STORMWATER MANAGEMENT REPORT

for the:

Americana Center

Township of East Windsor
Borough of Hightstown
Mercer County, New Jersey

Prepared By:

Menlo Engineering Associates, Inc
261 Cleveland Avenue
Highland Park, New Jersey 08904
T.: 732.846.8585
F.: 732.846.9439

Under the Immediate Supervision of:

Gregory S. Oman, P.E.
NJ PE # 43441

GSO/SK
MEA # 2005.109.02
Dated: October 9, 2017
Rev. 5) July 13, 2022

menlo engineering associates

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CONTENTS

INTRODUCTION

This report analyzes the stormwater drainage conditions that will occur as a result of the new development at proposed Americana Center property, divided between the Township of East Windsor (H-3 district) and the Borough of Hightstown (R-3 district), Mercer County, New Jersey. The subject site is more specifically defined as Block 57, Lots 9, 10, 11 (East Windsor) and Block 7, Lots 40.02 & 41 (Hightstown). Said existing lots are shown on the USGS and Site Location maps provided within this report and shall hereby be referenced as "the Site". The site consists of approximately 6.46 acres and is bounded by NJ State Highway US Route 130 to the north, Rocky Brook to the east, a single-family residential development to the south and a single-story furniture store to the west. Access to/from the site is handled by seven separate curb cuts along Route 130. Currently onsite resides a single-story furniture store, motel, diner and two small retail buildings. The applicant proposes demolishing all the buildings onsite with the exception of the diner and one of the retail buildings.

The applicant, Americana Hospitality Group, proposes redeveloping a 6.46-acre tract within the central portion of East Windsor Township as a commercial development. The project anticipates constructing one (1) new building, while expanding the existing diner and a small retail strip along Route 130. Three (3) structures are single users: renovated existing diner with 10,933 SF, proposed 11,608 SF Fitness Center, and the existing 5,790 SF retail building with 2,489 SF building addition. Additional improvements include driveways, sidewalks, parking and landscaped areas, stormwater management facilities, associated utilities, and related site improvements. Proposed stormwater management facilities on site were designed to support future three-story office building, with total floor area of 33,750 SF, which is not part of this application.
The scope of this report includes analysis of runoff generated by the proposed buildings, paved areas, landscaped areas, as well as an analysis of the resulting stormwater collection system and proposed underground detention basins, as shown on the accompanying Site Plan documents.

The following items shall be addressed within this report:

- Narrative of pre- and post-development conditions with calculations to substantiate derived runoff coefficients and time of concentration;
- Calculations for the water quality storm utilizing the NJDEP 1.25"/2 hours water quality design storm;
- Storm pollutant (TSS) removal;
- Calculations for the 2-, 10-, and 100- year storm peak runoff rates for involved parts of the site under pre- and post-development conditions, respectively;
- Calculations for the proposed underground detention basin including inflow hydrographs, outflow hydrographs and a storage volume versus depth table.
- Calculations to verify the capacity of the proposed stormwater conveyance system.

The primary design constraints for this project are based on the standards of the Township of East Windsor, the Borough of Hightstown, Mercer County, the New Jersey Soil Conservation Service, and the New Jersey Department of Environmental Protection (NJDEP) Rules and Regulations.

The purpose of this report is to demonstrate that the proposed stormwater management system will mitigate stormwater runoff while providing water quality, and to assist Engineer at the Municipal level in evaluating the drainage calculations and considerations incorporated in the design as shown on the plans submitted. The report supplements, and should be reviewed in conjunction with, the project development plans prepared by Menlo Engineering Associates, Inc.

ROAD MAP

Township of East Windsor &
Borough of Highstown
Mercer County

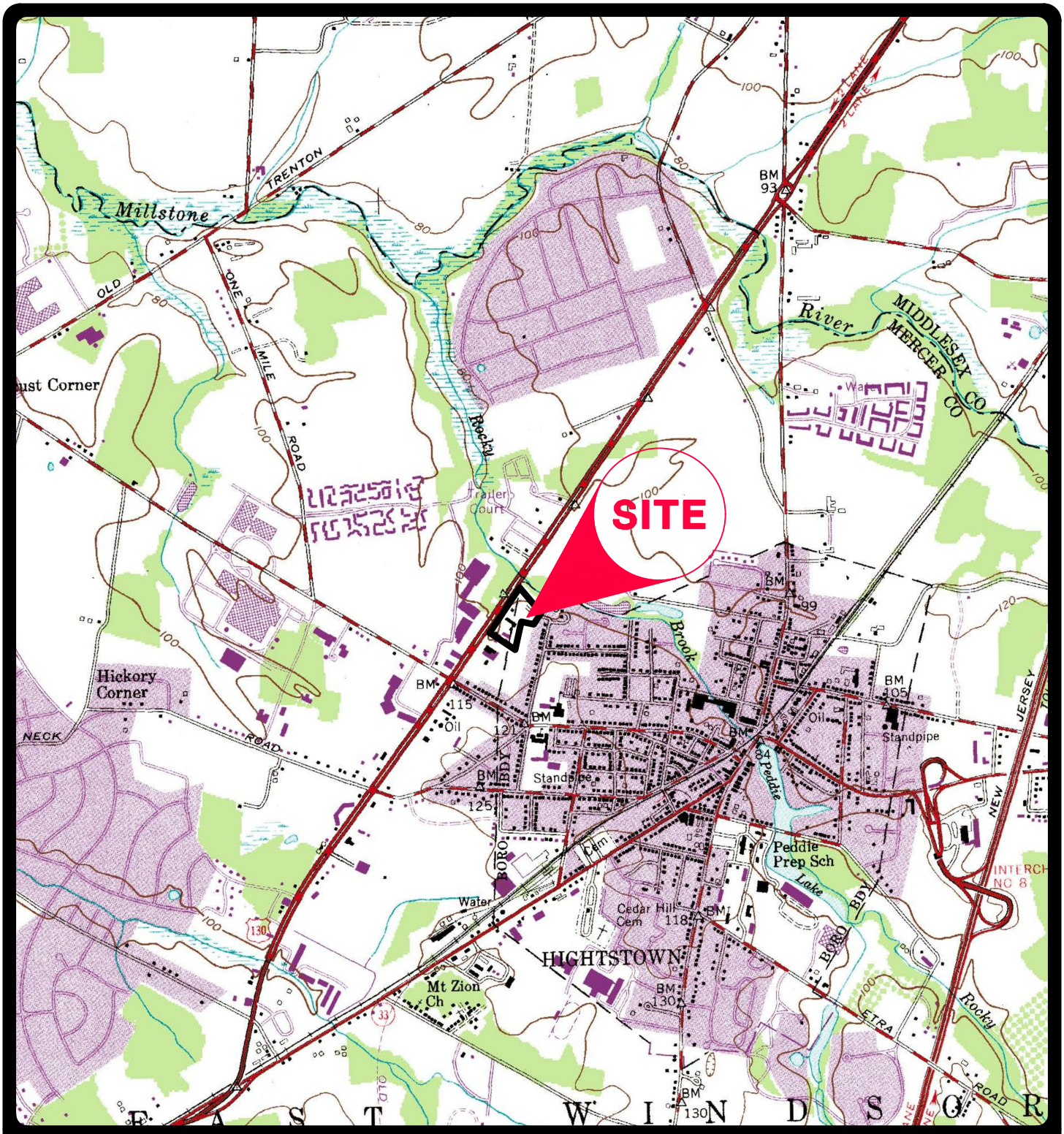
MENLO ENGINEERING ASSOCIATES, INC.
261 CLEVELAND AVENUE
HIGHLAND PARK, NJ 08904
(732) 846-8585

East Windsor	Hightstown
BLOCK	BLOCK
57	7
LOTS	LOTS
9, 10 & 11	40.02 & 41

Scale: 1"=1,000± ft Job # 2005.109.02

0 500' 1,000'
250' 750'

DP



U.S.G.S. MAP

Quad Name: Highstown
Township of East Windsor &
Borough of Highstown
Mercer County

MENLO ENGINEERING ASSOCIATES, INC.
261 CLEVELAND AVENUE
HIGHLAND PARK, NJ 08904
(732) 846-8585

State Plane Coordinates:
N: 525,022.20 ft.
E: 482,250.12 ft.

East Windsor	Hightstown
BLOCK 57	BLOCK 7
LOTS 9, 10 & 11	LOTS 40.02 & 41

Job # 2005.109.02
Scale: 1"=2,000± ft

0 500' 1,000' 1,500' 2,000'

DP

This office will readily respond to questions and requests for additional calculations or verification of the proposed design by Municipal Engineers and will be responsive to his suggestions and modifications to the design in conformance to the applicable codes in the interest of land use control consistent with environmental protection.

CRITERIA

In the hydraulic designs involved in this project, the drainage areas have been determined by electronic digitizer from the U.S.G.S. Quadrangle map, Legal and Topographic survey prepared by Control Layouts, Inc. and field observations to determine off-site and on-site areas. The Soil Conservation Service Soil Survey maps are used for hydrological soil group classification. Existing and proposed conditions are calculated for the 2, 10 and 100-year design storms. On-site storm sewer collection systems were sized for the 25-year storm and employed the Rational Method for design calculations.

STORMWATER MANAGEMENT PLAN & DESIGN

The guidelines for hydraulic design, as prepared by the Soil Conservation District, the Township of East Windsor and the Borough of Hightstown, Mercer County, and the New Jersey Department of Environmental Protection have been utilized for the drainage design of this project.

Additional stormwater detention systems are required on-site to attenuate flows from proposed impervious and pervious surfaces on the property. Calculations of runoff values, peak rates of discharge, and hydrographs were generated using the runoff control measures listed in the Soil Conservation Services TR-55 Method. This methodology was used to calculate both existing and proposed stormwater runoff generated from the site.

Existing Conditions:

The existing drainage pattern of the site drains from a South to North direction to existing drainage systems located within Route 130. These drainage systems eventually convey runoff down to Rocky Brook. Today, the drainage is broken into two separate systems, each of approximate equal area with the remaining drainage at the southern end of the site drains to an isolated wetland and ditch. This report demonstrates that the use of two separate underground detention basins provides the required rate of reduction to each of the points of analysis.

Under existing conditions, the portion of the site impacted by proposed development consists of two (2) drainage areas: EX-1 (3.07 ac), draining to the P.O.I. “A”, and EX-2 (2.65 ac), draining to the P.O.I. "B" at the right upper corner of the property, as depicted on the accompanying Existing Drainage Area Map (see Fig. 1). Some roof area (0.10 ac) of existing diner drains to an existing detention basin, located under existing parking lot behind the diner, and discharging runoffs to Rocky Brook at upper corner of this site.

This site is depicted by the Mercer County Soils Manual as a combination of SacB (Sassafras sandy loam), MBYB (Mattapex and Bertie loams), and UdstB (Udorthents, stratified substratum) soils.

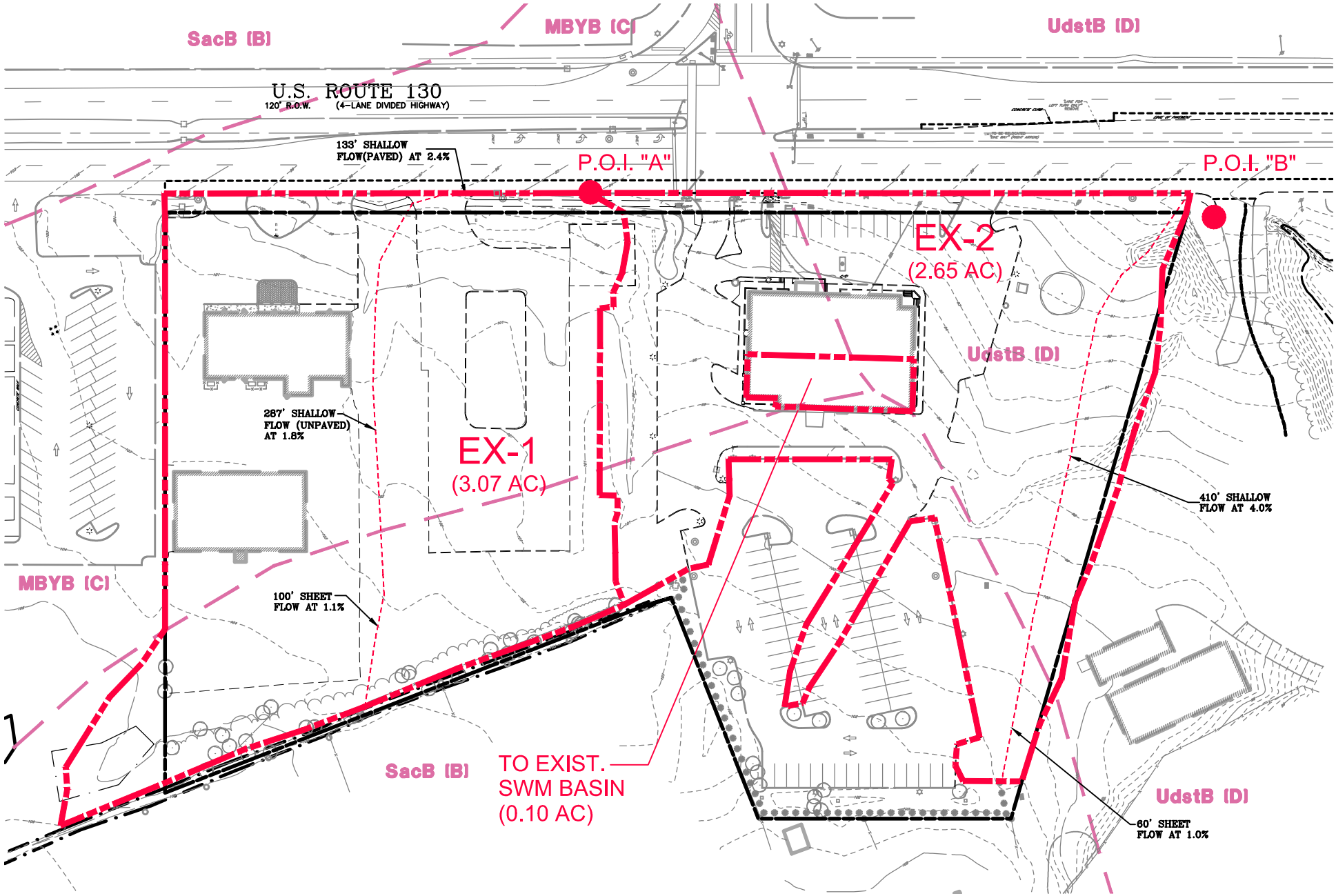


Figure 1. EXISTING DRAINAGE AREA MAP.

Per the Soil Conservation System Urban Hydrology for Small Watersheds, these soils belong to Hydrologic Soil Groups (HSG) "B, “C” and “D” respectively. Additional information on this soil types is contained in the Appendix E of this report.

Proposed Conditions:

The stormwater management facilities for the proposed development have been designed to maintain the natural, existing drainage patterns to the fullest extent possible, and to meet the governing agencies' requirements with respect to groundwater recharge, water quality and pick flow reductions. Under post-development conditions, four (4) main drainage areas PR-1a (0.19 AC), PR-1b (3.28 AC), PR-2a (0.47 AC) and PR-2b (1.78 AC) are proposed, as depicted on the accompanying Proposed Drainage Area Map (see Fig. 2).

Proposed pick rate of runoff from site during and after development to Point of Interest (P.O.I.) “A” will be increased, and the use of proposed underground detention basin will allow runoff rates for the 100, 10 and 2-year design storms to be reduced in accordance with current NJDEP standards. Based on the comparison of the peak discharge rates between the existing and proposed conditions, the outlet control structure at detention basin has been designed to reduce peak flows leaving the Site to P.O.I. “A” after development. See Appendix D for detention system routing calculations.

Proposed pick rates of runoff from site during and after development to Point of Interest (P.O.I.) "B" will be reduced, and for stormwater leaving the site to P.O.I. "B", post-construction runoff hydrographs for the 2, 10 and 100-year storm events will not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm event, which complies with requirements for stormwater runoff quantity control. Comparison tables and hydrographs for Existing and Proposed rates of runoff to P.O.I. "B" can be found at Appendix C of this report.

The time of concentration and travel time (Tc) calculations have been completed in accordance with Chapter 3 of the SCS Technical Release 55 Manual. Since all proposed areas have a time of concentration less than ten (10) minutes, a minimum of ten (10) minutes was used for calculations.

Pipe sizing calculations have been made using 25-year design storm for capacity verification. Conveyance calculations and an Inlet Drainage Area Map (see Fig. 5) supporting pipe sizing results are included in the Appendix F of this report.

Some runoff will be leaving proposed paved parking area at eastern border of the site through five (5) 3 feet wide curb cuts with 4 ft long stone filter strips behind (see Fig. 6). Since proposed stormwater velocities at these openings (see channel reports for curb cuts CC1, CC2, CC3, and CC4 in the Appendix F of this report) are lower than maximum allowable for sandy loams found in this area (2.5 ft./sec. maximum allowable velocity for sandy loam), no conduit outlet protections behind these curb cuts are required.

Summary of the Rate of Runoff:

As demonstrated in tables below, the proposed development will comply with the required rate or reductions for the 100, 10 and 2-year storm events, in accordance with NJDEP Stormwater Management Rules.

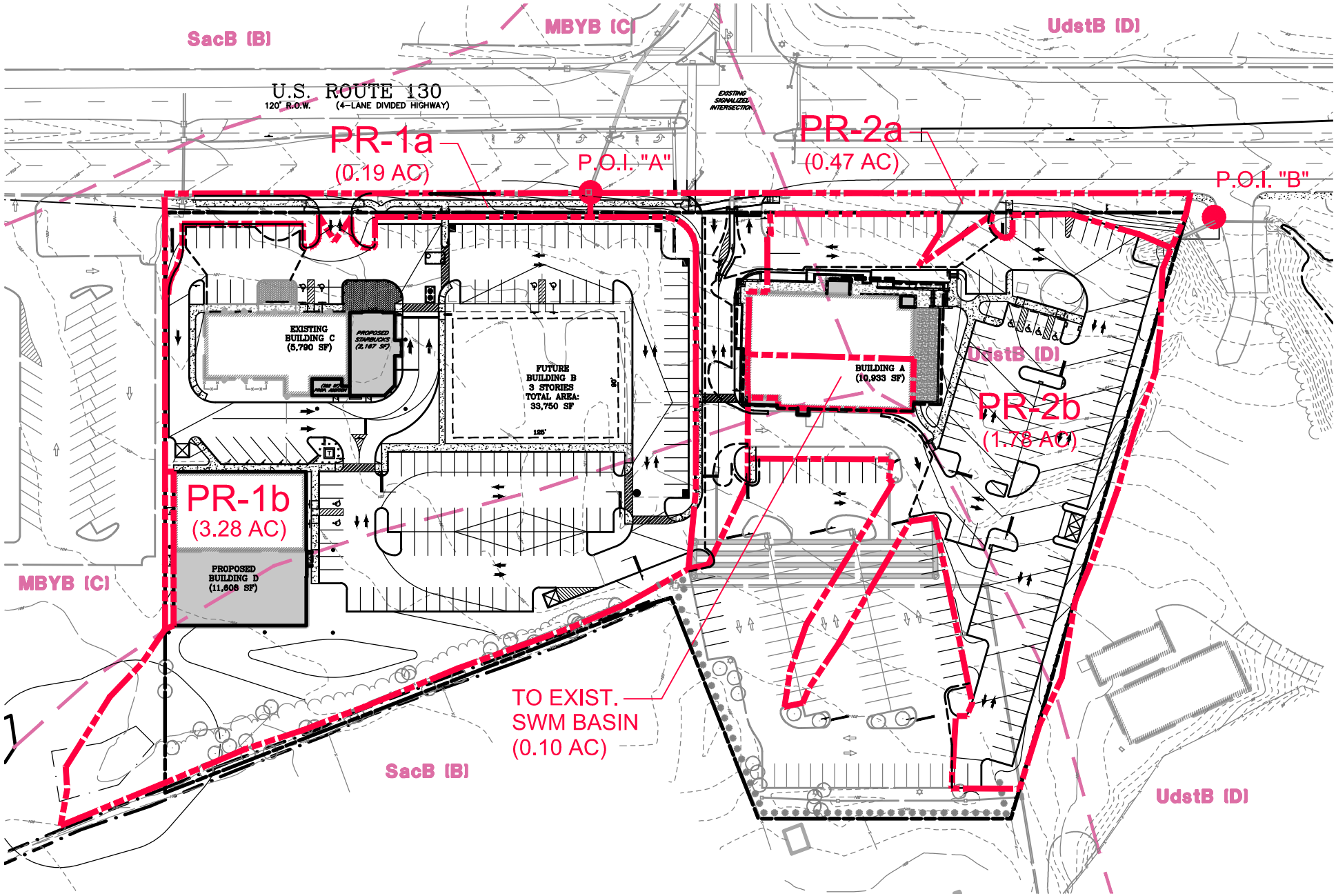


Figure 2. PROPOSED DRAINAGE AREA MAP.

SUMMARY OF SITE RUNOFF TO P.O.I. "A"

STORM	EXISTING RUNOFF FROM SITE TO P.O.I. "A" (CFS)	REQUIRED NJDEP REDUCTIONS	ALLOWABLE RUNOFF FROM SITE TO P.O.I. "A" (CFS)	PROPOSED RUNOFF FROM SITE TO P.O.I. "A" (CFS)
100	12.30	20%	9.84	9.75
10	6.39	25%	4.79	4.72
2	3.44	50%	1.72	1.67

SUMMARY OF SITE RUNOFF TO P.O.I. "B"

STORM	EXISTING RUNOFF FROM SITE TO P.O.I. "B" (CFS)	PROPOSED RUNOFF FROM SITE TO P.O.I. "B" (CFS)
100	13.74	11.92
10	7.96	6.87
2	4.93	4.23

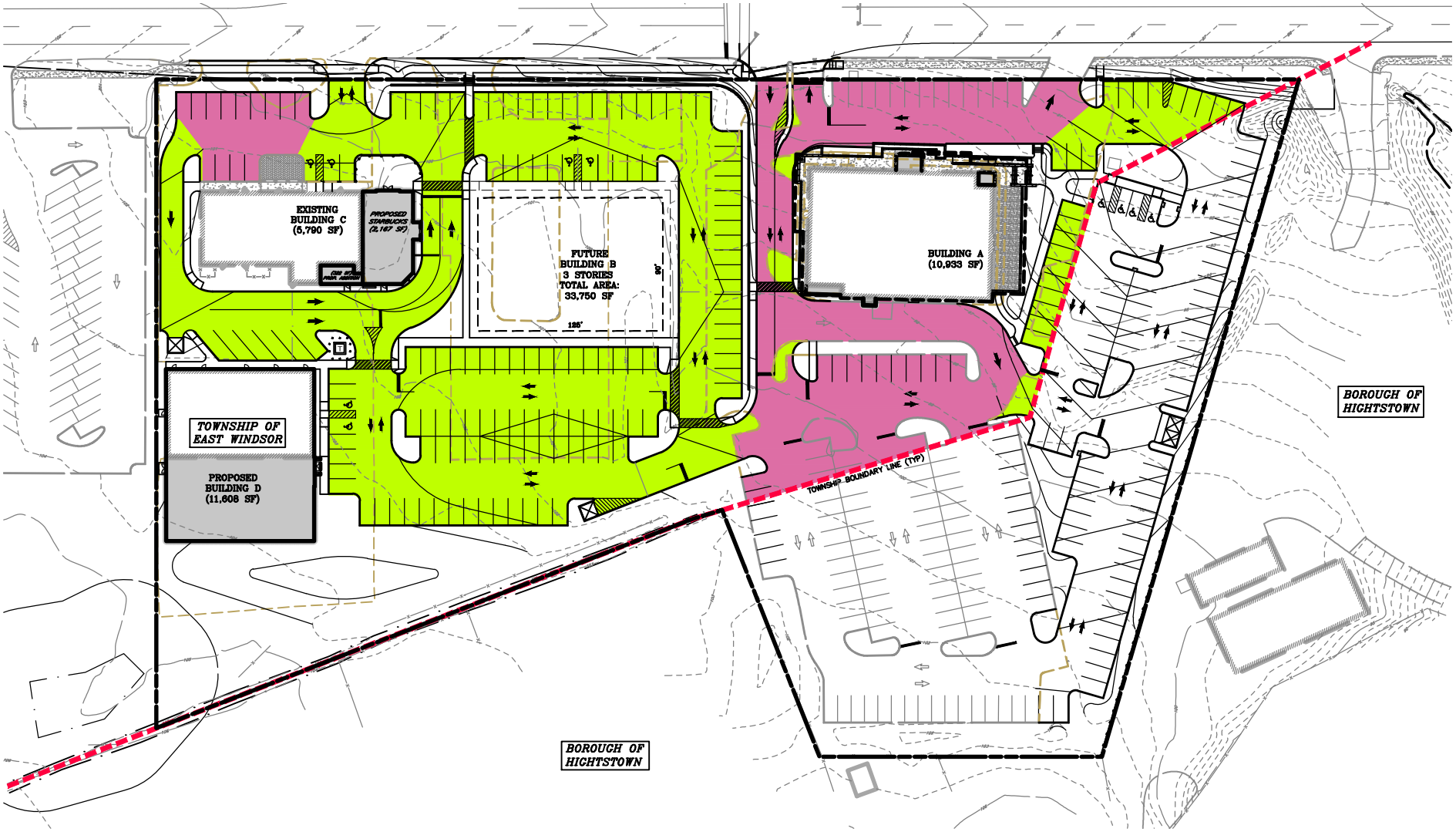
Result: The rate of runoff leaving the site complies with all required Municipal and State requirements and reductions up to and including the 100-year storm event.

Pipe calculations for Run B have been updated per adjusted pipe layout. (See Appendix F). Pipe calculations for Run C were not completed because the outfall from the existing underground basin was not modeled. The proposed outfall pipes have the same size pipe and steeper slopes than the existing pipes today. Based on our site inspections, the existing stormwater collection line has sufficient capacity for outfall flows and runoff from the site has been reduced per the summary table above.

The pipe calculations sheet showing capacity of existing outfall pipes based on their sizes and slopes can be found in Appendix F.

Summary of the Groundwater Recharge Analysis:

The onsite testing concludes that the permeability rates throughout the site are less than 0.20 inches per hour. Per the NJDEP standards, groundwater recharge is not possible and/or required for sites with little to no permeability.



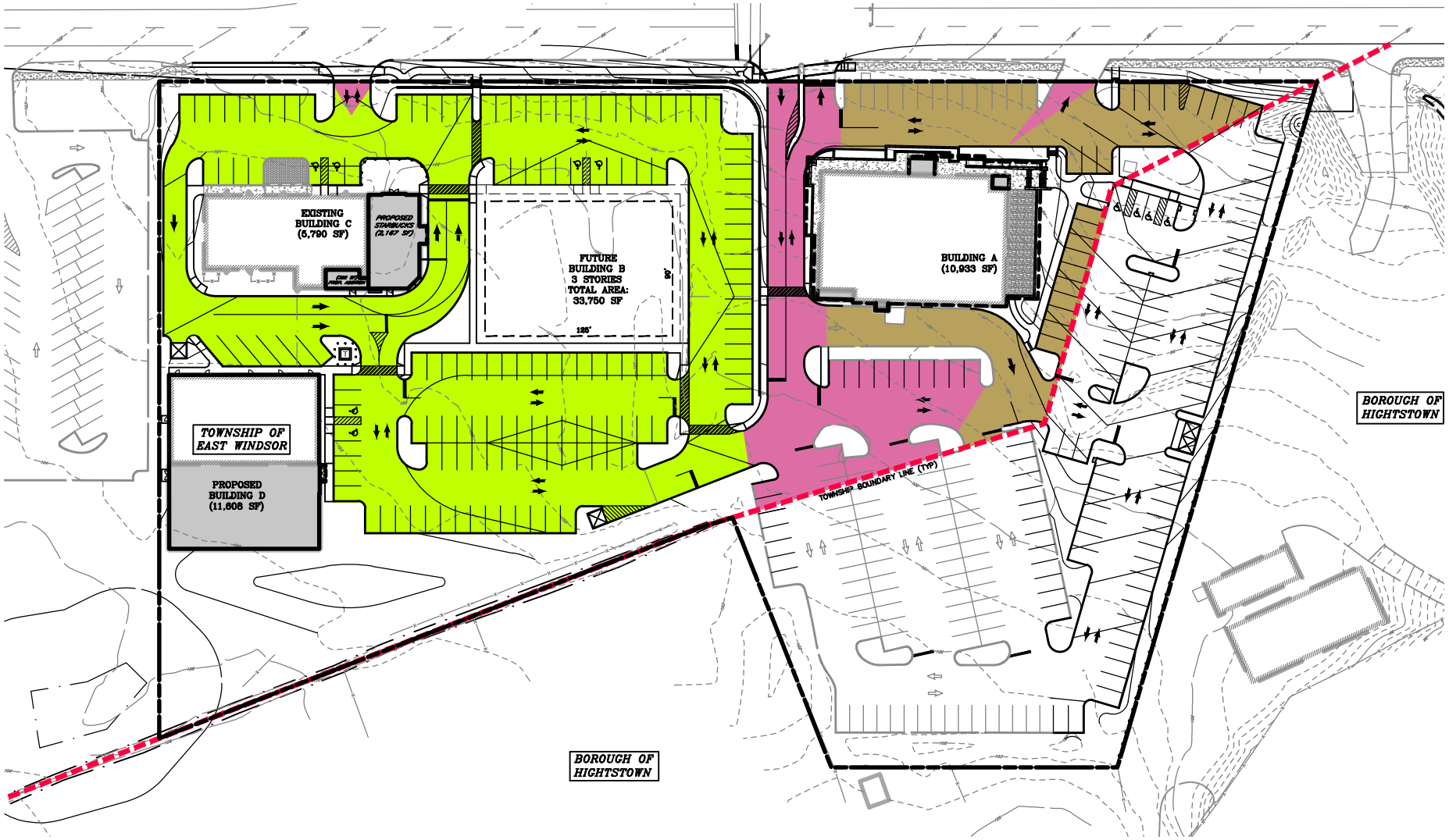
– AREA OF 0% TSS REMOVAL REQUIRED. EXISTING PAVEMENT TO REMAIN UNDISTURBED. (30,440 SF)

– AREA OF 80% TSS REMOVAL REQUIRED. AREA OF EXISTING PERVIOUS OR EXISTING PAVEMENT TO BE REPLACED WITH NEW PAVEMENT. (66,930 SF)

$$Wr = \frac{66{,}930 \times 0.80 + 30{,}440 \times 0}{97{,}370} = 54.99\ \%$$

Wr – WEIGHTED TSS REMOVAL RATE REQUIRED

Figure 3. TSS REMOVAL REQUIRED.



– AREA OF 0% TSS REMOVAL ACHIEVED. WATER NOT TREATED (16,396 SF)

– AREA OF 50% TSS REMOVAL ACHIEVED. WATER TREATED BY CDS TREATMENT DEVICE. (18,086 SF)

– AREA OF 80% TSS REMOVAL ACHIEVED. WATER TREATED BY STORMFILTER (62,888 SF)

$$Wa = \frac{62{,}888 \times 0.80 + 18{,}086 \times 0.50 + 16{,}396 \times 0}{97{,}370} = 60.96\ \%$$

Wa – WEIGHTED TSS REMOVAL RATE ACHIEVED

Figure 4. TSS REMOVAL ACHIEVED.

Summary of the Water Quality Analysis:

A Peak Diversion StormFilter SFPD0814 and CDS-3030-6-F treatment unit by Contech Engineered Solutions will provide 80% and 50% TSS removal. This, in conjunction with the replacement of existing pavement with new pavement allows the site to meet the TSS removal requirement.

Through the use of StormFilter and CSD Treatment device, the site provides a weighted TSS removal rate of 60.96%, where 54.99% is required (see Fig. 3 and Fig. 4). See Appendix G of this report for related documents.

Nonstructural Stormwater Management Strategies

The NJDEP Nonstructural Strategies Point System (NSPS) has been utilized (see Appendix H for supporting tables) in order to provide proof that the proposed nonstructural measures are adequate and have been used to the maximum extent practicable at this development, as required by NJDEP, the Township of East Windsor and the Borough of Hightstown Standards. Some of them are:

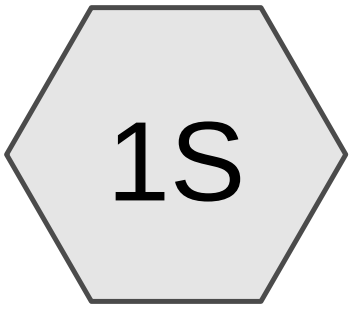
- Impervious coverage was minimized to the maximum extent practicable.
- Existing vegetation was preserved to the maximum extent possible.
- Disturbed areas were stabilized with non-lawn grass mixes.
- Low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides were provided.
- Clearing and grading was minimized in order to minimize land disturbance.

Conclusions:

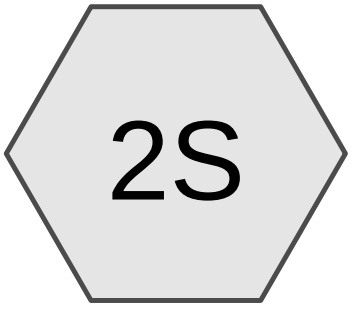
The proposed stormwater management system for a proposed development at Americana Center has been designed with provisions for safe and efficient control of stormwater runoff in a manner which will not adversely affect the existing drainage patterns found in the surrounding areas and consists of an underground detention basin and two stormwater treatment devices, designed to reduce the rate of runoff and enhance the runoff water quality.

It is the opinion of this office that the proposed development will not have any negative impacts on the drainage characteristics of the site, or the immediately surrounding areas. Further, it is the opinion of this office, that the proposed development will be in compliance with all applicable stormwater management regulations as established by the NJDEP, the Township of East Windsor and the Borough of Hightstown Standards.

APPENDIX A: EXISTING CONDITIONS



Existing Drainage Area
EX-1



Existing Drainage Area
EX-2

Subcat Reach Pond Link

Routing Diagram for 2005.109.02_EXISTING
Prepared by Menlo Engineering Associates, Inc., Printed 11/7/2018

2 YEAR STORM

Summary for Subcatchment 1S: Existing Drainage Area EX-1

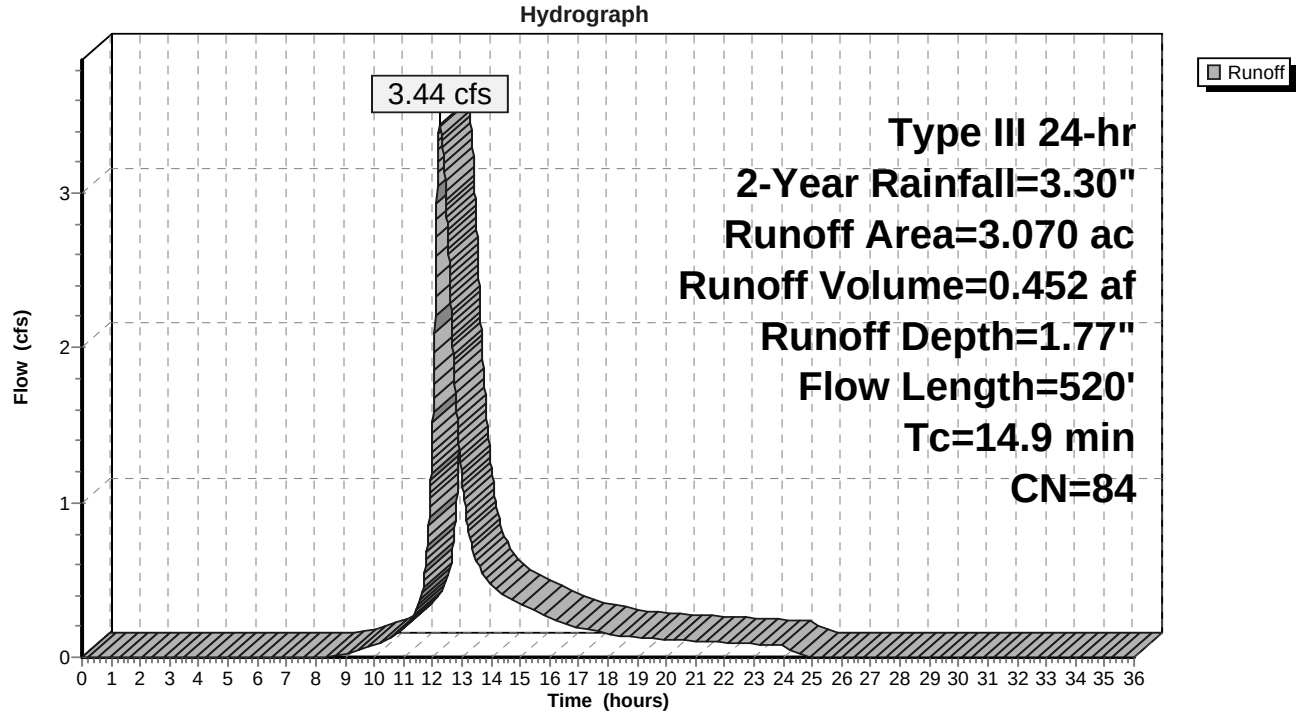
Runoff = 3.44 cfs @ 12.25 hrs, Volume= 0.452 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (ac)	CN	Description
	0.220	55	Woods, Good, HSG B
	0.490	61	>75% Grass cover, Good, HSG B
	0.640	74	>75% Grass cover, Good, HSG C
*	1.720	98	Paved parking
	3.070	84	Weighted Average
	1.350		43.97% Pervious Area
	1.720		56.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	100	0.0115	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.2	287	0.0188	2.21		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	133	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.9	520	Total			

Subcatchment 1S: Existing Drainage Area EX-1



Hydrograph for Subcatchment 1S: Existing Drainage Area EX-1

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.02	0.00	0.00
1.00	0.03	0.00	0.00
1.50	0.05	0.00	0.00
2.00	0.07	0.00	0.00
2.50	0.08	0.00	0.00
3.00	0.10	0.00	0.00
3.50	0.12	0.00	0.00
4.00	0.14	0.00	0.00
4.50	0.16	0.00	0.00
5.00	0.19	0.00	0.00
5.50	0.21	0.00	0.00
6.00	0.24	0.00	0.00
6.50	0.27	0.00	0.00
7.00	0.30	0.00	0.00
7.50	0.34	0.00	0.00
8.00	0.38	0.00	0.00
8.50	0.42	0.00	0.00
9.00	0.48	0.00	0.02
9.50	0.55	0.01	0.04
10.00	0.62	0.03	0.08
10.50	0.71	0.05	0.12
11.00	0.83	0.08	0.19
11.50	0.98	0.14	0.33
12.00	1.65	0.51	**1.45**
12.50	2.32	0.98	**2.80**
13.00	2.47	1.10	1.16
13.50	2.59	1.18	0.63
14.00	2.68	1.25	0.47
14.50	2.75	1.32	0.39
15.00	2.82	1.37	0.34
15.50	2.88	1.42	0.30
16.00	2.92	1.45	0.25
16.50	2.96	1.49	0.22
17.00	3.00	1.52	0.19
17.50	3.03	1.54	0.17
18.00	3.06	1.57	0.15
18.50	3.09	1.59	0.14
19.00	3.11	1.61	0.13
19.50	3.14	1.63	0.12
20.00	3.16	1.65	0.12
20.50	3.18	1.66	0.11
21.00	3.20	1.68	0.11
21.50	3.22	1.70	0.10
22.00	3.24	1.71	0.10
22.50	3.25	1.73	0.09
23.00	3.27	1.74	0.09
23.50	3.29	1.75	0.08
24.00	**3.30**	**1.77**	0.08
24.50	3.30	1.77	0.02
25.00	3.30	1.77	0.00
25.50	3.30	1.77	0.00
26.00	3.30	1.77	0.00
26.50	3.30	1.77	0.00
27.00	3.30	1.77	0.00
27.50	3.30	1.77	0.00
28.00	3.30	1.77	0.00
28.50	3.30	1.77	0.00
29.00	3.30	1.77	0.00
29.50	3.30	1.77	0.00
30.00	3.30	1.77	0.00
30.50	3.30	1.77	0.00
31.00	3.30	1.77	0.00
31.50	3.30	1.77	0.00
32.00	3.30	1.77	0.00
32.50	3.30	1.77	0.00
33.00	3.30	1.77	0.00
33.50	3.30	1.77	0.00
34.00	3.30	1.77	0.00
34.50	3.30	1.77	0.00
35.00	3.30	1.77	0.00
35.50	3.30	1.77	0.00
36.00	3.30	1.77	0.00

Summary for Subcatchment 2S: Existing Drainage Area EX-2

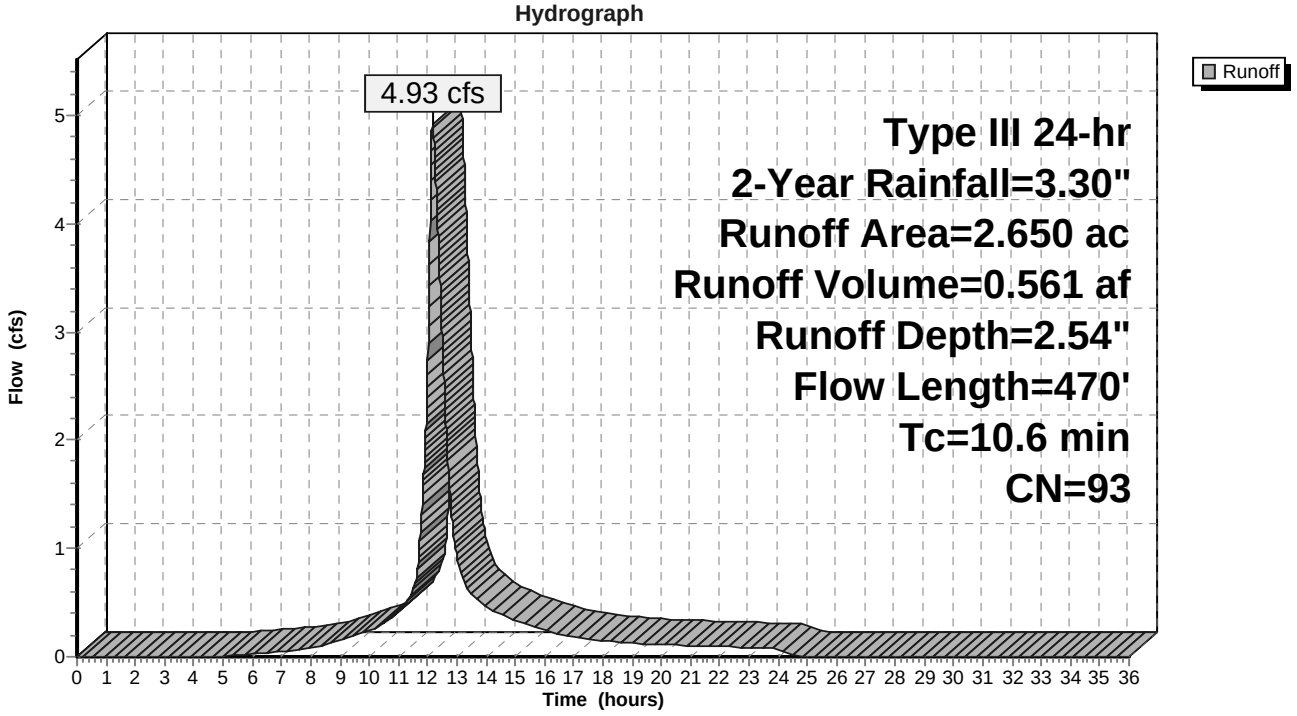
Runoff = 4.93 cfs @ 12.16 hrs, Volume= 0.561 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (ac)	CN	Description
	0.140	61	>75% Grass cover, Good, HSG B
	0.230	74	>75% Grass cover, Good, HSG C
	0.180	80	>75% Grass cover, Good, HSG D
	0.030	96	Gravel surface, HSG D
*	2.070	98	Paved parking & Roof
	2.650	93	Weighted Average
	0.580		21.89% Pervious Area
	2.070		78.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	60	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.1	410	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.6	470	Total			

Subcatchment 2S: Existing Drainage Area EX-2



Hydrograph for Subcatchment 2S: Existing Drainage Area EX-2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.02	0.00	0.00
1.00	0.03	0.00	0.00
1.50	0.05	0.00	0.00
2.00	0.07	0.00	0.00
2.50	0.08	0.00	0.00
3.00	0.10	0.00	0.00
3.50	0.12	0.00	0.00
4.00	0.14	0.00	0.00
4.50	0.16	0.00	0.00
5.00	0.19	0.00	0.01
5.50	0.21	0.00	0.02
6.00	0.24	0.01	0.02
6.50	0.27	0.02	0.03
7.00	0.30	0.02	0.05
7.50	0.34	0.04	0.06
8.00	0.38	0.05	0.08
8.50	0.42	0.07	0.11
9.00	0.48	0.10	0.15
9.50	0.55	0.14	0.19
10.00	0.62	0.18	0.24
10.50	0.71	0.24	0.31
11.00	0.83	0.32	0.41
11.50	0.98	0.44	0.63
12.00	1.65	1.00	**2.61**
12.50	2.32	1.61	**2.96**
13.00	2.47	1.76	0.94
13.50	2.59	1.86	0.57
14.00	2.68	1.95	0.46
14.50	2.75	2.02	0.39
15.00	2.82	2.08	0.34
15.50	2.88	2.14	0.29
16.00	2.92	2.18	0.24
16.50	2.96	2.22	0.21
17.00	3.00	2.26	0.19
17.50	3.03	2.29	0.17
18.00	3.06	2.31	0.15
18.50	3.09	2.34	0.13
19.00	3.11	2.36	0.13
19.50	3.14	2.38	0.12
20.00	3.16	2.41	0.11
20.50	3.18	2.43	0.11
21.00	3.20	2.44	0.10
21.50	3.22	2.46	0.10
22.00	3.24	2.48	0.09
22.50	3.25	2.50	0.09
23.00	3.27	2.51	0.08
23.50	3.29	2.53	0.08
24.00	**3.30**	**2.54**	0.07
24.50	3.30	2.54	0.01
25.00	3.30	2.54	0.00
25.50	3.30	2.54	0.00
26.00	3.30	2.54	0.00
26.50	3.30	2.54	0.00
27.00	3.30	2.54	0.00
27.50	3.30	2.54	0.00
28.00	3.30	2.54	0.00
28.50	3.30	2.54	0.00
29.00	3.30	2.54	0.00
29.50	3.30	2.54	0.00
30.00	3.30	2.54	0.00
30.50	3.30	2.54	0.00
31.00	3.30	2.54	0.00
31.50	3.30	2.54	0.00
32.00	3.30	2.54	0.00
32.50	3.30	2.54	0.00
33.00	3.30	2.54	0.00
33.50	3.30	2.54	0.00
34.00	3.30	2.54	0.00
34.50	3.30	2.54	0.00
35.00	3.30	2.54	0.00
35.50	3.30	2.54	0.00
36.00	3.30	2.54	0.00

10 YEAR STORM

Summary for Subcatchment 1S: Existing Drainage Area EX-1

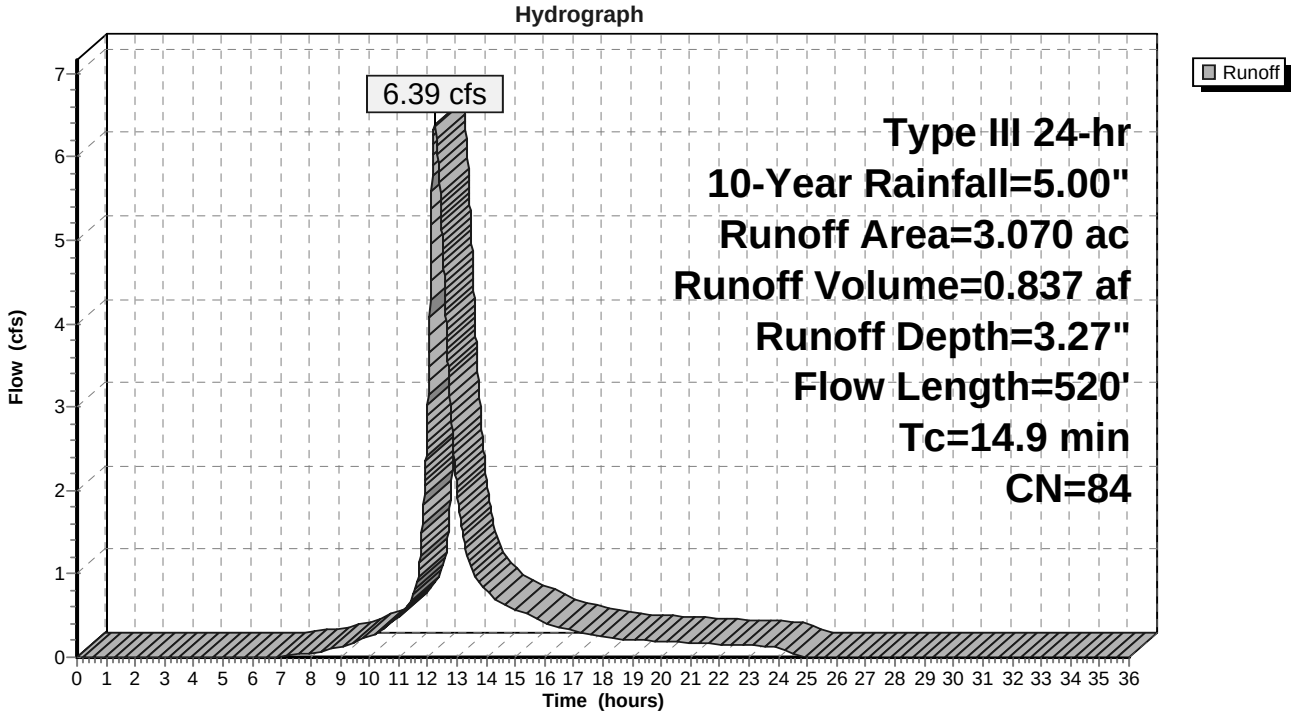
Runoff = 6.39 cfs @ 12.23 hrs, Volume= 0.837 af, Depth= 3.27"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.00"

	Area (ac)	CN	Description
	0.220	55	Woods, Good, HSG B
	0.490	61	>75% Grass cover, Good, HSG B
	0.640	74	>75% Grass cover, Good, HSG C
*	1.720	98	Paved parking
	3.070	84	Weighted Average
	1.350		43.97% Pervious Area
	1.720		56.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	100	0.0115	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.2	287	0.0188	2.21		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	133	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.9	520	Total			

Subcatchment 1S: Existing Drainage Area EX-1



Hydrograph for Subcatchment 1S: Existing Drainage Area EX-1

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00
1.00	0.05	0.00	0.00
1.50	0.08	0.00	0.00
2.00	0.10	0.00	0.00
2.50	0.13	0.00	0.00
3.00	0.15	0.00	0.00
3.50	0.18	0.00	0.00
4.00	0.22	0.00	0.00
4.50	0.25	0.00	0.00
5.00	0.28	0.00	0.00
5.50	0.32	0.00	0.00
6.00	0.36	0.00	0.00
6.50	0.40	0.00	0.00
7.00	0.45	0.00	0.01
7.50	0.51	0.01	0.03
8.00	0.57	0.02	0.05
8.50	0.64	0.03	0.08
9.00	0.73	0.05	0.12
9.50	0.83	0.09	0.18
10.00	0.95	0.13	0.25
10.50	1.08	0.19	0.34
11.00	1.25	0.27	0.48
11.50	1.49	0.41	0.75
12.00	2.50	1.12	**2.90**
12.50	3.51	1.95	**5.05**
13.00	3.75	2.15	2.03
13.50	3.92	2.30	1.07
14.00	4.06	2.42	0.80
14.50	4.17	2.52	0.66
15.00	4.27	2.61	0.58
15.50	4.36	2.69	0.50
16.00	4.43	2.75	0.42
16.50	4.49	2.81	0.36
17.00	4.55	2.86	0.32
17.50	4.60	2.90	0.28
18.00	4.64	2.94	0.25
18.50	4.68	2.98	0.22
19.00	4.72	3.01	0.21
19.50	4.75	3.04	0.20
20.00	4.79	3.07	0.19
20.50	4.82	3.10	0.18
21.00	4.85	3.13	0.17
21.50	4.88	3.16	0.17
22.00	4.90	3.18	0.16
22.50	4.93	3.21	0.15
23.00	4.95	3.23	0.14
23.50	4.98	3.25	0.13
24.00	**5.00**	**3.27**	0.13
24.50	5.00	3.27	0.03
25.00	5.00	3.27	0.00
25.50	5.00	3.27	0.00
26.00	5.00	3.27	0.00
26.50	5.00	3.27	0.00
27.00	5.00	3.27	0.00
27.50	5.00	3.27	0.00
28.00	5.00	3.27	0.00
28.50	5.00	3.27	0.00
29.00	5.00	3.27	0.00
29.50	5.00	3.27	0.00
30.00	5.00	3.27	0.00
30.50	5.00	3.27	0.00
31.00	5.00	3.27	0.00
31.50	5.00	3.27	0.00
32.00	5.00	3.27	0.00
32.50	5.00	3.27	0.00
33.00	5.00	3.27	0.00
33.50	5.00	3.27	0.00
34.00	5.00	3.27	0.00
34.50	5.00	3.27	0.00
35.00	5.00	3.27	0.00
35.50	5.00	3.27	0.00
36.00	5.00	3.27	0.00

Summary for Subcatchment 2S: Existing Drainage Area EX-2

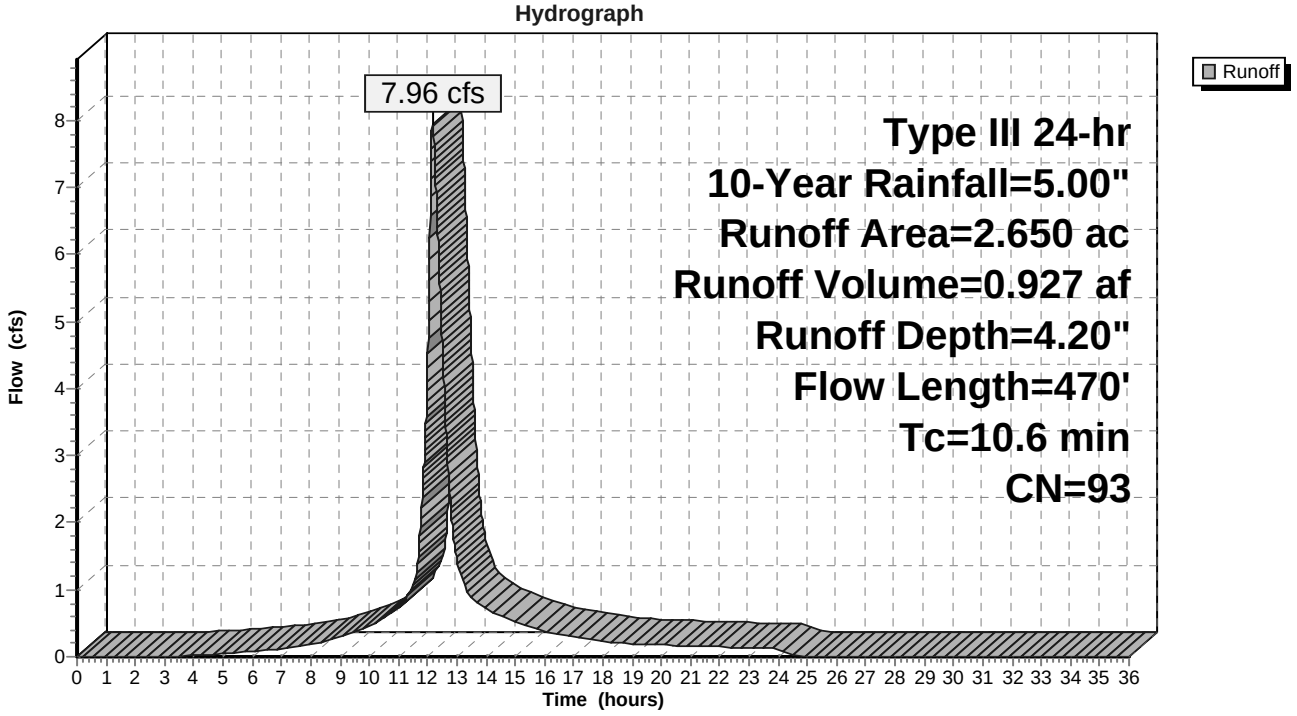
Runoff = 7.96 cfs @ 12.16 hrs, Volume= 0.927 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.00"

	Area (ac)	CN	Description
	0.140	61	>75% Grass cover, Good, HSG B
	0.230	74	>75% Grass cover, Good, HSG C
	0.180	80	>75% Grass cover, Good, HSG D
	0.030	96	Gravel surface, HSG D
*	2.070	98	Paved parking & Roof
	2.650	93	Weighted Average
	0.580		21.89% Pervious Area
	2.070		78.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	60	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.1	410	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.6	470	Total			

Subcatchment 2S: Existing Drainage Area EX-2



Hydrograph for Subcatchment 2S: Existing Drainage Area EX-2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00
1.00	0.05	0.00	0.00
1.50	0.08	0.00	0.00
2.00	0.10	0.00	0.00
2.50	0.13	0.00	0.00
3.00	0.15	0.00	0.00
3.50	0.18	0.00	0.01
4.00	0.22	0.01	0.02
4.50	0.25	0.01	0.03
5.00	0.28	0.02	0.05
5.50	0.32	0.03	0.06
6.00	0.36	0.05	0.07
6.50	0.40	0.06	0.09
7.00	0.45	0.09	0.12
7.50	0.51	0.12	0.15
8.00	0.57	0.15	0.19
8.50	0.64	0.19	0.23
9.00	0.73	0.25	0.30
9.50	0.83	0.32	0.38
10.00	0.95	0.41	0.46
10.50	1.08	0.52	0.57
11.00	1.25	0.65	0.73
11.50	1.49	0.86	1.09
12.00	2.50	1.78	**4.31**
12.50	3.51	2.74	**4.70**
13.00	3.75	2.98	1.47
13.50	3.92	3.14	0.89
14.00	4.06	3.27	0.72
14.50	4.17	3.39	0.61
15.00	4.27	3.48	0.53
15.50	4.36	3.57	0.45
16.00	4.43	3.64	0.38
16.50	4.49	3.70	0.33
17.00	4.55	3.75	0.29
17.50	4.60	3.80	0.26
18.00	4.64	3.84	0.23
18.50	4.68	3.88	0.21
19.00	4.72	3.92	0.20
19.50	4.75	3.95	0.19
20.00	4.79	3.99	0.18
20.50	4.82	4.02	0.17
21.00	4.85	4.05	0.16
21.50	4.88	4.08	0.15
22.00	4.90	4.10	0.14
22.50	4.93	4.13	0.14
23.00	4.95	4.15	0.13
23.50	4.98	4.18	0.12
24.00	**5.00**	**4.20**	0.12
24.50	5.00	4.20	0.01
25.00	5.00	4.20	0.00
25.50	5.00	4.20	0.00
26.00	5.00	4.20	0.00
26.50	5.00	4.20	0.00
27.00	5.00	4.20	0.00
27.50	5.00	4.20	0.00
28.00	5.00	4.20	0.00
28.50	5.00	4.20	0.00
29.00	5.00	4.20	0.00
29.50	5.00	4.20	0.00
30.00	5.00	4.20	0.00
30.50	5.00	4.20	0.00
31.00	5.00	4.20	0.00
31.50	5.00	4.20	0.00
32.00	5.00	4.20	0.00
32.50	5.00	4.20	0.00
33.00	5.00	4.20	0.00
33.50	5.00	4.20	0.00
34.00	5.00	4.20	0.00
34.50	5.00	4.20	0.00
35.00	5.00	4.20	0.00
35.50	5.00	4.20	0.00
36.00	5.00	4.20	0.00

100 YEAR STORM

Summary for Subcatchment 1S: Existing Drainage Area EX-1

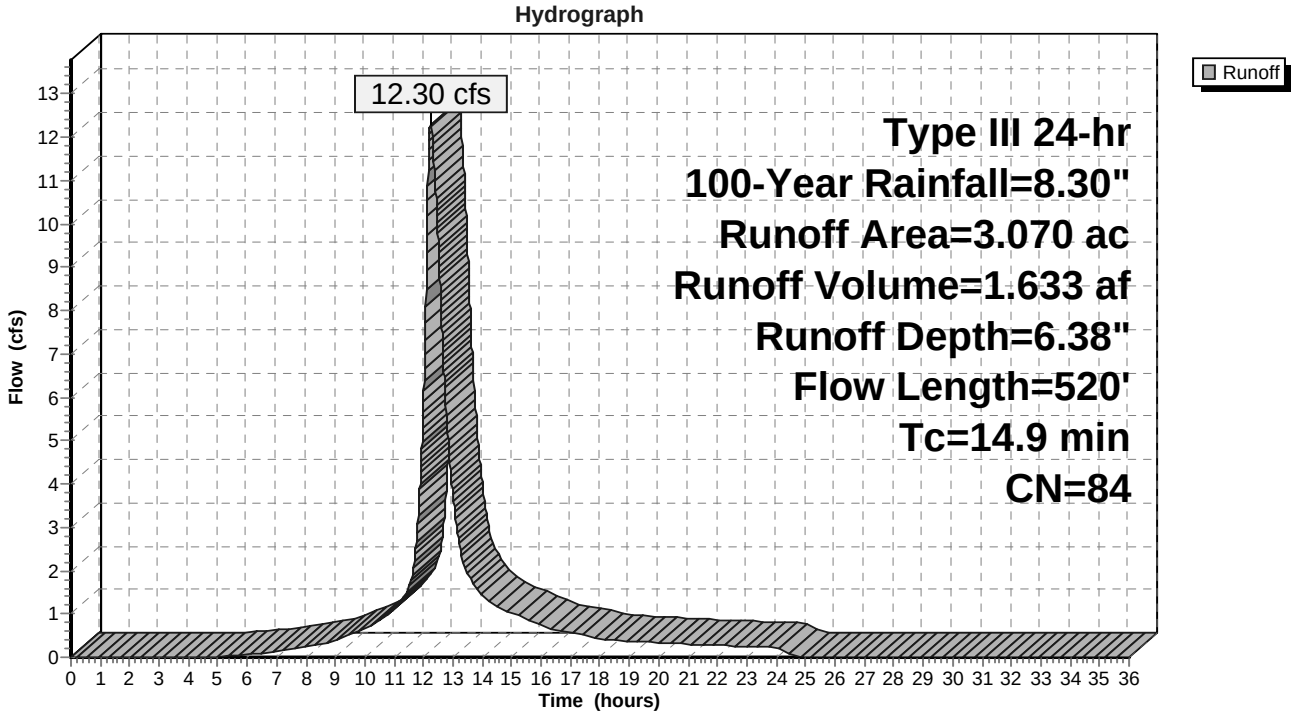
Runoff = 12.30 cfs @ 12.22 hrs, Volume= 1.633 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.30"

	Area (ac)	CN	Description
	0.220	55	Woods, Good, HSG B
	0.490	61	>75% Grass cover, Good, HSG B
	0.640	74	>75% Grass cover, Good, HSG C
*	1.720	98	Paved parking
	3.070	84	Weighted Average
	1.350		43.97% Pervious Area
	1.720		56.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	100	0.0115	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.2	287	0.0188	2.21		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	133	0.0240	3.14		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.9	520	Total			

Subcatchment 1S: Existing Drainage Area EX-1



Hydrograph for Subcatchment 1S: Existing Drainage Area EX-1

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.04	0.00	0.00
1.00	0.08	0.00	0.00
1.50	0.12	0.00	0.00
2.00	0.17	0.00	0.00
2.50	0.21	0.00	0.00
3.00	0.26	0.00	0.00
3.50	0.30	0.00	0.00
4.00	0.36	0.00	0.00
4.50	0.41	0.00	0.00
5.00	0.47	0.00	0.02
5.50	0.53	0.01	0.04
6.00	0.60	0.02	0.06
6.50	0.67	0.04	0.09
7.00	0.75	0.06	0.13
7.50	0.84	0.09	0.17
8.00	0.95	0.13	0.23
8.50	1.07	0.18	0.30
9.00	1.21	0.25	0.40
9.50	1.38	0.34	0.53
10.00	1.57	0.46	0.67
10.50	1.80	0.60	0.86
11.00	2.08	0.80	1.12
11.50	2.47	1.10	1.67
12.00	4.15	2.50	**5.90**
12.50	5.83	4.03	**9.47**
13.00	6.22	4.41	3.71
13.50	6.50	4.67	1.92
14.00	6.73	4.89	1.42
14.50	6.92	5.07	1.18
15.00	7.09	5.23	1.02
15.50	7.23	5.36	0.88
16.00	7.35	5.48	0.74
16.50	7.46	5.57	0.63
17.00	7.55	5.66	0.56
17.50	7.63	5.74	0.50
18.00	7.70	5.81	0.44
18.50	7.77	5.87	0.39
19.00	7.83	5.93	0.37
19.50	7.89	5.99	0.35
20.00	7.94	6.04	0.33
20.50	8.00	6.09	0.32
21.00	8.05	6.14	0.30
21.50	8.09	6.19	0.29
22.00	8.14	6.23	0.28
22.50	8.18	6.27	0.26
23.00	8.22	6.31	0.25
23.50	8.26	6.35	0.23
24.00	**8.30**	**6.38**	0.22
24.50	8.30	6.38	0.05
25.00	8.30	6.38	0.01
25.50	8.30	6.38	0.00
26.00	8.30	6.38	0.00
26.50	8.30	6.38	0.00
27.00	8.30	6.38	0.00
27.50	8.30	6.38	0.00
28.00	8.30	6.38	0.00
28.50	8.30	6.38	0.00
29.00	8.30	6.38	0.00
29.50	8.30	6.38	0.00
30.00	8.30	6.38	0.00
30.50	8.30	6.38	0.00
31.00	8.30	6.38	0.00
31.50	8.30	6.38	0.00
32.00	8.30	6.38	0.00
32.50	8.30	6.38	0.00
33.00	8.30	6.38	0.00
33.50	8.30	6.38	0.00
34.00	8.30	6.38	0.00
34.50	8.30	6.38	0.00
35.00	8.30	6.38	0.00
35.50	8.30	6.38	0.00
36.00	8.30	6.38	0.00

Summary for Subcatchment 2S: Existing Drainage Area EX-2

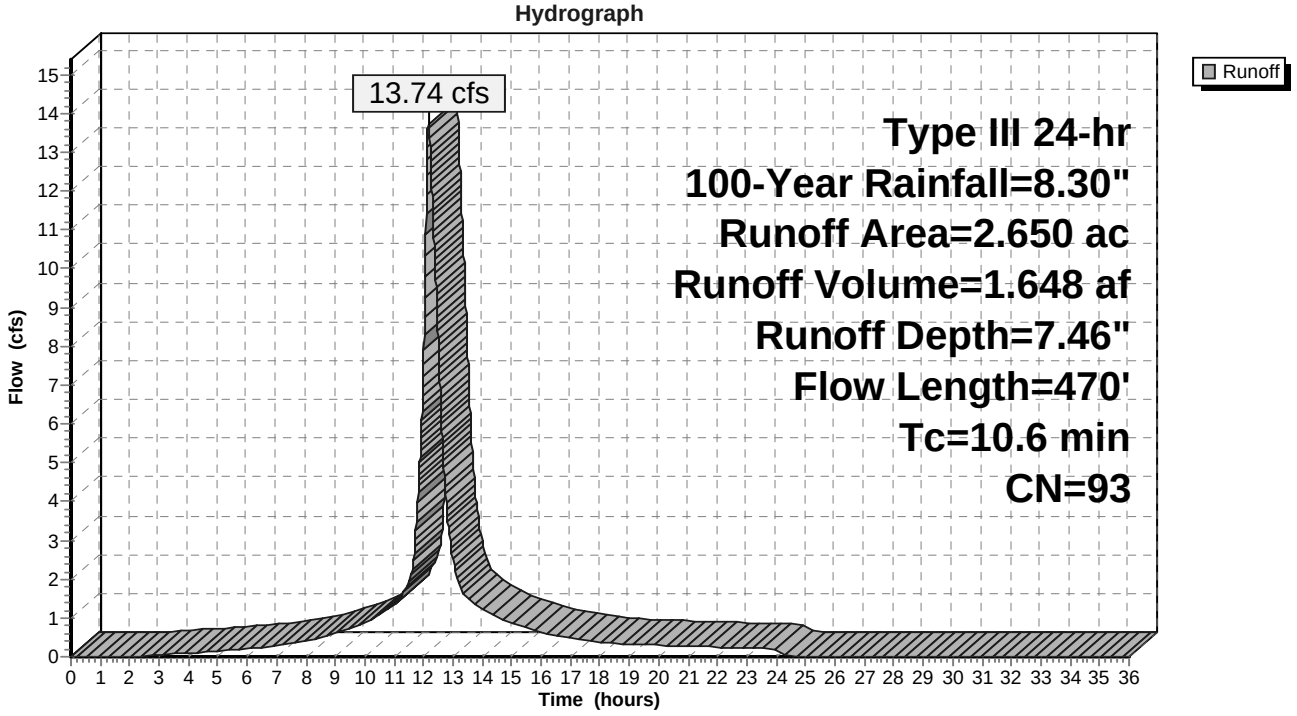
Runoff = 13.74 cfs @ 12.16 hrs, Volume= 1.648 af, Depth= 7.46"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.30"

	Area (ac)	CN	Description
	0.140	61	>75% Grass cover, Good, HSG B
	0.230	74	>75% Grass cover, Good, HSG C
	0.180	80	>75% Grass cover, Good, HSG D
	0.030	96	Gravel surface, HSG D
*	2.070	98	Paved parking & Roof
	2.650	93	Weighted Average
	0.580		21.89% Pervious Area
	2.070		78.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	60	0.0100	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
2.1	410	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.6	470	Total			

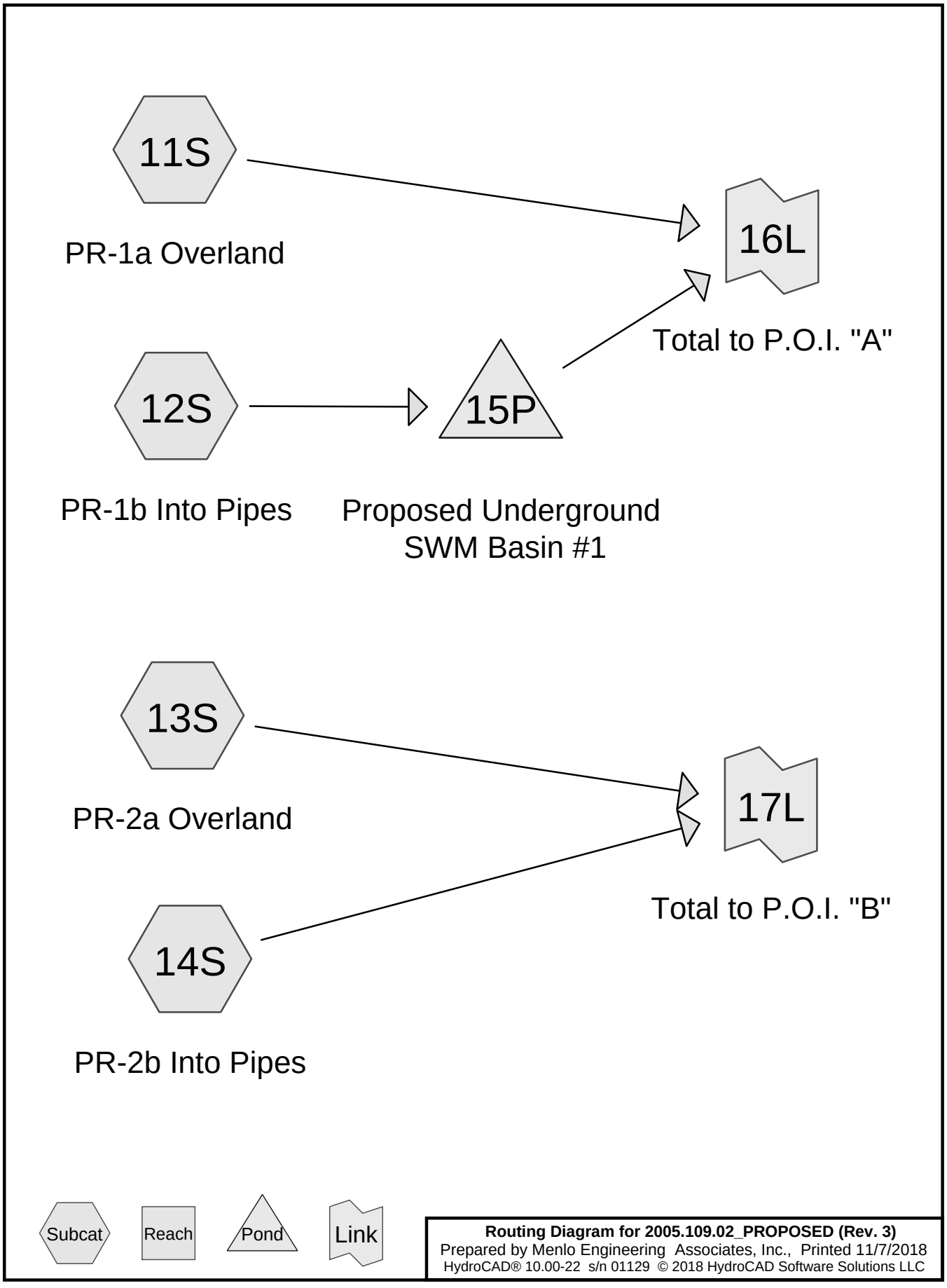
Subcatchment 2S: Existing Drainage Area EX-2



Hydrograph for Subcatchment 2S: Existing Drainage Area EX-2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.04	0.00	0.00
1.00	0.08	0.00	0.00
1.50	0.12	0.00	0.00
2.00	0.17	0.00	0.00
2.50	0.21	0.00	0.02
3.00	0.26	0.01	0.04
3.50	0.30	0.03	0.07
4.00	0.36	0.04	0.10
4.50	0.41	0.07	0.12
5.00	0.47	0.10	0.15
5.50	0.53	0.13	0.18
6.00	0.60	0.17	0.20
6.50	0.67	0.21	0.24
7.00	0.75	0.27	0.29
7.50	0.84	0.33	0.35
8.00	0.95	0.41	0.41
8.50	1.07	0.50	0.50
9.00	1.21	0.62	0.62
9.50	1.38	0.76	0.75
10.00	1.57	0.93	0.88
10.50	1.80	1.13	1.08
11.00	2.08	1.38	1.34
11.50	2.47	1.75	1.97
12.00	4.15	3.37	**7.56**
12.50	5.83	5.01	**8.02**
13.00	6.22	5.40	2.50
13.50	6.50	5.68	1.51
14.00	6.73	5.91	1.22
14.50	6.92	6.09	1.02
15.00	7.09	6.26	0.89
15.50	7.23	6.40	0.77
16.00	7.35	6.52	0.64
16.50	7.46	6.62	0.55
17.00	7.55	6.72	0.49
17.50	7.63	6.80	0.44
18.00	7.70	6.87	0.38
18.50	7.77	6.93	0.35
19.00	7.83	6.99	0.33
19.50	7.89	7.05	0.31
20.00	7.94	7.11	0.30
20.50	8.00	7.16	0.28
21.00	8.05	7.21	0.27
21.50	8.09	7.26	0.26
22.00	8.14	7.30	0.24
22.50	8.18	7.34	0.23
23.00	8.22	7.39	0.22
23.50	8.26	7.42	0.21
24.00	**8.30**	**7.46**	0.19
24.50	8.30	7.46	0.02
25.00	8.30	7.46	0.00
25.50	8.30	7.46	0.00
26.00	8.30	7.46	0.00
26.50	8.30	7.46	0.00
27.00	8.30	7.46	0.00
27.50	8.30	7.46	0.00
28.00	8.30	7.46	0.00
28.50	8.30	7.46	0.00
29.00	8.30	7.46	0.00
29.50	8.30	7.46	0.00
30.00	8.30	7.46	0.00
30.50	8.30	7.46	0.00
31.00	8.30	7.46	0.00
31.50	8.30	7.46	0.00
32.00	8.30	7.46	0.00
32.50	8.30	7.46	0.00
33.00	8.30	7.46	0.00
33.50	8.30	7.46	0.00
34.00	8.30	7.46	0.00
34.50	8.30	7.46	0.00
35.00	8.30	7.46	0.00
35.50	8.30	7.46	0.00
36.00	8.30	7.46	0.00

APPENDIX B: PROPOSED CONDITIONS



Routing Diagram for 2005.109.02_PROPOSED (Rev. 3)
Prepared by Menlo Engineering Associates, Inc., Printed 11/7/2018

2 YEAR STORM

Summary for Subcatchment 11S: PR-1a Overland

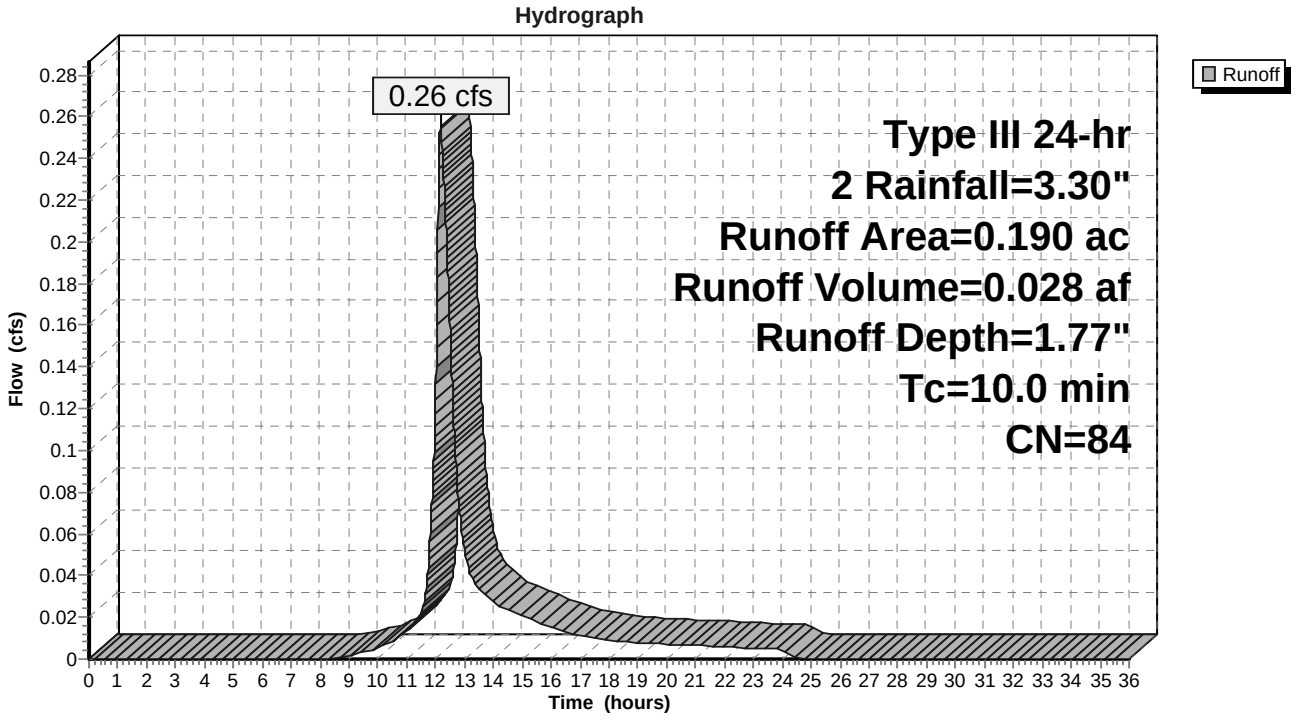
Runoff = 0.26 cfs @ 12.16 hrs, Volume= 0.028 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Rainfall=3.30"

Area (ac)	CN	Description
0.110	74	>75% Grass cover, Good, HSG C
0.080	98	Paved parking, HSG C
0.190	84	Weighted Average
0.110		57.89% Pervious Area
0.080		42.11% Impervious Area

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

Subcatchment 11S: PR-1a Overland



Hydrograph for Subcatchment 11S: PR-1a Overland

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.02	0.00	0.00
1.00	0.03	0.00	0.00
1.50	0.05	0.00	0.00
2.00	0.07	0.00	0.00
2.50	0.08	0.00	0.00
3.00	0.10	0.00	0.00
3.50	0.12	0.00	0.00
4.00	0.14	0.00	0.00
4.50	0.16	0.00	0.00
5.00	0.19	0.00	0.00
5.50	0.21	0.00	0.00
6.00	0.24	0.00	0.00
6.50	0.27	0.00	0.00
7.00	0.30	0.00	0.00
7.50	0.34	0.00	0.00
8.00	0.38	0.00	0.00
8.50	0.42	0.00	0.00
9.00	0.48	0.00	0.00
9.50	0.55	0.01	0.00
10.00	0.62	0.03	0.01
10.50	0.71	0.05	0.01
11.00	0.83	0.08	0.01
11.50	0.98	0.14	0.02
12.00	1.65	0.51	**0.12**
12.50	2.32	0.98	**0.16**
13.00	2.47	1.10	0.05
13.50	2.59	1.18	0.03
14.00	2.68	1.25	0.03
14.50	2.75	1.32	0.02
15.00	2.82	1.37	0.02
15.50	2.88	1.42	0.02
16.00	2.92	1.45	0.01
16.50	2.96	1.49	0.01
17.00	3.00	1.52	0.01
17.50	3.03	1.54	0.01
18.00	3.06	1.57	0.01
18.50	3.09	1.59	0.01
19.00	3.11	1.61	0.01
19.50	3.14	1.63	0.01
20.00	3.16	1.65	0.01
20.50	3.18	1.66	0.01
21.00	3.20	1.68	0.01
21.50	3.22	1.70	0.01
22.00	3.24	1.71	0.01
22.50	3.25	1.73	0.01
23.00	3.27	1.74	0.01
23.50	3.29	1.75	0.00
24.00	**3.30**	**1.77**	0.00
24.50	3.30	1.77	0.00
25.00	3.30	1.77	0.00
25.50	3.30	1.77	0.00
26.00	3.30	1.77	0.00
26.50	3.30	1.77	0.00
27.00	3.30	1.77	0.00
27.50	3.30	1.77	0.00
28.00	3.30	1.77	0.00
28.50	3.30	1.77	0.00
29.00	3.30	1.77	0.00
29.50	3.30	1.77	0.00
30.00	3.30	1.77	0.00
30.50	3.30	1.77	0.00
31.00	3.30	1.77	0.00
31.50	3.30	1.77	0.00
32.00	3.30	1.77	0.00
32.50	3.30	1.77	0.00
33.00	3.30	1.77	0.00
33.50	3.30	1.77	0.00
34.00	3.30	1.77	0.00
34.50	3.30	1.77	0.00
35.00	3.30	1.77	0.00
35.50	3.30	1.77	0.00
36.00	3.30	1.77	0.00

Summary for Subcatchment 12S: PR-1b Into Pipes

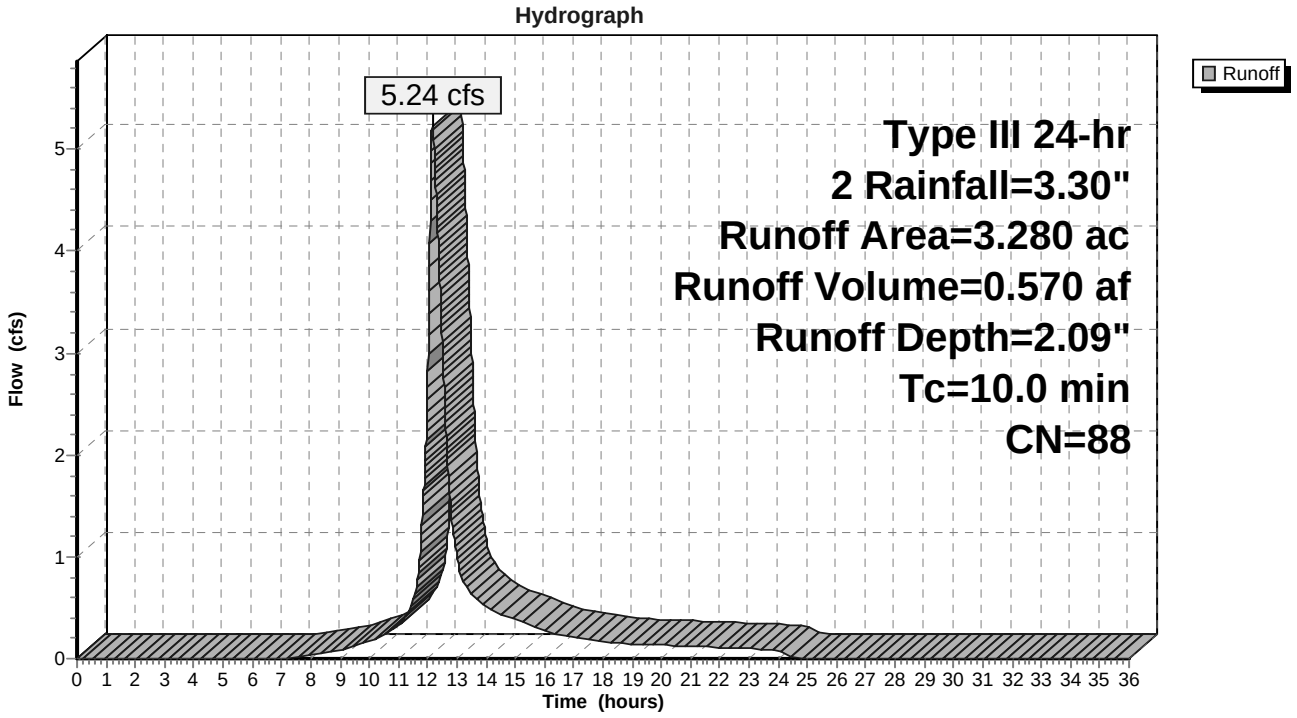
Runoff = 5.24 cfs @ 12.16 hrs, Volume= 0.570 af, Depth= 2.09"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Rainfall=3.30"

	Area (ac)	CN	Description
	0.470	61	>75% Grass cover, Good, HSG B
	0.210	74	>75% Grass cover, Good, HSG C
	0.220	55	Woods, Good, HSG B
*	0.720	98	Roofs
	1.660	98	Paved parking, HSG C
	3.280	88	Weighted Average
	0.900		27.44% Pervious Area
	2.380		72.56% Impervious Area

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

Subcatchment 12S: PR-1b Into Pipes



Hydrograph for Subcatchment 12S: PR-1b Into Pipes

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	3.30	2.09	0.00
0.50	0.02	0.00	0.00	26.50	3.30	2.09	0.00
1.00	0.03	0.00	0.00	27.00	3.30	2.09	0.00
1.50	0.05	0.00	0.00	27.50	3.30	2.09	0.00
2.00	0.07	0.00	0.00	28.00	3.30	2.09	0.00
2.50	0.08	0.00	0.00	28.50	3.30	2.09	0.00
3.00	0.10	0.00	0.00	29.00	3.30	2.09	0.00
3.50	0.12	0.00	0.00	29.50	3.30	2.09	0.00
4.00	0.14	0.00	0.00	30.00	3.30	2.09	0.00
4.50	0.16	0.00	0.00	30.50	3.30	2.09	0.00
5.00	0.19	0.00	0.00	31.00	3.30	2.09	0.00
5.50	0.21	0.00	0.00	31.50	3.30	2.09	0.00
6.00	0.24	0.00	0.00	32.00	3.30	2.09	0.00
6.50	0.27	0.00	0.00	32.50	3.30	2.09	0.00
7.00	0.30	0.00	0.00	33.00	3.30	2.09	0.00
7.50	0.34	0.00	0.01	33.50	3.30	2.09	0.00
8.00	0.38	0.01	0.03	34.00	3.30	2.09	0.00
8.50	0.42	0.02	0.05	34.50	3.30	2.09	0.00
9.00	0.48	0.03	0.08	35.00	3.30	2.09	0.00
9.50	0.55	0.05	0.12	35.50	3.30	2.09	0.00
10.00	0.62	0.07	0.17	36.00	3.30	2.09	0.00
10.50	0.71	0.11	0.24				
11.00	0.83	0.16	0.34				
11.50	0.98	0.24	0.56				
12.00	1.65	0.69	**2.67**				
12.50	2.32	1.23	**3.12**				
13.00	2.47	1.36	1.00				
13.50	2.59	1.45	0.64				
14.00	2.68	1.53	0.52				
14.50	2.75	1.60	0.44				
15.00	2.82	1.66	0.39				
15.50	2.88	1.71	0.33				
16.00	2.92	1.75	0.28				
16.50	2.96	1.79	0.24				
17.00	3.00	1.82	0.22				
17.50	3.03	1.85	0.19				
18.00	3.06	1.87	0.17				
18.50	3.09	1.90	0.15				
19.00	3.11	1.92	0.15				
19.50	3.14	1.94	0.14				
20.00	3.16	1.96	0.13				
20.50	3.18	1.98	0.12				
21.00	3.20	2.00	0.12				
21.50	3.22	2.01	0.11				
22.00	3.24	2.03	0.11				
22.50	3.25	2.05	0.10				
23.00	3.27	2.06	0.10				
23.50	3.29	2.07	0.09				
24.00	**3.30**	**2.09**	0.09				
24.50	3.30	2.09	0.01				
25.00	3.30	2.09	0.00				
25.50	3.30	2.09	0.00				

Summary for Subcatchment 13S: PR-2a Overland

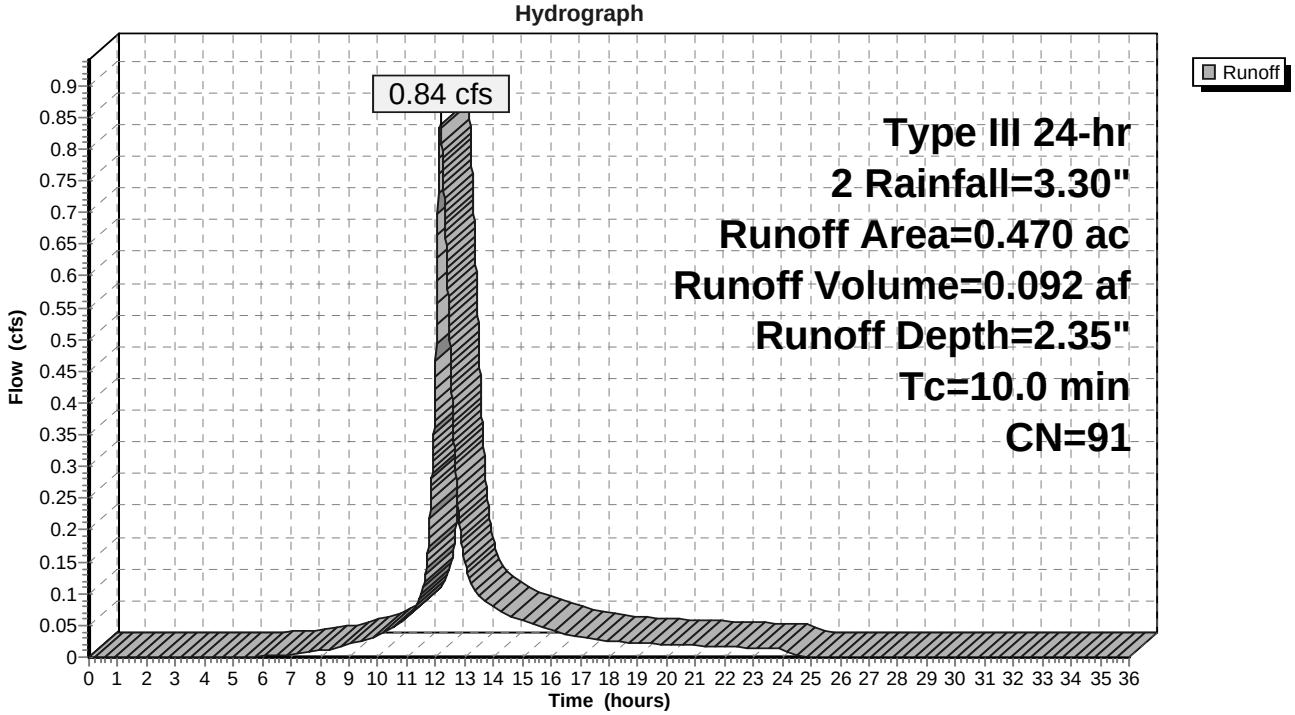
Runoff = 0.84 cfs @ 12.16 hrs, Volume= 0.092 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Rainfall=3.30"

	Area (ac)	CN	Description
	0.010	61	>75% Grass cover, Good, HSG B
	0.050	74	>75% Grass cover, Good, HSG C
	0.090	80	>75% Grass cover, Good, HSG D
*	0.320	98	Paved parking
	0.470	91	Weighted Average
	0.150		31.91% Pervious Area
	0.320		68.09% Impervious Area

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

Subcatchment 13S: PR-2a Overland



Hydrograph for Subcatchment 13S: PR-2a Overland

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.02	0.00	0.00
1.00	0.03	0.00	0.00
1.50	0.05	0.00	0.00
2.00	0.07	0.00	0.00
2.50	0.08	0.00	0.00
3.00	0.10	0.00	0.00
3.50	0.12	0.00	0.00
4.00	0.14	0.00	0.00
4.50	0.16	0.00	0.00
5.00	0.19	0.00	0.00
5.50	0.21	0.00	0.00
6.00	0.24	0.00	0.00
6.50	0.27	0.00	0.00
7.00	0.30	0.01	0.00
7.50	0.34	0.02	0.01
8.00	0.38	0.03	0.01
8.50	0.42	0.04	0.01
9.00	0.48	0.06	0.02
9.50	0.55	0.09	0.03
10.00	0.62	0.13	0.03
10.50	0.71	0.18	0.05
11.00	0.83	0.24	0.06
11.50	0.98	0.35	0.10
12.00	1.65	0.86	**0.44**
12.50	2.32	1.44	**0.49**
13.00	2.47	1.59	0.15
13.50	2.59	1.69	0.10
14.00	2.68	1.77	0.08
14.50	2.75	1.84	0.07
15.00	2.82	1.90	0.06
15.50	2.88	1.96	0.05
16.00	2.92	2.00	0.04
16.50	2.96	2.04	0.04
17.00	3.00	2.07	0.03
17.50	3.03	2.10	0.03
18.00	3.06	2.13	0.03
18.50	3.09	2.15	0.02
19.00	3.11	2.18	0.02
19.50	3.14	2.20	0.02
20.00	3.16	2.22	0.02
20.50	3.18	2.24	0.02
21.00	3.20	2.26	0.02
21.50	3.22	2.28	0.02
22.00	3.24	2.29	0.02
22.50	3.25	2.31	0.02
23.00	3.27	2.32	0.01
23.50	3.29	2.34	0.01
24.00	**3.30**	**2.35**	0.01
24.50	3.30	2.35	0.00
25.00	3.30	2.35	0.00
25.50	3.30	2.35	0.00
26.00	3.30	2.35	0.00
26.50	3.30	2.35	0.00
27.00	3.30	2.35	0.00
27.50	3.30	2.35	0.00
28.00	3.30	2.35	0.00
28.50	3.30	2.35	0.00
29.00	3.30	2.35	0.00
29.50	3.30	2.35	0.00
30.00	3.30	2.35	0.00
30.50	3.30	2.35	0.00
31.00	3.30	2.35	0.00
31.50	3.30	2.35	0.00
32.00	3.30	2.35	0.00
32.50	3.30	2.35	0.00
33.00	3.30	2.35	0.00
33.50	3.30	2.35	0.00
34.00	3.30	2.35	0.00
34.50	3.30	2.35	0.00
35.00	3.30	2.35	0.00
35.50	3.30	2.35	0.00
36.00	3.30	2.35	0.00

Summary for Subcatchment 14S: PR-2b Into Pipes

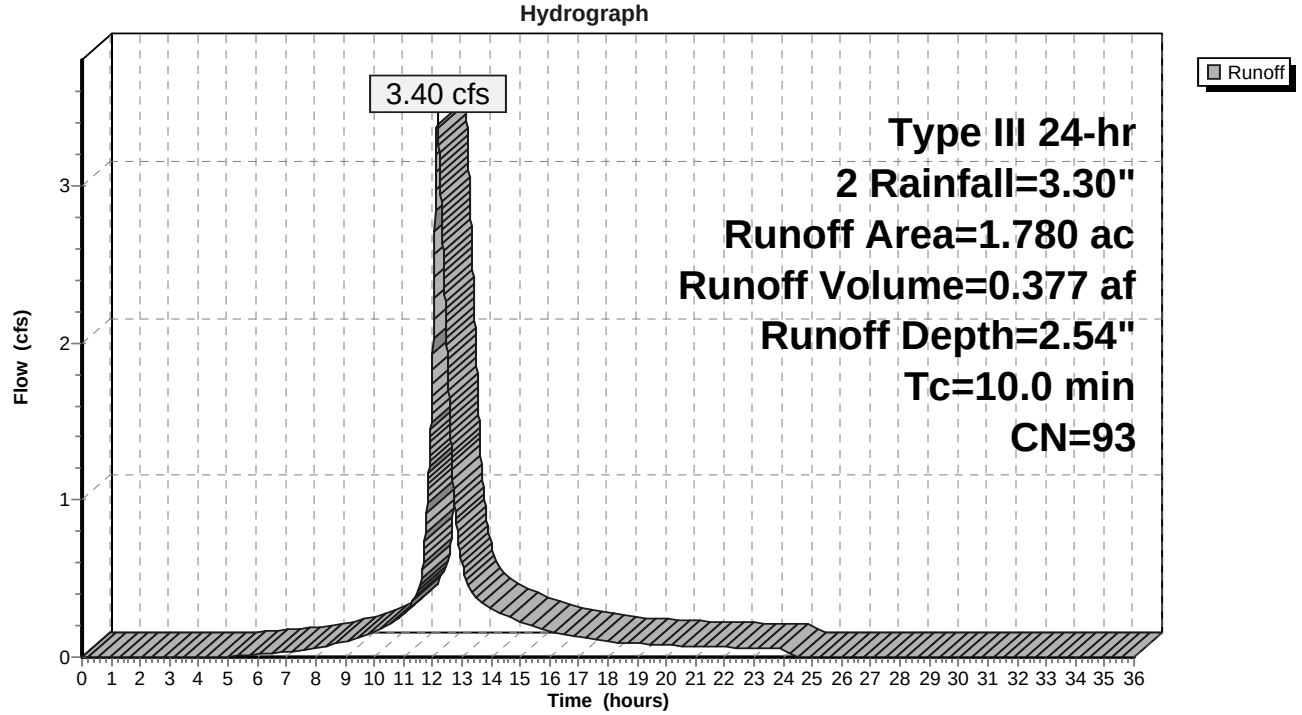
Runoff = 3.40 cfs @ 12.16 hrs, Volume= 0.377 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Rainfall=3.30"

	Area (ac)	CN	Description
	0.120	61	>75% Grass cover, Good, HSG B
	0.250	80	>75% Grass cover, Good, HSG D
*	1.270	98	Paved parking
	0.140	98	Roofs, HSG D
	1.780	93	Weighted Average
	0.370		20.79% Pervious Area
	1.410		79.21% Impervious Area

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

Subcatchment 14S: PR-2b Into Pipes



Hydrograph for Subcatchment 14S: PR-2b Into Pipes

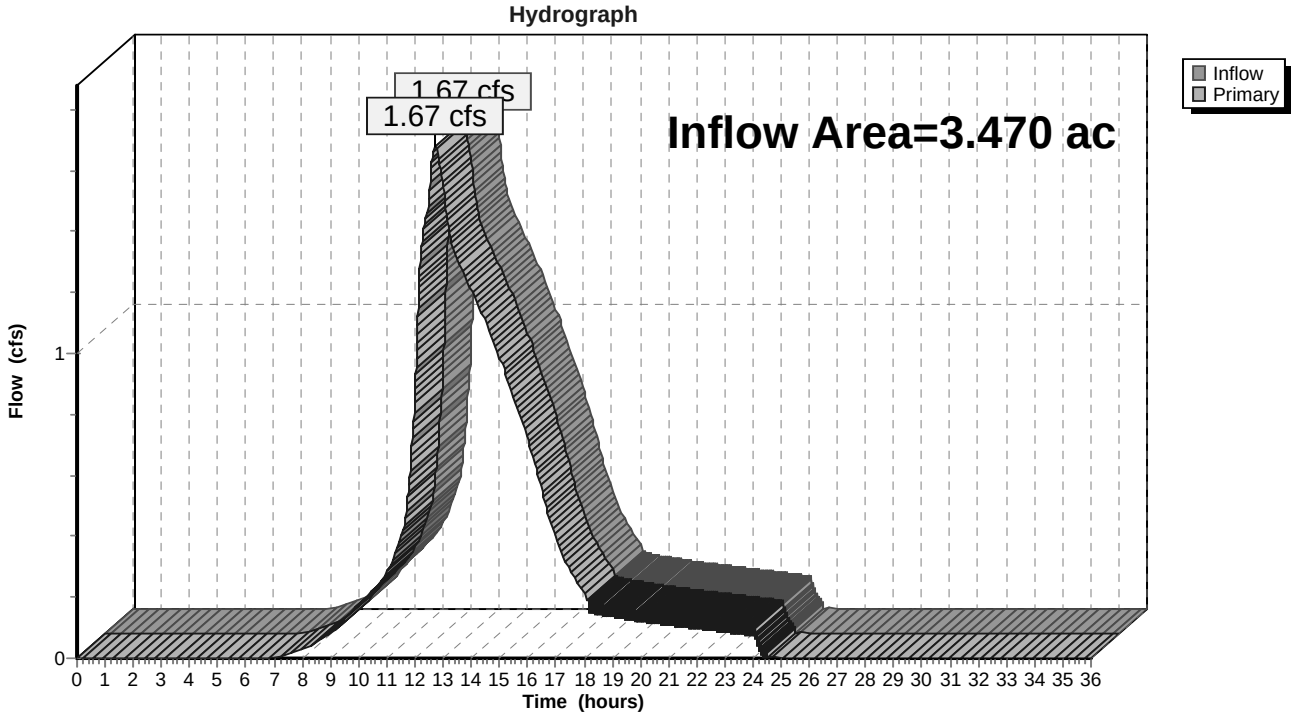
Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.02	0.00	0.00
1.00	0.03	0.00	0.00
1.50	0.05	0.00	0.00
2.00	0.07	0.00	0.00
2.50	0.08	0.00	0.00
3.00	0.10	0.00	0.00
3.50	0.12	0.00	0.00
4.00	0.14	0.00	0.00
4.50	0.16	0.00	0.00
5.00	0.19	0.00	0.01
5.50	0.21	0.00	0.01
6.00	0.24	0.01	0.02
6.50	0.27	0.02	0.02
7.00	0.30	0.02	0.03
7.50	0.34	0.04	0.04
8.00	0.38	0.05	0.06
8.50	0.42	0.07	0.07
9.00	0.48	0.10	0.10
9.50	0.55	0.14	0.13
10.00	0.62	0.18	0.16
10.50	0.71	0.24	0.21
11.00	0.83	0.32	0.28
11.50	0.98	0.44	0.43
12.00	1.65	1.00	**1.82**
12.50	2.32	1.61	**1.94**
13.00	2.47	1.76	0.60
13.50	2.59	1.86	0.38
14.00	2.68	1.95	0.31
14.50	2.75	2.02	0.26
15.00	2.82	2.08	0.23
15.50	2.88	2.14	0.20
16.00	2.92	2.18	0.16
16.50	2.96	2.22	0.14
17.00	3.00	2.26	0.13
17.50	3.03	2.29	0.11
18.00	3.06	2.31	0.10
18.50	3.09	2.34	0.09
19.00	3.11	2.36	0.08
19.50	3.14	2.38	0.08
20.00	3.16	2.41	0.08
20.50	3.18	2.43	0.07
21.00	3.20	2.44	0.07
21.50	3.22	2.46	0.07
22.00	3.24	2.48	0.06
22.50	3.25	2.50	0.06
23.00	3.27	2.51	0.06
23.50	3.29	2.53	0.05
24.00	**3.30**	**2.54**	0.05
24.50	3.30	2.54	0.00
25.00	3.30	2.54	0.00
25.50	3.30	2.54	0.00
26.00	3.30	2.54	0.00
26.50	3.30	2.54	0.00
27.00	3.30	2.54	0.00
27.50	3.30	2.54	0.00
28.00	3.30	2.54	0.00
28.50	3.30	2.54	0.00
29.00	3.30	2.54	0.00
29.50	3.30	2.54	0.00
30.00	3.30	2.54	0.00
30.50	3.30	2.54	0.00
31.00	3.30	2.54	0.00
31.50	3.30	2.54	0.00
32.00	3.30	2.54	0.00
32.50	3.30	2.54	0.00
33.00	3.30	2.54	0.00
33.50	3.30	2.54	0.00
34.00	3.30	2.54	0.00
34.50	3.30	2.54	0.00
35.00	3.30	2.54	0.00
35.50	3.30	2.54	0.00
36.00	3.30	2.54	0.00

Summary for Link 16L: Total to P.O.I. "A"

Inflow Area = 3.470 ac, 70.89% Impervious, Inflow Depth = 2.07" for 2 event
Inflow = 1.67 cfs @ 12.72 hrs, Volume= 0.598 af
Primary = 1.67 cfs @ 12.72 hrs, Volume= 0.598 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 16L: Total to P.O.I. "A"



Hydrograph for Link 16L: Total to P.O.I. "A"

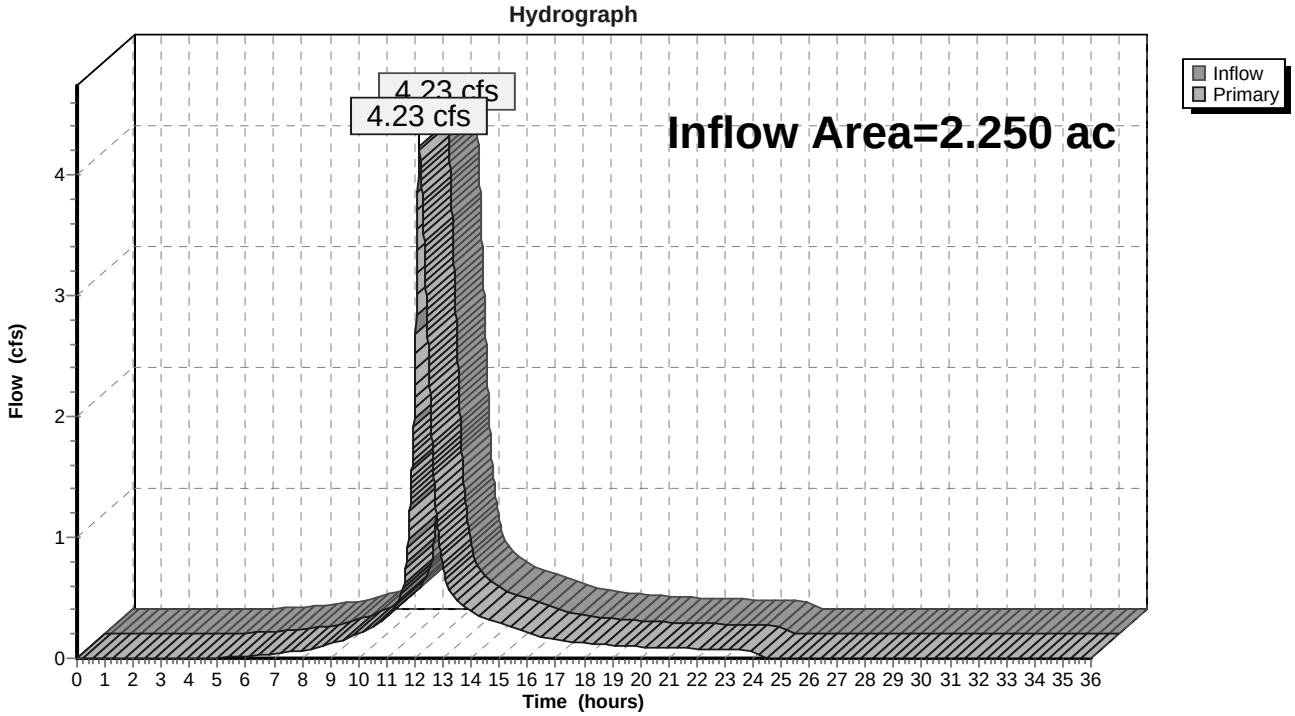
Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00	26.00	0.00	0.00	0.00
0.50	0.00	0.00	0.00	26.50	0.00	0.00	0.00
1.00	0.00	0.00	0.00	27.00	0.00	0.00	0.00
1.50	0.00	0.00	0.00	27.50	0.00	0.00	0.00
2.00	0.00	0.00	0.00	28.00	0.00	0.00	0.00
2.50	0.00	0.00	0.00	28.50	0.00	0.00	0.00
3.00	0.00	0.00	0.00	29.00	0.00	0.00	0.00
3.50	0.00	0.00	0.00	29.50	0.00	0.00	0.00
4.00	0.00	0.00	0.00	30.00	0.00	0.00	0.00
4.50	0.00	0.00	0.00	30.50	0.00	0.00	0.00
5.00	0.00	0.00	0.00	31.00	0.00	0.00	0.00
5.50	0.00	0.00	0.00	31.50	0.00	0.00	0.00
6.00	0.00	0.00	0.00	32.00	0.00	0.00	0.00
6.50	0.00	0.00	0.00	32.50	0.00	0.00	0.00
7.00	0.00	0.00	0.00	33.00	0.00	0.00	0.00
7.50	0.01	0.00	0.01	33.50	0.00	0.00	0.00
8.00	0.03	0.00	0.03	34.00	0.00	0.00	0.00
8.50	0.05	0.00	0.05	34.50	0.00	0.00	0.00
9.00	0.08	0.00	0.08	35.00	0.00	0.00	0.00
9.50	0.13	0.00	0.13	35.50	0.00	0.00	0.00
10.00	0.18	0.00	0.18	36.00	0.00	0.00	0.00
10.50	0.22	0.00	0.22				
11.00	0.28	0.00	0.28				
11.50	0.39	0.00	0.39				
12.00	0.86	0.00	0.86				
12.50	**1.51**	0.00	**1.51**				
13.00	**1.54**	0.00	**1.54**				
13.50	1.30	0.00	1.30				
14.00	1.21	0.00	1.21				
14.50	1.10	0.00	1.10				
15.00	0.99	0.00	0.99				
15.50	0.86	0.00	0.86				
16.00	0.72	0.00	0.72				
16.50	0.55	0.00	0.55				
17.00	0.39	0.00	0.39				
17.50	0.29	0.00	0.29				
18.00	0.22	0.00	0.22				
18.50	0.18	0.00	0.18				
19.00	0.17	0.00	0.17				
19.50	0.16	0.00	0.16				
20.00	0.16	0.00	0.16				
20.50	0.15	0.00	0.15				
21.00	0.14	0.00	0.14				
21.50	0.14	0.00	0.14				
22.00	0.13	0.00	0.13				
22.50	0.13	0.00	0.13				
23.00	0.12	0.00	0.12				
23.50	0.11	0.00	0.11				
24.00	0.11	0.00	0.11				
24.50	0.02	0.00	0.02				
25.00	0.00	0.00	0.00				
25.50	0.00	0.00	0.00				

Summary for Link 17L: Total to P.O.I. "B"

Inflow Area = 2.250 ac, 76.89% Impervious, Inflow Depth = 2.50" for 2 event
Inflow = 4.23 cfs @ 12.16 hrs, Volume= 0.469 af
Primary = 4.23 cfs @ 12.16 hrs, Volume= 0.469 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 17L: Total to P.O.I. "B"



Hydrograph for Link 17L: Total to P.O.I. "B"

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00	26.00	0.00	0.00	0.00
0.50	0.00	0.00	0.00	26.50	0.00	0.00	0.00
1.00	0.00	0.00	0.00	27.00	0.00	0.00	0.00
1.50	0.00	0.00	0.00	27.50	0.00	0.00	0.00
2.00	0.00	0.00	0.00	28.00	0.00	0.00	0.00
2.50	0.00	0.00	0.00	28.50	0.00	0.00	0.00
3.00	0.00	0.00	0.00	29.00	0.00	0.00	0.00
3.50	0.00	0.00	0.00	29.50	0.00	0.00	0.00
4.00	0.00	0.00	0.00	30.00	0.00	0.00	0.00
4.50	0.00	0.00	0.00	30.50	0.00	0.00	0.00
5.00	0.01	0.00	0.01	31.00	0.00	0.00	0.00
5.50	0.01	0.00	0.01	31.50	0.00	0.00	0.00
6.00	0.02	0.00	0.02	32.00	0.00	0.00	0.00
6.50	0.03	0.00	0.03	32.50	0.00	0.00	0.00
7.00	0.04	0.00	0.04	33.00	0.00	0.00	0.00
7.50	0.05	0.00	0.05	33.50	0.00	0.00	0.00
8.00	0.07	0.00	0.07	34.00	0.00	0.00	0.00
8.50	0.09	0.00	0.09	34.50	0.00	0.00	0.00
9.00	0.12	0.00	0.12	35.00	0.00	0.00	0.00
9.50	0.16	0.00	0.16	35.50	0.00	0.00	0.00
10.00	0.20	0.00	0.20	36.00	0.00	0.00	0.00
10.50	0.26	0.00	0.26				
11.00	0.34	0.00	0.34				
11.50	0.53	0.00	0.53				
12.00	**2.27**	0.00	**2.27**				
12.50	**2.42**	0.00	**2.42**				
13.00	0.76	0.00	0.76				
13.50	0.48	0.00	0.48				
14.00	0.39	0.00	0.39				
14.50	0.33	0.00	0.33				
15.00	0.29	0.00	0.29				
15.50	0.25	0.00	0.25				
16.00	0.21	0.00	0.21				
16.50	0.18	0.00	0.18				
17.00	0.16	0.00	0.16				
17.50	0.14	0.00	0.14				
18.00	0.12	0.00	0.12				
18.50	0.11	0.00	0.11				
19.00	0.11	0.00	0.11				
19.50	0.10	0.00	0.10				
20.00	0.10	0.00	0.10				
20.50	0.09	0.00	0.09				
21.00	0.09	0.00	0.09				
21.50	0.08	0.00	0.08				
22.00	0.08	0.00	0.08				
22.50	0.08	0.00	0.08				
23.00	0.07	0.00	0.07				
23.50	0.07	0.00	0.07				
24.00	0.06	0.00	0.06				
24.50	0.01	0.00	0.01				
25.00	0.00	0.00	0.00				
25.50	0.00	0.00	0.00				

10 YEAR STORM

Summary for Subcatchment 11S: PR-1a Overland

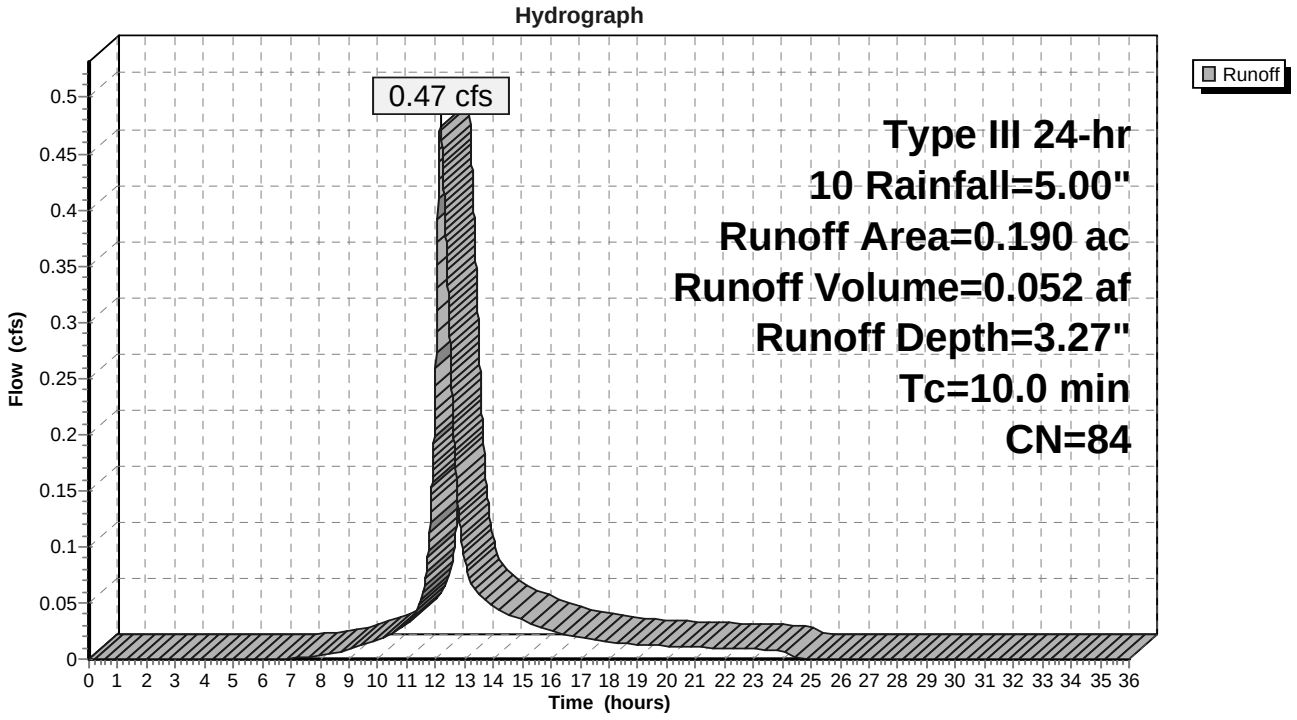
Runoff = 0.47 cfs @ 12.16 hrs, Volume= 0.052 af, Depth= 3.27"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Rainfall=5.00"

Area (ac)	CN	Description
0.110	74	>75% Grass cover, Good, HSG C
0.080	98	Paved parking, HSG C
0.190	84	Weighted Average
0.110		57.89% Pervious Area
0.080		42.11% Impervious Area

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

Subcatchment 11S: PR-1a Overland



Hydrograph for Subcatchment 11S: PR-1a Overland

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00
1.00	0.05	0.00	0.00
1.50	0.08	0.00	0.00
2.00	0.10	0.00	0.00
2.50	0.13	0.00	0.00
3.00	0.15	0.00	0.00
3.50	0.18	0.00	0.00
4.00	0.22	0.00	0.00
4.50	0.25	0.00	0.00
5.00	0.28	0.00	0.00
5.50	0.32	0.00	0.00
6.00	0.36	0.00	0.00
6.50	0.40	0.00	0.00
7.00	0.45	0.00	0.00
7.50	0.51	0.01	0.00
8.00	0.57	0.02	0.00
8.50	0.64	0.03	0.01
9.00	0.73	0.05	0.01
9.50	0.83	0.09	0.01
10.00	0.95	0.13	0.02
10.50	1.08	0.19	0.02
11.00	1.25	0.27	0.03
11.50	1.49	0.41	0.05
12.00	2.50	1.12	**0.24**
12.50	3.51	1.95	**0.28**
13.00	3.75	2.15	0.09
13.50	3.92	2.30	0.06
14.00	4.06	2.42	0.05
14.50	4.17	2.52	0.04
15.00	4.27	2.61	0.03
15.50	4.36	2.69	0.03
16.00	4.43	2.75	0.02
16.50	4.49	2.81	0.02
17.00	4.55	2.86	0.02
17.50	4.60	2.90	0.02
18.00	4.64	2.94	0.01
18.50	4.68	2.98	0.01
19.00	4.72	3.01	0.01
19.50	4.75	3.04	0.01
20.00	4.79	3.07	0.01
20.50	4.82	3.10	0.01
21.00	4.85	3.13	0.01
21.50	4.88	3.16	0.01
22.00	4.90	3.18	0.01
22.50	4.93	3.21	0.01
23.00	4.95	3.23	0.01
23.50	4.98	3.25	0.01
24.00	**5.00**	**3.27**	0.01
24.50	5.00	3.27	0.00
25.00	5.00	3.27	0.00
25.50	5.00	3.27	0.00
26.00	5.00	3.27	0.00
26.50	5.00	3.27	0.00
27.00	5.00	3.27	0.00
27.50	5.00	3.27	0.00
28.00	5.00	3.27	0.00
28.50	5.00	3.27	0.00
29.00	5.00	3.27	0.00
29.50	5.00	3.27	0.00
30.00	5.00	3.27	0.00
30.50	5.00	3.27	0.00
31.00	5.00	3.27	0.00
31.50	5.00	3.27	0.00
32.00	5.00	3.27	0.00
32.50	5.00	3.27	0.00
33.00	5.00	3.27	0.00
33.50	5.00	3.27	0.00
34.00	5.00	3.27	0.00
34.50	5.00	3.27	0.00
35.00	5.00	3.27	0.00
35.50	5.00	3.27	0.00
36.00	5.00	3.27	0.00

Summary for Subcatchment 12S: PR-1b Into Pipes

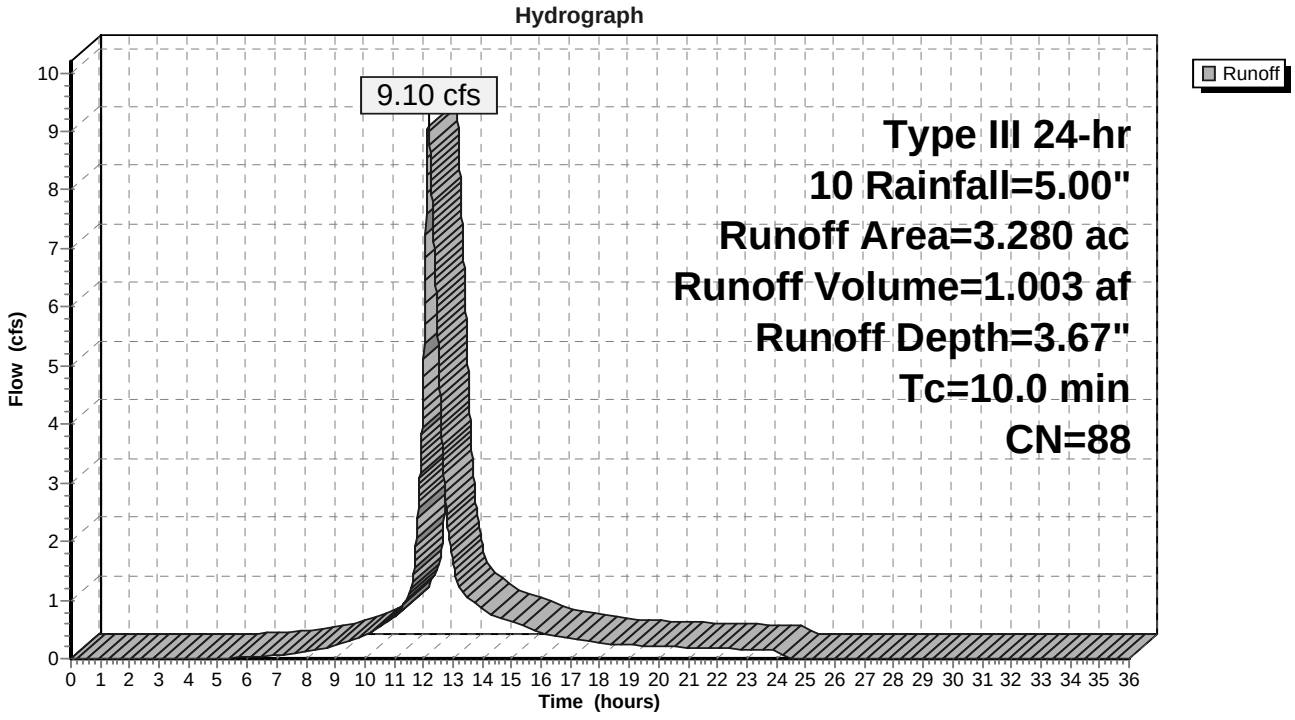
Runoff = 9.10 cfs @ 12.16 hrs, Volume= 1.003 af, Depth= 3.67"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Rainfall=5.00"

	Area (ac)	CN	Description
	0.470	61	>75% Grass cover, Good, HSG B
	0.210	74	>75% Grass cover, Good, HSG C
	0.220	55	Woods, Good, HSG B
*	0.720	98	Roofs
	1.660	98	Paved parking, HSG C
	3.280	88	Weighted Average
	0.900		27.44% Pervious Area
	2.380		72.56% Impervious Area

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

Subcatchment 12S: PR-1b Into Pipes



Hydrograph for Subcatchment 12S: PR-1b Into Pipes

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	5.00	3.67	0.00
0.50	0.03	0.00	0.00	26.50	5.00	3.67	0.00
1.00	0.05	0.00	0.00	27.00	5.00	3.67	0.00
1.50	0.08	0.00	0.00	27.50	5.00	3.67	0.00
2.00	0.10	0.00	0.00	28.00	5.00	3.67	0.00
2.50	0.13	0.00	0.00	28.50	5.00	3.67	0.00
3.00	0.15	0.00	0.00	29.00	5.00	3.67	0.00
3.50	0.18	0.00	0.00	29.50	5.00	3.67	0.00
4.00	0.22	0.00	0.00	30.00	5.00	3.67	0.00
4.50	0.25	0.00	0.00	30.50	5.00	3.67	0.00
5.00	0.28	0.00	0.00	31.00	5.00	3.67	0.00
5.50	0.32	0.00	0.01	31.50	5.00	3.67	0.00
6.00	0.36	0.01	0.02	32.00	5.00	3.67	0.00
6.50	0.40	0.01	0.04	32.50	5.00	3.67	0.00
7.00	0.45	0.02	0.06	33.00	5.00	3.67	0.00
7.50	0.51	0.03	0.09	33.50	5.00	3.67	0.00
8.00	0.57	0.05	0.12	34.00	5.00	3.67	0.00
8.50	0.64	0.08	0.17	34.50	5.00	3.67	0.00
9.00	0.73	0.11	0.23	35.00	5.00	3.67	0.00
9.50	0.83	0.16	0.31	35.50	5.00	3.67	0.00
10.00	0.95	0.22	0.40	36.00	5.00	3.67	0.00
10.50	1.08	0.30	0.53				
11.00	1.25	0.41	0.70				
11.50	1.49	0.57	1.10				
12.00	2.50	1.38	**4.83**				
12.50	3.51	2.28	**5.25**				
13.00	3.75	2.50	1.65				
13.50	3.92	2.65	1.04				
14.00	4.06	2.78	0.85				
14.50	4.17	2.89	0.71				
15.00	4.27	2.98	0.62				
15.50	4.36	3.06	0.54				
16.00	4.43	3.13	0.45				
16.50	4.49	3.19	0.39				
17.00	4.55	3.24	0.35				
17.50	4.60	3.29	0.31				
18.00	4.64	3.33	0.27				
18.50	4.68	3.36	0.24				
19.00	4.72	3.40	0.23				
19.50	4.75	3.43	0.22				
20.00	4.79	3.47	0.21				
20.50	4.82	3.50	0.20				
21.00	4.85	3.52	0.19				
21.50	4.88	3.55	0.18				
22.00	4.90	3.58	0.17				
22.50	4.93	3.60	0.16				
23.00	4.95	3.63	0.16				
23.50	4.98	3.65	0.15				
24.00	**5.00**	**3.67**	0.14				
24.50	5.00	3.67	0.01				
25.00	5.00	3.67	0.00				
25.50	5.00	3.67	0.00				

Summary for Subcatchment 13S: PR-2a Overland

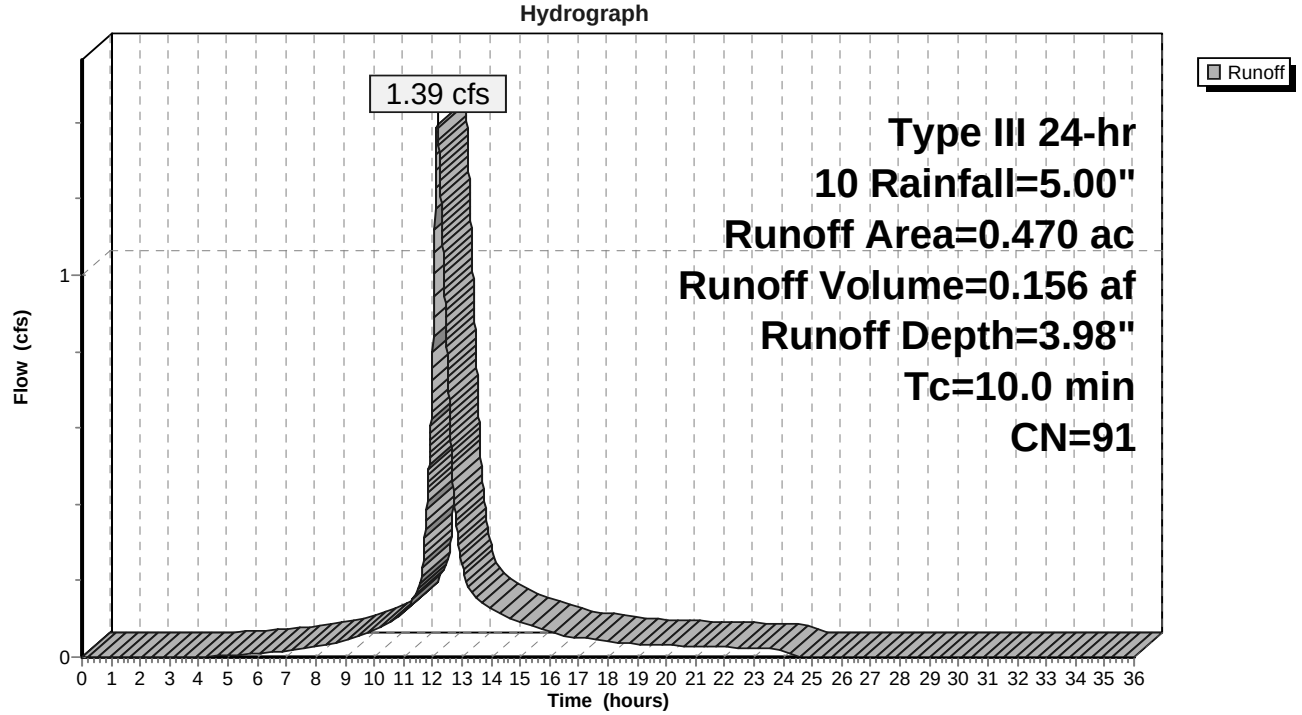
Runoff = 1.39 cfs @ 12.16 hrs, Volume= 0.156 af, Depth= 3.98"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Rainfall=5.00"

	Area (ac)	CN	Description
	0.010	61	>75% Grass cover, Good, HSG B
	0.050	74	>75% Grass cover, Good, HSG C
	0.090	80	>75% Grass cover, Good, HSG D
*	0.320	98	Paved parking
	0.470	91	Weighted Average
	0.150		31.91% Pervious Area
	0.320		68.09% Impervious Area

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

Subcatchment 13S: PR-2a Overland



Hydrograph for Subcatchment 13S: PR-2a Overland

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00
1.00	0.05	0.00	0.00
1.50	0.08	0.00	0.00
2.00	0.10	0.00	0.00
2.50	0.13	0.00	0.00
3.00	0.15	0.00	0.00
3.50	0.18	0.00	0.00
4.00	0.22	0.00	0.00
4.50	0.25	0.00	0.00
5.00	0.28	0.01	0.00
5.50	0.32	0.01	0.01
6.00	0.36	0.02	0.01
6.50	0.40	0.04	0.01
7.00	0.45	0.05	0.02
7.50	0.51	0.07	0.02
8.00	0.57	0.10	0.03
8.50	0.64	0.14	0.03
9.00	0.73	0.19	0.05
9.50	0.83	0.25	0.06
10.00	0.95	0.32	0.07
10.50	1.08	0.42	0.09
11.00	1.25	0.54	0.12
11.50	1.49	0.73	0.18
12.00	2.50	1.61	**0.75**
12.50	3.51	2.55	**0.79**
13.00	3.75	2.78	0.25
13.50	3.92	2.94	0.15
14.00	4.06	3.07	0.13
14.50	4.17	3.18	0.11
15.00	4.27	3.28	0.09
15.50	4.36	3.36	0.08
16.00	4.43	3.43	0.07
16.50	4.49	3.49	0.06
17.00	4.55	3.54	0.05
17.50	4.60	3.59	0.05
18.00	4.64	3.63	0.04
18.50	4.68	3.67	0.04
19.00	4.72	3.71	0.03
19.50	4.75	3.74	0.03
20.00	4.79	3.77	0.03
20.50	4.82	3.80	0.03
21.00	4.85	3.83	0.03
21.50	4.88	3.86	0.03
22.00	4.90	3.89	0.03
22.50	4.93	3.91	0.02
23.00	4.95	3.94	0.02
23.50	4.98	3.96	0.02
24.00	**5.00**	**3.98**	0.02
24.50	5.00	3.98	0.00
25.00	5.00	3.98	0.00
25.50	5.00	3.98	0.00
26.00	5.00	3.98	0.00
26.50	5.00	3.98	0.00
27.00	5.00	3.98	0.00
27.50	5.00	3.98	0.00
28.00	5.00	3.98	0.00
28.50	5.00	3.98	0.00
29.00	5.00	3.98	0.00
29.50	5.00	3.98	0.00
30.00	5.00	3.98	0.00
30.50	5.00	3.98	0.00
31.00	5.00	3.98	0.00
31.50	5.00	3.98	0.00
32.00	5.00	3.98	0.00
32.50	5.00	3.98	0.00
33.00	5.00	3.98	0.00
33.50	5.00	3.98	0.00
34.00	5.00	3.98	0.00
34.50	5.00	3.98	0.00
35.00	5.00	3.98	0.00
35.50	5.00	3.98	0.00
36.00	5.00	3.98	0.00

Summary for Subcatchment 14S: PR-2b Into Pipes

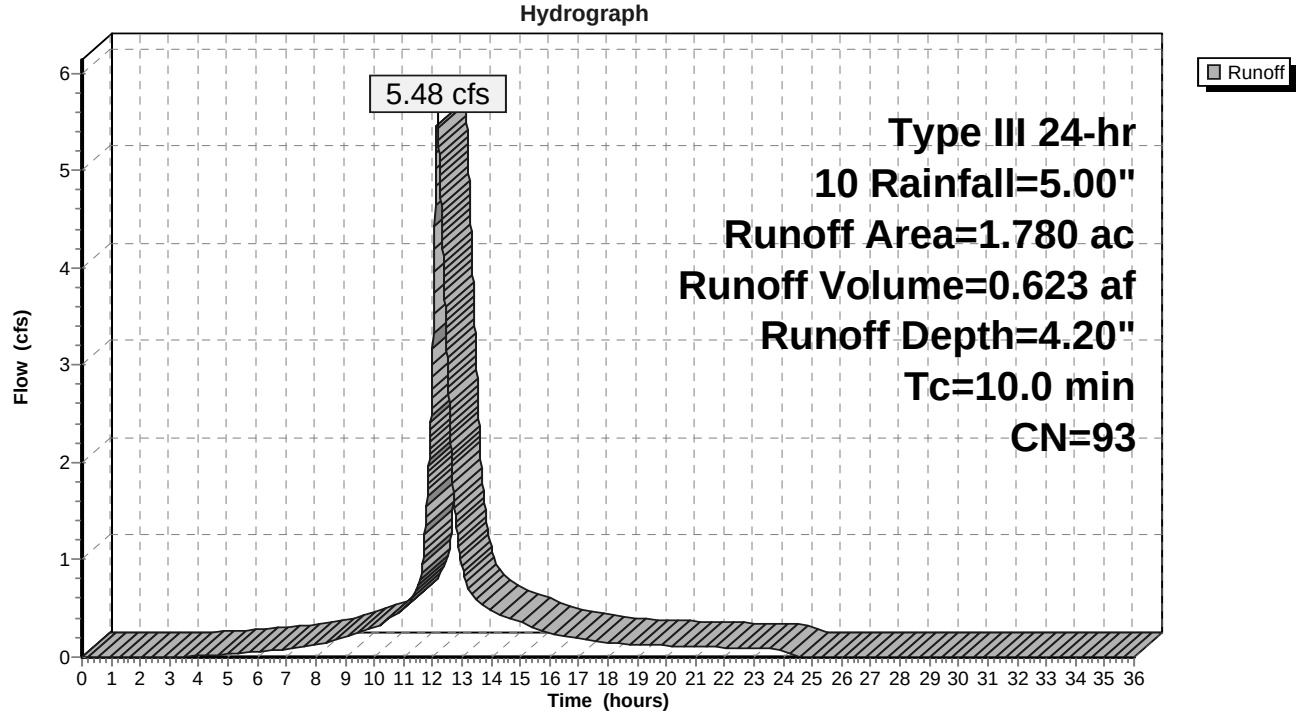
Runoff = 5.48 cfs @ 12.16 hrs, Volume= 0.623 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Rainfall=5.00"

	Area (ac)	CN	Description
	0.120	61	>75% Grass cover, Good, HSG B
	0.250	80	>75% Grass cover, Good, HSG D
*	1.270	98	Paved parking
	0.140	98	Roofs, HSG D
	1.780	93	Weighted Average
	0.370		20.79% Pervious Area
	1.410		79.21% Impervious Area

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

Subcatchment 14S: PR-2b Into Pipes



Hydrograph for Subcatchment 14S: PR-2b Into Pipes

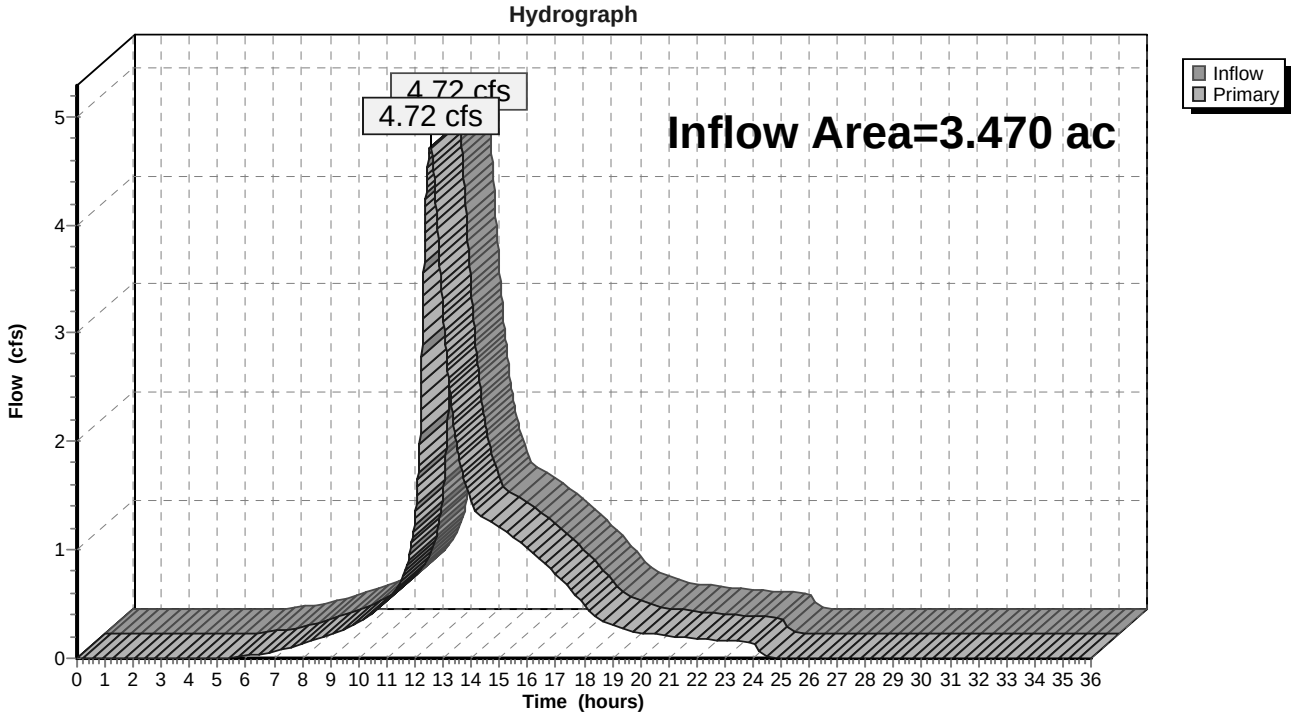
Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00
1.00	0.05	0.00	0.00
1.50	0.08	0.00	0.00
2.00	0.10	0.00	0.00
2.50	0.13	0.00	0.00
3.00	0.15	0.00	0.00
3.50	0.18	0.00	0.00
4.00	0.22	0.01	0.01
4.50	0.25	0.01	0.02
5.00	0.28	0.02	0.03
5.50	0.32	0.03	0.04
6.00	0.36	0.05	0.05
6.50	0.40	0.06	0.06
7.00	0.45	0.09	0.08
7.50	0.51	0.12	0.10
8.00	0.57	0.15	0.13
8.50	0.64	0.19	0.16
9.00	0.73	0.25	0.20
9.50	0.83	0.32	0.25
10.00	0.95	0.41	0.31
10.50	1.08	0.52	0.39
11.00	1.25	0.65	0.49
11.50	1.49	0.86	0.74
12.00	2.50	1.78	**3.01**
12.50	3.51	2.74	**3.08**
13.00	3.75	2.98	0.95
13.50	3.92	3.14	0.59
14.00	4.06	3.27	0.48
14.50	4.17	3.39	0.41
15.00	4.27	3.48	0.35
15.50	4.36	3.57	0.30
16.00	4.43	3.64	0.25
16.50	4.49	3.70	0.22
17.00	4.55	3.75	0.20
17.50	4.60	3.80	0.17
18.00	4.64	3.84	0.15
18.50	4.68	3.88	0.14
19.00	4.72	3.92	0.13
19.50	4.75	3.95	0.12
20.00	4.79	3.99	0.12
20.50	4.82	4.02	0.11
21.00	4.85	4.05	0.11
21.50	4.88	4.08	0.10
22.00	4.90	4.10	0.10
22.50	4.93	4.13	0.09
23.00	4.95	4.15	0.09
23.50	4.98	4.18	0.08
24.00	**5.00**	**4.20**	0.08
24.50	5.00	4.20	0.01
25.00	5.00	4.20	0.00
25.50	5.00	4.20	0.00
26.00	5.00	4.20	0.00
26.50	5.00	4.20	0.00
27.00	5.00	4.20	0.00
27.50	5.00	4.20	0.00
28.00	5.00	4.20	0.00
28.50	5.00	4.20	0.00
29.00	5.00	4.20	0.00
29.50	5.00	4.20	0.00
30.00	5.00	4.20	0.00
30.50	5.00	4.20	0.00
31.00	5.00	4.20	0.00
31.50	5.00	4.20	0.00
32.00	5.00	4.20	0.00
32.50	5.00	4.20	0.00
33.00	5.00	4.20	0.00
33.50	5.00	4.20	0.00
34.00	5.00	4.20	0.00
34.50	5.00	4.20	0.00
35.00	5.00	4.20	0.00
35.50	5.00	4.20	0.00
36.00	5.00	4.20	0.00

Summary for Link 16L: Total to P.O.I. "A"

Inflow Area = 3.470 ac, 70.89% Impervious, Inflow Depth = 3.65" for 10 event
Inflow = 4.72 cfs @ 12.54 hrs, Volume= 1.055 af
Primary = 4.72 cfs @ 12.54 hrs, Volume= 1.055 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 16L: Total to P.O.I. "A"



Hydrograph for Link 16L: Total to P.O.I. "A"

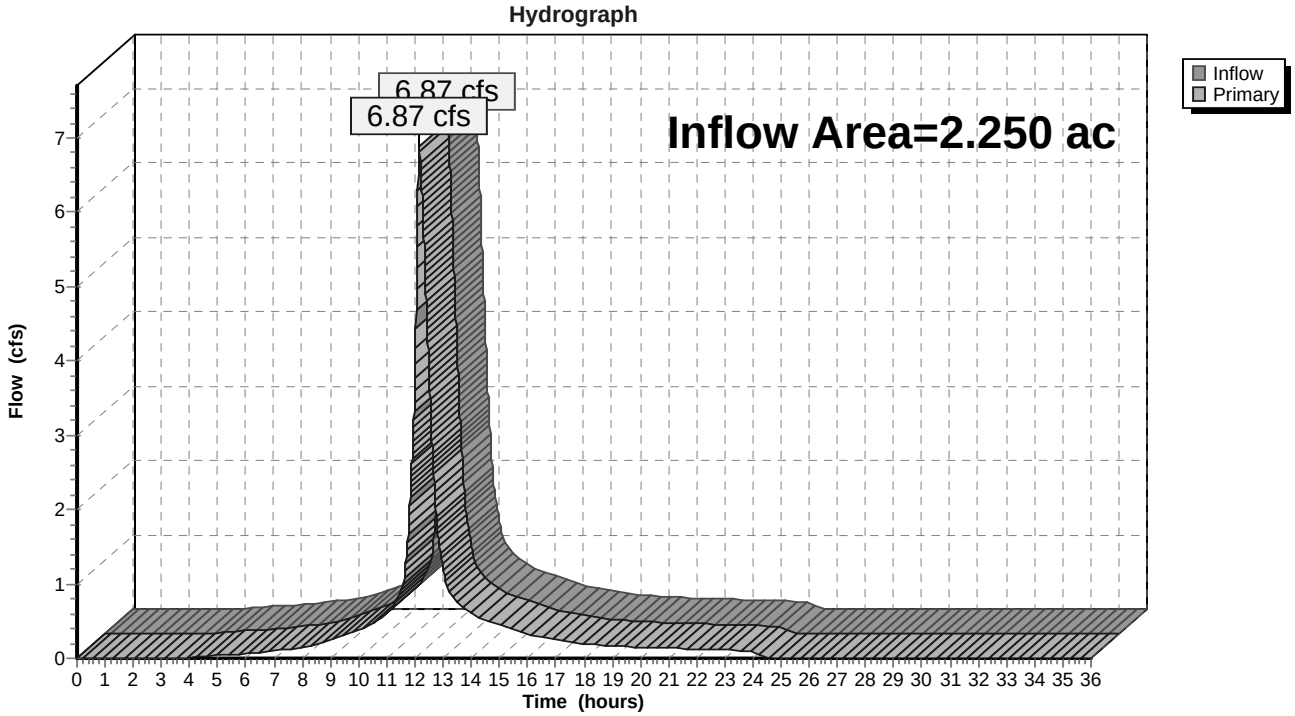
Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00	26.00	0.00	0.00	0.00
0.50	0.00	0.00	0.00	26.50	0.00	0.00	0.00
1.00	0.00	0.00	0.00	27.00	0.00	0.00	0.00
1.50	0.00	0.00	0.00	27.50	0.00	0.00	0.00
2.00	0.00	0.00	0.00	28.00	0.00	0.00	0.00
2.50	0.00	0.00	0.00	28.50	0.00	0.00	0.00
3.00	0.00	0.00	0.00	29.00	0.00	0.00	0.00
3.50	0.00	0.00	0.00	29.50	0.00	0.00	0.00
4.00	0.00	0.00	0.00	30.00	0.00	0.00	0.00
4.50	0.00	0.00	0.00	30.50	0.00	0.00	0.00
5.00	0.00	0.00	0.00	31.00	0.00	0.00	0.00
5.50	0.01	0.00	0.01	31.50	0.00	0.00	0.00
6.00	0.02	0.00	0.02	32.00	0.00	0.00	0.00
6.50	0.04	0.00	0.04	32.50	0.00	0.00	0.00
7.00	0.06	0.00	0.06	33.00	0.00	0.00	0.00
7.50	0.09	0.00	0.09	33.50	0.00	0.00	0.00
8.00	0.13	0.00	0.13	34.00	0.00	0.00	0.00
8.50	0.17	0.00	0.17	34.50	0.00	0.00	0.00
9.00	0.22	0.00	0.22	35.00	0.00	0.00	0.00
9.50	0.27	0.00	0.27	35.50	0.00	0.00	0.00
10.00	0.34	0.00	0.34	36.00	0.00	0.00	0.00
10.50	0.42	0.00	0.42				
11.00	0.54	0.00	0.54				
11.50	0.71	0.00	0.71				
12.00	1.28	0.00	1.28				
12.50	**4.68**	0.00	**4.68**				
13.00	**3.18**	0.00	**3.18**				
13.50	1.94	0.00	1.94				
14.00	1.44	0.00	1.44				
14.50	1.29	0.00	1.29				
15.00	1.21	0.00	1.21				
15.50	1.12	0.00	1.12				
16.00	1.02	0.00	1.02				
16.50	0.90	0.00	0.90				
17.00	0.78	0.00	0.78				
17.50	0.65	0.00	0.65				
18.00	0.50	0.00	0.50				
18.50	0.38	0.00	0.38				
19.00	0.30	0.00	0.30				
19.50	0.26	0.00	0.26				
20.00	0.24	0.00	0.24				
20.50	0.22	0.00	0.22				
21.00	0.20	0.00	0.20				
21.50	0.19	0.00	0.19				
22.00	0.18	0.00	0.18				
22.50	0.17	0.00	0.17				
23.00	0.16	0.00	0.16				
23.50	0.16	0.00	0.16				
24.00	0.15	0.00	0.15				
24.50	0.01	0.00	0.01				
25.00	0.00	0.00	0.00				
25.50	0.00	0.00	0.00				

Summary for Link 17L: Total to P.O.I. "B"

Inflow Area = 2.250 ac, 76.89% Impervious, Inflow Depth = 4.15" for 10 event
Inflow = 6.87 cfs @ 12.16 hrs, Volume= 0.779 af
Primary = 6.87 cfs @ 12.16 hrs, Volume= 0.779 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 17L: Total to P.O.I. "B"



Hydrograph for Link 17L: Total to P.O.I. "B"

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00	26.00	0.00	0.00	0.00
0.50	0.00	0.00	0.00	26.50	0.00	0.00	0.00
1.00	0.00	0.00	0.00	27.00	0.00	0.00	0.00
1.50	0.00	0.00	0.00	27.50	0.00	0.00	0.00
2.00	0.00	0.00	0.00	28.00	0.00	0.00	0.00
2.50	0.00	0.00	0.00	28.50	0.00	0.00	0.00
3.00	0.00	0.00	0.00	29.00	0.00	0.00	0.00
3.50	0.00	0.00	0.00	29.50	0.00	0.00	0.00
4.00	0.01	0.00	0.01	30.00	0.00	0.00	0.00
4.50	0.02	0.00	0.02	30.50	0.00	0.00	0.00
5.00	0.04	0.00	0.04	31.00	0.00	0.00	0.00
5.50	0.05	0.00	0.05	31.50	0.00	0.00	0.00
6.00	0.06	0.00	0.06	32.00	0.00	0.00	0.00
6.50	0.08	0.00	0.08	32.50	0.00	0.00	0.00
7.00	0.10	0.00	0.10	33.00	0.00	0.00	0.00
7.50	0.12	0.00	0.12	33.50	0.00	0.00	0.00
8.00	0.15	0.00	0.15	34.00	0.00	0.00	0.00
8.50	0.19	0.00	0.19	34.50	0.00	0.00	0.00
9.00	0.25	0.00	0.25	35.00	0.00	0.00	0.00
9.50	0.31	0.00	0.31	35.50	0.00	0.00	0.00
10.00	0.38	0.00	0.38	36.00	0.00	0.00	0.00
10.50	0.48	0.00	0.48				
11.00	0.61	0.00	0.61				
11.50	0.92	0.00	0.92				
12.00	**3.76**	0.00	**3.76**				
12.50	**3.87**	0.00	**3.87**				
13.00	1.19	0.00	1.19				
13.50	0.75	0.00	0.75				
14.00	0.61	0.00	0.61				
14.50	0.51	0.00	0.51				
15.00	0.45	0.00	0.45				
15.50	0.38	0.00	0.38				
16.00	0.32	0.00	0.32				
16.50	0.28	0.00	0.28				
17.00	0.25	0.00	0.25				
17.50	0.22	0.00	0.22				
18.00	0.19	0.00	0.19				
18.50	0.17	0.00	0.17				
19.00	0.17	0.00	0.17				
19.50	0.16	0.00	0.16				
20.00	0.15	0.00	0.15				
20.50	0.14	0.00	0.14				
21.00	0.13	0.00	0.13				
21.50	0.13	0.00	0.13				
22.00	0.12	0.00	0.12				
22.50	0.12	0.00	0.12				
23.00	0.11	0.00	0.11				
23.50	0.10	0.00	0.10				
24.00	0.10	0.00	0.10				
24.50	0.01	0.00	0.01				
25.00	0.00	0.00	0.00				
25.50	0.00	0.00	0.00				

100 YEAR STORM

Summary for Subcatchment 11S: PR-1a Overland

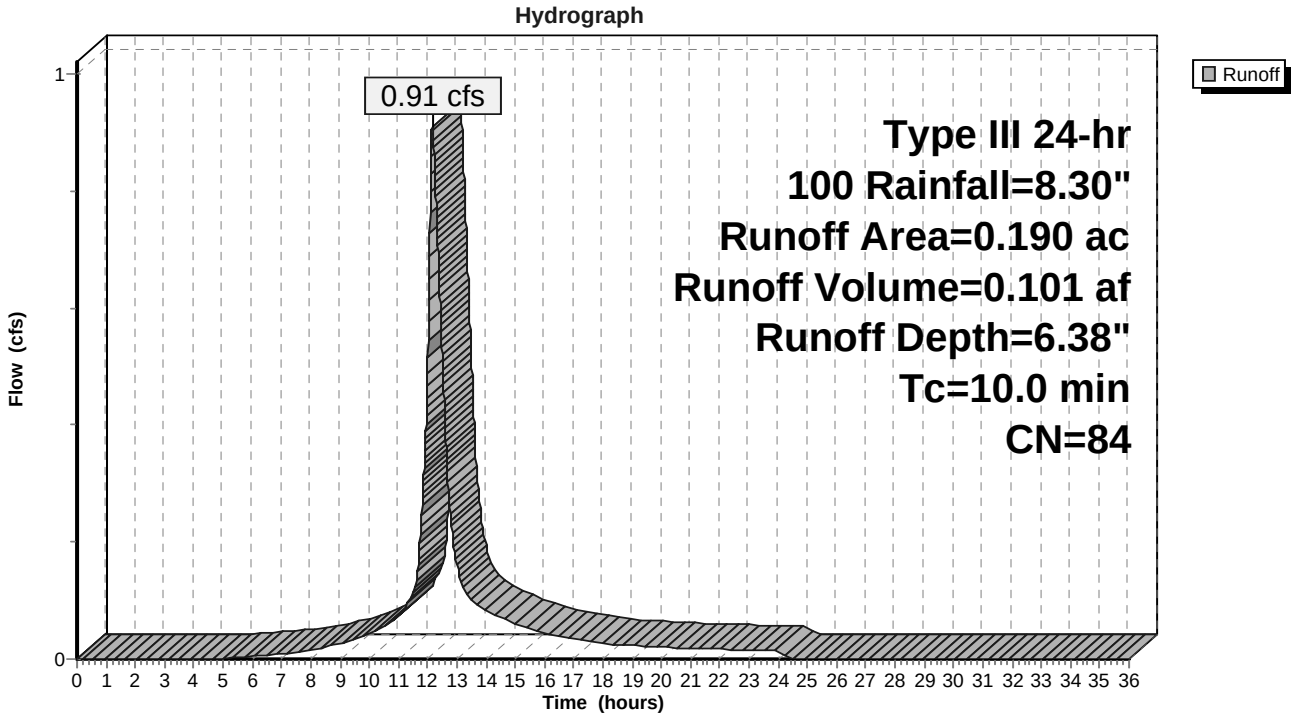
Runoff = 0.91 cfs @ 12.16 hrs, Volume= 0.101 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Rainfall=8.30"

Area (ac)	CN	Description
0.110	74	>75% Grass cover, Good, HSG C
0.080	98	Paved parking, HSG C
0.190	84	Weighted Average
0.110		57.89% Pervious Area
0.080		42.11% Impervious Area

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

Subcatchment 11S: PR-1a Overland



Hydrograph for Subcatchment 11S: PR-1a Overland

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.30	6.38	0.00
0.50	0.04	0.00	0.00	26.50	8.30	6.38	0.00
1.00	0.08	0.00	0.00	27.00	8.30	6.38	0.00
1.50	0.12	0.00	0.00	27.50	8.30	6.38	0.00
2.00	0.17	0.00	0.00	28.00	8.30	6.38	0.00
2.50	0.21	0.00	0.00	28.50	8.30	6.38	0.00
3.00	0.26	0.00	0.00	29.00	8.30	6.38	0.00
3.50	0.30	0.00	0.00	29.50	8.30	6.38	0.00
4.00	0.36	0.00	0.00	30.00	8.30	6.38	0.00
4.50	0.41	0.00	0.00	30.50	8.30	6.38	0.00
5.00	0.47	0.00	0.00	31.00	8.30	6.38	0.00
5.50	0.53	0.01	0.00	31.50	8.30	6.38	0.00
6.00	0.60	0.02	0.00	32.00	8.30	6.38	0.00
6.50	0.67	0.04	0.01	32.50	8.30	6.38	0.00
7.00	0.75	0.06	0.01	33.00	8.30	6.38	0.00
7.50	0.84	0.09	0.01	33.50	8.30	6.38	0.00
8.00	0.95	0.13	0.01	34.00	8.30	6.38	0.00
8.50	1.07	0.18	0.02	34.50	8.30	6.38	0.00
9.00	1.21	0.25	0.03	35.00	8.30	6.38	0.00
9.50	1.38	0.34	0.03	35.50	8.30	6.38	0.00
10.00	1.57	0.46	0.04	36.00	8.30	6.38	0.00
10.50	1.80	0.60	0.06				
11.00	2.08	0.80	0.07				
11.50	2.47	1.10	0.11				
12.00	4.15	2.50	**0.49**				
12.50	5.83	4.03	**0.52**				
13.00	6.22	4.41	0.16				
13.50	6.50	4.67	0.10				
14.00	6.73	4.89	0.08				
14.50	6.92	5.07	0.07				
15.00	7.09	5.23	0.06				
15.50	7.23	5.36	0.05				
16.00	7.35	5.48	0.04				
16.50	7.46	5.57	0.04				
17.00	7.55	5.66	0.03				
17.50	7.63	5.74	0.03				
18.00	7.70	5.81	0.03				
18.50	7.77	5.87	0.02				
19.00	7.83	5.93	0.02				
19.50	7.89	5.99	0.02				
20.00	7.94	6.04	0.02				
20.50	8.00	6.09	0.02				
21.00	8.05	6.14	0.02				
21.50	8.09	6.19	0.02				
22.00	8.14	6.23	0.02				
22.50	8.18	6.27	0.02				
23.00	8.22	6.31	0.02				
23.50	8.26	6.35	0.01				
24.00	**8.30**	**6.38**	0.01				
24.50	8.30	6.38	0.00				
25.00	8.30	6.38	0.00				
25.50	8.30	6.38	0.00				

Summary for Subcatchment 12S: PR-1b Into Pipes

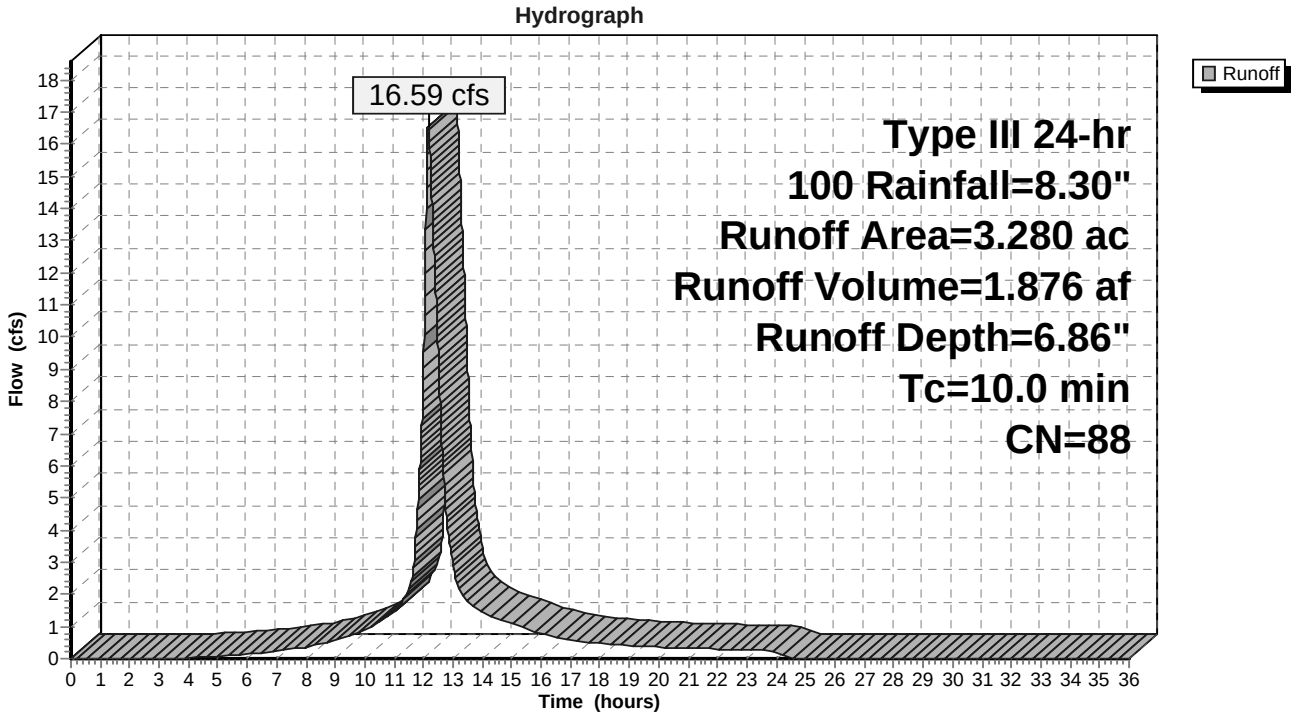
Runoff = 16.59 cfs @ 12.16 hrs, Volume= 1.876 af, Depth= 6.86"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Rainfall=8.30"

	Area (ac)	CN	Description
	0.470	61	>75% Grass cover, Good, HSG B
	0.210	74	>75% Grass cover, Good, HSG C
	0.220	55	Woods, Good, HSG B
*	0.720	98	Roofs
	1.660	98	Paved parking, HSG C
	3.280	88	Weighted Average
	0.900		27.44% Pervious Area
	2.380		72.56% Impervious Area

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

Subcatchment 12S: PR-1b Into Pipes



Hydrograph for Subcatchment 12S: PR-1b Into Pipes

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.04	0.00	0.00
1.00	0.08	0.00	0.00
1.50	0.12	0.00	0.00
2.00	0.17	0.00	0.00
2.50	0.21	0.00	0.00
3.00	0.26	0.00	0.00
3.50	0.30	0.00	0.01
4.00	0.36	0.00	0.03
4.50	0.41	0.01	0.05
5.00	0.47	0.03	0.08
5.50	0.53	0.04	0.11
6.00	0.60	0.06	0.14
6.50	0.67	0.09	0.18
7.00	0.75	0.12	0.23
7.50	0.84	0.17	0.29
8.00	0.95	0.22	0.36
8.50	1.07	0.29	0.46
9.00	1.21	0.38	0.59
9.50	1.38	0.49	0.74
10.00	1.57	0.63	0.91
10.50	1.80	0.80	1.14
11.00	2.08	1.03	1.46
11.50	2.47	1.36	2.21
12.00	4.15	2.87	**9.07**
12.50	5.83	4.46	**9.34**
13.00	6.22	4.84	2.89
13.50	6.50	5.11	1.81
14.00	6.73	5.33	1.47
14.50	6.92	5.52	1.24
15.00	7.09	5.68	1.08
15.50	7.23	5.82	0.93
16.00	7.35	5.94	0.77
16.50	7.46	6.04	0.67
17.00	7.55	6.13	0.60
17.50	7.63	6.21	0.53
18.00	7.70	6.28	0.46
18.50	7.77	6.34	0.42
19.00	7.83	6.40	0.40
19.50	7.89	6.46	0.38
20.00	7.94	6.51	0.36
20.50	8.00	6.56	0.34
21.00	8.05	6.61	0.33
21.50	8.09	6.66	0.31
22.00	8.14	6.71	0.30
22.50	8.18	6.75	0.28
23.00	8.22	6.79	0.27
23.50	8.26	6.83	0.25
24.00	**8.30**	**6.86**	0.24
24.50	8.30	6.86	0.02
25.00	8.30	6.86	0.00
25.50	8.30	6.86	0.00
26.00	8.30	6.86	0.00
26.50	8.30	6.86	0.00
27.00	8.30	6.86	0.00
27.50	8.30	6.86	0.00
28.00	8.30	6.86	0.00
28.50	8.30	6.86	0.00
29.00	8.30	6.86	0.00
29.50	8.30	6.86	0.00
30.00	8.30	6.86	0.00
30.50	8.30	6.86	0.00
31.00	8.30	6.86	0.00
31.50	8.30	6.86	0.00
32.00	8.30	6.86	0.00
32.50	8.30	6.86	0.00
33.00	8.30	6.86	0.00
33.50	8.30	6.86	0.00
34.00	8.30	6.86	0.00
34.50	8.30	6.86	0.00
35.00	8.30	6.86	0.00
35.50	8.30	6.86	0.00
36.00	8.30	6.86	0.00

Summary for Subcatchment 13S: PR-2a Overland

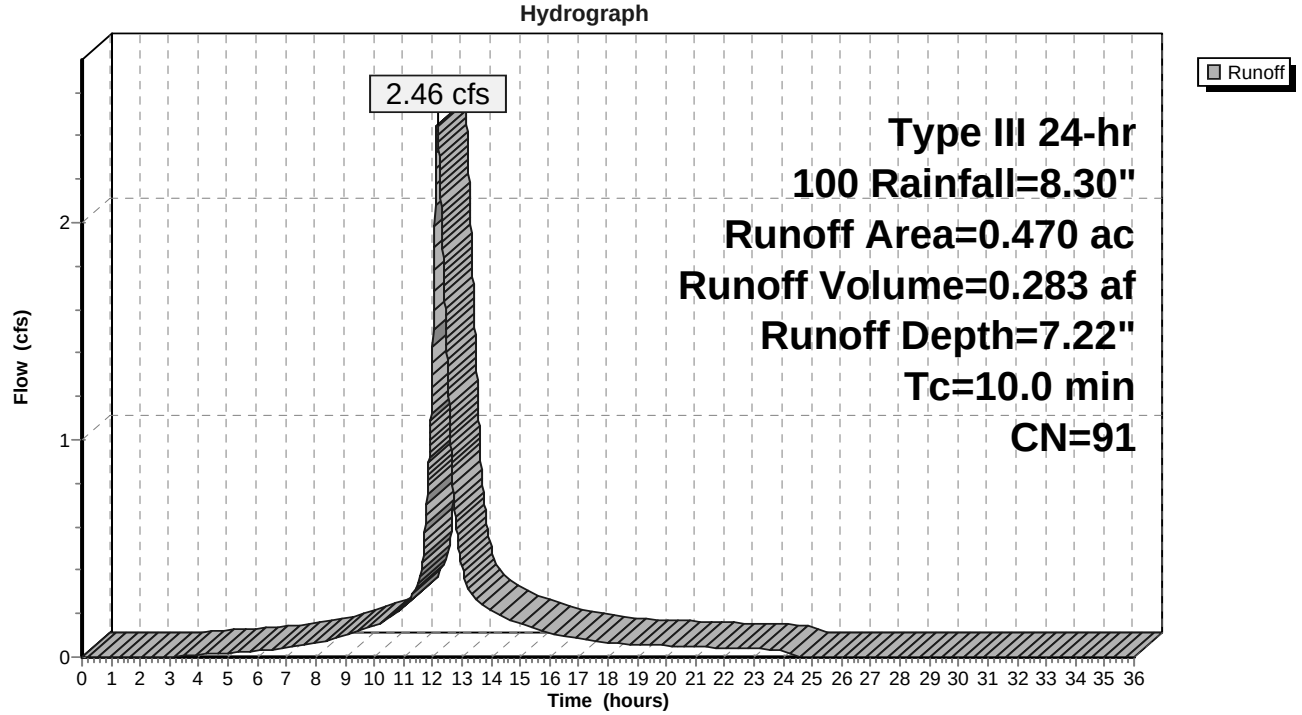
Runoff = 2.46 cfs @ 12.16 hrs, Volume= 0.283 af, Depth= 7.22"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Rainfall=8.30"

	Area (ac)	CN	Description
	0.010	61	>75% Grass cover, Good, HSG B
	0.050	74	>75% Grass cover, Good, HSG C
	0.090	80	>75% Grass cover, Good, HSG D
*	0.320	98	Paved parking
	0.470	91	Weighted Average
	0.150		31.91% Pervious Area
	0.320		68.09% Impervious Area

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

Subcatchment 13S: PR-2a Overland



Hydrograph for Subcatchment 13S: PR-2a Overland

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.04	0.00	0.00
1.00	0.08	0.00	0.00
1.50	0.12	0.00	0.00
2.00	0.17	0.00	0.00
2.50	0.21	0.00	0.00
3.00	0.26	0.00	0.00
3.50	0.30	0.01	0.01
4.00	0.36	0.02	0.01
4.50	0.41	0.04	0.02
5.00	0.47	0.06	0.02
5.50	0.53	0.08	0.02
6.00	0.60	0.12	0.03
6.50	0.67	0.15	0.04
7.00	0.75	0.20	0.04
7.50	0.84	0.26	0.05
8.00	0.95	0.32	0.06
8.50	1.07	0.41	0.08
9.00	1.21	0.51	0.10
9.50	1.38	0.64	0.12
10.00	1.57	0.80	0.15
10.50	1.80	0.99	0.18
11.00	2.08	1.23	0.23
11.50	2.47	1.59	0.34
12.00	4.15	3.16	**1.36**
12.50	5.83	4.79	**1.37**
13.00	6.22	5.18	0.42
13.50	6.50	5.45	0.26
14.00	6.73	5.67	0.21
14.50	6.92	5.86	0.18
15.00	7.09	6.03	0.16
15.50	7.23	6.17	0.13
16.00	7.35	6.29	0.11
16.50	7.46	6.39	0.10
17.00	7.55	6.48	0.09
17.50	7.63	6.56	0.08
18.00	7.70	6.63	0.07
18.50	7.77	6.69	0.06
19.00	7.83	6.76	0.06
19.50	7.89	6.81	0.05
20.00	7.94	6.87	0.05
20.50	8.00	6.92	0.05
21.00	8.05	6.97	0.05
21.50	8.09	7.02	0.05
22.00	8.14	7.06	0.04
22.50	8.18	7.11	0.04
23.00	8.22	7.15	0.04
23.50	8.26	7.18	0.04
24.00	**8.30**	**7.22**	0.03
24.50	8.30	7.22	0.00
25.00	8.30	7.22	0.00
25.50	8.30	7.22	0.00
26.00	8.30	7.22	0.00
26.50	8.30	7.22	0.00
27.00	8.30	7.22	0.00
27.50	8.30	7.22	0.00
28.00	8.30	7.22	0.00
28.50	8.30	7.22	0.00
29.00	8.30	7.22	0.00
29.50	8.30	7.22	0.00
30.00	8.30	7.22	0.00
30.50	8.30	7.22	0.00
31.00	8.30	7.22	0.00
31.50	8.30	7.22	0.00
32.00	8.30	7.22	0.00
32.50	8.30	7.22	0.00
33.00	8.30	7.22	0.00
33.50	8.30	7.22	0.00
34.00	8.30	7.22	0.00
34.50	8.30	7.22	0.00
35.00	8.30	7.22	0.00
35.50	8.30	7.22	0.00
36.00	8.30	7.22	0.00

Summary for Subcatchment 14S: PR-2b Into Pipes

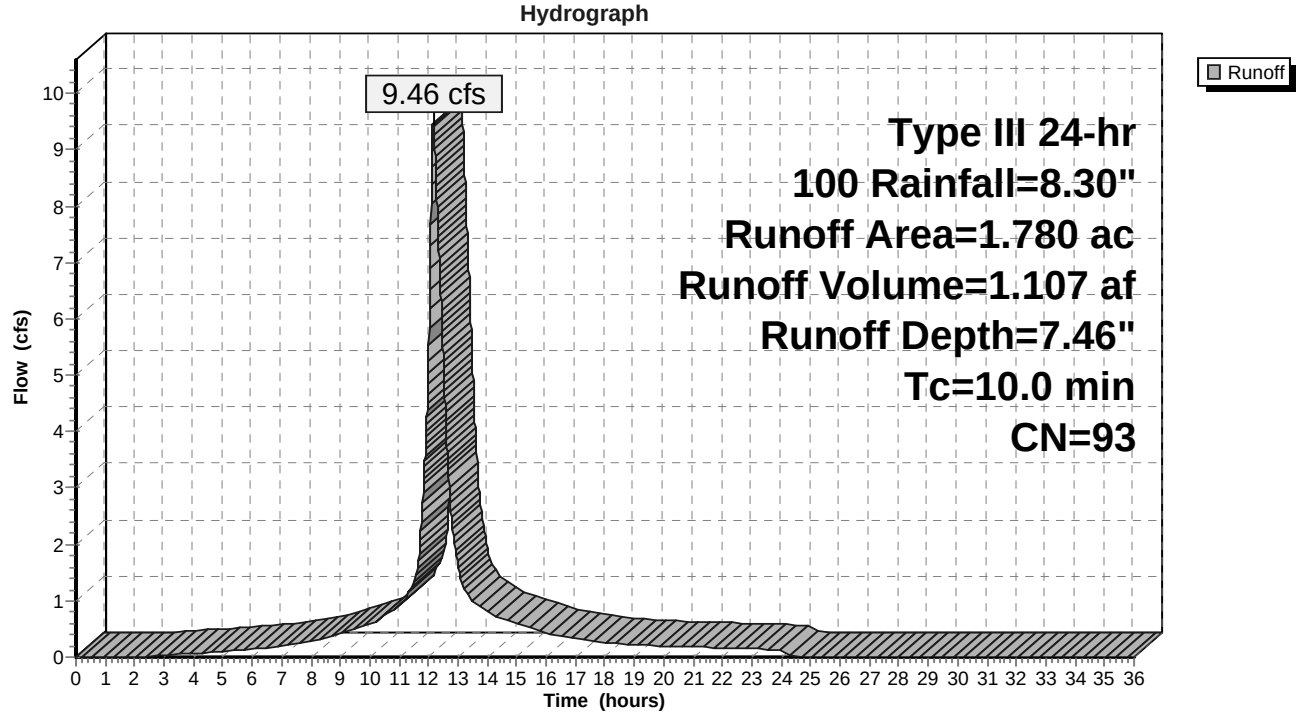
Runoff = 9.46 cfs @ 12.16 hrs, Volume= 1.107 af, Depth= 7.46"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Rainfall=8.30"

	Area (ac)	CN	Description
	0.120	61	>75% Grass cover, Good, HSG B
	0.250	80	>75% Grass cover, Good, HSG D
*	1.270	98	Paved parking
	0.140	98	Roofs, HSG D
	1.780	93	Weighted Average
	0.370		20.79% Pervious Area
	1.410		79.21% Impervious Area

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

Subcatchment 14S: PR-2b Into Pipes



Hydrograph for Subcatchment 14S: PR-2b Into Pipes

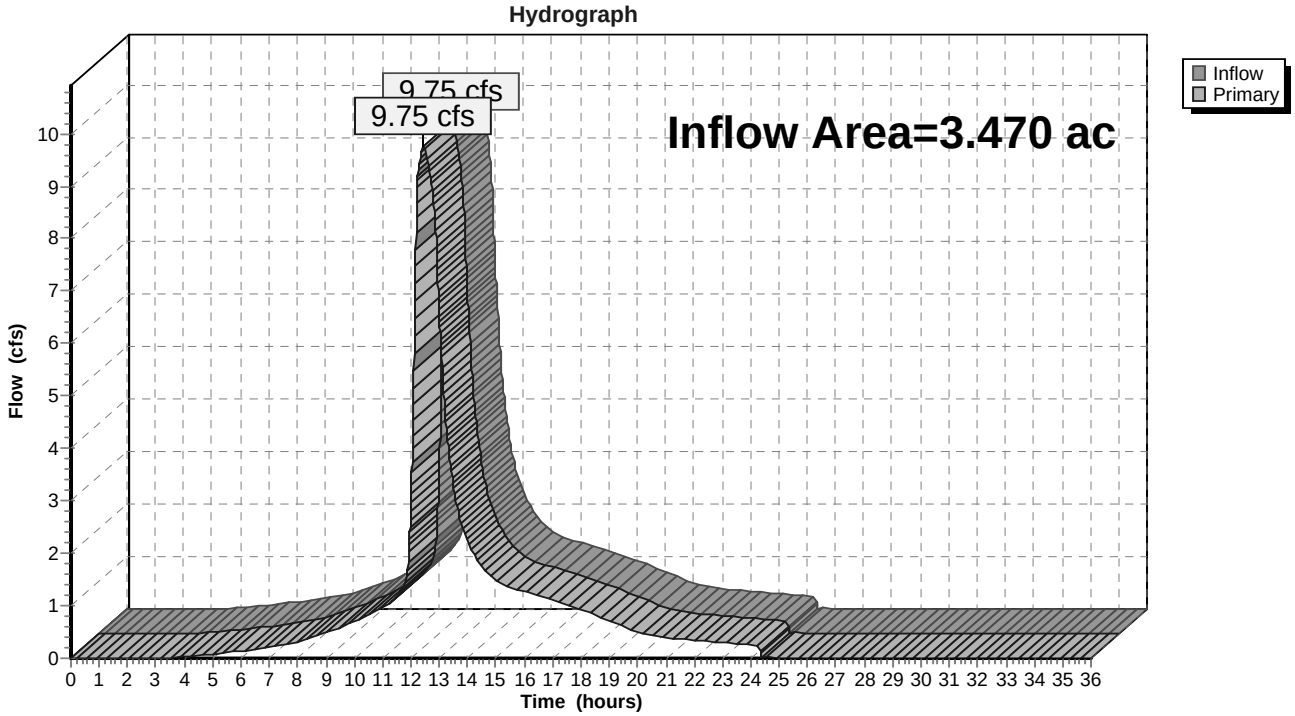
Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.30	7.46	0.00
0.50	0.04	0.00	0.00	26.50	8.30	7.46	0.00
1.00	0.08	0.00	0.00	27.00	8.30	7.46	0.00
1.50	0.12	0.00	0.00	27.50	8.30	7.46	0.00
2.00	0.17	0.00	0.00	28.00	8.30	7.46	0.00
2.50	0.21	0.00	0.01	28.50	8.30	7.46	0.00
3.00	0.26	0.01	0.03	29.00	8.30	7.46	0.00
3.50	0.30	0.03	0.05	29.50	8.30	7.46	0.00
4.00	0.36	0.04	0.07	30.00	8.30	7.46	0.00
4.50	0.41	0.07	0.08	30.50	8.30	7.46	0.00
5.00	0.47	0.10	0.10	31.00	8.30	7.46	0.00
5.50	0.53	0.13	0.12	31.50	8.30	7.46	0.00
6.00	0.60	0.17	0.14	32.00	8.30	7.46	0.00
6.50	0.67	0.21	0.16	32.50	8.30	7.46	0.00
7.00	0.75	0.27	0.20	33.00	8.30	7.46	0.00
7.50	0.84	0.33	0.24	33.50	8.30	7.46	0.00
8.00	0.95	0.41	0.27	34.00	8.30	7.46	0.00
8.50	1.07	0.50	0.34	34.50	8.30	7.46	0.00
9.00	1.21	0.62	0.42	35.00	8.30	7.46	0.00
9.50	1.38	0.76	0.51	35.50	8.30	7.46	0.00
10.00	1.57	0.93	0.60	36.00	8.30	7.46	0.00
10.50	1.80	1.13	0.73				
11.00	2.08	1.38	0.91				
11.50	2.47	1.75	1.34				
12.00	4.15	3.37	**5.26**				
12.50	5.83	5.01	**5.25**				
13.00	6.22	5.40	1.61				
13.50	6.50	5.68	1.00				
14.00	6.73	5.91	0.81				
14.50	6.92	6.09	0.68				
15.00	7.09	6.26	0.60				
15.50	7.23	6.40	0.51				
16.00	7.35	6.52	0.43				
16.50	7.46	6.62	0.37				
17.00	7.55	6.72	0.33				
17.50	7.63	6.80	0.29				
18.00	7.70	6.87	0.26				
18.50	7.77	6.93	0.23				
19.00	7.83	6.99	0.22				
19.50	7.89	7.05	0.21				
20.00	7.94	7.11	0.20				
20.50	8.00	7.16	0.19				
21.00	8.05	7.21	0.18				
21.50	8.09	7.26	0.17				
22.00	8.14	7.30	0.16				
22.50	8.18	7.34	0.15				
23.00	8.22	7.39	0.15				
23.50	8.26	7.42	0.14				
24.00	**8.30**	**7.46**	0.13				
24.50	8.30	7.46	0.01				
25.00	8.30	7.46	0.00				
25.50	8.30	7.46	0.00				

Summary for Link 16L: Total to P.O.I. "A"

Inflow Area = 3.470 ac, 70.89% Impervious, Inflow Depth = 6.84" for 100 event
Inflow = 9.75 cfs @ 12.46 hrs, Volume= 1.977 af
Primary = 9.75 cfs @ 12.46 hrs, Volume= 1.977 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 16L: Total to P.O.I. "A"



Hydrograph for Link 16L: Total to P.O.I. "A"

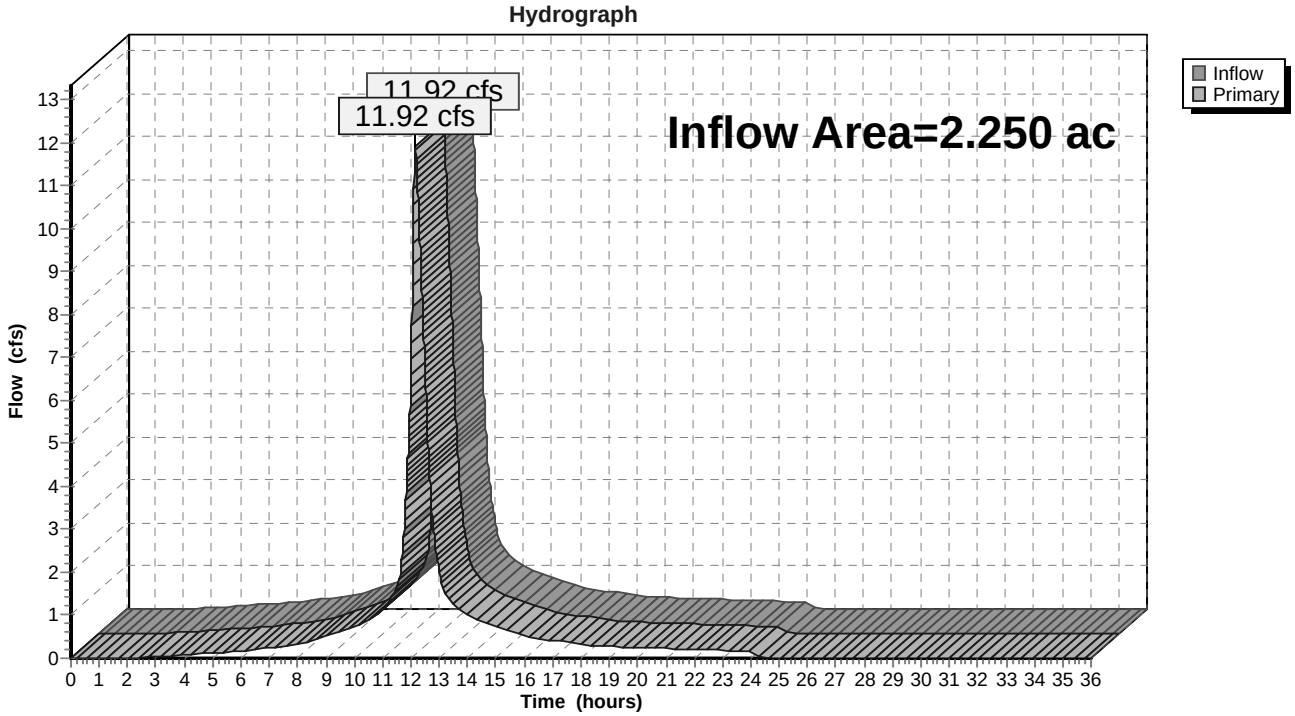
Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00	26.00	0.00	0.00	0.00
0.50	0.00	0.00	0.00	26.50	0.00	0.00	0.00
1.00	0.00	0.00	0.00	27.00	0.00	0.00	0.00
1.50	0.00	0.00	0.00	27.50	0.00	0.00	0.00
2.00	0.00	0.00	0.00	28.00	0.00	0.00	0.00
2.50	0.00	0.00	0.00	28.50	0.00	0.00	0.00
3.00	0.00	0.00	0.00	29.00	0.00	0.00	0.00
3.50	0.01	0.00	0.01	29.50	0.00	0.00	0.00
4.00	0.03	0.00	0.03	30.00	0.00	0.00	0.00
4.50	0.05	0.00	0.05	30.50	0.00	0.00	0.00
5.00	0.08	0.00	0.08	31.00	0.00	0.00	0.00
5.50	0.11	0.00	0.11	31.50	0.00	0.00	0.00
6.00	0.14	0.00	0.14	32.00	0.00	0.00	0.00
6.50	0.18	0.00	0.18	32.50	0.00	0.00	0.00
7.00	0.22	0.00	0.22	33.00	0.00	0.00	0.00
7.50	0.26	0.00	0.26	33.50	0.00	0.00	0.00
8.00	0.31	0.00	0.31	34.00	0.00	0.00	0.00
8.50	0.38	0.00	0.38	34.50	0.00	0.00	0.00
9.00	0.48	0.00	0.48	35.00	0.00	0.00	0.00
9.50	0.59	0.00	0.59	35.50	0.00	0.00	0.00
10.00	0.70	0.00	0.70	36.00	0.00	0.00	0.00
10.50	0.82	0.00	0.82				
11.00	0.96	0.00	0.96				
11.50	1.16	0.00	1.16				
12.00	**2.96**	0.00	**2.96**				
12.50	**9.73**	0.00	**9.73**				
13.00	6.53	0.00	6.53				
13.50	3.27	0.00	3.27				
14.00	2.21	0.00	2.21				
14.50	1.73	0.00	1.73				
15.00	1.47	0.00	1.47				
15.50	1.34	0.00	1.34				
16.00	1.27	0.00	1.27				
16.50	1.20	0.00	1.20				
17.00	1.12	0.00	1.12				
17.50	1.03	0.00	1.03				
18.00	0.93	0.00	0.93				
18.50	0.82	0.00	0.82				
19.00	0.72	0.00	0.72				
19.50	0.61	0.00	0.61				
20.00	0.51	0.00	0.51				
20.50	0.44	0.00	0.44				
21.00	0.39	0.00	0.39				
21.50	0.36	0.00	0.36				
22.00	0.34	0.00	0.34				
22.50	0.32	0.00	0.32				
23.00	0.30	0.00	0.30				
23.50	0.28	0.00	0.28				
24.00	0.26	0.00	0.26				
24.50	0.05	0.00	0.05				
25.00	0.00	0.00	0.00				
25.50	0.00	0.00	0.00				

Summary for Link 17L: Total to P.O.I. "B"

Inflow Area = 2.250 ac, 76.89% Impervious, Inflow Depth = 7.41" for 100 event
Inflow = 11.92 cfs @ 12.16 hrs, Volume= 1.389 af
Primary = 11.92 cfs @ 12.16 hrs, Volume= 1.389 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

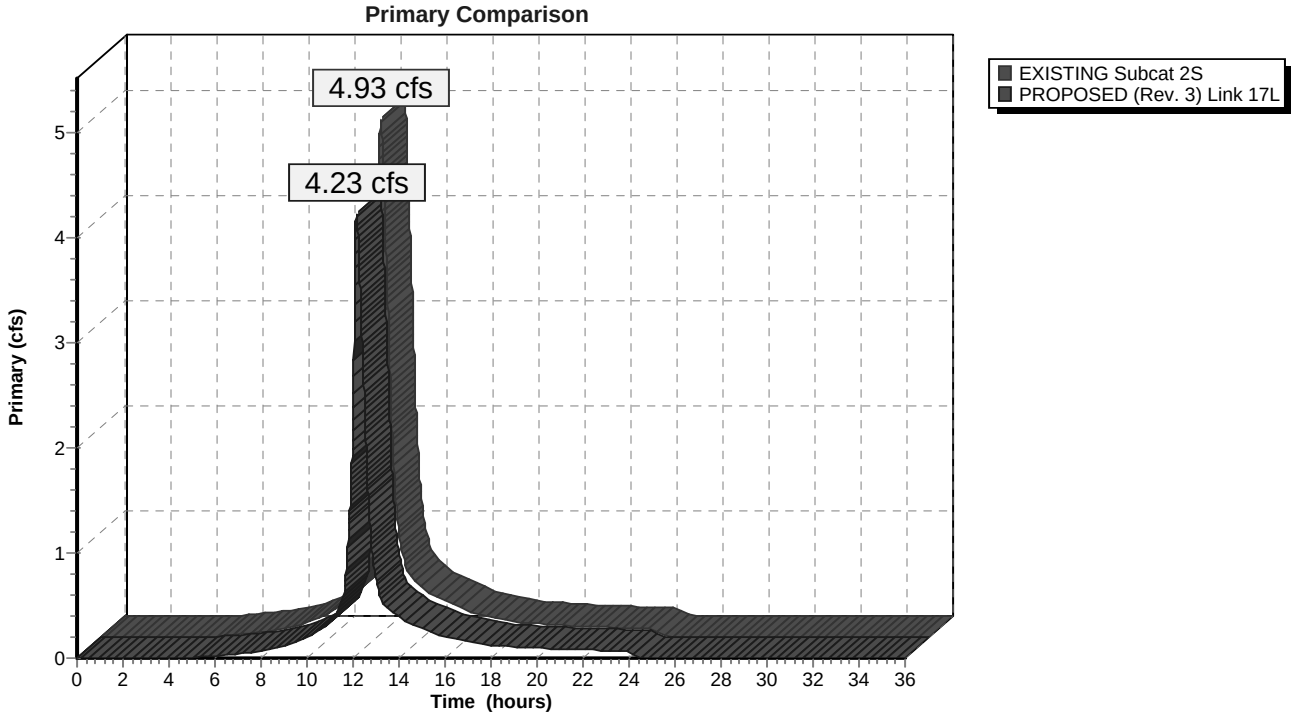
Link 17L: Total to P.O.I. "B"



Hydrograph for Link 17L: Total to P.O.I. "B"

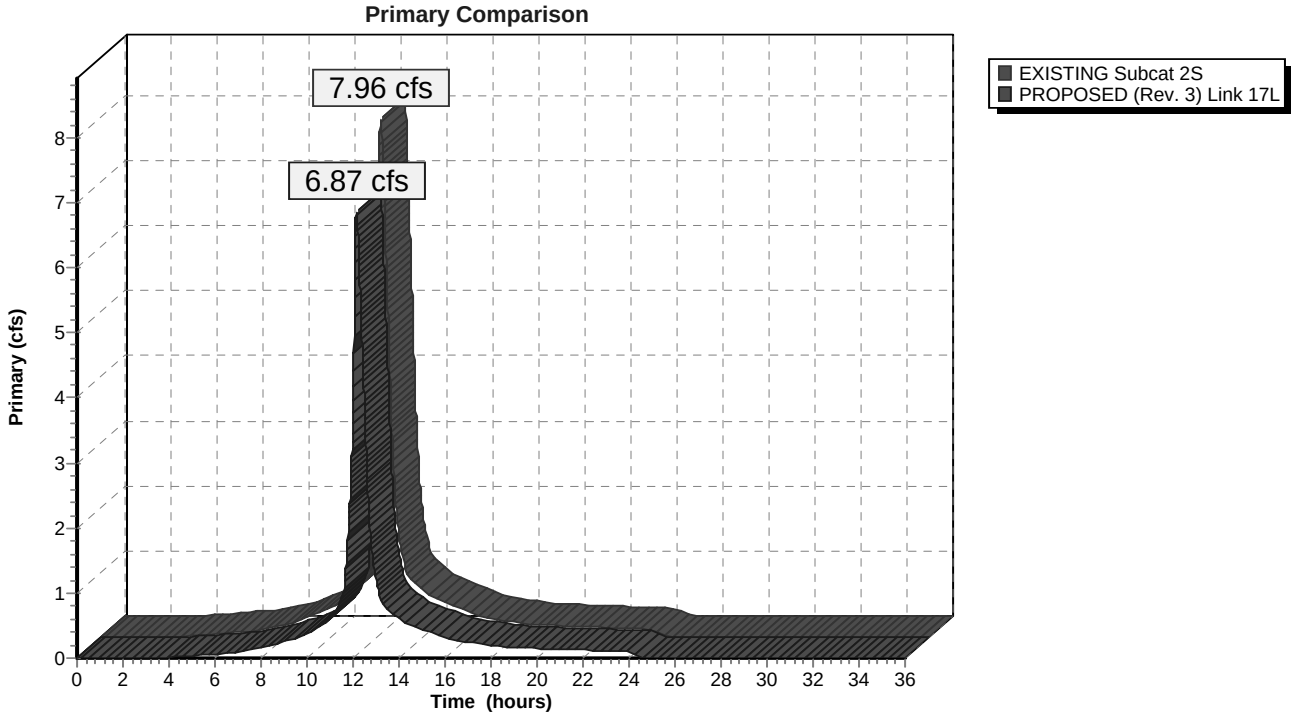
Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00	26.00	0.00	0.00	0.00
0.50	0.00	0.00	0.00	26.50	0.00	0.00	0.00
1.00	0.00	0.00	0.00	27.00	0.00	0.00	0.00
1.50	0.00	0.00	0.00	27.50	0.00	0.00	0.00
2.00	0.00	0.00	0.00	28.00	0.00	0.00	0.00
2.50	0.01	0.00	0.01	28.50	0.00	0.00	0.00
3.00	0.03	0.00	0.03	29.00	0.00	0.00	0.00
3.50	0.05	0.00	0.05	29.50	0.00	0.00	0.00
4.00	0.08	0.00	0.08	30.00	0.00	0.00	0.00
4.50	0.10	0.00	0.10	30.50	0.00	0.00	0.00
5.00	0.12	0.00	0.12	31.00	0.00	0.00	0.00
5.50	0.14	0.00	0.14	31.50	0.00	0.00	0.00
6.00	0.16	0.00	0.16	32.00	0.00	0.00	0.00
6.50	0.20	0.00	0.20	32.50	0.00	0.00	0.00
7.00	0.24	0.00	0.24	33.00	0.00	0.00	0.00
7.50	0.29	0.00	0.29	33.50	0.00	0.00	0.00
8.00	0.34	0.00	0.34	34.00	0.00	0.00	0.00
8.50	0.42	0.00	0.42	34.50	0.00	0.00	0.00
9.00	0.52	0.00	0.52	35.00	0.00	0.00	0.00
9.50	0.63	0.00	0.63	35.50	0.00	0.00	0.00
10.00	0.74	0.00	0.74	36.00	0.00	0.00	0.00
10.50	0.91	0.00	0.91				
11.00	1.14	0.00	1.14				
11.50	1.68	0.00	1.68				
12.00	**6.62**	0.00	**6.62**				
12.50	**6.62**	0.00	**6.62**				
13.00	2.03	0.00	2.03				
13.50	1.27	0.00	1.27				
14.00	1.03	0.00	1.03				
14.50	0.86	0.00	0.86				
15.00	0.75	0.00	0.75				
15.50	0.65	0.00	0.65				
16.00	0.54	0.00	0.54				
16.50	0.46	0.00	0.46				
17.00	0.42	0.00	0.42				
17.50	0.37	0.00	0.37				
18.00	0.32	0.00	0.32				
18.50	0.29	0.00	0.29				
19.00	0.28	0.00	0.28				
19.50	0.26	0.00	0.26				
20.00	0.25	0.00	0.25				
20.50	0.24	0.00	0.24				
21.00	0.23	0.00	0.23				
21.50	0.22	0.00	0.22				
22.00	0.21	0.00	0.21				
22.50	0.20	0.00	0.20				
23.00	0.19	0.00	0.19				
23.50	0.17	0.00	0.17				
24.00	0.16	0.00	0.16				
24.50	0.02	0.00	0.02				
25.00	0.00	0.00	0.00				
25.50	0.00	0.00	0.00				

APPENDIX C: COMPARISON FOR EXISTING AND PROPOSED RATES OF RUNOFF TO P.O.I. 'B'


Primary Comparison
4.93 cfs
4.23 cfs
EXISTING Subcat 2S
PROPOSED (Rev. 3) Link 17L
Primary (cfs)
0
1
2
3
4
5
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
Time (hours)

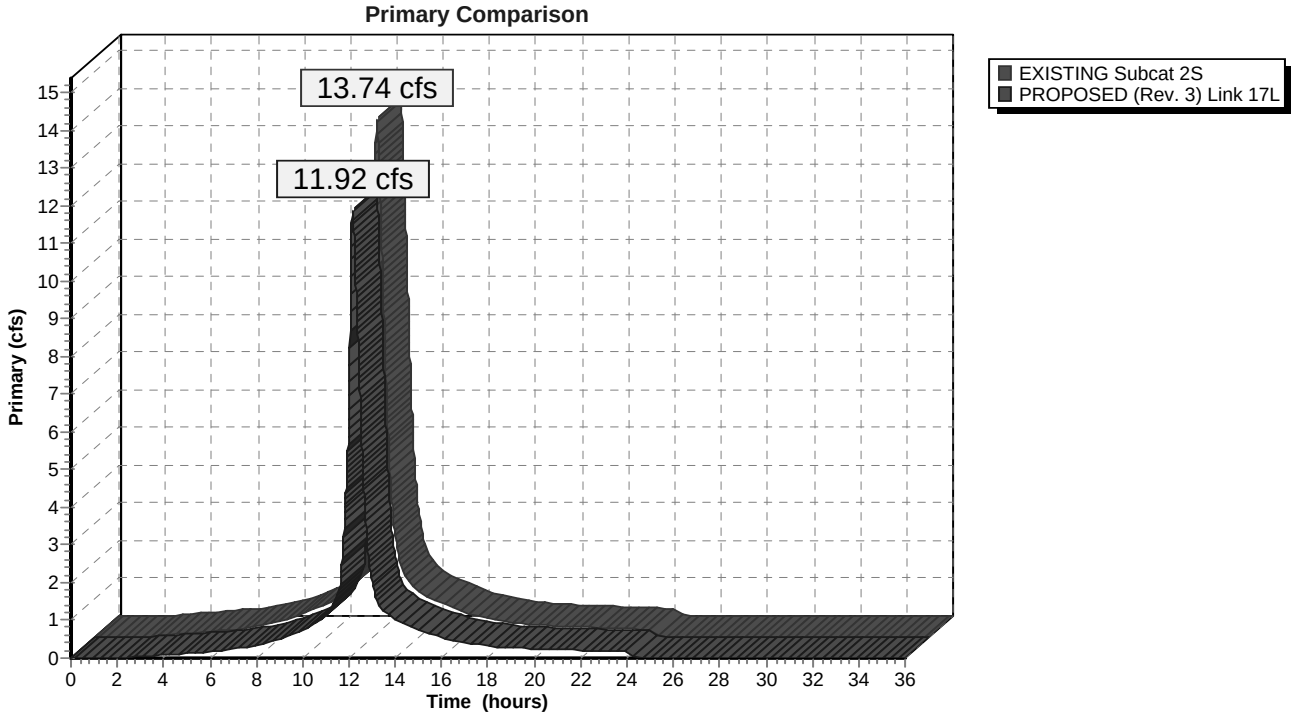
Primary Comparison

Time (hours)	EXISTING Subcat 2S (cfs)	PROPOSED (Rev. 3) Link 17L (cfs)
0.00	0.00	0.00
1.00	0.00	0.00
2.00	0.00	0.00
3.00	0.00	0.00
4.00	0.00	0.00
5.00	0.01	0.01
6.00	0.02	0.02
7.00	0.05	0.04
8.00	0.08	0.07
9.00	0.15	0.12
10.00	0.24	0.20
11.00	0.41	0.34
12.00	**2.61**	**2.27**
13.00	**0.94**	**0.76**
14.00	0.46	0.39
15.00	0.34	0.29
16.00	0.24	0.21
17.00	0.19	0.16
18.00	0.15	0.12
19.00	0.13	0.11
20.00	0.11	0.10
21.00	0.10	0.09
22.00	0.09	0.08
23.00	0.08	0.07
24.00	0.07	0.06
25.00	0.00	0.00
26.00	0.00	0.00
27.00	0.00	0.00
28.00	0.00	0.00
29.00	0.00	0.00
30.00	0.00	0.00
31.00	0.00	0.00
32.00	0.00	0.00
33.00	0.00	0.00
34.00	0.00	0.00
35.00	0.00	0.00
36.00	0.00	0.00


Primary Comparison
7.96 cfs
6.87 cfs
EXISTING Subcat 2S
PROPOSED (Rev. 3) Link 17L
Primary (cfs)
0
1
2
3
4
5
6
7
8
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
Time (hours)

Primary Comparison

Time (hours)	EXISTING Subcat 2S (cfs)	PROPOSED (Rev. 3) Link 17L (cfs)
0.00	0.00	0.00
1.00	0.00	0.00
2.00	0.00	0.00
3.00	0.00	0.00
4.00	0.02	0.01
5.00	0.05	0.04
6.00	0.07	0.06
7.00	0.12	0.10
8.00	0.19	0.15
9.00	0.30	0.25
10.00	0.46	0.38
11.00	0.73	0.61
12.00	**4.31**	**3.76**
13.00	**1.47**	**1.19**
14.00	0.72	0.61
15.00	0.53	0.45
16.00	0.38	0.32
17.00	0.29	0.25
18.00	0.23	0.19
19.00	0.20	0.17
20.00	0.18	0.15
21.00	0.16	0.13
22.00	0.14	0.12
23.00	0.13	0.11
24.00	0.12	0.10
25.00	0.00	0.00
26.00	0.00	0.00
27.00	0.00	0.00
28.00	0.00	0.00
29.00	0.00	0.00
30.00	0.00	0.00
31.00	0.00	0.00
32.00	0.00	0.00
33.00	0.00	0.00
34.00	0.00	0.00
35.00	0.00	0.00
36.00	0.00	0.00


Primary Comparison
13.74 cfs
11.92 cfs
EXISTING Subcat 2S
PROPOSED (Rev. 3) Link 17L
Primary (cfs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
Time (hours)

Primary Comparison

Time (hours)	EXISTING Subcat 2S (cfs)	PROPOSED (Rev. 3) Link 17L (cfs)
0.00	0.00	0.00
1.00	0.00	0.00
2.00	0.00	0.00
3.00	0.04	0.03
4.00	0.10	0.08
5.00	0.15	0.12
6.00	0.20	0.16
7.00	0.29	0.24
8.00	0.41	0.34
9.00	0.62	0.52
10.00	0.88	0.74
11.00	1.34	1.14
12.00	**7.56**	**6.62**
13.00	**2.50**	**2.03**
14.00	1.22	1.03
15.00	0.89	0.75
16.00	0.64	0.54
17.00	0.49	0.42
18.00	0.38	0.32
19.00	0.33	0.28
20.00	0.30	0.25
21.00	0.27	0.23
22.00	0.24	0.21
23.00	0.22	0.19
24.00	0.19	0.16
25.00	0.00	0.00
26.00	0.00	0.00
27.00	0.00	0.00
28.00	0.00	0.00
29.00	0.00	0.00
30.00	0.00	0.00
31.00	0.00	0.00
32.00	0.00	0.00
33.00	0.00	0.00
34.00	0.00	0.00
35.00	0.00	0.00
36.00	0.00	0.00

APPENDIX D: PROPOSED DETENTION SYSTEM ROUTING

Summary for Pond 15P: Proposed Underground SWM Basin #1

Inflow Area = 3.280 ac, 72.56% Impervious, Inflow Depth = 2.09" for 2 event
Inflow = 5.24 cfs @ 12.16 hrs, Volume= 0.570 af
Outflow = 1.59 cfs @ 12.75 hrs, Volume= 0.570 af, Atten= 70%, Lag= 35.6 min
Primary = 1.59 cfs @ 12.75 hrs, Volume= 0.570 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 96.41' @ 12.75 hrs Surf.Area= 0.393 ac Storage= 0.183 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 50.5 min (874.1 - 823.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	94.50'	0.000 af	**59.00'W x 290.00'L x 4.50'H Field A** 1.768 af Overall - 0.642 af Embedded = 1.125 af x 0.0% Voids
#2A	95.00'	0.515 af	**ADS N-12 36** x 11 Inside #1 Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.2 cf Row Length Adjustment= +267.00' x 7.10 sf x 11 rows
		0.515 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.80'	**15.0" Round HDPE_Round 15"** L= 45.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.80' / 94.00' S= 0.0178 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	95.00'	**7.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.30'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.59 cfs @ 12.75 hrs HW=96.41' (Free Discharge)
└**1=HDPE_Round 15"** (Passes 1.59 cfs of 5.86 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.36 cfs @ 5.09 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.23 cfs @ 1.07 fps)

Pond 15P: Proposed Underground SWM Basin #1 - Chamber Wizard Field A

Chamber Model = ADS N-12 36 (ADS N-12® Pipe)
Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf
Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.2 cf
Row Length Adjustment= +267.00' x 7.10 sf x 11 rows

42.0" Wide + 21.0" Spacing = 63.0" C-C Row Spacing

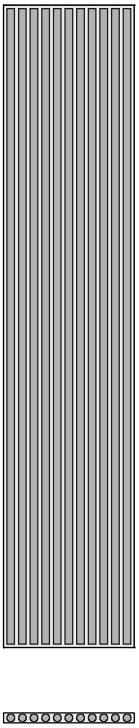
1 Chambers/Row x 20.00' Long +267.00' Row Adjustment = 287.00' Row Length +18.0" End Stone x 2 = 290.00' Base Length
11 Rows x 42.0" Wide + 21.0" Spacing x 10 + 18.0" Side Stone x 2 = 59.00' Base Width
6.0" Base + 42.0" Chamber Height + 6.0" Cover = 4.50' Field Height

11 Chambers x 142.0 cf +267.00' Row Adjustment x 7.10 sf x 11 Rows = 22,414.7 cf Chamber Storage
11 Chambers x 177.2 cf +267.00' Row Adjustment x 8.86 sf x 11 Rows = 27,974.2 cf Displacement

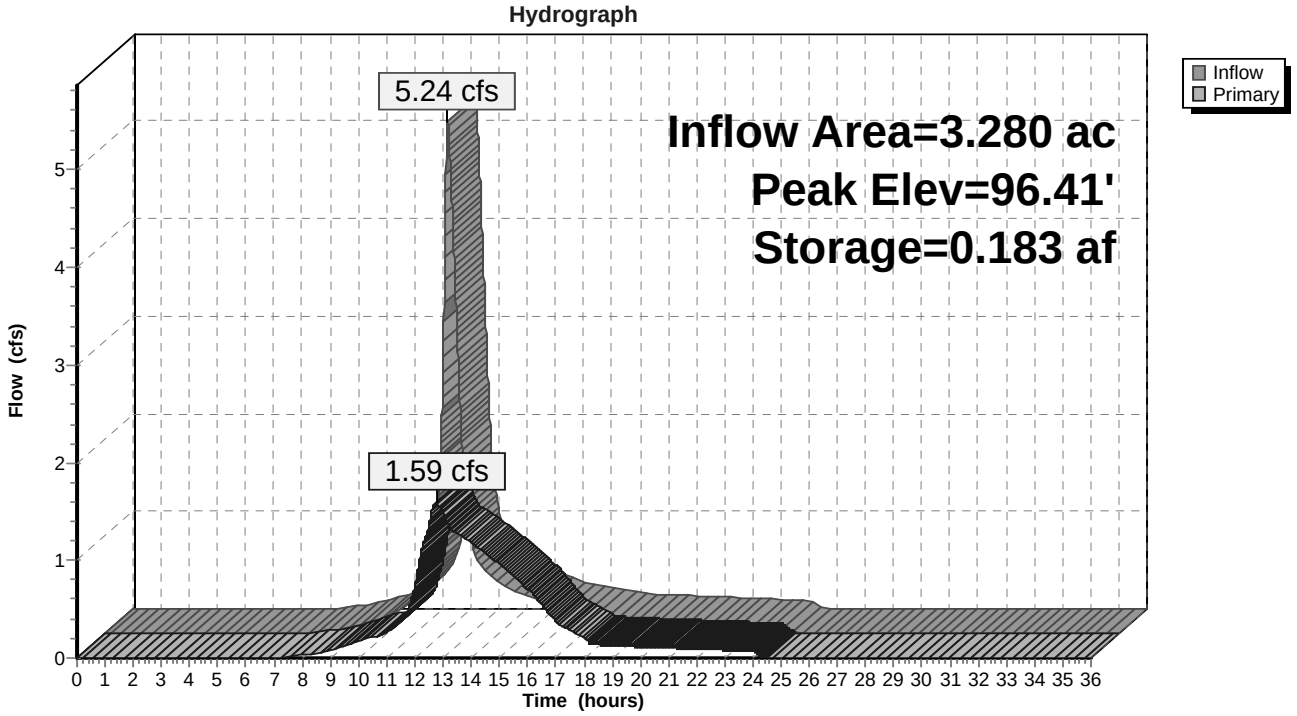
76,994.7 cf Field - 27,974.2 cf Chambers = 49,020.5 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 22,414.7 cf = 0.515 af
Overall Storage Efficiency = 29.1%
Overall System Size = 290.00' x 59.00' x 4.50'

11 Chambers
2,851.7 cy Field
1,815.6 cy Stone



Pond 15P: Proposed Underground SWM Basin #1



Hydrograph for Pond 15P: Proposed Underground SWM Basin #1

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.000	94.50	0.00
1.00	0.00	0.000	94.50	0.00
2.00	0.00	0.000	94.50	0.00
3.00	0.00	0.000	94.50	0.00
4.00	0.00	0.000	94.50	0.00
5.00	0.00	0.000	94.50	0.00
6.00	0.00	0.000	94.50	0.00
7.00	0.00	0.000	95.03	0.00
8.00	0.03	0.000	95.09	0.03
9.00	0.08	0.000	95.16	0.08
10.00	0.17	0.000	95.24	0.17
11.00	0.34	0.002	95.31	0.27
12.00	**2.67**	**0.037**	**95.62**	**0.74**
13.00	**1.00**	**0.177**	**96.38**	**1.49**
14.00	0.52	0.126	96.13	1.18
15.00	0.39	0.074	95.85	0.96
16.00	0.28	0.032	95.59	0.70
17.00	0.22	0.008	95.38	0.38
18.00	0.17	0.000	95.27	0.21
19.00	0.15	0.000	95.23	0.16
20.00	0.13	0.000	95.22	0.15
21.00	0.12	0.000	95.21	0.14
22.00	0.11	0.000	95.20	0.13
23.00	0.10	0.000	95.19	0.11
24.00	0.09	0.000	95.18	0.10
25.00	0.00	0.000	95.00	0.00
26.00	0.00	0.000	95.00	0.00
27.00	0.00	0.000	95.00	0.00
28.00	0.00	0.000	95.00	0.00
29.00	0.00	0.000	95.00	0.00
30.00	0.00	0.000	95.00	0.00
31.00	0.00	0.000	95.00	0.00
32.00	0.00	0.000	95.00	0.00
33.00	0.00	0.000	95.00	0.00
34.00	0.00	0.000	95.00	0.00
35.00	0.00	0.000	95.00	0.00
36.00	0.00	0.000	95.00	0.00

Summary for Pond 15P: Proposed Underground SWM Basin #1

Inflow Area = 3.280 ac, 72.56% Impervious, Inflow Depth = 3.67" for 10 event
Inflow = 9.10 cfs @ 12.16 hrs, Volume= 1.003 af
Outflow = 4.47 cfs @ 12.56 hrs, Volume= 1.003 af, Atten= 51%, Lag= 24.1 min
Primary = 4.47 cfs @ 12.56 hrs, Volume= 1.003 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 96.90' @ 12.56 hrs Surf.Area= 0.393 ac Storage= 0.289 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 49.9 min (857.6 - 807.7)

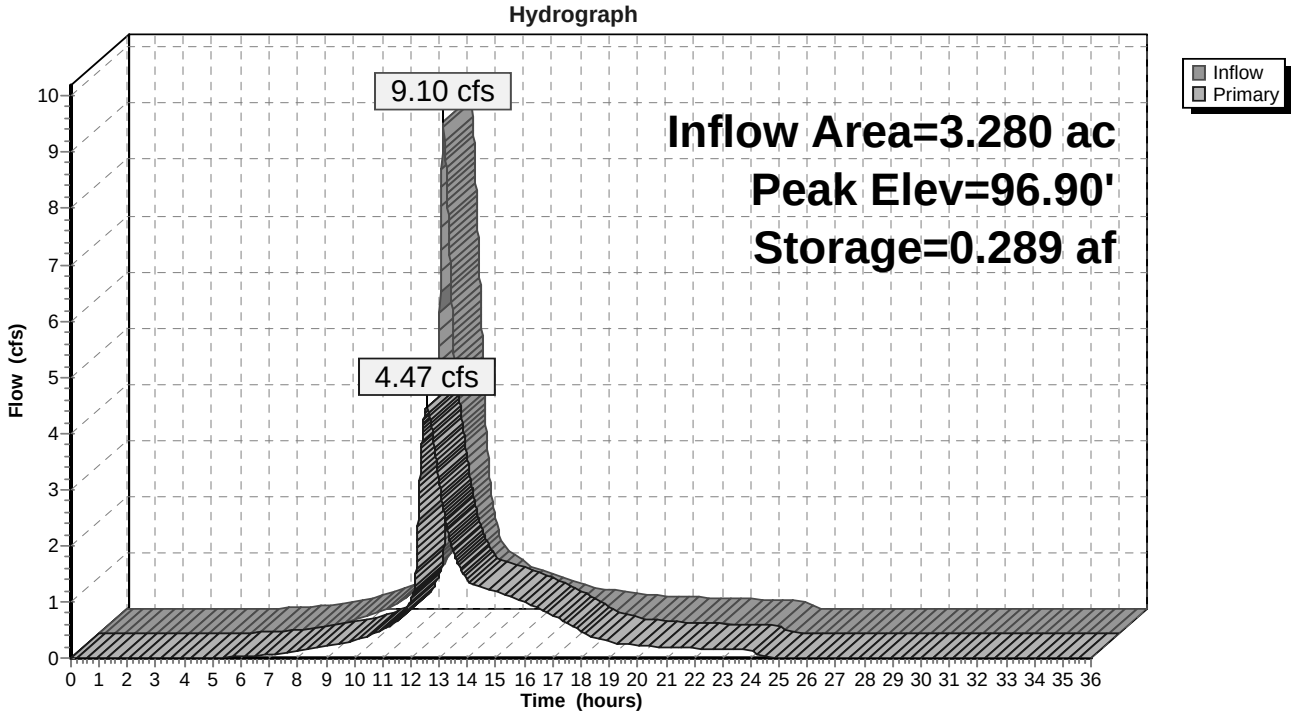
Volume	Invert	Avail.Storage	Storage Description
#1A	94.50'	0.000 af	**59.00'W x 290.00'L x 4.50'H Field A** 1.768 af Overall - 0.642 af Embedded = 1.125 af x 0.0% Voids
#2A	95.00'	0.515 af	**ADS N-12 36** x 11 Inside #1 Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.2 cf Row Length Adjustment= +267.00' x 7.10 sf x 11 rows
		0.515 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.80'	**15.0" Round HDPE_Round 15"** L= 45.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.80' / 94.00' S= 0.0178 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	95.00'	**7.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.30'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=4.47 cfs @ 12.56 hrs HW=96.90' (Free Discharge)
└**1=HDPE_Round 15"** (Passes 4.47 cfs of 7.17 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.63 cfs @ 6.10 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.84 cfs @ 2.53 fps)

Pond 15P: Proposed Underground SWM Basin #1



Hydrograph for Pond 15P: Proposed Underground SWM Basin #1

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.000	94.50	0.00
1.00	0.00	0.000	94.50	0.00
2.00	0.00	0.000	94.50	0.00
3.00	0.00	0.000	94.50	0.00
4.00	0.00	0.000	94.50	0.00
5.00	0.00	0.000	95.00	0.00
6.00	0.02	0.000	95.08	0.02
7.00	0.06	0.000	95.14	0.06
8.00	0.12	0.000	95.20	0.12
9.00	0.23	0.000	95.27	0.21
10.00	0.40	0.005	95.34	0.32
11.00	0.70	0.015	95.45	0.51
12.00	**4.83**	**0.090**	**95.94**	**1.04**
13.00	**1.65**	**0.246**	**96.70**	**3.09**
14.00	0.85	0.171	96.35	1.39
15.00	0.62	0.126	96.13	1.18
16.00	0.45	0.080	95.89	0.99
17.00	0.35	0.040	95.64	0.76
18.00	0.27	0.014	95.44	0.48
19.00	0.23	0.003	95.32	0.29
20.00	0.21	0.001	95.28	0.22
21.00	0.19	0.000	95.25	0.19
22.00	0.17	0.000	95.24	0.17
23.00	0.16	0.000	95.23	0.16
24.00	0.14	0.000	95.21	0.14
25.00	0.00	0.000	95.00	0.00
26.00	0.00	0.000	95.00	0.00
27.00	0.00	0.000	95.00	0.00
28.00	0.00	0.000	95.00	0.00
29.00	0.00	0.000	95.00	0.00
30.00	0.00	0.000	95.00	0.00
31.00	0.00	0.000	95.00	0.00
32.00	0.00	0.000	95.00	0.00
33.00	0.00	0.000	95.00	0.00
34.00	0.00	0.000	95.00	0.00
35.00	0.00	0.000	95.00	0.00
36.00	0.00	0.000	95.00	0.00

Summary for Pond 15P: Proposed Underground SWM Basin #1

Inflow Area = 3.280 ac, 72.56% Impervious, Inflow Depth = 4.82" for 25 event
Inflow = 11.84 cfs @ 12.16 hrs, Volume= 1.317 af
Outflow = 6.75 cfs @ 12.50 hrs, Volume= 1.317 af, Atten= 43%, Lag= 20.5 min
Primary = 6.75 cfs @ 12.50 hrs, Volume= 1.317 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 97.19' @ 12.50 hrs Surf.Area= 0.393 ac Storage= 0.351 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 48.1 min (848.3 - 800.2)

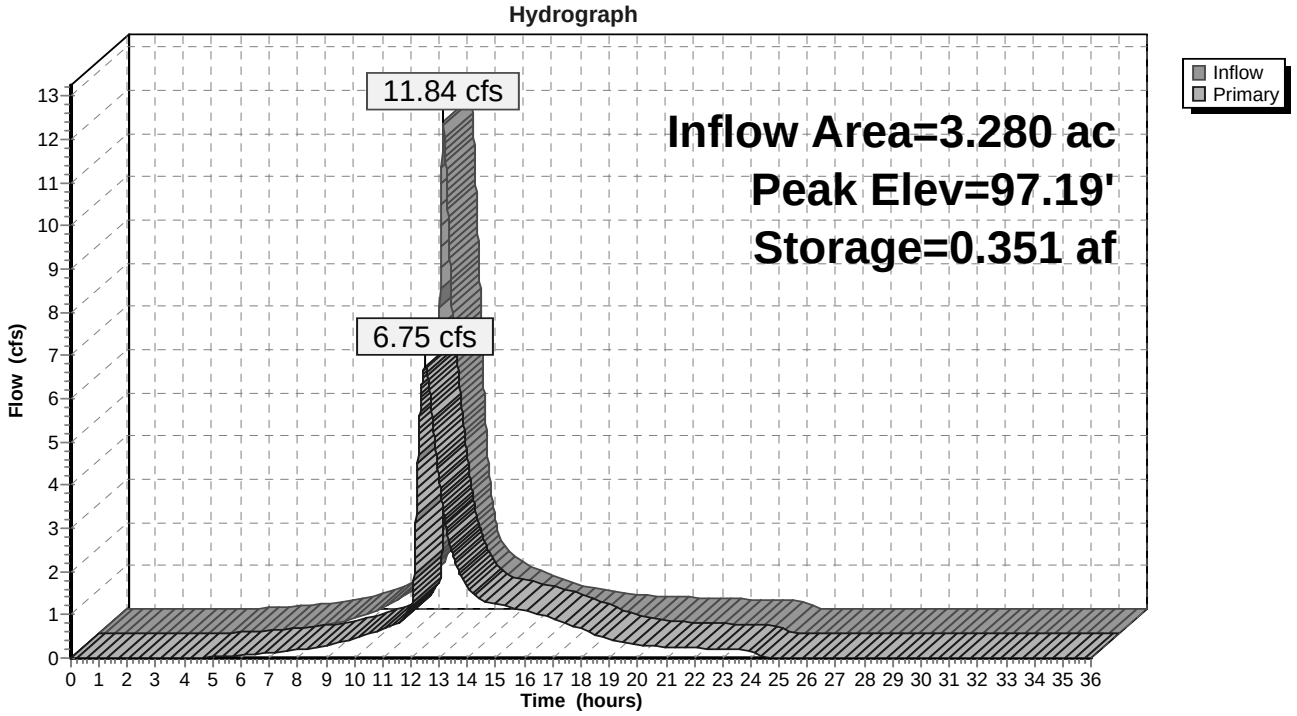
Volume	Invert	Avail.Storage	Storage Description
#1A	94.50'	0.000 af	**59.00'W x 290.00'L x 4.50'H Field A** 1.768 af Overall - 0.642 af Embedded = 1.125 af x 0.0% Voids
#2A	95.00'	0.515 af	**ADS N-12 36** x 11 Inside #1 Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.2 cf Row Length Adjustment= +267.00' x 7.10 sf x 11 rows
		0.515 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.80'	**15.0" Round HDPE_Round 15"** L= 45.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.80' / 94.00' S= 0.0178 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	95.00'	**7.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.30'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=6.75 cfs @ 12.50 hrs HW=97.19' (Free Discharge)
└─**1=HDPE_Round 15"** (Passes 6.75 cfs of 7.84 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.77 cfs @ 6.63 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 4.97 cfs @ 3.08 fps)

Pond 15P: Proposed Underground SWM Basin #1



Hydrograph for Pond 15P: Proposed Underground SWM Basin #1

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.000	94.50	0.00
1.00	0.00	0.000	94.50	0.00
2.00	0.00	0.000	94.50	0.00
3.00	0.00	0.000	94.50	0.00
4.00	0.00	0.000	94.50	0.00
5.00	0.02	0.000	95.08	0.02
6.00	0.06	0.000	95.14	0.06
7.00	0.12	0.000	95.19	0.12
8.00	0.20	0.000	95.25	0.19
9.00	0.36	0.003	95.32	0.29
10.00	0.58	0.012	95.42	0.45
11.00	0.97	0.028	95.56	0.67
12.00	**6.37**	**0.135**	**96.18**	**1.21**
13.00	**2.10**	**0.277**	**96.84**	**4.06**
14.00	1.07	0.186	96.42	1.64
15.00	0.79	0.148	96.24	1.25
16.00	0.57	0.106	96.03	1.10
17.00	0.44	0.064	95.79	0.91
18.00	0.34	0.030	95.57	0.68
19.00	0.29	0.010	95.40	0.43
20.00	0.26	0.004	95.33	0.30
21.00	0.24	0.002	95.30	0.25
22.00	0.22	0.001	95.28	0.23
23.00	0.20	0.000	95.26	0.20
24.00	0.17	0.000	95.24	0.18
25.00	0.00	0.000	95.01	0.00
26.00	0.00	0.000	95.00	0.00
27.00	0.00	0.000	95.00	0.00
28.00	0.00	0.000	95.00	0.00
29.00	0.00	0.000	95.00	0.00
30.00	0.00	0.000	95.00	0.00
31.00	0.00	0.000	95.00	0.00
32.00	0.00	0.000	95.00	0.00
33.00	0.00	0.000	95.00	0.00
34.00	0.00	0.000	95.00	0.00
35.00	0.00	0.000	95.00	0.00
36.00	0.00	0.000	95.00	0.00

Summary for Pond 15P: Proposed Underground SWM Basin #1

Inflow Area = 3.280 ac, 72.56% Impervious, Inflow Depth = 6.86" for 100 event
Inflow = 16.59 cfs @ 12.16 hrs, Volume= 1.876 af
Outflow = 9.21 cfs @ 12.51 hrs, Volume= 1.876 af, Atten= 44%, Lag= 20.9 min
Primary = 9.21 cfs @ 12.51 hrs, Volume= 1.876 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 97.85' @ 12.51 hrs Surf.Area= 0.393 ac Storage= 0.474 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 47.1 min (837.9 - 790.7)

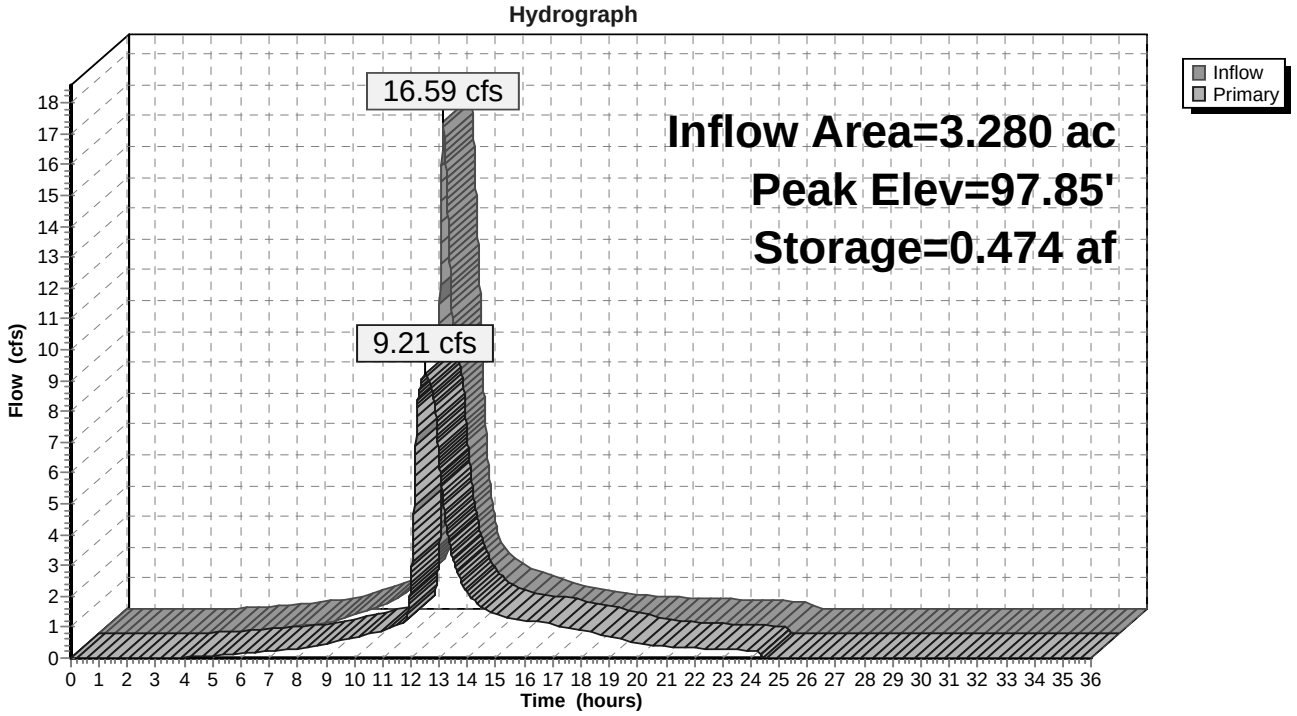
Volume	Invert	Avail.Storage	Storage Description
#1A	94.50'	0.000 af	**59.00'W x 290.00'L x 4.50'H Field A** 1.768 af Overall - 0.642 af Embedded = 1.125 af x 0.0% Voids
#2A	95.00'	0.515 af	**ADS N-12 36** x 11 Inside #1 Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.2 cf Row Length Adjustment= +267.00' x 7.10 sf x 11 rows
		0.515 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.80'	**15.0" Round HDPE_Round 15"** L= 45.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.80' / 94.00' S= 0.0178 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	95.00'	**7.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.30'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=9.21 cfs @ 12.51 hrs HW=97.85' (Free Discharge)
└─**1=HDPE_Round 15"** (Inlet Controls 9.21 cfs @ 7.50 fps)
  ├─**2=Orifice/Grate** (Passes < 2.06 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Passes < 10.69 cfs potential flow)

Pond 15P: Proposed Underground SWM Basin #1



Hydrograph for Pond 15P: Proposed Underground SWM Basin #1

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.000	94.50	0.00
1.00	0.00	0.000	94.50	0.00
2.00	0.00	0.000	94.50	0.00
3.00	0.00	0.000	94.50	0.00
4.00	0.03	0.000	95.09	0.03
5.00	0.08	0.000	95.16	0.08
6.00	0.14	0.000	95.21	0.14
7.00	0.23	0.000	95.27	0.21
8.00	0.36	0.004	95.33	0.30
9.00	0.59	0.012	95.42	0.45
10.00	0.91	0.027	95.55	0.66
11.00	1.46	0.060	95.77	0.89
12.00	**9.07**	**0.223**	**96.59**	**2.47**
13.00	**2.89**	**0.341**	**97.14**	**6.37**
14.00	1.47	0.209	96.53	2.13
15.00	1.08	0.172	96.35	1.41
16.00	0.77	0.141	96.21	1.23
17.00	0.60	0.101	96.00	1.08
18.00	0.46	0.062	95.78	0.90
19.00	0.40	0.031	95.58	0.69
20.00	0.36	0.014	95.44	0.49
21.00	0.33	0.007	95.37	0.37
22.00	0.30	0.005	95.34	0.32
23.00	0.27	0.003	95.32	0.28
24.00	0.24	0.002	95.29	0.25
25.00	0.00	0.000	95.01	0.00
26.00	0.00	0.000	95.00	0.00
27.00	0.00	0.000	95.00	0.00
28.00	0.00	0.000	95.00	0.00
29.00	0.00	0.000	95.00	0.00
30.00	0.00	0.000	95.00	0.00
31.00	0.00	0.000	95.00	0.00
32.00	0.00	0.000	95.00	0.00
33.00	0.00	0.000	95.00	0.00
34.00	0.00	0.000	95.00	0.00
35.00	0.00	0.000	95.00	0.00
36.00	0.00	0.000	95.00	0.00

APPENDIX E: SOILS INFORMATION

Map Scale: 1:1,780 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:24,000.

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:
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: Mercer County, New Jersey
Survey Area Data: Version 12, Sep 28, 2016

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

Date(s) aerial images were photographed: Mar 26, 2011—May 1, 2011

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 — Mercer County, New Jersey (NJ021)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
MBYB	Mattapex and Bertie loams, 0 to 5 percent slopes	C	2.6	39.9%
SacB	Sassafras sandy loam, 2 to 5 percent slopes, Northern Coastal Plain	B	2.6	39.7%
UdstB	Udorthents, stratified substratum, 0 to 8 percent slopes	D	1.3	20.4%
Totals for Area of Interest			**6.6**	**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

APPENDIX F: PIPE CALCULATIONS

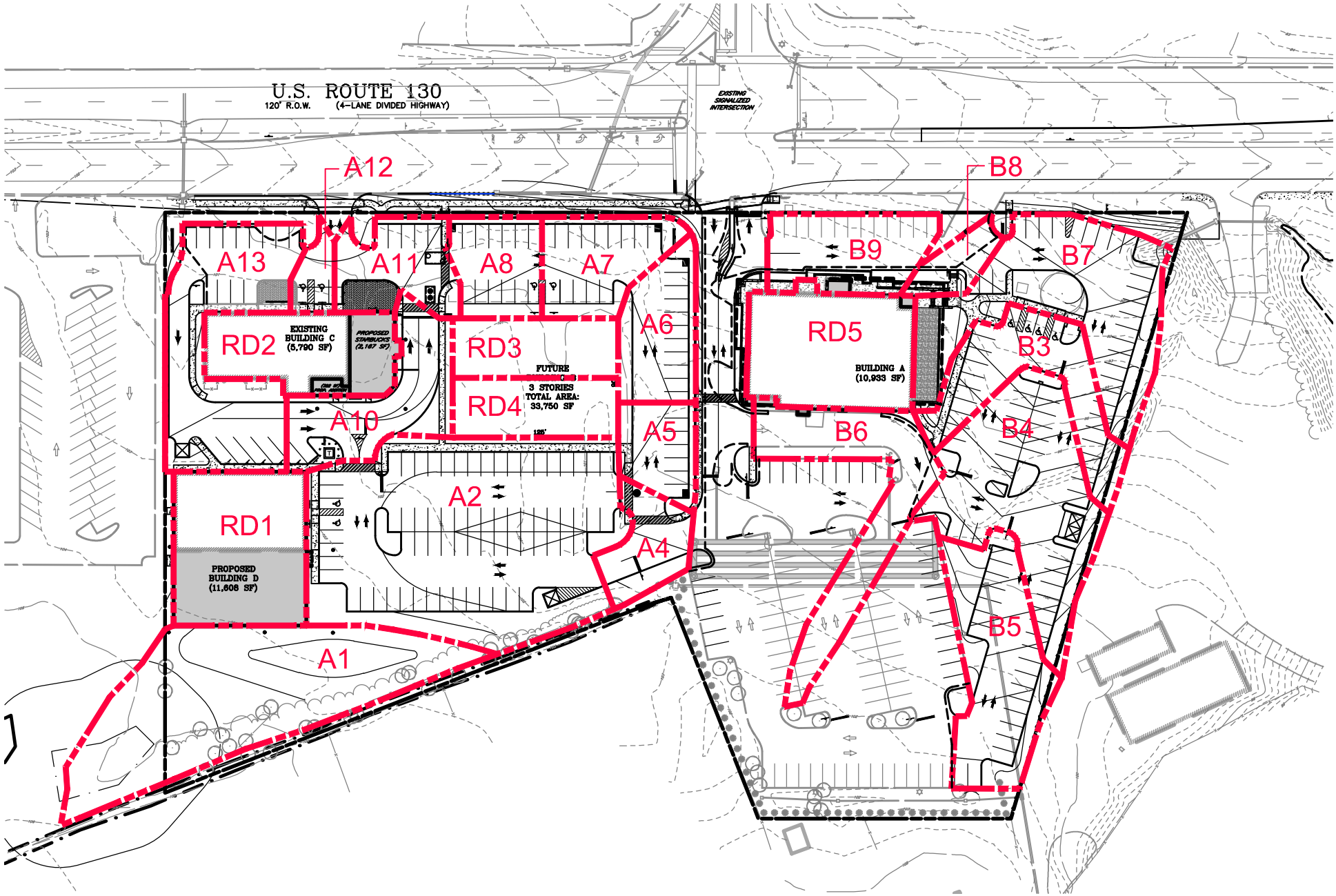


Figure 5. INLET DRAINAGE AREA MAP.

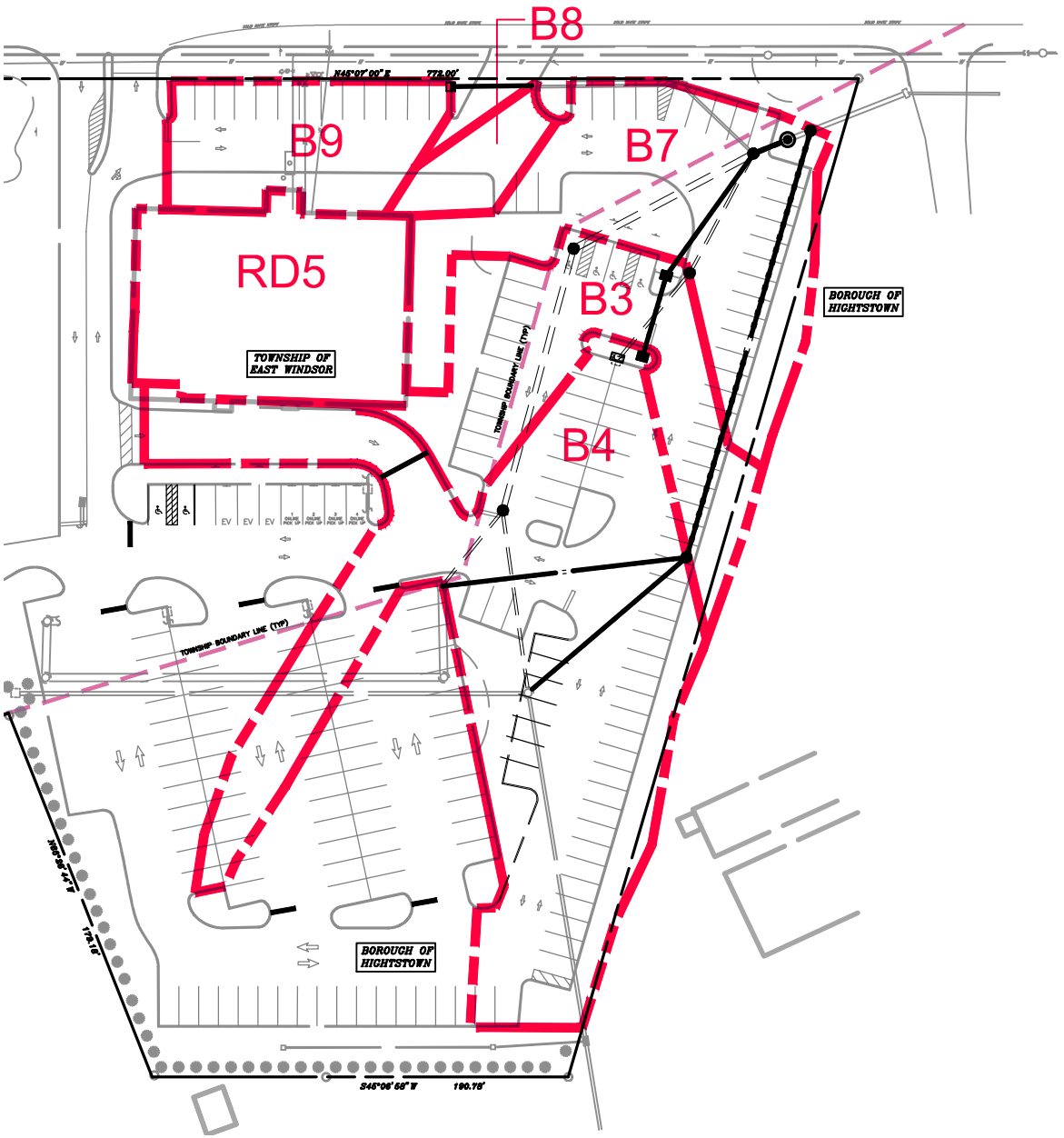


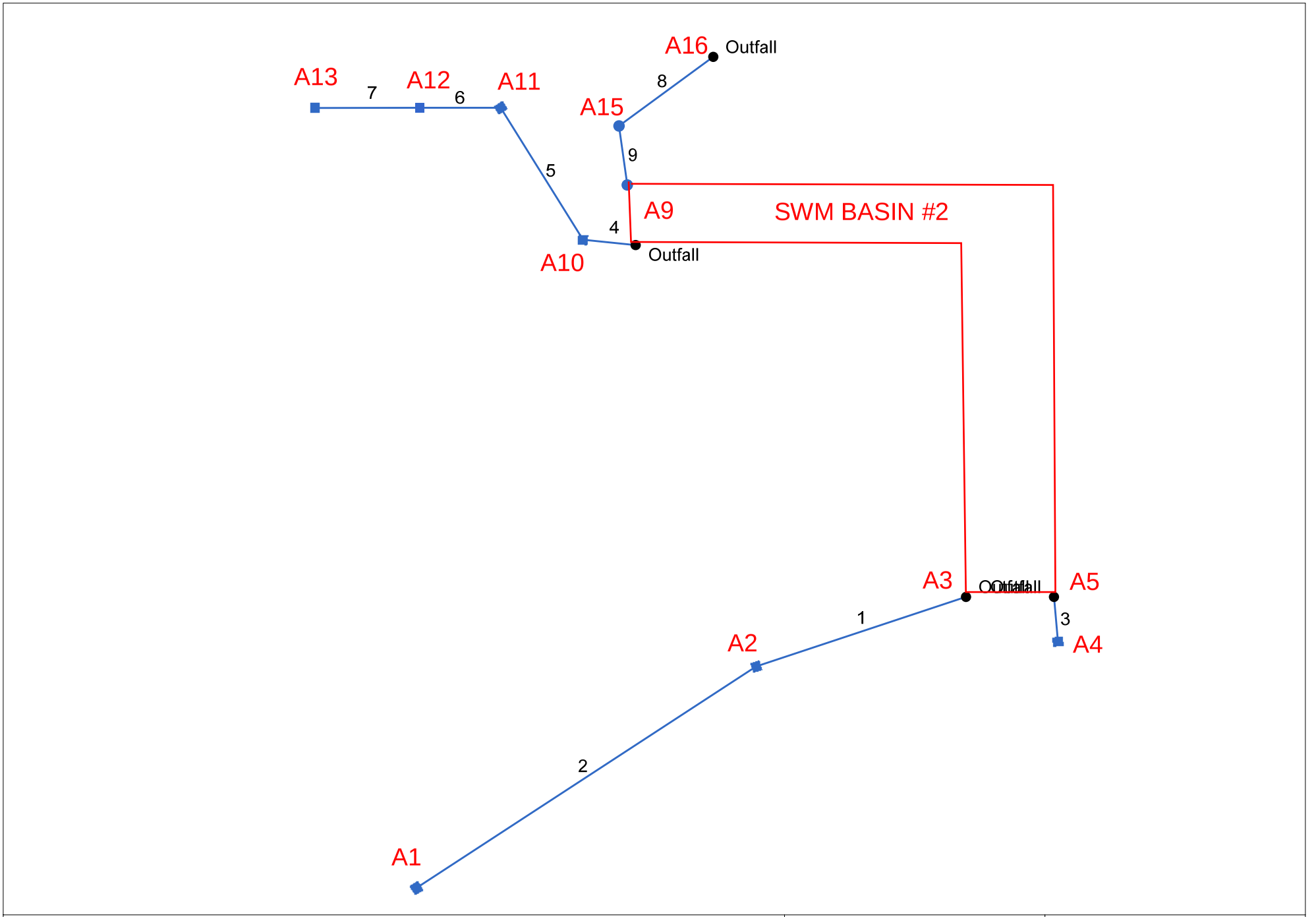
Figure 5a. AMENDED INLET DRAINAGE AREA MAP (HIGHTSTOWN ONLY).

2005.109.02 AMERICANA CENTER - WEIGHTED 'C' VALUES

SOIL TYPE(S) : SacB (TYPE 'B'), MBYB (TYPE 'C'), UdstB (TYPE 'D')

ID	TOTAL AREA (acres)	IMPERVIOUS 'C' = 0.99		GRASS 'B' 'C' = 0.25		GRASS 'C' 'C' = 0.51		GRASS 'D' 'C' = 0.65		WOODS 'B' 'C' = 0.01		WOODS 'C' 'C' = 0.45		WOOD 'D' 'C' = 0.59		TOTAL WEIGHTED 'C'
		AREA (acres)	%	AREA (acres)	%	AREA (acres)	%	AREA (acres)	%	AREA (acres)	%	AREA (acres)	%	AREA (acres)	%	
A1	0.52	0.00	0%	0.32	62%	0.00	0%	0.00	0%	0.20	38%	0.00	0%	0.00	0%	0.16
A2	0.77	0.60	78%	0.12	16%	0.03	4%	0.00	0%	0.02	3%	0.00	0%	0.00	0%	0.83
A4	0.09	0.07	78%	0.02	22%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.83
A5	0.09	0.07	78%	0.01	11%	0.01	11%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.85
A6	0.14	0.11	79%	0.00	0%	0.03	21%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.89
A7	0.15	0.12	80%	0.00	0%	0.03	20%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.89
A8	0.12	0.11	92%	0.00	0%	0.01	8%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.95
A10	0.19	0.15	79%	0.00	0%	0.04	21%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.89
A11	0.13	0.12	92%	0.00	0%	0.01	8%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.95
A12	0.04	0.04	100%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.99
A13	0.32	0.27	84%	0.00	0%	0.05	16%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.92
B3	0.20	0.17	85%	0.00	0%	0.00	0%	0.03	15%	0.00	0%	0.00	0%	0.00	0%	0.94
B4	0.86	0.66	77%	0.12	14%	0.00	0%	0.08	9%	0.00	0%	0.00	0%	0.00	0%	0.86
B7	0.37	0.25	68%	0.00	0%	0.00	0%	0.12	32%	0.00	0%	0.00	0%	0.00	0%	0.88
B8	0.05	0.04	80%	0.00	0%	0.00	0%	0.01	20%	0.00	0%	0.00	0%	0.00	0%	0.92
B9	0.16	0.15	94%	0.00	0%	0.00	0%	0.01	6%	0.00	0%	0.00	0%	0.00	0%	0.97
RD1	0.27	0.27	100%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.99
RD2	0.19	0.19	100%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.99
RD3	0.13	0.13	100%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.99
RD4	0.13	0.13	100%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.99
RD5	0.14	0.14	100%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.99
TOTALS	5.06	3.79	75%	0.59	12%	0.21	4%	0.25	5%	0.22	4%	0.00	0%	0.00	0%	

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 2005.109.02_STORM A (Rev. 4).stm	Number of lines: 9	Date: 4/24/2019

Pipe Calc

Line No.	Inlet ID	Line ID	Gnd/Rim El Up (ft)	Line Length (ft)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	i Inlet (in/hr)	Incr Q (cfs)	Total Area (ac)	Tc (min)	i Sys (in/hr)	Total Runoff (cfs)	Known Q (cfs)	Flow Rate (cfs)	Capac Full (cfs)	Line Size (in)	Line Slope (%)	Vel Ave (ft/s)	Invert Up (ft)	Invert Dn (ft)	n-val Pipe
1	A2	A2	100.50	92.434	0.77	0.83	10.0	6.73	4.30	1.29	16.2	5.33	3.85	0.00	3.85	6.98	15	1.00	3.92	95.92	95.00	0.012
2	A1	A1	102.00	169.598	0.52	0.16	10.0	6.73	0.56	0.52	10.0	6.73	0.56	0.00	0.56	7.00	15	1.00	1.84	97.87	96.17	0.012
3	A5	A4	100.50	18.686	0.09	0.83	10.0	6.73	0.50	0.09	10.0	6.73	0.50	0.00	0.50	4.85	15	0.48	2.53	96.84	96.75	0.012
4	A10	A10	101.00	22.143	0.19	0.89	10.0	6.73	1.14	0.68	10.8	6.49	4.07	0.00	4.07	4.93	15	0.50	3.31	95.11	95.00	0.012
5	A11	A11	99.00	67.590	0.13	0.95	10.0	6.73	0.83	0.49	10.4	6.62	3.03	0.00	3.03	4.96	15	0.50	2.47	95.45	95.11	0.012
6	A12	A12	99.15	24.120	0.04	0.99	10.0	6.73	0.27	0.36	10.2	6.68	2.23	0.00	2.23	4.93	15	0.50	1.82	95.57	95.45	0.012
7	A13	A13	99.75	15.680	0.32	0.92	10.0	6.73	1.98	0.32	10.0	6.73	1.98	0.00	1.98	5.00	15	0.51	1.61	95.65	95.57	0.012
8	A15	A15	101.00	48.861	0.00	0.00	10.0	0.00	0.00	0.00	10.1	0.00	0.00	0.00	9.15	9.39	15	1.80	7.46	91.35	90.47	0.012
9	A9	A9	102.30	24.983	0.00	0.00	10.0	0.00	9.15	0.00	10.0	0.00	0.00	9.15	9.15	9.39	15	1.80	7.46	94.80	94.35	0.012

Project File: 2005.109.02_STORM A (Rev. 4).stm | Number of lines: 9 | Date: 4/24/2019

NOTES: Intensity = 42.39 / (Inlet time + 5.10) ^ 0.68 -- Return period = 25 Yrs. ; ** Critical depth

Pipe Calc

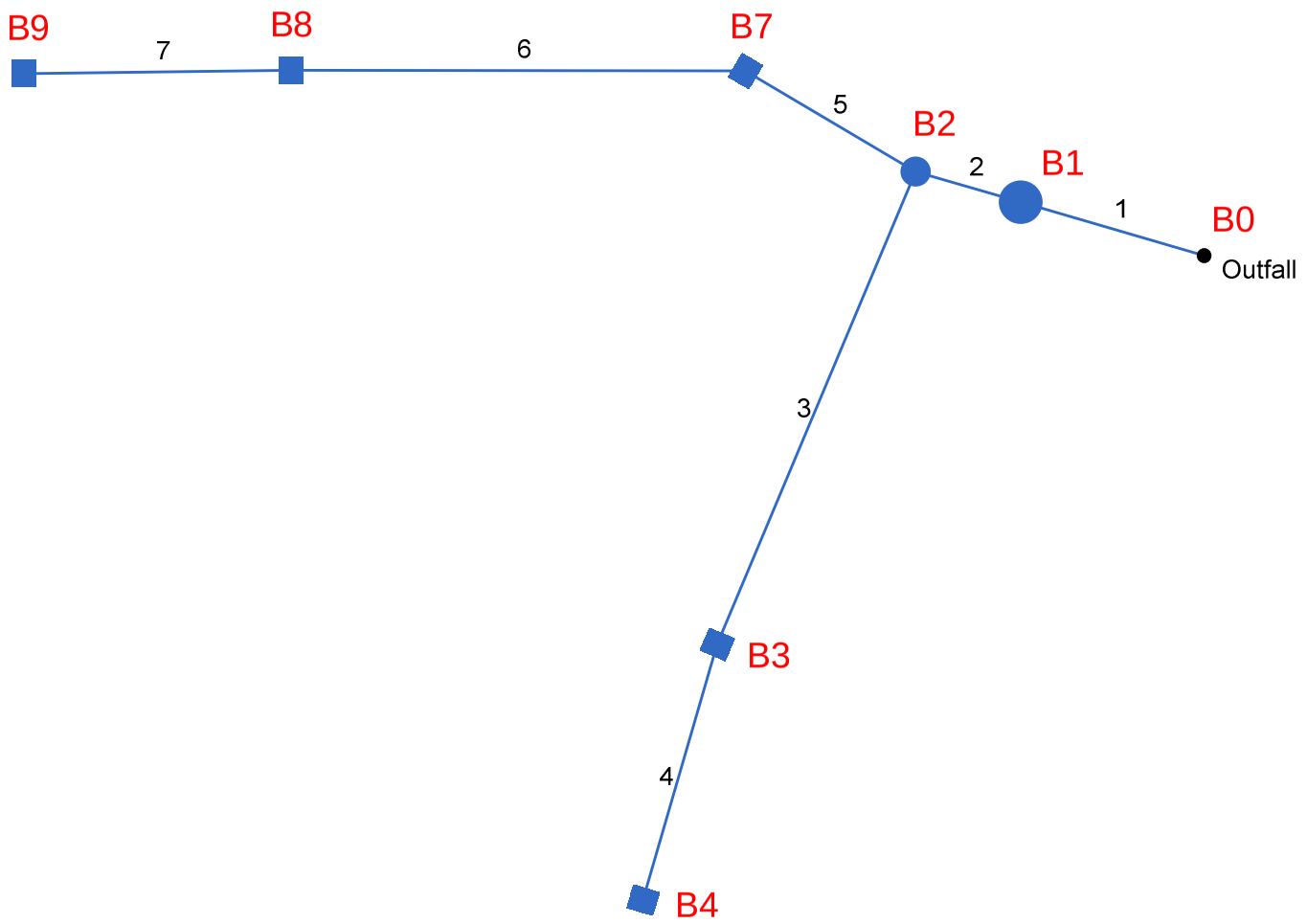
Line No.	Inlet ID	Line ID	Gnd/Rim El Up (ft)	Line Length (ft)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	i Inlet (in/hr)	Incr Q (cfs)	Total Area (ac)	Tc (min)	i Sys (in/hr)	Total Runoff (cfs)	Known Q (cfs)	Flow Rate (cfs)	Capac Full (cfs)	Line Size (in)	Line Slope (%)	Vel Ave (ft/s)	Invert Up (ft)	Invert Dn (ft)	n-val Pipe
1	EX1	EX1	98.80	45.000	0.00	0.00	10.0	0.00	1.00	0.00	10.0	0.00	0.00	1.00	1.00	4.08	15	0.40	2.74	93.37	93.19	0.013
2	EX2	EX2	98.50	85.000	0.00	0.00	10.0	0.00	1.00	0.00	10.0	0.00	0.00	1.00	1.00	7.70	15	1.42	2.90	94.30	93.09	0.013

Maximum possible total flow from existing underground basin, based on capacity of existing outfall pipes is 11.78 cfs.

Project File: 2005.109.02_STORM_EXISTING BASIN OUTFALL.stm | Number of lines: 2 | Date: 7/12/2022

NOTES: Intensity = 42.39 / (Inlet time + 5.10) ^ 0.68 -- Return period = 25 Yrs. ; ** Critical depth

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 2005.109.02_STORM B (Rev 5).stm	Number of lines: 7	Date: 2/11/2022

Pipe Calc

Line No.	Inlet ID	Line ID	Gnd/Rim El Up (ft)	Line Length (ft)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	i Inlet (in/hr)	Incr Q (cfs)	Total Area (ac)	Tc (min)	i Sys (in/hr)	Total Runoff (cfs)	Known Q (cfs)	Flow Rate (cfs)	Capac Full (cfs)	Line Size (in)	Line Slope (%)	Vel Ave (ft/s)	Invert Up (ft)	Invert Dn (ft)	n-val Pipe
1	B1	B1	89.50	12.000	0.00	0.00	10.0	0.00	0.00	1.64	11.4	6.34	9.22	0.00	9.22	44.74	24	3.33	8.25	84.14	83.74	0.012
2	B2	B2	90.70	17.000	0.00	0.00	10.0	0.00	0.00	1.64	11.3	6.36	9.25	0.00	9.25	17.83	24	0.53	5.32	84.23	84.14	0.012
3	B3	B3	91.00	69.135	0.20	0.94	10.0	6.73	1.27	1.06	10.2	6.68	6.20	0.00	6.20	6.99	15	1.00	6.15	85.39	84.70	0.012
4	B4	B4	92.00	39.000	0.86	0.86	10.0	6.73	4.98	0.86	10.0	6.73	4.98	0.00	4.98	7.00	15	1.00	4.97	85.78	85.39	0.012
5	B7	B7	89.00	46.241	0.37	0.88	10.0	6.73	2.19	0.58	11.1	6.41	3.38	0.00	3.38	4.36	12	1.28	5.61	85.27	84.68	0.012
6	B8	B8	89.35	66.574	0.05	0.92	10.0	6.73	0.31	0.21	10.5	6.59	1.33	0.00	1.33	3.44	12	0.80	3.77	86.15	85.62	0.012
7	B9	B9	91.00	39.043	0.16	0.97	10.0	6.73	1.04	0.16	10.0	6.73	1.04	0.00	1.04	3.86	12	1.00	3.00	86.54	86.15	0.012

Project File: 2005.109.02_STORM B (Rev 5).stm | Number of lines: 7 | Date: 2/11/2022

NOTES: Intensity = 42.39 / (Inlet time + 5.10) ^ 0.68 -- Return period = 25 Yrs. ; ** Critical depth

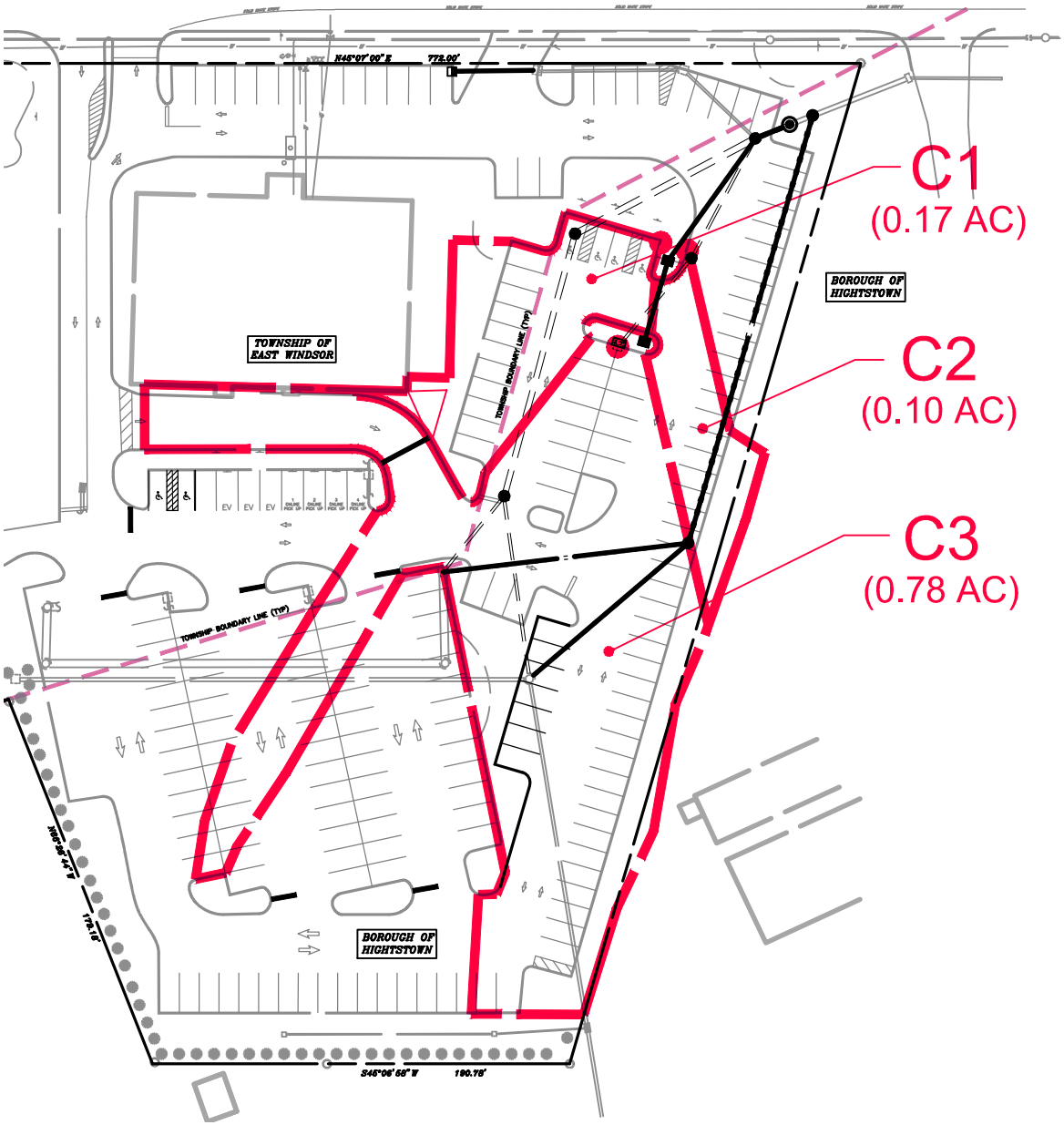
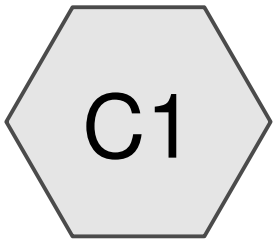
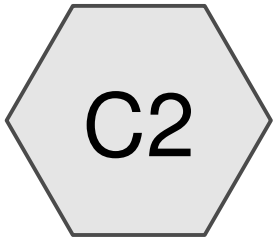


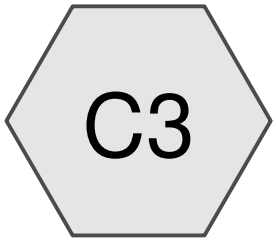
Figure 6. AMENDED CURB CUTS DRAINAGE AREA MAP (HIGHTSTOWN ONLY).



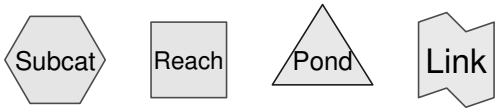
Proposed Curb Cut C1



Proposed Curb Cut C2



Proposed Curb Cut C3



Summary for Subcatchment C1: Proposed Curb Cut C1

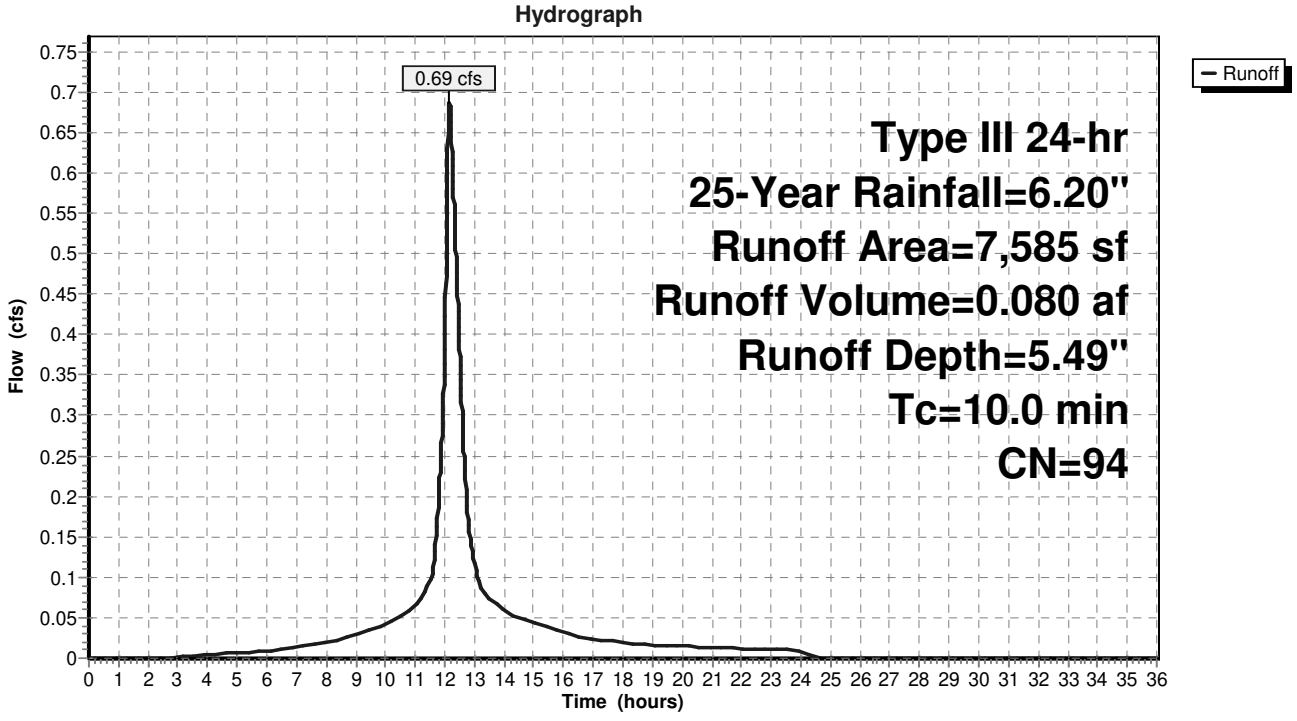
Runoff = 0.69 cfs @ 12.16 hrs, Volume= 0.080 af, Depth= 5.49"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

	Area (sf)	CN	Description
*	5,845	98	Paved parking
	1,740	80	>75% Grass cover, Good, HSG D
	7,585	94	Weighted Average
	1,740		22.94% Pervious Area
	5,845		77.06% Impervious Area

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

Subcatchment C1: Proposed Curb Cut C1



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Feb 11 2022

Proposed curb cut C1

Rectangular

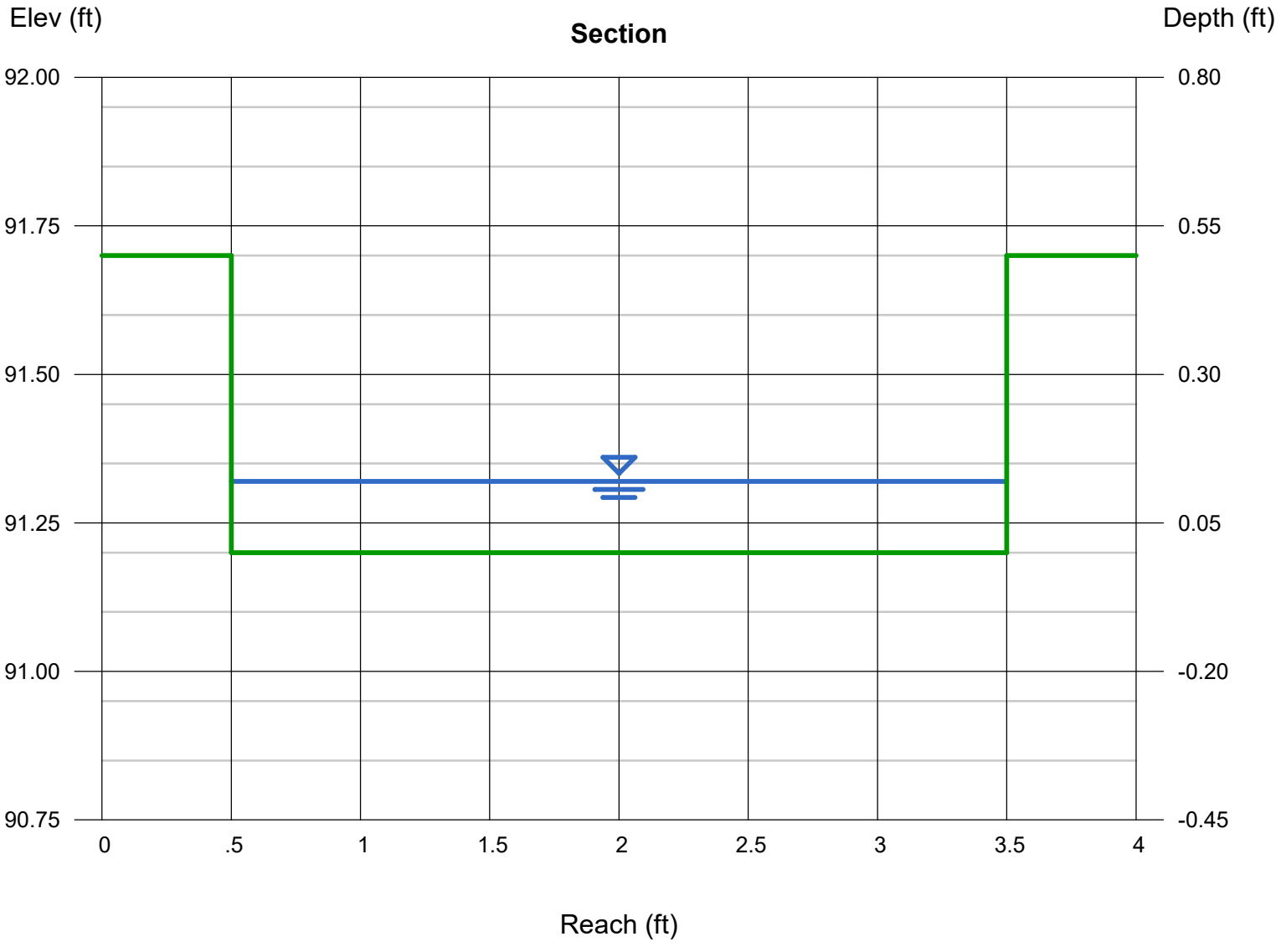
Bottom Width (ft)	= 3.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 91.20
Slope (%)	= 4.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.69

Highlighted

Depth (ft)	= 0.12
Q (cfs)	= 0.690
Area (sqft)	= 0.36
Velocity (ft/s)	= 1.92
Wetted Perim (ft)	= 3.24
Crit Depth, Yc (ft)	= 0.12
Top Width (ft)	= 3.00
EGL (ft)	= 0.18



Summary for Subcatchment C2: Proposed Curb Cut C2

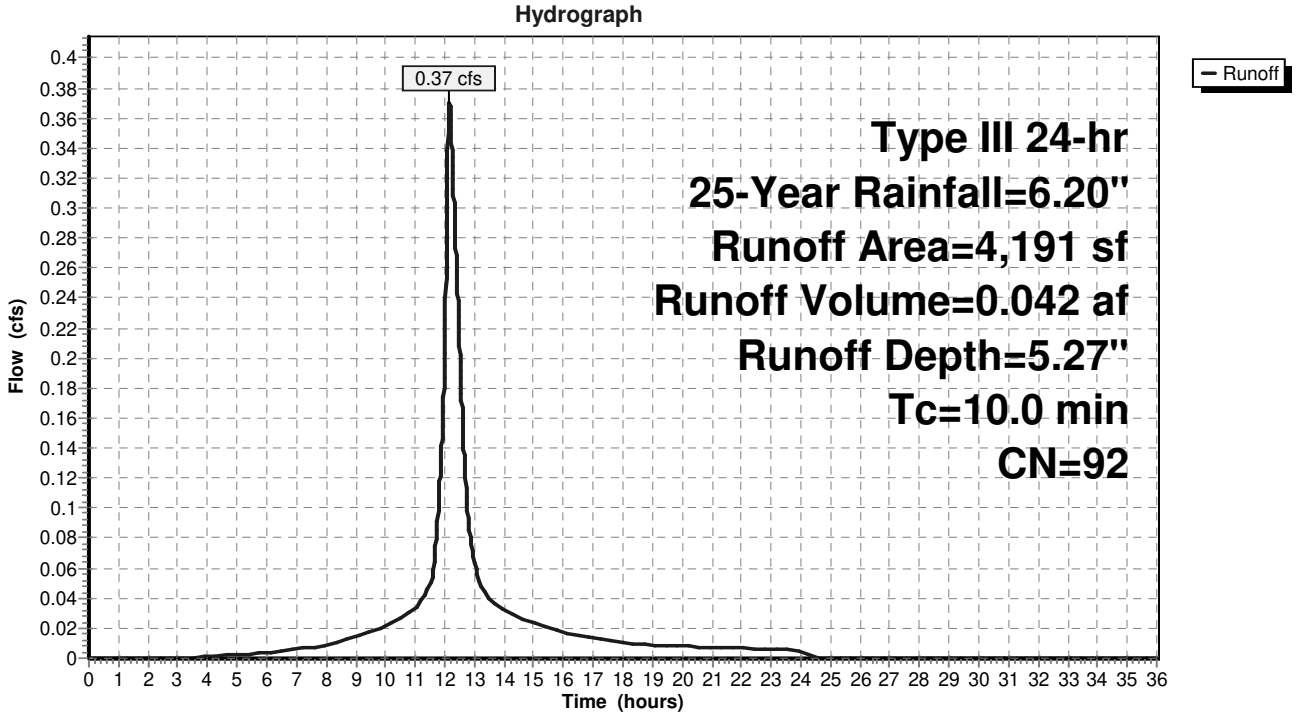
Runoff = 0.37 cfs @ 12.16 hrs, Volume= 0.042 af, Depth= 5.27"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

	Area (sf)	CN	Description
*	2,798	98	Paved parking
	1,393	80	>75% Grass cover, Good, HSG D
	4,191	92	Weighted Average
	1,393		33.24% Pervious Area
	2,798		66.76% Impervious Area

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

Subcatchment C2: Proposed Curb Cut C2



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Feb 11 2022

Proposed curb cut C2

Rectangular

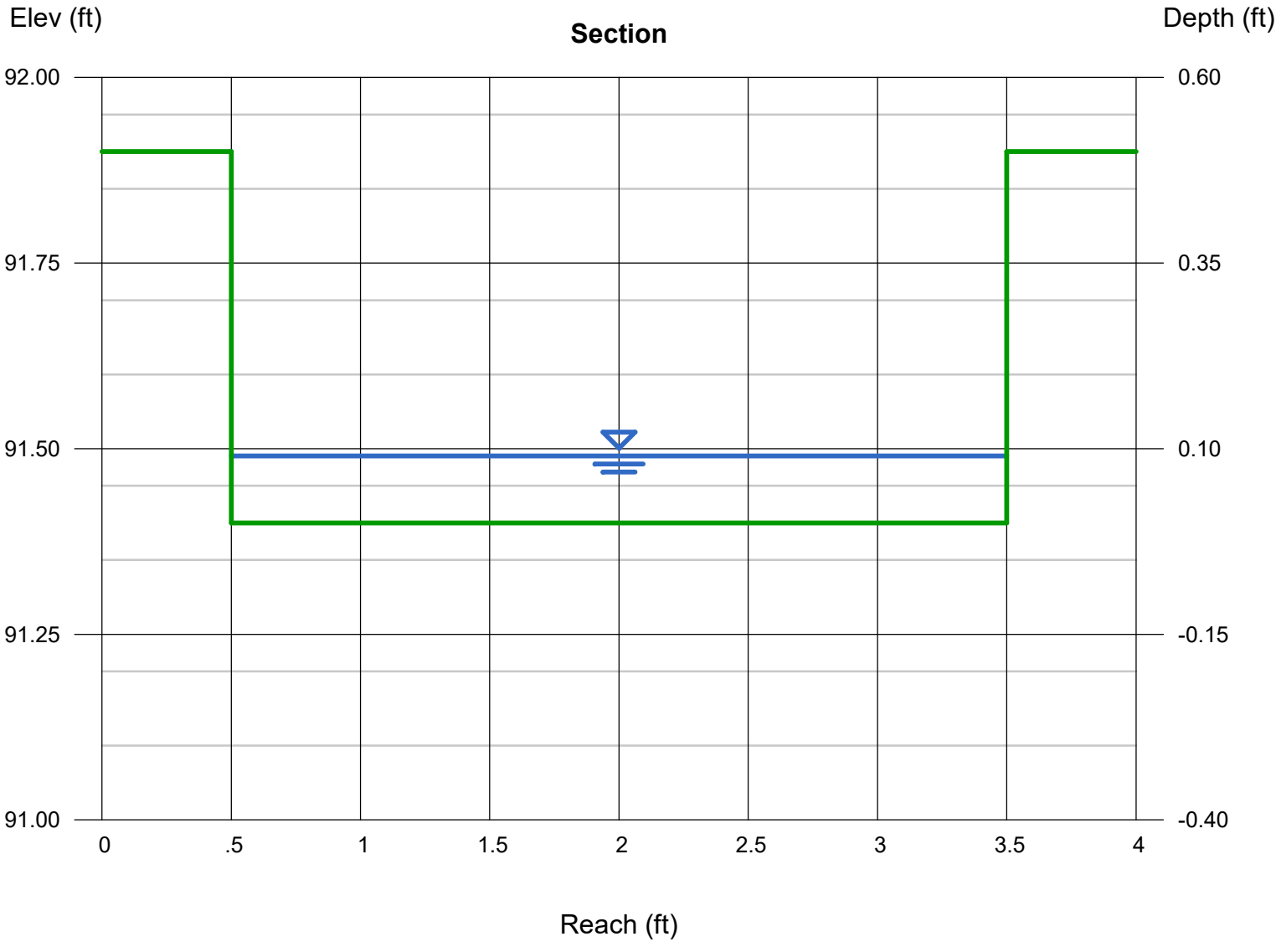
Bottom Width (ft)	= 3.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 91.40
Slope (%)	= 4.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.37

Highlighted

Depth (ft)	= 0.09
Q (cfs)	= 0.370
Area (sqft)	= 0.27
Velocity (ft/s)	= 1.37
Wetted Perim (ft)	= 3.18
Crit Depth, Yc (ft)	= 0.08
Top Width (ft)	= 3.00
EGL (ft)	= 0.12



Summary for Subcatchment C3: Proposed Curb Cut C3

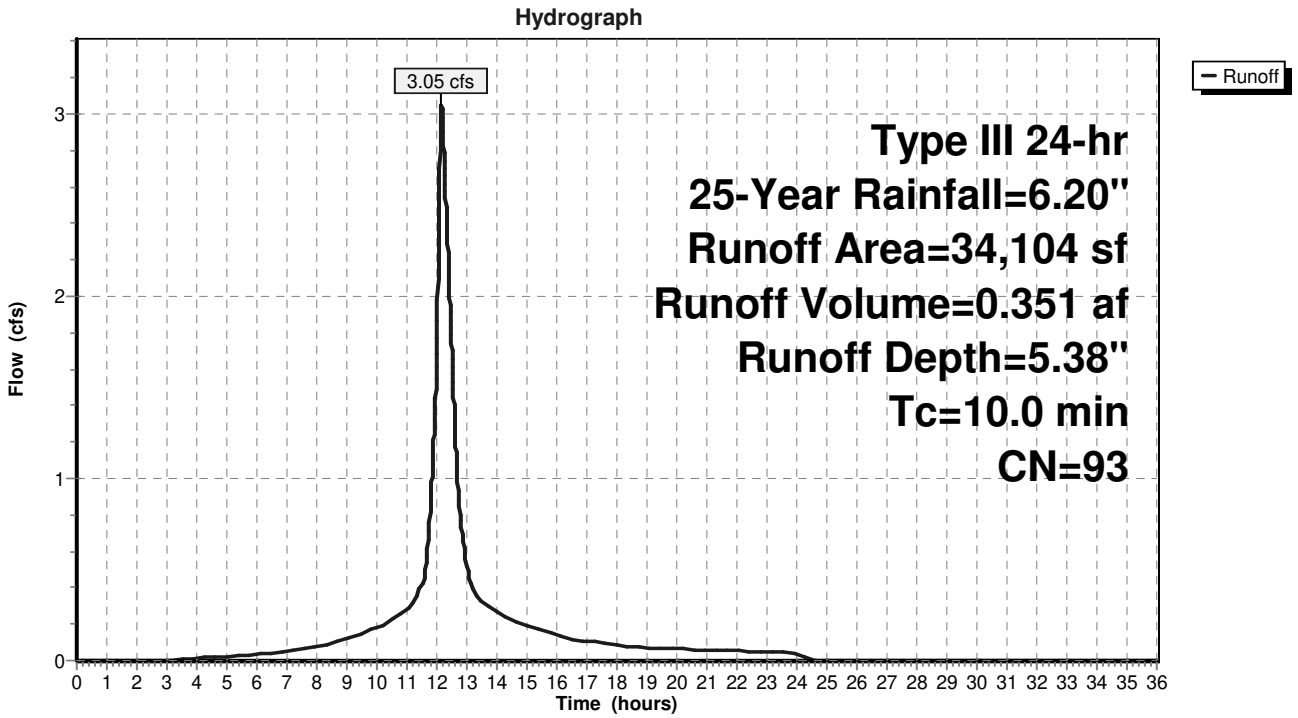
Runoff = 3.05 cfs @ 12.16 hrs, Volume= 0.351 af, Depth= 5.38"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.20"

	Area (sf)	CN	Description
*	26,985	98	Paved parking
	4,250	80	>75% Grass cover, Good, HSG D
	2,869	61	>75% Grass cover, Good, HSG B
	34,104	93	Weighted Average
	7,119		20.87% Pervious Area
	26,985		79.13% Impervious Area

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

Subcatchment C3: Proposed Curb Cut C3



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Feb 11 2022

Proposed curb cut C3

Rectangular

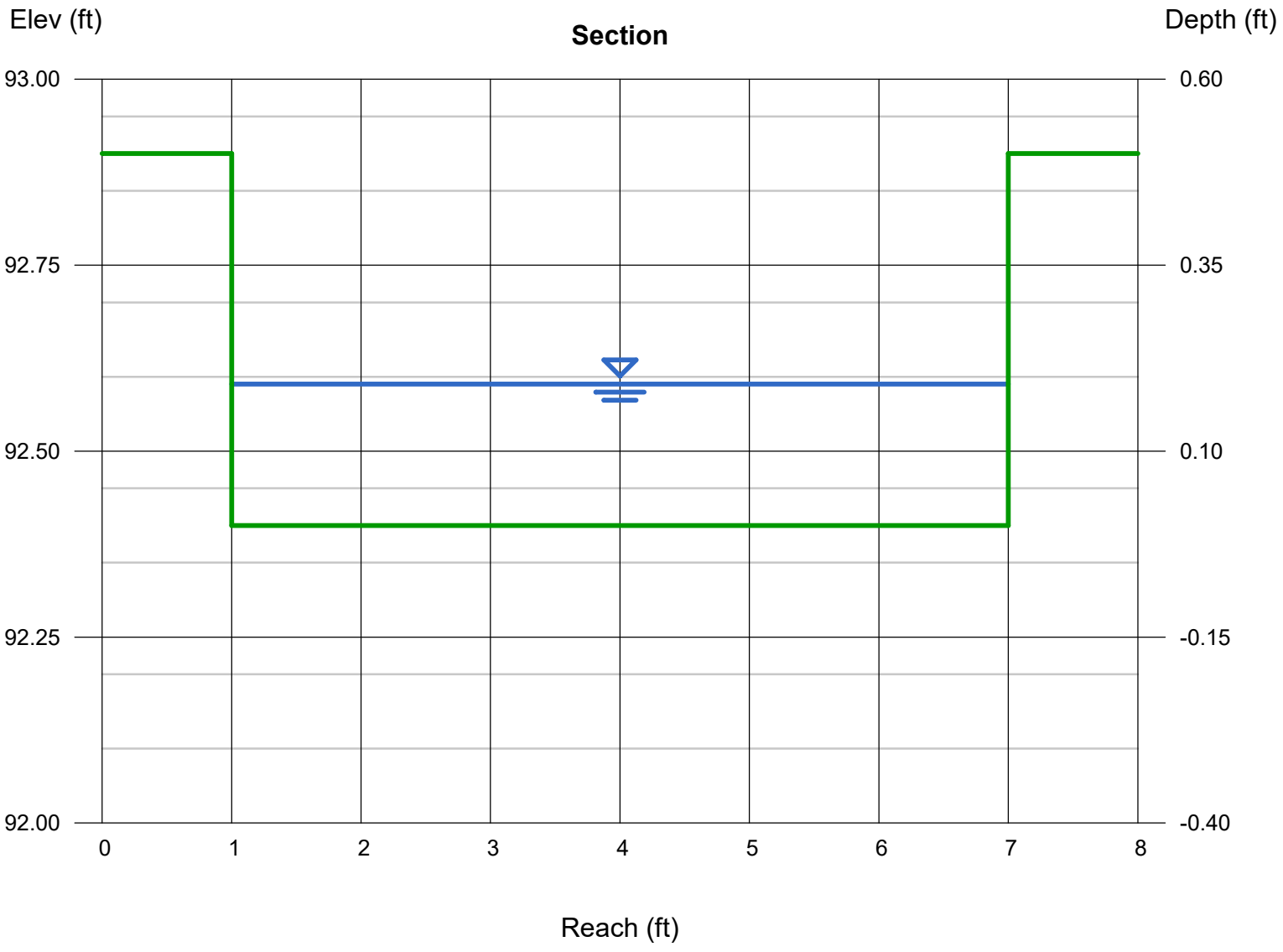
Bottom Width (ft)	= 6.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 92.40
Slope (%)	= 4.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.05

Highlighted

Depth (ft)	= 0.19
Q (cfs)	= 3.050
Area (sqft)	= 1.14
Velocity (ft/s)	= 2.68
Wetted Perim (ft)	= 6.38
Crit Depth, Yc (ft)	= 0.21
Top Width (ft)	= 6.00
EGL (ft)	= 0.30



APPENDIX G: WATER QUALITY CALCULATIONS

Summary for Pond 15P: Proposed Underground SWM Basin #1

Inflow Area = 3.280 ac, 72.56% Impervious, Inflow Depth = 0.41" for WQ event
Inflow = 2.33 cfs @ 1.20 hrs, Volume= 0.112 af
Outflow = 0.83 cfs @ 1.75 hrs, Volume= 0.112 af, Atten= 64%, Lag= 33.0 min
Primary = 0.83 cfs @ 1.75 hrs, Volume= 0.112 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 95.71' @ 1.75 hrs Surf.Area= 0.393 ac Storage= 0.050 af

Plug-Flow detention time= 32.7 min calculated for 0.112 af (100% of inflow)
Center-of-Mass det. time= 32.7 min (120.5 - 87.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	94.50'	0.000 af	**59.00'W x 290.00'L x 4.50'H Field A** 1.768 af Overall - 0.642 af Embedded = 1.125 af x 0.0% Voids
#2A	95.00'	0.515 af	**ADS N-12 36** x 11 Inside #1 Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.2 cf Row Length Adjustment= +267.00' x 7.10 sf x 11 rows
		0.515 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.80'	**15.0" Round HDPE_Round 15"** L= 45.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.80' / 94.00' S= 0.0178 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	95.00'	**7.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	96.30'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.83 cfs @ 1.75 hrs HW=95.71' (Free Discharge)
└─**1=HDPE_Round 15"** (Passes 0.83 cfs of 3.11 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.83 cfs @ 3.11 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 15P: Proposed Underground SWM Basin #1 - Chamber Wizard Field A

Chamber Model = ADS N-12 36 (ADS N-12® Pipe)
Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf
Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.2 cf
Row Length Adjustment= +267.00' x 7.10 sf x 11 rows

42.0" Wide + 21.0" Spacing = 63.0" C-C Row Spacing

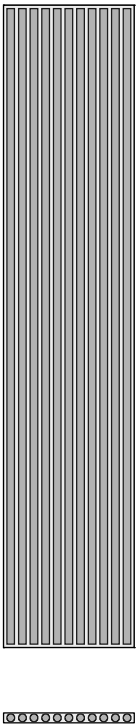
1 Chambers/Row x 20.00' Long +267.00' Row Adjustment = 287.00' Row Length +18.0" End Stone x 2 = 290.00' Base Length
11 Rows x 42.0" Wide + 21.0" Spacing x 10 + 18.0" Side Stone x 2 = 59.00' Base Width
6.0" Base + 42.0" Chamber Height + 6.0" Cover = 4.50' Field Height

11 Chambers x 142.0 cf +267.00' Row Adjustment x 7.10 sf x 11 Rows = 22,414.7 cf Chamber Storage
11 Chambers x 177.2 cf +267.00' Row Adjustment x 8.86 sf x 11 Rows = 27,974.2 cf Displacement

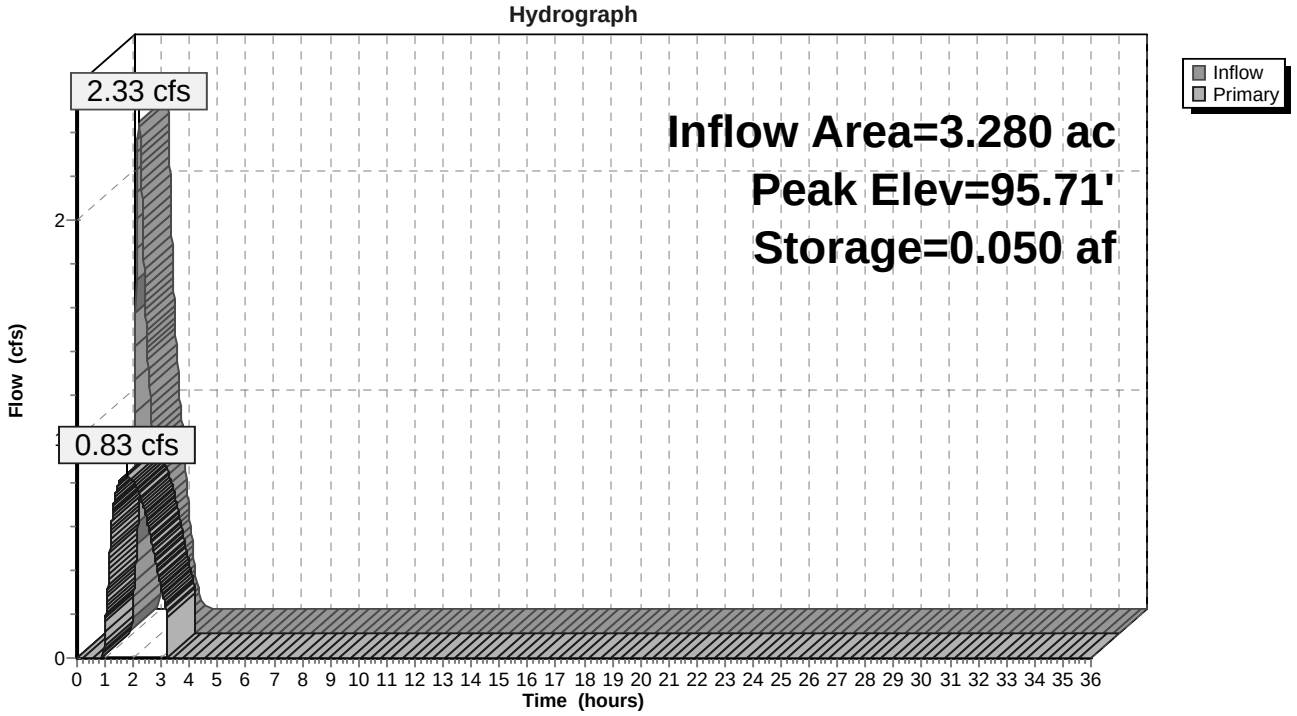
76,994.7 cf Field - 27,974.2 cf Chambers = 49,020.5 cf Stone x 0.0% Voids = 0.0 cf Stone Storage

Chamber Storage = 22,414.7 cf = 0.515 af
Overall Storage Efficiency = 29.1%
Overall System Size = 290.00' x 59.00' x 4.50'

11 Chambers
2,851.7 cy Field
1,815.6 cy Stone



Pond 15P: Proposed Underground SWM Basin #1



Hydrograph for Pond 15P: Proposed Underground SWM Basin #1

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.000	94.50	0.00
1.00	**0.23**	**0.000**	**95.25**	**0.18**
2.00	**0.43**	**0.046**	**95.68**	**0.81**
3.00	0.00	0.005	95.34	0.32
4.00	0.00	0.000	95.00	0.00
5.00	0.00	0.000	95.00	0.00
6.00	0.00	0.000	95.00	0.00
7.00	0.00	0.000	95.00	0.00
8.00	0.00	0.000	95.00	0.00
9.00	0.00	0.000	95.00	0.00
10.00	0.00	0.000	95.00	0.00
11.00	0.00	0.000	95.00	0.00
12.00	0.00	0.000	95.00	0.00
13.00	0.00	0.000	95.00	0.00
14.00	0.00	0.000	95.00	0.00
15.00	0.00	0.000	95.00	0.00
16.00	0.00	0.000	95.00	0.00
17.00	0.00	0.000	95.00	0.00
18.00	0.00	0.000	95.00	0.00
19.00	0.00	0.000	95.00	0.00
20.00	0.00	0.000	95.00	0.00
21.00	0.00	0.000	95.00	0.00
22.00	0.00	0.000	95.00	0.00
23.00	0.00	0.000	95.00	0.00
24.00	0.00	0.000	95.00	0.00
25.00	0.00	0.000	95.00	0.00
26.00	0.00	0.000	95.00	0.00
27.00	0.00	0.000	95.00	0.00
28.00	0.00	0.000	95.00	0.00
29.00	0.00	0.000	95.00	0.00
30.00	0.00	0.000	95.00	0.00
31.00	0.00	0.000	95.00	0.00
32.00	0.00	0.000	95.00	0.00
33.00	0.00	0.000	95.00	0.00
34.00	0.00	0.000	95.00	0.00
35.00	0.00	0.000	95.00	0.00
36.00	0.00	0.000	95.00	0.00

StormFilter Design Summary

Americana Center

East Windsor, NJ

Information Provided by Engineer (Menlo Engineering):

- Required TSS removal rate = 80%
- Treatment flow rate = 0.84 cfs
- Impervious drainage area = 2.35 acres
- Presiding agency = NJDEP

StormFilter Information and Cartridge Data:

The Stormwater Management StormFilter® is a passive, siphon-actuated, flow-through stormwater filtration system consisting of a precast concrete structure that houses rechargeable, media-filled filter cartridges. The StormFilter works by passing stormwater through the media-filled cartridges, which trap particulates and adsorb pollutants such as dissolved metals, nutrients, and hydrocarbons. **The StormFilter has received final certification from the NJDEP for 80% TSS removal as a stand-alone treatment system.**

- StormFilter cartridge filter media = Perlite
- StormFilter cartridge media height = 27 inches (nominal)
- StormFilter cartridge treatment flow = 22.5 gpm
- **Hydraulic head required: 3.0 feet** (with 27 inch cartridge)
- Minimum physical drop between inlet and outlet pipe = 6 inches

Design Summary:

The StormFilter is sized based on the NJDEP certification, which lists an approved treatment flow rate and maximum impervious acreage limit per cartridge in Table 1. The number of cartridges required based on the impervious drainage area is compared with the number of cartridges required based on the treatment flow rate; the larger number of cartridges governs the sizing.

The StormFilter for this site was sized to provide **18 cartridges** in order to meet the sediment load requirement (calculations shown below). To house this number of cartridges, Contech Engineered Solutions recommends an 8'x14' Peak Diversion StormFilters.

$$N_{\substack{cartridges \\ Hyd.Load}} = \frac{Q_{treat}\ x\ 449\ {}^{gpm}/_{cfs}}{Q_{cartridge}} = \frac{0.84\ \text{cfs}\ x\ 449\ {}^{gpm}/_{cfs}}{22.5\ {}^{gpm}/_{cartridge}} = 16.76 \rightarrow (17)\ \text{27" cartridges}$$

$$N_{\substack{cartridges \\ Mass\ Load}} = \frac{Area_{impervious}}{Max\ Area_{cartridge}} = \frac{2.35\ \text{acres}}{0.136\ {}^{acres}/_{cartridge}} = 17.27 \rightarrow \mathbf{(18)\ 27"\ cartridges}$$

conteches.com
7037 Ridge Road, Suite 350 | Hanover, MD 21076
Office: 443-457-1500 Fax: 410-740-8492

StormFilter Design Summary

Maintenance:

Maintenance of Stormwater best management practices is required per the New Jersey Administrative Code 7:8-5.8. Recommendations for maintenance are included in chapters 8 & 9 of the New Jersey Stormwater Best Management Practices Manual. To comply with requirements, CONTECH offers a network of Preferred Service Providers that have the capability to perform all necessary inspections, compliance reporting and cleaning services. CONTECH recommends inspecting the system annually and maintaining the system at the recommendation of the annual inspection. Full maintenance is typically required every 24-36 months. Disposal of material should be handled in accordance with local regulations. Please contact CONTECH's Maintenance Department for all questions regarding maintenance at (503) 258-3157 or visit our website at www.conteches.com/maintenance.

Thank you for the opportunity to present this information to you and your client. If you have any questions, please call me at (609-774-5528).

Sincerely,

Vince Smith
Sales Engineer – Stormwater & Pipe Products
Contech Engineered Solutions LLC

7037 Ridge Road, Suite 350 | Hanover, MD 21076
Office: 443-457-1500 Fax: 410-740-8492

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
Mail Code 401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

December 14, 2016

Derek M. Berg
Director - Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Laboratory Certification
Stormwater Management StormFilter® (StormFilter) by Contech Engineered Solutions LLC
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) 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). Contech Engineered Solutions LLC has requested a Laboratory Certification for the StormFilter System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced 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 afore-mentioned 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 for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the StormFilter System by Contech Engineered Solutions LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to 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 2.12 gpm/sf of effective filtration treatment area.

2. The StormFilter System shall be installed using the same configuration as the unit tested 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 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the StormFilter, which is attached to this document. However, it is recommended to review the maintenance website at http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813&PortalId=0&DownloadMethod=attachment for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for a StormFilter System.

   Example: A 0.25 acre impervious site is to be treated to 80% TSS removal using a StormFilter System. 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 calculation of the minimum number of cartridges for use in the StormFilter System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to calculate the required cartridges using both methods and to rely on the method that results in the highest minimum number of cartridges determined by the two methods.

   Inflow Drainage Area Evaluation:

   The drainage area to the StormFilter System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the maximum drainage area:

1. Five (5) 12” cartridges,
2. Three (3) 18” cartridges, or
3. Two (2) 27” cartridges

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined based on the following:

time of concentration = 10 minutes
i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
c=0.99 (runoff coefficient for impervious)
Q=ciA=0.99x3.2x0.25=0.79 cfs=0.79x448.83 gpm=354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the MTFR:

1. Thirty-six (36) 12” cartridges,
2. Twenty-four (24) 18” cartridges, or
3. Sixteen (16) 27” cartridges

The MTFR Evaluation results will be used since that method results in the higher minimum number of cartridges determined by the two methods.

The sizing table corresponding to the available system models are noted below:

TABLE 1 STORMFILTER CARTRIDGE HEIGHTS AND NEW JERSEY TREATMENT CAPACITIES

StormFilter Cartridge Heights and New Jersey Treatment Capacities				
StormFilter Cartridge Height	**Filtration Surface Area (sq.ft)**	**MTFR[1] (GPM)**	**Mass Capture Capacity (lbs)**	**Maximum Allowable Inflow Area[2] (acres)**
Low Drop (12")	4.71	10	36.3	0.061
18"	7.07	15	54.5	0.09
27"	10.61	22.5	81.8	0.136

Notes:

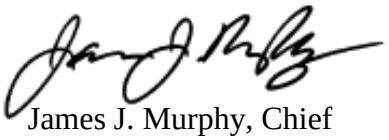
1. *MTFR calculated based on 4.72x10-3 cfs/sf (2.12 gpm/sf) of effective filtration treatment area.*
2. *Based upon the equation found in the NJDEP Filter Protocol Maximum Inflow Drainage Area (acres) = weight of TSS before 10% loss in MTFR (lbs)/600 lbs/acre of drainage area annually.*

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 Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of

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 Shashi Nayak of my office at (609) 633-7021.

Sincerely,



James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP - BNPC

Table A-1 Common StormFilter Model Sizes and New Jersey Treatment Capacities

Common StormFilter Model Sizes and New Jersey Treatment Capacities											
Configuration	Model Size	Max. # Cartridges (Low Drop & 18")	Sedimentation Area (ft^2)	Min. Sedimentation Area Per Cartridge[1] (ft^2)	MTFR Low Drop (12") Cartridge (gpm)	MTFR 18" Cartridge (gpm)	Max. # of 27" Cartridges	MTFR 27" Cartridge[2] (gpm)	Max. Treatable Area Low Drop (12") Cartridge (acre)	Max. Treatable Area 18" Cartridge (acre)	Max. Treatable Area 27" Cartridge (acre)
CATCHBASIN STEEL	SFCB1	1	4.00	4.00	10.0	15.0	0	N/A	0.061	0.090	N/A
	SFCB2	2	8.00	4.00	20.0	30.0	1	22.5	0.122	0.180	0.136
	SFCB3	3	11.33	3.78	30.0	45.0	2	45.0	0.183	0.270	0.272
	SFCB4	4	14.67	3.67	40.0	60.0	3	67.5	0.244	0.360	0.408
MANHOLE	SFMH48	3	12.56	4.19	30.0	45.0	2	45.0	0.183	0.270	0.272
	SFMH60	4	19.63	4.91	40.0	60.0	4	90.0	0.244	0.360	0.544
	SFMH72	7	28.27	4.04	70.0	105.0	6	135.0	0.427	0.630	0.816
	SFMH96	14	50.26	3.59	140.0	210.0	11	247.5	0.854	1.260	1.496
VAULT	SF0806	11	48.00	4.36	110.0	165.0	10	225.0	0.671	0.990	1.360
	SF0811	26	88.00	3.38	260.0	390.0	19	427.5	1.586	2.340	2.584
	SF0814	34	112.00	3.29	340.0	510.0	24	540.0	2.074	3.060	3.264
	SF0816	39	128.00	3.28	390.0	585.0	28	630.0	2.379	3.510	3.808
	SF0818	44	144.00	3.27	440.0	660.0	32	720.0	2.684	3.960	4.352
	SF0820	51	160.00	3.14	510.0	765.0	35	787.5	3.111	4.590	4.760
	SF0822	56	176.00	3.14	560.0	840.0	39	877.5	3.416	5.040	5.304
	SF0824	61	192.00	3.15	610.0	915.0	42	945.0	3.721	5.490	5.712
LINEAR GRATE	SFLG0408	4	23.33	5.83	40.0	60.0	4	90.0	0.244	0.360	0.544
	SFLG0608	9	38.67	4.30	90.0	135.0	8	180.0	0.549	0.810	1.088
	SFLG0610	11	49.67	4.52	110.0	165.0	10	225.0	0.671	0.990	1.360
	SFLG0612	15	60.67	4.04	150.0	225.0	13	292.5	0.915	1.350	1.768
	SFLG0614	18	71.67	3.98	180.0	270.0	15	337.5	1.098	1.620	2.040
	SFLG0616	21	82.67	3.94	210.0	315.0	18	405.0	1.281	1.890	2.448
	SFLG0618	24	90.67	3.78	240.0	360.0	20	450.0	1.464	2.160	2.720
	SFLG0816	25	110.67	4.43	250.0	375.0	24	540.0	1.525	2.250	3.264
	SFLG0818	29	121.29	4.18	290.0	435.0	26	585.0	1.769	2.610	3.536
PEAK DIVERSION	SFPD0806	8	34.28	4.28	80.0	120.0	7	157.5	0.488	0.720	0.952
	SFPD0612	11	55.58	5.05	110.0	165.0	11	247.5	0.671	0.990	1.496
	SFPD0811	18	68.83	3.82	180.0	270.0	15	337.5	1.098	1.620	2.040
	SFPD0814	25	92.83	3.71	250.0	375.0	20	450.0	1.525	2.250	2.720
	SFPD0816	33	108.83	3.30	330.0	495.0	24	540.0	2.013	2.970	3.264
	SFPD0818	38	124.83	3.29	380.0	570.0	27	607.5	2.318	3.420	3.672
	SFPD0820	43	140.83	3.28	430.0	645.0	31	697.5	2.623	3.870	4.216
	SFPD0822	48	156.83	3.27	480.0	720.0	34	765.0	2.928	4.320	4.624
	SFPD0824	55	172.83	3.14	550.0	825.0	38	855.0	3.355	4.950	5.168

1 - Sedimentation Area shown references maximum # cartridges column.

2 - MTFR 27" Cartridges uses reduced maximum cartridge count associated with maintaining 4.50 sqft/cartridge sedimentation area lower limit.

NOTE: ADDITIONAL SIZES AND CONFIGURATIONS AVAILABLE, CONSULT CONTECH FOR ASSISTANCE

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
Post Office Box 029
Trenton, New Jersey 08625-029
609-633-7021 Fax: 609-984-2147
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Acting Commissioner

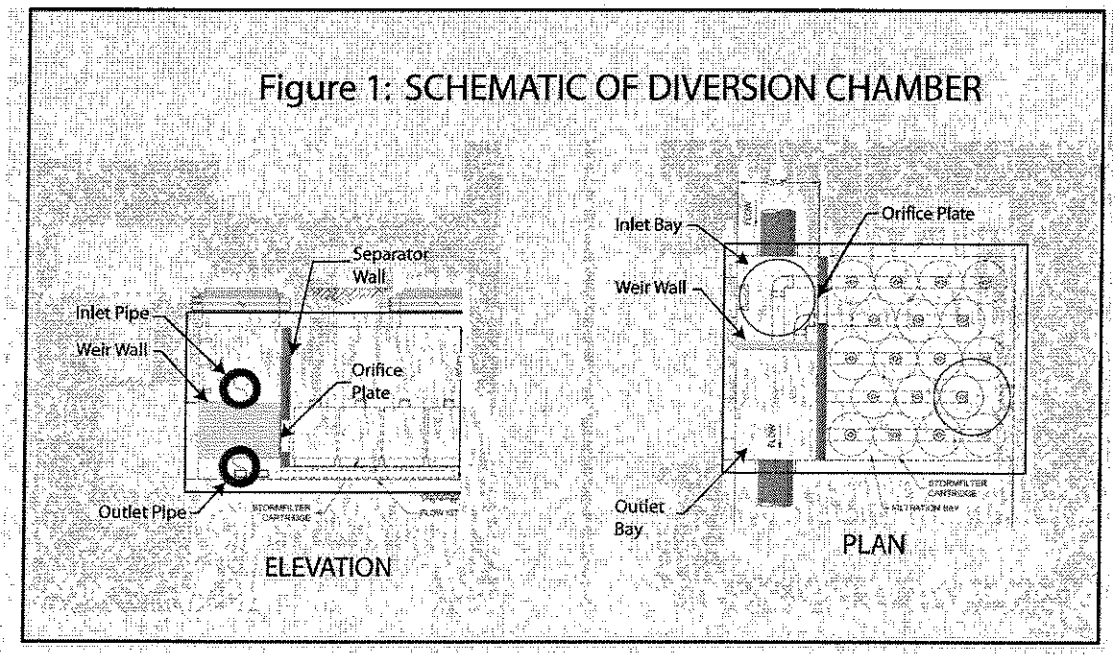
September 1, 2010

Derek M. Berg
Contech Construction Products, Inc.
200 Enterprise Drive
Scarborough, ME 04074

Re: Stormfilter by Contech Construction Products, Inc.

Dear Mr. Berg:

This is in response to your request for a determination regarding a new a bypass configuration for the Stormfilter. The use of the Stormfilter certification is limited to its use as an off-line manufactured treatment device. In such a configuration, the entire runoff from the water quality design storm is treated by the Stormfilter; however, any flows above the water quality design storm will not pass through the approved treatment system.



Based on the submitted information, the use of the chamber shown in Figure 1 qualifies as an off-line configuration provided that the elevation of the water quality design storm does not exceed the elevation of the weir wall, including any head necessary to ensure that the peak flow of the water quality design storm is diverted to the filter cartridges.

Please attach this to your previously issued certification letter for future reference. If you have any questions regarding this letter, please contact Ms. Sandra Blick at (609) 633-7021.

Sincerely,

Ed Dawkins for B.C.

Barry Chalofsky, P.P., Chief
Bureau of Nonpoint Pollution Control

c: Richard Magee, NJCAT
Tom Micai, DLUR

Summary for Subcatchment 14S: PR-2b Into Pipes

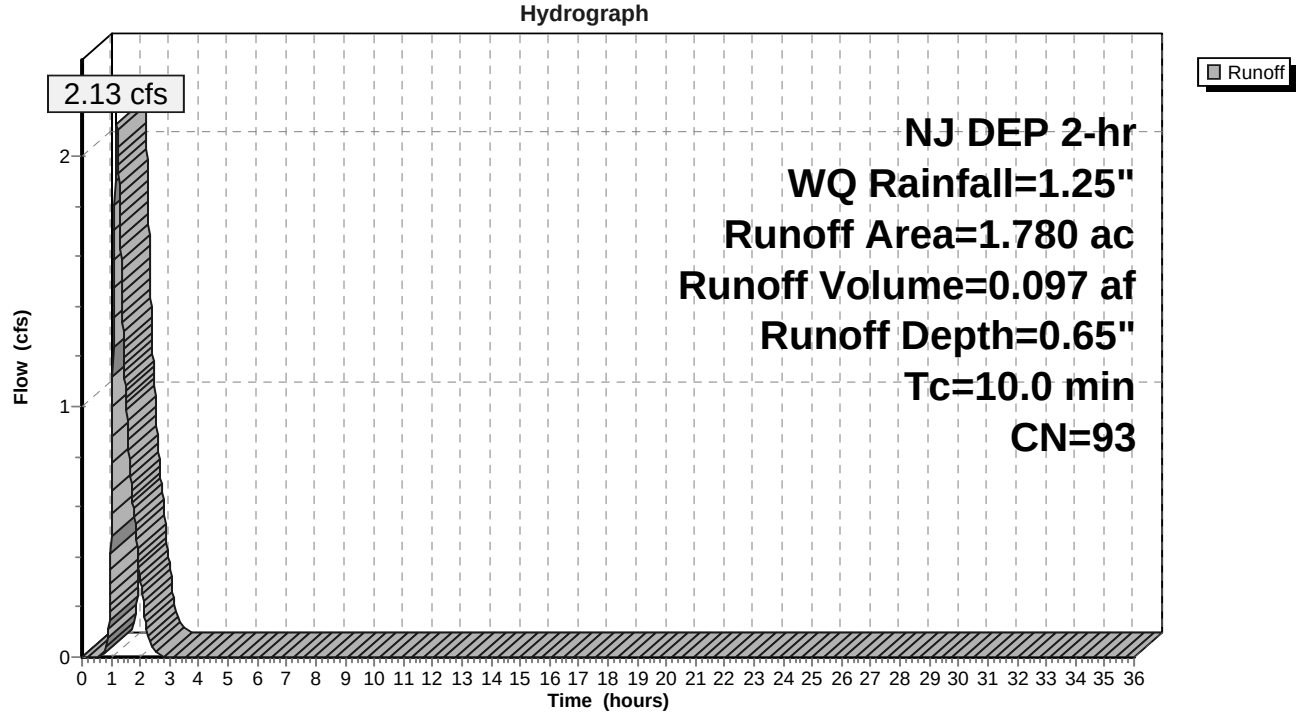
Runoff = 2.13 cfs @ 1.18 hrs, Volume= 0.097 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NJ DEP 2-hr WQ Rainfall=1.25"

	Area (ac)	CN	Description
	0.120	61	>75% Grass cover, Good, HSG B
	0.250	80	>75% Grass cover, Good, HSG D
*	1.270	98	Paved parking
	0.140	98	Roofs, HSG D
	1.780	93	Weighted Average
	0.370		20.79% Pervious Area
	1.410		79.21% Impervious Area

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

Subcatchment 14S: PR-2b Into Pipes



Hydrograph for Subcatchment 14S: PR-2b Into Pipes

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.10	0.00	0.00
1.00	0.63	0.18	**0.48**
1.50	1.15	0.57	**1.04**
2.00	**1.25**	**0.65**	0.30
2.50	1.25	0.65	0.02
3.00	1.25	0.65	0.00
3.50	1.25	0.65	0.00
4.00	1.25	0.65	0.00
4.50	1.25	0.65	0.00
5.00	1.25	0.65	0.00
5.50	1.25	0.65	0.00
6.00	1.25	0.65	0.00
6.50	1.25	0.65	0.00
7.00	1.25	0.65	0.00
7.50	1.25	0.65	0.00
8.00	1.25	0.65	0.00
8.50	1.25	0.65	0.00
9.00	1.25	0.65	0.00
9.50	1.25	0.65	0.00
10.00	1.25	0.65	0.00
10.50	1.25	0.65	0.00
11.00	1.25	0.65	0.00
11.50	1.25	0.65	0.00
12.00	1.25	0.65	0.00
12.50	1.25	0.65	0.00
13.00	1.25	0.65	0.00
13.50	1.25	0.65	0.00
14.00	1.25	0.65	0.00
14.50	1.25	0.65	0.00
15.00	1.25	0.65	0.00
15.50	1.25	0.65	0.00
16.00	1.25	0.65	0.00
16.50	1.25	0.65	0.00
17.00	1.25	0.65	0.00
17.50	1.25	0.65	0.00
18.00	1.25	0.65	0.00
18.50	1.25	0.65	0.00
19.00	1.25	0.65	0.00
19.50	1.25	0.65	0.00
20.00	1.25	0.65	0.00
20.50	1.25	0.65	0.00
21.00	1.25	0.65	0.00
21.50	1.25	0.65	0.00
22.00	1.25	0.65	0.00
22.50	1.25	0.65	0.00
23.00	1.25	0.65	0.00
23.50	1.25	0.65	0.00
24.00	1.25	0.65	0.00
24.50	1.25	0.65	0.00
25.00	1.25	0.65	0.00
25.50	1.25	0.65	0.00
26.00	1.25	0.65	0.00
26.50	1.25	0.65	0.00
27.00	1.25	0.65	0.00
27.50	1.25	0.65	0.00
28.00	1.25	0.65	0.00
28.50	1.25	0.65	0.00
29.00	1.25	0.65	0.00
29.50	1.25	0.65	0.00
30.00	1.25	0.65	0.00
30.50	1.25	0.65	0.00
31.00	1.25	0.65	0.00
31.50	1.25	0.65	0.00
32.00	1.25	0.65	0.00
32.50	1.25	0.65	0.00
33.00	1.25	0.65	0.00
33.50	1.25	0.65	0.00
34.00	1.25	0.65	0.00
34.50	1.25	0.65	0.00
35.00	1.25	0.65	0.00
35.50	1.25	0.65	0.00
36.00	1.25	0.65	0.00

CDS Design Summary

Americana Center

East Windsor, NJ

Information provided by Engineer (Menlo Engineering):

- Water Quality Flow = 2.10 cfs
- Peak Flowrate (100 Year) = 9.46
- Presiding agency = NJDEP
- Stormwater treatment system TSS removal required = 50%

Sizing Summary:

The CDS technology features a patented non-blocking, indirect screening technique developed to treat stormwater runoff. The unit is highly effective in the capture of suspended solids, fine sands and larger particles. Because of its non-blocking screening capacity, the CDS unit is un-matched in its ability to capture and retain gross pollutants such as trash and debris. The CDS system is NJCAT verified and as a result has received certification from the NJDEP for 50% TSS removal.

For this project the CDS system was designed to treat the water quality design storm. The peak water quality design storm runoff flow rate provided the engineer of record is **2.10 cfs**.

Water Quality Design Storm Peak Runoff Rate (cfs)	CDS-6 (CDS-3030-6) NJDEP Approved Water Quality Treatment Flow Rate (cfs)
2.10	2.10

Maintenance:

Like any stormwater best management practice, the CDS system requires regular inspection and maintenance to ensure optimal performance. Maintenance frequency will be driven by site conditions. Quarterly visual inspections are recommended, at which time the accumulation of pollutants can be determined. On average, the CDS system requires annual removal of accumulated pollutants.

Thank you for the opportunity to present this information to you and your client.

Sincerely,

Vince Smith
Sales Engineer – Stormwater & Pipe Products
Contech Engineered Solutions LLC

7037 Ridge Road, Suite 350 | Hanover, MD 21076
Office: 443.457.1500 Fax: 410.740.8492

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

March 21, 2017

Derek M. Berg
Contech Engineered Solutions, LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: Revised MTD Lab Certification
Continuous Deflective Separator (CDS®) Stormwater Treatment Device by Contech Engineered Solutions, LLC
On-line Installation

TSS Removal Rate 50%

Dear Mr. Berg:

This revised certification letter supersedes the Department's prior certification dated January 9, 2015. This revision was completed to reflect the updated Manufactured Treatment Device (MTD) scaling methodology as agreed upon by the manufacturers' working group on September 19, 2016. In part, the updated scaling for hydrodynamic MTDs is based on the depth of the reference (tested) MTD from the top of the false floor utilized during removal efficiency testing, not from the physical bottom of the unit. Based on the above decision, Table A-2 of the NJCAT Technology Verification report located at http://www.njcat.org/uploads/newDocs/CDSVerificationReportFinal1.pdf has been revised, and Table 1 noted below has been added.

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7 (c) 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). Contech Engineered Solutions, LLC has requested an MTD Laboratory Certification for the CDS® Stormwater Treatment Device.

The verification is subject to 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 Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation 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 September 2014 (Revised January 2017) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the CDS® Stormwater Treatment Device by Contech Engineered Solutions, LLC at a TSS removal rate of 50% 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.

2. The CDS® Stormwater Treatment Device shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in item 6 below.

3. This CDS® Stormwater Treatment 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 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the CDS® Stormwater Treatment Device. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at http://www.conteches.com/products/stormwater-management/treatment/cds.aspx#1822141-technical-info for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for the CDS®:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a CDS®. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   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 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
   c=0.99 (runoff coefficient for impervious)
   Q=ciA=0.99x3.2x0.25=0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the CDS® Model CDS-4 with an MTFR of 0.93 cfs would be the smallest model approved that could be used for this site that could remove 50% of the TSS from the impervious area without exceeding the MTFR.

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

Table 1 CDS Models

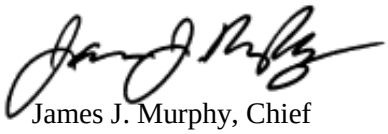
CDS Model	Manhole Diameter (ft.)	Treatment Chamber Depth (ft.)	MTFR (cfs)
CDS-3	3	3.50	0.52
CDS-4	4	3.50	0.93
CDS-5	5	3.75	1.5
CDS-6	6	4.50	2.1
CDS-7	7	5.25	2.8
CDS-8	8	6.00	3.7
CDS-10	10	7.50	5.8
CDS-12	12	9.00	8.4

- Treatment Chamber Depth is defined as the depth below the invert to the top of the false floor installed at 50% sediment depth.

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 Mr. Shashi Nayak of my office at (609) 633-7021.

Sincerely,



James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

c: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP – BNPC

APPENDIX H: NONSTRUCTURAL STORMWATER MANAGEMENT STRATEGIES

NJDEP Nonstructural Strategies Points System (NSPS)

Version: January 31, 2006

Note: Input Values in Yellow Cells Only

Project:	Americana Center
Date:	November 7, 2018
User:	SK
Notes:	

Step 1 - Provide Basic Major Development Site Information

A. Specify Total Area in Acres of Development Site Described in Steps 2 and 3 = 6.5 **Acres**

B. Specify by Percent the Various Planning Areas Located within the Development Site:

State Plan Planning Area:	PA-1	PA-2	PA-3	PA-4	PA-4B	PA-5	Total % Area
Percent of Each Planning Area within Site:		100.0%					100.0%

Note: See User's Guide for Equivalent Zones within Designated Centers and the NJ Meadowlands, Pinelands, and Highlands Districts

Step 2 - Describe Existing or Pre-Developed Site Conditions

A. Specify Existing Land Use/Land Cover Descriptions and Areas:

Site Segment	Land Use/Land Cover Description	Specify Land Use/Land Cover in Acres for Each HSG				Use/Cover Subtotals		Points
		HSG A	HSG B	HSG C	HSG D			
1	Wetlands and Undisturbed Stream Buffers		0.0			0.0		3
2	Lawn and Open Space		1.0	0.8	0.3	2.1		90
3	Brush and Shrub					0.0		0
4	Meadow, Pasture, Grassland, or Range					0.0		0
5	Row Crop					0.0		0
6	Small Grain and Legumes					0.0		0
7	Woods - Indigenous		0.2			0.2		11
8	Woods - Planted					0.0		0
9	Woods and Grass Combination					0.0		0
10	Ponds, Lakes, and Other Open Water					0.0		0
11	Gravel and Dirt		0.0		0.5	0.5		9
12	Porous and Permeable Paving					0.0		0
13	Directly Connected Impervious		1.5	1.7	0.4	3.6		0
14	Unconnected Impervious with Small D/S Pervious					0.0		0
15	Unconnected Impervious with Large D/S Pervious					0.0		0
	HSG Subtotals (Acres):	0.0	2.7	2.5	1.2		**Total Area:**	6.5
	HSG Subtotals (%):	0.0%	42.3%	38.9%	18.9%		**Total % Area:**	100.0%

Points Subtotal: **112**

Total Existing Site Points: **112**

Step 3 - Describe Proposed or Post-Developed Site Conditions

A. Specify Proposed Land Use/Land Cover Descriptions and Areas:

Site Segment	Land Use/Land Cover Description	Specify Land Use/Land Cover in Acres for Each HSG				Use/Cover Subtotals		Points
		HSG A	HSG B	HSG C	HSG D			
1	Wetlands and Undisturbed Stream Buffers		0.0			0.0		3
2	Lawn and Open Space		0.8	0.3	0.2	1.3		56
3	Brush and Shrub					0.0		0
4	Meadow, Pasture, Grassland, or Range					0.0		0
5	Row Crop					0.0		0
6	Small Grain and Legumes					0.0		0
7	Woods - Indigenous		0.2			0.2		11
8	Woods - Planted					0.0		0
9	Woods and Grass Combination					0.0		0
10	Ponds, Lakes, and Other Open Water					0.0		0
11	Gravel and Dirt					0.0		0
12	Porous and Permeable Paving					0.0		0
13	Directly Connected Impervious		1.6	2.2	0.6	4.4		0
14	Unconnected Impervious with Small D/S Pervious		0.2		0.4	0.6		6
15	Unconnected Impervious with Large D/S Pervious					0.0		0
	HSG Subtotals (Acres):	0.0	2.7	2.5	1.2		**Total Area:**	6.5
	HSG Subtotals (%):	0.0%	42.3%	38.9%	18.9%		**Total % Area:**	100.0%
							Points Subtotal:	**76**

B. Compare Proposed Impervious Coverage with Maximum Allowable Impervious Coverage:

Total Directly Connected Impervious Coverage =	68%	% of Site
Total Unconnected Impervious Coverage with Small D/S Pervious =	9%	% of Site
Total Unconnected Impervious Coverage with Large D/S Pervious =	0%	% of Site
Total Site Impervious Coverage =	77%	% of Site
Effective Site Impervious Coverage =	76%	% of Site
Specify Source of Maximum Allowable Impervious Coverage:	Table	(None or Table)
Allowable Site Impervious Cover from Maximum Impervious Cover Table:	85%	

Note: See Maximum Impervious Cover Table Worksheet for Details

Points Subtotal: 6

C. Compare Proposed Site Disturbance with Maximum Allowable Site Disturbance:

Total Proposed Site Disturbance =	71%	% of Site
Maximum Allowable Site Disturbance by Municipal Ordinance =	100%	% of Site

Points Subtotal: 15

D. Describe Proposed Runoff Conveyance System:

Total Length of Runoff Conveyance System =		Feet
Length of Vegetated Runoff Conveyance System =		Feet
% of Total Runoff Conveyance System That is Vegetated =	0%	

Points Subtotal: 0

E. Residential Lot Clustering:

Percent of Total Site Area that will be Clustered =		% of Site
Minimum Standard Lot Size as Per Zoning (Note: 1/2 Acre or Greater) =		Acres
Maximum Proposed Cluster Lot Size (Note:1/4 Acre or Less) =		Acres
Percent of Clustered Portion of Site to be Preserved as Vegetated Open Space =		% of Clustered Site Portion

Points Subtotal: 0

F. Will the Following be Utilized to Minimize Soil Compaction?

Proposed Lawn Areas will be Graded with Lightweight Construction Equipment:	Yes	(Yes or No)
Percent of Proposed Lawn Areas to be Graded with Such Equipment:	26%	% of Lawn Areas

Points Subtotal: 7

G. Are Any of the Following Stormwater Management Standards Met Using Only Nonstructural Strategies and Measures?

Groundwater Recharge Standards (NJAC 7:8-5.4-a-2):	No	(Yes or No)
Stormwater Runoff Quality Standards (NJAC 7:8-5.5):	No	(Yes or No)
Stormwater Runoff Quantity Standards (NJAC 7:8-5.4-a-3):	No	(Yes or No)

Points Subtotal: 0

Note: If the Answers to All Three Questions at G Above are "Yes", Adequate Nonstructural Measures have been Utilized.

Total Proposed Site Points: 103

Ratio of Proposed to Existing Site Points: 92%

Required Site Points Ratio: 90%

Nonstructural Point System Results: Proposed Nonstructural Measures are Adequate