



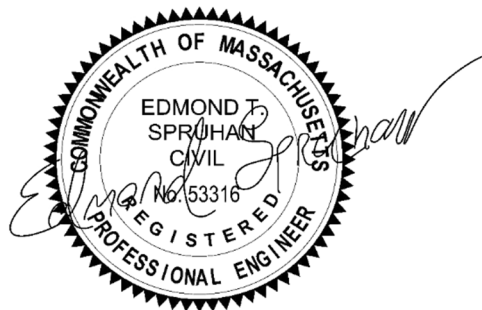
## SPRUHAN ENGINEERING

80 Jewett St Unit 01, Newton, MA 02458  
phone: 617-816-0722 email: edmond@spruhaneng.com

# STORMWATER MANAGEMENT REPORT

PROJECT:

**122-124 CABOT STREET, NEWTON, MA.**



Prepared by:  
Spruhan Engineering, P.C.  
April 25, 2025.

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### **Appendix A – HydroCAD Calculations**

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### **Appendix C – Precipitation Frequency Estimates for Newton (NOAA Atlas 14 Volume 10 V3)**

## 1. Introduction

Spruhan Engineering, P.C. (“Spruhan”) has prepared this Stormwater Management Report for the proposed development at **122-124 Cabot Street, Newton, Massachusetts** (the “Property”). The scope of the project proposes 2 units in this multi-family lot (the “Proposed Development”). The Property will also be improved with a driveway and landscaped areas.

In accordance with Section 29-148(C)(3) of the City of Newton Ordinances, the Proposed Development requires a “major stormwater management permit” because it will increase the amount of impervious surface at the Property by more than 1,000 square feet. Spruhan has designed the proposed stormwater management system to meet these standards.

## 2. Existing Conditions

The Property is a 7,128 square foot lot located on Cabot Street, between Langdon Street and Laudholm Road. The surrounding neighborhood is residential in character and abutting properties are improved by single-family or two-family dwellings. Table 1 provides a summary of the existing impervious, pervious, and landscaped areas at the Property.

<b>EXISTING AREAS</b>	
LOT AREA	7,128 S.F.
<b>IMPERVIOUS</b>	
BUILDING	1,457 S.F.
DRIVEWAY	2,378 S.F.
RETAINING WALLS	14 S.F.
PAVED WALKWAY	236 S.F.
LANDING	13 S.F.
<b>TOTAL</b>	<b>4,098 S.F.</b>
<b>PERVIOUS</b>	
WOODEN STEPS & LANDING	56 S.F.
<b>TOTAL</b>	<b>56 S.F.</b>
LANDSCAPE	2,974 S.F.

*Table 1- Summary of the existing impervious, pervious and landscaped areas at the Property*

## 2.1 Existing Topography and Drainage Infrastructure

The Property has an approximate 2.5% slope that runs from the Northeast (the front left area of the Property) to the Southwest (the rear right area of the Property). The Property currently has an existing catch basing at the rear which mainly collects the runoff coming from the existing driveway. Consequently, stormwater from the gutters in The Property currently scour across the surface at grade.

## 3. Proposed Conditions

### 3.1 Project Description

The scope of the proposed work involves developing the property with 2 units in this multi-family lot. Table 2 provides details on the proposed impervious, pervious, and landscaped areas at the Property.

<b>PROPOSED AREAS</b>	
LOT AREA	7,128 S.F.
<b>IMPERVIOUS</b>	
BUILDING	1,876 S.F.
PORCHES	94 S.F.
DRIVEWAY	790 S.F.
WALKWAYS	65 S.F.
STEPS	20 S.F.
<b>TOTAL</b>	<b>2,845 S.F.</b>
<b>PERVIOUS</b>	
WOODEN STEPS & LANDING	82 S.F.
<b>TOTAL</b>	<b>82 S.F.</b>
LANDSCAPE	4,201 S.F.

*Table 2- Proposed impervious, pervious, and landscaped areas at the Property*

### 3.2 Soil Information (Summary)

The NRCS Web Soil Survey shows one Map Unit inside our area of interest. This is listed next and the percentages of Area of Interest in the Map unit Legend Table:

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.2	100.0%
<b>Totals for Area of Interest</b>		<b>0.2</b>	<b>100.0%</b>

Map unit **626B** refers to **stratified gravel to very gravelly sand**, these soils have a Hydrological soil group “A”.

Also, 2 test pits were performed on the site and the hole logs showed **Gravelly Loamy Sand and Gravelly Sand**; properties for such soils were applied to the HydroCAD software calculations and Drawdown time calculations as well.

Further detailed information is described in Appendix B.

DEEP OBSERVATION HOLE LOG											
DEEP OBSERVATION HOLE NUMBER:				TP-1		GROUND ELEVATION:				78.50	
Depth (in)	Horizon/ Layer	Matrix: Color-Molst	Redox/morphic Features			Texture (USDA)	Coarse Fragments (Percent by Volume)		Structure	Consistence (Molst)	Other
			Depth (in)	Color	Percent		Gravel	Cobbles & Stones			
0-30 (76.00)	FILL	—	—	—	—	—	—	—	—	—	—
30-48 (74.50)	Bw	7.5YR 8/8	—	—	—	SANDY LOAM	<5	<5	MASSIVE	FRIABLE	—
48-80 (71.83)	C	7.5YR 6/4	NONE	—	—	GRAVELLY LOAMY SAND	20	10	SINGLE GRAINED	LOOSE	—
NOTES: 1. STANDING WATER @ 64" (73.16). NO WEEPING WATER OBSERVED. 2. NO REDOX. OBSERVED. 3. NO REFUSAL. 4. LOGGED BY MATTHEW MUJ, SE14259 ON 01/18/2024.											
DEEP OBSERVATION HOLE LOG											
DEEP OBSERVATION HOLE NUMBER:				TP-2		GROUND ELEVATION:				80.0	
Depth (in)	Horizon/ Layer	Matrix: Color-Molst	Redox/morphic Features			Texture (USDA)	Coarse Fragments (Percent by Volume)		Structure	Consistence (Molst)	Other
			Depth (in)	Color	Percent		Gravel	Cobbles & Stones			
0-10 (79.16)	A	10YR 3/2	—	—	—	SANDY LOAM	<5	<5	MASSIVE	FRIABLE	—
10-16 (78.66)	Bw	2.5Y 8/6	—	—	—	SANDY LOAM	<5	<5	MASSIVE	FRIABLE	—
16-84 (73.00)	C1	7.5YR 6/4	—	—	—	LOAMY SAND	10	10	SINGLE GRAINED	LOOSE	—
84-110 (70.83)	C2	7.5YR 5/3	84" (73.00)	—	—	GRAVELLY SAND	25	10	SINGLE GRAINED	LOOSE	—
NOTES: 1. WEEPING WATER OBSERVED @ 100". STANDING WATER OBSERVED AT BOTTOM OF EXCAVATION. 2. REDOX. OBSERVED @ 84" (73.00). 3. NO REFUSAL. 4. LOGGED BY MATTHEW MUJ, SE14259 ON 01/18/2024.											

### 3.3 Infiltration System

The proposed infiltration system consists of one (01) set of Cultec R-330 Chambers composed by 4 chambers, embedded in a crushed stone pit. The Calculations for such systems are shown next:

**Design Criteria:**

Proposed post-construction Impervious areas= 2,845 SF  
 Design for: 2" Rainstorm

**Total Storage Required:**

$$V_R = (2"/12) (2,845SF) = \underline{474 CF}$$

#### **CAPACITY OF PROPOSED INFILTRATION SYSTEM**

System #1			
Volume	Invert	Avail.Storage	Storage Description
#1A	75.00'	333 cf	<b>15.00'W x 20.00'L x 3.54'H Field A</b> 1,062 cf Overall - 231 cf Embedded = 832 cf x 40.0% Voids
#2A	75.50'	231 cf	<b>Cultec R-330XLHD x 4 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		<b>564 cf</b>	<b>Total Available Storage</b>

Total Storage Provided (**564 CF**) > Total Storage Required (**474 CF/D**)

The proposed infiltration system complies with the City of Newton Stormwater Management and Erosion Control Rules & Regulations, Section 5: Design Standards Part C.3.a page 6 of 17, where it states: “Stormwater management systems on new development sites shall be designed to: a) Retain the volume of runoff equivalent to, or greater than, two (2) inches multiplied by the total post-construction impervious surface area on the site...”

### 3.4 Drawdown time (Time to empty) Calculations.

**Drawdown time (Time to empty) Calculations**

$$Time = \frac{rv}{(k)(\text{Inf. System bottom Area})}$$

*rv = Storage capacity of the infiltration system.*

*k = Rawls rate based on soil texture class (8.27  $\frac{\text{in}}{\text{hr}}$  for Gravelly Sand*

**System #1**

$$\text{Time}_{\text{drawdown}} = (564 \text{ cf}) / [(8.27 \text{ in/hr}) (1\text{ft}/12\text{in}) (300 \text{ sf})]$$

**Time = 2.73hr < 72.00hr**

### 3.5 Flowrate & volume of stormwater runoff summary.

The proposed infiltration system designed for this site will control the runoff from the site and substantially improve drainage at the property.

HydroCAD was used to model the site for the existing and proposed conditions for the 2-year, 10-year, 25-year, and 100-year type III storm events based on The NOAA Atlas 14, Volume 10, Version 3, Rain Information for Newton Center, Massachusetts, USA.

Storm Event	Precipitation depths NOAA Atlas 14 (inches)	Precipitation depths used (inches)
2-Year	3.26	3.26
10-Year	5.13	5.13
25-Year	6.30	6.30
100-Year	8.10	8.78**

Table 3- Precipitation depths used for the HydroCAD analysis.

\*\*According to the City of Newton Stormwater Management and Erosion Control Rules & Regulations, Section 5: Design Standards Part B.6 page 5 of 17: “... the 100-year design storm is based on 8.78 inches of precipitation in 24 hours...”. In addition, Section 5: Design Standards Part C.2 page 6 of 17, states: “Projects shall comply with the Stormwater Standards of the most recent version of Massachusetts Stormwater Management Handbook (Handbook), and the City of Newton General Construction Detail Book and Streets Design Guide. Where an inconsistency exists between the Handbook and these Regulations, the stricter shall apply”.

Detailed HydroCAD calculations are included in Appendix A. Table 4, below, provides a summary of the existing and proposed conditions as they relate to flowrate and volume of stormwater runoff at the Property

SUMMARY TABLE				
Rainfall Event	Runoff Flow Rate (cfs)		Volume of Runoff (cf)	
	Existing	Proposed	Existing	Proposed
2-Year	0.19	0.00	607	0
10-Year	0.47	0.01	1415	81
25-Year	0.66	0.02	1983	191
100-Year	1.09	0.13	3271	535

### 3.6 Low Impact Development (LID)

Low Impact Development (LID) strategies use careful site design and decentralized stormwater management to reduce the environmental footprint of new growth and redevelopment. This approach improves water quality, minimizes the need for expensive pipe and pond stormwater systems, and creates more attractive developments.

The following strategies outline the LID methods that were implemented in this project:

1. **Use of Filter Mitts:**
  - a. Erosion control
  - b. Detains sediment, absorbs orders and degrades volatile organic compounds allows water by-pass, and is a food resource for beneficial microorganisms, which remediate by metabolizing wood preservatives, petroleum products, pesticides and both chlorinated and non-chlorinated hydrocarbons in stormwater runoff from reaching water resources, prevents erosion and silting on embankments parallel to creeks, lakes, and rivers, prevents erosion and turf loss on roadsides, hillsides, playing fields, and golf courses.
2. **Grass swales:** broad, open channels sown with erosion resistant and flood tolerant grasses.
  - a. Management Objectives:
    - i. Provide water quality treatment; remove suspended solids; heavy metals, trash.
    - ii. Reduce peak discharge rate and total runoff volume.
    - iii. Infiltrate water into the ground.
    - iv. Provide a location for snow storage.
3. **Infiltration Trenches and Dry Wells.** These are standard stormwater management structures that store water in the void space between crushed stone or gravel; the water slowly percolates downward into the subsoil.
  - a. Management Objectives:
    - i. Remove suspended solids, heavy metals trash, oil, and grease.
    - ii. Reduce peak discharge rate and total runoff volume.
    - iii. Provide modest infiltration and recharge.
    - iv. Provide snow storage areas.
4. **Grass Filter Strips** are low-angle vegetated slopes designed to treat sheet flow runoff from adjacent impervious areas.
  - a. Management Objectives:
    - i. Remove suspended solids, heavy metals, trash, oil, and grease.
    - ii. Reduce peak discharge rate and total runoff volume.
    - iii. Provide modest infiltration and recharge.
    - iv. Provide snow storage areas.
5. **Roadway and Parking Lot Design:**
  - a. Management Objectives:

- i. Remove suspended solids, heavy metals trash, oil, and grease.
- ii. Reduce peak discharge rate and total runoff volume.
- iii. Provide modest infiltration and recharge.
- iv. Provide snow storage areas.

6. Other LID Implementations:

- a. Shared Driveways
- b. Creating long flow paths over landscaped areas.

### 3.7 Total Suspended Solids (TSS) removal & Total Phosphorus (TP) reduction

According to City of Newton Stormwater Management and Erosion Control Rules & Regulations, Section 5: Design Standards Part:

- C.3.c: Stormwater management systems on **new development** sites shall be designed to:
  - a) Remove 90% of the average annual load of Total Suspended Solids generated from the total post-construction impervious area on the site; and
  - b) Calculate the existing and proposed average annual Total Phosphorus (TP) load based on the land use(s) and demonstrate 60% reduction of the TP load generated from the total post-construction impervious surface area on the site: and
- C.4.c: Stormwater management systems on **redevelopment** sites shall be designed to:
  - a) Remove 80% of the average annual load of Total Suspended Solids generated from the total post-construction impervious area on the site; and
  - b) Calculate the existing and proposed average annual Total Phosphorus (TP) load based on the land use(s) and demonstrate 50% reduction of the TP load generated from the total post-construction impervious surface area on the site: and

Therefore, the Stormwater system has been designed to remove **85%** the average annual load of Total Suspended Solids (TSS) generated from the total post-construction impervious area on the site and achieve a total of **97.01%** reduction of the average annual Total Phosphorus (TP) load based generated from the total post-construction impervious surface area on the site.

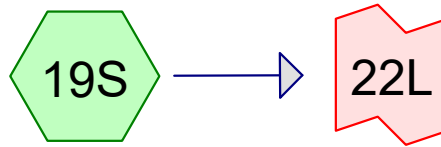
Location: 122-124 CABOT STREET, NEWTON, MA					
TSS Removal Calculation Worksheet	B	C	D	E	F
	BMP <sup>1</sup>	TSS Removal Rate <sup>1</sup>	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
	Infiltration Trench	0.80	1.00	0.80	0.20
	Deep Sump and Hooded Catch Basin	0.25	0.20	0.05	0.15
		0.00	0.15	0.00	0.15
		0.00	0.15	0.00	0.15
Total TSS Removal =			85%	Separate Form Needs to be Completed for Each Outlet or BMP Train	
Project:	122-124 CABOT STREET, NEWTON, MA				
Prepared By:	SPRUHAN ENGINEERING				
Date:	4.24.25				
			*Equals remaining load from previous BMP (E) which enters the BMP		

PHOSPHORUS LOADS / REDUCTIONS	
TP = A*L	
Where:	
A	= Total impervious area of post-development (acres)
L	= Load of a pollutant in pounds per acre per year.
Ac	= Captured impervious area of post-development (acres)
PRE-DEVELOPMENT PHOSPHORUS LOADING (Lpre)	
Tppre	= A*L
Tppre	= 0.0941 Acres x 1.96 lbs/acre/year
Tppre	= <b>0.184 lbs/year</b>
POST-DEVELOPMENT PHOSPHORUS LOADING (Lpost)	
TPpost	= A*L
TPpost	= 0.0653 Acres x 1.96 lbs/acre/year
TPpost	= <b>0.128 lbs/year</b>
REDUCED TP LOAD	
REDUCED TP	= AC*L
REDUCED TP	= 0.0634 Acres x 1.96 lbs/acre/year
REDUCED TP	= <b>0.124 lbs/year</b>
TOTAL PHOSPHORUS REDUCTION % (TP)	
TP RED. (%)	= <b>97.01 %</b>

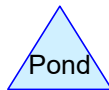
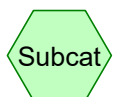
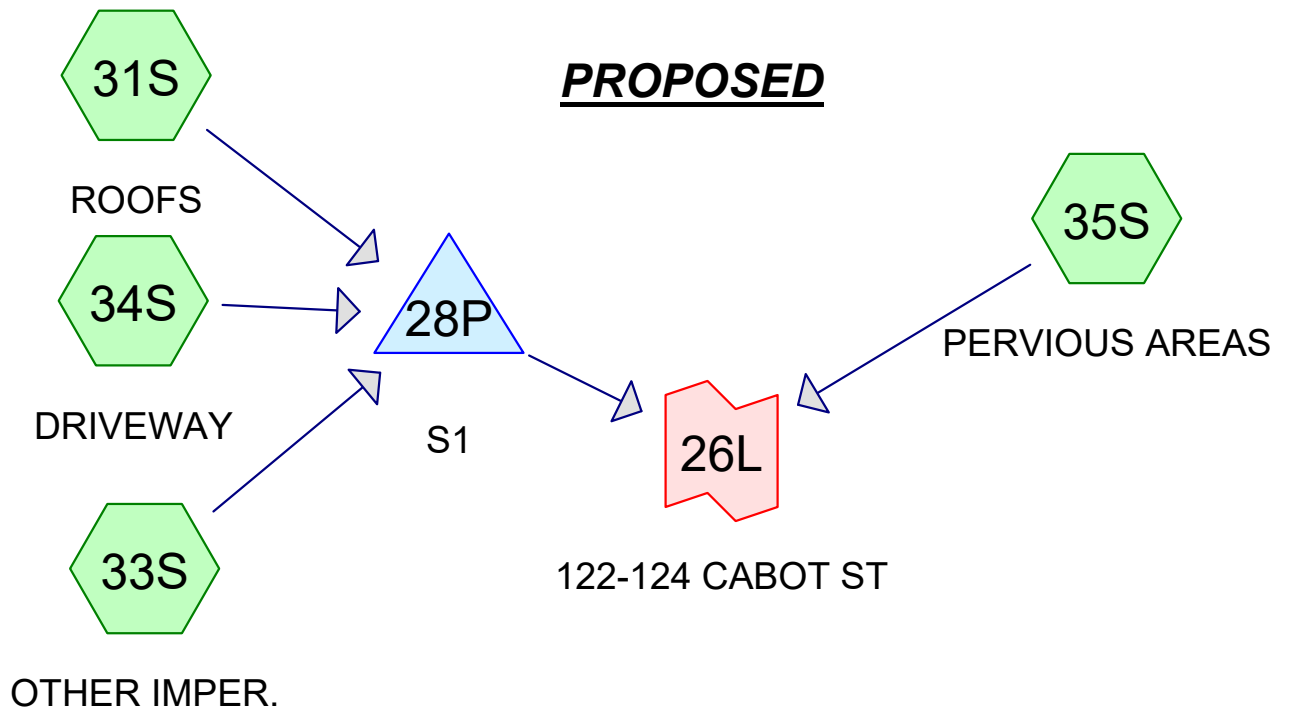
**Appendix A – HydroCAD Calculations**

**EXISTING**



EXISTING AREAS 22-124 CABOT ST

**PROPOSED**



**4 - HydroCAD R1**

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**Area Listing (all nodes)**

Area (sq-ft)	CN	Description (subcatchment-numbers)
7,313	39	>75% Grass cover, Good, HSG A (19S, 35S)
3,168	98	Paved parking, HSG A (19S, 34S)
3,427	98	Roofs, HSG A (19S, 31S)
348	98	Unconnected pavement, HSG A (19S, 33S)
<b>14,256</b>	<b>68</b>	<b>TOTAL AREA</b>

### 4 - HydroCAD R1

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#### Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
14,256	HSG A	19S, 31S, 33S, 34S, 35S
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
<b>14,256</b>		<b>TOTAL AREA</b>

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**Ground Covers (all nodes)**

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
7,313	0	0	0	0	7,313	>75% Grass cover, Good	
3,168	0	0	0	0	3,168	Paved parking	
3,427	0	0	0	0	3,427	Roofs	
348	0	0	0	0	348	Unconnected pavement	
<b>14,256</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>14,256</b>	<b>TOTAL AREA</b>	

**4 - HydroCAD R1**

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Type III 24-hr 2-Year Rainfall=3.26"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 19S: EXISTING AREAS</b>	Runoff Area=7,128 sf 57.49% Impervious Runoff Depth=1.02" Tc=5.0 min CN=73 Runoff=0.19 cfs 607 cf
<b>Subcatchment 31S: ROOFS</b>	Runoff Area=1,970 sf 100.00% Impervious Runoff Depth=3.03" Tc=5.0 min CN=98 Runoff=0.15 cfs 497 cf
<b>Subcatchment 33S: OTHER IMPER.</b>	Runoff Area=85 sf 100.00% Impervious Runoff Depth=3.03" Tc=5.0 min CN=98 Runoff=0.01 cfs 21 cf
<b>Subcatchment 34S: DRIVEWAY</b>	Runoff Area=790 sf 100.00% Impervious Runoff Depth=3.03" Tc=5.0 min CN=98 Runoff=0.06 cfs 199 cf
<b>Subcatchment 35S: PERVIOUS AREAS</b>	Runoff Area=4,283 sf 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=39 Runoff=0.00 cfs 0 cf
<b>Pond 28P: S1</b>	Peak Elev=75.77' Storage=112 cf Inflow=0.21 cfs 718 cf Outflow=0.07 cfs 718 cf
<b>Link 22L: 122-124 CABOT ST</b>	Inflow=0.19 cfs 607 cf Primary=0.19 cfs 607 cf
<b>Link 26L: 122-124 CABOT ST</b>	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
<b>Total Runoff Area = 14,256 sf Runoff Volume = 1,325 cf Average Runoff Depth = 1.12"</b>	
<b>51.30% Pervious = 7,313 sf 48.70% Impervious = 6,943 sf</b>	

**4 - HydroCAD R1**

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Type III 24-hr 2-Year Rainfall=3.26"

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**Summary for Subcatchment 19S: EXISTING AREAS**

Runoff = 0.19 cfs @ 12.08 hrs, Volume= 607 cf, Depth= 1.02"

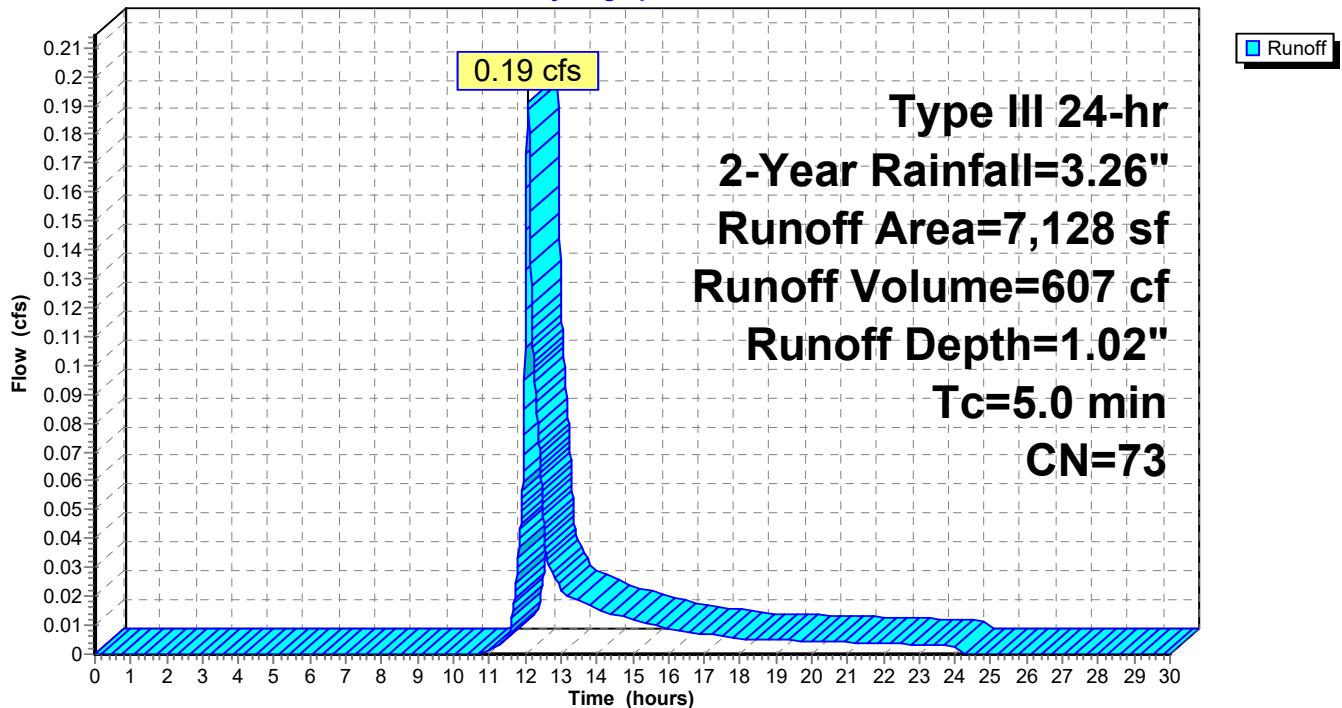
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.26"

Area (sf)	CN	Description
1,457	98	Roofs, HSG A
2,378	98	Paved parking, HSG A
14	98	Unconnected pavement, HSG A
* 236	98	Unconnected pavement, HSG A
* 13	98	Unconnected pavement, HSG A
56	39	>75% Grass cover, Good, HSG A
2,974	39	>75% Grass cover, Good, HSG A
7,128	73	Weighted Average
3,030		42.51% Pervious Area
4,098		57.49% Impervious Area
263		6.42% Unconnected

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

**Subcatchment 19S: EXISTING AREAS**

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 2-Year Rainfall=3.26"

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**Summary for Subcatchment 31S: ROOFS**

Runoff = 0.15 cfs @ 12.07 hrs, Volume= 497 cf, Depth= 3.03"

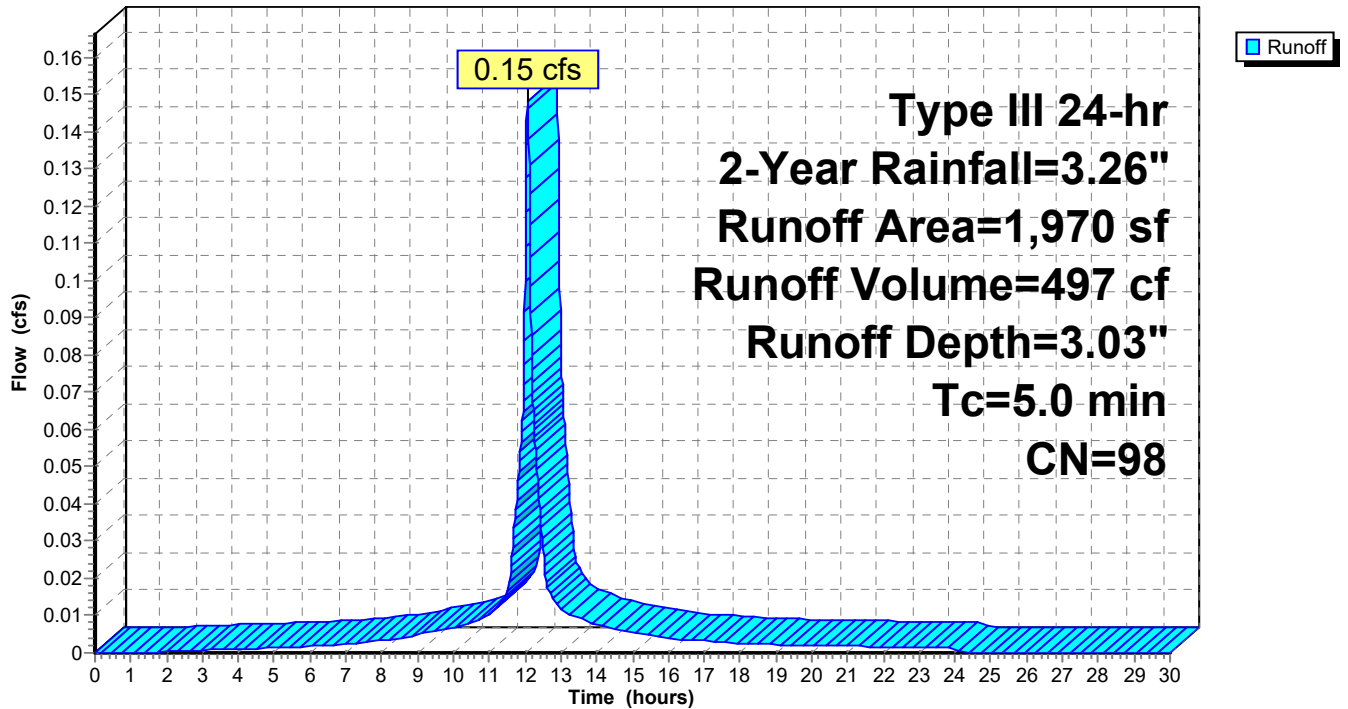
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.26"

	Area (sf)	CN	Description
	1,876	98	Roofs, HSG A
*	94	98	Roofs, HSG A
	1,970	98	Weighted Average
	1,970		100.00% Impervious Area

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

**Subcatchment 31S: ROOFS**

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 2-Year Rainfall=3.26"

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**Summary for Subcatchment 33S: OTHER IMPER.**

Runoff = 0.01 cfs @ 12.07 hrs, Volume= 21 cf, Depth= 3.03"

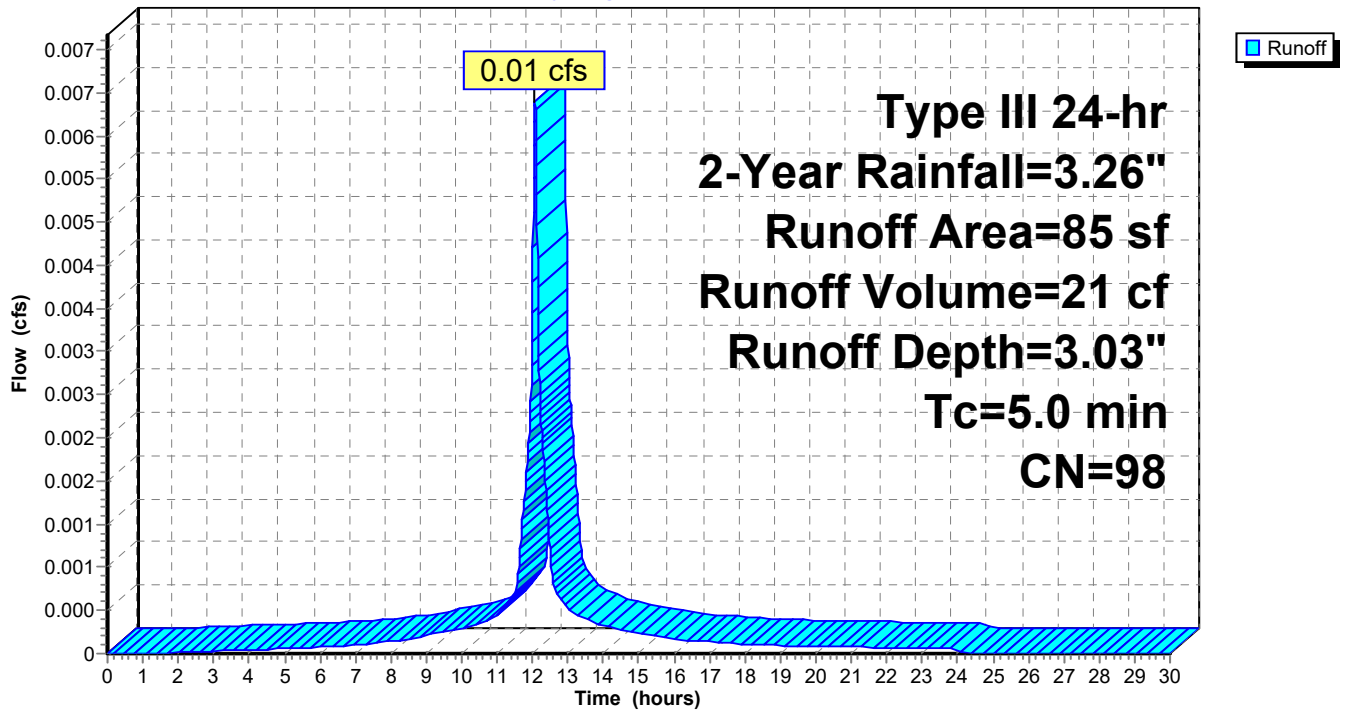
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.26"

Area (sf)	CN	Description
65	98	Unconnected pavement, HSG A
* 20	98	Unconnected pavement, HSG A
85	98	Weighted Average
85		100.00% Impervious Area
85		100.00% Unconnected

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

**Subcatchment 33S: OTHER IMPER.**

Hydrograph



**4 - HydroCAD R1**

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HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.26"

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**Summary for Subcatchment 34S: DRIVEWAY**

Runoff = 0.06 cfs @ 12.07 hrs, Volume= 199 cf, Depth= 3.03"

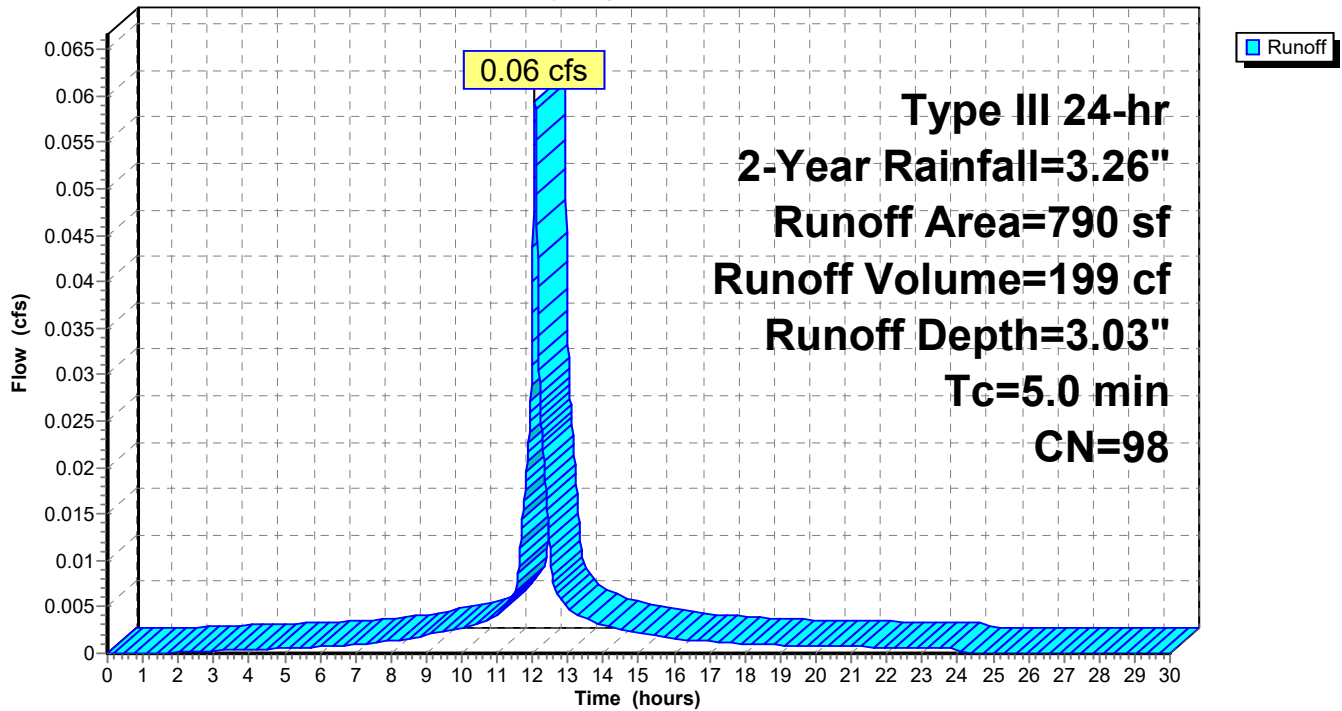
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.26"

Area (sf)	CN	Description
790	98	Paved parking, HSG A
790		100.00% Impervious Area

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

**Subcatchment 34S: DRIVEWAY**

Hydrograph



**4 - HydroCAD R1**

Type III 24-hr 2-Year Rainfall=3.26"

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**Summary for Subcatchment 35S: PERVIOUS AREAS**

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0 cf, Depth= 0.00"

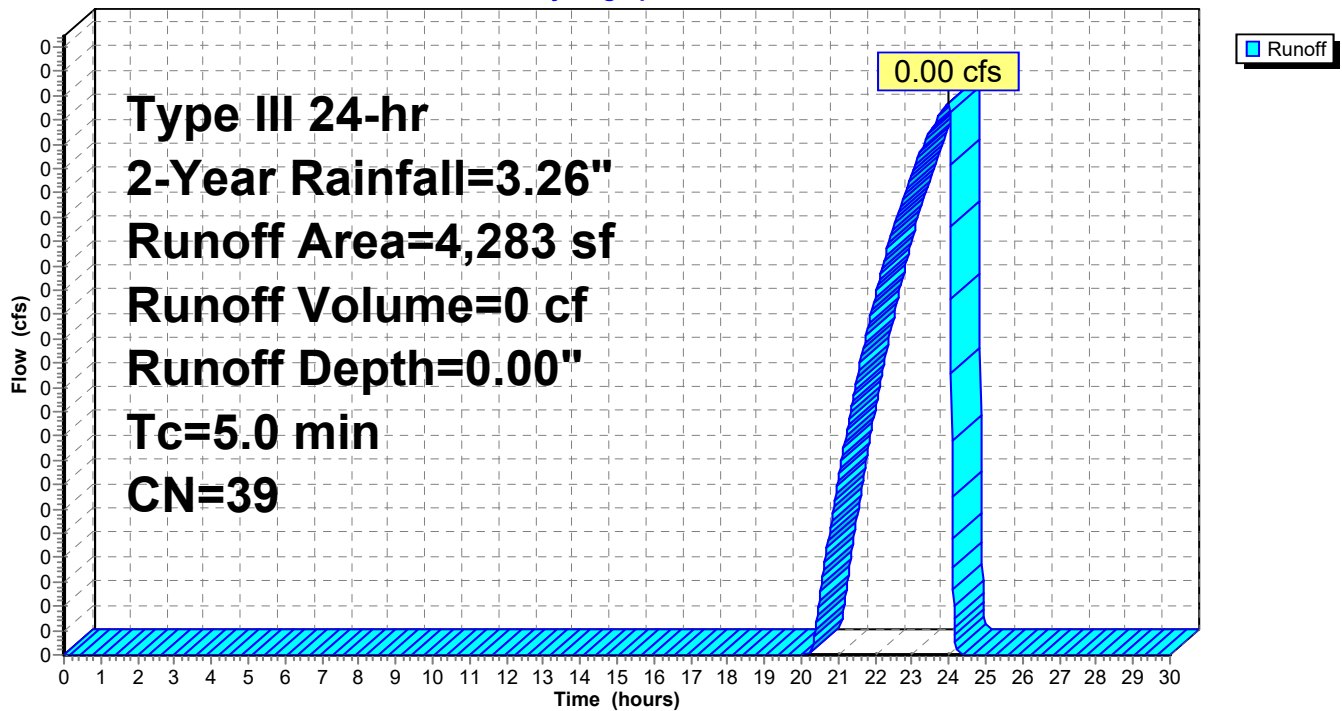
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.26"

Area (sf)	CN	Description
82	39	>75% Grass cover, Good, HSG A
4,201	39	>75% Grass cover, Good, HSG A
4,283	39	Weighted Average
4,283		100.00% Pervious Area

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

**Subcatchment 35S: PERVIOUS AREAS**

Hydrograph



**4 - HydroCAD R1**

**Summary for Pond 28P: S1**

Inflow Area = 2,845 sf, 100.00% Impervious, Inflow Depth = 3.03" for 2-Year event  
 Inflow = 0.21 cfs @ 12.07 hrs, Volume= 718 cf  
 Outflow = 0.07 cfs @ 12.35 hrs, Volume= 718 cf, Atten= 68%, Lag= 16.9 min  
 Discarded = 0.07 cfs @ 12.35 hrs, Volume= 718 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 75.77' @ 12.35 hrs Surf.Area= 300 sf Storage= 112 cf

Plug-Flow detention time= 7.9 min calculated for 718 cf (100% of inflow)  
 Center-of-Mass det. time= 7.9 min ( 763.0 - 755.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	75.00'	333 cf	<b>15.00'W x 20.00'L x 3.54'H Field A</b> 1,062 cf Overall - 231 cf Embedded = 832 cf x 40.0% Voids
#2A	75.50'	231 cf	<b>Cultec R-330XLHD x 4 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	75.00'	<b>8.270 in/hr Exfiltration over Wetted area</b>

**Discarded OutFlow** Max=0.07 cfs @ 12.35 hrs HW=75.77' (Free Discharge)  
 ↳ **1=Exfiltration** (Exfiltration Controls 0.07 cfs)

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## Pond 28P: S1 - Chamber Wizard Field A

### Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

2 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 15.50' Row Length +27.0" End Stone x 2 = 20.00' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 35.0" Side Stone x 2 = 15.00' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 231.0 cf Chamber Storage

1,062.5 cf Field - 231.0 cf Chambers = 831.5 cf Stone x 40.0% Voids = 332.6 cf Stone Storage

Chamber Storage + Stone Storage = 563.6 cf = 0.013 af

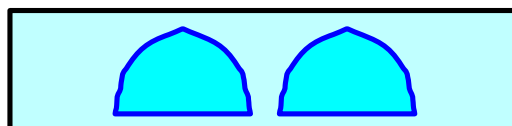
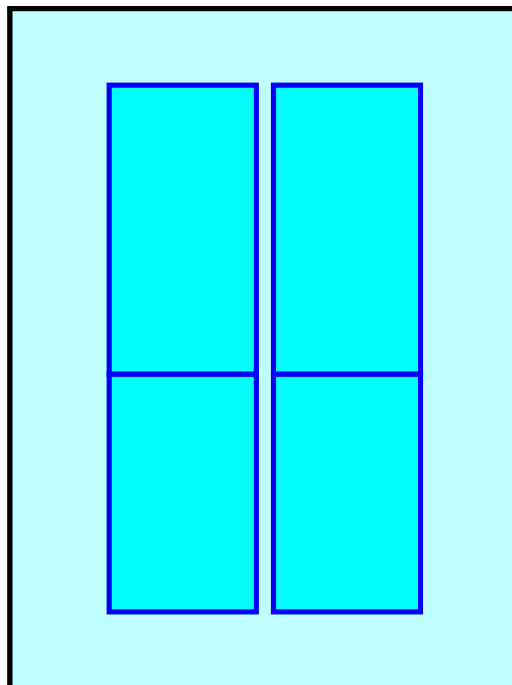
Overall Storage Efficiency = 53.0%

Overall System Size = 20.00' x 15.00' x 3.54'

4 Chambers

39.4 cy Field

30.8 cy Stone



### 4 - HydroCAD R1

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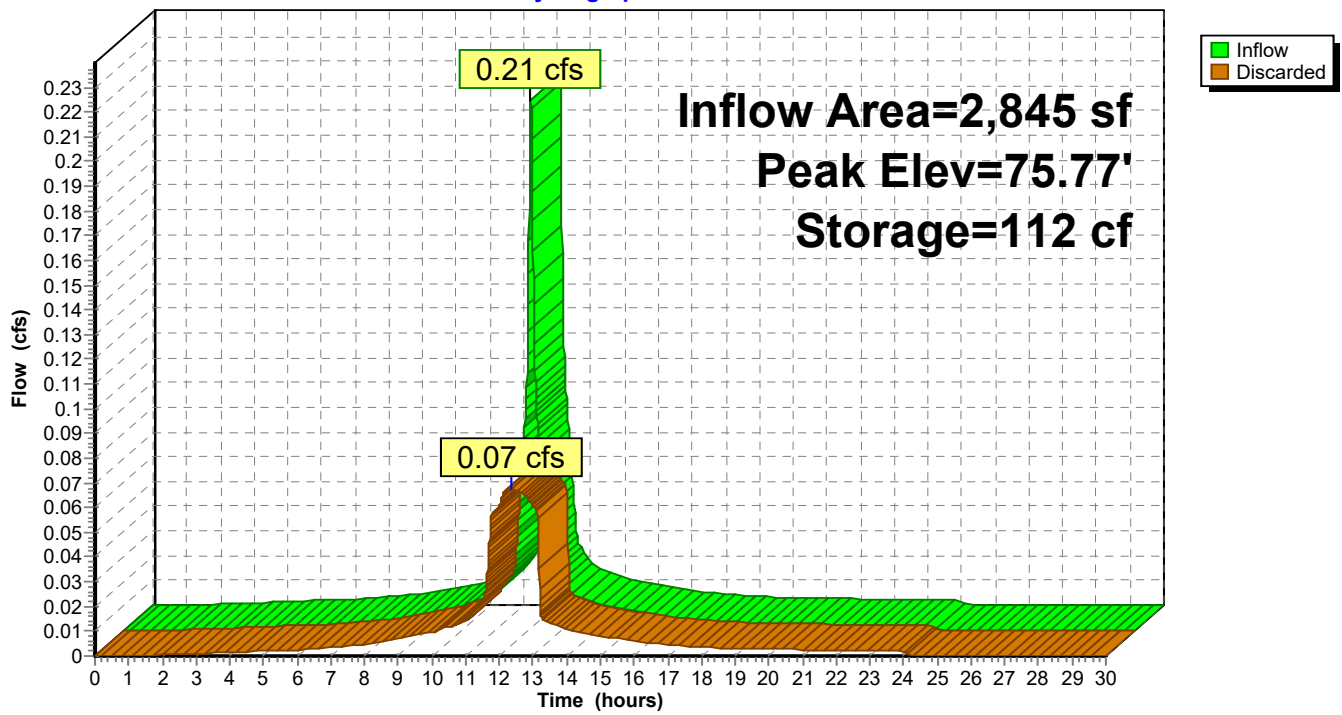
Type III 24-hr 2-Year Rainfall=3.26"

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### Pond 28P: S1

Hydrograph



**4 - HydroCAD R1**

Type III 24-hr 2-Year Rainfall=3.26"

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**Stage-Area-Storage for Pond 28P: S1**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
75.00	300	0	77.80	496	473
75.05	303	6	77.85	499	480
75.10	307	12	77.90	503	486
75.15	311	18	77.95	507	492
75.20	314	24	78.00	510	499
75.25	318	30	78.05	513	505
75.30	321	36	78.10	517	511
75.35	324	42	78.15	521	517
75.40	328	48	78.20	524	523
75.45	332	54	78.25	528	529
75.50	335	60	78.30	531	535
75.55	338	70	78.35	534	541
75.60	342	79	78.40	538	547
75.65	346	89	78.45	542	553
75.70	349	99	78.50	<b>545</b>	<b>559</b>
75.75	353	108			
75.80	356	118			
75.85	359	128			
75.90	363	137			
75.95	367	147			
76.00	370	156			
76.05	373	166			
76.10	377	175			
76.15	381	185			
76.20	384	194			
76.25	388	204			
76.30	391	213			
76.35	394	223			
76.40	398	232			
76.45	402	241			
76.50	405	251			
76.55	408	260			
76.60	412	269			
76.65	416	279			
76.70	419	288			
76.75	423	297			
76.80	426	306			
76.85	429	315			
76.90	433	325			
76.95	437	333			
77.00	440	342			
77.05	443	351			
77.10	447	360			
77.15	451	369			
77.20	454	377			
77.25	458	386			
77.30	461	394			
77.35	464	403			
77.40	468	411			
77.45	472	419			
77.50	475	427			
77.55	478	435			
77.60	482	443			
77.65	486	451			
77.70	489	458			
77.75	493	466			

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Type III 24-hr 2-Year Rainfall=3.26"

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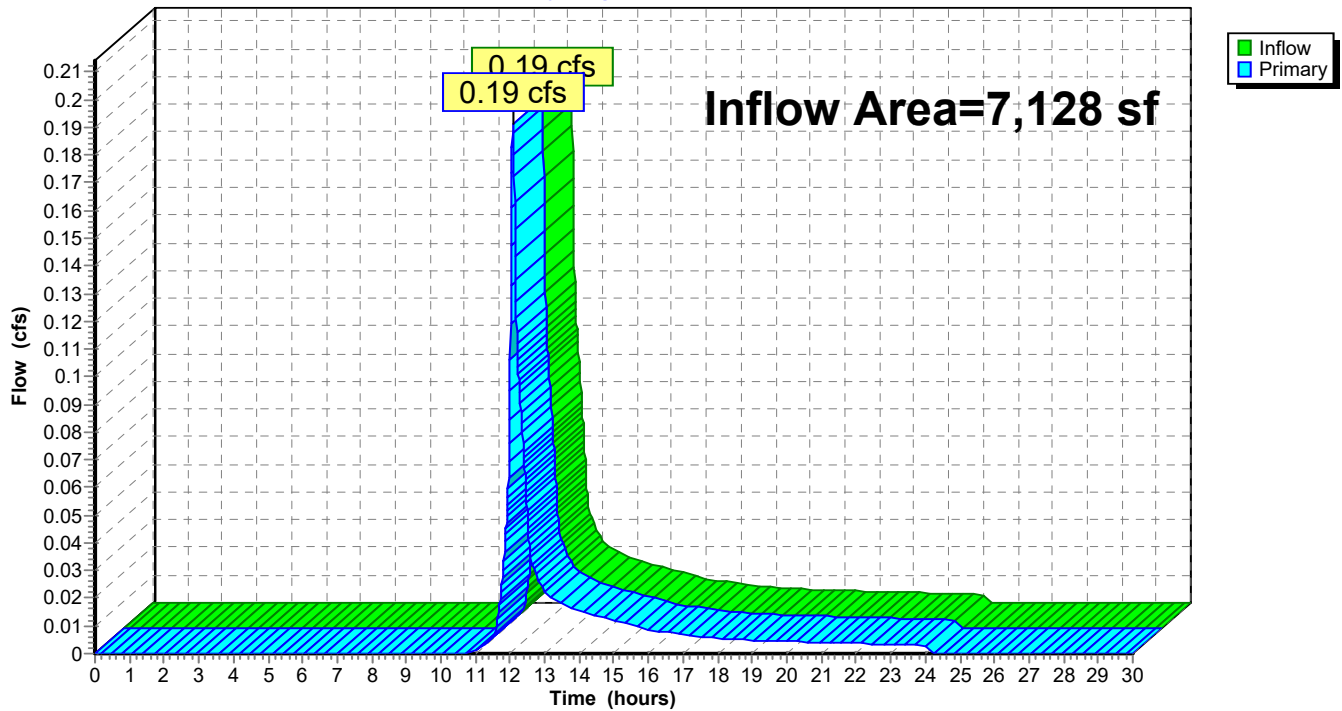
## Summary for Link 22L: 122-124 CABOT ST

Inflow Area = 7,128 sf, 57.49% Impervious, Inflow Depth = 1.02" for 2-Year event  
Inflow = 0.19 cfs @ 12.08 hrs, Volume= 607 cf  
Primary = 0.19 cfs @ 12.08 hrs, Volume= 607 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 22L: 122-124 CABOT ST

Hydrograph



### 4 - HydroCAD R1

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Type III 24-hr 2-Year Rainfall=3.26"

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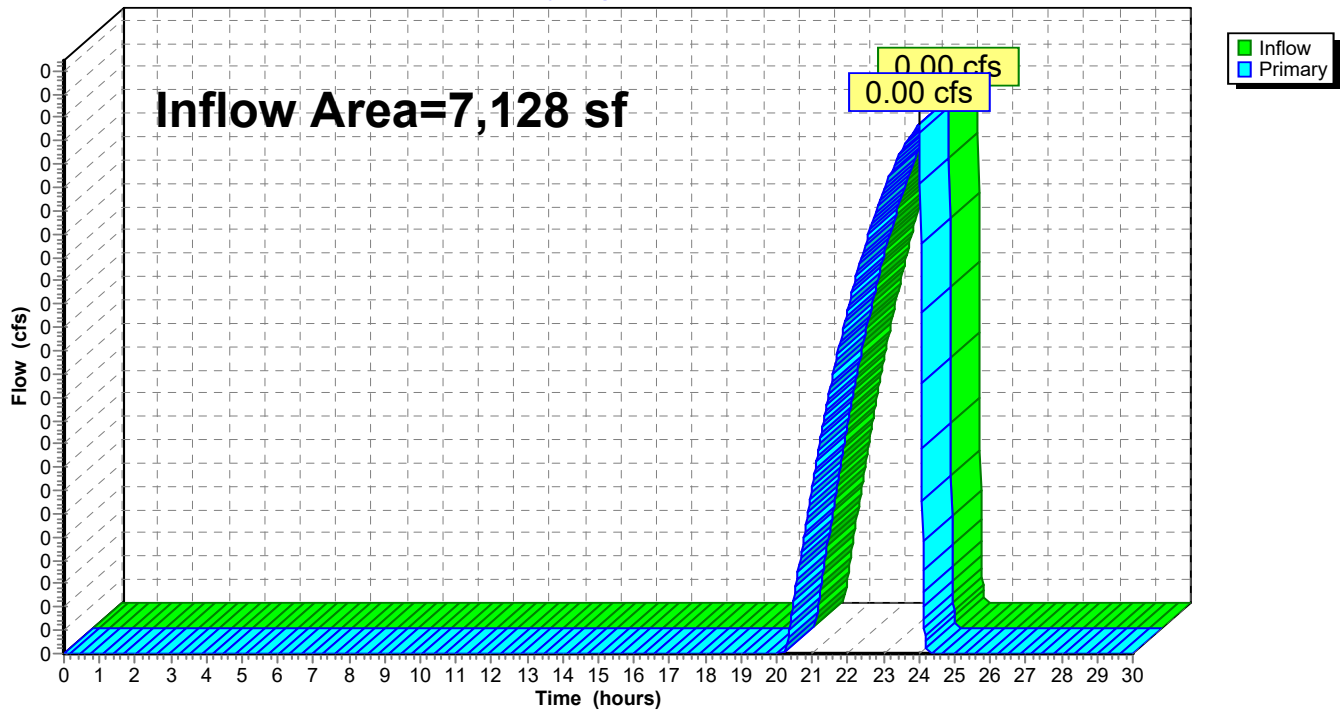
## Summary for Link 26L: 122-124 CABOT ST

Inflow Area = 7,128 sf, 39.91% Impervious, Inflow Depth = 0.00" for 2-Year event  
Inflow = 0.00 cfs @ 24.01 hrs, Volume= 0 cf  
Primary = 0.00 cfs @ 24.01 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

## Link 26L: 122-124 CABOT ST

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 10-Year Rainfall=5.13"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 19S: EXISTING AREAS</b>	Runoff Area=7,128 sf 57.49% Impervious Runoff Depth=2.38" Tc=5.0 min CN=73 Runoff=0.47 cfs 1,415 cf
<b>Subcatchment 31S: ROOFS</b>	Runoff Area=1,970 sf 100.00% Impervious Runoff Depth=4.89" Tc=5.0 min CN=98 Runoff=0.24 cfs 803 cf
<b>Subcatchment 33S: OTHER IMPER.</b>	Runoff Area=85 sf 100.00% Impervious Runoff Depth=4.89" Tc=5.0 min CN=98 Runoff=0.01 cfs 35 cf
<b>Subcatchment 34S: DRIVEWAY</b>	Runoff Area=790 sf 100.00% Impervious Runoff Depth=4.89" Tc=5.0 min CN=98 Runoff=0.09 cfs 322 cf
<b>Subcatchment 35S: PERVIOUS AREAS</b>	Runoff Area=4,283 sf 0.00% Impervious Runoff Depth=0.23" Tc=5.0 min CN=39 Runoff=0.01 cfs 81 cf
<b>Pond 28P: S1</b>	Peak Elev=76.52' Storage=254 cf Inflow=0.34 cfs 1,160 cf Outflow=0.08 cfs 1,160 cf
<b>Link 22L: 122-124 CABOT ST</b>	Inflow=0.47 cfs 1,415 cf Primary=0.47 cfs 1,415 cf
<b>Link 26L: 122-124 CABOT ST</b>	Inflow=0.01 cfs 81 cf Primary=0.01 cfs 81 cf

**Total Runoff Area = 14,256 sf Runoff Volume = 2,657 cf Average Runoff Depth = 2.24"**  
**51.30% Pervious = 7,313 sf 48.70% Impervious = 6,943 sf**

**4 - HydroCAD R1**

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Type III 24-hr 10-Year Rainfall=5.13"

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**Summary for Subcatchment 19S: EXISTING AREAS**

Runoff = 0.47 cfs @ 12.08 hrs, Volume= 1,415 cf, Depth= 2.38"

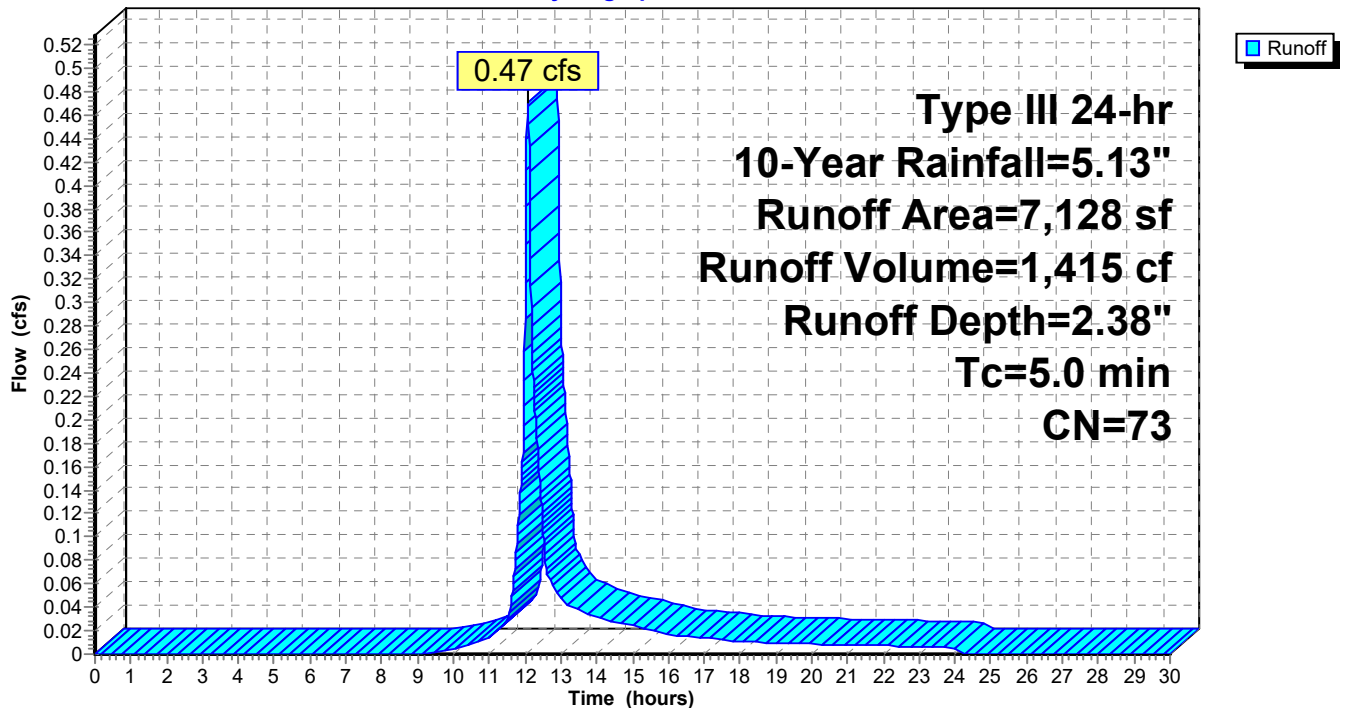
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=5.13"

Area (sf)	CN	Description
1,457	98	Roofs, HSG A
2,378	98	Paved parking, HSG A
14	98	Unconnected pavement, HSG A
* 236	98	Unconnected pavement, HSG A
* 13	98	Unconnected pavement, HSG A
56	39	>75% Grass cover, Good, HSG A
2,974	39	>75% Grass cover, Good, HSG A
7,128	73	Weighted Average
3,030		42.51% Pervious Area
4,098		57.49% Impervious Area
263		6.42% Unconnected

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

**Subcatchment 19S: EXISTING AREAS**

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 10-Year Rainfall=5.13"

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**Summary for Subcatchment 31S: ROOFS**

Runoff = 0.24 cfs @ 12.07 hrs, Volume= 803 cf, Depth= 4.89"

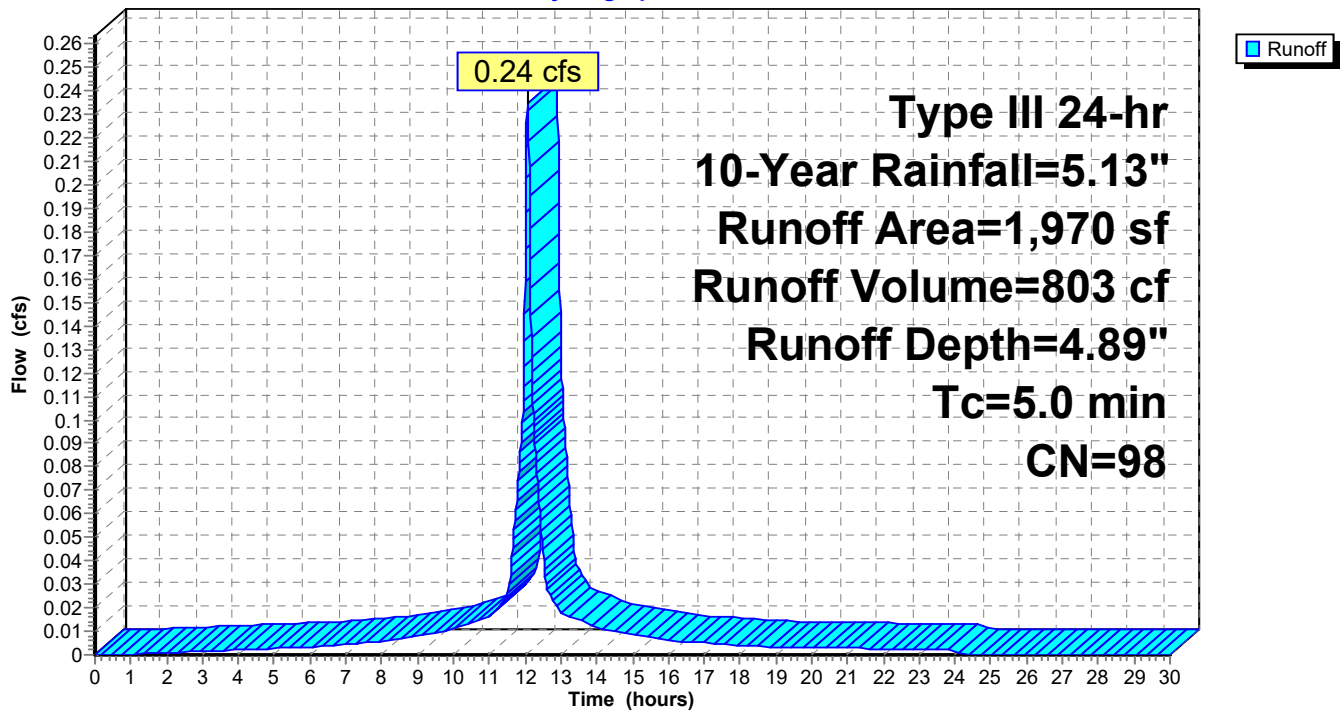
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.13"

	Area (sf)	CN	Description
	1,876	98	Roofs, HSG A
*	94	98	Roofs, HSG A
	1,970	98	Weighted Average
	1,970		100.00% Impervious Area

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

**Subcatchment 31S: ROOFS**

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 10-Year Rainfall=5.13"

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**Summary for Subcatchment 33S: OTHER IMPER.**

Runoff = 0.01 cfs @ 12.07 hrs, Volume= 35 cf, Depth= 4.89"

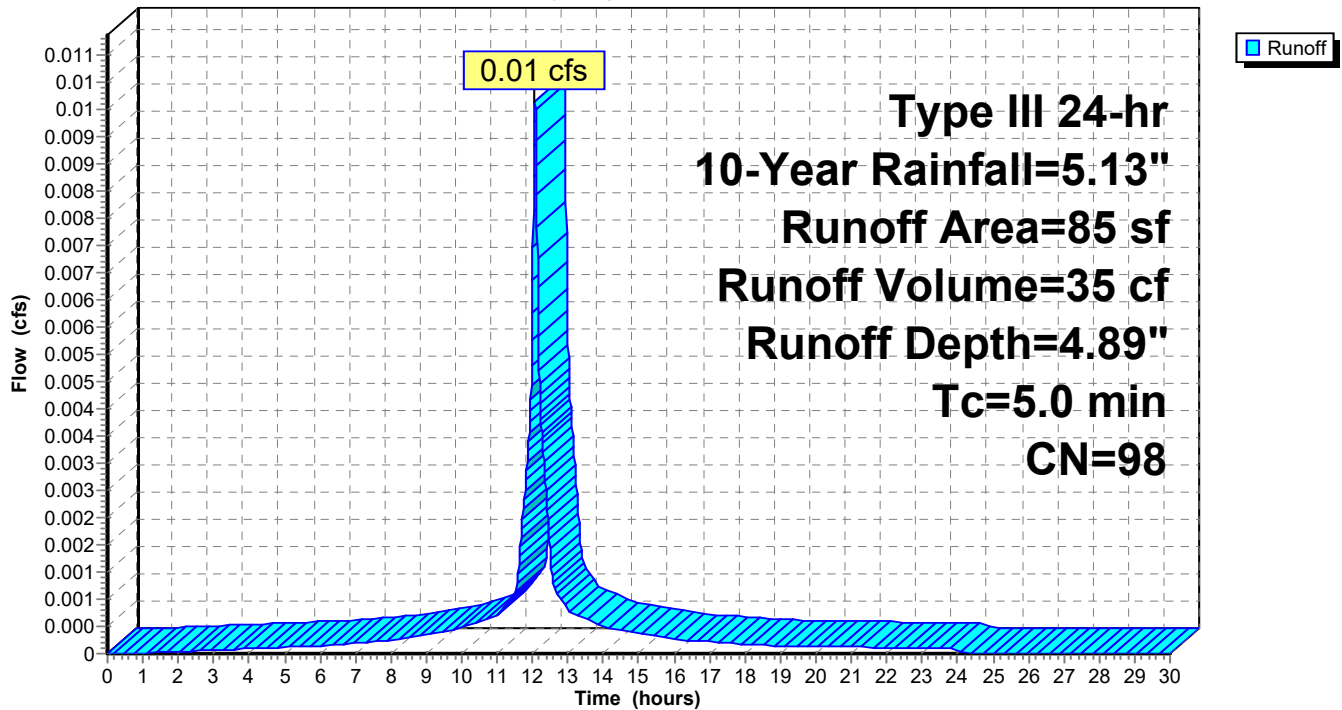
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.13"

Area (sf)	CN	Description
65	98	Unconnected pavement, HSG A
* 20	98	Unconnected pavement, HSG A
85	98	Weighted Average
85		100.00% Impervious Area
85		100.00% Unconnected

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

**Subcatchment 33S: OTHER IMPER.**

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 10-Year Rainfall=5.13"

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**Summary for Subcatchment 34S: DRIVEWAY**

Runoff = 0.09 cfs @ 12.07 hrs, Volume= 322 cf, Depth= 4.89"

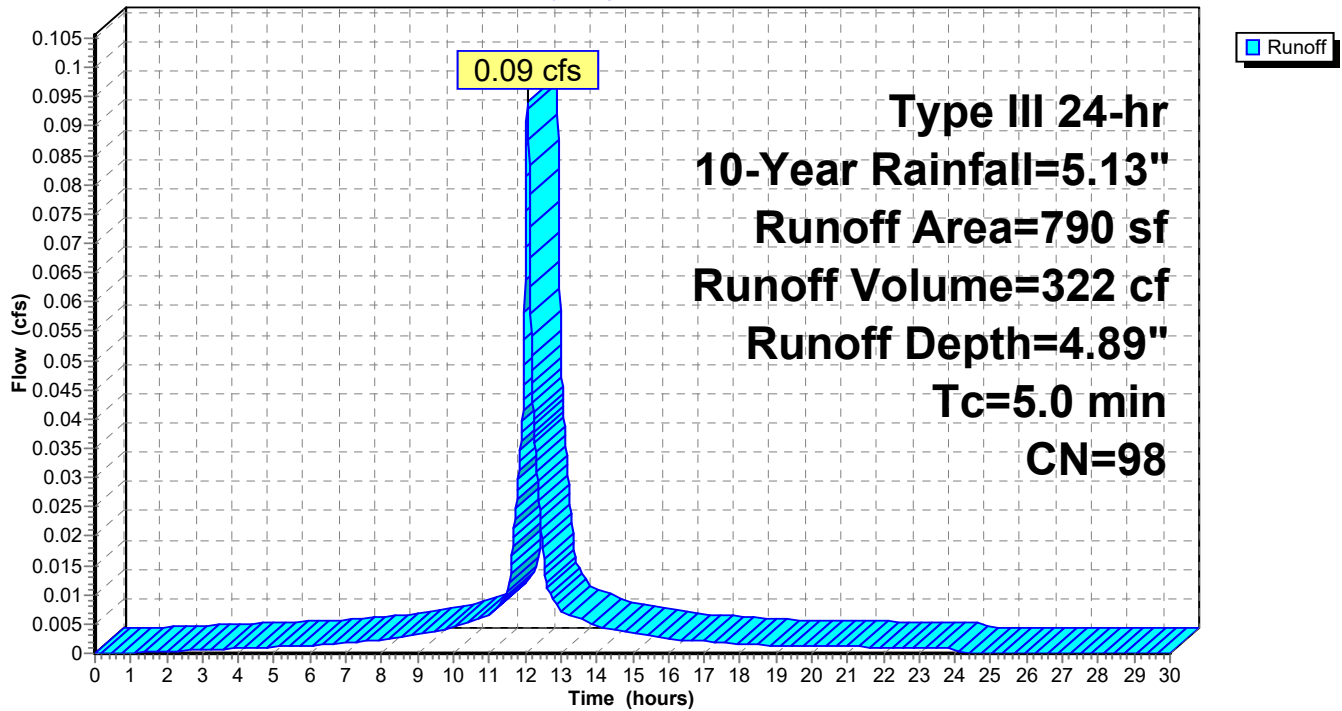
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.13"

Area (sf)	CN	Description
790	98	Paved parking, HSG A
790		100.00% Impervious Area

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

**Subcatchment 34S: DRIVEWAY**

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 10-Year Rainfall=5.13"

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**Summary for Subcatchment 35S: PERVIOUS AREAS**

Runoff = 0.01 cfs @ 12.44 hrs, Volume= 81 cf, Depth= 0.23"

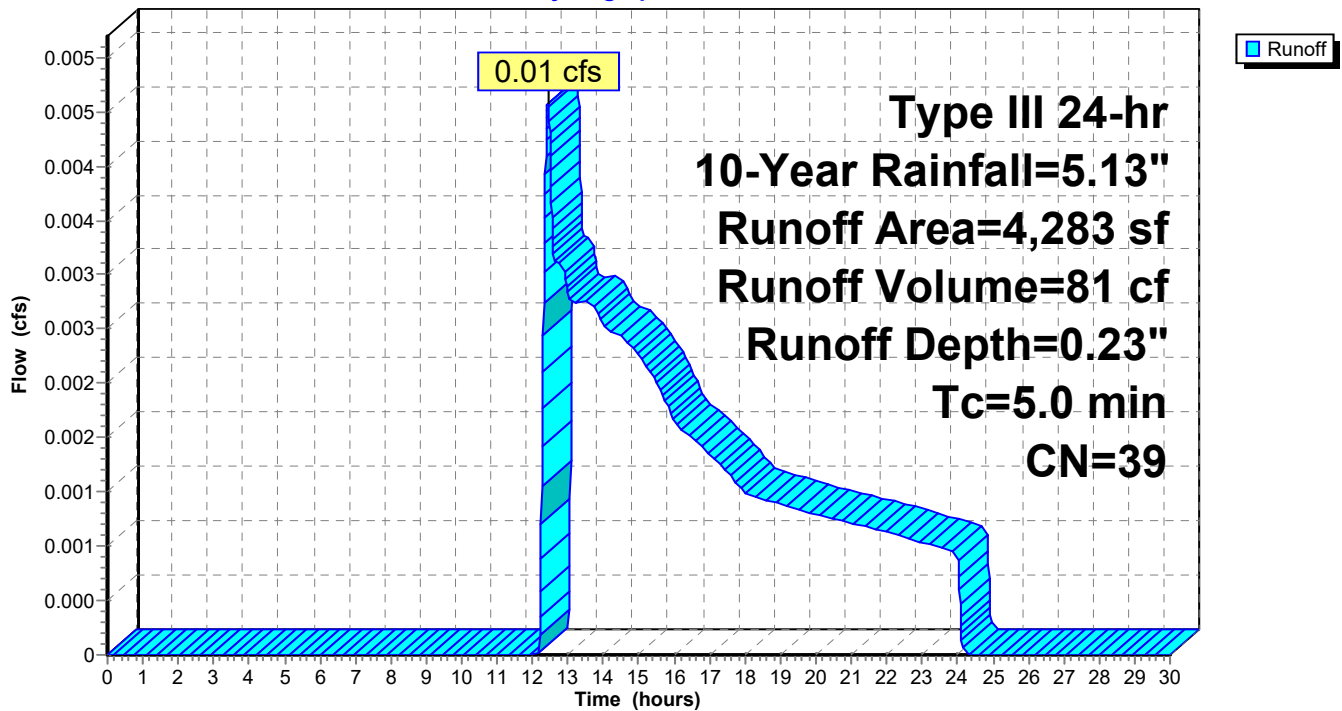
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.13"

Area (sf)	CN	Description
82	39	>75% Grass cover, Good, HSG A
4,201	39	>75% Grass cover, Good, HSG A
4,283	39	Weighted Average
4,283		100.00% Pervious Area

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

**Subcatchment 35S: PERVIOUS AREAS**

Hydrograph



**4 - HydroCAD R1**

Type III 24-hr 10-Year Rainfall=5.13"

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**Summary for Pond 28P: S1**

Inflow Area = 2,845 sf, 100.00% Impervious, Inflow Depth = 4.89" for 10-Year event  
 Inflow = 0.34 cfs @ 12.07 hrs, Volume= 1,160 cf  
 Outflow = 0.08 cfs @ 12.45 hrs, Volume= 1,160 cf, Atten= 77%, Lag= 22.8 min  
 Discarded = 0.08 cfs @ 12.45 hrs, Volume= 1,160 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 76.52' @ 12.45 hrs Surf.Area= 300 sf Storage= 254 cf

Plug-Flow detention time= 17.4 min calculated for 1,160 cf (100% of inflow)  
 Center-of-Mass det. time= 17.4 min ( 764.1 - 746.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	75.00'	333 cf	<b>15.00'W x 20.00'L x 3.54'H Field A</b> 1,062 cf Overall - 231 cf Embedded = 832 cf x 40.0% Voids
#2A	75.50'	231 cf	<b>Cultec R-330XLHD x 4 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	75.00'	<b>8.270 in/hr Exfiltration over Wetted area</b>

**Discarded OutFlow** Max=0.08 cfs @ 12.45 hrs HW=76.52' (Free Discharge)  
 ↳ **1=Exfiltration** (Exfiltration Controls 0.08 cfs)

### 4 - HydroCAD R1

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## Pond 28P: S1 - Chamber Wizard Field A

### Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

2 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 15.50' Row Length +27.0" End Stone x 2 = 20.00' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 35.0" Side Stone x 2 = 15.00' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 231.0 cf Chamber Storage

1,062.5 cf Field - 231.0 cf Chambers = 831.5 cf Stone x 40.0% Voids = 332.6 cf Stone Storage

Chamber Storage + Stone Storage = 563.6 cf = 0.013 af

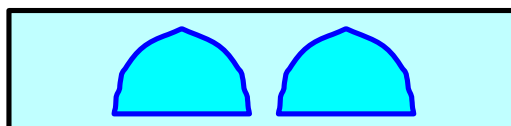
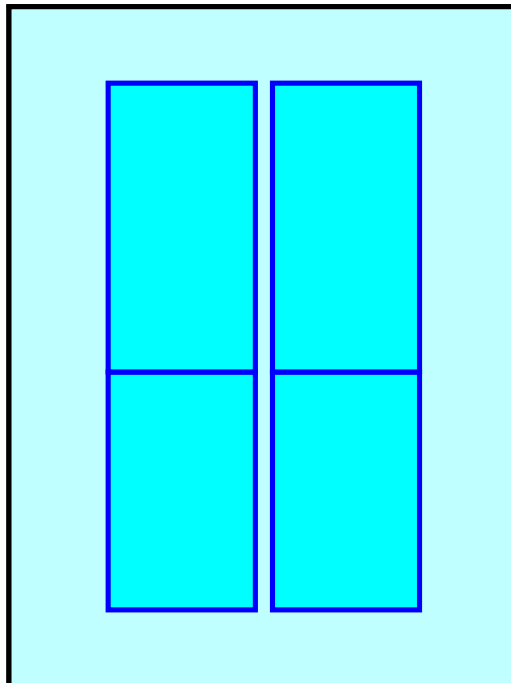
Overall Storage Efficiency = 53.0%

Overall System Size = 20.00' x 15.00' x 3.54'

4 Chambers

39.4 cy Field

30.8 cy Stone



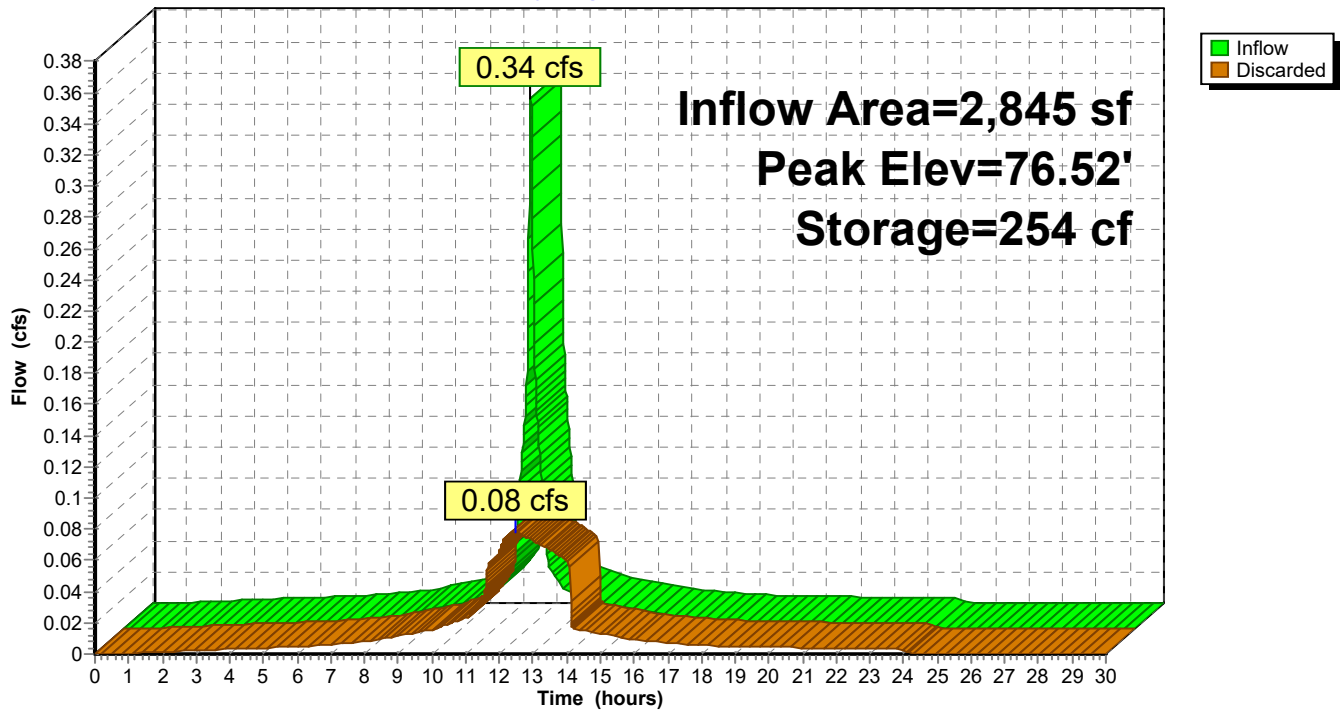
### 4 - HydroCAD R1

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### Pond 28P: S1

Hydrograph



**4 - HydroCAD R1**

Type III 24-hr 10-Year Rainfall=5.13"

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**Stage-Area-Storage for Pond 28P: S1**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
75.00	300	0	77.80	496	473
75.05	303	6	77.85	499	480
75.10	307	12	77.90	503	486
75.15	311	18	77.95	507	492
75.20	314	24	78.00	510	499
75.25	318	30	78.05	513	505
75.30	321	36	78.10	517	511
75.35	324	42	78.15	521	517
75.40	328	48	78.20	524	523
75.45	332	54	78.25	528	529
75.50	335	60	78.30	531	535
75.55	338	70	78.35	534	541
75.60	342	79	78.40	538	547
75.65	346	89	78.45	542	553
75.70	349	99	78.50	<b>545</b>	<b>559</b>
75.75	353	108			
75.80	356	118			
75.85	359	128			
75.90	363	137			
75.95	367	147			
76.00	370	156			
76.05	373	166			
76.10	377	175			
76.15	381	185			
76.20	384	194			
76.25	388	204			
76.30	391	213			
76.35	394	223			
76.40	398	232			
76.45	402	241			
76.50	405	251			
76.55	408	260			
76.60	412	269			
76.65	416	279			
76.70	419	288			
76.75	423	297			
76.80	426	306			
76.85	429	315			
76.90	433	325			
76.95	437	333			
77.00	440	342			
77.05	443	351			
77.10	447	360			
77.15	451	369			
77.20	454	377			
77.25	458	386			
77.30	461	394			
77.35	464	403			
77.40	468	411			
77.45	472	419			
77.50	475	427			
77.55	478	435			
77.60	482	443			
77.65	486	451			
77.70	489	458			
77.75	493	466			

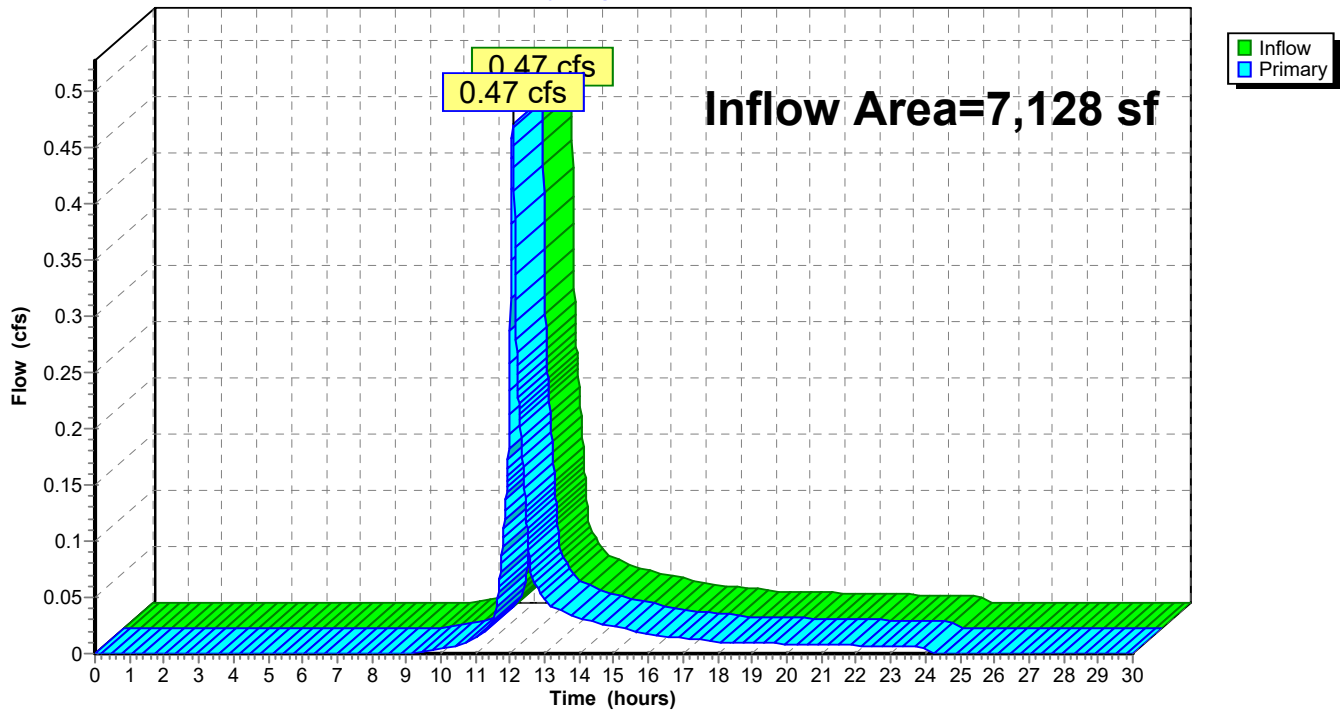
### Summary for Link 22L: 122-124 CABOT ST

Inflow Area = 7,128 sf, 57.49% Impervious, Inflow Depth = 2.38" for 10-Year event  
Inflow = 0.47 cfs @ 12.08 hrs, Volume= 1,415 cf  
Primary = 0.47 cfs @ 12.08 hrs, Volume= 1,415 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 22L: 122-124 CABOT ST

Hydrograph



### 4 - HydroCAD R1

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Type III 24-hr 10-Year Rainfall=5.13"

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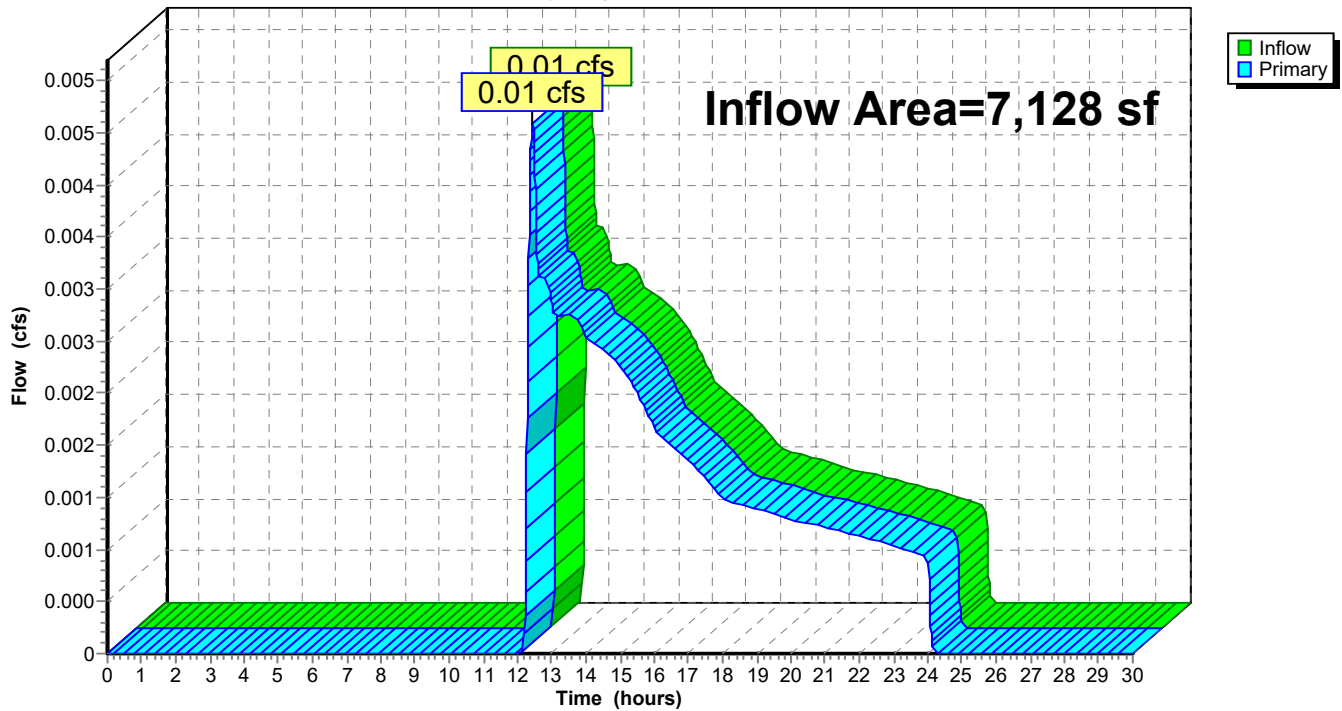
## Summary for Link 26L: 122-124 CABOT ST

Inflow Area = 7,128 sf, 39.91% Impervious, Inflow Depth = 0.14" for 10-Year event  
Inflow = 0.01 cfs @ 12.44 hrs, Volume= 81 cf  
Primary = 0.01 cfs @ 12.44 hrs, Volume= 81 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 26L: 122-124 CABOT ST

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 25-Year Rainfall=6.30"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 19S: EXISTING AREAS</b>	Runoff Area=7,128 sf 57.49% Impervious Runoff Depth=3.34" Tc=5.0 min CN=73 Runoff=0.66 cfs 1,983 cf
<b>Subcatchment 31S: ROOFS</b>	Runoff Area=1,970 sf 100.00% Impervious Runoff Depth=6.06" Tc=5.0 min CN=98 Runoff=0.29 cfs 995 cf
<b>Subcatchment 33S: OTHER IMPER.</b>	Runoff Area=85 sf 100.00% Impervious Runoff Depth=6.06" Tc=5.0 min CN=98 Runoff=0.01 cfs 43 cf
<b>Subcatchment 34S: DRIVEWAY</b>	Runoff Area=790 sf 100.00% Impervious Runoff Depth=6.06" Tc=5.0 min CN=98 Runoff=0.12 cfs 399 cf
<b>Subcatchment 35S: PERVIOUS AREAS</b>	Runoff Area=4,283 sf 0.00% Impervious Runoff Depth=0.53" Tc=5.0 min CN=39 Runoff=0.02 cfs 191 cf
<b>Pond 28P: S1</b>	Peak Elev=77.04' Storage=349 cf Inflow=0.42 cfs 1,437 cf Outflow=0.08 cfs 1,437 cf
<b>Link 22L: 122-124 CABOT ST</b>	Inflow=0.66 cfs 1,983 cf Primary=0.66 cfs 1,983 cf
<b>Link 26L: 122-124 CABOT ST</b>	Inflow=0.02 cfs 191 cf Primary=0.02 cfs 191 cf

**Total Runoff Area = 14,256 sf Runoff Volume = 3,611 cf Average Runoff Depth = 3.04"**  
**51.30% Pervious = 7,313 sf 48.70% Impervious = 6,943 sf**

**4 - HydroCAD R1**

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Type III 24-hr 25-Year Rainfall=6.30"

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**Summary for Subcatchment 19S: EXISTING AREAS**

Runoff = 0.66 cfs @ 12.08 hrs, Volume= 1,983 cf, Depth= 3.34"

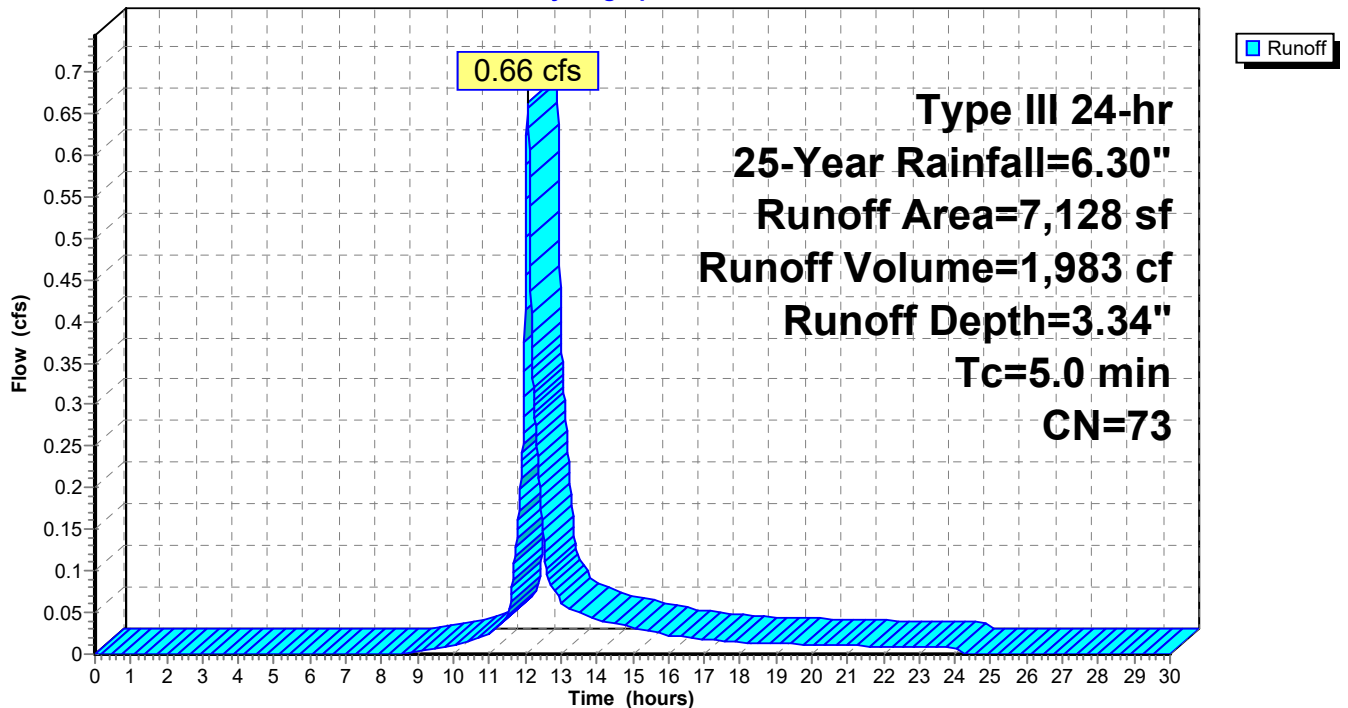
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.30"

Area (sf)	CN	Description
1,457	98	Roofs, HSG A
2,378	98	Paved parking, HSG A
14	98	Unconnected pavement, HSG A
* 236	98	Unconnected pavement, HSG A
* 13	98	Unconnected pavement, HSG A
56	39	>75% Grass cover, Good, HSG A
2,974	39	>75% Grass cover, Good, HSG A
7,128	73	Weighted Average
3,030		42.51% Pervious Area
4,098		57.49% Impervious Area
263		6.42% Unconnected

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

**Subcatchment 19S: EXISTING AREAS**

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.30"

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**Summary for Subcatchment 31S: ROOFS**

Runoff = 0.29 cfs @ 12.07 hrs, Volume= 995 cf, Depth= 6.06"

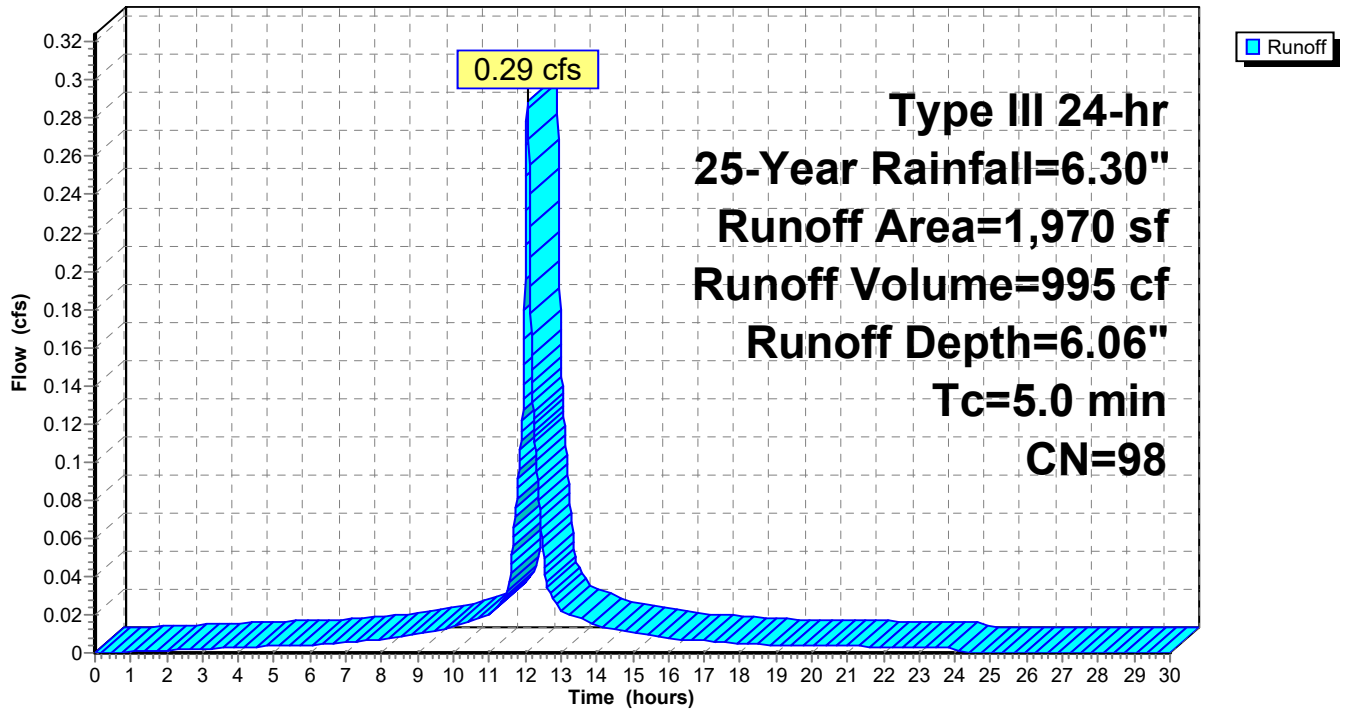
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.30"

	Area (sf)	CN	Description
	1,876	98	Roofs, HSG A
*	94	98	Roofs, HSG A
	1,970	98	Weighted Average
	1,970		100.00% Impervious Area

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

**Subcatchment 31S: ROOFS**

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.30"

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**Summary for Subcatchment 33S: OTHER IMPER.**

Runoff = 0.01 cfs @ 12.07 hrs, Volume= 43 cf, Depth= 6.06"

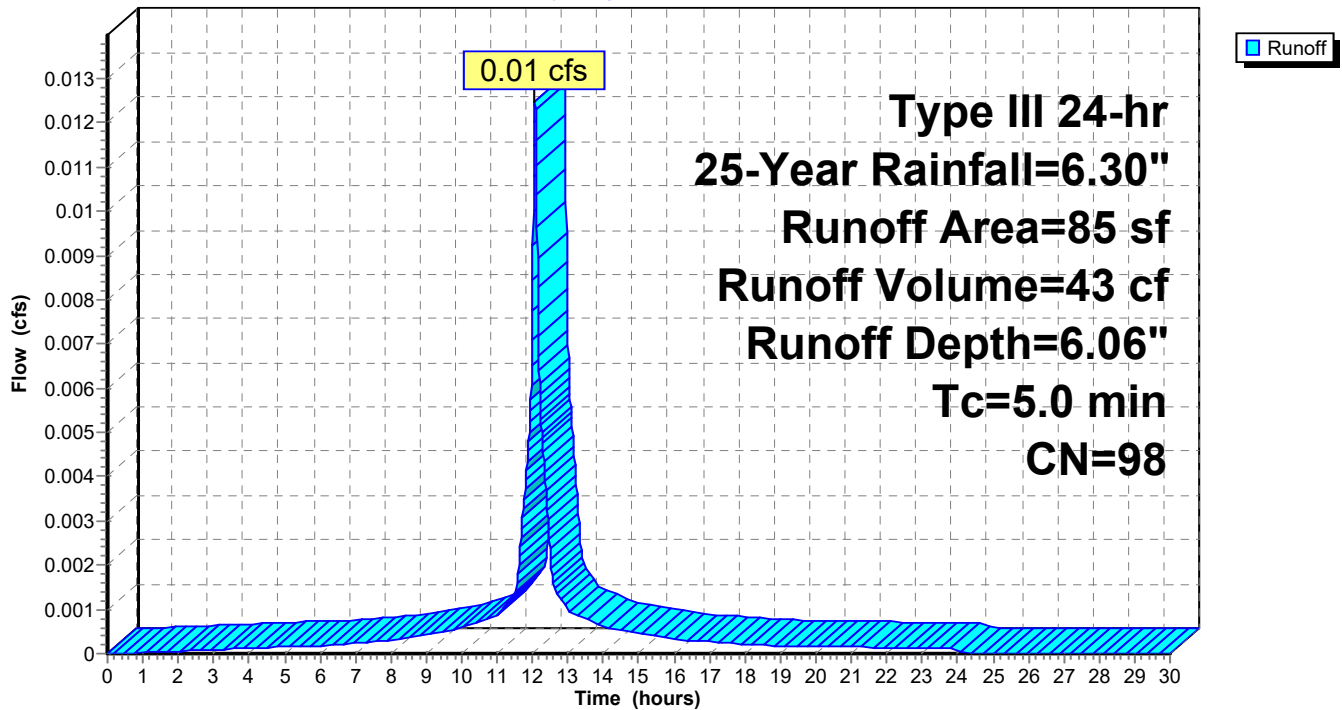
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.30"

Area (sf)	CN	Description
65	98	Unconnected pavement, HSG A
* 20	98	Unconnected pavement, HSG A
85	98	Weighted Average
85		100.00% Impervious Area
85		100.00% Unconnected

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

**Subcatchment 33S: OTHER IMPER.**

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 25-Year Rainfall=6.30"

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**Summary for Subcatchment 34S: DRIVEWAY**

Runoff = 0.12 cfs @ 12.07 hrs, Volume= 399 cf, Depth= 6.06"

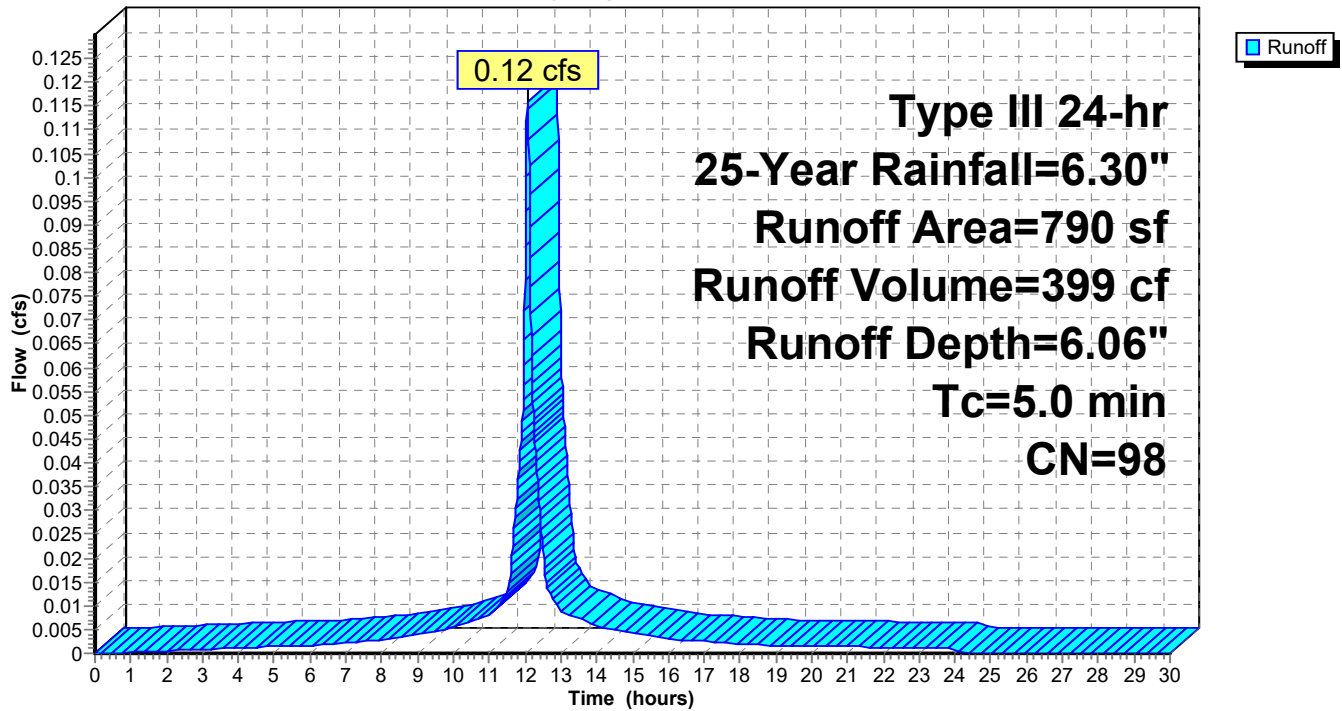
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.30"

Area (sf)	CN	Description
790	98	Paved parking, HSG A
790		100.00% Impervious Area

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

**Subcatchment 34S: DRIVEWAY**

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.30"

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**Summary for Subcatchment 35S: PERVIOUS AREAS**

Runoff = 0.02 cfs @ 12.30 hrs, Volume= 191 cf, Depth= 0.53"

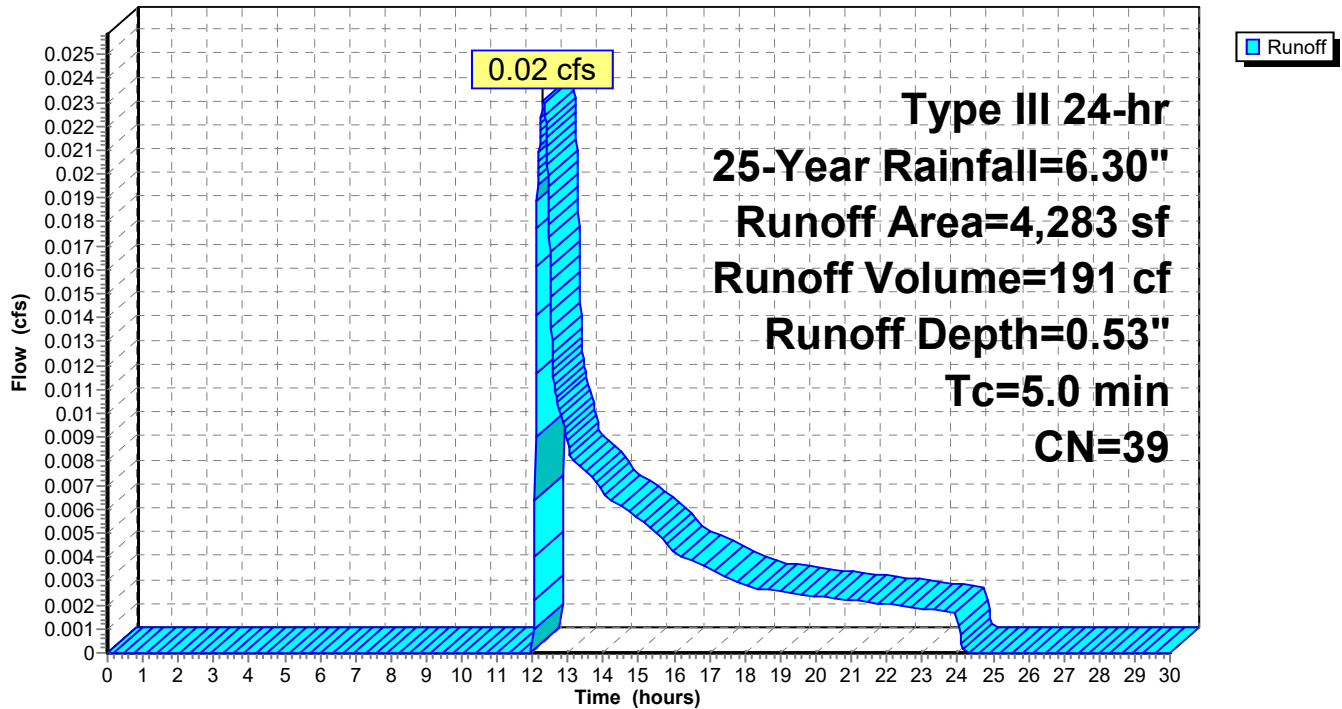
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.30"

Area (sf)	CN	Description
82	39	>75% Grass cover, Good, HSG A
4,201	39	>75% Grass cover, Good, HSG A
4,283	39	Weighted Average
4,283		100.00% Pervious Area

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

**Subcatchment 35S: PERVIOUS AREAS**

Hydrograph



**4 - HydroCAD R1**

**Summary for Pond 28P: S1**

Inflow Area = 2,845 sf, 100.00% Impervious, Inflow Depth = 6.06" for 25-Year event  
 Inflow = 0.42 cfs @ 12.07 hrs, Volume= 1,437 cf  
 Outflow = 0.08 cfs @ 12.48 hrs, Volume= 1,437 cf, Atten= 80%, Lag= 24.6 min  
 Discarded = 0.08 cfs @ 12.48 hrs, Volume= 1,437 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 77.04' @ 12.48 hrs Surf.Area= 300 sf Storage= 349 cf

Plug-Flow detention time= 23.5 min calculated for 1,437 cf (100% of inflow)  
 Center-of-Mass det. time= 23.5 min ( 767.0 - 743.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	75.00'	333 cf	<b>15.00'W x 20.00'L x 3.54'H Field A</b> 1,062 cf Overall - 231 cf Embedded = 832 cf x 40.0% Voids
#2A	75.50'	231 cf	<b>Cultec R-330XLHD x 4 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	75.00'	<b>8.270 in/hr Exfiltration over Wetted area</b>

**Discarded OutFlow** Max=0.08 cfs @ 12.48 hrs HW=77.04' (Free Discharge)  
 ↳ **1=Exfiltration** (Exfiltration Controls 0.08 cfs)

### 4 - HydroCAD R1

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## Pond 28P: S1 - Chamber Wizard Field A

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

2 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 15.50' Row Length +27.0" End Stone x 2 = 20.00' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 35.0" Side Stone x 2 = 15.00' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 231.0 cf Chamber Storage

1,062.5 cf Field - 231.0 cf Chambers = 831.5 cf Stone x 40.0% Voids = 332.6 cf Stone Storage

Chamber Storage + Stone Storage = 563.6 cf = 0.013 af

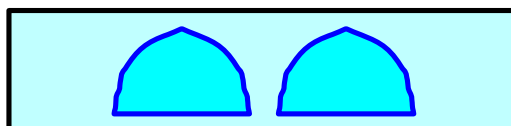
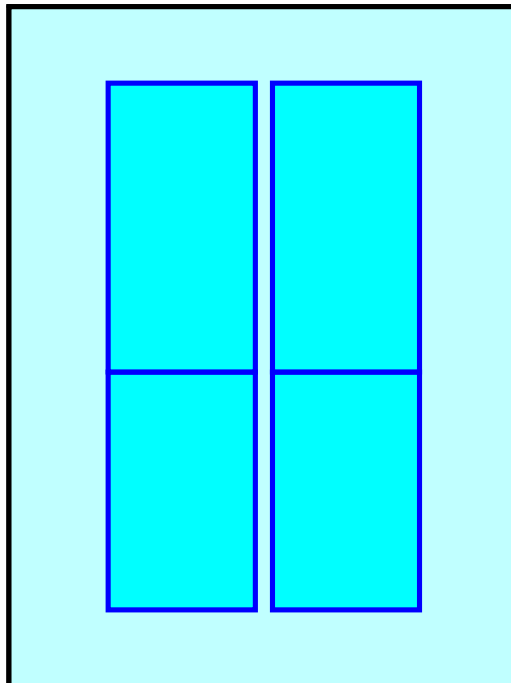
Overall Storage Efficiency = 53.0%

Overall System Size = 20.00' x 15.00' x 3.54'

4 Chambers

39.4 cy Field

30.8 cy Stone



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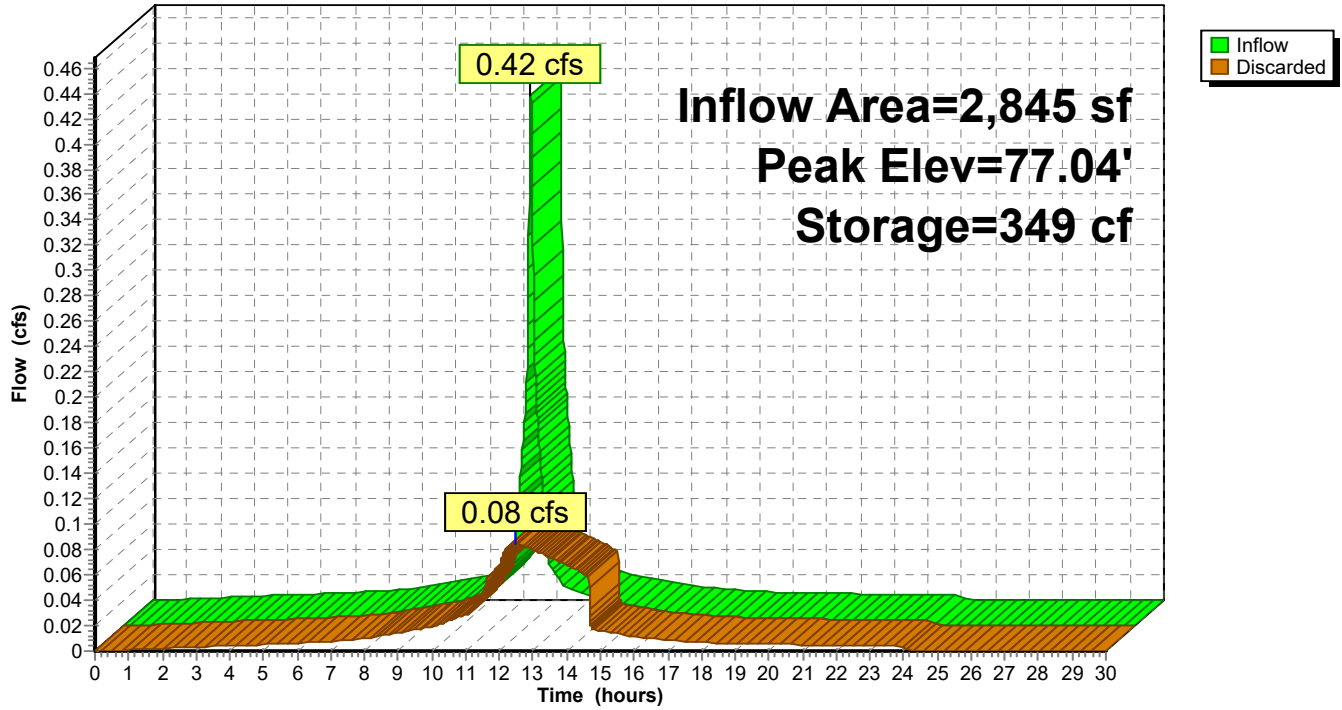
Type III 24-hr 25-Year Rainfall=6.30"

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### Pond 28P: S1

Hydrograph



**4 - HydroCAD R1**

Type III 24-hr 25-Year Rainfall=6.30"

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**Stage-Area-Storage for Pond 28P: S1**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
75.00	300	0	77.80	496	473
75.05	303	6	77.85	499	480
75.10	307	12	77.90	503	486
75.15	311	18	77.95	507	492
75.20	314	24	78.00	510	499
75.25	318	30	78.05	513	505
75.30	321	36	78.10	517	511
75.35	324	42	78.15	521	517
75.40	328	48	78.20	524	523
75.45	332	54	78.25	528	529
75.50	335	60	78.30	531	535
75.55	338	70	78.35	534	541
75.60	342	79	78.40	538	547
75.65	346	89	78.45	542	553
75.70	349	99	78.50	<b>545</b>	<b>559</b>
75.75	353	108			
75.80	356	118			
75.85	359	128			
75.90	363	137			
75.95	367	147			
76.00	370	156			
76.05	373	166			
76.10	377	175			
76.15	381	185			
76.20	384	194			
76.25	388	204			
76.30	391	213			
76.35	394	223			
76.40	398	232			
76.45	402	241			
76.50	405	251			
76.55	408	260			
76.60	412	269			
76.65	416	279			
76.70	419	288			
76.75	423	297			
76.80	426	306			
76.85	429	315			
76.90	433	325			
76.95	437	333			
77.00	440	342			
77.05	443	351			
77.10	447	360			
77.15	451	369			
77.20	454	377			
77.25	458	386			
77.30	461	394			
77.35	464	403			
77.40	468	411			
77.45	472	419			
77.50	475	427			
77.55	478	435			
77.60	482	443			
77.65	486	451			
77.70	489	458			
77.75	493	466			

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Type III 24-hr 25-Year Rainfall=6.30"

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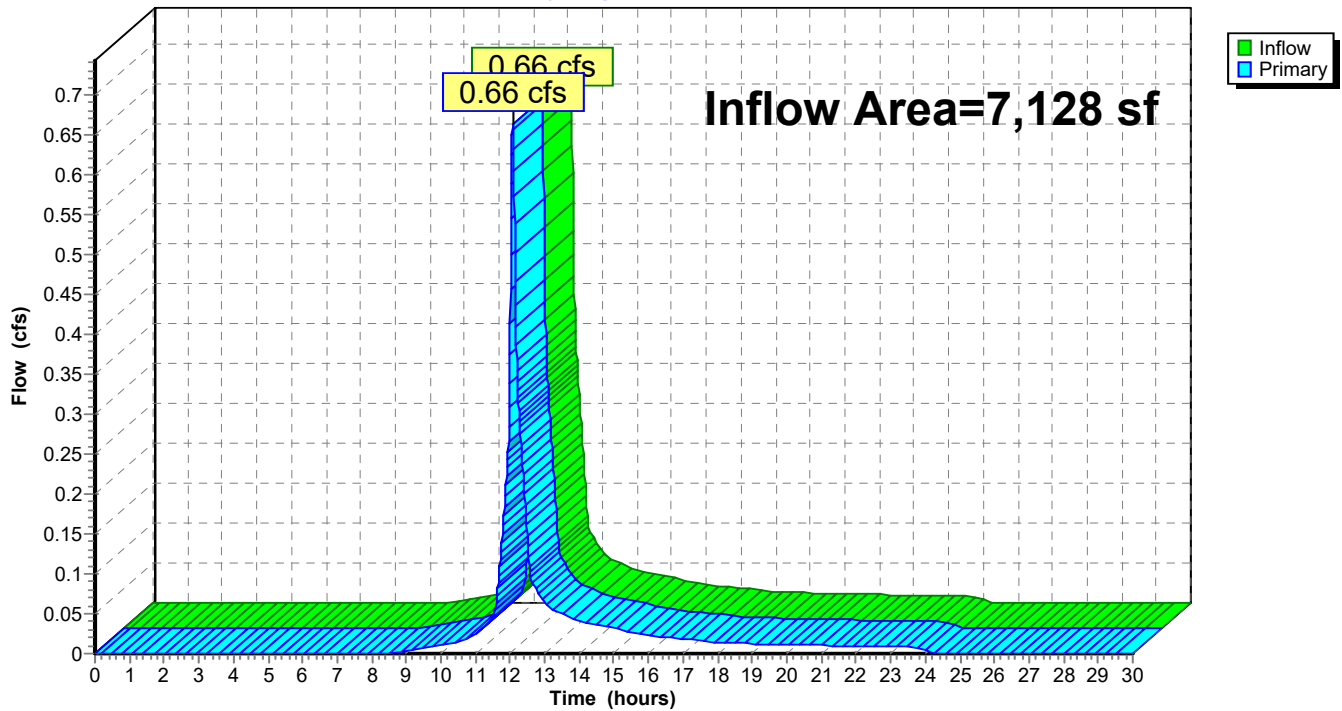
## Summary for Link 22L: 122-124 CABOT ST

Inflow Area = 7,128 sf, 57.49% Impervious, Inflow Depth = 3.34" for 25-Year event  
Inflow = 0.66 cfs @ 12.08 hrs, Volume= 1,983 cf  
Primary = 0.66 cfs @ 12.08 hrs, Volume= 1,983 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 22L: 122-124 CABOT ST

Hydrograph



### 4 - HydroCAD R1

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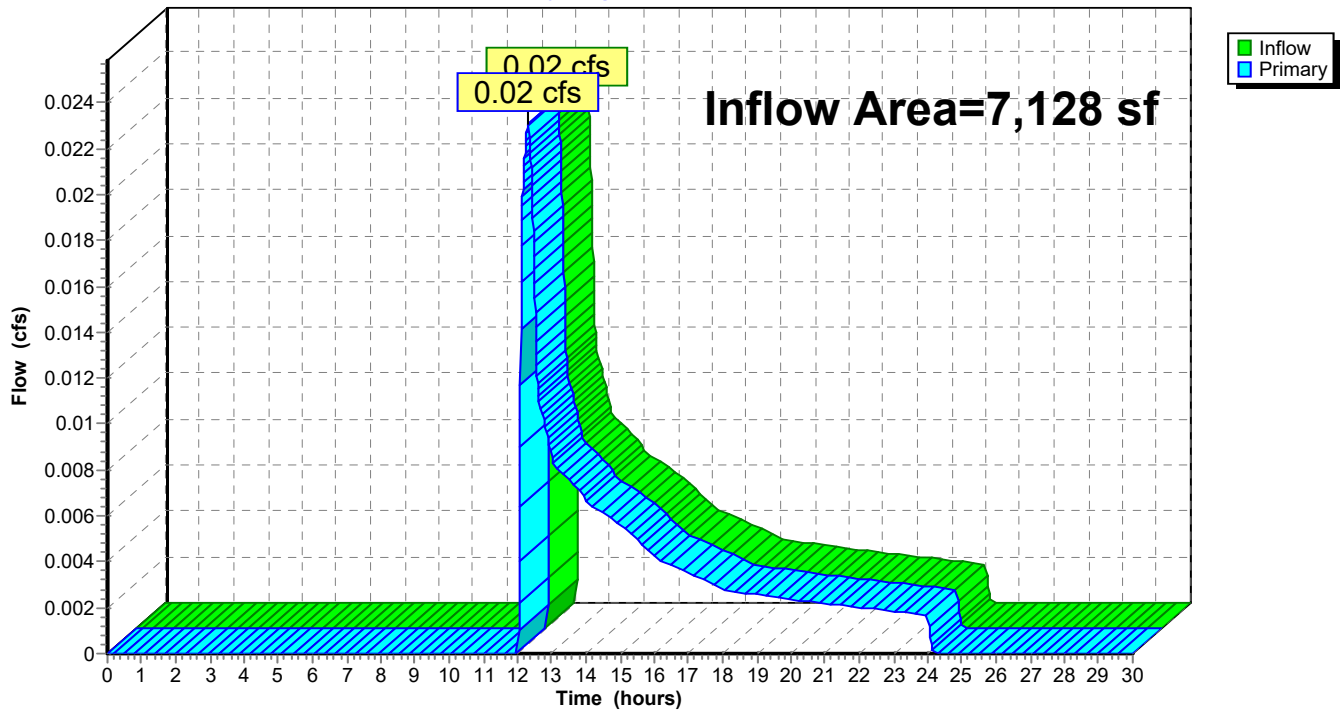
## Summary for Link 26L: 122-124 CABOT ST

Inflow Area = 7,128 sf, 39.91% Impervious, Inflow Depth = 0.32" for 25-Year event  
Inflow = 0.02 cfs @ 12.30 hrs, Volume= 191 cf  
Primary = 0.02 cfs @ 12.30 hrs, Volume= 191 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 26L: 122-124 CABOT ST

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 100-Year Rainfall=8.78"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 19S: EXISTING AREAS</b>	Runoff Area=7,128 sf 57.49% Impervious Runoff Depth=5.51" Tc=5.0 min CN=73 Runoff=1.09 cfs 3,271 cf
<b>Subcatchment 31S: ROOFS</b>	Runoff Area=1,970 sf 100.00% Impervious Runoff Depth=8.54" Tc=5.0 min CN=98 Runoff=0.40 cfs 1,402 cf
<b>Subcatchment 33S: OTHER IMPER.</b>	Runoff Area=85 sf 100.00% Impervious Runoff Depth=8.54" Tc=5.0 min CN=98 Runoff=0.02 cfs 60 cf
<b>Subcatchment 34S: DRIVEWAY</b>	Runoff Area=790 sf 100.00% Impervious Runoff Depth=8.54" Tc=5.0 min CN=98 Runoff=0.16 cfs 562 cf
<b>Subcatchment 35S: PERVIOUS AREAS</b>	Runoff Area=4,283 sf 0.00% Impervious Runoff Depth=1.50" Tc=5.0 min CN=39 Runoff=0.13 cfs 535 cf
<b>Pond 28P: S1</b>	Peak Elev=78.46' Storage=554 cf Inflow=0.58 cfs 2,025 cf Outflow=0.10 cfs 2,025 cf
<b>Link 22L: 122-124 CABOT ST</b>	Inflow=1.09 cfs 3,271 cf Primary=1.09 cfs 3,271 cf
<b>Link 26L: 122-124 CABOT ST</b>	Inflow=0.13 cfs 535 cf Primary=0.13 cfs 535 cf

**Total Runoff Area = 14,256 sf Runoff Volume = 5,831 cf Average Runoff Depth = 4.91"**  
**51.30% Pervious = 7,313 sf 48.70% Impervious = 6,943 sf**

**4 - HydroCAD R1**

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Type III 24-hr 100-Year Rainfall=8.78"

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**Summary for Subcatchment 19S: EXISTING AREAS**

Runoff = 1.09 cfs @ 12.07 hrs, Volume= 3,271 cf, Depth= 5.51"

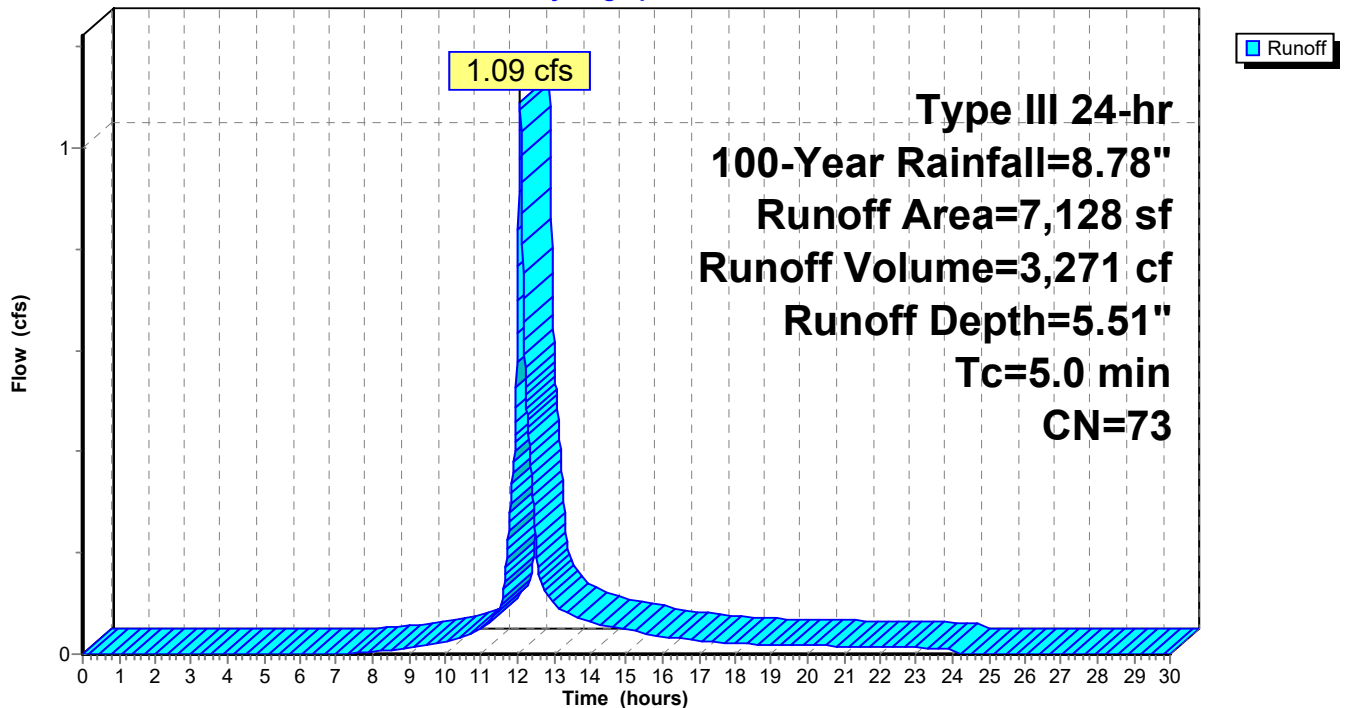
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
1,457	98	Roofs, HSG A
2,378	98	Paved parking, HSG A
14	98	Unconnected pavement, HSG A
* 236	98	Unconnected pavement, HSG A
* 13	98	Unconnected pavement, HSG A
56	39	>75% Grass cover, Good, HSG A
2,974	39	>75% Grass cover, Good, HSG A
7,128	73	Weighted Average
3,030		42.51% Pervious Area
4,098		57.49% Impervious Area
263		6.42% Unconnected

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

**Subcatchment 19S: EXISTING AREAS**

Hydrograph



**4 - HydroCAD R1**

Type III 24-hr 100-Year Rainfall=8.78"

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**Summary for Subcatchment 31S: ROOFS**

Runoff = 0.40 cfs @ 12.07 hrs, Volume= 1,402 cf, Depth= 8.54"

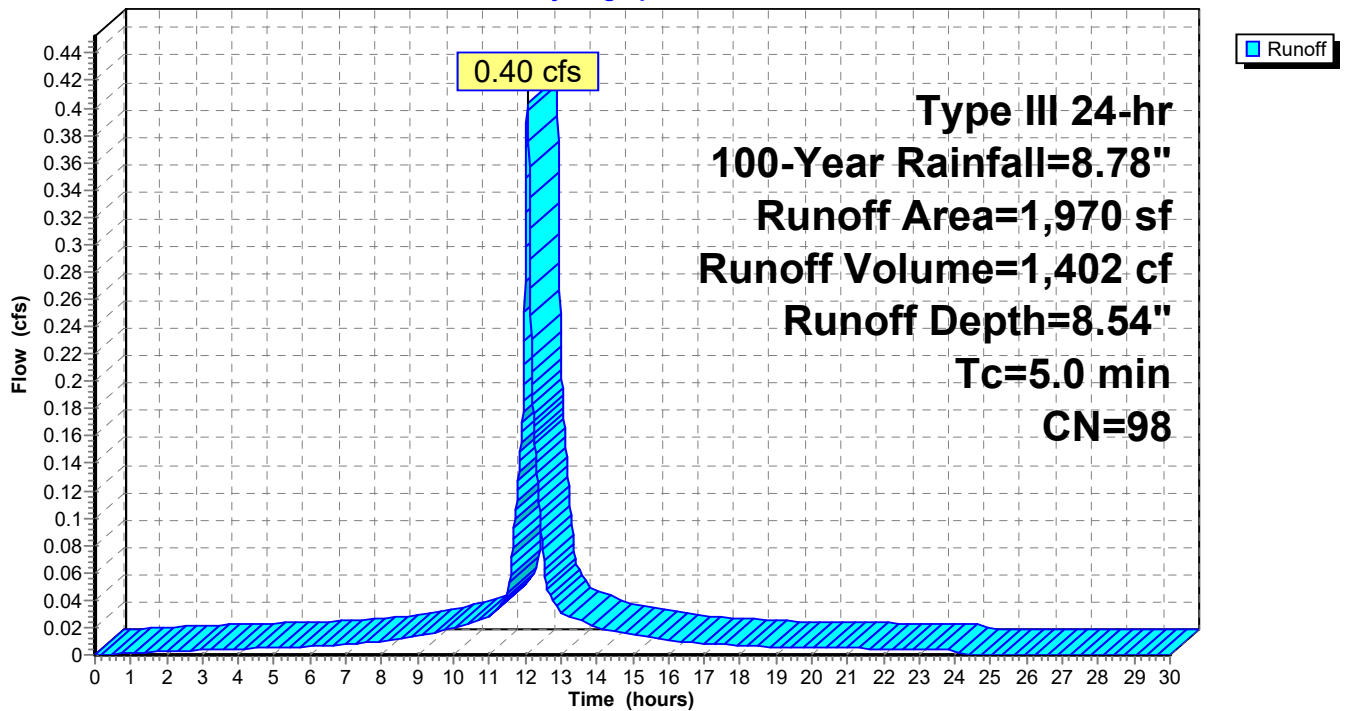
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.78"

	Area (sf)	CN	Description
	1,876	98	Roofs, HSG A
*	94	98	Roofs, HSG A
	1,970	98	Weighted Average
	1,970		100.00% Impervious Area

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

**Subcatchment 31S: ROOFS**

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 100-Year Rainfall=8.78"

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**Summary for Subcatchment 33S: OTHER IMPER.**

Runoff = 0.02 cfs @ 12.07 hrs, Volume= 60 cf, Depth= 8.54"

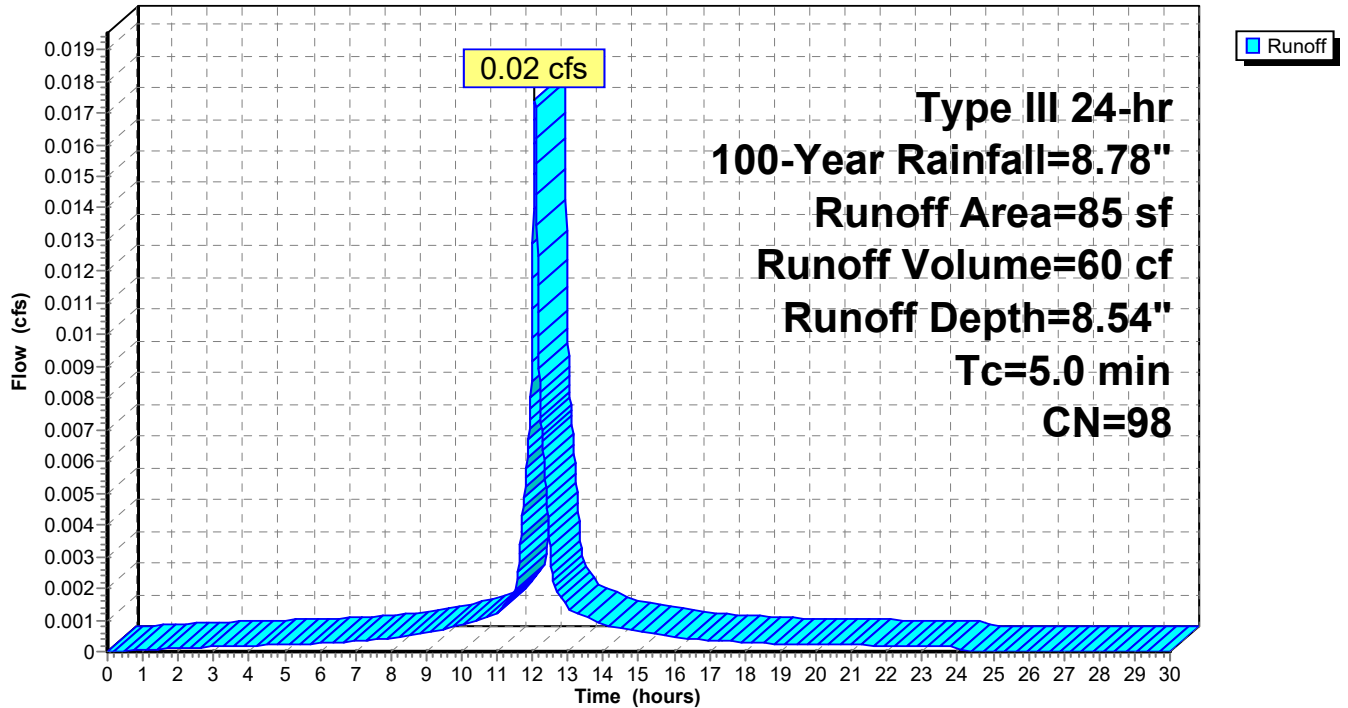
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
65	98	Unconnected pavement, HSG A
* 20	98	Unconnected pavement, HSG A
85	98	Weighted Average
85		100.00% Impervious Area
85		100.00% Unconnected

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

**Subcatchment 33S: OTHER IMPER.**

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 100-Year Rainfall=8.78"

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**Summary for Subcatchment 34S: DRIVEWAY**

Runoff = 0.16 cfs @ 12.07 hrs, Volume= 562 cf, Depth= 8.54"

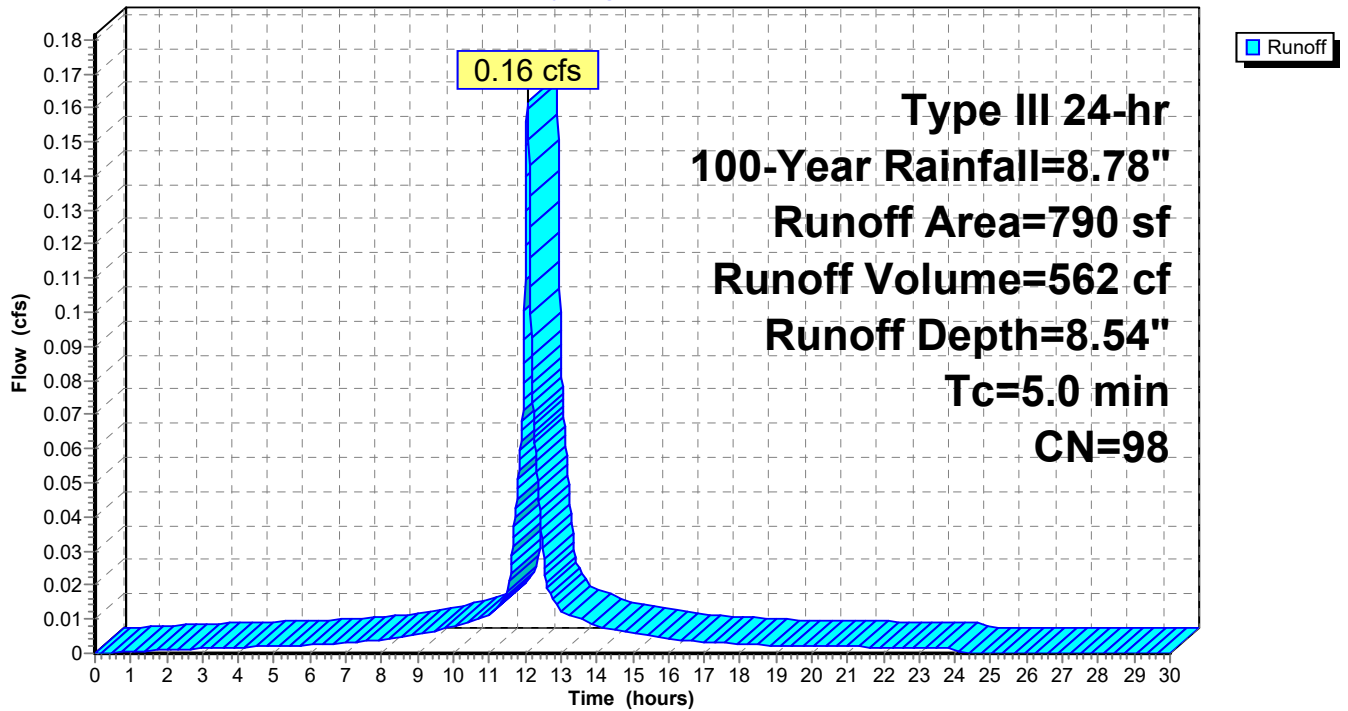
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
790	98	Paved parking, HSG A
790		100.00% Impervious Area

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

**Subcatchment 34S: DRIVEWAY**

Hydrograph



**4 - HydroCAD R1**

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Type III 24-hr 100-Year Rainfall=8.78"

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**Summary for Subcatchment 35S: PERVIOUS AREAS**

Runoff = 0.13 cfs @ 12.10 hrs, Volume= 535 cf, Depth= 1.50"

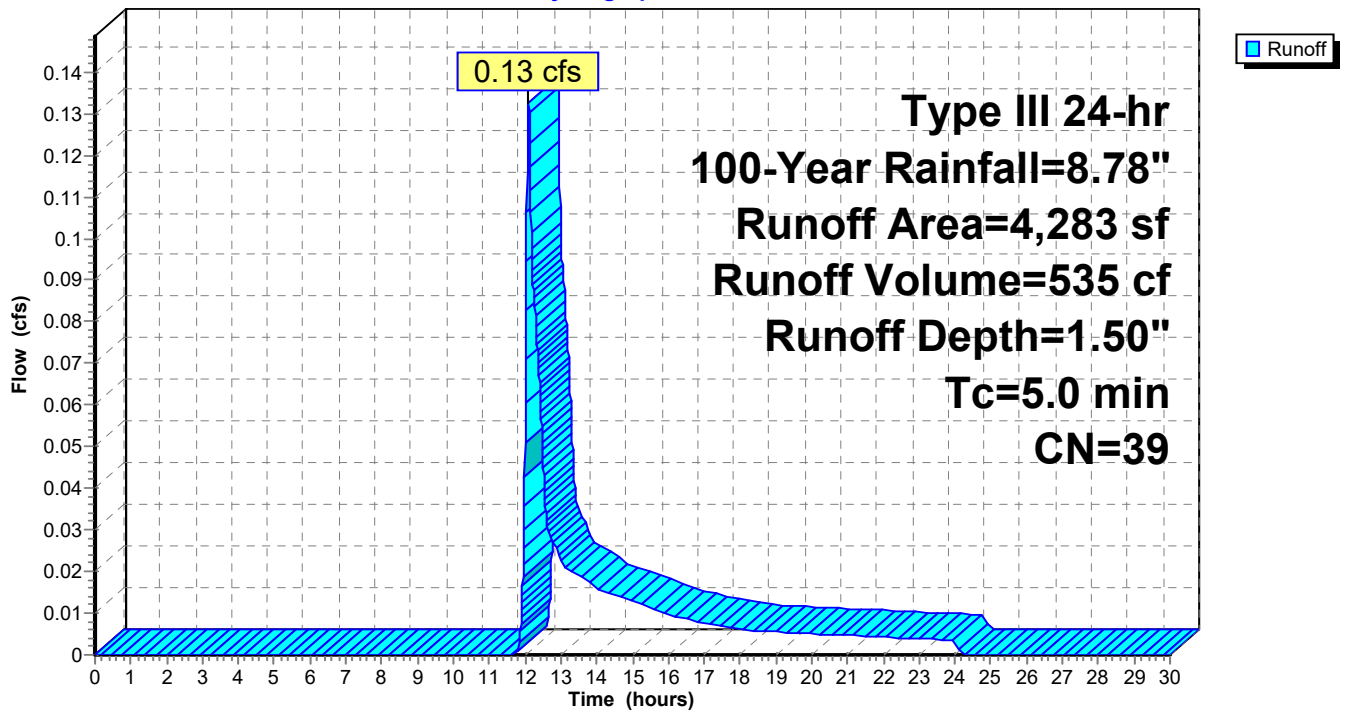
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
82	39	>75% Grass cover, Good, HSG A
4,201	39	>75% Grass cover, Good, HSG A
4,283	39	Weighted Average
4,283		100.00% Pervious Area

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

**Subcatchment 35S: PERVIOUS AREAS**

Hydrograph



**4 - HydroCAD R1**

Type III 24-hr 100-Year Rainfall=8.78"

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**Summary for Pond 28P: S1**

Inflow Area = 2,845 sf, 100.00% Impervious, Inflow Depth = 8.54" for 100-Year event  
 Inflow = 0.58 cfs @ 12.07 hrs, Volume= 2,025 cf  
 Outflow = 0.10 cfs @ 12.51 hrs, Volume= 2,025 cf, Atten= 82%, Lag= 26.3 min  
 Discarded = 0.10 cfs @ 12.51 hrs, Volume= 2,025 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 78.46' @ 12.51 hrs Surf.Area= 300 sf Storage= 554 cf

Plug-Flow detention time= 35.1 min calculated for 2,024 cf (100% of inflow)  
 Center-of-Mass det. time= 35.1 min ( 774.2 - 739.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	75.00'	333 cf	<b>15.00'W x 20.00'L x 3.54'H Field A</b> 1,062 cf Overall - 231 cf Embedded = 832 cf x 40.0% Voids
#2A	75.50'	231 cf	<b>Cultec R-330XLHD x 4 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	75.00'	<b>8.270 in/hr Exfiltration over Wetted area</b>

**Discarded OutFlow** Max=0.10 cfs @ 12.51 hrs HW=78.46' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

### 4 - HydroCAD R1

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## Pond 28P: S1 - Chamber Wizard Field A

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

2 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 15.50' Row Length +27.0" End Stone x 2 = 20.00' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 35.0" Side Stone x 2 = 15.00' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 231.0 cf Chamber Storage

1,062.5 cf Field - 231.0 cf Chambers = 831.5 cf Stone x 40.0% Voids = 332.6 cf Stone Storage

Chamber Storage + Stone Storage = 563.6 cf = 0.013 af

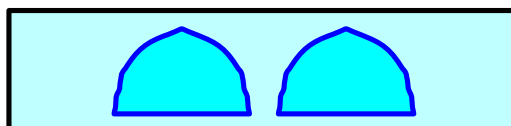
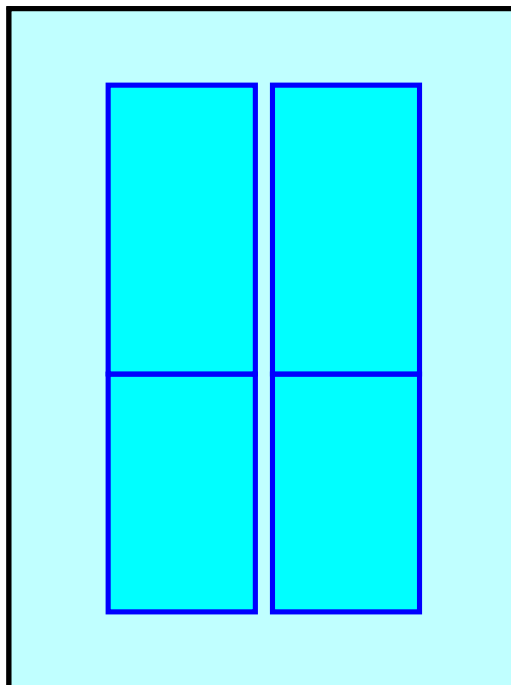
Overall Storage Efficiency = 53.0%

Overall System Size = 20.00' x 15.00' x 3.54'

4 Chambers

39.4 cy Field

30.8 cy Stone



### 4 - HydroCAD R1

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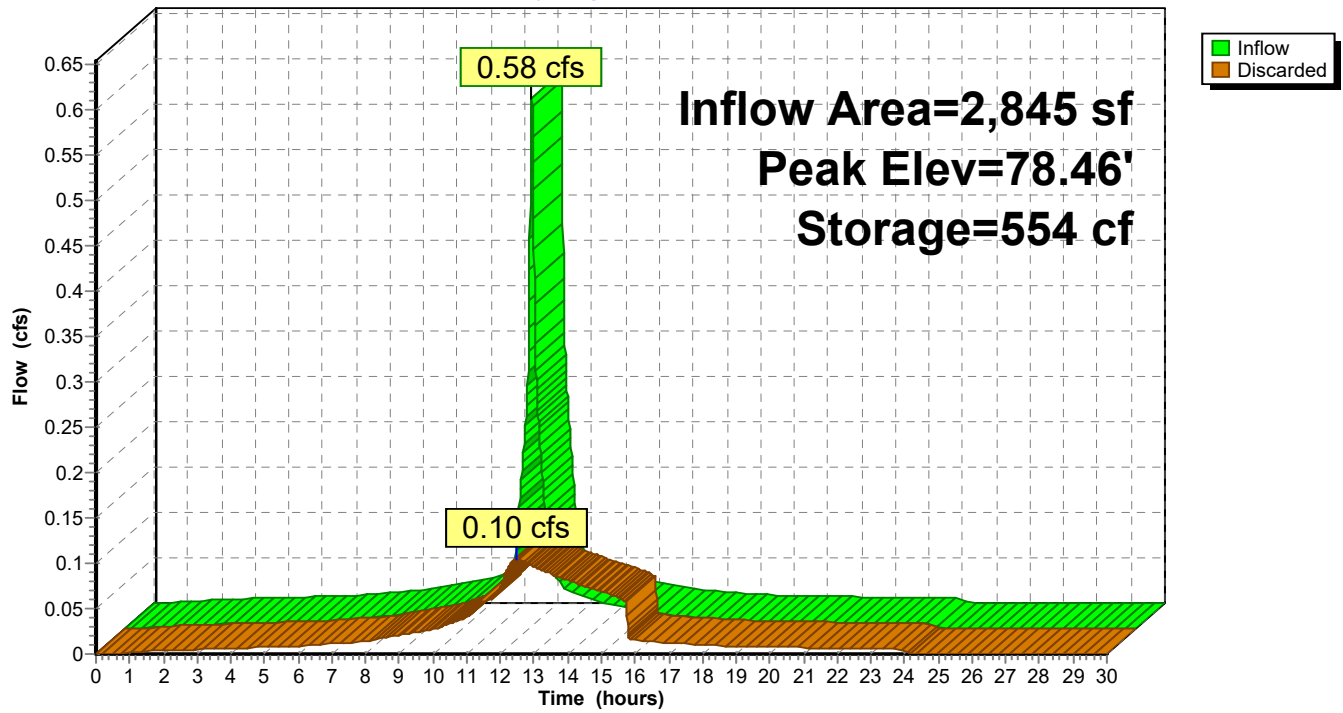
Type III 24-hr 100-Year Rainfall=8.78"

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### Pond 28P: S1

Hydrograph



**4 - HydroCAD R1**

Type III 24-hr 100-Year Rainfall=8.78"

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**Stage-Area-Storage for Pond 28P: S1**

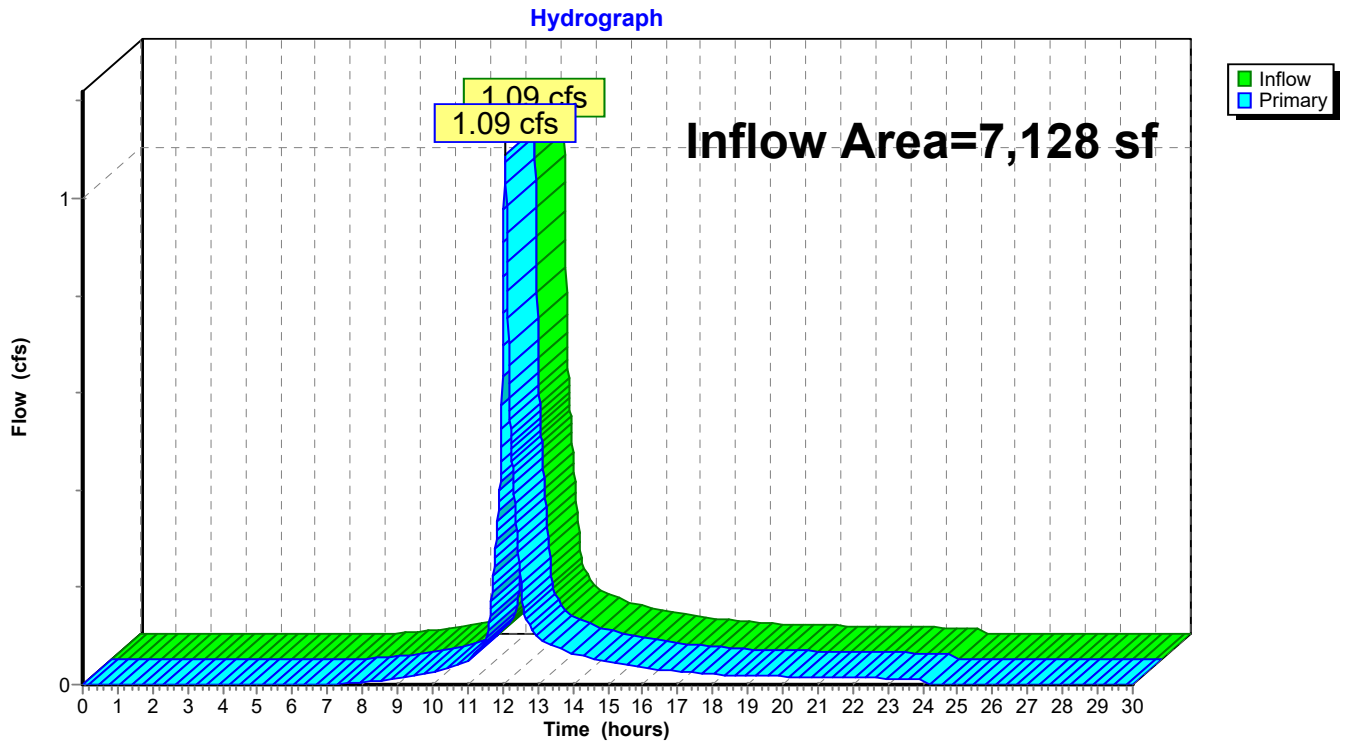
Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
75.00	300	0	77.80	496	473
75.05	303	6	77.85	499	480
75.10	307	12	77.90	503	486
75.15	311	18	77.95	507	492
75.20	314	24	78.00	510	499
75.25	318	30	78.05	513	505
75.30	321	36	78.10	517	511
75.35	324	42	78.15	521	517
75.40	328	48	78.20	524	523
75.45	332	54	78.25	528	529
75.50	335	60	78.30	531	535
75.55	338	70	78.35	534	541
75.60	342	79	78.40	538	547
75.65	346	89	78.45	542	553
75.70	349	99	78.50	<b>545</b>	<b>559</b>
75.75	353	108			
75.80	356	118			
75.85	359	128			
75.90	363	137			
75.95	367	147			
76.00	370	156			
76.05	373	166			
76.10	377	175			
76.15	381	185			
76.20	384	194			
76.25	388	204			
76.30	391	213			
76.35	394	223			
76.40	398	232			
76.45	402	241			
76.50	405	251			
76.55	408	260			
76.60	412	269			
76.65	416	279			
76.70	419	288			
76.75	423	297			
76.80	426	306			
76.85	429	315			
76.90	433	325			
76.95	437	333			
77.00	440	342			
77.05	443	351			
77.10	447	360			
77.15	451	369			
77.20	454	377			
77.25	458	386			
77.30	461	394			
77.35	464	403			
77.40	468	411			
77.45	472	419			
77.50	475	427			
77.55	478	435			
77.60	482	443			
77.65	486	451			
77.70	489	458			
77.75	493	466			

### Summary for Link 22L: 122-124 CABOT ST

Inflow Area = 7,128 sf, 57.49% Impervious, Inflow Depth = 5.51" for 100-Year event  
Inflow = 1.09 cfs @ 12.07 hrs, Volume= 3,271 cf  
Primary = 1.09 cfs @ 12.07 hrs, Volume= 3,271 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 22L: 122-124 CABOT ST



### 4 - HydroCAD R1

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Type III 24-hr 100-Year Rainfall=8.78"

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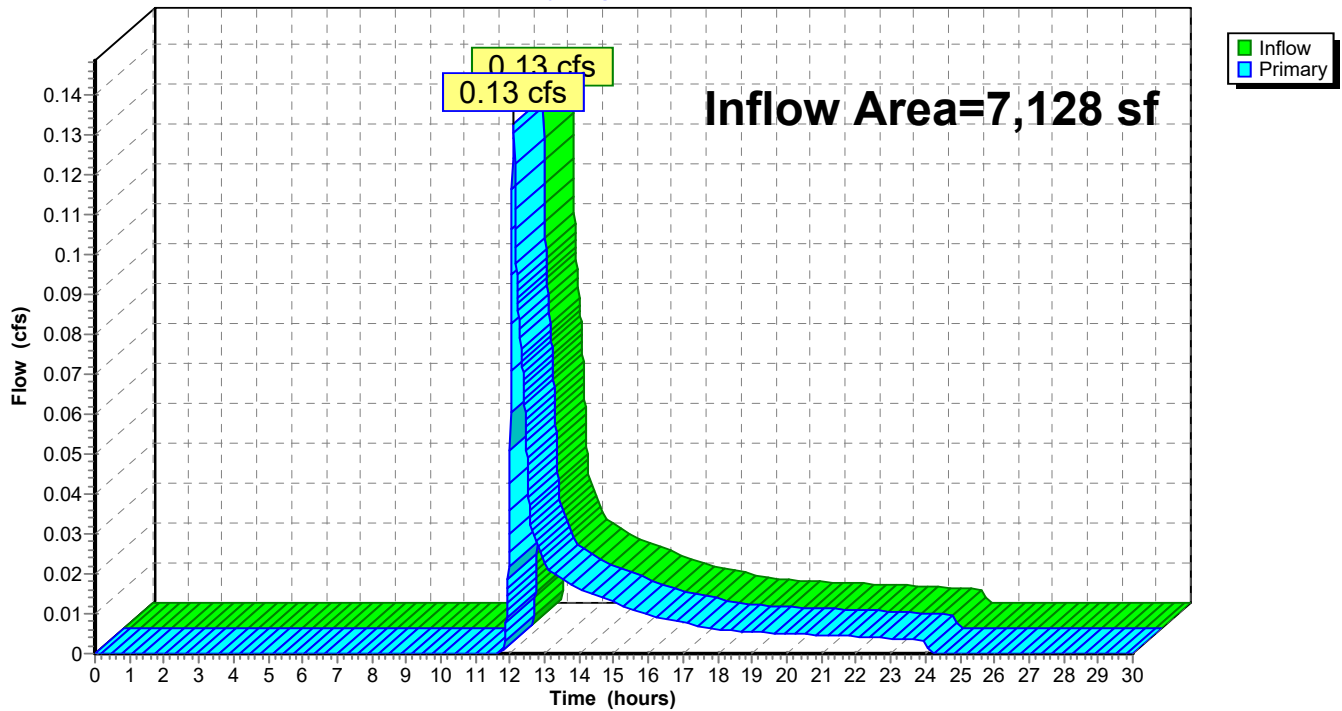
## Summary for Link 26L: 122-124 CABOT ST

Inflow Area = 7,128 sf, 39.91% Impervious, Inflow Depth = 0.90" for 100-Year event  
Inflow = 0.13 cfs @ 12.10 hrs, Volume= 535 cf  
Primary = 0.13 cfs @ 12.10 hrs, Volume= 535 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 26L: 122-124 CABOT ST

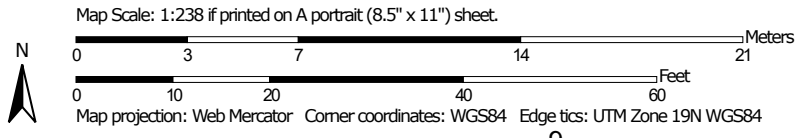
Hydrograph



**Appendix B – Soil Information**




Soil Map may not be valid at this scale.



### MAP LEGEND

**Area of Interest (AOI)**

 Area of Interest (AOI)




















**Soils**







 Soil Map Unit Polygons

 Soil Map Unit Lines


 Soil Map Unit Points

**Special Point Features**






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

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features


**Water Features**

 Streams and Canals

**Transportation**

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

**Background**

 Aerial Photography

### MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts  
 Survey Area Data: Version 24, Aug 27, 2024

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.2	100.0%
<b>Totals for Area of Interest</b>		<b>0.2</b>	<b>100.0%</b>

## Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

## Custom Soil Resource Report

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## Middlesex County, Massachusetts

### 626B—Merrimac-Urban land complex, 0 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2tyr9

*Elevation:* 0 to 820 feet

*Mean annual precipitation:* 36 to 71 inches

*Mean annual air temperature:* 39 to 55 degrees F

*Frost-free period:* 140 to 250 days

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Merrimac and similar soils:* 45 percent

*Urban land:* 40 percent

*Minor components:* 15 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Merrimac

##### Setting

*Landform:* Outwash plains, outwash terraces, moraines, eskers, kames

*Landform position (two-dimensional):* Summit, shoulder, backslope, footslope

*Landform position (three-dimensional):* Side slope, crest, riser, tread

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

##### Typical profile

*Ap - 0 to 10 inches:* fine sandy loam

*Bw1 - 10 to 22 inches:* fine sandy loam

*Bw2 - 22 to 26 inches:* stratified gravel to gravelly loamy sand

*2C - 26 to 65 inches:* stratified gravel to very gravelly sand

##### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat excessively drained

*Runoff class:* Very low

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to very high (1.42 to 99.90 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 2 percent

*Maximum salinity:* Nonsaline (0.0 to 1.4 mmhos/cm)

*Sodium adsorption ratio, maximum:* 1.0

*Available water supply, 0 to 60 inches:* Low (about 4.6 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* A

*Ecological site:* F144AY022MA - Dry Outwash

*Hydric soil rating:* No

### **Description of Urban Land**

#### **Typical profile**

*M - 0 to 10 inches:* cemented material

#### **Properties and qualities**

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* 0 inches to manufactured layer

*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water (Ksat):* Very low (0.00 to 0.00 in/hr)

*Available water supply, 0 to 60 inches:* Very low (about 0.0 inches)

#### **Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 8

*Hydrologic Soil Group:* D

*Hydric soil rating:* Unranked

### **Minor Components**

#### **Hinckley**

*Percent of map unit:* 5 percent

*Landform:* Deltas, kames, eskers, outwash plains

*Landform position (two-dimensional):* Summit, shoulder, backslope

*Landform position (three-dimensional):* Head slope, nose slope, side slope, crest, rise

*Down-slope shape:* Convex

*Across-slope shape:* Convex, linear

*Hydric soil rating:* No

#### **Sudbury**

*Percent of map unit:* 5 percent

*Landform:* Deltas, terraces, outwash plains

*Landform position (two-dimensional):* Footslope

*Landform position (three-dimensional):* Tread, dip

*Down-slope shape:* Concave

*Across-slope shape:* Linear

*Hydric soil rating:* No

#### **Windsor**

*Percent of map unit:* 5 percent

*Landform:* Outwash terraces, dunes, outwash plains, deltas

*Landform position (three-dimensional):* Tread, riser

*Down-slope shape:* Linear, convex

*Across-slope shape:* Linear, convex

*Hydric soil rating:* No

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**Appendix C**  
**Precipitation Frequency Estimates for Newton (NOAA Atlas 14 Volume 10 V3)**

122-124 Cabot Street, Newton, MA.



**NOAA Atlas 14, Volume 10, Version 3**  
**Location name: Newton Center, Massachusetts, USA\***

**Latitude: 42.3385°, Longitude: -71.2071°**

**Elevation: 96 ft\*\***

\* source: ESRI Maps

\*\* source: USGS



**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

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**PF tabular**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
<b>Duration</b>	<b>Average recurrence interval (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>100</b>	<b>200</b>	<b>500</b>	<b>1000</b>
<b>5-min</b>	<b>0.302</b> (0.239-0.383)	<b>0.373</b> (0.294-0.473)	<b>0.489</b> (0.384-0.623)	<b>0.585</b> (0.457-0.750)	<b>0.717</b> (0.542-0.968)	<b>0.816</b> (0.604-1.13)	<b>0.921</b> (0.662-1.33)	<b>1.04</b> (0.705-1.54)	<b>1.23</b> (0.795-1.88)	<b>1.38</b> (0.872-2.16)
<b>10-min</b>	<b>0.428</b> (0.338-0.543)	<b>0.529</b> (0.417-0.671)	<b>0.693</b> (0.544-0.882)	<b>0.829</b> (0.647-1.06)	<b>1.02</b> (0.768-1.37)	<b>1.16</b> (0.856-1.60)	<b>1.30</b> (0.938-1.89)	<b>1.48</b> (0.999-2.18)	<b>1.74</b> (1.12-2.66)	<b>1.95</b> (1.24-3.06)
<b>15-min</b>	<b>0.504</b> (0.398-0.638)	<b>0.622</b> (0.490-0.789)	<b>0.815</b> (0.640-1.04)	<b>0.975</b> (0.762-1.25)	<b>1.20</b> (0.903-1.61)	<b>1.36</b> (1.01-1.88)	<b>1.54</b> (1.10-2.22)	<b>1.74</b> (1.18-2.57)	<b>2.04</b> (1.32-3.13)	<b>2.30</b> (1.45-3.60)
<b>30-min</b>	<b>0.687</b> (0.543-0.871)	<b>0.849</b> (0.669-1.08)	<b>1.11</b> (0.875-1.42)	<b>1.33</b> (1.04-1.71)	<b>1.63</b> (1.23-2.21)	<b>1.86</b> (1.38-2.57)	<b>2.10</b> (1.51-3.04)	<b>2.38</b> (1.61-3.52)	<b>2.81</b> (1.82-4.31)	<b>3.18</b> (2.01-4.97)
<b>60-min</b>	<b>0.871</b> (0.688-1.10)	<b>1.08</b> (0.848-1.36)	<b>1.41</b> (1.11-1.79)	<b>1.69</b> (1.32-2.16)	<b>2.07</b> (1.57-2.80)	<b>2.35</b> (1.74-3.26)	<b>2.66</b> (1.92-3.86)	<b>3.02</b> (2.04-4.46)	<b>3.58</b> (2.32-5.49)	<b>4.06</b> (2.57-6.35)
<b>2-hr</b>	<b>1.13</b> (0.900-1.43)	<b>1.40</b> (1.11-1.76)	<b>1.84</b> (1.45-2.32)	<b>2.20</b> (1.73-2.80)	<b>2.70</b> (2.06-3.63)	<b>3.07</b> (2.29-4.24)	<b>3.47</b> (2.53-5.03)	<b>3.97</b> (2.69-5.81)	<b>4.75</b> (3.09-7.22)	<b>5.43</b> (3.45-8.42)
<b>3-hr</b>	<b>1.32</b> (1.05-1.66)	<b>1.63</b> (1.30-2.05)	<b>2.14</b> (1.70-2.69)	<b>2.56</b> (2.02-3.24)	<b>3.14</b> (2.40-4.21)	<b>3.56</b> (2.67-4.91)	<b>4.03</b> (2.95-5.82)	<b>4.62</b> (3.13-6.72)	<b>5.54</b> (3.61-8.38)	<b>6.35</b> (4.04-9.79)
<b>6-hr</b>	<b>1.71</b> (1.37-2.13)	<b>2.10</b> (1.69-2.63)	<b>2.75</b> (2.20-3.44)	<b>3.28</b> (2.60-4.13)	<b>4.02</b> (3.09-5.34)	<b>4.56</b> (3.44-6.22)	<b>5.15</b> (3.78-7.37)	<b>5.89</b> (4.02-8.50)	<b>7.06</b> (4.61-10.6)	<b>8.07</b> (5.15-12.3)
<b>12-hr</b>	<b>2.18</b> (1.76-2.70)	<b>2.68</b> (2.16-3.32)	<b>3.48</b> (2.80-4.33)	<b>4.15</b> (3.32-5.19)	<b>5.07</b> (3.92-6.69)	<b>5.75</b> (4.36-7.78)	<b>6.49</b> (4.78-9.19)	<b>7.40</b> (5.07-10.6)	<b>8.81</b> (5.78-13.1)	<b>10.0</b> (6.42-15.2)
<b>24-hr</b>	<b>2.63</b> (2.14-3.23)	<b>3.26</b> (2.65-4.01)	<b>4.28</b> (3.46-5.29)	<b>5.13</b> (4.13-6.37)	<b>6.30</b> (4.90-8.26)	<b>7.16</b> (5.46-9.63)	<b>8.10</b> (6.01-11.4)	<b>9.28</b> (6.38-13.2)	<b>11.1</b> (7.31-16.3)	<b>12.7</b> (8.15-19.0)
<b>2-day</b>	<b>3.01</b> (2.46-3.67)	<b>3.79</b> (3.10-4.63)	<b>5.08</b> (4.14-6.23)	<b>6.14</b> (4.97-7.58)	<b>7.61</b> (5.96-9.93)	<b>8.68</b> (6.67-11.6)	<b>9.87</b> (7.40-13.9)	<b>11.4</b> (7.86-16.0)	<b>13.9</b> (9.16-20.2)	<b>16.1</b> (10.3-23.8)
<b>3-day</b>	<b>3.30</b> (2.71-4.02)	<b>4.15</b> (3.41-5.05)	<b>5.54</b> (4.53-6.77)	<b>6.69</b> (5.44-8.22)	<b>8.28</b> (6.52-10.8)	<b>9.44</b> (7.28-12.6)	<b>10.7</b> (8.07-15.0)	<b>12.4</b> (8.57-17.3)	<b>15.1</b> (10.0-21.9)	<b>17.5</b> (11.3-25.9)
<b>4-day</b>	<b>3.58</b> (2.95-4.34)	<b>4.46</b> (3.67-5.41)	<b>5.90</b> (4.83-7.18)	<b>7.09</b> (5.77-8.68)	<b>8.73</b> (6.89-11.3)	<b>9.93</b> (7.68-13.2)	<b>11.3</b> (8.49-15.7)	<b>13.0</b> (9.00-18.1)	<b>15.8</b> (10.5-22.8)	<b>18.3</b> (11.8-26.9)
<b>7-day</b>	<b>4.33</b> (3.59-5.22)	<b>5.25</b> (4.34-6.34)	<b>6.75</b> (5.56-8.17)	<b>7.99</b> (6.54-9.73)	<b>9.70</b> (7.68-12.5)	<b>10.9</b> (8.49-14.4)	<b>12.3</b> (9.32-17.0)	<b>14.1</b> (9.82-19.5)	<b>17.0</b> (11.3-24.3)	<b>19.6</b> (12.7-28.5)
<b>10-day</b>	<b>5.03</b> (4.18-6.04)	<b>5.97</b> (4.96-7.18)	<b>7.51</b> (6.21-9.06)	<b>8.78</b> (7.21-10.7)	<b>10.5</b> (8.36-13.4)	<b>11.8</b> (9.18-15.4)	<b>13.2</b> (9.98-18.1)	<b>15.0</b> (10.5-20.7)	<b>17.9</b> (11.9-25.4)	<b>20.4</b> (13.2-29.5)
<b>20-day</b>	<b>7.05</b> (5.90-8.42)	<b>8.07</b> (6.74-9.63)	<b>9.73</b> (8.10-11.7)	<b>11.1</b> (9.18-13.4)	<b>13.0</b> (10.3-16.3)	<b>14.4</b> (11.2-18.5)	<b>15.9</b> (11.9-21.2)	<b>17.6</b> (12.4-23.9)	<b>20.1</b> (13.5-28.3)	<b>22.2</b> (14.4-31.8)
<b>30-day</b>	<b>8.72</b> (7.33-10.4)	<b>9.79</b> (8.22-11.6)	<b>11.5</b> (9.64-13.8)	<b>13.0</b> (10.8-15.6)	<b>15.0</b> (11.9-18.7)	<b>16.5</b> (12.8-21.0)	<b>18.1</b> (13.5-23.7)	<b>19.7</b> (13.9-26.6)	<b>22.0</b> (14.8-30.6)	<b>23.7</b> (15.4-33.8)
<b>45-day</b>	<b>10.8</b> (9.11-12.8)	<b>11.9</b> (10.1-14.1)	<b>13.8</b> (11.6-16.4)	<b>15.3</b> (12.8-18.3)	<b>17.4</b> (13.9-21.5)	<b>19.1</b> (14.8-24.0)	<b>20.7</b> (15.4-26.7)	<b>22.3</b> (15.7-29.8)	<b>24.2</b> (16.4-33.6)	<b>25.7</b> (16.8-36.4)
<b>60-day</b>	<b>12.5</b> (10.6-14.8)	<b>13.7</b> (11.6-16.2)	<b>15.6</b> (13.2-18.5)	<b>17.2</b> (14.4-20.5)	<b>19.4</b> (15.5-23.9)	<b>21.2</b> (16.4-26.4)	<b>22.8</b> (16.9-29.2)	<b>24.3</b> (17.3-32.5)	<b>26.2</b> (17.7-36.2)	<b>27.5</b> (18.0-38.7)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

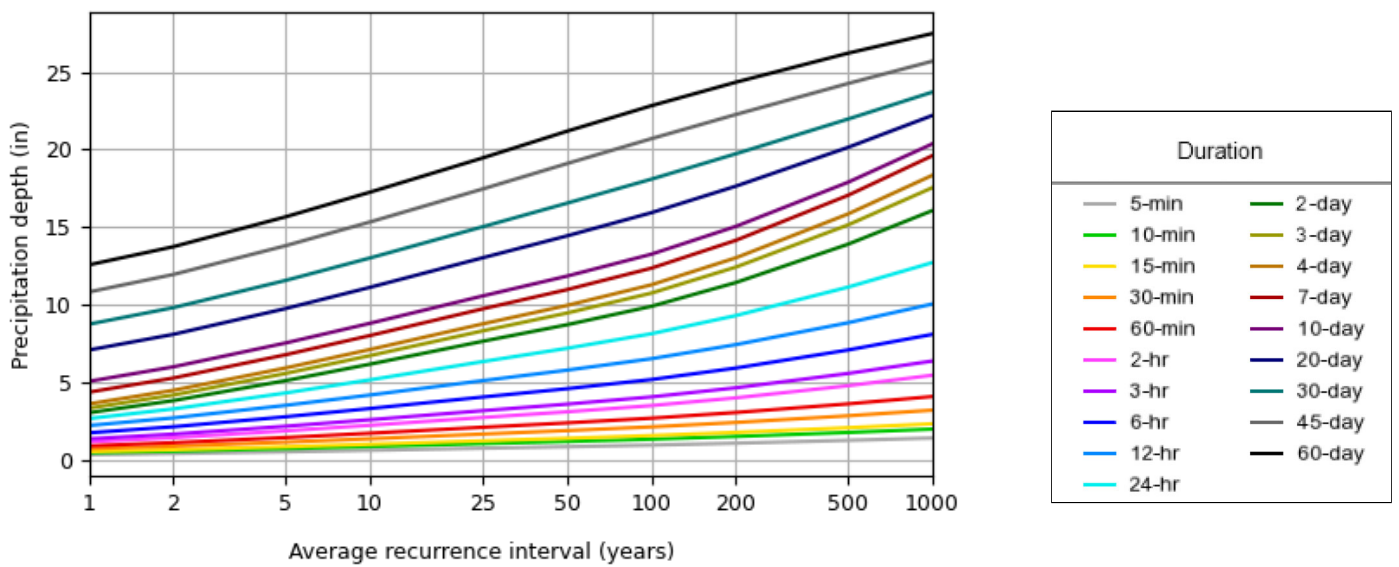
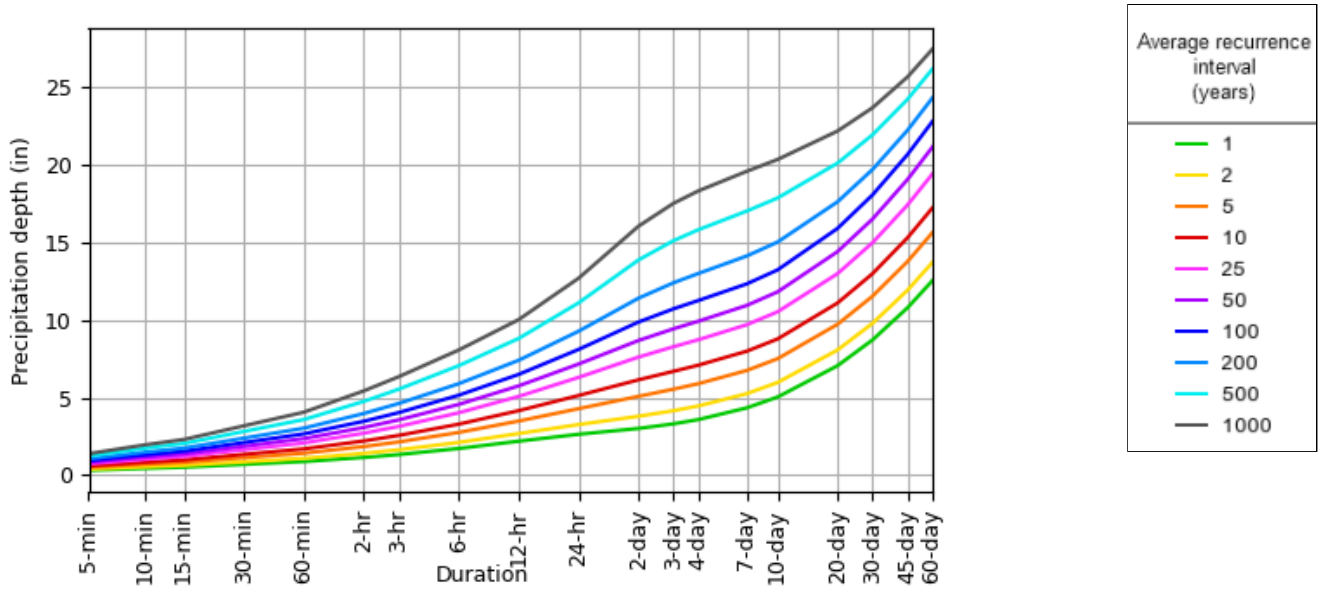
Please refer to NOAA Atlas 14 document for more information.

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**PF graphical**

122-124 Cabot Street, Newton, MA.

### PDS-based depth-duration-frequency (DDF) curves Latitude: 42.3385°, Longitude: -71.2071°

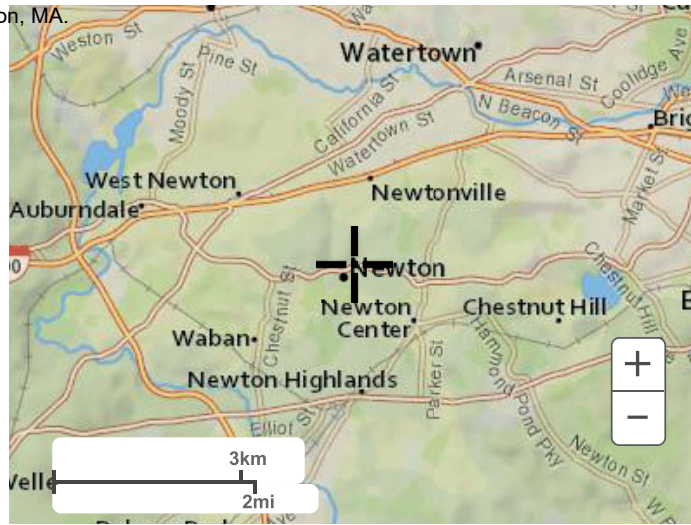


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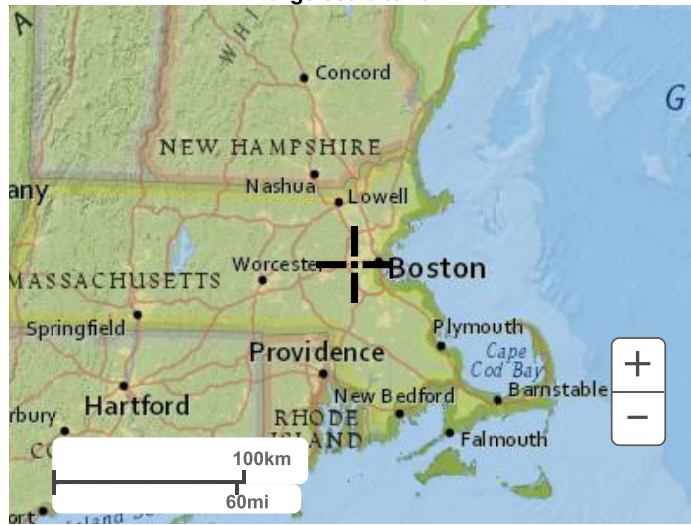
## Maps & aerials

Small scale terrain

122-124 Cabot Street, Newton, MA.



Large scale terrain

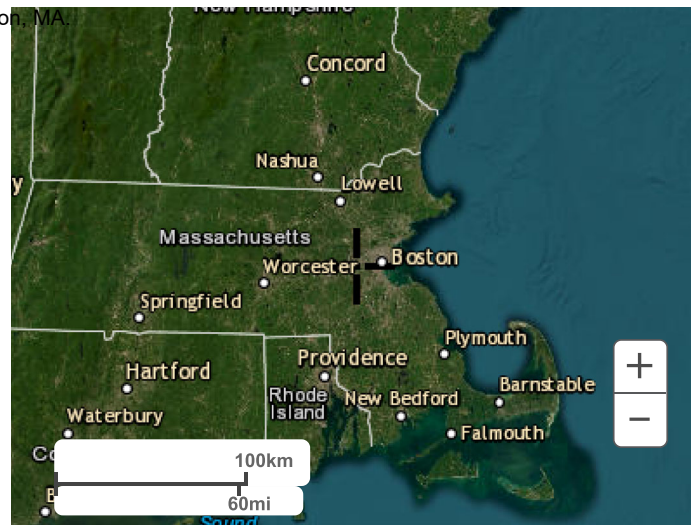


Large scale map



Large scale aerial

122-124 Cabot Street, Newton, MA



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1325 East West Highway  
Silver Spring, MD 20910  
Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

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