



✧ EMERALD ✧  
Environmental Solutions  
4 Dublin Road  
Pennington NJ 08534  
(609) 802-7202

---

January 8, 2010

Maya van Rossum  
The Riverkeeper  
Delaware Riverkeeper Network  
300 Pond Street, Second Floor  
Bristol, PA 19007

RE: Waterview Center  
Block 2610 Lot 27  
Hamilton Township, Mercer County, NJ

Dear Ms. van Rossum,

As you requested, I have reviewed the stormwater management system for the development of Block 2601 Lot 27 in Hamilton Township, Mercer County, New Jersey, otherwise known as Waterview Center. My analysis focused upon the project's compliance with the New Jersey Stormwater Regulations (N.J.A.C. 7:8) (Rule) and Hamilton Township Stormwater Control Ordinance 158 (Ordinance).

I utilized the following documents for this review:

"Stormwater Management and Engineer's Report for Waterview Center, Block 2610, Lot 17, Hamilton Township, Mercer County, NJ" revised to September 6, 2006 and prepared by ACT Engineers, Inc.

"Stormwater Management and Engineer's Report for Waterview Center "Banked" Parking, Block 2610, Lot 17, Hamilton Township, Mercer County, NJ" revised to September 12, 2006 and prepared by ACT Engineers, Inc.

"Report Preliminary Geotechnical Investigation, Proposed Office Development, Hamilton Township, Mercer County, NJ, Trackside Realty, LLC" dated June 14, 2005 and prepared by Melick-Tully and Associates, P.C. (pages 4 and 5, and Plate 5 missing)

"Stormwater Management Facilities Maintenance Manual, Waterview Center (Office Campus) Block 2610, Lot 27, Hamilton Township, Mercer County, NJ" dated April 17, 2006 and prepared by ACT Engineers, Inc.

“Grading, Drainage and Utility Plans and Construction Details for Preliminary Major Site Plan – Phase 1 and 2, Waterview Center, Lot 27, Block 2610 Situated in Hamilton Township, Mercer County, NJ” sheets 11 through 17 and 35 of 46, revised to June 8, 2007 and prepared by ACT Engineers, Inc.

“Supplemental Overall Plan for Preliminary Major Site Plan – Phase 1 and 2, Waterview Center, Lot 27 Block 2610 situated in Hamilton Township, Mercer County, NJ” dated December 30, 2005 and prepared by ACT Engineers, Inc.

“Environmental Impact Statement for Waterview Center, Block 2601, Lot 27, Hamilton Township, Mercer County, NJ” dated December 29, 2005 prepared by Amy S. Greene Environmental Consultants, Inc.

Interoffice Memorandums from Thomas Dunn, Hamilton Township Engineer to Michael Guhanick, Hamilton Township Land Use Coordinator; 3 documents: October 27, 2005, Revised to December 7, 2005, Revised to February 15, 2006

ACT Engineer’s Response document to the December 7, 2005 Hamilton Township Engineer’s Memo; ACT Engineers, Inc response dated December 30, 2005.

### **Overview of Development Project**

Waterview Center is a two-phased development consisting of 300,000 SF of office space contained in 4 multi story buildings. Phase One consists of two buildings, parking facilities, an access driveway and a large wet pond for stormwater management. Phase Two consists of two additional buildings, associated parking areas and an additional wet pond. The site is approximately 50 acres in size and consists of agricultural fields, wooded areas, wetlands and wetlands transition areas. The entire southern property line is delineated by Edge’s Brook, a tributary to Back Creek which is a tributary to Crosswicks Creek. All of the streams in this system are designated FW2-NT (i.e., freshwater, non-trout). The site is bisected by a north-to-south flowing tributary to Edge’s Brook.

The stormwater management system includes vegetated swale conveyance from portions of the parking areas to inlets and then to the wet basins. Building runoff is conveyed from roof drains that are directly connected to the storm sewer system. All of this piped runoff is directed to one of the two wet basins that are located near Edge’s Brook.

The two wet basins are hydraulically connected with a 485-foot equalization pipe. These basins have a permanent water surface elevation of 49.2 feet. Since the basins are constructed with bottoms below the groundwater elevation, portions of the permanent pool volume are supplied by groundwater flows. The outlet structures for the basins are nearly identical and for purposes of analysis, they are modeled as one basin for the full build-out scenario.

## **Stormwater Management Technical Review**

The Waterview Center stormwater management measures do not meet the following portions of the Rule (in boldface) and Ordinance (in brackets):

- 7:8-5.2 Stormwater management measures for major development** [158.3. (a) (1)]
- 7:8-5.3 Nonstructural stormwater management strategies** [158-4. (e)]
- 7:8-5.4 Erosion control, groundwater recharge and runoff quantity standards** [158-4.(f)]
- 7:8-5.5 Stormwater runoff quality standards** [158-4. (g)]
- 7:8-5.6 Calculation of stormwater runoff and groundwater recharge** [158-5. (a)]
- 7:8-5.7 Standards for structural stormwater management measures** [158-6. (a)]
- 7:8-5.8 Maintenance requirements** [158-10. (b)]

This technical review is presented in the following format:

The regulation will be cited as underlined with text in *italics* and my comment in **preceded by a Capital Letter**. The citation for the Hamilton Township Ordinance will be in brackets [Chapter.subchapter] following the N.J.A.C. 7:8 citation.

### 7:8-5.2 Stormwater management measures for major development [158.3. (a) (1)]

*(a) Stormwater management measures for major development shall be developed to meet the erosion control, groundwater recharge, stormwater runoff quantity, and stormwater runoff quality standards at N.J.A.C. 7:8-5.4 and 5.5. To the maximum extent practicable, these standards shall be met by incorporating nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 into the design. If these measures alone are not sufficient to meet these standards, structural stormwater management measures at N.J.A.C. 7:8-5.7 necessary to meet these standards shall be incorporated into the design. (b) The development shall incorporate a maintenance plan under N.J.A.C. 7:8-5.8 for the stormwater management measures.*

**A. The developer has not demonstrated that the stormwater management measures meet the groundwater recharge, stormwater runoff quantity, or stormwater runoff quality standards at N.J.A.C. 7:8-5.4 and 5.5. The developer chose to show compliance with the nonstructural stormwater strategies component of the Rule by utilizing the NJDEP's Nonstructural Stormwater Strategies Point System (NSPS). However, this development does not pass a properly completed NSPS. Additionally, the Maintenance Plan submitted for the project is incomplete. Therefore, this portion of the Rule and Ordinance has not been met.**

### 7:8-5.3 Nonstructural stormwater management strategies [158-4. (e)]

*(a) To the maximum extent practicable, the standards in N.J.A.C. 7:8-5.4 and 5.5 shall be met by incorporating nonstructural stormwater management strategies at N.J.A.C. 7:8- 5.3 into the design. The persons submitting an application for review shall identify the nonstructural strategies incorporated into the design of the project. If the applicant contends that it is not feasible for engineering, environmental, or safety reasons to incorporate any nonstructural stormwater*

*management strategies identified in (b) below into the design of a particular project, the applicant shall identify the strategy and provide a basis for the contention.*

**B. The developer submitted the NJDEP's Nonstructural Stormwater Strategies Point System Spreadsheet Analysis (NSPS) in an attempt to demonstrate that the project would use nonstructural stormwater strategies "to the maximum extent practicable" as required by the Rule and the Ordinance. This submission indicated that the site easily garnered enough points to pass the NSPS. To demonstrate sufficiency, the project needed to maintain 95% of the existing site points after development; it achieved 107% based on the applicant's input data.**

**However, the developer's spreadsheet made the following flawed assumptions:**

- 1. The NSPS indicates that there are no Hydrologic Soil Group (HSG) "B" soils on this site. There are actually 3.67 acres of HSG B Sassafras soils on the site based on the NRCS Web Soil Survey and the applicant's Stormwater Management Report.**
- 2. The spreadsheet assigns HSG "D" status to 38.7 acres of the site. This characterization is correct for 10.4 acres of the stream corridor and wetlands that are classified as Alluvial soils. However, with the exception of the HSG "B" soils mentioned above, the remainder of the site is classified as Othello (drained<sup>1</sup>), Mattapex and Dragston, all of which are HSG "C".**
- 3. The Engineer's Report describes the existing agricultural areas of the site as "Meadow". However, the developer assigned a land cover of "Row Crop" in the NSPS.**

**The effect of misclassifying the site soils and land cover as explained in paragraphs 1 through 3 above is that the existing site points are greatly underestimated. Thus, the development would require fewer post-development points in order to pass the NSPS.**

**I have run the NSPS using input data that corrects these flawed assumptions and have included the revised spreadsheets as Attachment A. When the NSPS is run with the corrected assumptions, the applicant achieves only 81% of the existing point total and fails to pass the NSPS by 14 percentage points. Therefore, the applicant has NOT demonstrated that nonstructural stormwater strategies have been used to the maximum extent practicable as required by the Rule and the Ordinance.**

*7:8-5.4 Erosion control, groundwater recharge and runoff quantity standards [158-4. (f)]*

*(a) 2. The minimum design and performance standards for groundwater recharge are as follows:*

---

<sup>1</sup> Preliminary Geotechnical Investigation Test Pit 22 indicates seepage at 2' below grade due to tile drain.

i. The design engineer shall, using the assumptions and factors for stormwater runoff and groundwater recharge calculations at N.J.A.C. 7:8-5.6, either:

(1) Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100 percent of the average annual pre- construction groundwater recharge volume for the site;

**C. The applicant has run the NJDEP’s Annual Groundwater Recharge Analysis Spreadsheet for this development. This Analysis indicates that there will be an annual groundwater recharge deficit of 113,395 cubic feet per year with this development. The developer is not proposing infiltration facilities to accomplish the groundwater recharge required by this portion of the Rule or Ordinance.**

**However, a developer may also demonstrate compliance with the groundwater recharge requirement using the following methodology:**

(2) Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the two-year storm is infiltrated.

**D. The hydrologic calculations in the developer’s stormwater report indicate that the increase in runoff volume that occurs with this development for the two-year storm event will not be infiltrated. The runoff volumes for the 2 year storm event are presented in Table 1 below.**

**TABLE 1**  
**RUNOFF VOLUMES FROM 2 YEAR STORM EVENT**

	Existing Runoff	Post Development Runoff
Phase 1	70,944 cf	157,633 cf
Phases 1 and 2	97,114 cf	239,923 cf

These calculations are derived from the engineer’s Stormwater Management Report. For the Phase 1 development, the runoff volume is 2.2 times the existing runoff volume. In the case of full build-out, the runoff volume is 2.5 times the existing runoff volume. Thus the difference in runoff between the existing and post-developed condition for the two-year storm event will not be infiltrated<sup>2</sup>.

**E. Concerning the groundwater recharge requirement, the Engineer’s Report states,**

*Soil testing on site has revealed that the permeability rates for the soils mapped on site vary significantly from the properties described in the USDA Soil Report.*

---

<sup>2</sup> My revised hydrological analysis (described below in paragraph L) indicates even larger increases in runoff volumes for the two year storm event: Phase 1 runoff volume would be 3.22 times the existing runoff and full build-out runoff volume would be 3.33 times the existing runoff.

*High clay content is present in all these soils and permeability is poor to none. These conditions make infiltration unsupportable and run counter to the assumptions on which the analysis is based. Therefore, no calculations are provided for post-developed recharge.*

**Additionally, the Geotechnical Report states that infiltration facilities may be inappropriate based on the shallow depth to mottling in many of the test pits as well as the presence of clayey soils. The applicant did not perform permeability tests to verify this and the Township did not request that they be done.**

**The stormwater regulations permit variances or exemptions from this design standard provided that a mitigation plan is included in the Township's Stormwater Management Plan. According to the Rule:**

*N.J.A.C. 7:8-4.2(c)11 In order to grant a variance or exemption from the design and performance standards in N.J.A.C. 7:8-5, include a mitigation plan that identifies what measures are necessary to offset the deficit created by granting the variance or exemption. The mitigation plan shall ensure that mitigation is completed within the drainage area and for the performance standard for which the variance or exemption was granted*

**Hamilton Township does have a mitigation plan. However, the Township approved this development project without requiring mitigation measures from the developer to offset the project's non-compliance with this portion of the Rule.**

*(a) 3 iii. Design stormwater management measures so that the post-construction peak runoff rates for the two, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates.*

**F. The developer's hydrologic analysis concludes that this project will meet the required peak flow reductions for both Phase 1 and the full build-out of the site. However, as discussed below in sections H through K, the analysis was based on several design assumptions that were not consistent with the Rule or the Ordinance. I have performed a revised hydrologic analysis that is discussed in section L below. This analysis indicates that the peak flow reductions will not be met with the build-out of Phases 1 and 2.**

7:8-5.5 Stormwater runoff quality standards [158-4. (g)]

*Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm by 80 percent of the anticipated load from the developed site, expressed as an annual average.*

*Stormwater management measures shall only be required for water quality control if an additional one-quarter acre of impervious surface is being proposed on a development site. The requirement to reduce TSS does not apply to any stormwater runoff in a discharge regulated under a numeric effluent limitation for TSS imposed under the New Jersey Pollutant Discharge Elimination System (NJPDES) rules, N.J.A.C. 7:14A, or in a discharge specifically exempt under a NJPDES permit*

*from this requirement. The water quality design storm is 1.25 inches of rainfall in two hours. Water quality calculations shall take into account the distribution of rain from the water quality design storm, as reflected in Table 1 below. The calculation of the volume of runoff may take into account the implementation of non-structural and structural stormwater management measures.*

**G. Chapter 9.11 of the New Jersey Stormwater Best Management Practices Manual (referenced in N.J.A.C. 7:8) shows a range of 50-90 percent TSS removal for a Wet Pond:**

*The adopted TSS removal rate for wet ponds is 50 to 90 percent depending on the permanent pool storage volume in the pond and, where extended detention is also provided, the duration of detention time provided in the pond.*

**The engineer's report states that an 80% TSS removal rate is achieved for each of the wet basins. This conclusion is based on a ratio of water quality storm volume to permanent pool volume that exceeds 3.0 for each basin. However, no water quality storm calculations are included in the report nor are the basin volume calculations presented in the report. This information is required to verify that the calculations were properly performed. Absent this documentation, it cannot be concluded with certainty that an 80% TSS removal rate will be met with this development.**

**7:8-5.6 Calculation of stormwater runoff and groundwater recharge [158-5. (a)]**

*(a) Stormwater runoff shall be calculated in accordance with the following:*

*3. In computing pre-construction stormwater runoff, the design engineer shall account for all significant land features and structures, such as ponds, wetlands, depressions, hedgerows, or culverts, that may reduce pre-construction stormwater runoff rates and volumes.*

**H. The hydrological calculations performed by the developer indicate that approximately .23 acres of indigenous woods on the eastern side of the site were modeled as pasture in the existing condition. This error would overestimate the existing runoff volumes and peak flows and could result in less peak flow reduction than is required by the Rule and the Ordinance.**

**I. The Stormwater Management Report states that the existing agricultural areas of the site are classified as "Meadow". However, the hydrological analysis uses Runoff Curve Numbers (RCN) associated with "Pasture, grassland or range" instead. Since the RCNs for Pasture are greater than those for Meadow, this error overestimates the existing runoff volumes and peak flows. This could result in less peak flow reduction than is required by the Rule and the Ordinance.**

*4. In computing stormwater runoff from all design storms, the design engineer shall consider the relative stormwater runoff rates and/or volumes of pervious and impervious surfaces separately to accurately compute the rates and volume of stormwater runoff from the site.*

**J. The engineer did not route the pervious and impervious areas separately as**

required by the Rule and the Ordinance. This error has the effect of underestimating the peak flows in the post-developed condition and would result in less peak flow reduction than is required by the Rule and the Ordinance.

7:8-5.7 Standards for structural stormwater management measures [158-6. (a)]

*(a) Standards for structural stormwater management measures are as follows:*

*1. Structural stormwater management measures shall be designed to take into account the existing site conditions, including, for example, environmentally critical areas; wetlands; flood-prone areas; slopes; depth to seasonal high water table; soil type, permeability and texture; drainage area and drainage patterns; and the presence of solution-prone carbonate rocks.*

**K. The hydrologic calculations consider the entire portion of the site west of the north-south tributary to be HSG "C" soils. However, the NRCS Web Soil Survey and the soil map submitted with the Stormwater Report indicate that there are approximately .8 acres of Sassafras (HSG "B") soils in this area (more than half of this area is proposed to be covered with impervious surfaces in Phase 2). This error overestimates the runoff volumes and peak flows in the existing condition. The Web Soil Survey map and associated soil area summary are included as Attachment B.**

**L. In order to quantify the effect of the inappropriate assumptions noted in sections H through K, I have performed a hydrological analysis for this development that corrects these assumptions. The Analysis was performed using HydroCAD 9.0 and is included as Attachment C. The analysis indicates that the Phase 1 portion of the development will meet the required peak flow reductions, however with the full build out of both Phases 1 and 2, the peak flow reductions will not be met for the 2, 10 and 100-year storms. The revised peak flows are illustrated in Table 2.**

**TABLE 2**  
**RUNOFF CALCULATIONS FOR PHASES 1 AND 2**

	<b>2 Yr Storm</b>	<b>10 Yr Storm</b>	<b>100 Yr Storm</b>
<b>Existing Runoff (cfs)</b>	<b>6.2</b>	<b>15.77</b>	<b>38.25</b>
<b>Reduction Percentage</b>	<b>50%</b>	<b>75%</b>	<b>80%</b>
<b>Target Discharge (cfs)</b>	<b>3.1</b>	<b>11.83</b>	<b>30.6</b>
<b>Proposed Basin Discharge (cfs)</b>	<b>3.92</b>	<b>12.04</b>	<b>35.31</b>
<b>Reduction Requirement Met</b>	<b>NO</b>	<b>NO</b>	<b>NO</b>

7:8-5.8 Maintenance requirements [158-10. (b)]

*(a) The design engineer shall prepare a maintenance plan for the stormwater management measures incorporated into the design of a major development.*

*(b) The maintenance plan shall contain specific preventative maintenance tasks and schedules; cost*



*estimates, including estimated cost of sediment, debris, or trash removal; and the name, address, and telephone number of the person or persons responsible for preventative and corrective maintenance (including replacement). Maintenance guidelines for stormwater management measures are available in the New Jersey Stormwater Best Management Practices Manual.*

**M. The developer has submitted a Stormwater Management Facilities Maintenance Plan for this project. The plan does not provide sufficient maintenance instructions for the pervious pavement areas proposed for the site. The NJDEP BMP Manual Chapter 9.7 “Standards for Pervious Paving Systems” states:**

*The surface course of a porous paving system must be vacuum swept at least four times a year. This should be following by a high pressure hosing. All dislodged sediment and other particulate matter must be removed and properly disposed.*

**This maintenance measure is not included in the Maintenance Plan for the project. Chapter 8 of the BMP Manual, “Maintenance and Retrofit of Stormwater Management Measures” requires that the following items be placed in the stormwater management maintenance plan:**

*Maintenance, repair, and replacement instructions for specialized, proprietary, and nonstandard measure components, including manufacturers’ product instructions and user manuals.*

**No maintenance instructions or user manuals have been included in the Plan for the aeration devices that will be installed in the wet ponds.**

**The Stormwater Maintenance Facilities Plan is incomplete due to the omission of these maintenance requirements.**

### **Conclusions**

The proposed stormwater management system for Waterview Center is not in compliance with the New Jersey Stormwater Regulations or the Hamilton Township Stormwater Control Ordinance and has not been suitably designed based upon the following findings:

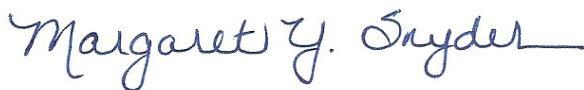
- An accurate Nonstructural Stormwater Strategies Point System spreadsheet analysis indicates this project has **not** demonstrated that nonstructural stormwater strategies will be used to the maximum extent practicable as required by N.J.A.C. 7:8-5.3 and Ordinance section 158-4. (e).
- The peak flow reductions of 50%, 75% and 80% for the 2, 10 and 100 year storms, respectively, have not been met for the full build-out of the project as required by N.J.A.C. 7:8-5.4 and Ordinance section 158-4. (f).
- This project has not met the groundwater recharge requirements of N.J.A.C.

7:8-5.4 and Ordinance section 158-4. (f). and no mitigation measures have been required by the Township.

- The engineer for this project did not submit calculations demonstrating that the basins will achieve the required TSS removal of 80% as required by N.J.A.C. 7:8-5.5 and Ordinance section 158-4. (g).
- The hydrological analysis did not accurately account for the existing land covers on the site. The analysis also did not route the pervious and impervious areas separately. Therefore, the plan does not meet N.J.A.C. 7:8-5.6 and Ordinance section 158-5. (a).
- The hydrological analysis did not accurately depict the existing soils on the site. Therefore, the plan does not meet N.J.A.C. 7:8-5.7 and Ordinance section 158-6. (a).
- The Stormwater Facilities Maintenance Plan is incomplete and therefore does not meet N.J.A.C. 7:8-5.8 and Ordinance section 158-10. (b).

Please feel free to contact me if you would like to discuss these issues.

Sincerely,

A handwritten signature in blue ink that reads "Margaret Y. Snyder" followed by a horizontal line.

Margaret Y. Snyder, P.E.  
Principal

ATTACHMENT A

NONSTRUCTURAL STORMWATER STRATEGIES POINT SYSTEM

## Nonstructural Stormwater Strategies Point System Analysis

### Summary of Developer's Spreadsheet Data:

Figure A-1 presents the NSPS data input by the developer. There are a number of input values that conflict with the soil survey data, the plans and the stormwater report. These are:

#### *Existing Land Use/Land Cover Chart*

1. There are no HSG B soils included on this chart. The stormwater report indicates that there are 2.87 acres of this soil group on the eastern portion of the site. The NRCS Web Soil Survey (WSS) indicates there are 0.8 acres of this soil group on the western portion of the site.
2. The HSG D soils on the site are seriously overestimated. According to the drainage area maps and the WSS, only the 10.4 acre stream corridor and its associated wetlands are HSG D. However, the developer has considered 38.7 acres of the site to be HSG D. The remainder of the site consists of the 3.7 acres of B soils mentioned above and an additional 11.5 acres HSG C soils. The soils on the NSPS should be re-classified as follows:

3.7 acres HSG B  
36.1 acres HSG C  
10.4 acres HSG D

3. The developer has considered the agricultural areas of the site to be row crop. This conflicts with the Engineer's Stormwater Report that identifies these areas as Meadow. These areas are input on the NSPS as 7.7 acres of HSG C and 23.5 acres of HSG D. These areas should be re-classified as meadow and the 23.5 acres of D soils should be changed to 23.5 acres of C soils; this would total 31.2 acres of HSG C Meadow. However, of these 31.2 acres, 3.7 acres should be removed and be re-classified as HSG B as stated in paragraph 1 above. The revised Meadow acreages would be as follows:

3.7 acres HSG B  
27.5 acres HSG C

4. The developer has considered 4.8 acres of the indigenous woods on the site to be HSG D. These areas should be reclassified as HSG C. When added to the correctly designated 2.5 acres of C woods, this would result in a total of 7.3 acres of HSG C woods.

### *Proposed Land Use/Land Cover Chart*

In the proposed condition, the HSG areas need to be consistent with the pre-developed condition. The following input data is not consistent with the stormwater report, drainage area maps and WSS:

1. The Lawn and Open Space soil groups should be revised to reflect the following:
  - a. 0.2 acres of the HSG D stream corridor has been disturbed. This should be considered Open Space.
  - b. 9.5 acres of Open Space is located in HSG D. This area should be revised to 9.3 acres of HSG C Open Space (based on "a" above) and should be added to the developer's 4.0 acres of C Open Space. This provides for a preliminary total of 13.3 acres of HSG C Open Space.
  - c. 1.0 acres of this revised HSG C Open Space should be changed to HSG B Open Space. According to the stormwater report, 0.64 acres of this B area is located on the east side of the site. The additional 0.4 acres is located on the west side of the site and represents a conservative estimate of this land use/land cover based upon the WSS and the plans.
2. All of the Indigenous Woods of the site should be reclassified as HSG C. The total area would be 6.5 acres.
3. All of the Permeable Paving should be classified as HSG C. The total area would be 1.4 acres.
4. The impervious surfaces of the site should total 17.9 acres. Of this, there should be 2.7 acres of HSG B (3.7 acres existing - 1.0 acres Open Space) and 15.2 acres of HSG C.

### Revised Spreadsheet Analysis

I have revised the NSPS to reflect all of the changes listed above. It is attached and labeled Figure A-2.

**FIGURE A-1**  
**NSPS Data Input by the Developer**

**NJDEP Nonstructural Strategies Points System (NSPS)**

**Version:** January 31, 2006

**Note:** Input Values in Yellow Cells Only

**Project:** Waterview Center

**Date:** December 22, 2009

**User:** Emerald Environmental Solutions

**Notes:** The following data was input by ACT Engineers on April 4, 2006 and submitted to Hamilton Township in order to show compliance with N.J.A.C. 7:8-5.3

**Step 1 - Provide Basic Major Development Site Information**

**A. Specify Total Area in Acres of Development Site Described in Steps 2 and 3 =** 50.2 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			1.3	10.4	11.7	79
2	Lawn and Open Space					0.0	0
3	Brush and Shrub					0.0	0
4	Meadow, Pasture, Grassland, or Range					0.0	0
5	Row Crop			7.7	23.5	31.2	96
6	Small Grain and Legumes					0.0	0
7	Woods - Indigenous			2.5	4.8	7.3	40
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					0.0	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	0.0	11.5	38.7		Total Area: 50.2
HSG Subtotals (%):		0.0%	0.0%	22.9%	77.1%		Total % Area: 100.0%
							Points Subtotal: 215
							Total Existing Site Points: 215

### 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			0.7	10.2	10.9	73
2	Lawn and Open Space			4.0	9.5	13.5	53
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			2.3	4.2	6.5	36
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			0.5	0.9	1.4	6
13	Directly Connected Impervious			4.0	13.9	17.9	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	0.0	11.5	38.7		
HSG Subtotals (%):		0.0%	0.0%	22.9%	77.1%		
						Total Area:	50.2
						Total % Area:	100.0%
						Points Subtotal:	167



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

Total Directly Connected Impervious Coverage =  
Total Unconnected Impervious Coverage with Small D/S Pervious =  
Total Unconnected Impervious Coverage with Large D/S Pervious =  
Total Site Impervious Coverage =  
Effective Site Impervious Coverage =

36%	% of Site
0%	% of Site
0%	% of Site
36%	% of Site
36%	% of Site

Specify Source of Maximum Allowable Impervious Coverage:

Table (None or Table)

Allowable Site Impervious Cover from Maximum Impervious Cover Table:  
Note: See Maximum Impervious Cover Table Worksheet for Details

85%

Points Subtotal: 22

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

Total Proposed Site Disturbance =  
Maximum Allowable Site Disturbance by Municipal Ordinance =

	% of Site
	% of Site

Points Subtotal: 0

**D. Describe Proposed Runoff Conveyance System:**

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

14456	Feet
6875	Feet
48%	

Points Subtotal: 37

**E. Residential Lot Clustering:**

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

	% of Site
	Acres
	Acres
	% 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:  
Percent of Proposed Lawn Areas to be Graded with Such Equipment:

Yes	(Yes or No)
29%	% of Lawn Areas

Points Subtotal: 6

**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):  
Stormwater Runoff Quality Standards (NJAC 7:8-5.5):  
Stormwater Runoff Quantity Standards (NJAC 7:8-5.4-a-3):

No	(Yes or No)
No	(Yes or No)
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: 231

Ratio of Proposed to Existing Site Points: 107%

Required Site Points Ratio: 95%

**Nonstructural Point System Results:**

**Proposed Nonstructural Measures are Adequate**

**FIGURE A-2**  
**Input Data Revised to Reflect Actual Site Conditions**

**NJDEP Nonstructural Strategies Points System (NSPS)**

**Version:** January 31, 2006

**Note:** Input Values in Yellow Cells Only

**Project:** Waterview Center

**Date:** December 22, 2009

**User:** Emerald Environmental Solutions

**Notes:**

The following input data reflects the changes that are discussed in the Spreadsheet Summary.
These changes reflect an accurate representation of soil groups and land covers.

**Step 1 - Provide Basic Major Development Site Information**

**A. Specify Total Area in Acres of Development Site Described in Steps 2 and 3 =** 50.2 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			1.3	10.4	11.7	79
2	Lawn and Open Space					0.0	0
3	Brush and Shrub					0.0	0
4	Meadow, Pasture, Grassland, or Range		3.7	27.5		31.2	196
5	Row Crop					0.0	0
6	Small Grain and Legumes					0.0	0
7	Woods - Indigenous			7.3		7.3	47
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					0.0	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	3.7	36.1	10.4		
HSG Subtotals (%):		0.0%	7.4%	71.9%	20.7%		
						Total Area:	50.2
						Total % Area:	100.0%
						Points Subtotal:	322
						Total Existing Site Points:	322

### **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			0.7	10.2	10.9	73
2	Lawn and Open Space		1.0	12.3	0.2	13.5	64
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			6.5		6.5	42
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			1.4		1.4	6
13	Directly Connected Impervious		2.7	15.2		17.9	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	3.7	36.1	10.4		
HSG Subtotals (%):		0.0%	7.4%	71.9%	20.7%		
						<b>Total Area:</b>	<b>50.2</b>
						<b>Total % Area:</b>	<b>100.0%</b>
						<b>Points Subtotal:</b>	<b>185</b>

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

Total Directly Connected Impervious Coverage =  
Total Unconnected Impervious Coverage with Small D/S Pervious =  
Total Unconnected Impervious Coverage with Large D/S Pervious =  
Total Site Impervious Coverage =  
Effective Site Impervious Coverage =

36%	% of Site
0%	% of Site
0%	% of Site
36%	% of Site
36%	% of Site

Specify Source of Maximum Allowable Impervious Coverage:

Table (None or Table)

Allowable Site Impervious Cover from Maximum Impervious Cover Table:  
Note: See Maximum Impervious Cover Table Worksheet for Details

85%

Points Subtotal: 26

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

Total Proposed Site Disturbance =  
Maximum Allowable Site Disturbance by Municipal Ordinance =

	% of Site
	% of Site

Points Subtotal: 0

**D. Describe Proposed Runoff Conveyance System:**

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

14456	Feet
6875	Feet
48%	

Points Subtotal: 43

**E. Residential Lot Clustering:**

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

	% of Site
	Acres
	Acres
	% 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:  
Percent of Proposed Lawn Areas to be Graded with Such Equipment:

Yes	(Yes or No)
29%	% 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):  
Stormwater Runoff Quality Standards (NJAC 7:8-5.5):  
Stormwater Runoff Quantity Standards (NJAC 7:8-5.4-a-3):

No	(Yes or No)
No	(Yes or No)
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: 261**

**Ratio of Proposed to Existing Site Points: 81%**

**Required Site Points Ratio: 95%**

**Nonstructural Point System Results:**

**Further Review of Proposed Nonstructural Measures is Necessary**

ATTACHMENT B

NRCS WEB SOIL SURVEY MAP AND AREA CALCULATIONS




# Soil Map—Mercer County, New Jersey



## MAP LEGEND






















### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Units

### Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot
-  Spoil Area
-  Stony Spot



Very Stony Spot



Wet Spot



Other

### Special Line Features



Gully



Short Steep Slope



Other

### Political Features



Cities

### Water Features



Oceans



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

## MAP INFORMATION

Map Scale: 1:1,390 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>

Coordinate System: UTM Zone 18N NAD83

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 8, Aug 18, 2008

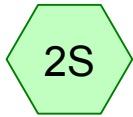
Date(s) aerial images were photographed: 8/5/2006

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.

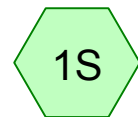
## Map Unit Legend

Mercer County, New Jersey (NJ021)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FmhAt	Fluvaquents, loamy, 0 to 3 percent slopes, frequently flooded	0.1	3.8%
MBYB	Mattapex and Bertie loams, 0 to 5 percent slopes	2.2	66.6%
OthA	Othello silt loam, 0 to 2 percent slopes	0.2	5.2%
SacB	Sassafras sandy loam, 2 to 5 percent slopes	0.8	24.4%
<b>Totals for Area of Interest</b>		<b>3.3</b>	<b>100.0%</b>

ATTACHMENT C  
HYDROLOGICAL ANALYSIS



Existing West



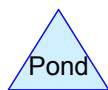
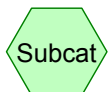
Existing East



Point of Analysis 2



Point of Analysis 1



**Drainage Diagram for Waterview Center Existing Phases 1 and 2**  
Prepared by Emerald Environmental Solutions, Printed 12/18/2009  
HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

## Waterview Center Existing Phases 1 and 2

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 2

### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.270	58	HSG B Meadow (1S, 2S)
0.230	70	HSG C Woods (1S)
21.030	71	HSG C Meadow (1S, 2S)
0.860	98	Impervious (1S)
<b>25.390</b>		<b>TOTAL AREA</b>

## Waterview Center Existing Phases 1 and 2

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 3

### Notes Listing (all nodes)

Line#	Node Number	Notes
1	1S	Grassy areas revised to Meadow from Pasture.
2		Land cover is revised to reflect 0.23 acres in Woods
3	2S	Grassy areas revised to Meadow from Pasture.
4		Revised to reflect HSG B soils; soil maps indicate 0.8 acres; 0.4 acres input to be conservative.
5	5L	The full site should be modelled with a Reach for Edge's Brook. POA 1 would be routed to Edge's Brook; Edge's Brook would be routed to POA 2. This would result in smaller peak flows in the existing condition. However, since an accurate representation for Edge's Brook was not available, this link has been removed. The resulting peak flows are conservative.

**Waterview Center Existing Phases 1 and 2***Type III 24-hr 2 Year Storm Rainfall=3.30"*

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 4

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=Delmarva

Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

**Subcatchment 1S: Existing East**

Runoff Area=19.330 ac 4.45% Impervious Runoff Depth&gt;0.76"

Tc=57.2 min CN=70 Runoff=4.44 cfs 1.229 af

**Subcatchment 2S: Existing West**

Runoff Area=6.060 ac 0.00% Impervious Runoff Depth&gt;0.78"

Tc=31.5 min CN=70 Runoff=2.04 cfs 0.396 af

**Link 3L: Point of Analysis 1**

Inflow=4.44 cfs 1.229 af

Primary=4.44 cfs 1.229 af

**Link 5L: Point of Analysis 2**

Inflow=6.20 cfs 1.625 af

Primary=6.20 cfs 1.625 af

**Total Runoff Area = 25.390 ac   Runoff Volume = 1.625 af   Average Runoff Depth = 0.77"**  
**96.61% Pervious = 24.530 ac   3.39% Impervious = 0.860 ac**



## Waterview Center Existing Phases 1 and 2

Type III 24-hr 2 Year Storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 5

### Summary for Subcatchment 1S: Existing East

Grassy areas revised to Meadow from Pasture.

Land cover is revised to reflect 0.23 acres in Woods

Runoff = 4.44 cfs @ 12.96 hrs, Volume= 1.229 af, Depth> 0.76"

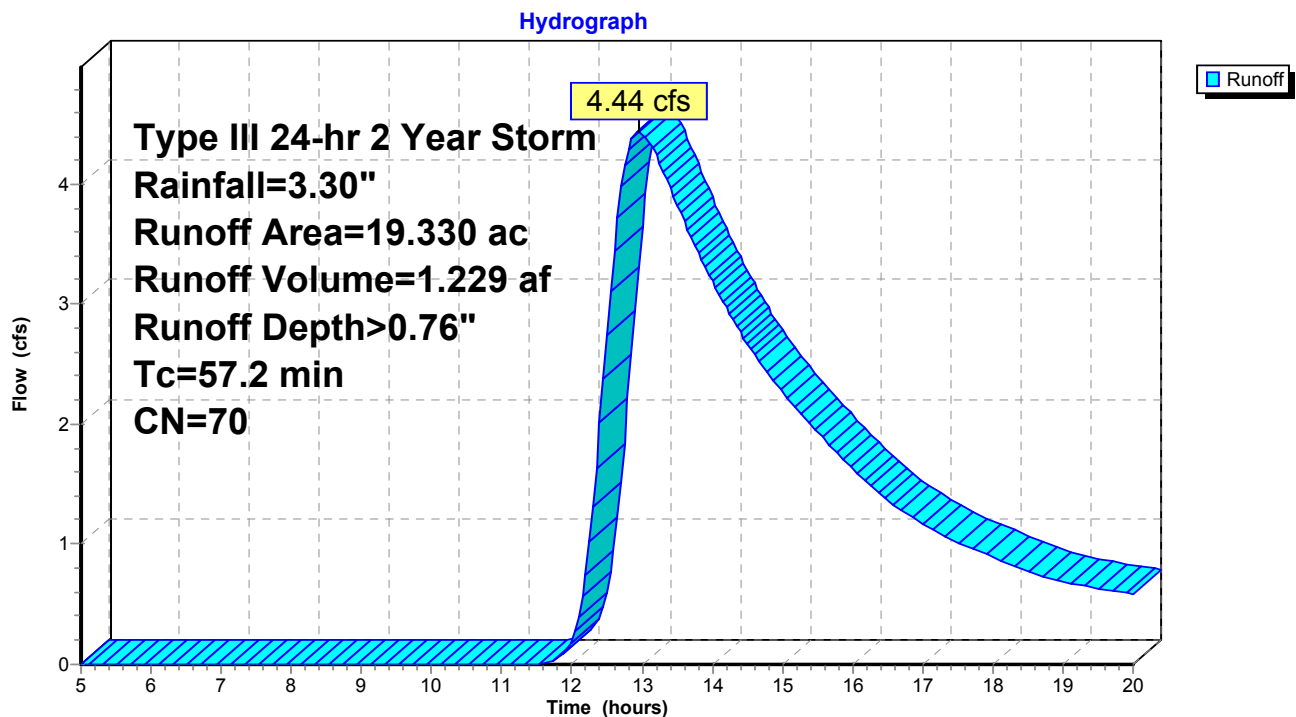
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 2 Year Storm Rainfall=3.30"

Area (ac)	CN	Description
* 2.870	58	HSG B Meadow
* 15.370	71	HSG C Meadow
* 0.230	70	HSG C Woods
* 0.860	98	Impervious
19.330	70	Weighted Average
18.470		95.55% Pervious Area
0.860		4.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2					Direct Entry, CN East

### Subcatchment 1S: Existing East



**Waterview Center Existing Phases 1 and 2**

Type III 24-hr 2 Year Storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 6

**Summary for Subcatchment 2S: Existing West**

Grassy areas revised to Meadow from Pasture.

Revised to reflect HSG B soils; soil maps indicate 0.8 acres; 0.4 acres input to be conservative.

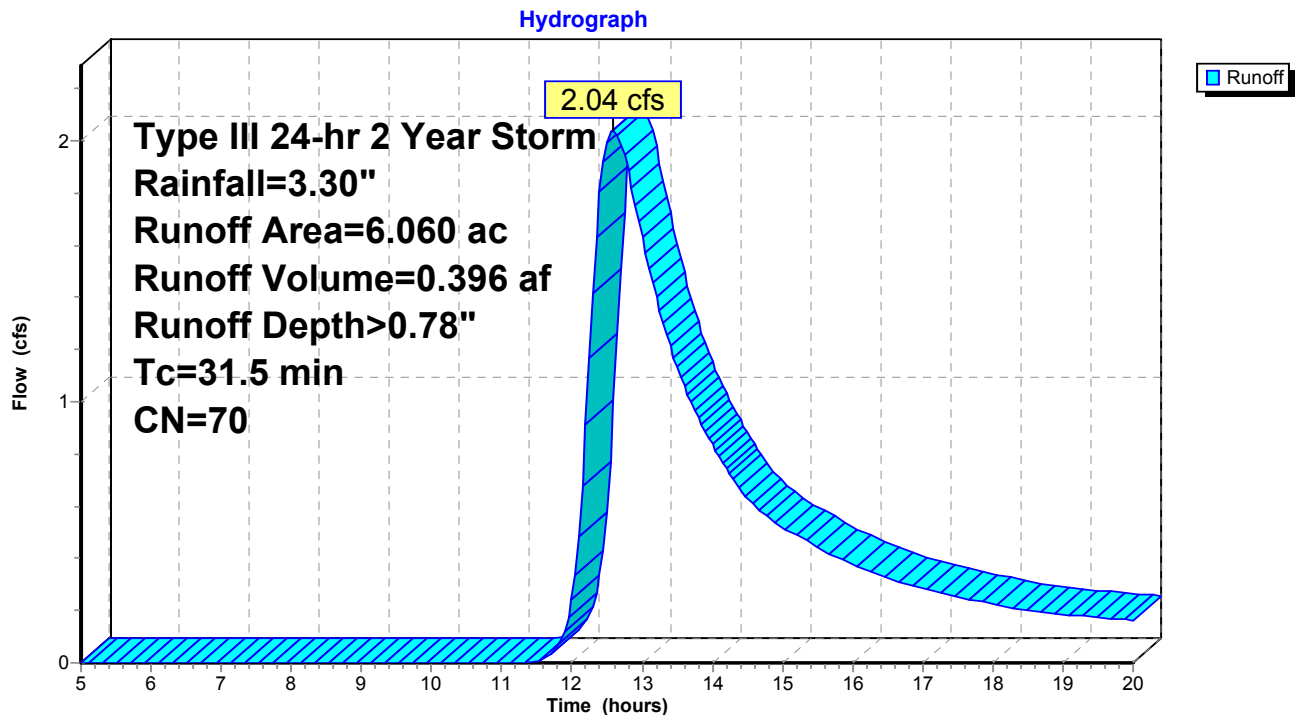
Runoff = 2.04 cfs @ 12.60 hrs, Volume= 0.396 af, Depth&gt; 0.78"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 2 Year Storm Rainfall=3.30"

	Area (ac)	CN	Description
*	5.660	71	HSG C Meadow
*	0.400	58	HSG B Meadow
	6.060	70	Weighted Average
	6.060		100.00% Pervious Area

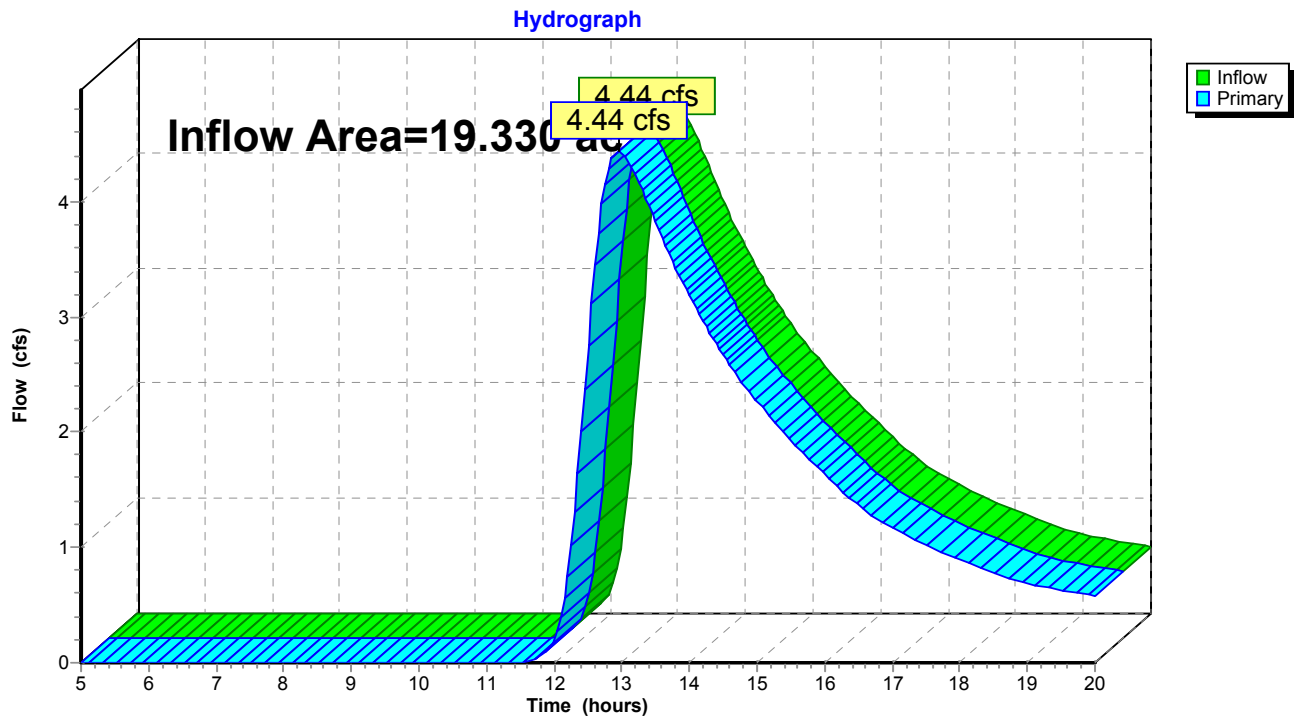
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5					Direct Entry, Direct Entry

**Subcatchment 2S: Existing West**

**Summary for Link 3L: Point of Analysis 1**

Inflow Area = 19.330 ac, 4.45% Impervious, Inflow Depth > 0.76" for 2 Year Storm event  
Inflow = 4.44 cfs @ 12.96 hrs, Volume= 1.229 af  
Primary = 4.44 cfs @ 12.96 hrs, Volume= 1.229 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

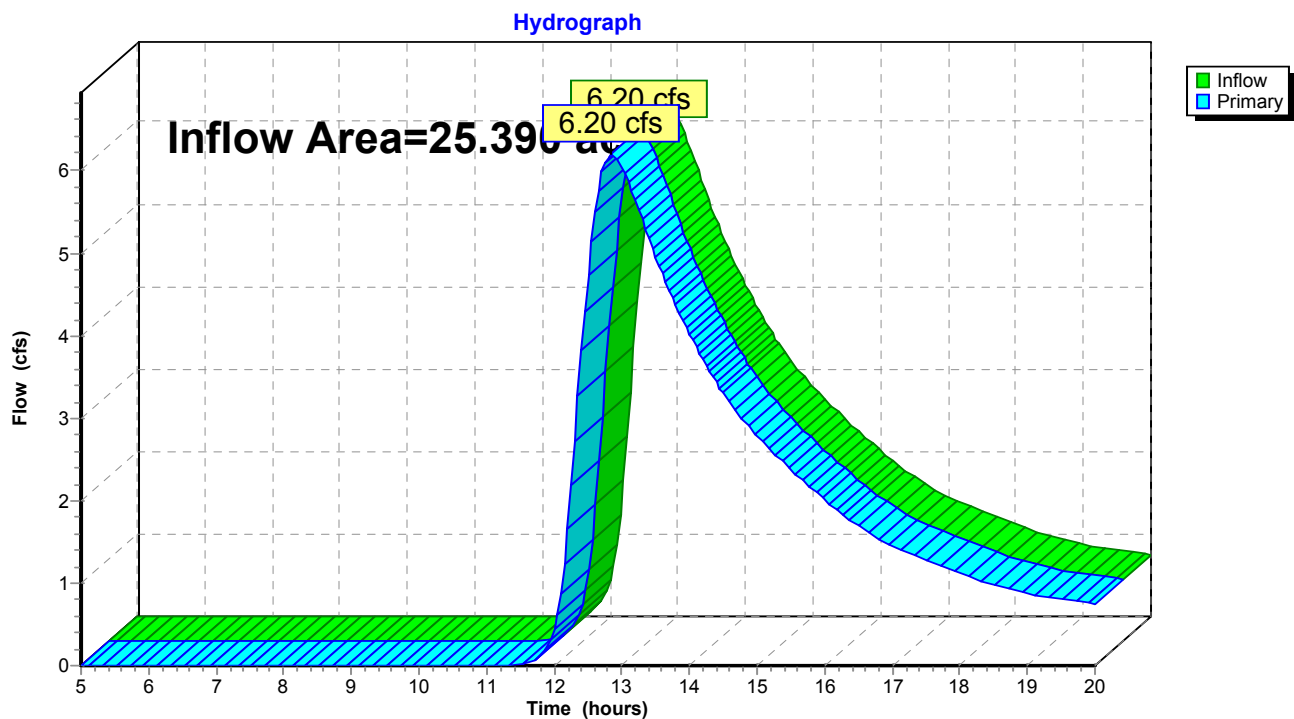
**Link 3L: Point of Analysis 1**

**Summary for Link 5L: Point of Analysis 2**

The full site should be modelled with a Reach for Edge's Brook. POA 1 would be routed to Edge's Brook; Edge's Brook would be routed to POA 2. This would result in smaller peak flows in the existing condition. However, since an accurate representation for Edge's Brook was not available, this link has been removed. The resulting peak flows are conservative.

Inflow Area = 25.390 ac, 3.39% Impervious, Inflow Depth > 0.77" for 2 Year Storm event  
Inflow = 6.20 cfs @ 12.85 hrs, Volume= 1.625 af  
Primary = 6.20 cfs @ 12.85 hrs, Volume= 1.625 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Link 5L: Point of Analysis 2**

**Waterview Center Existing Phases 1 and 2***Type III 24-hr 10 Year Storm Rainfall=5.00"*

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 9

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=Delmarva

Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

**Subcatchment 1S: Existing East**

Runoff Area=19.330 ac 4.45% Impervious Runoff Depth&gt;1.80"

Tc=57.2 min CN=70 Runoff=11.34 cfs 2.900 af

**Subcatchment 2S: Existing West**

Runoff Area=6.060 ac 0.00% Impervious Runoff Depth&gt;1.84"

Tc=31.5 min CN=70 Runoff=5.18 cfs 0.929 af

**Link 3L: Point of Analysis 1**

Inflow=11.34 cfs 2.900 af

Primary=11.34 cfs 2.900 af

**Link 5L: Point of Analysis 2**

Inflow=15.77 cfs 3.828 af

Primary=15.77 cfs 3.828 af

**Total Runoff Area = 25.390 ac   Runoff Volume = 3.828 af   Average Runoff Depth = 1.81"**  
**96.61% Pervious = 24.530 ac   3.39% Impervious = 0.860 ac**

### Summary for Subcatchment 1S: Existing East

Grassy areas revised to Meadow from Pasture.

Land cover is revised to reflect 0.23 acres in Woods

Runoff = 11.34 cfs @ 12.87 hrs, Volume= 2.900 af, Depth> 1.80"

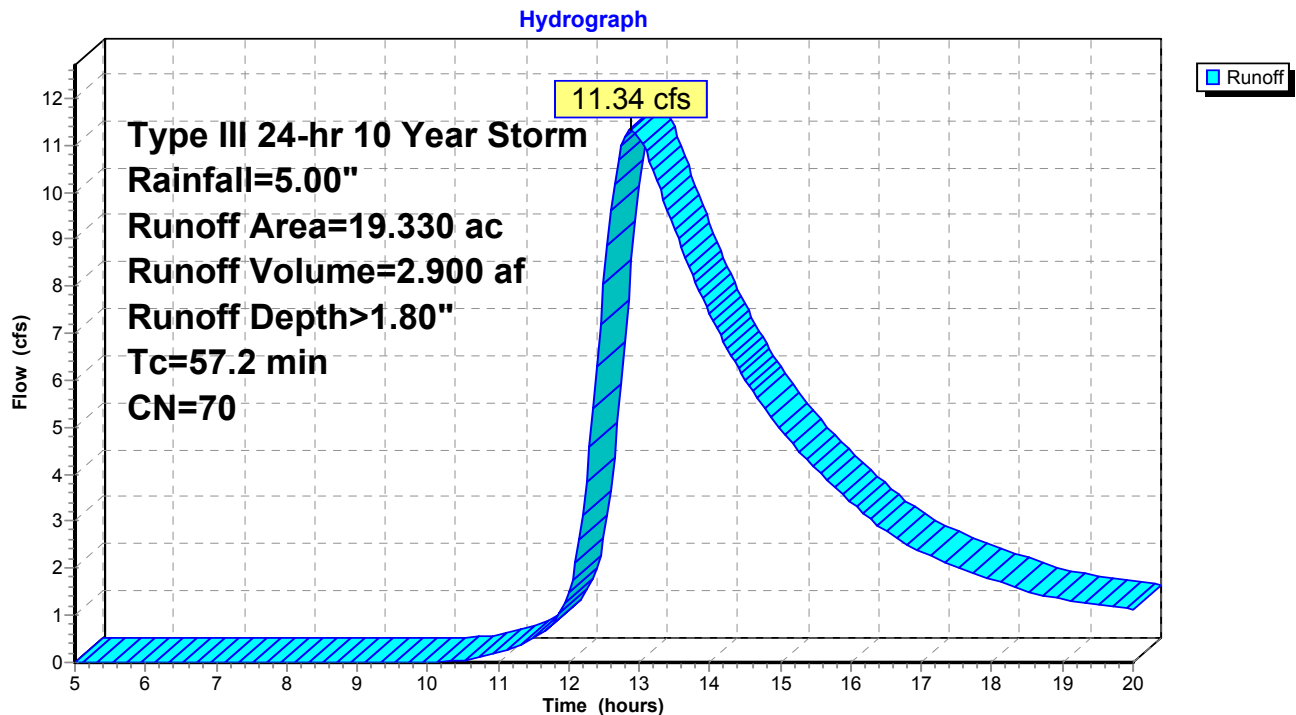
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
* 2.870	58	HSG B Meadow
* 15.370	71	HSG C Meadow
* 0.230	70	HSG C Woods
* 0.860	98	Impervious
19.330	70	Weighted Average
18.470		95.55% Pervious Area
0.860		4.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2					Direct Entry, CN East

### Subcatchment 1S: Existing East



### Summary for Subcatchment 2S: Existing West

Grassy areas revised to Meadow from Pasture.

Revised to reflect HSG B soils; soil maps indicate 0.8 acres; 0.4 acres input to be conservative.

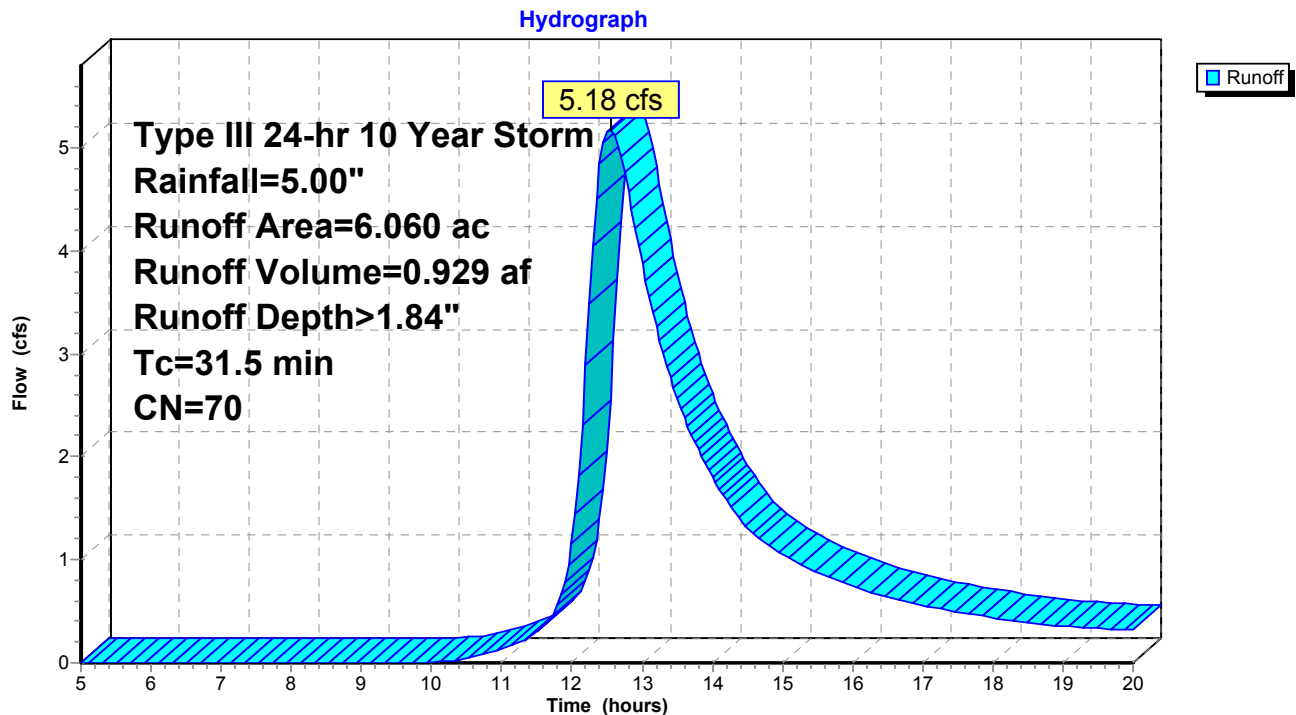
Runoff = 5.18 cfs @ 12.55 hrs, Volume= 0.929 af, Depth> 1.84"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 Year Storm Rainfall=5.00"

Area (ac)	CN	Description
* 5.660	71	HSG C Meadow
* 0.400	58	HSG B Meadow
6.060	70	Weighted Average
6.060		100.00% Pervious Area

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

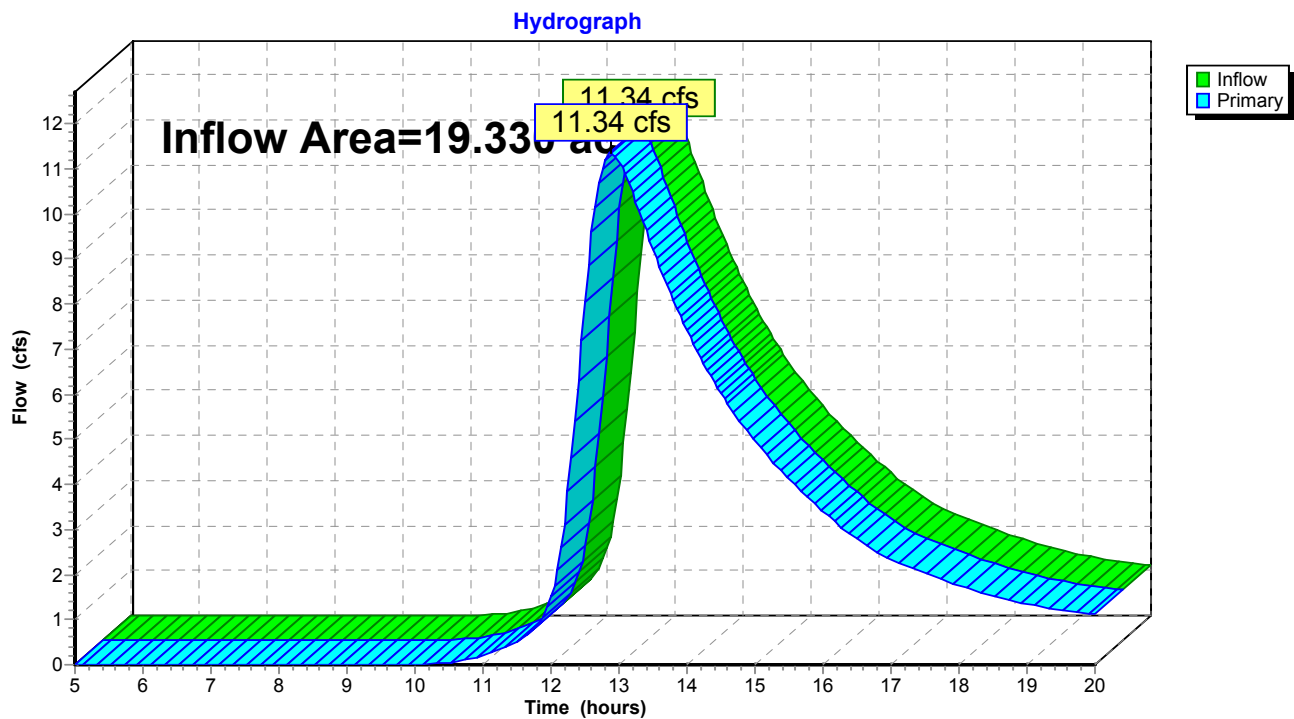
### Subcatchment 2S: Existing West



**Summary for Link 3L: Point of Analysis 1**

Inflow Area = 19.330 ac, 4.45% Impervious, Inflow Depth > 1.80" for 10 Year Storm event  
Inflow = 11.34 cfs @ 12.87 hrs, Volume= 2.900 af  
Primary = 11.34 cfs @ 12.87 hrs, Volume= 2.900 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Link 3L: Point of Analysis 1**

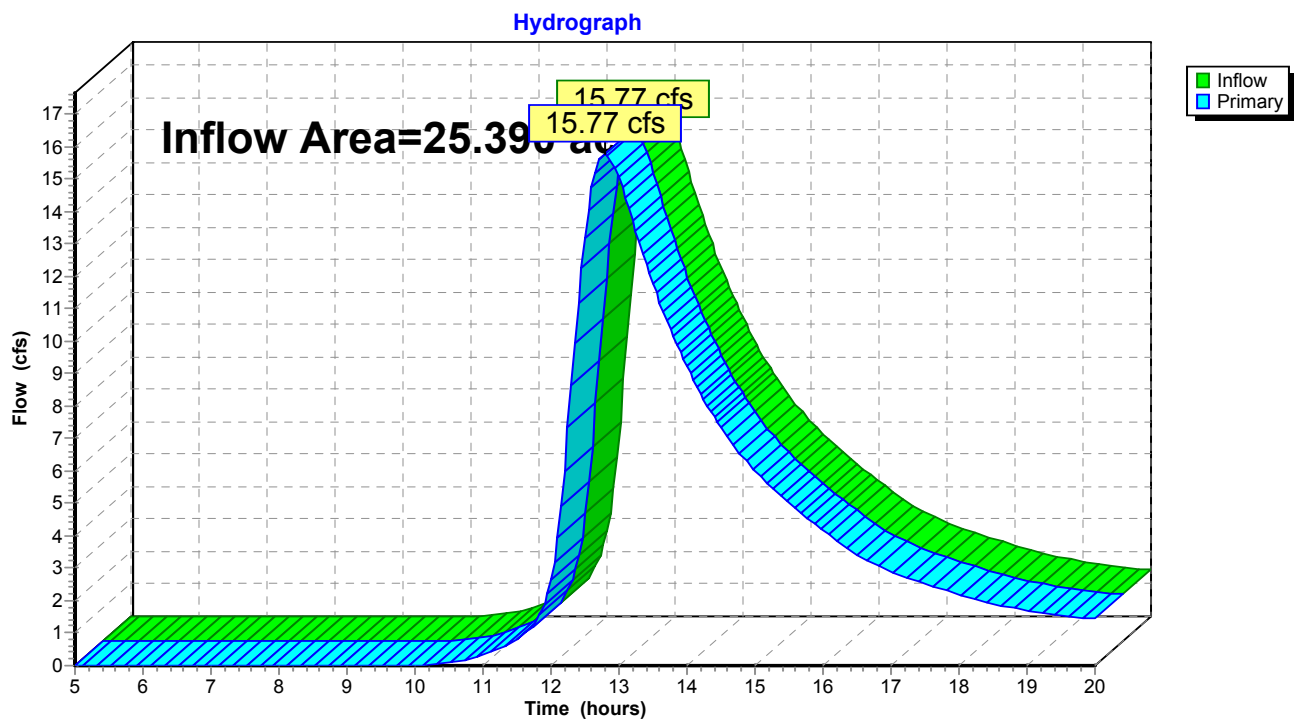


**Summary for Link 5L: Point of Analysis 2**

The full site should be modelled with a Reach for Edge's Brook. POA 1 would be routed to Edge's Brook; Edge's Brook would be routed to POA 2. This would result in smaller peak flows in the existing condition. However, since an accurate representation for Edge's Brook was not available, this link has been removed. The resulting peak flows are conservative.

Inflow Area = 25.390 ac, 3.39% Impervious, Inflow Depth > 1.81" for 10 Year Storm event  
Inflow = 15.77 cfs @ 12.79 hrs, Volume= 3.828 af  
Primary = 15.77 cfs @ 12.79 hrs, Volume= 3.828 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Link 5L: Point of Analysis 2**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=Delmarva  
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

**Subcatchment 1S: Existing East**    Runoff Area=19.330 ac   4.45% Impervious   Runoff Depth>4.26"  
Tc=57.2 min   CN=70   Runoff=27.58 cfs   6.865 af

**Subcatchment 2S: Existing West**    Runoff Area=6.060 ac   0.00% Impervious   Runoff Depth>4.34"  
Tc=31.5 min   CN=70   Runoff=12.45 cfs   2.191 af

**Link 3L: Point of Analysis 1**    Inflow=27.58 cfs   6.865 af  
Primary=27.58 cfs   6.865 af

**Link 5L: Point of Analysis 2**    Inflow=38.25 cfs   9.056 af  
Primary=38.25 cfs   9.056 af

**Total Runoff Area = 25.390 ac   Runoff Volume = 9.056 af   Average Runoff Depth = 4.28"**  
**96.61% Pervious = 24.530 ac   3.39% Impervious = 0.860 ac**

### Summary for Subcatchment 1S: Existing East

Grassy areas revised to Meadow from Pasture.  
 Land cover is revised to reflect 0.23 acres in Woods

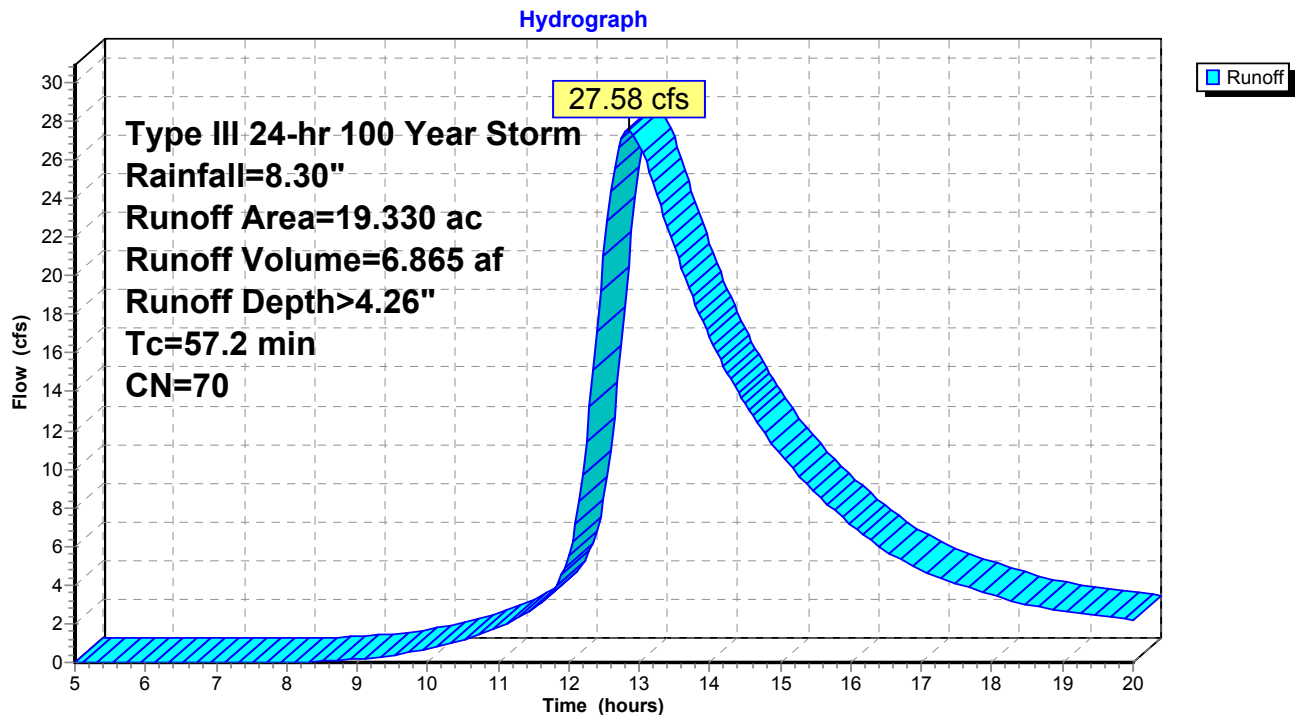
Runoff = 27.58 cfs @ 12.85 hrs, Volume= 6.865 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 Year Storm Rainfall=8.30"

Area (ac)	CN	Description
* 2.870	58	HSG B Meadow
* 15.370	71	HSG C Meadow
* 0.230	70	HSG C Woods
* 0.860	98	Impervious
19.330	70	Weighted Average
18.470		95.55% Pervious Area
0.860		4.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2					Direct Entry, CN East

### Subcatchment 1S: Existing East



### Summary for Subcatchment 2S: Existing West

Grassy areas revised to Meadow from Pasture.  
 Revised to reflect HSG B soils; soil maps indicate 0.8 acres; 0.4 acres input to be conservative.

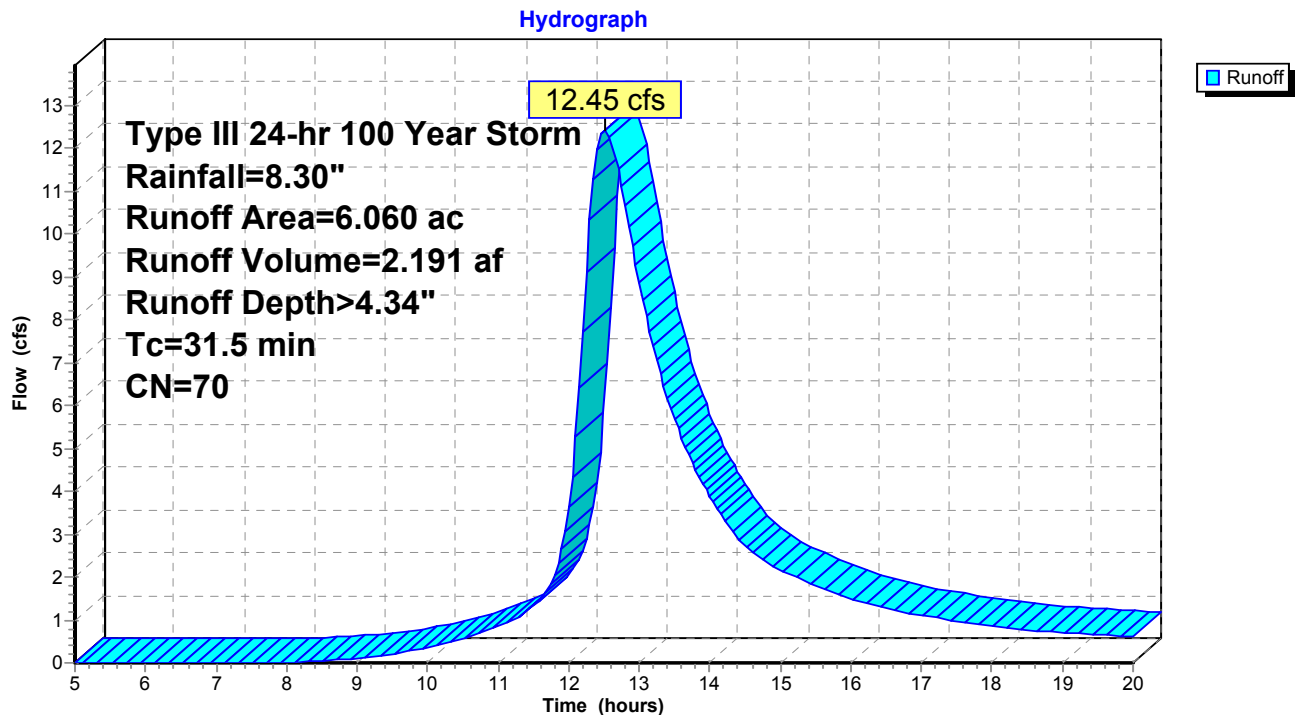
Runoff = 12.45 cfs @ 12.51 hrs, Volume= 2.191 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 Year Storm Rainfall=8.30"

Area (ac)	CN	Description
* 5.660	71	HSG C Meadow
* 0.400	58	HSG B Meadow
6.060	70	Weighted Average
6.060		100.00% Pervious Area

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

### Subcatchment 2S: Existing West

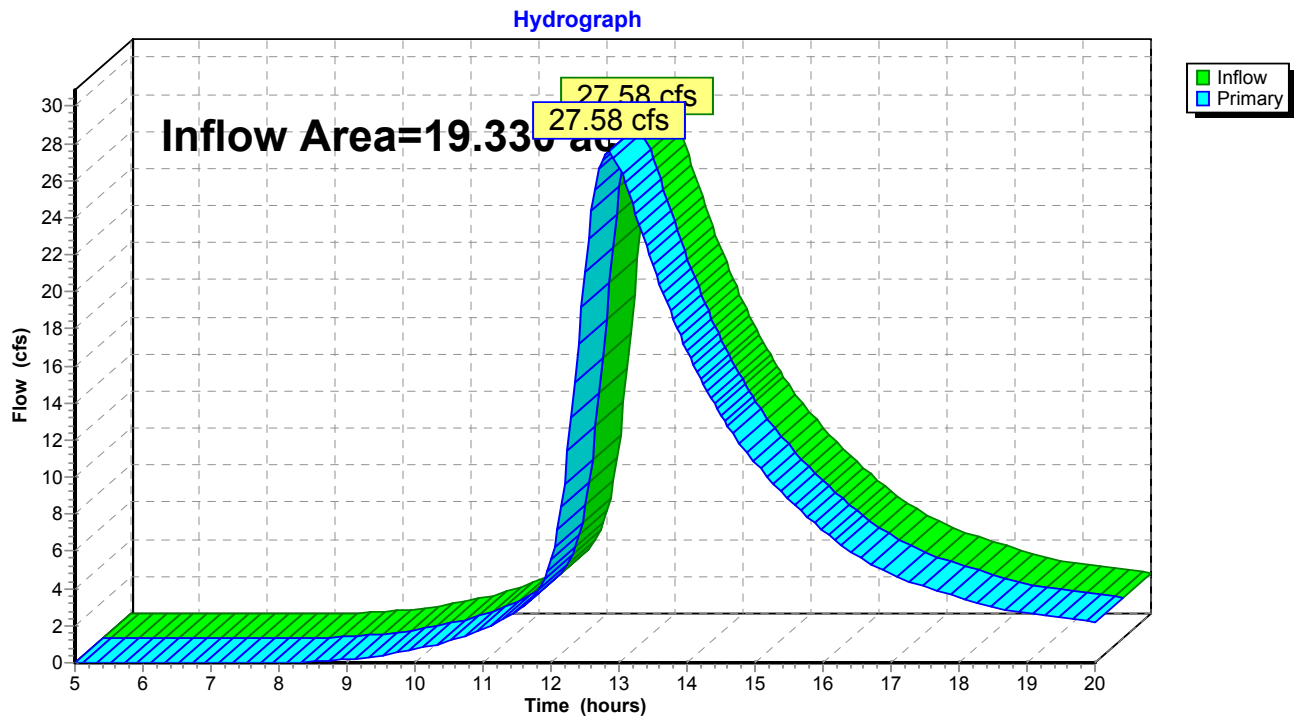


### Summary for Link 3L: Point of Analysis 1

Inflow Area =    19.330 ac,    4.45% Impervious,    Inflow Depth > 4.26"    for 100 Year Storm event  
Inflow        =    27.58 cfs @ 12.85 hrs,    Volume=            6.865 af  
Primary       =    27.58 cfs @ 12.85 hrs,    Volume=            6.865 af,    Atten= 0%,    Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Link 3L: Point of Analysis 1



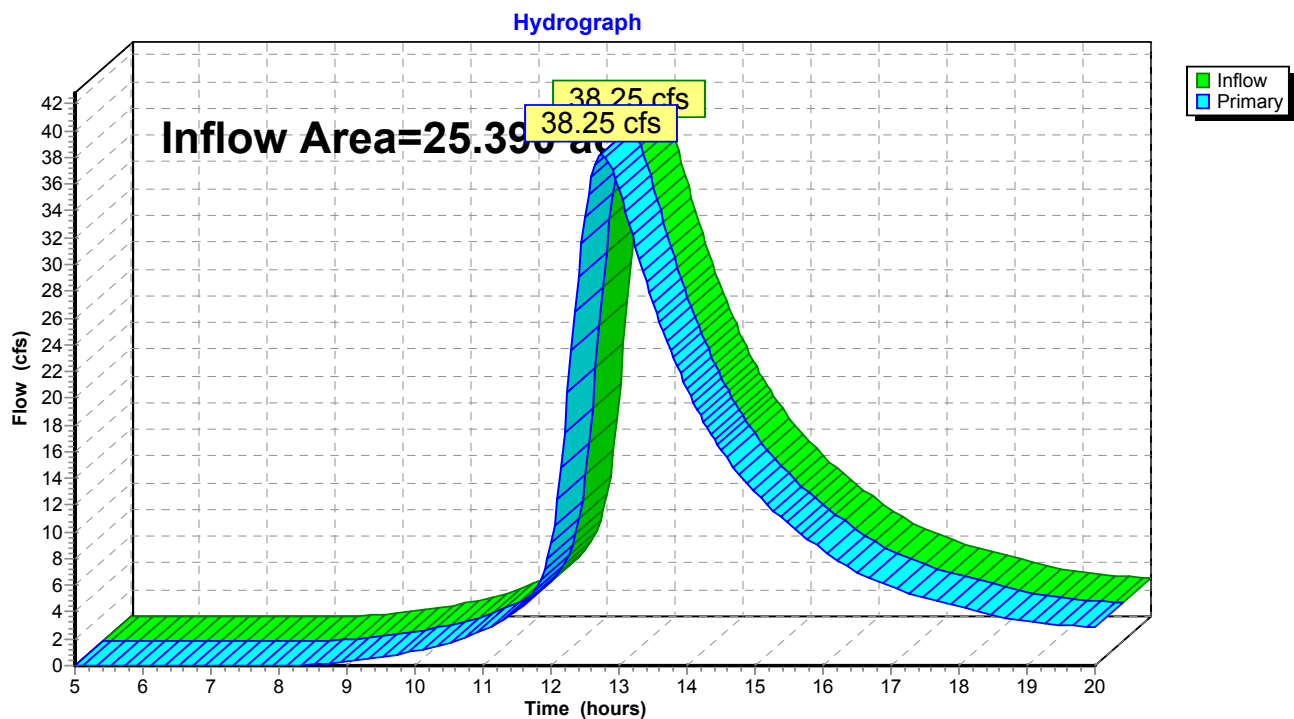
### Summary for Link 5L: Point of Analysis 2

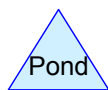
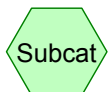
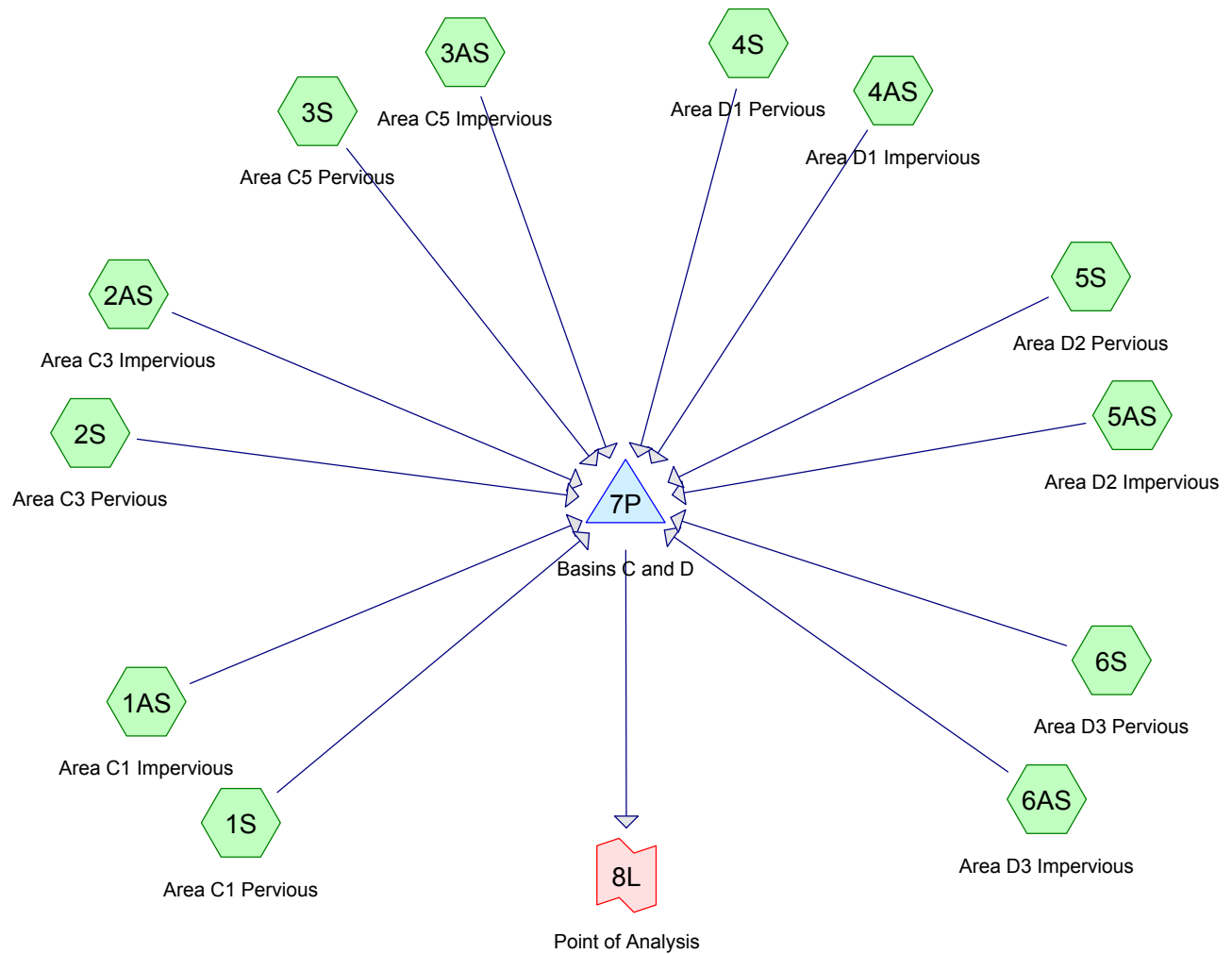
The full site should be modelled with a Reach for Edge's Brook. POA 1 would be routed to Edge's Brook; Edge's Brook would be routed to POA 2. This would result in smaller peak flows in the existing condition. However, since an accurate representation for Edge's Brook was not available, this link has been removed. The resulting peak flows are conservative.

Inflow Area = 25.390 ac, 3.39% Impervious, Inflow Depth > 4.28" for 100 Year Storm event  
 Inflow = 38.25 cfs @ 12.74 hrs, Volume= 9.056 af  
 Primary = 38.25 cfs @ 12.74 hrs, Volume= 9.056 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Link 5L: Point of Analysis 2





**Drainage Diagram for Waterview Center Proposed Phases 1 and 2**  
 Prepared by Emerald Environmental Solutions, Printed 12/18/2009  
 HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

## Waterview Center Proposed Phases 1 and 2

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 2

### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.220	70	Woods HSG C (1S)
0.900	79	Open Space HSG B (1S, 4S)
6.320	86	Open Space HSG C (1S, 2S, 3S, 5S, 6S)
17.940	98	Impervious (1AS, 2AS, 3AS, 4AS, 5AS, 6AS)
<b>25.380</b>		<b>TOTAL AREA</b>



## Waterview Center Proposed Phases 1 and 2

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 3

### Notes Listing (all nodes)

Line#	Node Number	Notes
1	1S	Curve number revised to reflect .22 acres of Woods rather than Open Space
2	4S	Open Space appears to be located in HSG C soils. Assume HSG B soils to be conservative.
3	7P	The available storage in the basins was derived from the Pond Report submitted by the developer.
4		The outlet structure data was derived from the developer's stormwater report.

**Waterview Center Proposed Phases 1 and 2***Type III 24-hr 2 year storm Rainfall=3.30"*

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 4

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=Delmarva

Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

**Subcatchment 1AS: Area C1 Impervious**    Runoff Area=4.120 ac    100.00% Impervious    Runoff Depth>2.92"  
Tc=10.0 min    CN=98    Runoff=8.81 cfs    1.001 af

**Subcatchment 1S: Area C1 Pervious**    Runoff Area=4.120 ac    0.00% Impervious    Runoff Depth>1.64"  
Tc=10.0 min    CN=84    Runoff=5.54 cfs    0.563 af

**Subcatchment 2AS: Area C3 Impervious**    Runoff Area=3.300 ac    100.00% Impervious    Runoff Depth>2.92"  
Tc=10.0 min    CN=98    Runoff=7.06 cfs    0.802 af

**Subcatchment 2S: Area C3 Pervious**    Runoff Area=0.600 ac    0.00% Impervious    Runoff Depth>1.79"  
Tc=10.0 min    CN=86    Runoff=0.88 cfs    0.089 af

**Subcatchment 3AS: Area C5 Impervious**    Runoff Area=5.730 ac    100.00% Impervious    Runoff Depth>2.92"  
Tc=10.0 min    CN=98    Runoff=12.25 cfs    1.392 af

**Subcatchment 3S: Area C5 Pervious**    Runoff Area=1.450 ac    0.00% Impervious    Runoff Depth>1.79"  
Tc=10.0 min    CN=86    Runoff=2.13 cfs    0.216 af

**Subcatchment 4AS: Area D1 Impervious**    Runoff Area=1.250 ac    100.00% Impervious    Runoff Depth>2.92"  
Tc=10.0 min    CN=98    Runoff=2.67 cfs    0.304 af

**Subcatchment 4S: Area D1 Pervious**    Runoff Area=0.260 ac    0.00% Impervious    Runoff Depth>1.30"  
Tc=10.0 min    CN=79    Runoff=0.27 cfs    0.028 af

**Subcatchment 5AS: Area D2 Impervious**    Runoff Area=2.120 ac    100.00% Impervious    Runoff Depth>2.92"  
Tc=10.0 min    CN=98    Runoff=4.53 cfs    0.515 af

**Subcatchment 5S: Area D2 Pervious**    Runoff Area=0.610 ac    0.00% Impervious    Runoff Depth>1.79"  
Tc=10.0 min    CN=86    Runoff=0.90 cfs    0.091 af

**Subcatchment 6AS: Area D3 Impervious**    Runoff Area=1.420 ac    100.00% Impervious    Runoff Depth>2.92"  
Tc=10.0 min    CN=98    Runoff=3.04 cfs    0.345 af

**Subcatchment 6S: Area D3 Pervious**    Runoff Area=0.400 ac    0.00% Impervious    Runoff Depth>1.79"  
Tc=10.0 min    CN=86    Runoff=0.59 cfs    0.060 af

**Pond 7P: Basins C and D**    Peak Elev=50.22'    Storage=169,392 cf    Inflow=48.65 cfs    5.406 af  
Outflow=3.92 cfs    2.028 af

**Link 8L: Point of Analysis**    Inflow=3.92 cfs    2.028 af  
Primary=3.92 cfs    2.028 af

**Total Runoff Area = 25.380 ac    Runoff Volume = 5.406 af    Average Runoff Depth = 2.56"**  
**29.31% Pervious = 7.440 ac    70.69% Impervious = 17.940 ac**

## Waterview Center Proposed Phases 1 and 2

Type III 24-hr 2 year storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 5

### Summary for Subcatchment 1AS: Area C1 Impervious

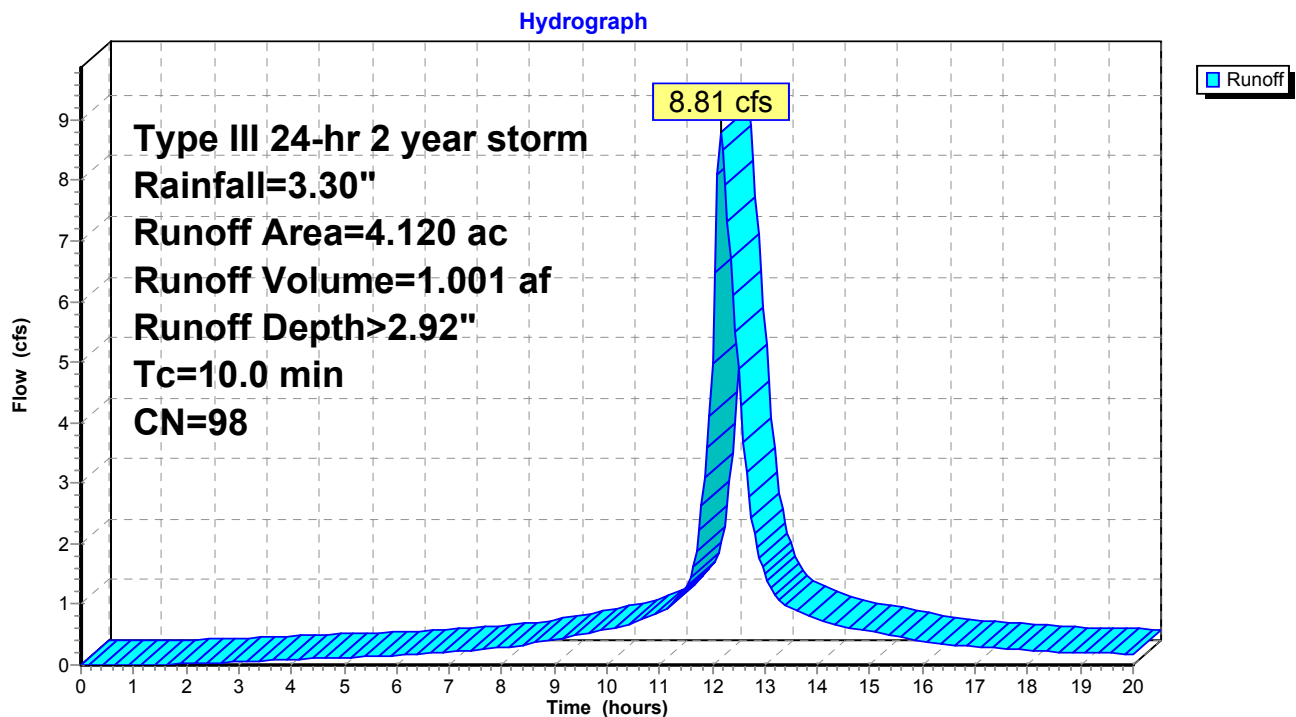
Runoff = 8.81 cfs @ 12.16 hrs, Volume= 1.001 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 4.120	98	Impervious
4.120		100.00% Impervious Area

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

### Subcatchment 1AS: Area C1 Impervious



**Waterview Center Proposed Phases 1 and 2**

Type III 24-hr 2 year storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 6

**Summary for Subcatchment 1S: Area C1 Pervious**

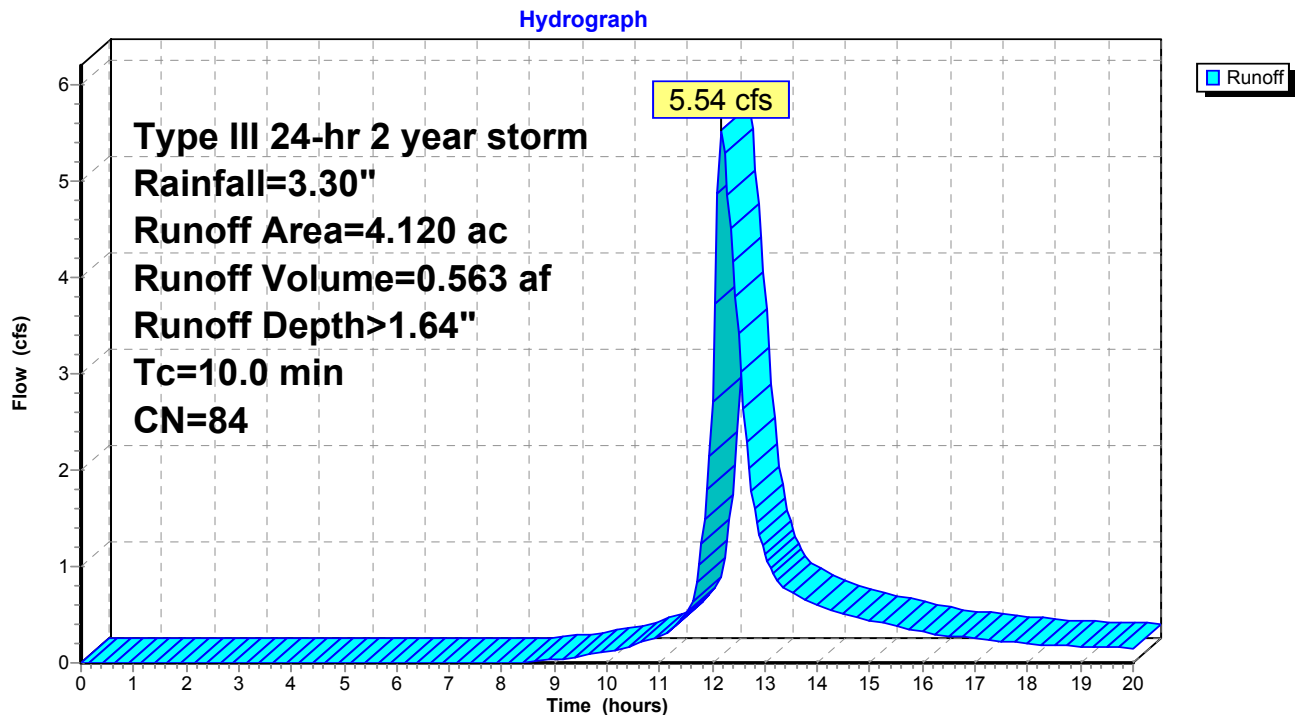
Curve number revised to reflect .22 acres of Woods rather than Open Space

Runoff = 5.54 cfs @ 12.17 hrs, Volume= 0.563 af, Depth&gt; 1.64"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 0.640	79	Open Space HSG B
* 3.260	86	Open Space HSG C
* 0.220	70	Woods HSG C
4.120	84	Weighted Average
4.120		100.00% Pervious Area

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

**Subcatchment 1S: Area C1 Pervious**

## Waterview Center Proposed Phases 1 and 2

Type III 24-hr 2 year storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 7

### Summary for Subcatchment 2AS: Area C3 Impervious

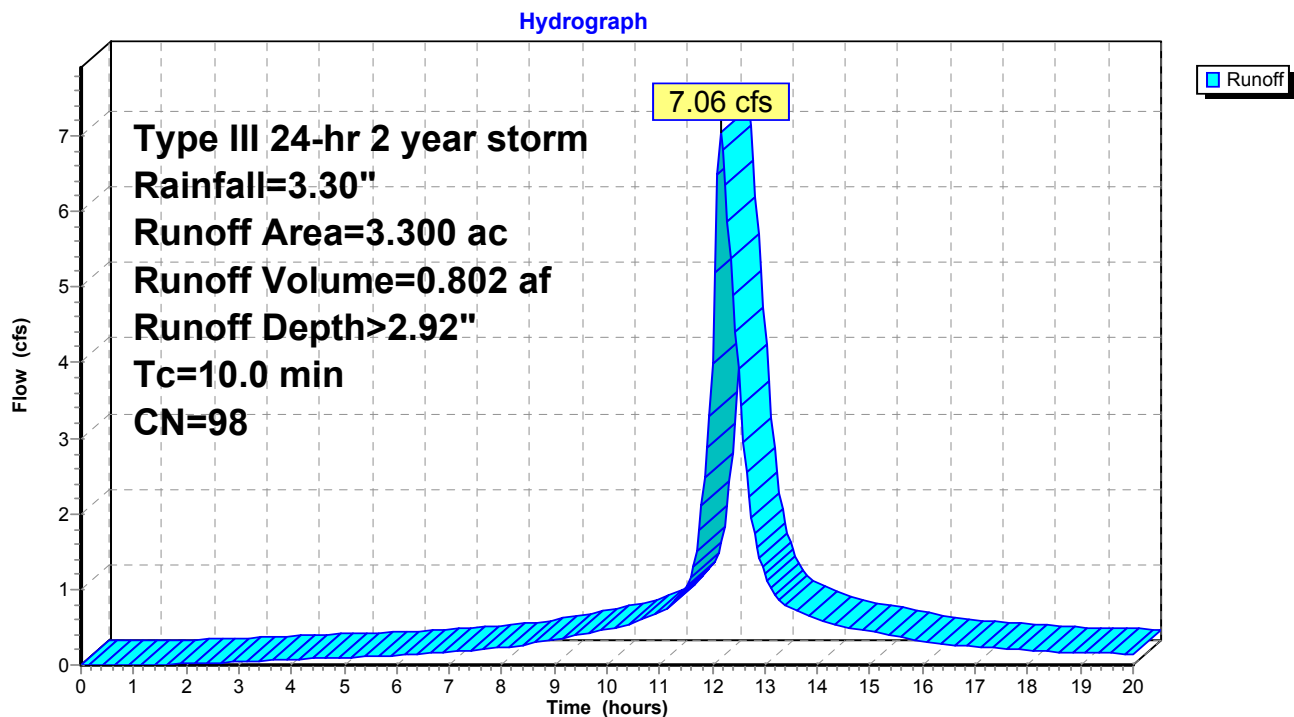
Runoff = 7.06 cfs @ 12.16 hrs, Volume= 0.802 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 3.300	98	Impervious
3.300		100.00% Impervious Area

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

### Subcatchment 2AS: Area C3 Impervious



**Summary for Subcatchment 2S: Area C3 Pervious**

Runoff = 0.88 cfs @ 12.17 hrs, Volume= 0.089 af, Depth&gt; 1.79"

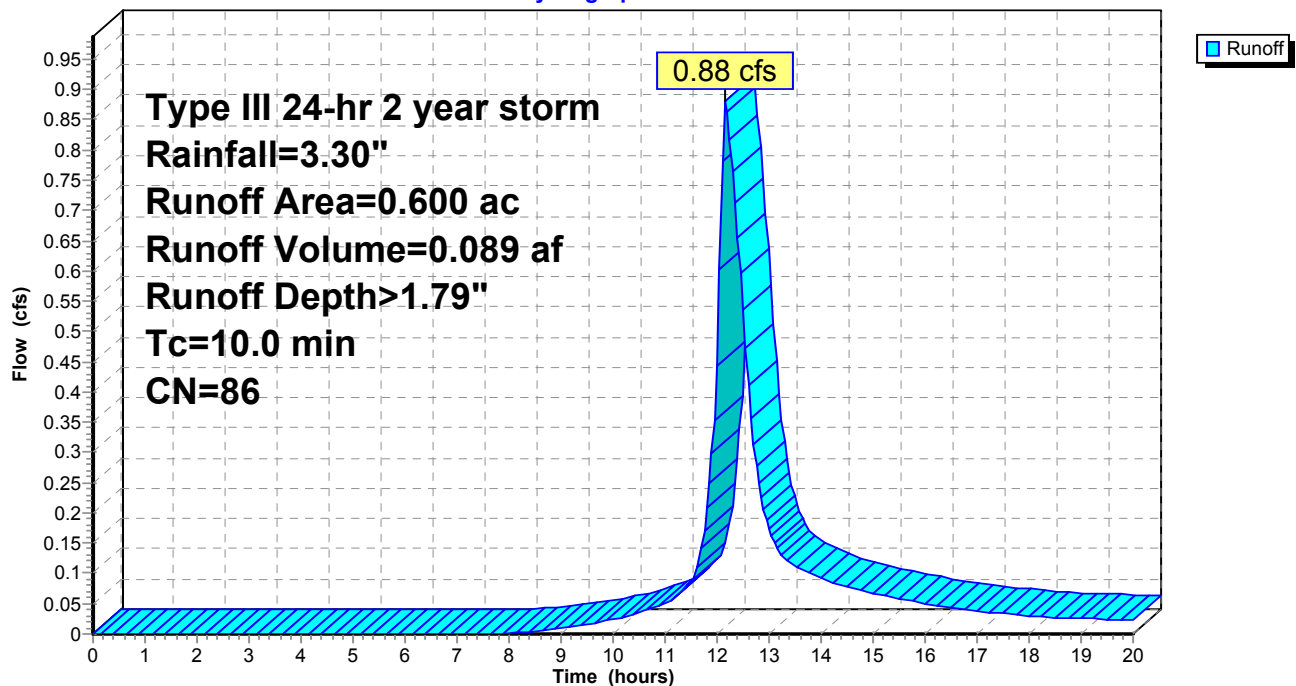
 Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 0.600	86	Open Space HSG C
0.600		100.00% Pervious Area

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

**Subcatchment 2S: Area C3 Pervious**

Hydrograph



**Waterview Center Proposed Phases 1 and 2**

Type III 24-hr 2 year storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 9

**Summary for Subcatchment 3AS: Area C5 Impervious**

Runoff = 12.25 cfs @ 12.16 hrs, Volume= 1.392 af, Depth&gt; 2.92"

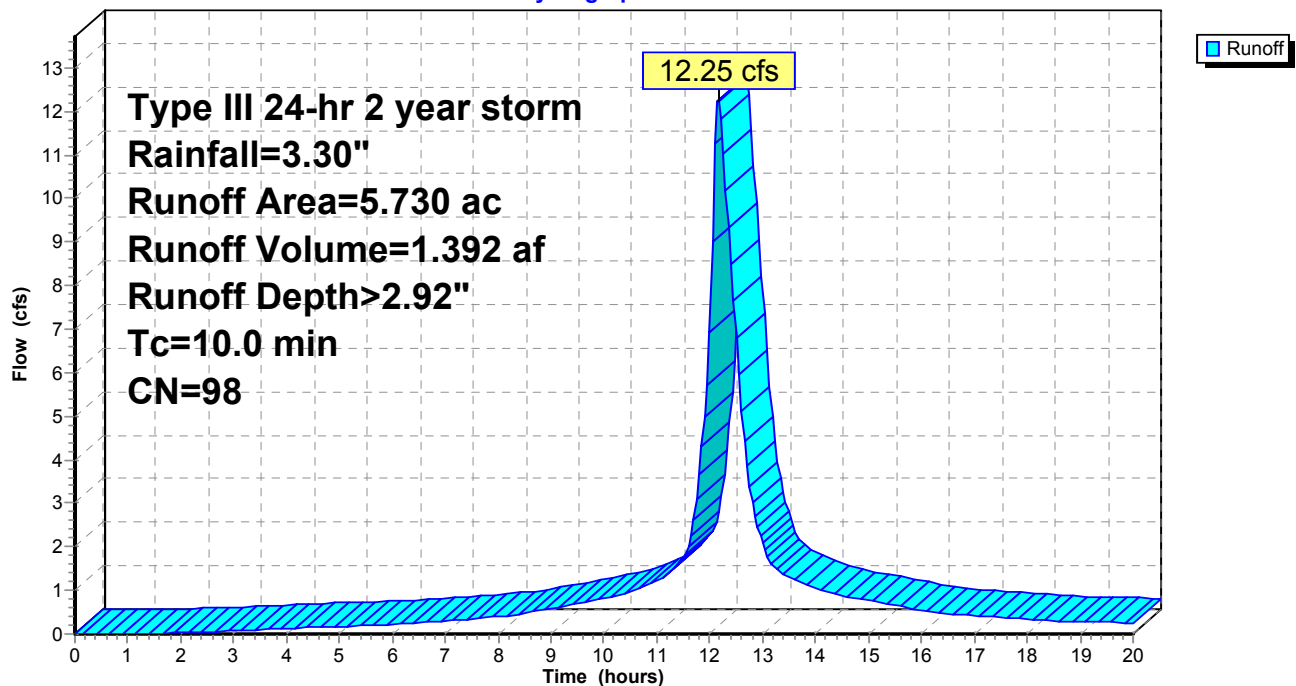
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 5.730	98	Impervious
5.730		100.00% Impervious Area

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

**Subcatchment 3AS: Area C5 Impervious**

Hydrograph



# Waterview Center Proposed Phases 1 and 2

Type III 24-hr 2 year storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 10

## Summary for Subcatchment 3S: Area C5 Pervious

Runoff = 2.13 cfs @ 12.17 hrs, Volume= 0.216 af, Depth> 1.79"

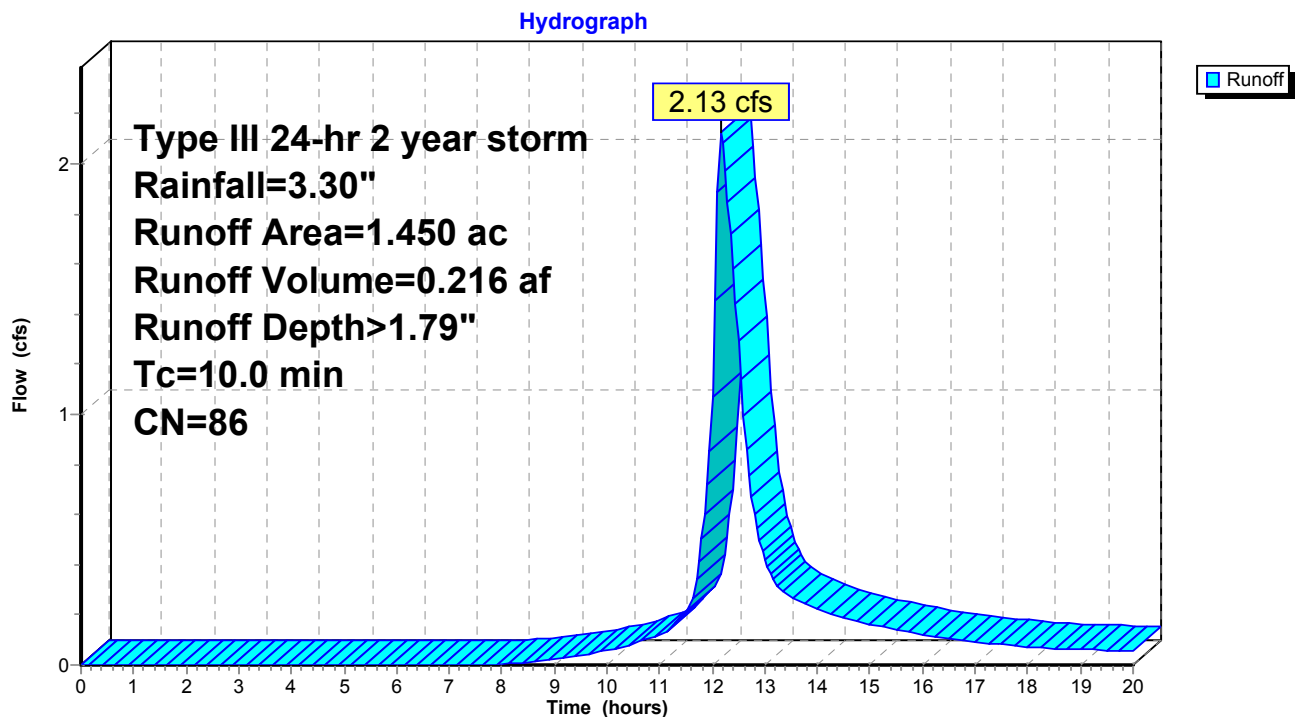
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 1.450	86	Open Space HSG C
1.450		100.00% Pervious Area

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

## Subcatchment 3S: Area C5 Pervious





# Waterview Center Proposed Phases 1 and 2

Type III 24-hr 2 year storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 11

## Summary for Subcatchment 4AS: Area D1 Impervious

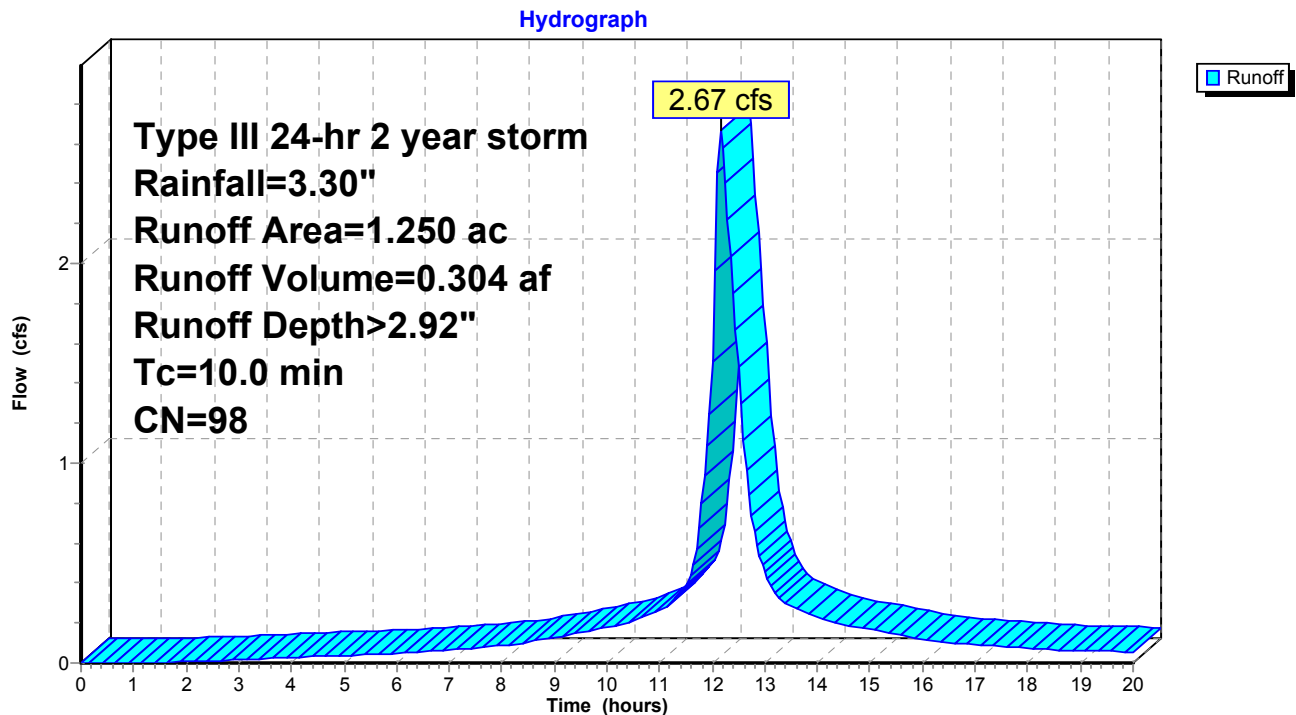
Runoff = 2.67 cfs @ 12.16 hrs, Volume= 0.304 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 1.250	98	Impervious
1.250		100.00% Impervious Area

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

## Subcatchment 4AS: Area D1 Impervious



### Summary for Subcatchment 4S: Area D1 Pervious

Open Space appears to be located in HSG C soils. Assume HSG B soils to be conservative.

Runoff = 0.27 cfs @ 12.18 hrs, Volume= 0.028 af, Depth> 1.30"

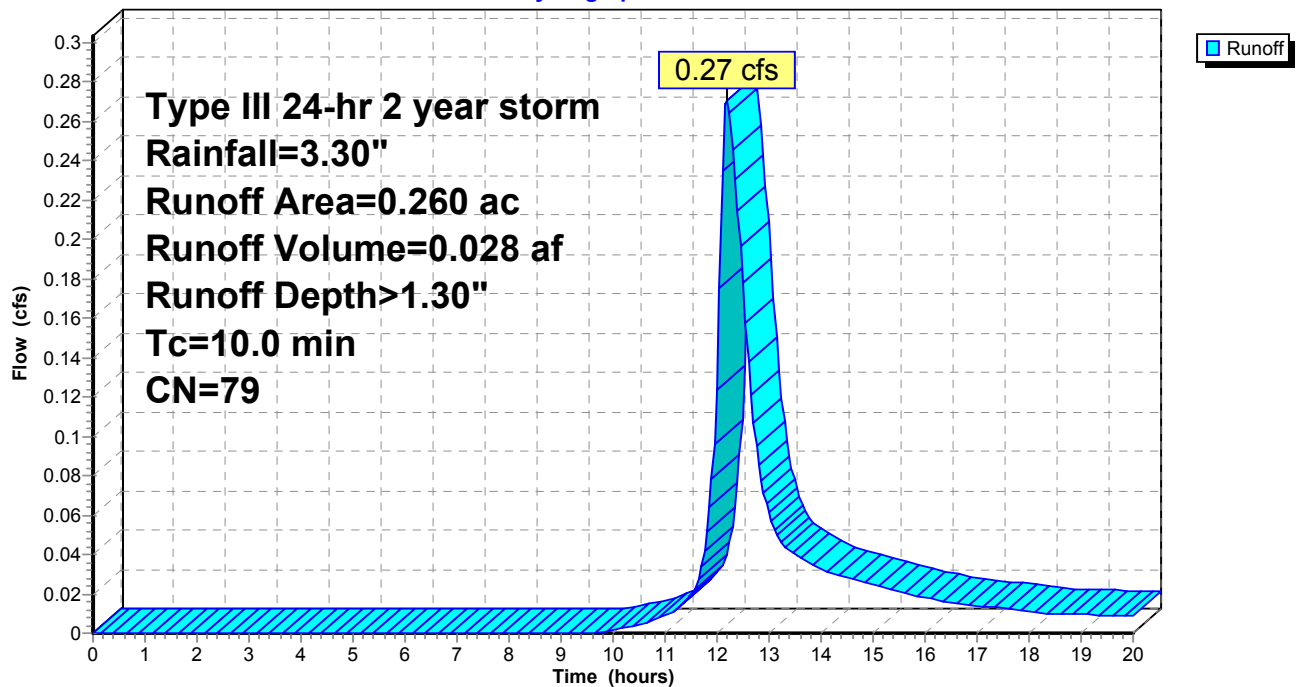
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 0.260	79	Open Space HSG B
0.260		100.00% Pervious Area

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

### Subcatchment 4S: Area D1 Pervious

Hydrograph



## Waterview Center Proposed Phases 1 and 2

Type III 24-hr 2 year storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 13

### Summary for Subcatchment 5AS: Area D2 Impervious

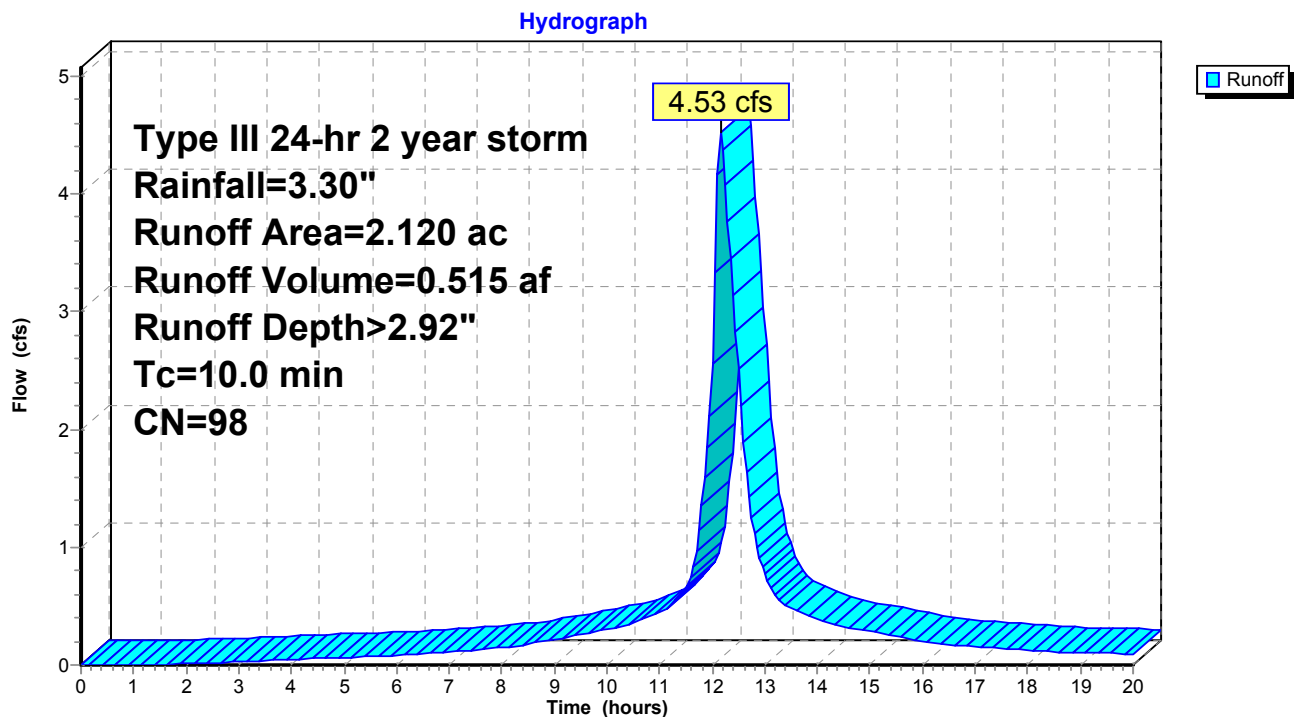
Runoff = 4.53 cfs @ 12.16 hrs, Volume= 0.515 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 2.120	98	Impervious
2.120		100.00% Impervious Area

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

### Subcatchment 5AS: Area D2 Impervious



**Waterview Center Proposed Phases 1 and 2**

Type III 24-hr 2 year storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 14

**Summary for Subcatchment 5S: Area D2 Pervious**

Runoff = 0.90 cfs @ 12.17 hrs, Volume= 0.091 af, Depth&gt; 1.79"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

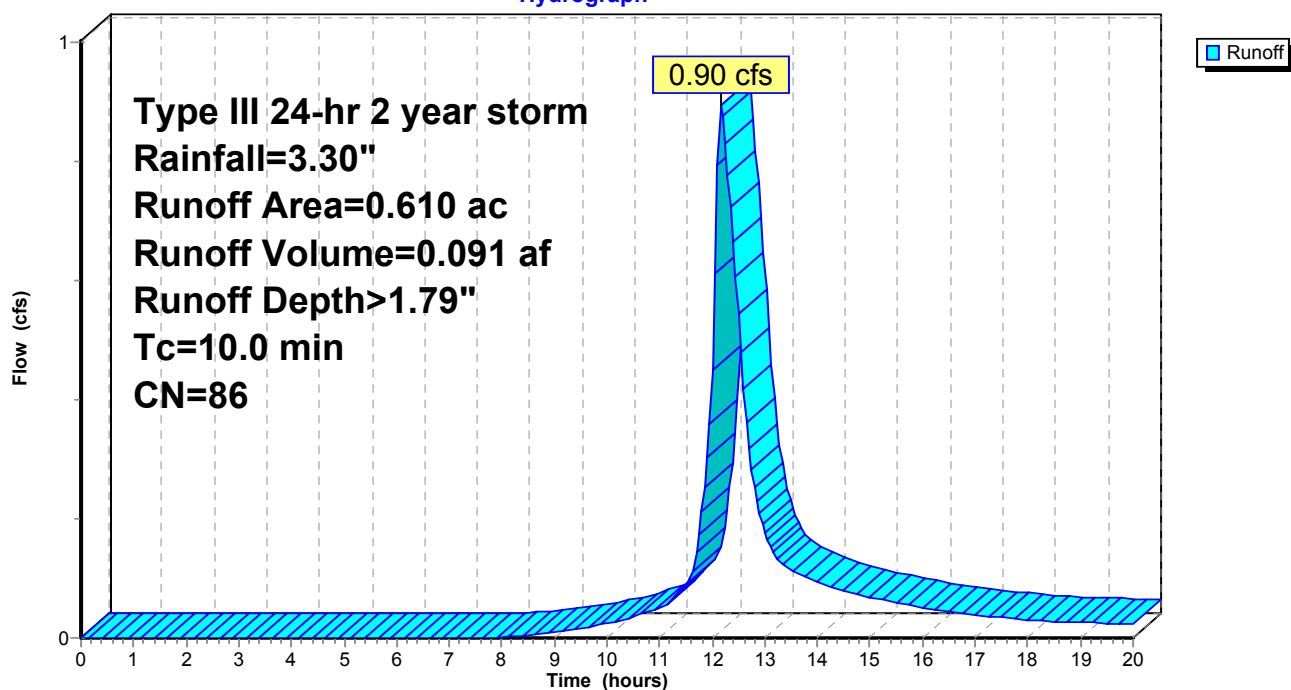
Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 0.610	86	Open Space HSG C
0.610		100.00% Pervious Area

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

**Subcatchment 5S: Area D2 Pervious**

Hydrograph



**Waterview Center Proposed Phases 1 and 2**

Type III 24-hr 2 year storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 15

**Summary for Subcatchment 6AS: Area D3 Impervious**

Runoff = 3.04 cfs @ 12.16 hrs, Volume= 0.345 af, Depth&gt; 2.92"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

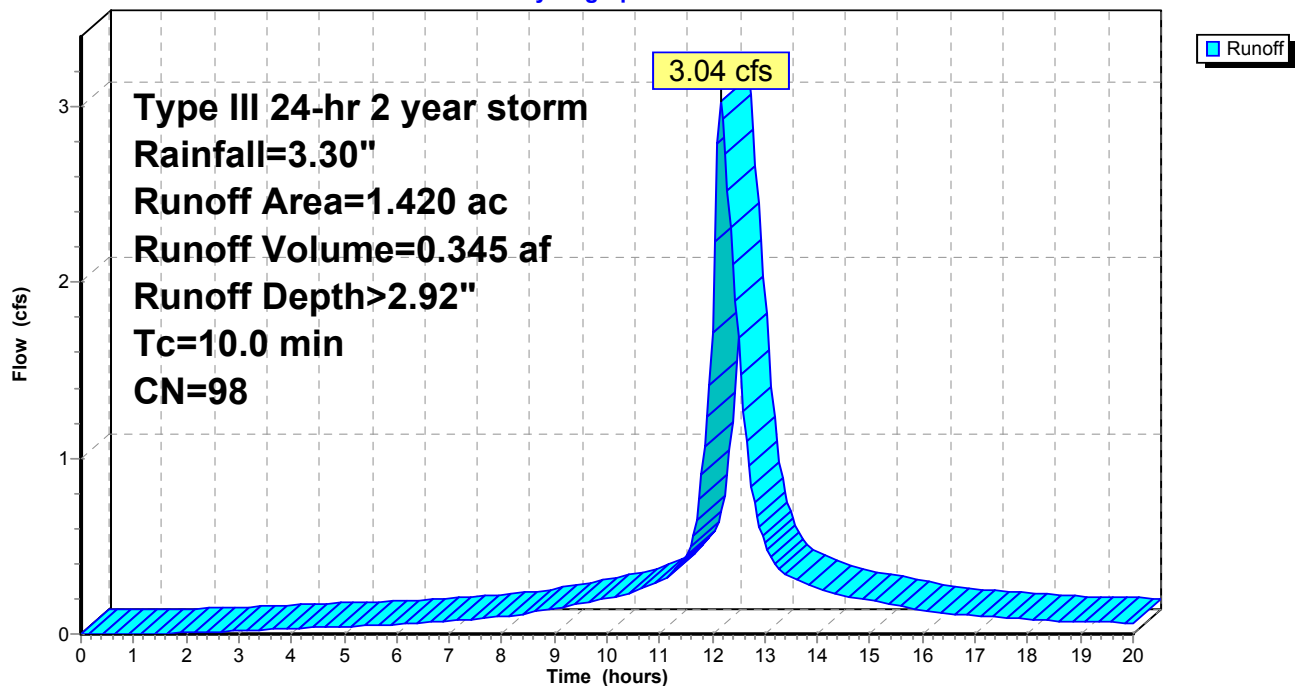
Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 1.420	98	Impervious
1.420		100.00% Impervious Area

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

**Subcatchment 6AS: Area D3 Impervious**

Hydrograph



## Waterview Center Proposed Phases 1 and 2

Type III 24-hr 2 year storm Rainfall=3.30"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 16

### Summary for Subcatchment 6S: Area D3 Pervious

Runoff = 0.59 cfs @ 12.17 hrs, Volume= 0.060 af, Depth> 1.79"

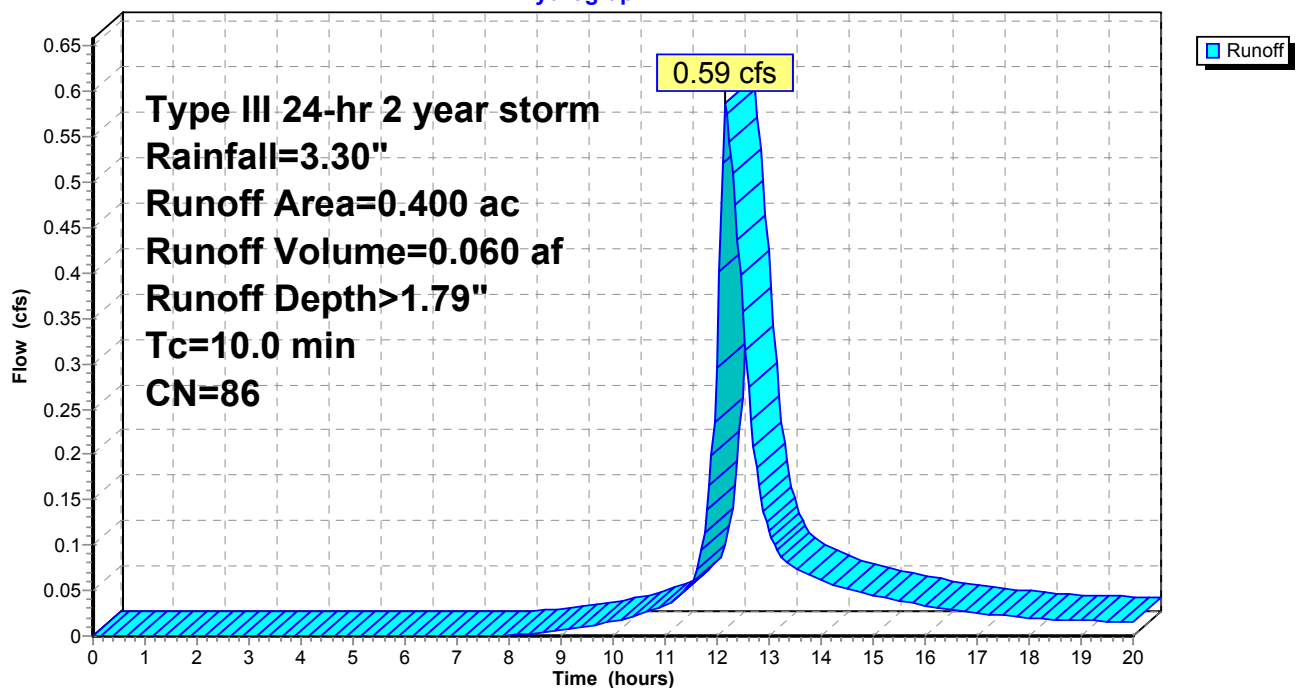
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2 year storm Rainfall=3.30"

Area (ac)	CN	Description
* 0.400	86	Open Space HSG C
0.400		100.00% Pervious Area

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

### Subcatchment 6S: Area D3 Pervious

Hydrograph



### Summary for Pond 7P: Basins C and D

The available storage in the basins was derived from the Pond Report submitted by the developer.  
The outlet structure data was derived from the developer's stormwater report.

Inflow Area = 25.380 ac, 70.69% Impervious, Inflow Depth > 2.56" for 2 year storm event  
 Inflow = 48.65 cfs @ 12.16 hrs, Volume= 5.406 af  
 Outflow = 3.92 cfs @ 14.29 hrs, Volume= 2.028 af, Atten= 92%, Lag= 127.4 min  
 Primary = 3.92 cfs @ 14.29 hrs, Volume= 2.028 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 50.22' @ 14.29 hrs Surf.Area= 0 sf Storage= 169,392 cf

Plug-Flow detention time= 324.1 min calculated for 2.023 af (37% of inflow)  
 Center-of-Mass det. time= 198.0 min ( 946.7 - 748.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	49.20'	510,366 cf	<b>Custom Stage Data</b> Listed below

Elevation (feet)	Cum.Store (cubic-feet)
49.20	0
50.00	132,098
50.20	166,073
50.30	183,793
51.00	314,791
52.00	510,366

Device	Routing	Invert	Outlet Devices
#1	Primary	42.07'	<b>48.0" Round Culvert</b> L= 63.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 42.00' S= 0.0011 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	49.20'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	49.92'	<b>3.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	51.26'	<b>16.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#5	Primary	42.90'	<b>30.0" Round Culvert</b> L= 112.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 42.00' S= 0.0080 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#6	Device 5	49.20'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#7	Device 5	49.92'	<b>3.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#8	Device 5	51.26'	<b>16.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=3.92 cfs @ 14.29 hrs HW=50.22' (Free Discharge)

1=Culvert (Passes 1.96 cfs of 150.04 cfs potential flow)

2=Orifice/Grate (Orifice Controls 0.39 cfs @ 4.44 fps)

3=Sharp-Crested Rectangular Weir (Weir Controls 1.57 cfs @ 1.79 fps)

4=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

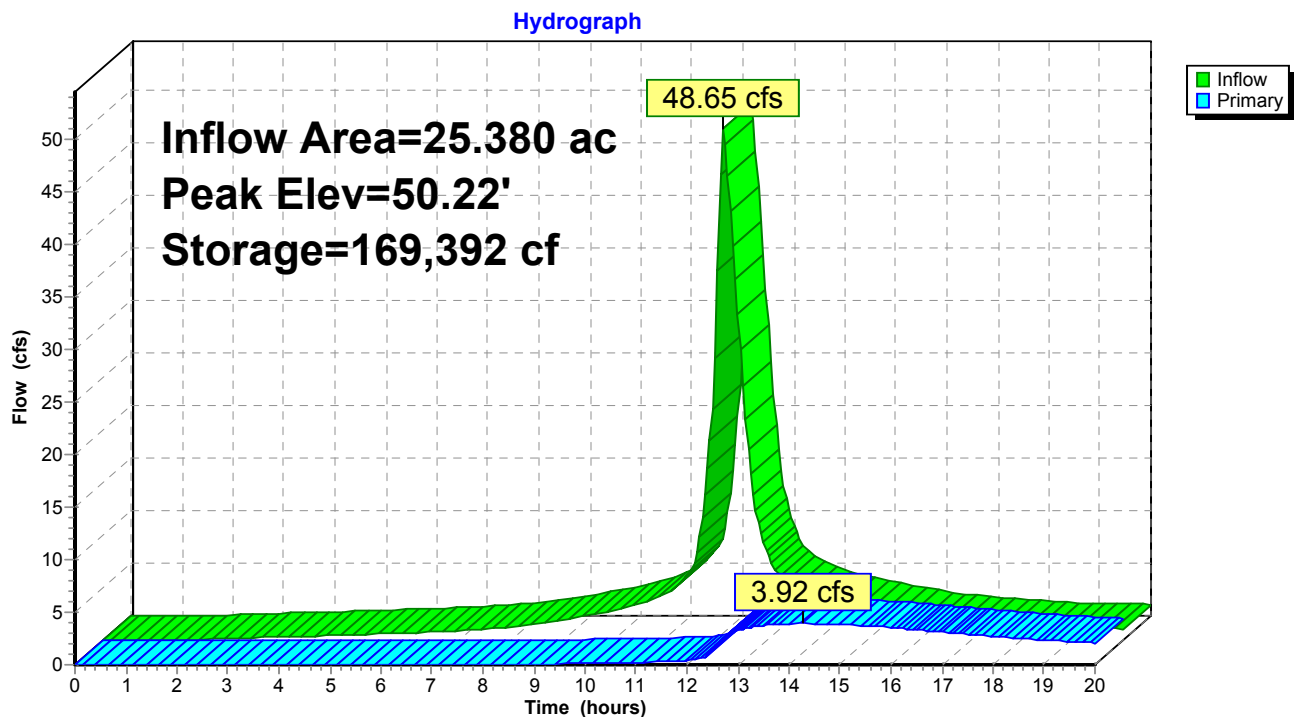
5=Culvert (Passes 1.96 cfs of 55.51 cfs potential flow)

6=Orifice/Grate (Orifice Controls 0.39 cfs @ 4.44 fps)

7=Sharp-Crested Rectangular Weir (Weir Controls 1.57 cfs @ 1.79 fps)

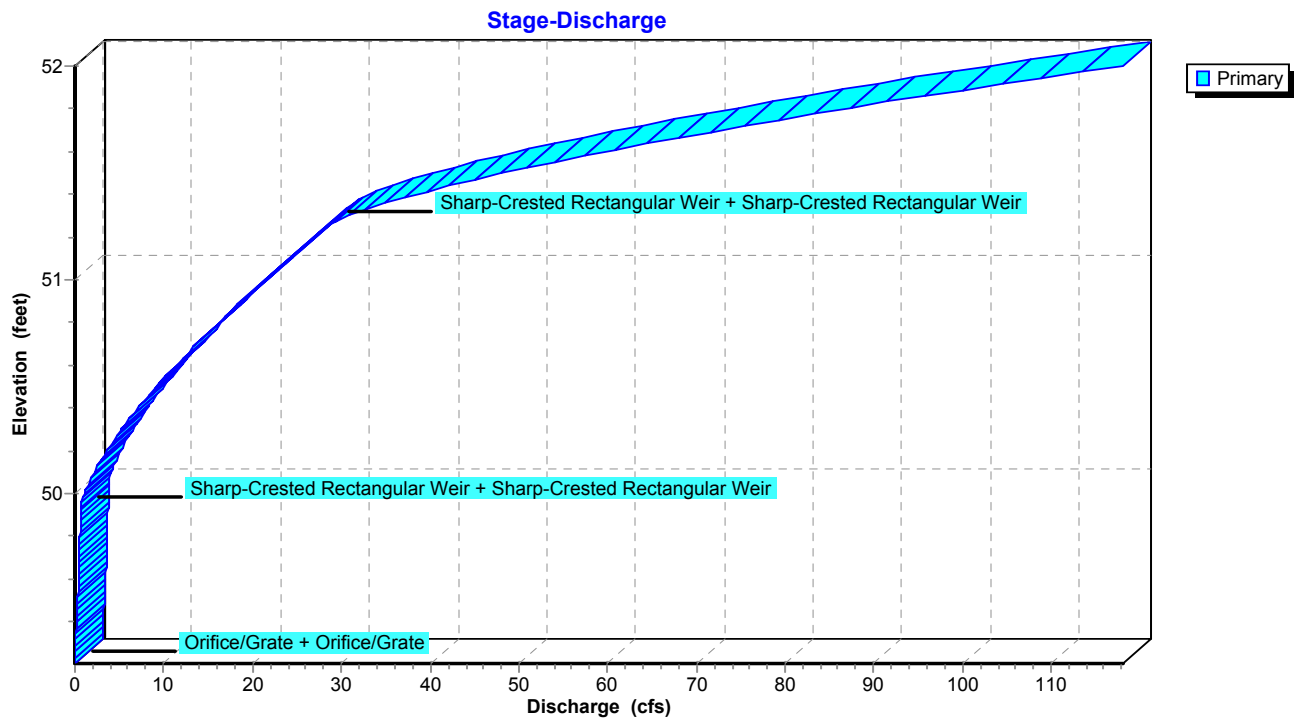
8=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

### Pond 7P: Basins C and D





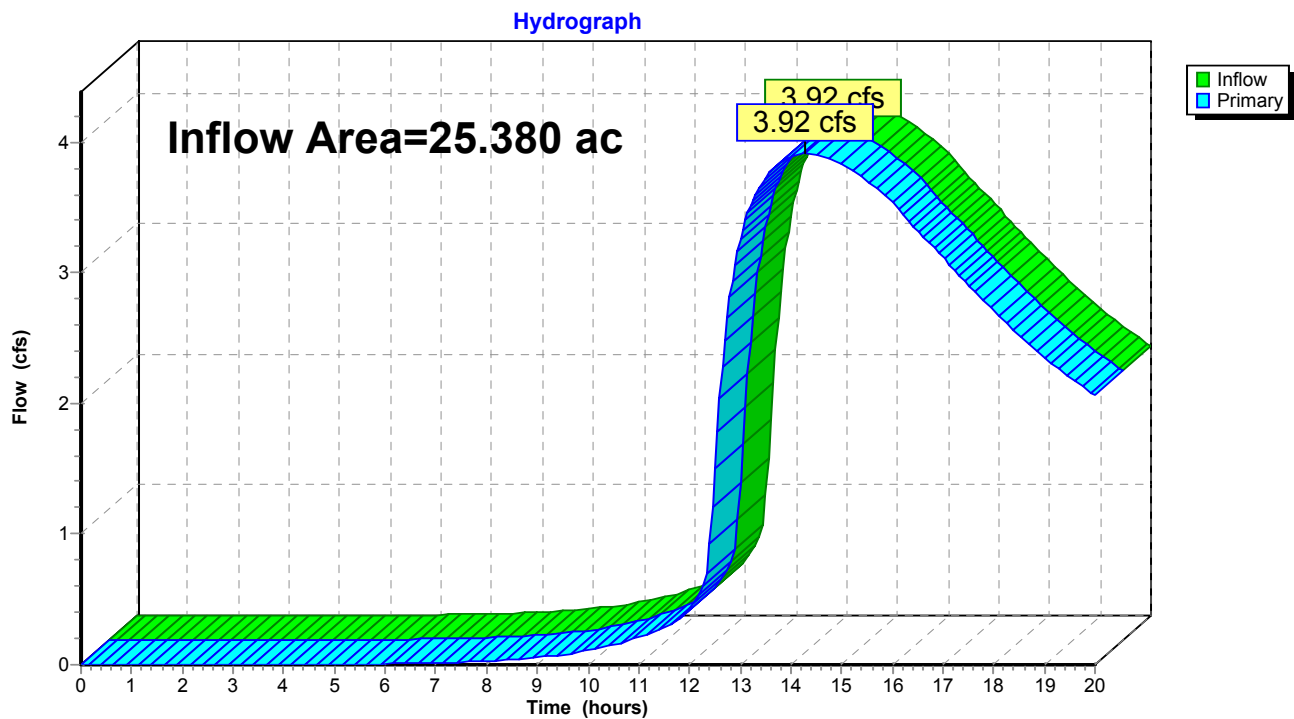
### Pond 7P: Basins C and D



**Summary for Link 8L: Point of Analysis**

Inflow Area = 25.380 ac, 70.69% Impervious, Inflow Depth > 0.96" for 2 year storm event  
Inflow = 3.92 cfs @ 14.29 hrs, Volume= 2.028 af  
Primary = 3.92 cfs @ 14.29 hrs, Volume= 2.028 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

**Link 8L: Point of Analysis**

**Waterview Center Proposed Phases 1 and 2***Type III 24-hr 10 yr storm Rainfall=5.00"*

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 21

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points

Runoff by SCS TR-20 method, UH=Delmarva

Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

**Subcatchment 1AS: Area C1 Impervious**    Runoff Area=4.120 ac    100.00% Impervious    Runoff Depth>4.53"  
Tc=10.0 min    CN=98    Runoff=13.45 cfs    1.556 af

**Subcatchment 1S: Area C1 Pervious**    Runoff Area=4.120 ac    0.00% Impervious    Runoff Depth>3.06"  
Tc=10.0 min    CN=84    Runoff=10.29 cfs    1.051 af

**Subcatchment 2AS: Area C3 Impervious**    Runoff Area=3.300 ac    100.00% Impervious    Runoff Depth>4.53"  
Tc=10.0 min    CN=98    Runoff=10.77 cfs    1.247 af

**Subcatchment 2S: Area C3 Pervious**    Runoff Area=0.600 ac    0.00% Impervious    Runoff Depth>3.25"  
Tc=10.0 min    CN=86    Runoff=1.58 cfs    0.163 af

**Subcatchment 3AS: Area C5 Impervious**    Runoff Area=5.730 ac    100.00% Impervious    Runoff Depth>4.53"  
Tc=10.0 min    CN=98    Runoff=18.71 cfs    2.165 af

**Subcatchment 3S: Area C5 Pervious**    Runoff Area=1.450 ac    0.00% Impervious    Runoff Depth>3.25"  
Tc=10.0 min    CN=86    Runoff=3.82 cfs    0.393 af

**Subcatchment 4AS: Area D1 Impervious**    Runoff Area=1.250 ac    100.00% Impervious    Runoff Depth>4.53"  
Tc=10.0 min    CN=98    Runoff=4.08 cfs    0.472 af

**Subcatchment 4S: Area D1 Pervious**    Runoff Area=0.260 ac    0.00% Impervious    Runoff Depth>2.60"  
Tc=10.0 min    CN=79    Runoff=0.56 cfs    0.056 af

**Subcatchment 5AS: Area D2 Impervious**    Runoff Area=2.120 ac    100.00% Impervious    Runoff Depth>4.53"  
Tc=10.0 min    CN=98    Runoff=6.92 cfs    0.801 af

**Subcatchment 5S: Area D2 Pervious**    Runoff Area=0.610 ac    0.00% Impervious    Runoff Depth>3.25"  
Tc=10.0 min    CN=86    Runoff=1.61 cfs    0.165 af

**Subcatchment 6AS: Area D3 Impervious**    Runoff Area=1.420 ac    100.00% Impervious    Runoff Depth>4.53"  
Tc=10.0 min    CN=98    Runoff=4.64 cfs    0.536 af

**Subcatchment 6S: Area D3 Pervious**    Runoff Area=0.400 ac    0.00% Impervious    Runoff Depth>3.25"  
Tc=10.0 min    CN=86    Runoff=1.05 cfs    0.108 af

**Pond 7P: Basins C and D**    Peak Elev=50.63'    Storage=244,831 cf    Inflow=77.47 cfs    8.714 af  
Outflow=12.04 cfs    4.941 af

**Link 8L: Point of Analysis**    Inflow=12.04 cfs    4.941 af  
Primary=12.04 cfs    4.941 af

**Total Runoff Area = 25.380 ac    Runoff Volume = 8.714 af    Average Runoff Depth = 4.12"**  
**29.31% Pervious = 7.440 ac    70.69% Impervious = 17.940 ac**

### Summary for Subcatchment 1AS: Area C1 Impervious

Runoff = 13.45 cfs @ 12.16 hrs, Volume= 1.556 af, Depth> 4.53"

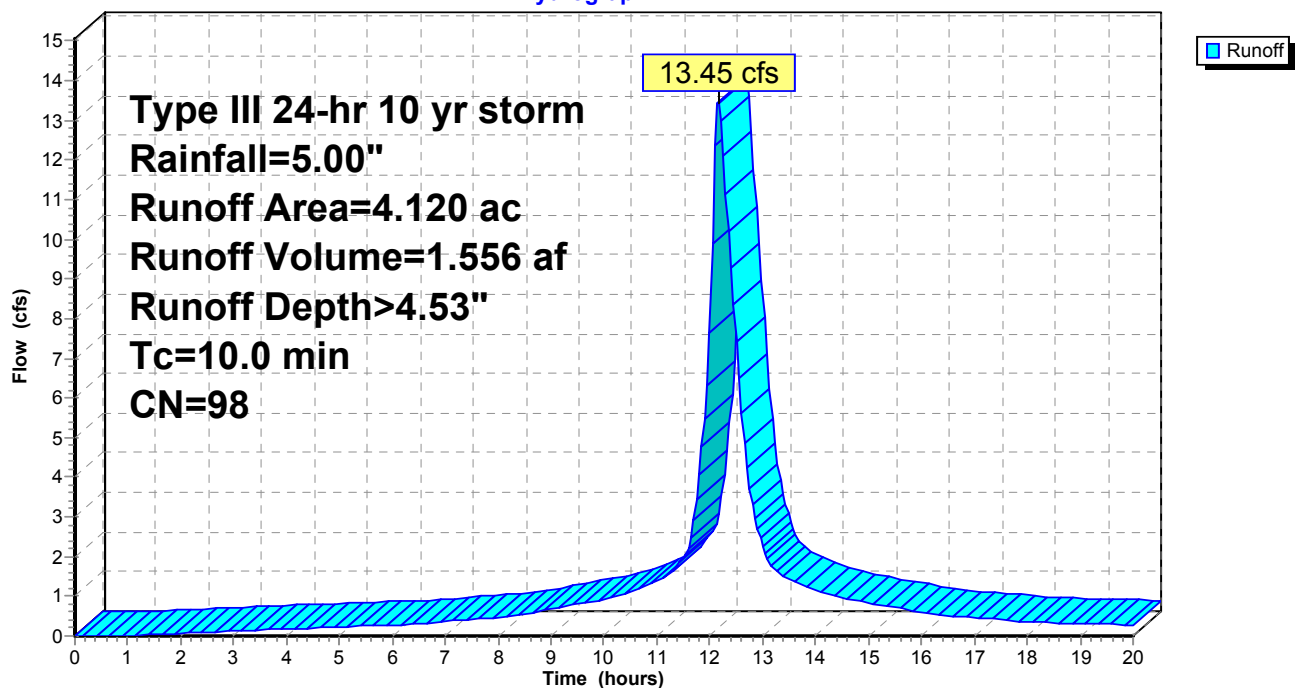
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 4.120	98	Impervious
4.120		100.00% Impervious Area

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

### Subcatchment 1AS: Area C1 Impervious

Hydrograph



### Summary for Subcatchment 1S: Area C1 Pervious

Curve number revised to reflect .22 acres of Woods rather than Open Space

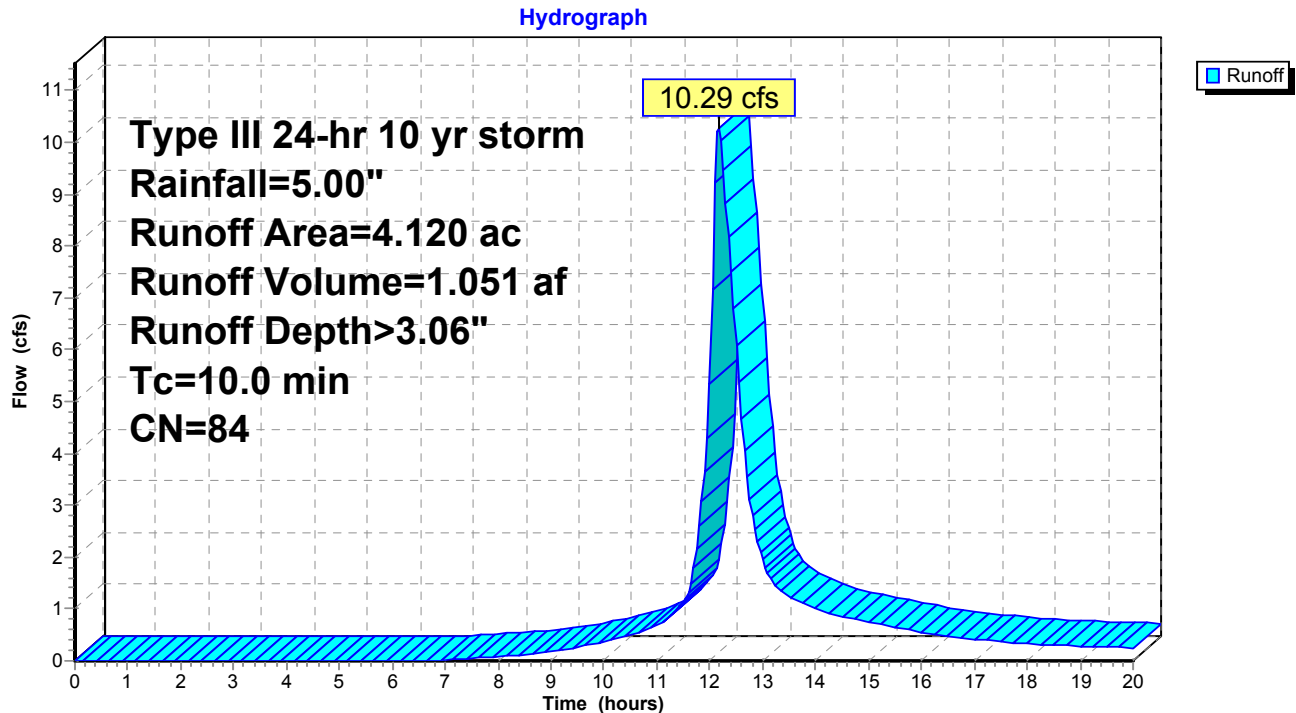
Runoff = 10.29 cfs @ 12.17 hrs, Volume= 1.051 af, Depth> 3.06"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 0.640	79	Open Space HSG B
* 3.260	86	Open Space HSG C
* 0.220	70	Woods HSG C
4.120	84	Weighted Average
4.120		100.00% Pervious Area

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

### Subcatchment 1S: Area C1 Pervious



# Waterview Center Proposed Phases 1 and 2

Type III 24-hr 10 yr storm Rainfall=5.00"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 24

## Summary for Subcatchment 2AS: Area C3 Impervious

Runoff = 10.77 cfs @ 12.16 hrs, Volume= 1.247 af, Depth> 4.53"

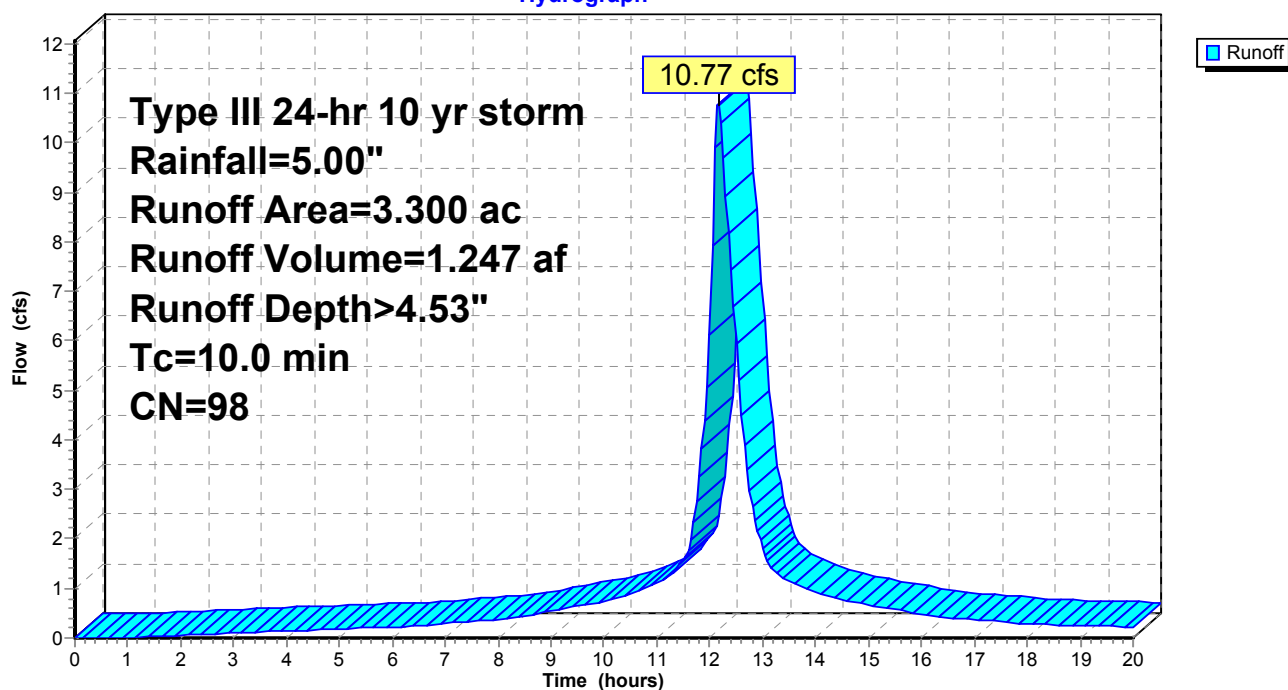
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 3.300	98	Impervious
3.300		100.00% Impervious Area

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

## Subcatchment 2AS: Area C3 Impervious

Hydrograph



**Waterview Center Proposed Phases 1 and 2**

Type III 24-hr 10 yr storm Rainfall=5.00"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 25

**Summary for Subcatchment 2S: Area C3 Pervious**

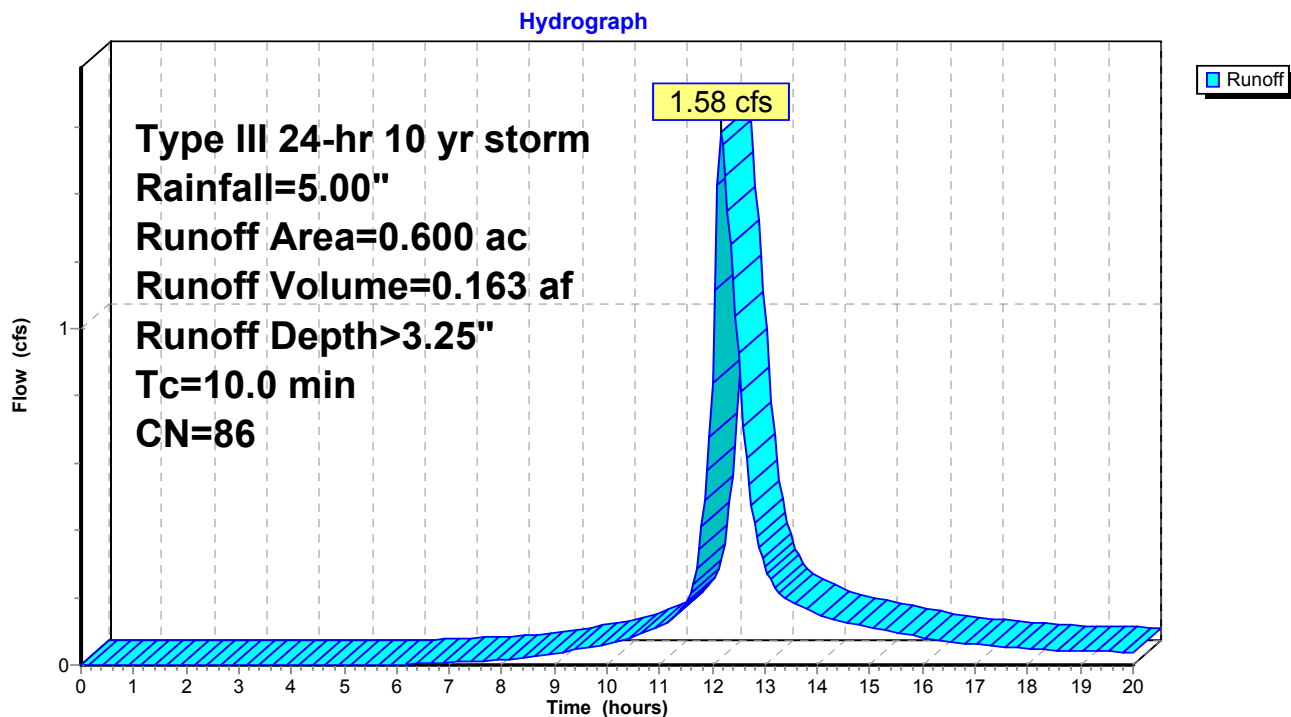
Runoff = 1.58 cfs @ 12.17 hrs, Volume= 0.163 af, Depth&gt; 3.25"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 0.600	86	Open Space HSG C
0.600		100.00% Pervious Area

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

**Subcatchment 2S: Area C3 Pervious**

### Summary for Subcatchment 3AS: Area C5 Impervious

Runoff = 18.71 cfs @ 12.16 hrs, Volume= 2.165 af, Depth> 4.53"

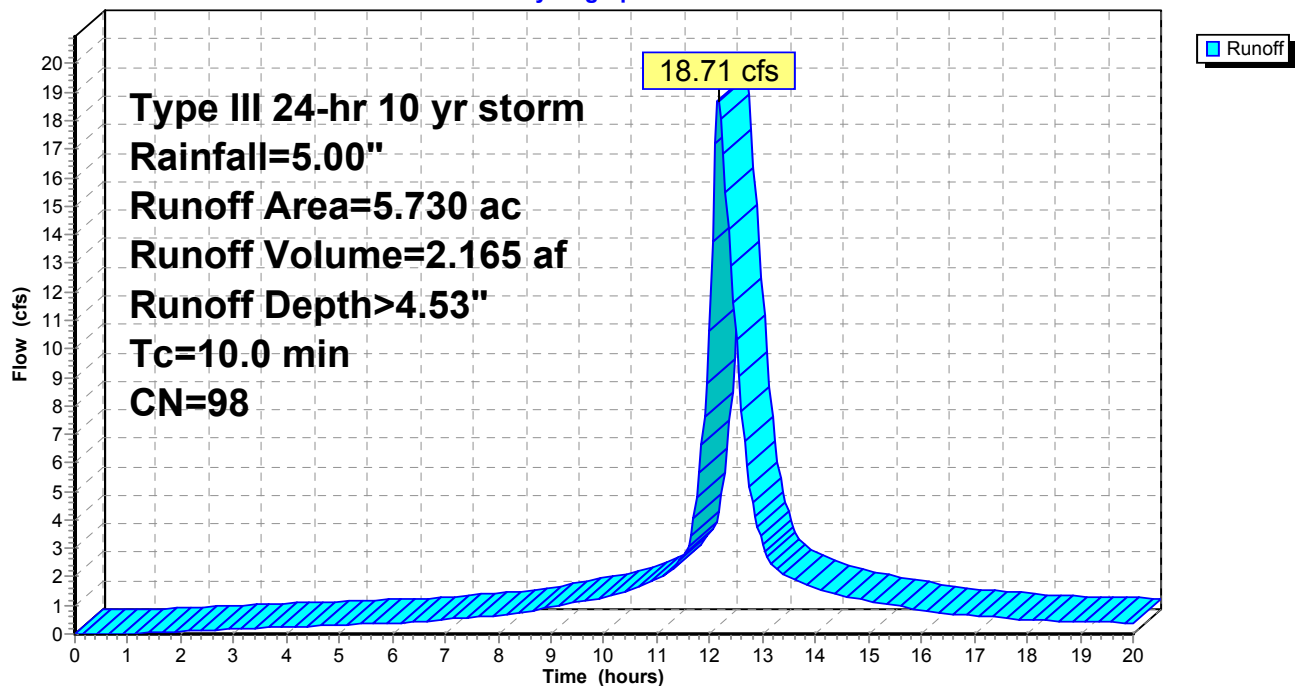
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 5.730	98	Impervious
5.730		100.00% Impervious Area

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

### Subcatchment 3AS: Area C5 Impervious

Hydrograph





**Waterview Center Proposed Phases 1 and 2**

Type III 24-hr 10 yr storm Rainfall=5.00"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 27

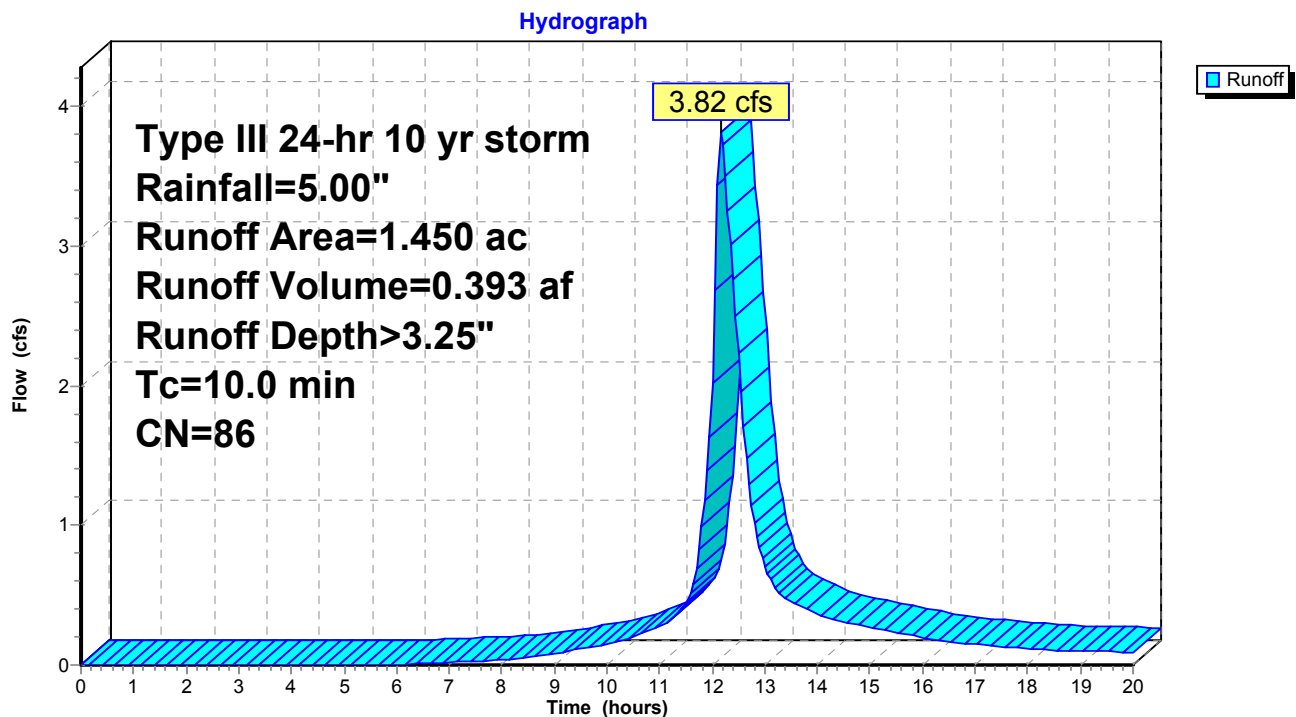
**Summary for Subcatchment 3S: Area C5 Pervious**

Runoff = 3.82 cfs @ 12.17 hrs, Volume= 0.393 af, Depth&gt; 3.25"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 1.450	86	Open Space HSG C
1.450		100.00% Pervious Area

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

**Subcatchment 3S: Area C5 Pervious**

# Waterview Center Proposed Phases 1 and 2

Type III 24-hr 10 yr storm Rainfall=5.00"

Prepared by Emerald Environmental Solutions

Printed 12/18/2009

HydroCAD® 9.00 s/n 06215 © 2009 HydroCAD Software Solutions LLC

Page 28

## Summary for Subcatchment 4AS: Area D1 Impervious

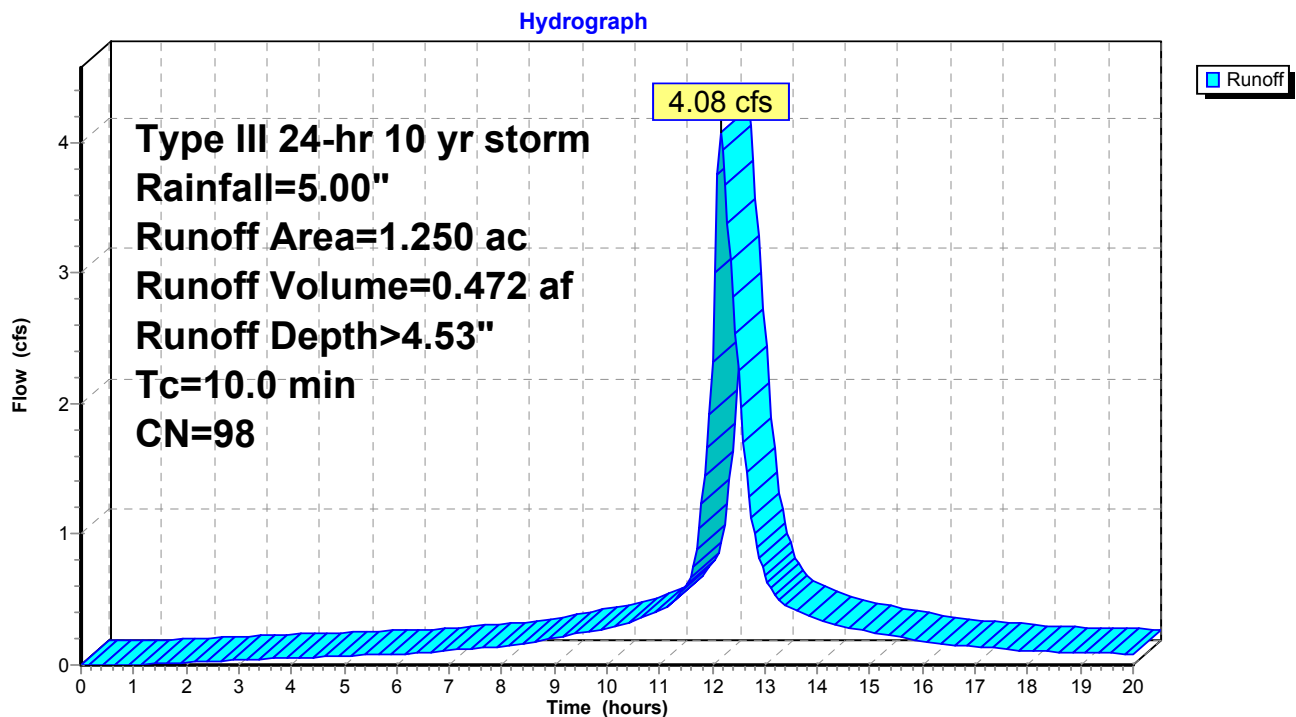
Runoff = 4.08 cfs @ 12.16 hrs, Volume= 0.472 af, Depth> 4.53"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 1.250	98	Impervious
1.250		100.00% Impervious Area

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

## Subcatchment 4AS: Area D1 Impervious



### Summary for Subcatchment 4S: Area D1 Pervious

Open Space appears to be located in HSG C soils. Assume HSG B soils to be conservative.

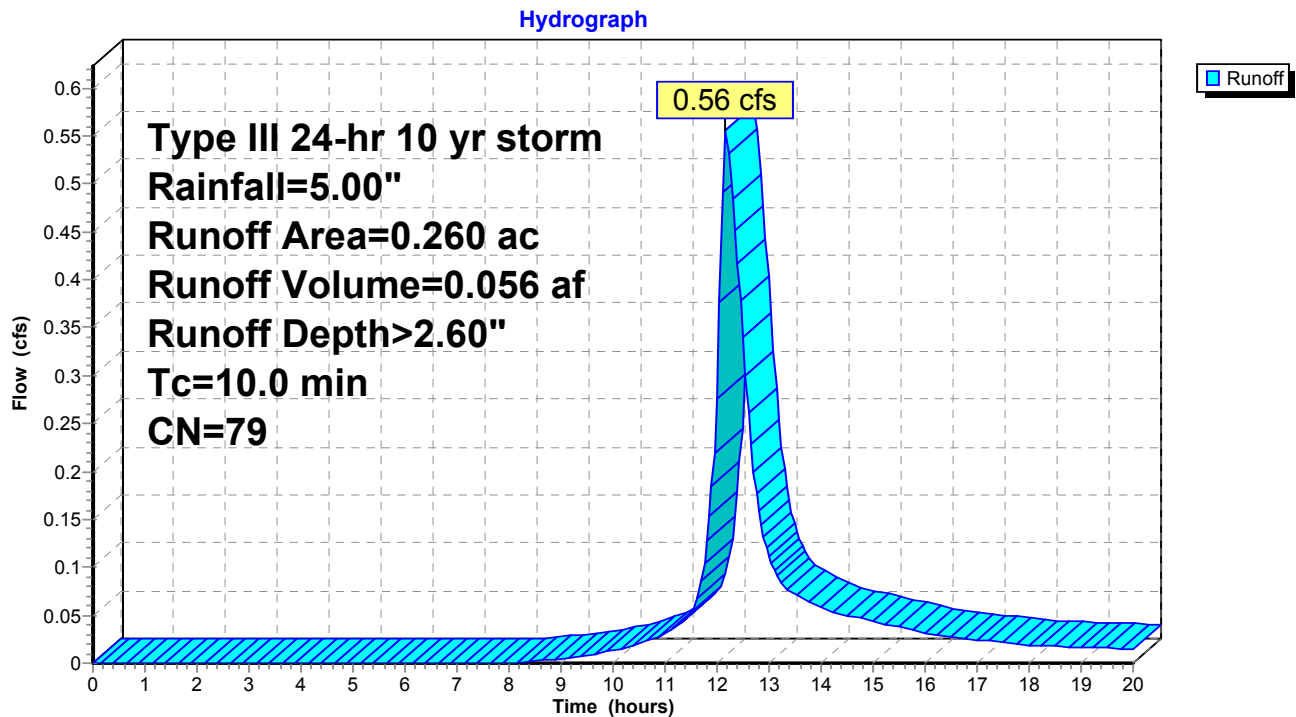
Runoff = 0.56 cfs @ 12.17 hrs, Volume= 0.056 af, Depth> 2.60"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 0.260	79	Open Space HSG B
0.260		100.00% Pervious Area

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

### Subcatchment 4S: Area D1 Pervious



### Summary for Subcatchment 5AS: Area D2 Impervious

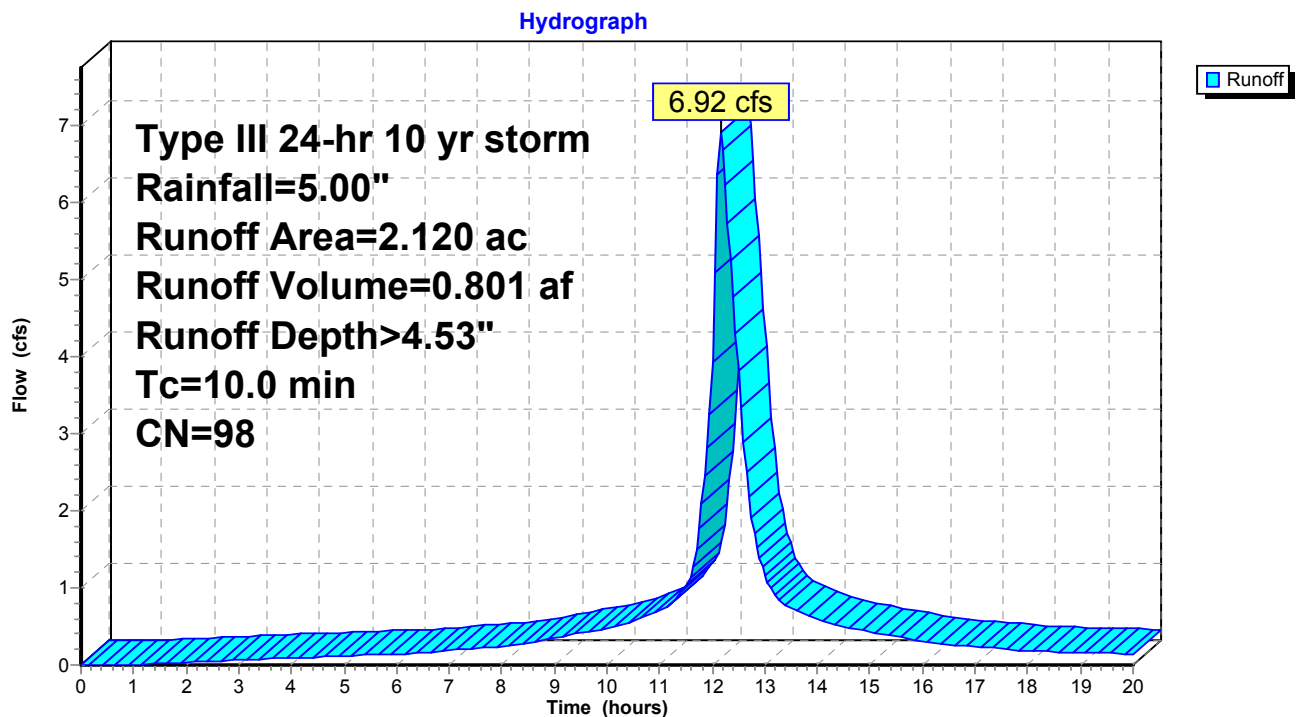
Runoff = 6.92 cfs @ 12.16 hrs, Volume= 0.801 af, Depth> 4.53"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 2.120	98	Impervious
2.120		100.00% Impervious Area

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

### Subcatchment 5AS: Area D2 Impervious



### Summary for Subcatchment 5S: Area D2 Pervious

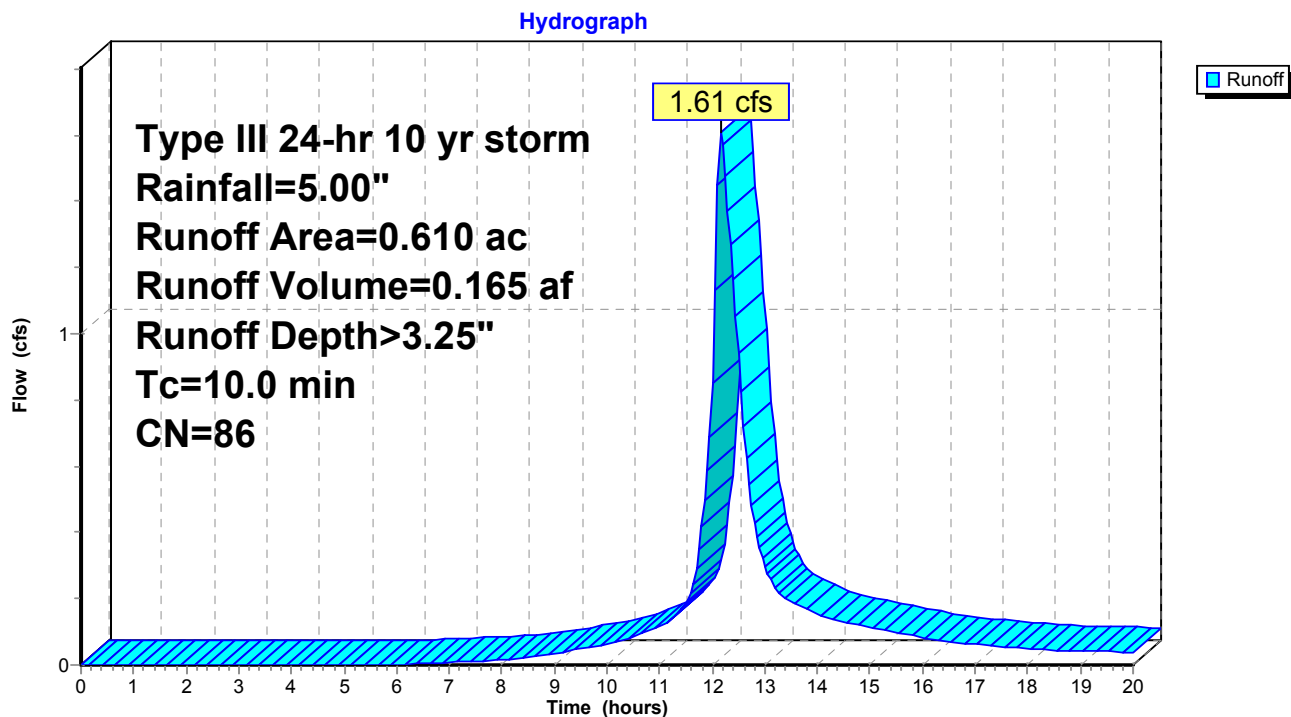
Runoff = 1.61 cfs @ 12.17 hrs, Volume= 0.165 af, Depth> 3.25"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 0.610	86	Open Space HSG C
0.610		100.00% Pervious Area

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

### Subcatchment 5S: Area D2 Pervious



### Summary for Subcatchment 6AS: Area D3 Impervious

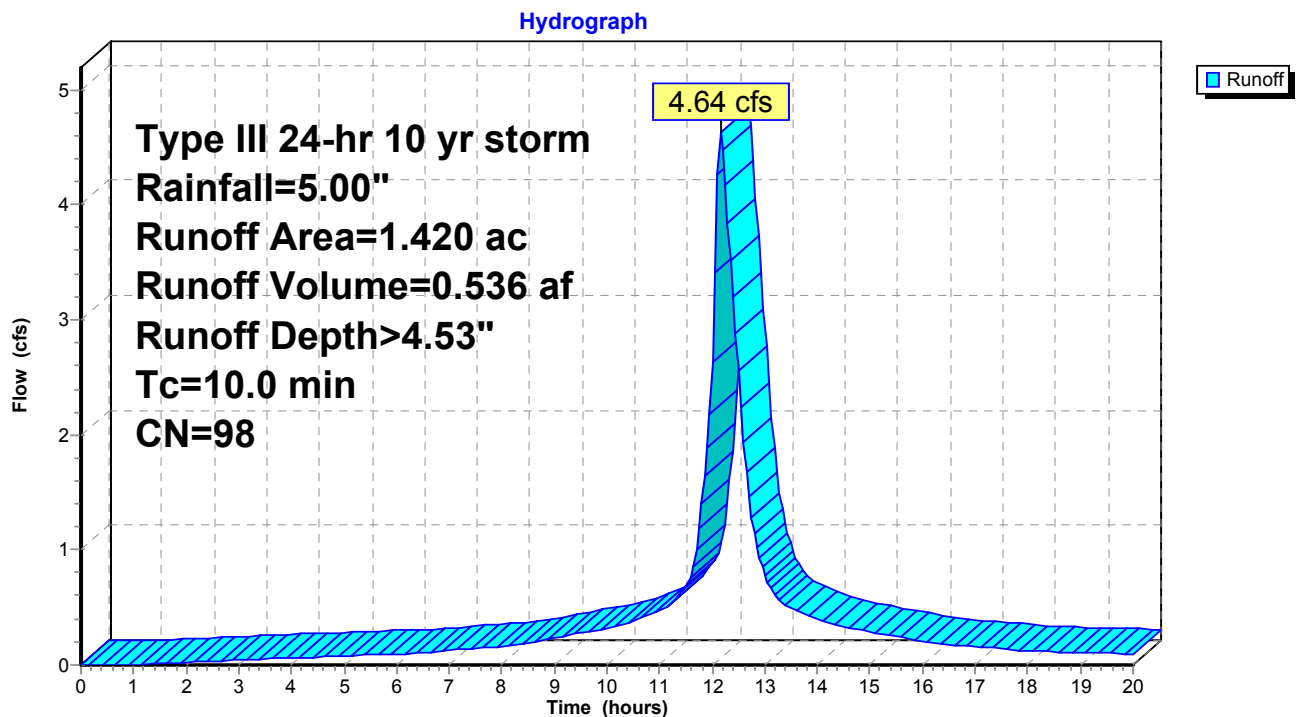
Runoff = 4.64 cfs @ 12.16 hrs, Volume= 0.536 af, Depth> 4.53"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 1.420	98	Impervious
1.420		100.00% Impervious Area

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

### Subcatchment 6AS: Area D3 Impervious



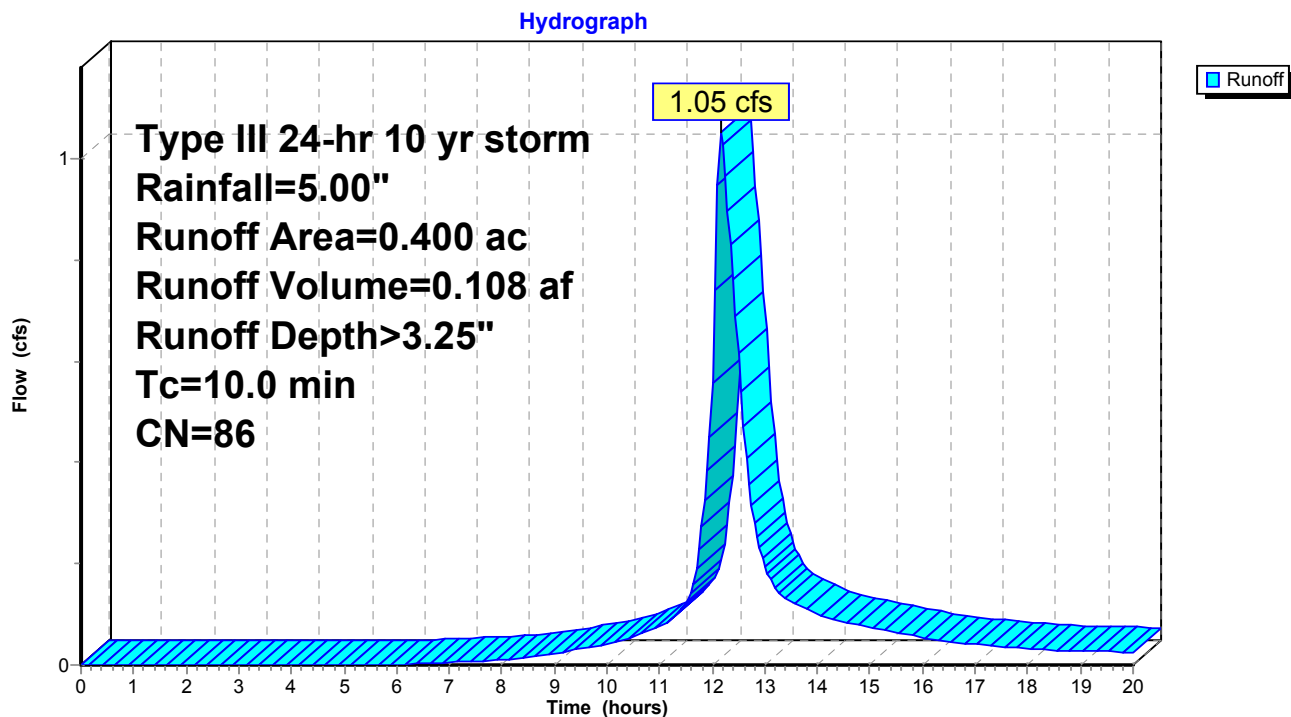
**Summary for Subcatchment 6S: Area D3 Pervious**

Runoff = 1.05 cfs @ 12.17 hrs, Volume= 0.108 af, Depth&gt; 3.25"

 Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 10 yr storm Rainfall=5.00"

Area (ac)	CN	Description
* 0.400	86	Open Space HSG C
0.400		100.00% Pervious Area

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

**Subcatchment 6S: Area D3 Pervious**


### Summary for Pond 7P: Basins C and D

The available storage in the basins was derived from the Pond Report submitted by the developer.  
The outlet structure data was derived from the developer's stormwater report.

---

Inflow Area = 25.380 ac, 70.69% Impervious, Inflow Depth > 4.12" for 10 yr storm event  
 Inflow = 77.47 cfs @ 12.16 hrs, Volume= 8.714 af  
 Outflow = 12.04 cfs @ 13.07 hrs, Volume= 4.941 af, Atten= 84%, Lag= 54.5 min  
 Primary = 12.04 cfs @ 13.07 hrs, Volume= 4.941 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 50.63' @ 13.07 hrs Surf.Area= 0 sf Storage= 244,831 cf

Plug-Flow detention time= 262.6 min calculated for 4.941 af (57% of inflow)  
 Center-of-Mass det. time= 172.4 min ( 913.9 - 741.5 )

---

Volume	Invert	Avail.Storage	Storage Description
#1	49.20'	510,366 cf	<b>Custom Stage Data</b> Listed below

---

Elevation (feet)	Cum.Store (cubic-feet)
49.20	0
50.00	132,098
50.20	166,073
50.30	183,793
51.00	314,791
52.00	510,366

---

Device	Routing	Invert	Outlet Devices
#1	Primary	42.07'	<b>48.0" Round Culvert</b> L= 63.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 42.00' S= 0.0011 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	49.20'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	49.92'	<b>3.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	51.26'	<b>16.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#5	Primary	42.90'	<b>30.0" Round Culvert</b> L= 112.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 42.00' S= 0.0080 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#6	Device 5	49.20'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#7	Device 5	49.92'	<b>3.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#8	Device 5	51.26'	<b>16.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)



**Primary OutFlow** Max=12.04 cfs @ 13.07 hrs HW=50.63' (Free Discharge)

1=Culvert (Passes 6.02 cfs of 154.93 cfs potential flow)

2=Orifice/Grate (Orifice Controls 0.47 cfs @ 5.40 fps)

3=Sharp-Crested Rectangular Weir (Weir Controls 5.55 cfs @ 2.75 fps)

4=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

5=Culvert (Passes 6.02 cfs of 57.45 cfs potential flow)

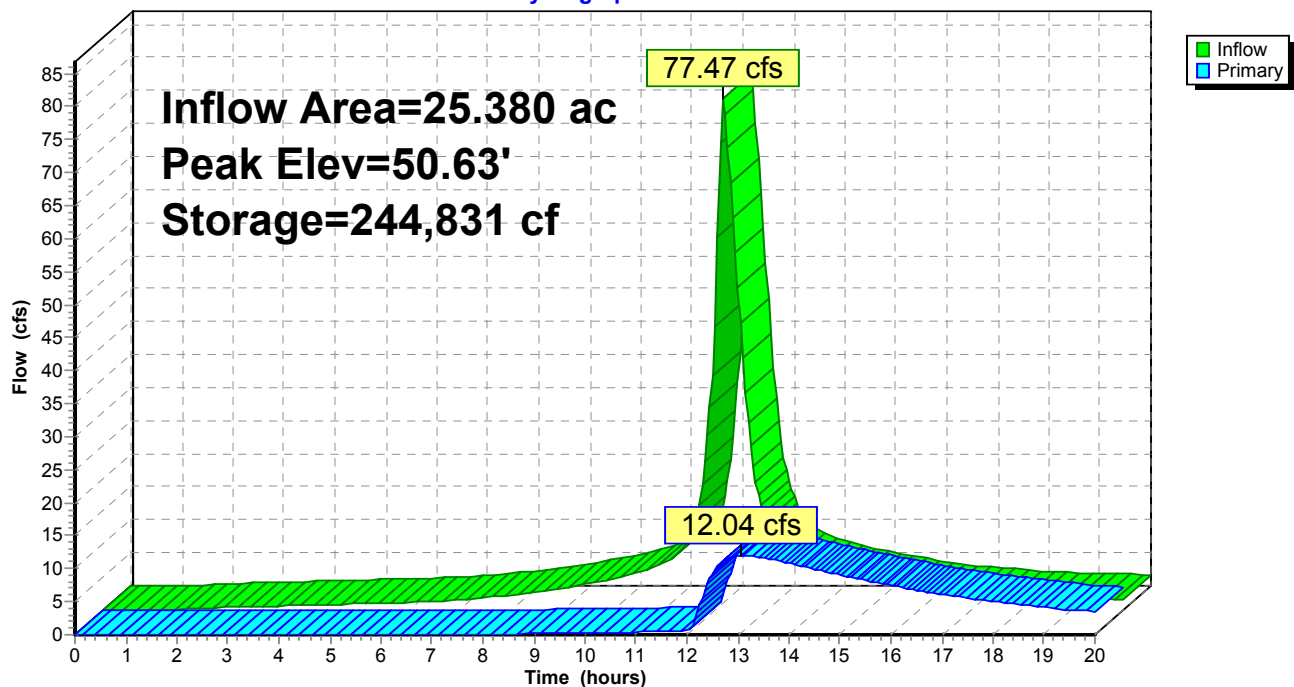
6=Orifice/Grate (Orifice Controls 0.47 cfs @ 5.40 fps)

7=Sharp-Crested Rectangular Weir (Weir Controls 5.55 cfs @ 2.75 fps)

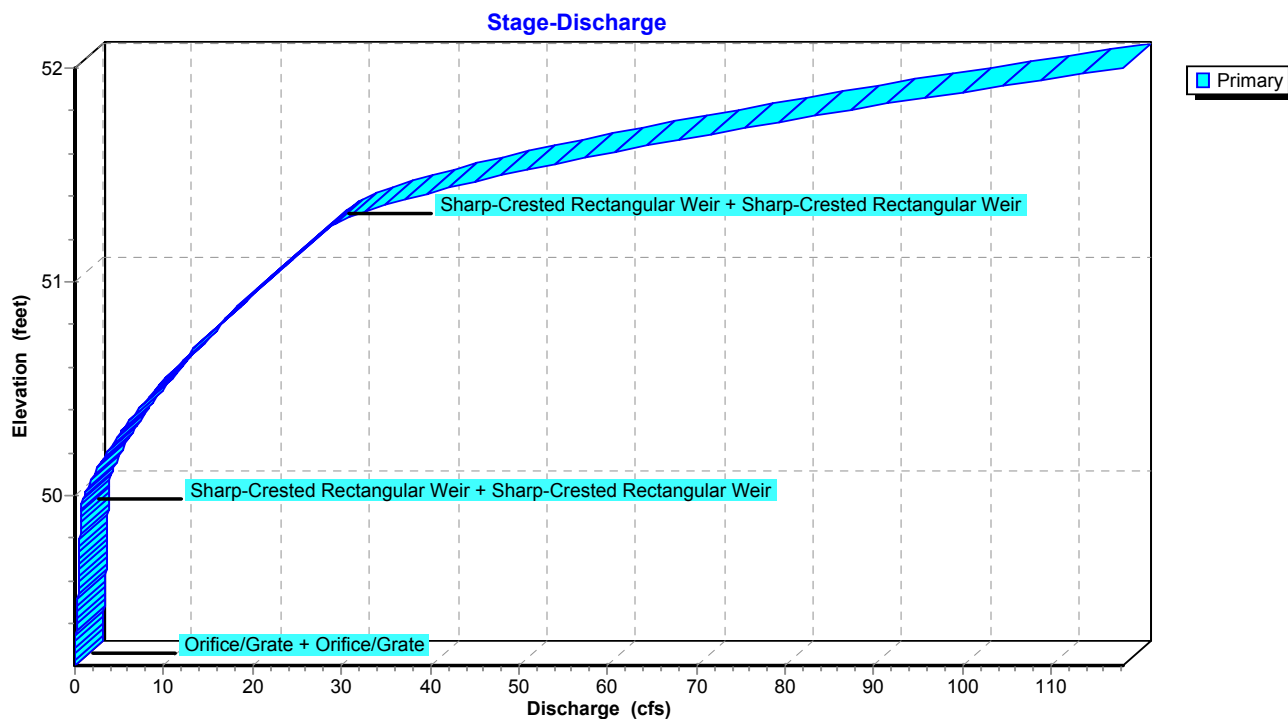
8=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

### Pond 7P: Basins C and D

Hydrograph



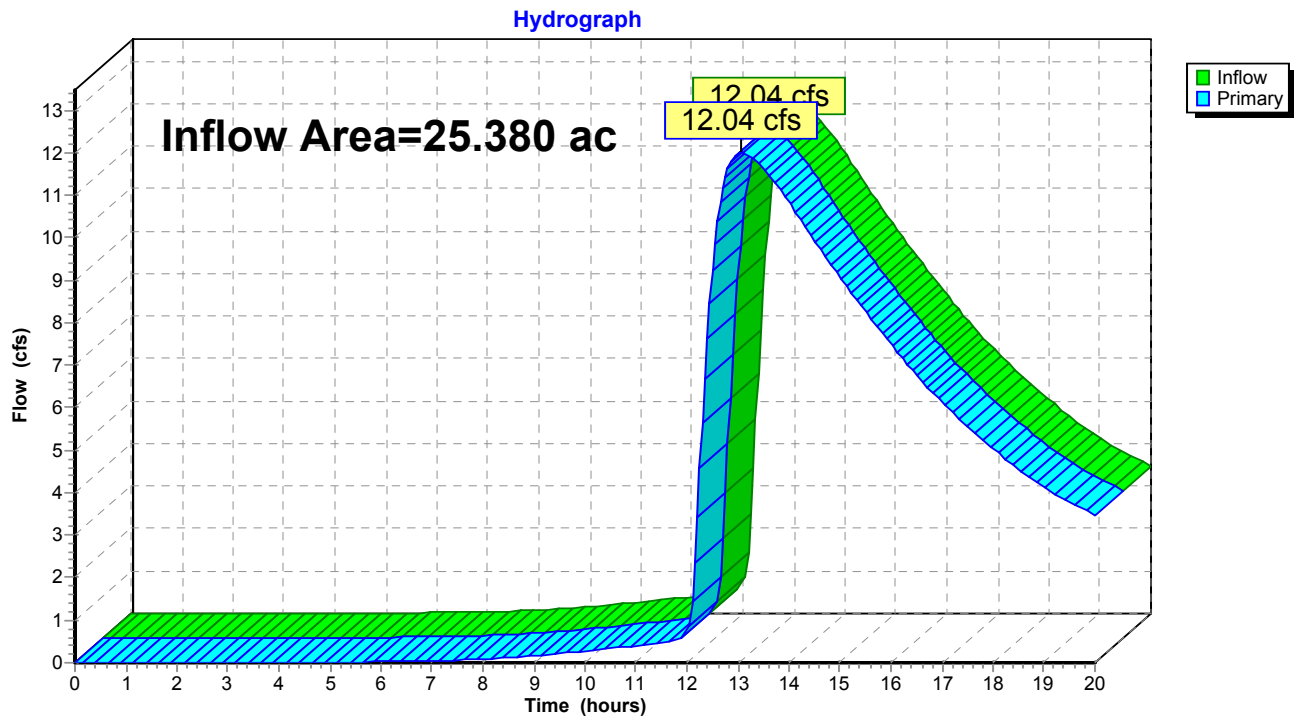
### Pond 7P: Basins C and D



**Summary for Link 8L: Point of Analysis**

Inflow Area = 25.380 ac, 70.69% Impervious, Inflow Depth > 2.34" for 10 yr storm event  
Inflow = 12.04 cfs @ 13.07 hrs, Volume= 4.941 af  
Primary = 12.04 cfs @ 13.07 hrs, Volume= 4.941 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

**Link 8L: Point of Analysis**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points  
 Runoff by SCS TR-20 method, UH=Delmarva  
 Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

<b>Subcatchment 1AS: Area C1 Impervious</b>	Runoff Area=4.120 ac 100.00% Impervious Runoff Depth>7.68" Tc=10.0 min CN=98 Runoff=22.42 cfs 2.636 af
<b>Subcatchment 1S: Area C1 Pervious</b>	Runoff Area=4.120 ac 0.00% Impervious Runoff Depth>6.02" Tc=10.0 min CN=84 Runoff=19.70 cfs 2.066 af
<b>Subcatchment 2AS: Area C3 Impervious</b>	Runoff Area=3.300 ac 100.00% Impervious Runoff Depth>7.68" Tc=10.0 min CN=98 Runoff=17.96 cfs 2.111 af
<b>Subcatchment 2S: Area C3 Pervious</b>	Runoff Area=0.600 ac 0.00% Impervious Runoff Depth>6.25" Tc=10.0 min CN=86 Runoff=2.95 cfs 0.313 af
<b>Subcatchment 3AS: Area C5 Impervious</b>	Runoff Area=5.730 ac 100.00% Impervious Runoff Depth>7.68" Tc=10.0 min CN=98 Runoff=31.18 cfs 3.666 af
<b>Subcatchment 3S: Area C5 Pervious</b>	Runoff Area=1.450 ac 0.00% Impervious Runoff Depth>6.25" Tc=10.0 min CN=86 Runoff=7.13 cfs 0.755 af
<b>Subcatchment 4AS: Area D1 Impervious</b>	Runoff Area=1.250 ac 100.00% Impervious Runoff Depth>7.68" Tc=10.0 min CN=98 Runoff=6.80 cfs 0.800 af
<b>Subcatchment 4S: Area D1 Pervious</b>	Runoff Area=0.260 ac 0.00% Impervious Runoff Depth>5.43" Tc=10.0 min CN=79 Runoff=1.14 cfs 0.118 af
<b>Subcatchment 5AS: Area D2 Impervious</b>	Runoff Area=2.120 ac 100.00% Impervious Runoff Depth>7.68" Tc=10.0 min CN=98 Runoff=11.54 cfs 1.356 af
<b>Subcatchment 5S: Area D2 Pervious</b>	Runoff Area=0.610 ac 0.00% Impervious Runoff Depth>6.25" Tc=10.0 min CN=86 Runoff=3.00 cfs 0.318 af
<b>Subcatchment 6AS: Area D3 Impervious</b>	Runoff Area=1.420 ac 100.00% Impervious Runoff Depth>7.68" Tc=10.0 min CN=98 Runoff=7.73 cfs 0.909 af
<b>Subcatchment 6S: Area D3 Pervious</b>	Runoff Area=0.400 ac 0.00% Impervious Runoff Depth>6.25" Tc=10.0 min CN=86 Runoff=1.97 cfs 0.208 af
<b>Pond 7P: Basins C and D</b>	Peak Elev=51.36' Storage=385,581 cf Inflow=133.53 cfs 15.256 af Outflow=35.31 cfs 10.948 af
<b>Link 8L: Point of Analysis</b>	Inflow=35.31 cfs 10.948 af Primary=35.31 cfs 10.948 af

**Total Runoff Area = 25.380 ac Runoff Volume = 15.256 af Average Runoff Depth = 7.21"**  
**29.31% Pervious = 7.440 ac 70.69% Impervious = 17.940 ac**

### Summary for Subcatchment 1AS: Area C1 Impervious

Runoff = 22.42 cfs @ 12.16 hrs, Volume= 2.636 af, Depth> 7.68"

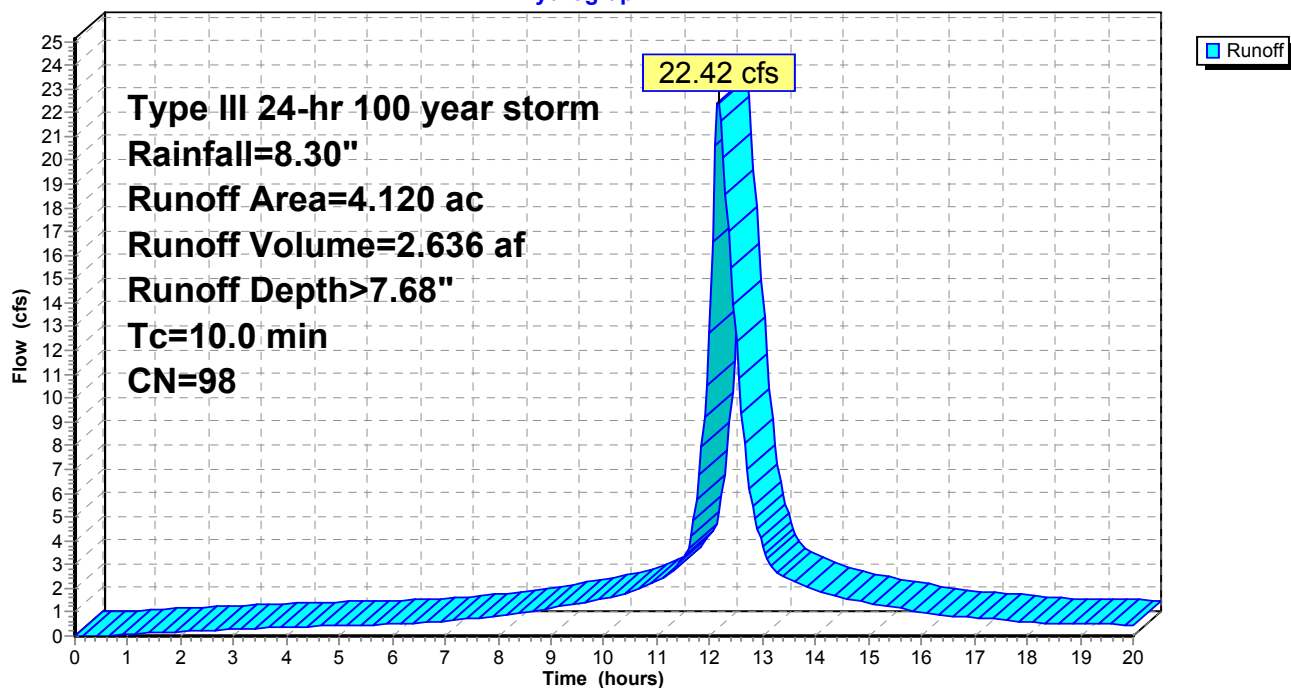
Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 4.120	98	Impervious
4.120		100.00% Impervious Area

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

### Subcatchment 1AS: Area C1 Impervious

Hydrograph



### Summary for Subcatchment 1S: Area C1 Pervious

Curve number revised to reflect .22 acres of Woods rather than Open Space

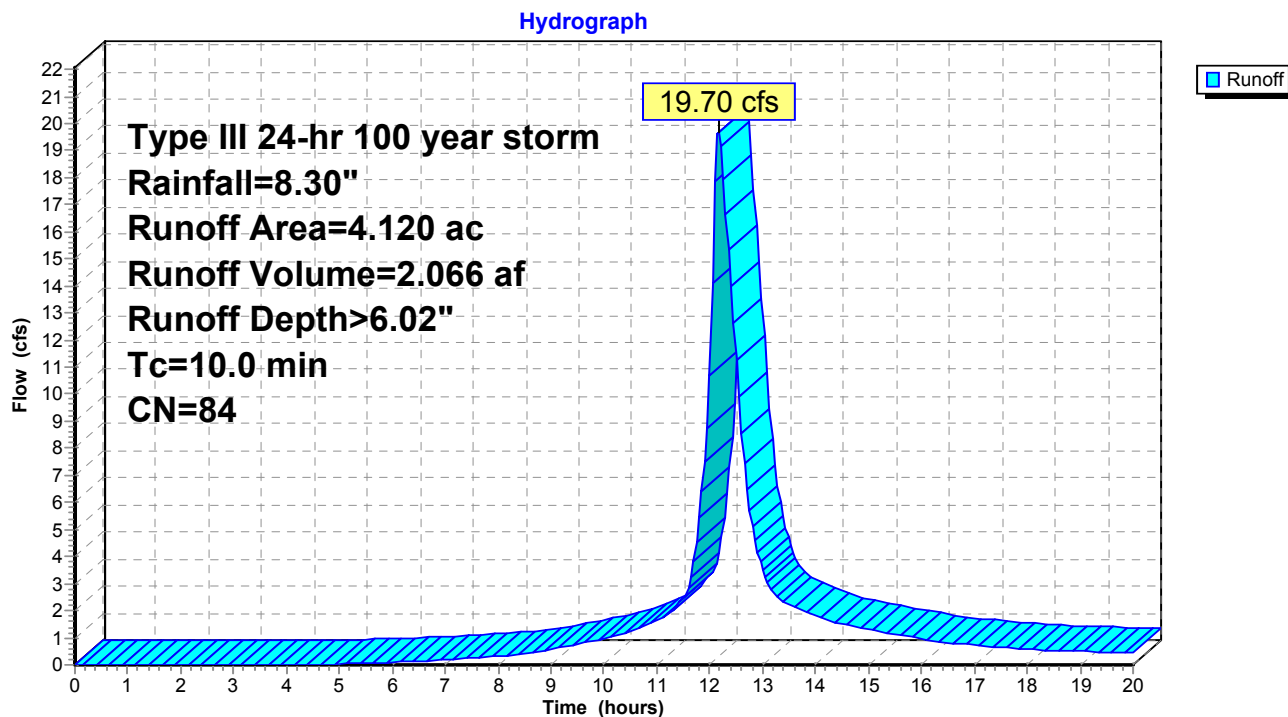
Runoff = 19.70 cfs @ 12.16 hrs, Volume= 2.066 af, Depth> 6.02"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 0.640	79	Open Space HSG B
* 3.260	86	Open Space HSG C
* 0.220	70	Woods HSG C
4.120	84	Weighted Average
4.120		100.00% Pervious Area

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

### Subcatchment 1S: Area C1 Pervious



### Summary for Subcatchment 2AS: Area C3 Impervious

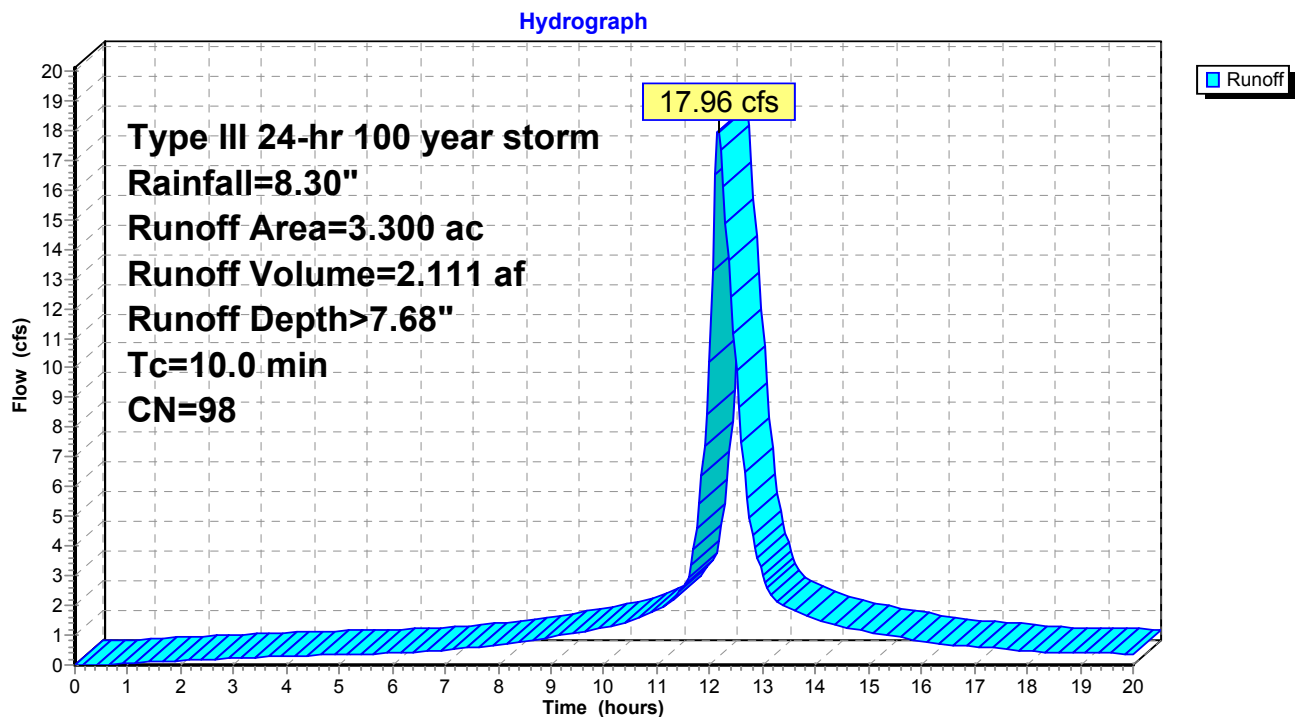
Runoff = 17.96 cfs @ 12.16 hrs, Volume= 2.111 af, Depth> 7.68"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 3.300	98	Impervious
3.300		100.00% Impervious Area

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

### Subcatchment 2AS: Area C3 Impervious



### Summary for Subcatchment 2S: Area C3 Pervious

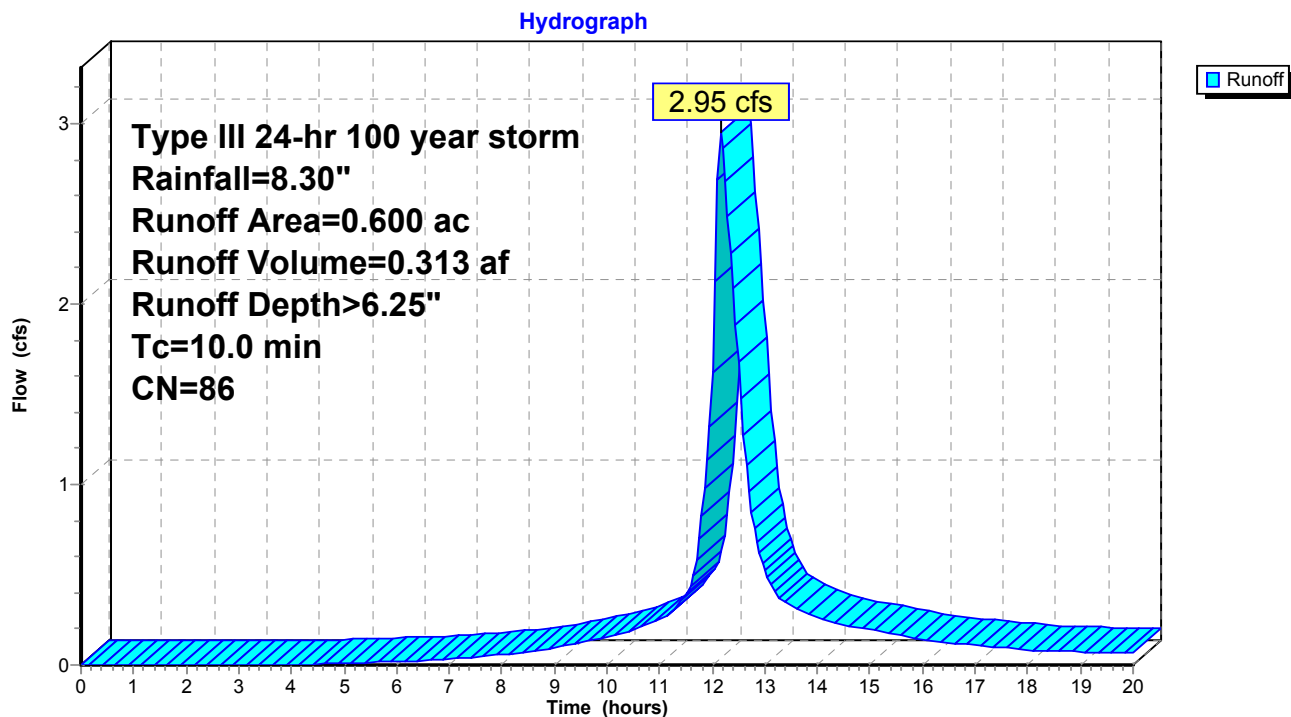
Runoff = 2.95 cfs @ 12.16 hrs, Volume= 0.313 af, Depth> 6.25"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 0.600	86	Open Space HSG C
0.600		100.00% Pervious Area

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

### Subcatchment 2S: Area C3 Pervious





### Summary for Subcatchment 3AS: Area C5 Impervious

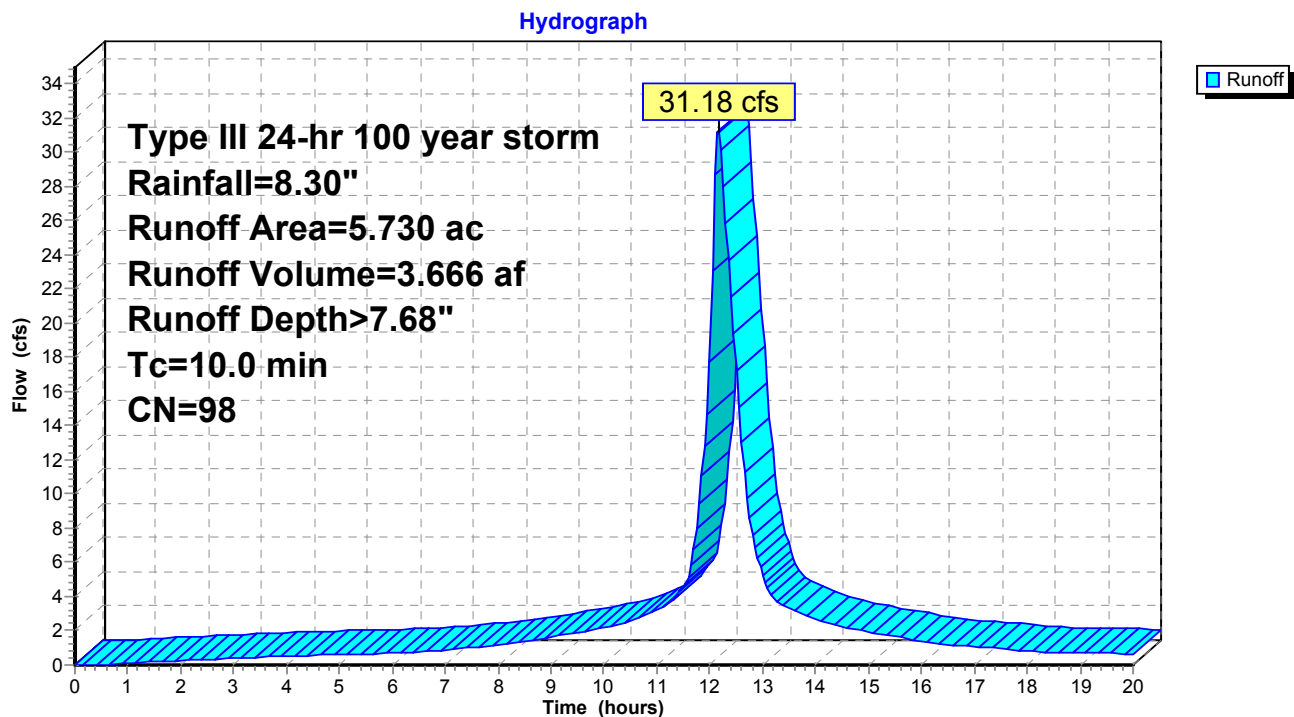
Runoff = 31.18 cfs @ 12.16 hrs, Volume= 3.666 af, Depth> 7.68"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 5.730	98	Impervious
5.730		100.00% Impervious Area

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

### Subcatchment 3AS: Area C5 Impervious



### Summary for Subcatchment 3S: Area C5 Pervious

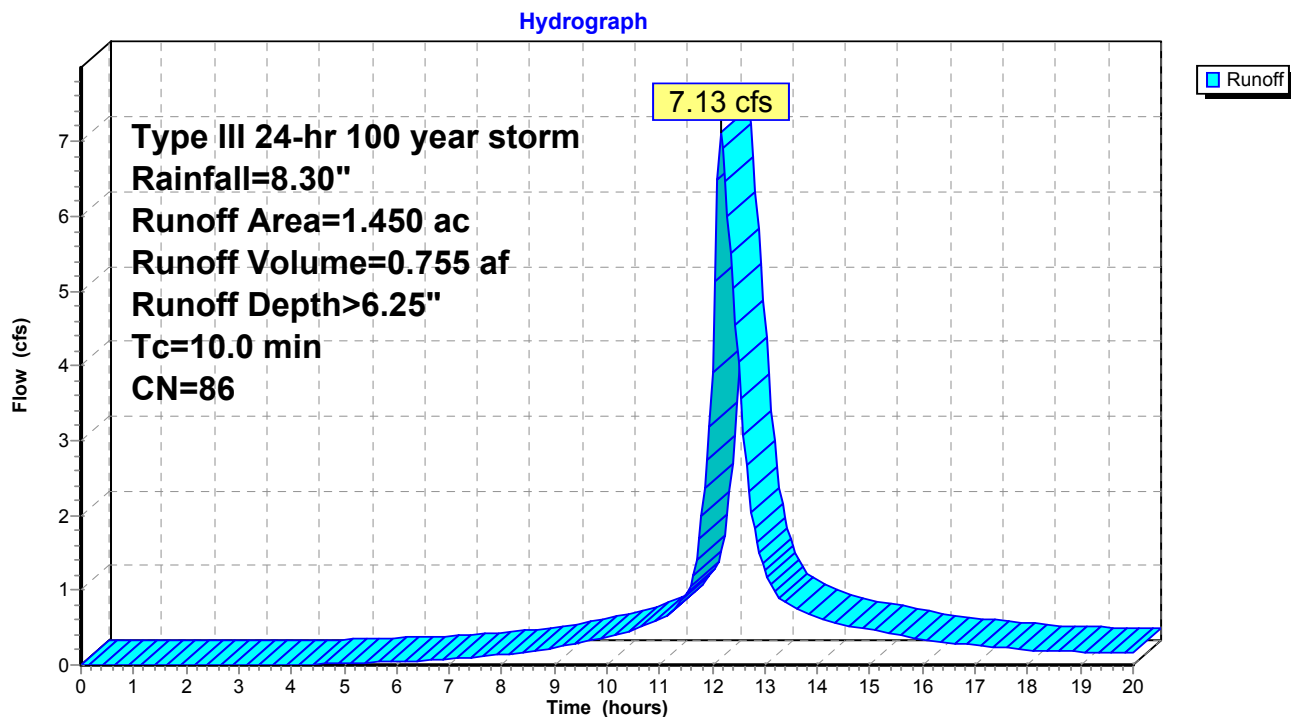
Runoff = 7.13 cfs @ 12.16 hrs, Volume= 0.755 af, Depth> 6.25"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 1.450	86	Open Space HSG C
1.450		100.00% Pervious Area

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

### Subcatchment 3S: Area C5 Pervious



### Summary for Subcatchment 4AS: Area D1 Impervious

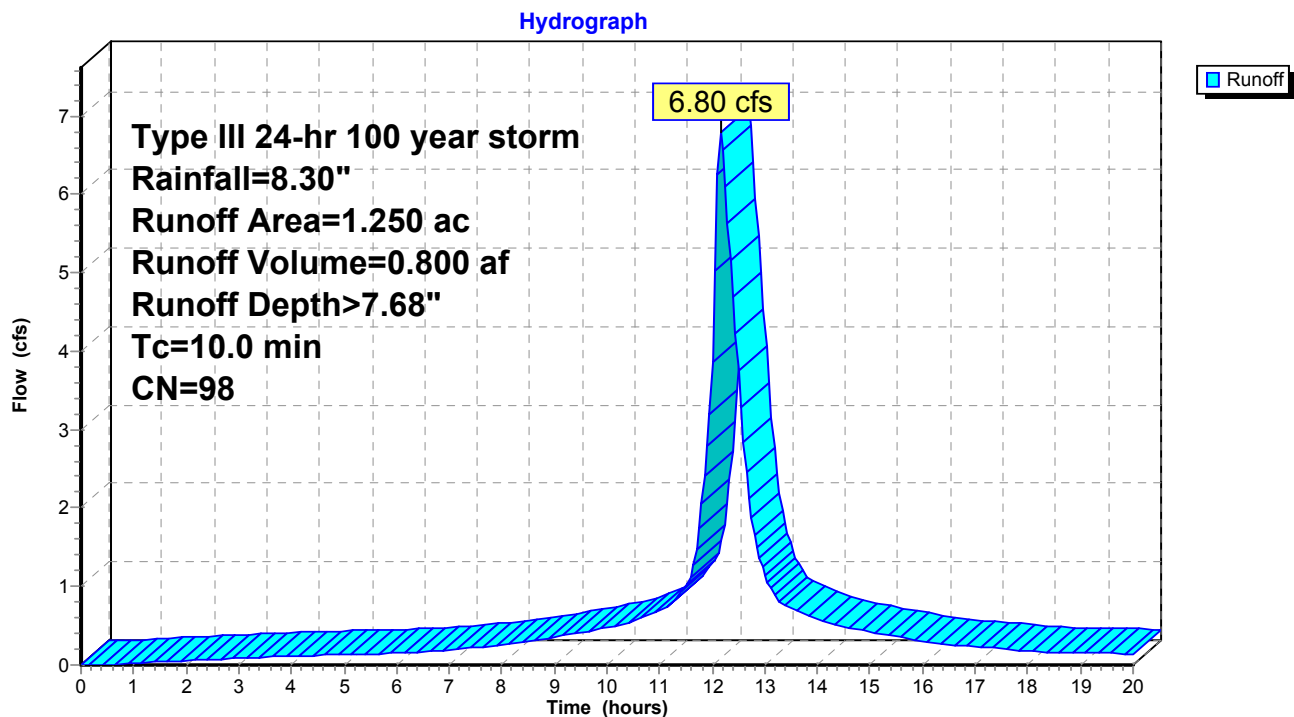
Runoff = 6.80 cfs @ 12.16 hrs, Volume= 0.800 af, Depth> 7.68"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 1.250	98	Impervious
1.250		100.00% Impervious Area

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

### Subcatchment 4AS: Area D1 Impervious



### Summary for Subcatchment 4S: Area D1 Pervious

Open Space appears to be located in HSG C soils. Assume HSG B soils to be conservative.

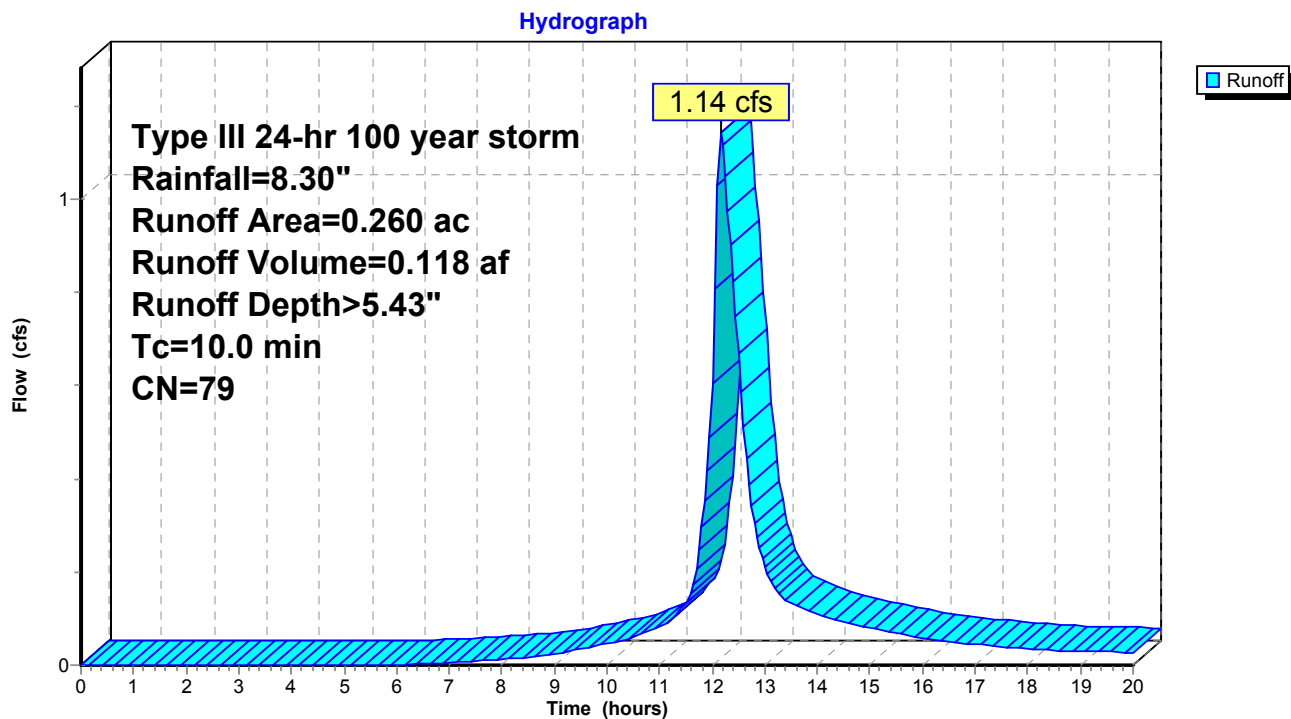
Runoff = 1.14 cfs @ 12.17 hrs, Volume= 0.118 af, Depth> 5.43"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 0.260	79	Open Space HSG B
0.260		100.00% Pervious Area

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

### Subcatchment 4S: Area D1 Pervious



### Summary for Subcatchment 5AS: Area D2 Impervious

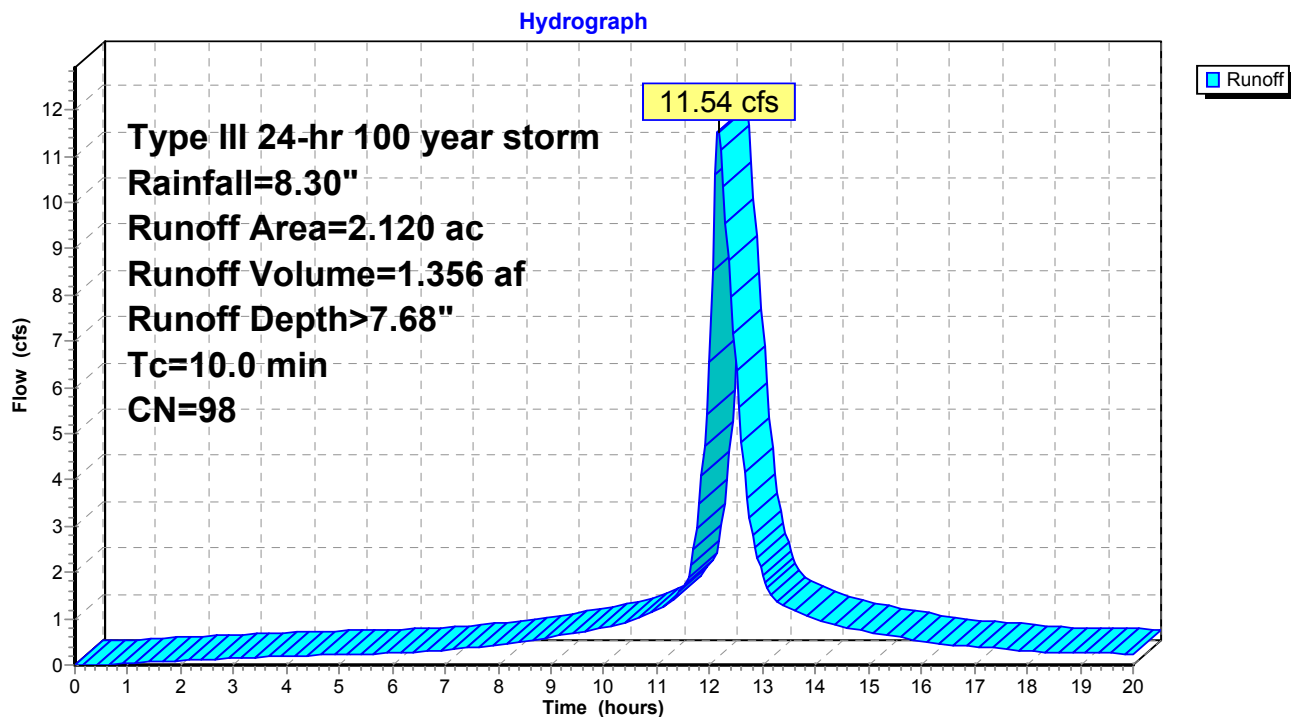
Runoff = 11.54 cfs @ 12.16 hrs, Volume= 1.356 af, Depth> 7.68"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 2.120	98	Impervious
2.120		100.00% Impervious Area

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

### Subcatchment 5AS: Area D2 Impervious



### Summary for Subcatchment 5S: Area D2 Pervious

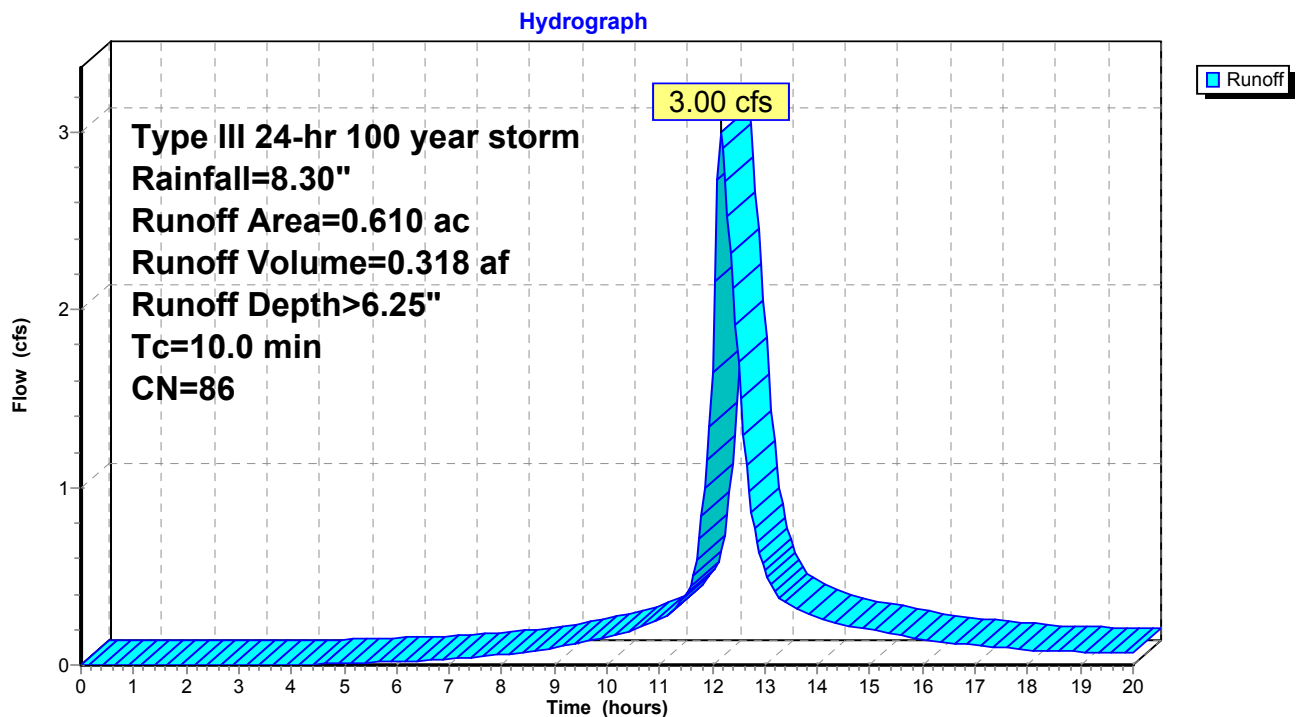
Runoff = 3.00 cfs @ 12.16 hrs, Volume= 0.318 af, Depth> 6.25"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 0.610	86	Open Space HSG C
0.610		100.00% Pervious Area

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

### Subcatchment 5S: Area D2 Pervious



### Summary for Subcatchment 6AS: Area D3 Impervious

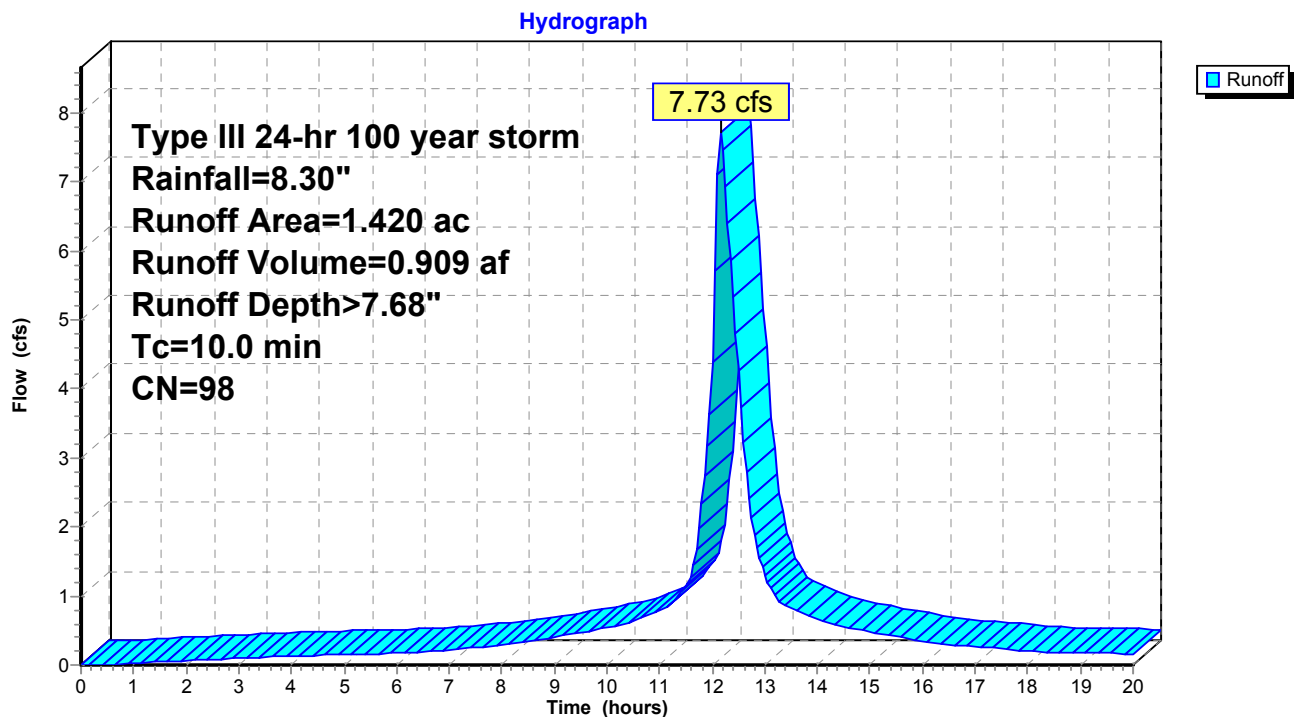
Runoff = 7.73 cfs @ 12.16 hrs, Volume= 0.909 af, Depth> 7.68"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 1.420	98	Impervious
1.420		100.00% Impervious Area

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

### Subcatchment 6AS: Area D3 Impervious



### Summary for Subcatchment 6S: Area D3 Pervious

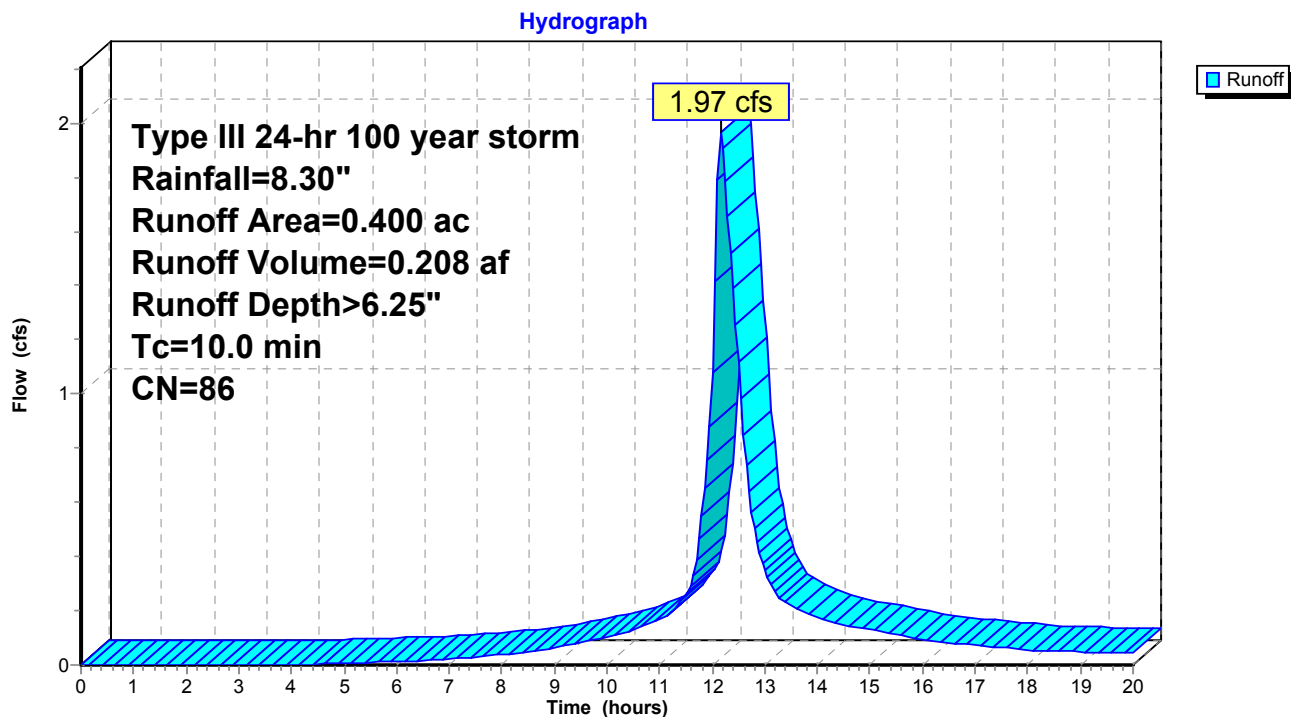
Runoff = 1.97 cfs @ 12.16 hrs, Volume= 0.208 af, Depth> 6.25"

Runoff by SCS TR-20 method, UH=Delmarva, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100 year storm Rainfall=8.30"

Area (ac)	CN	Description
* 0.400	86	Open Space HSG C
0.400		100.00% Pervious Area

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

### Subcatchment 6S: Area D3 Pervious





### Summary for Pond 7P: Basins C and D

The available storage in the basins was derived from the Pond Report submitted by the developer.  
 The outlet structure data was derived from the developer's stormwater report.

Inflow Area = 25.380 ac, 70.69% Impervious, Inflow Depth > 7.21" for 100 year storm event  
 Inflow = 133.53 cfs @ 12.16 hrs, Volume= 15.256 af  
 Outflow = 35.31 cfs @ 12.77 hrs, Volume= 10.948 af, Atten= 74%, Lag= 36.8 min  
 Primary = 35.31 cfs @ 12.77 hrs, Volume= 10.948 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 51.36' @ 12.77 hrs Surf.Area= 0 sf Storage= 385,581 cf

Plug-Flow detention time= 220.5 min calculated for 10.921 af (72% of inflow)  
 Center-of-Mass det. time= 151.6 min ( 885.3 - 733.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	49.20'	510,366 cf	<b>Custom Stage Data</b> Listed below

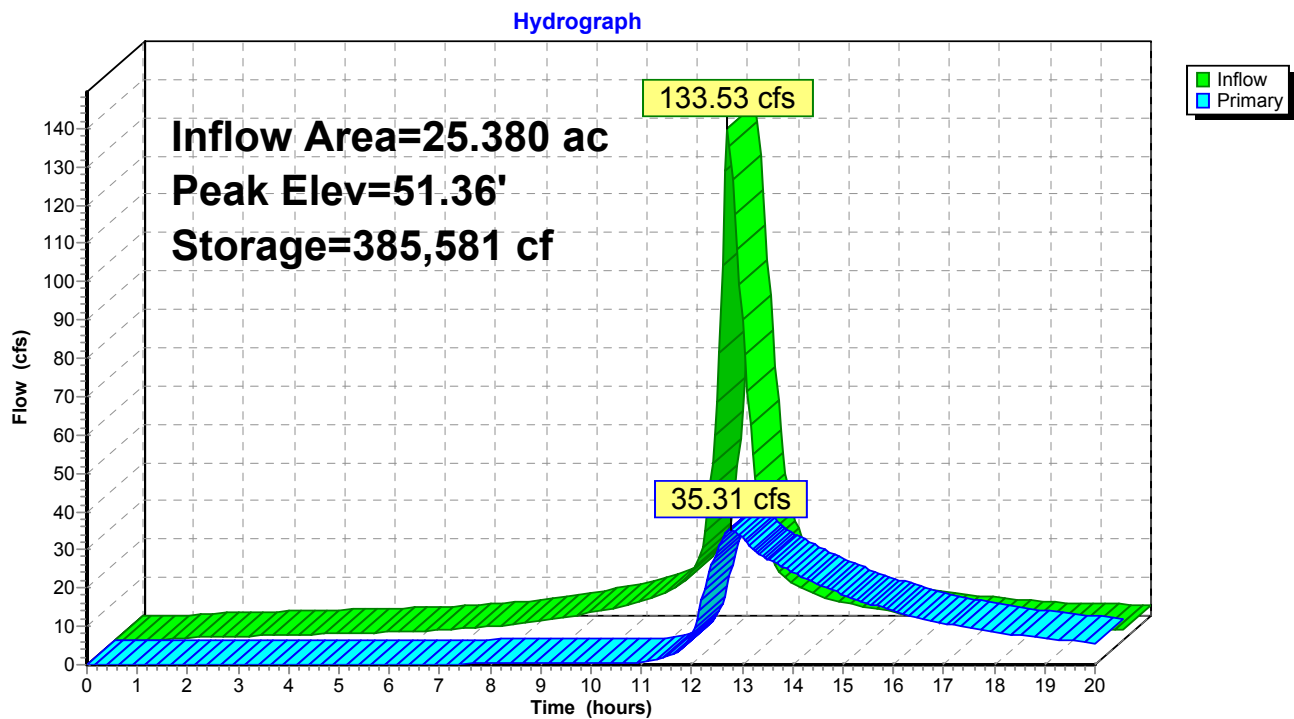
Elevation (feet)	Cum.Store (cubic-feet)
49.20	0
50.00	132,098
50.20	166,073
50.30	183,793
51.00	314,791
52.00	510,366

Device	Routing	Invert	Outlet Devices
#1	Primary	42.07'	<b>48.0" Round Culvert</b> L= 63.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 42.00' S= 0.0011 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	49.20'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	49.92'	<b>3.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	51.26'	<b>16.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#5	Primary	42.90'	<b>30.0" Round Culvert</b> L= 112.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 42.00' S= 0.0080 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets
#6	Device 5	49.20'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#7	Device 5	49.92'	<b>3.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#8	Device 5	51.26'	<b>16.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

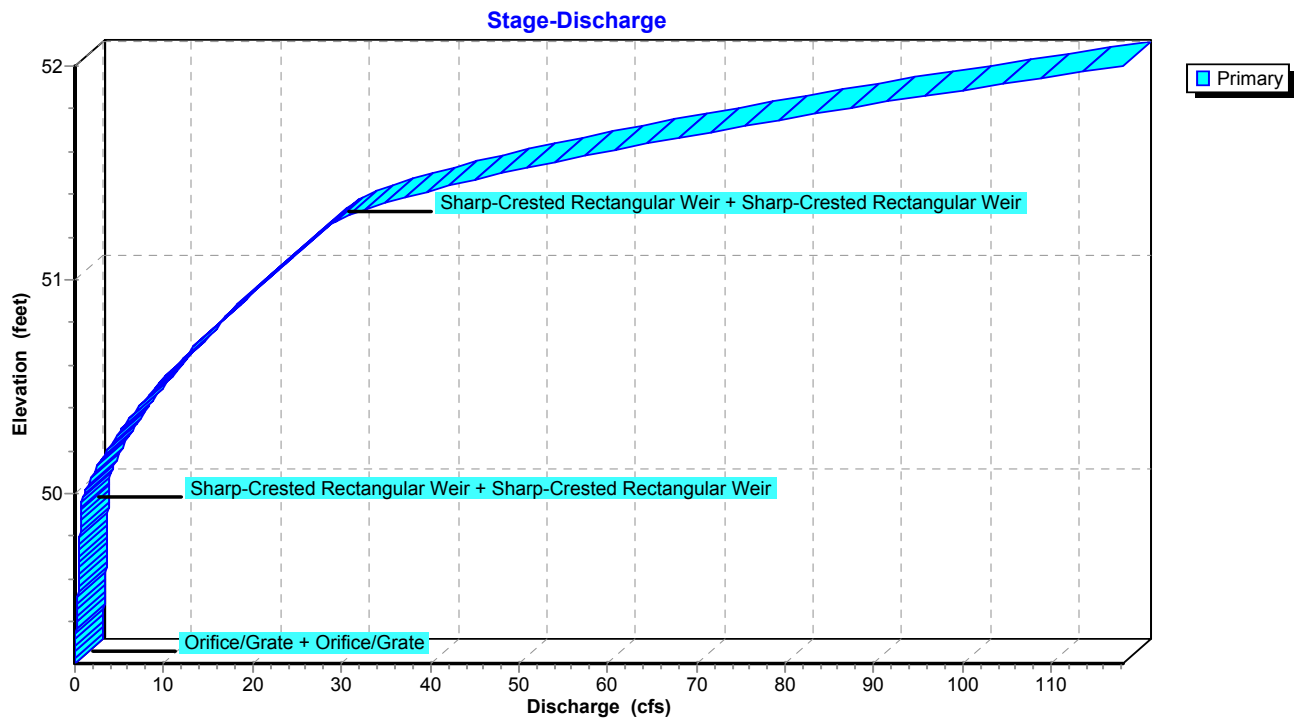
**Primary OutFlow** Max=35.25 cfs @ 12.77 hrs HW=51.36' (Free Discharge)

- 1=Culvert (Passes 17.63 cfs of 163.38 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.59 cfs @ 6.80 fps)
- 3=Sharp-Crested Rectangular Weir (Weir Controls 15.35 cfs @ 3.93 fps)
- 4=Sharp-Crested Rectangular Weir (Weir Controls 1.69 cfs @ 1.04 fps)
- 5=Culvert (Passes 17.63 cfs of 60.80 cfs potential flow)
- 6=Orifice/Grate (Orifice Controls 0.59 cfs @ 6.80 fps)
- 7=Sharp-Crested Rectangular Weir (Weir Controls 15.35 cfs @ 3.93 fps)
- 8=Sharp-Crested Rectangular Weir (Weir Controls 1.69 cfs @ 1.04 fps)

**Pond 7P: Basins C and D**



### Pond 7P: Basins C and D



### Summary for Link 8L: Point of Analysis

Inflow Area =    25.380 ac, 70.69% Impervious, Inflow Depth > 5.18"    for 100 year storm event  
Inflow        =    35.31 cfs @ 12.77 hrs, Volume=            10.948 af  
Primary       =    35.31 cfs @ 12.77 hrs, Volume=            10.948 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

### Link 8L: Point of Analysis

