OGS)	• No upstream quantity control.	• Stormceptor EF012 will provide 63% TSS removal of the ETV particle size distribution and treat >90% of the annual runoff volume.	• Feasible option for **water quality** control. • Will form part of a treatment train approach, unable to achieve Enhanced protection as a standalone feature.

Table 5 – SWM Strategy Summary (OUT 2)

Facility Description	Outlet Control	Volume / Area Requirements[1]	Comments and Feasibility
Underground Storage	• 1-stage outlet • Control proposed flows to existing at **OUT-2**	• Approx. total volume required = 692 m^3. • Assumed two (2) separate connected underground chamber storage systems (SC-740) below landscape area and south parking lot. • Approx. total area required = 1,092 m^2.	• Feasible option for **water quantity** and **water quality** control. • Isolator row plus provides LID credit. • Two (2) OGS units located upstream provides quality pre-treatment for each detention area. • Can be supplemented with other options such as parking lot / surface storage.
Oil-Grit Separator (OGS)	• No upstream quantity control.	• Two (2) Stormceptor units will be required based on detention area location. • Stormceptor EF08 (North Area) will provide 63% TSS removal of the ETV particle size distribution Stormceptor EF06 (South Area) will provide 63% TSS removal of the ETV particle size distribution • Both units will treat >90% of the annual runoff volume.	• Feasible option for **water quality** control. • Will form part of a treatment train approach, unable to achieve Enhanced protection as a standalone feature.

4.3 Stormwater Quantity Control Summary

The proposed controlled peak flow rates at **OUT 1** and **OUT 2** are included in **Table 6**.

Table 6 – Peak Flow Rates

Return Interval (year)	Peak Flow (m^3/s)			
	OUT 1		OUT 2	
	Ex.	Pr.	Ex.	Pr.
2	0.034	0.034	0.012	0.012
5	0.069	0.048	0.024	0.013
10	0.094	0.057	0.032	0.014
25	0.172	0.085	0.060	0.016
50	0.221	0.104	0.077	0.018
100	0.274	0.124	0.096	0.019

Notes:
1. **Ex.** refers to the existing flow rates at each outlet location. VO3 NHYD = 4 and 5
2. **Pr.** refers to the controlled proposed flow rates at each outlet location. VO3 NHYD = 12 and 24

A review of **Table 6** indicates the proposed peak flow rates do not exceed the overall existing condition rates at each outlet location, with the use of underground storage chamber systems in catchments **PR-101** and **PR-200**.

The maximum volume of storage that is required for the 100-year event in **PR-101** (**OUT 1)** is 1,075 m^3. The maximum volume of storage that is required for the 100-year event in **PR-200** (**OUT 2)** is 692 m^3. During detailed design, a multi-stage outlet design will be completed for each chamber system, which will reduce the storage volume required. As such, the quantity control storage volumes provided are conservative.

5.0 Conclusion

The proposed development is located at 540 King Street East in the Town of Cobourg. As the proposed site works will alter existing drainage patterns, a preliminary stormwater management report has been prepared to address the requirements of the Town of Cobourg and GRCA.

Low Impact Development considerations and stormwater quality controls can be used in combination to achieve "Enhanced" Level 1 protection as defined in the Stormwater Management Planning and Design Manual (March 2003).

Stormwater quality control measures are required to ensure that the receiving drainage system will not be adversely affected. Stormwater quality control for the Site will be provided by a combination of LID features and oil-grit separator structures.

Stormwater quantity control for the Site will be provided by underground chamber storage. Peak flows in catchments are controlled to ensure that the overall peak flows discharging to **OUT 1** and **OUT 2** do not exceed the existing condition levels. The underground chamber system will require an impermeable liner to avoid any contact between detained stormwater and groundwater.

If you require any further information, or have any questions, please do not hesitate to contact the undersigned.

Respectfully submitted,

Chris Proctor-Bennett, P.Eng.,
Water Resources Engineer

Mark Wilson, A.Sc.T
Senior Project Designer

MW/CPB

Statement of Limitations

This report has been prepared by D.M. Wills Associates Limited on behalf of Restoration Depot Inc. to address the requirements of the Town of Cobourg and GRCA.

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

The report is intended to determine the feasibility of the proposed development with respect to Stormwater Management of the Site. The design information provided in this report is preliminary in nature and should not be used for site plan application or construction purposes.

Any use that a third party makes of this report other than a Preliminary Stormwater Management Report for the proposed development is the responsibility of such third parties. D.M. Wills Associates Limited accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or action taken based on using this report for purposes other than a Preliminary Stormwater Management Report for the Site located at 540 King Street East, Cobourg.

Appendix A

Rainfall Data and Hydrology

Clarington Intensity Formulas

IDF Equation	I =a/(b+Td)		Td --- Time in hour I -- Intensity in mm/Hr				Conservative a i = --------- (td + b)^c
Return Period Parameters	2 year	5 year	10 year	25 year	50 year	100 year	100year
a	1778	2464	2819	3886	4750	5588	1770
b	13	16	16	18	24	28	4
							0.82

Rainfall Intensity Formulas (beyond Clarington)

Yarnell Equation

	I =a/(b+Td)		Td --- Time in hour I -- Intensity in mm/Hr			
Return Period Parameters	2 year	5 year	10 year	25 year	50 year	100 year
a	1778	2464	2819	3886	4750	5588
b	13	16	16	18	24	28

Hydrologic Parameters for EX-100

Sheet 1 of 1

Project No: 10927
Project Name: King Street Residential
Designed/Checked By: RC/CPB
Date: 2-Feb-22

Land Use

Agriculture	0.41	0.57	ha
Range	1.16	0.32	ha
Grass	0.00	0.00	ha
Woods	0.10	0.04	ha
Wetland	0.00	0.16	ha
Gravel	0.00	0.00	ha
Impervious	0.00	0.00	ha
SUM	**1.67**	**1.09**	
Hydrologic Soil Group[1]	B	C	
Soil Type	Tecumseth Sandy Loam	Smithfield Clay Loam	
C	0.17	0.27	
CN (Nashyd)	66.8	75.1	

Rainfall Data

Gauging Station =
12 hr, 100 Yr Rainfall = 99.3 mm

Drainage Area	**2.76**	ha
Impervious Area	**0.00**	ha
Percent Impervious	**0.0%**	
Connected Impervious	0.0%	

Pervious

Length	130	m
US Elev	89.0	m
DS Elev	87.1	m
Slope	1.5	%
	Flat	

Parameter	Soil Group	Land Use: Agriculture	Range	Grass	Woods	Wetland	Gravel	Imperv.	Weighted Value: Incl. Imperv. NASHYD	Weighted Value: Not Incl. Imperv. STANDHYD
Runoff Coefficient[2]**, C**	**B**	0.26	0.14	0.08	0.08	0.05	0.76	0.90	0.17	
	C	0.39	0.20	0.12	0.10	0.05	0.84	0.90	0.27	n.a.
SCS Curve No.[3]**, CN**	**B**	74	65	61	58	50	85	98	66.8	66.8
	C	82	76	74	71	50	89	98	75.1	75.1
Initial Abstraction[5]**, mm**		6.0	8.0	5.0	10.0	10.0	2.5	2.0	7.5	7.5

Time of Concentration[6]

Total Length	130	m	
Average Slope	1.5	%	
Airport	**29.0**	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Bransby - Williams	6.2	min.	
Applicable Minimum[7]	10.0	min.	
Time to Peak	19.4	min.	
	0.32	**hr.**	

Composite Parameters

Drainage Area	2.76 ha	
Runoff Coefficient	0.21	
SCS Curve No.	70.1	70.1
Modified Curve No.[4]**, CN***	**73.6**	73.6
Initial Abstraction.	**7.5**	7.5

Notes:

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

Hydrologic Parameters for EX-200

Sheet 1 of 1

Project No: 10927
Project Name: King Street Residential
Designed/Checked By: RC/CPB
Date: 2-Feb-22

Land Use

Agriculture	0.00	ha
Range	0.98	ha
Grass	0.00	ha
Woods	0.12	ha
Wetland	0.00	ha
Gravel	0.03	ha
Impervious	0.08	ha
SUM	**1.21**	

Hydrologic Soil Group[1]	B
Soil Type	Tecumseth Sandy Loam
C	0.20
CN (Nashyd)	67.0

Rainfall Data

Gauging Station = Cobourg
12 hr, 100 Yr Rainfall = 99.3 mm

Drainage Area	**1.21**	ha
Impervious Area	**0.08**	ha
Percent Impervious	**6.6%**	
Connected Impervious	6.6%	

Pervious

Length	120	m
US Elev	89.9	m
DS Elev	87.5	m
Slope	2.0	%
	Flat	

Parameter	Soil Group	Land Use							Weighted Value	
		Agriculture	Range	Grass	Woods	Wetland	Gravel	Imperv.	Incl. Imperv. NASHYD	Not Incl. Imperv. STANDHYD
Runoff Coefficient[2]**, C**	**B**	0.26	0.14	0.08	0.08	0.05	0.76	0.90	0.20	n.a.
SCS Curve No.[3]**, CN**	**B**	74	65	61	58	50	85	98	67.0	64.8
Initial Abstraction[5]**, mm**		6.0	8.0	5.0	10.0	10.0	2.5	2.0	7.7	8.1

Time of Concentration[6]

Total Length	120	m	
Average Slope	2.0	%	
Airport	**25.6**	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Bransby - Williams	5.8	min.	
Applicable Minimum[7]	10.0	min.	
Time to Peak	17.1	min.	
	0.29	**hr.**	

Composite Parameters

Drainage Area	1.21 ha	
Runoff Coefficient	0.20	
SCS Curve No.	67.0	64.8
Modified Curve No.[4]**, CN***	**70.2**	68.0
Initial Abstraction.	**7.7**	8.1

Notes:

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

Hydrologic Parameters for EXT-100

Sheet 1 of 1

Project No: 10927
Project Name: King Street Residential
Designed/Checked By: RC/CPB
Date: 2-Feb-22

Land Use

Agriculture	0.00	0.00	ha
Range	0.15	0.20	ha
Grass	0.00	0.00	ha
Woods	0.00	0.00	ha
Wetland	0.00	0.00	ha
Gravel	0.00	0.00	ha
Impervious	0.00	0.00	ha
SUM	**0.15**	**0.20**	
Hydrologic Soil Group[1]	B	C	
Soil Type	Tecumseth Sandy Loam	Smithfield Clay Loam	
C	0.14	0.20	
CN (Nashyd)	65.0	76.0	

Rainfall Data

Gauging Station = Cobourg
12 hr, 100 Yr Rainfall = 99.3 mm

Drainage Area	**0.35**	ha
Impervious Area	**0.00**	ha
Percent Impervious	**0.0%**	
Connected Impervious	0.0%	

Pervious

Length	165	m
US Elev	89.9	m
DS Elev	88.3	m
Slope	1.0	%
	Flat	

Parameter	Soil Group	Land Use							Weighted Value	
		Agriculture	Range	Grass	Woods	Wetland	Gravel	Imperv.	Incl. Imperv. NASHYD	Not Incl. Imperv. STANDHYD
Runoff Coefficient[2]**, C**	**B**	0.26	0.14	0.08	0.08	0.05	0.76	0.90	0.14	
	C	0.39	0.20	0.12	0.10	0.05	0.84	0.90	0.20	n.a.
SCS Curve No.[3]**, CN**	**B**	74	65	61	58	50	85	98	65.0	65.0
	C	82	76	74	71	50	89	98	76.0	76.0
Initial Abstraction[5]**, mm**		6.0	8.0	5.0	10.0	10.0	2.5	2.0	8.0	8.0

Time of Concentration[6]

Total Length	165	m	
Average Slope	1.0	%	
Airport	**38.8**	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Bransby - Williams	10.4	min.	
Applicable Minimum[7]	10.0	min.	
Time to Peak	26.0	min.	
	0.43	**hr.**	

Composite Parameters

Drainage Area	0.35 ha	
Runoff Coefficient	0.17	
SCS Curve No.	71.3	71.3
Modified Curve No.[4]**, CN***	**75.2**	75.2
Initial Abstraction.	**8.0**	8.0

Notes:

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

Hydrologic Parameters for EXT-101

Sheet 1 of 1

Project No: 10927
Project Name: King Street Residential
Designed/Checked By: RC/CPB
Date: 2-Feb-22

Land Use

Agriculture	0.00	0.00	ha
Range	0.00	0.00	ha
Grass	0.00	0.10	ha
Woods	0.00	0.35	ha
Wetland	0.00	0.00	ha
Gravel	0.00	0.00	ha
Impervious	0.00	0.00	ha
SUM	**0.00**	**0.45**	
Hydrologic Soil Group[1]	B	C	
Soil Type	Tecumseth Sandy Loam	Smithfield Clay Loam	
C		0.10	
CN (Nashyd)		71.7	

Rainfall Data

Gauging Station = Cobourg
12 hr, 100 Yr Rainfall = 99.3 mm

Drainage Area	**0.45**	ha
Impervious Area	**0.00**	ha
Percent Impervious	**0.0%**	
Connected Impervious	0.0%	

Pervious

Length	190	m
US Elev	89.0	m
DS Elev	88.3	m
Slope	0.4	%
	Flat	

Parameter	Soil Group	Land Use: Agriculture	Range	Grass	Woods	Wetland	Gravel	Imperv.	Weighted Value: Incl. Imperv. NASHYD	Weighted Value: Not Incl. Imperv. STANDHYD
Runoff Coefficient[2]**, C**	**B**	0.26	0.14	0.08	0.08	0.05	0.76	0.90		
	C	0.39	0.20	0.12	0.10	0.05	0.84	0.90	0.10	n.a.
SCS Curve No.[3]**, CN**	**B**	74	65	61	58	50		98		
	C	82	76	74	71	50	89	98	71.7	71.7
Initial Abstraction[5]**, mm**		6.0	8.0	5.0	10.0	10.0	2.5	2.0	8.9	8.9

Time of Concentration[6]

Total Length	190	m	
Average Slope	0.4	%	
Airport	**60.8**	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Bransby - Williams	14.1	min.	
Applicable Minimum[7]	10.0	min.	
Time to Peak	40.7	min.	
	0.68	**hr.**	

Composite Parameters

Drainage Area	0.45 ha	
Runoff Coefficient	0.10	
SCS Curve No.	71.7	71.7
Modified Curve No.[4]**, CN***	**76.5**	76.5
Initial Abstraction.	**8.9**	8.9

Notes:

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

Hydrologic Parameters for PR-100

Sheet 1 of 1

Project No: 10927
Project Name: King Street Residential
Designed/Checked By: RC/CPB
Date: 2-Feb-22

Land Use

Agriculture	0.00	0.00	ha
Range	0.00	0.28	ha
Grass	0.00	0.00	ha
Woods	0.00	0.04	ha
Wetland	0.00	0.16	ha
Gravel	0.00	0.00	ha
Impervious	0.00	0.00	ha
SUM	**0.00**	**0.48**	

Hydrologic Soil Group[1]	B	C
Soil Type	Tecumseth Sandy Loam	Smithfield Clay Loam
C		0.14
CN (Nashyd)		66.9

Rainfall Data

Gauging Station = Cobourg
12 hr, 100 Yr Rainfall = 99.3 mm

Drainage Area	**0.48**	ha
Impervious Area	**0.00**	ha
Percent Impervious	**0.0%**	
Connected Impervious	0.0%	

Pervious

Length	120	m
US Elev	88.5	m
DS Elev	88.2	m
Slope	0.3	%
	Flat	

Parameter	Soil Group	Land Use							Weighted Value	
		Agriculture	Range	Grass	Woods	Wetland	Gravel	Imperv.	Incl. Imperv. NASHYD	Not Incl. Imperv. STANDHYD
Runoff Coefficient[2]**, C**	**B**	0.26	0.14	0.08	0.08	0.05	0.76	0.90	0.14	n.a.
	C	0.39	0.20	0.12	0.10	0.05	0.84	0.90		
SCS Curve No.[3]**, CN**	**B**	74	65	61	58	50		98	66.9	66.9
	C	82	76	74	71	50	89	98		
Initial Abstraction[5]**, mm**		6.0	8.0	5.0	10.0	10.0	2.5	2.0	8.8	8.8

Time of Concentration[6]

Total Length	120	m	
Average Slope	0.3	%	
Airport	**51.4**	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Bransby - Williams	9.4	min.	
Applicable Minimum[7]	10.0	min.	
Time to Peak	34.4	min.	
	0.57	**hr.**	

Composite Parameters

Drainage Area	0.48 ha	
Runoff Coefficient	0.14	
SCS Curve No.	66.9	66.9
Modified Curve No.[4]**, CN***	**71.5**	71.5
Initial Abstraction.	**8.8**	8.8

Notes:

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

Hydrologic Parameters for PR-101

Sheet 1 of 1

Project No: 10927
Project Name: King Street Residential
Designed/Checked By: RC/CPB
Date: 2-Feb-22

Land Use

Agriculture	0.00	0.00	ha
Range	0.00	0.00	ha
Grass	0.33	0.18	ha
Woods	0.00	0.00	ha
Wetland	0.00	0.00	ha
Gravel	0.00	0.00	ha
Impervious	1.11	0.43	ha
SUM	**1.44**	**0.60**	
Hydrologic Soil Group[1]	B	C	
Soil Type	Tecumseth Sandy Loam	Smithfield Clay Loam	
C	0.72	0.69	
CN (Nashyd)	89.6	91.0	

Rainfall Data

Gauging Station = Cobourg
12 hr, 100 Yr Rainfall = 99.3 mm

Drainage Area	**2.04**	ha
Impervious Area	**1.54**	ha
Percent Impervious	**75.3%**	
Connected Impervious	75.3%	

	Pervious	Impervious	
Length	10	230	m
US Elev	88.5	91.5	m
DS Elev	88.3	89.2	m
Slope	2.0	1.0	%
	Rolling	Flat	

Parameter	Soil Group	Land Use: Agriculture	Range	Grass	Woods	Wetland	Gravel	Imperv.	Weighted Value: Incl. Imperv. NASHYD	Weighted Value: Not Incl. Imperv. STANDHYD
Runoff Coefficient[2]**, C**	**B**	0.32	0.22	0.13	0.11	0.05	0.76	0.90	0.72	
	C	0.45	0.28	0.17	0.13	0.05	0.84	0.90	0.69	n.a.
SCS Curve No.[3]**, CN**	**B**	74	65	61	58	50	85	98	89.6	61.0
	C	82	76	74	71	50	89	98	91.0	74.0
Initial Abstraction[5]**, mm**		6.0	8.0	5.0	10.0	10.0	2.5	2.0	2.7	5.0

Time of Concentration[6]

Total Length	240	m	
Average Slope	1.0	%	
Airport	19.3	min.	
Bransby - Williams	**12.6**	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Applicable Minimum[7]	10.0	min.	
Time to Peak	8.5	min.	
	0.14	**hr.**	

Composite Parameters

Drainage Area	2.04 ha	
Runoff Coefficient	0.71	
SCS Curve No.	90.0	65.5
Modified Curve No.[4]**, CN***	90.8	**66.5**
Initial Abstraction.	2.7	**5.0**

Notes:

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

Hydrologic Parameters for PR-200

Sheet 1 of 1

Project No: 10927
Project Name: King Street Residential
Designed/Checked By: RC/CPB
Date: 2-Feb-22

Land Use

Agriculture	0.00	ha
Range	0.00	ha
Grass	0.40	ha
Woods	0.00	ha
Wetland	0.00	ha
Gravel	0.00	ha
Impervious	0.92	ha
SUM	**1.32**	

Hydrologic Soil Group[1]	B
Soil Type	Tecumseth Sandy Loam
C	0.67
CN (Nashyd)	86.9

Rainfall Data

Gauging Station = Cobourg
12 hr, 100 Yr Rainfall = 99.3 mm

Drainage Area	**1.32**	ha
Impervious Area	**0.92**	ha
Percent Impervious	**70.0%**	
Connected Impervious	70.0%	

	Pervious	Impervious	
Length	10	215	m
US Elev	88.5	91.5	m
DS Elev	88.3	89.4	m
Slope	2.0	1.0	%
	Rolling	Flat	

Parameter	Soil Group	Land Use							Weighted Value	
		Agriculture	Range	Grass	Woods	Wetland	Gravel	Imperv.	Incl. Imperv. NASHYD	Not Incl. Imperv. STANDHYD
Runoff Coefficient[2]**, C**	**B**	0.32	0.22	0.13	0.11	0.05	0.76	0.90	0.67	n.a.
SCS Curve No.[3]**, CN**	**B**	74	65	61	58	50	85	98	86.9	61.0
Initial Abstraction[5]**, mm**		6.0	8.0	5.0	10.0	10.0	2.5	2.0	2.9	5.0

Time of Concentration[6]

Total Length	225	m	
Average Slope	1.0	%	
Airport	20.8	min.	
Bransby - Williams	**12.4**	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes Hilly: >6% Slopes
Applicable Minimum[7]	10.0	min.	
Time to Peak	8.3	min.	
	0.14	**hr.**	

Composite Parameters

Drainage Area	1.32 ha	
Runoff Coefficient	0.67	
SCS Curve No.	86.9	61.0
Modified Curve No.[4]**, CN***	87.4	**60.5**
Initial Abstraction.	2.9	**5.0**

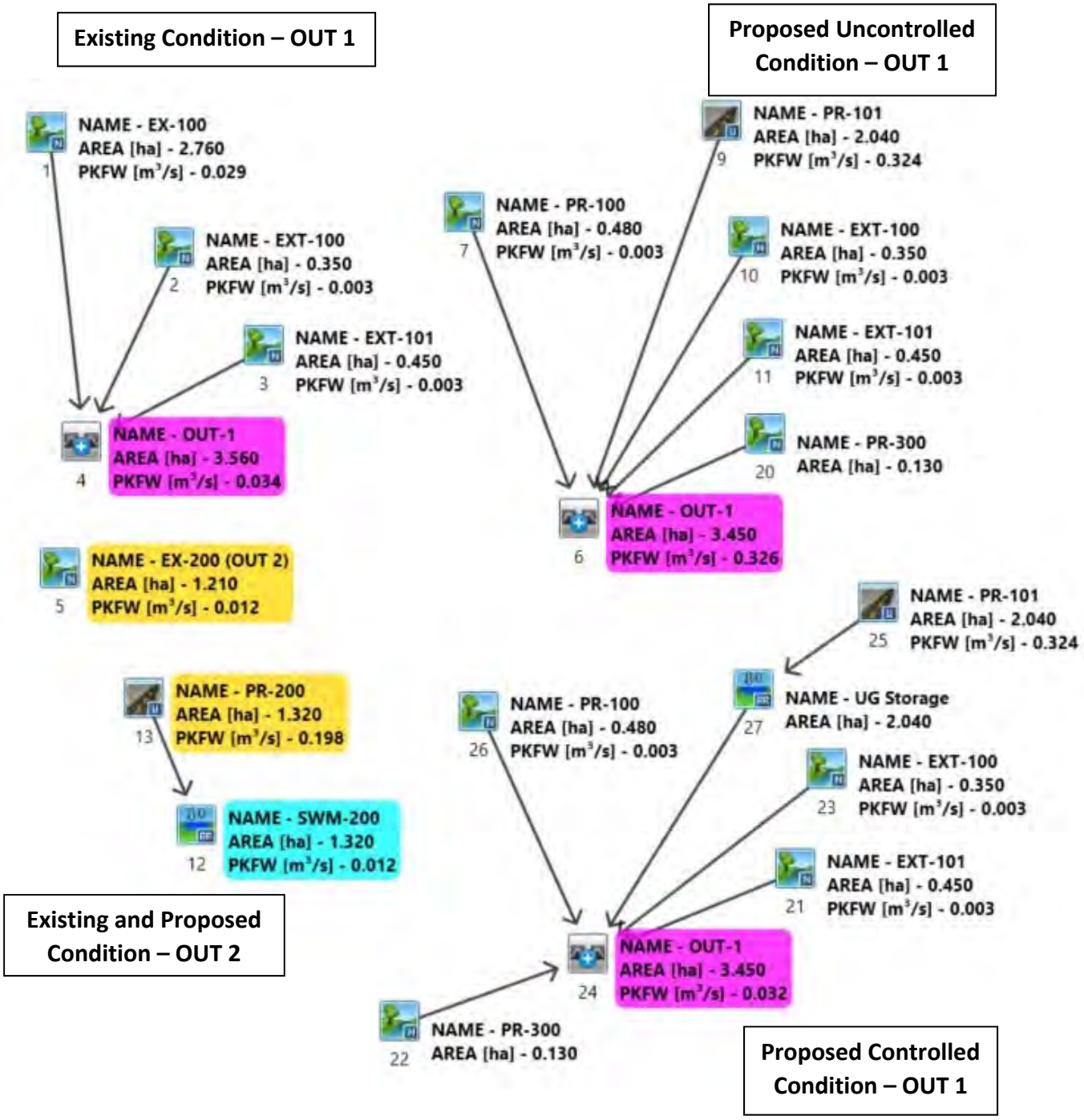
Notes:

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

Appendix B

Peak Flow Calculatiions

VO3 Analysis



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

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

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


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

  Output  filename: C:\Users\cproctorbennett\AppData\Local\Temp\8ed3e64f-cd93-4679-
b877-7a60ebf388c3\Scenario.out
  Summary filename: C:\Users\cproctorbennett\AppData\Local\Temp\8ed3e64f-cd93-4679-
b877-7a60ebf388c3\Scenario.sum


DATE: 02-08-2022                          TIME: 04:04:18

USER:


COMMENTS: _____________________________________________________________


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

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1778.000
| Ptotal= 28.11 mm |                          B=  13.000
--------------------                          C=   1.000
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.17    0.49 |  1.17   18.95 |  2.17    2.84 |  3.17    0.71
                0.33    0.66 |  1.33   77.30 |  2.33    2.09 |  3.33    0.61
                0.50    0.93 |  1.50   26.45 |  2.50    1.60 |  3.50    0.52
                0.67    1.43 |  1.67   11.48 |  2.67    1.26 |  3.67    0.46
```



```
                0.83    2.46 |  1.83    6.42 |  2.83    1.02 |  3.83    0.40
                1.00    5.25 |  2.00    4.10 |  3.00    0.85 |  4.00    0.35

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0005) |   Area     (ha)=   1.21   Curve Number    (CN)= 70.2
|ID= 1 DT= 5.0 min |   Ia       (mm)=   7.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.29

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


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    0.49 | 1.083   18.95 | 2.083    2.84 |  3.08    0.71
               0.167    0.49 | 1.167   18.95 | 2.167    2.84 |  3.17    0.71
               0.250    0.66 | 1.250   77.30 | 2.250    2.09 |  3.25    0.61
               0.333    0.66 | 1.333   77.30 | 2.333    2.09 |  3.33    0.61
               0.417    0.93 | 1.417   26.45 | 2.417    1.60 |  3.42    0.52
               0.500    0.93 | 1.500   26.45 | 2.500    1.60 |  3.50    0.52
               0.583    1.43 | 1.583   11.48 | 2.583    1.26 |  3.58    0.46
               0.667    1.43 | 1.667   11.48 | 2.667    1.26 |  3.67    0.46
               0.750    2.46 | 1.750    6.42 | 2.750    1.02 |  3.75    0.40
               0.833    2.46 | 1.833    6.42 | 2.833    1.02 |  3.83    0.40
               0.917    5.25 | 1.917    4.10 | 2.917    0.85 |  3.92    0.35
               1.000    5.25 | 2.000    4.10 | 3.000    0.85 |  4.00    0.35

     Unit Hyd Qpeak  (cms)=   0.159

     PEAK FLOW       (cms)=   0.012 (i)
     TIME TO PEAK    (hrs)=   1.750
     RUNOFF VOLUME    (mm)=   3.245
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.115

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0001) |   Area     (ha)=   2.76   Curve Number    (CN)= 73.6
|ID= 1 DT= 5.0 min |   Ia       (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   0.329

     PEAK FLOW       (cms)=   0.029 (i)
     TIME TO PEAK    (hrs)=   1.750
     RUNOFF VOLUME    (mm)=   3.799
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.135

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
```

```
| NASHYD    (0002) |   Area    (ha)=   0.35   Curve Number   (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   1.917
     RUNOFF VOLUME    (mm)=   3.888
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.138

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0003) |   Area    (ha)=   0.45   Curve Number   (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   2.250
     RUNOFF VOLUME    (mm)=   3.790
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.135

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

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

--------------------
| ADD HYD   (0004) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)     (cms)    (hrs)     (mm)
          ID1= 1 (0001):     2.76   0.029     1.75     3.80
        + ID2= 2 (0002):     0.35   0.003     1.92     3.89
          ================================================
          ID = 3 (0004):     3.11   0.032     1.75     3.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0004) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)     (cms)    (hrs)     (mm)
          ID1= 3 (0004):     3.11   0.032     1.75     3.81
        + ID2= 2 (0003):     0.45   0.003     2.25     3.79
          ================================================
          ID = 1 (0004):     3.56   0.034     1.75     3.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
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```
| NASHYD    (0007) |   Area    (ha)=   0.48   Curve Number   (CN)= 71.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.80   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   0.032

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=   3.089
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.110

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

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--------------------
| CALIB            |
| NASHYD    (0010) |   Area    (ha)=   0.35   Curve Number   (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   1.917
     RUNOFF VOLUME    (mm)=   3.888
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.138

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

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--------------------
| CALIB            |
| NASHYD    (0011) |   Area    (ha)=   0.45   Curve Number   (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   2.250
     RUNOFF VOLUME    (mm)=   3.790
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.135

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

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--------------------
| CALIB            |
| NASHYD    (0020) |   Area    (ha)=   0.13   Curve Number   (CN)= 68.4
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.11

     Unit Hyd Qpeak  (cms)=   0.045

     PEAK FLOW       (cms)=   0.002 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=   2.883
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     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.103

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

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--------------------
| CALIB            |
| STANDHYD  (0009) |   Area    (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53         0.51
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     116.62        10.00
     Mannings n            =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      77.30         7.71
               over (min)        5.00        10.00
     Storage Coeff.  (min)=       3.11 (ii)    5.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.27         0.16
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.32         0.01          0.324 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      27.11         3.53          21.21
     TOTAL RAINFALL   (mm)=      28.11        28.11          28.11
     RUNOFF COEFFICIENT   =       0.96         0.13           0.75

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  66.5    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0006) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0010):     0.35   0.003     1.92     3.89
        + ID2= 2 (0011):     0.45   0.003     2.25     3.79
          ================================================
          ID = 3 (0006):     0.80   0.006     2.00     3.83

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0006) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0006):     0.80   0.006     2.00     3.83
        + ID2= 2 (0020):     0.13   0.002     1.50     2.88
          ================================================
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          ID = 1 (0006):     0.93   0.006     2.00     3.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0006) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0006):     0.93   0.006     2.00     3.70
        + ID2= 2 (0007):     0.48   0.003     2.08     3.09
          ================================================
          ID = 3 (0006):     1.41   0.009     2.00     3.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0006) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0006):     1.41   0.009     2.00     3.49
        + ID2= 2 (0009):     2.04   0.324     1.33    21.21
          ================================================
          ID = 1 (0006):     3.45   0.326     1.33    13.97

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| STANDHYD  (0013) |   Area    (ha)=   1.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.92         0.40
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      93.81        10.00
     Mannings n            =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      77.30         6.12
               over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.73 (ii)    5.15 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.29         0.16
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.19         0.01          0.198 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      27.11         2.83          19.82
     TOTAL RAINFALL   (mm)=      28.11        28.11          28.11
     RUNOFF COEFFICIENT   =       0.96         0.10           0.71

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  60.5    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
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THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR (0012) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0120      0.0219
                          0.0044     0.0000   |   0.0130      0.0342
                          0.0067     0.0000   |   0.0140      0.0479
                          0.0083     0.0000   |   0.0149      0.0602
                          0.0097     0.0000   |   0.0157      0.0725
                          0.0109     0.0096   |   0.0000      0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0013)     1.320     0.198      1.33      19.82
     OUTFLOW: ID= 1 (0012)     1.320     0.012      2.00      19.85

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.93
                    TIME SHIFT OF PEAK FLOW         (min)= 40.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0193

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--------------------
| CALIB            |
| NASHYD    (0021) |   Area    (ha)=   0.45   Curve Number   (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   2.250
     RUNOFF VOLUME    (mm)=   3.790
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.135

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   0.13   Curve Number   (CN)= 68.4
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.11

     Unit Hyd Qpeak  (cms)=   0.045

     PEAK FLOW       (cms)=   0.002 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=   2.883
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.103

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

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--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   0.35   Curve Number   (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   1.917
     RUNOFF VOLUME    (mm)=   3.888
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.138

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0026) |   Area    (ha)=   0.48   Curve Number   (CN)= 71.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.80   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   0.032

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=   3.089
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.110

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0025) |   Area    (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------

                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53          0.51
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     116.62         10.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      77.30          7.71
               over (min)        5.00         10.00
     Storage Coeff.  (min)=       3.11 (ii)     5.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.27          0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.32          0.01          0.324 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.42           1.33
     RUNOFF VOLUME    (mm)=      27.11          3.53          21.21
     TOTAL RAINFALL   (mm)=      28.11         28.11          28.11
     RUNOFF COEFFICIENT   =       0.96          0.13           0.75

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 66.5 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR (0027)
IN= 2---> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0353	0.0664
0.0087	0.0114	0.0383	0.0768
0.0173	0.0218	0.0413	0.0882
0.0233	0.0332	0.0439	0.0986
0.0276	0.0436	0.0466	0.1100
0.0317	0.0550	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0025)	2.040	0.324	1.33	21.21
OUTFLOW: ID= 1 (0027)	2.040	0.023	1.92	21.05

PEAK FLOW REDUCTION [Qout/Qin](%)= 7.20
TIME SHIFT OF PEAK FLOW (min)= 35.00
MAXIMUM STORAGE USED (ha.m.)= 0.0335

ADD HYD (0024)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0021):	0.45	0.003	2.25	3.79
+ ID2= 2 (0022):	0.13	0.002	1.50	2.88
ID = 3 (0024):	0.58	0.003	2.17	3.59

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0024)
3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0024):	0.58	0.003	2.17	3.59
+ ID2= 2 (0023):	0.35	0.003	1.92	3.89
ID = 1 (0024):	0.93	0.006	2.00	3.70

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0024)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)

ID1= 1 (0024):	0.93	0.006	2.00	3.70
+ ID2= 2 (0026):	0.48	0.003	2.08	3.09
ID = 3 (0024):	1.41	0.009	2.00	3.49

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0024)
3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0024):	1.41	0.009	2.00	3.49
+ ID2= 2 (0027):	2.04	0.023	1.92	21.05
ID = 1 (0024):	3.45	0.032	2.00	13.87

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

****
** SIMULATION NUMBER: 2 **
****

CHICAGO STORM
Ptotal= 38.49 mm

IDF curve parameters: A=2464.000
B= 16.000
C= 1.000
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	0.81	1.17	27.06	2.17	4.54	3.17	1.17
0.33	1.09	1.33	94.77	2.33	3.37	3.33	1.00
0.50	1.53	1.50	36.99	2.50	2.60	3.50	0.87
0.67	2.32	1.67	17.18	2.67	2.06	3.67	0.76
0.83	3.95	1.83	9.92	2.83	1.68	3.83	0.67
1.00	8.18	2.00	6.46	3.00	1.39	4.00	0.59

CALIB
NASHYD (0005)
ID= 1 DT= 5.0 min

Area (ha)= 1.21 Curve Number (CN)= 70.2
Ia (mm)= 7.70 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.29

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.81	1.083	27.06	2.083	4.54	3.08	1.17
0.167	0.81	1.167	27.06	2.167	4.54	3.17	1.17

0.250	1.09	1.250	94.77	2.250	3.37	3.25	1.00
0.333	1.09	1.333	94.77	2.333	3.37	3.33	1.00
0.417	1.53	1.417	36.99	2.417	2.60	3.42	0.87
0.500	1.53	1.500	36.99	2.500	2.60	3.50	0.87
0.583	2.32	1.583	17.18	2.583	2.06	3.58	0.76
0.667	2.32	1.667	17.18	2.667	2.06	3.67	0.76
0.750	3.95	1.750	9.92	2.750	1.68	3.75	0.67
0.833	3.95	1.833	9.92	2.833	1.68	3.83	0.67
0.917	8.18	1.917	6.46	2.917	1.39	3.92	0.59
1.000	8.18	2.000	6.46	3.000	1.39	4.00	0.59

Unit Hyd Qpeak (cms)= 0.159

PEAK FLOW (cms)= 0.024 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 6.837
TOTAL RAINFALL (mm)= 38.492
RUNOFF COEFFICIENT = 0.178

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

CALIB					
NASHYD (0001)	Area (ha)=	2.76	Curve Number (CN)=	73.6	
ID= 1 DT= 5.0 min	Ia (mm)=	7.50	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.32			

Unit Hyd Qpeak (cms)= 0.329

PEAK FLOW (cms)= 0.059 (i)
TIME TO PEAK (hrs)= 1.750
RUNOFF VOLUME (mm)= 7.864
TOTAL RAINFALL (mm)= 38.492
RUNOFF COEFFICIENT = 0.204

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

CALIB					
NASHYD (0002)	Area (ha)=	0.35	Curve Number (CN)=	75.2	
ID= 1 DT= 5.0 min	Ia (mm)=	8.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.43			

Unit Hyd Qpeak (cms)= 0.031

PEAK FLOW (cms)= 0.006 (i)
TIME TO PEAK (hrs)= 1.917
RUNOFF VOLUME (mm)= 8.134
TOTAL RAINFALL (mm)= 38.492
RUNOFF COEFFICIENT = 0.211

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

CALIB					
NASHYD (0003)	Area (ha)=	0.45	Curve Number (CN)=	76.5	
ID= 1 DT= 5.0 min	Ia (mm)=	8.90	# of Linear Res.(N)=	3.00	

	U.H. Tp(hrs)=	0.68			

Unit Hyd Qpeak (cms)= 0.025

PEAK FLOW (cms)= 0.006 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 8.133
TOTAL RAINFALL (mm)= 38.492
RUNOFF COEFFICIENT = 0.211

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

ADD HYD (0004)					
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	
ID1= 1 (0001):	2.76	0.059	1.75	7.86	
+ ID2= 2 (0002):	0.35	0.006	1.92	8.13	
ID = 3 (0004):	3.11	0.065	1.75	7.89	

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)					
3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	
ID1= 3 (0004):	3.11	0.065	1.75	7.89	
+ ID2= 2 (0003):	0.45	0.006	2.17	8.13	
ID = 1 (0004):	3.56	0.069	1.75	7.92	

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB					
NASHYD (0007)	Area (ha)=	0.48	Curve Number (CN)=	71.5	
ID= 1 DT= 5.0 min	Ia (mm)=	8.80	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.57			

Unit Hyd Qpeak (cms)= 0.032

PEAK FLOW (cms)= 0.006 (i)
TIME TO PEAK (hrs)= 2.083
RUNOFF VOLUME (mm)= 6.730
TOTAL RAINFALL (mm)= 38.492
RUNOFF COEFFICIENT = 0.175

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

CALIB					
NASHYD (0010)	Area (ha)=	0.35	Curve Number (CN)=	75.2	
ID= 1 DT= 5.0 min	Ia (mm)=	8.00	# of Linear Res.(N)=	3.00	

```
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.006 (i)
     TIME TO PEAK    (hrs)=   1.917
     RUNOFF VOLUME    (mm)=   8.134
     TOTAL RAINFALL   (mm)=  38.492
     RUNOFF COEFFICIENT   =   0.211

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

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--------------------
| CALIB            |
| NASHYD    (0011) |   Area    (ha)=   0.45   Curve Number   (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.006 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=   8.133
     TOTAL RAINFALL   (mm)=  38.492
     RUNOFF COEFFICIENT   =   0.211

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0020) |   Area    (ha)=   0.13   Curve Number   (CN)= 68.4
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.11

     Unit Hyd Qpeak  (cms)=   0.045

     PEAK FLOW       (cms)=   0.004 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=   6.171
     TOTAL RAINFALL   (mm)=  38.492
     RUNOFF COEFFICIENT   =   0.160

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

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--------------------
| CALIB            |
| STANDHYD  (0009) |   Area    (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53         0.51
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     116.62        10.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      94.77        13.67
```



```
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.86 (ii)    4.89 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.28         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.39         0.02          0.413 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      37.49         6.95          29.86
     TOTAL RAINFALL   (mm)=      38.49        38.49          38.49
     RUNOFF COEFFICIENT   =       0.97         0.18           0.78

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  66.5    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD   (0006) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0010):     0.35   0.006     1.92     8.13
        + ID2= 2 (0011):     0.45   0.006     2.17     8.13
          ================================================
          ID = 3 (0006):     0.80   0.012     2.00     8.13

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0006) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0006):     0.80   0.012     2.00     8.13
        + ID2= 2 (0020):     0.13   0.004     1.50     6.17
          ================================================
          ID = 1 (0006):     0.93   0.013     2.00     7.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0006) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0006):     0.93   0.013     2.00     7.86
        + ID2= 2 (0007):     0.48   0.006     2.08     6.73
          ================================================
          ID = 3 (0006):     1.41   0.019     2.00     7.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
```

```
--------------------
| ADD HYD   (0006) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0006):     1.41   0.019     2.00     7.47
        + ID2= 2 (0009):     2.04   0.413     1.33    29.86
          ================================================
          ID = 1 (0006):     3.45   0.418     1.33    20.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0013) |   Area    (ha)=   1.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.92         0.40
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      93.81        10.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      94.77        10.96
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.51 (ii)    4.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.29         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.24         0.01          0.252 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      37.49         5.63          27.93
     TOTAL RAINFALL   (mm)=      38.49        38.49          38.49
     RUNOFF COEFFICIENT   =       0.97         0.15           0.73

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  60.5    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR (0012) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.0120     0.0219
                         0.0044     0.0000    |   0.0130     0.0342
                         0.0067     0.0000    |   0.0140     0.0479
                         0.0083     0.0000    |   0.0149     0.0602
                         0.0097     0.0000    |   0.0157     0.0725
                         0.0109     0.0096    |   0.0000     0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0013)     1.320     0.252      1.33      27.93
```



```
     OUTFLOW: ID= 1 (0012)      1.320      0.012      2.17      27.97

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.95
                    TIME SHIFT OF PEAK FLOW          (min)= 50.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0279

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0021) |   Area    (ha)=   0.45   Curve Number   (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.006 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=   8.133
     TOTAL RAINFALL   (mm)=  38.492
     RUNOFF COEFFICIENT   =   0.211

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   0.13   Curve Number   (CN)= 68.4
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.11

     Unit Hyd Qpeak  (cms)=   0.045

     PEAK FLOW       (cms)=   0.004 (i)
     TIME TO PEAK    (hrs)=   1.500
     RUNOFF VOLUME    (mm)=   6.171
     TOTAL RAINFALL   (mm)=  38.492
     RUNOFF COEFFICIENT   =   0.160

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   0.35   Curve Number   (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.006 (i)
     TIME TO PEAK    (hrs)=   1.917
     RUNOFF VOLUME    (mm)=   8.134
     TOTAL RAINFALL   (mm)=  38.492
     RUNOFF COEFFICIENT   =   0.211

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

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| CALIB            |
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```
| NASHYD    (0026) |   Area    (ha)=   0.48   Curve Number   (CN)= 71.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.80   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   0.032

     PEAK FLOW       (cms)=   0.006 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=   6.730
     TOTAL RAINFALL   (mm)=  38.492
     RUNOFF COEFFICIENT   =   0.175

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0025) |   Area    (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53         0.51
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     116.62        10.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      94.77        13.67
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.86 (ii)    4.89 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.28         0.22
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.39         0.02          0.413 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      37.49         6.95          29.86
     TOTAL RAINFALL   (mm)=      38.49        38.49          38.49
     RUNOFF COEFFICIENT   =       0.97         0.18           0.78

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  66.5    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (0027) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0353     0.0664
                         0.0087     0.0114   |   0.0383     0.0768
                         0.0173     0.0218   |   0.0413     0.0882
                         0.0233     0.0332   |   0.0439     0.0986
                         0.0276     0.0436   |   0.0466     0.1100
                         0.0317     0.0550   |   0.0000     0.0000
```



```
                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0025)      2.040     0.413      1.33      29.86
     OUTFLOW: ID= 1 (0027)      2.040     0.029      2.00      29.69

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.96
                   TIME SHIFT OF PEAK FLOW         (min)= 40.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0469

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

--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0021):     0.45    0.006     2.17     8.13
        + ID2= 2 (0022):     0.13    0.004     1.50     6.17
          ================================================
          ID = 3 (0024):     0.58    0.007     2.17     7.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0024) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0024):     0.58    0.007     2.17     7.69
        + ID2= 2 (0023):     0.35    0.006     1.92     8.13
          ================================================
          ID = 1 (0024):     0.93    0.013     2.00     7.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0024):     0.93    0.013     2.00     7.86
        + ID2= 2 (0026):     0.48    0.006     2.08     6.73
          ================================================
          ID = 3 (0024):     1.41    0.019     2.00     7.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0024) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0024):     1.41    0.019     2.00     7.47
        + ID2= 2 (0027):     2.04    0.029     2.00    29.69
          ================================================
          ID = 1 (0024):     3.45    0.047     2.00    20.61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

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

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2819.000
| Ptotal= 44.04 mm |                          B=  16.000
--------------------                          C=   1.000
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.17    0.93 |  1.17   30.96 |  2.17    5.20 |  3.17    1.34
                0.33    1.24 |  1.33  108.42 |  2.33    3.85 |  3.33    1.15
                0.50    1.75 |  1.50   42.32 |  2.50    2.97 |  3.50    0.99
                0.67    2.66 |  1.67   19.65 |  2.67    2.36 |  3.67    0.87
                0.83    4.51 |  1.83   11.35 |  2.83    1.92 |  3.83    0.76
                1.00    9.35 |  2.00    7.39 |  3.00    1.59 |  4.00    0.68


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0005) |   Area    (ha)=   1.21   Curve Number    (CN)= 70.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.29

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

                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    0.93 | 1.083   30.96 | 2.083    5.20 |  3.08    1.34
               0.167    0.93 | 1.167   30.96 | 2.167    5.20 |  3.17    1.34
               0.250    1.24 | 1.250  108.42 | 2.250    3.85 |  3.25    1.15
               0.333    1.24 | 1.333  108.42 | 2.333    3.85 |  3.33    1.15
               0.417    1.75 | 1.417   42.32 | 2.417    2.97 |  3.42    0.99
               0.500    1.75 | 1.500   42.32 | 2.500    2.97 |  3.50    0.99
               0.583    2.66 | 1.583   19.65 | 2.583    2.36 |  3.58    0.87
               0.667    2.66 | 1.667   19.65 | 2.667    2.36 |  3.67    0.87
               0.750    4.51 | 1.750   11.35 | 2.750    1.92 |  3.75    0.76
               0.833    4.51 | 1.833   11.35 | 2.833    1.92 |  3.83    0.76
               0.917    9.35 | 1.917    7.39 | 2.917    1.59 |  3.92    0.68
               1.000    9.35 | 2.000    7.39 | 3.000    1.59 |  4.00    0.68

     Unit Hyd Qpeak  (cms)=   0.159

     PEAK FLOW       (cms)=   0.032 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=   9.155
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.208
```



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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   2.76   Curve Number    (CN)= 73.6
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.32

     Unit Hyd Qpeak  (cms)=   0.329

     PEAK FLOW       (cms)=   0.080 (i)
     TIME TO PEAK    (hrs)=   1.750
     RUNOFF VOLUME    (mm)=  10.455
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.237

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0002) |   Area    (ha)=   0.35   Curve Number    (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.009 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  10.837
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.246

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0003) |   Area    (ha)=   0.45   Curve Number    (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.008 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  10.907
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.248

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

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

--------------------
| ADD HYD   (0004) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     2.76   0.080     1.75    10.46
```

```
        + ID2= 2 (0002):     0.35   0.009     1.83    10.84
          ================================================
          ID = 3 (0004):     3.11   0.088     1.75    10.50

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0004) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0004):     3.11   0.088     1.75    10.50
        + ID2= 2 (0003):     0.45   0.008     2.17    10.91
          ================================================
          ID = 1 (0004):     3.56   0.094     1.75    10.55

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0007) |   Area     (ha)=   0.48   Curve Number    (CN)= 71.5
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.80   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   0.032

     PEAK FLOW       (cms)=   0.008 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=   9.095
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.207

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0010) |   Area     (ha)=   0.35   Curve Number    (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.009 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  10.837
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.246

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0011) |   Area     (ha)=   0.45   Curve Number    (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68
```



```
     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.008 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  10.907
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.248

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0020) |   Area     (ha)=   0.13   Curve Number    (CN)= 68.4
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.11

     Unit Hyd Qpeak  (cms)=   0.045

     PEAK FLOW       (cms)=   0.005 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=   8.308
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.189

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0009) |   Area     (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------

                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53          0.51
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     116.62         10.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     108.42         18.20
               over (min)          5.00          5.00
     Storage Coeff.  (min)=       2.71 (ii)     4.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.29          0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.45          0.03          0.479 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.33           1.33
     RUNOFF VOLUME    (mm)=      43.04          9.13          34.56
     TOTAL RAINFALL   (mm)=      44.04         44.04          44.04
     RUNOFF COEFFICIENT   =       0.98          0.21           0.78

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  66.5     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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

--------------------
| ADD HYD   (0006) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0010):     0.35   0.009     1.83    10.84
        + ID2= 2 (0011):     0.45   0.008     2.17    10.91
          ================================================
          ID = 3 (0006):     0.80   0.016     2.00    10.88

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0006) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0006):     0.80   0.016     2.00    10.88
        + ID2= 2 (0020):     0.13   0.005     1.42     8.31
          ================================================
          ID = 1 (0006):     0.93   0.017     1.92    10.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0006) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0006):     0.93   0.017     1.92    10.52
        + ID2= 2 (0007):     0.48   0.008     2.08     9.09
          ================================================
          ID = 3 (0006):     1.41   0.025     2.00    10.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0006) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0006):     1.41   0.025     2.00    10.03
        + ID2= 2 (0009):     2.04   0.479     1.33    34.56
          ================================================
          ID = 1 (0006):     3.45   0.485     1.33    24.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| CALIB            |
| STANDHYD  (0013) |   Area    (ha)=   1.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.92         0.40
```



```
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      93.81        10.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     108.42        14.55
               over (min)          5.00         5.00
     Storage Coeff.  (min)=       2.38 (ii)    4.50 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.30         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.28         0.02          0.292 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      43.04         7.44          32.36
     TOTAL RAINFALL   (mm)=      44.04        44.04          44.04
     RUNOFF COEFFICIENT   =       0.98         0.17           0.73

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  60.5     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| RESERVOIR (0012) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.0120      0.0219
                         0.0044     0.0000    |   0.0130      0.0342
                         0.0067     0.0000    |   0.0140      0.0479
                         0.0083     0.0000    |   0.0149      0.0602
                         0.0097     0.0000    |   0.0157      0.0725
                         0.0109     0.0096    |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0013)       1.320     0.292      1.33      32.36
     OUTFLOW: ID= 1 (0012)       1.320     0.013      2.25      32.45

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.41
                   TIME SHIFT OF PEAK FLOW          (min)= 55.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0331

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

--------------------
| CALIB            |
| NASHYD    (0021) |   Area    (ha)=   0.45   Curve Number   (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.008 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  10.907
     TOTAL RAINFALL   (mm)=  44.038
```

```
     RUNOFF COEFFICIENT   =   0.248

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   0.13   Curve Number   (CN)= 68.4
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.11

     Unit Hyd Qpeak  (cms)=   0.045

     PEAK FLOW       (cms)=   0.005 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=   8.308
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.189

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   0.35   Curve Number   (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.009 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  10.837
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.246

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0026) |   Area    (ha)=   0.48   Curve Number   (CN)= 71.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.80   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   0.032

     PEAK FLOW       (cms)=   0.008 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=   9.095
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.207

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0025) |   Area    (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
```



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--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53          0.51
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     116.62         10.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     108.42         18.20
               over (min)          5.00          5.00
     Storage Coeff.  (min)=       2.71 (ii)     4.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.29          0.22
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.45          0.03          0.479 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.33          1.33
     RUNOFF VOLUME    (mm)=      43.04          9.13         34.56
     TOTAL RAINFALL   (mm)=      44.04         44.04         44.04
     RUNOFF COEFFICIENT   =       0.98          0.21          0.78

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  66.5     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (0027) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.0353     0.0664
                         0.0087     0.0114    |   0.0383     0.0768
                         0.0173     0.0218    |   0.0413     0.0882
                         0.0233     0.0332    |   0.0439     0.0986
                         0.0276     0.0436    |   0.0466     0.1100
                         0.0317     0.0550    |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0025)      2.040     0.479      1.33      34.56
     OUTFLOW: ID= 1 (0027)      2.040     0.032      2.00      34.40

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.59
                   TIME SHIFT OF PEAK FLOW          (min)= 40.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0548

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--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0021):     0.45    0.008     2.17    10.91
        + ID2= 2 (0022):     0.13    0.005     1.42     8.31
          ================================================
          ID = 3 (0024):     0.58    0.009     2.08    10.32
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0024)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0024):	0.58	0.009	2.08	10.32
	+ ID2= 2 (0023):	0.35	0.009	1.83	10.84
	ID = 1 (0024):	0.93	0.017	1.92	10.52

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0024)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0024):	0.93	0.017	1.92	10.52
	+ ID2= 2 (0026):	0.48	0.008	2.08	9.09
	ID = 3 (0024):	1.41	0.025	2.00	10.03

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0024)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0024):	1.41	0.025	2.00	10.03
	+ ID2= 2 (0027):	2.04	0.032	2.00	34.40
	ID = 1 (0024):	3.45	0.057	2.00	24.44

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

****
** SIMULATION NUMBER: 4 **
****

CHICAGO STORM		IDF curve parameters: A=3886.000
Ptotal= 60.23 mm		B= 18.000
		C= 1.000

used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	1.41	1.17	43.05	2.17	7.72	3.17	2.04
0.33	1.89	1.33	138.79	2.33	5.76	3.33	1.74
0.50	2.65	1.50	58.11	2.50	4.46	3.50	1.51
0.67	4.00	1.67	28.06	2.67	3.56	3.67	1.32
0.83	6.73	1.83	16.53	2.83	2.90	3.83	1.16
1.00	13.69	2.00	10.90	3.00	2.41	4.00	1.03

CALIB					
NASHYD (0005)	Area	(ha)=	1.21	Curve Number (CN)=	70.2
ID= 1 DT= 5.0 min	Ia	(mm)=	7.70	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=		0.29		

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.41	1.083	43.05	2.083	7.72	3.08	2.04
0.167	1.41	1.167	43.05	2.167	7.72	3.17	2.04
0.250	1.89	1.250	138.79	2.250	5.76	3.25	1.74
0.333	1.89	1.333	138.79	2.333	5.76	3.33	1.74
0.417	2.65	1.417	58.11	2.417	4.46	3.42	1.51
0.500	2.65	1.500	58.11	2.500	4.46	3.50	1.51
0.583	4.00	1.583	28.06	2.583	3.56	3.58	1.32
0.667	4.00	1.667	28.06	2.667	3.56	3.67	1.32
0.750	6.73	1.750	16.53	2.750	2.90	3.75	1.16
0.833	6.73	1.833	16.53	2.833	2.90	3.83	1.16
0.917	13.69	1.917	10.90	2.917	2.41	3.92	1.03
1.000	13.69	2.000	10.90	3.000	2.41	4.00	1.03

Unit Hyd Qpeak (cms)= 0.159

PEAK FLOW (cms)= 0.060 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 17.202
TOTAL RAINFALL (mm)= 60.234
RUNOFF COEFFICIENT = 0.286

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

CALIB					
NASHYD (0001)	Area	(ha)=	2.76	Curve Number (CN)=	73.6
ID= 1 DT= 5.0 min	Ia	(mm)=	7.50	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=		0.32		

Unit Hyd Qpeak (cms)= 0.329

PEAK FLOW (cms)= 0.146 (i)
TIME TO PEAK (hrs)= 1.750
RUNOFF VOLUME (mm)= 19.327
TOTAL RAINFALL (mm)= 60.234
RUNOFF COEFFICIENT = 0.321

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

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--------------------
| CALIB            |
| NASHYD    (0002) |   Area    (ha)=   0.35   Curve Number   (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.016 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  20.057
     TOTAL RAINFALL   (mm)=  60.234
     RUNOFF COEFFICIENT   =   0.333

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

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--------------------
| CALIB            |
| NASHYD    (0003) |   Area    (ha)=   0.45   Curve Number   (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.015 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  20.367
     TOTAL RAINFALL   (mm)=  60.234
     RUNOFF COEFFICIENT   =   0.338

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

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--------------------
| ADD HYD   (0004) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     2.76   0.146     1.75    19.33
        + ID2= 2 (0002):     0.35   0.016     1.83    20.06
          ================================================
          ID = 3 (0004):     3.11   0.161     1.75    19.41

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0004) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0004):     3.11   0.161     1.75    19.41
        + ID2= 2 (0003):     0.45   0.015     2.17    20.37
          ================================================
          ID = 1 (0004):     3.56   0.172     1.75    19.53

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0007) |   Area    (ha)=   0.48   Curve Number   (CN)= 71.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.80   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   0.032

     PEAK FLOW       (cms)=   0.015 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  17.324
     TOTAL RAINFALL   (mm)=  60.234
     RUNOFF COEFFICIENT   =   0.288

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0010) |   Area    (ha)=   0.35   Curve Number   (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.016 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  20.057
     TOTAL RAINFALL   (mm)=  60.234
     RUNOFF COEFFICIENT   =   0.333

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0011) |   Area    (ha)=   0.45   Curve Number   (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.015 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  20.367
     TOTAL RAINFALL   (mm)=  60.234
     RUNOFF COEFFICIENT   =   0.338

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0020) |   Area    (ha)=   0.13   Curve Number   (CN)= 68.4
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.11

     Unit Hyd Qpeak  (cms)=   0.045
```

```
     PEAK FLOW       (cms)=   0.009 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  15.791
     TOTAL RAINFALL   (mm)=  60.234
     RUNOFF COEFFICIENT   =   0.262

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

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--------------------
| CALIB            |
| STANDHYD  (0009) |   Area    (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53         0.51
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     116.62        10.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     138.79        32.62
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.46 (ii)    4.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.30         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.58         0.05          0.631 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      59.23        16.65          48.59
     TOTAL RAINFALL   (mm)=      60.23        60.23          60.23
     RUNOFF COEFFICIENT   =       0.98         0.28           0.81

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  66.5    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------
| ADD HYD   (0006) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0010):     0.35   0.016     1.83    20.06
       + ID2= 2 (0011):     0.45   0.015     2.17    20.37
         ==========================================
         ID = 3 (0006):     0.80   0.030     2.00    20.23

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------
| ADD HYD   (0006) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (0006):     0.80   0.030     2.00    20.23
       + ID2= 2 (0020):     0.13   0.009     1.42    15.79
         ==========================================
         ID = 1 (0006):     0.93   0.032     1.92    19.61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------
| ADD HYD   (0006) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0006):     0.93   0.032     1.92    19.61
       + ID2= 2 (0007):     0.48   0.015     2.08    17.32
         ==========================================
         ID = 3 (0006):     1.41   0.047     2.00    18.83

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------
| ADD HYD   (0006) |
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (0006):     1.41   0.047     2.00    18.83
       + ID2= 2 (0009):     2.04   0.631     1.33    48.59
         ==========================================
         ID = 1 (0006):     3.45   0.644     1.33    36.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------
| CALIB            |
| STANDHYD  (0013) |   Area    (ha)=   1.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  70.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.92         0.40
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      93.81        10.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     138.79        26.38
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.16 (ii)    4.08 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.31         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.35         0.03          0.384 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      59.23        13.80          45.60
     TOTAL RAINFALL   (mm)=      60.23        60.23          60.23
     RUNOFF COEFFICIENT   =       0.98         0.23           0.76

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 60.5 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR (0012)
IN= 2---> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0120	0.0219
0.0044	0.0000	0.0130	0.0342
0.0067	0.0000	0.0140	0.0479
0.0083	0.0000	0.0149	0.0602
0.0097	0.0000	0.0157	0.0725
0.0109	0.0096	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0013)	1.320	0.384	1.33	45.60
OUTFLOW: ID= 1 (0012)	1.320	0.014	2.42	45.60

PEAK FLOW REDUCTION [Qout/Qin](%)= 3.65
TIME SHIFT OF PEAK FLOW (min)= 65.00
MAXIMUM STORAGE USED (ha.m.)= 0.0481

CALIB					
NASHYD (0021)	Area	(ha)=	0.45	Curve Number	(CN)= 76.5
ID= 1 DT= 5.0 min	Ia	(mm)=	8.90	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	0.68		

Unit Hyd Qpeak (cms)= 0.025

PEAK FLOW (cms)= 0.015 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 20.367
TOTAL RAINFALL (mm)= 60.234
RUNOFF COEFFICIENT = 0.338

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

CALIB					
NASHYD (0022)	Area	(ha)=	0.13	Curve Number	(CN)= 68.4
ID= 1 DT= 5.0 min	Ia	(mm)=	8.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	0.11		

Unit Hyd Qpeak (cms)= 0.045

PEAK FLOW (cms)= 0.009 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 15.791
TOTAL RAINFALL (mm)= 60.234
RUNOFF COEFFICIENT = 0.262

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

CALIB					
NASHYD (0023)	Area	(ha)=	0.35	Curve Number	(CN)= 75.2
ID= 1 DT= 5.0 min	Ia	(mm)=	8.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	0.43		

Unit Hyd Qpeak (cms)= 0.031

PEAK FLOW (cms)= 0.016 (i)
TIME TO PEAK (hrs)= 1.833
RUNOFF VOLUME (mm)= 20.057
TOTAL RAINFALL (mm)= 60.234
RUNOFF COEFFICIENT = 0.333

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

CALIB					
NASHYD (0026)	Area	(ha)=	0.48	Curve Number	(CN)= 71.5
ID= 1 DT= 5.0 min	Ia	(mm)=	8.80	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	0.57		

Unit Hyd Qpeak (cms)= 0.032

PEAK FLOW (cms)= 0.015 (i)
TIME TO PEAK (hrs)= 2.083
RUNOFF VOLUME (mm)= 17.324
TOTAL RAINFALL (mm)= 60.234
RUNOFF COEFFICIENT = 0.288

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

CALIB					
STANDHYD (0025)	Area	(ha)=	2.04		
ID= 1 DT= 5.0 min	Total Imp	(%)=	75.00	Dir. Conn.	(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	1.53	0.51	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	116.62	10.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.	(mm/hr)=	138.79	32.62	
over	(min)	5.00	5.00	
Storage Coeff.	(min)=	2.46 (ii)	4.19 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	5.00	
Unit Hyd. peak	(cms)=	0.30	0.24	
				TOTALS
PEAK FLOW	(cms)=	0.58	0.05	0.631 (iii)
TIME TO PEAK	(hrs)=	1.33	1.33	1.33
RUNOFF VOLUME	(mm)=	59.23	16.65	48.59
TOTAL RAINFALL	(mm)=	60.23	60.23	60.23
RUNOFF COEFFICIENT	=	0.98	0.28	0.81

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 66.5 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR (0027)
IN= 2---> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0353	0.0664
0.0087	0.0114	0.0383	0.0768
0.0173	0.0218	0.0413	0.0882
0.0233	0.0332	0.0439	0.0986
0.0276	0.0436	0.0466	0.1100
0.0317	0.0550	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0025)	2.040	0.631	1.33	48.59
OUTFLOW: ID= 1 (0027)	2.040	0.038	2.17	48.43

PEAK FLOW REDUCTION [Qout/Qin](%)= 6.10
TIME SHIFT OF PEAK FLOW (min)= 50.00
MAXIMUM STORAGE USED (ha.m.)= 0.0775

ADD HYD (0024)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0021):	0.45	0.015	2.17	20.37
+ ID2= 2 (0022):	0.13	0.009	1.42	15.79
ID = 3 (0024):	0.58	0.017	2.08	19.34

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0024)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0024):	0.58	0.017	2.08	19.34
+ ID2= 2 (0023):	0.35	0.016	1.83	20.06
ID = 1 (0024):	0.93	0.032	1.92	19.61

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0024)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0024):	0.93	0.032	1.92	19.61
+ ID2= 2 (0026):	0.48	0.015	2.08	17.32
ID = 3 (0024):	1.41	0.047	2.00	18.83

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0024)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0024):	1.41	0.047	2.00	18.83
+ ID2= 2 (0027):	2.04	0.038	2.17	48.43
ID = 1 (0024):	3.45	0.086	2.00	36.33

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

****
** SIMULATION NUMBER: 5 **
****

CHICAGO STORM
Ptotal= 71.95 mm

IDF curve parameters: A=4750.000
B= 24.000
C= 1.000
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	2.18	1.17	52.37	2.17	11.13	3.17	3.12
0.33	2.89	1.33	139.71	2.33	8.44	3.33	2.68
0.50	4.02	1.50	68.44	2.50	6.62	3.50	2.33
0.67	5.96	1.67	36.37	2.67	5.33	3.67	2.04
0.83	9.77	1.83	22.56	2.83	4.38	3.83	1.81
1.00	18.93	2.00	15.36	3.00	3.67	4.00	1.61

CALIB	
NASHYD (0005)	Area (ha)= 1.21
ID= 1 DT= 5.0 min	Ia (mm)= 7.70
	U.H. Tp(hrs)= 0.29

Curve Number (CN)= 70.2
# of Linear Res.(N)= 3.00

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	2.18	1.083	52.37	2.083	11.13	3.08	3.12
0.167	2.18	1.167	52.37	2.167	11.13	3.17	3.12
0.250	2.89	1.250	139.71	2.250	8.44	3.25	2.68
0.333	2.89	1.333	139.71	2.333	8.44	3.33	2.68
0.417	4.02	1.417	68.44	2.417	6.62	3.42	2.33
0.500	4.02	1.500	68.44	2.500	6.62	3.50	2.33
0.583	5.96	1.583	36.37	2.583	5.33	3.58	2.04
0.667	5.96	1.667	36.37	2.667	5.33	3.67	2.04
0.750	9.77	1.750	22.56	2.750	4.38	3.75	1.81
0.833	9.77	1.833	22.56	2.833	4.38	3.83	1.81
0.917	18.93	1.917	15.36	2.917	3.67	3.92	1.61
1.000	18.93	2.000	15.36	3.000	3.67	4.00	1.61

Unit Hyd Qpeak (cms)= 0.159

PEAK FLOW (cms)= 0.077 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 23.978
TOTAL RAINFALL (mm)= 71.949
RUNOFF COEFFICIENT = 0.333

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

CALIB					
NASHYD (0001)	Area (ha)=	2.76	Curve Number (CN)=	73.6	
ID= 1 DT= 5.0 min	Ia (mm)=	7.50	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.32			

Unit Hyd Qpeak (cms)= 0.329

PEAK FLOW (cms)= 0.187 (i)
TIME TO PEAK (hrs)= 1.750
RUNOFF VOLUME (mm)= 26.693
TOTAL RAINFALL (mm)= 71.949
RUNOFF COEFFICIENT = 0.371

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

CALIB					
NASHYD (0002)	Area (ha)=	0.35	Curve Number (CN)=	75.2	
ID= 1 DT= 5.0 min	Ia (mm)=	8.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.43			

Unit Hyd Qpeak (cms)= 0.031

PEAK FLOW (cms)= 0.021 (i)
TIME TO PEAK (hrs)= 1.917
RUNOFF VOLUME (mm)= 27.679
TOTAL RAINFALL (mm)= 71.949
RUNOFF COEFFICIENT = 0.385

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

CALIB					
NASHYD (0003)	Area (ha)=	0.45	Curve Number (CN)=	76.5	
ID= 1 DT= 5.0 min	Ia (mm)=	8.90	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.68			

Unit Hyd Qpeak (cms)= 0.025

PEAK FLOW (cms)= 0.020 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 28.174
TOTAL RAINFALL (mm)= 71.949
RUNOFF COEFFICIENT = 0.392

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

ADD HYD (0004)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	2.76	0.187	1.75	26.69
+ ID2= 2 (0002):	0.35	0.021	1.92	27.68
ID = 3 (0004):	3.11	0.207	1.75	26.80

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)				
3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0004):	3.11	0.207	1.75	26.80
+ ID2= 2 (0003):	0.45	0.020	2.17	28.17
ID = 1 (0004):	3.56	0.221	1.75	26.98

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB					
NASHYD (0007)	Area (ha)=	0.48	Curve Number (CN)=	71.5	
ID= 1 DT= 5.0 min	Ia (mm)=	8.80	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.57			

Unit Hyd Qpeak (cms)= 0.032

PEAK FLOW (cms)= 0.021 (i)
TIME TO PEAK (hrs)= 2.083
RUNOFF VOLUME (mm)= 24.254
TOTAL RAINFALL (mm)= 71.949
RUNOFF COEFFICIENT = 0.337

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

```
| CALIB             |
| NASHYD    (0010) |   Area    (ha)=   0.35   Curve Number   (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.021 (i)
     TIME TO PEAK    (hrs)=   1.917
     RUNOFF VOLUME    (mm)=  27.679
     TOTAL RAINFALL   (mm)=  71.949
     RUNOFF COEFFICIENT   =   0.385

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0011) |   Area    (ha)=   0.45   Curve Number   (CN)= 76.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.020 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  28.174
     TOTAL RAINFALL   (mm)=  71.949
     RUNOFF COEFFICIENT   =   0.392

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD    (0020) |   Area    (ha)=   0.13   Curve Number   (CN)= 68.4
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.11

     Unit Hyd Qpeak  (cms)=   0.045

     PEAK FLOW       (cms)=   0.011 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  22.141
     TOTAL RAINFALL   (mm)=  71.949
     RUNOFF COEFFICIENT   =   0.308

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD  (0009) |   Area    (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------

                         IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53         0.51
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     116.62        10.00
```



```
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     139.71        38.27
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       2.45 (ii)    4.18 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.30         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.59         0.06          0.643 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      70.95        23.00          58.96
     TOTAL RAINFALL   (mm)=      71.95        71.95          71.95
     RUNOFF COEFFICIENT   =       0.99         0.32           0.82

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  66.5    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD   (0006) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0010):     0.35   0.021     1.92    27.68
        + ID2= 2 (0011):     0.45   0.020     2.17    28.17
          ================================================
          ID = 3 (0006):     0.80   0.039     2.00    27.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0006) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0006):     0.80   0.039     2.00    27.96
        + ID2= 2 (0020):     0.13   0.011     1.42    22.14
          ================================================
          ID = 1 (0006):     0.93   0.042     2.00    27.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0006) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0006):     0.93   0.042     2.00    27.14
        + ID2= 2 (0007):     0.48   0.021     2.08    24.25
          ================================================
          ID = 3 (0006):     1.41   0.063     2.00    26.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

ADD HYD (0006)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0006):	1.41	0.063	2.00	26.16
	+ ID2= 2 (0009):	2.04	0.643	1.33	58.96
	ID = 1 (0006):	3.45	0.660	1.33	45.55

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB				
STANDHYD (0013)	Area (ha)= 1.32			
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00	Dir. Conn.(%)= 70.00		

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.92	0.40	
Dep. Storage	(mm)=	1.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	93.81	10.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		139.71	31.16	
over (min)		5.00	5.00	
Storage Coeff. (min)=		2.15 (ii)	4.07 (ii)	
Unit Hyd. Tpeak (min)=		5.00	5.00	
Unit Hyd. peak (cms)=		0.31	0.24	
				TOTALS
PEAK FLOW	(cms)=	0.36	0.04	0.392 (iii)
TIME TO PEAK	(hrs)=	1.33	1.33	1.33
RUNOFF VOLUME	(mm)=	70.95	19.25	55.44
TOTAL RAINFALL	(mm)=	71.95	71.95	71.95
RUNOFF COEFFICIENT	=	0.99	0.27	0.77

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 60.5 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR (0012)				
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0120	0.0219
	0.0044	0.0000	0.0130	0.0342
	0.0067	0.0000	0.0140	0.0479
	0.0083	0.0000	0.0149	0.0602
	0.0097	0.0000	0.0157	0.0725
	0.0109	0.0096	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0013)	1.320	0.392	1.33	55.44
OUTFLOW: ID= 1 (0012)	1.320	0.015	2.75	55.47

PEAK FLOW REDUCTION [Qout/Qin](%)= 3.76
TIME SHIFT OF PEAK FLOW (min)= 85.00
MAXIMUM STORAGE USED (ha.m.)= 0.0586

CALIB				
NASHYD (0021)	Area (ha)= 0.45	Curve Number (CN)= 76.5		
ID= 1 DT= 5.0 min	Ia (mm)= 8.90	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.68			

Unit Hyd Qpeak (cms)= 0.025

PEAK FLOW (cms)= 0.020 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 28.174
TOTAL RAINFALL (mm)= 71.949
RUNOFF COEFFICIENT = 0.392

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

CALIB				
NASHYD (0022)	Area (ha)= 0.13	Curve Number (CN)= 68.4		
ID= 1 DT= 5.0 min	Ia (mm)= 8.00	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.11			

Unit Hyd Qpeak (cms)= 0.045

PEAK FLOW (cms)= 0.011 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 22.141
TOTAL RAINFALL (mm)= 71.949
RUNOFF COEFFICIENT = 0.308

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

CALIB				
NASHYD (0023)	Area (ha)= 0.35	Curve Number (CN)= 75.2		
ID= 1 DT= 5.0 min	Ia (mm)= 8.00	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.43			

Unit Hyd Qpeak (cms)= 0.031

PEAK FLOW (cms)= 0.021 (i)
TIME TO PEAK (hrs)= 1.917
RUNOFF VOLUME (mm)= 27.679
TOTAL RAINFALL (mm)= 71.949
RUNOFF COEFFICIENT = 0.385

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

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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0026) |   Area    (ha)=   0.48   Curve Number   (CN)= 71.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.80   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   0.032

     PEAK FLOW       (cms)=   0.021 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  24.254
     TOTAL RAINFALL   (mm)=  71.949
     RUNOFF COEFFICIENT   =   0.337

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

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--------------------
| CALIB            |
| STANDHYD  (0025) |   Area    (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------

                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53          0.51
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     116.62         10.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     139.71         38.27
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       2.45 (ii)     4.18 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.30          0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.59          0.06          0.643 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.33           1.33
     RUNOFF VOLUME    (mm)=      70.95         23.00          58.96
     TOTAL RAINFALL   (mm)=      71.95         71.95          71.95
     RUNOFF COEFFICIENT   =       0.99          0.32           0.82

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  66.5    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR (0027) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0353      0.0664
                         0.0087     0.0114   |   0.0383      0.0768
                         0.0173     0.0218   |   0.0413      0.0882
                         0.0233     0.0332   |   0.0439      0.0986
```



```
                         0.0276     0.0436   |   0.0466      0.1100
                         0.0317     0.0550   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0025)       2.040     0.643      1.33      58.96
     OUTFLOW: ID= 1 (0027)       2.040     0.042      2.33      58.80

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.60
                TIME SHIFT OF PEAK FLOW          (min)= 60.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0926

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--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0021):     0.45    0.020     2.17    28.17
        + ID2= 2 (0022):     0.13    0.011     1.42    22.14
          ================================================
          ID = 3 (0024):     0.58    0.022     2.08    26.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0024) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0024):     0.58    0.022     2.08    26.82
        + ID2= 2 (0023):     0.35    0.021     1.92    27.68
          ================================================
          ID = 1 (0024):     0.93    0.042     2.00    27.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0024):     0.93    0.042     2.00    27.14
        + ID2= 2 (0026):     0.48    0.021     2.08    24.25
          ================================================
          ID = 3 (0024):     1.41    0.063     2.00    26.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0024) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0024):     1.41    0.063     2.00    26.16
        + ID2= 2 (0027):     2.04    0.042     2.33    58.80
          ================================================
```

ID = 1 (0024): 3.45 0.105 2.00 45.46

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

CHICAGO STORM	Ptotal= 83.38 mm

IDF curve parameters: A=5588.000
B= 28.000
C= 1.000
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	2.89	1.17	60.52	2.17	14.14	3.17	4.10
0.33	3.81	1.33	147.05	2.33	10.82	3.33	3.54
0.50	5.26	1.50	77.70	2.50	8.55	3.50	3.08
0.67	7.73	1.67	43.43	2.67	6.93	3.67	2.71
0.83	12.46	1.83	27.74	2.83	5.73	3.83	2.40
1.00	23.45	2.00	19.25	3.00	4.81	4.00	2.14

CALIB	NASHYD (0005)	ID= 1 DT= 5.0 min

Area (ha)= 1.21 Curve Number (CN)= 70.2
Ia (mm)= 7.70 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.29

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.89	1.083	60.52	2.083	14.14	3.08	4.10
0.167	2.89	1.167	60.52	2.167	14.14	3.17	4.10
0.250	3.81	1.250	147.05	2.250	10.82	3.25	3.54
0.333	3.81	1.333	147.05	2.333	10.82	3.33	3.54
0.417	5.26	1.417	77.70	2.417	8.55	3.42	3.08
0.500	5.26	1.500	77.70	2.500	8.55	3.50	3.08
0.583	7.73	1.583	43.43	2.583	6.93	3.58	2.71
0.667	7.73	1.667	43.43	2.667	6.93	3.67	2.71
0.750	12.46	1.750	27.74	2.750	5.73	3.75	2.40
0.833	12.46	1.833	27.74	2.833	5.73	3.83	2.40
0.917	23.45	1.917	19.25	2.917	4.81	3.92	2.14
1.000	23.45	2.000	19.25	3.000	4.81	4.00	2.14

Unit Hyd Qpeak (cms)= 0.159

PEAK FLOW (cms)= 0.096 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 31.194

TOTAL RAINFALL (mm)= 83.375
RUNOFF COEFFICIENT = 0.374

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

CALIB	NASHYD (0001)	ID= 1 DT= 5.0 min

Area (ha)= 2.76 Curve Number (CN)= 73.6
Ia (mm)= 7.50 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.32

Unit Hyd Qpeak (cms)= 0.329

PEAK FLOW (cms)= 0.232 (i)
TIME TO PEAK (hrs)= 1.750
RUNOFF VOLUME (mm)= 34.466
TOTAL RAINFALL (mm)= 83.375
RUNOFF COEFFICIENT = 0.413

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

CALIB	NASHYD (0002)	ID= 1 DT= 5.0 min

Area (ha)= 0.35 Curve Number (CN)= 75.2
Ia (mm)= 8.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.43

Unit Hyd Qpeak (cms)= 0.031

PEAK FLOW (cms)= 0.026 (i)
TIME TO PEAK (hrs)= 1.917
RUNOFF VOLUME (mm)= 35.694
TOTAL RAINFALL (mm)= 83.375
RUNOFF COEFFICIENT = 0.428

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

CALIB	NASHYD (0003)	ID= 1 DT= 5.0 min

Area (ha)= 0.45 Curve Number (CN)= 76.5
Ia (mm)= 8.90 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.68

Unit Hyd Qpeak (cms)= 0.025

PEAK FLOW (cms)= 0.025 (i)
TIME TO PEAK (hrs)= 2.250
RUNOFF VOLUME (mm)= 36.366
TOTAL RAINFALL (mm)= 83.375
RUNOFF COEFFICIENT = 0.436

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

ADD HYD (0004)

```
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)     (cms)    (hrs)      (mm)
          ID1= 1 (0001):     2.76   0.232     1.75     34.47
        + ID2= 2 (0002):     0.35   0.026     1.92     35.69
          ================================================
          ID = 3 (0004):     3.11   0.257     1.75     34.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0004) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)     (cms)    (hrs)      (mm)
          ID1= 3 (0004):     3.11   0.257     1.75     34.60
        + ID2= 2 (0003):     0.45   0.025     2.25     36.37
          ================================================
          ID = 1 (0004):     3.56   0.274     1.75     34.83

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| CALIB            |
| NASHYD    (0007) |   Area     (ha)=   0.48   Curve Number   (CN)= 71.5
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.80   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   0.032

     PEAK FLOW       (cms)=   0.026 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  31.628
     TOTAL RAINFALL   (mm)=  83.375
     RUNOFF COEFFICIENT   =   0.379

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

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--------------------
| CALIB            |
| NASHYD    (0010) |   Area     (ha)=   0.35   Curve Number   (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.026 (i)
     TIME TO PEAK    (hrs)=   1.917
     RUNOFF VOLUME    (mm)=  35.694
     TOTAL RAINFALL   (mm)=  83.375
     RUNOFF COEFFICIENT   =   0.428

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

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--------------------
| CALIB            |
| NASHYD    (0011) |   Area     (ha)=   0.45   Curve Number   (CN)= 76.5
```



```
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.68

     Unit Hyd Qpeak  (cms)=   0.025

     PEAK FLOW       (cms)=   0.025 (i)
     TIME TO PEAK    (hrs)=   2.250
     RUNOFF VOLUME    (mm)=  36.366
     TOTAL RAINFALL   (mm)=  83.375
     RUNOFF COEFFICIENT   =   0.436

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0020) |   Area     (ha)=   0.13   Curve Number   (CN)= 68.4
|ID= 1 DT= 5.0 min |   Ia       (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.11

     Unit Hyd Qpeak  (cms)=   0.045

     PEAK FLOW       (cms)=   0.014 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  28.936
     TOTAL RAINFALL   (mm)=  83.375
     RUNOFF COEFFICIENT   =   0.347

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

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--------------------
| CALIB            |
| STANDHYD  (0009) |   Area     (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------

                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53          0.51
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     116.62         10.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     147.05         45.63
               over (min)          5.00          5.00
     Storage Coeff.  (min)=       2.40 (ii)     4.10 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.30          0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.62          0.07          0.685 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.33           1.33
     RUNOFF VOLUME    (mm)=      82.38         29.77          69.22
     TOTAL RAINFALL   (mm)=      83.38         83.38          83.38
     RUNOFF COEFFICIENT   =       0.99          0.36           0.83

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  66.5    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
```

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

ADD HYD (0006)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0010):	0.35	0.026	1.92	35.69
	+ ID2= 2 (0011):	0.45	0.025	2.25	36.37
	ID = 3 (0006):	0.80	0.049	2.00	36.07

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0006)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0006):	0.80	0.049	2.00	36.07
	+ ID2= 2 (0020):	0.13	0.014	1.42	28.94
	ID = 1 (0006):	0.93	0.053	2.00	35.07

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0006)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0006):	0.93	0.053	2.00	35.07
	+ ID2= 2 (0007):	0.48	0.026	2.08	31.63
	ID = 3 (0006):	1.41	0.079	2.00	33.90

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0006)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
	ID1= 3 (0006):	1.41	0.079	2.00	33.90
	+ ID2= 2 (0009):	2.04	0.685	1.33	69.22
	ID = 1 (0006):	3.45	0.707	1.33	54.79

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB					
STANDHYD (0013)	Area (ha)= 1.32				
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00	Dir. Conn.(%)= 70.00			

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.92	0.40
Dep. Storage (mm)=	1.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	93.81	10.00
Mannings n =	0.013	0.250
Max.Eff.Inten.(mm/hr)=	147.05	37.41
over (min)	5.00	5.00
Storage Coeff. (min)=	2.11 (ii)	3.98 (ii)
Unit Hyd. Tpeak (min)=	5.00	5.00
Unit Hyd. peak (cms)=	0.31	0.24

		TOTALS
PEAK FLOW (cms)=	0.38	0.04	0.418 (iii)
TIME TO PEAK (hrs)=	1.33	1.33	1.33
RUNOFF VOLUME (mm)=	82.38	25.15	65.21
TOTAL RAINFALL (mm)=	83.38	83.38	83.38
RUNOFF COEFFICIENT =	0.99	0.30	0.78

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 60.5 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR (0012)				
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0120	0.0219
	0.0044	0.0000	0.0130	0.0342
	0.0067	0.0000	0.0140	0.0479
	0.0083	0.0000	0.0149	0.0602
	0.0097	0.0000	0.0157	0.0725
	0.0109	0.0096	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0013)	1.320	0.418	1.33	65.21
OUTFLOW: ID= 1 (0012)	1.320	0.015	2.92	65.31

PEAK FLOW REDUCTION [Qout/Qin](%)= 3.71
TIME SHIFT OF PEAK FLOW (min)= 95.00
MAXIMUM STORAGE USED (ha.m.)= 0.0697

CALIB				
NASHYD (0021)	Area (ha)= 0.45	Curve Number (CN)= 76.5		
ID= 1 DT= 5.0 min	Ia (mm)= 8.90	# of Linear Res.(N)= 3.00		
	U.H. Tp(hrs)= 0.68			

Unit Hyd Qpeak (cms)= 0.025

PEAK FLOW (cms)= 0.025 (i)

```
     TIME TO PEAK    (hrs)=   2.250
     RUNOFF VOLUME    (mm)=  36.366
     TOTAL RAINFALL   (mm)=  83.375
     RUNOFF COEFFICIENT   =   0.436

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0022) |   Area    (ha)=   0.13   Curve Number   (CN)= 68.4
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.11

     Unit Hyd Qpeak  (cms)=   0.045

     PEAK FLOW       (cms)=   0.014 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  28.936
     TOTAL RAINFALL   (mm)=  83.375
     RUNOFF COEFFICIENT   =   0.347

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0023) |   Area    (ha)=   0.35   Curve Number   (CN)= 75.2
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.43

     Unit Hyd Qpeak  (cms)=   0.031

     PEAK FLOW       (cms)=   0.026 (i)
     TIME TO PEAK    (hrs)=   1.917
     RUNOFF VOLUME    (mm)=  35.694
     TOTAL RAINFALL   (mm)=  83.375
     RUNOFF COEFFICIENT   =   0.428

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0026) |   Area    (ha)=   0.48   Curve Number   (CN)= 71.5
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.80   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.57

     Unit Hyd Qpeak  (cms)=   0.032

     PEAK FLOW       (cms)=   0.026 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  31.628
     TOTAL RAINFALL   (mm)=  83.375
     RUNOFF COEFFICIENT   =   0.379

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

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| CALIB            |
| STANDHYD  (0025) |   Area    (ha)=   2.04
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------

                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.53          0.51
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     116.62         10.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     147.05         45.63
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       2.40 (ii)     4.10 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.30          0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.62          0.07          0.685 (iii)
     TIME TO PEAK    (hrs)=       1.33          1.33          1.33
     RUNOFF VOLUME    (mm)=      82.38         29.77         69.22
     TOTAL RAINFALL   (mm)=      83.38         83.38         83.38
     RUNOFF COEFFICIENT   =       0.99          0.36          0.83

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  66.5    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (0027) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0353     0.0664
                          0.0087     0.0114   |   0.0383     0.0768
                          0.0173     0.0218   |   0.0413     0.0882
                          0.0233     0.0332   |   0.0439     0.0986
                          0.0276     0.0436   |   0.0466     0.1100
                          0.0317     0.0550   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0025)      2.040     0.685      1.33      69.22
     OUTFLOW: ID= 1 (0027)      2.040     0.046      2.42      69.06

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.75
                    TIME SHIFT OF PEAK FLOW         (min)= 65.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.1085

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

--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0021):     0.45   0.025     2.25    36.37
```

```
        + ID2= 2 (0022):     0.13   0.014     1.42    28.94
          ================================================
          ID = 3 (0024):     0.58   0.029     2.17    34.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0024) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0024):     0.58   0.029     2.17    34.70
        + ID2= 2 (0023):     0.35   0.026     1.92    35.69
          ================================================
          ID = 1 (0024):     0.93   0.053     2.00    35.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0024) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0024):     0.93   0.053     2.00    35.07
        + ID2= 2 (0026):     0.48   0.026     2.08    31.63
          ================================================
          ID = 3 (0024):     1.41   0.079     2.00    33.90

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD   (0024) |
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0024):     1.41   0.079     2.00    33.90
        + ID2= 2 (0027):     2.04   0.046     2.42    69.06
          ================================================
          ID = 1 (0024):     3.45   0.125     2.00    54.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

 FINISH
================================================================================
====================
```

Appendix C

Stormwater Quantity

Stage-Storage-Discharge: U/G Storage - OUT 1

Project No: 19-10927
Project Name: King Street East, Cobourg
Designed/Checked By: MW / CP-B
Date: January 28, 2022

Storage Summary		
Top of Permanent Pool:	87.33	m
Permanent Pool Volume:	0.0	m^3
Active Storage Volume:	1079.1	m^3

Outlet Capacity Summary				
Type	Diameter	Slope	Peak Flow	% Full

Discharge Summary				
Stage	Type	Invert Elev (m)	Diameter / Width (mm)	(m)
1	Orifice Plate: Vertical	87.33	145	

Stage-Storage-Discharge Summary Table

Elevation	Stage	Stage 1 Orifice Plate						Active Storage	Total Discharge	Notes
m	m	m^3/s						ha*m	m^3/s	
87.33	0.00	0.000						**0.0000**	**0.000**	
87.34	0.01	**0.000**						**0.0000**	**0.000**	
87.35	0.02	**0.000**						**0.0000**	**0.000**	
87.36	0.03	**0.001**						**0.0000**	**0.001**	
87.37	0.04	**0.001**						**0.0000**	**0.001**	
87.38	0.05	**0.002**						**0.0000**	**0.002**	
87.39	0.06	**0.003**						**0.0000**	**0.003**	
87.40	0.07	**0.004**						**0.0000**	**0.004**	
87.41	0.08	**0.005**						**0.0000**	**0.005**	
87.42	0.09	**0.006**						**0.0010**	**0.006**	
87.43	0.10	**0.007**						**0.0020**	**0.007**	
87.44	0.11	**0.008**						**0.0031**	**0.008**	
87.45	0.12	**0.010**						**0.0041**	**0.010**	
87.46	0.13	**0.011**						**0.0051**	**0.011**	
87.47	0.14	**0.011**						**0.0061**	**0.011**	
87.48	0.15	**0.012**						**0.0071**	**0.012**	
87.49	0.16	**0.013**						**0.0081**	**0.013**	
87.50	0.17	**0.014**						**0.0092**	**0.014**	
87.51	0.18	**0.014**						**0.0102**	**0.014**	
87.52	0.19	**0.015**						**0.0112**	**0.015**	
87.53	0.20	**0.016**						**0.0122**	**0.016**	
87.54	0.21	**0.016**						**0.0132**	**0.016**	
87.55	0.22	**0.017**						**0.0143**	**0.017**	
87.56	0.23	**0.017**						**0.0153**	**0.017**	
87.57	0.24	**0.018**						**0.0163**	**0.018**	
87.58	0.25	**0.018**						**0.0173**	**0.018**	
87.59	0.26	**0.019**						**0.0183**	**0.019**	
87.60	0.27	**0.020**						**0.0193**	**0.020**	
87.61	0.28	**0.020**						**0.0204**	**0.020**	
87.62	0.29	**0.020**						**0.0214**	**0.020**	
87.63	0.30	**0.021**						**0.0224**	**0.021**	
87.64	0.31	**0.021**						**0.0234**	**0.021**	
87.65	0.32	**0.022**						**0.0244**	**0.022**	
87.66	0.33	**0.022**						**0.0255**	**0.022**	
87.67	0.34	**0.023**						**0.0265**	**0.023**	
87.68	0.35	**0.023**						**0.0275**	**0.023**	
87.69	0.36	**0.024**						**0.0285**	**0.024**	
87.70	0.37	**0.024**						**0.0295**	**0.024**	
87.71	0.38	**0.024**						**0.0305**	**0.024**	
87.72	0.39	**0.025**						**0.0316**	**0.025**	
87.73	0.40	**0.025**						**0.0326**	**0.025**	<= 2 Yr: 325 m³ (87.73m)
87.74	0.41	**0.025**						**0.0336**	**0.025**	
87.75	0.42	**0.026**						**0.0346**	**0.026**	
87.76	0.43	**0.026**						**0.0356**	**0.026**	
87.77	0.44	**0.027**						**0.0366**	**0.027**	
87.78	0.45	**0.027**						**0.0377**	**0.027**	
87.79	0.46	**0.027**						**0.0387**	**0.027**	
87.80	0.47	**0.028**						**0.0397**	**0.028**	
87.81	0.48	**0.028**						**0.0407**	**0.028**	

Stage-Storage-Discharge Summary Table										
Elevation	Stage	Stage 1 Orifice Plate						Active Storage	Total Discharge	Notes
m	m	m^3/s						ha*m	m^3/s	
87.82	0.49	**0.028**						**0.0417**	**0.028**	
87.83	0.50	**0.029**						**0.0428**	**0.029**	
87.84	0.51	**0.029**						**0.0438**	**0.029**	
87.85	0.52	**0.029**						**0.0448**	**0.029**	
87.86	0.53	**0.030**						**0.0458**	**0.030**	
87.87	0.54	**0.030**						**0.0468**	**0.030**	<= 5 Yr: 459 m³ (87.87m)
87.88	0.55	**0.030**						**0.0478**	**0.030**	
87.89	0.56	**0.031**						**0.0489**	**0.031**	
87.90	0.57	**0.031**						**0.0499**	**0.031**	
87.91	0.58	**0.031**						**0.0509**	**0.031**	
87.92	0.59	**0.032**						**0.0519**	**0.032**	
87.93	0.60	**0.032**						**0.0529**	**0.032**	
87.94	0.61	**0.032**						**0.0540**	**0.032**	<= 10 Yr: 537 m³ (87.94m)
87.95	0.62	**0.032**						**0.0550**	**0.032**	
87.96	0.63	**0.033**						**0.0560**	**0.033**	
87.97	0.64	**0.033**						**0.0570**	**0.033**	
87.98	0.65	**0.033**						**0.0580**	**0.033**	
87.99	0.66	**0.034**						**0.0590**	**0.034**	
88.00	0.67	**0.034**						**0.0601**	**0.034**	
88.01	0.68	**0.034**						**0.0611**	**0.034**	
88.02	0.69	**0.034**						**0.0621**	**0.034**	
88.03	0.70	**0.035**						**0.0631**	**0.035**	
88.04	0.71	**0.035**						**0.0641**	**0.035**	
88.05	0.72	**0.035**						**0.0652**	**0.035**	
88.06	0.73	**0.036**						**0.0662**	**0.036**	
88.07	0.74	**0.036**						**0.0672**	**0.036**	
88.08	0.75	**0.036**						**0.0682**	**0.036**	
88.09	0.76	**0.036**						**0.0692**	**0.036**	
88.10	0.77	**0.037**						**0.0702**	**0.037**	
88.11	0.78	**0.037**						**0.0713**	**0.037**	
88.12	0.79	**0.037**						**0.0723**	**0.037**	
88.13	0.80	**0.037**						**0.0733**	**0.037**	
88.14	0.81	**0.038**						**0.0743**	**0.038**	
88.15	0.82	**0.038**						**0.0753**	**0.038**	
88.16	0.83	**0.038**						**0.0764**	**0.038**	
88.17	0.84	**0.038**						**0.0774**	**0.038**	<= 25 Yr: 765 m³ (88.17m)
88.18	0.85	**0.039**						**0.0784**	**0.039**	
88.19	0.86	**0.039**						**0.0794**	**0.039**	
88.20	0.87	**0.039**						**0.0804**	**0.039**	
88.21	0.88	**0.039**						**0.0814**	**0.039**	
88.22	0.89	**0.040**						**0.0825**	**0.040**	
88.23	0.90	**0.040**						**0.0835**	**0.040**	
88.24	0.91	**0.040**						**0.0845**	**0.040**	
88.25	0.92	**0.040**						**0.0855**	**0.040**	
88.26	0.93	**0.041**						**0.0865**	**0.041**	
88.27	0.94	**0.041**						**0.0876**	**0.041**	
88.28	0.95	**0.041**						**0.0886**	**0.041**	
88.29	0.96	**0.041**						**0.0896**	**0.041**	
88.30	0.97	**0.042**						**0.0906**	**0.042**	
88.31	0.98	**0.042**						**0.0916**	**0.042**	<= 50 Yr: 916 m³ (88.31m)
88.32	0.99	**0.042**						**0.0926**	**0.042**	
88.33	1.00	**0.042**						**0.0937**	**0.042**	
88.34	1.01	**0.042**						**0.0947**	**0.042**	
88.35	1.02	**0.043**						**0.0957**	**0.043**	
88.36	1.03	**0.043**						**0.0967**	**0.043**	
88.37	1.04	**0.043**						**0.0977**	**0.043**	
88.38	1.05	**0.043**						**0.0987**	**0.043**	
88.39	1.06	**0.044**						**0.0998**	**0.044**	
88.40	1.07	**0.044**						**0.1008**	**0.044**	
88.41	1.08	**0.044**						**0.1018**	**0.044**	
88.42	1.09	**0.044**						**0.1028**	**0.044**	
88.43	1.10	**0.044**						**0.1038**	**0.044**	
88.44	1.11	**0.045**						**0.1049**	**0.045**	
88.45	1.12	**0.045**						**0.1059**	**0.045**	
88.46	1.13	**0.045**						**0.1069**	**0.045**	
88.47	1.14	**0.045**						**0.1079**	**0.045**	<= 100 Yr: 1075 m³ (88.47m)

Stage-Storage-Discharge: U/G Storage - OUT 1

Project No: 19-10927
Project Name: King Street East, Cobourg
Designed/Checked By: MW / CP-B
Date: January 28, 2022

Storage Summary		
Top of Permanent Pool:	87.32	m
Permanent Pool Volume:	0.0	m^3
Active Storage Volume:	710.8	m^3

Outlet Capacity Summary				
Type	Diameter	Slope	Peak Flow	% Full

Discharge Summary				
Stage	Type	Invert Elev (m)	Diameter / Width (mm)	(m)
1	Orifice Plate: Vertical	87.32	90	

Stage-Storage-Discharge Summary Table

Elevation	Stage	Stage 1 Orifice Plate						Active Storage	Total Discharge	Notes
m	m	m^3/s						ha*m	m^3/s	
87.32	0.00	0.000						**0.0000**	**0.000**	
87.34	0.02	**0.000**						**0.0000**	**0.000**	
87.36	0.04	**0.001**						**0.0000**	**0.001**	
87.38	0.06	**0.002**						**0.0002**	**0.002**	
87.40	0.08	**0.003**						**0.0005**	**0.003**	
87.42	0.10	**0.004**						**0.0008**	**0.004**	
87.44	0.12	**0.005**						**0.0012**	**0.005**	
87.46	0.14	**0.005**						**0.0015**	**0.005**	
87.48	0.16	**0.006**						**0.0018**	**0.006**	
87.50	0.18	**0.006**						**0.0021**	**0.006**	
87.52	0.20	**0.007**						**0.0025**	**0.007**	
87.54	0.22	**0.007**						**0.0028**	**0.007**	
87.56	0.24	**0.007**						**0.0031**	**0.007**	
87.58	0.26	**0.008**						**0.0035**	**0.008**	
87.60	0.28	**0.008**						**0.0038**	**0.008**	
87.62	0.30	**0.009**						**0.0041**	**0.009**	
87.64	0.32	**0.009**						**0.0045**	**0.009**	
87.66	0.34	**0.009**						**0.0058**	**0.009**	
87.68	0.36	**0.009**						**0.0071**	**0.009**	
87.70	0.38	**0.010**						**0.0085**	**0.010**	
87.72	0.40	**0.010**						**0.0098**	**0.010**	
87.74	0.42	**0.010**						**0.0112**	**0.010**	
87.76	0.44	**0.011**						**0.0125**	**0.011**	
87.78	0.46	**0.011**						**0.0138**	**0.011**	
87.80	0.48	**0.011**						**0.0152**	**0.011**	
87.82	0.50	**0.011**						**0.0165**	**0.011**	
87.84	0.52	**0.012**						**0.0179**	**0.012**	
87.86	0.54	**0.012**						**0.0192**	**0.012**	
87.88	0.56	**0.012**						**0.0206**	**0.012**	<= 2 Yr: 201 m³ (87.88m)
87.90	0.58	**0.012**						**0.0219**	**0.012**	
87.92	0.60	**0.013**						**0.0232**	**0.013**	
87.94	0.62	**0.013**						**0.0246**	**0.013**	
87.96	0.64	**0.013**						**0.0259**	**0.013**	
87.98	0.66	**0.013**						**0.0273**	**0.013**	
88.00	0.68	**0.013**						**0.0286**	**0.013**	
88.02	0.70	**0.014**						**0.0299**	**0.014**	<= 5 Yr: 287 m³ (88.01m)
88.04	0.72	**0.014**						**0.0313**	**0.014**	
88.06	0.74	**0.014**						**0.0326**	**0.014**	
88.08	0.76	**0.014**						**0.0340**	**0.014**	<= 10 Yr: 338 m³ (88.08m)
88.10	0.78	**0.014**						**0.0353**	**0.014**	
88.12	0.80	**0.015**						**0.0366**	**0.015**	
88.14	0.82	**0.015**						**0.0380**	**0.015**	
88.16	0.84	**0.015**						**0.0393**	**0.015**	
88.18	0.86	**0.015**						**0.0407**	**0.015**	
88.20	0.88	**0.015**						**0.0420**	**0.015**	
88.22	0.90	**0.016**						**0.0434**	**0.016**	
88.24	0.92	**0.016**						**0.0447**	**0.016**	
88.26	0.94	**0.016**						**0.0460**	**0.016**	
88.28	0.96	**0.016**						**0.0474**	**0.016**	

Stage-Storage-Discharge Summary Table										
Elevation	**Stage**	**Stage 1 Orifice Plate**						**Active Storage**	**Total Discharge**	**Notes**
m	**m**	**m^3/s**						**ha*m**	**m^3/s**	
88.30	0.98	**0.016**						**0.0487**	**0.016**	<= 25 Yr: 485 m³ (88.3m)
88.32	1.00	**0.017**						**0.0501**	**0.017**	
88.34	1.02	**0.017**						**0.0514**	**0.017**	
88.36	1.04	**0.017**						**0.0527**	**0.017**	
88.38	1.06	**0.017**						**0.0541**	**0.017**	
88.40	1.08	**0.017**						**0.0554**	**0.017**	
88.42	1.10	**0.017**						**0.0568**	**0.017**	
88.44	1.12	**0.018**						**0.0579**	**0.018**	
88.46	1.14	**0.018**						**0.0589**	**0.018**	<= 50 Yr: 587 m³ (88.46m)
88.48	1.16	**0.018**						**0.0600**	**0.018**	
88.50	1.18	**0.018**						**0.0610**	**0.018**	
88.52	1.20	**0.018**						**0.0620**	**0.018**	
88.54	1.22	**0.018**						**0.0630**	**0.018**	
88.56	1.24	**0.018**						**0.0640**	**0.018**	
88.58	1.26	**0.019**						**0.0650**	**0.019**	
88.60	1.28	**0.019**						**0.0660**	**0.019**	
88.62	1.30	**0.019**						**0.0670**	**0.019**	
88.64	1.32	**0.019**						**0.0680**	**0.019**	
88.66	1.34	**0.019**						**0.0691**	**0.019**	
88.68	1.36	**0.019**						**0.0701**	**0.019**	<= 100 Yr: 692 m³ (88.67m)
88.70	1.38	**0.020**						**0.0711**	**0.020**	

Appendix D

Stormwater Quality

Verification Statement

StormTech Isolator® Row PLUS
Registration number: (V-2020-10-01)
Date of issue: (2020-October-27)

Technology type	Stormwater Filtration Device
Application	Stormwater filtration technology to remove sediments, nutrients, heavy metals, and organic contaminants from stormwater runoff
Company	StormTech, LLC.
Address	520 Cromwell Avenue, Rocky Hill, CT 06067 USA **Phone** +1-888-892-2694
Website	www.stormtech.com
E-mail	info@stormtech.com

Verified Performance Claims

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Based on the laboratory testing conducted, the verified performance claims are as follows:

Total Suspended Solids (TSS) Removal Efficiency - The StormTech Isolator® Row PLUS achieved 82% ± 1% removal efficiency of suspended sediment concentration (SCC) at a 95% confidence level.

Average Loading Rate - Based on the reported flow rate data and the effective sedimentation and filtration treatment area of the test unit, the average loading rate of the test unit was 4.15 ± 0.03 GPM/ft^2 at a 95% confidence level.

Maximum Treatment Flow Rate (MTFR) - Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 gpm/ ft^2 of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft^2.

Detention Time and Volume - The StormTech Isolator Row PLUS detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft^3 and a detention time of 2.2 minutes.

Maximum Sediment Storage Depth and Volume - The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft^3 at a sediment depth of 0.5 inches.

Effective Sedimentation/Filtration Treatment Areas - The Effective Sedimentation Area (ESA) and the Effective Filtration Treatment Area (EFTA) increase as the size of the system increases. For the two overlapping StormTech SC-740 chambers tested, the ESA and the ratio of ESA/EFTA were 54.5 ft^2 and 1.0, respectively.

Sediment Mass Load Capacity - The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs ± 0.8 lbs (2.91 ±0.01 lbs/ ft^2) following a total sediment loading of 195.2 lbs.

Technology Application

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers covered in a non-woven geotextile fabric with a single layer of proprietary woven fabric at the bottom that serves as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal. The following features make the Isolator® Row PLUS effective as a water quality solution:

- Enhanced infiltration Surface Area
- Runoff Volume Reduction
- Peak Flow Reduction
- Sediment/Pollutant Removal
- Internal Water Storage (IWS)
- Water Temperature Cooling (Thermal Buffer).

Technology Description

The Isolator® Row PLUS (shown in Figures 1 and 2) is the first row of StormTech chambers that is surrounded with filter fabric and connected to a closely located manhole for easy access. The Isolator® Row PLUS provides for settling and filtration of sediment as stormwater rises in the chamber and ultimately passes through the filter fabric. The open-bottom chambers allow stormwater to flow out of the chambers, while sediment is captured in the Isolator® Row PLUS.

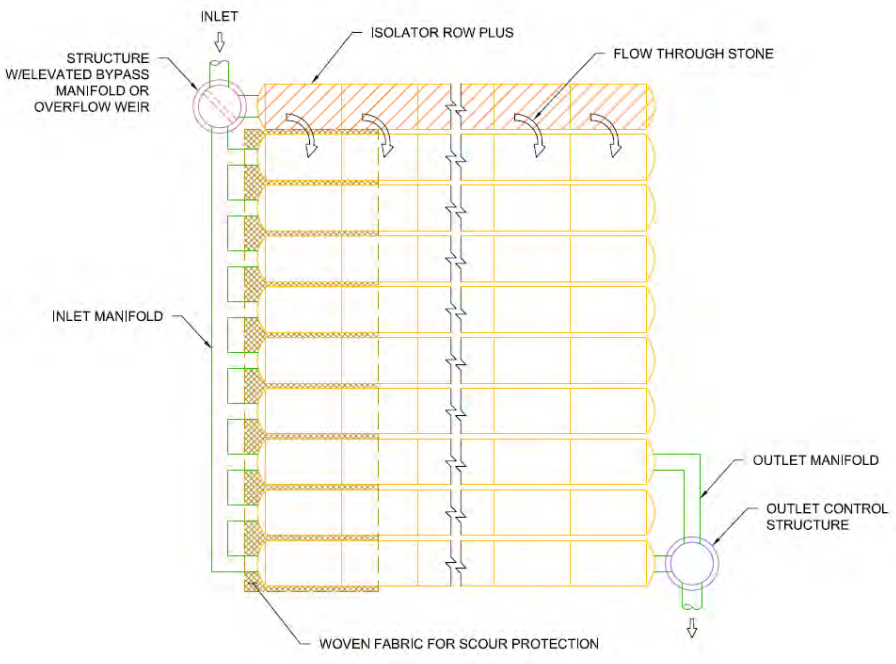

Figure 1: Schematic of the StormTech Isolator® Row PLUS System

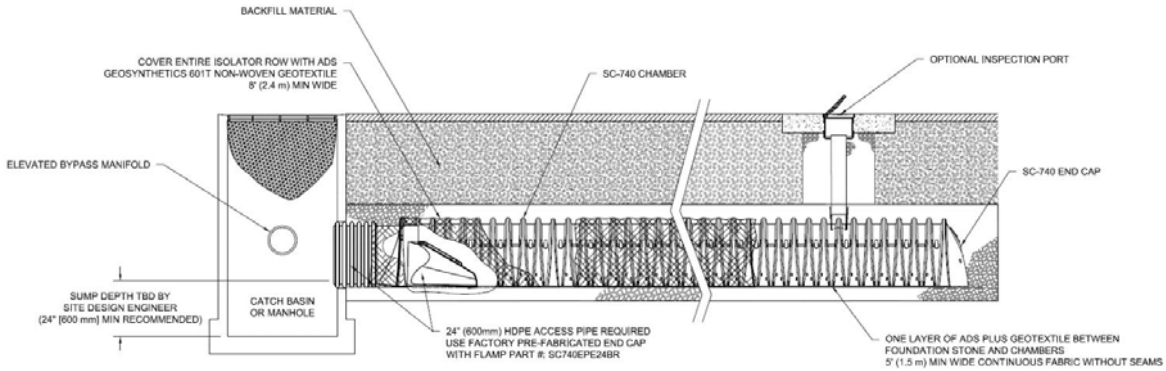

Figure 2: Isolator® Row PLUS Detail

A single layer of proprietary Advanced Drainage Systems (ADS) PLUS fabric is placed between the angular base stone and the Isolator Row PLUS chamber. The geotextile provides the means for stormwater filtration and provides a durable surface for maintenance operations. A 6 oz. non-woven fabric is placed over the chambers.

The Isolator® Row PLUS is designed to capture the “first flush” and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator® Row PLUS but includes a high low/concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator® Row PLUS bypass through a manifold to the other chambers. This is achieved with either a high-flow weir or an elevated manifold. This creates a differential between the Isolator® Row PLUS and the manifold, thus allowing for settlement time in the Isolator® Row PLUS. After Stormwater flows through the Isolator® Row PLUS and into the rest of the StormTech chamber system it is either infiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

StormTech developed and owns the Isolator® Row PLUS technology and has filed a number of patent applications relating to the Isolator® Row PLUS system.[1]

Description of Test Procedure for the StormTech Isolator® Row PLUS

In January 2020, two overlapping StormTech SC-740 Isolator® Row PLUS commercial size chambers were installed at the Mid-Atlantic Storm Water Research Center (MASWRC, a subsidiary of BaySaver), in Mount Airy, Maryland, to evaluate the performance of the Isolator® Row PLUS system for Total Suspended Solid (TSS) removal (Figure 3) All testing and data collection procedures were supervised by Boggs Environmental Consultants, Inc. (BEC), who was hired by ADS for third party oversight, and were in accordance with the *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device (January 2013)*.

Prior to the start of testing, a Quality Assurance Project Plan (QAPP), revision dated January 09, 2020, was submitted and approved by the New Jersey Corporation for Advanced Technology (NJCAT), c/o Center for Environmental Systems, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ 07030.

[1] (U.S. Provisional Application No. 62/753,050, filed October 30, 2018; U.S. Non-Provisional Application No. 16/670,628, filed October 31, 2019; International Application No. PCT/US2019/059283, filed October 31, 2019; U.S. Application No. 16/938,482, filed July 24, 2020; U.S. Application No. 16/938,657, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043557, filed July 24, 2020.

Figure 3: StormTech "Isolator® Row PLUS" Test Set-up at MASWRC

Verification Results

The verification process for the StormTech Isolator® Row PLUS technology was conducted by GHL in accordance with the VerifiGlobal Verification Plan for the StormTech "Isolator® Row PLUS" Technology – 2020-09-09. The technology performance claims verified by GHL are summarized at the front of this Verification Statement and in Table 6 on Page 8 under the heading "Verification Summary".

Particle size distribution analysis was performed by ECS Mid-Atlantic, LLC of Frederick, MD in accordance with ASTM D422-63(2007). ECS is accredited by the American Association of State Highways and Transportation Officials (AASHTO).

ASTM D422-63(2007) is a sieve and hydrometer method where the larger particles, > 75 microns, are measured using a standard sieve stack while the smaller particles are measured based on their settling time using a hydrometer.

The PSD meets the requirements of NJDEP, which is generally accepted as representative of the type of particle sizes an OGS would be designed to treat. Actual PSD is site and rainfall event specific, so it was necessary to choose a standard PSD to make testing and comparison manageable.

Table 1 shows the NJDEP PSD specification. Table 2 and Figure 4 show the incoming material PSD as determined by ECS Mid-Atlantic and confirmed by the verifier.

Table 1: NJDEP PSD Specification

Particle Size (µm)	NJDEP Minimum Specification
1000	98
500	93
250	88
150	73
100	58
75	48
50	43
20	33
8	18
5	8
2	3
d_{50}	< 75 µm

Table 2 – Particle Size Distribution (PSD) of Test Sediment

Mesh (mm)	US Sieve Size	Sample ID		
		PSD A	PSD B	PSD C
		Percent Finer		
9.525	0.375	100.0	100.0	100.0
4.750	#4	100.0	100.0	100.0
4.000	#5	100.0	100.0	100.0
2.360	#8	100.0	100.0	100.0
2.000	#10	100.0	100.0	100.0
1.180	#16	100.0	100.0	100.0
1.000	#18	100.0	100.0	100.0
0.500	#35	100.0	100.0	100.0
0.425	#40	93.3	93.0	93.6
0.250	#60	90.3	89.8	90.2
0.150	#100	79.3	78.1	78.1
0.125	#120	73.6	71.7	71.7
0.106	#140	68.4	65.2	64.8
0.090	#170	60.2	58.3	57.5
0.075	#200	52.0	50.9	50.3
0.053	#270	48.0	48.3	47.8
0.045	Hydrometer	46.6	46.7	46.7
0.032		42.8	42.9	41.0
0.021		37.1	37.2	35.3
0.0125		25.7	25.7	25.8
0.0090		20.1	20.1	19.2
0.0064		16.3	16.4	14.5
0.0032		8.8	8.7	7.8
0.0014		3.8	3.7	3.8

The suspended sediment concentration analysis was completed by Fredericktowne Labs Inc., Meyersville, MD. Fredericktown Labs is accredited by the Maryland Department of Environment as Maryland Certified Water Quality Laboratory. The analysis procedure was ASTM D3977-97, Suspended Sediment Concentration. The sampling procedure and submission of samples to the test lab were overseen by the independent observer, Boggs Environmental Consultants, Inc.

All test data and calculations were detailed in the report “NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC”, July 2020, which was submitted to and verified by the New Jersey Corporation for Advanced Technology (NJCAT).

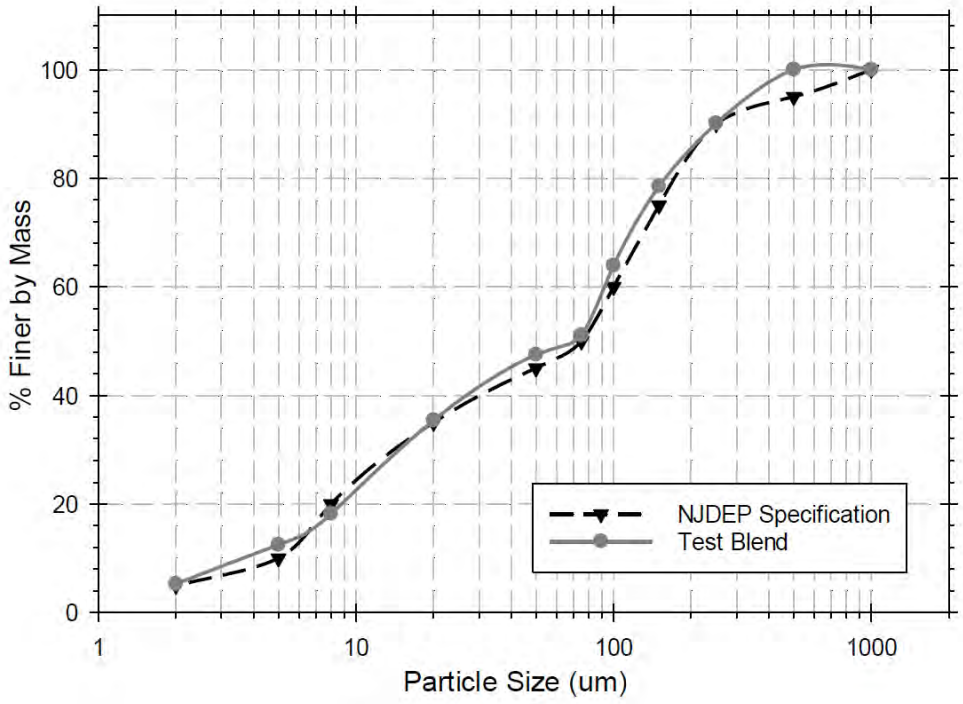

Figure 4– Particle Size Distribution (PSD)

The data in Table 3 (Flow Rate and Temperature) and Table 4 (Removal Efficiency) form the basis for the verified technology performance claim, specifically, flow rate, sediment captured and removal efficiency.

Table 3: Flow Rate and Temperature Summary

Run	Max Flow (gpm)	Min Flow (gpm)	Average Flow (gpm)	Flow COV	Flow Compliance (COV< 0.1)	Maximum Temperature (Fahrenheit)	NJDEP Temperature Compliance (< 80 F)
1	232.8	223.9	226.3	0.0078	Y	48.2	Y
2	228.9	218.6	220.8	0.0104	Y	51.5	Y
3	229.4	220.0	227.2	0.0094	Y	44.7	Y
4	230.2	218.7	223.2	0.0138	Y	40.5	Y
5	228.7	216.9	222.2	0.0103	Y	44.7	Y
6	227.6	217.0	224.2	0.0115	Y	46.7	Y
7	229.7	221.9	226.4	0.0092	Y	44.6	Y
8	230.3	222.2	226.8	0.0089	Y	43.5	Y
9	233.2	218.4	225.6	0.0136	Y	45.5	Y
10	232.2	219.7	228.4	0.0126	Y	44.7	Y
11	226.9	219.2	224.1	0.0088	Y	52.4	Y
12	232.2	222.1	226.9	0.0107	Y	48.5	Y
13	234.7	221.2	226.1	0.0109	Y	48.5	Y
14	231.9	223.4	228.7	0.0103	Y	45.6	Y
15	236.8	224.1	231.4	0.0131	Y	52.2	Y
16	232.5	221.3	229.0	0.0137	Y	47.8	Y

Table 4: Removal Efficiency Results

Run	Average Influent TSS (mg/L)	Influent Water Volume (gal)	Adjusted Average Effluent TSS (mg/L)	Effluent Water Volume (gal)	Adjusted Average Drain Down TSS (mg/L)	Drain Down Water Volume (gal)	Single Run Removal Efficiency (%)	Mass of Captured Sediment (g)	Cumulative Removal Efficiency (%)
1	203	7166	46	6881	34	285	77.8	4282	77.8
2	199	6993	32	6639	27	354	84.0	4415	80.8
3	207	7197	37	6793	27	403	82.6	4654	81.4
4	217	7068	33	6635	29	433	84.9	4923	82.3
5	215	7037	39	6593	29	444	82.2	4705	82.3
6	207	7097	40	6643	31	454	81.2	4504	82.1
7	198	7169	37	6693	30	476	81.6	4386	82.0
8	201	7184	37	6716	32	468	81.6	4473	82.0
9	205	7147	38	6675	30	472	81.8	4539	82.0
10	203	7235	38	6759	31	476	81.4	4523	81.9
11	208	7096	38	6624	30	472	81.8	4567	81.9
12	209	7185	41	6709	30	476	80.7	4584	81.8
13	198	7162	41	6680	32	482	79.7	4277	81.6
14	200	7242	43	6757	34	485	78.8	4318	81.4
15	196	7329	41	6842	32	487	79.5	4320	81.3
16	202	7254	44	6769	31	485	78.9	4384	81.2
Avg.	**204.2**	**7160**	**39**	**6713**	**31**	**447**	**81.2**	**4491**	**N/A**
Cumulative Mass Removed (g)							**71854**		
Cumulative Mass Removed (lb)							**158.4**		
Total Mass Loaded (lb)							**195.2**		
Cumulative Removal Efficiency (%)							**81.2**		

Quality Assurance

Performance verification of the StormTech Isolator® Row PLUS technology was performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. This included reviewing all data sheets and calculated values, as well as overall management of the test system, quality control and data integrity.

Additional information on quality control measures taken can be found in section 5 of the QAPP for StormTech Isolator Row New Jersey Department of Environmental Protection Testing, Rev. 1/9/2020.

Specific QA/QC measures reviewed by the verifier are summarized in Table 5 below.

Table 5. Validation of QA/QC Procedures

QC Parameter	Acceptance Criteria
Independence of observer	Confirmed in letter from Boggs Environmental Consultants, Inc. to NJCAT
Consistency of procedure	Daily logs confirm proper procedure
Existence of QAPP	Confirmed. “QAPP For StormTech Isolator Row New Jersey Department of Environmental Protection Testing”, Rev. 1/9/2020*)*
Use of appropriate sample analysis method – ASTM D3799	Confirmed by method reference on lab reports from Fredericktowne Labs Inc.
Test method appropriate for the technology	Used industry stakeholder approved protocol: *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids*

	Removal by a Filtration Manufactured Treatment Device (January 2013)
Test parameters stayed within required limits	Confirmed in report "NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC", July 2020
Third party verified data	All testing was observed and reviewed by Boggs Environmental Consultants, Inc.

Variance

Performance claims regarding structural load limitations were not verified as they are outside the scope of the performance testing that was conducted in accordance with the 'Quality Assurance Project Plan (QAPP) for StormTech Isolator Row, New Jersey Department of Environmental Protection Testing', revision dated January 09, 2020.

Verification Summary

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers wrapped in woven geotextile fabric with two layers at the bottom that serve as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal.

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Table 6 summarizes the verification results in relation to the technology performance parameters that were identified in the Verification Plan to determine the efficacy of the StormTech Isolator® Row PLUS technology.

Table 6 - Summary of Verification Results Against Performance Parameters

Parameters	Verified Claims	Accuracy
Total Suspended Solids (TSS) Removal Efficiency	Based on the laboratory testing conducted, the StormTech Isolator® Row PLUS achieved an average 82% removal efficiency of SSC	± 1% (95% confidence level)
Average Loading Rate	Based on the laboratory testing parameters, the StormTech Isolator® Row PLUS maintained a loading rate of 4.15 GPM/sf	±0.03 GPM/sf (95% confidence level)
Maximum Treatment Flow Rate (MTFR)	Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 GPM/ft^2 of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft^2.	± 1.4 GPM (95% confidence level)
Detention Time and Volume	Detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft^3 (based on	N/A

	physical measurement) and a detention time of 2.2 minutes.	
Maximum Sediment Storage Depth and Volume	The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft^3 at a sediment depth of 0.5 inches.	N/A
Effective Sedimentation/ Filtration Treatment Area	The effective sedimentation and filtration treatment area increases as the size of the chamber increases. Under the tested conditions using 2 overlapping chambers, the treatment area was 54.5 ft^2	The sedimentation /filtration area was determined from the actual physical dimensions of the test unit*
Sediment Mass Load Capacity	The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs (2.91 lbs/ ft^2) following a total sediment loading of 195.2 lbs	± 0.8 lbs (±0.01 lbs/ft^2) (95% confidence level)

*Note: These numbers are determined based on physical measurement or a dimensional drawing, which is standard practice. Highly accurate measurements are not practical.

In conclusion, the StormTech Isolator® Row PLUS is a viable technology that can be used to remove contaminants from stormwater runoff via filtration. This technology has proven effective at removing suspended sediment from stormwater through in-lab testing using an industry recognized laboratory protocol.

By extension of sediment removal, this technology should also remove particle bound nutrients, heavy metals, and a wide variety of organic contaminants. Performance is a function of pollutant properties, hydraulic retention time, filter media, pre-treatment, and flow rate, such that proper design of the system is critical to achieving the desired results.

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the StormTech "Isolator® Row PLUS" technology, contact:	For more information on VerifiGlobal, contact:
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Signed for StormTech: *Original signed by:* *Greg Spires* Greg Spires, P.E. General Manager	Signed for VerifiGlobal: *Original signed by:* *Thomas Bruun* Thomas Bruun, Managing Director *Original signed by:* *John Neate* John Neate, Managing Director

StormTech®
Detention • Retention • Water Quality
An ADS company

Isolator® Row PLUS O&M Manual


SC-740


MC-3500


FLAMP

THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS®

ADS®

THE ISOLATOR® ROW PLUS

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row PLUS is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

THE ISOLATOR ROW PLUS

The Isolator Row PLUS is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row PLUS and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row PLUS protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row PLUS chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row PLUS is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator Row PLUS but includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row PLUS bypass through a manifold to the other chambers. This is achieved with either an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row PLUS row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row PLUS. After Stormwater flows through the Isolator Row PLUS and into the rest of the StormTech chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

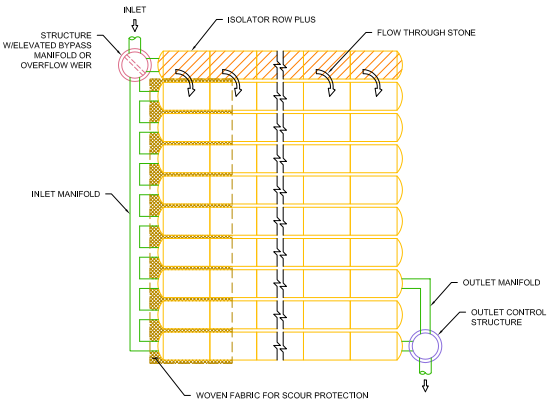
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus that is attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by enhancing outflow of solid debris that would otherwise collect at an end of the chamber. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row PLUS may be part of a treatment train system. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row PLUS is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row PLUS.

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



ISOLATOR ROW PLUS INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row PLUS should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row PLUS incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row PLUS, clean-out should be performed.

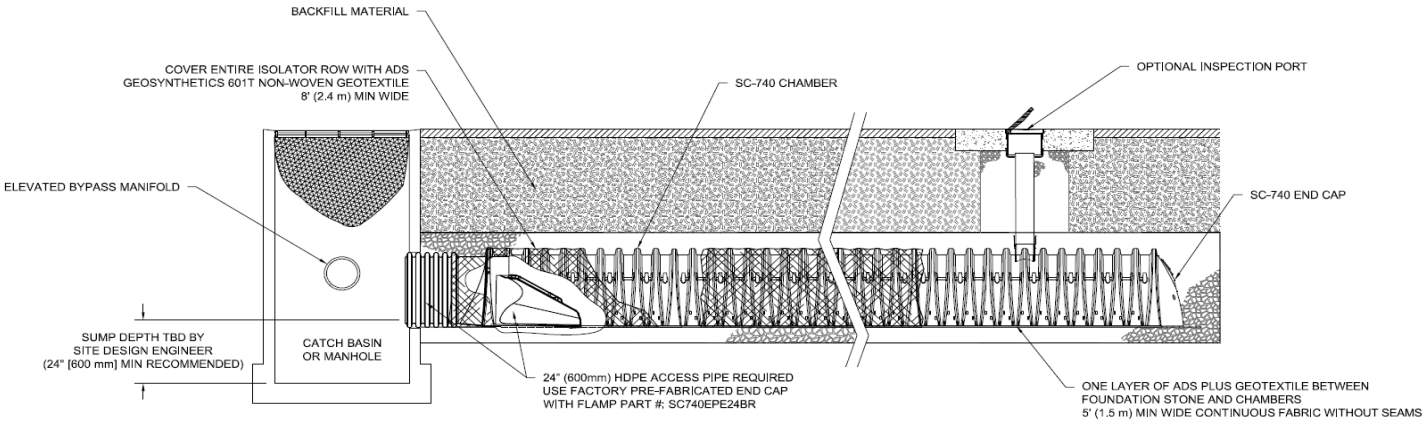
MAINTENANCE

The Isolator Row PLUS was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row PLUS while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row PLUS up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Row PLUS that have ADS PLUS Fabric (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row PLUS (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row PLUS.



ISOLATOR ROW PLUS STEP BY STEP MAINTENANCE PROCEDURES

STEP 1

Inspect Isolator Row PLUS for sediment.

A) Inspection ports (if present)
   i. Remove lid from floor box frame
   ii. Remove cap from inspection riser
   iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
   iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row PLUS
   i. Remove cover from manhole at upstream end of Isolator Row PLUS
   ii. Using a flashlight, inspect down Isolator Row PLUS through outlet pipe
      1. Mirrors on poles or cameras may be used to avoid a confined space entry
      2. Follow OSHA regulations for confined space entry if entering manhole
   iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2

Clean out Isolator Row PLUS using the JetVac process.

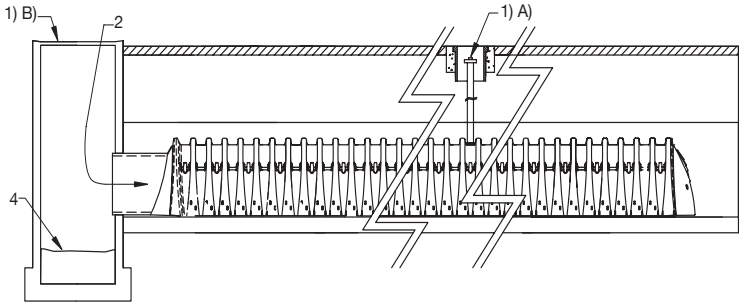
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

STEP 3

Replace all caps, lids and covers, record observations and actions.

STEP 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

StormTech Detention • Retention • Water Quality
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