DRAINAGE REPORT

135, 139 & 149R Howard Street
(Map 10 / Lots 75, 76, & 77)
Reading, Massachusetts

CIVIL DESIGN
Consultants, Inc.
Survey - Design - Permitting - Construction Administration
30 River Street
Methuen, MA 01844-3032
Tel: (978) 416-0920
Fax: (978) 416-7865

APPLICANT:

Infrastructure Holdings, LLC
122 Boston Road
Billerica, MA 01862

SUBMITTED TO:

Town of Reading
Town Hall
16 Lowell Street
Reading, MA 01867

ISSUED:

December 21, 2018
Revised: November 8, 2019

CDCI FILE #: 18-10120

DRAINAGE REPORT

TAB 1

DRAINAGE REPORT

135, 139 & 149R Howard Street
Reading, Massachusetts

PROJECT DESCRIPTION

The applicant proposes to develop 135, 139 & 149R Howard Street in Reading, MA into a six (6) lot single family residential subdivision. The parcels total 4.1-AC± of land and contains two (2) existing single family residences. The project consists of construction of a new 346-FT roadway along with associated infrastructure including driveways, landscaping, drainage facilities, and utilities. Project plans entitled *Definitive Subdivision Plans for 135, 139 & 149R Howard Street*, revised November 8, 2019, have been prepared by this office and provided for your review. These plans illustrate the proposal in detail including zoning, easements, construction details, roadway profile and provisions for utilities. Drainage will be collected and routed through a series of best management practices sized to address the MADEP Stormwater Management Standards as well as the local stormwater regulations.

SITE DESCRIPTION

The total lot area of the project site is approximately 4.1-AC and provides 247-FT of frontage on Howard Street. On-site resource areas consist of bordering vegetated wetland, a locally jurisdictional isolated vegetated wetland a 100-FT Wetland Buffer, the local 25-FT Zone of Natural Vegetation, and the 35-FT No Foundation Zone. Elevations range from a high of approximately 167-FT adjacent to the existing dwellings, #139 & # 139, to a low of approximately 156-FT at the wetlands in the northern portion of the site. The bordering vegetated wetlands drain through a culvert to the north. The wetland resource areas have been delineated by Norse Environmental and have been reviewed by the Town of Reading Conservation Commission and Horsley Witten Group through the Notice of Intent.

According to the Natural Resource Conservation Service Soil Survey for Middlesex County, Massachusetts soils beyond the limit of the wetlands consist of Haven-Urban Land Complex (Hydrologic Soils Group (HSG) A) and Paxton-Urban Land Complex (HSG-C). Test pits were conducted by Norse Environmental Services, Inc. in October of 2018 to determine soil texture and estimated seasonal high groundwater elevations. Test pit logs are provided under Tab 5 of this report. Finally, according to the Flood Insurance Rate Map for Essex County, Massachusetts Panel 313 of 656 (25017C0313E), no part of this site is located within the 100-year base flood elevation.

SURFACE DRAINAGE

Pre-Development Condition

The pre-development condition consists of three (3) watershed areas contributing to a three (3) design points. Design Point #1 (DP-1) receives runoff from drainage area EWA-1 and consists of overland flow to the wetlands located in the northern portion of the site. Design Point #2 (DP-2) receives runoff from EWA-2 and consists of overland flow offsite to the northeast. Design Point #3 (DP-3) receives runoff from EWA-3 and consists of overland flow offsite towards Howard Street to the southeast. Contributing areas to the Design Points are detailed in the following Table 1.

TABLE 1: EXISTING WATERSHED DESIGN POINT DETAILS

DESIGN POINT	AREA NAME	AREA (Acres)	Tc (min.)	CN
DP-1	EWA-1	2.80	20.7	43
DP-2	EWA-2	1.34	20.9	33
DP-3	EWA-3	0.22	9.9	49

Post-Development Condition

The proposed project includes six (6) single family residences. Other components include construction of a new 346-FT roadway along with associated infrastructure. Associated infrastructure includes landscaping, drainage facilities and utilities. Drainage will be collected and routed through a series of best management practices sized to address the MADEP Stormwater Management Standards as well as the local stormwater regulations. Impervious area will include the roadway, driveways and roof tops and totals approximately 0.76-AC.

The proposed construction results in three (3) individual sub-watersheds discharging to DP-1. DP-1 receives flow from infiltration basin 1 (PWA-1A), infiltration basin 2 (PWA-1B), as well as overland flow from PWA-1C. Infiltration basin 1 receives runoff from offsite impervious areas, grass, and woodland. Since no new impervious area is discharging to infiltration basin 1, no forebay or storage is proposed. Additionally, infiltration basin 1 has been designed to ensure that water will not encroach on to the abutting property at 149 Howard Street. PWA-2 discharges to DP-2 and is smaller in area than EWA-2 due to re-directing flows with the construction of a new dwelling and driveway. DP-3 contains three (3) sub-watersheds, PWA-3A, PWA-3B, and PWA-3C. PWA-3A and PWA-3A discharge to infiltration basins 3 and 4, respectively, which overflow into the existing manhole in Howard Street. PWA-3C consists of overland flow to Howard Street. Individual roofs are being directed to roof drywells which store and infiltrate flow up to and including the 100-YR storm event, therefore the areas of the roofs have been subtracted from the subcatchment areas. Similarly, the driveway for Lot 4 is being treated and infiltrated through an infiltration trench and is not included in the subcatchment areas below. The design points are summarized in Table 2 below.

TABLE 2: PROPOSED WATERSHED DESIGN POINT DETAILS

DESIGN POINT	AREA NAME	AREA (Acres)	Tc (min.)	CN
DP-1	PWA-1A	1.31	13.3	54
	PWA-1B	0.90	9.8	66
	PWA-1C	0.70	14.0	36
DP-2	PWA-2	0.80	10.1	34
DP-3	PWA-3A	0.12	6.0	49
	PWA-3B	0.08	6.0	54
	PWA-3C	0.11	6.0	37

Peak Discharge Comparison

As illustrated in the following tables, the impact of the proposed improvements has been mitigated through the use of best management practices including swales, an infiltration trench, roof drywells, a sediment forebay, and infiltration basins for up to and including the 100-year, 24-hour storm event.

Design Point #1

Peak Flow:

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	100-YR (6.5-IN)
	CFS	CFS	CFS	CFS
Pre-Development	0.0	0.1	0.4	1.2
Post-Development	0.0	0.1	0.4	1.1

Peak Volume:

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	100-YR (6.5-IN)
	AC-FT	AC-FT	AC-FT	AC-FT
Pre-Development	0.003	0.053	0.103	0.202
Post-Development	0.000	0.011	0.058	0.157

Design Point #2

Peak Flow:

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	100-YR (6.5-IN)
	CFS	CFS	CFS	CFS
Pre-Development	0.0	0.0	0.0	0.1
Post-Development	0.0	0.0	0.0	0.1

Peak Volume:

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	100-YR (6.5-IN)
	AC-FT	AC-FT	AC-FT	AC-FT
Pre-Development	0.000	0.001	0.008	0.029
Post-Development	0.000	0.001	0.006	0.021

Design Point #3

Peak Flow:

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	100-YR (6.5-IN)
	CFS	CFS	CFS	CFS
Pre-Development	0.0	0.1	0.1	0.2
Post-Development	0.0	0.0	0.0	0.2

Peak Volume:

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	100-YR (6.5-IN)
	AC-FT	AC-FT	AC-FT	AC-FT
Pre-Development	0.002	0.008	0.014	0.024
Post-Development	0.000	0.001	0.002	0.008

METHODOLOGY

Drainage calculations were performed using the computer program HydroCAD by HydroCAD Software Solutions, LLC based upon Technical Release 20 (TR-20), developed by the NRCS, formerly the Soils Conservation Service. Drainage calculations were prepared for the 2-YR, 10-YR, 25-YR, and 100-YR Type III 24-hour storm events. Rainfall data corresponds with National Weather Service Technical Paper 40 (TP-40) used in Technical Release 55 (TR-55). Curve numbers were generated using the information provided in TR-55 and the SCS Soils Survey. The storm drain system is designed to convey the 25-Year storm event to the infiltration ponds using the Rational Method. Culvert Design was performed using Hydraflow Express Extension by Autodesk. Pipe Design Calculations are located under Tab 5.

TAB 2

CIVIL DESIGN
Consultants, Inc.
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LAND SURVEYING
30 River Street
Methuen, MA 01844
Tel: (978) 416-0920
Fax: (978) 416-7865

PROJECT:
SINGLE FAMILY RESIDENTIAL DEVELOPMENT
135, 139 & 149 HOWARD STREET
READING, MA 01867

PREPARED FOR:
INFRASTRUCTURE HOLDINGS, LLC
122 BOSTON ROAD
BILLERICA, MA 01862

FIGURE 1: ORTHO

PREPARED BY: WJH
SCALE: 1"=400'
CDCI FILE #: 18-10120
DATE: DECEMBER 4, 2018

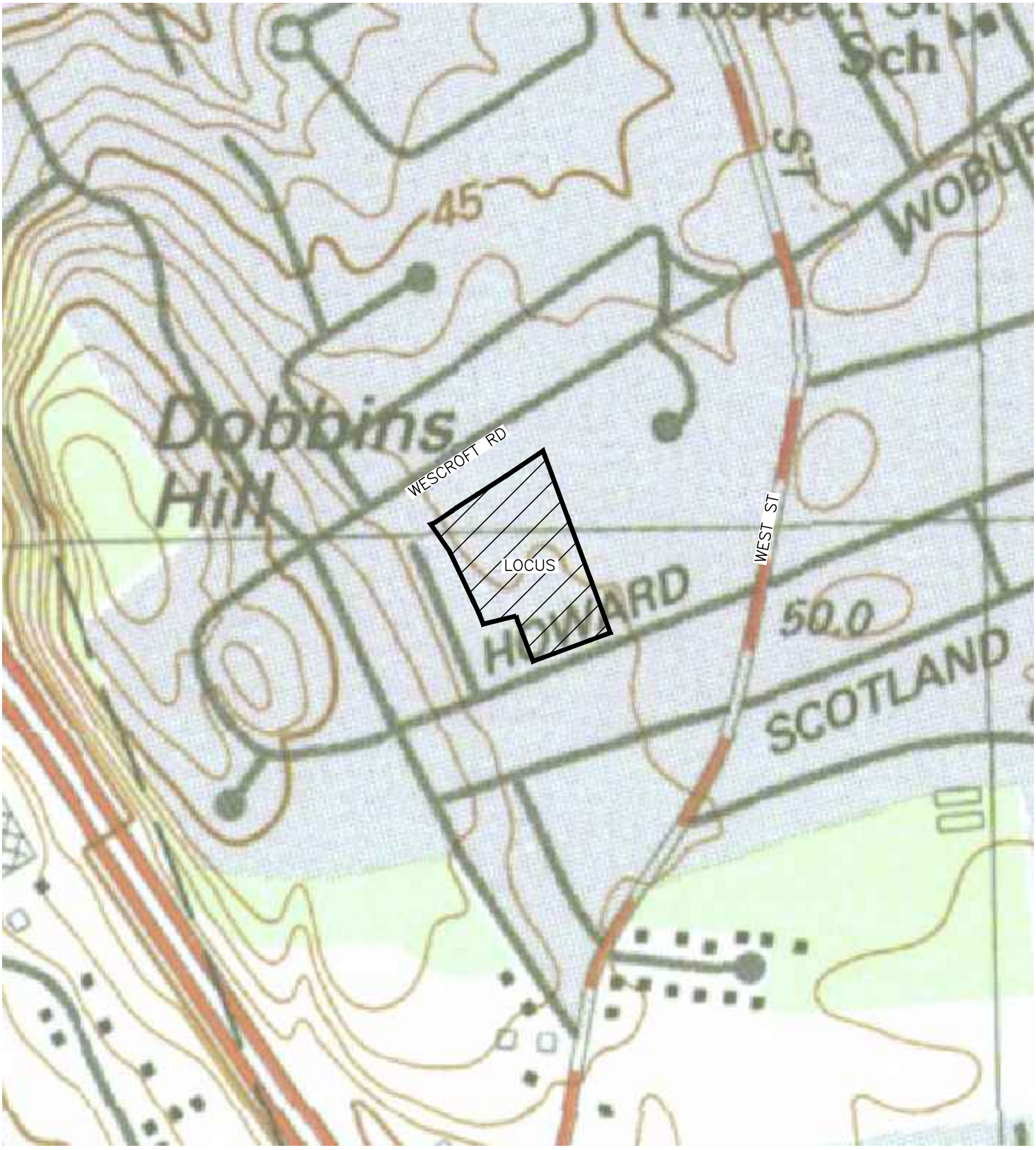

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FIGURE 2: USGS

PREPARED BY: WJH
SCALE: 1"=400'
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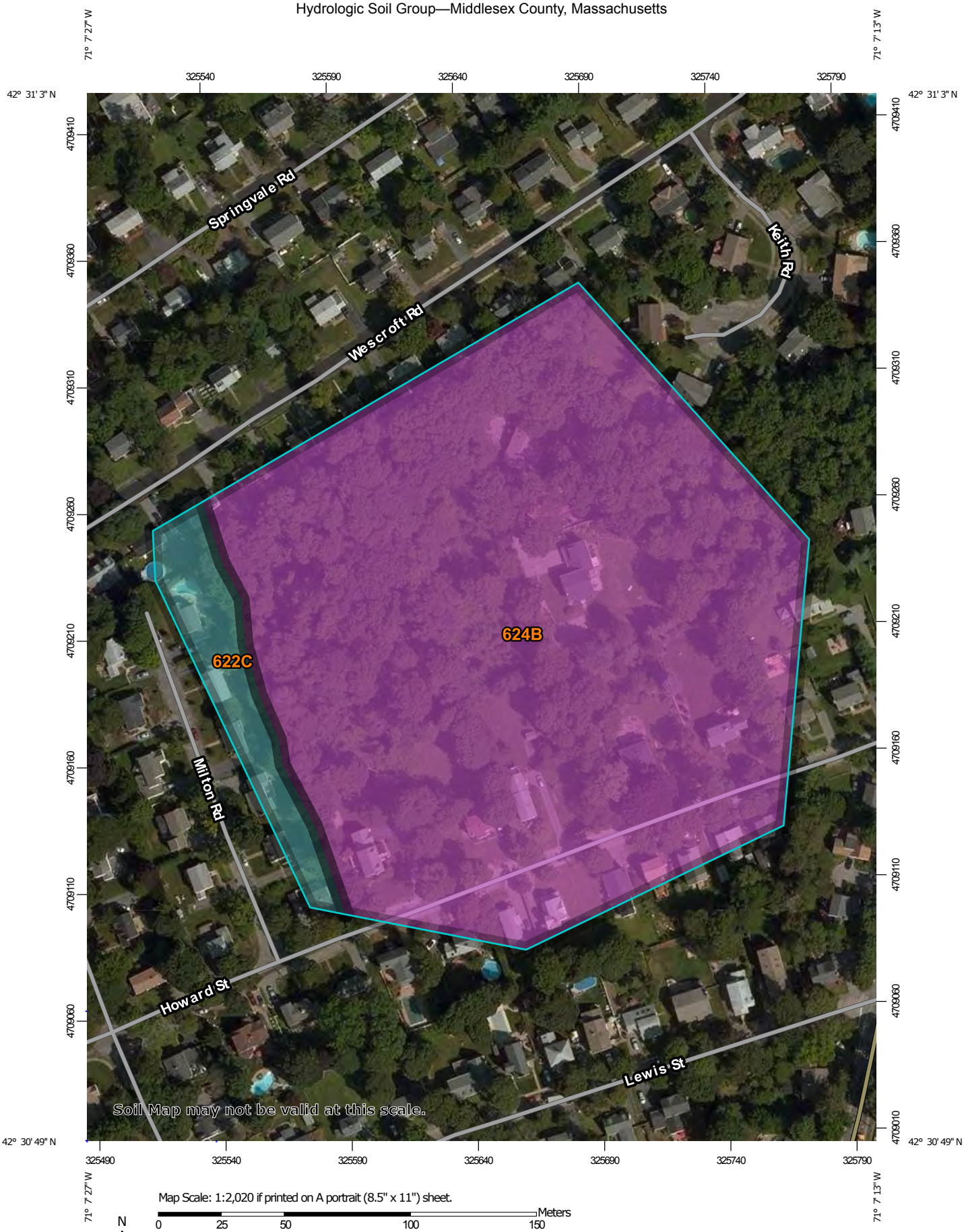
FIGURE 3:
FIRM

PREPARED BY: WJH
SCALE: 1"=400'
CDCI FILE #: 18-10120
DATE: DECEMBER 4, 2018



Map Scale: 1:2,020 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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: Middlesex County, Massachusetts
Survey Area Data: Version 18, Sep 7, 2018

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 2014

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

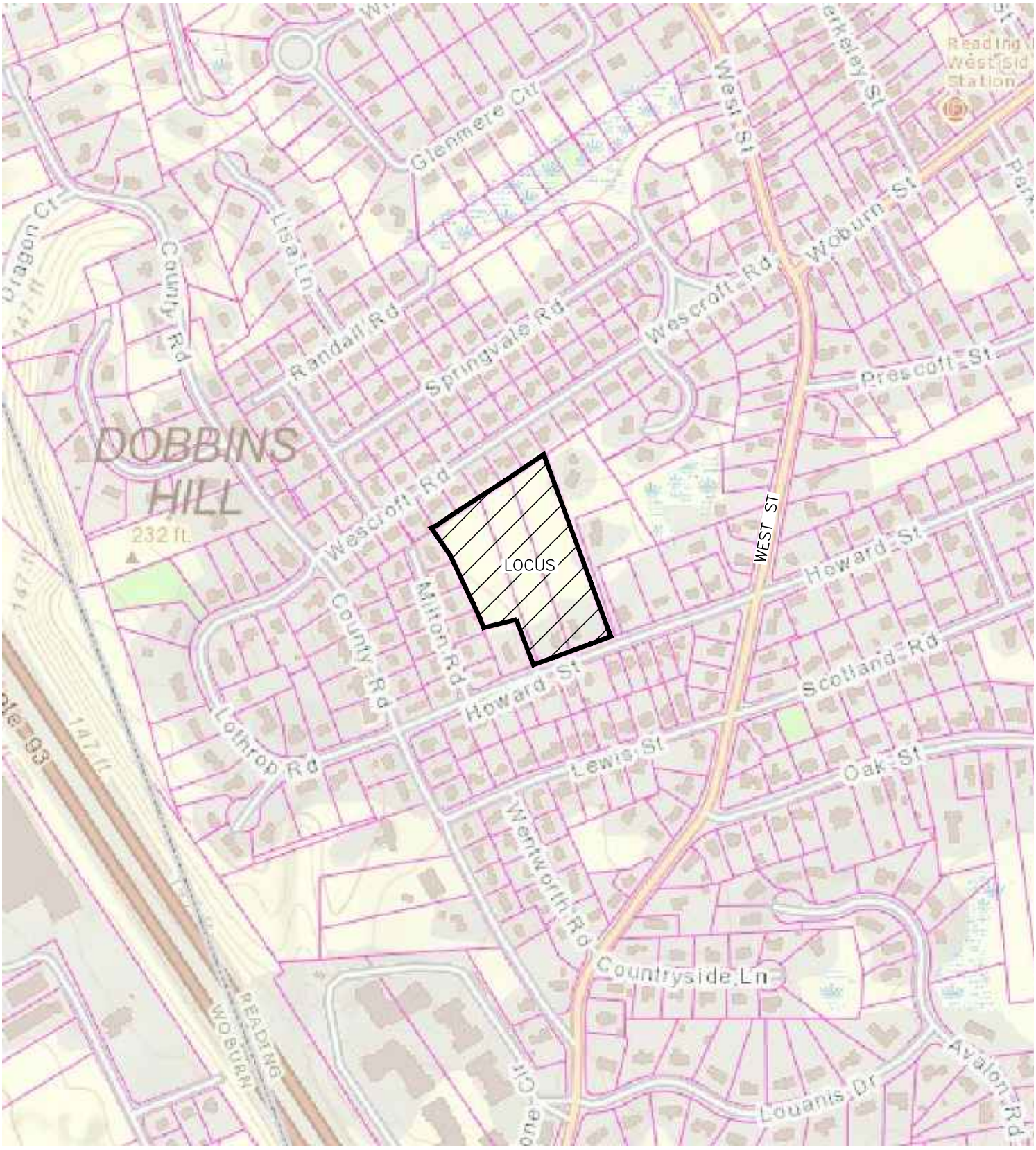


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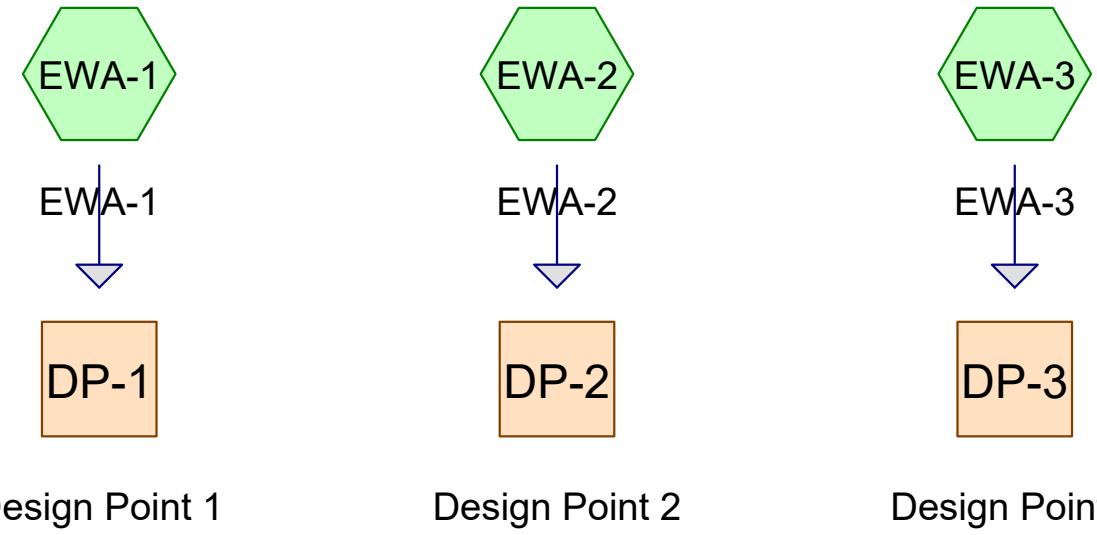
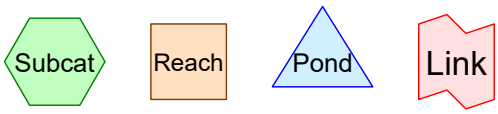
FIGURE 5: NHESP

PREPARED BY: WJH
SCALE: 1"=400'
CDCI FILE #: 18-10120
DATE: DECEMBER 4, 2018

TAB 3





Drainage Diagram for Pre-Development-112118
Prepared by HP Inc., Printed 11/8/2019

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.650	30	Woods, Good, HSG A (EWA-1, EWA-2, EWA-3)
1.050	39	>75% Grass cover, Good, HSG A (EWA-1, EWA-2, EWA-3)
0.130	70	Woods, Good, HSG C (EWA-1)
0.230	74	>75% Grass cover, Good, HSG C (EWA-1)
0.300	98	Paved parking, HSG A (EWA-1, EWA-2, EWA-3)
4.360	40	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
4.000	HSG A	EWA-1, EWA-2, EWA-3
0.000	HSG B	
0.360	HSG C	EWA-1
0.000	HSG D	
0.000	Other	
4.360		**TOTAL AREA**

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWA-1: EWA-1 Runoff Area=2.800 ac 7.86% Impervious Runoff Depth=0.01"
Flow Length=204' Tc=20.7 min CN=43 Runoff=0.0 cfs 0.003 af

Subcatchment EWA-2: EWA-2 Runoff Area=1.340 ac 2.99% Impervious Runoff Depth=0.00"
Flow Length=224' Tc=20.9 min CN=33 Runoff=0.0 cfs 0.000 af

Subcatchment EWA-3: EWA-3 Runoff Area=0.220 ac 18.18% Impervious Runoff Depth=0.09"
Flow Length=50' Slope=0.0350 '/' Tc=9.9 min CN=49 Runoff=0.0 cfs 0.002 af

Reach DP-1: Design Point 1 Inflow=0.0 cfs 0.003 af
Outflow=0.0 cfs 0.003 af

Reach DP-2: Design Point 2 Inflow=0.0 cfs 0.000 af
Outflow=0.0 cfs 0.000 af

Reach DP-3: Design Point 3 Inflow=0.0 cfs 0.002 af
Outflow=0.0 cfs 0.002 af

Total Runoff Area = 4.360 ac Runoff Volume = 0.005 af Average Runoff Depth = 0.01"
93.12% Pervious = 4.060 ac 6.88% Impervious = 0.300 ac

Summary for Subcatchment EWA-1: EWA-1

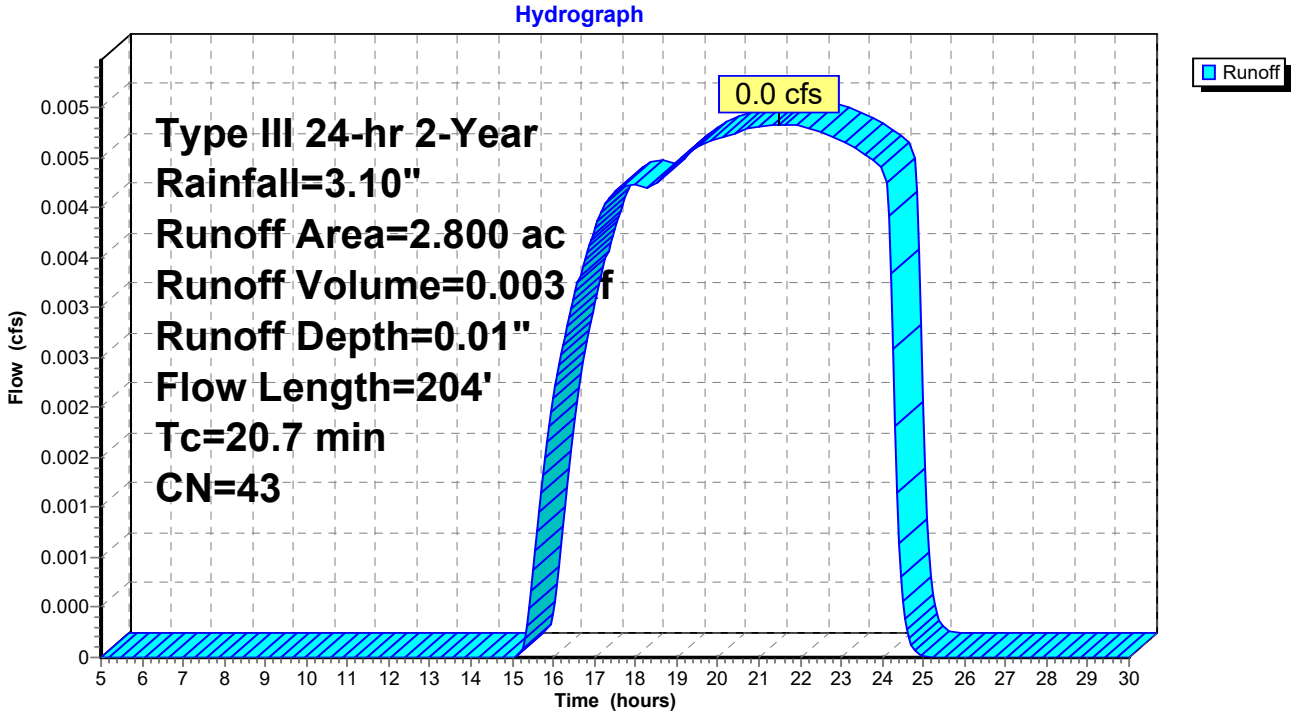
Runoff = 0.0 cfs @ 21.48 hrs, Volume= 0.003 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
1.540	30	Woods, Good, HSG A
0.130	70	Woods, Good, HSG C
0.680	39	>75% Grass cover, Good, HSG A
0.220	98	Paved parking, HSG A
0.230	74	>75% Grass cover, Good, HSG C
2.800	43	Weighted Average
2.580		92.14% Pervious Area
0.220		7.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
4.2	154	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
20.7	204	Total			

Subcatchment EWA-1: EWA-1



Summary for Subcatchment EWA-2: EWA-2

[45] Hint: Runoff=Zero

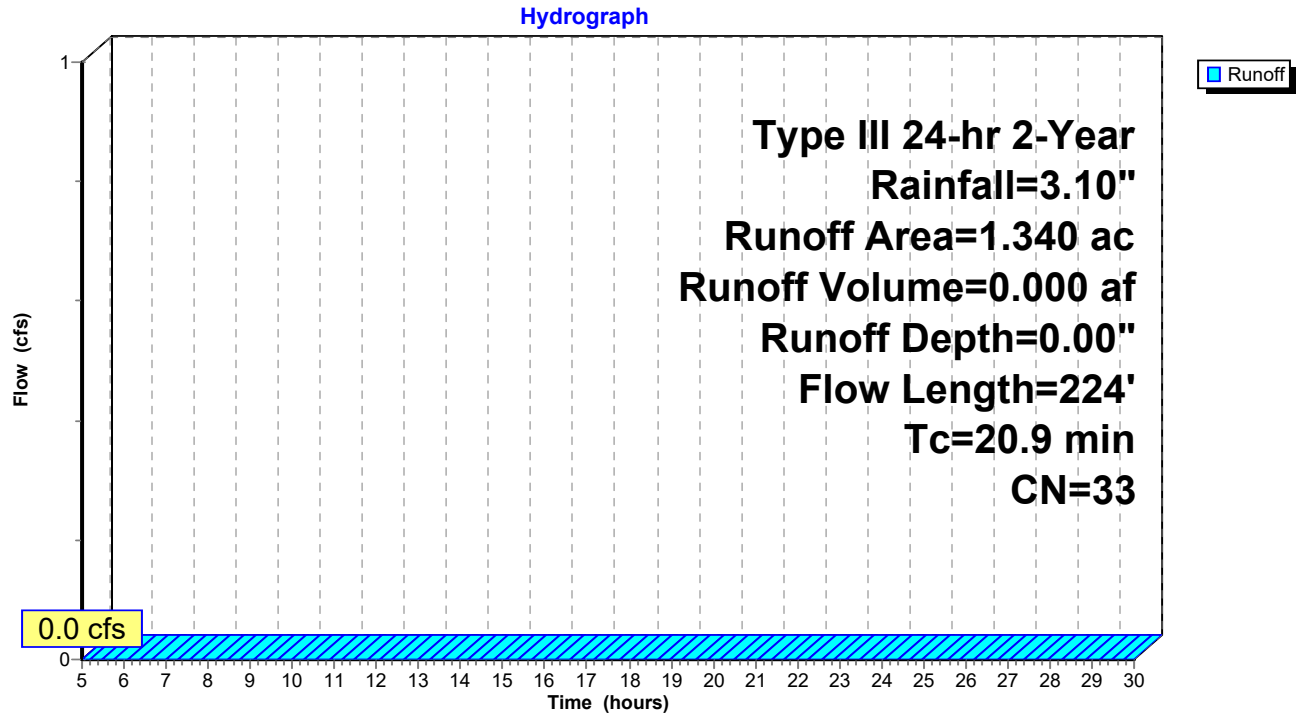
Runoff = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
1.090	30	Woods, Good, HSG A
0.210	39	>75% Grass cover, Good, HSG A
1.340	33	Weighted Average
1.300		97.01% Pervious Area
0.040		2.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
4.4	174	0.0170	0.65		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
20.9	224	Total			

Subcatchment EWA-2: EWA-2



Summary for Subcatchment EWA-3: EWA-3

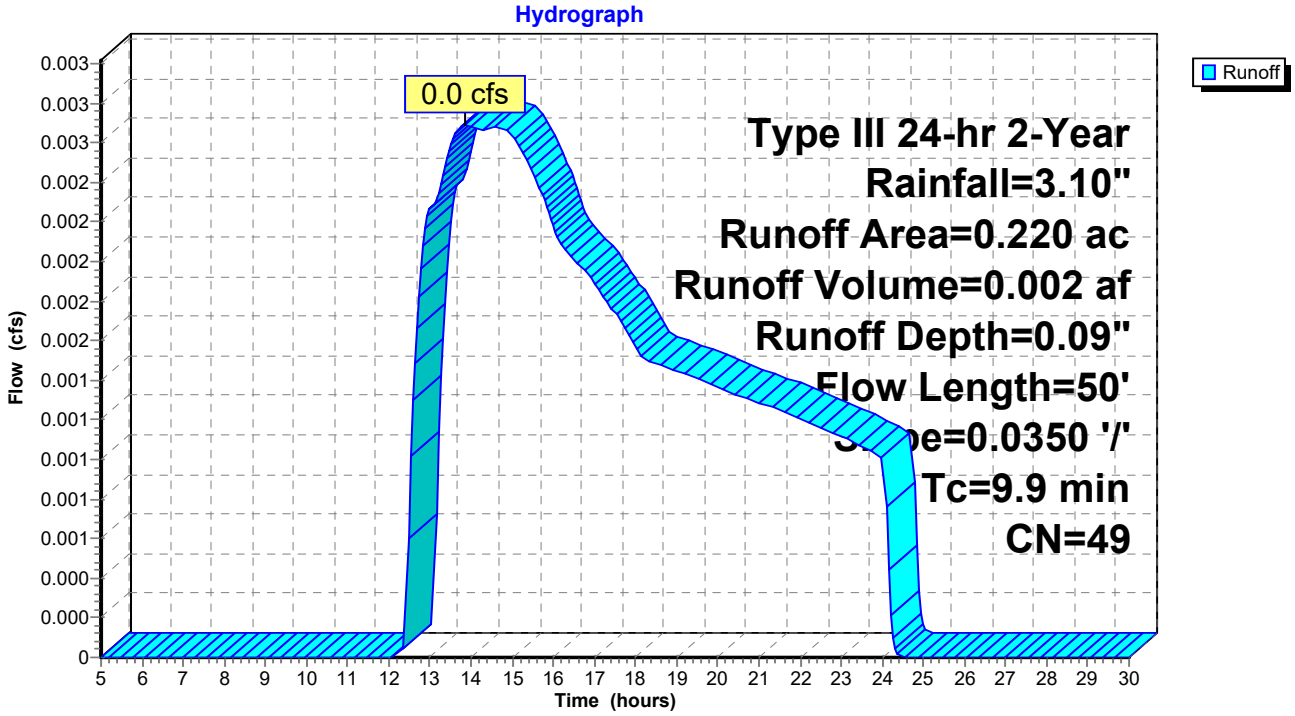
Runoff = 0.0 cfs @ 13.86 hrs, Volume= 0.002 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.160	39	>75% Grass cover, Good, HSG A
0.020	30	Woods, Good, HSG A
0.220	49	Weighted Average
0.180		81.82% Pervious Area
0.040		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	19	0.0350	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
6.8	31	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
9.9	50	Total			

Subcatchment EWA-3: EWA-3



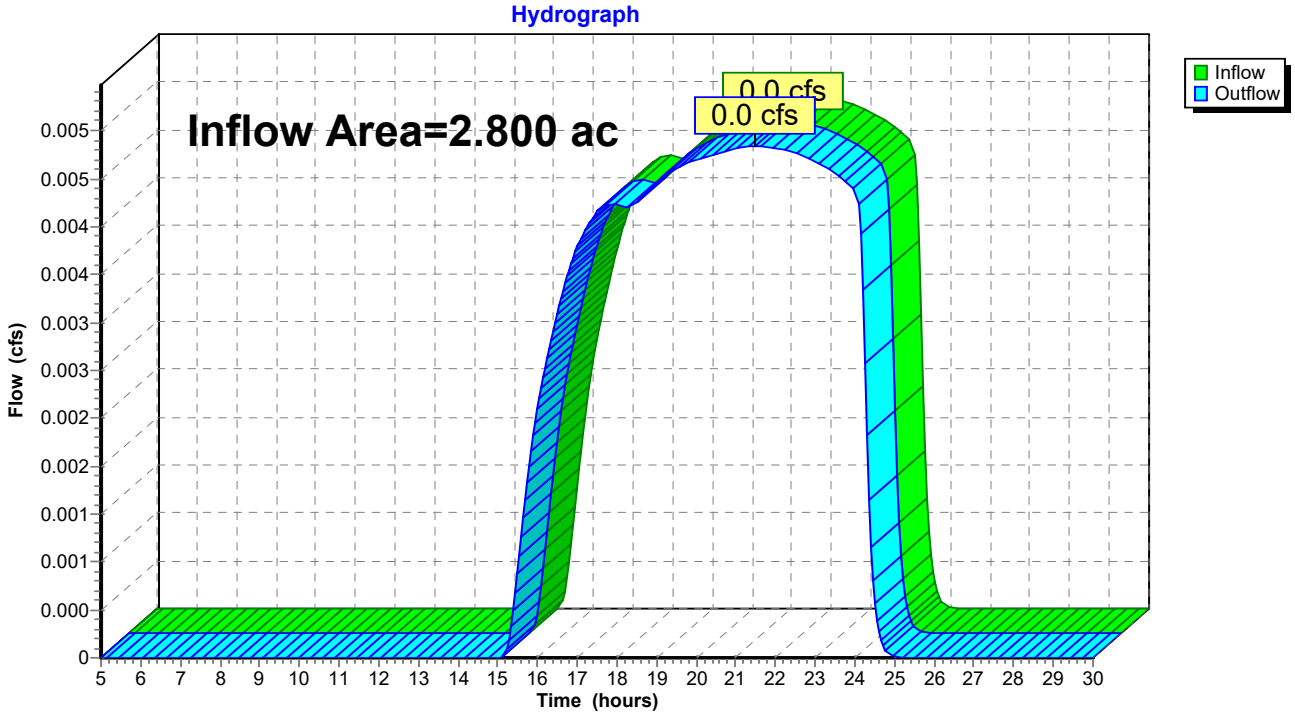
Summary for Reach DP-1: Design Point 1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.800 ac, 7.86% Impervious, Inflow Depth = 0.01" for 2-Year event
Inflow = 0.0 cfs @ 21.48 hrs, Volume= 0.003 af
Outflow = 0.0 cfs @ 21.48 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1



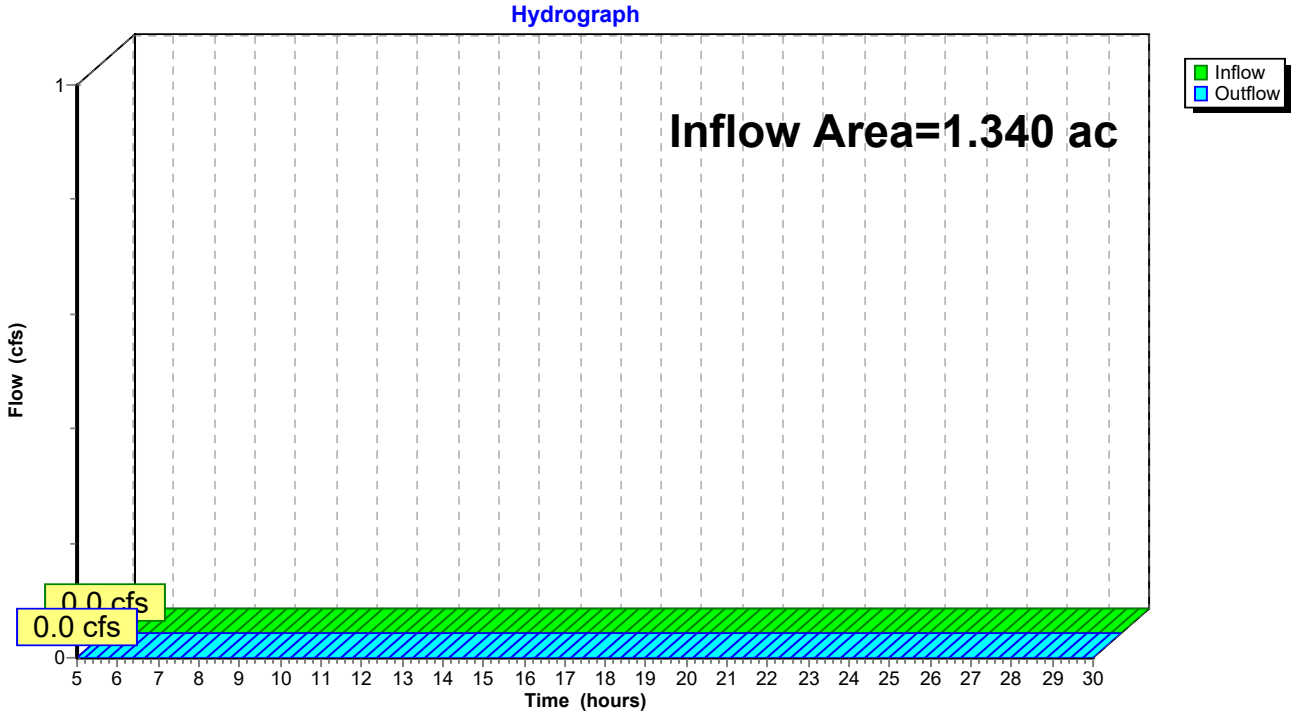
Summary for Reach DP-2: Design Point 2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.340 ac, 2.99% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2



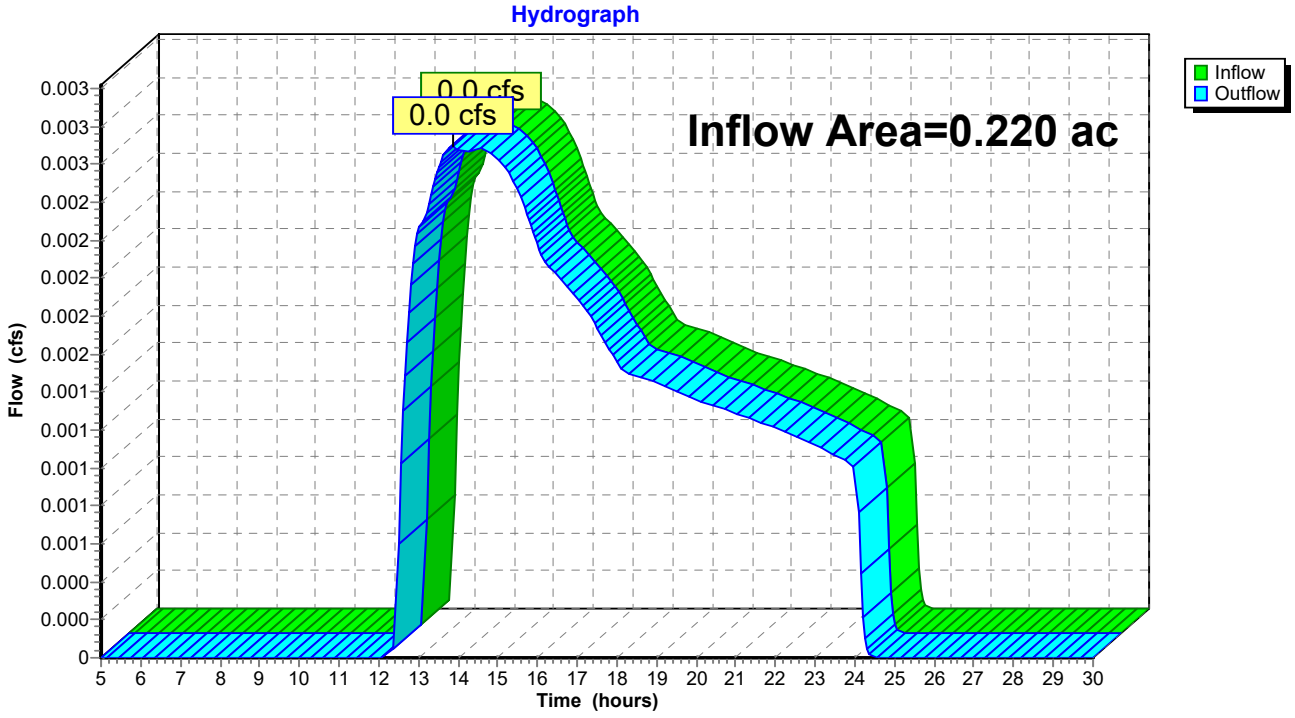
Summary for Reach DP-3: Design Point 3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.220 ac, 18.18% Impervious, Inflow Depth = 0.09" for 2-Year event
Inflow = 0.0 cfs @ 13.86 hrs, Volume= 0.002 af
Outflow = 0.0 cfs @ 13.86 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3



Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWA-1: EWA-1 Runoff Area=2.800 ac 7.86% Impervious Runoff Depth=0.23"
Flow Length=204' Tc=20.7 min CN=43 Runoff=0.1 cfs 0.053 af

Subcatchment EWA-2: EWA-2 Runoff Area=1.340 ac 2.99% Impervious Runoff Depth=0.01"
Flow Length=224' Tc=20.9 min CN=33 Runoff=0.0 cfs 0.001 af

Subcatchment EWA-3: EWA-3 Runoff Area=0.220 ac 18.18% Impervious Runoff Depth=0.46"
Flow Length=50' Slope=0.0350 '/' Tc=9.9 min CN=49 Runoff=0.0 cfs 0.008 af

Reach DP-1: Design Point 1 Inflow=0.1 cfs 0.053 af
Outflow=0.1 cfs 0.053 af

Reach DP-2: Design Point 2 Inflow=0.0 cfs 0.001 af
Outflow=0.0 cfs 0.001 af

Reach DP-3: Design Point 3 Inflow=0.0 cfs 0.008 af
Outflow=0.0 cfs 0.008 af

Total Runoff Area = 4.360 ac Runoff Volume = 0.062 af Average Runoff Depth = 0.17"
93.12% Pervious = 4.060 ac 6.88% Impervious = 0.300 ac

Summary for Subcatchment EWA-1: EWA-1

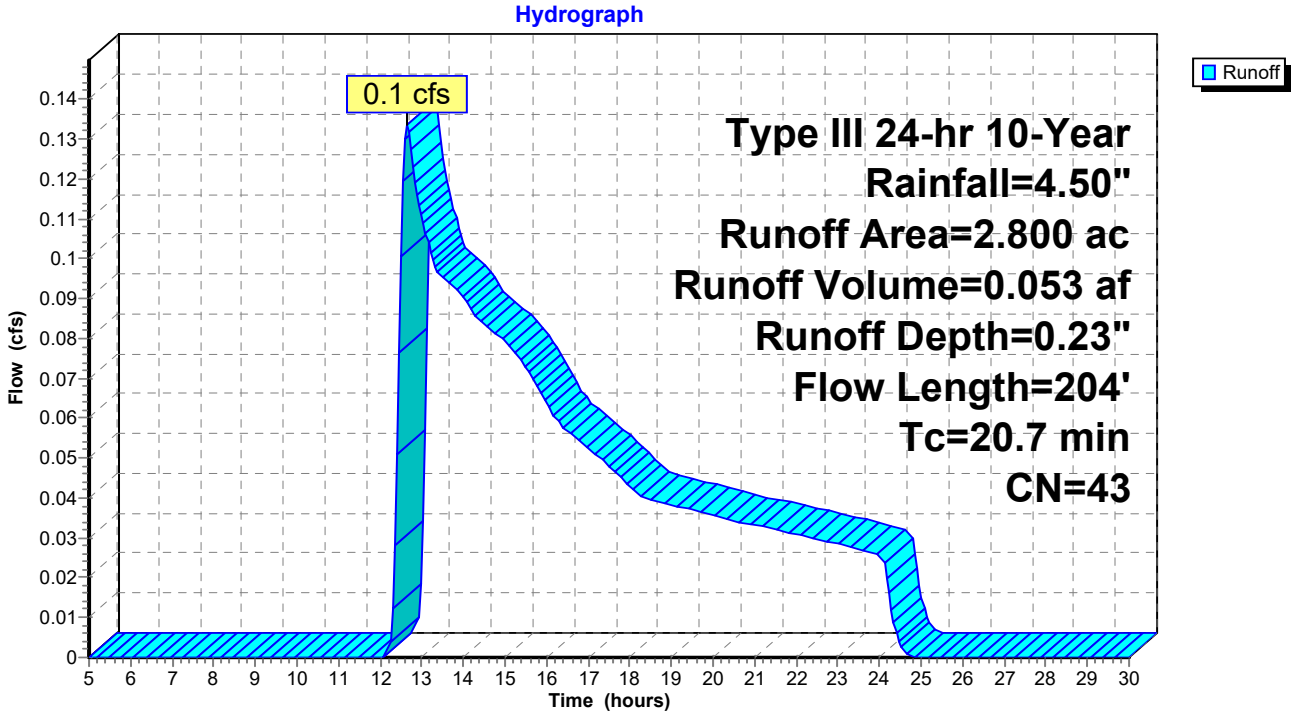
Runoff = 0.1 cfs @ 12.66 hrs, Volume= 0.053 af, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
1.540	30	Woods, Good, HSG A
0.130	70	Woods, Good, HSG C
0.680	39	>75% Grass cover, Good, HSG A
0.220	98	Paved parking, HSG A
0.230	74	>75% Grass cover, Good, HSG C
2.800	43	Weighted Average
2.580		92.14% Pervious Area
0.220		7.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
4.2	154	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
20.7	204	Total			

Subcatchment EWA-1: EWA-1



Summary for Subcatchment EWA-2: EWA-2

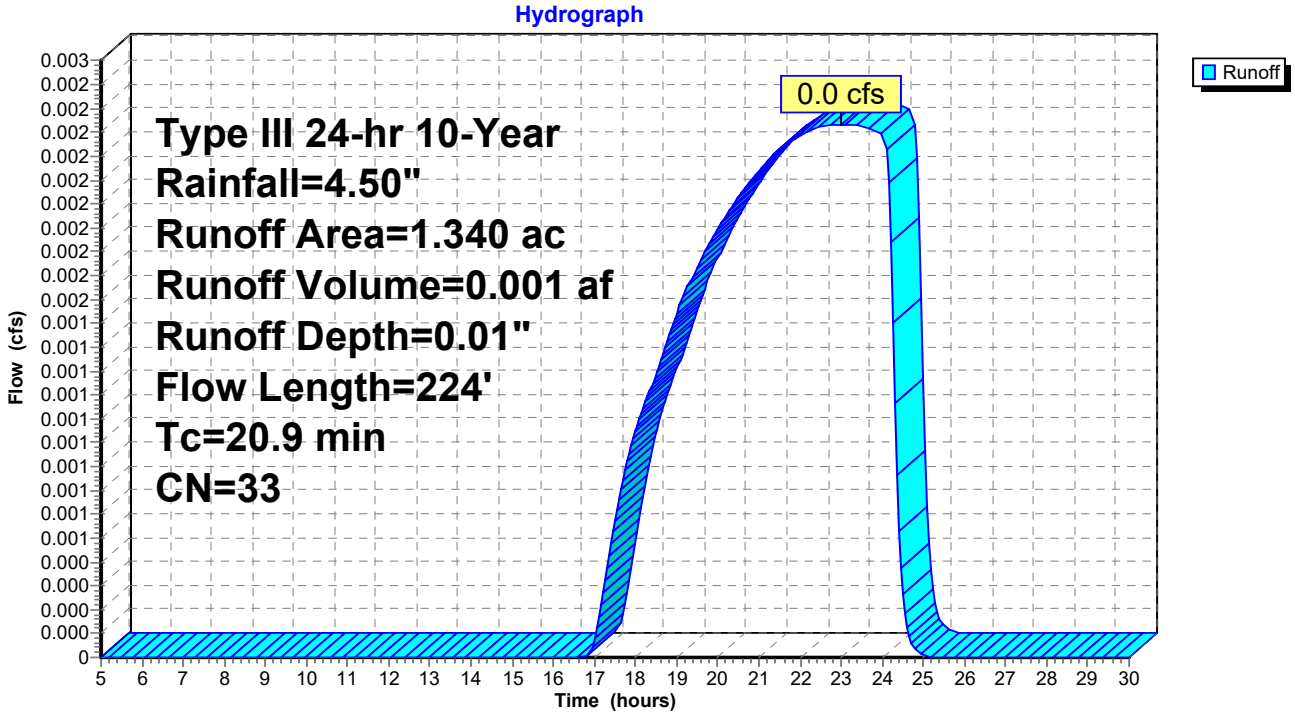
Runoff = 0.0 cfs @ 23.02 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
1.090	30	Woods, Good, HSG A
0.210	39	>75% Grass cover, Good, HSG A
1.340	33	Weighted Average
1.300		97.01% Pervious Area
0.040		2.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
4.4	174	0.0170	0.65		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
20.9	224	Total			

Subcatchment EWA-2: EWA-2



Summary for Subcatchment EWA-3: EWA-3

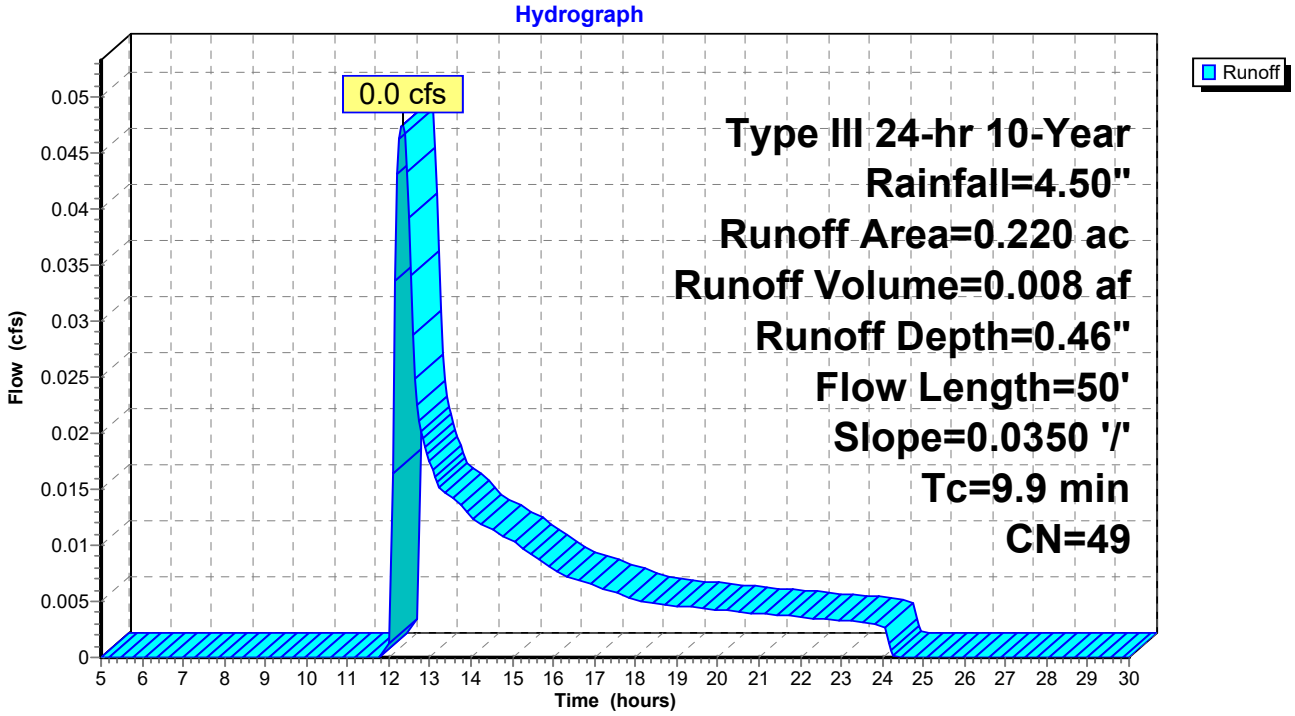
Runoff = 0.0 cfs @ 12.33 hrs, Volume= 0.008 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.160	39	>75% Grass cover, Good, HSG A
0.020	30	Woods, Good, HSG A
0.220	49	Weighted Average
0.180		81.82% Pervious Area
0.040		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	19	0.0350	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
6.8	31	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
9.9	50	Total			

Subcatchment EWA-3: EWA-3



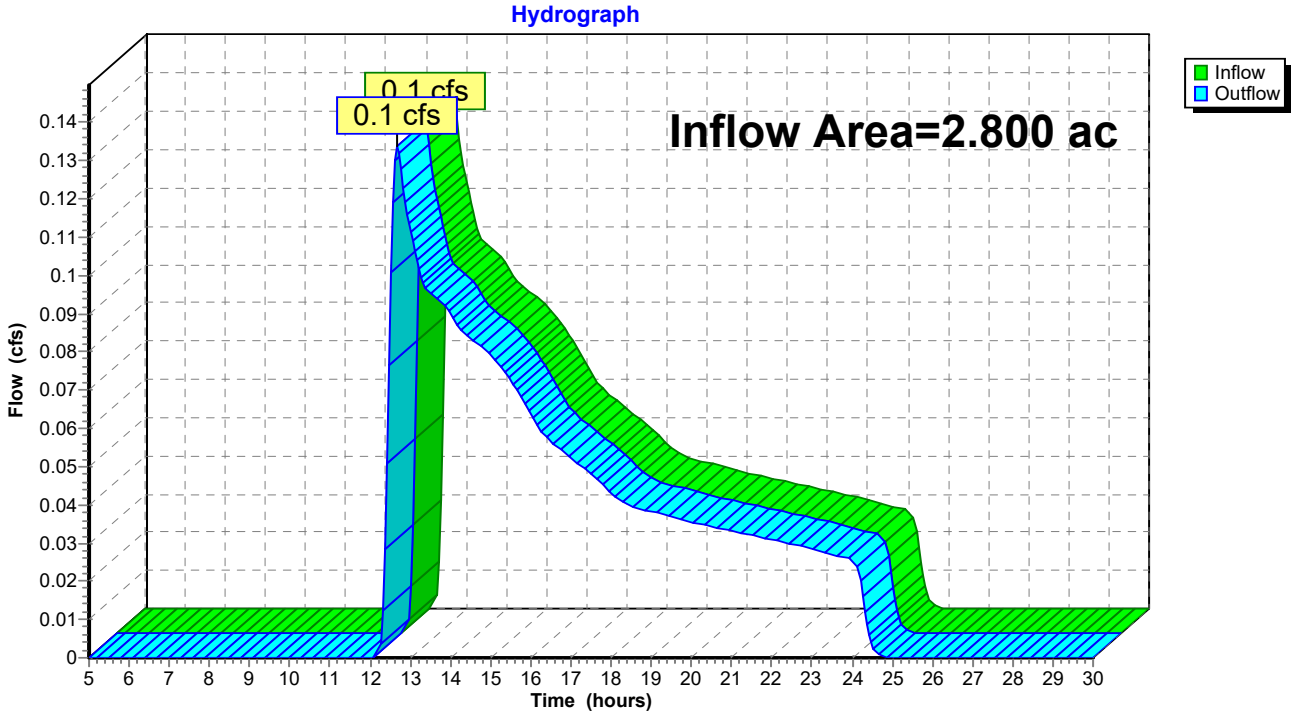
Summary for Reach DP-1: Design Point 1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.800 ac, 7.86% Impervious, Inflow Depth = 0.23" for 10-Year event
Inflow = 0.1 cfs @ 12.66 hrs, Volume= 0.053 af
Outflow = 0.1 cfs @ 12.66 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1



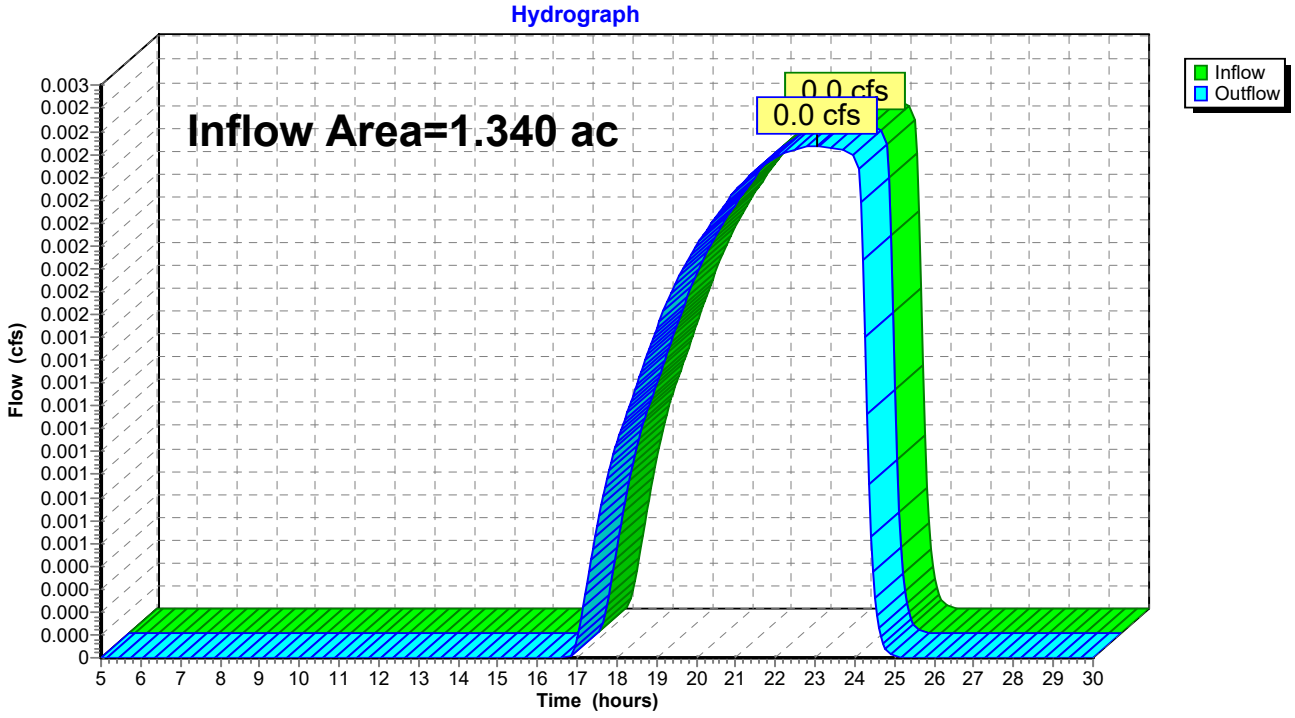
Summary for Reach DP-2: Design Point 2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.340 ac, 2.99% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.0 cfs @ 23.02 hrs, Volume= 0.001 af
Outflow = 0.0 cfs @ 23.02 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2



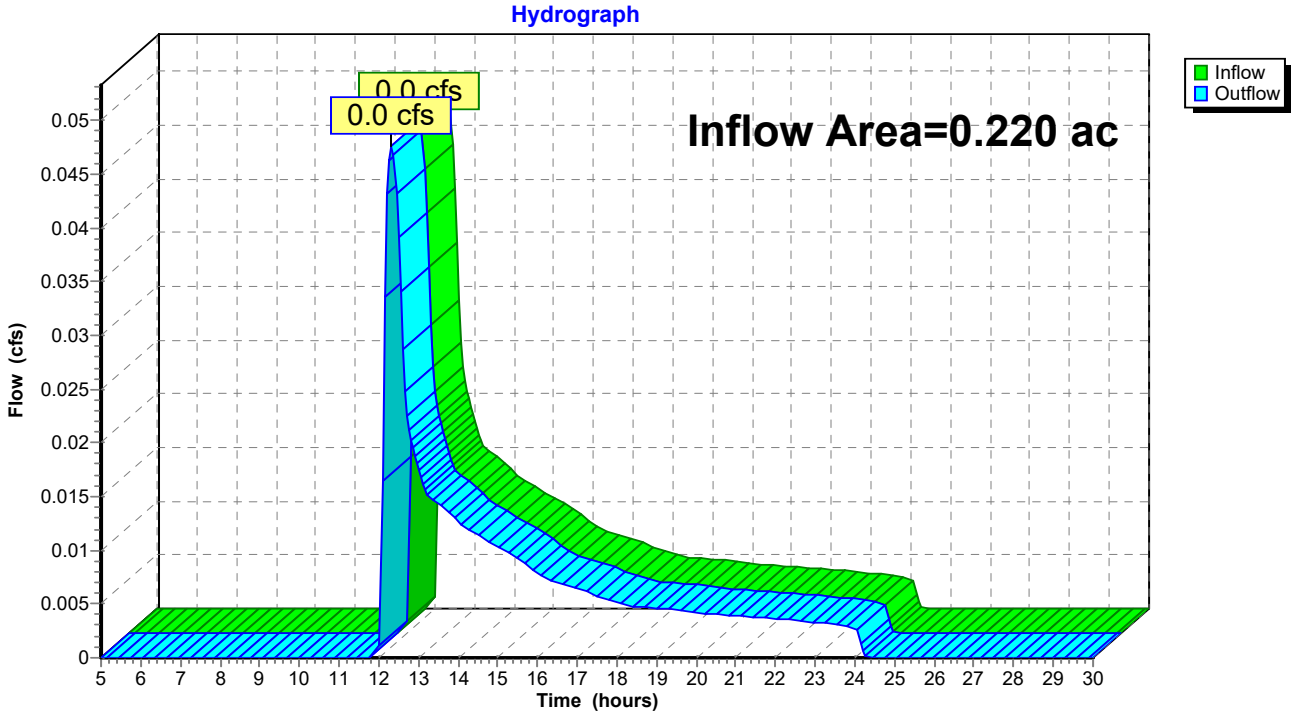
Summary for Reach DP-3: Design Point 3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.220 ac, 18.18% Impervious, Inflow Depth = 0.46" for 10-Year event
Inflow = 0.0 cfs @ 12.33 hrs, Volume= 0.008 af
Outflow = 0.0 cfs @ 12.33 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3



Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWA-1: EWA-1 Runoff Area=2.800 ac 7.86% Impervious Runoff Depth=0.44"
Flow Length=204' Tc=20.7 min CN=43 Runoff=0.4 cfs 0.103 af

Subcatchment EWA-2: EWA-2 Runoff Area=1.340 ac 2.99% Impervious Runoff Depth=0.07"
Flow Length=224' Tc=20.9 min CN=33 Runoff=0.0 cfs 0.008 af

Subcatchment EWA-3: EWA-3 Runoff Area=0.220 ac 18.18% Impervious Runoff Depth=0.76"
Flow Length=50' Slope=0.0350 '/' Tc=9.9 min CN=49 Runoff=0.1 cfs 0.014 af

Reach DP-1: Design Point 1 Inflow=0.4 cfs 0.103 af
Outflow=0.4 cfs 0.103 af

Reach DP-2: Design Point 2 Inflow=0.0 cfs 0.008 af
Outflow=0.0 cfs 0.008 af

Reach DP-3: Design Point 3 Inflow=0.1 cfs 0.014 af
Outflow=0.1 cfs 0.014 af

Total Runoff Area = 4.360 ac Runoff Volume = 0.125 af Average Runoff Depth = 0.34"
93.12% Pervious = 4.060 ac 6.88% Impervious = 0.300 ac

Summary for Subcatchment EWA-1: EWA-1

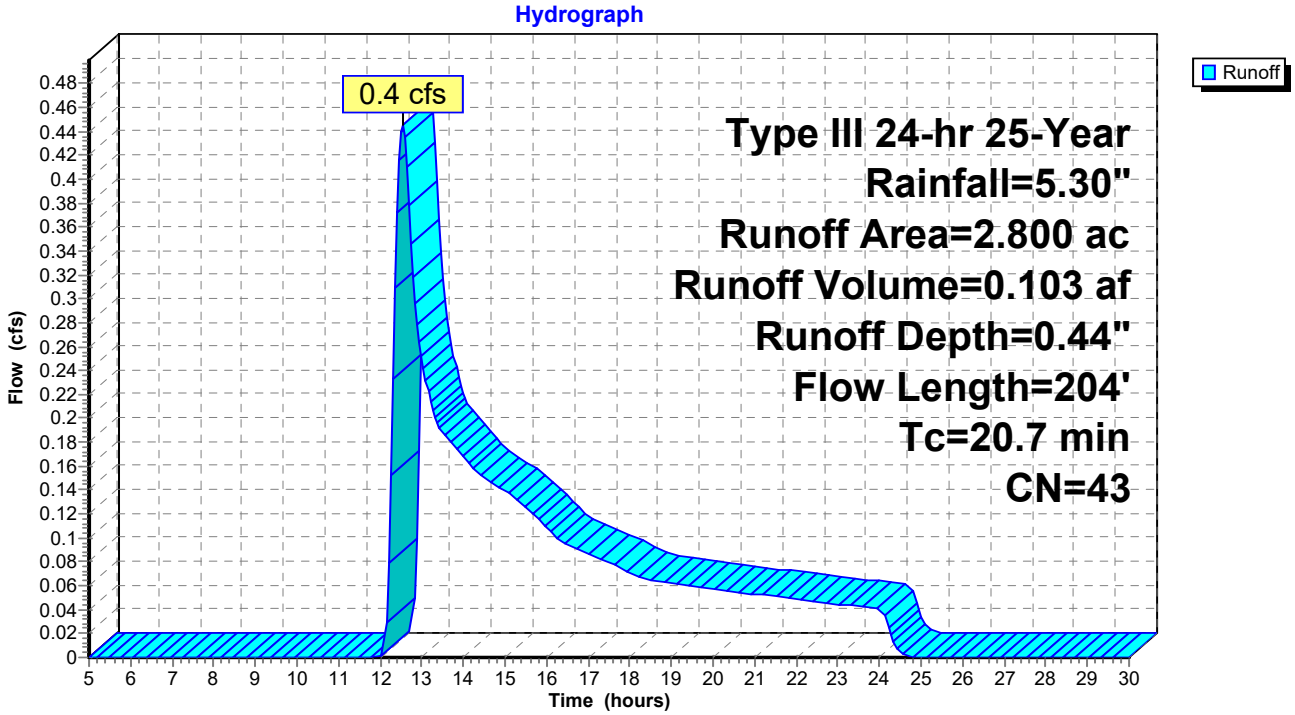
Runoff = 0.4 cfs @ 12.54 hrs, Volume= 0.103 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
1.540	30	Woods, Good, HSG A
0.130	70	Woods, Good, HSG C
0.680	39	>75% Grass cover, Good, HSG A
0.220	98	Paved parking, HSG A
0.230	74	>75% Grass cover, Good, HSG C
2.800	43	Weighted Average
2.580		92.14% Pervious Area
0.220		7.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
4.2	154	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
20.7	204	Total			

Subcatchment EWA-1: EWA-1



Summary for Subcatchment EWA-2: EWA-2

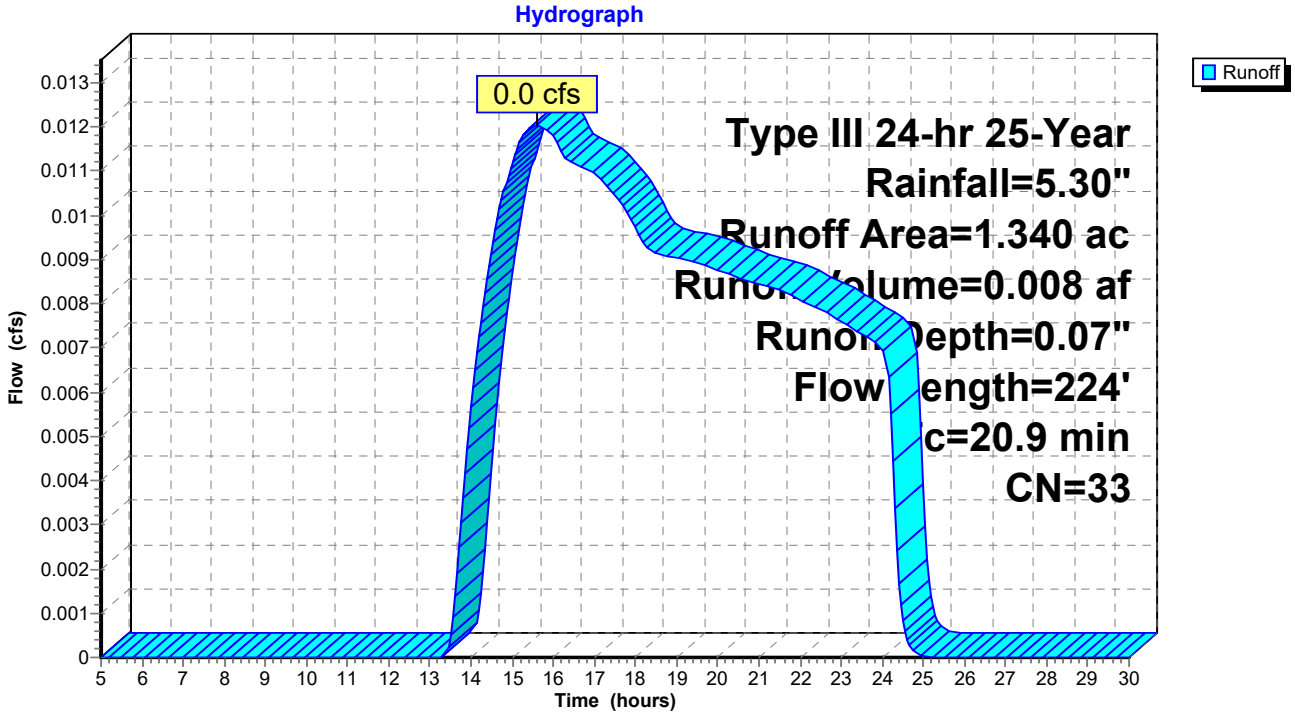
Runoff = 0.0 cfs @ 15.61 hrs, Volume= 0.008 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
1.090	30	Woods, Good, HSG A
0.210	39	>75% Grass cover, Good, HSG A
1.340	33	Weighted Average
1.300		97.01% Pervious Area
0.040		2.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
4.4	174	0.0170	0.65		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
20.9	224	Total			

Subcatchment EWA-2: EWA-2



Summary for Subcatchment EWA-3: EWA-3

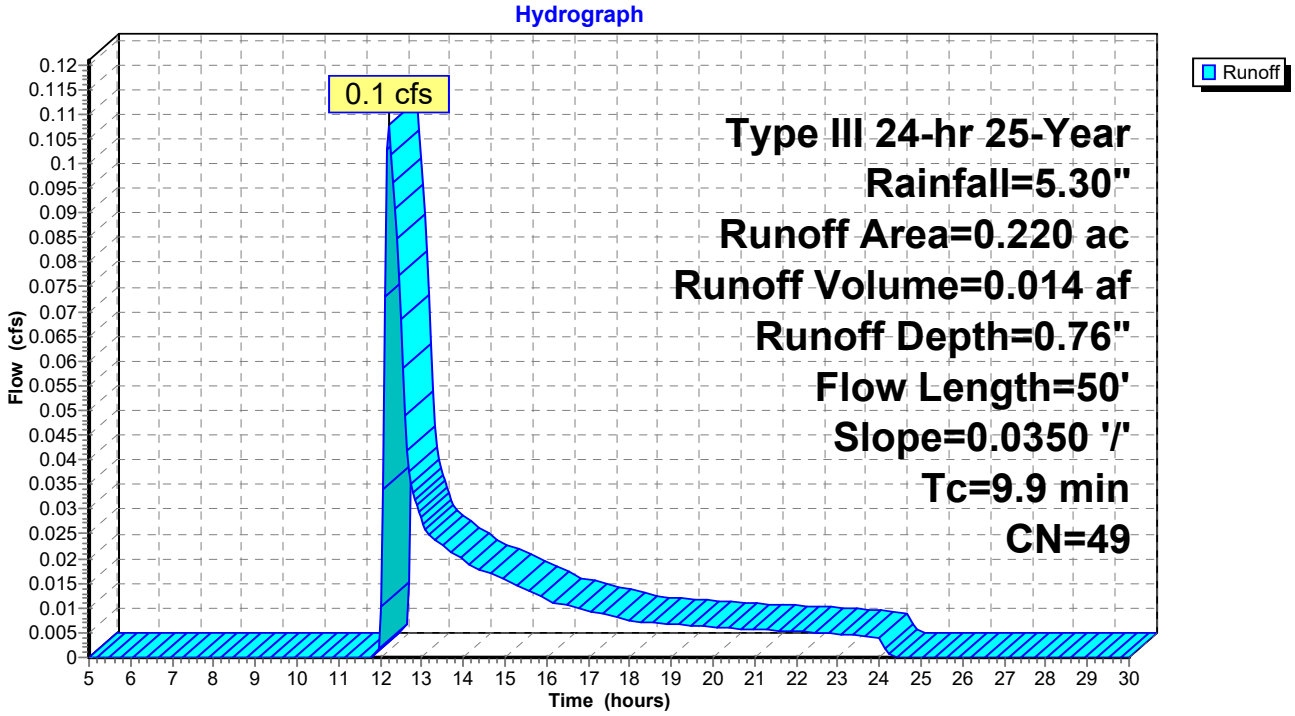
Runoff = 0.1 cfs @ 12.20 hrs, Volume= 0.014 af, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.160	39	>75% Grass cover, Good, HSG A
0.020	30	Woods, Good, HSG A
0.220	49	Weighted Average
0.180		81.82% Pervious Area
0.040		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	19	0.0350	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
6.8	31	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
9.9	50	Total			

Subcatchment EWA-3: EWA-3



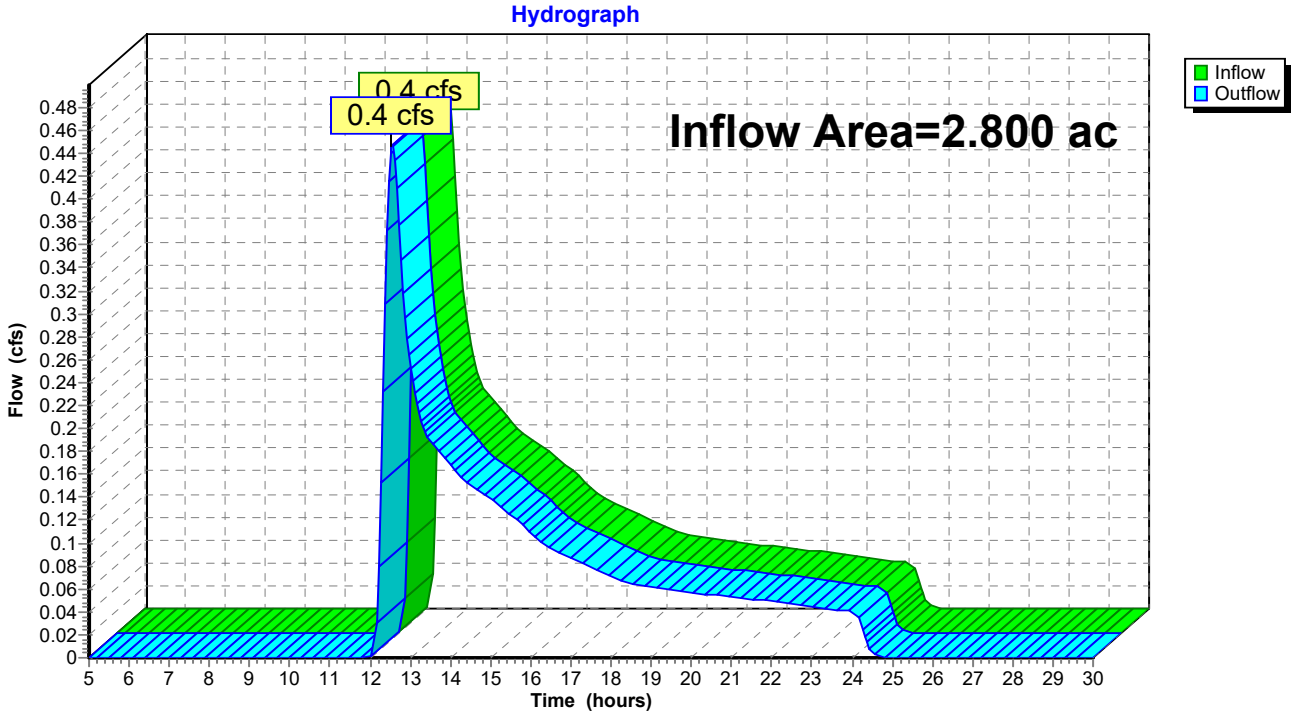
Summary for Reach DP-1: Design Point 1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.800 ac, 7.86% Impervious, Inflow Depth = 0.44" for 25-Year event
Inflow = 0.4 cfs @ 12.54 hrs, Volume= 0.103 af
Outflow = 0.4 cfs @ 12.54 hrs, Volume= 0.103 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1



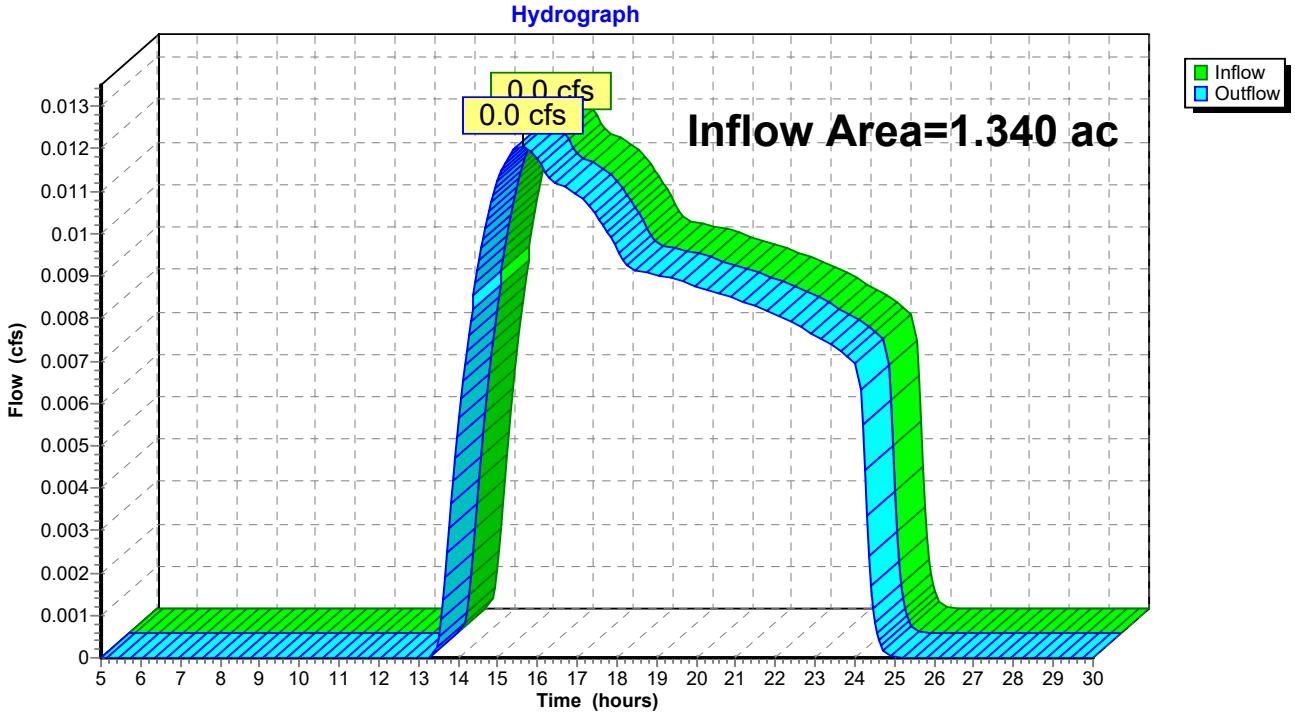
Summary for Reach DP-2: Design Point 2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.340 ac, 2.99% Impervious, Inflow Depth = 0.07" for 25-Year event
Inflow = 0.0 cfs @ 15.61 hrs, Volume= 0.008 af
Outflow = 0.0 cfs @ 15.61 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2



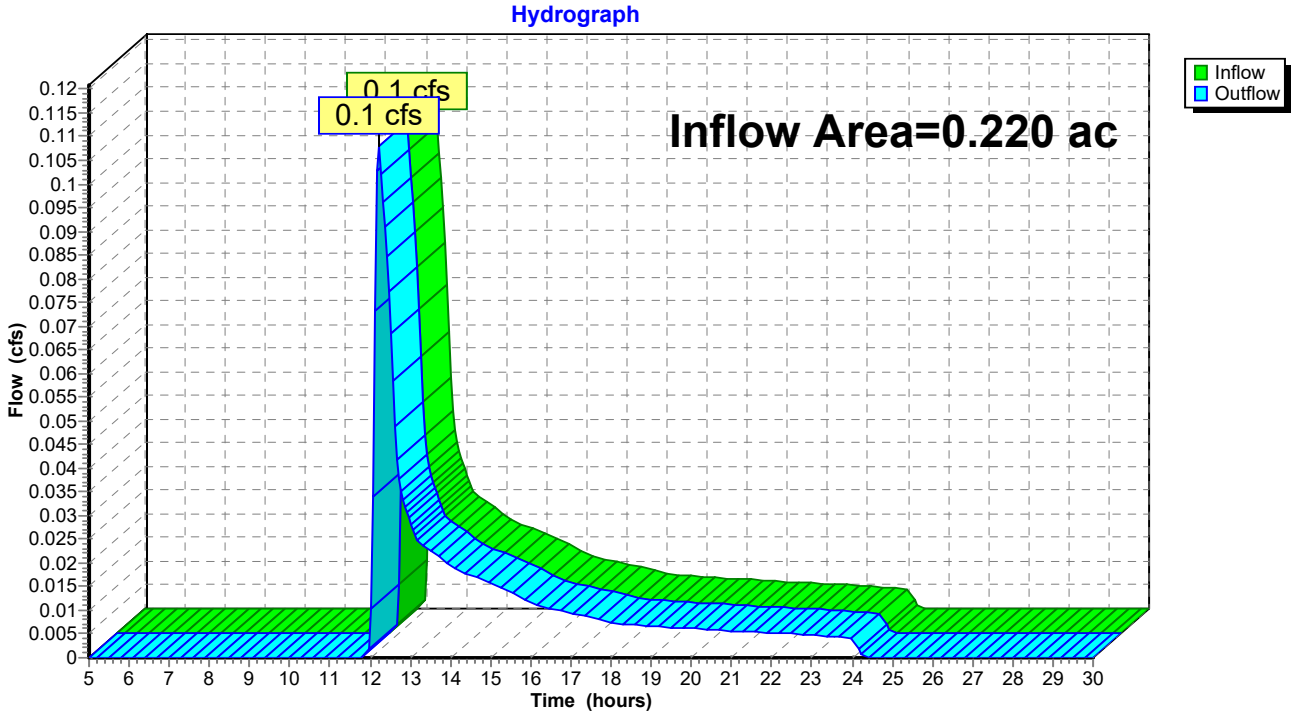
Summary for Reach DP-3: Design Point 3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.220 ac, 18.18% Impervious, Inflow Depth = 0.76" for 25-Year event
Inflow = 0.1 cfs @ 12.20 hrs, Volume= 0.014 af
Outflow = 0.1 cfs @ 12.20 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3



Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWA-1: EWA-1 Runoff Area=2.800 ac 7.86% Impervious Runoff Depth=0.87"
Flow Length=204' Tc=20.7 min CN=43 Runoff=1.2 cfs 0.202 af

Subcatchment EWA-2: EWA-2 Runoff Area=1.340 ac 2.99% Impervious Runoff Depth=0.26"
Flow Length=224' Tc=20.9 min CN=33 Runoff=0.1 cfs 0.029 af

Subcatchment EWA-3: EWA-3 Runoff Area=0.220 ac 18.18% Impervious Runoff Depth=1.32"
Flow Length=50' Slope=0.0350 '/' Tc=9.9 min CN=49 Runoff=0.2 cfs 0.024 af

Reach DP-1: Design Point 1 Inflow=1.2 cfs 0.202 af
Outflow=1.2 cfs 0.202 af

Reach DP-2: Design Point 2 Inflow=0.1 cfs 0.029 af
Outflow=0.1 cfs 0.029 af

Reach DP-3: Design Point 3 Inflow=0.2 cfs 0.024 af
Outflow=0.2 cfs 0.024 af

Total Runoff Area = 4.360 ac Runoff Volume = 0.255 af Average Runoff Depth = 0.70"
93.12% Pervious = 4.060 ac 6.88% Impervious = 0.300 ac

Summary for Subcatchment EWA-1: EWA-1

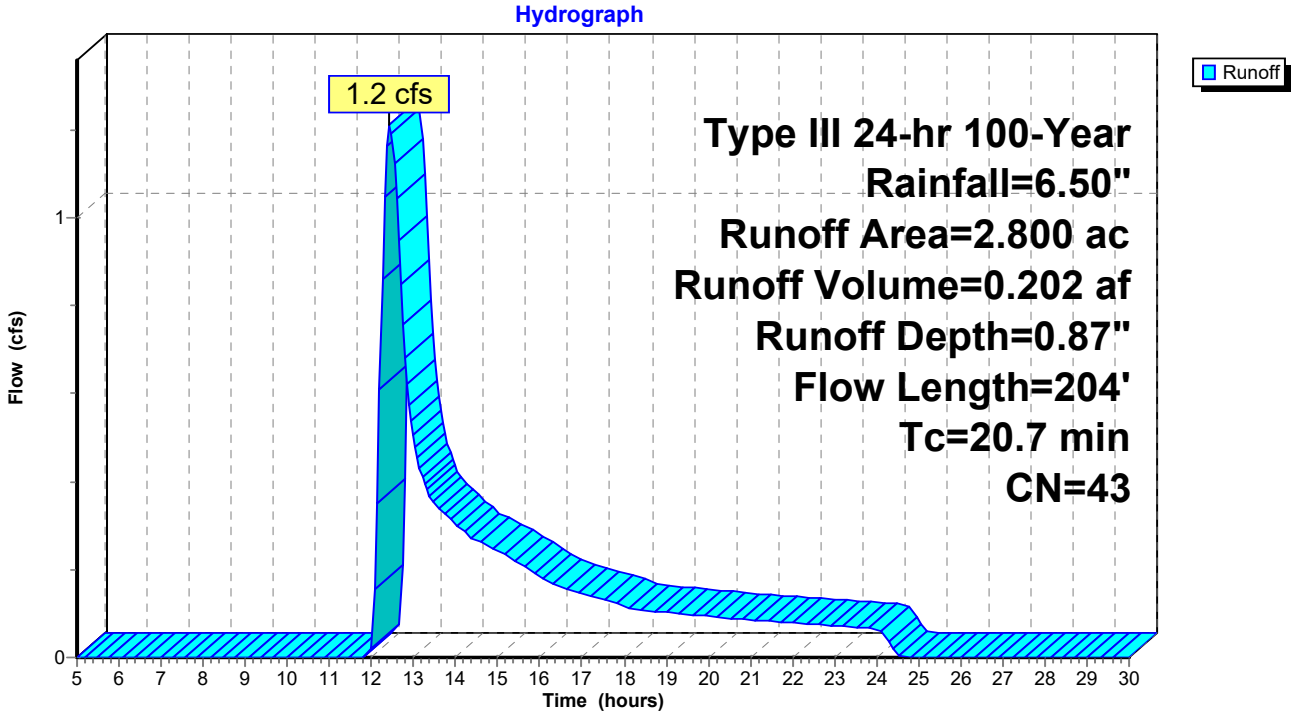
Runoff = 1.2 cfs @ 12.42 hrs, Volume= 0.202 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
1.540	30	Woods, Good, HSG A
0.130	70	Woods, Good, HSG C
0.680	39	>75% Grass cover, Good, HSG A
0.220	98	Paved parking, HSG A
0.230	74	>75% Grass cover, Good, HSG C
2.800	43	Weighted Average
2.580		92.14% Pervious Area
0.220		7.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
4.2	154	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
20.7	204	Total			

Subcatchment EWA-1: EWA-1



Summary for Subcatchment EWA-2: EWA-2

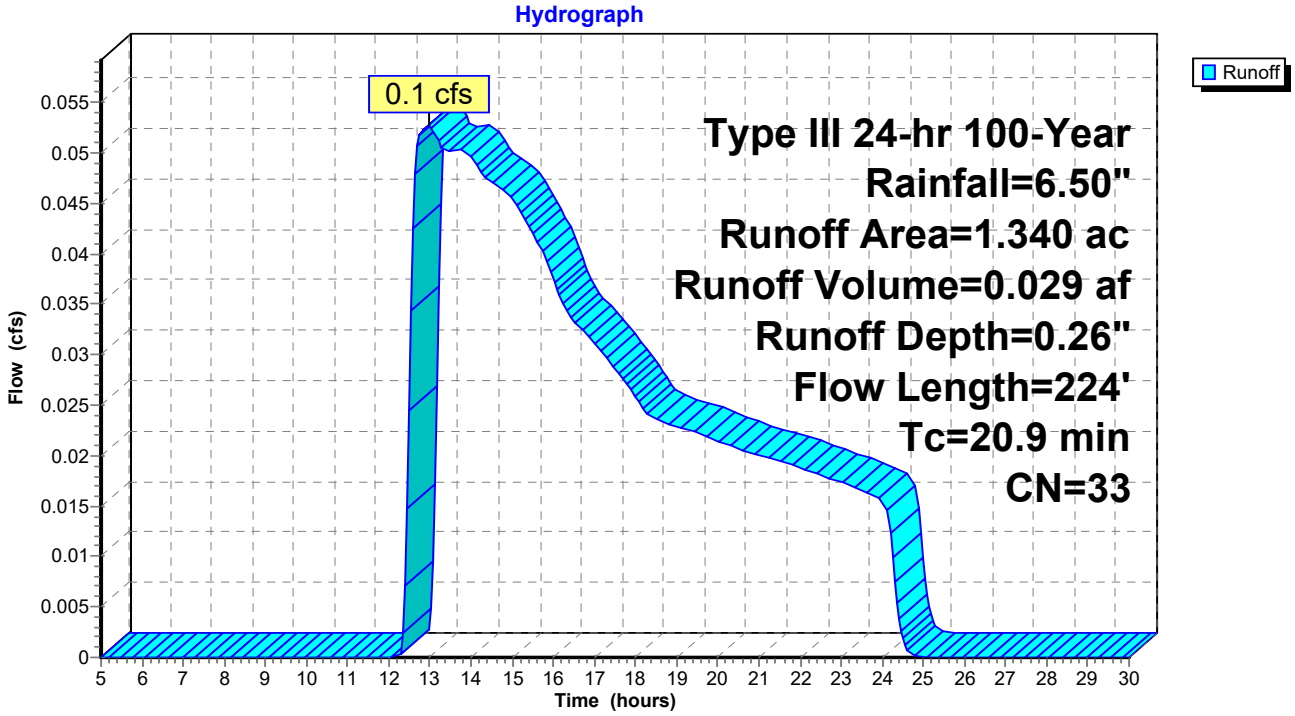
Runoff = 0.1 cfs @ 12.99 hrs, Volume= 0.029 af, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
1.090	30	Woods, Good, HSG A
0.210	39	>75% Grass cover, Good, HSG A
1.340	33	Weighted Average
1.300		97.01% Pervious Area
0.040		2.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
4.4	174	0.0170	0.65		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
20.9	224	Total			

Subcatchment EWA-2: EWA-2



Summary for Subcatchment EWA-3: EWA-3

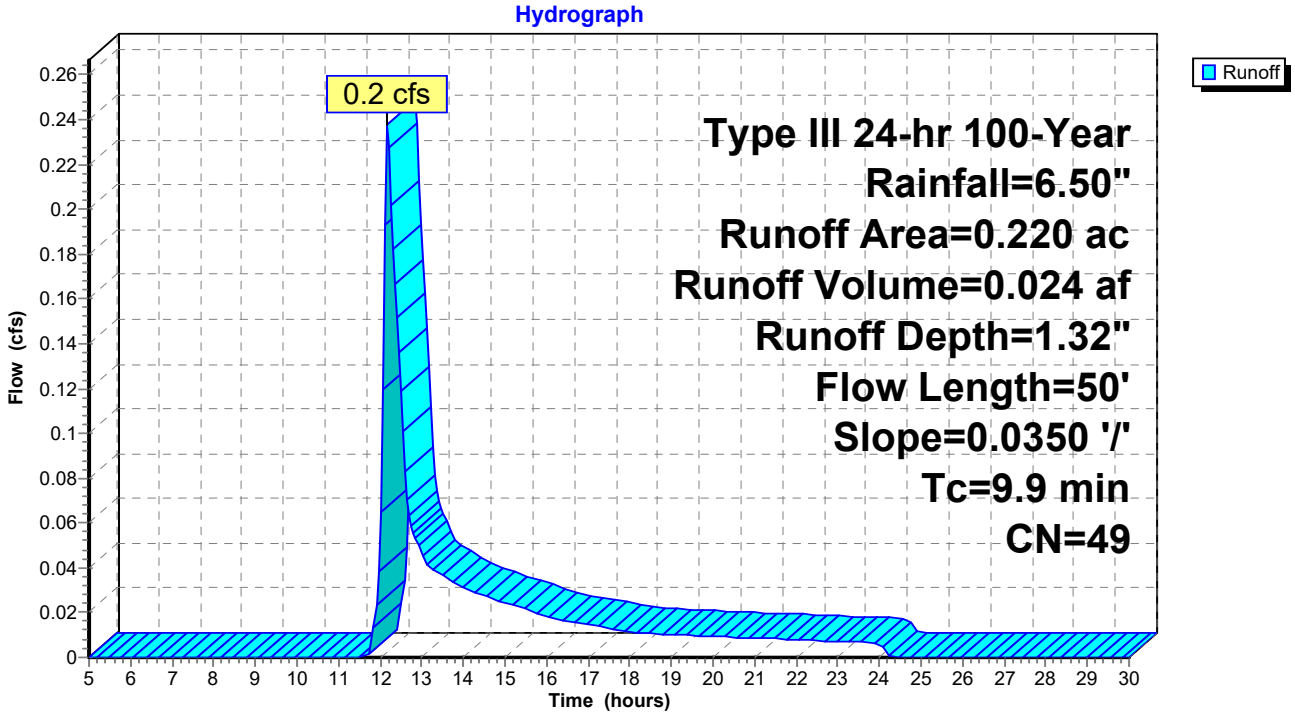
Runoff = 0.2 cfs @ 12.17 hrs, Volume= 0.024 af, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.160	39	>75% Grass cover, Good, HSG A
0.020	30	Woods, Good, HSG A
0.220	49	Weighted Average
0.180		81.82% Pervious Area
0.040		18.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	19	0.0350	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
6.8	31	0.0350	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
9.9	50	Total			

Subcatchment EWA-3: EWA-3



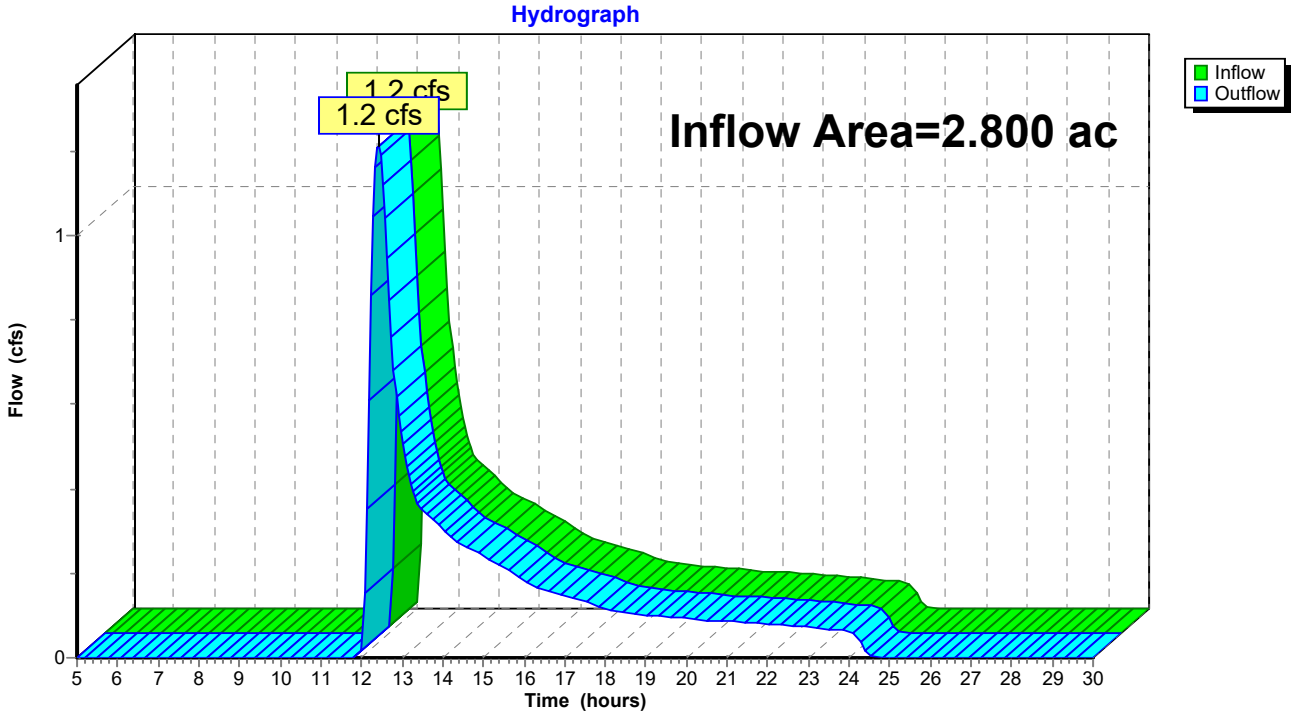
Summary for Reach DP-1: Design Point 1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.800 ac, 7.86% Impervious, Inflow Depth = 0.87" for 100-Year event
Inflow = 1.2 cfs @ 12.42 hrs, Volume= 0.202 af
Outflow = 1.2 cfs @ 12.42 hrs, Volume= 0.202 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1



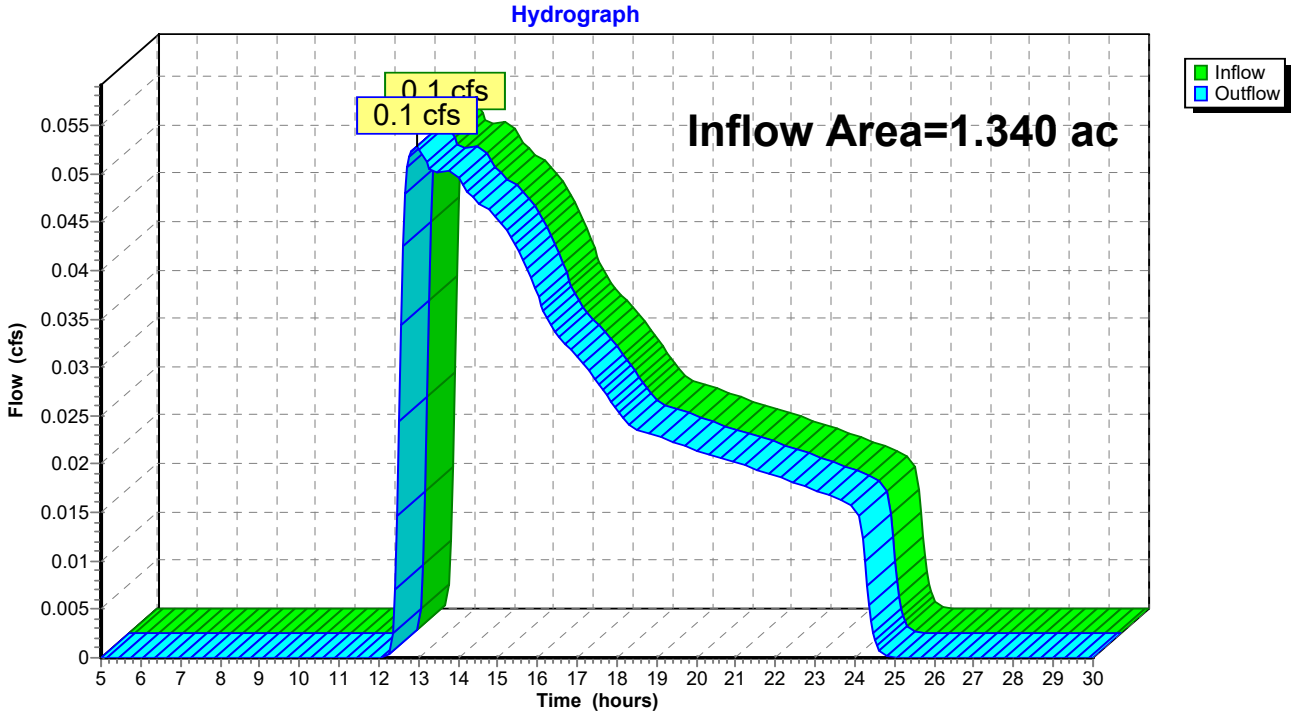
Summary for Reach DP-2: Design Point 2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.340 ac, 2.99% Impervious, Inflow Depth = 0.26" for 100-Year event
Inflow = 0.1 cfs @ 12.99 hrs, Volume= 0.029 af
Outflow = 0.1 cfs @ 12.99 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2



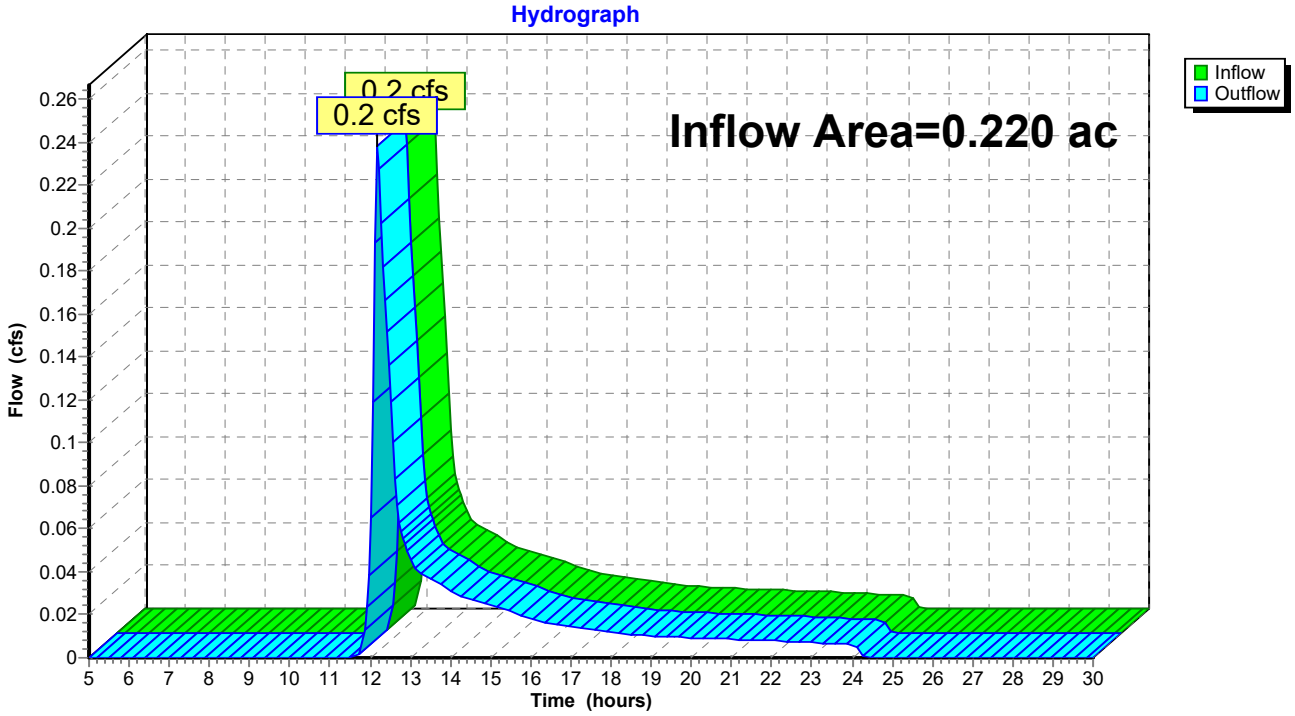
Summary for Reach DP-3: Design Point 3

[40] Hint: Not Described (Outflow=Inflow)

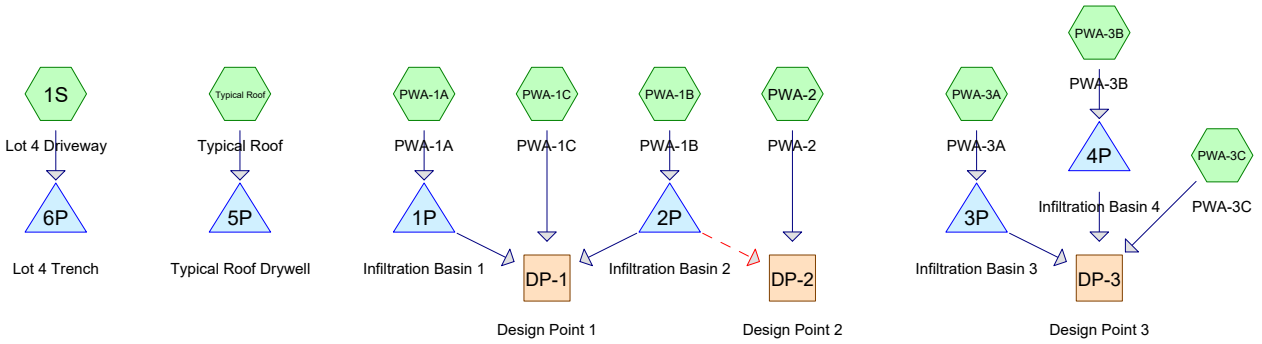
Inflow Area = 0.220 ac, 18.18% Impervious, Inflow Depth = 1.32" for 100-Year event
Inflow = 0.2 cfs @ 12.17 hrs, Volume= 0.024 af
Outflow = 0.2 cfs @ 12.17 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3



TAB 4



Subcat Reach Pond Link

Drainage Diagram for Post-Development-R2
Prepared by HP Inc., Printed 11/11/2019

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.070	30	Woods, Good, HSG A (PWA-1A, PWA-1C, PWA-2, PWA-3C)
1.960	39	>75% Grass cover, Good, HSG A (PWA-1A, PWA-1B, PWA-1C, PWA-2, PWA-3A, PWA-3B, PWA-3C)
0.130	70	Woods, Good, HSG C (PWA-1A, PWA-1C)
0.220	74	>75% Grass cover, Good, HSG C (PWA-1A)
0.190	98	Offsite Impervious (PWA-1A)
0.544	98	Paved parking, HSG A (1S, PWA-1B, PWA-3A, PWA-3B, Typical Roof)
4.114	50	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
3.574	HSG A	1S, PWA-1A, PWA-1B, PWA-1C, PWA-2, PWA-3A, PWA-3B, PWA-3C, Typical Roof
0.000	HSG B	
0.350	HSG C	PWA-1A, PWA-1C
0.000	HSG D	
0.190	Other	PWA-1A
4.114		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	1P	162.00	160.50	108.0	0.0139	0.013	12.0	0.0	0.0
2	2P	160.22	160.00	43.0	0.0051	0.013	12.0	0.0	0.0
3	3P	159.00	157.93	42.0	0.0255	0.013	6.0	0.0	0.0
4	4P	159.00	157.93	28.0	0.0382	0.013	6.0	0.0	0.0

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 4 Driveway Runoff Area=2,350 sf 100.00% Impervious Runoff Depth>2.82"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.013 af

Subcatchment PWA-1A: PWA-1A Runoff Area=1.310 ac 14.50% Impervious Runoff Depth=0.20"
Flow Length=263' Tc=13.3 min CN=54 Runoff=0.1 cfs 0.021 af

Subcatchment PWA-1B: PWA-1B Runoff Area=0.900 ac 45.56% Impervious Runoff Depth=0.59"
Flow Length=231' Tc=9.8 min CN=66 Runoff=0.4 cfs 0.044 af

Subcatchment PWA-1C: PWA-1C Runoff Area=0.700 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=140' Tc=14.0 min CN=36 Runoff=0.0 cfs 0.000 af

Subcatchment PWA-2: PWA-2 Runoff Area=0.800 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=126' Slope=0.0200 '/' Tc=10.1 min CN=34 Runoff=0.0 cfs 0.000 af

Subcatchment PWA-3A: PWA-3A Runoff Area=0.120 ac 16.67% Impervious Runoff Depth=0.09"
Tc=6.0 min CN=49 Runoff=0.0 cfs 0.001 af

Subcatchment PWA-3B: PWA-3B Runoff Area=0.080 ac 25.00% Impervious Runoff Depth=0.20"
Tc=6.0 min CN=54 Runoff=0.0 cfs 0.001 af

Subcatchment PWA-3C: PWA-3C Runoff Area=0.110 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=37 Runoff=0.0 cfs 0.000 af

Subcatchment Typical Roof: Typical Roof Runoff Area=0.040 ac 100.00% Impervious Runoff Depth>2.82"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.009 af

Reach DP-1: Design Point 1 Inflow=0.0 cfs 0.000 af
Outflow=0.0 cfs 0.000 af

Reach DP-2: Design Point 2 Inflow=0.0 cfs 0.000 af
Outflow=0.0 cfs 0.000 af

Reach DP-3: Design Point 3 Inflow=0.0 cfs 0.000 af
Outflow=0.0 cfs 0.000 af

Pond 1P: Infiltration Basin 1 Peak Elev=162.00' Storage=14 cf Inflow=0.1 cfs 0.021 af
Discarded=0.1 cfs 0.021 af Primary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.021 af

Pond 2P: Infiltration Basin 2 Peak Elev=160.36' Storage=506 cf Inflow=0.4 cfs 0.044 af
Discarded=0.1 cfs 0.044 af Primary=0.0 cfs 0.000 af Secondary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.044 af

Pond 3P: Infiltration Basin 3 Peak Elev=164.00' Storage=0 cf Inflow=0.0 cfs 0.001 af
Discarded=0.0 cfs 0.001 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.001 af

Pond 4P: Infiltration Basin 4 Peak Elev=164.00' Storage=1 cf Inflow=0.0 cfs 0.001 af
Discarded=0.0 cfs 0.001 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.001 af

Pond 5P: Typical Roof Drywell Peak Elev=100.66' Storage=101 cf Inflow=0.1 cfs 0.009 af
Outflow=0.0 cfs 0.009 af

Pond 6P: Lot 4 Trench Peak Elev=159.62' Storage=128 cf Inflow=0.2 cfs 0.013 af
Outflow=0.0 cfs 0.013 af

Total Runoff Area = 4.114 ac Runoff Volume = 0.090 af Average Runoff Depth = 0.26"
82.16% Pervious = 3.380 ac 17.84% Impervious = 0.734 ac

Summary for Subcatchment 1S: Lot 4 Driveway

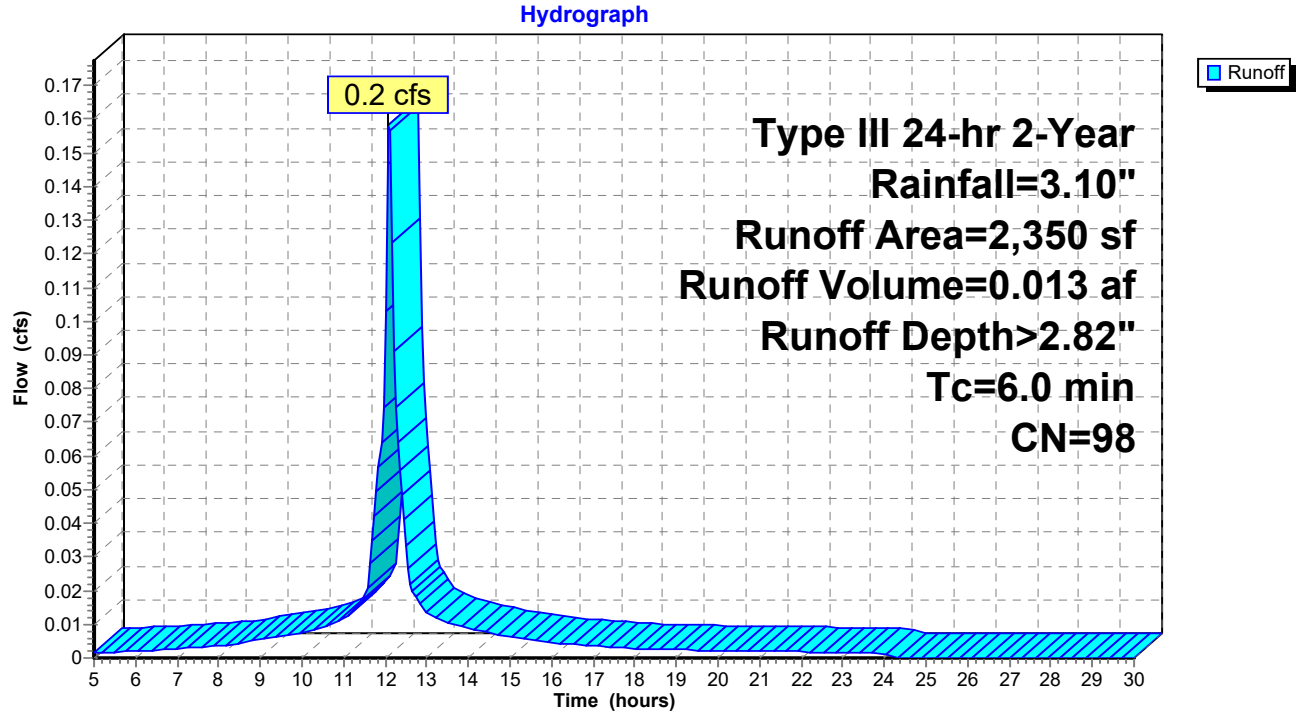
Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.013 af, Depth> 2.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,350	98	Paved parking, HSG A
2,350		100.00% Impervious Area

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

Subcatchment 1S: Lot 4 Driveway



Summary for Subcatchment PWA-1A: PWA-1A

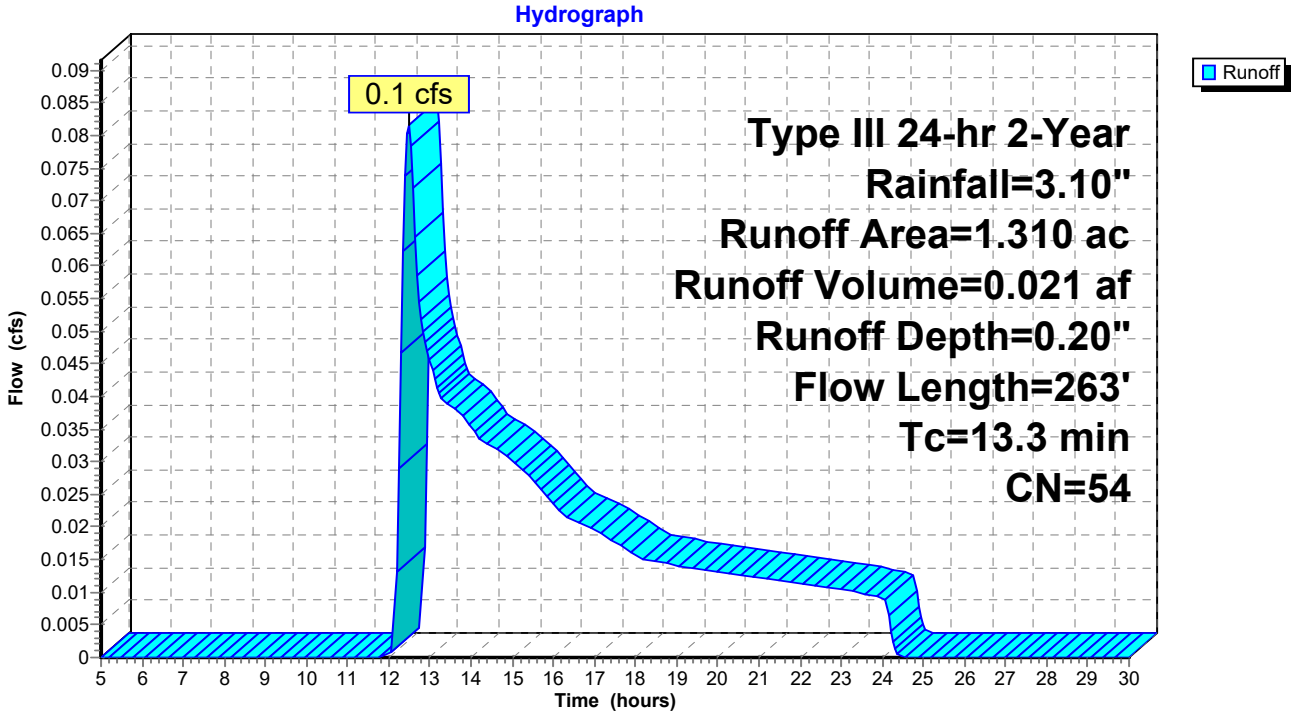
Runoff = 0.1 cfs @ 12.49 hrs, Volume= 0.021 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (ac)	CN	Description
	0.680	39	>75% Grass cover, Good, HSG A
*	0.190	98	Offsite Impervious
	0.160	30	Woods, Good, HSG A
	0.220	74	>75% Grass cover, Good, HSG C
	0.060	70	Woods, Good, HSG C
	1.310	54	Weighted Average
	1.120		85.50% Pervious Area
	0.190		14.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	20	0.0200	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
5.5	30	0.0200	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.8	213	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.3	263	Total			

Subcatchment PWA-1A: PWA-1A



Summary for Subcatchment PWA-1B: PWA-1B

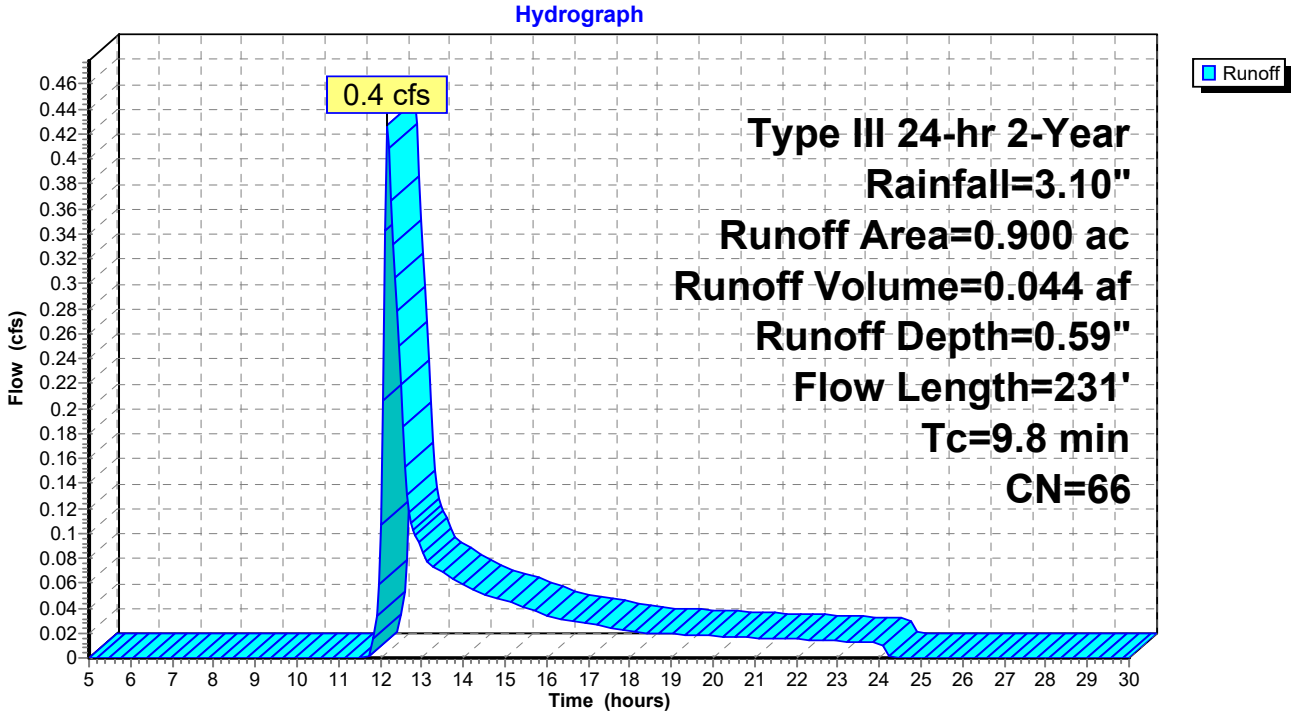
Runoff = 0.4 cfs @ 12.17 hrs, Volume= 0.044 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.410	98	Paved parking, HSG A
0.490	39	>75% Grass cover, Good, HSG A
0.900	66	Weighted Average
0.490		54.44% Pervious Area
0.410		45.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.1	12	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.4	169	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.8	231	Total			

Subcatchment PWA-1B: PWA-1B



Summary for Subcatchment PWA-1C: PWA-1C

[45] Hint: Runoff=Zero

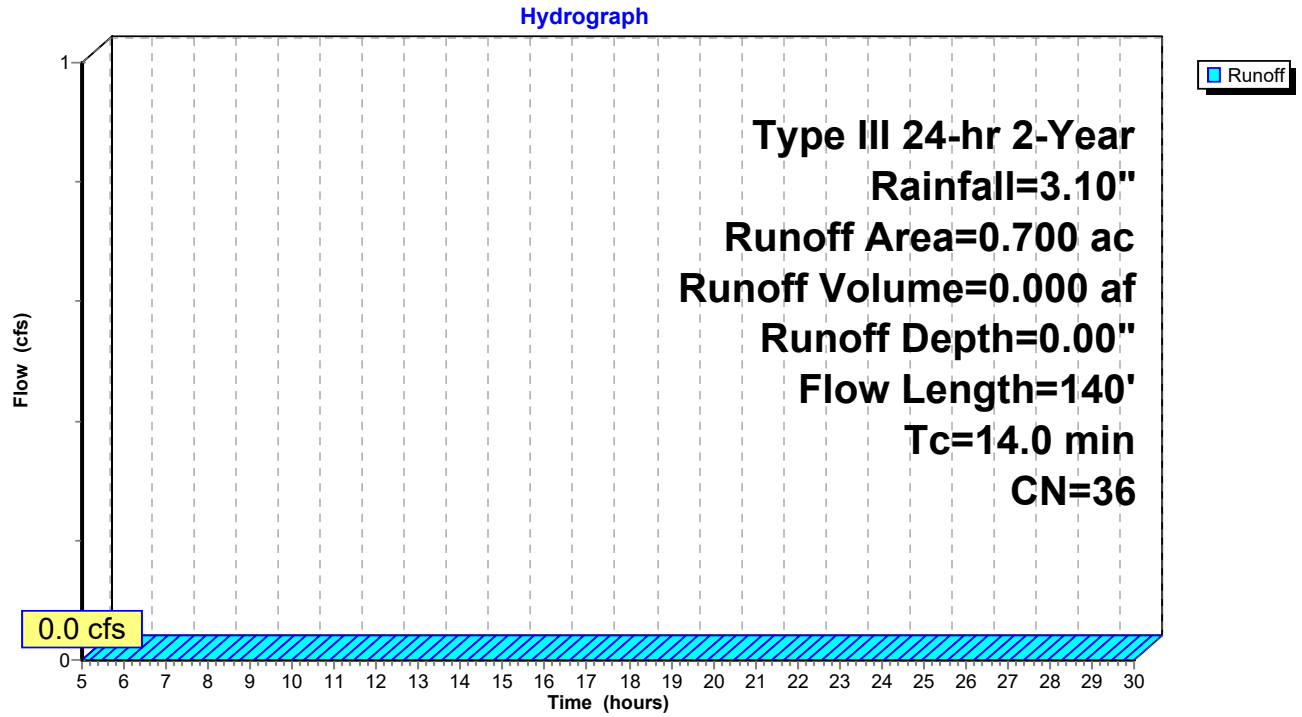
Runoff = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.070	70	Woods, Good, HSG C
0.180	39	>75% Grass cover, Good, HSG A
0.450	30	Woods, Good, HSG A
0.700	36	Weighted Average
0.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	90	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	140	Total			

Subcatchment PWA-1C: PWA-1C



Summary for Subcatchment PWA-2: PWA-2

[45] Hint: Runoff=Zero

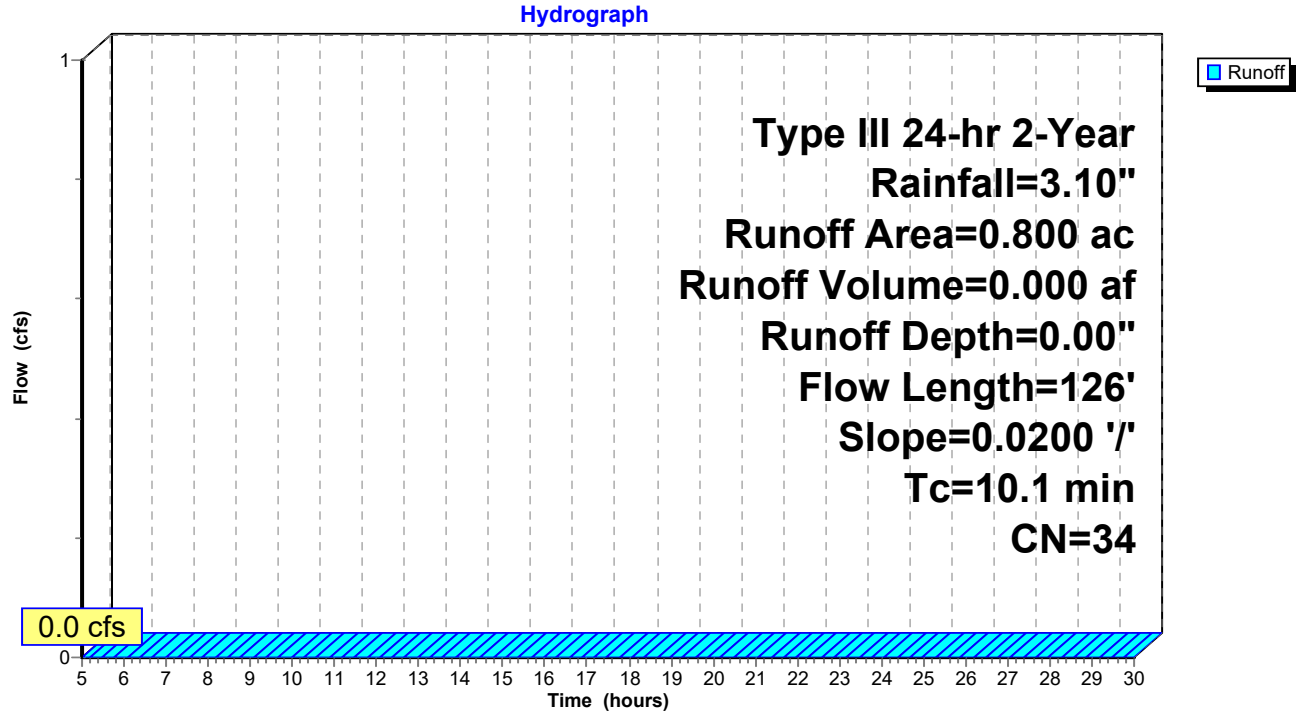
Runoff = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.430	30	Woods, Good, HSG A
0.370	39	>75% Grass cover, Good, HSG A
0.800	34	Weighted Average
0.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.8	76	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.1	126	Total			

Subcatchment PWA-2: PWA-2



Summary for Subcatchment PWA-3A: PWA-3A

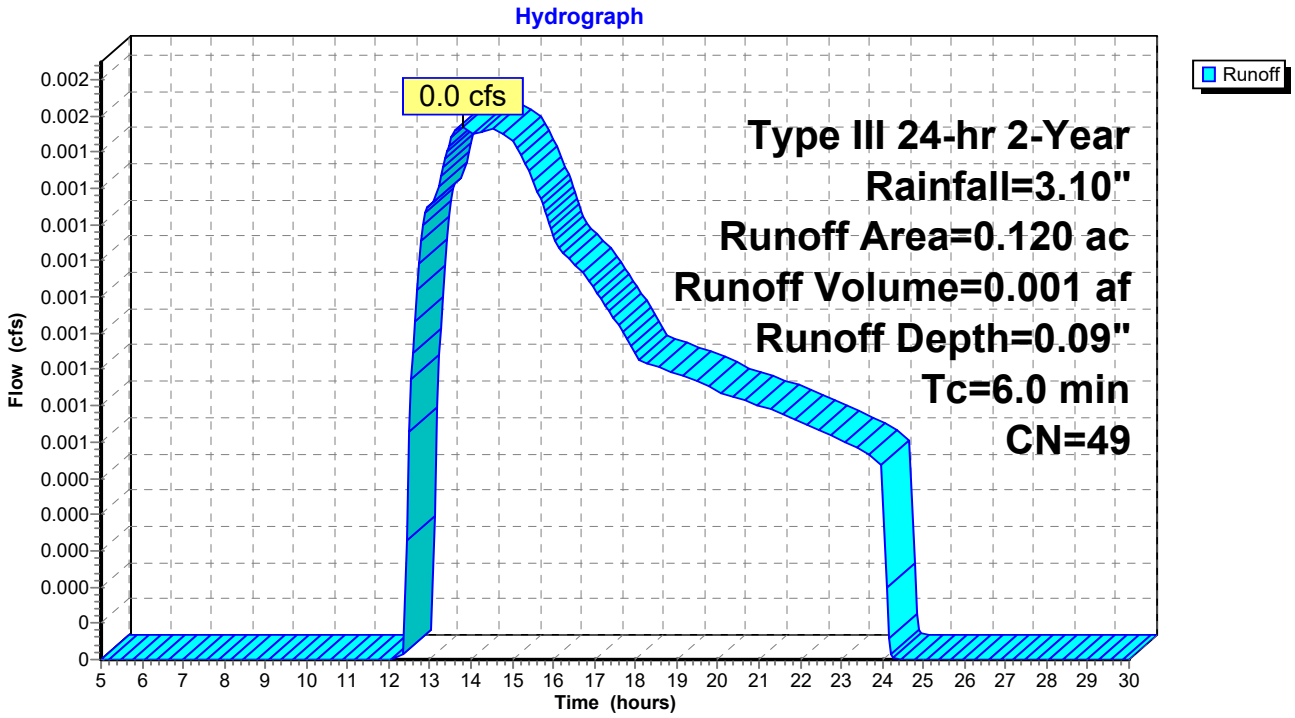
Runoff = 0.0 cfs @ 13.80 hrs, Volume= 0.001 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG A
0.100	39	>75% Grass cover, Good, HSG A
0.120	49	Weighted Average
0.100		83.33% Pervious Area
0.020		16.67% Impervious Area

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

Subcatchment PWA-3A: PWA-3A



Summary for Subcatchment PWA-3B: PWA-3B

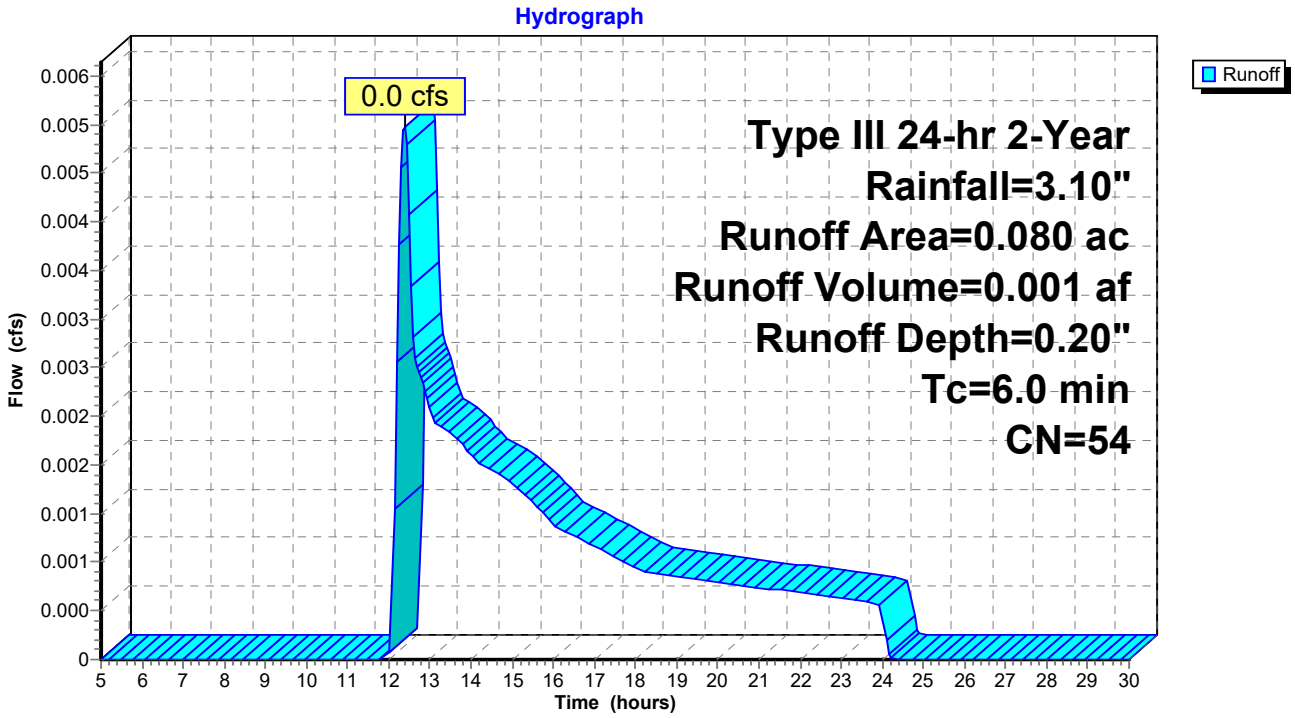
Runoff = 0.0 cfs @ 12.38 hrs, Volume= 0.001 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG A
0.060	39	>75% Grass cover, Good, HSG A
0.080	54	Weighted Average
0.060		75.00% Pervious Area
0.020		25.00% Impervious Area

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

Subcatchment PWA-3B: PWA-3B



Summary for Subcatchment PWA-3C: PWA-3C

[45] Hint: Runoff=Zero

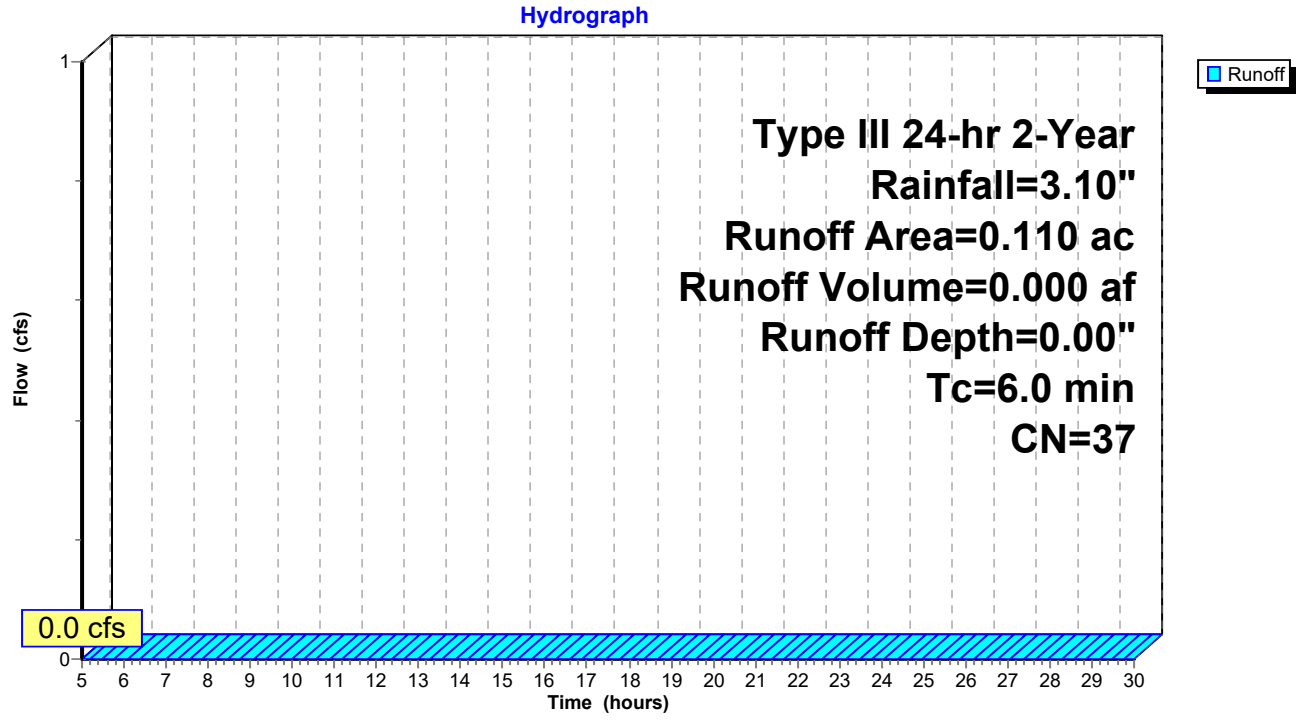
Runoff = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.080	39	>75% Grass cover, Good, HSG A
0.030	30	Woods, Good, HSG A
0.110	37	Weighted Average
0.110		100.00% Pervious Area

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

Subcatchment PWA-3C: PWA-3C



Summary for Subcatchment Typical Roof: Typical Roof

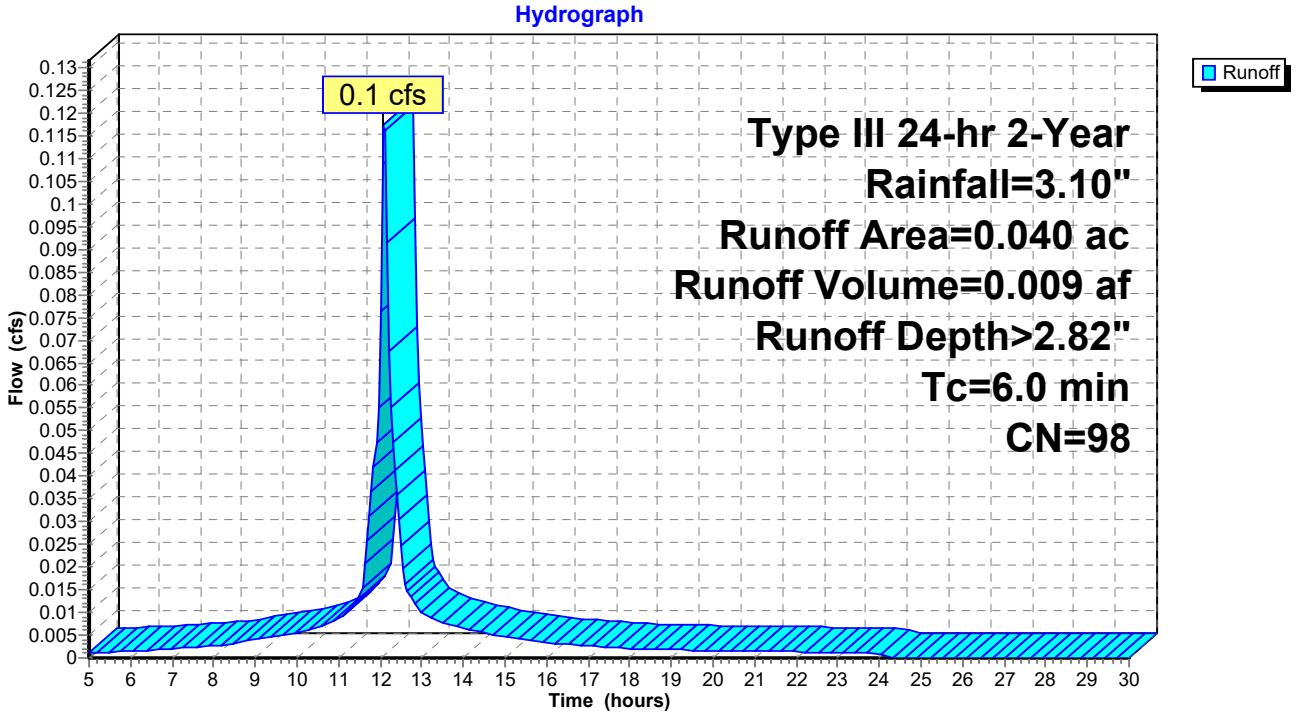
Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.009 af, Depth> 2.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.040		100.00% Impervious Area

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

Subcatchment Typical Roof: Typical Roof



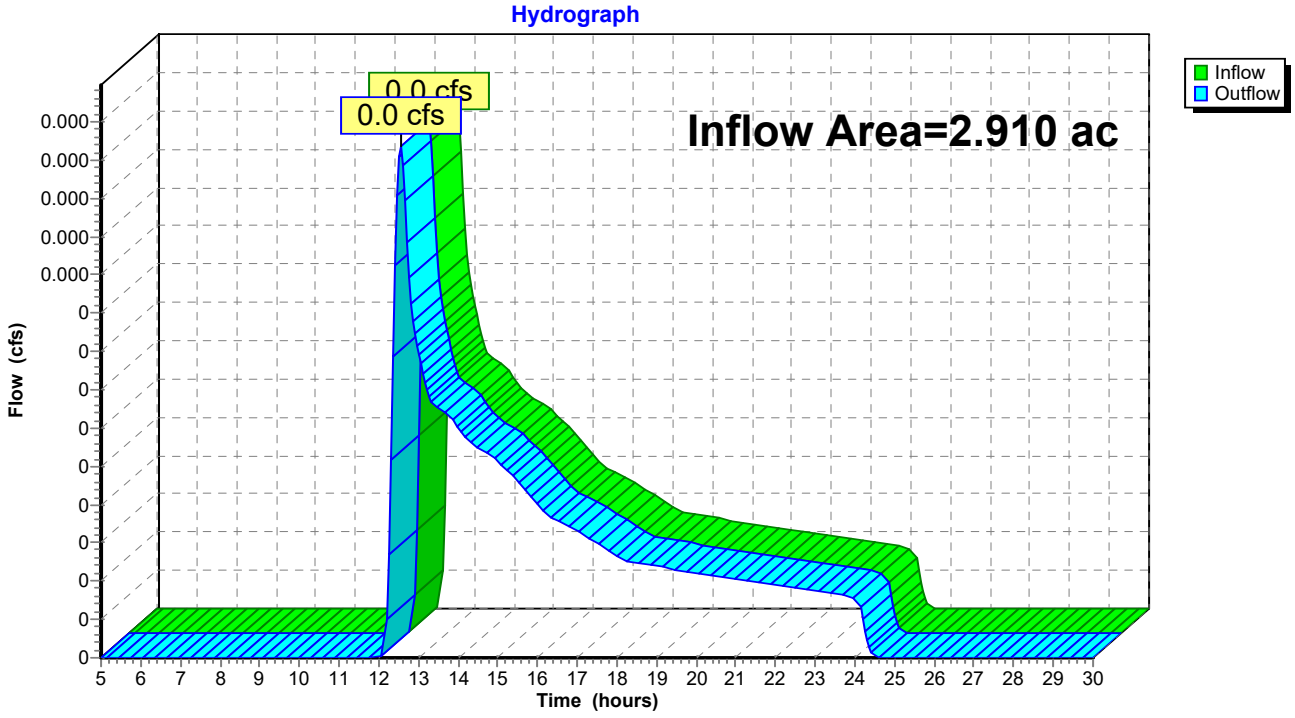
Summary for Reach DP-1: Design Point 1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.910 ac, 20.62% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.0 cfs @ 12.54 hrs, Volume= 0.000 af
Outflow = 0.0 cfs @ 12.54 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1



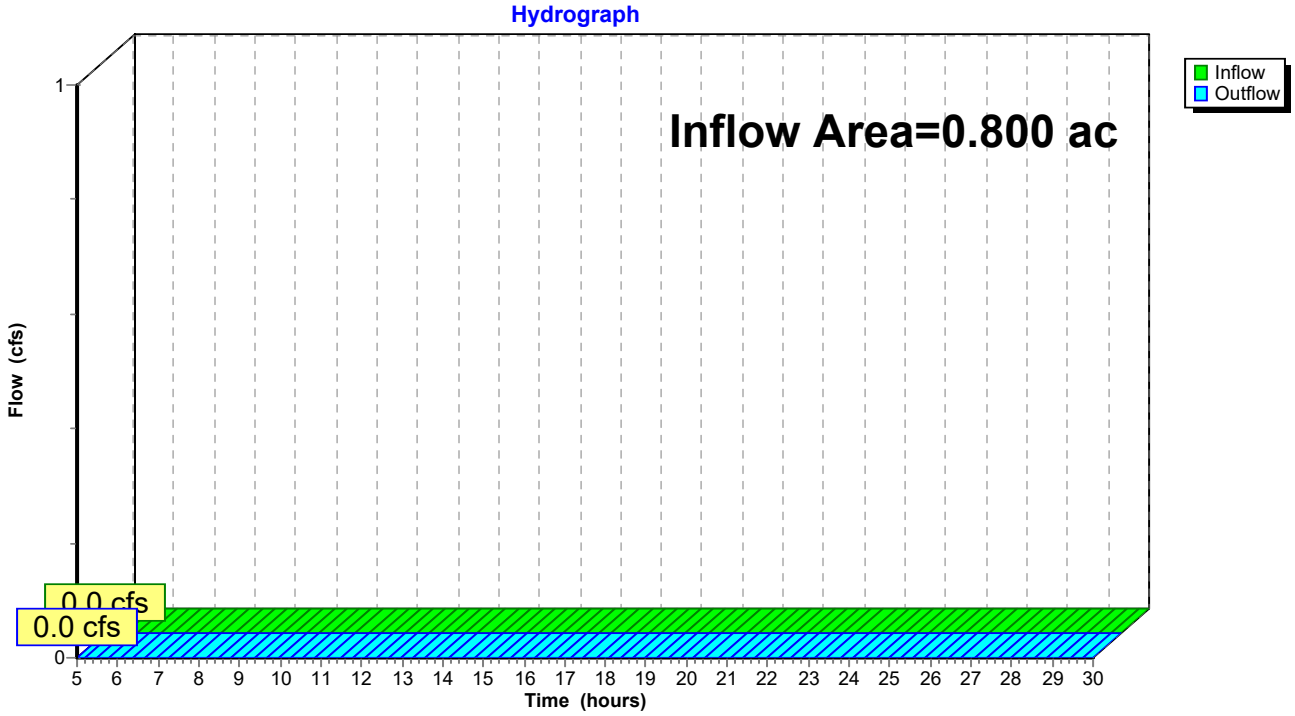
Summary for Reach DP-2: Design Point 2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.800 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2



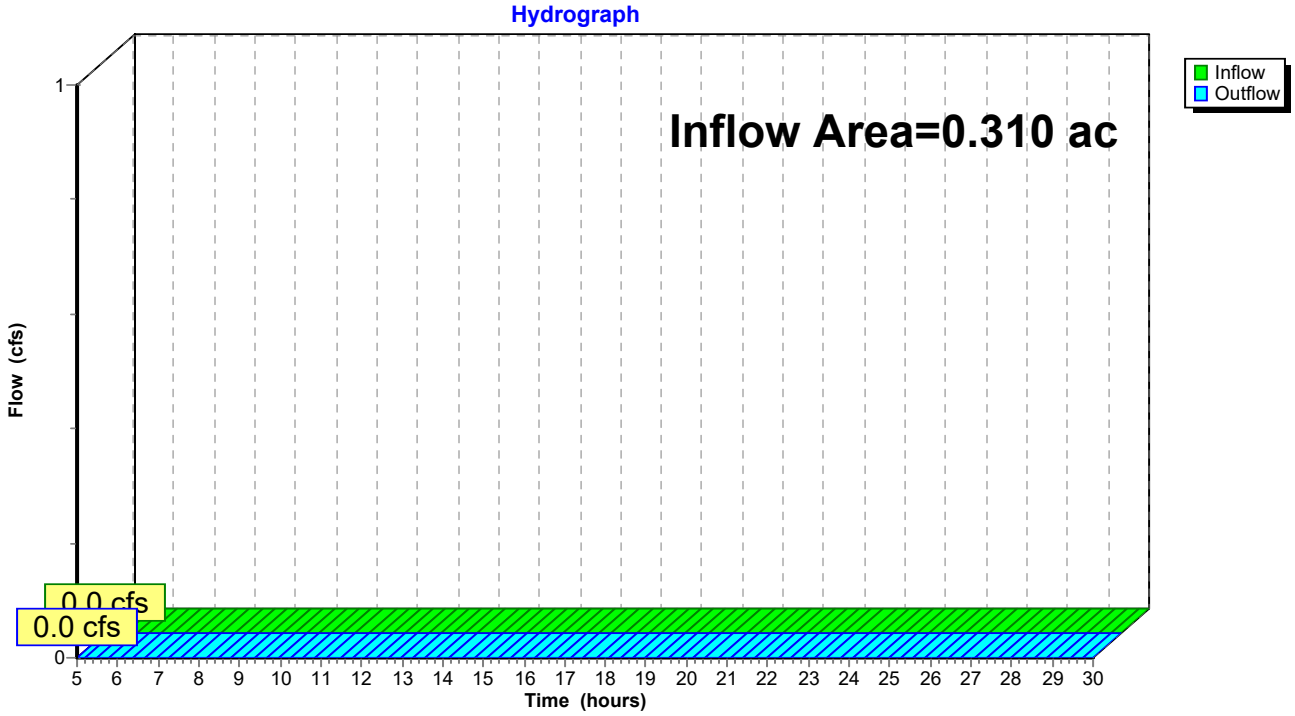
Summary for Reach DP-3: Design Point 3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.310 ac, 12.90% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3



Summary for Pond 1P: Infiltration Basin 1

Inflow Area = 1.310 ac, 14.50% Impervious, Inflow Depth = 0.20" for 2-Year event
Inflow = 0.1 cfs @ 12.49 hrs, Volume= 0.021 af
Outflow = 0.1 cfs @ 12.54 hrs, Volume= 0.021 af, Atten= 3%, Lag= 3.1 min
Discarded = 0.1 cfs @ 12.54 hrs, Volume= 0.021 af
Primary = 0.0 cfs @ 12.54 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 162.00' @ 12.54 hrs Surf.Area= 3,576 sf Storage= 14 cf

Plug-Flow detention time= 3.0 min calculated for 0.021 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (981.6 - 978.7)

Volume	Invert	Avail.Storage	Storage Description
#1	162.00'	4,749 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

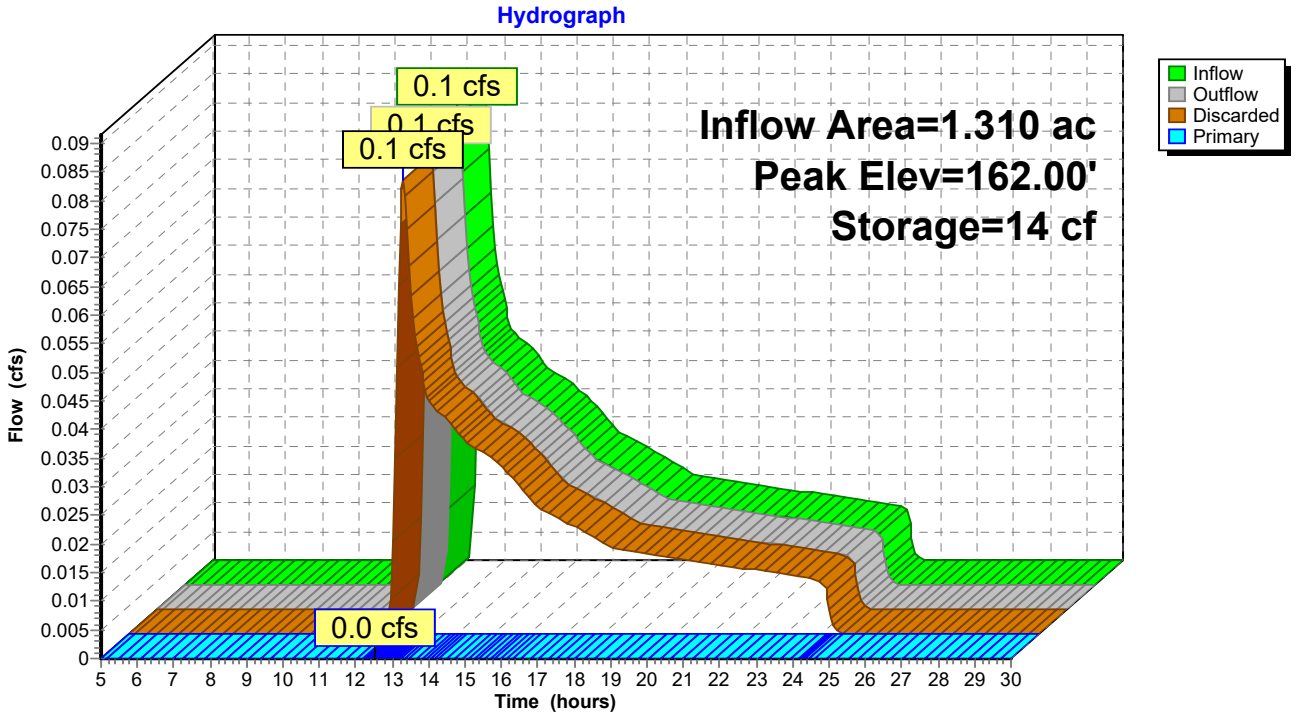
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
162.00	3,568	0	0	3,568
163.00	6,037	4,749	4,749	6,049

Device	Routing	Invert	Outlet Devices
#1	Discarded	162.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 160.00'
#2	Primary	162.00'	**12.0" Round Culvert** L= 108.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 162.00' / 160.50' S= 0.0139 '/' Cc= 0.900 n= 0.013

Discarded OutFlow Max=0.2 cfs @ 12.54 hrs HW=162.00' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.2 cfs)

Primary OutFlow Max=0.0 cfs @ 12.54 hrs HW=162.00' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 0.0 cfs @ 0.21 fps)

Pond 1P: Infiltration Basin 1



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 0.900 ac, 45.56% Impervious, Inflow Depth = 0.59" for 2-Year event
Inflow = 0.4 cfs @ 12.17 hrs, Volume= 0.044 af
Outflow = 0.1 cfs @ 13.02 hrs, Volume= 0.044 af, Atten= 80%, Lag= 51.2 min
Discarded = 0.1 cfs @ 13.02 hrs, Volume= 0.044 af
Primary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af
Secondary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 160.36' @ 13.02 hrs Surf.Area= 1,514 sf Storage= 506 cf

Plug-Flow detention time= 53.0 min calculated for 0.044 af (100% of inflow)
Center-of-Mass det. time= 52.9 min (950.5 - 897.7)

Volume	Invert	Avail.Storage	Storage Description
#1	160.00'	6,975 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
160.00	1,300	0	0	1,300
161.00	1,934	1,607	1,607	1,950
162.00	2,669	2,292	3,898	2,704
163.00	3,504	3,077	6,975	3,562

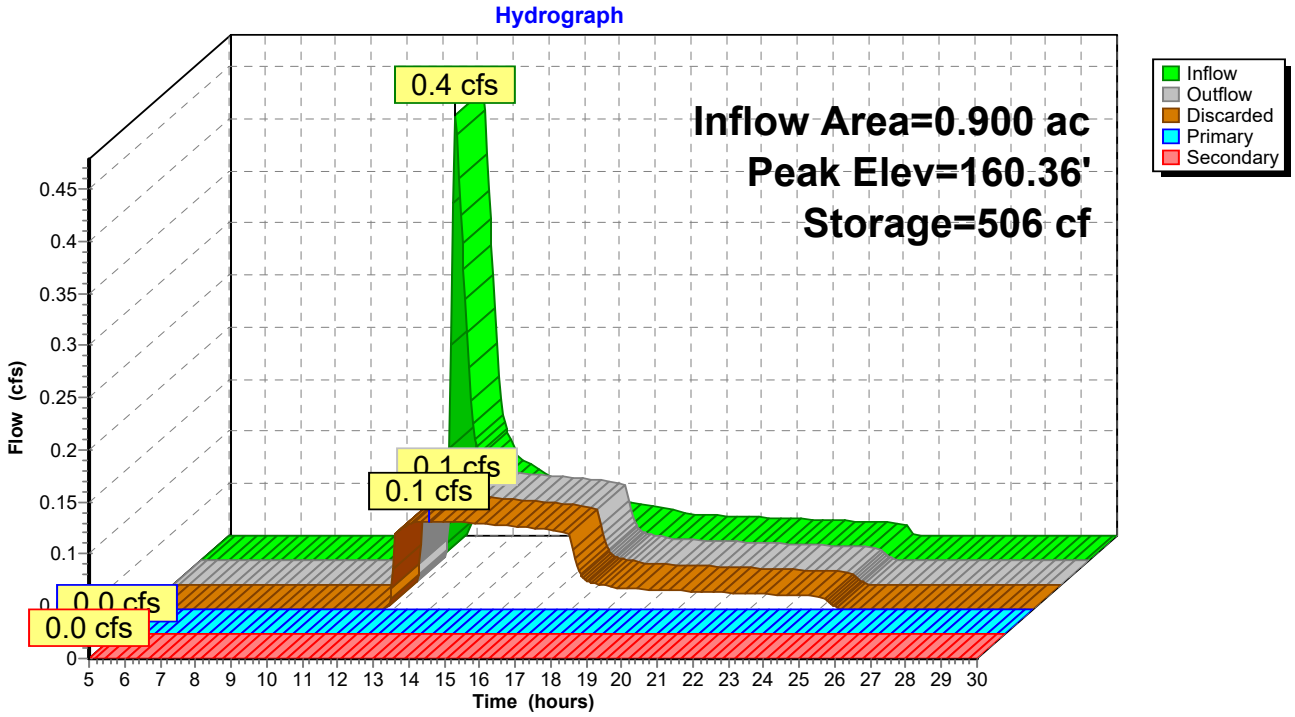
Device	Routing	Invert	Outlet Devices
#1	Discarded	160.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Secondary	162.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	160.22'	**12.0" Round Culvert** L= 43.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 160.22' / 160.00' S= 0.0051 '/' Cc= 0.900 n= 0.013
#4	Device 3	161.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	162.00'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.1 cfs @ 13.02 hrs HW=160.36' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 5.00 hrs HW=160.00' (Free Discharge)
└**3=Culvert** (Controls 0.0 cfs)
  ├**4=Orifice/Grate** (Controls 0.0 cfs)
  └**5=Orifice/Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 5.00 hrs HW=160.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 2P: Infiltration Basin 2



Summary for Pond 3P: Infiltration Basin 3

Inflow Area = 0.120 ac, 16.67% Impervious, Inflow Depth = 0.09" for 2-Year event
Inflow = 0.0 cfs @ 13.80 hrs, Volume= 0.001 af
Outflow = 0.0 cfs @ 13.85 hrs, Volume= 0.001 af, Atten= 0%, Lag= 3.0 min
Discarded = 0.0 cfs @ 13.85 hrs, Volume= 0.001 af
Primary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 164.00' @ 13.85 hrs Surf.Area= 224 sf Storage= 0 cf

Plug-Flow detention time= 3.0 min calculated for 0.001 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (1,040.9 - 1,038.0)

Volume	Invert	Avail.Storage	Storage Description
#1	164.00'	303 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

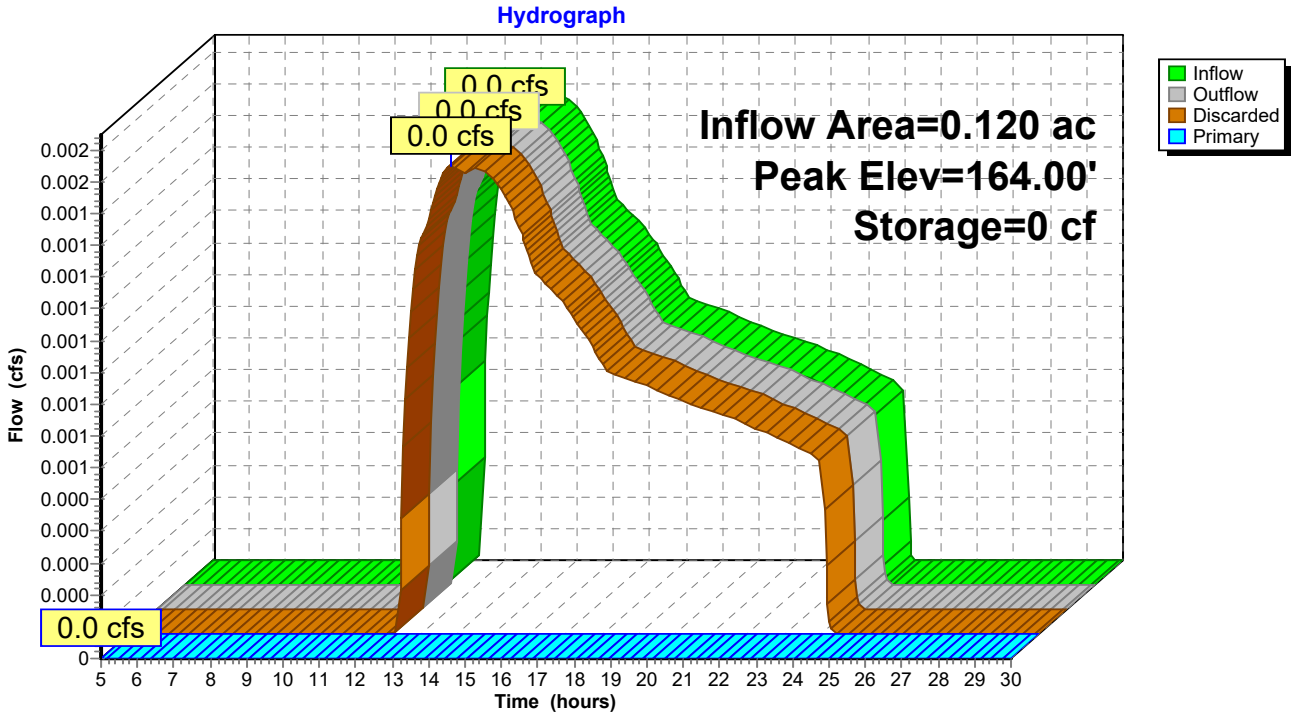
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
164.00	224	0	0	224
165.00	390	303	303	401

Device	Routing	Invert	Outlet Devices
#1	Primary	159.00'	**6.0" Round Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 159.00' / 157.93' S= 0.0255 '/' Cc= 0.900 n= 0.013
#2	Discarded	164.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 162.00'
#3	Device 1	164.33'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 13.85 hrs HW=164.00' (Free Discharge)
└**2=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 5.00 hrs HW=164.00' (Free Discharge)
└**1=Culvert** (Passes 0.0 cfs of 1.7 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.0 cfs)

Pond 3P: Infiltration Basin 3



Summary for Pond 4P: Infiltration Basin 4

Inflow Area = 0.080 ac, 25.00% Impervious, Inflow Depth = 0.20" for 2-Year event
Inflow = 0.0 cfs @ 12.38 hrs, Volume= 0.001 af
Outflow = 0.0 cfs @ 12.43 hrs, Volume= 0.001 af, Atten= 3%, Lag= 3.1 min
Discarded = 0.0 cfs @ 12.43 hrs, Volume= 0.001 af
Primary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 164.00' @ 12.43 hrs Surf.Area= 225 sf Storage= 1 cf

Plug-Flow detention time= 3.0 min calculated for 0.001 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (974.9 - 971.9)

Volume	Invert	Avail.Storage	Storage Description
#1	164.00'	303 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

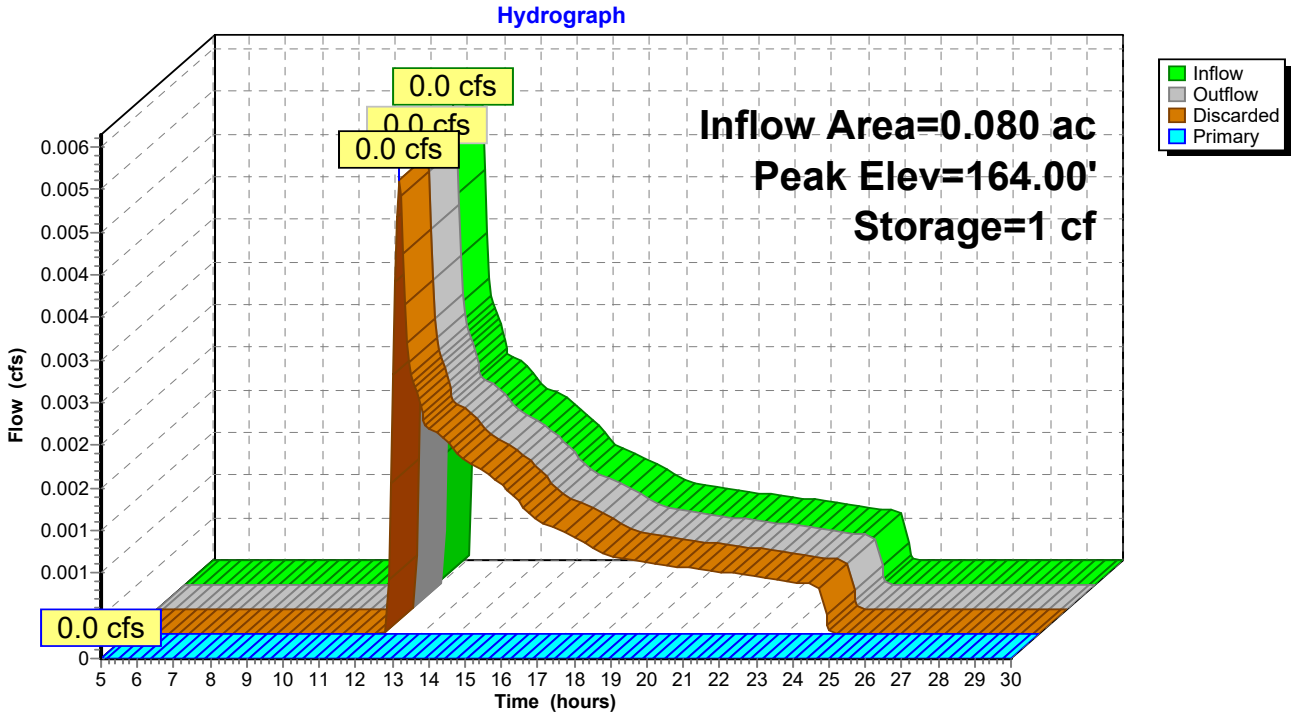
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
164.00	224	0	0	224
165.00	390	303	303	401

Device	Routing	Invert	Outlet Devices
#1	Primary	159.00'	**6.0" Round Culvert** L= 28.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 159.00' / 157.93' S= 0.0382 '/' Cc= 0.900 n= 0.013
#2	Discarded	164.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 162.00'
#3	Device 1	164.33'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.43 hrs HW=164.00' (Free Discharge)
└**2=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 5.00 hrs HW=164.00' (Free Discharge)
└**1=Culvert** (Passes 0.0 cfs of 1.9 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.0 cfs)

Pond 4P: Infiltration Basin 4



Summary for Pond 5P: Typical Roof Drywell

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.040 ac,100.00% Impervious, Inflow Depth > 2.82" for 2-Year event
Inflow = 0.1 cfs @ 12.09 hrs, Volume= 0.009 af
Outflow = 0.0 cfs @ 12.48 hrs, Volume= 0.009 af, Atten= 77%, Lag= 23.8 min
Discarded = 0.0 cfs @ 12.48 hrs, Volume= 0.009 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 100.66' @ 12.48 hrs Surf.Area= 319 sf Storage= 101 cf

Plug-Flow detention time= 22.8 min calculated for 0.009 af (100% of inflow)
Center-of-Mass det. time= 22.6 min (789.2 - 766.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	210 cf	**13.00'W x 24.50'L x 2.04'H Field A** 650 cf Overall - 126 cf Embedded = 525 cf x 40.0% Voids
#2A	100.50'	126 cf	**Cultec C-100** x 9 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
		335 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 98.00'

Discarded OutFlow Max=0.0 cfs @ 12.48 hrs HW=100.66' (Free Discharge)
1=Exfiltration (Controls 0.0 cfs)

Pond 5P: Typical Roof Drywell - Chamber Wizard Field A

Chamber Model = Cultec C-100
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

36.0" Wide + 12.0" Spacing = 48.0" C-C

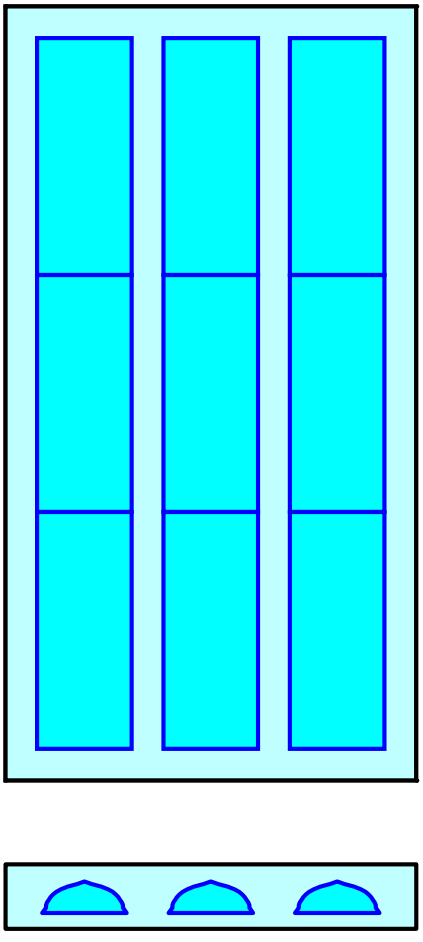
3 Chambers/Row x 7.50' Long = 22.50' + 12.0" End Stone x 2 = 24.50' Base Length
3 Rows x 36.0" Wide + 12.0" Spacing x 2 + 12.0" Side Stone x 2 = 13.00' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

9 Chambers x 14.0 cf = 125.7 cf Chamber Storage

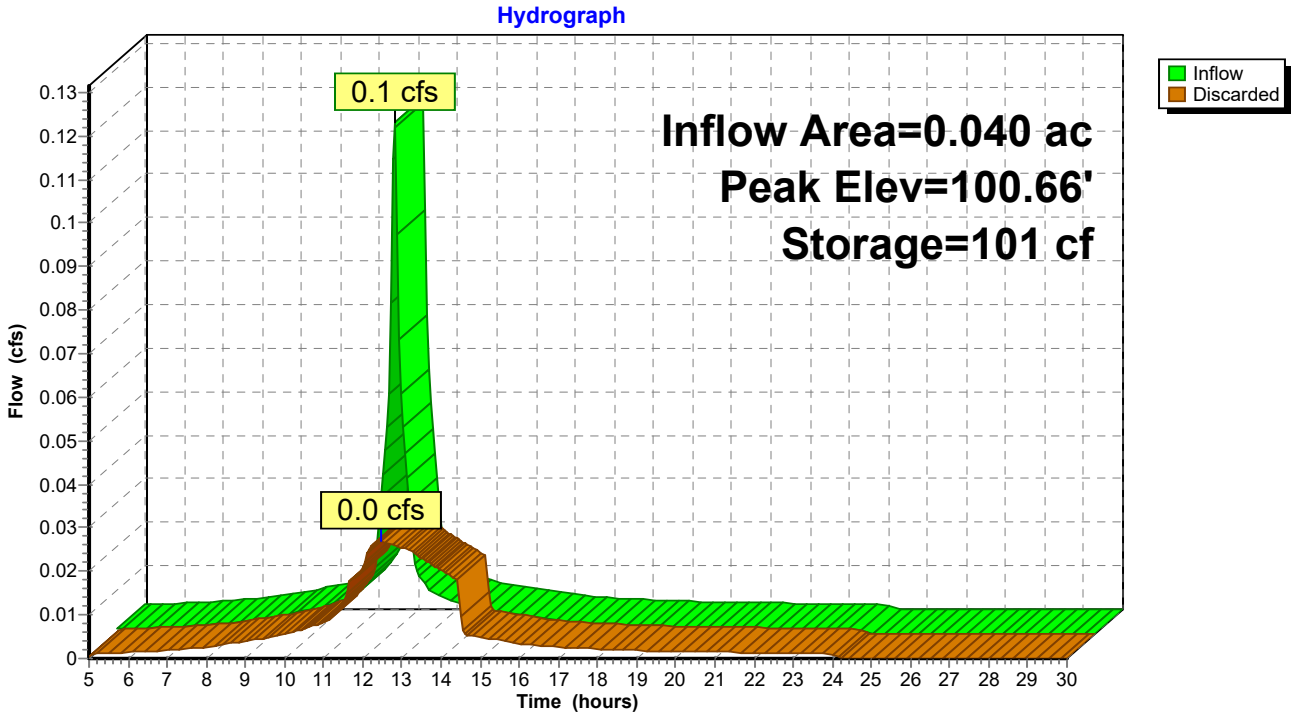
650.3 cf Field - 125.7 cf Chambers = 524.6 cf Stone x 40.0% Voids = 209.8 cf Stone Storage

Stone + Chamber Storage = 335.5 cf = 0.008 af

9 Chambers
24.1 cy Field
19.4 cy Stone



Pond 5P: Typical Roof Drywell



Summary for Pond 6P: Lot 4 Trench

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.054 ac,100.00% Impervious, Inflow Depth > 2.82" for 2-Year event
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.013 af
Outflow = 0.0 cfs @ 12.47 hrs, Volume= 0.013 af, Atten= 76%, Lag= 23.2 min
Discarded = 0.0 cfs @ 12.47 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 159.62' @ 12.47 hrs Surf.Area= 510 sf Storage= 128 cf

Plug-Flow detention time= 19.2 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 19.0 min (785.6 - 766.6)

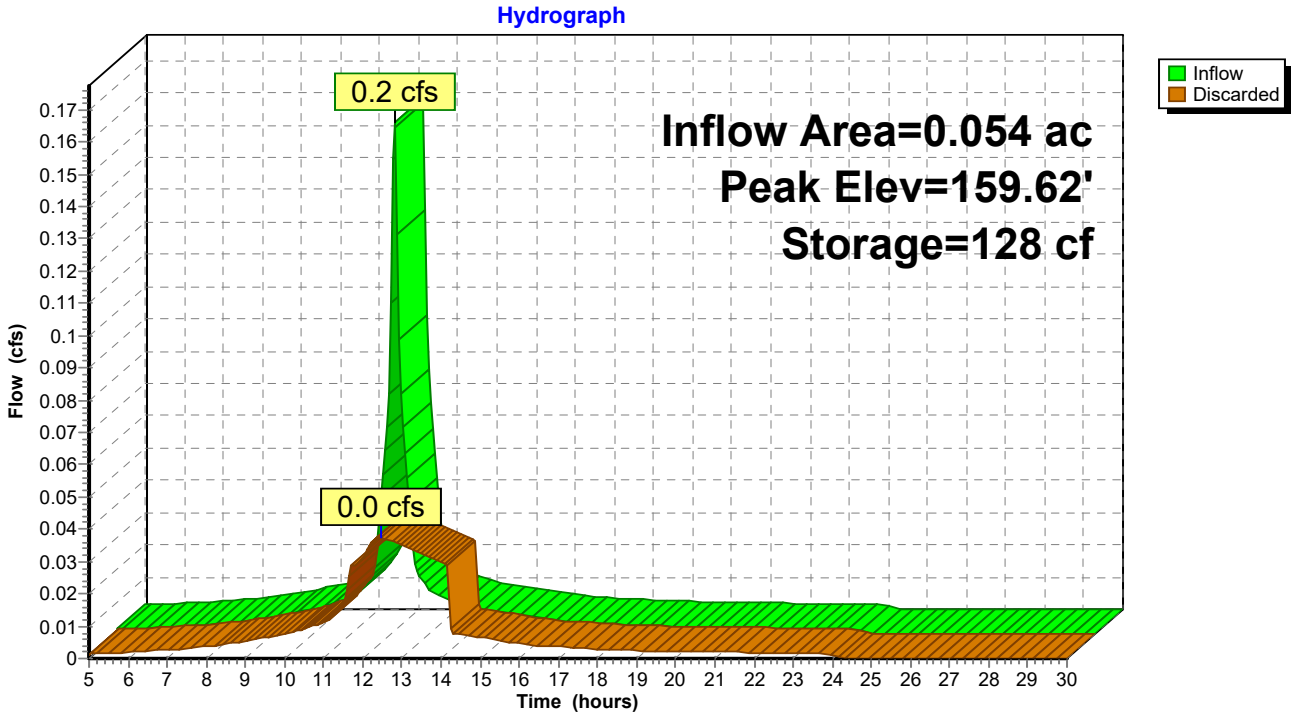
Volume	Invert	Avail.Storage	Storage Description
#1	158.99'	410 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
158.99	510	0.0	0	0
159.00	510	40.0	2	2
160.00	510	40.0	204	206
161.00	510	40.0	204	410

Device	Routing	Invert	Outlet Devices
#1	Discarded	158.99'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 157.00'

Discarded OutFlow Max=0.0 cfs @ 12.47 hrs HW=159.61' (Free Discharge)
1=Exfiltration (Controls 0.0 cfs)

Pond 6P: Lot 4 Trench



Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 4 Driveway Runoff Area=2,350 sf 100.00% Impervious Runoff Depth>4.16"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.019 af

Subcatchment PWA-1A: PWA-1A Runoff Area=1.310 ac 14.50% Impervious Runoff Depth=0.69"
Flow Length=263' Tc=13.3 min CN=54 Runoff=0.6 cfs 0.075 af

Subcatchment PWA-1B: PWA-1B Runoff Area=0.900 ac 45.56% Impervious Runoff Depth=1.40"
Flow Length=231' Tc=9.8 min CN=66 Runoff=1.2 cfs 0.105 af

Subcatchment PWA-1C: PWA-1C Runoff Area=0.700 ac 0.00% Impervious Runoff Depth=0.05"
Flow Length=140' Tc=14.0 min CN=36 Runoff=0.0 cfs 0.003 af

Subcatchment PWA-2: PWA-2 Runoff Area=0.800 ac 0.00% Impervious Runoff Depth=0.02"
Flow Length=126' Slope=0.0200 '/' Tc=10.1 min CN=34 Runoff=0.0 cfs 0.001 af

Subcatchment PWA-3A: PWA-3A Runoff Area=0.120 ac 16.67% Impervious Runoff Depth=0.46"
Tc=6.0 min CN=49 Runoff=0.0 cfs 0.005 af

Subcatchment PWA-3B: PWA-3B Runoff Area=0.080 ac 25.00% Impervious Runoff Depth=0.69"
Tc=6.0 min CN=54 Runoff=0.0 cfs 0.005 af

Subcatchment PWA-3C: PWA-3C Runoff Area=0.110 ac 0.00% Impervious Runoff Depth=0.07"
Tc=6.0 min CN=37 Runoff=0.0 cfs 0.001 af

Subcatchment Typical Roof: Typical Roof Runoff Area=0.040 ac 100.00% Impervious Runoff Depth>4.16"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.014 af

Reach DP-1: Design Point 1 Inflow=0.1 cfs 0.011 af
Outflow=0.1 cfs 0.011 af

Reach DP-2: Design Point 2 Inflow=0.0 cfs 0.001 af
Outflow=0.0 cfs 0.001 af

Reach DP-3: Design Point 3 Inflow=0.0 cfs 0.001 af
Outflow=0.0 cfs 0.001 af

Pond 1P: Infiltration Basin 1 Peak Elev=162.12' Storage=432 cf Inflow=0.6 cfs 0.075 af
Discarded=0.2 cfs 0.072 af Primary=0.1 cfs 0.004 af Outflow=0.3 cfs 0.075 af

Pond 2P: Infiltration Basin 2 Peak Elev=161.11' Storage=1,824 cf Inflow=1.2 cfs 0.105 af
Discarded=0.1 cfs 0.100 af Primary=0.0 cfs 0.004 af Secondary=0.0 cfs 0.000 af Outflow=0.1 cfs 0.105 af

Pond 3P: Infiltration Basin 3 Peak Elev=164.08' Storage=19 cf Inflow=0.0 cfs 0.005 af
Discarded=0.0 cfs 0.005 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.005 af

Pond 4P: Infiltration Basin 4 Peak Elev=164.14' Storage=32 cf Inflow=0.0 cfs 0.005 af
Discarded=0.0 cfs 0.005 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.005 af

Pond 5P: Typical Roof Drywell Peak Elev=100.99' Storage=173 cf Inflow=0.2 cfs 0.014 af
Outflow=0.0 cfs 0.014 af

Pond 6P: Lot 4 Trench Peak Elev=160.09' Storage=224 cf Inflow=0.2 cfs 0.019 af
Outflow=0.0 cfs 0.019 af

Total Runoff Area = 4.114 ac Runoff Volume = 0.227 af Average Runoff Depth = 0.66"
82.16% Pervious = 3.380 ac 17.84% Impervious = 0.734 ac

Summary for Subcatchment 1S: Lot 4 Driveway

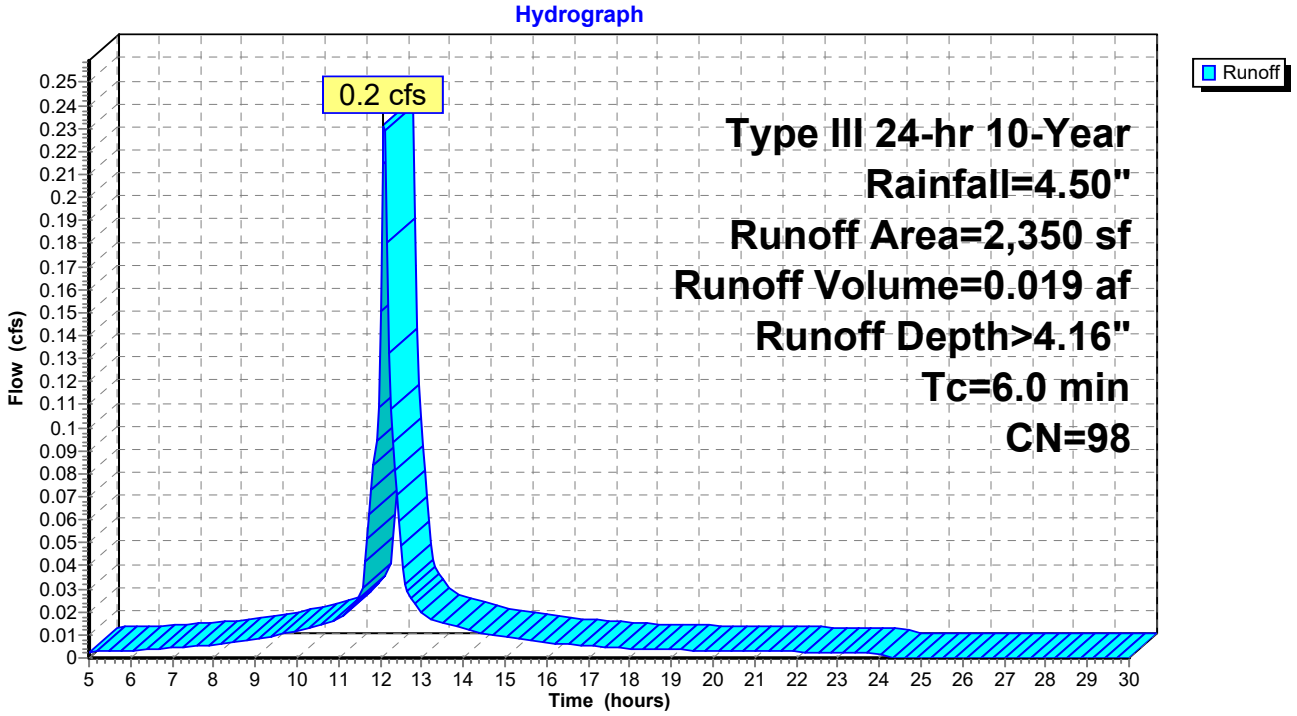
Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.019 af, Depth> 4.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,350	98	Paved parking, HSG A
2,350		100.00% Impervious Area

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

Subcatchment 1S: Lot 4 Driveway



Summary for Subcatchment PWA-1A: PWA-1A

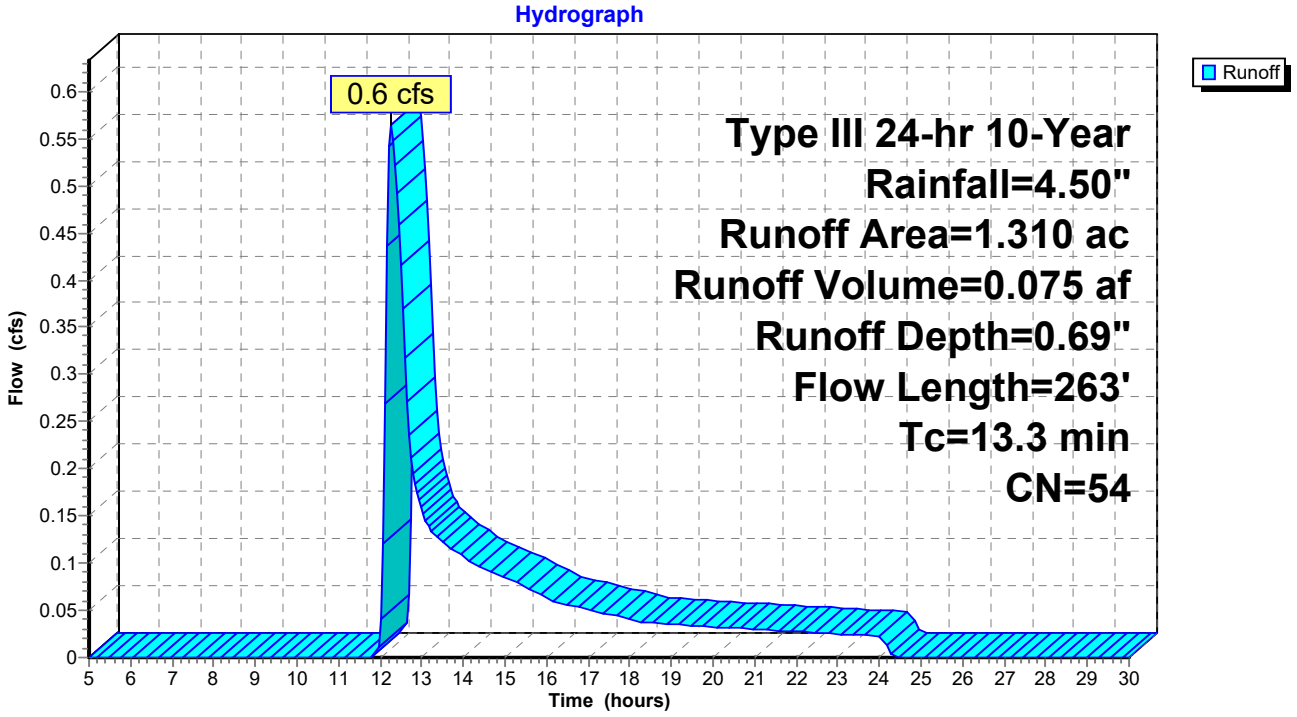
Runoff = 0.6 cfs @ 12.25 hrs, Volume= 0.075 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (ac)	CN	Description
	0.680	39	>75% Grass cover, Good, HSG A
*	0.190	98	Offsite Impervious
	0.160	30	Woods, Good, HSG A
	0.220	74	>75% Grass cover, Good, HSG C
	0.060	70	Woods, Good, HSG C
	1.310	54	Weighted Average
	1.120		85.50% Pervious Area
	0.190		14.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	20	0.0200	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
5.5	30	0.0200	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.8	213	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.3	263	Total			

Subcatchment PWA-1A: PWA-1A



Summary for Subcatchment PWA-1B: PWA-1B

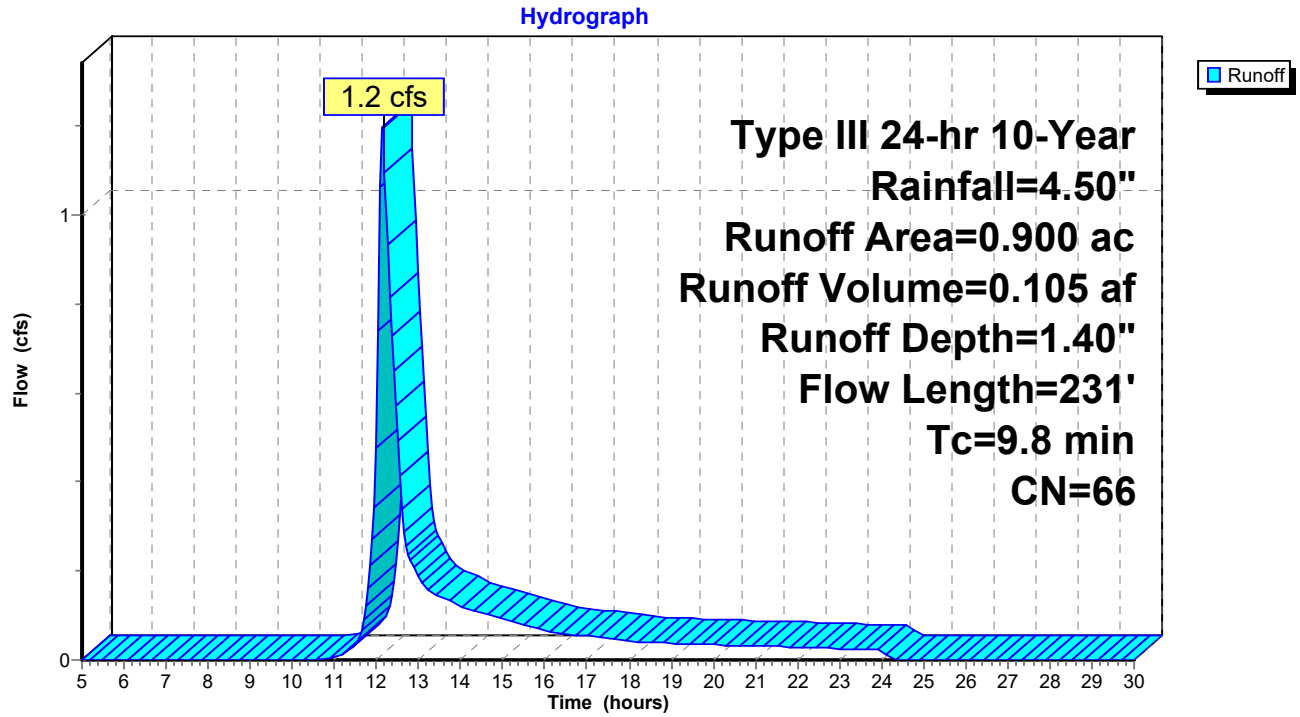
Runoff = 1.2 cfs @ 12.15 hrs, Volume= 0.105 af, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.410	98	Paved parking, HSG A
0.490	39	>75% Grass cover, Good, HSG A
0.900	66	Weighted Average
0.490		54.44% Pervious Area
0.410		45.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.1	12	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.4	169	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.8	231	Total			

Subcatchment PWA-1B: PWA-1B



Summary for Subcatchment PWA-1C: PWA-1C

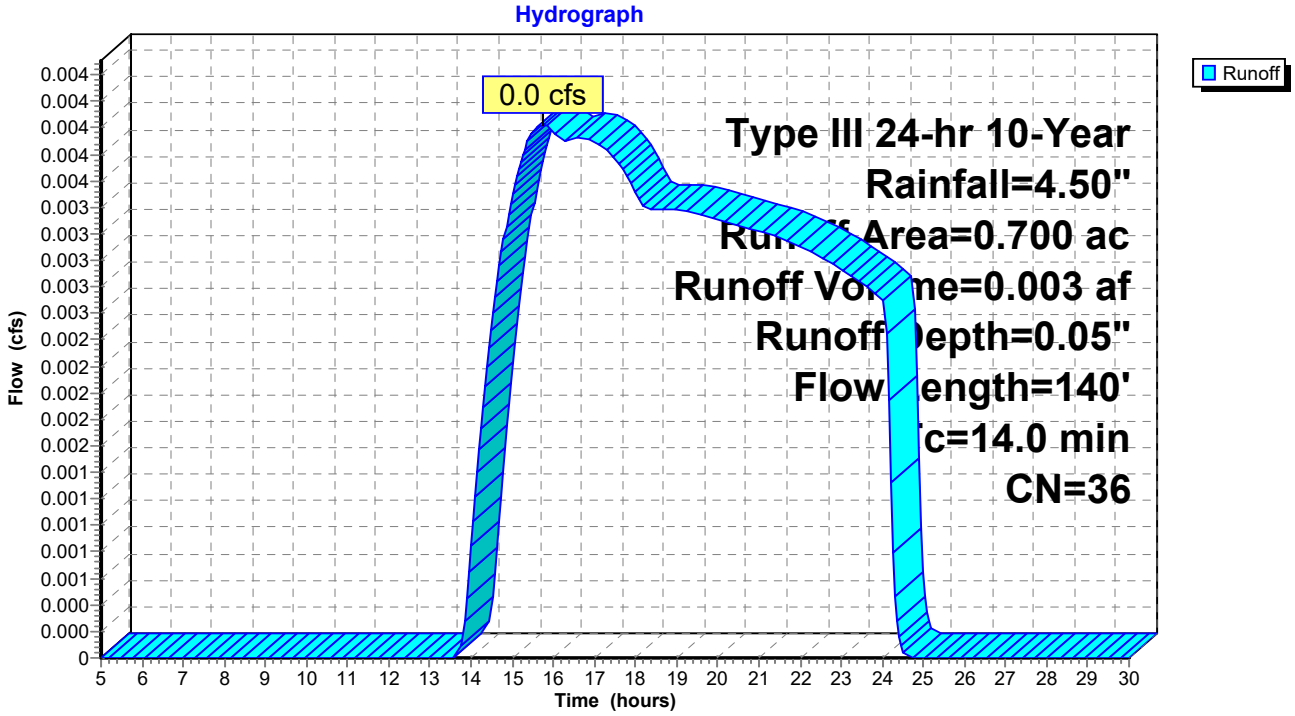
Runoff = 0.0 cfs @ 15.76 hrs, Volume= 0.003 af, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.070	70	Woods, Good, HSG C
0.180	39	>75% Grass cover, Good, HSG A
0.450	30	Woods, Good, HSG A
0.700	36	Weighted Average
0.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	90	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	140	Total			

Subcatchment PWA-1C: PWA-1C



Summary for Subcatchment PWA-2: PWA-2

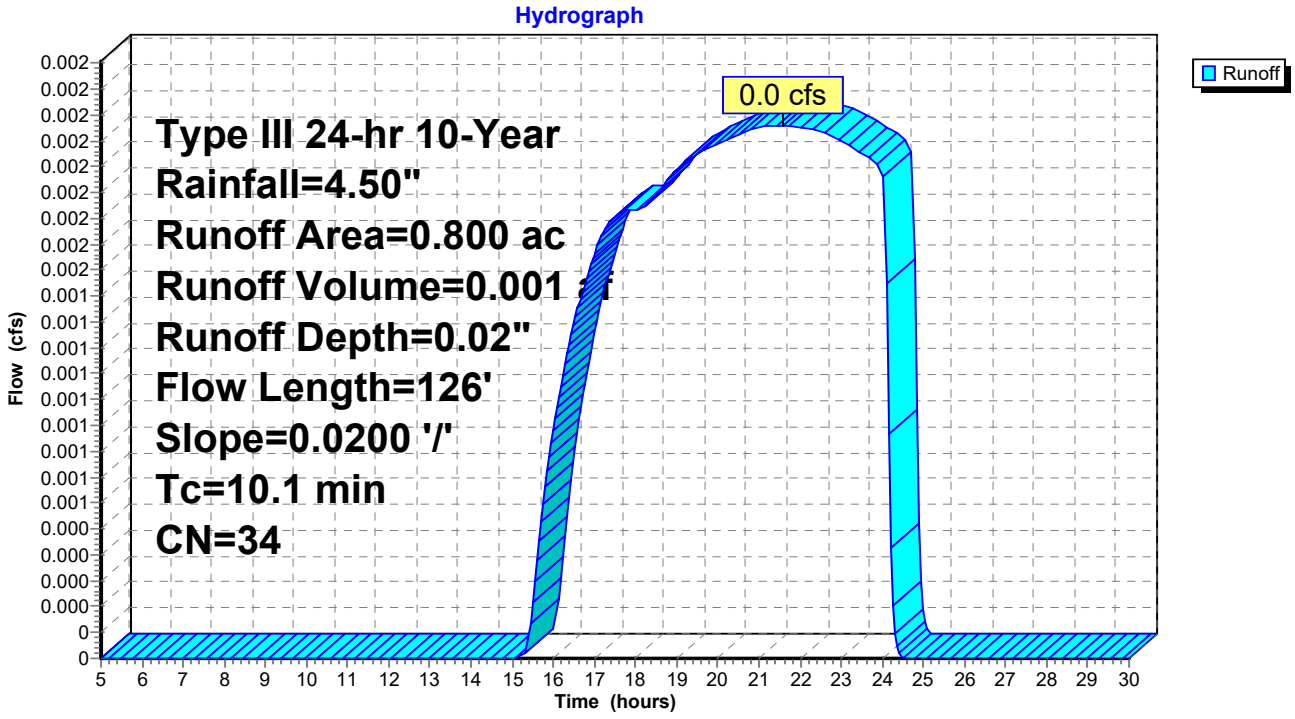
Runoff = 0.0 cfs @ 21.60 hrs, Volume= 0.001 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.430	30	Woods, Good, HSG A
0.370	39	>75% Grass cover, Good, HSG A
0.800	34	Weighted Average
0.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.8	76	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.1	126	Total			

Subcatchment PWA-2: PWA-2



Summary for Subcatchment PWA-3A: PWA-3A

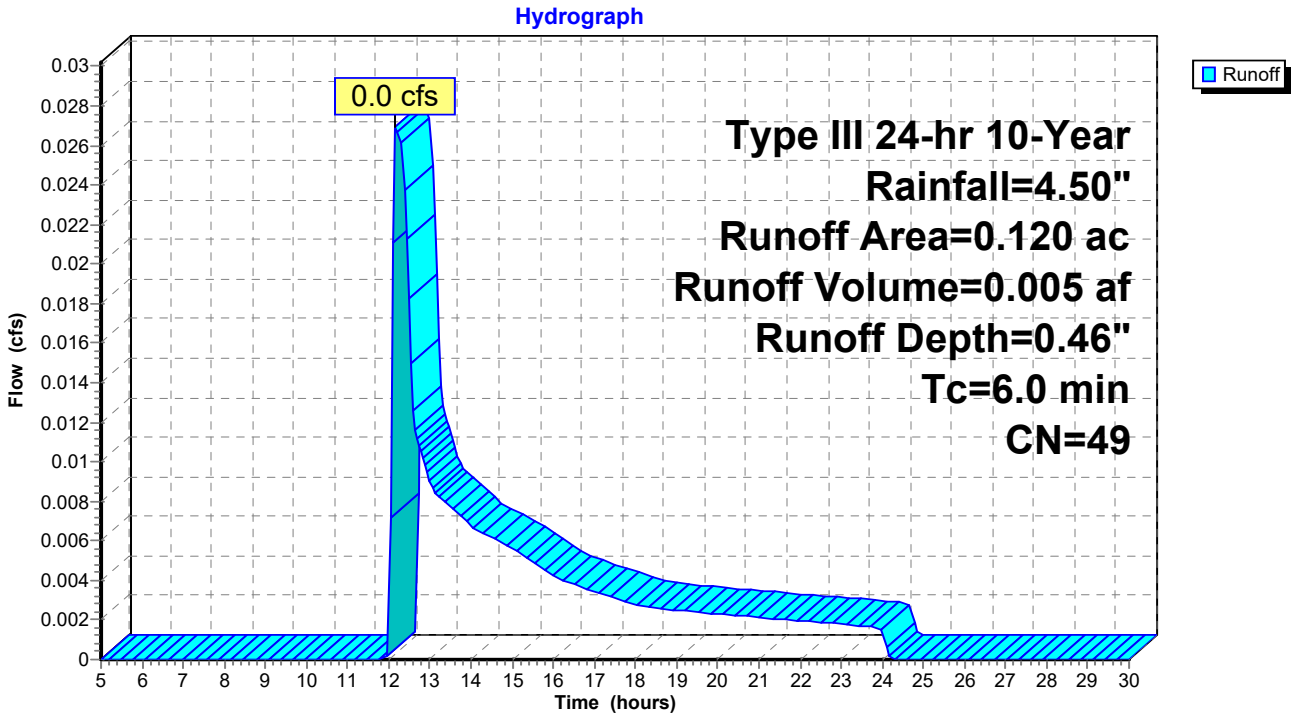
Runoff = 0.0 cfs @ 12.15 hrs, Volume= 0.005 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG A
0.100	39	>75% Grass cover, Good, HSG A
0.120	49	Weighted Average
0.100		83.33% Pervious Area
0.020		16.67% Impervious Area

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

Subcatchment PWA-3A: PWA-3A



Summary for Subcatchment PWA-3B: PWA-3B

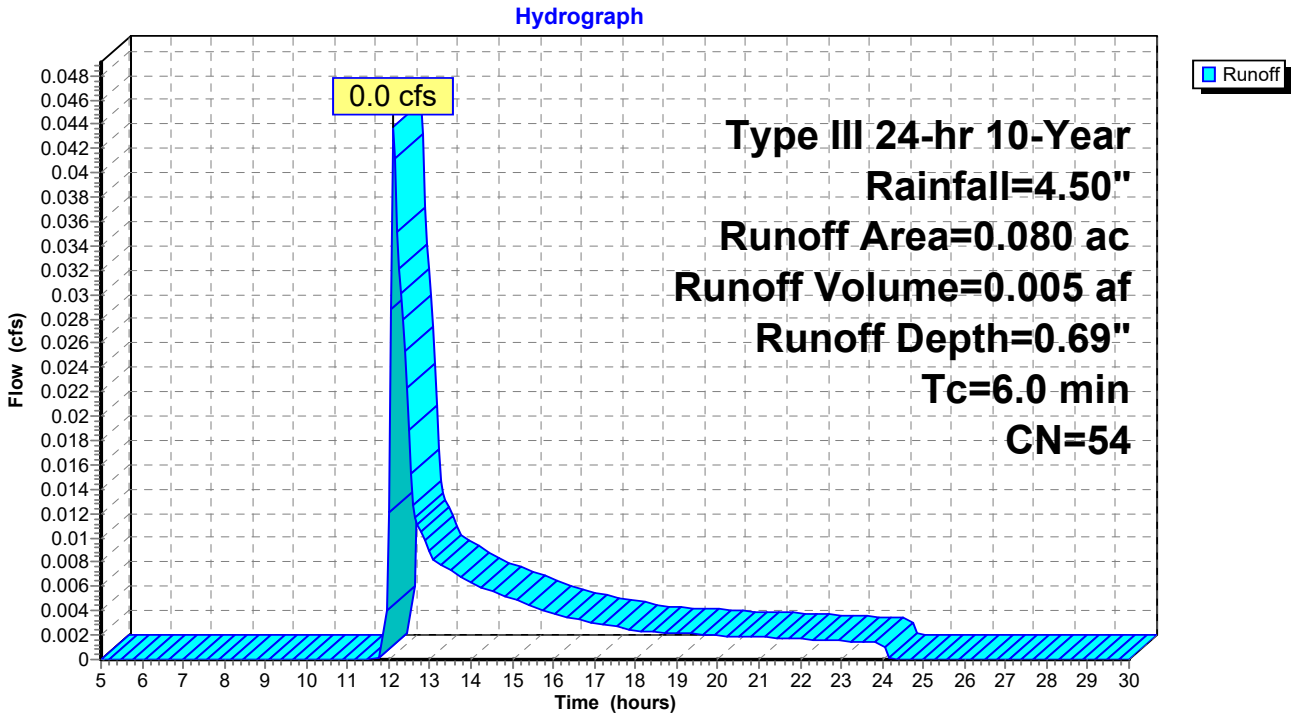
Runoff = 0.0 cfs @ 12.12 hrs, Volume= 0.005 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG A
0.060	39	>75% Grass cover, Good, HSG A
0.080	54	Weighted Average
0.060		75.00% Pervious Area
0.020		25.00% Impervious Area

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

Subcatchment PWA-3B: PWA-3B



Summary for Subcatchment PWA-3C: PWA-3C

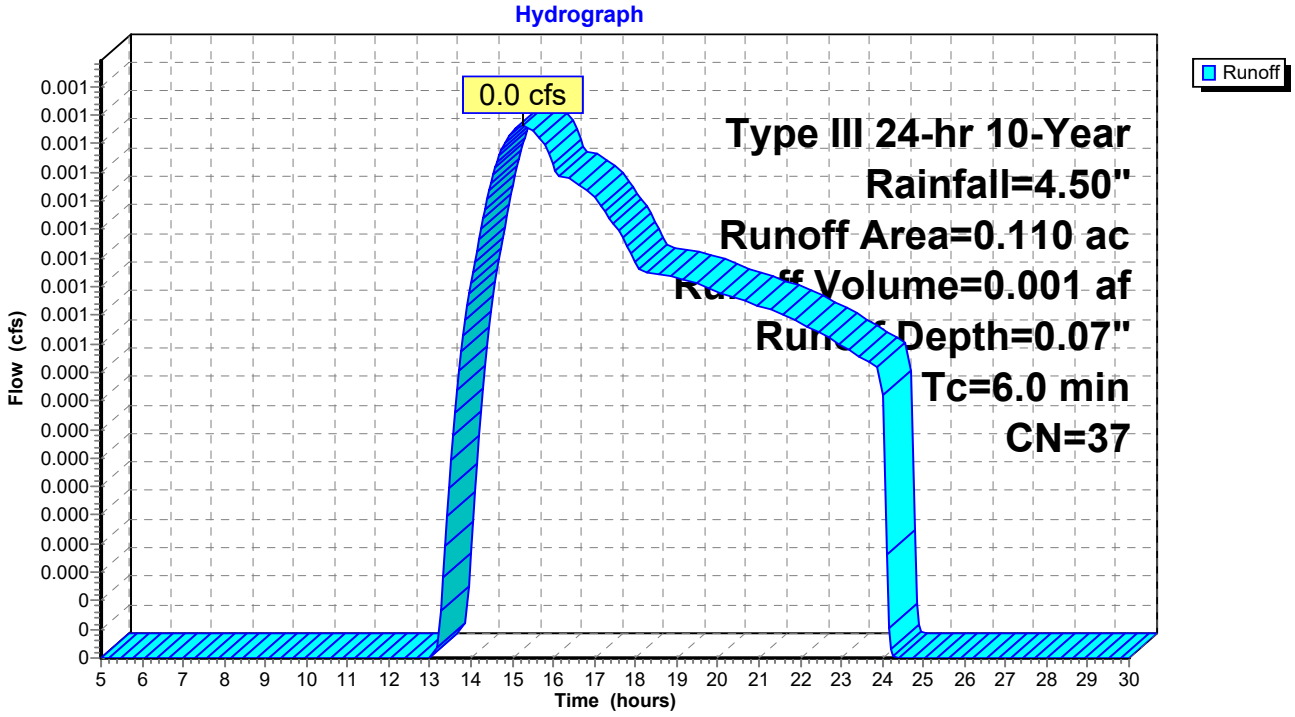
Runoff = 0.0 cfs @ 15.28 hrs, Volume= 0.001 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.080	39	>75% Grass cover, Good, HSG A
0.030	30	Woods, Good, HSG A
0.110	37	Weighted Average
0.110		100.00% Pervious Area

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

Subcatchment PWA-3C: PWA-3C



Summary for Subcatchment Typical Roof: Typical Roof

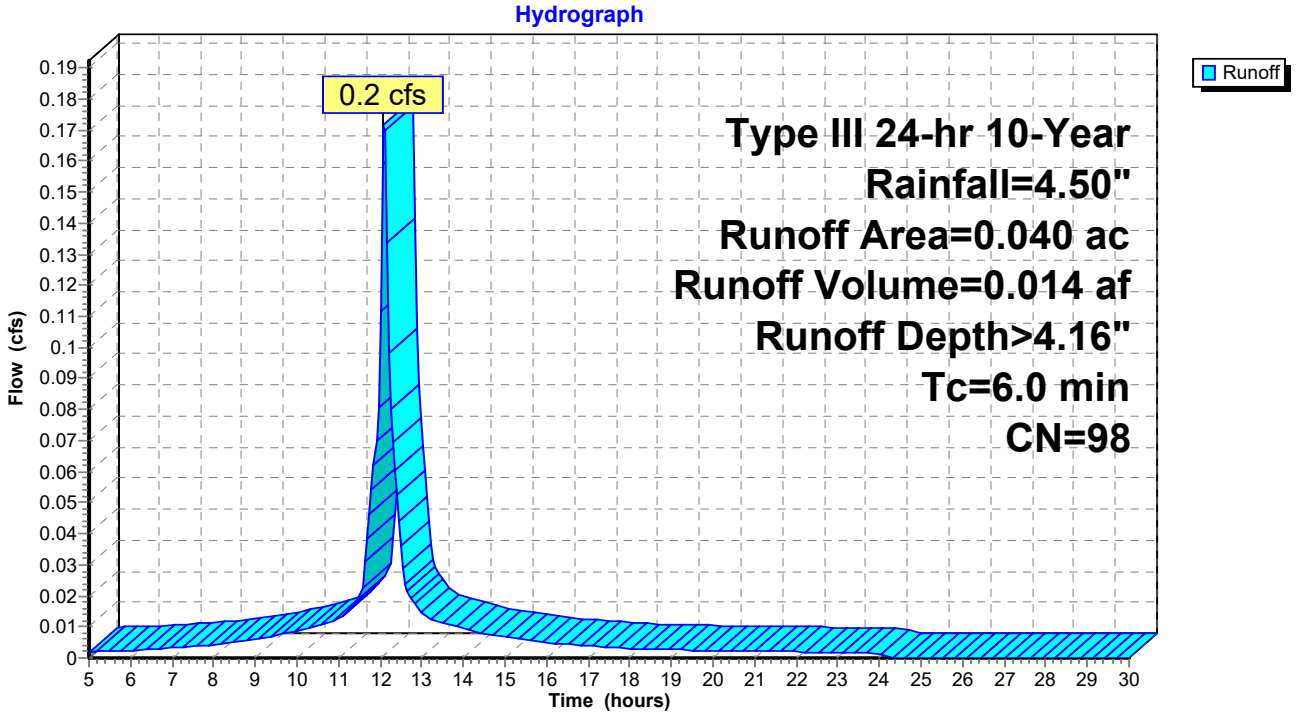
Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.014 af, Depth> 4.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.040		100.00% Impervious Area

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

Subcatchment Typical Roof: Typical Roof



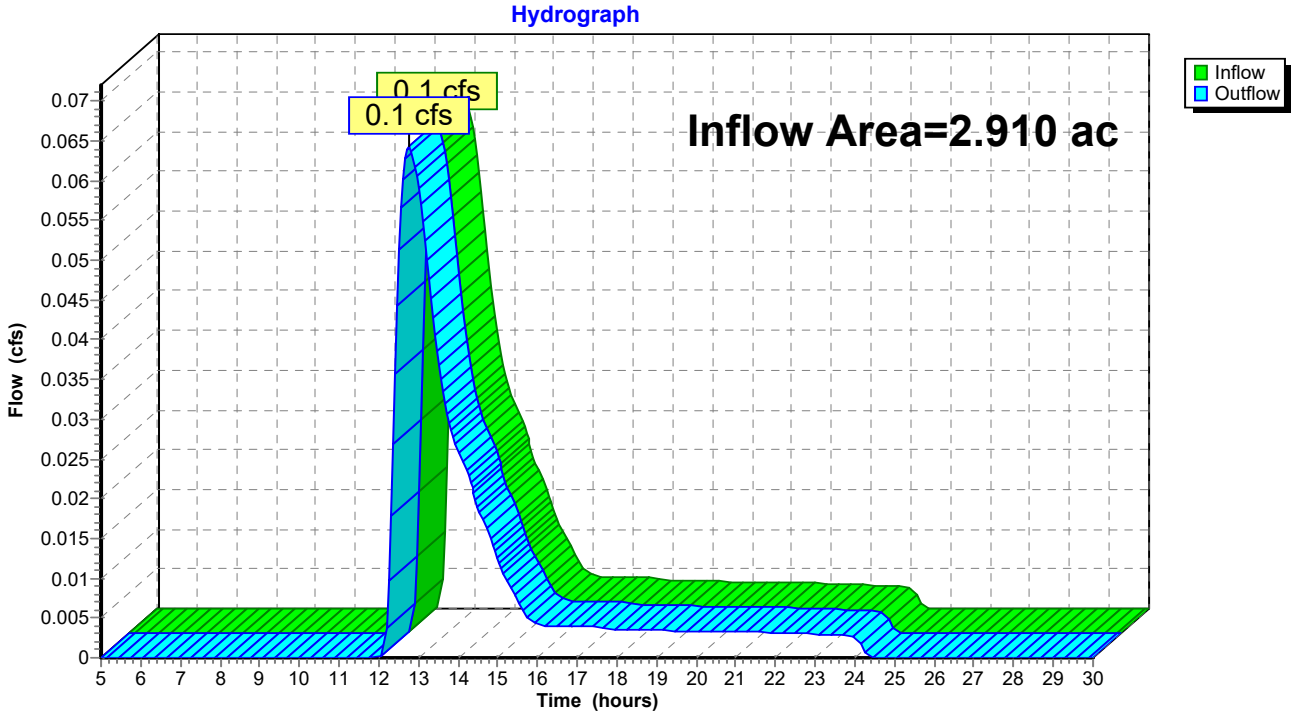
Summary for Reach DP-1: Design Point 1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.910 ac, 20.62% Impervious, Inflow Depth = 0.05" for 10-Year event
Inflow = 0.1 cfs @ 12.75 hrs, Volume= 0.011 af
Outflow = 0.1 cfs @ 12.75 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1



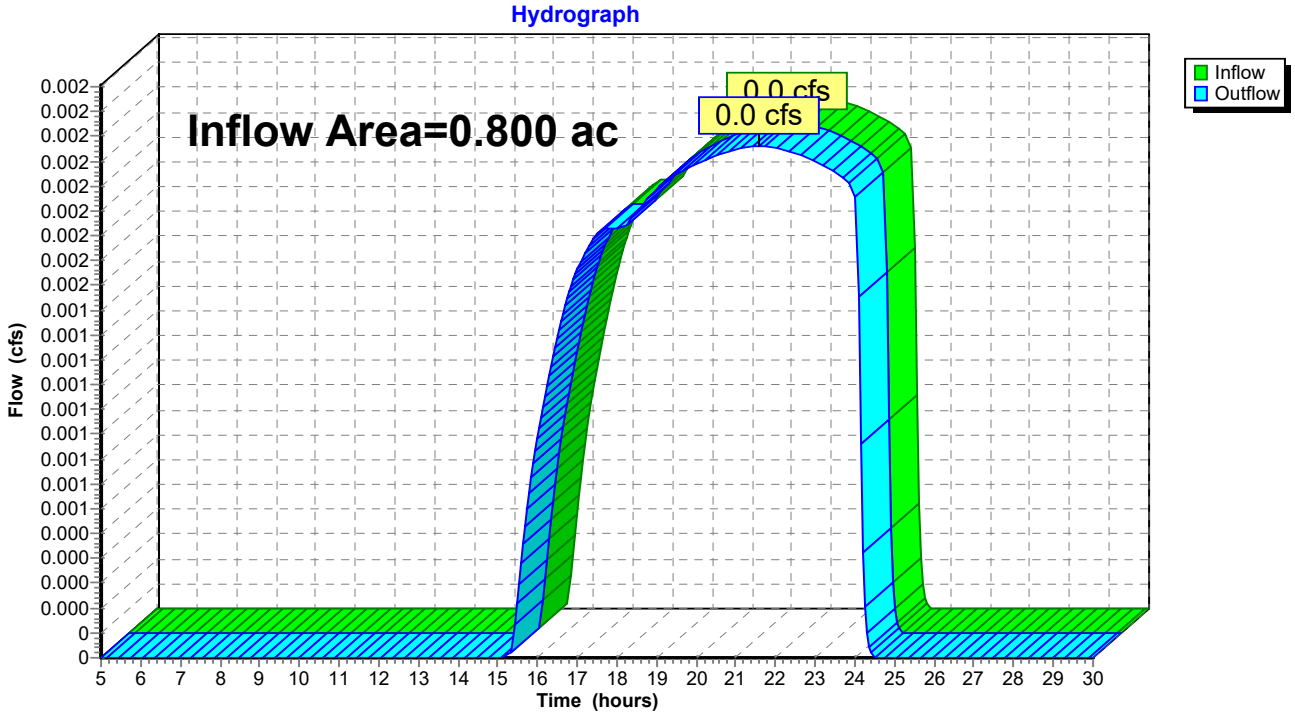
Summary for Reach DP-2: Design Point 2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.800 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-Year event
Inflow = 0.0 cfs @ 21.60 hrs, Volume= 0.001 af
Outflow = 0.0 cfs @ 21.60 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2



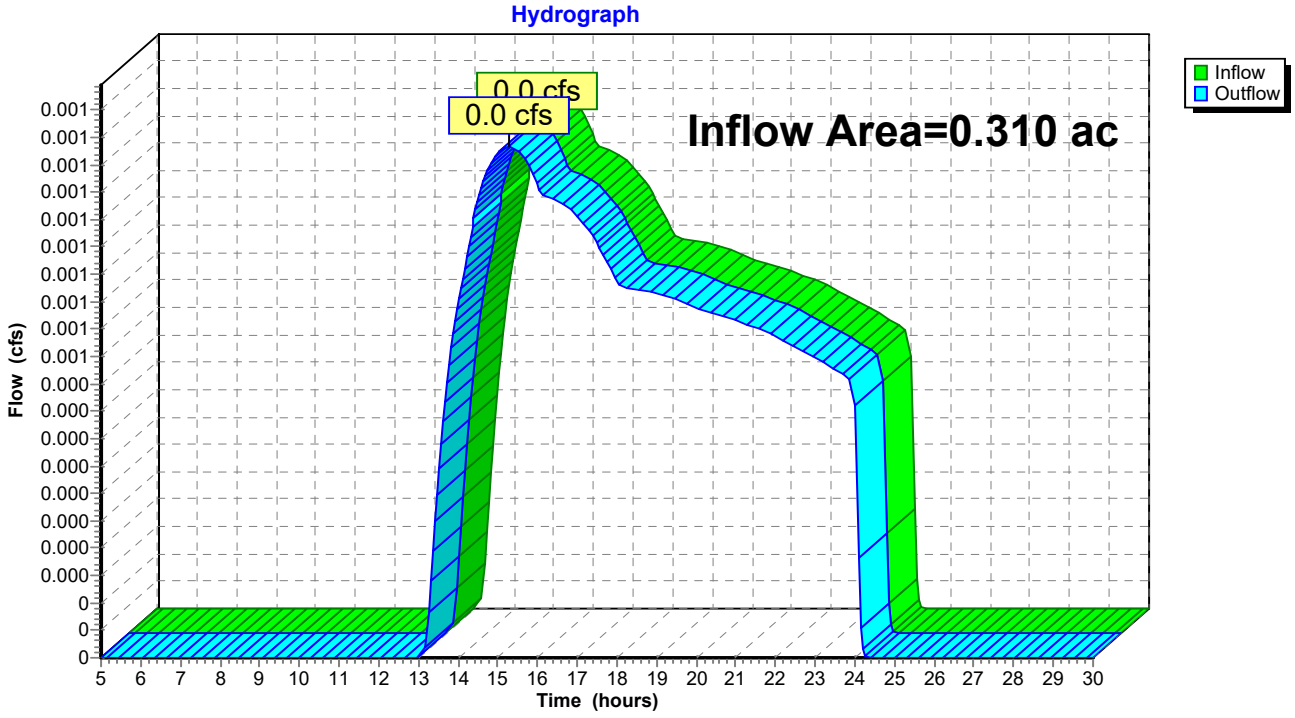
Summary for Reach DP-3: Design Point 3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.310 ac, 12.90% Impervious, Inflow Depth = 0.02" for 10-Year event
Inflow = 0.0 cfs @ 15.28 hrs, Volume= 0.001 af
Outflow = 0.0 cfs @ 15.28 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3



Summary for Pond 1P: Infiltration Basin 1

Inflow Area = 1.310 ac, 14.50% Impervious, Inflow Depth = 0.69" for 10-Year event
Inflow = 0.6 cfs @ 12.25 hrs, Volume= 0.075 af
Outflow = 0.3 cfs @ 12.64 hrs, Volume= 0.075 af, Atten= 50%, Lag= 23.0 min
Discarded = 0.2 cfs @ 12.64 hrs, Volume= 0.072 af
Primary = 0.1 cfs @ 12.64 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 162.12' @ 12.64 hrs Surf.Area= 3,823 sf Storage= 432 cf

Plug-Flow detention time= 9.8 min calculated for 0.075 af (100% of inflow)
Center-of-Mass det. time= 9.8 min (924.6 - 914.9)

Volume	Invert	Avail.Storage	Storage Description
#1	162.00'	4,749 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

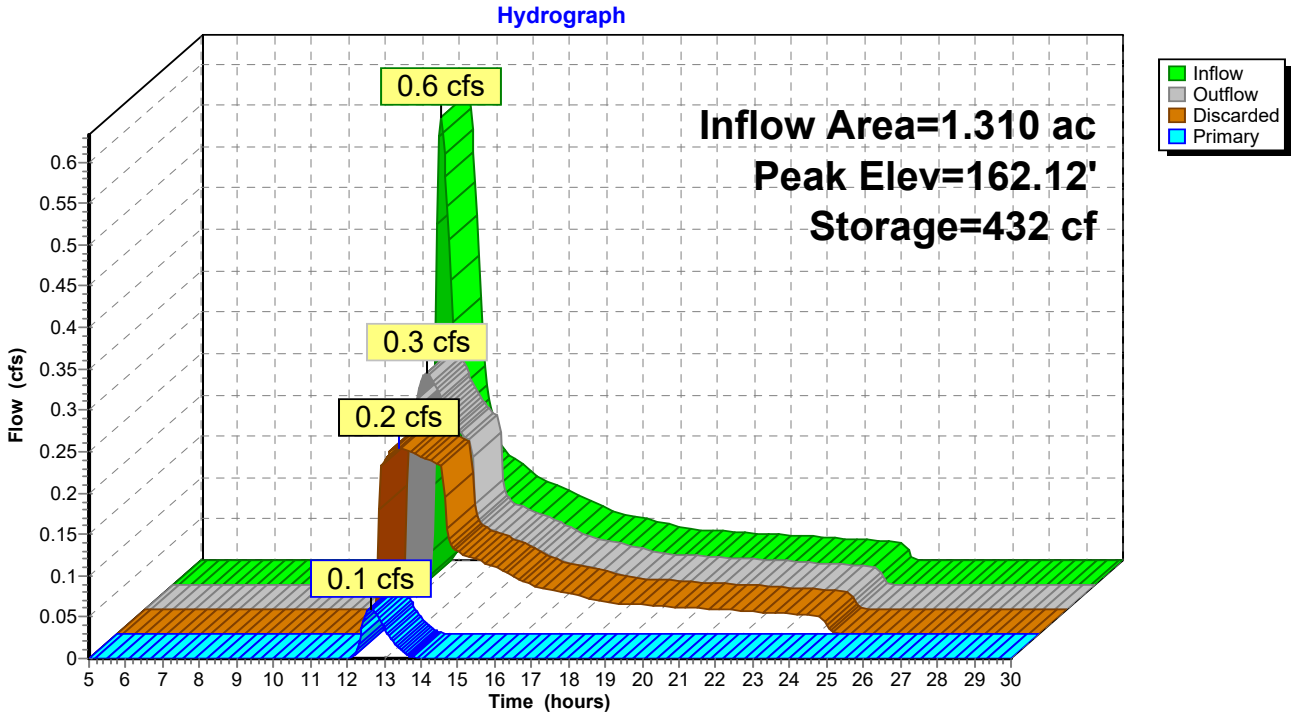
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
162.00	3,568	0	0	3,568
163.00	6,037	4,749	4,749	6,049

Device	Routing	Invert	Outlet Devices
#1	Discarded	162.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 160.00'
#2	Primary	162.00'	**12.0" Round Culvert** L= 108.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 162.00' / 160.50' S= 0.0139 '/' Cc= 0.900 n= 0.013

Discarded OutFlow Max=0.2 cfs @ 12.64 hrs HW=162.12' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.2 cfs)

Primary OutFlow Max=0.1 cfs @ 12.64 hrs HW=162.12' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.1 cfs @ 1.16 fps)

Pond 1P: Infiltration Basin 1



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 0.900 ac, 45.56% Impervious, Inflow Depth = 1.40" for 10-Year event
Inflow = 1.2 cfs @ 12.15 hrs, Volume= 0.105 af
Outflow = 0.1 cfs @ 13.52 hrs, Volume= 0.105 af, Atten= 88%, Lag= 82.3 min
Discarded = 0.1 cfs @ 13.52 hrs, Volume= 0.100 af
Primary = 0.0 cfs @ 13.52 hrs, Volume= 0.004 af
Secondary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 161.11' @ 13.52 hrs Surf.Area= 2,009 sf Storage= 1,824 cf

Plug-Flow detention time= 173.1 min calculated for 0.105 af (100% of inflow)
Center-of-Mass det. time= 172.7 min (1,041.0 - 868.3)

Volume	Invert	Avail.Storage	Storage Description
#1	160.00'	6,975 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
160.00	1,300	0	0	1,300
161.00	1,934	1,607	1,607	1,950
162.00	2,669	2,292	3,898	2,704
163.00	3,504	3,077	6,975	3,562

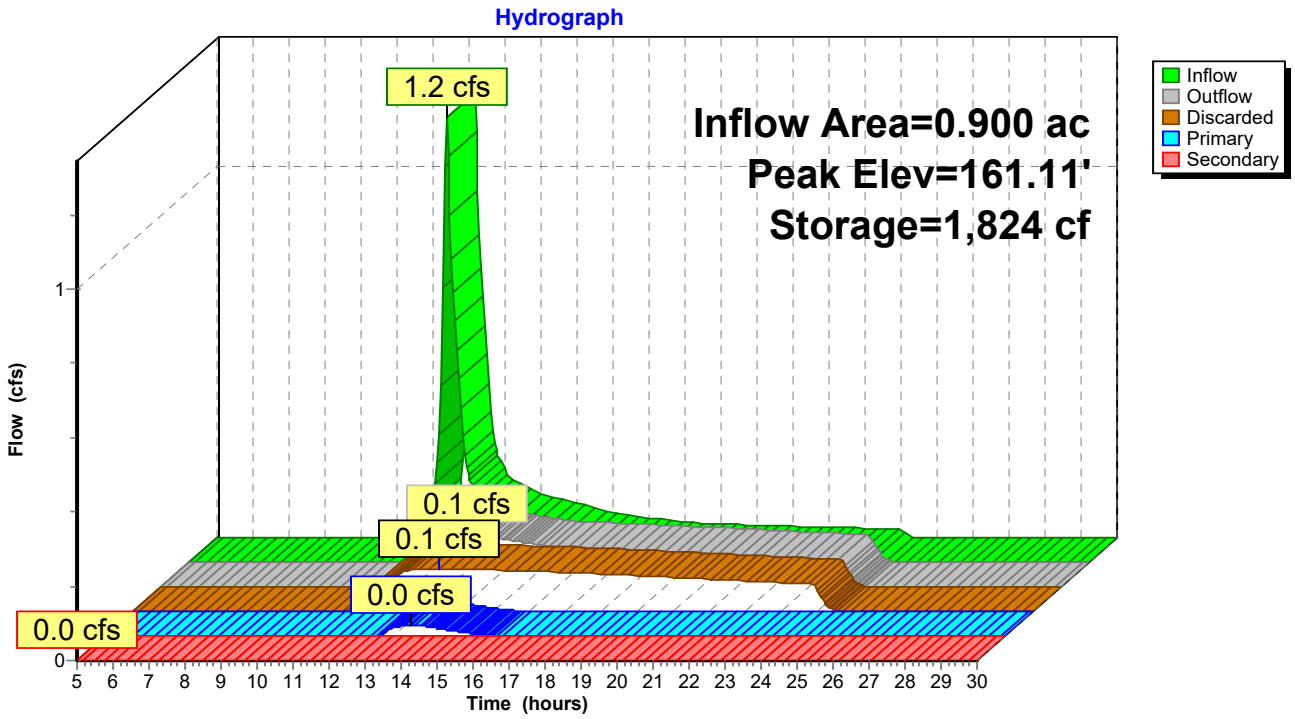
Device	Routing	Invert	Outlet Devices
#1	Discarded	160.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Secondary	162.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	160.22'	**12.0" Round Culvert** L= 43.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 160.22' / 160.00' S= 0.0051 '/' Cc= 0.900 n= 0.013
#4	Device 3	161.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	162.00'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.1 cfs @ 13.52 hrs HW=161.11' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 13.52 hrs HW=161.11' (Free Discharge)
└**3=Culvert** (Passes 0.0 cfs of 1.8 cfs potential flow)
  ├**4=Orifice/Grate** (Orifice Controls 0.0 cfs @ 1.13 fps)
  └**5=Orifice/Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 5.00 hrs HW=160.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 2P: Infiltration Basin 2



Summary for Pond 3P: Infiltration Basin 3

Inflow Area = 0.120 ac, 16.67% Impervious, Inflow Depth = 0.46" for 10-Year event
Inflow = 0.0 cfs @ 12.15 hrs, Volume= 0.005 af
Outflow = 0.0 cfs @ 12.58 hrs, Volume= 0.005 af, Atten= 49%, Lag= 25.6 min
Discarded = 0.0 cfs @ 12.58 hrs, Volume= 0.005 af
Primary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 164.08' @ 12.58 hrs Surf.Area= 236 sf Storage= 19 cf

Plug-Flow detention time= 7.5 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 7.5 min (944.0 - 936.4)

Volume	Invert	Avail.Storage	Storage Description
#1	164.00'	303 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

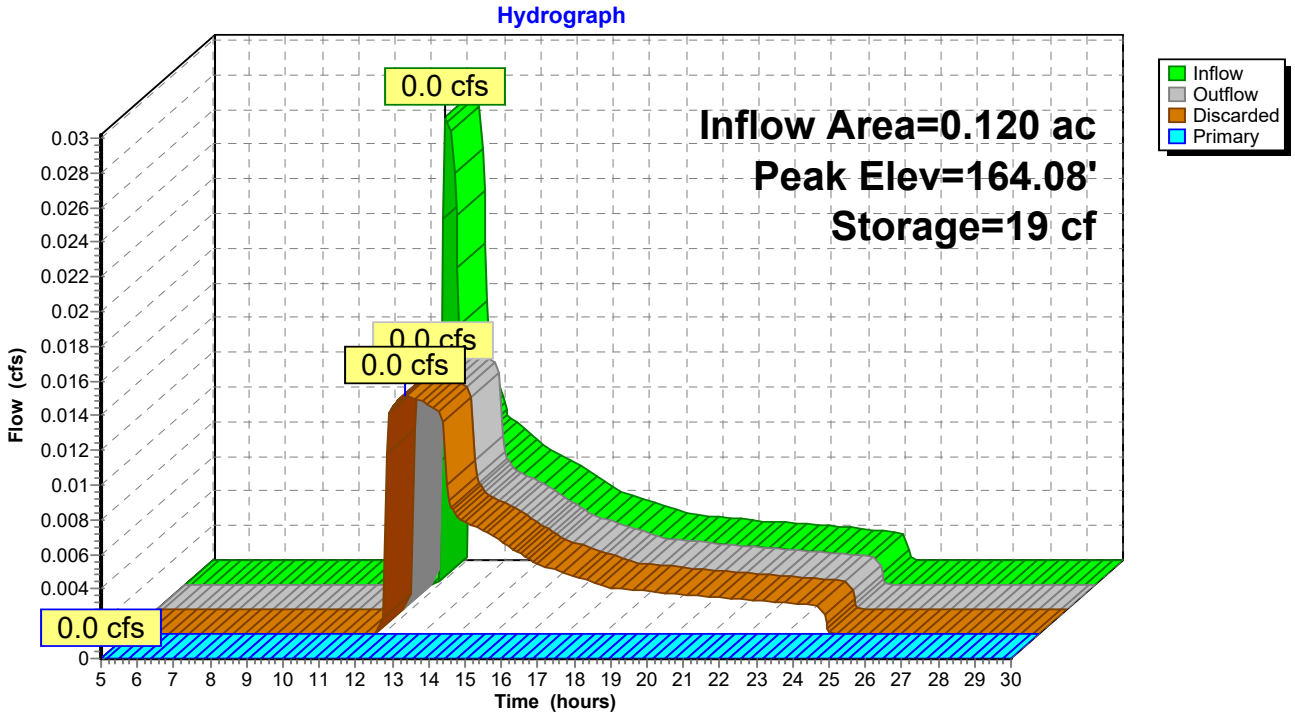
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
164.00	224	0	0	224
165.00	390	303	303	401

Device	Routing	Invert	Outlet Devices
#1	Primary	159.00'	**6.0" Round Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 159.00' / 157.93' S= 0.0255 '/' Cc= 0.900 n= 0.013
#2	Discarded	164.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 162.00'
#3	Device 1	164.33'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.58 hrs HW=164.08' (Free Discharge)
└**2=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 5.00 hrs HW=164.00' (Free Discharge)
└**1=Culvert** (Passes 0.0 cfs of 1.7 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.0 cfs)

Pond 3P: Infiltration Basin 3



Summary for Pond 4P: Infiltration Basin 4

Inflow Area = 0.080 ac, 25.00% Impervious, Inflow Depth = 0.69" for 10-Year event
Inflow = 0.0 cfs @ 12.12 hrs, Volume= 0.005 af
Outflow = 0.0 cfs @ 12.57 hrs, Volume= 0.005 af, Atten= 67%, Lag= 26.7 min
Discarded = 0.0 cfs @ 12.57 hrs, Volume= 0.005 af
Primary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 164.14' @ 12.57 hrs Surf.Area= 244 sf Storage= 32 cf

Plug-Flow detention time= 13.2 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 13.1 min (921.2 - 908.1)

Volume	Invert	Avail.Storage	Storage Description
#1	164.00'	303 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

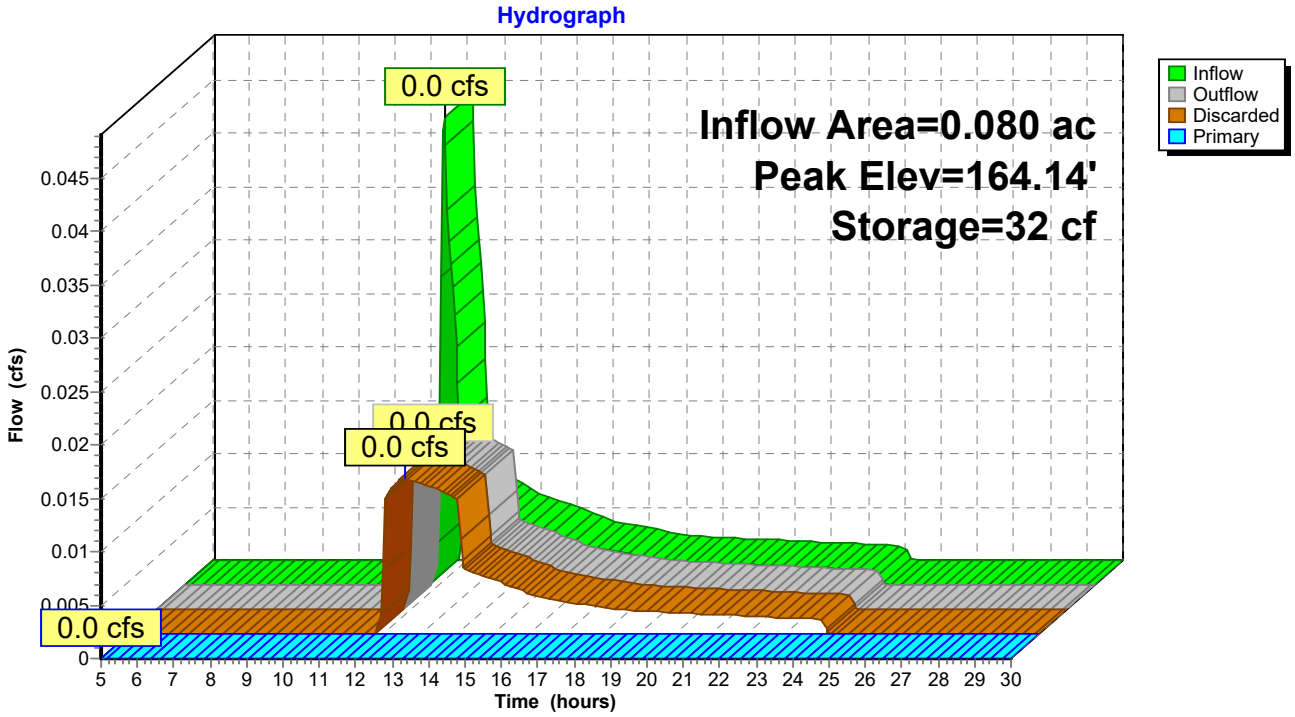
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
164.00	224	0	0	224
165.00	390	303	303	401

Device	Routing	Invert	Outlet Devices
#1	Primary	159.00'	**6.0" Round Culvert** L= 28.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 159.00' / 157.93' S= 0.0382 '/' Cc= 0.900 n= 0.013
#2	Discarded	164.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 162.00'
#3	Device 1	164.33'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.57 hrs HW=164.14' (Free Discharge)
└**2=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 5.00 hrs HW=164.00' (Free Discharge)
└**1=Culvert** (Passes 0.0 cfs of 1.9 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.0 cfs)

Pond 4P: Infiltration Basin 4



Summary for Pond 5P: Typical Roof Drywell

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.040 ac,100.00% Impervious, Inflow Depth > 4.16" for 10-Year event
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.014 af
Outflow = 0.0 cfs @ 12.53 hrs, Volume= 0.014 af, Atten= 82%, Lag= 26.8 min
Discarded = 0.0 cfs @ 12.53 hrs, Volume= 0.014 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 100.99' @ 12.53 hrs Surf.Area= 319 sf Storage= 173 cf

Plug-Flow detention time= 37.1 min calculated for 0.014 af (100% of inflow)
Center-of-Mass det. time= 36.8 min (800.0 - 763.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	210 cf	**13.00'W x 24.50'L x 2.04'H Field A** 650 cf Overall - 126 cf Embedded = 525 cf x 40.0% Voids
#2A	100.50'	126 cf	**Cultec C-100** x 9 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
		335 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 98.00'

Discarded OutFlow Max=0.0 cfs @ 12.53 hrs HW=100.99' (Free Discharge)
1=Exfiltration (Controls 0.0 cfs)

Pond 5P: Typical Roof Drywell - Chamber Wizard Field A

Chamber Model = Cultec C-100
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

36.0" Wide + 12.0" Spacing = 48.0" C-C

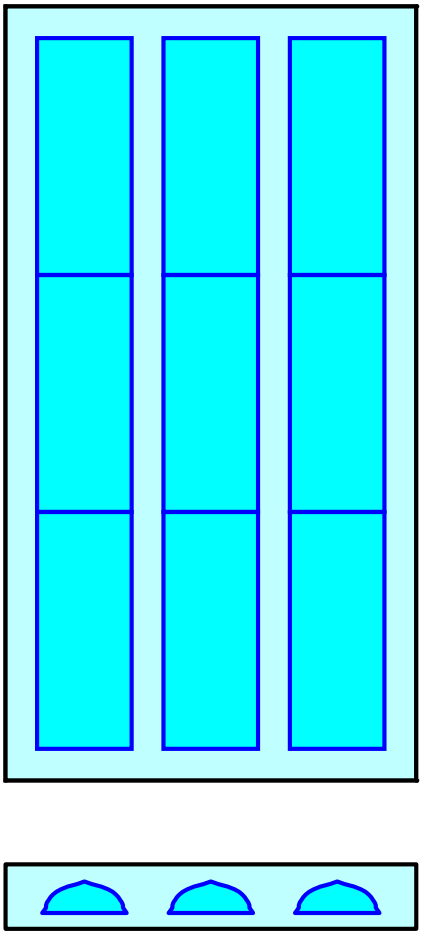
3 Chambers/Row x 7.50' Long = 22.50' + 12.0" End Stone x 2 = 24.50' Base Length
3 Rows x 36.0" Wide + 12.0" Spacing x 2 + 12.0" Side Stone x 2 = 13.00' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

9 Chambers x 14.0 cf = 125.7 cf Chamber Storage

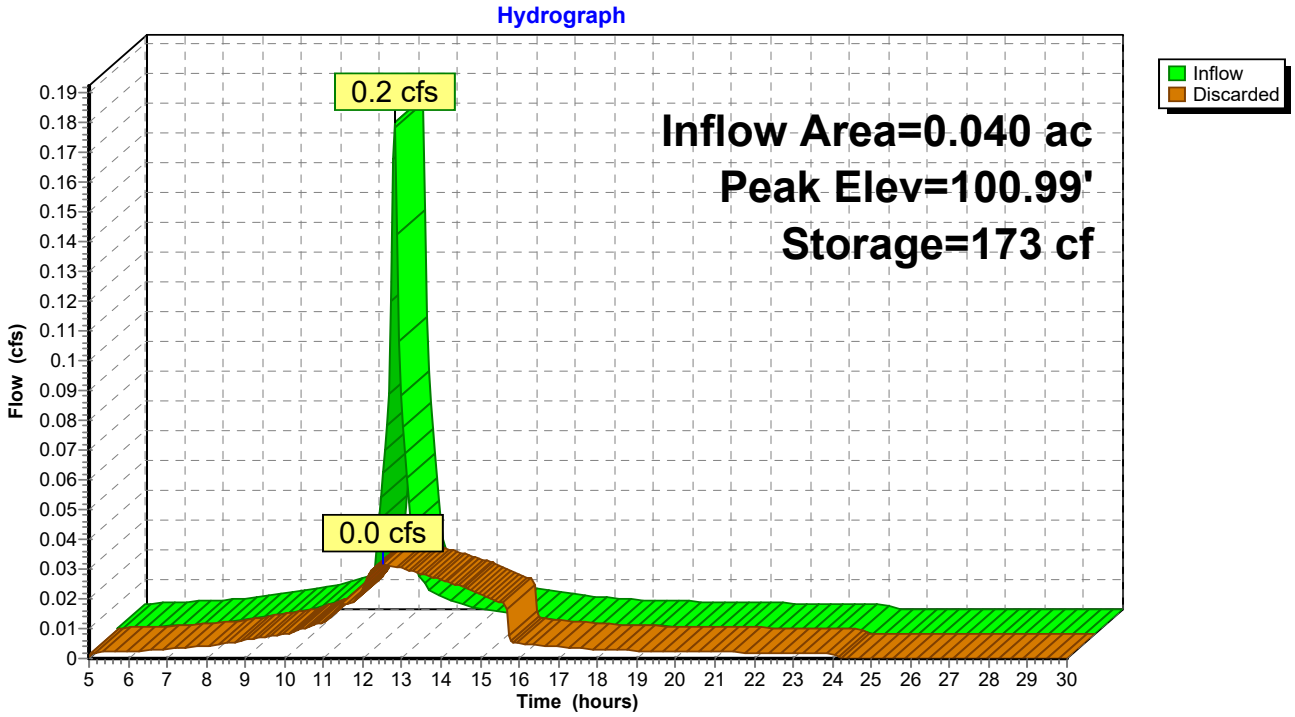
650.3 cf Field - 125.7 cf Chambers = 524.6 cf Stone x 40.0% Voids = 209.8 cf Stone Storage

Stone + Chamber Storage = 335.5 cf = 0.008 af

9 Chambers
24.1 cy Field
19.4 cy Stone



Pond 5P: Typical Roof Drywell



Summary for Pond 6P: Lot 4 Trench

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.054 ac,100.00% Impervious, Inflow Depth > 4.16" for 10-Year event
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.019 af
Outflow = 0.0 cfs @ 12.52 hrs, Volume= 0.019 af, Atten= 81%, Lag= 26.2 min
Discarded = 0.0 cfs @ 12.52 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 160.09' @ 12.52 hrs Surf.Area= 510 sf Storage= 224 cf

Plug-Flow detention time= 32.4 min calculated for 0.019 af (100% of inflow)
Center-of-Mass det. time= 32.2 min (795.4 - 763.2)

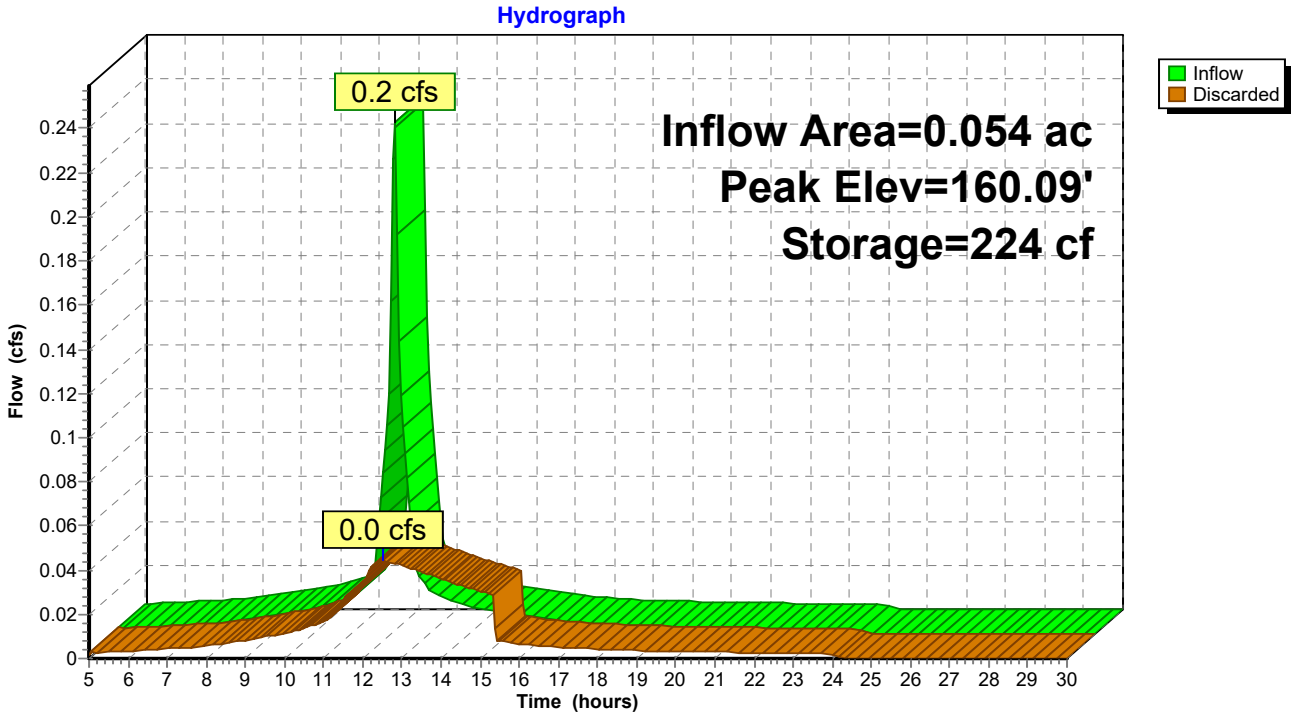
Volume	Invert	Avail.Storage	Storage Description
#1	158.99'	410 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
158.99	510	0.0	0	0
159.00	510	40.0	2	2
160.00	510	40.0	204	206
161.00	510	40.0	204	410

Device	Routing	Invert	Outlet Devices
#1	Discarded	158.99'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 157.00'

Discarded OutFlow Max=0.0 cfs @ 12.52 hrs HW=160.08' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.0 cfs)

Pond 6P: Lot 4 Trench



Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 4 Driveway Runoff Area=2,350 sf 100.00% Impervious Runoff Depth>4.92"
Tc=6.0 min CN=98 Runoff=0.3 cfs 0.022 af

Subcatchment PWA-1A: PWA-1A Runoff Area=1.310 ac 14.50% Impervious Runoff Depth=1.07"
Flow Length=263' Tc=13.3 min CN=54 Runoff=1.0 cfs 0.117 af

Subcatchment PWA-1B: PWA-1B Runoff Area=0.900 ac 45.56% Impervious Runoff Depth=1.94"
Flow Length=231' Tc=9.8 min CN=66 Runoff=1.7 cfs 0.145 af

Subcatchment PWA-1C: PWA-1C Runoff Area=0.700 ac 0.00% Impervious Runoff Depth=0.16"
Flow Length=140' Tc=14.0 min CN=36 Runoff=0.0 cfs 0.009 af

Subcatchment PWA-2: PWA-2 Runoff Area=0.800 ac 0.00% Impervious Runoff Depth=0.10"
Flow Length=126' Slope=0.0200 '/' Tc=10.1 min CN=34 Runoff=0.0 cfs 0.006 af

Subcatchment PWA-3A: PWA-3A Runoff Area=0.120 ac 16.67% Impervious Runoff Depth=0.76"
Tc=6.0 min CN=49 Runoff=0.1 cfs 0.008 af

Subcatchment PWA-3B: PWA-3B Runoff Area=0.080 ac 25.00% Impervious Runoff Depth=1.07"
Tc=6.0 min CN=54 Runoff=0.1 cfs 0.007 af

Subcatchment PWA-3C: PWA-3C Runoff Area=0.110 ac 0.00% Impervious Runoff Depth=0.19"
Tc=6.0 min CN=37 Runoff=0.0 cfs 0.002 af

Subcatchment Typical Roof: Typical Roof Runoff Area=0.040 ac 100.00% Impervious Runoff Depth>4.92"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.016 af

Reach DP-1: Design Point 1 Inflow=0.4 cfs 0.058 af
Outflow=0.4 cfs 0.058 af

Reach DP-2: Design Point 2 Inflow=0.0 cfs 0.006 af
Outflow=0.0 cfs 0.006 af

Reach DP-3: Design Point 3 Inflow=0.0 cfs 0.002 af
Outflow=0.0 cfs 0.002 af

Pond 1P: Infiltration Basin 1 Peak Elev=162.23' Storage=894 cf Inflow=1.0 cfs 0.117 af
Discarded=0.3 cfs 0.098 af Primary=0.2 cfs 0.019 af Outflow=0.5 cfs 0.117 af

Pond 2P: Infiltration Basin 2 Peak Elev=161.37' Storage=2,367 cf Inflow=1.7 cfs 0.145 af
Discarded=0.1 cfs 0.115 af Primary=0.2 cfs 0.030 af Secondary=0.0 cfs 0.000 af Outflow=0.3 cfs 0.145 af

Pond 3P: Infiltration Basin 3 Peak Elev=164.27' Storage=66 cf Inflow=0.1 cfs 0.008 af
Discarded=0.0 cfs 0.008 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.008 af

Pond 4P: Infiltration Basin 4 Peak Elev=164.30' Storage=73 cf Inflow=0.1 cfs 0.007 af
Discarded=0.0 cfs 0.007 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.007 af

Pond 5P: Typical Roof Drywell Peak Elev=101.20' Storage=217 cf Inflow=0.2 cfs 0.016 af
Outflow=0.0 cfs 0.016 af

Pond 6P: Lot 4 Trench Peak Elev=160.37' Storage=281 cf Inflow=0.3 cfs 0.022 af
Outflow=0.0 cfs 0.022 af

Total Runoff Area = 4.114 ac Runoff Volume = 0.332 af Average Runoff Depth = 0.97"
82.16% Pervious = 3.380 ac 17.84% Impervious = 0.734 ac

Summary for Subcatchment 1S: Lot 4 Driveway

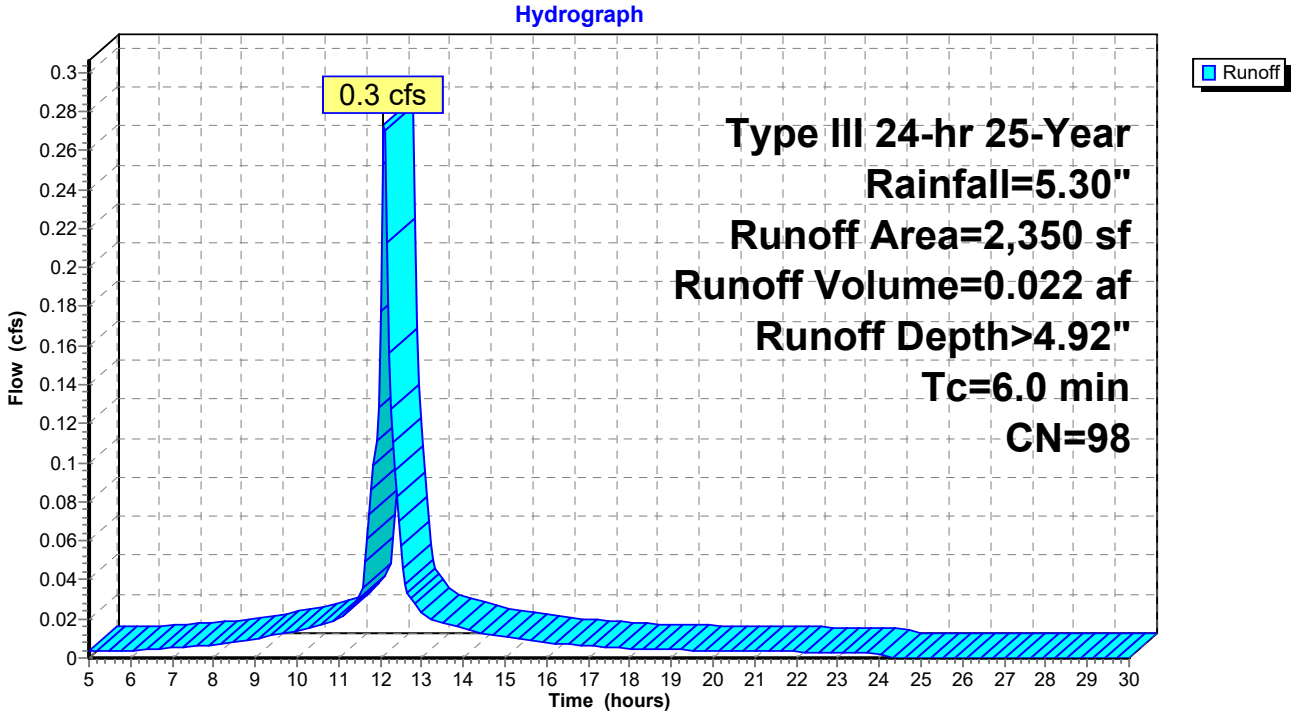
Runoff = 0.3 cfs @ 12.09 hrs, Volume= 0.022 af, Depth> 4.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
2,350	98	Paved parking, HSG A
2,350		100.00% Impervious Area

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

Subcatchment 1S: Lot 4 Driveway



Summary for Subcatchment PWA-1A: PWA-1A

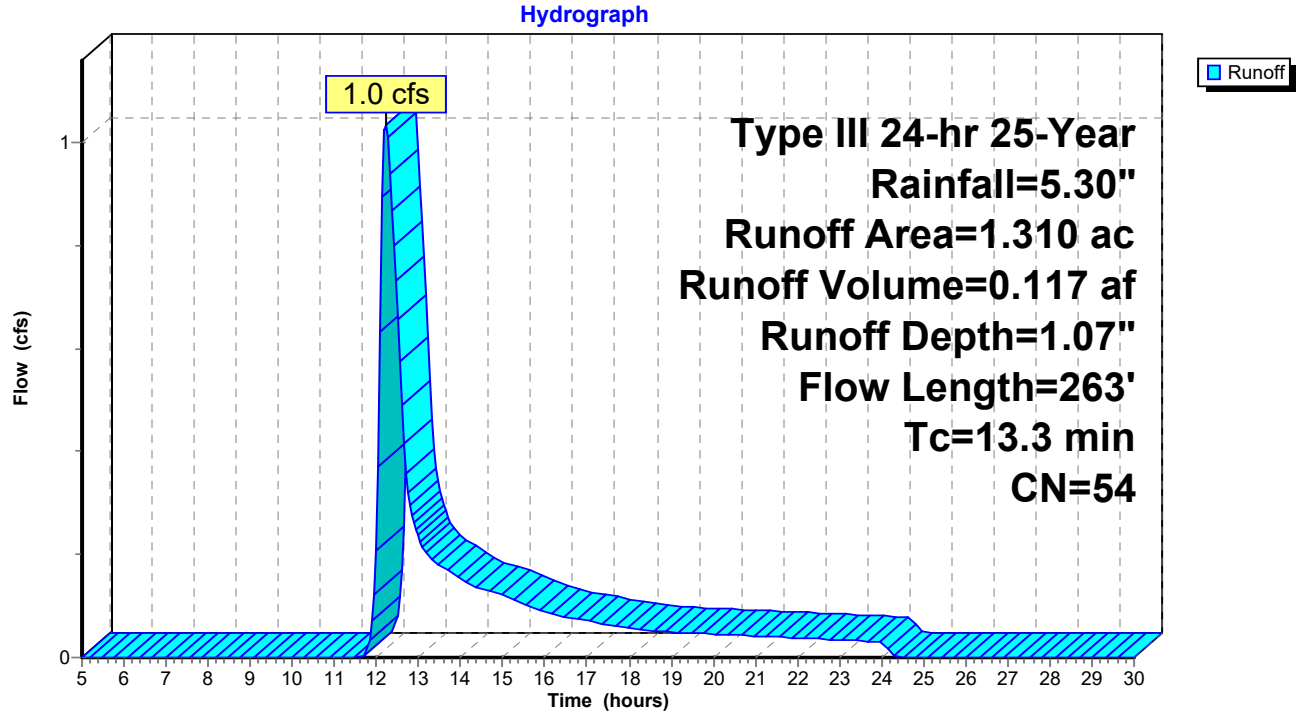
Runoff = 1.0 cfs @ 12.22 hrs, Volume= 0.117 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (ac)	CN	Description
	0.680	39	>75% Grass cover, Good, HSG A
*	0.190	98	Offsite Impervious
	0.160	30	Woods, Good, HSG A
	0.220	74	>75% Grass cover, Good, HSG C
	0.060	70	Woods, Good, HSG C
	1.310	54	Weighted Average
	1.120		85.50% Pervious Area
	0.190		14.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	20	0.0200	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
5.5	30	0.0200	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.8	213	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.3	263	Total			

Subcatchment PWA-1A: PWA-1A



Summary for Subcatchment PWA-1B: PWA-1B

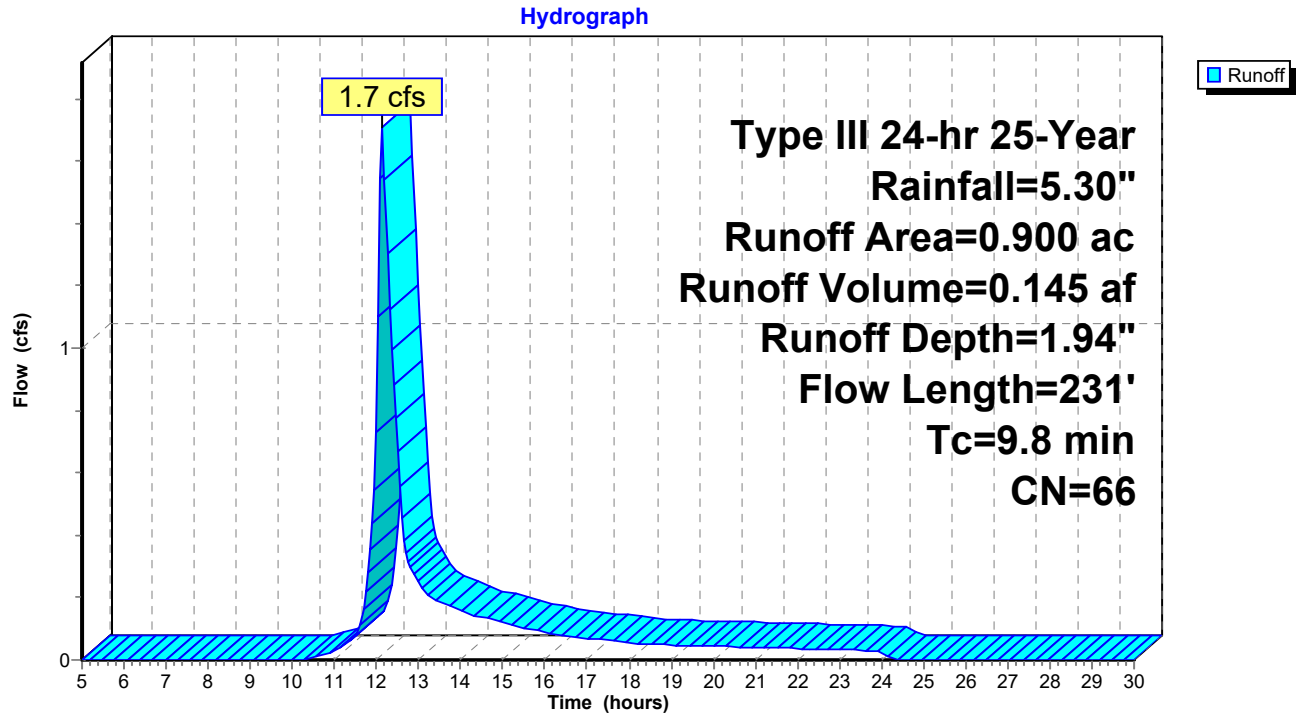
Runoff = 1.7 cfs @ 12.15 hrs, Volume= 0.145 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.410	98	Paved parking, HSG A
0.490	39	>75% Grass cover, Good, HSG A
0.900	66	Weighted Average
0.490		54.44% Pervious Area
0.410		45.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.1	12	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.4	169	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.8	231	Total			

Subcatchment PWA-1B: PWA-1B



Summary for Subcatchment PWA-1C: PWA-1C

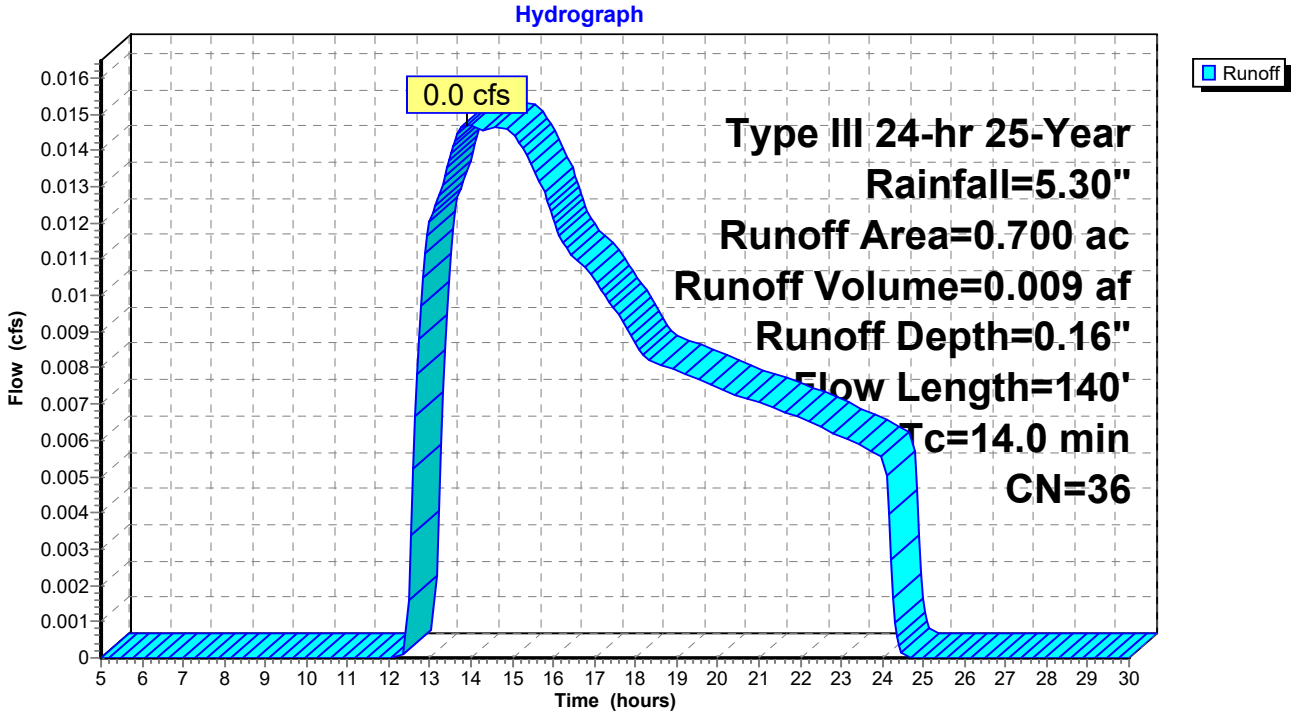
Runoff = 0.0 cfs @ 13.92 hrs, Volume= 0.009 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.070	70	Woods, Good, HSG C
0.180	39	>75% Grass cover, Good, HSG A
0.450	30	Woods, Good, HSG A
0.700	36	Weighted Average
0.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	90	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	140	Total			

Subcatchment PWA-1C: PWA-1C



Summary for Subcatchment PWA-2: PWA-2

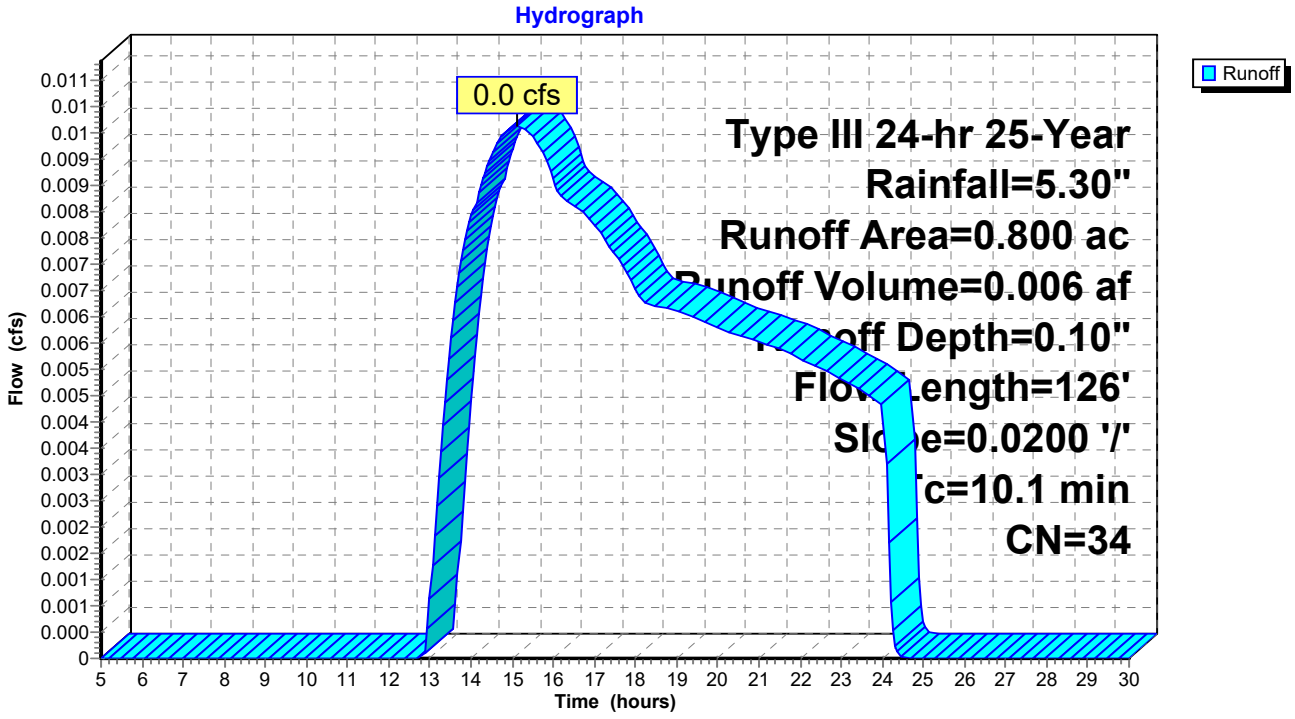
Runoff = 0.0 cfs @ 15.11 hrs, Volume= 0.006 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.430	30	Woods, Good, HSG A
0.370	39	>75% Grass cover, Good, HSG A
0.800	34	Weighted Average
0.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.8	76	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.1	126	Total			

Subcatchment PWA-2: PWA-2



Summary for Subcatchment PWA-3A: PWA-3A

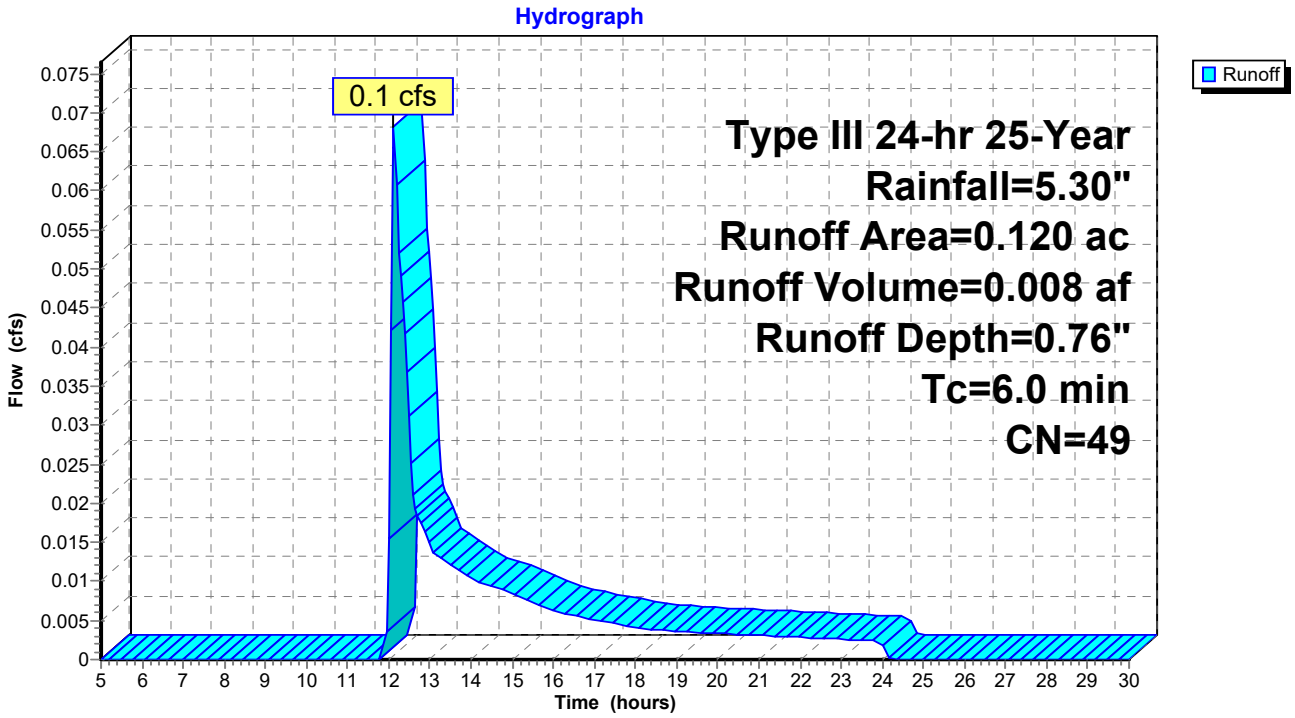
Runoff = 0.1 cfs @ 12.12 hrs, Volume= 0.008 af, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG A
0.100	39	>75% Grass cover, Good, HSG A
0.120	49	Weighted Average
0.100		83.33% Pervious Area
0.020		16.67% Impervious Area

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

Subcatchment PWA-3A: PWA-3A



Summary for Subcatchment PWA-3B: PWA-3B

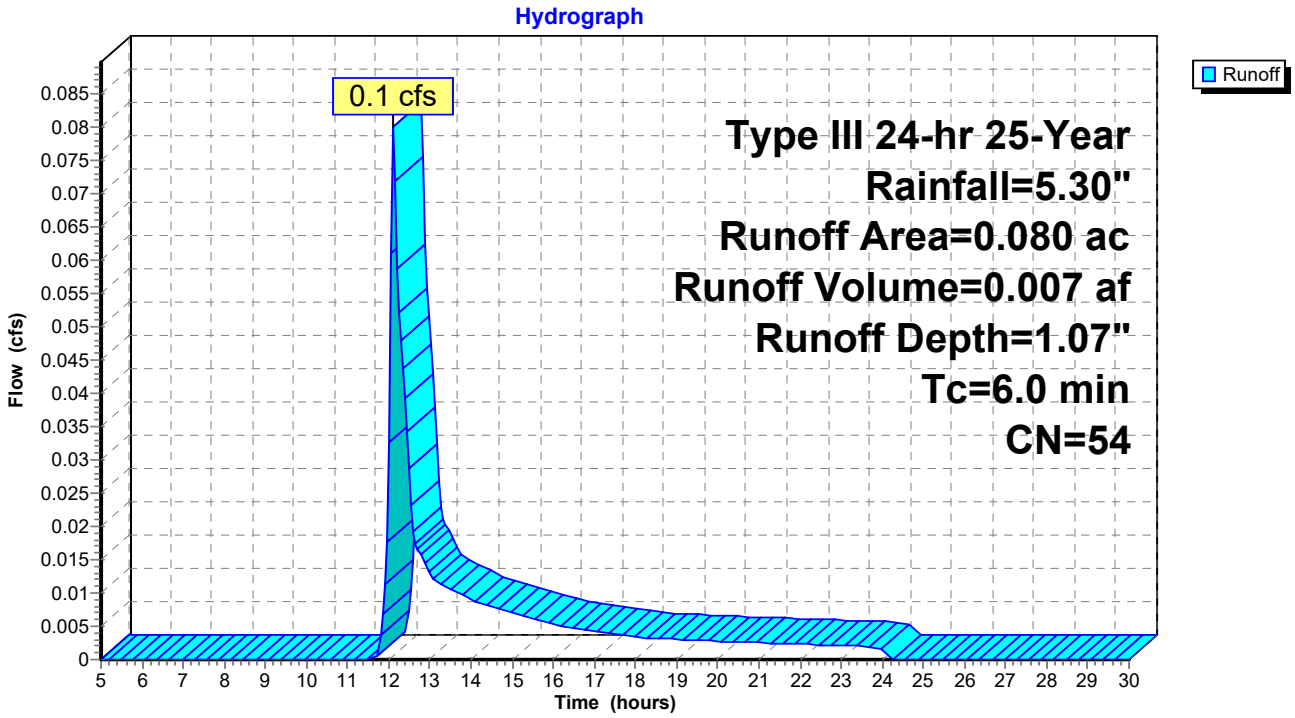
Runoff = 0.1 cfs @ 12.11 hrs, Volume= 0.007 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG A
0.060	39	>75% Grass cover, Good, HSG A
0.080	54	Weighted Average
0.060		75.00% Pervious Area
0.020		25.00% Impervious Area

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

Subcatchment PWA-3B: PWA-3B



Summary for Subcatchment PWA-3C: PWA-3C

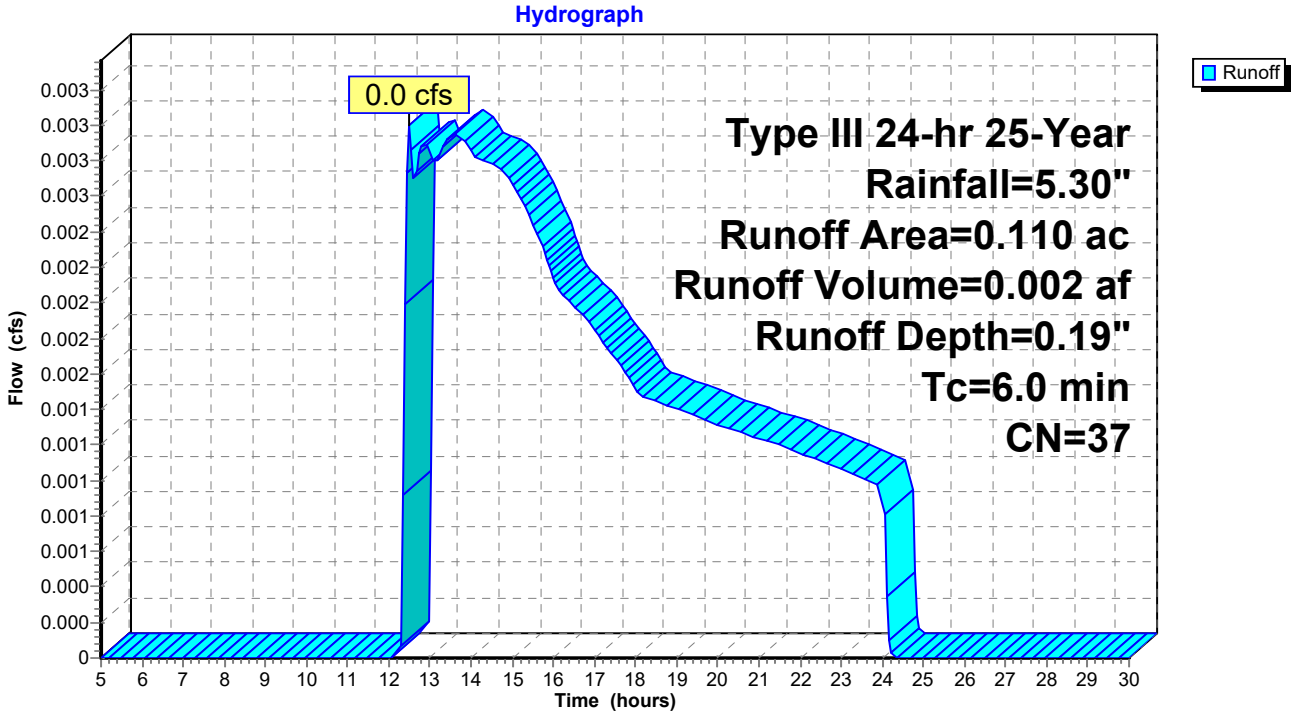
Runoff = 0.0 cfs @ 12.51 hrs, Volume= 0.002 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.080	39	>75% Grass cover, Good, HSG A
0.030	30	Woods, Good, HSG A
0.110	37	Weighted Average
0.110		100.00% Pervious Area

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

Subcatchment PWA-3C: PWA-3C



Summary for Subcatchment Typical Roof: Typical Roof

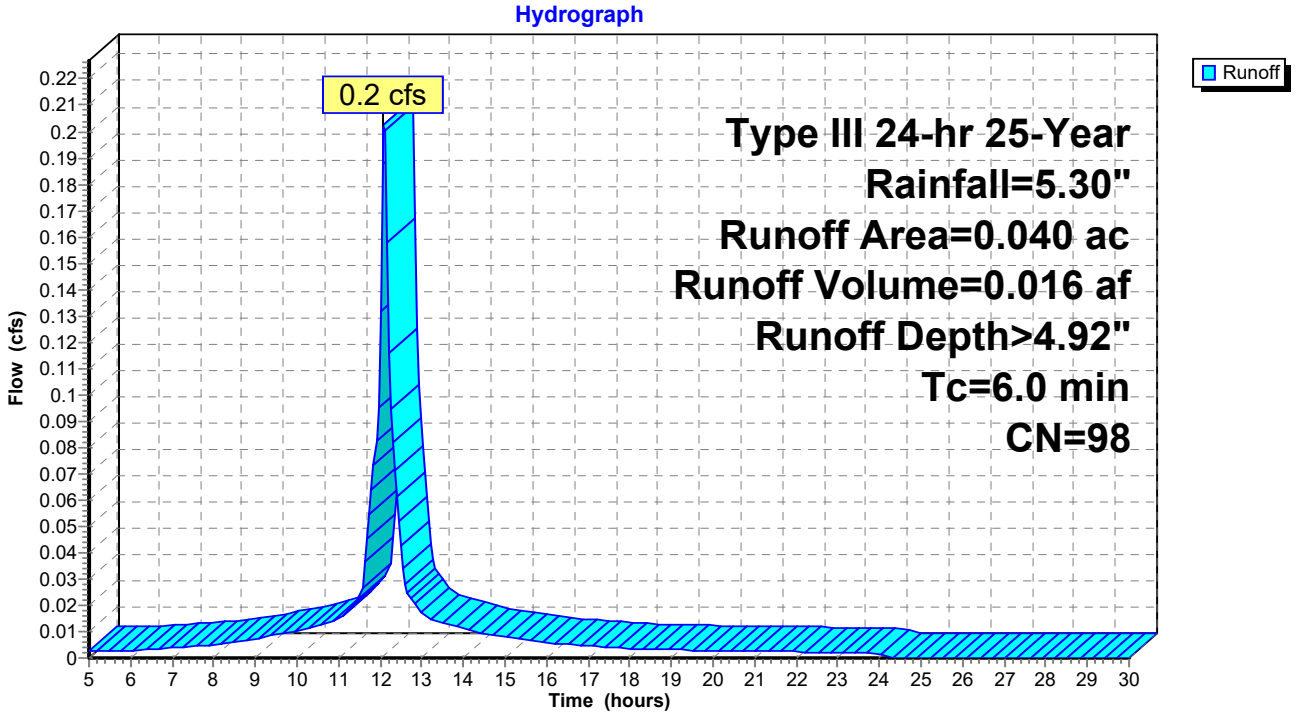
Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.016 af, Depth> 4.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.040		100.00% Impervious Area

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

Subcatchment Typical Roof: Typical Roof



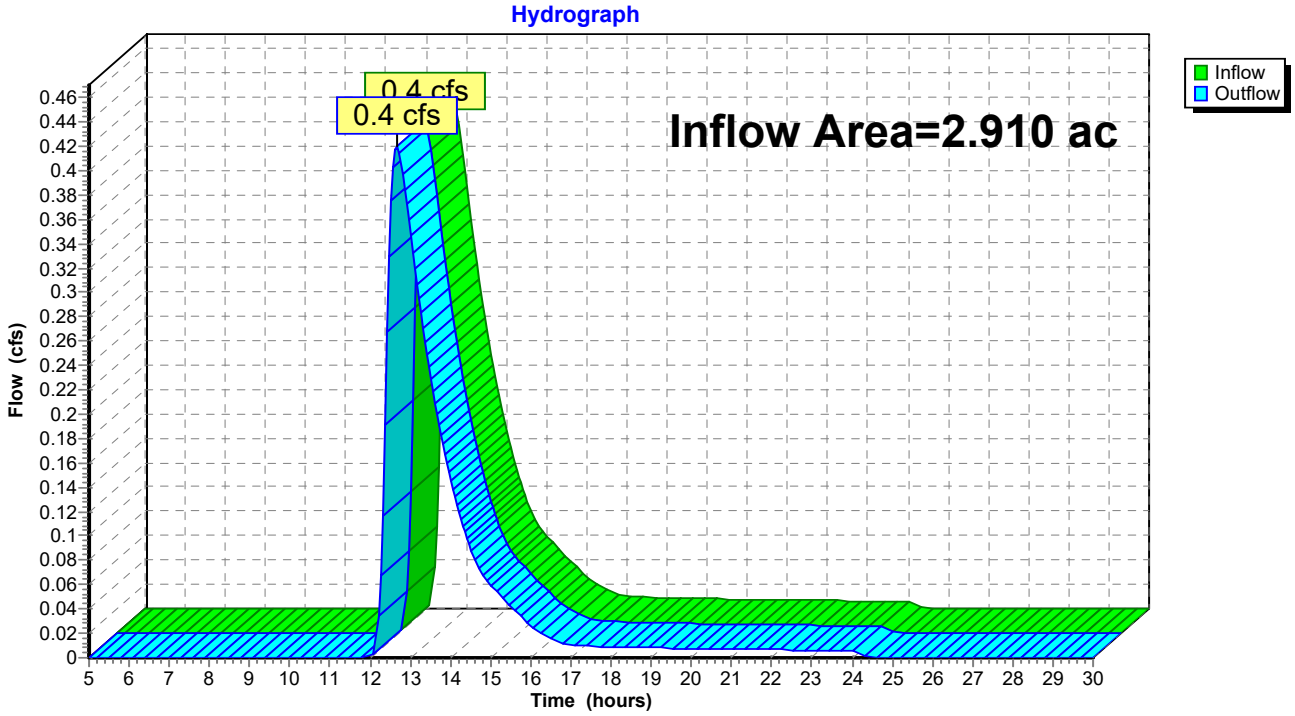
Summary for Reach DP-1: Design Point 1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.910 ac, 20.62% Impervious, Inflow Depth = 0.24" for 25-Year event
Inflow = 0.4 cfs @ 12.65 hrs, Volume= 0.058 af
Outflow = 0.4 cfs @ 12.65 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1



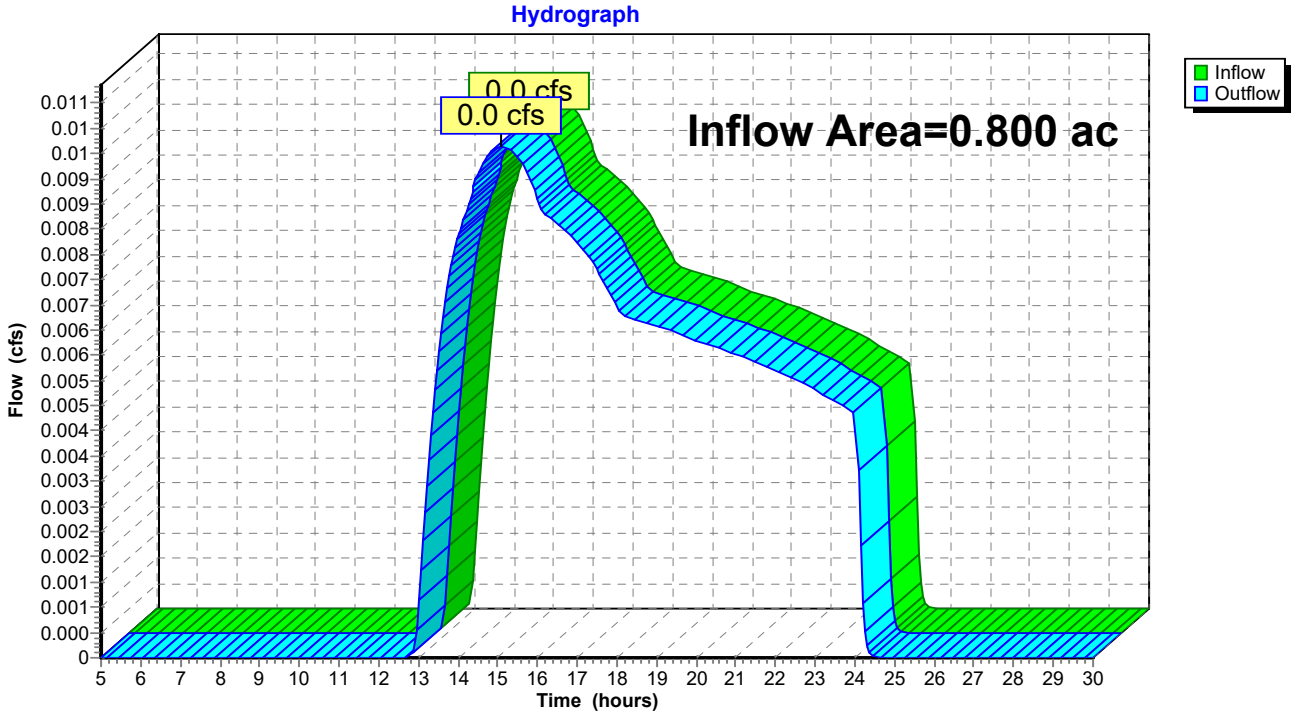
Summary for Reach DP-2: Design Point 2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.800 ac, 0.00% Impervious, Inflow Depth = 0.10" for 25-Year event
Inflow = 0.0 cfs @ 15.11 hrs, Volume= 0.006 af
Outflow = 0.0 cfs @ 15.11 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2



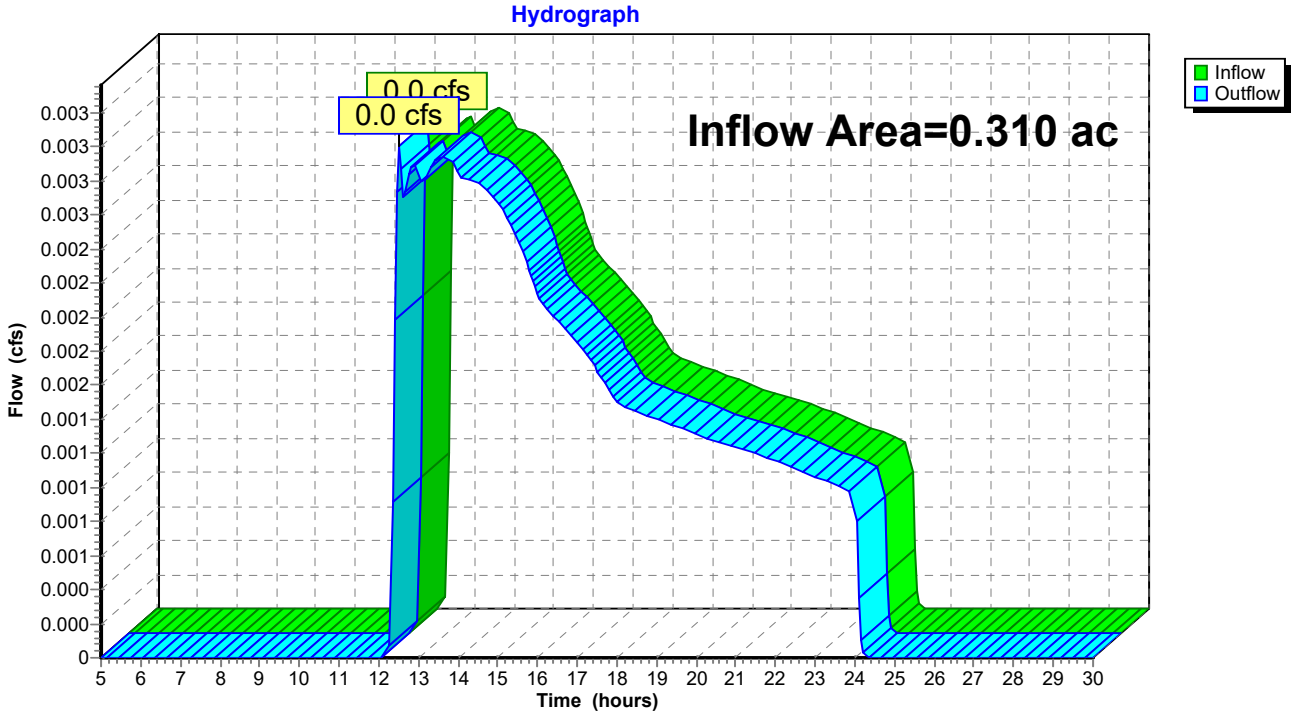
Summary for Reach DP-3: Design Point 3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.310 ac, 12.90% Impervious, Inflow Depth = 0.07" for 25-Year event
Inflow = 0.0 cfs @ 12.51 hrs, Volume= 0.002 af
Outflow = 0.0 cfs @ 12.51 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3



Summary for Pond 1P: Infiltration Basin 1

Inflow Area = 1.310 ac, 14.50% Impervious, Inflow Depth = 1.07" for 25-Year event
Inflow = 1.0 cfs @ 12.22 hrs, Volume= 0.117 af
Outflow = 0.5 cfs @ 12.61 hrs, Volume= 0.117 af, Atten= 53%, Lag= 23.2 min
Discarded = 0.3 cfs @ 12.61 hrs, Volume= 0.098 af
Primary = 0.2 cfs @ 12.61 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 162.23' @ 12.61 hrs Surf.Area= 4,087 sf Storage= 894 cf

Plug-Flow detention time= 15.8 min calculated for 0.116 af (100% of inflow)
Center-of-Mass det. time= 15.8 min (913.5 - 897.7)

Volume	Invert	Avail.Storage	Storage Description
#1	162.00'	4,749 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

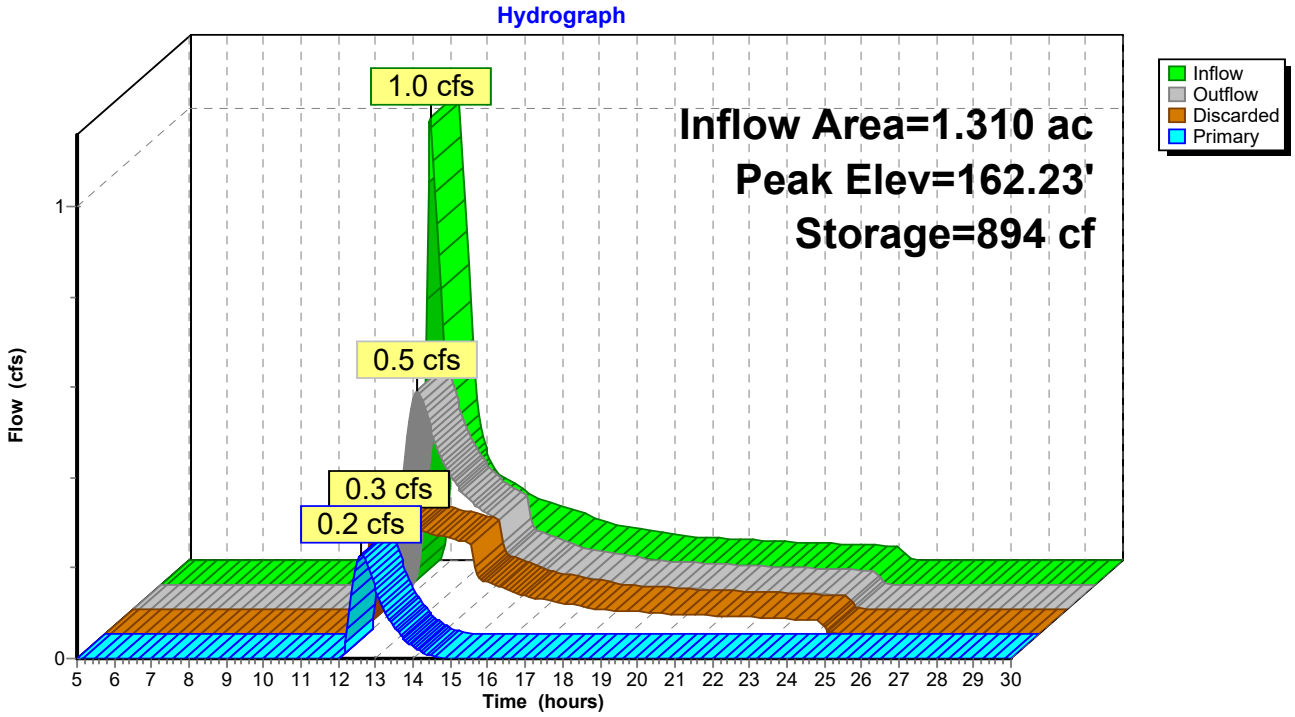
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
162.00	3,568	0	0	3,568
163.00	6,037	4,749	4,749	6,049

Device	Routing	Invert	Outlet Devices
#1	Discarded	162.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 160.00'
#2	Primary	162.00'	**12.0" Round Culvert** L= 108.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 162.00' / 160.50' S= 0.0139 '/' Cc= 0.900 n= 0.013

Discarded OutFlow Max=0.3 cfs @ 12.61 hrs HW=162.23' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.3 cfs)

Primary OutFlow Max=0.2 cfs @ 12.61 hrs HW=162.23' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.2 cfs @ 1.65 fps)

Pond 1P: Infiltration Basin 1



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 0.900 ac, 45.56% Impervious, Inflow Depth = 1.94" for 25-Year event
Inflow = 1.7 cfs @ 12.15 hrs, Volume= 0.145 af
Outflow = 0.3 cfs @ 12.76 hrs, Volume= 0.145 af, Atten= 82%, Lag= 36.9 min
Discarded = 0.1 cfs @ 12.76 hrs, Volume= 0.115 af
Primary = 0.2 cfs @ 12.76 hrs, Volume= 0.030 af
Secondary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 161.37' @ 12.76 hrs Surf.Area= 2,191 sf Storage= 2,367 cf

Plug-Flow detention time= 158.3 min calculated for 0.145 af (100% of inflow)
Center-of-Mass det. time= 158.1 min (1,016.3 - 858.2)

Volume	Invert	Avail.Storage	Storage Description
#1	160.00'	6,975 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
160.00	1,300	0	0	1,300
161.00	1,934	1,607	1,607	1,950
162.00	2,669	2,292	3,898	2,704
163.00	3,504	3,077	6,975	3,562

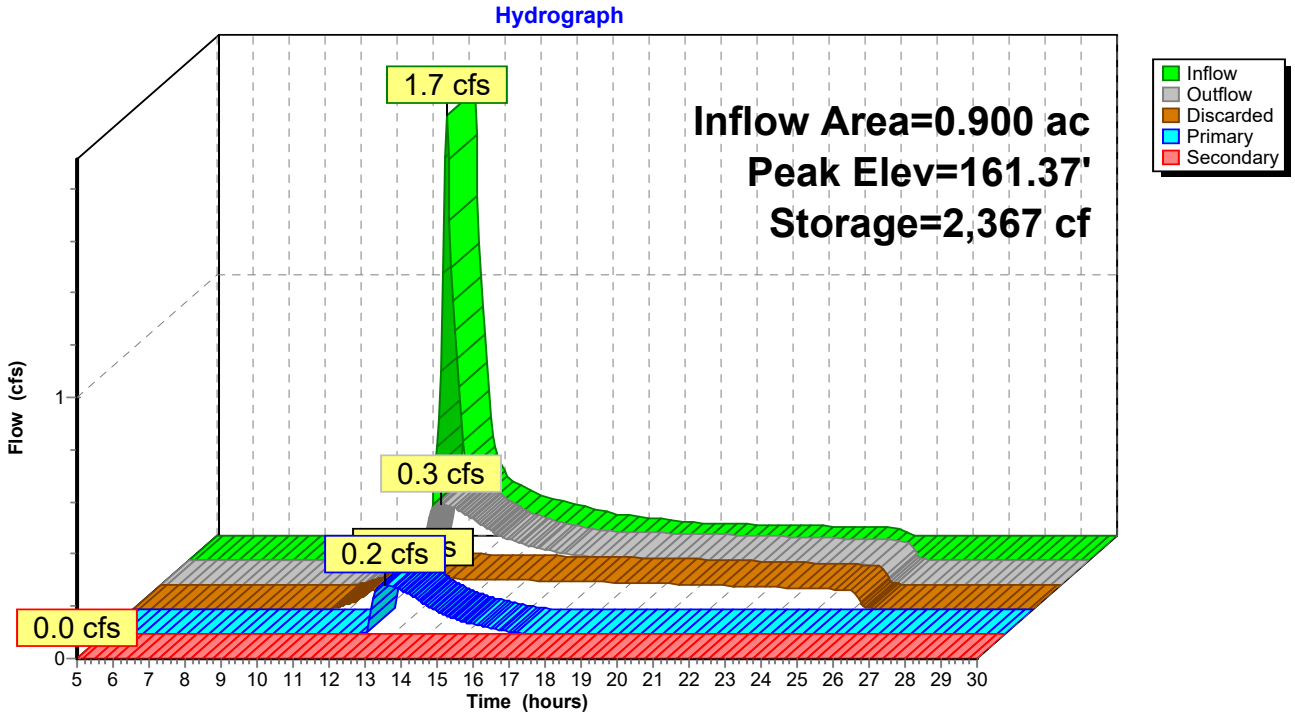
Device	Routing	Invert	Outlet Devices
#1	Discarded	160.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Secondary	162.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	160.22'	**12.0" Round Culvert** L= 43.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 160.22' / 160.00' S= 0.0051 '/' Cc= 0.900 n= 0.013
#4	Device 3	161.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	162.00'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.1 cfs @ 12.76 hrs HW=161.37' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.2 cfs @ 12.76 hrs HW=161.37' (Free Discharge)
└**3=Culvert** (Passes 0.2 cfs of 2.6 cfs potential flow)
  ├**4=Orifice/Grate** (Orifice Controls 0.2 cfs @ 2.16 fps)
  └**5=Orifice/Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 5.00 hrs HW=160.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 2P: Infiltration Basin 2



Summary for Pond 3P: Infiltration Basin 3

Inflow Area = 0.120 ac, 16.67% Impervious, Inflow Depth = 0.76" for 25-Year event
Inflow = 0.1 cfs @ 12.12 hrs, Volume= 0.008 af
Outflow = 0.0 cfs @ 12.84 hrs, Volume= 0.008 af, Atten= 75%, Lag= 42.8 min
Discarded = 0.0 cfs @ 12.84 hrs, Volume= 0.008 af
Primary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 164.27' @ 12.84 hrs Surf.Area= 264 sf Storage= 66 cf

Plug-Flow detention time= 31.5 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 31.5 min (944.0 - 912.6)

Volume	Invert	Avail.Storage	Storage Description
#1	164.00'	303 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

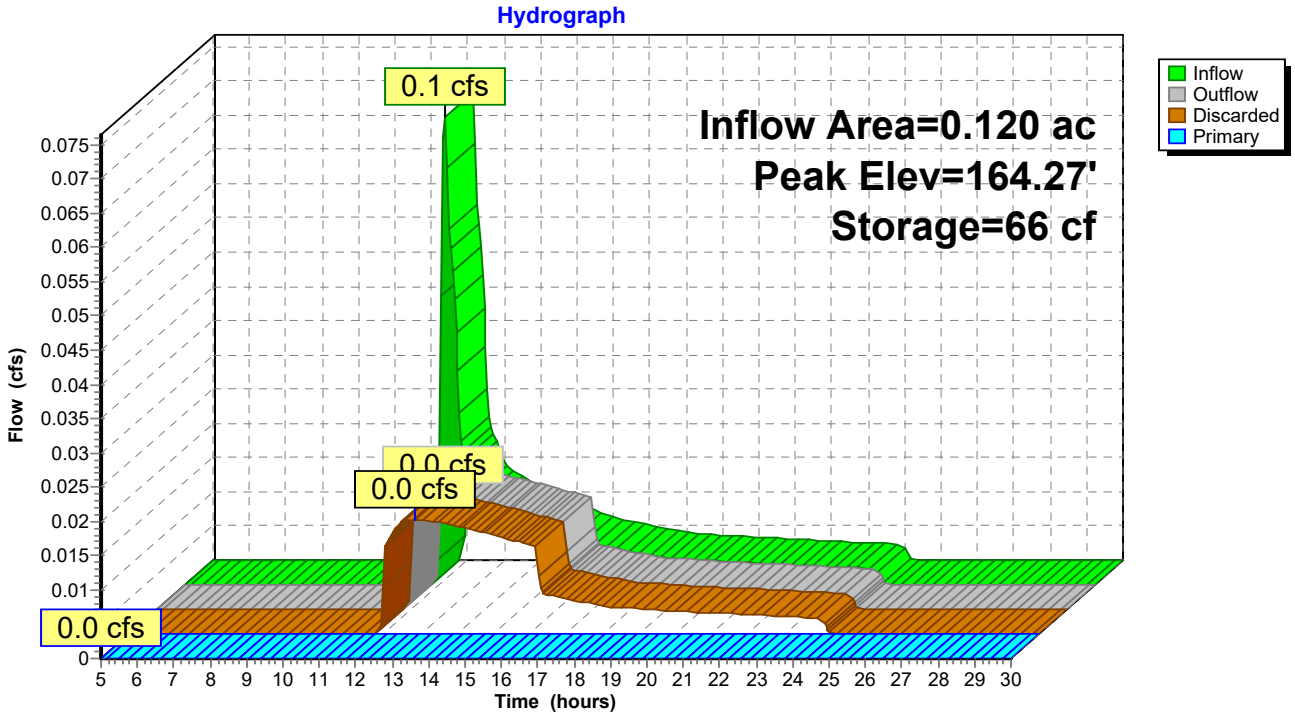
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
164.00	224	0	0	224
165.00	390	303	303	401

Device	Routing	Invert	Outlet Devices
#1	Primary	159.00'	**6.0" Round Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 159.00' / 157.93' S= 0.0255 '/' Cc= 0.900 n= 0.013
#2	Discarded	164.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 162.00'
#3	Device 1	164.33'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.84 hrs HW=164.27' (Free Discharge)
└**2=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 5.00 hrs HW=164.00' (Free Discharge)
└**1=Culvert** (Passes 0.0 cfs of 1.7 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.0 cfs)

Pond 3P: Infiltration Basin 3



Summary for Pond 4P: Infiltration Basin 4

Inflow Area = 0.080 ac, 25.00% Impervious, Inflow Depth = 1.07" for 25-Year event
Inflow = 0.1 cfs @ 12.11 hrs, Volume= 0.007 af
Outflow = 0.0 cfs @ 12.67 hrs, Volume= 0.007 af, Atten= 79%, Lag= 33.7 min
Discarded = 0.0 cfs @ 12.67 hrs, Volume= 0.007 af
Primary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 164.30' @ 12.67 hrs Surf.Area= 268 sf Storage= 73 cf

Plug-Flow detention time= 33.5 min calculated for 0.007 af (100% of inflow)
Center-of-Mass det. time= 33.4 min (924.4 - 891.0)

Volume	Invert	Avail.Storage	Storage Description
#1	164.00'	303 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

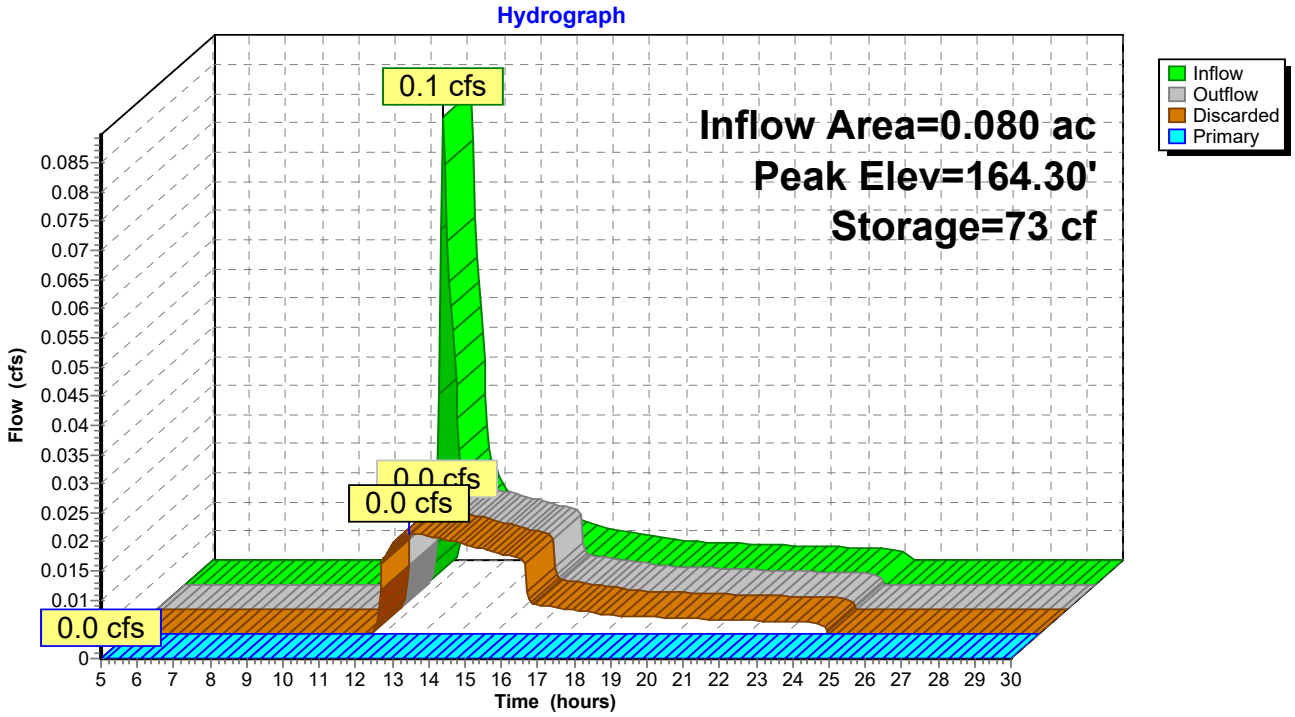
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
164.00	224	0	0	224
165.00	390	303	303	401

Device	Routing	Invert	Outlet Devices
#1	Primary	159.00'	**6.0" Round Culvert** L= 28.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 159.00' / 157.93' S= 0.0382 '/' Cc= 0.900 n= 0.013
#2	Discarded	164.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 162.00'
#3	Device 1	164.33'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.67 hrs HW=164.30' (Free Discharge)
└**2=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 5.00 hrs HW=164.00' (Free Discharge)
└**1=Culvert** (Passes 0.0 cfs of 1.9 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.0 cfs)

Pond 4P: Infiltration Basin 4



Summary for Pond 5P: Typical Roof Drywell

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.040 ac,100.00% Impervious, Inflow Depth > 4.92" for 25-Year event
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.016 af
Outflow = 0.0 cfs @ 12.55 hrs, Volume= 0.016 af, Atten= 83%, Lag= 27.8 min
Discarded = 0.0 cfs @ 12.55 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 101.20' @ 12.55 hrs Surf.Area= 319 sf Storage= 217 cf

Plug-Flow detention time= 44.8 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 44.5 min (806.7 - 762.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	210 cf	**13.00'W x 24.50'L x 2.04'H Field A** 650 cf Overall - 126 cf Embedded = 525 cf x 40.0% Voids
#2A	100.50'	126 cf	**Cultec C-100** x 9 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
		335 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 98.00'

Discarded OutFlow Max=0.0 cfs @ 12.55 hrs HW=101.20' (Free Discharge)
1=Exfiltration (Controls 0.0 cfs)

Pond 5P: Typical Roof Drywell - Chamber Wizard Field A

Chamber Model = Cultec C-100
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

36.0" Wide + 12.0" Spacing = 48.0" C-C

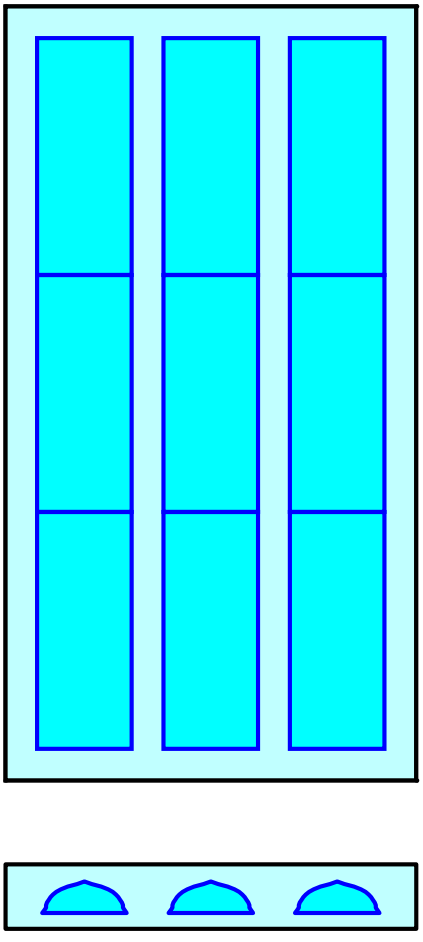
3 Chambers/Row x 7.50' Long = 22.50' + 12.0" End Stone x 2 = 24.50' Base Length
3 Rows x 36.0" Wide + 12.0" Spacing x 2 + 12.0" Side Stone x 2 = 13.00' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

9 Chambers x 14.0 cf = 125.7 cf Chamber Storage

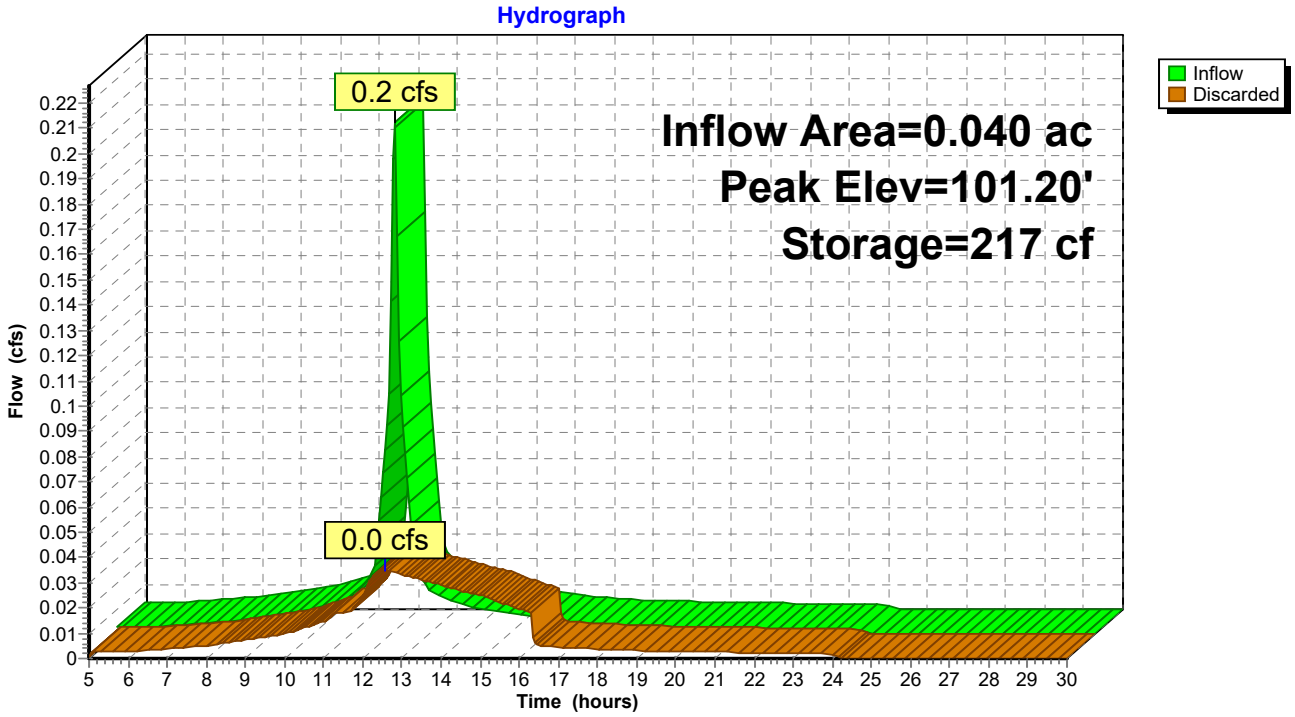
650.3 cf Field - 125.7 cf Chambers = 524.6 cf Stone x 40.0% Voids = 209.8 cf Stone Storage

Stone + Chamber Storage = 335.5 cf = 0.008 af

9 Chambers
24.1 cy Field
19.4 cy Stone



Pond 5P: Typical Roof Drywell



Summary for Pond 6P: Lot 4 Trench

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.054 ac,100.00% Impervious, Inflow Depth > 4.92" for 25-Year event
Inflow = 0.3 cfs @ 12.09 hrs, Volume= 0.022 af
Outflow = 0.0 cfs @ 12.54 hrs, Volume= 0.022 af, Atten= 82%, Lag= 27.4 min
Discarded = 0.0 cfs @ 12.54 hrs, Volume= 0.022 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 160.37' @ 12.54 hrs Surf.Area= 510 sf Storage= 281 cf

Plug-Flow detention time= 39.6 min calculated for 0.022 af (100% of inflow)
Center-of-Mass det. time= 39.3 min (801.5 - 762.1)

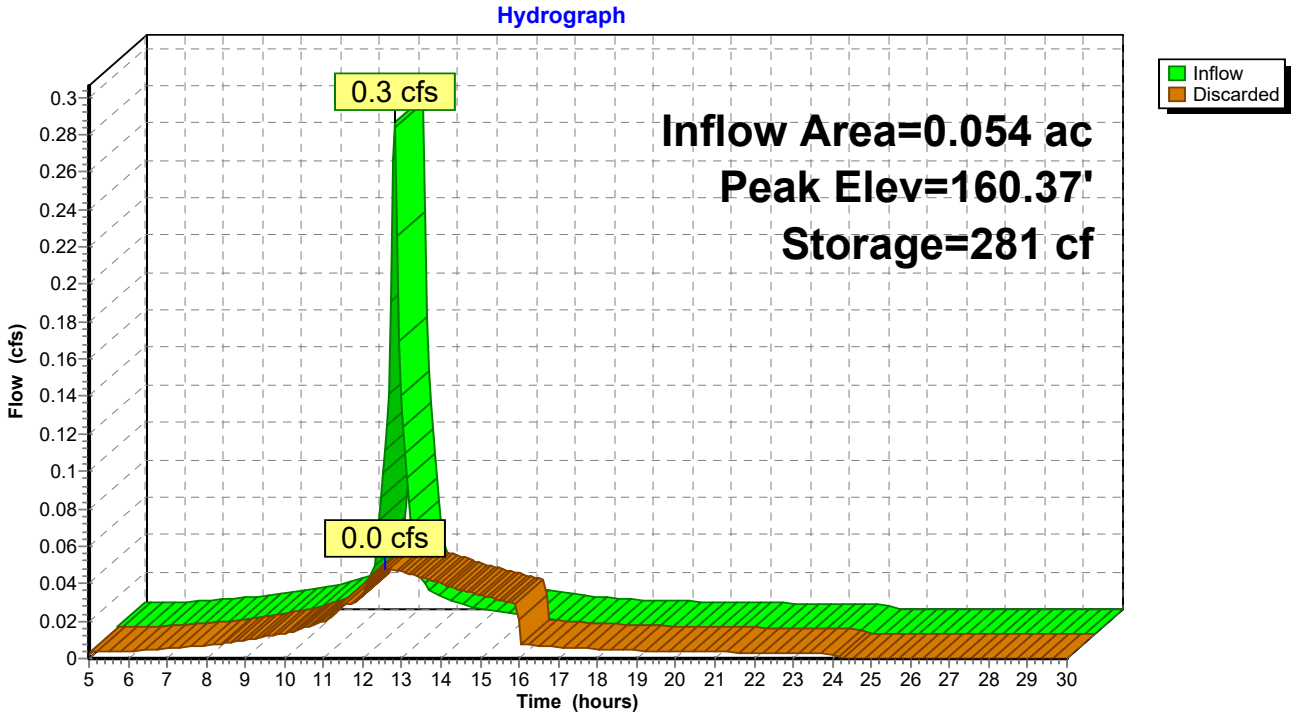
Volume	Invert	Avail.Storage	Storage Description
#1	158.99'	410 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
158.99	510	0.0	0	0
159.00	510	40.0	2	2
160.00	510	40.0	204	206
161.00	510	40.0	204	410

Device	Routing	Invert	Outlet Devices
#1	Discarded	158.99'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 157.00'

Discarded OutFlow Max=0.0 cfs @ 12.54 hrs HW=160.36' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.0 cfs)

Pond 6P: Lot 4 Trench



Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lot 4 Driveway Runoff Area=2,350 sf 100.00% Impervious Runoff Depth>6.07"
Tc=6.0 min CN=98 Runoff=0.3 cfs 0.027 af

Subcatchment PWA-1A: PWA-1A Runoff Area=1.310 ac 14.50% Impervious Runoff Depth=1.73"
Flow Length=263' Tc=13.3 min CN=54 Runoff=1.9 cfs 0.189 af

Subcatchment PWA-1B: PWA-1B Runoff Area=0.900 ac 45.56% Impervious Runoff Depth=2.82"
Flow Length=231' Tc=9.8 min CN=66 Runoff=2.5 cfs 0.211 af

Subcatchment PWA-1C: PWA-1C Runoff Area=0.700 ac 0.00% Impervious Runoff Depth=0.42"
Flow Length=140' Tc=14.0 min CN=36 Runoff=0.1 cfs 0.024 af

Subcatchment PWA-2: PWA-2 Runoff Area=0.800 ac 0.00% Impervious Runoff Depth=0.31"
Flow Length=126' Slope=0.0200 '/' Tc=10.1 min CN=34 Runoff=0.1 cfs 0.021 af

Subcatchment PWA-3A: PWA-3A Runoff Area=0.120 ac 16.67% Impervious Runoff Depth=1.32"
Tc=6.0 min CN=49 Runoff=0.1 cfs 0.013 af

Subcatchment PWA-3B: PWA-3B Runoff Area=0.080 ac 25.00% Impervious Runoff Depth=1.73"
Tc=6.0 min CN=54 Runoff=0.1 cfs 0.012 af

Subcatchment PWA-3C: PWA-3C Runoff Area=0.110 ac 0.00% Impervious Runoff Depth=0.48"
Tc=6.0 min CN=37 Runoff=0.0 cfs 0.004 af

Subcatchment Typical Roof: Typical Roof Runoff Area=0.040 ac 100.00% Impervious Runoff Depth>6.07"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.020 af

Reach DP-1: Design Point 1 Inflow=1.1 cfs 0.157 af
Outflow=1.1 cfs 0.157 af

Reach DP-2: Design Point 2 Inflow=0.1 cfs 0.021 af
Outflow=0.1 cfs 0.021 af

Reach DP-3: Design Point 3 Inflow=0.2 cfs 0.009 af
Outflow=0.2 cfs 0.009 af

Pond 1P: Infiltration Basin 1 Peak Elev=162.40' Storage=1,612 cf Inflow=1.9 cfs 0.189 af
Discarded=0.3 cfs 0.132 af Primary=0.6 cfs 0.057 af Outflow=0.9 cfs 0.189 af

Pond 2P: Infiltration Basin 2 Peak Elev=161.84' Storage=3,485 cf Inflow=2.5 cfs 0.211 af
Discarded=0.1 cfs 0.135 af Primary=0.3 cfs 0.076 af Secondary=0.0 cfs 0.000 af Outflow=0.5 cfs 0.211 af

Pond 3P: Infiltration Basin 3 Peak Elev=164.37' Storage=92 cf Inflow=0.1 cfs 0.013 af
Discarded=0.0 cfs 0.011 af Primary=0.1 cfs 0.002 af Outflow=0.1 cfs 0.013 af

Pond 4P: Infiltration Basin 4 Peak Elev=164.37' Storage=92 cf Inflow=0.1 cfs 0.012 af
Discarded=0.0 cfs 0.010 af Primary=0.1 cfs 0.002 af Outflow=0.1 cfs 0.012 af

Pond 5P: Typical Roof Drywell Peak Elev=101.63' Storage=283 cf Inflow=0.2 cfs 0.020 af
Outflow=0.0 cfs 0.020 af

Pond 6P: Lot 4 Trench Peak Elev=160.80' Storage=370 cf Inflow=0.3 cfs 0.027 af
Outflow=0.1 cfs 0.027 af

Total Runoff Area = 4.114 ac Runoff Volume = 0.522 af Average Runoff Depth = 1.52"
82.16% Pervious = 3.380 ac 17.84% Impervious = 0.734 ac

Summary for Subcatchment 1S: Lot 4 Driveway

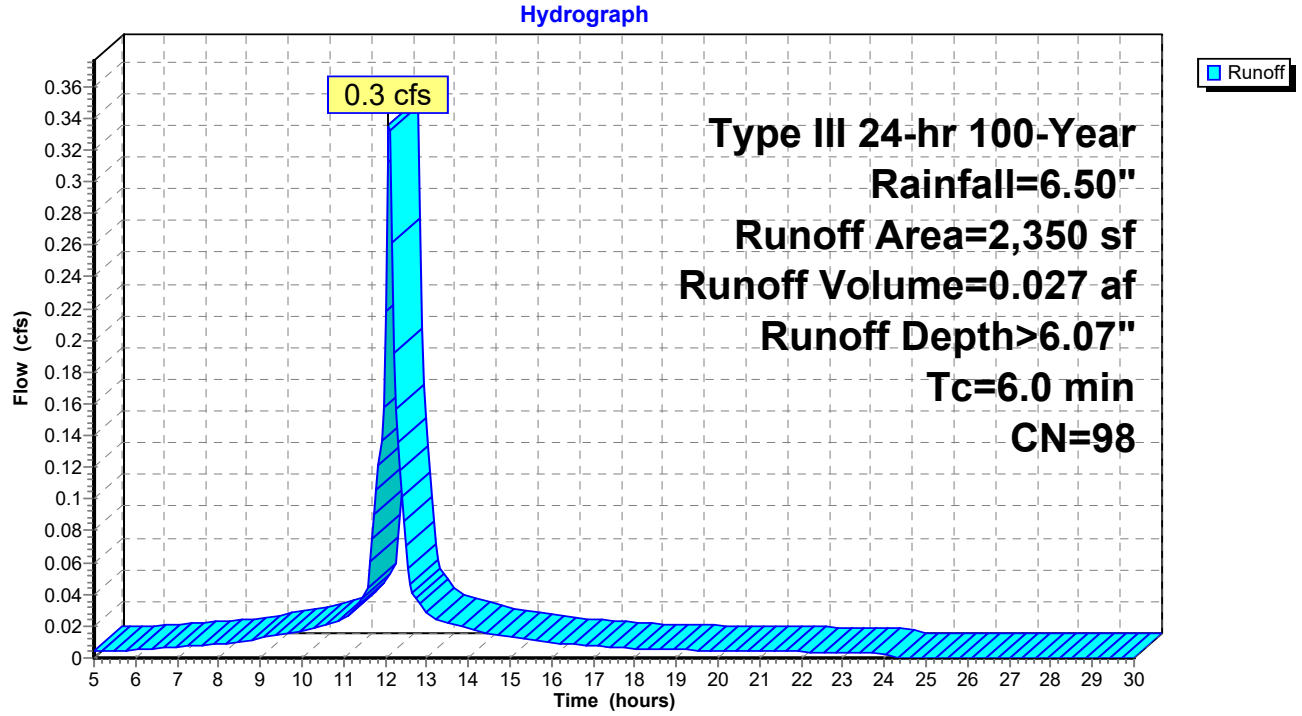
Runoff = 0.3 cfs @ 12.09 hrs, Volume= 0.027 af, Depth> 6.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
2,350	98	Paved parking, HSG A
2,350		100.00% Impervious Area

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

Subcatchment 1S: Lot 4 Driveway



Summary for Subcatchment PWA-1A: PWA-1A

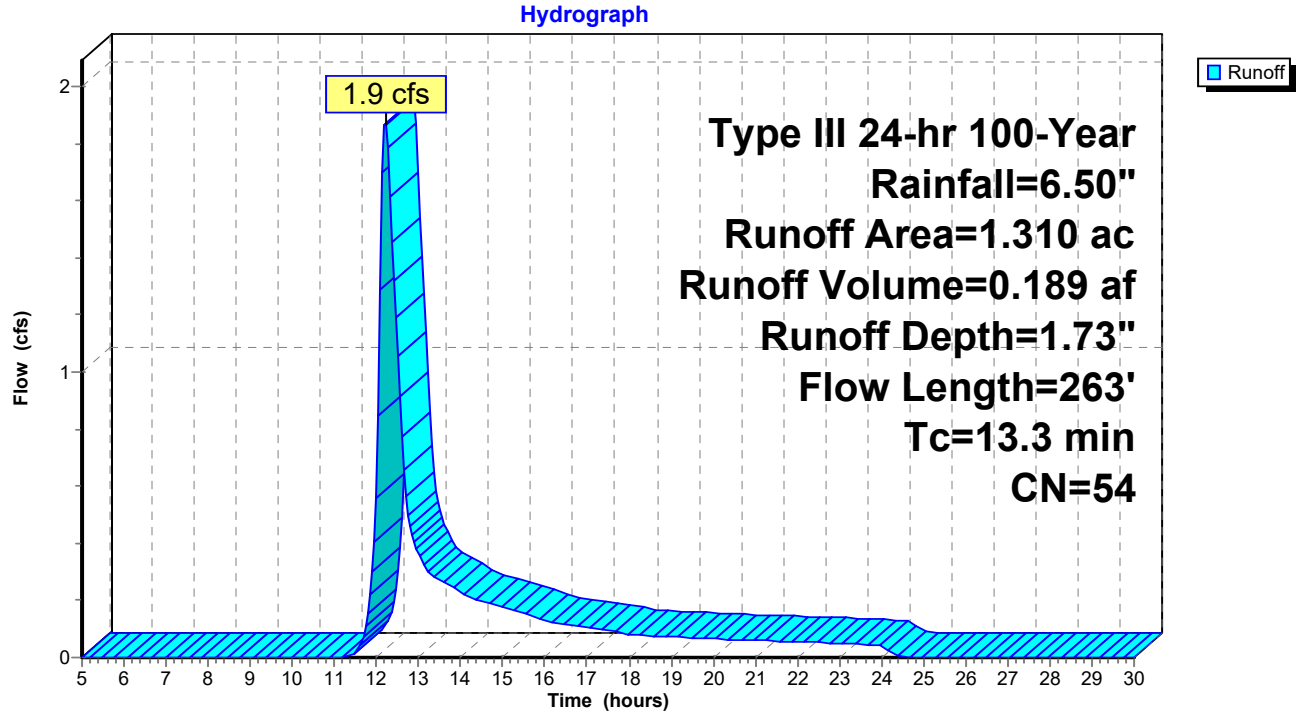
Runoff = 1.9 cfs @ 12.21 hrs, Volume= 0.189 af, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (ac)	CN	Description
	0.680	39	>75% Grass cover, Good, HSG A
*	0.190	98	Offsite Impervious
	0.160	30	Woods, Good, HSG A
	0.220	74	>75% Grass cover, Good, HSG C
	0.060	70	Woods, Good, HSG C
	1.310	54	Weighted Average
	1.120		85.50% Pervious Area
	0.190		14.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	20	0.0200	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
5.5	30	0.0200	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.8	213	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.3	263	Total			

Subcatchment PWA-1A: PWA-1A



Summary for Subcatchment PWA-1B: PWA-1B

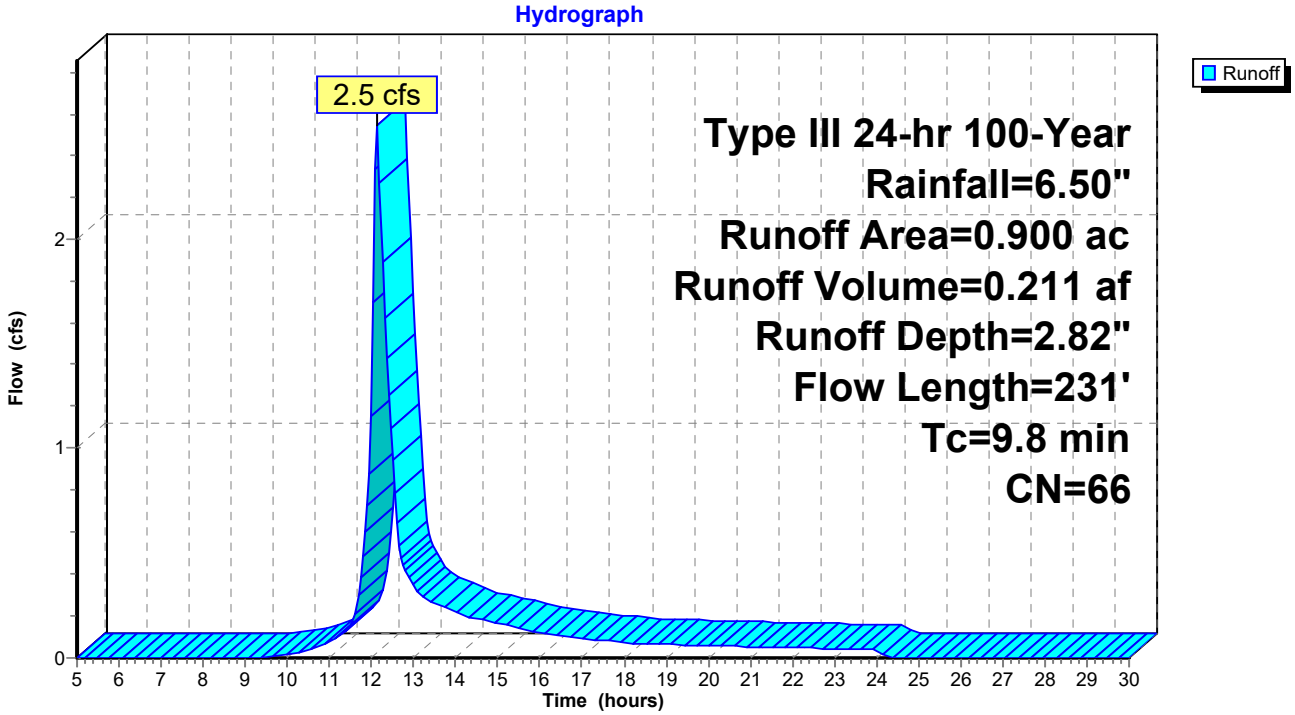
Runoff = 2.5 cfs @ 12.15 hrs, Volume= 0.211 af, Depth= 2.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.410	98	Paved parking, HSG A
0.490	39	>75% Grass cover, Good, HSG A
0.900	66	Weighted Average
0.490		54.44% Pervious Area
0.410		45.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.1	12	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.4	169	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.8	231	Total			

Subcatchment PWA-1B: PWA-1B



Summary for Subcatchment PWA-1C: PWA-1C

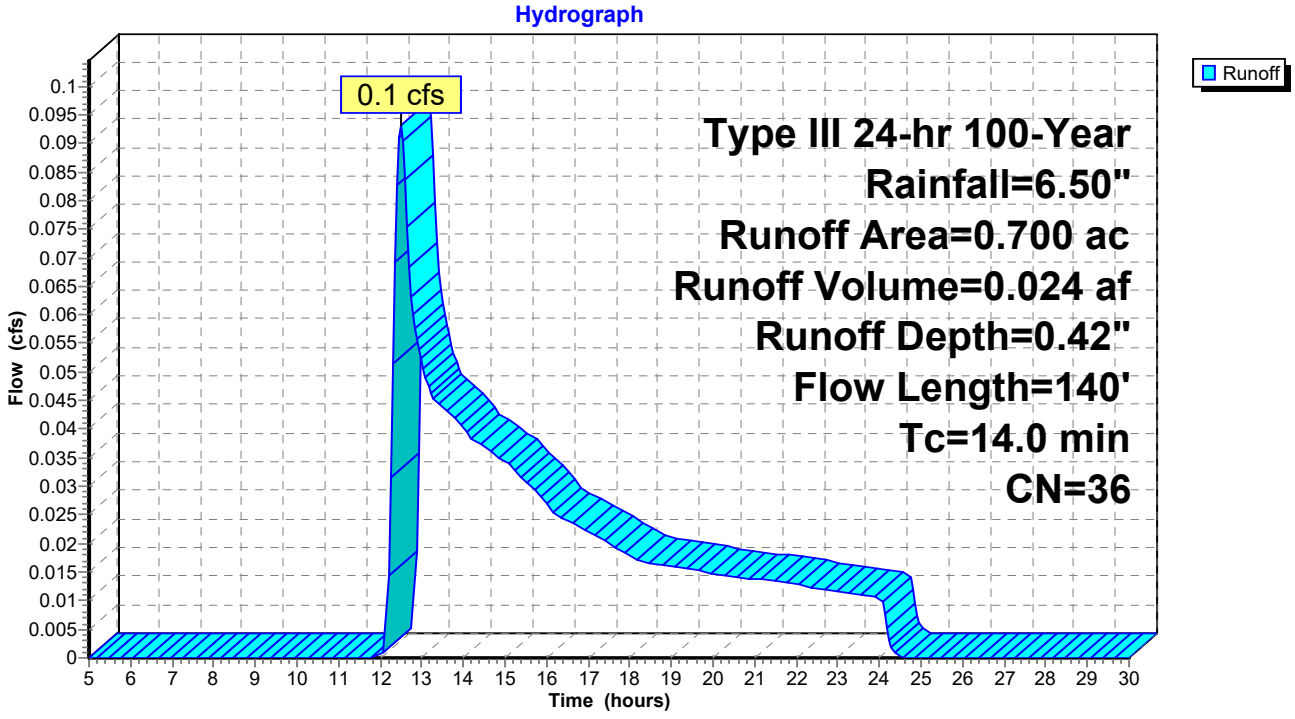
Runoff = 0.1 cfs @ 12.50 hrs, Volume= 0.024 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.070	70	Woods, Good, HSG C
0.180	39	>75% Grass cover, Good, HSG A
0.450	30	Woods, Good, HSG A
0.700	36	Weighted Average
0.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	90	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	140	Total			

Subcatchment PWA-1C: PWA-1C



Summary for Subcatchment PWA-2: PWA-2

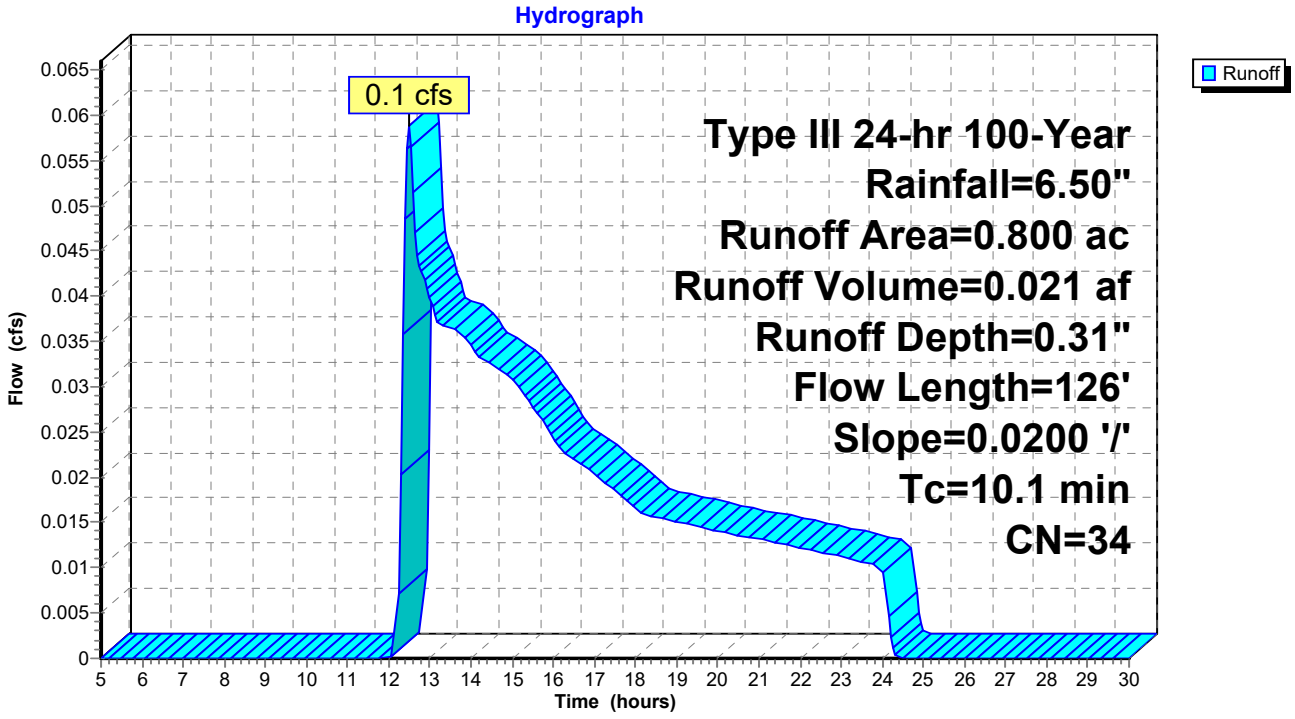
Runoff = 0.1 cfs @ 12.50 hrs, Volume= 0.021 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.430	30	Woods, Good, HSG A
0.370	39	>75% Grass cover, Good, HSG A
0.800	34	Weighted Average
0.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
1.8	76	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.1	126	Total			

Subcatchment PWA-2: PWA-2



Summary for Subcatchment PWA-3A: PWA-3A

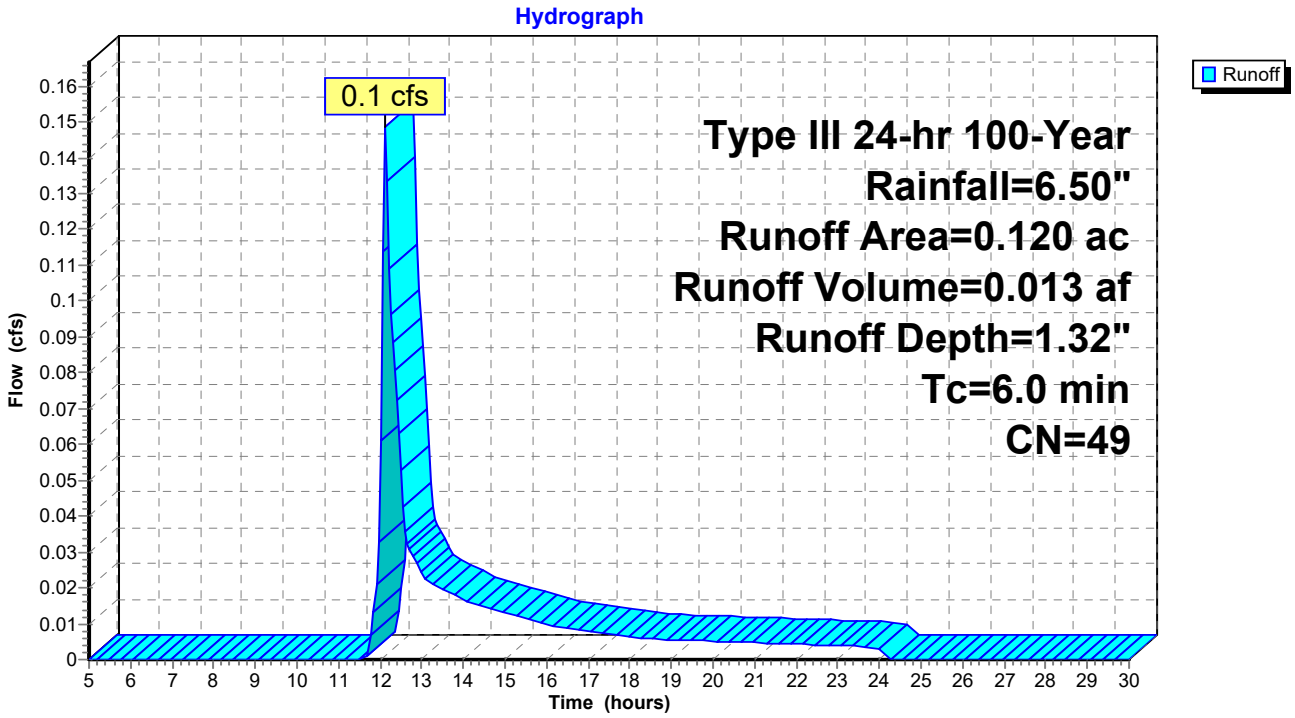
Runoff = 0.1 cfs @ 12.11 hrs, Volume= 0.013 af, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG A
0.100	39	>75% Grass cover, Good, HSG A
0.120	49	Weighted Average
0.100		83.33% Pervious Area
0.020		16.67% Impervious Area

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

Subcatchment PWA-3A: PWA-3A



Summary for Subcatchment PWA-3B: PWA-3B

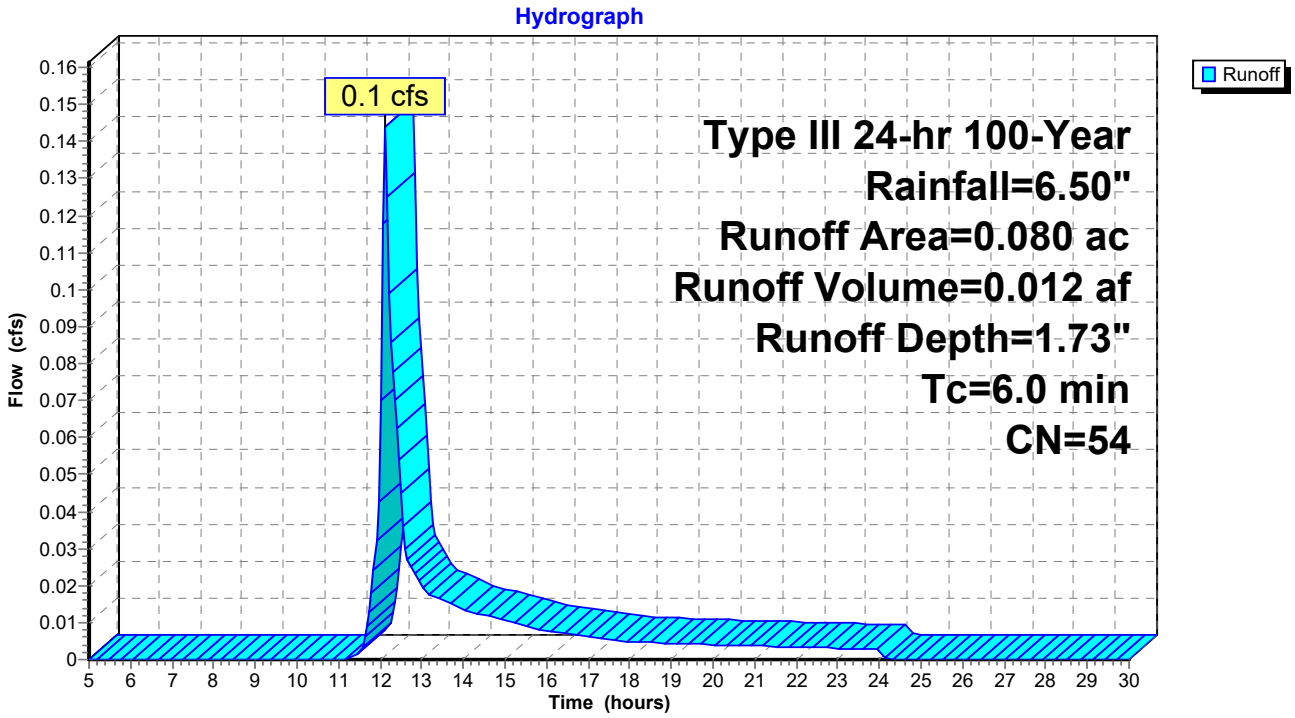
Runoff = 0.1 cfs @ 12.10 hrs, Volume= 0.012 af, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.020	98	Paved parking, HSG A
0.060	39	>75% Grass cover, Good, HSG A
0.080	54	Weighted Average
0.060		75.00% Pervious Area
0.020		25.00% Impervious Area

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

Subcatchment PWA-3B: PWA-3B



Summary for Subcatchment PWA-3C: PWA-3C

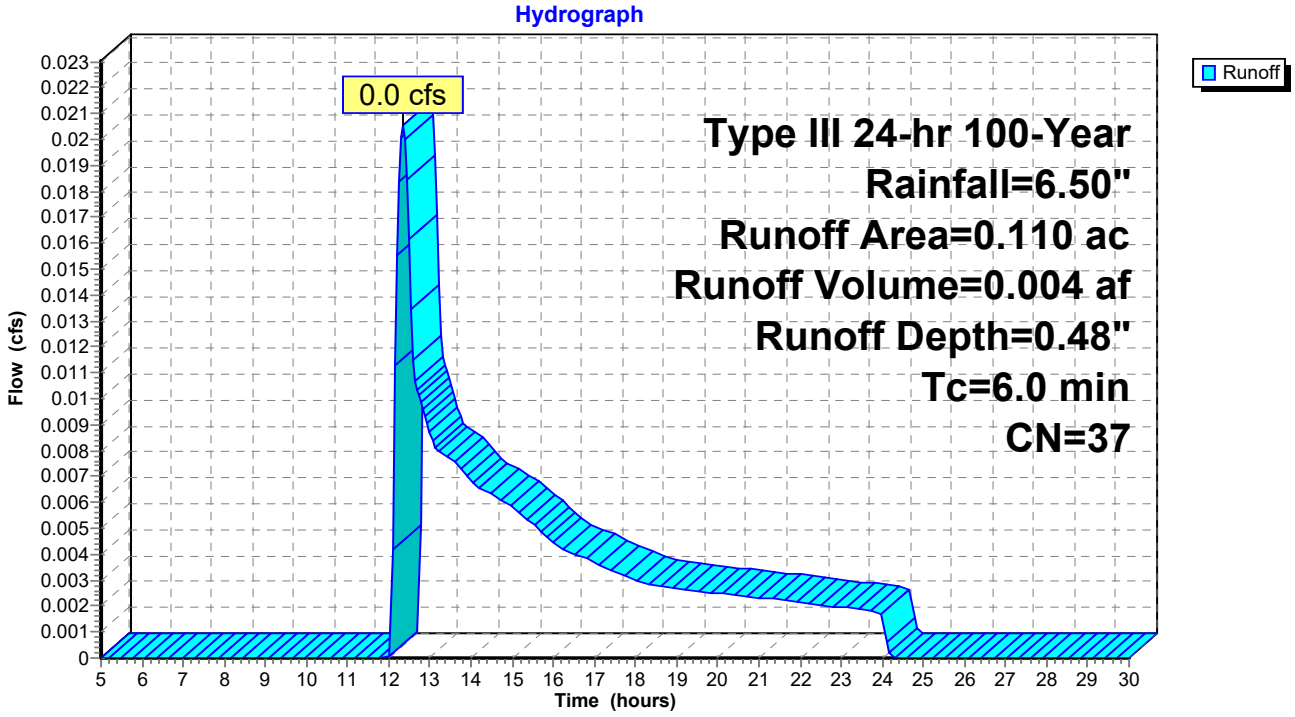
Runoff = 0.0 cfs @ 12.35 hrs, Volume= 0.004 af, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.080	39	>75% Grass cover, Good, HSG A
0.030	30	Woods, Good, HSG A
0.110	37	Weighted Average
0.110		100.00% Pervious Area

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

Subcatchment PWA-3C: PWA-3C



Summary for Subcatchment Typical Roof: Typical Roof

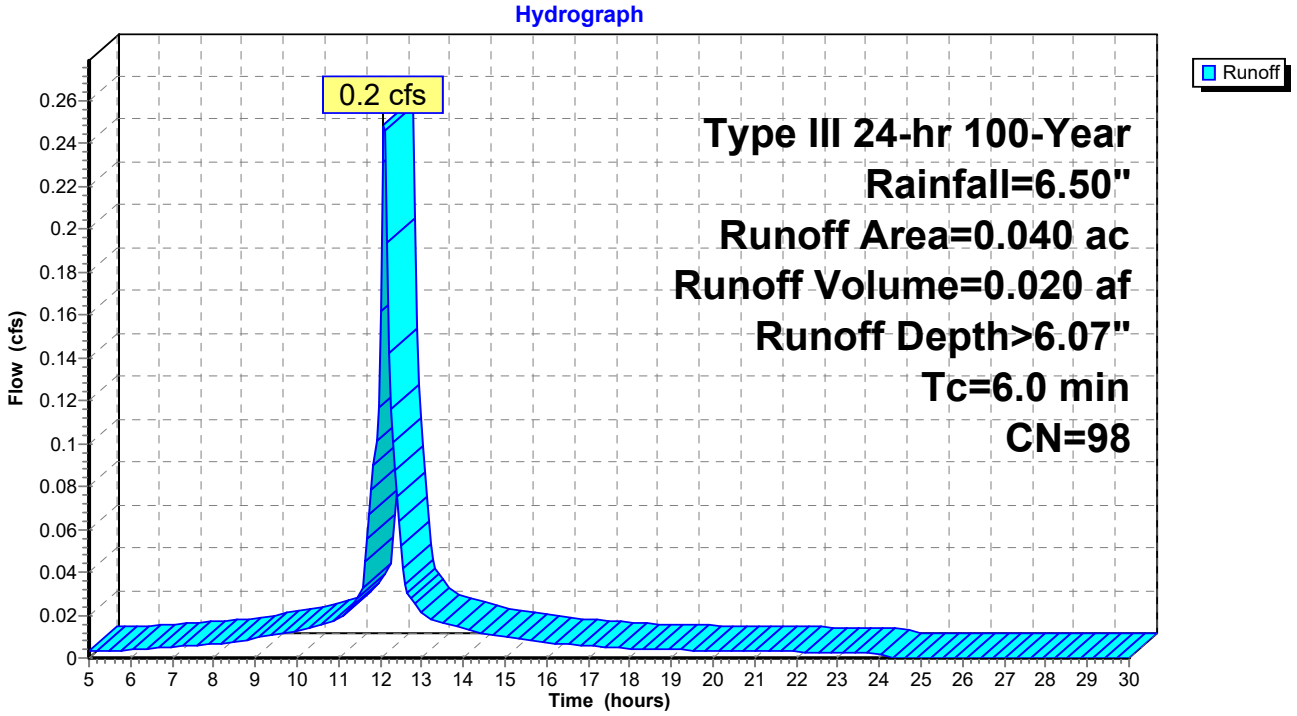
Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.020 af, Depth> 6.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.040		100.00% Impervious Area

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

Subcatchment Typical Roof: Typical Roof



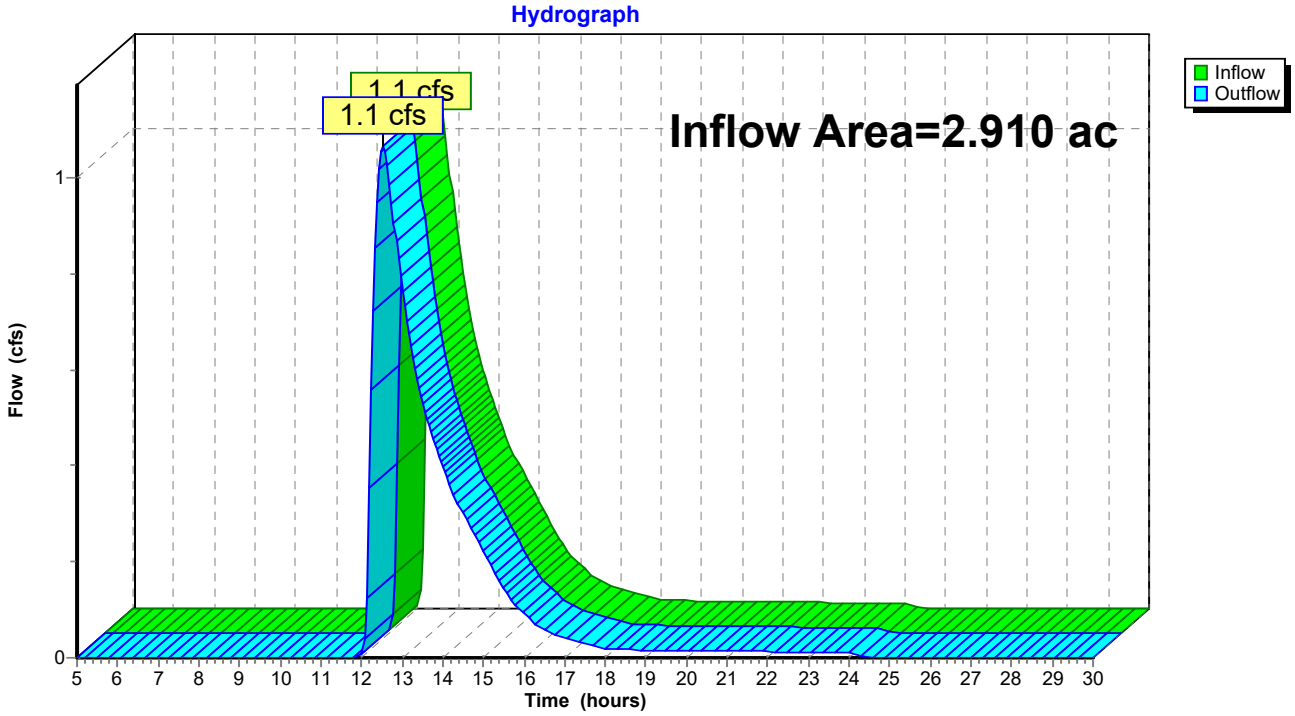
Summary for Reach DP-1: Design Point 1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.910 ac, 20.62% Impervious, Inflow Depth = 0.65" for 100-Year event
Inflow = 1.1 cfs @ 12.55 hrs, Volume= 0.157 af
Outflow = 1.1 cfs @ 12.55 hrs, Volume= 0.157 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1: Design Point 1



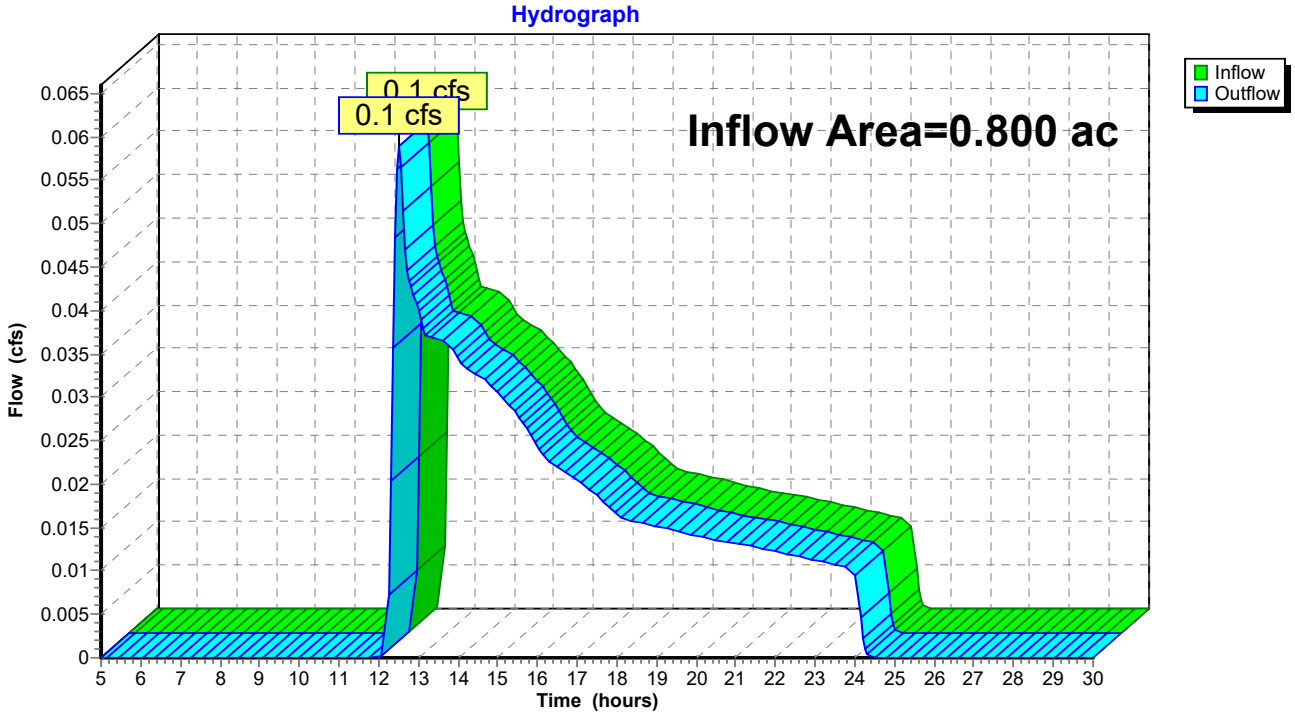
Summary for Reach DP-2: Design Point 2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.800 ac, 0.00% Impervious, Inflow Depth = 0.31" for 100-Year event
Inflow = 0.1 cfs @ 12.50 hrs, Volume= 0.021 af
Outflow = 0.1 cfs @ 12.50 hrs, Volume= 0.021 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-2: Design Point 2



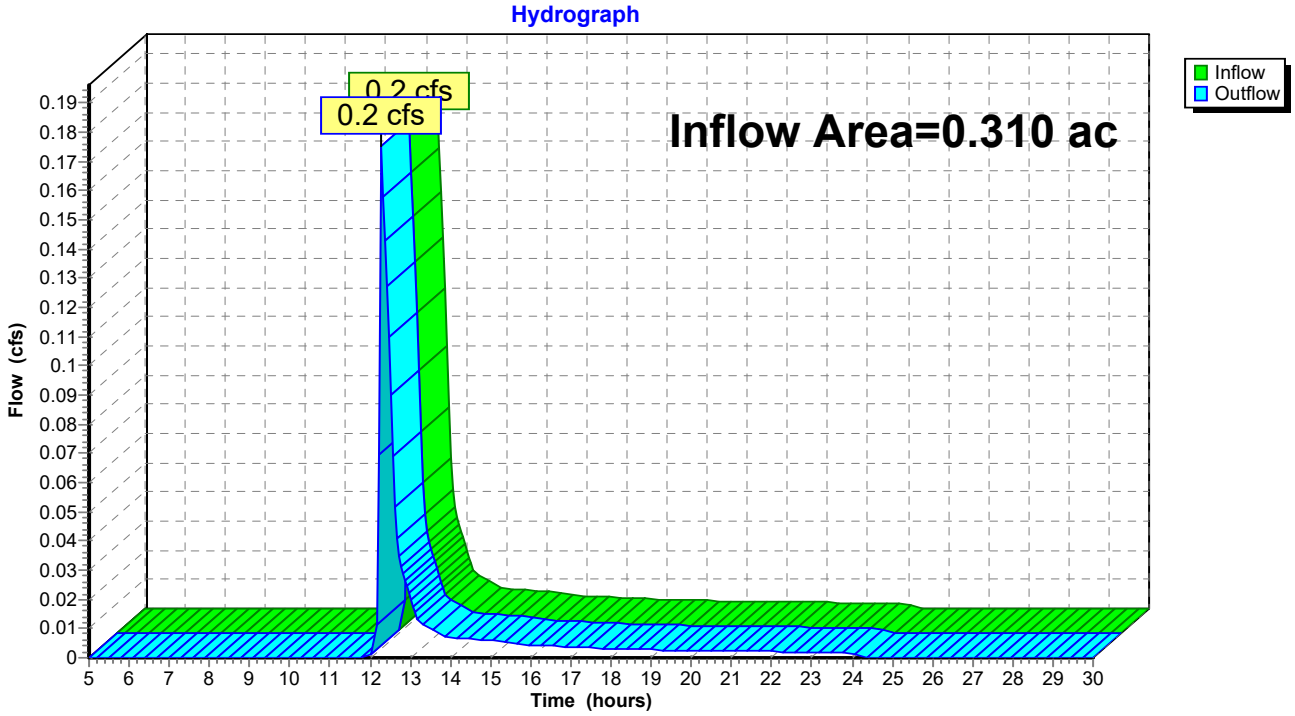
Summary for Reach DP-3: Design Point 3

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.310 ac, 12.90% Impervious, Inflow Depth = 0.33" for 100-Year event
Inflow = 0.2 cfs @ 12.27 hrs, Volume= 0.009 af
Outflow = 0.2 cfs @ 12.27 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Reach DP-3: Design Point 3



Summary for Pond 1P: Infiltration Basin 1

Inflow Area = 1.310 ac, 14.50% Impervious, Inflow Depth = 1.73" for 100-Year event
Inflow = 1.9 cfs @ 12.21 hrs, Volume= 0.189 af
Outflow = 0.9 cfs @ 12.55 hrs, Volume= 0.189 af, Atten= 50%, Lag= 20.2 min
Discarded = 0.3 cfs @ 12.55 hrs, Volume= 0.132 af
Primary = 0.6 cfs @ 12.55 hrs, Volume= 0.057 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 162.40' @ 12.55 hrs Surf.Area= 4,482 sf Storage= 1,612 cf

Plug-Flow detention time= 19.8 min calculated for 0.189 af (100% of inflow)
Center-of-Mass det. time= 19.8 min (900.7 - 880.9)

Volume	Invert	Avail.Storage	Storage Description
#1	162.00'	4,749 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

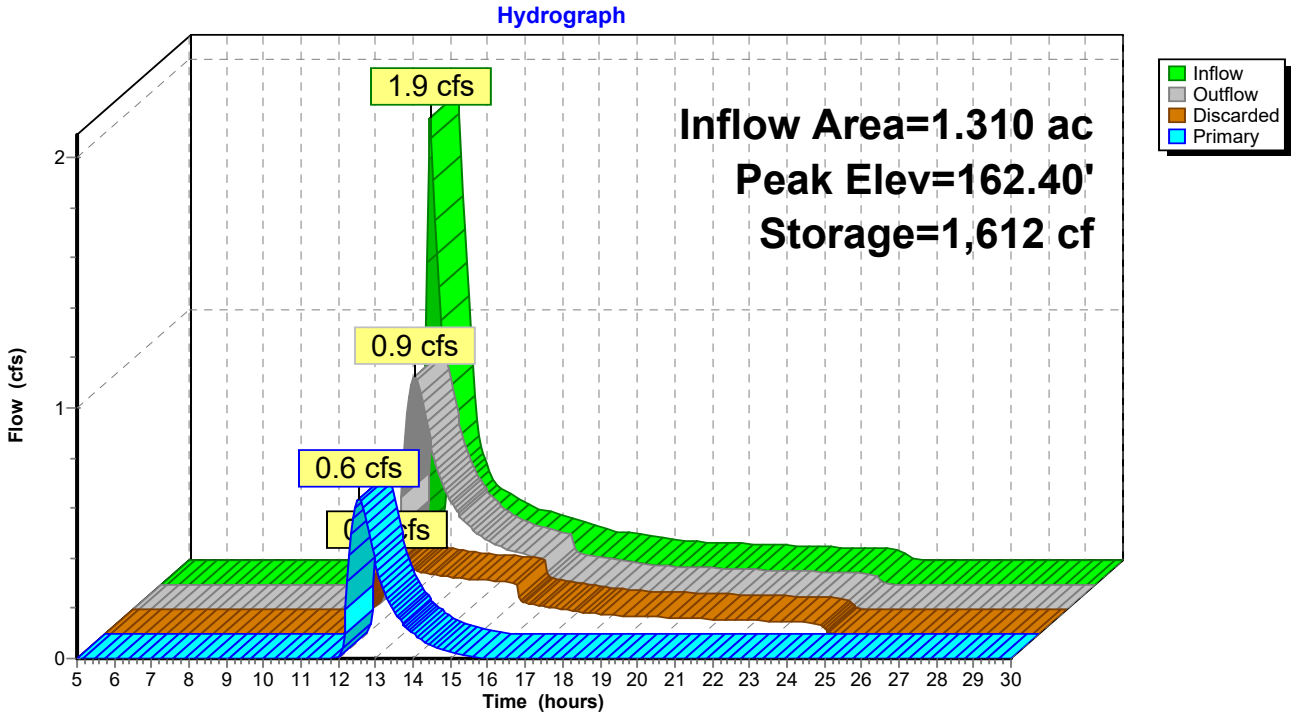
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
162.00	3,568	0	0	3,568
163.00	6,037	4,749	4,749	6,049

Device	Routing	Invert	Outlet Devices
#1	Discarded	162.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 160.00'
#2	Primary	162.00'	**12.0" Round Culvert** L= 108.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 162.00' / 160.50' S= 0.0139 '/' Cc= 0.900 n= 0.013

Discarded OutFlow Max=0.3 cfs @ 12.55 hrs HW=162.40' (Free Discharge)
1=Exfiltration (Controls 0.3 cfs)

Primary OutFlow Max=0.6 cfs @ 12.55 hrs HW=162.40' (Free Discharge)
2=Culvert (Inlet Controls 0.6 cfs @ 2.16 fps)

Pond 1P: Infiltration Basin 1



Summary for Pond 2P: Infiltration Basin 2

Inflow Area = 0.900 ac, 45.56% Impervious, Inflow Depth = 2.82" for 100-Year event
Inflow = 2.5 cfs @ 12.15 hrs, Volume= 0.211 af
Outflow = 0.5 cfs @ 12.70 hrs, Volume= 0.211 af, Atten= 81%, Lag= 33.0 min
Discarded = 0.1 cfs @ 12.70 hrs, Volume= 0.135 af
Primary = 0.3 cfs @ 12.70 hrs, Volume= 0.076 af
Secondary = 0.0 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 161.84' @ 12.70 hrs Surf.Area= 2,545 sf Storage= 3,485 cf

Plug-Flow detention time= 144.3 min calculated for 0.211 af (100% of inflow)
Center-of-Mass det. time= 144.3 min (991.4 - 847.0)

Volume	Invert	Avail.Storage	Storage Description
#1	160.00'	6,975 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
160.00	1,300	0	0	1,300
161.00	1,934	1,607	1,607	1,950
162.00	2,669	2,292	3,898	2,704
163.00	3,504	3,077	6,975	3,562

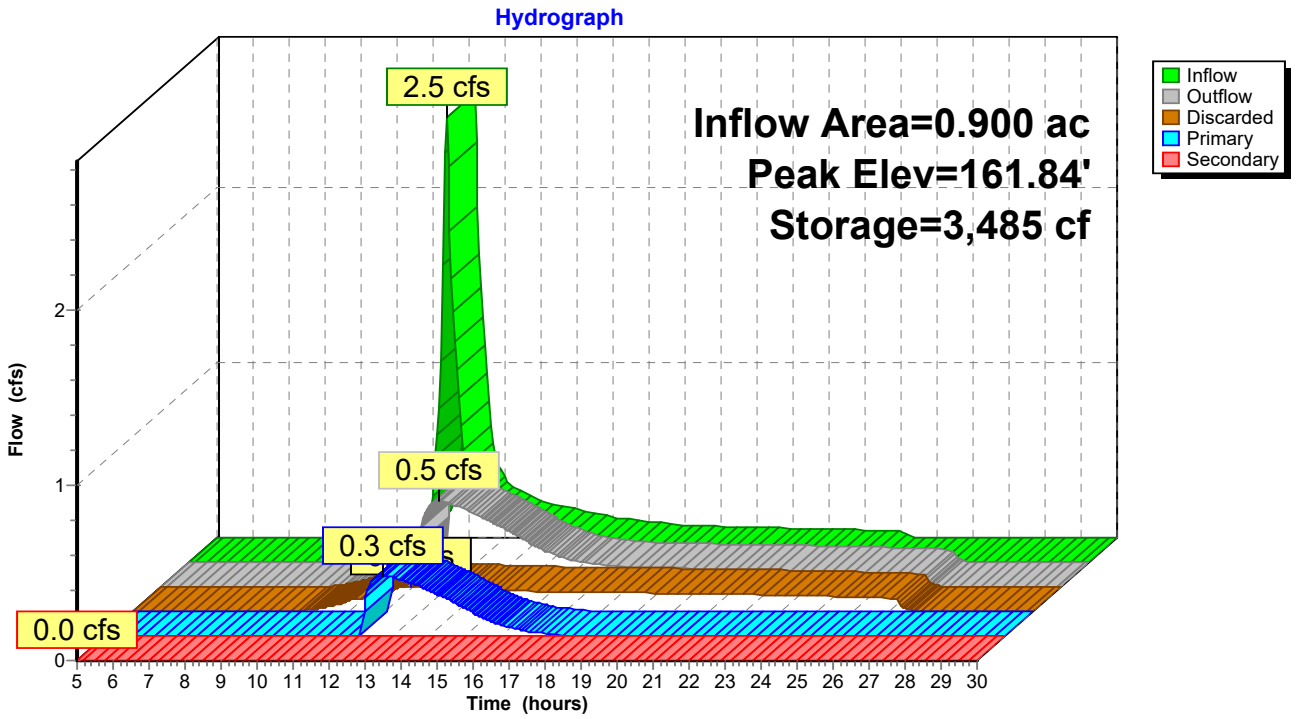
Device	Routing	Invert	Outlet Devices
#1	Discarded	160.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Secondary	162.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	160.22'	**12.0" Round Culvert** L= 43.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 160.22' / 160.00' S= 0.0051 '/' Cc= 0.900 n= 0.013
#4	Device 3	161.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#5	Device 3	162.00'	**48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.1 cfs @ 12.70 hrs HW=161.84' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.3 cfs @ 12.70 hrs HW=161.84' (Free Discharge)
└**3=Culvert** (Passes 0.3 cfs of 3.4 cfs potential flow)
  ├**4=Orifice/Grate** (Orifice Controls 0.3 cfs @ 3.95 fps)
  └**5=Orifice/Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 5.00 hrs HW=160.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 2P: Infiltration Basin 2



Summary for Pond 3P: Infiltration Basin 3

Inflow Area = 0.120 ac, 16.67% Impervious, Inflow Depth = 1.32" for 100-Year event
Inflow = 0.1 cfs @ 12.11 hrs, Volume= 0.013 af
Outflow = 0.1 cfs @ 12.27 hrs, Volume= 0.013 af, Atten= 32%, Lag= 9.8 min
Discarded = 0.0 cfs @ 12.25 hrs, Volume= 0.011 af
Primary = 0.1 cfs @ 12.27 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 164.37' @ 12.25 hrs Surf.Area= 280 sf Storage= 92 cf

Plug-Flow detention time= 38.7 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 38.7 min (929.3 - 890.6)

Volume	Invert	Avail.Storage	Storage Description
#1	164.00'	303 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

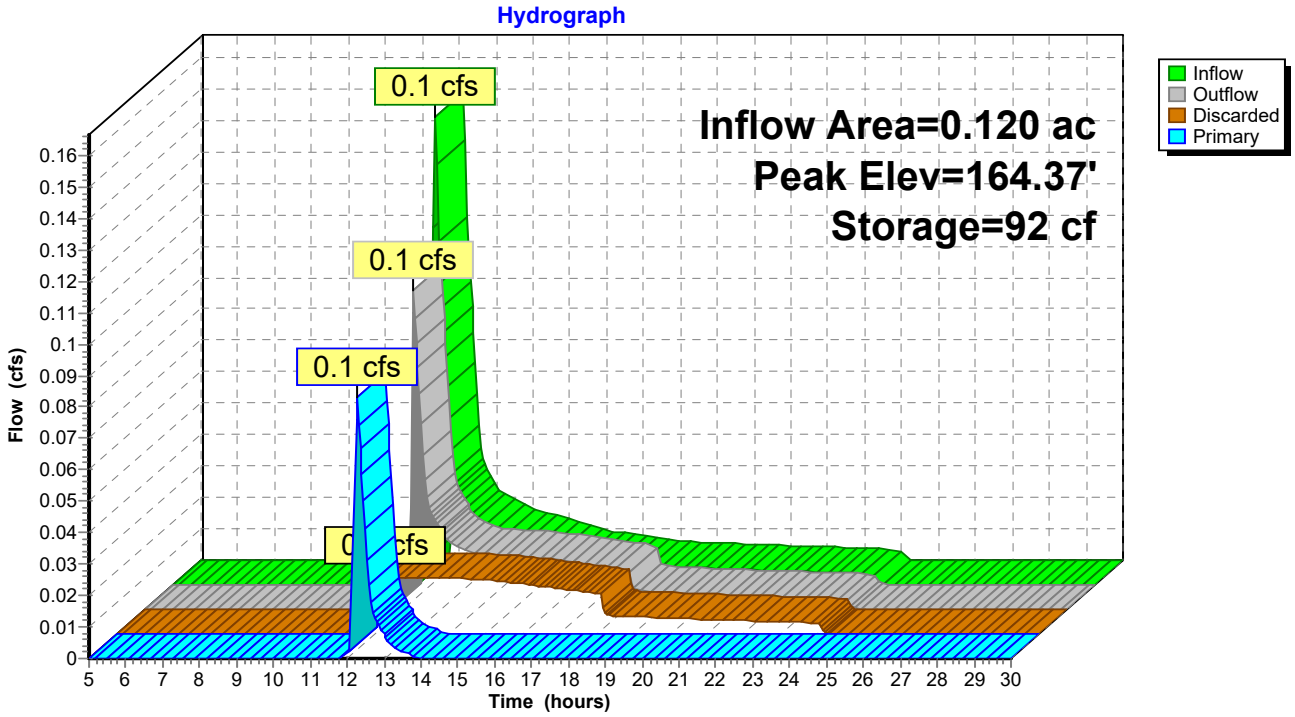
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
164.00	224	0	0	224
165.00	390	303	303	401

Device	Routing	Invert	Outlet Devices
#1	Primary	159.00'	**6.0" Round Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 159.00' / 157.93' S= 0.0255 '/' Cc= 0.900 n= 0.013
#2	Discarded	164.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 162.00'
#3	Device 1	164.33'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.25 hrs HW=164.37' (Free Discharge)
└**2=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.27 hrs HW=164.37' (Free Discharge)
└**1=Culvert** (Passes 0.1 cfs of 1.7 cfs potential flow)
└**3=Orifice/Grate** (Weir Controls 0.1 cfs @ 0.63 fps)

Pond 3P: Infiltration Basin 3



Summary for Pond 4P: Infiltration Basin 4

Inflow Area = 0.080 ac, 25.00% Impervious, Inflow Depth = 1.73" for 100-Year event
Inflow = 0.1 cfs @ 12.10 hrs, Volume= 0.012 af
Outflow = 0.1 cfs @ 12.27 hrs, Volume= 0.012 af, Atten= 36%, Lag= 9.7 min
Discarded = 0.0 cfs @ 12.27 hrs, Volume= 0.010 af
Primary = 0.1 cfs @ 12.27 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 164.37' @ 12.27 hrs Surf.Area= 280 sf Storage= 92 cf

Plug-Flow detention time= 36.7 min calculated for 0.011 af (100% of inflow)
Center-of-Mass det. time= 36.7 min (910.8 - 874.1)

Volume	Invert	Avail.Storage	Storage Description
#1	164.00'	303 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

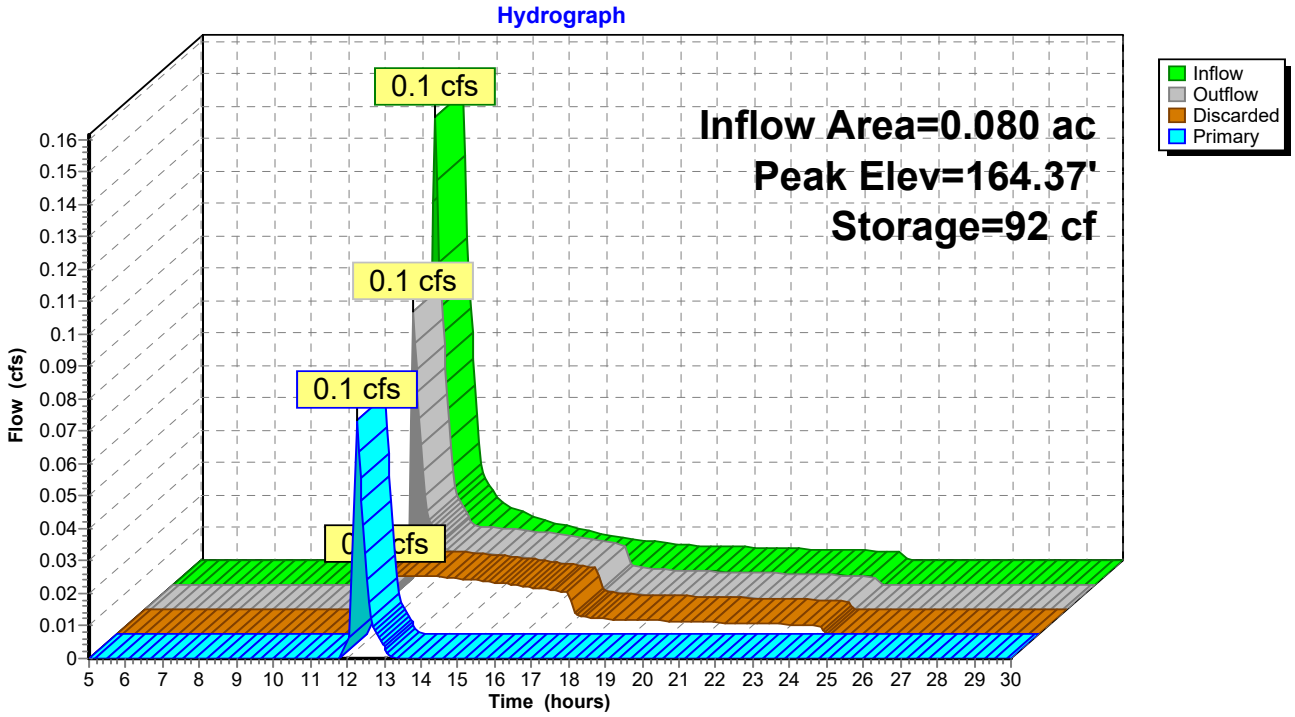
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
164.00	224	0	0	224
165.00	390	303	303	401

Device	Routing	Invert	Outlet Devices
#1	Primary	159.00'	**6.0" Round Culvert** L= 28.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 159.00' / 157.93' S= 0.0382 '/' Cc= 0.900 n= 0.013
#2	Discarded	164.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 162.00'
#3	Device 1	164.33'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.27 hrs HW=164.37' (Free Discharge)
↑**2=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.27 hrs HW=164.37' (Free Discharge)
↑**1=Culvert** (Passes 0.1 cfs of 2.0 cfs potential flow)
↑**3=Orifice/Grate** (Weir Controls 0.1 cfs @ 0.62 fps)

Pond 4P: Infiltration Basin 4



Summary for Pond 5P: Typical Roof Drywell

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.040 ac,100.00% Impervious, Inflow Depth > 6.07" for 100-Year event
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.020 af
Outflow = 0.0 cfs @ 12.56 hrs, Volume= 0.020 af, Atten= 83%, Lag= 28.2 min
Discarded = 0.0 cfs @ 12.56 hrs, Volume= 0.020 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 101.63' @ 12.56 hrs Surf.Area= 319 sf Storage= 283 cf

Plug-Flow detention time= 54.6 min calculated for 0.020 af (100% of inflow)
Center-of-Mass det. time= 54.3 min (815.4 - 761.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	210 cf	**13.00'W x 24.50'L x 2.04'H Field A** 650 cf Overall - 126 cf Embedded = 525 cf x 40.0% Voids
#2A	100.50'	126 cf	**Cultec C-100** x 9 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
		335 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**2.410 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 98.00'

Discarded OutFlow Max=0.0 cfs @ 12.56 hrs HW=101.63' (Free Discharge)
1=Exfiltration (Controls 0.0 cfs)

Pond 5P: Typical Roof Drywell - Chamber Wizard Field A

Chamber Model = Cultec C-100
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

36.0" Wide + 12.0" Spacing = 48.0" C-C

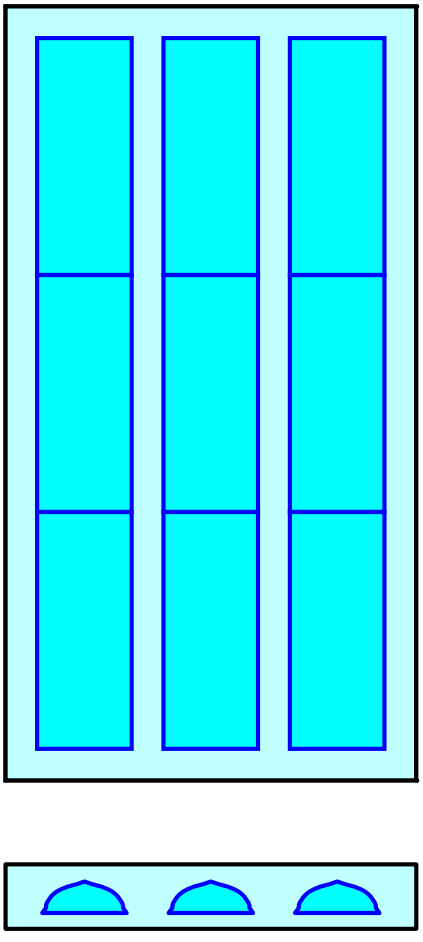
3 Chambers/Row x 7.50' Long = 22.50' + 12.0" End Stone x 2 = 24.50' Base Length
3 Rows x 36.0" Wide + 12.0" Spacing x 2 + 12.0" Side Stone x 2 = 13.00' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

9 Chambers x 14.0 cf = 125.7 cf Chamber Storage

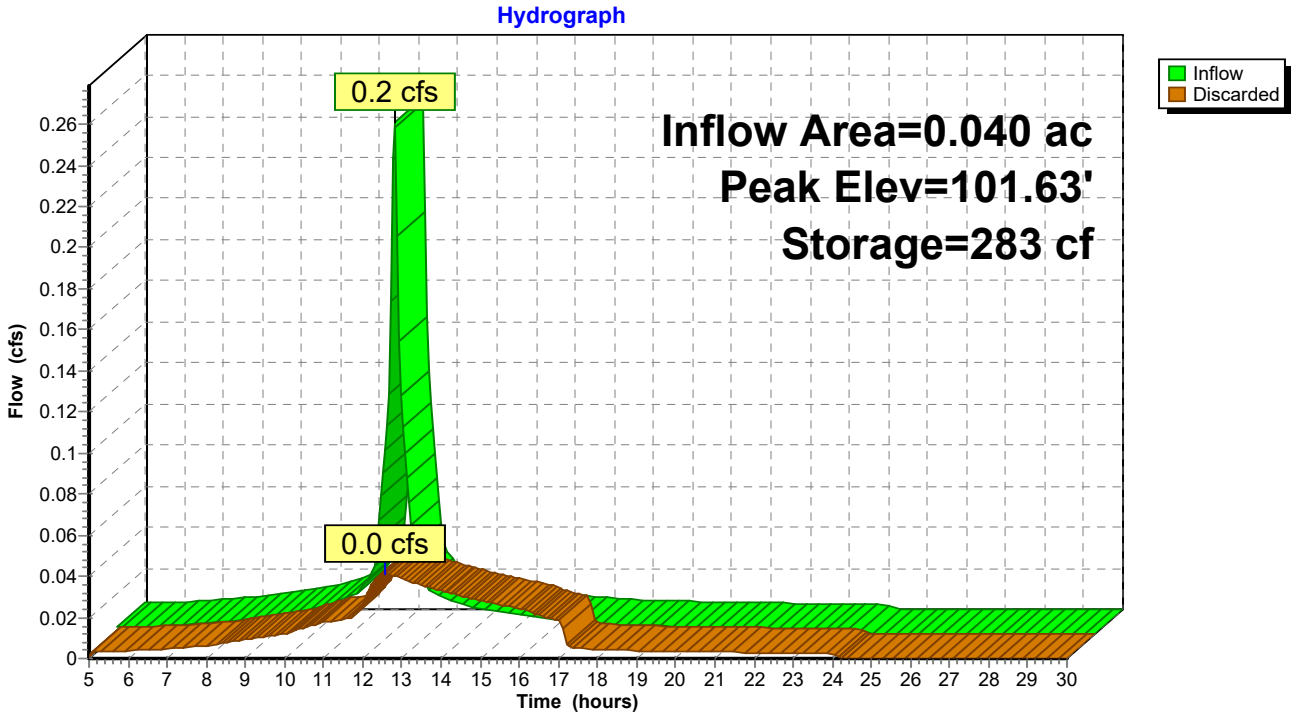
650.3 cf Field - 125.7 cf Chambers = 524.6 cf Stone x 40.0% Voids = 209.8 cf Stone Storage

Stone + Chamber Storage = 335.5 cf = 0.008 af

9 Chambers
24.1 cy Field
19.4 cy Stone



Pond 5P: Typical Roof Drywell



Summary for Pond 6P: Lot 4 Trench

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.054 ac,100.00% Impervious, Inflow Depth > 6.07" for 100-Year event
Inflow = 0.3 cfs @ 12.09 hrs, Volume= 0.027 af
Outflow = 0.1 cfs @ 12.56 hrs, Volume= 0.027 af, Atten= 84%, Lag= 28.5 min
Discarded = 0.1 cfs @ 12.56 hrs, Volume= 0.027 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 160.80' @ 12.56 hrs Surf.Area= 510 sf Storage= 370 cf

Plug-Flow detention time= 49.8 min calculated for 0.027 af (100% of inflow)
Center-of-Mass det. time= 49.6 min (810.7 - 761.1)

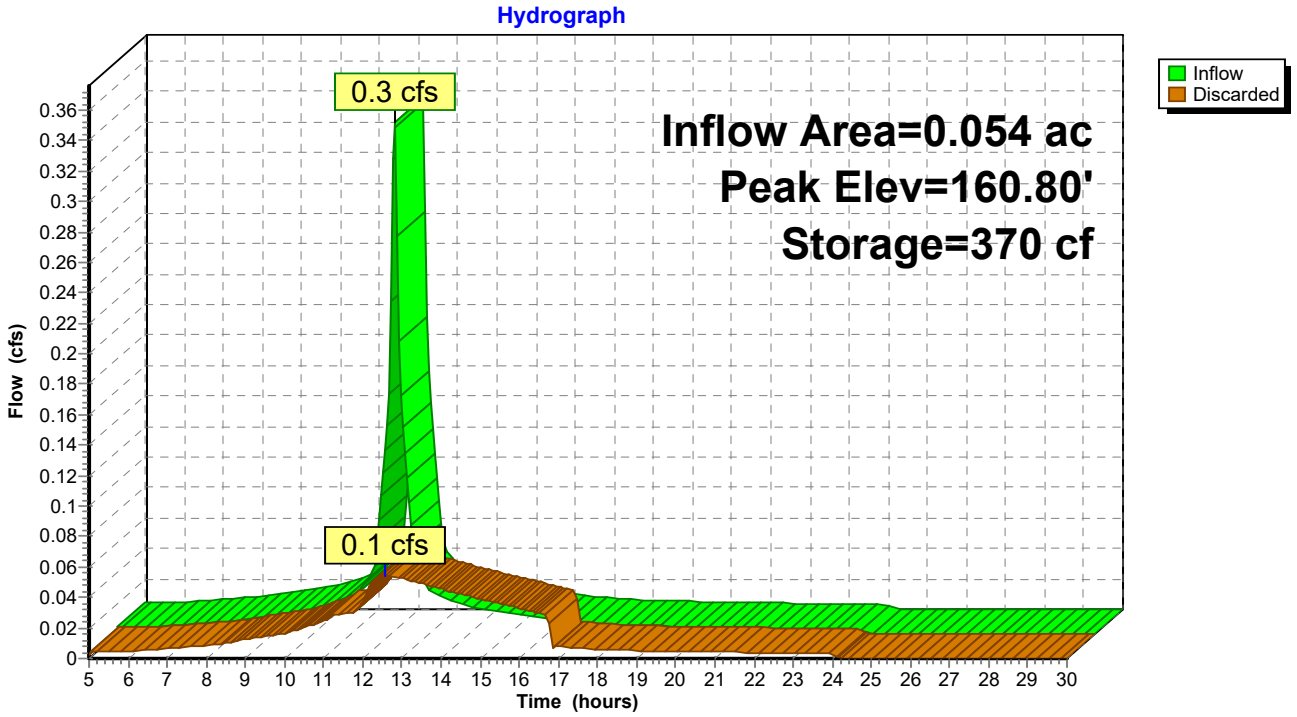
Volume	Invert	Avail.Storage	Storage Description
#1	158.99'	410 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
158.99	510	0.0	0	0
159.00	510	40.0	2	2
160.00	510	40.0	204	206
161.00	510	40.0	204	410

Device	Routing	Invert	Outlet Devices
#1	Discarded	158.99'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 157.00'

Discarded OutFlow Max=0.1 cfs @ 12.56 hrs HW=160.80' (Free Discharge)
↑**1=Exfiltration** (Controls 0.1 cfs)

Pond 6P: Lot 4 Trench



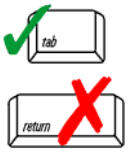
TAB 5

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

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[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

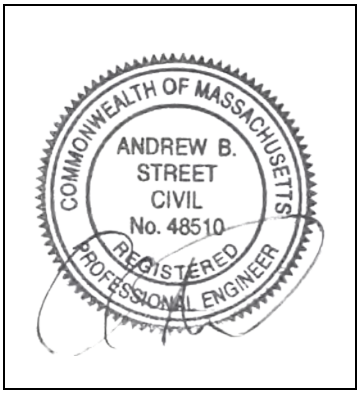
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



11/08/19

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☒ No disturbance to any Wetland Resource Areas

☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Infiltration Basins, Roof Drywells, Infiltration Trenches

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Project: 135, 139 & 149R Howard Street
Location: Reading, MA
Client: Infrastructure Holdings, LLC

Project Number: 18-10120
Prepared By: William Hall, P.E.
Date: November 8, 2019

STORMWATER MANAGEMENT STANDARDS CALCULATIONS

Standard 1: Velocity & Rip-Rap Apron Sizing and Gradation Calculations

Outlet:	Q_{10}: (CFS)	Velocity (FPS)	Req'd	D_o: (FT)	L_A: (FT)	W_1: (FT)	W_2: (FT)	T_W: (FT)	d_{50}: (FT)
FES-2	0.04	1.1	No	1	7.1	3.0	10.1	0.5	0.00
FES-4	0.10	1.2	No	1	7.2	3.0	10.2	0.5	0.00

Conclusion: Discharge from outlet FES-2 and FES-4 for up to and including the 10-Year storm event is < 5.0 FPS and does not require velocity protection. The Stormwater Management System conforms to Standard 1.

Standard 2: Peak Discharge Summary

Design Point 1	2-Year (3.1-IN)	10-Year (4.5-IN)	25-Year (5.3-IN)	100-Year (6.5-IN)
Pre-Development Conditions:	0.0	0.1	0.4	1.2
Post Development Conditions:	0.0	0.1	0.4	1.1
Design Point 2				
Pre-Development Conditions:	0.0	0.0	0.0	0.1
Post Development Conditions:	0.0	0.0	0.0	0.1
Design Point 3				
Pre-Development Conditions:	0.0	0.1	0.1	0.2
Post Development Conditions:	0.0	0.0	0.0	0.2

Conclusion: The Stormwater Management System conforms to Standard 2.

Standard 3: Recharge Calculations (Static Method)

Infiltration Pond 1

Hydrologic Soils Group:	A	B	C	D	
Total Proposed Impervious Area:	0.00	0.00	0.00	0.00	0.00
Target Factor:	0.60	0.35	0.25	0.10	
Required Recharge Volume:	0	0	0	0	0 CF

Volume Below Lowest Outlet:	0 CF
Elevation of Lowest Invert:	162.00

Determine Drawdown Time

Saturated Hydraulic Conductivity (Rawls Rate):	2.41	IN/HR
Bottom Area of Infiltration Basin:	3,568	SF
Drawdown Time:	0.0	HRS

Note: Runoff discharging to Infiltration Pond 1 consists entirely of off-site impervious area, open space, or woods. No new impervious surfaces are being directed to Infiltration Pond 1.

Infiltration Pond 2

Hydrologic Soils Group:	A	B	C	D		
Total Proposed Impervious Area:	0.34	0.00	0.00	0.00	0.34	
Target Factor:	0.60	0.35	0.25	0.10		
Required Recharge Volume:	741	0	0	0	741	CF

Volume Below Lowest Outlet:	1,607	CF
Elevation of Lowest Invert:	161.00	

Determine Drawdown Time

Saturated Hydraulic Conductivity (Rawls Rate):	2.41	IN/HR
Bottom Area of Infiltration Basin:	1,300	SF
Drawdown Time:	6.2	HRS

Infiltration Pond 3 & 4

Hydrologic Soils Group:	A	B	C	D		
Total Proposed Impervious Area:	0.02	0.00	0.00	0.00	0.02	
Target Factor:	0.60	0.35	0.25	0.10		
Required Recharge Volume:	44	0	0	0	44	CF

Volume Below Lowest Outlet:	82	CF
Elevation of Lowest Invert:	164.33	

Determine Drawdown Time

Saturated Hydraulic Conductivity (Rawls Rate):	2.41	IN/HR
Bottom Area of Infiltration Basin:	224	SF
Drawdown Time:	1.8	HRS

Conclusion: The volume provided below the lowest invert in the infiltration basins exceed the minimum recharge volume required. In addition, the basins drain within 72-HRS to comply with DEP regulations. The Stormwater Management System conforms to Standard 3.

Standard 4: Water Quality Volume Calculations

Infiltration Pond 1

Water Quality Depth:	0.5	IN
Total Proposed Impervious Area:	0.00	Acres
Required Water Quality Volume:	0	CF
Provided Water Quality Volume:	0	CF

Infiltration Pond 2

Water Quality Depth:	0.5	IN
Total Proposed Impervious Area:	0.34	Acres
Required Water Quality Volume:	617	CF
Provided Water Quality Volume:	1,607	CF

Infiltration Ponds 3 & 4

Water Quality Depth:	0.5	IN
Total Proposed Impervious Area:	0.02	Acres
Required Water Quality Volume:	36	CF
Provided Water Quality Volume:	82	CF

TSS Removal Rate Calculations

Treatment Provided at Discharge From Infiltration Pond 2

	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Deep Sump Catch Basin:	25%	1.00	0.25	0.75
Sediment Forebay & Infiltration Basin:	80%	0.75	0.60	0.15
TSS Removed at Discharge from Pond:				85.0%

Treatment Provided at Discharge From Infiltration Ponds 3 & 4

	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Sediment Forebay & Infiltration Basin:	80%	100.00	80.00	20.00
TSS Removed at Discharge from Pond:				80.0%

Conclusion: The volume provided below the lowest invert in the infiltration basins exceeds the Water Quality Volume and the Weighted Average TSS Removal Rate exceeds 80%. The Stormwater Management System conforms to Standard 4.

Standard 5: Land Uses With Higher Potential Pollutant Loads

Conclusion: The proposed use is not considered a Land Use with Higher Potential Pollutant Loads. This Standard is NOT Applicable.

Standard 6: Critical Areas

Conclusion: The proposal is not located within a Critical Area. This Standard is NOT Applicable.

Standard 7: Redevelopment

Conclusion: The development does not meet the criteria for Redevelopment. This Standard is NOT Applicable.

Standard 8: Construction Period Controls

Conclusion: The project is covered by a NPDES Construction General Permit. The SWPPP will be submitted prior to construction to address construction period pollution prevention measures and to reduce the potential for erosion and sedimentation. The Stormwater Management System Conforms to Standard 8.

Standard 9: Operations and Maintenance Plan

Conclusion: An Operations and Maintenance Plan has been prepared and provided with this summary. The Stormwater Management System Conforms to Standard 9.

Standard 10: Illicit Discharges to Drainage System

Conclusion: All off-site discharges are comprised entirely of stormwater. The Stormwater Management System Conforms to Standard 10.

Project: 135, 139 & 149R Howard Street
Location: Reading, MA
Client: Infrastructure Holdings, LLC

Project Number: 18-10120
Prepared By: William Hall, P.E.
Date: November 8, 2019

FOREBAY SIZING CALCULATIONS

Infiltration Pond 2

Watershed Characteristics

Impervious Area (Ai):	0.34	Acres
Required (0.1-IN x Ai):	123	CF
Sediment Forebay Volume:	688	CF
	OK	

Stage / Storage Tables

Sediment Forebay:	Elevation	Surface Area (SF)	Incremental Storage (CF)	Total Storage (CF)
	159.5	345	0	0
	160.0	345	173	173
	161.0	686	516	688

Infiltration Pond 3 & 4

Watershed Characteristics

Impervious Area (Ai):	0.02	Acres
Required (0.1-IN x Ai):	7	CF
Sediment Forebay Volume:	13	CF
	OK	

Stage / Storage Tables

Sediment Forebay:	Elevation	Surface Area (SF)	Incremental Storage (CF)	Total Storage (CF)
	164.0	38	0	0
	164.3	38	13	13

Stage-Area-Storage for Pond 2P: Infiltration Basin 2

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
160.00	1,300	1,300	0
160.10	1,358	1,359	133
160.20	1,417	1,420	272
160.30	1,477	1,481	416
160.40	1,539	1,544	567
160.50	1,601	1,609	724
160.60	1,665	1,674	887
160.70	1,731	1,741	1,057
160.80	1,797	1,809	1,234
160.90	1,865	1,879	1,417
161.00	1,934	1,950	1,607
161.10	2,002	2,020	1,803
161.20	2,072	2,091	2,007
161.30	2,142	2,163	2,218
161.40	2,214	2,237	2,435
161.50	2,287	2,312	2,660
161.60	2,361	2,388	2,893
161.70	2,436	2,465	3,133
161.80	2,513	2,543	3,380
161.90	2,590	2,623	3,635
162.00	2,669	2,704	3,898
162.10	2,747	2,785	4,169
162.20	2,827	2,866	4,448
162.30	2,908	2,949	4,734
162.40	2,989	3,033	5,029
162.50	3,072	3,118	5,332
162.60	3,156	3,205	5,644
162.70	3,242	3,292	5,964
162.80	3,328	3,381	6,292
162.90	3,415	3,471	6,629
163.00	**3,504**	**3,562**	**6,975**

Stage-Area-Storage for Pond 3P: Infiltration Basin 3

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
164.00	224	224	0
164.02	227	227	5
164.04	230	230	9
164.06	233	233	14
164.08	236	236	18
164.10	239	240	23
164.12	242	243	28
164.14	244	246	33
164.16	247	249	38
164.18	251	252	43
164.20	254	256	48
164.22	257	259	53
164.24	260	262	58
164.26	263	265	63
164.28	266	269	68
164.30	269	272	74
164.32	272	275	79
164.34	275	279	85
164.36	278	282	90
164.38	282	286	96
164.40	285	289	102
164.42	288	292	107
164.44	291	296	113
164.46	295	299	119
164.48	298	303	125
164.50	301	306	131
164.52	305	310	137
164.54	308	314	143
164.56	311	317	149
164.58	315	321	155
164.60	318	324	162
164.62	322	328	168
164.64	325	332	175
164.66	328	335	181
164.68	332	339	188
164.70	335	343	194
164.72	339	347	201
164.74	342	350	208
164.76	346	354	215
164.78	350	358	222
164.80	353	362	229
164.82	357	366	236
164.84	360	369	243
164.86	364	373	250
164.88	368	377	258
164.90	371	381	265
164.92	375	385	273
164.94	379	389	280
164.96	382	393	288
164.98	386	397	295
165.00	**390**	**401**	**303**

Stage-Area-Storage for Pond 4P: Infiltration Basin 4

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
164.00	224	224	0
164.02	227	227	5
164.04	230	230	9
164.06	233	233	14
164.08	236	236	18
164.10	239	240	23
164.12	242	243	28
164.14	244	246	33
164.16	247	249	38
164.18	251	252	43
164.20	254	256	48
164.22	257	259	53
164.24	260	262	58
164.26	263	265	63
164.28	266	269	68
164.30	269	272	74
164.32	272	275	79
164.34	275	279	85
164.36	278	282	90
164.38	282	286	96
164.40	285	289	102
164.42	288	292	107
164.44	291	296	113
164.46	295	299	119
164.48	298	303	125
164.50	301	306	131
164.52	305	310	137
164.54	308	314	143
164.56	311	317	149
164.58	315	321	155
164.60	318	324	162
164.62	322	328	168
164.64	325	332	175
164.66	328	335	181
164.68	332	339	188
164.70	335	343	194
164.72	339	347	201
164.74	342	350	208
164.76	346	354	215
164.78	350	358	222
164.80	353	362	229
164.82	357	366	236
164.84	360	369	243
164.86	364	373	250
164.88	368	377	258
164.90	371	381	265
164.92	375	385	273
164.94	379	389	280
164.96	382	393	288
164.98	386	397	295
165.00	**390**	**401**	**303**

Groundwater Mounding Analysis Narrative

CDCI Project #18-10120 Date:11/08/19
135, 139 & 149R Howard Street
Reading, MA 01867

This narrative has been prepared to accompany the attached mounding analysis performed for the infiltration basins proposed on the site. The mounding analysis has been performed using a readily available Excel spreadsheet that was assembled by the USGS to solve the Hantush (1967) equation for groundwater mounding beneath an infiltration basin based on specific site conditions. A variety of user inputs are required, which have been acquired by readily available information. The inputs have been chosen to demonstrate compliance with the Massachusetts Stormwater Handbook. The following describes the required inputs:

Recharge Rate: Recharge rate, also described as Rate of Application, is calculated by dividing the volume stored below the outlet of the basin by the bottom area of the basin.

Specific Yield: Specific yield describes the volume of water released by an unconfined aquifer. This value was chosen from a table, attached, which was acquired from a MassDEP presentation on groundwater mounding for septic systems larger than 2,000 gallons per day. The value of 0.23 was chosen for this calculation due to the NRCS description of the parent material being "stratified coarse sand to sand to fine sand."

Hydraulic Conductivity: Hydraulic conductivity describes the materials ability to transmit water. A Rawls rate of 2.41 inches per day is the accepted value for the material present on site, this was then converted to be 4.82 feet per day.

½ Length of Basin: Half of the length of the infiltration basin.

½ Width of Basin: Half of the width of the infiltration basin.

Duration of Infiltration: Duration of infiltration is the time, in days, during which the specified volume of water is infiltrated by the basin. This was previously calculated and noted as "Drawdown Time" in the MassDEP calculation spreadsheet. For a stormwater BMP this value must always be less than 72 hours.

Saturated Thickness: Saturated thickness is the difference between the estimated seasonal high groundwater elevation and the depth to bedrock. Soil logs and a well completion report for 119 Howard Street are attached to demonstrate the value chosen.

SPECIFIC YIELD VALUES (%)

Coarse gravel	0.23
Medium gravel	0.24
Fine gravel	0.25
Coarse sand	0.27
Medium sand	0.28
Fine sand	0.23
Silt	0.08
Clay	0.03

HYDRAULIC CONDUCTIVITY VALUES (FT/DAY)

MATERIAL	AVERAGE	RANGE
Fine gravel	1476	1181 - 3280
Medium gravel	886	689 - 1181
Coarse gravel	492	328 – 689
Coarse sand	148	65 - 328
Medium sand	39	16 - 65
Fine sand	8	3 - 16
Silt	0.3	0.03 – 3
Clay	0.0007	<0.03
S & G mix	172	16 – 328
S & G glacial till		<100
Glacial till		<10

*Mass DEP Groundwater Mounding for Systems Larger than 2,000 GPD Presentation

TABLE 2-1 HYDROLOGIC SOIL PROPERTIES CLASSIFIED BY SOIL TEXTURE*

Texture Class	Effective Water Capacity (C_w)	Minimum Infiltration Rate (f)	Hydrologic Soil Grouping
Sand	0.35	8.27	A
Loamy Sand	0.31	2.41	A
Sandy Loam	0.25	1.02	B
Loam	0.19	.52	B
Silt Loam	0.17	.27	C
Sandy Clay Loam	0.14	.17	C
Clay Loam	0.14	.09	D
Silty Clay Loam	0.11	.06	D
Sandy Clay	0.09	.05	D
Silty Clay	0.09	.04	D
Clay	0.08	.02	D

* Source: Rawls, Brakensiek and Saxton, 1982

MassDEP

Well Completion Report

WELL LOCATION

GPS North: 42.515256 **GPS West:** -71.121292 **Assessors Map:**

Address: 119 Howard Street **Assessors Lot:** 13

Sub Division: **Permit Number:**

City/Town: READING **Date Issued:**

Board Of Health Permit Obtained: NR

Work Performed	Well Type	Drilling Method Overburden	Drilling Method Bedrock
New Well	Irrigation		

ADDITIONAL WELL INFORMATION

Developed: Yes

Disinfected: No

Total Well Depth: 700.00

Fracture Enhancement: No

Well Seal Type:

Depth to Bedrock: 40.00

PERMANENT PUMP (IF AVAILABLE)

Pump Description:

Type:

Nominal Pump Capacity: 5.00

Intake Depth: 240.00

Horsepower: 1

Comments: bedrock is very soft, has collapsed at 120'

CASING

From(ft)	To(ft)	Type	Thickness	Diameter
40.00 (Above Ground)	50.00	Steel		6

SCREEN

From(ft)	To(ft)	Type	slotsize	Diameter

WELL SEAL / FILTER PACK / ABANDONMENT MATERIAL

From(ft)	To(ft)	Material Description	Purpose

STATIC WATER LEVEL(ALL WELLS)

Date Measured	Depth Below Ground Surface
06/27/2001	20.00

WELL TEST DATA (ALL SECTIONS MANDATORY FOR PRODUCTION WELLS)

Date	Method	Yield(GPM)	Time Pumped (hrs & min)	Pumping Level (Ft. BGS)	Time To Recoover (Hrs & min)	Recovery
06/26/2001	Air Lift	3.00	01:00:00	300	01:00:00	120

OVER BURDEN

From(ft)	To(ft)	Lithology	Color	Comment	Water Zone	Loss / Add of Fluid	Drill Stem Drop	Drill Rate

BEDROCK

From(ft)	To(ft)	Lithology	Comment	Water Zone	Drill Stem Drop	Extra Large	Drill Rate	Rust Stain	Loss / Add Of Fluid	# of Fract Per Ft

Infiltration Basin 2 Mounding Analysis

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
1.2360	*R*	**Recharge (infiltration) rate (feet/day)**
0.230	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
4.82	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
23.000	x	**1/2 length of basin (x direction, in feet)**
14.000	y	**1/2 width of basin (y direction, in feet)**
0.258	t	**duration of infiltration period (days)**
37.500	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

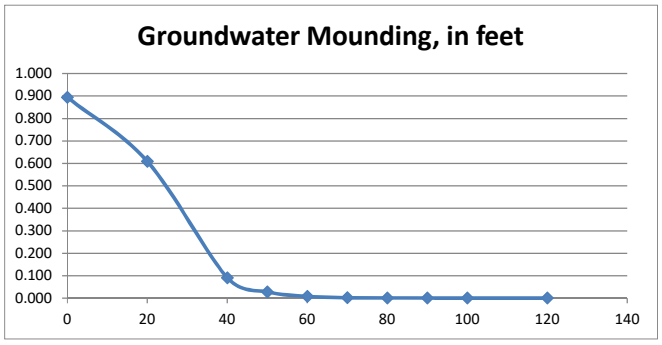
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

38.394	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.894	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.894	0
0.609	20
0.091	40
0.028	50
0.008	60
0.002	70
0.001	80
0.001	90
0.000	100
0.000	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Infiltration Basin 3 and 4 Mounding Analysis

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.3660	*R*	**Recharge (infiltration) rate (feet/day)**
0.230	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
4.82	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
19.000	x	**1/2 length of basin (x direction, in feet)**
3.000	y	**1/2 width of basin (y direction, in feet)**
0.075	t	**duration of infiltration period (days)**
37.500	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

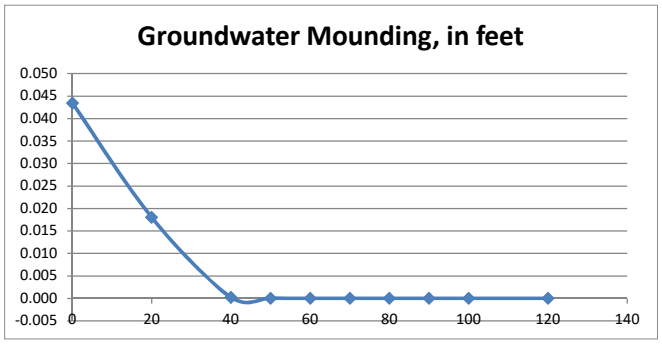
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

37.543	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.043	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.043	0
0.018	20
0.000	40
0.000	50
0.000	60
0.000	70
0.000	80
0.000	90
0.000	100
0.000	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Project:	135, 139 & 149R Howard Street	Project Number:	18-10120
Location:	Reading, MA	Prepared By:	William Hall, PE
Client:	Infrastructure Holdings, LLC	Date:	November 8, 2019

GUTTER CAPACITY CALCULATIONS

Cross Slope of Roadway:	**0.03**	FT/FT
Width of Flow From Face of Curb:	**16.0**	FT
Depth of Flow in Gutter Line:	0.48	FT
Slope (Direction of Flow):	**0.010**	FT/FT
Mannings "N":	**0.016**	
Gutter Capacity (Q):	16.4	CFS
Peak Discharge (Q):	2.5	CFS (100-YR Event)

16.4 > 2.5 OK

Storm Drainage Computations

Name 135 Howard Street | Proj. No. 18-10120 | Design Parameters
Client Greenwood | Date 11/8/2019 | 25 Year Storm
Subject Stormdrain Calculation | Comp. WJH | 12 "Min. Pipe Size
Check | Project File:
Location in Massachusetts 1 (1-Boston, 2-Barnstable, 3-Worcester, 4-Springfield, 5-Pittsfield)
(NOTE ENTER CELLS AS HIGHLIGHTED IN FIRST ROW) | Manning's roughness coefficien 0.013

ENGLISH | Rainfall Data is Boston

LOCATION FROM DRAINAGE NO.	LOCATION TO DRAINAGE NO.	RAINFALL CONCENTRATION PERIOD IN MINUTES		COMBINED RUNOFF COEFF.	TRIBUTARY AREA IN ACRES		C x A		RAINFALL INTENSITY (i)	PEAK FLOW	PIPE								PROFILE			
											SIZE	n VALUE	SLOPE	LENGTH	FULL CAPACITY	FULL VELOCITY	PEAK FLOW CONDITIONS		INVERT ELEVATION		RIM ELEVATION & DEPTH OF COVER	
		PIPE	TOTAL	C	INC	TOTAL	INC	TOTAL	IN/HR	CFS	IN		FT/FT	FT	CFS	VELOCITY FT/S	FT/S	d/D	UPPER END	LOWER END	UPPER RIM	DEPTH
CB 1	FES-5		5.00	0.63	0.900	0.900	0.57	0.57	6.00	3.39	12	0.013	0.010	43	3.52	4.5	5.1	0.78	159.92	159.50	162.72	1.60

Qf/Qd
0.96310057

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

A. Facility Information

1. Facility Information

Kevin Greenwood
Owner Name

135, 139 & 141 Howard Street
Street Address

Map/Lot: Map 10 Lots 75, 76 & 77

Reading
City/Town

MA
State

01867
Zip Code

B. Site Information

1. (Check one) New Construction ☒ Upgrade ☐ Repair ☐

2. Published Soil Survey available? Yes ☒ No ☐ If yes: Web Soil Survey (Year Published) 1"=1120 (Publication Scale) 624B (Soil Map Unit)

Haven-Urban Land complex
Soil Name

Few to None
Soil limitations

3. Surficial Geological Report available? Yes ☐ No ☒ If yes: (Year Published) (Publication Scale) (Map Unit)

Geologic Material

Landform

4. Flood Rate Insurance Map:

Above the 500-year flood boundary? Yes ☒ No ☐ Within the 100-year flood boundary? Yes ☐ No ☒

Within the 500-year flood boundary? Yes ☐ No ☒ Within a Velocity Zone? Yes ☐ No ☒

5. Wetland Area: National Wetland Inventory Map (Map Unit) (Name)

Wetlands Conservancy Program Map (Map Unit) (Name)

6. Current Water Resource Conditions (USGS) Oct/2018 (Month/Year) Range: Above Normal ☒ Normal ☐ Below Normal ☐

7. Other references reviewed:

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

C. On-Site Review

Deep Observation Hole Number: TP-1 – TP 7 | 10/17/18 (Date) | 8:30 a.m. (Time) | partly cloudy- 60F (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: Existing single-family dwellings, lawn & woodland (e.g. woodland, agricultural field, vacant lot, etc.) | None (Surface Stones) | 0-3% (Slope (%))

   Lawn & woods (Vegetation) | Outwash (Landform) | Toeslope (Position on landscape (attach sheet))

3. Distances from: Open Water Body >100 ft. feet | Drainage Way >50 ft. feet | Possible Wet Area >50 ft feet

   Property Line _____ feet | Drinking Water Well _____ feet | Other _____

4. Parent Material: Outwash | Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☒ No ☐ - See attached test tit information

   If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

   Estimated Depth to High Groundwater: _____ inches | _____ elevation

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

Deep Observation Hole Number: TP-1

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	Ap	10 YR 2/2				FSL			Granular	Friable	
12-24"	Bw	10 YR 4/4				FSL			Weak Blocky	Friable	
24-48"	C1	2.5Y 4/3	40"	7.5 YR 5/6	15%	LS&G		10%	Massive	Firm	

Additional Notes: ESHWT 40" .

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

Deep Observation Hole Number: TP-2

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-9"	Ap	10YR 2/2				FSL			Granular	Friable	
9-18"	Bw	10 YR 5/6				FSL			Weak Blocky	Friable	
18-42"	C1	7.5 YR 3/3	30"	7.5YR 5/6	10%	Silt Loam Lenses			Massive	Friable	
42-96"	C2	2.5 Y 3/3		7.5 YR 4/4	15%	LS&G		10%	Massive	Firm	

Additional Notes: ESHWT 30"

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

Deep Observation Hole Number: TP-3

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	Ap	10YR 2/2				FSL			Granular	Friable	
12-20"	Bw	10YR 4/4				FSL			Weak Blocky	Friable	
20-50"	C1	2.5Y 4/3	34"	7.5YR 5/6	15%	LS&G		10%	Massive	Firm	

Additional Notes: ESHWT 34"

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

Deep Observation Hole Number: TP-4

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	Ap	10YR 2/2				FSL			Granular	Friable	
12-26"	Bw	10YR 4/4				FSL			Weak Blocky	Friable	
26-72"	C1	2.5 Y 4/3	34"	7.5YR 5/4	10%	LS&G			Massive	Firm	

Additional Notes: ESHWT 34"

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

Deep Observation Hole Number: TP-5

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	Ap	10YR 2/2				FSL			Granular	Friable	
12-24"	Bw	10YR 4/4				FSL			Weak Blocky	Friable	
24-66"	C1	2.5Y 4/3	28"	7.5YR 5/6	10%	LS&G			Massive	Firm	

Additional Notes: ESHWT 28"

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

Deep Observation Hole Number: TP-6

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10"	Ap	10YR 2/2				FSL			Granular	Friable	
10-24"	Bw	10YR 4/4				FSL			Weak Blocky	Friable	
24-60"	C1	2.5Y 4/3	28"	7.5 YR 5/6	10%	LS&G			Massive	Firm	

Additional Notes: ESHWT 28"

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

Deep Observation Hole Number: TP-7

Depth (In.)	Soil Horizon / Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-9"	Ap	10YR 2/2				FSL			Granular	Friable	
9-20"	Bw	10YR 4/4				FSL			Weak Blocky	Friable	
20-46"	C1	7.5YR 3/3	30"	7.5YR 4/6	15%	Silt loam lenses			Massive	Friable	
46-96"	C2	2.5 Y 3/3		7.5 YR 4/4	20%	LS&G		10%	Massive	Firm	

Additional Notes: ESHWT 30" / Weeping 72"

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

E. Test Pit Locations – See Plan

Soil Suitability Assessment for Stormwater Management

City/Town: Reading, MA
Site: 135, 139 & 149 Howard Street
Soil Evaluator/Soil Scientist: Steven Eriksen

D. Certification

I certify that I have passed the soil evaluator examination* approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017.

Signature of Soil Evaluator	Date
Steve Eriksen Typed or Printed Name of Soil Evaluator	SE685 Soil Evaluator Number
Christopher Cole	Reading Engineering Division

LONG TERM OPERATIONS AND MAINTENANCE PROGRAM

November 8, 2019

This Long Term Operations and Maintenance Program Plan has been prepared in accordance with the Stormwater Management Policy issued by the Department of Environmental Protection (DEP) for the proposed *Definitive Subdivision Plan for 135, 139 & 149R Howard Street*, a residential development located at 135, 139 & 149R Howard Street in Reading, MA. Upon a period beginning twelve months after the completion of the roadway, all structural BMP's shall be inspected twice annually, once in April and once in November. The inspection shall be performed as indicated below:

Snow Storage / Removal

Snow plowed from the proposed roadway will be placed or disposed of in accordance with the policy developed by DEP. Any snow that accumulates in front of the swale at the end of the cul-de-sac shall be removed to ensure that the drainage systems functions properly. Under no circumstances shall snow plowed or removed from the road be stockpiled within wetland resource areas. If conditions arise where snow storage areas are at capacity the Operator is required to remove and dispose of snow off site in conformance with all local, state and federal regulations.

Catch Basins

The sump/hooded catch basins will be inspected and/or cleaned at least four times per year and at the end of the foliage and snow removal seasons. Sediment shall be removed four times per year or whenever the depth of the deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. Sediment shall be removed and disposed of with a truck-mounted vacuum unit or other appropriate apparatus. The sediment will be disposed of at an approved offsite location in accordance with all applicable local, state, and federal regulations.

Drainage Outfalls

The outlets of the storm water management system will be inspected biannually. Any evidence of erosion or other damage will be reported to the appropriate town representative and repaired as soon as possible. Any sediment should be removed from the outlet structures.

Sediment Forebays

Sediments and associated pollutants are removed only when sediment forebays are actually cleaned out, so regular maintenance is essential. Frequently removing accumulated sediments will make it less likely that sediments will be re-suspended. At a minimum, inspect sediment forebays monthly and clean them out at least four times per year. Stabilize the floor and sidewalls of the sediment forebay before making it operational, otherwise the practice will discharge excess amounts of suspended sediments. When mowing grasses, keep the grass height no greater than 6 inches. Set mower blades no lower than 3 to 4 inches. Check for signs of rilling and gullying and repair as needed. After removing the sediment, replace any vegetation damaged during the clean-out by either reseeding or resodding. When reseeding, incorporate practices such as hydroseeding with a tackifier, blanket, or similar practice to ensure that no scour occurs in the forebay while the seeds germinate and develop roots.

Infiltration Basins

Infiltration basins are prone to clogging and failure, so it is imperative to develop and implement aggressive maintenance plans and schedules. Installing the required pretreatment BMPs will significantly reduce maintenance requirements for the basin. Inspections and preventive maintenance must be performed at least twice a year.

Once the basin is in use, inspect it after every major storm for the first few months to ensure it is stabilized and functioning properly and if necessary take corrective action. Note how long water remains standing in the basin after a storm; standing water within the basin 48 to 72 hours after a storm indicates that the infiltration capacity may have been overestimated. If the ponding is due to clogging, immediately address the reasons for the clogging (such as upland sediment erosion, excessive compaction of soils, or low spots).

Thereafter, inspect the infiltration basin at least twice per year. Important items to check during the inspection include:

- Signs of differential settlement,
- Cracking,
- Erosion,
- Leakage in the embankments,
- Tree growth on the embankments,
- Condition of riprap,
- Operation of the drawdown device,
- Sediment accumulation and
- The health of the turf.

At least twice a year, mow the buffer area, side slopes, and basin bottom. Remove grass clippings and accumulated organic matter to prevent an impervious organic mat from forming. Remove trash and debris at the same time. Use deep tilling to break up clogged surfaces, and revegetate immediately. Remove sediment from the basin as necessary, but wait until the floor of the basin is thoroughly dry. Use light equipment to remove the top layer so as to not compact the underlying soil. Deeply till the remaining soil, and revegetate as soon as possible. Inspect and clean pretreatment devices associated with basins at least twice a year, and ideally every other month.

Subsurface Infiltration Systems (Roof Drywells)

The subsurface infiltration systems shall be inspected twice annually, once in April and once in November. Any and all debris and/or sediments shall be removed from the units and be disposed of at an approved offsite location in accordance with all applicable local, state, and federal regulations.

Infiltration Trenches

Infiltration trenches are prone to clogging and failure, so it is imperative to develop and implement aggressive maintenance plans and schedules. Installing the required pretreatment BMPs will significantly reduce maintenance requirements for the trench. Inspections and preventive maintenance must be performed at least twice a year.

The grass and gravel pretreatment strip shall be inspected and repaired every six months. Accumulated sediment, trash, debris, leaves, and grass clippings shall be removed. Inspect the infiltration trench after the first several rainfall events, after all major storms, and on regularly scheduled dates every six months. If there is ponded water on the surface of the trench, it is likely that the trench is clogged. To address clogging, remove and replace the first six inches of stone and filter fabric. If water is ponded inside the trench, it may indicate that the bottom of the trench is clogged. In this event, the trench shall be removed and replaced for its entire depth.

Estimated Operations and Maintenance Budget

It is anticipated that the stormwater management system will require an annual budget of $2,500 to maintain.

OPERATIONS AND MAINTENANCE PLAN

November 8, 2019

This Operations and Maintenance (O&M) Plan has been prepared in accordance with the Stormwater Management Policy issued by the Department of Environmental Protection (DEP) for *'Definitive Subdivision Plans for 135, 139 & 149R Howard Street,'* a residential development located at 135, 139 & 149R Howard Street in Reading, MA.

Project Summary

The applicant proposes to develop 135, 139 & 149R Howard Street in Reading, MA into a six (6) lot single family residential subdivision. The parcels total 4.1-AC± of land and contains two (2) existing single family residences. The project consists of construction of a new 346-FT roadway along with associated infrastructure including driveways, landscaping, drainage facilities, and utilities. Project plans entitled *Definitive Subdivision Plans for 135, 139 & 149R Howard Street*, Revised November 8, 2019, have been prepared by this office and provided for your review. These plans illustrate the proposal in detail including zoning, easements, construction details, roadway profile and provisions for utilities.

Property Owner / Applicant / Responsible Party:

Infrastructure Holdings, LLC
Kevin Greenwood
122 Boston Road
Billerica, MA 01862

Construction Period Pollution Prevention Plan:

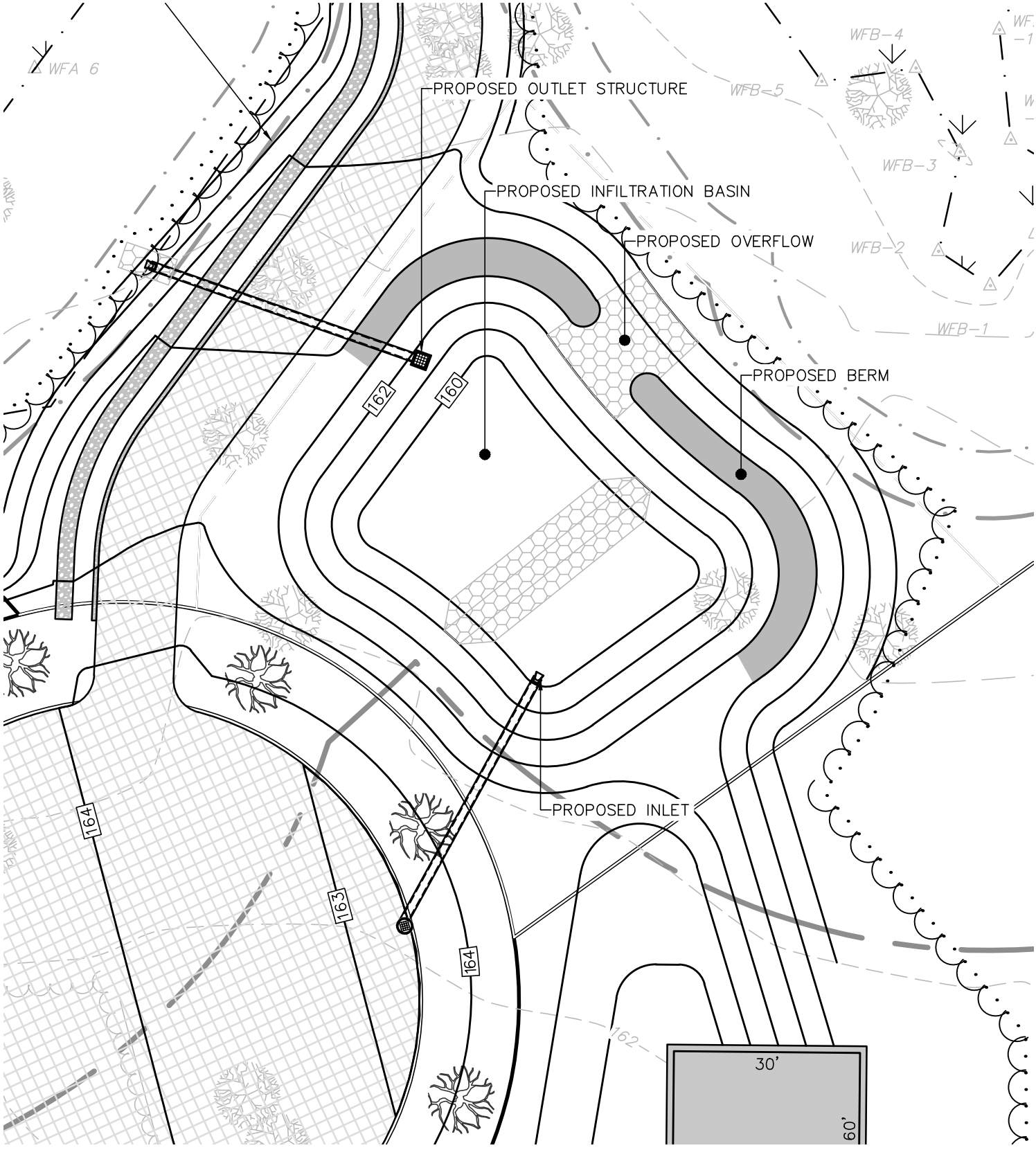
A Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to construction to address the project's NPDES obligations with the EPA. The SWPPP will address the requirements of the Construction Period Pollution Prevention Plan.

Long Term Operations and Maintenance Plan:

See attached Long Term Operations and Maintenance Plan.

System Map:

See attached sketches with an issue date of November 8, 2019 for the location of all stormwater management facilities.



CIVIL DESIGN Consultants, Inc.

LAND PLANNING - DESIGN - PERMITTING - CONSTRUCTION ADMINISTRATION
LAND SURVEYING

30 River Street
Methuen, MA 01844

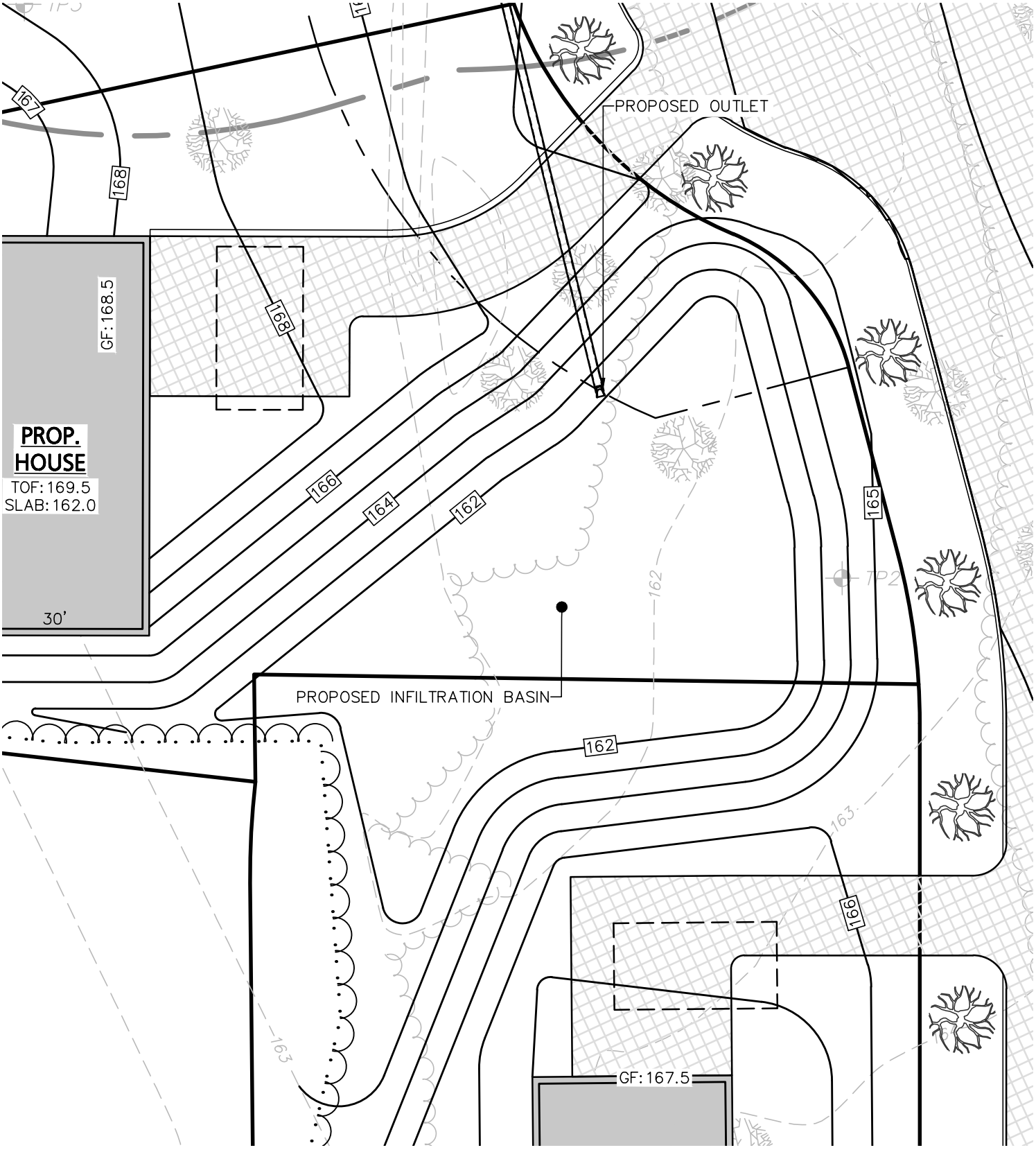
Tel: (978) 416-0920
Fax: (978) 416-7865

PROJECT:
SINGLE FAMILY RESIDENTIAL DEVELOPMENT
135, 139 & 149 HOWARD STREET
READING, MA 01867

PREPARED FOR:
INFRASTRUCTURE HOLDINGS, LLC
122 BOSTON ROAD
BILLERICA, MA 01862

FIGURE 1: IB-1 SKETCH

PREPARED BY: WJH
SCALE: 1"=20'
CDCI FILE #: 18-10120
DATE: NOVEMBER 8, 2019



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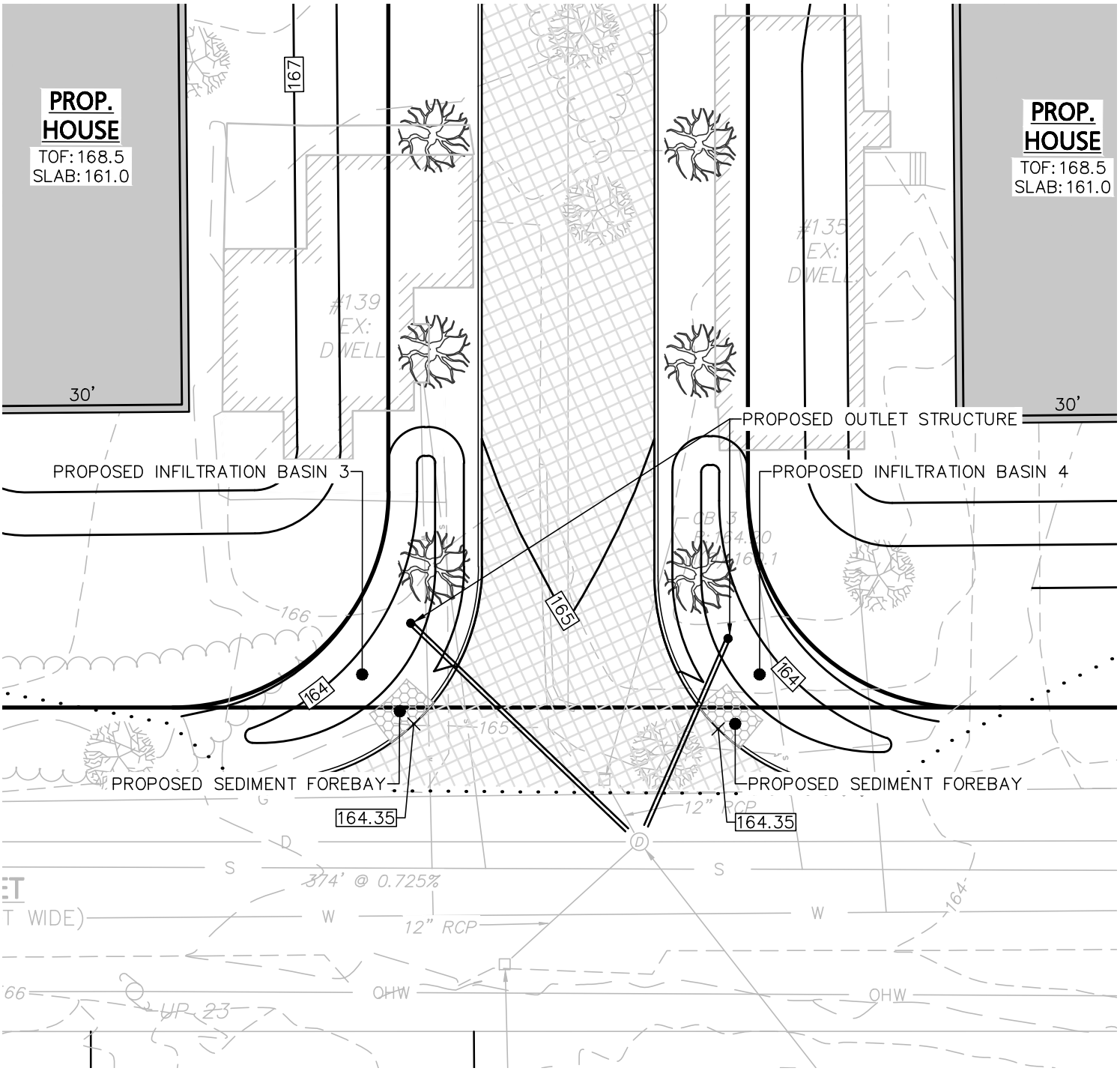
135, 139 & 149 HOWARD STREET
READING, MA 01867

PREPARED FOR:
INFRASTRUCTURE HOLDINGS, LLC
122 BOSTON ROAD
BILLERICA, MA 01862

FIGURE 1: IB-2 SKETCH

PREPARED BY: WJH
SCALE: 1"=20'
CDCI FILE #: 18-10120
DATE: NOVEMBER 8, 2019



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PROJECT:
SINGLE FAMILY RESIDENTIAL DEVELOPMENT
135, 139 & 149 HOWARD STREET
READING, MA 01867

PREPARED FOR:
INFRASTRUCTURE HOLDINGS, LLC
122 BOSTON ROAD
BILLERICA, MA 01862

FIGURE 1: IB-3&4 SKETCH

PREPARED BY: WJH
SCALE: 1"=20'
CDCI FILE #: 18-10120
DATE: NOVEMBER 8, 2019

LEGEND

PROPERTY LINE	
ABUTTERS PROPERTY LINE	
EXISTING EDGE OF PAVEMENT	
LIMIT OF BORDERING VEGETATED WETLAND (BVW)	
WETLAND FLAG	WF BD
WETLAND	
25 FT ZONE OF NATURAL VEGETATION	
50 FT BUFFER ZONE TO BVW	
100 FT BUFFER ZONE TO BVW	
EXISTING CONTOUR	
EXISTING WATERSHED BOUNDARY	
EXISTING TC	
HYDROLOGIC SOILS GROUP A	
HYDROLOGIC SOILS GROUP C	

SOILS SUMMARY:

SYMBOL	DESCRIPTION	HSG
624B	HAVEN – URBAN LAND COMPLEX, 0–8% SLOPES	A
622C	PAXTON – URBAN LAND COMPLEX, 3–15% SLOPES	C

HORIZONTAL SCALE

40 0 20 40 80 160

(IN FEET)

1"=40'

11/08/19	REVISIONS PER TOWN REVIEW
DATE	DESCRIPTION
REVISIONS	

OWNER / APPLICANT:
INFRASTRUCTURE HOLDINGS, LLC
122 BOSTON ROAD
BILLERICA, MA 01862

PROJECT:
135, 139 & 149R HOWARD STREET
READING, MA 01867

DATE ISSUED:	DECEMBER 5, 2018
PROJECT #:	18-10120
PREPARED BY:	WILLIAM HALL, P.E.

COMMONWEALTH OF MASSACHUSETTS
ANDREW B. STREET
CIVIL
No. 48510
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL LAND SURVEYOR FOR CIVIL DESIGN CONSULTANTS, INC.

CIVIL DESIGN Consultants, Inc.
SURVEY • DESIGN • PERMITTING • CONSTRUCTION ADMINISTRATION
30 River Street
Methuen, MA 01844
Tel: (978) 416-0920
Fax: (978) 416-7865

DRAWING TITLE:
EXISTING WATERSHED PLAN

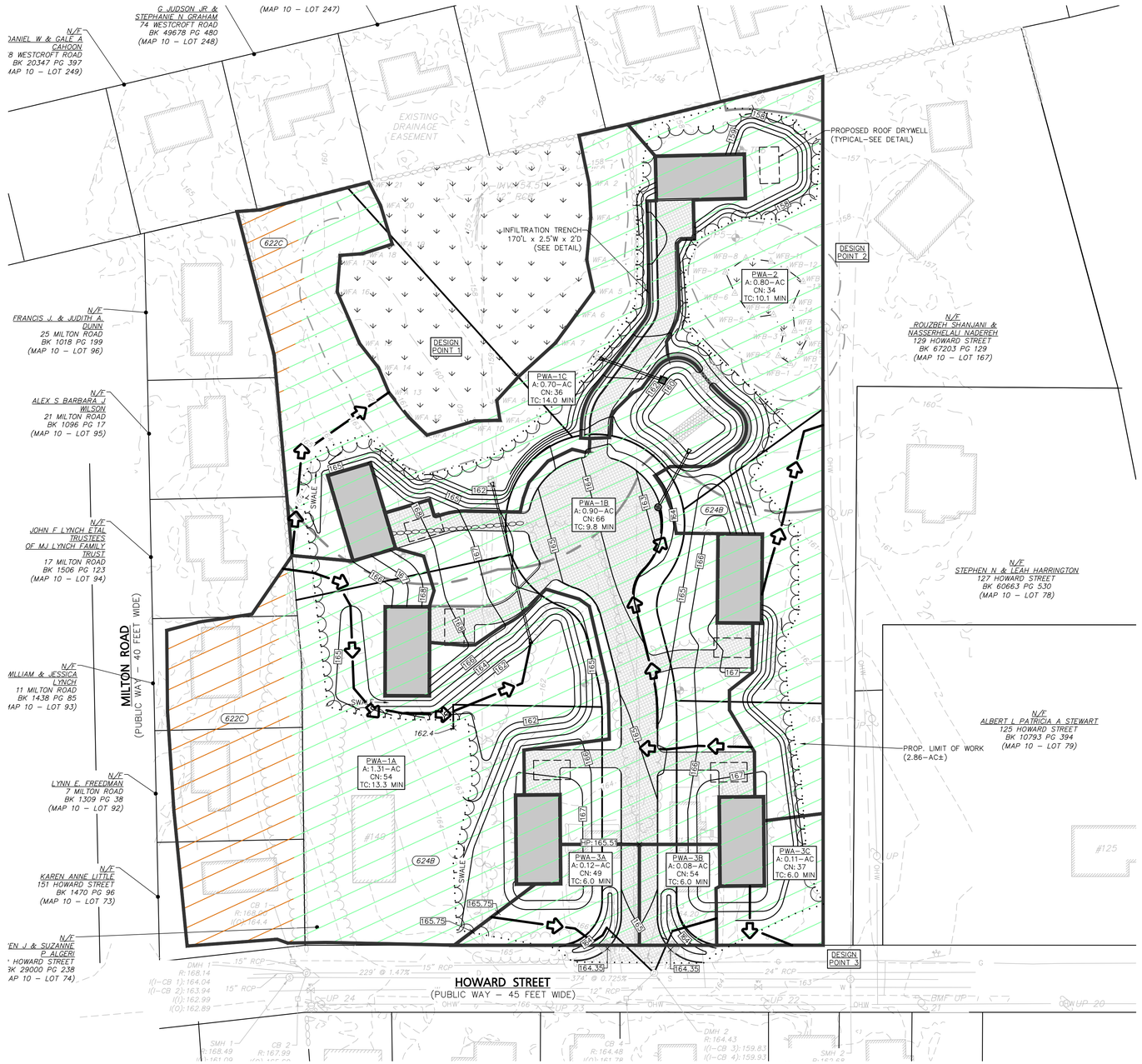
DRAWING #:
EWP

LEGEND

PROPERTY LINE	
PROPOSED BUILDING	
PROPOSED CONTOUR	148
PROPOSED SPOT GRADE	161.00
PROPOSED SPOT GRADE (TW/BW)	TW:159.57 BW:155.67
PROPOSED DRAIN	
PROPOSED RETAINING WALL	
PROPOSED WATERSHED BOUNDARY	
PROPOSED TC	
PROPOSED IMPERVIOUS SURFACE	
HYDROLOGIC SOILS GROUP A	
HYDROLOGIC SOILS GROUP C	
LIMIT OF BORDERING VEGETATED WETLAND (BVW)	
WETLAND FLAG	WF 8D
WETLAND	
25 FT ZONE OF NATURAL VEGETATION	
35 FT BUFFER ZONE TO BVW	
100 FT BUFFER ZONE TO BVW	

SOILS SUMMARY:

SYMBOL	DESCRIPTION	HSG
624B	HAVEN – URBAN LAND COMPLEX, 0–8% SLOPES	A
622C	PAXTON – URBAN LAND COMPLEX, 3–15% SLOPES	C



HORIZONTAL SCALE

40 0 20 40 80 160

(IN FEET)
1"=40'

11/08/19	REVISIONS PER TOWN REVIEW
DATE	DESCRIPTION
REVISIONS	

OWNER / APPLICANT:
INFRASTRUCTURE HOLDINGS, LLC
122 BOSTON ROAD
BILLERICA, MA 01862

PROJECT:
135, 139 & 149R HOWARD STREET
READING, MA 01867

DATE ISSUED:	DECEMBER 5, 2018
PROJECT #:	18-10120
PREPARED BY:	WILLIAM HALL, P.E.

COMMONWEALTH OF MASSACHUSETTS
ANDREW B. STREET
CIVIL
No. 48510
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER FOR CIVIL DESIGN CONSULTANTS, INC.

CIVIL DESIGN Consultants, Inc.
SURVEY • DESIGN • PERMITTING • CONSTRUCTION ADMINISTRATION
30 River Street
Methuen, MA 01844
Tel: (978) 416-0920
Fax: (978) 416-7865

DRAWING TITLE:
PROPOSED WATERSHED PLAN

DRAWING #:
PWP