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.

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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**.



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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**.

Standhyd ¹							
Catchment ID	Area (ha)	Impervious %	CN*2	la 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	

Table 1 – Existing and Proposed Hydrologic Parameters

Nashyd ¹							
Catchment ID	Area (ha)	Impervious %	CN*2	la ³	Tp⁴ (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. la 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**.

	Peak Flow (m³/s)				
Return Interval (vear)	OUI	1	OUT 2		
(your)	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	

Table 2 – Peak Flow Rates

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.

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

Table 3 – Borehole and Groundwater Elevation Summary

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.**

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 m³. Assumed two (2) separate connected underground chamber storage systems (SC-740) below landscape area and parking lot. Approx. total area required = 1,641 m². 	 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 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-2 	 Approx. total volume required = 692 m³. Assumed two (2) separate connected underground chamber storage systems (SC-740) below landscape area and south parking lot. Approx. total area required = 1,092 m². 	 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.

Table 5 – SWM Strategy Summary (OUT 2)



4.3 Stormwater Quantity Control Summary

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

	Peak Flow (m³/s)					
Return Interval (vear)	OUI	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		

Table 6 – Peak Flow Rates

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 m³. The maximum volume of storage that is required for the 100-year event in **PR-200** (**OUT 2**) is 692 m³. 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,

Mis Preto Bonet

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

MW/CPB

Mark Wilson, A.Sc.T Senior Project Designer



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 I Intensity	e in hour y 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
а	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 I Intensit	einhour yinmm/Hr		
Return Period Parameters	2 year	5 year	10 year	25 year	50 year	100 year
a b	1778 13	2464 16	2819 16	3886 18	4750 24	5588 28

Hydrologic Parameters for EX-100





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

		Land Use			Rainfa	II Data	
Agriculture	0.41	0.57	ha	Gaugir 12 hr, 100 Y	ig Station = ′r Rainfall =	99.3	mm
Grass	0.00	0.32	ha				
Woods	0.10	0.04	ha	Dra	ainage Area	2.76	ha
Wetland	0.00	0.16	ha	Impe	rvious Area	0.00	ha
Gravel	0.00	0.00	ha	Percent	Impervious	0.0%	
Impervious	0.00	0.00	ha	Connected	I Impervious	0.0%	
SUM	1.67	1.09					
					Pervious		
Hydrologic Soil Group ¹	В	С		Length	130	m	
Soil Turpa	Tecumseth	Smithfield		US Elev	89.0	m	
Son Type	Sandy Loam	Clay Loam		DS Elev	87.1	m	
С	0.17	0.27		Slope	1.5	%	
CN (Nashyd)	66.8	75.1			Flat		

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

Time of	Concentra	tion ⁶		Composite Param	eters	
Total Length	130	m				
Average Slope	1.5	%		Drainage Area	2.76	ha
Airport	29.0	min.		Runoff Coefficient		0.21
Bransby - Williams	6.2	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes	SCS Curve No.	70.1	70.1
			Hilly: >6% Slopes	Modified Curve No. ⁴ , CN*	73.6	73.6
Applicable Minimum ⁷	10.0	min.		Initial Abstraction.	7.5	7.5
Time to Book	19.4	min.				
Time to Feak	0.32	hr.				

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.

 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

Hydrologic	Parameters	for EX-200
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Project No: 10927 Project Name: King Street Residential Designed/Checked By: RC/CPB Date: 2-Feb-22

	Li	and Use	Rainfall Data
			Gauging Station = Cobourg
Agriculture	0.00	ha	12 hr, 100 Yr Rainfall = 99.3 mm
Range	0.98	ha	
Grass	0.00	ha	
Woods	0.12	ha	Drainage Area 1.21 ha
Wetland	0.00	ha	Impervious Area 0.08 ha
Gravel	0.03	ha	Percent Impervious 6.6%
Impervious	0.08	ha	Connected Impervious 6.6%
SUM	1.21		
			Pervious
Hydrologic Soil Group ¹	В		Length 120 m
Soil Tuno	Tecumseth		US Elev 89.9 m
Son Type	Sandy Loam		DS Elev 87.5 m
С	0.20		Slope 2.0 %
CN (Nashvd)	67.0		Flat

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

Time of	Concentra	ition ⁶		Composite Param	eters	
Total Length	120	m				
Average Slope	2.0	%		Drainage Area	1.21	ha
Airport	25.6	min.		Runoff Coefficient		0.20
Bransby - Williams	5.8	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes	SCS Curve No.	67.0	6
			Hilly: >6% Slopes	Modified Curve No. ⁴ , CN*	70.2	6
Applicable Minimum ⁷	10.0	min.		Initial Abstraction.	7.7	8
Time to Book	17.1	min.				
Time to Feak	0.29	hr.				

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.

 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

Hydrologic Parameters for EXT-100





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

		Land Use			Rainfa	II Data	
				Gaugir	ng Station = C	Cobourg	
Agriculture	0.00	0.00	ha	12 hr, 100 Y	'r Rainfall =	99.3	mm
Range	0.15	0.20	ha				
Grass	0.00	0.00	ha				
Woods	0.00	0.00	ha	Dra	ainage Area	0.35	ha
Wetland	0.00	0.00	ha	Impe	rvious Area	0.00	ha
Gravel	0.00	0.00	ha	Percent	Impervious	0.0%	
Impervious	0.00	0.00	ha	Connected	I Impervious	0.0%	
SUM	0.15	0.20					
					Pervious		
Hydrologic Soil Group ¹	В	С		Length	165	m	
Soil Turne	Tecumseth	Smithfield		US Elev	89.9	m	
Son Type	Sandy Loam	Clay Loam		DS Elev	88.3	m	
С	0.14	0.20		Slope	1.0	%	
CN (Nashyd)	65.0	76.0		-	Flat		

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

Time of	Concentra	tion ⁶		Composite Param	eters	
Total Length	165	m				
Average Slope	1.0	%		Drainage Area	0.35	ha
Airport	38.8	min.		Runoff Coefficient		0.17
Bransby - Williams	10.4	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes	SCS Curve No.	71.3	71.3
			Hilly: >6% Slopes	Modified Curve No. ⁴ , CN*	75.2	75.2
Applicable Minimum ⁷	10.0	min.		Initial Abstraction.	8.0	8.0
Time to Book	26.0	min.				
Time to Feak	0.43	hr.				

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.

 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

Hydrologic Parameters for EXT-101





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

		Land Use		Rainfall Data
				Gauging Station = Cobourg
Agriculture	0.00	0.00	ha	12 hr, 100 Yr Rainfall = 99.3 mm
Range	0.00	0.00	ha	
Grass	0.00	0.10	ha	
Woods	0.00	0.35	ha	Drainage Area 0.45 ha
Wetland	0.00	0.00	ha	Impervious Area 0.00 ha
Gravel	0.00	0.00	ha	Percent Impervious 0.0%
Impervious	0.00	0.00	ha	Connected Impervious 0.0%
SUM	0.00	0.45		
				Pervious
Hydrologic Soil Group ¹	В	С		Length 190 m
Coll True	Tecumseth	Smithfield		US Elev 89.0 m
Soli Type	Sandy Loam	Clay Loam		DS Elev 88.3 m
с		0.10		Slope 0.4 %
CN (Nashyd)		71.7		Flat

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

Time of	Concentra	tion ⁶		Composite Parar	neters	
Total Length	190	m				
Average Slope	0.4	%		Drainage Area	0.45	ha
Airport	60.8	min.	FL + 0.294 Cl	Runoff Coefficient		0.10
Bransby - Williams	14.1	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes	SCS Curve No.	71.7	71.7
			Hilly: >6% Slopes	Modified Curve No. ⁴ , CN*	76.5	76.5
Applicable Minimum ⁷	10.0	min.		Initial Abstraction.	8.9	8.9
Time to Beak	Time to Peak 40.7 min					
Time to Feak	0.68 hr.					

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.

 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

Hydrologic Parameters for PR-100



Project No: 10927 Project Name: King Street Residential Designed/Checked By: RC/CPB Date: 2-Feb-22 Sheet 1 of 1

		Land Use			Rainf	all Data	
				G	auging Station = (Cobourg	
Agriculture	0.00	0.00	ha	12 hr,	100 Yr Rainfall =	99.3	mm
Range	0.00	0.28	ha				
Grass	0.00	0.00	ha				
Woods	0.00	0.04	ha		Drainage Area	0.48	ha
Wetland	0.00	0.16	ha		mpervious Area	0.00	ha
Gravel	0.00	0.00	ha	Per	cent Impervious	0.0%	
Impervious	0.00	0.00	ha	Conr	ected Impervious	0.0%	
SUM	0.00	0.48					
					Pervious		
Hydrologic Soil Group ¹	В	С		Len	gth 120	m	
0	Tecumseth	Smithfield		US E	lev 88.5	m	
Soli Type	Sandy Loam	Clay Loam		DS E	lev 88.2	m	
С		0.14		Sic	pe 0.3	%	
CN (Nashyd)		66.9			Flat		

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

Time of	Concentra	tion ⁶		Composite Param	eters	
Total Length	120	m				
Average Slope	0.3	%		Drainage Area	0.48	ha
Airport	51.4	min.		Runoff Coefficient		0.14
Bransby - Williams	9.4	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes	SCS Curve No.	66.9	
			Hilly: >6% Slopes	Modified Curve No. ⁴ , CN*	71.5	
Applicable Minimum ⁷	10.0	min.		Initial Abstraction.	8.8	
Time to Book	34.4	min.				
Time to Feak	0.57	hr.				

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.

 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

Hydrologic Parameters for PR-101





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

		Land Use				Rain	fall Data		
			Gauging Station = Cobourg						
Agriculture	0.00	0.00	ha		12 hr, 100 Yr Rainfall =		99.3	mm	
Range	0.00	0.00	ha						
Grass	0.33	0.18	ha						
Woods	0.00	0.00	ha		Dr	ainage Area	2.04	ha	
Wetland	0.00	0.00	ha		Impe	ervious Area	1.54	ha	
Gravel	0.00	0.00	ha		Percent	Impervious	75.3%		
Impervious	1.11	0.43	ha		Connecte	d Impervious	75.3%		
SUM	1.44	0.60							
						Pervious	Impervious		
Hydrologic Soil Group ¹	В	С			Length	10	230	m	
Soil Type	Tecumseth	Smithfield			US Elev	88.5	91.5	m	
Son Type	Sandy Loam	Clay Loam			DS Elev	88.3	89.2	m	
С	0.72	0.69			Slope	2.0	1.0	%	
CN (Nashyd)	89.6	91.0				Rolling	Flat		

	dno			Weighted Value						
Parameter 9		Agriculture	Range	Grass	Woods	Wetland	Gravel	Imperv.	Incl. Imperv. NASHYD	Not Incl. Imperv. STANDHYD
Runoff Coefficient ² , C	B C	0.32 0.45	0.22 0.28	0.13 0.17	0.11 0.13	0.05 0.05	0.76 0.84	0.90 0.90	0.72 0.69	n.a.
SCS Curve No. ³ , CN	B C	74 82	65 76	61 74	58 71	50 50	85 89	98 98	89.6 91.0	61.0 74.0
Initial Abstraction ⁵ , n	nm	6.0	8.0	5.0	10.0	10.0	2.5	2.0	2.7	5.0

Time of	Concentra	tion ⁶		Composite Param	eters	
Total Length	240	m				
Average Slope	1.0	%		Drainage Area	2.04	ha
Airport	19.3	min.		Runoff Coefficient		0.71
Bransby - Williams	12.6	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes	SCS Curve No.	90.0	
			Hilly: >6% Slopes	Modified Curve No. ⁴ , CN*	90.8	
Applicable Minimum ⁷	10.0	min.		Initial Abstraction.	2.7	
Time to Book	8.5	min.				
Time to Peak	0.14	hr.				

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.

 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

Hydrologic	Parameters	for PR-200
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Project No: 10927 Project Name: King Street Residential Designed/Checked By: RC/CPB Date: 2-Feb-22

	Li	and Use			Rain	fall Data		
				Gaugi	ng Station =	Cobourg		
Agriculture	0.00	ha		12 hr, 100 \	r Rainfall =	99.3	mm	
Range	0.00	ha						
Grass	0.40	ha						
Woods	0.00	ha		Dr	ainage Area	1.32	ha	
Wetland	0.00	ha		Impe	rvious Area	0.92	ha	
Gravel	0.00	ha		Percent	Impervious	70.0%		
Impervious	0.92	ha		Connecte	d Impervious	70.0%		
SUM	1.32							
					Pervious	Impervious		
Hydrologic Soil Group ¹	В			Length	10	215	m	
Soil Turne	Tecumseth			US Elev	88.5	91.5	m	
Son Type	Sandy Loam			DS Elev	88.3	89.4	m	
с	0.67			Slope	2.0	1.0	%	
CN (Nashyd)	86.9				Rolling	Flat		

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

Time of	Concentra	tion ⁶		Composite Paran	neters	
Total Length	225	m				
Average Slope	1.0	%		Drainage Area	1.32	ha
Airport	20.8	min.	51 J. 0 201 Cl	Runoff Coefficient		0.67
Bransby - Williams	12.4	min.	Flat: 0-2% Slopes Rolling: 2-6% Slopes	SCS Curve No.	86.9	61.0
			Hilly: >6% Slopes	Modified Curve No. ⁴ , CN*	87.4	60.5
Applicable Minimum ⁷	10.0	min.		Initial Abstraction.	2.9	5.0
Time to Beak	8.3	min.				
Time to Feak	0.14	hr.				

Notes:

1. Hydrologic Soil Group obtained from Design Chart H2-6A, M.T.O. Drainage Manual, 1980.

 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

Appendix B

Peak Flow Calculatiions

VO3 Analysis



							1/53
	ssss u u ssss u u ss u u sss u u uvuu	A A A AAAAA AAAAA A A	5 5 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7				
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** * *	** DETB	I L	ОО	TDJT	* * * *		
<pre>Input filename: C:' Output filename: C' 0utput filename: C' b877-7a60ebf388c3\scent Summary filename: C' b877-7a60ebf388c3\scent</pre>	<pre> Program Fi (Users\cpro ario.out (Users\cpro ario.sum a</pre>	les (x8 ctorben ctorben	6)\VO S nett\Ap nett\Ap	uite 3.0\ pData\Loc pData\Loc	VO2\voin.da al\Temp\8ed al\Temp\8ed	t 3e64f- 3e64f-	-cd93-4679-
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** SIMULATION NUMBER ** SIMULATION NUMBER	* * * * * * * * * * * * * * * *						
CHICAGO STORM Ptotal= 28.11 mm	IDF curve used in:	parame	ters: A B C SITY =	=1778.000 = 13.000 = 1.000 A / (t +	B) ^C		
	Duration Storm tim Time to p	of storn e step eak rat	н 10 10 10	.00 hrs .00 min .33			
TIME 115 0.17 0.30 0.50	RAIN mm/hr 0.49 0.66 1.43 1.43	TIME hrs 1.17 1.33 1.50 1.67	RAIN mm/hr 18.95 77.30 26.45 11.48	TIME hrs 2.17 2.33 2.50 2.50 2.67	RAIN T mm/hr 2.84 3. 2.09 3. 1.60 3. 1.26 3.	IME hrs 333 67 67	RAIN mm/hr 0.71 0.61 0.52 0.52 0.46
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0.40 0.83 2.46 | 1.83 6.42 | 2.83 1.02 | 3.83 1.00 5.25 | 2.00 4.10 | 3.00 0.85 | 4.00

		RATN	mm/hr	0.71	0.71	0.61	0.61	0.52	0.52	0.46	0.46	0.40	0.40	0.35	0.35							
()= 70.2 ()= 3.00		TME	hrs	3.08	3.17	3.25	3.33	3.42	3.50	3.58	3.67	3.75	3.83	3.92	4.00							
ber (CN ar Res.(N	TIME STEP	RATN	mm/hr	2.84	2.84	2.09	2.09	1.60	1.60	1.26	1.26	1.02	1.02	0.85	0.85							
urve Numk of Lines	. NIM 0.	TTME	hrs	2.083	2.167	2.250	2.333	2.417	2.500	2.583	2.667	2.750	2.833	2.917	3.000							
1.21 C 7.70 # 0.29	ID TO 5	RATN I	mm/hr	18.95	18.95	77.30	77.30	26.45	26.45	11.48	11.48	6.42	6.42	4.10	4.10							
(ha)= (mm)= (hrs)=	RANSFORME	TME	hrs	1.083	1.167	1.250	1.333	1 1.417	1.500	1.583	1.667	1.750	1.833	1.917	2.000	0.159	0.012 (i)	1.750	3.245	8.106	0.115	
Area Ia U.H. Tp	LL WAS T	RAIN	mm/hr	0.49	0.49	0.66	0.66	0.93	0.93	1.43	1.43	2.46	2.46	5.25	5.25	cms)=	cms)=	hrs)=	= (uuu)	(mm) = 2	=	
(0005) 5.0 min	JTE: RAINFA	T TMF.	hrs	0.083	0.167	0.250	0.333	0.417	0.500	0.583	0.667	0.750	0.833	0.917	1.000	iyd Qpeak () MOTE	FO PEAK (7 VOLUME	RAINFALL	7 COEFFICIEN	
CALIB NASHYD ID= 1 DT=	N															Unit 1	PEAK 1	TIME	RUNOF	TOTAL	RUNOF	

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

Curve Number (CN)= 73.6 # of Linear Res.(N)= 3.00		
2.76 7.50 0.32		Ð
(ha) = (mm) = Tp(hrs) =	0.329	0.029 1.750 3.799 28.106 0.135
Area Ia U.H.	(cms)=	(cms) = (hrs) = (mm) = (mm) = cNT =
CALIB CALIB NASHYD (0001) ID= 1 DT= 5.0 min	Unit Hyd Qpeak	FEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICIE

| CALIB

_

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

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NASHYD (0002) Area (ha)= 0.35 Curve Number (CN)= 75.2 D=1 DT=5.0 min Ia (mm)= 8.00 # of Linear Res.(N)= 3.00 	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)= 0.031	Unit Hyd Opeak (cms)= 0.032
PEAK FLOW (cms)= 0.003 (i) TIME TO PEAK (hrs)= 1.917 RUNGF VOLUME (mm)= 3.888 RUNGFF VOLUME (mm)= 28.106 RUNGFF COEFFICIENT = 0.138	PEAK FLOW (cms) = 0.003 (i) TIME TO PEAK (hrs) = 2.083 TUNCE YOLME (mm) = 3.069 TOTAL RAINFALL (mm) = 20.066 RUNOFF COEFFICIENT 0.1106
(i) PEAK FLOW DOES NOT INCLUDE BASEFIOW IF ANY.	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
CALTB Area (ha) = 0.45 Curve Number (CN) = 76.5 NASHTD (0003) Area (ha) = 0.45 Curve Number (CN) = 76.5 D = 1 DT= 5.0 min Ia (mm) = 8.90 # of Linear Res.(N) = 3.00	CALIE I CALIE I I CALIE I I NASHYD (0010) Area (ha)= 0.35 Curve Number IID=1 DT=5.0 DT=1 DT=5.0 U.H. Tp(hrs)= 0.43
Unit Hyd Qpeak (cms)= 0.025	Unit Hyd Qpeak (cms)= 0.031
PEAK FLOW (cms) = 0.003 (i) TIME TO PEAK (hrs) = 2.250 RUNOFF VOLUME (mm) = 3.790 TOTAL RAINFLL (mm) = 28.106 RUNOFF COEFFICIENT 0.135	PEAK FLOW (cms) = 0.003 (i) TIME TO PEAK (hrs) = 1.917 TUNCE YOLDER (mm) = 3.888 TOTAL RAINEALL (mm) = 28.066 RUNOFF COEFFICIENT 0.136
(i) PEAK FLOW DOES NOT INCLUDE BASEFILOW IF ANY.	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
ADD HYD (0004) AREA OPEAK TPEAK R.V. 1 + 2 = 3 1 AREA OPEAK TPEAK R.V. 1 + 2 = 3 1 AREA OPEAK TPEAK R.V. 1 + 1 = 1 (0001): 2.76 0.029 1.75 3.80 + 1D2 = 2 (00021): 0.35 0.003 1.92 3.89	CALIB I CALIB 1 I CALID 1 Area (ha)= 0.45 Curve Number (CN)= 76.5 I NASHYD (0011) 1 Ta (mm)= 8.90 # of Linear Res.(N)= 3.00 IID= 1 Ta 0.68 # of Linear Res.(N)= 3.00 Unit Hyd Opeak 0.025 0.025 0.025 0.025
ID = 3 (0004): 3.11 0.032 1.75 3.81	PEAK FLOW (cms) = 0.003 (i) TIME TO PEAK (hrs) = 2.250 TIME TO PEAK (hrs) = 2.250
NULE: FEAR FLOWS DO NUT INCLUDE PASSEFLOWS IF ANY.	RUNGEF VLLONGLA (TTML) = 3./99 TOTAL RAINPALLA (TTML) = 28.106 TOTADEF COEFFICIENT = 0.135
ADD HYD (0004)	(1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
3 + 2 = 1 REA QPEAK TFAAK K.V. (na) (na) (na) (na) ID1= 3 (0004): 3.11 0.032 1.75 3.81 + ID2= 2 (0003): 0.45 0.003 2.25 3.79	CALIE I I CALIE I NASHYD
ID = 1 (0004): 3.56 0.034 1.75 3.81	112-1 21-3:000 14 14 100 - 0:00 7 01 1411641 Nes.(N)- 3:00
NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	Unit Hyd Qpeak (cms)= 0.045
CALIB	PEAK FLOW (cms)= 0.002 (i) TIMS TO PEAK (hrs)= 1.500 RUNOFF VOLUME (mm)= 2.883
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ID = 1 (0006): 0.93 0.006 2.00 3.70 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	ADD HYD (0006) AREA QPEAK TPEAK R.V. 1 + 2 = 3 AREA QPEAK TPEAK R.V. (ha) (cmm) (hrs) (mmn)	<pre>ID1= 1 (0006): 0.93 0.006 2.00 3.70 + ID2= 2 (0007): 0.48 0.003 2.08 3.09 ====================================</pre>	ADD HYD (0006) ADD HYD ADD HYD (0006) ADD HYD ADD HYD	ID = 1 (0006): 3.45 0.326 1.33 13.97 Note: peak flows do not include baseflows if any.		$ \begin{array}{cccccc} \text{INPERVIOUS} & \text{ERVIOUS} & (1) \\ \text{Surface Area} & (ha) = & 0.92 & 0.40 & (1) \\ \text{Dep. Storage} & (mn) = & 1.00 & 5.00 \\ \text{Depr. Storage} & (n) = & 1.00 & 2.00 \\ \text{Length} & (m) = & 93.81 & 10.00 \\ \text{Mannings} & n = & 9.013 & 0.250 \\ \end{array} $	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) = 2.00 10.00 Unit Hyd. pack (cms) = 0.29 0.16	PEAK FLOW (cms) = 0.19 0.01 "TUTAD" TIME TO FEAK (hrs) = 1.33 1.42 1.38 (iii) TIME TO FEAK (hrs) = 1.33 1.42 1.33 RUNDFF VOLUME (mm) = 27.11 22.13 19.82 TOTAL BATREALL (mm) = 28.11 28.11 28.11 RUNDFF COEFFICIENT 0.96 0.10 0.71	<pre>***** WARNING: STORAGE COEFF. IS SWALLER THAN TIME STEP! (1) CN PROCEDURE SELECTED POR PERVIOUS LOSSES: (1) CN* = 60.5 La = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SWALLER OR EQUAL</pre>	
TOTAL RAINFALL (mm)= 28.106 RUNOFF COBEFICIENT = 0.103 (1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	CALIEB CALIEB TRYANDERT (0009) Area (ha)= 2.04 ID=1 DTT=5.0 min Total Inne(8)= 75.00 Dir. Conn.(8)= 75.00	$ \begin{array}{llllllllllllllllllllllllllllllllllll$	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 (min)= 0.27 0.16 PEAK FLOW cms)= 0.27 0.16 THME TO PEAK (mr)= 1.32 0.142 1.33	RUNOFF VOLUME (mm)= 27.11 3.53 21.21 TOTAL RAINFALL (mm)= 28.11 28.11 28.11 RUNOFF COEFTCIENT = 0.96 0.13 0.75	<pre>***** WARNING: STORAGE COEFF. IS SWALLER THAN TIME STEP! (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>	<pre>(111) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.</pre>	1 + 2 = 3 AREA CPEAK TEEAK R.V. 	NOTE: FEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	ADD HYD (0006) AREA OPEAK TPEAK R.V. 1 3 + 2 1 AREA OPEAK TPEAK R.V. 1 3 + 2 1 AREA OPEAK TPEAK R.V. 1 3 + 2 1 (ma) (ma) (ma) 1 1D1 3 (0006) 0.80 0.006 1.00 3.83 + 1D2 2 (0020) 0.13 0.002 1.50 2.88	2022-02-11 6:12:44 FM 10927_Detailed Output.txt

	Unit Hyd Qpeak (cms) = 0.43 Unit Hyd Qpeak (cms) = 0.031 FEAK FLOW (cms) = 0.003 (i) RIME TO PEAK (hrs) = 1.917 RUNOFF VOLDME (nm) = 3.888 TOTAL RAINFALL (nm) = 3.888 TOTAL RAINFALL (nm) = 3.138 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	I CALIB I CALIB I I CALIB I CALIB I I CALIB I Area (ha)= I MASHYD (0026) I Area (ha)= I NASHYD (0026) I Area (ha)= I NASHYD (0026) I Area (ha)= I NASHYD (0026) I Area (ha)= I D= 1 DT= 5.0 min I Ia (mm)= 8.80 # of Linear Res.(N)= Unit Hyd Qpeak 0.32 0.32	PEAK FLOW (cms) = 0.003 (i) TUME TO PEAK (lns) = 2.083 RUNOFF VOLUME (mm) = 2.083 TOTAL RAINFALL (mm) = 2.089 RUNOFF COEFFICIENT = 0.110 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOM IF ANY.	CALIB CALIB STANDHYD (0025) Area (ha)= 2.04 ID= 1 DT= 5.0 min Total Imp(%)= 75.00 Dir. Conn.(%)= 75.00	$ \begin{array}{llllllllllllllllllllllllllllllllllll$	Manings n = 0.013 0.200 Max.Eff.Inten.(mm/hr)= 77.30 7.71 Storage Coeff. (min) 5.30 (10.00 Unit Hyd. Tpeak (min)= 5.01 (11) 5.30 (11) Unit Hyd. Dpeak (mmin)= 0.27 0.16	FEAK FLOW (mms) 0.01 *TOTALS* FEAK FLOW (mms) 0.32 0.01 0.324 (ii) TIME TO PEAK (Incs) 0.32 1.42 1.33 1.42 1.31 RUNOFF VOLUME (imm) 27.11 3.53 21.21 1.21 1.21 RUNOFF COEFFICIENT 0.96 0.13 0.75 0.75	***** WARNING: STORAGE COBFF. IS SWALLER THAN TIME STEP!
E STORAGE COEFFICIENT. OW DOES NOT INCLUDE BASEFLOW IF ANY.		AREA QPEAK TPEAK R.V. 2 (0013) (1.320 0.198 1.33 19.42 1 (0012) 1.320 0.012 1.93 19.42 TIME SHIFT OF REAUCTION [004L/Qin] (%) = 6.93 0.012 5.93 TIME SHIFT OF REAUCTION [004L/Qin] (%) = 5.93 TIME SHIFT OF REAUCTION [004L/Qin] (%) = 6.03 0.0193 (min) = 40.00 0.0193	<pre></pre>	(cms)= 0.003 (i) (hrs)= 2.250 1 (mm)= 3.790 L.1 (mm)= 28.106 CTFNT = 0.13	DOES NOT INCLUDE BASEFLOW IF ANY.	Area (ha)= 0.13 Curve Number (CN)= 68.4 1 Ia (mm)= 8.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.11 k (cms)= 0.045	(cms)= 0.002 (i) (hrs)= 1.500 1. (mm)= 2.883 1. (mm)= 2.8.105 crieNT = 0.103	DOES NOT INCLUDE BASEFION IF ANY.

<pre>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.</pre>	ADD HYD (0024) AREA QPEAK TPEAK R.V. 1 3 + 2 1 AREA QPEAK TPEAK R.V. 1 3 + 2 1 1 (na) (cmn) (hrs) (mm) + TD2 = 2 10021): 2.00 2.00 3.49 + TD2 = 2 10027): 2.04 0.023 1.92 21.05 TD = 1 (0024): 3.45 0.032 2.00 13.87 NOTE: PEAK FLOWS DNOT <include< td=""> BASEFLOWS F ANY. ************************************</include<>		I CALIB I I CALIB I I CALIB I I NASHYD (0005) Area (ha)= IID=1 Dr=5.0 min Ia (mm)= 7.70 # of Linear Res.(N)= IID=1 Dr=5.0 min Ia (mm)= 7.70 # of Linear Res.(N)= 3.00 NOTE: NATE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.	TIME RAIN TINE RAIN <th< th=""></th<>
 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 66.5 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SWALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 	RESERVOIR (10271) Image: Second (1000) STORAGE OUTFLOW STORAGE IDT= 5.0 min 0.00172 (cms) (ina)) (cms) (ina)) 0.00067 0.0114 0.0333 0.0664 0.0066 0.0066 0.00173 0.0114 0.0333 0.0664 0.0066 0.0066 0.0175 0.0114 0.0333 0.0664 0.0066 0.0066 0.0175 0.0114 0.0333 0.0664 0.0066 0.0066 0.0175 0.0114 0.0333 0.0664 0.0066 0.0066 0.0175 0.0114 0.0333 0.0664 0.0060 0.0066 0.0175 0.0114 0.0333 0.0439 0.0066 0.0066 0.0131 0.0126 0.0126 0.0439 0.0066 0.0006 0.0131 0.0146 0.0146 0.0006 0.0000 0.0000 INFLOW: ID= 1 0.023 1.192 21.016 0.1120 OUTFLOW: ID= 1 0.023 1.023 1.025 0.014 0.023 1.055 PEAK	ADD HYD (0024) AREA QPEAK TPEAK R.V. 1 1 + 2 3 1 AREA QPEAK TPEAK R.V. 1 1 + 2 3 1 (mm) (mm) 1 101 (1ma) (1ma) (1ma) (mm) + 1D2 1 0021 0.43 0.002 1.50 2.88 + 1D2 2 00221 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) AREA QPEAK TPEAK R.V. 1 3 + 2 = 1 (ha) (cms) (hrs) (mm) 1 3 + 2 = 1 (ha) (cms) (hrs) (mm) 1 1 = 3 (0024): 0.56 0.003 2.17 3.59 + IDD= 2 00230: 0.003 1.92 3.69 ID = 1 00240: 0.006 2.00 3.70 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	I ADD HYD (0024) I 1 + 2 3 I 1 + 2 3 I (ha) (cmes) (hzs) (hrs) 2022-02-11 6:12:44 EM

Unit Hyd Opeak (cms) = 0.68 Unit Hyd Opeak (cms) = 0.025 PEAK FLOW (cms) = 0.006 (i) TIME TO PEAK (hrs) = 2.167 RUNOFF VOLUME (mm) = 8.133 TOTAL RAINFALL (mm) = 8.492 RUNOFF COEFFICENT = 0.211	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	ADD HYD (0004) ADD HYD (0004) 1 + 2 = 3 AREA QPEAK TPEAK R.V. 1 + 2 = 3 (ha) (cms) (ln:2) (mm) 1 = 1 (000): 2.76 0.059 1.75 7.86	+ ID2= 2 (0002): 0.35 0.006 1.92 8.13 ====================================	NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	ADD HYD (0004) AREA QPEAK TPEAK R.V. 3 + 2 = 1 AREA QPEAK TPEAK R.V.	ID1=3 (0004): (JLR2) (JLR2) (JLR2) + ID2=2 (0003): 0.45 0.06 2.17 8.13	ID = 1 (0004): 3.56 0.069 1.75 7.92 Note: Peak Flows do Not Include baseflows if any.	CALLB CARLA 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 (1) TIME TO PEAK (hrs) = 2.003 RUNOF YOLDME (mm) = 6.730 TOTAL RAINFALL (mm) = 38.492 RUNOFF COEFFICIENT 0.175	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	CALIB CALIB CALIB 1 Area (ha)= NASHYD (0010) Area (ha)= 0.35 Curve Number ID= 1 DT= 5.0 Min Ia (nm)= 8.00 # of Linear Res.(N)= 3.00	2022-02-11 6:12:44 PM 10927_Detailed Output.txt
0.250 1.09 1.250 94.77 1.2.550 3.37 1.3.25 1.00 0.333 1.09 1.333 94.77 1.2.31 3.4.97 1.3.33 1.00 0.4137 1.59 1.333 94.77 1.2.31 3.4.97 1.3.33 1.00 0.417 1.53 11.417 2.66 1.3.42 0.87 0.87 0.500 1.53 11.563 17.18 2.560 3.54 0.76 0.583 2.32 11.667 17.18 2.567 2.06 3.57 0.76 0.507 3.95 11.718 2.567 2.667 3.76 0.76 0.573 2.95 11.718 2.567 2.667 3.76 0.76 0.750 3.95 11.667 17.18 2.567 2.667 0.76 0.750 3.95 11.677 9.922 2.750 1.68 3.75 0.67 0.757 3.95 11.913 9.921 2.937 1.68 3.67 0.67 0.7818 11.913 0.615 2.937	Unit Hyd Qpeak (cms)= 0.159	PEAK FLOW (cms) = 0.024 (i) THRE TO PEAK (hrs) = 1.67 RUNOFF VOLDME (mm) = 6.837 TOTAL RAINFALL (mm) = 38.492 RUNOFF COEFFICIENT = 0.178	(1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	CALIB 1 CALIB CALIB INASHYD (0001) Area (ha)= 2.76 Curve Number (CN)= 7.9. (III)= DT= 0.4. P(hrs)= 0.32 0.32	Unit Hyd Qpeak (cms)= 0.329 prak rrow (cms)- 0.050 (i)	TIME TO FEAK LUMD (his) = 1.750 TIME TO FEAK (his) = 1.750 RUNCFF VOLUME (him) = 7.864 TOTAL RAINFALL (him) = 38.492	RUNOFF COEFFICIENT = 0.204 (i) PEAK FLOW DOES NOT INCLUDE BASFFLOW IF ANY.	U CALLB 100020 1 Area (ha)= 0.35 Curve Number (CN)= 75.2 1 ID= 1 DT= 5.0 min 1 a (mm)= 8.00 # of Linear Res.(N)= 3.00	Unit Hyd Qpeak (cms)= 0.031	PEAK FLOW (cms) = 0.006 (i) TIME TO PEAK (hrs) = 1.917 RUNOFF VOLUME (mn) = 8.134 TOTAL RAINFALL (mn) = 8.134 RUNOFF COEFFICIENT = 0.211	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	CALIB CALIB CALIB Area NASHTD (0003) Area (ha)= 0.45 Curve Number (CN)= 76.5 ID= 1 TDT= 5.0 # of 1 IDT= 1	2022-02-11 6:12:44 PM 10927_Detailed Output.txt

	HOFALS:	0.413 (iii) 0.413 (iii) 29.86 38.49 0.78			R. V. (mm) 113	.13		R.V.	(mm) .13 .17	.86		R.V.	(mm) .86 .73	.47		
	5.00 4.89 (ii) 5.00 0.22	0.02 1.33 6.95 38.49 0.18	TIME STEP!	JOSSES: (Above) EQUAL IF ANY.	rpeakk i (hrs) 8. 1.92 8. 2.17 8.	2.00 8.	S IF ANY.	PEAK I	(hrs) 2.00 8. 1.50 6.	2.00 7.	S IF ANY.	rpeak i	(hrs) 2.00 7. 2.08 6.	2.00 7.	S IF ANY.	
	5.00 2.86 (ii) 5.00 0.28	0.33 37.49 38.49 0.97 0.97	IS SMALLER THAN 7	TED FOR PERVIOUS I a = Dep. Storage DID BE SMALLER OR DILD BE SMALLER OR DEFFICIENT. INCLUDE BASEFLOW	AREA QPEAK (ha) (cms) 0.35 0.006 0.455 0.006	0.80 0.012	INCLUDE BASEFLOWS	area qpeak	(ha) (cms) 0.80 0.012 0.13 0.004	0.93 0.013 2	INCLUDE BASEFLOWS	AREA QPEAK 1	(ha) (cms) 0.93 0.013 0.48 0.006	1.41 0.019 2	INCLUDE BASEFLOWS	
	r (min) (min)= k (min)= (cms)=	(cms) = (hrs) = (nm) = (mm) = LENT =	AGE COEFF.	DURE SELECT 66.5 Ia P (DT) SHOU STORAGE CC N DOES NOT		006): (0	TON DO NOT		006): 020): 020):	006): (0	DWS DO NOT			006): 1	DWS DO NOT	
	ove Storage Coeff. Unit Hyd. Tpeal Unit Hyd. peak	PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC.	*** WARNING: STOR	 (i) CN PROCEI CN* = CN* = (ii) TIME STEI THAN THE (iii) PEAK FLOW 	D HYD (0006) 1 + 2 = 3 + ID1= 1 (00 + ID2= 2 (00	ID = 3 (00	NOTE: PEAK FLO	ADD HYD (0006) 3 + 2 = 1	ID1= 3 (00 + ID2= 2 (00	ID = 1 (00	NOTE: PEAK FLO	ADD HYD (0006) 1 + 2 = 3	ID1= 1 (00 + ID2= 2 (00	ID = 3 (00	NOTE: PEAK FLO	
00/0T				bber (CN) = 76.5 ar Res.(N) = 3.00			nber (CN)= 68.4	ar Res.(N)= 3.00					1.(*) = 75.00			
0.7 2.0 1		OF TE ANY	JM LF ANY.	<pre>b Curve Number (CN) = 76.5 1 # of Linear Res.(N) = 3.00</pre>		00 IF ANY.	: Curve Number (CN)= 68.4	0 # of Linear Res.(N)= 3.00			D0 IF ANY.) Dir. Conn.(%)= 75.00 PERVIOUS (i)	0.51 5.00 2.00	10.00	13.67
00/01	p(hrs)= 0.43 0.031 0.006 fil	1.917 ±/ 1.917 ±/ 8.134 3.1492 0.211 Biseberiow TF anv	NCLUDE BASEFLOW IF ANT.	<pre>(ha) = 0.45 Curve Number (CN) = 76.5 (mm) = 8.90 # of Linear Res.(N) = 3.00 p(hrs) = 0.68</pre>	0.025 0.006 (i) 8.133 38.492 0.211	NCLUDE BASEFLOW IF ANY.	(ha)= 0.13 Curve Number (CN)= 68.4	(umm) = 8.00 # of Linear Res.(N) = 3.00 p(hrs) = 0.11 0.045	0.004 (i) 1.500	0.1/1 38.492 0.160	VILO BASEFLOW IF ANY.	(ha) = 2.04	<pre>Imp(%)= 75.00 Dir.Conn.(%)= 75.00 IMPERVIOUS PERVIOUS (i)</pre>	1.53 0.51 1.00 5.00 1.00 2.00	116.62 10.00 0.013 0.250	94.77 13.67
0.0 2.01	- U.H. Tp(hrs)= 0.43 (cms)= 0.031 (rms)= 0.006 (i)	(htts)= 1.917 (A) (htts)= 1.917 (mm)= 8.134 (mm)= 8.134 (mm)= 3.492 (mm)= 3.0.211 DESNT TARTITIPE BAREFICION IF ANV	JOES NOT INCLUDE BASEFLOW IF ANY.	<pre>Area (ha)= 0.45 Curve Number (CN)= 76.5 1 Ia (mm)= 8.90 # of Linear Res.(N)= 3.00 - U.H. Tp(hrs)= 0.68</pre>	(cms) = 0.025 (cms) = 0.006 (i) (ms) = 2.167 (mm) = 8.133 (mm) = 38.492 (mm) = 0.211	JOES NOT INCLUDE BASEFLOW IF ANY.	Area (ha)= 0.13 Curve Number (CN)= 68.4	Ia (mm)= 8.00 # of Linear Res.(N)= 3.00 - U.H. Tp(hrs)= 0.11 (cms)= 0.045	(cms)= 0.004 (i) (hrs)= 1.500 (hrs)= 1.500	(mm) = 0.1.6((mm) = 30.492 rewr = 0.1.6(JOES NOT INCLUDE BASEFLOW IF ANY.		<pre>I Total Imp(%)= 75.00 Dir. Conn.(%)= 75.00 IMPERVIOUS PERVIOUS (i)</pre>	$\begin{array}{llllllllllllllllllllllllllllllllllll$	(m)= 116.62 10.00 = 0.013 0.250	(mn/hr) = 94.77 13.67

OUTELOW: ID= 1 (0012) 1.320 0.012 2.17 27.97	PEAK FLOW REDUCTION [QOUL/Qin](%)= 4.95 TINE SHIFT OF PEAK FLOW (min)= 50.00 MAXIMUM STORAGE USED (ha.m.)= 0.0279		CALIB Area (ha)= 0.45 Curve Number (CN)= 76.5 MASHYD (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		TIME TO FEAK (hrs)= 2.167 RUNOFF VOLUME (mm)= 8.133 TOTAL FAINFALL (mm)= 8.133 RUNOFF COEFFICIENT = 0.211 (i) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	<pre></pre>	Unit Hyd Qpeak (cms)= 0.045 PEAK FLOW (cms)= 0.004 (i) TIME TO PEAK (hrs)= 1.500 RUNOFF VOLUME (mm)= 6.171 RUNOFF VOLUME (mm)= 6.171	TUTAL KALINFALL (mm) = 35.492 RUNOFF COEFFICIENT = 0.160	(i) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	<pre>[ID=1 DT=5.0 min Ia (mm)= 8.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.43 Unit Hyd Opeak (cms)= 0.031 FEAK FLOW (cms)= 0.006 (i) TUKE TO PEAK (hrs)= 1.917 RUNOFF VOLUNE (mm)= 8.134 TOTAL RAINPALL (mm)= 8.134 TOTAL RAINPALL (mm)= 8.134 TOTAL RAINPALL (mm)= 0.211 (i) PEAK FLOM DOES NOT INCLUDE BASEFLOW IF ANY.</pre>	CALIB	2022-02-11 6:12:44 PM 10927_Detailed Output.txt
				70.00			OTALS* 1.252 (iii) 1.33 2.93 2.93 8.49 0.73			TORAGE ha.m.) 0.0219 0.0312 0.0479 0.0602 0.0725 0.0000	R.V. (mm) 27.93	10927_Detailed Output.txt
	PEAK R.V. hrs) (mn) 2.00 7.47 .33 29.86	.33 20.71	: IF ANY.	jir. Conn.(%)=	VIOUS (i) 0.40 2.00 0.00 2.00 0.00	0.96 5.00 4.75 (ii) 0.22	0.01 1.33 5.63 8.49 0.15	IME STEP!	OSSES: (Above) EQUAL IF ANY.	OUTFLOW S7 (cms) (t (cms) 0.0120 0.0120 0.0149 0.0149 0.0149 0.0167 0.0000	TPEAK (hrs) 2 1.33	
	AREA QPEAK ha) (cms) 41 0.019 04 0.413	.45 0.418	INCLUDE BASEFLOW	(ha) = 1.32 mp(%) = 70.00 I	IMPERVIOUS PEI 0.92 1.00 1.00 93.81 0.013	94.77 5.00 2.51 (ii) 5.00 0.29	0.24 33.1.43 37.49 0.97 0.97	IS SMALLER THAN	ED FOR PERVIOUS] (= Dep. Storage ILD BE SMALLER OR DEFFICIENT. INCLUDE BASEFLOW	ON STORAGE ON STORAGE () (ha.m.) 000 0.0000 144 0.0000 167 0.0000 183 0.0000 197 0.0000	AREA QPEAK (ha) (cms) 1.320 0.29	
- 19000/ GAN GAN -	I 1000 (1000) 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ID = 1 (0006):	NOTE: PEAK FLOWS DO NOT	CALLB CALLB STANDHYD (0013) Area ID= 1 DT= 5.0 min Total 1	Surface Area (ha) = Dep. Storage (mm) = Average Slope (%) = Length (m) = Mannings n	Max.Eff.Inten.(mm/hr) over (min) Storage Coeff. (min) Unit Hyd. Ppeak (cms) Unit Hyd. peak (cms)	PEAK FLOW (cms) TIME TO PEAK (hrs) RUNOFF VOLUM (mm) TOTAL RAINFALL (mm) RUNOFF COEFFICIENT	***** WARNING: STORAGE COEFF.	 (i) CN PROCEDURE SELEC; ON = 60.5 Iz (ii) TIME STEP (DT) SHOT THAN THE STORAGE CC (iii) PEAK FLOW DOES NOT 	I RESERVOIR (0012) I I IN= 2> OUT= 1 OUTE1 00TE1 I DT= 5.0 min I 0.00 0 0.00 0.00 0.00 0 0.00 0.00 0.00 0 0.00 0.00 0.00 0 0.00 0.00 0.00 0 0.00 0.00 0.00 0 0.00 0.00 0.00 0 0.00 0.00 0.00	INFLOW : ID= 2 (0013)	2022-02-11 6:12:44 PM

AREA QPEAK TPEAK R.V. ELOW: ID= 2 (0025) (004) (133) 29.69 TFLOW: ID= 1 (0027) 2.040 0.413 1.33 29.69 TFLOW: ID= 1 (0027) 2.040 0.029 20.69 PEAK FLOW REDUCTION [Qout/Qin] (%) = 6.96 20.69	TIME SHIFT OF PRAK FLOW (min) = 40.00 MAXINUM STORAGE USED (ha.m.) = 0.0469	XD (0024) AREA QPEAK TPEAK R.V. 2 = 3 AREA CPEAK TPEAK R.V.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	TE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	XD (0024)	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	ID = 1 (0024): 0.93 0.013 2.00 7.86	TE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	XD (0024) XD (0024)	2 = 3 AREA QEEAK TPEAK R.V. (ha) CGMS (hrs) (mm) (024): 0.3 0.013 2.00 7.86	+ ID2= 2 (0026): 0.48 0.006 2.08 6.73 ====================================	TE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	VD (10024)	2 = 1 AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (nm)	IDI= 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	TE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
2N) = 71.5 (N) = 3.00			.00				71 S.*	413 (iii) 1.33	. 49 5. 49 5. 78				RAGE		0.0768 0.0882	0.0986 0.1100	0.0000

17/53

2022-02-11
CALIB CALID NASHYD (0001) Area (ha)= 2.76 Curve Number (CN)= 73.6	<pre>[ID= 1 DT= 5.0 min Ia (mm)= 7.50 # of Linear Res.(N)= 3.00 Unit Hyd Opeak (cms)= 0.32 # of Linear Res.(N)= 3.00 EEAK (cms)= 0.329 FEAK (cms)= 0.080 (i) THME TO PEAK (cms)= 1.750 FORT (hrsh= 1.750 FORT (hrsh= 1.750 FORT (hrsh= 1.750 FORT (hrsh= 0.455 FORT (hrsh= 1.750 FORT (hrsh= 0.237 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.</pre>	CALIE I CALIE I I CALIE 0002) Àrea (ha)= 0.35 Curve Number (CN)= 75.2 IID=1 DT=5.0 0 I I (mm)= 8.00 # of Linear Res.(N)= 3.00 Unit Hyd Opeak (cms)= 0.43 0.43 Onit Hyd Opeak (cms)= 0.031	PEAK FLOW (ems) - 0.00 (i) PEAK FLOW (ems) - 0.00 (i) THME TO PEAK (htts) - 0.03 RUNOFF VOLUME (mm) = 1.833 RUNOFF VOLUME (mm) = 44.038 RUNOFF COEFFICIENT = 0.246 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	I CALIB (N35HYD (0003) Area (ha)= 0.45 Curve Number (CN)= 76.5 IID=1 DT= 5.0 min Ia (mm) = 8.90 # of Linear Res.(N)= 3.00 Unit Hyd Opeak (cms) = 0.68 # of Linear Res.(N)= 3.00 Unit Hyd Opeak (cms) = 0.008 (i) THE TO PEAK (cms) = 0.008 (i) THE TO PEAK (cms) = 0.008 (i) THE TO PEAK (hrs) = 2.167 TOTAL RAINFLIA (mm) = 10.007 (i) TORDE COEFTCIENT 0.248 (i) (i) (1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	ADD HYD (0004) ABEA QPEAK TPEAK R.V. 1 1 + 2 = 3 1 ABEA QPEAK TPEAK R.V. 1 1 + 2 = 3 1 (ha) (cma) (hrs) (mm) TD1= 1 0001): 2.76 0.080 1.75 10.46
	curve parameters: A=2819.000 B= 16.000 C= 1.000 c= 1.000 a in: INTENSITY = A / (t + B) ^ ation of storm = 4.00 hrs rm time step = 10.00 min e to peak ratio = 0.33 tin TIME RAIN TIME RAIN TIME RAIN hr hrs mm/hr hrs mm/hr hrs mm/hr 23 1.17 30.96 2.17 5.20 3.17 1.34	9 1.50 100142 2.50 3.03 1 3.50 1.19 6 1.67 19.65 2.50 2.36 3.57 0.99 1 1.03 11.35 2.67 2.36 3.67 0.87 1 1.03 11.35 2.83 1.92 3.03 0.76 5 2.00 7.39 3.00 1.59 4.00 0.68	<pre>1 (ha)= 1.21 Curve Number (CN)= 70.2 (mm)= 7.70 # of Linear Res.(N)= 3.00 Tp(hrs)= 0.29 # 0.11 File STEP. S TRANSFORMED TO 5.0 MIN. TIME STEP.</pre>	TRANSFORMED HYETOGRAPH TAIL TTME RAIN TTME RAIN JT TURE RAIN TTME RAIN TTME RAIN 93 1.063 30.96 12.083 5.201 3.08 1.34 24 1.267 30.96 2.167 5.201 3.17 1.34 23 1.1667 30.96 2.263 3.251 1.15 1.15 24 1.233 30.96 2.2633 3.651 3.253 1.15 24 1.333 108-42 2.2333 3.651 3.25 1.15 25 1.417 42.32 2.401 2.97 3.42 0.99 66 1.563 12.667 2.361 3.57 0.87 0.97 66 1.501 12.567 2.361 3.57 0.76 0.76 51 1.730 12.35 2.7750 1.22 3.33 0.76 0.76 51 1.730 1.352 2.361	0.159 0.032 (i) 1.667 9.155 44.038 0.208

Unit Hyd Qpeak (cms)= 0.025	PEAK FLOW (cms) = 0.008 (i) TUME TO PEAK (hrs) = 2.167 RUNDEF VOLUME (mm) = 10.907 POTAL REPLAL (mm) = 44.038 PATAPE ADAPTETTEN (mm) = 44.038	(i) PEAK ELOW DOES NOT INCLUDE BASEFLOW IF ANY.		Unit Hyd Qpeak (cms)= 0.045	PEAK FLOW (cms) = 0.005 (i) TUME TO PEAK (lrs) = 1.417 RUNGF VOLUME (mm) = 8.308 POTAL RAINFALL (mm) = 4.038 RUNGF COEFFICIENT = 0.189	(1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.		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 Manhings n = 0.013 0.250	<pre>Max.Eff.Inten.(mm/hr) = 108.42 18.20</pre>	Unit Hyd. Tpeak (min)= 5.00 5.00 Unit Hyd. peak (cms)= 0.29 0.22	PEAK FLOW Coms) = 0.45 0.03 0.479 (ii) TUME TO PEAK (hrs) = 1.33 1.33 1.33 1.33 1.33 1.479 1.13 RUNDET VOLUME (mm) = 43.04 9.13 34.56 97.64 94.04 94.04 94.04 ROTAL FALLE (mm) = 44.04 94.04	ANNOTE COEFFLUENT - 0.50 ***** MARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!	 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL (iii) FLAR THE STORAGE COEFFICIENT. (iii) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 	
·ID2= 2 (0002): 0.35 0.009 1.83 10.84	ID = 3 (0004): 3.11 0.088 1.75 10.50 E: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	XD (0004)	+ 2 1 ARAA CPEAK TPEAK R.V.	OTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	B B (007) Area (ha)= 0.48 Curve Number (CN)= 71.5 DT= 5.0 min Ia (mm)= 8.80 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.57	nit Hyd Qpeak (cms)= 0.032	ZAK FLOW (cms)= 0.008 (i) HME TO PEAK (hrs)= 2.093 DOFF VOLUME (hrm)= 2.095 STAL RAINFEAL (rmn)= 44.038	UNDER CUERFICIENT = 0.20/ 1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.		<pre>YID (0010) Ärea (hal= 0.35 Curve Number (CN)= 75.2 DT= 5.0 min Ia (mm)= 8.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.43</pre>	nit Hyd Qpeak (cms)= 0.031	EAK FLOW (mms) = 0.109 (1) THE TO FEAK (mms) = 0.109 (1) UNDEP FOLDHE (mm) = 1.833 TOTL RAINPEL (mm) = 10.837 UNDEF COEFFICIENT = 0.246	i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	B (0011) Area (ha)= 0.45 Curve Number (CN)= 76.5 PT= 5.0 min Ia (mm)= 8.90 # of Linear Res.(N)= 3.00 DT= 5.0 min Ia (mm)= 0.68	-11 6.12.44 PM 10927 Detailed Output txt

$ \begin{array}{llllllllllllllllllllllllllllllllllll$	<pre>***** WARNING: STORAGE COEFF. IS SWALLER THAN TIME STEP! (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>	RESERVOIR (0012) OUTFLOW STOBAGE OUTFLOW STOBAGE DT= 5.0 min OUTFLOW STOBAGE OUTFLOW STOBAGE DT= 5.0 min (cms) (fm.m.) (cms) 0.0004 0.0000 0.0120 0.02342 0.02342 0.0044 0.0000 0.0149 0.0342 0.0342 0.0097 0.0000 0.0149 0.0662 0.0449 0.0662 0.0097 0.0000 0.0157 0.0157 0.0725 0.0007 0.0000 0.0157 0.0700 0.0000 1RFLM : ID= 2 (0013) 1.220 0.0292 0.0000 0.0157 0.0000 INFLOW : ID= 2 (0013) 1.220 0.0292 0.0123 0.0333 0.03336	PEAK FLOW REDUCTION Qout/Qin](%) = 4.41 TIME HIFT OF PEAK FLOW TIME HIFT OF PEAK FLOW MAXINUM STORAGE USED (min) = 55.00 MAXINUM STORAGE USED (min) = 0.0331 I CALLE (no21) Area (ha) = 0.45 I MASHD (0021) Area (ha) = 0.45	11D= 1 DT= 5.0 mln la (mm)= 2.30 m of Linear Kes.(W)= 3.00 Unit Hyd Qpeak (cms)= 0.68 Unit Hyd Qpeak (cms)= 0.008 (i) TEAK FLOW (cms)= 0.008 (i) TIME TO PEAK (mm)= 2.167 RUNOFF VOLONE (mm)= 10.903 TOTAL RAINFALL (mm)= 44.038 2022-02-11 6:12:44 PM 10927_Detailed Output.txt
ADD HYD (0006) 1 + 2 = 3 AREA QFBAK TD1 = 1 (0100); 0.35 0.099 1 + 1D2 = 2 (0011); 0.45 0.009 1 = 3 0.45 0.09 1.83 1 = 3 0.010; 1 = 1 0.010; 1 = 2 0.011); 0.45 0.008 1 = 3 0006); 0 = 3 0.016 2 = 3 0.006); 0 = 0.016 2.00 1 = 3 0.006); 0 = 0.016 2.00 1 = 3 0.006); 0 = 0.016 2.00 1 = 3 0.005); 1 = 3 0.006); 1 = 3 0.016 1 = 3 0.005 1 = 3 0.016 1 = 3 0.016 1 = 3 0.015 1 = 3 0.016	ADD HYD (006) AREA QFEAK TPEAK R.V. 1 3 + 2 = 1 1 (ha) (cms) (hrs) (mm) 1 111 = 3 0006051 0.30 0.16 2.00 1.42 89 + ID2 = 2 (00201: 0.13 0.0055 1.42 81.31 ID = 1 (0006): 0.13 0.0055 1.42 81.31 ID = 1 000651: 0.13 0.017 1.92 10.52 NOTE: PEAK FLOWS DO NOT NOLUDE BASEFLOWS IF ANY. 1.052	1 ADD HYD (0006) AREA QFEAK TPEAK R.V. 1 1 + 2 = 3 (ha) (cms) (hrs) (mm) 1 111 = 1 (0006): 0.33 0.017 1.52 (mm) + 112 = 1 (0006): 0.48 0.006 2.08 9.09 1D = 3 0006): 1.41 0.025 2.00 10.03 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	<pre> ADD HTD [0006) AREA QPEAK TPEAK R.V. 3 + 2 = 1 (ha) (cms) (hrs) (mm) TD1= 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 0.479 1.33 24.54 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.</pre>	CALIB Area (ha)= 1.32 STANDHYD (0013) Area (ha)= 1.32 ID= DT= 5.0 min Total Imp(%)= 70.00 ID= 1 DT= 5.0 min Total Imp(%)= 70.00 Surface Area (ha)= 0.92 0.40 10927_Detailed Output.txt

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		POTALS* 0.01415* 1.33 (iii) 3.1.56 3.4.04 0.78		STORAGE (ha.m.) 0.0664 0.0768 0.0982 0.0982 0.0966	0.0000 R.V. (mm) 34.56 34.40	6.59 0.00 0.0548			10927 Detailed Output.txt
<pre>IS PERVIOUS (i) 0.51 5.00 2.00 10.00</pre>	0.250 18.20 5.00 4.63 (ii) 0.22 0.22	0.03 1.33 9.13 44.04 0.21	R THAN TIME STEP! RVIOUS LOSSES: Torage (Above) LLER OR EQUAL ASEFLOW IF ANY.	RAGE OUTFLOW m.) (cms) 0000 (cms) 0128 0.0353 0128 0.0413 0232 0.0436 0332 0.0456	0550 0.0000 QPEAK TPEAK (cms) (hrs) 0.479 1.33 0.032 2.00	<pre>ION [Qout/Qin] (%) = IOW [Qout/Qin] (%) = COW (min) = (min) = SED (ha.m.) =</pre>	EAK TPEAK R.V ms) (hrs) (nm 08 2.17 10.91 05 1.42 8.3	09 2.08 10.32	
	= 0.013 (mm/hr)= 108.42 er (min) 5.00 . (min)= 2.71 . (min)= 2.02 c (cms)= 0.29	(cms) = 0.45 (hrs) = 1.33 (mm) = 43.04 c (mm) = 44.04 STENT = 0.98	AGE COEFF. IS SWALLE DURE SELECTED FOR FE 66.5 Ia = Dep. S 22 [UT] SHOULD BE SWA 5 STORAGE COEFFICIENT M DOES NOT INCLUDE B		0.0317 0. AREA (ha) 2 (0025) 2.040 1 (0027) 2.040	PEAK FLOW REDUCT TIME SHIFT OF PEAK E MAXIMUM STORAGE U		0024): 0.58 0.0	Ma
Surface Area Surface Area Dep. Storage Average Slope Length	Mannings n Max.Eff.Inten. ov Storage Coeff. Unit Hyd. Tpea Unit Hyd. pea	FEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALI RUNOFF COEFFI	***** WARNING: STO! (1) CN PROCI CN* = (11) TIME STU THAN THI (111) PEAK FL(RESERVOIR (0027) RESERVOIR (0027) IN= 2> OUT= 1 DT= 5.0 min	INFLOW : ID=		ADD HYD (0024) ADD HYD (0024) 1 + 2 = 3 111= 1 ((ID = 3 (0	2022-02-11 6:12:44
	= 68.4 1= 3.00) = 75.2) = 3.00)= 71.5)= 3.00			00	27 Detailed Output.txt

RUNOFF COEFFICIENT = 0.248

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

CALTB Image: Calter Calter <thcalter< th=""> <thcalter< th=""> <thcalt< td=""><td>• •</td></thcalt<></thcalter<></thcalter<>	• •
Unit Hyd Qpeak (cms)= 0.045	
PEAK FLOW (cms)= 0.005 (i) TIME TO PEAK (hrs)= 1.417 RUNGF VOLUNE (mn)= 8.308 RUNGF VOLUNE (mn)= 4.038 RUNGFF COEFFICIENT = 0.189	
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	
CALIB Area (ha)= 0.35 Curve Number (CN)= 7 NASHYD (0023) Area (ha)= 0.35 Curve Number (CN)= 7 D=1 DT= 5.0 min Ia (mm)= 8.00 # of Linear Res.(N)= 3 U.H. Tp(hrs)= 0.43	00
Unit Hyd Qpeak (cms)= 0.031	
PEAK FLOW (cms) = 0.009 (i) TIME TO PEAK (hrs) = 1.833 TUNDEF VOLUME (mm) = 10.837 RUNDFF VOLUME (mm) = 44.038 RUNDFF COEFFICIENT = 0.246	
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	
CALIB	. o 0
Unit Hyd Qpeak (cms)= 0.032	
PEAK FLOW (cms)= 0.008 (i) TIME TO PEAK (hrs)= 2.083 RONCE VOLUNE (mn)= 2.085 RONAL RAINFALL (mn)= 4.4.038 RUNOFF COEFFICIENT = 0.207	
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	
CALLE CALLE CALLE CALLE I Atea (ha)= 2.04 DE-1 DF= 5.0 min Total Imp(%)= 75.00 Dir. Conn.(%)= 75.00	

2022-02-11 6:12:44 PM

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0.33 1.99 1.33 138.79 2.33 5.76 3.33 1.74 0.57 4.00 1.57 58.11 2.50 4.46 3.50 1.51 0.67 4.00 1.67 28.06 1.57 3.56 3.67 1.32 0.33 1.18 2.33 2.93 2.91 3.67 1.32 0.30 13.69 2.00 10.90 3.00 2.41 4.00 1.03 1.01 1.03 13.69 2.00 10.90 3.00 2.41 4.00 1.03 1.01 1.03 1.61 Area (ha) = 1.21 Curve Number (CN) = 70.2	<pre> 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.</pre>	TRANSDORMED HYEPOGRAEH TIME RAIN TIME 1 hrs mm/hr hrs mr hrs m	0.500 2.65 11.500 58.11 2.500 44.46 3.50 1.51 0.687 4.00 11.553 28.06 2.583 3.56 3.57 1.51 0.673 4.00 11.553 28.06 2.583 3.56 3.57 1.32 0.750 6.73 11.750 16.53 2.633 2.90 3.75 1.16 0.833 6.73 1.933 1.6.53 2.833 2.90 3.75 1.16 0.833 6.73 1.933 1.6.53 2.833 2.90 13.30 1.03 1.000 13.69 1.917 10.90 12.917 2.41 4.00 1.03	Unit Hyd Qpeak (cms)= 0.159 EEAK FLOW (cms)= 0.060 (i) TIME TO PEAK (hrs)= 1.667 RUNOFF VOLUME (mm)= 1.202 TOTAL RAINFALL (mm)= 60.234 RUNOFF COEFFICIENT = 0.286	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	IIID=1 DT=5.0001) Allow (ind) = 7.50 # of Linear Res.(N) = 3.00 IIID=1 DT=5.001h U.H. Tp(hrs)= 0.32 Unit Hyd Qpeak (cms)= 0.329 0.329 PEAK FLOW (cms)= 0.146 (i) TIME TO PEAK (hrs)= 1.150 RIME TO PEAK (hrs)= 1.360 NOTAL RATIPATL ROUTL RATIPATL (mn)= 1.32	RUNDEF COEFFICIENT = 0.001 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
							AIN M ⁽)hr .04

Y. Y. Y. Y. K. R.V. K. R.V. K. R.V. K. R.V. K. R.V. (i) PEAK FLOM DOES NOT INCLUDE BASEFLOM IF ANY. (i) PEAK FLOM (cms) = 0.45 Curve Number (i) 0.69 # of Linear Re (i) 0.611 Area (ha) = 0.45 Curve Number (i) 0.61 0.41. Tp(hrs) = 0.68 # of Linear Re (i) 0.61 0.41. Tp(hrs) = 0.05 # of Linear Re (i) 0.61 1 = 0.45 Curve Number (i) 0.61 1 = 0.15 # of Linear Re (i) 0.61 1 = 0.05 # of Linear Re (i) 19.41 (i) PEAK FLOM DOES NOT INCLUDE BASEFLOM IF ANY. (i) PEAK FLOM DOES NOT INCLUDE PASEFLOM IF ANY. (i) PEAK FLOM FLOM FLOM FLOW FLOW FLOM FLOW FLOM FLOM FLOM FLOM FLOW FLOW FLOW FLOW F	225 237 238 239 239 239 239 239 239 239 239
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32/53	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.	<pre> ADD HYD (0006) AREA QEEAK TPEAK R.V. 1 + 2 = 3 (ha) (cms) (ha) (mm) TD1=1 (006); 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.</pre>	ADD HYD (0006) AREA QPEAK TPEAK R.V. 3 + 2 = 1 (ha) (cms) (1ha) (mms) (mms) 1 = 3 (0006): 1.41 0.047 2.00 18.83 + ID2= 2 (0009): 2.44 0.631 1.33 49.59 ID= 1 (0006): 3.45 0.644 1.33 36.43 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	CALTE I CALTE I CALTE (0013) Area (ha)= I STANDHYD (0013) I STANDHYD (013) I STANDHYD (1000) I STANDHYD (1000) Surface Area (ha)= Name (ha)= Surface Area (ha)= Name (ha)	Average (mu) = 1.00 2.00 Average Slope (m) = 93.81 1.00 2.00 Length (m) = 93.81 0.013 0.200 Max.Eff.Inten.(mm/hr) = 138.79 2.638 Max.Eff.Inten.(mm/hr) = 138.79 2.00 Storage Coeff. (min) = 2.16 (ii) 5.00 Firsten Coeff. (min) = 2.16 (ii) 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	RUNGEF VOLINE (mm) = 59.23 13.80 45.60 TOTAL RALINEAL (mm) = 60.23 60.23 60.23 RUNGF CALFEILENT = 60.23 60.23 60.23 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
31/53	cms)= 0.009 (i) hrs)= 1.417 (cm)= 15.791 (cm)= 65.234 T = 0.262 S NOT INCLUDE BASEFLOW IF ANY.	Area (ha)= 2.04 Total Imp(%)= 75.00 IMPERVIOUS PERVIOUS (i) ha)= 1.53 (i)= 1.00 (%)= 1.00 (%)= 1.6.00 (%)= 0.013 0.250 (%)= 0.013 0.250	$ \begin{array}{llllllllllllllllllllllllllllllllllll$	DEFT. IS SMALLER THAN TIME STEP! SELECTED FOR FERITOUS LOSSES: 1 = Dep. Storage (Above) 5 SHOULD BE SMALLER OR EQUAL 4GE COEFFICIENT. 5 NOT INCLUDE BASEFLOW IF ANY.	AREA QPEAK TPEAK R.V. (ha) (cms) (hm) 0.35 0.016 1.83 20.06 0.45 0.015 2.17 20.37	0.80 0.030 2.00 20.23 O NOT INCLUDE BASEFLOWS IF ANY.	ВЕА СРЕАК ТРЕАК R.V.

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	CALLE CALLE (0023) Area (ha)= 0.35 Curve Number (CN)= 75.2 NASHYD (0023) Area (ha)= 0.35 Curve Number (CN)= 75.2	PEAK FLOW POEND U.H. Tp(his) = 0.43 To initiat res.(N) = 0.00 Unit Hyd Qpeak (cms) = 0.031 PEAK FLOW (cms) = 0.016 (i) TIME TO PEAK (mm) = 20.057 TOTAL RINPELL (mm) = 20.057 TOTAL RINPELL (mm) = 60.234 RUNOFF COEFFICIENT = 60.234 RUNOFF COEFFICIENT = 60.234	(1) CALTB CALTB NASHYD (0026 Area (ha)= 0.48 Curve Number (CN)= 71.5	<pre>ID= 1 DT= 5.0 min Ia (mm) = 8.80 # of Linear Res.(N) = 3.00 U.H. Tp(hrs) = 0.57 Unit Hyd Opeak (cms) = 0.032</pre>	PEAK FLOW (cms) = 0.015 (i) TUBE TO FEAK (hrss) = 2.083 0.015 (i) RUNOFF VOLDME (mmm) = 17.324 0.234 TOTAL RAINFALL (mm) = 0.234 0.234	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	CALIB	IMPERVIOUS PERVIOUS (1) Surface Area (ha)= 1.53 0.51 Dep.Storage (mm)= 1.00 5.00 Average Slope (5)= 1.00 2.00	Length (m)= 116.62 10.00 Mannings n = 0.013 0.250 Max.Eff.lten.(mm/hr)= 138.79 32.62 ovver (minh 5.00 5.00	Storage Coeff. (min)= 2.46 (ii) 4.19 (ii) Unit Hyd Tpeak (min)= 5.00 5.00 Unit Hyd Deak (cms)= 0.30 0.24	TIME TOTALS* *TOTALS* PEAK FLOK (cms) = 0.58 0.05 0.31 (ii) TIME TO PEAK (hrs) = 1.33 1.33 1.33 TUMOFF VOLUME (mm) = 50.23 16.65 48.59 TOTAL RAINFALL (mm) = 50.23 60.23 60.23 RUNOFF COEFFICIENT 0.98 0.28 0.81	2022-02-11 6:12:44 PM 10927 Detailed Output.tx
 (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 ODEFILIENT: (iii) many more non-non-non-non-non-non-non-non-non-non	(111) FEAK FLUW LOES NOT INCLUDE BASEFLUW IF ANY.	RESERVOIR (0012) INSERVOIR (0012) INS 2> OUTE 1 OUTFLOW STORAGE DT= 5.0 min INS (ma) (cms) 0.0000 0.0000 10.0120 0.0001 0.0000 0.0120 0.0067 0.0000 0.0149 0.0063 0.0000 0.0149 0.0063 0.0000 0.0149 0.0097 0.0000 0.0127 0.0097 0.0000 0.0129 0.0000 0.0000 0.0149 0.0001 0.0000 0.0127	AREA OPEAK R.V. AREA OPEAK R.V. (ha) (ms) (tra) (mm) (mm) DUTELOW: ID= 2 (0013) 1.320 0.384 1.33 45.60 OUTELOW: ID= 1 (0012) 1.320 0.014 5.45 60	PEAK FLOW REDUCTION [QOUL/Qin](%)= 3.65 TIME SHIFT OF PEAK FLOW (min)= 65.00 MAXINUM STORAGE USED (ha.m.)= 0.0481	CALIB CALIB INABHYD (0021) Area (ha)= 0.45 Curve Number (CN)= 76.5 IID=1 Dr= 0.0 # 06 IID=1 Dr= 0.0 0.6	Unit Hyd Qpeak (cms)= 0.025	PEAK FLOW (cms) = 0.015 (i) TIME TO FEAK (hrs) = 2.167 RUNOFF VOLUME (mm) = 20.367 TOTAL RAINFLL 60.234 RUNOFF COEFFICIENT 0.338	(1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	CALIB CALIB CALIB (All B) INDERTD (0022) Area (Ha)= 0.13 Curve Number (CN)= 68.4 (ID=1 DT=5.0 0.14 Tro(hrsdr Res.(N)= 0.14 Dr(H) 0.14 Dr(H)	Unit Hyd Qpeak (cms)= 0.045	PEAK FLOW (cms) 0.009 (1) TIME TO PEAK (hrs) 1.417 RUNDEF VOLDME (mn) 15.794 RUNDEF VOLDME (mm) = 60.234 RUNDFF COEFFICIENT = 0.262	2022-02-11 6:12:44 PM 10927 Detailed Output.txt

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utput.txt

ADD HYD (0024) AREA QPEAK R.V. 1 + 2 = 3 (na) (cms) (hrs) (mm) ID1= 1(0024): 0.93 0.032 1.92 19.61 + ID2= 2(0026): 0.48 0.015 2.08 17.32 ID1= 3(0024): 1.41 0.047 2.00 18.33 NOTE: PEAK FLOWS DO NOT INCIDE BASEFLOWS IF ANY.	ADD HYD (0024) AEA AEA PEAK R.V. 1 3 + 2 = 1 1 AEA PEAK R.V. 1 3 + 2 = 1 1 AEA PEAK R.V. 1 13 + 2 = 1 1 AEA PEAK R.V. 1 11 = 3 (0024): 1.41 0.047 2.00 18.83 1 1D1 = 2 (0021): 2.04 0.038 2.17 48.43 1D = 1 (0024): 3.45 0.086 2.00 36.33 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	**************************************	Used in: INTENSITY $Z = 1.000$ used in: INTENSITY $= A / (t + B) \land Z$ Duration of storm = 4.00 hrs Form time step = 10.00 min Time to peak ratio = 0.33 Time to peak ratio = 0.33 TIME BAIN TIME BAIN TIME BAIN TIME RAIN hrs mm/hr hrs mm/hr hrs mm/hr hrs 0.17 2.18 1.17 52.37 2.17 11.13 3.17 3.12 0.13 2.89 1.50 36.37 2.17 11.13 3.17 3.12 0.50 4.02 1.50 36.37 2.57 2.53 3.57 2.34 0.67 5.96 1.67 36.37 2.67 2.63 3.57 2.34 0.67 5.96 1.67 36.37 2.57 2.53 3.57 2.34 0.67 5.96 1.67 36.37 2.57 2.57 2.53 3.57 2.34 0.67 5.96 1.67 36.37 2.57 2.53 3.57 2.34 0.67 5.96 1.67 36.37 2.57 2.57 2.57 2.54 2.56 2.53 3.57 2.54 2.56 2.55 2.54 2.55 2.54 2.55 2.54 2.55 2.54 2.55 2.54 2.55 2.54 2.55 2.54 2.55 2.54 2.55 2.54 2.55 2.54 2.55 2.55	1.00 18.93 2.00 15.36 3.00 3.67 4.00 1.61 CALIB CALIB CALIB NMSHPD (0005) Area (tha) = 1.21 Curve Number (CN) = 70.2 ID= 1 DT= 5.0 min 1 m (tmm) = 7.70 # of Linear Res.(N) = 3.00 NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.	TIME RAIN TIME RAIN TIME RAIN TIME RAIN TIME RAIN 2022-02-11 6:12:44 PM 1027_Detailed Output.txt
<pre>***** WARNING: STORAGE COEFF. IS SWALLER THAN TIME STEF! (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>	RESERVOIR (0027) NUTELOW STORAGE OUTFLOW STORAGE OUTFLOW STORAGE IPT= 5.0 min 0.000 0.0005 0.0064 0.0664 0.0007 0.0013 0.0114 0.0353 0.0664 0.0664 0.0007 0.0114 0.0353 0.01664 0.0082 0.0113 0.0982 0.00173 0.02124 0.0123 0.0123 0.0439 0.0982 0.0236 0.0276 0.0436 0.0114 0.0363 0.0466 0.1100 0.0213 0.0232 0.0439 0.0436 0.0100 0.0000	AREA DEBAK TFRAK R.V. INFLOW: ID= 2 (0025) 2.040 0.631 1.33 (mm) OUTFLOW: ID= 1 (0027) 2.040 0.631 1.33 44.59 PEAK FLOW REDUCTION 0.038 2.17 48.43 PEAK FLOW REDUCTION 0.031 8.1 48.43 MAXINUM SHET OF 0.038 2.17 48.43 PLAK FLOW REDUCTION [QOUL/QII] (%) = 6.10 7.10 48.43 MAXINUM STORAGE USED (mi.n) = 50.00 7.0775	1 ADD HYP (0024) 1 AREA QPEAK TPEAK R.V. 1 1 + 2 3 1 (ha) (cms) (hm) 1 D1=1 (0021): 0.45 0.013 2.17 20.37 + 1D2=2 (0022): 0.13 0.009 1.42 15.79 ID =3 (0024): 0.56 0.017 2.08 19.34 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	ADD HYD (0024) AREA QPEAK TPEAK R.V. 3 + 2 = 1 AREA QPEAK TPEAK R.V. 1 3 + 2 = 1 (na) (cms) (trs) (mm) 1 1 1 3 (0024): 0.58 0.016 1.03 19.34 + ID1 = 2 (0023): 0.35 0.016 1.03 20.06 ID = 1 (0024): 0.33 0.032 1.92 19.61 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	2022-02-11 6:12:44 FM 10927 Detailed Output.txt

CALTB 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 	UNIT HYG UPEAK (TMS) = 0.025 PEAK PLOW (TMS) = 0.020 (i) TIME TO PEAK (hrs) = 2.167 RUNOFF VOLUME (hmm) = 2.167 RUNOFF VOLUME (mmm) = 71.949 RUNOFF COEFFICIENT = 0.392	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	ADD HTD (0004) ADD HTD (0004) 1 + 2 = 3 AREA QPEAK PEAK R.V.	+ ID2 2 (0001): 0.32 (0.021 1.92 27.68) + ID2 2 (0002): 0.32 0.021 1.92 27.68 ====================================	NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	ADD HYD (0004)	3 + 2 = 1 ARRA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) ID1= 3 (0004): 3.11 + ID2= 2 (0003): 0.45 0.207 ID1= 1 (0004): 3.45 0.200 ID1= 1 (0004): 3.45 0.201	NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY	CALIB CALIB CALIP Area (ha)= 0.48 CULYP (a007) Area (ha)= 0.48 Curve Number (CN)= 1.5 (II)= 1.07= 1.07= 5.0 min 1.1. 1.07= 1.1. 1.07 1.1. 0.57	Unit Hyd Qpeak (cms)= 0.032	$\begin{array}{llllllllllllllllllllllllllllllllllll$	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	2022-02-11 6:12:44 EM 10927_Detailed Output.txt
hrs mm/hr hrs hrs<	0.41/ 4.02 1.41/ 0.6444 2.541/ 0.622 3.452 2.33 0.500 68.444 12.500 66.62 3.50 2.33 0.583 5.96 1.1833 36.37 12.553 5.33 3.56 2.04 0.583 5.96 1.1667 3.66 12.566 5.33 3.53 2.04 0.503 9.77 1.1933 22.56 12.833 4.38 3.75 1.81 0.750 9.77 1.933 22.56 12.833 4.38 3.75 1.81 0.833 9.77 1.933 22.56 12.833 4.38 3.92 1.81 0.917 18.93 1.907 15.36 2.917 3.67 4.00 1.61 1.000 18.93 2.917 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 VOLDUE (mm) = 23.578 TOTAL RAINFLL (mm) = 71.949 RUNOFF COEFFLIENT 0.333	(i) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	ALLEB ALLEB NASHYD (10001) Årea (ha)= 2.76 Curve Number (CN)= 73.6 ID=1 DT= 5.0 min Ia (mm)= 7.50 # of Linear Res.(N)= 3.00 11D=1 DT= 5.0 min 11 m.(hnea)= 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 (1002) Area (ha)= 0.35 Curve Number (CN)= 75.2 MASHYD (1002) Area (ha)= 0.35 Curve Number (CN)= 75.2 IID=11T7=5.0 min Ia (mm)= 8.00 # of Linear Res.(N)= 3.00	Unit Hyd Qpeak (cms)= 0.031	PEAK FLOW (cms) = 0.021 (i) TIME TO PEAK (hrs) = 1.917 TIME TO PEAK (hrs) = 21.679 RUNOFF VOLDME (mm) = 71.679 TOTAL RAINFLL (mm) = 71.949 RUNOFF COEFFICIENT 0.385	(i) PEAK FLOW DOES NOT INCLUDE BASEFIOW IF ANY.	2022-02-11 6:12:44 FM 10927_Detailed Output.txt

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 i 5.00 Unit Hyd. Ppeak (min)= 0.30 0.24 ************************************	PEAK FLOW (cms)= 0.59 0.06 '0.144.5 TIME TO PEAK (ms)= 1.33 1.33 1.33 1.33 RUDG TO PEAK (mm)= 70.95 23.00 58.96 RUDGL RAINFALL (mm)= 71.95 71.95 71.95 RUNGE CORFICIENT 0.99 0.32 0.62	**** WARNING: STORAGE COBFF. IS SWALLER THAN TIME STEP!	 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: (i) TIME = 66.5 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE CORFECTENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 	ADD HYD (0006) AREA QPEAK TPEAK R.V. 1 1 2 3 1 AREA QPEAK TPEAK R.V. 1 1 + 2 3 0 (cms) (mm) 1 1 - 2 0 0 (cms) (mm) 1 1 0 35 0 0 27.68 + 1D2=2 1001012 0.45 0.0202 2.17 28.17	ID = 3 (0006): 0.80 0.039 2.00 27.96	NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	AD HYD (0006) AREA OPEAK TPEAK R.V. 3 + 2 = 1 0 AREA OPEAK TPEAK R.V. 	ID = 1 (0006): 0.93 0.042 2.00 27.14	NOTE: PEAK FLOWS DO NOT INCLUDE BASBFLOWS IF ANY.	ADD HYD (0006) 1 AREA OPEAK TPEAK R.V. 1 1 + 2 3 1 (ma) (ma) (mu) 1 1 + 2 3 1 (ma) (ma) (mu) 1 1 + 2 3 1 (ma) (ma) (mu) 1 1 + 2 3 1 (ma) (ma) (mu) 1 1 + 2 3 0 0 2 0 7 14 1 1 1 0 0 0 0 2 0 2 7 14 1 1 1 1 0 0 0 0 2 2 0 2 7 14	ID = 3 (0006): 1.41 0.063 2.00 26.16 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
<pre>ca (ha)= 0.35 Curve Number (CN)= 75.2 (mm)= 8.00 # of Linear Res.(N)= 3.00 1. Tp(hrs)= 0.43</pre>)= 0.031	$\begin{array}{llllllllllllllllllllllllllllllllllll$	S NOT INCLUDE BASEFLOW IF ANY.	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	$\begin{array}{llllllllllllllllllllllllllllllllllll$	S NOT INCLUDE BASEFLOW IF ANY.	Area (ha)= 0.13 Curve Number (CN)= 68.4 Ia (mm)= 8.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.11	cms)= 0.045 cms)= 0.011 (i) hrs)= 1.417	(mm) = 22.141 (mm) = 71.949 T = 0.109	S NOT INCLUDE BASEFLOW IF ANY.	Area (ha)= 2.04 Total Imp(%)= 75.00 bir. Conn.(%)= 75.00 IMPERVIOUS PERVIOUS (i)	$\begin{array}{llllllllllllllllllllllllllllllllllll$

R.V. 26.16 58.96 45.55 45.55 (1) (2) (1) (2) (2) (3) (3) (3) (3) (3) (4) (3) (4) (5) (5) (4) (5) (1) (2) (2) (3) (1) (2) (3) (1) (2) (2) (1) (2) (2) (1) (2) (2) (2) (2) (2) (2) (2) (2	AK TPEAK R.V. 3) (hrs) 2(mm) 3) (hrs) 2(mm) 3) (1.33 58.96 5.00 2(mm) EEELOWS IF ANY. 5.00 1.33 45.55 EEELOWS IF ANY. 5.00 0.000 1.33 45.55 5.00 1.33 45.55 1.33 45.55 70.00 PEENTORS (i) 70.00 PEENTORS (i) 70.00 0.24 1.33 1.33 1.33 1.6 5.00 1.200 0.250 (ii) 5.00 1.33 1.6 5.00 1.200 0.255 1.33 1.33 (iii) 1.33 1.6 5.00 1.200 0.27 0.000 0.0149 0.0725 0.00149 0.0002 1.03140 0.0120 0.0149 0.0002 0.0149 0.0000 0.0149 0.0000 0.0149 0.0000 0.0149 0.0000 0.00140 0.0120 0.0149 0.0000 1.00140 0.0120 0.0149 0.0000 1.00140 0.0000 1.00140 0.0000 0.00140 0.000	AREA QFEAK TFEAK R.V. TAB QFEAK TEAS Terms) Times) 1.41 0.0633 2.000 56.16 3.45 0.660 1.33 45.55 INCLUDE BASEFLOWS IF ANY. Truchube BASEFLOWS IF ANY. Truchube BASEFLOWS IF ANY. The (%) = 70.00 Dir. <	AREA OPEAK TPEAK R.V. 006): (1a) (cass) (1a) (cass) (1a) 006): 1.41 0.663 1.33 58.96 006): 3.45 0.660 1.33 55.55 006): 3.45 0.660 1.33 55.55 006): 3.45 0.660 1.33 55.55 008 <donot anv.<="" baseflows="" if="" include="" td=""> ANV. ANV. Area (ha)= 1.22 5.00 5.00 Area (ha)= 0.613 1.33 55.45 Area (ha)= 0.02 2.00 5.00 (ma) 1.00 2.040 1.00 2.00 (ma) 0.02 2.00 2.03 1.13 (ma) 1.00 2.04 0.03 1.13 (ma) 0.013 0.024 0.017 1.133 (ma) 1.00 2.16 0.139 1.133 (ma) 0.21 0.23 0.25</donot>	. (ha) (cms) (hrs) (hm) INFLOW: ID= 2 (0013) 1.320 0.392 1.33 55.4(0UTFLOW: ID= 1 (0012) 1.320 0.392 1.33 55.4(FEAK FLOW REDUCTION [Qout/Qin](%)= 3.76 TIME SHIFT OF FEAK FLOW (quin) 85.00	MAXIMUM STORAGE USED (ha.m.)= 0.0586	CALIB NASHYD (0021) Area (ha)= 0.45 Curve Number (CN)= 7 ID=1 DT=5.0 min Ia (mm)= 8.90 # of Linear Res.(N)= 3	Unit Hyd Opeak (cms) = 0.00 Unit Hyd Opeak (cms) = 0.025 PEAK FLOW (cms) = 0.026 THE TO PEAK (thrs) = 0.020 THE TO PEAK (thrs) = 2.167 RUNOFF VOLINE (mm) = 2.167 RUNOFF VOLINE (mm) = 71.949 RUNOFF COEFFICIENT = 0.392 (1) PEAK FLOW DES NOT INCLUDE BASEFLOW IF ANY.		TOTAL RINKPLJ (mm) = 71.949 RUNOFF CORFFICIENT = 0.308 (1) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	CALTB CALTB CALTB CALTB CALTB CALTB CALTB NASHYD (0023) Area (ha)= 0.35 CUTVE Number (CN)= 7! ID= 1 DT= 5.0 min a (mm) = 8.00 # of Linear Res.(N) = 3.	PEAK FLOW PEAK FLOW TIME TO PEAK (res) = 1.017 TIME TO PEAK (res) = 1.017 RUNOFF VOLUME (rem) = 27.679 TOTALL BARTRAIL (rem) = 2.7.639 RUNOFF COEFFICIENT = 0.385 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	tput.txt 2022-02-11 6:12:44 FM 10927_D
	AK TFEAK AK TFEAK 3 (103) 3 (103) 5 (103) 1 (103) 5 (1	AREA CPEAK TPEAK (1a) (cms) (trs) 1.41 0.633 (trs) 2.041 0.663 1.33 3.45 0.660 1.33 INCLUDE BASEFLOWS IF AN (ha) = 1.32 Imp(%) = 70.00 Dir. Co 1.00 2.01 0.22 0.40 1.00 2.00 0.013 0.250 0.013 0.250 0.013 0.250 0.013 0.250 0.013 0.250 0.013 0.250 0.013 0.250 0.013 0.250 0.013 0.250 0.014 0.00 0.000 10.00 0.000 10.00 0.010 0.00 0.000 10.00 0.000 10.00 0.0000 10.0000 10.00 0.0000 10.0000 10.0000 10.0000 10.00000 10.00000 10.00000 10.00000 10.00000000	AREA OPEAK TPEAK 0060: (1ab) (cms) (hrs) 0060: 1.41 0.033 1.333 0060: 3.45 0.660 1.333 0060: 3.45 0.660 1.333 0060: 3.45 0.660 1.333 007 TOLUDE BASEFLOWS FN NO 008 DO NOT INCLUDE BASEFLOWS FN NO 008 DO NOT INCLUDE BASEFLOWS FN NO 008 DO NOT INCLUDE BASEFLOWS FN NO 108 INPERVIOUS PENVIOUS 0.40 (mm) 10.02 0.013 0.200 (mm) 10.02 1.00 0.40 (mm) 10.03 10.03 0.02 (mm) 0.013 0.24 0.260 (mm) 1.33 1.33 0.25 (mm) 2.13 0.13 0.25 (mm) 2.13 0.23 0.25 (mm) 2.13 0.25 0.25 (mm) 1.33 1.33 0.25 (mm) 2.13 0.25 0.25 (mm) 1.33 1.35 0.25 (mm) <td></td> <td></td> <td></td> <td>70.00</td> <td>orrALS* 0.392 (iii) 1.33 (iii) 71.95</td> <td></td> <td></td> <td>STORAGE (ha.m.) 0.0219 0.0342 0.0479 0.0602 0.725 0.0000</td> <td>10927_Detailed O</td>				70.00	orrALS* 0.392 (iii) 1.33 (iii) 71.95			STORAGE (ha.m.) 0.0219 0.0342 0.0479 0.0602 0.725 0.0000	10927_Detailed O

0.0276 0.0436 0.0466 0.1100 0.0317 0.0550 0.0000 0.0000 AREA 0FEAK TPEAK R.V. (ha) (cms) (hrs) (hrs) (hrs) (hrs) (hrs) INFLOW: ID= 1 (0027) 2.040 0.043 1.33 56.96 00TFLOW: ID= 1 (0027) 2.040 0.042 2.33 56.96	PEAK FLOM REDUCTION [gout/gin](%)= 6.60 TIME SHIFT OF PEAK FLOM (min)= 60.00 MAXINUM STORAGE USED (ha.m.)= 0.0926	ADD HYD (0024) 1 + 2 = 3 AREA QPEAK TPEAK R.V.	IDI = 1 (0021): (145 0.020 2.17 20) (116) (112) (112) (110) (112) (112) (110) (112	NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	ADD HYD (0024) ADD HYD (0024) AREA QFEAK TFEAK R.V. TFEAK (nam) TD1= 0.58 TD2= 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 INCIUDE BASEFLOWS IF ANY.	ADD HYD (0024) ADD HYD (0024) 1 + 2 = 3 AREA OFEAK F.V.	IDI=1 (no24) (na) (cms) (hrs) (mm) IDI=1 (0024) 0.93 0.042 2.00 27.14 + IDZ=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.	ADD HYD (0024) 1 AREA QFEAK F.V. 1 3 + 2 1 1 AREA QFEAK F.V. 1 3 + 2 1 1 1.41 0.063 1.41 1 3 + 2 1 1 1.41 0.063 26.16 + 1D2=2 10221 2.04 0.042 2.33 58.80
ve Number $(CN) = 71.5$ if Linear Res. $(N) = 3.00$		IF ANY.	4 0 Dir. Conn.(%)= 75.00	PERVIOUS (i) 0.51 7.52	2.00 2.00 10.00 3.25 3.27 3.27 3.27 3.27 3.27 3.27 3.27 3.27	0.00 -24 *TOTALS* 0.06 0.643 (iii) 1.33 0.63 -3.00 5.05	71.95 71.95 0.32 0.82 ANTTIME STEP!	S LOSSES: e (above)	OW IF ANY.	OUTFLOW STORAGE CHNB) (ha.m.) 0.0353 0.064 0.0383 0.0768 0.0413 0.0982 0.0439 0.0986

CUCRL RAINERLL (mm) = 83.135 RUDOFF CORFECIENT = 0.374 (i) perk friend for Mon Instring respected to ANV	(1) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	CALIB CALIB CALUE NASHYD (0001) Area (ha)= 2.76 Curve Numk ID=1 DT= 5.0 min Ia (mm)= 7.50 # of Lines	Unit Hyd Qpeak (cms)= 0.329	PEAK FLOW (mms)= 0.232 (1) TIME TO PEAK (hrss)= 0.232 (1) RUNOFF VOLUME (mm)= 34.466 TOTL RAINFALL (mm)= 83.375 RUNOFF COFFFICTENT = 0.413	RAIN mm/hr (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	2.14 2.17 2.17 2.14	Unit Hyd Opeakk (cms)= 0.031 PEAK FLOW (cms)= 0.026 (i) TIME TO PEAK (hrs)= 1.917 RUNCFF VOLMME (mm)= 35.894 TOTAL FAIRFALL (mm)= 33.375	RUNOFF COEFFICIENT = 0.428 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	RAIN Imm/hr CALIB 0003) Area 0.45 Curve Numt 4.10 Imm/hr NASHYD 0003) Area 0.45 Curve Numt 3.54 U.1 I.Ta 0.03 0.45 Curve Numt 3.54 U.1 U.1 0.03 0.68 405 Line 3.54 U.1 U.1 0.05 9.90 405 Line 3.54 U.1 U.1 0.68 0.68 405 Line 3.08 Unit Hyd Opeak Umms 0.025 10 11 1
U.IU5 Z.UU 45.46 UDE BASEFLOWS IF ANY.	**************************************		$C = 1.000$ 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	IMB RAIN TIME RAIN TIME RAIN TIME nrs mm/hr hrs mm/hr ' hrs m hrs m 17 2.89 1.17 60.52 2.17 14.4 3.17 4	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Area (ha)= 1.21 Curve Number (CN)= 70.2 1 (mn)= 7.70 # of Linear Res.(N)= 3.00 - U.H. Tp(hrs)= 0.29	AINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.	TIME RAIN TERMSFORMED HYETOGRAPH TIME RAIN TIME RAIN

	3.00	68.4 3.00	0 (iii)
	ar Res.(N):	ber (CN). ar Res. (N)	.) .) .) .) .) *TOTAL: .0.68 .0.68 .0.68 .0.68 .0.68 .0.81 .0.68 .0.81 .0.68
	# of Line	LE ANY. Curve Num # of Line H of Line	Dir. Conn PERVIOUS (1 0.51 2.000 12.000 0.250 45.63 45.63 45.63 45.00 0.24 5.000 0.24 5.000 0.24 1.33 8.007 1.33 8.007 0.36 0.36 0.36 0.36 0.36 0.36 0.36 0.36
	(mm)= 8.90 hrs)= 0.68 .025 .025 (1) .356 .375	LUDE BASEFLOW (ha)= 0.13 (mm)= 0.11 hrs)= 0.11 .045 .014 (i) .914 .375 .375 .375 .347 .10DE BASEFLOW	(ha)= 2.04 (p(%)= 75.00 MPERVIOUS 1.53 1.53 1.00 1.00 1.00 1.66 0.13 0.13 5.00 0.30 0.30 0.30 0.33 1.33 82.38 82.38 82.38 82.38 82.38 0.93 0.90 5.00 0.30 0.30 0.30 0.30 0.30 0.30 0.3
	Ia U.H. Tp((cms) = 0 (cms) = 0 (hrs) = 2 (mu) = 36 (mu) = 36 ENT = 0	OES NOT INC Area IArea IArea U.H. Tp((cms) = 0 (cms) = 0 (cms) = 2 (hrs) = 2 (hrs) = 2 ENT = 83 ENT = 0 0 OES NOT INC	Area Total Im (ha)= (m)= (m)= (m)= (m)= (min
	= 5.0 min Hyd Qpeak : FLOW : TO PEAK EF VOLUME L RAINFALL	PEAK FLOW D PEAK FLOW D (0020) (0020) PEDW FLOW T PEAK FF VOIDME FF COEFICI	<pre>D (0009) = 5.0 min = 5.0 min = 5.0 min = 5.0 min th th th th fings n Eff.Inten.(erge coeff. Hyd. Peak Hyd. peak Hyd. peak Hyd. peak Froume tr to the tr to th th th th th th th th th th th th th t</pre>
	IID= 1 DT Unit PEAK TIME RUNC	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	CALIE CALLE I STANDHY IIID= 1 DT Surf Sourt Max Max Max Stor. CULL UNLL UNLL TIME TIME TIME TIME TIME TIME TIME TIME
47/53	EA QPEAK TFEAK R.V. (a) (cmms) (hrs) (mm) 76 0.232 1.75 34.47 35 0.026 1.92 35.69 11 0.257 1.75 34.60 NCLUDE BASEFLOWS IF ANY.	EA QPEAK TPEAK R.V. 11 0.527 1.75 34.60 45 0.225 2.25 36.37 56 0.274 1.75 34.83 NCLUDE BASEFLOWS IF ANY. NCLUDE BASEFLOWS IF ANY. NCLUDE BASEFLOWS IF ANY. 0.27 # 0.48 Curve Number (CN) = 71.5 (mm) = 0.48 Curve Number (CN) = 71.5 (mm) = 0.57 # of Linear Res.(N) = 3.00 hrsb = 0.57	.026 (i) .083 .375 .375 .476 .470E BASEFLOW IF ANY. (ha)= 0.45 Curve Number (CN)= 75.2 (mm)= 8.00 # 9f Linear Res.(N)= 3.00 hrs)= 0.43 # 9f Linear Res.(N)= 3.00 hrs)= 0.43 ther Res.(N)= 76.5 (i)= 0.45 Curve Number (CN)= 76.5

$ \begin{array}{llllllllllllllllllllllllllllllllllll$	Max.Eff.Inten.(mm/hr)= 147.05 37.41 over (min) 5.00 5.00 Storage Coeff. (min)= 5.11 3.38 Unit Hyd. Tpeak (mm)= 5.00 5.00 Unit Hyd. Tpeak (cms)= 0.31 0.24	FEAK FLOW (cmms)= 0.38 0.04 *TOTALS* TIME TO PEAK (hrs)= 1.33 0.44 0.416 1.13 TIME TO PEAK (hrs)= 1.33 1.33 1.33 1.33 RUNCF VOLUME (mm)= 82.38 23.15 65.21 7.33 TOTAL RAINFALL 0.19 0.30 0.38 0.78	<pre>**** MARNING: STORAGE COEFT IS SMALLER THAN TIME STEP! (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 60.5 I = Dep. Storage (Above) (ii) TIME STEP (PI) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFTICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANV.</pre>	RESERVOIR (0012) OUTFLOW STORAGE INE 2> OUT= 1 OUTFLOW STORAGE OUTFLOW STORAGE DT= 5.0 min (cms) (ha.m.) (cms) (ha.m.) 0.0000 0.0000 0.0129 0.00219 0.0132 0.0000 0.0000 0.0120 0.0342 0.0342 0.0067 0.0000 1 0.0120 0.0479	0.0009 0.0000 1 0.01149 0.0202 0.00097 0.0000 1 0.0157 0.0725 0.0109 0.0006 1 0.0000 0.0000	AREA OPEAK R.Y. (ha) (CHS) (hrs) (mrs) 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 [cout/Qin](%) 3.71 TIME SHIFT OF PEAK FLOW (min)= 95.00 MAXIMOM 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 	Unit Hyd Qpeak (cms)= 0.025 PEAK FLOW (cms)= 0.025 (i)
(iii) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.) HYD (0006)	+ 2 = 3 1 AREA OPEAK TPEAK R.V. 	WOTE: FEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	<pre></pre>	HYD (0006) + 2 = 3 AREA QPEAK TPEAK R.V. + 12= 1 (0006); (-33 (-20) 35.07 + 1D2= 2 (0007); 0.48 0.026 2.08 31.63	ID = 3 (0006): 1.41 0.779 2.00 33.90 WOTE: FEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.	HYD (0006) AREA QPEAK TPEAK R.V. + 2 = 1 AREA QPEAK TPEAK R.V. 111= 3 (0006) : 1.41 (0.79 2.100 33.90 + ID2= 2 (0009) : 2.04 0.685 1.33 69.22	<pre>ID = 1 (0006): 3.45 0.707 1.33 54.79 toTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.</pre>	B B 112D (0013) Area (ha)= 1.32 DT= 5.0 min Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

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3.45	(0000)	ID = 1
2.04	: (6000)	ID2= 2
1.41	:(9000)	ID1= 3
(ha)		
AREA	_	2 = 1
	1 (9	0000)
	AREA (ha) 1.41 2.04 3.45) AREA AREA (0006): 1.41 (0009): 2.04 (0006): 3.45

27_Detailed Output.txt

<pre>%) = 75.00</pre>				*TOTALS* 0.685 (iii) 1.33 69.22 83.38	co.0			STORAGE (ha.m.) 0.0664	0.0768 0.0882 0.0986	00000.0	R.V. (mm) 3 69.22 69.22		6.73 65.00 0.1085		.V. (mm	o/ 10927_Detailed
Dir. Conn.({	PERVIOUS (i) 0.51 5.00	2.00 0.250	4.10 (ii) 5.00 5.00 0.24	2000 2000 2000 2000 2000 2000 2000 200	U.JO N TIME STEP!	s LOSSES: e (Above) OR EQUAL OW IF ANY.		OUTFLOW (cms) 0.0353	0.0383	0.0000	AK TPEAK s) (hrs) .685 1.33	-10/1-:0/10	Vout/Uln] (*) = (min) = (ha.m.) =		TPEAK R. (hrs) (n	r
(ha)= 2.04 mp(%)= 75.00	IMPERVIOUS 1.53 1.00	116.62 0.013	14/.00 5.00 2.40 (ii) 5.00	821.33 821.33 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 93.38 94.59 94.5	U.39 IS SMALLER THA	ED FOR PERVIOU = Dep. Storag LD BE SMALLER EFFICIENT. INCLUDE BASEFL		OW STORAGE (ha.m.) 00000000000000000000000000000000000	87 0.0114 73 0.0218 33 0.0332 76 0.0332	17 0.0550	AREA QPE. (ha) (cm 2.040 0	0 00000	REDUCTION L		REA QPEAK ha) (cms) /f	272.2 64.
25) Area in Total I	ea (ha)= Je (mm)=	= (心) = (山) - 、	cen.(uuu/nr)= over (min) eff. (min)= Tpeak (min)=	$\frac{dK}{ME} (hrs) = \frac{dm}{mm} $	STORAGE COEFF. :	CCEDURE SELECTI = 66.5 Ia STEP (DT) SHOU THE STORAGE CO FLOW DOES NOT		27) = 1 OUTEL((cms	0.000	0.033)= 2 (0025) - 1 (0027)	(1200) H	FEAR FLOW TIME SHIFT (MAXIMUM ST		24) () () ()	1 (UV41). V
CALIB STANDHYD (00: ID= 1 DT= 5.0 1	Surface Ar Dep. Stora	Average Si Length Mannings n	Storage Co Unit Hyd. 7 Unit Hyd. 7	PEAK FLOW TIME TO PE RUNOFF VOLI TOTAL RAIN	***** WARNING: :	(i) CN PI CN* CN* (ii) TIME THAN (iii) PEAK		RESERVOIR (00) IN= 2> OUT DT= 5.0 min			INELOW : I			CON CONT CARE 1	ADU HYU (VU) 1 + 2 = 3	2022-02-11 6:12
	F ANY.	Curve Number (CN)= 68.4	H OT PTDEAL RES.(N) = 3.00		F ANY .	Curre Number (CN)= 75.2 # of Linear Res.(N)= 3.00			F ANY.		Curve Number (CN)= 71.5 # of Linear Res.(N)= 3.00				F ANY.	10927 Detailed Output.txt
(hrs) = 2.250 (mm) = 36.366 (mm) = 83.375	0.430 ICLUDE BASEFLOW IF	(ha) = 0.13 C	(mm)= 0.00 # hrs)= 0.11 .045	0 014 (i) 1 417 8 936 3 375 0 347	CLUDE BASEFLOW IF	(ha) = 0.35 C (mm) = 8.00 # 0(hrs) = 0.43	.031	0.026 (i) 1.917 35.694 33.375 0.428	ICLUDE BASEFLOW IF		(ha) = 0.48 C (mm) = 8.80 # o(hrs) = 0.57	0.032	0.026 (i) 2.083 31.628 83.375	0.379	NCLUDE BASEFLOW IF	

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0927_Detailed Output.txt

+ 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.

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

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ł

	R.V.	(11011)	33.90	69.06	54.69
	TPEAK	(STII)	2.00	2.42	2.00
	QPEAK	(CIIIS)	0.079	0.046	0.125
	AREA	(119)	1.41	2.04	3.45
ADD HYD (0024)	3 + 2 = 1		ID1= 3 (0024):	+ ID2= 2 (0027):	ID = 1 (0024):

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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2022-02-11 6:12:44 PM

10927_Detailed Output.txt

Appendix C

Stormwater Quantity

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

Storage Summary



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

Discharge Summary

	Pormonont	Real Volumo:		87.33	m m ³		Stage	Ту	ype	Invert Elev	(mm) (m)
		rade Volume:		1079 1	m ³		1	Orifice Plate	Vertical	87.33	145
		nage volume.		1013.1		1	1	Onnoe Fiale.	. voruodi	07.00	140
1		Outlet	Canacity Sur	nmarv		ן ו					
	Type	Diameter	Slope	Peak Flow	% Full						
	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Blamotor	olopo	- out - ion	70 T dil						
L						1					
				Sta	ge-Storage-D	ischarge Sur	nmary Tabl	e			
		Stage 1						Activo	Total		
Elevation	Stage	Orifice						Storage	Discharge		Notes
		Plate						g-			
m	m			m	³/s			ha*m	m³/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		
07.40	0.13	0.011						0.0051	0.011		
07.47	0.14	0.011						0.0061	0.011		
07.40	0.15	0.012						0.0071	0.012		
87.50	0.10	0.013						0.0001	0.013		
87.50	0.17	0.014						0.0092	0.014		
87.52	0.10	0.014						0.0102	0.014		
87.53	0.10	0.016						0.0122	0.016		
87.54	0.20	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 m	า ^ง (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		
J 87.81	U.48	0.028						0.0407	0.028	1	

			Sta	ge-Storage-D	ischarge Sun	nmary Table	•		
		Stage 1						-	
Elevation	Stage	Orifice					Active	Iotal	
	-	Plate					Storage	Discharge	Notes
m	m			³ /e	II		ha*m	m ³ /e	
87.82	0.49	0.028		13			0 0417	0.028	
87.83	0.50	0.020					0.0428	0.020	
07.00	0.50	0.025					0.0420	0.029	
07.04	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	
87.04	0.61	0.032					0.0540	0.032	$\leq = 10$ Vr: 537 m ³ (87 94m)
97.05	0.62	0.032					0.0550	0.002	
07.95	0.02	0.032					0.0550	0.032	
87.90	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	0.70	0.035					0.0641	0.000	
00.04	0.71	0.035					0.0041	0.035	
00.05	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	
00.14	0.01	0.030					0.0743	0.030	
00.15	0.62	0.036					0.0753	0.038	
88.10	0.83	0.038					0.0764	0.038	
88.17	0.84	0.038					0.0774	0.038	<= 25 Yr: 765 m ³ (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	0.00	0.040					0.0845	0.040	
88.25	0.07	0.040					0.0855	0.040	
00.20	0.02	0.044					0.0000	0.044	
00.20	0.93	0.041					0.0000	0.041	
88.27	0.94	0.041					0.08/6	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	
88.39	1.05	0.043					0.0097	0.043	
00.00	1.00	0.043					0.0307	0.043	
00.39	1.00	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

Storage Summary



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

Discharge Summary

	Top of Pe	ermanent Pool:		87.32	m	1	Stage	т	(D0	Invert Elev	Diameter / Width
	Permanen	t Pool Volume:		0.0	m ³		Slage	13	he	(m)	(mm) (m)
	Active St	orage Volume:		710.8	m³		1	Orifice Plate:	Vertical	87.32	90
		0.11.1.0				-					
	Type	Diameter	Slope	Peak Flow	/ % Full	-					
	Type	Diamotor	Clope	1 GUILT ION	70 T Cli	1					
				St	age-Storage-	Discharge Su	Immary Tabl	e			
		Stage 1						Activo	Total		
Elevation	Stage	Orifice						Storage	Discharge		Notes
		Plate			-3/-			h o * m	34		
07.22	<u> </u>	0.000		r	n²/s			na*m	<u>m°/s</u>		
87.32	0.00	0.000						0.0000	0.000		
07.34	0.02	0.000						0.0000	0.000		
07.30	0.04	0.007						0.0000	0.001		
87.00	0.00	0.002						0.0002	0.002		
07.40	0.00	0.003						0.0003	0.003		
07.42	0.10	0.004						0.0008	0.004		
07.44	0.12	0.005						0.0012	0.005		
07.40	0.14	0.005						0.0015	0.005		
07.40	0.16	0.006						0.0018	0.006		
07.50	0.16	0.008						0.0021	0.006		
07.52	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		
07.02	0.30	0.009						0.0041	0.009		
87.64	0.32	0.009						0.0045	0.009		
87.00	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 n	n³ (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 n	n³ (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		

0.88

0.90

0.92

0.94

0.96

0.015

0.016

0.016

0.016

0.016

88.20

88.22

88.24

88.26

88.28

0.0420

0.0434

0.0447

0.0460

0.0474

0.015

0.016

0.016

0.016

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	m³/s	
88.30	0.98	0.016						0.0487	0.016	<= 25 Yr: 485 m ³ (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	ion Stormwater filtration technology to remove sediments, nutrients heavy metals, and organic contaminants from stormwater runof				
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/ft² 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/ ft² 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 ft².

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 ft³ 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 ft³ 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 ft² 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 \pm 0.8 lbs (2.91 \pm 0.01 lbs/ ft²) 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/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, 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.

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 um

Table 1: NJDEP PSD Specification



		Sample ID					
Mesh (mm)	US Sieve Size	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		46.6	46.7	46.7			
0.032		42.8	42.9	41.0			
0.021	e L	37.1	37.2	35.3			
0.0125	met	25.7	25.7	25.8			
0.0090	/dro	20.1	20.1	19.2			
0.0064	f	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.

Run	Max Flow (gpm)	Min Flow (gpm)	Average Flow (gpm)	Flow COV	Flow Com- pliance (COV< 0.1)	Maximum Temperature (Fahrenheit)	NJDEP Tem- perature 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

StormTech Isolator® Row PLUS Verification Statement



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 Re- moval 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 I	Mass Remove	ed (lb)			158.4		
		Total Mass L	oaded (lb)				195.2		
		Cumulative I		81.2					

Table 4: Removal Efficiency Results

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.

QC Parameter	Acceptance Criteria
Independence of observer	Confirmed in letter from Boggs Environmental Consult- ants, 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 Test- ing", 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

Table 5. Validation of QA/QC Procedures



	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 Envi- ronmental 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.

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% con- fidence 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

Table 6	- Summary of	Verification Results	Against	Performance	Parameters
	e annai y ei	· · · · · · · · · · · · · · · · · · ·	/ gamer	- en en an ee	. arametere



	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 config- uration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft ³ at a sed- iment depth of 0.5 inches.	N/A
Effective Sedimenta- tion/ Filtration Treat- ment 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 dimen- sions 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/ft²) (95% confidence lev- el)

*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 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:
StormTech, LLC. 520 Cromwell Avenue, Rocky Hill, CT 06067 USA t: +1-888-892-2694 e: info@stormtech.com w: www.stormtech.com	VerifiGlobal c/o ETA-Danmark A/S Göteborg Plads 1, DK-2150 Nordhaven t +45 7224 5900 e: info@verifiglobal.com w: www. verifiglobal.com
Signed for StormTech:	Signed for VerifiGlobal:
Original signed by:	Original signed by:
Greg Spires	Thomas Bruun
Greg Spires, P.E. General Manager	Thomas Bruun, Managing Director
	Original signed by:
	John Neate
	John Neate, Managing Director

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Isolator[®] Row PLUS 0&M Manual









THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS®

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.







THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS®


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		Sodimont Donth		
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)	(1)–(2)	Observations/Actions	Inspector
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	MCG
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

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Advanced Drainage Systems, Inc. 4640 Trueman Blvd., Hilliard, OH 43026 1-800-821-6710 www.ads-pipe.com