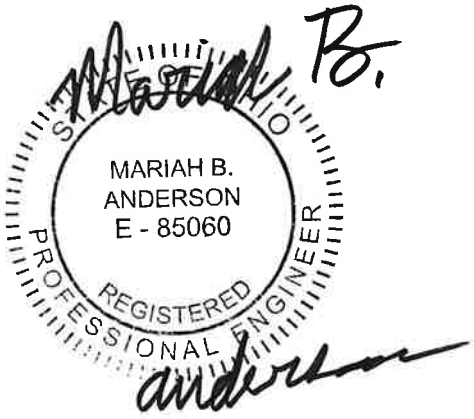
BRIDGE PARK BLOCKS H2 & H3

Stormwater Management Plan (SWMP)

Prepared For: Crawford Hoying

January 15, 2025



1/15/2025

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JN: 2023-0704

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PROJECT SUMMARY

Project Name:	Bridge Park Blocks H2 & H3
Location:	City of Dublin, Franklin County, Ohio
Type:	Stormwater Management Plan
Reviewing Agency:	City of Dublin, Ohio EPA

HYDROLOGIC SUMMARY

Rainfall Data: NOAA Atlas 14, Volume 2, Version 3, 2004

1-yr	2.20”
2-yr	2.63”
5-yr	3.24”
10-yr	3.74”
25-yr	4.44”
50-yr	5.02”
100-yr	5.63”

Rainfall Distribution:	NRCS Type II 24 hour
Detention Policy:	City of Dublin
Water Quality:	City of Dublin, Ohio EPA
Hydrology Modeling Program:	HydroCAD 10.20

DESIGN SUMMARY

Detention:	Not required due to location within “*Bridge Street District East A Exemption Area*”
Water Quality:	HydroChain and Aqua-Swirl Hydrodynamic Devices
Receiving Water Body:	Scioto River

REVISIONS

January 2025 Submittal: Addressed City of Dublin review comments by including full NJDEP certification letter with device sizing chart, as requested. Updated flood routing exhibit and storm calculations.

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EXHIBITS

1.0 INTRODUCTION

The following report provides a detailed analysis and design of the Stormwater Management Plan for Bridge Park Blocks H2 & H3. The proposed site is located north of Tuller Ridge Drive and south of John Shields Parkway. The Stormwater Management Plan was prepared in accordance with the requirements of both the City of Dublin and the Ohio EPA. The proposed development blocks (H2 and H3) will be routed to existing and proposed hydrodynamic devices for post-construction water quality control before discharging to the Scioto River which is located directly west of the site.

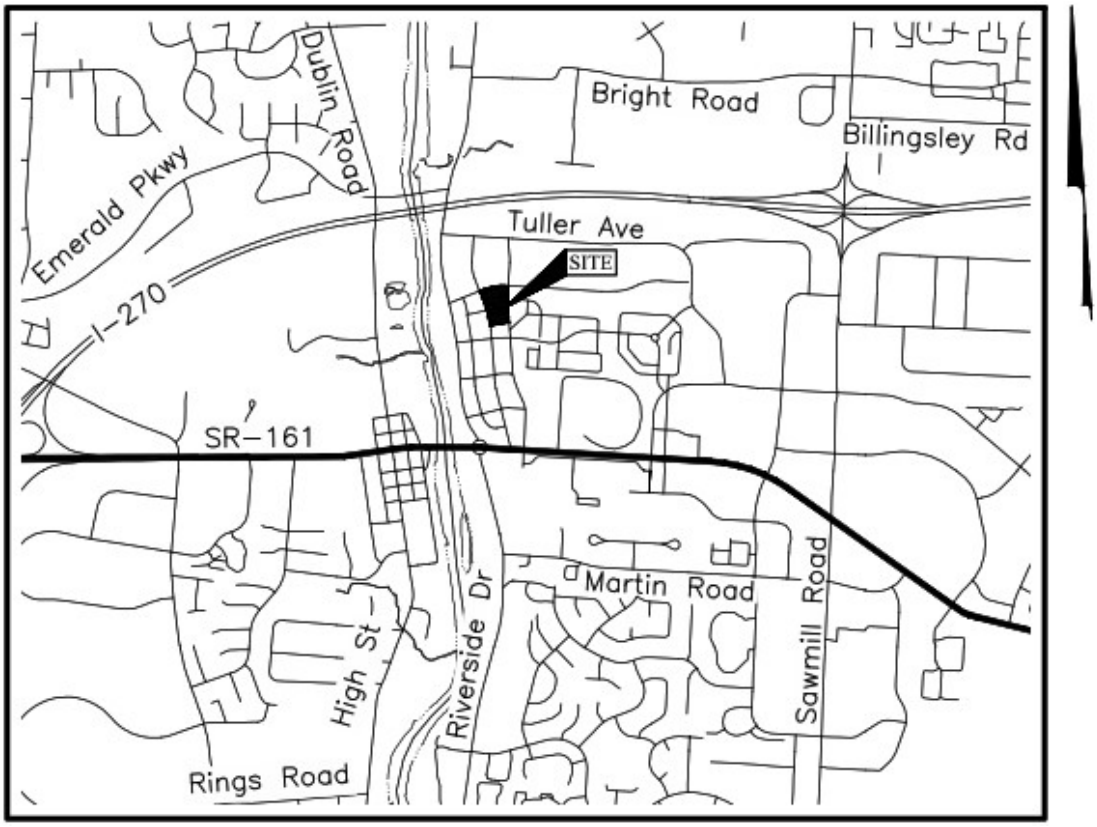

FIGURE 1-1
Site Location Map

2.0 HYDROLOGIC ANALYSIS

Hydrologic parameters such as Runoff Curve Number (RCN) and Time of Concentration were determined using standard Natural Resources Conservation Service (NRCS) methodology. The 1-, 2-, 5-, 10-, 25-, 50-, and 100-year storm event discharge amounts were calculated using the NRCS TR-55 method. This analysis reflects the NRCS Type II distribution, 24-hr storm duration. Rainfall depths were obtained from NOAA Atlas 14, Volume 2, Version 3, 2004. The peak flow rates were computed using the HydroCAD 10.20 computer program.

3.0 EXISTING CONDITIONS ANALYSIS

The existing condition, as seen on Exhibit 1 in Appendix E, consists of two subareas. Pre-developed 01 and Pre-developed 02 consist of open space area in Type "C" soils (Milton Silt Loam, Miamian Silt Loam, Kendallville Silt Loam). Pre-developed 01 also consists of existing impervious from the H1 development south of the proposed H2 development. Time of concentration calculations can be found in the HydroCAD output within Appendix D. The existing site characteristics are shown in Table 3-1.

TABLE 3-1
Existing Subarea Characteristics

Subarea Identifier	Tributary Area (acres)	Land Usage	Runoff Curve Number	% Impervious (%)	Time of Concentration (min)
Pre-developed 01	1.946	Open Space, Multi-family Residential Development (H1)	85	45%	8.5
Pre-developed 02	1.366	Open Space, Gravel	75	7%	8.8
Total	**3.313**	**-**	**81**	**29%**	**-**

The proposed development is located within the "*Bridge Street District East A Exemption Area*" and will not be required to provide stormwater quantity control. Since there is no detention requirement, no existing condition peak flow rate analysis has been performed.

4.0 PROPOSED CONDITIONS ANALYSIS

Exhibit 2, provided within Appendix E, shows the post-developed site condition which consists of a multi-family residential development. The proposed developments will utilize hydrodynamic devices to meet post-construction water quality requirements. Runoff from Subarea 01 will drain to the existing hydrodynamic device designed and constructed as part of the Block H1 development. Subarea 02 will have runoff directed to a proposed hydrodynamic device for water quality treatment. Subarea 01 corresponds to Blocks H1 and H2, Subarea 02 corresponds to Block H3. Undetained 01 consists of primarily open space with proposed sidewalks and will drain to existing storm sewers north of the site.

The proposed roadways (Larimer Street and Mooney Street) shown in Exhibit 2, between Subarea 01 and 02 and to the west of the proposed blocks are part of a separate stormwater management plan called "Bridge Park Block H-Public Roadways". All stormwater runoff from the project area eventually discharges directly to the Scioto River, situated west of the project area. The post-developed subarea characteristics are summarized in Table 4-1.

TABLE 4-1
Proposed Subarea Characteristics

Subarea Identifier	Tributary Area (acres)	Land Usage	Runoff Curve Number	% Impervious (%)	Time of Concentration (min)
Subarea 01	1.946	Multi-family Residential Development (H1 & H2)	94	83%	5.0
Subarea 02	0.965	Multi-family Residential Development (H3)	94	82%	5.0
Direct Release	0.402	Open space, Impervious cover	77	13%	5.0
Total	**3.313**	**-**	**92**	**74%**	**-**

5.0 OUTLET STRUCTURE DESIGN

Subareas 01 and 02 will utilize in-line hydrodynamic devices for water quality treatment. The existing and proposed in-line hydrodynamic device models have the ability to treat the first flush (water quality flow) while the peak design storm (100-yr) is diverted internally and channeled through the main conveyance pipe. The hydrodynamic device details will be provided upon final engineering. The control structures are described below.

Subarea 01 – Existing HD3 Aqua Swirl AS-4 Internal Bypass (BYP) Model

- 18-inch invert in/out – 821.25 ft.

*Subarea 02 – HD4 HydroChain Vortex Filter HCVF-12 Model**

- 12-inch invert in/out – 822.04 ft.

*Or approved equivalent for 80% TSS removal.

6.0 POST-CONSTRUCTION WATER QUALITY

Due to site constraints and insufficient room for a traditional water quality BMP, a proprietary flow-through device will be utilized as a supplemental BMP to assist with meeting the 80% TSS Removal requirement. The existing and proposed hydrodynamic devices will provide full treatment of Subareas 01 and 02. There is no drawdown requirement for this site due to the project directly discharging to the Scioto River. Water quality calculations are provided within Appendix C and summarized in Table 6-1 below.

To determine the required hydrodynamic device size and characteristics, the Rational Method was utilized to calculate the water quality flow rate, as specified by the OEPA NPDES Permit. The intensity was set based on the 0.90" water quality precipitation event, and the runoff coefficient utilized the time of concentration calculations provided in the HydroCAD output in Appendix D.

Subarea 01 will utilize the existing in-line Aqua-Swirl Internal Bypass AS-4 to treat the water quality flow from the tributary area. The AS-4 system was approved and installed with the Block H1 development and met 80% TSS removal during the submittal. Subarea 02 will utilize a HydroChain

Vortex Filter HCVF-12 (or approved equivalent for 80% TSS removal) to treat the water quality flow from the tributary area. The aforementioned water quality structures are appropriate for this application as the proposed water quality flow is less than the design capacity of the water quality structure (up to 3.2 cfs and 1.43 cfs for the AS-4 and HCVF-12, respectively). An Aqua-Swirl and HydroChain sizing chart is included in Appendix C for reference. Specification for the proposed water quality unit can be found in Bridge Park Blocks H2 & H3 plans.

TABLE 6-1
Hydrodynamic Device Sizing Calculations

Subarea Identifier	Tributary area (acres)	Calculated Water Quality Volume (ac-ft)	Water Quality Peak Flow (cfs)	Required Model
Subarea 01	1.946	0.116	2.93	AS-4
Subarea 02	0.965	0.057	1.43	HCVF-12

7.0 CONCLUSION

The proposed stormwater management plan for the Bridge Park Blocks H2 & H3 project meets all requirements for water quality as set forth by the City of Dublin and the Ohio EPA.

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APPENDIX A:

USDA Soils Report

Map Scale: 1:1,300 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Franklin County, Ohio
Survey Area Data: Version 14, Sep 22, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 4, 2014—Aug 27, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Franklin County, Ohio (OH049)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
KeB	Kendallville silt loam, 2 to 6 percent slopes	C	3.2	46.2%
MkB	Miamian silt loam, 2 to 6 percent slopes	C	2.6	38.5%
MoC2	Milton silt loam, 6 to 12 percent slopes, eroded	C	1.0	15.3%
Totals for Area of Interest			**6.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

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APPENDIX B:

Storm Sewer Calculations

REVISIONS

MARK	DATE	DESCRIPTION

CRAWFORD HOYING development

CITY OF DUBLIN, FRANKLIN COUNTY, OHIO
AMENDED FINAL DEVELOPMENT PLAN
FOR

BRIDGE PARK
BLOCKS H2 & H3
STORM SEWER TRIBUTARY MAP

EMHT
Evans, Mechwart, Hambleton & Tilton, Inc.
Engineers • Surveyors • Planners • Scientists
5500 New Albany Road, Columbus, OH 43054
Phone: 614.775.4500 Toll Free: 888.775.3648
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DATE
January 15, 2025

SCALE
1" = 30'

JOB NO.
20230704

SHEET
1/1

STORM SEWER COMPUTATION SHEET

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SHT 1

Project: **Block H2**
Job No.: **20230704**
Intensity Reference: Dublin

Date: 1/14/25
By: SLW
Checked:

Revised:
Revised:

2 Yr Design Storm n= **0.013**

Struc.	Struc. Index	Sta.	Drainage Area Trib	Cumul.	C	Cumul CA	Time Delta t Min.	Sum t Min.	Intensity in/hr	Des Q CFS	Length ft.	Dia. In	Slope %	Vel fps	Cap. Flowing Full	In	Out	TC	Remarks	10 YEAR HYDRAULIC GRADE LINE: 10 Yr Rainfall Intensity	Discharge Q	Slope %	Minor Losses	10 Yr HGL w/ minor losses
4	MH2	1+88.20	0.00	0.15	0.90		5.00	5.00	5.06	0.68						828.69		834.37						
Manhole Type C			0.15		0.90	0.14					66.52	12	1.50%	5.6	4.4				4.51 ft. cover	6.84	0.92	0.0668	0.0000	829.49
AA-S102																			5.68 ft. depth					ok
3	MH2	1+21.68	0.00	0.21	0.90		0.20	5.20	5.00	0.95						827.59	827.69	832.23	0.10 DROP					
Manhole Type C			0.06		0.90	0.19					29.74	12	0.95%	4.4	3.5				3.37 ft. cover	6.76	1.28	0.1278	0.0000	828.39
AA-S102																			4.64 ft. depth					ok
2	CB2	0+91.94	0.00	0.59	0.90		0.11	5.31	4.97	2.64						827.21	827.31	832.00	0.10 DROP					
Std. Catch Basin			0.38		0.90	0.53					55.20	12	1.50%	5.6	4.4				3.52 ft. cover	6.71	3.56	0.9954	0.0000	828.01
AA-S133A																			4.79 ft. depth					ok
1	CB2	0+36.74	0.00	0.73	0.90		0.17	5.48	4.93	3.24						826.28	826.38	832.00	0.10 DROP					
Std. Catch Basin			0.14		0.90	0.66					36.74	12	1.08%	4.7	3.7				4.45 ft. cover	6.65	4.37	1.4942	0.0000	827.08
AA-S133A																			5.72 ft. depth					ok
EX21	MH0	0+00.00	0.00	0.73	0.90		0.13	5.61	4.89	3.21						821.58	825.88	830.68	4.30 DROP					
Existing Manhole			0.00		0.90	0.66						18							3.63 ft. cover	6.60	4.33	0.1693	0.0000	822.78
																			9.10 ft. depth					ok
5	MH2	0+21.72	0.00	0.06	0.90		5.00	5.00	5.06	0.27						827.91		832.55	0.10 DROP					
Manhole Type C			0.06		0.90	0.05					21.72	12	1.00%	4.5	3.6				3.47 ft. cover	6.84	0.37	0.0107	0.0000	828.71
AA-S102																			4.64 ft. depth					ok
3	MH2	0+00.00	0.00	0.06	0.90		0.08	5.08	5.04	0.27						827.59	827.69	832.23	0.10 DROP					
Manhole Type C			0.00		0.90	0.05						12							3.37 ft. cover	6.81	0.37	0.0106	0.0000	828.39
AA-S102																			4.64 ft. depth					ok
TD1	TD	1+36.52	0.23	0.23	0.90		5.00	5.00	5.06	1.05						830.82		832.00	0.00 DROP					
Trench Drain			0.00		0.90	0.21					81.32	12	0.50%	3.2	2.5				0.01 ft. cover	6.84	1.42	0.1571	0.0000	831.62
																			1.18 ft. depth					ok
2	TD	0+55.20	0.00	0.38	0.90		0.42	5.42	4.94	1.69						830.41	830.41	832.00	0.00 DROP					
Trench Drain			0.15		0.90	0.34					55.20	12	0.50%	3.2	2.5				0.42 ft. cover	6.67	2.28	0.4075	0.0000	831.21
																			1.59 ft. depth					ok
1	TD	0+00.00	0.14	0.73	0.90		0.29	5.71	4.87	3.20						826.28	830.13	832.00	3.85 DROP					
Trench Drain			0.21		0.90	0.66						12							0.70 ft. cover	6.56	4.31	1.4541	0.0000	827.08
																			5.72 ft. depth					ok

STORM SEWER COMPUTATION SHEET

SHT 2

Project: **Block H3** Date: 1/14/25
Job No.: **20230704** By: SLW
Intensity Reference: Dublin Checked:
Revised:
Revised:

2 Yr Design Storm n= **0.013**

Struc.	Struc. Index	Sta.	Drainage Area Trib	Cumul.	C	Cumul CA	Time Delta t Min.	Sum t Min.	Intensity in/hr	Des Q CFS	Length ft.	Dia. In	Slope %	Vel fps	Cap. Flowing Full	In	Out	TC	Remarks	10 YEAR HYDRAULIC GRADE LINE: 10 Yr Rainfall Intensity	Discharge Q	Slope %	Minor Losses	10 Yr HGL w/ minor losses
12	MH2	2+91.47	0.00	0.14	0.90		5.00	5.00	5.06	0.64						829.10		836.37						
Manhole Type C			0.14		0.90	0.13					80.32	12	3.00%	7.9	6.2				6.11 ft. cover	6.84	0.86	0.0582	0.0000	829.90
AA-S102																			7.27 ft. depth					ok
11	MH2	2+11.15	0.00	0.28	0.90		0.17	5.17	5.01	1.26						826.59	826.69	833.68	0.10 DROP					
Manhole Type C			0.14		0.90	0.25					33.30	12	3.00%	7.9	6.2				5.82 ft. cover	6.77	1.71	0.2280	0.0000	827.39
AA-S102																			7.08 ft. depth					ok
10	CB2	1+77.85	0.00	0.86	0.90		0.07	5.24	4.99	3.86						825.49	825.59	831.60	0.10 DROP					
Std. Catch Basin			0.58		0.90	0.77					39.85	12	3.00%	7.9	6.2				4.84 ft. cover	6.74	5.22	2.1330	0.0000	826.29
AA-S133A																			6.11 ft. depth					ok
9	CB2	1+38.00	0.03	0.89	0.90		0.08	5.32	4.97	3.98						824.19	824.29	831.00	0.10 DROP					
Std. Catch Basin			0.00		0.90	0.80					22.76	12	4.79%	10.0	7.8				5.54 ft. cover	6.71	5.37	2.2613	0.0000	824.99
AA-S133A																			6.81 ft. depth					ok
8	MH2	1+15.24	0.00	0.89	0.90		0.04	5.36	4.96	3.97						823.00	823.10	829.26	0.10 DROP					
Manhole Type C			0.00		0.90	0.80					34.76	12	2.76%	7.6	5.9				4.99 ft. cover	6.69	5.36	2.2511	0.0000	823.80
AA-S102																			6.26 ft. depth					ok
7	MH2	0+80.48	0.00	0.89	0.90		0.08	5.44	4.94	3.95						822.04	822.04	826.99	0.00 DROP					
Manhole Type C			0.00		0.90	0.80					70.39	12	1.52%	5.6	4.4				3.78 ft. cover	6.66	5.34	2.2306	0.0000	822.84
AA-S102																			4.95 ft. depth					ok
6	CB2	0+10.09	0.40	1.29	0.90		0.21	5.65	4.88	5.67						818.02	820.97	826.00	2.95 DROP					
Std. Catch Basin			0.00		0.90	1.16					10.09	12	3.00%	7.9	6.2				3.86 ft. cover	6.58	7.64	4.5721	0.0000	818.82
AA-S133A																			7.98 ft. depth					ok
EX17	MH0	0+00.00	0.00	1.29	0.90		0.02	5.67	4.88	5.66						815.69	817.72	827.61	2.03 DROP					
Existing Manhole			0.00		0.90	1.16						36							8.59 ft. cover	6.57	7.63	0.0130	0.0000	818.09
																			11.92 ft. depth					ok
13	CB2	0+87.47	0.00	0.58	0.90		5.00	5.00	5.06	2.64						826.46		831.60						
Std. Catch Basin			0.58		0.90	0.52					87.47	12	1.00%	4.5	3.6				3.97 ft. cover	6.84	3.57	0.9989	0.0000	827.26
AA-S133A																			5.14 ft. depth					ok
10	CB2	0+00.00	0.00	0.58	0.90		0.32	5.32	4.97	2.59						825.49	825.59	831.60	0.10 DROP					
Std. Catch Basin			0.00		0.90	0.52						12							4.84 ft. cover	6.71	3.50	0.9609	0.0000	826.29
AA-S133A																			6.11 ft. depth					ok
14	MH2	0+22.46	0.00	0.06	0.90		5.00	5.00	5.06	0.27						826.91		833.77						
Manhole Type C			0.06		0.90	0.05					22.46	12	1.00%	4.5	3.6				5.69 ft. cover	6.84	0.37	0.0107	0.0000	827.71
AA-S102																			6.86 ft. depth					ok
11	MH2	0+00.00	0.00	0.06	0.90		0.08	5.08	5.04	0.27						826.59	826.69	833.68	0.10 DROP					
Manhole Type C			0.00		0.90	0.05						12							5.82 ft. cover	6.81	0.37	0.0106	0.0000	827.39
AA-S102																			7.08 ft. depth					ok
13	TD	0+87.47	0.50	0.58	0.90		5.00	5.00	5.06	2.64						830.50		831.60						
Trench Drain			0.08		0.90	0.52					87.47	12	1.00%	4.6	3.6				ft. cover	6.84	3.57	0.9989	0.0000	831.30
																			1.10 ft. depth					ok
10	TD	0+00.00	0.00	0.58	0.90		0.32	5.32	4.97	2.59						825.49	829.62	831.60	4.13 DROP					
Trench Drain			0.00		0.90	0.52						12							0.81 ft. cover	6.71	3.50	0.9609	0.0000	826.29
																			6.11 ft. depth					ok

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APPENDIX C:

Water Quality Calculations

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A legacy of **experience**. A reputation for **excellence**.

BLOCKS H1 & H2 (2023-0704) - HD3

HYDRODYNAMIC UNIT		
C =	0.64	
Tc =	5.00	minutes
intensity =	2.37	in/hr
Water Quality Flow =	2.93	cfs

C = runoff coefficient (calculated using the ASCE method)

$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$

WATER QUALITY VOLUME CALCULATIONS

BMP	Subarea Identifier	Area (acres)	Percent Impervious (%)	Rv	Water Quality Volume (ac-ft)	Water Quality Volume Elevation (feet)
HD3	Subarea 01	1.95	83%	0.80	0.116	-
	Total	**1.95**	**83%**	**0.80**	**0.116**	-

Water Quality Volume calculated using the Ohio EPA formula:

$$WQ_v = \frac{R_v \times P \times A}{12}$$

where:

A = area draining into the BMP (acres)

P = 0.90" precipitation depth

Rv = the volumetric runoff coefficient

Rv = 0.05+0.9i

Where i = fraction of post-construction impervious surface

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A legacy of **experience**. A reputation for **excellence**.

BLOCKS H2 & H3 (2023-0704) - HD4

HYDRODYNAMIC UNIT		
C =	0.62	
Tc =	5.00	minutes
intensity =	2.37	in/hr
Water Quality Flow =	1.43	cfs

C = runoff coefficient (calculated using the ASCE method)

$$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

WATER QUALITY VOLUME CALCULATIONS

BMP	Subarea Identifier	Area (acres)	Percent Impervious (%)	Rv	Water Quality Volume (ac-ft)	Water Quality Volume Elevation (feet)
HD4	Subarea 02	0.97	82%	0.79	0.057	-
	Total	**0.97**	**82%**	**0.79**	**0.057**	-

Water Quality Volume calculated using the Ohio EPA formula:

$$WQ_v = \frac{R_v \times P \times A}{12}$$

where:

A = area draining into the BMP (acres)

P = 0.90" precipitation depth

Rv = the volumetric runoff coefficient

Rv = 0.05+0.9i

Where i = fraction of post-construction impervious surface

Aqua-Swirl™ Sizing Chart

Aqua-Swirl™ Model	Swirl Chamber Diameter (ft.)	Maximum Stub-Out Pipe Outer Diameter (in.)		Water Quality Treatment Flow[2] (cfs)	Oil/Debris Storage Capacity (gal)	Sediment Storage Capacity (ft^3)
		On/Offline	BYP[1]			
AS-2	2.50	8	15	1.1	37	10
AS-3	3.25	10	21	1.8	110	20
AS-4	4.25	12	27	3.2	190	32
AS-5	5.00	12	30	4.4	270	45
AS-6	6.00	14	36	6.3	390	65
AS-7	7.00	16	42	8.6	540	90
AS-8	8.00	18	48	11.2	710	115
AS-9	9.00	20	>48 *	14.2	910	145
AS-10	10.0	22	>48 *	17.5	1130	180
AS-11	11.0	24	>48 *	21.2	1422	222
AS-12	12.0	26	>48 *	25.2	1698	270
AS-13	13.0	28	>48 *	29.6	1986	310
AS-XX	Custom	--	--	>26 **	--	--

*** See Representative for larger pipe diameters available **Higher water quality treatment flow rates can be designed with multiple swirls.**

1) *The **Aqua-Swirl™ Internal Bypass (BYP)** provides full treatment of the "first flush," while the peak design storm is diverted and channeled through the main conveyance pipe. Please refer to your local representative for more information.*

2) *Many regulatory agencies are establishing "water quality treatment flow rates" for their areas based on the initial movement of pollutants into the storm drainage system. The treatment flow rate of the Aqua-Swirl™ system is engineered to meet or exceed the local water quality treatment criteria. This **"water quality treatment flow rate"** typically represents approximately 90% to 95% of the total annual runoff volume.*

The design and orientation of the Aqua-Filter™ generally entails some degree of customization. For assistance in design and specific sizing using historical rainfall data, please refer to an AquaShield™ representative or visit our website at www.AquaShieldInc.com. CAD details and specifications are available upon request.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
PHILIP D. MURPHY
Governor
SHEILA Y. OLIVER
Lt. Governor
DIVISION OF WATERSHED PROTECTION AND RESTORATION
BUREAU OF NJPDES STORMWATER PERMITTING & WATER QUALITY MANAGEMENT
P.O. Box 420 Mail Code 501-02A
Trenton, New Jersey 08625-0420
609-633-7021 / Fax: 609-777-0432
www.njstormwater.org
SHAWN M. LATOURETTE
Commissioner

May 5, 2023

Jim Merchlewitz
Business Development Manager
Xerxes
7901 Xerxes Avenue South, Suite 201
Minneapolis, MN 55431

Re: MTD Lab Certification
HydroChain™ Vortex Filter (HCVF)
Online Installation

TSS Removal Rate 80%

Dear Mr. Merchlewitz:

This revised certification supersedes the Department's prior certification dated February 11, 2022. This revision was completed as a result of a change to the company name (formerly Shawcor) and the development of an updated maintenance manual. No other modifications were made to this certification.

The Stormwater Management rules under N.J.A.C. 7:8-5.2(f) and 5.2(j) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Xerxes has requested a Laboratory Certification for the HydroChain™ Vortex Filter (HCVF).

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated February 2022) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the HCVF by Xerxes at a TSS removal rate of 80% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 8.24 gpm/ft^2 of effective filtration treatment area.

2. The HCVF shall be installed using the same configuration reviewed by NJCAT, and sized in accordance with the criteria specified in item 6 below.

3. This device cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 11.3 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the HCVF. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at https://cdn.shawcor.com/shawcor/files/c3/c37793ad-4ee2-4df2-a91f-6c53f5a8fa52.pdf for any changes to the maintenance requirements.

6. Sizing Requirement:

   The example below demonstrates the sizing procedure for the HCVF:

   Example: A 0.25-acre impervious site is to be treated to 80% TSS removal using an HCVF. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

   The selection of the appropriate model of an HCVF is based upon both the maximum inflow drainage area and the MTFR. It is necessary to calculate the required model using both methods and to use the largest model determined by the two methods.

   Inflow Drainage Area Evaluation:

   The drainage area to the HCVF in this example is 0.25 acres. Based upon the information in Table 1 below, one HCVF-5 model with 6 HCFC-5 filter cartridges would be the smallest model able to treat the runoff without exceeding the maximum allowable drainage area of the model selected.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i = 3.2 in/hr (page 74, Fig. 5-16 of Chapter 5 of the NJ Stormwater BMP Manual)
   c = 0.99 (runoff coefficient for impervious)
   Q = ciA = 0.99 x 3.2 x 0.25 = 0.79 cfs (354.58 gpm)
   (Note: 1 cfs = 448.83 gpm)

Given the site runoff is 0.79 cfs and based on Table 1 below, one HCVF-9 model with 18 HCFC-5 filter cartridges could be used to treat the impervious area without exceeding the MTFR of the individual model.

The MTFR evaluation results will be used since that method results in the highest minimum configuration determined by the two methods.

The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the NJCAT Verification Report in the Verification Appendix under Tables A-1 and A-2.

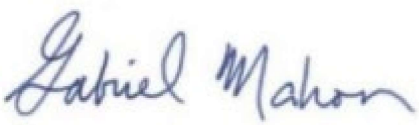
Table 1. HydroChain™ Vortex Filter Model MTFRs and Maximum Allowable Drainage Area.

HCVF Model	Manhole Diameter (ft)	Filter Cartridges Model	No. of Cartridges	MTFR (cfs)	Maximum Allowable Drainage Area (acres)
HCVF-4	4	HCFC-4	4	0.119	0.20
HCVF-5	5	HCFC-5	6	0.268	0.44
HCVF-6	6	HCFC-5	7	0.313	0.51
HCVF-7	7	HCFC-5	8	0.358	0.59
HCVF-8	8	HCFC-5	12	0.537	0.88
HCVF-9	9	HCFC-5	18	0.805	1.32
HCVF-10	10	HCFC-5	20	0.895	1.47
HCVF-12	12	HCFC-5	32	1.43	2.35

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Lisa Schaefer of my office at lisa.schaefer@dep.nj.gov.

Sincerely,



Gabriel Mahon, Chief
Bureau of NJPDES Stormwater Permitting & Water Quality Management
Division of Watershed Protection and Restoration
New Jersey Department of Environmental Protection

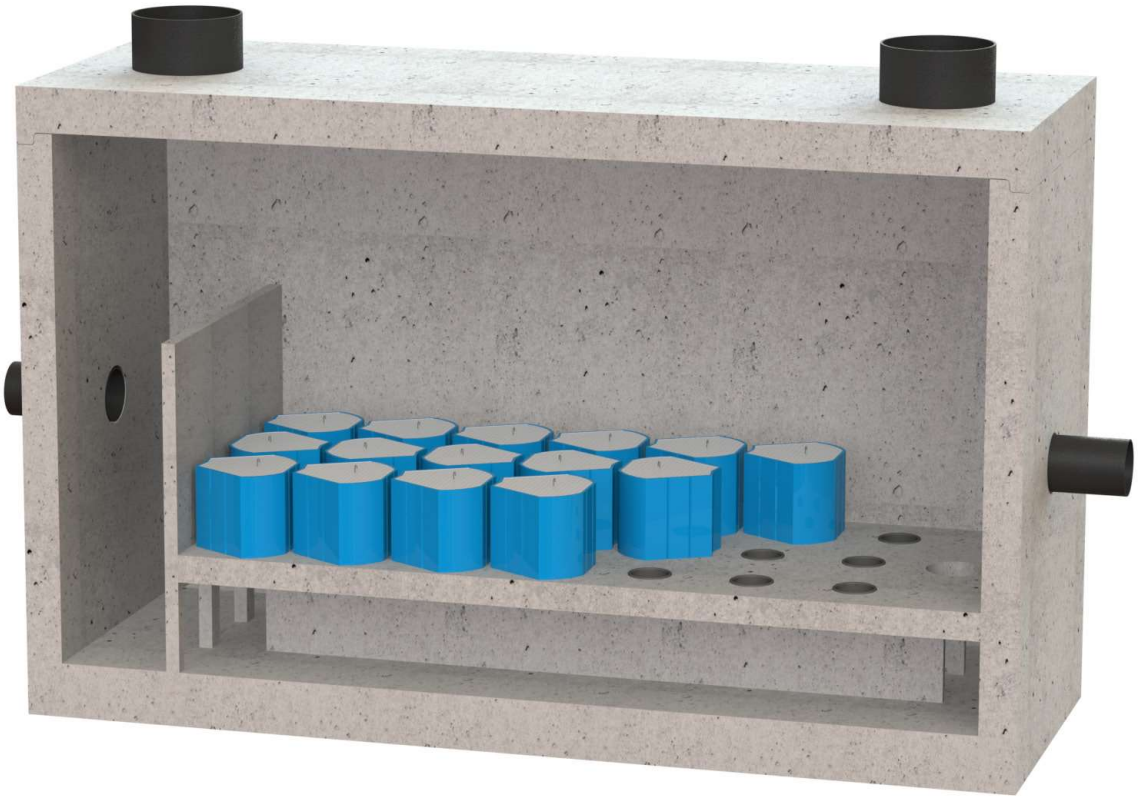
Attachment: Maintenance Plan

cc: Richard Magee, NJCAT

XERXES®

HydroChain™ Vortex Filter & Cartridges Manual

For Installation, Operation & Maintenance in Concrete Manholes & Vaults



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HOW THE VORTEX FILTER WORKS

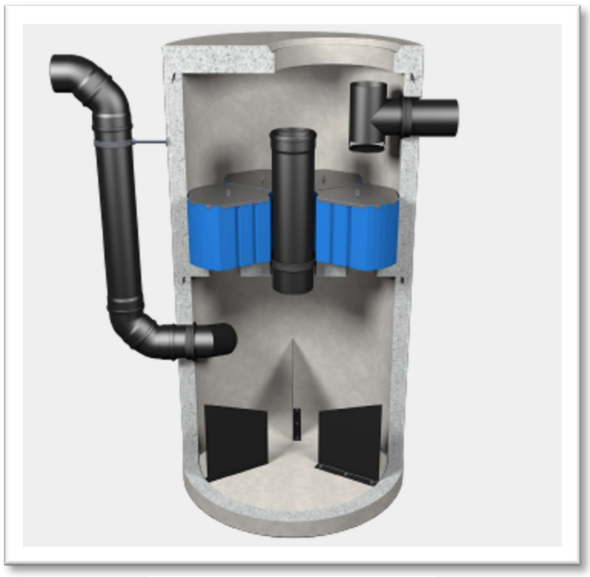

IMAGE 1

1. The stormwater feeds into the lower end of the filter housing, or the bottom of the manhole or tank. The angled inlet pipe generates a radial flow pattern.
2. The hydrodynamic separator shifts turbulent stormwater into a radial laminar flow, which generates particle sedimentation.
3. The larger particles settle at the bottom of the housing, manhole or tank. Suspended and settled solids are periodically cleaned out.
4. In the central section of the unit, the Filter Cartridges filter out fine particles in an upward flow process. The majority of dissolved pollutants are precipitated and adsorbed.
5. The Filter Cartridges can be flushed from street level and, when needed, are easily exchanged. The cartridges are easily removed (with lifting eyes) through the access opening.
6. The clean water (above the filter elements) passes through an oil separator and flows through the outlet pipe into the groundwater or surface water.

EASY INSTALLATION STEPS

1. Install flow breakers (manhole only)
2. Connect Inlet piping
3. Install Filters
4. Install Internal Piping
5. Connect Outlet Piping

NOTE TO CONTRACTING INSTALLER:

Before beginning the installation, read through this entire document. Keep this document at the work site to refer to safety procedures as needed. It is the contractor's responsibility to ensure that all the correct piping components required by product and site drawings have been ordered and are at the site before installation begins.

SECTION 1: INTRODUCTION

1. These instructions relate to installing, operating and maintaining the Vortex Filter and Filter Cartridges.
2. Compliance with this manual is necessary for the proper handling, installation, maintenance, inspection and operation of these products.
3. It is the responsibility of the project owner and the installing contractor performing the installation to understand and follow all requirements contained in this document (the edition in effect at the time of installation), and to comply with all federal, state or provincial, and local safety regulations that apply.

NOTE: The presence of our representative does not relieve the installer of having sole responsibility for proper installation.

4. No instructions or procedures presented in this manual should be interpreted so as to put at risk any person's health or safety, or to harm any property or the environment.
5. Work must be performed according to standard industry practices applicable to this installation and product operation.
6. Work must comply with all relevant codes, regulations and standards of appropriate governmental agencies, such as:
   - construction, health, safety and environmental codes
   - industry standard practices
   - confined space entry
7. Governmental agency codes, regulations and standards always take precedence over our requirements.
8. Any variation to, or deviation from, these instructions must be approved in writing from us prior to installation.
9. Failure to comply with this document will void our obligations under the applicable limited warranty.
10. If project requirements exceed any of our requirements, the project engineer must consult with our engineers by contacting us at stormwater.eng@shawcor.com for approval.
11. For questions regarding the interpretation of these instructions or for any other technical inquiries, contact us at stormwater.eng@shawcor.com.

SECTION 2: PRODUCT DELIVERY AND INSPECTION

12. Check the delivery against the project order. If any components are missing, contact your sales representative.
13. Every Vortex Filter for a manhole includes the following components **(See IMAGE 1.):**
    - Filter cartridges
    - Gaskets
    - Flow breakers
14. Filter Cartridges for a vault includes the following:
    - Filter Cartridges
    - Gaskets

NOTE: For both manholes and vaults, piping and anchors will be supplied either by us, the contractor or the precaster.

15. Visually inspect the Vortex Filter – both the interior and exterior – and/or the Filter Cartridges to make sure that no shipping or handling damage has occurred. Look particularly for visible damage, cracks or deep scrapes.

NOTE: Do not attempt any repairs. If damage is detected, contact your sales representative.

SECTION 3: HANDLING AND LIFTING THE VORTEX FILTER AND FILTER CARTRIDGES

NOTE: Protect the filters from dirt and debris at all times. Store and install filters and gaskets at temperatures between 40-110° F / 4-44° C.

16. Before unloading the Vortex Filter and Filter Cartridges when they are delivered, select a smooth, solid, level area on which to place them, and clear that area of all large rocks, trash and debris.

NOTICE

The installer must take care so that the Vortex Filter or Filter Cartridges are not rolled, dropped or damaged during loading, unloading, handling and installing as this could result in damage to the product.

17. Use the lifting lug on top of each Filter Cartridge when handling it. **See IMAGE 2.**

NOTE: Each Filter Cartridge weighs about 150 pounds.

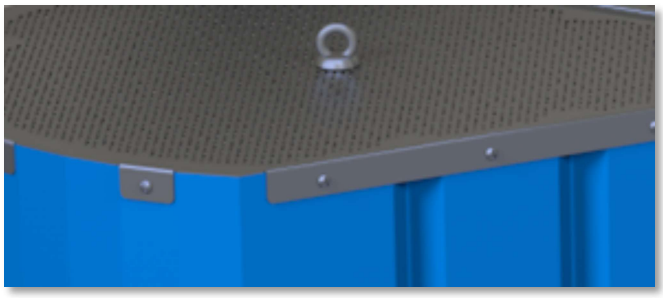

IMAGE 2

⚠ CAUTION
While moving or lifting the Vortex Filter or Filter Cartridges, do not position any part of your body underneath it. Failure to follow this caution could result in minor or moderate injury.

SECTION 4: PREPARING THE EXCAVATION AND THE MANHOLE OR VAULT

⚠ WARNING
Working in and around excavations is dangerous. Follow all OSHA and/or Canadian regulations related to excavations. Collapse of excavation walls could result in death or serious injury.

⚠ WARNING
Careless activity or reckless operation of equipment can cause death, serious injury or property damage.

18. Locate the excavation location according to the project's site plan.
19. Prepare the excavation according to the site requirements and standard industry practices.
20. Make sure excavation walls are supported according to applicable industry and regulatory requirements.
21. Install the concrete manhole or vault according to its manufacturer's instructions.
22. Before installing the manhole or vault, make sure that the piping openings, such as bypass and internal piping, weirs and baffles correspond to the product and/or system drawings.

NOTE: The bottom of the outlet pipe tee must be at least 10 inches above the top of the Filter Cartridge.

SECTION 5: INSTALLING A VORTEX FILTER IN MANHOLE OR FILTER CARTRIDGES IN VAULT

NOTE: Protect the filters from dirt and debris during installation.

23. In a manhole installation, install the flow breakers. The flow breakers are to be spaced at 120 degrees from each other. Each flow breaker has 3 predrilled holes. Attach the flow breakers to the wall of the manhole, with a 3/8"-diameter concrete anchor. **See IMAGE 3.**

IMAGE 3

24. In manhole installations, connect the inlet piping and make sure the 90-degree elbow of the piping inside the manhole is oriented in a horizontal (not vertical) plane.
25. For a vault installation follow the shop drawings, typically there is not a horizontal interior bend for the inlet pipe.
26. Seal the inlet connection with non-shrink grout or other industry-standard watertight connection.
27. The inlet should be just above the flow breakers. Seal the connection by applying non-shrink grout or another industry-standard watertight seal.

NOTE: Alternatively, the engineer may recommend using a watertight connection.

NOTE: Be sure the piping joint is tightly sealed.

28. In a manhole installation, place the top section of the manhole on the bottom section. The top section will have the filter platform.
29. Install the gaskets into the preformed holes on the filter platform in the manhole or vault platform according to the product and/or system drawings. **See IMAGE 4.**

NOTE: We recommend lubricating the gaskets with soapy water to allow for easier insertion.

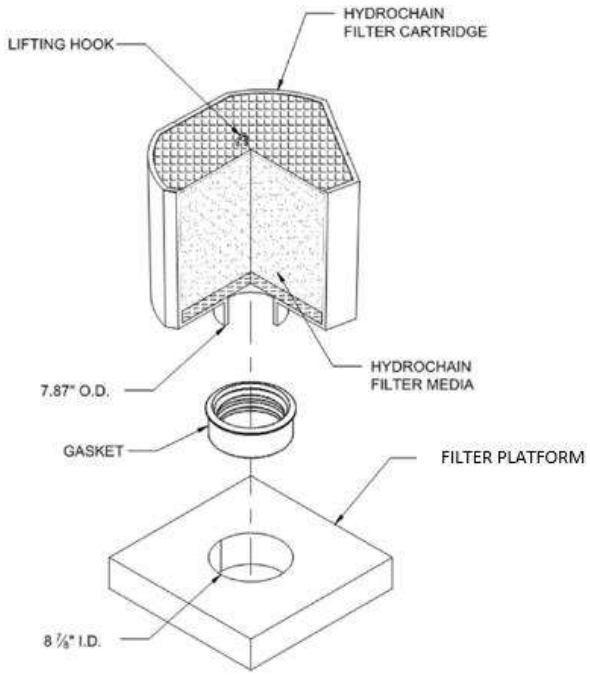

IMAGE 4

30. Make sure the gasket lip is on the top of the preformed hole.
31. When the filters are placed in a circular configuration, place the gasket for the center pipe now. The center pipe gasket size will be called out on the shop drawing and is not included when the Vortex Filter or Filter Cartridges are shipped.

NOTE: Each new Filter Cartridge weighs approximately 150 lbs.

32. Install Filter Cartridges by lowering each one into the structure with a davit crane connected to the filter's lifting ring. **See IMAGE 5.**

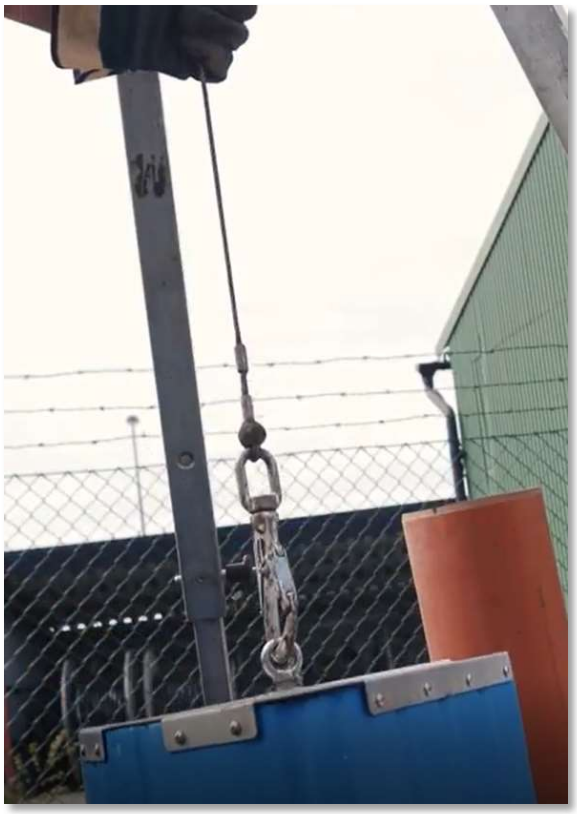

IMAGE 5

NOTE: The Filter Cartridges are held in place by their own weight. No anchors are needed. Check to make sure the Filter Cartridges are level.

33. When all Filter Cartridges have been installed, insert the outlet pipe tee.

NOTE: So the filters don't become clogged during installation, we recommend covering them at all times to protect them from dirt, joint sealer and mortar, etc. This will eliminate the need to clean or replace them.

34. Push the outlet pipe tee through the outlet opening. Seal the connection with non-shrink grout or other industry-standard watertight seal.

NOTE: Alternatively, the engineer may recommend using a watertight connection instead.

NOTE: Be sure the piping joint is tightly sealed.

35. Use a pipe ring, connecting dowel and anchor plate (provided by others) to secure the pipe tee to the interior of the concrete manhole or vault.

NOTE: We recommend installing the pipe ring on the upper portion of the pipe tee. This will allow for easy removal during maintenance.

36. If outlet piping is completed now, complete the connection to the storm sewer, which can be done with a coupler.
37. Install bypass and internal piping per the product and/or system drawings.

NOTE: The bottom of the site invert piping must be at least 10 inches above the bottom of the outlet piping.

38. In a manhole installation, complete the inlet piping on the outside of the manhole.
    - Connect appropriate pipe elbows on the outside of the manhole inlet connection so the piping orientation is vertical.
    - Extend the vertical inlet pipe to the required top height per site plans and install the final pipe bend so it is in the horizontal position when connected to the existing storm sewer.
    - Connect the vertical inlet piping to the exterior manhole or vault with the anchor and pipe ring (provided by others).

NOTE: The connection to the storm sewer can be made with a coupler.

39. In a vault installation, complete the inlet piping connection to storm sewer per site and product and/or system drawings.
40. If the outlet piping connection to storm sewer has not been completed, do that now.
41. Continue assembling the manhole or vault.
42. Backfill the excavation hole according to project specifications.

SECTION 6: INSPECTION, MAINTENANCE AND CLEANING

NOTE: Inspecting, maintaining and cleaning Vortex Filters in a manhole and Filter Cartridges in a vault generally do not involve confined space entry. Consult system product and/or system drawings to determine whether entry is necessary.

⚠ WARNING

If entering a manhole or vault is required, follow applicable OSHA and Canadian regulations related to confined space entry. Failure to follow this warning could result in death or serious injury.

GENERAL

43. The owner is responsible for determining the inspection and maintenance schedule.

NOTE: Refer to the project drawings for the system's vault or manhole configuration when establishing an inspection and maintenance schedule. Contact the design engineer to obtain drawings.

44. We also recommend that the site owner establish an inspection and maintenance schedule based on the following factors:
    - Manhole or vault size
    - Site and environmental conditions
    - Drainage area
    - Annual rainfall
    - Volume of stormwater runoff
    - Volume of sediment, dirt, debris and trash entering the system
    - Volume and type of pollutants collected
45. We recommend that following installation, the system be inspected a minimum of every 6 months. To ensure that the system is functioning as designed, we recommend inspecting the system immediately after the first major rainfall or storm event following installation. Inspection may then be increased or decreased based on the project drawings and the factors listed above.
46. We recommend that the system be cleaned at regular intervals. Typically, the manhole or vault structure is emptied of sludge every three to six years. Cleaning may be required more or less frequently depending on the factors listed above.

NOTE: Filters can be functional up to 10 years from initial installation if properly flushed and maintained. Depending on the volume of sediment and pollutants, filters need to be flushed (or replaced) every 3 to 6 years. We recommend flushing filters no more than twice.

47. The site owner is responsible for creating, recording and retaining inspection and maintenance records in accordance with their own site requirements and applicable regulations. The log at the end of this manual is provided only as an example.

NOTE: Proper and optimum operation of the Vortex Filter and Filter Cartridges requires following these recommended inspection, maintenance and cleaning guidelines.

NOTE: Exceeding the recommended maximum volume of suspended solids and hydrocarbons will jeopardize the effectiveness of the filters.

INSPECTION PROCEDURE

48. Visually inspect the Vortex Filter or Filter Cartridges at each access point. **See IMAGE 1** for example of manhole configuration. **See IMAGE 6** for example of vault configuration.

IMAGE 6

49. Remove the access cover and record the inspection location.
50. Visually inspect for floating waste to determine if maintenance is required.
51. If there is floating waste, remove it.
52. Visually inspect the bypass system, such as bypass and internal piping, weirs and baffles.
53. If the water level rises above the center bypass pipe, it indicates that the system is clogged, and maintenance and/or cleaning of the filters and/or manhole is required.
54. Sediment visibly accumulating on top of the Filter Cartridges is also an indication that the system is clogged and cleaning of the filters and/or manhole is required.
55. A sheen of free oil floating above the filters indicates a possible oil spill, for which maintenance is required.

NOTE: If the system is inspected when there are no flows, unless the filters are completely clogged the height of the water level will be the same across the bypass pipe and outlet. This should not be considered a definitive sign that the system is fully functioning, and periodic maintenance is still required to maintain system performance.

56. To determine the level of standing water and accumulated sediment, follow this procedure:
    - Measure the distance between the top of the access riser and the top of the standing water. This is measurement #1.
    - Measure the distance between the top of the access riser to the top of the sediment in the lower chamber. This is measurement #2.
    - Measure the distance between the top of the access riser and the floor of the manhole or vault. This is the measurement #3.

NOTE: One method to determine measurements #2 and #3 is to lower a stadia rod towards the bottom of the manhole or vault until resistance is encountered. If sediment has collected, this is the top of the collected sediment (#2). Push the stadia rod through the sediment to the manhole or vault floor (#3).

57. Subtract measurement #2 from #3. If the value is greater than 20 inches, it indicates that maintenance and/or cleaning of the manhole or vault is required.
58. Replace the access cover.
59. Record recommended or required maintenance on the inspection and maintenance log (provided by site owner).

MAINTENANCE AND CLEANING PROCEDURES

NOTE: We recommend using a pump-out vehicle equipped with suction and flushing capabilities, or a submersible sediment (sludge) pump with hoses, such as a hydrovac truck. A truck with sufficient storage capacity is necessary in order to remove floatables, standing water and sediment.

NOTE: For a vault installation, a separate truck may be required to remove the standing water before cleaning.

60. Before beginning maintenance and cleaning, review the inspection record to see recommended or required maintenance, and the amount of standing water and sediment to be removed.
61. Determine the standing water volume to be removed.

NOTE: In a vault installation, use the following formula to determine the volume:

- In U.S. installations, standing water volume in gallons = vault width (feet) x vault length (feet) x standing water depth (feet) x 7.48 (this equals XX cubic feet)
- In Canadian installations, standing water volume in liters = vault width (meters) x vault length (meters) x standing water depth (meters) x 1000 (this equals xx cubic meters).

62. Determine the equipment needed for maintenance and cleaning.
63. If the filters are to be cleaned onsite:
    - Place a flushing washtub close to the manhole or vault excavation.
    - Prepare a clean protected area to hold the cleaned cartridges before re-installation.

NOTE: Flushing washtubs can be purchased by contacting us at watersales@shawcor.com. **See IMAGE 7.**

IMAGE 7

64. To begin maintenance and cleaning, remove each access cover.
65. Suction out the water in the manhole or vault until the water level is below the filter platform. When the filters need to be cleaned, this allows them to drain (and be lighter in weight) for easier removal. **See IMAGE 8.**

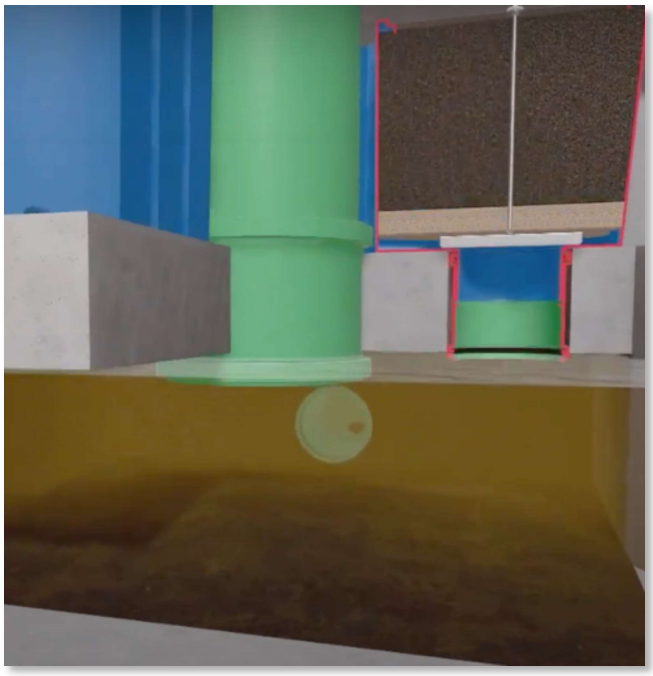

IMAGE 8

66. To remove the accumulated sediment from the bottom of the chamber, insert a suction hose in the bypass piping and suction out all sediment and remaining water from below the filter platform. **See IMAGE 9.**

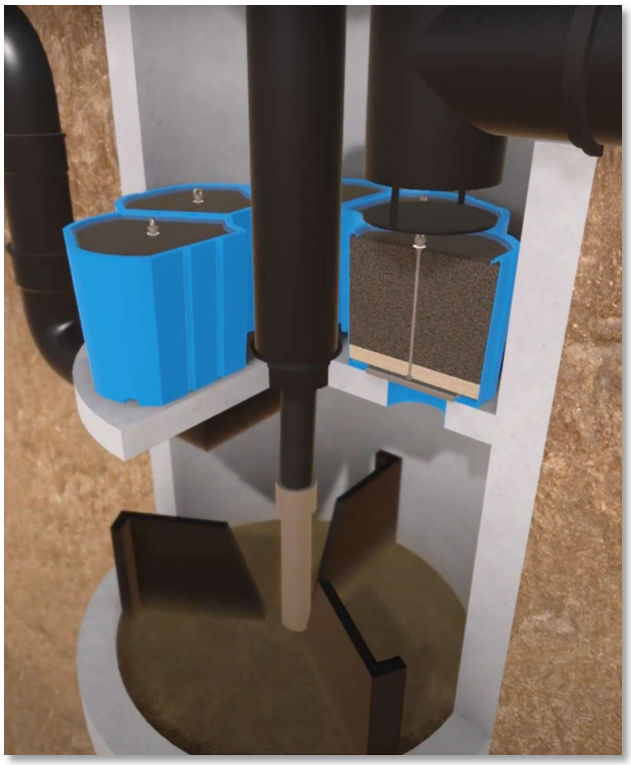

IMAGE 9

67. If cleaning of the manhole/vault or flushing of the filters is required in addition to removing the accumulated sediment, remove each filter with a davit crane connected to the filter's lifting ring. If undamaged, the filter gaskets may be reused. If damaged, purchase new gaskets by contacting us at watersales@shawcor.com.

NOTE: Each filter weighs approximately 200 pounds when saturated with trapped pollutants.

68. To clean the chamber after removing the filters, use a hose with a spray nozzle to power wash the walls and floors of the manhole or vault above and below the filter platform. Water accumulating during the cleaning process may need to be removed periodically before the entire chamber is cleaned.

NOTE: For vaults, we recommend using a nozzle with a 36-42" spray width and pressure of 1000-2000 psi.

69. To clean filters onsite, install saturated filters into the flushing washtub and prime the washtub with water and pressurized air.
70. Flush the filters in the washtub with alternately cycles of water and air, releasing solids and oils upward out of the filter media. Repeat this process until the water flushed through the filter appears clear, which typically takes 5-15 minutes. **See IMAGE 10** (on the left: sediment being flushed out, on the right: oil being flushed out).

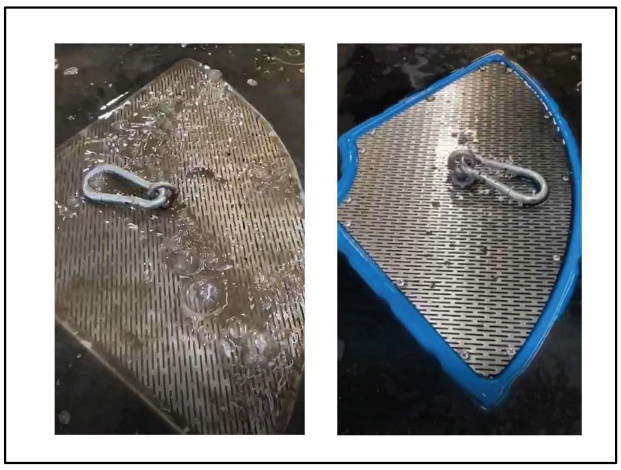

IMAGE 10

71. Drain the flushing washtub of entrained water and remove the flushed filter, placing it in a clean, protected area free of sediment and debris until it can be reinstalled in the filter plate.

NOTE: Dispose of the pollutants per applicable regulations.

72. Repeat the flushing process for each saturated filter.
73. When the filters have been flushed and the manhole or vault has been cleared of sediment and cleaned, reinstall the filters with the proper orientation and gaskets following the installation instructions above.

NOTE: There is no manifold system below the filters, simply reinsert them into their existing orifices, making sure the gasket is still in place.

74. Once the cartridges are reinstalled, reinstall any remaining piping (for example, the outlet pipe tee).
75. Close and lock the access covers.
76. Dispose of all removed water and waste material in accordance with applicable regulations.
77. Record details of maintenance performed in the inspection, maintenance and cleaning log provided by the site owner.

SAMPLE INSPECTION AND MAINTENANCE RECORDS LOG

SITE DATA

Site Owner	
Site Address	
Type of Treatment	
Product Number and Order Number	
Type of Installation (Manhole or Vault)	
Installing Contractor	
Installation Date(s)	

INSPECTION AND MAINTENANCE LOG

Inspection or Maintenance Specify					
Date of Inspection or Maintenance					
Name of Inspector or Maintenance Contractor					
Standing Water Record Volume					
Visible Oil Yes or No					
Oil Removed Yes or No					
Floatable Debris Yes or No					
Floatables Removed Yes or No					
Sediment Record Depth					
Sediment Removed Yes or No					
Recommend that Filters Be Cleaned or Replaced Yes or No					
Were Filters Cleaned? Yes or No					
Were Filters Relaced? Yes or No					

NOTE: Consult appropriate regulatory agency for information on disposal of pumped-out water and waste material.

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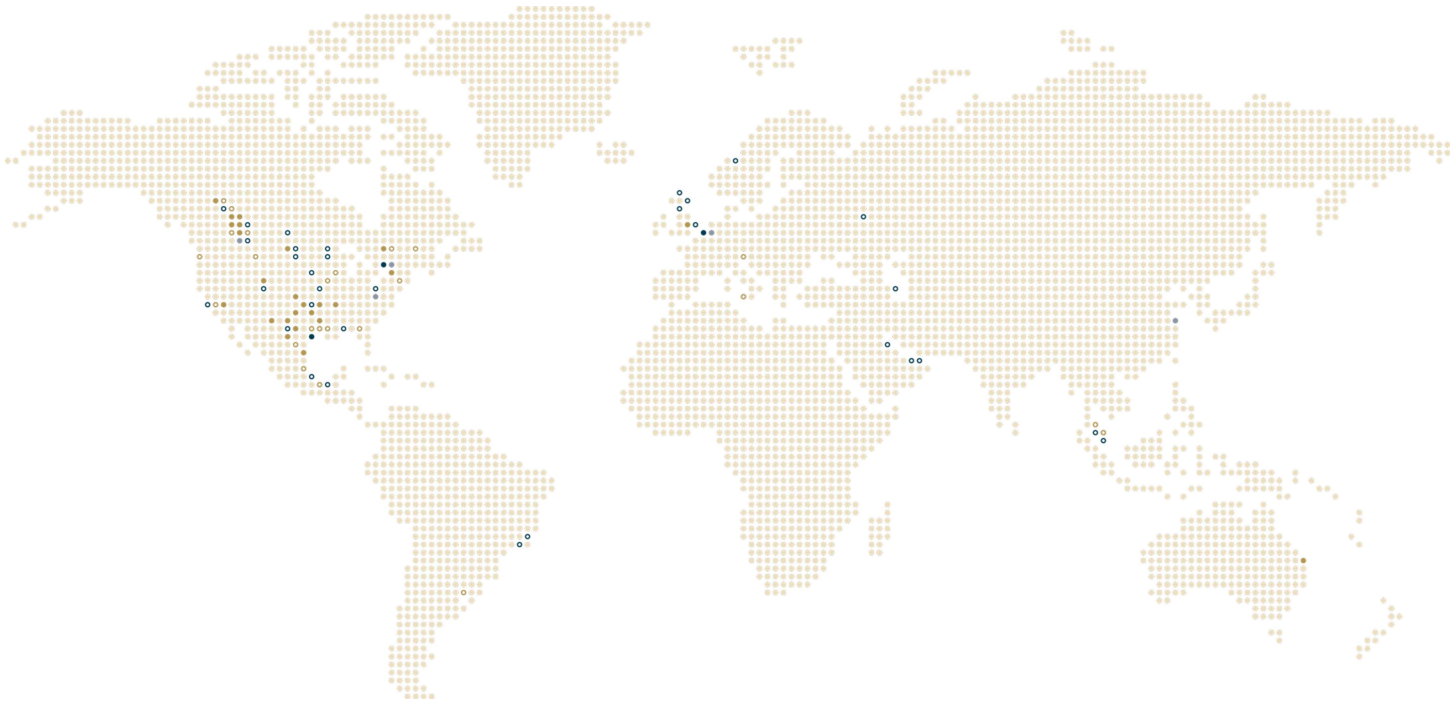

CARING FOR WATER AROUND THE WORLD

When you need to manage and treat stormwater, we have the expertise and technology to meet your requirements.

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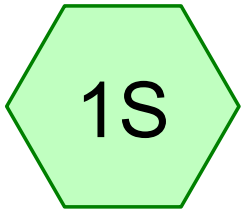
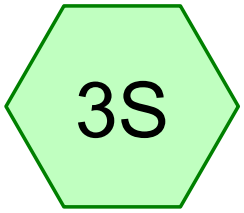
APPENDIX D:

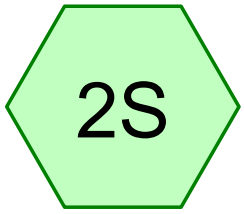
HydroCAD Output



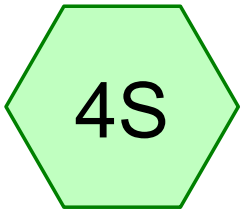
Pre-developed 01



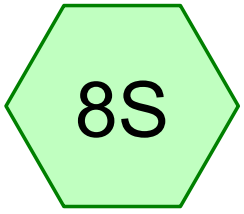
Subarea 01



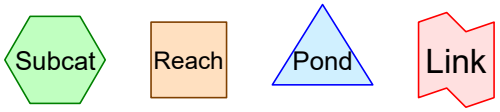
Pre-developed 02



Subarea 02



Direct Release



Routing Diagram for 2023-0704 Block H (2024-11-12)
Prepared by EMH&T, Printed 11/14/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1 year	Type II 24-hr		Default	24.00	1	2.20	2
2	2 year	Type II 24-hr		Default	24.00	1	2.63	2
3	5 year	Type II 24-hr		Default	24.00	1	3.24	2
4	10 year	Type II 24-hr		Default	24.00	1	3.74	2
5	25 year	Type II 24-hr		Default	24.00	1	4.44	2
6	50 year	Type II 24-hr		Default	24.00	1	5.02	2
7	100 year	Type II 24-hr		Default	24.00	1	5.63	2

Summary for Subcatchment 1S: Pre-developed 01

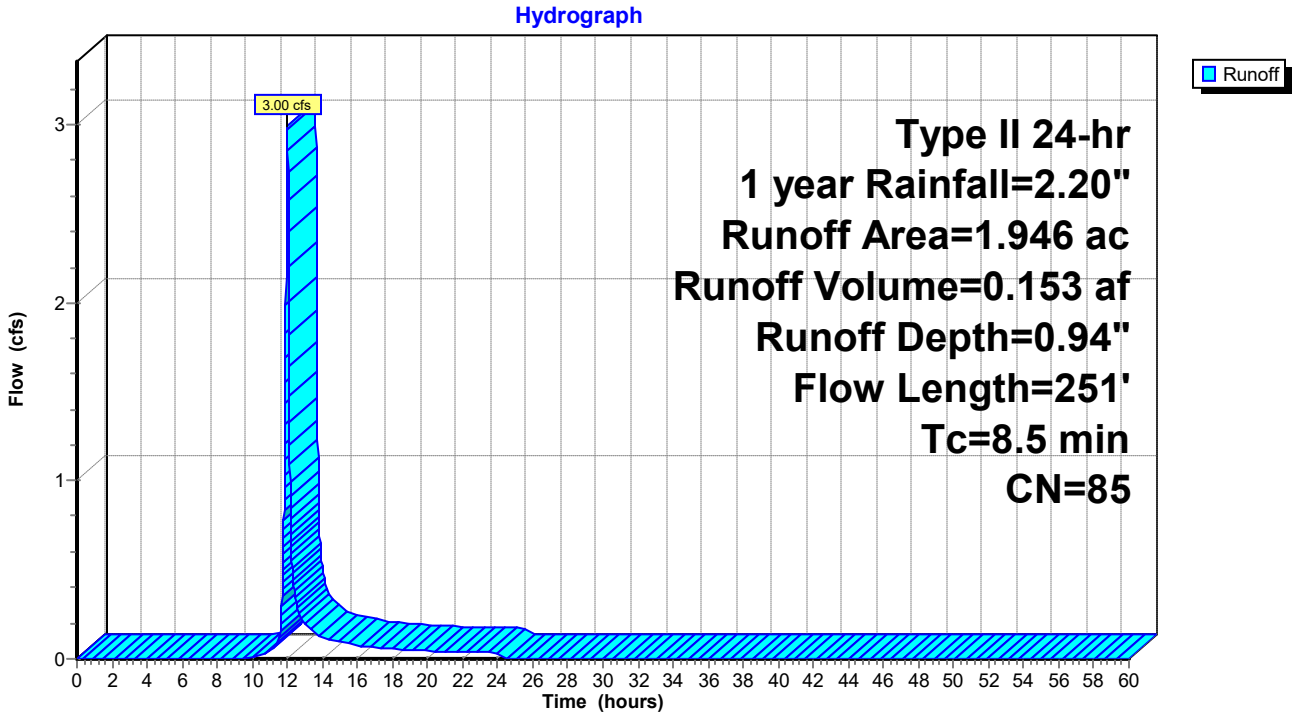
Runoff = 3.00 cfs @ 12.00 hrs, Volume= 0.153 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.20"

Area (ac)	CN	Description
0.869	98	Paved parking, HSG C
1.077	74	>75% Grass cover, Good, HSG C
1.946	85	Weighted Average
1.077		55.34% Pervious Area
0.869		44.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0871	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.5	151	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.5	251	Total			

Subcatchment 1S: Pre-developed 01



Summary for Subcatchment 2S: Pre-developed 02

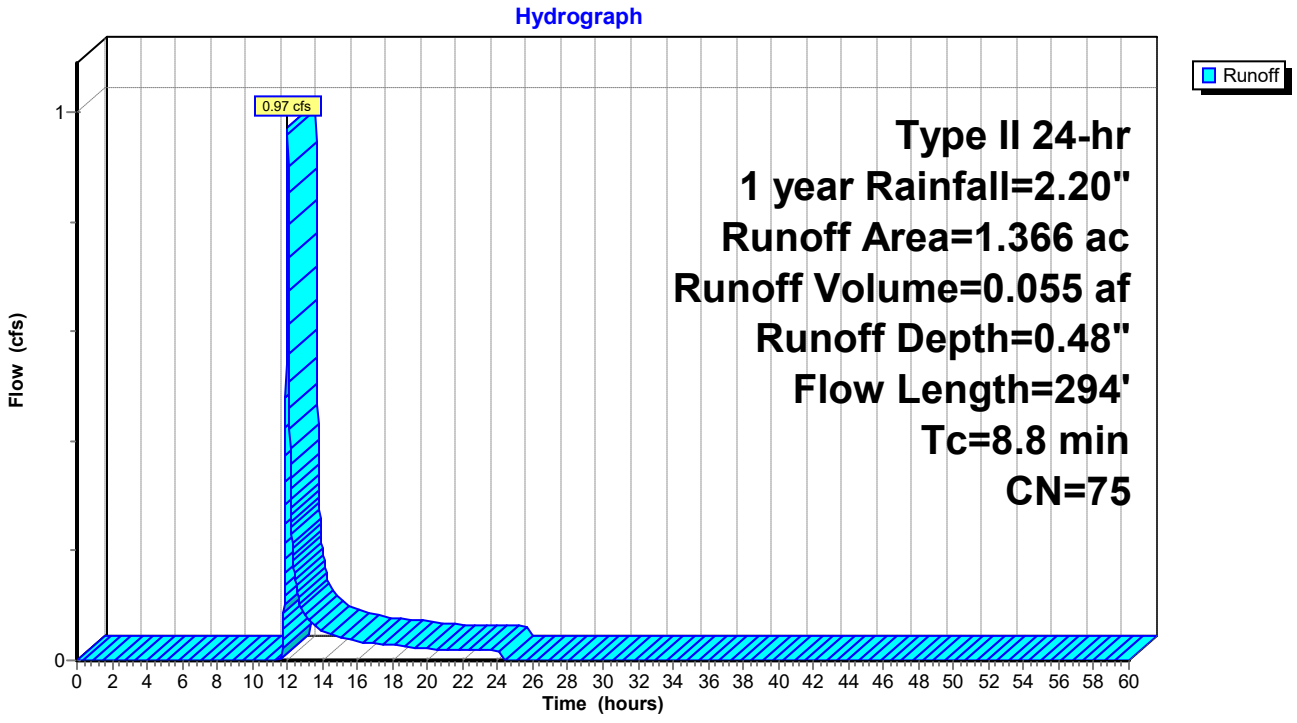
Runoff = 0.97 cfs @ 12.02 hrs, Volume= 0.055 af, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.20"

Area (ac)	CN	Description
0.023	98	Paved parking, HSG C
0.066	96	Gravel surface, HSG C
1.277	74	>75% Grass cover, Good, HSG C
1.366	75	Weighted Average
1.343		98.32% Pervious Area
0.023		1.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0752	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.4	194	0.0361	1.33		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.8	294	Total			

Subcatchment 2S: Pre-developed 02



Summary for Subcatchment 3S: Subarea 01

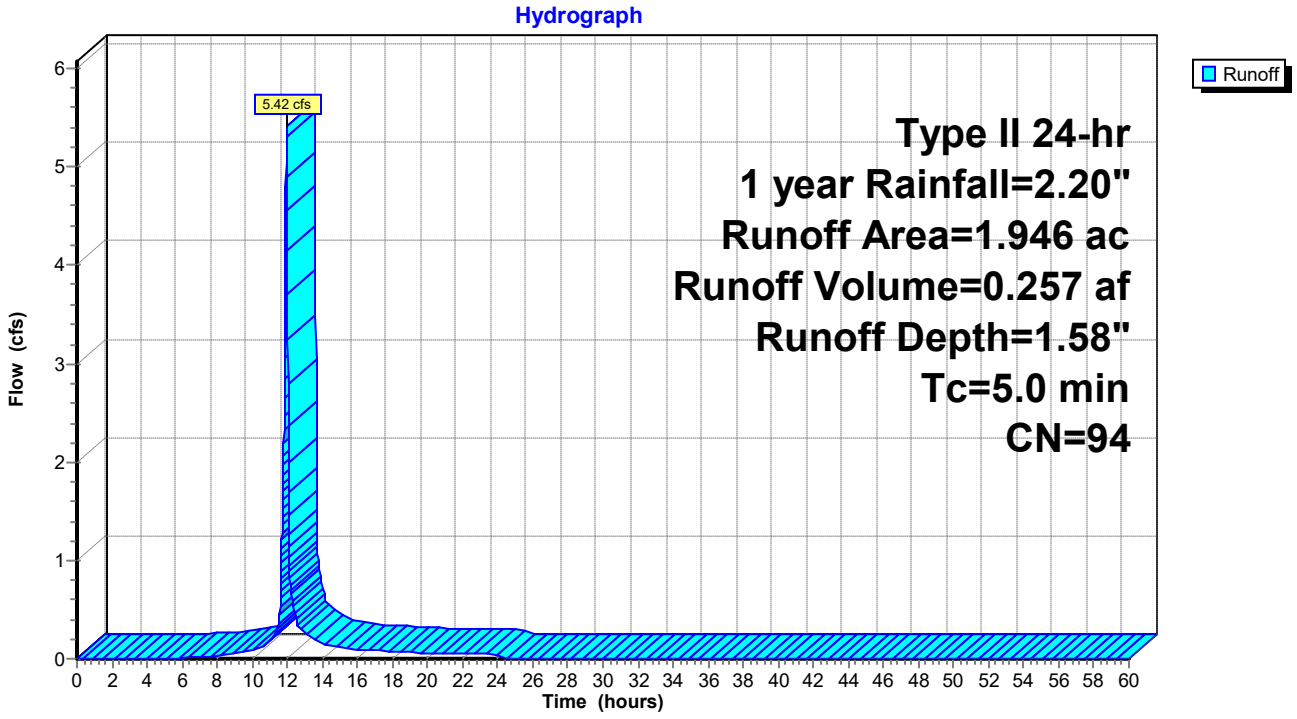
Runoff = 5.42 cfs @ 11.96 hrs, Volume= 0.257 af, Depth= 1.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.20"

Area (ac)	CN	Description
1.608	98	Paved parking, HSG C
0.338	74	>75% Grass cover, Good, HSG C
1.946	94	Weighted Average
0.338		17.37% Pervious Area
1.608		82.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Subarea 01



Summary for Subcatchment 4S: Subarea 02

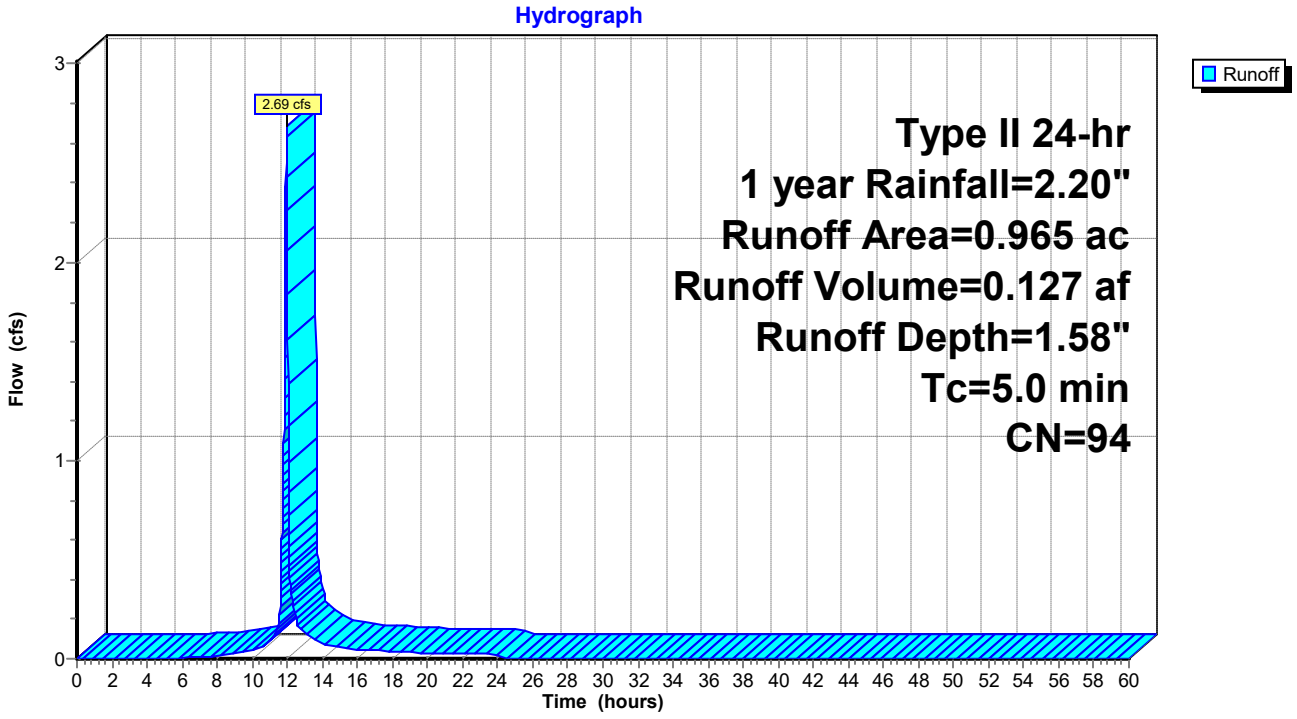
Runoff = 2.69 cfs @ 11.96 hrs, Volume= 0.127 af, Depth= 1.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.20"

Area (ac)	CN	Description
0.790	98	Paved parking, HSG C
0.175	74	>75% Grass cover, Good, HSG C
0.965	94	Weighted Average
0.175		18.13% Pervious Area
0.790		81.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 4S: Subarea 02



Summary for Subcatchment 8S: Direct Release

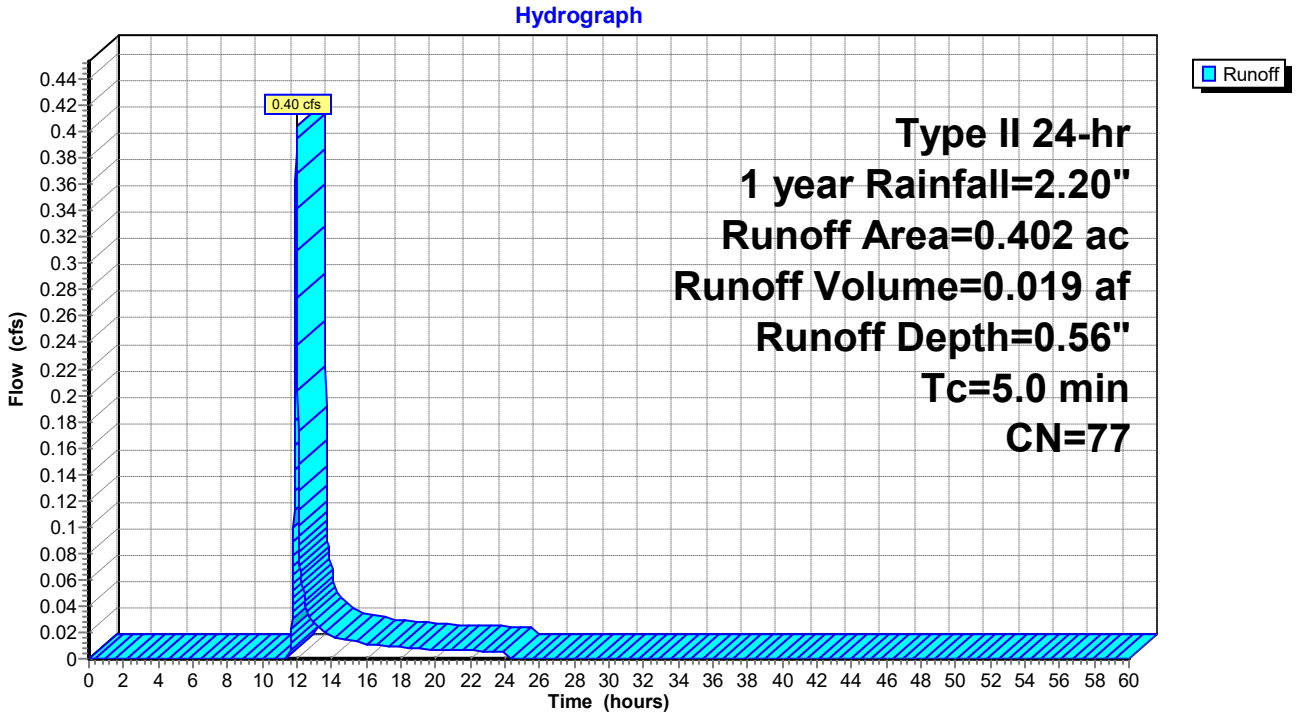
Runoff = 0.40 cfs @ 11.97 hrs, Volume= 0.019 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 year Rainfall=2.20"

Area (ac)	CN	Description
0.053	98	Paved parking, HSG C
0.349	74	>75% Grass cover, Good, HSG C
0.402	77	Weighted Average
0.349		86.82% Pervious Area
0.053		13.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 8S: Direct Release



Summary for Subcatchment 1S: Pre-developed 01

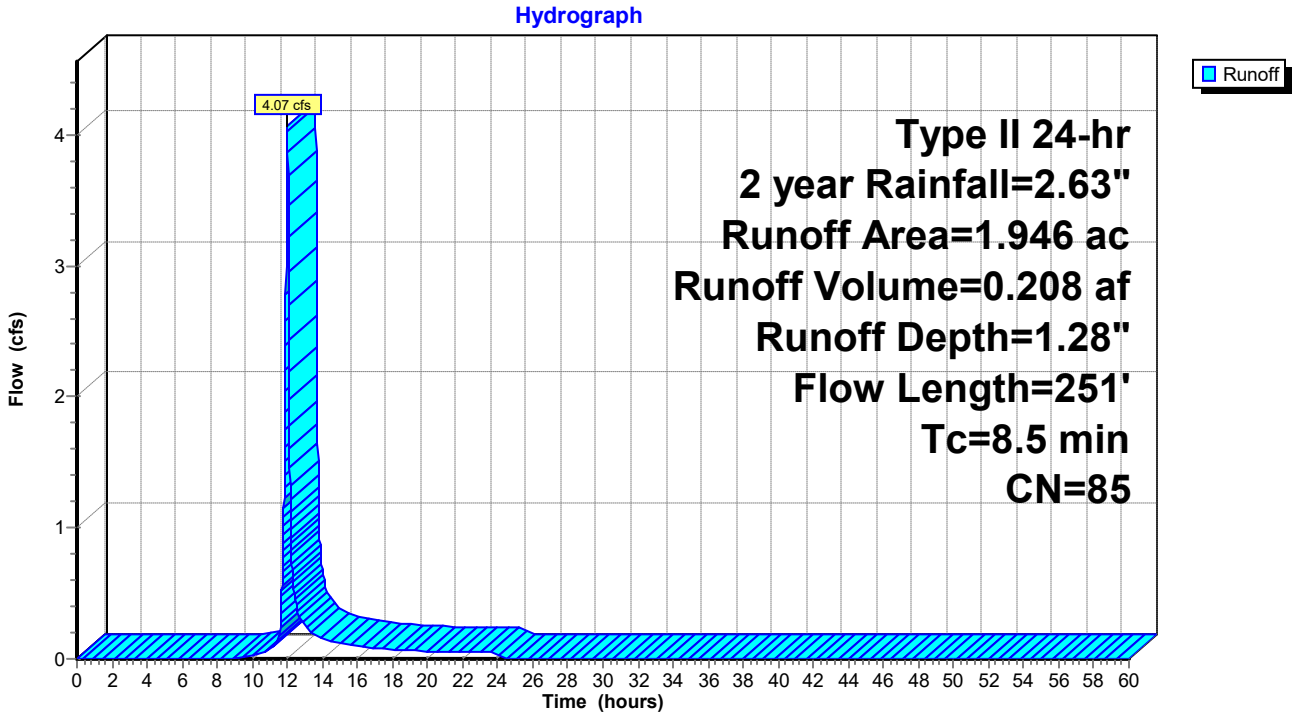
Runoff = 4.07 cfs @ 12.00 hrs, Volume= 0.208 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=2.63"

Area (ac)	CN	Description
0.869	98	Paved parking, HSG C
1.077	74	>75% Grass cover, Good, HSG C
1.946	85	Weighted Average
1.077		55.34% Pervious Area
0.869		44.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0871	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.5	151	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.5	251	Total			

Subcatchment 1S: Pre-developed 01



Summary for Subcatchment 2S: Pre-developed 02

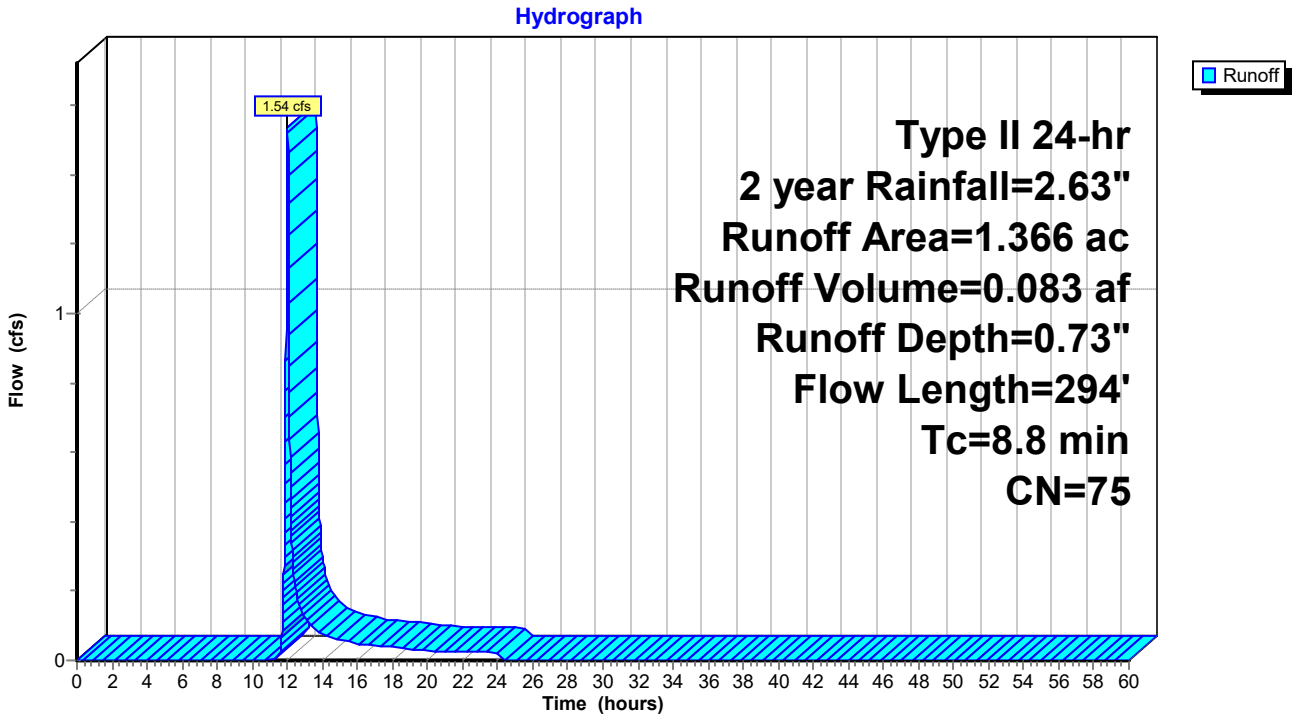
Runoff = 1.54 cfs @ 12.02 hrs, Volume= 0.083 af, Depth= 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=2.63"

Area (ac)	CN	Description
0.023	98	Paved parking, HSG C
0.066	96	Gravel surface, HSG C
1.277	74	>75% Grass cover, Good, HSG C
1.366	75	Weighted Average
1.343		98.32% Pervious Area
0.023		1.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0752	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.4	194	0.0361	1.33		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.8	294	Total			

Subcatchment 2S: Pre-developed 02



Summary for Subcatchment 3S: Subarea 01

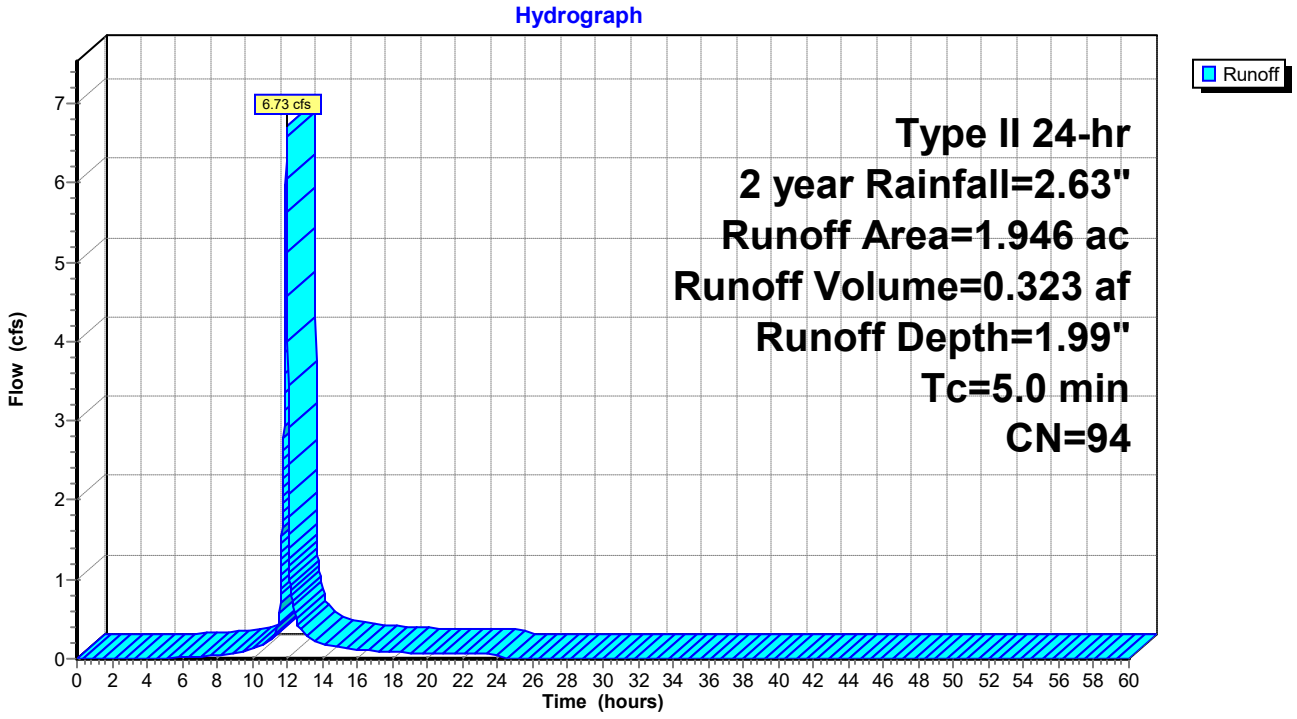
Runoff = 6.73 cfs @ 11.96 hrs, Volume= 0.323 af, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=2.63"

Area (ac)	CN	Description
1.608	98	Paved parking, HSG C
0.338	74	>75% Grass cover, Good, HSG C
1.946	94	Weighted Average
0.338		17.37% Pervious Area
1.608		82.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Subarea 01



Summary for Subcatchment 4S: Subarea 02

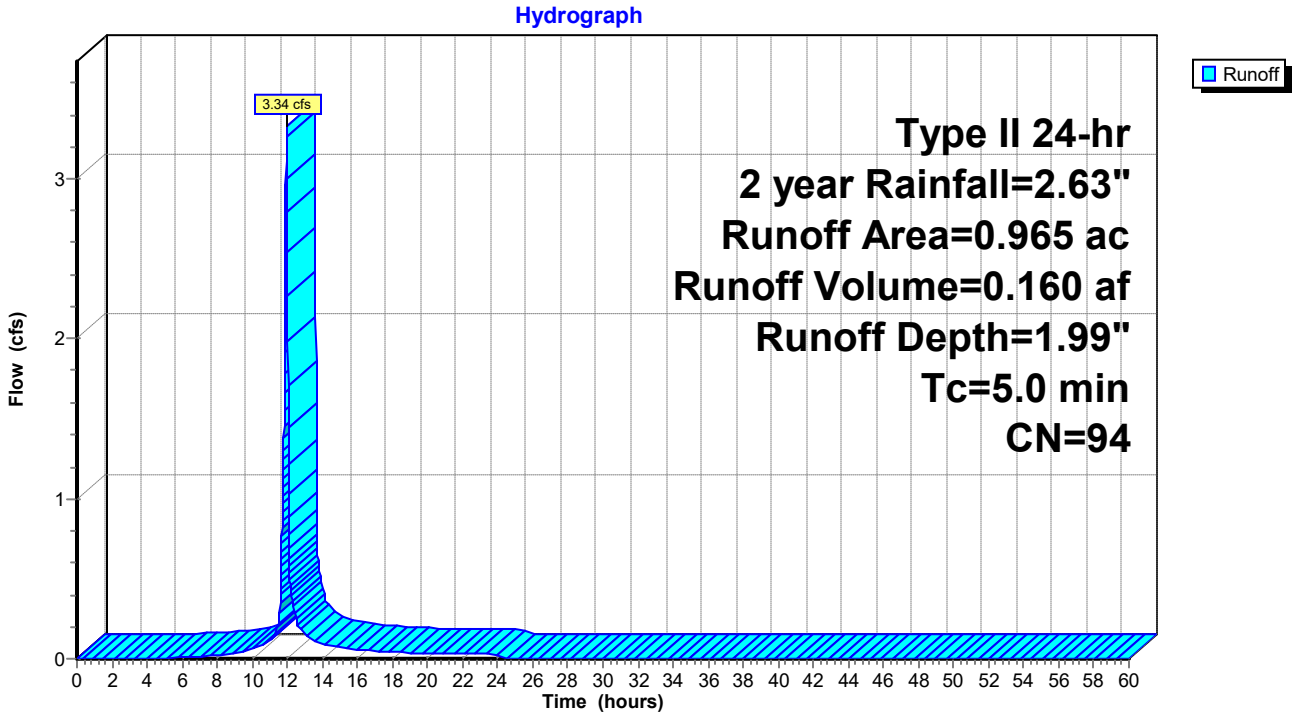
Runoff = 3.34 cfs @ 11.96 hrs, Volume= 0.160 af, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=2.63"

Area (ac)	CN	Description
0.790	98	Paved parking, HSG C
0.175	74	>75% Grass cover, Good, HSG C
0.965	94	Weighted Average
0.175		18.13% Pervious Area
0.790		81.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 4S: Subarea 02



Summary for Subcatchment 8S: Direct Release

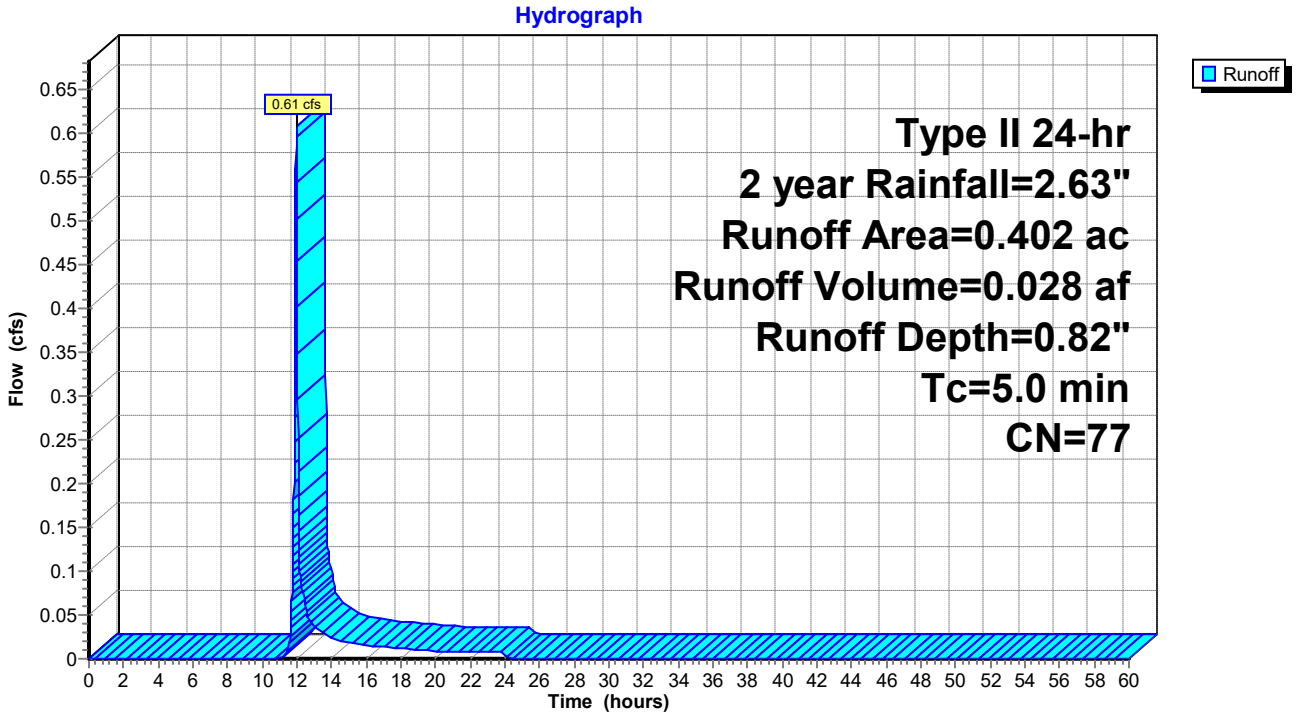
Runoff = 0.61 cfs @ 11.97 hrs, Volume= 0.028 af, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=2.63"

Area (ac)	CN	Description
0.053	98	Paved parking, HSG C
0.349	74	>75% Grass cover, Good, HSG C
0.402	77	Weighted Average
0.349		86.82% Pervious Area
0.053		13.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 8S: Direct Release



Summary for Subcatchment 1S: Pre-developed 01

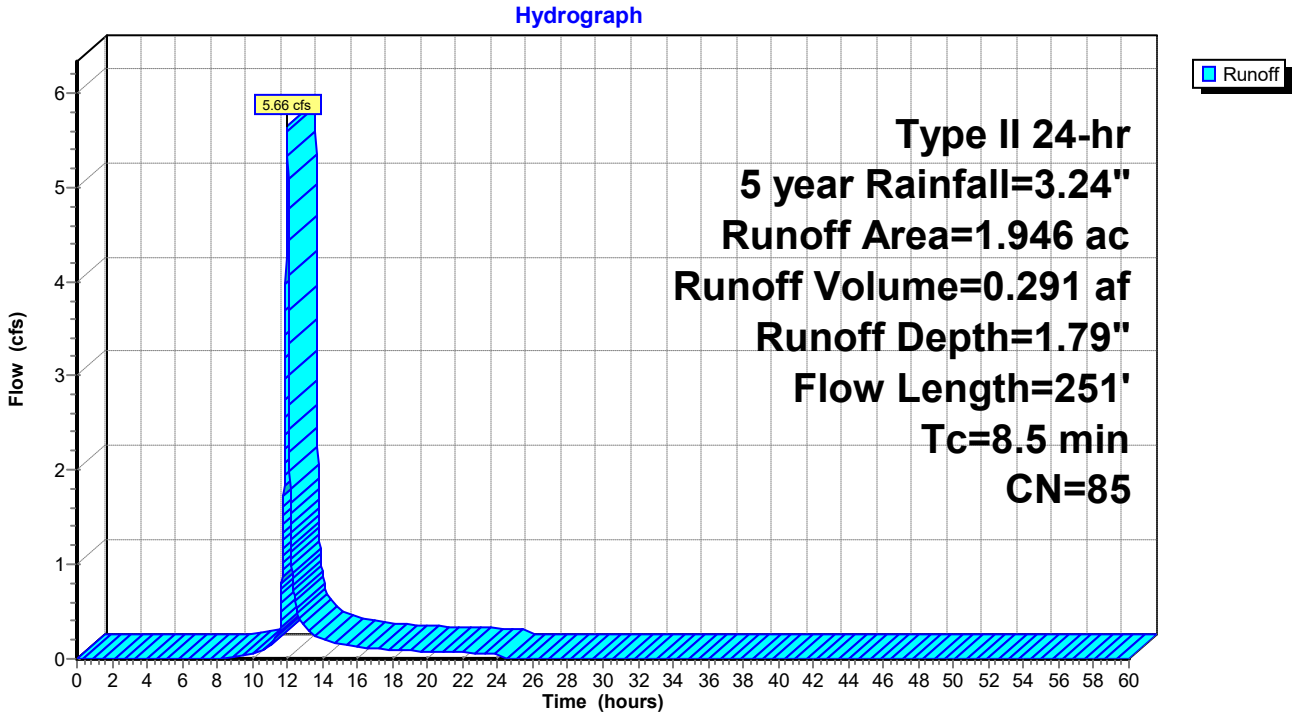
Runoff = 5.66 cfs @ 12.00 hrs, Volume= 0.291 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 5 year Rainfall=3.24"

Area (ac)	CN	Description
0.869	98	Paved parking, HSG C
1.077	74	>75% Grass cover, Good, HSG C
1.946	85	Weighted Average
1.077		55.34% Pervious Area
0.869		44.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0871	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.5	151	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.5	251	Total			

Subcatchment 1S: Pre-developed 01



Summary for Subcatchment 2S: Pre-developed 02

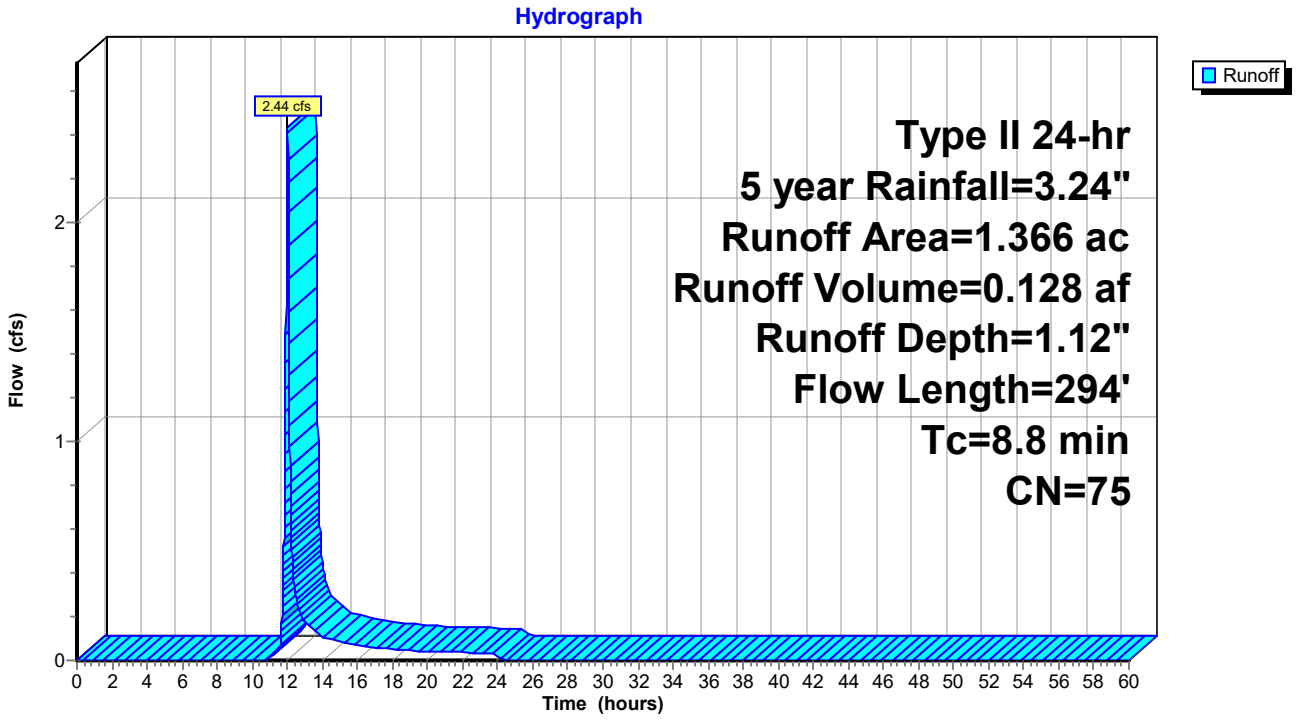
Runoff = 2.44 cfs @ 12.01 hrs, Volume= 0.128 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 5 year Rainfall=3.24"

Area (ac)	CN	Description
0.023	98	Paved parking, HSG C
0.066	96	Gravel surface, HSG C
1.277	74	>75% Grass cover, Good, HSG C
1.366	75	Weighted Average
1.343		98.32% Pervious Area
0.023		1.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0752	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.4	194	0.0361	1.33		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.8	294	Total			

Subcatchment 2S: Pre-developed 02



Summary for Subcatchment 3S: Subarea 01

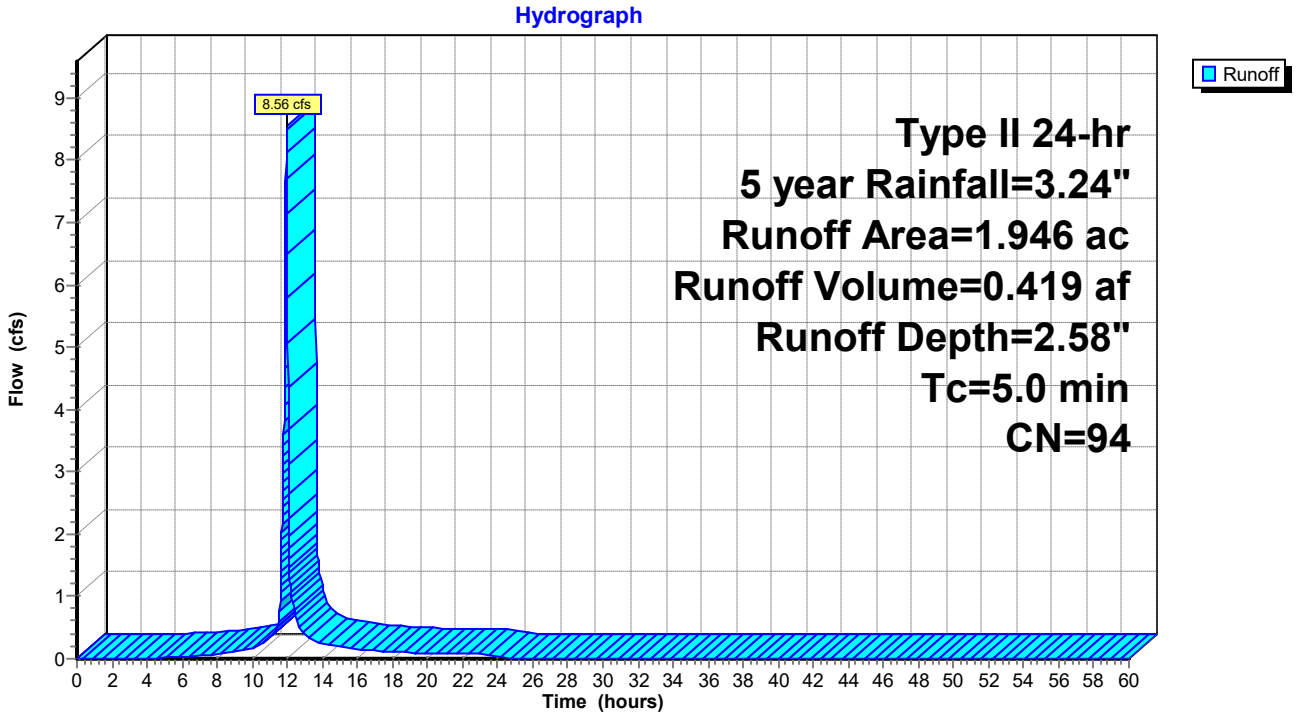
Runoff = 8.56 cfs @ 11.96 hrs, Volume= 0.419 af, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 5 year Rainfall=3.24"

Area (ac)	CN	Description
1.608	98	Paved parking, HSG C
0.338	74	>75% Grass cover, Good, HSG C
1.946	94	Weighted Average
0.338		17.37% Pervious Area
1.608		82.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Subarea 01



Summary for Subcatchment 4S: Subarea 02

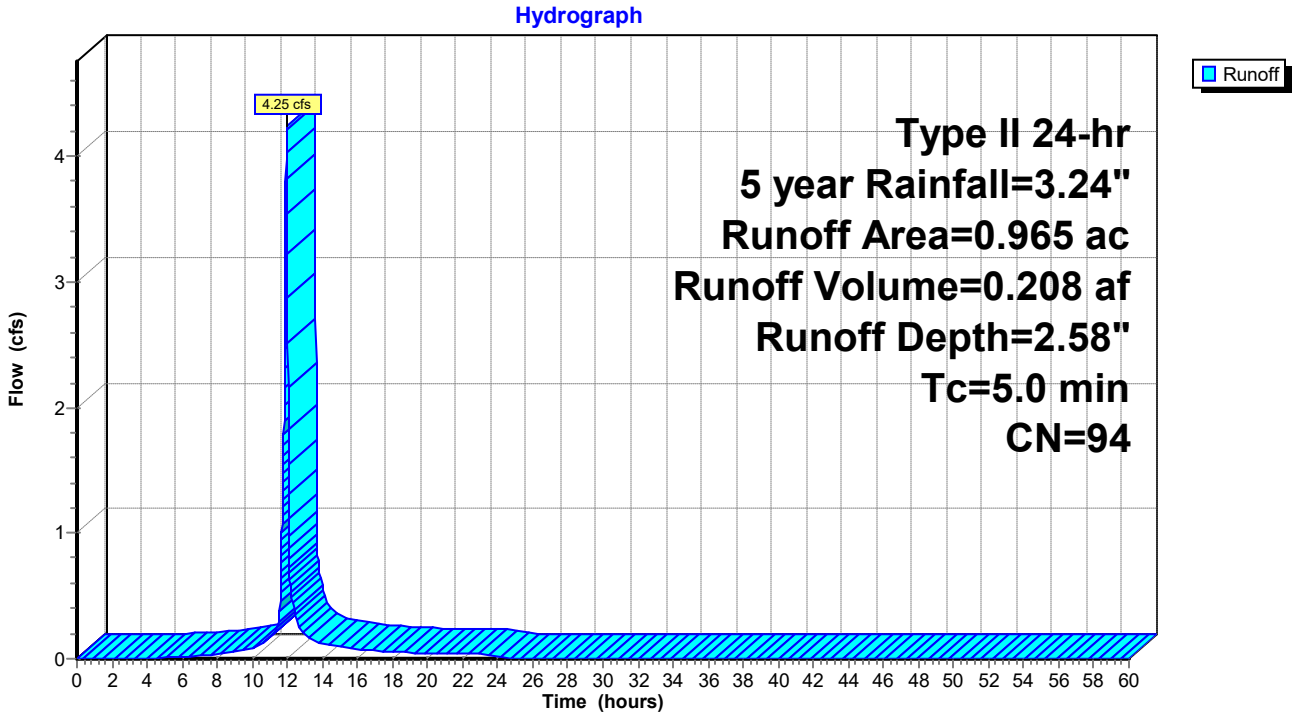
Runoff = 4.25 cfs @ 11.96 hrs, Volume= 0.208 af, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 5 year Rainfall=3.24"

Area (ac)	CN	Description
0.790	98	Paved parking, HSG C
0.175	74	>75% Grass cover, Good, HSG C
0.965	94	Weighted Average
0.175		18.13% Pervious Area
0.790		81.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 4S: Subarea 02



Summary for Subcatchment 8S: Direct Release

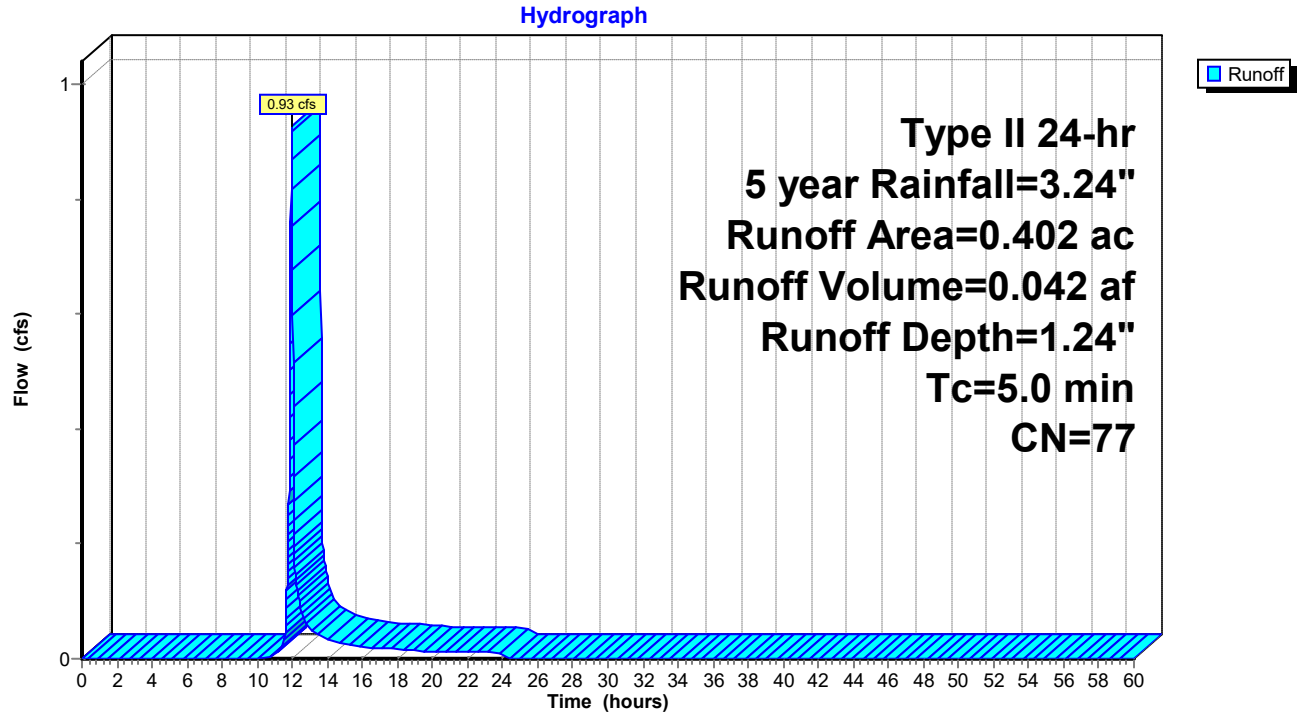
Runoff = 0.93 cfs @ 11.97 hrs, Volume= 0.042 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 5 year Rainfall=3.24"

Area (ac)	CN	Description
0.053	98	Paved parking, HSG C
0.349	74	>75% Grass cover, Good, HSG C
0.402	77	Weighted Average
0.349		86.82% Pervious Area
0.053		13.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 8S: Direct Release



Summary for Subcatchment 1S: Pre-developed 01

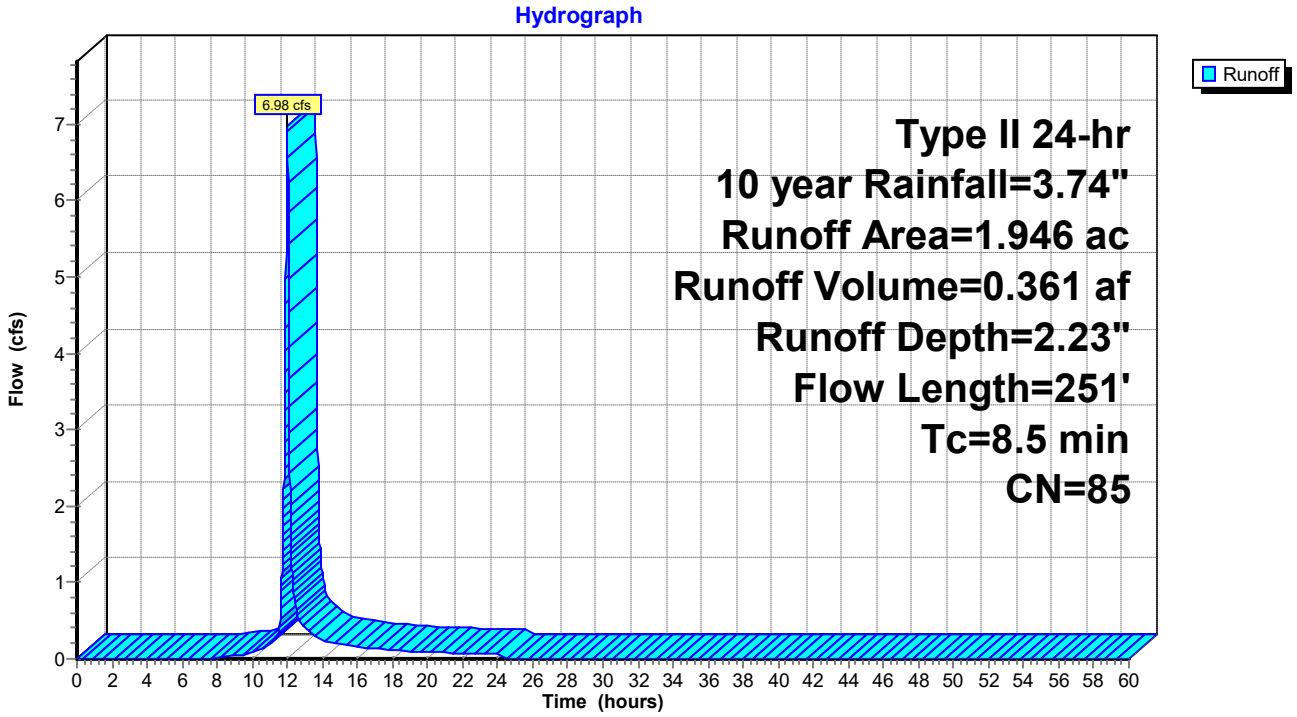
Runoff = 6.98 cfs @ 12.00 hrs, Volume= 0.361 af, Depth= 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=3.74"

Area (ac)	CN	Description
0.869	98	Paved parking, HSG C
1.077	74	>75% Grass cover, Good, HSG C
1.946	85	Weighted Average
1.077		55.34% Pervious Area
0.869		44.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0871	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.5	151	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.5	251	Total			

Subcatchment 1S: Pre-developed 01



Summary for Subcatchment 2S: Pre-developed 02

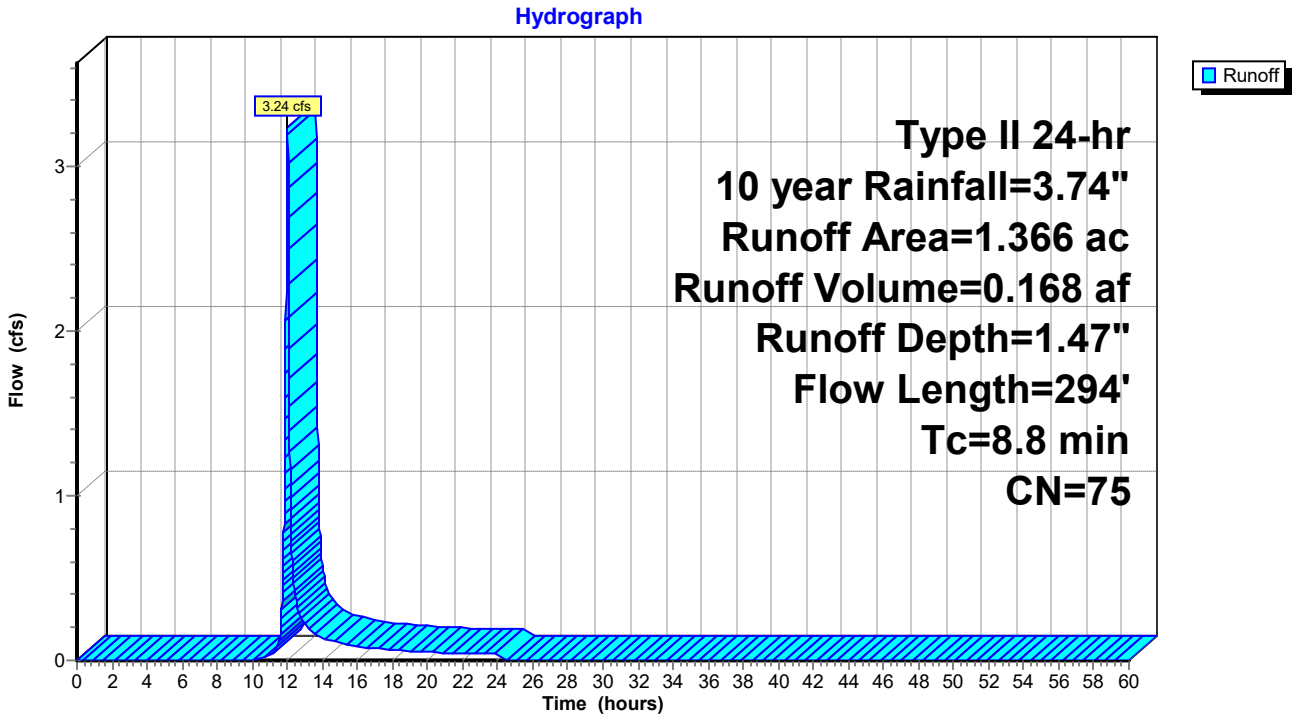
Runoff = 3.24 cfs @ 12.01 hrs, Volume= 0.168 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=3.74"

Area (ac)	CN	Description
0.023	98	Paved parking, HSG C
0.066	96	Gravel surface, HSG C
1.277	74	>75% Grass cover, Good, HSG C
1.366	75	Weighted Average
1.343		98.32% Pervious Area
0.023		1.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0752	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.4	194	0.0361	1.33		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.8	294	Total			

Subcatchment 2S: Pre-developed 02



Summary for Subcatchment 3S: Subarea 01

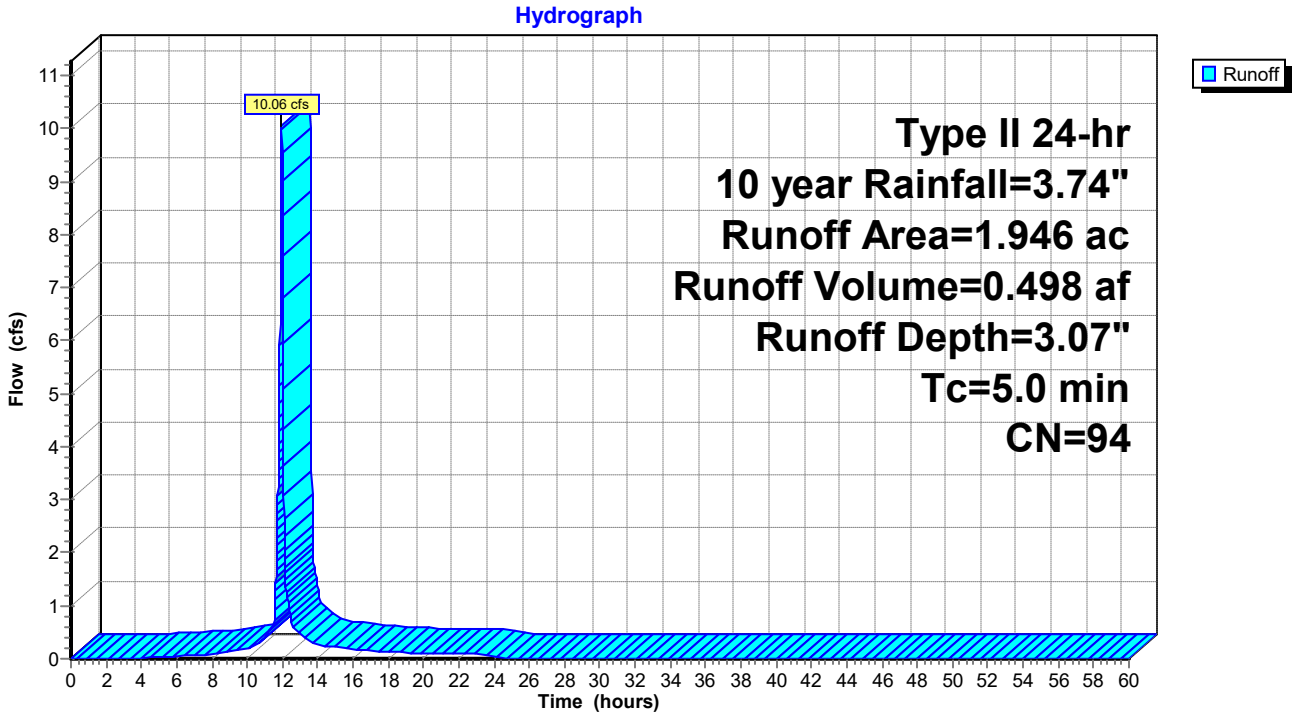
Runoff = 10.06 cfs @ 11.96 hrs, Volume= 0.498 af, Depth= 3.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=3.74"

Area (ac)	CN	Description
1.608	98	Paved parking, HSG C
0.338	74	>75% Grass cover, Good, HSG C
1.946	94	Weighted Average
0.338		17.37% Pervious Area
1.608		82.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Subarea 01



Summary for Subcatchment 4S: Subarea 02

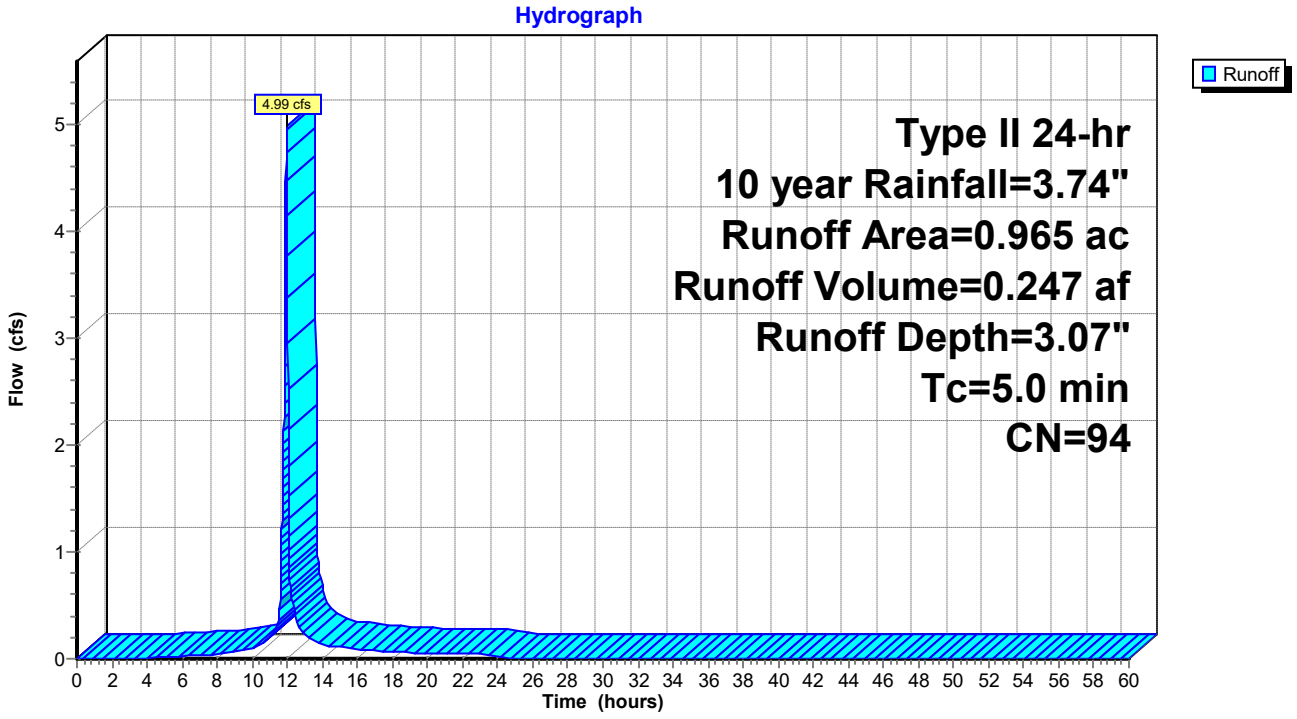
Runoff = 4.99 cfs @ 11.96 hrs, Volume= 0.247 af, Depth= 3.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=3.74"

Area (ac)	CN	Description
0.790	98	Paved parking, HSG C
0.175	74	>75% Grass cover, Good, HSG C
0.965	94	Weighted Average
0.175		18.13% Pervious Area
0.790		81.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 4S: Subarea 02



Summary for Subcatchment 8S: Direct Release

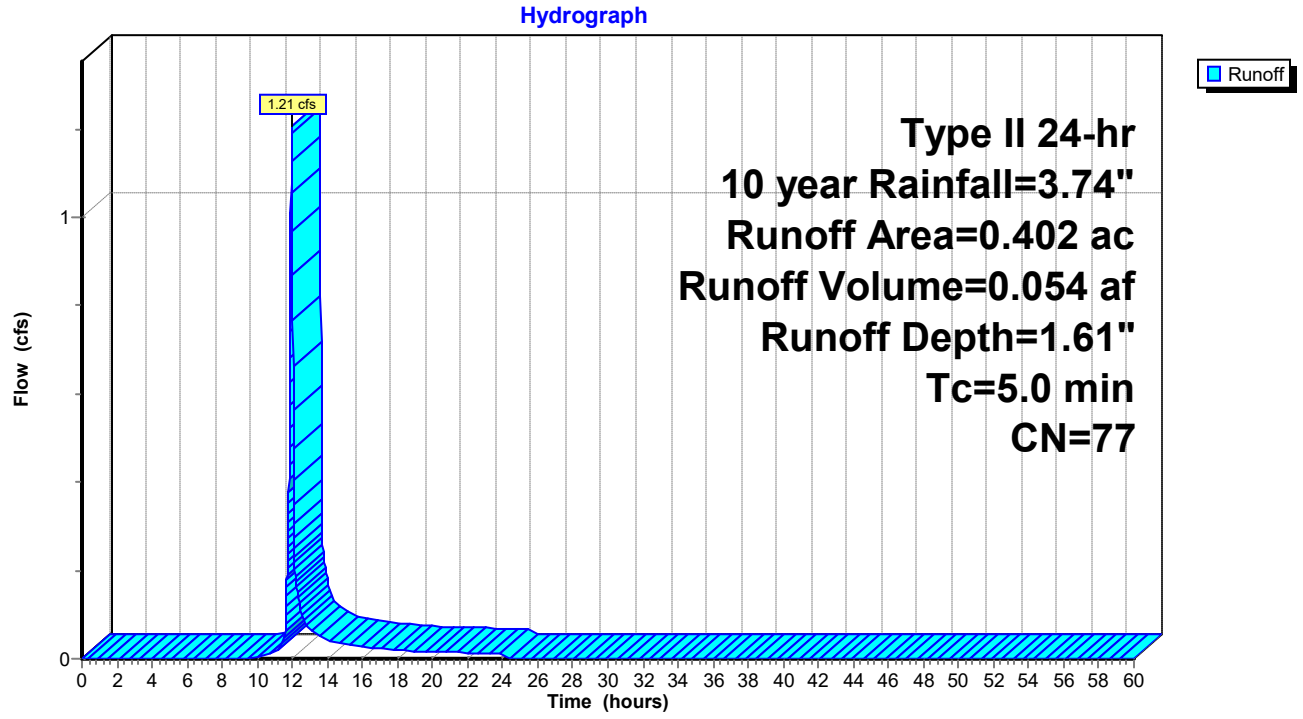
Runoff = 1.21 cfs @ 11.96 hrs, Volume= 0.054 af, Depth= 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=3.74"

Area (ac)	CN	Description
0.053	98	Paved parking, HSG C
0.349	74	>75% Grass cover, Good, HSG C
0.402	77	Weighted Average
0.349		86.82% Pervious Area
0.053		13.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 8S: Direct Release



Summary for Subcatchment 1S: Pre-developed 01

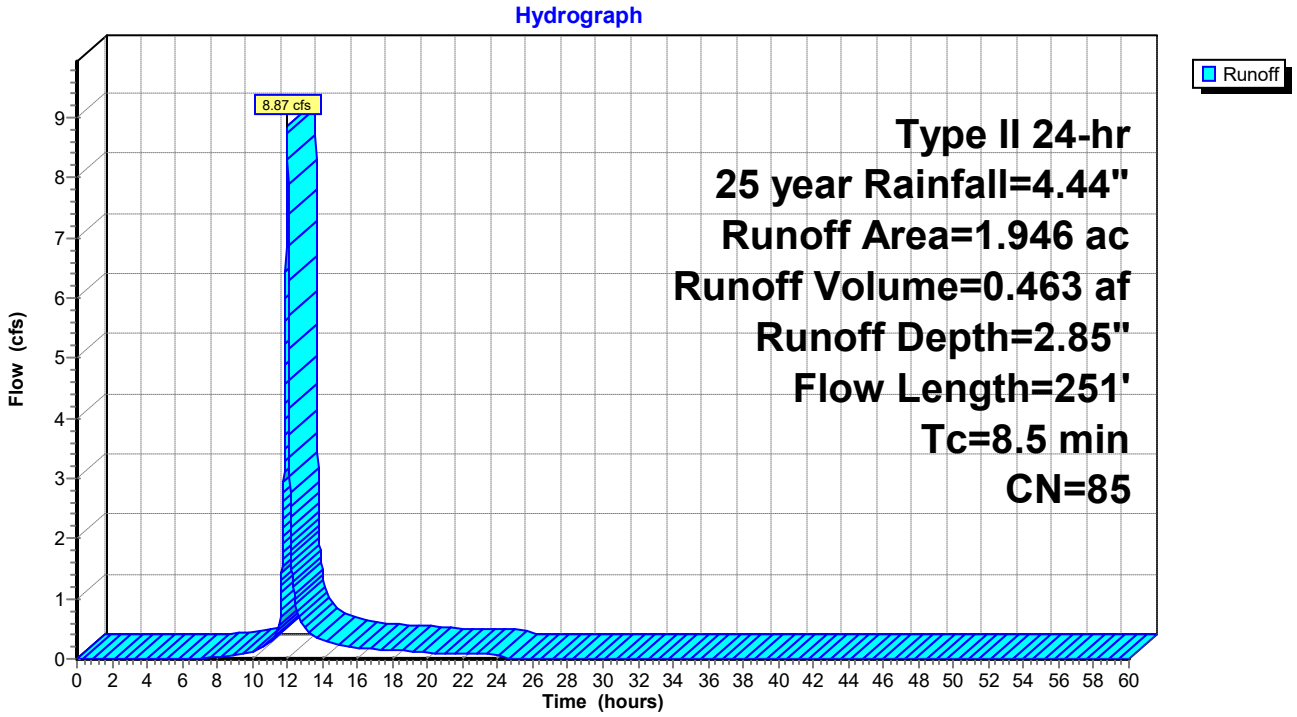
Runoff = 8.87 cfs @ 12.00 hrs, Volume= 0.463 af, Depth= 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 year Rainfall=4.44"

Area (ac)	CN	Description
0.869	98	Paved parking, HSG C
1.077	74	>75% Grass cover, Good, HSG C
1.946	85	Weighted Average
1.077		55.34% Pervious Area
0.869		44.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0871	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.5	151	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.5	251	Total			

Subcatchment 1S: Pre-developed 01



Summary for Subcatchment 2S: Pre-developed 02

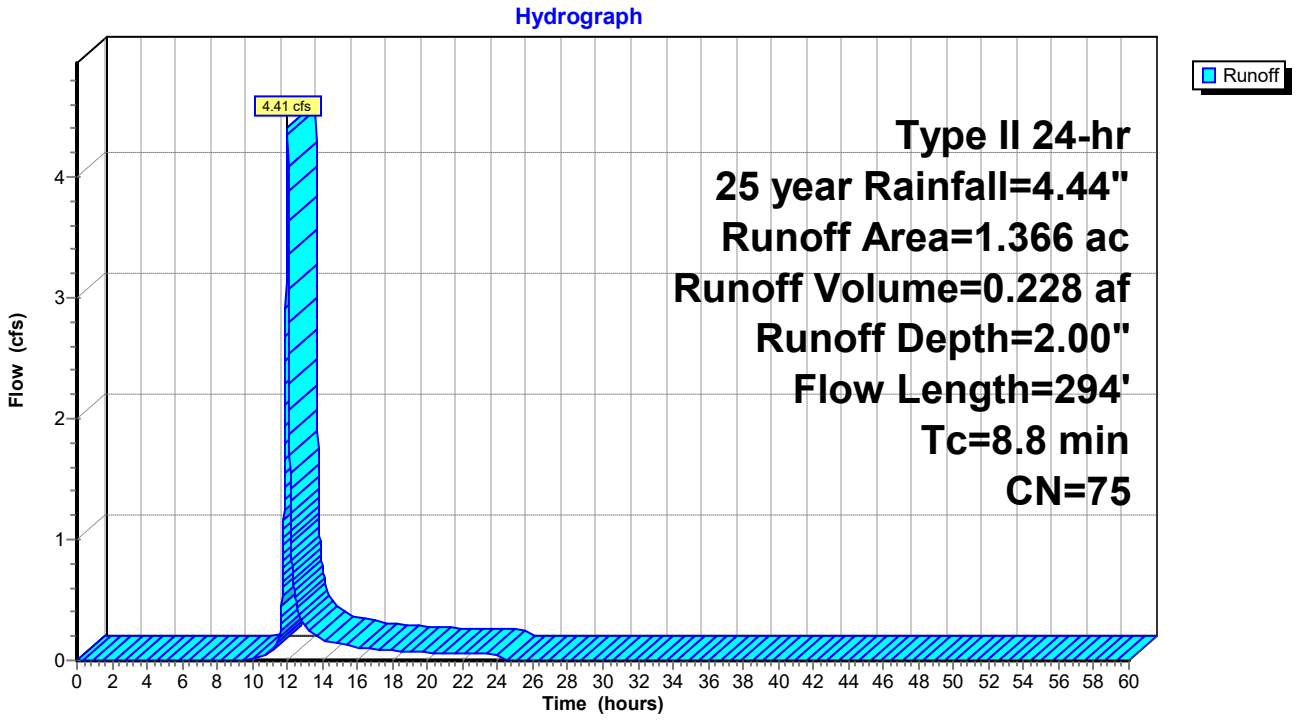
Runoff = 4.41 cfs @ 12.01 hrs, Volume= 0.228 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 year Rainfall=4.44"

Area (ac)	CN	Description
0.023	98	Paved parking, HSG C
0.066	96	Gravel surface, HSG C
1.277	74	>75% Grass cover, Good, HSG C
1.366	75	Weighted Average
1.343		98.32% Pervious Area
0.023		1.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0752	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.4	194	0.0361	1.33		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.8	294	Total			

Subcatchment 2S: Pre-developed 02



Summary for Subcatchment 3S: Subarea 01

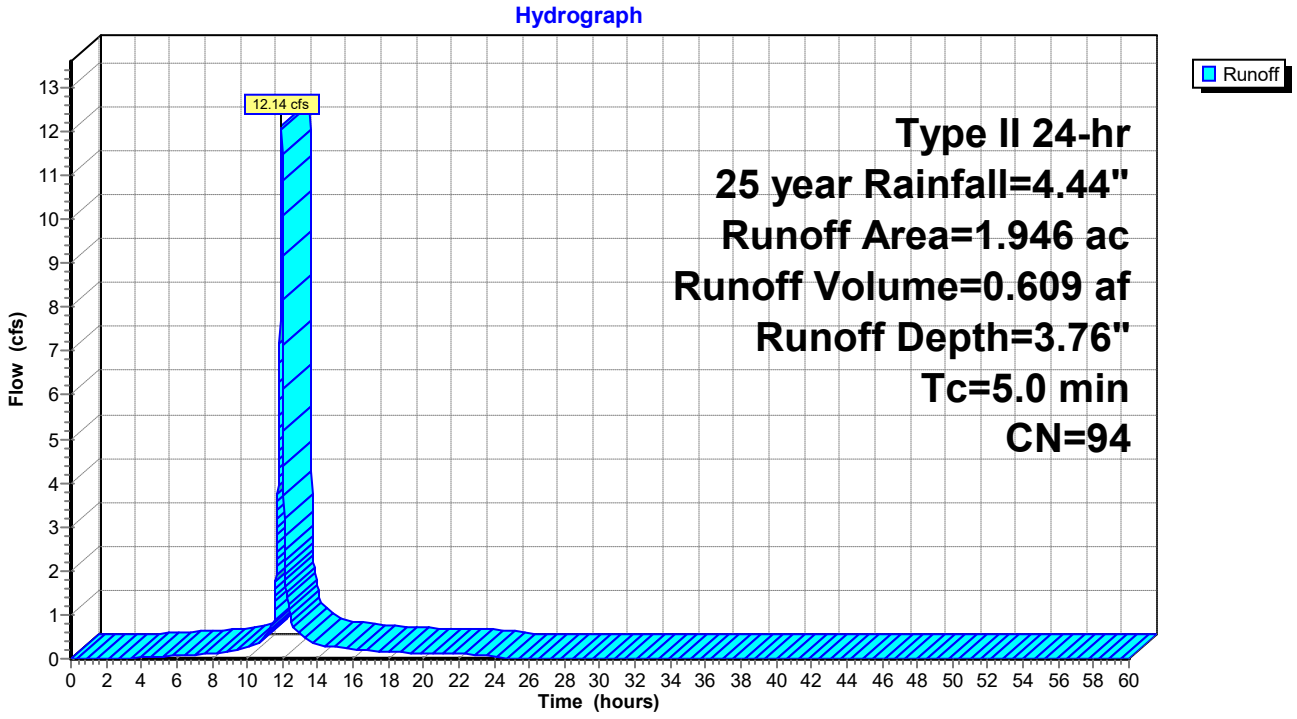
Runoff = 12.14 cfs @ 11.96 hrs, Volume= 0.609 af, Depth= 3.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 year Rainfall=4.44"

Area (ac)	CN	Description
1.608	98	Paved parking, HSG C
0.338	74	>75% Grass cover, Good, HSG C
1.946	94	Weighted Average
0.338		17.37% Pervious Area
1.608		82.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Subarea 01



Summary for Subcatchment 4S: Subarea 02

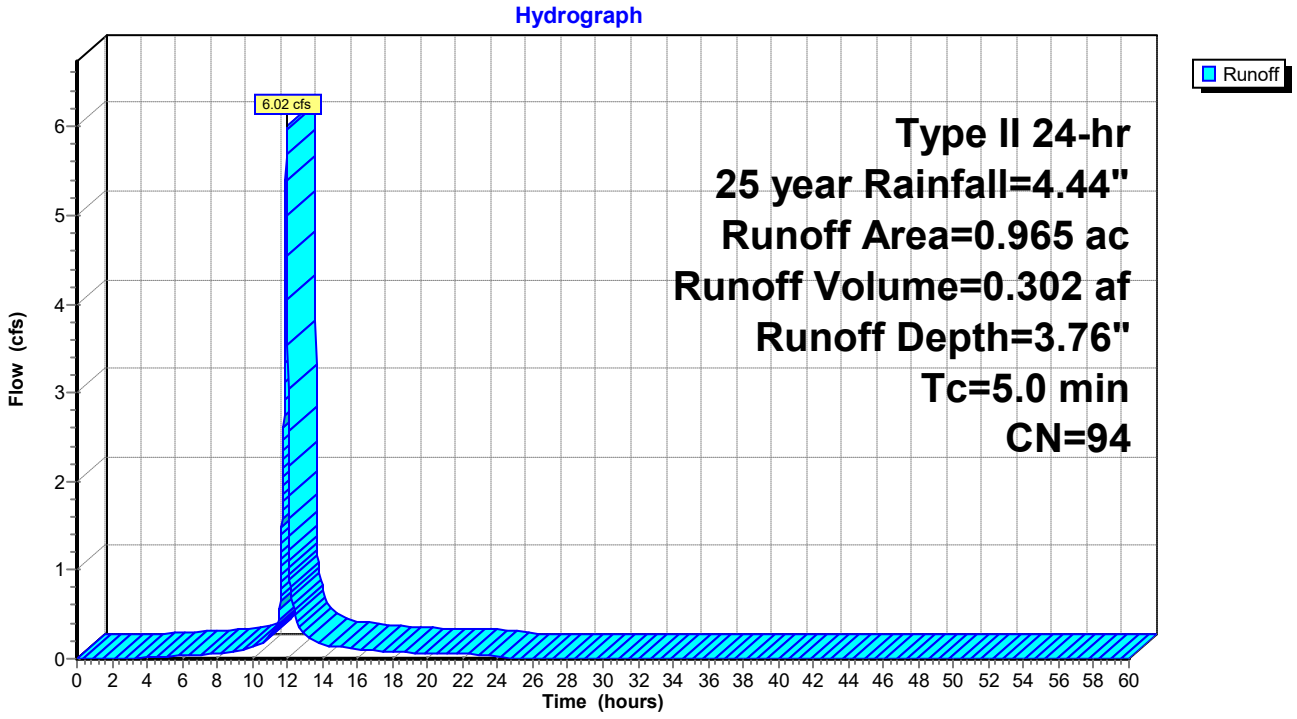
Runoff = 6.02 cfs @ 11.96 hrs, Volume= 0.302 af, Depth= 3.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 year Rainfall=4.44"

Area (ac)	CN	Description
0.790	98	Paved parking, HSG C
0.175	74	>75% Grass cover, Good, HSG C
0.965	94	Weighted Average
0.175		18.13% Pervious Area
0.790		81.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 4S: Subarea 02



Summary for Subcatchment 8S: Direct Release

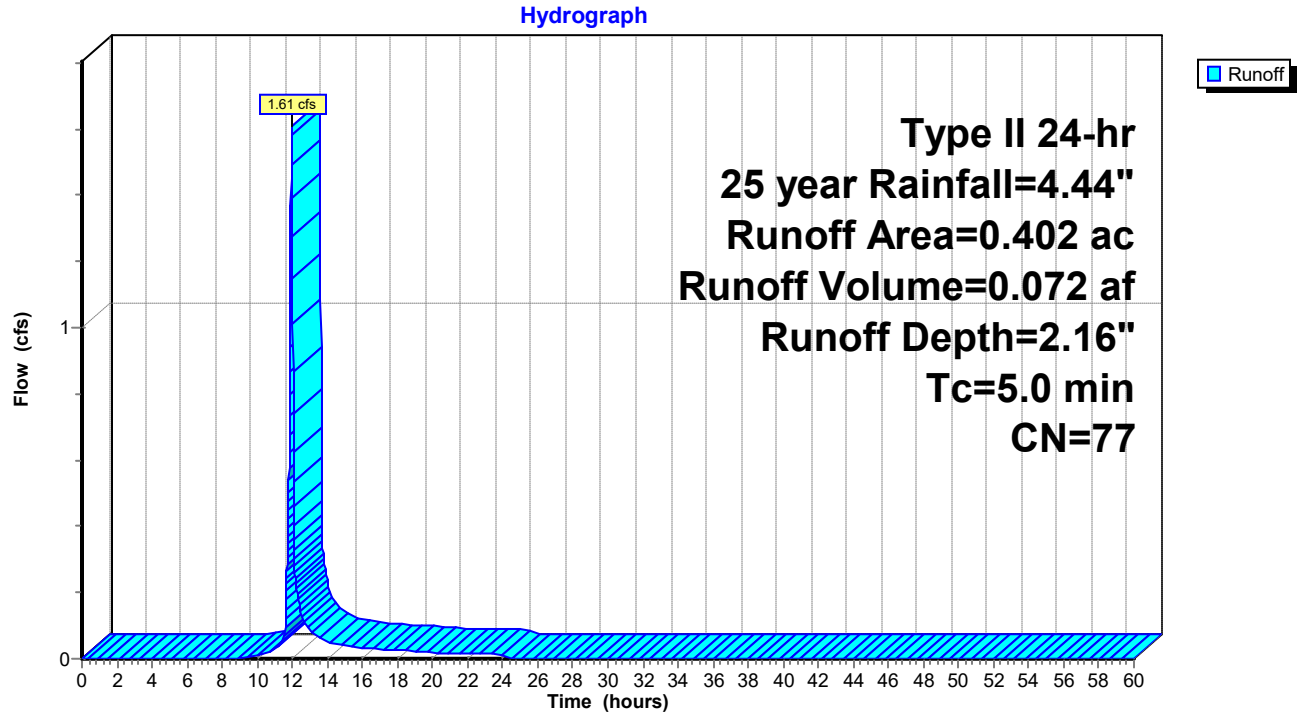
Runoff = 1.61 cfs @ 11.96 hrs, Volume= 0.072 af, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 year Rainfall=4.44"

Area (ac)	CN	Description
0.053	98	Paved parking, HSG C
0.349	74	>75% Grass cover, Good, HSG C
0.402	77	Weighted Average
0.349		86.82% Pervious Area
0.053		13.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 8S: Direct Release



Summary for Subcatchment 1S: Pre-developed 01

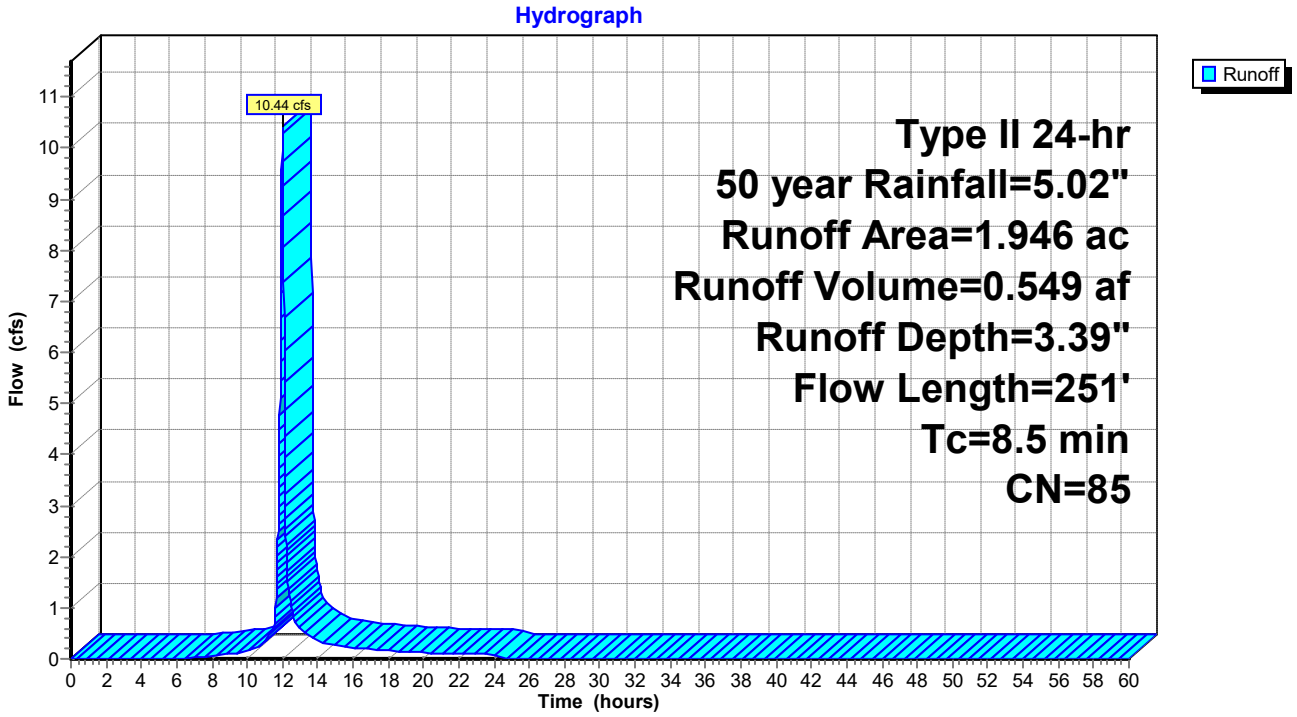
Runoff = 10.44 cfs @ 12.00 hrs, Volume= 0.549 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 50 year Rainfall=5.02"

Area (ac)	CN	Description
0.869	98	Paved parking, HSG C
1.077	74	>75% Grass cover, Good, HSG C
1.946	85	Weighted Average
1.077		55.34% Pervious Area
0.869		44.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0871	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.5	151	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.5	251	Total			

Subcatchment 1S: Pre-developed 01



Summary for Subcatchment 2S: Pre-developed 02

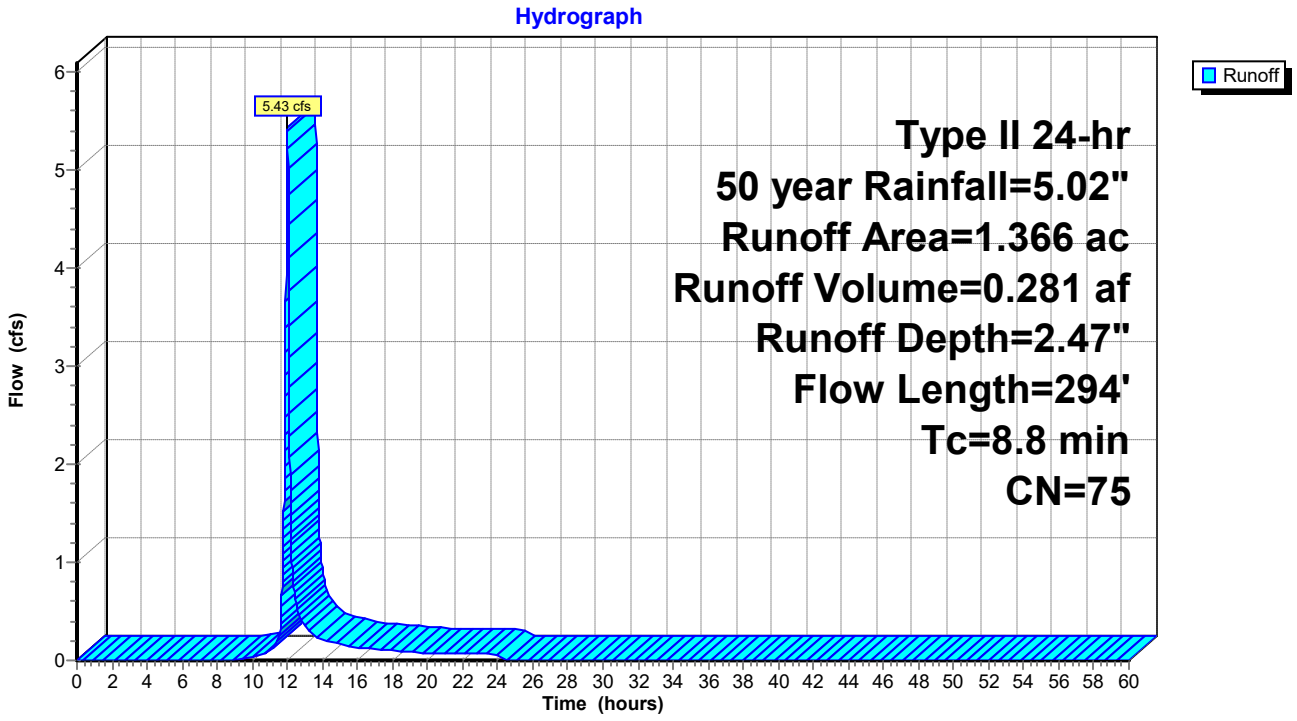
Runoff = 5.43 cfs @ 12.01 hrs, Volume= 0.281 af, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 50 year Rainfall=5.02"

Area (ac)	CN	Description
0.023	98	Paved parking, HSG C
0.066	96	Gravel surface, HSG C
1.277	74	>75% Grass cover, Good, HSG C
1.366	75	Weighted Average
1.343		98.32% Pervious Area
0.023		1.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0752	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.4	194	0.0361	1.33		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.8	294	Total			

Subcatchment 2S: Pre-developed 02



Summary for Subcatchment 3S: Subarea 01

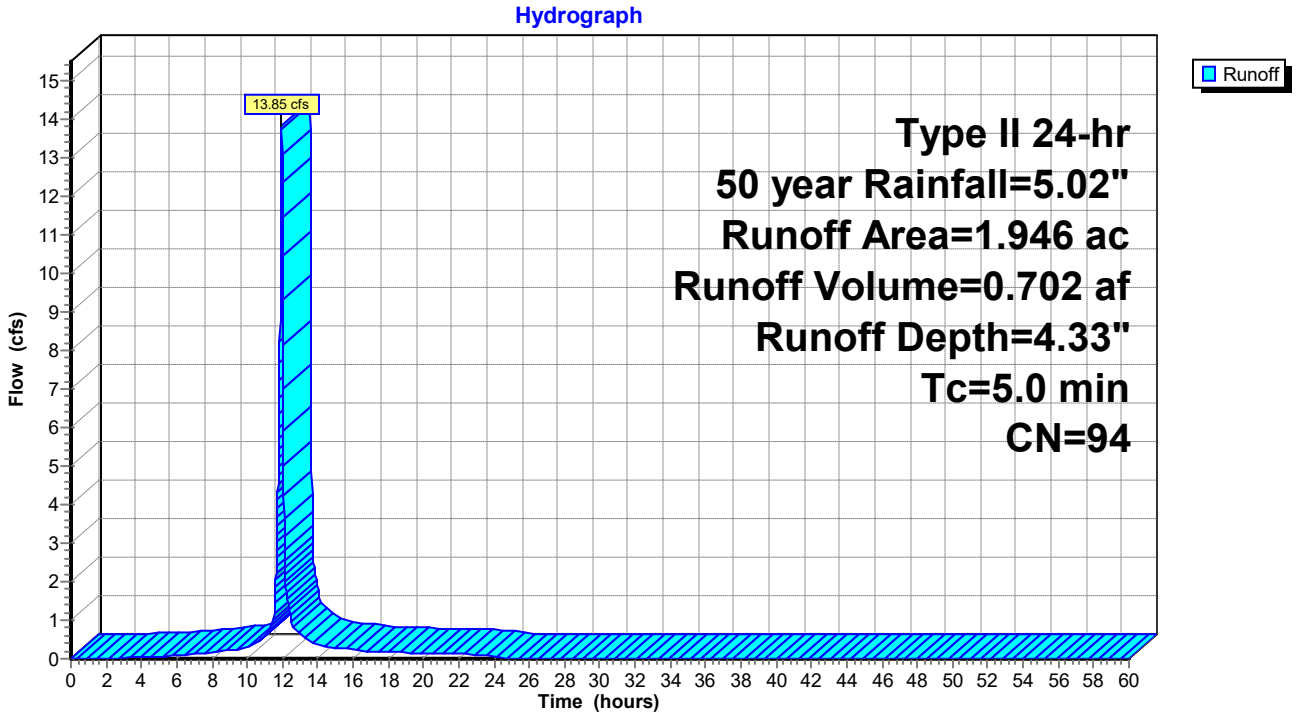
Runoff = 13.85 cfs @ 11.96 hrs, Volume= 0.702 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 50 year Rainfall=5.02"

Area (ac)	CN	Description
1.608	98	Paved parking, HSG C
0.338	74	>75% Grass cover, Good, HSG C
1.946	94	Weighted Average
0.338		17.37% Pervious Area
1.608		82.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Subarea 01



Summary for Subcatchment 4S: Subarea 02

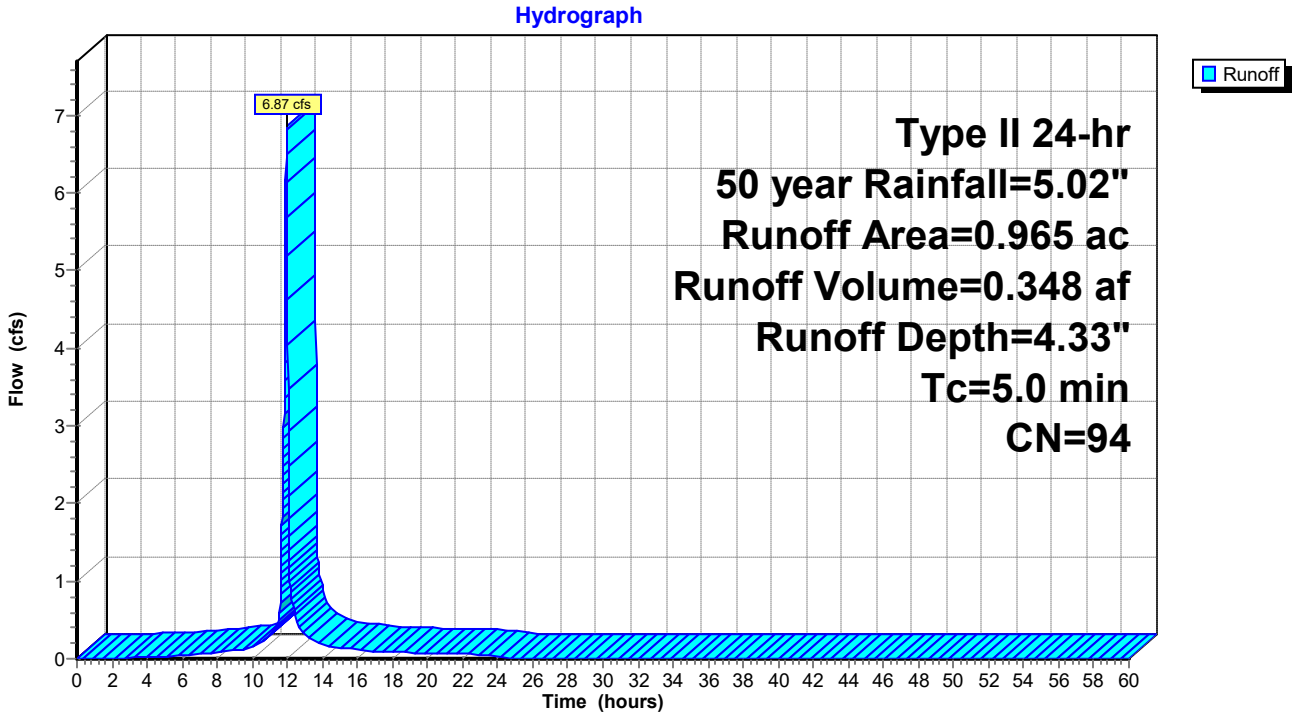
Runoff = 6.87 cfs @ 11.96 hrs, Volume= 0.348 af, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 50 year Rainfall=5.02"

Area (ac)	CN	Description
0.790	98	Paved parking, HSG C
0.175	74	>75% Grass cover, Good, HSG C
0.965	94	Weighted Average
0.175		18.13% Pervious Area
0.790		81.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 4S: Subarea 02



Summary for Subcatchment 8S: Direct Release

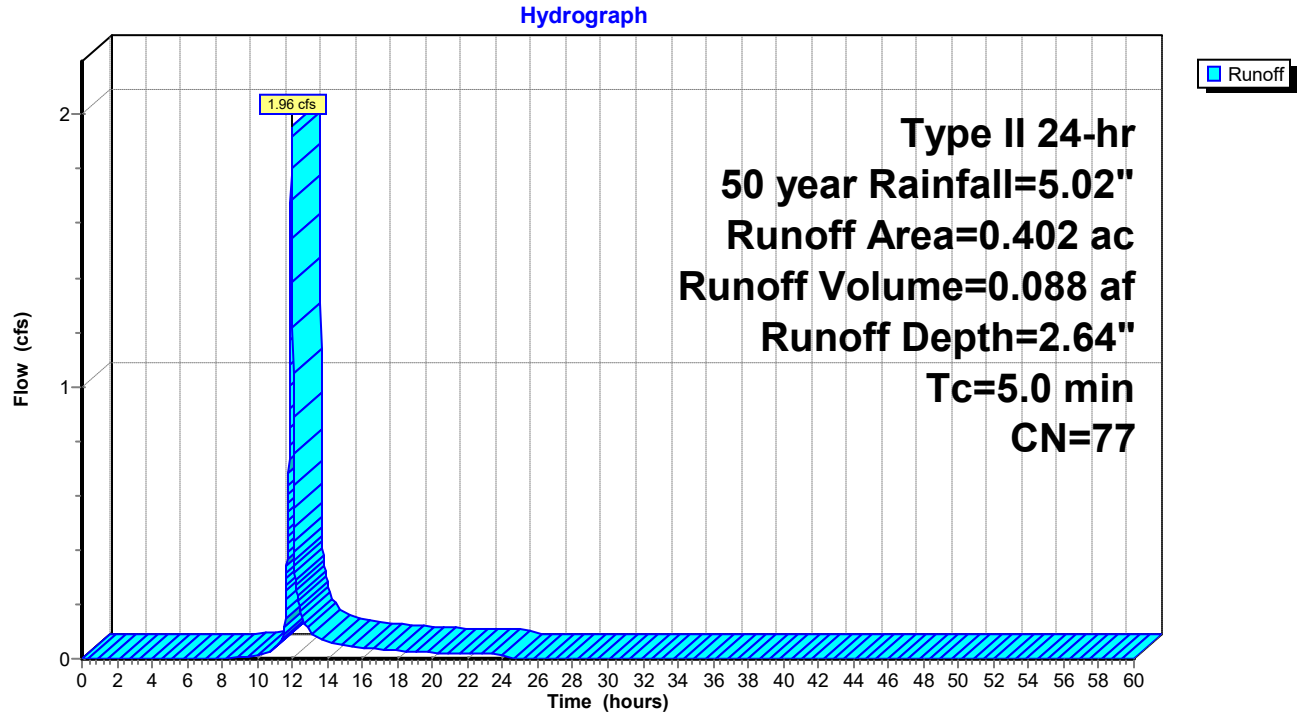
Runoff = 1.96 cfs @ 11.96 hrs, Volume= 0.088 af, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 50 year Rainfall=5.02"

Area (ac)	CN	Description
0.053	98	Paved parking, HSG C
0.349	74	>75% Grass cover, Good, HSG C
0.402	77	Weighted Average
0.349		86.82% Pervious Area
0.053		13.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 8S: Direct Release



Summary for Subcatchment 1S: Pre-developed 01

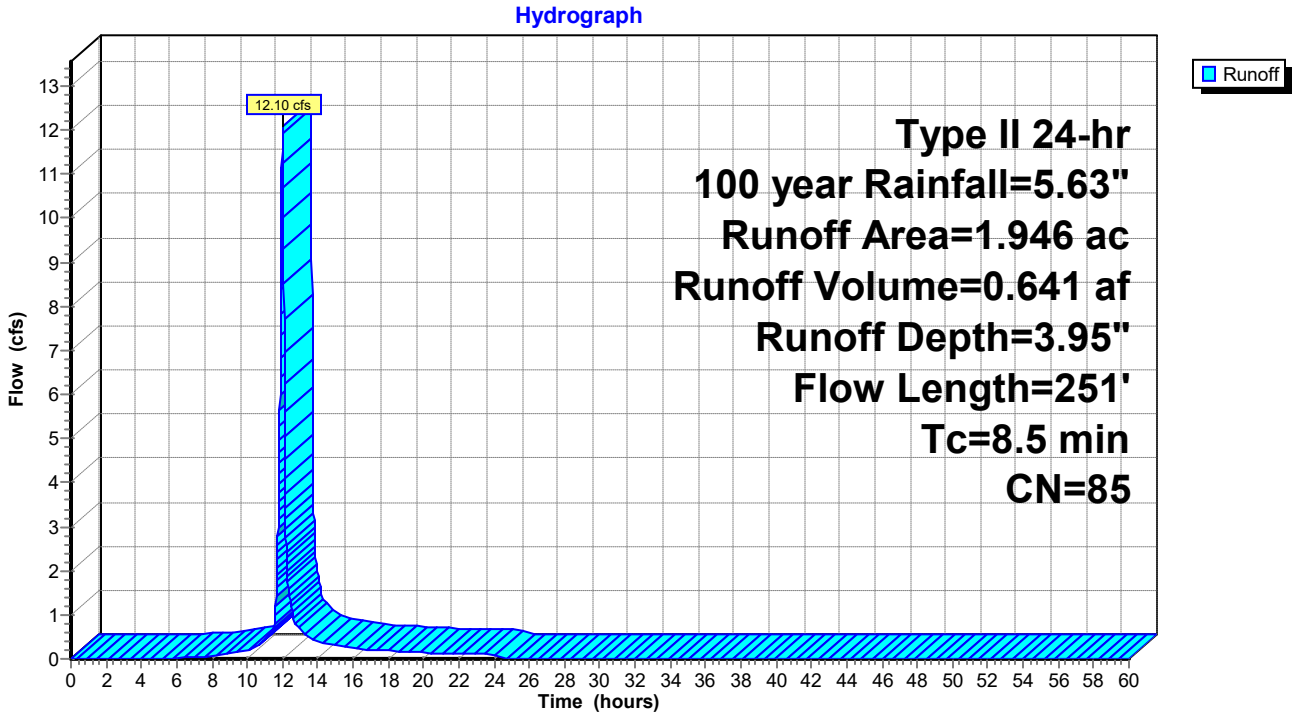
Runoff = 12.10 cfs @ 12.00 hrs, Volume= 0.641 af, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=5.63"

Area (ac)	CN	Description
0.869	98	Paved parking, HSG C
1.077	74	>75% Grass cover, Good, HSG C
1.946	85	Weighted Average
1.077		55.34% Pervious Area
0.869		44.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100	0.0871	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.5	151	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.5	251	Total			

Subcatchment 1S: Pre-developed 01



Summary for Subcatchment 2S: Pre-developed 02

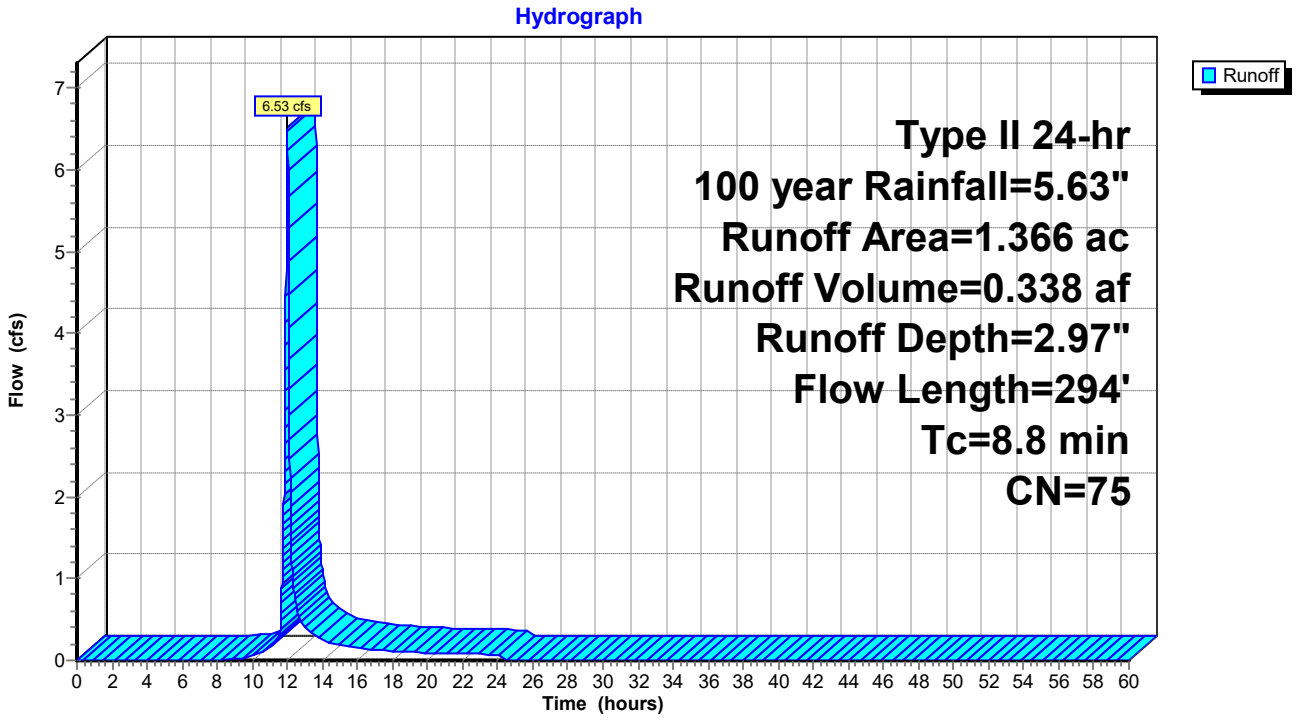
Runoff = 6.53 cfs @ 12.00 hrs, Volume= 0.338 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=5.63"

Area (ac)	CN	Description
0.023	98	Paved parking, HSG C
0.066	96	Gravel surface, HSG C
1.277	74	>75% Grass cover, Good, HSG C
1.366	75	Weighted Average
1.343		98.32% Pervious Area
0.023		1.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	100	0.0752	0.26		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.63"
2.4	194	0.0361	1.33		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.8	294	Total			

Subcatchment 2S: Pre-developed 02



Summary for Subcatchment 3S: Subarea 01

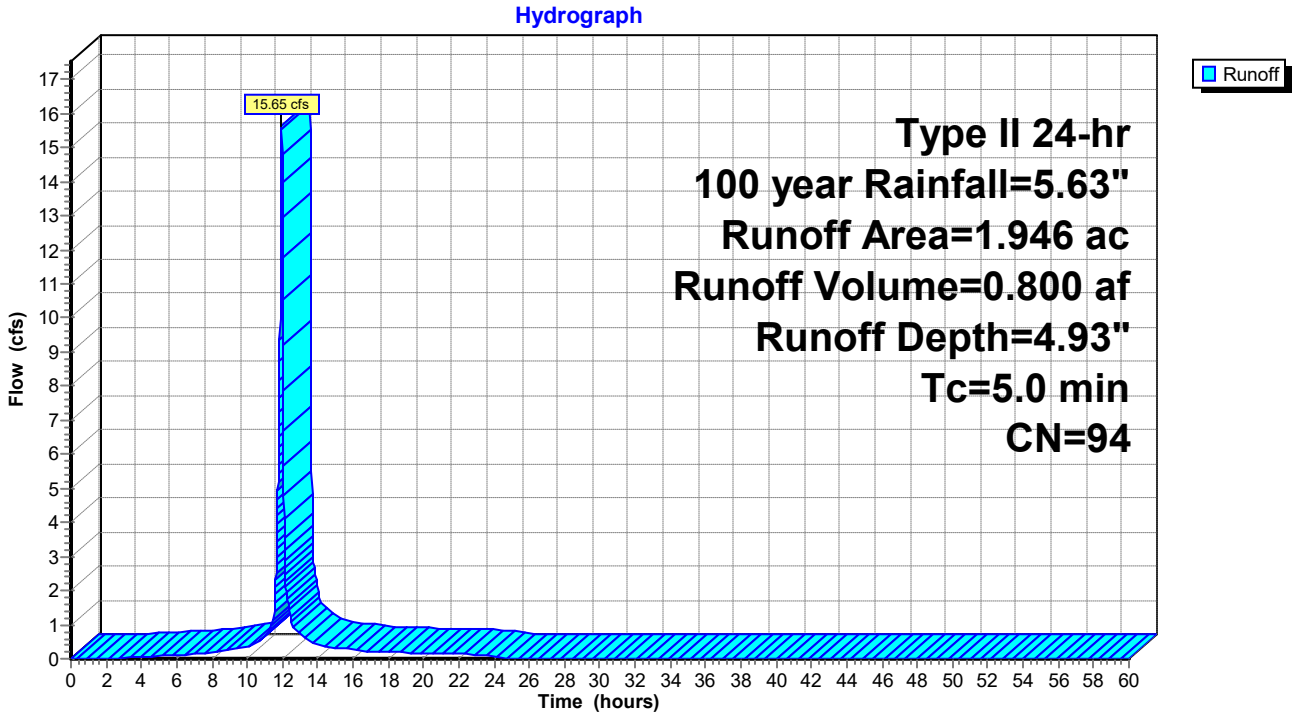
Runoff = 15.65 cfs @ 11.96 hrs, Volume= 0.800 af, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=5.63"

Area (ac)	CN	Description
1.608	98	Paved parking, HSG C
0.338	74	>75% Grass cover, Good, HSG C
1.946	94	Weighted Average
0.338		17.37% Pervious Area
1.608		82.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: Subarea 01



Summary for Subcatchment 4S: Subarea 02

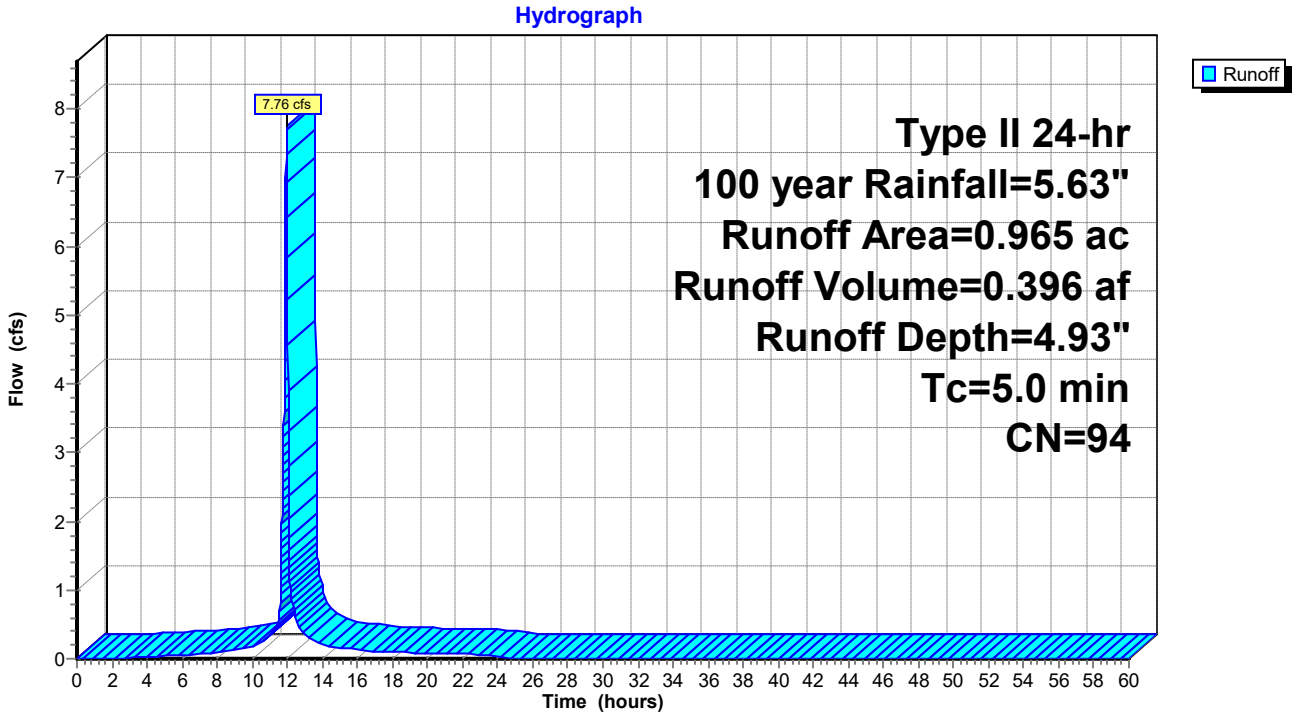
Runoff = 7.76 cfs @ 11.96 hrs, Volume= 0.396 af, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=5.63"

Area (ac)	CN	Description
0.790	98	Paved parking, HSG C
0.175	74	>75% Grass cover, Good, HSG C
0.965	94	Weighted Average
0.175		18.13% Pervious Area
0.790		81.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 4S: Subarea 02



Summary for Subcatchment 8S: Direct Release

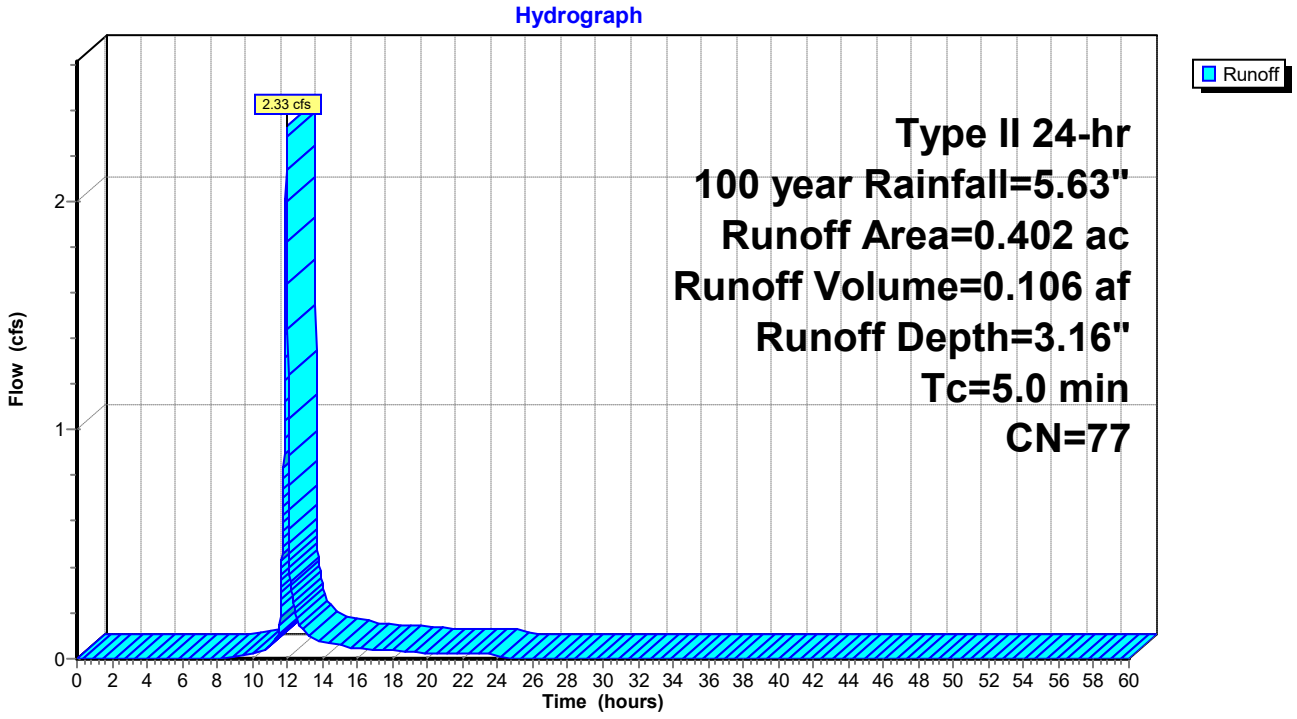
Runoff = 2.33 cfs @ 11.96 hrs, Volume= 0.106 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=5.63"

Area (ac)	CN	Description
0.053	98	Paved parking, HSG C
0.349	74	>75% Grass cover, Good, HSG C
0.402	77	Weighted Average
0.349		86.82% Pervious Area
0.053		13.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 8S: Direct Release



Events for Subcatchment 1S: Pre-developed 01

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1 year	2.20	3.00	0.153	0.94
2 year	2.63	4.07	0.208	1.28
5 year	3.24	5.66	0.291	1.79
10 year	3.74	6.98	0.361	2.23
25 year	4.44	8.87	0.463	2.85
50 year	5.02	10.44	0.549	3.39
100 year	**5.63**	**12.10**	**0.641**	**3.95**

Events for Subcatchment 2S: Pre-developed 02

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1 year	2.20	0.97	0.055	0.48
2 year	2.63	1.54	0.083	0.73
5 year	3.24	2.44	0.128	1.12
10 year	3.74	3.24	0.168	1.47
25 year	4.44	4.41	0.228	2.00
50 year	5.02	5.43	0.281	2.47
100 year	**5.63**	**6.53**	**0.338**	**2.97**

Events for Subcatchment 3S: Subarea 01

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1 year	2.20	5.42	0.257	1.58
2 year	2.63	6.73	0.323	1.99
5 year	3.24	8.56	0.419	2.58
10 year	3.74	10.06	0.498	3.07
25 year	4.44	12.14	0.609	3.76
50 year	5.02	13.85	0.702	4.33
100 year	**5.63**	**15.65**	**0.800**	**4.93**

Events for Subcatchment 4S: Subarea 02

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1 year	2.20	2.69	0.127	1.58
2 year	2.63	3.34	0.160	1.99
5 year	3.24	4.25	0.208	2.58
10 year	3.74	4.99	0.247	3.07
25 year	4.44	6.02	0.302	3.76
50 year	5.02	6.87	0.348	4.33
100 year	**5.63**	**7.76**	**0.396**	**4.93**

Events for Subcatchment 8S: Direct Release

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
1 year	2.20	0.40	0.019	0.56
2 year	2.63	0.61	0.028	0.82
5 year	3.24	0.93	0.042	1.24
10 year	3.74	1.21	0.054	1.61
25 year	4.44	1.61	0.072	2.16
50 year	5.02	1.96	0.088	2.64
100 year	**5.63**	**2.33**	**0.106**	**3.16**

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APPENDIX E:

Exhibits

John Shields Parkway

Larimer Street

Mooney Street

Dale Drive

Tuller Ridge Drive

Existing HD2
Hydrodynamic Unit AS-2

Existing HD3
Hydrodynamic Unit AS-4

Existing HD1
Hydrodynamic Unit AS-6

H1

H2

H3

PRE-DEVELOPED 02
Tributary Area = 1.366 Ac.
% Impervious = 7%
RCN = 75
TC = 8.8 Min.

PRE-DEVELOPED 01
Tributary Area = 1.946 Ac.
% Impervious = 45%
RCN = 85
TC = 8.5 Min.

LEGEND

- Ex Tributary
- Ex Time of Concentration
- Ex Storm Sewer
- Ex FEMA Floodway
- Ex FEMA 100-yr Floodplain
- Ex FEMA 500-yr Floodplain
- Ex Impervious Area

SOURCE

Elevation
- EMH&T Survey Data (September 2024)
- Columbus 1-foot Contours (2017)

Imagery
- Franklin County Aerial (2023)

GRAPHIC SCALE

0 15 30 60

1 inch = 30 feet

EMH&T
Evans, Mechwart, Hambleton & Tilton, Inc.
Engineers • Surveyors • Planners • Scientists
5500 New Albany Road, Columbus, OH 43054
Phone: 614.775.4500 Toll Free: 888.775.3648
emht.com

CITY OF DUBLIN, FRANKLIN COUNTY, OHIO
EXHIBIT
FOR

BRIDGE PARK
BLOCKS H2 & H3
PRE-DEVELOPED TRIBUTARY MAP

CRAWFORD HOYING

DATE: November 14, 2024

JOB NO.: 2023-0704

SCALE: 1" = 30'

SHEET: Exhibit 1

J:\2023\0704\Dwg\04Sheets\Exhibits\Stormwater\20230704_H2H3_Pre_Trib_Map_(2024-11-14).dwg, Last Saved By: mrhebert, 11/14/2024 4:46 PM Last Printed By: Hebert, Mackenzie, 11/14/2024 4:47 PM (No Xrefs)

John Shields Parkway

Larimer Street

Mooney Street

Dale Drive

Tuller Ridge Drive

Existing HD2
Hydrodynamic Unit AS-2

Proposed HD4
Hydrodynamic Unit HCVF-12

Existing HD3
Hydrodynamic Unit AS-4

Existing HD1
Hydrodynamic Unit AS-6

DIRECT RELEASE
Tributary Area = 0.402 Ac.
% Impervious = 13%
RCN = 77
TC = 5.0 Min.

SUBAREA 02
Tributary Area = 0.965 Ac.
% Impervious = 82%
RCN = 94
TC = 5.0 Min.

SUBAREA 01
Tributary Area = 1.946 Ac.
% Impervious = 83%
RCN = 94
TC = 5.0 Min.

H3 H2 H1

EX1 EX2 EX2.1 EX2.2 EXHD3

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

LEGEND

- Prop Tributary
- Ex Storm Sewer
- Prop Storm Sewer
- Ex FEMA Floodway
- Ex FEMA 100-yr Floodplain
- Ex FEMA 500-yr Floodplain
- Prop Impervious Area

SOURCE

Elevation
- EMH&T Survey Data (September 2024)
- Columbus 1-foot Contours (2017)

Imagery
- Franklin County Aerial (2023)

GRAPHIC SCALE

0 15 30 60

1 inch = 30 feet

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CITY OF DUBLIN, FRANKLIN COUNTY, OHIO
EXHIBIT
FOR

BRIDGE PARK
BLOCKS H2 & H3
POST-DEVELOPED TRIBUTARY MAP

CRAWFORD HOYING

DATE: November 14, 2024

JOB NO.: 2023-0704

SCALE: 1" = 30'

SHEET: Exhibit 2