

# Stormwater Management Report

## Proposed Convenience Store with Gas & Retail

Block 436, Lot 11.01  
City of Linden, Union County, New Jersey

March 18, 2020

*Prepared For*

Linden Edgar, LLC  
4 Caufield Place, Suite 102  
Newtown, PA 18940

*Prepared By*

Maser Consulting P.A.  
Corporate Headquarters  
331 Newman Springs Road  
Red Bank, NJ 07701  
732.383.1950

Certificate of Authorization: 24GA27986500



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Jelena Balorda-Barone, P.E.  
N.J. Professional Engineer License No. 44465

MC Project No. 15002372A





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## **INTRODUCTION**

This stormwater management report is being submitted as part of the development application known as Linden Edgar, LLC. This report was prepared in accordance with the City of Linden and New Jersey Department of Environmental Protection (NJDEP) standards, as well as current industry standards and practices for stormwater management. The project will disturb approximately 112,426 SF (2.581 AC.) and will increase the area of impervious coverage by approximately 45,471 SF (1.044 AC.) The purpose of this report is to summarize the stormwater management design as it pertains to the stormwater rules and to provide calculations to support the design. The stormwater management measures proposed for the site have been designed to meet erosion control, stormwater runoff quantity and quality standards as set forth by NJAC 7:8.

## **LOCATION OF SITE**

The subject property is known as Block 436, Lot 11.01 as shown on sheet 141 of the Official Tax Map of City of Linden, Union County, New Jersey and consists of approximately 2.424 acres (Appendix). The property is bounded to the east by New Jersey State Highway (NJSH) Route 1 and 9, Park Avenue to the north, and a shopping center to the south and west. The site is currently developed as a convenience store with gas station, a car wash, storage building. The proposed development consists of one retail building, a 5,051 SF retail store with gasoline fuel sales and with typical appurtenant site improvements. The property is located within a Redevelopment Zone, known as the Infineum Redevelopment Project, in which the proposed uses are permitted. The location of the site is shown on the Elizabeth Park NJ Quadrangle U.S. Geological Survey Topographic Map (Appendix).

## **SOIL CHARACTERISTICS**

The existing soil classifications for the site are based on the USDA NRCS Web Soil Survey. The survey is useful at the planning level to draw general conclusions about the suitability of a site for certain land uses. Based on the web site data, the site consists of the following soil types:



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**SOIL NAME****HYDROLOGIC GROUP**

HatB – Haledon-Urban land-Hasbrouck complex,

0 to 8 percent slopes

C

UR – Urban land

D

For results of the geotechnical investigation, refer to a report titled “Report of Geotechnical Engineering Study for Proposed Retail Development,” prepared for Richard C. Dreher” prepared by Maser Consulting P.A., dated July 18, 2017.

**FLOOD PLAINS**

In accordance with Flood Insurance Rate Map (FIRM) Community-Panel Number 34039C0034F, as prepared by the Federal Emergency Management Agency (FEMA), revised September 20, 2006, the subject site is not located within a flood hazard zone.

**COMPLIANCE STATEMENT**

This project is designed in accordance with N.J.A.C. 7:8. The proposed stormwater measures have been designed to meet the City’s and NJDEP Standards. The site complies with the requirements for water quantity, water quality, groundwater recharge and SCD requirements. Each of these requirements have been outlined in greater detail below.

**STUDY AREAS**

The drainage areas utilized to analyze and calculate the stormwater attenuation requirements for this development were established based on the proposed hydrologic limits of disturbance and the existing and proposed topography. The following is a listing of the drainage areas used in this report and a description of their location:



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## Existing Hydrologic Analysis

### Existing Area 1

This area contains the developed portion of the site which drains into the stormwater sewer system within NJSH Route 1 & 9 and Park Avenue. The area contains mostly impervious areas from the building and parking lot.

### Existing Area 2

This drainage area is the western portion of the site which flows to the south then east around the developed portion of the site and into NJSH Route 1 & 9. The drainage area contains the perimeter landscaped area containing mostly grassed lawn.

### Existing Off-site Drainage Area

This area is the grassed lawn area around the perimeter of the subject site which drains onto the proposed development. This area is accounted for in the proposed stormwater design but is not subject to reductions but must be counted in the analysis for sizing the proposed stormwater management basin.

## Proposed Hydrologic Analysis

The proposed drainage areas have been separated out by pervious and impervious surfaces for the analysis purposes but are described as one entity below.

### Proposed Area 1

This area contains the majority of the proposed site which is captured by inlets and is conveyed into the proposed basin before discharging to an existing manhole located in the Route 1 & 9 ROW. The area contains mostly paved surfaces and building runoff as well as landscaped islands.

### Proposed Area 2

This area is the rest of the site, which is not captured and drains directly into the roadways existing stormwater conveyance system. The area contains both mostly grassed lawn area and impervious surfaces from the driveway connection to each roadway.

### Offsite Drainage Area

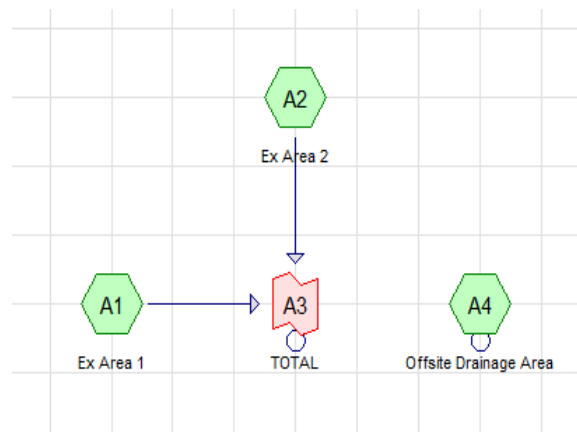
This area is the same area as described in the existing conditions and will not be disturbed. As stated before, this area is not subject to reductions but must be counted in the analysis for sizing the proposed stormwater management basin.



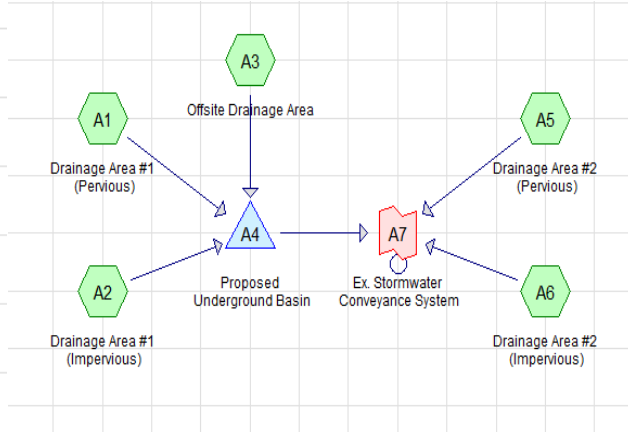
## **STORMWATER MANAGEMENT METHODOLOGY**

### **STORMWATER MANAGEMENT NETWORK DIAGRAM**

#### **EXISTING CONDITIONS**



#### **PROPOSED CONDITIONS**



The stormwater runoff resulting from the proposed development must be managed both qualitatively and quantitatively in accordance with the NJDEP requirements. To meet the City's and NJDEP standards, must be designed so that the post-development peak runoff rate for the 2-year, 10-year and 100-year storm events is reduced to 50%, 75% and 80%, respectively, of the pre-development peak runoff rate from the developed portion of the site.

To evaluate the proposed site for compliance with the above standards, the HydroCAD v10.00 hydrologic/hydraulic model were utilized. Per NJDEP new regulations all sites must be evaluated utilizing the NOAA Atlas Point Precipitation Frequency Estimates (a Type D rainfall distribution was used in the case of this subject site). This along with the Soil Conservation Service's (SCS) Unit Hydrograph was utilized for modeling both the existing and proposed conditions. Under existing conditions, impervious surfaces are analyzed separately from any drainage area with a time of concentration greater than 10 minutes to accurately model the earlier peak from the impervious surfaces. A summary of the results is presented in the following tables:





#### EXISTING AND ALLOWABLE FLOW

STORM (YEAR)	EX. FLOWS (CFS) (A)	REDUCTIONS (B)	EX. OFFSITE AREA (NOT SUBJECT TO REDUCTIONS) (C)	ALLOWABLE (CFS) (A*B + C)
2	4.47	50%	0.22	2.45
10	7.94	75%	0.47	6.42
100	15.13	80%	1.00	13.10

#### PROPOSED PEAK FLOW RATES

STORM (YEAR)	ALLOWABLE (CFS)	PR. TO AP (CFS)
2	2.45	2.20
10	6.42	6.37
100	13.10	12.18

#### **STORM SEWER DESIGN**

The storm sewer has been designed in accordance with the City's and NJDEP requirements. The proposed stormwater conveyance system was designed to pass the 25-year storm event. The outfall pipe has been designed to pass the 100-year storm event. Using the Rational Method with a minimum time of concentration of 10 minutes and the Trenton Intensity-Duration-Frequency Table, the proposed conveyance pipes were analyzed. Manning's formula is used for sizing the stormwater pipes to have capacity to handle flows, the coefficients used are 0.012 for HDPE and 0.013 for RCP. When modeling the storm sewers, a conservative "C" coefficient of 0.99 was used for all surfaces, corresponding to a paved impervious surface. The storm sewer design calculations can be found in the Appendix.

All existing pipes downstream of the proposed basin were not analyzed for capacity as they are receiving reduced peak rates of runoff for the 25-year storm due to the reductions that are required and proposed for the various design storms.

#### **WATER QUALITY N.J.A.C. 7:8-5.5**

NJDEP regulations require that water quality treatment be provided for the proposed site runoff. The water quality standards require that stormwater management measures be designed to reduce



the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm for new asphalt areas by 80 percent of the anticipated load from the developed site and 50 percent for the existing asphalt areas, expressed as an annual average.

Existing and proposed rooftop areas are excluded from the required treatment rate and the proposed treatment rate calculations as runoff from the rooftops is considered clean. A summary of the existing and proposed rooftop and impervious pavement sizes are presented in the table below:

Condition	Rooftop (sf)	Pavement (sf)
Existing	2,098	40,402
Proposed	12,251	75,720

The site has total impervious surface (excluding rooftop areas) of 75,720 sf. 40,402 sf of which is existing impervious surfaces ( $40,402/75,720 = 0.533$ ). 35,318 sf is new impervious surfaces ( $35,318/75,720 = 0.467$ ). Required TSS removal rate =  $(0.533 \times 50\%) + (0.467 \times 80\%) = 64.01\%$ . The proposed stormwater management system has been designed to incorporate an 80% TSS manufactured treatment device (MTD). The total amount of impervious surfaces (excluding rooftop areas) receiving treatment is 68,110 sf ( $68,110/75,720 = 0.899$ ). There is 7,610 sf of impervious are that flows directly offsite and receives not treatment ( $7,610/75,720 = 0.101$ ). The provided TSS removal rate =  $(0.899 \times 80\%) + (0.101 \times 0\%) = 71.92\%$ . Since the provided 71.92% > the required 64.01%, the site complies with the water quality requirement.

#### **GROUNDWATER RECHARGE N.J.A.C. 7:8-5.4(A)2**

The proposed development is located within Planning Area 1 (Metropolitan Planning Area). In accordance with N.J.A.C. 7:8-5.4(a).2.ii, groundwater recharge does not apply to projects within the “urban redevelopment area”. An Urban Redevelopment Area is defined, per N.J.A.C. 7:8-1.2, as development portions of areas delineated on the State Plan Policy Map as the Metropolitan Planning Area. Therefore, the proposed development is not required to meet groundwater recharge.



## **SOIL EROSION AND SEDIMENT CONTROL**

In accordance with the Soil Erosion and Sediment Control Act, soil erosion measures will be incorporated into the design and graphically depicted on the Soil Erosion and Sediment Control Plans. These measures consist of, but are not limited to:

- Silt Fences
- Stormwater Management Basins
- Stabilized Construction Access
- Topsoil Stockpiles
- Storm Sewer Inlet Protection
- Temporary and Permanent Stabilization

Per the Standards for Soil Erosion and Sediment Control in New Jersey 2014 Manual, the point of discharge stability and downstream (off-site) stability must be met. At the point is met by the fact that the discharge from the proposed basin connects into an existing manhole, which is considered a stable discharge point. Off-site stability is met at the point of analysis by meeting/reducing the peak rate of runoff from the existing conditions to the proposed conditions for the 2- and 10- year storm events while discounting infiltration in the proposed basin and assuming the basin is filled to the initial outfall device. The proposed basin has been designed a detention basin only, infiltration is disregarded already, and the invert of the initial orifice is the same elevation as the bottom of the basin. Therefore; the off-site stability analysis has the is the same peak runoff rates as the proposed conditions described in the above section.

### **EXISTING AND PROPOSED FLOW**

STORM (YEAR)	EX. FLOWS (CFS)	PROPOSED FLOW (CFS)
2	4.47	2.20
10	7.94	6.37
100	15.13	13.10



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## **CONCLUSION**

The proposed development complies with the City's, County and SCD requirements for water quantity, water quality, groundwater recharge and SCD.

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## **APPENDIX A**

**TAX MAP**

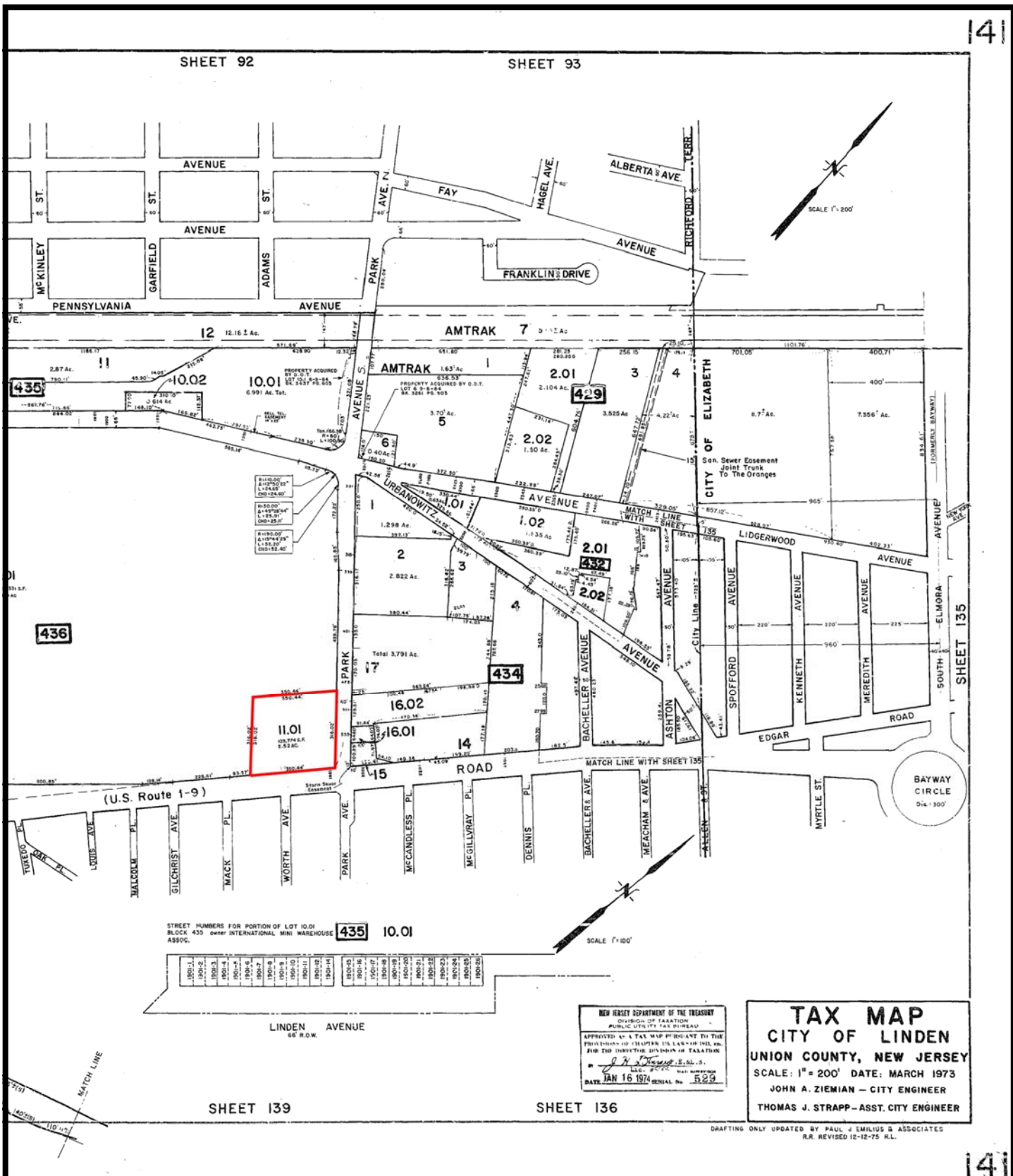
**LOCATION MAP**

**USGS MAP**

**SOILS MAP**

**FEMA MAP**





**Corporate Headquarters**  
 331 Newman Springs Road  
 Suite 203  
 Red Bank, NJ 07701  
 T: 732.383.1950  
 F: 732.383.1984  
 www.maserconsulting.com

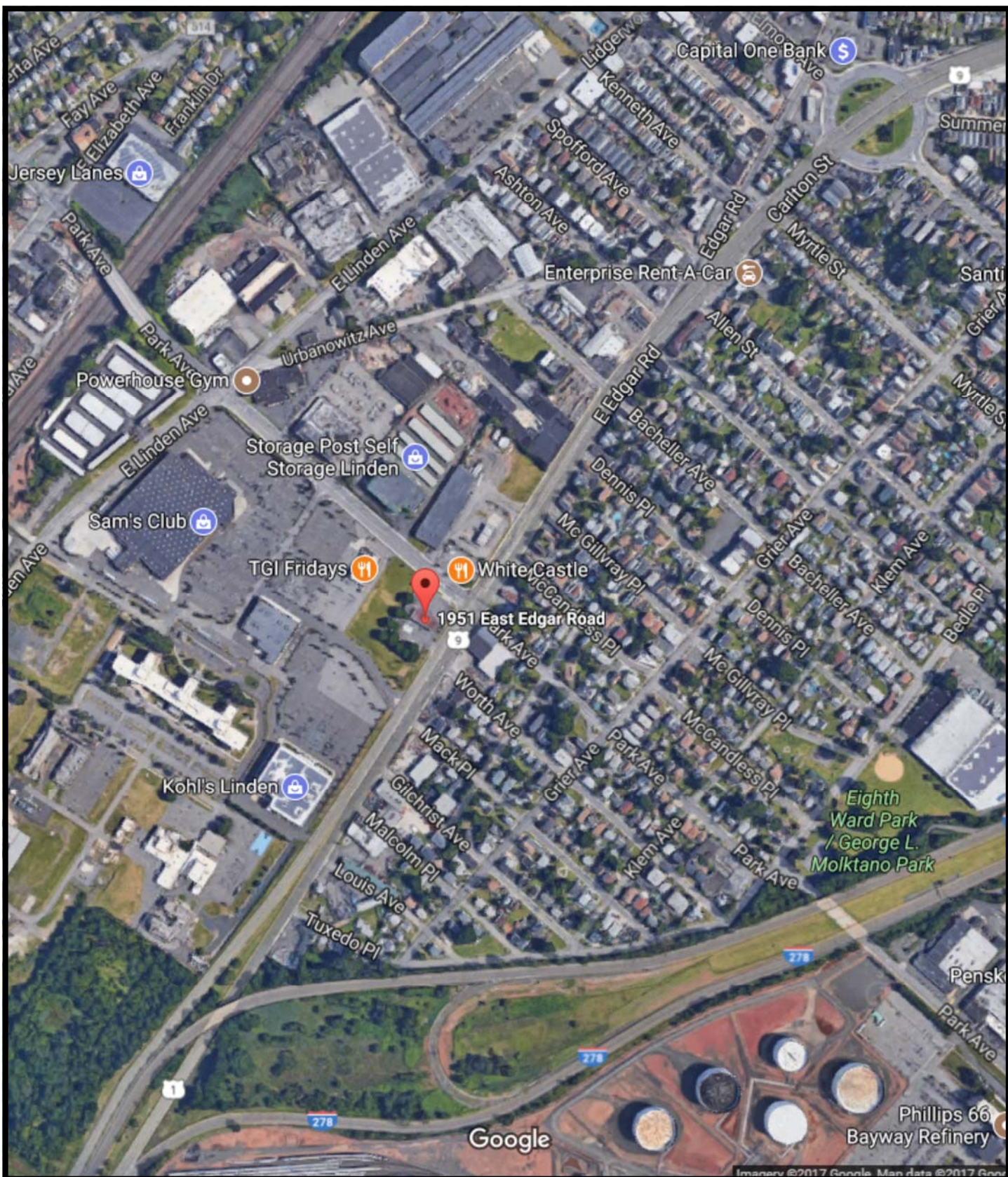
**Figure No. 1**  
**Tax Map**  
**THE DREHER GROUP**  
 Image Source: Official Tax Map of City of  
 Linden Sheet 141

**Scale: NTS**

**Date: October 2017**

**MC Project No. 15002372A**





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 331 Newman Springs Road  
 Suite 203  
 Red Bank, NJ 07701  
 T: 732.383.1950  
 F: 732.383.1984  
[www.maserconsulting.com](http://www.maserconsulting.com)

**Figure No. 2**  
**Location Map**  
**THE DREHER GROUP**  
 Image Source: Google Map

**Scale: NTS**

**Date: October 2017**

**MC Project No. 15002372A**









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 331 Newman Springs Road  
 Suite 203  
 Red Bank, NJ 07701  
 T: 732.383.1950  
 F: 732.383.1984  
[www.maserconsulting.com](http://www.maserconsulting.com)

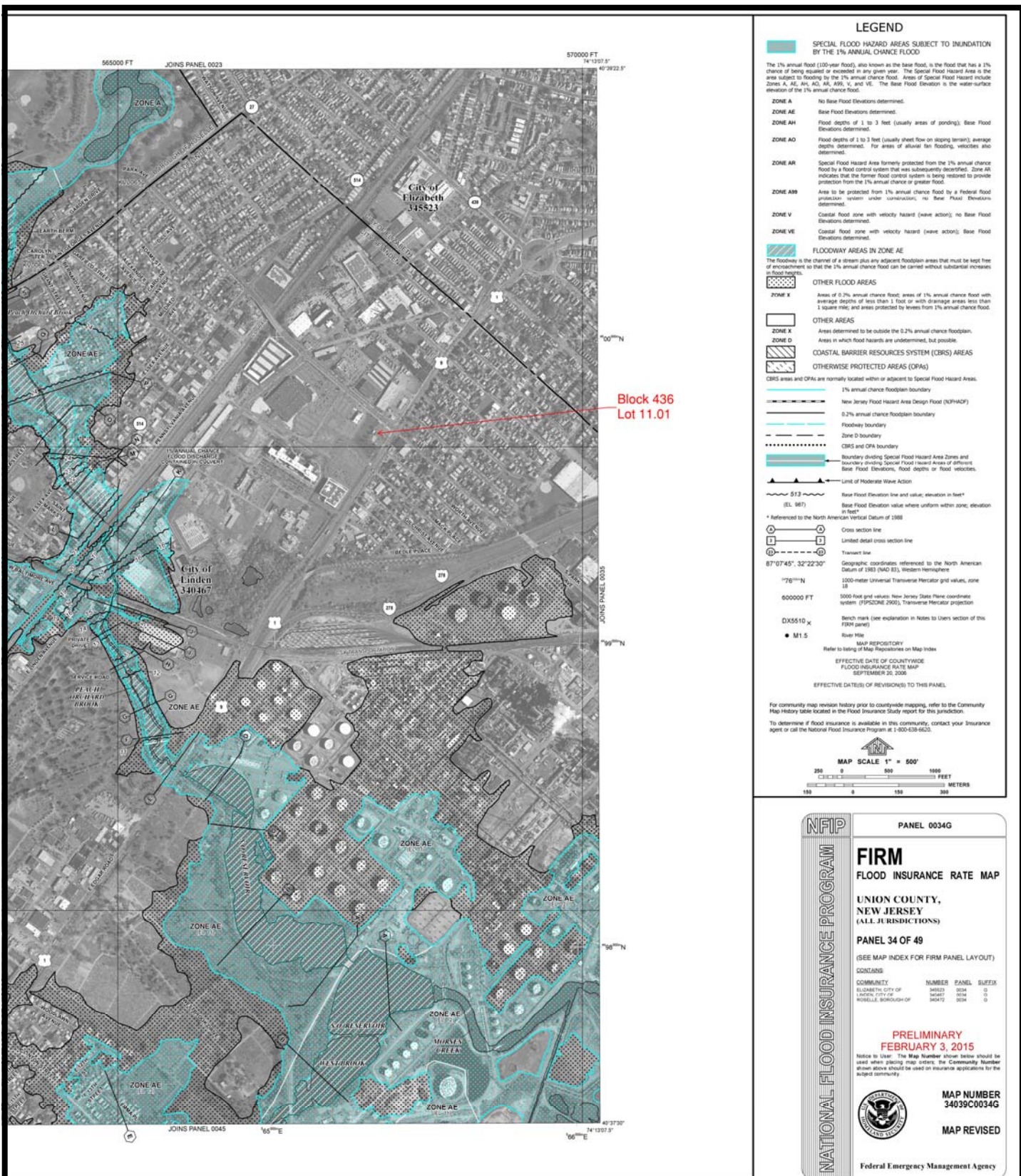
**Figure No. 4**  
**Soils Map**  
**THE DREHER GROUP**  
 Image Source: Web Soil Survey

**Scale: As Shown**

**Date: October 2017**

**MC Project No. 15002372A**





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331 Newman Springs Road  
Suite 203  
Red Bank, NJ 07701  
T: 732.383.1950  
F: 732.383.1984  
www.maserconsulting.com

**Figure No. 5**  
**FEMA Map**  
**THE DREHER GROUP**  
Image Source: U.S. Department of Homeland Security Federal Emergency Management Agency..

**Scale: As Shown**

**Date: October 2017**

**MC Project No. 15002372A**

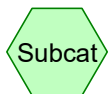
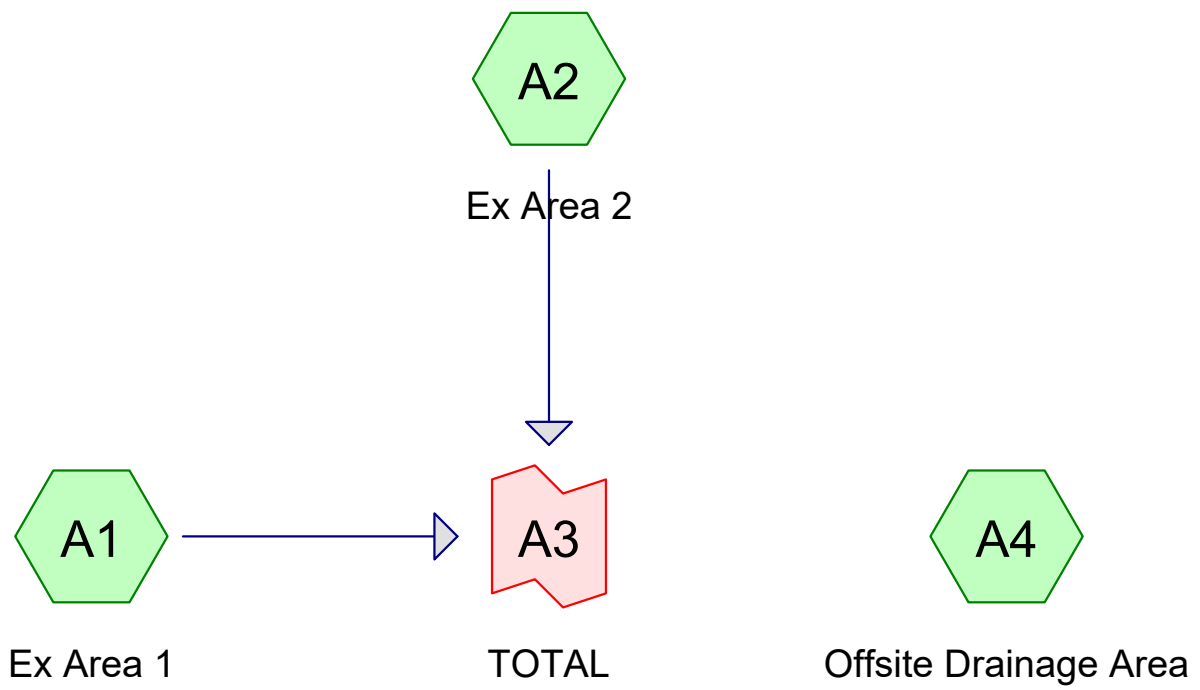




## **APPENDIX B**

### **EXISTING CONDITIONS ANALYSIS PROPOSED CONDITIONS ANALYSIS**

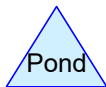




Subcat



Reach



Pond



Link

**Routing Diagram for 200311 - Existing Analysis**  
Prepared by Maser Consulting PA, Printed 3/18/2020  
HydroCAD® 10.00-22 s/n 04431 © 2018 HydroCAD Software Solutions LLC

## 200311 - Existing Analysis

Prepared by Maser Consulting PA

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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.177	74	>75% Grass cover, Good, HSG C (A1, A2, A4)
0.602	80	>75% Grass cover, Good, HSG D (A1, A2, A4)
0.976	98	Paved parking, HSG C (A1)
<b>2.755</b>	<b>84</b>	<b>TOTAL AREA</b>



## 200311 - Existing Analysis

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### Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.153	HSG C	A1, A2, A4
0.602	HSG D	A1, A2, A4
0.000	Other	
<b>2.755</b>		<b>TOTAL AREA</b>

## 200311 - Existing Analysis

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### Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.177	0.602	0.000	1.779	>75% Grass cover, Good	A1, A2, A4
0.000	0.000	0.976	0.000	0.000	0.976	Paved parking	A1
<b>0.000</b>	<b>0.000</b>	<b>2.153</b>	<b>0.602</b>	<b>0.000</b>	<b>2.755</b>	<b>TOTAL AREA</b>	

## 200311 - Existing Analysis

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NOAA 24-hr D A-2yr Rainfall=3.39"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.

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

### SubcatchmentA1: Ex Area 1

Runoff Area=54,670 sf 77.74% Impervious Runoff Depth=2.75"

Tc=10.0 min CN=77/98 Runoff=3.10 cfs 0.288 af

### SubcatchmentA2: Ex Area 2

Runoff Area=57,756 sf 0.00% Impervious Runoff Depth=1.29"

Flow Length=550' Tc=13.8 min CN=76/0 Runoff=1.49 cfs 0.142 af

### Link A3: TOTAL

Inflow=4.47 cfs 0.430 af

Primary=4.47 cfs 0.430 af

### SubcatchmentA4: Offsite Drainage Area

Runoff Area=7,578 sf 0.00% Impervious Runoff Depth=1.29"

Tc=10.0 min CN=76/0 Runoff=0.22 cfs 0.019 af

**Total Runoff Area = 2.755 ac Runoff Volume = 0.449 af Average Runoff Depth = 1.96"**  
**64.58% Pervious = 1.779 ac 35.42% Impervious = 0.976 ac**

## 200311 - Existing Analysis

Prepared by Maser Consulting PA

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NOAA 24-hr D A-2yr Rainfall=3.39"

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### Summary for Subcatchment A1: Ex Area 1

Runoff = 3.10 cfs @ 12.17 hrs, Volume= 0.288 af, Depth= 2.75"

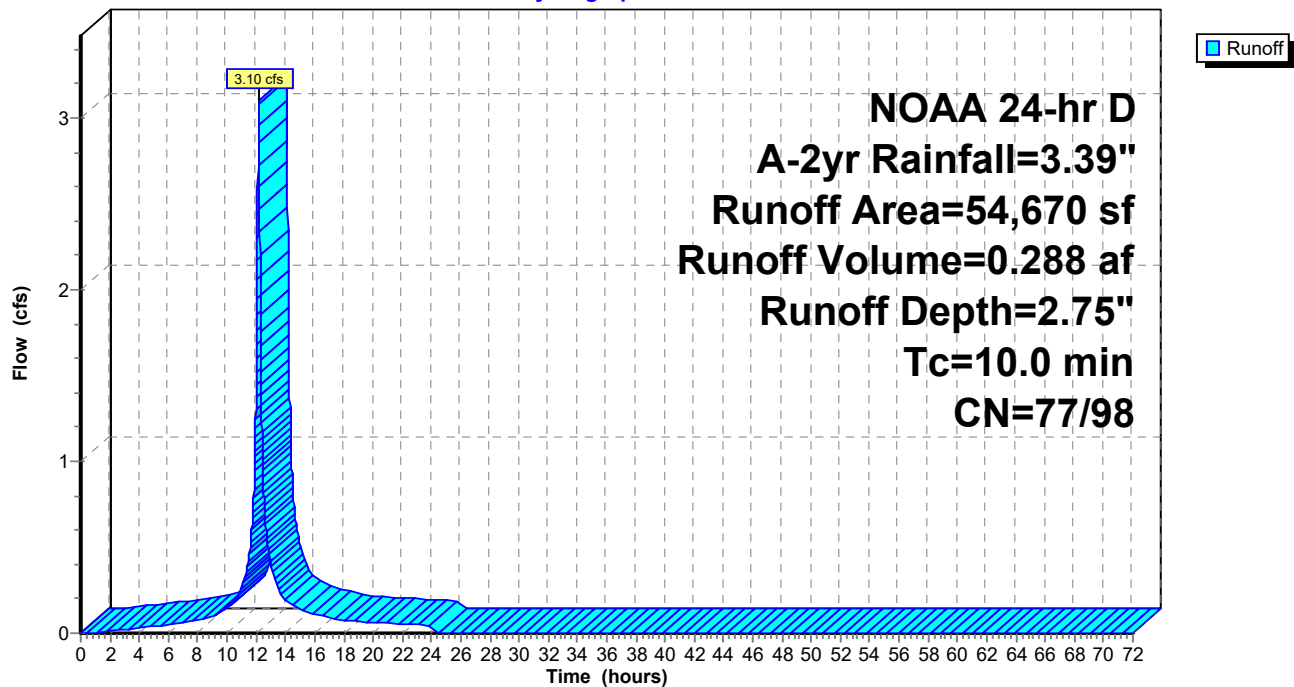
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
42,500	98	Paved parking, HSG C
5,780	74	>75% Grass cover, Good, HSG C
6,390	80	>75% Grass cover, Good, HSG D
54,670	93	Weighted Average
12,170	77	22.26% Pervious Area
42,500	98	77.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, 1

### Subcatchment A1: Ex Area 1

Hydrograph



**200311 - Existing Analysis**

Prepared by Maser Consulting PA

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NOAA 24-hr D A-2yr Rainfall=3.39"

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**Summary for Subcatchment A2: Ex Area 2**

Runoff = 1.49 cfs @ 12.22 hrs, Volume= 0.142 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

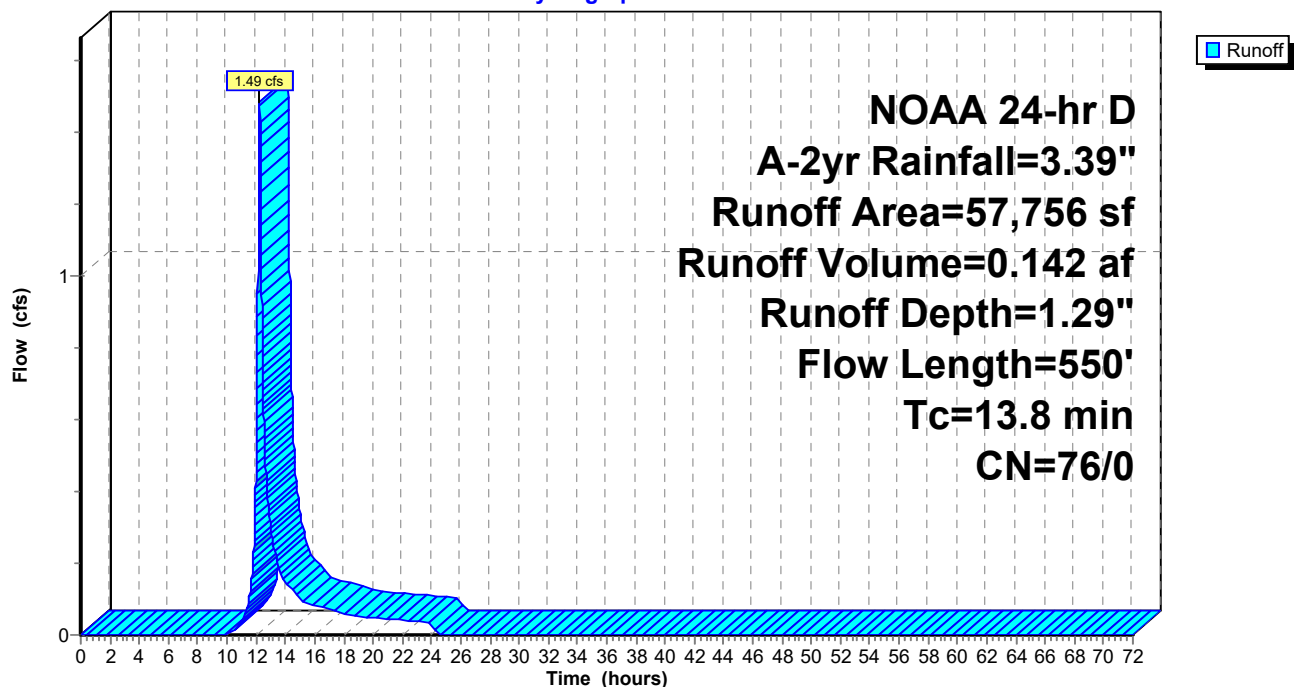
Area (sf)	CN	Description
17,809	80	>75% Grass cover, Good, HSG D
39,947	74	>75% Grass cover, Good, HSG C
57,756	76	Weighted Average
57,756	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	100	0.0350	0.22		<b>Sheet Flow, 1</b> Grass: Short n= 0.150 P2= 3.40"
4.7	300	0.0050	1.06		<b>Shallow Concentrated Flow, 2</b> Grassed Waterway Kv= 15.0 fps
0.4	50	0.0200	2.12		<b>Shallow Concentrated Flow, 3</b> Grassed Waterway Kv= 15.0 fps
1.1	100	0.0100	1.50		<b>Shallow Concentrated Flow, 4</b> Grassed Waterway Kv= 15.0 fps
13.8	550	Total			

**Subcatchment A2: Ex Area 2**

Hydrograph



## 200311 - Existing Analysis

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NOAA 24-hr D A-2yr Rainfall=3.39"

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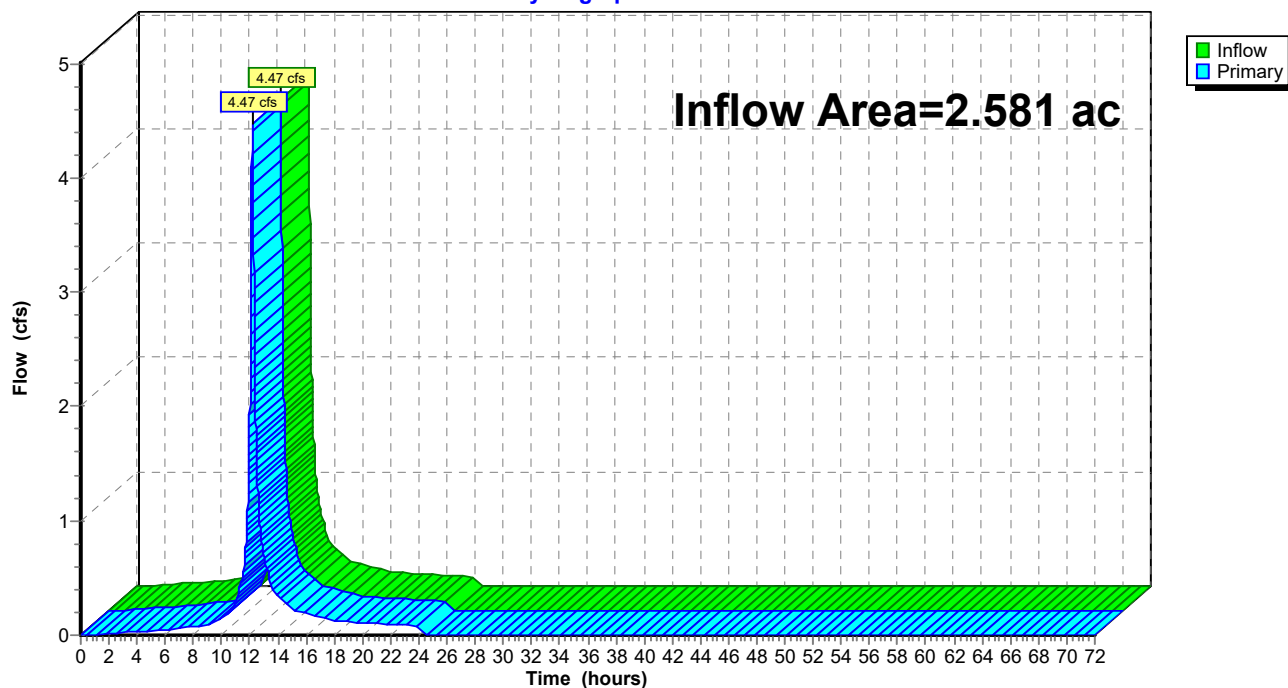
### Summary for Link A3: TOTAL

Inflow Area = 2.581 ac, 37.80% Impervious, Inflow Depth = 2.00" for A-2yr event  
Inflow = 4.47 cfs @ 12.18 hrs, Volume= 0.430 af  
Primary = 4.47 cfs @ 12.18 hrs, Volume= 0.430 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

### Link A3: TOTAL

Hydrograph



## 200311 - Existing Analysis

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NOAA 24-hr D A-2yr Rainfall=3.39"

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### Summary for Subcatchment A4: Offsite Drainage Area

Runoff = 0.22 cfs @ 12.18 hrs, Volume= 0.019 af, Depth= 1.29"

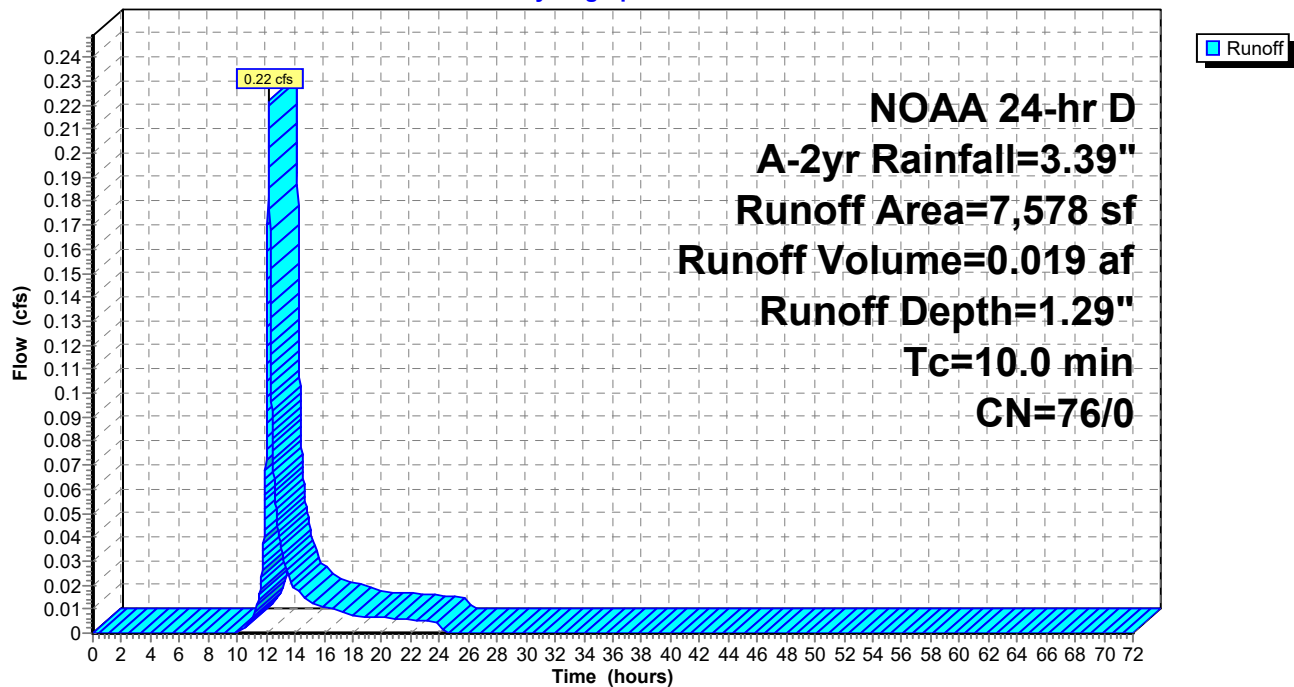
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
2,024	80	>75% Grass cover, Good, HSG D
7,578	76	Weighted Average
7,578	76	100.00% Pervious Area

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

### Subcatchment A4: Offsite Drainage Area

Hydrograph



## 200311 - Existing Analysis

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NOAA 24-hr D B-10yr Rainfall=5.17"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points  
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

### SubcatchmentA1: Ex Area 1

Runoff Area=54,670 sf 77.74% Impervious Runoff Depth=4.45"  
Tc=10.0 min CN=77/98 Runoff=4.97 cfs 0.465 af

### SubcatchmentA2: Ex Area 2

Runoff Area=57,756 sf 0.00% Impervious Runoff Depth=2.68"  
Flow Length=550' Tc=13.8 min CN=76/0 Runoff=3.16 cfs 0.296 af

### Link A3: TOTAL

Inflow=7.94 cfs 0.761 af  
Primary=7.94 cfs 0.761 af

### SubcatchmentA4: Offsite Drainage Area

Runoff Area=7,578 sf 0.00% Impervious Runoff Depth=2.68"  
Tc=10.0 min CN=76/0 Runoff=0.47 cfs 0.039 af

**Total Runoff Area = 2.755 ac Runoff Volume = 0.800 af Average Runoff Depth = 3.48"**  
**64.58% Pervious = 1.779 ac 35.42% Impervious = 0.976 ac**



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NOAA 24-hr D B-10yr Rainfall=5.17"

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### Summary for Subcatchment A1: Ex Area 1

Runoff = 4.97 cfs @ 12.17 hrs, Volume= 0.465 af, Depth= 4.45"

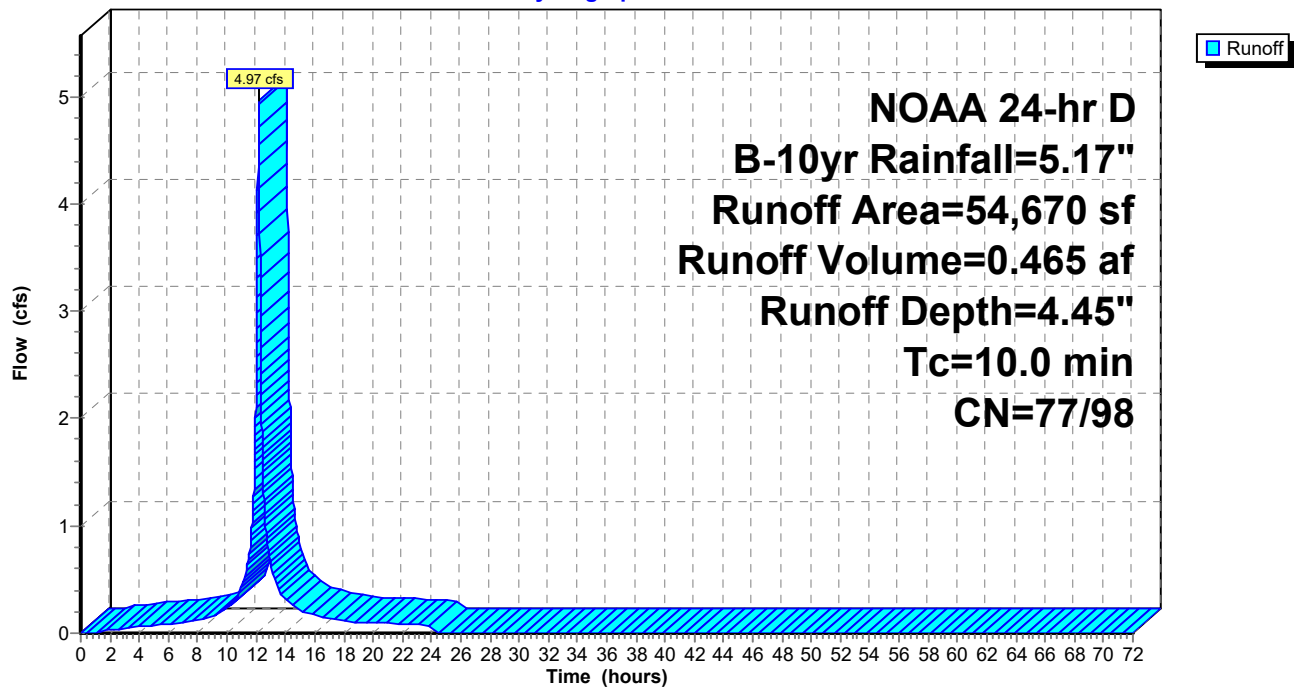
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
42,500	98	Paved parking, HSG C
5,780	74	>75% Grass cover, Good, HSG C
6,390	80	>75% Grass cover, Good, HSG D
54,670	93	Weighted Average
12,170	77	22.26% Pervious Area
42,500	98	77.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, 1

### Subcatchment A1: Ex Area 1

Hydrograph



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NOAA 24-hr D B-10yr Rainfall=5.17"

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**Summary for Subcatchment A2: Ex Area 2**

Runoff = 3.16 cfs @ 12.22 hrs, Volume= 0.296 af, Depth= 2.68"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

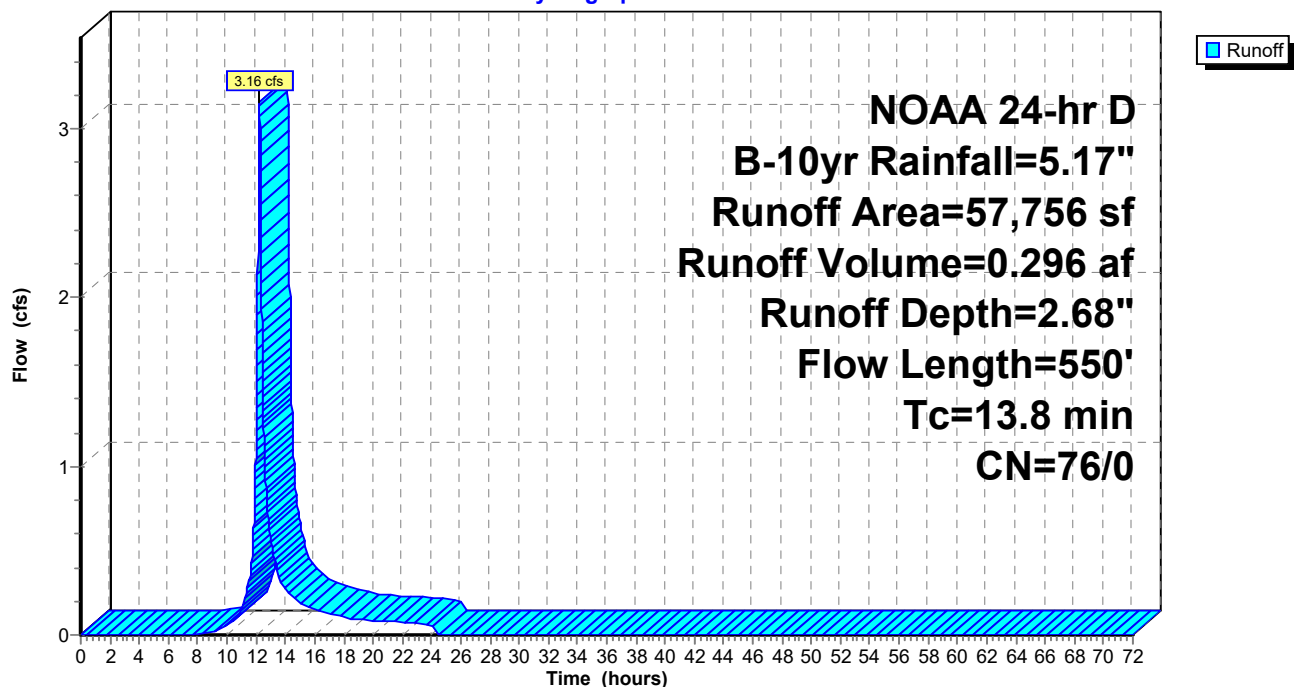
Area (sf)	CN	Description
17,809	80	>75% Grass cover, Good, HSG D
39,947	74	>75% Grass cover, Good, HSG C
57,756	76	Weighted Average
57,756	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	100	0.0350	0.22		<b>Sheet Flow, 1</b> Grass: Short n= 0.150 P2= 3.40"
4.7	300	0.0050	1.06		<b>Shallow Concentrated Flow, 2</b> Grassed Waterway Kv= 15.0 fps
0.4	50	0.0200	2.12		<b>Shallow Concentrated Flow, 3</b> Grassed Waterway Kv= 15.0 fps
1.1	100	0.0100	1.50		<b>Shallow Concentrated Flow, 4</b> Grassed Waterway Kv= 15.0 fps
13.8	550	Total			

**Subcatchment A2: Ex Area 2**

Hydrograph



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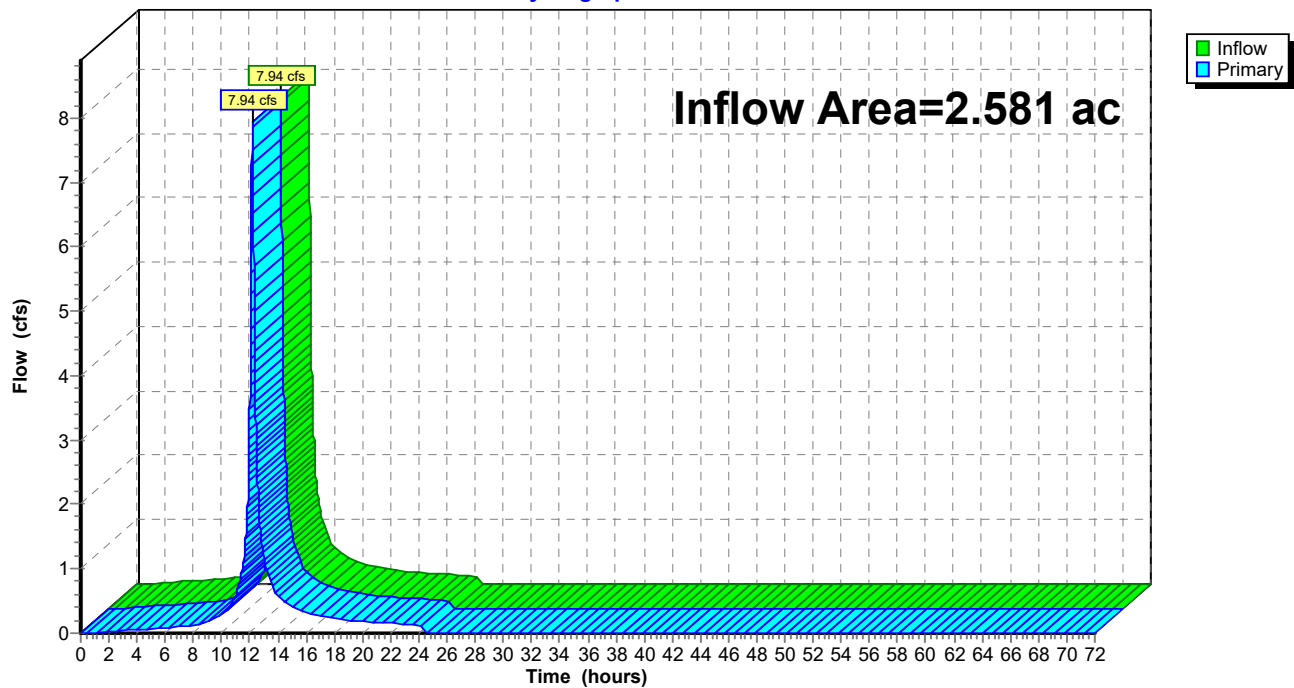
### Summary for Link A3: TOTAL

Inflow Area = 2.581 ac, 37.80% Impervious, Inflow Depth = 3.54" for B-10yr event  
Inflow = 7.94 cfs @ 12.19 hrs, Volume= 0.761 af  
Primary = 7.94 cfs @ 12.19 hrs, Volume= 0.761 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

### Link A3: TOTAL

Hydrograph



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NOAA 24-hr D B-10yr Rainfall=5.17"

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### Summary for Subcatchment A4: Offsite Drainage Area

Runoff = 0.47 cfs @ 12.18 hrs, Volume= 0.039 af, Depth= 2.68"

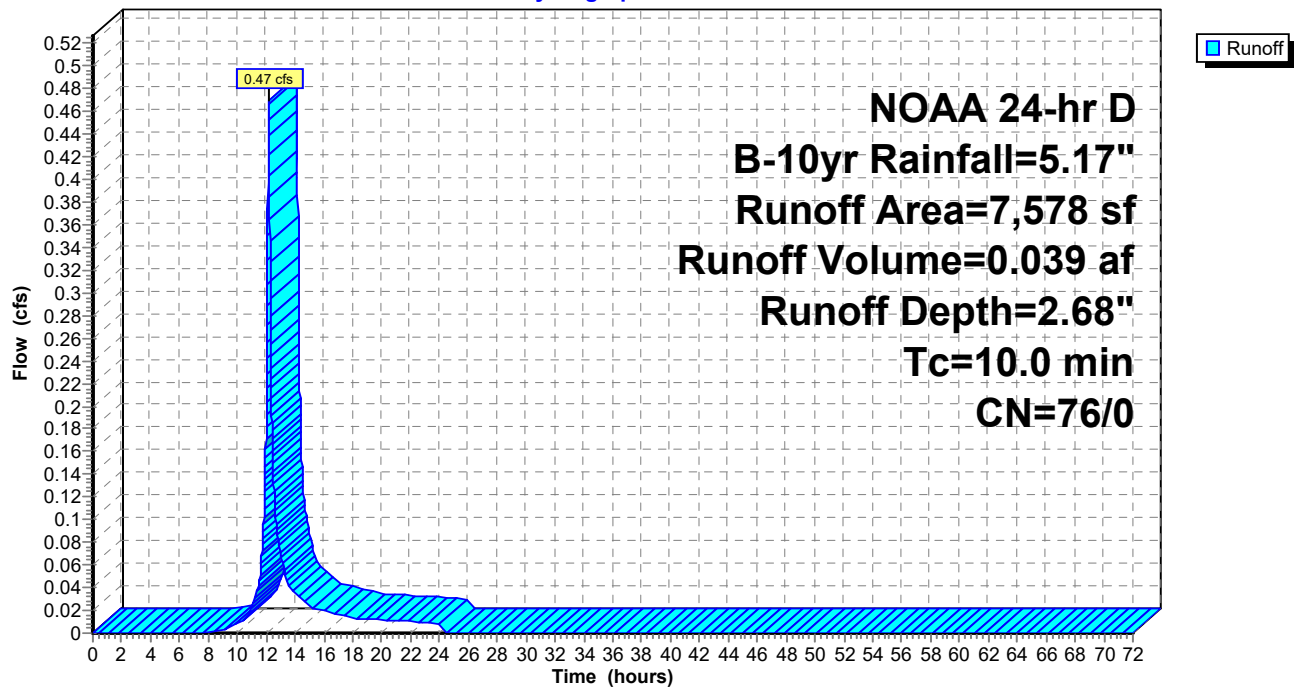
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
2,024	80	>75% Grass cover, Good, HSG D
7,578	76	Weighted Average
7,578	76	100.00% Pervious Area

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

### Subcatchment A4: Offsite Drainage Area

Hydrograph



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NOAA 24-hr D C-100yr Rainfall=8.69"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points  
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

### SubcatchmentA1: Ex Area 1

Runoff Area=54,670 sf 77.74% Impervious Runoff Depth=7.88"  
Tc=10.0 min CN=77/98 Runoff=8.70 cfs 0.825 af

### SubcatchmentA2: Ex Area 2

Runoff Area=57,756 sf 0.00% Impervious Runoff Depth=5.79"  
Flow Length=550' Tc=13.8 min CN=76/0 Runoff=6.75 cfs 0.640 af

### Link A3: TOTAL

Inflow=15.13 cfs 1.464 af  
Primary=15.13 cfs 1.464 af

### SubcatchmentA4: Offsite Drainage Area

Runoff Area=7,578 sf 0.00% Impervious Runoff Depth=5.79"  
Tc=10.0 min CN=76/0 Runoff=1.00 cfs 0.084 af

**Total Runoff Area = 2.755 ac Runoff Volume = 1.548 af Average Runoff Depth = 6.74"**  
**64.58% Pervious = 1.779 ac 35.42% Impervious = 0.976 ac**

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NOAA 24-hr D C-100yr Rainfall=8.69"

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**Summary for Subcatchment A1: Ex Area 1**

Runoff = 8.70 cfs @ 12.17 hrs, Volume= 0.825 af, Depth= 7.88"

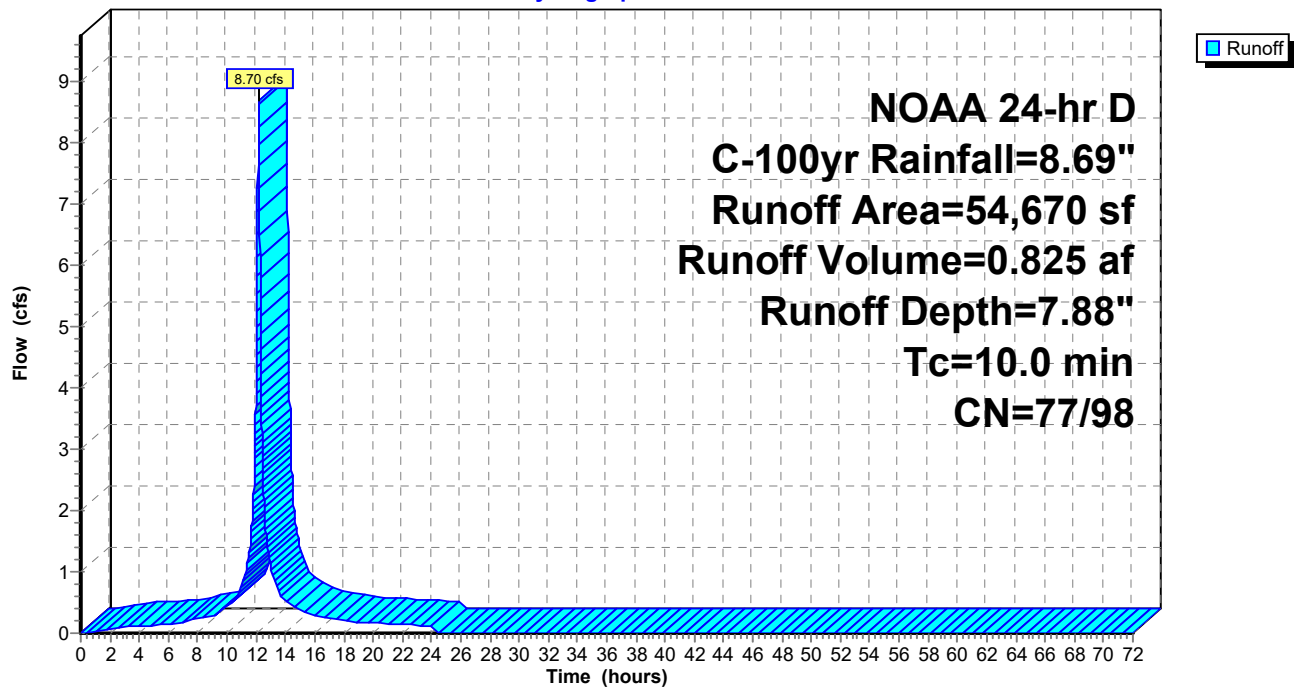
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D C-100yr Rainfall=8.69"

Area (sf)	CN	Description
42,500	98	Paved parking, HSG C
5,780	74	>75% Grass cover, Good, HSG C
6,390	80	>75% Grass cover, Good, HSG D
54,670	93	Weighted Average
12,170	77	22.26% Pervious Area
42,500	98	77.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, 1

**Subcatchment A1: Ex Area 1**

Hydrograph



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**Summary for Subcatchment A2: Ex Area 2**

Runoff = 6.75 cfs @ 12.22 hrs, Volume= 0.640 af, Depth= 5.79"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D C-100yr Rainfall=8.69"

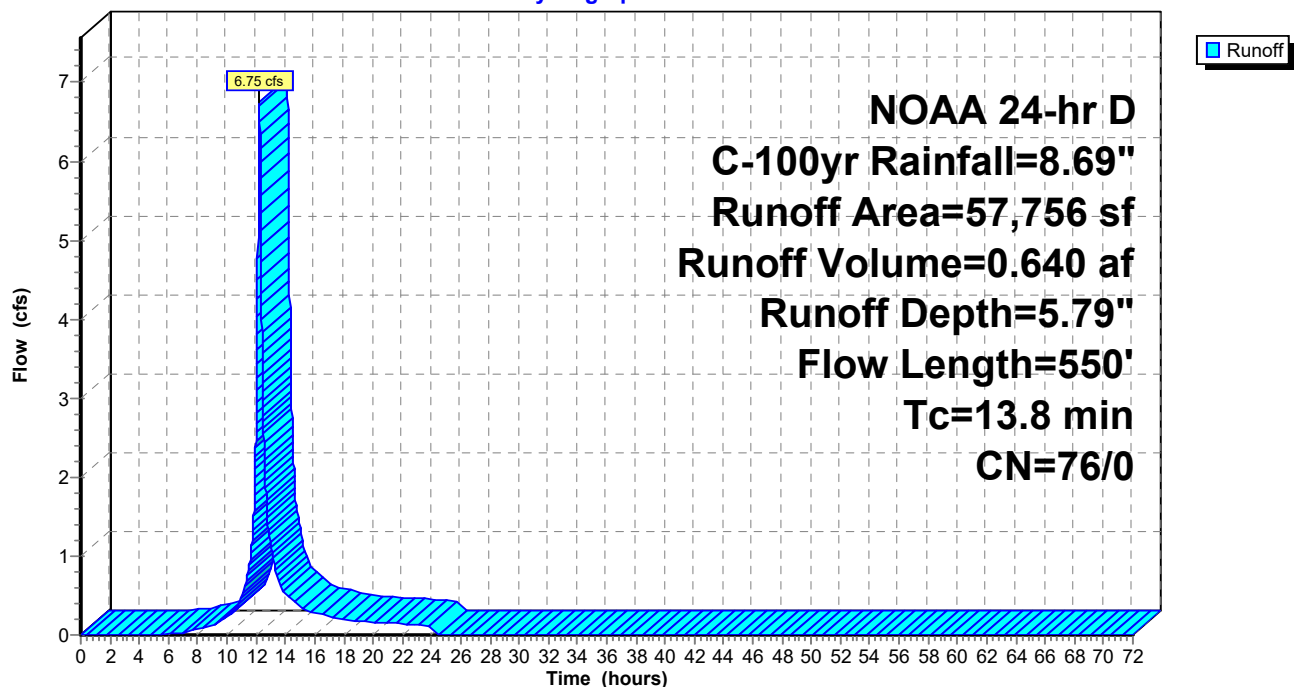
Area (sf)	CN	Description
17,809	80	>75% Grass cover, Good, HSG D
39,947	74	>75% Grass cover, Good, HSG C
57,756	76	Weighted Average
57,756	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	100	0.0350	0.22		<b>Sheet Flow, 1</b> Grass: Short n= 0.150 P2= 3.40"
4.7	300	0.0050	1.06		<b>Shallow Concentrated Flow, 2</b> Grassed Waterway Kv= 15.0 fps
0.4	50	0.0200	2.12		<b>Shallow Concentrated Flow, 3</b> Grassed Waterway Kv= 15.0 fps
1.1	100	0.0100	1.50		<b>Shallow Concentrated Flow, 4</b> Grassed Waterway Kv= 15.0 fps
13.8	550	Total			

**Subcatchment A2: Ex Area 2**

Hydrograph



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### Summary for Link A3: TOTAL

Inflow Area = 2.581 ac, 37.80% Impervious, Inflow Depth = 6.81" for C-100yr event

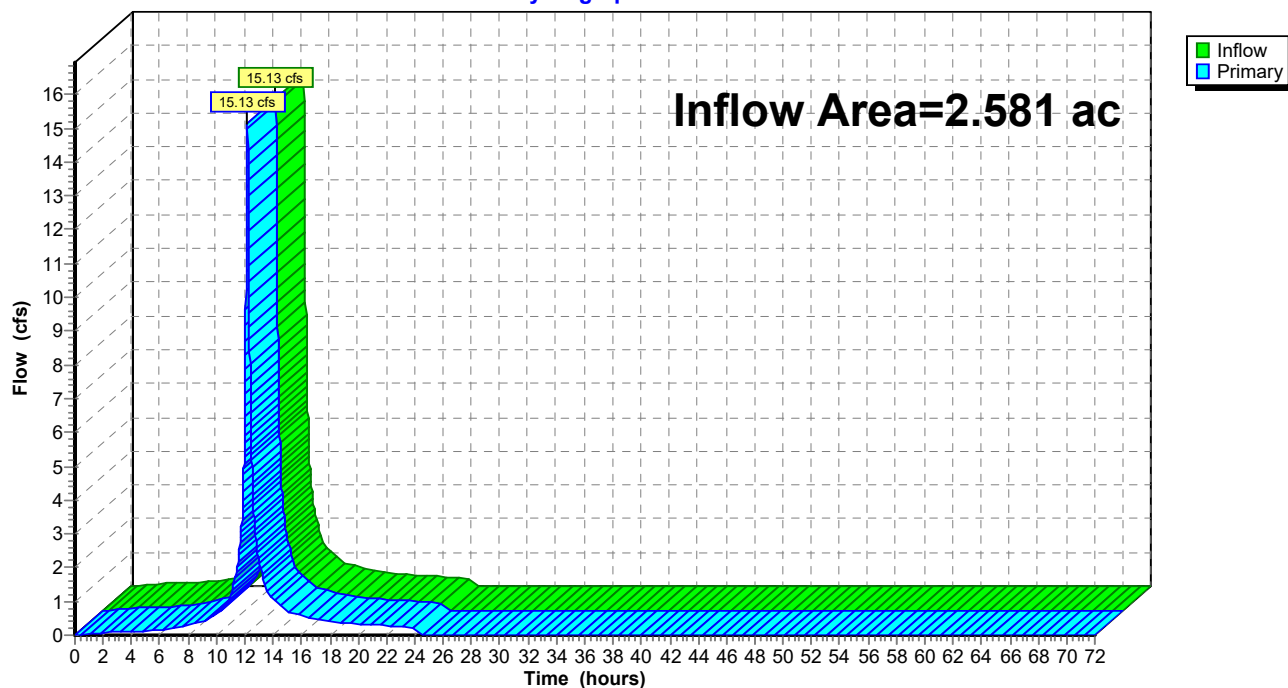
Inflow = 15.13 cfs @ 12.19 hrs, Volume= 1.464 af

Primary = 15.13 cfs @ 12.19 hrs, Volume= 1.464 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

### Link A3: TOTAL

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NOAA 24-hr D C-100yr Rainfall=8.69"

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### Summary for Subcatchment A4: Offsite Drainage Area

Runoff = 1.00 cfs @ 12.17 hrs, Volume= 0.084 af, Depth= 5.79"

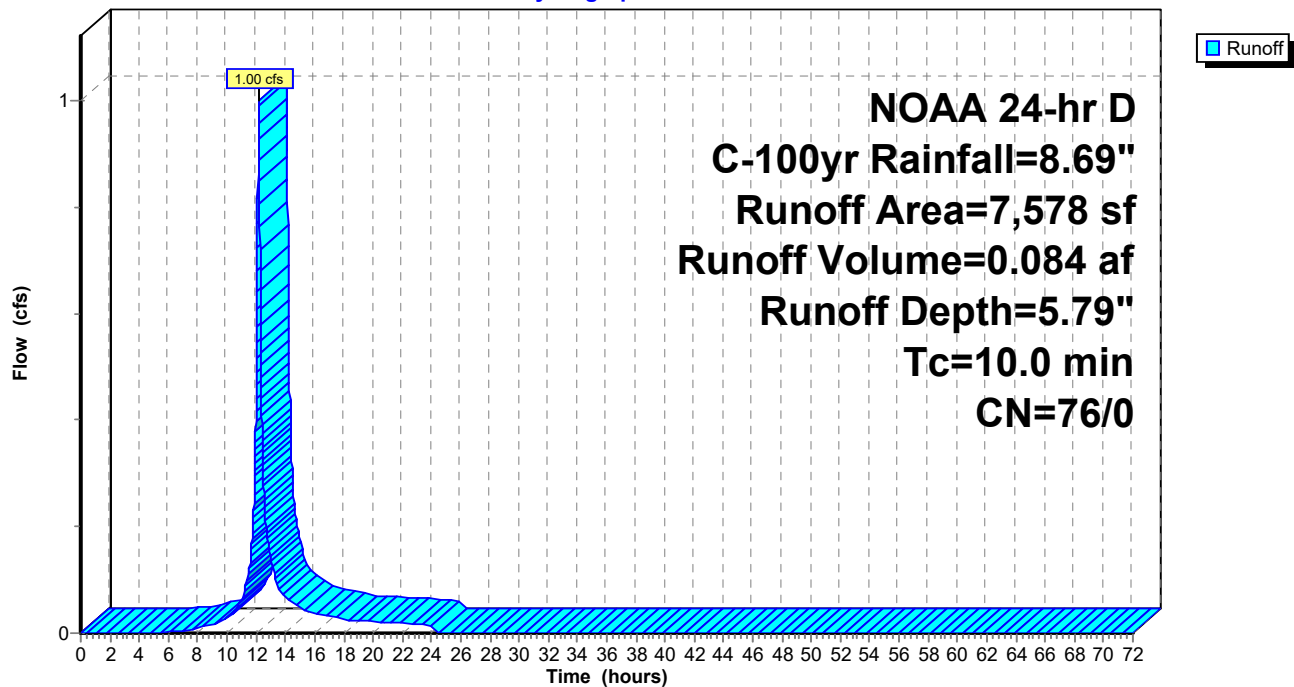
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D C-100yr Rainfall=8.69"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
2,024	80	>75% Grass cover, Good, HSG D
7,578	76	Weighted Average
7,578	76	100.00% Pervious Area

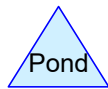
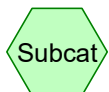
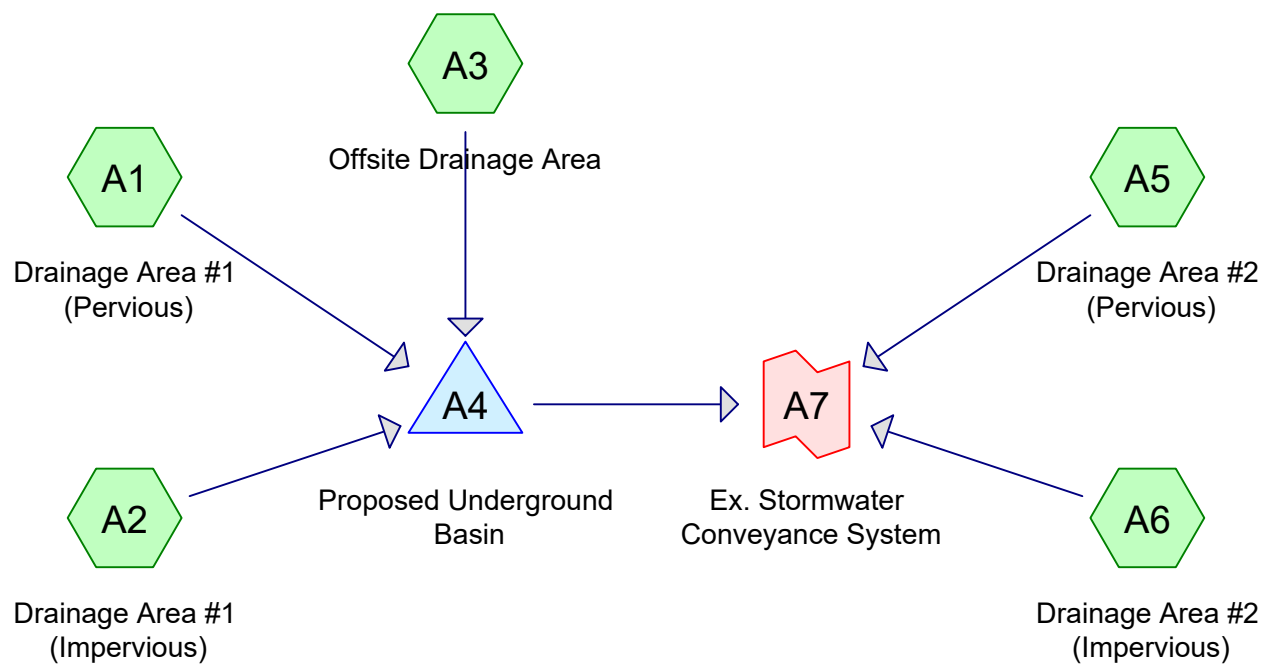
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,

### Subcatchment A4: Offsite Drainage Area

Hydrograph







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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.391	74	>75% Grass cover, Good, HSG C (A1, A3, A5)
0.345	80	>75% Grass cover, Good, HSG D (A1, A3, A5)
1.845	98	Paved parking (A2)
0.175	98	Unconnected pavement (A6)
<b>2.755</b>	<b>92</b>	<b>TOTAL AREA</b>

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### Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.391	HSG C	A1, A3, A5
0.345	HSG D	A1, A3, A5
2.020	Other	A2, A6
<b>2.755</b>		<b>TOTAL AREA</b>

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### Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.391	0.345	0.000	0.735	>75% Grass cover, Good	A1, A3, A5
0.000	0.000	0.000	0.000	1.845	1.845	Paved parking	A2
0.000	0.000	0.000	0.000	0.175	0.175	Unconnected pavement	A6
<b>0.000</b>	<b>0.000</b>	<b>0.391</b>	<b>0.345</b>	<b>2.020</b>	<b>2.755</b>	<b>TOTAL AREA</b>	

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### Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	A4	9.80	9.00	55.0	0.0145	0.013	15.0	0.0	0.0

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Time span=0.00-200.00 hrs, dt=0.01 hrs, 20001 points

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.

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

**SubcatchmentA1: Drainage Area #1**      Runoff Area=9,195 sf   0.00% Impervious   Runoff Depth=1.35"  
Tc=10.0 min   CN=77/0   Runoff=0.28 cfs   0.024 af

**SubcatchmentA2: Drainage Area #1**      Runoff Area=80,361 sf   100.00% Impervious   Runoff Depth=3.16"  
Tc=10.0 min   CN=0/98   Runoff=5.16 cfs   0.485 af

**SubcatchmentA3: Offsite Drainage Area**      Runoff Area=7,578 sf   0.00% Impervious   Runoff Depth=1.29"  
Tc=10.0 min   CN=76/0   Runoff=0.22 cfs   0.019 af

**Pond A4: Proposed Underground Basin**      Peak Elev=11.62'   Storage=6,307 cf   Inflow=5.66 cfs   0.528 af  
Outflow=1.48 cfs   0.528 af

**SubcatchmentA5: Drainage Area #2**      Runoff Area=15,260 sf   0.00% Impervious   Runoff Depth=1.35"  
Tc=10.0 min   CN=77/0   Runoff=0.47 cfs   0.039 af

**SubcatchmentA6: Drainage Area #2**      Runoff Area=7,610 sf   100.00% Impervious   Runoff Depth=3.16"  
Tc=10.0 min   CN=0/98   Runoff=0.49 cfs   0.046 af

**Link A7: Ex. Stormwater Conveyance System**      Inflow=2.22 cfs   0.613 af  
Primary=2.22 cfs   0.613 af

**Total Runoff Area = 2.755 ac   Runoff Volume = 0.613 af   Average Runoff Depth = 2.67"**  
**26.69% Pervious = 0.735 ac   73.31% Impervious = 2.020 ac**



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NOAA 24-hr D A-2yr Rainfall=3.39"

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**Summary for Subcatchment A1: Drainage Area #1 (Pervious)**

Runoff = 0.28 cfs @ 12.18 hrs, Volume= 0.024 af, Depth= 1.35"

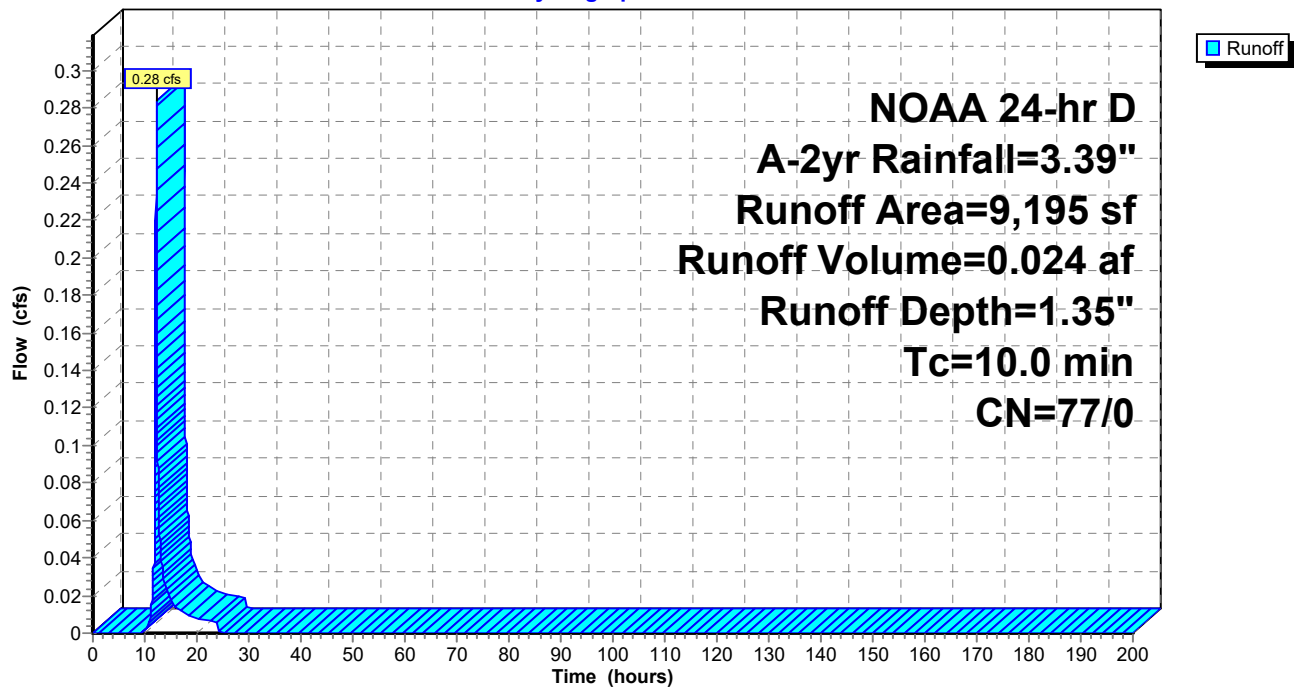
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
4,150	74	>75% Grass cover, Good, HSG C
5,045	80	>75% Grass cover, Good, HSG D
9,195	77	Weighted Average
9,195	77	100.00% Pervious Area

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

**Subcatchment A1: Drainage Area #1 (Pervious)**

Hydrograph



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**Summary for Subcatchment A2: Drainage Area #1 (Impervious)**

Runoff = 5.16 cfs @ 12.17 hrs, Volume= 0.485 af, Depth= 3.16"

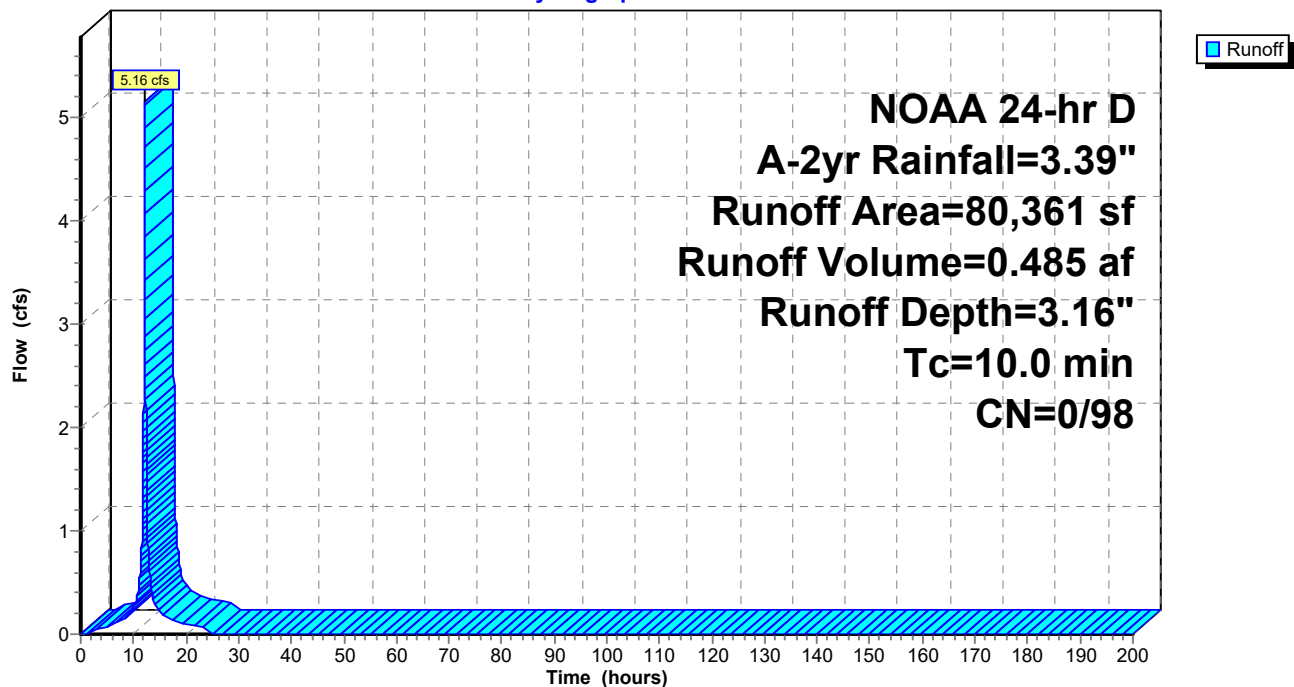
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

	Area (sf)	CN	Description
*	80,361	98	Paved parking
	80,361	98	100.00% Impervious Area

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

**Subcatchment A2: Drainage Area #1 (Impervious)**

Hydrograph



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**Summary for Subcatchment A3: Offsite Drainage Area**

Runoff = 0.22 cfs @ 12.18 hrs, Volume= 0.019 af, Depth= 1.29"

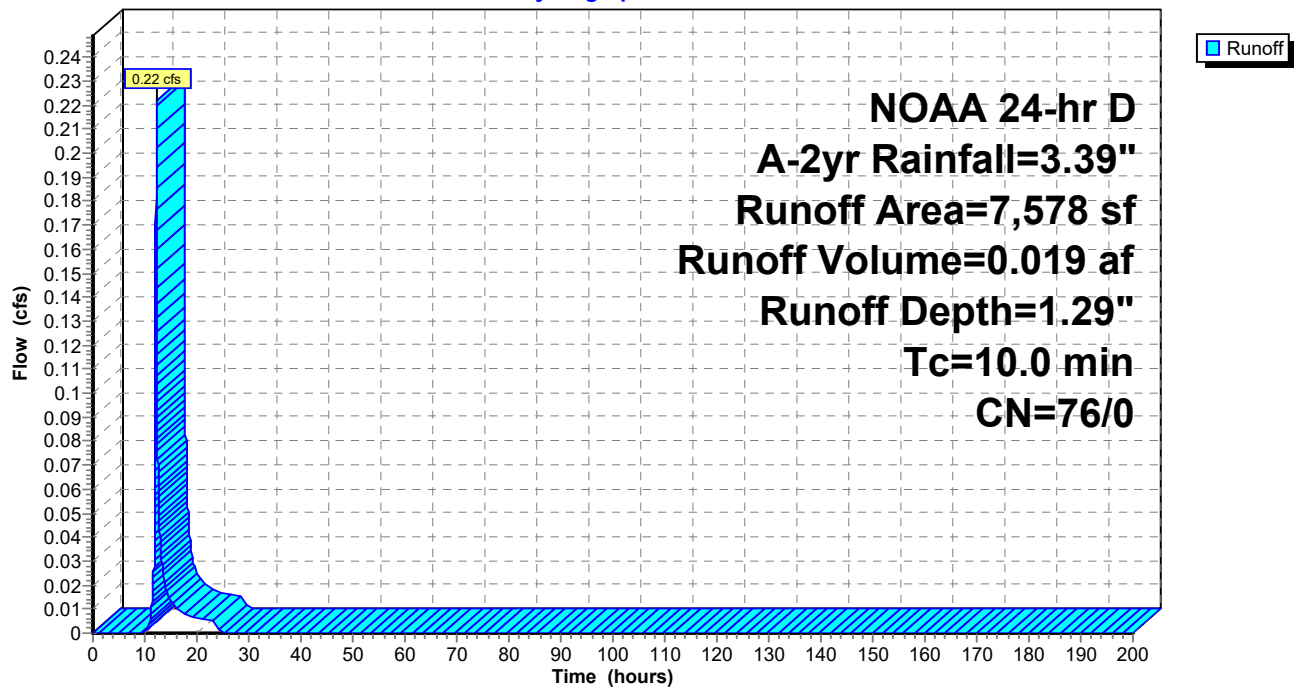
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
2,024	80	>75% Grass cover, Good, HSG D
7,578	76	Weighted Average
7,578	76	100.00% Pervious Area

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

**Subcatchment A3: Offsite Drainage Area**

Hydrograph



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**Summary for Pond A4: Proposed Underground Basin**

Inflow Area = 2.230 ac, 82.73% Impervious, Inflow Depth = 2.84" for A-2yr event  
 Inflow = 5.66 cfs @ 12.17 hrs, Volume= 0.528 af  
 Outflow = 1.48 cfs @ 12.51 hrs, Volume= 0.528 af, Atten= 74%, Lag= 20.2 min  
 Primary = 1.48 cfs @ 12.51 hrs, Volume= 0.528 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
 Peak Elev= 11.62' @ 12.51 hrs Surf.Area= 6,727 sf Storage= 6,307 cf

Plug-Flow detention time= 59.0 min calculated for 0.528 af (100% of inflow)  
 Center-of-Mass det. time= 59.4 min ( 828.6 - 769.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	10.00'	6,286 cf	<b>74.75'W x 90.00'L x 4.00'H Field A</b> 26,910 cf Overall - 11,196 cf Embedded = 15,714 cf x 40.0% Voids
#2A	10.00'	8,971 cf	<b>ADS N-12 36" x 56 Inside #1</b> Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.1 cf 14 Rows of 4 Chambers 71.75' Header x 7.10 sf x 2 = 1,018.8 cf Inside
		15,256 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	9.80'	<b>15.0" Round Culvert</b> L= 55.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.80' / 9.00' S= 0.0145 ' /' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	10.00'	<b>7.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	11.65'	<b>3.8' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	13.00'	<b>5.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=1.48 cfs @ 12.51 hrs HW=11.62' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 1.48 cfs of 6.45 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.48 cfs @ 5.54 fps)
- 3=Sharp-Crested Rectangular Weir( Controls 0.00 cfs)
- 4=Sharp-Crested Rectangular Weir( Controls 0.00 cfs)

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NOAA 24-hr D A-2yr Rainfall=3.39"

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### Pond A4: Proposed Underground Basin - Chamber Wizard Field A

#### Chamber Model = ADS N-12 36" (ADS N-12® Pipe)

Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf

Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.1 cf

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

4 Chambers/Row x 20.00' Long +3.50' Header x 2 = 87.00' Row Length +18.0" End Stone x 2 = 90.00' Base Length

14 Rows x 42.0" Wide + 21.0" Spacing x 13 + 18.0" Side Stone x 2 = 74.75' Base Width

42.0" Chamber Height + 6.00" Cover = 4.00' Field Height

56 Chambers x 142.0 cf + 71.75' Header x 7.10 sf x 2 = 8,970.8 cf Chamber Storage

56 Chambers x 177.1 cf + 71.75' Header x 8.86 sf x 2 = 11,191.1 cf Displacement

26,909.9 cf Field - 11,191.1 cf Chambers = 15,718.8 cf Stone x 40.0% Voids = 6,287.5 cf Stone Storage

Chamber Storage + Stone Storage = 15,258.4 cf = 0.350 af

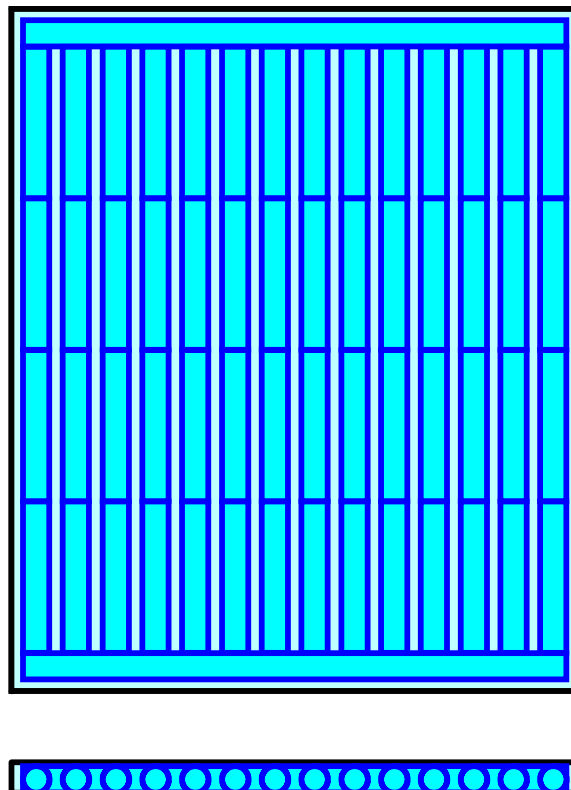
Overall Storage Efficiency = 56.7%

Overall System Size = 90.00' x 74.75' x 4.00'

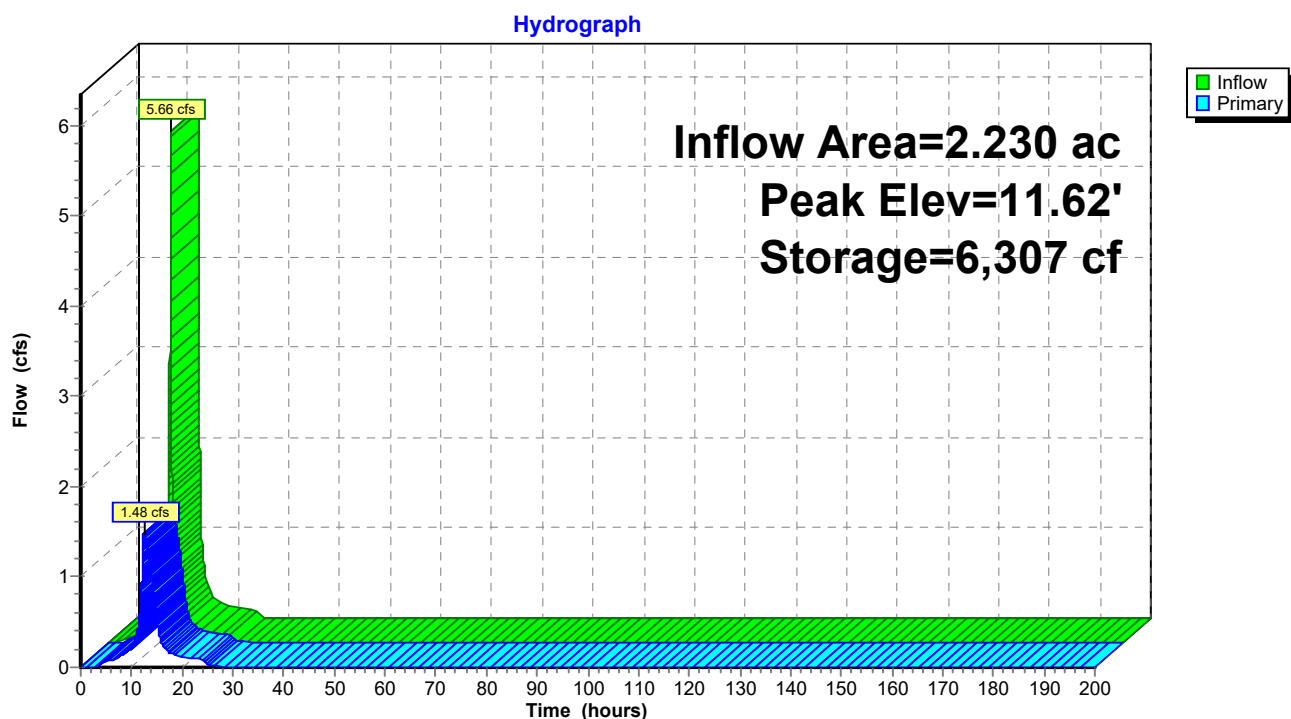
56 Chambers

996.7 cy Field

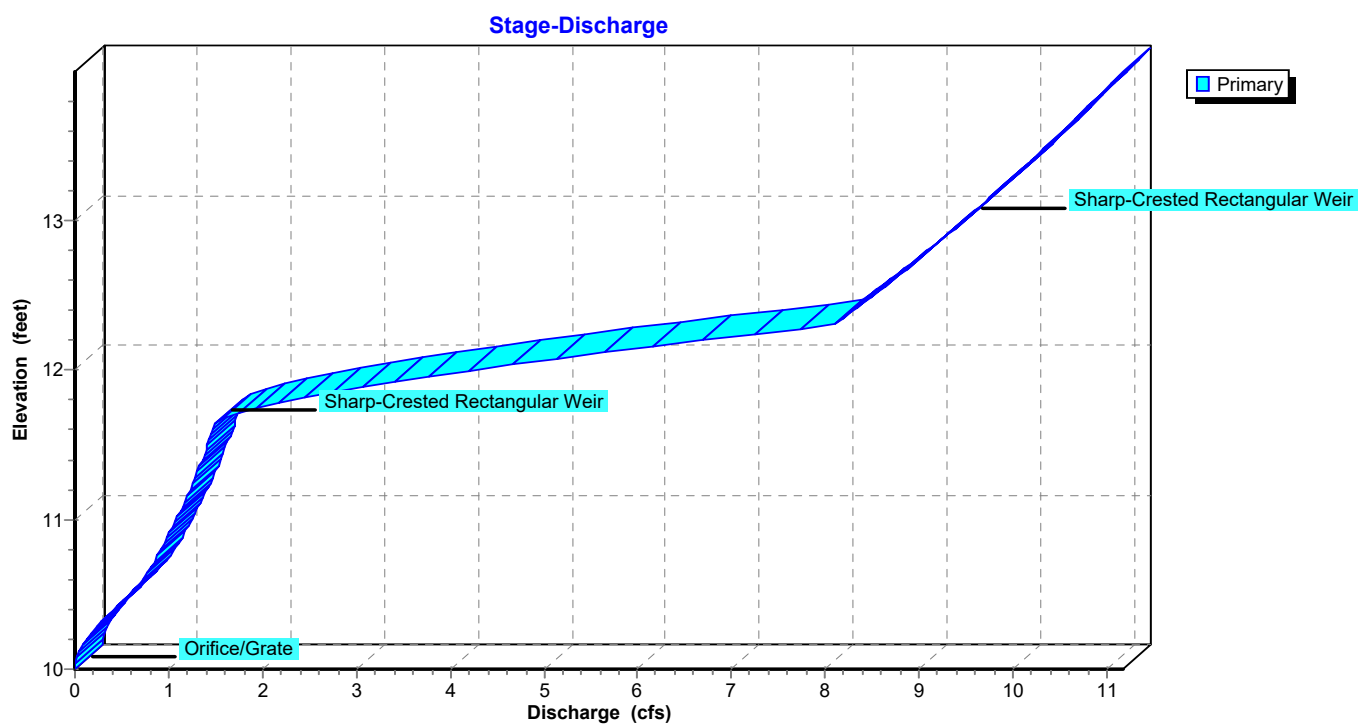
582.2 cy Stone



## Pond A4: Proposed Underground Basin



## Pond A4: Proposed Underground Basin



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NOAA 24-hr D A-2yr Rainfall=3.39"

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**Summary for Subcatchment A5: Drainage Area #2 (Pervious)**

Runoff = 0.47 cfs @ 12.18 hrs, Volume= 0.039 af, Depth= 1.35"

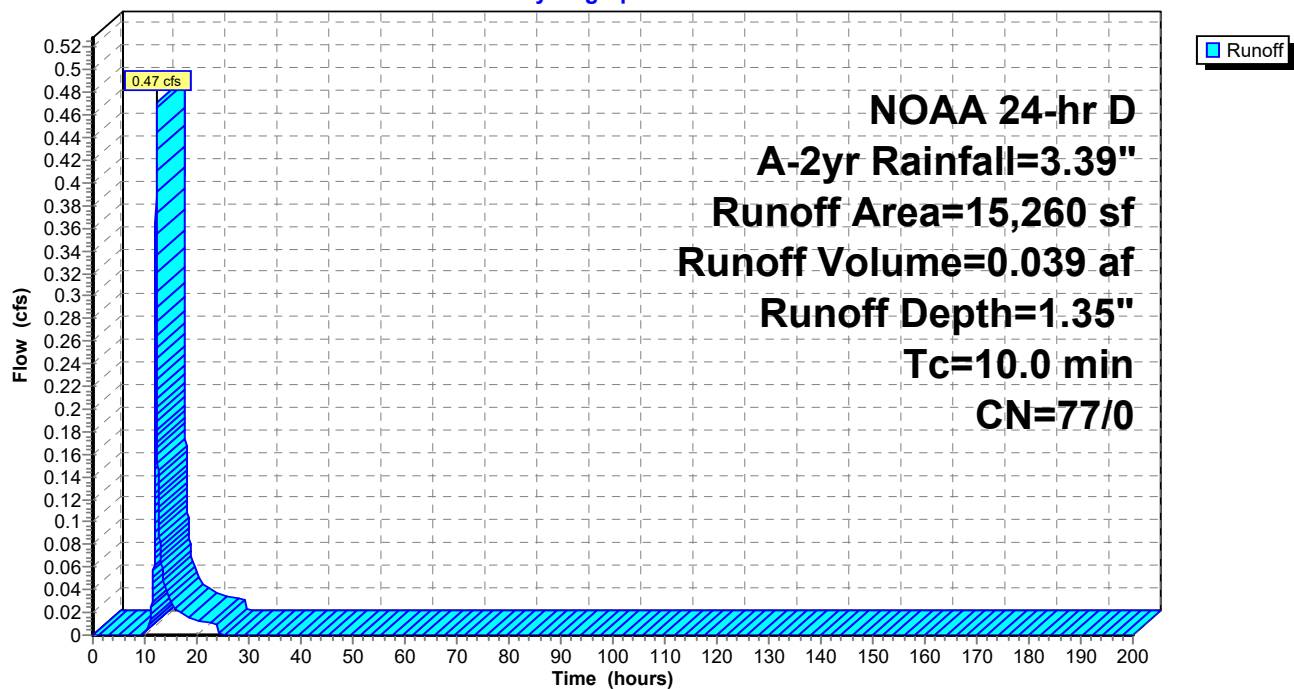
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
7,950	80	>75% Grass cover, Good, HSG D
7,310	74	>75% Grass cover, Good, HSG C
15,260	77	Weighted Average
15,260	77	100.00% Pervious Area

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

**Subcatchment A5: Drainage Area #2 (Pervious)**

Hydrograph



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**Summary for Subcatchment A6: Drainage Area #2 (Impervious)**

Runoff = 0.49 cfs @ 12.17 hrs, Volume= 0.046 af, Depth= 3.16"

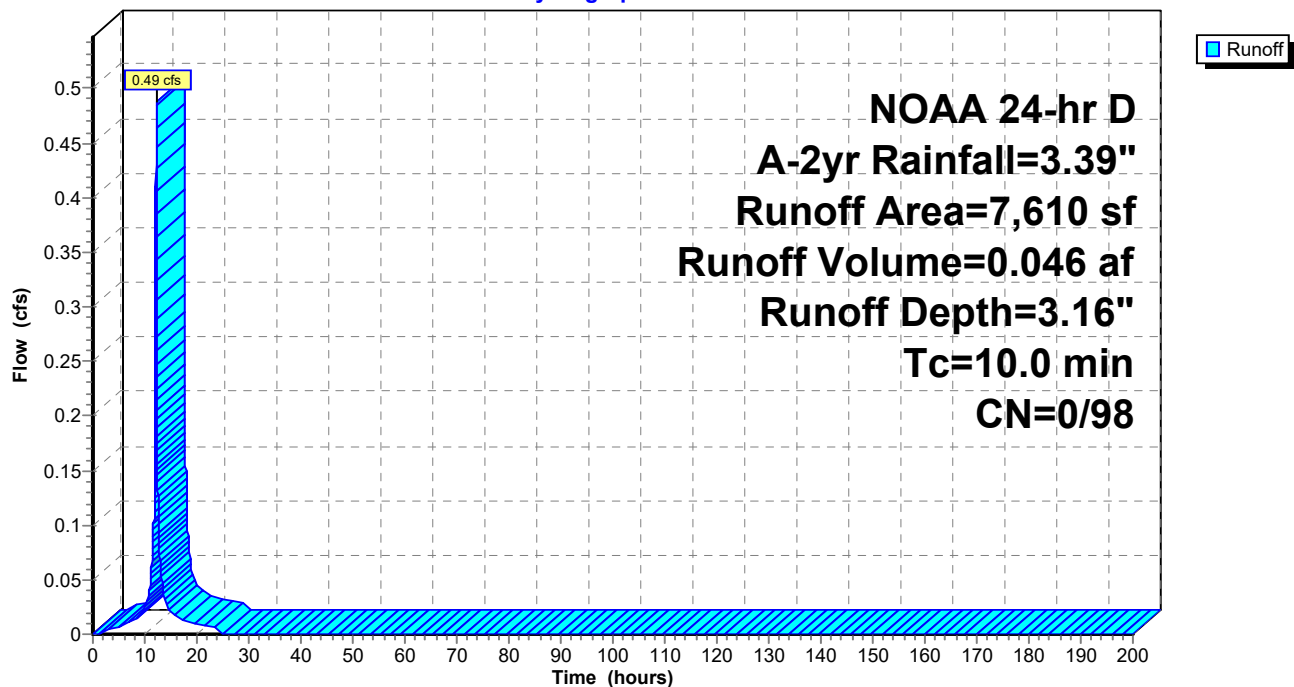
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
7,610	98	Unconnected pavement
7,610	98	100.00% Impervious Area

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

**Subcatchment A6: Drainage Area #2 (Impervious)**

Hydrograph





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NOAA 24-hr D A-2yr Rainfall=3.39"

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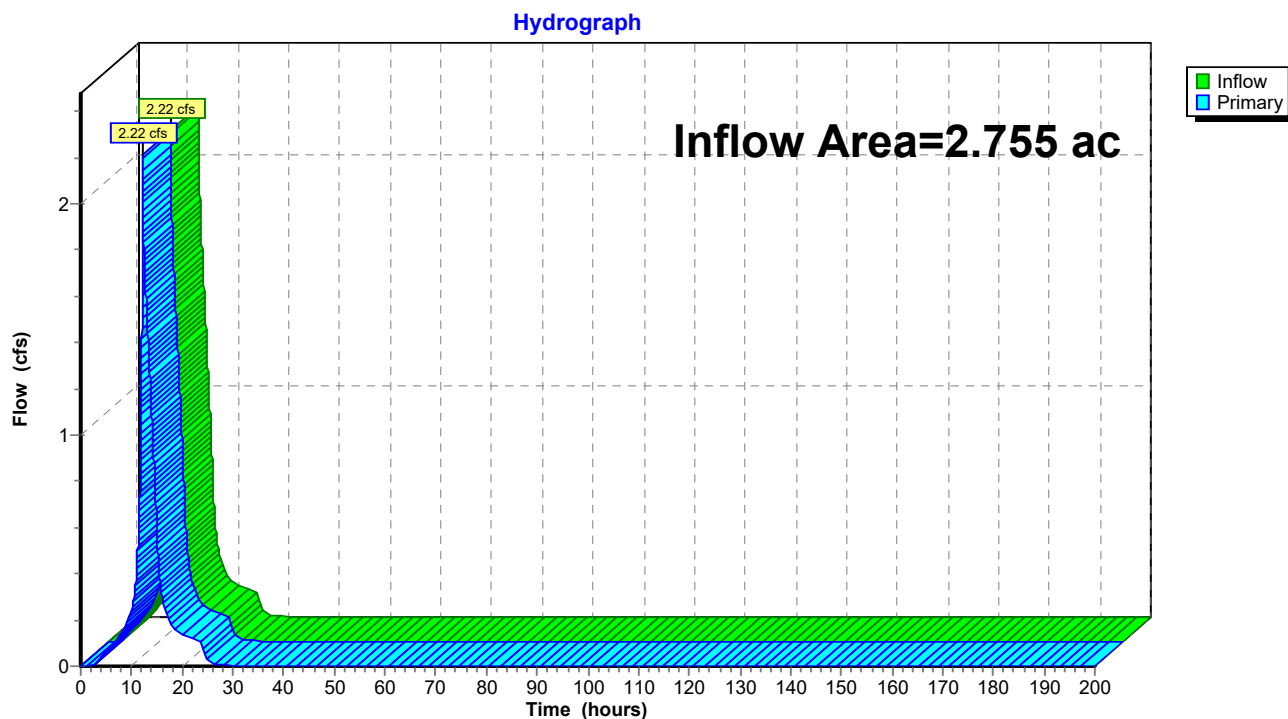
Page 15

### Summary for Link A7: Ex. Stormwater Conveyance System

Inflow Area = 2.755 ac, 73.31% Impervious, Inflow Depth = 2.67" for A-2yr event  
Inflow = 2.22 cfs @ 12.19 hrs, Volume= 0.613 af  
Primary = 2.22 cfs @ 12.19 hrs, Volume= 0.613 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-200.00 hrs, dt= 0.01 hrs

### Link A7: Ex. Stormwater Conveyance System



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Time span=0.00-200.00 hrs, dt=0.01 hrs, 20001 points

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.

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

**SubcatchmentA1: Drainage Area #1**      Runoff Area=9,195 sf   0.00% Impervious   Runoff Depth=2.77"  
Tc=10.0 min   CN=77/0   Runoff=0.59 cfs   0.049 af

**SubcatchmentA2: Drainage Area #1**      Runoff Area=80,361 sf   100.00% Impervious   Runoff Depth=4.93"  
Tc=10.0 min   CN=0/98   Runoff=7.92 cfs   0.758 af

**SubcatchmentA3: Offsite Drainage Area**      Runoff Area=7,578 sf   0.00% Impervious   Runoff Depth=2.68"  
Tc=10.0 min   CN=76/0   Runoff=0.47 cfs   0.039 af

**Pond A4: Proposed Underground Basin**      Peak Elev=12.09'   Storage=8,603 cf   Inflow=8.98 cfs   0.846 af  
Outflow=5.27 cfs   0.846 af

**SubcatchmentA5: Drainage Area #2**      Runoff Area=15,260 sf   0.00% Impervious   Runoff Depth=2.77"  
Tc=10.0 min   CN=77/0   Runoff=0.98 cfs   0.081 af

**SubcatchmentA6: Drainage Area #2**      Runoff Area=7,610 sf   100.00% Impervious   Runoff Depth=4.93"  
Tc=10.0 min   CN=0/98   Runoff=0.75 cfs   0.072 af

**Link A7: Ex. Stormwater Conveyance System**      Inflow=6.37 cfs   0.998 af  
Primary=6.37 cfs   0.998 af

**Total Runoff Area = 2.755 ac   Runoff Volume = 0.998 af   Average Runoff Depth = 4.35"**  
**26.69% Pervious = 0.735 ac   73.31% Impervious = 2.020 ac**

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**Summary for Subcatchment A1: Drainage Area #1 (Pervious)**

Runoff = 0.59 cfs @ 12.17 hrs, Volume= 0.049 af, Depth= 2.77"

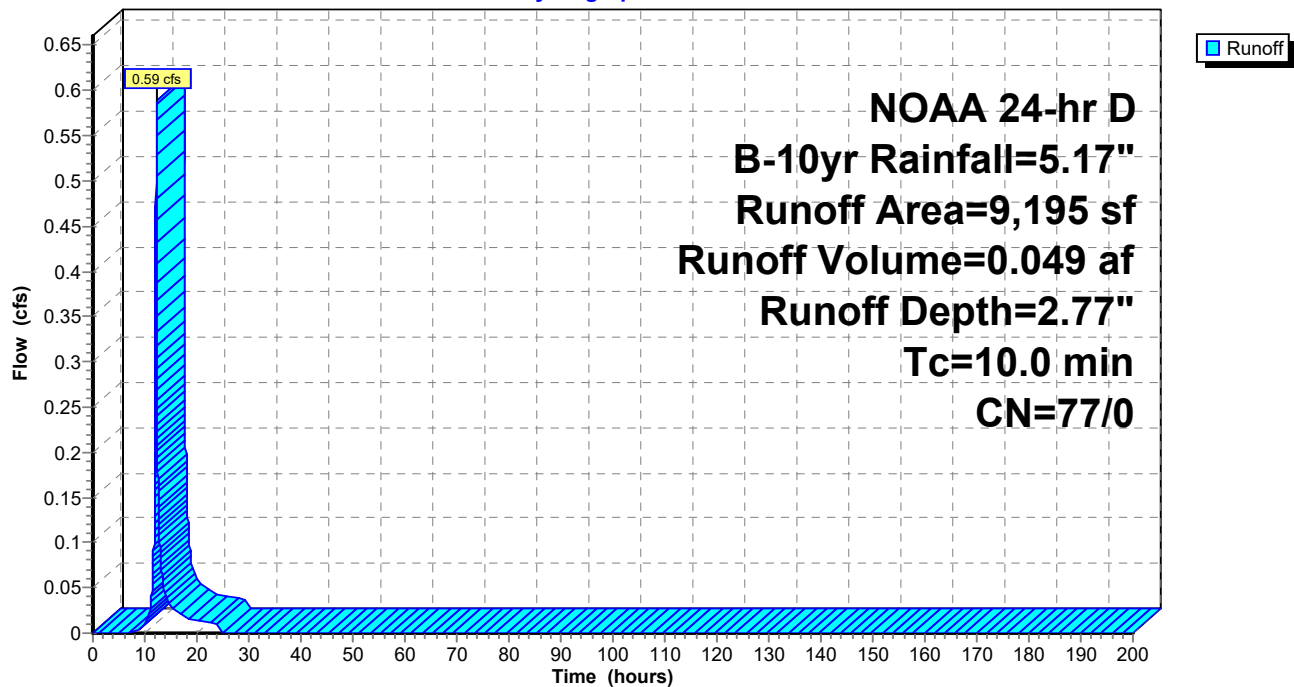
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
4,150	74	>75% Grass cover, Good, HSG C
5,045	80	>75% Grass cover, Good, HSG D
9,195	77	Weighted Average
9,195	77	100.00% Pervious Area

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

**Subcatchment A1: Drainage Area #1 (Pervious)**

Hydrograph



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**Summary for Subcatchment A2: Drainage Area #1 (Impervious)**

Runoff = 7.92 cfs @ 12.17 hrs, Volume= 0.758 af, Depth= 4.93"

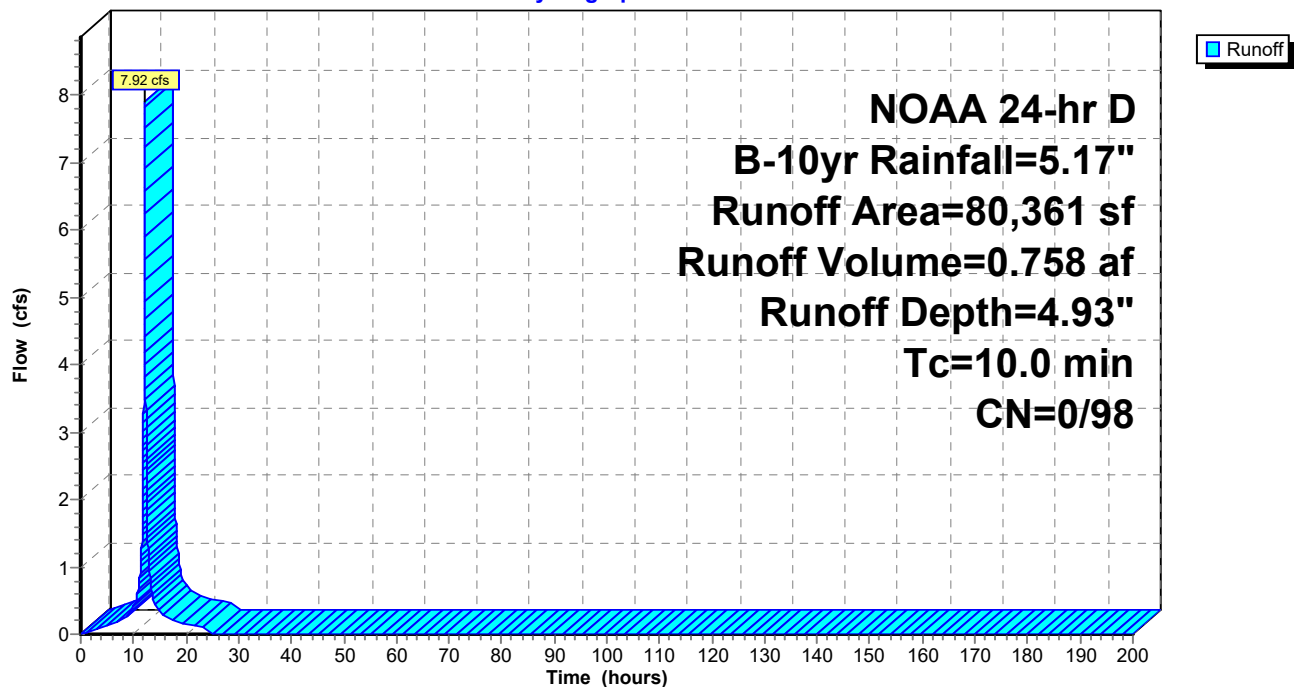
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

	Area (sf)	CN	Description
*	80,361	98	Paved parking
	80,361	98	100.00% Impervious Area

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

**Subcatchment A2: Drainage Area #1 (Impervious)**

Hydrograph



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**Summary for Subcatchment A3: Offsite Drainage Area**

Runoff = 0.47 cfs @ 12.18 hrs, Volume= 0.039 af, Depth= 2.68"

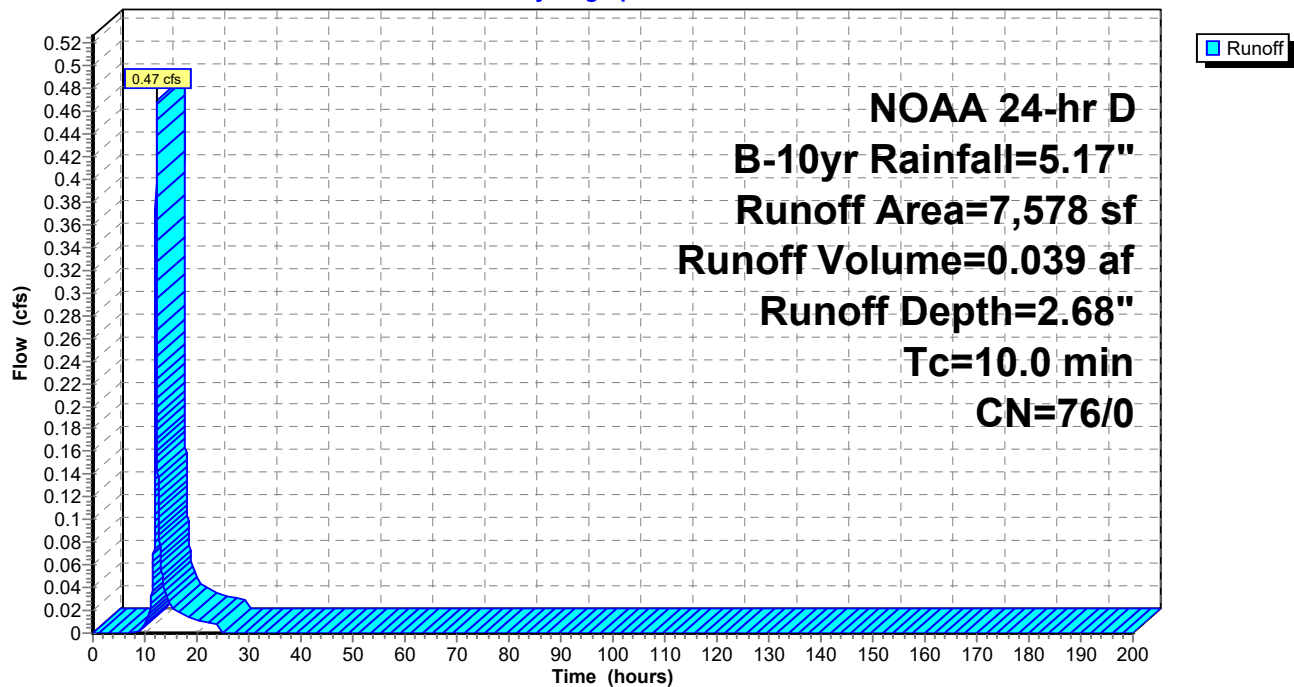
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
2,024	80	>75% Grass cover, Good, HSG D
7,578	76	Weighted Average
7,578	76	100.00% Pervious Area

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

**Subcatchment A3: Offsite Drainage Area**

Hydrograph



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**Summary for Pond A4: Proposed Underground Basin**

Inflow Area = 2.230 ac, 82.73% Impervious, Inflow Depth = 4.55" for B-10yr event  
 Inflow = 8.98 cfs @ 12.17 hrs, Volume= 0.846 af  
 Outflow = 5.27 cfs @ 12.29 hrs, Volume= 0.846 af, Atten= 41%, Lag= 7.3 min  
 Primary = 5.27 cfs @ 12.29 hrs, Volume= 0.846 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
 Peak Elev= 12.09' @ 12.29 hrs Surf.Area= 6,727 sf Storage= 8,603 cf

Plug-Flow detention time= 51.1 min calculated for 0.846 af (100% of inflow)  
 Center-of-Mass det. time= 51.0 min ( 812.8 - 761.8 )

Volume	Invert	Avail.Storage	Storage Description
#1A	10.00'	6,286 cf	<b>74.75'W x 90.00'L x 4.00'H Field A</b> 26,910 cf Overall - 11,196 cf Embedded = 15,714 cf x 40.0% Voids
#2A	10.00'	8,971 cf	<b>ADS N-12 36" x 56</b> Inside #1 Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.1 cf 14 Rows of 4 Chambers 71.75' Header x 7.10 sf x 2 = 1,018.8 cf Inside
		15,256 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	9.80'	<b>15.0" Round Culvert</b> L= 55.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.80' / 9.00' S= 0.0145 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	10.00'	<b>7.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	11.65'	<b>3.8' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	13.00'	<b>5.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=5.27 cfs @ 12.29 hrs HW=12.09' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 5.27 cfs of 7.63 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.73 cfs @ 6.46 fps)
- 3=Sharp-Crested Rectangular Weir (Weir Controls 3.55 cfs @ 2.17 fps)
- 4=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)

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### Pond A4: Proposed Underground Basin - Chamber Wizard Field A

#### Chamber Model = ADS N-12 36" (ADS N-12® Pipe)

Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf

Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.1 cf

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

4 Chambers/Row x 20.00' Long +3.50' Header x 2 = 87.00' Row Length +18.0" End Stone x 2 = 90.00' Base Length

14 Rows x 42.0" Wide + 21.0" Spacing x 13 + 18.0" Side Stone x 2 = 74.75' Base Width

42.0" Chamber Height + 6.00" Cover = 4.00' Field Height

56 Chambers x 142.0 cf + 71.75' Header x 7.10 sf x 2 = 8,970.8 cf Chamber Storage

56 Chambers x 177.1 cf + 71.75' Header x 8.86 sf x 2 = 11,191.1 cf Displacement

26,909.9 cf Field - 11,191.1 cf Chambers = 15,718.8 cf Stone x 40.0% Voids = 6,287.5 cf Stone Storage

Chamber Storage + Stone Storage = 15,258.4 cf = 0.350 af

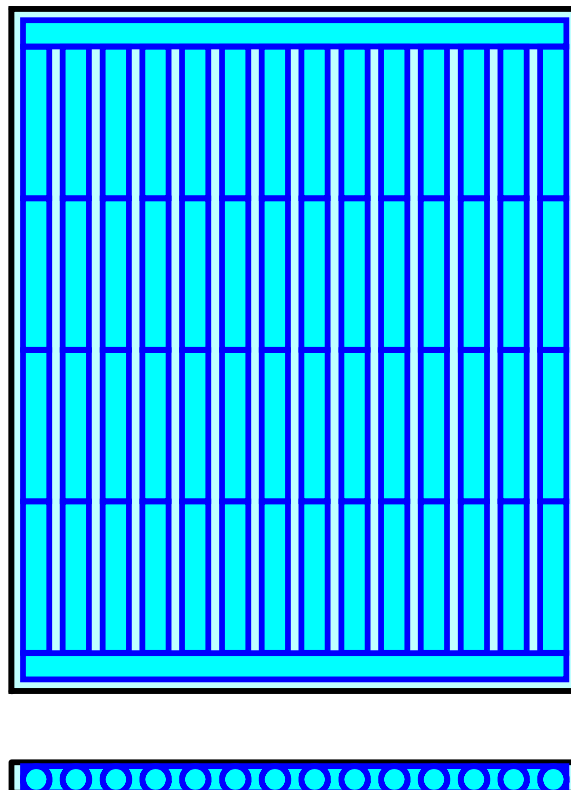
Overall Storage Efficiency = 56.7%

Overall System Size = 90.00' x 74.75' x 4.00'

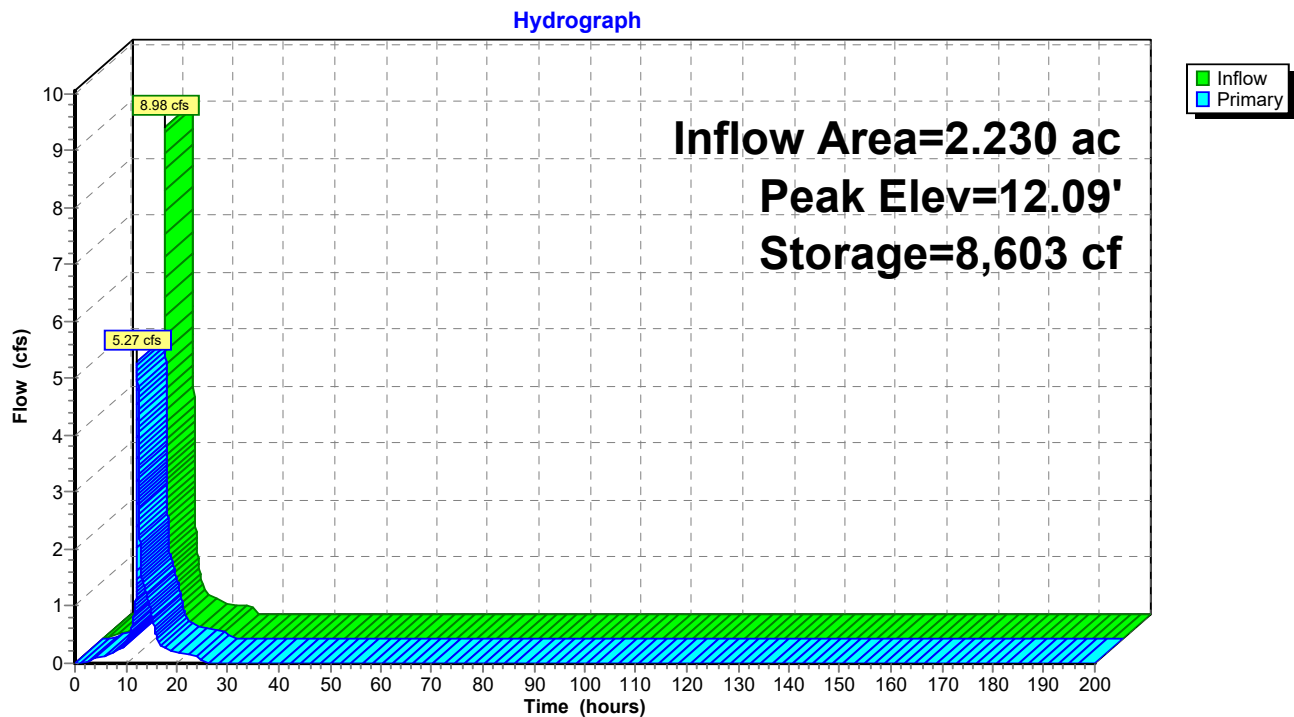
56 Chambers

996.7 cy Field

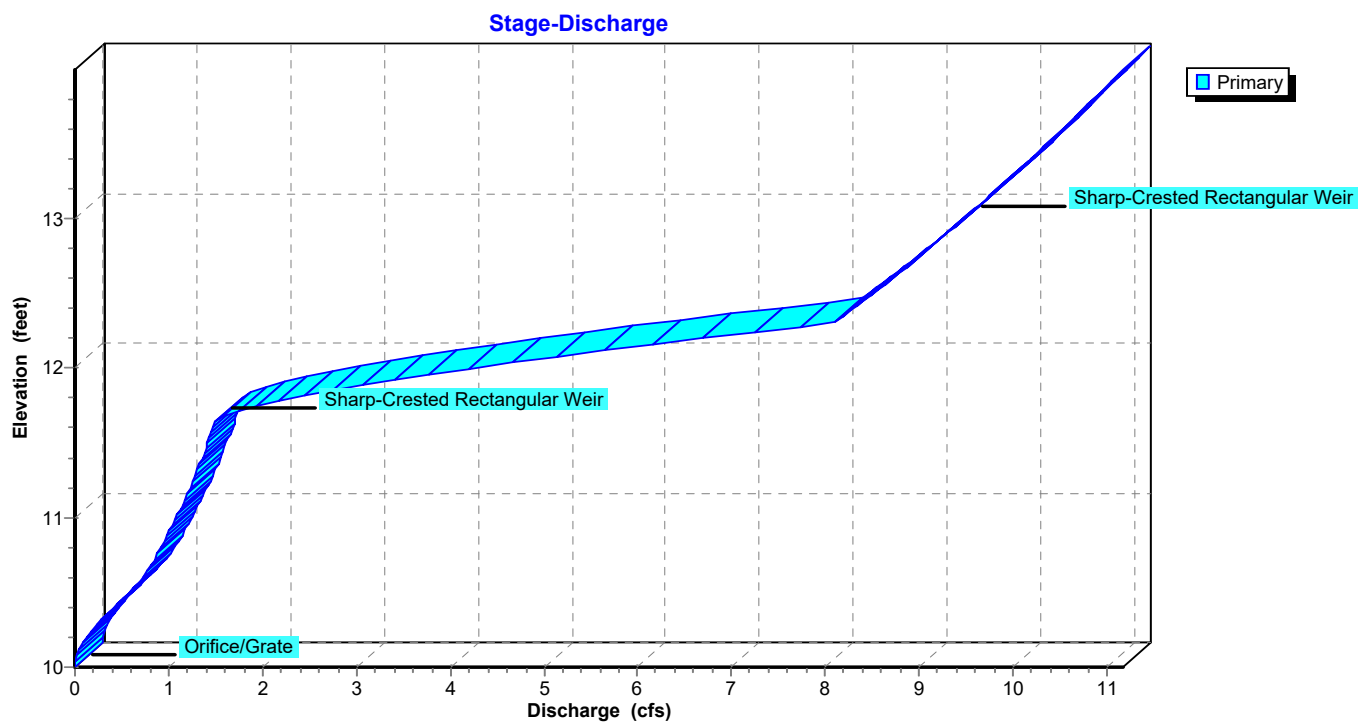
582.2 cy Stone



### Pond A4: Proposed Underground Basin



### Pond A4: Proposed Underground Basin





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**Summary for Subcatchment A5: Drainage Area #2 (Pervious)**

Runoff = 0.98 cfs @ 12.17 hrs, Volume= 0.081 af, Depth= 2.77"

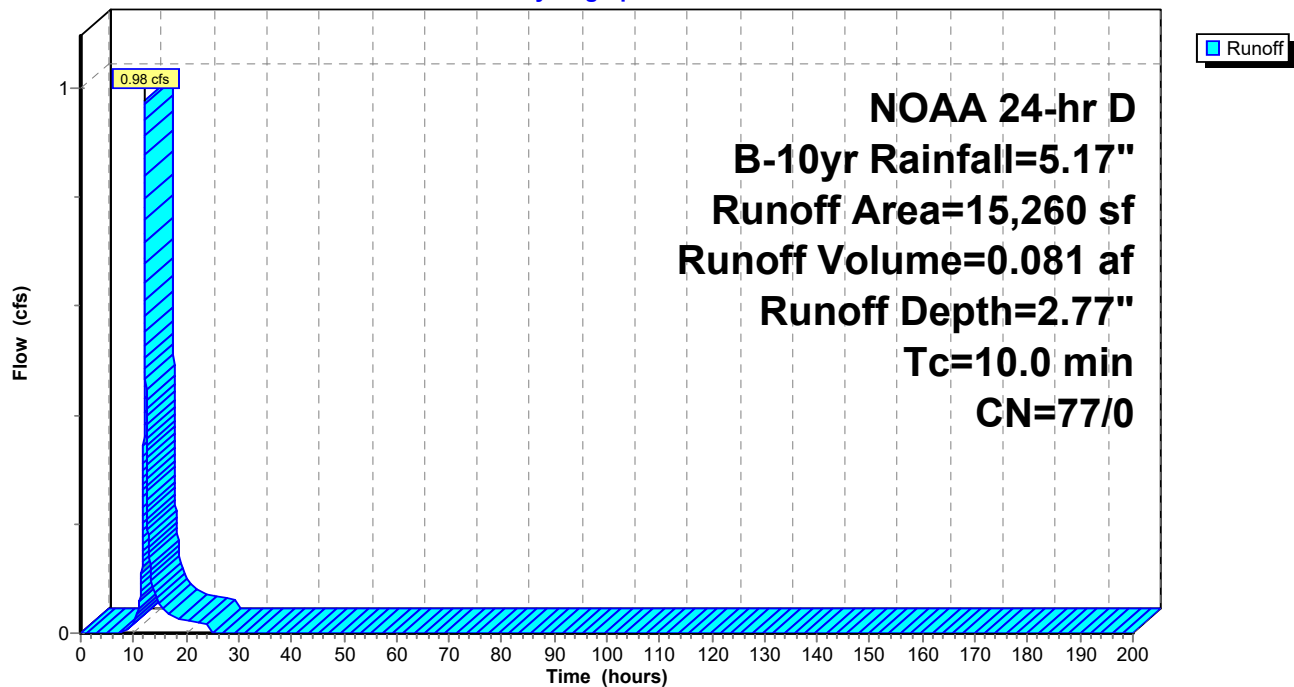
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
7,950	80	>75% Grass cover, Good, HSG D
7,310	74	>75% Grass cover, Good, HSG C
15,260	77	Weighted Average
15,260	77	100.00% Pervious Area

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

**Subcatchment A5: Drainage Area #2 (Pervious)**

Hydrograph



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**Summary for Subcatchment A6: Drainage Area #2 (Impervious)**

Runoff = 0.75 cfs @ 12.17 hrs, Volume= 0.072 af, Depth= 4.93"

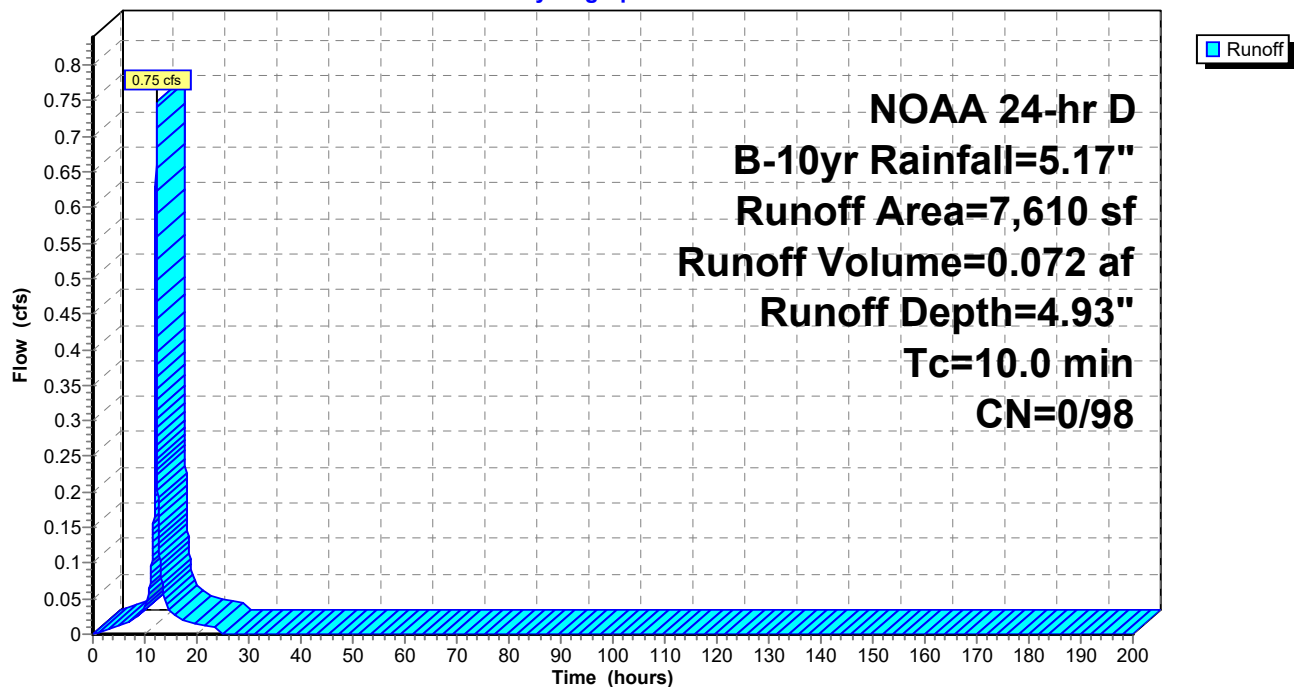
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
7,610	98	Unconnected pavement
7,610	98	100.00% Impervious Area

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

**Subcatchment A6: Drainage Area #2 (Impervious)**

Hydrograph



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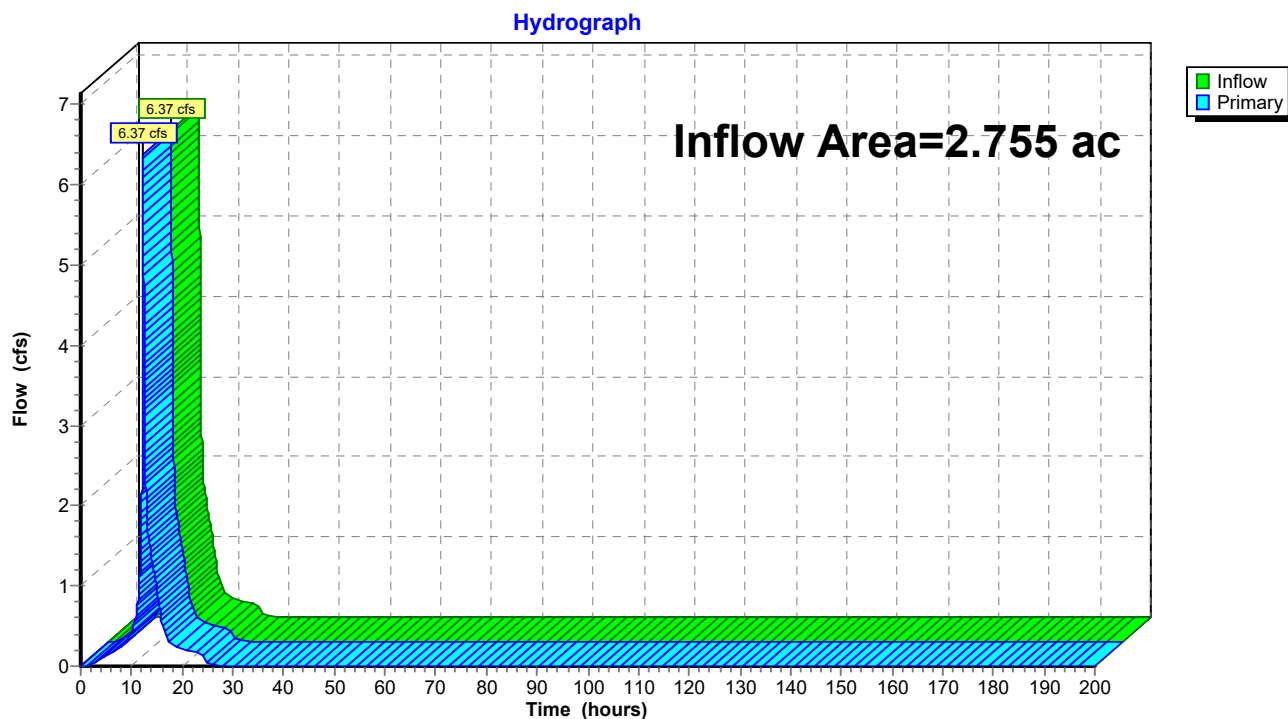
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### Summary for Link A7: Ex. Stormwater Conveyance System

Inflow Area = 2.755 ac, 73.31% Impervious, Inflow Depth = 4.35" for B-10yr event  
Inflow = 6.37 cfs @ 12.27 hrs, Volume= 0.998 af  
Primary = 6.37 cfs @ 12.27 hrs, Volume= 0.998 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-200.00 hrs, dt= 0.01 hrs

### Link A7: Ex. Stormwater Conveyance System



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NOAA 24-hr D C-100yr Rainfall=8.69"

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Time span=0.00-200.00 hrs, dt=0.01 hrs, 20001 points  
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**SubcatchmentA1: Drainage Area #1**      Runoff Area=9,195 sf   0.00% Impervious   Runoff Depth=5.91"  
Tc=10.0 min   CN=77/0   Runoff=1.24 cfs   0.104 af

**SubcatchmentA2: Drainage Area #1**      Runoff Area=80,361 sf   100.00% Impervious   Runoff Depth=8.45"  
Tc=10.0 min   CN=0/98   Runoff=13.36 cfs   1.299 af

**SubcatchmentA3: Offsite Drainage Area**      Runoff Area=7,578 sf   0.00% Impervious   Runoff Depth=5.79"  
Tc=10.0 min   CN=76/0   Runoff=1.00 cfs   0.084 af

**Pond A4: Proposed Underground Basin**      Peak Elev=12.97'   Storage=12,500 cf   Inflow=15.59 cfs   1.487 af  
Outflow=9.43 cfs   1.487 af

**SubcatchmentA5: Drainage Area #2**      Runoff Area=15,260 sf   0.00% Impervious   Runoff Depth=5.91"  
Tc=10.0 min   CN=77/0   Runoff=2.05 cfs   0.173 af

**SubcatchmentA6: Drainage Area #2**      Runoff Area=7,610 sf   100.00% Impervious   Runoff Depth=8.45"  
Tc=10.0 min   CN=0/98   Runoff=1.26 cfs   0.123 af

**Link A7: Ex. Stormwater Conveyance System**      Inflow=12.18 cfs   1.782 af  
Primary=12.18 cfs   1.782 af

**Total Runoff Area = 2.755 ac   Runoff Volume = 1.783 af   Average Runoff Depth = 7.76"**  
**26.69% Pervious = 0.735 ac   73.31% Impervious = 2.020 ac**

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NOAA 24-hr D C-100yr Rainfall=8.69"

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**Summary for Subcatchment A1: Drainage Area #1 (Pervious)**

Runoff = 1.24 cfs @ 12.17 hrs, Volume= 0.104 af, Depth= 5.91"

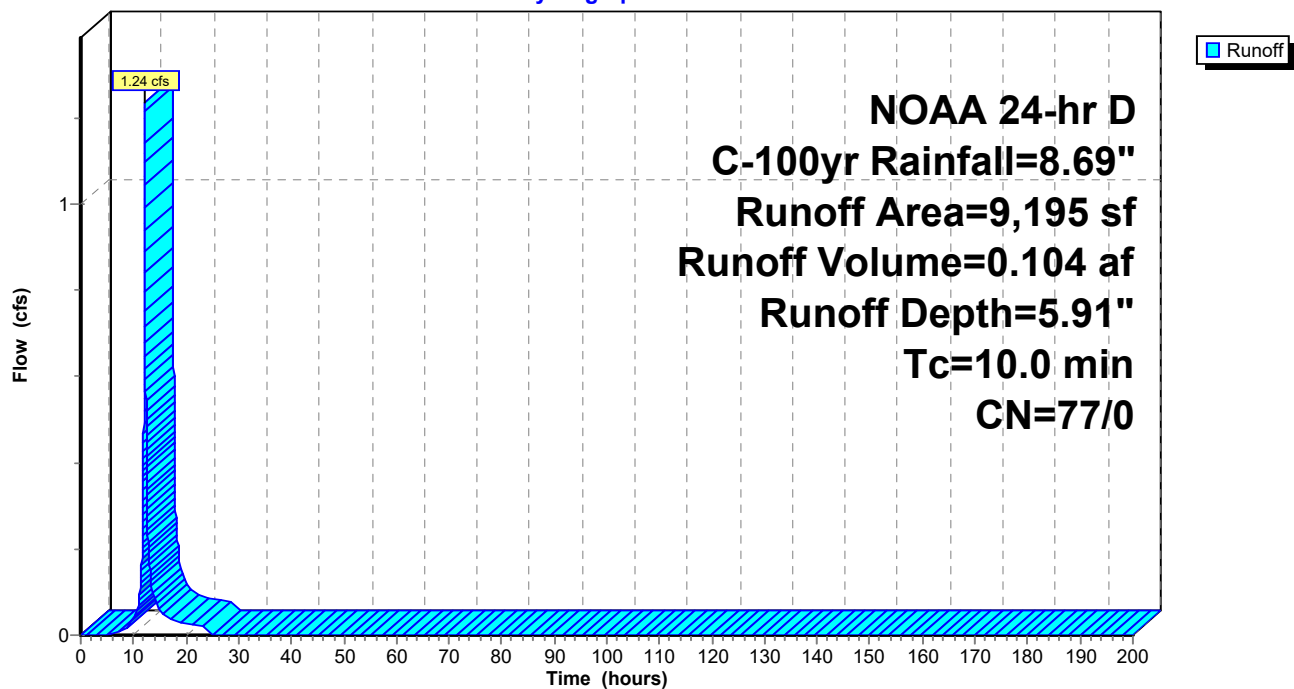
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D C-100yr Rainfall=8.69"

Area (sf)	CN	Description
4,150	74	>75% Grass cover, Good, HSG C
5,045	80	>75% Grass cover, Good, HSG D
9,195	77	Weighted Average
9,195	77	100.00% Pervious Area

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

**Subcatchment A1: Drainage Area #1 (Pervious)**

Hydrograph



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NOAA 24-hr D C-100yr Rainfall=8.69"

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**Summary for Subcatchment A2: Drainage Area #1 (Impervious)**

Runoff = 13.36 cfs @ 12.17 hrs, Volume= 1.299 af, Depth= 8.45"

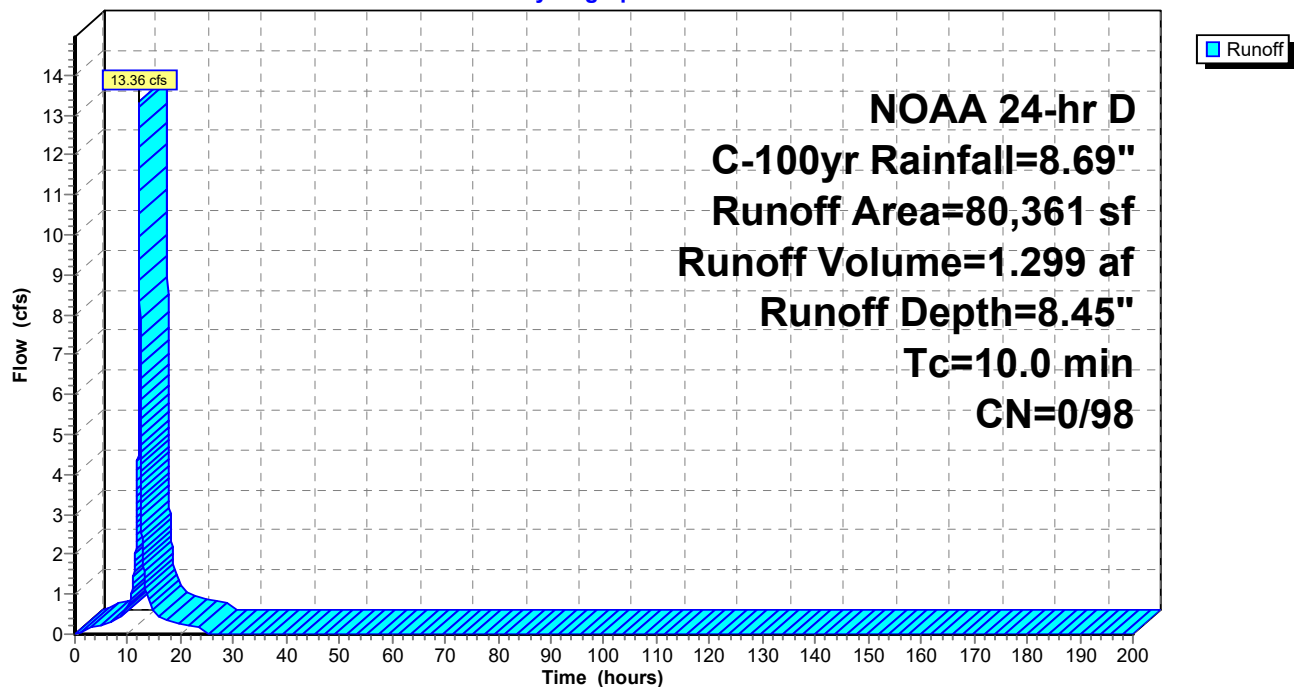
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D C-100yr Rainfall=8.69"

	Area (sf)	CN	Description
*	80,361	98	Paved parking
	80,361	98	100.00% Impervious Area

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

**Subcatchment A2: Drainage Area #1 (Impervious)**

Hydrograph



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NOAA 24-hr D C-100yr Rainfall=8.69"

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**Summary for Subcatchment A3: Offsite Drainage Area**

Runoff = 1.00 cfs @ 12.17 hrs, Volume= 0.084 af, Depth= 5.79"

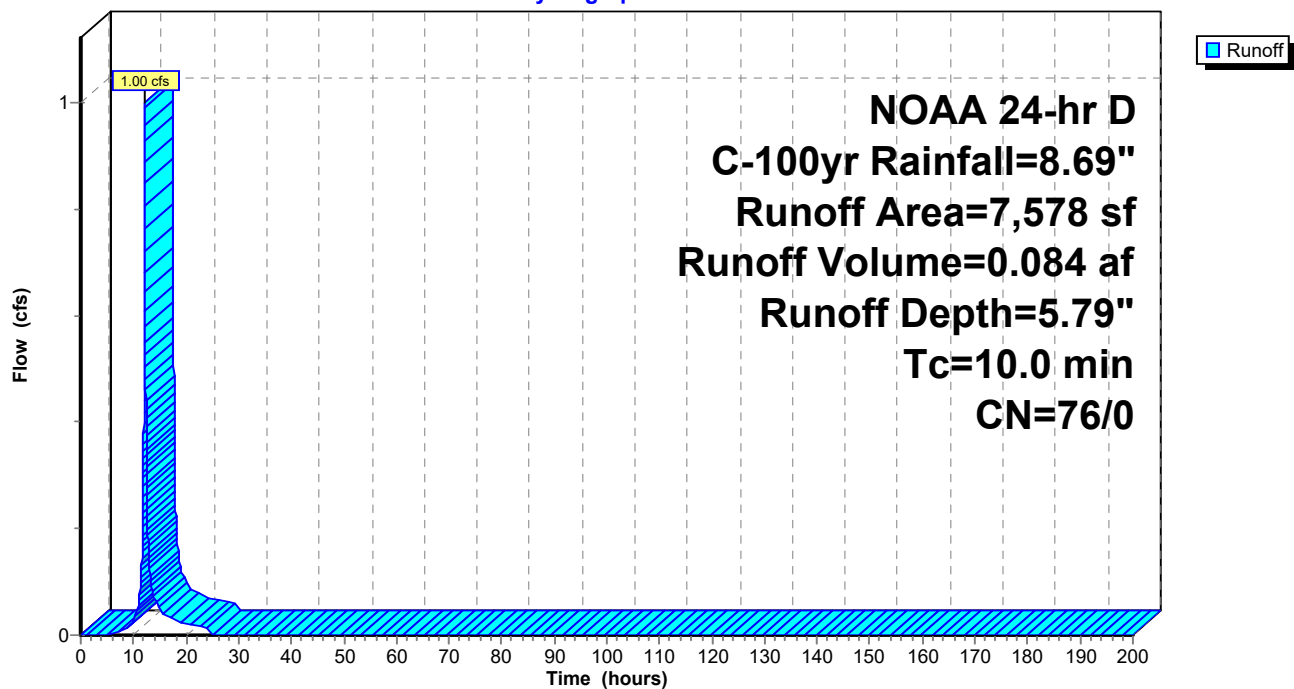
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D C-100yr Rainfall=8.69"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
2,024	80	>75% Grass cover, Good, HSG D
7,578	76	Weighted Average
7,578	76	100.00% Pervious Area

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

**Subcatchment A3: Offsite Drainage Area**

Hydrograph



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NOAA 24-hr D C-100yr Rainfall=8.69"

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**Summary for Pond A4: Proposed Underground Basin**

Inflow Area = 2.230 ac, 82.73% Impervious, Inflow Depth = 8.00" for C-100yr event  
 Inflow = 15.59 cfs @ 12.17 hrs, Volume= 1.487 af  
 Outflow = 9.43 cfs @ 12.29 hrs, Volume= 1.487 af, Atten= 39%, Lag= 7.0 min  
 Primary = 9.43 cfs @ 12.29 hrs, Volume= 1.487 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
 Peak Elev= 12.97' @ 12.29 hrs Surf.Area= 6,727 sf Storage= 12,500 cf

Plug-Flow detention time= 42.6 min calculated for 1.487 af (100% of inflow)  
 Center-of-Mass det. time= 42.5 min ( 796.6 - 754.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	10.00'	6,286 cf	<b>74.75'W x 90.00'L x 4.00'H Field A</b> 26,910 cf Overall - 11,196 cf Embedded = 15,714 cf x 40.0% Voids
#2A	10.00'	8,971 cf	<b>ADS N-12 36" x 56 Inside #1</b> Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.1 cf 14 Rows of 4 Chambers 71.75' Header x 7.10 sf x 2 = 1,018.8 cf Inside
		15,256 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	9.80'	<b>15.0" Round Culvert</b> L= 55.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.80' / 9.00' S= 0.0145 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	10.00'	<b>7.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	11.65'	<b>3.8' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	13.00'	<b>5.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=9.43 cfs @ 12.29 hrs HW=12.97' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Inlet Controls 9.43 cfs @ 7.69 fps)
- 2=Orifice/Grate (Passes < 2.11 cfs potential flow)
- 3=Sharp-Crested Rectangular Weir (Passes < 17.61 cfs potential flow)
- 4=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)



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### Pond A4: Proposed Underground Basin - Chamber Wizard Field A

#### Chamber Model = ADS N-12 36" (ADS N-12® Pipe)

Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf

Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.1 cf

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

4 Chambers/Row x 20.00' Long +3.50' Header x 2 = 87.00' Row Length +18.0" End Stone x 2 = 90.00' Base Length

14 Rows x 42.0" Wide + 21.0" Spacing x 13 + 18.0" Side Stone x 2 = 74.75' Base Width

42.0" Chamber Height + 6.0" Cover = 4.00' Field Height

56 Chambers x 142.0 cf + 71.75' Header x 7.10 sf x 2 = 8,970.8 cf Chamber Storage

56 Chambers x 177.1 cf + 71.75' Header x 8.86 sf x 2 = 11,191.1 cf Displacement

26,909.9 cf Field - 11,191.1 cf Chambers = 15,718.8 cf Stone x 40.0% Voids = 6,287.5 cf Stone Storage

Chamber Storage + Stone Storage = 15,258.4 cf = 0.350 af

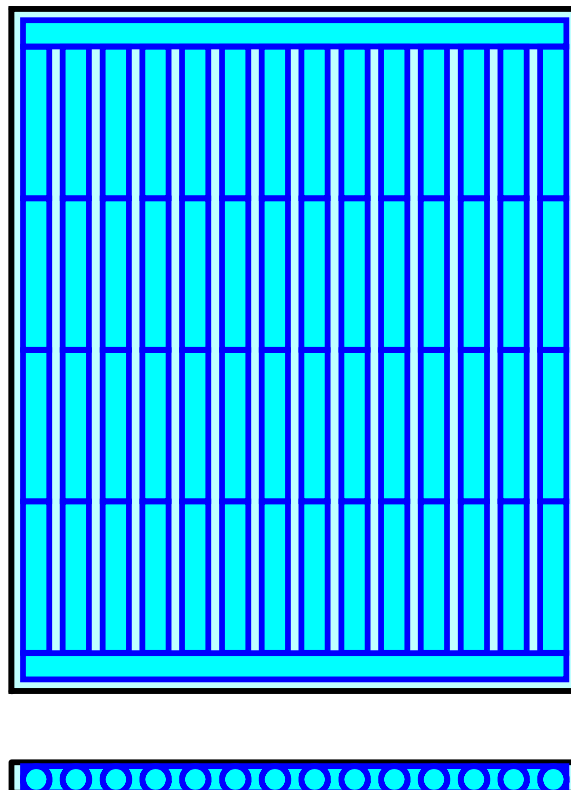
Overall Storage Efficiency = 56.7%

Overall System Size = 90.00' x 74.75' x 4.00'

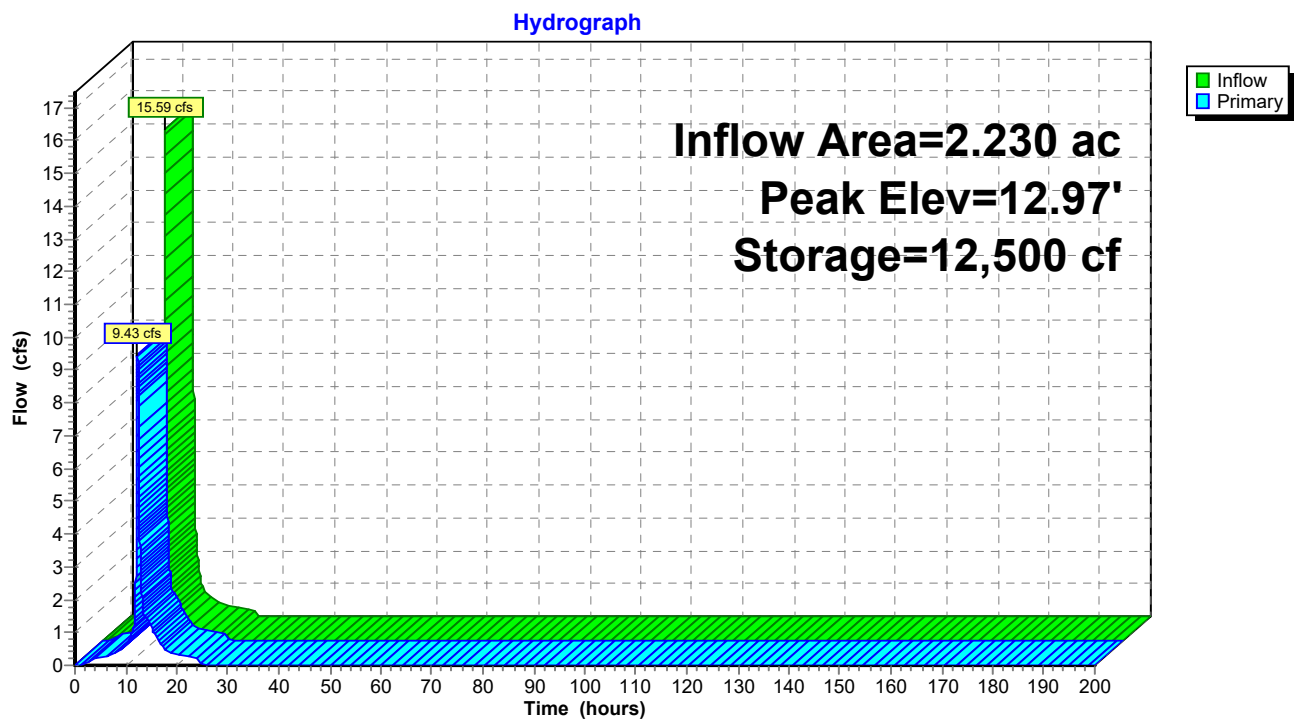
56 Chambers

996.7 cy Field

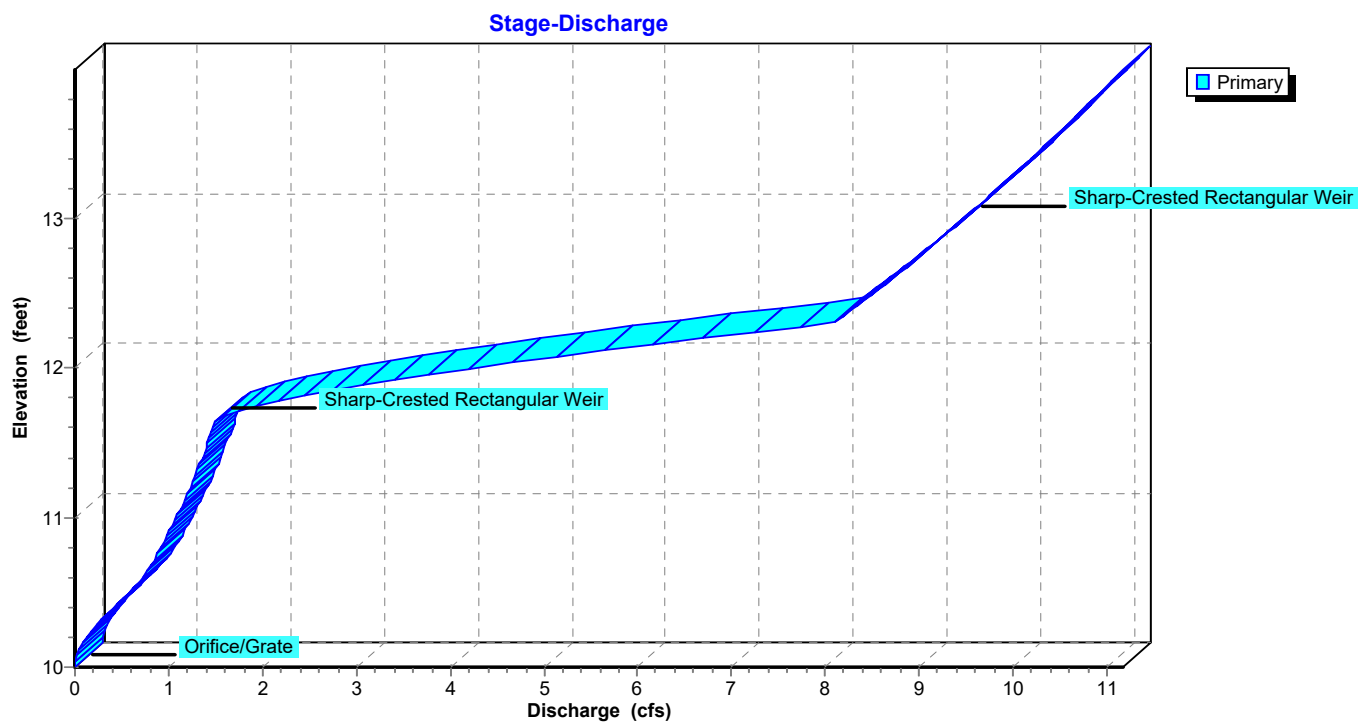
582.2 cy Stone



### Pond A4: Proposed Underground Basin



### Pond A4: Proposed Underground Basin



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**Summary for Subcatchment A5: Drainage Area #2 (Pervious)**

Runoff = 2.05 cfs @ 12.17 hrs, Volume= 0.173 af, Depth= 5.91"

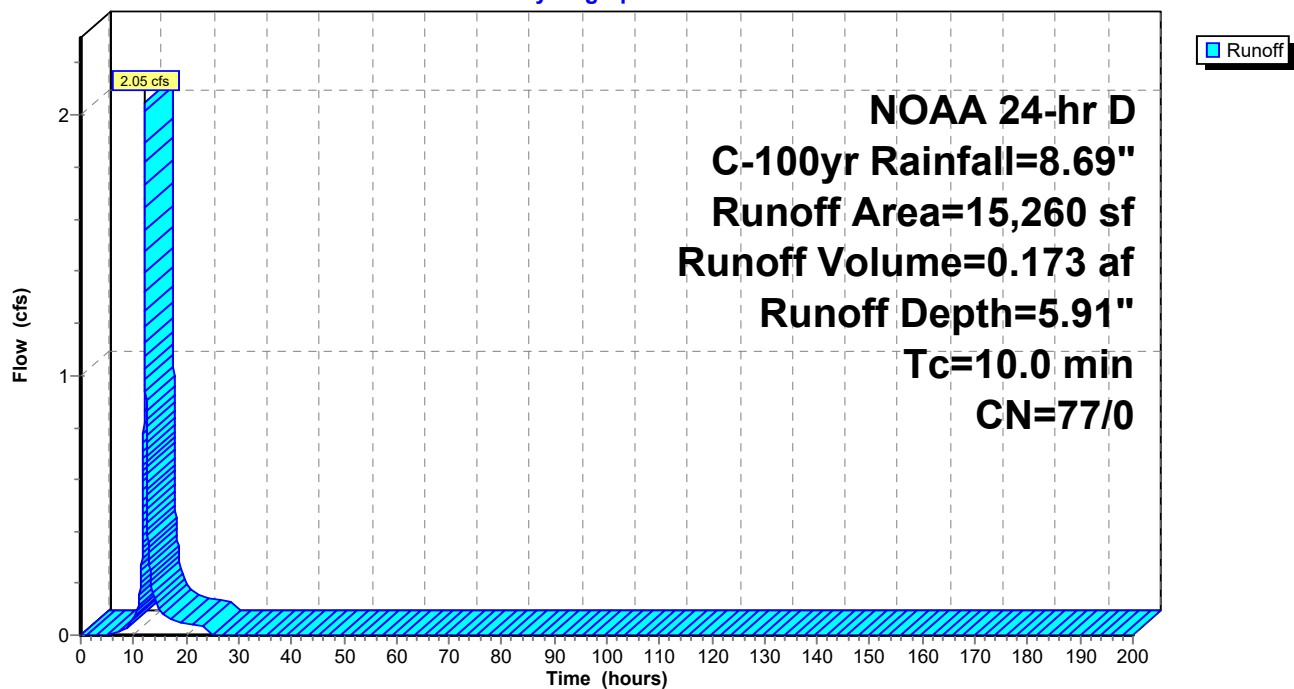
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D C-100yr Rainfall=8.69"

Area (sf)	CN	Description
7,950	80	>75% Grass cover, Good, HSG D
7,310	74	>75% Grass cover, Good, HSG C
15,260	77	Weighted Average
15,260	77	100.00% Pervious Area

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

**Subcatchment A5: Drainage Area #2 (Pervious)**

Hydrograph



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**Summary for Subcatchment A6: Drainage Area #2 (Impervious)**

Runoff = 1.26 cfs @ 12.17 hrs, Volume= 0.123 af, Depth= 8.45"

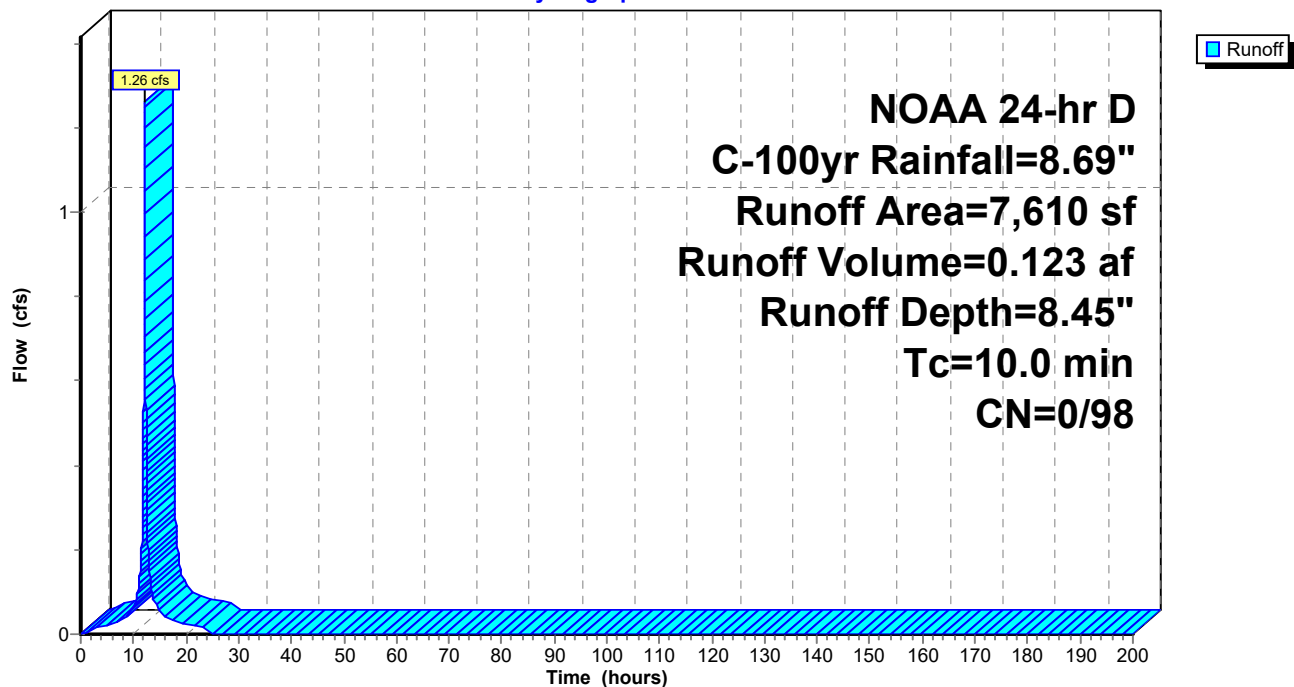
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D C-100yr Rainfall=8.69"

Area (sf)	CN	Description
7,610	98	Unconnected pavement
7,610	98	100.00% Impervious Area

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

**Subcatchment A6: Drainage Area #2 (Impervious)**

Hydrograph



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NOAA 24-hr D C-100yr Rainfall=8.69"

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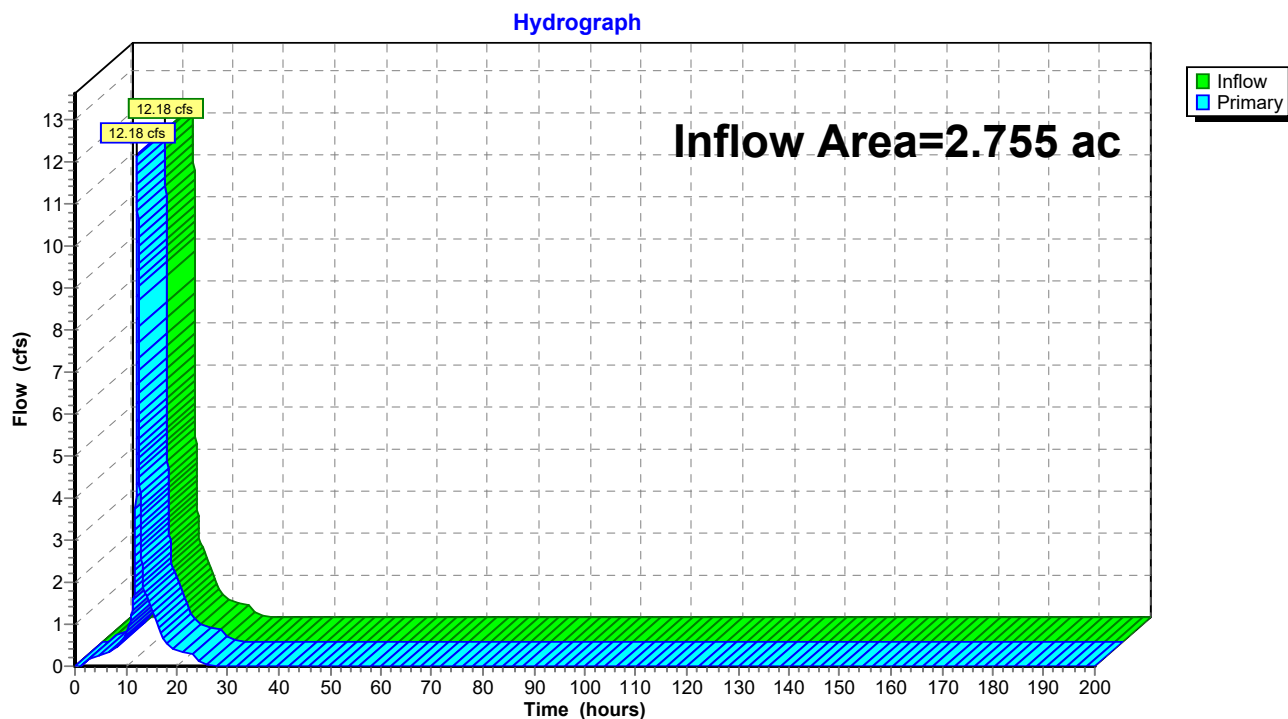
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### Summary for Link A7: Ex. Stormwater Conveyance System

Inflow Area = 2.755 ac, 73.31% Impervious, Inflow Depth = 7.76" for C-100yr event  
Inflow = 12.18 cfs @ 12.20 hrs, Volume= 1.782 af  
Primary = 12.18 cfs @ 12.20 hrs, Volume= 1.782 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-200.00 hrs, dt= 0.01 hrs

### Link A7: Ex. Stormwater Conveyance System







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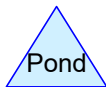
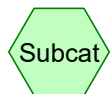
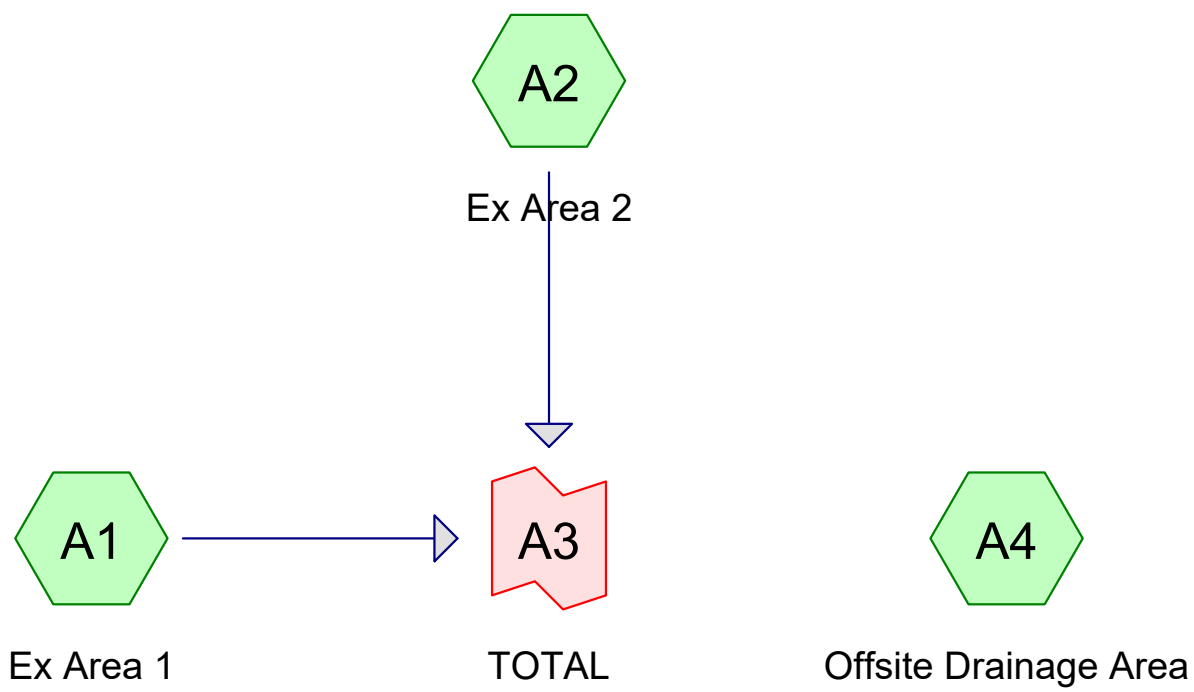
**APPENDIX C**  
**ON-SITE CONVEYANCE SYSTEM DESIGN**  
**SCD ANALYSIS**





Label	Start Node	Stop Node	Length (Unified) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n
P-17 (Proposed Stormwater)	CO	CO	57.7	14.79	14.5	0.005	8	0.01
P-51 (Proposed Stormwater)	A5	UP-FLO-FILTER	14	11.39	11.32	0.005	24	0.012
P-11 (Proposed Stormwater)	A7	A6	119	15.75	14.56	0.01	15	0.012
P-48 (Proposed Stormwater)	CO	CO	76.2	13.13	12.37	0.01	10	0.012
P-49 (Proposed Stormwater)	CO	A14	27	12.27	12	0.01	10	0.012
P-16 (Proposed Stormwater)	CO	CO	77.7	15.18	14.79	0.005	8	0.01
P-10 (Proposed Stormwater)	A6	A5	162.9	14.46	13.65	0.005	15	0.012
P-46 (Proposed Stormwater)	A14	A3	30	11.55	11.4	0.005	15	0.012
P-9 (Proposed Stormwater)	A8	A5	36.3	11.67	11.49	0.005	24	0.012
P-7 (Proposed Stormwater)	A11	A8	50.1	12.54	12.29	0.005	18	0.012
P-8 (Proposed Stormwater)	A9	A8	59.8	12.3	12	0.005	15	0.012
P-6 (Proposed Stormwater)	CO	A11	102	13.88	13.37	0.005	10	0.012
P-50 (Proposed Stormwater)	A12	A11	22.5	13.23	13	0.01	15	0.012
P-76 (Proposed Stormwater)	A13	A12	94.1	14.27	13.33	0.01	15	0.012
P-20 (Proposed Stormwater)	A10	A9	17.9	12.58	12.4	0.01	15	0.012
P-44 (Proposed Stormwater)	OCS	EX. INLET	49.8	9.8	9.3	0.01	18	0.013

Upstream Inlet Area (acres)	Upstream Inlet Tc (hours)	Upstream Inlet C	Upstream Structure Flow (Total Surface) (cfs)	Velocity (ft/s)	Flow (cfs)	Capacity (Full Flow) (cfs)	Elevation Ground (Start) (ft)	Hydraulic Grade Line (In) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (Out) (ft)
(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	1.11	19.48	(N/A)	19.15	(N/A)
0.08	0.17	0.99	0.52	5.95	11.94	17.33	18.43	12.63	18.9	12.54
0.23	0.17	0.99	1.51	4.55	1.51	6.99	19.76	16.49	18.76	15.45
0.08	0.17	0.99	0.52	3.49	0.52	2.37	19.6	13.45	19.57	12.83
0.08	0.17	0.99	0.52	4.21	1.04	2.37	19.57	12.72	17.5	12.38
(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	1.11	19.52	(N/A)	19.48	(N/A)
0.29	0.17	0.99	1.9	4.33	3.35	4.95	18.76	15.21	18.43	14.38
0.18	0.17	0.99	1.18	3.91	2.19	4.95	17.5	12.33	18.59	12.32
0.14	0.17	0.99	0.92	5.45	8.27	17.33	17.88	13.01	18.43	13
0.001	0.17	0.99	0.01	4.53	3.94	8.05	17.54	13.3	17.88	13.2
0.35	0.17	0.99	2.29	4.38	3.53	4.96	16.53	13.3	17.88	13.2
0.16	0.17	0.99	1.05	3.25	1.05	1.68	17.63	14.36	17.54	13.83
0.04	0.17	0.99	0.26	5.49	2.91	7.08	16.96	13.92	17.54	13.57
0.41	0.17	0.99	2.68	4.54	2.68	6.99	16.84	14.6	16.96	14.08
0.19	0.17	0.99	1.24	4.32	1.24	7.02	15.69	13.44	16.53	13.44
(N/A)	0	(N/A)	0	6.73	9.43	10.52	17.25	10.99	14.15	10.41



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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.177	74	>75% Grass cover, Good, HSG C (A1, A2, A4)
0.602	80	>75% Grass cover, Good, HSG D (A1, A2, A4)
0.976	98	Paved parking, HSG C (A1)
<b>2.755</b>	<b>84</b>	<b>TOTAL AREA</b>

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### Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.153	HSG C	A1, A2, A4
0.602	HSG D	A1, A2, A4
0.000	Other	
<b>2.755</b>		<b>TOTAL AREA</b>

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### Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.177	0.602	0.000	1.779	>75% Grass cover, Good	A1, A2, A4
0.000	0.000	0.976	0.000	0.000	0.976	Paved parking	A1
<b>0.000</b>	<b>0.000</b>	<b>2.153</b>	<b>0.602</b>	<b>0.000</b>	<b>2.755</b>	<b>TOTAL AREA</b>	

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.

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

**SubcatchmentA1: Ex Area 1**

Runoff Area=54,670 sf 77.74% Impervious Runoff Depth=2.75"

Tc=10.0 min CN=77/98 Runoff=3.10 cfs 0.288 af

**SubcatchmentA2: Ex Area 2**

Runoff Area=57,756 sf 0.00% Impervious Runoff Depth=1.29"

Flow Length=550' Tc=13.8 min CN=76/0 Runoff=1.49 cfs 0.142 af

**Link A3: TOTAL**

Inflow=4.47 cfs 0.430 af

Primary=4.47 cfs 0.430 af

**SubcatchmentA4: Offsite Drainage Area**

Runoff Area=7,578 sf 0.00% Impervious Runoff Depth=1.29"

Tc=10.0 min CN=76/0 Runoff=0.22 cfs 0.019 af

**Total Runoff Area = 2.755 ac Runoff Volume = 0.449 af Average Runoff Depth = 1.96"**  
**64.58% Pervious = 1.779 ac 35.42% Impervious = 0.976 ac**

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NOAA 24-hr D A-2yr Rainfall=3.39"

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**Summary for Subcatchment A1: Ex Area 1**

Runoff = 3.10 cfs @ 12.17 hrs, Volume= 0.288 af, Depth= 2.75"

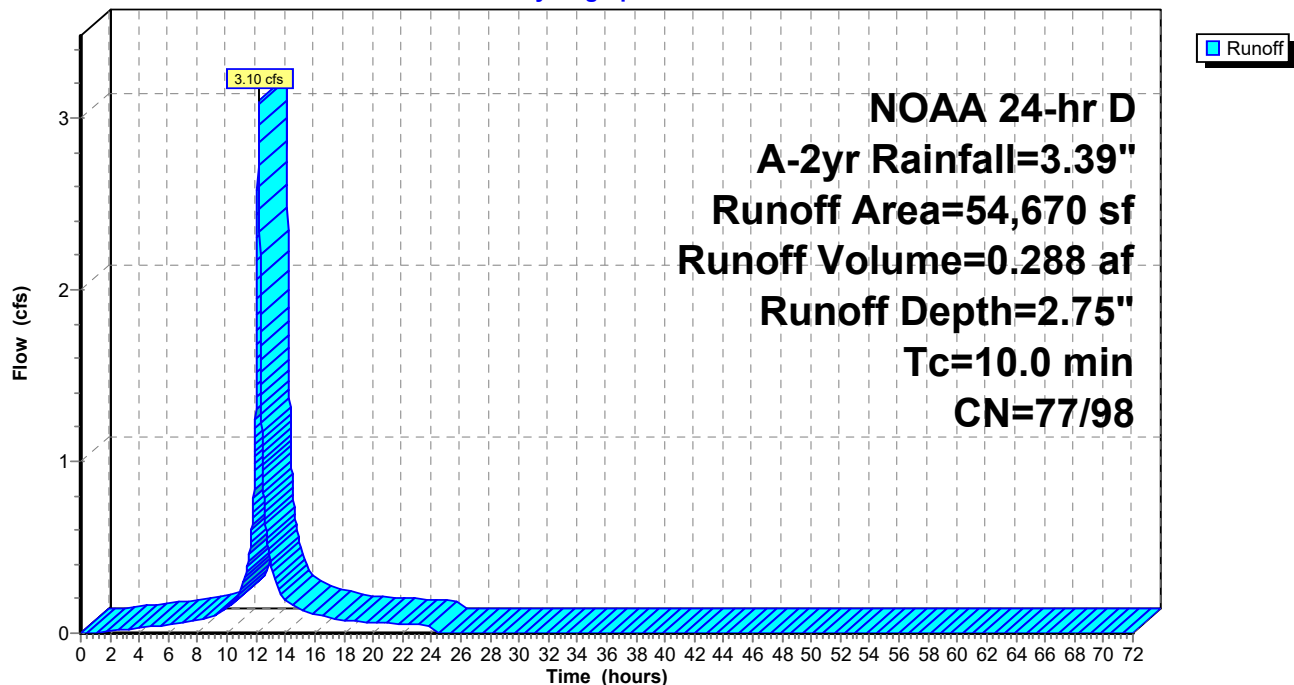
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
42,500	98	Paved parking, HSG C
5,780	74	>75% Grass cover, Good, HSG C
6,390	80	>75% Grass cover, Good, HSG D
54,670	93	Weighted Average
12,170	77	22.26% Pervious Area
42,500	98	77.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, 1

**Subcatchment A1: Ex Area 1**

Hydrograph





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**Summary for Subcatchment A2: Ex Area 2**

Runoff = 1.49 cfs @ 12.22 hrs, Volume= 0.142 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

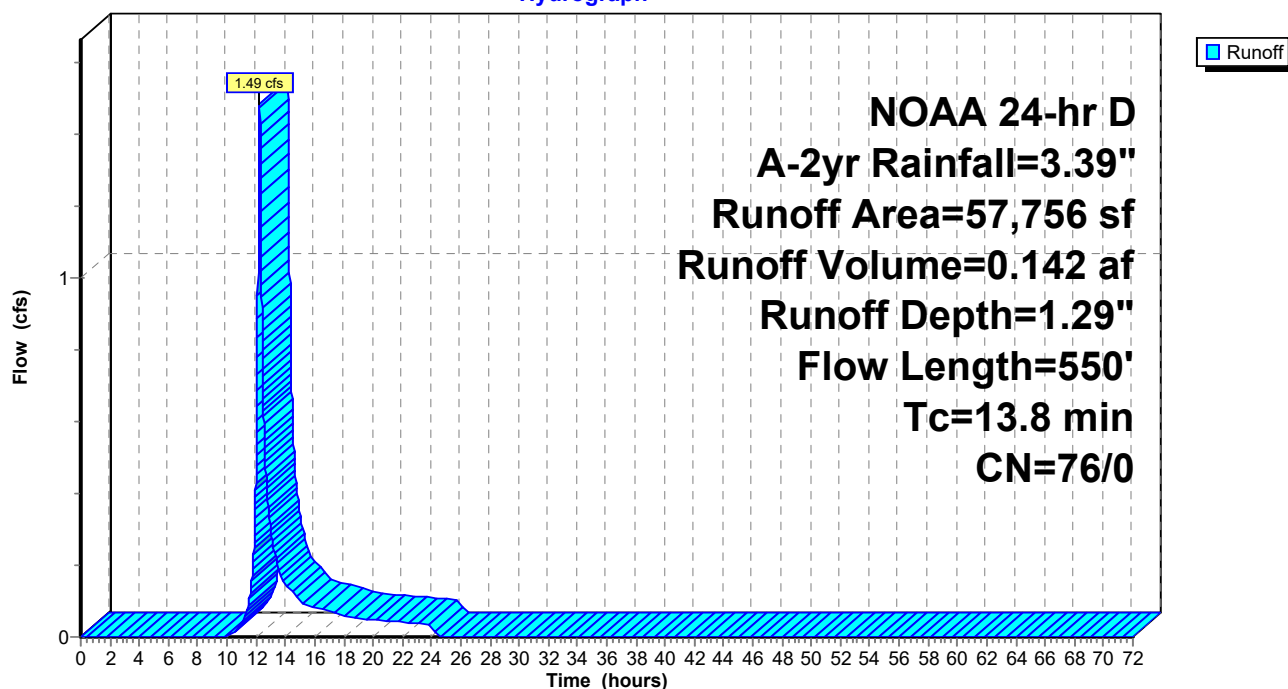
Area (sf)	CN	Description
17,809	80	>75% Grass cover, Good, HSG D
39,947	74	>75% Grass cover, Good, HSG C
57,756	76	Weighted Average
57,756	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	100	0.0350	0.22		<b>Sheet Flow, 1</b> Grass: Short n= 0.150 P2= 3.40"
4.7	300	0.0050	1.06		<b>Shallow Concentrated Flow, 2</b> Grassed Waterway Kv= 15.0 fps
0.4	50	0.0200	2.12		<b>Shallow Concentrated Flow, 3</b> Grassed Waterway Kv= 15.0 fps
1.1	100	0.0100	1.50		<b>Shallow Concentrated Flow, 4</b> Grassed Waterway Kv= 15.0 fps
13.8	550	Total			

**Subcatchment A2: Ex Area 2**

Hydrograph



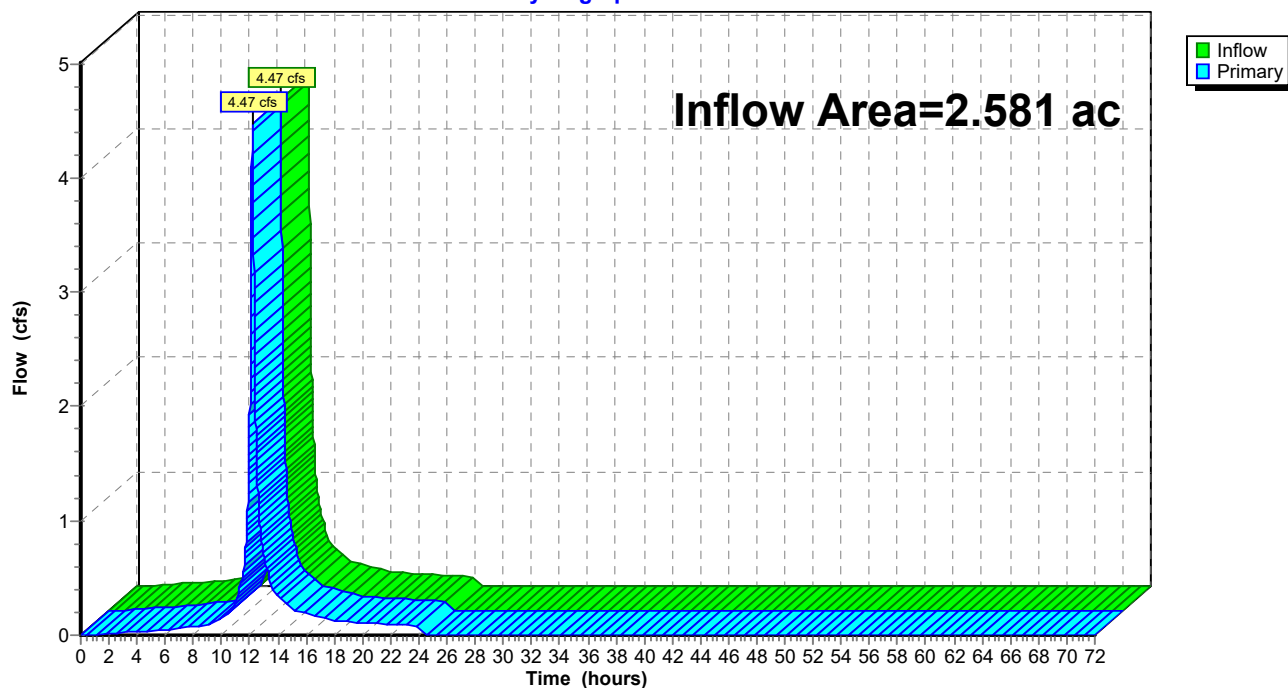
**Summary for Link A3: TOTAL**

Inflow Area = 2.581 ac, 37.80% Impervious, Inflow Depth = 2.00" for A-2yr event  
Inflow = 4.47 cfs @ 12.18 hrs, Volume= 0.430 af  
Primary = 4.47 cfs @ 12.18 hrs, Volume= 0.430 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Link A3: TOTAL**

Hydrograph



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**Summary for Subcatchment A4: Offsite Drainage Area**

Runoff = 0.22 cfs @ 12.18 hrs, Volume= 0.019 af, Depth= 1.29"

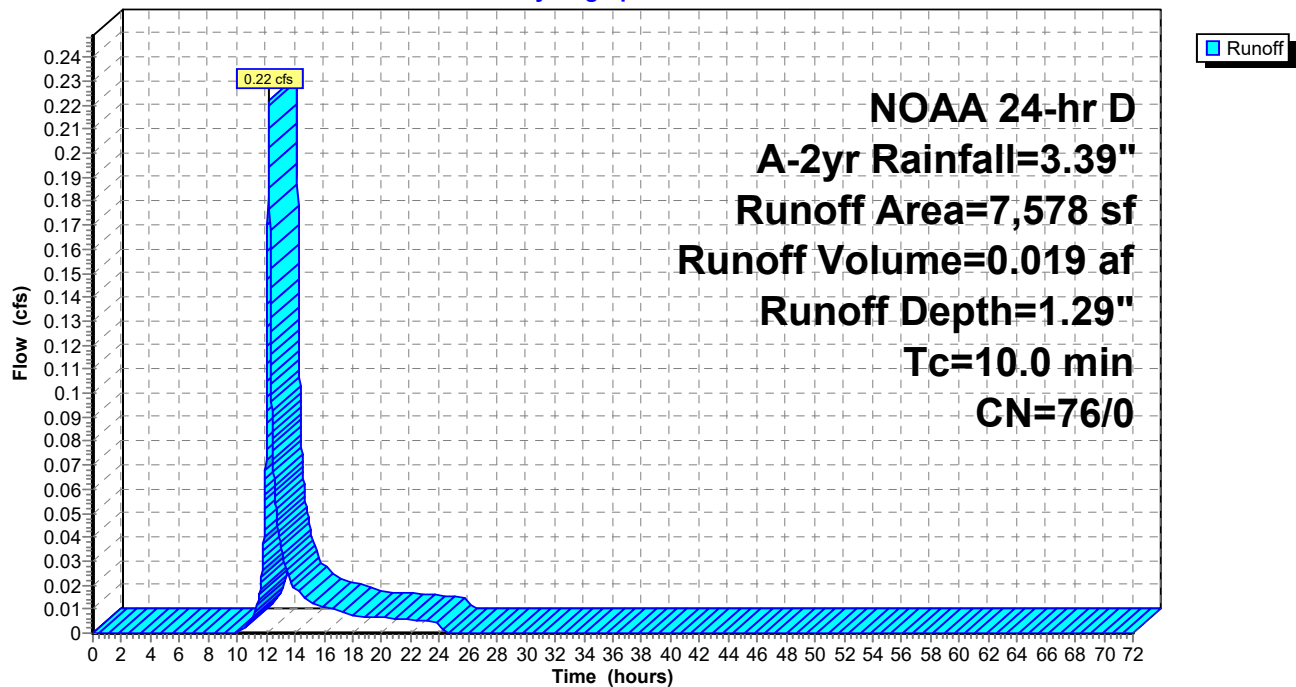
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
2,024	80	>75% Grass cover, Good, HSG D
7,578	76	Weighted Average
7,578	76	100.00% Pervious Area

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

**Subcatchment A4: Offsite Drainage Area**

Hydrograph



**200311 - Existing Analysis\_SCD**

NOAA 24-hr D B-10yr Rainfall=5.17"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points  
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**SubcatchmentA1: Ex Area 1**

Runoff Area=54,670 sf 77.74% Impervious Runoff Depth=4.45"  
Tc=10.0 min CN=77/98 Runoff=4.97 cfs 0.465 af

**SubcatchmentA2: Ex Area 2**

Runoff Area=57,756 sf 0.00% Impervious Runoff Depth=2.68"  
Flow Length=550' Tc=13.8 min CN=76/0 Runoff=3.16 cfs 0.296 af

**Link A3: TOTAL**

Inflow=7.94 cfs 0.761 af  
Primary=7.94 cfs 0.761 af

**SubcatchmentA4: Offsite Drainage Area**

Runoff Area=7,578 sf 0.00% Impervious Runoff Depth=2.68"  
Tc=10.0 min CN=76/0 Runoff=0.47 cfs 0.039 af

**Total Runoff Area = 2.755 ac Runoff Volume = 0.800 af Average Runoff Depth = 3.48"**  
**64.58% Pervious = 1.779 ac 35.42% Impervious = 0.976 ac**

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NOAA 24-hr D B-10yr Rainfall=5.17"

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**Summary for Subcatchment A1: Ex Area 1**

Runoff = 4.97 cfs @ 12.17 hrs, Volume= 0.465 af, Depth= 4.45"

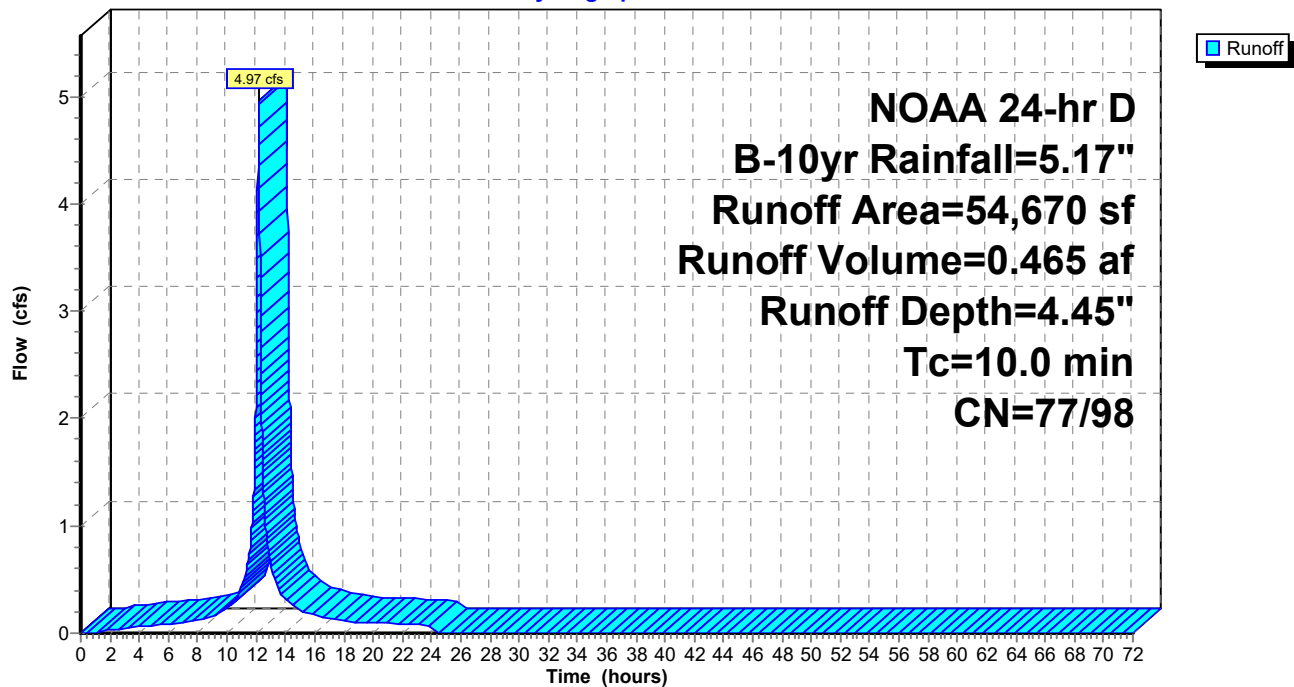
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
42,500	98	Paved parking, HSG C
5,780	74	>75% Grass cover, Good, HSG C
6,390	80	>75% Grass cover, Good, HSG D
54,670	93	Weighted Average
12,170	77	22.26% Pervious Area
42,500	98	77.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, 1

**Subcatchment A1: Ex Area 1**

Hydrograph



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NOAA 24-hr D B-10yr Rainfall=5.17"

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**Summary for Subcatchment A2: Ex Area 2**

Runoff = 3.16 cfs @ 12.22 hrs, Volume= 0.296 af, Depth= 2.68"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

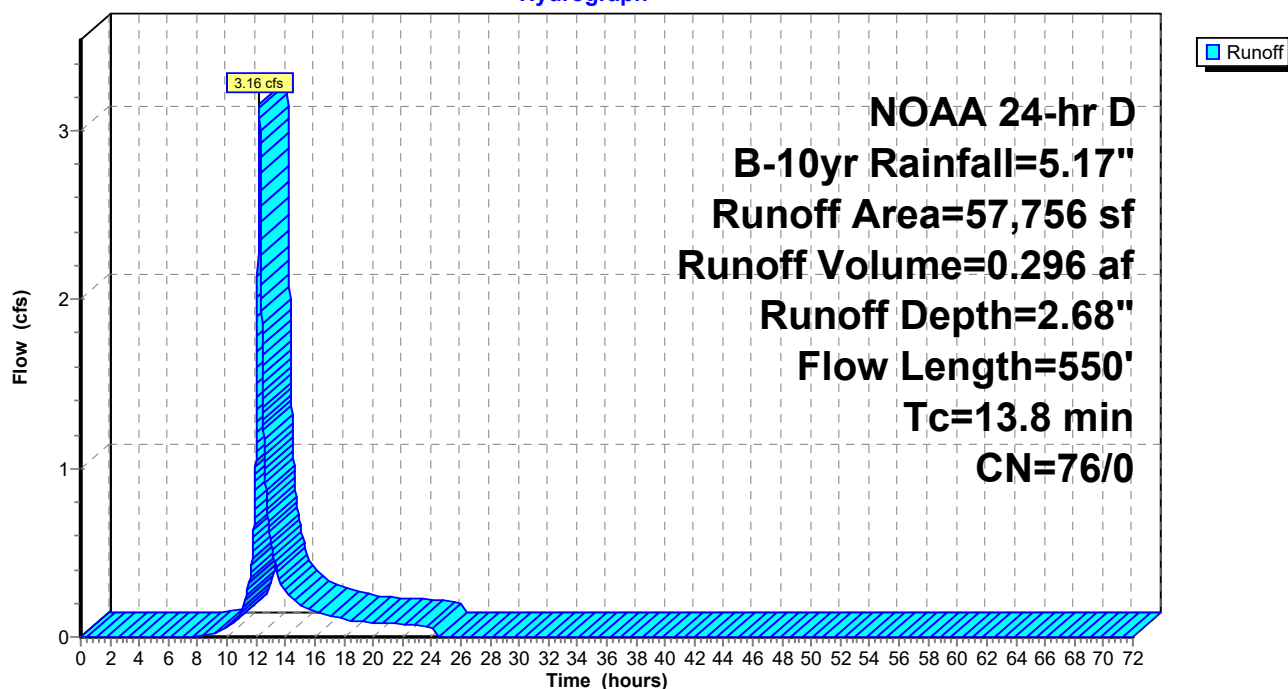
Area (sf)	CN	Description
17,809	80	>75% Grass cover, Good, HSG D
39,947	74	>75% Grass cover, Good, HSG C
57,756	76	Weighted Average
57,756	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	100	0.0350	0.22		<b>Sheet Flow, 1</b> Grass: Short n= 0.150 P2= 3.40"
4.7	300	0.0050	1.06		<b>Shallow Concentrated Flow, 2</b> Grassed Waterway Kv= 15.0 fps
0.4	50	0.0200	2.12		<b>Shallow Concentrated Flow, 3</b> Grassed Waterway Kv= 15.0 fps
1.1	100	0.0100	1.50		<b>Shallow Concentrated Flow, 4</b> Grassed Waterway Kv= 15.0 fps
13.8	550	Total			

**Subcatchment A2: Ex Area 2**

Hydrograph



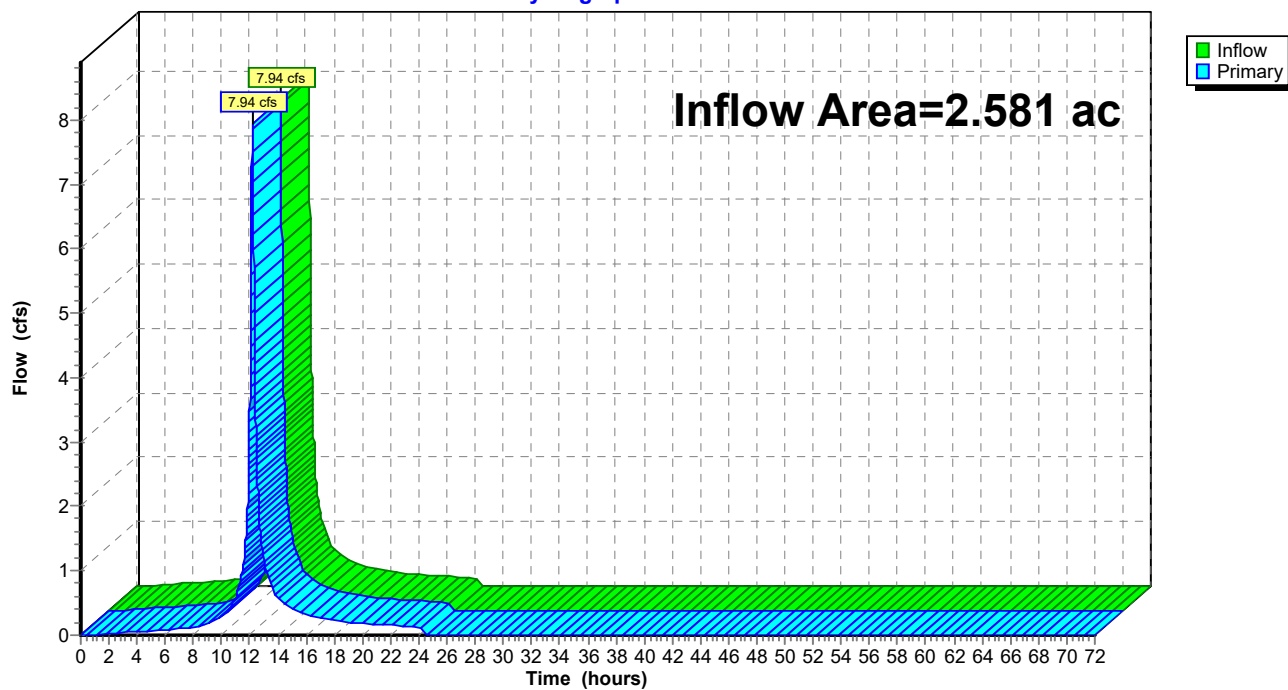
**Summary for Link A3: TOTAL**

Inflow Area = 2.581 ac, 37.80% Impervious, Inflow Depth = 3.54" for B-10yr event  
Inflow = 7.94 cfs @ 12.19 hrs, Volume= 0.761 af  
Primary = 7.94 cfs @ 12.19 hrs, Volume= 0.761 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Link A3: TOTAL**

Hydrograph



**200311 - Existing Analysis\_SCD**

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**Summary for Subcatchment A4: Offsite Drainage Area**

Runoff = 0.47 cfs @ 12.18 hrs, Volume= 0.039 af, Depth= 2.68"

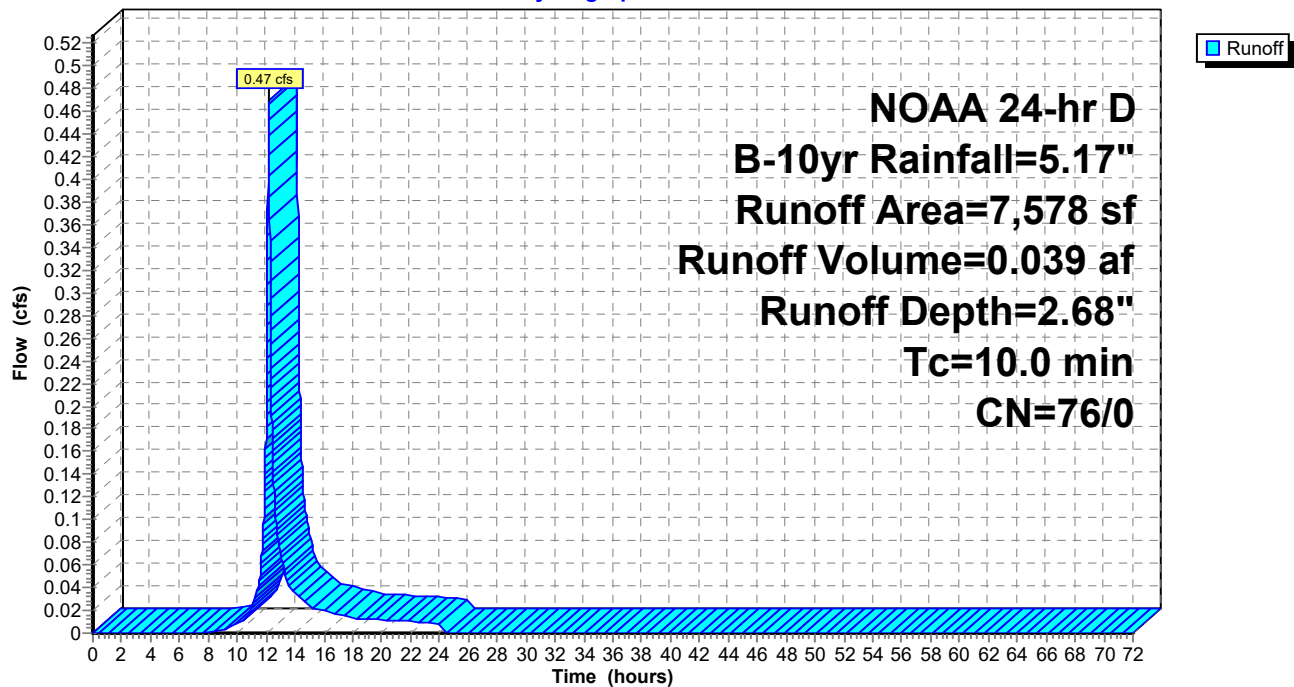
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
2,024	80	>75% Grass cover, Good, HSG D
7,578	76	Weighted Average
7,578	76	100.00% Pervious Area

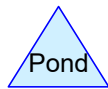
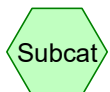
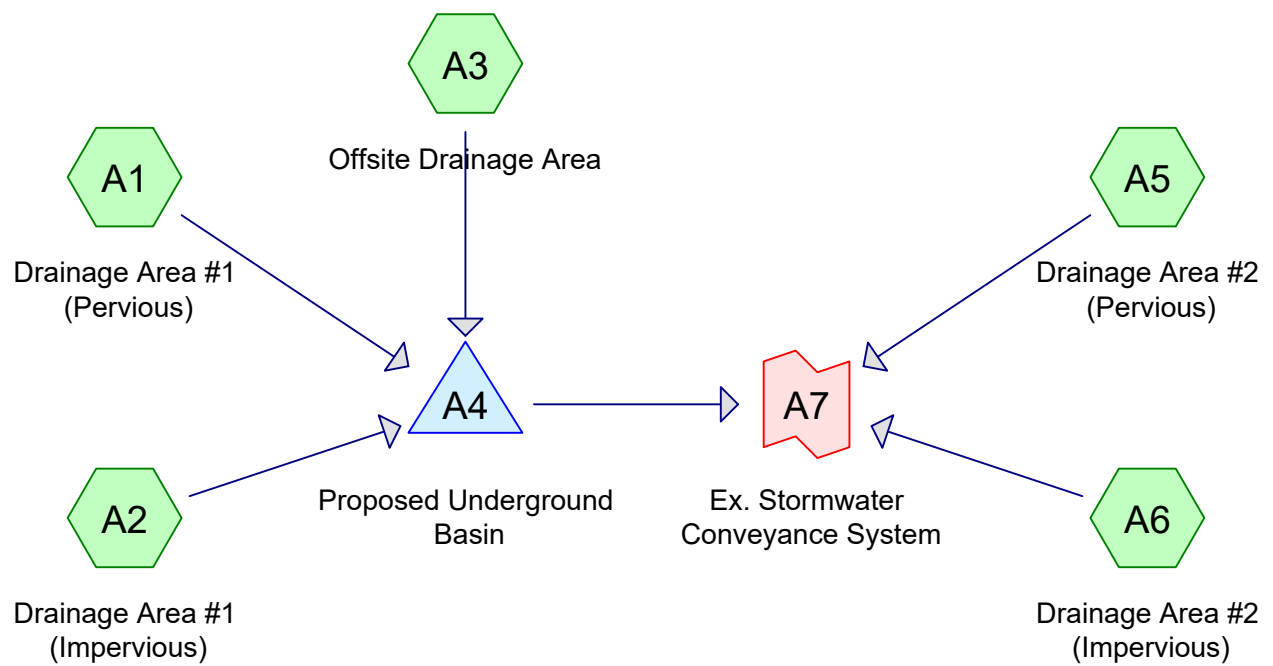
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,

**Subcatchment A4: Offsite Drainage Area**

Hydrograph







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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.391	74	>75% Grass cover, Good, HSG C (A1, A3, A5)
0.345	80	>75% Grass cover, Good, HSG D (A1, A3, A5)
1.845	98	Paved parking (A2)
0.175	98	Unconnected pavement (A6)
<b>2.755</b>	<b>92</b>	<b>TOTAL AREA</b>

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### Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.391	HSG C	A1, A3, A5
0.345	HSG D	A1, A3, A5
2.020	Other	A2, A6
<b>2.755</b>		<b>TOTAL AREA</b>

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### Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.391	0.345	0.000	0.735	>75% Grass cover, Good	A1, A3, A5
0.000	0.000	0.000	0.000	1.845	1.845	Paved parking	A2
0.000	0.000	0.000	0.000	0.175	0.175	Unconnected pavement	A6
<b>0.000</b>	<b>0.000</b>	<b>0.391</b>	<b>0.345</b>	<b>2.020</b>	<b>2.755</b>	<b>TOTAL AREA</b>	

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### Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	A4	9.80	9.00	55.0	0.0145	0.013	15.0	0.0	0.0

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Time span=0.00-200.00 hrs, dt=0.01 hrs, 20001 points

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.

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

**SubcatchmentA1: Drainage Area #1**      Runoff Area=9,195 sf   0.00% Impervious   Runoff Depth=1.35"  
Tc=10.0 min   CN=77/0   Runoff=0.28 cfs   0.024 af

**SubcatchmentA2: Drainage Area #1**      Runoff Area=80,361 sf   100.00% Impervious   Runoff Depth=3.16"  
Tc=10.0 min   CN=0/98   Runoff=5.16 cfs   0.485 af

**SubcatchmentA3: Offsite Drainage Area**      Runoff Area=7,578 sf   0.00% Impervious   Runoff Depth=1.29"  
Tc=10.0 min   CN=76/0   Runoff=0.22 cfs   0.019 af

**SubcatchmentA5: Drainage Area #2**      Runoff Area=15,260 sf   0.00% Impervious   Runoff Depth=1.35"  
Tc=10.0 min   CN=77/0   Runoff=0.47 cfs   0.039 af

**SubcatchmentA6: Drainage Area #2**      Runoff Area=7,610 sf   100.00% Impervious   Runoff Depth=3.16"  
Tc=10.0 min   CN=0/98   Runoff=0.49 cfs   0.046 af

**Pond A4: Proposed Underground Basin**      Peak Elev=11.62'   Storage=6,307 cf   Inflow=5.66 cfs   0.528 af  
Outflow=1.48 cfs   0.528 af

**Link A7: Ex. Stormwater Conveyance System**      Inflow=2.22 cfs   0.613 af  
Primary=2.22 cfs   0.613 af

**Total Runoff Area = 2.755 ac   Runoff Volume = 0.613 af   Average Runoff Depth = 2.67"**  
**26.69% Pervious = 0.735 ac   73.31% Impervious = 2.020 ac**

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**Summary for Subcatchment A1: Drainage Area #1 (Pervious)**

Runoff = 0.28 cfs @ 12.18 hrs, Volume= 0.024 af, Depth= 1.35"

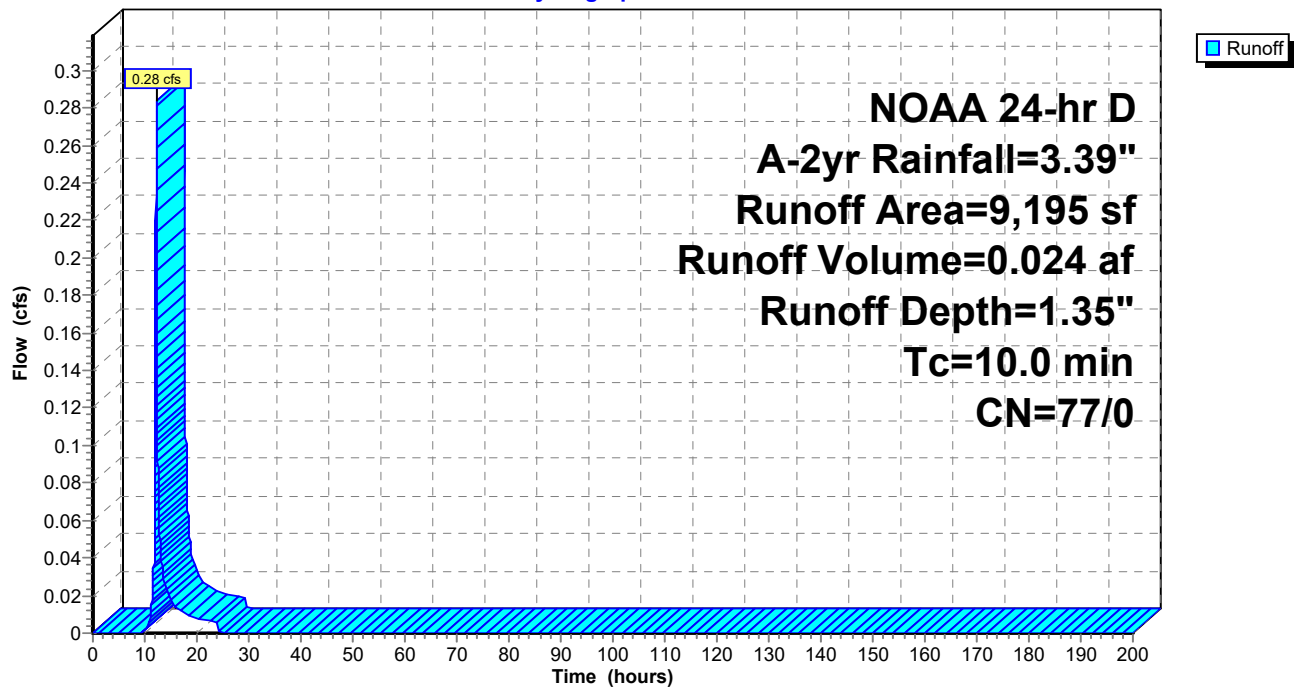
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
4,150	74	>75% Grass cover, Good, HSG C
5,045	80	>75% Grass cover, Good, HSG D
9,195	77	Weighted Average
9,195	77	100.00% Pervious Area

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

**Subcatchment A1: Drainage Area #1 (Pervious)**

Hydrograph



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**Summary for Subcatchment A2: Drainage Area #1 (Impervious)**

Runoff = 5.16 cfs @ 12.17 hrs, Volume= 0.485 af, Depth= 3.16"

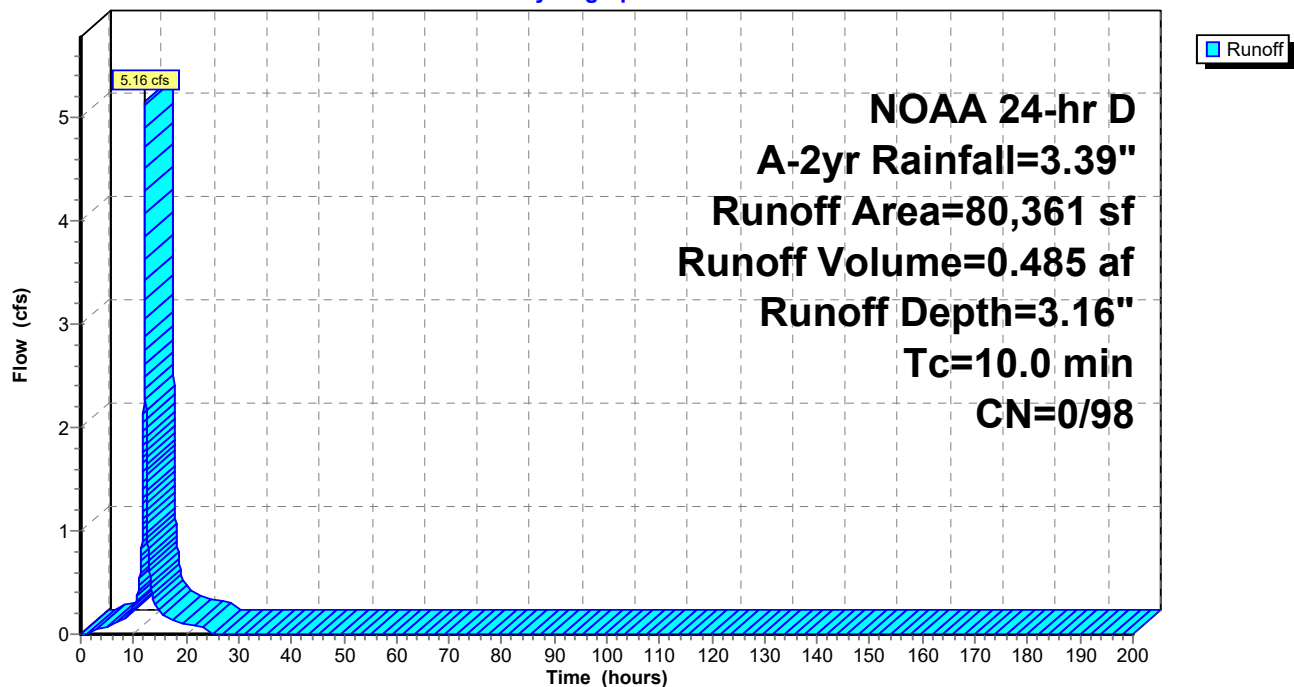
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

	Area (sf)	CN	Description
*	80,361	98	Paved parking
	80,361	98	100.00% Impervious Area

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

**Subcatchment A2: Drainage Area #1 (Impervious)**

Hydrograph





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**Summary for Subcatchment A3: Offsite Drainage Area**

Runoff = 0.22 cfs @ 12.18 hrs, Volume= 0.019 af, Depth= 1.29"

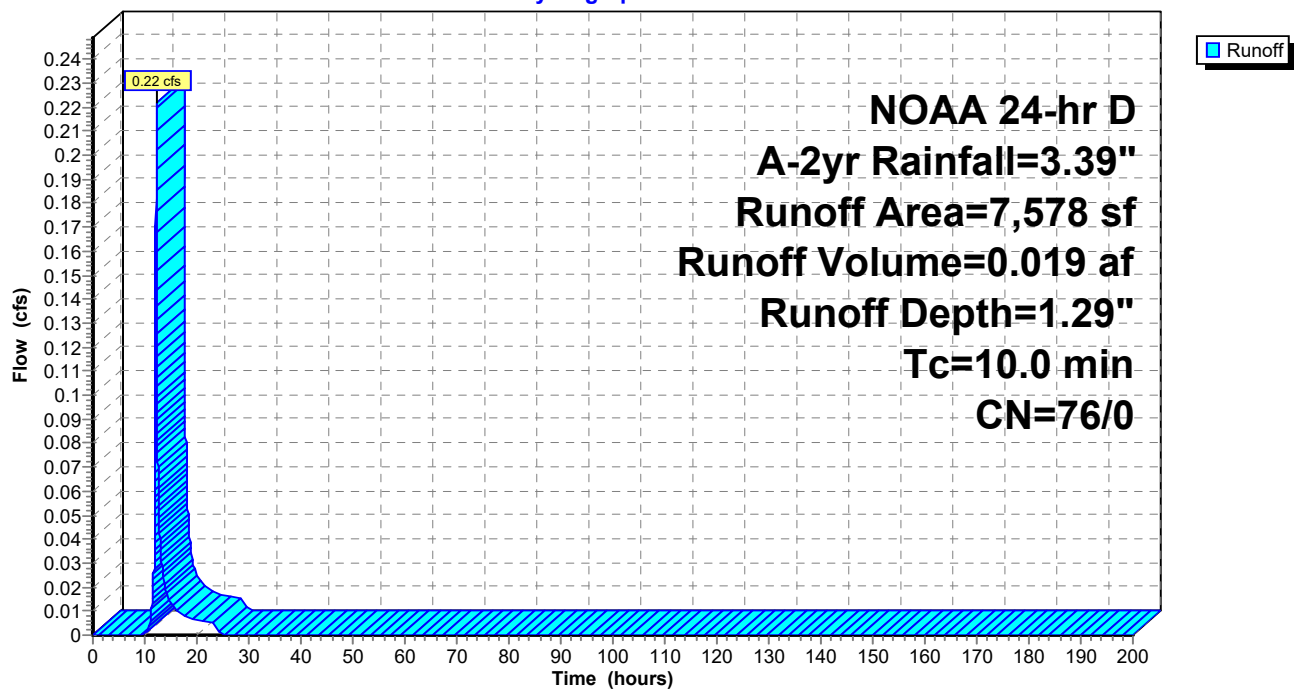
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
2,024	80	>75% Grass cover, Good, HSG D
7,578	76	Weighted Average
7,578	76	100.00% Pervious Area

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

**Subcatchment A3: Offsite Drainage Area**

Hydrograph



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**Summary for Subcatchment A5: Drainage Area #2 (Pervious)**

Runoff = 0.47 cfs @ 12.18 hrs, Volume= 0.039 af, Depth= 1.35"

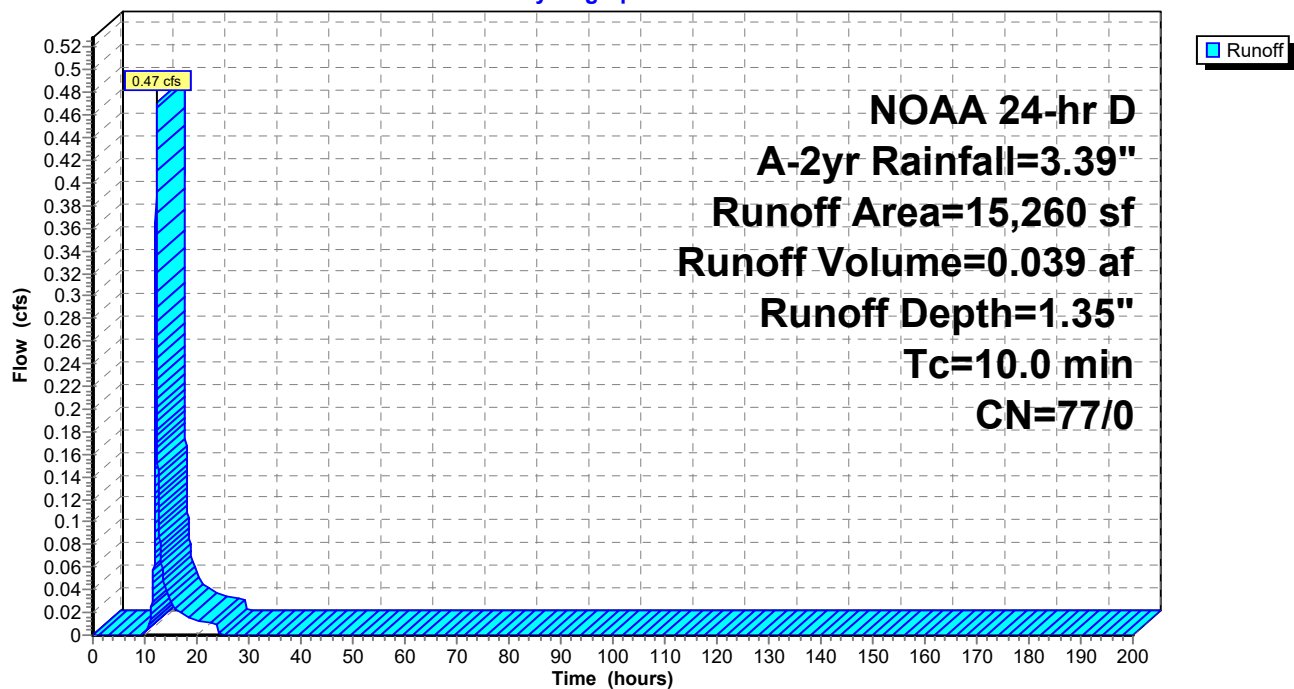
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
7,950	80	>75% Grass cover, Good, HSG D
7,310	74	>75% Grass cover, Good, HSG C
15,260	77	Weighted Average
15,260	77	100.00% Pervious Area

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

**Subcatchment A5: Drainage Area #2 (Pervious)**

Hydrograph



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**Summary for Subcatchment A6: Drainage Area #2 (Impervious)**

Runoff = 0.49 cfs @ 12.17 hrs, Volume= 0.046 af, Depth= 3.16"

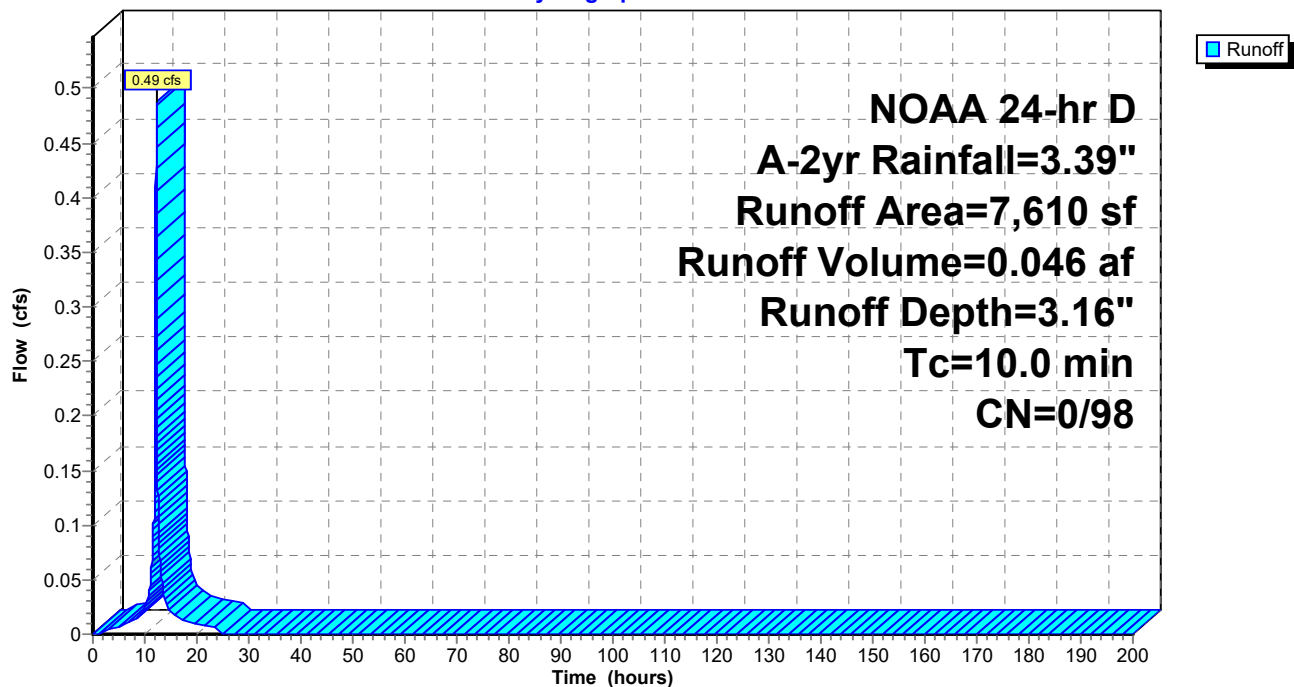
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D A-2yr Rainfall=3.39"

Area (sf)	CN	Description
7,610	98	Unconnected pavement
7,610	98	100.00% Impervious Area

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

**Subcatchment A6: Drainage Area #2 (Impervious)**

Hydrograph



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**Summary for Pond A4: Proposed Underground Basin**

Inflow Area = 2.230 ac, 82.73% Impervious, Inflow Depth = 2.84" for A-2yr event  
 Inflow = 5.66 cfs @ 12.17 hrs, Volume= 0.528 af  
 Outflow = 1.48 cfs @ 12.51 hrs, Volume= 0.528 af, Atten= 74%, Lag= 20.2 min  
 Primary = 1.48 cfs @ 12.51 hrs, Volume= 0.528 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
 Peak Elev= 11.62' @ 12.51 hrs Surf.Area= 6,727 sf Storage= 6,307 cf

Plug-Flow detention time= 59.0 min calculated for 0.528 af (100% of inflow)  
 Center-of-Mass det. time= 59.4 min ( 828.6 - 769.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	10.00'	6,286 cf	<b>74.75'W x 90.00'L x 4.00'H Field A</b> 26,910 cf Overall - 11,196 cf Embedded = 15,714 cf x 40.0% Voids
#2A	10.00'	8,971 cf	<b>ADS N-12 36" x 56 Inside #1</b> Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.1 cf 14 Rows of 4 Chambers 71.75' Header x 7.10 sf x 2 = 1,018.8 cf Inside
		15,256 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	9.80'	<b>15.0" Round Culvert</b> L= 55.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.80' / 9.00' S= 0.0145 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	10.00'	<b>7.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	11.65'	<b>3.8' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	13.00'	<b>5.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

Primary OutFlow Max=1.48 cfs @ 12.51 hrs HW=11.62' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 1.48 cfs of 6.45 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.48 cfs @ 5.54 fps)
- 3=Sharp-Crested Rectangular Weir( Controls 0.00 cfs)
- 4=Sharp-Crested Rectangular Weir( Controls 0.00 cfs)

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### Pond A4: Proposed Underground Basin - Chamber Wizard Field A

#### Chamber Model = ADS N-12 36" (ADS N-12® Pipe)

Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf

Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.1 cf

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

4 Chambers/Row x 20.00' Long +3.50' Header x 2 = 87.00' Row Length +18.0" End Stone x 2 = 90.00' Base Length

14 Rows x 42.0" Wide + 21.0" Spacing x 13 + 18.0" Side Stone x 2 = 74.75' Base Width

42.0" Chamber Height + 6.00" Cover = 4.00' Field Height

56 Chambers x 142.0 cf + 71.75' Header x 7.10 sf x 2 = 8,970.8 cf Chamber Storage

56 Chambers x 177.1 cf + 71.75' Header x 8.86 sf x 2 = 11,191.1 cf Displacement

26,909.9 cf Field - 11,191.1 cf Chambers = 15,718.8 cf Stone x 40.0% Voids = 6,287.5 cf Stone Storage

Chamber Storage + Stone Storage = 15,258.4 cf = 0.350 af

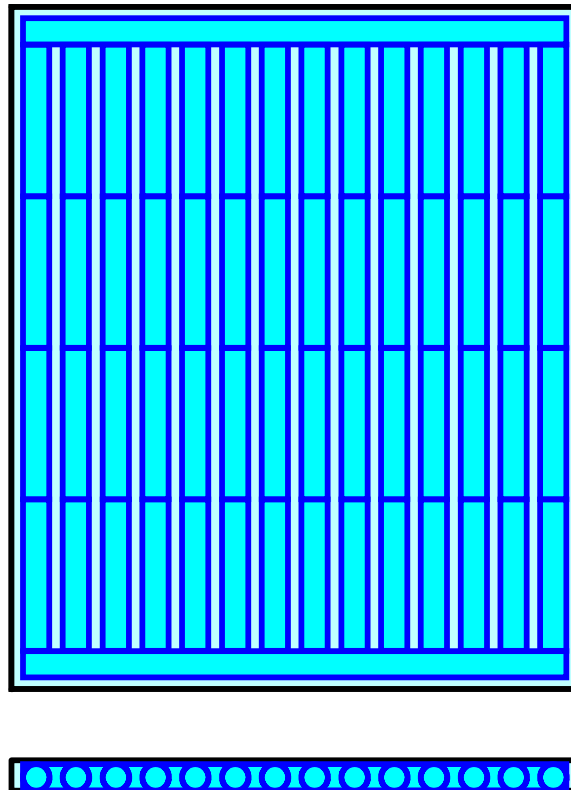
Overall Storage Efficiency = 56.7%

Overall System Size = 90.00' x 74.75' x 4.00'

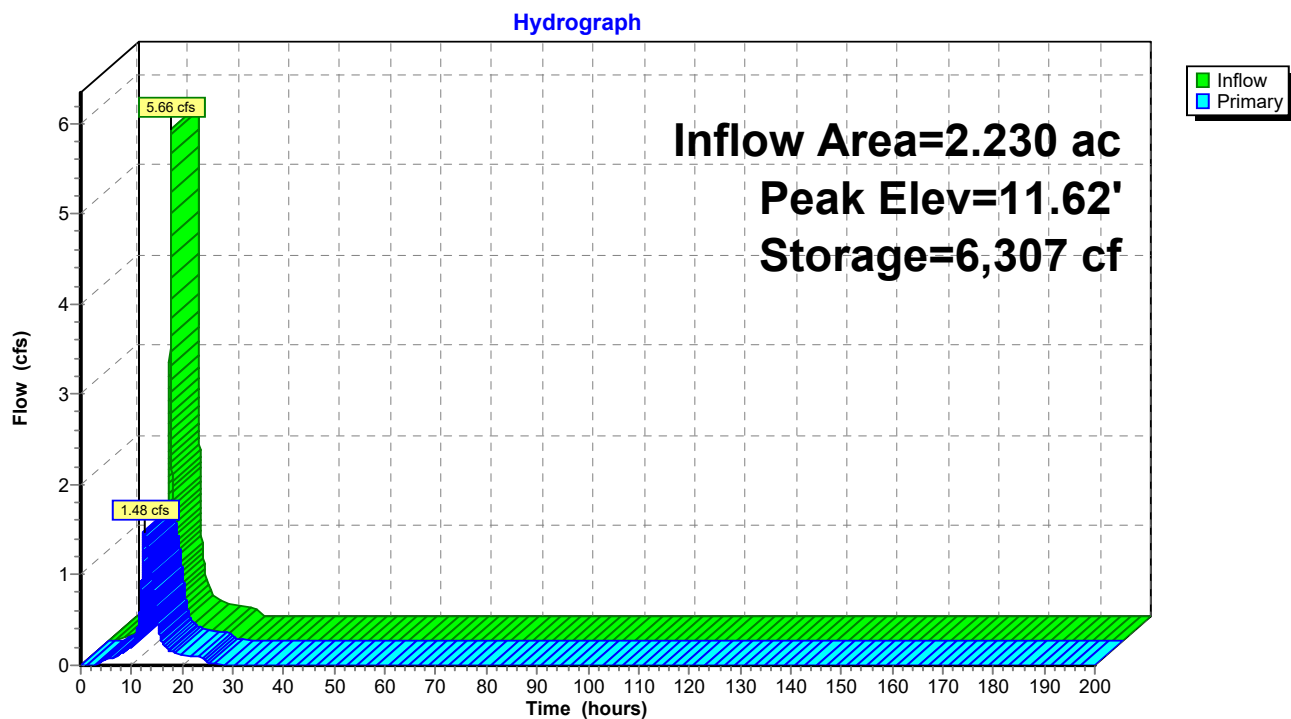
56 Chambers

996.7 cy Field

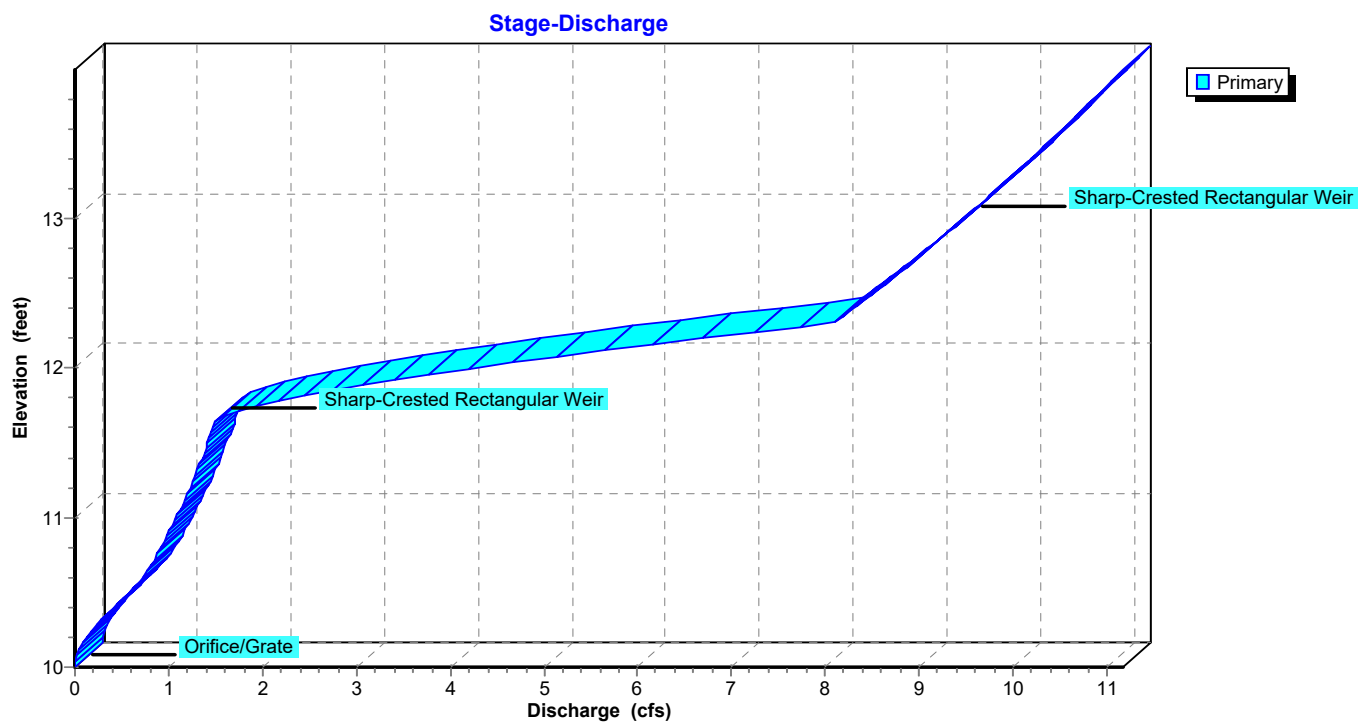
582.2 cy Stone



## Pond A4: Proposed Underground Basin



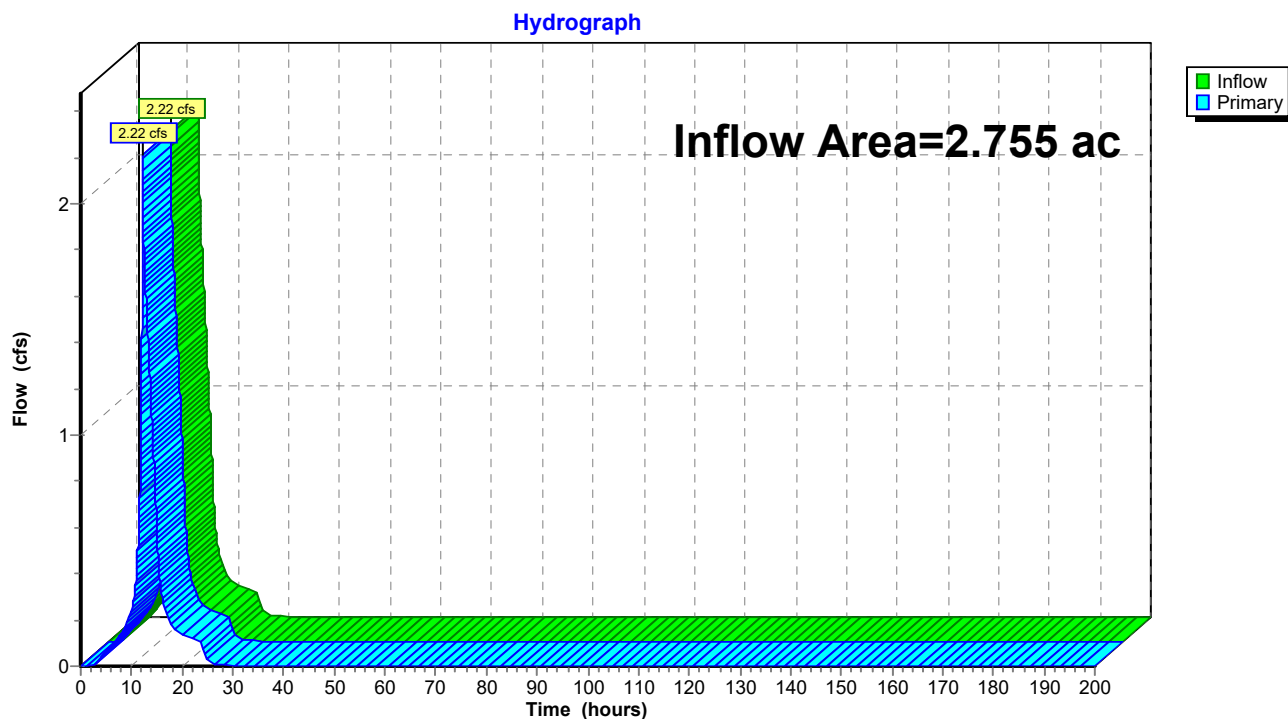
## Pond A4: Proposed Underground Basin



**Summary for Link A7: Ex. Stormwater Conveyance System**

Inflow Area = 2.755 ac, 73.31% Impervious, Inflow Depth = 2.67" for A-2yr event  
Inflow = 2.22 cfs @ 12.19 hrs, Volume= 0.613 af  
Primary = 2.22 cfs @ 12.19 hrs, Volume= 0.613 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-200.00 hrs, dt= 0.01 hrs

**Link A7: Ex. Stormwater Conveyance System**

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Time span=0.00-200.00 hrs, dt=0.01 hrs, 20001 points  
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**SubcatchmentA1: Drainage Area #1**      Runoff Area=9,195 sf   0.00% Impervious   Runoff Depth=2.77"  
Tc=10.0 min   CN=77/0   Runoff=0.59 cfs   0.049 af

**SubcatchmentA2: Drainage Area #1**      Runoff Area=80,361 sf   100.00% Impervious   Runoff Depth=4.93"  
Tc=10.0 min   CN=0/98   Runoff=7.92 cfs   0.758 af

**SubcatchmentA3: Offsite Drainage Area**      Runoff Area=7,578 sf   0.00% Impervious   Runoff Depth=2.68"  
Tc=10.0 min   CN=76/0   Runoff=0.47 cfs   0.039 af

**SubcatchmentA5: Drainage Area #2**      Runoff Area=15,260 sf   0.00% Impervious   Runoff Depth=2.77"  
Tc=10.0 min   CN=77/0   Runoff=0.98 cfs   0.081 af

**SubcatchmentA6: Drainage Area #2**      Runoff Area=7,610 sf   100.00% Impervious   Runoff Depth=4.93"  
Tc=10.0 min   CN=0/98   Runoff=0.75 cfs   0.072 af

**Pond A4: Proposed Underground Basin**      Peak Elev=12.09'   Storage=8,603 cf   Inflow=8.98 cfs   0.846 af  
Outflow=5.27 cfs   0.846 af

**Link A7: Ex. Stormwater Conveyance System**      Inflow=6.37 cfs   0.998 af  
Primary=6.37 cfs   0.998 af

**Total Runoff Area = 2.755 ac   Runoff Volume = 0.998 af   Average Runoff Depth = 4.35"**  
**26.69% Pervious = 0.735 ac   73.31% Impervious = 2.020 ac**



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**Summary for Subcatchment A1: Drainage Area #1 (Pervious)**

Runoff = 0.59 cfs @ 12.17 hrs, Volume= 0.049 af, Depth= 2.77"

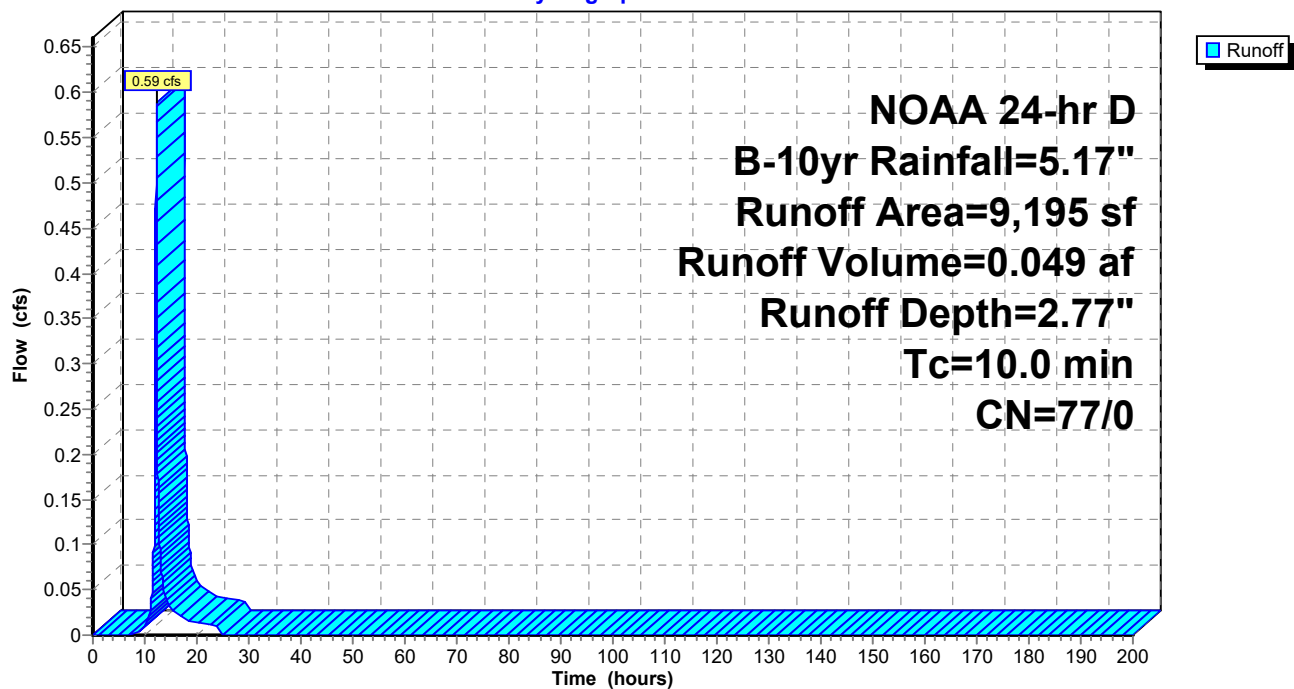
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
4,150	74	>75% Grass cover, Good, HSG C
5,045	80	>75% Grass cover, Good, HSG D
9,195	77	Weighted Average
9,195	77	100.00% Pervious Area

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

**Subcatchment A1: Drainage Area #1 (Pervious)**

Hydrograph



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**Summary for Subcatchment A2: Drainage Area #1 (Impervious)**

Runoff = 7.92 cfs @ 12.17 hrs, Volume= 0.758 af, Depth= 4.93"

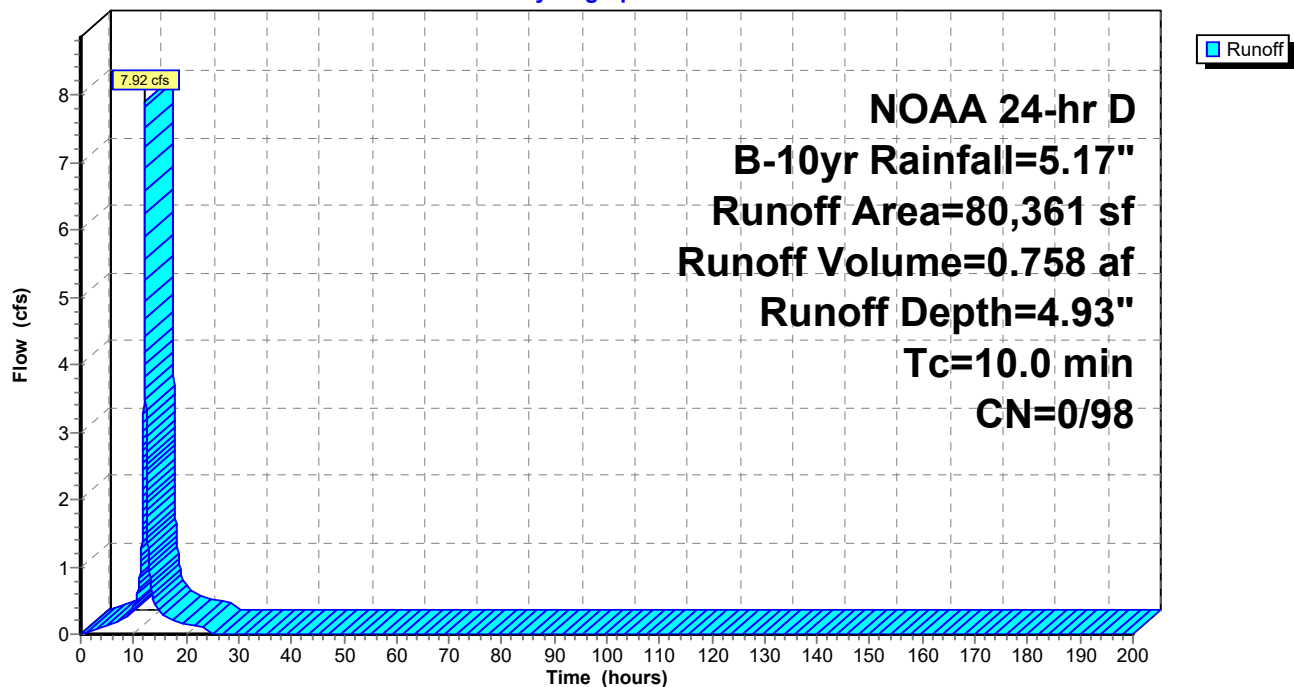
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

	Area (sf)	CN	Description
*	80,361	98	Paved parking
	80,361	98	100.00% Impervious Area

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

**Subcatchment A2: Drainage Area #1 (Impervious)**

Hydrograph



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**Summary for Subcatchment A3: Offsite Drainage Area**

Runoff = 0.47 cfs @ 12.18 hrs, Volume= 0.039 af, Depth= 2.68"

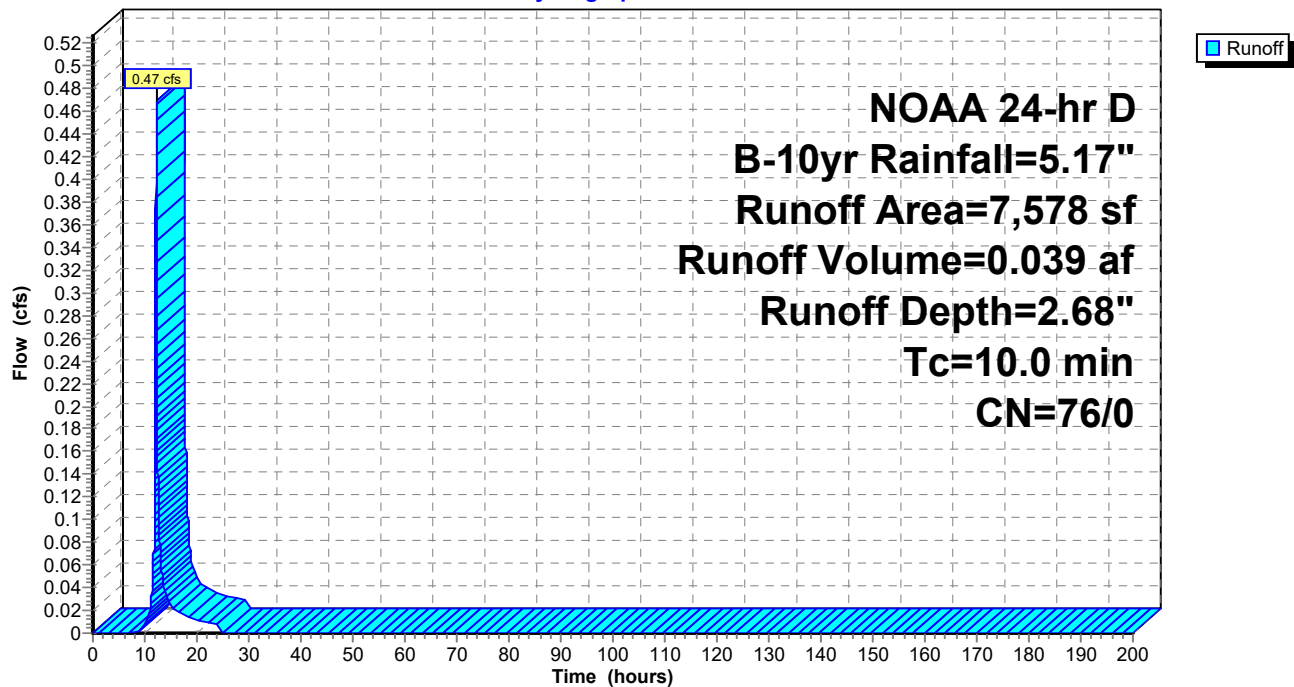
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
2,024	80	>75% Grass cover, Good, HSG D
7,578	76	Weighted Average
7,578	76	100.00% Pervious Area

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

**Subcatchment A3: Offsite Drainage Area**

Hydrograph



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**Summary for Subcatchment A5: Drainage Area #2 (Pervious)**

Runoff = 0.98 cfs @ 12.17 hrs, Volume= 0.081 af, Depth= 2.77"

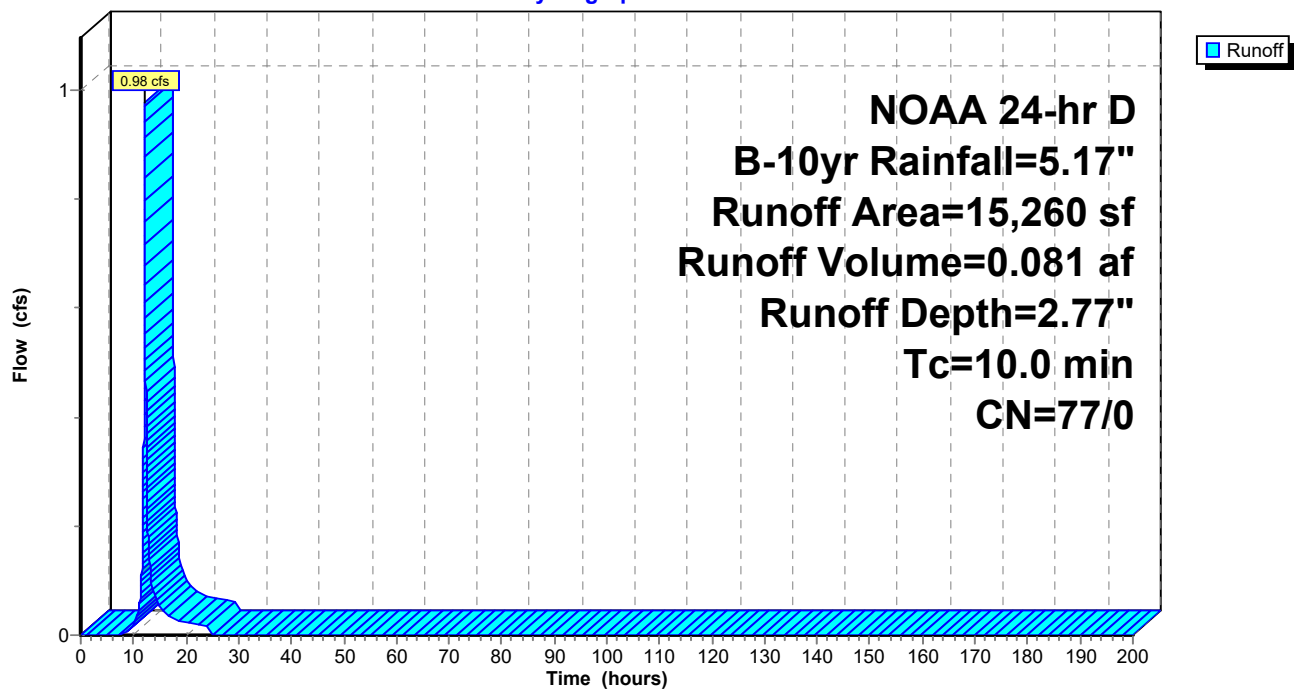
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
7,950	80	>75% Grass cover, Good, HSG D
7,310	74	>75% Grass cover, Good, HSG C
15,260	77	Weighted Average
15,260	77	100.00% Pervious Area

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

**Subcatchment A5: Drainage Area #2 (Pervious)**

Hydrograph



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### Summary for Subcatchment A6: Drainage Area #2 (Impervious)

Runoff = 0.75 cfs @ 12.17 hrs, Volume= 0.072 af, Depth= 4.93"

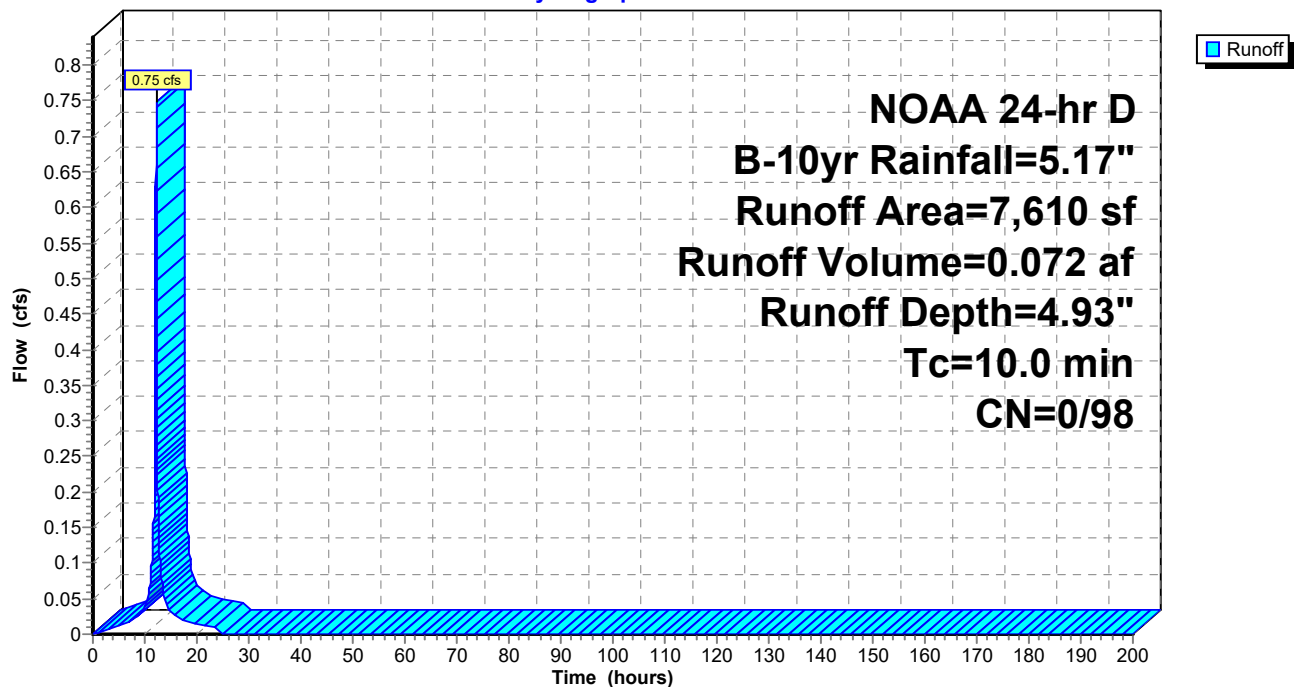
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
NOAA 24-hr D B-10yr Rainfall=5.17"

Area (sf)	CN	Description
7,610	98	Unconnected pavement
7,610	98	100.00% Impervious Area

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

### Subcatchment A6: Drainage Area #2 (Impervious)

Hydrograph



**Summary for Pond A4: Proposed Underground Basin**

Inflow Area = 2.230 ac, 82.73% Impervious, Inflow Depth = 4.55" for B-10yr event  
 Inflow = 8.98 cfs @ 12.17 hrs, Volume= 0.846 af  
 Outflow = 5.27 cfs @ 12.29 hrs, Volume= 0.846 af, Atten= 41%, Lag= 7.3 min  
 Primary = 5.27 cfs @ 12.29 hrs, Volume= 0.846 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.01 hrs  
 Peak Elev= 12.09' @ 12.29 hrs Surf.Area= 6,727 sf Storage= 8,603 cf

Plug-Flow detention time= 51.1 min calculated for 0.846 af (100% of inflow)  
 Center-of-Mass det. time= 51.0 min ( 812.8 - 761.8 )

Volume	Invert	Avail.Storage	Storage Description
#1A	10.00'	6,286 cf	<b>74.75'W x 90.00'L x 4.00'H Field A</b> 26,910 cf Overall - 11,196 cf Embedded = 15,714 cf x 40.0% Voids
#2A	10.00'	8,971 cf	<b>ADS N-12 36" x 56 Inside #1</b> Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.1 cf 14 Rows of 4 Chambers 71.75' Header x 7.10 sf x 2 = 1,018.8 cf Inside
		15,256 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	9.80'	<b>15.0" Round Culvert</b> L= 55.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.80' / 9.00' S= 0.0145 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	10.00'	<b>7.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	11.65'	<b>3.8' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)
#4	Device 1	13.00'	<b>5.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=5.27 cfs @ 12.29 hrs HW=12.09' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 5.27 cfs of 7.63 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.73 cfs @ 6.46 fps)
- 3=Sharp-Crested Rectangular Weir (Weir Controls 3.55 cfs @ 2.17 fps)
- 4=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)

## 200311 - Proposed Analysis\_SCD

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### Pond A4: Proposed Underground Basin - Chamber Wizard Field A

#### Chamber Model = ADS N-12 36" (ADS N-12® Pipe)

Inside= 36.1"W x 36.1"H => 7.10 sf x 20.00'L = 142.0 cf

Outside= 42.0"W x 42.0"H => 8.86 sf x 20.00'L = 177.1 cf

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

4 Chambers/Row x 20.00' Long +3.50' Header x 2 = 87.00' Row Length +18.0" End Stone x 2 = 90.00' Base Length

14 Rows x 42.0" Wide + 21.0" Spacing x 13 + 18.0" Side Stone x 2 = 74.75' Base Width

42.0" Chamber Height + 6.00" Cover = 4.00' Field Height

56 Chambers x 142.0 cf + 71.75' Header x 7.10 sf x 2 = 8,970.8 cf Chamber Storage

56 Chambers x 177.1 cf + 71.75' Header x 8.86 sf x 2 = 11,191.1 cf Displacement

26,909.9 cf Field - 11,191.1 cf Chambers = 15,718.8 cf Stone x 40.0% Voids = 6,287.5 cf Stone Storage

Chamber Storage + Stone Storage = 15,258.4 cf = 0.350 af

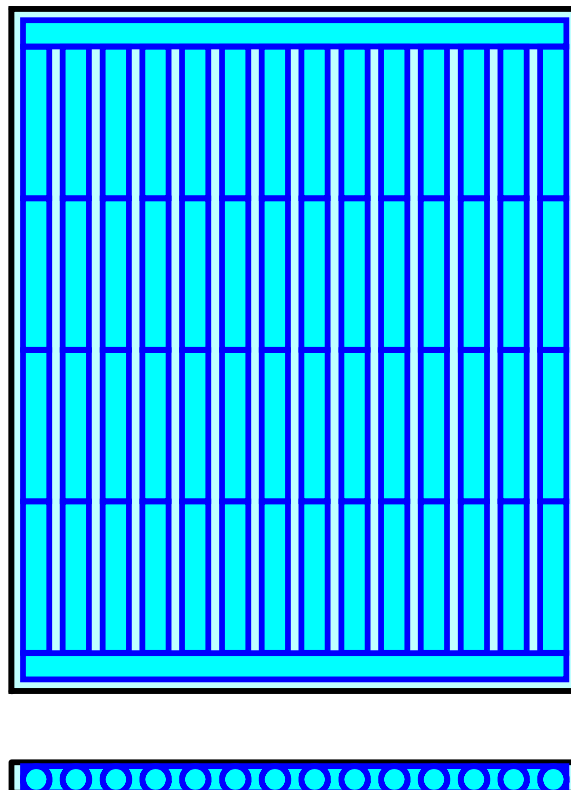
Overall Storage Efficiency = 56.7%

Overall System Size = 90.00' x 74.75' x 4.00'

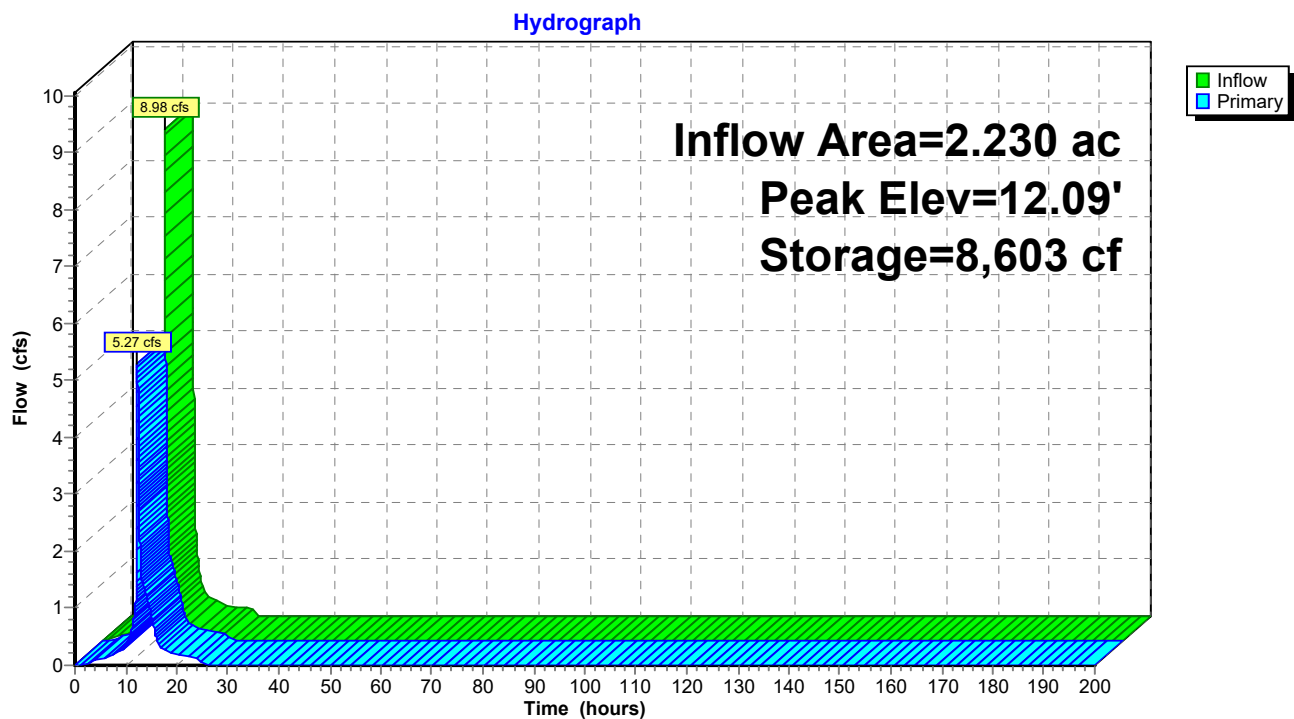
56 Chambers

996.7 cy Field

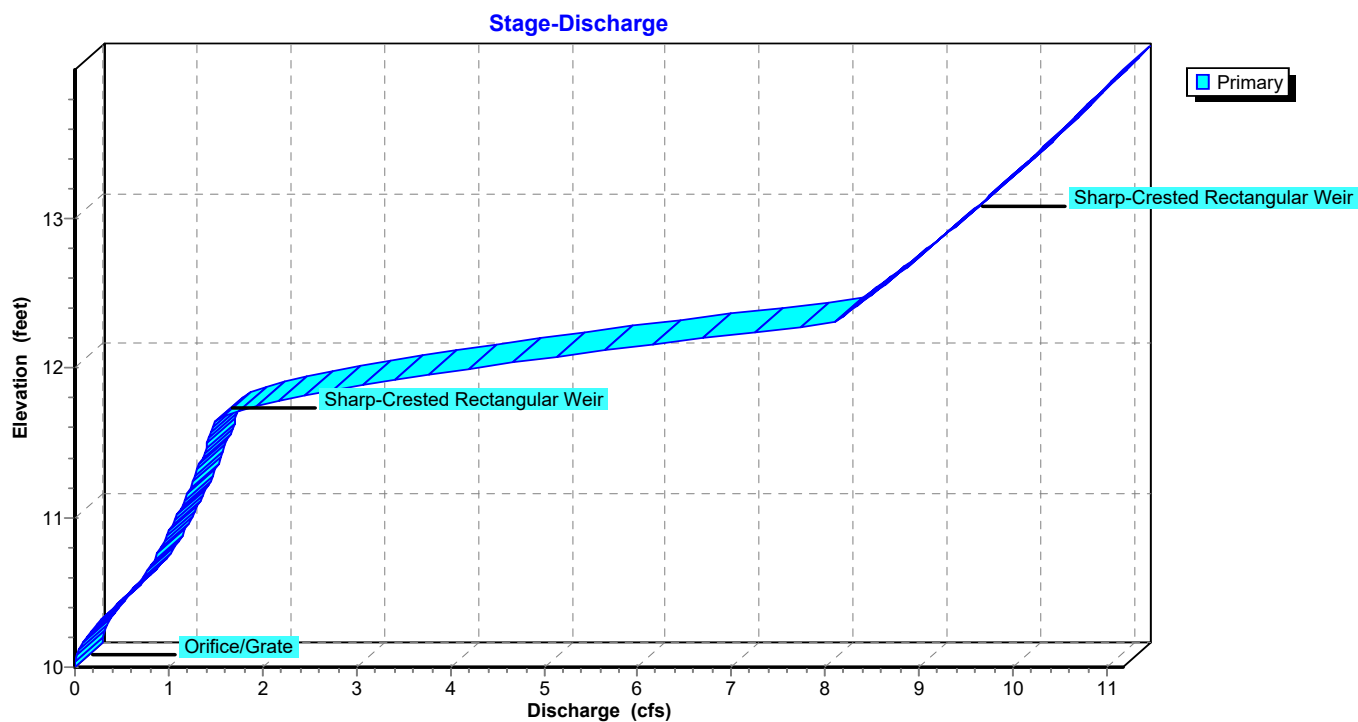
582.2 cy Stone



### Pond A4: Proposed Underground Basin



### Pond A4: Proposed Underground Basin

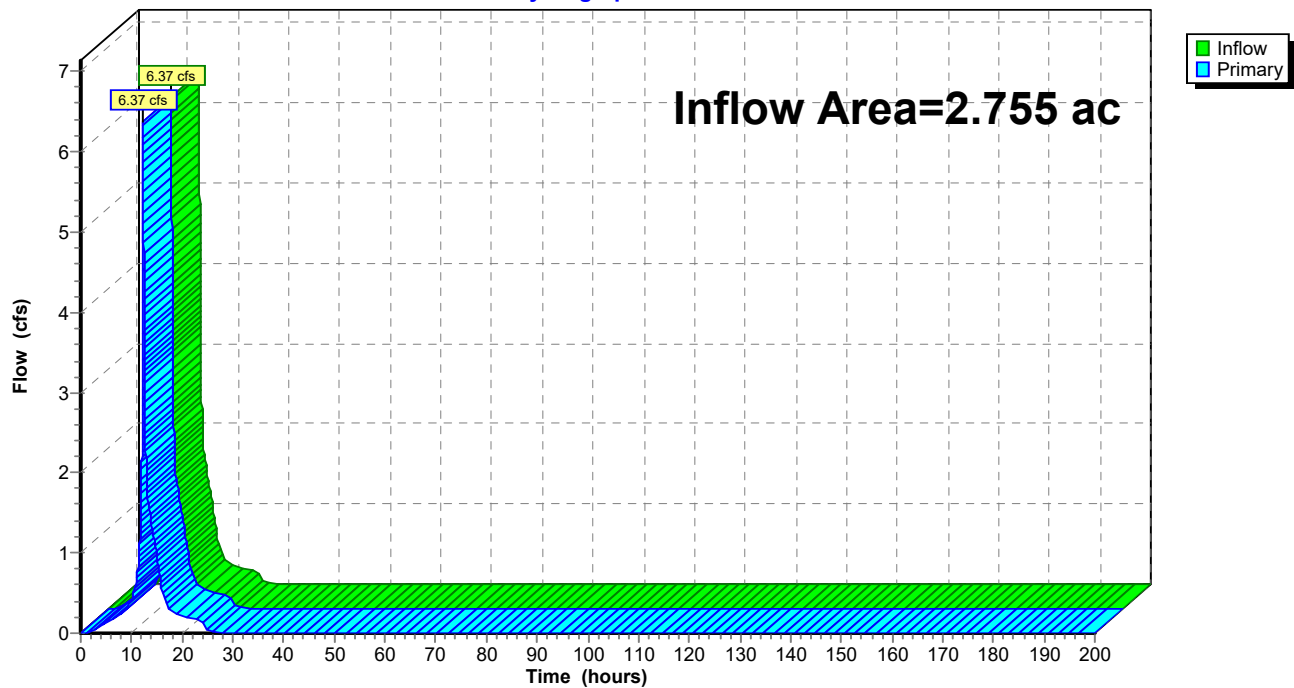




**Summary for Link A7: Ex. Stormwater Conveyance System**

Inflow Area = 2.755 ac, 73.31% Impervious, Inflow Depth = 4.35" for B-10yr event  
Inflow = 6.37 cfs @ 12.27 hrs, Volume= 0.998 af  
Primary = 6.37 cfs @ 12.27 hrs, Volume= 0.998 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-200.00 hrs, dt= 0.01 hrs

**Link A7: Ex. Stormwater Conveyance System****Hydrograph**





## **APPENDIX D**

### **DRAINAGE AREA MAPS**