

 November 30, 2020

## **STORMWATER MANAGEMENT REPORT**

Proposed Lidl Grocery Store – MONROE TOWNSHIP,  
GLOUCESTER COUNTY, NEW JERSEY

1020 NJ State Highway Route 42

Block 1101: Lot 11.01

Prepared for:

LIDL US OPERATIONS, LLC

Prepared by:

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**Kimley»»Horn**

**Table of Contents**

1. EXECUTIVE SUMMARY .....2

2. HYDROLOGY REPORT .....4

    2.1 - Background .....4

        2.1.1 Project Description.....4

        2.1.2 Objectives.....4

        2.1.3 Stormwater Modeling .....4

    2.2 - Existing Conditions .....5

        2.2.1 Overview.....5

    2.3 - Post-Developed Conditions .....6

        2.3.1 Overview.....6

        2.3.2 SWM Approach.....6

        2.3.3 Water Quality .....6

        2.3.4 Peak Discharge Control.....7

        2.3.5 Groundwater Recharge.....7

        2.3.6 Stormwater Conveyance.....8

3. EXHIBITS .....9

    EXHIBIT 1 - Existing Condition Drainage map.....10

    EXHIBIT 2 – Proposed Condition Drainage Map .....11

4. APPENDICES.....12

    APPENDIX A – Soil Type .....13

    APPENDIX B - Hydrocad Analysis - Existing .....14

    APPENDIX C - Hydrocad Analysis – Proposed .....15

    APPENDIX D – Groundwater Recharge Spreadsheet.....16

    APPENDIX E – Proposed Stormwater Conveyance Calculations .....17

## 1. EXECUTIVE SUMMARY

This report outlines the proposed Stormwater Management improvements (SWM) to be constructed for the proposed Lidl Grocery Store in Monroe Township, New Jersey. The proposed SWM system was designed in accordance with Monroe Township’s Code of Ordinances Chapter 175-140 – Stormwater Management as well as New Jersey Administrative Code, Section 7:8 (“NJAC”). The proposed storm system discharges into the modified stormwater basins. The existing drainage pattern intent will be maintained in the proposed condition to the extent practicable to meet the NJAC requirements for quantity control.

The total proposed stormwater management analysis area accounts for an area of 17.88 acres of which only 5.55 acres are disturbed. Existing and Proposed Condition Drainage Maps are provided as **Exhibit 1** and **Exhibit 2**, respectively.

NJAC 7:8 requires the peak post-development stormwater runoff rates from the project site for the 2-, 10-, and 100-year storms are 50%, 75%, and 80%, respectively, of the site’s peak pre-development stormwater runoff rates for the areas to be developed for the same storms. The proposed development provides additional storage volume by expanding the existing stormwater basins and uses a modified outlet control structure to meet the SWM ordinance requirement for quantity control.

The summary of flows is shown in Table 1 below for the 2, 10, and 100-year storm events. The peak discharge reduction required is calculated based on the pre-development runoff rate for the disturbed area only and not the total area of analysis. The table demonstrates that the post-developed condition will achieve the required flows, thus meeting the stormwater requirements of NJAC and Chapter 175-140 D. (2) (d) 3 of the Monroe Township Code of Ordinances. A detailed summary of flows for the point of investigation can be found in section 2.3.4 – Discharge Control.

**Table 1: Summary of Flows**

Design Year Storm	Total $Q_{Pre-Dev}$ (ft <sup>3</sup> /s)	LOD $Q_{Pre-Dev}$ (ft <sup>3</sup> /s)	Required Rate Reduction (%)	Required Rate Reduction (ft <sup>3</sup> /s)	Total Allowable $Q_{Post-Dev}$ (ft <sup>3</sup> /s)	Design Total $Q_{Post-Dev}$ (ft <sup>3</sup> /s)	Post ≤ Total Allowable?
2-year	1.04	0.49	50	0.25	0.79	0.64	Yes
10-year	2.33	2.98	25	0.75	1.58	1.56	Yes
100-year	12.16	11.28	20	2.26	9.90	9.17	Yes

The proposed development utilizes an infiltration basin to treat stormwater runoff and therefore satisfies the water quality control per Chapter 175-140 D. (5) (b) of the Monroe Township Code of Ordinances to reduce total suspended solids load in the stormwater runoff from the post-development site by 80 percent. The infiltration basin is designed in accordance with the New Jersey BMP Manual Chapter 9.5 – Infiltration Basins.

The proposed development and its stormwater management measures maintain 100 percent of the of the average annual preconstruction groundwater recharge volume for the site, and is compliant with groundwater recharge per Chapter 175-140 D. 1(3) (a) of the Monroe Township Code of Ordinances.

The project proposes underground stormwater conveyance system on the site. The proposed system will discharge into the stormwater basins on site. The proposed stormwater conveyance system was designed in accordance with Chapter 175-140 K. (5) of the Monroe Township Code of Ordinances and is sized to convey the 25-year storm event without overtopping the structures.

## 2. HYDROLOGY REPORT

### 2.1 - BACKGROUND

#### 2.1.1 Project Description

The proposed project involves the construction of a grocery store with associated parking in Monroe Township, New Jersey. The stormwater management system is designed to comply with the New Jersey Administrative Code (“NJAC”), Section 7:8 and the Monroe Township’s Code of Ordinances Chapter 175-140 – Stormwater Management. The proposed development’s stormwater runoff will be collected with a catch basin network to a proposed underground conveyance system. The proposed conveyance system will discharge at two locations into one of two stormwater basins located in the southern portion of the site along Lake Avenue. The existing stormwater basins will be modified to control runoff generated from the proposed development. The proposed development will maintain the existing drainage pattern intent to the ultimate discharge point at the southwest corner of the site.

#### 2.1.2 Objectives

The purpose of the following study is to evaluate the pre- and post-developed hydrologic and hydraulic conditions of the proposed development in order to determine appropriate site design measures or detention requirements for stormwater runoff. The NJAC requires that the peak post-development stormwater runoff rates from the project site for the 2-, 10-, and 100-year storms are 50%, 75%, and 80%, respectively, of the site’s peak pre-development stormwater runoff rates for the areas to be developed for the same storms.

With regard to water quality, the code requires that stormwater management measures shall be designed to reduce the total suspended solids (TSS) load in the stormwater runoff from the post-development site by 80%.

#### 2.1.3 Stormwater Modeling

To evaluate the impact of the proposed improvements on the stormwater runoff from the site, a procedure based upon the USDA Soil Conservation Service (SCS), TR-20 Method was chosen. Site area was divided into sub-watersheds using requirements set forth in the NJDEP 2004 Stormwater Management Regulations (including updated revisions). The SCS methods developed in TR-20 model the drainage area's response to rainfall in the form of an excess rainfall (runoff) hydrograph. A drainage shed's response is dependent upon the individual parameters which affect runoff. These parameters include:

1. Storm rainfall amount
2. Watershed size and shape
3. Hydrologic soils group
4. Land use and treatment classification
5. Time of concentration.

The time of concentrations (Tc) for the analyzed area were based on SCS TR-55 Methodology. The minimum Tc of 6 minutes was used for directly connected impervious areas in the calculations when applicable. For the Site Stormwater Management analysis, HydroCAD v10.0 computer program developed by HydroCAD Software Solutions LLC was used. The program is modeled after the SCS, USDA TR-20 Program. The design storm depth is determined from rainfall maps, based on the return period being modeled. Combined with the rainfall distribution, this specifies the cumulative rainfall depth at all times during the storm. For this study a Type III, 24-hour rainfall distribution was used for the storm durations for the 2-, 10-, and 100-year storm events. Cumulative rainfall depth obtained from the National Oceanic and Atmospheric Administration (NOAA) for the project site are presented in Table 2 and included in Appendix A.

**Table 2: Rainfall Amounts for Monroe Township**

Design Year Storm	24-Hour Rainfall Accumulation (inches)
2-year	3.31
10-year	5.11
100-year	8.69

## 2.2 - EXISTING CONDITIONS

### 2.2.1 Overview

The existing ±6.21-acre property is mostly undeveloped area with an existing access road. The existing development consists mostly of wooded open space. Two existing stormwater basins are located in the southern portion of the site along Lake Avenue.

The site is delineated into three existing drainage areas, which ultimately converge in the existing storm conveyance system at the intersection of Black Horse Pike and Lake Avenue in the southwest corner of the site. All cover types were considered to be in “good” condition, and all runoff curve number/coefficient data was obtained via the NRCS TR-55 manual or directly from NJAC. Drainage Area 1 consists of all areas that drain via overland surface flow to the existing eastern stormwater basin (Basin 1). Included in this drainage area is approximately 6 acres of offsite drainage from the adjacent properties to the north, which drain to the Herbert Boulevard right-of-way and eventually flows on to the subject property site. The drainage divide between Drainage Area 1 and Drainage Area 2 is primarily the existing eastern curb of the access road onsite. Drainage Area 2 consists of all areas that drain via overland surface flow and storm conveyance systems to the western stormwater basin (Basin 2). Included in this drainage area is approximately 3.8 acres of offsite drainage from the adjacent properties to the north, which drain to an existing storm conveyance system into Basin 2. Basin 1 discharges via an outlet control structure to Basin 1. Drainage Area 3 consists of portions of the subject property that drain directly into the right-of-way. The existing drainage conditions can be seen on the *Existing Conditions*

*Drainage Map* found as **Exhibit 1** of this report. The point of analysis for the present study is considered the existing storm inlet at the southwest corner of the site located at the intersection of Black Horse Pike and Lake Avenue.

Additional information regarding the existing stormwater basins were obtained from the Township with an Open Public Records Act (OPRA) Request. The drainage report provided was not complete, however the existing drainage area maps confirm there is significant amounts of offsite drainage to the basins. The documents provided indicate there were multiple phases of development proposed for Lake Plaza, including a third detention basin. In the drainage report provided, only two basins were proposed and analyzed. The drainage report analyzed the buildout of the bank property and an approximately 7,000 square foot building with all required parking adjacent to the western basin. The stormwater design proposed post-development peak runoff rates for the 2-, 10-, and 100-year storm events be 50, 75, and 80 percent, respectively, of the pre-construction peak runoff rates as well as provide the required groundwater recharge.

## 2.3 - POST-DEVELOPED CONDITIONS

### 2.3.1 Overview

This report analyzes approximately 17.88 acres of total area with approximately 5.55 acres of disturbance. The proposed development will maintain the existing condition drainage pattern intent to the point of analysis. The proposed roof drainage will be collected and discharged into Basin 1. The majority of the proposed parking lot will be collected via a storm conveyance system and discharged into Basin 2. All offsite drainage patterns will be maintained and conveyed to the same basin as in the existing conditions. Runoff to the right-of-way will ultimately discharge to the point of analysis.

### 2.3.2 SWM Approach

The approach taken in designing the proposed conditions was based on topographical and geographical constraints, as well as existing stormwater management and conveyance system. The approach takes into consideration maintaining the existing drainage patterns to the extent practicable. To meet the stormwater management requirements, the existing systems in place will be modified for the proposed development. The proposed development's runoff will be collected in a storm conveyance system and discharged into the existing basins. The existing basins will be expanded to account for the additional runoff volume. Basin 2 will be converted into an infiltration basin for stormwater quality treatment. The Basin 2 outlet control structure will be modified, but it will maintain its discharge into the existing storm conveyance system in Lake Avenue.

### 2.3.3 Water Quality

Per Chapter 175-140 D. (5) (b) of the Monroe Township Code of Ordinances, stormwater management measures shall be designed to reduce the total suspended solids (TSS) load in the stormwater runoff from the post-development site by 80 percent. The proposed development will convert Basin 2 into an infiltration basin to satisfy the water quality requirement. An infiltration basin provides 80 percent TSS removal. The infiltration is designed in accordance with the New Jersey

BMP Manual Chapter 9.5 – Infiltration Basins. All runoff from proposed impervious surfaces will be collected and discharged into Basin 1 or Basin 2. Basin 1 will maintain its discharge into Basin 1. Ultimately, all impervious area runoff will pass through Basin 1 to be treated.

**2.3.4 Peak Discharge Control**

To satisfy Chapter 175-140 D. (2) (d) 3 of the Monroe Township Code of Ordinances, it shall be demonstrated through hydrologic and hydraulic analysis that for stormwater leaving the site, the peak post-development stormwater runoff rates for the 2-, 10- and 100-year storm events are 50, 75, 80 percent, respectively, of the site’s peak pre-development stormwater runoff rates for the same storms. To the achieve water quantity requirement, the existing stormwater basins will be expanded and the outlet control structure for Basin 2 will be modified.

The project evaluated the pre-development peak discharges to the point of analysis for the full contributing drainage area of 17.88 acres. The existing runoff rates within the proposed limits of analysis were also calculated. The rate reductions for the 2-, 10-, and 100-year storm events of 50, 25, and 20 percent were calculated based on the disturbed area runoff rates only. These reductions were then applied to the pre-development peak discharges at the point of analysis. The hydrologic and hydraulic analysis for the post-development conditions demonstrates that the peak post-development stormwater runoff rates for the 2-, 10- and 100-year storm events are 50, 75, 80 percent, respectively, of the site’s peak pre-development stormwater runoff rates for the same storms. The peak discharges for the point of analysis are summarized in Table 3 below. The results of the existing and proposed analysis can be found in **Appendix B** and **C**, respectively.

**Table 3: Summary of Flows**

Design Year Storm	Total Q <sub>Pre-Dev</sub> (ft <sup>3</sup> /s)	LOD Q <sub>Pre-Dev</sub> (ft <sup>3</sup> /s)	Required Rate Reduction (%)	Required Rate Reduction (ft <sup>3</sup> /s)	Total Allowable Q <sub>Post-Dev</sub> (ft <sup>3</sup> /s)	Design Total Q <sub>Post-Dev</sub> (ft <sup>3</sup> /s)	Post ≤ Total Allowable?
2-year	1.04	0.49	50	0.25	0.79	0.64	Yes
10-year	2.33	2.98	25	0.75	1.58	1.56	Yes
100-year	12.16	11.28	20	2.26	9.90	9.17	Yes

**2.3.5 Groundwater Recharge**

To satisfy Chapter 175-140 D. 1(3) (a) of the Monroe Township Code of Ordinances, it shall be demonstrated through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100 percent of the average annual preconstruction groundwater recharge volume for the site. The Groundwater Recharge Spreadsheet can be found in **Appendix D** of this report. By providing infiltration with the infiltration basin, the proposed development satisfies this requirement.



**2.3.6 Stormwater Conveyance**

The project proposes underground stormwater conveyance system on the site. The proposed system will discharge into the stormwater basins on site. The proposed stormwater conveyance system was designed in accordance with Chapter 175-140 K. (5) of the Monroe Township Code of Ordinances. For flood protection, the proposed storm drain network is sized to convey the 25-year storm event without overtopping the structures. Calculations for the proposed conveyance system can be found in **Appendix E** of this report.

### **3. EXHIBITS**



**NOAA Atlas 14, Volume 2, Version 3**  
**Location name: Williamstown, New Jersey, USA\***  
**Latitude: 39.6995°, Longitude: -75.0013°**  
**Elevation: 142.88 ft\*\***  
 \* source: ESRI Maps  
 \*\* source: USGS



**POINT PRECIPITATION FREQUENCY ESTIMATES**

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps & aerials](#)

**PF tabular**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
<b>5-min</b>	<b>0.351</b> (0.318-0.386)	<b>0.417</b> (0.378-0.458)	<b>0.490</b> (0.444-0.539)	<b>0.549</b> (0.496-0.604)	<b>0.618</b> (0.556-0.680)	<b>0.670</b> (0.600-0.739)	<b>0.721</b> (0.643-0.797)	<b>0.767</b> (0.679-0.852)	<b>0.824</b> (0.721-0.921)	<b>0.870</b> (0.754-0.980)
<b>10-min</b>	<b>0.560</b> (0.508-0.616)	<b>0.666</b> (0.605-0.733)	<b>0.785</b> (0.711-0.863)	<b>0.877</b> (0.793-0.966)	<b>0.985</b> (0.886-1.08)	<b>1.07</b> (0.956-1.18)	<b>1.15</b> (1.02-1.27)	<b>1.22</b> (1.08-1.35)	<b>1.30</b> (1.14-1.46)	<b>1.37</b> (1.19-1.54)
<b>15-min</b>	<b>0.700</b> (0.635-0.770)	<b>0.838</b> (0.760-0.921)	<b>0.993</b> (0.899-1.09)	<b>1.11</b> (1.00-1.22)	<b>1.25</b> (1.12-1.37)	<b>1.35</b> (1.21-1.49)	<b>1.45</b> (1.29-1.60)	<b>1.53</b> (1.36-1.70)	<b>1.64</b> (1.44-1.83)	<b>1.72</b> (1.49-1.94)
<b>30-min</b>	<b>0.960</b> (0.870-1.06)	<b>1.16</b> (1.05-1.27)	<b>1.41</b> (1.28-1.55)	<b>1.61</b> (1.45-1.77)	<b>1.85</b> (1.66-2.04)	<b>2.03</b> (1.82-2.24)	<b>2.22</b> (1.98-2.45)	<b>2.39</b> (2.11-2.65)	<b>2.61</b> (2.29-2.92)	<b>2.79</b> (2.42-3.14)
<b>60-min</b>	<b>1.20</b> (1.09-1.32)	<b>1.45</b> (1.32-1.60)	<b>1.81</b> (1.64-1.99)	<b>2.09</b> (1.89-2.31)	<b>2.46</b> (2.22-2.71)	<b>2.76</b> (2.47-3.04)	<b>3.05</b> (2.72-3.38)	<b>3.35</b> (2.97-3.72)	<b>3.74</b> (3.28-4.19)	<b>4.07</b> (3.53-4.58)
<b>2-hr</b>	<b>1.44</b> (1.29-1.60)	<b>1.75</b> (1.57-1.95)	<b>2.19</b> (1.97-2.44)	<b>2.56</b> (2.29-2.85)	<b>3.04</b> (2.70-3.39)	<b>3.43</b> (3.03-3.82)	<b>3.82</b> (3.36-4.28)	<b>4.22</b> (3.69-4.75)	<b>4.76</b> (4.11-5.40)	<b>5.21</b> (4.44-5.94)
<b>3-hr</b>	<b>1.57</b> (1.42-1.75)	<b>1.91</b> (1.72-2.12)	<b>2.40</b> (2.15-2.67)	<b>2.81</b> (2.51-3.13)	<b>3.35</b> (2.98-3.74)	<b>3.81</b> (3.36-4.24)	<b>4.27</b> (3.74-4.78)	<b>4.75</b> (4.12-5.34)	<b>5.42</b> (4.62-6.13)	<b>5.97</b> (5.03-6.78)
<b>6-hr</b>	<b>1.95</b> (1.76-2.19)	<b>2.36</b> (2.12-2.64)	<b>2.95</b> (2.65-3.30)	<b>3.47</b> (3.10-3.88)	<b>4.18</b> (3.71-4.68)	<b>4.79</b> (4.21-5.37)	<b>5.43</b> (4.73-6.10)	<b>6.12</b> (5.26-6.90)	<b>7.10</b> (5.99-8.06)	<b>7.94</b> (6.60-9.07)
<b>12-hr</b>	<b>2.36</b> (2.13-2.65)	<b>2.85</b> (2.56-3.20)	<b>3.58</b> (3.22-4.02)	<b>4.25</b> (3.81-4.76)	<b>5.22</b> (4.62-5.84)	<b>6.07</b> (5.32-6.80)	<b>6.99</b> (6.04-7.86)	<b>8.00</b> (6.81-9.04)	<b>9.49</b> (7.89-10.8)	<b>10.8</b> (8.81-12.4)
<b>24-hr</b>	<b>2.73</b> (2.48-3.01)	<b>3.31</b> (3.02-3.65)	<b>4.28</b> (3.89-4.72)	<b>5.11</b> (4.63-5.63)	<b>6.37</b> (5.72-6.99)	<b>7.47</b> (6.67-8.17)	<b>8.69</b> (7.71-9.49)	<b>10.1</b> (8.85-11.0)	<b>12.2</b> (10.5-13.2)	<b>14.0</b> (12.0-15.2)
<b>2-day</b>	<b>3.10</b> (2.82-3.43)	<b>3.77</b> (3.44-4.17)	<b>4.87</b> (4.43-5.38)	<b>5.81</b> (5.27-6.40)	<b>7.22</b> (6.50-7.93)	<b>8.43</b> (7.55-9.25)	<b>9.79</b> (8.70-10.7)	<b>11.3</b> (9.96-12.4)	<b>13.6</b> (11.8-14.9)	<b>15.5</b> (13.4-17.0)
<b>3-day</b>	<b>3.27</b> (2.99-3.59)	<b>3.97</b> (3.64-4.36)	<b>5.11</b> (4.67-5.60)	<b>6.07</b> (5.54-6.65)	<b>7.51</b> (6.80-8.19)	<b>8.75</b> (7.88-9.53)	<b>10.1</b> (9.05-11.0)	<b>11.6</b> (10.3-12.6)	<b>13.9</b> (12.2-15.1)	<b>15.9</b> (13.7-17.3)
<b>4-day</b>	<b>3.44</b> (3.17-3.76)	<b>4.17</b> (3.84-4.56)	<b>5.35</b> (4.91-5.83)	<b>6.34</b> (5.80-6.89)	<b>7.81</b> (7.11-8.46)	<b>9.06</b> (8.20-9.81)	<b>10.4</b> (9.39-11.3)	<b>12.0</b> (10.7-12.9)	<b>14.2</b> (12.6-15.4)	<b>16.2</b> (14.1-17.5)
<b>7-day</b>	<b>4.02</b> (3.72-4.38)	<b>4.84</b> (4.48-5.28)	<b>6.11</b> (5.65-6.66)	<b>7.18</b> (6.61-7.81)	<b>8.74</b> (8.02-9.50)	<b>10.1</b> (9.19-10.9)	<b>11.5</b> (10.4-12.5)	<b>13.1</b> (11.8-14.2)	<b>15.5</b> (13.8-16.8)	<b>17.5</b> (15.4-18.9)
<b>10-day</b>	<b>4.54</b> (4.21-4.91)	<b>5.45</b> (5.06-5.90)	<b>6.76</b> (6.27-7.31)	<b>7.84</b> (7.26-8.48)	<b>9.40</b> (8.66-10.1)	<b>10.7</b> (9.81-11.5)	<b>12.1</b> (11.0-13.0)	<b>13.5</b> (12.3-14.6)	<b>15.8</b> (14.2-17.0)	<b>17.7</b> (15.7-19.1)
<b>20-day</b>	<b>6.14</b> (5.76-6.56)	<b>7.30</b> (6.85-7.80)	<b>8.81</b> (8.25-9.41)	<b>10.0</b> (9.38-10.7)	<b>11.7</b> (10.9-12.5)	<b>13.1</b> (12.1-13.9)	<b>14.5</b> (13.4-15.4)	<b>15.9</b> (14.7-17.0)	<b>17.9</b> (16.4-19.1)	<b>19.5</b> (17.7-20.9)
<b>30-day</b>	<b>7.61</b> (7.17-8.09)	<b>9.01</b> (8.49-9.57)	<b>10.7</b> (10.1-11.4)	<b>12.0</b> (11.3-12.8)	<b>13.8</b> (13.0-14.7)	<b>15.3</b> (14.3-16.2)	<b>16.7</b> (15.6-17.7)	<b>18.1</b> (16.9-19.3)	<b>20.1</b> (18.6-21.4)	<b>21.6</b> (19.9-23.0)
<b>45-day</b>	<b>9.70</b> (9.17-10.3)	<b>11.4</b> (10.8-12.1)	<b>13.4</b> (12.6-14.1)	<b>14.8</b> (14.0-15.7)	<b>16.7</b> (15.8-17.7)	<b>18.2</b> (17.1-19.2)	<b>19.6</b> (18.4-20.7)	<b>20.9</b> (19.6-22.2)	<b>22.7</b> (21.2-24.1)	<b>24.0</b> (22.3-25.5)
<b>60-day</b>	<b>11.6</b> (11.0-12.3)	<b>13.7</b> (13.0-14.4)	<b>15.8</b> (14.9-16.6)	<b>17.3</b> (16.4-18.3)	<b>19.3</b> (18.3-20.4)	<b>20.8</b> (19.6-21.9)	<b>22.2</b> (20.9-23.4)	<b>23.5</b> (22.1-24.8)	<b>25.1</b> (23.5-26.6)	<b>26.3</b> (24.6-27.9)

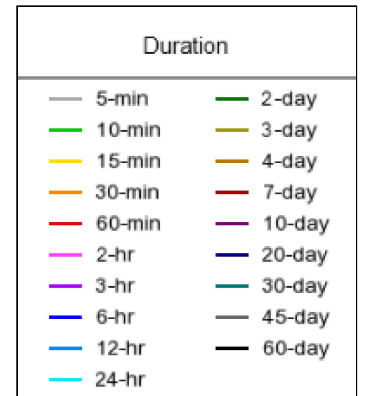
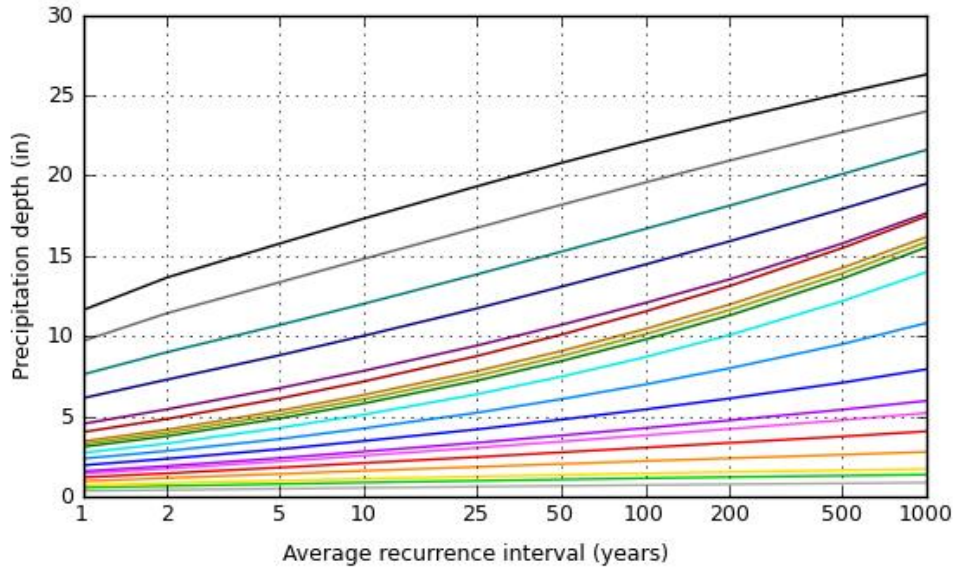
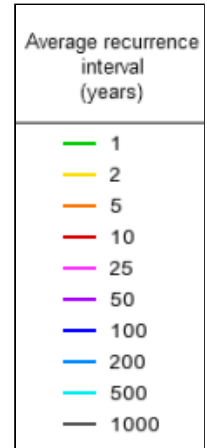
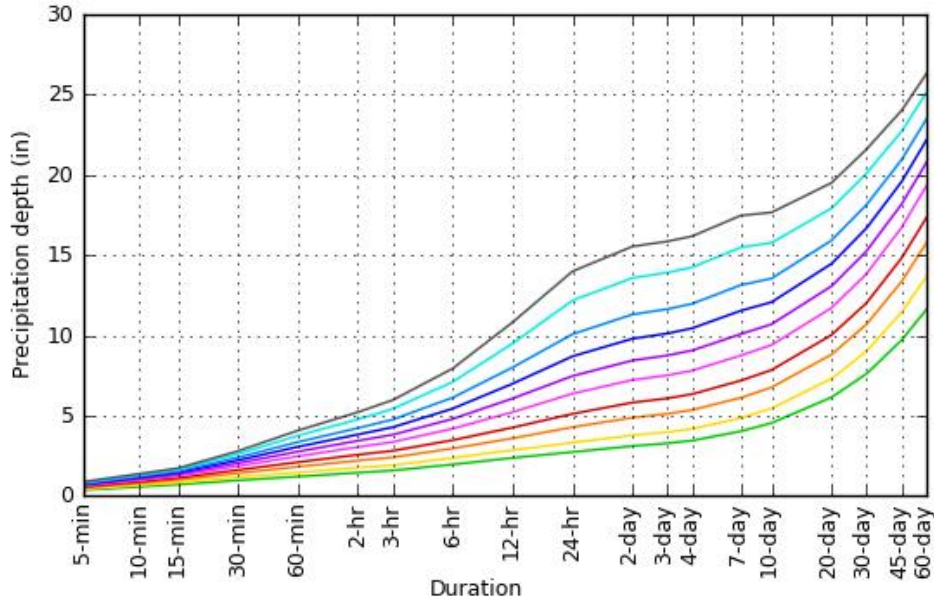
<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

**PF graphical**

PDS-based depth-duration-frequency (DDF) curves

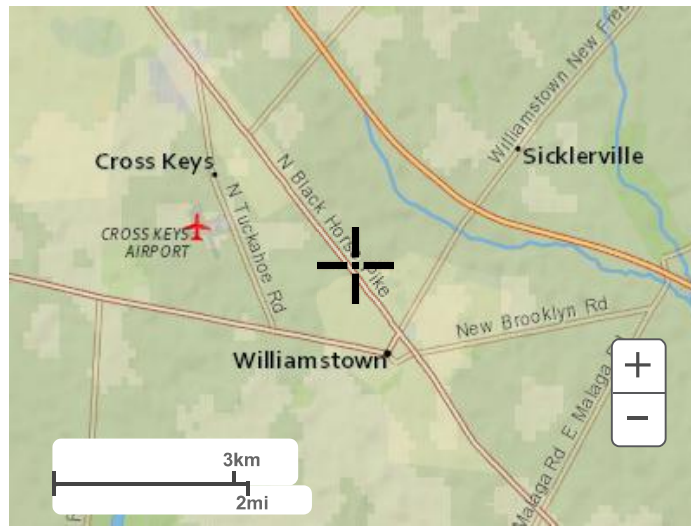
Latitude: 39.6995°, Longitude: -75.0013°



[Back to Top](#)

**Maps & aeriels**

**Small scale terrain**



Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)

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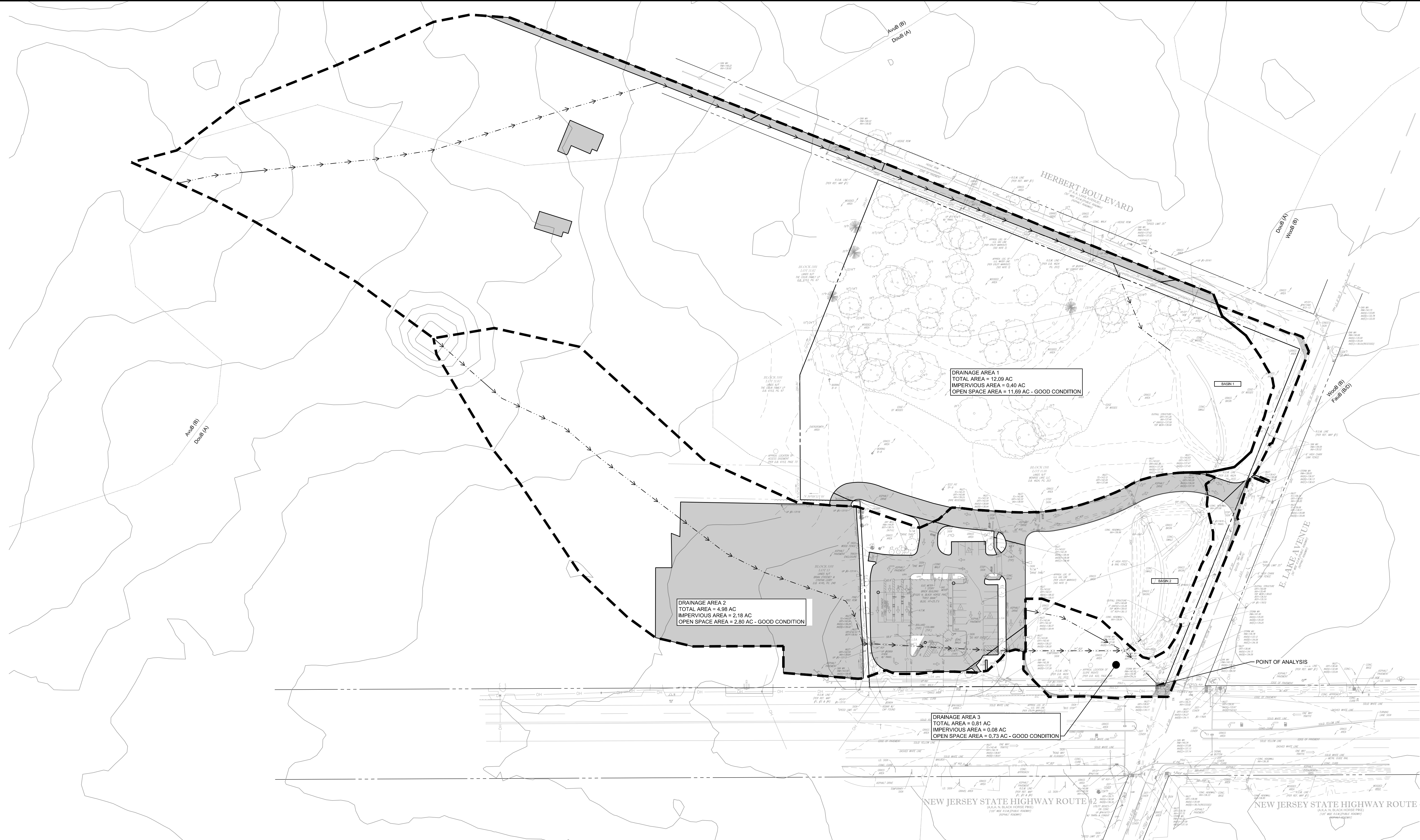
[US Department of Commerce](#)  
[National Oceanic and Atmospheric Administration](#)  
[National Weather Service](#)  
[National Water Center](#)  
1325 East West Highway  
Silver Spring, MD 20910  
Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

[Disclaimer](#)

**EXHIBIT 1 - EXISTING CONDITION  
DRAINAGE MAP**



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**DRAINAGE AREA 1**  
 TOTAL AREA = 12.09 AC  
 IMPERVIOUS AREA = 0.40 AC  
 OPEN SPACE AREA = 11.69 AC - GOOD CONDITION

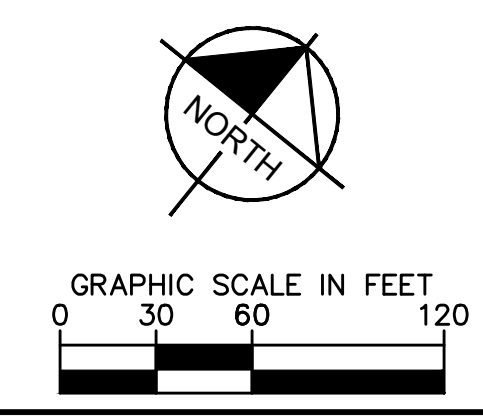
**DRAINAGE AREA 2**  
 TOTAL AREA = 4.98 AC  
 IMPERVIOUS AREA = 2.18 AC  
 OPEN SPACE AREA = 2.80 AC - GOOD CONDITION

**DRAINAGE AREA 3**  
 TOTAL AREA = 0.81 AC  
 IMPERVIOUS AREA = 0.08 AC  
 OPEN SPACE AREA = 0.73 AC - GOOD CONDITION

**LEGEND**

PROPERTY LINE	
SOIL BOUNDARY	
DRAINAGE AREA	
TIME OF CONCENTRATION PATH	
IMPERVIOUS AREA	
SOIL TYPE	AdmM
HYDROLOGIC SOIL GROUP	(HSG C)

- NOTES**
1. A TIME OF CONCENTRATION OF 6 MINUTES IS USED FOR DIRECTLY CONNECTED IMPERVIOUS AREA.
  2. TIME OF CONCENTRATION PATHS FOR THE SITE HAVE A TRAVEL TIME LESS THAN THE MINIMUM TIME OF CONCENTRATION OF 6 MINUTES. A TIME OF CONCENTRATION OF 6 MINUTES IS USED FOR THE DRAINAGE AREAS.
  3. FOR AREAS OUTSIDE OF THE LIMITS OF THE TOPOGRAPHIC SURVEY, 2' CONTOURS ARE GENERATED FROM THE USGS NED 1-METER DELAWARE VALLEY HD (2015) OBTAINED FROM THE USGS NATIONAL MAP.



**Know what's below.  
 Call before you dig.**

PRIOR TO CONSTRUCTION, CONTRACTOR SHALL CALL  
 NEW JERSEY ONE CALL CENTER  
 STATE OF NEW JERSEY  
 DIAL 811 OR 1-800-272-1000  
 FOR LOCATION OF UNDERGROUND UTILITIES

No.	REVISIONS	DATE	BY

PREPARED BY: **Kimley»Horn**  
 © 2020 KIMLEY-HORN AND ASSOCIATES, INC.  
 902 CARNEGIE CENTER BLVD., SUITE 140, PRINCETON, NJ 08540  
 PHONE: 609-681-2428  
 WWW.KIMLEY-HORN.COM

CERTIFICATE OF AUTHORIZATION No. 24GA28039500

KHA PROJECT	110424119
DATE	11/25/2020
SCALE	AS SHOWN
DESIGNED BY	AAC
DRAWN BY	RDA
CHECKED BY	AAC

DRAWING NAME:  
**DRAINAGE AREA  
 EXISTING  
 CONDITIONS**

**LIDL US OPERATIONS, LLC**  
 PROPOSED GROCERY STORE #1480  
 1020 NORTH BLACK HORSE PIKE  
 BLOCK 1101 - LOT 11.01

SHEET NUMBER  
**DA-EX**

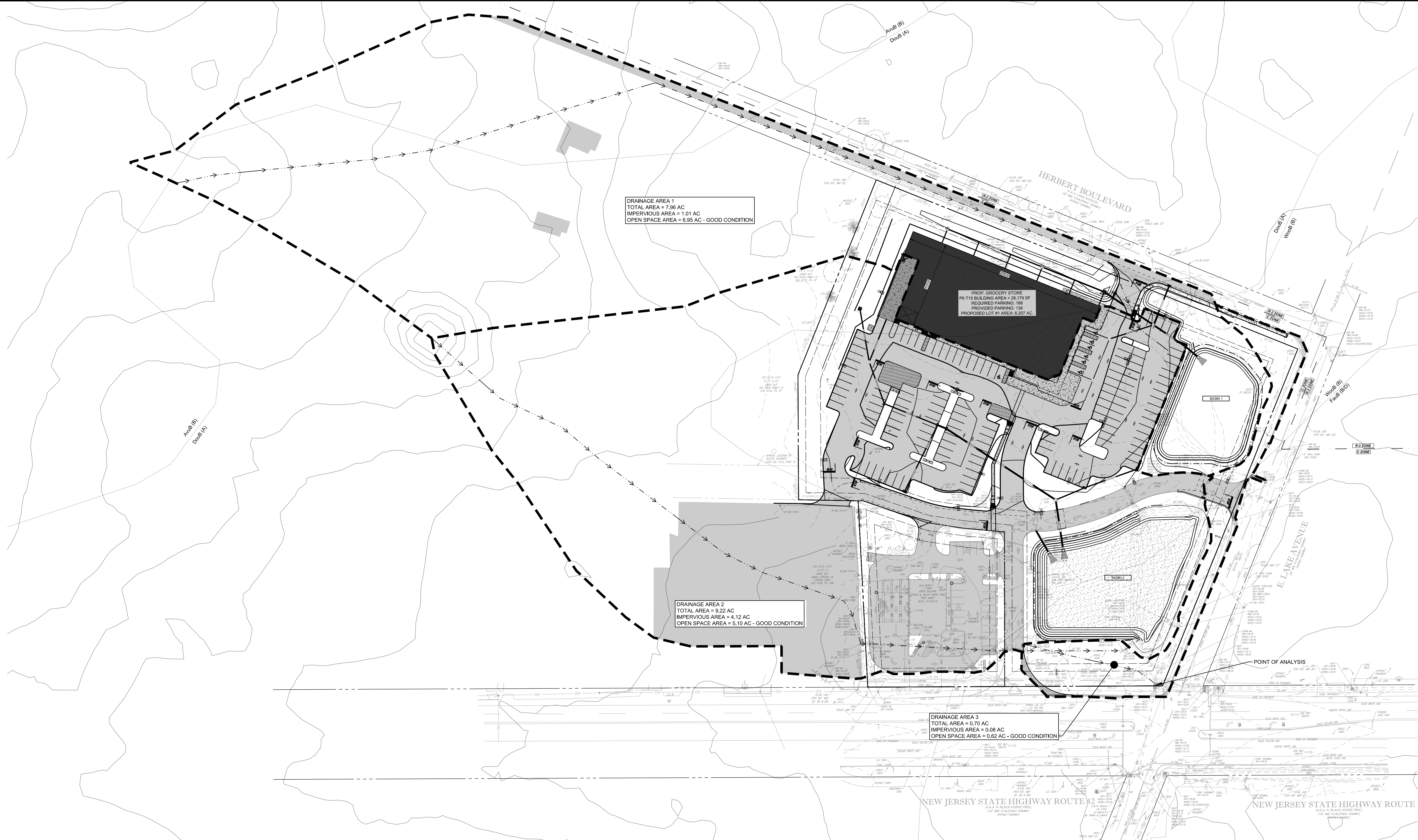
NEW JERSEY



## **EXHIBIT 2 – PROPOSED CONDITION DRAINAGE MAP**



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**DRAINAGE AREA 1**  
 TOTAL AREA = 7.96 AC  
 IMPERVIOUS AREA = 1.01 AC  
 OPEN SPACE AREA = 6.95 AC - GOOD CONDITION

**PROP. GROCERY STORE**  
 PB T15 BUILDING AREA = 33,779 SF  
 REQUIRED PARKING: 188  
 PROVIDED PARKING: 138  
 PROPOSED LOT #1 AREA: 6,207 AC

**DRAINAGE AREA 2**  
 TOTAL AREA = 9.22 AC  
 IMPERVIOUS AREA = 4.12 AC  
 OPEN SPACE AREA = 5.10 AC - GOOD CONDITION

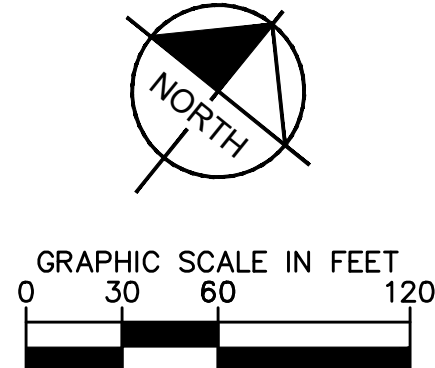
**DRAINAGE AREA 3**  
 TOTAL AREA = 0.70 AC  
 IMPERVIOUS AREA = 0.08 AC  
 OPEN SPACE AREA = 0.62 AC - GOOD CONDITION

**LEGEND**

- PROPERTY LINE
- SOIL BOUNDARY
- DRAINAGE AREA
- TIME OF CONCENTRATION PATH
- IMPERVIOUS AREA
- SOIL TYPE
- HYDROLOGIC SOIL GROUP

**NOTES**

1. A TIME OF CONCENTRATION OF 6 MINUTES IS USED FOR DIRECTLY CONNECTED IMPERVIOUS AREA.
2. TIME OF CONCENTRATION PATHS FOR THE SITE HAVE A TRAVEL TIME LESS THAN THE MINIMUM TIME OF CONCENTRATION OF 6 MINUTES. A TIME OF CONCENTRATION OF 6 MINUTES IS USED FOR THE DRAINAGE AREAS.
3. FOR AREAS OUTSIDE OF THE LIMITS OF THE TOPOGRAPHIC SURVEY, 2' CONTOURS ARE GENERATED FROM THE USGS NED 1-METER DELAWARE VALLEY HD (2015) OBTAINED FROM THE USGS NATIONAL MAP.



**Know what's below.  
 Call before you dig.**

PRIOR TO CONSTRUCTION, CONTRACTOR SHALL CALL  
 NEW JERSEY ONE CALL CENTER  
 STATE OF NEW JERSEY  
 DIAL 811 OR 1-800-272-1000  
 FOR LOCATION OF UNDERGROUND UTILITIES

No.	REVISIONS	DATE	BY

PREPARED BY: **Kimley»Horn**  
 © 2020 KIMLEY-HORN AND ASSOCIATES, INC.  
 902 CARNEGIE CENTER BLVD, SUITE 140, PRINCETON, NJ 08540  
 PHONE: 609-681-2428  
 WWW.KIMLEY-HORN.COM  
 CERTIFICATE OF AUTHORIZATION No. 24GA38039500

KHA PROJECT	110424119
DATE	11/25/2020
SCALE	AS SHOWN
DESIGNED BY	AAC
DRAWN BY	RDA
CHECKED BY	AAC

DRAWING NAME:  
**DRAINAGE AREA  
 PROPOSED  
 CONDITIONS**

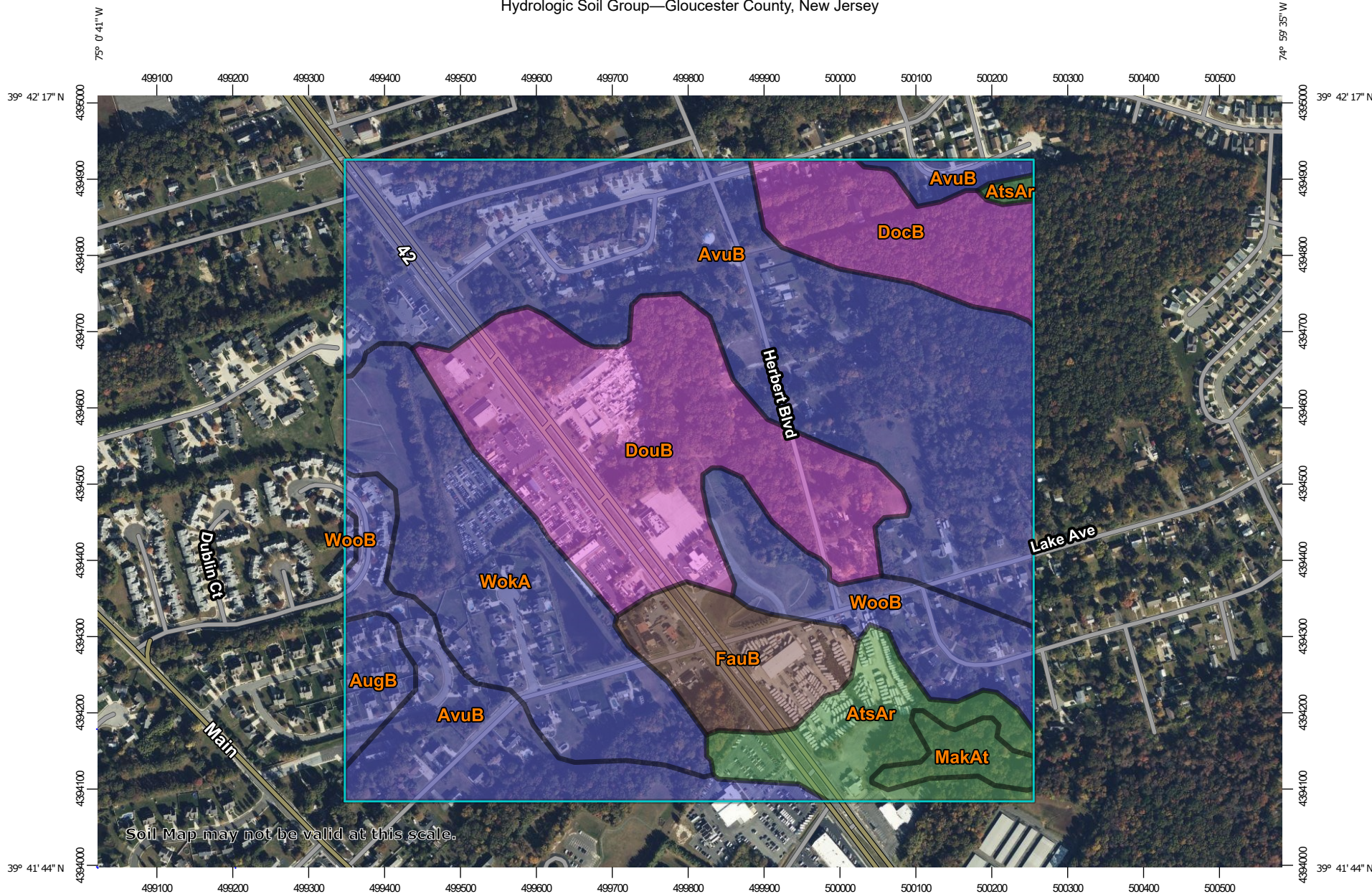
**LIDL US OPERATIONS, LLC**  
 PROPOSED GROCERY STORE #1480  
 1020 NORTH BLACK HORSE PIKE  
 BLOCK 1101 - LOT 11.01  
 SITUATED IN: TOWNSHIP OF  
 GLoucester COUNTY  
 NEW JERSEY  
 SHEET NUMBER  
**DA-PR**



# 4. APPENDICES

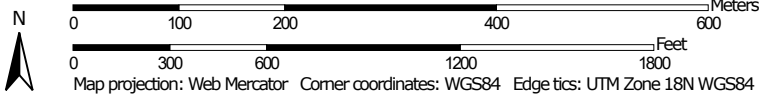
# **APPENDIX A – SOIL TYPE**

Hydrologic Soil Group—Gloucester County, New Jersey




Soil Map may not be valid at this scale.

Map Scale: 1:7,140 if printed on A landscape (11" x 8.5") sheet.



## MAP LEGEND

### Area of Interest (AOI)









 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons





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

#### Soil Rating Lines


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

#### Soil Rating Points






 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available


### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Gloucester County, New Jersey  
 Survey Area Data: Version 18, Jun 1, 2020

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

Date(s) aerial images were photographed: Data not available.

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



## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AtsAr	Atsion sand, 0 to 2 percent slopes, rarely flooded	A/D	11.1	5.9%
AugB	Aura sandy loam, 2 to 5 percent slopes, Northern Tidewater Area	B	3.1	1.7%
AvuB	Aura-Urban land complex, 0 to 5 percent slopes	B	77.7	41.0%
DocB	Downer loamy sand, 0 to 5 percent slopes, Northern Coastal Plain	A	12.0	6.3%
DouB	Downer-Urban land complex, 0 to 5 percent slopes	A	34.5	18.2%
FauB	Fallsington-Urban land complex, 0 to 5 percent slopes	B/D	10.1	5.3%
MakAt	Manahawkin muck, 0 to 2 percent slopes, frequently flooded	A/D	2.9	1.5%
WokA	Woodstown-Glassboro complex, 0 to 2 percent slopes	B	26.3	13.9%
WooB	Woodstown-Urban land complex, 0 to 5 percent slopes	B	11.9	6.3%
<b>Totals for Area of Interest</b>			<b>189.6</b>	<b>100.0%</b>

## Description

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

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

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

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

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

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

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

## Rating Options

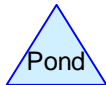
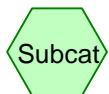
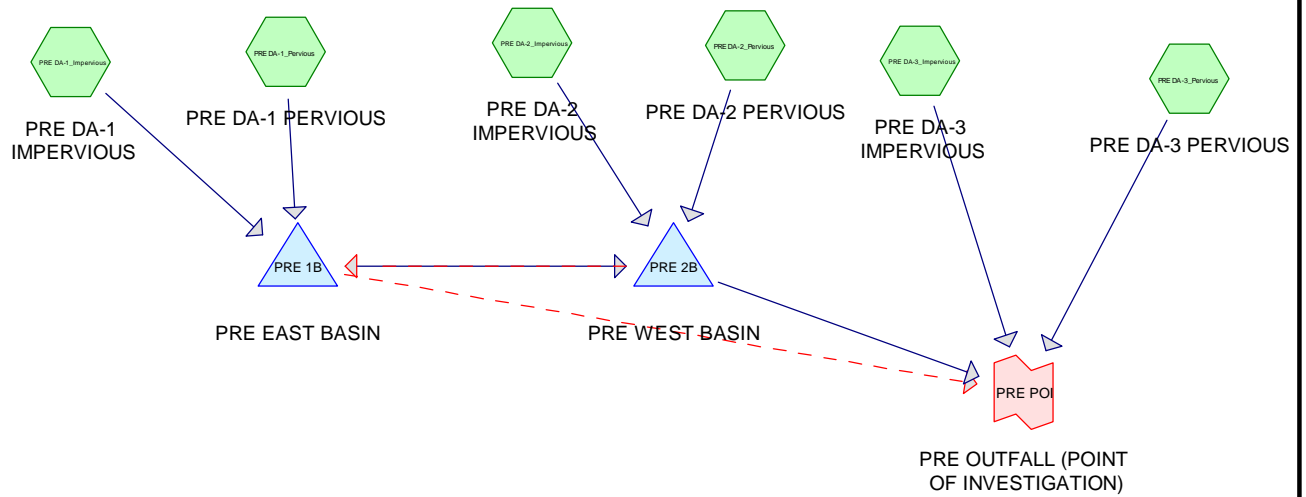
*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher



## **APPENDIX B - HYDROCAD ANALYSIS - EXISTING**



**Routing Diagram for Williamstown**  
 Prepared by Kimley-Horn, Printed 11/30/2020  
 HydroCAD® 10.00-22 s/n 09843 © 2018 HydroCAD Software Solutions LLC

**Williamstown**

Prepared by Kimley-Horn

Printed 11/30/2020

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Page 2

**Area Listing (selected nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.890	39	>75% Grass cover, Good, HSG A (PRE DA-1_Pervious, PRE DA-2_Pervious, PRE DA-3_Pervious)
2.810	61	>75% Grass cover, Good, HSG B (PRE DA-1_Pervious, PRE DA-2_Pervious, PRE DA-3_Pervious)
0.910	80	>75% Grass cover, Good, HSG D (PRE DA-2_Pervious, PRE DA-3_Pervious)
2.110	98	Paved parking, HSG A (PRE DA-1_Impervious, PRE DA-2_Impervious)
0.480	98	Paved parking, HSG B (PRE DA-1_Impervious, PRE DA-2_Impervious, PRE DA-3_Impervious)
0.070	98	Paved parking, HSG D (PRE DA-2_Impervious, PRE DA-3_Impervious)
7.590	30	Woods, Good, HSG A (PRE DA-1_Pervious, PRE DA-2_Pervious)
3.020	55	Woods, Good, HSG B (PRE DA-1_Pervious, PRE DA-3_Pervious)
<b>17.880</b>	<b>52</b>	<b>TOTAL AREA</b>

**Williamstown**

Prepared by Kimley-Horn  
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 Page 3

**Soil Listing (selected nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
10.590	HSG A	PRE DA-1_Impervious, PRE DA-1_Pervious, PRE DA-2_Impervious, PRE DA-2_Pervious, PRE DA-3_Pervious
6.310	HSG B	PRE DA-1_Impervious, PRE DA-1_Pervious, PRE DA-2_Impervious, PRE DA-2_Pervious, PRE DA-3_Impervious, PRE DA-3_Pervious
0.000	HSG C	
0.980	HSG D	PRE DA-2_Impervious, PRE DA-2_Pervious, PRE DA-3_Impervious, PRE DA-3_Pervious
0.000	Other	
<b>17.880</b>		<b>TOTAL AREA</b>

**Williamstown**

Prepared by Kimley-Horn

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

Printed 11/30/2020

Page 4

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment PRE DA-1\_Impervious: PRE** Runoff Area=0.400 ac 100.00% Impervious Runoff Depth=3.08"  
Tc=6.0 min CN=98 Runoff=1.29 cfs 0.103 af

**Subcatchment PRE DA-1\_Pervious: PRE DA-1** Runoff Area=11.690 ac 0.00% Impervious Runoff Depth=0.03"  
Flow Length=1,456' Tc=62.6 min CN=43 Runoff=0.04 cfs 0.030 af

**Subcatchment PRE DA-2\_Impervious: PRE** Runoff Area=2.180 ac 100.00% Impervious Runoff Depth=3.08"  
Tc=6.0 min CN=98 Runoff=7.01 cfs 0.559 af

**Subcatchment PRE DA-2\_Pervious: PRE DA-2** Runoff Area=2.800 ac 0.00% Impervious Runoff Depth=0.02"  
Flow Length=1,097' Tc=24.2 min CN=42 Runoff=0.01 cfs 0.005 af

**Subcatchment PRE DA-3\_Impervious: PRE** Runoff Area=0.080 ac 100.00% Impervious Runoff Depth=3.08"  
Tc=6.0 min CN=98 Runoff=0.26 cfs 0.021 af

**Subcatchment PRE DA-3\_Pervious: PRE DA-3** Runoff Area=0.730 ac 0.00% Impervious Runoff Depth=1.05"  
Flow Length=185' Tc=18.4 min CN=73 Runoff=0.59 cfs 0.064 af

**Pond PRE 1B: PRE EAST BASIN** Peak Elev=138.66' Storage=3,135 cf Inflow=1.80 cfs 0.156 af  
Primary=0.23 cfs 0.156 af Secondary=0.00 cfs 0.000 af Outflow=0.23 cfs 0.156 af

**Pond PRE 2B: PRE WEST BASIN** Peak Elev=138.64' Storage=13,085 cf Inflow=7.17 cfs 0.720 af  
Primary=0.35 cfs 0.697 af Secondary=1.02 cfs 0.023 af Outflow=1.35 cfs 0.720 af

**Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)** Inflow=1.04 cfs 0.781 af  
Primary=1.04 cfs 0.781 af

**Total Runoff Area = 17.880 ac Runoff Volume = 0.781 af Average Runoff Depth = 0.52"**  
**85.12% Pervious = 15.220 ac 14.88% Impervious = 2.660 ac**

**Williamstown**

Prepared by Kimley-Horn

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

Printed 11/30/2020

Page 5

**Summary for Subcatchment PRE DA-1\_Impervious: PRE DA-1 IMPERVIOUS**

Runoff = 1.29 cfs @ 12.08 hrs, Volume= 0.103 af, Depth= 3.08"

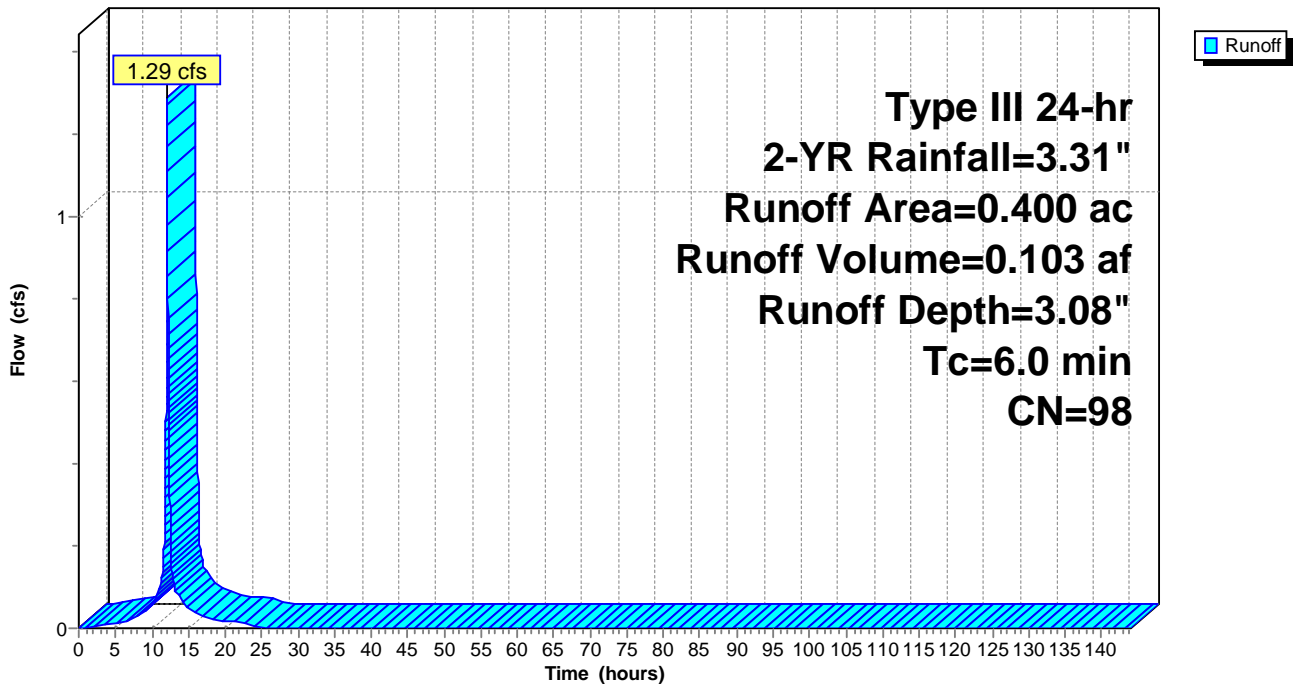
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.180	98	Paved parking, HSG A
0.220	98	Paved parking, HSG B
0.400	98	Weighted Average
0.400		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-1\_Impervious: PRE DA-1 IMPERVIOUS**

Hydrograph



**Williamstown**

Prepared by Kimley-Horn

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

Printed 11/30/2020

Page 6

**Summary for Subcatchment PRE DA-1\_Pervious: PRE DA-1 PERVIOUS**

Runoff = 0.04 cfs @ 17.46 hrs, Volume= 0.030 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.540	39	>75% Grass cover, Good, HSG A
2.310	61	>75% Grass cover, Good, HSG B
5.860	30	Woods, Good, HSG A
2.980	55	Woods, Good, HSG B
11.690	43	Weighted Average
11.690		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2	100	0.0040	0.04		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.8	557	0.0180	0.67		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
6.0	655	0.0080	1.82		<b>Shallow Concentrated Flow, Shallow Concentrated Flow Along Road</b> Paved Kv= 20.3 fps
2.6	144	0.0350	0.94		<b>Shallow Concentrated Flow, Shallow Concentrated Flow Wooded Area</b> Woodland Kv= 5.0 fps
62.6	1,456	Total			

**Williamstown**

Prepared by Kimley-Horn

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PRE-DEVELOPMENT CONDITIONS

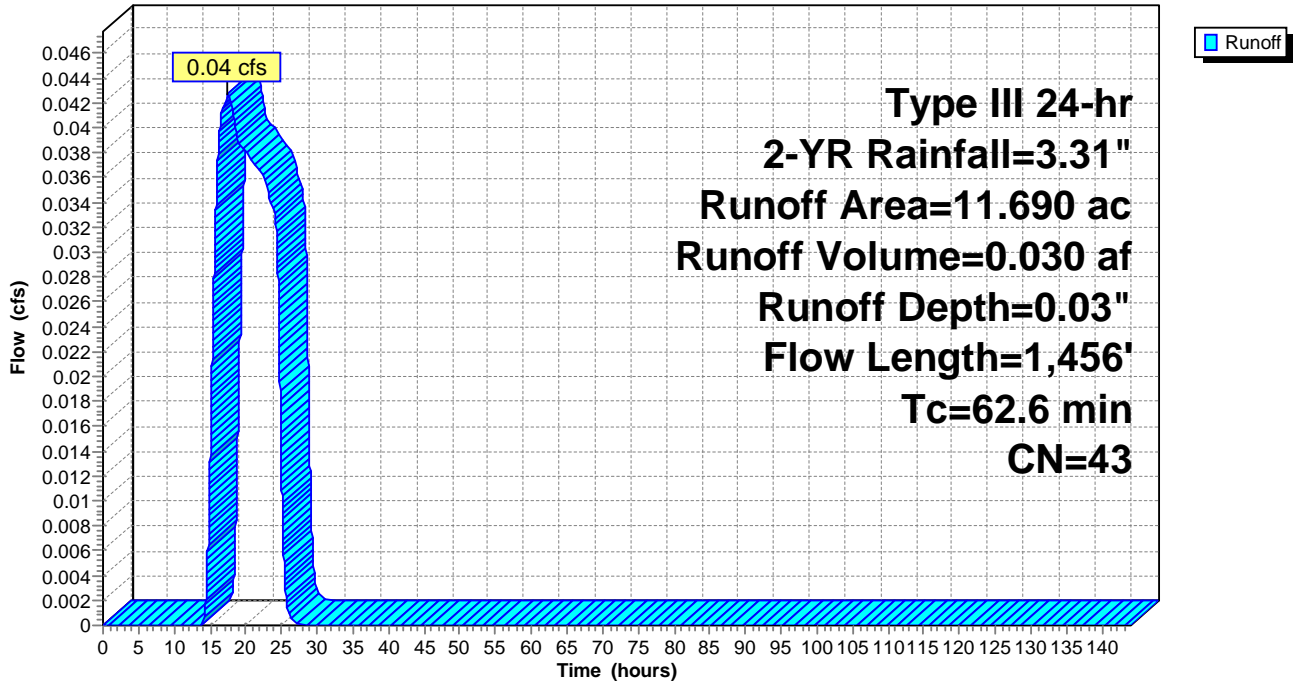
Type III 24-hr 2-YR Rainfall=3.31"

Printed 11/30/2020

Page 7

**Subcatchment PRE DA-1\_Pervious: PRE DA-1 PERVIOUS**

Hydrograph





**Williamstown**

Prepared by Kimley-Horn

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

Printed 11/30/2020

Page 8

**Summary for Subcatchment PRE DA-2\_Impervious: PRE DA-2 IMPERVIOUS**

Runoff = 7.01 cfs @ 12.08 hrs, Volume= 0.559 af, Depth= 3.08"

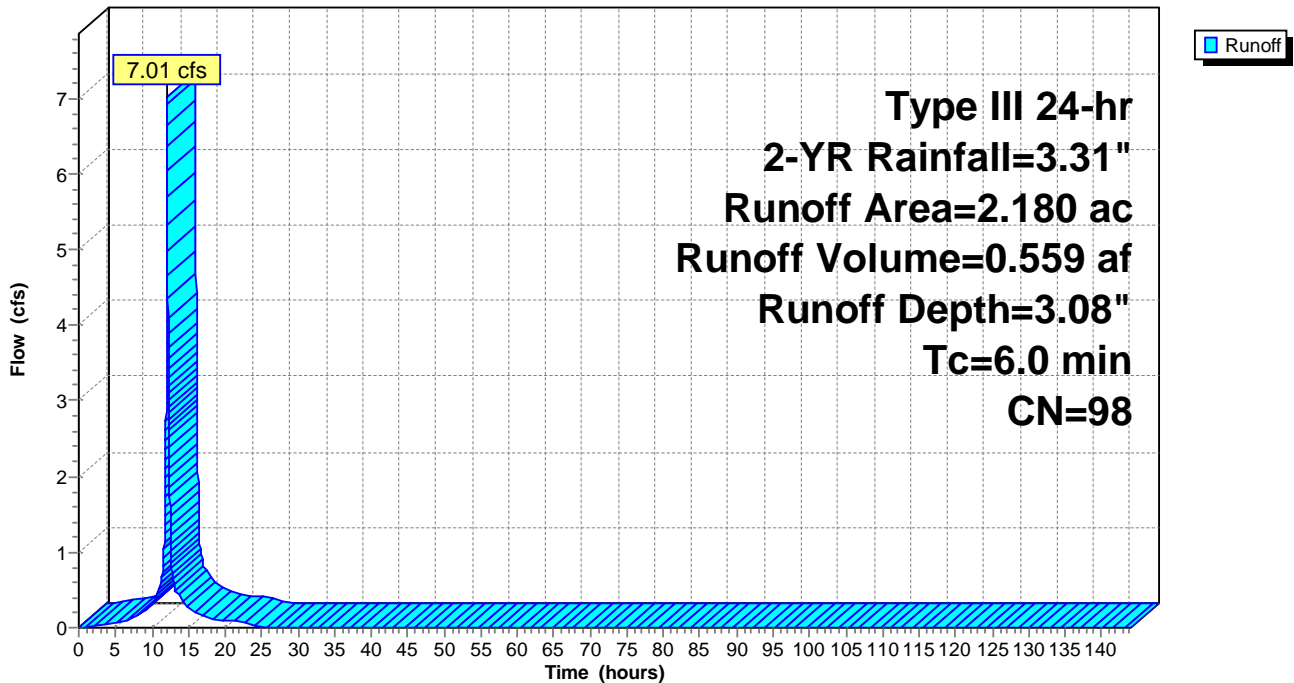
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
1.930	98	Paved parking, HSG A
0.230	98	Paved parking, HSG B
0.020	98	Paved parking, HSG D
2.180	98	Weighted Average
2.180		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-2\_Impervious: PRE DA-2 IMPERVIOUS**

Hydrograph



**Williamstown**

Prepared by Kimley-Horn

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

Printed 11/30/2020

Page 9

**Summary for Subcatchment PRE DA-2\_Pervious: PRE DA-2 PERVIOUS**

Runoff = 0.01 cfs @ 17.56 hrs, Volume= 0.005 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.330	39	>75% Grass cover, Good, HSG A
0.340	61	>75% Grass cover, Good, HSG B
0.400	80	>75% Grass cover, Good, HSG D
1.730	30	Woods, Good, HSG A
2.800	42	Weighted Average
2.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0850	0.14		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
9.4	310	0.0120	0.55		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
2.0	310	0.0170	2.65		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
1.0	377	0.0080	6.44	20.23	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
24.2	1,097	Total			

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PRE-DEVELOPMENT CONDITIONS

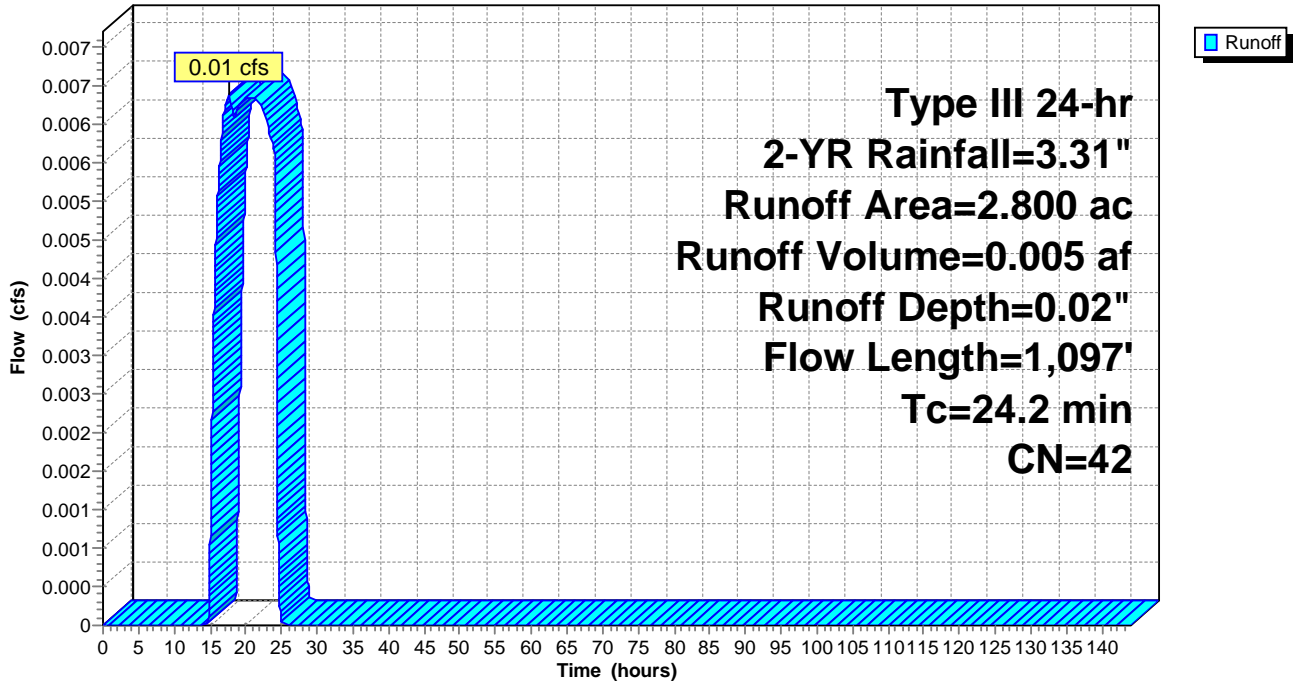
Type III 24-hr 2-YR Rainfall=3.31"

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Page 10

**Subcatchment PRE DA-2\_Pervious: PRE DA-2 PERVIOUS**

Hydrograph



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Type III 24-hr 2-YR Rainfall=3.31"

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Page 11

**Summary for Subcatchment PRE DA-3\_Impervious: PRE DA-3 IMPERVIOUS**

Runoff = 0.26 cfs @ 12.08 hrs, Volume= 0.021 af, Depth= 3.08"

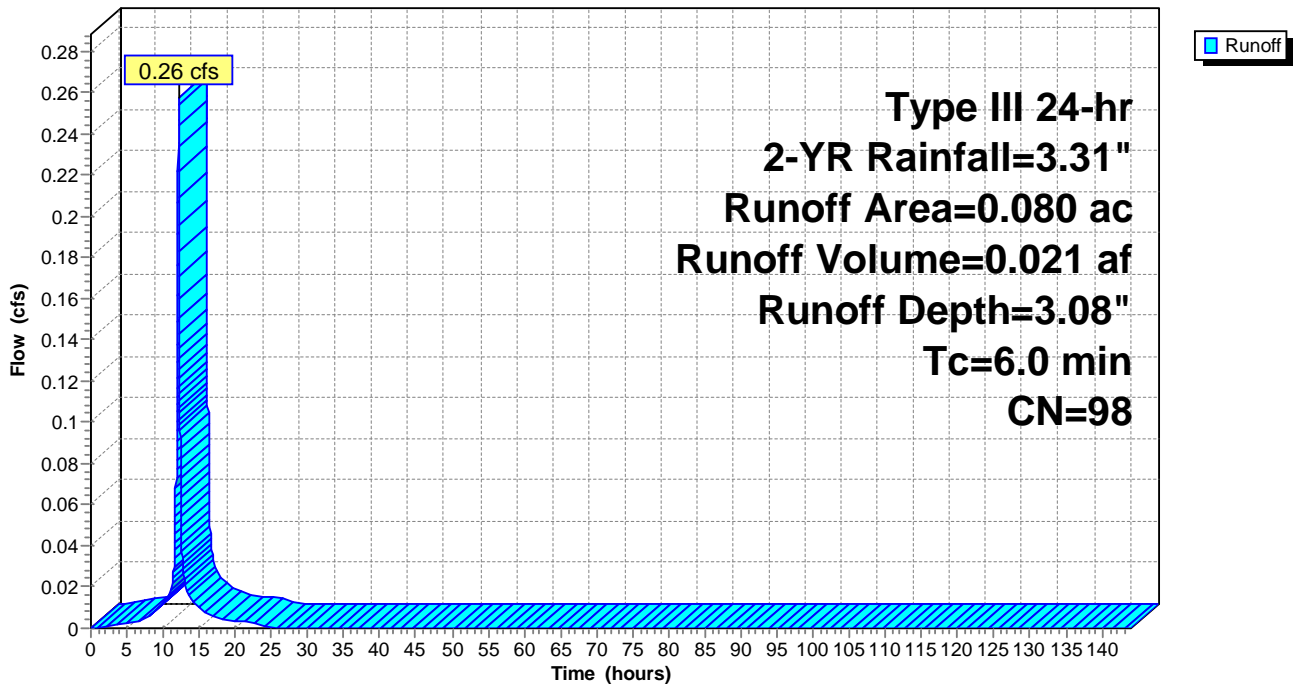
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG B
0.050	98	Paved parking, HSG D
0.080	98	Weighted Average
0.080		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-3\_Impervious: PRE DA-3 IMPERVIOUS**

Hydrograph



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Type III 24-hr 2-YR Rainfall=3.31"

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Page 12

**Summary for Subcatchment PRE DA-3\_Pervious: PRE DA-3 PERVIOUS**

Runoff = 0.59 cfs @ 12.28 hrs, Volume= 0.064 af, Depth= 1.05"

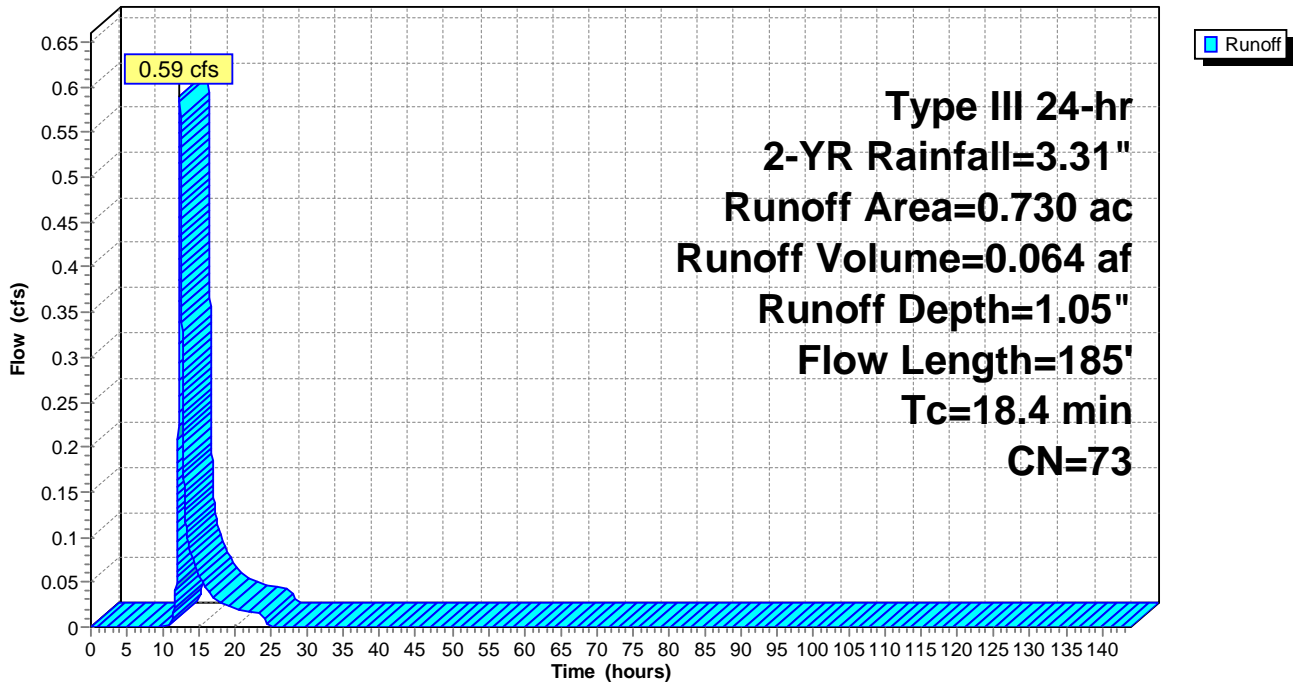
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.020	39	>75% Grass cover, Good, HSG A
0.160	61	>75% Grass cover, Good, HSG B
0.510	80	>75% Grass cover, Good, HSG D
0.040	55	Woods, Good, HSG B
0.730	73	Weighted Average
0.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0120	0.10		<b>Sheet Flow, Sheet Flow over Grass</b> Grass: Dense n= 0.240 P2= 3.31"
1.2	85	0.0280	1.17		<b>Shallow Concentrated Flow, Shallow Concentrated Flow over Grass</b> Short Grass Pasture Kv= 7.0 fps
18.4	185	Total			

**Subcatchment PRE DA-3\_Pervious: PRE DA-3 PERVIOUS**

Hydrograph



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**Summary for Pond PRE 1B: PRE EAST BASIN**

Inflow = 1.80 cfs @ 12.18 hrs, Volume= 0.156 af  
 Outflow = 0.23 cfs @ 11.88 hrs, Volume= 0.156 af, Atten= 87%, Lag= 0.0 min  
 Primary = 0.23 cfs @ 11.88 hrs, Volume= 0.156 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 138.66' @ 15.84 hrs Surf.Area= 8,346 sf Storage= 3,135 cf  
 Flood Elev= 140.88' Surf.Area= 38,141 sf Storage= 43,393 cf

Plug-Flow detention time= 296.1 min calculated for 0.156 af (100% of inflow)  
 Center-of-Mass det. time= 294.8 min ( 1,134.5 - 839.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.46'	68,833 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.46	13	0	0
138.00	634	175	175
139.00	12,333	6,484	6,658
140.00	14,666	13,500	20,158
141.00	41,342	28,004	48,162
141.50	41,342	20,671	68,833

Device	Routing	Invert	Outlet Devices
#1	Primary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.46' / 137.09' S= 0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.59'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	139.46'	<b>3.0' long x 1.80' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	141.26'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	140.50'	<b>55.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=0.23 cfs @ 11.88 hrs HW=138.06' TW=137.77' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 0.23 cfs of 1.27 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.23 cfs @ 2.62 fps)
- ↑ **3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)
- ↑ **4=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=137.46' TW=136.31' (Dynamic Tailwater)

- ↑ **5=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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PRE-DEVELOPMENT CONDITIONS

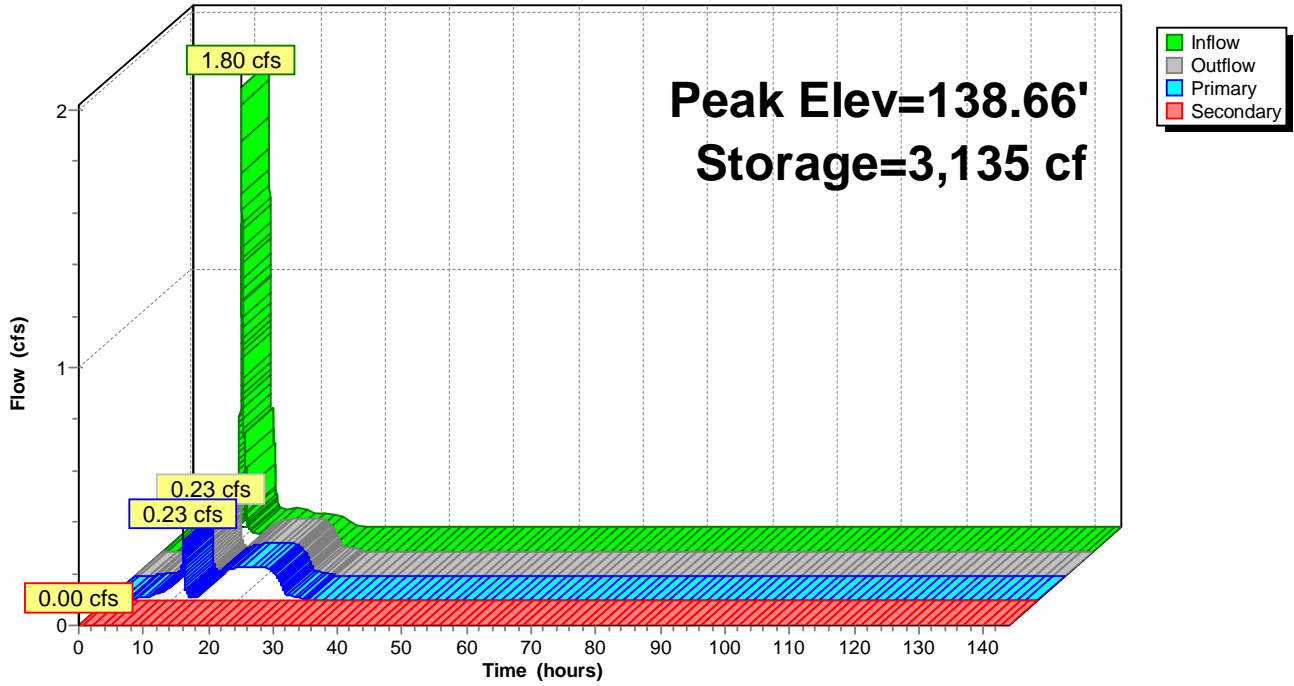
Type III 24-hr 2-YR Rainfall=3.31"

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Page 14

**Pond PRE 1B: PRE EAST BASIN**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

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Page 15

**Summary for Pond PRE 2B: PRE WEST BASIN**

Inflow = 7.17 cfs @ 12.08 hrs, Volume= 0.720 af  
 Outflow = 1.35 cfs @ 12.18 hrs, Volume= 0.720 af, Atten= 81%, Lag= 6.1 min  
 Primary = 0.35 cfs @ 14.54 hrs, Volume= 0.697 af  
 Secondary = 1.02 cfs @ 12.18 hrs, Volume= 0.023 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 138.64' @ 14.54 hrs Surf.Area= 10,218 sf Storage= 13,085 cf

Plug-Flow detention time= 394.5 min calculated for 0.719 af (100% of inflow)  
 Center-of-Mass det. time= 394.4 min ( 1,235.0 - 840.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	136.28'	42,593 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
136.28	8	0	0
137.00	2,829	1,021	1,021
138.00	8,947	5,888	6,909
139.00	10,919	9,933	16,842
140.00	12,886	11,903	28,745
141.00	14,810	13,848	42,593

Device	Routing	Invert	Outlet Devices
#1	Primary	135.48'	<b>24.0" Round Culvert</b> L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 135.48' / 135.05' S= 0.0287 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	138.83'	<b>4.0' long x 1.85' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#3	Primary	136.13'	<b>15.0" Round Culvert</b> L= 48.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 136.13' / 134.45' S= 0.0350 '/ Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#4	Device 3	136.28'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 3	139.43'	<b>9.0' long x 1.25' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#6	Device 1	140.68'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#7	Primary	140.50'	<b>60.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#8	Secondary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.09' / 137.46' S= -0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf



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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

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Page 16

**Primary OutFlow** Max=0.35 cfs @ 14.54 hrs HW=138.64' TW=136.31' (Dynamic Tailwater)

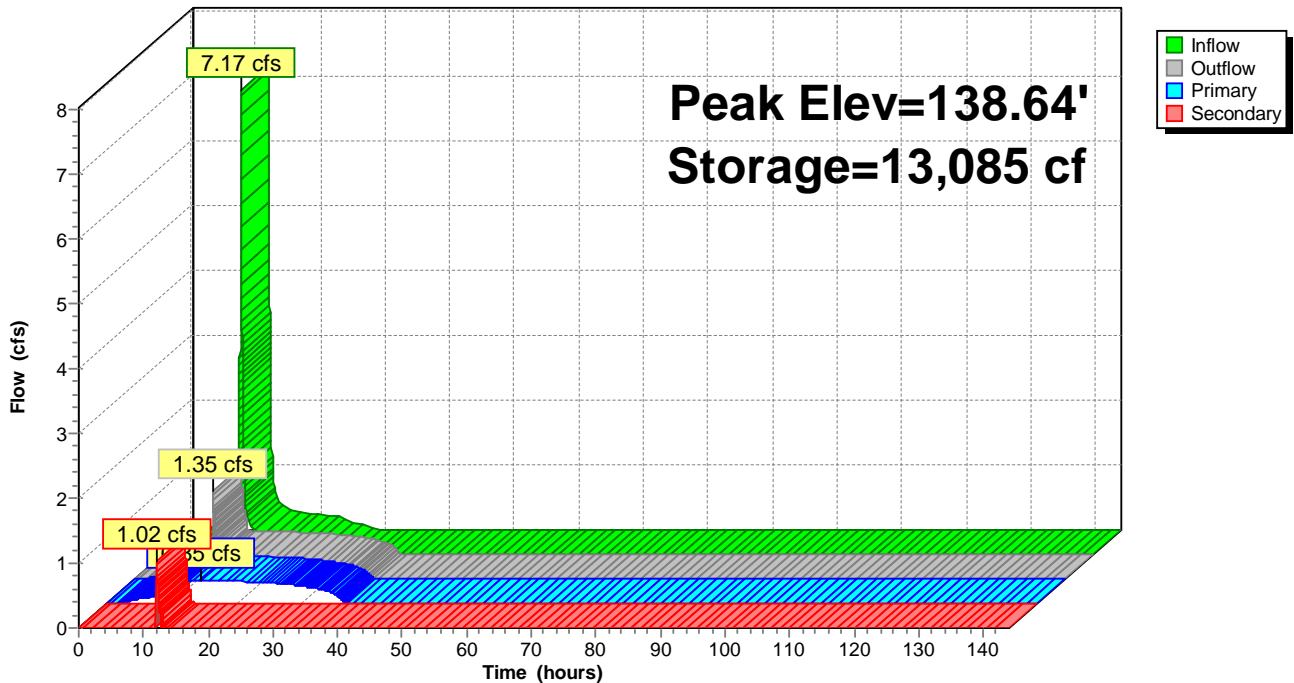
- 1=Culvert (Passes 0.00 cfs of 27.03 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 6=Orifice/Grate (Controls 0.00 cfs)
- 3=Culvert (Passes 0.35 cfs of 9.88 cfs potential flow)
- 4=Orifice/Grate (Orifice Controls 0.35 cfs @ 7.21 fps)
- 5=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 7=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

**Secondary OutFlow** Max=0.41 cfs @ 12.18 hrs HW=138.34' TW=138.34' (Dynamic Tailwater)

- 8=Culvert (Outlet Controls 0.41 cfs @ 0.28 fps)

## Pond PRE 2B: PRE WEST BASIN

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

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Page 17

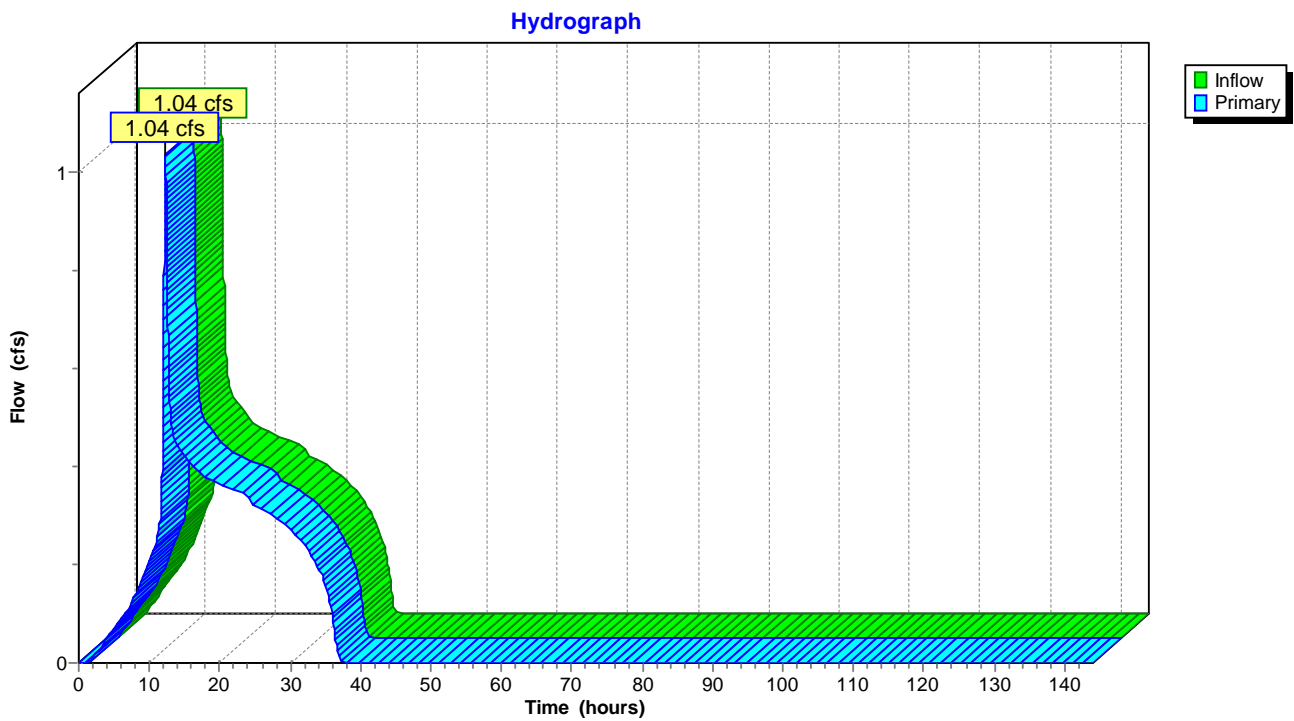
**Summary for Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)**

Inflow = 1.04 cfs @ 12.25 hrs, Volume= 0.781 af  
Primary = 1.04 cfs @ 12.26 hrs, Volume= 0.781 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)**



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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 18

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment PRE DA-1\_Impervious: PRE** Runoff Area=0.400 ac 100.00% Impervious Runoff Depth=4.87"  
Tc=6.0 min CN=98 Runoff=2.00 cfs 0.162 af

**Subcatchment PRE DA-1\_Pervious: PRE DA-1** Runoff Area=11.690 ac 0.00% Impervious Runoff Depth=0.38"  
Flow Length=1,456' Tc=62.6 min CN=43 Runoff=0.94 cfs 0.375 af

**Subcatchment PRE DA-2\_Impervious: PRE** Runoff Area=2.180 ac 100.00% Impervious Runoff Depth=4.87"  
Tc=6.0 min CN=98 Runoff=10.90 cfs 0.885 af

**Subcatchment PRE DA-2\_Pervious: PRE DA-2** Runoff Area=2.800 ac 0.00% Impervious Runoff Depth=0.34"  
Flow Length=1,097' Tc=24.2 min CN=42 Runoff=0.27 cfs 0.080 af

**Subcatchment PRE DA-3\_Impervious: PRE** Runoff Area=0.080 ac 100.00% Impervious Runoff Depth=4.87"  
Tc=6.0 min CN=98 Runoff=0.40 cfs 0.032 af

**Subcatchment PRE DA-3\_Pervious: PRE DA-3** Runoff Area=0.730 ac 0.00% Impervious Runoff Depth=2.37"  
Flow Length=185' Tc=18.4 min CN=73 Runoff=1.40 cfs 0.144 af

**Pond PRE 1B: PRE EAST BASIN** Peak Elev=139.52' Storage=13,413 cf Inflow=5.00 cfs 0.625 af  
Primary=0.47 cfs 0.625 af Secondary=0.00 cfs 0.000 af Outflow=0.47 cfs 0.625 af

**Pond PRE 2B: PRE WEST BASIN** Peak Elev=139.03' Storage=17,142 cf Inflow=10.90 cfs 1.590 af  
Primary=1.52 cfs 1.502 af Secondary=3.26 cfs 0.088 af Outflow=3.62 cfs 1.590 af

**Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)** Inflow=2.33 cfs 1.678 af  
Primary=2.33 cfs 1.678 af

**Total Runoff Area = 17.880 ac Runoff Volume = 1.679 af Average Runoff Depth = 1.13"**  
**85.12% Pervious = 15.220 ac 14.88% Impervious = 2.660 ac**

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 19

**Summary for Subcatchment PRE DA-1\_Impervious: PRE DA-1 IMPERVIOUS**

Runoff = 2.00 cfs @ 12.08 hrs, Volume= 0.162 af, Depth= 4.87"

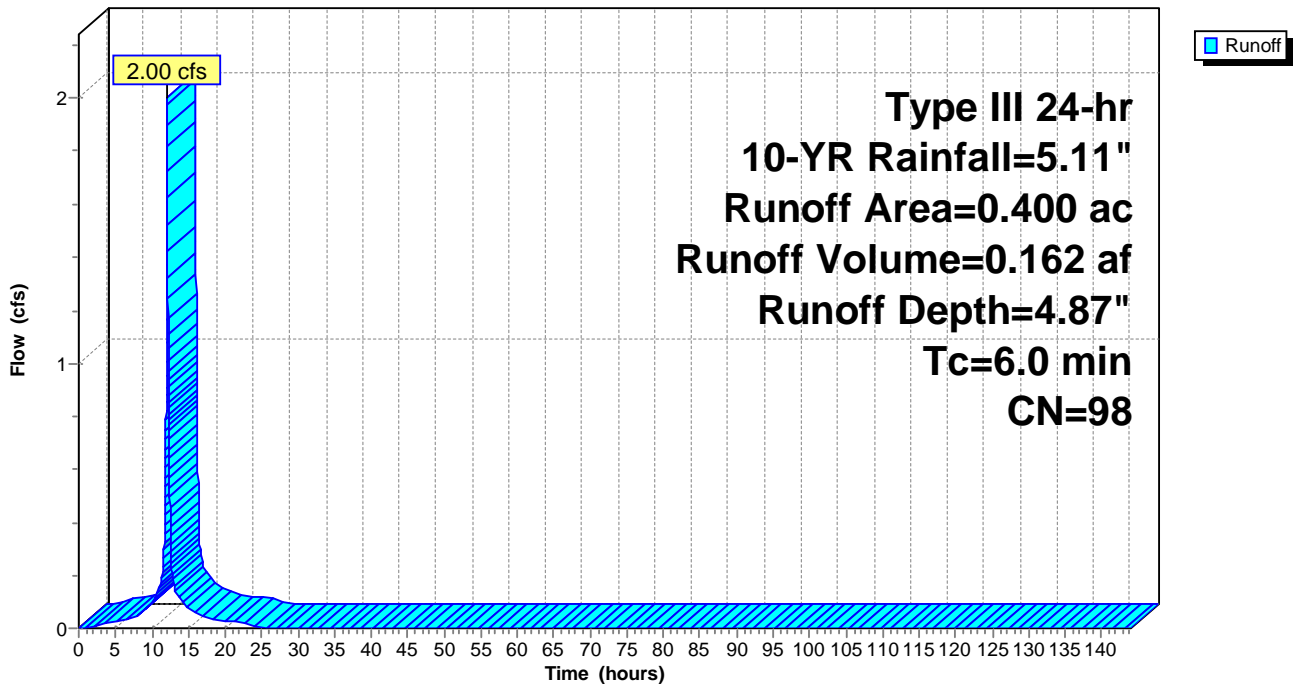
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.180	98	Paved parking, HSG A
0.220	98	Paved parking, HSG B
0.400	98	Weighted Average
0.400		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-1\_Impervious: PRE DA-1 IMPERVIOUS**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 20

**Summary for Subcatchment PRE DA-1\_Pervious: PRE DA-1 PERVIOUS**

Runoff = 0.94 cfs @ 13.28 hrs, Volume= 0.375 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.540	39	>75% Grass cover, Good, HSG A
2.310	61	>75% Grass cover, Good, HSG B
5.860	30	Woods, Good, HSG A
2.980	55	Woods, Good, HSG B
11.690	43	Weighted Average
11.690		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2	100	0.0040	0.04		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.8	557	0.0180	0.67		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
6.0	655	0.0080	1.82		<b>Shallow Concentrated Flow, Shallow Concentrated Flow Along Road</b> Paved Kv= 20.3 fps
2.6	144	0.0350	0.94		<b>Shallow Concentrated Flow, Shallow Concentrated Flow Wooded Area</b> Woodland Kv= 5.0 fps
62.6	1,456	Total			

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PRE-DEVELOPMENT CONDITIONS

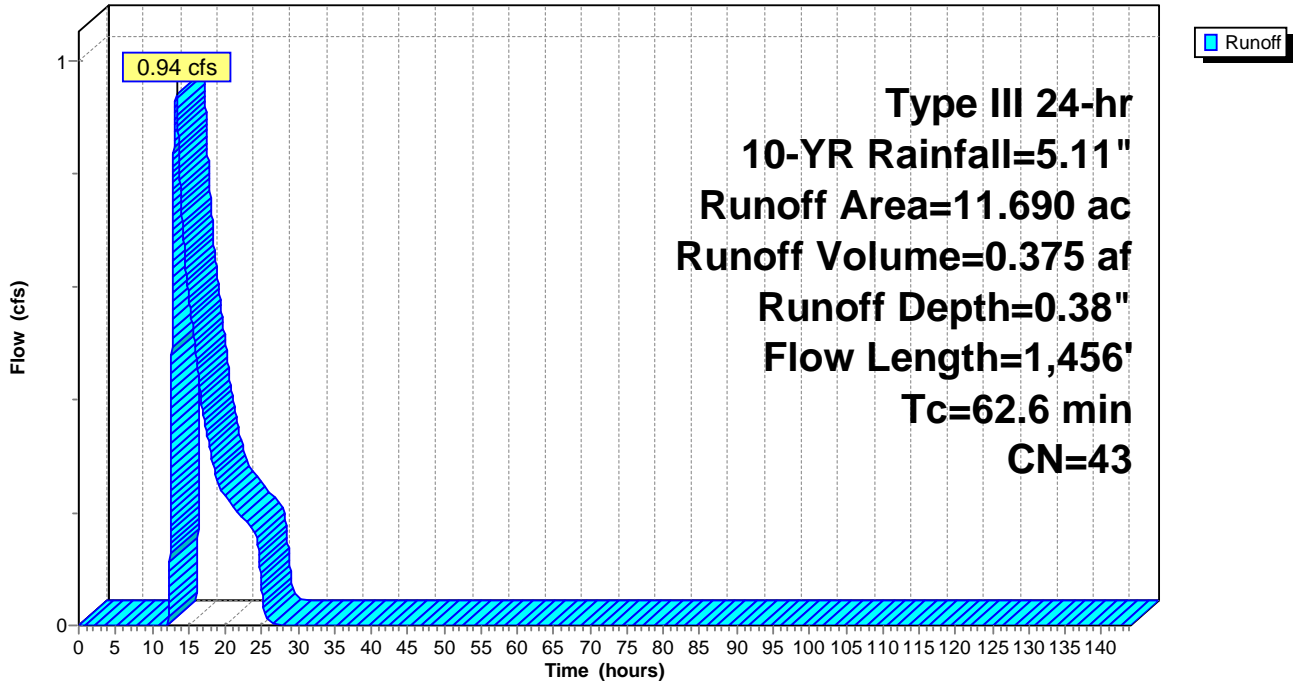
Type III 24-hr 10-YR Rainfall=5.11"

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Page 21

**Subcatchment PRE DA-1\_Pervious: PRE DA-1 PERVIOUS**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 22

**Summary for Subcatchment PRE DA-2\_Impervious: PRE DA-2 IMPERVIOUS**

Runoff = 10.90 cfs @ 12.08 hrs, Volume= 0.885 af, Depth= 4.87"

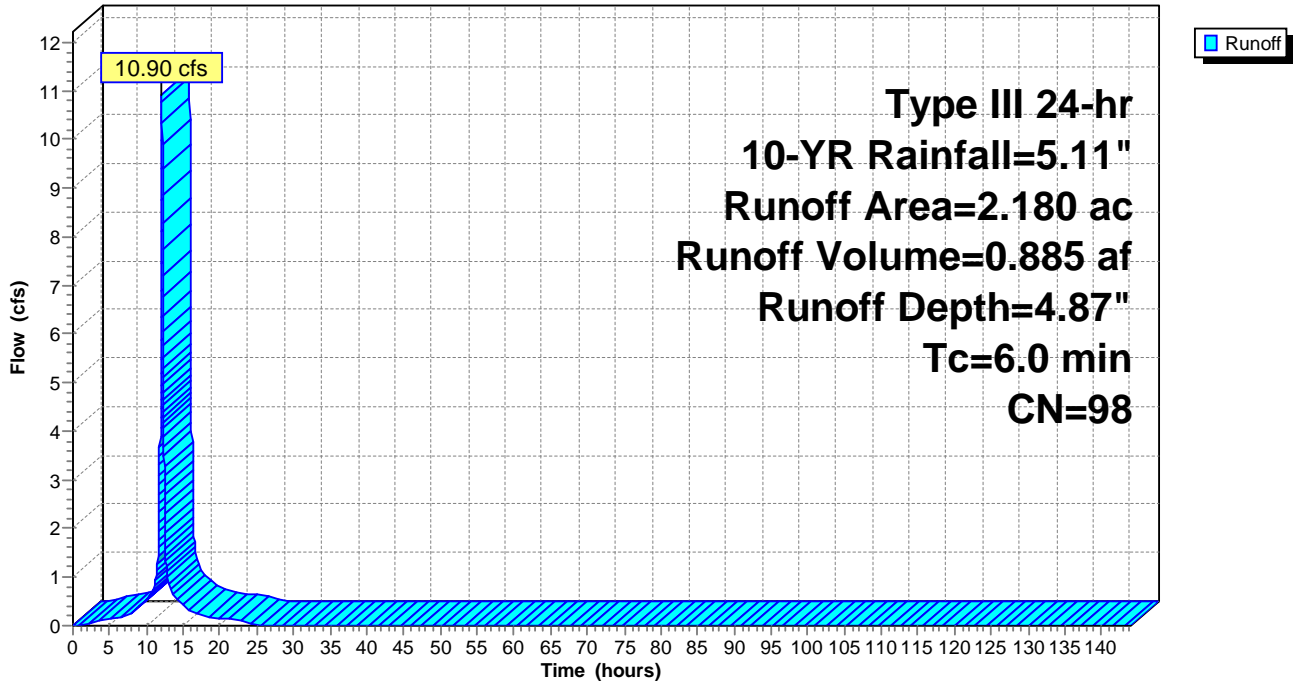
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
1.930	98	Paved parking, HSG A
0.230	98	Paved parking, HSG B
0.020	98	Paved parking, HSG D
2.180	98	Weighted Average
2.180		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-2\_Impervious: PRE DA-2 IMPERVIOUS**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 23

**Summary for Subcatchment PRE DA-2\_Pervious: PRE DA-2 PERVIOUS**

Runoff = 0.27 cfs @ 12.64 hrs, Volume= 0.080 af, Depth= 0.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.330	39	>75% Grass cover, Good, HSG A
0.340	61	>75% Grass cover, Good, HSG B
0.400	80	>75% Grass cover, Good, HSG D
1.730	30	Woods, Good, HSG A
2.800	42	Weighted Average
2.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0850	0.14		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
9.4	310	0.0120	0.55		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
2.0	310	0.0170	2.65		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
1.0	377	0.0080	6.44	20.23	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
24.2	1,097	Total			



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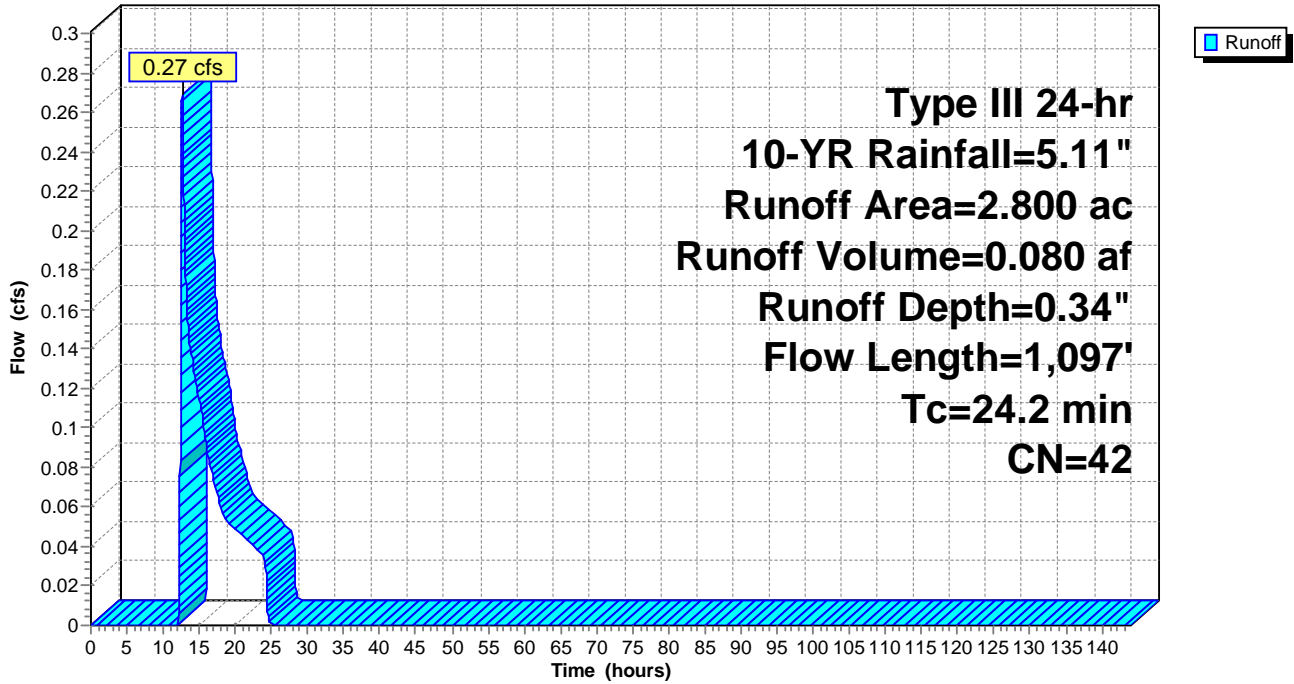
Type III 24-hr 10-YR Rainfall=5.11"

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Page 24

**Subcatchment PRE DA-2\_Pervious: PRE DA-2 PERVIOUS**

Hydrograph



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Type III 24-hr 10-YR Rainfall=5.11"

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Page 25

**Summary for Subcatchment PRE DA-3\_Impervious: PRE DA-3 IMPERVIOUS**

Runoff = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af, Depth= 4.87"

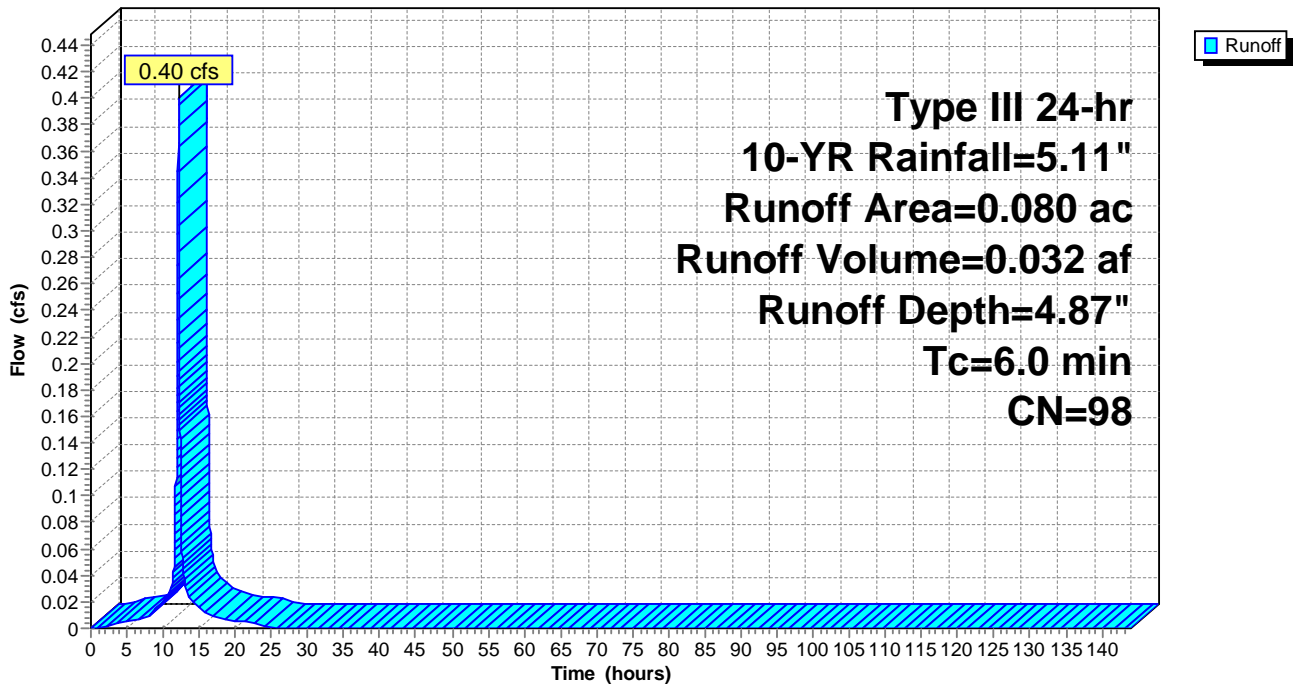
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG B
0.050	98	Paved parking, HSG D
0.080	98	Weighted Average
0.080		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-3\_Impervious: PRE DA-3 IMPERVIOUS**

Hydrograph



**Williamstown**

Prepared by Kimley-Horn

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 26

**Summary for Subcatchment PRE DA-3\_Pervious: PRE DA-3 PERVIOUS**

Runoff = 1.40 cfs @ 12.25 hrs, Volume= 0.144 af, Depth= 2.37"

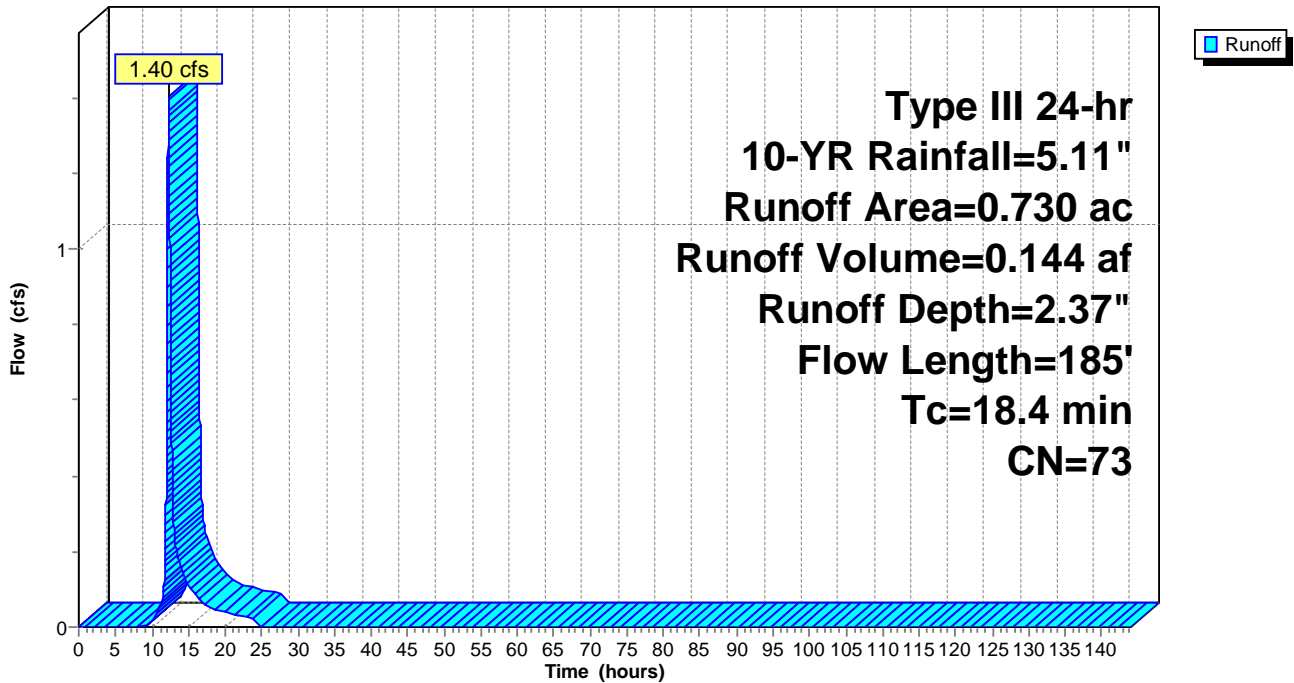
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.020	39	>75% Grass cover, Good, HSG A
0.160	61	>75% Grass cover, Good, HSG B
0.510	80	>75% Grass cover, Good, HSG D
0.040	55	Woods, Good, HSG B
0.730	73	Weighted Average
0.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0120	0.10		<b>Sheet Flow, Sheet Flow over Grass</b> Grass: Dense n= 0.240 P2= 3.31"
1.2	85	0.0280	1.17		<b>Shallow Concentrated Flow, Shallow Concentrated Flow over Grass</b> Short Grass Pasture Kv= 7.0 fps
18.4	185	Total			

**Subcatchment PRE DA-3\_Pervious: PRE DA-3 PERVIOUS**

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 27

**Summary for Pond PRE 1B: PRE EAST BASIN**

Inflow = 5.00 cfs @ 12.12 hrs, Volume= 0.625 af  
 Outflow = 0.47 cfs @ 16.53 hrs, Volume= 0.625 af, Atten= 91%, Lag= 264.8 min  
 Primary = 0.47 cfs @ 16.53 hrs, Volume= 0.625 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 139.52' @ 16.52 hrs Surf.Area= 13,551 sf Storage= 13,413 cf  
 Flood Elev= 140.88' Surf.Area= 38,141 sf Storage= 43,393 cf

Plug-Flow detention time= 488.3 min calculated for 0.625 af (100% of inflow)  
 Center-of-Mass det. time= 488.0 min ( 1,391.2 - 903.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.46'	68,833 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.46	13	0	0
138.00	634	175	175
139.00	12,333	6,484	6,658
140.00	14,666	13,500	20,158
141.00	41,342	28,004	48,162
141.50	41,342	20,671	68,833

Device	Routing	Invert	Outlet Devices
#1	Primary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.46' / 137.09' S= 0.0049 ' / ' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.59'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	139.46'	<b>3.0' long x 1.80' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	141.26'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	140.50'	<b>55.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=0.47 cfs @ 16.53 hrs HW=139.52' TW=138.94' (Dynamic Tailwater)

- ↑ 1=Culvert (Passes 0.47 cfs of 11.50 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 0.32 cfs @ 3.68 fps)
- ↑ 3=Sharp-Crested Rectangular Weir (Weir Controls 0.15 cfs @ 0.81 fps)
- ↑ 4=Orifice/Grate ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=137.46' TW=136.31' (Dynamic Tailwater)

- ↑ 5=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

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PRE-DEVELOPMENT CONDITIONS

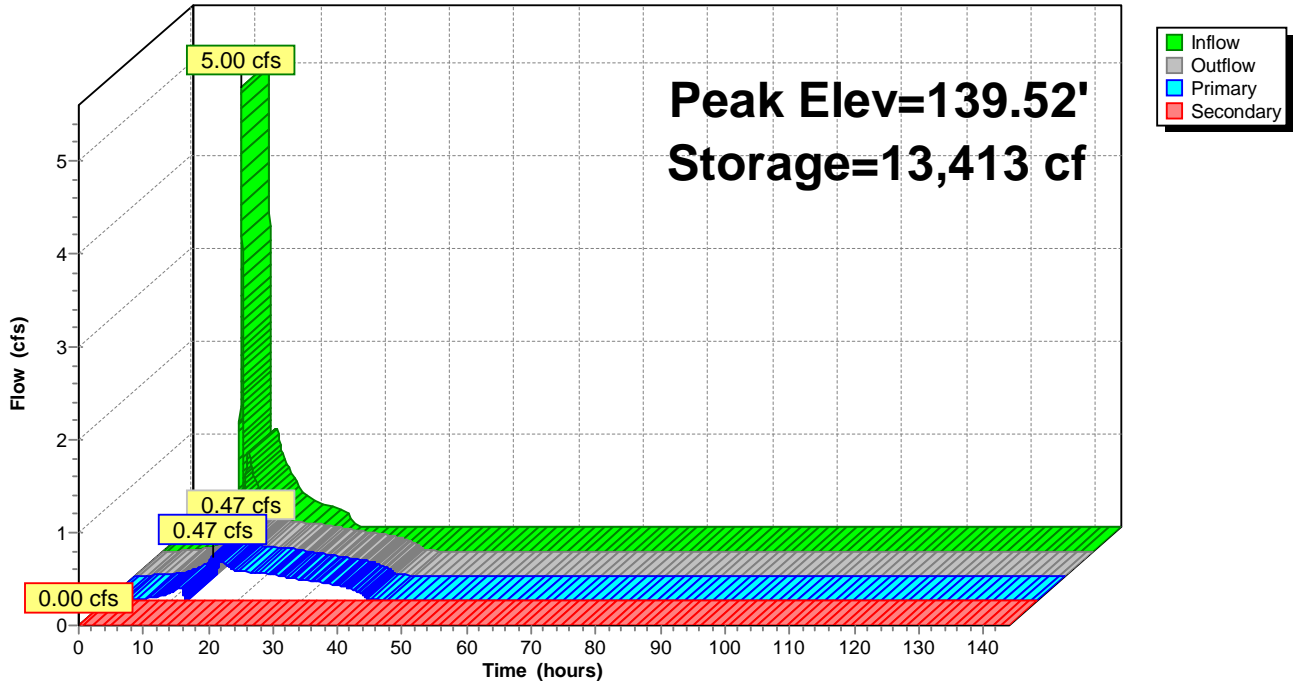
Type III 24-hr 10-YR Rainfall=5.11"

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Page 28

**Pond PRE 1B: PRE EAST BASIN**

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 29

**Summary for Pond PRE 2B: PRE WEST BASIN**

Inflow = 10.90 cfs @ 12.08 hrs, Volume= 1.590 af  
 Outflow = 3.62 cfs @ 12.14 hrs, Volume= 1.590 af, Atten= 67%, Lag= 3.5 min  
 Primary = 1.52 cfs @ 12.73 hrs, Volume= 1.502 af  
 Secondary = 3.26 cfs @ 12.14 hrs, Volume= 0.088 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 139.03' @ 12.73 hrs Surf.Area= 10,973 sf Storage= 17,142 cf

Plug-Flow detention time= 369.6 min calculated for 1.590 af (100% of inflow)  
 Center-of-Mass det. time= 369.3 min ( 1,381.7 - 1,012.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	136.28'	42,593 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
136.28	8	0	0
137.00	2,829	1,021	1,021
138.00	8,947	5,888	6,909
139.00	10,919	9,933	16,842
140.00	12,886	11,903	28,745
141.00	14,810	13,848	42,593

Device	Routing	Invert	Outlet Devices
#1	Primary	135.48'	<b>24.0" Round Culvert</b> L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 135.48' / 135.05' S= 0.0287 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	138.83'	<b>4.0' long x 1.85' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#3	Primary	136.13'	<b>15.0" Round Culvert</b> L= 48.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 136.13' / 134.45' S= 0.0350 '/ Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#4	Device 3	136.28'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 3	139.43'	<b>9.0' long x 1.25' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#6	Device 1	140.68'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#7	Primary	140.50'	<b>60.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#8	Secondary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.09' / 137.46' S= -0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

# Williamstown

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 30

**Primary OutFlow** Max=1.52 cfs @ 12.73 hrs HW=139.03' TW=136.31' (Dynamic Tailwater)

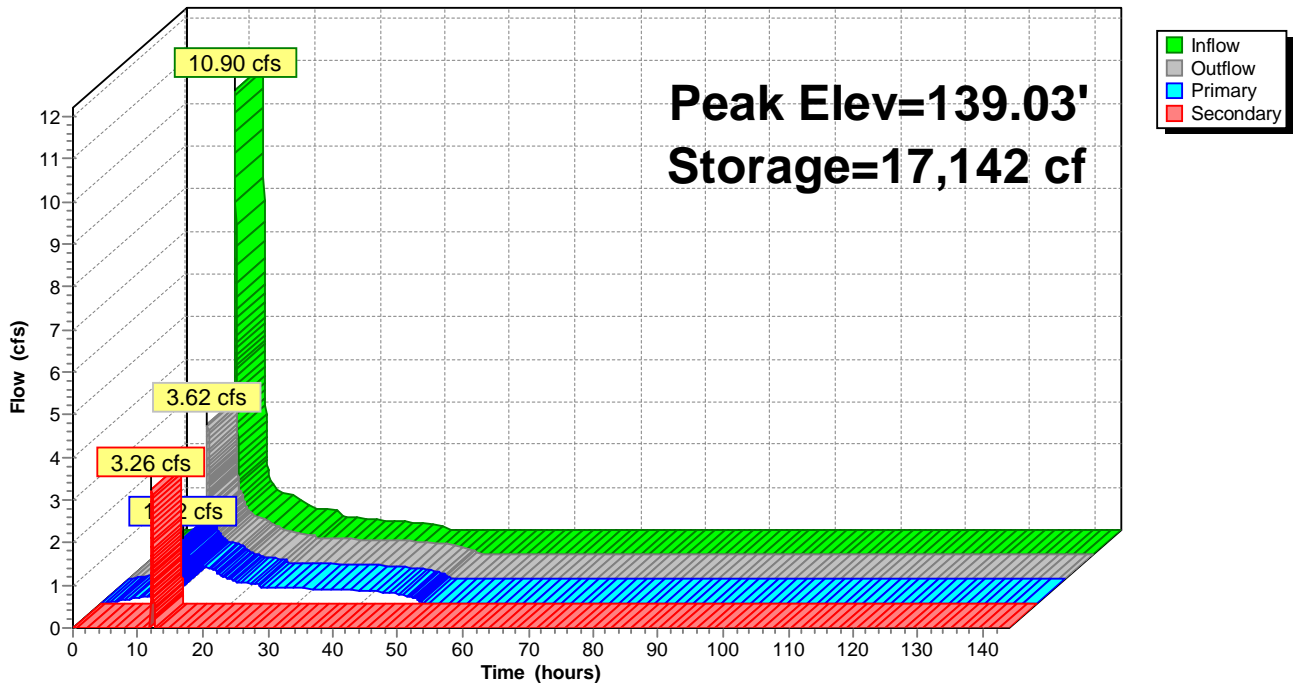
- 1=Culvert (Passes 1.14 cfs of 30.10 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Weir Controls 1.14 cfs @ 1.45 fps)
- 6=Orifice/Grate (Controls 0.00 cfs)
- 3=Culvert (Passes 0.38 cfs of 10.66 cfs potential flow)
- 4=Orifice/Grate (Orifice Controls 0.38 cfs @ 7.80 fps)
- 5=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 7=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

**Secondary OutFlow** Max=2.79 cfs @ 12.14 hrs HW=138.75' TW=138.69' (Dynamic Tailwater)

- 8=Culvert (Outlet Controls 2.79 cfs @ 1.36 fps)

## Pond PRE 2B: PRE WEST BASIN

Hydrograph



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Type III 24-hr 10-YR Rainfall=5.11"

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Page 31

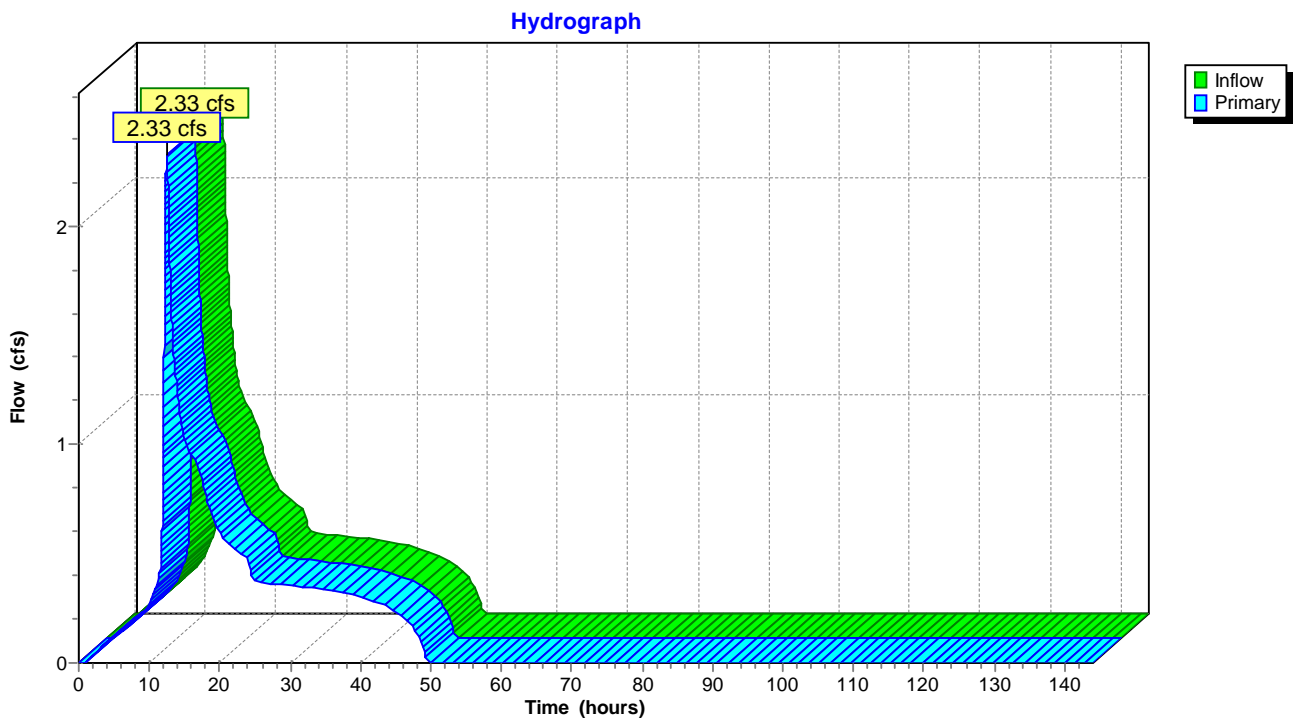
**Summary for Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)**

Inflow = 2.33 cfs @ 12.48 hrs, Volume= 1.678 af  
Primary = 2.33 cfs @ 12.49 hrs, Volume= 1.678 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)**





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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 100-YR Rainfall=8.69"

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Page 32

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment PRE DA-1\_Impervious: PRE** Runoff Area=0.400 ac 100.00% Impervious Runoff Depth=8.45"  
Tc=6.0 min CN=98 Runoff=3.41 cfs 0.282 af

**Subcatchment PRE DA-1\_Pervious: PRE DA-1** Runoff Area=11.690 ac 0.00% Impervious Runoff Depth=1.89"  
Flow Length=1,456' Tc=62.6 min CN=43 Runoff=8.31 cfs 1.841 af

**Subcatchment PRE DA-2\_Impervious: PRE** Runoff Area=2.180 ac 100.00% Impervious Runoff Depth=8.45"  
Tc=6.0 min CN=98 Runoff=18.61 cfs 1.535 af

**Subcatchment PRE DA-2\_Pervious: PRE DA-2** Runoff Area=2.800 ac 0.00% Impervious Runoff Depth=1.78"  
Flow Length=1,097' Tc=24.2 min CN=42 Runoff=2.98 cfs 0.415 af

**Subcatchment PRE DA-3\_Impervious: PRE** Runoff Area=0.080 ac 100.00% Impervious Runoff Depth=8.45"  
Tc=6.0 min CN=98 Runoff=0.68 cfs 0.056 af

**Subcatchment PRE DA-3\_Pervious: PRE DA-3** Runoff Area=0.730 ac 0.00% Impervious Runoff Depth=5.43"  
Flow Length=185' Tc=18.4 min CN=73 Runoff=3.24 cfs 0.330 af

**Pond PRE 1B: PRE EAST BASIN** Peak Elev=140.24' Storage=24,471 cf Inflow=9.55 cfs 2.296 af  
Primary=6.76 cfs 2.296 af Secondary=0.00 cfs 0.000 af Outflow=6.76 cfs 2.296 af

**Pond PRE 2B: PRE WEST BASIN** Peak Elev=139.55' Storage=23,086 cf Inflow=19.24 cfs 4.247 af  
Primary=9.19 cfs 4.073 af Secondary=5.98 cfs 0.173 af Outflow=11.53 cfs 4.246 af

**Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)** Inflow=12.16 cfs 4.459 af  
Primary=12.16 cfs 4.459 af

**Total Runoff Area = 17.880 ac Runoff Volume = 4.460 af Average Runoff Depth = 2.99"**  
**85.12% Pervious = 15.220 ac 14.88% Impervious = 2.660 ac**

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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 100-YR Rainfall=8.69"

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Page 33

**Summary for Subcatchment PRE DA-1\_Impervious: PRE DA-1 IMPERVIOUS**

Runoff = 3.41 cfs @ 12.08 hrs, Volume= 0.282 af, Depth= 8.45"

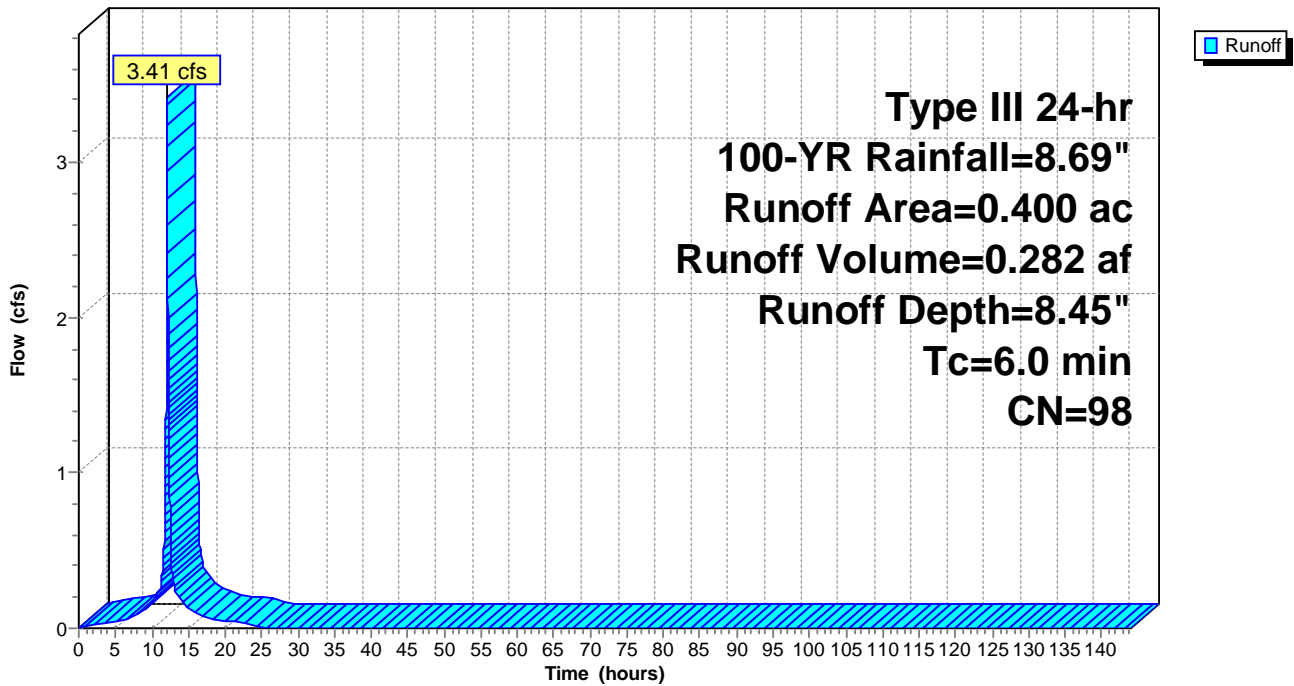
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.180	98	Paved parking, HSG A
0.220	98	Paved parking, HSG B
0.400	98	Weighted Average
0.400		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-1\_Impervious: PRE DA-1 IMPERVIOUS**

Hydrograph



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Type III 24-hr 100-YR Rainfall=8.69"

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Page 34

**Summary for Subcatchment PRE DA-1\_Pervious: PRE DA-1 PERVIOUS**

Runoff = 8.31 cfs @ 13.00 hrs, Volume= 1.841 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.540	39	>75% Grass cover, Good, HSG A
2.310	61	>75% Grass cover, Good, HSG B
5.860	30	Woods, Good, HSG A
2.980	55	Woods, Good, HSG B
11.690	43	Weighted Average
11.690		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2	100	0.0040	0.04		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.8	557	0.0180	0.67		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
6.0	655	0.0080	1.82		<b>Shallow Concentrated Flow, Shallow Concentrated Flow Along Road</b> Paved Kv= 20.3 fps
2.6	144	0.0350	0.94		<b>Shallow Concentrated Flow, Shallow Concentrated Flow Wooded Area</b> Woodland Kv= 5.0 fps
62.6	1,456	Total			

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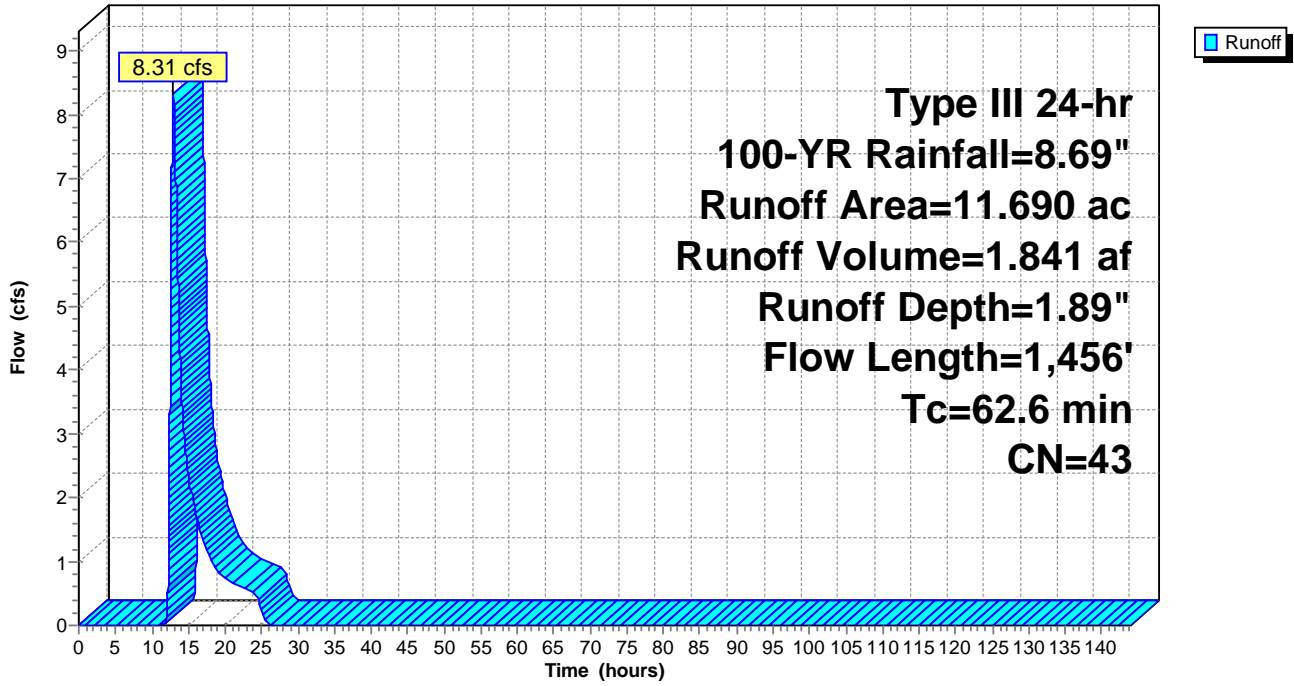
PRE-DEVELOPMENT CONDITIONS  
Type III 24-hr 100-YR Rainfall=8.69"

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Page 35

**Subcatchment PRE DA-1\_Pervious: PRE DA-1 PERVIOUS**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 100-YR Rainfall=8.69"

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Page 36

**Summary for Subcatchment PRE DA-2\_Impervious: PRE DA-2 IMPERVIOUS**

Runoff = 18.61 cfs @ 12.08 hrs, Volume= 1.535 af, Depth= 8.45"

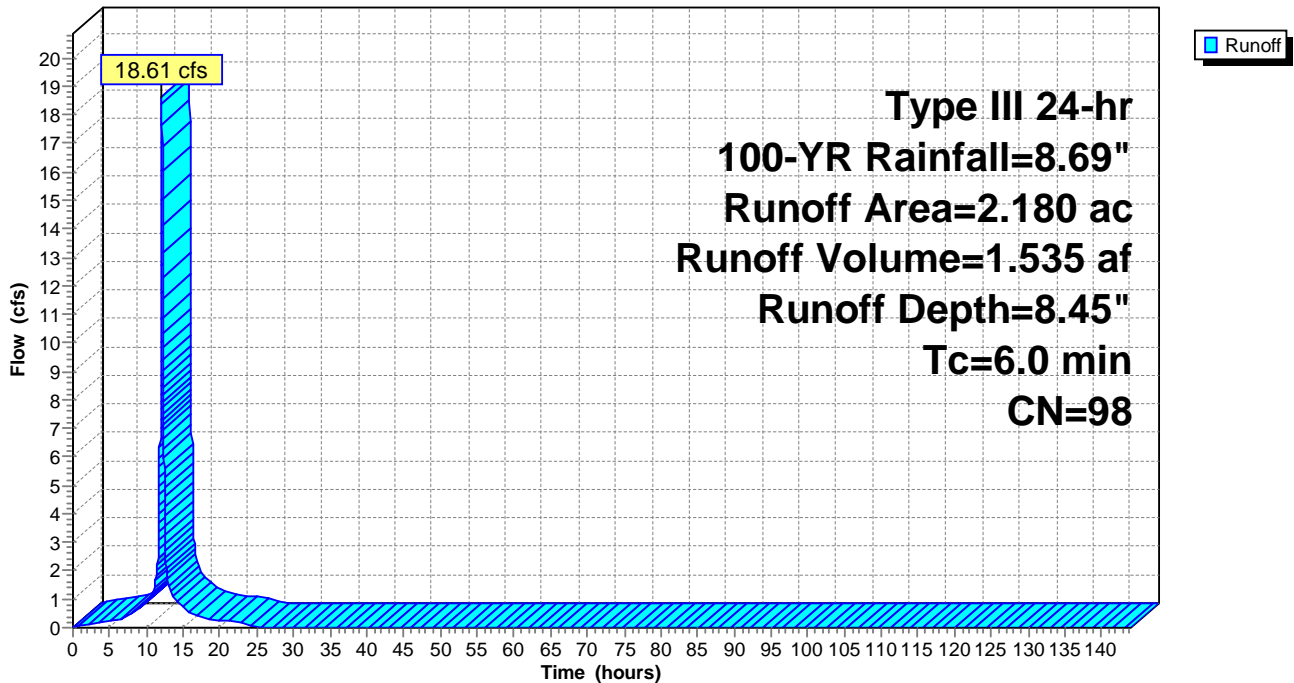
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
1.930	98	Paved parking, HSG A
0.230	98	Paved parking, HSG B
0.020	98	Paved parking, HSG D
2.180	98	Weighted Average
2.180		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-2\_Impervious: PRE DA-2 IMPERVIOUS**

Hydrograph



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Type III 24-hr 100-YR Rainfall=8.69"

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Page 37

**Summary for Subcatchment PRE DA-2\_Pervious: PRE DA-2 PERVIOUS**

Runoff = 2.98 cfs @ 12.40 hrs, Volume= 0.415 af, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.330	39	>75% Grass cover, Good, HSG A
0.340	61	>75% Grass cover, Good, HSG B
0.400	80	>75% Grass cover, Good, HSG D
1.730	30	Woods, Good, HSG A
2.800	42	Weighted Average
2.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0850	0.14		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
9.4	310	0.0120	0.55		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
2.0	310	0.0170	2.65		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
1.0	377	0.0080	6.44	20.23	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
24.2	1,097	Total			

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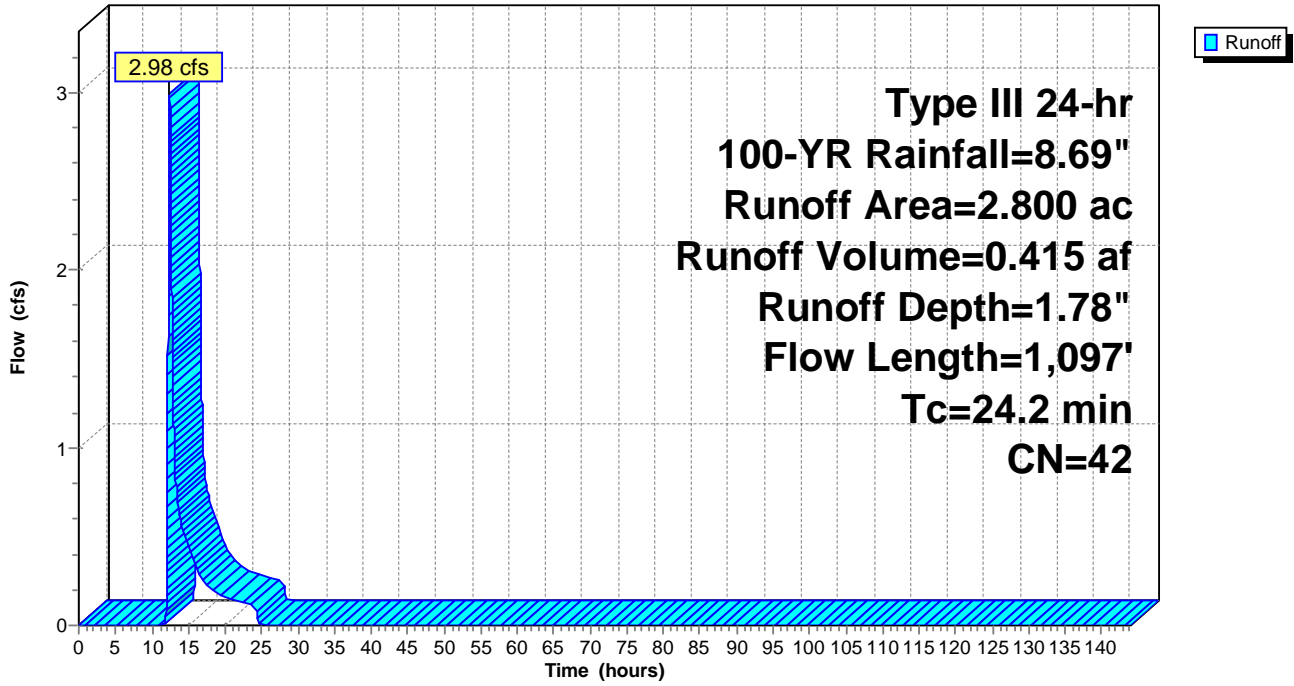
PRE-DEVELOPMENT CONDITIONS  
Type III 24-hr 100-YR Rainfall=8.69"

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Page 38

**Subcatchment PRE DA-2\_Pervious: PRE DA-2 PERVIOUS**

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Type III 24-hr 100-YR Rainfall=8.69"

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Page 39

**Summary for Subcatchment PRE DA-3\_Impervious: PRE DA-3 IMPERVIOUS**

Runoff = 0.68 cfs @ 12.08 hrs, Volume= 0.056 af, Depth= 8.45"

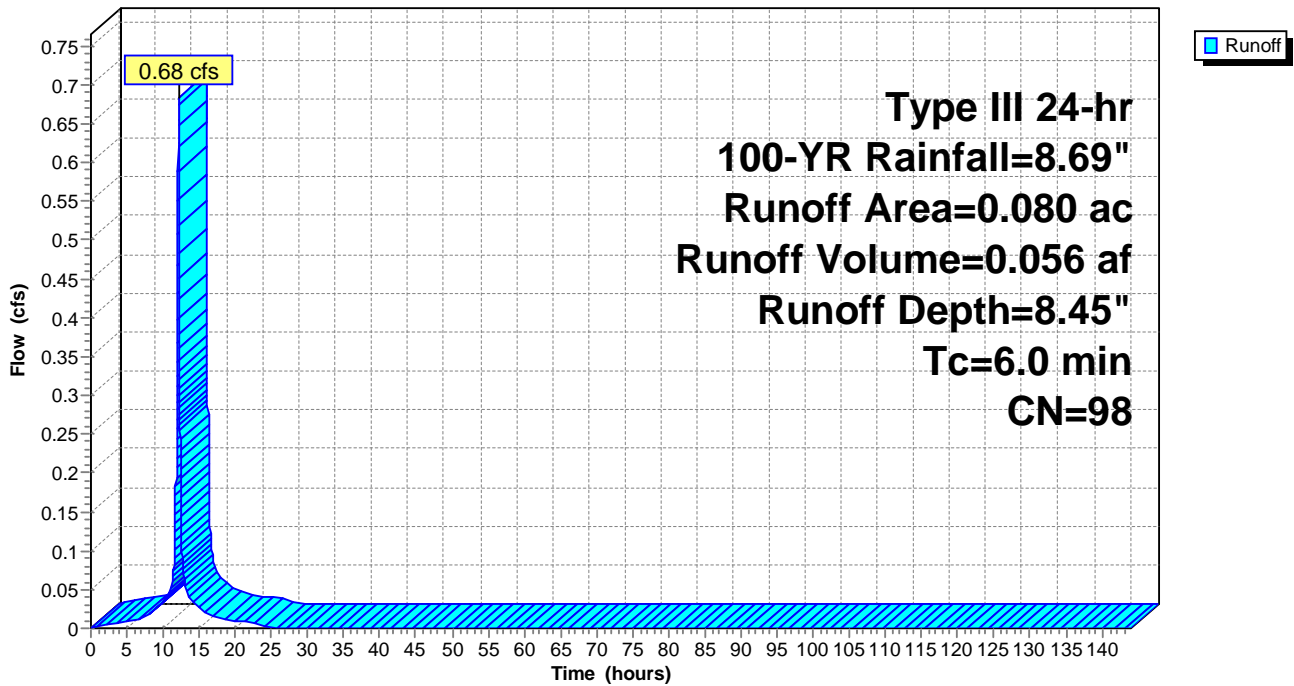
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG B
0.050	98	Paved parking, HSG D
0.080	98	Weighted Average
0.080		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-3\_Impervious: PRE DA-3 IMPERVIOUS**

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Type III 24-hr 100-YR Rainfall=8.69"

Printed 11/30/2020

Page 40

**Summary for Subcatchment PRE DA-3\_Pervious: PRE DA-3 PERVIOUS**

Runoff = 3.24 cfs @ 12.25 hrs, Volume= 0.330 af, Depth= 5.43"

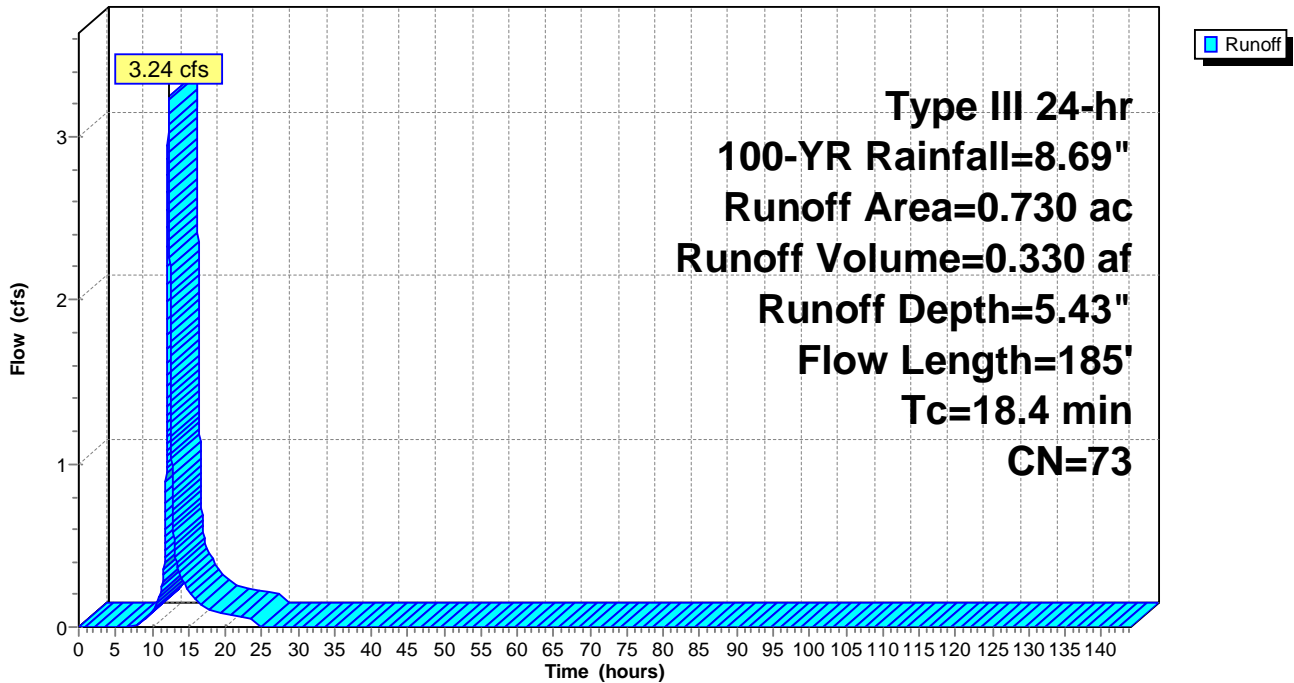
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.020	39	>75% Grass cover, Good, HSG A
0.160	61	>75% Grass cover, Good, HSG B
0.510	80	>75% Grass cover, Good, HSG D
0.040	55	Woods, Good, HSG B
0.730	73	Weighted Average
0.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0120	0.10		<b>Sheet Flow, Sheet Flow over Grass</b> Grass: Dense n= 0.240 P2= 3.31"
1.2	85	0.0280	1.17		<b>Shallow Concentrated Flow, Shallow Concentrated Flow over Grass</b> Short Grass Pasture Kv= 7.0 fps
18.4	185	Total			

**Subcatchment PRE DA-3\_Pervious: PRE DA-3 PERVIOUS**

Hydrograph



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Type III 24-hr 100-YR Rainfall=8.69"

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Page 41

**Summary for Pond PRE 1B: PRE EAST BASIN**

Inflow = 9.55 cfs @ 12.10 hrs, Volume= 2.296 af  
 Outflow = 6.76 cfs @ 13.35 hrs, Volume= 2.296 af, Atten= 29%, Lag= 74.9 min  
 Primary = 6.76 cfs @ 13.35 hrs, Volume= 2.296 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 140.24' @ 13.35 hrs Surf.Area= 21,100 sf Storage= 24,471 cf  
 Flood Elev= 140.88' Surf.Area= 38,141 sf Storage= 43,393 cf

Plug-Flow detention time= 185.9 min calculated for 2.296 af (100% of inflow)  
 Center-of-Mass det. time= 185.6 min ( 1,083.1 - 897.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.46'	68,833 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.46	13	0	0
138.00	634	175	175
139.00	12,333	6,484	6,658
140.00	14,666	13,500	20,158
141.00	41,342	28,004	48,162
141.50	41,342	20,671	68,833

Device	Routing	Invert	Outlet Devices
#1	Primary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.46' / 137.09' S= 0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.59'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	139.46'	<b>3.0' long x 1.80' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	141.26'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	140.50'	<b>55.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=6.76 cfs @ 13.35 hrs HW=140.24' TW=139.53' (Dynamic Tailwater)

- ↑ 1=Culvert (Passes 6.76 cfs of 14.51 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 0.35 cfs @ 4.06 fps)
- ↑ 3=Sharp-Crested Rectangular Weir (Weir Controls 6.40 cfs @ 2.88 fps)
- ↑ 4=Orifice/Grate ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=137.46' TW=136.31' (Dynamic Tailwater)

- ↑ 5=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

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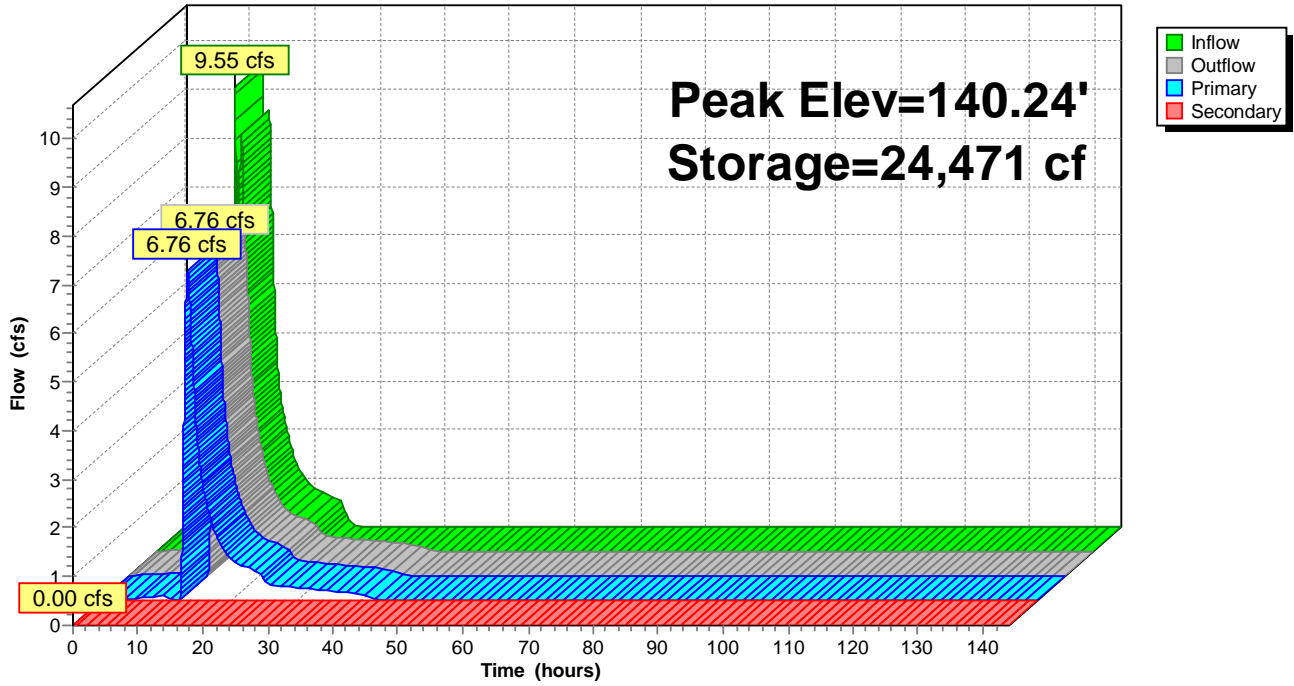
PRE-DEVELOPMENT CONDITIONS  
Type III 24-hr 100-YR Rainfall=8.69"

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Page 42

**Pond PRE 1B: PRE EAST BASIN**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

Type III 24-hr 100-YR Rainfall=8.69"

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Page 43

**Summary for Pond PRE 2B: PRE WEST BASIN**

Inflow = 19.24 cfs @ 12.09 hrs, Volume= 4.247 af  
 Outflow = 11.53 cfs @ 12.14 hrs, Volume= 4.246 af, Atten= 40%, Lag= 3.3 min  
 Primary = 9.19 cfs @ 12.39 hrs, Volume= 4.073 af  
 Secondary = 5.98 cfs @ 12.11 hrs, Volume= 0.173 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 139.55' @ 12.39 hrs Surf.Area= 11,991 sf Storage= 23,086 cf

Plug-Flow detention time= 166.6 min calculated for 4.246 af (100% of inflow)  
 Center-of-Mass det. time= 166.6 min ( 1,108.6 - 941.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	136.28'	42,593 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
136.28	8	0	0
137.00	2,829	1,021	1,021
138.00	8,947	5,888	6,909
139.00	10,919	9,933	16,842
140.00	12,886	11,903	28,745
141.00	14,810	13,848	42,593

Device	Routing	Invert	Outlet Devices
#1	Primary	135.48'	<b>24.0" Round Culvert</b> L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 135.48' / 135.05' S= 0.0287 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	138.83'	<b>4.0' long x 1.85' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#3	Primary	136.13'	<b>15.0" Round Culvert</b> L= 48.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 136.13' / 134.45' S= 0.0350 '/ Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#4	Device 3	136.28'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 3	139.43'	<b>9.0' long x 1.25' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#6	Device 1	140.68'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#7	Primary	140.50'	<b>60.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#8	Secondary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.09' / 137.46' S= -0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

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PRE-DEVELOPMENT CONDITIONS  
Type III 24-hr 100-YR Rainfall=8.69"

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Page 44

**Primary OutFlow** Max=9.19 cfs @ 12.39 hrs HW=139.55' TW=136.31' (Dynamic Tailwater)

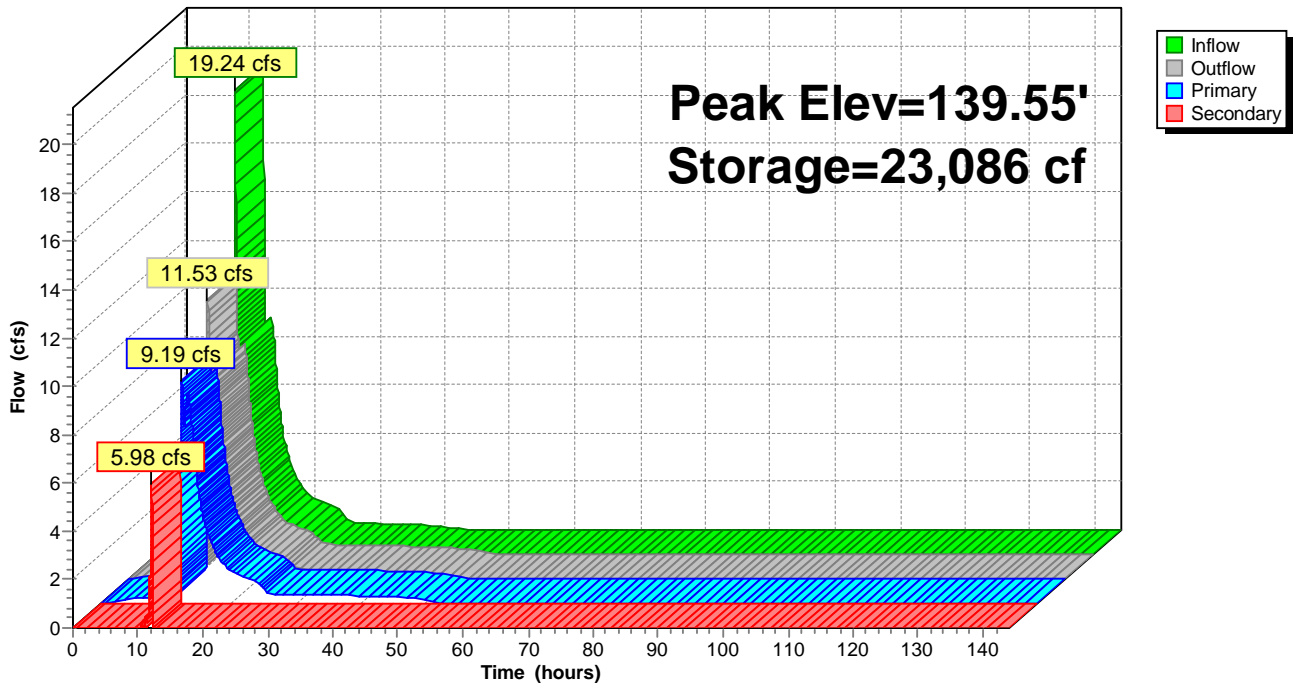
- 1=Culvert (Passes 7.63 cfs of 33.10 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Weir Controls 7.63 cfs @ 2.77 fps)
- 6=Orifice/Grate ( Controls 0.00 cfs)
- 3=Culvert (Passes 1.56 cfs of 11.63 cfs potential flow)
- 4=Orifice/Grate (Orifice Controls 0.42 cfs @ 8.53 fps)
- 5=Sharp-Crested Rectangular Weir (Weir Controls 1.15 cfs @ 1.11 fps)
- 7=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

**Secondary OutFlow** Max=5.35 cfs @ 12.11 hrs HW=139.34' TW=139.23' (Dynamic Tailwater)

- 8=Culvert (Outlet Controls 5.35 cfs @ 1.89 fps)

## Pond PRE 2B: PRE WEST BASIN

Hydrograph



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PRE-DEVELOPMENT CONDITIONS  
Type III 24-hr 100-YR Rainfall=8.69"

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Page 45

**Summary for Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)**

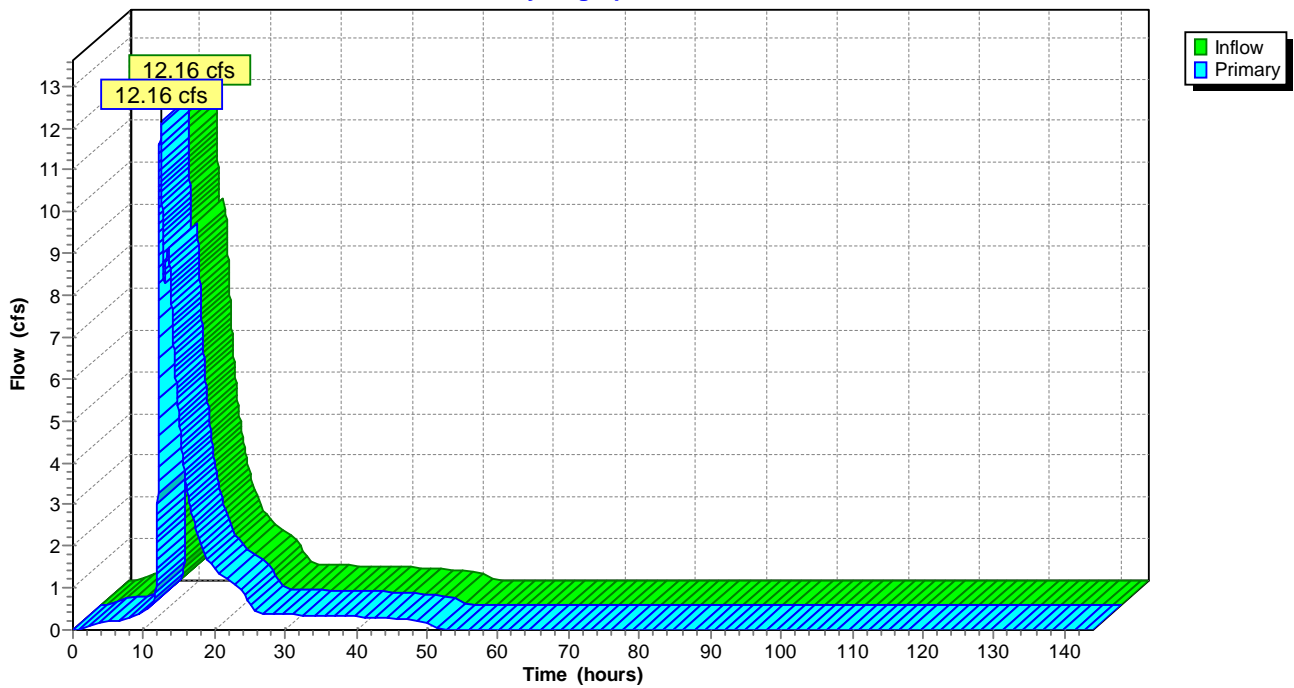
Inflow = 12.16 cfs @ 12.34 hrs, Volume= 4.459 af  
Primary = 12.16 cfs @ 12.35 hrs, Volume= 4.459 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 46

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment PRE DA-1\_Impervious: PRE** Runoff Area=0.400 ac 100.00% Impervious Runoff Depth=1.03"  
Tc=6.0 min CN=98 Runoff=1.17 cfs 0.034 af

**Subcatchment PRE DA-1\_Pervious: PRE DA-1** Runoff Area=11.690 ac 0.00% Impervious Runoff Depth=0.00"  
Flow Length=1,456' Tc=62.6 min CN=43 Runoff=0.00 cfs 0.000 af

**Subcatchment PRE DA-2\_Impervious: PRE** Runoff Area=2.180 ac 100.00% Impervious Runoff Depth=1.03"  
Tc=6.0 min CN=98 Runoff=6.38 cfs 0.188 af

**Subcatchment PRE DA-2\_Pervious: PRE DA-2** Runoff Area=2.800 ac 0.00% Impervious Runoff Depth=0.00"  
Flow Length=1,097' Tc=24.2 min CN=42 Runoff=0.00 cfs 0.000 af

**Subcatchment PRE DA-3\_Impervious: PRE** Runoff Area=0.080 ac 100.00% Impervious Runoff Depth=1.03"  
Tc=6.0 min CN=98 Runoff=0.23 cfs 0.007 af

**Subcatchment PRE DA-3\_Pervious: PRE DA-3** Runoff Area=0.730 ac 0.00% Impervious Runoff Depth=0.06"  
Flow Length=185' Tc=18.4 min CN=73 Runoff=0.06 cfs 0.004 af

**Pond PRE 1B: PRE EAST BASIN** Peak Elev=138.27' Storage=772 cf Inflow=1.17 cfs 0.034 af  
Primary=0.29 cfs 0.034 af Secondary=0.00 cfs 0.000 af Outflow=0.29 cfs 0.034 af

**Pond PRE 2B: PRE WEST BASIN** Peak Elev=138.09' Storage=7,755 cf Inflow=6.65 cfs 0.222 af  
Primary=0.31 cfs 0.222 af Secondary=0.00 cfs 0.000 af Outflow=0.31 cfs 0.222 af

**Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)** Inflow=0.49 cfs 0.233 af  
Primary=0.49 cfs 0.233 af

**Total Runoff Area = 17.880 ac Runoff Volume = 0.233 af Average Runoff Depth = 0.16"**  
**85.12% Pervious = 15.220 ac 14.88% Impervious = 2.660 ac**

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PRE-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 47

**Summary for Subcatchment PRE DA-1\_Impervious: PRE DA-1 IMPERVIOUS**

Runoff = 1.17 cfs @ 1.11 hrs, Volume= 0.034 af, Depth= 1.03"

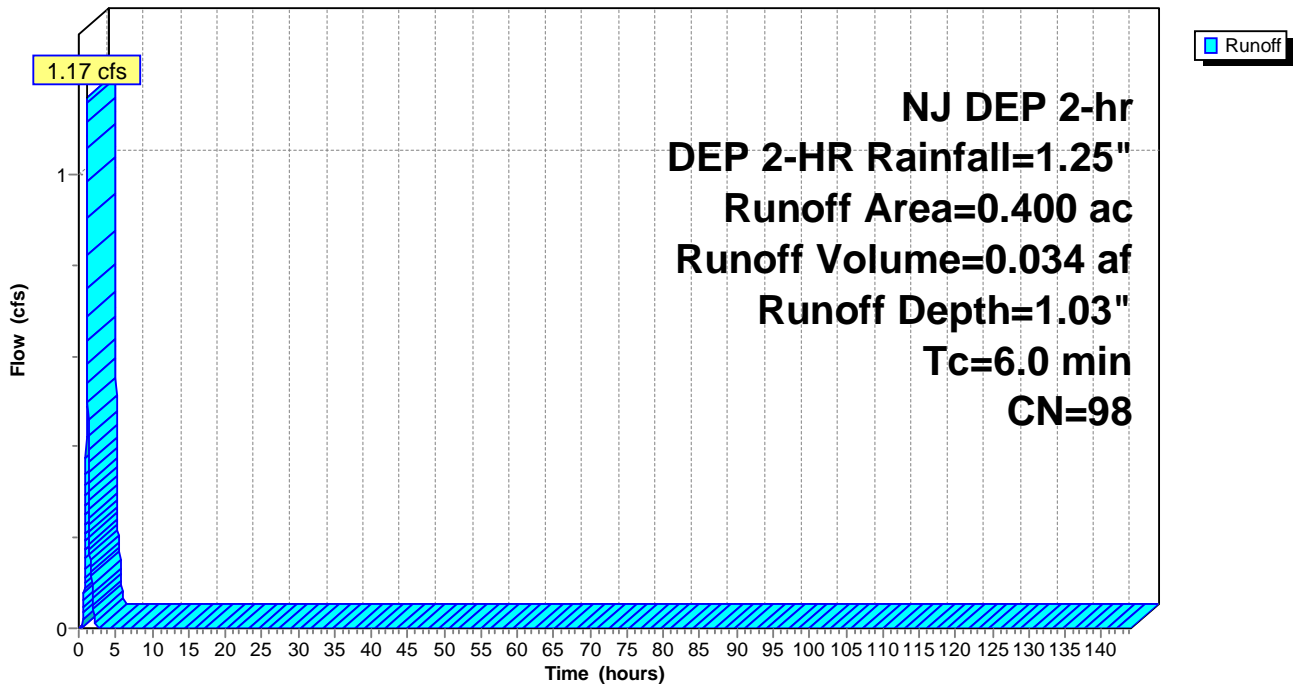
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.180	98	Paved parking, HSG A
0.220	98	Paved parking, HSG B
0.400	98	Weighted Average
0.400		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-1\_Impervious: PRE DA-1 IMPERVIOUS**

Hydrograph





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PRE-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 48

**Summary for Subcatchment PRE DA-1\_Pervious: PRE DA-1 PERVIOUS**

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.540	39	>75% Grass cover, Good, HSG A
2.310	61	>75% Grass cover, Good, HSG B
5.860	30	Woods, Good, HSG A
2.980	55	Woods, Good, HSG B
11.690	43	Weighted Average
11.690		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2	100	0.0040	0.04		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.8	557	0.0180	0.67		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
6.0	655	0.0080	1.82		<b>Shallow Concentrated Flow, Shallow Concentrated Flow Along Road</b> Paved Kv= 20.3 fps
2.6	144	0.0350	0.94		<b>Shallow Concentrated Flow, Shallow Concentrated Flow Wooded Area</b> Woodland Kv= 5.0 fps
62.6	1,456	Total			

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PRE-DEVELOPMENT CONDITIONS

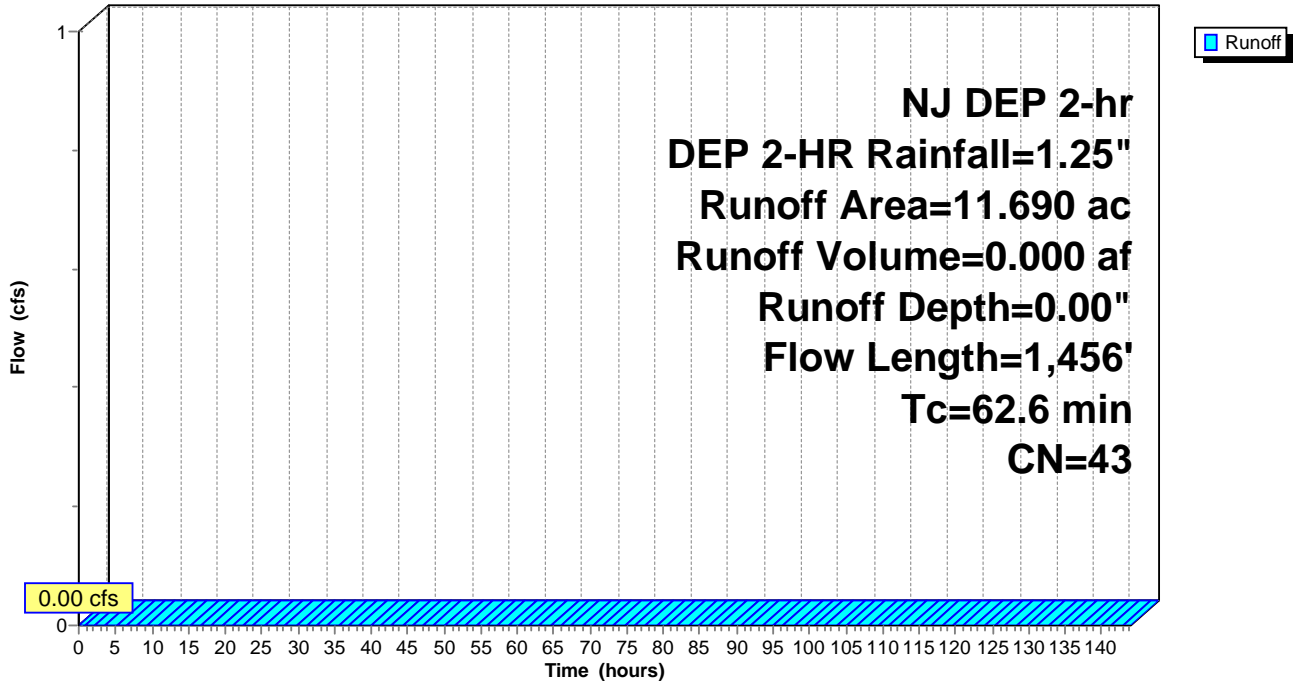
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 49

**Subcatchment PRE DA-1\_Pervious: PRE DA-1 PERVIOUS**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 50

**Summary for Subcatchment PRE DA-2\_Impervious: PRE DA-2 IMPERVIOUS**

Runoff = 6.38 cfs @ 1.11 hrs, Volume= 0.188 af, Depth= 1.03"

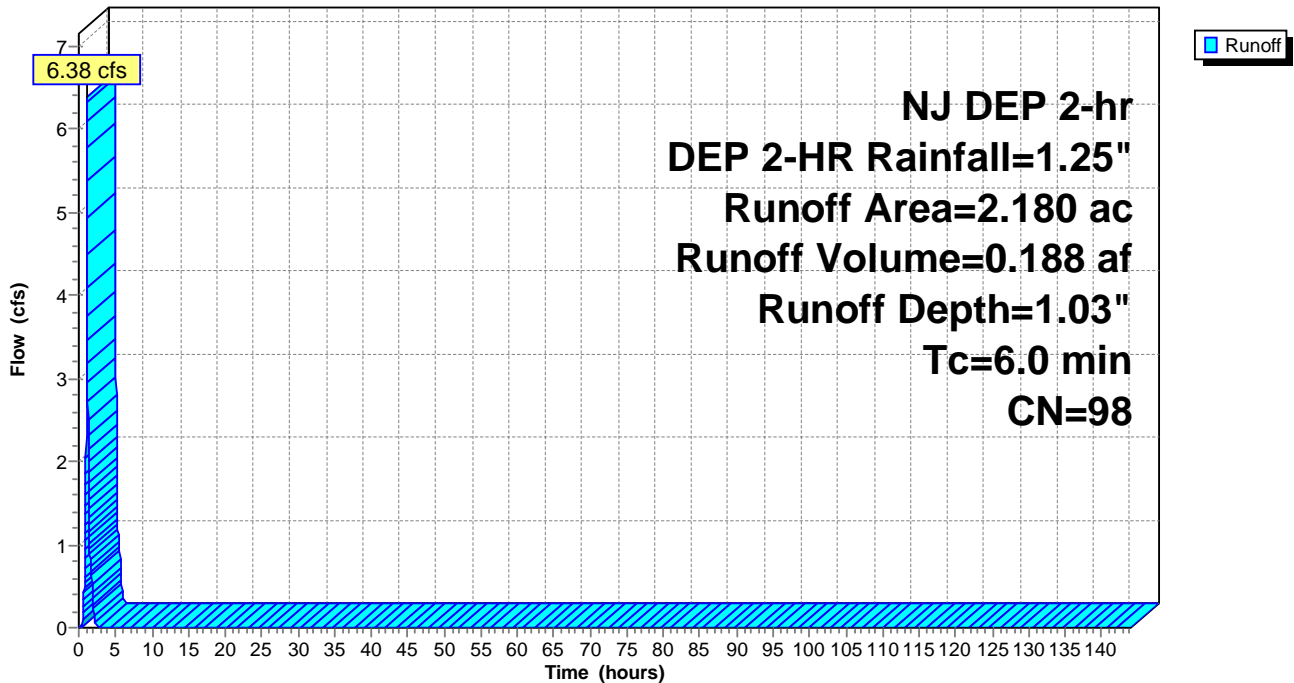
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
1.930	98	Paved parking, HSG A
0.230	98	Paved parking, HSG B
0.020	98	Paved parking, HSG D
2.180	98	Weighted Average
2.180		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-2\_Impervious: PRE DA-2 IMPERVIOUS**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 51

**Summary for Subcatchment PRE DA-2\_Pervious: PRE DA-2 PERVIOUS**

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.330	39	>75% Grass cover, Good, HSG A
0.340	61	>75% Grass cover, Good, HSG B
0.400	80	>75% Grass cover, Good, HSG D
1.730	30	Woods, Good, HSG A
2.800	42	Weighted Average
2.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0850	0.14		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
9.4	310	0.0120	0.55		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
2.0	310	0.0170	2.65		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
1.0	377	0.0080	6.44	20.23	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
24.2	1,097	Total			

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PRE-DEVELOPMENT CONDITIONS

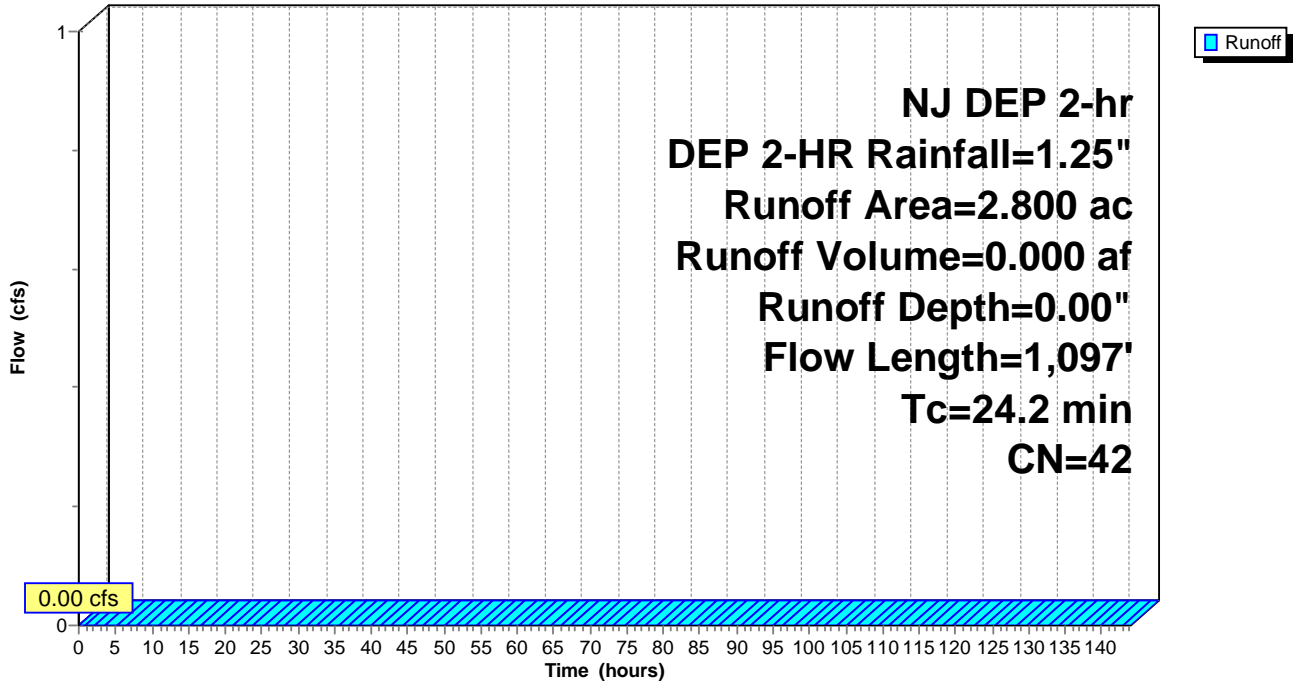
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 52

**Subcatchment PRE DA-2\_Pervious: PRE DA-2 PERVIOUS**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 53

**Summary for Subcatchment PRE DA-3\_Impervious: PRE DA-3 IMPERVIOUS**

Runoff = 0.23 cfs @ 1.11 hrs, Volume= 0.007 af, Depth= 1.03"

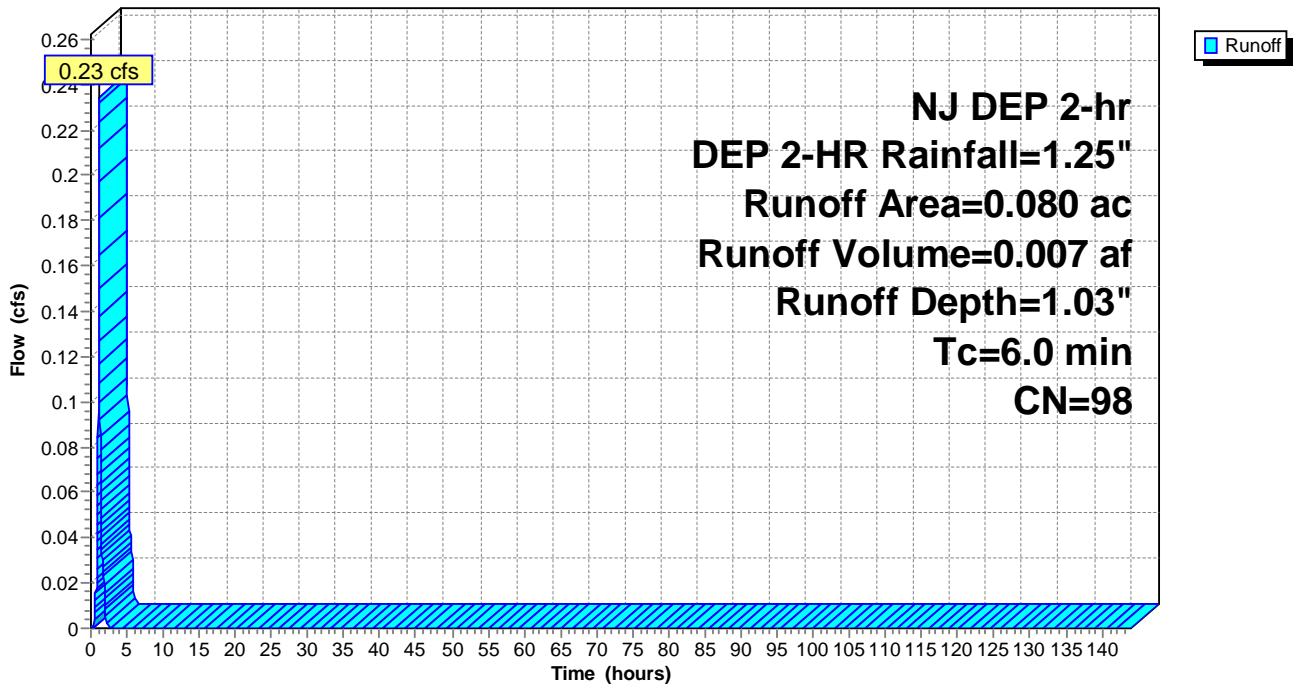
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG B
0.050	98	Paved parking, HSG D
0.080	98	Weighted Average
0.080		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment PRE DA-3\_Impervious: PRE DA-3 IMPERVIOUS**

Hydrograph



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NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 54

**Summary for Subcatchment PRE DA-3\_Pervious: PRE DA-3 PERVIOUS**

Runoff = 0.06 cfs @ 1.41 hrs, Volume= 0.004 af, Depth= 0.06"

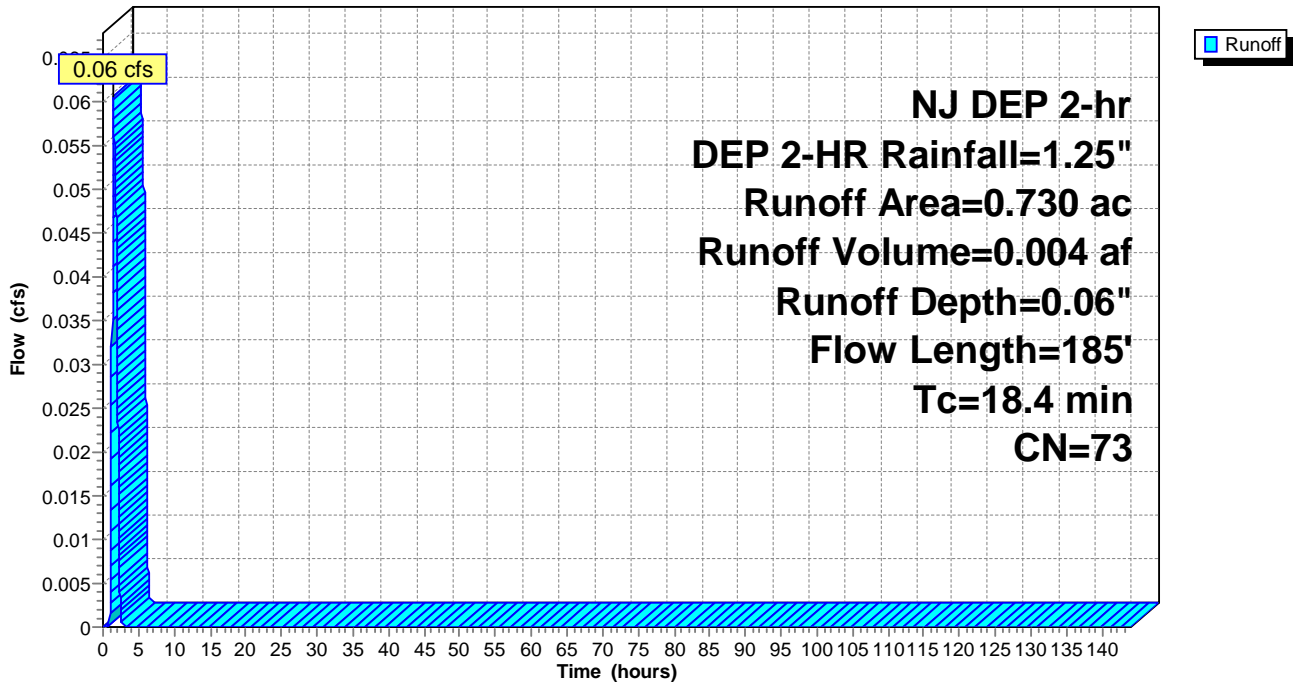
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.020	39	>75% Grass cover, Good, HSG A
0.160	61	>75% Grass cover, Good, HSG B
0.510	80	>75% Grass cover, Good, HSG D
0.040	55	Woods, Good, HSG B
0.730	73	Weighted Average
0.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.0120	0.10		<b>Sheet Flow, Sheet Flow over Grass</b> Grass: Dense n= 0.240 P2= 3.31"
1.2	85	0.0280	1.17		<b>Shallow Concentrated Flow, Shallow Concentrated Flow over Grass</b> Short Grass Pasture Kv= 7.0 fps
18.4	185	Total			

**Subcatchment PRE DA-3\_Pervious: PRE DA-3 PERVIOUS**

Hydrograph



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**Summary for Pond PRE 1B: PRE EAST BASIN**

Inflow = 1.17 cfs @ 1.11 hrs, Volume= 0.034 af  
 Outflow = 0.29 cfs @ 1.18 hrs, Volume= 0.034 af, Atten= 75%, Lag= 4.3 min  
 Primary = 0.29 cfs @ 1.18 hrs, Volume= 0.034 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 138.27' @ 1.34 hrs Surf.Area= 3,791 sf Storage= 772 cf  
 Flood Elev= 140.88' Surf.Area= 38,141 sf Storage= 43,393 cf

Plug-Flow detention time= 54.4 min calculated for 0.034 af (99% of inflow)  
 Center-of-Mass det. time= 54.2 min ( 124.5 - 70.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.46'	68,833 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.46	13	0	0
138.00	634	175	175
139.00	12,333	6,484	6,658
140.00	14,666	13,500	20,158
141.00	41,342	28,004	48,162
141.50	41,342	20,671	68,833

Device	Routing	Invert	Outlet Devices
#1	Primary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.46' / 137.09' S= 0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.59'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	139.46'	<b>3.0' long x 1.80' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	141.26'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	140.50'	<b>55.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=0.29 cfs @ 1.18 hrs HW=138.24' TW=137.77' (Dynamic Tailwater)

- ↑ 1=Culvert (Passes 0.29 cfs of 2.50 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 0.29 cfs @ 3.29 fps)
- ↑ 3=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)
- ↑ 4=Orifice/Grate ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=137.46' TW=136.31' (Dynamic Tailwater)

- ↑ 5=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)



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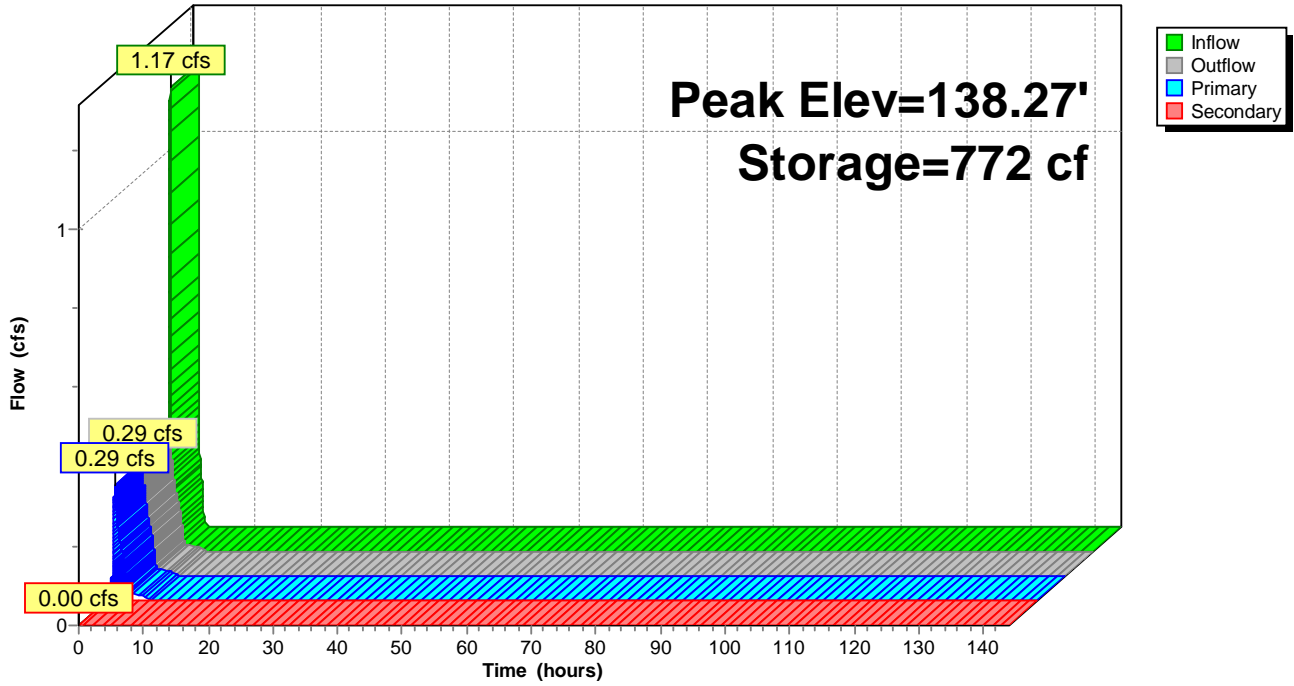
PRE-DEVELOPMENT CONDITIONS  
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 56

**Pond PRE 1B: PRE EAST BASIN**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 57

**Summary for Pond PRE 2B: PRE WEST BASIN**

Inflow = 6.65 cfs @ 1.11 hrs, Volume= 0.222 af  
 Outflow = 0.31 cfs @ 2.07 hrs, Volume= 0.222 af, Atten= 95%, Lag= 57.6 min  
 Primary = 0.31 cfs @ 2.07 hrs, Volume= 0.222 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 138.09' @ 2.07 hrs Surf.Area= 9,131 sf Storage= 7,755 cf

Plug-Flow detention time= 260.5 min calculated for 0.222 af (100% of inflow)  
 Center-of-Mass det. time= 260.1 min ( 338.7 - 78.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	136.28'	42,593 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
136.28	8	0	0
137.00	2,829	1,021	1,021
138.00	8,947	5,888	6,909
139.00	10,919	9,933	16,842
140.00	12,886	11,903	28,745
141.00	14,810	13,848	42,593

Device	Routing	Invert	Outlet Devices
#1	Primary	135.48'	<b>24.0" Round Culvert</b> L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 135.48' / 135.05' S= 0.0287 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	138.83'	<b>4.0' long x 1.85' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#3	Primary	136.13'	<b>15.0" Round Culvert</b> L= 48.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 136.13' / 134.45' S= 0.0350 '/ Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#4	Device 3	136.28'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#5	Device 3	139.43'	<b>9.0' long x 1.25' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#6	Device 1	140.68'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#7	Primary	140.50'	<b>60.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#8	Secondary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.09' / 137.46' S= -0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

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PRE-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 58

**Primary OutFlow** Max=0.31 cfs @ 2.07 hrs HW=138.09' TW=136.31' (Dynamic Tailwater)

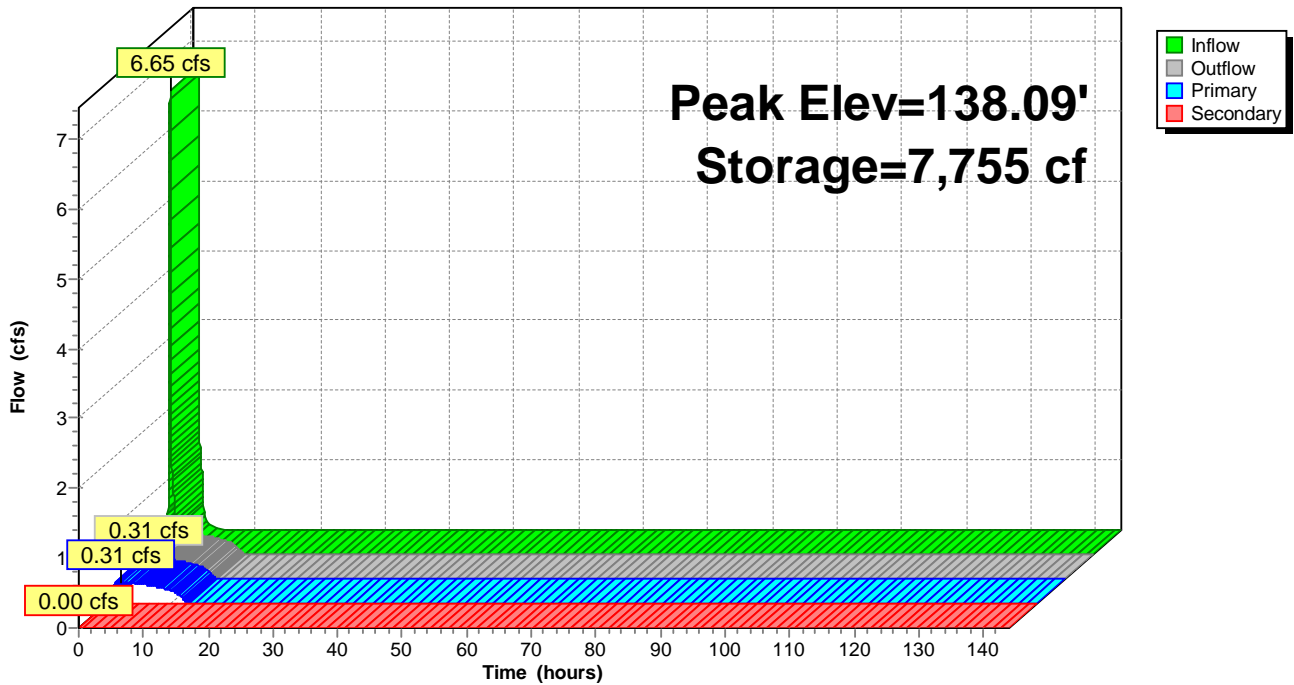
- 1=Culvert (Passes 0.00 cfs of 22.35 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 6=Orifice/Grate (Controls 0.00 cfs)
- 3=Culvert (Passes 0.31 cfs of 8.55 cfs potential flow)
- 4=Orifice/Grate (Orifice Controls 0.31 cfs @ 6.26 fps)
- 5=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 7=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=136.28' TW=137.46' (Dynamic Tailwater)

- 8=Culvert (Controls 0.00 cfs)

**Pond PRE 2B: PRE WEST BASIN**

Hydrograph



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PRE-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 59

**Summary for Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)**

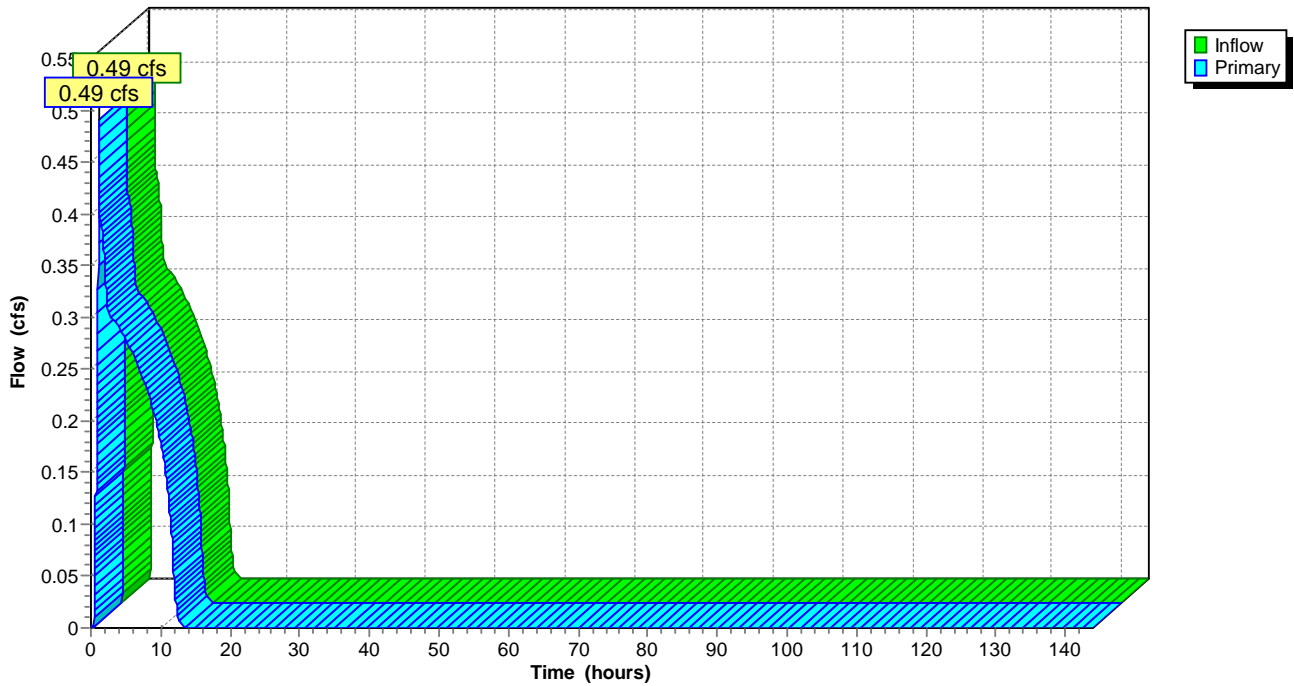
Inflow = 0.49 cfs @ 1.12 hrs, Volume= 0.233 af  
Primary = 0.49 cfs @ 1.13 hrs, Volume= 0.233 af, Atten= 0%, Lag= 0.6 min

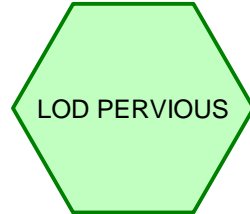
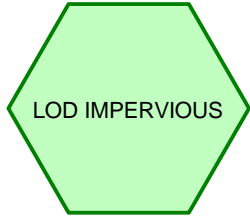
Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link PRE POI: PRE OUTFALL (POINT OF INVESTIGATION)**

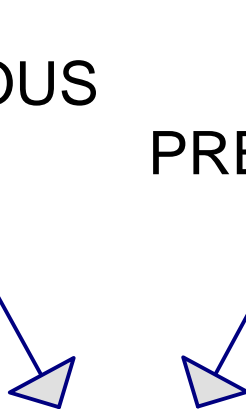
Hydrograph



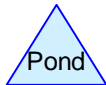
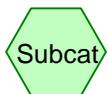


PRE LOD IMPERVIOUS

PRE LOD PERVIOUS



PRE LOD DISCHARGE



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Page 2

**Area Listing (selected nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.230	39	>75% Grass cover, Good, HSG A (LOD PERVIOUS)
2.200	61	>75% Grass cover, Good, HSG B (LOD PERVIOUS)
0.490	80	>75% Grass cover, Good, HSG D (LOD PERVIOUS)
0.010	98	Paved parking, HSG A (LOD IMPERVIOUS)
0.040	98	Paved parking, HSG B (LOD IMPERVIOUS)
0.010	98	Paved parking, HSG D (LOD IMPERVIOUS)
1.190	30	Woods, Good, HSG A (LOD PERVIOUS)
1.370	55	Woods, Good, HSG B (LOD PERVIOUS)
<b>5.540</b>	<b>54</b>	<b>TOTAL AREA</b>

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Page 3

**Soil Listing (selected nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
1.430	HSG A	LOD IMPERVIOUS, LOD PERVIOUS
3.610	HSG B	LOD IMPERVIOUS, LOD PERVIOUS
0.000	HSG C	
0.500	HSG D	LOD IMPERVIOUS, LOD PERVIOUS
0.000	Other	
<b>5.540</b>		<b>TOTAL AREA</b>

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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 2-YR Rainfall=3.31"

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Page 4

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment LOD IMPERVIOUS: PRE LOD** Runoff Area=0.060 ac 100.00% Impervious Runoff Depth=3.08"  
Flow Length=512' Tc=30.2 min CN=98 Runoff=0.11 cfs 0.015 af

**Subcatchment LOD PERVIOUS: PRE LOD** Runoff Area=5.480 ac 0.00% Impervious Runoff Depth=0.25"  
Flow Length=512' Tc=30.2 min CN=54 Runoff=0.41 cfs 0.116 af

**Link PRE LOD: PRE LOD DISCHARGE** Inflow=0.49 cfs 0.132 af  
Primary=0.49 cfs 0.132 af

**Total Runoff Area = 5.540 ac Runoff Volume = 0.132 af Average Runoff Depth = 0.29"**  
**98.92% Pervious = 5.480 ac 1.08% Impervious = 0.060 ac**



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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 2-YR Rainfall=3.31"

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Page 5

**Summary for Subcatchment LOD IMPERVIOUS: PRE LOD IMPERVIOUS**

Runoff = 0.11 cfs @ 12.38 hrs, Volume= 0.015 af, Depth= 3.08"

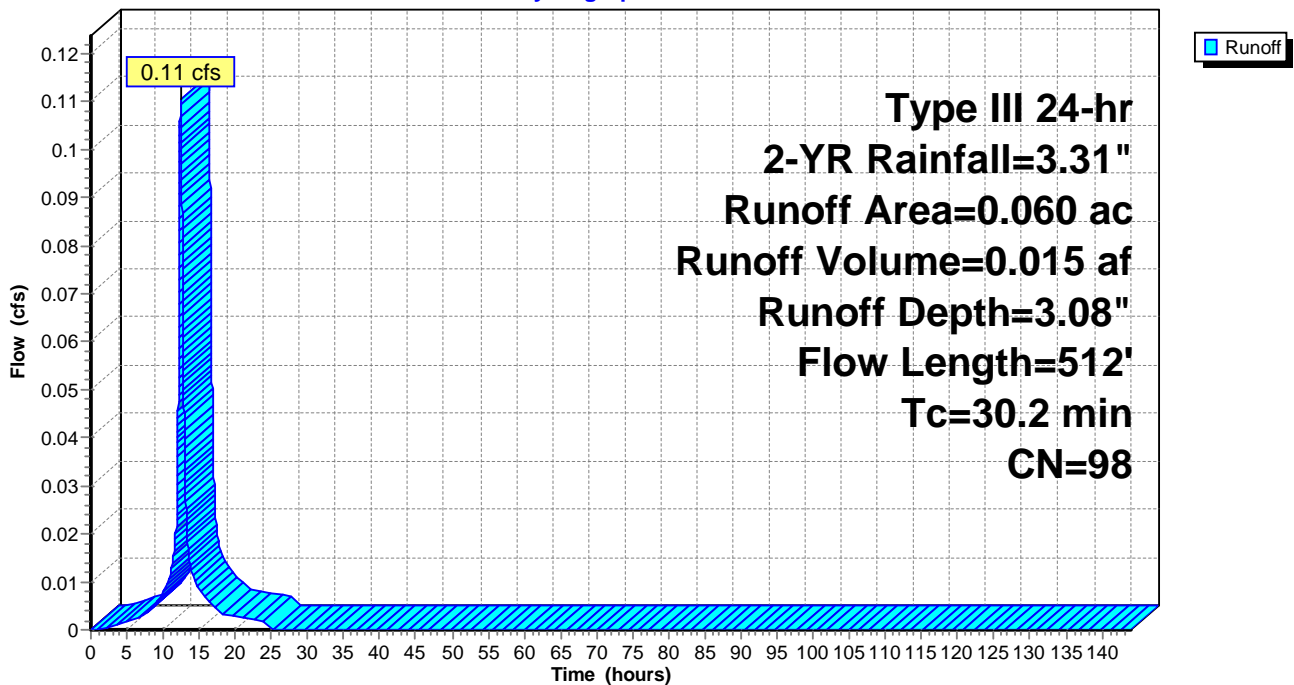
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG B
0.010	98	Paved parking, HSG D
0.010	98	Paved parking, HSG A
0.060	98	Weighted Average
0.060		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0340	0.10		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.1	412	0.0110	0.52		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
30.2	512	Total			

**Subcatchment LOD IMPERVIOUS: PRE LOD IMPERVIOUS**

Hydrograph



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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 2-YR Rainfall=3.31"

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Page 6

**Summary for Subcatchment LOD PERVIOUS: PRE LOD PERVIOUS**

Runoff = 0.41 cfs @ 12.69 hrs, Volume= 0.116 af, Depth= 0.25"

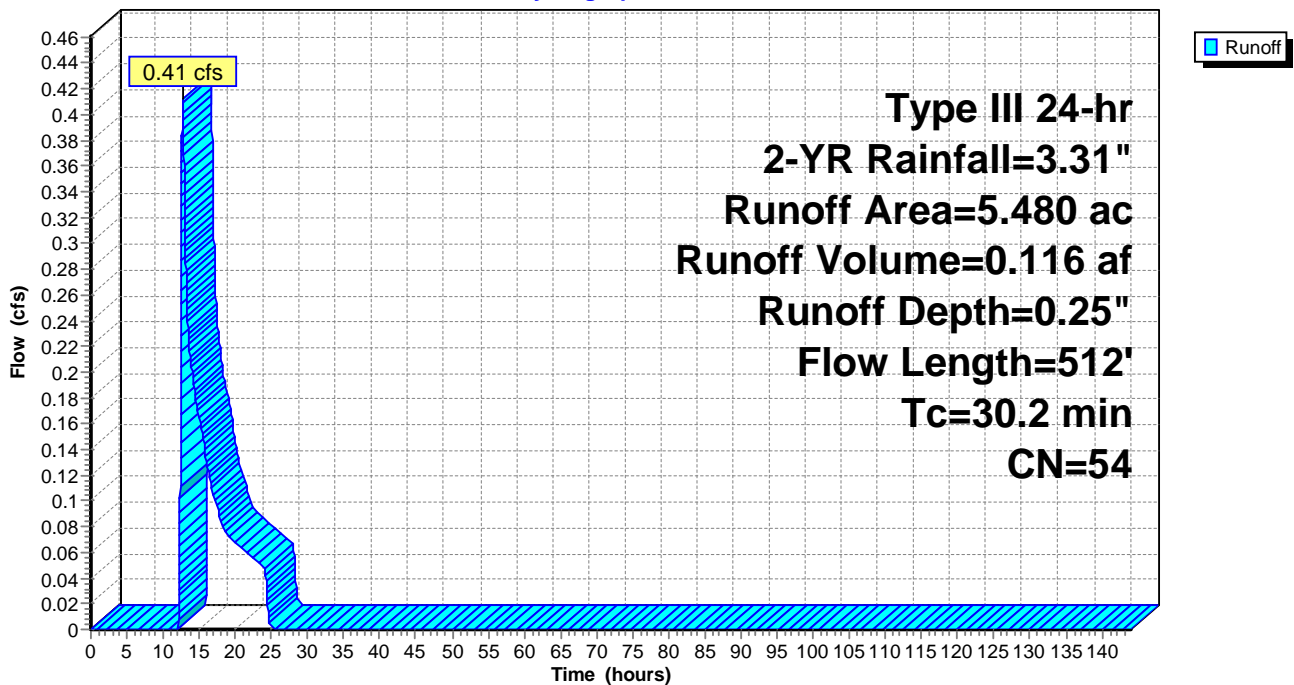
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.230	39	>75% Grass cover, Good, HSG A
2.200	61	>75% Grass cover, Good, HSG B
0.490	80	>75% Grass cover, Good, HSG D
1.190	30	Woods, Good, HSG A
1.370	55	Woods, Good, HSG B
5.480	54	Weighted Average
5.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0340	0.10		<b>Sheet Flow, Sheet Flow thru Wooded Area</b>
					Woods: Light underbrush n= 0.400 P2= 3.31"
13.1	412	0.0110	0.52		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b>
					Woodland Kv= 5.0 fps
30.2	512	Total			

**Subcatchment LOD PERVIOUS: PRE LOD PERVIOUS**

Hydrograph



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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 2-YR Rainfall=3.31"

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Page 7

**Summary for Link PRE LOD: PRE LOD DISCHARGE**

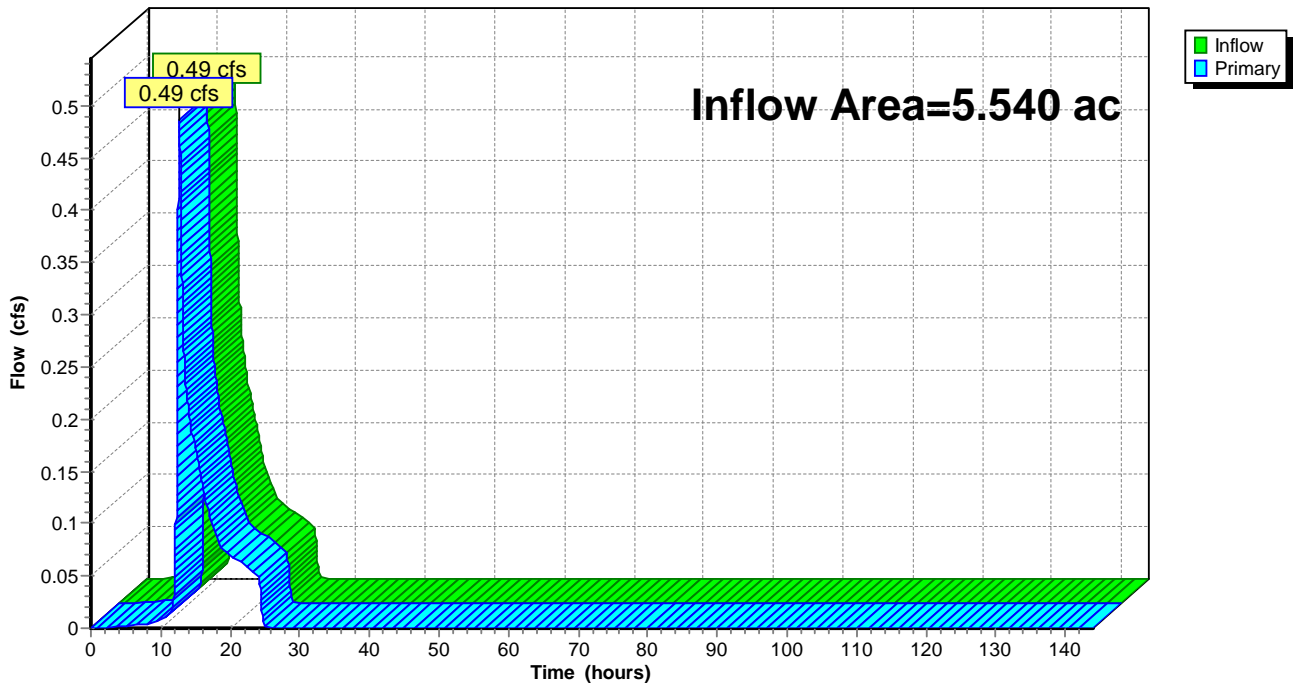
Inflow Area = 5.540 ac, 1.08% Impervious, Inflow Depth = 0.29" for 2-YR event  
Inflow = 0.49 cfs @ 12.65 hrs, Volume= 0.132 af  
Primary = 0.49 cfs @ 12.66 hrs, Volume= 0.132 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link PRE LOD: PRE LOD DISCHARGE**

Hydrograph



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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 10-YR Rainfall=5.11"

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Page 8

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment LOD IMPERVIOUS: PRE LOD** Runoff Area=0.060 ac 100.00% Impervious Runoff Depth=4.87"  
Flow Length=512' Tc=30.2 min CN=98 Runoff=0.17 cfs 0.024 af

**Subcatchment LOD PERVIOUS: PRE LOD** Runoff Area=5.480 ac 0.00% Impervious Runoff Depth=0.97"  
Flow Length=512' Tc=30.2 min CN=54 Runoff=2.83 cfs 0.444 af

**Link PRE LOD: PRE LOD DISCHARGE** Inflow=2.98 cfs 0.469 af  
Primary=2.98 cfs 0.469 af

**Total Runoff Area = 5.540 ac Runoff Volume = 0.469 af Average Runoff Depth = 1.02"**  
**98.92% Pervious = 5.480 ac 1.08% Impervious = 0.060 ac**

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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 10-YR Rainfall=5.11"

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Page 9

**Summary for Subcatchment LOD IMPERVIOUS: PRE LOD IMPERVIOUS**

Runoff = 0.17 cfs @ 12.38 hrs, Volume= 0.024 af, Depth= 4.87"

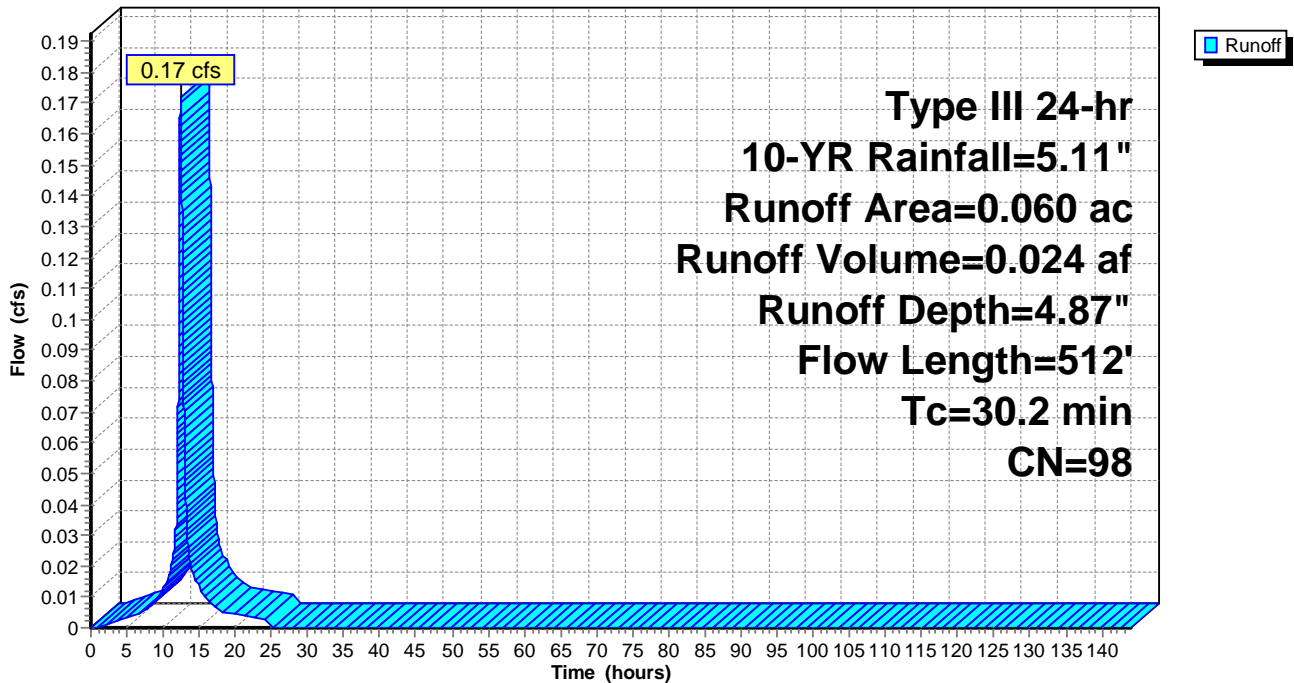
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG B
0.010	98	Paved parking, HSG D
0.010	98	Paved parking, HSG A
0.060	98	Weighted Average
0.060		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0340	0.10		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.1	412	0.0110	0.52		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
30.2	512	Total			

**Subcatchment LOD IMPERVIOUS: PRE LOD IMPERVIOUS**

Hydrograph



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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 10-YR Rainfall=5.11"

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Page 10

**Summary for Subcatchment LOD PERVIOUS: PRE LOD PERVIOUS**

Runoff = 2.83 cfs @ 12.52 hrs, Volume= 0.444 af, Depth= 0.97"

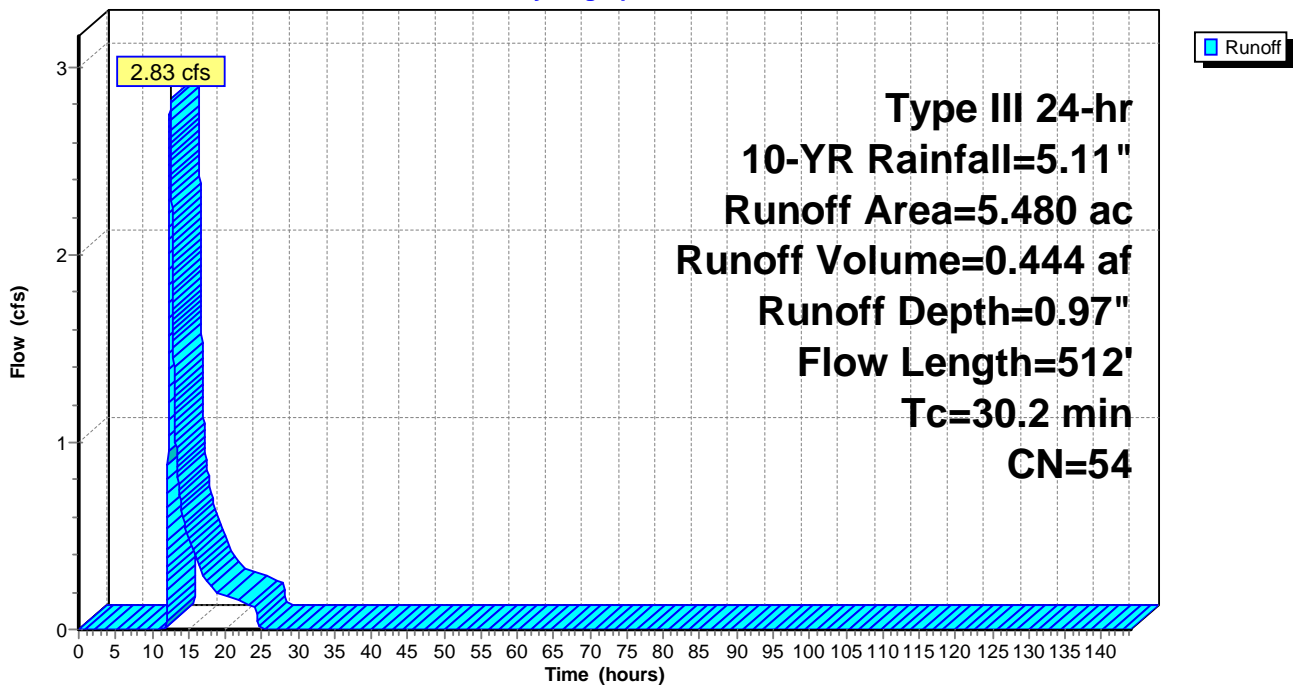
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.230	39	>75% Grass cover, Good, HSG A
2.200	61	>75% Grass cover, Good, HSG B
0.490	80	>75% Grass cover, Good, HSG D
1.190	30	Woods, Good, HSG A
1.370	55	Woods, Good, HSG B
5.480	54	Weighted Average
5.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0340	0.10		<b>Sheet Flow, Sheet Flow thru Wooded Area</b>
					Woods: Light underbrush n= 0.400 P2= 3.31"
13.1	412	0.0110	0.52		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b>
					Woodland Kv= 5.0 fps
30.2	512	Total			

**Subcatchment LOD PERVIOUS: PRE LOD PERVIOUS**

Hydrograph



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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 10-YR Rainfall=5.11"

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Page 11

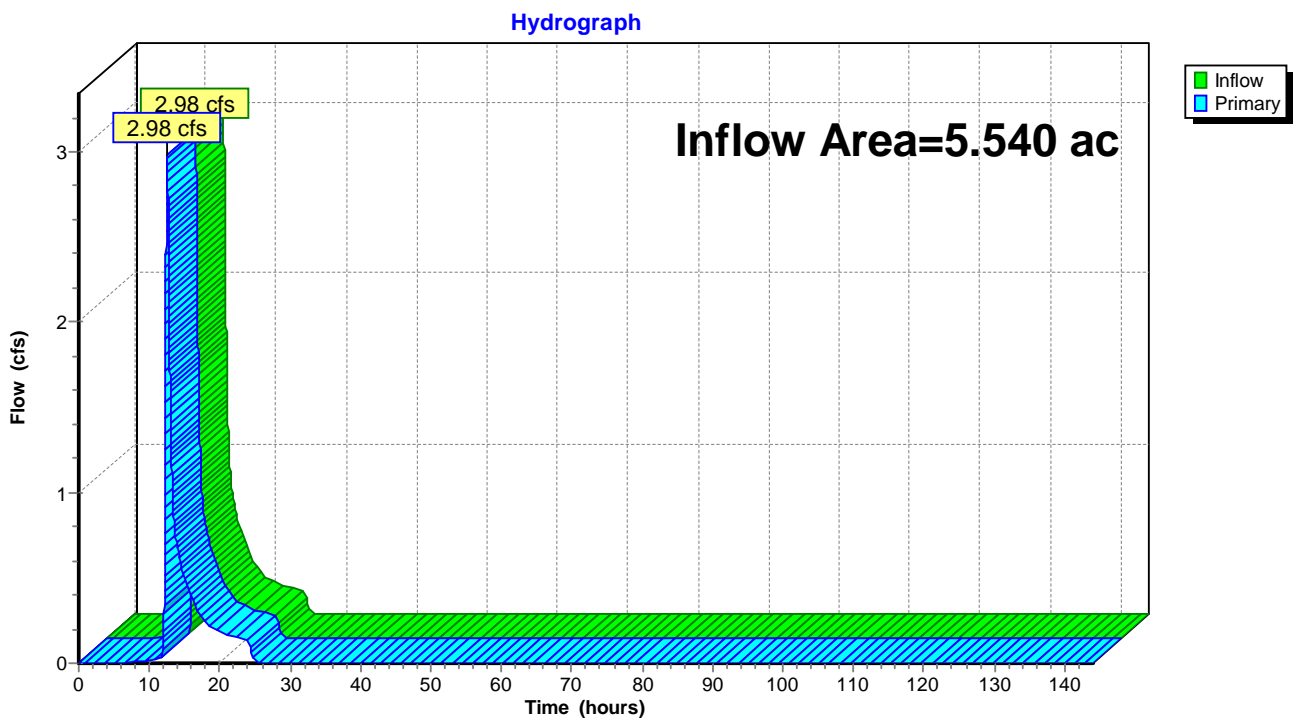
**Summary for Link PRE LOD: PRE LOD DISCHARGE**

Inflow Area = 5.540 ac, 1.08% Impervious, Inflow Depth = 1.02" for 10-YR event  
Inflow = 2.98 cfs @ 12.51 hrs, Volume= 0.469 af  
Primary = 2.98 cfs @ 12.52 hrs, Volume= 0.469 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link PRE LOD: PRE LOD DISCHARGE**



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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 100-YR Rainfall=8.69"

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Page 12

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment LOD IMPERVIOUS: PRE LOD** Runoff Area=0.060 ac 100.00% Impervious Runoff Depth=8.45"  
Flow Length=512' Tc=30.2 min CN=98 Runoff=0.29 cfs 0.042 af

**Subcatchment LOD PERVIOUS: PRE LOD** Runoff Area=5.480 ac 0.00% Impervious Runoff Depth=3.15"  
Flow Length=512' Tc=30.2 min CN=54 Runoff=10.99 cfs 1.438 af

**Link PRE LOD: PRE LOD DISCHARGE** Inflow=11.28 cfs 1.480 af  
Primary=11.28 cfs 1.480 af

**Total Runoff Area = 5.540 ac Runoff Volume = 1.480 af Average Runoff Depth = 3.21"**  
**98.92% Pervious = 5.480 ac 1.08% Impervious = 0.060 ac**



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PRE-DEVELOPMENT LOD AREA  
 Type III 24-hr 100-YR Rainfall=8.69"

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Page 13

**Summary for Subcatchment LOD IMPERVIOUS: PRE LOD IMPERVIOUS**

Runoff = 0.29 cfs @ 12.38 hrs, Volume= 0.042 af, Depth= 8.45"

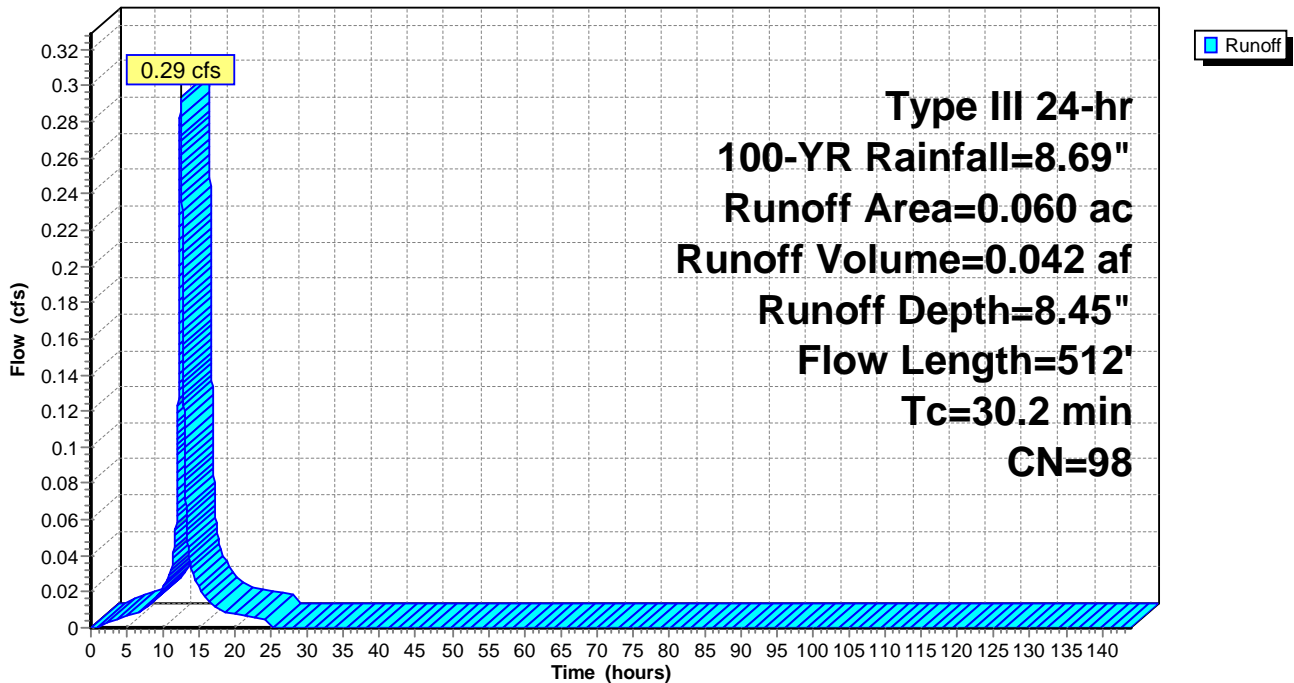
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG B
0.010	98	Paved parking, HSG D
0.010	98	Paved parking, HSG A
0.060	98	Weighted Average
0.060		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0340	0.10		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.1	412	0.0110	0.52		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
30.2	512	Total			

**Subcatchment LOD IMPERVIOUS: PRE LOD IMPERVIOUS**

Hydrograph



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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 100-YR Rainfall=8.69"

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Page 14

**Summary for Subcatchment LOD PERVIOUS: PRE LOD PERVIOUS**

Runoff = 10.99 cfs @ 12.45 hrs, Volume= 1.438 af, Depth= 3.15"

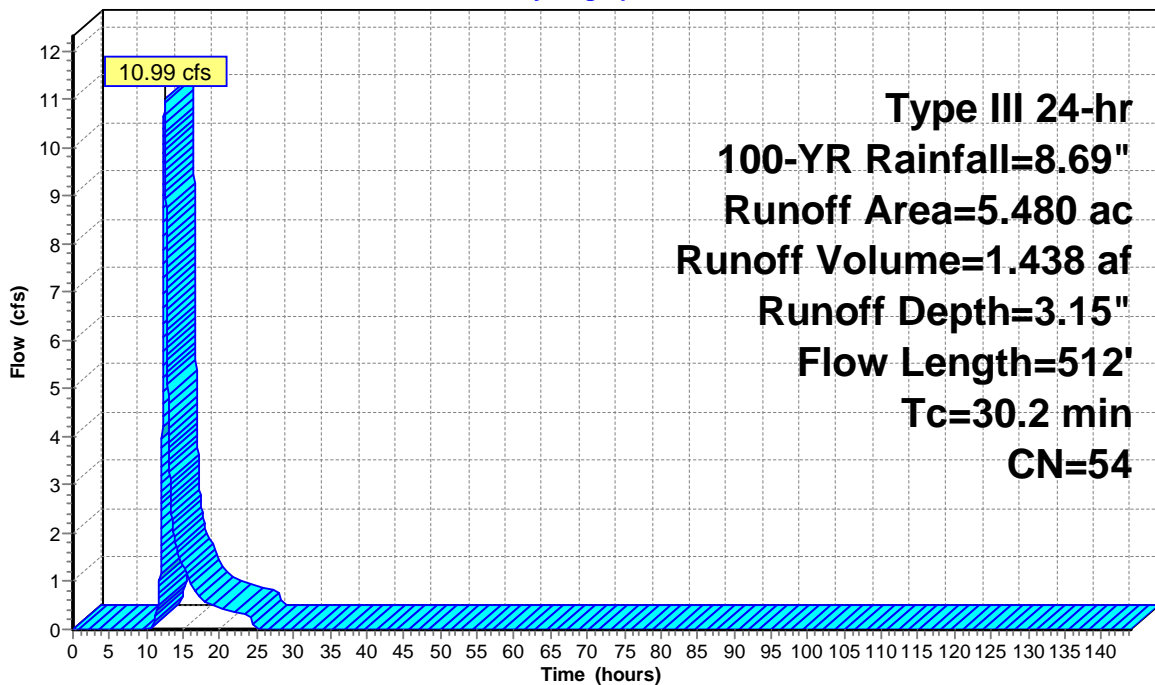
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.230	39	>75% Grass cover, Good, HSG A
2.200	61	>75% Grass cover, Good, HSG B
0.490	80	>75% Grass cover, Good, HSG D
1.190	30	Woods, Good, HSG A
1.370	55	Woods, Good, HSG B
5.480	54	Weighted Average
5.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0340	0.10		<b>Sheet Flow, Sheet Flow thru Wooded Area</b>
					Woods: Light underbrush n= 0.400 P2= 3.31"
13.1	412	0.0110	0.52		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b>
					Woodland Kv= 5.0 fps
30.2	512	Total			

**Subcatchment LOD PERVIOUS: PRE LOD PERVIOUS**

Hydrograph



**Type III 24-hr  
100-YR Rainfall=8.69"  
Runoff Area=5.480 ac  
Runoff Volume=1.438 af  
Runoff Depth=3.15"  
Flow Length=512'  
Tc=30.2 min  
CN=54**

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PRE-DEVELOPMENT LOD AREA  
Type III 24-hr 100-YR Rainfall=8.69"

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Page 15

**Summary for Link PRE LOD: PRE LOD DISCHARGE**

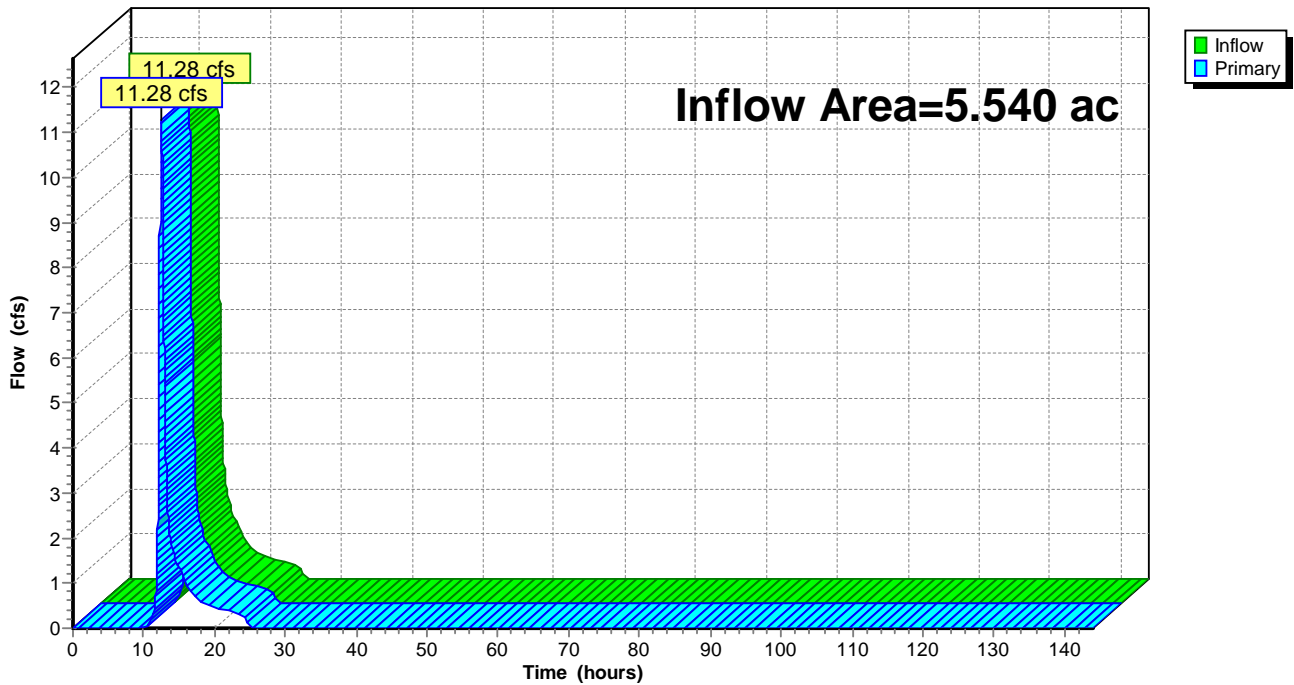
Inflow Area = 5.540 ac, 1.08% Impervious, Inflow Depth = 3.21" for 100-YR event  
Inflow = 11.28 cfs @ 12.45 hrs, Volume= 1.480 af  
Primary = 11.28 cfs @ 12.46 hrs, Volume= 1.480 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link PRE LOD: PRE LOD DISCHARGE**

Hydrograph



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PRE-DEVELOPMENT LOD AREA  
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 16

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment LOD IMPERVIOUS: PRE LOD** Runoff Area=0.060 ac 100.00% Impervious Runoff Depth=1.03"  
Flow Length=512' Tc=30.2 min CN=98 Runoff=0.09 cfs 0.005 af

**Subcatchment LOD PERVIOUS: PRE LOD** Runoff Area=5.480 ac 0.00% Impervious Runoff Depth=0.00"  
Flow Length=512' Tc=30.2 min CN=54 Runoff=0.00 cfs 0.000 af

**Link PRE LOD: PRE LOD DISCHARGE** Inflow=0.09 cfs 0.005 af  
Primary=0.09 cfs 0.005 af

**Total Runoff Area = 5.540 ac Runoff Volume = 0.005 af Average Runoff Depth = 0.01"**  
**98.92% Pervious = 5.480 ac 1.08% Impervious = 0.060 ac**

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PRE-DEVELOPMENT LOD AREA  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 17

**Summary for Subcatchment LOD IMPERVIOUS: PRE LOD IMPERVIOUS**

Runoff = 0.09 cfs @ 1.38 hrs, Volume= 0.005 af, Depth= 1.03"

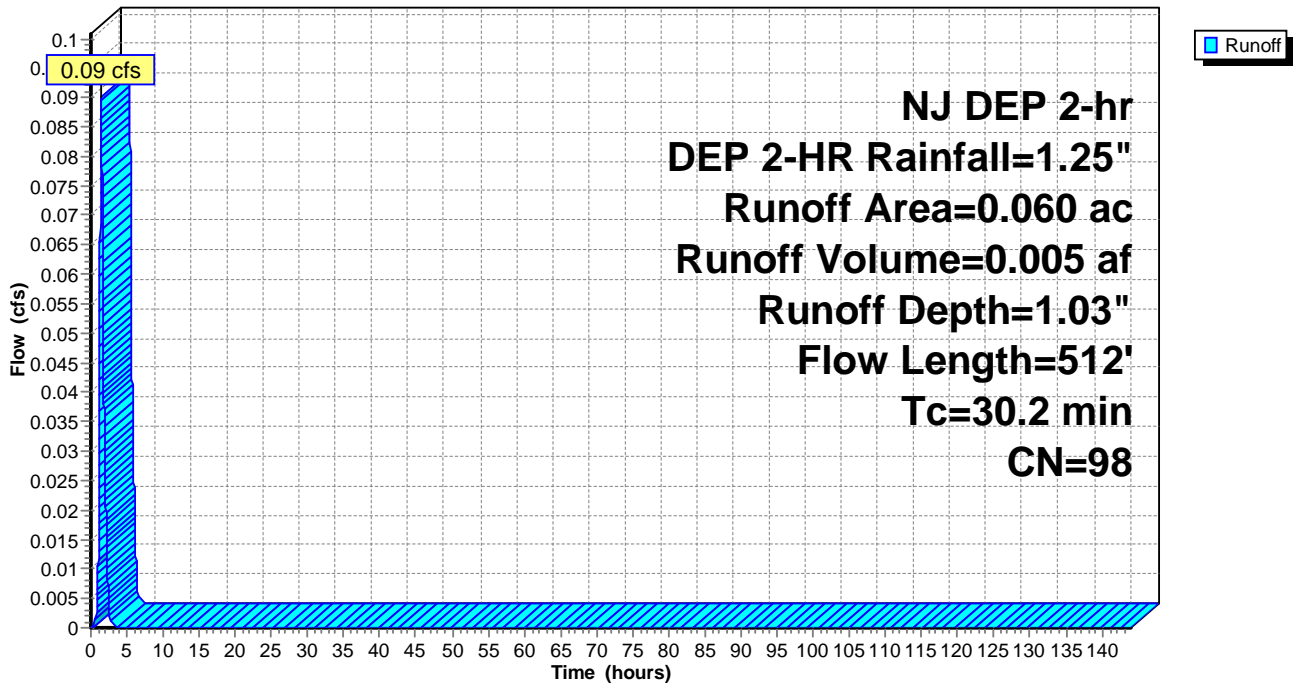
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG B
0.010	98	Paved parking, HSG D
0.010	98	Paved parking, HSG A
0.060	98	Weighted Average
0.060		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0340	0.10		Sheet Flow, Sheet Flow thru Wooded Area
					Woods: Light underbrush n= 0.400 P2= 3.31"
13.1	412	0.0110	0.52		Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood
					Woodland Kv= 5.0 fps
30.2	512	Total			

**Subcatchment LOD IMPERVIOUS: PRE LOD IMPERVIOUS**

Hydrograph



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PRE-DEVELOPMENT LOD AREA  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 18

**Summary for Subcatchment LOD PERVIOUS: PRE LOD PERVIOUS**

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

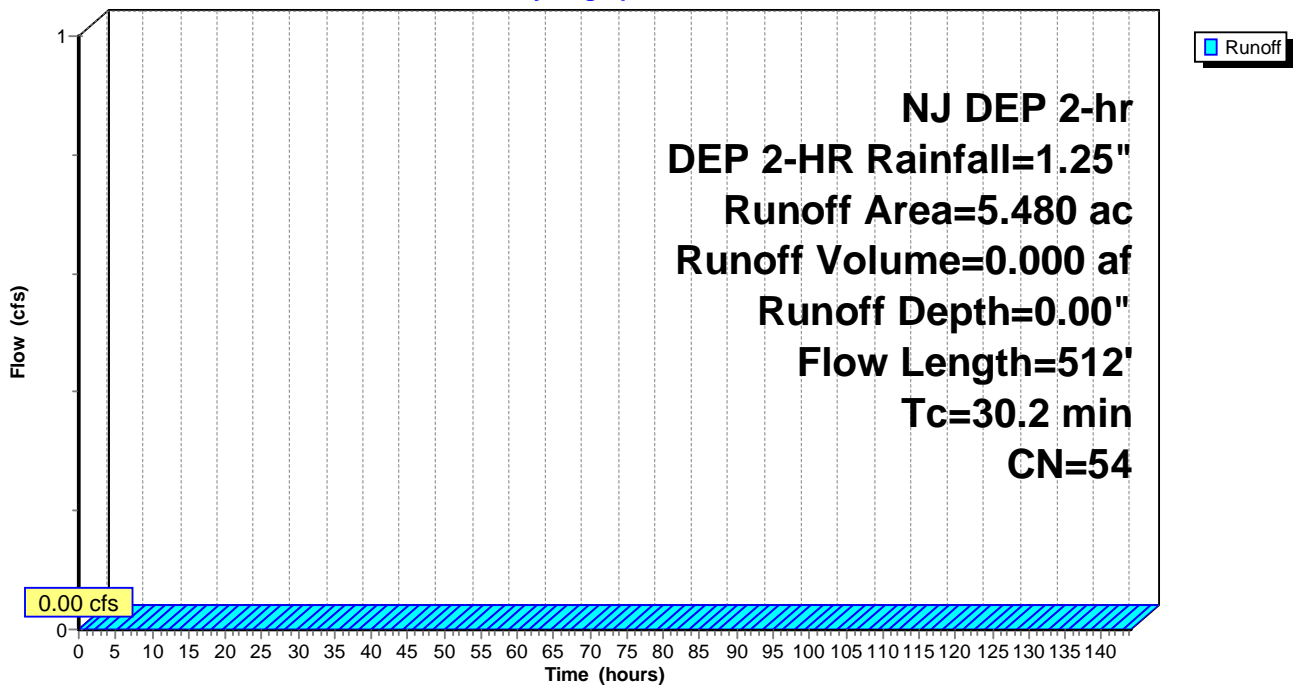
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.230	39	>75% Grass cover, Good, HSG A
2.200	61	>75% Grass cover, Good, HSG B
0.490	80	>75% Grass cover, Good, HSG D
1.190	30	Woods, Good, HSG A
1.370	55	Woods, Good, HSG B
5.480	54	Weighted Average
5.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.0340	0.10		<b>Sheet Flow, Sheet Flow thru Wooded Area</b>
					Woods: Light underbrush n= 0.400 P2= 3.31"
13.1	412	0.0110	0.52		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b>
					Woodland Kv= 5.0 fps
30.2	512	Total			

**Subcatchment LOD PERVIOUS: PRE LOD PERVIOUS**

Hydrograph



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PRE-DEVELOPMENT LOD AREA  
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 19

**Summary for Link PRE LOD: PRE LOD DISCHARGE**

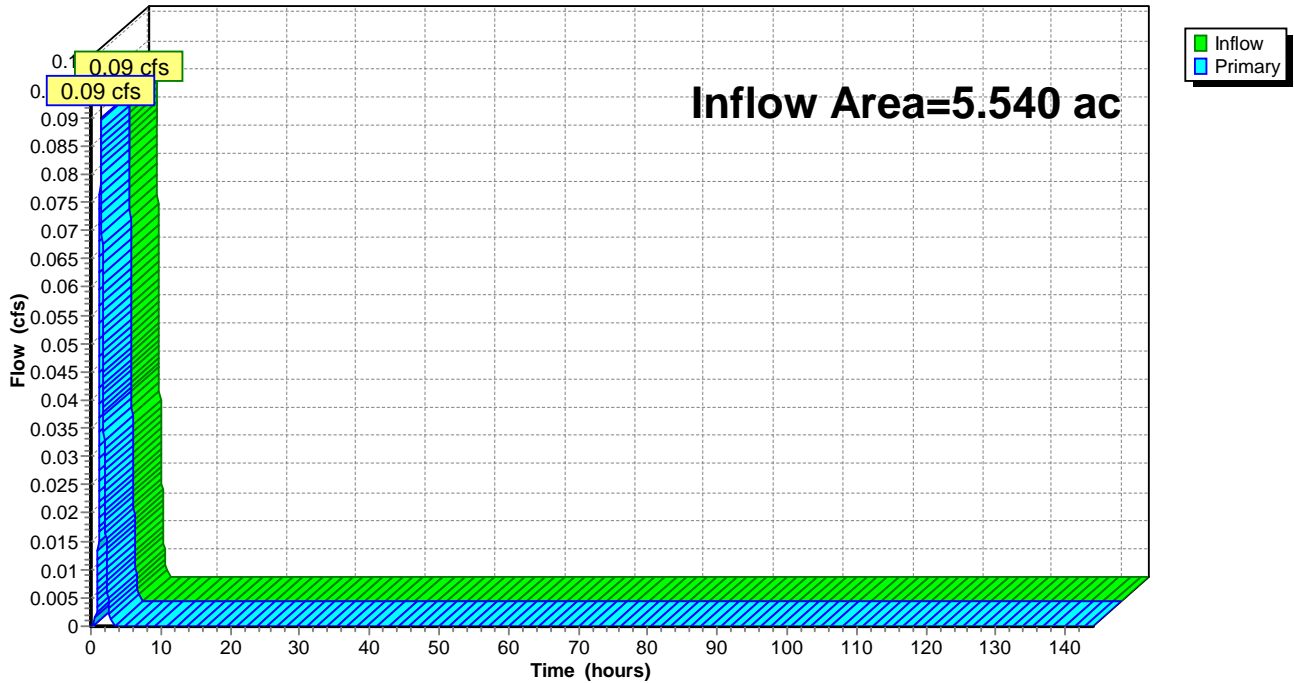
Inflow Area = 5.540 ac, 1.08% Impervious, Inflow Depth = 0.01" for DEP 2-HR event  
Inflow = 0.09 cfs @ 1.38 hrs, Volume= 0.005 af  
Primary = 0.09 cfs @ 1.39 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

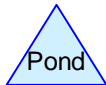
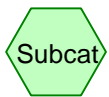
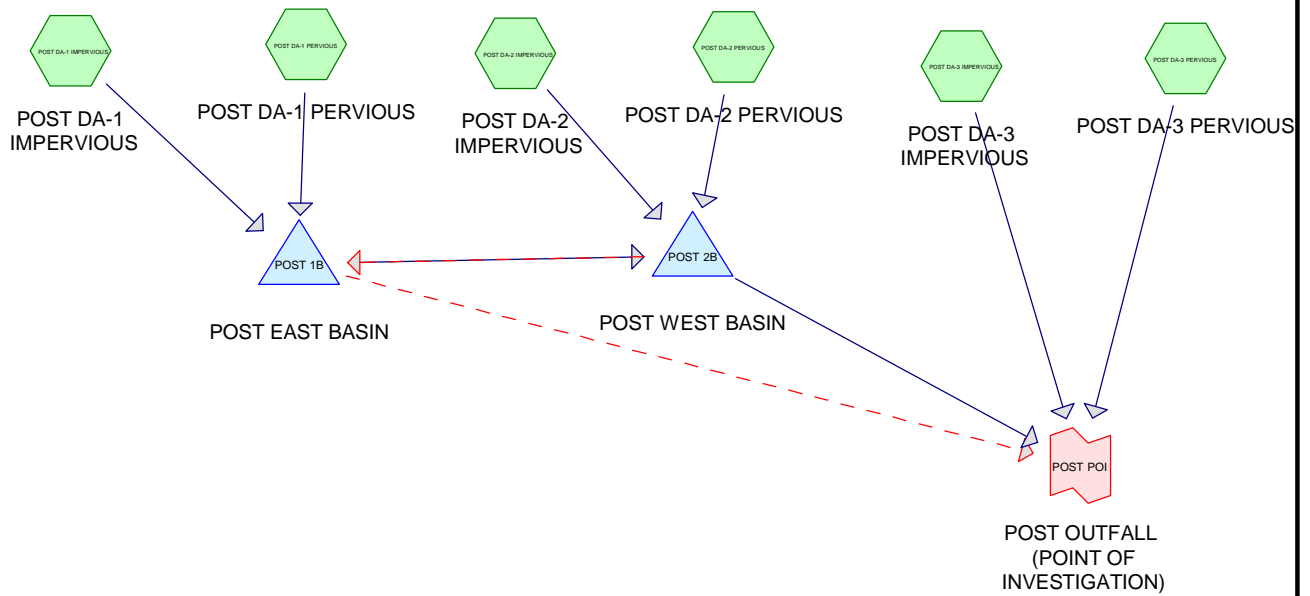
**Link PRE LOD: PRE LOD DISCHARGE**

Hydrograph



# **APPENDIX C - HYDROCAD ANALYSIS – PROPOSED**





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 Page 2

**Area Listing (selected nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
1.510	39	>75% Grass cover, Good, HSG A (POST DA-1 PERVIOUS, POST DA-2 PERVIOUS)
2.240	61	>75% Grass cover, Good, HSG B (POST DA-1 PERVIOUS, POST DA-2 PERVIOUS, POST DA-3 PERVIOUS)
0.900	80	>75% Grass cover, Good, HSG D (POST DA-2 PERVIOUS, POST DA-3 PERVIOUS)
2.680	98	Paved parking, HSG A (POST DA-1 IMPERVIOUS, POST DA-2 IMPERVIOUS)
2.450	98	Paved parking, HSG B (POST DA-1 IMPERVIOUS, POST DA-2 IMPERVIOUS, POST DA-3 IMPERVIOUS)
0.080	98	Paved parking, HSG D (POST DA-2 IMPERVIOUS, POST DA-3 IMPERVIOUS)
6.400	30	Woods, Good, HSG A (POST DA-1 PERVIOUS, POST DA-2 PERVIOUS)
1.620	55	Woods, Good, HSG B (POST DA-1 PERVIOUS, POST DA-2 PERVIOUS)
<b>17.880</b>	<b>59</b>	<b>TOTAL AREA</b>

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**Soil Listing (selected nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
10.590	HSG A	POST DA-1 IMPERVIOUS, POST DA-1 PERVIOUS, POST DA-2 IMPERVIOUS, POST DA-2 PERVIOUS
6.310	HSG B	POST DA-1 IMPERVIOUS, POST DA-1 PERVIOUS, POST DA-2 IMPERVIOUS, POST DA-2 PERVIOUS, POST DA-3 IMPERVIOUS, POST DA-3 PERVIOUS
0.000	HSG C	
0.980	HSG D	POST DA-2 IMPERVIOUS, POST DA-2 PERVIOUS, POST DA-3 IMPERVIOUS, POST DA-3 PERVIOUS
0.000	Other	
<b>17.880</b>		<b>TOTAL AREA</b>

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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

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Page 4

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment POST DA-1 IMPERVIOUS:** Runoff Area=1.010 ac 100.00% Impervious Runoff Depth=3.08"  
Tc=6.0 min CN=98 Runoff=3.25 cfs 0.259 af

**Subcatchment POST DA-1 PERVIOUS: POST** Runoff Area=6.950 ac 0.00% Impervious Runoff Depth=0.01"  
Flow Length=1,440' Tc=60.4 min CN=40 Runoff=0.01 cfs 0.004 af

**Subcatchment POST DA-2 IMPERVIOUS:** Runoff Area=4.120 ac 100.00% Impervious Runoff Depth=3.08"  
Tc=6.0 min CN=98 Runoff=13.25 cfs 1.056 af

**Subcatchment POST DA-2 PERVIOUS: POST** Runoff Area=5.100 ac 0.00% Impervious Runoff Depth=0.04"  
Flow Length=1,097' Tc=24.2 min CN=44 Runoff=0.03 cfs 0.018 af

**Subcatchment POST DA-3 IMPERVIOUS:** Runoff Area=0.080 ac 100.00% Impervious Runoff Depth=3.08"  
Tc=6.0 min CN=98 Runoff=0.26 cfs 0.021 af

**Subcatchment POST DA-3 PERVIOUS: POST** Runoff Area=0.620 ac 0.00% Impervious Runoff Depth=1.05"  
Flow Length=185' Tc=16.9 min CN=73 Runoff=0.52 cfs 0.054 af

**Pond POST 1B: POST EAST BASIN** Peak Elev=138.22' Storage=5,835 cf Inflow=3.25 cfs 0.263 af  
Primary=0.29 cfs 0.260 af Secondary=0.00 cfs 0.000 af Outflow=0.29 cfs 0.260 af

**Pond POST 2B: POST WEST BASIN** Peak Elev=138.07' Storage=48,421 cf Inflow=13.47 cfs 1.335 af  
Primary=0.17 cfs 0.558 af Secondary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.558 af

**Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)** Inflow=0.64 cfs 0.633 af  
Primary=0.64 cfs 0.633 af

**Total Runoff Area = 17.880 ac Runoff Volume = 1.412 af Average Runoff Depth = 0.95"**  
**70.86% Pervious = 12.670 ac 29.14% Impervious = 5.210 ac**

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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

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Page 5

**Summary for Subcatchment POST DA-1 IMPERVIOUS: POST DA-1 IMPERVIOUS**

Runoff = 3.25 cfs @ 12.08 hrs, Volume= 0.259 af, Depth= 3.08"

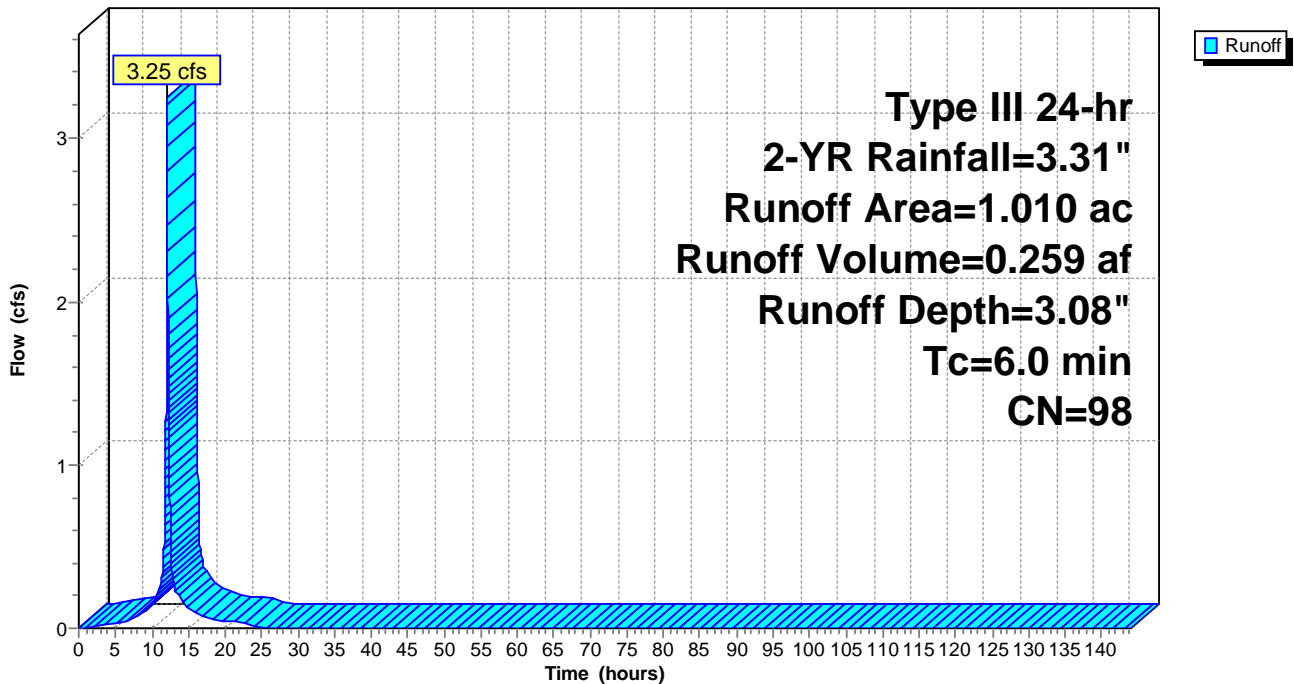
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.670	98	Paved parking, HSG A
0.340	98	Paved parking, HSG B
1.010	98	Weighted Average
1.010		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-1 IMPERVIOUS: POST DA-1 IMPERVIOUS**

Hydrograph



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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

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Page 6

**Summary for Subcatchment POST DA-1 PERVIOUS: POST DA-1 PERVIOUS**

Runoff = 0.01 cfs @ 23.82 hrs, Volume= 0.004 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.610	39	>75% Grass cover, Good, HSG A
0.760	61	>75% Grass cover, Good, HSG B
4.000	30	Woods, Good, HSG A
1.580	55	Woods, Good, HSG B
6.950	40	Weighted Average
6.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2	100	0.0040	0.04		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.8	557	0.0180	0.67		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
6.0	655	0.0080	1.82		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
0.4	128	0.0050	5.09	16.00	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
60.4	1,440	Total			

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POST-DEVELOPMENT CONDITIONS

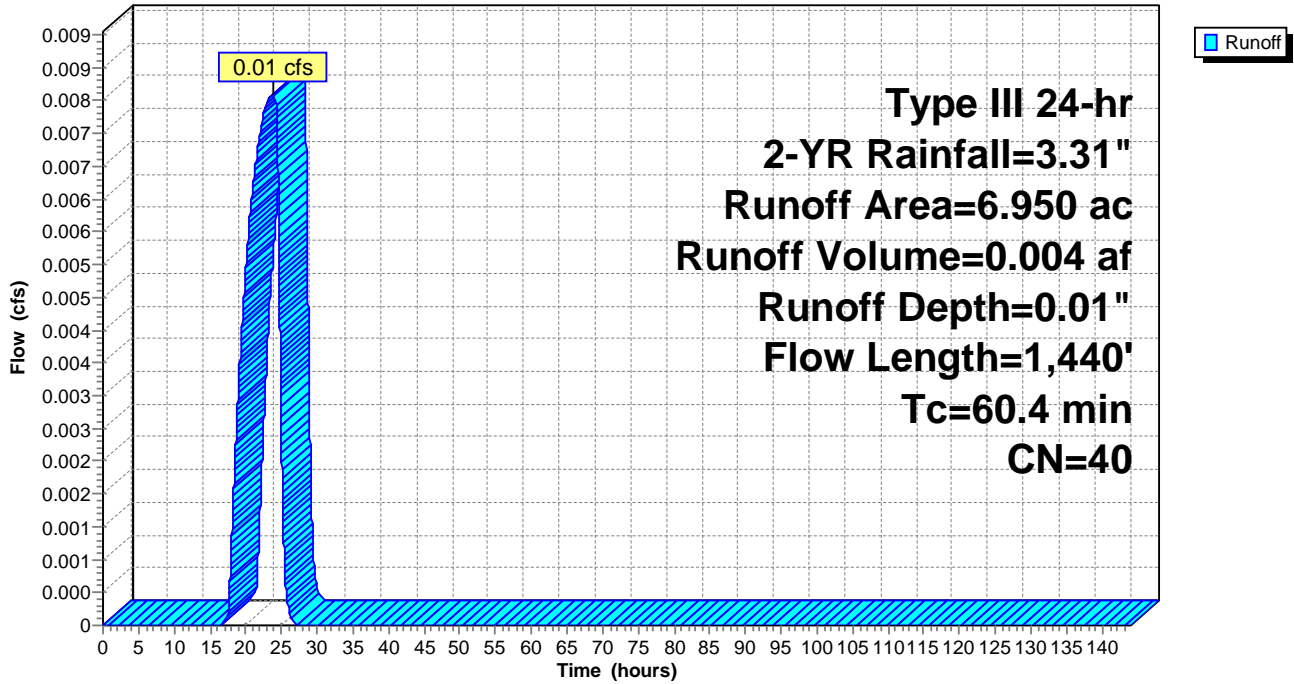
Type III 24-hr 2-YR Rainfall=3.31"

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Page 7

**Subcatchment POST DA-1 PERVIOUS: POST DA-1 PERVIOUS**

Hydrograph



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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

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Page 8

**Summary for Subcatchment POST DA-2 IMPERVIOUS: POST DA-2 IMPERVIOUS**

Runoff = 13.25 cfs @ 12.08 hrs, Volume= 1.056 af, Depth= 3.08"

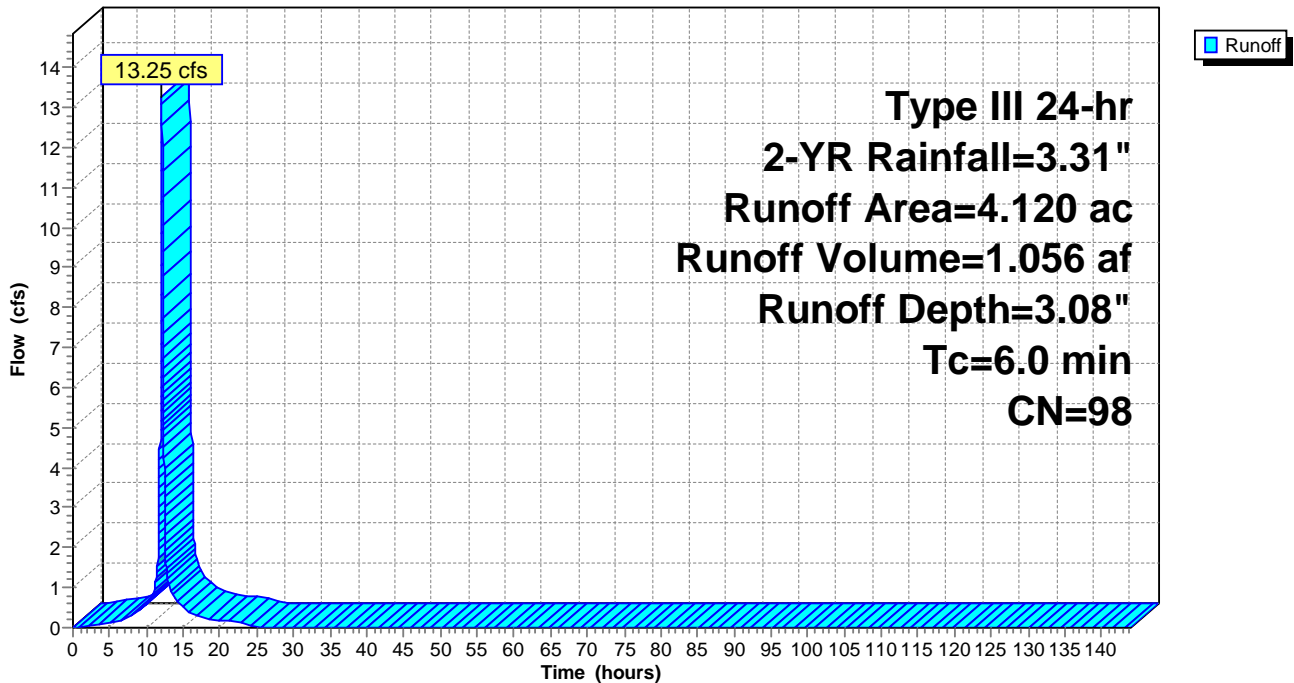
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
2.010	98	Paved parking, HSG A
2.090	98	Paved parking, HSG B
0.020	98	Paved parking, HSG D
4.120	98	Weighted Average
4.120		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-2 IMPERVIOUS: POST DA-2 IMPERVIOUS**

Hydrograph





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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

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Page 9

**Summary for Subcatchment POST DA-2 PERVIOUS: POST DA-2 PERVIOUS**

Runoff = 0.03 cfs @ 15.68 hrs, Volume= 0.018 af, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.900	39	>75% Grass cover, Good, HSG A
1.260	61	>75% Grass cover, Good, HSG B
0.500	80	>75% Grass cover, Good, HSG D
2.400	30	Woods, Good, HSG A
0.040	55	Woods, Good, HSG B
5.100	44	Weighted Average
5.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0850	0.14		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
9.4	310	0.0120	0.55		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
2.0	310	0.0170	2.65		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
1.0	377	0.0080	6.44	20.23	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
24.2	1,097	Total			

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POST-DEVELOPMENT CONDITIONS

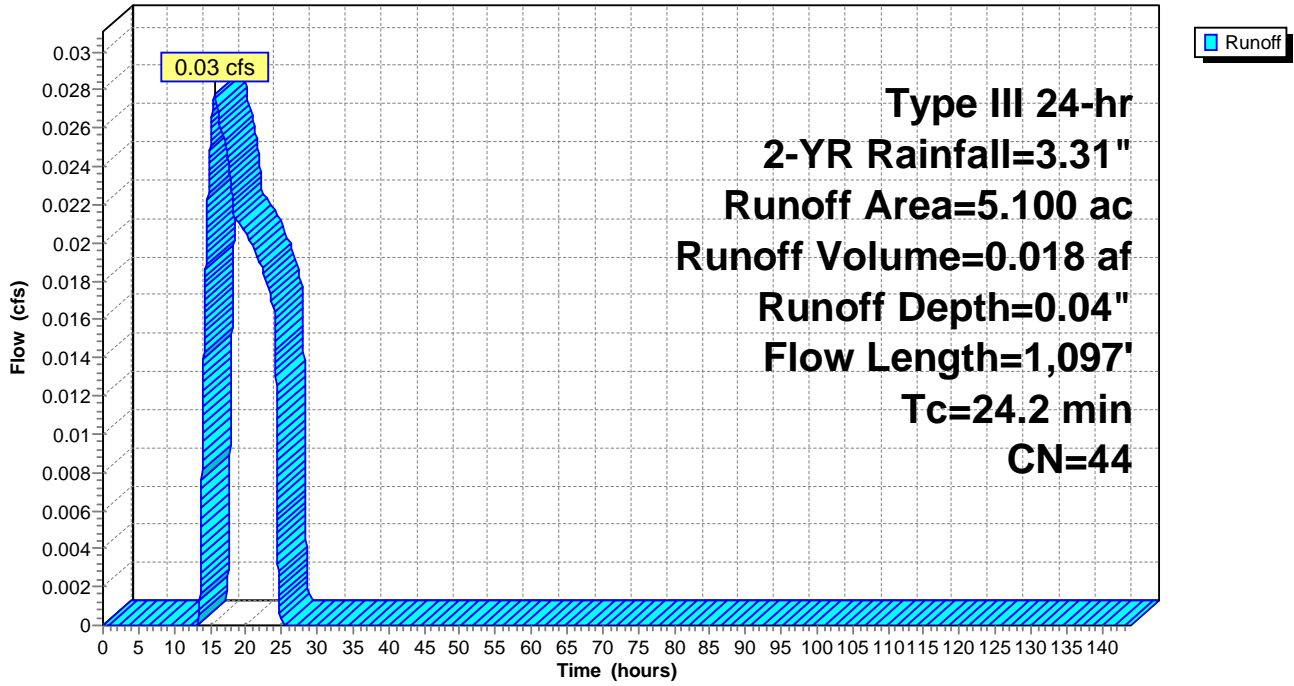
Type III 24-hr 2-YR Rainfall=3.31"

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Page 10

**Subcatchment POST DA-2 PERVIOUS: POST DA-2 PERVIOUS**

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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

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Page 11

**Summary for Subcatchment POST DA-3 IMPERVIOUS: POST DA-3 IMPERVIOUS**

Runoff = 0.26 cfs @ 12.08 hrs, Volume= 0.021 af, Depth= 3.08"

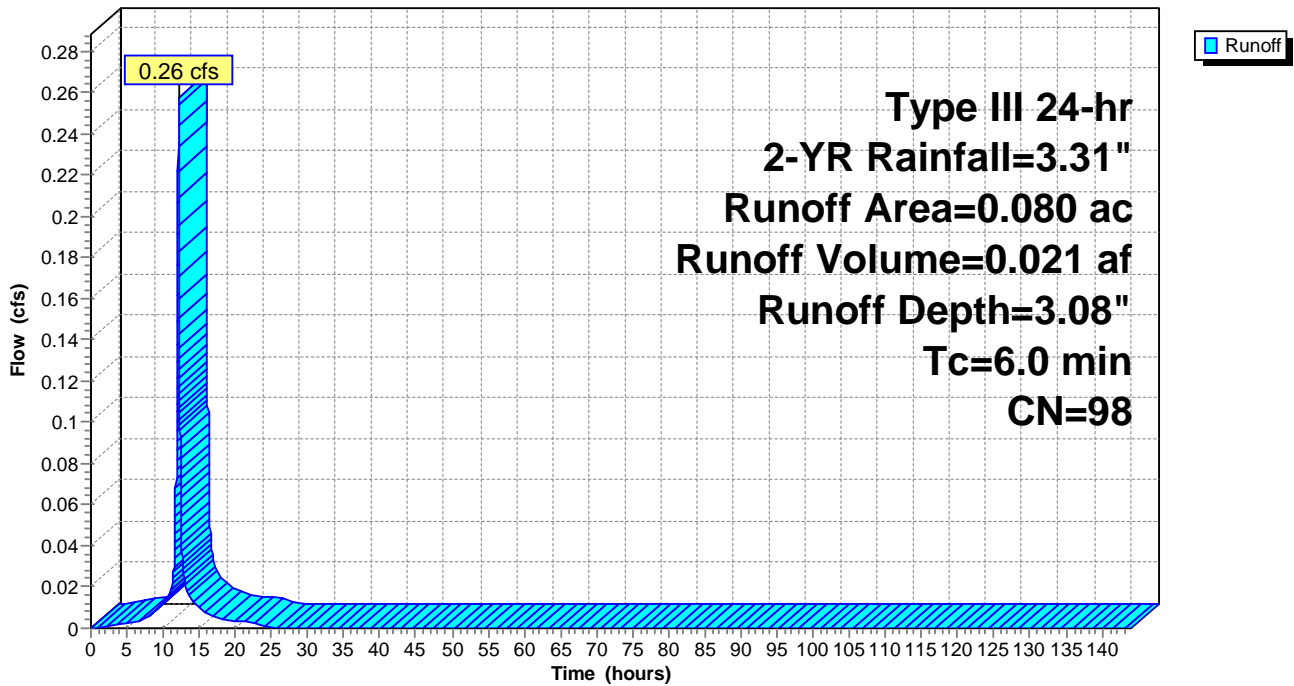
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG B
0.060	98	Paved parking, HSG D
0.080	98	Weighted Average
0.080		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-3 IMPERVIOUS: POST DA-3 IMPERVIOUS**

Hydrograph



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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 2-YR Rainfall=3.31"

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Page 12

**Summary for Subcatchment POST DA-3 PERVIOUS: POST DA-3 PERVIOUS**

Runoff = 0.52 cfs @ 12.26 hrs, Volume= 0.054 af, Depth= 1.05"

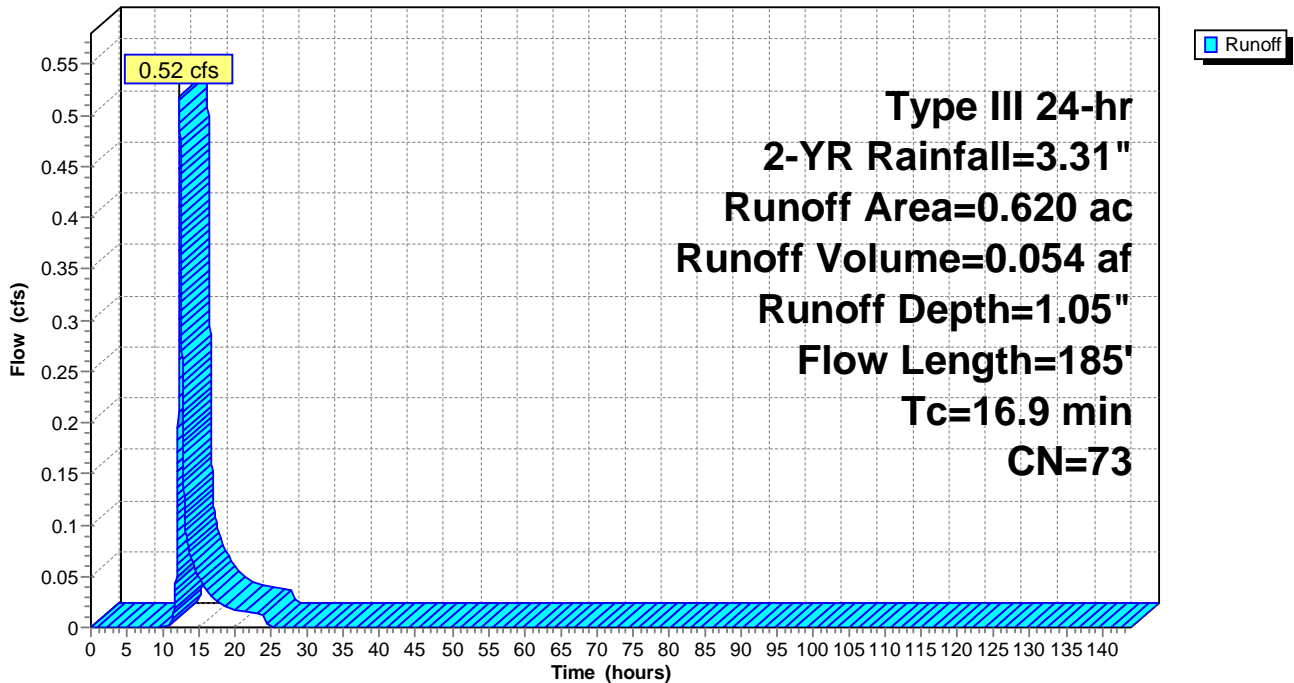
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.31"

Area (ac)	CN	Description
0.220	61	>75% Grass cover, Good, HSG B
0.400	80	>75% Grass cover, Good, HSG D
0.620	73	Weighted Average
0.620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0150	0.11		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.31"
1.2	85	0.0280	1.17		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
16.9	185	Total			

**Subcatchment POST DA-3 PERVIOUS: POST DA-3 PERVIOUS**

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Page 13

**Summary for Pond POST 1B: POST EAST BASIN**

Inflow = 3.25 cfs @ 12.08 hrs, Volume= 0.263 af  
 Outflow = 0.29 cfs @ 12.97 hrs, Volume= 0.260 af, Atten= 91%, Lag= 52.9 min  
 Primary = 0.29 cfs @ 12.97 hrs, Volume= 0.260 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 138.22' @ 12.97 hrs Surf.Area= 12,576 sf Storage= 5,835 cf  
 Flood Elev= 140.88' Surf.Area= 17,579 sf Storage= 44,667 cf

Plug-Flow detention time= 620.8 min calculated for 0.260 af (99% of inflow)  
 Center-of-Mass det. time= 613.6 min ( 1,377.1 - 763.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.46'	55,766 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.46	13	0	0
137.50	200	4	4
138.00	12,293	3,123	3,128
139.00	13,592	12,943	16,070
140.00	14,964	14,278	30,348
141.00	17,936	16,450	46,798
141.50	17,936	8,968	55,766

Device	Routing	Invert	Outlet Devices
#1	Primary	137.46'	<b>24.0" Round RCP_Round 24"</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.46' / 137.09' S= 0.0049 1/ S= 0.0049 1/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.59'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	139.46'	<b>3.0' long x 1.80' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	141.26'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	140.50'	<b>55.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=0.29 cfs @ 12.97 hrs HW=138.22' TW=137.55' (Dynamic Tailwater)

- ↑ 1=RCP\_Round 24" (Passes 0.29 cfs of 2.60 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 0.29 cfs @ 3.27 fps)
- ↑ 3=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)
- ↑ 4=Orifice/Grate ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=137.46' TW=136.31' (Dynamic Tailwater)

- ↑ 5=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

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POST-DEVELOPMENT CONDITIONS

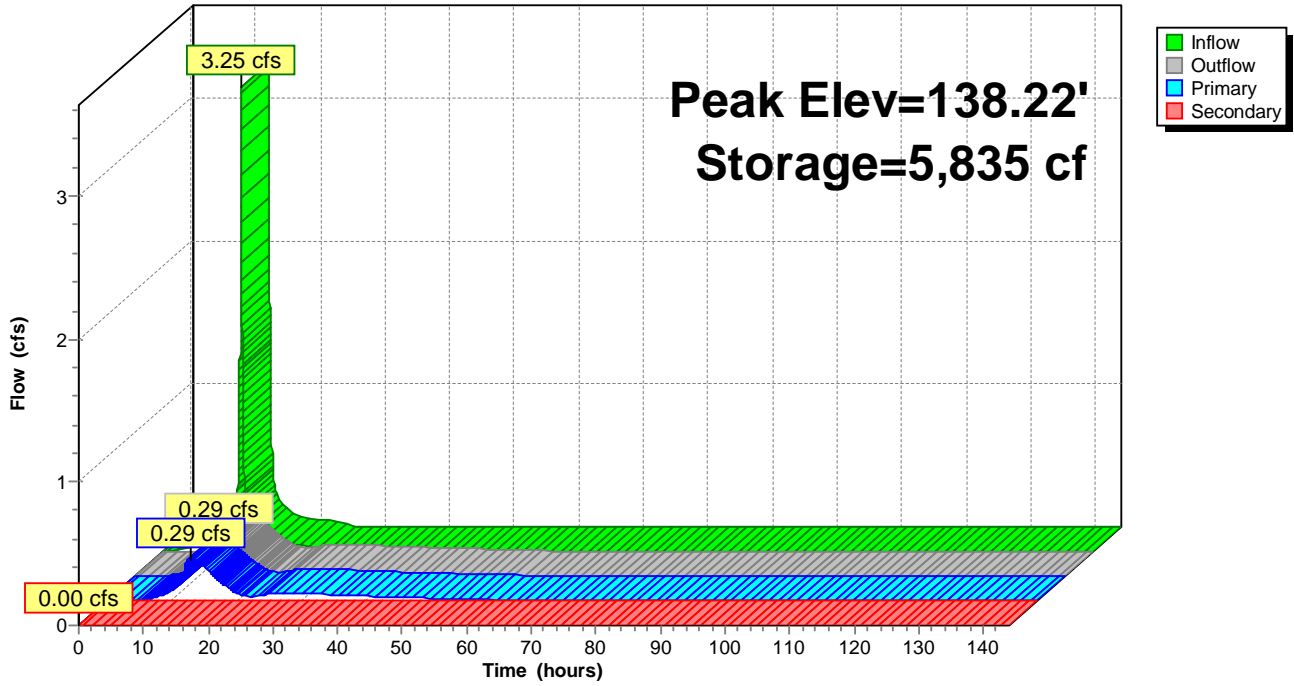
Type III 24-hr 2-YR Rainfall=3.31"

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Page 14

**Pond POST 1B: POST EAST BASIN**

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**Summary for Pond POST 2B: POST WEST BASIN**

Inflow = 13.47 cfs @ 12.08 hrs, Volume= 1.335 af  
 Outflow = 0.17 cfs @ 24.03 hrs, Volume= 0.558 af, Atten= 99%, Lag= 716.5 min  
 Primary = 0.17 cfs @ 24.03 hrs, Volume= 0.558 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 138.07' @ 24.03 hrs Surf.Area= 25,475 sf Storage= 48,421 cf

Plug-Flow detention time= 1,833.8 min calculated for 0.558 af (42% of inflow)  
 Center-of-Mass det. time= 1,580.8 min ( 2,462.6 - 881.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	136.00'	133,466 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
136.00	21,387	0	0
137.00	23,291	22,339	22,339
138.00	25,304	24,298	46,637
139.00	27,739	26,522	73,158
140.00	30,143	28,941	102,099
141.00	32,590	31,367	133,466

Device	Routing	Invert	Outlet Devices
#1	Primary	135.48'	<b>24.0" Round Culvert</b> L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 135.48' / 135.05' S= 0.0287 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.45'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	138.83'	<b>4.0' long x 1.85' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	140.68'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.09' / 137.46' S= -0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

**Primary OutFlow** Max=0.17 cfs @ 24.03 hrs HW=138.07' TW=136.31' (Dynamic Tailwater)

- ↑ 1=Culvert (Passes 0.17 cfs of 22.24 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 0.17 cfs @ 3.39 fps)
- ↑ 3=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)
- ↑ 4=Orifice/Grate ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=136.00' TW=137.46' (Dynamic Tailwater)

- ↑ 5=Culvert ( Controls 0.00 cfs)

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POST-DEVELOPMENT CONDITIONS

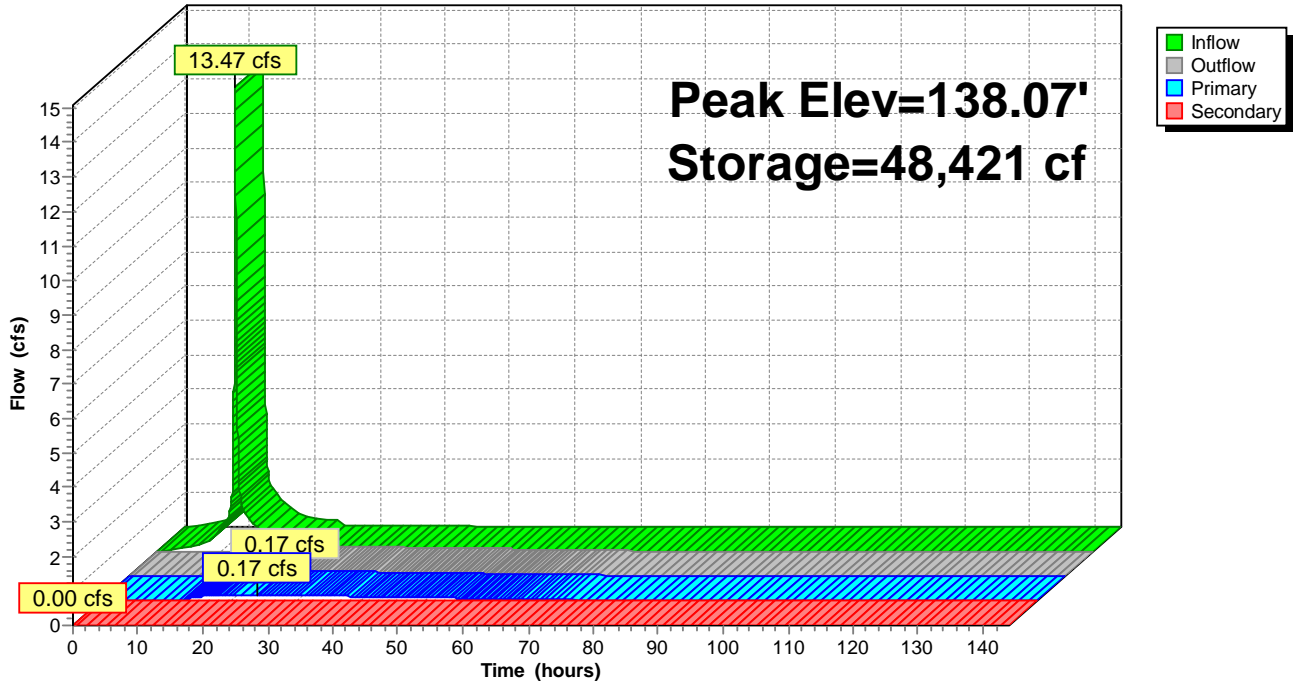
Type III 24-hr 2-YR Rainfall=3.31"

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Page 16

**Pond POST 2B: POST WEST BASIN**

Hydrograph





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Type III 24-hr 2-YR Rainfall=3.31"

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Page 17

**Summary for Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)**

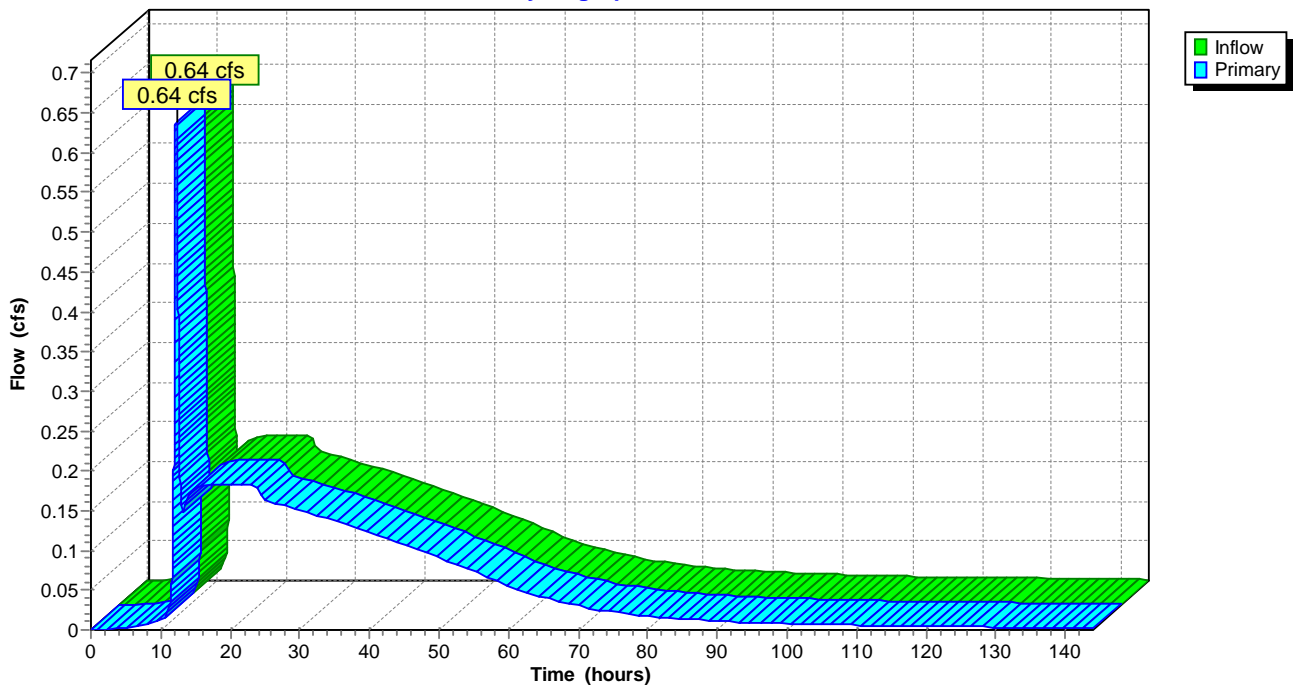
Inflow = 0.64 cfs @ 12.23 hrs, Volume= 0.633 af  
Primary = 0.64 cfs @ 12.24 hrs, Volume= 0.633 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)**

Hydrograph



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Type III 24-hr 10-YR Rainfall=5.11"

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Page 18

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment POST DA-1 IMPERVIOUS:** Runoff Area=1.010 ac 100.00% Impervious Runoff Depth=4.87"  
Tc=6.0 min CN=98 Runoff=5.05 cfs 0.410 af

**Subcatchment POST DA-1 PERVIOUS: POST** Runoff Area=6.950 ac 0.00% Impervious Runoff Depth=0.26"  
Flow Length=1,440' Tc=60.4 min CN=40 Runoff=0.28 cfs 0.151 af

**Subcatchment POST DA-2 IMPERVIOUS:** Runoff Area=4.120 ac 100.00% Impervious Runoff Depth=4.87"  
Tc=6.0 min CN=98 Runoff=20.60 cfs 1.673 af

**Subcatchment POST DA-2 PERVIOUS: POST** Runoff Area=5.100 ac 0.00% Impervious Runoff Depth=0.43"  
Flow Length=1,097' Tc=24.2 min CN=44 Runoff=0.76 cfs 0.183 af

**Subcatchment POST DA-3 IMPERVIOUS:** Runoff Area=0.080 ac 100.00% Impervious Runoff Depth=4.87"  
Tc=6.0 min CN=98 Runoff=0.40 cfs 0.032 af

**Subcatchment POST DA-3 PERVIOUS: POST** Runoff Area=0.620 ac 0.00% Impervious Runoff Depth=2.37"  
Flow Length=185' Tc=16.9 min CN=73 Runoff=1.23 cfs 0.122 af

**Pond POST 1B: POST EAST BASIN** Peak Elev=139.03' Storage=16,466 cf Inflow=5.05 cfs 0.561 af  
Primary=0.31 cfs 0.558 af Secondary=0.00 cfs 0.000 af Outflow=0.31 cfs 0.558 af

**Pond POST 2B: POST WEST BASIN** Peak Elev=138.91' Storage=70,777 cf Inflow=20.89 cfs 2.414 af  
Primary=0.59 cfs 1.623 af Secondary=0.00 cfs 0.000 af Outflow=0.59 cfs 1.623 af

**Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)** Inflow=1.56 cfs 1.778 af  
Primary=1.56 cfs 1.778 af

**Total Runoff Area = 17.880 ac Runoff Volume = 2.571 af Average Runoff Depth = 1.73"**  
**70.86% Pervious = 12.670 ac 29.14% Impervious = 5.210 ac**

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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 19

**Summary for Subcatchment POST DA-1 IMPERVIOUS: POST DA-1 IMPERVIOUS**

Runoff = 5.05 cfs @ 12.08 hrs, Volume= 0.410 af, Depth= 4.87"

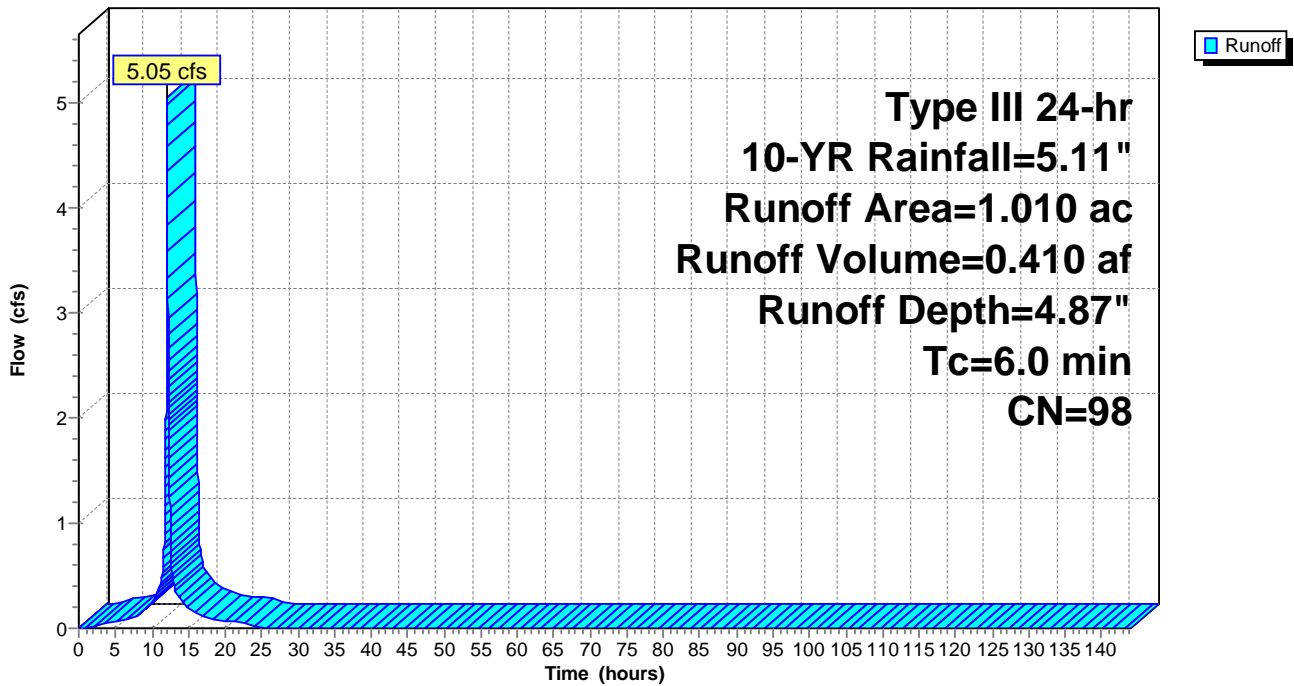
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.670	98	Paved parking, HSG A
0.340	98	Paved parking, HSG B
1.010	98	Weighted Average
1.010		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-1 IMPERVIOUS: POST DA-1 IMPERVIOUS**

Hydrograph



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Type III 24-hr 10-YR Rainfall=5.11"

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Page 20

**Summary for Subcatchment POST DA-1 PERVIOUS: POST DA-1 PERVIOUS**

Runoff = 0.28 cfs @ 13.49 hrs, Volume= 0.151 af, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.610	39	>75% Grass cover, Good, HSG A
0.760	61	>75% Grass cover, Good, HSG B
4.000	30	Woods, Good, HSG A
1.580	55	Woods, Good, HSG B
6.950	40	Weighted Average
6.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2	100	0.0040	0.04		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.8	557	0.0180	0.67		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
6.0	655	0.0080	1.82		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
0.4	128	0.0050	5.09	16.00	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
60.4	1,440	Total			

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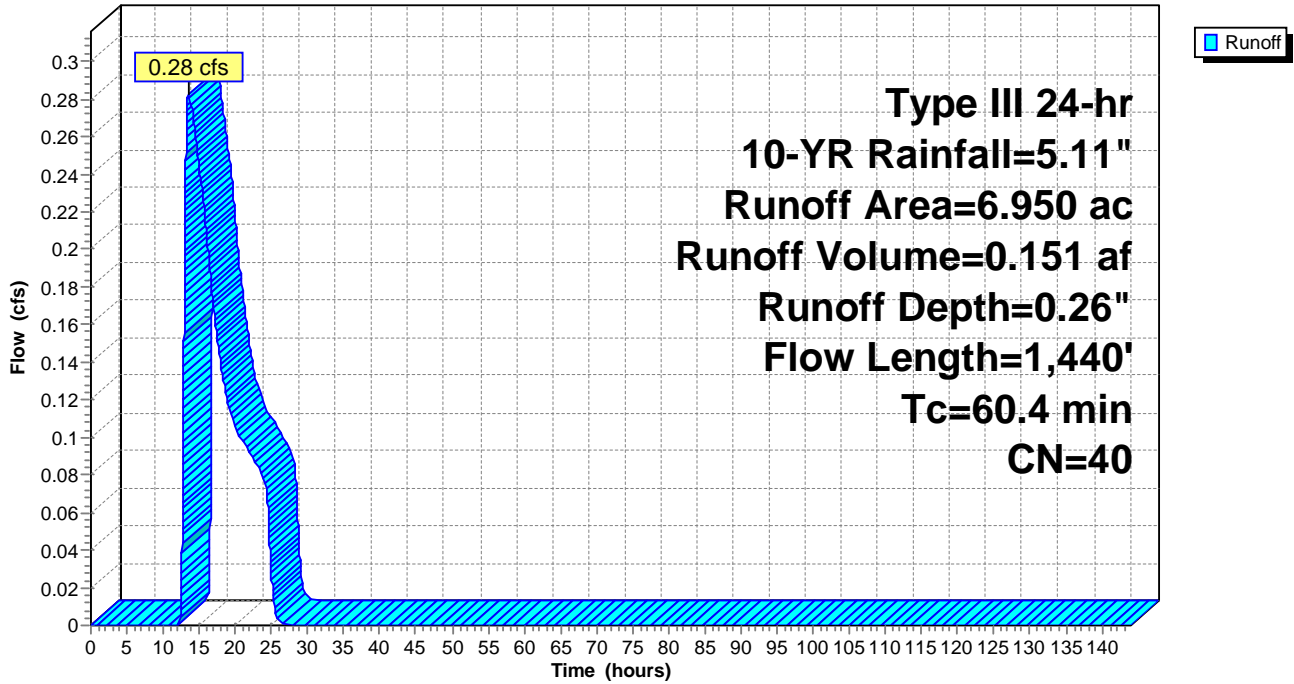
Type III 24-hr 10-YR Rainfall=5.11"

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Page 21

**Subcatchment POST DA-1 PERVIOUS: POST DA-1 PERVIOUS**

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Type III 24-hr 10-YR Rainfall=5.11"

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Page 22

**Summary for Subcatchment POST DA-2 IMPERVIOUS: POST DA-2 IMPERVIOUS**

Runoff = 20.60 cfs @ 12.08 hrs, Volume= 1.673 af, Depth= 4.87"

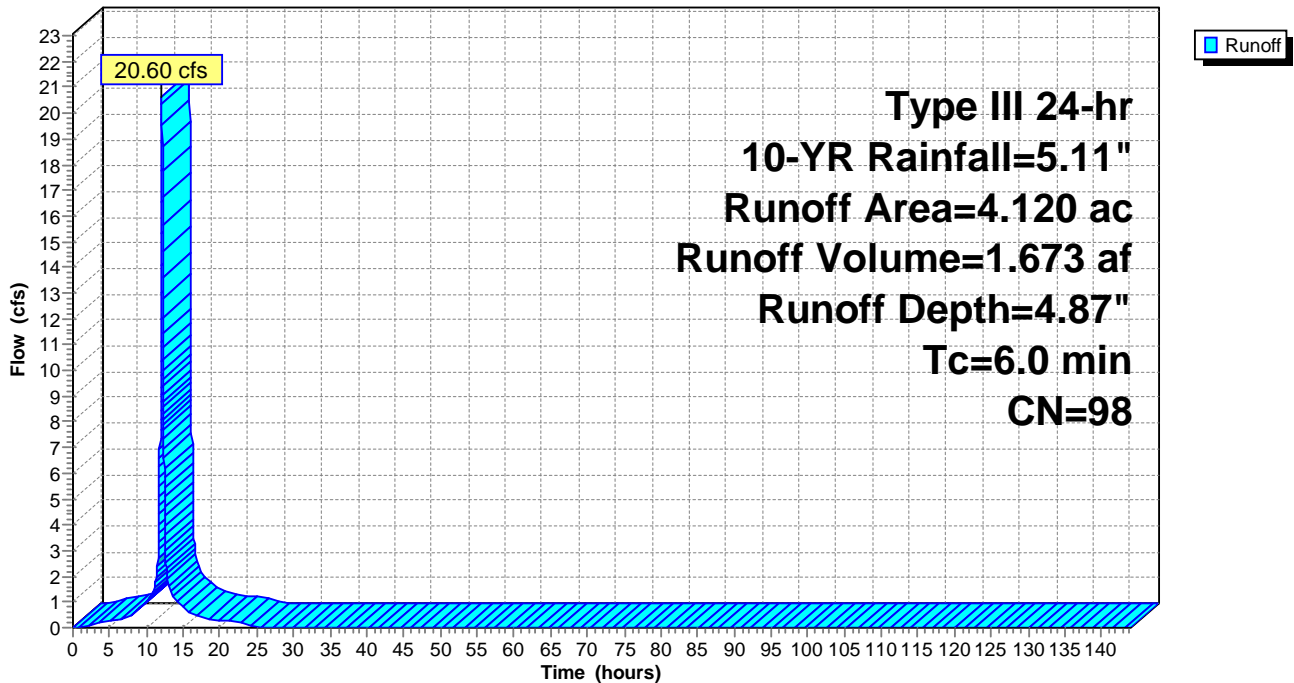
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
2.010	98	Paved parking, HSG A
2.090	98	Paved parking, HSG B
0.020	98	Paved parking, HSG D
4.120	98	Weighted Average
4.120		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-2 IMPERVIOUS: POST DA-2 IMPERVIOUS**

Hydrograph



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Type III 24-hr 10-YR Rainfall=5.11"

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Page 23

**Summary for Subcatchment POST DA-2 PERVIOUS: POST DA-2 PERVIOUS**

Runoff = 0.76 cfs @ 12.59 hrs, Volume= 0.183 af, Depth= 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.900	39	>75% Grass cover, Good, HSG A
1.260	61	>75% Grass cover, Good, HSG B
0.500	80	>75% Grass cover, Good, HSG D
2.400	30	Woods, Good, HSG A
0.040	55	Woods, Good, HSG B
5.100	44	Weighted Average
5.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0850	0.14		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
9.4	310	0.0120	0.55		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
2.0	310	0.0170	2.65		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
1.0	377	0.0080	6.44	20.23	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
24.2	1,097	Total			

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POST-DEVELOPMENT CONDITIONS

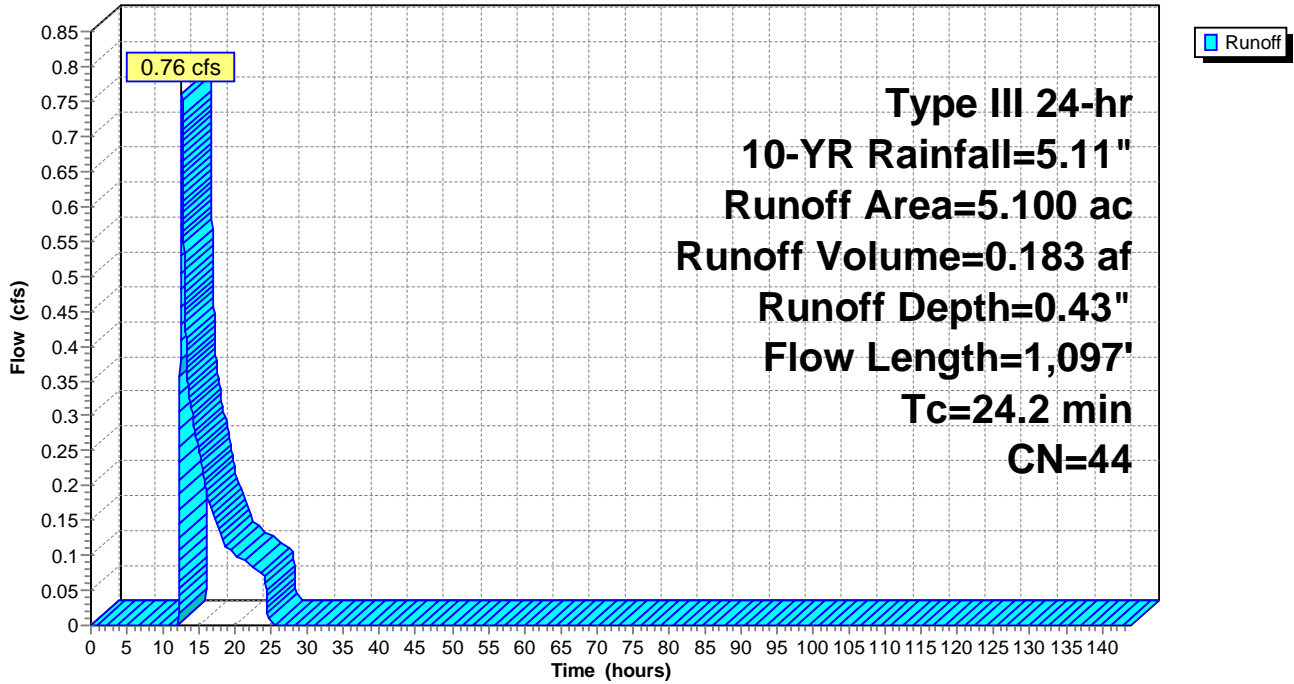
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Page 24

**Subcatchment POST DA-2 PERVIOUS: POST DA-2 PERVIOUS**

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Type III 24-hr 10-YR Rainfall=5.11"

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Page 25

**Summary for Subcatchment POST DA-3 IMPERVIOUS: POST DA-3 IMPERVIOUS**

Runoff = 0.40 cfs @ 12.08 hrs, Volume= 0.032 af, Depth= 4.87"

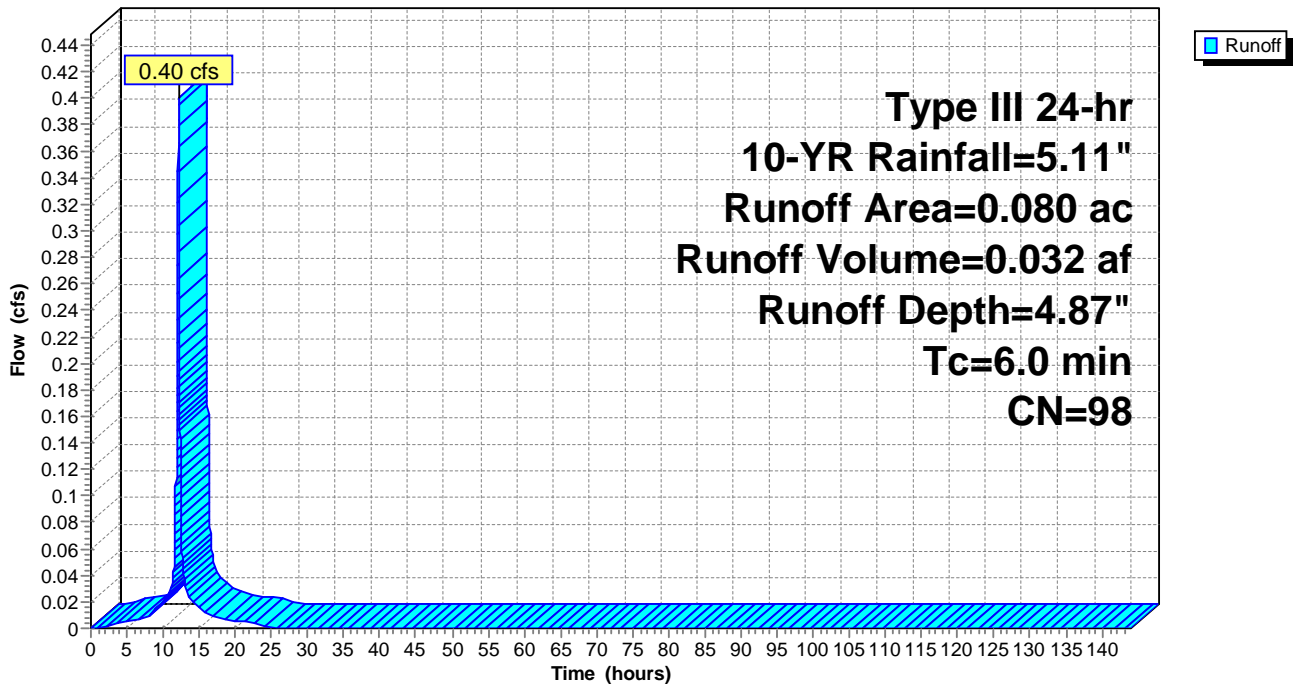
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG B
0.060	98	Paved parking, HSG D
0.080	98	Weighted Average
0.080		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-3 IMPERVIOUS: POST DA-3 IMPERVIOUS**

Hydrograph



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Type III 24-hr 10-YR Rainfall=5.11"

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Page 26

**Summary for Subcatchment POST DA-3 PERVIOUS: POST DA-3 PERVIOUS**

Runoff = 1.23 cfs @ 12.23 hrs, Volume= 0.122 af, Depth= 2.37"

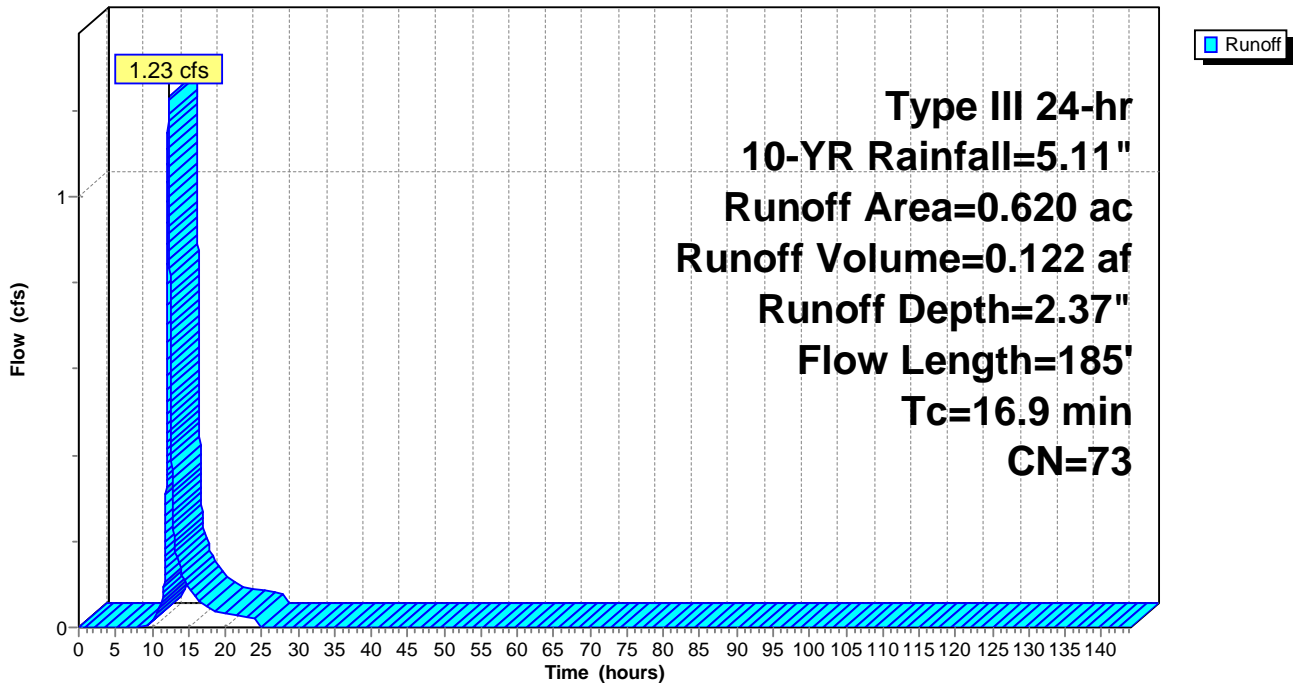
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=5.11"

Area (ac)	CN	Description
0.220	61	>75% Grass cover, Good, HSG B
0.400	80	>75% Grass cover, Good, HSG D
0.620	73	Weighted Average
0.620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0150	0.11		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.31"
1.2	85	0.0280	1.17		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
16.9	185	Total			

**Subcatchment POST DA-3 PERVIOUS: POST DA-3 PERVIOUS**

Hydrograph



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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 27

**Summary for Pond POST 1B: POST EAST BASIN**

Inflow = 5.05 cfs @ 12.08 hrs, Volume= 0.561 af  
 Outflow = 0.31 cfs @ 12.15 hrs, Volume= 0.558 af, Atten= 94%, Lag= 4.1 min  
 Primary = 0.31 cfs @ 12.15 hrs, Volume= 0.558 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 139.03' @ 21.77 hrs Surf.Area= 13,632 sf Storage= 16,466 cf  
 Flood Elev= 140.88' Surf.Area= 17,579 sf Storage= 44,667 cf

Plug-Flow detention time= 1,573.3 min calculated for 0.558 af (99% of inflow)  
 Center-of-Mass det. time= 1,569.5 min ( 2,395.8 - 826.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.46'	55,766 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.46	13	0	0
137.50	200	4	4
138.00	12,293	3,123	3,128
139.00	13,592	12,943	16,070
140.00	14,964	14,278	30,348
141.00	17,936	16,450	46,798
141.50	17,936	8,968	55,766

Device	Routing	Invert	Outlet Devices
#1	Primary	137.46'	<b>24.0" Round RCP_Round 24"</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.46' / 137.09' S= 0.0049 1/ S= 0.0049 1/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.59'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	139.46'	<b>3.0' long x 1.80' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	141.26'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	140.50'	<b>55.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=0.31 cfs @ 12.15 hrs HW=138.30' TW=137.78' (Dynamic Tailwater)  
 ↑ **1=RCP\_Round 24"** (Passes 0.31 cfs of 3.04 cfs potential flow)  
 ↑ **2=Orifice/Grate** (Orifice Controls 0.31 cfs @ 3.50 fps)  
 ↑ **3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)  
 ↑ **4=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=137.46' TW=136.31' (Dynamic Tailwater)  
 ↑ **5=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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POST-DEVELOPMENT CONDITIONS

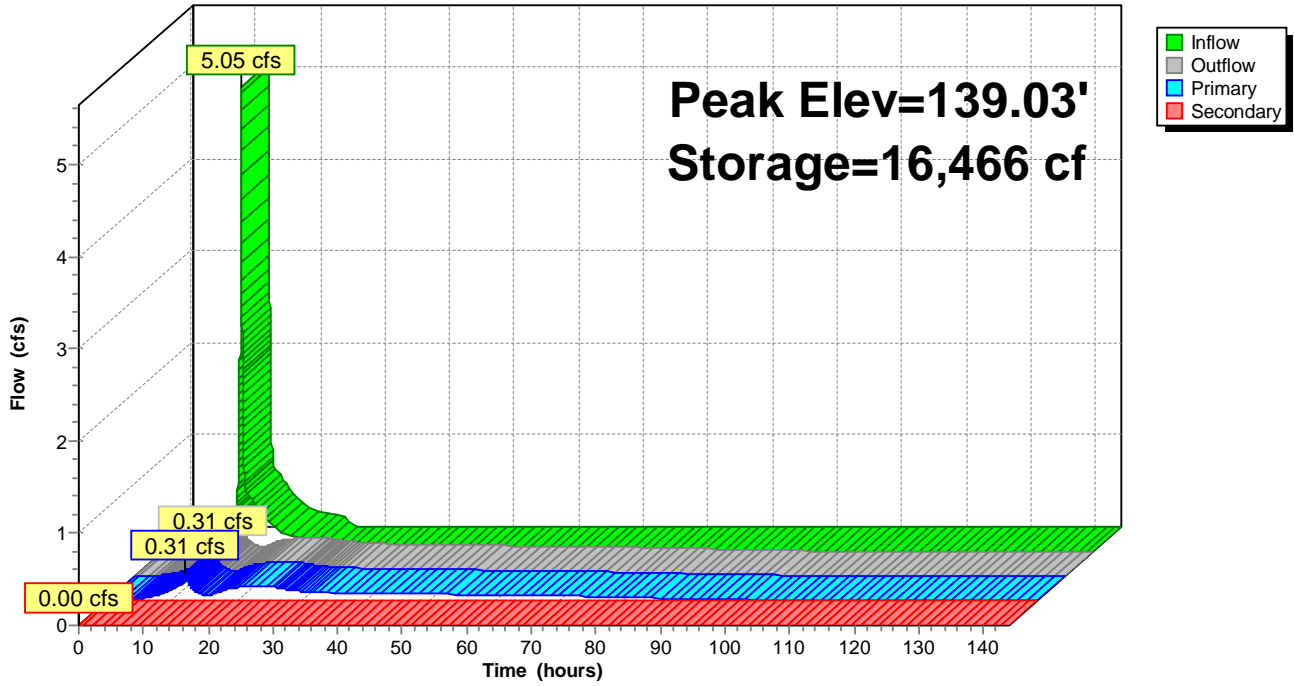
Type III 24-hr 10-YR Rainfall=5.11"

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Page 28

**Pond POST 1B: POST EAST BASIN**

Hydrograph



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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 10-YR Rainfall=5.11"

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Page 29

**Summary for Pond POST 2B: POST WEST BASIN**

Inflow = 20.89 cfs @ 12.08 hrs, Volume= 2.414 af  
 Outflow = 0.59 cfs @ 18.01 hrs, Volume= 1.623 af, Atten= 97%, Lag= 355.5 min  
 Primary = 0.59 cfs @ 18.01 hrs, Volume= 1.623 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 138.91' @ 18.01 hrs Surf.Area= 27,529 sf Storage= 70,777 cf

Plug-Flow detention time= 2,199.5 min calculated for 1.623 af (67% of inflow)  
 Center-of-Mass det. time= 1,745.7 min ( 2,890.7 - 1,145.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	136.00'	133,466 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
136.00	21,387	0	0
137.00	23,291	22,339	22,339
138.00	25,304	24,298	46,637
139.00	27,739	26,522	73,158
140.00	30,143	28,941	102,099
141.00	32,590	31,367	133,466

Device	Routing	Invert	Outlet Devices
#1	Primary	135.48'	<b>24.0" Round Culvert</b> L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 135.48' / 135.05' S= 0.0287 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.45'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	138.83'	<b>4.0' long x 1.85' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	140.68'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.09' / 137.46' S= -0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

**Primary OutFlow** Max=0.59 cfs @ 18.01 hrs HW=138.91' TW=136.31' (Dynamic Tailwater)

↑ **1=Culvert** (Passes 0.59 cfs of 29.23 cfs potential flow)  
 ↑ **2=Orifice/Grate** (Orifice Controls 0.27 cfs @ 5.57 fps)  
 ↑ **3=Sharp-Crested Rectangular Weir** (Weir Controls 0.32 cfs @ 0.95 fps)  
 ↑ **4=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=136.00' TW=137.46' (Dynamic Tailwater)

↑ **5=Culvert** ( Controls 0.00 cfs)

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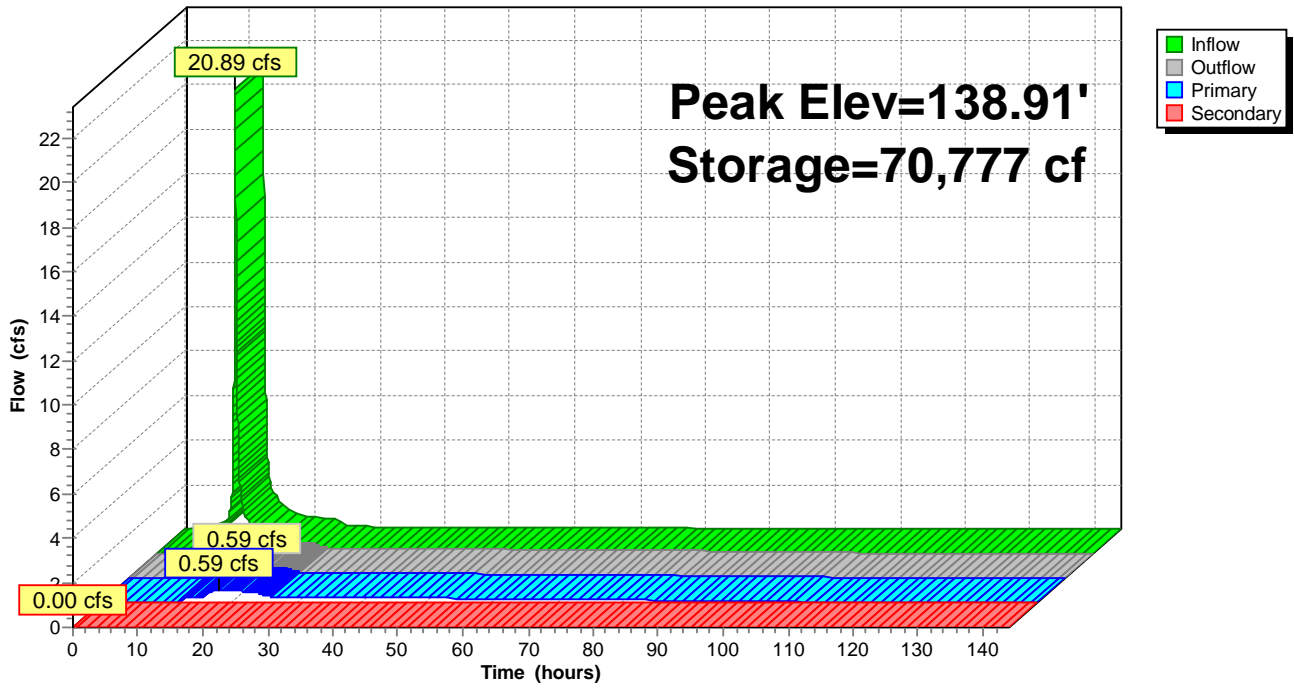
Type III 24-hr 10-YR Rainfall=5.11"

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Page 30

**Pond POST 2B: POST WEST BASIN**

Hydrograph



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Page 31

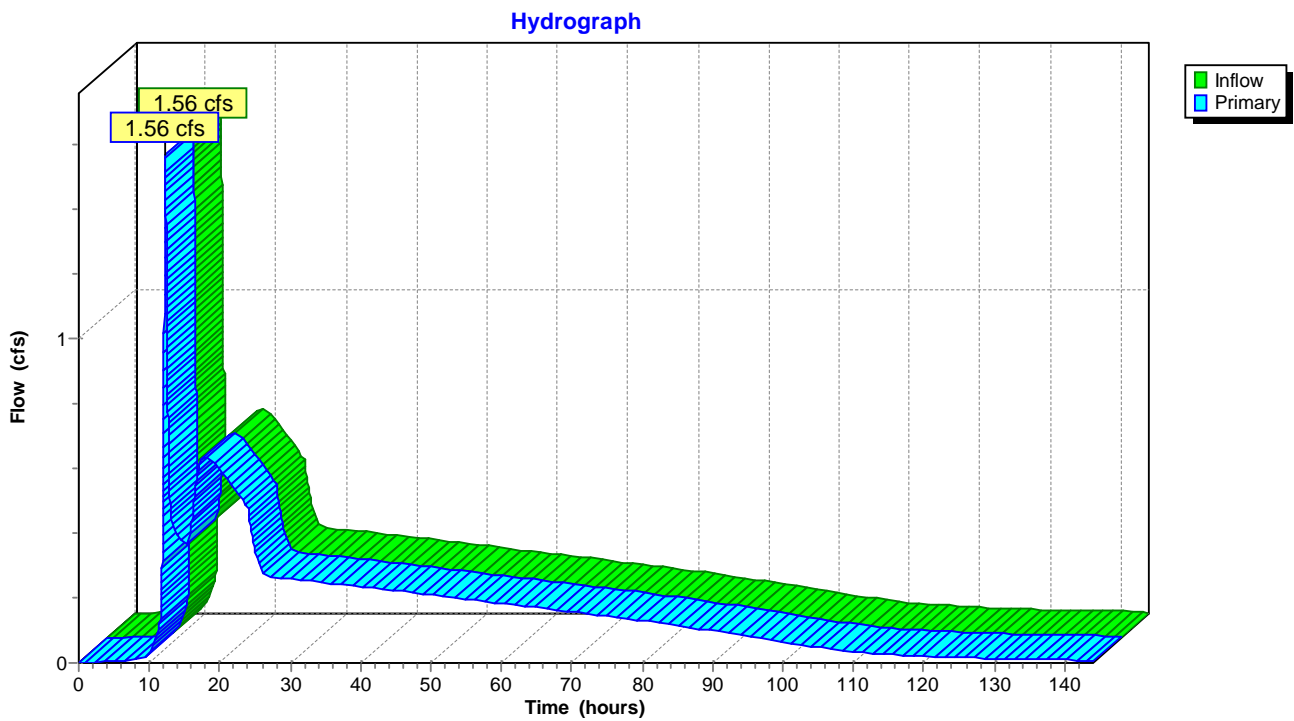
**Summary for Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)**

Inflow = 1.56 cfs @ 12.23 hrs, Volume= 1.778 af  
Primary = 1.56 cfs @ 12.24 hrs, Volume= 1.778 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)**



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Type III 24-hr 100-YR Rainfall=8.69"

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Page 32

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment POST DA-1 IMPERVIOUS:** Runoff Area=1.010 ac 100.00% Impervious Runoff Depth=8.45"  
Tc=6.0 min CN=98 Runoff=8.62 cfs 0.711 af

**Subcatchment POST DA-1 PERVIOUS: POST** Runoff Area=6.950 ac 0.00% Impervious Runoff Depth=1.56"  
Flow Length=1,440' Tc=60.4 min CN=40 Runoff=3.89 cfs 0.906 af

**Subcatchment POST DA-2 IMPERVIOUS:** Runoff Area=4.120 ac 100.00% Impervious Runoff Depth=8.45"  
Tc=6.0 min CN=98 Runoff=35.16 cfs 2.901 af

**Subcatchment POST DA-2 PERVIOUS: POST** Runoff Area=5.100 ac 0.00% Impervious Runoff Depth=2.00"  
Flow Length=1,097' Tc=24.2 min CN=44 Runoff=6.39 cfs 0.850 af

**Subcatchment POST DA-3 IMPERVIOUS:** Runoff Area=0.080 ac 100.00% Impervious Runoff Depth=8.45"  
Tc=6.0 min CN=98 Runoff=0.68 cfs 0.056 af

**Subcatchment POST DA-3 PERVIOUS: POST** Runoff Area=0.620 ac 0.00% Impervious Runoff Depth=5.43"  
Flow Length=185' Tc=16.9 min CN=73 Runoff=2.85 cfs 0.280 af

**Pond POST 1B: POST EAST BASIN** Peak Elev=139.95' Storage=29,600 cf Inflow=12.28 cfs 1.734 af  
Primary=3.49 cfs 1.731 af Secondary=0.00 cfs 0.000 af Outflow=3.49 cfs 1.731 af

**Pond POST 2B: POST WEST BASIN** Peak Elev=139.57' Storage=89,223 cf Inflow=36.84 cfs 5.482 af  
Primary=8.28 cfs 4.571 af Secondary=4.97 cfs 0.117 af Outflow=8.28 cfs 4.688 af

**Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)** Inflow=9.16 cfs 4.907 af  
Primary=9.16 cfs 4.907 af

**Total Runoff Area = 17.880 ac Runoff Volume = 5.706 af Average Runoff Depth = 3.83"**  
**70.86% Pervious = 12.670 ac 29.14% Impervious = 5.210 ac**



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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 100-YR Rainfall=8.69"

Printed 11/30/2020

Page 33

**Summary for Subcatchment POST DA-1 IMPERVIOUS: POST DA-1 IMPERVIOUS**

Runoff = 8.62 cfs @ 12.08 hrs, Volume= 0.711 af, Depth= 8.45"

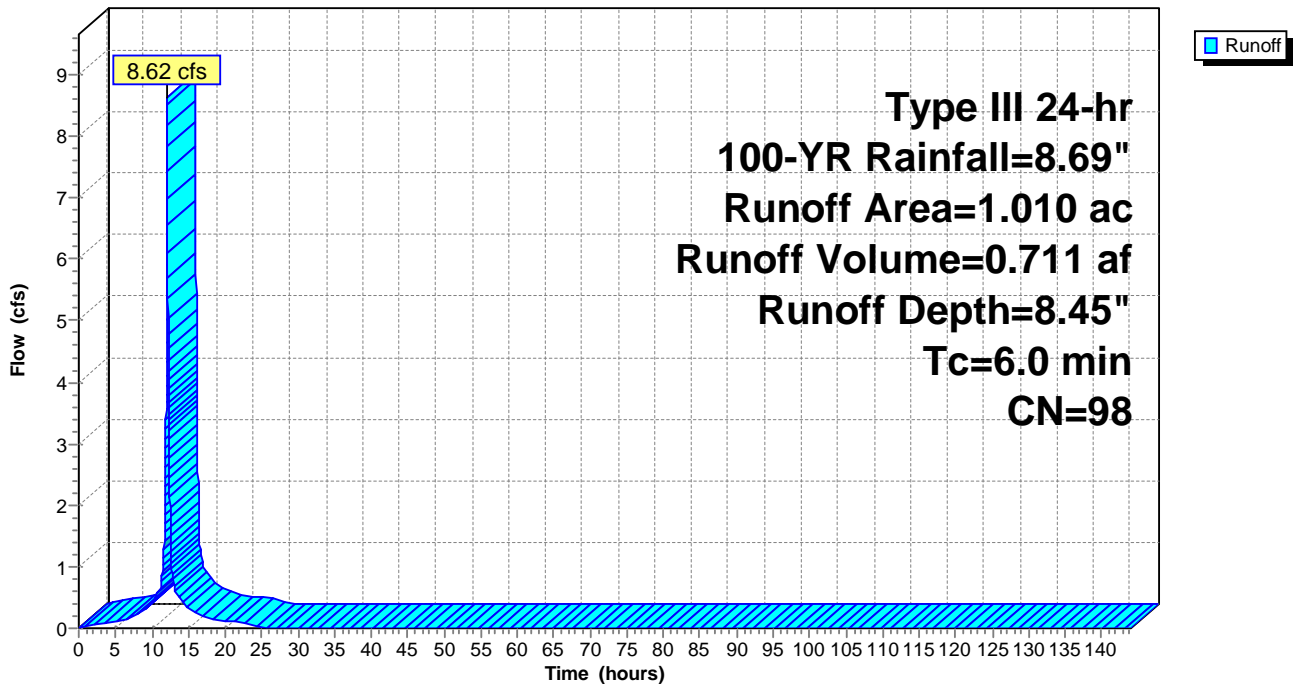
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.670	98	Paved parking, HSG A
0.340	98	Paved parking, HSG B
1.010	98	Weighted Average
1.010		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-1 IMPERVIOUS: POST DA-1 IMPERVIOUS**

Hydrograph



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Type III 24-hr 100-YR Rainfall=8.69"

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Page 34

**Summary for Subcatchment POST DA-1 PERVIOUS: POST DA-1 PERVIOUS**

Runoff = 3.89 cfs @ 12.95 hrs, Volume= 0.906 af, Depth= 1.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.610	39	>75% Grass cover, Good, HSG A
0.760	61	>75% Grass cover, Good, HSG B
4.000	30	Woods, Good, HSG A
1.580	55	Woods, Good, HSG B
6.950	40	Weighted Average
6.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2	100	0.0040	0.04		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.8	557	0.0180	0.67		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
6.0	655	0.0080	1.82		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
0.4	128	0.0050	5.09	16.00	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
60.4	1,440	Total			

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POST-DEVELOPMENT CONDITIONS

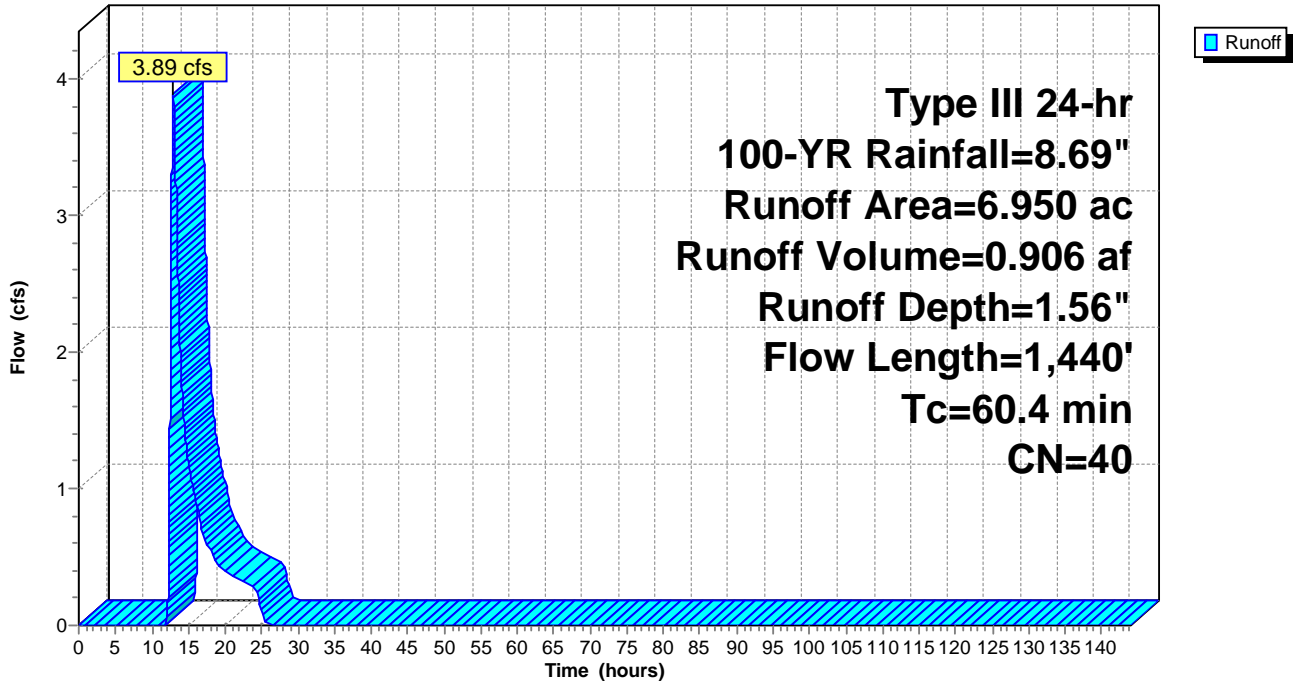
Type III 24-hr 100-YR Rainfall=8.69"

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Page 35

**Subcatchment POST DA-1 PERVIOUS: POST DA-1 PERVIOUS**

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Type III 24-hr 100-YR Rainfall=8.69"

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Page 36

**Summary for Subcatchment POST DA-2 IMPERVIOUS: POST DA-2 IMPERVIOUS**

Runoff = 35.16 cfs @ 12.08 hrs, Volume= 2.901 af, Depth= 8.45"

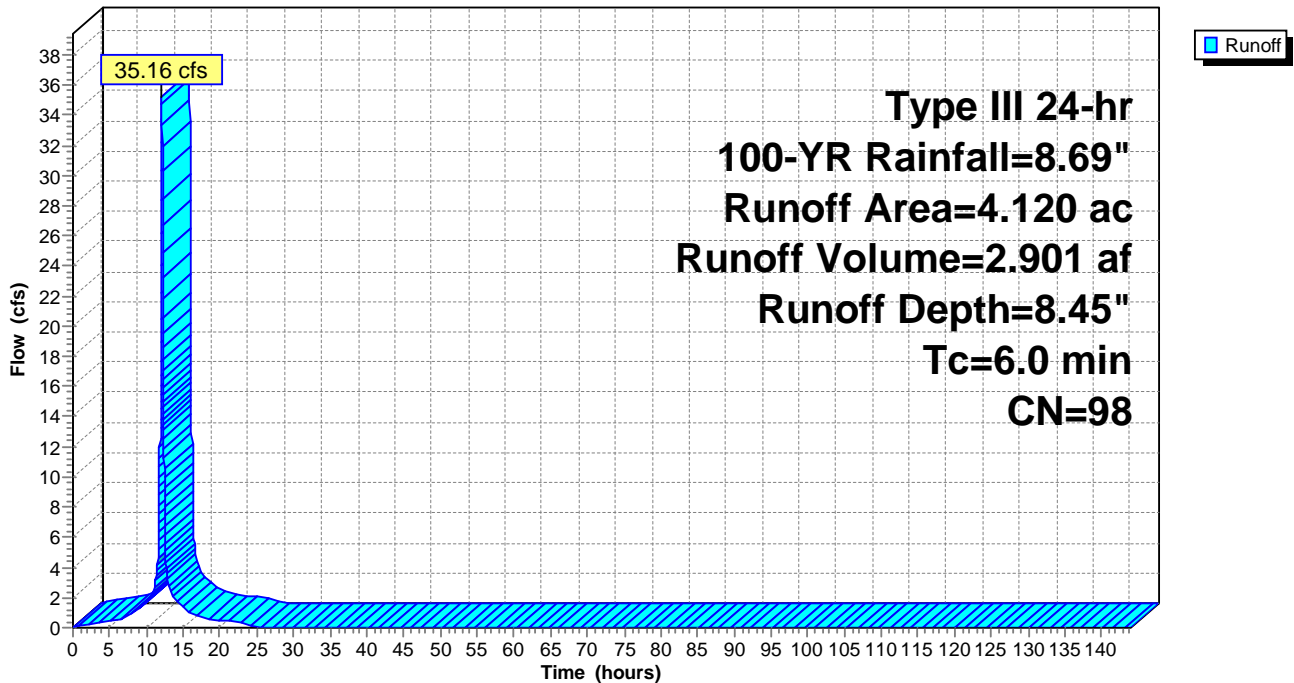
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
2.010	98	Paved parking, HSG A
2.090	98	Paved parking, HSG B
0.020	98	Paved parking, HSG D
4.120	98	Weighted Average
4.120		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-2 IMPERVIOUS: POST DA-2 IMPERVIOUS**

Hydrograph



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Type III 24-hr 100-YR Rainfall=8.69"

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Page 37

**Summary for Subcatchment POST DA-2 PERVIOUS: POST DA-2 PERVIOUS**

Runoff = 6.39 cfs @ 12.40 hrs, Volume= 0.850 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.900	39	>75% Grass cover, Good, HSG A
1.260	61	>75% Grass cover, Good, HSG B
0.500	80	>75% Grass cover, Good, HSG D
2.400	30	Woods, Good, HSG A
0.040	55	Woods, Good, HSG B
5.100	44	Weighted Average
5.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0850	0.14		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
9.4	310	0.0120	0.55		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
2.0	310	0.0170	2.65		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
1.0	377	0.0080	6.44	20.23	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
24.2	1,097	Total			

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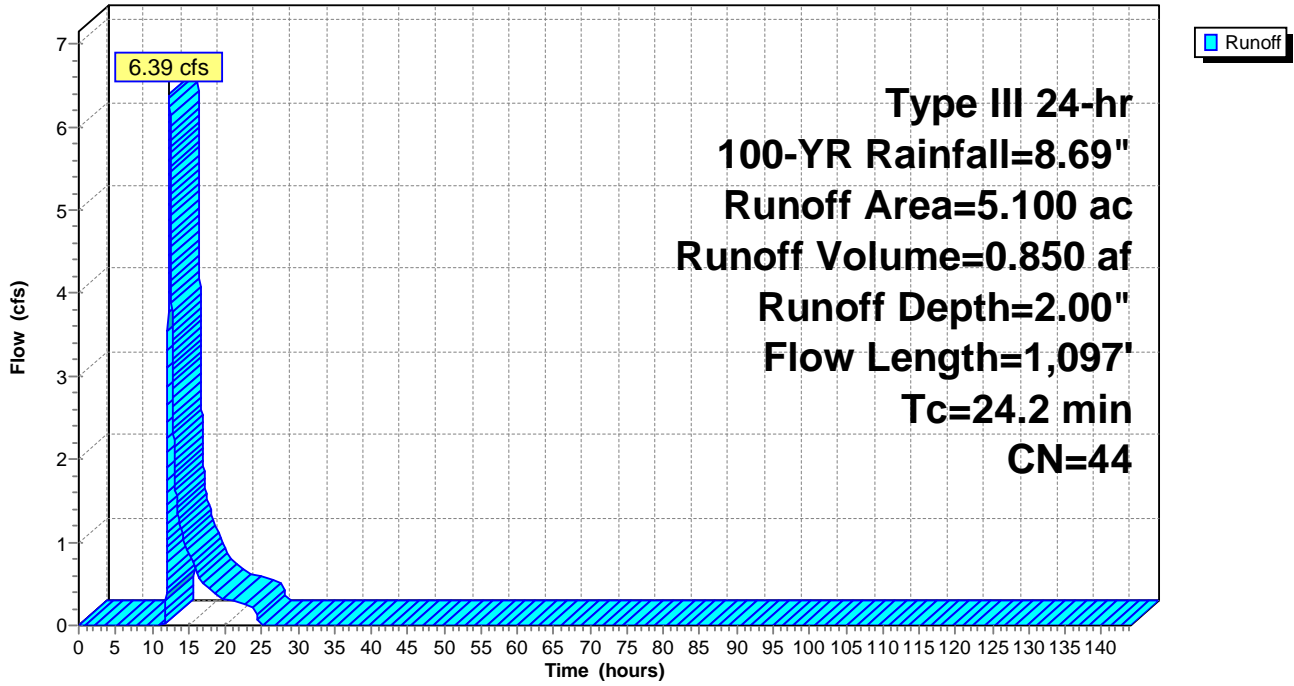
Type III 24-hr 100-YR Rainfall=8.69"

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Page 38

**Subcatchment POST DA-2 PERVIOUS: POST DA-2 PERVIOUS**

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Type III 24-hr 100-YR Rainfall=8.69"

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Page 39

**Summary for Subcatchment POST DA-3 IMPERVIOUS: POST DA-3 IMPERVIOUS**

Runoff = 0.68 cfs @ 12.08 hrs, Volume= 0.056 af, Depth= 8.45"

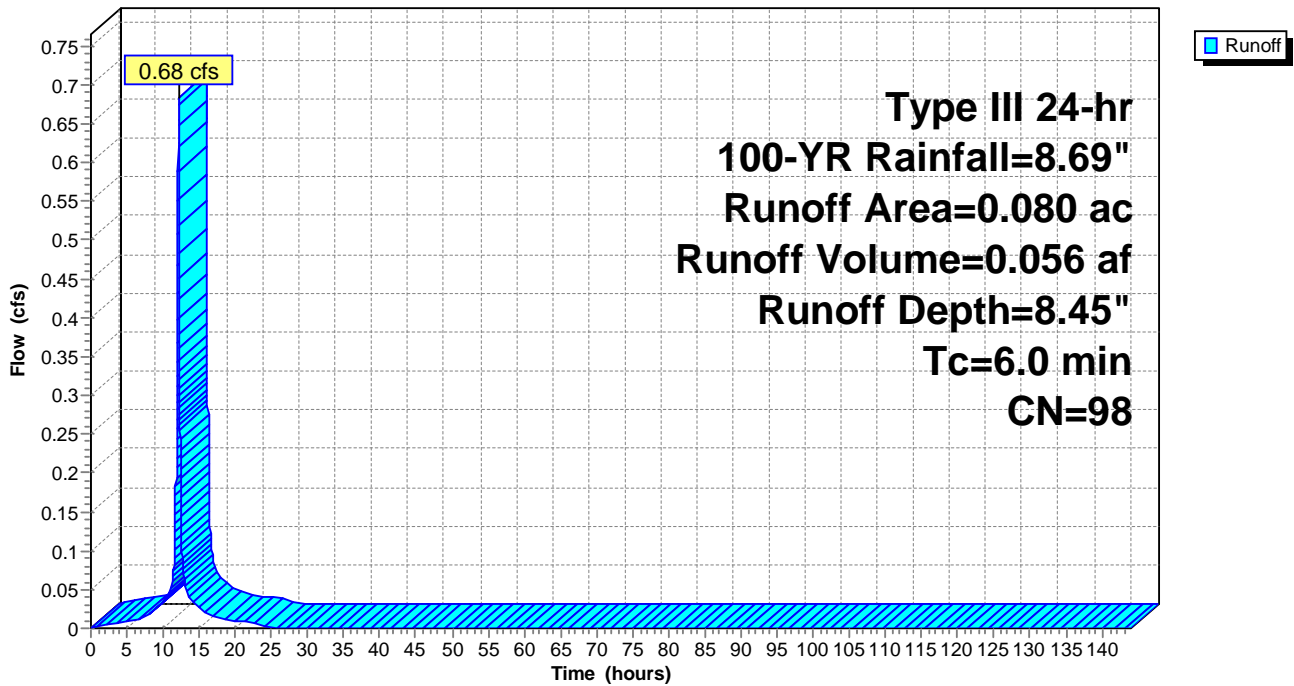
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG B
0.060	98	Paved parking, HSG D
0.080	98	Weighted Average
0.080		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-3 IMPERVIOUS: POST DA-3 IMPERVIOUS**

Hydrograph



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Type III 24-hr 100-YR Rainfall=8.69"

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Page 40

**Summary for Subcatchment POST DA-3 PERVIOUS: POST DA-3 PERVIOUS**

Runoff = 2.85 cfs @ 12.23 hrs, Volume= 0.280 af, Depth= 5.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=8.69"

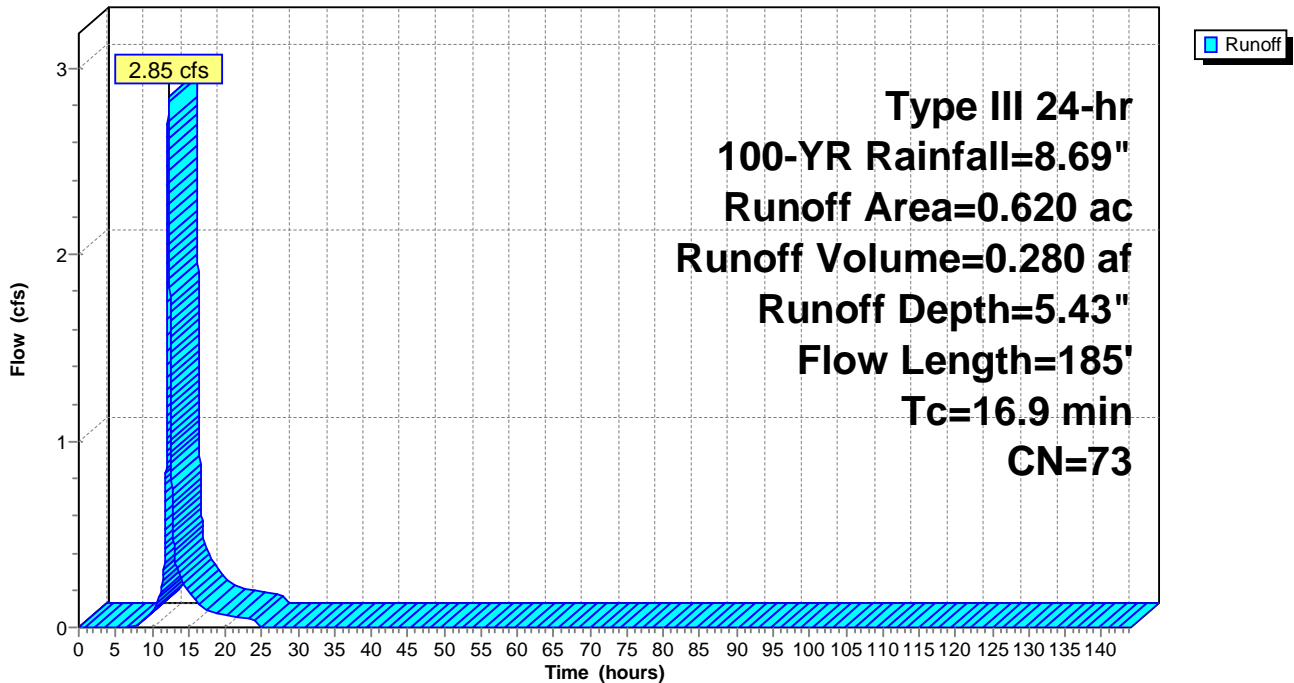
Area (ac)	CN	Description
0.220	61	>75% Grass cover, Good, HSG B
0.400	80	>75% Grass cover, Good, HSG D
0.620	73	Weighted Average
0.620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0150	0.11		Sheet Flow, Grass: Dense n= 0.240 P2= 3.31"
1.2	85	0.0280	1.17		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
16.9	185	Total			

**Subcatchment POST DA-3 PERVIOUS: POST DA-3 PERVIOUS**

Hydrograph





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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 100-YR Rainfall=8.69"

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Page 41

**Summary for Pond POST 1B: POST EAST BASIN**

Inflow = 12.28 cfs @ 12.11 hrs, Volume= 1.734 af  
 Outflow = 3.49 cfs @ 13.41 hrs, Volume= 1.731 af, Atten= 72%, Lag= 78.1 min  
 Primary = 3.49 cfs @ 13.41 hrs, Volume= 1.731 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 139.95' @ 13.40 hrs Surf.Area= 14,895 sf Storage= 29,600 cf  
 Flood Elev= 140.88' Surf.Area= 17,579 sf Storage= 44,667 cf

Plug-Flow detention time= 717.2 min calculated for 1.731 af (100% of inflow)  
 Center-of-Mass det. time= 715.9 min ( 1,564.5 - 848.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.46'	55,766 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.46	13	0	0
137.50	200	4	4
138.00	12,293	3,123	3,128
139.00	13,592	12,943	16,070
140.00	14,964	14,278	30,348
141.00	17,936	16,450	46,798
141.50	17,936	8,968	55,766

Device	Routing	Invert	Outlet Devices
#1	Primary	137.46'	<b>24.0" Round RCP_Round 24"</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.46' / 137.09' S= 0.0049 1/ S= 0.0049 1/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.59'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	139.46'	<b>3.0' long x 1.80' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	141.26'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	140.50'	<b>55.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=3.49 cfs @ 13.41 hrs HW=139.95' TW=139.54' (Dynamic Tailwater)  
 ↑ **1=RCP\_Round 24"** (Passes 3.49 cfs of 11.21 cfs potential flow)  
 ↑ **2=Orifice/Grate** (Orifice Controls 0.27 cfs @ 3.10 fps)  
 ↑ **3=Sharp-Crested Rectangular Weir** (Weir Controls 3.22 cfs @ 2.27 fps)  
 ↑ **4=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=137.46' TW=136.31' (Dynamic Tailwater)  
 ↑ **5=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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POST-DEVELOPMENT CONDITIONS

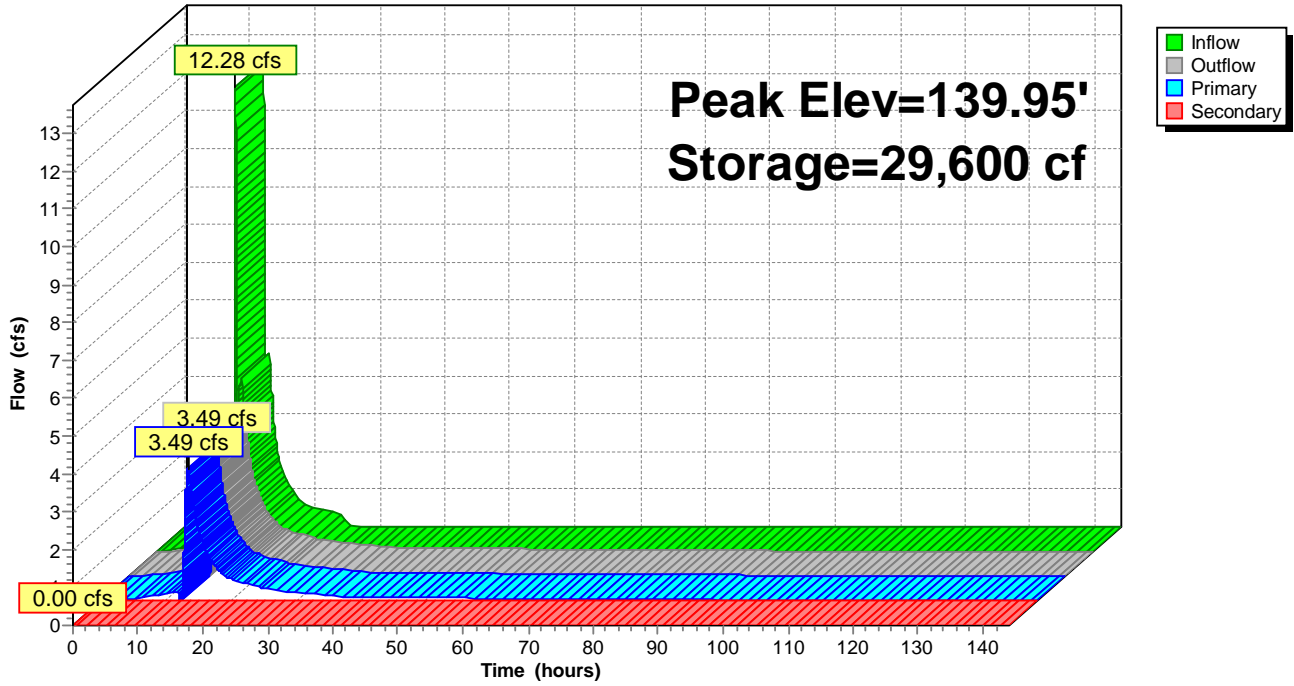
Type III 24-hr 100-YR Rainfall=8.69"

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Page 42

**Pond POST 1B: POST EAST BASIN**

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POST-DEVELOPMENT CONDITIONS

Type III 24-hr 100-YR Rainfall=8.69"

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Page 43

**Summary for Pond POST 2B: POST WEST BASIN**

Inflow = 36.84 cfs @ 12.09 hrs, Volume= 5.482 af  
 Outflow = 8.28 cfs @ 12.83 hrs, Volume= 4.688 af, Atten= 78%, Lag= 44.7 min  
 Primary = 8.28 cfs @ 12.83 hrs, Volume= 4.571 af  
 Secondary = 4.97 cfs @ 12.18 hrs, Volume= 0.117 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 139.57' @ 12.83 hrs Surf.Area= 29,098 sf Storage= 89,223 cf

Plug-Flow detention time= 939.6 min calculated for 4.688 af (86% of inflow)  
 Center-of-Mass det. time= 701.0 min ( 1,726.2 - 1,025.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	136.00'	133,466 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
136.00	21,387	0	0
137.00	23,291	22,339	22,339
138.00	25,304	24,298	46,637
139.00	27,739	26,522	73,158
140.00	30,143	28,941	102,099
141.00	32,590	31,367	133,466

Device	Routing	Invert	Outlet Devices
#1	Primary	135.48'	<b>24.0" Round Culvert</b> L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 135.48' / 135.05' S= 0.0287 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.45'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	138.83'	<b>4.0' long x 1.85' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	140.68'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.09' / 137.46' S= -0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

**Primary OutFlow** Max=8.28 cfs @ 12.83 hrs HW=139.57' TW=136.31' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 8.28 cfs of 33.21 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.33 cfs @ 6.79 fps)
- ↑ **3=Sharp-Crested Rectangular Weir** (Weir Controls 7.94 cfs @ 2.80 fps)
- ↑ **4=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=4.36 cfs @ 12.18 hrs HW=139.02' TW=138.92' (Dynamic Tailwater)

- ↑ **5=Culvert** (Outlet Controls 4.36 cfs @ 1.79 fps)

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POST-DEVELOPMENT CONDITIONS

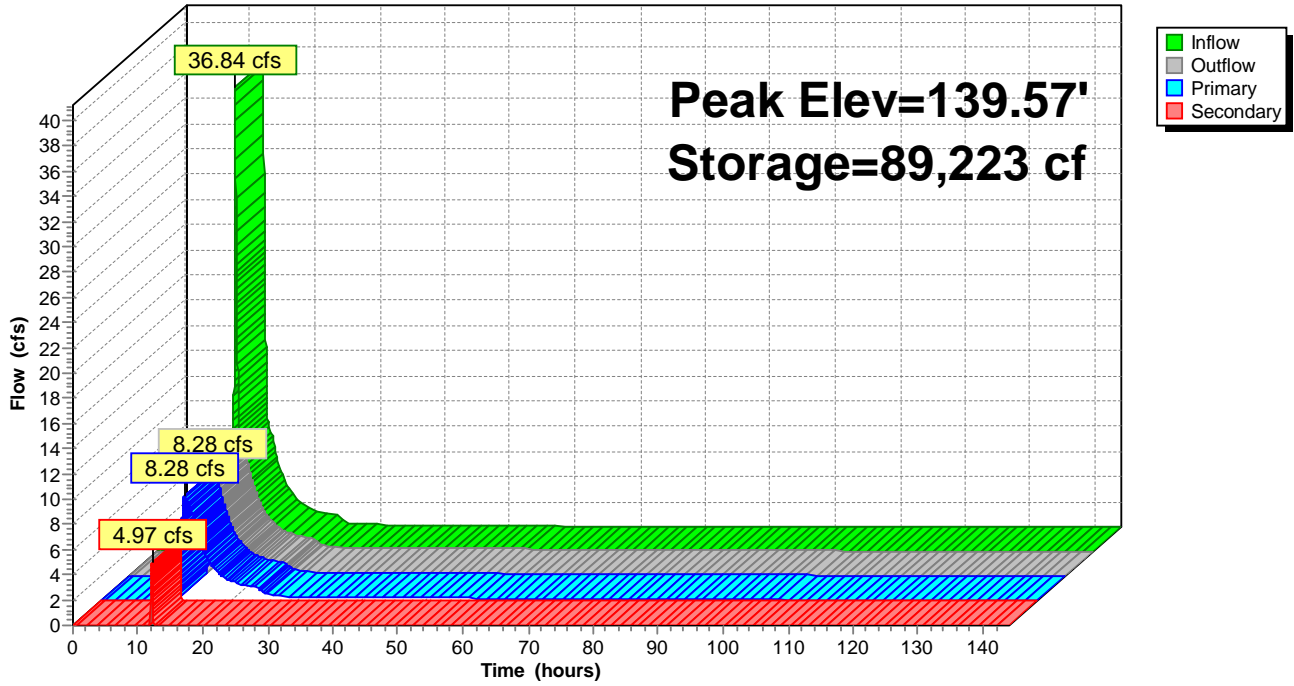
Type III 24-hr 100-YR Rainfall=8.69"

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Page 44

**Pond POST 2B: POST WEST BASIN**

Hydrograph



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Type III 24-hr 100-YR Rainfall=8.69"

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Page 45

**Summary for Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)**

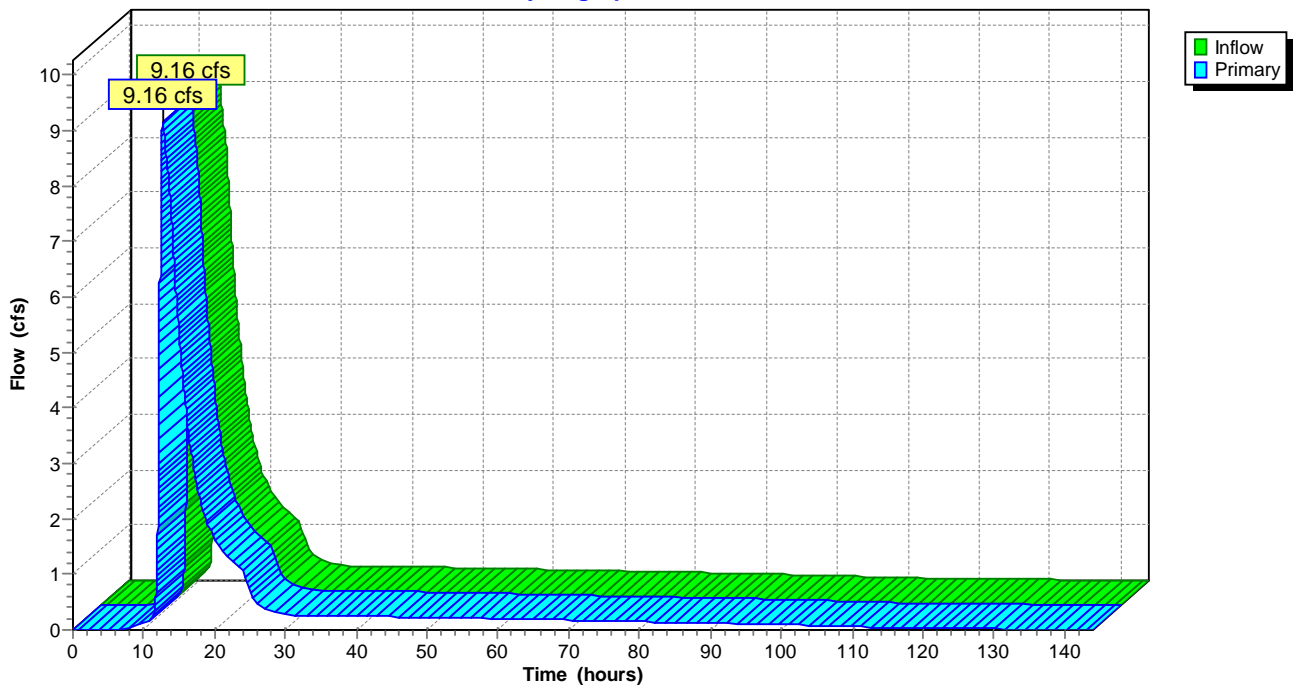
Inflow = 9.16 cfs @ 12.62 hrs, Volume= 4.907 af  
Primary = 9.16 cfs @ 12.63 hrs, Volume= 4.907 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)**

Hydrograph



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NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 46

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Sim-Route method - Pond routing by Sim-Route method

**Subcatchment POST DA-1 IMPERVIOUS:** Runoff Area=1.010 ac 100.00% Impervious Runoff Depth=1.03"  
Tc=6.0 min CN=98 Runoff=2.96 cfs 0.087 af

**Subcatchment POST DA-1 PERVIOUS: POST** Runoff Area=6.950 ac 0.00% Impervious Runoff Depth=0.00"  
Flow Length=1,440' Tc=60.4 min CN=40 Runoff=0.00 cfs 0.000 af

**Subcatchment POST DA-2 IMPERVIOUS:** Runoff Area=4.120 ac 100.00% Impervious Runoff Depth=1.03"  
Tc=6.0 min CN=98 Runoff=12.06 cfs 0.355 af

**Subcatchment POST DA-2 PERVIOUS: POST** Runoff Area=5.100 ac 0.00% Impervious Runoff Depth=0.00"  
Flow Length=1,097' Tc=24.2 min CN=44 Runoff=0.00 cfs 0.000 af

**Subcatchment POST DA-3 IMPERVIOUS:** Runoff Area=0.080 ac 100.00% Impervious Runoff Depth=1.03"  
Tc=6.0 min CN=98 Runoff=0.23 cfs 0.007 af

**Subcatchment POST DA-3 PERVIOUS: POST** Runoff Area=0.620 ac 0.00% Impervious Runoff Depth=0.06"  
Flow Length=185' Tc=16.9 min CN=73 Runoff=0.05 cfs 0.003 af

**Pond POST 1B: POST EAST BASIN** Peak Elev=138.00' Storage=3,127 cf Inflow=2.96 cfs 0.087 af  
Primary=0.21 cfs 0.084 af Secondary=0.00 cfs 0.000 af Outflow=0.21 cfs 0.084 af

**Pond POST 2B: POST WEST BASIN** Peak Elev=136.86' Storage=19,139 cf Inflow=12.19 cfs 0.439 af  
Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

**Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)** Inflow=0.23 cfs 0.010 af  
Primary=0.23 cfs 0.010 af

**Total Runoff Area = 17.880 ac Runoff Volume = 0.452 af Average Runoff Depth = 0.30"**  
**70.86% Pervious = 12.670 ac 29.14% Impervious = 5.210 ac**

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POST-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 47

**Summary for Subcatchment POST DA-1 IMPERVIOUS: POST DA-1 IMPERVIOUS**

Runoff = 2.96 cfs @ 1.11 hrs, Volume= 0.087 af, Depth= 1.03"

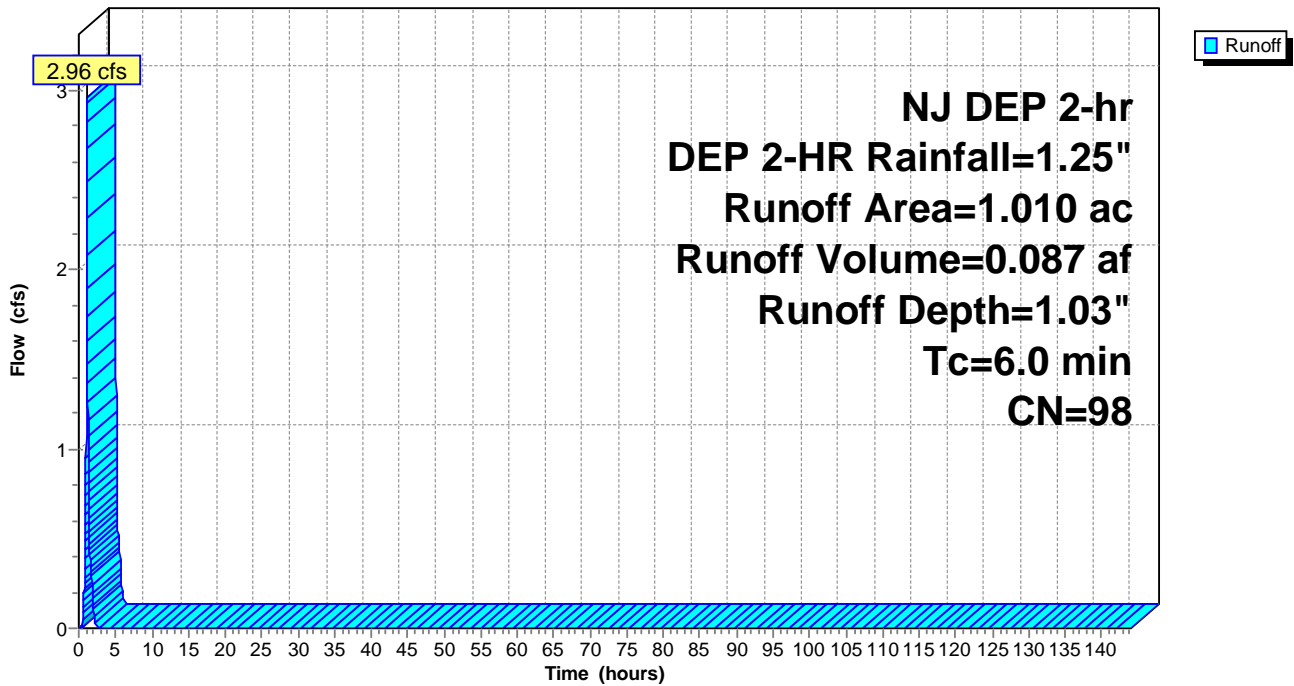
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.670	98	Paved parking, HSG A
0.340	98	Paved parking, HSG B
1.010	98	Weighted Average
1.010		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-1 IMPERVIOUS: POST DA-1 IMPERVIOUS**

Hydrograph



**Williamstown**

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POST-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 48

**Summary for Subcatchment POST DA-1 PERVIOUS: POST DA-1 PERVIOUS**

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.610	39	>75% Grass cover, Good, HSG A
0.760	61	>75% Grass cover, Good, HSG B
4.000	30	Woods, Good, HSG A
1.580	55	Woods, Good, HSG B
6.950	40	Weighted Average
6.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.2	100	0.0040	0.04		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
13.8	557	0.0180	0.67		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
6.0	655	0.0080	1.82		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
0.4	128	0.0050	5.09	16.00	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
60.4	1,440	Total			



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POST-DEVELOPMENT CONDITIONS

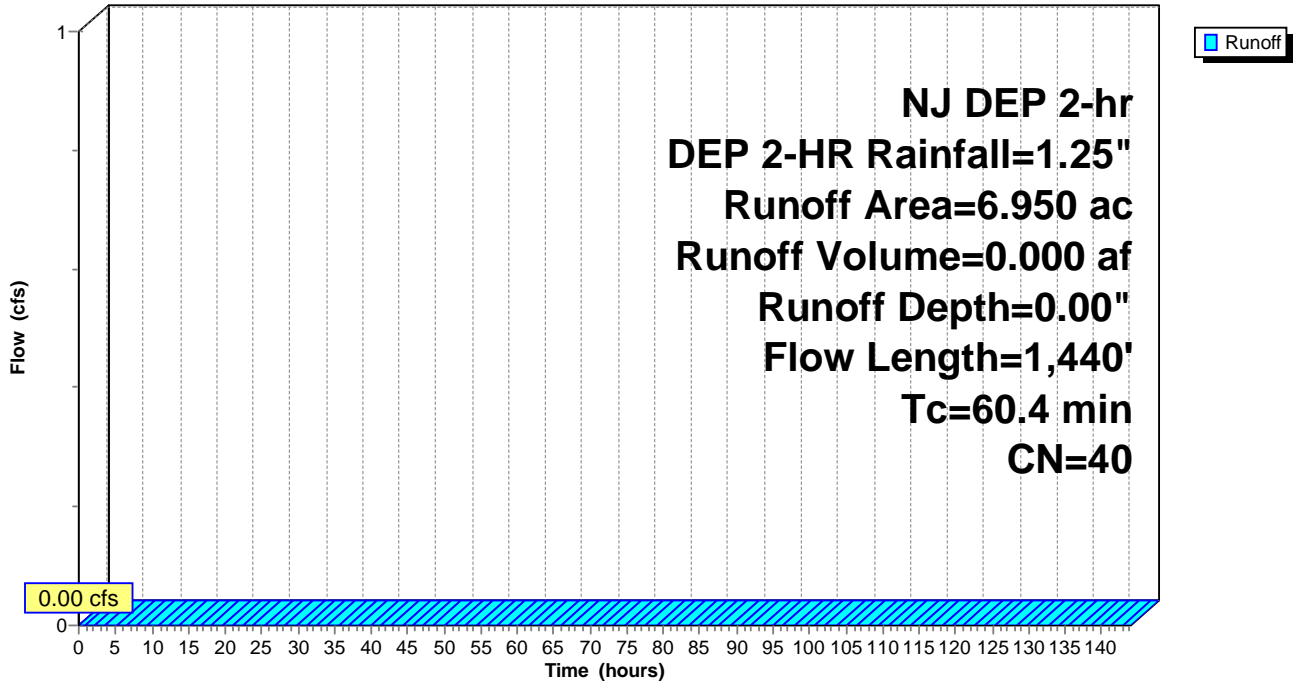
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 49

**Subcatchment POST DA-1 PERVIOUS: POST DA-1 PERVIOUS**

Hydrograph



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POST-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 50

**Summary for Subcatchment POST DA-2 IMPERVIOUS: POST DA-2 IMPERVIOUS**

Runoff = 12.06 cfs @ 1.11 hrs, Volume= 0.355 af, Depth= 1.03"

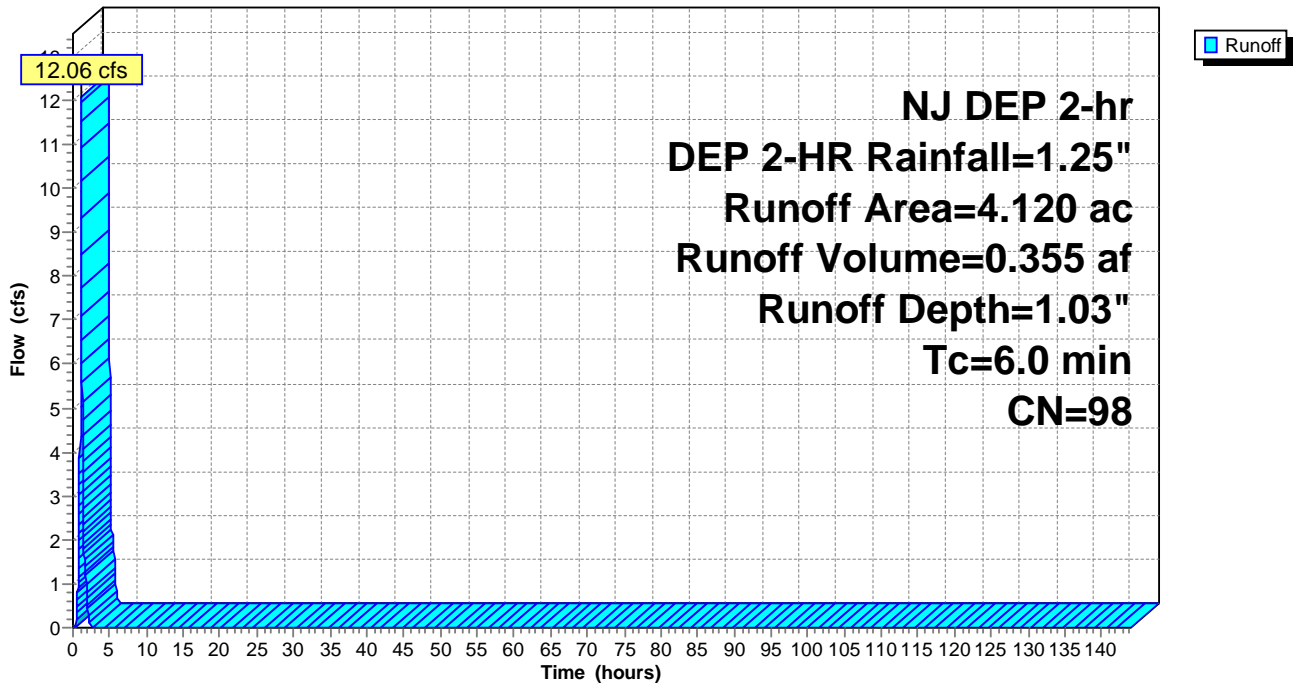
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
2.010	98	Paved parking, HSG A
2.090	98	Paved parking, HSG B
0.020	98	Paved parking, HSG D
4.120	98	Weighted Average
4.120		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-2 IMPERVIOUS: POST DA-2 IMPERVIOUS**

Hydrograph



**Williamstown**

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POST-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 51

**Summary for Subcatchment POST DA-2 PERVIOUS: POST DA-2 PERVIOUS**

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.900	39	>75% Grass cover, Good, HSG A
1.260	61	>75% Grass cover, Good, HSG B
0.500	80	>75% Grass cover, Good, HSG D
2.400	30	Woods, Good, HSG A
0.040	55	Woods, Good, HSG B
5.100	44	Weighted Average
5.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0850	0.14		<b>Sheet Flow, Sheet Flow thru Wooded Area</b> Woods: Light underbrush n= 0.400 P2= 3.31"
9.4	310	0.0120	0.55		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Wood</b> Woodland Kv= 5.0 fps
2.0	310	0.0170	2.65		<b>Shallow Concentrated Flow, Shallow Concentrated Sheet Flow Paved</b> Paved Kv= 20.3 fps
1.0	377	0.0080	6.44	20.23	<b>Pipe Channel, RCP_Round 24"</b> 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
24.2	1,097	Total			

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POST-DEVELOPMENT CONDITIONS

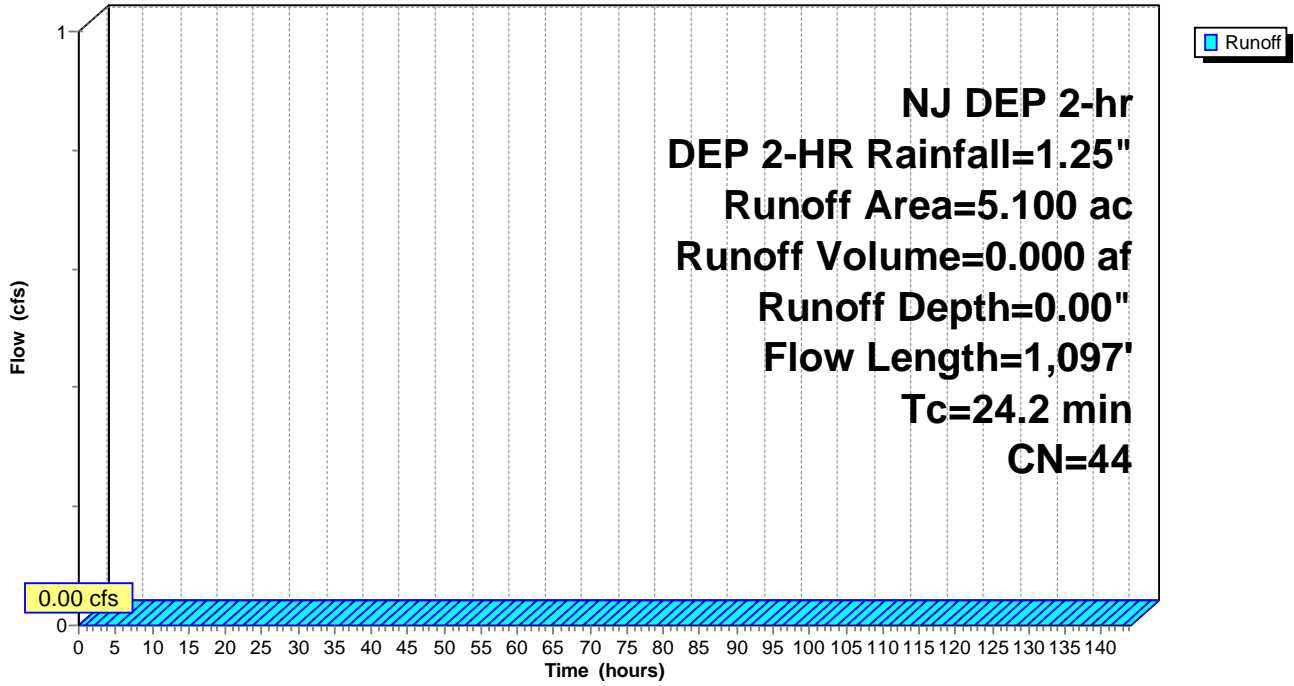
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 52

**Subcatchment POST DA-2 PERVIOUS: POST DA-2 PERVIOUS**

Hydrograph



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POST-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 53

**Summary for Subcatchment POST DA-3 IMPERVIOUS: POST DA-3 IMPERVIOUS**

Runoff = 0.23 cfs @ 1.11 hrs, Volume= 0.007 af, Depth= 1.03"

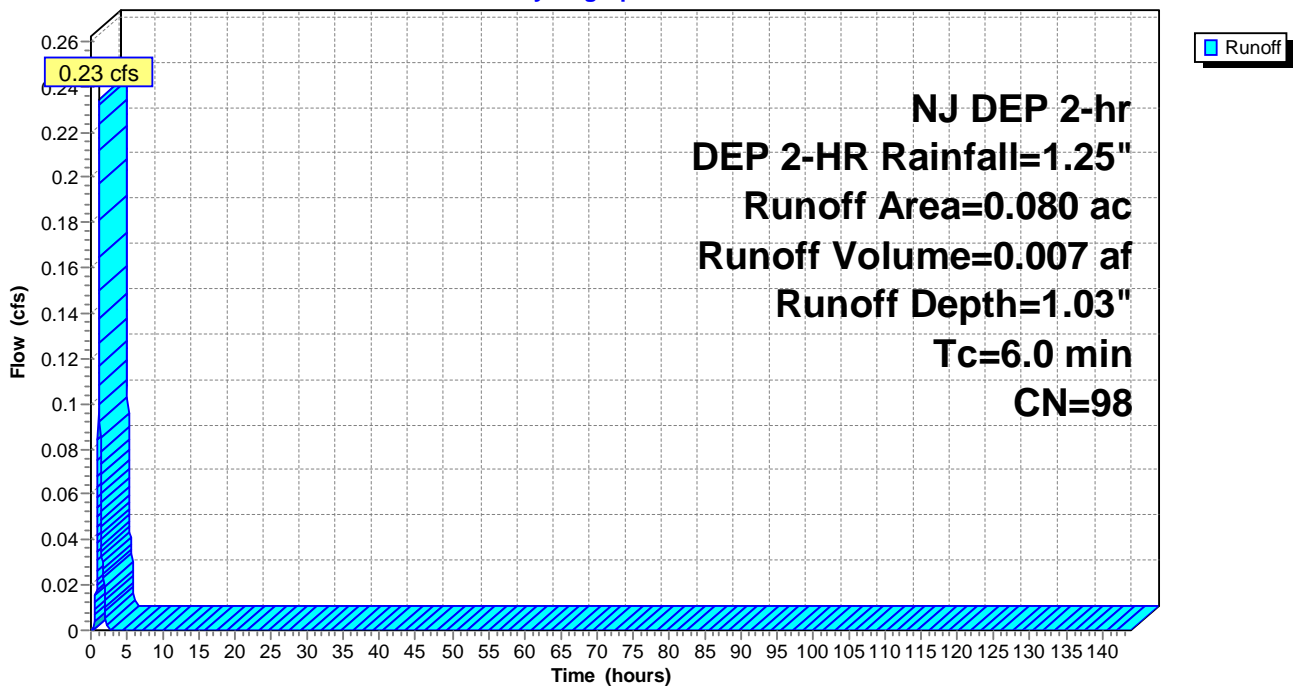
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG B
0.060	98	Paved parking, HSG D
0.080	98	Weighted Average
0.080		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Directly Connected Impervious Area

**Subcatchment POST DA-3 IMPERVIOUS: POST DA-3 IMPERVIOUS**

Hydrograph



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POST-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 54

**Summary for Subcatchment POST DA-3 PERVIOUS: POST DA-3 PERVIOUS**

Runoff = 0.05 cfs @ 1.39 hrs, Volume= 0.003 af, Depth= 0.06"

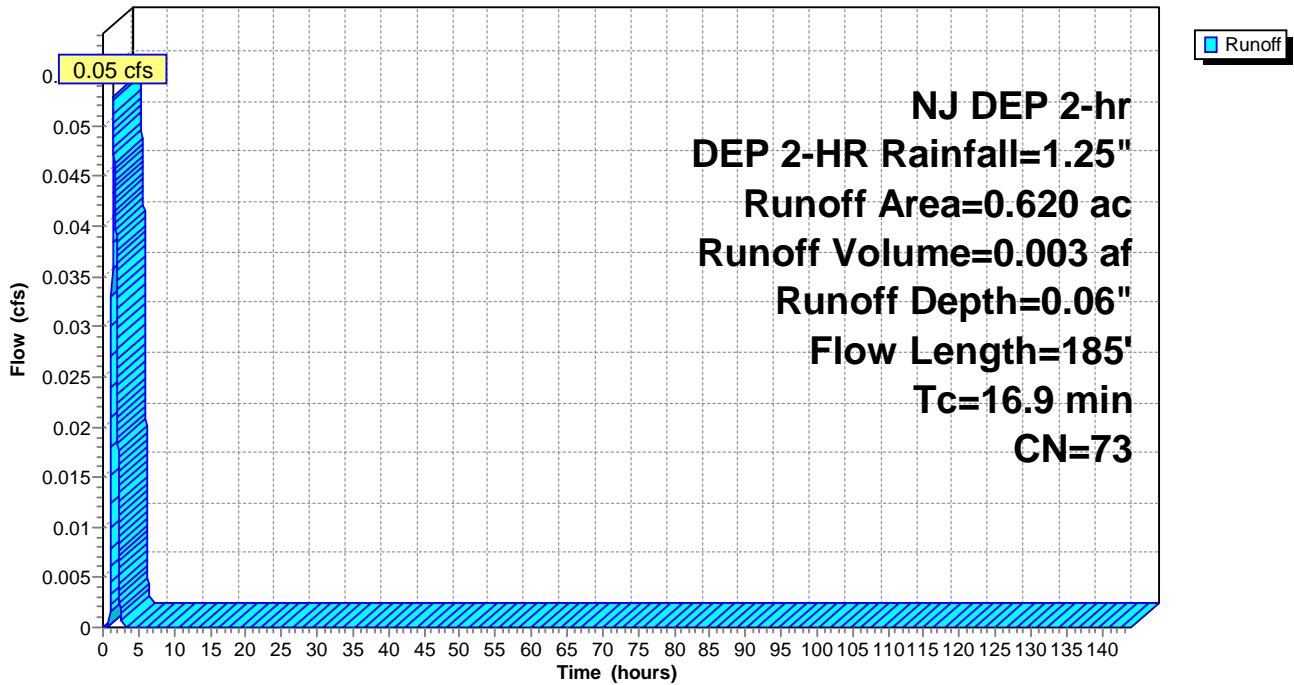
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

Area (ac)	CN	Description
0.220	61	>75% Grass cover, Good, HSG B
0.400	80	>75% Grass cover, Good, HSG D
0.620	73	Weighted Average
0.620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.7	100	0.0150	0.11		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.31"
1.2	85	0.0280	1.17		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
16.9	185	Total			

**Subcatchment POST DA-3 PERVIOUS: POST DA-3 PERVIOUS**

Hydrograph



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POST-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 55

**Summary for Pond POST 1B: POST EAST BASIN**

Inflow = 2.96 cfs @ 1.11 hrs, Volume= 0.087 af  
 Outflow = 0.21 cfs @ 1.84 hrs, Volume= 0.084 af, Atten= 93%, Lag= 43.8 min  
 Primary = 0.21 cfs @ 1.84 hrs, Volume= 0.084 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 138.00' @ 1.84 hrs Surf.Area= 12,291 sf Storage= 3,127 cf  
 Flood Elev= 140.88' Surf.Area= 17,579 sf Storage= 44,667 cf

Plug-Flow detention time= 242.1 min calculated for 0.084 af (97% of inflow)  
 Center-of-Mass det. time= 241.1 min ( 311.4 - 70.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	137.46'	55,766 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
137.46	13	0	0
137.50	200	4	4
138.00	12,293	3,123	3,128
139.00	13,592	12,943	16,070
140.00	14,964	14,278	30,348
141.00	17,936	16,450	46,798
141.50	17,936	8,968	55,766

Device	Routing	Invert	Outlet Devices
#1	Primary	137.46'	<b>24.0" Round RCP_Round 24"</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.46' / 137.09' S= 0.0049 1/ S= 0.0049 1/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.59'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	139.46'	<b>3.0' long x 1.80' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	141.26'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	140.50'	<b>55.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=0.21 cfs @ 1.84 hrs HW=138.00' TW=136.71' (Dynamic Tailwater)

- ↑ 1=RCP\_Round 24" (Passes 0.21 cfs of 1.36 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 0.21 cfs @ 2.37 fps)
- ↑ 3=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)
- ↑ 4=Orifice/Grate ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=137.46' TW=136.31' (Dynamic Tailwater)

- ↑ 5=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

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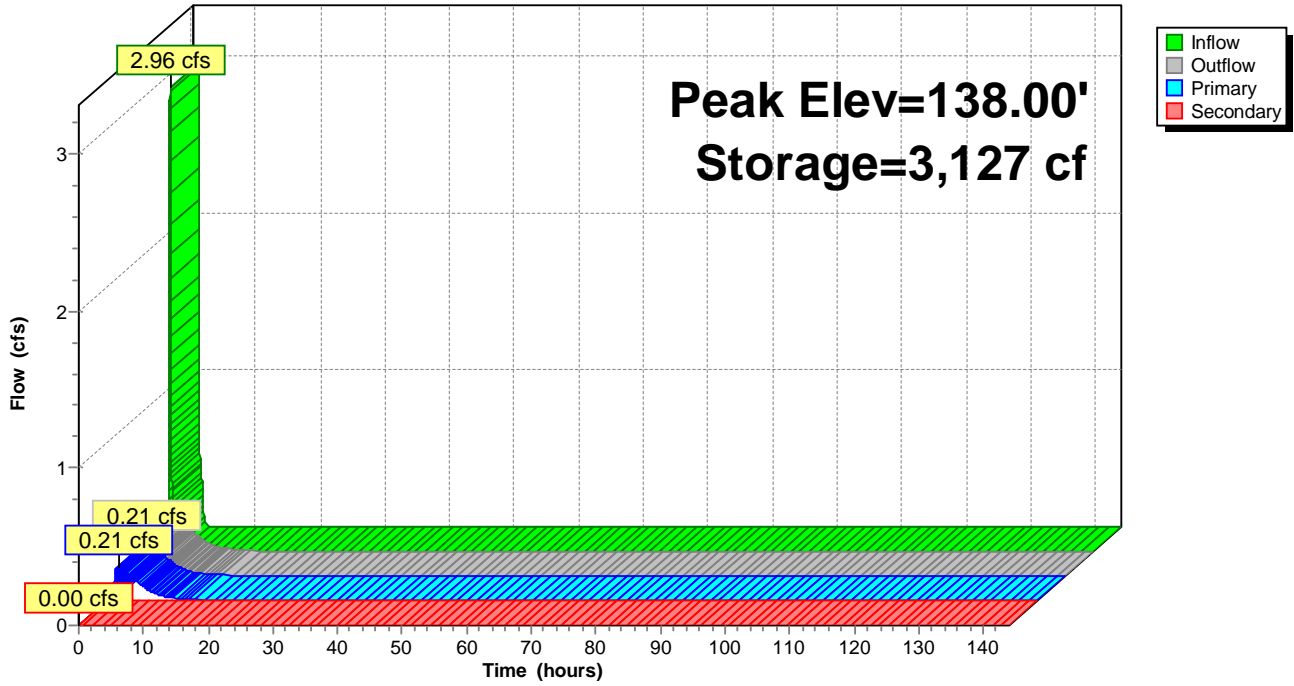
POST-DEVELOPMENT CONDITIONS  
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 56

**Pond POST 1B: POST EAST BASIN**

Hydrograph





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POST-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 57

**Summary for Pond POST 2B: POST WEST BASIN**

Inflow = 12.19 cfs @ 1.11 hrs, Volume= 0.439 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Sim-Route method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs  
 Peak Elev= 136.86' @ 144.00 hrs Surf.Area= 23,028 sf Storage= 19,139 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	136.00'	133,466 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
136.00	21,387	0	0
137.00	23,291	22,339	22,339
138.00	25,304	24,298	46,637
139.00	27,739	26,522	73,158
140.00	30,143	28,941	102,099
141.00	32,590	31,367	133,466

Device	Routing	Invert	Outlet Devices
#1	Primary	135.48'	<b>24.0" Round Culvert</b> L= 15.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 135.48' / 135.05' S= 0.0287 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	137.45'	<b>3.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	138.83'	<b>4.0' long x 1.85' rise Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	140.68'	<b>48.0" x 48.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#5	Secondary	137.46'	<b>24.0" Round Culvert</b> L= 76.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 137.09' / 137.46' S= -0.0049 '/ Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=136.00' TW=136.31' (Dynamic Tailwater)

↑ **1=Culvert** ( Controls 0.00 cfs)  
 ↑ **2=Orifice/Grate** ( Controls 0.00 cfs)  
 ↑ **3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)  
 ↑ **4=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=136.00' TW=137.46' (Dynamic Tailwater)

↑ **5=Culvert** ( Controls 0.00 cfs)

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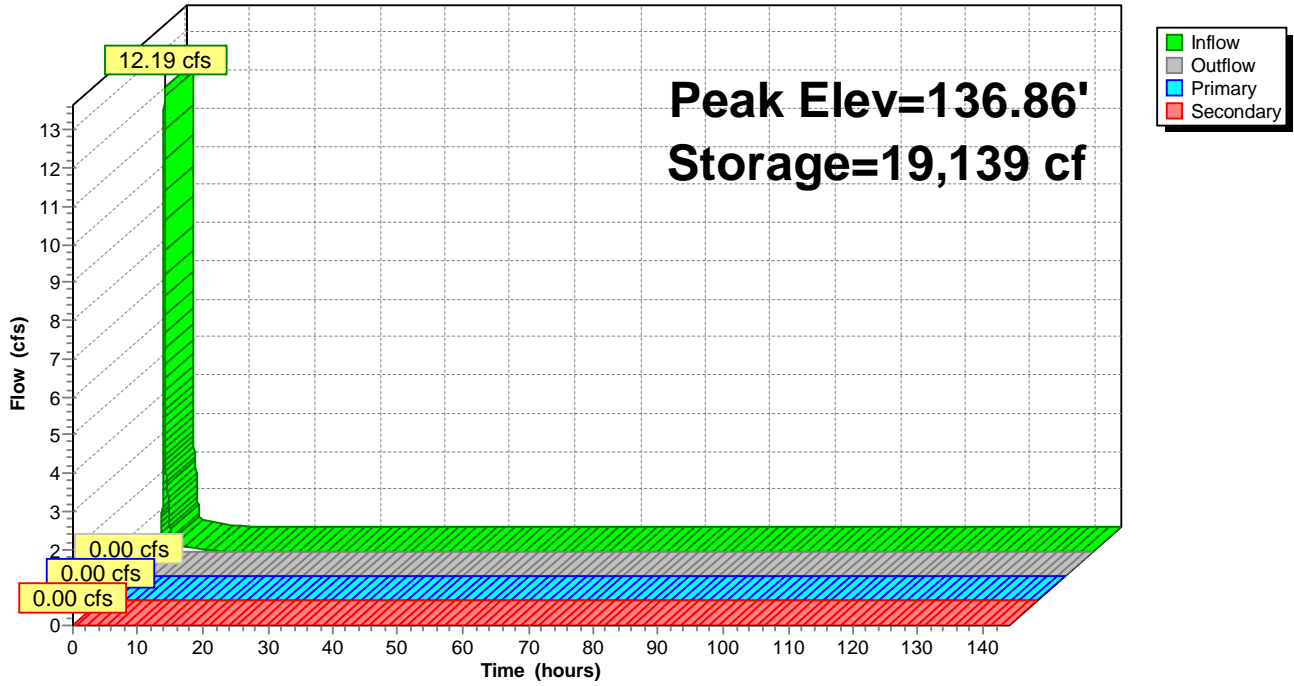
POST-DEVELOPMENT CONDITIONS  
NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 58

**Pond POST 2B: POST WEST BASIN**

Hydrograph



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POST-DEVELOPMENT CONDITIONS

NJ DEP 2-hr DEP 2-HR Rainfall=1.25"

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Page 59

**Summary for Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)**

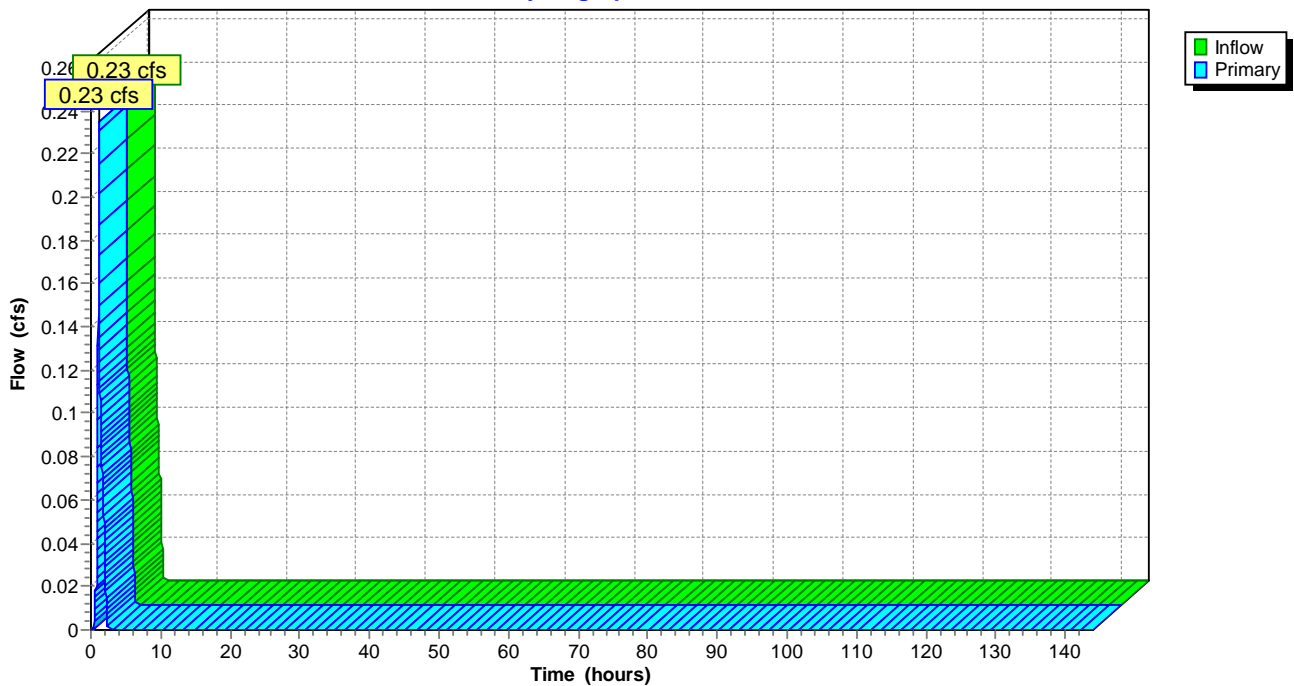
Inflow = 0.23 cfs @ 1.11 hrs, Volume= 0.010 af  
Primary = 0.23 cfs @ 1.12 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.6 min

Primary outflow = Inflow, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 136.31'

**Link POST POI: POST OUTFALL (POINT OF INVESTIGATION)**

Hydrograph



## **APPENDIX D – GROUNDWATER RECHARGE SPREADSHEET**

New Jersey  
Groundwater  
Recharge  
Spreadsheet  
Version 2.0  
November 2003

## Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓	Average Annual P (in)	Climatic Factor
GLOUCESTER CO., MONROE TWP	44.0	1.36

Project Name:	Williamstown - Lidl
Description:	Proposed Grocery Store
Analysis Date:	11/30/20

Pre-Developed Conditions					
Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	2.21	Open space	Woodstown	10.2	81,654
2	0.04	Impervious areas	Woodstown	0.0	-
3	1.37	Woods	Woodstown	9.6	47,907
4	0.23	Open space	Downer	13.0	10,853
5	0.01	Impervious areas	Downer	0.0	-
6	1.19	Woods	Downer	12.3	52,954
7	0.49	Open space	Fallsington	0.0	-
8	0.01	Impervious areas	Fallsington	0.0	-
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	5.6			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				9.6	193,368

Post-Developed Conditions					
Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	1.56	Open space	Woodstown	10.2	57,638
2	2.06	Impervious areas	Woodstown	0.0	-
3	0.85	Open space	Downer	13.0	40,109
4	0.58	Impervious areas	Downer	0.0	-
5	0.48	Open space	Fallsington	0.0	-
6	0.02	Impervious areas	Fallsington	0.0	-
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	5.6			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				4.9	97,747

### Procedure to fill the Pre-Development and Post-Development Conditions Tables

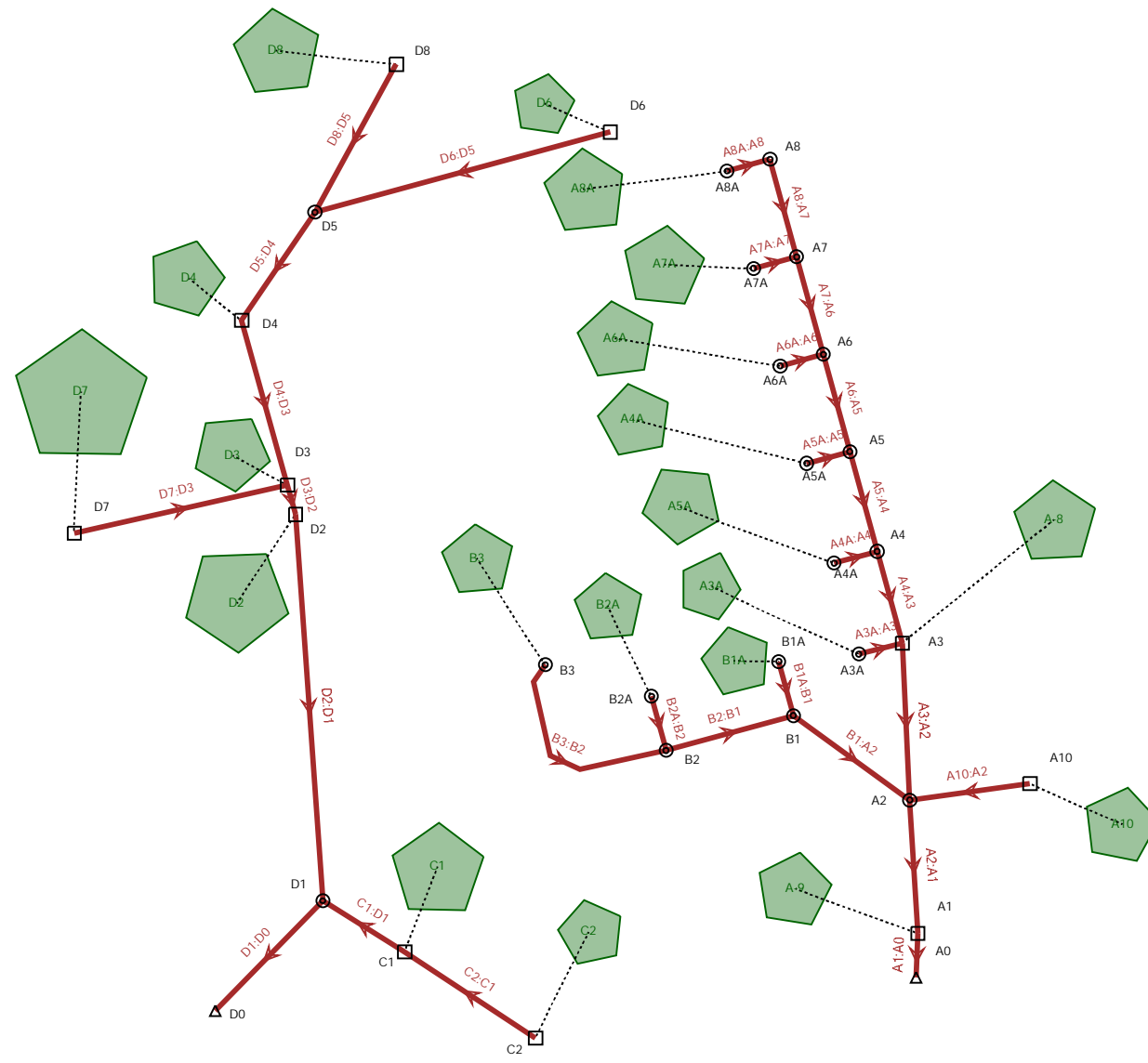
For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

<b>Annual Recharge Requirements Calculation ↓</b>			
% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft)	115,870
<b>Post-Development Annual Recharge Deficit=</b>	<b>95,621</b>	(cubic feet)	
<b>Recharge Efficiency Parameters Calculations (area averages)</b>			
RWC= 2.76	(in)	DRWC= 0.00	(in)
ERWC = 0.88	(in)	EDRWC= 0.00	(in)

Project Name		Description		Analysis Date		BMP or LID Type					
Williamstown - Lidl		Proposed Grocery Store		11/30/20		Infiltration Basin					
Recharge BMP Input Parameters				Root Zone Water capacity Calculated Parameters				Recharge Design Parameters			
Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit
BMP Area	ABMP	21387.4	sq.ft	Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.88	in	Inches of Runoff to capture	Qdesign	0.14	in
BMP Effective Depth, this is the design variable	dBMP	0.8	in	ERWC Modified to consider dEXC	EDRWC	0.00	in	Inches of Rainfall to capture	Pdesign	0.21	in
Upper level of the BMP surface (negative if above ground)	dBMPu	36.6	in	Empty Portion of RWC under Infiltration BMP	RERWC	0.00	in	Recharge Provided Avg. over Imp. Area		9.9	in
Depth of lower surface of BMP, must be >= dBMPu	dEXC	54.0	in					Runoff Captured Avg. over imp. Area		9.9	in
Post-development Land Segment Location of BMP, Input Zero if Location is distributed or undetermined	SegBMP	0	unitless								
				BMP Calculated Size Parameters				CALCULATION CHECK MESSAGES			
				ABMP/Aimp	Aratio	0.18	unitless	Volume Balance--> <b>OK</b>			
				BMP Volume	VBMP	1,378	cu.ft	dBMP Check--> <b>OK</b>			
								dEXC Check--> <b>OK</b>			
								BMP Location--> <b>Location is selected as distributed or undetermined</b>			
Parameters from Annual Recharge Worksheet				System Performance Calculated Parameters				OTHER NOTES			
Post-D Deficit Recharge (or desired recharge volume)	Vdef	95,621	cu.ft	Annual BMP Recharge Volume		95,621	cu.ft	Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensitive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses			
Post-D Impervious Area (or target Impervious Area)	Aimp	115,870	sq.ft	Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged				
Root Zone Water Capacity	RWC	2.76	in	%Rainfall became Runoff		77.6%	%				
RWC Modified to consider dEXC	DRWC	0.00	in	%Runoff Infiltrated		29.0%	%				
Climatic Factor	C-factor	1.36	no units	%Runoff Recharged		29.0%	%				
Average Annual P	Pavg	44.0	in	%Rainfall Recharged		22.5%	%				
Recharge Requirement over Imp. Area	dr	9.9	in								
<p><b>How to solve for different recharge volumes:</b> By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.</p> <p>To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration click the "Default Vdef &amp; Aimp" button.</p>											

## **APPENDIX E – PROPOSED STORMWATER CONVEYANCE CALCULATIONS**

Scenario: Base





### Conduit FlexTable: Hydraulic Report

-Node- Upstream Downstream	Notes	Diameter (in)	Length (Unified) (ft)	Manning's n	Slope (Calculated) (ft/ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Upstre am Inlet C	Upstream Inlet Area (acres)	System CA (acres)	System Flow Time (min)	System Intensity (in/h)	System Rational Flow (cfs)	Flow (cfs)	Capacity (Design) (cfs)	Velocity (ft/s)	Cover (Start) (ft)	Cover (Stop) (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (In) (ft)	-Ground- Upstream Downstream (ft)
D7	15" RCP	15.0	99.3	0.013	0.005	138.73	138.23	0.770	0.160	0.123	5.000	7.700	0.96	0.96	4.57	2.94	3.38	3.70	139.42	139.42	143.36
D3																					143.19
D8	15" RCP	15.0	72.0	0.013	0.005	139.37	139.01	0.300	1.110	0.333	15.000	5.700	1.91	1.91	4.57	3.56	3.38	4.89	139.97	139.94	144.00
D5																					145.16
D6	15" RCP	15.0	137.7	0.013	0.005	139.80	139.11	0.900	0.040	0.036	5.000	7.700	0.28	0.28	4.57	2.06	0.89	4.79	140.01	140.01	141.94
D5																					145.16
D5	15" RCP	15.0	59.4	0.013	0.005	139.01	138.72	(N/A)	(N/A)	0.369	15.337	5.636	2.10	2.10	4.57	3.64	4.89	4.57	139.66	139.61	145.16
D4																					144.54
D4	15" RCP	15.0	76.6	0.013	0.005	138.62	138.23	0.860	0.140	0.489	15.609	5.584	2.75	2.75	4.57	3.89	4.67	3.70	139.50	139.50	144.54
D3																					143.19
D3	24" RCP	24.0	12.1	0.013	0.005	137.48	137.42	0.870	0.400	0.961	15.937	5.521	5.35	5.35	15.95	4.57	3.70	3.76	139.41	139.41	143.19
D2																					143.18
D2	24" RCP	24.0	175.0	0.013	0.005	137.32	136.45	0.830	0.320	1.226	15.981	5.513	6.81	6.81	16.00	2.17	3.86	5.09	139.41	139.41	143.18
D1																					143.54
C2	15" RCP	15.0	74.8	0.013	0.005	137.78	137.41	0.840	0.250	0.210	5.000	7.700	1.63	1.63	4.57	1.33	3.47	5.21	139.36	139.36	142.50
C1																					143.87
C1	15" RCP	15.0	41.4	0.013	0.005	137.31	137.10	0.880	0.130	0.324	5.938	7.513	2.46	2.46	4.57	2.00	5.31	5.19	139.31	139.31	143.87
D1																					143.54
D1	24" RCP	24.0	69.6	0.013	0.005	136.35	136.00	(N/A)	(N/A)	1.551	17.326	5.256	8.22	8.22	16.00	2.62	5.19	1.17	139.25	139.20	143.54
D0																					139.17
A10	18" RCP	18.0	55.9	0.013	0.005	139.24	138.96	0.300	6.140	1.842	18.000	5.128	9.52	9.52	7.42	5.39	2.25	3.45	140.81	140.73	142.98
A2																					143.91
A3A	12" RCP	12.0	20.1	0.013	0.097	141.00	139.05	0.900	0.070	0.063	5.000	7.700	0.49	0.49	11.08	7.07	4.00	2.61	141.31	141.29	146.00
A3																					142.66
A4A	12" PVC	12.0	20.1	0.013	0.041	141.00	140.17	0.900	0.130	0.117	5.000	7.700	0.91	0.91	7.25	6.29	4.00	1.84	141.42	141.40	146.00
A4																					143.01
A5A	12" PVC	12.0	20.1	0.013	0.030	141.00	140.40	0.900	0.120	0.108	5.000	7.700	0.84	0.84	6.15	5.48	4.00	1.93	141.41	141.38	146.00
A5																					143.33
A6A	12" PVC	12.0	20.1	0.013	0.018	141.00	140.63	0.900	0.120	0.108	5.000	7.700	0.84	0.84	4.85	4.62	4.00	1.94	141.41	141.38	146.00
A6																					143.57
A7A	12" PVC	12.0	20.1	0.013	0.007	141.00	140.86	0.900	0.120	0.108	5.000	7.700	0.84	0.84	3.01	3.28	4.00	1.97	141.41	141.38	146.00
A7																					143.83
A8A	12" PVC	12.0	20.1	0.013	0.008	141.00	140.83	0.900	0.080	0.072	5.000	7.700	0.56	0.56	3.25	3.09	4.00	2.23	141.33	141.31	146.00
A8																					144.06
A8	15" RCP	15.0	45.5	0.013	0.005	140.83	140.61	(N/A)	(N/A)	0.072	5.108	7.678	0.56	0.56	4.56	2.52	1.98	1.97	141.24	141.21	144.06
A7																					143.83
A7	15" RCP	15.0	45.5	0.013	0.005	140.61	140.38	(N/A)	(N/A)	0.180	5.409	7.618	1.38	1.38	4.57	3.26	1.97	1.94	141.20	141.09	143.83
A6																					143.57
A6	15" RCP	15.0	45.5	0.013	0.005	140.38	140.15	(N/A)	(N/A)	0.288	5.641	7.572	2.20	2.20	4.56	3.69	1.94	1.93	141.06	140.99	143.57
A5																					143.33
A5	18" RCP	18.0	46.6	0.013	0.005	139.90	139.67	(N/A)	(N/A)	0.396	5.847	7.531	3.01	3.01	7.43	3.98	1.93	1.84	140.73	140.58	143.33
A4																					143.01
A4	18" RCP	18.0	42.8	0.013	0.005	139.67	139.45	(N/A)	(N/A)	0.513	6.042	7.492	3.87	3.87	7.43	4.25	1.84	1.71	140.55	140.44	143.01
A3																					142.66
A3	24" RCP	24.0	79.1	0.013	0.005	138.95	138.56	0.350	0.530	0.762	6.210	7.459	5.73	5.73	15.99	4.67	1.71	3.35	140.08	139.88	142.66
A2																					143.91
B3	4" PVC	4.0	103.1	0.013	0.007	142.00	141.23	0.900	0.014	0.013	5.000	7.700	0.10	0.10	0.16	1.97	3.48	3.74	142.19	142.19	145.82
B2																					145.30
B2A	12" RCP	6.0	36.2	0.013	0.010	142.00	141.64	0.900	0.018	0.016	5.000	7.700	0.12	0.12	0.56	2.30	3.41	3.16	142.19	142.18	145.91
B2																					145.30
B2	6" PVC	6.0	59.4	0.013	0.007	141.06	140.62	(N/A)	(N/A)	0.029	5.872	7.526	0.22	0.22	0.49	2.40	3.74	4.12	141.35	141.30	145.30
B1																					145.24

### Conduit FlexTable: Hydraulic Report

-Node- Upstream Downstream	Notes	Diameter (in)	Length (Unified) (ft)	Manning's n	Slope (Calculated) (ft/ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Upstream Inlet C	Upstream Inlet Area (acres)	System CA (acres)	System Flow Time (min)	System Intensity (in/h)	System Rational Flow (cfs)	Flow (cfs)	Capacity (Design) (cfs)	Velocity (ft/s)	Cover (Start) (ft)	Cover (Stop) (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (In) (ft)	-Ground- Upstream Downstream (ft)
B1A	6" PVC	6.0	36.2	0.013	0.015	141.00	140.46	0.900	0.006	0.005	5.000	7.700	0.04	0.04	0.69	1.90	4.41	4.28	141.10	141.10	145.91
B1																					145.24
B1	15" RCP	15.0	61.9	0.013	0.005	139.52	139.21	(N/A)	(N/A)	0.034	6.284	7.444	0.25	0.25	4.56	2.00	4.47	3.45	140.70	139.88	145.24
A2																					143.91
A2	24" RCP	24.0	52.4	0.013	0.005	138.46	138.20	(N/A)	(N/A)	2.637	18.173	5.095	13.54	13.54	16.00	5.71	3.45	2.18	139.88	139.88	143.91
A1																					142.38
A1	24" RCP	24.0	19.4	0.013	0.005	138.10	138.00	0.900	0.340	2.943	18.326	5.066	15.03	15.03	15.97	5.78	2.28	-0.83	139.64	139.64	142.38
A0																					139.17