

# STORMWATER REPORT

FOR

## *ACORN PLACE*

ACORN STREET  
MILLIS, MA 02054

*PROPOSED SENIOR RESIDENTIAL COMMUNITY*

JULY 12, 2018

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VOLUME 1 OF 1



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# INTRODUCTION

This report presents a description along with supporting calculations for the stormwater runoff treatment and mitigation systems proposed for the senior residential community development to be known as Acorn Place as presented on a plan set entitled "Acorn Place Site Plan of Land in Millis, Massachusetts" prepared by Merrikin Engineering, LLP with an original date of July 12, 2018. The development consists of 48 new multi-family dwelling units.

## EXISTING SITE

The proposed development lies on the westerly side of Acorn Street in Millis, totaling approximately 24.3 acres. The site predominately consists of woods, with a thin strip of isolated wetlands running through the center.

## SOILS

A series of test pits have been conducted across the site, which have generally confirmed the soils conditions described in the soils conservation service on-line soils website maps (see Attachment H). The soils conservation service maps indicate that the site is comprised of various soils types as follows:

Northern and Central Portions:

- Woodbridge (310A): A class C/D soil.

Southeast, and Southwest Portions:

- Woodbridge (310B): A class C/D soil.

## GROUNDWATER CONDITIONS

On-site testing concluded that seasonal high groundwater throughout the site is 24-36" below grade.

## SOIL PERMEABILITY

For the purposes of this report and based on the soils present at the proposed stormwater infiltration facility, a Rawls rate for sandy loam (1.02 inches per hour) is used for infiltration related calculations.

## **FLOOD PLAIN**

No portion of this site lies within a flood plain.

## **WETLAND PROTECTION ACT**

Central and western portions of the site include isolated vegetated wetlands. A Notice of Intent will be filed for proposed work within wetland jurisdictional areas.

## **PROPOSED DEVELOPMENT**

The proposed multi-family development consists of 22 two-unit dwellings, 4 single unit dwellings, and a club house along with associated driveways, landscape areas, utility systems, and stormwater management systems.

## **MASSACHUSETTS STORMWATER MANAGEMENT STANDARDS**

The stormwater management system design consists of a series of catch basins, manholes, and piping which collect runoff from the proposed development and the adjacent watersheds. These devices provide pretreatment prior to conveying stormwater into the various BMPs described herein. The stormwater management system is designed in accordance with the provisions of the DEP Stormwater Management Standards and Handbook, which are summarized below.

### **STANDARD 1 - New Stormwater Conveyances**

*No New Stormwater Conveyances (e.g. outfalls) May Discharge Untreated Stormwater Directly to or Cause Erosion in Wetlands or Waters of the Commonwealth.* The proposed development complies with this standard.

The development includes three primary stormwater discharge points. Note the following:

- Design Point #1: Flow to Shadowfax Farm: This design point represents the discharge to the westerly abutter. Stormwater from the driveway and adjacent houses will be piped to infiltration Basin #1, overflow from which will be dissipated by a level spreader. Stormwater runoff to Pearl Street will be infiltrated through an existing infiltration basin, overflow from which will be dissipated by a level spreader towards Shadowfax Farm.
- Design Point #2: Flow to Southern Abutters: This design point represents the discharge to the on-site isolated wetlands, which overflow into the southern abutter. Stormwater from the roadway and adjacent houses will be piped to

infiltration Basin #2, overflow from which will be dissipated by use of a level spreader.

- Design Point #3: Flow to Acorn Street: This design point represents the uncontrolled stormwater discharge to Acorn Street.

## **STANDARD 2 – Peak Discharge Rates**

*Stormwater Management Systems shall be designed so that the Post-Development Peak Discharge Rates do not Exceed Pre-Development Peak Discharge Rates.* The proposed development complies with this standard.

In order to model pre and post peak discharges, a program called Hydrocad was used, which employs the TR-20 modeling system. The DEP Stormwater Management regulations require that the 2 and 10 year storms should be considered for peak rates and the 100-year storm for flooding considerations, and the Millis EHIR regulations additionally require analysis of the 1 and 50 year storms. The following five theoretical storm events were used to model the site before and after the proposed activities occur<sup>1</sup>:

<u>Design Storm</u>	<u>Rainfall</u>
1-Year	2.5 inches
2-Year	3.2 inches
10-Year	4.7 inches
50-Year	6.1 inches
100-Year	6.7 inches

### **DESIGN POINT #1: Flow to Shadowfax Farm**

Description of Existing Conditions: In the existing condition, Watershed E1a and E1b represents uncontrolled overland flow from the western portion of the site that flows to the western abutter. The watershed consists entirely of wooded land. Watersheds E1c and E1d represent stormwater runoff from the adjacent the Hickory Hills existing stormwater basin. Watersheds E1b through E1d are taken from the proposed conditions of the approved Hickory Hills Stormwater Report so that the proposed incorporation of three lots from the Hickory Hills subdivision into the project can be evaluated with respect to operation of the existing Pearl Street stormwater basin.

Description of Proposed Conditions: In the proposed condition, Watersheds P1a through P1f represent stormwater runoff from areas tributary to the proposed stormwater management system. Runoff is collected in catch basins and discharged to a stormwater infiltration basin. Watershed P1g and P1h will shed

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<sup>1</sup> Rainfall depths are as specified by MassDEP in Appendix F-1 of the Hydrology Handbook for Conservation Commissioners dated March 2002.

uncontrolled to the abutter. Watersheds P1i and P1j shed to the existing Hickory Hills stormwater basin. The previously approved design included the construction of three single family dwellings along with associated driveways. These three dwelling were not built as part of the Hickory Hills Subdivision. Instead, two dwellings attributable to the stormwater runoff to Pearl Street are being constructed as part of the Acorn Place development.

Summary of Peak Flow Rates to Design Point:

Design Storm (Year)	Peak Runoff Rate (cfs)		Volume of Runoff (ac-ft)	
	Existing	Proposed	Existing	Proposed
1	1.82	1.55	0.248	0.150
2	3.80	3.02	0.449	0.263
10	9.06	6.81	0.983	0.833
50	14.71	12.03	1.603	1.553
100	17.30	16.08	1.899	1.890

**DESIGN POINT #2: Flow to Southern Abutters**

Description of Existing Conditions: In the existing condition, Watershed E2 represents uncontrolled overland flow from the central portion of the site that flows to the southern abutter. The watershed consists of wooded land and contains small areas of isolated wetlands.

Description of Proposed Conditions: In the proposed condition, Watersheds P2b through P2d represent stormwater runoff from areas tributary to the proposed stormwater management system. Runoff is collected in catch basins and discharged to a stormwater infiltration basin. Watershed P2a will shed uncontrolled runoff to the abutter.

Summary of Peak Flow Rates to Design Point:

Design Storm (Year)	Peak Runoff Rate (cfs)		Volume of Runoff (ac-ft)	
	Existing	Proposed	Existing	Proposed
1	3.24	2.79	0.509	0.425
2	6.72	5.60	0.927	0.759
10	16.01	13.88	2.033	1.833
50	25.96	25.07	3.228	3.021
100	30.45	29.97	3.771	3.560

**DESIGN POINT #3: Flow to Acorn Street**

Description of Existing Conditions: In the existing condition, Watershed E3 represents uncontrolled overland flow from the eastern portion of the site that flows to Acorn Street. The watershed consists of wooded land.

Description of Proposed Conditions: In the proposed condition, Watershed P3 sheds uncontrolled runoff through the western abutters to Acorn Street. The proposed watershed is smaller than the existing watershed, resulting in reduced stormwater discharges.

Summary of Peak Flow Rates to Design Point:

Design Storm (Year)	Peak Runoff Rate (cfs)		Volume of Runoff (ac-ft)	
	Existing	Proposed	Existing	Proposed
1	1.29	1.24	0.161	0.144
2	2.74	2.54	0.292	0.258
10	6.59	5.93	0.641	0.556
50	10.71	9.51	1.018	0.875
100	12.57	11.12	1.189	1.020

### **STANDARD 3 - Loss of Annual Recharge**

*Loss of Annual Recharge to Groundwater shall be Eliminated or Minimized through the use of Environmentally Sensitive Site Design, Low Impact Development Techniques, Stormwater Best Management Practices, and Good Operation and Maintenance.*

#### **RECHARGE CALCULATIONS AND METHODS**

The DEP Stormwater Management Standards requires that a minimum volume of runoff (Required Recharge Volume, Rv) be recharged on the site based on soils conditions in accordance with the following table:

	Class A Soils	Class B Soils	Class C Soils	Class D Soils
Runoff Depth (d) to be Recharged	d = 0.60 inches	d = 0.35 inches	d = 0.25 inches	d = 0.10 inches

The Required Recharge Volume is calculated by multiplying the runoff depth to be recharged (d) for each soils class by the amount of impervious coverage (on the site) under the proposed condition.

## STORMWATER INFILTRATION BASIN #1

Recharge required (Rv)=(Impervious coverage)\*(depth to be recharged)

	Class A Soils	Class B Soils	Class C Soils	Class D Soils
On-Site Impervious Area	0 s.f.	0 s.f.	104,317 s.f.	0 s.f.
Required Recharge Volume (Rv)	0 c.f.	0 c.f.	2,173 c.f.	0 c.f.
Total Rv	2,173 c.f.			

Capture Area Adjustment: All new impervious surfaces are routed through infiltration BMPs except for some of the patios at the rear of the units. A capture area adjustment is provided as follows for design point #1:

- Design point #1 Impervious Coverage: 106,057 s.f.
- Percent to Infiltration BMP: 98.4%
- Ratio: 1.02
- Capture Area Adjusted Rv: 2,210 c.f.

Standard 3 requires that infiltration facilities be provided and sized in accordance with three acceptable methods; 1) the Static Method, 2) The Simple Dynamic Method, and 3) the Dynamic Field Method. Each method is summarized below.

Static Method: The Static Method simply requires that the proposed recharge facility contain a total raw volume (adjusted for void space if stone is used within the storage volume) equal to or greater than the Required Recharge Volume.

Simple Dynamic Method: The Simple Dynamic method allows for a very conservative inclusion of some of the recharge which occurs within the infiltration facility during the design storm in accordance with the following formula:

$$A' = Rv \div (D + kT)$$

$$V' = A \times D$$

Where

*A' is the minimum required bottom area*

*V' is the minimum required storage volume of the infiltration facility*

*Rv is the Required Recharge Volume*

*D is the depth of the infiltration facility (adjusted by the void space factor if the leaching facility is filled with stone)*

*K is the saturated hydraulic conductivity determined by the Rawls Rate (Table 2.3.3 of Volume 3, Chapter 1 of the Stormwater Handbook)*

*T is the allowable drawdown during the peak of the storm = 2 hours for this method*



This method allows the designer to include two hours of ongoing recharge during the design storm using a permeability rate (saturated hydraulic conductivity) selected based on the classification of the soil under the infiltration facility.

*Dynamic Field Method:* The Dynamic Field Method uses a more aggressive inclusion of on-going recharge from an infiltration facility during the design storm. This method is calculated using rainfall routing software (Hydrocad) and a truncated hydrograph which assumes that the Required Recharge Volume is loaded to the infiltration facility during a 12 hour period. For this method the design permeability rate must be based on in-situ permeability testing with a safety factor of 50% applied to the actual rate found.

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For this infiltration facility, the Static Method has been utilized. The Static Method simply requires that the infiltration facility's raw storage volume be at least equal to Rv. The proposed infiltration basin has a volume of 19,325 c.f. below the outlet, which satisfies the requirement.

A secondary check is required to ensure that the Rv will recharge within at least 72 hours. The WQV has been used instead of the Rv, as the required volume to be treated is greater for the WQV. A K value of 1.02 is used for drawdown design purposes since soils testing found sandy loam soils at this location. Using the following formula, the drawdown time is calculated:

$$\text{Time}_{\text{drawdown}} = [Rv / (K \times \text{Bottom Area})]$$

Where:

$$WQV = 4,347 \text{ c.f.}$$

$$K = 1.02 \text{ inches per hour} = 0.09 \text{ feet per hour}$$

$$\text{Bottom Area} = 12,754 \text{ s.f.}$$

It is concluded that the drawdown time for the infiltrated volume is 4.0 hours, which satisfies this requirement.

*Mounding Analysis:*

A mounding analysis has been conducted and can be found in attachment L. The bottom of Stormwater Basin #1 is at elevation 210.5, with a seasonal high groundwater elevation below the basin at 208.5. The mound for the infiltration of the WQV of this basin is 1.6 feet.

## STORMWATER INFILTRATION BASIN #2

Recharge required (Rv)=(Impervious coverage)\*(depth to be recharged)

	Class A Soils	Class B Soils	Class C Soils	Class D Soils
On-Site Impervious Area	0 s.f.	0 s.f.	63,157 s.f.	0 s.f.
Required Recharge Volume (Rv)	0 c.f.	0 c.f.	1,316 c.f.	0 c.f.
Total Rv	1,316 c.f.			

Capture Area Adjustment: All new impervious surfaces are routed through infiltration BMPs except for some of the patios at the rear of the units. A capture area adjustment is provided as follows for design point #3:

- Design point #3 Impervious Coverage: 66,811 s.f.
- Percent to Infiltration BMP: 94.5%
- Ratio: 1.06
- Capture Area Adjusted Rv: 1,392 c.f.

For this infiltration facility, the Static Method has been utilized. The Static Method simply requires that the infiltration facility's raw storage volume be at least equal to Rv. The proposed infiltration basin has a volume of 10,565 c.f. below the outlet, which satisfies the requirement.

A secondary check is required to ensure that the Rv will recharge within at least 72 hours. The WQV has been used instead of the Rv, as the required volume to be treated is greater for the WQV. A K value of 1.02 is used for drawdown design purposes since soils testing found sandy loam soils at this location. Using the following formula, the drawdown time is calculated:

$$\text{Time}_{\text{drawdown}} = [\text{Rv}/(\text{K} \times \text{Bottom Area})]$$

Where:

$$\text{WQV} = 2,632 \text{ c.f.}$$

$$K = 1.02 \text{ inches per hour} = 0.09 \text{ feet per hour}$$

$$\text{Bottom Area} = 12,268 \text{ s.f.}$$

It is concluded that the drawdown time for the infiltrated volume is 2.5 hours, which satisfies this requirement.

### Mounding Analysis:

A mounding analysis has been conducted and can be found in attachment L. The bottom of Stormwater Basin #2 is at elevation 216.0, with a seasonal high

groundwater elevation below the basin at 214.0. The mound for the infiltration of the WQV of this basin is 1.0 feet.

#### **STANDARD 4 - TSS Removal**

*Stormwater Management Systems shall be Designed to Remove 80% of Average Annual Post-Construction Load of Total Suspended Solids (TSS).* This standard is met when:

- a) A long-term pollution prevention plan is provided and implemented as required (refer to Attachment A),
- b) Structural stormwater BMP's are provided as required, and
- c) Pretreatment is provided as required.

The proposed stormwater management system has been designed to provide a series of Best Management Practices in accordance with the Stormwater Management Policy to remove the pollutants found in runoff as described below for each drainage sub-system.

#### **WATER QUALITY VOLUME (WQV)**

The Water Quality Volume represents the volume of water which must receive TSS removal treatment in order to comply with Standard 4. The water quality volume is calculated based on either 0.5 inches of runoff or 1.0 inches of runoff from all non-roof impervious surfaces on the site. 0.5 inches is used except in sensitive locations as described in the Stormwater Handbook. Since this site does not discharge towards a sensitive location, the WQV is based on 0.5 inches of runoff. The total WQV for the site is split amongst the various BMP treatment trains as described below (or may not apply if the specific BMP's utilized do not use it as a sizing criteria). Using the following formula, the WQV is calculated:

$$\begin{aligned}\text{WQV} &= (\text{Impervious Area}) * (0.5 \text{ in.}) \\ \text{WQV} &= (167,474 \text{ sq. ft.}) * (0.5 \text{ in.}) / (12 \text{ in./ft}) = 6,978 \text{ c.f.}\end{aligned}$$

The water volume to be treated below all infiltration basin outlets is 29,890 c.f., which is greater than the required 7,063 c.f. This satisfies the WQV requirement.

#### **PROPOSED BMP DESIGN**

##### *Deep Sump Catch Basins:*

All proposed deep sump catch basins have 4' sumps with hoods designed in accordance with the DEP Stormwater Handbook. Each structure represents one of the pretreatment BMP's in each treatment train and provides a 25% TSS removal credit.

#### Stormwater Infiltration Basin:

Stormwater pre-treatment is achieved by deep sump catch basin devices and a sediment forebay (see Attachment E for TSS calculations).

The infiltration basins have been designed with a simple concrete outlet headwall with a notch designed to control design storm conditions. The weir wall itself acts as the higher emergency overflow, which discharges via a level spreader.

The basins are designed with a total depth of 3.0 feet (Basin #1) and 2.5 feet (Basin #2). The maximum water level in the 100-year storm event is 1.88 feet for infiltration Basin #1, and 1.30 for Infiltration Basin #2.

### **TSS REMOVAL CALCULATIONS**

In accordance with the DEP Stormwater Management Handbook, each of the drainage treatment trains has been analyzed for TSS removal. The required TSS removal calculation sheets are included in Attachment E and the following sections provide a narrative discussion of each.

#### Infiltration Basin:

Although not required for this site, the deep sump catch basins and sediment forebay provide a total pretreatment TSS removal prior to the infiltration basin of 44%. The infiltration basin provides 80% TSS removal, for a total of 85% TSS removal.

### **DE MINIMIS DISCHARGE CALCULATIONS**

The stormwater runoff from the patios behind each dwelling shed does not receive treatment, and therefore a De Minimis Discharge calculation is required.

Discharge is considered to be De Minimis when the following criteria are met:

- 1. Physical site conditions preclude installation of a TSS treatment practice prior to discharge (e.g., lack of space between a wetland and a road, lack of head differential).*

It would not be practicable or cost effective to capture and treat the runoff from every patio in the development.

- 2. The discharge is less than or equal to 1 CFS for the runoff associated with the 2-year 24-hour storm.*

The rate of runoff for these areas amounts to 0.59 cfs.

3. *80% TSS removal is achieved on an average weighted basis from the site as a whole using the weighted average method described below. This will require more than 80% TSS removal at some stormwater outlets to compensate for the outlets that achieve less than 80% TSS removal and achieve an overall weighted average reduction in TSS of 80% or more across the entire site.*

$$\text{Weighted Average \%} = \frac{(\text{Area}_1) \times (\text{TSS}_1\%) + (\text{Area}_2) \times (\text{TSS}_2\%) + (\text{Area}_n) \times (\text{TSS}_n\%)}{(\text{Total Area})}$$

**Infiltration Basin #1:** (2.30 ac. Imp.)x(85%)=1.96

Untreated: (0.04 ac. Imp.)x(0%)=0.00

The weighted average is 83.5%, which meets the minimum average TSS removal of 80%.

**Infiltration Basin #2:** (1.47 ac. Imp.)x(85%)=1.25

Untreated: (0.08 ac. Imp.)x(0%)=0.00

The weighted average is 80.4%, which meets the minimum average TSS removal of 80%.

4. *The stormwater outlets where additional controls are used to achieve more than 80% TSS removal must discharge to the same reach of the same wetland or water body as the outlets that achieve less than 80% TSS removal.*

The calculations in criteria 3 are divided to show compliance with this requirement.

5. *Controls are placed at the outlet to prevent erosion or scour of the wetland/stream channel and bank.*

The untreated runoff consists of 174 s.f. patios distributed throughout the development, which will not concentrate runoff or produce erosion.

6. *Standard 2 (Peak rate attenuation) and Standard 3 (recharge) must be achieved on a sitewide basis.*

Standards 2 & 3 are met as stated previously in this report.

7. *Source control and pollution prevention measures that mitigate the impact of the untreated or partially treated discharges are identified in the*

*Pollution Prevention Plan required by Standard 4 and fully implemented (e.g., such as street sweeping).*

Pollution prevention measures are identified in the SWPPP (Attachment D).

8. *The size of the drainage area contributing runoff to the untreated outlet has been reduced to the maximum extent practicable.*

The untreated runoff of the patios are small in size relative to the overall watersheds.

## **STANDARD 5 - Land Uses with Higher Potential Pollutant Loads**

*For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If, through source control and/or pollution prevention, all land uses with higher potential pollutant load cannot be completely protected from exposure to rain, snow, snow melt and stormwater runoff, the proponent shall use the specific structural stormwater BMP's determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

This development is not a Land Use with Higher Potential Pollutant Loads.

## **STANDARD 6 – Critical Areas**

*Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharge near or to any other critical area requires the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such area, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "stormwater discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314*

*CMR 4.00. Stormwater discharges to a Zone 1 or Zone A are prohibited unless essential to the operation of the public water supply.*

This site does not lie within a critical area.

### **STANDARD 7 - Redevelopment**

*A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structures stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

The site is undeveloped and is therefore not considered to be a redevelopment.

### **STANDARD 8 – Erosion Control**

*A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

A construction activity NPDES Stormwater Pollution Prevention Plan has been prepared and included as Attachment D.

### **STANDARD 9 – Long-Term Operations and Maintenance Plan**

*A Long-Term Operations and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

A Drainage System Operations and Maintenance Plan has been prepared and included as Attachment A.

### **STANDARD 10 – Illicit Discharge Compliance**

*All illicit discharges to the stormwater management system are prohibited.*

See Attachment C for the Illicit Discharge Compliance Statement.

# **ATTACHMENT A: OPERATIONS AND MAINTENANCE PLAN**



# OPERATIONS & MAINTENANCE PLAN

FOR

## *ACORN PLACE*

ACORN STREET  
MILLIS MA, 02054

*PROPOSED SENIOR RESIDENTIAL COMMUNITY*

JULY 12, 2018

PREPARED BY:  
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# INTRODUCTION

This Operations and Maintenance Plan (hereinafter referred to "O&M Plan") is provided to ensure the long-term monitoring and maintenance of various components of the Acorn Place infrastructure. This O&M Plan includes the following provisions:

1. Stormwater System Operations and Maintenance
2. Miscellaneous Provisions
3. Accidental Spill and Emergency Response Plan

The "Development" and the various components which are referenced in this O&M Plan are described on the site plan referenced below.

## **Project Name**

Acorn Place

## **Project Location**

Acorn Street  
Millis MA, 02054

## **Operator Name and Address**

Acorn Millis Residential, LLC  
38 Benjamins Gate  
Plymouth, MA 02360

## **References**

This O&M Plan references other documents as follows:

Site Plan - Plans entitled "Acorn Place Site Plan of Land in Millis, Massachusetts" with an original date of July 12, 2018 (as may be amended), and prepared by Merrikin Engineering, LLP, hereinafter referred to as the "Site Plan".

Stormwater Report - Report entitled "Stormwater Report for Acorn Place, Acorn Street Millis, MA 02054 prepared by Merrikin Engineering, LLP with an original date of July 12, 2018 (as may be amended).

## **Site Description**

The 24.26 acre site consists of 22 two unit dwellings and 4 single unit dwellings along with associated driveways, landscape areas, utility systems, and stormwater management systems. Those land areas are collectively referred to herein as the "Development."

## **Site Usage and Activities**

A senior residential community and associated appurtenances.

# **PART 1: STORMWATER SYSTEM OPERATIONS AND MAINTENANCE**

In order to maximize the continued effectiveness of the Stormwater Management BMP's for Acorn Place, the following Operation and Maintenance requirements apply to all stormwater facilities within the extents of the Development. The stormwater facilities are depicted on the Site Plan and are hereinafter referred to as the "Stormwater Facilities."

## **Operations and Maintenance Responsibilities**

The Operator or its designee shall be responsible for implementing all Operations and Maintenance (O&M) responsibilities.

## **Commencement of Operations and Maintenance Responsibilities**

Operations and Maintenance tasks shall be commenced once each respective Stormwater Facility is fully constructed and is receiving runoff from the Development.

## **Operations and Maintenance Tasks**

### *Deep Sump Catch Basins:*

1. Deep sump catch basins shall be inspected daily during construction activities and all sediments and debris shall be removed four times per year unless the owner can determine through recorded observations that sediment accumulation does not warrant such frequent cleanings. If deep sump catch basin cleaning occurs less than four times per year, cleaning shall occur when two feet of sediments have accumulated in the sump and at least once per year.
2. Silt sacks shall be installed on all catch basins throughout the time of construction.
3. All sediments and hydrocarbons shall be disposed of off-site in accordance with all applicable local, state, and federal regulations.

### *Sediment Forebays:*

1. Sediment forebays shall be inspected at least four times per year to insure proper operation (during a storm event).
2. Sediment forebays should be mowed and all clippings and debris removed at least twice per year. Debris shall be removed at more frequent intervals if warranted by extreme weather events.
3. Sediment should be removed when 3-inches of sediment accumulates anywhere in the forebay.
4. Remove woody vegetation, leaves, and other materials that would affect the life of the system or its operations.

#### Stormwater Infiltration Basin:

1. Stormwater basins shall be inspected at least twice per year to insure proper operation (during a storm event).
2. Inspections shall include ensuring that inlet, outlet, and splash pad rip-rap aprons are in good condition and that that interior wall systems are in good condition. Deficiencies shall be remedied immediately.
3. Inspections shall include an observation of the accumulation of sediment in the basin. Pretreatment BMPs are intended to capture and contain coarse sediments. Should indication of significant accumulation of sediments in the infiltration basin be observed, increased frequency of cleaning of the preceding sediment forebay and catch basins shall be implemented.
4. Inspections shall include ensuring that outlet structures are unobstructed and free-flowing per the Site Plan design specifications.
5. Inspections shall include ensuring that all berms are fully stabilized, structurally sound and not eroded. Deficiencies shall be remedied immediately.
6. Stormwater basins should be mowed and all clippings and debris removed at least twice per year. Debris shall be removed at more frequent intervals if warranted by extreme weather events. If wetland vegetation grows at the bottom of the stormwater basin, it shall only be mowed once per year at the beginning of the winter season.
7. Sediment should be removed at least once every 5 years or when 2-inches of sediment accumulates anywhere in the basin and disposed of off-site in accordance with all applicable local, state, and federal regulations. Two sedimentation markers shall be installed in the basin by a Registered Land Surveyors with a clear marking of the 2-inch accumulation line. It is recommended that stone bounds be installed with chiseled marks indicating the limit of accumulation, although other similarly permanent marking methods may be utilized.

#### Stormwater Pipes, Inlets and Outfalls:

1. All stormwater inlets and outfalls shall be inspected twice per year.
2. Trash, leaves, debris and sediment shall be removed from inlets and outfalls as needed to keep them free flowing.
3. If inspections indicate that stormwater pipelines have become partially obstructed with trash, leaves, debris or sediment, the pipelines shall be cleaned by water jet truck and the obstructions removed and disposed of.

The various operations and maintenance schedule requirements listed above may be reduced in frequency by approval from the Town. Should such permission be desired, the Operator shall provide documentation of actual on-site maintenance observations by a qualified source (engineer or other qualified person meeting the approval of the Town) demonstrating that the particular Stormwater BMP in question does not warrant the specified frequency of inspection or maintenance activities.

## Reporting Requirements

The following documentation shall be submitted no later than December 31<sup>st</sup> of each calendar year to the Town:

1. A statement, signed by an authorized representative of the Operator indicating that the requirements of this O&M Plan were performed during the previous calendar year. Where requirements were not met, a schedule for their completion shall be provided and a follow-up statement submitted when complete.
2. A list of the maintenance activities performed along with the approximate date of the work.
3. A list of the inspections performed along with a statement by each inspector summarizing the results of the inspections performed in accordance with this O&M plan.
4. Copies of appurtenant documentation supporting the completion of the O&M responsibilities such as copies of contracts and/or receipts with parties engaged to perform maintenance and inspection services.
5. A notation regarding whether there has been any change in the name and or contact information for the Operator.

## Public Safety Features

The stormwater system has been designed to safely collect surface runoff from developed areas (as described on the Site Plan and Stormwater Report) by providing collections systems at regular intervals to prevent surface flooding and to treat that runoff in accordance with the provisions of the Massachusetts Stormwater Management Standards and Handbook.

# PART 2: MISCELLANEOUS PROVISIONS

## Good Housekeeping Controls

The following good housekeeping measures will be implemented in the day-to-day operation of the Development:

1. The site will be maintained in a neat and orderly manner.
2. Fertilizers and pesticide application on the lots shall be in accordance with this plan.
3. All waste materials from the development will be collected in dumpsters and removed from the site by properly licensed disposal companies.

## Management of Deicing Chemicals and Snow

Management of on-site snow will be as follows:

1. The site shall be plowed as needed to maintain safe driving conditions. Snow will be stored in windrows along pavement edges and shall be piled in landscape strips as needed.
2. Snow will not be plowed into piles which block or obstruct stormwater management facilities.
3. Snow will not be plowed into piles at roadway intersections such that it would obstruct visibility for entering or exiting vehicles.

4. Deicing chemicals application will be as little as possible while provide a safe environment for vehicular operation and function.

### **Operator Training**

The Operator is responsible for providing training for the staff that will be responsible for the implementation of this O&M Plan. Such training shall occur at least once annually.

### **Illicit Discharges**

The Operator shall not allow non-stormwater discharges into the development's stormwater system. Any discovered non-stormwater discharges into the development's stormwater system shall be immediately disconnected.

### **Estimated Operations and Maintenance Budget**

It is estimated that the regular annual maintenance tasks described herein will cost \$3,000 per year (2018 value).

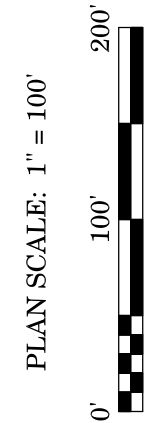
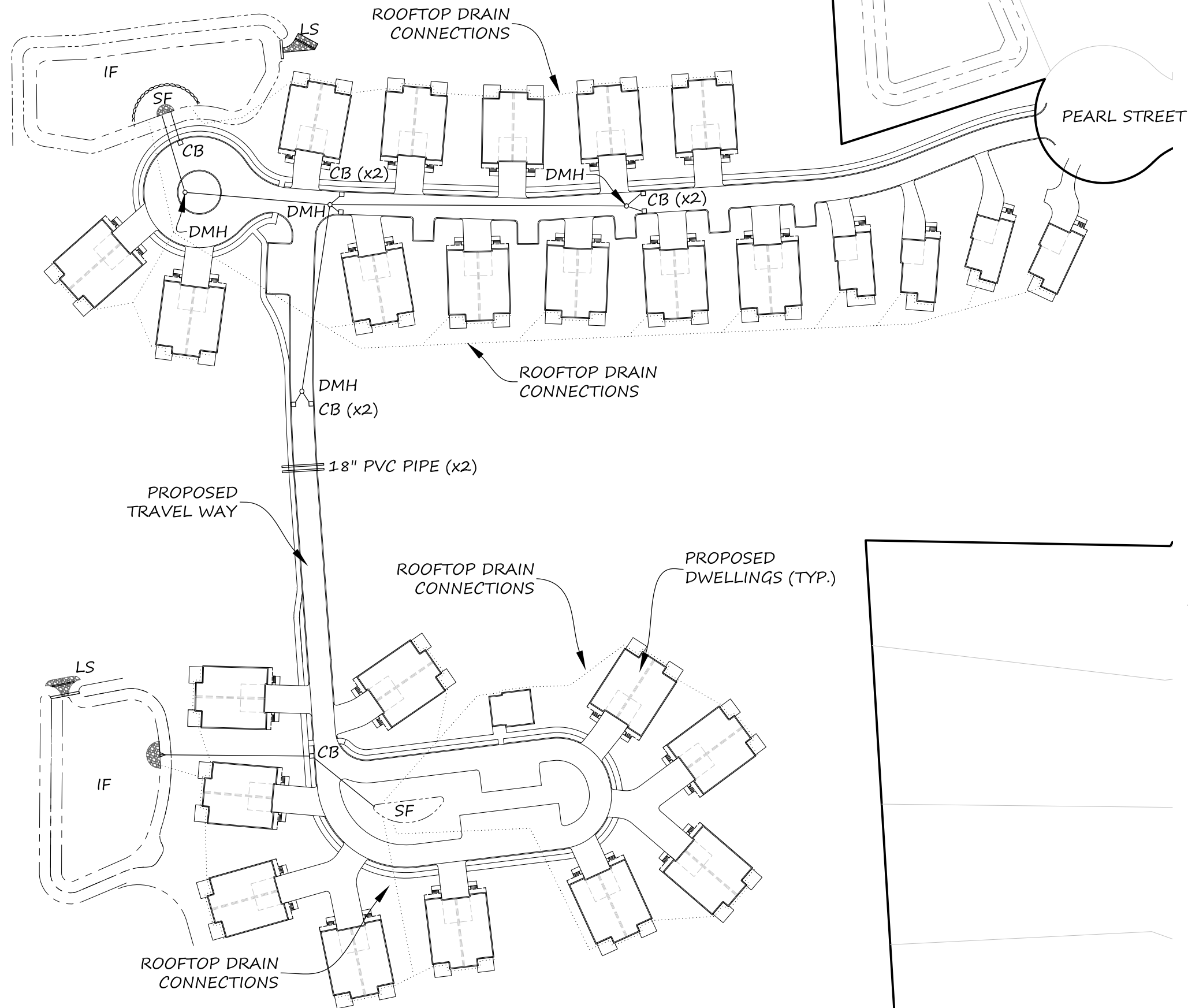
## **PART 3: ACCIDENTAL SPILL AND EMERGENCY RESPONSE PLAN**

In the event of an accident within the boundaries of the Site, where significant gasoline or other petroleum products or other hazardous materials are released, the following procedure shall be followed in the order noted.

1. As quickly as possible, attempt to block the nearest stormwater catch basins if on a roadway, or if in proximity to wetlands, create a berm of soil downslope of the spill.
2. Immediately, and while the containment measures are implemented as described above, notify the following governmental entities and inform them of the type of spill that occurred:
  - Millis Fire Department at 508-376-2361,
  - Millis Board of Health at 508-376-7042,
  - Millis Conservation Commission at 508-376-7045,
  - Mass. Department of Environmental Protection (DEP) Central Region at (508) 792-7650 (address is 8 New Bond Street Worcester, MA 01606), and
  - National Response Center (NRC) at (800) 424-8802 (for spills that require such notification pursuant to 40 CFR Part 110, 40 CFR Part 117, and 40 CR Part 302).
3. Once the various emergency response teams have arrived at the site and if the spill occurs on a lot, the owner shall follow the instructions of the various governmental entities, which may include the following:
  - A clean up firm may need to be immediately contacted.
  - If the hazardous materials have entered the stormwater system, portions of it may need to be cleaned and restored per the DEP. All such activities shall be as specified by the DEP.

# **EXHIBIT 1 STORMWATER FACILITIES SITE PLAN**





PLAN DATE: JULY 12, 2018			
REVISION	DATE	BY	

ACORN PLACE  
OPERATION &  
MAINTENANCE  
PLAN OF LAND IN  
MILLIS, MA

NOTES:

1. REFER TO APPROVED SUBDIVISION PLAN FOR COMPLETE DETAILS OF EXISTING AND PROPOSED SITE FEATURES.
2. IB=INFILTRATION BASIN
3. SF=SEDIMENT FOREBAY
4. CB=CATCH BASIN
5. DMH= DRAIN MANHOLE
6. LS= LEVEL SPREADER



730 MAIN STREET, SUITE 2C  
MILLIS, MA 02054  
ph. 508-376-8883 fax 508-376-8823

# **EXHIBIT 2** STORMWATER SYSTEM OPERATIONS AND MAINTENANCE LOG FORM

# Stormwater System Operations and Maintenance Log

Year \_\_\_\_\_

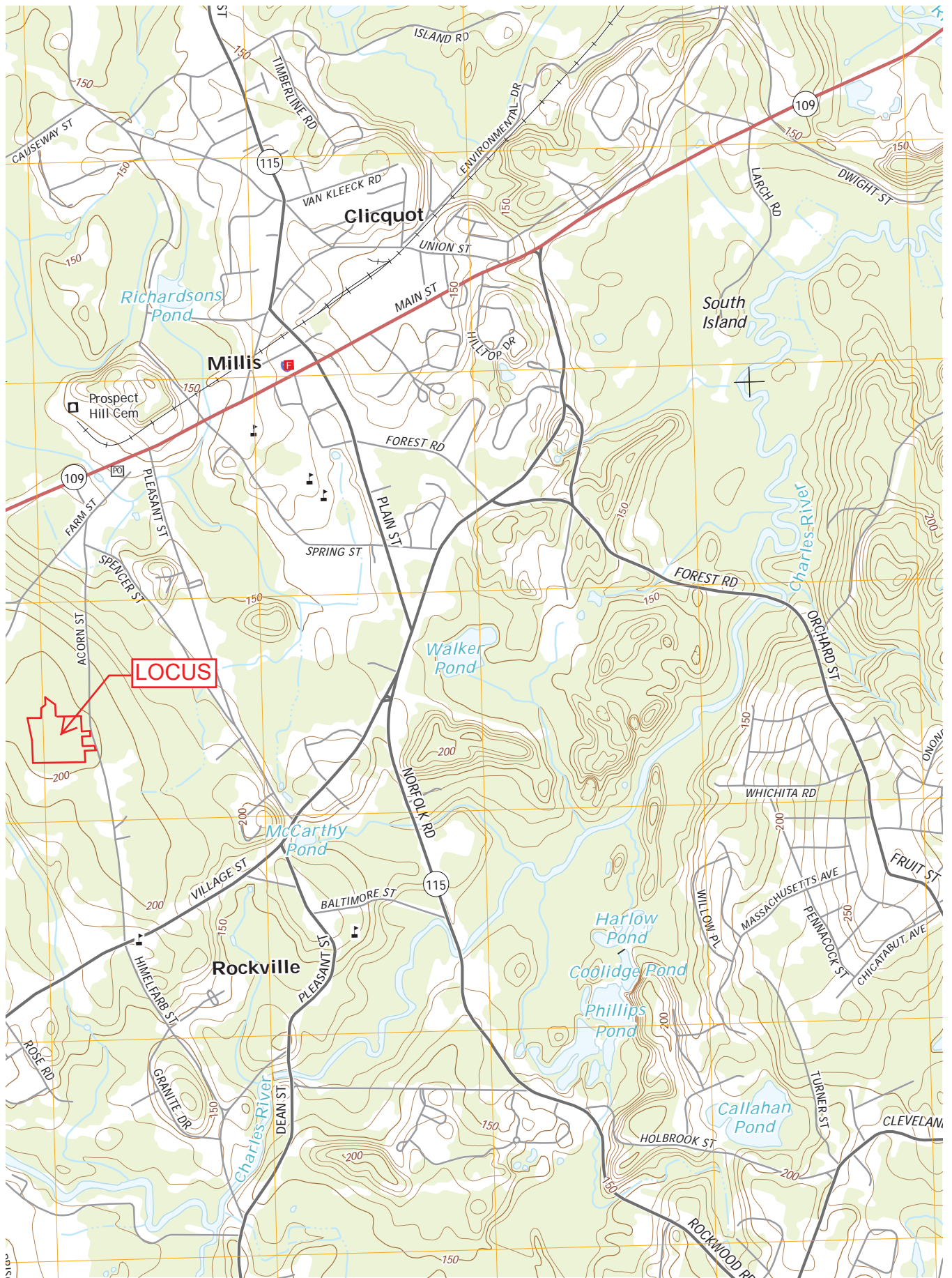
General Information	
Project Name	Acorn Place
Site Location	Acorn Street Millis, MA 02054
Inspector's Name	
Inspector's Title	
Inspector's Phone	
Signature of Operator at end of Year, Certifying that Work was Completed as Noted. Date:	

## O&M Task Checklist

	O&M Activity	Date Completed	Notes/Comments
Deep Sump Catch Basins			
	1 <sup>st</sup> Quarter Cleanout		
	2 <sup>nd</sup> Quarter Cleanout		
	3 <sup>rd</sup> Quarter Cleanout		
	4 <sup>th</sup> Quarter Cleanout		
Sediment Forebay			
	1 <sup>st</sup> Annual Inspection		
	2 <sup>nd</sup> Annual Inspection		
	3 <sup>rd</sup> Annual Inspection		
	4 <sup>th</sup> Annual Inspection		
	1 <sup>st</sup> Annual Mowing		
	2 <sup>nd</sup> Annual Mowing		
	Sediment Rem. Req'd?		

Stormwater Infiltration Basin			
	1 <sup>st</sup> Annual Inspection		
	2 <sup>nd</sup> Annual Inspection		
	1 <sup>st</sup> Annual Mowing		
	2 <sup>nd</sup> Annual Mowing		
	Sediment Rem. Req'd?		
Stormwater Pipes, Inlets and Outlets			
	1 <sup>st</sup> Annual Inspection		
	2 <sup>nd</sup> Annual inspection		

## **ATTACHMENT B: USGS MAP**



# **ATTACHMENT C: ILLICIT DISCHARGE COMPLIANCE STATEMENT**

# ILLICIT DISCHARGE COMPLIANCE STATEMENT

## Acorn Place Millis, MA

This statement is provided in accordance with the provisions of the Massachusetts Stormwater Management Standard 10 and of the Massachusetts Stormwater Management Handbook.

Note the following:

- ➡ All stormwater management systems contain no connection to the site's wastewater sewer system or to any other non-stormwater collection system.
- ➡ Groundwater collection systems on the site are not connected to the site's wastewater sewer system or to any other non-stormwater collection system.
- ➡ The facility's Operations & Maintenance Plan is designed to prevent any discharge of non-stormwater to the drainage system.
- ➡ Any illicit discharges identified during or after construction will be immediately disconnected.

Date: July 12, 2018



**ATTACHMENT D: CONSTRUCTION  
ACTIVITY NPDES STORMWATER POLLUTION  
PREVENTION PLAN**

# STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

FOR A

## *CONSTRUCTION ACTIVITY*

FOR

## *ACORN PLACE*

ACORN STREET  
MILLIS MA, 02054

### *PROPOSED SENIOR RESIDENTIAL COMMUNITY*

JULY 12, 2018

PREPARED BY:  
MERRIKIN ENGINEERING, LLP  
CONSULTING ENGINEERS  
730 MAIN STREET, SUITE 2C  
MILLIS, MA 02054

PREPARED FOR:  
ACORN MILLIS RESIDENTIAL, LLC  
38 BENJAMINS GATE  
PLYMOUTH, MA 02360

VOLUME 1 OF 1

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## ACORN PLACE SWPPP

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## 1.0 PROJECT DESCRIPTION AND ELIGIBILITY

This SWPPP is prepared in accordance with the requirements of the National Pollutant Discharge Elimination System (NPDES) 2017 Construction General Permit (CGP) for Discharges from Construction Activities, pursuant to the provisions of the Clean Water Act as amended by the Water Quality Act of 1987. The 2017 CGP became effective on February 16, 2017 and expires at midnight on February 16, 2022.

This SWPPP provides project-specific guidance and requirements for the proposed construction activity. Operators are, however, responsible to read, understand, and comply with all applicable requirements of the CGP, which is appended to this SWPPP.

### 1.1 Project Name

Acorn Street

### 1.2 Project Location

Acorn Street  
Millis MA, 02054

### 1.3 Owner Name and Address

Acorn Millis Residential, LLC  
38 Benjamins Gate  
Plymouth, MA 02360

### 1.4 General Contractor/Operator Name and Address

Owner Operator:  
Acorn Millis Residential, LLC  
38 Benjamins Gate  
Plymouth, MA 02360

Designation of Site Manager and Emergency Contact (person responsible for the day-to-day management of site operations): Robert Fox (or other individual as may be appointed by the Operator).

General Contractor/Operator:  
(to be determined)

\_\_\_\_\_ will have day-to-day operational control and responsibility of construction activities.

Designation of Site Manager (person responsible for the day-to-day management of site operations): (to be determined) or other individual as may be appointed by the Operator.

### 1.5 Stormwater Team

The stormwater team is identified in Appendix 10.5.

### 1.6 Associated Project Documents

This SWPPP references other documents as follows:

Site Plan - Plans entitled "Acorn Place Site Plan of Land in Millis, Massachusetts" with an original date of July 12, 2018 (as may be amended), and prepared by Merrikin Engineering, LLP, hereinafter referred to as the "Site Plan".

Stormwater Report - Report entitled "Stormwater Report for Acorn Place, Acorn Street Millis, MA 02054 prepared by Merrikin Engineering, LLP with an original date of July 12, 2018 (as may be amended).

### 1.7 SWPPP Site Plan and Relation to Other Permits

Attached to this document is a SWPPP Site Plan which summarizes the various structural construction erosion control measures to be implemented during construction. Refer to the Site Plan for additional details and requirements. In the event that provisions of this SWPPP conflict with the requirements of the other permits obtained for the project, the requirements of the other permits will prevail unless such conformance will violate the provisions of the CGP. When such conflict is discovered, this SWPPP will be revised to reflect conformance with said permit.

### 1.8 Nature of Construction Activities

1. The project proposes the construction of 22 two unit dwelling, 4 single unit dwellings, and a community building along with associated driveways, landscape areas, utility systems, and stormwater management systems.
2. The total lot area of the development is approximately 24.26 acres.
3. The site is mostly wooded with a narrow isolated wetland running through the middle of the site.
4. The proposed construction activities will disturb approximately 11.32 acres in two principal phases. Phase 1 will consist of the construction of the rear 28 dwelling units, their driveways and stormwater facilities, along with all appurtenant work and will involve the disturbance of 6.20 acres. Phase 2 will consist of the construction of the front 20 dwelling units, their driveways and stormwater facilities, and all appurtenant work and will involve the disturbance of the remaining 5.12 acres.
5. The only on-site construction support activities consist of minor areas of materials storage, which will vary in nature and location depending on the stage of construction.
6. Refer to Section 1.10 and Appendix 7.12 for a discussion of construction sequencing and schedule.
7. Refer to Attachment 10.10 for a list of pollutant generating activities, including materials inventories.
8. Construction activities are expected to occur Mondays through Saturday, 7:00 am through 6:00 pm.
9. This SWPPP is not for a public emergency.

### 1.9 Overall Phasing

The project will be constructed in two phases. Phase 1 will include the construction of units 1 through and all appurtenant work. Phase 2 will include the construction of

units 29 through 48 and all appurtenant work. Phase 1 is expected to commence in the fall of 2018 and to be completed by the spring of 2019. Phase 2 is tentatively expected to be built out in 2018-2020.

### 1.10 Major Activity Construction Sequence

#### 1.10.1 Per Phase Construction Sequence

- ✓ Install construction entrance and stakeout and install erosion and perimeter controls (which will delineate the limit of work for the project);
- ✓ Demarcate the location of existing utilities on and around the construction area;
- ✓ Clear the proposed entry driveway areas and install the construction entrance apron(s);
- ✓ Clear and grub the remaining portions of the development area;
- ✓ Strip and stockpile topsoil;
- ✓ On the balance of the site, commence rough grading to sub grade elevations;
- ✓ Install new site utilities, including the stormwater management system;
- ✓ Pave the road and sidewalk to binder course;
- ✓ Commence dwelling unit construction;
- ✓ Loam, seed, and stabilize disturbed areas;
- ✓ Top course pave the road and sidewalk;
- ✓ Cleanout all catch basins in the portion of the site affected by construction activities after the site is fully stabilized.

### 1.11 Anticipated Discharges

The following discharges as authorized in the CGP are expected from the proposed construction and associated activities:

- ✓ Stormwater discharges associated with the proposed construction activity.
- ✓ Stormwater discharges from supporting activities such as equipment staging yards, material storage areas, excavated materials disposal areas, etc... directly related to the above noted construction activity.
- ✓ The following non-stormwater discharges, which are directly associated with the proposed large construction activity:
  - Fire hydrant flushing,
  - Waters used to wash vehicles when detergents are not used,
  - Water used to control dust in accordance with Part 3.1.B of the CGP,
  - Potable water including uncontaminated water line flushings,
  - Routine external building wash down that does not use detergents,
  - Pavement wash waters where detergents, spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed). Such wash waters may only be discharged to a surface water if it will first pass through a stormwater treatment BMP,
  - Uncontaminated air conditioning or compressor condensate,
  - Uncontaminated, non-turbid ground water or spring water,
  - Uncontaminated foundation or footing drains,
  - Treated dewatering water;
  - Landscape irrigation, and
  - Any other non-stormwater discharges otherwise allowed in the CGP

### 1.12 Anticipated Construction and Waste Materials

It is anticipated that the following materials will be present on the site during construction:

- ✓ Earthen materials such as dirt, gravel, crushed stone, loam, sand, fill, and other such substances.
- ✓ Asphalt and paving related materials.
- ✓ Utility piping, manholes, structures, and relative materials.
- ✓ Building materials typically involved in the construction of a residential building.
- ✓ Other typical construction materials.
- ✓ All such materials which are deemed potential pollutants shall be itemized in the log in Appendix 7.10. Potential pollutants include pesticides, fertilizers, plaster, cleaning solvents, glue/adhesives, curing compounds, wood preservatives, hydraulic oil/fluids, gasoline/diesel fuel, kerosene, antifreeze/coolant, sanitary facilities and other similar items.

Waste materials are expected to be limited to excess or discarded portions of the construction materials noted above.

### 1.13 Project Eligibility

The proposed construction activity is eligible to be permitted under the Construction General Permit for Massachusetts (CGP Permit No. MAR1200000) as the proposed activity will be completed in accordance with all requirements of the CGP.

The proposed construction activity is eligible to be permitted under the Construction General Permit for Massachusetts (CGP Permit No. MAR1200000) for the following reasons:

- ✓ The site will discharge construction-stage stormwater to be covered under the CGP.
- ✓ The parties listed are "operators" as defined in the CGP.
- ✓ The proposed work will disturb more than one acre of land.
- ✓ The EPA is the permitting authority for Massachusetts.
- ✓ As described in 1.9.1, the project meets one of the criteria related to the protection of species that are federally listed as endangered or threatened.
- ✓ The screening process related to the protection of historic properties has or will be completed.
- ✓ The site does not discharge to a Tier 2 water.
- ✓ No cationic treatment chemicals are proposed for use in sediment control.



### 1.13.1 Endangered Species

The proposed work is not likely to adversely affect ESA-listed species and/or designated critical habitats. Per the most recent NHESP data found on MassGIS, the site does not lie within, nor will it affect an area containing endangered species. Information from the U.S. Fish & Wildlife Service IPaC website indicates that the site may potentially affect one endangered species, the northern long-eared bat. We have therefore conducted a review and concluded the following:

- Per IPaC data, the site does not lie within a critical habitat for said species.
- NHESP mapping data indicates that this site is not a habitat area for said species.
- Stormwater discharges will be managed in accordance with applicable requirements and will therefore not represent a hydrological or toxicity threat to the species of concern.

It is therefore concluded that the activity not likely to adversely affect an ESA-listed species and/or designated critical habitat.

### 1.13.2 Historic Properties

The proposed activity involves excavation for the installation of various stormwater management BMPs. To the best of our knowledge the site is not considered to be historically significant. There are no site features that suggest historical significance and the site is not listed on the National Register of Historic Places. Consequently, the proposed construction activity meets Appendix E of the CGP.

## **1.14 Coverage Dates**

Coverage under the 2017 CGP terminates at the earliest of the following:

- ✓ The date a Notice of Termination is submitted to the EPA;
- ✓ Expiration of the 2017 CGP on February 16, 2022 (unless the CGP is temporarily extended or the subsequent replacement CGP automatically authorizes continuing coverage)
- ✓ In the event the construction activity extends beyond the termination date of the 2017 CGP, the Operator will be responsible for complying with the subsequent replacement CGP, including any applicability eligibility requirements.

## **1.15 Receiving Waters**

Stormwater runoff from the entire site will discharge to various isolated wetlands both inside and outside of the property, which flow towards an unnamed tributary to the Charles River.

### 1.15.1 Impaired Waters

In accordance with Section 3.2 of the CGP, the following analysis is provided with respect to Impaired Waters:

- The tributary is not listed in the Massachusetts Year 2016 Integrated List of Waters.
- Section 3.2 of the CGP therefore does apply to this site. As such, inspection frequencies need not comply with section 4.3 of the CGP and stabilization

completion deadlines comply with relevant portions of section 2.2.14 of the CGP.

### 1.15.2 Tier 2, 2.5 and 3 Waters

In accordance with Section 3.2 of the CGP, the following analysis is provided with respect to Tier 2, Tier 2.5, and Tier 3 waters.

- Tier 2 waters in Massachusetts are those waters designated as “High Quality Waters” on 314 CMR 4’s associated watershed tables.
- Tier 2.5 waters in Massachusetts are those waters designated as Outstanding Resource Waters on the aforementioned watershed tables.
- To the best of our knowledge, there are no separate Tier 3 waters in Massachusetts.
- The unnamed tributary is not identified as a High Quality Water or Outstanding Resource Water on the tables appended to 314 CMR 4.

### 1.15.3 TMDL Compliance

As of the date of this report, a review of the EPA’s TMDL website (<http://cfpub.epa.gov/npdes/stormwater/tmdl.cfm>) concludes that there are TMDL’s that apply to the town where this project is located. A summary of each and its relationship to the proposed construction activity are discussed below.

#### *Northeast Regional Mercury Total Maximum Daily Load:*

This TMDL is not exclusive to Massachusetts but rather applies to all of New England. It provides for a reduction in mercury concentrations within surface water bodies. The primary sources of mercury are wastewater (sewer) and atmospheric deposition. Page 27 of the October 24, 2007 “Northeast Regional Mercury Total Maximum Daily Load” report states “Because the majority of mercury in stormwater originates from atmospheric deposition, reductions of mercury loading in stormwater will be addressed through controls on atmospheric deposition.” It is therefore concluded that this project is not required to implement any specific measure to comply with this TMDL.

#### *Nutrient (Phosphorus) TMDL for the Upper/Middle Charles River:*

This TMDL provides for a reduction in phosphorus discharges into the Charles River to reduce warm-weather eutrophication that regularly occurs. A review of the MassDEP implementation plan is available for this TMDL concludes that there are no specific numeric limitations or requirements for individual construction or development projects. Rather, the focus of the proposed implementation plan is in requiring additional regulation by local communities to control and reduce phosphorus generation. The primary impact of a project of this nature relative to phosphorus generation is stormwater generation. The Final TMDL recommends that local communities adopt stormwater management regulations/bylaws to ensure adequate treatment of stormwater runoff, thus reducing phosphorus loadings. The Town of Millis has implemented such regulations and this project is designed to be consistent with the local stormwater regulations, the DEP Stormwater

Management Handbook, and the NPDES Construction General Permit. The Final TMDL also highly recommends a few specific BMP's for phosphorus reduction. One such approach is the use of infiltration facilities, which are highly effective at removing phosphorus as the phosphorus is almost eliminated through vegetation and soils contact as the water infiltrates downward. Data within the TMDL indicates that infiltration facilities designed to hold 1.0 inches of runoff from impervious surfaces, will remove more than 80% of the total annual phosphorus load from the site. Runoff from the site's impervious areas are routed to infiltration facilities designed to accommodate a minimum of 1-inches of runoff. Another focus of the Final TMDL is the elimination of illicit discharges, of which there are none within this project. It is therefore concluded that the proposed site design is consistent with the Nutrient TMDL for the Upper Charles River.

### *Nutrient (Phosphorus) TMDL for the Lower Charles River:*

This TMDL is essentially the same as noted above for the Upper Charles River. For the same reasons as discussed above, it is therefore concluded that the proposed site design is consistent with the Nutrient TMDL for the Lower Charles River.

### *Pathogen TMDL for the Charles River Watershed:*

This TMDL provides for reduction in pathogen concentrations in the Charles River watershed's impaired waterbody segments. A review of the EPA TMDL approval dated May 22, 2007 finds a reference to the requirement that projects of this nature implement stormwater BMP's consistent with the NPDES and other applicable regulations. The DEP has issued an implementation guide for this TMDL entitled "Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts," which is the basis for the TMDL compliance assessment for this project. Pathogen sources within the Charles River watershed are numerous but many have no specific relation to this project such as combined-sewer overflows (CSO's), agricultural sources, and septic systems. For this project, the only significant potential source of pathogens is stormwater runoff. Stormwater runoff itself is not a source of pathogens. Rather, increases in the peak rate and volume of runoff from a site contribute to a potential increase in the amount of animal waste and other pathogen sources that can be washed into a waterbody. The DEP implementation guides reference the need for local communities to adopt local bylaws and regulations regulating stormwater runoff from both construction activities and post-construction site conditions. Millis has these regulations and the project has been designed accordingly. The DEP implementation guide also notes that infiltration facilities are perhaps the most effective pathogen removal BMP as the pathogens are removed through vegetation contact and by movement through the soil matrix. It is therefore concluded that the project is consistent with the TMDL for pathogens.

### **1.16 Site Notice & SWPPP Accessibility**

A notice will be posted conspicuously near the main entrance of the site adjacent to a public road or right-of-way. It will denote the following:

1. That this site is permitted under the NPDES Construction General Permit No. MAR1200000 and shall include the NPDES Permit tracking number.
2. A contact name and phone number for obtaining additional site information.
3. A URL where the SWPPP is posted or the following statement "If you would like to obtain a copy of the Stormwater Pollution Prevention Plan (SWPPP) for this site, contact the EPA Regional Office at <https://www.epa.gov/aboutepa/epa-region-1-new-england>.
4. The following statement "If you observe indicators of stormwater pollutants in the discharge or in the receiving waterbody, contact the EPA through the following website: <https://www.epa.gov/enforcement/report-environmental-violations>.

The site notice must use fonts large enough to be readily viewed from the adjacent public right-of-way.

This Plan will be kept on-site at all times except where not practical. The Plan will be easily available to Approving Authority inspectors during normal working hours for the construction site.

## **2.0 STORMWATER CONTROLS**

### **2.1 Project Limits and General Control Considerations**

The site boundaries are shown on the Site Plan. Construction activities will be limited only to those areas necessary for site construction and no soil disturbance will occur downstream of the limits of erosion controls on the site. The proposed area of disturbance in Phase 1 is 6.20 acres. The proposed area of disturbance in Phase 2 is an additional 5.12 acres. Neither phase involves the disturbance of more than 10 acres of land that drain to a single point. Furthermore, the limit of work along downstream wetlands buffer areas span some >1,500 linear feet with no concentration points. As such, there is no requirement for a construction sedimentation basin and none will be used unless construction conditions dictate otherwise. Stormwater runoff shall not be directed to the proposed stormwater infiltration basin until the sideslopes and bottom of the basin are vegetated. Perimeter erosion controls are provided to prevent eroded materials from leaving the site. The construction sequence has been proposed in such a way as to minimize the amount of time that disturbed soils will be exposed to weather. The soils on the disturbed area of the site are Class A and B, which will generate minimal amounts of runoff during construction. Temporary sediment basins will be implemented if needed during construction.

### **2.3 Perimeter Erosion and Sediment Controls**

Perimeter erosion and sediment control barriers will be provided, installed, and maintained downstream of all proposed construction activities in accordance with this Plan, the Site Plan, and all permits issued for the site development. Such controls must be installed before any earth-disturbing activities occur on the site in question.

Erosion and sediment controls may be installed in phases so long as it precedes any earth-disturbing activities within the controls' upstream watershed.

The proposed single layer of perimeter erosion controls will provide adequate protection.

Sediment shall be removed along such controls on a regular basis. In no case, shall sediment be allowed to reach a depth equal to one half of the above ground height of the erosion control device.

### **2.4 Site Access Controls**

Construction vehicles will use designated entry points for each site. Crushed stone or rip-rap entry apron(s) will be installed and properly maintained during construction until the site is paved. All construction access will be via Pearl Street. In the vicinity of the site, Pearl Street will be kept clean and swept as needed to minimize the tracking of soils and dust from the site.

### **2.5 Stockpiled Soils**

Soil stockpiles to be left in place more than 24 hours shall be surrounded with a line of silt fence to prevent the piles from eroding into the site and to discourage on-site runoff from eroding the stockpiles. Soil stockpiles to be left in place more than 14 days shall be stabilized temporarily in accordance with this plan. Dust control measures shall be implemented to prevent wind erosion of the stockpiles.

### **2.6 Dust Control**

Dust control measures will be implemented regularly to prevent the off-site deposition of wind-eroded soils. The principal form of dust control will be water application.

### **2.7 Disturbance of Steep Slopes**

Contractors must pay careful attention to steep slopes and must implement additional temporary erosion and sediment control measures during work on steep slopes to prevent erosion.

### **2.8 Topsoil Preservation**

Topsoil generated from the site construction activities must either be stockpiled for reuse on site in accordance with the practices noted above, or shall be removed from the site for reuse on other sites. Topsoil may not be mixed with general fill.

### **2.9 Soil Compaction**

Areas designated for final vegetative surfaces or construction-stage or final stormwater infiltration practices shall be protected from excessive compaction by restricting vehicle access and the types of equipment that may be used in such areas. Prior to seeding/planting of such areas, exposed soil that has been compacted shall be loosened by tilling or other similar methods. Conditioning shall consist of deep tilling with a rotary tiller, disc harrowing, or manual loosening and re-grading with an excavator bucket. Conditioning shall extend to a depth of at least 12-inches.

## **2.10 Protection of Storm Drain Inlets**

All storm drain system inlets inside of perimeter controls shall be protected with sediment control measures designed to remove sediment from stormwater prior to entering the inlet. Catch basins along the street frontage shall also be protected.

Such measures shall be periodically maintained and replaced as needed to ensure their proper functionality. Sediment shall be removed daily where found.

## **2.11 Protection of Channels and Discharge Points**

Areas of concentrated stormwater discharge points such as swales, channels, and pipe outfalls shall incorporate velocity mitigation controls. Channels and swales shall implement temporary check dams constructed of straw bales or crushed stone berms. Discharge points shall be protected with temporary rip-rap aprons to dissipate the energy and velocity of stormwater flows.

## **2.12 Construction Stage Sediment Traps/Basins**

Due to the size of this project and the decentralized nature of runoff patterns, sediment traps are not expected to be needed. Should construction conditions dictate otherwise, this SWPPP shall be updated to incorporate properly designed sediment trap(s).

## **2.13 Treatment Chemicals**

There is no planned use of polymers, flocculants, or other erosion and sediment-control related treatment chemicals at this site.

## **2.14 Temporary Stabilization**

Where construction activities have permanently ceased or where they have temporarily ceased for a period of more than 14 days, temporary soil stabilization measures will be employed in the affected areas in accordance with the following schedule:

- For disturbed areas less than 5 acres: as soon as practicable but no later than 14 calendar days after stabilization has been initiated.
- For disturbed areas larger than 5 acres and for site discharging to sediment- or nutrient-impaired waters: as soon as practicable but no later than 7 calendar days after stabilization has been initiated.

Such stabilization measures will consist of either erosion control mats or seeding. Where seeded for temporary erosion control purposes, a minimum of 6 pounds per 1,000 square feet of seed will be applied along with an appropriate fertilizer (based on the time of year applied) or as necessary to obtain a 70% vegetative cover. Additional seeding will be completed if needed and periodic watering will also be employed if necessary. Where stabilization by the 14<sup>th</sup> day is precluded by snow cover, frozen ground conditions, or other similar circumstances, stabilization measures will be initiated as soon as practicable.

Areas which are to ultimately be stabilized with pavement or other structural measures will be temporarily stabilized (when construction activities cease for more than 14 days), with crushed stone or a compacted gravel sub-base. Such temporary stabilization measures will be maintained in good condition.



## **2.15 Maintenance of Erosion & Sediment Control Measures**

Erosion and sediment control measures will be maintained in good condition for the duration of the construction activity and until such time as the upstream areas achieve final stabilization as described herein. Sediment will be removed along haybales, silt fence, or filter socks when the depth exceeds four-inches. All control measures will be maintained in effective operating condition. If site inspections identify control measures that are not operating effectively or finds other problems, the Operator must:

- ✓ Initiate work to correct the problem immediately upon discovery and complete the work by the close of the next work day if the problem can be corrected through routine maintenance;
- ✓ For more significant repairs or where inspections determine that additional erosion and sediment controls are needed, such work must be completed and operation no later than 7 calendar days after discovery of the problem.

## **2.16 Pollution Prevention (Good Housekeeping Practices)**

### **2.16.1 Construction Staging Areas**

Construction staging areas will be limited in quantity and will be maintained in a neat and orderly fashion. Refer to the Site Plan for staging area location(s).

### **2.16.2 Vehicle Storage, Fueling and Maintenance Area**

The Operator will designate a specific area of the site for fueling and overnight storage of vehicles on the site. Such area shall be located as far from wetlands areas and stormwater inlets as practicable and outside of the 100' buffer zone. Refer to the Site Plan for vehicle storage area location(s).

All equipment stored on-site will be monitored for leaks and will receive regular preventative maintenance to reduce the chance of leakage. Where vehicle leaks are identified, drip pans and absorbent pads shall be employed until the leak can be repaired, which shall be completed as soon as practicable. The Operator will maintain a bag of chemical sorbent, absorbent pads and an emergency spill kit on the site at all times within one of the designated Staging Areas. A sign shall be posted at the entrance to each Staging Area noting the location of the emergency spill kit. Spill kits shall include the following at a minimum.

- Universal chemical sorbent capable of absorbing up to 15 gallons of liquid.
- Gloves and safety glasses,
- Four chemical socks,
- Four chemical pads,
- Four chemical pillows, and
- Four plastic disposal bags.

### **2.16.3 Equipment Washing**

Vehicle or equipment washing is not allowed on-site.

### **2.16.4 Building Products, Materials and Wastes**

- ✓ The site will be maintained in a neat and orderly manner, with debris regularly disposed of.

- ✓ All products and materials stored on-site will be stored in a neat and orderly manner in appropriate containers. Building materials must be stored under cover (i.e. under a roof or under plastic sheeting) to prevent contact with rainwater.
- ✓ Manufacturer recommendations relative to the proper storage, use, and disposal of products and materials will be followed.
- ✓ An effort will be made to minimize the on-site storage of excess construction materials. In all cases, materials will be removed from the site if unused for more than three months.
- ✓ When use of products and materials have been completed, any excess products and materials will be promptly removed from the site and/or properly disposed of in accordance with all applicable state and federal regulations.
- ✓ All equipment to be stored on-site will be stored in a neat and orderly manner and such equipment will only be stored in the designated equipment Staging Areas on the site.

### 2.16.5 Fertilizer, Pesticide, Herbicide, or Insecticide Storage

Such materials may not be stored on-site and shall only be brought on-site in the quantities needed for application. Application shall be in accordance with manufacturer recommendation. Disposal of excess products shall follow local, state and federal law.

### 2.16.7 Petroleum and Other Chemical Products Storage

- ✓ Petroleum products may only be stored on-site in the limited quantities necessary for the ongoing work.
- ✓ All petroleum products will be stored in tightly sealed containers in one of the designated Staging Areas on the site and must be covered to prevent contact with rainwater.
- ✓ All paint and other hazardous materials containers will be stored in a tightly sealed container whenever not in use and stored under cover. Any waste and/or excess for these products will be disposed of off-site in accordance with all applicable state and federal regulations.

### 2.16.8 Hazardous Products and Hazardous Waste

- ✓ The use of hazardous products during construction will be in accordance with manufacturer recommendations and established construction practices.
- ✓ Hazardous materials must be stored in a separately designated area, under cover, and within secondary storage containers designed to hold at least 110% of the volume of the substance in question.
- ✓ Hazardous products will be kept in their original containers until they are used, and the container labels will be kept on-site within a designated Staging Area until use of the product is no longer needed.
- ✓ Unused quantities of hazardous products will be removed from the site in accordance with all applicable state and federal regulations.
- ✓ Hazardous waste materials generated by the construction (if any) will be disposed of off-site in accordance with all applicable state and federal regulations pertaining to such disposal. The Site Manager will be informed of these requirements and will ensure that this provision is adhered to.
- ✓ Any spills of hazardous materials found on the site will be cleaned up immediately using dry-cleanup procedures and reported in accordance with



procedures established by local, state, and federal regulations. Washdowns of spill areas is prohibited.

- ✓ The Site Manager will be properly trained in hazardous materials spill prevention and clean-up.

### 2.16.9 Construction and Domestic Waste

- ✓ All waste materials from the site will be collected in dumpsters and disposed of off-site in accordance with all applicable state and federal regulations. The dumpster will be emptied as needed and the Operator will ensure that trash collection does not accumulate outside the dumpster. Trash and debris will be collected at least once per working day.
- ✓ The Operator will keep a portable toilet on the site for the use of work personnel and shall dispose of the waste materials in accordance with local, state, and federal regulations.

### 2.16.10 Materials/Tools Washing

- ✓ Any such wash water shall be directed into a leak-proof container and disposed of off-site in accordance with local, state and federal regulations.
- ✓ Concrete trucks will only wash out or dump surplus concrete within areas designated by the Operator on the site in designated depressions to prevent uncontrolled migration of such materials. All such surplus concrete will be cleaned-up by crushing the concrete and either re-using it in the construction activities or by removing it from the site.
- ✓ Wash waters from concrete or stucco applications, or from paint brushes or other similar activities must be directed into a leak-proof container or pit designed to prevent overflows due to precipitation. Accumulated wastewater must be disposed of in accordance with all local, state, and federal regulations to the extent it is deemed hazardous. Washwater generating activities must be conducted as far away from wetlands areas and storm drain inlets as possible.

### 2.16.11 Fertilizer Application

- ✓ Fertilizer shall be applied in accordance with the rates specified herein and in no case more than stipulated in the manufacturer's specifications.
- ✓ To the extent practicable, apply fertilizers in optimal seasons to maximize vegetation uptake and growth.
- ✓ Avoid applying fertilizers before heavy rains are expected and never apply to frozen ground or during winter conditions.
- ✓ Fertilizer may not be used in stormwater BMPs unless the BMP discharges to upland areas and unless the BMP is an infiltration practice.
- ✓ Fertilizers are not to be applied within buffer zones or within the Zone II for drinking water.

### 2.16.12 Spill Prevention and Response

(This portion of the document is written as if giving instructions to parties working on the property and/or the owner of the property)

In the event of an accident where significant gasoline or other petroleum products are released, the following procedure shall be followed in the order noted.

- ✓ Seek to contain the spill by constructing a berm of earthen or other materials around the spill site until the appropriate emergency response personnel has arrived. Seek to seal off any downstream stormwater facilities by earthen berms or the emergency spill kit materials.
- ✓ Immediately notify the following governmental entities and inform them of the type of spill that occurred:
  - Millis Fire Department at 508-376-2361,
  - Millis Board of Health at 508-376-7042,
  - Millis Conservation Commission at 508-376-7045,
  - Mass. Department of Environmental Protection (DEP) Central Region at (508) 792-7650 (address is 8 New Bond Street Worcester, MA 01606), and
  - National Response Center (NRC) at (800) 424-8802 (for spills that require such notification pursuant to 40 CFR Part 110, 40 CFR Part 117, and 40 CR Part 302).
- ✓ Once the various emergency response teams have arrived at the site, the owner shall follow the instructions of the various governmental entities, which may include the following:
  - A clean up firm may need to be immediately contacted.
  - If the materials have remained trapped in the catch basins or proprietary stormwater treatment units, then these structures may be pumped out. All materials shall be removed by qualified personnel and disposed of in accordance with all applicable local, state, and federal regulations.

## 2.17 Dewatering Practices

This site is not expected to encounter significant quantities of groundwater during construction activities but if it does, the following practices will be implemented:

- ✓ Do not discharge any floating solids or foam;
- ✓ If dewatering water is found to contain oil, grease, etc... it must be filtered or passed through an oil/water separator prior to discharge;
- ✓ Wherever possible, discharge dewatering water to vegetated upland areas for infiltration. Where this is not possible, discharge dewatering water into a filtering pit consisting of a perimeter of double rows of haybales lined with three layers of filter fabric. Do not direct dewatering water into wetlands without prior treatment;
- ✓ Velocity dissipation measures must be included at all discharge points (rip-rap or crushed stone apron).

## 2.18 Infiltration Systems

The proposed construction-stage stormwater controls do not include any underground stormwater infiltration BMPs.

# 3.0 INSPECTIONS

## 3.1 Inspection Frequency

The Operator will designate an inspector or inspectors, who shall be a “qualified person” as defined in the CGP and will familiarize himself/herself with the design plans, with the CGP, and with the specifications of this SWPPP. The inspector will inspect the site for compliance with this Plan at least once every seven calendar days

or once every fourteen calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater for the entire duration of construction, except as otherwise noted herein. The site does not discharge to a sediment or nutrient impaired water. Refer to CGP for additional inspection requirements.

Inspections may be reduced to twice per month in the first month, and thereafter once per month, in areas that have been temporarily stabilized or to areas that have achieved final stabilization. Wherever work within temporarily stabilized areas resumes, inspections shall be at the normal frequency specified above.

Should construction span a winter season, inspection may cease so long as the ground is frozen, all disturbed areas have been stabilized and construction is not continuing during the frozen conditions. In such case, inspections will resume one month before expected thaw of soil on the site. In areas where work will proceed through frozen ground conditions, inspections may be monthly until the area thaws or until rainfall is expected, whichever occurs earlier.

Once specific areas have received final stabilization, no further inspections are necessary for that area.

### 3.2 Inspection Areas

The Inspector will inspect all areas that have been cleared, graded, or excavated and which have not yet been stabilized; all stormwater controls including erosion and sediment controls; all equipment, materials, or waste storage areas; all areas where stormwater typically flows on the site; all areas where stormwater discharges from the site; and all areas where stabilization measures have been implemented.

### 3.2 Scope of Inspection

The inspection will review the following, at a minimum:

- ✓ Ensure that all snow fence lines (to be orange color) are vertical and strung securely between stakes;
- ✓ Ensure that all silt fence lines are vertical and strung securely between stakes and have no tears;
- ✓ Ensure that straw bales are not buried;
- ✓ Ensure that filter socks are not buried;
- ✓ Ensure that sediment accumulation along erosion controls does not exceed amounts specified above;
- ✓ Ensure that sediment accumulation within existing catch basins are not excessive and that sediment is removed when the depth of accumulation exceeds two feet or 50% of the sump depth, whichever is less;
- ✓ Ensure that un-stabilized areas during active construction activities are not eroding unduly;
- ✓ Ensure that slopes on the construction site are not eroding unduly;
- ✓ Ensure that drainage swales and drainage basins (once constructed) are functioning properly during construction;
- ✓ Ensure that areas where construction activities cease for more than 7 days are temporarily stabilized as specified herein;
- ✓ Ensure that temporary and permanent stabilization measures are thorough and complete and that there are no unprotected or deficient areas;
- ✓ Ensure that the point of vehicular entry into the site is not resulting in soils being tracked into the adjacent street;

- ✓ Care will be taken to determine if pollutants are leaving the site via either overland runoff or entrance into the municipal stormwater system;
- ✓ Determine if pollutants are passing erosion prevention measures and determine whether such issue will result in adverse downstream impacts, in which case additional measures shall be installed as required herein;
- ✓ Identify any areas where new or modified stormwater, sediment and erosion controls are needed;
- ✓ Check for the presence of conditions that could lead to leaks, spills or other accumulations of pollutants on the site;
- ✓ Identify and document all instances of non-compliance; and
- ✓ If a discharge from the property is identified: specify the location, document the visual quality of the discharge including color, odor, floating, settled, or suspended solids, foam, oil sheen or other obvious indicators of stormwater pollutants; and documents the effectiveness and any needed improvements to stormwater controls on the site.

All deficiencies will be remedied immediately and no later than seven days after discovery of the deficiency, and if possible, prior to the next anticipated rainfall event, if that event is anticipated to occur sooner than seven days. In addition, this Plan will be updated if needed, upon the documentation of a deficiency. The inspector will complete an inspection report after each site inspection and will provide a copy of this report to the Operator, who will keep the reports on-file. The inspection reports will at a minimum, contain the following information:

- ✓ The inspection date,
- ✓ Name, title, and qualifications of personnel conducting the inspection,
- ✓ Weather information for the period since the last inspection, including an estimate of the beginning time, duration, and rainfall quantity for any rainfall events since the last inspection,
- ✓ Weather information for the time of the inspection,
- ✓ Location of discharges of sediment or pollution from the site, if any are discovered during the inspection,
- ✓ Location of Controls (identified below) that need to be maintained,
- ✓ Location of Controls (identified below) that have failed to perform adequately, and which need redesign or improvement, and
- ✓ Location where additional Controls (not originally designed) need to be provided (if any).
- ✓ The report must identify any discovered incidents of non-compliance, and if none are found, a certification that the site is in compliance with this Plan. The report must be signed by the Inspector and the Operator as identified above.

### 4.0 CORRECTIVE ACTIONS

Any corrective actions (spills, repairs of stormwater controls, replacement of stormwater controls, installation of new stormwater controls, etc...) must be completed within seven calendar days of the first deficiency observation. A log report must be prepared for each corrective action in accordance with the requirements of the CGP and appended to this SWPPP.

## **5.0 PERSONNEL TRAINING AND RECORDING KEEPING**

### **5.1 Personnel Training**

Inspectors and personnel who are responsible for taking corrective action or for designing, installing, maintaining or repairing stormwater controls, must be trained. Each such person must receive sufficient training such that they understand the requirements of the SWPPP and CGP and the scope of their responsibilities pursuant to these documents. Training will include a thorough description of the location of stormwater controls, the design function of stormwater controls, requirements for inspections and corrective action, and proper procedures to follow when implementing the requirements of the CGP and SWPPP.

### **5.2 Records**

In addition to the inspection reports required herein, the Operator shall keep a record of:

- ✓ Dates when grading occurred,
- ✓ Dates when construction activities temporarily or permanently cease on any portion of the site, and
- ✓ Dates when stabilization measures are installed.

Inspection reports shall be copied to the Town of Millis Conservation Agent.

### **5.3 Retention of Records**

This SWPPP along with the NOI, acknowledgement letter from the EPA, all correspondence, inspection reports, records, and supporting data for this Notice of Intent will be kept for at least three years from the date of termination of coverage under the CGP.

### **5.4 Updating This SWPPP**

This SWPPP will be updated as needed during the construction process to reflect changes in design, construction methodology, operation, maintenance, or other factors that may affect the discharge of stormwater and/or pollutants off the site during construction.

## **6.0 CERTIFICATIONS**

I certify under the penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: \_\_\_\_\_  
(Signature)

Date: \_\_\_\_\_

Signed: \_\_\_\_\_  
(Signature)

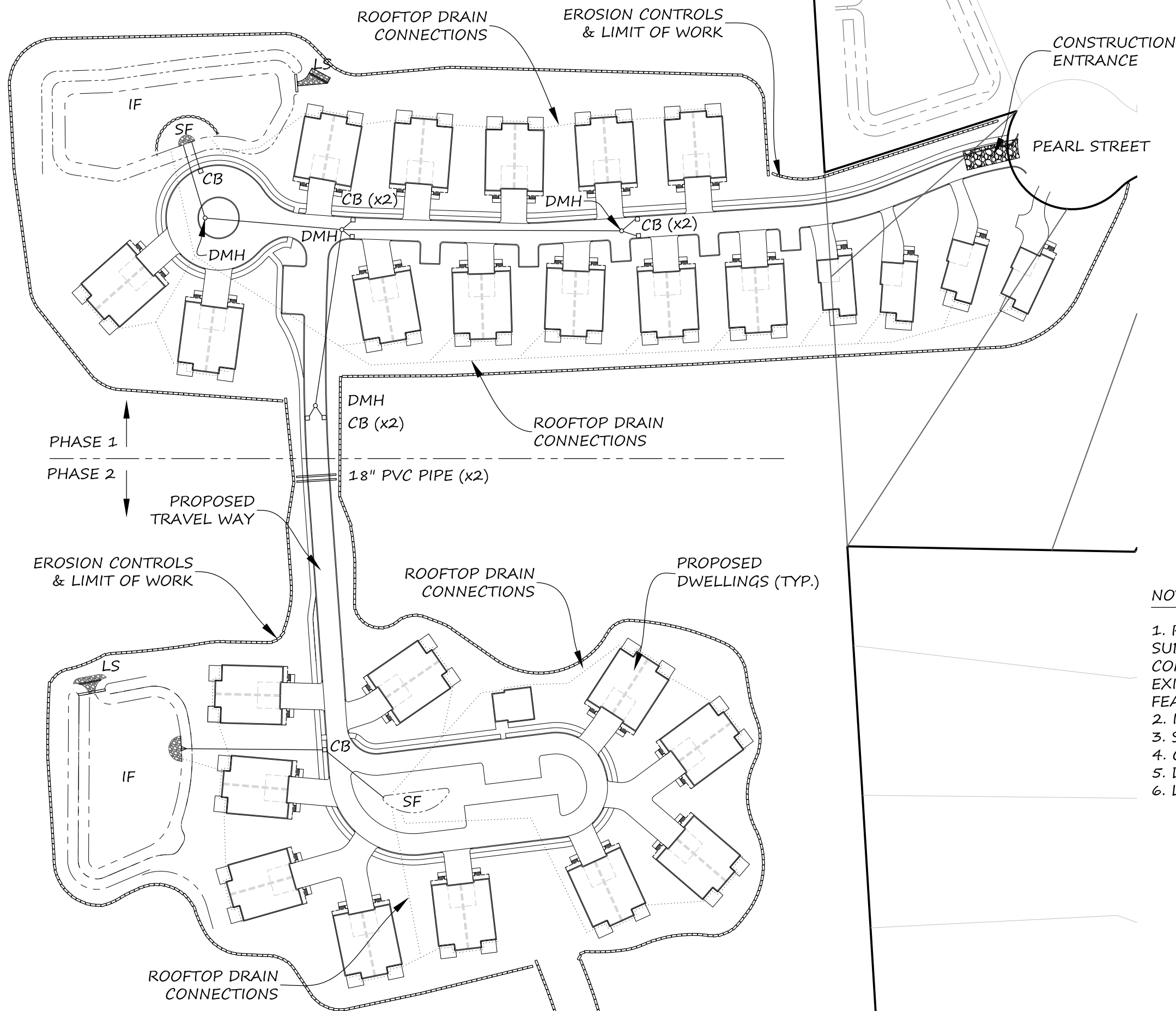
Date: \_\_\_\_\_

## 7.0 APPENDICES

## APPENDIX 7.1 USGS MAP

## APPENDIX 7.2 SWPPP SITE PLAN





**NOTES:**

1. REFER TO APPROVED SUBDIVISION PLAN FOR COMPLETE DETAILS OF EXISTING AND PROPOSED SITE FEATURES.
2. IB=INFILTRATION BASIN
3. SF=SEDIMENT FOREBAY
4. CB=CATCH BASIN
5. DMH= DRAIN MANHOLE
6. LS= LEVEL SPREADER

PLAN SCALE: 1" = 100'

PLAN DATE: JULY 12, 2018

REVISION	DATE	BY

ACORN PLACE  
SWPPP  
PLAN  
OF LAND IN  
MILLIS, MA



730 MAIN STREET, SUITE 2C  
MILLIS, MA 02054  
ph. 508-376-8883 fax 508-376-8823

D69-01

SHEET 1 OF 1

**APPENDIX 7.3**  
**CONSTRUCTION GENERAL**  
**PERMIT (CGP)**  
(TO BE ADDED AT TIME OF CONSTRUCTION)

**APPENDIX 7.4**  
**NOTICE OF INTENT**  
(TO BE ADDED AT TIME OF CONSTRUCTION)

**APPENDIX 7.5**  
**STORMWATER TEAM**  
(TO BE FINALIZED AT TIME OF CONSTRUCTION)

# STORMWATER TEAM

## Operator #1 Stormwater Team

Owner/Operator Name: Acorn Millis Residential, LLC

### Stormwater Team

	Team Member	Responsibility
1	SWPPP Preparer: Merrikin Engineering, LLP	Preparing and modifying SWPPP
2	SWPPP Compliance & Oversight: Robert Fox	General oversight of compliance with SWPPP & CGP
3	Qualified Inspector: Operator 2 to perform Inspections: T.B.D.	Performing Site Inspections
4	Construction Manager: Operator 2 to provide construction management: T.B.D.	Overseeing the installation & maintenance of all stormwater and erosion controls throughout construction. Day-to-day responsibility for compliance with the SWPPP and CGP

## Operator #2 Stormwater Team

Construction Operator Name:

### Stormwater Team

	Team Member	Responsibility
1	SWPPP Preparer: Merrikin Engineering, LLP	Preparing and modifying SWPPP
2	SWPPP Compliance & Oversight: T.B.D.	General oversight of compliance with SWPPP & CGP
3	Qualified Inspector: T.B.D.	Performing Site Inspections
4	Construction Manager: T.B.D.	Overseeing the installation & maintenance of all stormwater and erosion controls throughout construction. Day-to-day responsibility for compliance with the SWPPP and CGP

# APPENDIX 7.6 INSPECTION REPORTS

(TO BE ADDED AS THEY ARE GENERATED)

# STORMWATER CONSTRUCTION SITE INSPECTION REPORT

General Information			
Project Name	Acorn Place		
NPDES Tracking No.	MAR_____	Location	Acorn Street Millis, MA 02054
Date of Site Inspection		Start/End Time	
Inspector's Name(s) and Qualifications			
Inspector's Title(s)			
Inspector's Contact Information			
Describe present phase of construction			
Type of Inspection ("Storm" = any rainfall event of 0.25 inches or more)			
<input type="checkbox"/> Regular 14-day Inspection <input type="checkbox"/> Pre-storm event <input type="checkbox"/> During storm event <input type="checkbox"/> Post-storm event			
Weather Information			
Has it rained since the last inspection?			
<input type="checkbox"/> Yes <input type="checkbox"/> No			
If yes, provide:			
Storm Start Date & Time:	Storm Duration (hrs):	Approximate Rainfall (in):	
Weather at time of this inspection?			
Do you suspect that discharges may have occurred since the last inspection?			
<input type="checkbox"/> Yes <input type="checkbox"/> No			
Is it safe to perform the required inspection? If no, indicate why and where these limitations apply			
<input type="checkbox"/> Yes <input type="checkbox"/> No			

## Site-specific BMPs Inspection Checklist

	BMP Description	BMP Installed and Operating Properly?	Corrective Action Needed	Date for corrective action/responsible person
1	Entrance Aprons	<input type="checkbox"/> Yes <input type="checkbox"/> No		
2	Erosion Barriers along perimeter of work area	<input type="checkbox"/> Yes <input type="checkbox"/> No		
3	Catch Basin Inlet protection	<input type="checkbox"/> Yes <input type="checkbox"/> No		
4	Other-	<input type="checkbox"/> Yes <input type="checkbox"/> No		
5	Other-	<input type="checkbox"/> Yes <input type="checkbox"/> No		

## ACORN PLACE SWPPP

### Overall Site Issues

	BMP/activity	Implemented?	Maintained?	Corrective Action	Date for corrective action/responsible person
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
2	Are perimeter controls and sediment barriers adequately installed and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
3	Are stormwater discharges free of sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
4	Are storm drain inlets properly protected?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
5	Is there evidence of sediment being tracked into the street?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
6	Is trash/litter from work areas collected and placed in covered dumpsters?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
7	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		



## ACORN PLACE SWPPP

	BMP/activity	Implemented?	Maintained?	Corrective Action	Date for corrective action/responsible person
8	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
9	Are new or additional stormwater controls necessary to ensure compliance with the CGP?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
10	Do material storage areas present risk of spillage or leakage of potentially hazardous materials ?	<input type="checkbox"/> Yes <input type="checkbox"/> No	n/a		
11	Other-	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		

**Non-Compliance:** Record any incidents of non-compliance with the Construction General Permit or the SWPPP since the last inspection in the table below.

Have any incidents of non-compliance occurred since the last inspection?

☐Yes ☐No

	Incident Description	Corrective Action Needed & Date of Initiation
1		
2		
3		
4		

## ACORN PLACE SWPPP

Have any incidents of non-compliance occurred since the last inspection?

☐ Yes ☐ No

	Incident Description	Corrective Action Needed & Date of Initiation
5		

**Discharges:** Record any incidents of the discharge of sediment or eroded materials from the site

Have any discharges from the site occurred since the last inspection?

☐ Yes ☐ No

	Location of Discharge & Description of Water Quality (color, odor, floating, settled, or suspected solids, foam, sheen, etc...)	Corrective Action Needed & Date of Initiation (i.e. correction of existing stormwater controls or installation of new stormwater controls)
1		
2		
3		
4		
5		

**Certification statement:**

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name:

\_\_\_\_\_

Signature:

\_\_\_\_\_

Date: \_\_\_\_\_

**APPENDIX 7.7**  
**LOG OF CORRECTIVE**  
**ACTIONS**  
(TO BE ADDED AS INCIDENTS OCCUR)

## LOG OF CORRECTIVE ACTION

Corrective Action: "Any action taken to (1) repair, modify, or replace any stormwater control used at the site; (2) clean up and dispose of spills, releases, or other deposits found on the site; and (3) remedy a permit violation."

	Condition Type & Description	Date & Time Condition was Identified	Is SWPPP Modification Required?	Description of Corrective Action Taken (attach additional sheets as needed to describe). Specify type of materials disposed and the disposal location.
1			<input type="checkbox"/> Yes <input type="checkbox"/> No	
2			<input type="checkbox"/> Yes <input type="checkbox"/> No	
3			<input type="checkbox"/> Yes <input type="checkbox"/> No	
4			<input type="checkbox"/> Yes <input type="checkbox"/> No	
5			<input type="checkbox"/> Yes <input type="checkbox"/> No	
6			<input type="checkbox"/> Yes <input type="checkbox"/> No	
7			<input type="checkbox"/> Yes <input type="checkbox"/> No	
8			<input type="checkbox"/> Yes <input type="checkbox"/> No	
9			<input type="checkbox"/> Yes <input type="checkbox"/> No	
10			<input type="checkbox"/> Yes <input type="checkbox"/> No	

**APPENDIX 7.8**  
**LOG OF REDUCED**  
**INSPECTIONS**  
(TO BE ADDED AS INCIDENTS OCCUR)

# LOG OF REDUCED INSPECTIONS

Log of reduced inspections permissible pursuant to section 4.4 of the Construction General Permit.

	Reason for Reduced Inspection	Portion of Site Applicable To	Beginning of Reduced Inspection Period	Conclusion of Reduced Inspection Period
1	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
2	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
3	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
4	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
5	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
6	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
7	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
8	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
9	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			
10	<input type="checkbox"/> Stabilized Area (reduced to monthly) <input type="checkbox"/> Frozen Conditions			

**APPENDIX 7.9**  
**LOG OF SWPPP**  
**MODIFICATIONS**  
(TO BE ADDED AS MODIFICATIONS OCCUR)

## LOG OF SWPPP MODIFICATIONS

	Date of Modification	Person Authorizing Modification	General Description of Modification
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			



## APPENDIX 7.10 LOG OF POTENTIAL POLLUTANTS

LIST OF CONSTRUCTION MATERIALS WHICH MAY BE  
CONSIDERED A POTENTIAL POLLUTANT  
(TO BE ADDED AS SUCH INFORMATION IS DETERMINED)

# CONSTRUCTION MATERIALS POLLUTANT LIST

No. \_\_\_\_\_

DESCRIPTION OF CONSTRUCTION ACTIVITY:

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	Construction Material	Solid/Liquid?	General Description of Storage and Use
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

## APPENDIX 7.11 SUB-CONTRACTOR LOG

LIST ALL SUB-CONTRACTORS AND APPEND A  
CERTIFICATION STATEMENT FOR EACH INDICATING THEIR  
KNOWLEDGE OF AND COMPLIANCE WITH THIS SWPPP

(TO BE ADDED AS SUCH INFORMATION IS DETERMINED)

## SUB-CONTRACTOR LOG

	Sub-Contractor Name	Address	Contact Name and Phone Number

## APPENDIX 7.12 ESTIMATED SCHEDULE

(TO BE ADDED AS SUCH INFORMATION IS DETERMINED)

## ESTIMATED SCHEDULE

Task	Estimated Start Date	Estimated Duration
Earth Disturbing Activities		
Clearing and Grubbing		
Mass Grading (major cuts and fills)		
Final Grading		
Soil Stockpile Creation		
Removal of Temporary Stormwater Conveyances (if applicable)		
Removal of Other Temporary Stormwater Control Measures		
Removal of Construction Equipment and Vehicles		
Cessation of Any Pollutant-Generating Activities		

# **ATTACHMENT E: TSS REMOVAL CALCULATION SHEETS**

**INSTRUCTIONS:**

*Non-automated: Mar. 4, 2008*

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

**Location: Infiltration Basins**

**TSS Removal Calculation  
Worksheet**

A	B	C	D	E
BMP1	TSS Removal Rate1	Starting TSS Load*	Amount Removed (B*C)	Remaining Load (C-D)
Deep Sump Catch Basin	25%	1.00	25%	75%
Infiltration Basin with Sediment Forebay	80%	0.75	60%	15%

**Total TSS Removal =**

85%

**Separate Form Needs to be  
Completed for Each Outlet  
or BMP Train**

Project: Acorn Place  
Prepared By: Merrikin Engineering, LLP  
Date: July 12, 2018

\*Equals remaining load from previous BMP (E)  
which enters the BMP



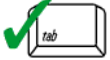
## **ATTACHMENT F: STORMWATER MANAGEMENT HANDBOOK CHECKLIST**



# Checklist for Stormwater Report

## A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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



# Checklist for Stormwater Report

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## B. Stormwater Checklist and Certification

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

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

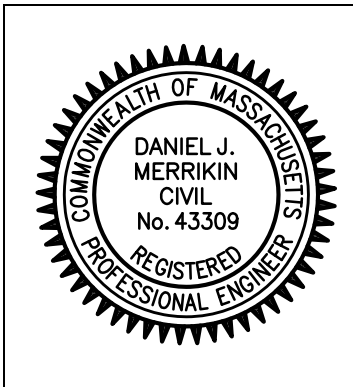
A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

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### Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



\_\_\_\_\_  
Signature and Date

---

## Checklist

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

- ☒ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment



# Checklist for Stormwater Report

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## Checklist (continued)

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

- ☐ No disturbance to any Wetland Resource Areas
- ☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☒ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): \_\_\_\_\_

### Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 2: Peak Rate Attenuation

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

### Standard 3: Recharge

- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
  - ☒ Static
  - ☐ Simple Dynamic
  - ☐ Dynamic Field<sup>1</sup>
- ☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
  - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
  - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
  - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
  - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

---

<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 3: Recharge (continued)

- ☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

### Standard 4: Water Quality

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

- Good housekeeping practices;
  - Provisions for storing materials and waste products inside or under cover;
  - Vehicle washing controls;
  - Requirements for routine inspections and maintenance of stormwater BMPs;
  - Spill prevention and response plans;
  - Provisions for maintenance of lawns, gardens, and other landscaped areas;
  - Requirements for storage and use of fertilizers, herbicides, and pesticides;
  - Pet waste management provisions;
  - Provisions for operation and management of septic systems;
  - Provisions for solid waste management;
  - Snow disposal and plowing plans relative to Wetland Resource Areas;
  - Winter Road Salt and/or Sand Use and Storage restrictions;
  - Street sweeping schedules;
  - Provisions for prevention of illicit discharges to the stormwater management system;
  - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
  - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
  - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
  - ☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
    - ☐ is within the Zone II or Interim Wellhead Protection Area
    - ☐ is near or to other critical areas
    - ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
    - ☐ involves runoff from land uses with higher potential pollutant loads.
  - ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
  - ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
  - ☒ The ½" or 1" Water Quality Volume or
  - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the proprietary BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☒ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does **not** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

### Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.



# Checklist for Stormwater Report

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## Checklist (continued)

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

- ☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
  - ☐ Limited Project
  - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
  - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
  - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
  - ☐ Bike Path and/or Foot Path
  - ☐ Redevelopment Project
  - ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
  - Construction Period Operation and Maintenance Plan;
  - Names of Persons or Entity Responsible for Plan Compliance;
  - Construction Period Pollution Prevention Measures;
  - Erosion and Sedimentation Control Plan Drawings;
  - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
  - Vegetation Planning;
  - Site Development Plan;
  - Construction Sequencing Plan;
  - Sequencing of Erosion and Sedimentation Controls;
  - Operation and Maintenance of Erosion and Sedimentation Controls;
  - Inspection Schedule;
  - Maintenance Schedule;
  - Inspection and Maintenance Log Form.
- ☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.





# Checklist for Stormwater Report

---

## Checklist (continued)

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

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☒ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

### Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
  - ☒ Name of the stormwater management system owners;
  - ☒ Party responsible for operation and maintenance;
  - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
  - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
  - ☒ Description and delineation of public safety features;
  - ☒ Estimated operation and maintenance budget; and
  - ☒ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
  - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
  - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

### Standard 10: Prohibition of Illicit Discharges

- ☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☒ An Illicit Discharge Compliance Statement is attached;
- ☐ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

## **ATTACHMENT G: FEMA FIRMETTE**

# National Flood Hazard Layer FIRMette



## Legend

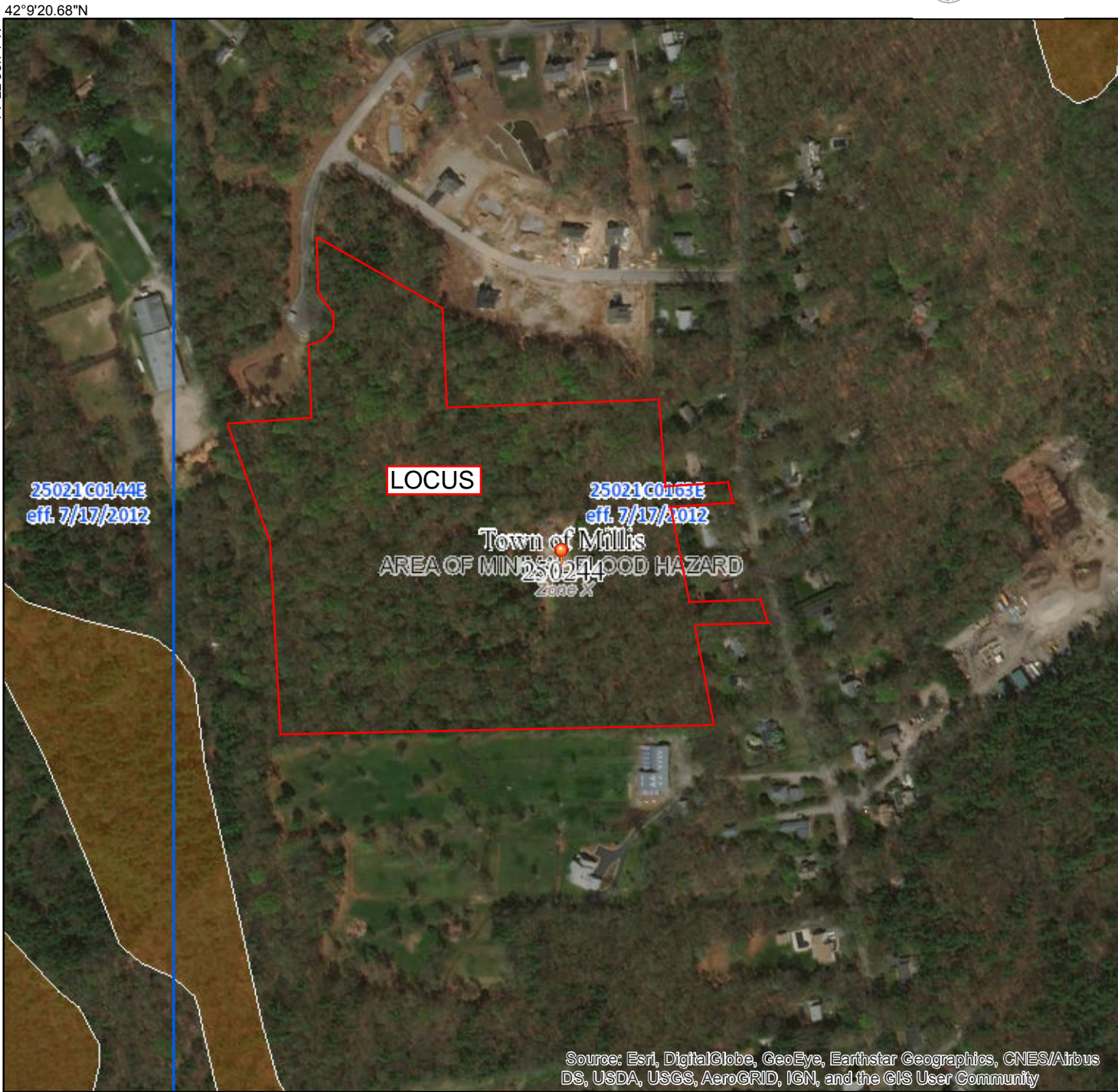
SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth
		Regulatory Floodway Zone AE, AO, AH, VE, AR
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The base map shown complies with FEMA's base map accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **5/28/2018 at 10:06:02 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: base map imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

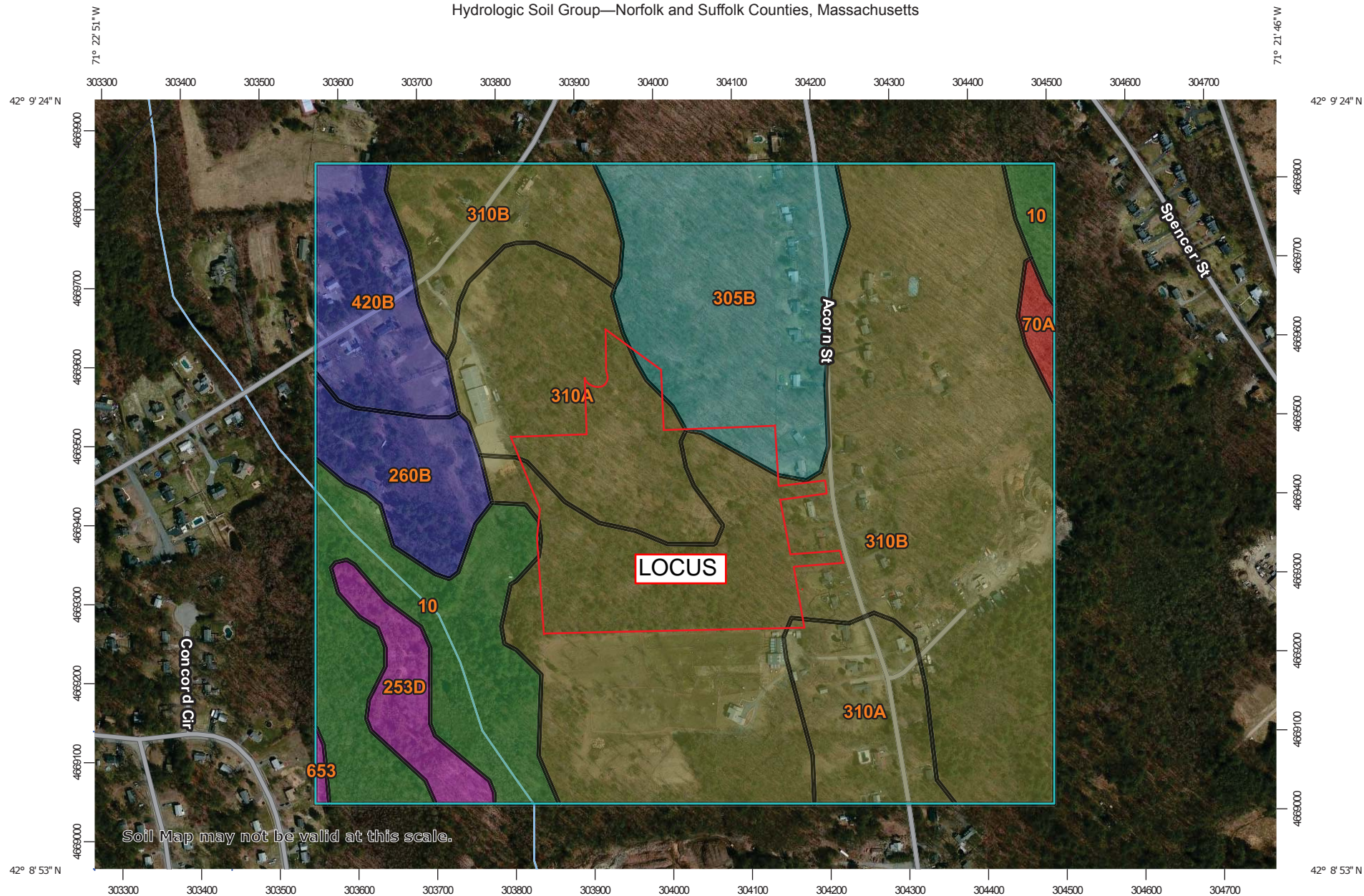


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

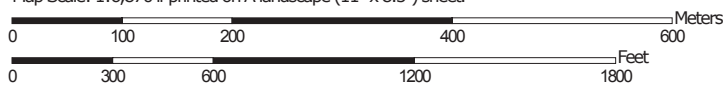
## **ATTACHMENT H: SOILS DATA**



# Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts



Map Scale: 1:6,870 if printed on A landscape (11" x 8.5") sheet.



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




**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

5/28/2018  
Page 1 of 4

## MAP LEGEND

### Area of Interest (AOI)









 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons





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

#### Soil Rating Lines

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

#### Soil Rating Points






 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available


### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts  
 Survey Area Data: Version 13, Oct 6, 2017

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

Date(s) aerial images were photographed: Apr 8, 2011—Apr 9, 2011

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	A/D	20.7	11.0%
70A	Ridgebury fine sandy loam, 0 to 3 percent slopes	D	1.2	0.6%
253D	Hinckley loamy sand, 15 to 35 percent slopes	A	5.0	2.6%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	B	7.8	4.1%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	23.5	12.5%
310A	Woodbridge fine sandy loam, 0 to 3 percent slopes	C/D	28.2	14.9%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	92.0	48.7%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	10.1	5.3%
653	Udorthents, sandy	A	0.3	0.2%
<b>Totals for Area of Interest</b>			<b>188.8</b>	<b>100.0%</b>

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher



# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 1

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
5"	Ap	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	
28"	B	10YR5/7	No			Sandy Loam	1%	1%	V. Friable	Massive	
48"	C1	7.5YR6/3	42"	7.5Y6/8	5%	Sandy Loam	3%	2%	V. Friable	Massive	
100"	C2	2.5Y6/3	Yes			Loamy Sand	3%	2%	V. Friable	Massive	No refusal

Additional Notes: Ground Elev.=214.1

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 42" (Elev.=210.6)

☒ Depth weeping from side of observation hole: 68" (Elev.=208.8)

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 2

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
5"	Ap	10YR4/4	No			Sandy Loam	1%	1%	V. Friable	Massive	
31"	Bw	10YR6/8	No			Sandy Loam	1%	1%	V. Friable	Massive	
110"	C	7.5YR6/3	37"	7.5Y6/8	5%	Loamy Sand	3%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=213.3

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 37" (Elev.=210.2)

☐ Depth weeping from side of observation hole: None

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 3

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
5"	Ap	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	
26"	Bw	10YR5/7	No			Sandy Loam	3%	3%	V. Friable	Massive	
110"	C	7.5YR6/3	26"	7.5Y6/8	5%	Sandy Loam	2%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=213.6

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 26" (Elev.=211.4)

☐ Depth weeping from side of observation hole: None

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 4

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
5"	Ap	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	
28"	B	10YR6/8	No			Sandy Loam	1%	1%	V. Friable	Massive	
110"	C	7.5YR6/3	28"	7.5Y6/3	5%	Loamy Sand	3%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=212.6

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 28" (Elev.=210.3)

☐ Depth weeping from side of observation hole: None

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 5

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6"	Ap	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	
24"	Bw	10YR6/8	No			Sandy Loam	2%	1%	V. Friable	Massive	
110"	C1	7.5YR6/3	26"	7.5Y6/8	5%	LS/SL	3%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=211.0

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 26" (Elev.=208.8)

☐ Depth weeping from side of observation hole: 36" (Elev.=tbd)

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 6

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
5"	Ap	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	
20"	Bw	10YR6/8	No			Sandy Loam	2%	2%	V. Friable	Massive	
110"	C	7.5YR6/3	24"	7.5Y6/8	5%	Loamy Sand	2%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=209.0

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 24" (Elev.=207.0)

☐ Depth weeping from side of observation hole: 84" (Elev.=tbd)

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 7

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6"	Ap	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	Surface Boulders
26"	Bw	10YR6/8	No			Sandy Loam	1%	1%	V. Friable	Massive	
60"	C1	7.5YR6/3	26"	7.5Y6/8	5%	Loamy Sand	3%	3%	V. Friable	Massive	
110"	C2	7.5YR6/3	Yes			Sandy Loam	3%	3%	V. Friable	Massive	Boulders

Additional Notes: Ground Elev.=206.6

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 26" (Elev.=204.4)

☐ Depth weeping from side of observation hole: None

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 8

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4"	Ap	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	
27"	Bw	10YR6/8	No			Sandy Loam	2%	1%	V. Friable	Massive	
110"	C	7.5YR6/3	27"	7.5Y6/8	5%	Sandy Loam	2%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=205.7

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 27" (Elev.=203.4)

☐ Depth weeping from side of observation hole: None



# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 9

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4"	Ap	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	
26"	Bw	10YR5/6	No			Sandy Loam	2%	1%	V. Friable	Massive	
50"	C1	7.5YR6/3	28"	7.5Y6/8	5%	Loamy Sand	3%	2%	V. Friable	Massive	
110"	C2	7.5YR6/3	Yes			Sandy Loam	3%	2%	V. Friable	Massive	No refusal

Additional Notes: Ground Elev.=205.2

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 28" (Elev.=202.9)

☐ Depth weeping from side of observation hole: 48" (Elev.=tbd)

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 10    Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4"	A	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	
22"	Bw	10YR6/7	No			Sandy Loam	2%	1%	V. Friable	Massive	
110"	C1	7.5YR6/3	33"	7.5Y6/8	5%	SL/LS	3%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=214.8

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 33" (Elev.=212.0)

☐ Depth weeping from side of observation hole: 60" (Elev.=tbd)

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 11

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
5"	A	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	
28"	Bw	10YR6/8	No			Sandy Loam	1%	1%	V. Friable	Massive	
110"	C	7.5YR6/3	32"	7.5Y6/8	5%	Loamy Sand	3%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=214.9

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 32" (Elev.=212.2)

☐ Depth weeping from side of observation hole: 48" (Elev.=tbd)

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 12

Date of Test Hole: May 15, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4"	A	10YR4/3	No			Sandy Loam	1%	1%	V. Friable	Massive	
28"	Bw	10YR6/7	No			Sandy Loam	2%	2%	V. Friable	Massive	
110"	C	7.5YR6/3	34"	7.5Y6/8	5%	Loamy Sand	3%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=218.2

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 34" (Elev.=215.4)

☐ Depth weeping from side of observation hole: None

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 13

Date of Test Hole: July 12, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4"	A	10YR4/3	No			Loamy Sand	1%	1%	V. Friable	Massive	
24"	B	10YR6/7	No			Loamy Sand	1%	1%	V. Friable	Massive	
115"	C	7.5YR6/3	26"	7.5Y6/8	5%	Sandy Loam	3%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=214.4

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 26" (Elev.=212.2)

☒ Depth weeping from side of observation hole: 90" (Elev.=206.9)

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 14

Date of Test Hole: July 12, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4"	A	10YR4/3	No			Loamy Sand	1%	1%	V. Friable	Massive	
24"	B	10YR6/7	No			Loamy Sand	1%	1%	V. Friable	Massive	
115"	C	7.5YR6/3	26"	7.5Y6/8	5%	Sandy Loam	3%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=215.1

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 26" (Elev.=212.9)

☐ Depth weeping from side of observation hole: None

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 15

Date of Test Hole: July 12, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4"	A	10YR4/3	No			Loamy Sand	1%	1%	V. Friable	Massive	Few surface boulders
26"	B	10YR6/7	No			Loamy Sand	1%	1%	V. Friable	Massive	
115"	C	7.5YR6/3	27"	7.5Y6/8	5%	Sandy Loam	2%	2%	V. Friable	Massive	

Additional Notes: Ground Elev.=215.4

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 27" (Elev.=213.2)

☐ Depth weeping from side of observation hole: None

# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 16

Date of Test Hole: July 12, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
23"	Fill										
36"	B	10YR5/6	No			Sandy Loam	1%	1%	V. Friable	Massive	
110"	C	7.5YR6/3	42"	7.5Y6/8	5%	Sandy Loam	3%	3%	V. Friable	Massive	

Additional Notes: Ground Elev.=217.2

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 42" (Elev.=213.7)

☐ Depth weeping from side of observation hole: None



# DEEP OBSERVATION TEST HOLE SOIL LOG

## Acorn Street Millis, MA 02054

Deep Observation Hole: OTH 17

Date of Test Hole: July 12, 2018

Soil Evaluation By: Daniel J. Merrikin, P.E.  
(Mass. Approved Soil Evaluator)

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
7"	A	10YR4/3	No			Loamy Sand	1%	1%	V. Friable	Massive	
28"	Bw	10YR5/6	No			Loamy Sand	1%	1%	V. Friable	Massive	
112"	C	7.5YR6/3	29"	7.5Y6/8	5%	Sandy Loam	3%	3%	V. Friable	Massive	

Additional Notes: Ground Elev.=218.5

Signature of Soil Inspector: Daniel J. Merrikin, P.E. \_\_\_\_\_

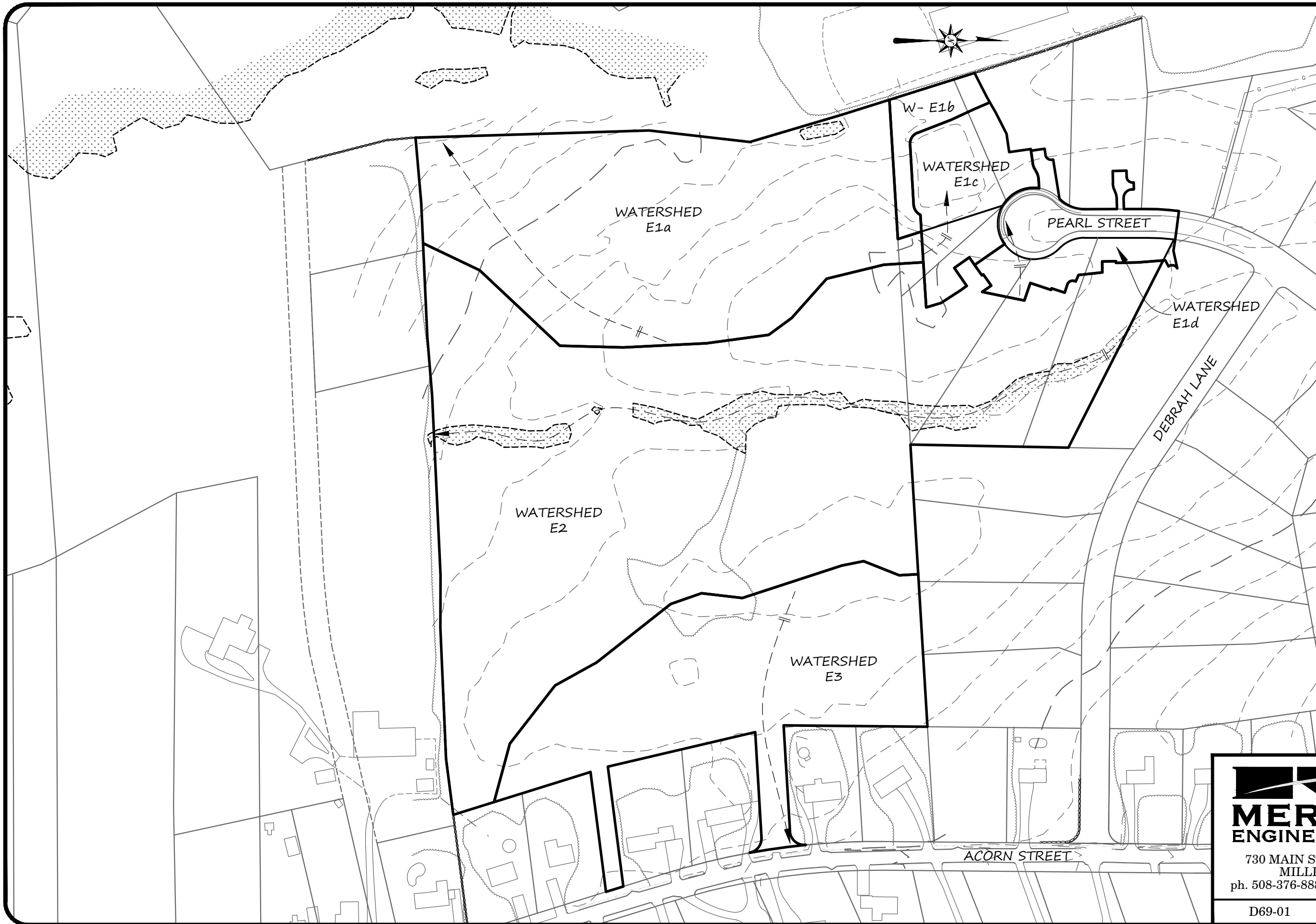
### Groundwater Indicators Observed at Time of Testing:

☐ Depth observed standing water in observation hole: None

☒ Depth to soil redoximorphic features (mottles): 29" (Elev.=216.1)

☐ Depth weeping from side of observation hole: None

# **ATTACHMENT I: EXISTING WATERSHED PLAN**



PLAN SCALE: 1" = 160'



PLAN DATE: JULY 12, 2018

REVISION	DATE	BY

ACORN PLACE  
EXISTING CONDITIONS  
WATERSHEDS PLAN  
OF LAND IN  
MILLIS, MA



730 MAIN STREET, SUITE 2C  
MILLIS, MA 02054  
ph. 508-376-8883 fax 508-376-8823

D69-01

SHEET 1 OF 1

# **ATTACHMENT J: PROPOSED WATERSHED PLAN**



PLAN SCALE: 1" = 160'



PLAN DATE: JULY 12, 2018

REVISION	DATE	BY

ACORN PLACE  
PROPOSED CONDITIONS  
WATERSHEDS PLAN  
OF LAND IN  
MILLIS, MA



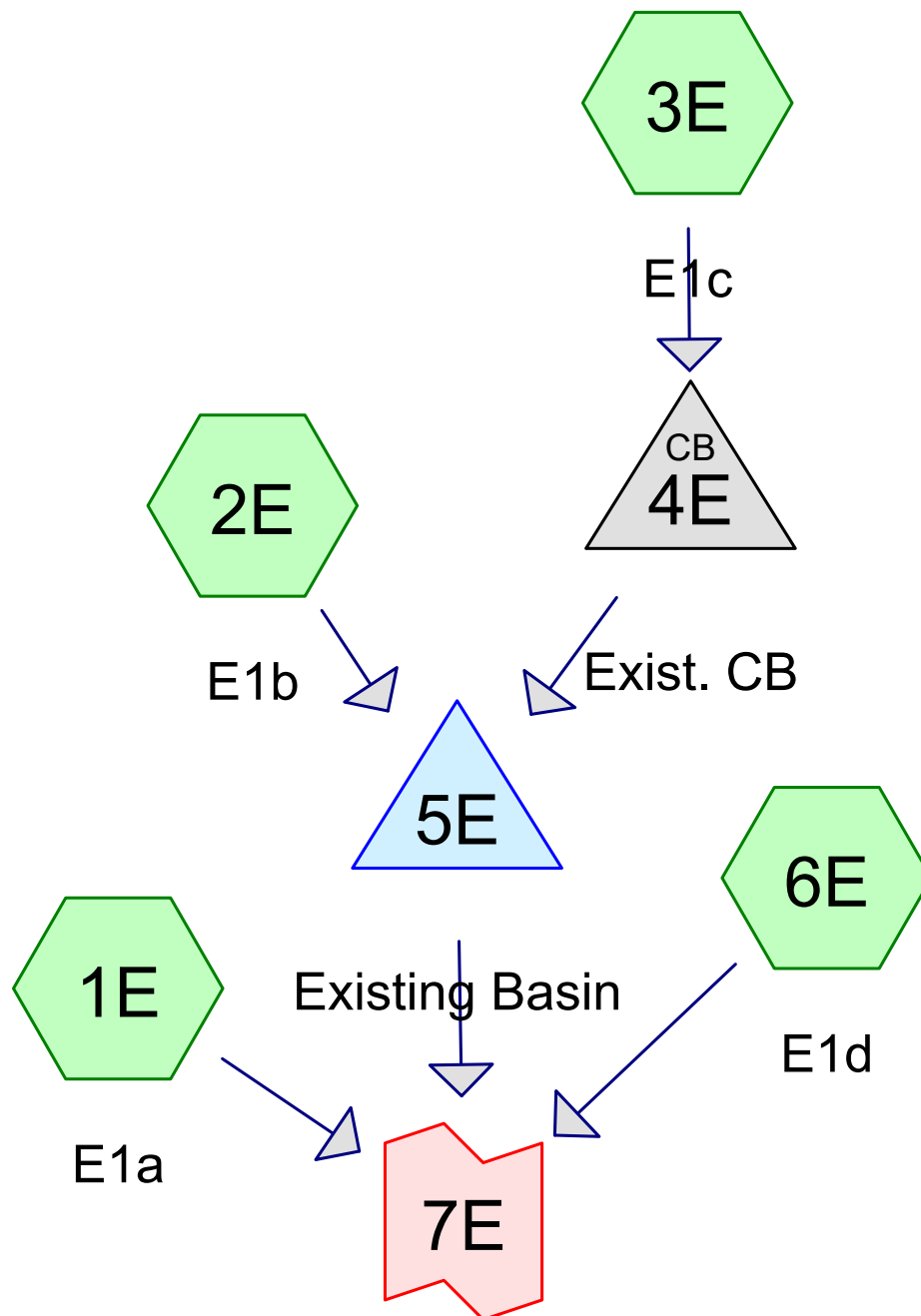
730 MAIN STREET, SUITE 2C  
MILLIS, MA 02054  
ph. 508-376-8883 fax 508-376-8823

D69-01

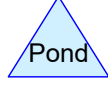
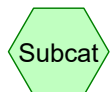
SHEET 1 OF 1

# **ATTACHMENT K: HYDROCAD HYDROLOGY CALCULATIONS**

DESIGN POINT #1: FLOW TO  
SHADOWFAX FARM EXISTING  
CONDITIONS



Design Point #1: Flow to  
Shadowfax Farm



**Routing Diagram for Stormwater Calculations**

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## Stormwater Calculations

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.416	74	>75% Grass cover, Good, HSG C (2E, 3E, 6E)
0.373	98	Paved parking, HSG C (3E)
6.698	70	Woods, Good, HSG C (1E, 2E, 3E)
<b>8.486</b>	<b>72</b>	<b>TOTAL AREA</b>

## Stormwater Calculations

Type III 24-hr 1-YR Rainfall=2.50"

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

### Subcatchment1E: E1a

Runoff Area=262,688 sf 0.00% Impervious Runoff Depth=0.46"  
Flow Length=542' Tc=19.2 min CN=70 Runoff=1.69 cfs 0.229 af

### Subcatchment2E: E1b

Runoff Area=45,571 sf 0.00% Impervious Runoff Depth=0.57"  
Flow Length=111' Tc=7.4 min CN=73 Runoff=0.56 cfs 0.049 af

### Subcatchment3E: E1c

Runoff Area=44,627 sf 36.37% Impervious Runoff Depth=0.94"  
Flow Length=131' Slope=0.0200 '/ Tc=12.9 min CN=81 Runoff=0.88 cfs 0.080 af

### Pond 4E: Exist. CB

Peak Elev=213.94' Inflow=0.88 cfs 0.080 af  
15.0" Round Culvert n=0.011 L=59.0' S=0.0085 '/ Outflow=0.88 cfs 0.080 af

### Pond 5E: Existing Basin

Peak Elev=213.09' Storage=935 cf Inflow=1.38 cfs 0.130 af  
Discarded=0.60 cfs 0.130 af Primary=0.00 cfs 0.000 af Outflow=0.60 cfs 0.130 af

### Subcatchment6E: E1d

Runoff Area=16,759 sf 0.00% Impervious Runoff Depth=0.61"  
Flow Length=162' Slope=0.0300 '/ Tc=7.7 min CN=74 Runoff=0.23 cfs 0.020 af

### Link 7E: Design Point #1: Flow to Shadowfax Farm

Inflow=1.82 cfs 0.248 af  
Primary=1.82 cfs 0.248 af

**Total Runoff Area = 8.486 ac Runoff Volume = 0.378 af Average Runoff Depth = 0.53"**  
**95.61% Pervious = 8.113 ac 4.39% Impervious = 0.373 ac**

## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 1E: E1a

Runoff = 1.69 cfs @ 12.33 hrs, Volume= 0.229 af, Depth= 0.46"

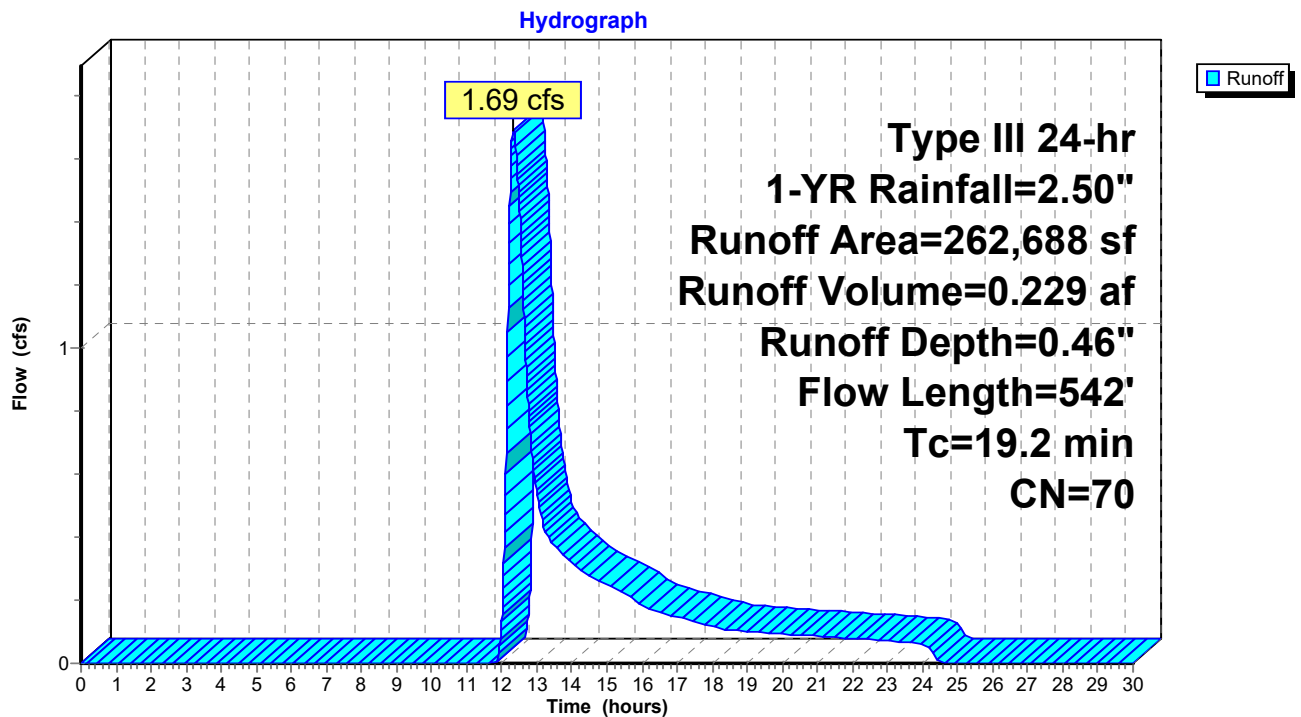
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
262,688	70	Woods, Good, HSG C
262,688		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	492	0.0300	2.79		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
19.2	542	Total			

### Subcatchment 1E: E1a



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 2E: E1b

Runoff = 0.56 cfs @ 12.12 hrs, Volume= 0.049 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

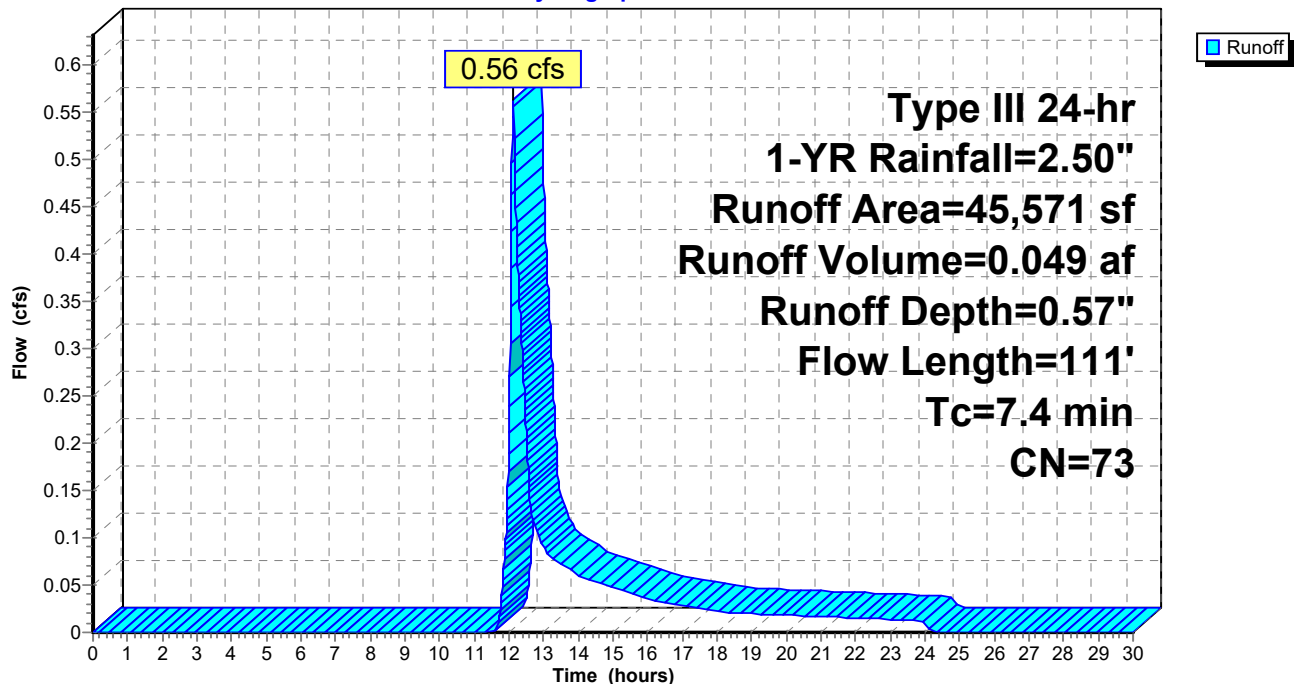
Area (sf)	CN	Description
13,116	70	Woods, Good, HSG C
32,455	74	>75% Grass cover, Good, HSG C
45,571	73	Weighted Average
45,571		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	61	0.0500	3.60		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.4	111	Total			

### Subcatchment 2E: E1b

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 3E: E1c

Runoff = 0.88 cfs @ 12.19 hrs, Volume= 0.080 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

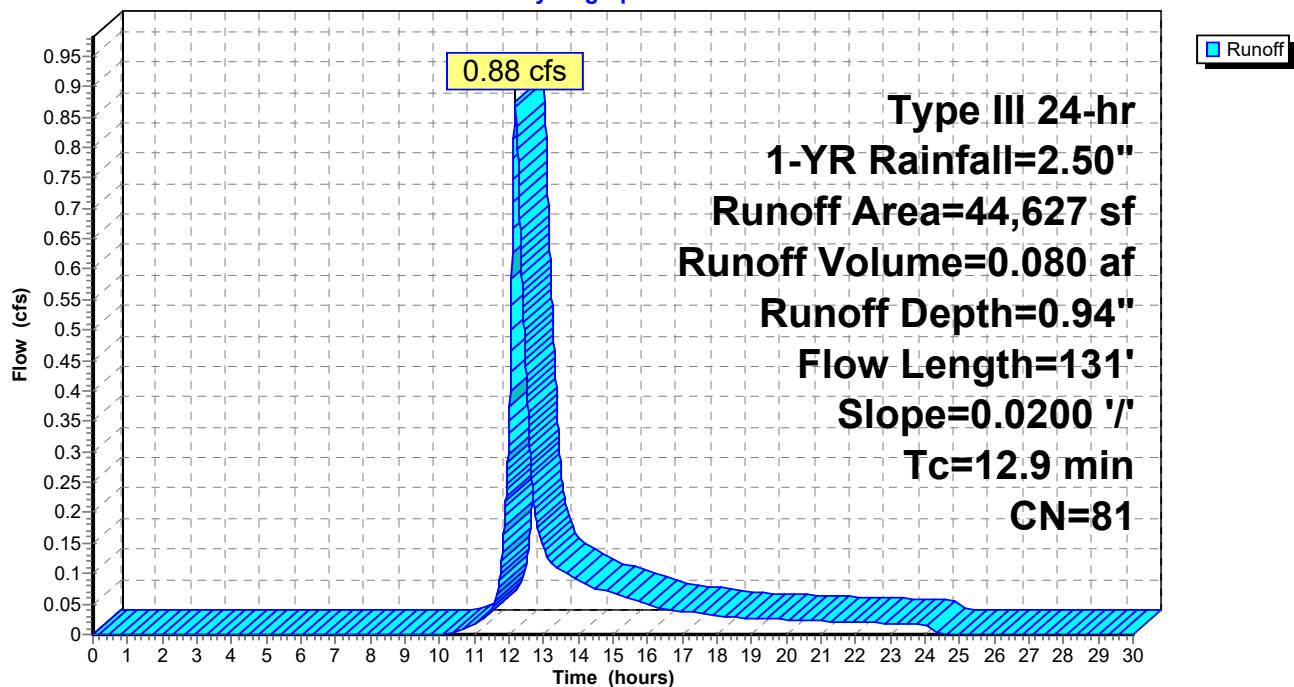
Area (sf)	CN	Description
16,229	98	Paved parking, HSG C
15,951	70	Woods, Good, HSG C
12,447	74	>75% Grass cover, Good, HSG C
44,627	81	Weighted Average
28,398		63.63% Pervious Area
16,229		36.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	36	0.0200	2.28		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.3	45	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
12.9	131	Total			

### Subcatchment 3E: E1c

Hydrograph



## Stormwater Calculations

Prepared by {enter your company name here}

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 4E: Exist. CB

Inflow Area = 1.024 ac, 36.37% Impervious, Inflow Depth = 0.94" for 1-YR event  
Inflow = 0.88 cfs @ 12.19 hrs, Volume= 0.080 af  
Outflow = 0.88 cfs @ 12.19 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.88 cfs @ 12.19 hrs, Volume= 0.080 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 213.94' @ 12.19 hrs

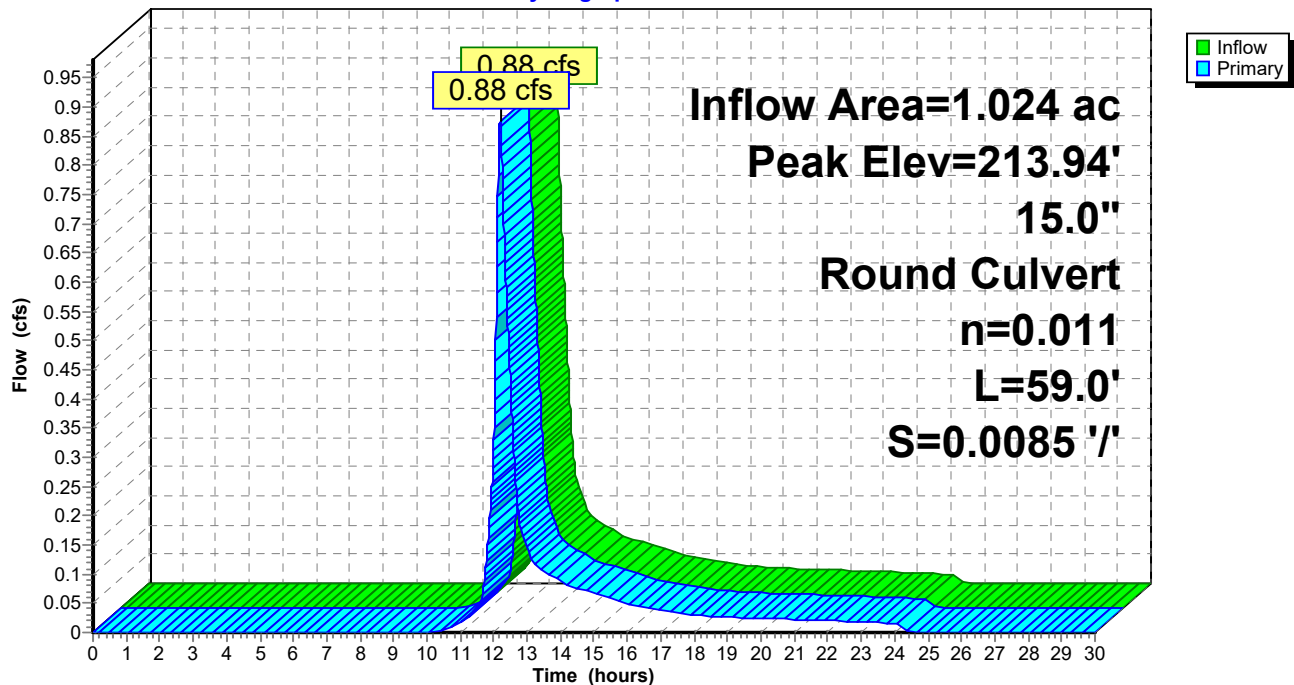
Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	<b>15.0" Round Culvert</b> L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.50' / 213.00' S= 0.0085 '/ Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

**Primary OutFlow** Max=0.88 cfs @ 12.19 hrs HW=213.94' (Free Discharge)

↑1=Culvert (Inlet Controls 0.88 cfs @ 2.26 fps)

### Pond 4E: Exist. CB

#### Hydrograph



## Stormwater Calculations

Prepared by {enter your company name here}

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 5E: Existing Basin

Inflow Area = 2.071 ac, 17.99% Impervious, Inflow Depth = 0.75" for 1-YR event  
Inflow = 1.38 cfs @ 12.16 hrs, Volume= 0.130 af  
Outflow = 0.60 cfs @ 12.52 hrs, Volume= 0.130 af, Atten= 56%, Lag= 21.7 min  
Discarded = 0.60 cfs @ 12.52 hrs, Volume= 0.130 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 213.09' @ 12.52 hrs Surf.Area= 10,810 sf Storage= 935 cf

Plug-Flow detention time= 12.1 min calculated for 0.130 af (100% of inflow)  
Center-of-Mass det. time= 12.1 min ( 881.0 - 868.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	32,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
213.00	10,659	0	0
214.00	12,392	11,526	11,526
215.50	15,086	20,609	32,134

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	<b>2.410 in/hr Exfiltration over Horizontal area</b>
#2	Primary	213.40'	<b>5.0' long x 0.8' breadth Level Spreader</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32
#3	Device 2	213.50'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.80 0.80 1.50 Width (feet) 0.25 0.25 8.00 8.00

**Discarded OutFlow** Max=0.60 cfs @ 12.52 hrs HW=213.09' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.60 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=213.00' (Free Discharge)

↑ **2=Level Spreader** ( Controls 0.00 cfs)

↑ **3=Custom Weir/Orifice** ( Controls 0.00 cfs)

## Stormwater Calculations

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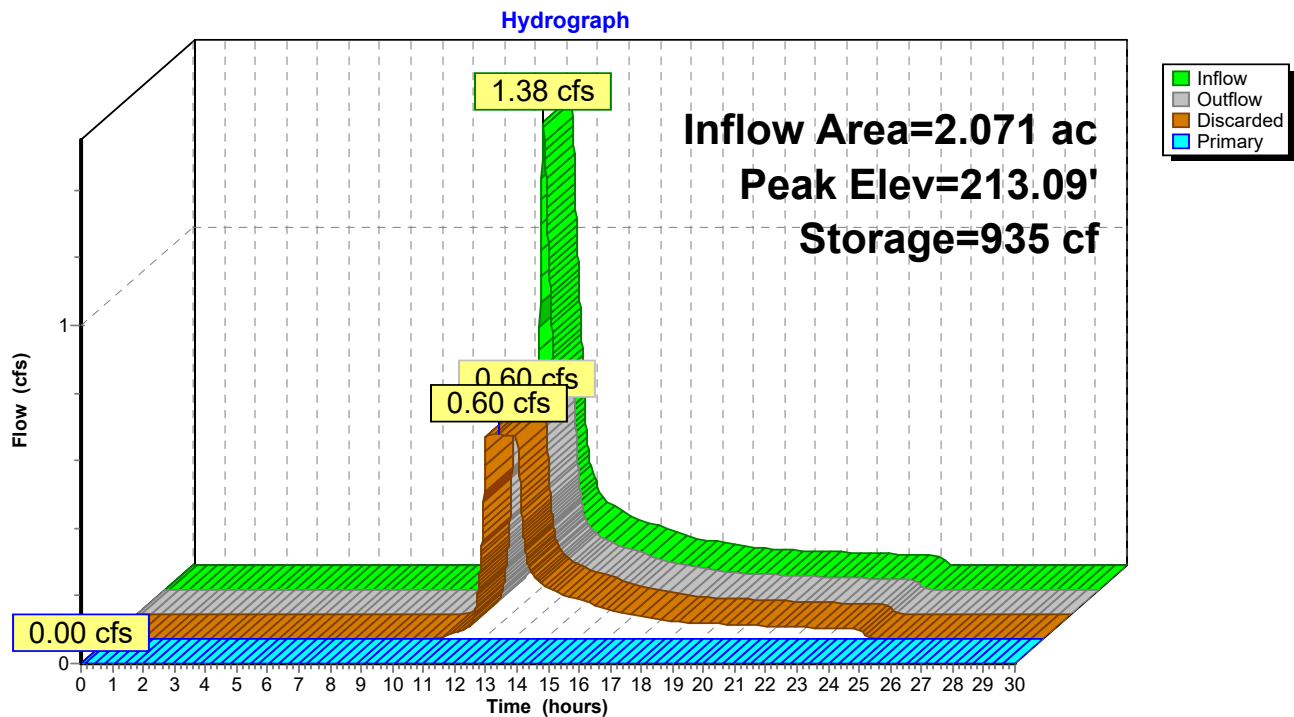
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Type III 24-hr 1-YR Rainfall=2.50"

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### Pond 5E: Existing Basin





## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 6E: E1d

Runoff = 0.23 cfs @ 12.12 hrs, Volume= 0.020 af, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

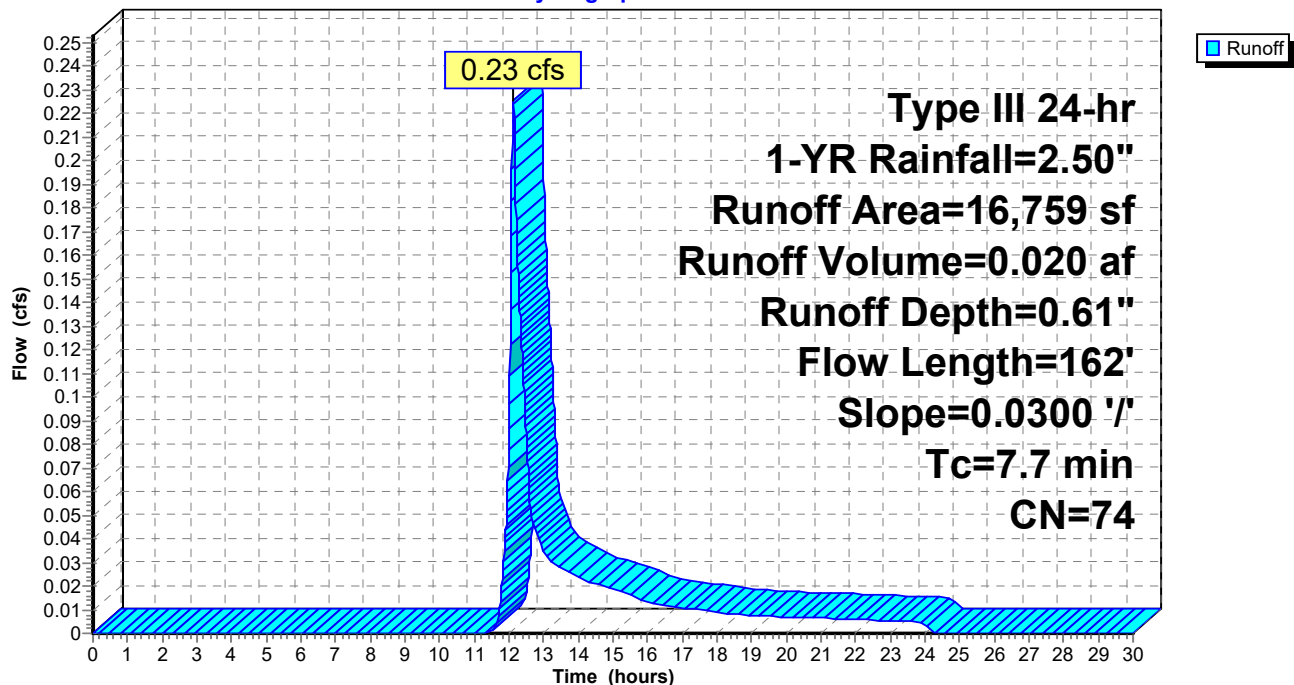
Area (sf)	CN	Description
16,759	74	>75% Grass cover, Good, HSG C
16,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	112	0.0300	2.79		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.7	162	Total			

### Subcatchment 6E: E1d

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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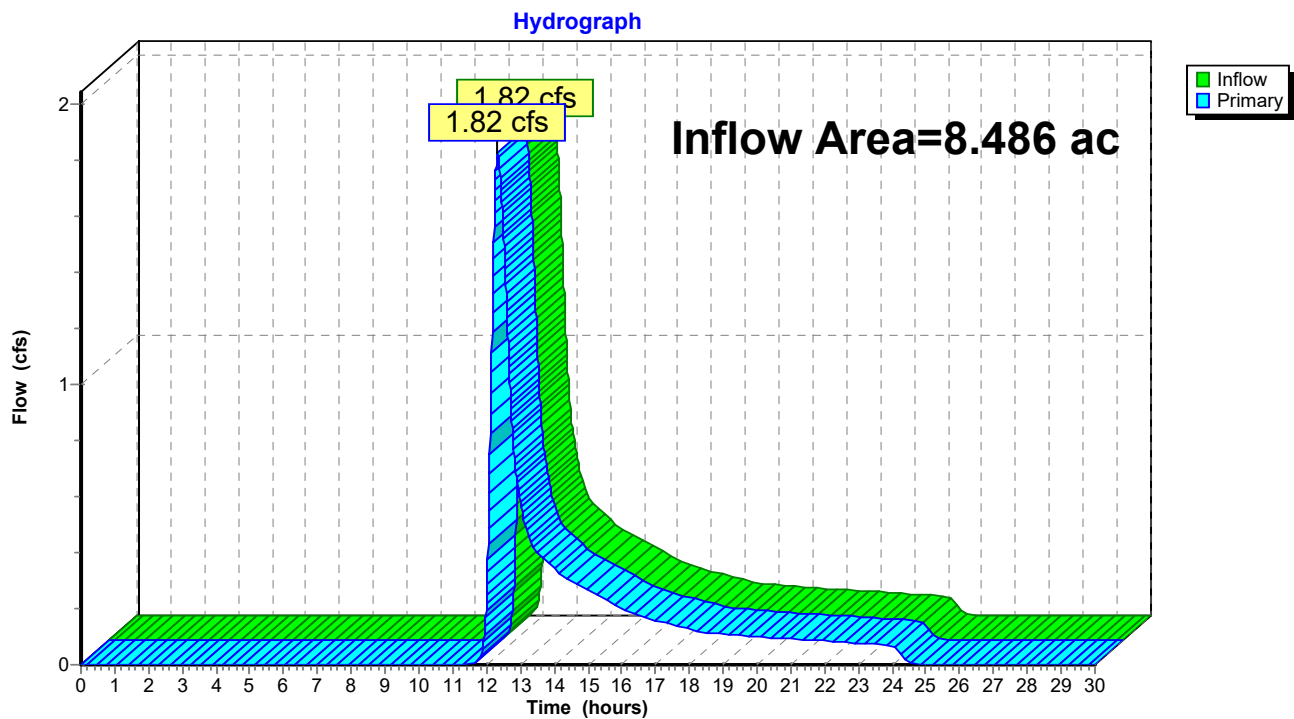
Page 11

### Summary for Link 7E: Design Point #1: Flow to Shadowfax Farm

Inflow Area = 8.486 ac, 4.39% Impervious, Inflow Depth = 0.35" for 1-YR event  
Inflow = 1.82 cfs @ 12.33 hrs, Volume= 0.248 af  
Primary = 1.82 cfs @ 12.33 hrs, Volume= 0.248 af, Atten= 0%, Lag= 0.0 min

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

### Link 7E: Design Point #1: Flow to Shadowfax Farm



## Stormwater Calculations

Type III 24-hr 2-YR Rainfall=3.20"

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

### Subcatchment1E: E1a

Runoff Area=262,688 sf 0.00% Impervious Runoff Depth=0.83"  
Flow Length=542' Tc=19.2 min CN=70 Runoff=3.56 cfs 0.416 af

### Subcatchment2E: E1b

Runoff Area=45,571 sf 0.00% Impervious Runoff Depth=0.98"  
Flow Length=111' Tc=7.4 min CN=73 Runoff=1.07 cfs 0.086 af

### Subcatchment3E: E1c

Runoff Area=44,627 sf 36.37% Impervious Runoff Depth=1.47"  
Flow Length=131' Slope=0.0200 '/ Tc=12.9 min CN=81 Runoff=1.40 cfs 0.125 af

### Pond 4E: Exist. CB

Peak Elev=214.07' Inflow=1.40 cfs 0.125 af  
15.0" Round Culvert n=0.011 L=59.0' S=0.0085 '/ Outflow=1.40 cfs 0.125 af

### Pond 5E: Existing Basin

Peak Elev=213.22' Storage=2,335 cf Inflow=2.36 cfs 0.211 af  
Discarded=0.62 cfs 0.211 af Primary=0.00 cfs 0.000 af Outflow=0.62 cfs 0.211 af

### Subcatchment6E: E1d

Runoff Area=16,759 sf 0.00% Impervious Runoff Depth=1.04"  
Flow Length=162' Slope=0.0300 '/ Tc=7.7 min CN=74 Runoff=0.42 cfs 0.033 af

### Link 7E: Design Point #1: Flow to Shadowfax Farm

Inflow=3.80 cfs 0.449 af  
Primary=3.80 cfs 0.449 af

**Total Runoff Area = 8.486 ac Runoff Volume = 0.661 af Average Runoff Depth = 0.93"**  
**95.61% Pervious = 8.113 ac 4.39% Impervious = 0.373 ac**

## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 1E: E1a

Runoff = 3.56 cfs @ 12.31 hrs, Volume= 0.416 af, Depth= 0.83"

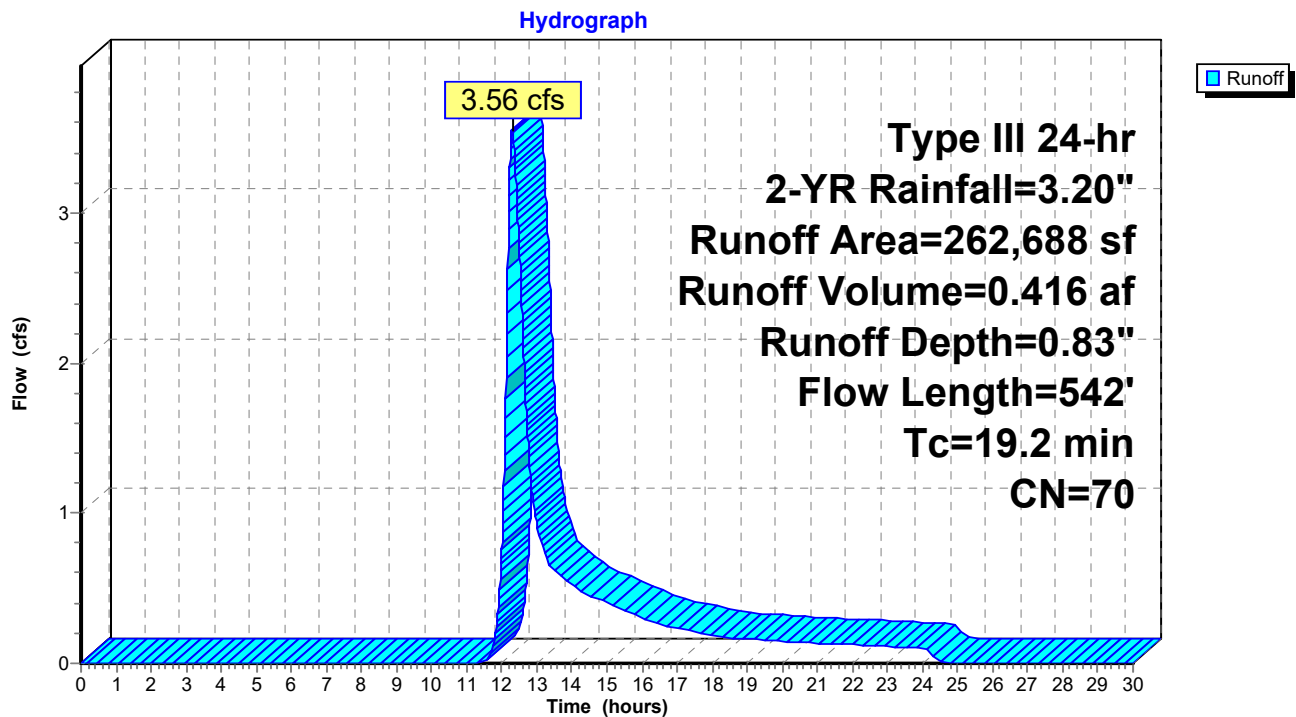
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
262,688	70	Woods, Good, HSG C
262,688		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	492	0.0300	2.79		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
19.2	542	Total			

### Subcatchment 1E: E1a



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 2E: E1b

Runoff = 1.07 cfs @ 12.12 hrs, Volume= 0.086 af, Depth= 0.98"

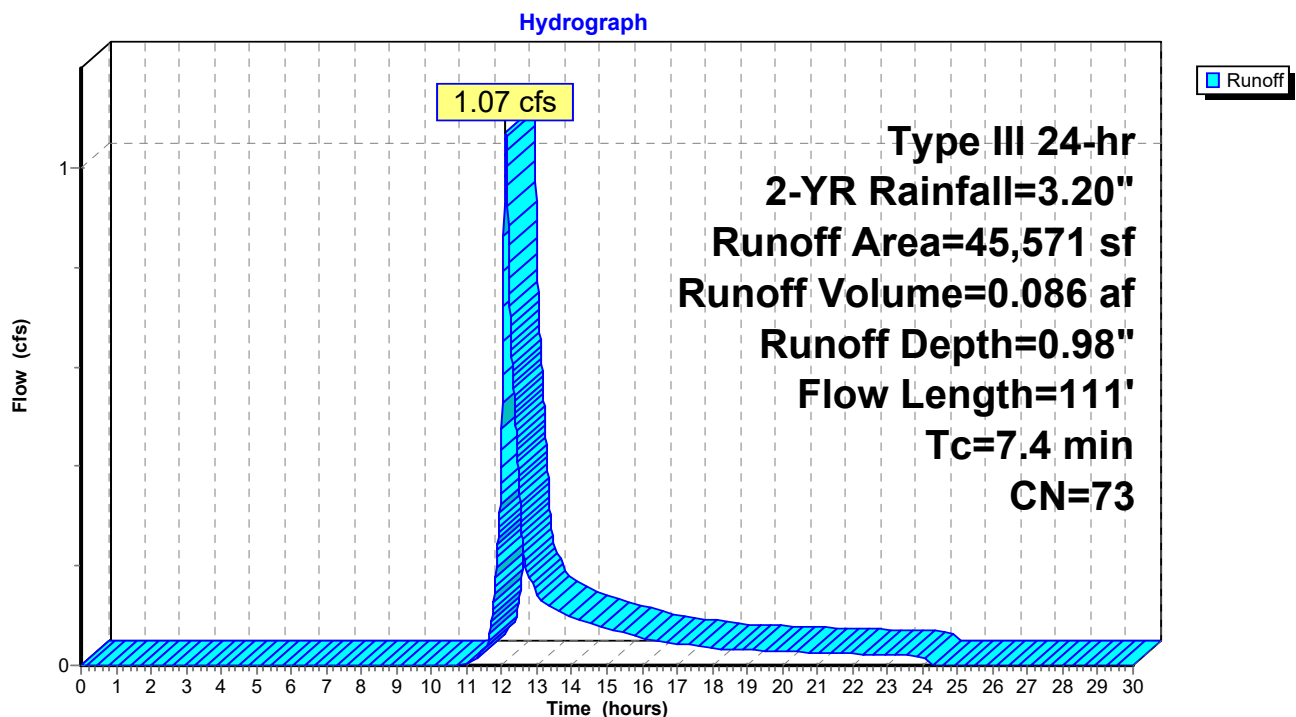
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
13,116	70	Woods, Good, HSG C
32,455	74	>75% Grass cover, Good, HSG C
45,571	73	Weighted Average
45,571		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	61	0.0500	3.60		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.4	111	Total			

### Subcatchment 2E: E1b



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 3E: E1c

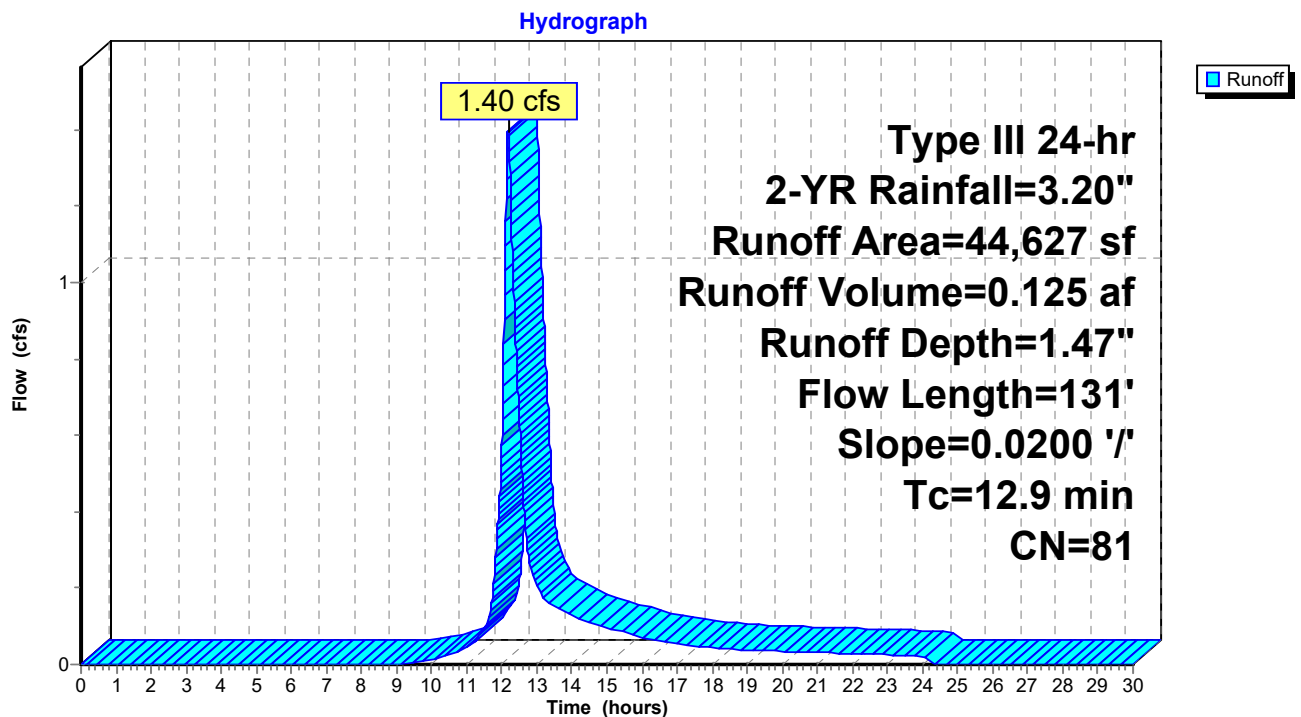
Runoff = 1.40 cfs @ 12.18 hrs, Volume= 0.125 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
16,229	98	Paved parking, HSG C
15,951	70	Woods, Good, HSG C
12,447	74	>75% Grass cover, Good, HSG C
44,627	81	Weighted Average
28,398		63.63% Pervious Area
16,229		36.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	36	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.3	45	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.9	131	Total			

### Subcatchment 3E: E1c



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 4E: Exist. CB

Inflow Area = 1.024 ac, 36.37% Impervious, Inflow Depth = 1.47" for 2-YR event  
Inflow = 1.40 cfs @ 12.18 hrs, Volume= 0.125 af  
Outflow = 1.40 cfs @ 12.18 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.40 cfs @ 12.18 hrs, Volume= 0.125 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.07' @ 12.18 hrs

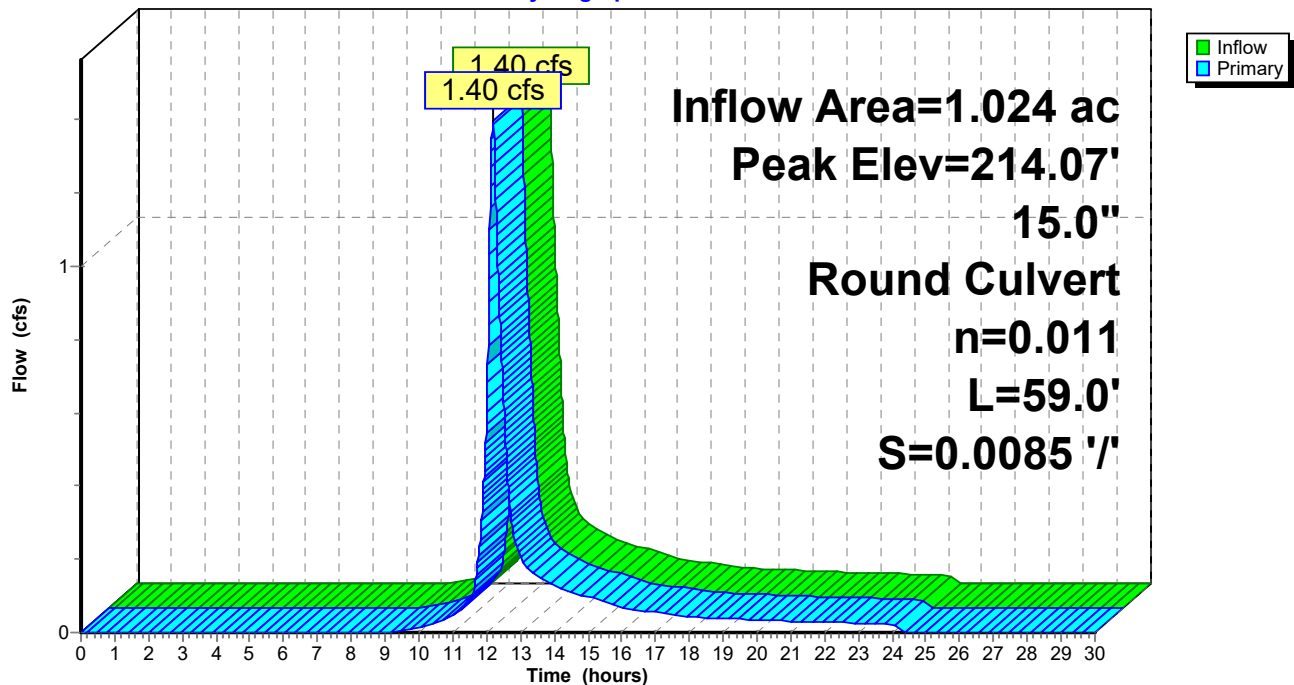
Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	<b>15.0" Round Culvert</b> L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.50' / 213.00' S= 0.0085 '/ Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

**Primary OutFlow** Max=1.40 cfs @ 12.18 hrs HW=214.07' (Free Discharge)

↑1=Culvert (Barrel Controls 1.40 cfs @ 3.77 fps)

### Pond 4E: Exist. CB

Hydrograph



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 5E: Existing Basin

Inflow Area = 2.071 ac, 17.99% Impervious, Inflow Depth = 1.22" for 2-YR event  
Inflow = 2.36 cfs @ 12.15 hrs, Volume= 0.211 af  
Outflow = 0.62 cfs @ 12.64 hrs, Volume= 0.211 af, Atten= 74%, Lag= 29.5 min  
Discarded = 0.62 cfs @ 12.64 hrs, Volume= 0.211 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 213.22' @ 12.64 hrs Surf.Area= 11,032 sf Storage= 2,335 cf

Plug-Flow detention time= 26.9 min calculated for 0.211 af (100% of inflow)  
Center-of-Mass det. time= 26.9 min ( 881.2 - 854.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	32,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
213.00	10,659	0	0
214.00	12,392	11,526	11,526
215.50	15,086	20,609	32,134

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	<b>2.410 in/hr Exfiltration over Horizontal area</b>
#2	Primary	213.40'	<b>5.0' long x 0.8' breadth Level Spreader</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32
#3	Device 2	213.50'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.80 0.80 1.50 Width (feet) 0.25 0.25 8.00 8.00

**Discarded OutFlow** Max=0.62 cfs @ 12.64 hrs HW=213.22' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.62 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=213.00' (Free Discharge)

↑**2=Level Spreader** ( Controls 0.00 cfs)

↑**3=Custom Weir/Orifice** ( Controls 0.00 cfs)



## Stormwater Calculations

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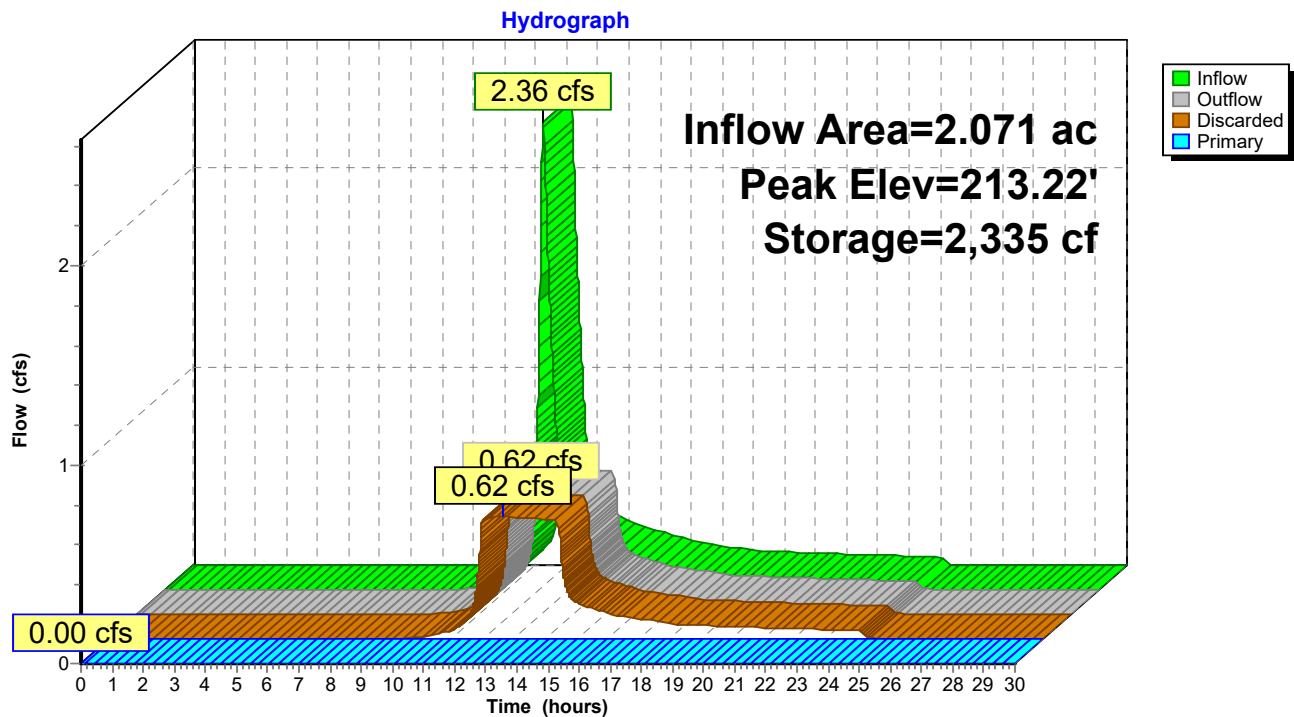
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Type III 24-hr 2-YR Rainfall=3.20"

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### Pond 5E: Existing Basin



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 6E: E1d

Runoff = 0.42 cfs @ 12.12 hrs, Volume= 0.033 af, Depth= 1.04"

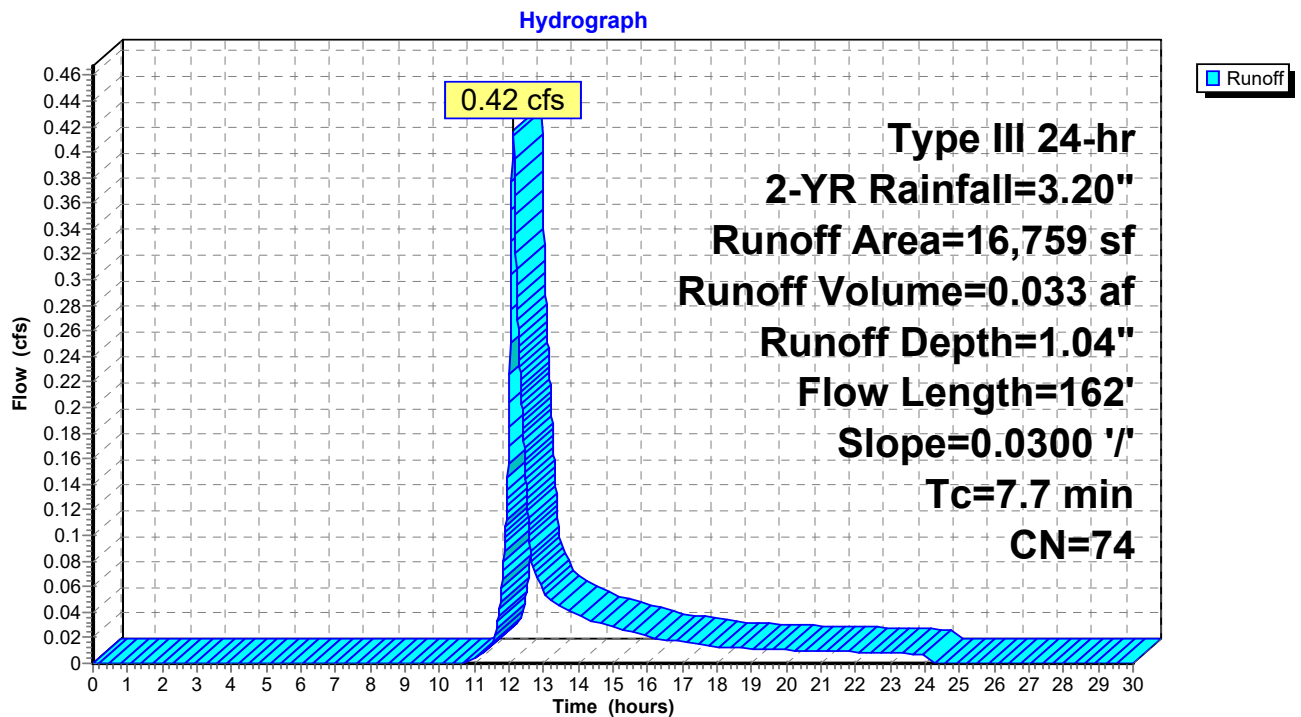
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
16,759	74	>75% Grass cover, Good, HSG C
16,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	112	0.0300	2.79		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.7	162	Total			

### Subcatchment 6E: E1d



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Type III 24-hr 2-YR Rainfall=3.20"

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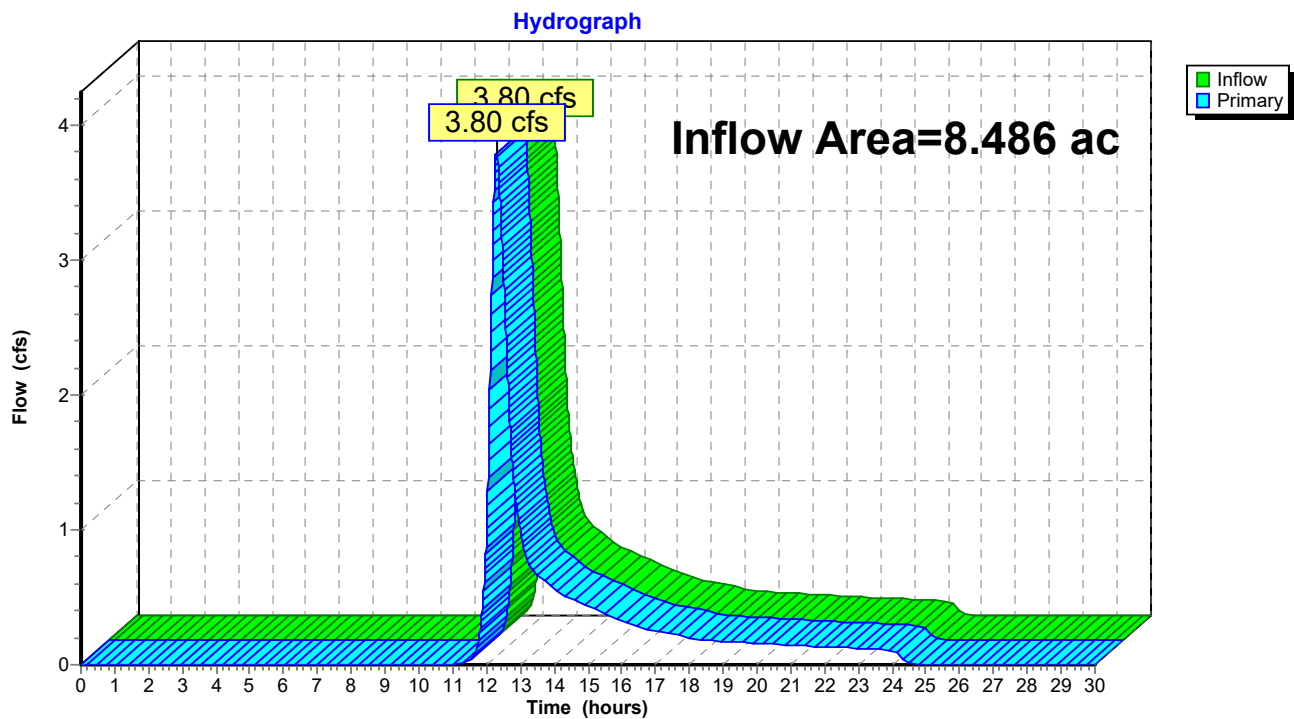
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### Summary for Link 7E: Design Point #1: Flow to Shadowfax Farm

Inflow Area = 8.486 ac, 4.39% Impervious, Inflow Depth = 0.64" for 2-YR event  
Inflow = 3.80 cfs @ 12.29 hrs, Volume= 0.449 af  
Primary = 3.80 cfs @ 12.29 hrs, Volume= 0.449 af, Atten= 0%, Lag= 0.0 min

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

### Link 7E: Design Point #1: Flow to Shadowfax Farm



## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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

### Subcatchment1E: E1a

Runoff Area=262,688 sf 0.00% Impervious Runoff Depth=1.82"  
Flow Length=542' Tc=19.2 min CN=70 Runoff=8.55 cfs 0.913 af

### Subcatchment2E: E1b

Runoff Area=45,571 sf 0.00% Impervious Runoff Depth=2.05"  
Flow Length=111' Tc=7.4 min CN=73 Runoff=2.37 cfs 0.179 af

### Subcatchment3E: E1c

Runoff Area=44,627 sf 36.37% Impervious Runoff Depth=2.72"  
Flow Length=131' Slope=0.0200 '/ Tc=12.9 min CN=81 Runoff=2.62 cfs 0.232 af

### Pond 4E: Exist. CB

Peak Elev=214.33' Inflow=2.62 cfs 0.232 af  
15.0" Round Culvert n=0.011 L=59.0' S=0.0085 '/ Outflow=2.62 cfs 0.232 af

### Pond 5E: Existing Basin

Peak Elev=213.58' Storage=6,423 cf Inflow=4.74 cfs 0.411 af  
Discarded=0.65 cfs 0.409 af Primary=0.02 cfs 0.001 af Outflow=0.67 cfs 0.411 af

### Subcatchment6E: E1d

Runoff Area=16,759 sf 0.00% Impervious Runoff Depth=2.13"  
Flow Length=162' Slope=0.0300 '/ Tc=7.7 min CN=74 Runoff=0.90 cfs 0.068 af

### Link 7E: Design Point #1: Flow to Shadowfax Farm

Inflow=9.06 cfs 0.983 af  
Primary=9.06 cfs 0.983 af

**Total Runoff Area = 8.486 ac Runoff Volume = 1.392 af Average Runoff Depth = 1.97"**  
**95.61% Pervious = 8.113 ac 4.39% Impervious = 0.373 ac**

## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 1E: E1a

Runoff = 8.55 cfs @ 12.27 hrs, Volume= 0.913 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

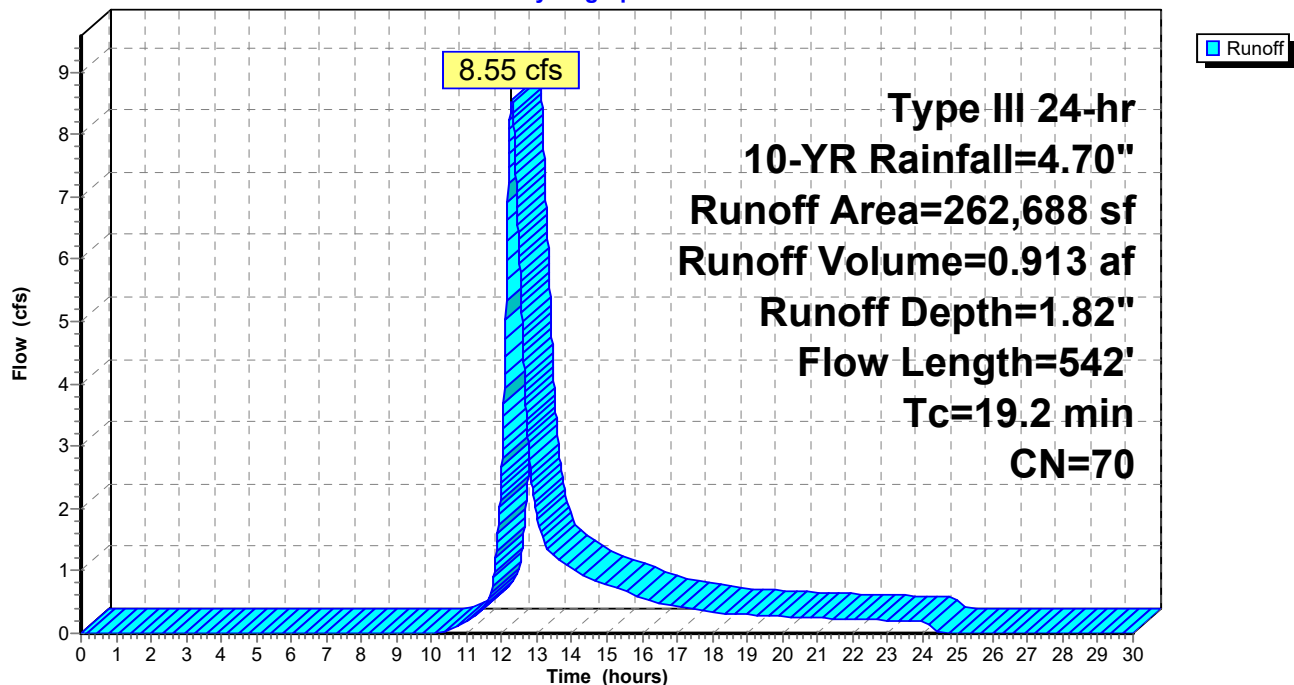
Area (sf)	CN	Description
262,688	70	Woods, Good, HSG C
262,688		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	492	0.0300	2.79		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
19.2	542	Total			

### Subcatchment 1E: E1a

Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 2E: E1b

Runoff = 2.37 cfs @ 12.11 hrs, Volume= 0.179 af, Depth= 2.05"

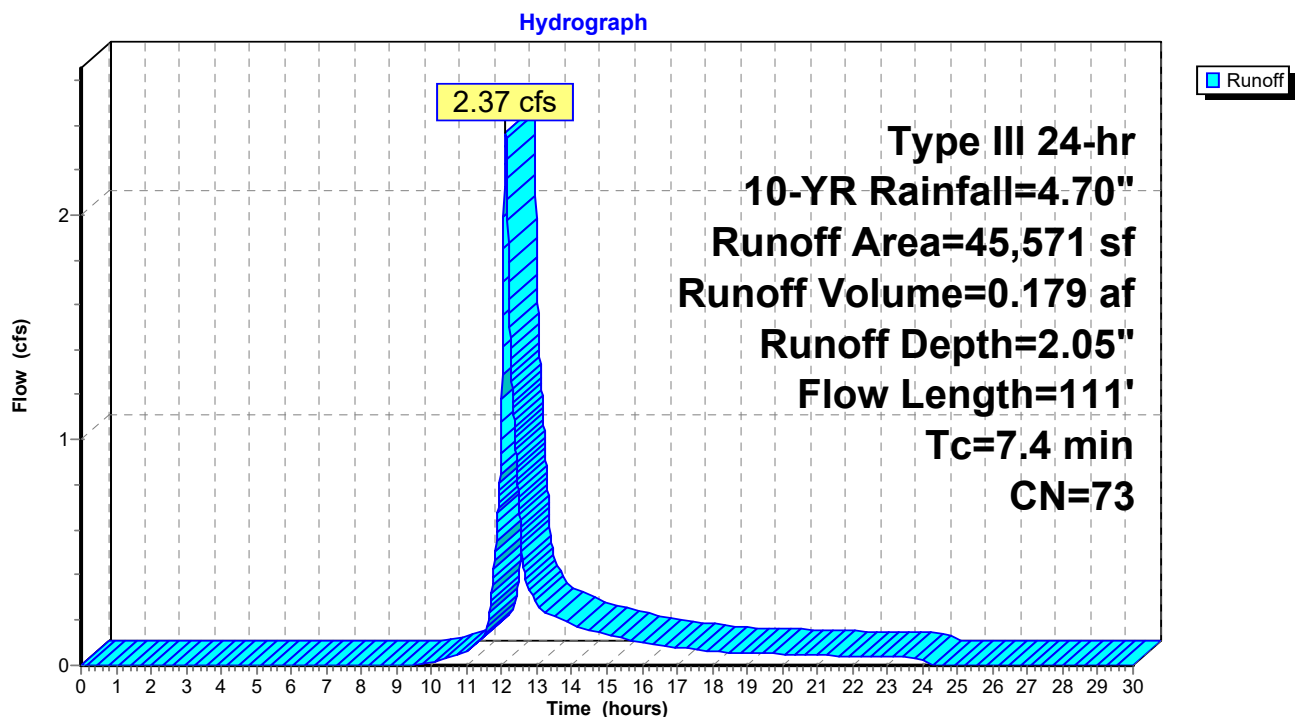
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
13,116	70	Woods, Good, HSG C
32,455	74	>75% Grass cover, Good, HSG C
45,571	73	Weighted Average
45,571		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	61	0.0500	3.60		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.4	111	Total			

### Subcatchment 2E: E1b



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 3E: E1c

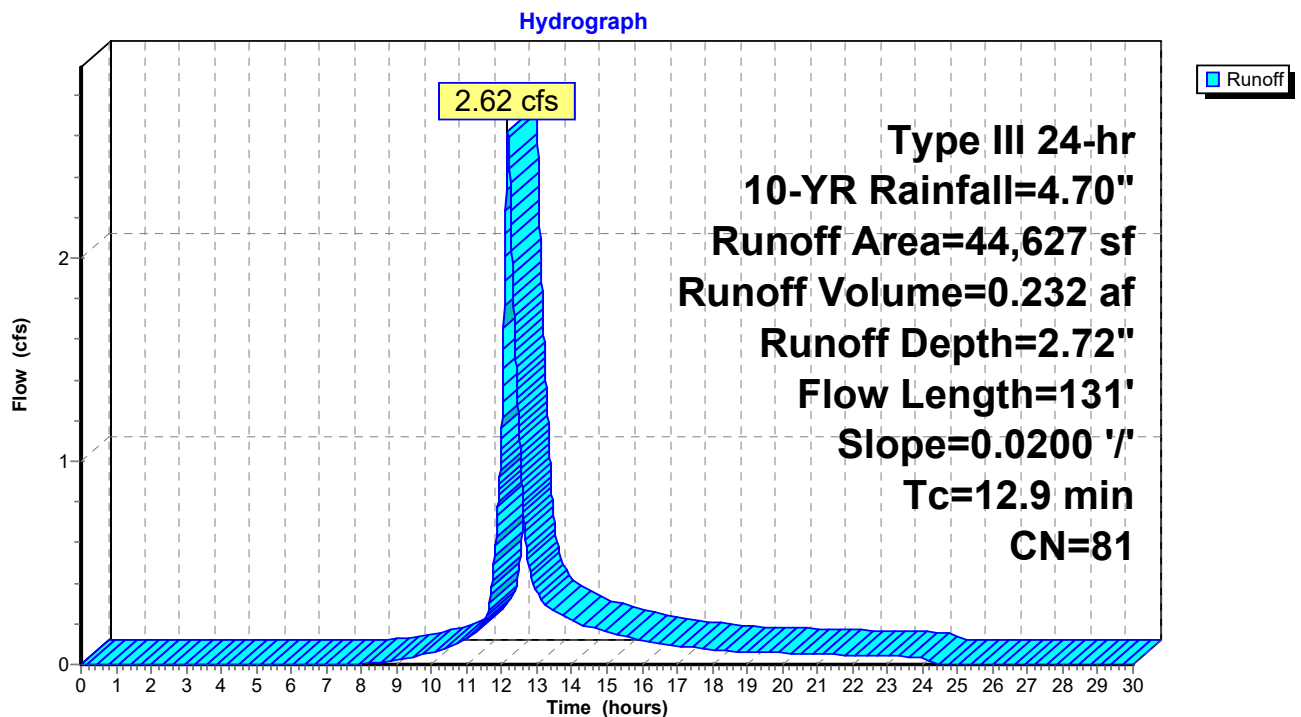
Runoff = 2.62 cfs @ 12.17 hrs, Volume= 0.232 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
16,229	98	Paved parking, HSG C
15,951	70	Woods, Good, HSG C
12,447	74	>75% Grass cover, Good, HSG C
44,627	81	Weighted Average
28,398		63.63% Pervious Area
16,229		36.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	36	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.3	45	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.9	131	Total			

### Subcatchment 3E: E1c



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 4E: Exist. CB

Inflow Area = 1.024 ac, 36.37% Impervious, Inflow Depth = 2.72" for 10-YR event  
Inflow = 2.62 cfs @ 12.17 hrs, Volume= 0.232 af  
Outflow = 2.62 cfs @ 12.17 hrs, Volume= 0.232 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.62 cfs @ 12.17 hrs, Volume= 0.232 af

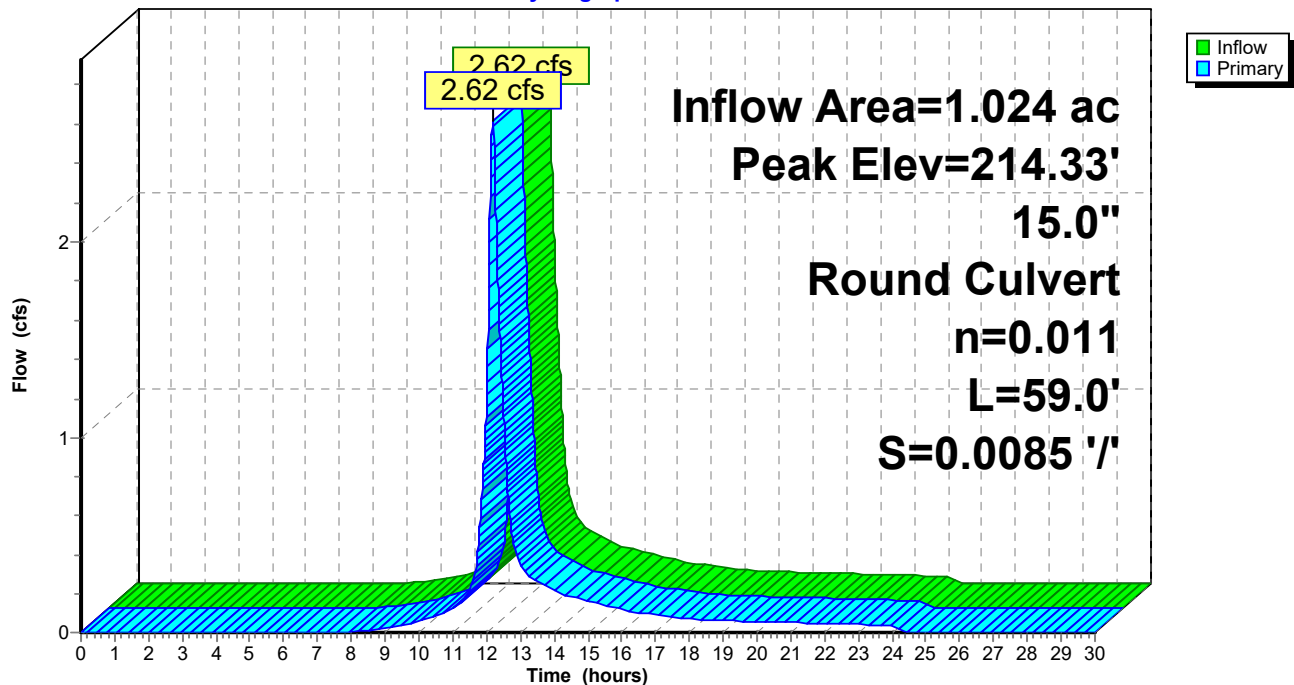
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 214.33' @ 12.17 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	<b>15.0" Round Culvert</b> L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.50' / 213.00' S= 0.0085 '/ Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

**Primary OutFlow** Max=2.62 cfs @ 12.17 hrs HW=214.33' (Free Discharge)  
↑1=Culvert (Barrel Controls 2.62 cfs @ 4.28 fps)

### Pond 4E: Exist. CB

Hydrograph





## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 5E: Existing Basin

Inflow Area = 2.071 ac, 17.99% Impervious, Inflow Depth = 2.38" for 10-YR event  
Inflow = 4.74 cfs @ 12.14 hrs, Volume= 0.411 af  
Outflow = 0.67 cfs @ 12.96 hrs, Volume= 0.411 af, Atten= 86%, Lag= 49.1 min  
Discarded = 0.65 cfs @ 12.96 hrs, Volume= 0.409 af  
Primary = 0.02 cfs @ 12.96 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 213.58' @ 12.96 hrs Surf.Area= 11,657 sf Storage= 6,423 cf

Plug-Flow detention time= 83.1 min calculated for 0.411 af (100% of inflow)  
Center-of-Mass det. time= 83.1 min ( 918.3 - 835.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	32,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
213.00	10,659	0	0
214.00	12,392	11,526	11,526
215.50	15,086	20,609	32,134

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	<b>2.410 in/hr Exfiltration over Horizontal area</b>
#2	Primary	213.40'	<b>5.0' long x 0.8' breadth Level Spreader</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32
#3	Device 2	213.50'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.80 0.80 1.50 Width (feet) 0.25 0.25 8.00 8.00

**Discarded OutFlow** Max=0.65 cfs @ 12.96 hrs HW=213.58' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.65 cfs)

**Primary OutFlow** Max=0.02 cfs @ 12.96 hrs HW=213.58' (Free Discharge)

↑**2=Level Spreader** (Passes 0.02 cfs of 1.01 cfs potential flow)

↑**3=Custom Weir/Orifice** (Weir Controls 0.02 cfs @ 0.90 fps)

## Stormwater Calculations

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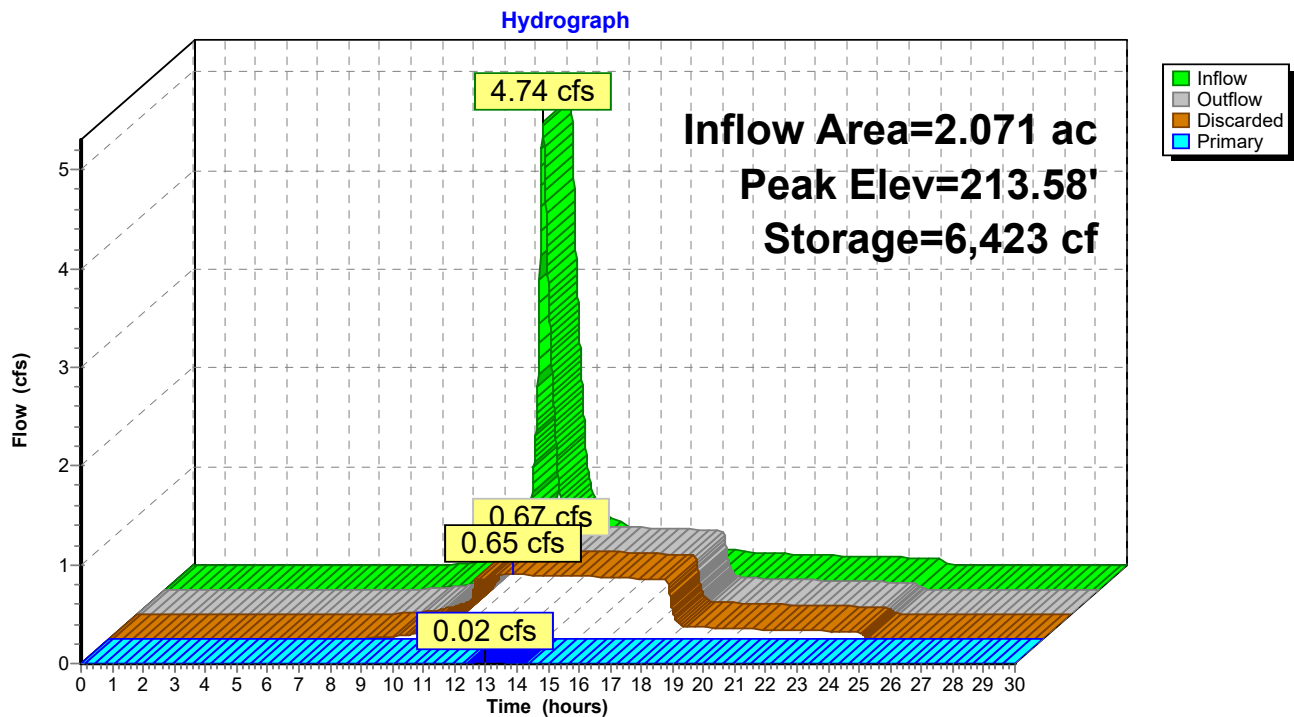
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Type III 24-hr 10-YR Rainfall=4.70"

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### Pond 5E: Existing Basin



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 6E: E1d

Runoff = 0.90 cfs @ 12.11 hrs, Volume= 0.068 af, Depth= 2.13"

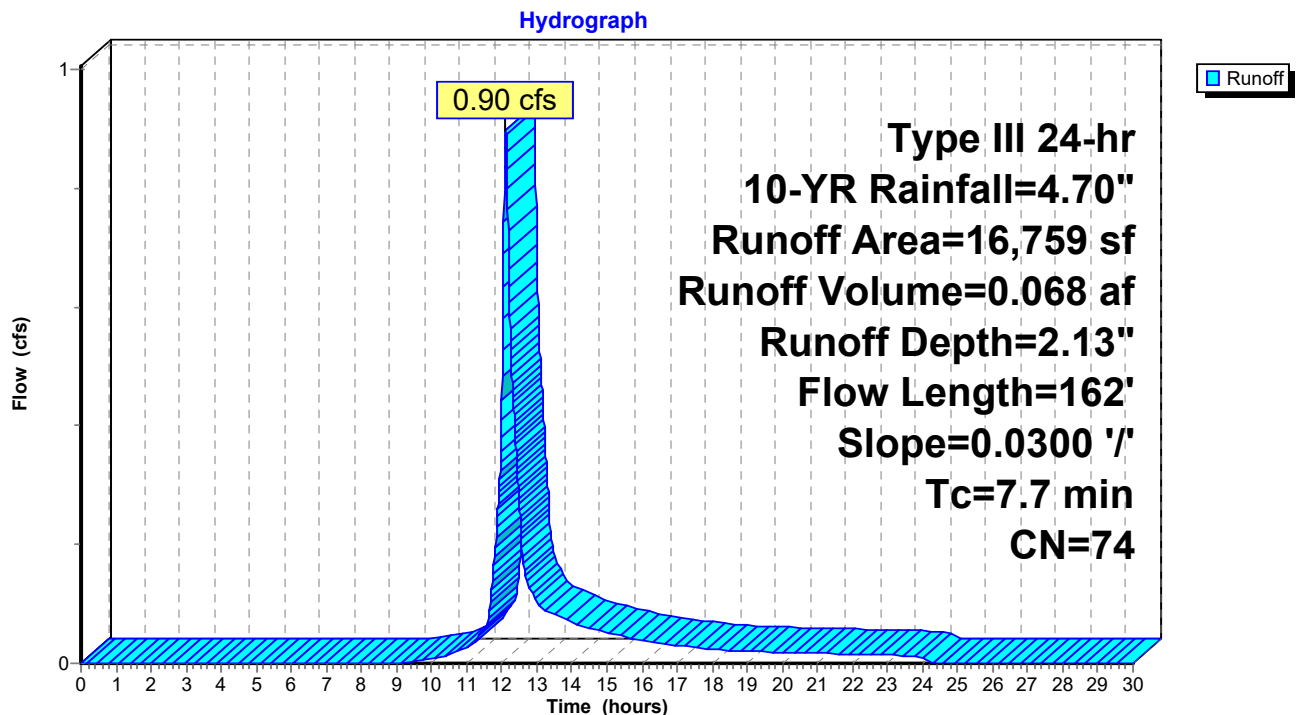
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
16,759	74	>75% Grass cover, Good, HSG C
16,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	112	0.0300	2.79		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.7	162	Total			

### Subcatchment 6E: E1d



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Type III 24-hr 10-YR Rainfall=4.70"

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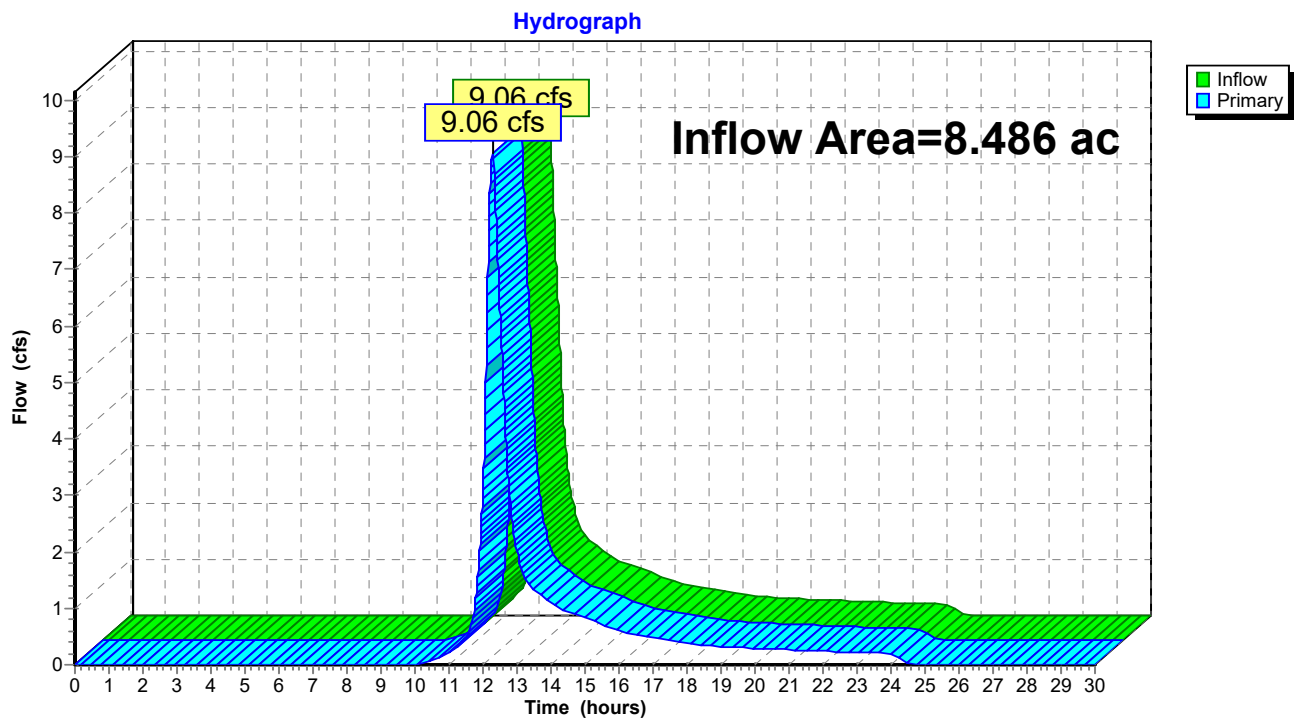
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### Summary for Link 7E: Design Point #1: Flow to Shadowfax Farm

Inflow Area = 8.486 ac, 4.39% Impervious, Inflow Depth = 1.39" for 10-YR event  
Inflow = 9.06 cfs @ 12.27 hrs, Volume= 0.983 af  
Primary = 9.06 cfs @ 12.27 hrs, Volume= 0.983 af, Atten= 0%, Lag= 0.0 min

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

### Link 7E: Design Point #1: Flow to Shadowfax Farm



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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

### Subcatchment1E: E1a

Runoff Area=262,688 sf 0.00% Impervious Runoff Depth=2.88"  
Flow Length=542' Tc=19.2 min CN=70 Runoff=13.90 cfs 1.450 af

### Subcatchment2E: E1b

Runoff Area=45,571 sf 0.00% Impervious Runoff Depth=3.17"  
Flow Length=111' Tc=7.4 min CN=73 Runoff=3.70 cfs 0.277 af

### Subcatchment3E: E1c

Runoff Area=44,627 sf 36.37% Impervious Runoff Depth=3.97"  
Flow Length=131' Slope=0.0200 '/ Tc=12.9 min CN=81 Runoff=3.81 cfs 0.339 af

### Pond 4E: Exist. CB

Peak Elev=214.56' Inflow=3.81 cfs 0.339 af  
15.0" Round Culvert n=0.011 L=59.0' S=0.0085 '/ Outflow=3.81 cfs 0.339 af

### Pond 5E: Existing Basin

Peak Elev=213.92' Storage=10,577 cf Inflow=7.14 cfs 0.616 af  
Discarded=0.68 cfs 0.567 af Primary=0.23 cfs 0.048 af Outflow=0.91 cfs 0.616 af

### Subcatchment6E: E1d

Runoff Area=16,759 sf 0.00% Impervious Runoff Depth=3.27"  
Flow Length=162' Slope=0.0300 '/ Tc=7.7 min CN=74 Runoff=1.39 cfs 0.105 af

### Link 7E: Design Point #1: Flow to Shadowfax Farm

Inflow=14.71 cfs 1.603 af  
Primary=14.71 cfs 1.603 af

**Total Runoff Area = 8.486 ac Runoff Volume = 2.170 af Average Runoff Depth = 3.07"**  
**95.61% Pervious = 8.113 ac 4.39% Impervious = 0.373 ac**

## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 1E: E1a

Runoff = 13.90 cfs @ 12.27 hrs, Volume= 1.450 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

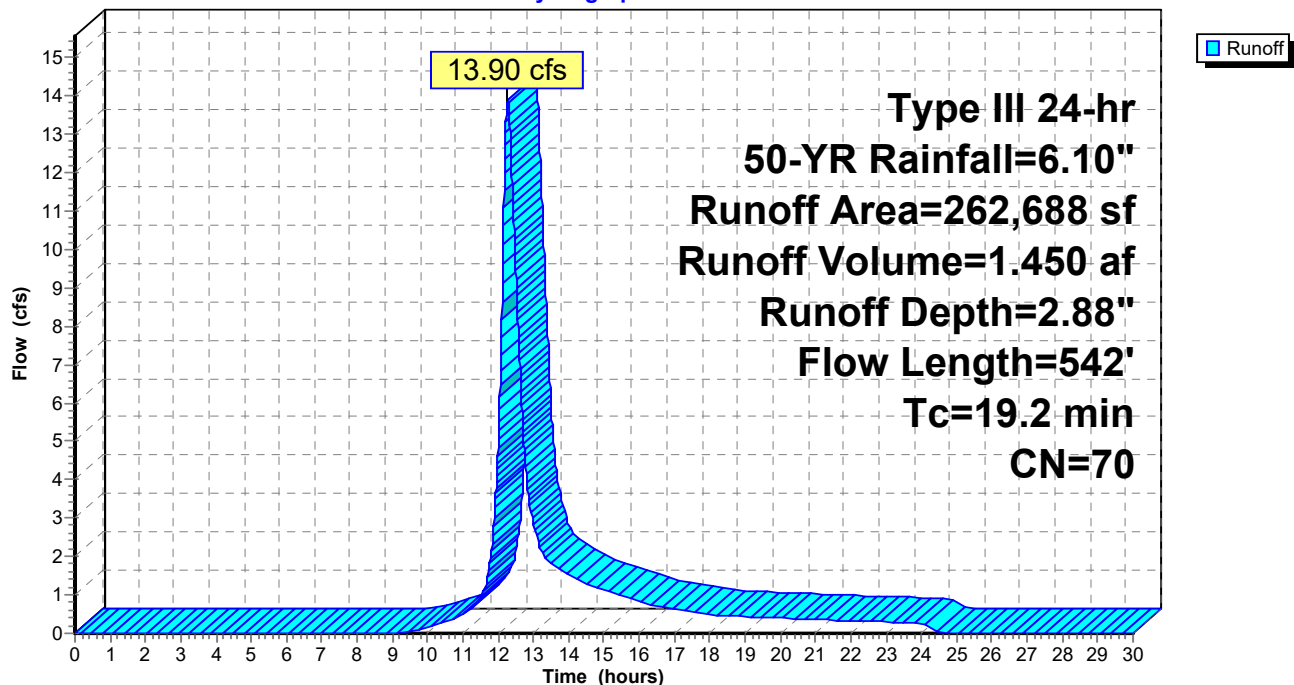
Area (sf)	CN	Description
262,688	70	Woods, Good, HSG C
262,688		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	492	0.0300	2.79		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
19.2	542	Total			

### Subcatchment 1E: E1a

Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 2E: E1b

Runoff = 3.70 cfs @ 12.11 hrs, Volume= 0.277 af, Depth= 3.17"

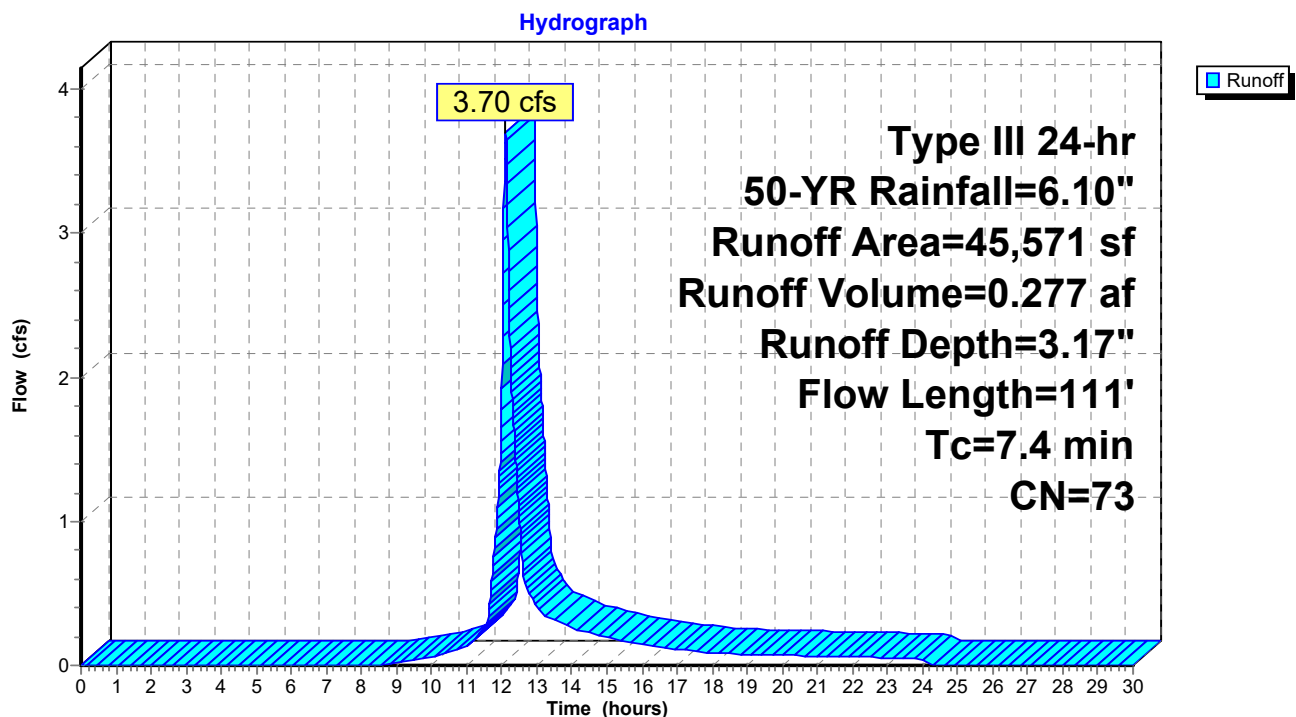
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
13,116	70	Woods, Good, HSG C
32,455	74	>75% Grass cover, Good, HSG C
45,571	73	Weighted Average
45,571		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	61	0.0500	3.60		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.4	111	Total			

### Subcatchment 2E: E1b



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 3E: E1c

Runoff = 3.81 cfs @ 12.17 hrs, Volume= 0.339 af, Depth= 3.97"

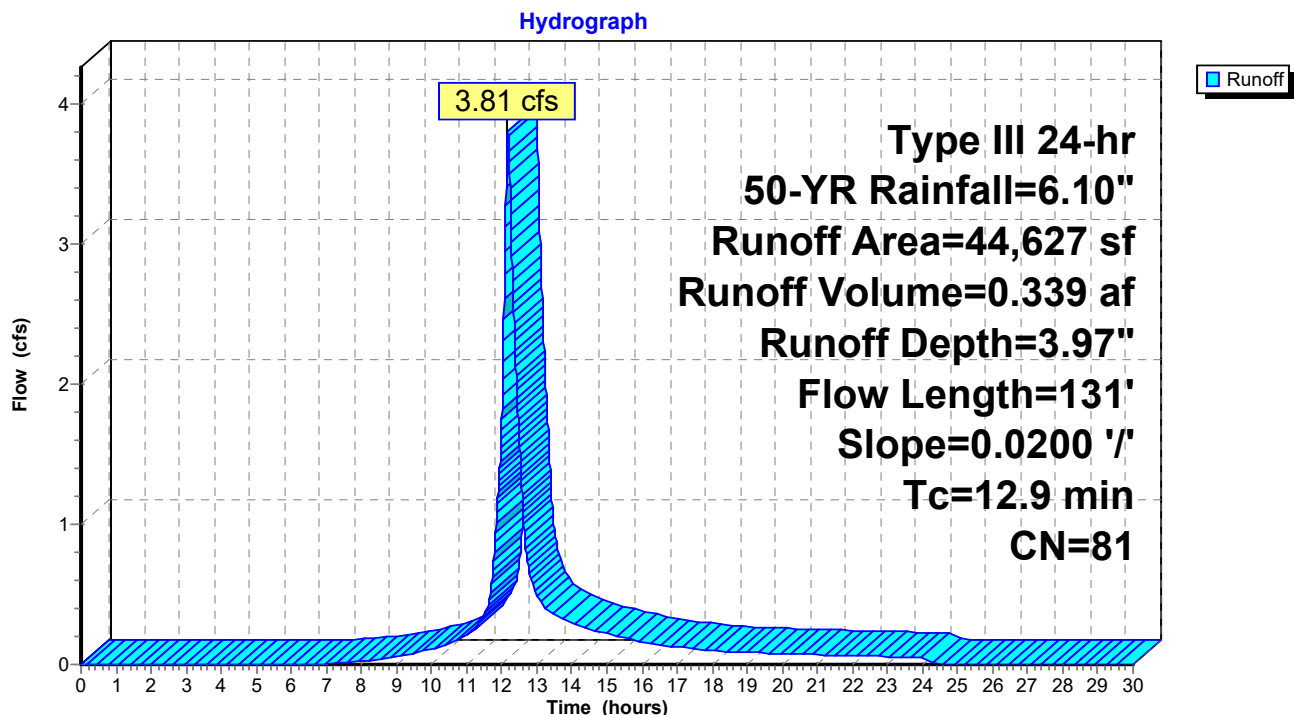
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
16,229	98	Paved parking, HSG C
15,951	70	Woods, Good, HSG C
12,447	74	>75% Grass cover, Good, HSG C
44,627	81	Weighted Average
28,398		63.63% Pervious Area
16,229		36.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	36	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.3	45	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.9	131	Total			

### Subcatchment 3E: E1c





## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 4E: Exist. CB

Inflow Area = 1.024 ac, 36.37% Impervious, Inflow Depth = 3.97" for 50-YR event  
Inflow = 3.81 cfs @ 12.17 hrs, Volume= 0.339 af  
Outflow = 3.81 cfs @ 12.17 hrs, Volume= 0.339 af, Atten= 0%, Lag= 0.0 min  
Primary = 3.81 cfs @ 12.17 hrs, Volume= 0.339 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.56' @ 12.17 hrs

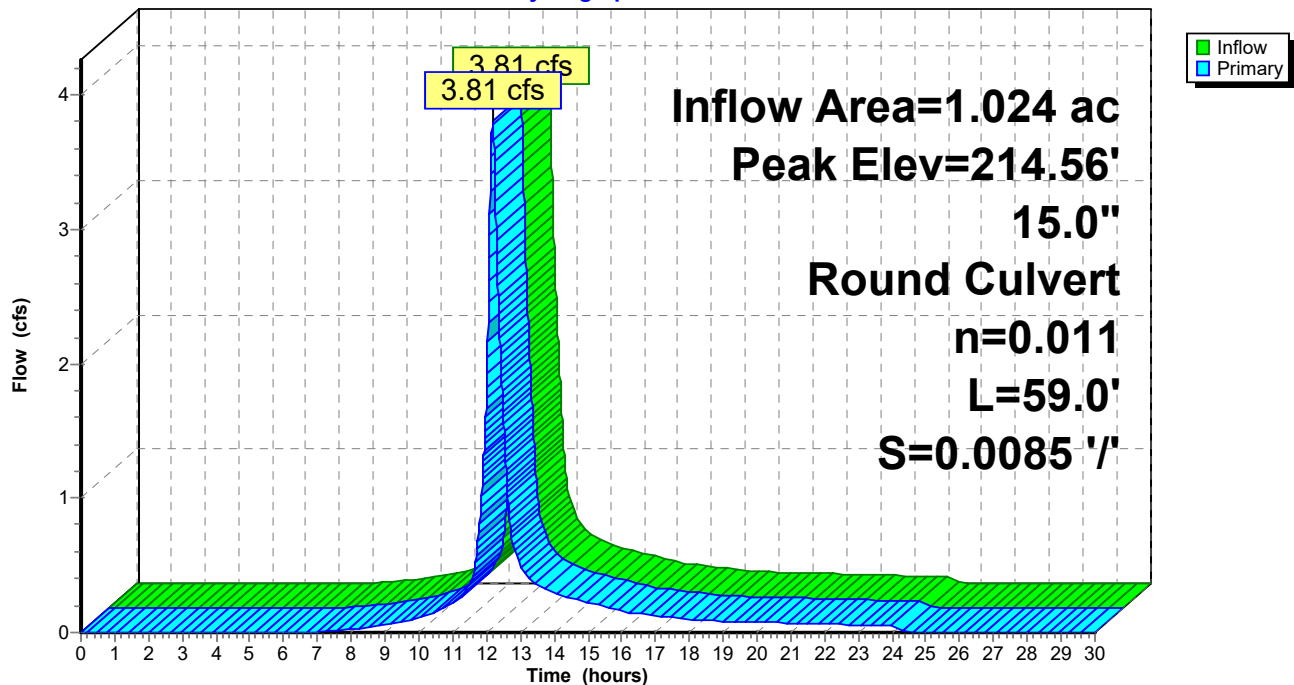
Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	<b>15.0" Round Culvert</b> L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.50' / 213.00' S= 0.0085 '/ Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

**Primary OutFlow** Max=3.80 cfs @ 12.17 hrs HW=214.56' (Free Discharge)

↑1=Culvert (Barrel Controls 3.80 cfs @ 4.61 fps)

### Pond 4E: Exist. CB

Hydrograph



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 5E: Existing Basin

Inflow Area = 2.071 ac, 17.99% Impervious, Inflow Depth = 3.57" for 50-YR event  
Inflow = 7.14 cfs @ 12.13 hrs, Volume= 0.616 af  
Outflow = 0.91 cfs @ 13.00 hrs, Volume= 0.616 af, Atten= 87%, Lag= 51.8 min  
Discarded = 0.68 cfs @ 13.00 hrs, Volume= 0.567 af  
Primary = 0.23 cfs @ 13.00 hrs, Volume= 0.048 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 213.92' @ 13.00 hrs Surf.Area= 12,259 sf Storage= 10,577 cf

Plug-Flow detention time= 120.5 min calculated for 0.616 af (100% of inflow)  
Center-of-Mass det. time= 120.4 min ( 944.2 - 823.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	32,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
213.00	10,659	0	0
214.00	12,392	11,526	11,526
215.50	15,086	20,609	32,134

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	<b>2.410 in/hr Exfiltration over Horizontal area</b>
#2	Primary	213.40'	<b>5.0' long x 0.8' breadth Level Spreader</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32
#3	Device 2	213.50'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.80 0.80 1.50 Width (feet) 0.25 0.25 8.00 8.00

**Discarded OutFlow** Max=0.68 cfs @ 13.00 hrs HW=213.92' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.68 cfs)

**Primary OutFlow** Max=0.23 cfs @ 13.00 hrs HW=213.92' (Free Discharge)

↑**2=Level Spreader** (Passes 0.23 cfs of 5.35 cfs potential flow)

↑**3=Custom Weir/Orifice** (Weir Controls 0.23 cfs @ 2.13 fps)

## Stormwater Calculations

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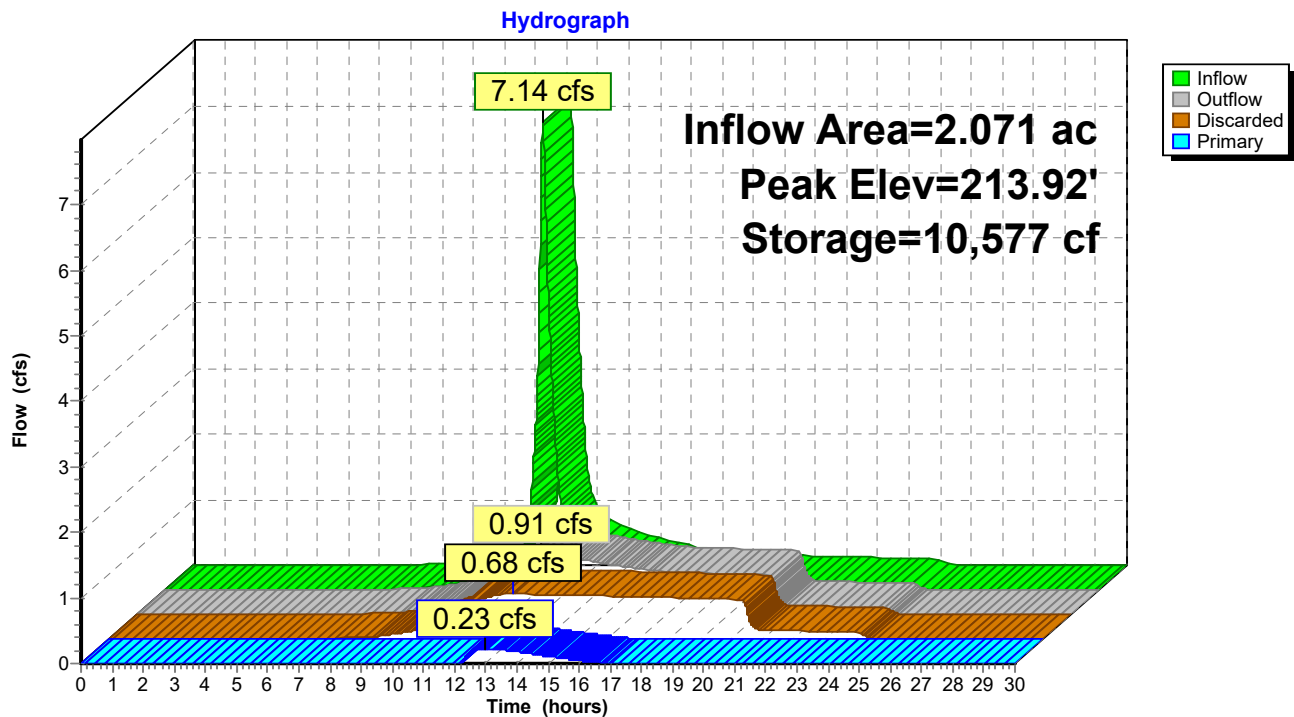
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Type III 24-hr 50-YR Rainfall=6.10"

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### Pond 5E: Existing Basin



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 6E: E1d

Runoff = 1.39 cfs @ 12.11 hrs, Volume= 0.105 af, Depth= 3.27"

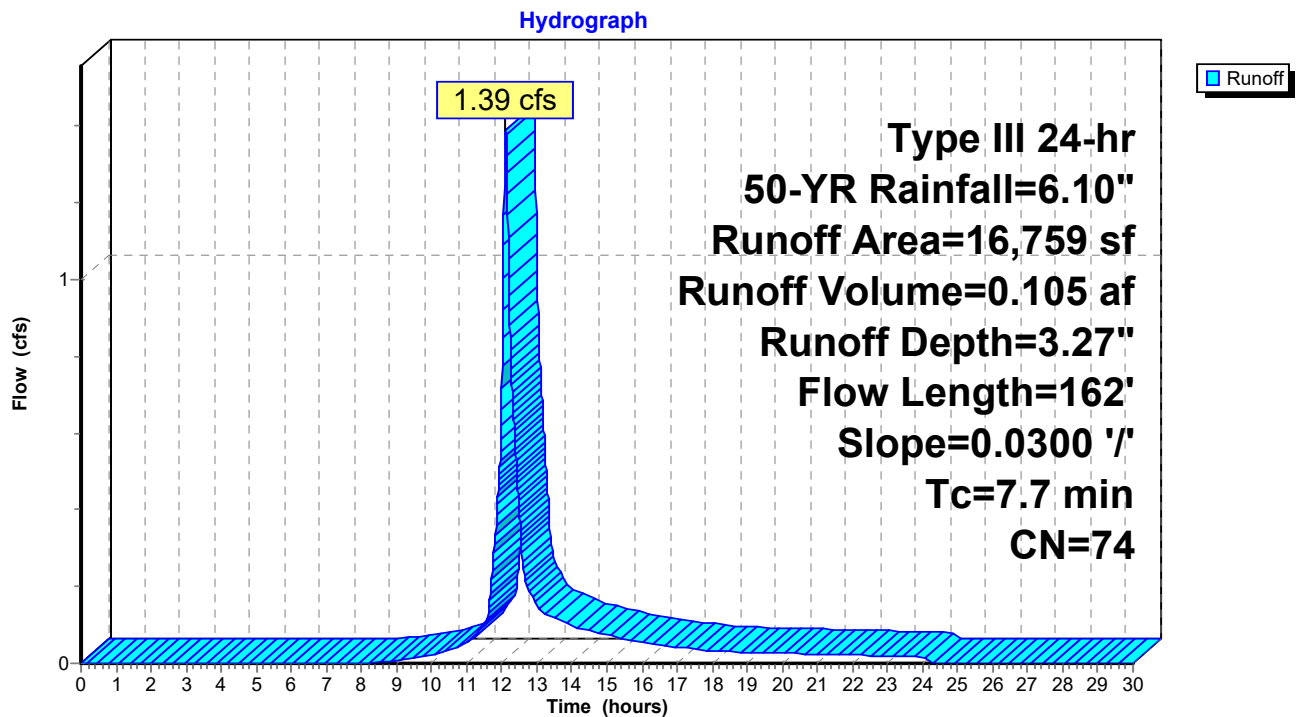
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
16,759	74	>75% Grass cover, Good, HSG C
16,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	112	0.0300	2.79		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.7	162	Total			

### Subcatchment 6E: E1d



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Type III 24-hr 50-YR Rainfall=6.10"

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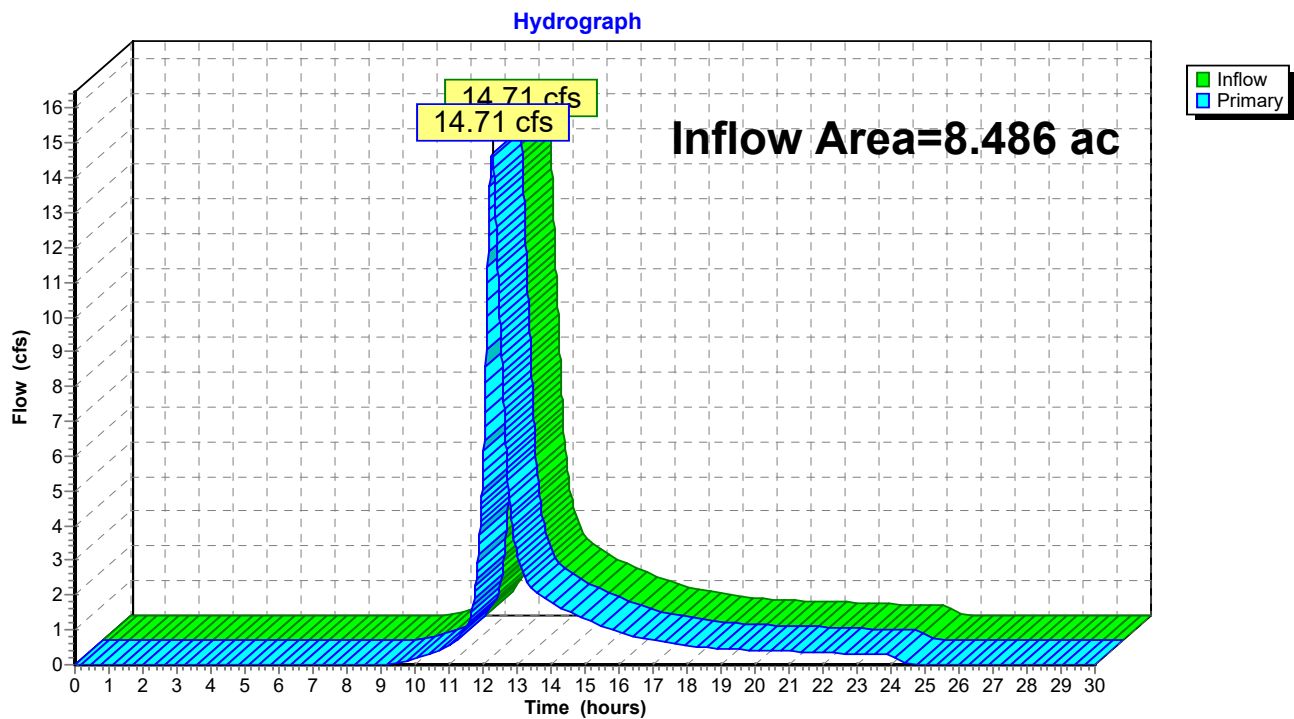
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### Summary for Link 7E: Design Point #1: Flow to Shadowfax Farm

Inflow Area = 8.486 ac, 4.39% Impervious, Inflow Depth = 2.27" for 50-YR event  
Inflow = 14.71 cfs @ 12.27 hrs, Volume= 1.603 af  
Primary = 14.71 cfs @ 12.27 hrs, Volume= 1.603 af, Atten= 0%, Lag= 0.0 min

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

### Link 7E: Design Point #1: Flow to Shadowfax Farm



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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

### Subcatchment1E: E1a

Runoff Area=262,688 sf 0.00% Impervious Runoff Depth=3.37"  
Flow Length=542' Tc=19.2 min CN=70 Runoff=16.30 cfs 1.694 af

### Subcatchment2E: E1b

Runoff Area=45,571 sf 0.00% Impervious Runoff Depth=3.68"  
Flow Length=111' Tc=7.4 min CN=73 Runoff=4.30 cfs 0.321 af

### Subcatchment3E: E1c

Runoff Area=44,627 sf 36.37% Impervious Runoff Depth=4.53"  
Flow Length=131' Slope=0.0200 '/' Tc=12.9 min CN=81 Runoff=4.32 cfs 0.386 af

### Pond 4E: Exist. CB

Peak Elev=214.66' Inflow=4.32 cfs 0.386 af  
15.0" Round Culvert n=0.011 L=59.0' S=0.0085 '/' Outflow=4.32 cfs 0.386 af

### Pond 5E: Existing Basin

Peak Elev=214.07' Storage=12,368 cf Inflow=8.20 cfs 0.707 af  
Discarded=0.70 cfs 0.623 af Primary=0.35 cfs 0.084 af Outflow=1.05 cfs 0.707 af

### Subcatchment6E: E1d

Runoff Area=16,759 sf 0.00% Impervious Runoff Depth=3.78"  
Flow Length=162' Slope=0.0300 '/' Tc=7.7 min CN=74 Runoff=1.61 cfs 0.121 af

### Link 7E: Design Point #1: Flow to Shadowfax Farm

Inflow=17.30 cfs 1.899 af  
Primary=17.30 cfs 1.899 af

**Total Runoff Area = 8.486 ac Runoff Volume = 2.522 af Average Runoff Depth = 3.57"**  
**95.61% Pervious = 8.113 ac 4.39% Impervious = 0.373 ac**

## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 1E: E1a

Runoff = 16.30 cfs @ 12.27 hrs, Volume= 1.694 af, Depth= 3.37"

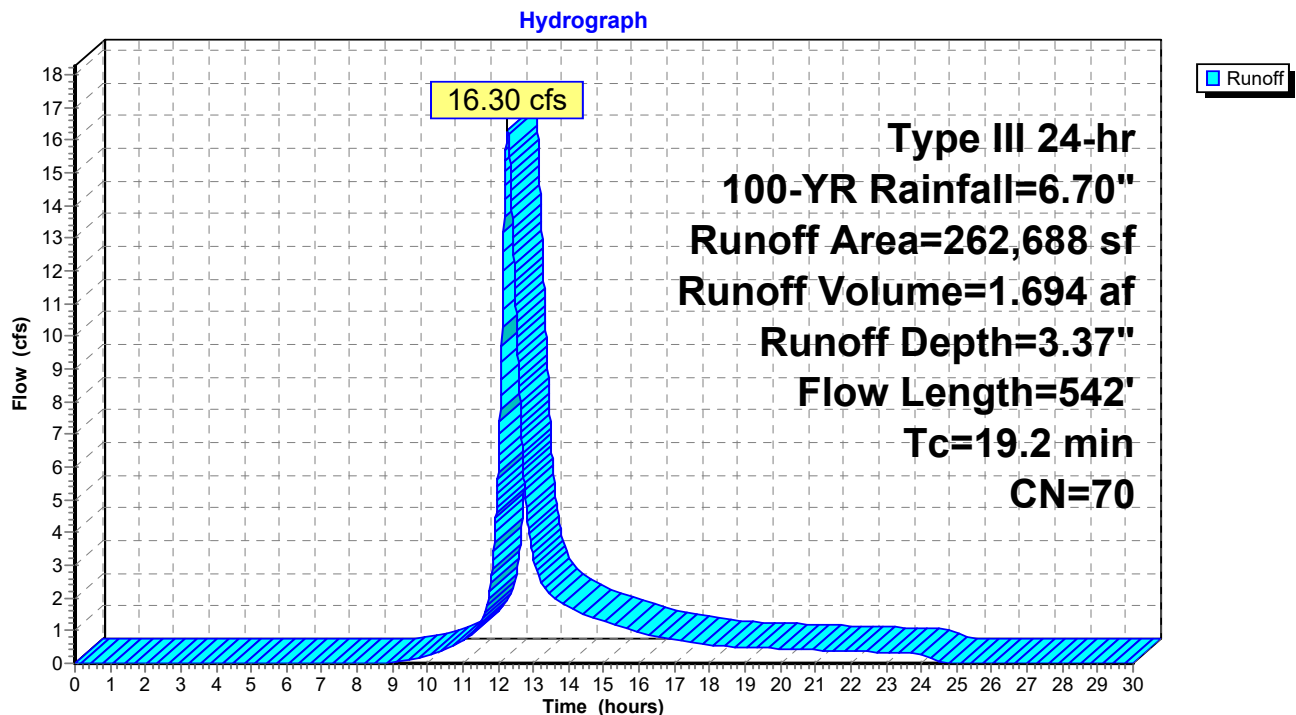
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
262,688	70	Woods, Good, HSG C
262,688		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	492	0.0300	2.79		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
19.2	542	Total			

### Subcatchment 1E: E1a



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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 2E: E1b

Runoff = 4.30 cfs @ 12.11 hrs, Volume= 0.321 af, Depth= 3.68"

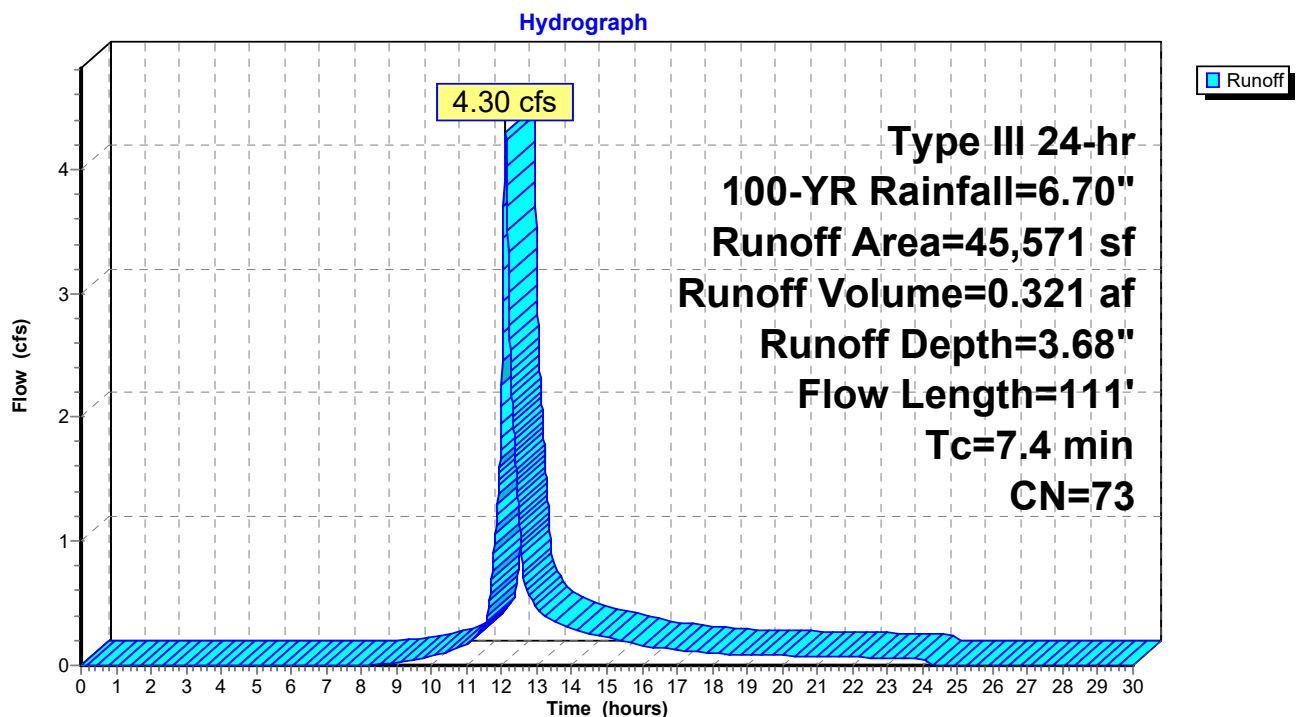
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
13,116	70	Woods, Good, HSG C
32,455	74	>75% Grass cover, Good, HSG C
45,571	73	Weighted Average
45,571		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0800	0.12		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	61	0.0500	3.60		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.4	111	Total			

### Subcatchment 2E: E1b





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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 3E: E1c

Runoff = 4.32 cfs @ 12.17 hrs, Volume= 0.386 af, Depth= 4.53"

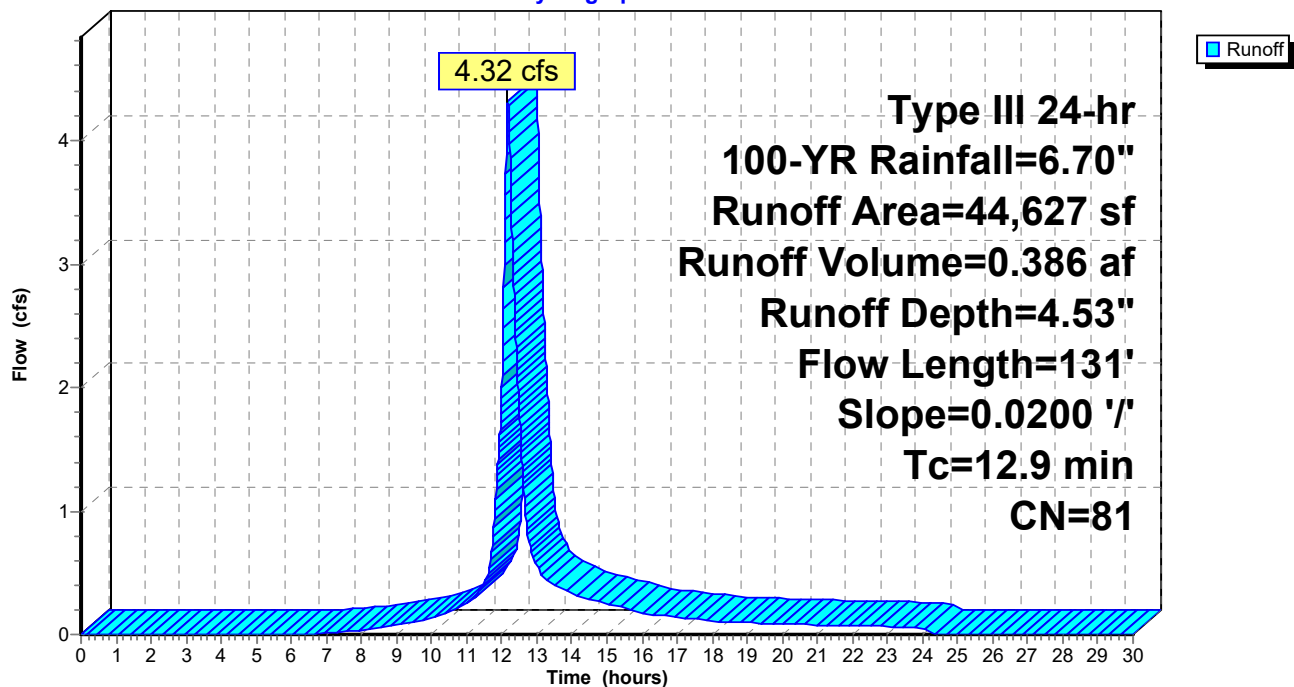
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
16,229	98	Paved parking, HSG C
15,951	70	Woods, Good, HSG C
12,447	74	>75% Grass cover, Good, HSG C
44,627	81	Weighted Average
28,398		63.63% Pervious Area
16,229		36.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	36	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.3	45	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.9	131	Total			

### Subcatchment 3E: E1c

Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 4E: Exist. CB

Inflow Area = 1.024 ac, 36.37% Impervious, Inflow Depth = 4.53" for 100-YR event  
Inflow = 4.32 cfs @ 12.17 hrs, Volume= 0.386 af  
Outflow = 4.32 cfs @ 12.17 hrs, Volume= 0.386 af, Atten= 0%, Lag= 0.0 min  
Primary = 4.32 cfs @ 12.17 hrs, Volume= 0.386 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.66' @ 12.17 hrs

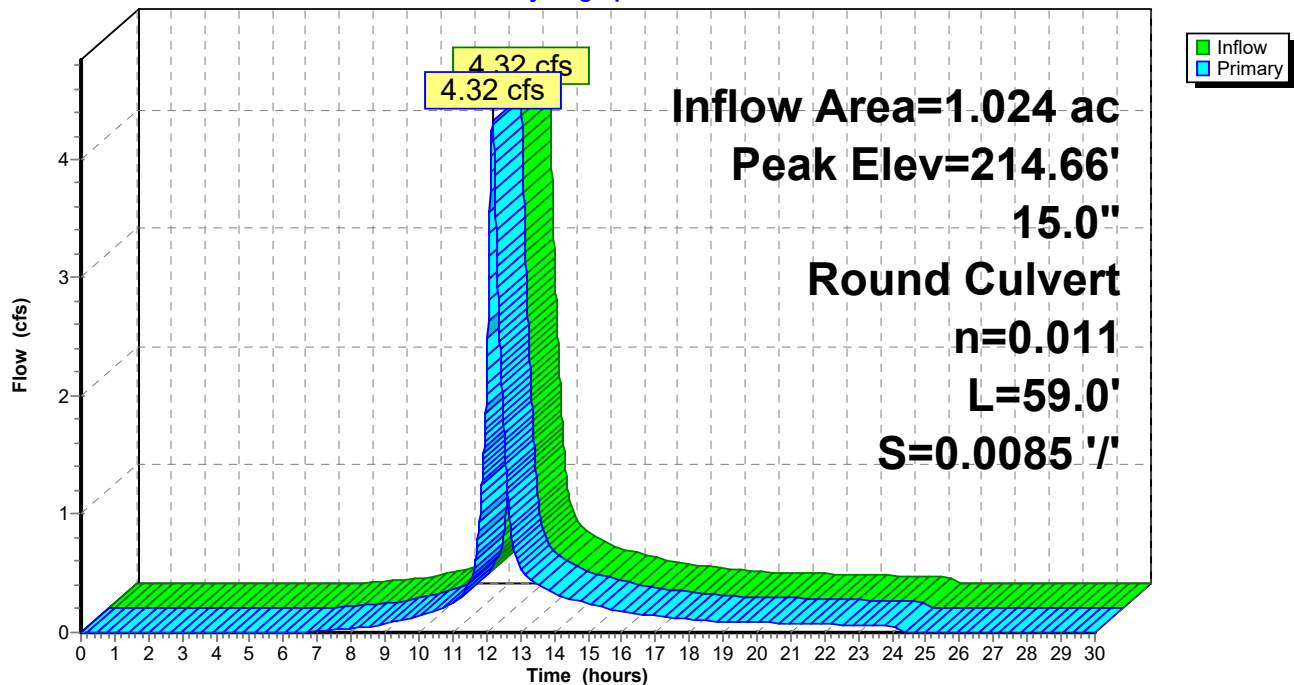
Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	<b>15.0" Round Culvert</b> L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.50' / 213.00' S= 0.0085 '/ Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

**Primary OutFlow** Max=4.32 cfs @ 12.17 hrs HW=214.66' (Free Discharge)

1=Culvert (Barrel Controls 4.32 cfs @ 4.72 fps)

### Pond 4E: Exist. CB

Hydrograph



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 5E: Existing Basin

Inflow Area = 2.071 ac, 17.99% Impervious, Inflow Depth = 4.10" for 100-YR event  
Inflow = 8.20 cfs @ 12.13 hrs, Volume= 0.707 af  
Outflow = 1.05 cfs @ 12.98 hrs, Volume= 0.707 af, Atten= 87%, Lag= 50.6 min  
Discarded = 0.70 cfs @ 12.98 hrs, Volume= 0.623 af  
Primary = 0.35 cfs @ 12.98 hrs, Volume= 0.084 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 214.07' @ 12.98 hrs Surf.Area= 12,513 sf Storage= 12,368 cf

Plug-Flow detention time= 129.5 min calculated for 0.707 af (100% of inflow)  
Center-of-Mass det. time= 129.4 min ( 949.3 - 819.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	32,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
213.00	10,659	0	0
214.00	12,392	11,526	11,526
215.50	15,086	20,609	32,134

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	<b>2.410 in/hr Exfiltration over Horizontal area</b>
#2	Primary	213.40'	<b>5.0' long x 0.8' breadth Level Spreader</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32
#3	Device 2	213.50'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.80 0.80 1.50 Width (feet) 0.25 0.25 8.00 8.00

**Discarded OutFlow** Max=0.70 cfs @ 12.98 hrs HW=214.07' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.70 cfs)

**Primary OutFlow** Max=0.35 cfs @ 12.98 hrs HW=214.07' (Free Discharge)

↑**2=Level Spreader** (Passes 0.35 cfs of 7.93 cfs potential flow)

↑**3=Custom Weir/Orifice** (Weir Controls 0.35 cfs @ 2.47 fps)

## Stormwater Calculations

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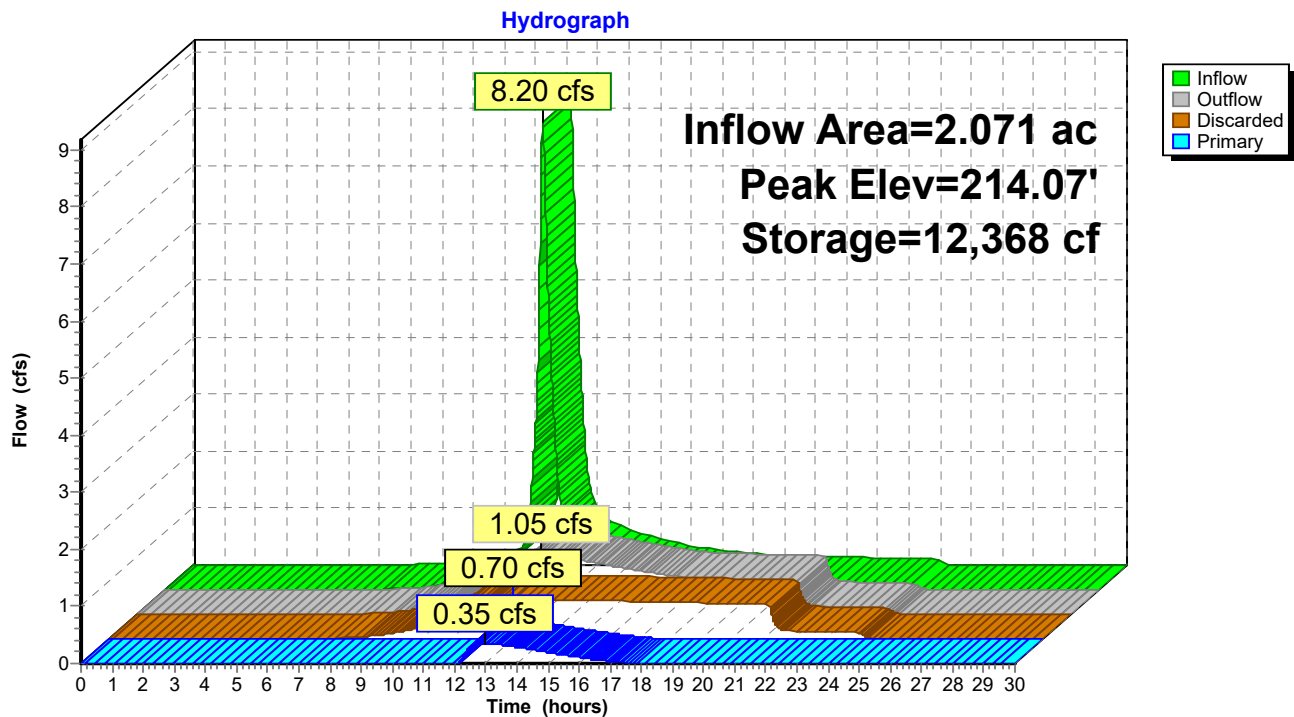
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Type III 24-hr 100-YR Rainfall=6.70"

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### Pond 5E: Existing Basin



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 6E: E1d

Runoff = 1.61 cfs @ 12.11 hrs, Volume= 0.121 af, Depth= 3.78"

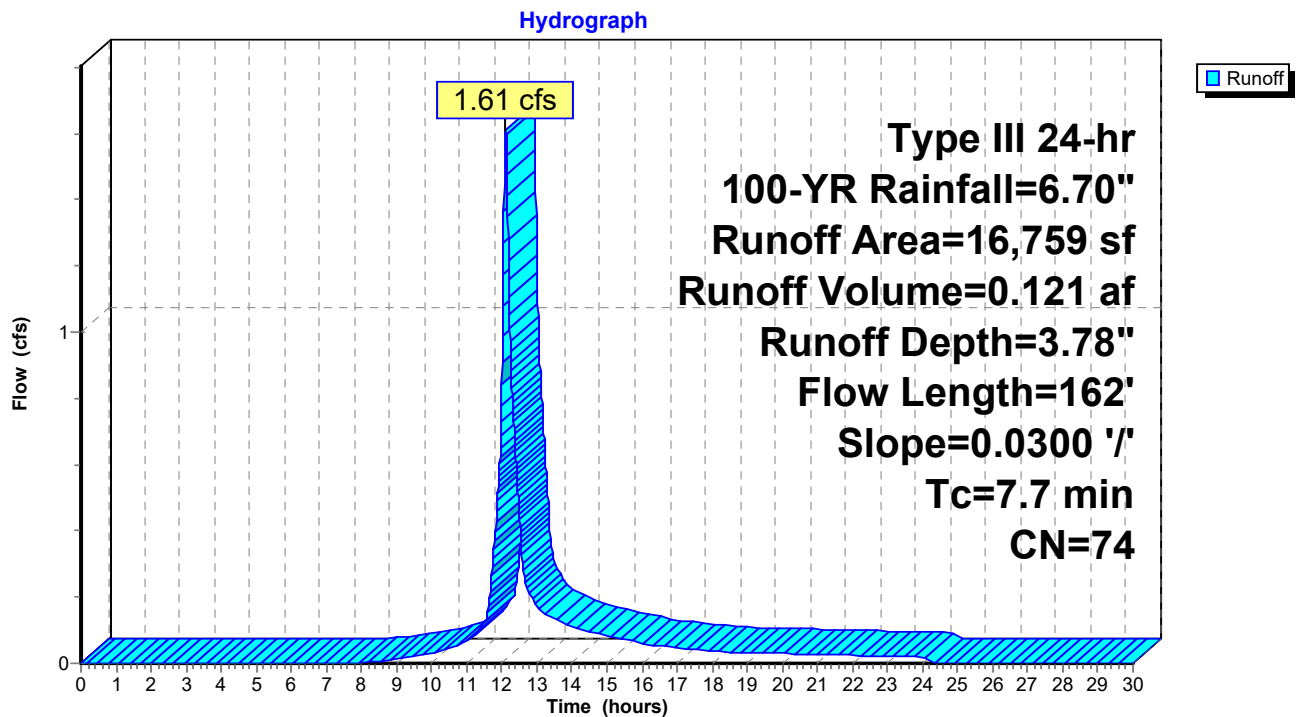
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
16,759	74	>75% Grass cover, Good, HSG C
16,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	112	0.0300	2.79		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.7	162	Total			

### Subcatchment 6E: E1d



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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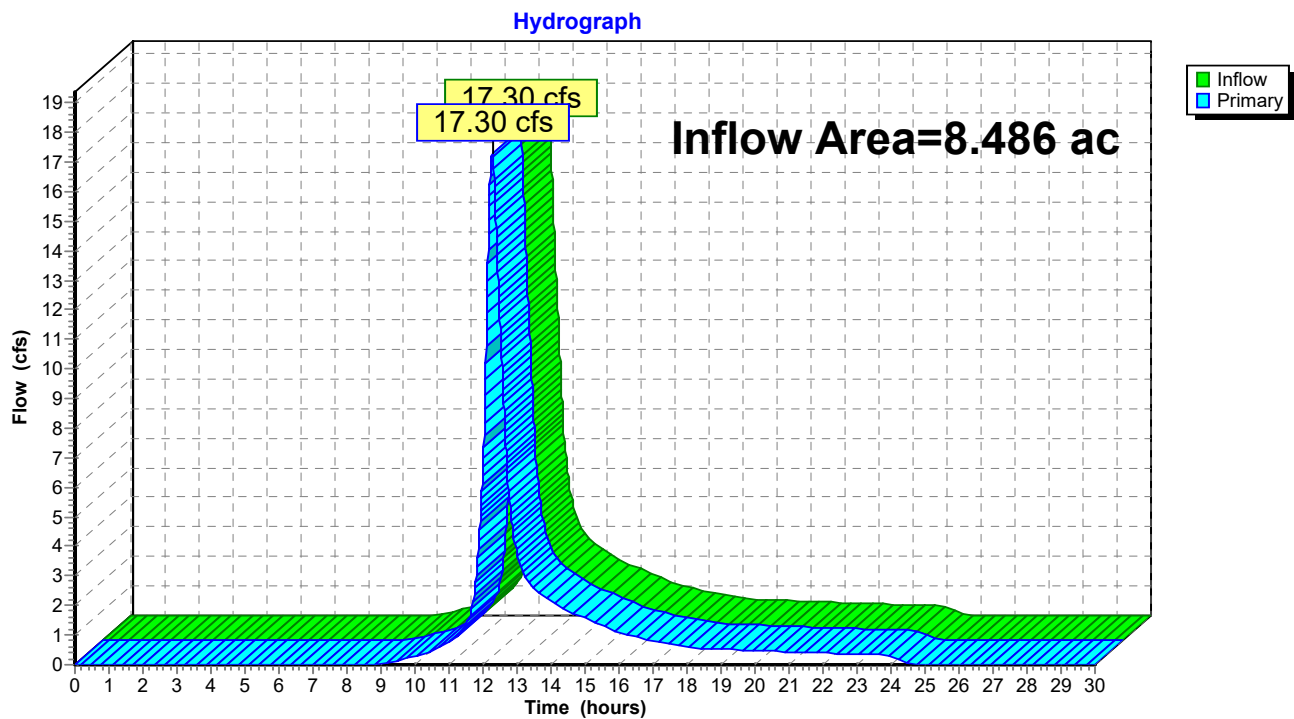
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### Summary for Link 7E: Design Point #1: Flow to Shadowfax Farm

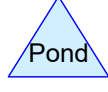
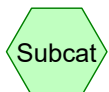
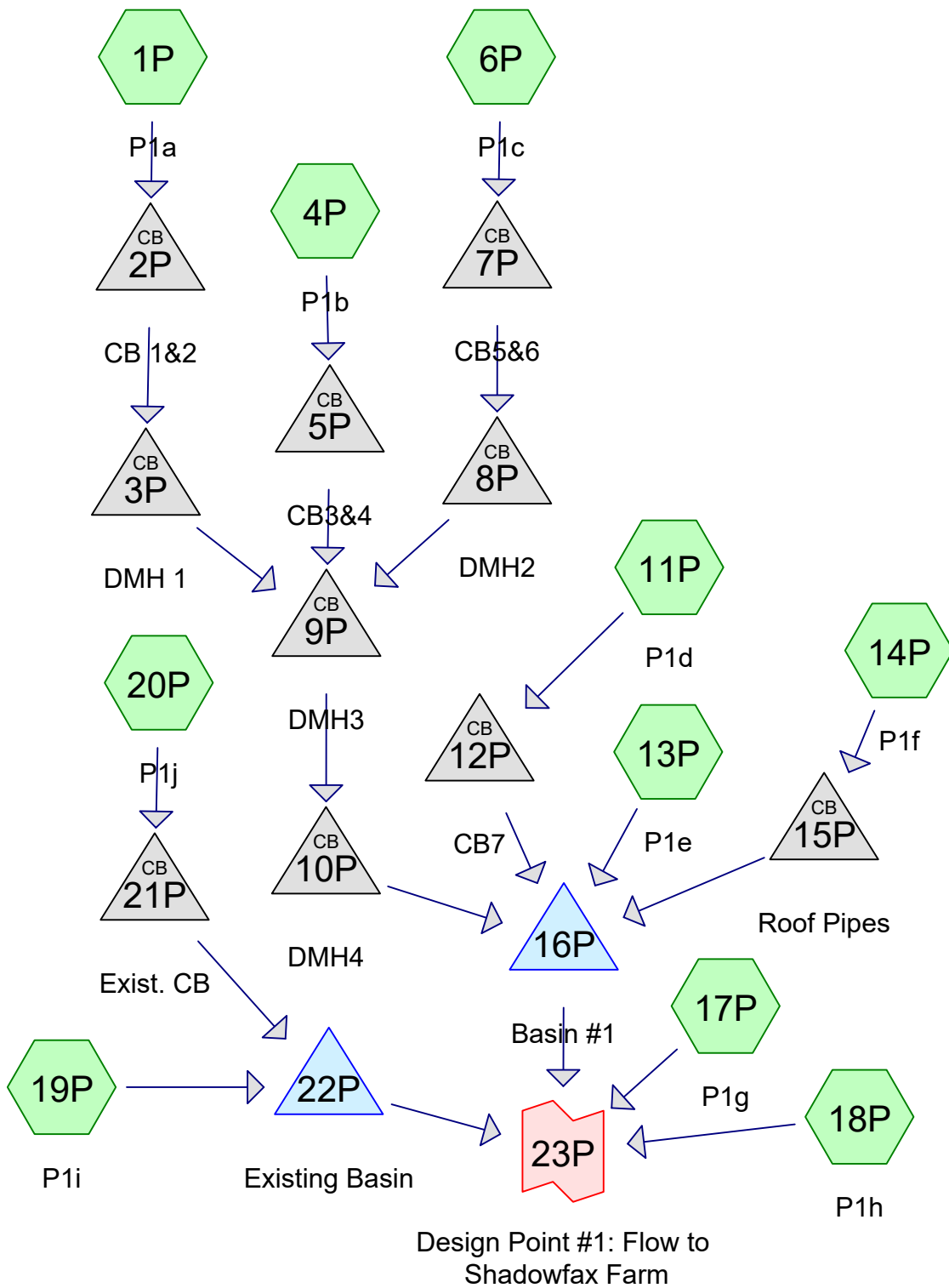
Inflow Area = 8.486 ac, 4.39% Impervious, Inflow Depth = 2.69" for 100-YR event  
Inflow = 17.30 cfs @ 12.27 hrs, Volume= 1.899 af  
Primary = 17.30 cfs @ 12.27 hrs, Volume= 1.899 af, Atten= 0%, Lag= 0.0 min

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

### Link 7E: Design Point #1: Flow to Shadowfax Farm



DESIGN POINT #1: FLOW TO  
SHADOWFAX FARM PROPOSED  
CONDITIONS



#### Routing Diagram for Stormwater Calculations

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## Stormwater Calculations

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.264	74	>75% Grass cover, Good, HSG C (1P, 4P, 6P, 11P, 13P, 17P, 18P, 19P, 20P)
1.905	98	Paved parking, HSG C (1P, 4P, 6P, 11P, 17P, 20P)
1.165	98	Roofs, HSG C (1P, 4P, 6P, 11P, 14P)
1.863	70	Woods, Good, HSG C (17P, 20P)
<b>9.197</b>	<b>81</b>	<b>TOTAL AREA</b>

## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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

### Subcatchment1P: P1a

Runoff Area=25,448 sf 67.62% Impervious Runoff Depth=1.53"  
Flow Length=195' Slope=0.0100 '/' Tc=12.0 min CN=90 Runoff=0.86 cfs 0.075 af

### Pond 2P: CB 1&2

Peak Elev=214.99' Inflow=0.86 cfs 0.075 af  
12.0" Round Culvert n=0.011 L=16.0' S=0.0125 '/' Outflow=0.86 cfs 0.075 af

### Pond 3P: DMH 1

Peak Elev=214.67' Inflow=0.86 cfs 0.075 af  
12.0" Round Culvert n=0.011 L=266.0' S=0.0083 '/' Outflow=0.86 cfs 0.075 af

### Subcatchment4P: P1b

Runoff Area=37,521 sf 63.69% Impervious Runoff Depth=1.45"  
Flow Length=291' Slope=0.0100 '/' Tc=12.8 min CN=89 Runoff=1.18 cfs 0.104 af

### Pond 5P: CB3&4

Peak Elev=212.75' Inflow=1.18 cfs 0.104 af  
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=1.18 cfs 0.104 af

### Subcatchment6P: P1c

Runoff Area=15,616 sf 84.56% Impervious Runoff Depth=1.87"  
Flow Length=300' Slope=0.0110 '/' Tc=8.1 min CN=94 Runoff=0.71 cfs 0.056 af

### Pond 7P: CB5&6

Peak Elev=214.08' Inflow=0.71 cfs 0.056 af  
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=0.71 cfs 0.056 af

### Pond 8P: DMH2

Peak Elev=213.83' Inflow=0.71 cfs 0.056 af  
12.0" Round Culvert n=0.011 L=167.0' S=0.0084 '/' Outflow=0.71 cfs 0.056 af

### Pond 9P: DMH3

Peak Elev=212.66' Inflow=2.67 cfs 0.235 af  
18.0" Round Culvert n=0.011 L=127.0' S=0.0071 '/' Outflow=2.67 cfs 0.235 af

### Pond 10P: DMH4

Peak Elev=211.74' Inflow=2.67 cfs 0.235 af  
18.0" Round Culvert n=0.011 L=80.0' S=0.0050 '/' Outflow=2.67 cfs 0.235 af

### Subcatchment11P: P1d

Runoff Area=37,689 sf 66.15% Impervious Runoff Depth=1.53"  
Flow Length=215' Slope=0.0100 '/' Tc=12.2 min CN=90 Runoff=1.27 cfs 0.110 af

### Pond 12P: CB7

Peak Elev=211.37' Inflow=1.27 cfs 0.110 af  
12.0" Round Culvert n=0.011 L=36.0' S=0.0056 '/' Outflow=1.27 cfs 0.110 af

### Subcatchment13P: P1e

Runoff Area=27,962 sf 0.00% Impervious Runoff Depth=0.61"  
Flow Length=82' Slope=0.0100 '/' Tc=11.1 min CN=74 Runoff=0.34 cfs 0.033 af

### Subcatchment14P: P1f

Runoff Area=27,821 sf 100.00% Impervious Runoff Depth=2.27"  
Tc=2.0 min CN=98 Runoff=1.77 cfs 0.121 af

### Pond 15P: Roof Pipes

Peak Elev=214.73' Inflow=1.77 cfs 0.121 af  
Outflow=1.77 cfs 0.121 af

### Pond 16P: Basin #1

Peak Elev=211.26' Storage=10,573 cf Inflow=4.98 cfs 0.499 af  
Discarded=0.36 cfs 0.499 af Primary=0.00 cfs 0.000 af Outflow=0.36 cfs 0.499 af

## Stormwater Calculations

Type III 24-hr 1-YR Rainfall=2.50"

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### Subcatchment 17P: P1g

Runoff Area=128,924 sf 1.35% Impervious Runoff Depth=0.53"  
Flow Length=257' Tc=9.6 min CN=72 Runoff=1.33 cfs 0.130 af

### Subcatchment 18P: P1h

Runoff Area=16,759 sf 0.00% Impervious Runoff Depth=0.61"  
Flow Length=162' Slope=0.0300 '/' Tc=7.7 min CN=74 Runoff=0.23 cfs 0.020 af

### Subcatchment 19P: P1i

Runoff Area=34,286 sf 0.00% Impervious Runoff Depth=0.61"  
Flow Length=122' Tc=6.3 min CN=74 Runoff=0.49 cfs 0.040 af

### Subcatchment 20P: P1j

Runoff Area=48,576 sf 51.25% Impervious Runoff Depth=1.24"  
Flow Length=127' Slope=0.0200 '/' Tc=8.7 min CN=86 Runoff=1.48 cfs 0.116 af

### Pond 21P: Exist. CB

Peak Elev=214.09' Inflow=1.48 cfs 0.116 af  
15.0" Round Culvert n=0.011 L=59.0' S=0.0085 '/' Outflow=1.48 cfs 0.116 af

### Pond 22P: Existing Basin

Peak Elev=213.13' Storage=1,416 cf Inflow=1.95 cfs 0.155 af  
Discarded=0.61 cfs 0.155 af Primary=0.00 cfs 0.000 af Outflow=0.61 cfs 0.155 af

### Link 23P: Design Point #1: Flow to Shadowfax Farm

Inflow=1.55 cfs 0.150 af  
Primary=1.55 cfs 0.150 af

**Total Runoff Area = 9.197 ac Runoff Volume = 0.804 af Average Runoff Depth = 1.05"**  
**66.62% Pervious = 6.127 ac 33.38% Impervious = 3.069 ac**

## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 1P: P1a

Runoff = 0.86 cfs @ 12.17 hrs, Volume= 0.075 af, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

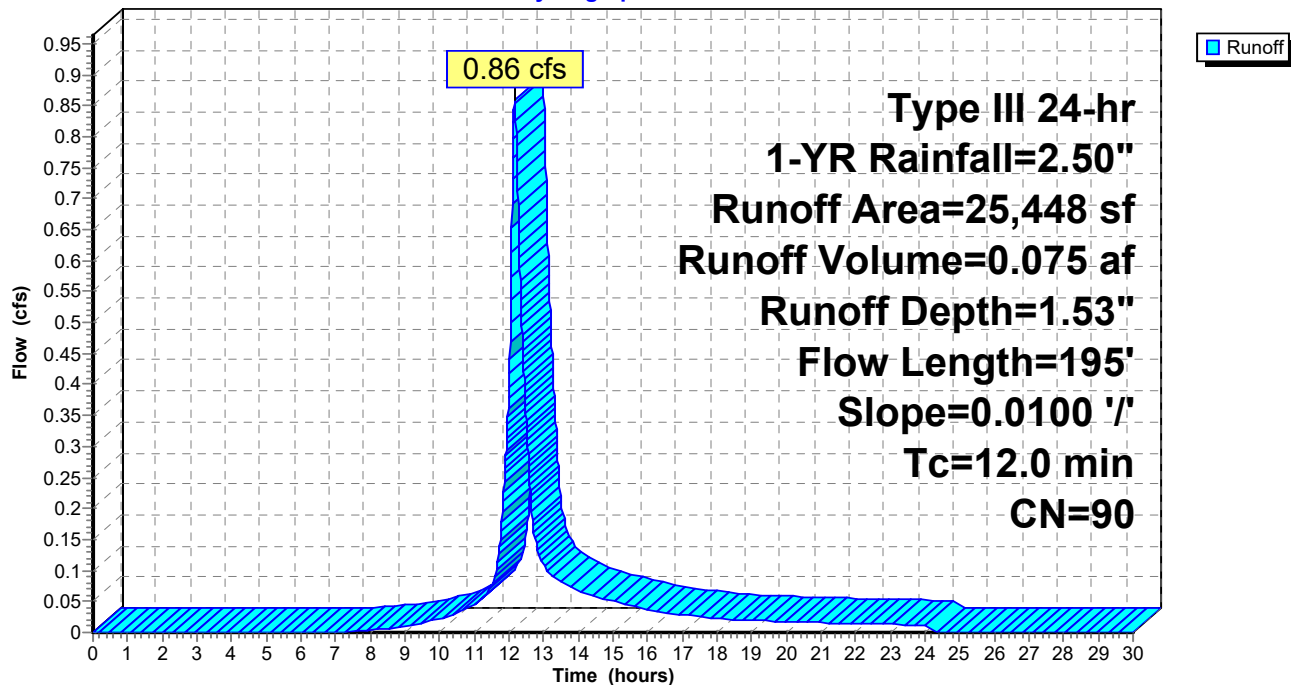
Area (sf)	CN	Description
11,922	98	Paved parking, HSG C
8,239	74	>75% Grass cover, Good, HSG C
5,287	98	Roofs, HSG C
25,448	90	Weighted Average
8,239		32.38% Pervious Area
17,209		67.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	21	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
1.0	124	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
12.0	195	Total			

### Subcatchment 1P: P1a

Hydrograph



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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 2P: CB 1&2

Inflow Area = 0.584 ac, 67.62% Impervious, Inflow Depth = 1.53" for 1-YR event  
Inflow = 0.86 cfs @ 12.17 hrs, Volume= 0.075 af  
Outflow = 0.86 cfs @ 12.17 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.86 cfs @ 12.17 hrs, Volume= 0.075 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.99' @ 12.17 hrs

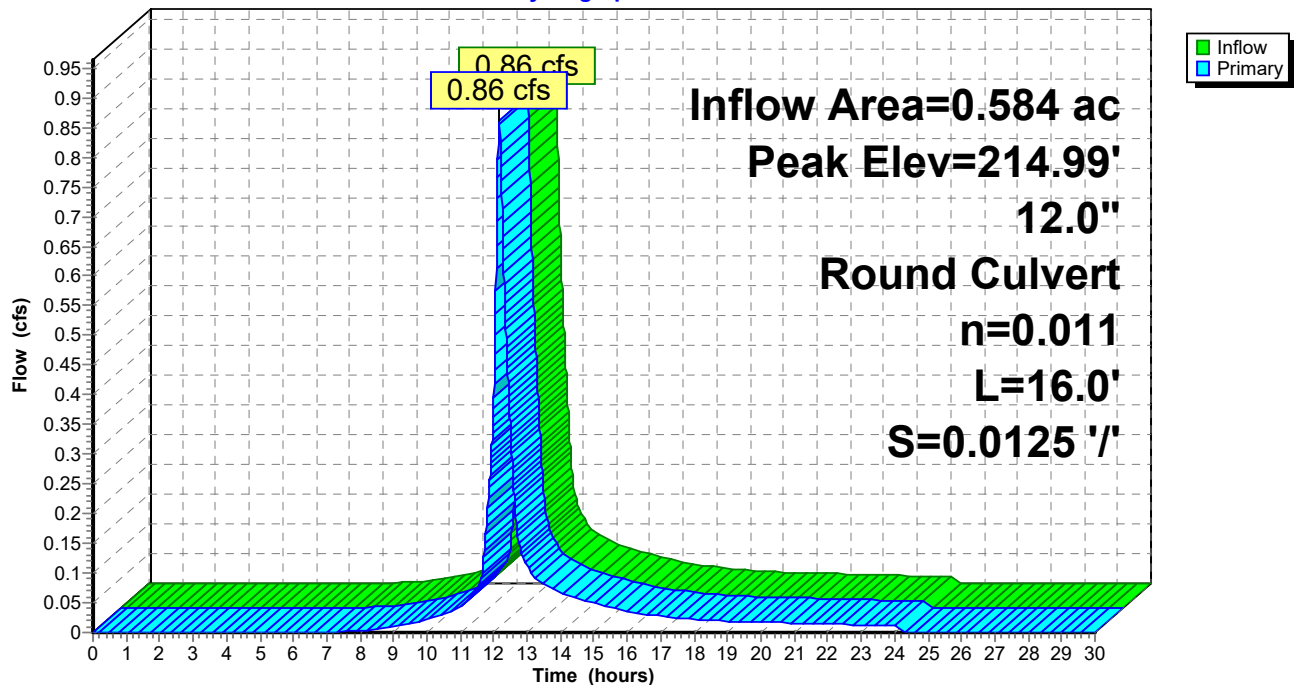
Device	Routing	Invert	Outlet Devices
#1	Primary	214.50'	<b>12.0" Round Culvert</b> L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.50' / 214.30' S= 0.0125 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.86 cfs @ 12.17 hrs HW=214.99' (Free Discharge)

↑**1=Culvert** (Barrel Controls 0.86 cfs @ 3.25 fps)

### Pond 2P: CB 1&2

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 3P: DMH 1

Inflow Area = 0.584 ac, 67.62% Impervious, Inflow Depth = 1.53" for 1-YR event  
Inflow = 0.86 cfs @ 12.17 hrs, Volume= 0.075 af  
Outflow = 0.86 cfs @ 12.17 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.86 cfs @ 12.17 hrs, Volume= 0.075 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.67' @ 12.17 hrs

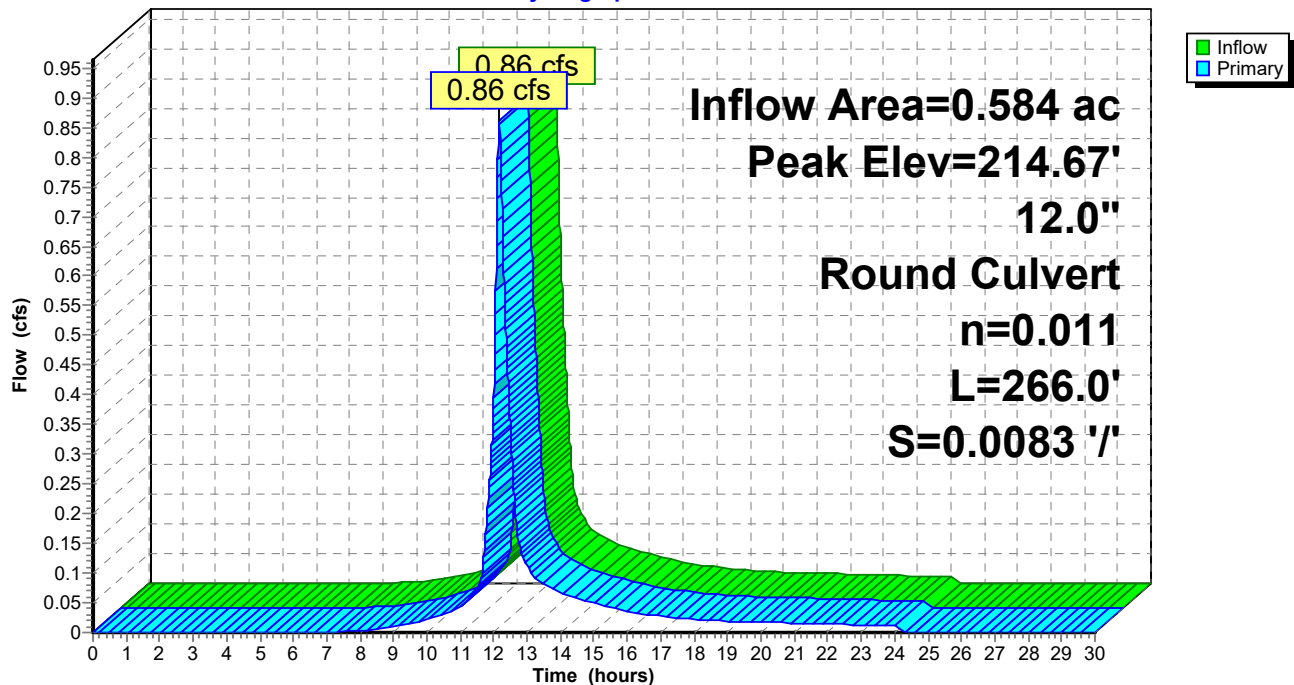
Device	Routing	Invert	Outlet Devices
#1	Primary	214.20'	<b>12.0" Round Culvert</b> L= 266.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.20' / 212.00' S= 0.0083 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.86 cfs @ 12.17 hrs HW=214.67' (Free Discharge)

↑**1=Culvert** (Inlet Controls 0.86 cfs @ 2.34 fps)

### Pond 3P: DMH 1

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 4P: P1b

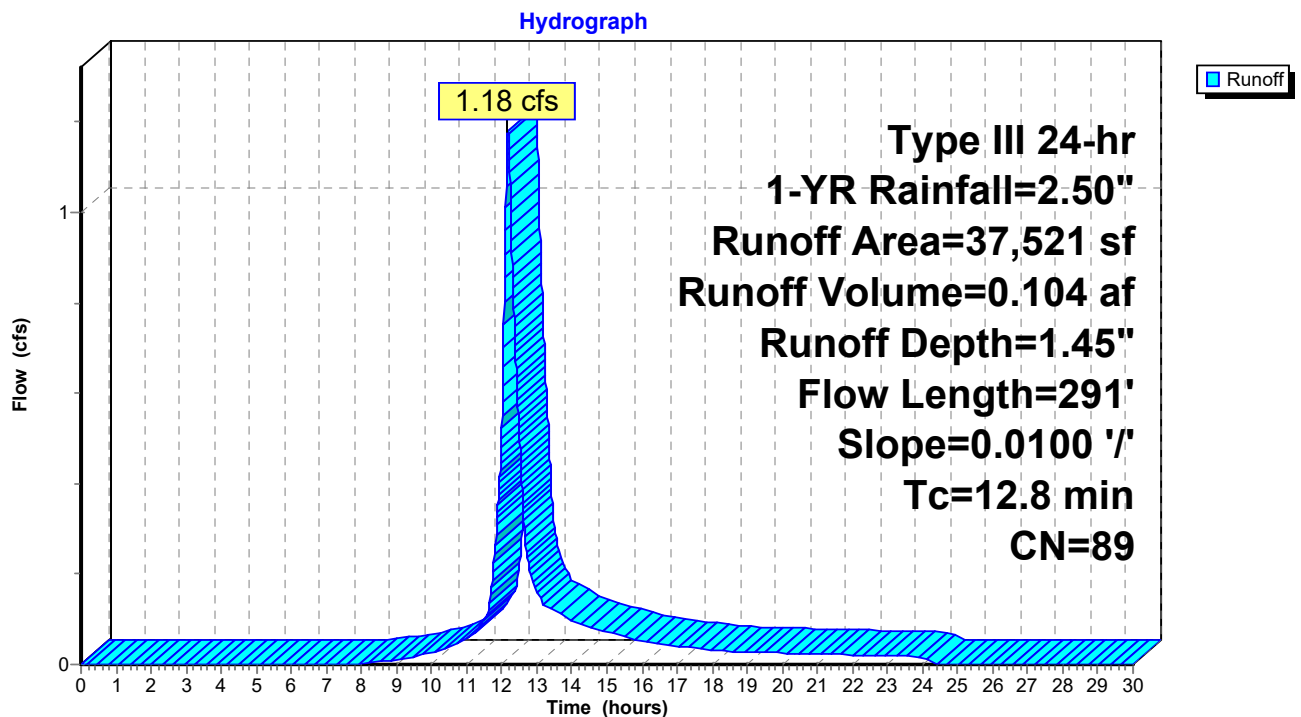
Runoff = 1.18 cfs @ 12.18 hrs, Volume= 0.104 af, Depth= 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
14,283	98	Paved parking, HSG C
13,625	74	>75% Grass cover, Good, HSG C
9,613	98	Roofs, HSG C
37,521	89	Weighted Average
13,625		36.31% Pervious Area
23,896		63.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.1	14	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.9	227	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.8	291	Total			

### Subcatchment 4P: P1b



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 5P: CB3&4

Inflow Area = 0.861 ac, 63.69% Impervious, Inflow Depth = 1.45" for 1-YR event  
Inflow = 1.18 cfs @ 12.18 hrs, Volume= 0.104 af  
Outflow = 1.18 cfs @ 12.18 hrs, Volume= 0.104 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.18 cfs @ 12.18 hrs, Volume= 0.104 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 212.75' @ 12.18 hrs

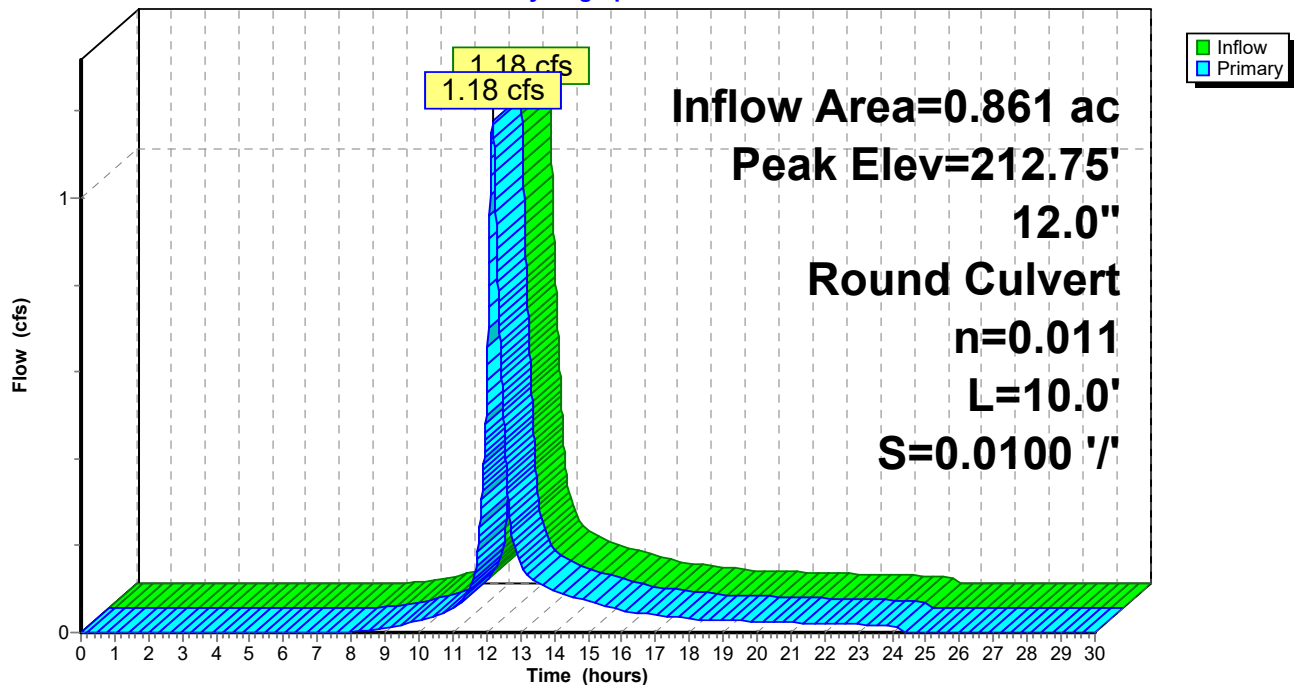
Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	<b>12.0" Round Culvert</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 212.10' / 212.00' S= 0.0100 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.18 cfs @ 12.18 hrs HW=212.75' (Free Discharge)

↑1=Culvert (Barrel Controls 1.18 cfs @ 3.12 fps)

### Pond 5P: CB3&4

Hydrograph





## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 6P: P1c

Runoff = 0.71 cfs @ 12.11 hrs, Volume= 0.056 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

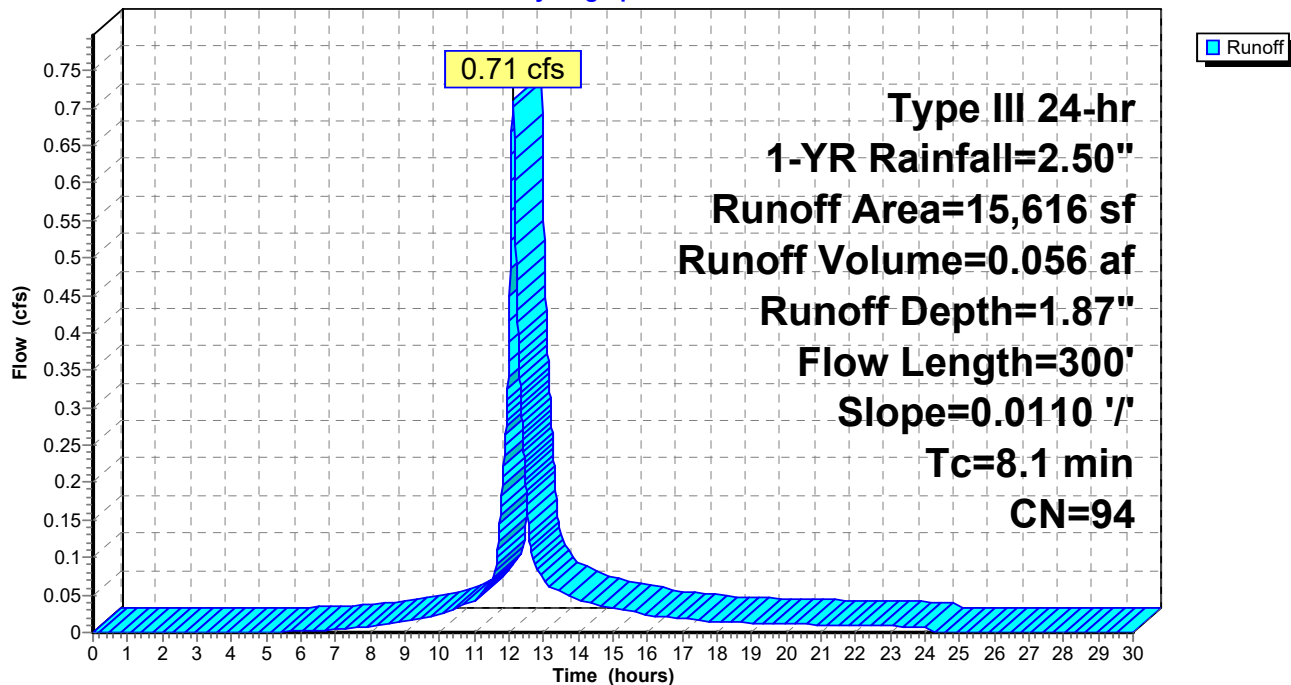
Area (sf)	CN	Description
10,458	98	Paved parking, HSG C
2,411	74	>75% Grass cover, Good, HSG C
2,747	98	Roofs, HSG C
15,616	94	Weighted Average
2,411		15.44% Pervious Area
13,205		84.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	23	0.0110	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.5	27	0.0110	0.83		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
2.0	250	0.0110	2.13		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
8.1	300	Total			

### Subcatchment 6P: P1c

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 7P: CB5&6

Inflow Area = 0.358 ac, 84.56% Impervious, Inflow Depth = 1.87" for 1-YR event  
Inflow = 0.71 cfs @ 12.11 hrs, Volume= 0.056 af  
Outflow = 0.71 cfs @ 12.11 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.71 cfs @ 12.11 hrs, Volume= 0.056 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.08' @ 12.11 hrs

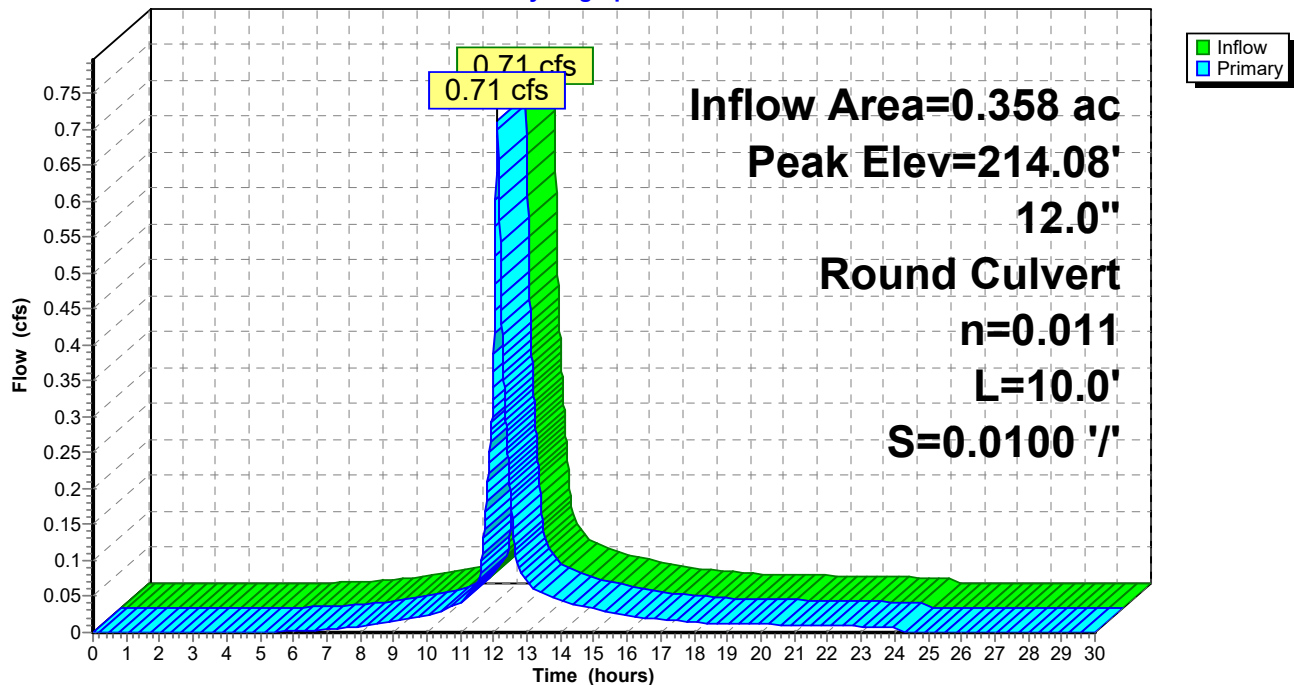
Device	Routing	Invert	Outlet Devices
#1	Primary	213.60'	<b>12.0" Round Culvert</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.60' / 213.50' S= 0.0100 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.71 cfs @ 12.11 hrs HW=214.08' (Free Discharge)

1=Culvert (Barrel Controls 0.71 cfs @ 2.80 fps)

### Pond 7P: CB5&6

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 8P: DMH2

Inflow Area = 0.358 ac, 84.56% Impervious, Inflow Depth = 1.87" for 1-YR event  
Inflow = 0.71 cfs @ 12.11 hrs, Volume= 0.056 af  
Outflow = 0.71 cfs @ 12.11 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.71 cfs @ 12.11 hrs, Volume= 0.056 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 213.83' @ 12.11 hrs

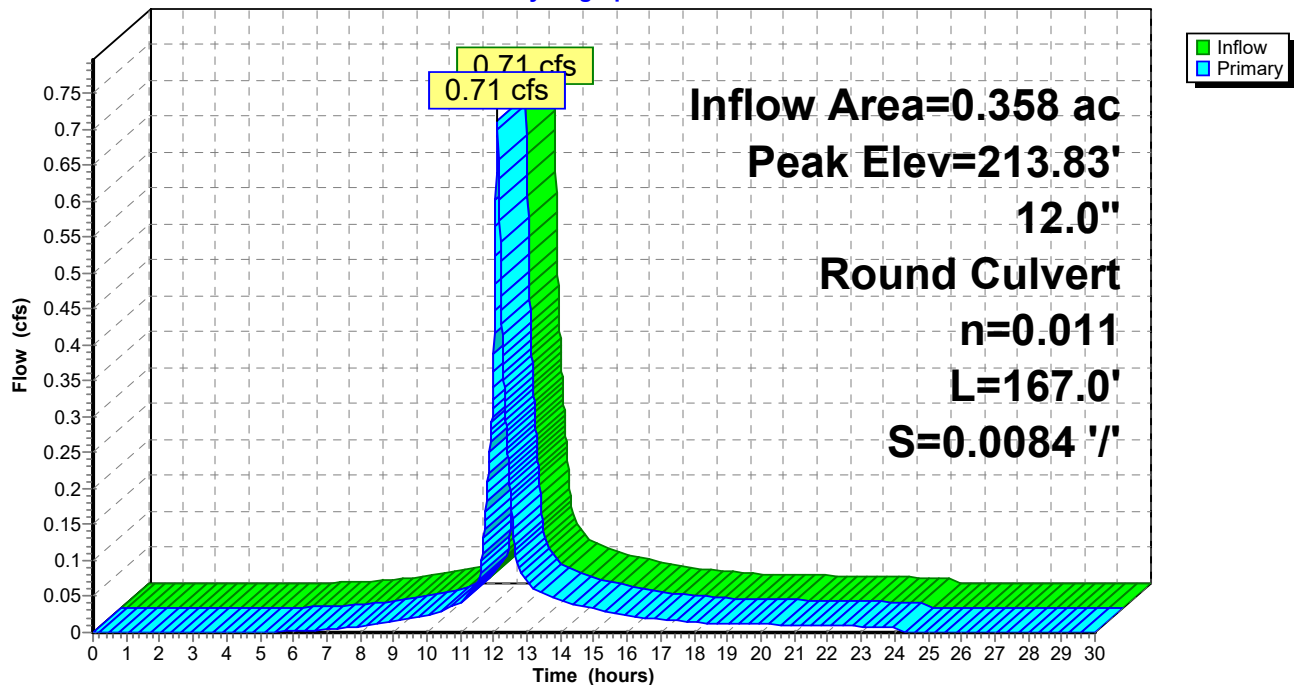
Device	Routing	Invert	Outlet Devices
#1	Primary	213.40'	<b>12.0" Round Culvert</b> L= 167.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.40' / 212.00' S= 0.0084 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.71 cfs @ 12.11 hrs HW=213.83' (Free Discharge)

↑1=Culvert (Inlet Controls 0.71 cfs @ 2.22 fps)

### Pond 8P: DMH2

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 9P: DMH3

Inflow Area = 1.804 ac, 69.11% Impervious, Inflow Depth = 1.56" for 1-YR event  
Inflow = 2.67 cfs @ 12.15 hrs, Volume= 0.235 af  
Outflow = 2.67 cfs @ 12.15 hrs, Volume= 0.235 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.67 cfs @ 12.15 hrs, Volume= 0.235 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 212.66' @ 12.15 hrs

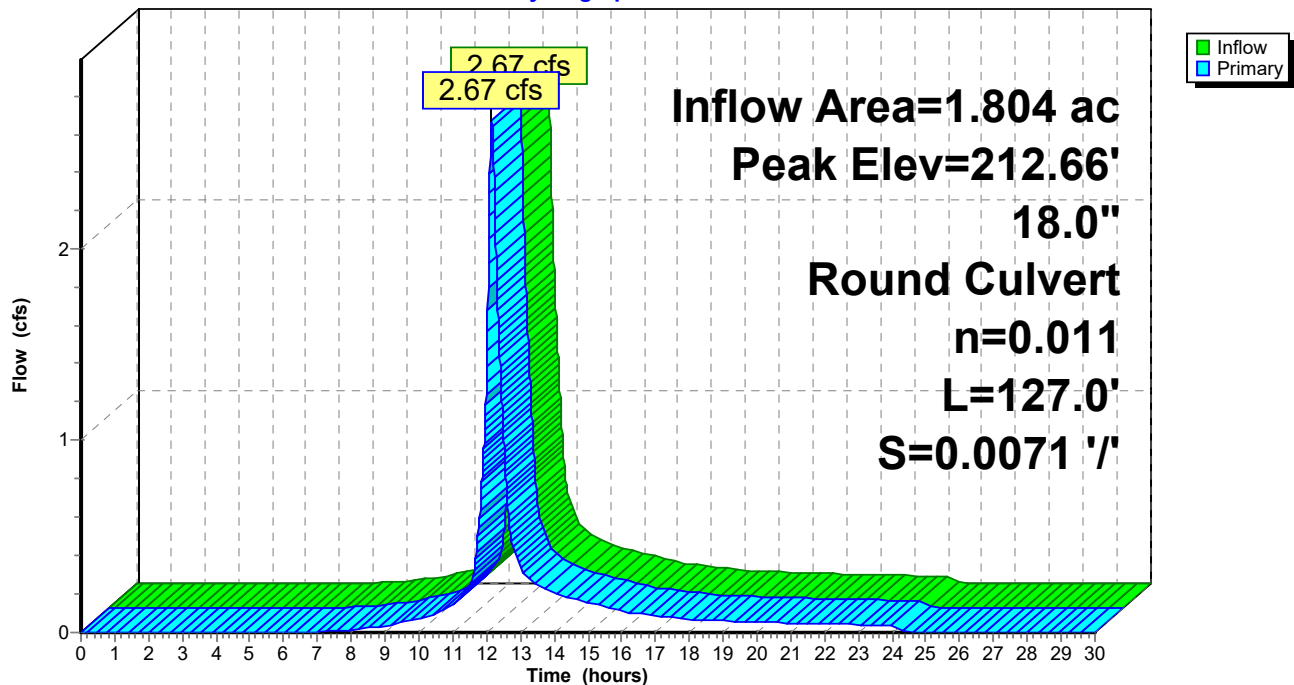
Device	Routing	Invert	Outlet Devices
#1	Primary	211.90'	<b>18.0" Round Culvert</b> L= 127.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 211.90' / 211.00' S= 0.0071 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=2.66 cfs @ 12.15 hrs HW=212.66' (Free Discharge)

↑**1=Culvert** (Inlet Controls 2.66 cfs @ 2.97 fps)

### Pond 9P: DMH3

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 10P: DMH4

Inflow Area = 1.804 ac, 69.11% Impervious, Inflow Depth = 1.56" for 1-YR event  
Inflow = 2.67 cfs @ 12.15 hrs, Volume= 0.235 af  
Outflow = 2.67 cfs @ 12.15 hrs, Volume= 0.235 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.67 cfs @ 12.15 hrs, Volume= 0.235 af

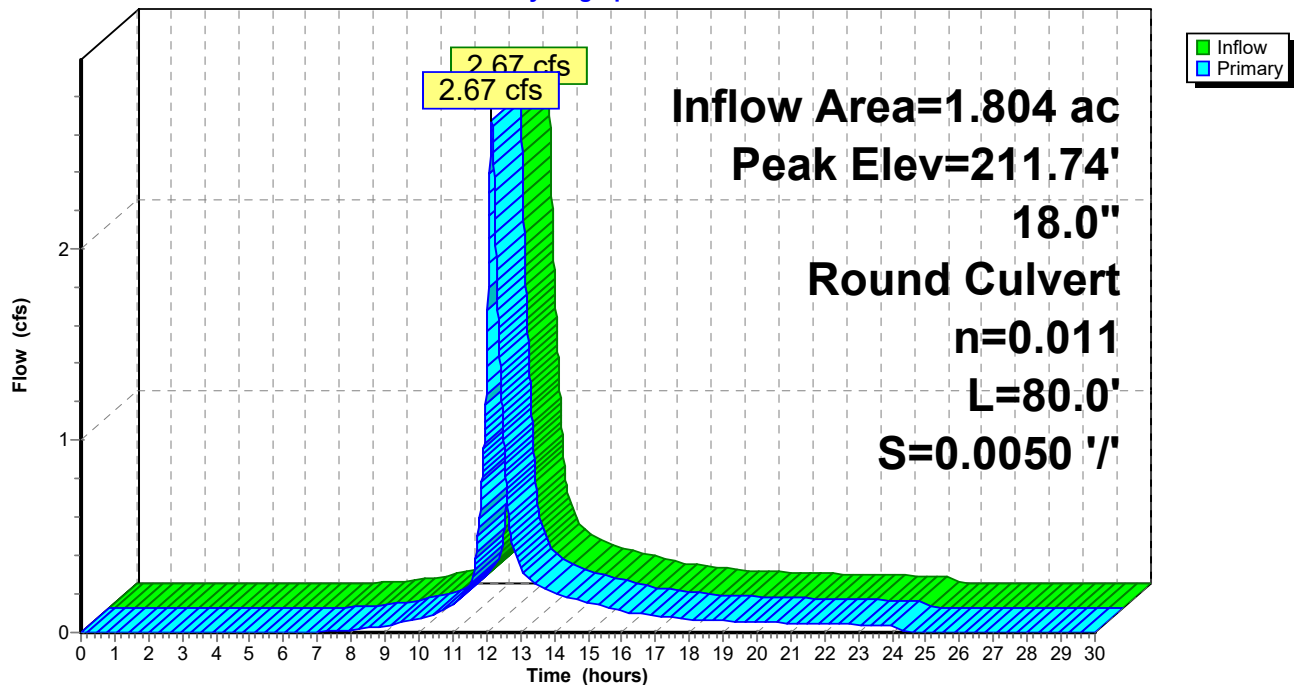
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 211.74' @ 12.15 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	210.90'	<b>18.0" Round Culvert</b> L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.90' / 210.50' S= 0.0050 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=2.66 cfs @ 12.15 hrs HW=211.74' (Free Discharge)  
↑ **1=Culvert** (Barrel Controls 2.66 cfs @ 3.79 fps)

### Pond 10P: DMH4

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 11P: P1d

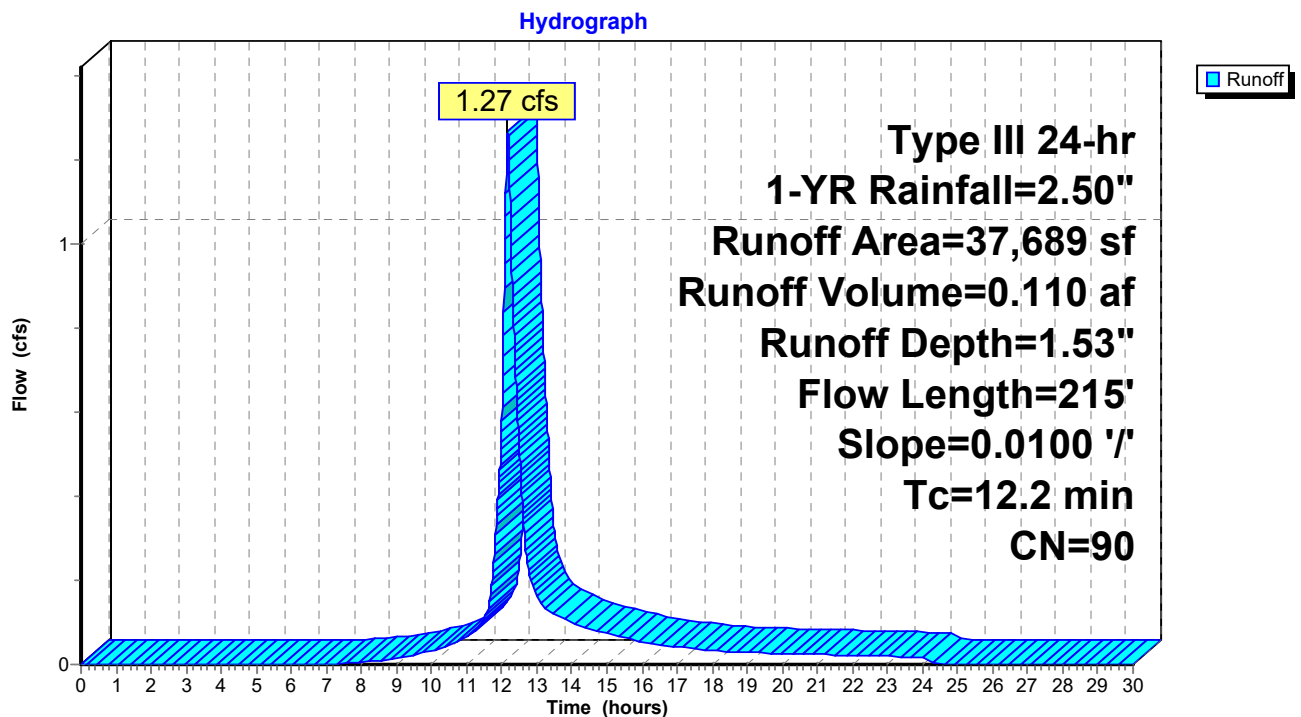
Runoff = 1.27 cfs @ 12.16 hrs, Volume= 0.110 af, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
19,670	98	Paved parking, HSG C
12,756	74	>75% Grass cover, Good, HSG C
5,263	98	Roofs, HSG C
37,689	90	Weighted Average
12,756		33.85% Pervious Area
24,933		66.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	15	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.2	215	Total			

### Subcatchment 11P: P1d



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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 12P: CB7

Inflow Area = 0.865 ac, 66.15% Impervious, Inflow Depth = 1.53" for 1-YR event  
Inflow = 1.27 cfs @ 12.16 hrs, Volume= 0.110 af  
Outflow = 1.27 cfs @ 12.16 hrs, Volume= 0.110 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.27 cfs @ 12.16 hrs, Volume= 0.110 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 211.37' @ 12.16 hrs

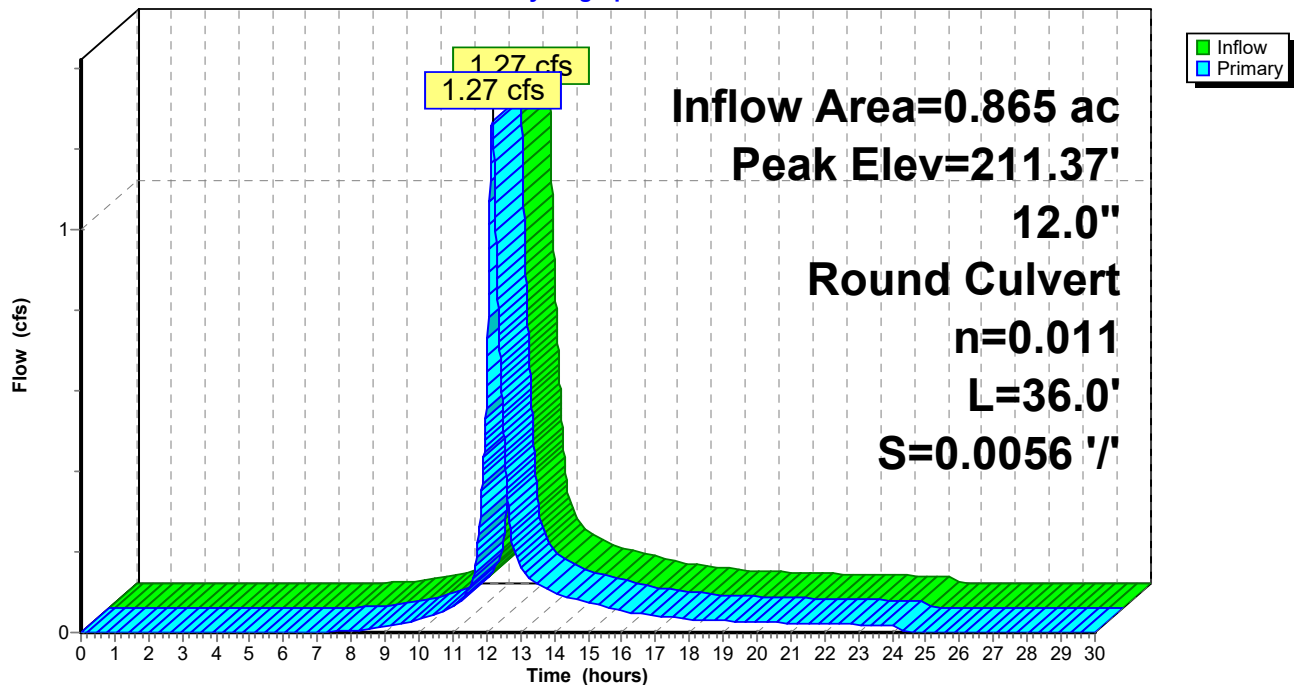
Device	Routing	Invert	Outlet Devices
#1	Primary	210.70'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.70' / 210.50' S= 0.0056 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.27 cfs @ 12.16 hrs HW=211.37' (Free Discharge)

↑1=Culvert (Barrel Controls 1.27 cfs @ 3.20 fps)

### Pond 12P: CB7

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 13P: P1e

Runoff = 0.34 cfs @ 12.17 hrs, Volume= 0.033 af, Depth= 0.61"

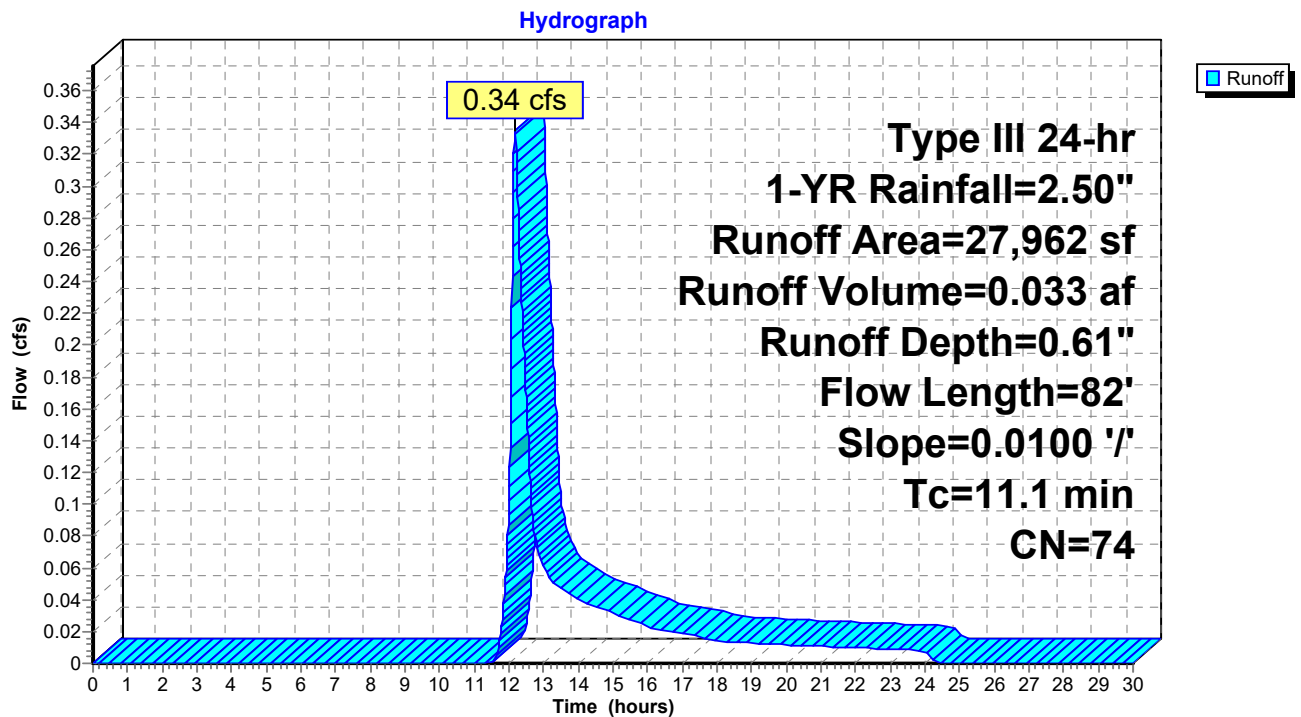
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
27,962	74	>75% Grass cover, Good, HSG C
27,962		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.3	32	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.1	82	Total			

### Subcatchment 13P: P1e





## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 14P: P1f

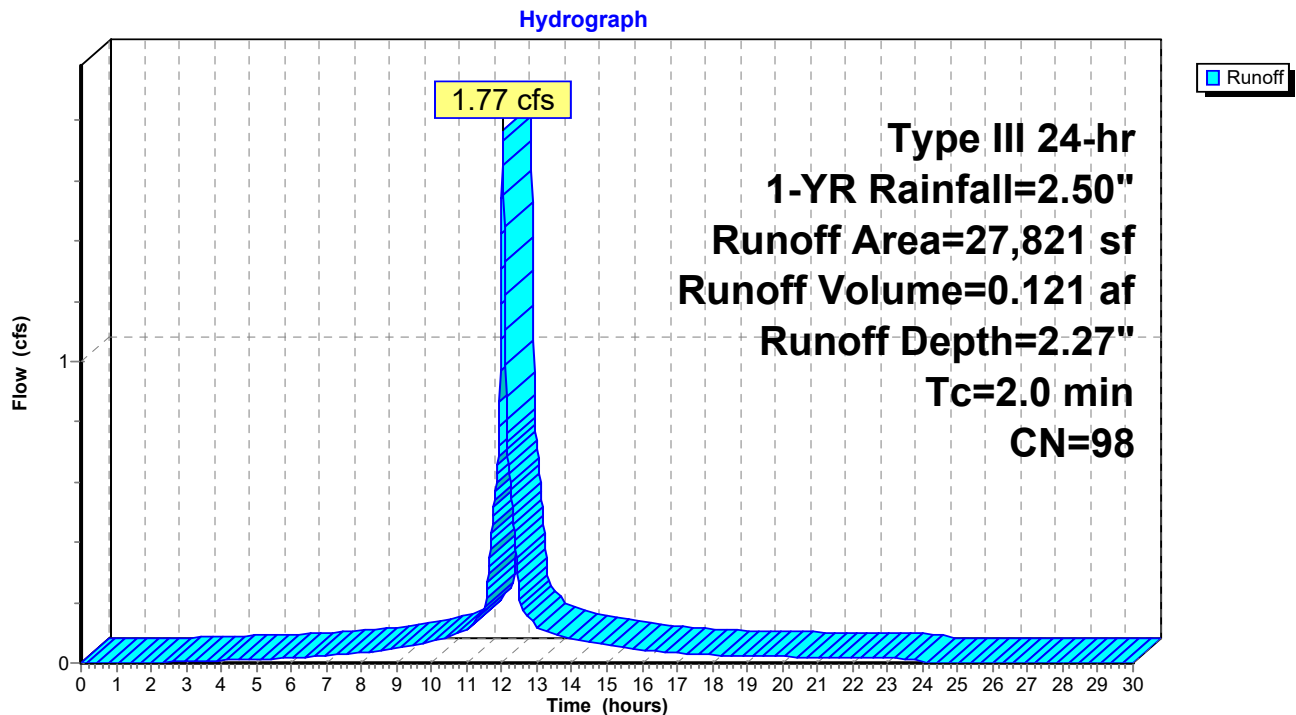
Runoff = 1.77 cfs @ 12.03 hrs, Volume= 0.121 af, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
27,821	98	Roofs, HSG C
27,821		100.00% Impervious Area

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

### Subcatchment 14P: P1f



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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 15P: Roof Pipes

Inflow Area = 0.639 ac, 100.00% Impervious, Inflow Depth = 2.27" for 1-YR event  
Inflow = 1.77 cfs @ 12.03 hrs, Volume= 0.121 af  
Outflow = 1.77 cfs @ 12.03 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.77 cfs @ 12.03 hrs, Volume= 0.121 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.73' @ 12.03 hrs

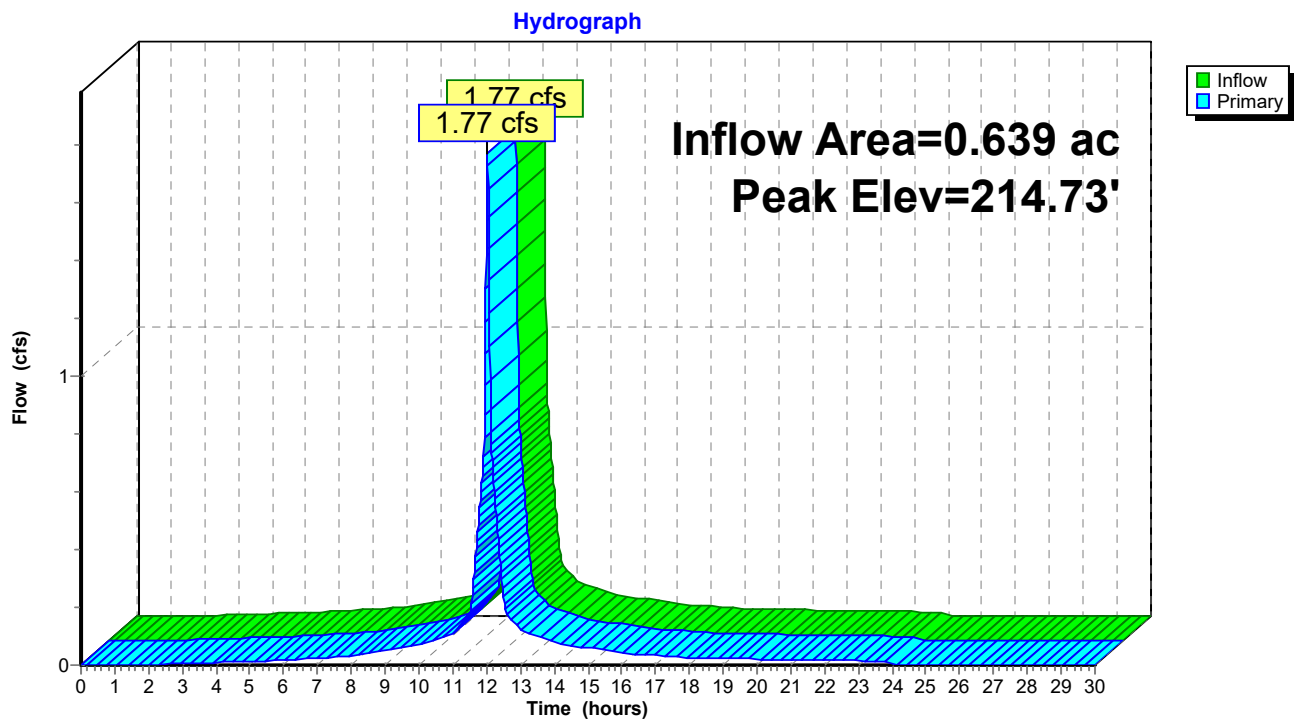
Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	<b>12.0" Round Culvert</b> L= 300.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.00' / 210.50' S= 0.0117 ' S= 0.0117 ' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#2	Primary	216.00'	<b>12.0" Round Culvert</b> L= 450.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 210.50' S= 0.0122 ' S= 0.0122 ' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.77 cfs @ 12.03 hrs HW=214.73' (Free Discharge)

1=Culvert (Inlet Controls 1.77 cfs @ 2.90 fps)

2=Culvert ( Controls 0.00 cfs)

### Pond 15P: Roof Pipes



## Stormwater Calculations

Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 16P: Basin #1

Inflow Area = 3.950 ac, 62.23% Impervious, Inflow Depth = 1.51" for 1-YR event  
Inflow = 4.98 cfs @ 12.15 hrs, Volume= 0.499 af  
Outflow = 0.36 cfs @ 14.60 hrs, Volume= 0.499 af, Atten= 93%, Lag= 146.9 min  
Discarded = 0.36 cfs @ 14.60 hrs, Volume= 0.499 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 211.26' @ 14.60 hrs Surf.Area= 15,199 sf Storage= 10,573 cf

Plug-Flow detention time= 292.6 min calculated for 0.499 af (100% of inflow)  
Center-of-Mass det. time= 292.6 min ( 1,101.8 - 809.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	210.50'	32,180 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
210.50	12,754	521.0	0	0	12,754
212.50	19,675	607.0	32,180	32,180	20,556

Device	Routing	Invert	Outlet Devices
#1	Primary	211.80'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 211.80 213.00 Width (feet) 6.00 6.00
#2	Discarded	210.50'	<b>1.020 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.36 cfs @ 14.60 hrs HW=211.26' (Free Discharge)  
↑**2=Exfiltration** (Exfiltration Controls 0.36 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=210.50' (Free Discharge)  
↑**1=Custom Weir/Orifice** ( Controls 0.00 cfs)

## Stormwater Calculations

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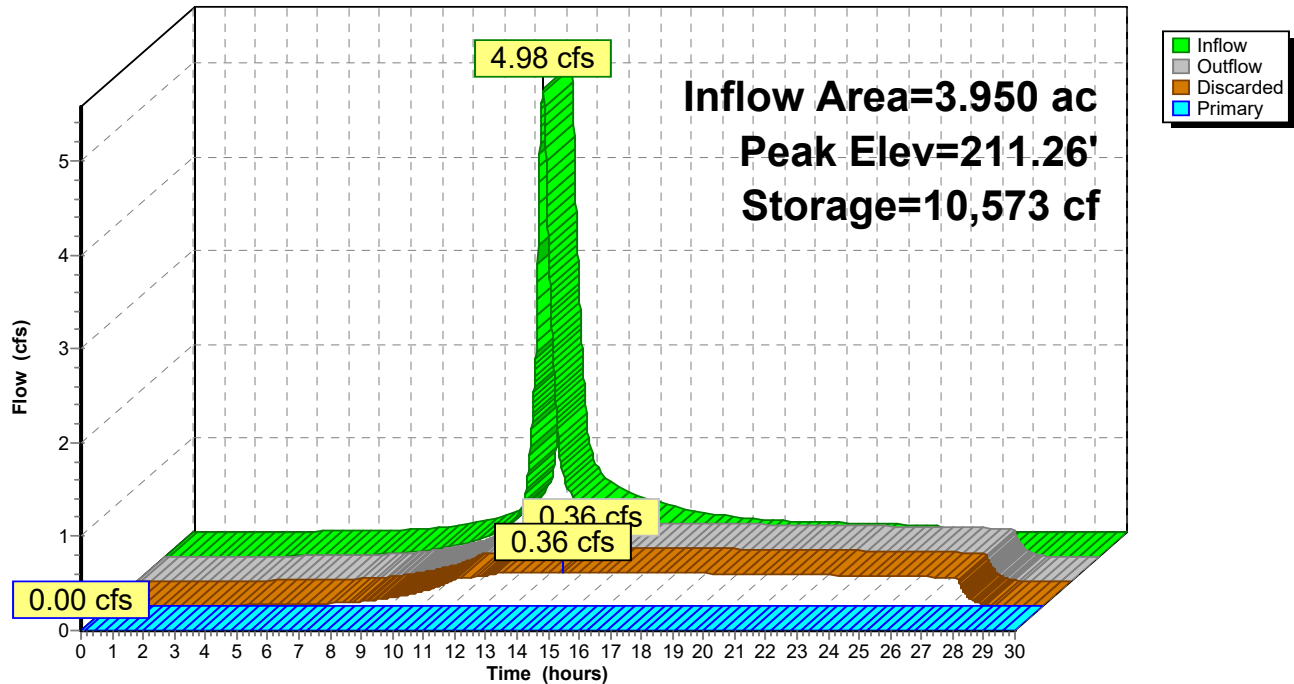
Type III 24-hr 1-YR Rainfall=2.50"

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### Pond 16P: Basin #1

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 17P: P1g

Runoff = 1.33 cfs @ 12.15 hrs, Volume= 0.130 af, Depth= 0.53"

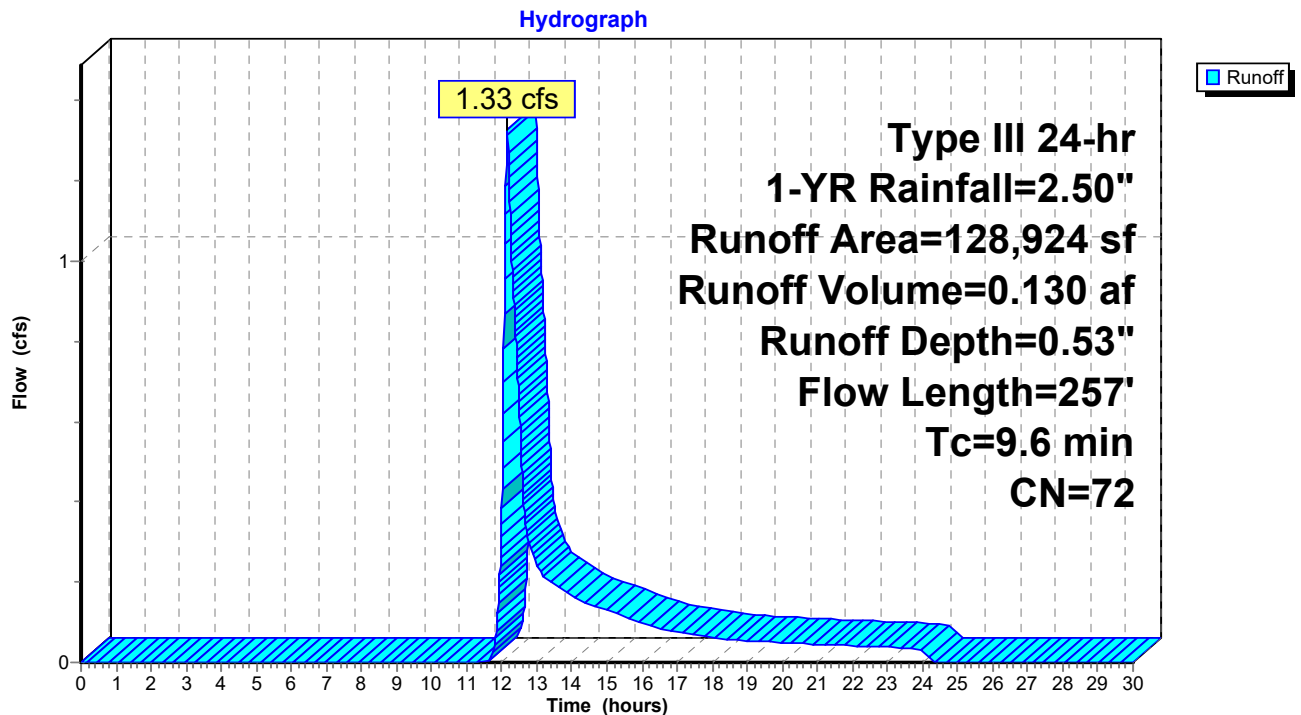
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
1,740	98	Paved parking, HSG C
50,163	74	>75% Grass cover, Good, HSG C
77,021	70	Woods, Good, HSG C
128,924	72	Weighted Average
127,184		98.65% Pervious Area
1,740		1.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	207	0.0240	2.49		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.6	257	Total			

### Subcatchment 17P: P1g



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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 18P: P1h

Runoff = 0.23 cfs @ 12.12 hrs, Volume= 0.020 af, Depth= 0.61"

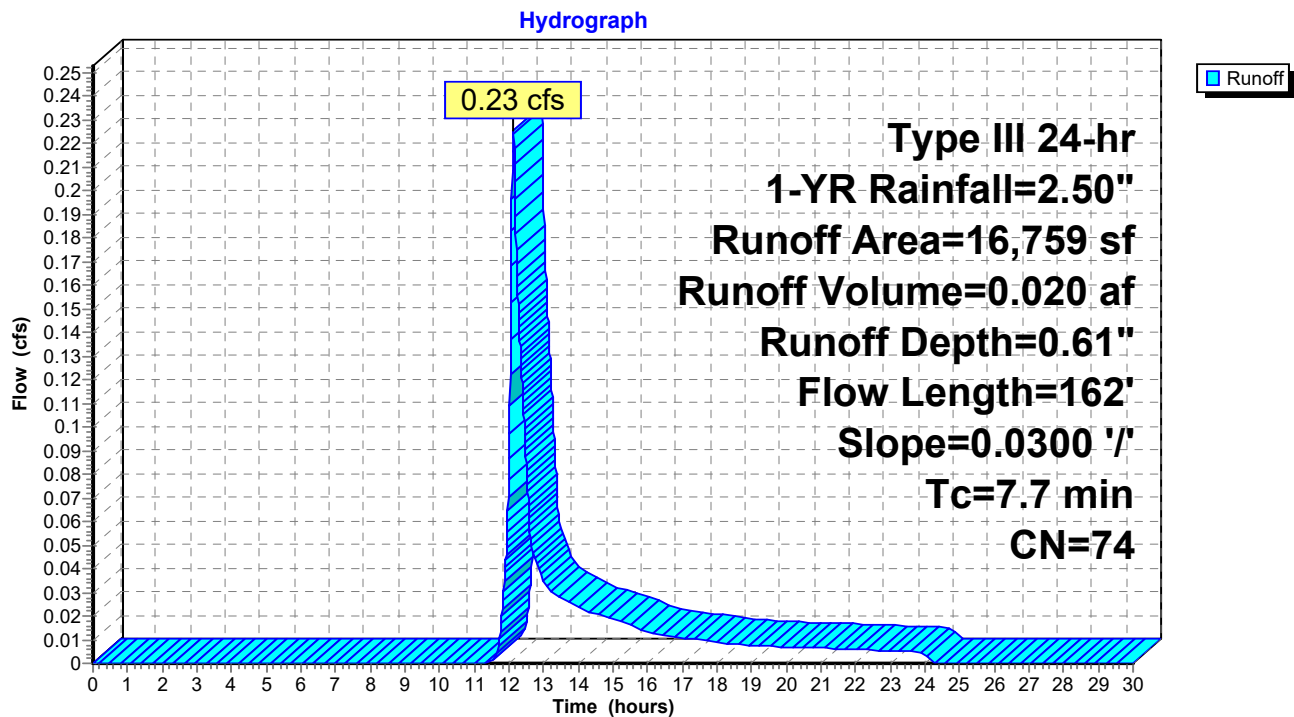
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
16,759	74	>75% Grass cover, Good, HSG C
16,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	112	0.0300	2.79		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.7	162	Total			

### Subcatchment 18P: P1h



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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 19P: P1i

Runoff = 0.49 cfs @ 12.11 hrs, Volume= 0.040 af, Depth= 0.61"

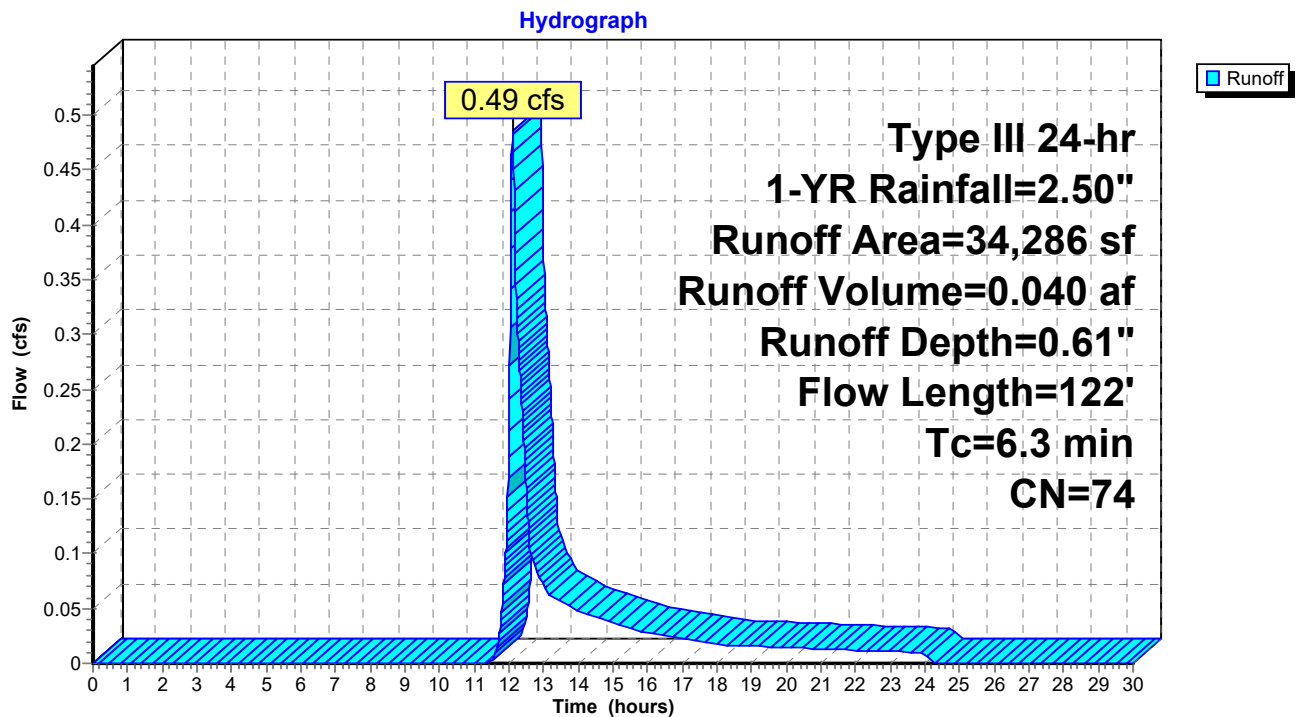
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
34,286	74	>75% Grass cover, Good, HSG C
34,286		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.1	72	0.9000	15.27		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.3	122	Total			

### Subcatchment 19P: P1i



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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 20P: P1j

Runoff = 1.48 cfs @ 12.13 hrs, Volume= 0.116 af, Depth= 1.24"

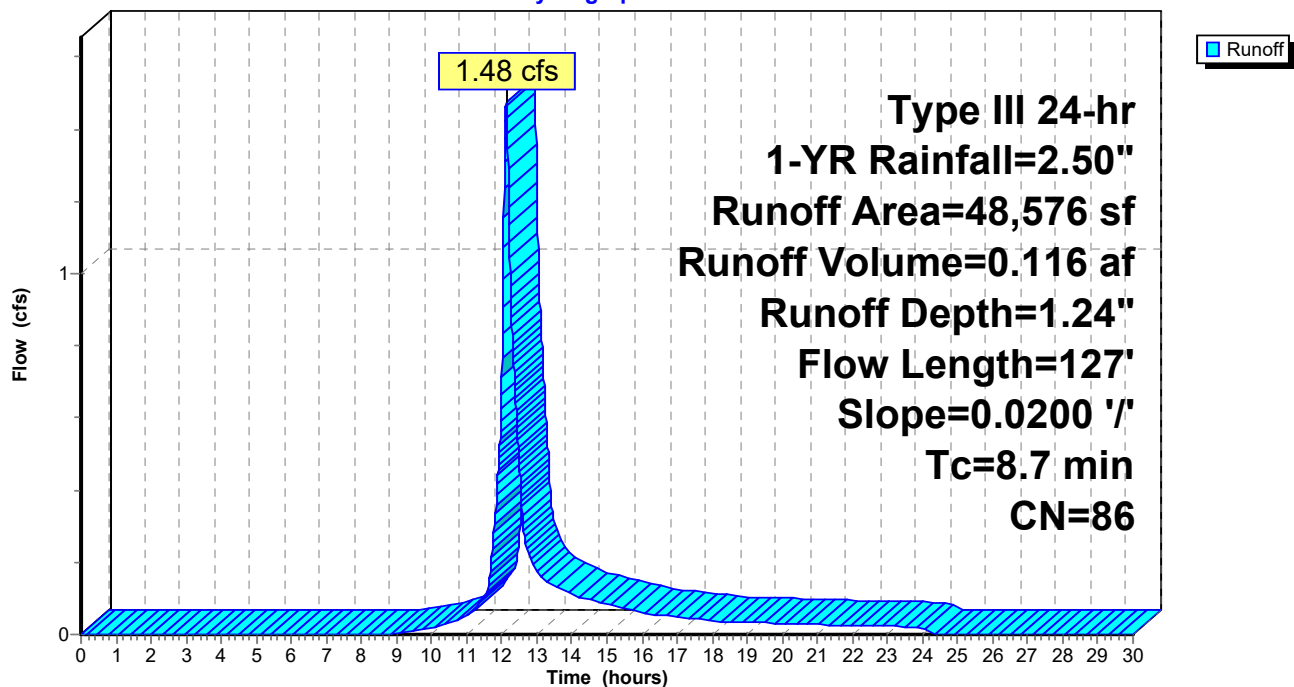
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
24,897	98	Paved parking, HSG C
4,121	70	Woods, Good, HSG C
19,558	74	>75% Grass cover, Good, HSG C
48,576	86	Weighted Average
23,679		48.75% Pervious Area
24,897		51.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	57	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.1	20	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
8.7	127	Total			

### Subcatchment 20P: P1j

Hydrograph





## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 21P: Exist. CB

Inflow Area = 1.115 ac, 51.25% Impervious, Inflow Depth = 1.24" for 1-YR event  
Inflow = 1.48 cfs @ 12.13 hrs, Volume= 0.116 af  
Outflow = 1.48 cfs @ 12.13 hrs, Volume= 0.116 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.48 cfs @ 12.13 hrs, Volume= 0.116 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.09' @ 12.13 hrs

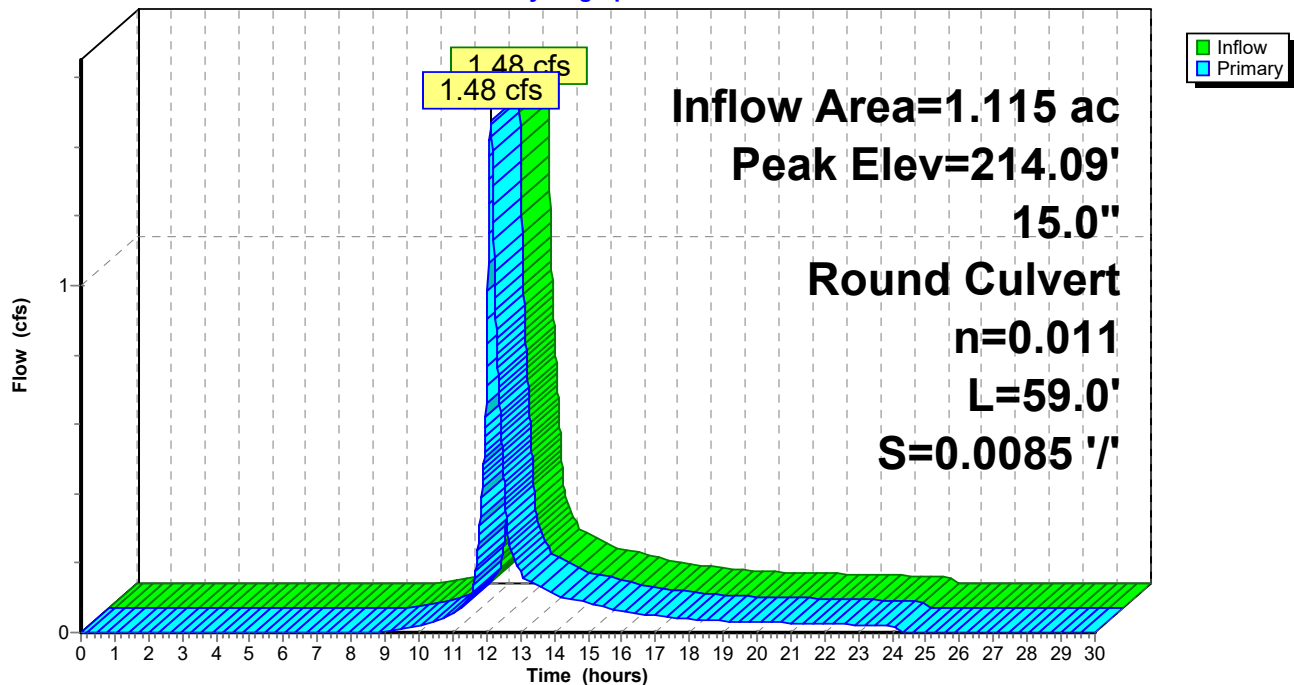
Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	<b>15.0" Round Culvert</b> L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.50' / 213.00' S= 0.0085 '/ Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

**Primary OutFlow** Max=1.48 cfs @ 12.13 hrs HW=214.09' (Free Discharge)

↑1=Culvert (Barrel Controls 1.48 cfs @ 3.81 fps)

### Pond 21P: Exist. CB

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 22P: Existing Basin

Inflow Area = 1.902 ac, 30.05% Impervious, Inflow Depth = 0.98" for 1-YR event  
Inflow = 1.95 cfs @ 12.12 hrs, Volume= 0.155 af  
Outflow = 0.61 cfs @ 12.51 hrs, Volume= 0.155 af, Atten= 69%, Lag= 23.4 min  
Discarded = 0.61 cfs @ 12.51 hrs, Volume= 0.155 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 213.13' @ 12.51 hrs Surf.Area= 10,887 sf Storage= 1,416 cf

Plug-Flow detention time= 16.4 min calculated for 0.155 af (100% of inflow)  
Center-of-Mass det. time= 16.4 min ( 863.8 - 847.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	32,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
213.00	10,659	0	0
214.00	12,392	11,526	11,526
215.50	15,086	20,609	32,134

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	<b>2.410 in/hr Exfiltration over Horizontal area</b>
#2	Primary	213.40'	<b>5.0' long x 0.8' breadth Level Spreader</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32
#3	Device 2	213.50'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.80 0.80 1.50 Width (feet) 0.25 0.25 8.00 8.00

**Discarded OutFlow** Max=0.61 cfs @ 12.51 hrs HW=213.13' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.61 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=213.00' (Free Discharge)

↑**2=Level Spreader** ( Controls 0.00 cfs)

↑**3=Custom Weir/Orifice** ( Controls 0.00 cfs)

## Stormwater Calculations

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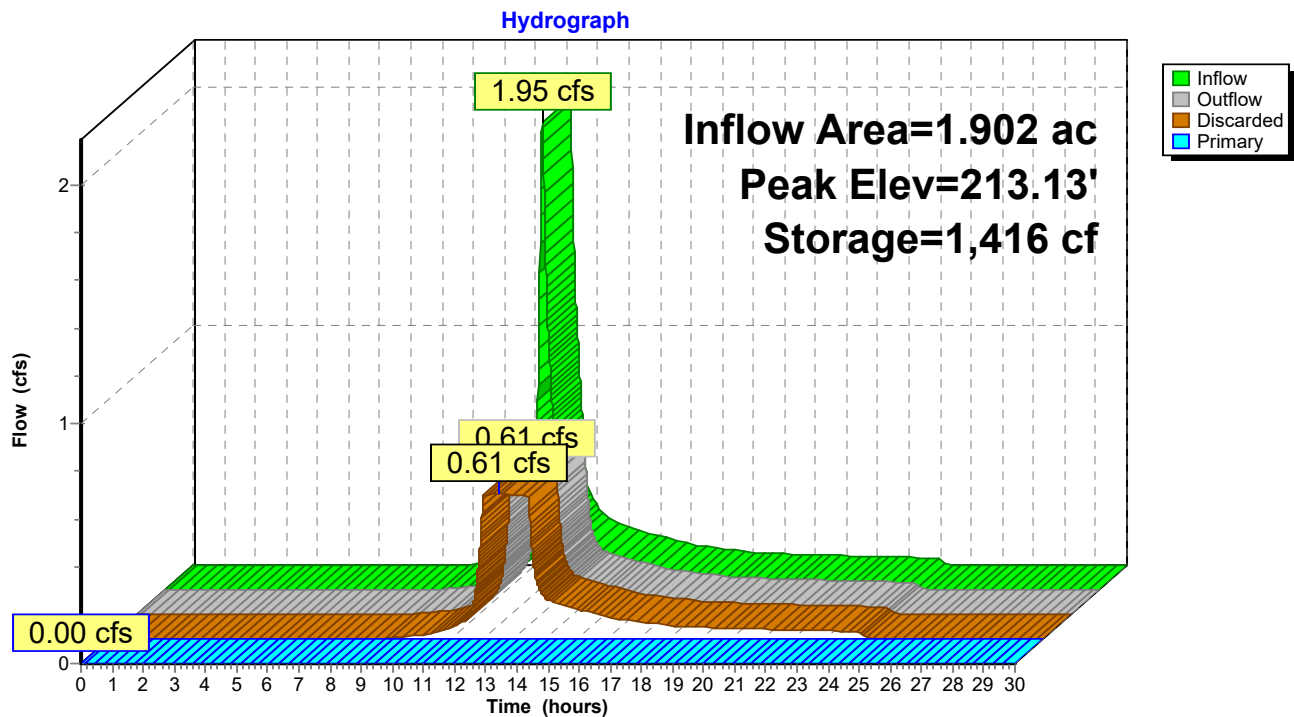
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Type III 24-hr 1-YR Rainfall=2.50"

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### Pond 22P: Existing Basin



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Type III 24-hr 1-YR Rainfall=2.50"

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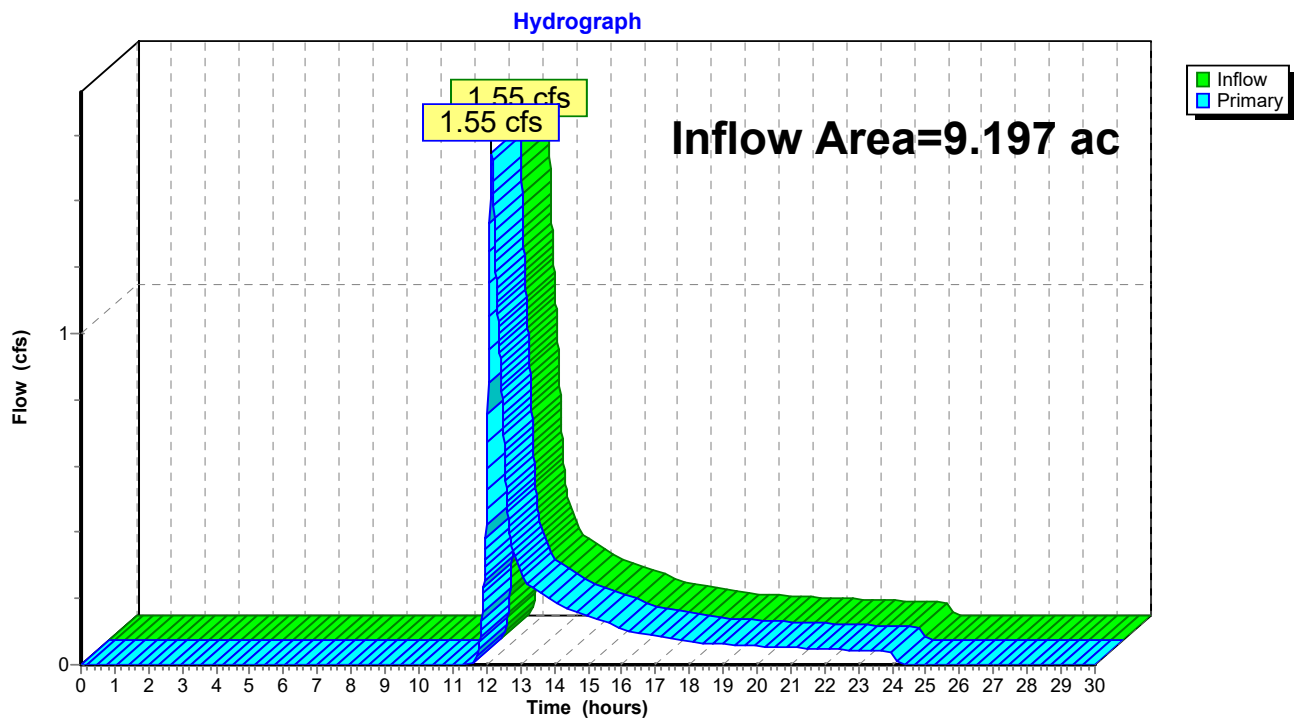
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### Summary for Link 23P: Design Point #1: Flow to Shadowfax Farm

Inflow Area = 9.197 ac, 33.38% Impervious, Inflow Depth = 0.20" for 1-YR event  
Inflow = 1.55 cfs @ 12.15 hrs, Volume= 0.150 af  
Primary = 1.55 cfs @ 12.15 hrs, Volume= 0.150 af, Atten= 0%, Lag= 0.0 min

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

### Link 23P: Design Point #1: Flow to Shadowfax Farm



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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

### Subcatchment1P: P1a

Runoff Area=25,448 sf 67.62% Impervious Runoff Depth=2.17"  
Flow Length=195' Slope=0.0100 '/' Tc=12.0 min CN=90 Runoff=1.21 cfs 0.106 af

### Pond 2P: CB 1&2

Peak Elev=215.11' Inflow=1.21 cfs 0.106 af  
12.0" Round Culvert n=0.011 L=16.0' S=0.0125 '/' Outflow=1.21 cfs 0.106 af

### Pond 3P: DMH 1

Peak Elev=214.78' Inflow=1.21 cfs 0.106 af  
12.0" Round Culvert n=0.011 L=266.0' S=0.0083 '/' Outflow=1.21 cfs 0.106 af

### Subcatchment4P: P1b

Runoff Area=37,521 sf 63.69% Impervious Runoff Depth=2.08"  
Flow Length=291' Slope=0.0100 '/' Tc=12.8 min CN=89 Runoff=1.68 cfs 0.149 af

### Pond 5P: CB3&4

Peak Elev=212.91' Inflow=1.68 cfs 0.149 af  
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=1.68 cfs 0.149 af

### Subcatchment6P: P1c

Runoff Area=15,616 sf 84.56% Impervious Runoff Depth=2.54"  
Flow Length=300' Slope=0.0110 '/' Tc=8.1 min CN=94 Runoff=0.95 cfs 0.076 af

### Pond 7P: CB5&6

Peak Elev=214.17' Inflow=0.95 cfs 0.076 af  
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=0.95 cfs 0.076 af

### Pond 8P: DMH2

Peak Elev=213.90' Inflow=0.95 cfs 0.076 af  
12.0" Round Culvert n=0.011 L=167.0' S=0.0084 '/' Outflow=0.95 cfs 0.076 af

### Pond 9P: DMH3

Peak Elev=212.82' Inflow=3.73 cfs 0.331 af  
18.0" Round Culvert n=0.011 L=127.0' S=0.0071 '/' Outflow=3.73 cfs 0.331 af

### Pond 10P: DMH4

Peak Elev=211.93' Inflow=3.73 cfs 0.331 af  
18.0" Round Culvert n=0.011 L=80.0' S=0.0050 '/' Outflow=3.73 cfs 0.331 af

### Subcatchment11P: P1d

Runoff Area=37,689 sf 66.15% Impervious Runoff Depth=2.17"  
Flow Length=215' Slope=0.0100 '/' Tc=12.2 min CN=90 Runoff=1.78 cfs 0.156 af

### Pond 12P: CB7

Peak Elev=211.53' Inflow=1.78 cfs 0.156 af  
12.0" Round Culvert n=0.011 L=36.0' S=0.0056 '/' Outflow=1.78 cfs 0.156 af

### Subcatchment13P: P1e

Runoff Area=27,962 sf 0.00% Impervious Runoff Depth=1.04"  
Flow Length=82' Slope=0.0100 '/' Tc=11.1 min CN=74 Runoff=0.62 cfs 0.056 af

### Subcatchment14P: P1f

Runoff Area=27,821 sf 100.00% Impervious Runoff Depth=2.97"  
Tc=2.0 min CN=98 Runoff=2.29 cfs 0.158 af

### Pond 15P: Roof Pipes

Peak Elev=214.87' Inflow=2.29 cfs 0.158 af  
Outflow=2.29 cfs 0.158 af

### Pond 16P: Basin #1

Peak Elev=211.63' Storage=16,553 cf Inflow=7.06 cfs 0.701 af  
Discarded=0.39 cfs 0.629 af Primary=0.00 cfs 0.000 af Outflow=0.39 cfs 0.629 af

## Stormwater Calculations

Type III 24-hr 2-YR Rainfall=3.20"

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### Subcatchment 17P: P1g

Runoff Area=128,924 sf 1.35% Impervious Runoff Depth=0.93"  
Flow Length=257' Tc=9.6 min CN=72 Runoff=2.62 cfs 0.229 af

### Subcatchment 18P: P1h

Runoff Area=16,759 sf 0.00% Impervious Runoff Depth=1.04"  
Flow Length=162' Slope=0.0300 '/' Tc=7.7 min CN=74 Runoff=0.42 cfs 0.033 af

### Subcatchment 19P: P1i

Runoff Area=34,286 sf 0.00% Impervious Runoff Depth=1.04"  
Flow Length=122' Tc=6.3 min CN=74 Runoff=0.90 cfs 0.068 af

### Subcatchment 20P: P1j

Runoff Area=48,576 sf 51.25% Impervious Runoff Depth=1.84"  
Flow Length=127' Slope=0.0200 '/' Tc=8.7 min CN=86 Runoff=2.19 cfs 0.171 af

### Pond 21P: Exist. CB

Peak Elev=214.24' Inflow=2.19 cfs 0.171 af  
15.0" Round Culvert n=0.011 L=59.0' S=0.0085 '/' Outflow=2.19 cfs 0.171 af

### Pond 22P: Existing Basin

Peak Elev=213.27' Storage=2,910 cf Inflow=3.06 cfs 0.239 af  
Discarded=0.62 cfs 0.239 af Primary=0.00 cfs 0.000 af Outflow=0.62 cfs 0.239 af

### Link 23P: Design Point #1: Flow to Shadowfax Farm

Inflow=3.02 cfs 0.263 af  
Primary=3.02 cfs 0.263 af

**Total Runoff Area = 9.197 ac Runoff Volume = 1.202 af Average Runoff Depth = 1.57"**  
**66.62% Pervious = 6.127 ac 33.38% Impervious = 3.069 ac**

## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 1P: P1a

Runoff = 1.21 cfs @ 12.16 hrs, Volume= 0.106 af, Depth= 2.17"

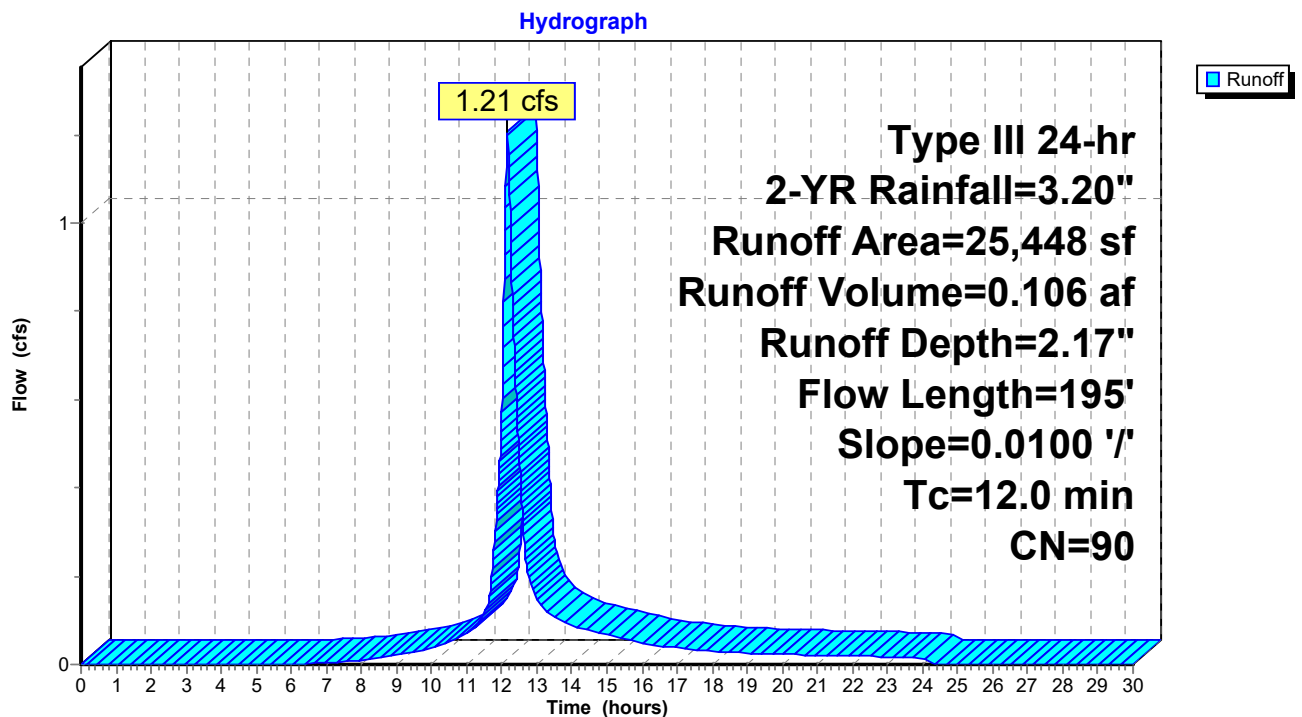
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
11,922	98	Paved parking, HSG C
8,239	74	>75% Grass cover, Good, HSG C
5,287	98	Roofs, HSG C
25,448	90	Weighted Average
8,239		32.38% Pervious Area
17,209		67.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	21	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.0	124	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.0	195	Total			

### Subcatchment 1P: P1a



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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 2P: CB 1&2

Inflow Area = 0.584 ac, 67.62% Impervious, Inflow Depth = 2.17" for 2-YR event  
Inflow = 1.21 cfs @ 12.16 hrs, Volume= 0.106 af  
Outflow = 1.21 cfs @ 12.16 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.21 cfs @ 12.16 hrs, Volume= 0.106 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 215.11' @ 12.16 hrs

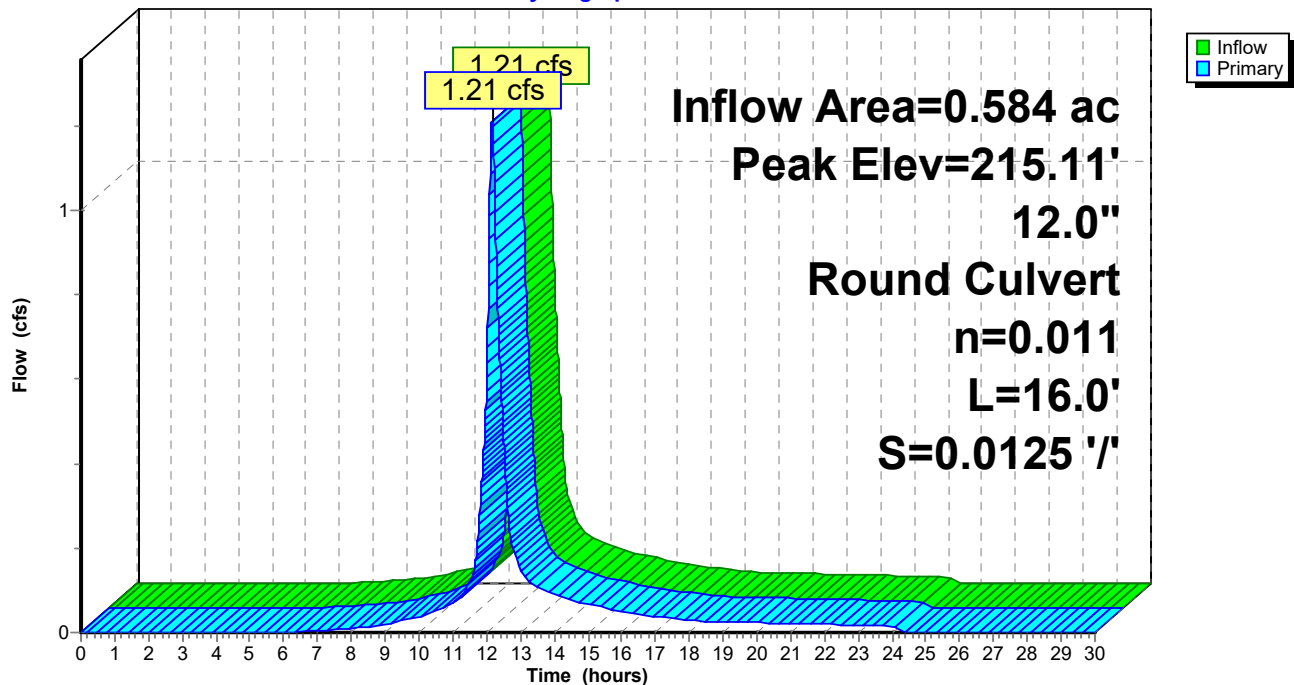
Device	Routing	Invert	Outlet Devices
#1	Primary	214.50'	<b>12.0" Round Culvert</b> L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.50' / 214.30' S= 0.0125 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.21 cfs @ 12.16 hrs HW=215.11' (Free Discharge)

↑1=Culvert (Barrel Controls 1.21 cfs @ 3.46 fps)

### Pond 2P: CB 1&2

Hydrograph





## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 3P: DMH 1

Inflow Area = 0.584 ac, 67.62% Impervious, Inflow Depth = 2.17" for 2-YR event  
Inflow = 1.21 cfs @ 12.16 hrs, Volume= 0.106 af  
Outflow = 1.21 cfs @ 12.16 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.21 cfs @ 12.16 hrs, Volume= 0.106 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.78' @ 12.16 hrs

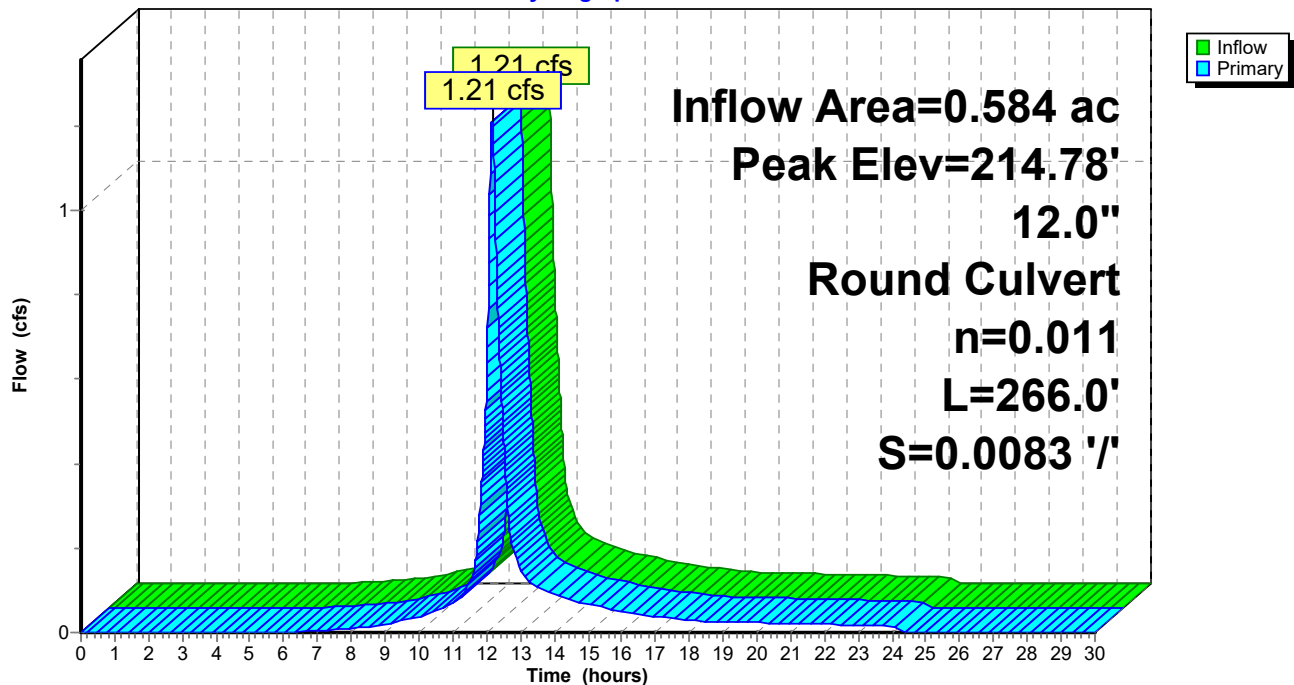
Device	Routing	Invert	Outlet Devices
#1	Primary	214.20'	<b>12.0" Round Culvert</b> L= 266.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.20' / 212.00' S= 0.0083 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.21 cfs @ 12.16 hrs HW=214.78' (Free Discharge)

↑1=Culvert (Inlet Controls 1.21 cfs @ 2.58 fps)

### Pond 3P: DMH 1

Hydrograph



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 4P: P1b

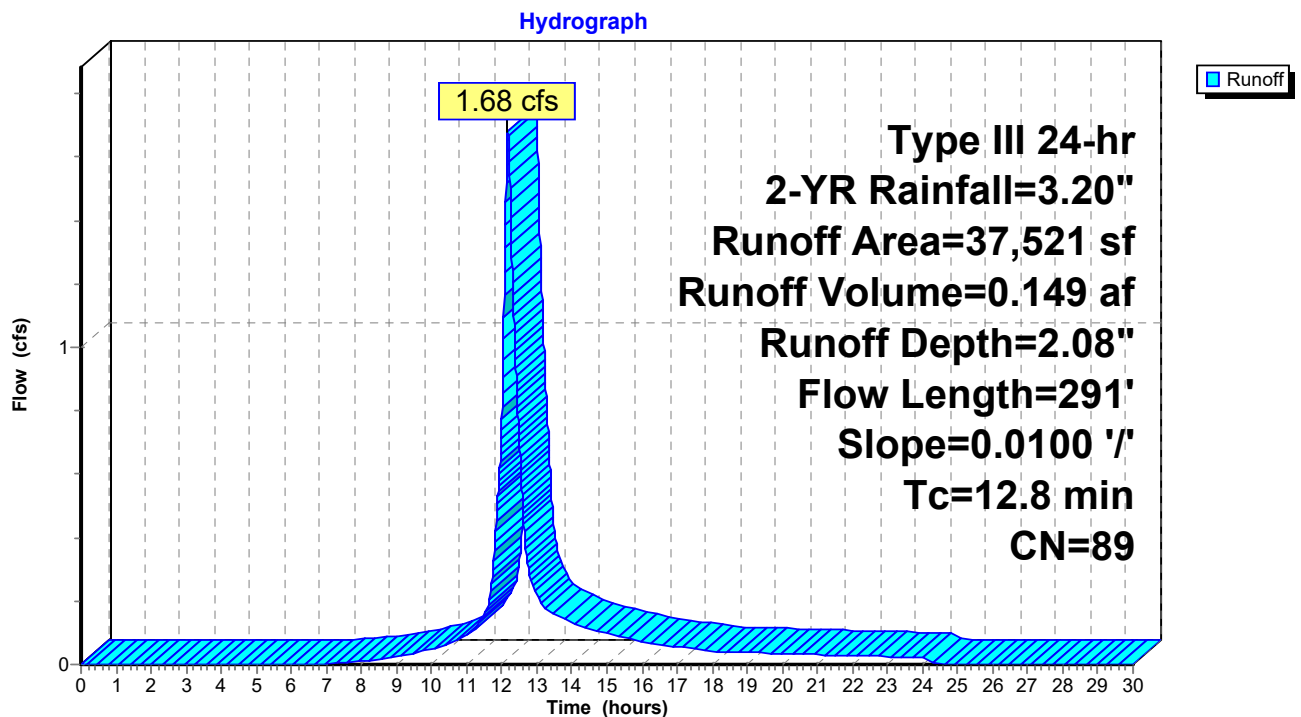
Runoff = 1.68 cfs @ 12.17 hrs, Volume= 0.149 af, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
14,283	98	Paved parking, HSG C
13,625	74	>75% Grass cover, Good, HSG C
9,613	98	Roofs, HSG C
37,521	89	Weighted Average
13,625		36.31% Pervious Area
23,896		63.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.1	14	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.9	227	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.8	291	Total			

### Subcatchment 4P: P1b



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 5P: CB3&4

Inflow Area = 0.861 ac, 63.69% Impervious, Inflow Depth = 2.08" for 2-YR event  
Inflow = 1.68 cfs @ 12.17 hrs, Volume= 0.149 af  
Outflow = 1.68 cfs @ 12.17 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.68 cfs @ 12.17 hrs, Volume= 0.149 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 212.91' @ 12.17 hrs

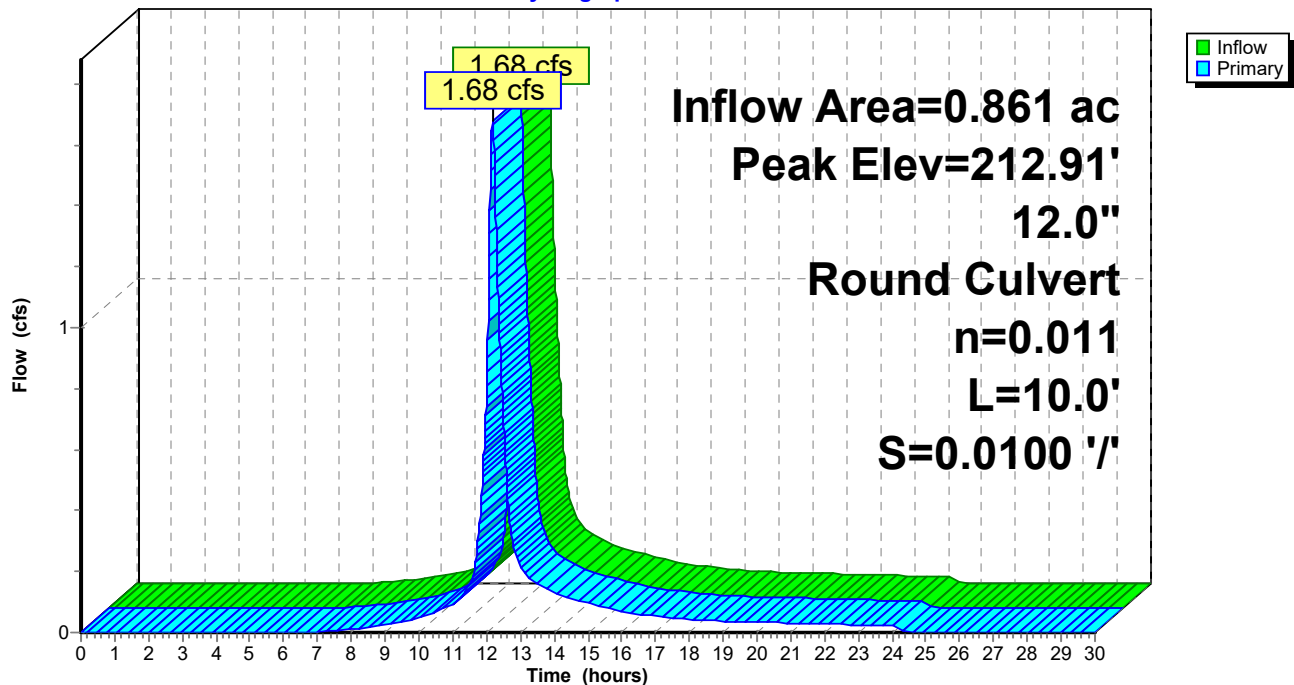
Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	<b>12.0" Round Culvert</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 212.10' / 212.00' S= 0.0100 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.68 cfs @ 12.17 hrs HW=212.91' (Free Discharge)

↑1=Culvert (Barrel Controls 1.68 cfs @ 3.38 fps)

### Pond 5P: CB3&4

Hydrograph



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 6P: P1c

Runoff = 0.95 cfs @ 12.11 hrs, Volume= 0.076 af, Depth= 2.54"

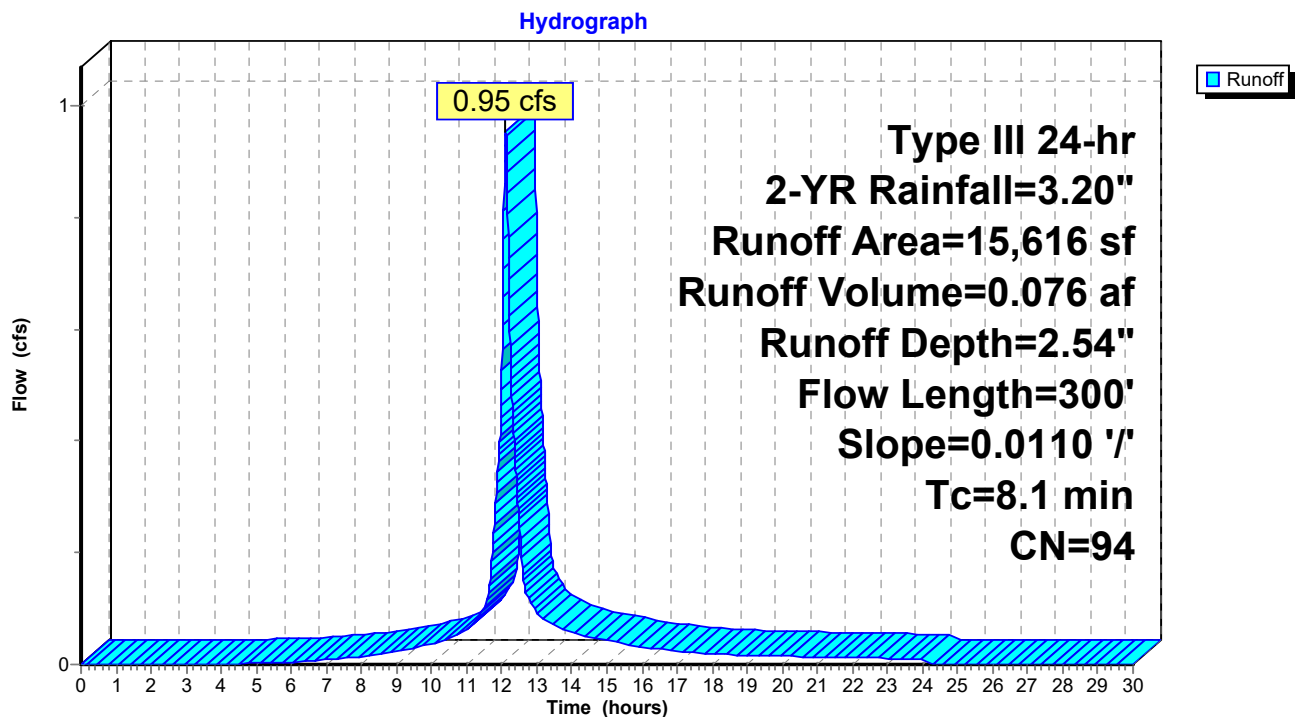
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
10,458	98	Paved parking, HSG C
2,411	74	>75% Grass cover, Good, HSG C
2,747	98	Roofs, HSG C
15,616	94	Weighted Average
2,411		15.44% Pervious Area
13,205		84.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	23	0.0110	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.5	27	0.0110	0.83		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
2.0	250	0.0110	2.13		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
8.1	300	Total			

### Subcatchment 6P: P1c



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 7P: CB5&6

Inflow Area = 0.358 ac, 84.56% Impervious, Inflow Depth = 2.54" for 2-YR event  
Inflow = 0.95 cfs @ 12.11 hrs, Volume= 0.076 af  
Outflow = 0.95 cfs @ 12.11 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.95 cfs @ 12.11 hrs, Volume= 0.076 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.17' @ 12.11 hrs

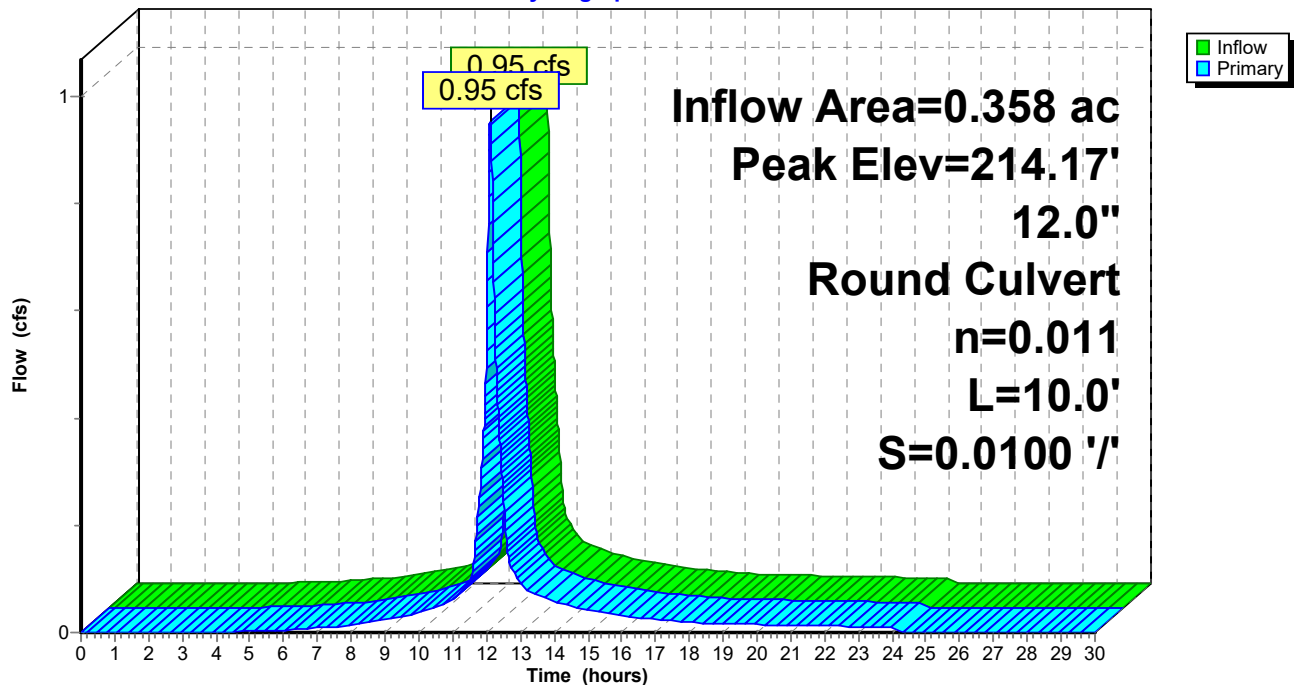
Device	Routing	Invert	Outlet Devices
#1	Primary	213.60'	<b>12.0" Round Culvert</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.60' / 213.50' S= 0.0100 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.95 cfs @ 12.11 hrs HW=214.17' (Free Discharge)

↑1=Culvert (Barrel Controls 0.95 cfs @ 2.98 fps)

### Pond 7P: CB5&6

Hydrograph



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 8P: DMH2

Inflow Area = 0.358 ac, 84.56% Impervious, Inflow Depth = 2.54" for 2-YR event  
Inflow = 0.95 cfs @ 12.11 hrs, Volume= 0.076 af  
Outflow = 0.95 cfs @ 12.11 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.95 cfs @ 12.11 hrs, Volume= 0.076 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 213.90' @ 12.11 hrs

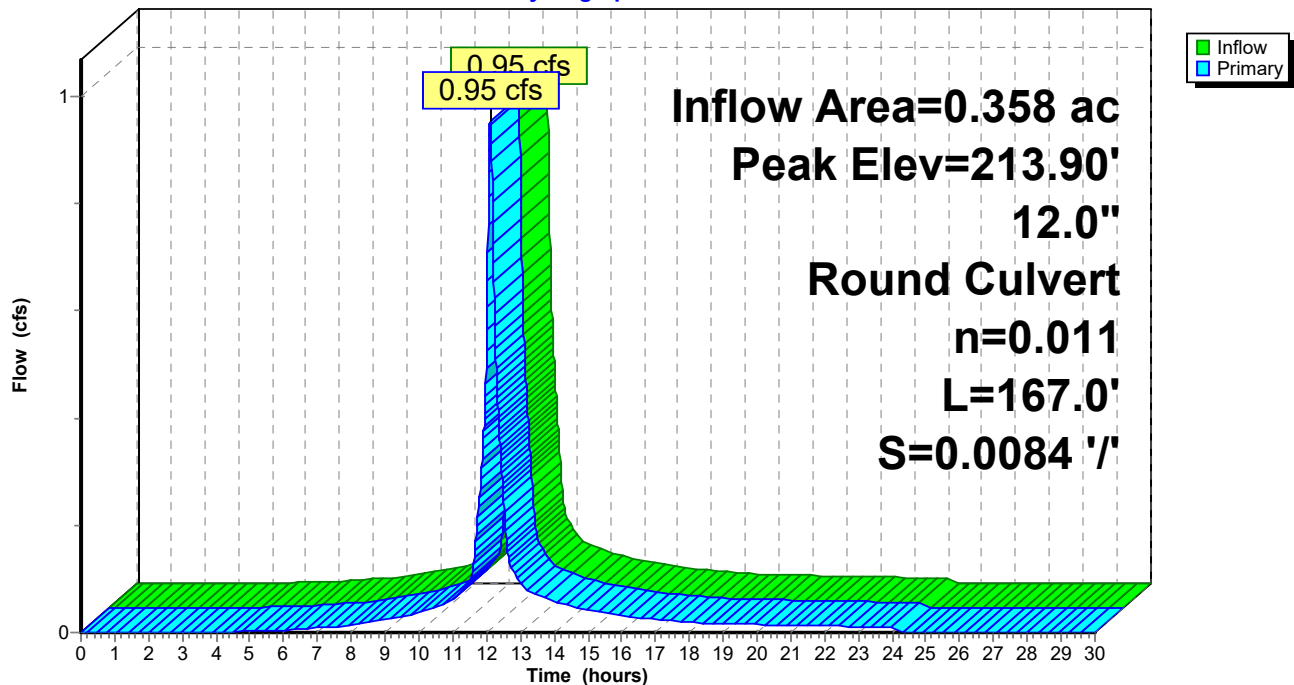
Device	Routing	Invert	Outlet Devices
#1	Primary	213.40'	<b>12.0" Round Culvert</b> L= 167.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.40' / 212.00' S= 0.0084 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.95 cfs @ 12.11 hrs HW=213.90' (Free Discharge)

↑1=Culvert (Inlet Controls 0.95 cfs @ 2.41 fps)

### Pond 8P: DMH2

Hydrograph



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 9P: DMH3

Inflow Area = 1.804 ac, 69.11% Impervious, Inflow Depth = 2.20" for 2-YR event  
Inflow = 3.73 cfs @ 12.15 hrs, Volume= 0.331 af  
Outflow = 3.73 cfs @ 12.15 hrs, Volume= 0.331 af, Atten= 0%, Lag= 0.0 min  
Primary = 3.73 cfs @ 12.15 hrs, Volume= 0.331 af

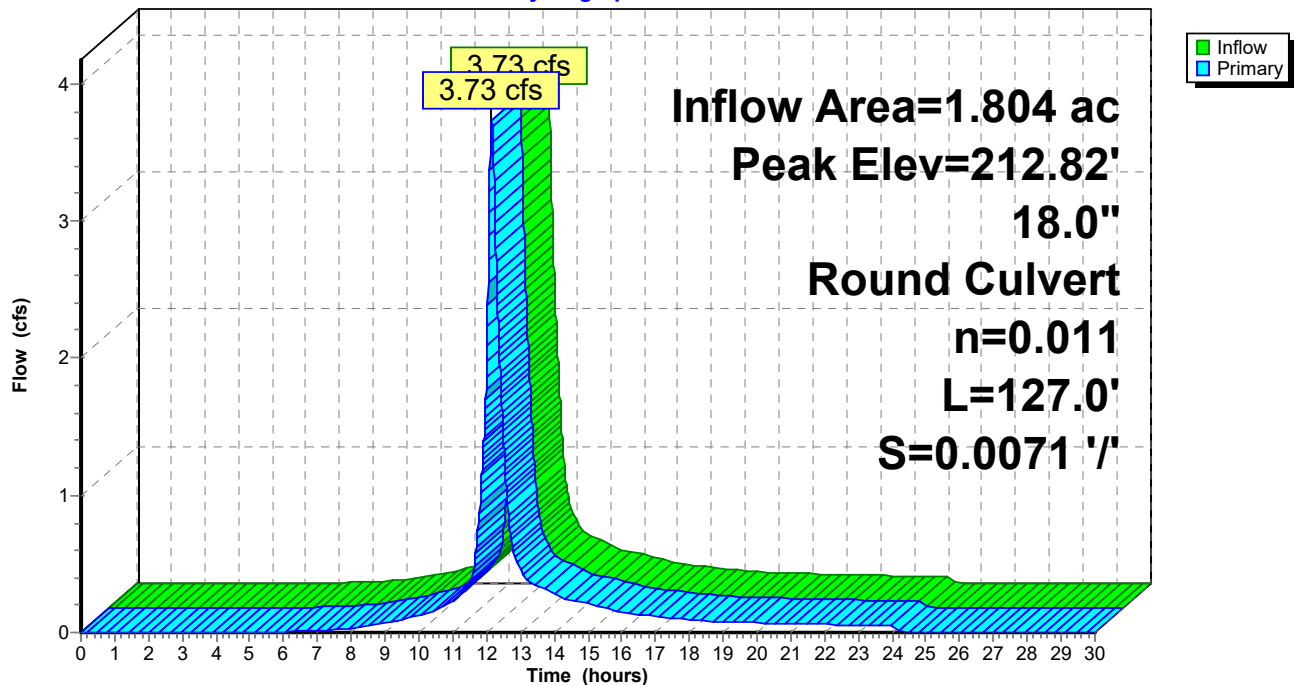
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 212.82' @ 12.15 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	211.90'	<b>18.0" Round Culvert</b> L= 127.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 211.90' / 211.00' S= 0.0071 '/' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=3.73 cfs @ 12.15 hrs HW=212.82' (Free Discharge)  
↑ **1=Culvert** (Inlet Controls 3.73 cfs @ 3.27 fps)

### Pond 9P: DMH3

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 10P: DMH4

Inflow Area = 1.804 ac, 69.11% Impervious, Inflow Depth = 2.20" for 2-YR event  
Inflow = 3.73 cfs @ 12.15 hrs, Volume= 0.331 af  
Outflow = 3.73 cfs @ 12.15 hrs, Volume= 0.331 af, Atten= 0%, Lag= 0.0 min  
Primary = 3.73 cfs @ 12.15 hrs, Volume= 0.331 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 211.93' @ 12.15 hrs

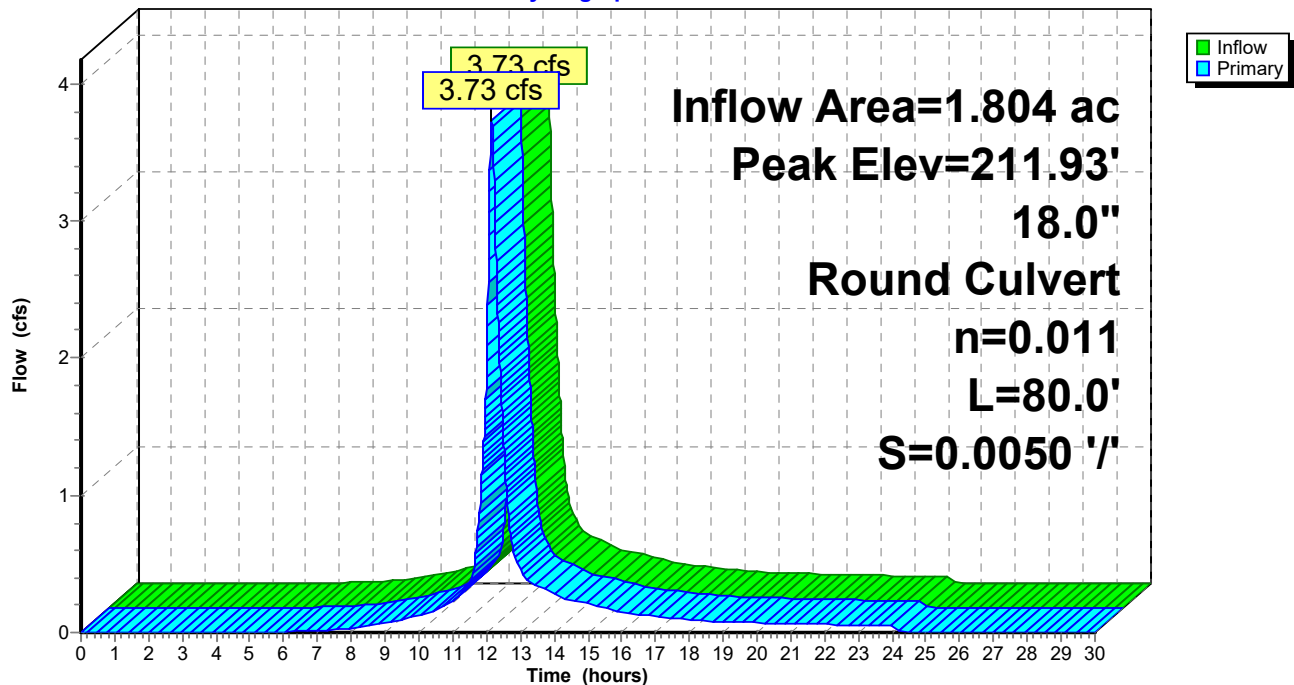
Device	Routing	Invert	Outlet Devices
#1	Primary	210.90'	<b>18.0" Round Culvert</b> L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.90' / 210.50' S= 0.0050 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=3.73 cfs @ 12.15 hrs HW=211.92' (Free Discharge)

↑1=Culvert (Barrel Controls 3.73 cfs @ 4.09 fps)

### Pond 10P: DMH4

#### Hydrograph





## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 11P: P1d

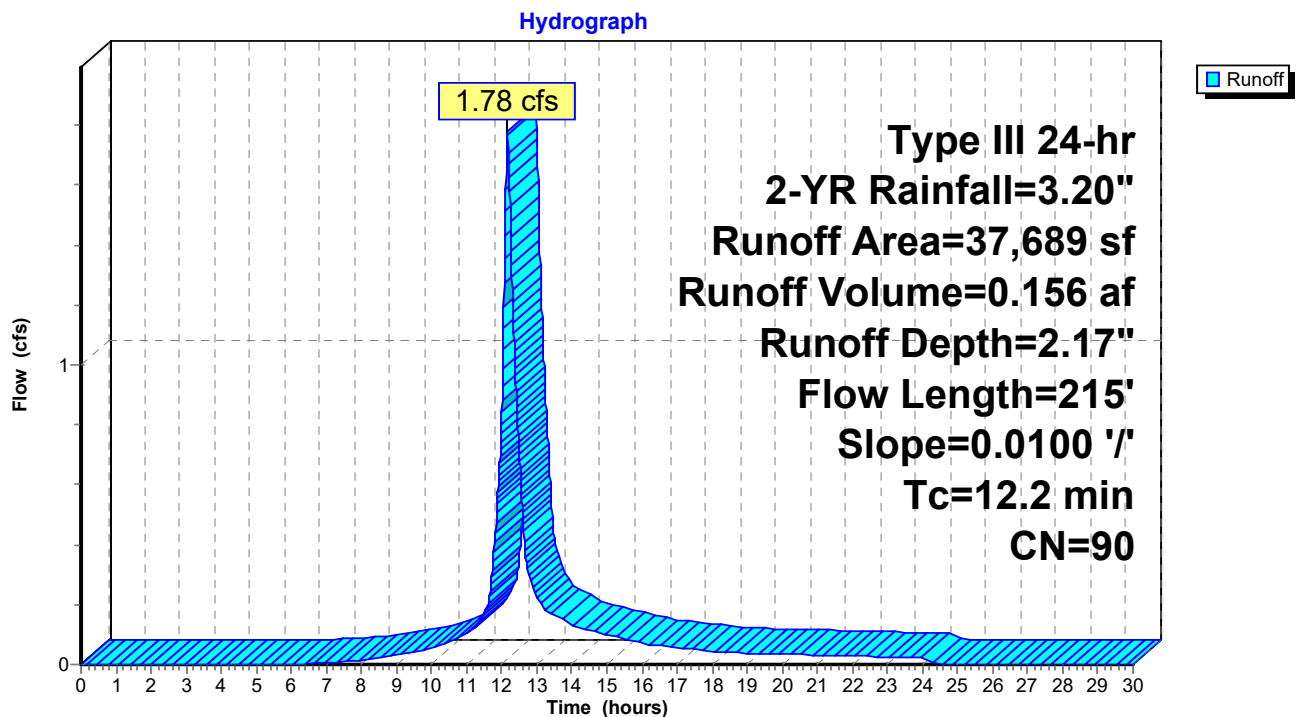
Runoff = 1.78 cfs @ 12.16 hrs, Volume= 0.156 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
19,670	98	Paved parking, HSG C
12,756	74	>75% Grass cover, Good, HSG C
5,263	98	Roofs, HSG C
37,689	90	Weighted Average
12,756		33.85% Pervious Area
24,933		66.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	15	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.2	215	Total			

### Subcatchment 11P: P1d



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 12P: CB7

Inflow Area = 0.865 ac, 66.15% Impervious, Inflow Depth = 2.17" for 2-YR event  
Inflow = 1.78 cfs @ 12.16 hrs, Volume= 0.156 af  
Outflow = 1.78 cfs @ 12.16 hrs, Volume= 0.156 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.78 cfs @ 12.16 hrs, Volume= 0.156 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 211.53' @ 12.16 hrs

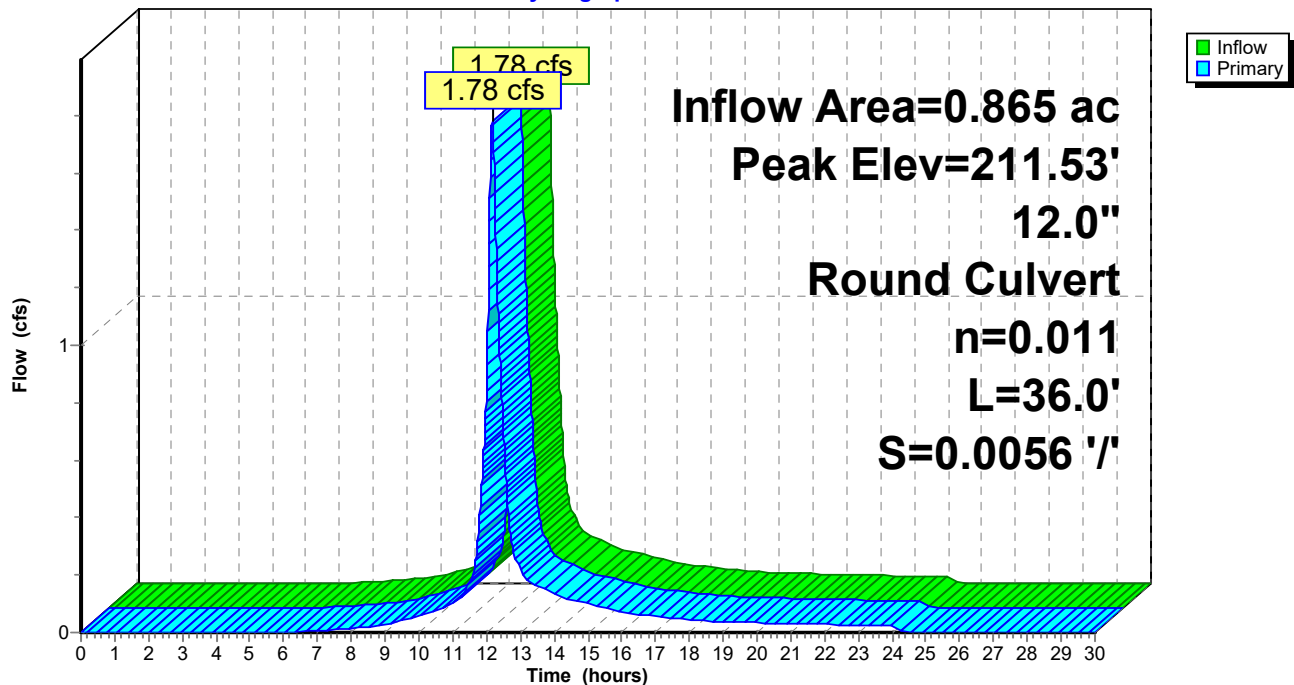
Device	Routing	Invert	Outlet Devices
#1	Primary	210.70'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.70' / 210.50' S= 0.0056 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.78 cfs @ 12.16 hrs HW=211.53' (Free Discharge)

↑1=Culvert (Barrel Controls 1.78 cfs @ 3.46 fps)

### Pond 12P: CB7

Hydrograph



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 13P: P1e

Runoff = 0.62 cfs @ 12.17 hrs, Volume= 0.056 af, Depth= 1.04"

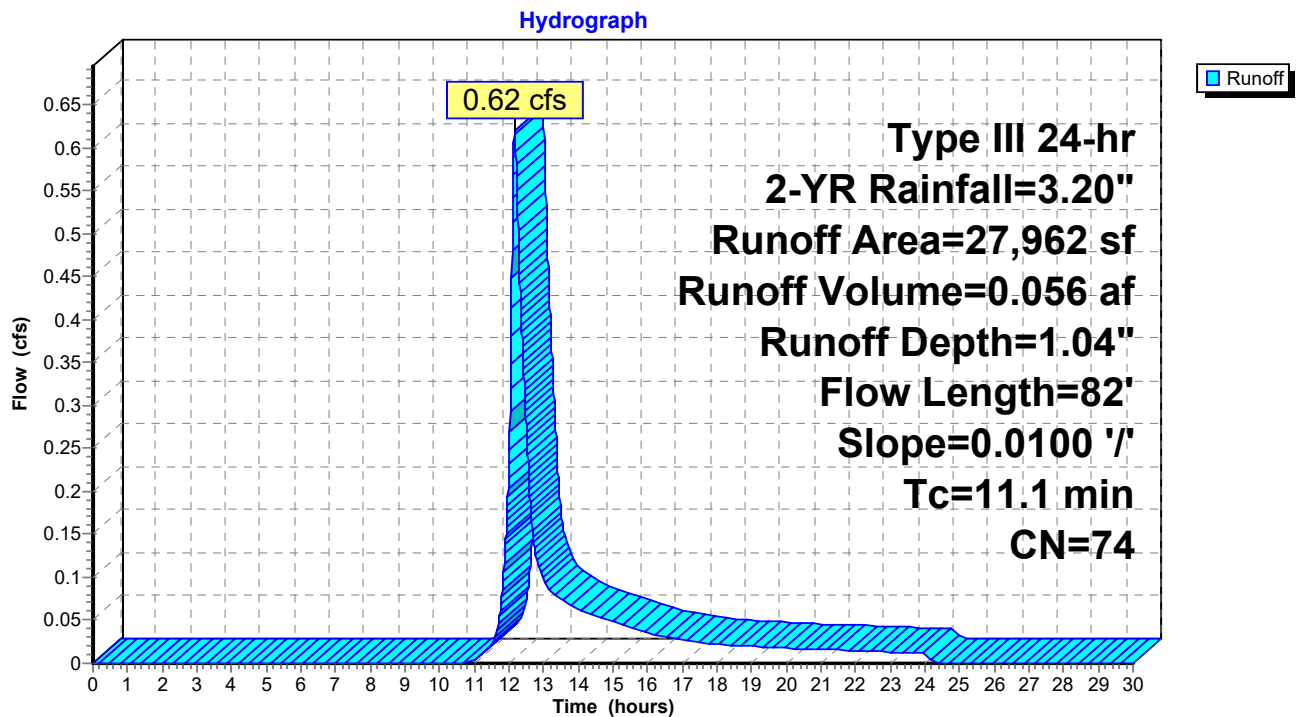
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
27,962	74	>75% Grass cover, Good, HSG C
27,962		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.3	32	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.1	82	Total			

### Subcatchment 13P: P1e



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 14P: P1f

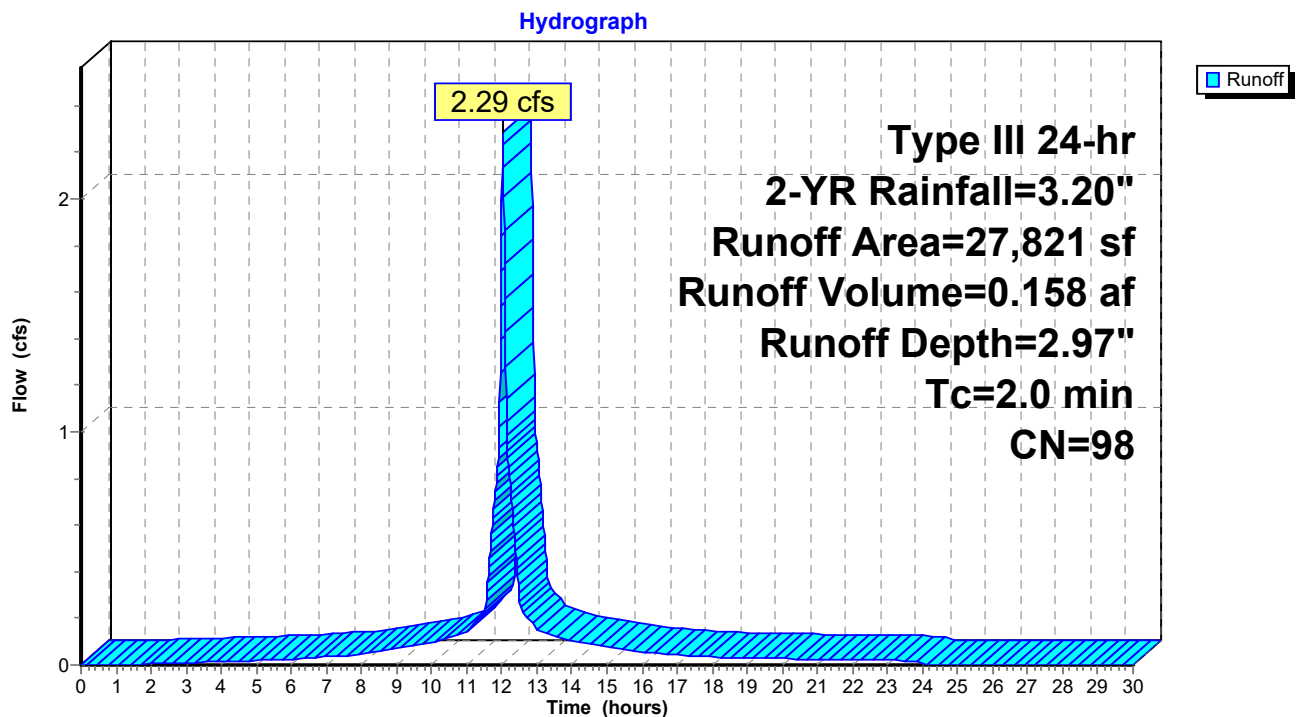
Runoff = 2.29 cfs @ 12.03 hrs, Volume= 0.158 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
27,821	98	Roofs, HSG C
27,821		100.00% Impervious Area

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

### Subcatchment 14P: P1f



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 15P: Roof Pipes

Inflow Area = 0.639 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2-YR event  
Inflow = 2.29 cfs @ 12.03 hrs, Volume= 0.158 af  
Outflow = 2.29 cfs @ 12.03 hrs, Volume= 0.158 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.29 cfs @ 12.03 hrs, Volume= 0.158 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.87' @ 12.03 hrs

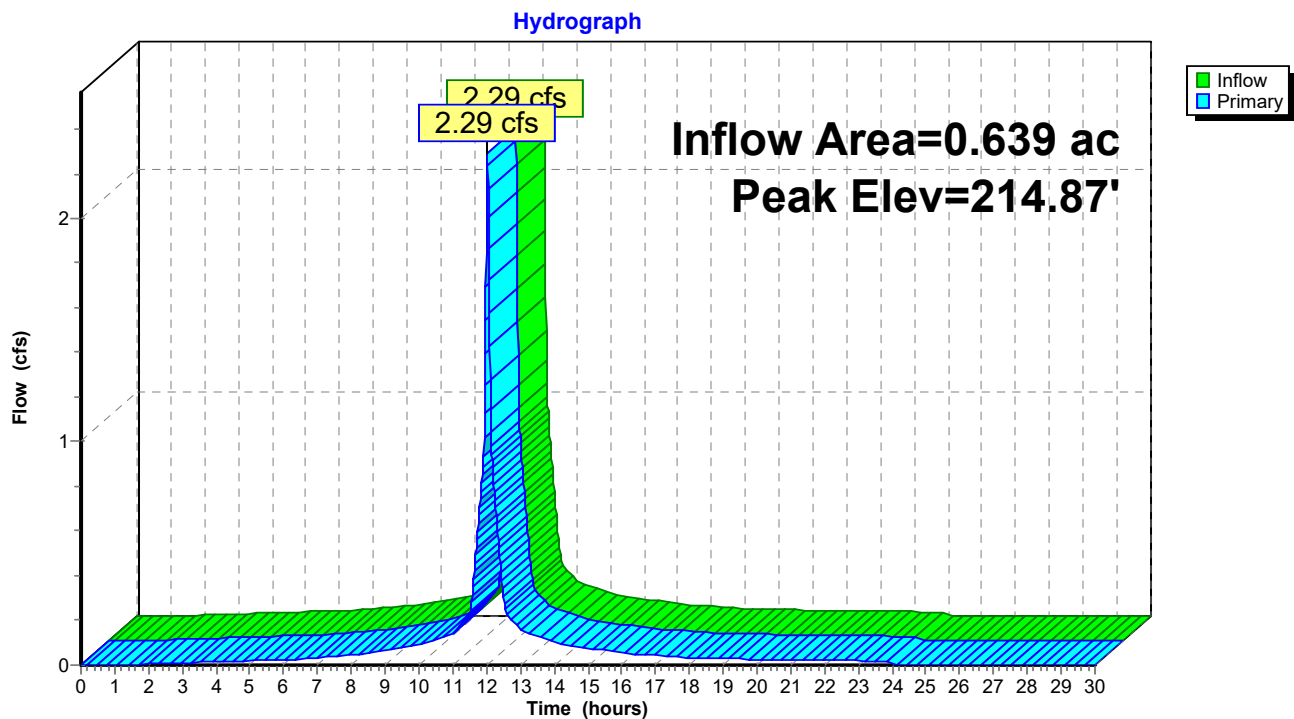
Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	<b>12.0" Round Culvert</b> L= 300.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.00' / 210.50' S= 0.0117 ' S= 0.0117 ' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#2	Primary	216.00'	<b>12.0" Round Culvert</b> L= 450.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 210.50' S= 0.0122 ' S= 0.0122 ' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.29 cfs @ 12.03 hrs HW=214.86' (Free Discharge)

1=Culvert (Inlet Controls 2.29 cfs @ 3.17 fps)

2=Culvert ( Controls 0.00 cfs)

### Pond 15P: Roof Pipes



## Stormwater Calculations

Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 16P: Basin #1

Inflow Area = 3.950 ac, 62.23% Impervious, Inflow Depth = 2.13" for 2-YR event  
Inflow = 7.06 cfs @ 12.15 hrs, Volume= 0.701 af  
Outflow = 0.39 cfs @ 15.37 hrs, Volume= 0.629 af, Atten= 94%, Lag= 193.2 min  
Discarded = 0.39 cfs @ 15.37 hrs, Volume= 0.629 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 211.63' @ 15.37 hrs Surf.Area= 16,498 sf Storage= 16,553 cf

Plug-Flow detention time= 402.6 min calculated for 0.629 af (90% of inflow)  
Center-of-Mass det. time= 352.3 min ( 1,154.1 - 801.8 )

Volume	Invert	Avail.Storage	Storage Description		
#1	210.50'	32,180 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
210.50	12,754	521.0	0	0	12,754
212.50	19,675	607.0	32,180	32,180	20,556

Device	Routing	Invert	Outlet Devices
#1	Primary	211.80'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 211.80 213.00 Width (feet) 6.00 6.00
#2	Discarded	210.50'	<b>1.020 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.39 cfs @ 15.37 hrs HW=211.63' (Free Discharge)  
↑**2=Exfiltration** (Exfiltration Controls 0.39 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=210.50' (Free Discharge)  
↑**1=Custom Weir/Orifice** ( Controls 0.00 cfs)

## Stormwater Calculations

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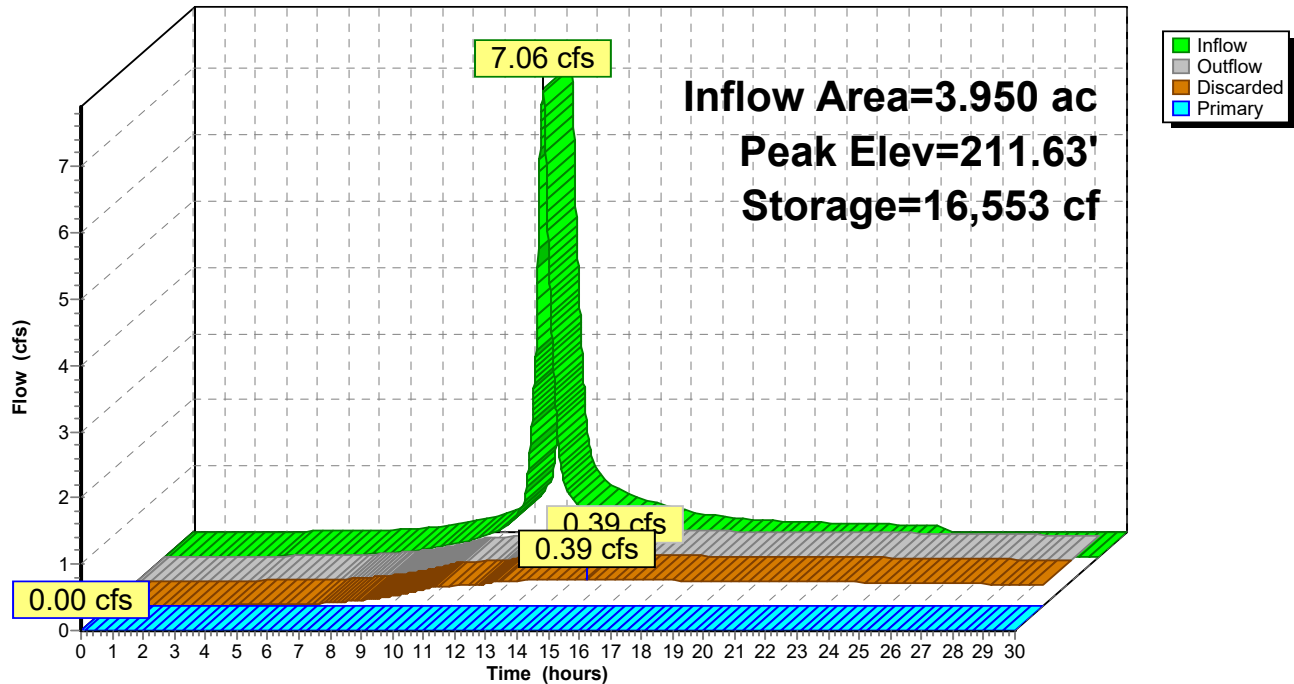
Type III 24-hr 2-YR Rainfall=3.20"

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### Pond 16P: Basin #1

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 17P: P1g

Runoff = 2.62 cfs @ 12.15 hrs, Volume= 0.229 af, Depth= 0.93"

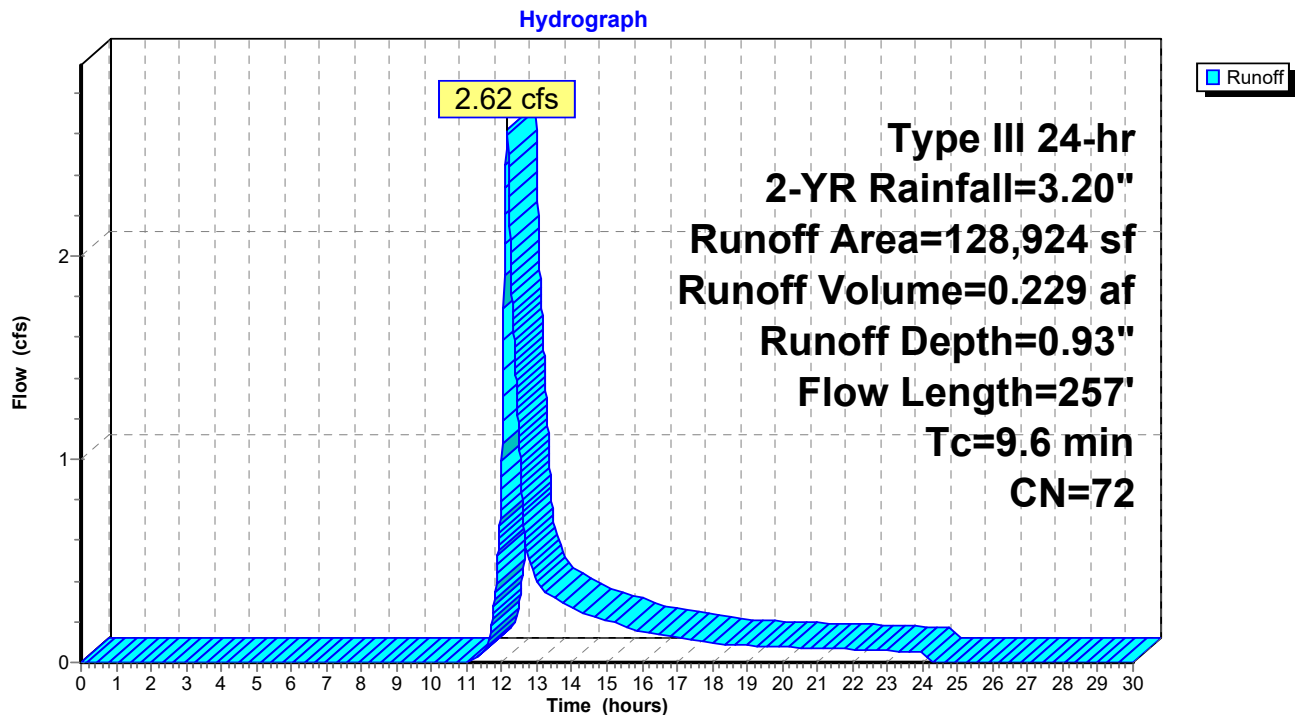
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
1,740	98	Paved parking, HSG C
50,163	74	>75% Grass cover, Good, HSG C
77,021	70	Woods, Good, HSG C
128,924	72	Weighted Average
127,184		98.65% Pervious Area
1,740		1.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	207	0.0240	2.49		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.6	257	Total			

### Subcatchment 17P: P1g





## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 18P: P1h

Runoff = 0.42 cfs @ 12.12 hrs, Volume= 0.033 af, Depth= 1.04"

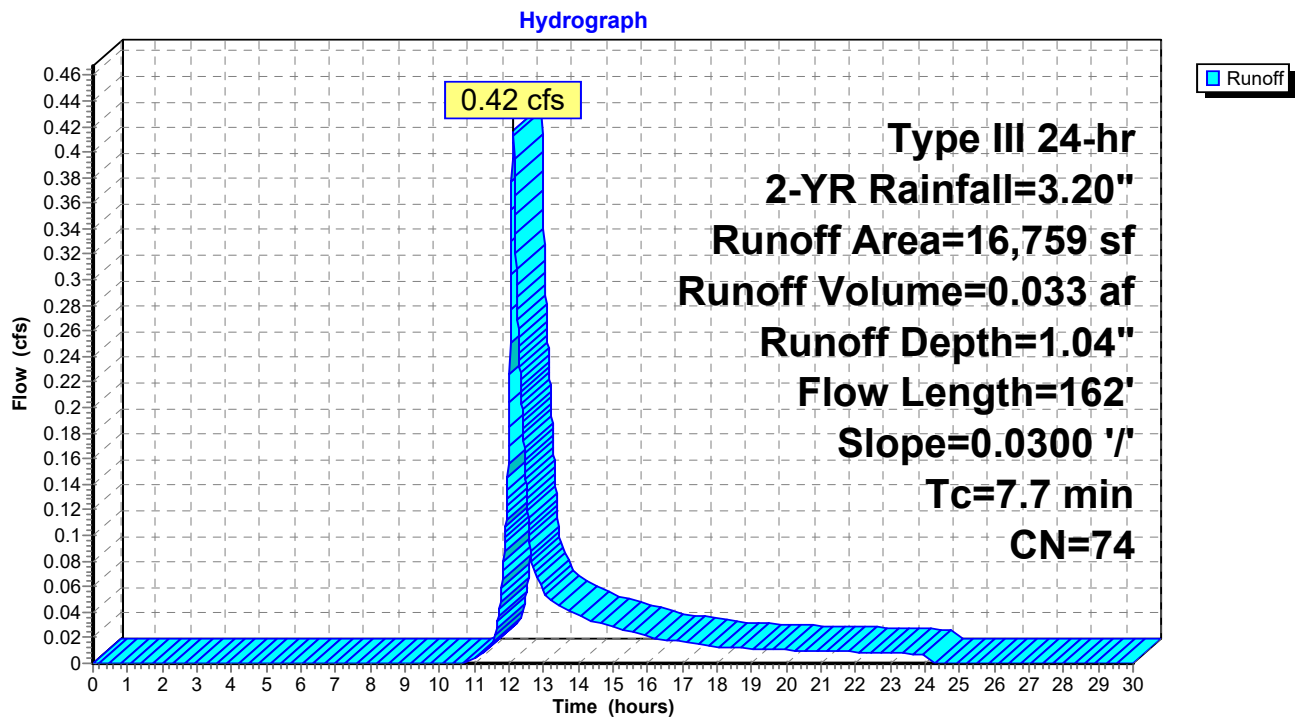
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
16,759	74	>75% Grass cover, Good, HSG C
16,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	112	0.0300	2.79		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.7	162	Total			

### Subcatchment 18P: P1h



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 19P: P1i

Runoff = 0.90 cfs @ 12.10 hrs, Volume= 0.068 af, Depth= 1.04"

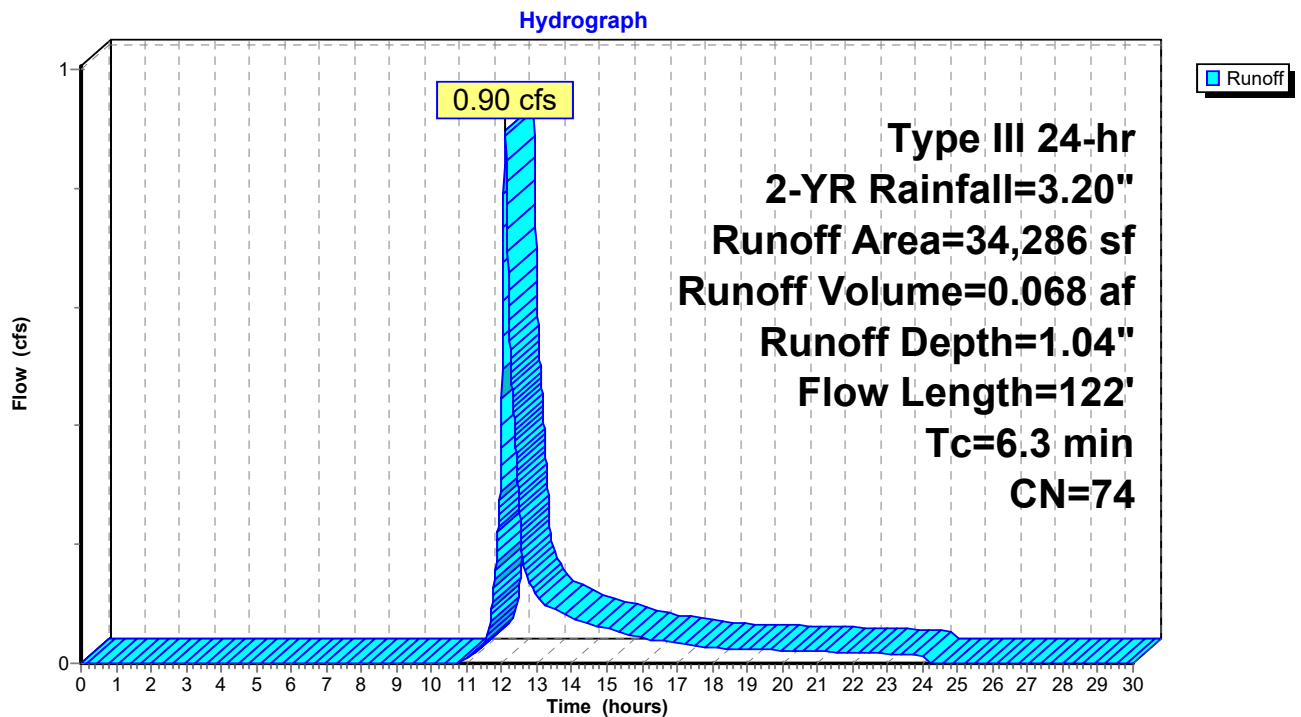
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
34,286	74	>75% Grass cover, Good, HSG C
34,286		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.1	72	0.9000	15.27		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.3	122	Total			

### Subcatchment 19P: P1i



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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 20P: P1j

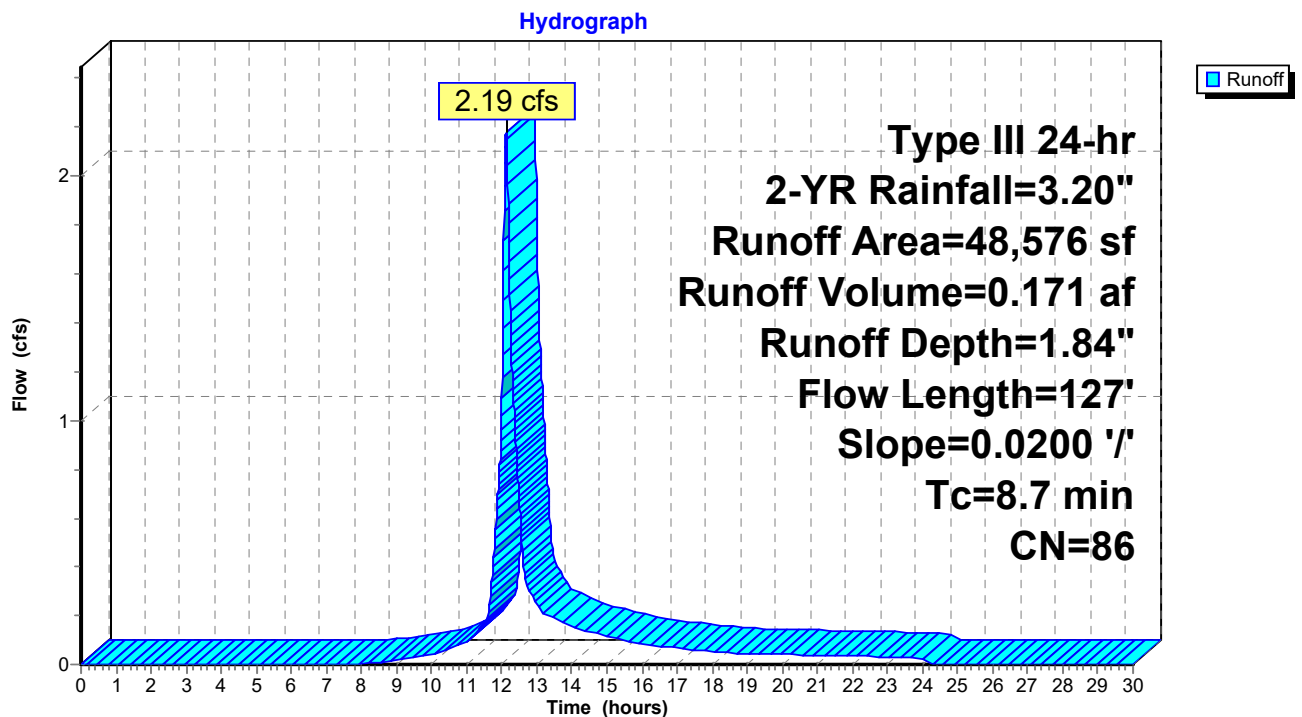
Runoff = 2.19 cfs @ 12.12 hrs, Volume= 0.171 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
24,897	98	Paved parking, HSG C
4,121	70	Woods, Good, HSG C
19,558	74	>75% Grass cover, Good, HSG C
48,576	86	Weighted Average
23,679		48.75% Pervious Area
24,897		51.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.4	57	0.0200	2.28		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.1	20	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
8.7	127	Total			

### Subcatchment 20P: P1j



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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 21P: Exist. CB

Inflow Area = 1.115 ac, 51.25% Impervious, Inflow Depth = 1.84" for 2-YR event  
Inflow = 2.19 cfs @ 12.12 hrs, Volume= 0.171 af  
Outflow = 2.19 cfs @ 12.12 hrs, Volume= 0.171 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.19 cfs @ 12.12 hrs, Volume= 0.171 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.24' @ 12.12 hrs

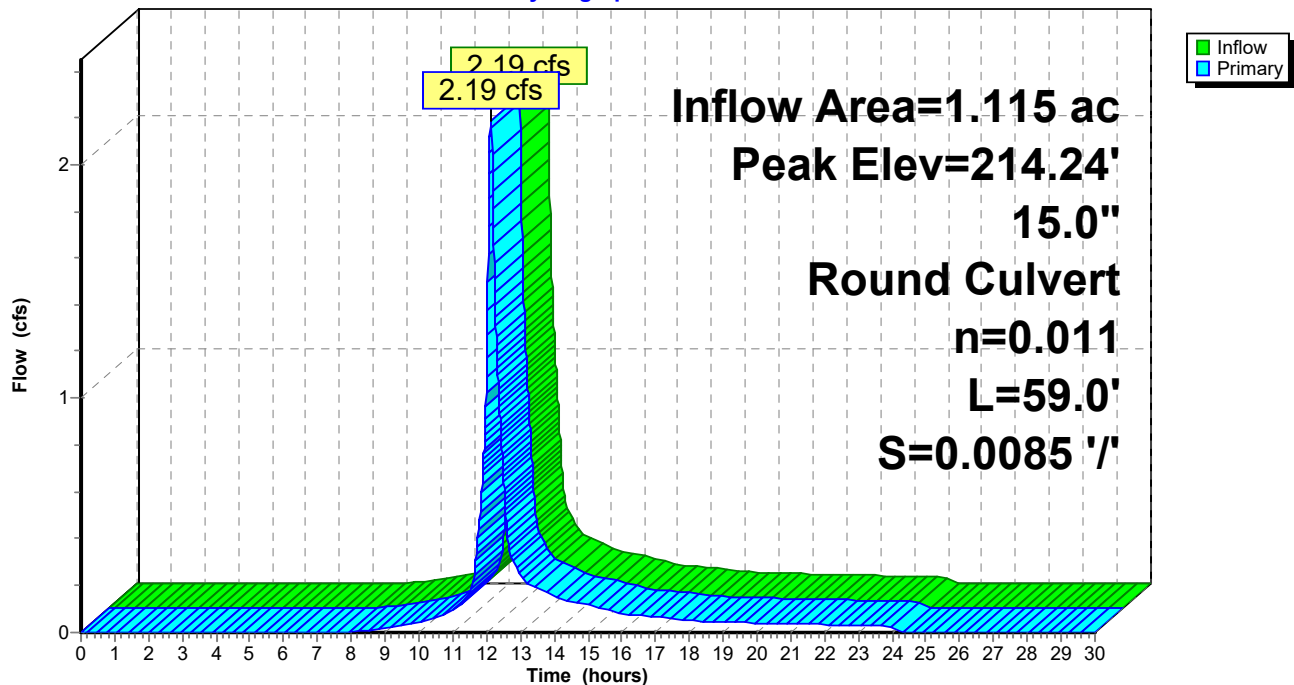
Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	<b>15.0" Round Culvert</b> L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.50' / 213.00' S= 0.0085 '/ Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

**Primary OutFlow** Max=2.18 cfs @ 12.12 hrs HW=214.24' (Free Discharge)

↑1=Culvert (Barrel Controls 2.18 cfs @ 4.13 fps)

### Pond 21P: Exist. CB

Hydrograph



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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 22P: Existing Basin

Inflow Area = 1.902 ac, 30.05% Impervious, Inflow Depth = 1.51" for 2-YR event  
Inflow = 3.06 cfs @ 12.12 hrs, Volume= 0.239 af  
Outflow = 0.62 cfs @ 12.60 hrs, Volume= 0.239 af, Atten= 80%, Lag= 28.9 min  
Discarded = 0.62 cfs @ 12.60 hrs, Volume= 0.239 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 213.27' @ 12.60 hrs Surf.Area= 11,122 sf Storage= 2,910 cf

Plug-Flow detention time= 33.2 min calculated for 0.239 af (100% of inflow)  
Center-of-Mass det. time= 33.2 min ( 868.8 - 835.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	32,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
213.00	10,659	0	0
214.00	12,392	11,526	11,526
215.50	15,086	20,609	32,134

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	<b>2.410 in/hr Exfiltration over Horizontal area</b>
#2	Primary	213.40'	<b>5.0' long x 0.8' breadth Level Spreader</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32
#3	Device 2	213.50'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.80 0.80 1.50 Width (feet) 0.25 0.25 8.00 8.00

**Discarded OutFlow** Max=0.62 cfs @ 12.60 hrs HW=213.27' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.62 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=213.00' (Free Discharge)

↑**2=Level Spreader** ( Controls 0.00 cfs)

↑**3=Custom Weir/Orifice** ( Controls 0.00 cfs)

## Stormwater Calculations

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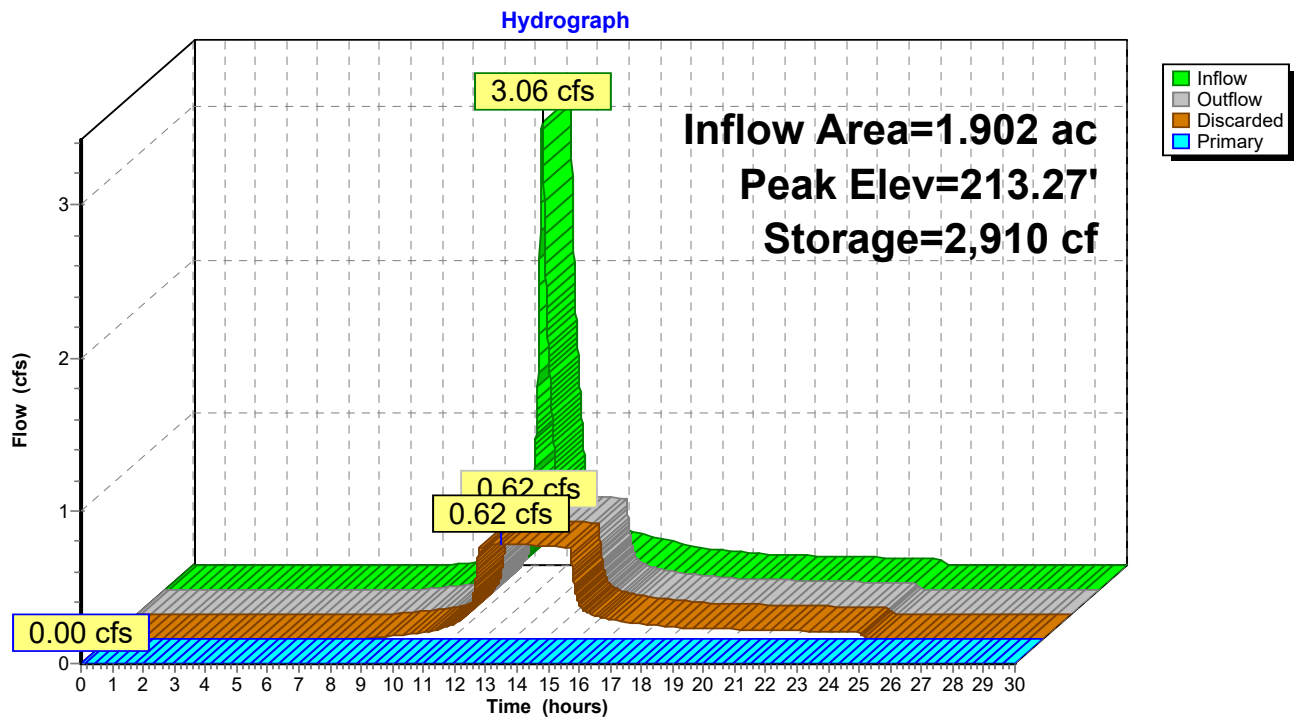
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Type III 24-hr 2-YR Rainfall=3.20"

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### Pond 22P: Existing Basin



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Type III 24-hr 2-YR Rainfall=3.20"

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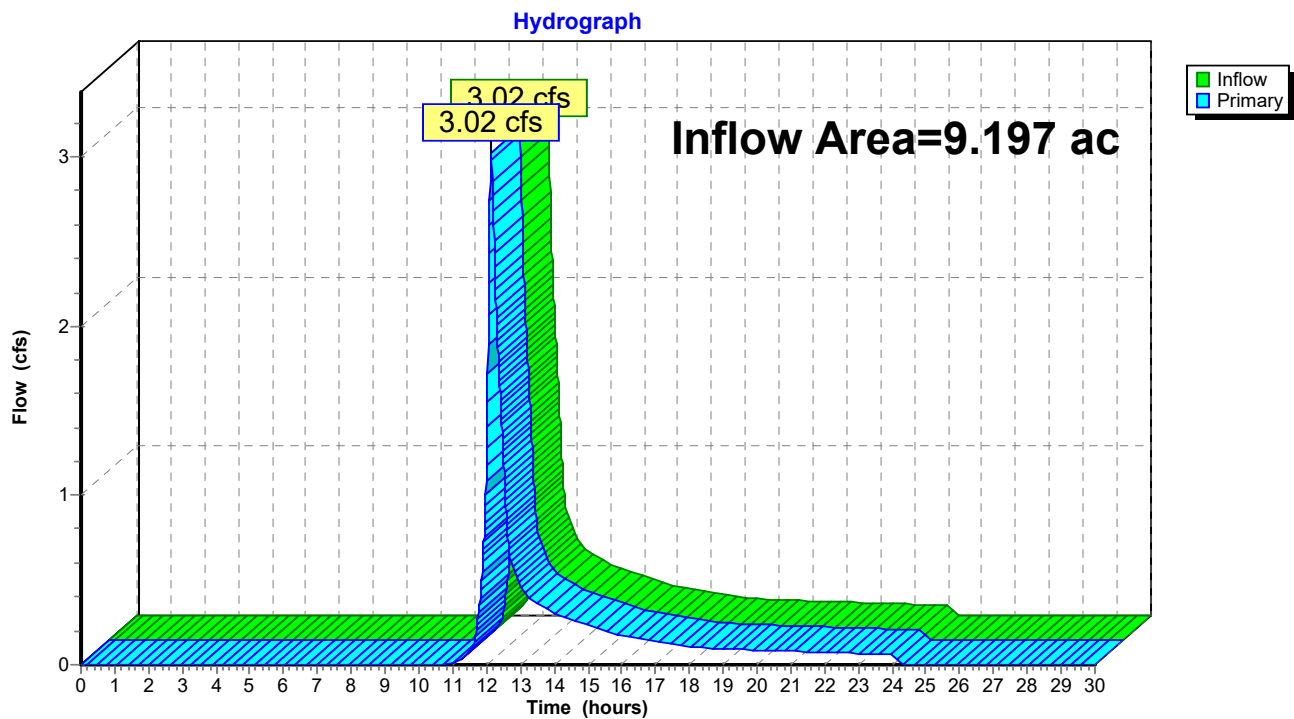
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### Summary for Link 23P: Design Point #1: Flow to Shadowfax Farm

Inflow Area = 9.197 ac, 33.38% Impervious, Inflow Depth = 0.34" for 2-YR event  
Inflow = 3.02 cfs @ 12.14 hrs, Volume= 0.263 af  
Primary = 3.02 cfs @ 12.14 hrs, Volume= 0.263 af, Atten= 0%, Lag= 0.0 min

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

### Link 23P: Design Point #1: Flow to Shadowfax Farm



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Type III 24-hr 10-YR Rainfall=4.70"

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

### Subcatchment1P: P1a

Runoff Area=25,448 sf 67.62% Impervious Runoff Depth=3.59"  
Flow Length=195' Slope=0.0100 '/' Tc=12.0 min CN=90 Runoff=1.96 cfs 0.175 af

### Pond 2P: CB 1&2

Peak Elev=215.33' Inflow=1.96 cfs 0.175 af  
12.0" Round Culvert n=0.011 L=16.0' S=0.0125 '/' Outflow=1.96 cfs 0.175 af

### Pond 3P: DMH 1

Peak Elev=214.98' Inflow=1.96 cfs 0.175 af  
12.0" Round Culvert n=0.011 L=266.0' S=0.0083 '/' Outflow=1.96 cfs 0.175 af

### Subcatchment4P: P1b

Runoff Area=37,521 sf 63.69% Impervious Runoff Depth=3.49"  
Flow Length=291' Slope=0.0100 '/' Tc=12.8 min CN=89 Runoff=2.76 cfs 0.250 af

### Pond 5P: CB3&4

Peak Elev=213.24' Inflow=2.76 cfs 0.250 af  
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=2.76 cfs 0.250 af

### Subcatchment6P: P1c

Runoff Area=15,616 sf 84.56% Impervious Runoff Depth=4.01"  
Flow Length=300' Slope=0.0110 '/' Tc=8.1 min CN=94 Runoff=1.47 cfs 0.120 af

### Pond 7P: CB5&6

Peak Elev=214.34' Inflow=1.47 cfs 0.120 af  
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=1.47 cfs 0.120 af

### Pond 8P: DMH2

Peak Elev=214.05' Inflow=1.47 cfs 0.120 af  
12.0" Round Culvert n=0.011 L=167.0' S=0.0084 '/' Outflow=1.47 cfs 0.120 af

### Pond 9P: DMH3

Peak Elev=213.16' Inflow=6.03 cfs 0.545 af  
18.0" Round Culvert n=0.011 L=127.0' S=0.0071 '/' Outflow=6.03 cfs 0.545 af

### Pond 10P: DMH4

Peak Elev=212.30' Inflow=6.03 cfs 0.545 af  
18.0" Round Culvert n=0.011 L=80.0' S=0.0050 '/' Outflow=6.03 cfs 0.545 af

### Subcatchment11P: P1d

Runoff Area=37,689 sf 66.15% Impervious Runoff Depth=3.59"  
Flow Length=215' Slope=0.0100 '/' Tc=12.2 min CN=90 Runoff=2.89 cfs 0.259 af

### Pond 12P: CB7

Peak Elev=211.90' Inflow=2.89 cfs 0.259 af  
12.0" Round Culvert n=0.011 L=36.0' S=0.0056 '/' Outflow=2.89 cfs 0.259 af

### Subcatchment13P: P1e

Runoff Area=27,962 sf 0.00% Impervious Runoff Depth=2.13"  
Flow Length=82' Slope=0.0100 '/' Tc=11.1 min CN=74 Runoff=1.34 cfs 0.114 af

### Subcatchment14P: P1f

Runoff Area=27,821 sf 100.00% Impervious Runoff Depth=4.46"  
Tc=2.0 min CN=98 Runoff=3.39 cfs 0.238 af

### Pond 15P: Roof Pipes

Peak Elev=215.30' Inflow=3.39 cfs 0.238 af  
Outflow=3.39 cfs 0.238 af

### Pond 16P: Basin #1

Peak Elev=212.03' Storage=23,371 cf Inflow=11.63 cfs 1.155 af  
Discarded=0.42 cfs 0.704 af Primary=2.19 cfs 0.275 af Outflow=2.61 cfs 0.979 af



## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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### Subcatchment 17P: P1g

Runoff Area=128,924 sf 1.35% Impervious Runoff Depth=1.97"  
Flow Length=257' Tc=9.6 min CN=72 Runoff=5.94 cfs 0.486 af

### Subcatchment 18P: P1h

Runoff Area=16,759 sf 0.00% Impervious Runoff Depth=2.13"  
Flow Length=162' Slope=0.0300 '/' Tc=7.7 min CN=74 Runoff=0.90 cfs 0.068 af

### Subcatchment 19P: P1i

Runoff Area=34,286 sf 0.00% Impervious Runoff Depth=2.13"  
Flow Length=122' Tc=6.3 min CN=74 Runoff=1.93 cfs 0.140 af

### Subcatchment 20P: P1j

Runoff Area=48,576 sf 51.25% Impervious Runoff Depth=3.19"  
Flow Length=127' Slope=0.0200 '/' Tc=8.7 min CN=86 Runoff=3.76 cfs 0.296 af

### Pond 21P: Exist. CB

Peak Elev=214.55' Inflow=3.76 cfs 0.296 af  
15.0" Round Culvert n=0.011 L=59.0' S=0.0085 '/' Outflow=3.76 cfs 0.296 af

### Pond 22P: Existing Basin

Peak Elev=213.62' Storage=6,907 cf Inflow=5.63 cfs 0.436 af  
Discarded=0.65 cfs 0.432 af Primary=0.03 cfs 0.003 af Outflow=0.69 cfs 0.436 af

### Link 23P: Design Point #1: Flow to Shadowfax Farm

Inflow=6.81 cfs 0.833 af  
Primary=6.81 cfs 0.833 af

**Total Runoff Area = 9.197 ac Runoff Volume = 2.145 af Average Runoff Depth = 2.80"**  
**66.62% Pervious = 6.127 ac 33.38% Impervious = 3.069 ac**

## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 1P: P1a

Runoff = 1.96 cfs @ 12.16 hrs, Volume= 0.175 af, Depth= 3.59"

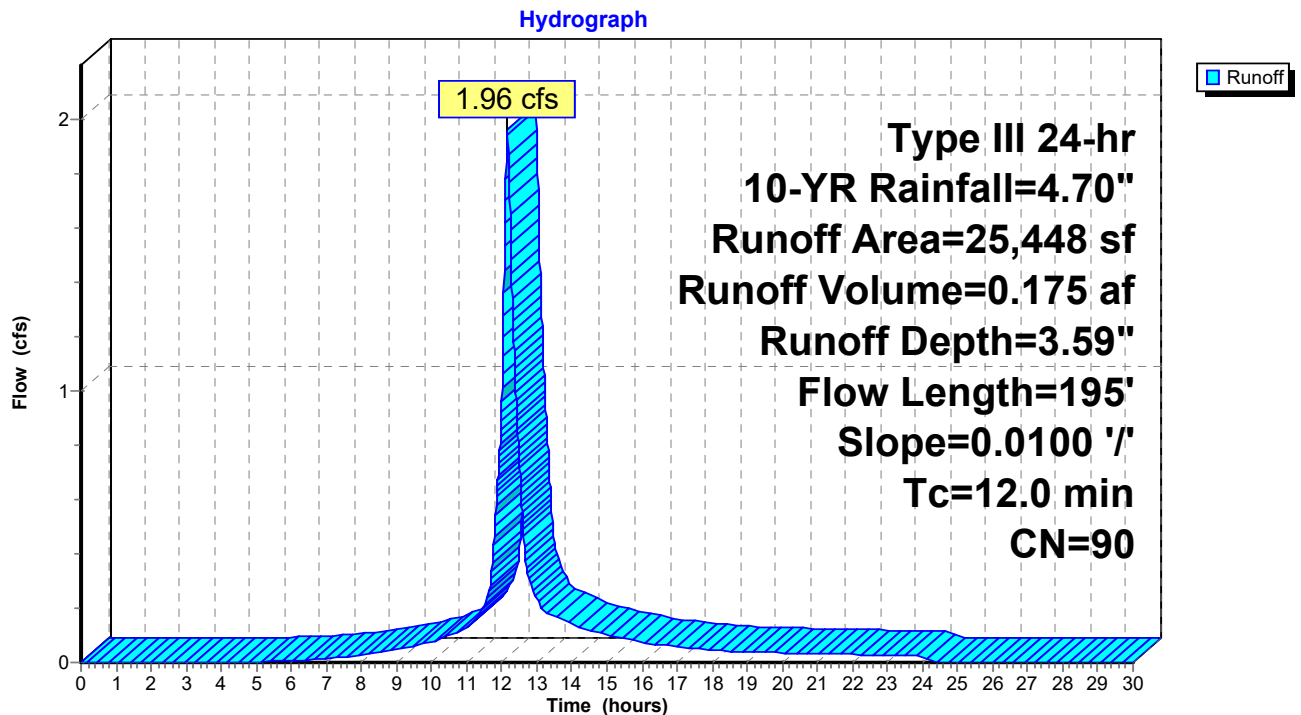
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
11,922	98	Paved parking, HSG C
8,239	74	>75% Grass cover, Good, HSG C
5,287	98	Roofs, HSG C
25,448	90	Weighted Average
8,239		32.38% Pervious Area
17,209		67.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	21	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.0	124	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.0	195	Total			

### Subcatchment 1P: P1a



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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 2P: CB 1&2

Inflow Area = 0.584 ac, 67.62% Impervious, Inflow Depth = 3.59" for 10-YR event  
Inflow = 1.96 cfs @ 12.16 hrs, Volume= 0.175 af  
Outflow = 1.96 cfs @ 12.16 hrs, Volume= 0.175 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.96 cfs @ 12.16 hrs, Volume= 0.175 af

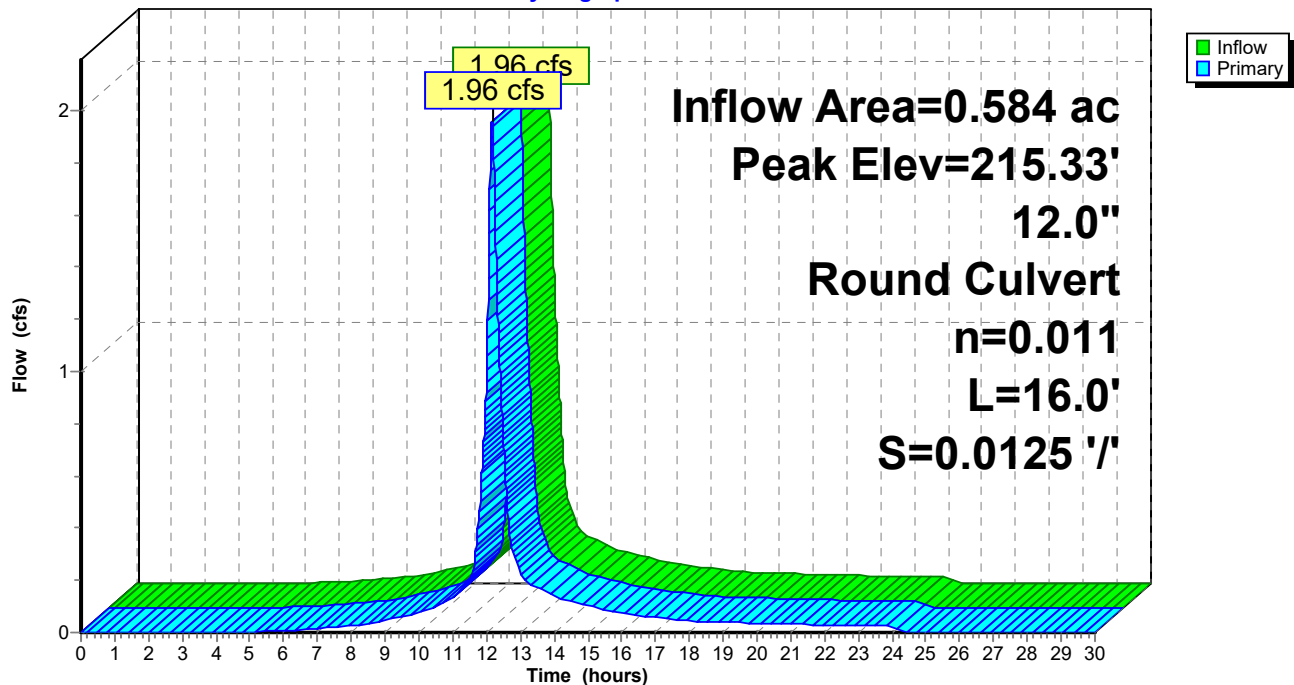
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 215.33' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	214.50'	<b>12.0" Round Culvert</b> L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.50' / 214.30' S= 0.0125 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.96 cfs @ 12.16 hrs HW=215.33' (Free Discharge)  
↑1=Culvert (Barrel Controls 1.96 cfs @ 3.81 fps)

### Pond 2P: CB 1&2

Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 3P: DMH 1

Inflow Area = 0.584 ac, 67.62% Impervious, Inflow Depth = 3.59" for 10-YR event  
Inflow = 1.96 cfs @ 12.16 hrs, Volume= 0.175 af  
Outflow = 1.96 cfs @ 12.16 hrs, Volume= 0.175 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.96 cfs @ 12.16 hrs, Volume= 0.175 af

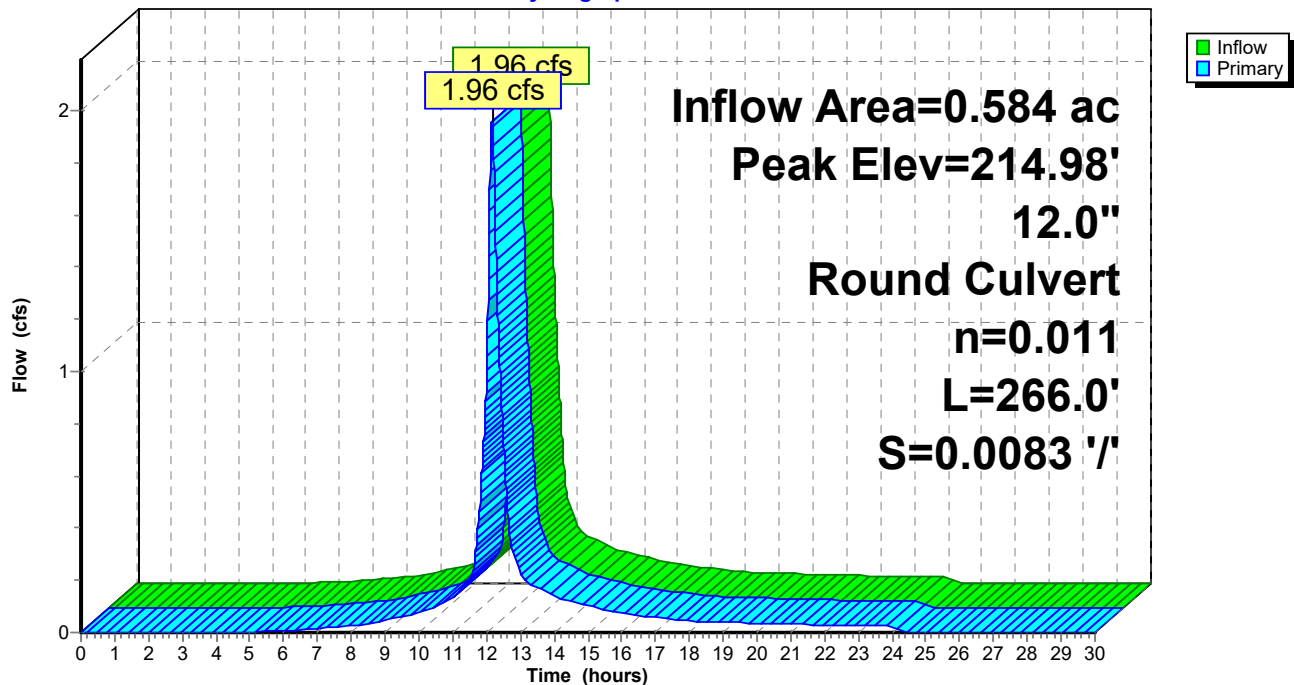
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 214.98' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	214.20'	<b>12.0" Round Culvert</b> L= 266.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.20' / 212.00' S= 0.0083 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.96 cfs @ 12.16 hrs HW=214.98' (Free Discharge)  
↑ **1=Culvert** (Inlet Controls 1.96 cfs @ 3.00 fps)

### Pond 3P: DMH 1

Hydrograph



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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 4P: P1b

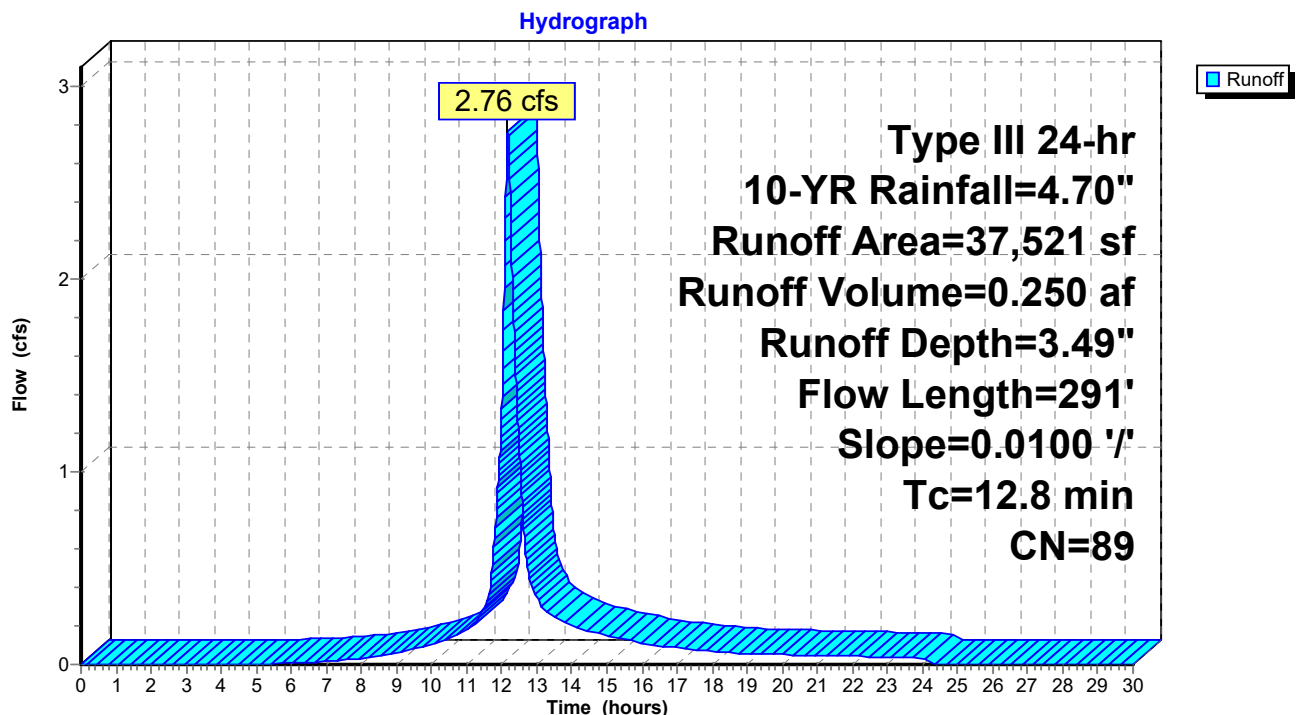
Runoff = 2.76 cfs @ 12.17 hrs, Volume= 0.250 af, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
14,283	98	Paved parking, HSG C
13,625	74	>75% Grass cover, Good, HSG C
9,613	98	Roofs, HSG C
37,521	89	Weighted Average
13,625		36.31% Pervious Area
23,896		63.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.1	14	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.9	227	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.8	291	Total			

### Subcatchment 4P: P1b



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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 5P: CB3&4

Inflow Area = 0.861 ac, 63.69% Impervious, Inflow Depth = 3.49" for 10-YR event  
Inflow = 2.76 cfs @ 12.17 hrs, Volume= 0.250 af  
Outflow = 2.76 cfs @ 12.17 hrs, Volume= 0.250 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.76 cfs @ 12.17 hrs, Volume= 0.250 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 213.24' @ 12.17 hrs

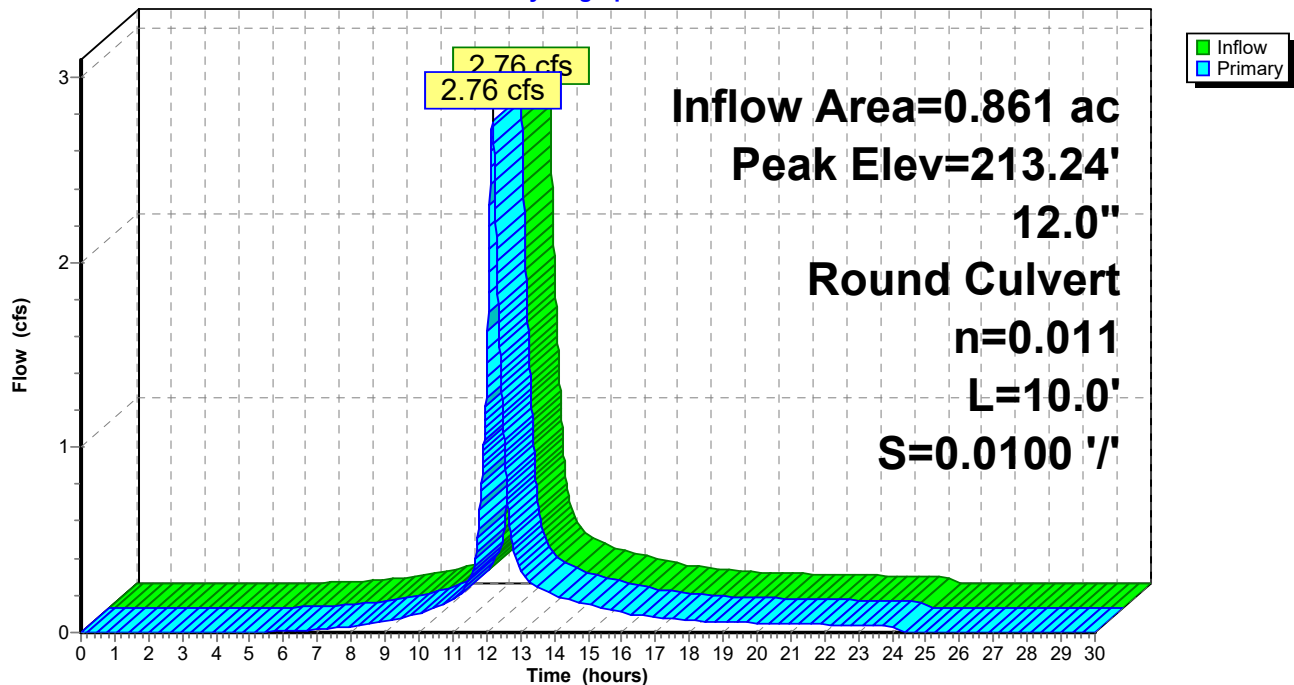
Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	<b>12.0" Round Culvert</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 212.10' / 212.00' S= 0.0100 '/' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.76 cfs @ 12.17 hrs HW=213.24' (Free Discharge)

↑1=Culvert (Barrel Controls 2.76 cfs @ 3.85 fps)

### Pond 5P: CB3&4

Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 6P: P1c

Runoff = 1.47 cfs @ 12.11 hrs, Volume= 0.120 af, Depth= 4.01"

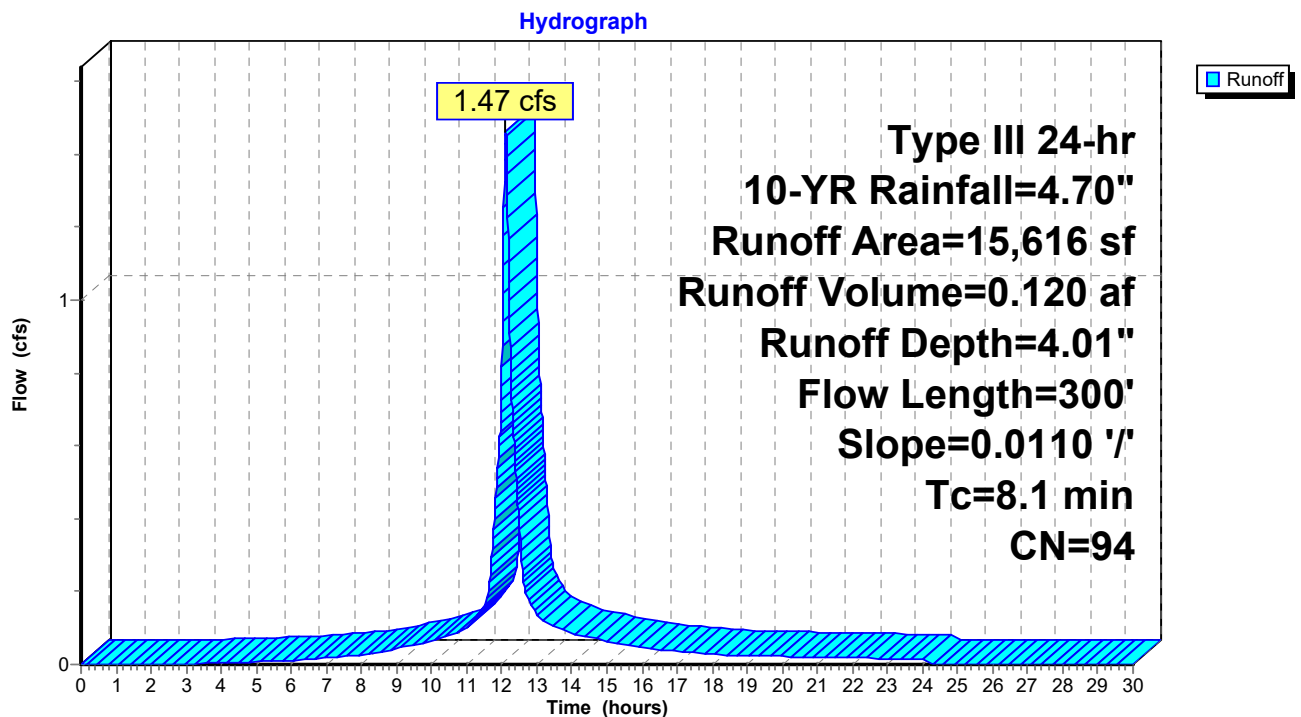
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
10,458	98	Paved parking, HSG C
2,411	74	>75% Grass cover, Good, HSG C
2,747	98	Roofs, HSG C
15,616	94	Weighted Average
2,411		15.44% Pervious Area
13,205		84.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	23	0.0110	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.5	27	0.0110	0.83		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
2.0	250	0.0110	2.13		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
8.1	300	Total			

### Subcatchment 6P: P1c



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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 7P: CB5&6

Inflow Area = 0.358 ac, 84.56% Impervious, Inflow Depth = 4.01" for 10-YR event  
Inflow = 1.47 cfs @ 12.11 hrs, Volume= 0.120 af  
Outflow = 1.47 cfs @ 12.11 hrs, Volume= 0.120 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.47 cfs @ 12.11 hrs, Volume= 0.120 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.34' @ 12.11 hrs

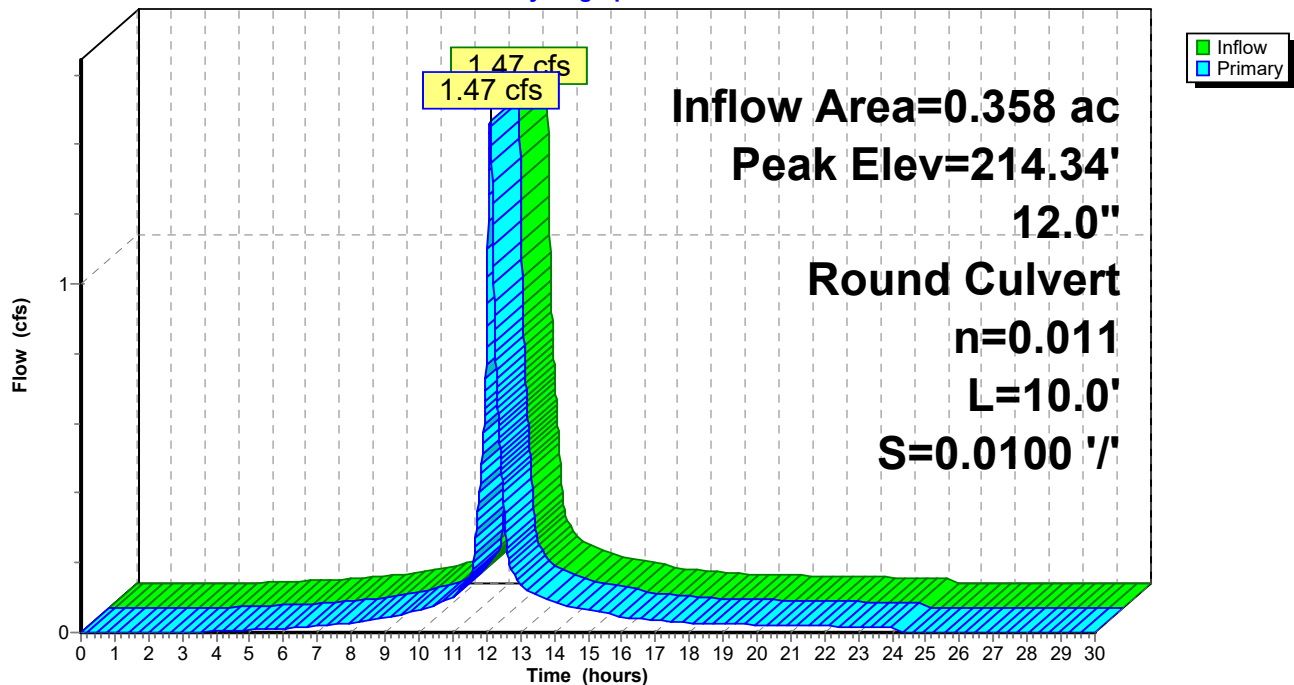
Device	Routing	Invert	Outlet Devices
#1	Primary	213.60'	<b>12.0" Round Culvert</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.60' / 213.50' S= 0.0100 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.47 cfs @ 12.11 hrs HW=214.34' (Free Discharge)

↑1=Culvert (Barrel Controls 1.47 cfs @ 3.28 fps)

### Pond 7P: CB5&6

#### Hydrograph





## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 8P: DMH2

Inflow Area = 0.358 ac, 84.56% Impervious, Inflow Depth = 4.01" for 10-YR event  
Inflow = 1.47 cfs @ 12.11 hrs, Volume= 0.120 af  
Outflow = 1.47 cfs @ 12.11 hrs, Volume= 0.120 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.47 cfs @ 12.11 hrs, Volume= 0.120 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.05' @ 12.11 hrs

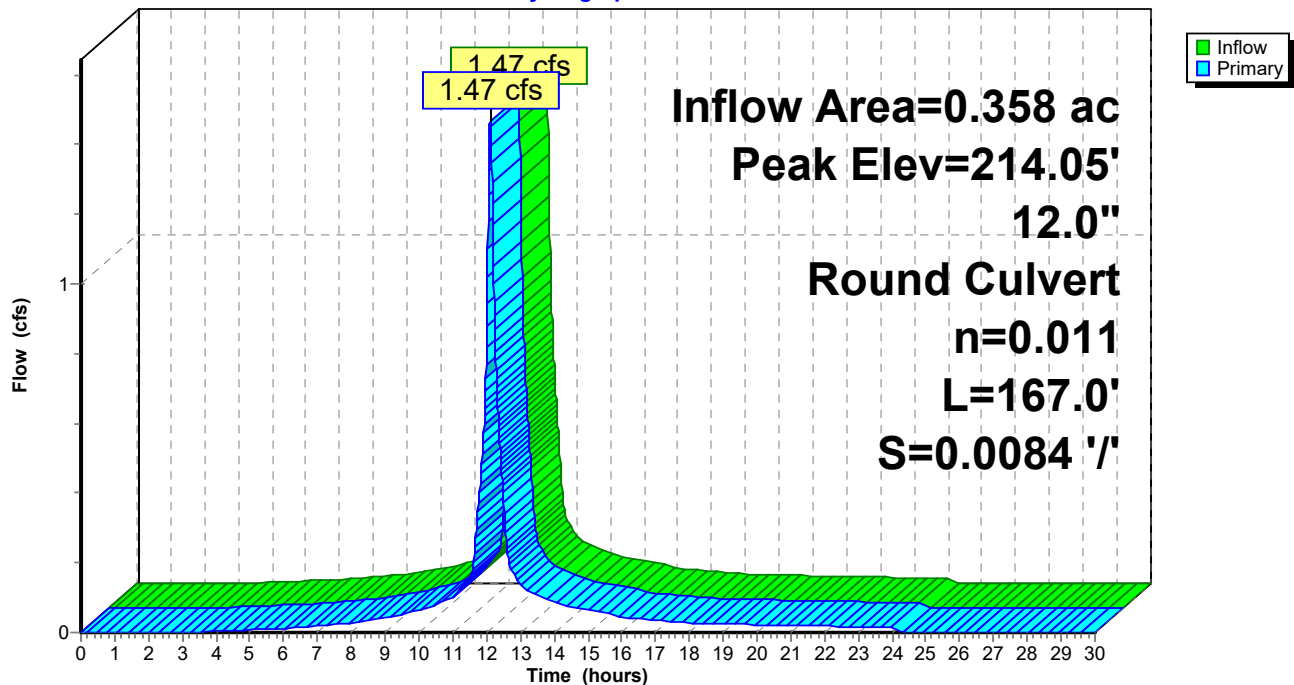
Device	Routing	Invert	Outlet Devices
#1	Primary	213.40'	<b>12.0" Round Culvert</b> L= 167.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.40' / 212.00' S= 0.0084 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.47 cfs @ 12.11 hrs HW=214.05' (Free Discharge)

↑1=Culvert (Inlet Controls 1.47 cfs @ 2.74 fps)

### Pond 8P: DMH2

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 9P: DMH3

Inflow Area = 1.804 ac, 69.11% Impervious, Inflow Depth = 3.62" for 10-YR event  
Inflow = 6.03 cfs @ 12.15 hrs, Volume= 0.545 af  
Outflow = 6.03 cfs @ 12.15 hrs, Volume= 0.545 af, Atten= 0%, Lag= 0.0 min  
Primary = 6.03 cfs @ 12.15 hrs, Volume= 0.545 af

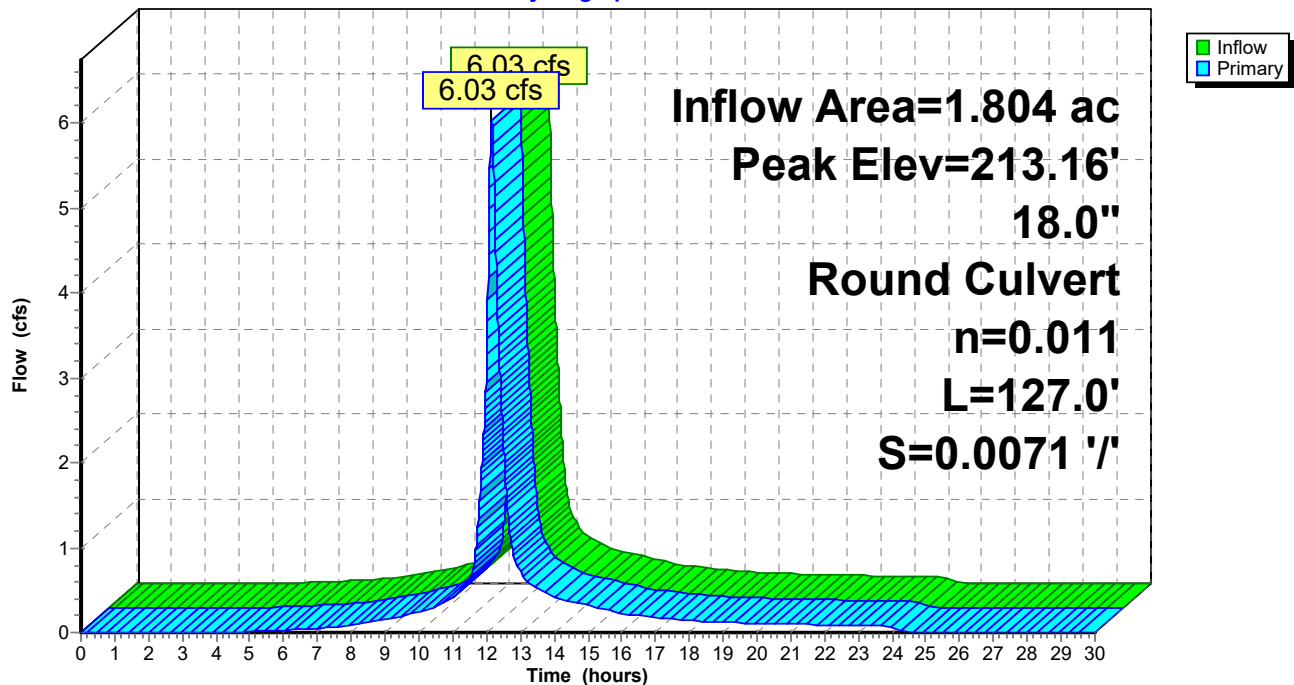
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 213.16' @ 12.15 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	211.90'	<b>18.0" Round Culvert</b> L= 127.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 211.90' / 211.00' S= 0.0071 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=6.02 cfs @ 12.15 hrs HW=213.16' (Free Discharge)  
↑ **1=Culvert** (Inlet Controls 6.02 cfs @ 3.81 fps)

### Pond 9P: DMH3

Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 10P: DMH4

Inflow Area = 1.804 ac, 69.11% Impervious, Inflow Depth = 3.62" for 10-YR event  
Inflow = 6.03 cfs @ 12.15 hrs, Volume= 0.545 af  
Outflow = 6.03 cfs @ 12.15 hrs, Volume= 0.545 af, Atten= 0%, Lag= 0.0 min  
Primary = 6.03 cfs @ 12.15 hrs, Volume= 0.545 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 212.30' @ 12.15 hrs

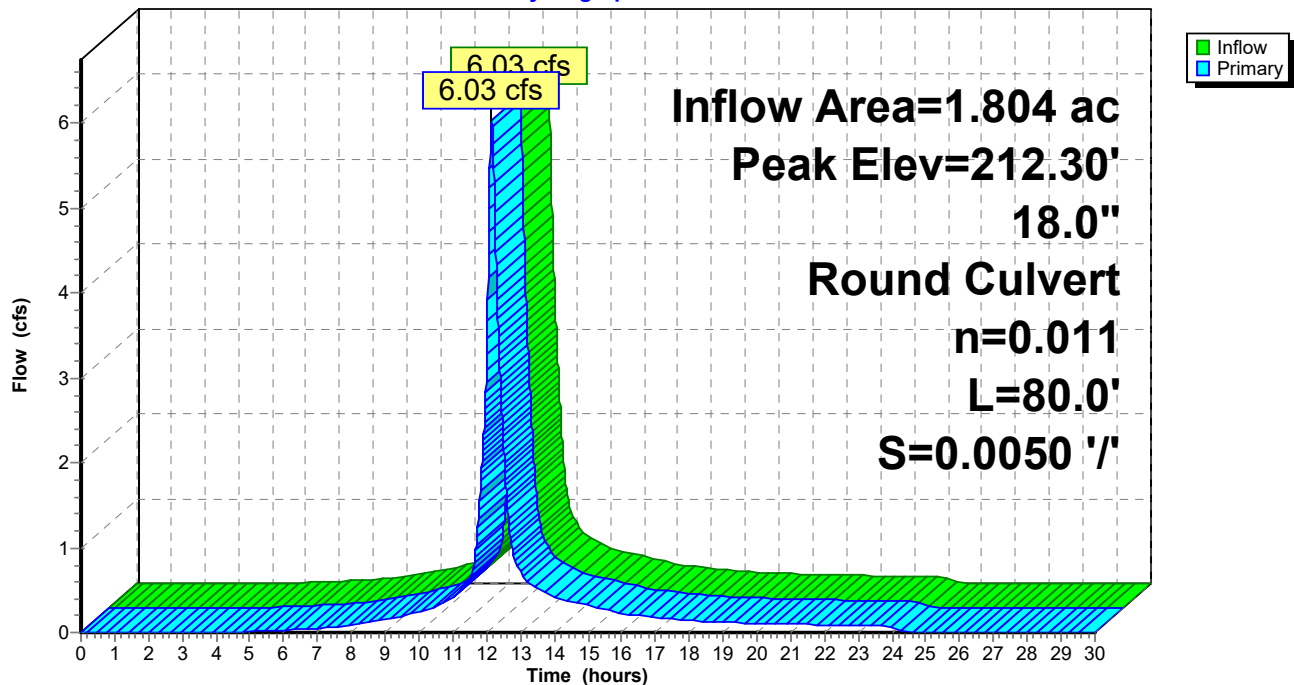
Device	Routing	Invert	Outlet Devices
#1	Primary	210.90'	<b>18.0" Round Culvert</b> L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.90' / 210.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=6.02 cfs @ 12.15 hrs HW=212.30' (Free Discharge)

↑1=Culvert (Barrel Controls 6.02 cfs @ 4.55 fps)

### Pond 10P: DMH4

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 11P: P1d

Runoff = 2.89 cfs @ 12.16 hrs, Volume= 0.259 af, Depth= 3.59"

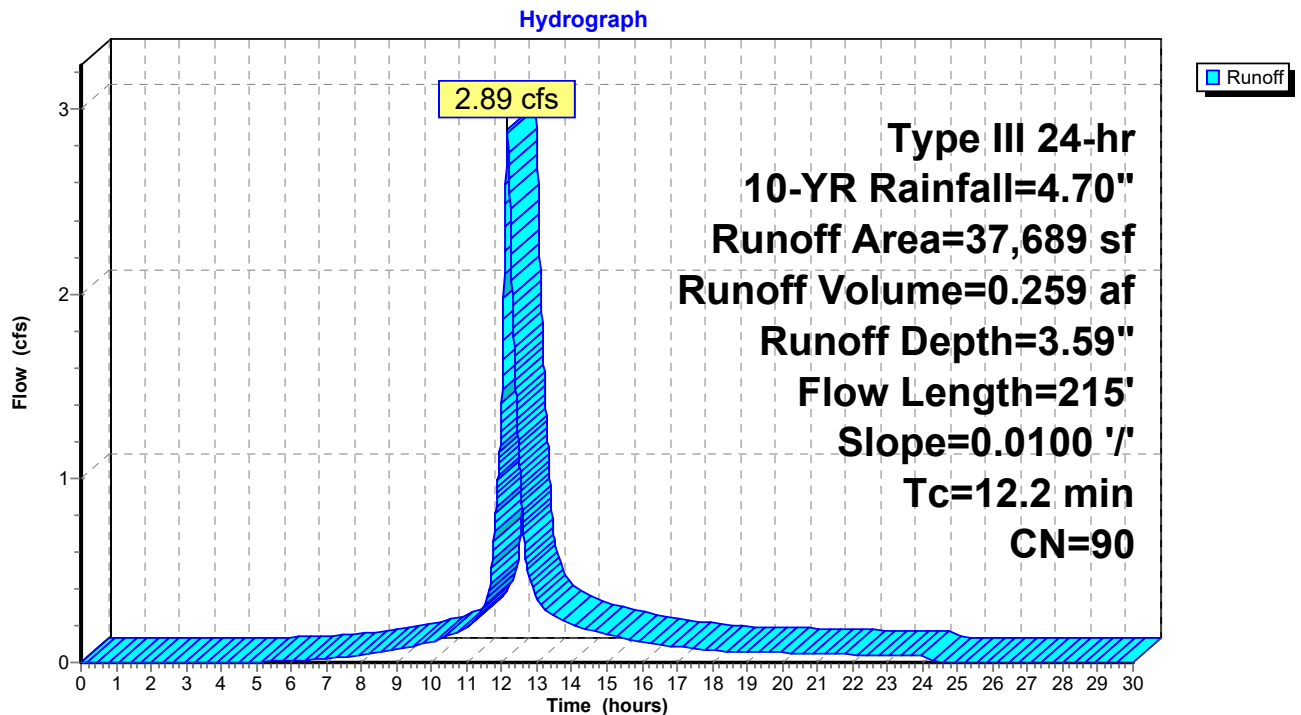
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
19,670	98	Paved parking, HSG C
12,756	74	>75% Grass cover, Good, HSG C
5,263	98	Roofs, HSG C
37,689	90	Weighted Average
12,756		33.85% Pervious Area
24,933		66.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	15	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.2	215	Total			

### Subcatchment 11P: P1d



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 12P: CB7

Inflow Area = 0.865 ac, 66.15% Impervious, Inflow Depth = 3.59" for 10-YR event  
Inflow = 2.89 cfs @ 12.16 hrs, Volume= 0.259 af  
Outflow = 2.89 cfs @ 12.16 hrs, Volume= 0.259 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.89 cfs @ 12.16 hrs, Volume= 0.259 af

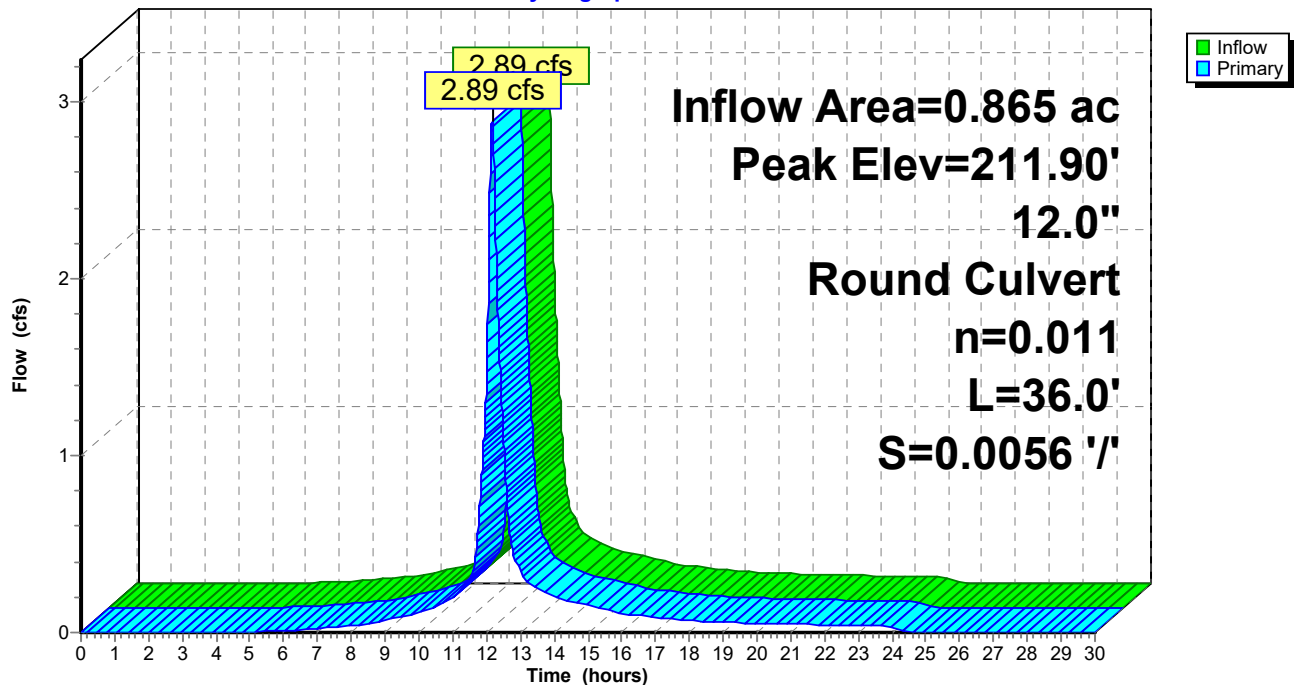
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 211.90' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	210.70'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.70' / 210.50' S= 0.0056 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.89 cfs @ 12.16 hrs HW=211.90' (Free Discharge)  
↑1=Culvert (Barrel Controls 2.89 cfs @ 3.88 fps)

### Pond 12P: CB7

Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 13P: P1e

Runoff = 1.34 cfs @ 12.16 hrs, Volume= 0.114 af, Depth= 2.13"

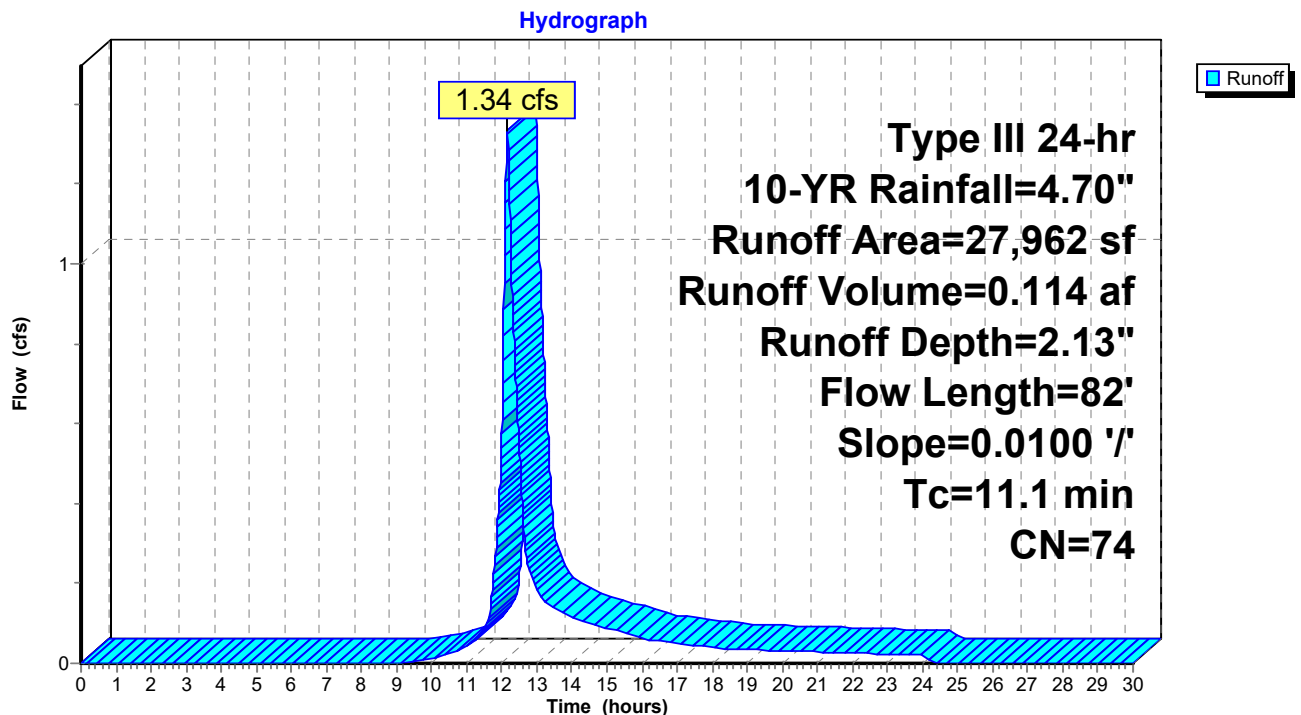
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
27,962	74	>75% Grass cover, Good, HSG C
27,962		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.3	32	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.1	82	Total			

### Subcatchment 13P: P1e



## Stormwater Calculations

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### Summary for Subcatchment 14P: P1f

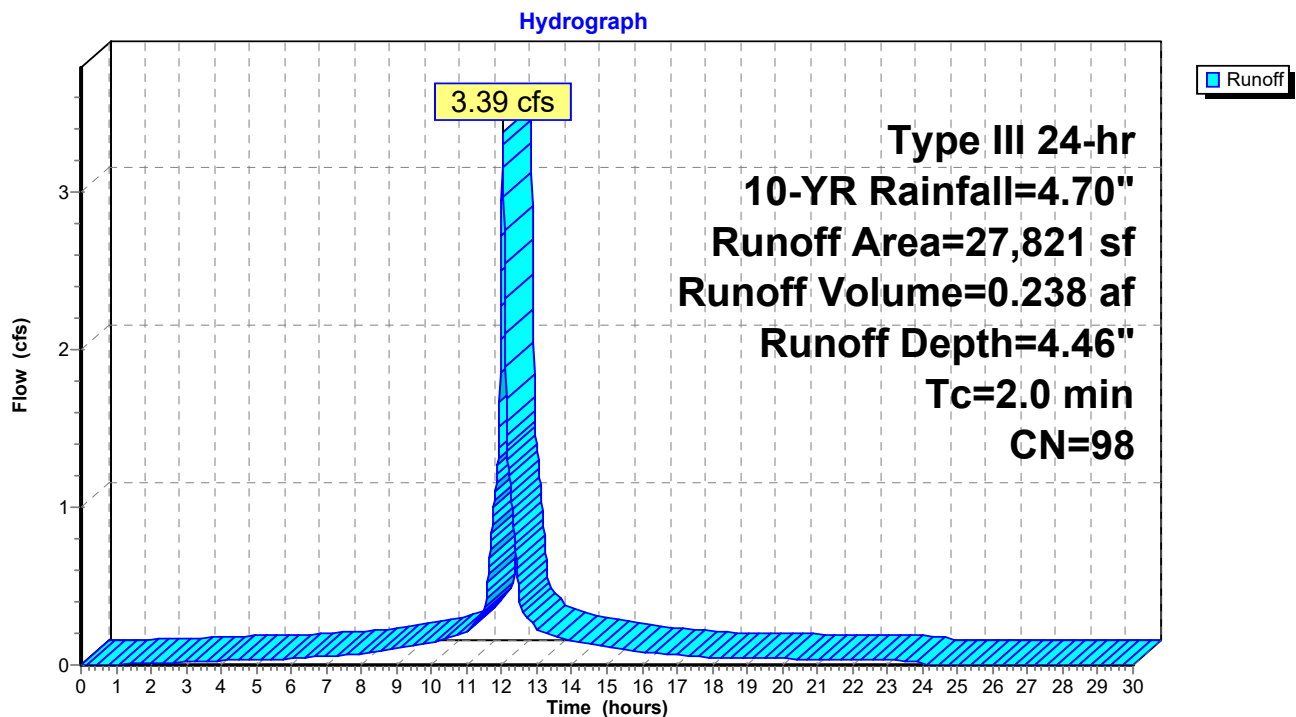
Runoff = 3.39 cfs @ 12.03 hrs, Volume= 0.238 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
27,821	98	Roofs, HSG C
27,821		100.00% Impervious Area

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

### Subcatchment 14P: P1f



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 15P: Roof Pipes

Inflow Area = 0.639 ac, 100.00% Impervious, Inflow Depth = 4.46" for 10-YR event  
Inflow = 3.39 cfs @ 12.03 hrs, Volume= 0.238 af  
Outflow = 3.39 cfs @ 12.03 hrs, Volume= 0.238 af, Atten= 0%, Lag= 0.0 min  
Primary = 3.39 cfs @ 12.03 hrs, Volume= 0.238 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 215.30' @ 12.03 hrs

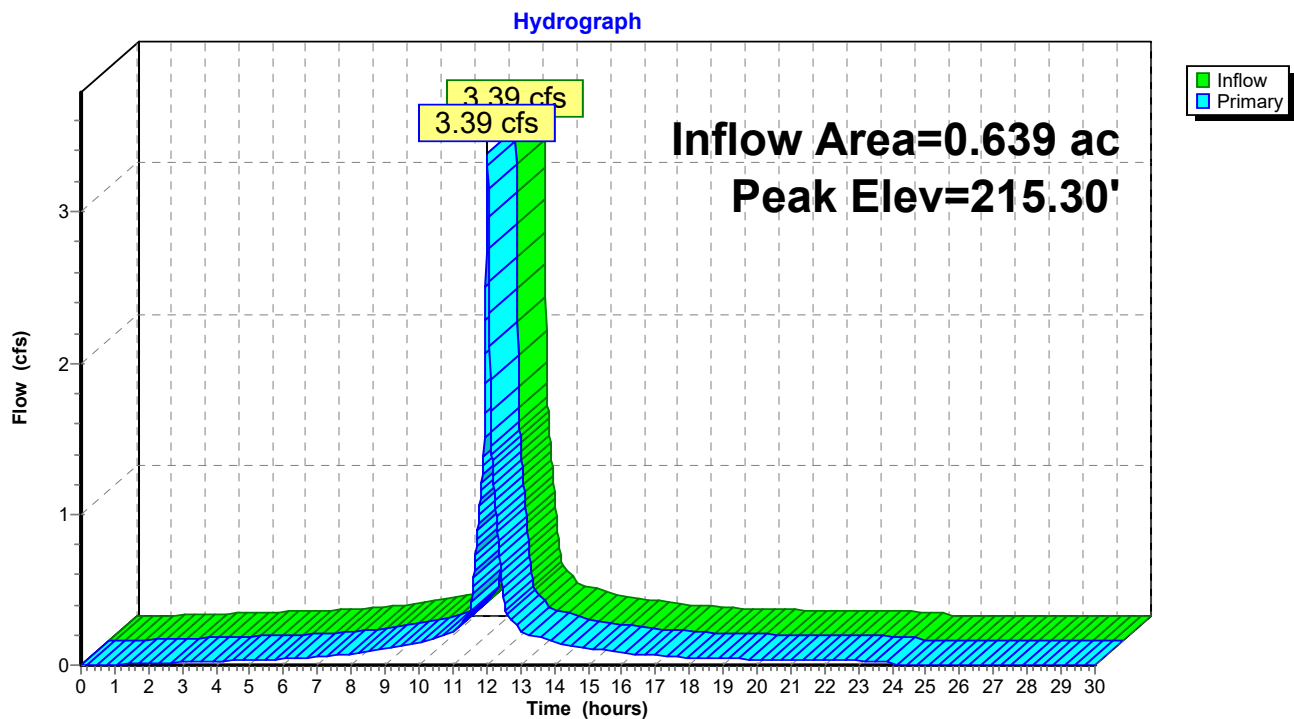
Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	<b>12.0" Round Culvert</b> L= 300.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.00' / 210.50' S= 0.0117 ' S= 0.0117 ' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#2	Primary	216.00'	<b>12.0" Round Culvert</b> L= 450.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 210.50' S= 0.0122 ' S= 0.0122 ' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=3.38 cfs @ 12.03 hrs HW=215.30' (Free Discharge)

1=Culvert (Inlet Controls 3.38 cfs @ 4.30 fps)

2=Culvert ( Controls 0.00 cfs)

### Pond 15P: Roof Pipes





## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 16P: Basin #1

Inflow Area = 3.950 ac, 62.23% Impervious, Inflow Depth = 3.51" for 10-YR event  
Inflow = 11.63 cfs @ 12.15 hrs, Volume= 1.155 af  
Outflow = 2.61 cfs @ 12.64 hrs, Volume= 0.979 af, Atten= 78%, Lag= 29.6 min  
Discarded = 0.42 cfs @ 12.64 hrs, Volume= 0.704 af  
Primary = 2.19 cfs @ 12.64 hrs, Volume= 0.275 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 212.03' @ 12.64 hrs Surf.Area= 17,918 sf Storage= 23,371 cf

Plug-Flow detention time= 311.4 min calculated for 0.979 af (85% of inflow)  
Center-of-Mass det. time= 246.1 min ( 1,037.1 - 790.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	210.50'	32,180 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
210.50	12,754	521.0	0	0	12,754
212.50	19,675	607.0	32,180	32,180	20,556

Device	Routing	Invert	Outlet Devices
#1	Primary	211.80'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 211.80 213.00 Width (feet) 6.00 6.00
#2	Discarded	210.50'	<b>1.020 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.42 cfs @ 12.64 hrs HW=212.03' (Free Discharge)  
↑**2=Exfiltration** (Exfiltration Controls 0.42 cfs)

**Primary OutFlow** Max=2.18 cfs @ 12.64 hrs HW=212.03' (Free Discharge)  
↑**1=Custom Weir/Orifice** (Weir Controls 2.18 cfs @ 1.57 fps)

## Stormwater Calculations

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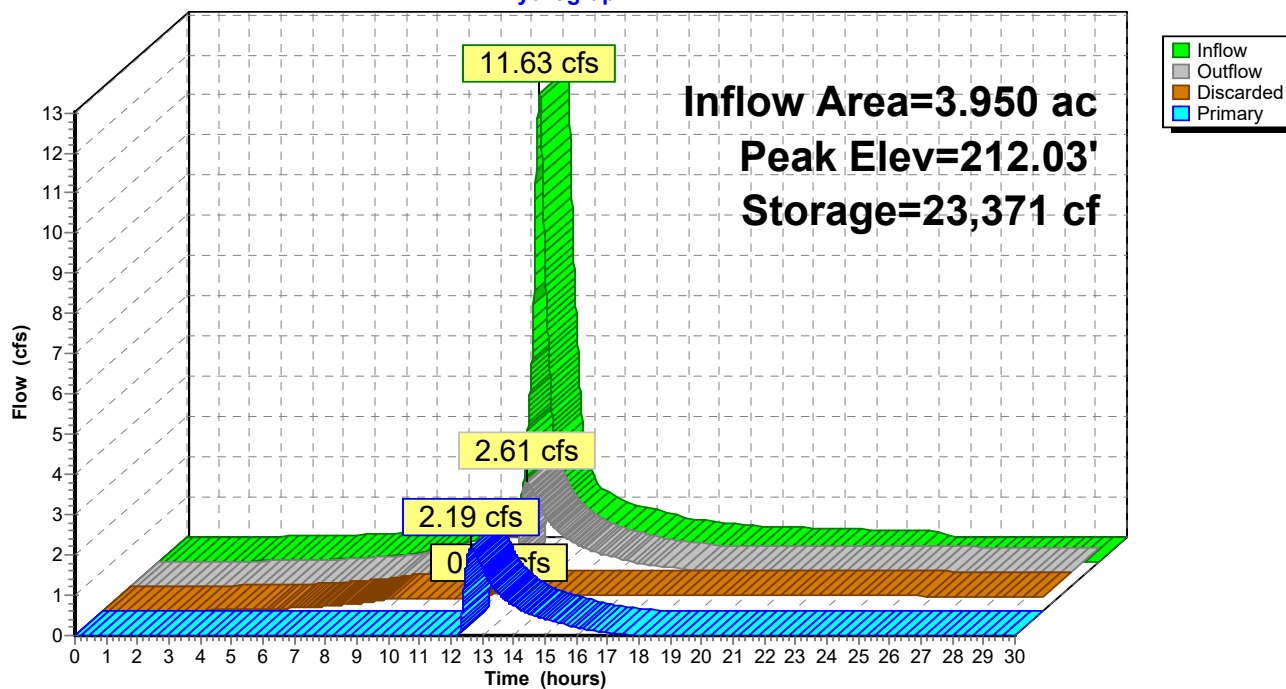
Type III 24-hr 10-YR Rainfall=4.70"

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### Pond 16P: Basin #1

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 17P: P1g

Runoff = 5.94 cfs @ 12.14 hrs, Volume= 0.486 af, Depth= 1.97"

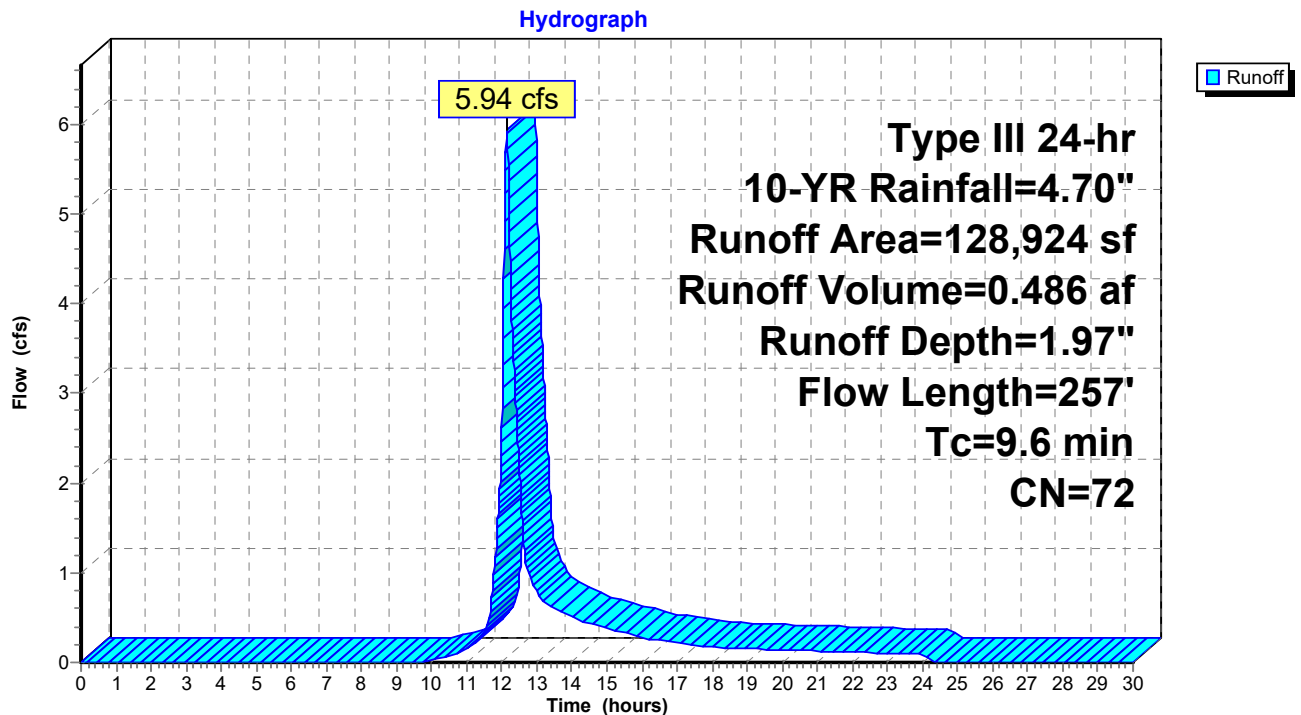
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
1,740	98	Paved parking, HSG C
50,163	74	>75% Grass cover, Good, HSG C
77,021	70	Woods, Good, HSG C
128,924	72	Weighted Average
127,184		98.65% Pervious Area
1,740		1.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.4	207	0.0240	2.49		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
9.6	257	Total			

### Subcatchment 17P: P1g



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 18P: P1h

Runoff = 0.90 cfs @ 12.11 hrs, Volume= 0.068 af, Depth= 2.13"

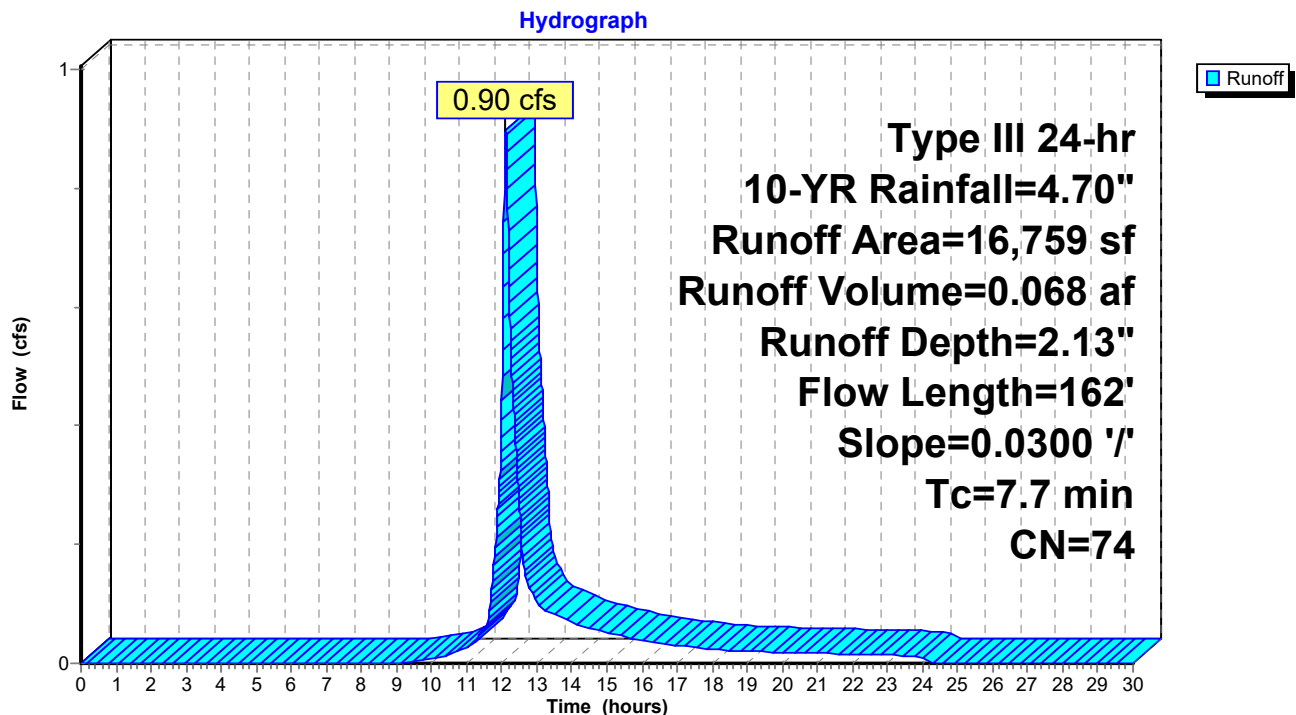
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
16,759	74	>75% Grass cover, Good, HSG C
16,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	112	0.0300	2.79		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.7	162	Total			

### Subcatchment 18P: P1h



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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 19P: P1i

Runoff = 1.93 cfs @ 12.10 hrs, Volume= 0.140 af, Depth= 2.13"

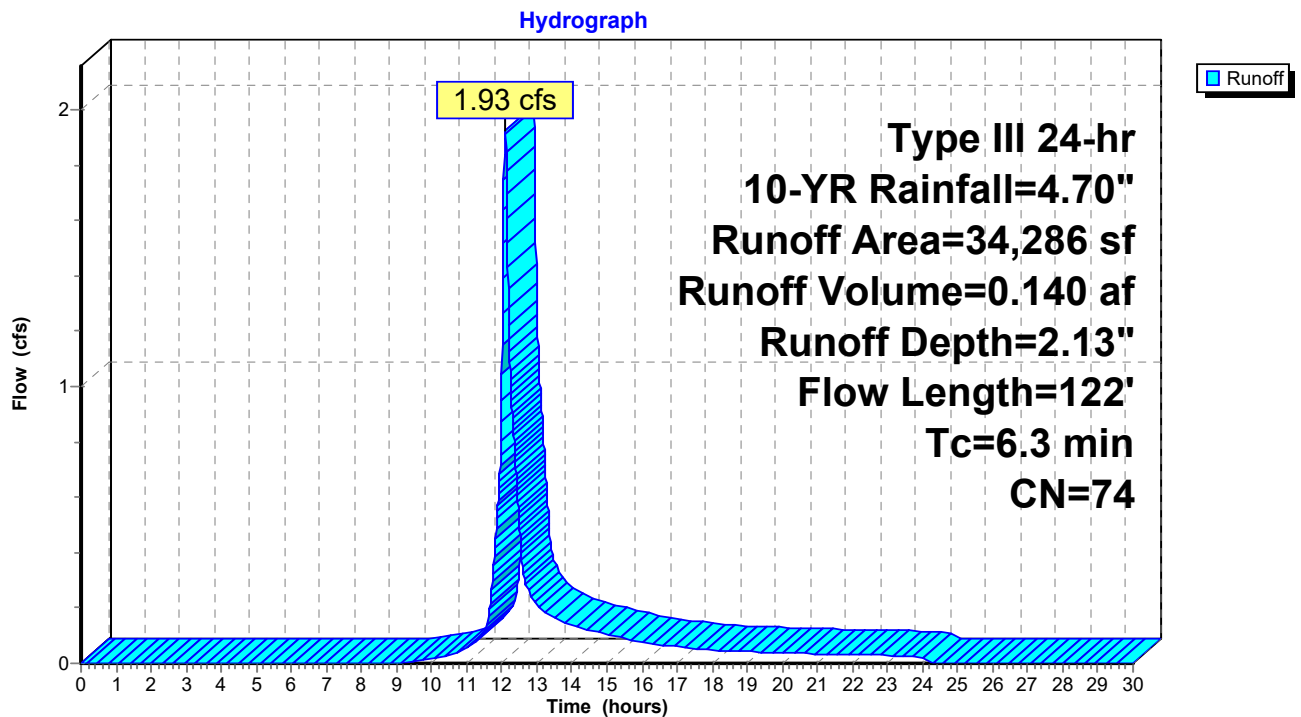
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
34,286	74	>75% Grass cover, Good, HSG C
34,286		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.1	72	0.9000	15.27		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.3	122	Total			

### Subcatchment 19P: P1i



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### Summary for Subcatchment 20P: P1j

Runoff = 3.76 cfs @ 12.12 hrs, Volume= 0.296 af, Depth= 3.19"

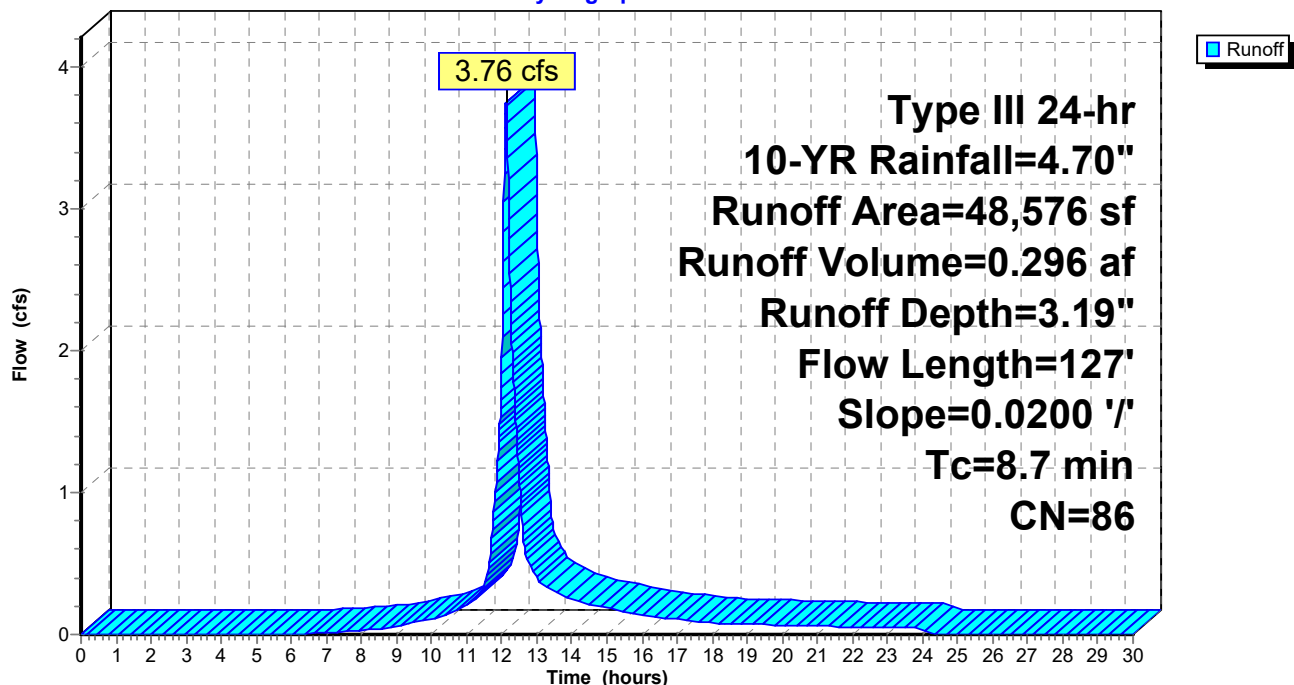
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
24,897	98	Paved parking, HSG C
4,121	70	Woods, Good, HSG C
19,558	74	>75% Grass cover, Good, HSG C
48,576	86	Weighted Average
23,679		48.75% Pervious Area
24,897		51.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	57	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.1	20	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
8.7	127	Total			

### Subcatchment 20P: P1j

Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 21P: Exist. CB

Inflow Area = 1.115 ac, 51.25% Impervious, Inflow Depth = 3.19" for 10-YR event  
Inflow = 3.76 cfs @ 12.12 hrs, Volume= 0.296 af  
Outflow = 3.76 cfs @ 12.12 hrs, Volume= 0.296 af, Atten= 0%, Lag= 0.0 min  
Primary = 3.76 cfs @ 12.12 hrs, Volume= 0.296 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.55' @ 12.12 hrs

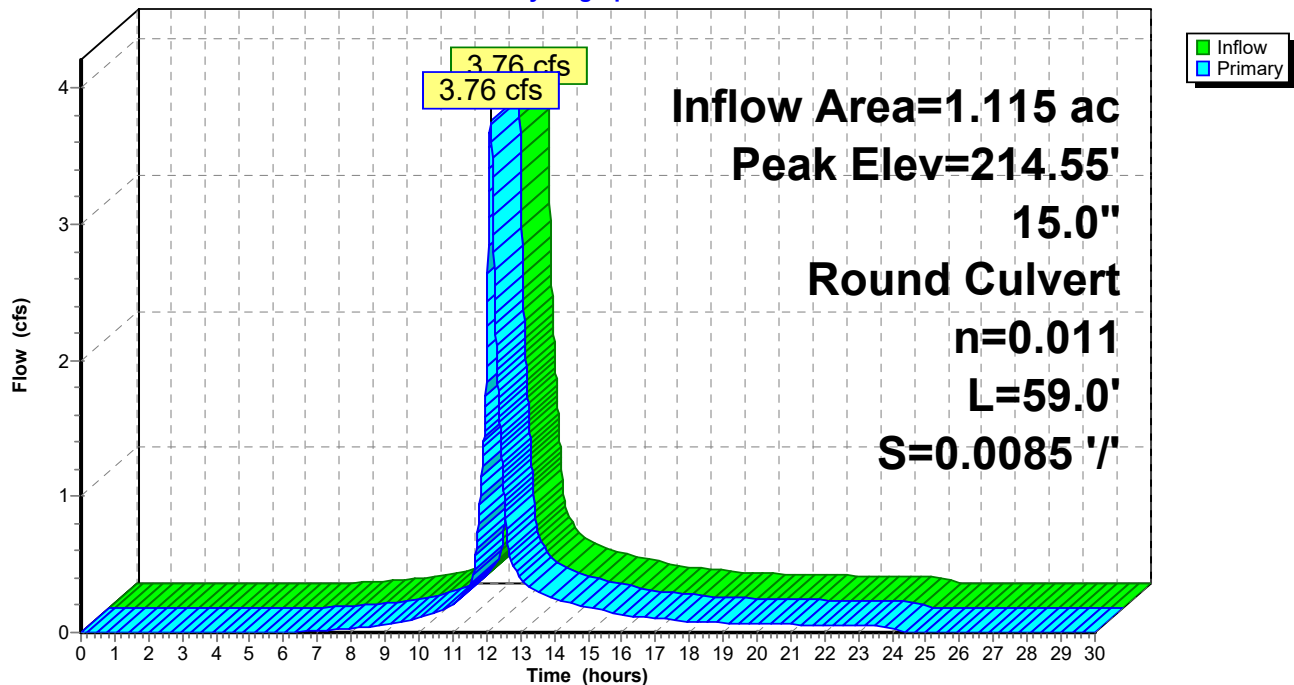
Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	<b>15.0" Round Culvert</b> L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.50' / 213.00' S= 0.0085 '/ Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

**Primary OutFlow** Max=3.76 cfs @ 12.12 hrs HW=214.55' (Free Discharge)

1=Culvert (Barrel Controls 3.76 cfs @ 4.60 fps)

### Pond 21P: Exist. CB

Hydrograph



## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 22P: Existing Basin

Inflow Area = 1.902 ac, 30.05% Impervious, Inflow Depth = 2.75" for 10-YR event  
Inflow = 5.63 cfs @ 12.11 hrs, Volume= 0.436 af  
Outflow = 0.69 cfs @ 12.88 hrs, Volume= 0.436 af, Atten= 88%, Lag= 46.1 min  
Discarded = 0.65 cfs @ 12.88 hrs, Volume= 0.432 af  
Primary = 0.03 cfs @ 12.88 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 213.62' @ 12.88 hrs Surf.Area= 11,728 sf Storage= 6,907 cf

Plug-Flow detention time= 86.1 min calculated for 0.436 af (100% of inflow)  
Center-of-Mass det. time= 86.1 min ( 905.5 - 819.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	32,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
213.00	10,659	0	0
214.00	12,392	11,526	11,526
215.50	15,086	20,609	32,134

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	<b>2.410 in/hr Exfiltration over Horizontal area</b>
#2	Primary	213.40'	<b>5.0' long x 0.8' breadth Level Spreader</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32
#3	Device 2	213.50'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.80 0.80 1.50 Width (feet) 0.25 0.25 8.00 8.00

**Discarded OutFlow** Max=0.65 cfs @ 12.88 hrs HW=213.62' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.65 cfs)

**Primary OutFlow** Max=0.03 cfs @ 12.88 hrs HW=213.62' (Free Discharge)

↑**2=Level Spreader** (Passes 0.03 cfs of 1.39 cfs potential flow)

↑**3=Custom Weir/Orifice** (Weir Controls 0.03 cfs @ 1.12 fps)



## Stormwater Calculations

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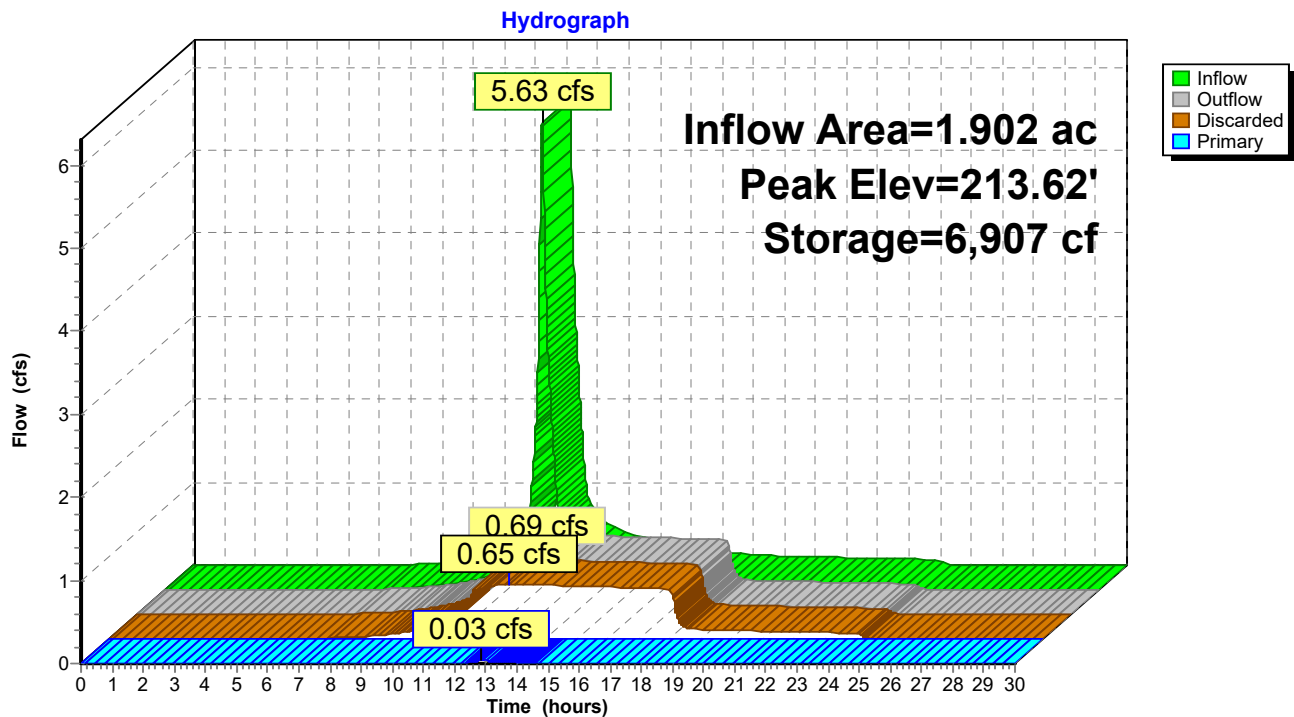
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Type III 24-hr 10-YR Rainfall=4.70"

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### Pond 22P: Existing Basin



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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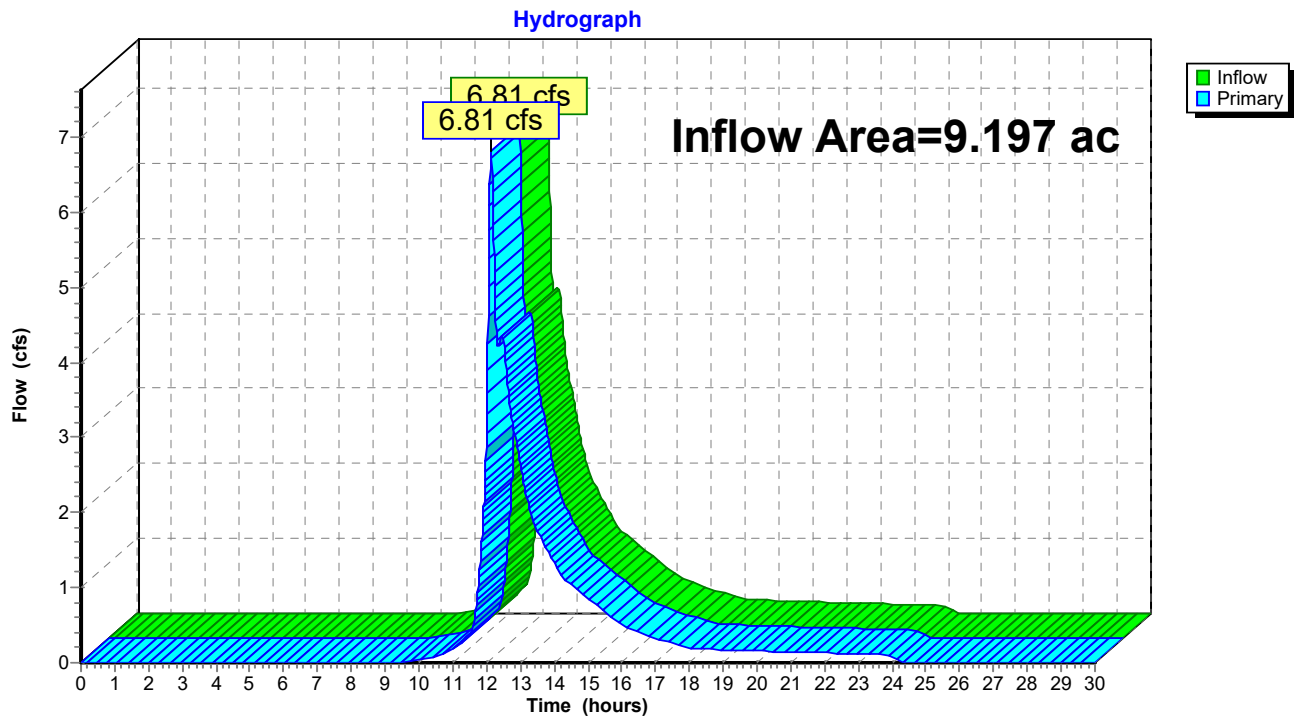
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### Summary for Link 23P: Design Point #1: Flow to Shadowfax Farm

Inflow Area = 9.197 ac, 33.38% Impervious, Inflow Depth = 1.09" for 10-YR event  
Inflow = 6.81 cfs @ 12.13 hrs, Volume= 0.833 af  
Primary = 6.81 cfs @ 12.13 hrs, Volume= 0.833 af, Atten= 0%, Lag= 0.0 min

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

### Link 23P: Design Point #1: Flow to Shadowfax Farm



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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

### Subcatchment1P: P1a

Runoff Area=25,448 sf 67.62% Impervious Runoff Depth=4.94"  
Flow Length=195' Slope=0.0100 '/' Tc=12.0 min CN=90 Runoff=2.66 cfs 0.241 af

### Pond 2P: CB 1&2

Peak Elev=215.53' Inflow=2.66 cfs 0.241 af  
12.0" Round Culvert n=0.011 L=16.0' S=0.0125 '/' Outflow=2.66 cfs 0.241 af

### Pond 3P: DMH 1

Peak Elev=215.19' Inflow=2.66 cfs 0.241 af  
12.0" Round Culvert n=0.011 L=266.0' S=0.0083 '/' Outflow=2.66 cfs 0.241 af

### Subcatchment4P: P1b

Runoff Area=37,521 sf 63.69% Impervious Runoff Depth=4.83"  
Flow Length=291' Slope=0.0100 '/' Tc=12.8 min CN=89 Runoff=3.78 cfs 0.347 af

### Pond 5P: CB3&4

Peak Elev=213.62' Inflow=3.78 cfs 0.347 af  
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=3.78 cfs 0.347 af

### Subcatchment6P: P1c

Runoff Area=15,616 sf 84.56% Impervious Runoff Depth=5.40"  
Flow Length=300' Slope=0.0110 '/' Tc=8.1 min CN=94 Runoff=1.94 cfs 0.161 af

### Pond 7P: CB5&6

Peak Elev=214.48' Inflow=1.94 cfs 0.161 af  
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=1.94 cfs 0.161 af

### Pond 8P: DMH2

Peak Elev=214.17' Inflow=1.94 cfs 0.161 af  
12.0" Round Culvert n=0.011 L=167.0' S=0.0084 '/' Outflow=1.94 cfs 0.161 af

### Pond 9P: DMH3

Peak Elev=213.57' Inflow=8.16 cfs 0.749 af  
18.0" Round Culvert n=0.011 L=127.0' S=0.0071 '/' Outflow=8.16 cfs 0.749 af

### Pond 10P: DMH4

Peak Elev=212.71' Inflow=8.16 cfs 0.749 af  
18.0" Round Culvert n=0.011 L=80.0' S=0.0050 '/' Outflow=8.16 cfs 0.749 af

### Subcatchment11P: P1d

Runoff Area=37,689 sf 66.15% Impervious Runoff Depth=4.94"  
Flow Length=215' Slope=0.0100 '/' Tc=12.2 min CN=90 Runoff=3.92 cfs 0.356 af

### Pond 12P: CB7

Peak Elev=212.40' Inflow=3.92 cfs 0.356 af  
12.0" Round Culvert n=0.011 L=36.0' S=0.0056 '/' Outflow=3.92 cfs 0.356 af

### Subcatchment13P: P1e

Runoff Area=27,962 sf 0.00% Impervious Runoff Depth=3.27"  
Flow Length=82' Slope=0.0100 '/' Tc=11.1 min CN=74 Runoff=2.08 cfs 0.175 af

### Subcatchment14P: P1f

Runoff Area=27,821 sf 100.00% Impervious Runoff Depth=5.86"  
Tc=2.0 min CN=98 Runoff=4.41 cfs 0.312 af

### Pond 15P: Roof Pipes

Peak Elev=215.86' Inflow=4.41 cfs 0.312 af  
Outflow=4.41 cfs 0.312 af

### Pond 16P: Basin #1

Peak Elev=212.29' Storage=28,046 cf Inflow=15.95 cfs 1.592 af  
Discarded=0.45 cfs 0.743 af Primary=6.65 cfs 0.639 af Outflow=7.09 cfs 1.382 af

## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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### Subcatchment 17P: P1g

Runoff Area=128,924 sf 1.35% Impervious Runoff Depth=3.08"  
Flow Length=257' Tc=9.6 min CN=72 Runoff=9.42 cfs 0.758 af

### Subcatchment 18P: P1h

Runoff Area=16,759 sf 0.00% Impervious Runoff Depth=3.27"  
Flow Length=162' Slope=0.0300 '/' Tc=7.7 min CN=74 Runoff=1.39 cfs 0.105 af

### Subcatchment 19P: P1i

Runoff Area=34,286 sf 0.00% Impervious Runoff Depth=3.27"  
Flow Length=122' Tc=6.3 min CN=74 Runoff=2.99 cfs 0.214 af

### Subcatchment 20P: P1j

Runoff Area=48,576 sf 51.25% Impervious Runoff Depth=4.50"  
Flow Length=127' Slope=0.0200 '/' Tc=8.7 min CN=86 Runoff=5.24 cfs 0.419 af

### Pond 21P: Exist. CB

Peak Elev=214.91' Inflow=5.24 cfs 0.419 af  
15.0" Round Culvert n=0.011 L=59.0' S=0.0085 '/' Outflow=5.24 cfs 0.419 af

### Pond 22P: Existing Basin

Peak Elev=213.94' Storage=10,810 cf Inflow=8.14 cfs 0.633 af  
Discarded=0.69 cfs 0.582 af Primary=0.24 cfs 0.051 af Outflow=0.93 cfs 0.633 af

### Link 23P: Design Point #1: Flow to Shadowfax Farm

Inflow=12.03 cfs 1.553 af  
Primary=12.03 cfs 1.553 af

**Total Runoff Area = 9.197 ac Runoff Volume = 3.088 af Average Runoff Depth = 4.03"**  
**66.62% Pervious = 6.127 ac 33.38% Impervious = 3.069 ac**

## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 1P: P1a

Runoff = 2.66 cfs @ 12.16 hrs, Volume= 0.241 af, Depth= 4.94"

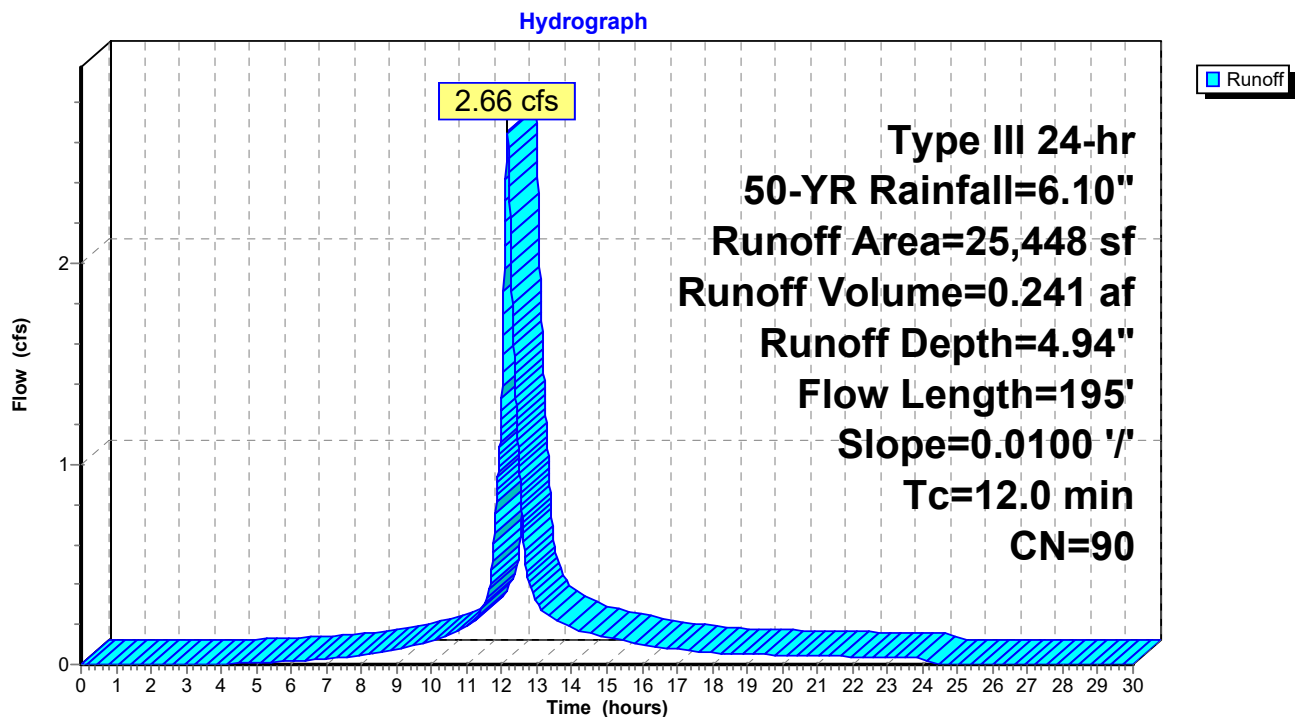
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
11,922	98	Paved parking, HSG C
8,239	74	>75% Grass cover, Good, HSG C
5,287	98	Roofs, HSG C
25,448	90	Weighted Average
8,239		32.38% Pervious Area
17,209		67.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	21	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.0	124	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.0	195	Total			

### Subcatchment 1P: P1a



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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 2P: CB 1&2

Inflow Area = 0.584 ac, 67.62% Impervious, Inflow Depth = 4.94" for 50-YR event  
Inflow = 2.66 cfs @ 12.16 hrs, Volume= 0.241 af  
Outflow = 2.66 cfs @ 12.16 hrs, Volume= 0.241 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.66 cfs @ 12.16 hrs, Volume= 0.241 af

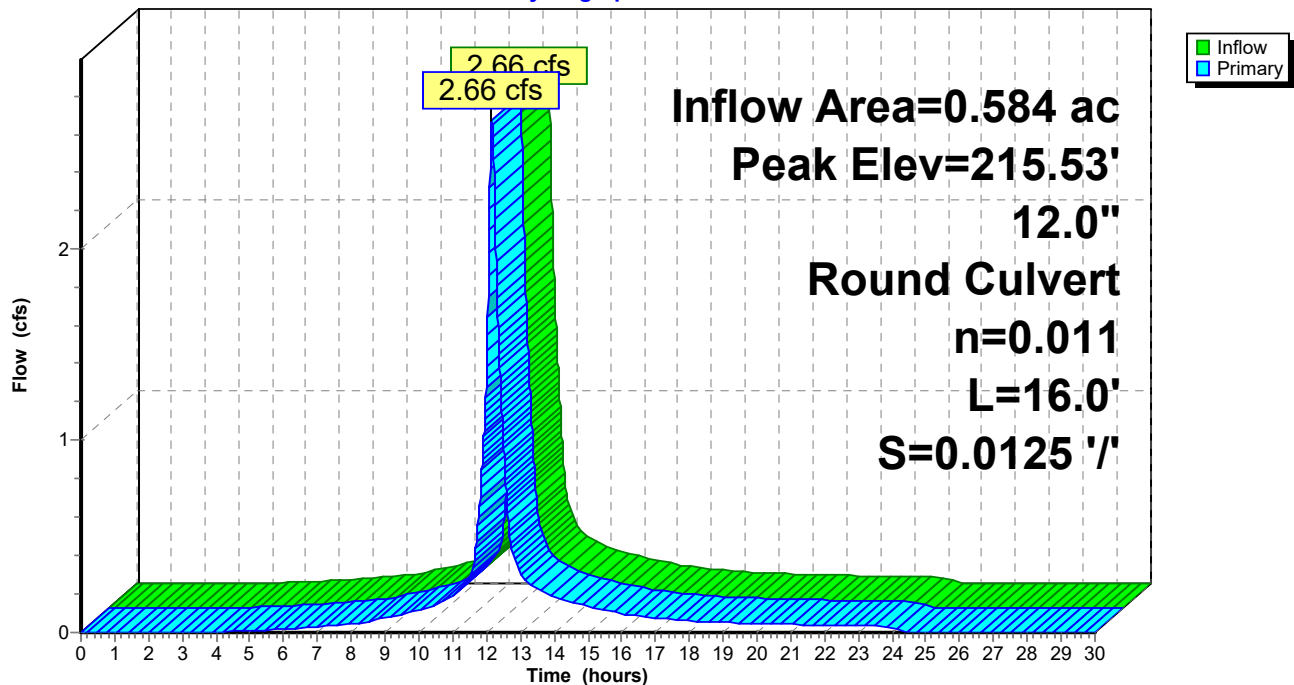
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 215.53' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	214.50'	<b>12.0" Round Culvert</b> L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.50' / 214.30' S= 0.0125 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.66 cfs @ 12.16 hrs HW=215.53' (Free Discharge)  
↑**1=Culvert** (Barrel Controls 2.66 cfs @ 4.07 fps)

### Pond 2P: CB 1&2

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 3P: DMH 1

Inflow Area = 0.584 ac, 67.62% Impervious, Inflow Depth = 4.94" for 50-YR event  
Inflow = 2.66 cfs @ 12.16 hrs, Volume= 0.241 af  
Outflow = 2.66 cfs @ 12.16 hrs, Volume= 0.241 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.66 cfs @ 12.16 hrs, Volume= 0.241 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 215.19' @ 12.16 hrs

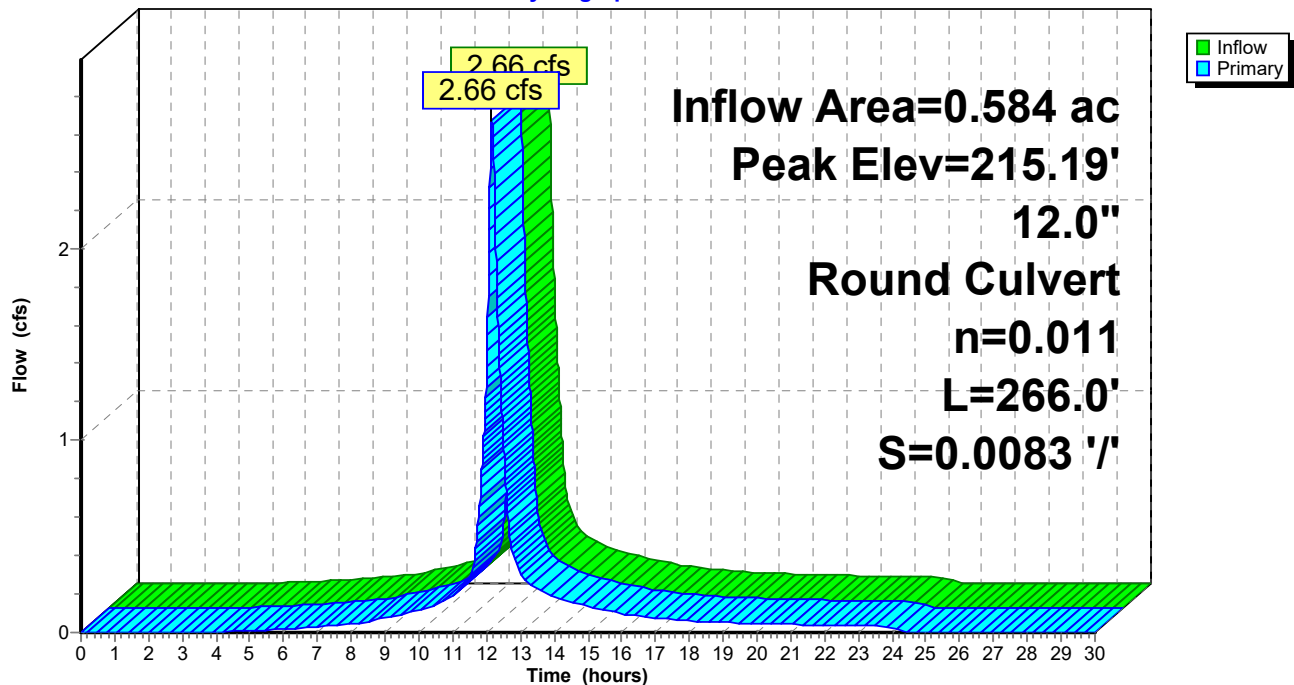
Device	Routing	Invert	Outlet Devices
#1	Primary	214.20'	<b>12.0" Round Culvert</b> L= 266.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.20' / 212.00' S= 0.0083 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.66 cfs @ 12.16 hrs HW=215.19' (Free Discharge)

↑1=Culvert (Inlet Controls 2.66 cfs @ 3.39 fps)

### Pond 3P: DMH 1

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 4P: P1b

Runoff = 3.78 cfs @ 12.17 hrs, Volume= 0.347 af, Depth= 4.83"

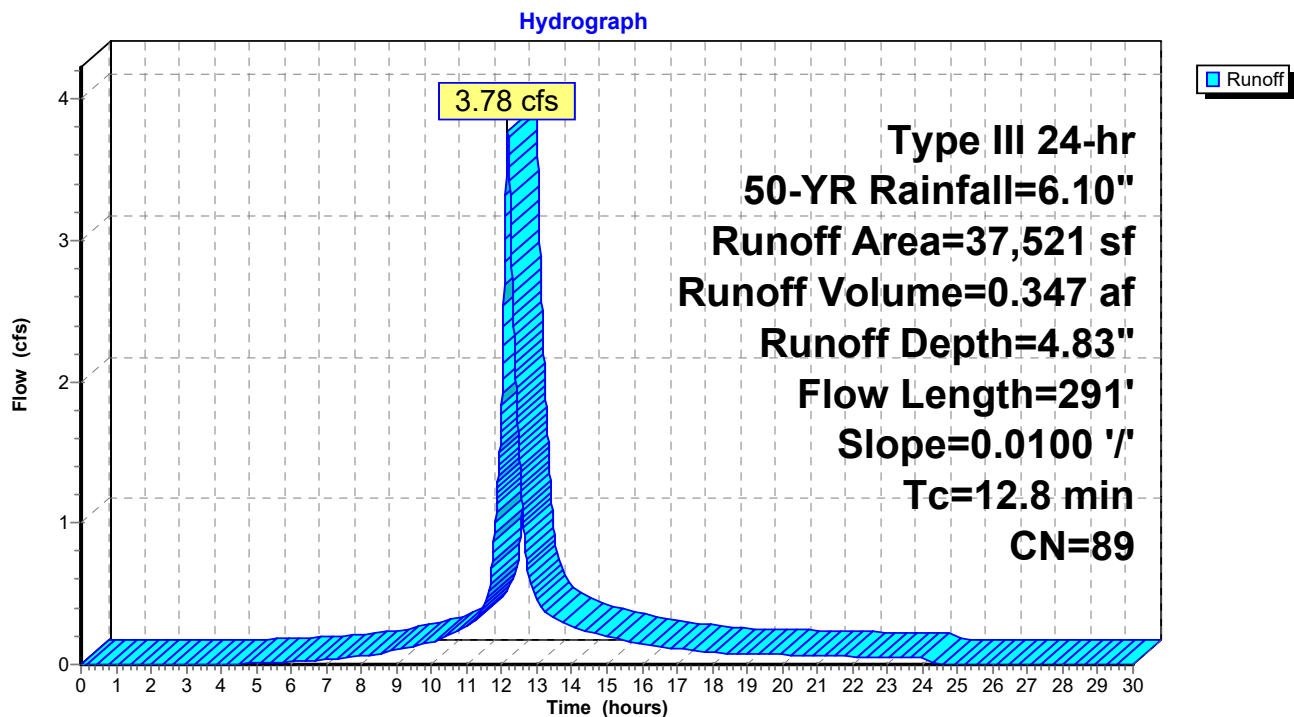
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
14,283	98	Paved parking, HSG C
13,625	74	>75% Grass cover, Good, HSG C
9,613	98	Roofs, HSG C
37,521	89	Weighted Average
13,625		36.31% Pervious Area
23,896		63.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.1	14	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.9	227	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.8	291	Total			

### Subcatchment 4P: P1b





## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 5P: CB3&4

Inflow Area = 0.861 ac, 63.69% Impervious, Inflow Depth = 4.83" for 50-YR event  
Inflow = 3.78 cfs @ 12.17 hrs, Volume= 0.347 af  
Outflow = 3.78 cfs @ 12.17 hrs, Volume= 0.347 af, Atten= 0%, Lag= 0.0 min  
Primary = 3.78 cfs @ 12.17 hrs, Volume= 0.347 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 213.62' @ 12.17 hrs

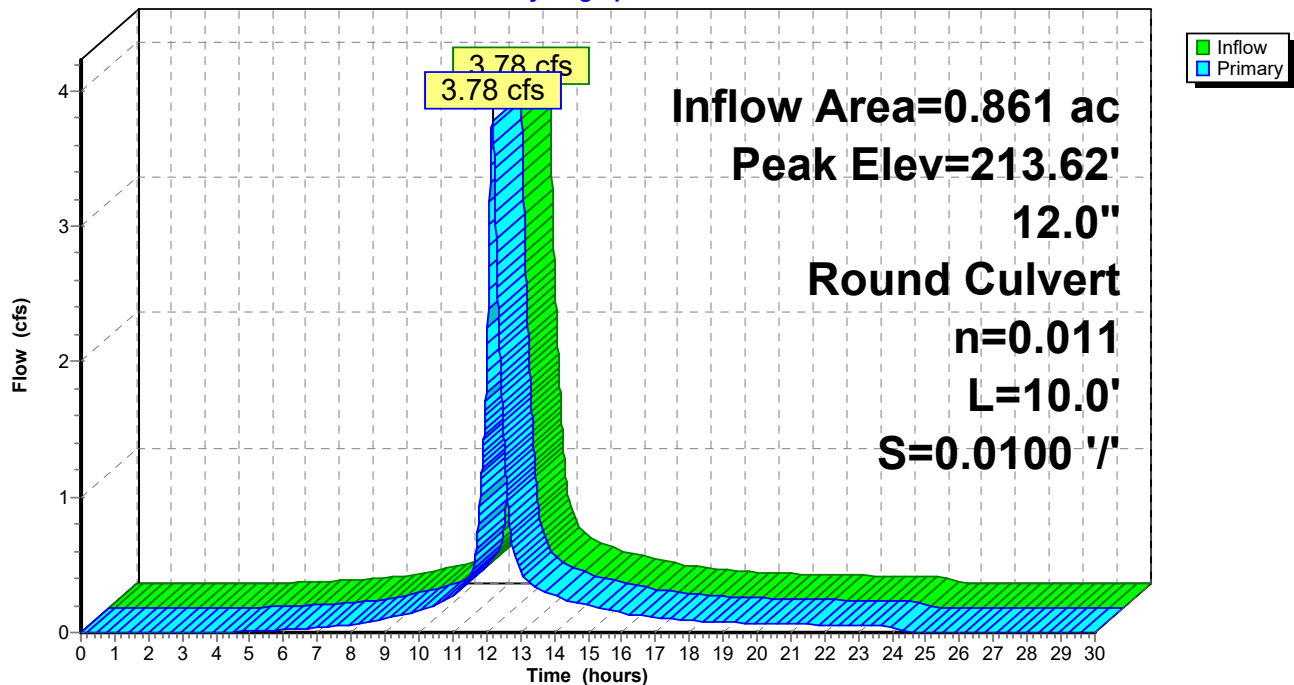
Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	<b>12.0" Round Culvert</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 212.10' / 212.00' S= 0.0100 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=3.77 cfs @ 12.17 hrs HW=213.62' (Free Discharge)

↑1=Culvert (Barrel Controls 3.77 cfs @ 4.81 fps)

### Pond 5P: CB3&4

Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 6P: P1c

Runoff = 1.94 cfs @ 12.11 hrs, Volume= 0.161 af, Depth= 5.40"

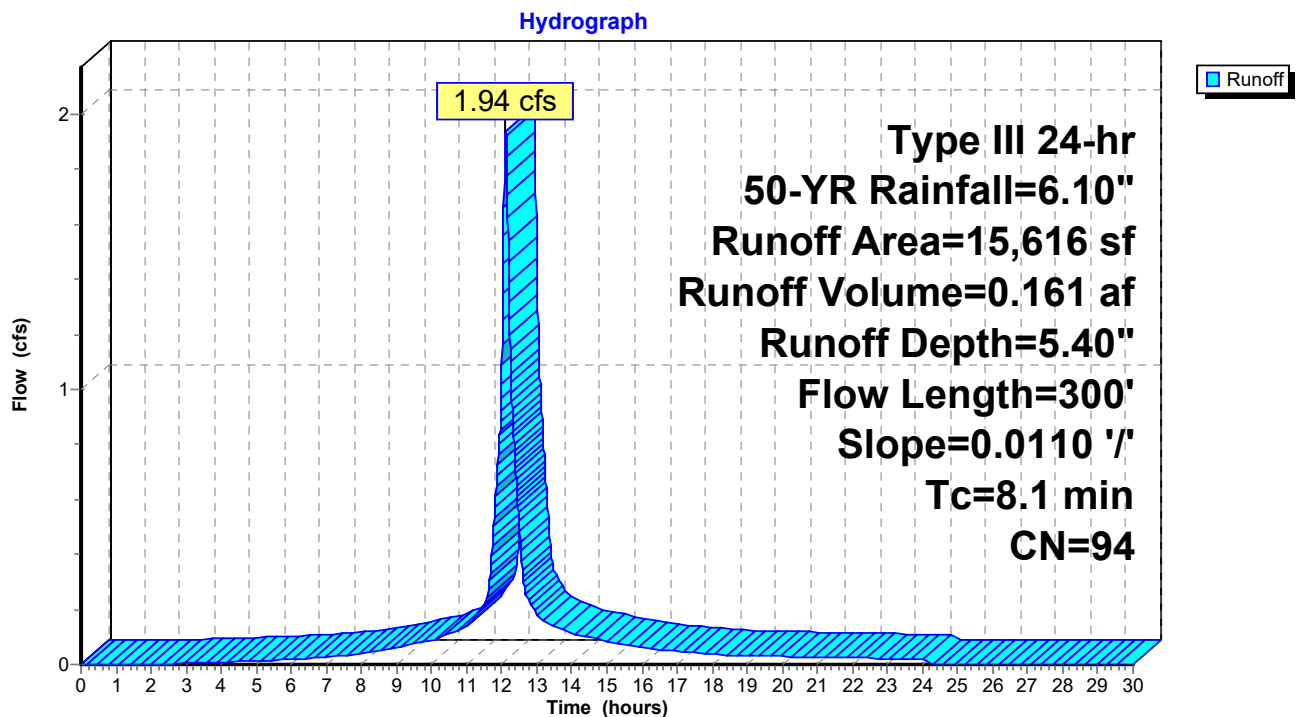
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
10,458	98	Paved parking, HSG C
2,411	74	>75% Grass cover, Good, HSG C
2,747	98	Roofs, HSG C
15,616	94	Weighted Average
2,411		15.44% Pervious Area
13,205		84.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	23	0.0110	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.5	27	0.0110	0.83		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
2.0	250	0.0110	2.13		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
8.1	300	Total			

### Subcatchment 6P: P1c



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 7P: CB5&6

Inflow Area = 0.358 ac, 84.56% Impervious, Inflow Depth = 5.40" for 50-YR event  
Inflow = 1.94 cfs @ 12.11 hrs, Volume= 0.161 af  
Outflow = 1.94 cfs @ 12.11 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.94 cfs @ 12.11 hrs, Volume= 0.161 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.48' @ 12.11 hrs

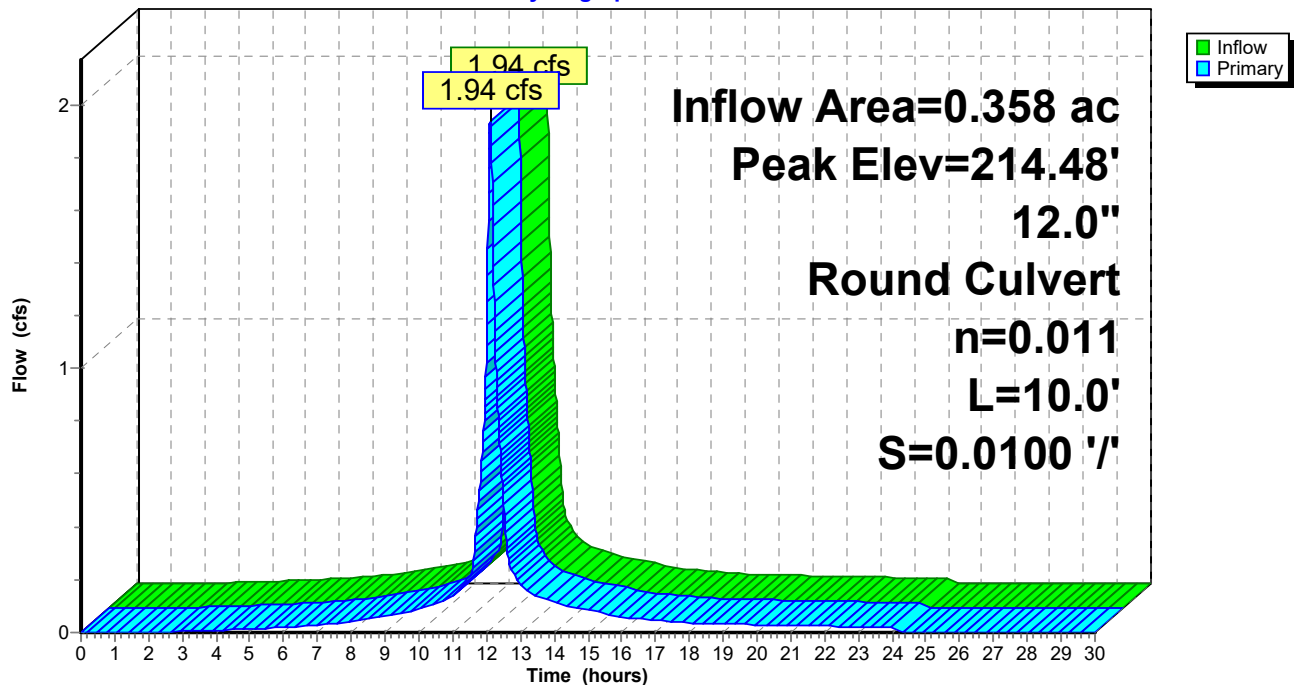
Device	Routing	Invert	Outlet Devices
#1	Primary	213.60'	<b>12.0" Round Culvert</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.60' / 213.50' S= 0.0100 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.94 cfs @ 12.11 hrs HW=214.48' (Free Discharge)

↑1=Culvert (Barrel Controls 1.94 cfs @ 3.50 fps)

### Pond 7P: CB5&6

Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 8P: DMH2

Inflow Area = 0.358 ac, 84.56% Impervious, Inflow Depth = 5.40" for 50-YR event  
Inflow = 1.94 cfs @ 12.11 hrs, Volume= 0.161 af  
Outflow = 1.94 cfs @ 12.11 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.94 cfs @ 12.11 hrs, Volume= 0.161 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.17' @ 12.11 hrs

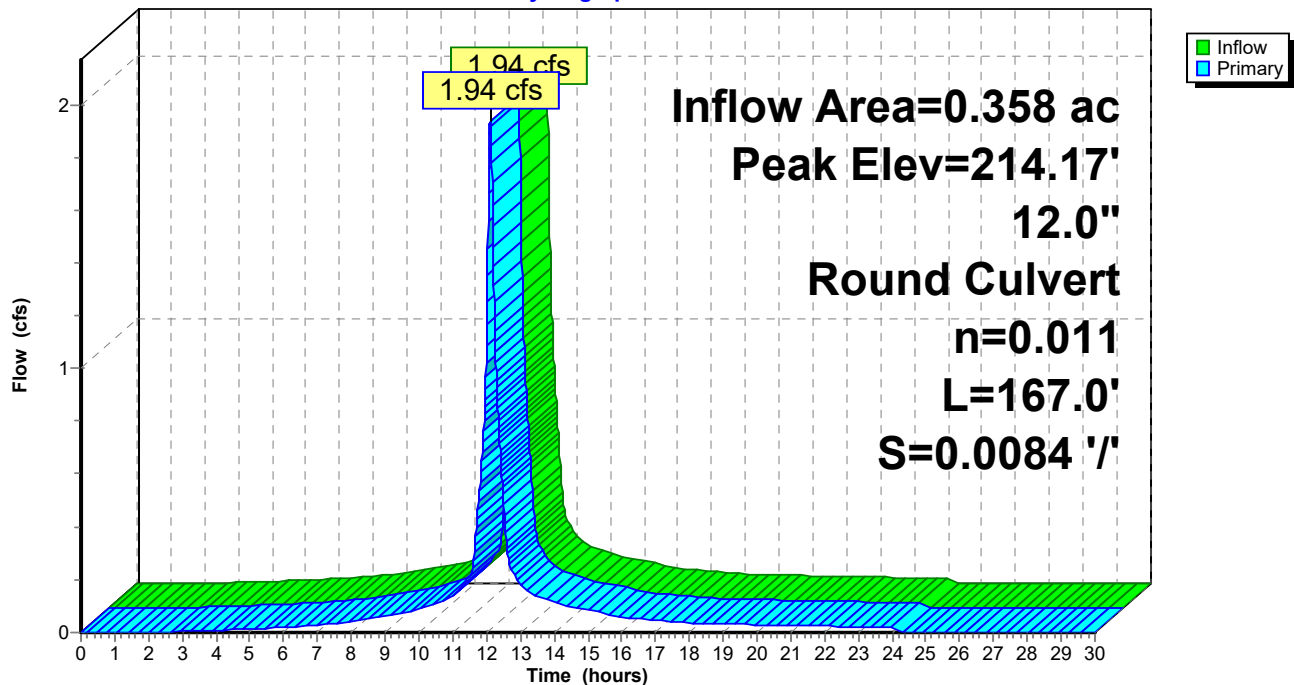
Device	Routing	Invert	Outlet Devices
#1	Primary	213.40'	<b>12.0" Round Culvert</b> L= 167.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.40' / 212.00' S= 0.0084 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.94 cfs @ 12.11 hrs HW=214.17' (Free Discharge)

↑**1=Culvert** (Inlet Controls 1.94 cfs @ 2.99 fps)

### Pond 8P: DMH2

Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 9P: DMH3

Inflow Area = 1.804 ac, 69.11% Impervious, Inflow Depth = 4.98" for 50-YR event  
Inflow = 8.16 cfs @ 12.15 hrs, Volume= 0.749 af  
Outflow = 8.16 cfs @ 12.15 hrs, Volume= 0.749 af, Atten= 0%, Lag= 0.0 min  
Primary = 8.16 cfs @ 12.15 hrs, Volume= 0.749 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 213.57' @ 12.15 hrs

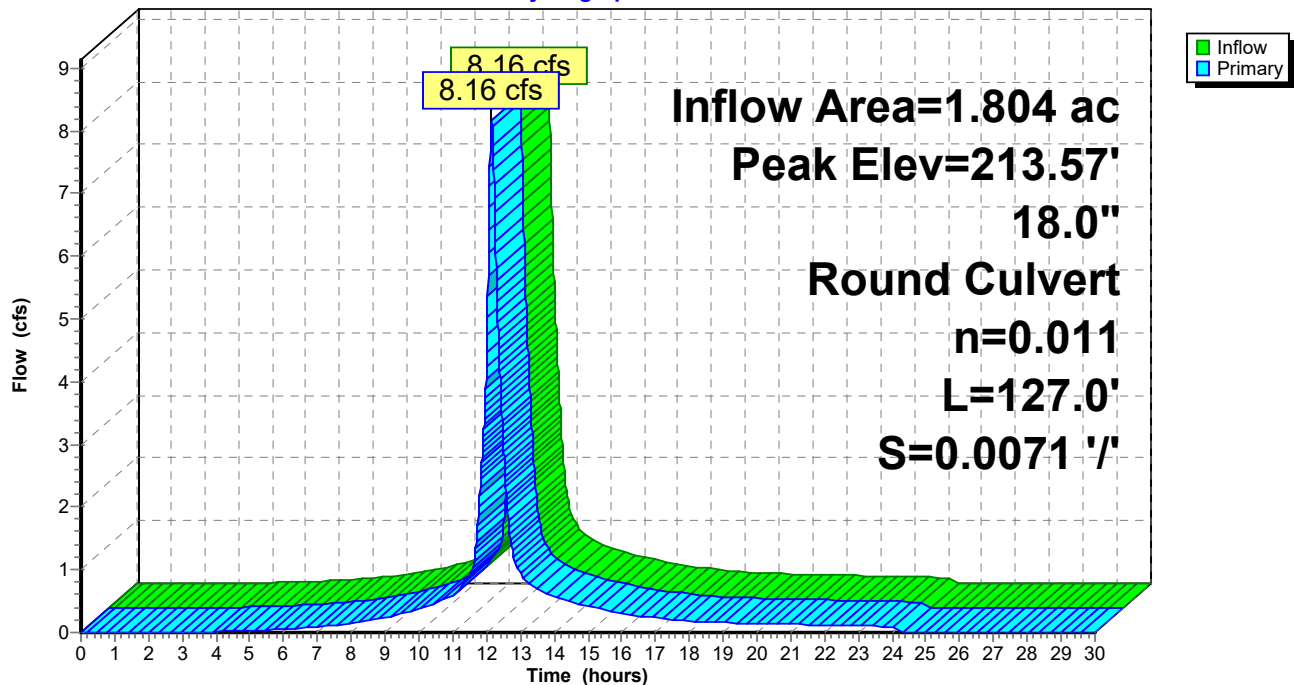
Device	Routing	Invert	Outlet Devices
#1	Primary	211.90'	<b>18.0" Round Culvert</b> L= 127.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 211.90' / 211.00' S= 0.0071 '/' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=8.16 cfs @ 12.15 hrs HW=213.57' (Free Discharge)

↑**1=Culvert** (Inlet Controls 8.16 cfs @ 4.62 fps)

### Pond 9P: DMH3

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 10P: DMH4

Inflow Area = 1.804 ac, 69.11% Impervious, Inflow Depth = 4.98" for 50-YR event  
Inflow = 8.16 cfs @ 12.15 hrs, Volume= 0.749 af  
Outflow = 8.16 cfs @ 12.15 hrs, Volume= 0.749 af, Atten= 0%, Lag= 0.0 min  
Primary = 8.16 cfs @ 12.15 hrs, Volume= 0.749 af

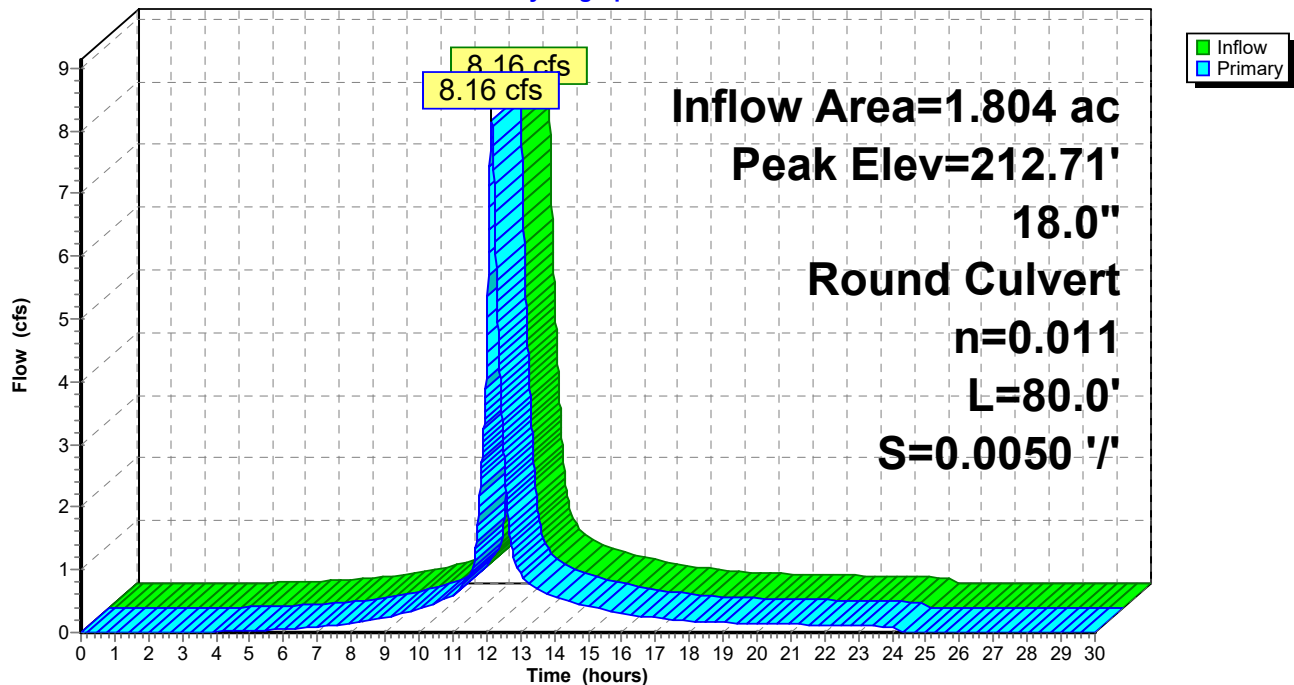
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 212.71' @ 12.15 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	210.90'	<b>18.0" Round Culvert</b> L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.90' / 210.50' S= 0.0050 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=8.16 cfs @ 12.15 hrs HW=212.71' (Free Discharge)  
↑1=Culvert (Barrel Controls 8.16 cfs @ 4.85 fps)

### Pond 10P: DMH4

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 11P: P1d

Runoff = 3.92 cfs @ 12.16 hrs, Volume= 0.356 af, Depth= 4.94"

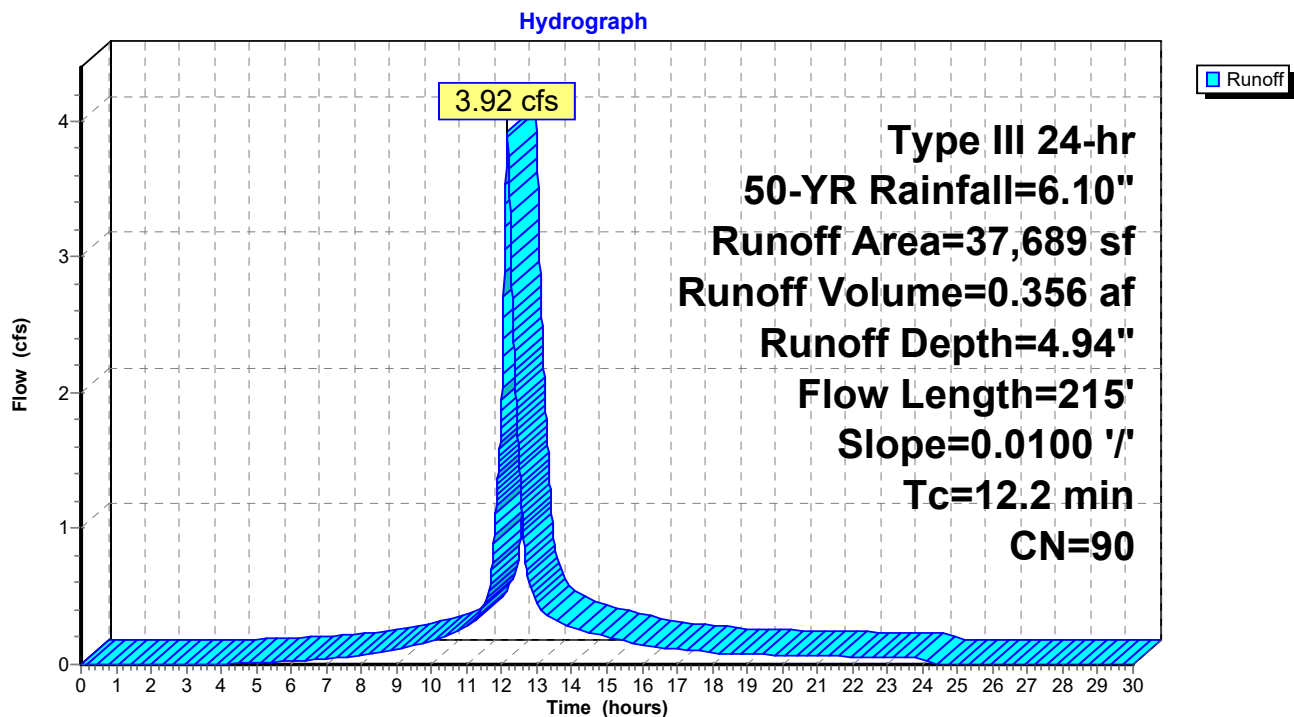
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
19,670	98	Paved parking, HSG C
12,756	74	>75% Grass cover, Good, HSG C
5,263	98	Roofs, HSG C
37,689	90	Weighted Average
12,756		33.85% Pervious Area
24,933		66.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	15	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.2	215	Total			

### Subcatchment 11P: P1d



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 12P: CB7

Inflow Area = 0.865 ac, 66.15% Impervious, Inflow Depth = 4.94" for 50-YR event  
Inflow = 3.92 cfs @ 12.16 hrs, Volume= 0.356 af  
Outflow = 3.92 cfs @ 12.16 hrs, Volume= 0.356 af, Atten= 0%, Lag= 0.0 min  
Primary = 3.92 cfs @ 12.16 hrs, Volume= 0.356 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 212.40' @ 12.16 hrs

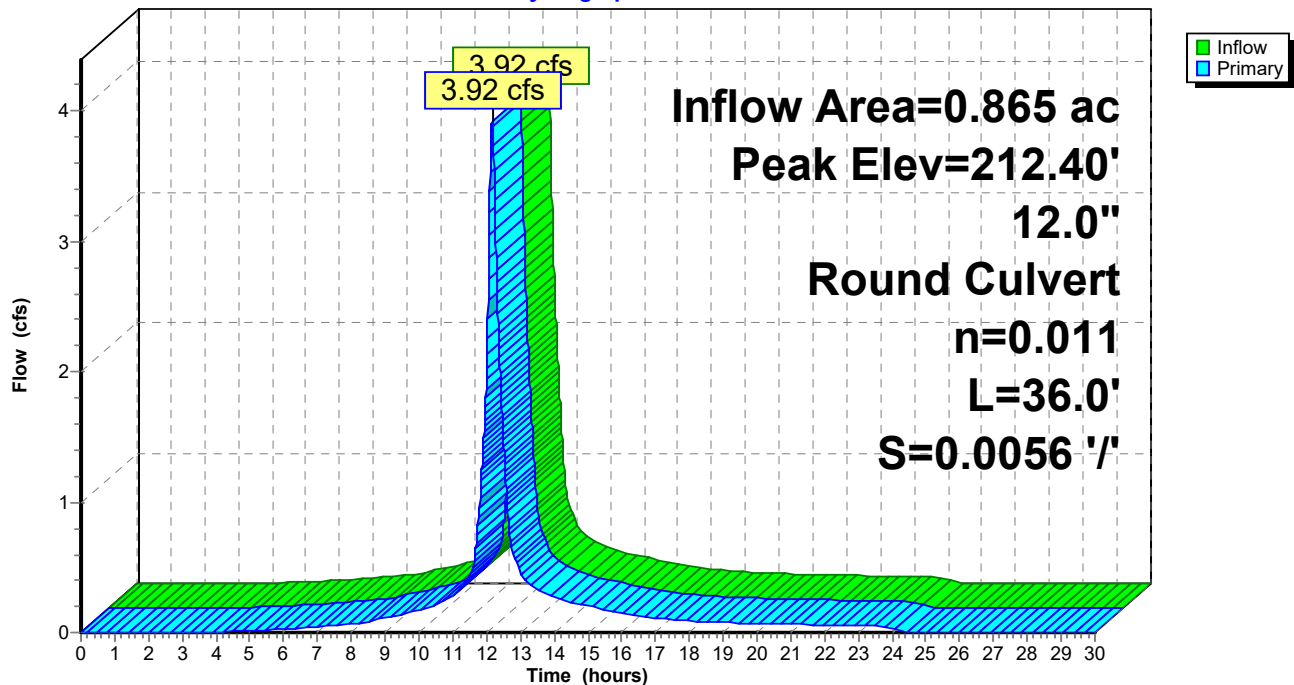
Device	Routing	Invert	Outlet Devices
#1	Primary	210.70'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.70' / 210.50' S= 0.0056 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=3.92 cfs @ 12.16 hrs HW=212.39' (Free Discharge)

↑1=Culvert (Barrel Controls 3.92 cfs @ 4.99 fps)

### Pond 12P: CB7

Hydrograph





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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 13P: P1e

Runoff = 2.08 cfs @ 12.15 hrs, Volume= 0.175 af, Depth= 3.27"

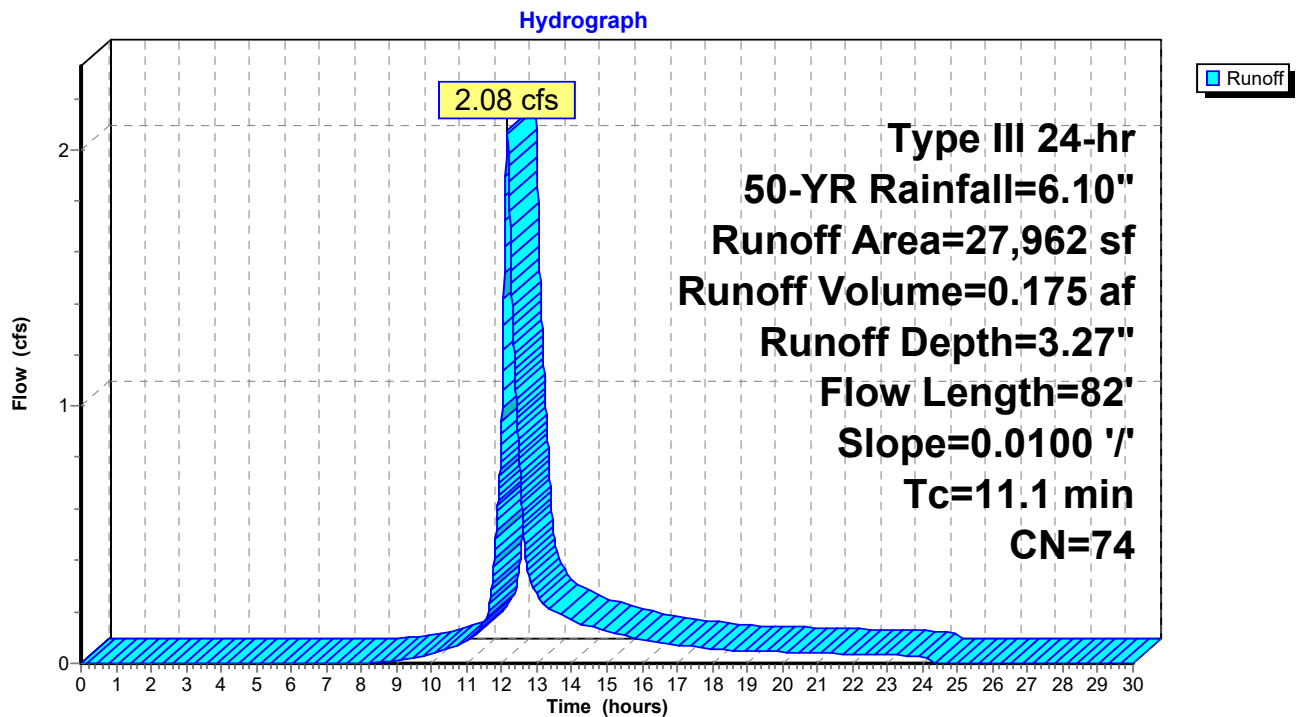
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
27,962	74	>75% Grass cover, Good, HSG C
27,962		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.3	32	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.1	82	Total			

### Subcatchment 13P: P1e



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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 14P: P1f

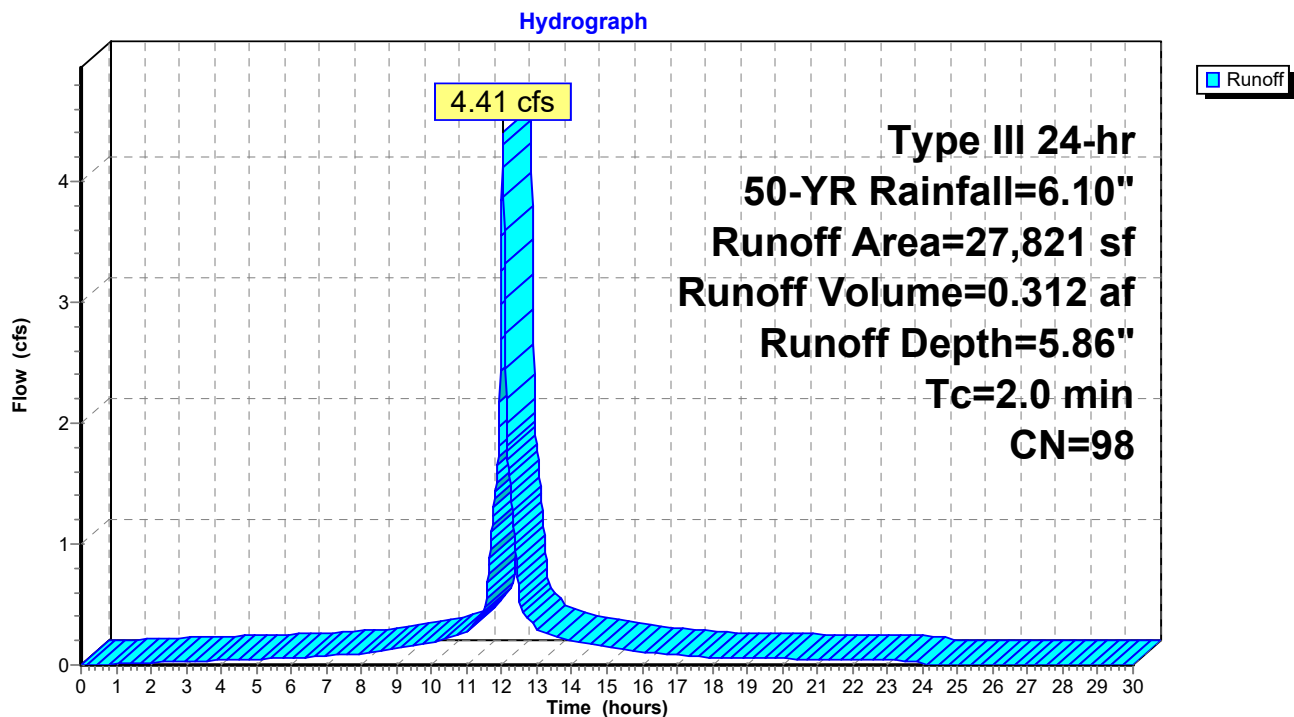
Runoff = 4.41 cfs @ 12.03 hrs, Volume= 0.312 af, Depth= 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
27,821	98	Roofs, HSG C
27,821		100.00% Impervious Area

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

### Subcatchment 14P: P1f



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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 15P: Roof Pipes

Inflow Area = 0.639 ac, 100.00% Impervious, Inflow Depth = 5.86" for 50-YR event  
Inflow = 4.41 cfs @ 12.03 hrs, Volume= 0.312 af  
Outflow = 4.41 cfs @ 12.03 hrs, Volume= 0.312 af, Atten= 0%, Lag= 0.0 min  
Primary = 4.41 cfs @ 12.03 hrs, Volume= 0.312 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 215.86' @ 12.03 hrs

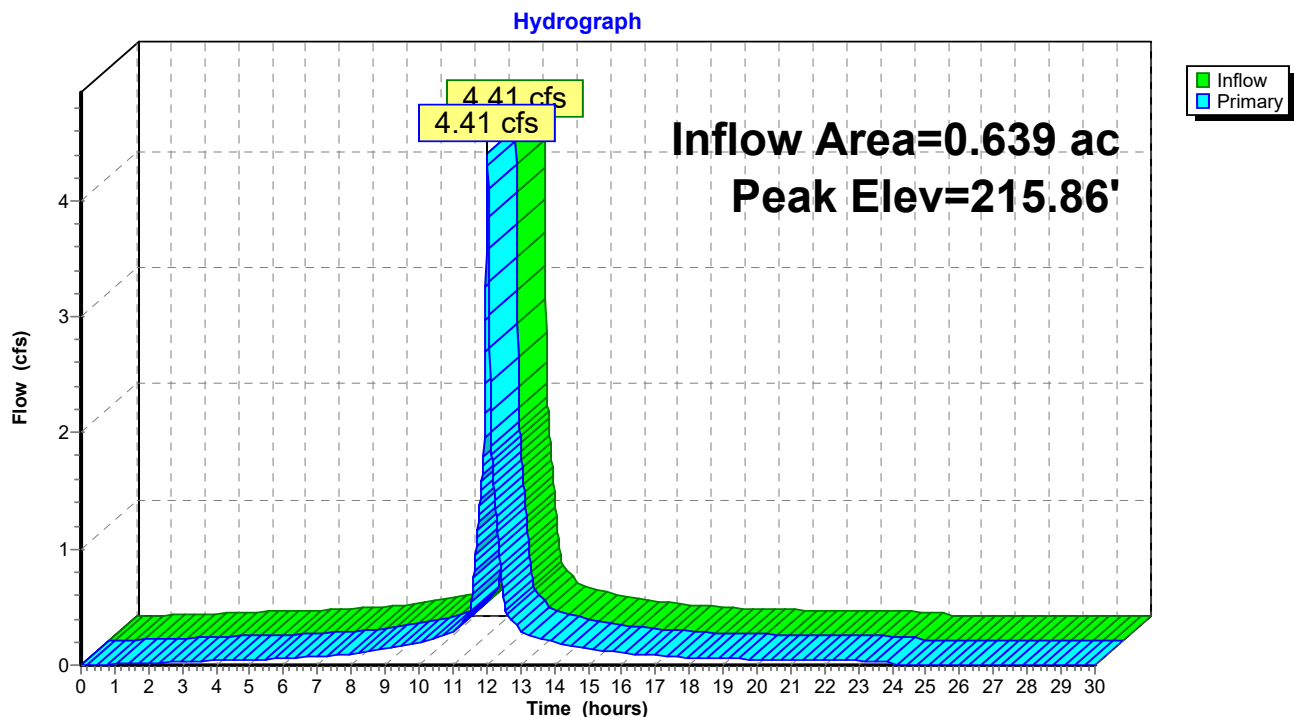
Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	<b>12.0" Round Culvert</b> L= 300.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.00' / 210.50' S= 0.0117 ' S= 0.0117 ' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#2	Primary	216.00'	<b>12.0" Round Culvert</b> L= 450.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 210.50' S= 0.0122 ' S= 0.0122 ' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=4.40 cfs @ 12.03 hrs HW=215.85' (Free Discharge)

1=Culvert (Inlet Controls 4.40 cfs @ 5.60 fps)

2=Culvert ( Controls 0.00 cfs)

### Pond 15P: Roof Pipes



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 16P: Basin #1

Inflow Area = 3.950 ac, 62.23% Impervious, Inflow Depth = 4.84" for 50-YR event  
Inflow = 15.95 cfs @ 12.15 hrs, Volume= 1.592 af  
Outflow = 7.09 cfs @ 12.44 hrs, Volume= 1.382 af, Atten= 56%, Lag= 17.5 min  
Discarded = 0.45 cfs @ 12.44 hrs, Volume= 0.743 af  
Primary = 6.65 cfs @ 12.44 hrs, Volume= 0.639 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 212.29' @ 12.44 hrs Surf.Area= 18,861 sf Storage= 28,046 cf

Plug-Flow detention time= 236.6 min calculated for 1.382 af (87% of inflow)  
Center-of-Mass det. time= 177.4 min ( 961.3 - 783.9 )

Volume	Invert	Avail.Storage	Storage Description		
#1	210.50'	32,180 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
210.50	12,754	521.0	0	0	12,754
212.50	19,675	607.0	32,180	32,180	20,556

Device	Routing	Invert	Outlet Devices
#1	Primary	211.80'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 211.80 213.00 Width (feet) 6.00 6.00
#2	Discarded	210.50'	<b>1.020 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.45 cfs @ 12.44 hrs HW=212.29' (Free Discharge)  
↑**2=Exfiltration** (Exfiltration Controls 0.45 cfs)

**Primary OutFlow** Max=6.65 cfs @ 12.44 hrs HW=212.29' (Free Discharge)  
↑**1=Custom Weir/Orifice** (Weir Controls 6.65 cfs @ 2.28 fps)

## Stormwater Calculations

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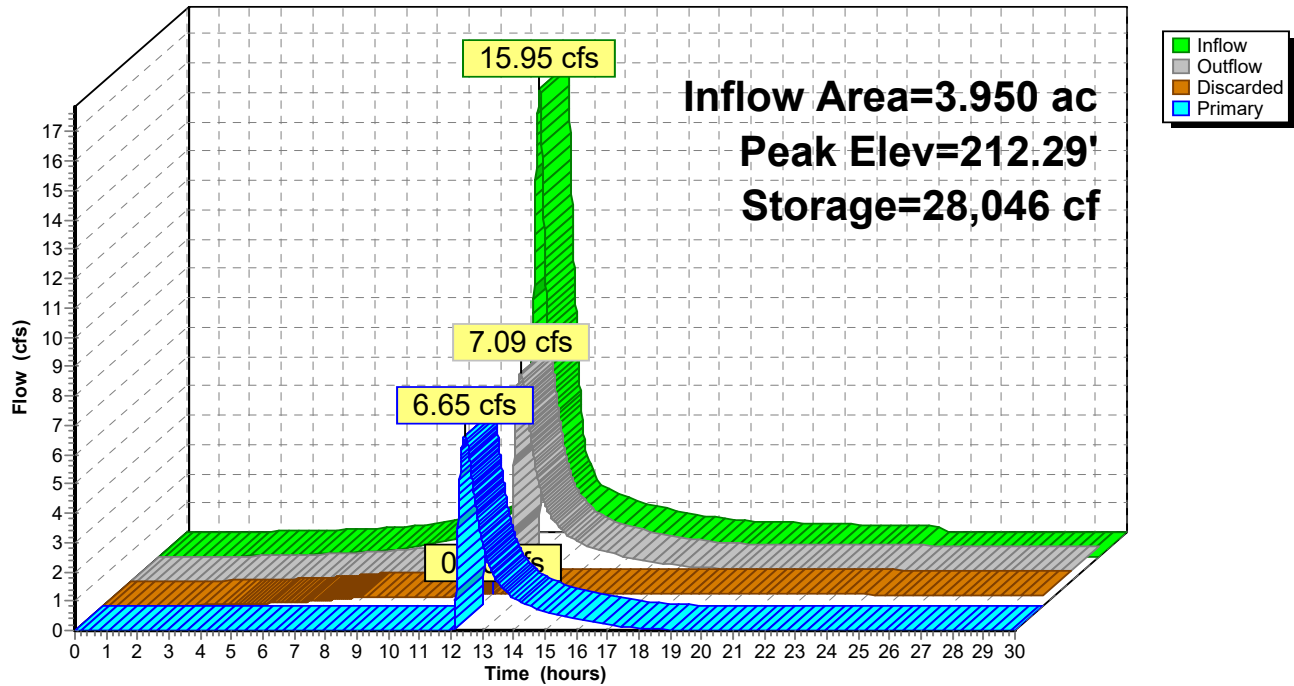
Type III 24-hr 50-YR Rainfall=6.10"

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### Pond 16P: Basin #1

#### Hydrograph



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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 17P: P1g

Runoff = 9.42 cfs @ 12.14 hrs, Volume= 0.758 af, Depth= 3.08"

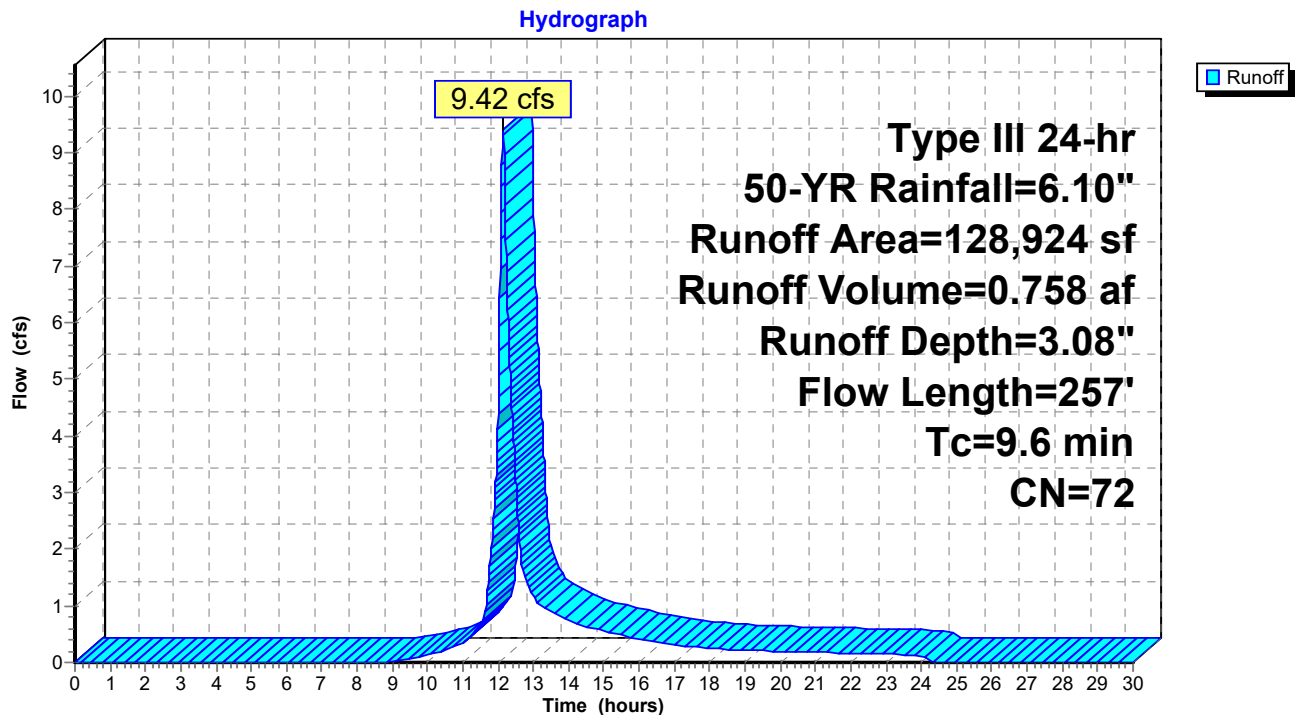
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
1,740	98	Paved parking, HSG C
50,163	74	>75% Grass cover, Good, HSG C
77,021	70	Woods, Good, HSG C
128,924	72	Weighted Average
127,184		98.65% Pervious Area
1,740		1.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	207	0.0240	2.49		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.6	257	Total			

### Subcatchment 17P: P1g



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### Summary for Subcatchment 18P: P1h

Runoff = 1.39 cfs @ 12.11 hrs, Volume= 0.105 af, Depth= 3.27"

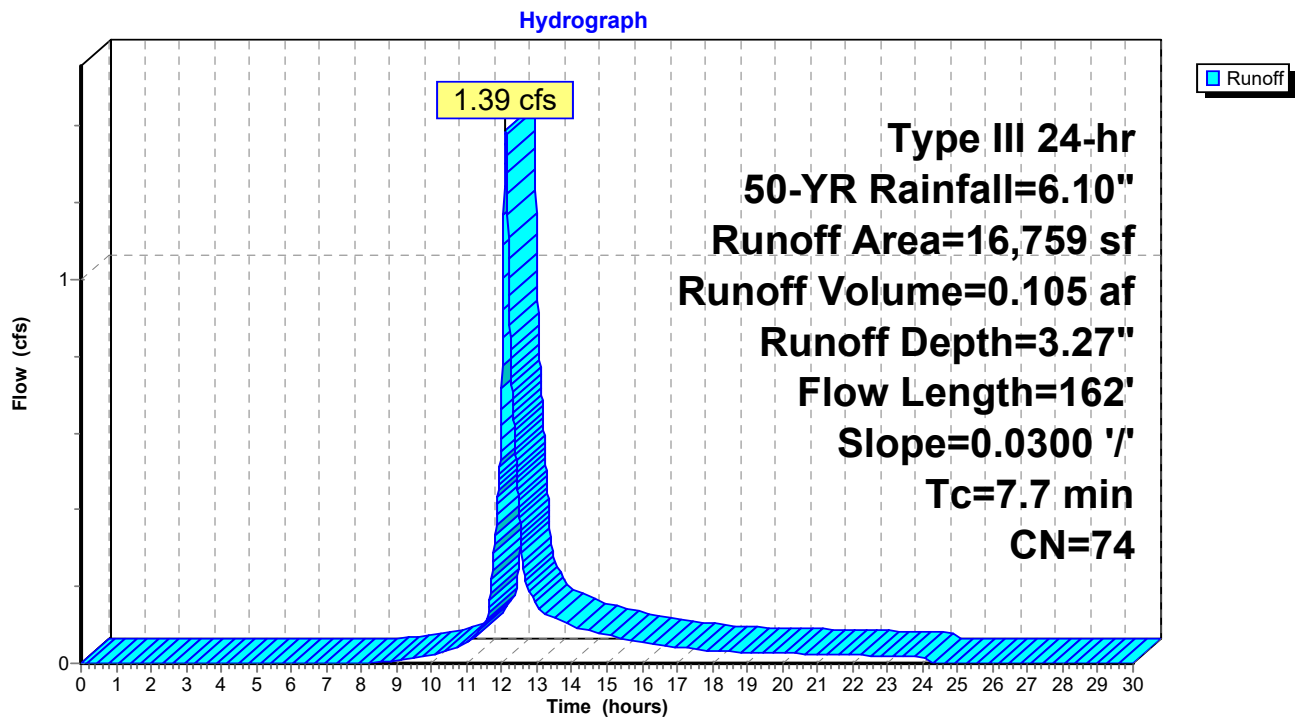
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
16,759	74	>75% Grass cover, Good, HSG C
16,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	112	0.0300	2.79		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.7	162	Total			

### Subcatchment 18P: P1h



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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 19P: P1i

Runoff = 2.99 cfs @ 12.09 hrs, Volume= 0.214 af, Depth= 3.27"

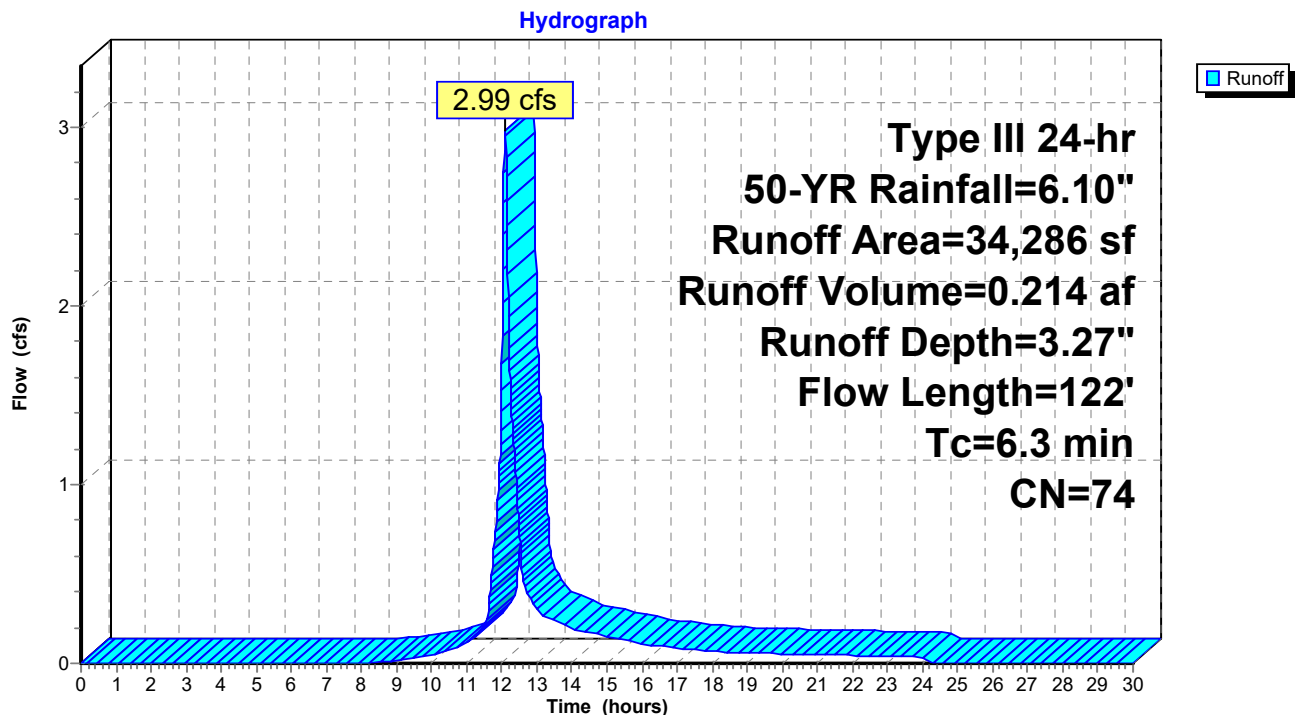
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
34,286	74	>75% Grass cover, Good, HSG C
34,286		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.1	72	0.9000	15.27		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.3	122	Total			

### Subcatchment 19P: P1i





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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 20P: P1j

Runoff = 5.24 cfs @ 12.12 hrs, Volume= 0.419 af, Depth= 4.50"

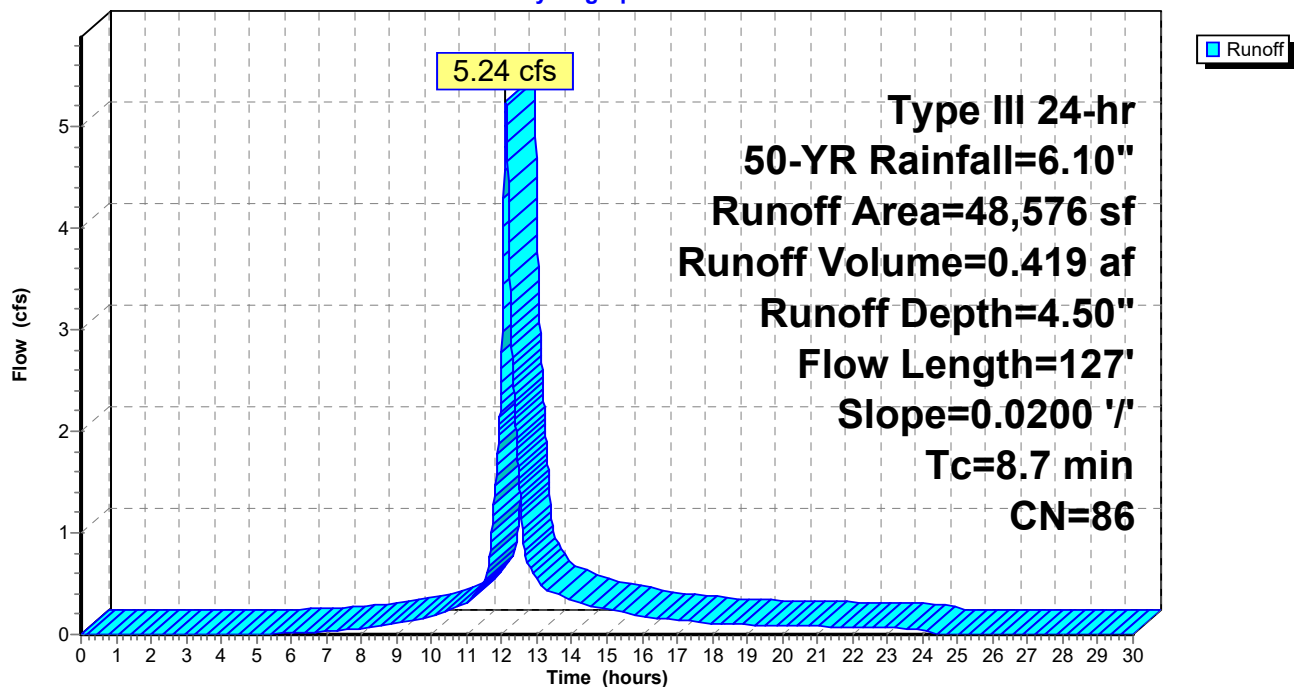
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
24,897	98	Paved parking, HSG C
4,121	70	Woods, Good, HSG C
19,558	74	>75% Grass cover, Good, HSG C
48,576	86	Weighted Average
23,679		48.75% Pervious Area
24,897		51.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	57	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.1	20	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
8.7	127	Total			

### Subcatchment 20P: P1j

Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 21P: Exist. CB

Inflow Area = 1.115 ac, 51.25% Impervious, Inflow Depth = 4.50" for 50-YR event  
Inflow = 5.24 cfs @ 12.12 hrs, Volume= 0.419 af  
Outflow = 5.24 cfs @ 12.12 hrs, Volume= 0.419 af, Atten= 0%, Lag= 0.0 min  
Primary = 5.24 cfs @ 12.12 hrs, Volume= 0.419 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.91' @ 12.12 hrs

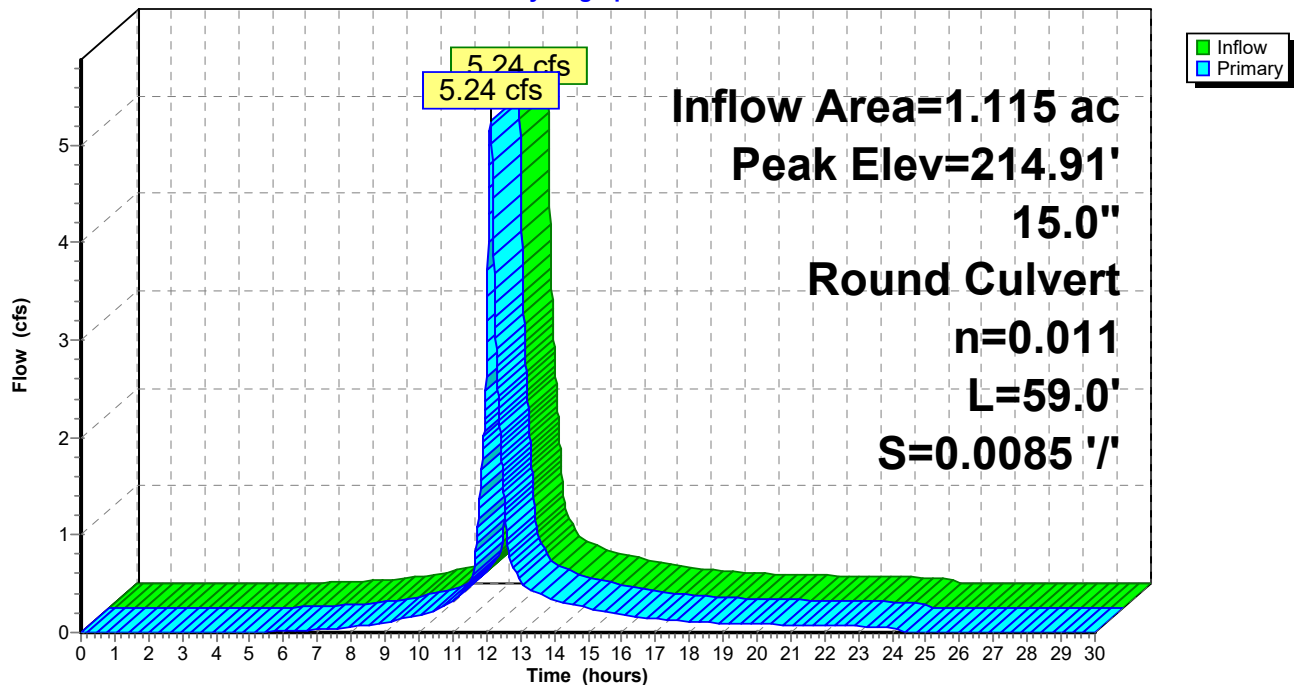
Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	<b>15.0" Round Culvert</b> L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.50' / 213.00' S= 0.0085 '/ Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

**Primary OutFlow** Max=5.24 cfs @ 12.12 hrs HW=214.91' (Free Discharge)

↑**1=Culvert** (Inlet Controls 5.24 cfs @ 4.27 fps)

### Pond 21P: Exist. CB

#### Hydrograph



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 22P: Existing Basin

Inflow Area = 1.902 ac, 30.05% Impervious, Inflow Depth = 3.99" for 50-YR event  
Inflow = 8.14 cfs @ 12.11 hrs, Volume= 0.633 af  
Outflow = 0.93 cfs @ 12.91 hrs, Volume= 0.633 af, Atten= 89%, Lag= 48.1 min  
Discarded = 0.69 cfs @ 12.91 hrs, Volume= 0.582 af  
Primary = 0.24 cfs @ 12.91 hrs, Volume= 0.051 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 213.94' @ 12.91 hrs Surf.Area= 12,292 sf Storage= 10,810 cf

Plug-Flow detention time= 118.0 min calculated for 0.633 af (100% of inflow)  
Center-of-Mass det. time= 117.9 min ( 927.3 - 809.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	32,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
213.00	10,659	0	0
214.00	12,392	11,526	11,526
215.50	15,086	20,609	32,134

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	<b>2.410 in/hr Exfiltration over Horizontal area</b>
#2	Primary	213.40'	<b>5.0' long x 0.8' breadth Level Spreader</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32
#3	Device 2	213.50'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.80 0.80 1.50 Width (feet) 0.25 0.25 8.00 8.00

**Discarded OutFlow** Max=0.69 cfs @ 12.91 hrs HW=213.94' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.69 cfs)

**Primary OutFlow** Max=0.24 cfs @ 12.91 hrs HW=213.94' (Free Discharge)

↑**2=Level Spreader** (Passes 0.24 cfs of 5.66 cfs potential flow)

↑**3=Custom Weir/Orifice** (Weir Controls 0.24 cfs @ 2.18 fps)

## Stormwater Calculations

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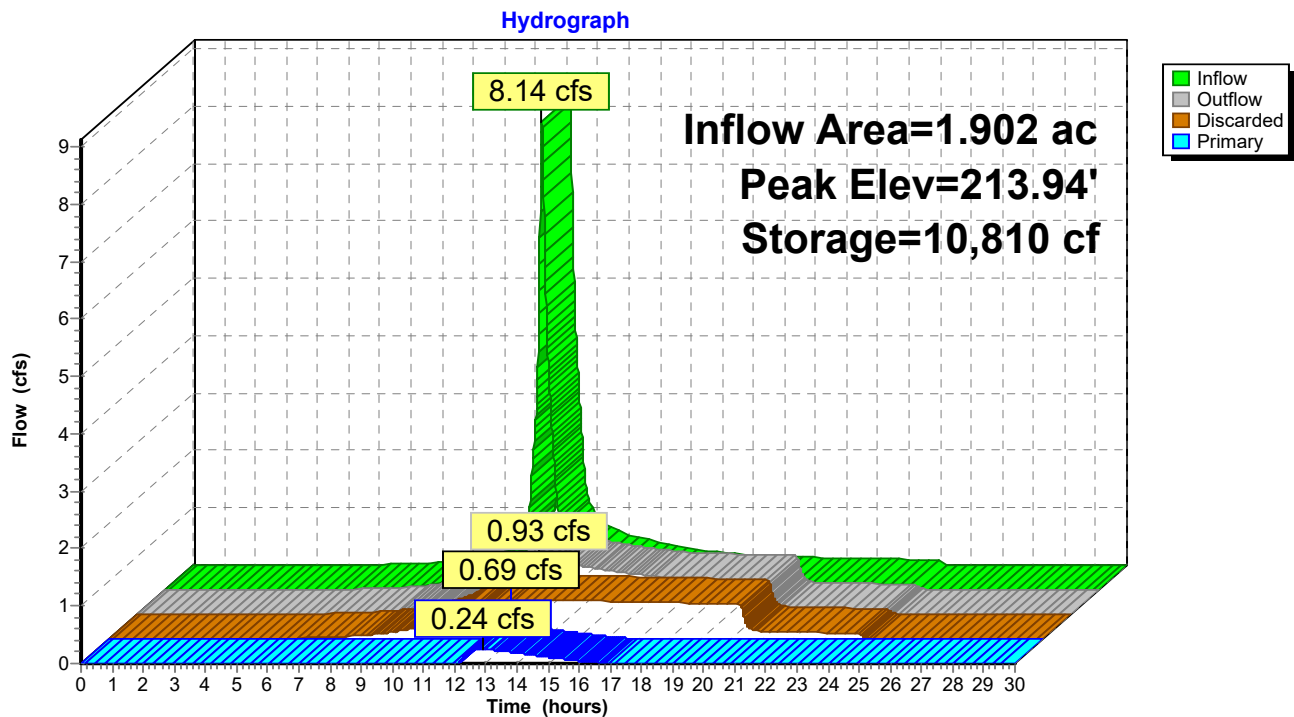
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### Pond 22P: Existing Basin



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### Summary for Link 23P: Design Point #1: Flow to Shadowfax Farm

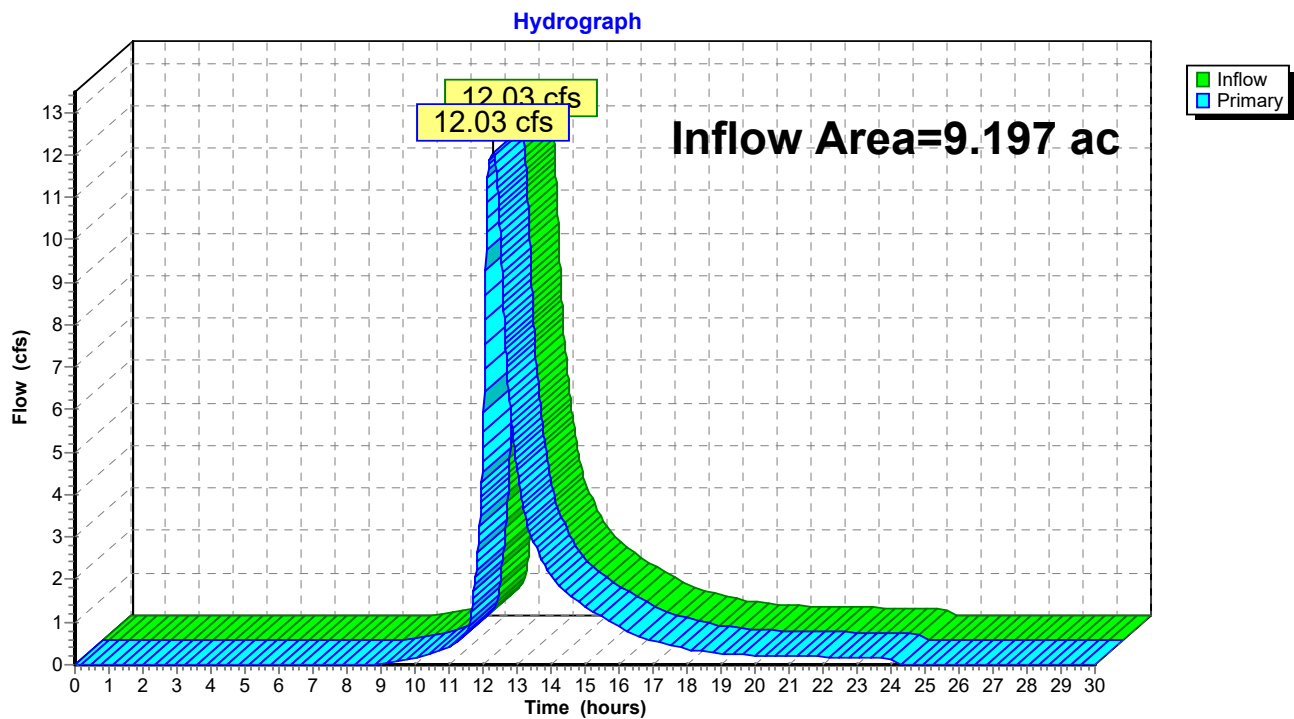
Inflow Area = 9.197 ac, 33.38% Impervious, Inflow Depth = 2.03" for 50-YR event

Inflow = 12.03 cfs @ 12.30 hrs, Volume= 1.553 af

Primary = 12.03 cfs @ 12.30 hrs, Volume= 1.553 af, Atten= 0%, Lag= 0.0 min

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

### Link 23P: Design Point #1: Flow to Shadowfax Farm



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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

### Subcatchment1P: P1a

Runoff Area=25,448 sf 67.62% Impervious Runoff Depth=5.53"  
Flow Length=195' Slope=0.0100 '/' Tc=12.0 min CN=90 Runoff=2.96 cfs 0.269 af

### Pond 2P: CB 1&2

Peak Elev=215.63' Inflow=2.96 cfs 0.269 af  
12.0" Round Culvert n=0.011 L=16.0' S=0.0125 '/' Outflow=2.96 cfs 0.269 af

### Pond 3P: DMH 1

Peak Elev=215.31' Inflow=2.96 cfs 0.269 af  
12.0" Round Culvert n=0.011 L=266.0' S=0.0083 '/' Outflow=2.96 cfs 0.269 af

### Subcatchment4P: P1b

Runoff Area=37,521 sf 63.69% Impervious Runoff Depth=5.42"  
Flow Length=291' Slope=0.0100 '/' Tc=12.8 min CN=89 Runoff=4.21 cfs 0.389 af

### Pond 5P: CB3&4

Peak Elev=213.84' Inflow=4.21 cfs 0.389 af  
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=4.21 cfs 0.389 af

### Subcatchment6P: P1c

Runoff Area=15,616 sf 84.56% Impervious Runoff Depth=5.99"  
Flow Length=300' Slope=0.0110 '/' Tc=8.1 min CN=94 Runoff=2.14 cfs 0.179 af

### Pond 7P: CB5&6

Peak Elev=214.55' Inflow=2.14 cfs 0.179 af  
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=2.14 cfs 0.179 af

### Pond 8P: DMH2

Peak Elev=214.22' Inflow=2.14 cfs 0.179 af  
12.0" Round Culvert n=0.011 L=167.0' S=0.0084 '/' Outflow=2.14 cfs 0.179 af

### Pond 9P: DMH3

Peak Elev=213.79' Inflow=9.07 cfs 0.837 af  
18.0" Round Culvert n=0.011 L=127.0' S=0.0071 '/' Outflow=9.07 cfs 0.837 af

### Pond 10P: DMH4

Peak Elev=213.04' Inflow=9.07 cfs 0.837 af  
18.0" Round Culvert n=0.011 L=80.0' S=0.0050 '/' Outflow=9.07 cfs 0.837 af

### Subcatchment11P: P1d

Runoff Area=37,689 sf 66.15% Impervious Runoff Depth=5.53"  
Flow Length=215' Slope=0.0100 '/' Tc=12.2 min CN=90 Runoff=4.36 cfs 0.399 af

### Pond 12P: CB7

Peak Elev=212.61' Inflow=4.36 cfs 0.399 af  
12.0" Round Culvert n=0.011 L=36.0' S=0.0056 '/' Outflow=4.36 cfs 0.399 af

### Subcatchment13P: P1e

Runoff Area=27,962 sf 0.00% Impervious Runoff Depth=3.78"  
Flow Length=82' Slope=0.0100 '/' Tc=11.1 min CN=74 Runoff=2.40 cfs 0.202 af

### Subcatchment14P: P1f

Runoff Area=27,821 sf 100.00% Impervious Runoff Depth=6.46"  
Tc=2.0 min CN=98 Runoff=4.84 cfs 0.344 af

### Pond 15P: Roof Pipes

Peak Elev=216.16' Inflow=4.84 cfs 0.344 af  
Outflow=4.84 cfs 0.344 af

### Pond 16P: Basin #1

Peak Elev=212.38' Storage=29,859 cf Inflow=17.80 cfs 1.782 af  
Discarded=0.45 cfs 0.758 af Primary=8.70 cfs 0.802 af Outflow=9.15 cfs 1.560 af

## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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### Subcatchment17P: P1g

Runoff Area=128,924 sf 1.35% Impervious Runoff Depth=3.57"  
Flow Length=257' Tc=9.6 min CN=72 Runoff=10.98 cfs 0.882 af

### Subcatchment18P: P1h

Runoff Area=16,759 sf 0.00% Impervious Runoff Depth=3.78"  
Flow Length=162' Slope=0.0300 '/' Tc=7.7 min CN=74 Runoff=1.61 cfs 0.121 af

### Subcatchment19P: P1i

Runoff Area=34,286 sf 0.00% Impervious Runoff Depth=3.78"  
Flow Length=122' Tc=6.3 min CN=74 Runoff=3.46 cfs 0.248 af

### Subcatchment20P: P1j

Runoff Area=48,576 sf 51.25% Impervious Runoff Depth=5.08"  
Flow Length=127' Slope=0.0200 '/' Tc=8.7 min CN=86 Runoff=5.88 cfs 0.472 af

### Pond 21P: Exist. CB

Peak Elev=215.11' Inflow=5.88 cfs 0.472 af  
15.0" Round Culvert n=0.011 L=59.0' S=0.0085 '/' Outflow=5.88 cfs 0.472 af

### Pond 22P: Existing Basin

Peak Elev=214.08' Storage=12,498 cf Inflow=9.23 cfs 0.720 af  
Discarded=0.70 cfs 0.635 af Primary=0.36 cfs 0.085 af Outflow=1.06 cfs 0.720 af

### Link 23P: Design Point #1: Flow to Shadowfax Farm

Inflow=16.08 cfs 1.890 af  
Primary=16.08 cfs 1.890 af

**Total Runoff Area = 9.197 ac Runoff Volume = 3.505 af Average Runoff Depth = 4.57"**  
**66.62% Pervious = 6.127 ac 33.38% Impervious = 3.069 ac**

## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 1P: P1a

Runoff = 2.96 cfs @ 12.16 hrs, Volume= 0.269 af, Depth= 5.53"

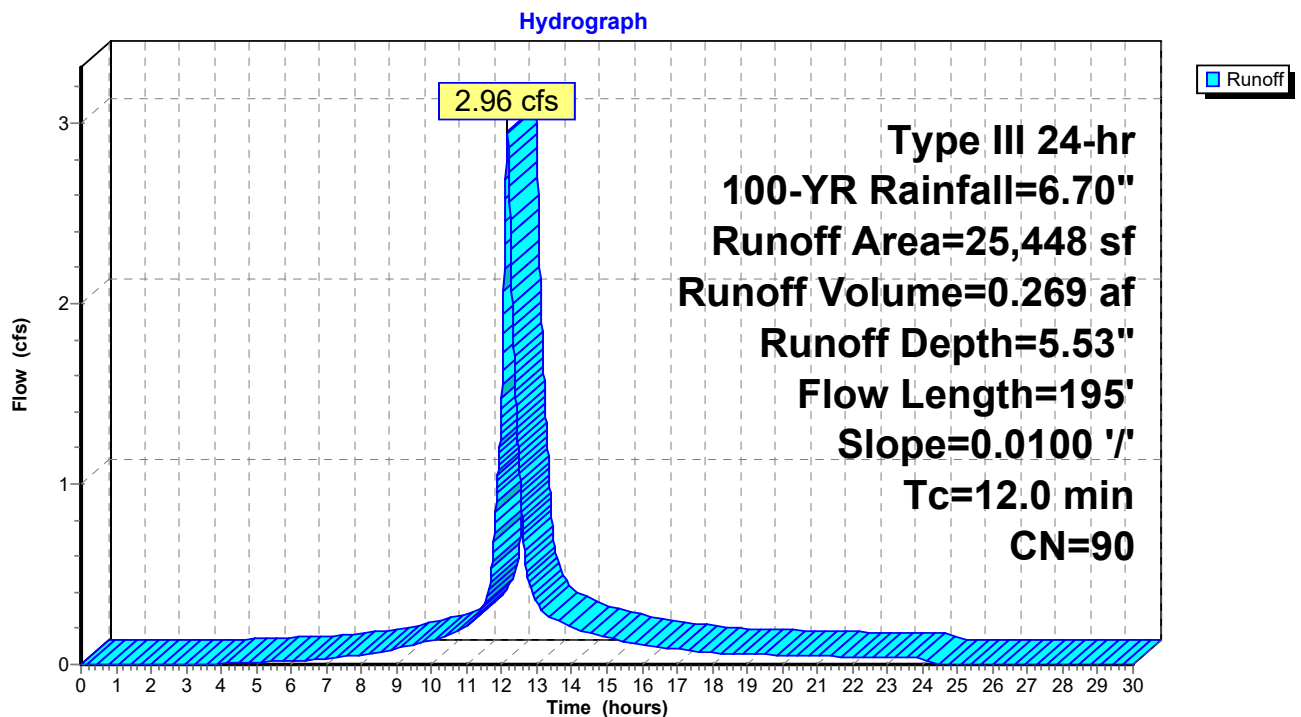
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
11,922	98	Paved parking, HSG C
8,239	74	>75% Grass cover, Good, HSG C
5,287	98	Roofs, HSG C
25,448	90	Weighted Average
8,239		32.38% Pervious Area
17,209		67.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	21	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.0	124	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.0	195	Total			

### Subcatchment 1P: P1a





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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 2P: CB 1&2

Inflow Area = 0.584 ac, 67.62% Impervious, Inflow Depth = 5.53" for 100-YR event  
Inflow = 2.96 cfs @ 12.16 hrs, Volume= 0.269 af  
Outflow = 2.96 cfs @ 12.16 hrs, Volume= 0.269 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.96 cfs @ 12.16 hrs, Volume= 0.269 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 215.63' @ 12.16 hrs

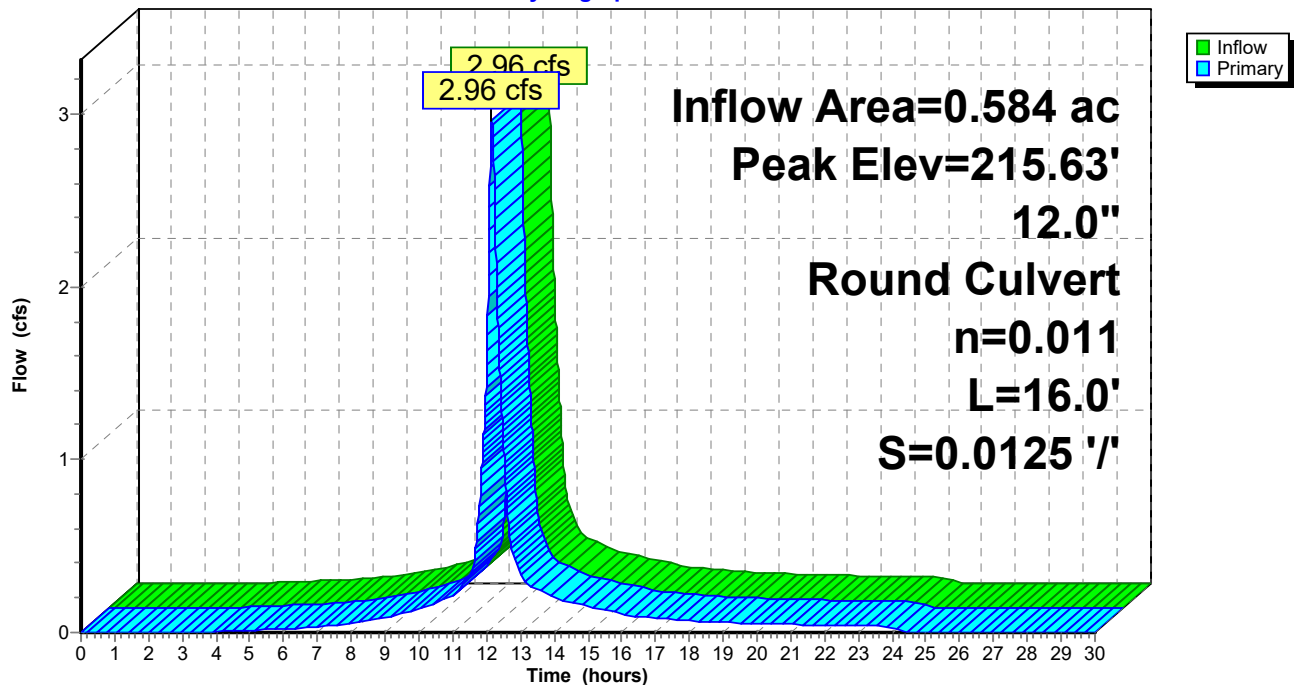
Device	Routing	Invert	Outlet Devices
#1	Primary	214.50'	<b>12.0" Round Culvert</b> L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.50' / 214.30' S= 0.0125 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.96 cfs @ 12.16 hrs HW=215.63' (Free Discharge)

↑1=Culvert (Barrel Controls 2.96 cfs @ 4.18 fps)

### Pond 2P: CB 1&2

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 3P: DMH 1

Inflow Area = 0.584 ac, 67.62% Impervious, Inflow Depth = 5.53" for 100-YR event  
Inflow = 2.96 cfs @ 12.16 hrs, Volume= 0.269 af  
Outflow = 2.96 cfs @ 12.16 hrs, Volume= 0.269 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.96 cfs @ 12.16 hrs, Volume= 0.269 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 215.31' @ 12.16 hrs

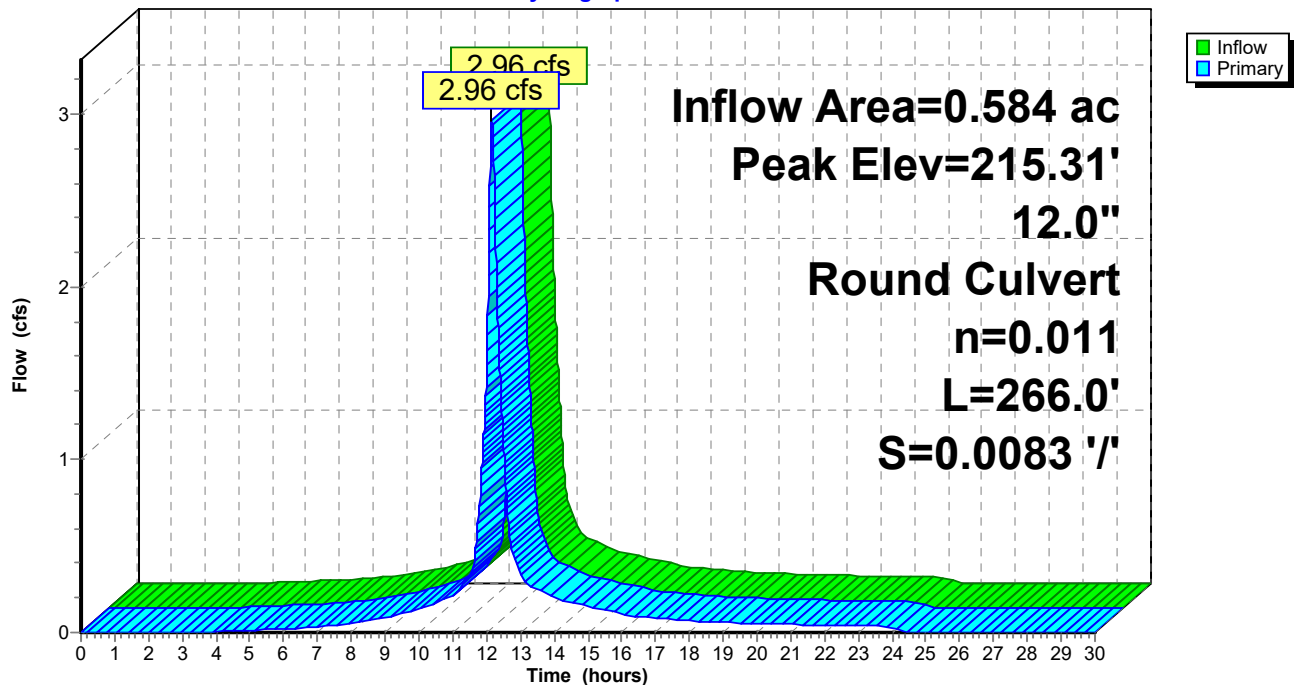
Device	Routing	Invert	Outlet Devices
#1	Primary	214.20'	<b>12.0" Round Culvert</b> L= 266.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.20' / 212.00' S= 0.0083 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.96 cfs @ 12.16 hrs HW=215.31' (Free Discharge)

↑**1=Culvert** (Inlet Controls 2.96 cfs @ 3.77 fps)

### Pond 3P: DMH 1

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 4P: P1b

Runoff = 4.21 cfs @ 12.17 hrs, Volume= 0.389 af, Depth= 5.42"

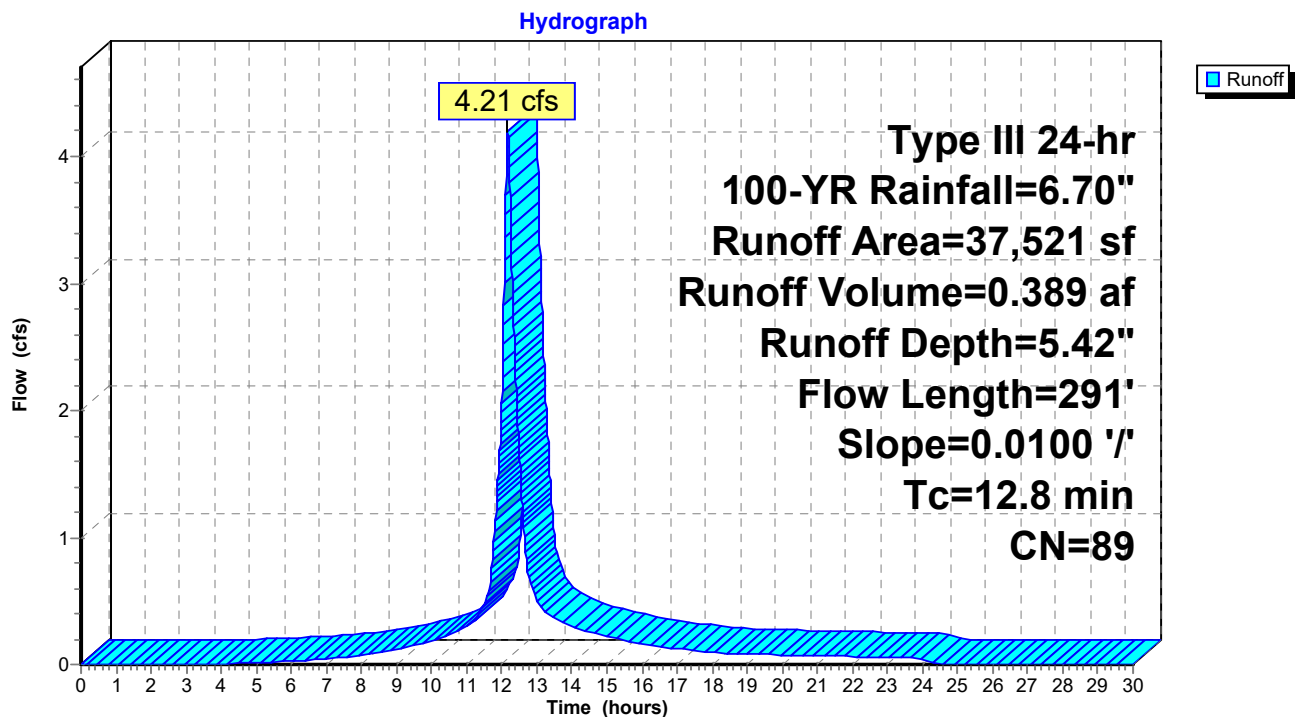
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
14,283	98	Paved parking, HSG C
13,625	74	>75% Grass cover, Good, HSG C
9,613	98	Roofs, HSG C
37,521	89	Weighted Average
13,625		36.31% Pervious Area
23,896		63.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.1	14	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.9	227	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.8	291	Total			

### Subcatchment 4P: P1b



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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 5P: CB3&4

Inflow Area = 0.861 ac, 63.69% Impervious, Inflow Depth = 5.42" for 100-YR event  
Inflow = 4.21 cfs @ 12.17 hrs, Volume= 0.389 af  
Outflow = 4.21 cfs @ 12.17 hrs, Volume= 0.389 af, Atten= 0%, Lag= 0.0 min  
Primary = 4.21 cfs @ 12.17 hrs, Volume= 0.389 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 213.84' @ 12.17 hrs

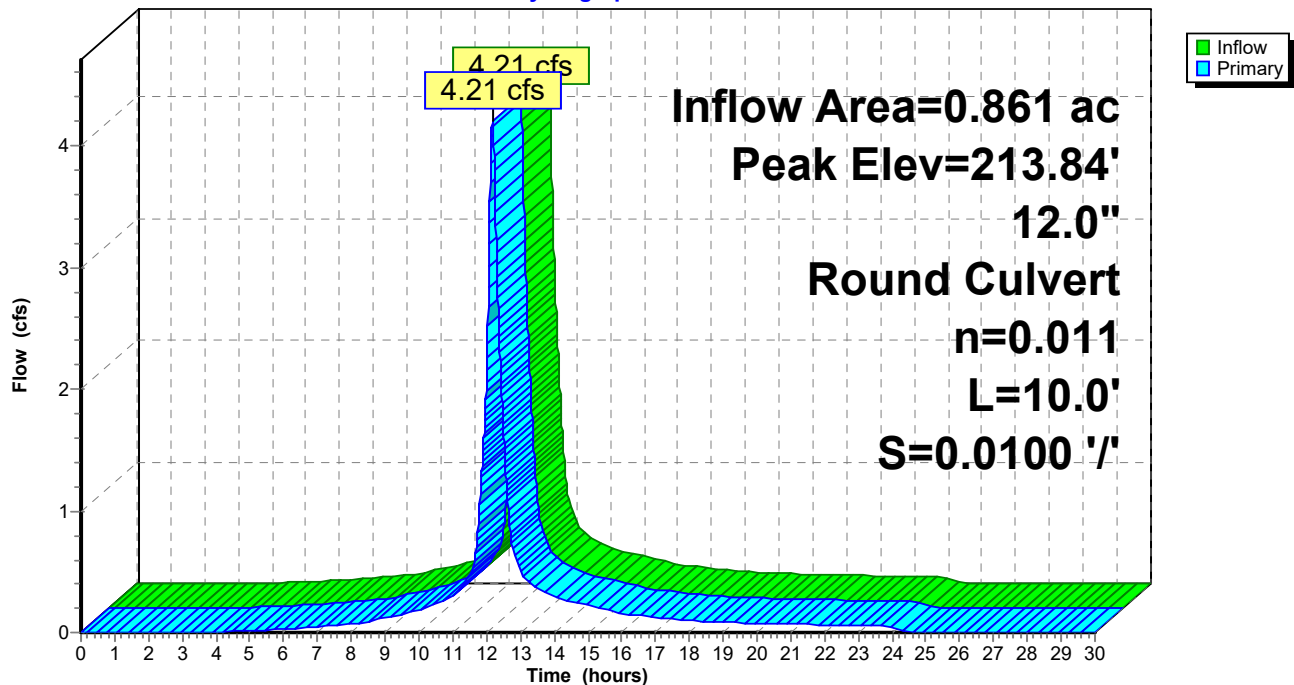
Device	Routing	Invert	Outlet Devices
#1	Primary	212.10'	<b>12.0" Round Culvert</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 212.10' / 212.00' S= 0.0100 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=4.20 cfs @ 12.17 hrs HW=213.84' (Free Discharge)

↑1=Culvert (Inlet Controls 4.20 cfs @ 5.35 fps)

### Pond 5P: CB3&4

Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 6P: P1c

Runoff = 2.14 cfs @ 12.11 hrs, Volume= 0.179 af, Depth= 5.99"

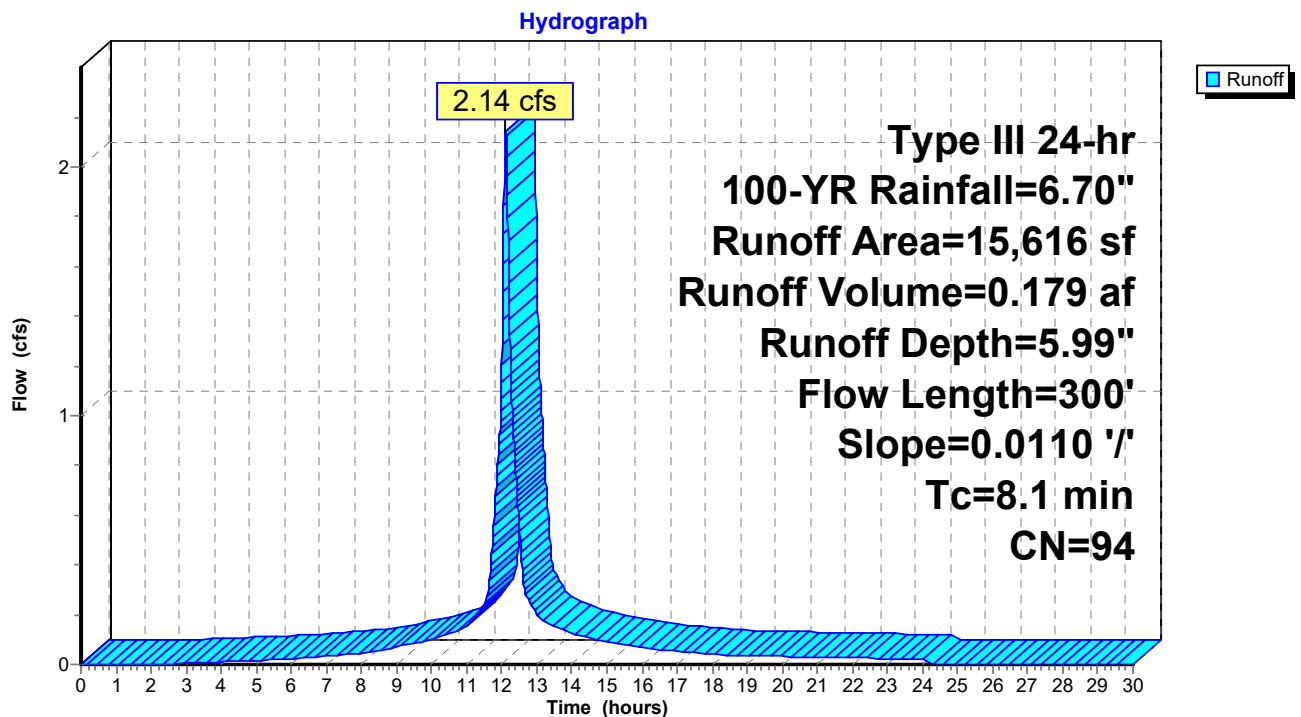
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
10,458	98	Paved parking, HSG C
2,411	74	>75% Grass cover, Good, HSG C
2,747	98	Roofs, HSG C
15,616	94	Weighted Average
2,411		15.44% Pervious Area
13,205		84.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	23	0.0110	0.07		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.5	27	0.0110	0.83		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
2.0	250	0.0110	2.13		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
8.1	300	Total			

### Subcatchment 6P: P1c



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### Summary for Pond 7P: CB5&6

Inflow Area = 0.358 ac, 84.56% Impervious, Inflow Depth = 5.99" for 100-YR event  
Inflow = 2.14 cfs @ 12.11 hrs, Volume= 0.179 af  
Outflow = 2.14 cfs @ 12.11 hrs, Volume= 0.179 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.14 cfs @ 12.11 hrs, Volume= 0.179 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 214.55' @ 12.11 hrs

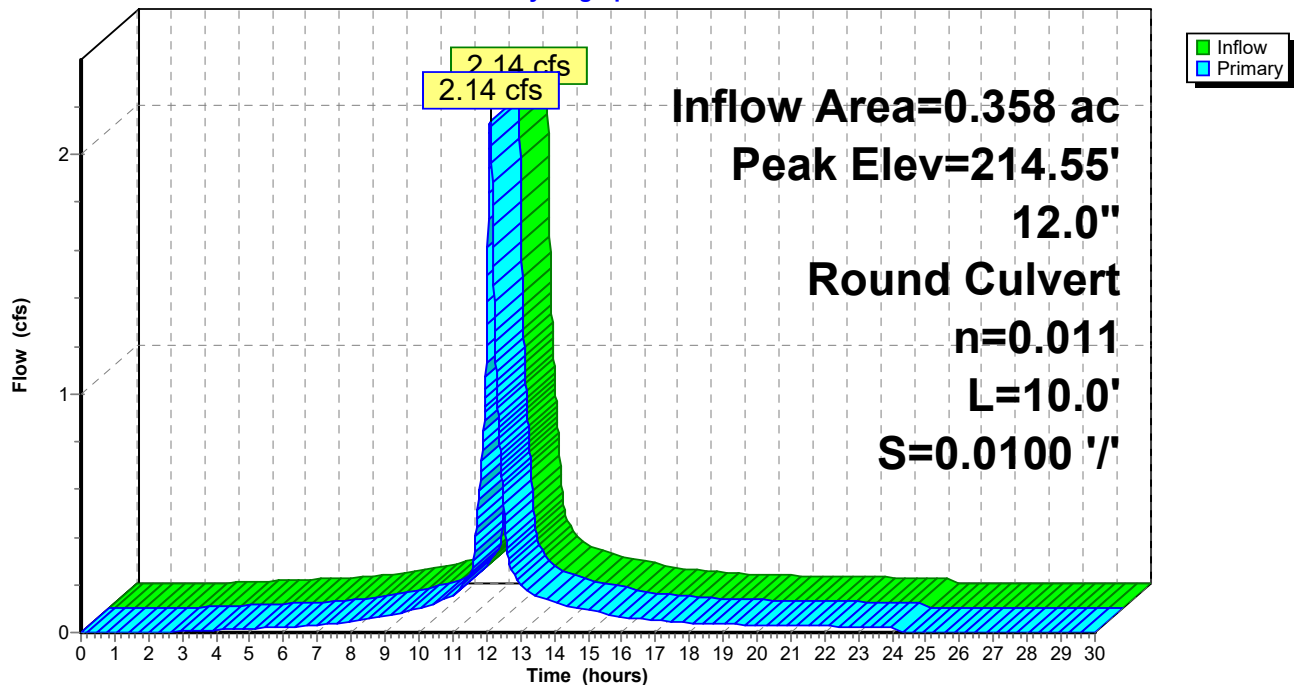
Device	Routing	Invert	Outlet Devices
#1	Primary	213.60'	<b>12.0" Round Culvert</b> L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.60' / 213.50' S= 0.0100 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.14 cfs @ 12.11 hrs HW=214.55' (Free Discharge)

↑1=Culvert (Barrel Controls 2.14 cfs @ 3.59 fps)

### Pond 7P: CB5&6

Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 8P: DMH2

Inflow Area = 0.358 ac, 84.56% Impervious, Inflow Depth = 5.99" for 100-YR event  
Inflow = 2.14 cfs @ 12.11 hrs, Volume= 0.179 af  
Outflow = 2.14 cfs @ 12.11 hrs, Volume= 0.179 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.14 cfs @ 12.11 hrs, Volume= 0.179 af

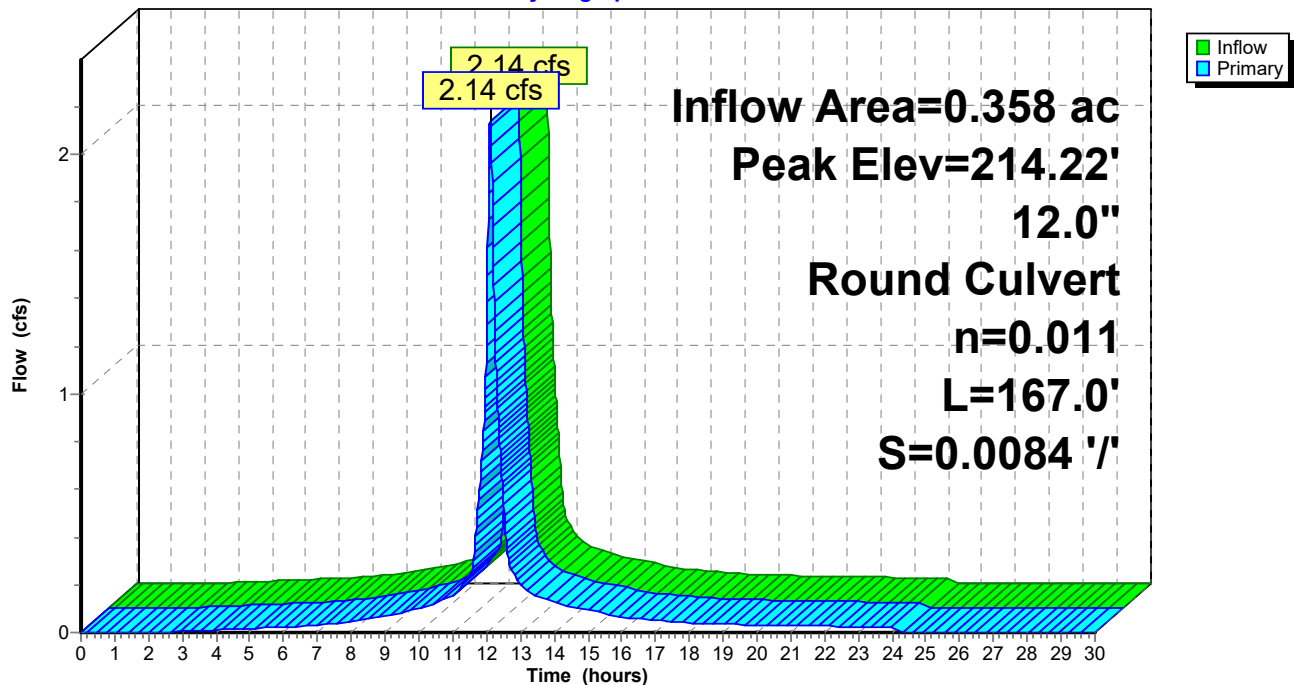
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 214.22' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	213.40'	<b>12.0" Round Culvert</b> L= 167.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.40' / 212.00' S= 0.0084 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.14 cfs @ 12.11 hrs HW=214.22' (Free Discharge)  
↑1=Culvert (Inlet Controls 2.14 cfs @ 3.09 fps)

### Pond 8P: DMH2

Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 9P: DMH3

Inflow Area = 1.804 ac, 69.11% Impervious, Inflow Depth = 5.57" for 100-YR event  
Inflow = 9.07 cfs @ 12.15 hrs, Volume= 0.837 af  
Outflow = 9.07 cfs @ 12.15 hrs, Volume= 0.837 af, Atten= 0%, Lag= 0.0 min  
Primary = 9.07 cfs @ 12.15 hrs, Volume= 0.837 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 213.79' @ 12.15 hrs

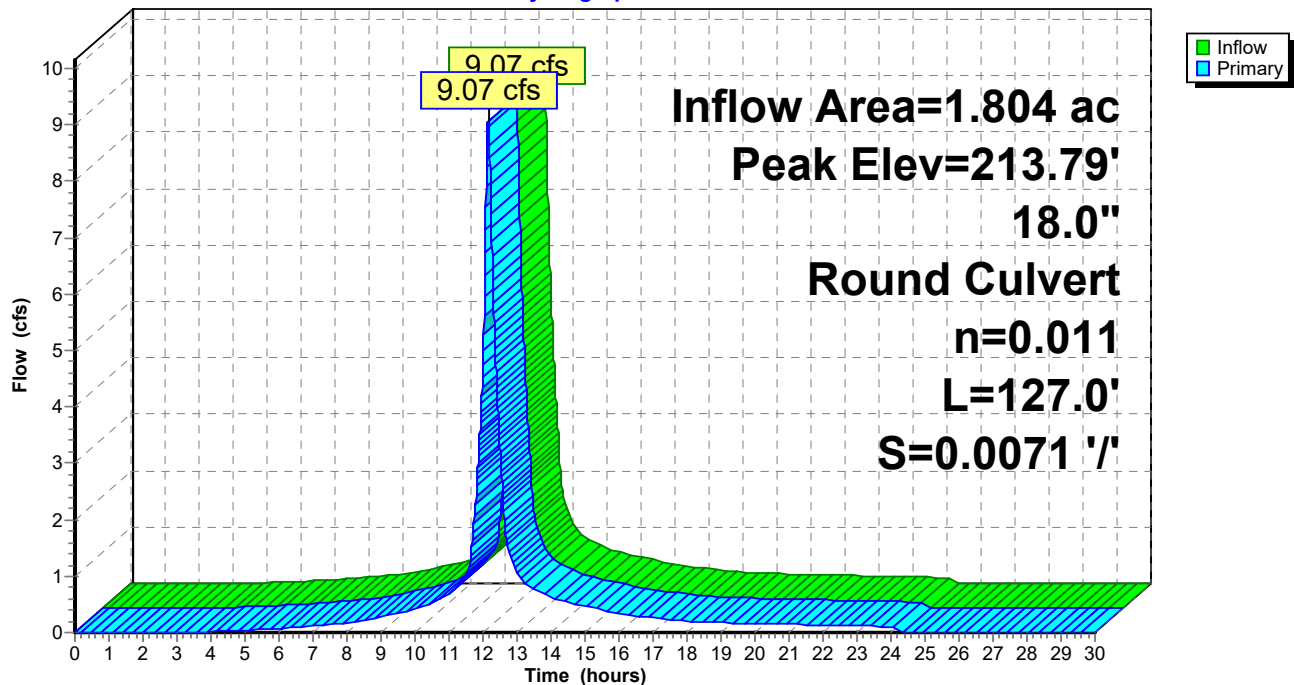
Device	Routing	Invert	Outlet Devices
#1	Primary	211.90'	<b>18.0" Round Culvert</b> L= 127.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 211.90' / 211.00' S= 0.0071 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=9.06 cfs @ 12.15 hrs HW=213.78' (Free Discharge)

↑**1=Culvert** (Inlet Controls 9.06 cfs @ 5.13 fps)

### Pond 9P: DMH3

#### Hydrograph





## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 10P: DMH4

Inflow Area = 1.804 ac, 69.11% Impervious, Inflow Depth = 5.57" for 100-YR event  
Inflow = 9.07 cfs @ 12.15 hrs, Volume= 0.837 af  
Outflow = 9.07 cfs @ 12.15 hrs, Volume= 0.837 af, Atten= 0%, Lag= 0.0 min  
Primary = 9.07 cfs @ 12.15 hrs, Volume= 0.837 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 213.04' @ 12.15 hrs

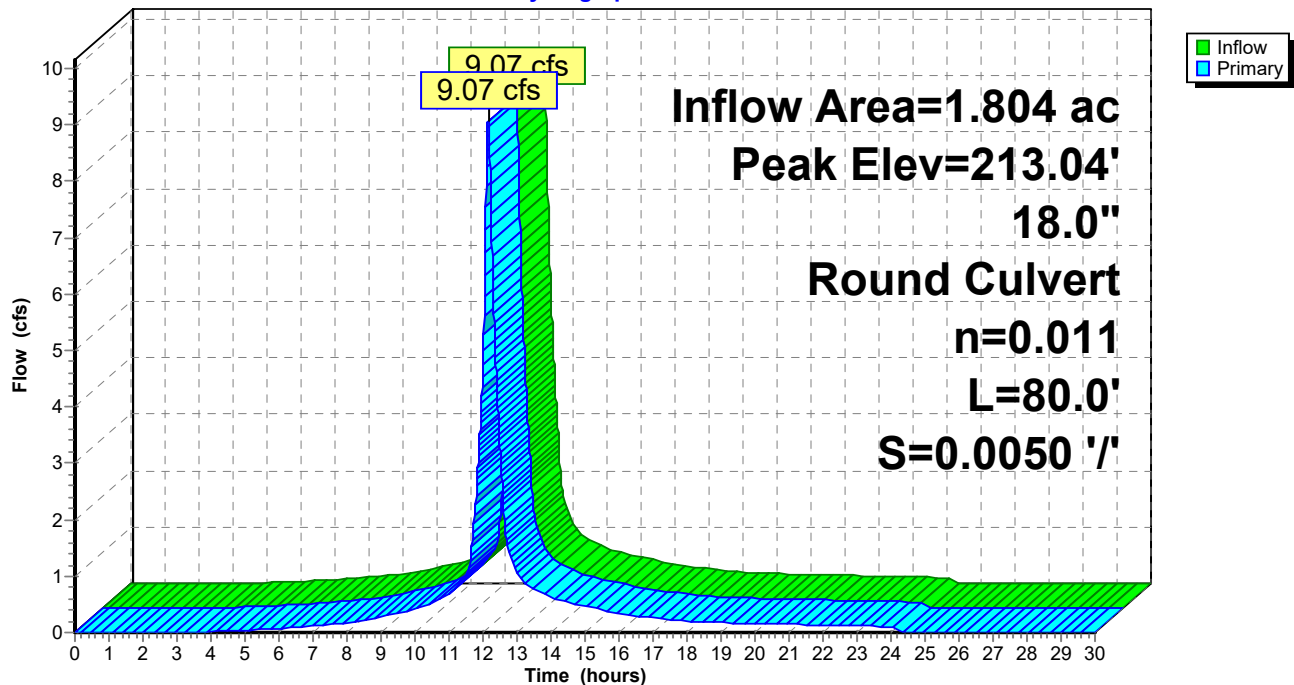
Device	Routing	Invert	Outlet Devices
#1	Primary	210.90'	<b>18.0" Round Culvert</b> L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.90' / 210.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=9.06 cfs @ 12.15 hrs HW=213.04' (Free Discharge)

↑1=Culvert (Barrel Controls 9.06 cfs @ 5.13 fps)

### Pond 10P: DMH4

Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 11P: P1d

Runoff = 4.36 cfs @ 12.16 hrs, Volume= 0.399 af, Depth= 5.53"

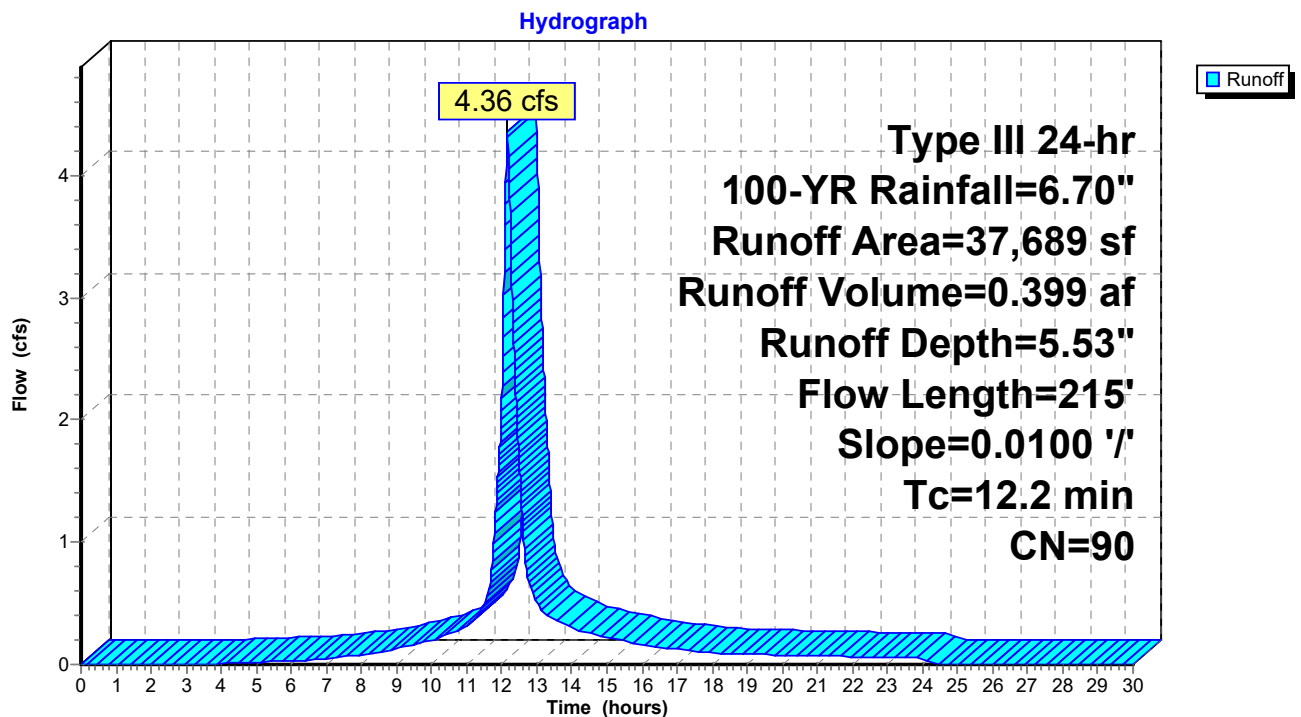
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
19,670	98	Paved parking, HSG C
12,756	74	>75% Grass cover, Good, HSG C
5,263	98	Roofs, HSG C
37,689	90	Weighted Average
12,756		33.85% Pervious Area
24,933		66.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.2	15	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
12.2	215	Total			

### Subcatchment 11P: P1d



## Stormwater Calculations

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### Summary for Pond 12P: CB7

Inflow Area = 0.865 ac, 66.15% Impervious, Inflow Depth = 5.53" for 100-YR event  
Inflow = 4.36 cfs @ 12.16 hrs, Volume= 0.399 af  
Outflow = 4.36 cfs @ 12.16 hrs, Volume= 0.399 af, Atten= 0%, Lag= 0.0 min  
Primary = 4.36 cfs @ 12.16 hrs, Volume= 0.399 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 212.61' @ 12.16 hrs

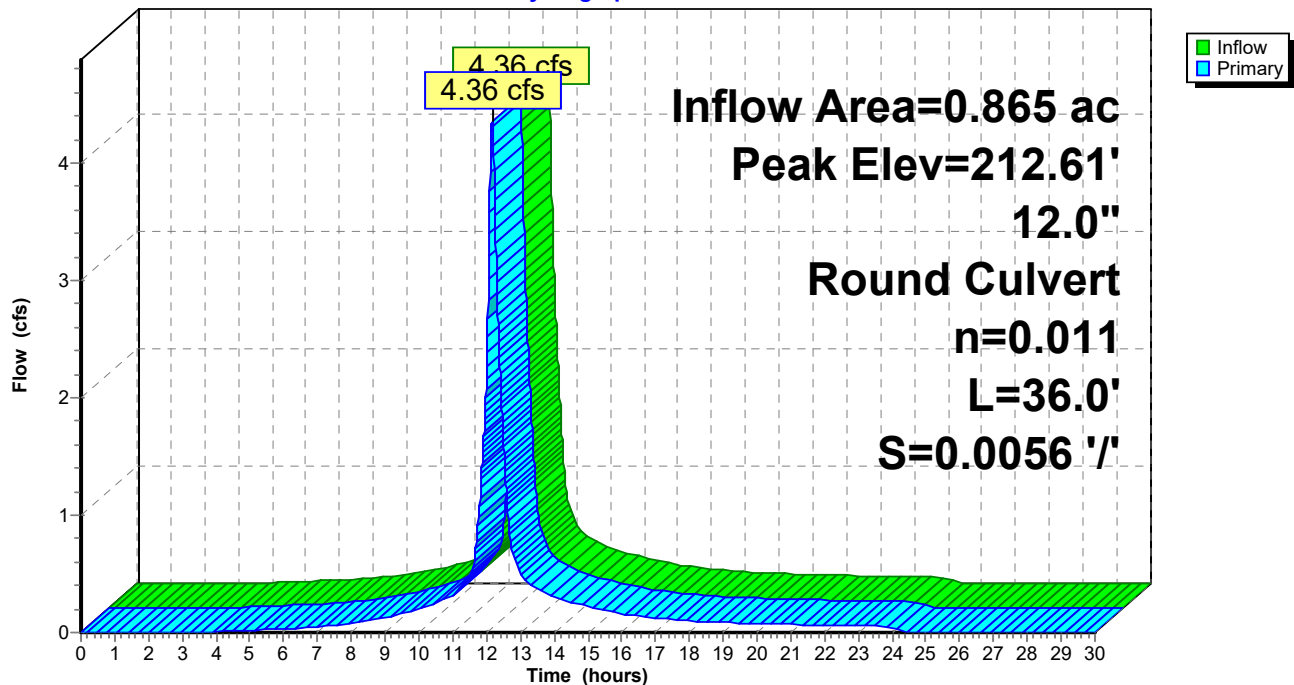
Device	Routing	Invert	Outlet Devices
#1	Primary	210.70'	<b>12.0" Round Culvert</b> L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 210.70' / 210.50' S= 0.0056 '/ Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=4.36 cfs @ 12.16 hrs HW=212.61' (Free Discharge)

↑1=Culvert (Barrel Controls 4.36 cfs @ 5.55 fps)

### Pond 12P: CB7

Hydrograph



## Stormwater Calculations

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### Summary for Subcatchment 13P: P1e

Runoff = 2.40 cfs @ 12.15 hrs, Volume= 0.202 af, Depth= 3.78"

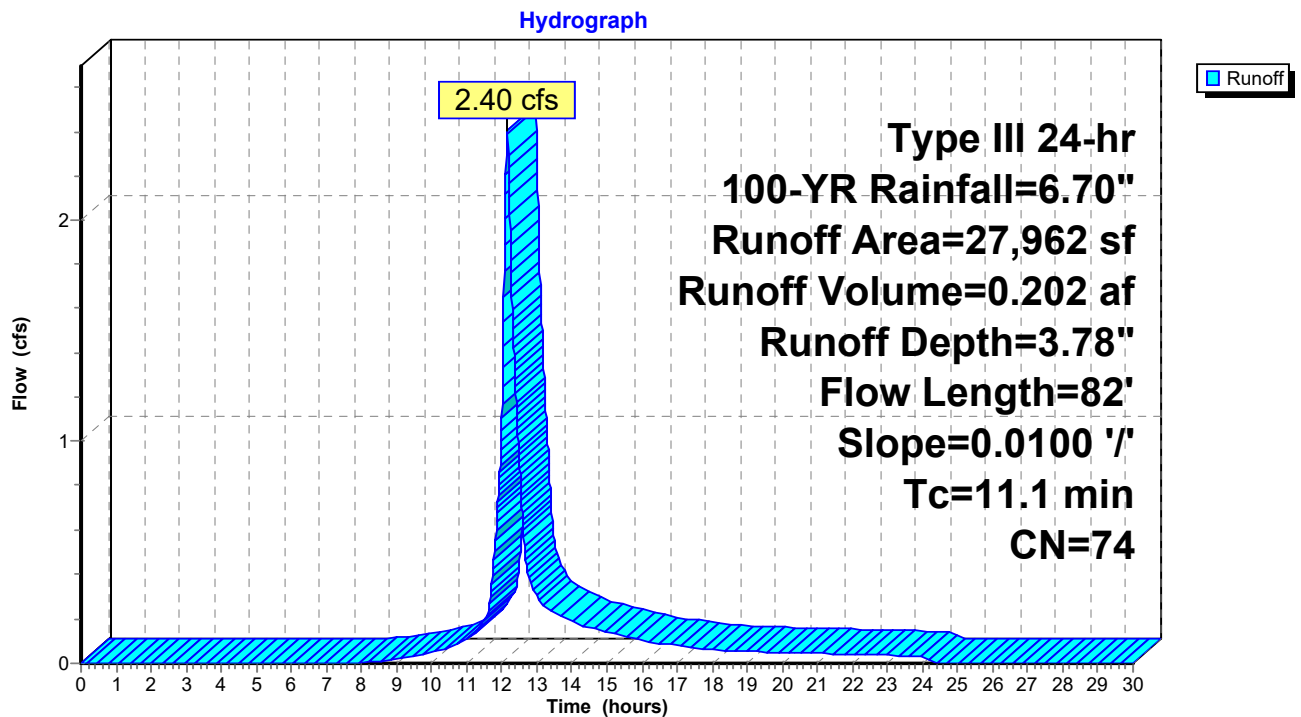
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
27,962	74	>75% Grass cover, Good, HSG C
27,962		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.3	32	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.1	82	Total			

### Subcatchment 13P: P1e



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### Summary for Subcatchment 14P: P1f

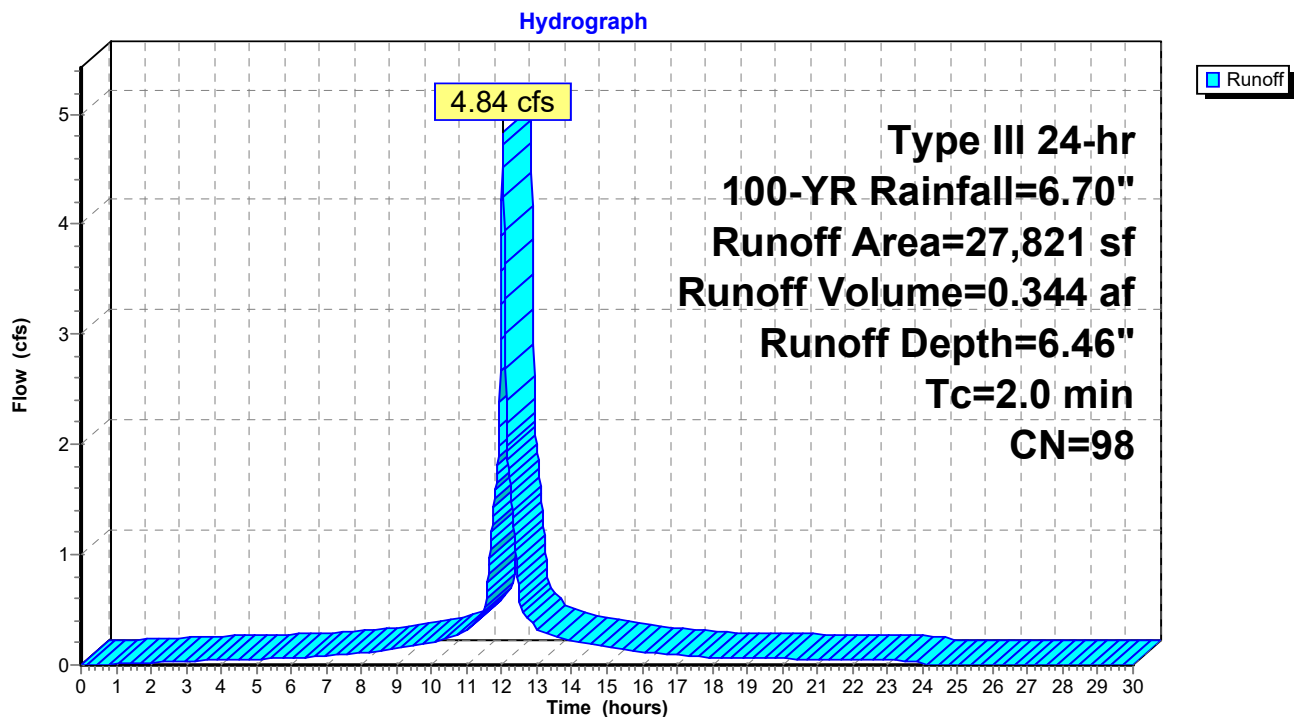
Runoff = 4.84 cfs @ 12.03 hrs, Volume= 0.344 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
27,821	98	Roofs, HSG C
27,821		100.00% Impervious Area

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

### Subcatchment 14P: P1f



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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 15P: Roof Pipes

Inflow Area = 0.639 ac, 100.00% Impervious, Inflow Depth = 6.46" for 100-YR event  
Inflow = 4.84 cfs @ 12.03 hrs, Volume= 0.344 af  
Outflow = 4.84 cfs @ 12.03 hrs, Volume= 0.344 af, Atten= 0%, Lag= 0.0 min  
Primary = 4.84 cfs @ 12.03 hrs, Volume= 0.344 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 216.16' @ 12.03 hrs

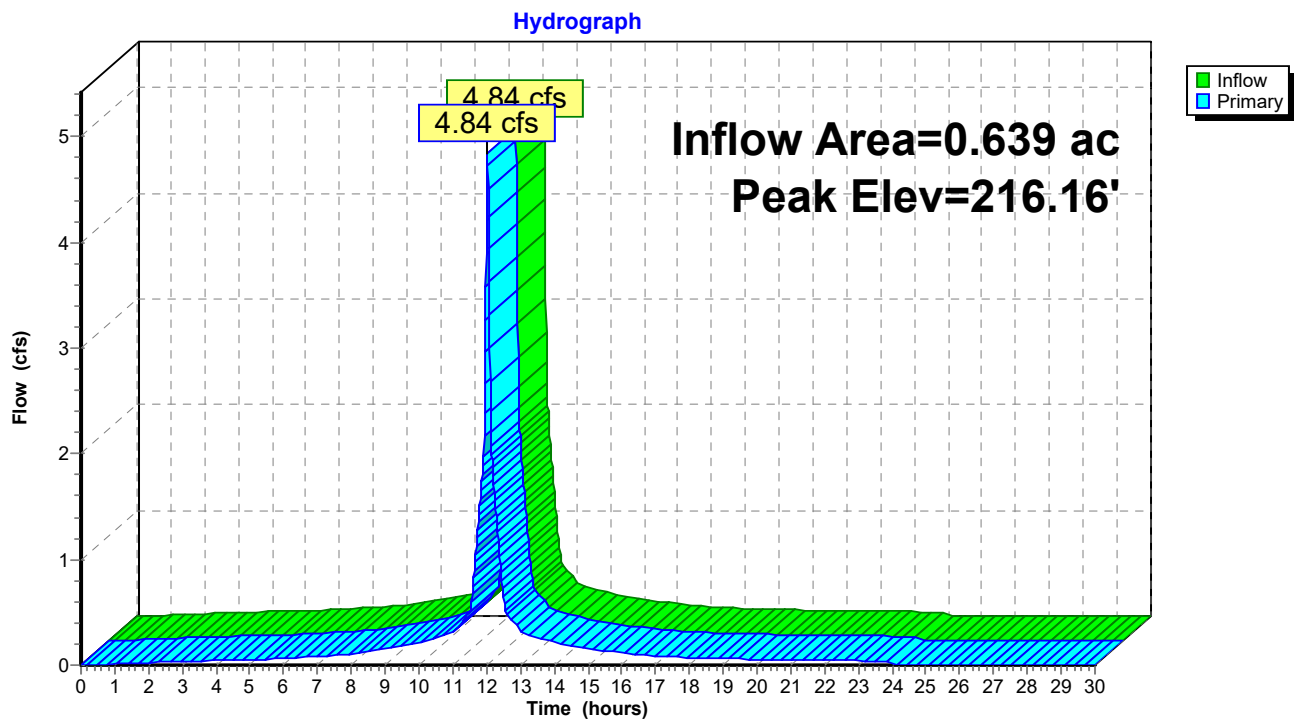
Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	<b>12.0" Round Culvert</b> L= 300.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.00' / 210.50' S= 0.0117 ' S= 0.0117 ' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf
#2	Primary	216.00'	<b>12.0" Round Culvert</b> L= 450.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.00' / 210.50' S= 0.0122 ' S= 0.0122 ' Cc= 0.900 n= 0.011, Flow Area= 0.79 sf

**Primary OutFlow** Max=4.83 cfs @ 12.03 hrs HW=216.15' (Free Discharge)

1=Culvert (Barrel Controls 4.73 cfs @ 6.03 fps)

2=Culvert (Inlet Controls 0.10 cfs @ 1.32 fps)

### Pond 15P: Roof Pipes



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 16P: Basin #1

Inflow Area = 3.950 ac, 62.23% Impervious, Inflow Depth = 5.41" for 100-YR event  
Inflow = 17.80 cfs @ 12.15 hrs, Volume= 1.782 af  
Outflow = 9.15 cfs @ 12.39 hrs, Volume= 1.560 af, Atten= 49%, Lag= 14.6 min  
Discarded = 0.45 cfs @ 12.39 hrs, Volume= 0.758 af  
Primary = 8.70 cfs @ 12.39 hrs, Volume= 0.802 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 212.38' @ 12.39 hrs Surf.Area= 19,220 sf Storage= 29,859 cf

Plug-Flow detention time= 215.9 min calculated for 1.560 af (88% of inflow)  
Center-of-Mass det. time= 158.7 min ( 940.1 - 781.5 )

Volume	Invert	Avail.Storage	Storage Description		
#1	210.50'	32,180 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
210.50	12,754	521.0	0	0	12,754
212.50	19,675	607.0	32,180	32,180	20,556

Device	Routing	Invert	Outlet Devices
#1	Primary	211.80'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 211.80 213.00 Width (feet) 6.00 6.00
#2	Discarded	210.50'	<b>1.020 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.45 cfs @ 12.39 hrs HW=212.38' (Free Discharge)  
↑**2=Exfiltration** (Exfiltration Controls 0.45 cfs)

**Primary OutFlow** Max=8.69 cfs @ 12.39 hrs HW=212.38' (Free Discharge)  
↑**1=Custom Weir/Orifice** (Weir Controls 8.69 cfs @ 2.50 fps)

## Stormwater Calculations

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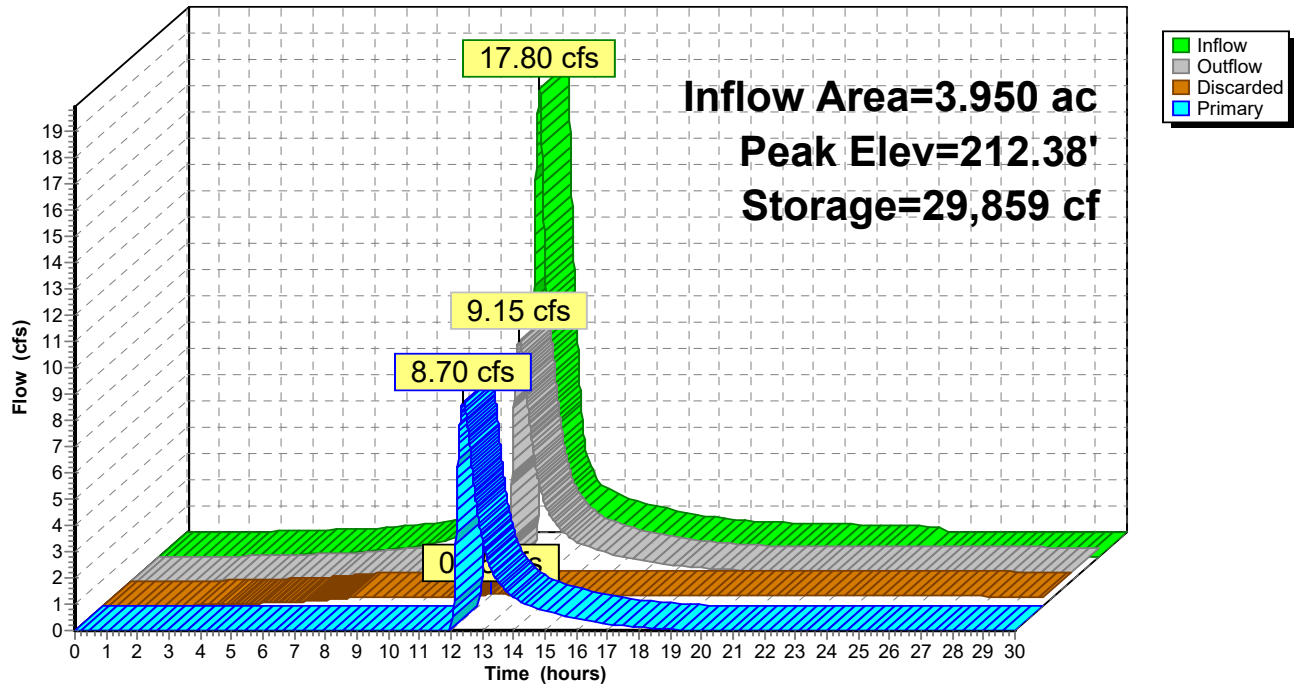
Type III 24-hr 100-YR Rainfall=6.70"

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### Pond 16P: Basin #1

#### Hydrograph





## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 17P: P1g

Runoff = 10.98 cfs @ 12.13 hrs, Volume= 0.882 af, Depth= 3.57"

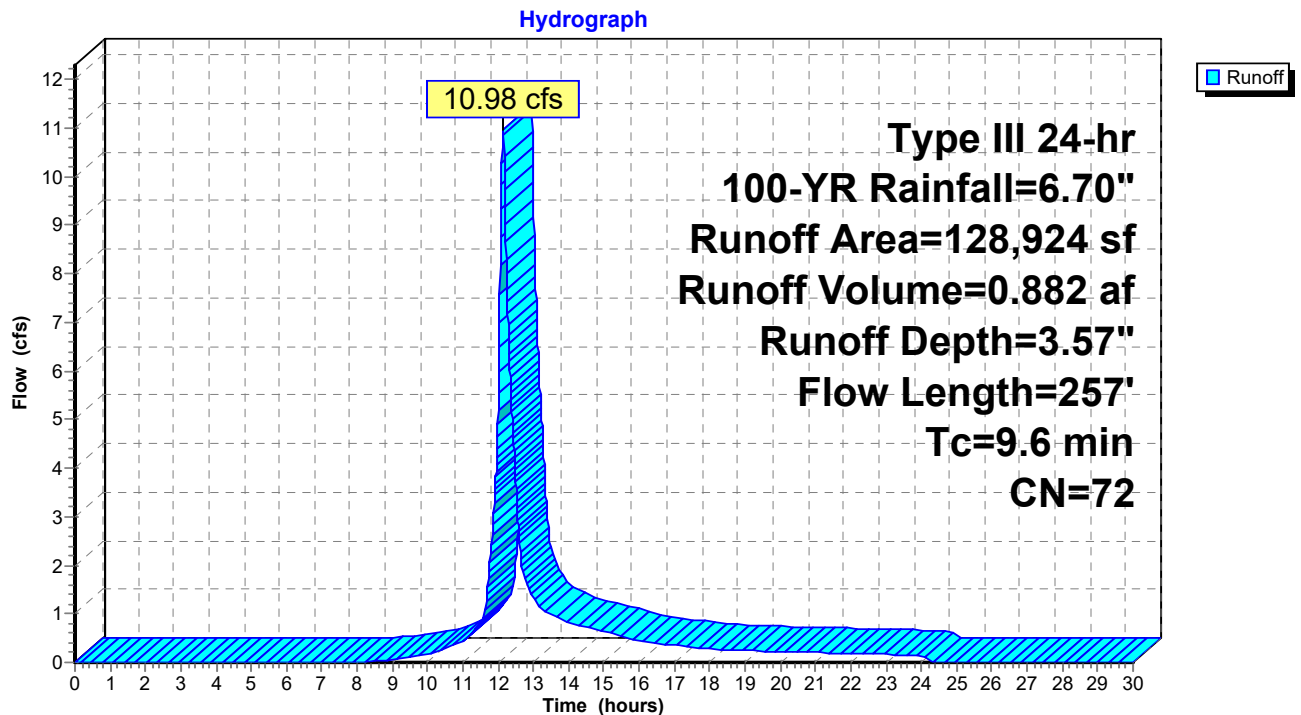
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
1,740	98	Paved parking, HSG C
50,163	74	>75% Grass cover, Good, HSG C
77,021	70	Woods, Good, HSG C
128,924	72	Weighted Average
127,184		98.65% Pervious Area
1,740		1.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
1.4	207	0.0240	2.49		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.6	257	Total			

### Subcatchment 17P: P1g



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### Summary for Subcatchment 18P: P1h

Runoff = 1.61 cfs @ 12.11 hrs, Volume= 0.121 af, Depth= 3.78"

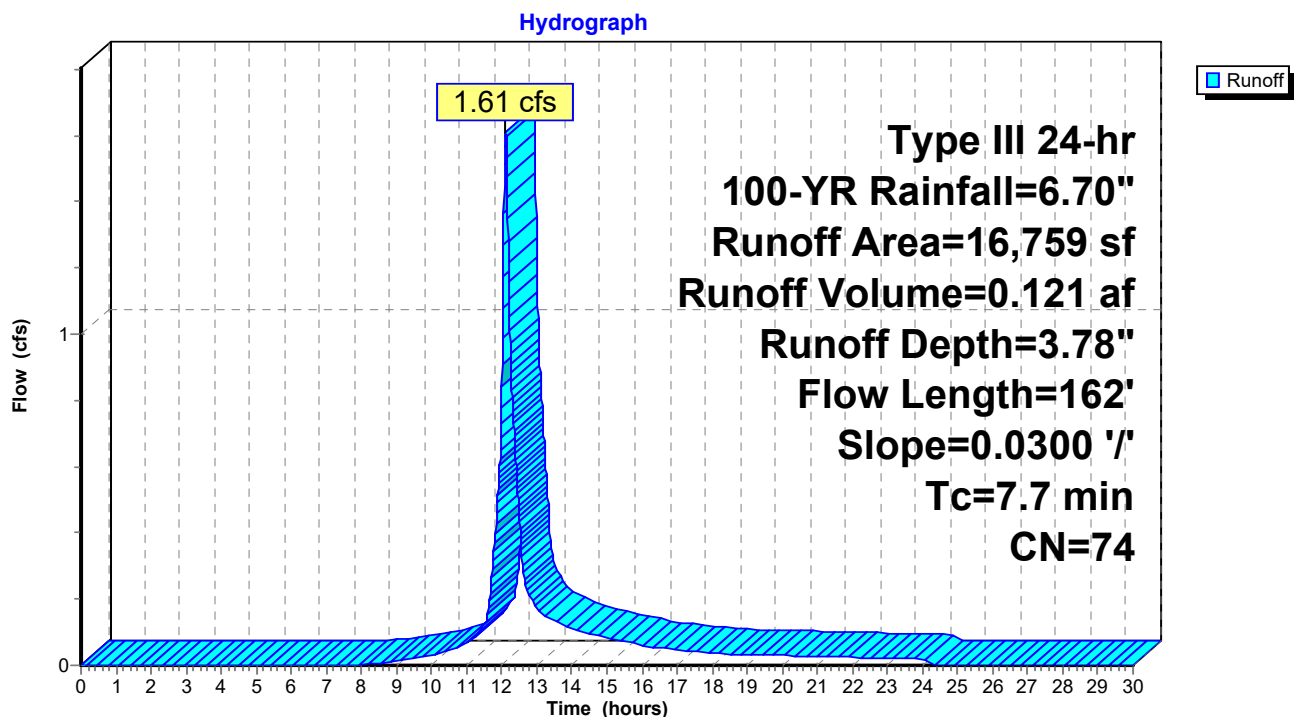
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
16,759	74	>75% Grass cover, Good, HSG C
16,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0300	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.7	112	0.0300	2.79		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.7	162	Total			

### Subcatchment 18P: P1h



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### Summary for Subcatchment 19P: P1i

Runoff = 3.46 cfs @ 12.09 hrs, Volume= 0.248 af, Depth= 3.78"

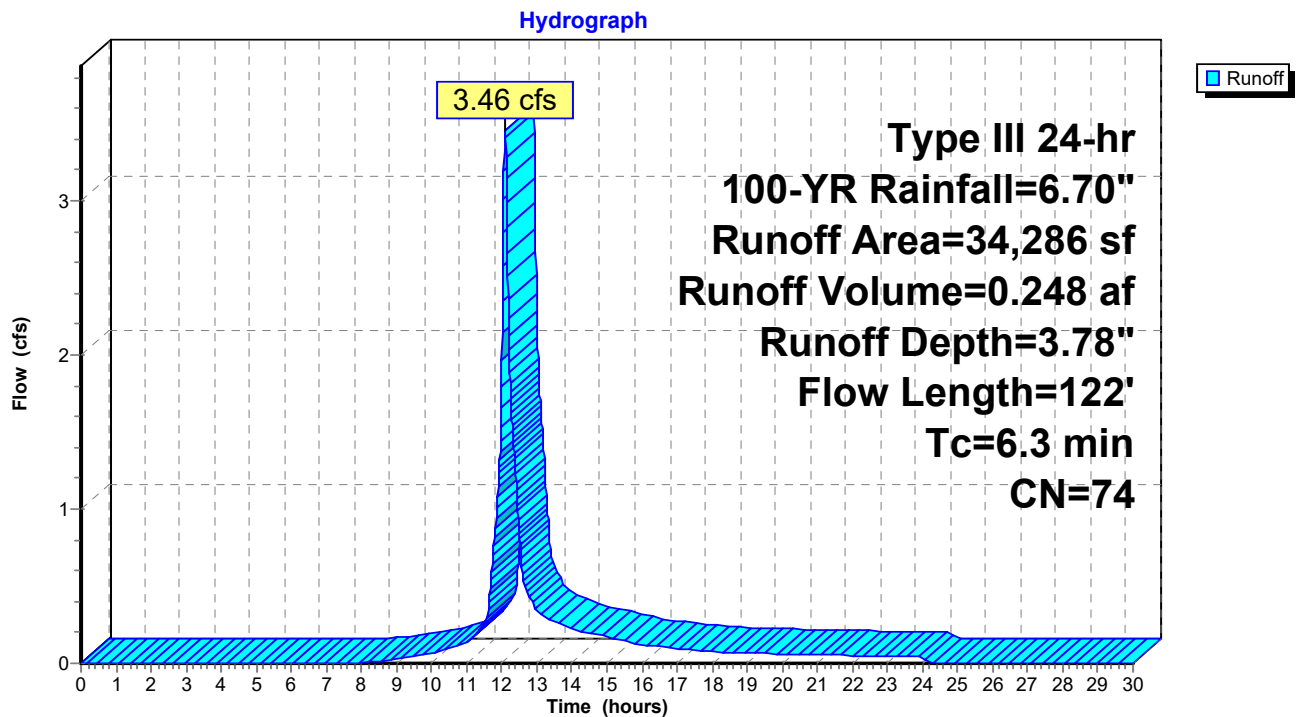
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
34,286	74	>75% Grass cover, Good, HSG C
34,286		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.1	72	0.9000	15.27		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.3	122	Total			

### Subcatchment 19P: P1i



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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 20P: P1j

Runoff = 5.88 cfs @ 12.12 hrs, Volume= 0.472 af, Depth= 5.08"

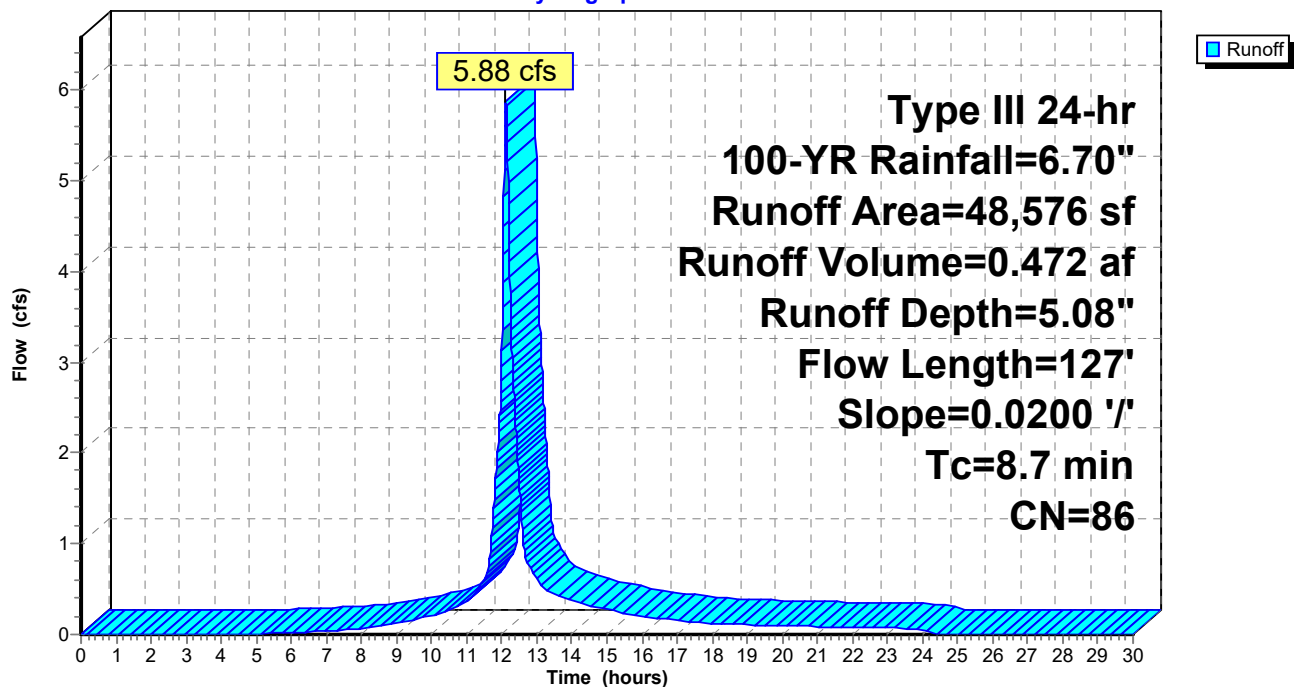
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
24,897	98	Paved parking, HSG C
4,121	70	Woods, Good, HSG C
19,558	74	>75% Grass cover, Good, HSG C
48,576	86	Weighted Average
23,679		48.75% Pervious Area
24,897		51.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	57	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.1	20	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
8.7	127	Total			

### Subcatchment 20P: P1j

Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 21P: Exist. CB

Inflow Area = 1.115 ac, 51.25% Impervious, Inflow Depth = 5.08" for 100-YR event  
Inflow = 5.88 cfs @ 12.12 hrs, Volume= 0.472 af  
Outflow = 5.88 cfs @ 12.12 hrs, Volume= 0.472 af, Atten= 0%, Lag= 0.0 min  
Primary = 5.88 cfs @ 12.12 hrs, Volume= 0.472 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 215.11' @ 12.12 hrs

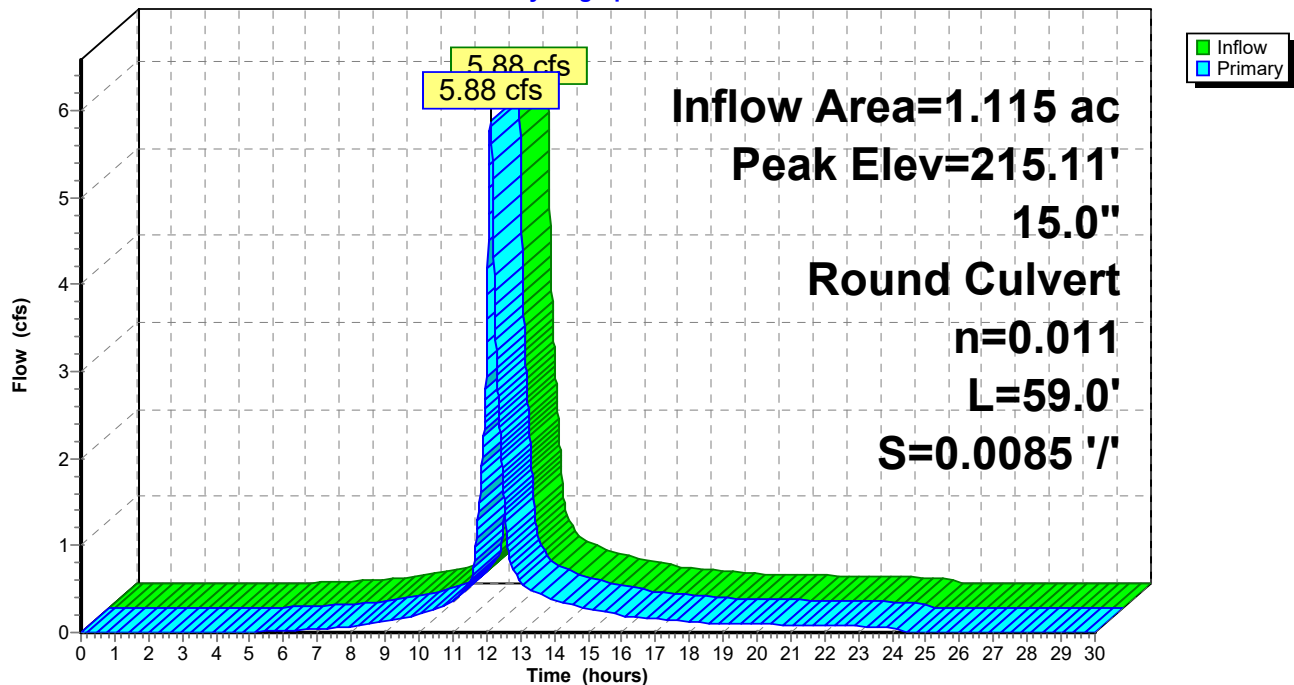
Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	<b>15.0" Round Culvert</b> L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 213.50' / 213.00' S= 0.0085 '/ Cc= 0.900 n= 0.011, Flow Area= 1.23 sf

**Primary OutFlow** Max=5.88 cfs @ 12.12 hrs HW=215.11' (Free Discharge)

↑ **1=Culvert** (Inlet Controls 5.88 cfs @ 4.79 fps)

### Pond 21P: Exist. CB

Hydrograph



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 22P: Existing Basin

Inflow Area = 1.902 ac, 30.05% Impervious, Inflow Depth = 4.54" for 100-YR event  
Inflow = 9.23 cfs @ 12.11 hrs, Volume= 0.720 af  
Outflow = 1.06 cfs @ 12.89 hrs, Volume= 0.720 af, Atten= 89%, Lag= 46.9 min  
Discarded = 0.70 cfs @ 12.89 hrs, Volume= 0.635 af  
Primary = 0.36 cfs @ 12.89 hrs, Volume= 0.085 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 214.08' @ 12.89 hrs Surf.Area= 12,532 sf Storage= 12,498 cf

Plug-Flow detention time= 126.1 min calculated for 0.720 af (100% of inflow)  
Center-of-Mass det. time= 126.0 min ( 931.9 - 805.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	32,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
213.00	10,659	0	0
214.00	12,392	11,526	11,526
215.50	15,086	20,609	32,134

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	<b>2.410 in/hr Exfiltration over Horizontal area</b>
#2	Primary	213.40'	<b>5.0' long x 0.8' breadth Level Spreader</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32
#3	Device 2	213.50'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Head (feet) 0.00 0.80 0.80 1.50 Width (feet) 0.25 0.25 8.00 8.00

**Discarded OutFlow** Max=0.70 cfs @ 12.89 hrs HW=214.08' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.70 cfs)

**Primary OutFlow** Max=0.36 cfs @ 12.89 hrs HW=214.08' (Free Discharge)

↑ **2=Level Spreader** (Passes 0.36 cfs of 8.14 cfs potential flow)

↑ **3=Custom Weir/Orifice** (Weir Controls 0.36 cfs @ 2.49 fps)

## Stormwater Calculations

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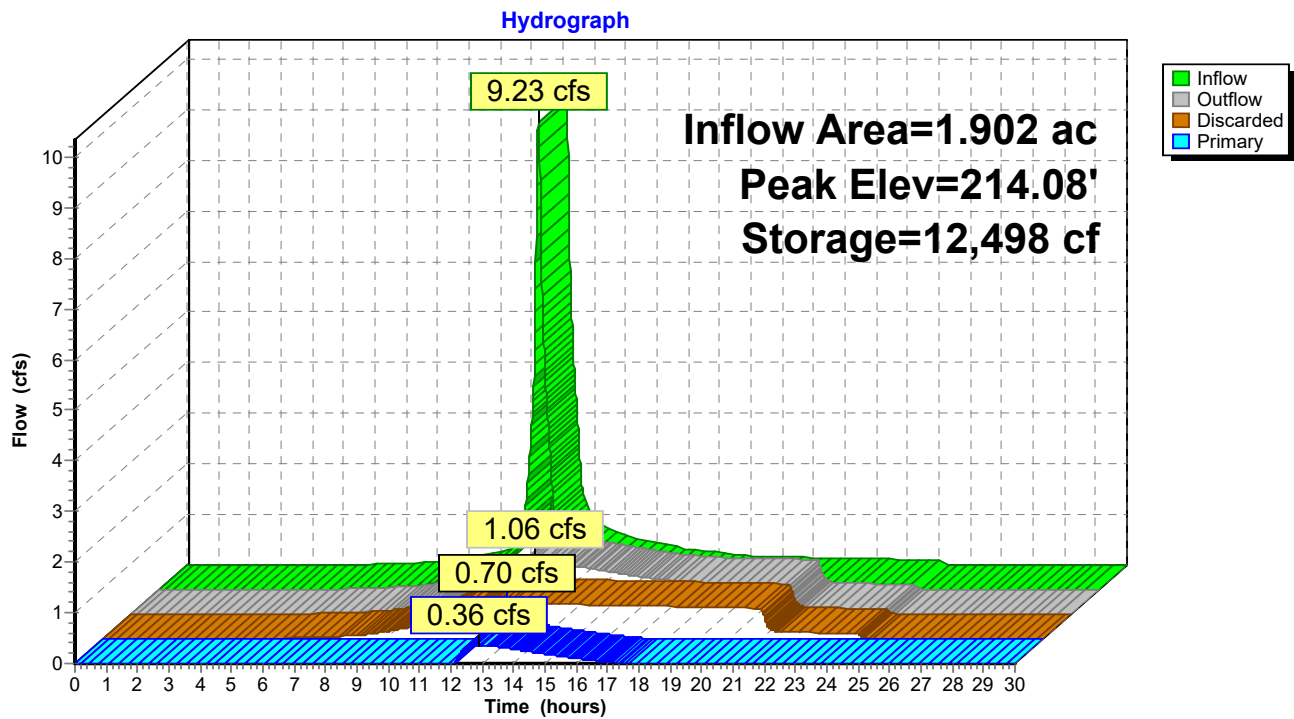
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Type III 24-hr 100-YR Rainfall=6.70"

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### Pond 22P: Existing Basin



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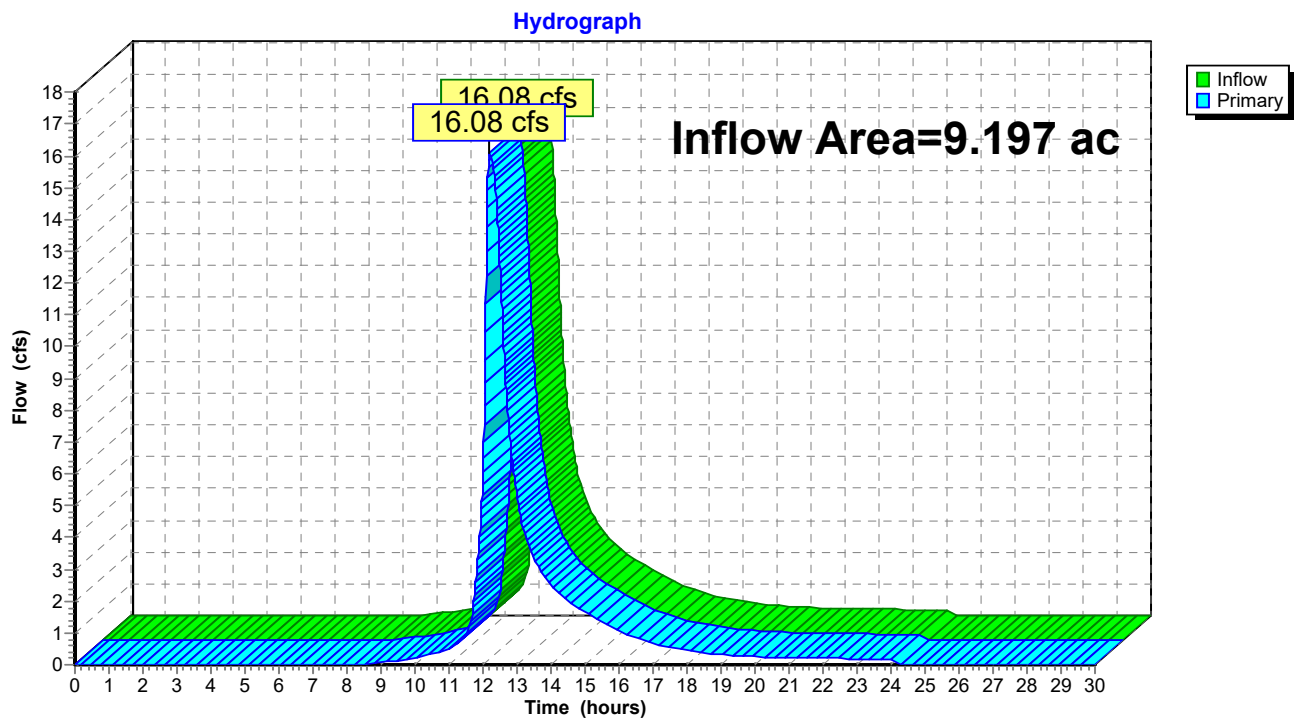
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### Summary for Link 23P: Design Point #1: Flow to Shadowfax Farm

Inflow Area = 9.197 ac, 33.38% Impervious, Inflow Depth = 2.47" for 100-YR event  
Inflow = 16.08 cfs @ 12.19 hrs, Volume= 1.890 af  
Primary = 16.08 cfs @ 12.19 hrs, Volume= 1.890 af, Atten= 0%, Lag= 0.0 min

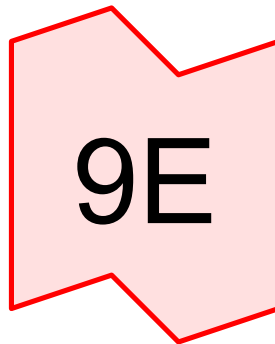
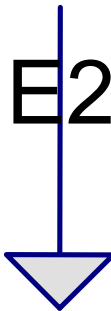
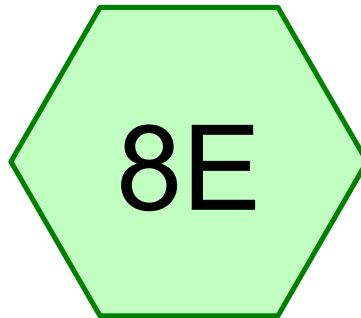
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 23P: Design Point #1: Flow to Shadowfax Farm

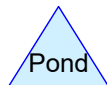
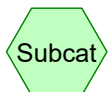




**DESIGN POINT #2: FLOW TO**  
**SOUTHERN ABUTTER EXISTING**  
**CONDITIONS**



## Design Point #2: Flow to Southern Abutters



### Routing Diagram for Stormwater Calculations

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## Stormwater Calculations

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Page 2

### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.456	79	50-75% Grass cover, Fair, HSG C (8E)
12.971	70	Woods, Good, HSG C (8E)
<b>13.427</b>	<b>70</b>	<b>TOTAL AREA</b>

## Stormwater Calculations

Type III 24-hr 1-YR Rainfall=2.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment8E: E2

Runoff Area=584,876 sf 0.00% Impervious Runoff Depth=0.46"

Flow Length=1,260' Slope=0.0100 '/' Tc=28.8 min CN=70 Runoff=3.24 cfs 0.509 af

### Link 9E: Design Point #2: Flow to Southern Abutters

Inflow=3.24 cfs 0.509 af

Primary=3.24 cfs 0.509 af

**Total Runoff Area = 13.427 ac Runoff Volume = 0.509 af Average Runoff Depth = 0.46"**  
**100.00% Pervious = 13.427 ac 0.00% Impervious = 0.000 ac**

## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 8E: E2

Runoff = 3.24 cfs @ 12.51 hrs, Volume= 0.509 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

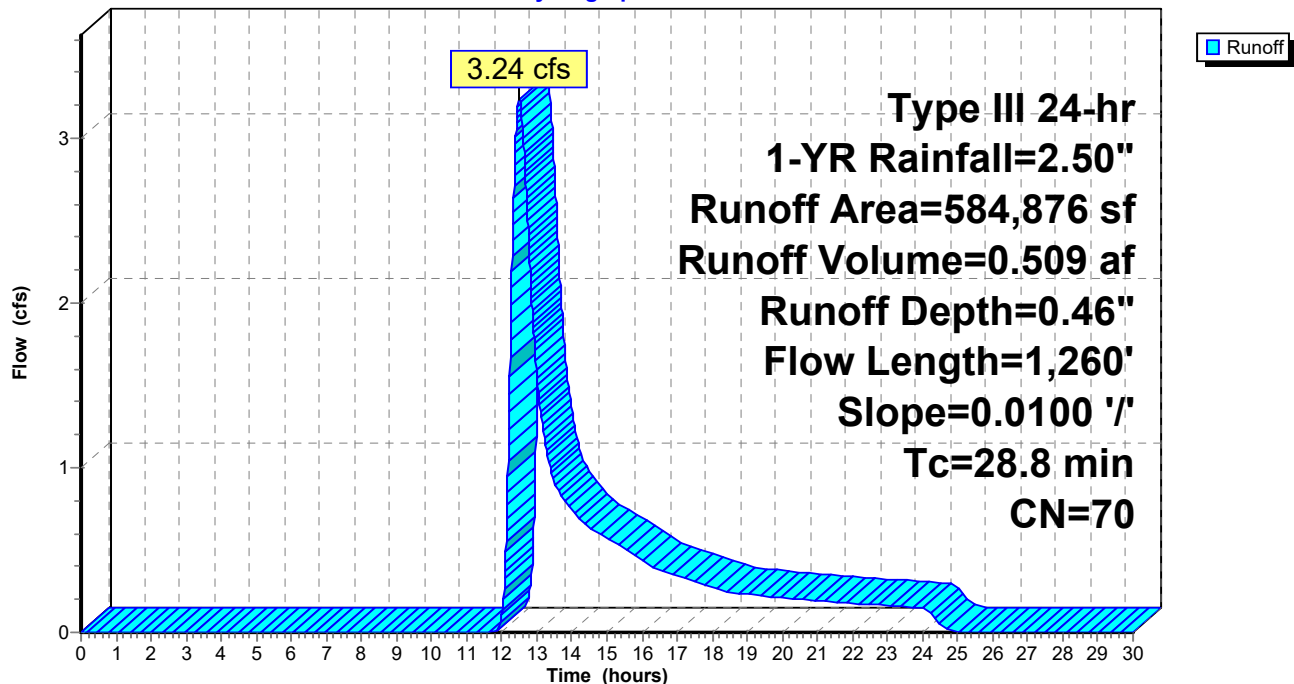
Area (sf)	CN	Description
565,029	70	Woods, Good, HSG C
19,847	79	50-75% Grass cover, Fair, HSG C
584,876	70	Weighted Average
584,876		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
12.5	1,210	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
28.8	1,260	Total			

### Subcatchment 8E: E2

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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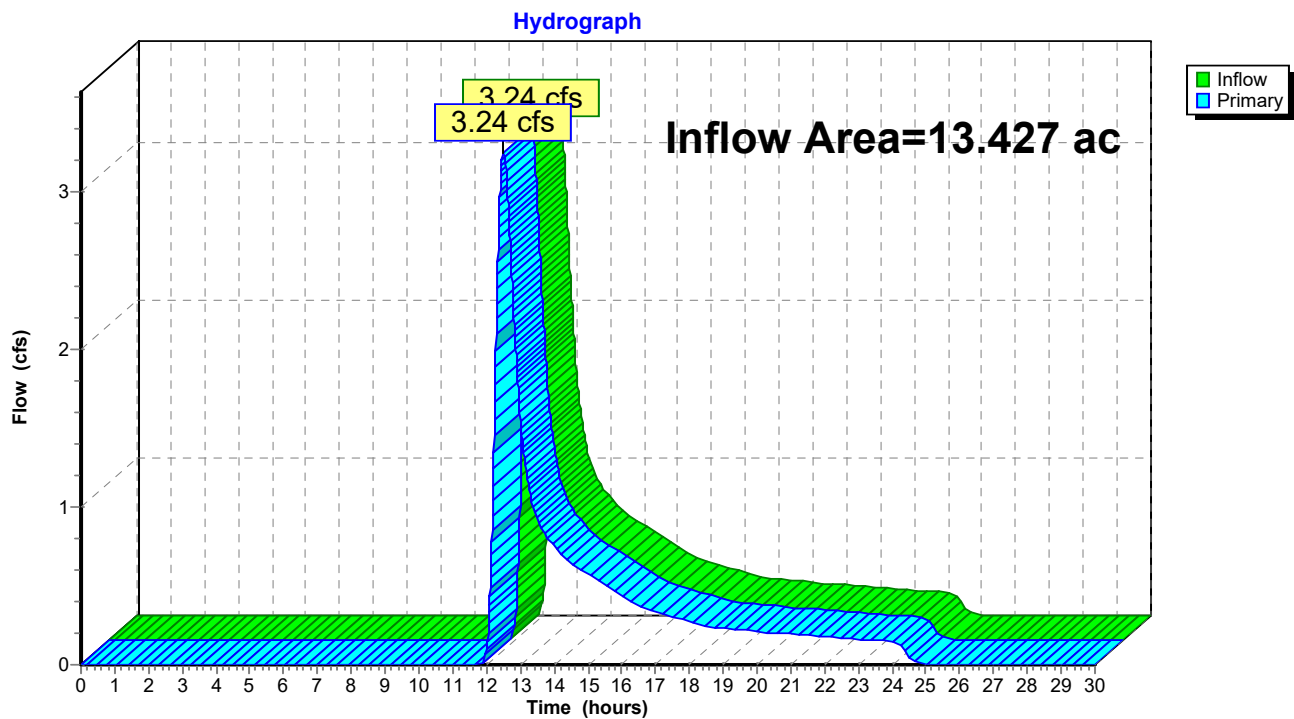
Page 5

### Summary for Link 9E: Design Point #2: Flow to Southern Abutters

Inflow Area = 13.427 ac, 0.00% Impervious, Inflow Depth = 0.46" for 1-YR event  
Inflow = 3.24 cfs @ 12.51 hrs, Volume= 0.509 af  
Primary = 3.24 cfs @ 12.51 hrs, Volume= 0.509 af, Atten= 0%, Lag= 0.0 min

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

### Link 9E: Design Point #2: Flow to Southern Abutters



## Stormwater Calculations

Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment8E: E2

Runoff Area=584,876 sf 0.00% Impervious Runoff Depth=0.83"

Flow Length=1,260' Slope=0.0100 '/' Tc=28.8 min CN=70 Runoff=6.72 cfs 0.927 af

### Link 9E: Design Point #2: Flow to Southern Abutters

Inflow=6.72 cfs 0.927 af

Primary=6.72 cfs 0.927 af

**Total Runoff Area = 13.427 ac Runoff Volume = 0.927 af Average Runoff Depth = 0.83"**  
**100.00% Pervious = 13.427 ac 0.00% Impervious = 0.000 ac**

## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 8E: E2

Runoff = 6.72 cfs @ 12.45 hrs, Volume= 0.927 af, Depth= 0.83"

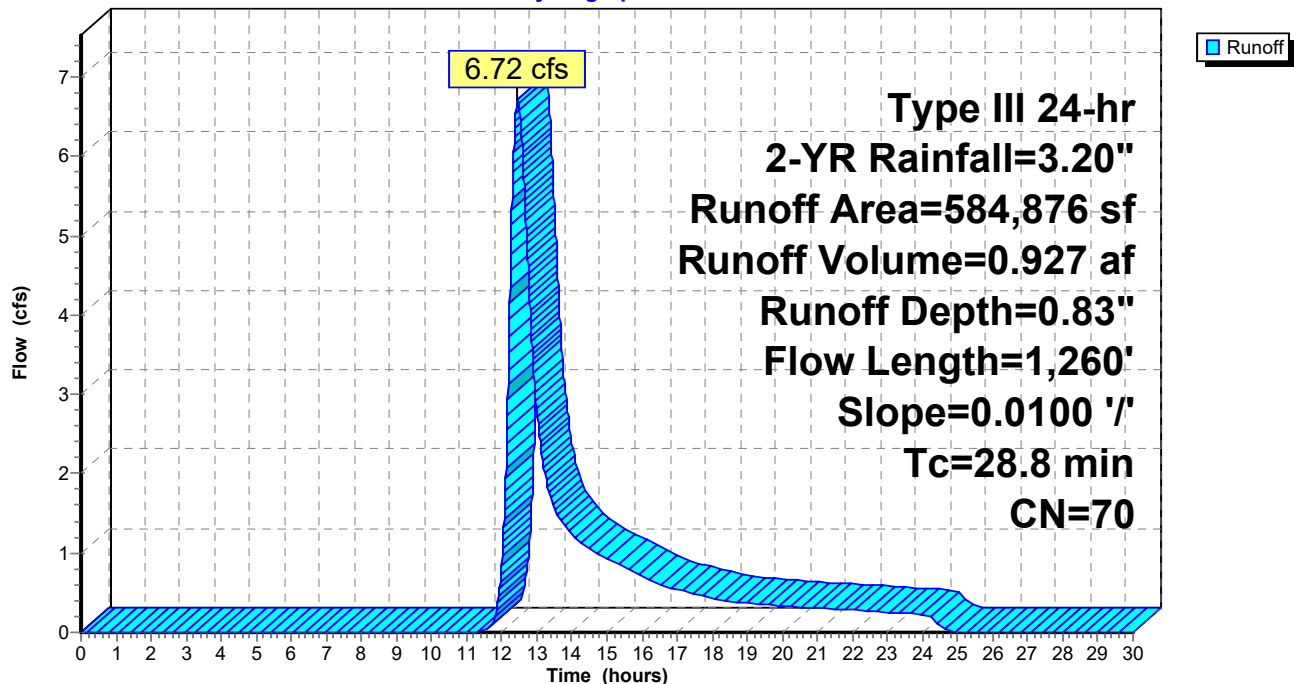
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
565,029	70	Woods, Good, HSG C
19,847	79	50-75% Grass cover, Fair, HSG C
584,876	70	Weighted Average
584,876		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
12.5	1,210	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
28.8	1,260	Total			

### Subcatchment 8E: E2

Hydrograph





## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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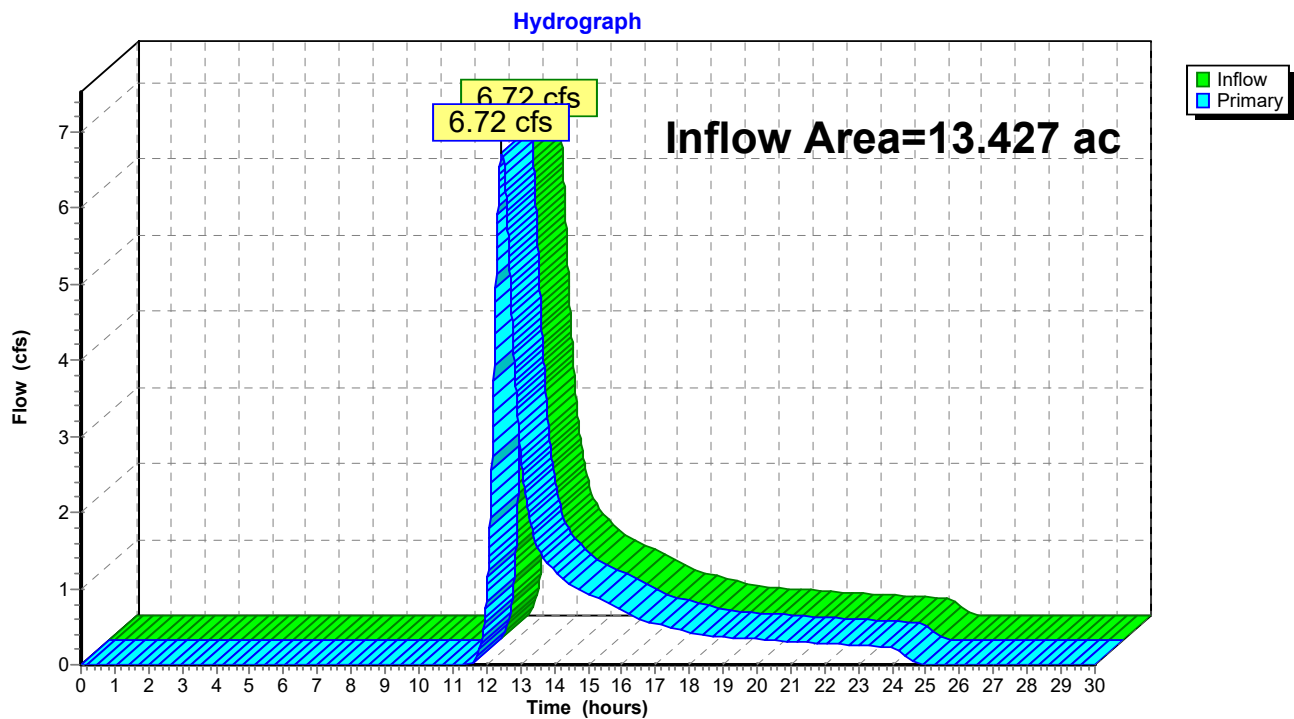
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### Summary for Link 9E: Design Point #2: Flow to Southern Abutters

Inflow Area = 13.427 ac, 0.00% Impervious, Inflow Depth = 0.83" for 2-YR event  
Inflow = 6.72 cfs @ 12.45 hrs, Volume= 0.927 af  
Primary = 6.72 cfs @ 12.45 hrs, Volume= 0.927 af, Atten= 0%, Lag= 0.0 min

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

### Link 9E: Design Point #2: Flow to Southern Abutters



## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment8E: E2

Runoff Area=584,876 sf 0.00% Impervious Runoff Depth=1.82"

Flow Length=1,260' Slope=0.0100 '/' Tc=28.8 min CN=70 Runoff=16.01 cfs 2.033 af

### Link 9E: Design Point #2: Flow to Southern Abutters

Inflow=16.01 cfs 2.033 af

Primary=16.01 cfs 2.033 af

**Total Runoff Area = 13.427 ac Runoff Volume = 2.033 af Average Runoff Depth = 1.82"**  
**100.00% Pervious = 13.427 ac 0.00% Impervious = 0.000 ac**

## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 8E: E2

Runoff = 16.01 cfs @ 12.42 hrs, Volume= 2.033 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

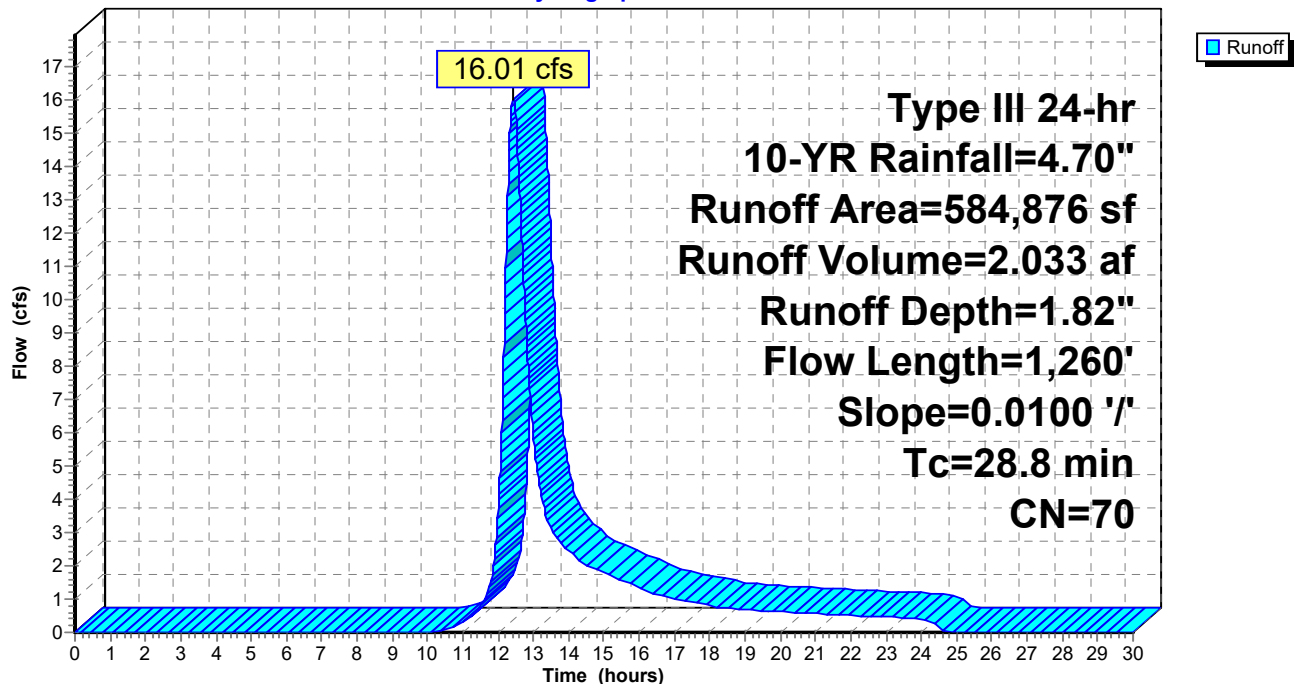
Area (sf)	CN	Description
565,029	70	Woods, Good, HSG C
19,847	79	50-75% Grass cover, Fair, HSG C
584,876	70	Weighted Average
584,876		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
12.5	1,210	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
28.8	1,260	Total			

### Subcatchment 8E: E2

Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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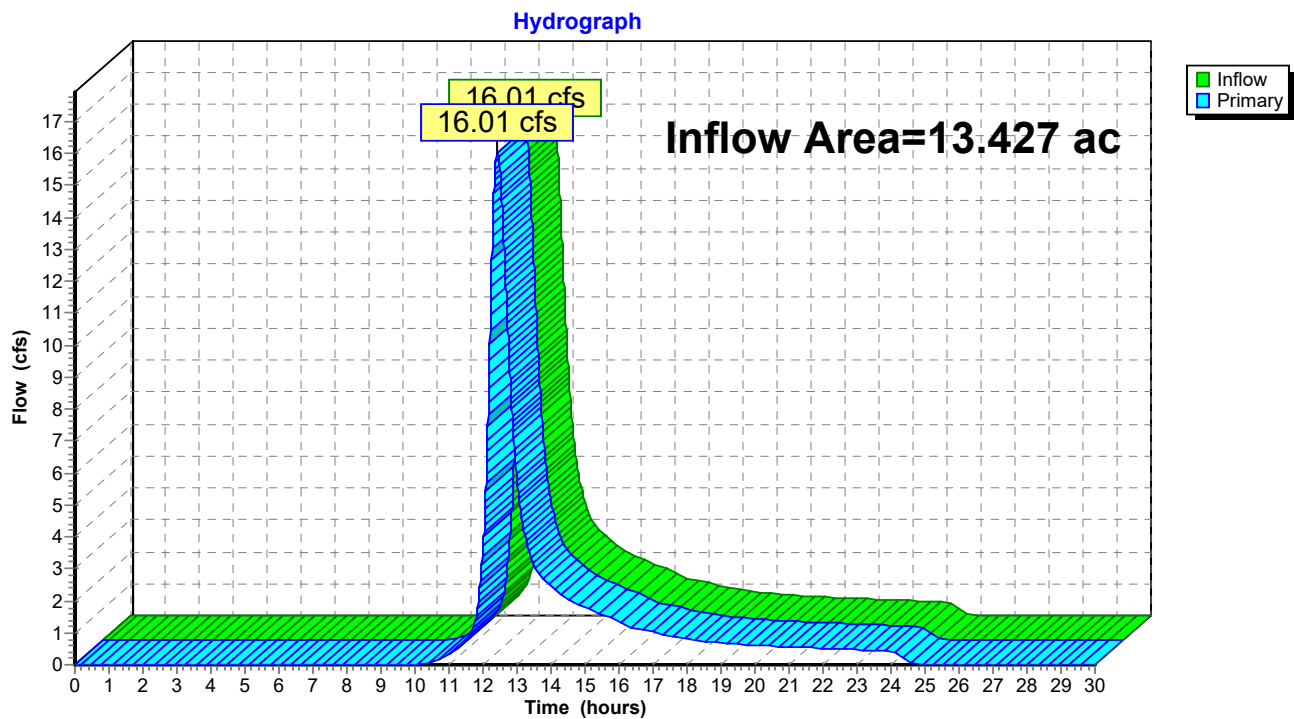
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### Summary for Link 9E: Design Point #2: Flow to Southern Abutters

Inflow Area = 13.427 ac, 0.00% Impervious, Inflow Depth = 1.82" for 10-YR event  
Inflow = 16.01 cfs @ 12.42 hrs, Volume= 2.033 af  
Primary = 16.01 cfs @ 12.42 hrs, Volume= 2.033 af, Atten= 0%, Lag= 0.0 min

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

### Link 9E: Design Point #2: Flow to Southern Abutters



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment8E: E2

Runoff Area=584,876 sf 0.00% Impervious Runoff Depth=2.88"

Flow Length=1,260' Slope=0.0100 '/' Tc=28.8 min CN=70 Runoff=25.96 cfs 3.228 af

### Link 9E: Design Point #2: Flow to Southern Abutters

Inflow=25.96 cfs 3.228 af

Primary=25.96 cfs 3.228 af

**Total Runoff Area = 13.427 ac Runoff Volume = 3.228 af Average Runoff Depth = 2.88"**  
**100.00% Pervious = 13.427 ac 0.00% Impervious = 0.000 ac**

## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 8E: E2

Runoff = 25.96 cfs @ 12.41 hrs, Volume= 3.228 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

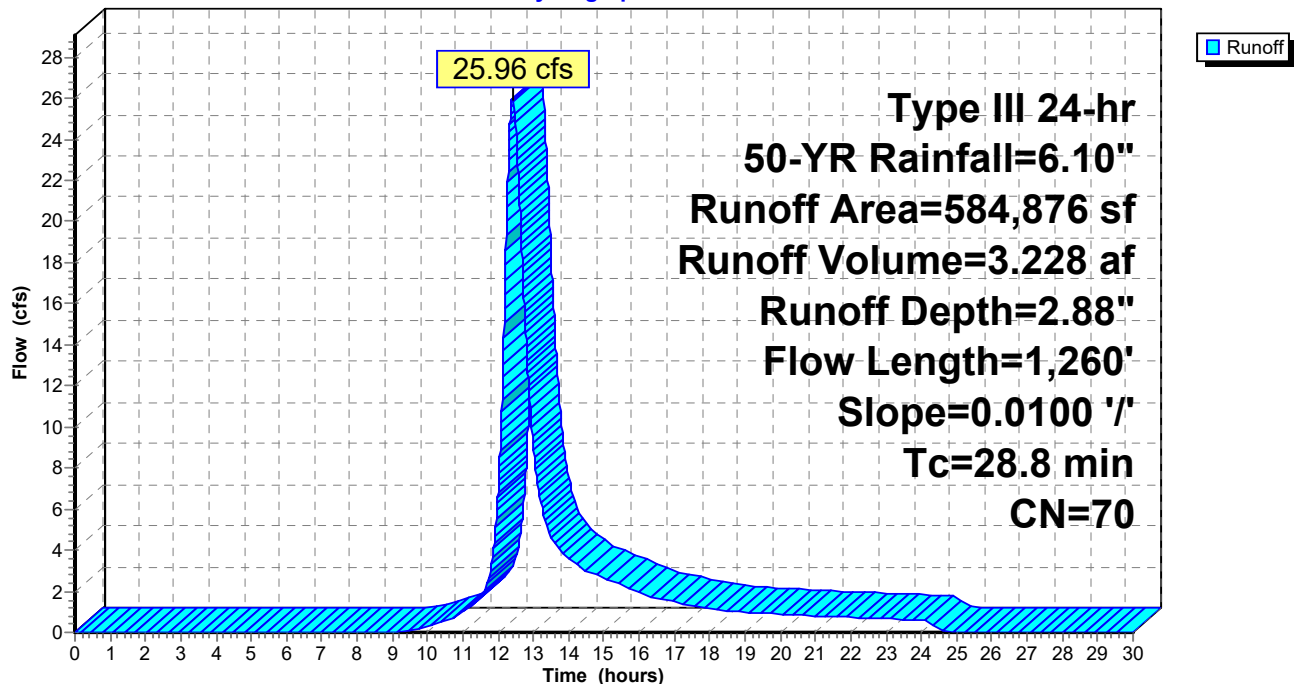
Area (sf)	CN	Description
565,029	70	Woods, Good, HSG C
19,847	79	50-75% Grass cover, Fair, HSG C
584,876	70	Weighted Average
584,876		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
12.5	1,210	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
28.8	1,260	Total			

### Subcatchment 8E: E2

Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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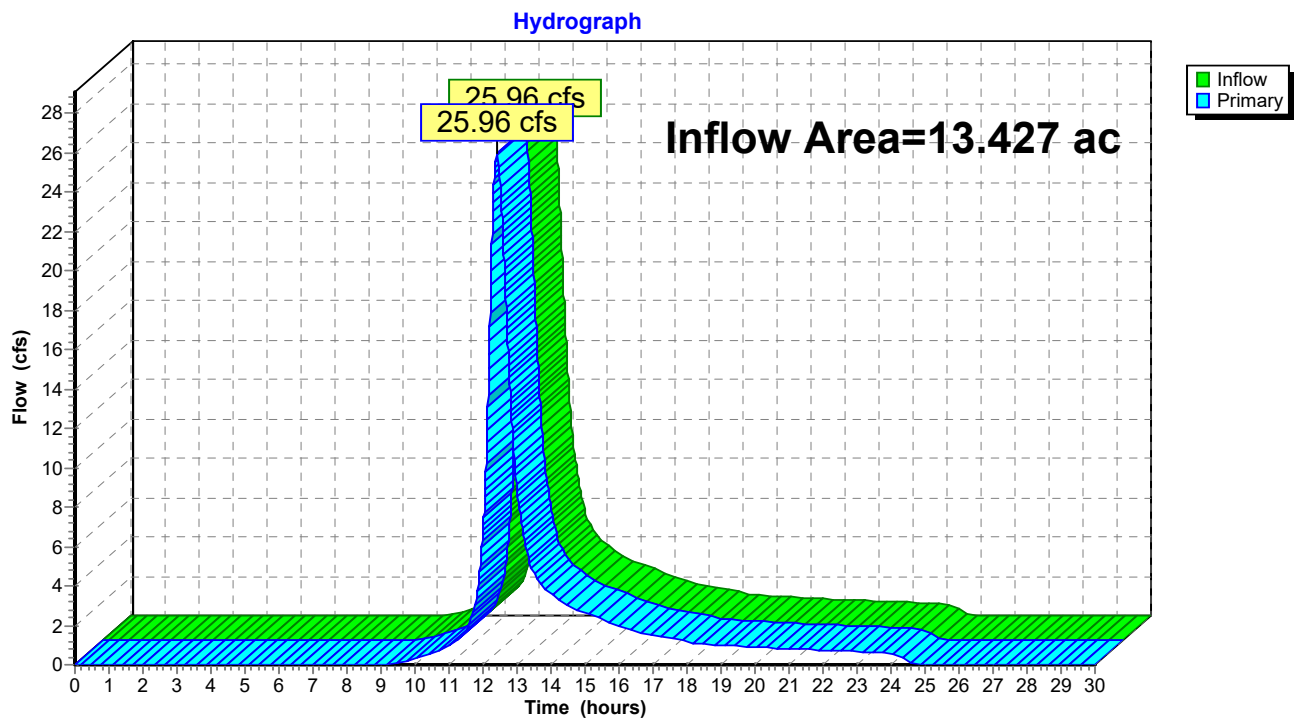
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### Summary for Link 9E: Design Point #2: Flow to Southern Abutters

Inflow Area = 13.427 ac, 0.00% Impervious, Inflow Depth = 2.88" for 50-YR event  
Inflow = 25.96 cfs @ 12.41 hrs, Volume= 3.228 af  
Primary = 25.96 cfs @ 12.41 hrs, Volume= 3.228 af, Atten= 0%, Lag= 0.0 min

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

### Link 9E: Design Point #2: Flow to Southern Abutters



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment8E: E2

Runoff Area=584,876 sf 0.00% Impervious Runoff Depth=3.37"

Flow Length=1,260' Slope=0.0100 '/' Tc=28.8 min CN=70 Runoff=30.45 cfs 3.771 af

### Link 9E: Design Point #2: Flow to Southern Abutters

Inflow=30.45 cfs 3.771 af

Primary=30.45 cfs 3.771 af

**Total Runoff Area = 13.427 ac Runoff Volume = 3.771 af Average Runoff Depth = 3.37"**  
**100.00% Pervious = 13.427 ac 0.00% Impervious = 0.000 ac**



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 8E: E2

Runoff = 30.45 cfs @ 12.41 hrs, Volume= 3.771 af, Depth= 3.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

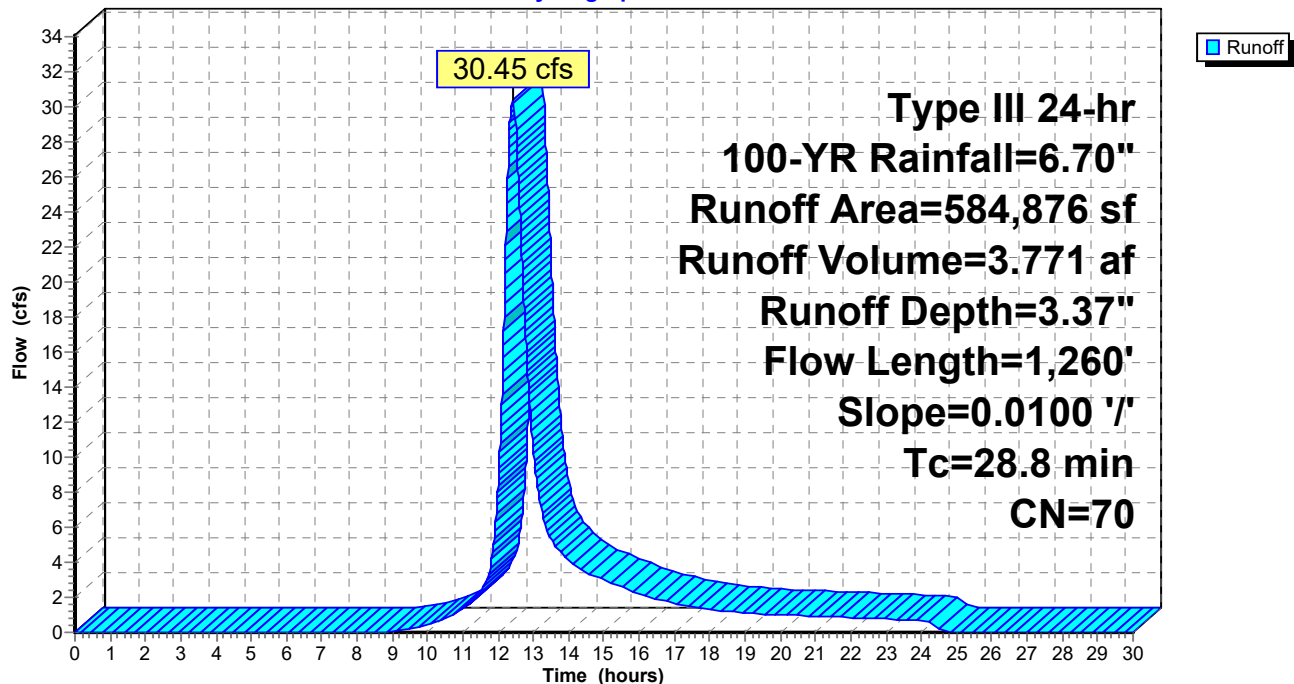
Area (sf)	CN	Description
565,029	70	Woods, Good, HSG C
19,847	79	50-75% Grass cover, Fair, HSG C
584,876	70	Weighted Average
584,876		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
12.5	1,210	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
28.8	1,260	Total			

### Subcatchment 8E: E2

Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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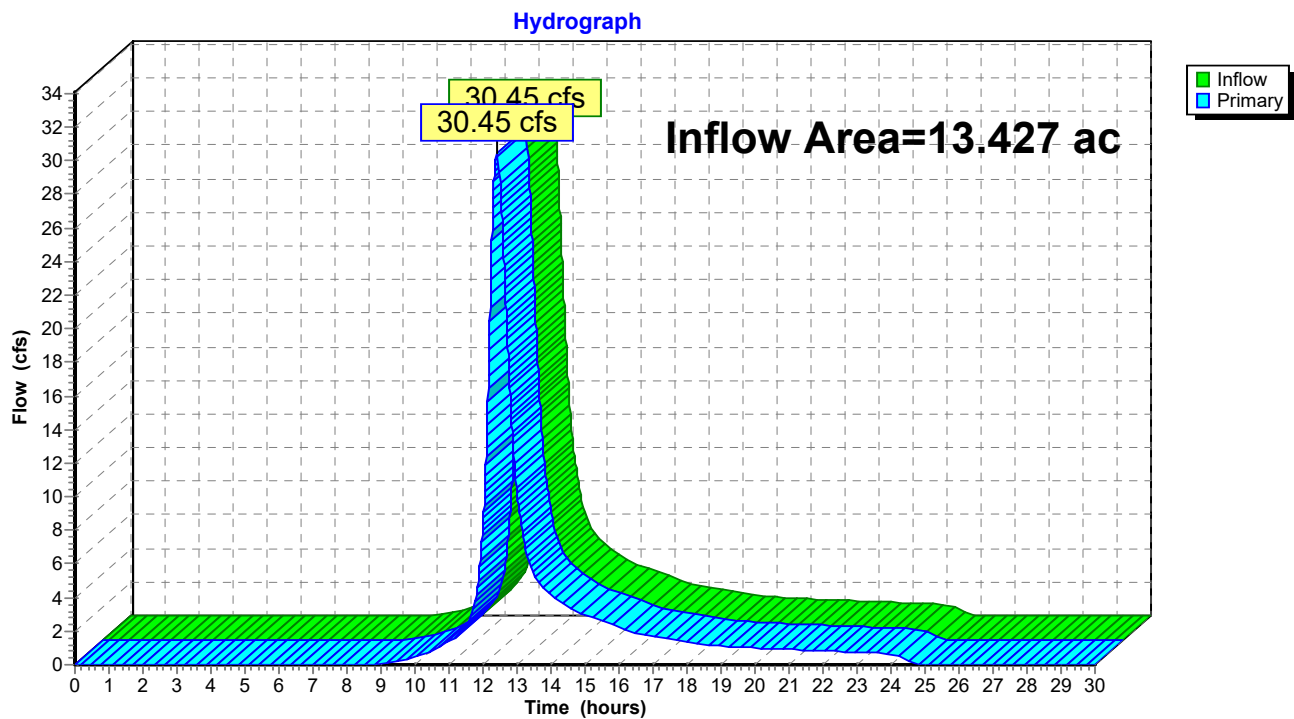
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### Summary for Link 9E: Design Point #2: Flow to Southern Abutters

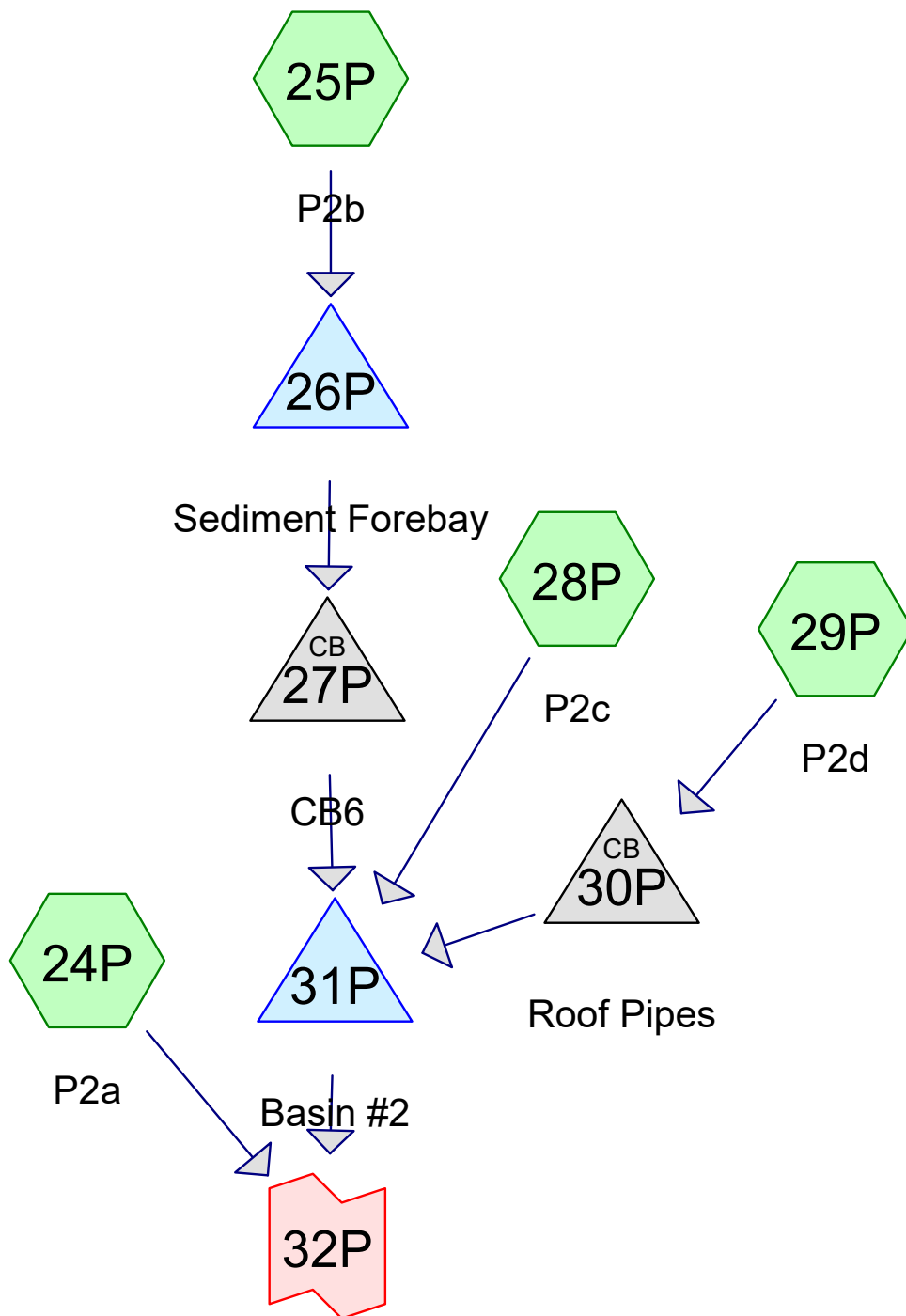
Inflow Area = 13.427 ac, 0.00% Impervious, Inflow Depth = 3.37" for 100-YR event  
Inflow = 30.45 cfs @ 12.41 hrs, Volume= 3.771 af  
Primary = 30.45 cfs @ 12.41 hrs, Volume= 3.771 af, Atten= 0%, Lag= 0.0 min

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

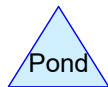
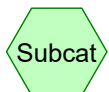
### Link 9E: Design Point #2: Flow to Southern Abutters



DESIGN POINT #2: FLOW TO  
SOUTHERN ABUTTER PROPOSED  
CONDITIONS



Design Point #2: Flow to  
Southern Abutters



#### Routing Diagram for Stormwater Calculations

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## Stormwater Calculations

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.512	74	>75% Grass cover, Good, HSG C (24P, 25P, 28P)
0.096	98	Patio, HSG C (24P, 28P)
0.692	98	Paved parking, HSG C (25P)
0.032	74	Pervious Pavers, HSG C (24P)
0.746	98	Roofs, HSG C (25P, 29P)
8.166	70	Woods, Good, HSG C (24P)
<b>13.245</b>	<b>74</b>	<b>TOTAL AREA</b>

## Stormwater Calculations

Type III 24-hr 1-YR Rainfall=2.50"

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

**Subcatchment24P: P2a** Runoff Area=451,888 sf 0.81% Impervious Runoff Depth=0.49"  
Flow Length=1,260' Slope=0.0100 '/' Tc=28.8 min CN=71 Runoff=2.79 cfs 0.425 af

**Subcatchment25P: P2b** Runoff Area=79,025 sf 55.65% Impervious Runoff Depth=1.31"  
Flow Length=245' Tc=12.5 min CN=87 Runoff=2.26 cfs 0.198 af

**Pond 26P: Sediment Forebay** Peak Elev=218.04' Storage=478 cf Inflow=2.26 cfs 0.198 af  
18.0" Round Culvert n=0.011 L=71.0' S=0.0085 '/' Outflow=1.96 cfs 0.198 af

**Pond 27P: CB6** Peak Elev=217.42' Inflow=1.96 cfs 0.198 af  
18.0" Round Culvert n=0.011 L=141.0' S=0.0053 '/' Outflow=1.96 cfs 0.198 af

**Subcatchment28P: P2c** Runoff Area=27,363 sf 1.91% Impervious Runoff Depth=0.61"  
Flow Length=98' Tc=11.0 min CN=74 Runoff=0.33 cfs 0.032 af

**Subcatchment29P: P2d** Runoff Area=18,655 sf 100.00% Impervious Runoff Depth=2.27"  
Tc=2.0 min CN=98 Runoff=1.19 cfs 0.081 af

**Pond 30P: Roof Pipes** Peak Elev=218.83' Inflow=1.19 cfs 0.081 af  
Outflow=1.19 cfs 0.081 af

**Pond 31P: Basin #2** Peak Elev=216.44' Storage=5,656 cf Inflow=2.65 cfs 0.311 af  
Discarded=0.31 cfs 0.311 af Primary=0.00 cfs 0.000 af Outflow=0.31 cfs 0.311 af

**Link 32P: Design Point #2: Flow to Southern Abutters** Inflow=2.79 cfs 0.425 af  
Primary=2.79 cfs 0.425 af

**Total Runoff Area = 13.245 ac Runoff Volume = 0.736 af Average Runoff Depth = 0.67"**  
**88.42% Pervious = 11.711 ac 11.58% Impervious = 1.534 ac**

## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 24P: P2a

Runoff = 2.79 cfs @ 12.48 hrs, Volume= 0.425 af, Depth= 0.49"

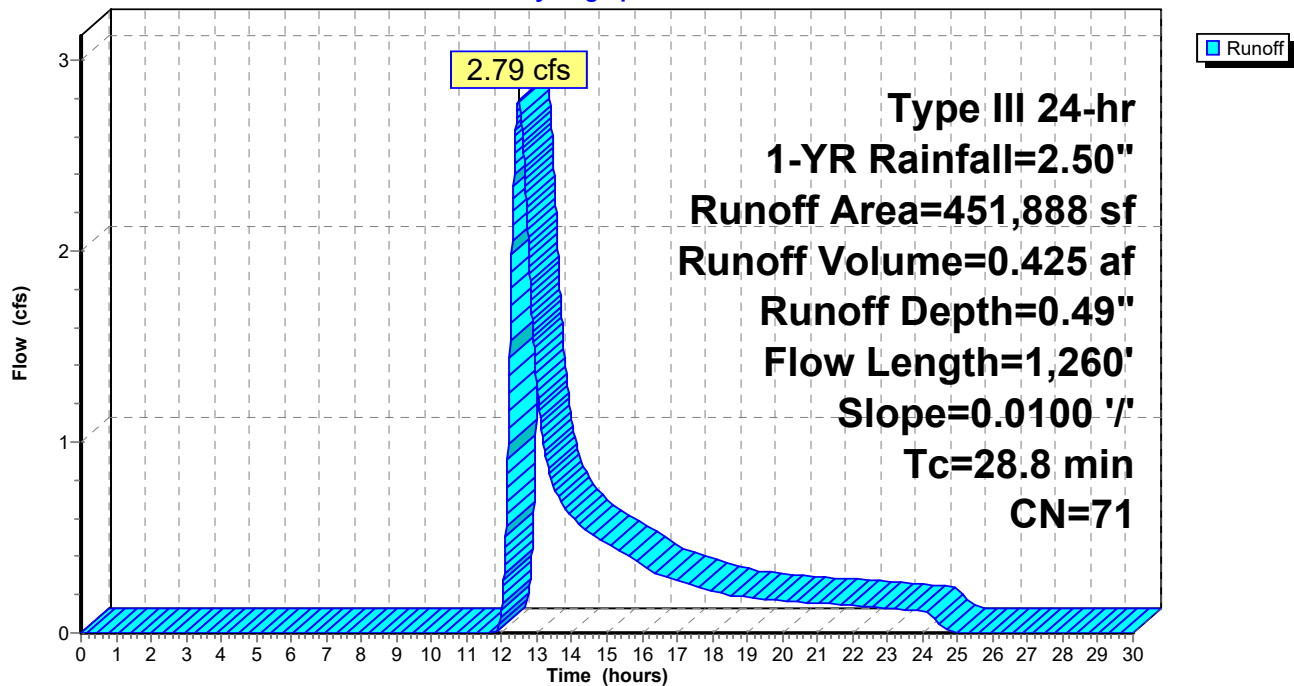
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	3,654	98	Patio, HSG C
	91,113	74	>75% Grass cover, Good, HSG C
	355,713	70	Woods, Good, HSG C
*	1,408	74	Pervious Pavers, HSG C
	451,888	71	Weighted Average
	448,234		99.19% Pervious Area
	3,654		0.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
12.5	1,210	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
28.8	1,260	Total			

### Subcatchment 24P: P2a

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 25P: P2b

Runoff = 2.26 cfs @ 12.18 hrs, Volume= 0.198 af, Depth= 1.31"

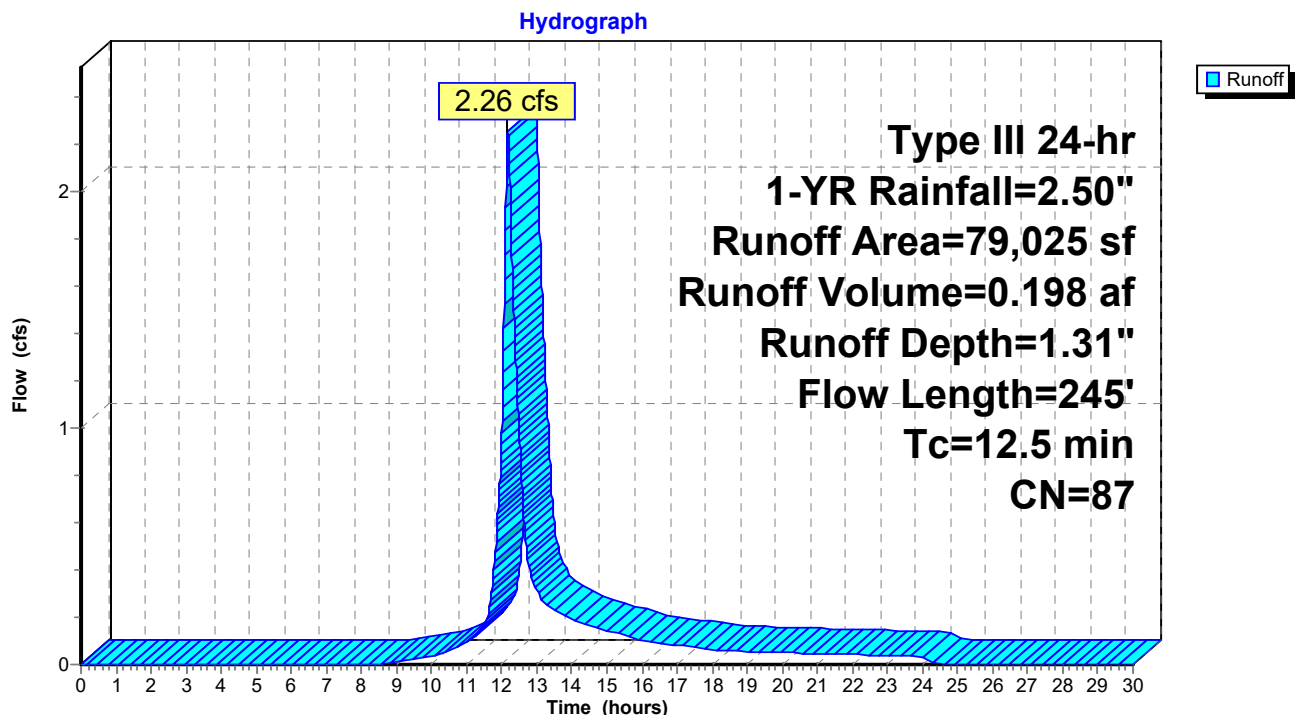
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
30,132	98	Paved parking, HSG C
35,045	74	>75% Grass cover, Good, HSG C
13,848	98	Roofs, HSG C
79,025	87	Weighted Average
35,045		44.35% Pervious Area
43,980		55.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	38	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.2	26	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	131	0.0150	1.97		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
12.5	245	Total			

### Subcatchment 25P: P2b





## Stormwater Calculations

Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 26P: Sediment Forebay

Inflow Area = 1.814 ac, 55.65% Impervious, Inflow Depth = 1.31" for 1-YR event  
Inflow = 2.26 cfs @ 12.18 hrs, Volume= 0.198 af  
Outflow = 1.96 cfs @ 12.25 hrs, Volume= 0.198 af, Atten= 13%, Lag= 4.4 min  
Primary = 1.96 cfs @ 12.25 hrs, Volume= 0.198 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 218.04' @ 12.25 hrs Surf.Area= 1,934 sf Storage= 478 cf

Plug-Flow detention time= 2.4 min calculated for 0.198 af (100% of inflow)  
Center-of-Mass det. time= 2.4 min ( 838.2 - 835.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	217.40'	3,225 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.40	10	10.0	0	0	10
218.00	1,868	267.0	403	403	5,676
219.00	3,900	300.0	2,822	3,225	7,191

Device	Routing	Invert	Outlet Devices
#1	Primary	217.40'	<b>18.0" Round Culvert</b> L= 71.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 217.40' / 216.80' S= 0.0085 ' / ' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=1.96 cfs @ 12.25 hrs HW=218.04' (Free Discharge)

↑1=Culvert (Inlet Controls 1.96 cfs @ 2.72 fps)

## Stormwater Calculations

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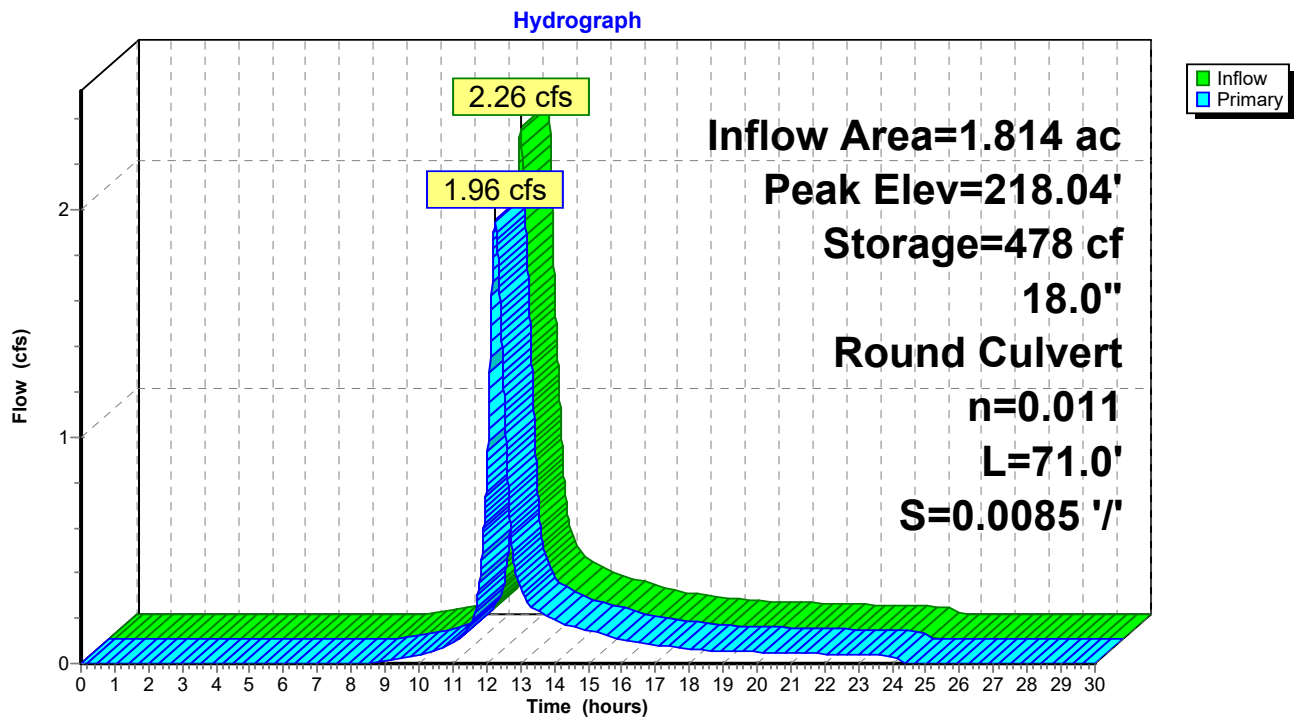
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Type III 24-hr 1-YR Rainfall=2.50"

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### Pond 26P: Sediment Forebay



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 27P: CB6

Inflow Area = 1.814 ac, 55.65% Impervious, Inflow Depth = 1.31" for 1-YR event  
Inflow = 1.96 cfs @ 12.25 hrs, Volume= 0.198 af  
Outflow = 1.96 cfs @ 12.25 hrs, Volume= 0.198 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.96 cfs @ 12.25 hrs, Volume= 0.198 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 217.42' @ 12.25 hrs

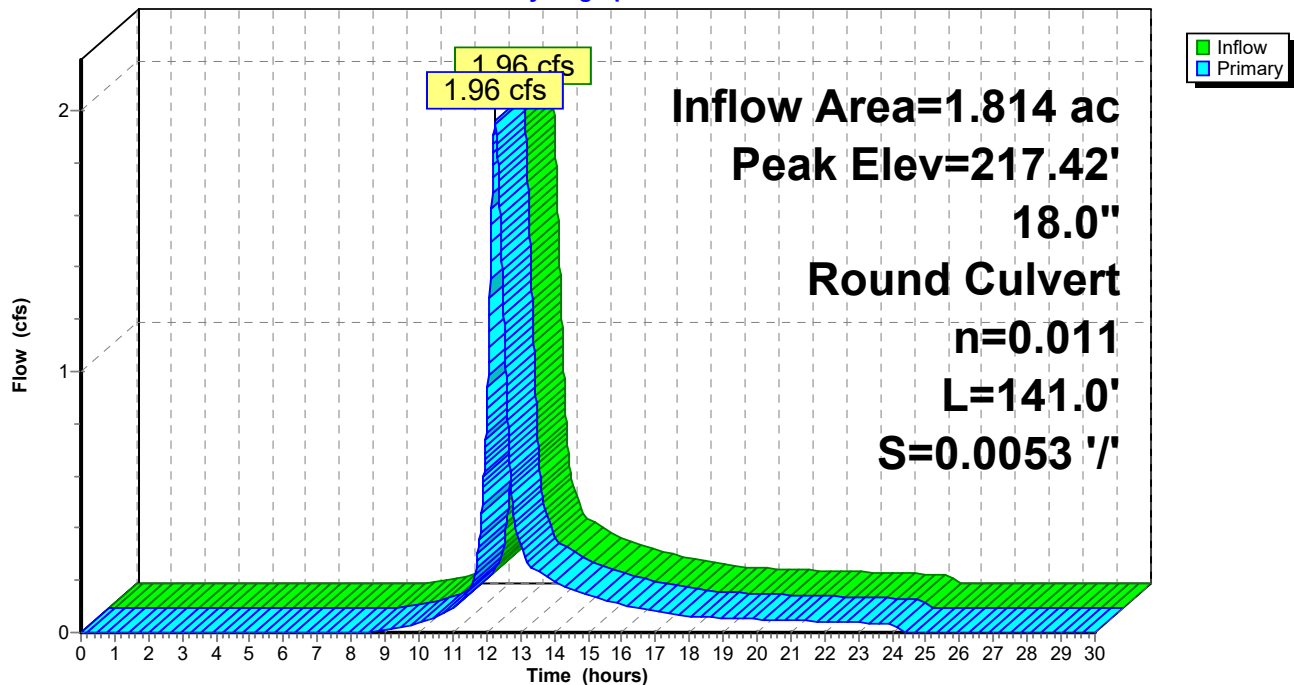
Device	Routing	Invert	Outlet Devices
#1	Primary	216.75'	<b>18.0" Round Culvert</b> L= 141.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.75' / 216.00' S= 0.0053 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=1.96 cfs @ 12.25 hrs HW=217.42' (Free Discharge)

↑1=Culvert (Barrel Controls 1.96 cfs @ 3.75 fps)

### Pond 27P: CB6

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 28P: P2c

Runoff = 0.33 cfs @ 12.17 hrs, Volume= 0.032 af, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

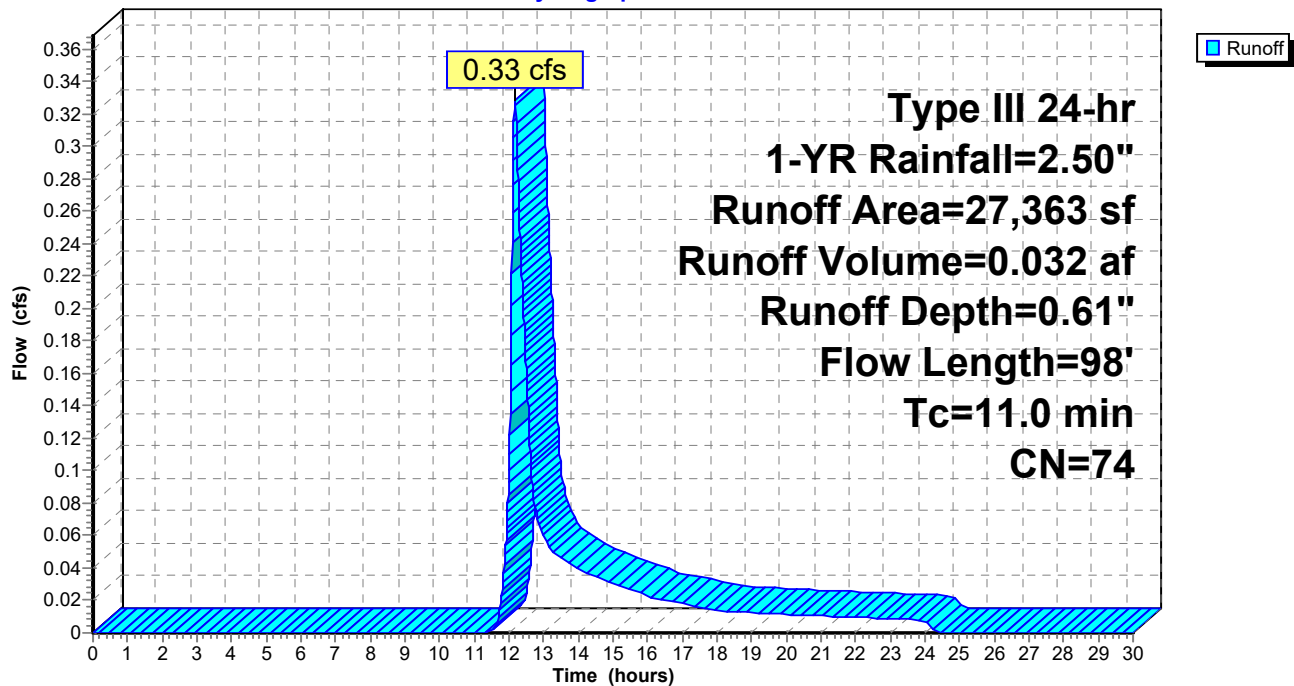
Area (sf)	CN	Description
26,841	74	>75% Grass cover, Good, HSG C
* 522	98	Patio, HSG C
27,363	74	Weighted Average
26,841		98.09% Pervious Area
522		1.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	48	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.0	98	Total			

### Subcatchment 28P: P2c

Hydrograph



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 29P: P2d

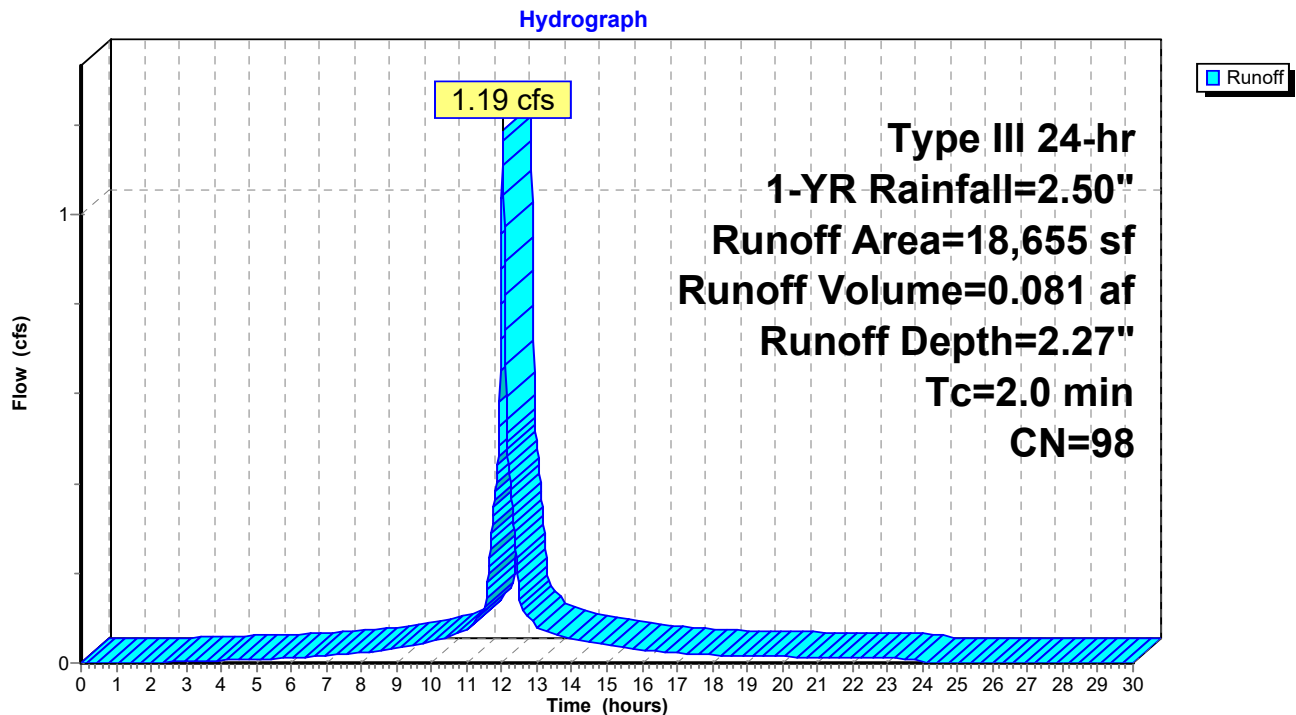
Runoff = 1.19 cfs @ 12.03 hrs, Volume= 0.081 af, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
18,655	98	Roofs, HSG C
18,655		100.00% Impervious Area

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

### Subcatchment 29P: P2d



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 30P: Roof Pipes

Inflow Area = 0.428 ac, 100.00% Impervious, Inflow Depth = 2.27" for 1-YR event  
Inflow = 1.19 cfs @ 12.03 hrs, Volume= 0.081 af  
Outflow = 1.19 cfs @ 12.03 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.19 cfs @ 12.03 hrs, Volume= 0.081 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 218.83' @ 12.03 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#2	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#3	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#4	Primary	218.50'	<b>8.0" Round Culvert</b> L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 216.00' S= 0.0250 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

**Primary OutFlow** Max=1.19 cfs @ 12.03 hrs HW=218.83' (Free Discharge)

↑  
1=Culvert (Barrel Controls 0.28 cfs @ 2.43 fps)  
2=Culvert (Barrel Controls 0.28 cfs @ 2.43 fps)  
3=Culvert (Barrel Controls 0.28 cfs @ 2.43 fps)  
4=Culvert (Inlet Controls 0.33 cfs @ 1.95 fps)

## Stormwater Calculations

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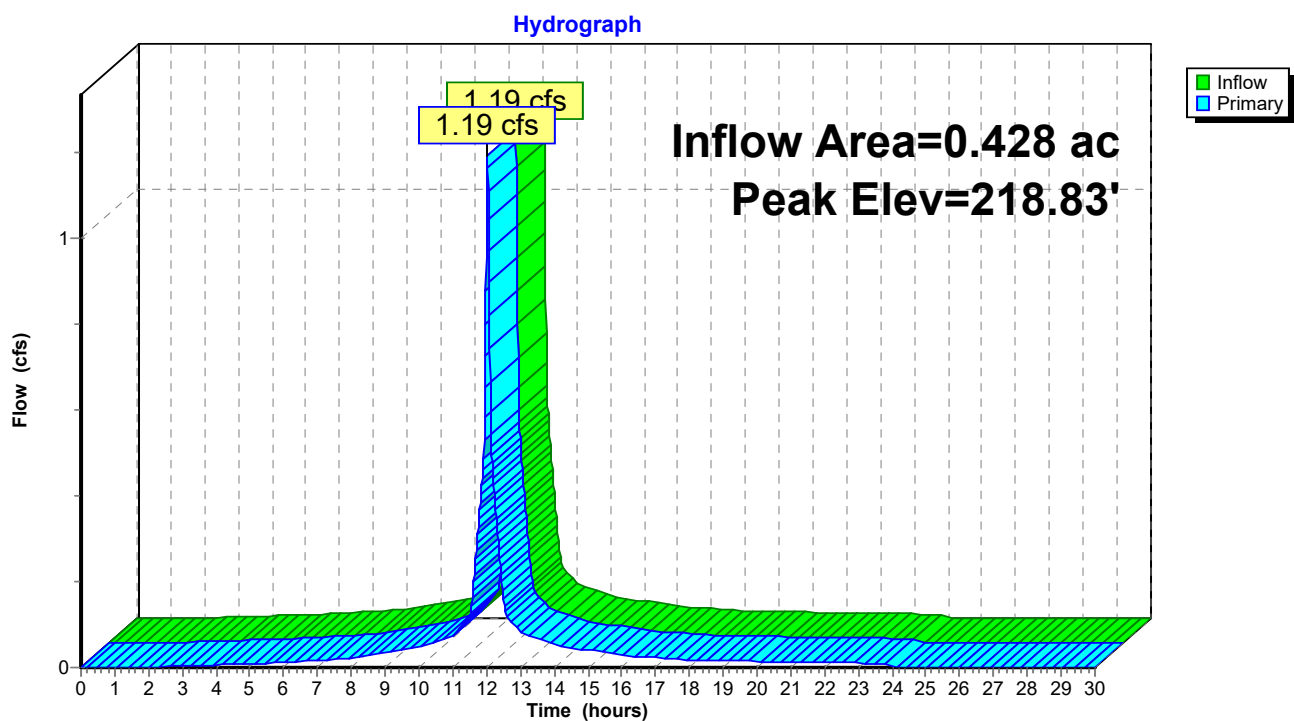
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Type III 24-hr 1-YR Rainfall=2.50"

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### Pond 30P: Roof Pipes



## Stormwater Calculations

Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Pond 31P: Basin #2

Inflow Area = 2.871 ac, 50.51% Impervious, Inflow Depth = 1.30" for 1-YR event  
Inflow = 2.65 cfs @ 12.23 hrs, Volume= 0.311 af  
Outflow = 0.31 cfs @ 13.78 hrs, Volume= 0.311 af, Atten= 88%, Lag= 93.2 min  
Discarded = 0.31 cfs @ 13.78 hrs, Volume= 0.311 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 216.44' @ 13.78 hrs Surf.Area= 13,302 sf Storage= 5,656 cf

Plug-Flow detention time= 168.0 min calculated for 0.311 af (100% of inflow)  
Center-of-Mass det. time= 168.0 min ( 990.1 - 822.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	216.00'	29,400 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
216.00	12,268	457.0	0	0	12,268
218.00	17,274	522.0	29,400	29,400	17,426

Device	Routing	Invert	Outlet Devices
#1	Discarded	216.00'	<b>1.020 in/hr Exfiltration over Surface area</b>
#2	Primary	216.80'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 216.80 217.50 Width (feet) 5.00 5.00

**Discarded OutFlow** Max=0.31 cfs @ 13.78 hrs HW=216.44' (Free Discharge)  
↑**1=Exfiltration** (Exfiltration Controls 0.31 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=216.00' (Free Discharge)  
↑**2=Custom Weir/Orifice** ( Controls 0.00 cfs)



## Stormwater Calculations

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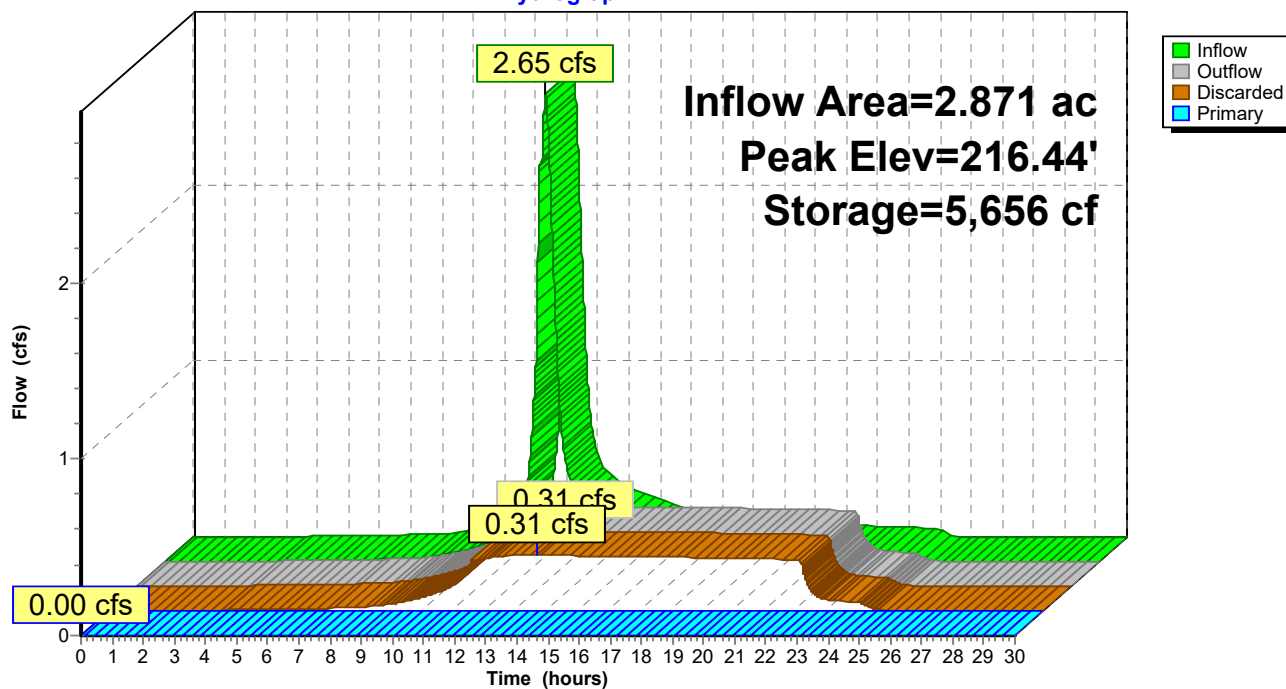
Type III 24-hr 1-YR Rainfall=2.50"

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### Pond 31P: Basin #2

#### Hydrograph



## Stormwater Calculations

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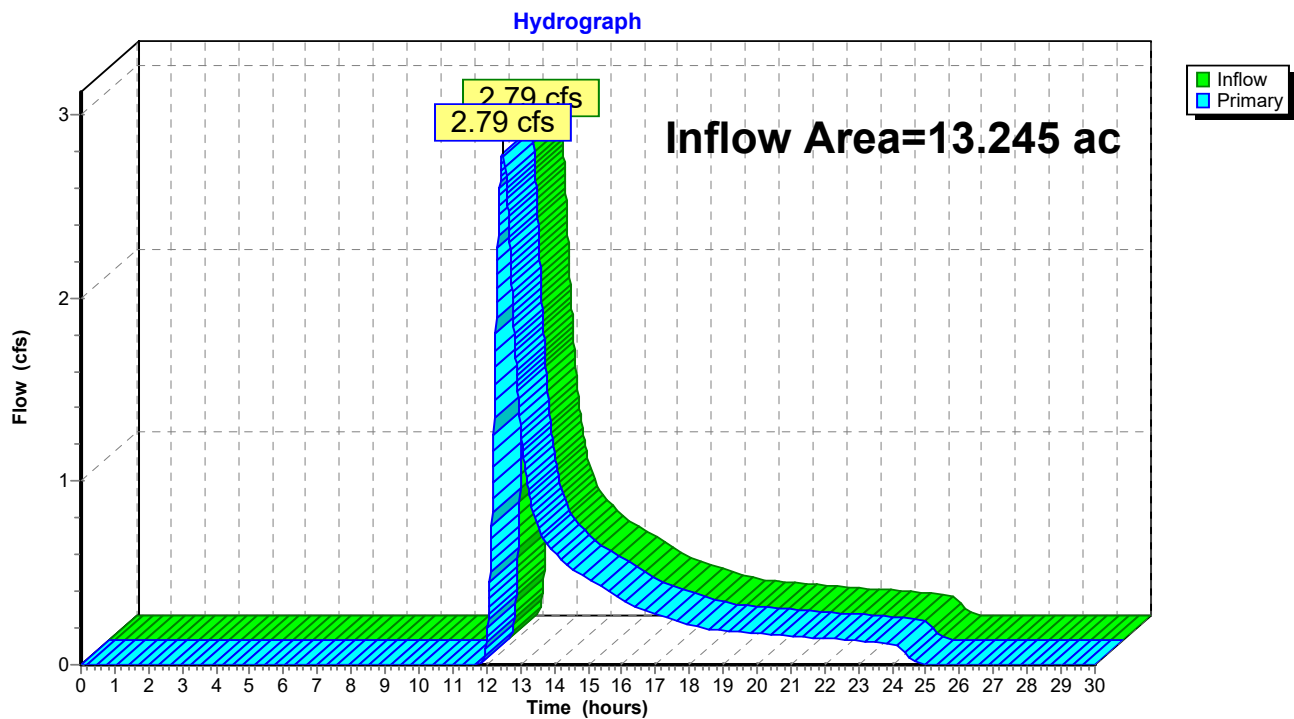
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### Summary for Link 32P: Design Point #2: Flow to Southern Abutters

Inflow Area = 13.245 ac, 11.58% Impervious, Inflow Depth = 0.38" for 1-YR event  
Inflow = 2.79 cfs @ 12.48 hrs, Volume= 0.425 af  
Primary = 2.79 cfs @ 12.48 hrs, Volume= 0.425 af, Atten= 0%, Lag= 0.0 min

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

### Link 32P: Design Point #2: Flow to Southern Abutters



## Stormwater Calculations

Type III 24-hr 2-YR Rainfall=3.20"

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

**Subcatchment24P: P2a** Runoff Area=451,888 sf 0.81% Impervious Runoff Depth=0.88"  
Flow Length=1,260' Slope=0.0100 '/' Tc=28.8 min CN=71 Runoff=5.60 cfs 0.759 af

**Subcatchment25P: P2b** Runoff Area=79,025 sf 55.65% Impervious Runoff Depth=1.91"  
Flow Length=245' Tc=12.5 min CN=87 Runoff=3.30 cfs 0.289 af

**Pond 26P: Sediment Forebay** Peak Elev=218.19' Storage=781 cf Inflow=3.30 cfs 0.289 af  
18.0" Round Culvert n=0.011 L=71.0' S=0.0085 '/' Outflow=2.83 cfs 0.289 af

**Pond 27P: CB6** Peak Elev=217.58' Inflow=2.83 cfs 0.289 af  
18.0" Round Culvert n=0.011 L=141.0' S=0.0053 '/' Outflow=2.83 cfs 0.289 af

**Subcatchment28P: P2c** Runoff Area=27,363 sf 1.91% Impervious Runoff Depth=1.04"  
Flow Length=98' Tc=11.0 min CN=74 Runoff=0.61 cfs 0.054 af

**Subcatchment29P: P2d** Runoff Area=18,655 sf 100.00% Impervious Runoff Depth=2.97"  
Tc=2.0 min CN=98 Runoff=1.53 cfs 0.106 af

**Pond 30P: Roof Pipes** Peak Elev=218.88' Inflow=1.53 cfs 0.106 af  
Outflow=1.53 cfs 0.106 af

**Pond 31P: Basin #2** Peak Elev=216.72' Storage=9,408 cf Inflow=3.88 cfs 0.450 af  
Discarded=0.33 cfs 0.450 af Primary=0.00 cfs 0.000 af Outflow=0.33 cfs 0.450 af

**Link 32P: Design Point #2: Flow to Southern Abutters** Inflow=5.60 cfs 0.759 af  
Primary=5.60 cfs 0.759 af

**Total Runoff Area = 13.245 ac Runoff Volume = 1.209 af Average Runoff Depth = 1.10"**  
**88.42% Pervious = 11.711 ac 11.58% Impervious = 1.534 ac**

## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 24P: P2a

Runoff = 5.60 cfs @ 12.45 hrs, Volume= 0.759 af, Depth= 0.88"

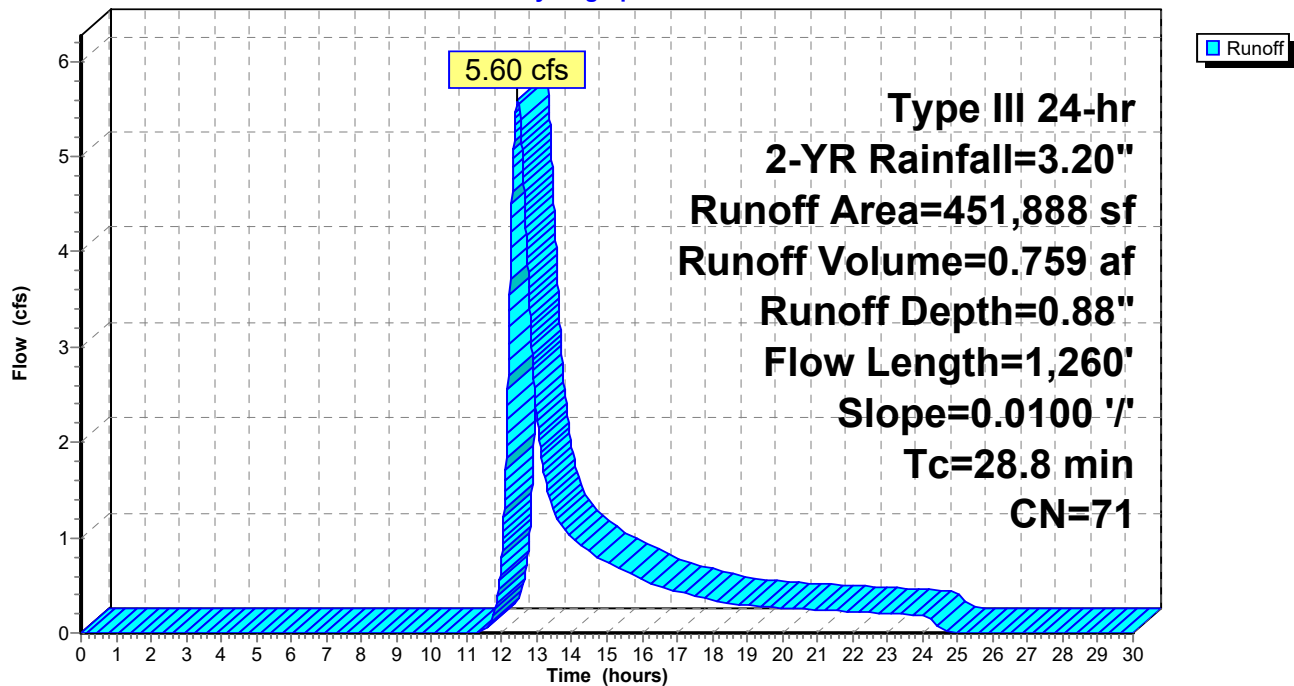
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

	Area (sf)	CN	Description
*	3,654	98	Patio, HSG C
	91,113	74	>75% Grass cover, Good, HSG C
	355,713	70	Woods, Good, HSG C
*	1,408	74	Pervious Pavers, HSG C
	451,888	71	Weighted Average
	448,234		99.19% Pervious Area
	3,654		0.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
12.5	1,210	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
28.8	1,260	Total			

### Subcatchment 24P: P2a

Hydrograph



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 25P: P2b

Runoff = 3.30 cfs @ 12.17 hrs, Volume= 0.289 af, Depth= 1.91"

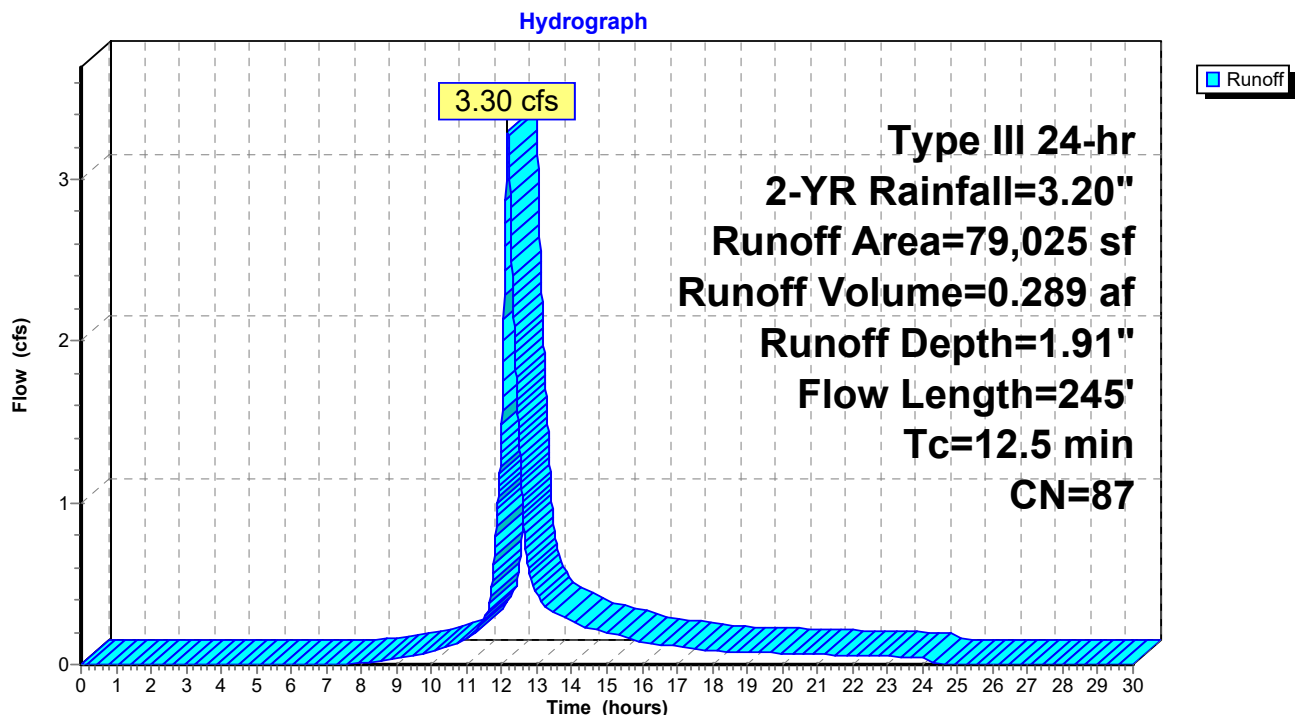
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
30,132	98	Paved parking, HSG C
35,045	74	>75% Grass cover, Good, HSG C
13,848	98	Roofs, HSG C
79,025	87	Weighted Average
35,045		44.35% Pervious Area
43,980		55.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	38	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.2	26	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	131	0.0150	1.97		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
12.5	245	Total			

### Subcatchment 25P: P2b



## Stormwater Calculations

Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 26P: Sediment Forebay

Inflow Area = 1.814 ac, 55.65% Impervious, Inflow Depth = 1.91" for 2-YR event  
Inflow = 3.30 cfs @ 12.17 hrs, Volume= 0.289 af  
Outflow = 2.83 cfs @ 12.25 hrs, Volume= 0.289 af, Atten= 14%, Lag= 4.6 min  
Primary = 2.83 cfs @ 12.25 hrs, Volume= 0.289 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 218.19' @ 12.25 hrs Surf.Area= 2,191 sf Storage= 781 cf

Plug-Flow detention time= 2.8 min calculated for 0.289 af (100% of inflow)  
Center-of-Mass det. time= 2.8 min ( 827.6 - 824.9 )

Volume	Invert	Avail.Storage	Storage Description		
#1	217.40'	3,225 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.40	10	10.0	0	0	10
218.00	1,868	267.0	403	403	5,676
219.00	3,900	300.0	2,822	3,225	7,191

Device	Routing	Invert	Outlet Devices
#1	Primary	217.40'	<b>18.0" Round Culvert</b> L= 71.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 217.40' / 216.80' S= 0.0085 '/' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=2.83 cfs @ 12.25 hrs HW=218.19' (Free Discharge)

↑**1=Culvert** (Barrel Controls 2.83 cfs @ 4.39 fps)

## Stormwater Calculations

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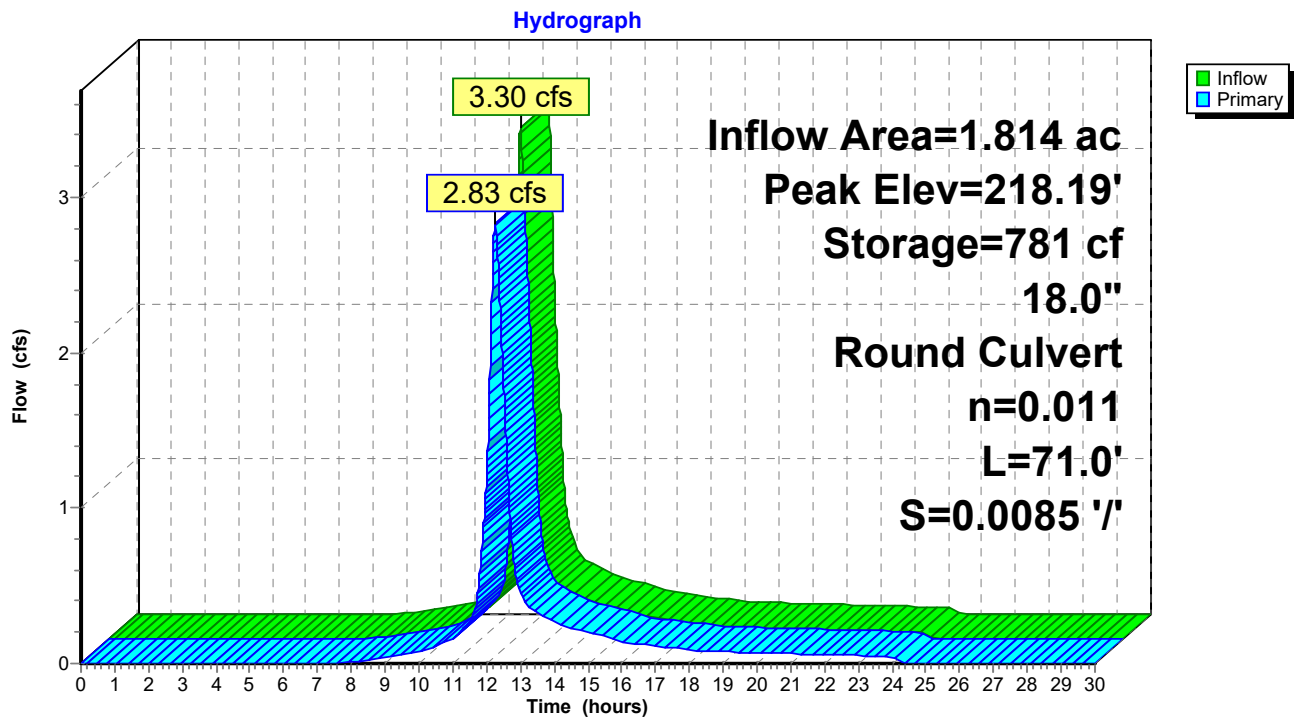
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Type III 24-hr 2-YR Rainfall=3.20"

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### Pond 26P: Sediment Forebay



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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 27P: CB6

Inflow Area = 1.814 ac, 55.65% Impervious, Inflow Depth = 1.91" for 2-YR event  
Inflow = 2.83 cfs @ 12.25 hrs, Volume= 0.289 af  
Outflow = 2.83 cfs @ 12.25 hrs, Volume= 0.289 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.83 cfs @ 12.25 hrs, Volume= 0.289 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 217.58' @ 12.25 hrs

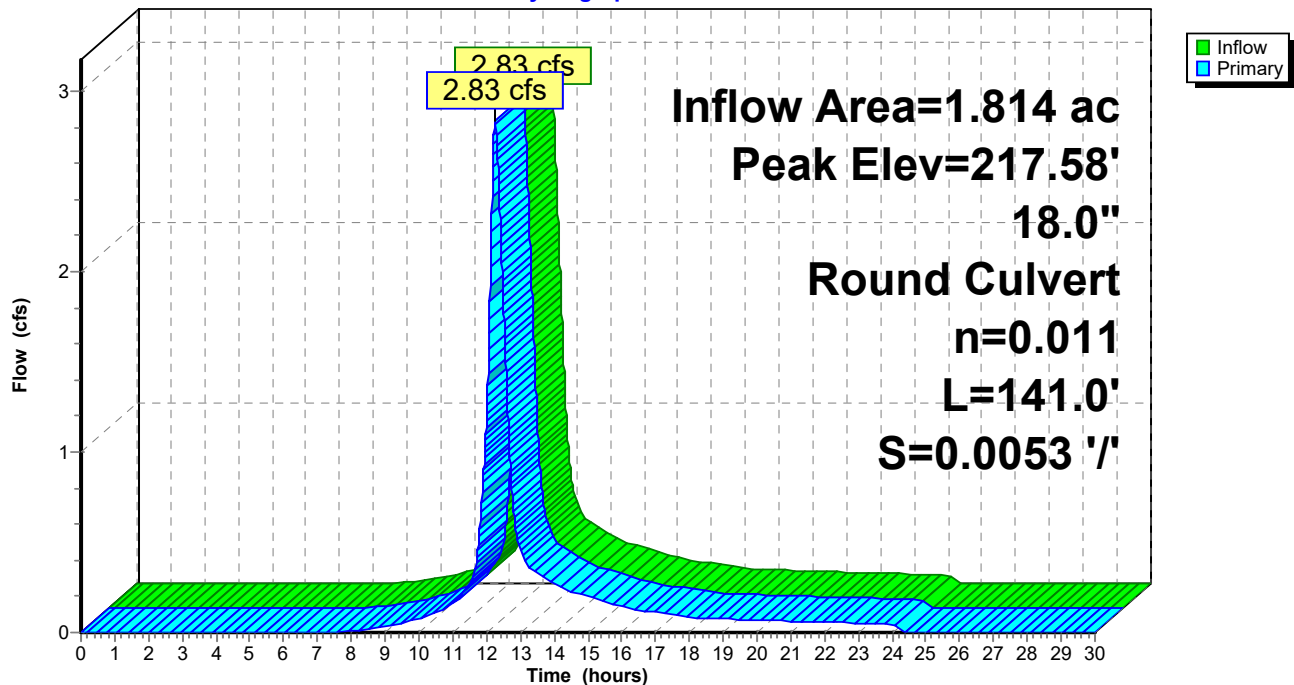
Device	Routing	Invert	Outlet Devices
#1	Primary	216.75'	<b>18.0" Round Culvert</b> L= 141.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.75' / 216.00' S= 0.0053 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=2.83 cfs @ 12.25 hrs HW=217.58' (Free Discharge)

↑1=Culvert (Barrel Controls 2.83 cfs @ 4.09 fps)

### Pond 27P: CB6

Hydrograph





## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 28P: P2c

Runoff = 0.61 cfs @ 12.16 hrs, Volume= 0.054 af, Depth= 1.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

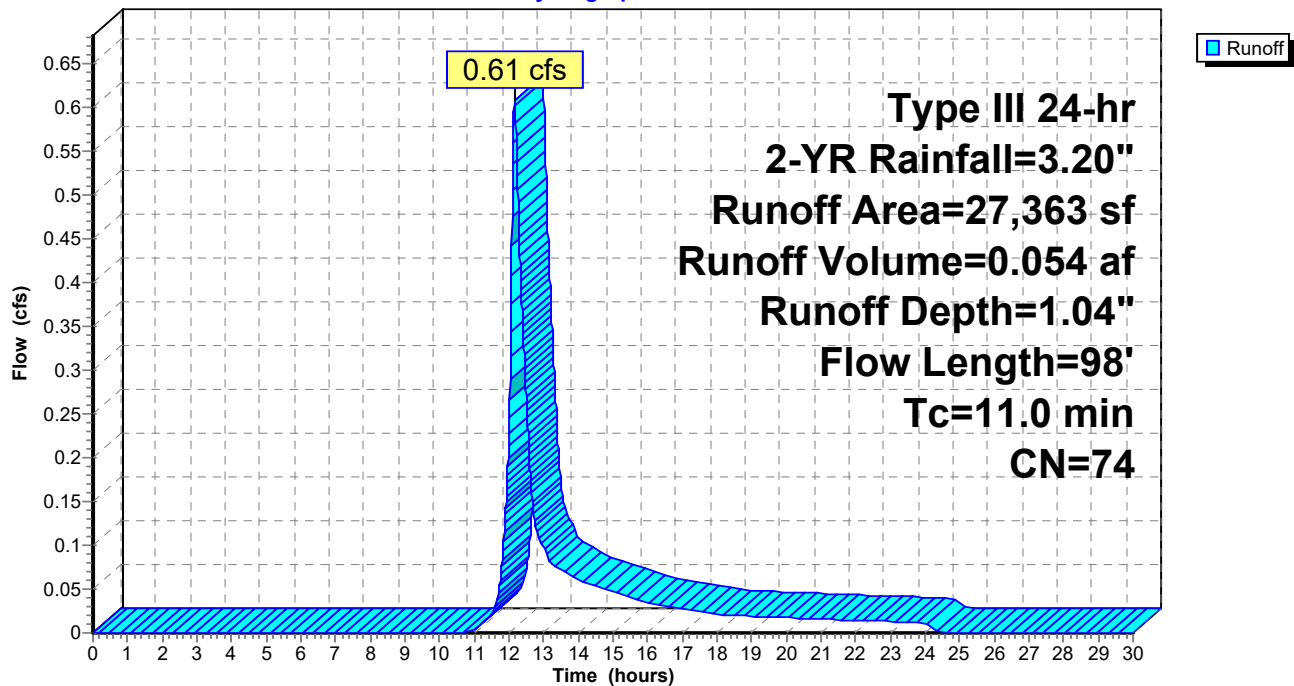
Area (sf)	CN	Description
26,841	74	>75% Grass cover, Good, HSG C
* 522	98	Patio, HSG C
27,363	74	Weighted Average
26,841		98.09% Pervious Area
522		1.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	48	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.0	98	Total			

### Subcatchment 28P: P2c

Hydrograph



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 29P: P2d

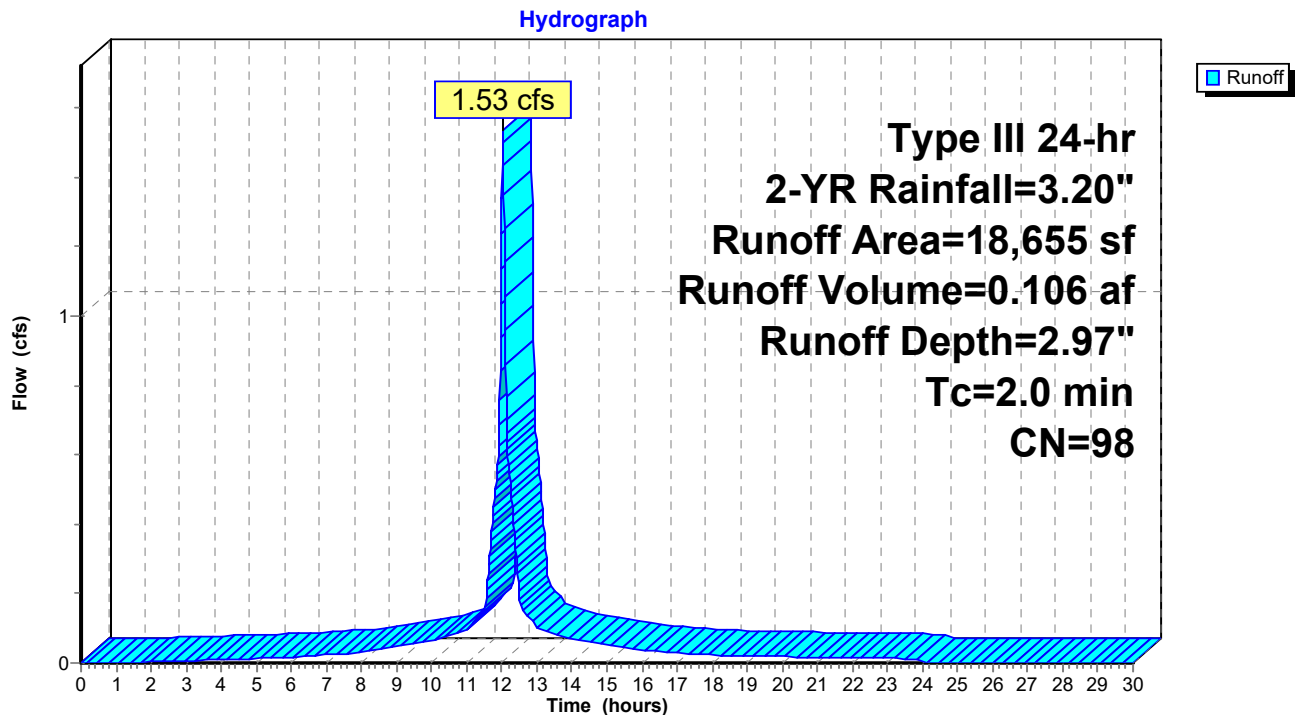
Runoff = 1.53 cfs @ 12.03 hrs, Volume= 0.106 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
18,655	98	Roofs, HSG C
18,655		100.00% Impervious Area

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

### Subcatchment 29P: P2d



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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 30P: Roof Pipes

Inflow Area = 0.428 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2-YR event  
Inflow = 1.53 cfs @ 12.03 hrs, Volume= 0.106 af  
Outflow = 1.53 cfs @ 12.03 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min  
Primary = 1.53 cfs @ 12.03 hrs, Volume= 0.106 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 218.88' @ 12.03 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#2	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#3	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#4	Primary	218.50'	<b>8.0" Round Culvert</b> L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 216.00' S= 0.0250 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

**Primary OutFlow** Max=1.53 cfs @ 12.03 hrs HW=218.88' (Free Discharge)

- 1=Culvert (Barrel Controls 0.37 cfs @ 2.60 fps)
- 2=Culvert (Barrel Controls 0.37 cfs @ 2.60 fps)
- 3=Culvert (Barrel Controls 0.37 cfs @ 2.60 fps)
- 4=Culvert (Inlet Controls 0.43 cfs @ 2.09 fps)

## Stormwater Calculations

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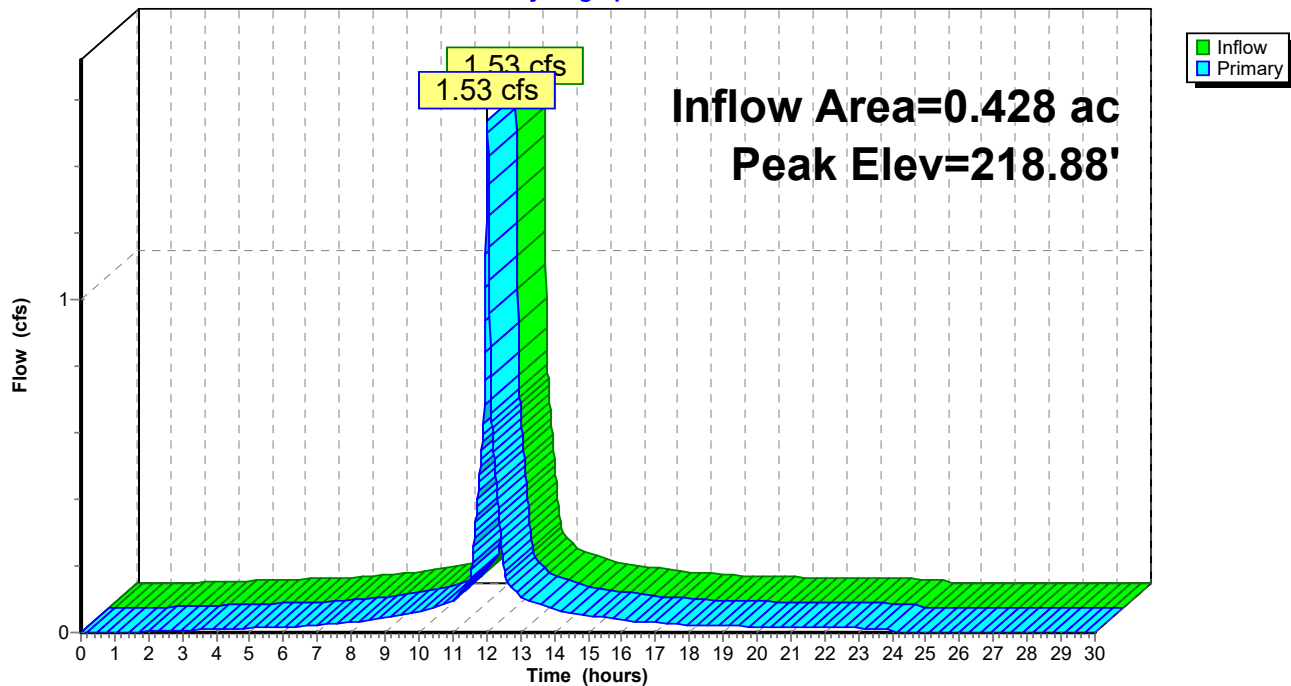
Type III 24-hr 2-YR Rainfall=3.20"

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### Pond 30P: Roof Pipes

Hydrograph



## Stormwater Calculations

Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Pond 31P: Basin #2

Inflow Area = 2.871 ac, 50.51% Impervious, Inflow Depth = 1.88" for 2-YR event  
Inflow = 3.88 cfs @ 12.22 hrs, Volume= 0.450 af  
Outflow = 0.33 cfs @ 14.64 hrs, Volume= 0.450 af, Atten= 92%, Lag= 145.2 min  
Discarded = 0.33 cfs @ 14.64 hrs, Volume= 0.450 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 216.72' @ 14.64 hrs Surf.Area= 13,966 sf Storage= 9,408 cf

Plug-Flow detention time= 280.6 min calculated for 0.450 af (100% of inflow)  
Center-of-Mass det. time= 280.6 min ( 1,095.3 - 814.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	216.00'	29,400 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
216.00	12,268	457.0	0	0	12,268
218.00	17,274	522.0	29,400	29,400	17,426

Device	Routing	Invert	Outlet Devices
#1	Discarded	216.00'	<b>1.020 in/hr Exfiltration over Surface area</b>
#2	Primary	216.80'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 216.80 217.50 Width (feet) 5.00 5.00

**Discarded OutFlow** Max=0.33 cfs @ 14.64 hrs HW=216.72' (Free Discharge)  
↑**1=Exfiltration** (Exfiltration Controls 0.33 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=216.00' (Free Discharge)  
↑**2=Custom Weir/Orifice** ( Controls 0.00 cfs)

## Stormwater Calculations

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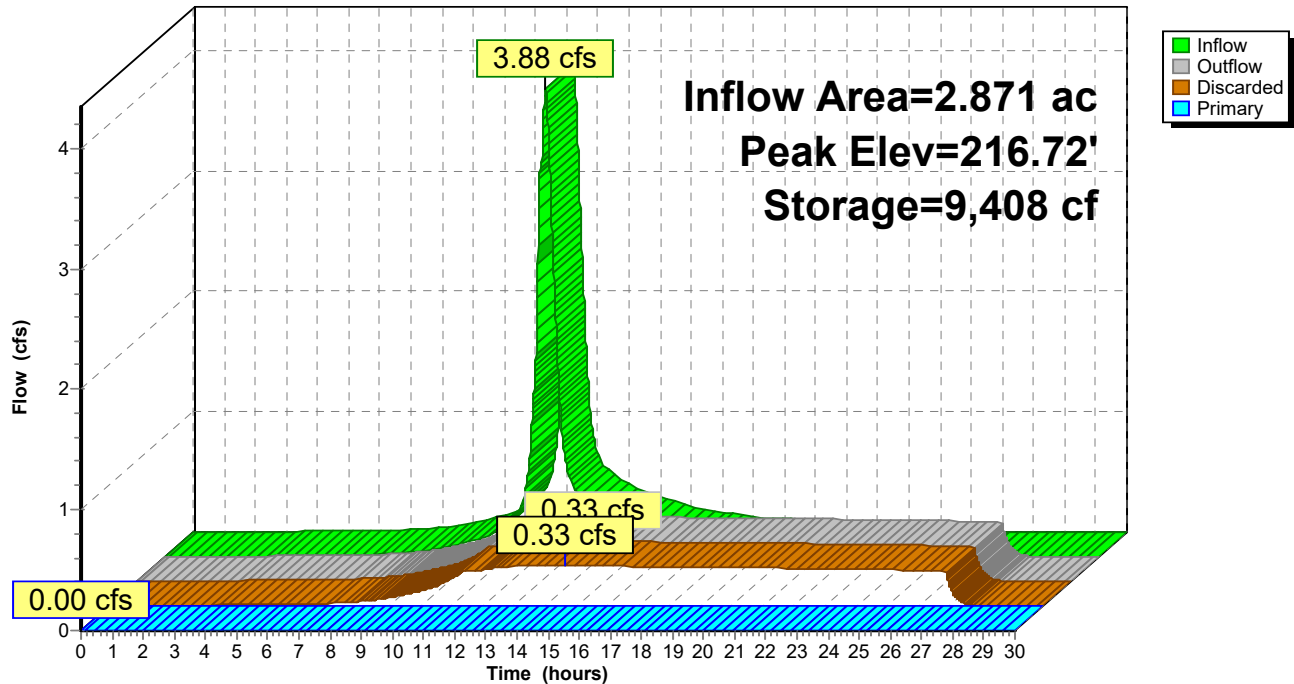
Type III 24-hr 2-YR Rainfall=3.20"

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### Pond 31P: Basin #2

#### Hydrograph



## Stormwater Calculations

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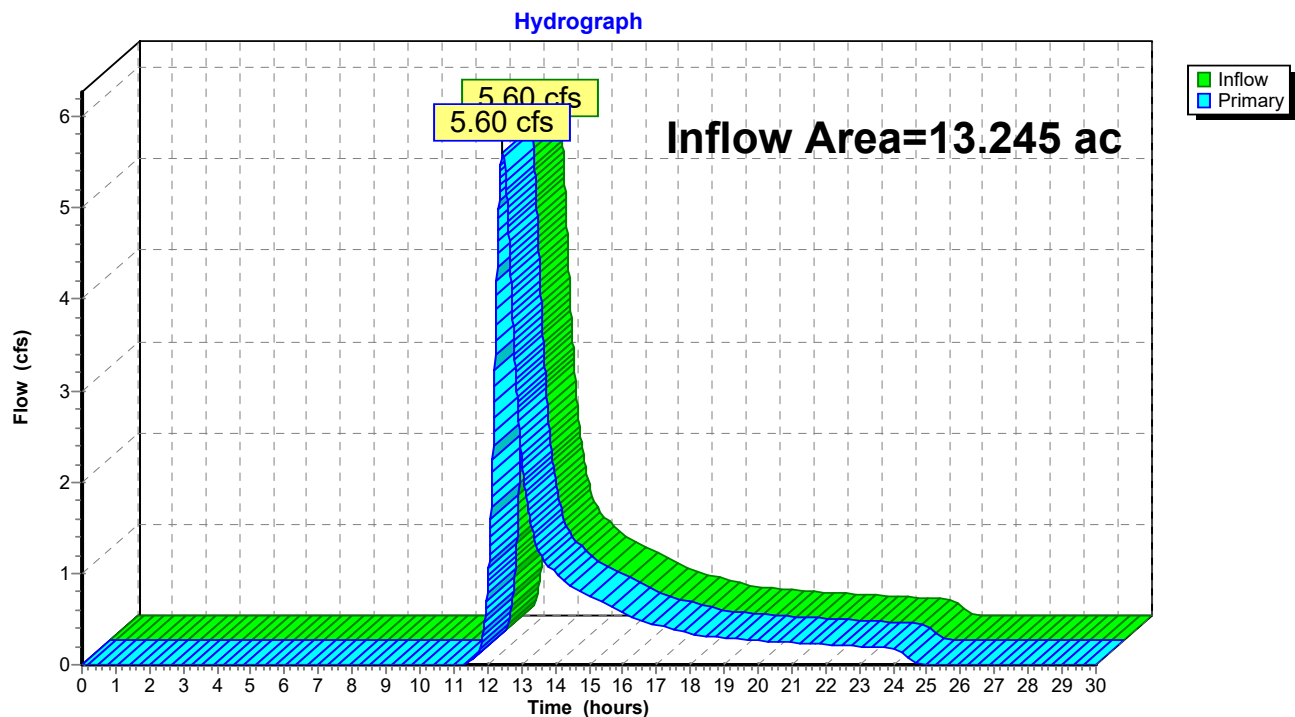
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### Summary for Link 32P: Design Point #2: Flow to Southern Abutters

Inflow Area = 13.245 ac, 11.58% Impervious, Inflow Depth = 0.69" for 2-YR event  
Inflow = 5.60 cfs @ 12.45 hrs, Volume= 0.759 af  
Primary = 5.60 cfs @ 12.45 hrs, Volume= 0.759 af, Atten= 0%, Lag= 0.0 min

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

### Link 32P: Design Point #2: Flow to Southern Abutters



## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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

**Subcatchment24P: P2a** Runoff Area=451,888 sf 0.81% Impervious Runoff Depth=1.89"  
Flow Length=1,260' Slope=0.0100 '/' Tc=28.8 min CN=71 Runoff=12.95 cfs 1.636 af

**Subcatchment25P: P2b** Runoff Area=79,025 sf 55.65% Impervious Runoff Depth=3.29"  
Flow Length=245' Tc=12.5 min CN=87 Runoff=5.59 cfs 0.497 af

**Pond 26P: Sediment Forebay** Peak Elev=218.48' Storage=1,498 cf Inflow=5.59 cfs 0.497 af  
18.0" Round Culvert n=0.011 L=71.0' S=0.0085 '/' Outflow=4.71 cfs 0.497 af

**Pond 27P: CB6** Peak Elev=217.88' Inflow=4.71 cfs 0.497 af  
18.0" Round Culvert n=0.011 L=141.0' S=0.0053 '/' Outflow=4.71 cfs 0.497 af

**Subcatchment28P: P2c** Runoff Area=27,363 sf 1.91% Impervious Runoff Depth=2.13"  
Flow Length=98' Tc=11.0 min CN=74 Runoff=1.31 cfs 0.111 af

**Subcatchment29P: P2d** Runoff Area=18,655 sf 100.00% Impervious Runoff Depth=4.46"  
Tc=2.0 min CN=98 Runoff=2.27 cfs 0.159 af

**Pond 30P: Roof Pipes** Peak Elev=218.98' Inflow=2.27 cfs 0.159 af  
Outflow=2.27 cfs 0.159 af

**Pond 31P: Basin #2** Peak Elev=217.03' Storage=13,876 cf Inflow=6.60 cfs 0.767 af  
Discarded=0.35 cfs 0.568 af Primary=1.80 cfs 0.197 af Outflow=2.14 cfs 0.765 af

**Link 32P: Design Point #2: Flow to Southern Abutters** Inflow=13.88 cfs 1.833 af  
Primary=13.88 cfs 1.833 af

**Total Runoff Area = 13.245 ac Runoff Volume = 2.403 af Average Runoff Depth = 2.18"**  
**88.42% Pervious = 11.711 ac 11.58% Impervious = 1.534 ac**



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 24P: P2a

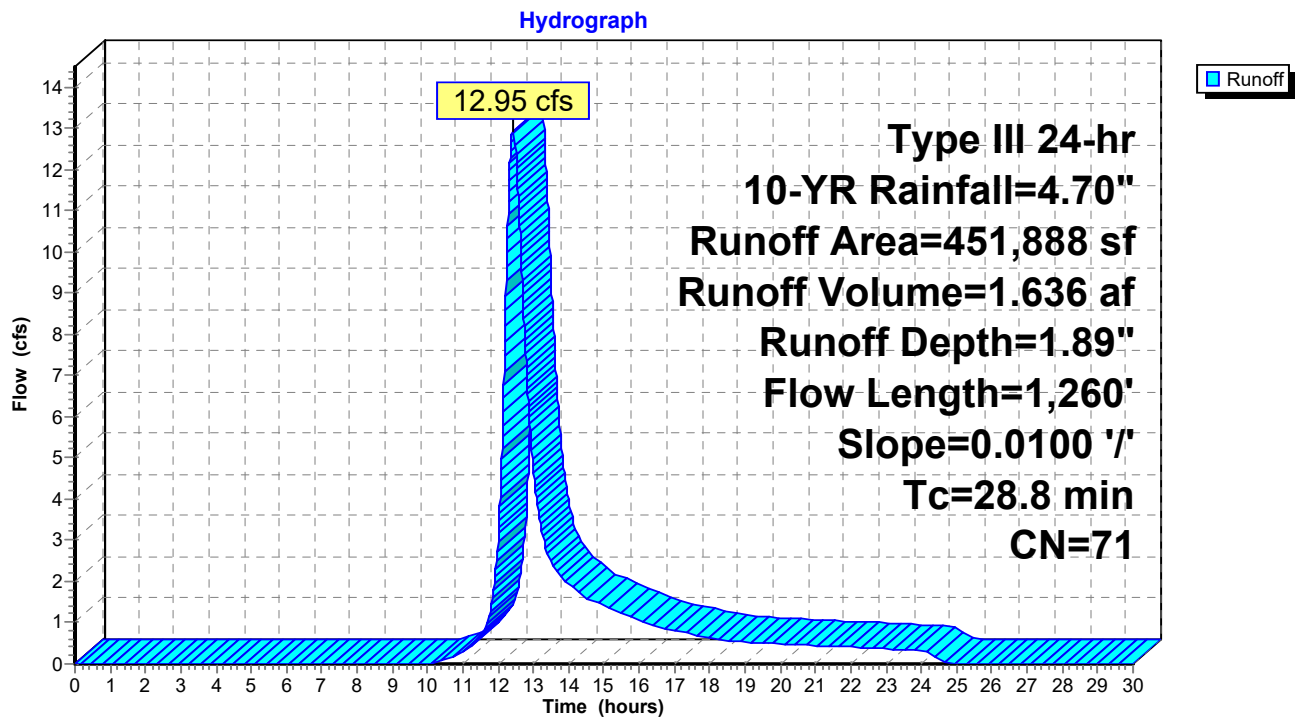
Runoff = 12.95 cfs @ 12.42 hrs, Volume= 1.636 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	3,654	98	Patio, HSG C
	91,113	74	>75% Grass cover, Good, HSG C
	355,713	70	Woods, Good, HSG C
*	1,408	74	Pervious Pavers, HSG C
	451,888	71	Weighted Average
	448,234		99.19% Pervious Area
	3,654		0.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
12.5	1,210	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
28.8	1,260	Total			

### Subcatchment 24P: P2a



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 25P: P2b

Runoff = 5.59 cfs @ 12.17 hrs, Volume= 0.497 af, Depth= 3.29"

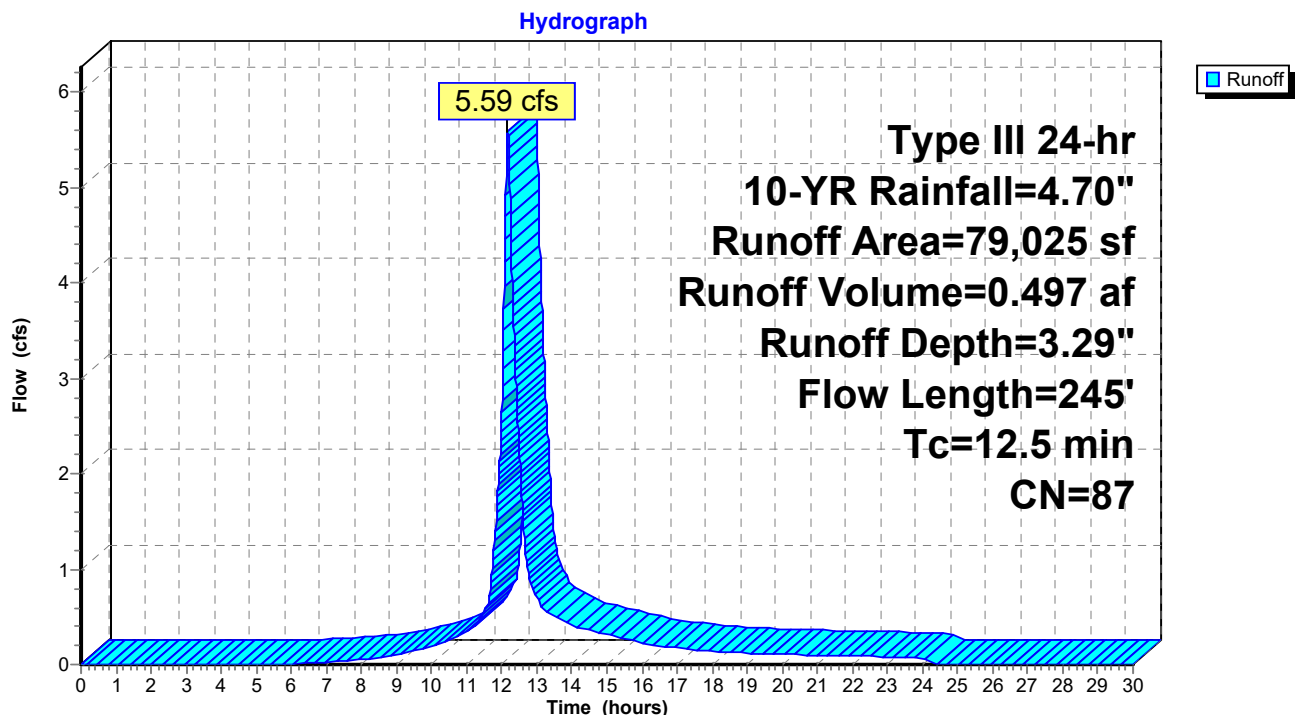
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
30,132	98	Paved parking, HSG C
35,045	74	>75% Grass cover, Good, HSG C
13,848	98	Roofs, HSG C
79,025	87	Weighted Average
35,045		44.35% Pervious Area
43,980		55.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	38	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.2	26	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	131	0.0150	1.97		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
12.5	245	Total			

### Subcatchment 25P: P2b



## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 26P: Sediment Forebay

Inflow Area = 1.814 ac, 55.65% Impervious, Inflow Depth = 3.29" for 10-YR event  
Inflow = 5.59 cfs @ 12.17 hrs, Volume= 0.497 af  
Outflow = 4.71 cfs @ 12.25 hrs, Volume= 0.497 af, Atten= 16%, Lag= 4.9 min  
Primary = 4.71 cfs @ 12.25 hrs, Volume= 0.497 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 218.48' @ 12.25 hrs Surf.Area= 2,746 sf Storage= 1,498 cf

Plug-Flow detention time= 3.2 min calculated for 0.497 af (100% of inflow)  
Center-of-Mass det. time= 3.2 min ( 812.8 - 809.6 )

Volume	Invert	Avail.Storage	Storage Description		
#1	217.40'	3,225 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.40	10	10.0	0	0	10
218.00	1,868	267.0	403	403	5,676
219.00	3,900	300.0	2,822	3,225	7,191

Device	Routing	Invert	Outlet Devices
#1	Primary	217.40'	<b>18.0" Round Culvert</b> L= 71.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 217.40' / 216.80' S= 0.0085 ' / ' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=4.71 cfs @ 12.25 hrs HW=218.48' (Free Discharge)

↑**1=Culvert** (Barrel Controls 4.71 cfs @ 4.86 fps)

## Stormwater Calculations

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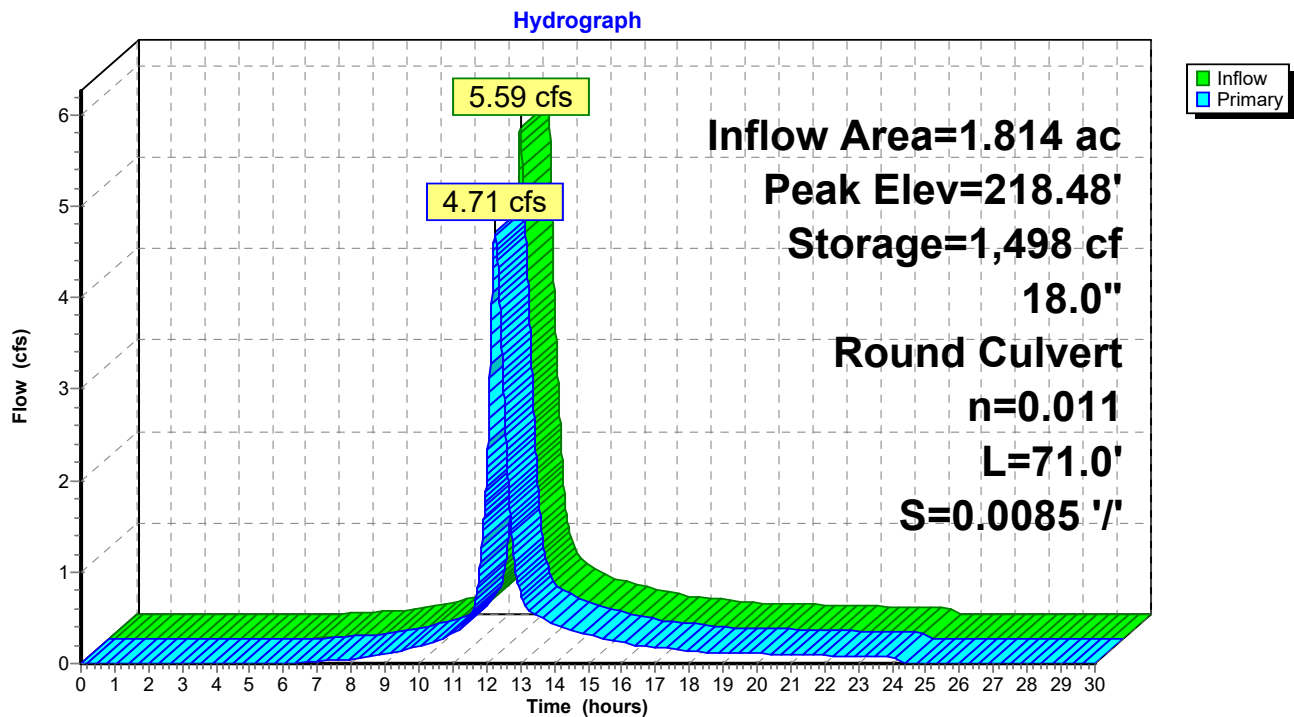
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Type III 24-hr 10-YR Rainfall=4.70"

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### Pond 26P: Sediment Forebay



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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 27P: CB6

Inflow Area = 1.814 ac, 55.65% Impervious, Inflow Depth = 3.29" for 10-YR event  
Inflow = 4.71 cfs @ 12.25 hrs, Volume= 0.497 af  
Outflow = 4.71 cfs @ 12.25 hrs, Volume= 0.497 af, Atten= 0%, Lag= 0.0 min  
Primary = 4.71 cfs @ 12.25 hrs, Volume= 0.497 af

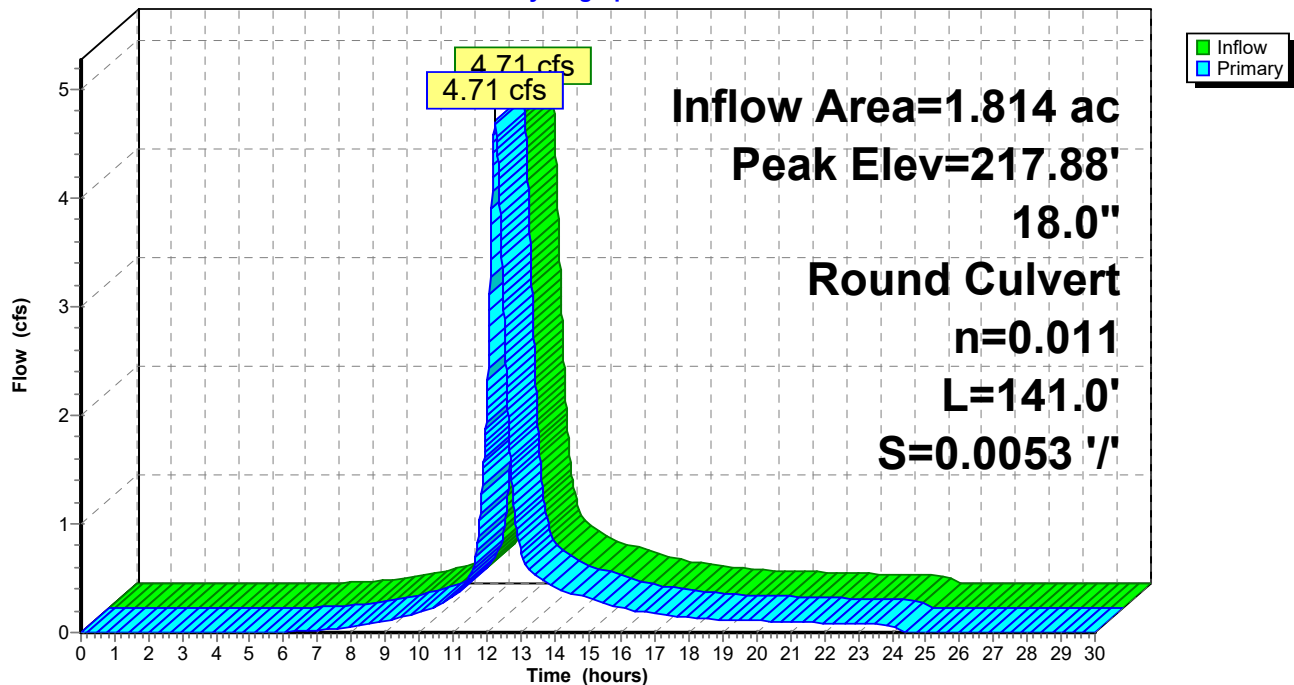
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 217.88' @ 12.25 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	216.75'	<b>18.0" Round Culvert</b> L= 141.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.75' / 216.00' S= 0.0053 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=4.71 cfs @ 12.25 hrs HW=217.88' (Free Discharge)  
↑1=Culvert (Barrel Controls 4.71 cfs @ 4.58 fps)

### Pond 27P: CB6

Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 28P: P2c

Runoff = 1.31 cfs @ 12.16 hrs, Volume= 0.111 af, Depth= 2.13"

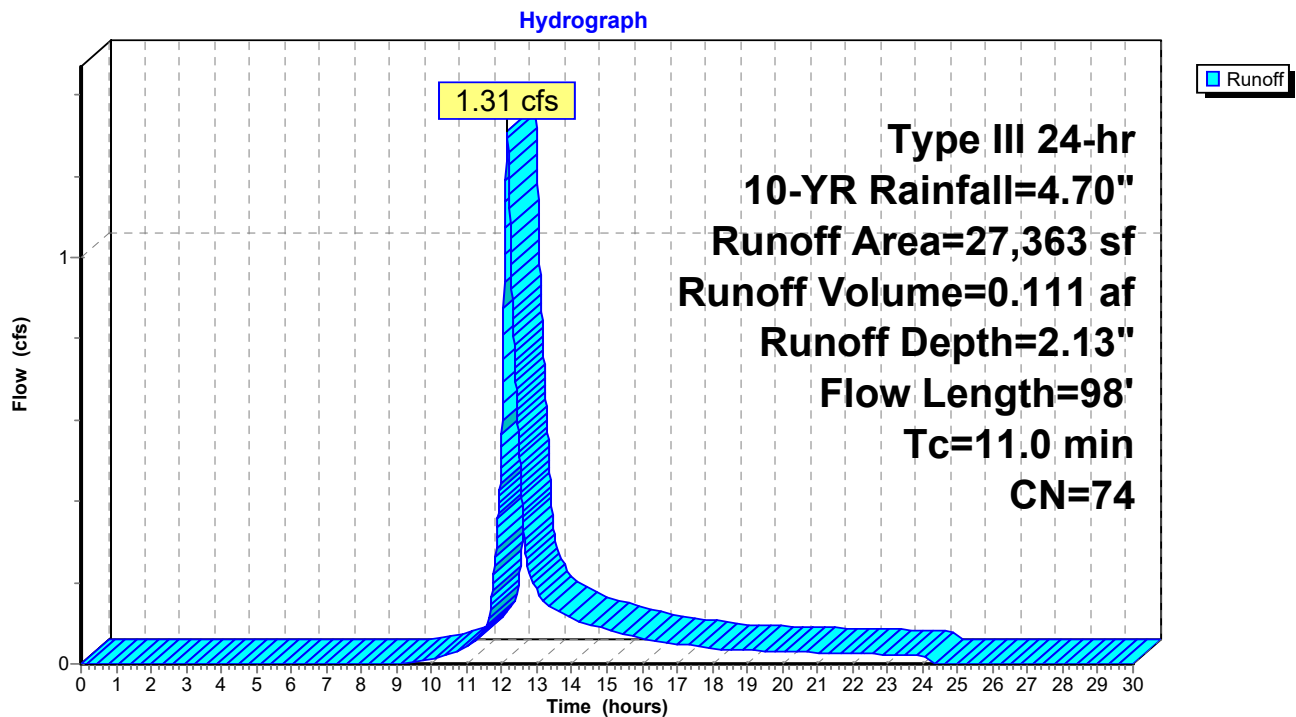
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
26,841	74	>75% Grass cover, Good, HSG C
* 522	98	Patio, HSG C
27,363	74	Weighted Average
26,841		98.09% Pervious Area
522		1.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	48	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.0	98	Total			

### Subcatchment 28P: P2c



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 29P: P2d

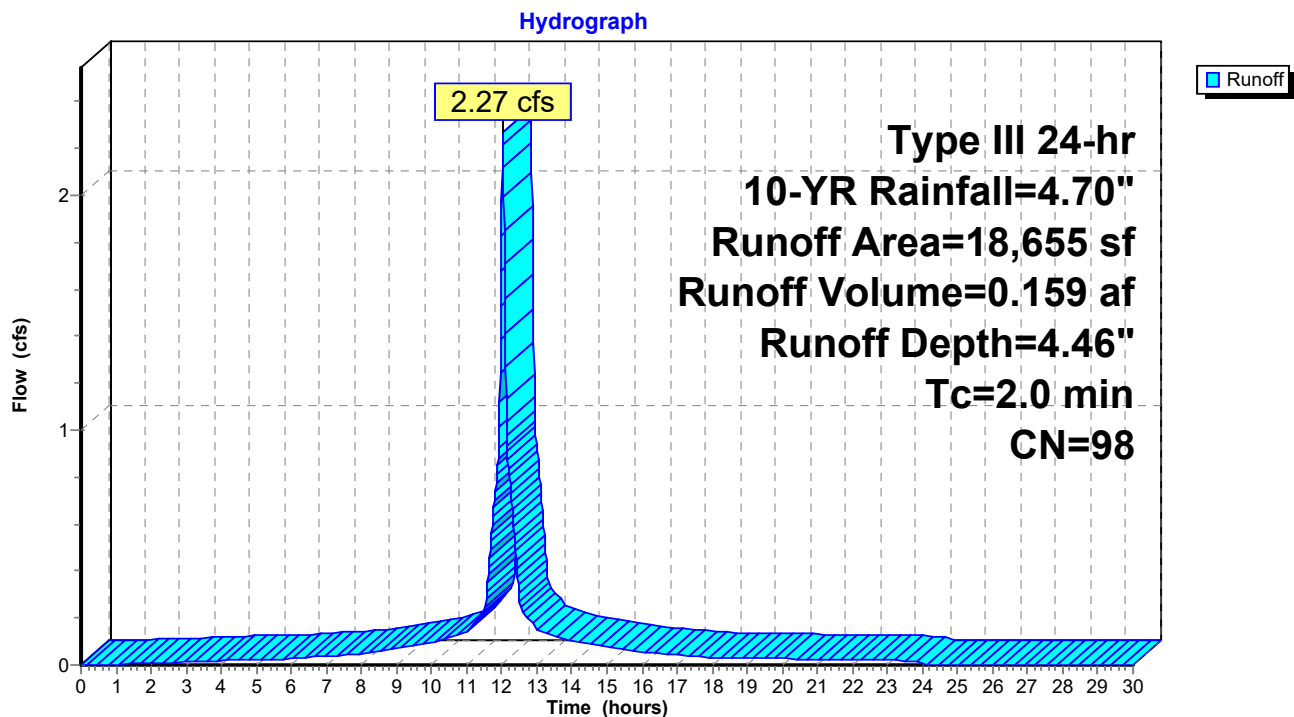
Runoff = 2.27 cfs @ 12.03 hrs, Volume= 0.159 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
18,655	98	Roofs, HSG C
18,655		100.00% Impervious Area

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

### Subcatchment 29P: P2d



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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 30P: Roof Pipes

Inflow Area = 0.428 ac, 100.00% Impervious, Inflow Depth = 4.46" for 10-YR event  
Inflow = 2.27 cfs @ 12.03 hrs, Volume= 0.159 af  
Outflow = 2.27 cfs @ 12.03 hrs, Volume= 0.159 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.27 cfs @ 12.03 hrs, Volume= 0.159 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 218.98' @ 12.03 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#2	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#3	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#4	Primary	218.50'	<b>8.0" Round Culvert</b> L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 216.00' S= 0.0250 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

**Primary OutFlow** Max=2.27 cfs @ 12.03 hrs HW=218.98' (Free Discharge)

↑  
—1=Culvert (Barrel Controls 0.55 cfs @ 2.86 fps)  
—2=Culvert (Barrel Controls 0.55 cfs @ 2.86 fps)  
—3=Culvert (Barrel Controls 0.55 cfs @ 2.86 fps)  
—4=Culvert (Inlet Controls 0.63 cfs @ 2.35 fps)



## Stormwater Calculations

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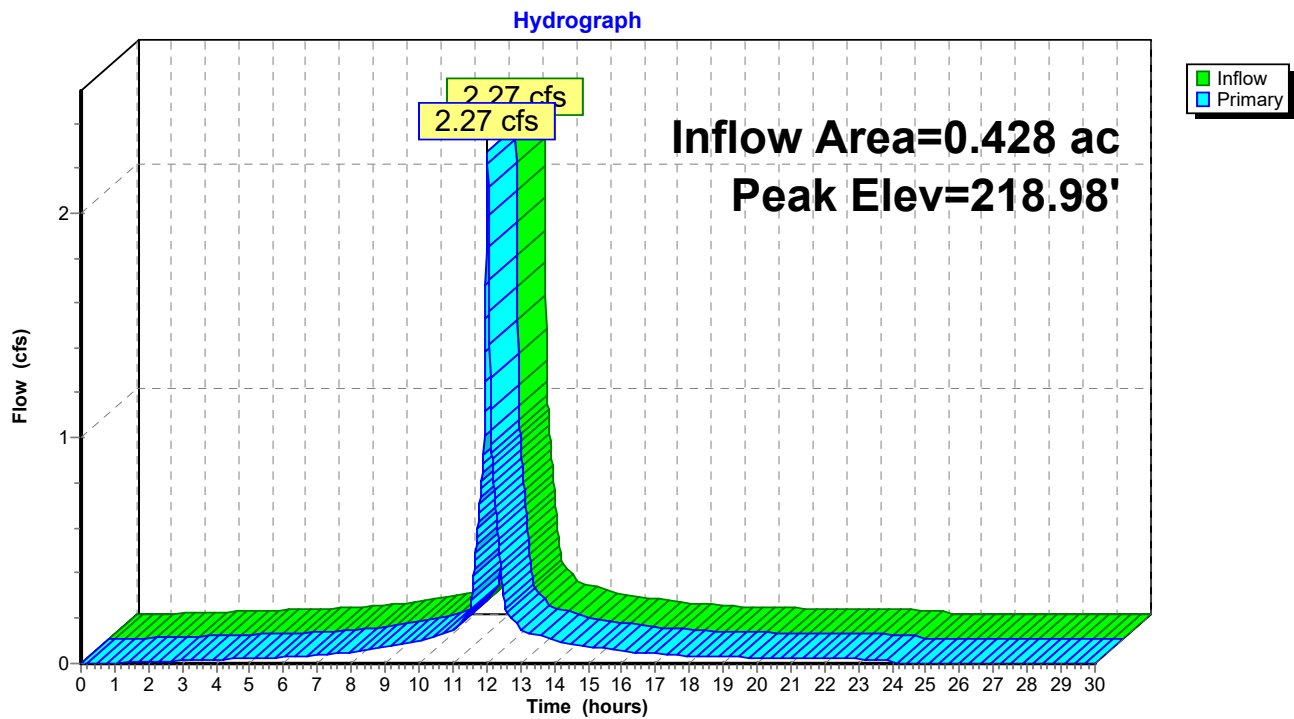
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Type III 24-hr 10-YR Rainfall=4.70"

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### Pond 30P: Roof Pipes



## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Pond 31P: Basin #2

Inflow Area = 2.871 ac, 50.51% Impervious, Inflow Depth = 3.21" for 10-YR event  
Inflow = 6.60 cfs @ 12.22 hrs, Volume= 0.767 af  
Outflow = 2.14 cfs @ 12.69 hrs, Volume= 0.765 af, Atten= 67%, Lag= 28.6 min  
Discarded = 0.35 cfs @ 12.69 hrs, Volume= 0.568 af  
Primary = 1.80 cfs @ 12.69 hrs, Volume= 0.197 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 217.03' @ 12.69 hrs Surf.Area= 14,737 sf Storage= 13,876 cf

Plug-Flow detention time= 254.3 min calculated for 0.765 af (100% of inflow)  
Center-of-Mass det. time= 252.1 min ( 1,055.6 - 803.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	216.00'	29,400 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
216.00	12,268	457.0	0	0	12,268
218.00	17,274	522.0	29,400	29,400	17,426

Device	Routing	Invert	Outlet Devices
#1	Discarded	216.00'	<b>1.020 in/hr Exfiltration over Surface area</b>
#2	Primary	216.80'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 216.80 217.50 Width (feet) 5.00 5.00

**Discarded OutFlow** Max=0.35 cfs @ 12.69 hrs HW=217.03' (Free Discharge)  
↑**1=Exfiltration** (Exfiltration Controls 0.35 cfs)

**Primary OutFlow** Max=1.80 cfs @ 12.69 hrs HW=217.03' (Free Discharge)  
↑**2=Custom Weir/Orifice** (Weir Controls 1.80 cfs @ 1.57 fps)

## Stormwater Calculations

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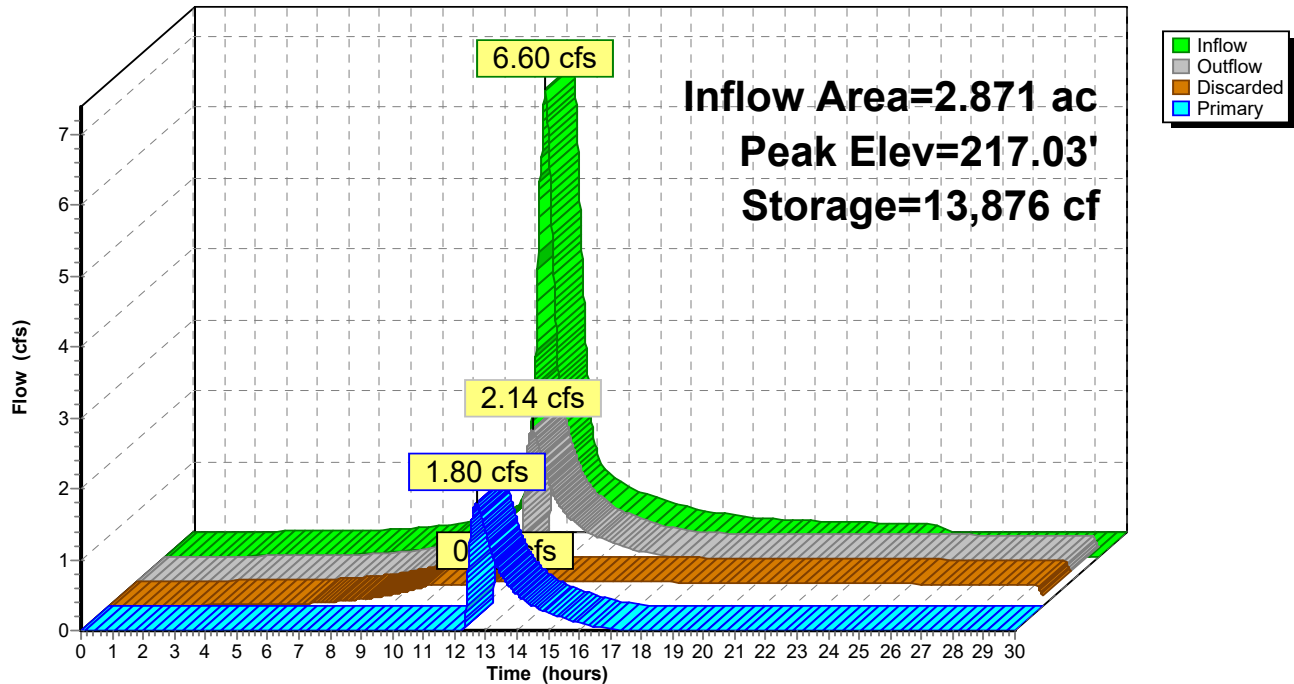
Type III 24-hr 10-YR Rainfall=4.70"

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### Pond 31P: Basin #2

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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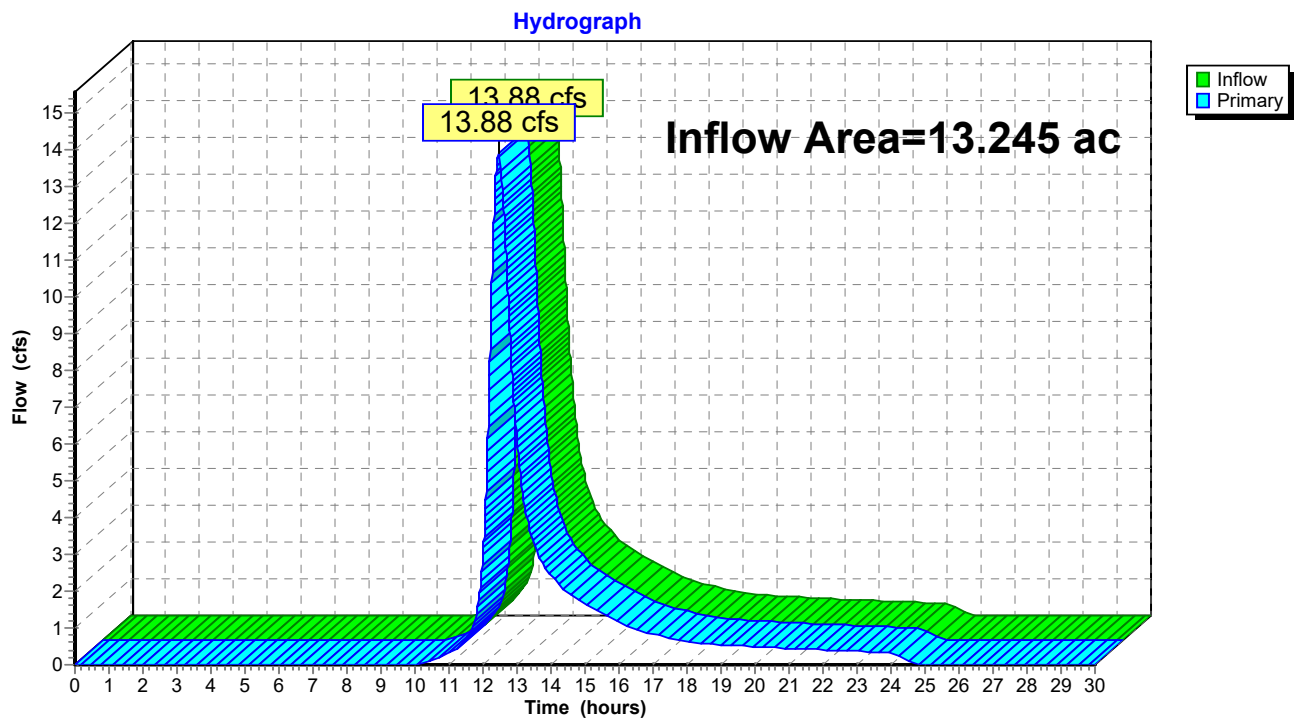
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### Summary for Link 32P: Design Point #2: Flow to Southern Abutters

Inflow Area = 13.245 ac, 11.58% Impervious, Inflow Depth = 1.66" for 10-YR event  
Inflow = 13.88 cfs @ 12.45 hrs, Volume= 1.833 af  
Primary = 13.88 cfs @ 12.45 hrs, Volume= 1.833 af, Atten= 0%, Lag= 0.0 min

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

### Link 32P: Design Point #2: Flow to Southern Abutters



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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

**Subcatchment24P: P2a** Runoff Area=451,888 sf 0.81% Impervious Runoff Depth=2.98"  
Flow Length=1,260' Slope=0.0100 '/' Tc=28.8 min CN=71 Runoff=20.76 cfs 2.576 af

**Subcatchment25P: P2b** Runoff Area=79,025 sf 55.65% Impervious Runoff Depth=4.61"  
Flow Length=245' Tc=12.5 min CN=87 Runoff=7.74 cfs 0.697 af

**Pond 26P: Sediment Forebay** Peak Elev=218.72' Storage=2,238 cf Inflow=7.74 cfs 0.697 af  
18.0" Round Culvert n=0.011 L=71.0' S=0.0085 '/' Outflow=6.39 cfs 0.697 af

**Pond 27P: CB6** Peak Elev=218.14' Inflow=6.39 cfs 0.697 af  
18.0" Round Culvert n=0.011 L=141.0' S=0.0053 '/' Outflow=6.39 cfs 0.697 af

**Subcatchment28P: P2c** Runoff Area=27,363 sf 1.91% Impervious Runoff Depth=3.27"  
Flow Length=98' Tc=11.0 min CN=74 Runoff=2.04 cfs 0.171 af

**Subcatchment29P: P2d** Runoff Area=18,655 sf 100.00% Impervious Runoff Depth=5.86"  
Tc=2.0 min CN=98 Runoff=2.95 cfs 0.209 af

**Pond 30P: Roof Pipes** Peak Elev=219.07' Inflow=2.95 cfs 0.209 af  
Outflow=2.95 cfs 0.209 af

**Pond 31P: Basin #2** Peak Elev=217.23' Storage=16,935 cf Inflow=9.10 cfs 1.078 af  
Discarded=0.36 cfs 0.601 af Primary=4.67 cfs 0.445 af Outflow=5.03 cfs 1.047 af

**Link 32P: Design Point #2: Flow to Southern Abutters** Inflow=25.07 cfs 3.021 af  
Primary=25.07 cfs 3.021 af

**Total Runoff Area = 13.245 ac Runoff Volume = 3.654 af Average Runoff Depth = 3.31"**  
**88.42% Pervious = 11.711 ac 11.58% Impervious = 1.534 ac**

## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 24P: P2a

Runoff = 20.76 cfs @ 12.41 hrs, Volume= 2.576 af, Depth= 2.98"

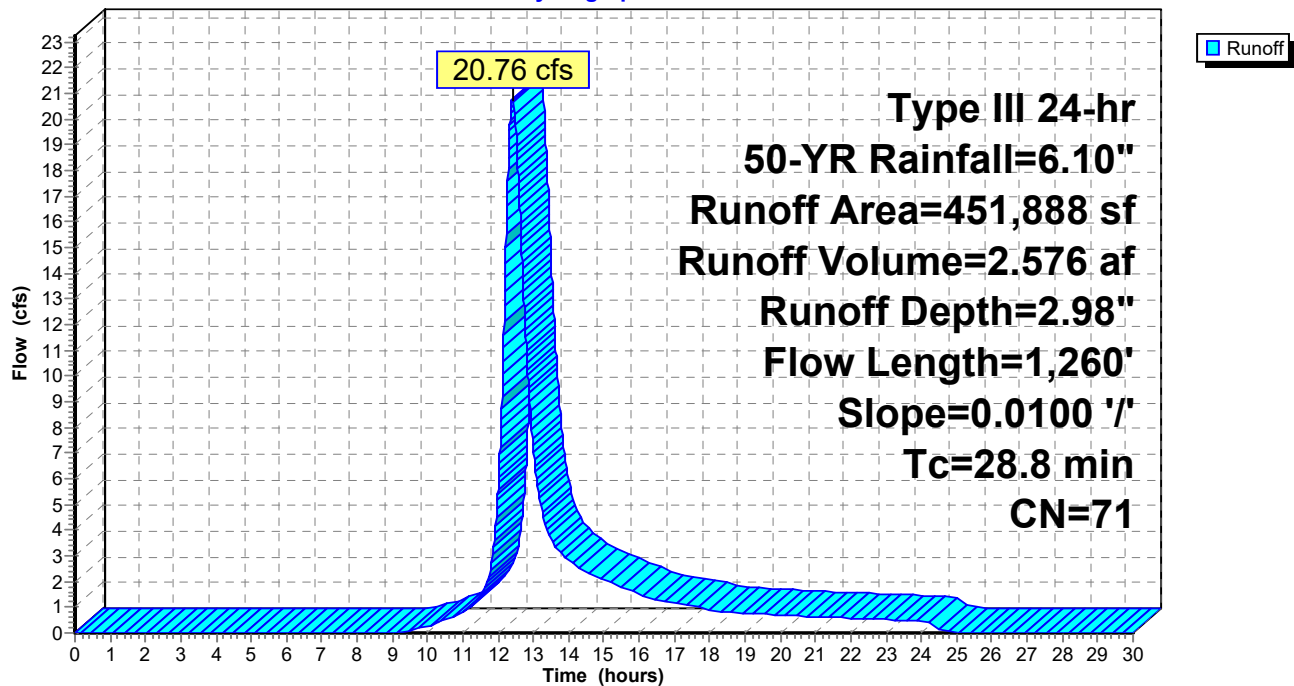
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

	Area (sf)	CN	Description
*	3,654	98	Patio, HSG C
	91,113	74	>75% Grass cover, Good, HSG C
	355,713	70	Woods, Good, HSG C
*	1,408	74	Pervious Pavers, HSG C
	451,888	71	Weighted Average
	448,234		99.19% Pervious Area
	3,654		0.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
12.5	1,210	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
28.8	1,260	Total			

### Subcatchment 24P: P2a

Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 25P: P2b

Runoff = 7.74 cfs @ 12.17 hrs, Volume= 0.697 af, Depth= 4.61"

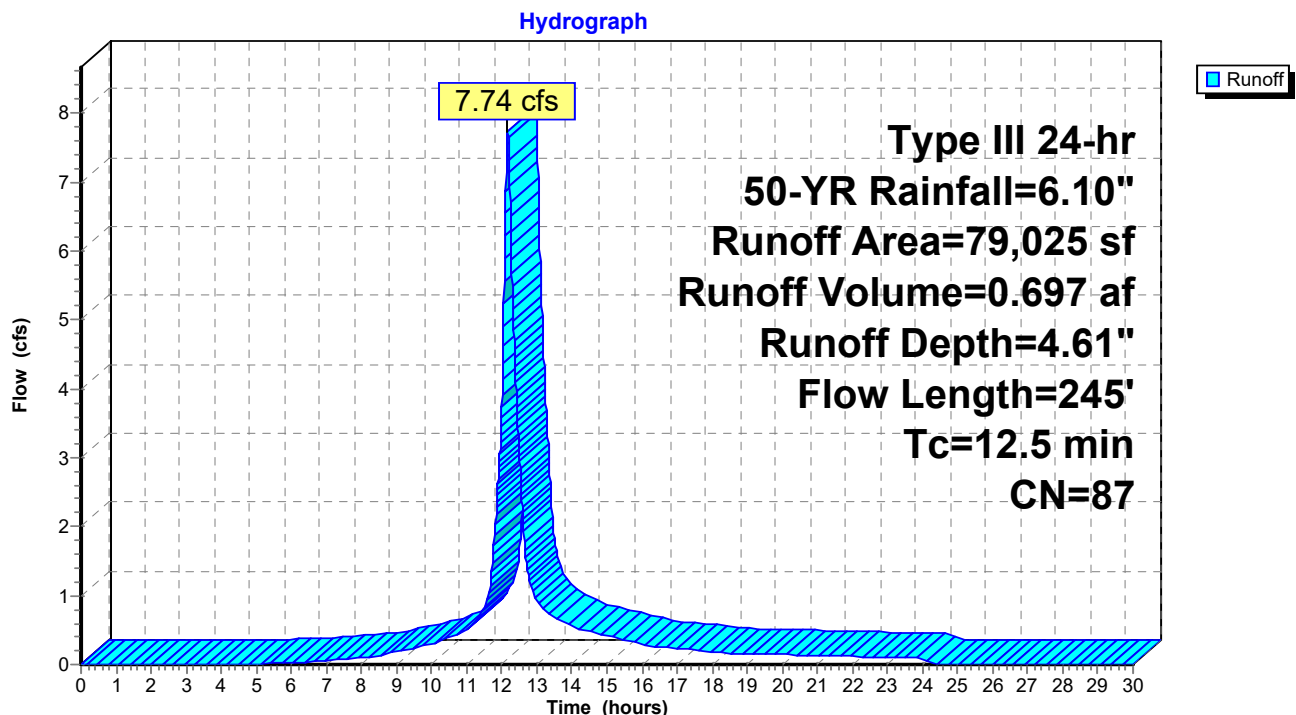
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
30,132	98	Paved parking, HSG C
35,045	74	>75% Grass cover, Good, HSG C
13,848	98	Roofs, HSG C
79,025	87	Weighted Average
35,045		44.35% Pervious Area
43,980		55.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	38	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.2	26	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	131	0.0150	1.97		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
12.5	245	Total			

### Subcatchment 25P: P2b



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 26P: Sediment Forebay

Inflow Area = 1.814 ac, 55.65% Impervious, Inflow Depth = 4.61" for 50-YR event  
Inflow = 7.74 cfs @ 12.17 hrs, Volume= 0.697 af  
Outflow = 6.39 cfs @ 12.25 hrs, Volume= 0.697 af, Atten= 17%, Lag= 5.2 min  
Primary = 6.39 cfs @ 12.25 hrs, Volume= 0.697 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 218.72' @ 12.25 hrs Surf.Area= 3,265 sf Storage= 2,238 cf

Plug-Flow detention time= 3.5 min calculated for 0.697 af (100% of inflow)  
Center-of-Mass det. time= 3.5 min ( 803.6 - 800.1 )

Volume	Invert	Avail.Storage	Storage Description		
#1	217.40'	3,225 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.40	10	10.0	0	0	10
218.00	1,868	267.0	403	403	5,676
219.00	3,900	300.0	2,822	3,225	7,191

Device	Routing	Invert	Outlet Devices
#1	Primary	217.40'	<b>18.0" Round Culvert</b> L= 71.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 217.40' / 216.80' S= 0.0085 ' / ' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=6.39 cfs @ 12.25 hrs HW=218.72' (Free Discharge)

↑**1=Culvert** (Barrel Controls 6.39 cfs @ 5.15 fps)



## Stormwater Calculations

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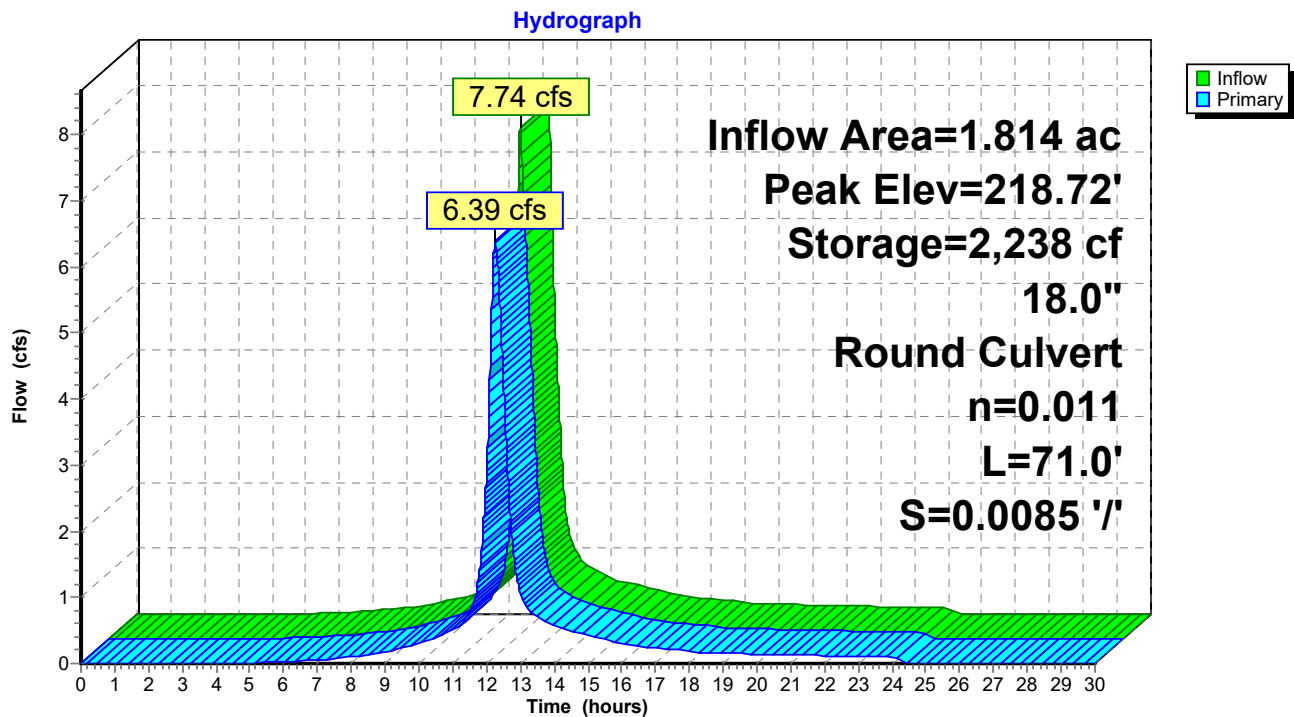
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Type III 24-hr 50-YR Rainfall=6.10"

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### Pond 26P: Sediment Forebay



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 27P: CB6

Inflow Area = 1.814 ac, 55.65% Impervious, Inflow Depth = 4.61" for 50-YR event  
Inflow = 6.39 cfs @ 12.25 hrs, Volume= 0.697 af  
Outflow = 6.39 cfs @ 12.25 hrs, Volume= 0.697 af, Atten= 0%, Lag= 0.0 min  
Primary = 6.39 cfs @ 12.25 hrs, Volume= 0.697 af

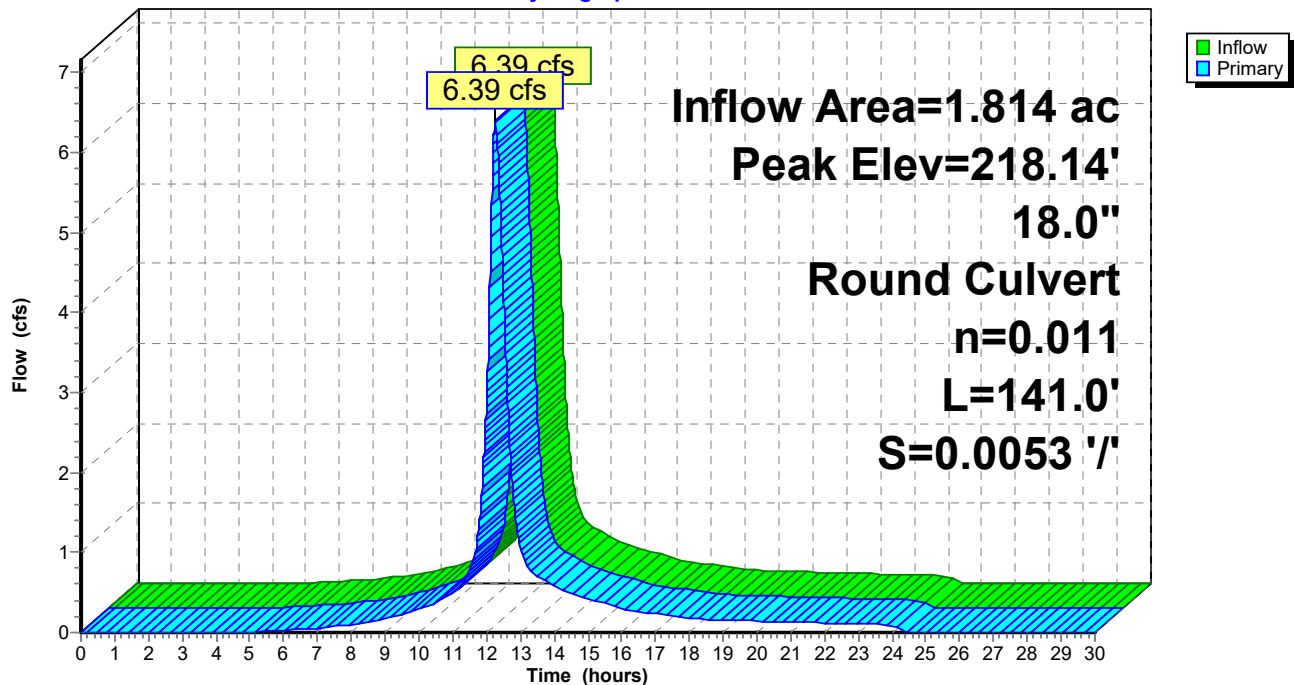
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 218.14' @ 12.25 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	216.75'	<b>18.0" Round Culvert</b> L= 141.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.75' / 216.00' S= 0.0053 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=6.39 cfs @ 12.25 hrs HW=218.14' (Free Discharge)  
↑1=Culvert (Barrel Controls 6.39 cfs @ 4.87 fps)

### Pond 27P: CB6

Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 28P: P2c

Runoff = 2.04 cfs @ 12.16 hrs, Volume= 0.171 af, Depth= 3.27"

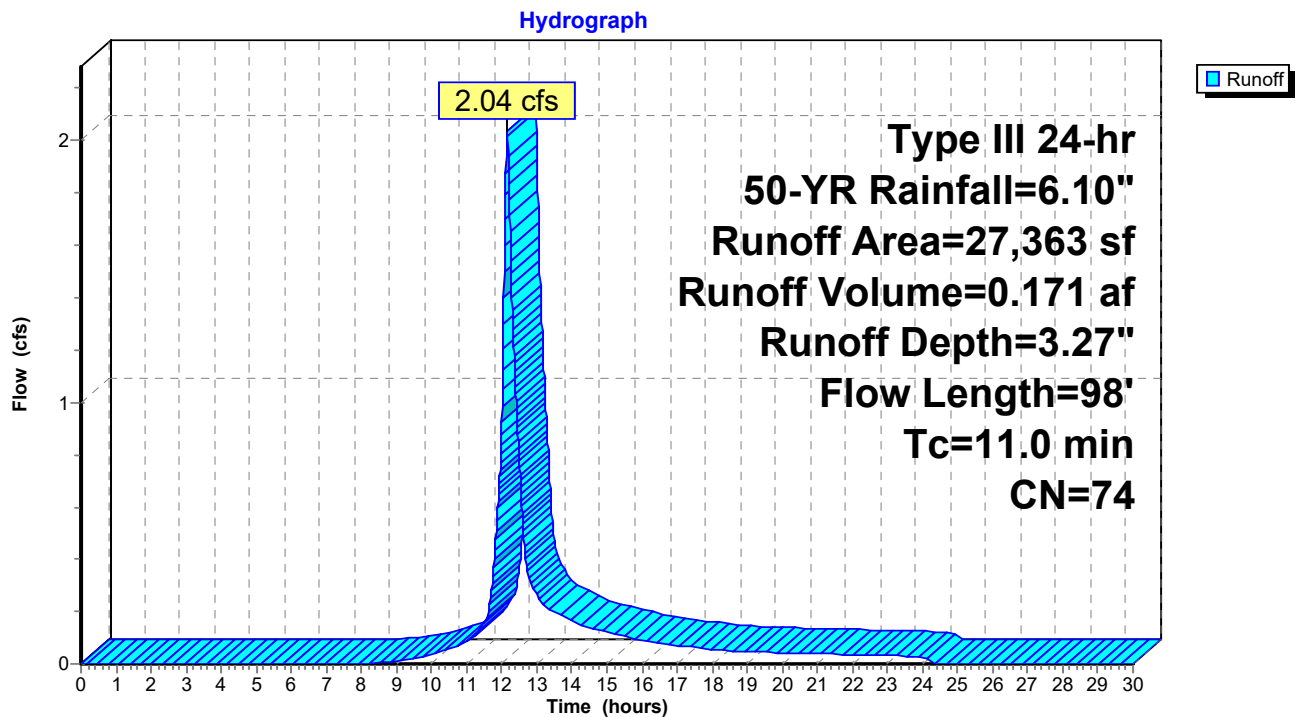
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
26,841	74	>75% Grass cover, Good, HSG C
* 522	98	Patio, HSG C
27,363	74	Weighted Average
26,841		98.09% Pervious Area
522		1.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	48	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.0	98	Total			

### Subcatchment 28P: P2c



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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 29P: P2d

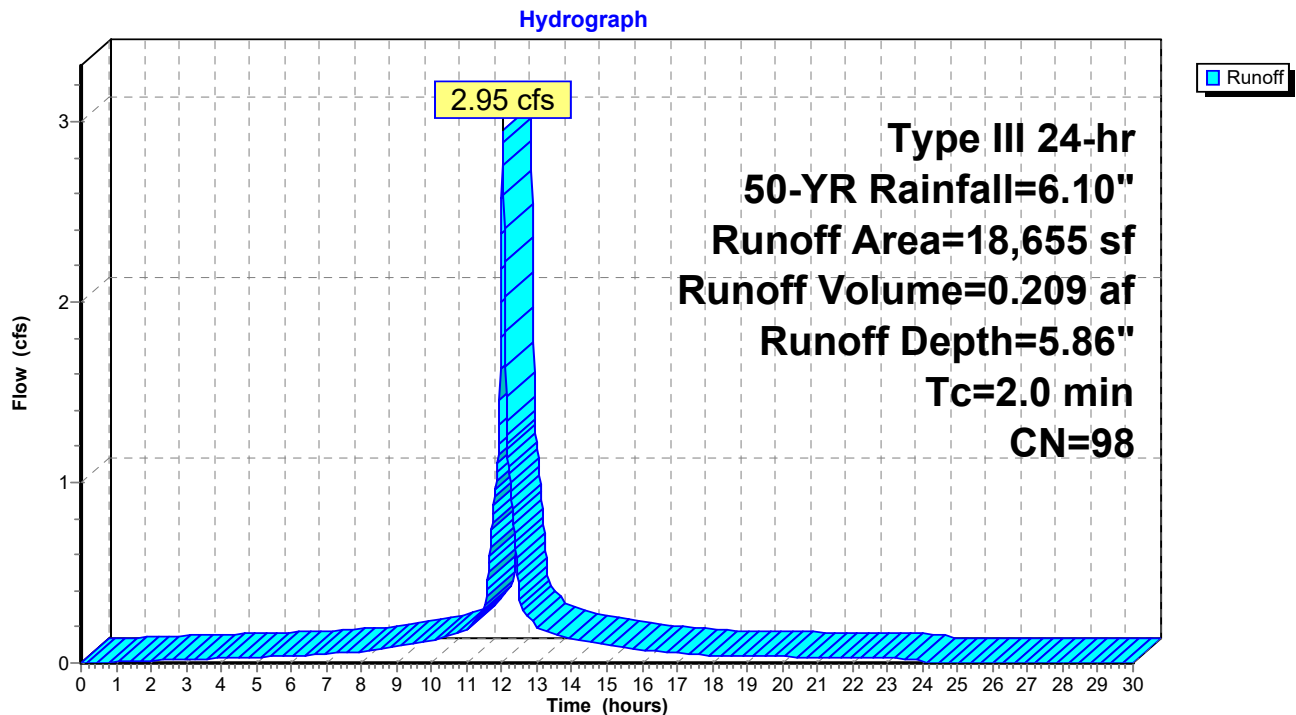
Runoff = 2.95 cfs @ 12.03 hrs, Volume= 0.209 af, Depth= 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

Area (sf)	CN	Description
18,655	98	Roofs, HSG C
18,655		100.00% Impervious Area

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

### Subcatchment 29P: P2d



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 30P: Roof Pipes

Inflow Area = 0.428 ac, 100.00% Impervious, Inflow Depth = 5.86" for 50-YR event  
Inflow = 2.95 cfs @ 12.03 hrs, Volume= 0.209 af  
Outflow = 2.95 cfs @ 12.03 hrs, Volume= 0.209 af, Atten= 0%, Lag= 0.0 min  
Primary = 2.95 cfs @ 12.03 hrs, Volume= 0.209 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 219.07' @ 12.03 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#2	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#3	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#4	Primary	218.50'	<b>8.0" Round Culvert</b> L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 216.00' S= 0.0250 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

**Primary OutFlow** Max=2.95 cfs @ 12.03 hrs HW=219.07' (Free Discharge)

- 1=Culvert (Barrel Controls 0.71 cfs @ 3.04 fps)
- 2=Culvert (Barrel Controls 0.71 cfs @ 3.04 fps)
- 3=Culvert (Barrel Controls 0.71 cfs @ 3.04 fps)
- 4=Culvert (Inlet Controls 0.81 cfs @ 2.56 fps)

## Stormwater Calculations

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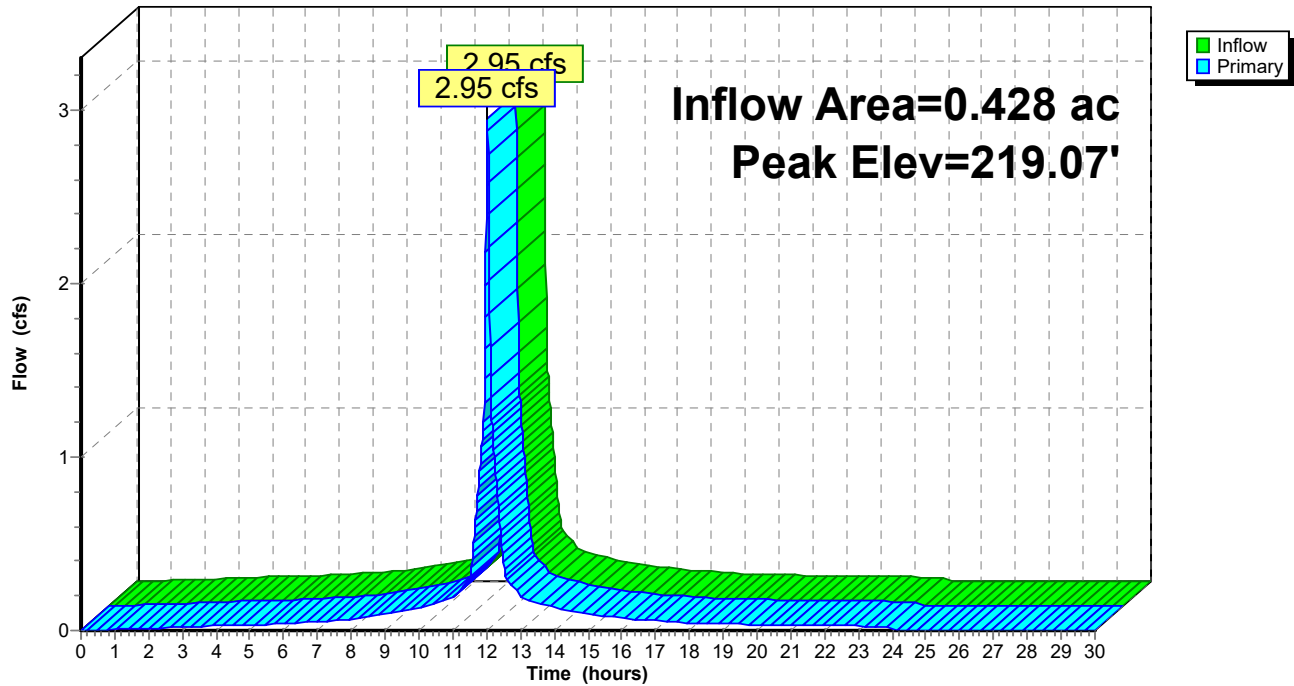
Type III 24-hr 50-YR Rainfall=6.10"

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### Pond 30P: Roof Pipes

Hydrograph



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Pond 31P: Basin #2

Inflow Area = 2.871 ac, 50.51% Impervious, Inflow Depth = 4.51" for 50-YR event  
Inflow = 9.10 cfs @ 12.21 hrs, Volume= 1.078 af  
Outflow = 5.03 cfs @ 12.52 hrs, Volume= 1.047 af, Atten= 45%, Lag= 18.8 min  
Discarded = 0.36 cfs @ 12.52 hrs, Volume= 0.601 af  
Primary = 4.67 cfs @ 12.52 hrs, Volume= 0.445 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 217.23' @ 12.52 hrs Surf.Area= 15,254 sf Storage= 16,935 cf

Plug-Flow detention time= 203.1 min calculated for 1.047 af (97% of inflow)  
Center-of-Mass det. time= 185.8 min ( 981.9 - 796.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	216.00'	29,400 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
216.00	12,268	457.0	0	0	12,268
218.00	17,274	522.0	29,400	29,400	17,426

Device	Routing	Invert	Outlet Devices
#1	Discarded	216.00'	<b>1.020 in/hr Exfiltration over Surface area</b>
#2	Primary	216.80'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 216.80 217.50 Width (feet) 5.00 5.00

**Discarded OutFlow** Max=0.36 cfs @ 12.52 hrs HW=217.23' (Free Discharge)  
↑**1=Exfiltration** (Exfiltration Controls 0.36 cfs)

**Primary OutFlow** Max=4.67 cfs @ 12.52 hrs HW=217.23' (Free Discharge)  
↑**2=Custom Weir/Orifice** (Weir Controls 4.67 cfs @ 2.16 fps)

## Stormwater Calculations

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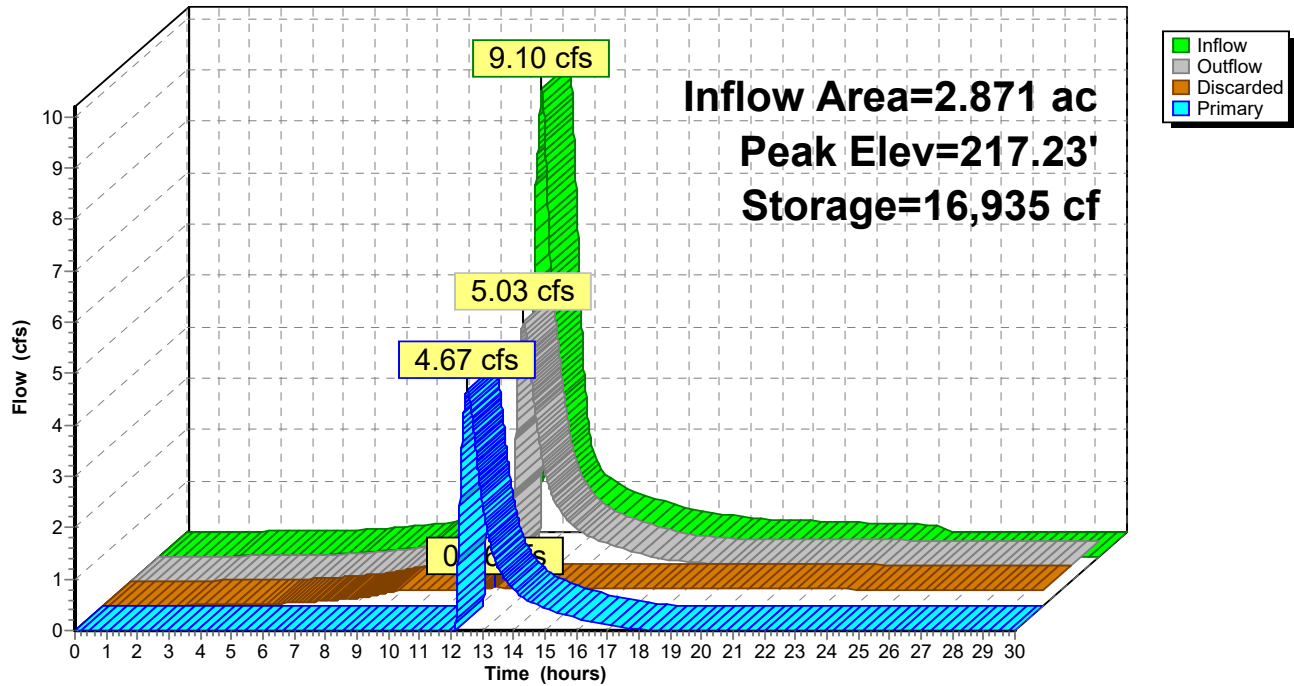
Type III 24-hr 50-YR Rainfall=6.10"

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### Pond 31P: Basin #2

#### Hydrograph





## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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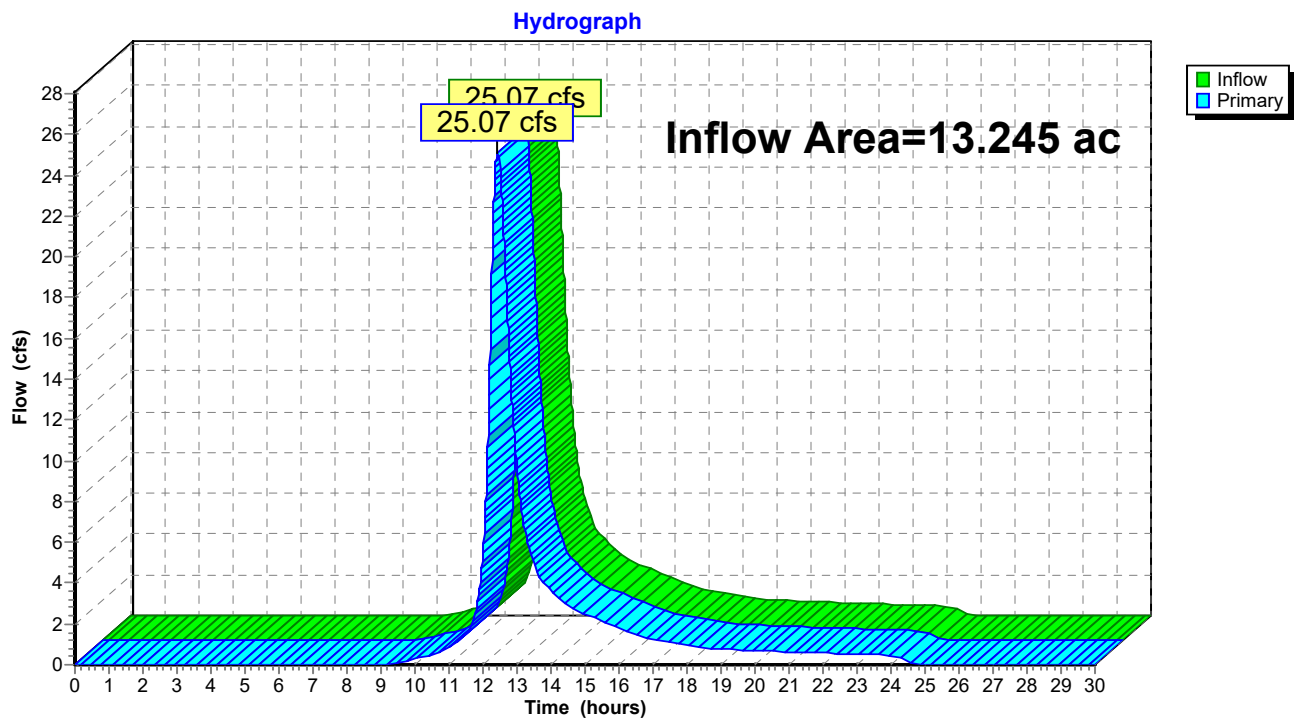
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### Summary for Link 32P: Design Point #2: Flow to Southern Abutters

Inflow Area = 13.245 ac, 11.58% Impervious, Inflow Depth = 2.74" for 50-YR event  
Inflow = 25.07 cfs @ 12.44 hrs, Volume= 3.021 af  
Primary = 25.07 cfs @ 12.44 hrs, Volume= 3.021 af, Atten= 0%, Lag= 0.0 min

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

### Link 32P: Design Point #2: Flow to Southern Abutters



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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

**Subcatchment24P: P2a** Runoff Area=451,888 sf 0.81% Impervious Runoff Depth=3.47"  
Flow Length=1,260' Slope=0.0100 '/' Tc=28.8 min CN=71 Runoff=24.27 cfs 3.002 af

**Subcatchment25P: P2b** Runoff Area=79,025 sf 55.65% Impervious Runoff Depth=5.19"  
Flow Length=245' Tc=12.5 min CN=87 Runoff=8.66 cfs 0.785 af

**Pond 26P: Sediment Forebay** Peak Elev=218.83' Storage=2,582 cf Inflow=8.66 cfs 0.785 af  
18.0" Round Culvert n=0.011 L=71.0' S=0.0085 '/' Outflow=7.05 cfs 0.785 af

**Pond 27P: CB6** Peak Elev=218.25' Inflow=7.05 cfs 0.785 af  
18.0" Round Culvert n=0.011 L=141.0' S=0.0053 '/' Outflow=7.05 cfs 0.785 af

**Subcatchment28P: P2c** Runoff Area=27,363 sf 1.91% Impervious Runoff Depth=3.78"  
Flow Length=98' Tc=11.0 min CN=74 Runoff=2.36 cfs 0.198 af

**Subcatchment29P: P2d** Runoff Area=18,655 sf 100.00% Impervious Runoff Depth=6.46"  
Tc=2.0 min CN=98 Runoff=3.25 cfs 0.231 af

**Pond 30P: Roof Pipes** Peak Elev=219.11' Inflow=3.25 cfs 0.231 af  
Outflow=3.25 cfs 0.231 af

**Pond 31P: Basin #2** Peak Elev=217.31' Storage=18,088 cf Inflow=10.13 cfs 1.213 af  
Discarded=0.36 cfs 0.613 af Primary=5.93 cfs 0.558 af Outflow=6.30 cfs 1.171 af

**Link 32P: Design Point #2: Flow to Southern Abutters** Inflow=29.97 cfs 3.560 af  
Primary=29.97 cfs 3.560 af

**Total Runoff Area = 13.245 ac Runoff Volume = 4.215 af Average Runoff Depth = 3.82"**  
**88.42% Pervious = 11.711 ac 11.58% Impervious = 1.534 ac**

## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 24P: P2a

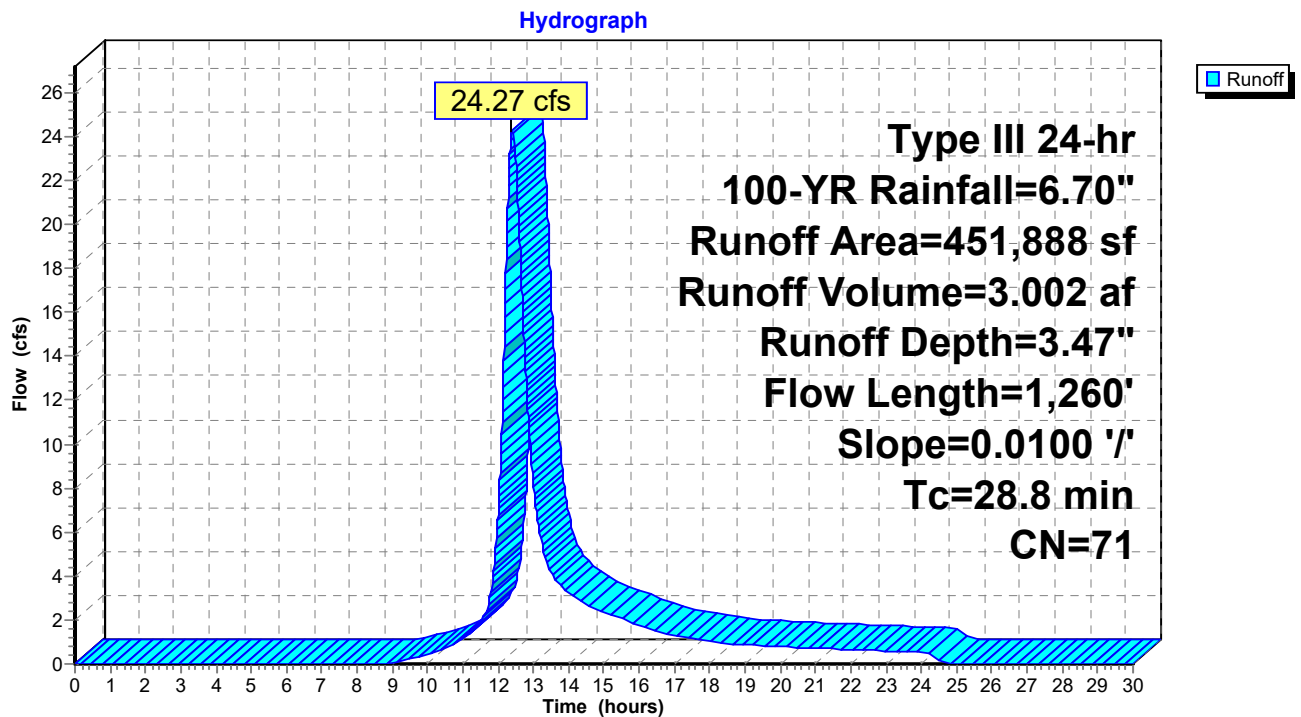
Runoff = 24.27 cfs @ 12.39 hrs, Volume= 3.002 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

	Area (sf)	CN	Description
*	3,654	98	Patio, HSG C
	91,113	74	>75% Grass cover, Good, HSG C
	355,713	70	Woods, Good, HSG C
*	1,408	74	Pervious Pavers, HSG C
	451,888	71	Weighted Average
	448,234		99.19% Pervious Area
	3,654		0.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
12.5	1,210	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
28.8	1,260	Total			

### Subcatchment 24P: P2a



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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 25P: P2b

Runoff = 8.66 cfs @ 12.17 hrs, Volume= 0.785 af, Depth= 5.19"

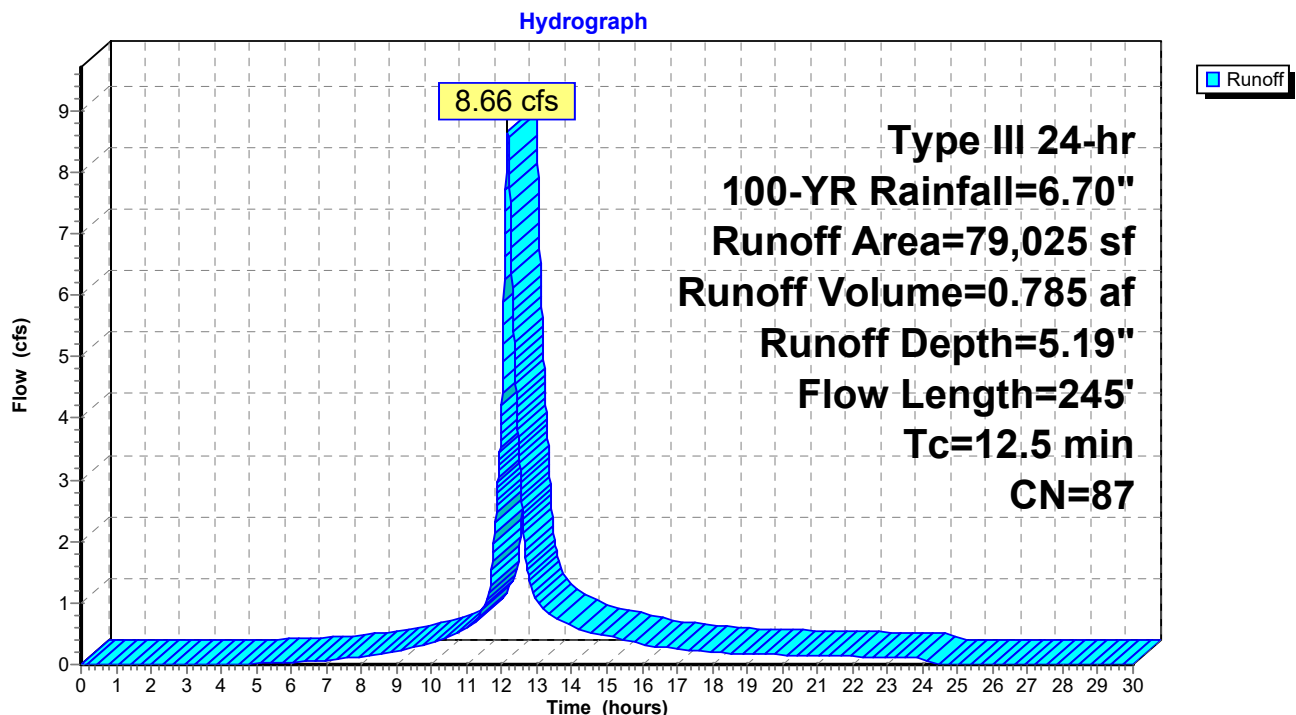
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
30,132	98	Paved parking, HSG C
35,045	74	>75% Grass cover, Good, HSG C
13,848	98	Roofs, HSG C
79,025	87	Weighted Average
35,045		44.35% Pervious Area
43,980		55.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
0.4	38	0.0100	1.61		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
0.2	26	0.0100	2.03		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	131	0.0150	1.97		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
12.5	245	Total			

### Subcatchment 25P: P2b



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 26P: Sediment Forebay

Inflow Area = 1.814 ac, 55.65% Impervious, Inflow Depth = 5.19" for 100-YR event  
Inflow = 8.66 cfs @ 12.17 hrs, Volume= 0.785 af  
Outflow = 7.05 cfs @ 12.26 hrs, Volume= 0.785 af, Atten= 19%, Lag= 5.5 min  
Primary = 7.05 cfs @ 12.26 hrs, Volume= 0.785 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 218.83' @ 12.26 hrs Surf.Area= 3,493 sf Storage= 2,582 cf

Plug-Flow detention time= 3.7 min calculated for 0.784 af (100% of inflow)  
Center-of-Mass det. time= 3.7 min ( 800.5 - 796.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	217.40'	3,225 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.40	10	10.0	0	0	10
218.00	1,868	267.0	403	403	5,676
219.00	3,900	300.0	2,822	3,225	7,191

Device	Routing	Invert	Outlet Devices
#1	Primary	217.40'	<b>18.0" Round Culvert</b> L= 71.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 217.40' / 216.80' S= 0.0085 ' / ' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=7.05 cfs @ 12.26 hrs HW=218.83' (Free Discharge)

↑**1=Culvert** (Inlet Controls 7.05 cfs @ 4.07 fps)

## Stormwater Calculations

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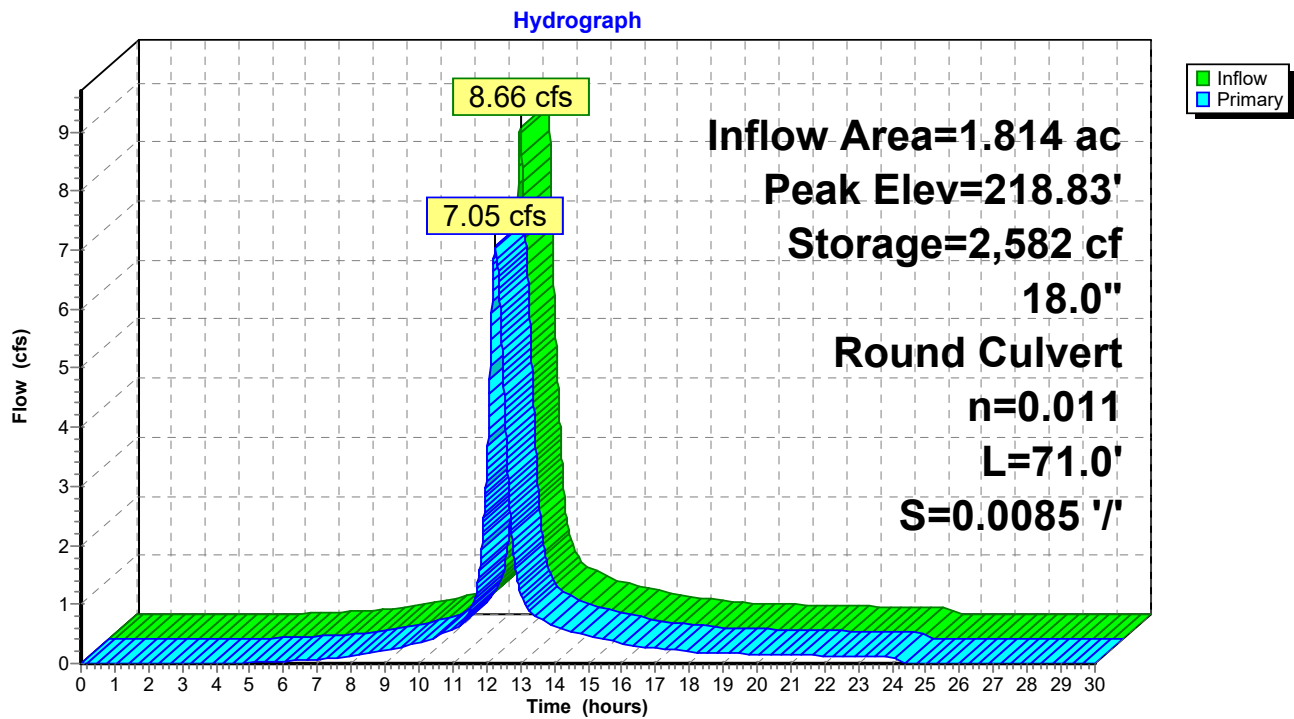
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Type III 24-hr 100-YR Rainfall=6.70"

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### Pond 26P: Sediment Forebay



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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 27P: CB6

Inflow Area = 1.814 ac, 55.65% Impervious, Inflow Depth = 5.19" for 100-YR event  
Inflow = 7.05 cfs @ 12.26 hrs, Volume= 0.785 af  
Outflow = 7.05 cfs @ 12.26 hrs, Volume= 0.785 af, Atten= 0%, Lag= 0.0 min  
Primary = 7.05 cfs @ 12.26 hrs, Volume= 0.785 af

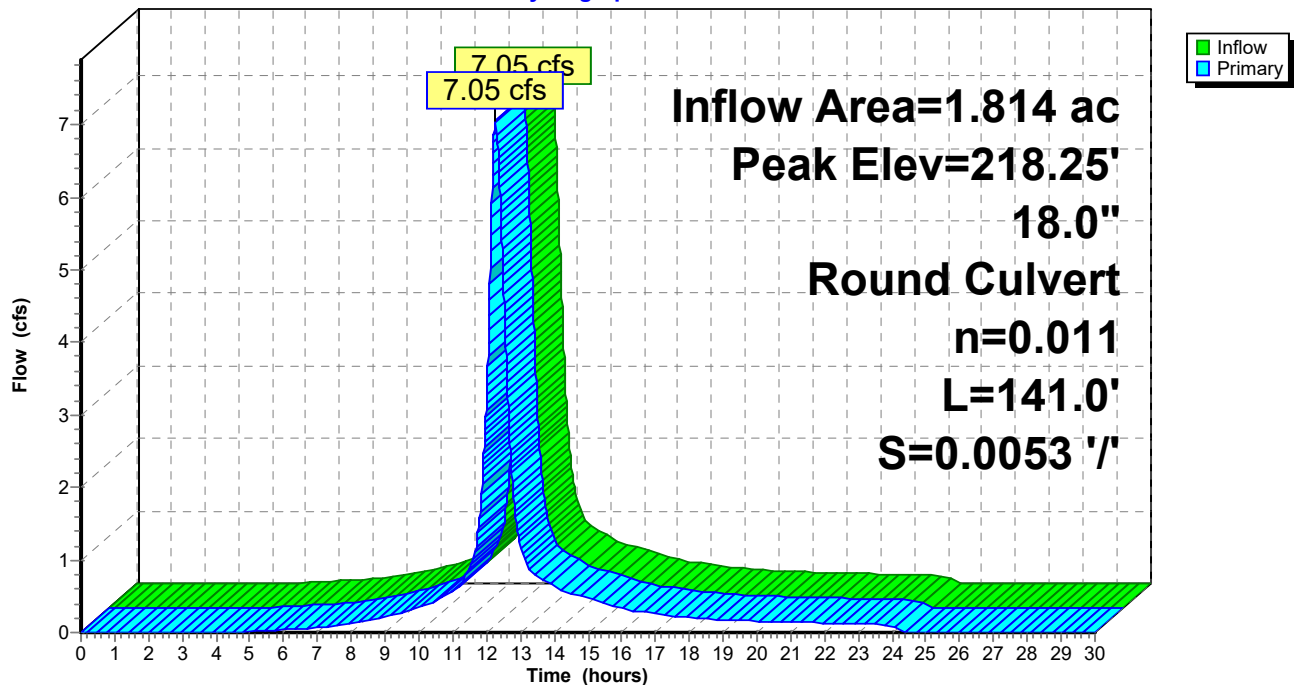
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 218.25' @ 12.26 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	216.75'	<b>18.0" Round Culvert</b> L= 141.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 216.75' / 216.00' S= 0.0053 '/ Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

**Primary OutFlow** Max=7.05 cfs @ 12.26 hrs HW=218.25' (Free Discharge)  
1=Culvert (Barrel Controls 7.05 cfs @ 4.97 fps)

### Pond 27P: CB6

Hydrograph



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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 28P: P2c

Runoff = 2.36 cfs @ 12.15 hrs, Volume= 0.198 af, Depth= 3.78"

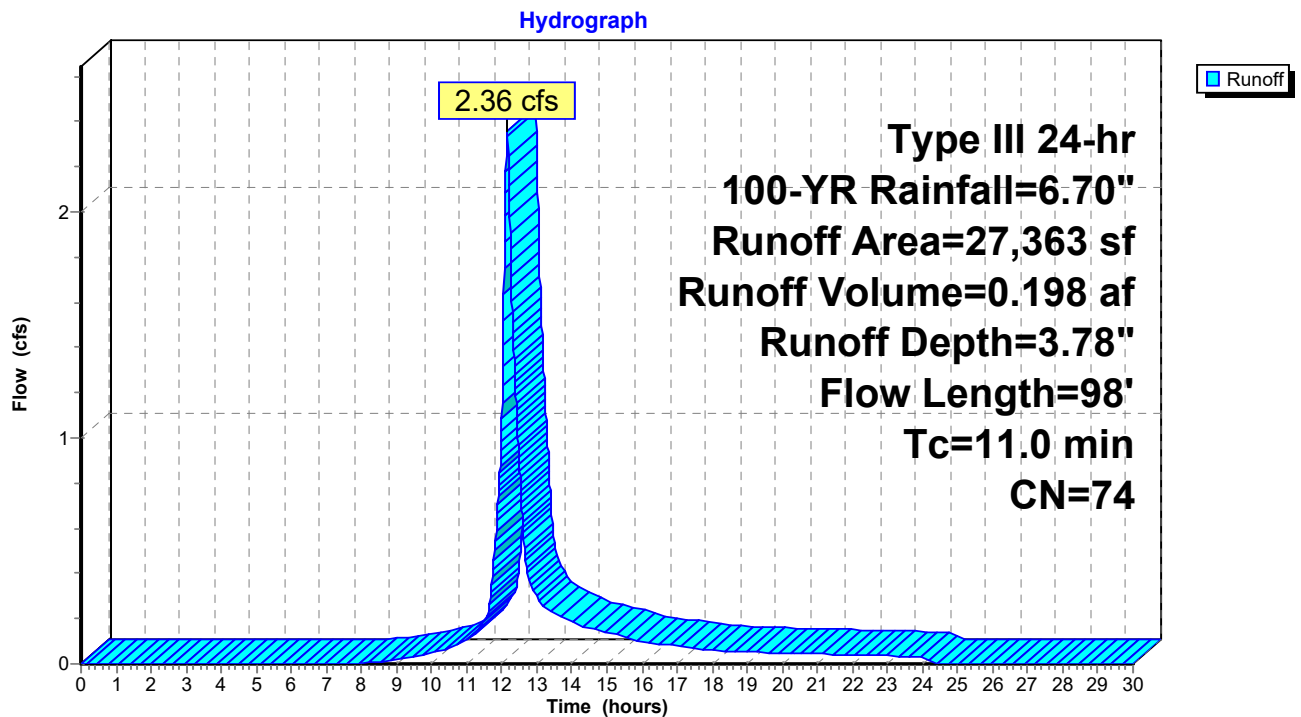
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
26,841	74	>75% Grass cover, Good, HSG C
* 522	98	Patio, HSG C
27,363	74	Weighted Average
26,841		98.09% Pervious Area
522		1.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.2	48	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.0	98	Total			

### Subcatchment 28P: P2c





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### Summary for Subcatchment 29P: P2d

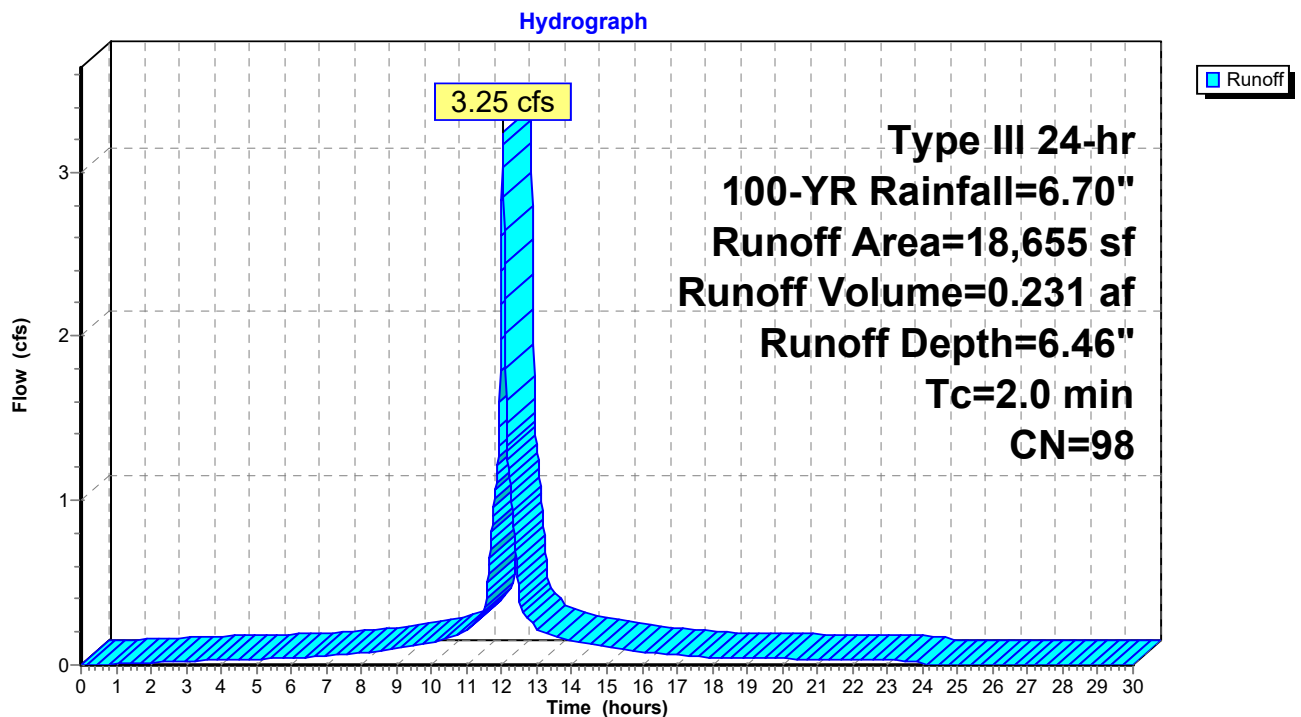
Runoff = 3.25 cfs @ 12.03 hrs, Volume= 0.231 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
18,655	98	Roofs, HSG C
18,655		100.00% Impervious Area

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

### Subcatchment 29P: P2d



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 30P: Roof Pipes

Inflow Area = 0.428 ac, 100.00% Impervious, Inflow Depth = 6.46" for 100-YR event  
Inflow = 3.25 cfs @ 12.03 hrs, Volume= 0.231 af  
Outflow = 3.25 cfs @ 12.03 hrs, Volume= 0.231 af, Atten= 0%, Lag= 0.0 min  
Primary = 3.25 cfs @ 12.03 hrs, Volume= 0.231 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 219.11' @ 12.03 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#2	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#3	Primary	218.50'	<b>8.0" Round Culvert</b> L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 217.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf
#4	Primary	218.50'	<b>8.0" Round Culvert</b> L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 218.50' / 216.00' S= 0.0250 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

**Primary OutFlow** Max=3.24 cfs @ 12.03 hrs HW=219.11' (Free Discharge)

- 1=Culvert (Barrel Controls 0.79 cfs @ 3.10 fps)
- 2=Culvert (Barrel Controls 0.79 cfs @ 3.10 fps)
- 3=Culvert (Barrel Controls 0.79 cfs @ 3.10 fps)
- 4=Culvert (Inlet Controls 0.88 cfs @ 2.65 fps)

## Stormwater Calculations

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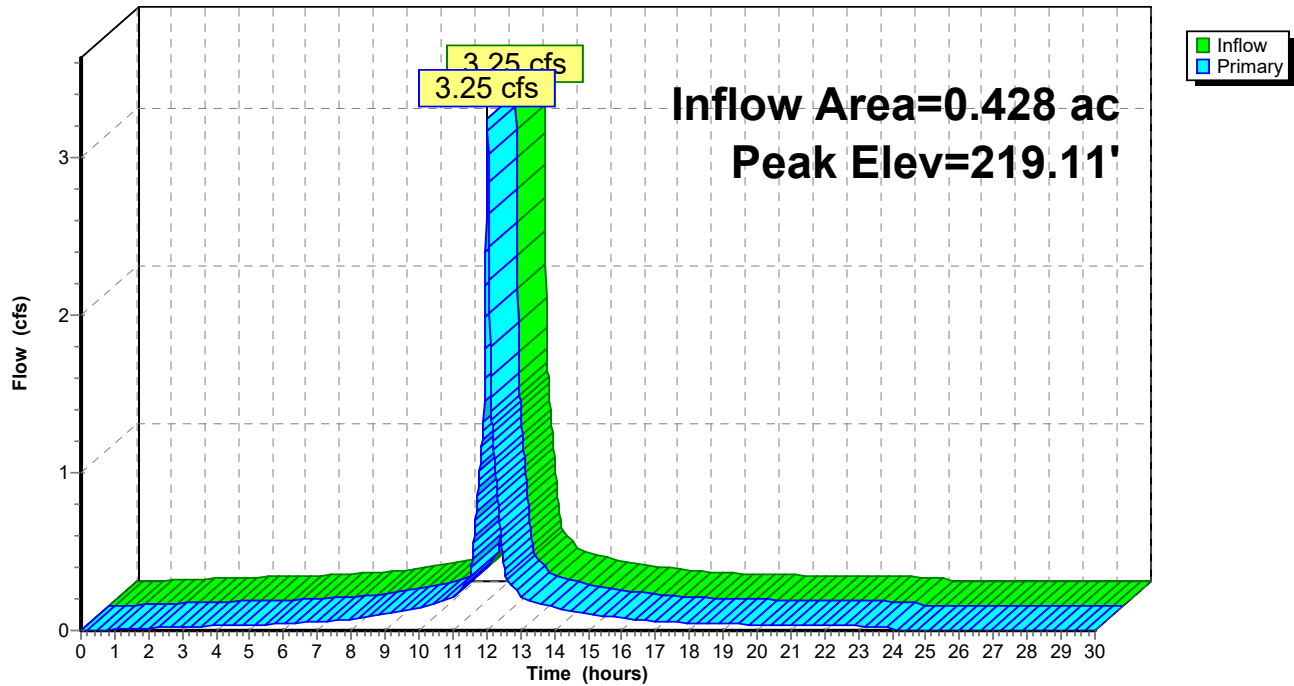
Type III 24-hr 100-YR Rainfall=6.70"

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### Pond 30P: Roof Pipes

Hydrograph



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Pond 31P: Basin #2

Inflow Area = 2.871 ac, 50.51% Impervious, Inflow Depth = 5.07" for 100-YR event  
Inflow = 10.13 cfs @ 12.21 hrs, Volume= 1.213 af  
Outflow = 6.30 cfs @ 12.49 hrs, Volume= 1.171 af, Atten= 38%, Lag= 16.8 min  
Discarded = 0.36 cfs @ 12.49 hrs, Volume= 0.613 af  
Primary = 5.93 cfs @ 12.49 hrs, Volume= 0.558 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Peak Elev= 217.31' @ 12.49 hrs Surf.Area= 15,446 sf Storage= 18,088 cf

Plug-Flow detention time= 186.7 min calculated for 1.171 af (97% of inflow)  
Center-of-Mass det. time= 166.4 min ( 960.0 - 793.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	216.00'	29,400 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
216.00	12,268	457.0	0	0	12,268
218.00	17,274	522.0	29,400	29,400	17,426

Device	Routing	Invert	Outlet Devices
#1	Discarded	216.00'	<b>1.020 in/hr Exfiltration over Surface area</b>
#2	Primary	216.80'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 216.80 217.50 Width (feet) 5.00 5.00

**Discarded OutFlow** Max=0.36 cfs @ 12.49 hrs HW=217.31' (Free Discharge)  
↑**1=Exfiltration** (Exfiltration Controls 0.36 cfs)

**Primary OutFlow** Max=5.93 cfs @ 12.49 hrs HW=217.31' (Free Discharge)  
↑**2=Custom Weir/Orifice** (Weir Controls 5.93 cfs @ 2.33 fps)

## Stormwater Calculations

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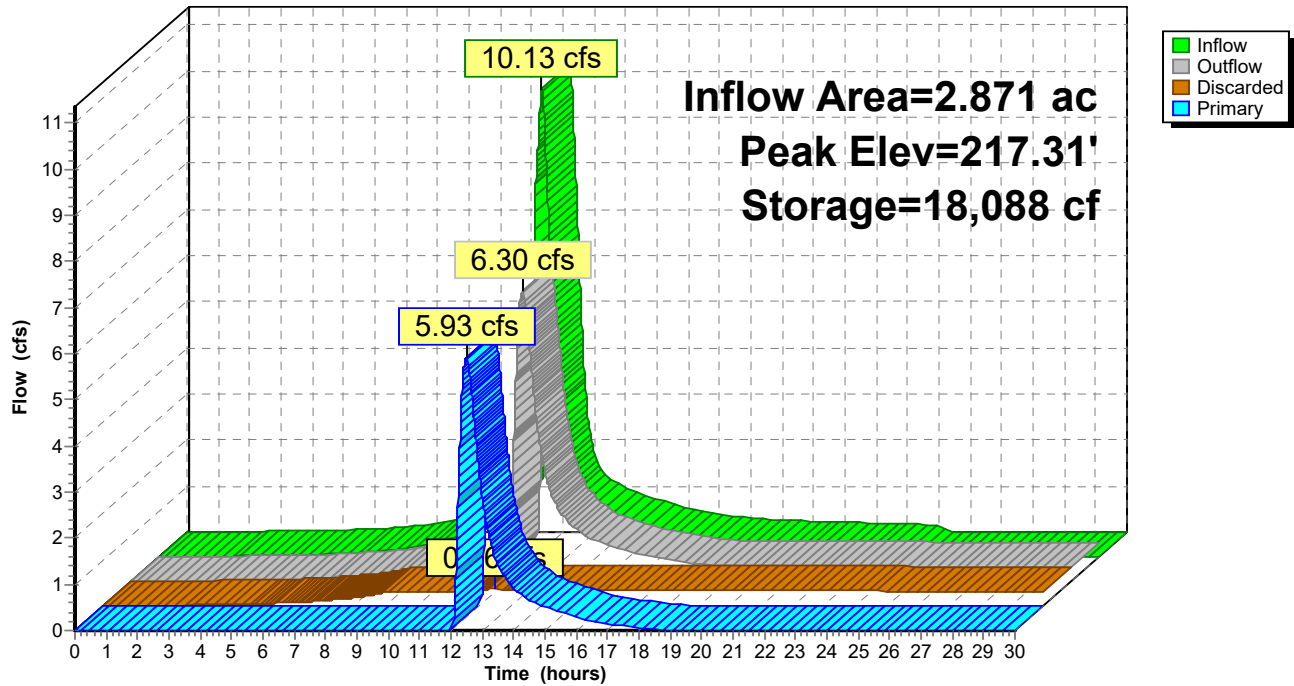
Type III 24-hr 100-YR Rainfall=6.70"

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### Pond 31P: Basin #2

#### Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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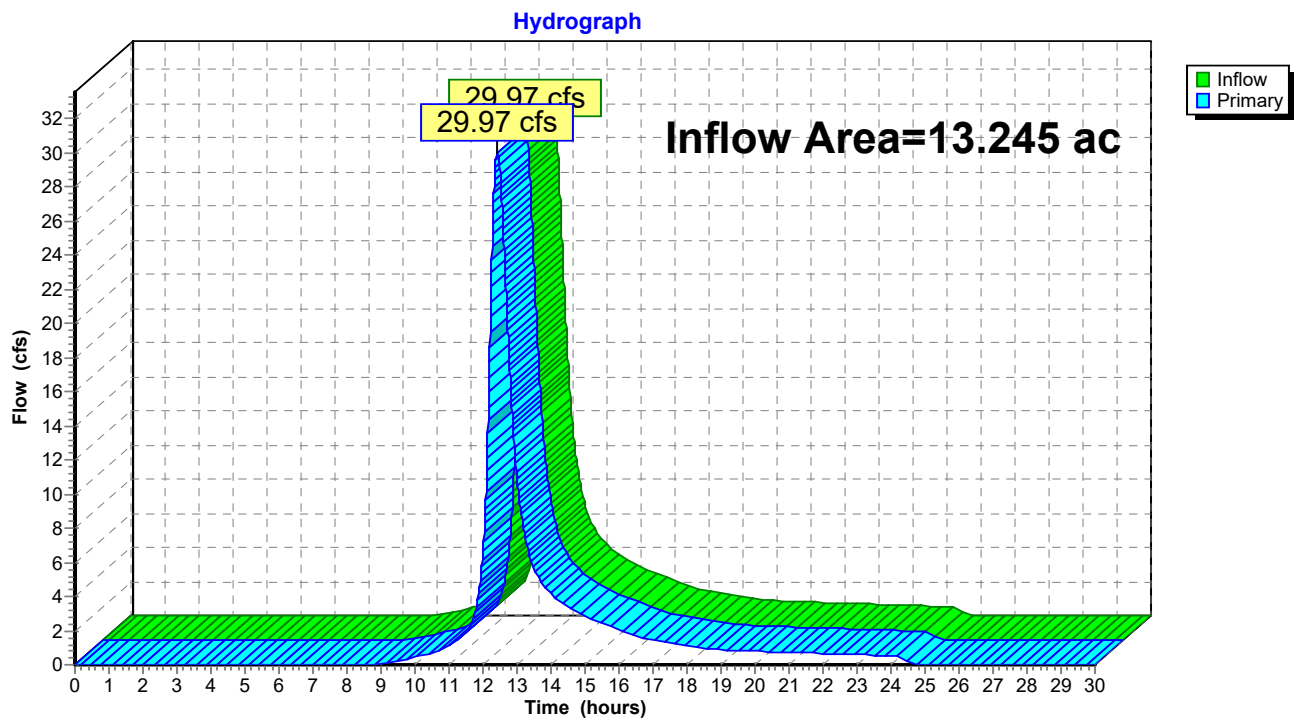
Page 67

### Summary for Link 32P: Design Point #2: Flow to Southern Abutters

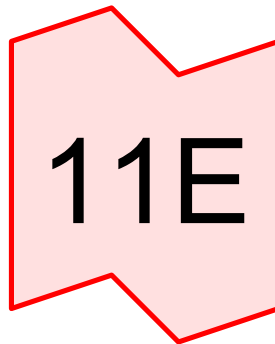
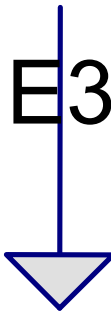
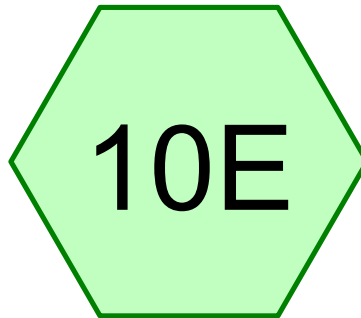
Inflow Area = 13.245 ac, 11.58% Impervious, Inflow Depth = 3.23" for 100-YR event  
Inflow = 29.97 cfs @ 12.42 hrs, Volume= 3.560 af  
Primary = 29.97 cfs @ 12.42 hrs, Volume= 3.560 af, Atten= 0%, Lag= 0.0 min

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

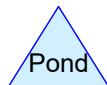
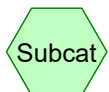
### Link 32P: Design Point #2: Flow to Southern Abutters



**DESIGN POINT #3: FLOW TO ACORN  
STREET EXISTING CONDITIONS**



## Design Point #3: Flow to Acorn Street



### Routing Diagram for Stormwater Calculations

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## Stormwater Calculations

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.164	74	>75% Grass cover, Good, HSG C (10E)
4.069	70	Woods, Good, HSG C (10E)
<b>4.233</b>	<b>70</b>	<b>TOTAL AREA</b>

## Stormwater Calculations

Type III 24-hr 1-YR Rainfall=2.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment 10E: E3

Runoff Area=184,402 sf 0.00% Impervious Runoff Depth=0.46"

Flow Length=453' Slope=0.0200 '/' Tc=15.2 min CN=70 Runoff=1.29 cfs 0.161 af

### Link 11E: Design Point #3: Flow to Acorn Street

Inflow=1.29 cfs 0.161 af

Primary=1.29 cfs 0.161 af

**Total Runoff Area = 4.233 ac Runoff Volume = 0.161 af Average Runoff Depth = 0.46"**  
**100.00% Pervious = 4.233 ac 0.00% Impervious = 0.000 ac**

## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 10E: E3

Runoff = 1.29 cfs @ 12.26 hrs, Volume= 0.161 af, Depth= 0.46"

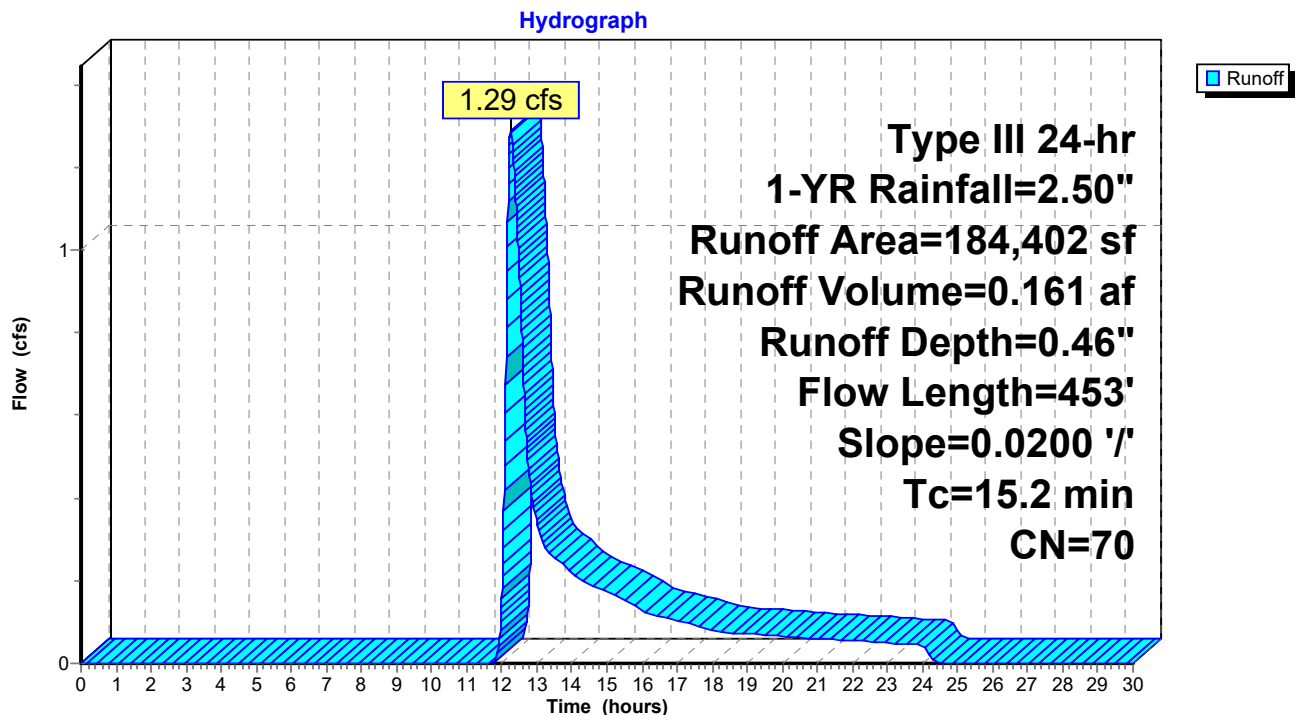
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

Area (sf)	CN	Description
177,263	70	Woods, Good, HSG C
7,139	74	>75% Grass cover, Good, HSG C
184,402	70	Weighted Average
184,402		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	403	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
15.2	453	Total			

### Subcatchment 10E: E3



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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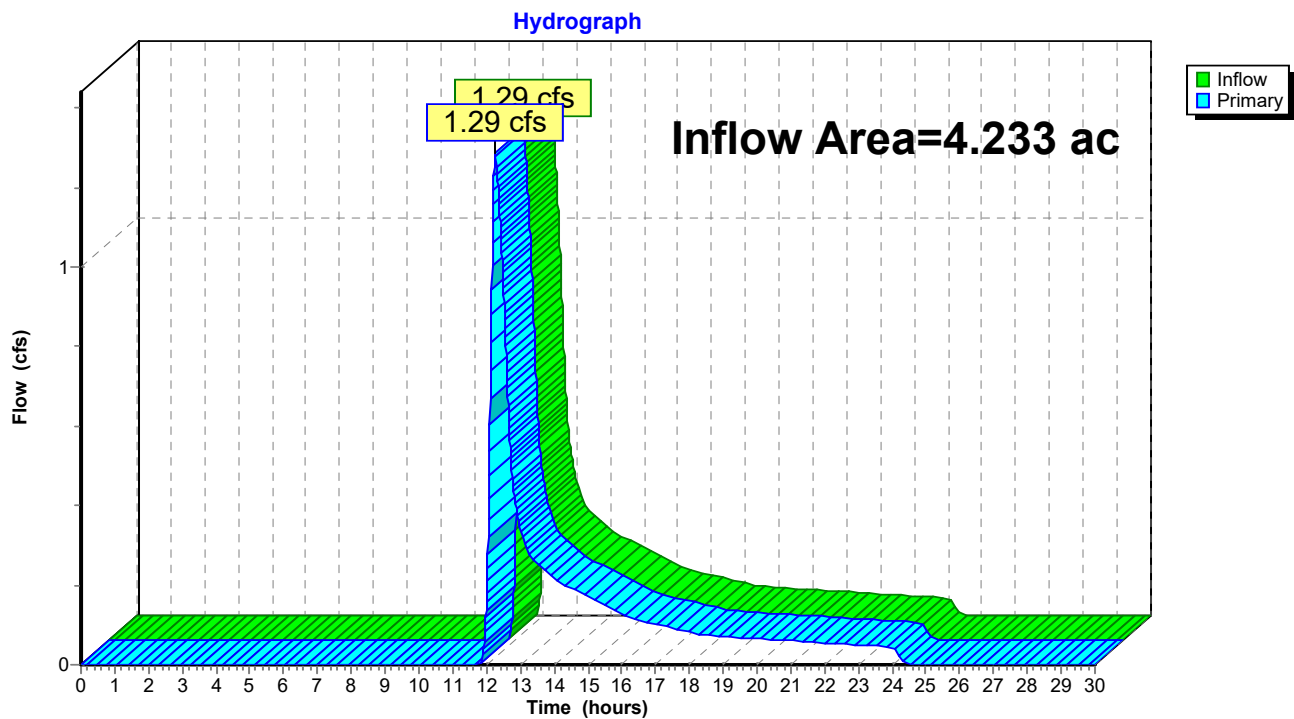
Page 5

### Summary for Link 11E: Design Point #3: Flow to Acorn Street

Inflow Area = 4.233 ac, 0.00% Impervious, Inflow Depth = 0.46" for 1-YR event  
Inflow = 1.29 cfs @ 12.26 hrs, Volume= 0.161 af  
Primary = 1.29 cfs @ 12.26 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min

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

### Link 11E: Design Point #3: Flow to Acorn Street



## Stormwater Calculations

Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment 10E: E3

Runoff Area=184,402 sf 0.00% Impervious Runoff Depth=0.83"

Flow Length=453' Slope=0.0200 '/' Tc=15.2 min CN=70 Runoff=2.74 cfs 0.292 af

### Link 11E: Design Point #3: Flow to Acorn Street

Inflow=2.74 cfs 0.292 af

Primary=2.74 cfs 0.292 af

**Total Runoff Area = 4.233 ac   Runoff Volume = 0.292 af   Average Runoff Depth = 0.83"**  
**100.00% Pervious = 4.233 ac   0.00% Impervious = 0.000 ac**

## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 10E: E3

Runoff = 2.74 cfs @ 12.24 hrs, Volume= 0.292 af, Depth= 0.83"

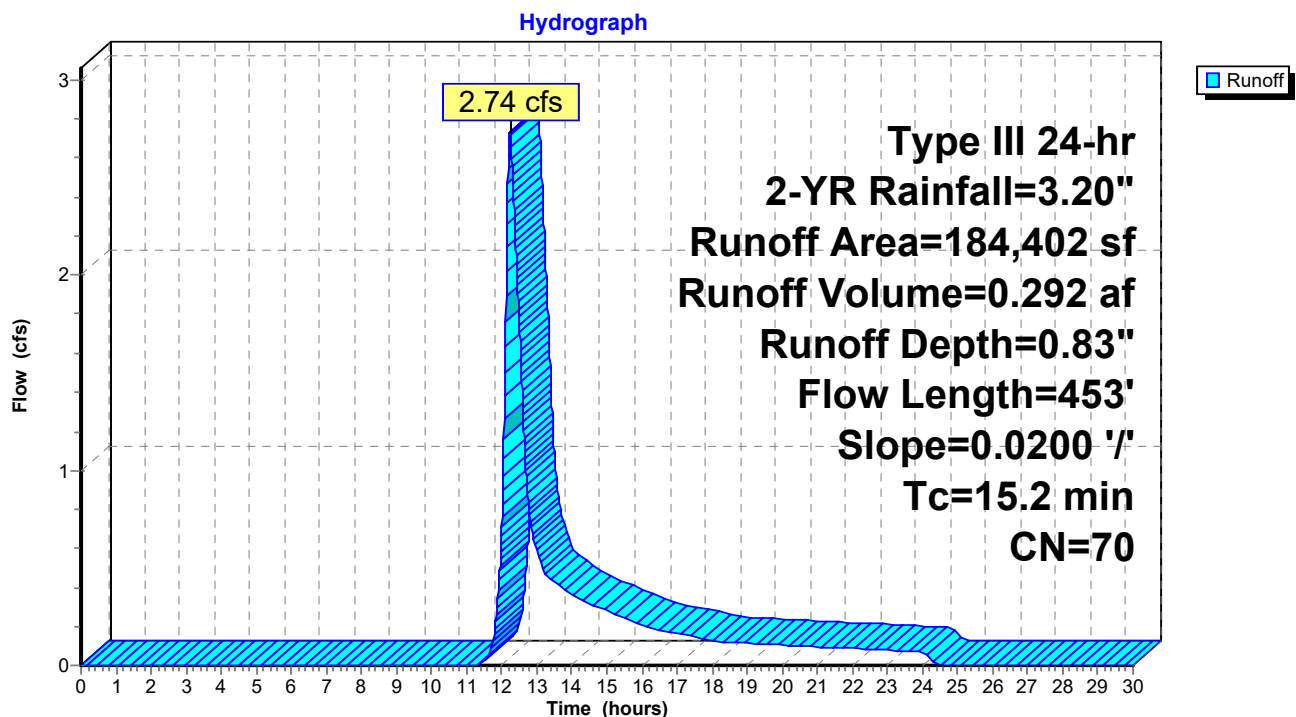
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
177,263	70	Woods, Good, HSG C
7,139	74	>75% Grass cover, Good, HSG C
184,402	70	Weighted Average
184,402		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	403	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
15.2	453	Total			

### Subcatchment 10E: E3



## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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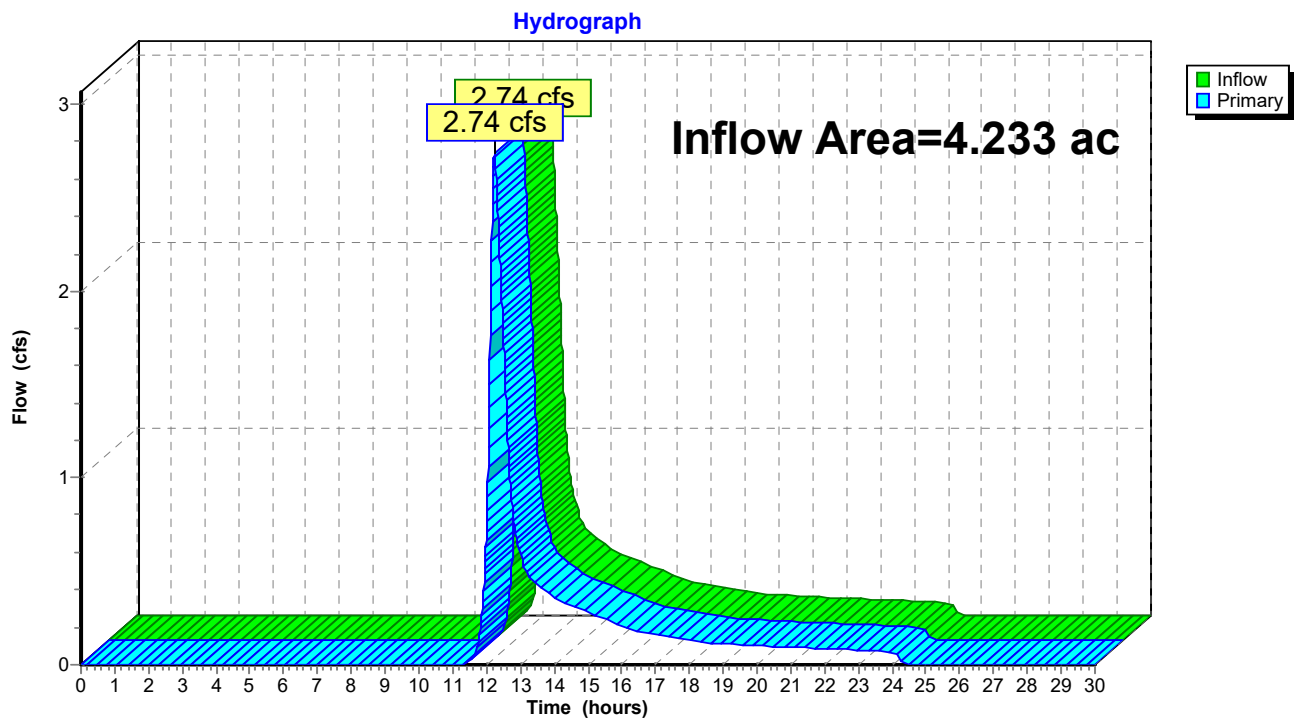
Page 8

### Summary for Link 11E: Design Point #3: Flow to Acorn Street

Inflow Area = 4.233 ac, 0.00% Impervious, Inflow Depth = 0.83" for 2-YR event  
Inflow = 2.74 cfs @ 12.24 hrs, Volume= 0.292 af  
Primary = 2.74 cfs @ 12.24 hrs, Volume= 0.292 af, Atten= 0%, Lag= 0.0 min

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

### Link 11E: Design Point #3: Flow to Acorn Street



## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment 10E: E3

Runoff Area=184,402 sf 0.00% Impervious Runoff Depth=1.82"

Flow Length=453' Slope=0.0200 '/' Tc=15.2 min CN=70 Runoff=6.59 cfs 0.641 af

### Link 11E: Design Point #3: Flow to Acorn Street

Inflow=6.59 cfs 0.641 af

Primary=6.59 cfs 0.641 af

**Total Runoff Area = 4.233 ac   Runoff Volume = 0.641 af   Average Runoff Depth = 1.82"**  
**100.00% Pervious = 4.233 ac   0.00% Impervious = 0.000 ac**



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 10E: E3

Runoff = 6.59 cfs @ 12.21 hrs, Volume= 0.641 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

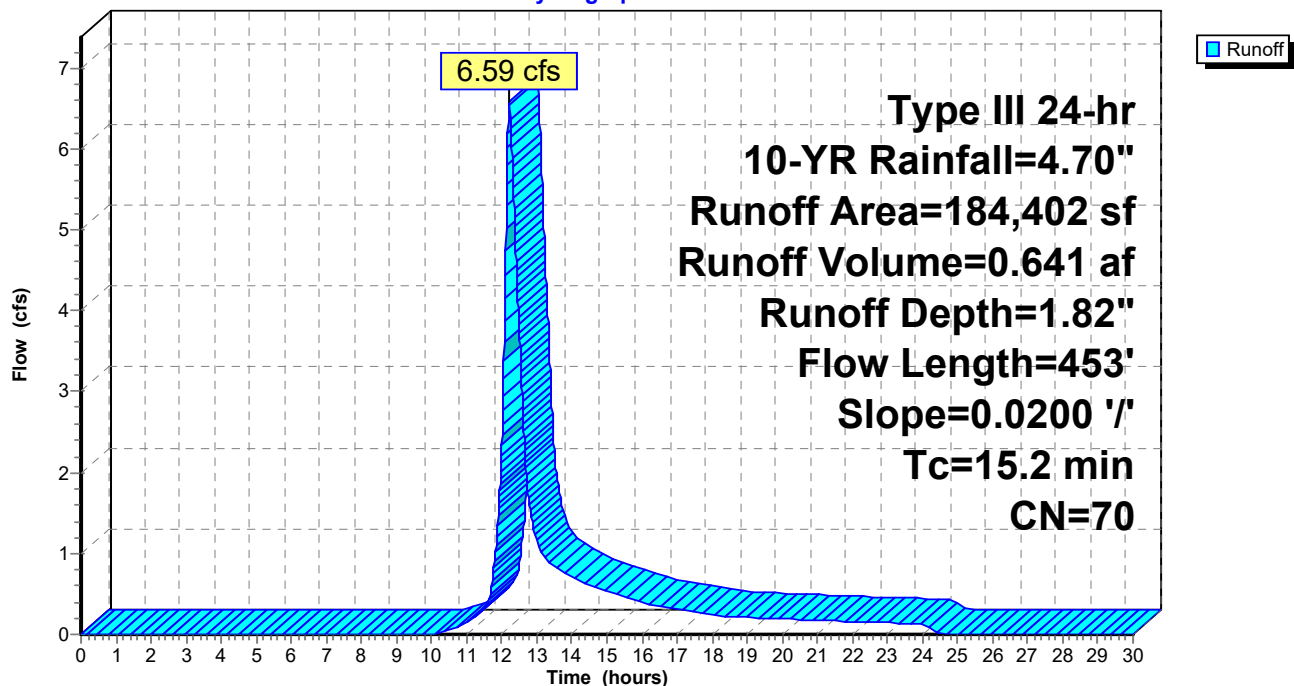
Area (sf)	CN	Description
177,263	70	Woods, Good, HSG C
7,139	74	>75% Grass cover, Good, HSG C
184,402	70	Weighted Average
184,402		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	403	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
15.2	453	Total			

### Subcatchment 10E: E3

Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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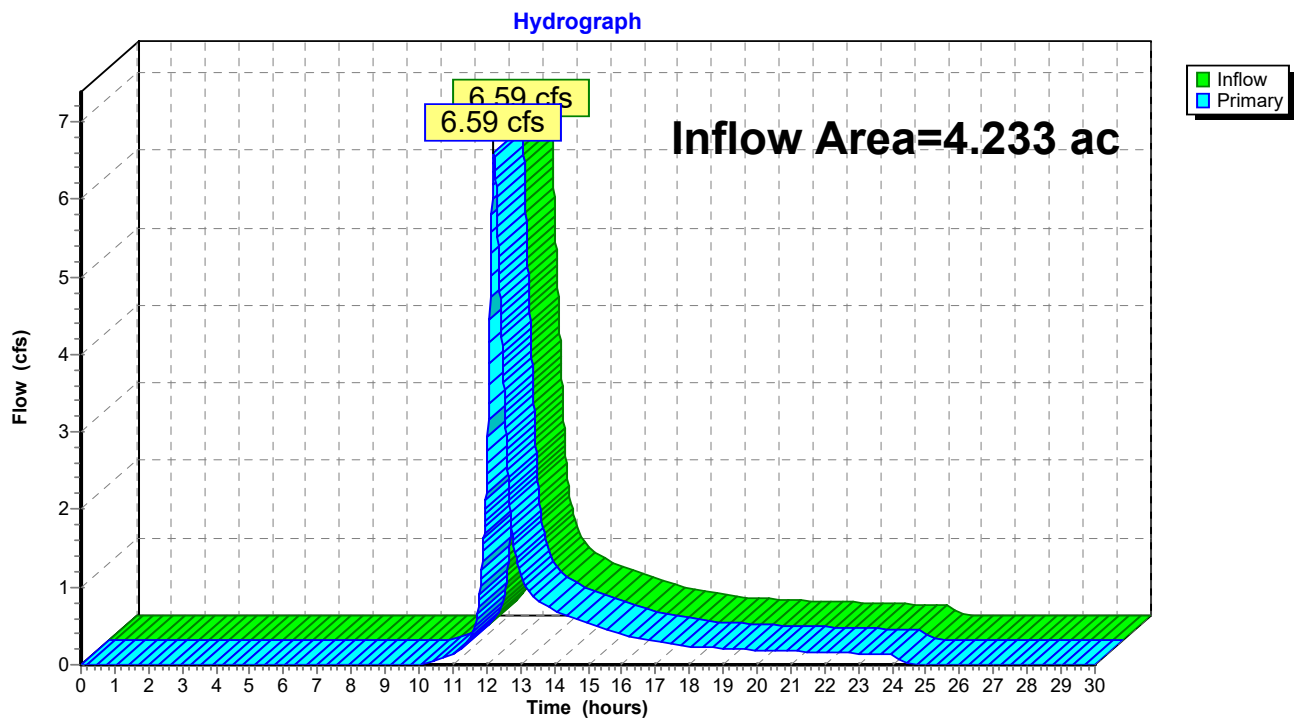
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### Summary for Link 11E: Design Point #3: Flow to Acorn Street

Inflow Area = 4.233 ac, 0.00% Impervious, Inflow Depth = 1.82" for 10-YR event  
Inflow = 6.59 cfs @ 12.21 hrs, Volume= 0.641 af  
Primary = 6.59 cfs @ 12.21 hrs, Volume= 0.641 af, Atten= 0%, Lag= 0.0 min

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

### Link 11E: Design Point #3: Flow to Acorn Street



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment 10E: E3

Runoff Area=184,402 sf 0.00% Impervious Runoff Depth=2.88"

Flow Length=453' Slope=0.0200 '/' Tc=15.2 min CN=70 Runoff=10.71 cfs 1.018 af

### Link 11E: Design Point #3: Flow to Acorn Street

Inflow=10.71 cfs 1.018 af

Primary=10.71 cfs 1.018 af

**Total Runoff Area = 4.233 ac   Runoff Volume = 1.018 af   Average Runoff Depth = 2.88"**  
**100.00% Pervious = 4.233 ac   0.00% Impervious = 0.000 ac**

## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 10E: E3

Runoff = 10.71 cfs @ 12.21 hrs, Volume= 1.018 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

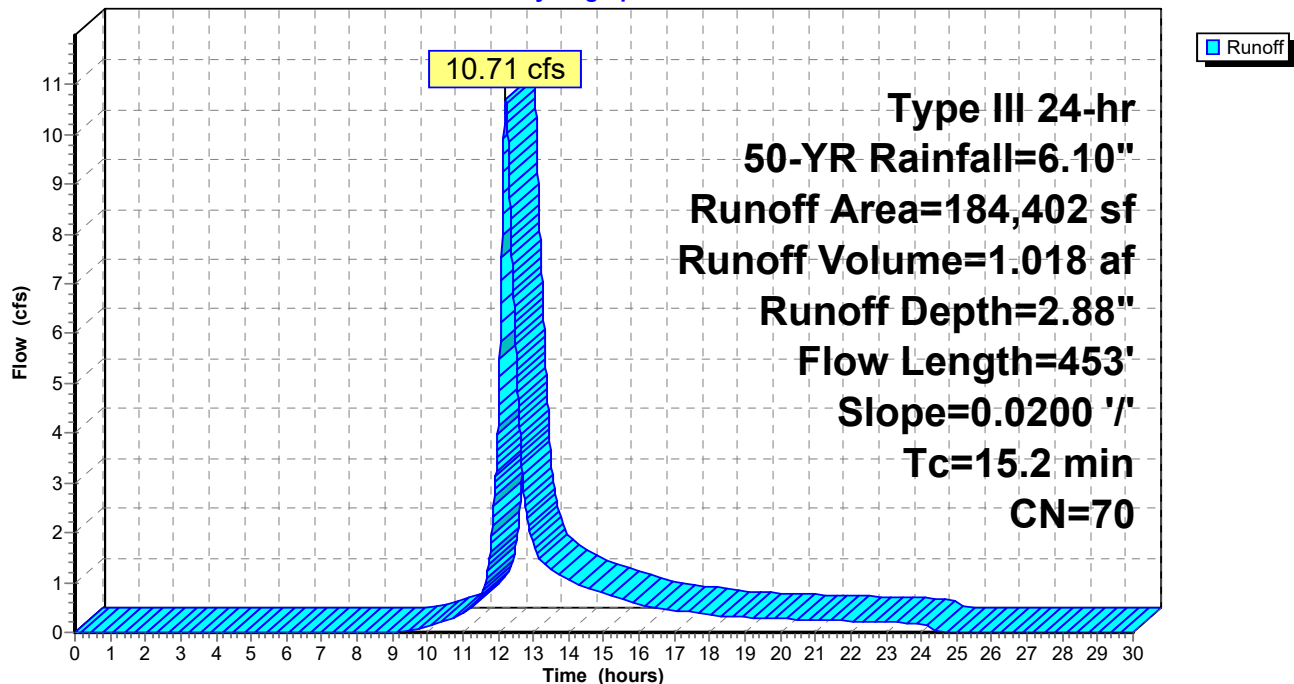
Area (sf)	CN	Description
177,263	70	Woods, Good, HSG C
7,139	74	>75% Grass cover, Good, HSG C
184,402	70	Weighted Average
184,402		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	403	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
15.2	453	Total			

### Subcatchment 10E: E3

Hydrograph



## Stormwater Calculations

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Link 11E: Design Point #3: Flow to Acorn Street

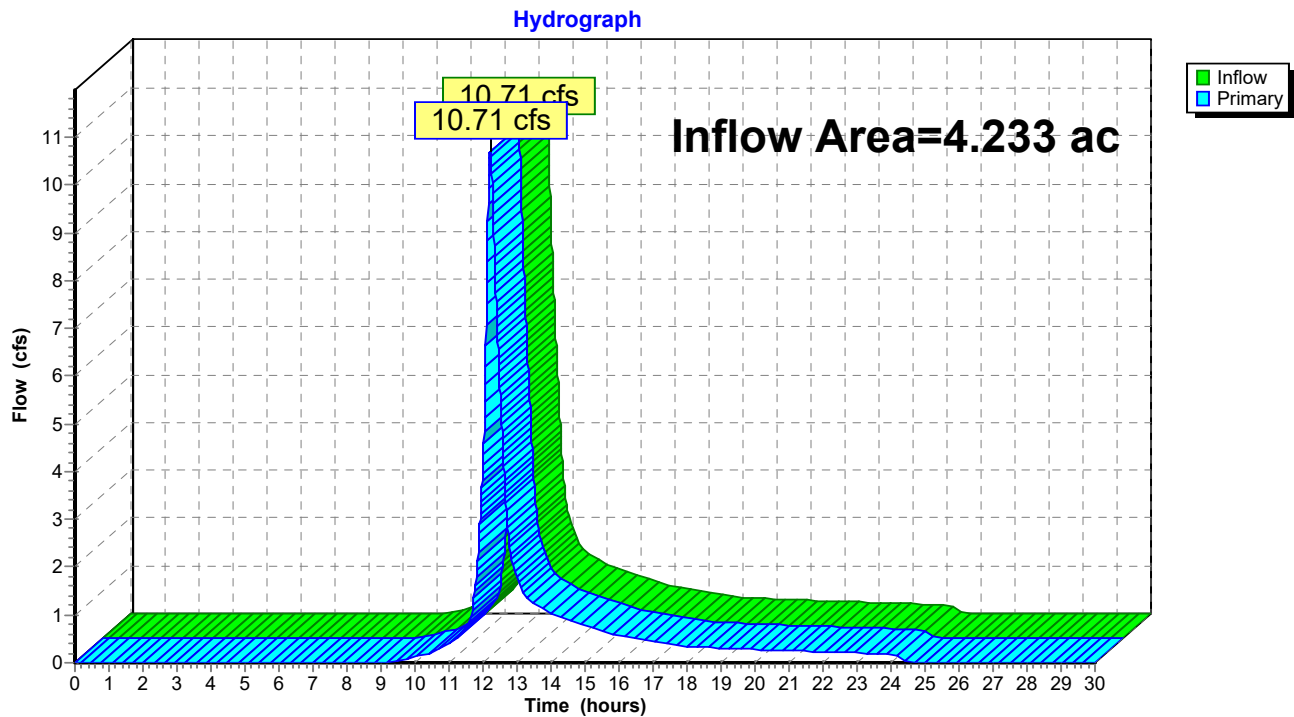
Inflow Area = 4.233 ac, 0.00% Impervious, Inflow Depth = 2.88" for 50-YR event

Inflow = 10.71 cfs @ 12.21 hrs, Volume= 1.018 af

Primary = 10.71 cfs @ 12.21 hrs, Volume= 1.018 af, Atten= 0%, Lag= 0.0 min

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

### Link 11E: Design Point #3: Flow to Acorn Street



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment 10E: E3

Runoff Area=184,402 sf 0.00% Impervious Runoff Depth=3.37"

Flow Length=453' Slope=0.0200 '/' Tc=15.2 min CN=70 Runoff=12.57 cfs 1.189 af

### Link 11E: Design Point #3: Flow to Acorn Street

Inflow=12.57 cfs 1.189 af

Primary=12.57 cfs 1.189 af

**Total Runoff Area = 4.233 ac Runoff Volume = 1.189 af Average Runoff Depth = 3.37"**  
**100.00% Pervious = 4.233 ac 0.00% Impervious = 0.000 ac**

## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 10E: E3

Runoff = 12.57 cfs @ 12.21 hrs, Volume= 1.189 af, Depth= 3.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

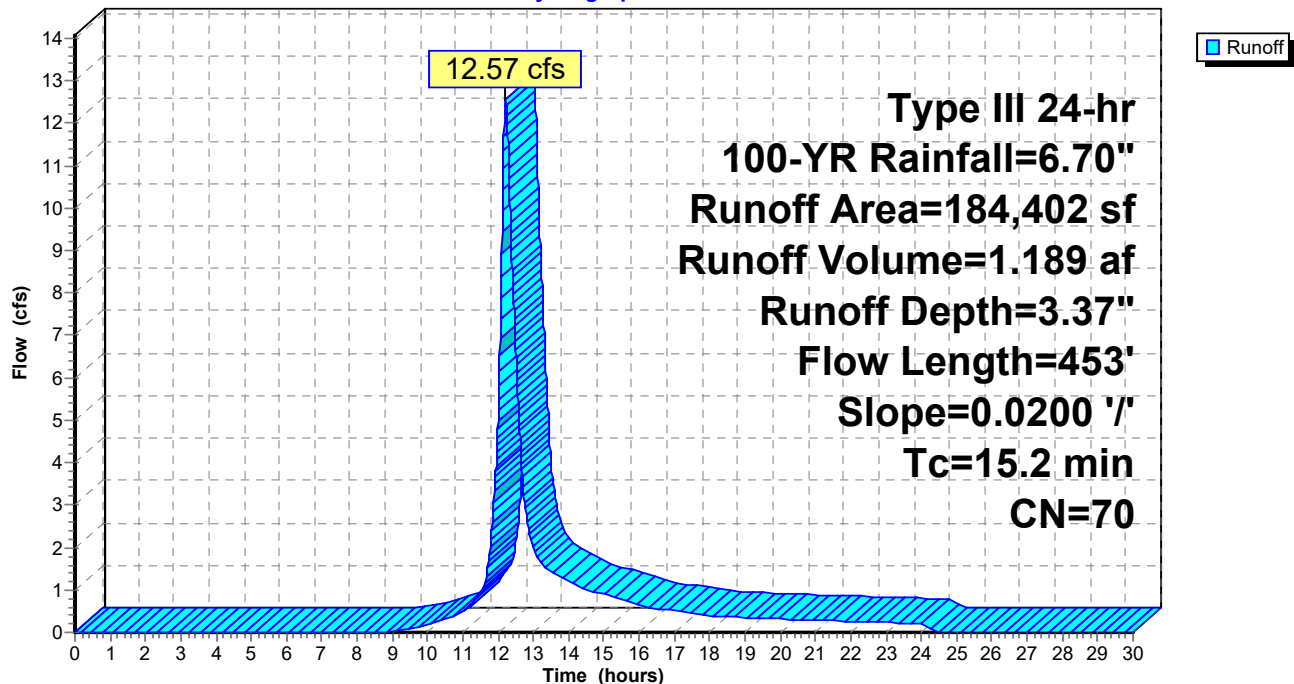
Area (sf)	CN	Description
177,263	70	Woods, Good, HSG C
7,139	74	>75% Grass cover, Good, HSG C
184,402	70	Weighted Average
184,402		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.9	403	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
15.2	453	Total			

### Subcatchment 10E: E3

Hydrograph



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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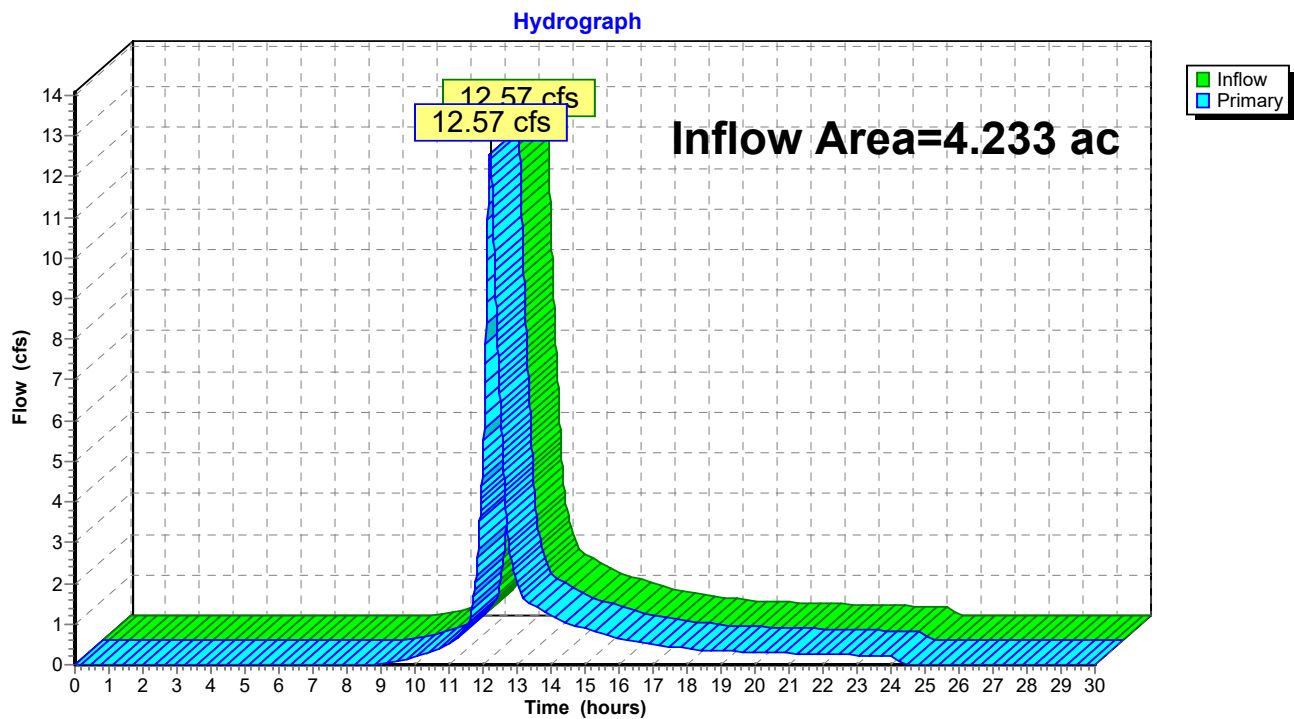
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### Summary for Link 11E: Design Point #3: Flow to Acorn Street

Inflow Area = 4.233 ac, 0.00% Impervious, Inflow Depth = 3.37" for 100-YR event  
Inflow = 12.57 cfs @ 12.21 hrs, Volume= 1.189 af  
Primary = 12.57 cfs @ 12.21 hrs, Volume= 1.189 af, Atten= 0%, Lag= 0.0 min

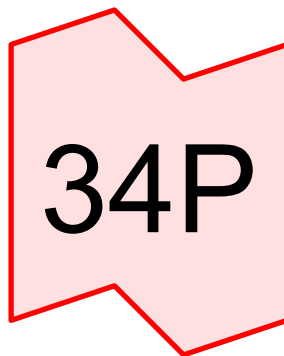
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 11E: Design Point #3: Flow to Acorn Street

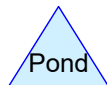
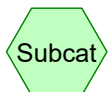




**DESIGN POINT #3: FLOW TO ACORN  
STREET PROPOSED CONDITIONS**



Design Point #3: Flow to  
Acorn Street



**Routing Diagram for Stormwater Calculations**

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## Stormwater Calculations

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.099	74	>75% Grass cover, Good, HSG C (33P)
0.032	74	Pervious Pavers, HSG C (33P)
2.394	70	Woods, Good, HSG C (33P)
<b>3.525</b>	<b>71</b>	<b>TOTAL AREA</b>

## Stormwater Calculations

Type III 24-hr 1-YR Rainfall=2.50"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment33P: P3

Runoff Area=153,536 sf 0.00% Impervious Runoff Depth=0.49"

Flow Length=276' Slope=0.0200 '/' Tc=14.0 min CN=71 Runoff=1.24 cfs 0.144 af

### Link 34P: Design Point #3: Flow to Acorn Street

Inflow=1.24 cfs 0.144 af

Primary=1.24 cfs 0.144 af

**Total Runoff Area = 3.525 ac   Runoff Volume = 0.144 af   Average Runoff Depth = 0.49"**  
**100.00% Pervious = 3.525 ac   0.00% Impervious = 0.000 ac**

## Stormwater Calculations

Prepared by {enter your company name here}

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Type III 24-hr 1-YR Rainfall=2.50"

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### Summary for Subcatchment 33P: P3

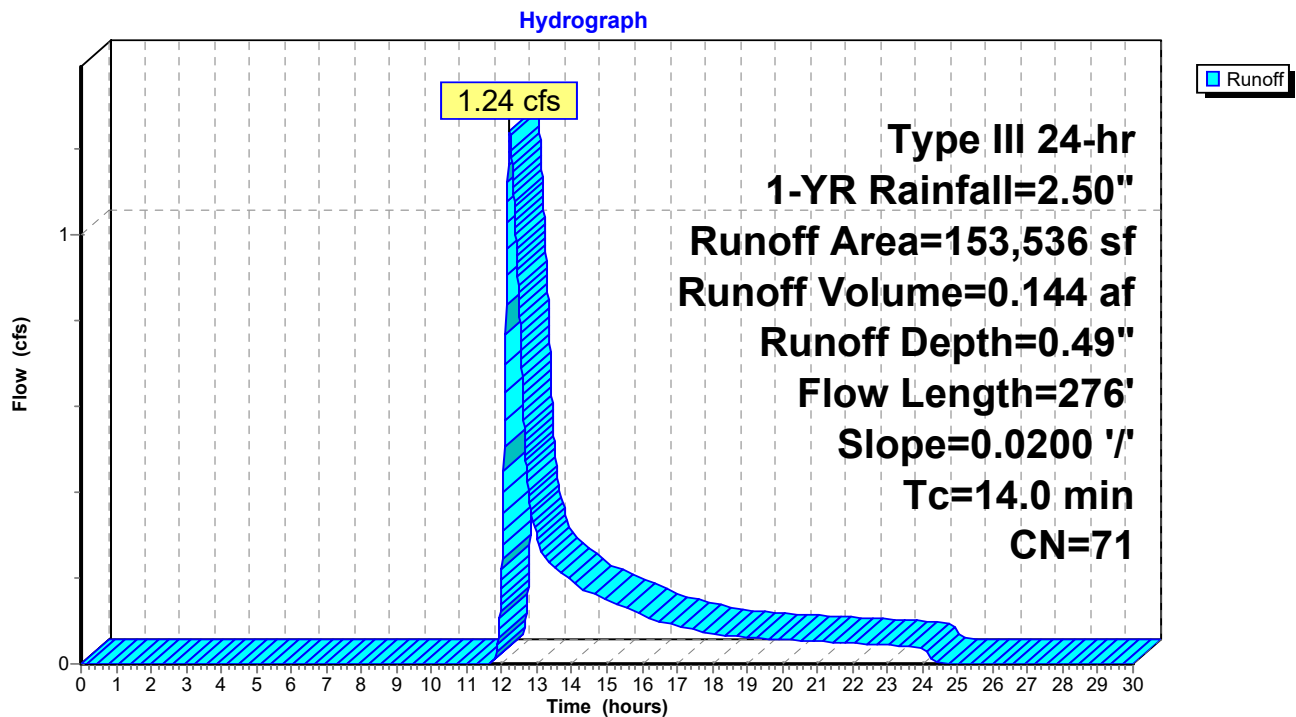
Runoff = 1.24 cfs @ 12.23 hrs, Volume= 0.144 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	1,392	74	Pervious Pavers, HSG C
	47,871	74	>75% Grass cover, Good, HSG C
	104,273	70	Woods, Good, HSG C
	153,536	71	Weighted Average
	153,536		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	226	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
14.0	276	Total			

### Subcatchment 33P: P3



## Stormwater Calculations

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Type III 24-hr 1-YR Rainfall=2.50"

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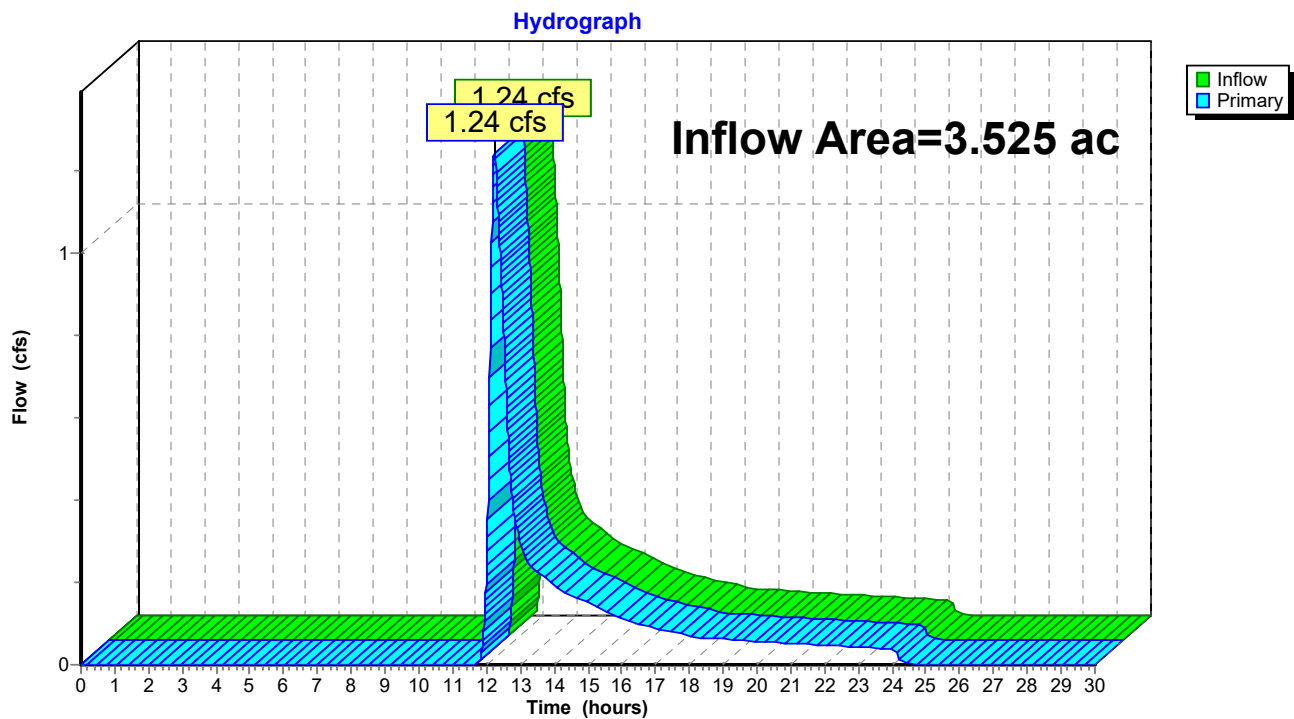
Page 5

### Summary for Link 34P: Design Point #3: Flow to Acorn Street

Inflow Area = 3.525 ac, 0.00% Impervious, Inflow Depth = 0.49" for 1-YR event  
Inflow = 1.24 cfs @ 12.23 hrs, Volume= 0.144 af  
Primary = 1.24 cfs @ 12.23 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

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

### Link 34P: Design Point #3: Flow to Acorn Street



## Stormwater Calculations

Type III 24-hr 2-YR Rainfall=3.20"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment33P: P3

Runoff Area=153,536 sf 0.00% Impervious Runoff Depth=0.88"

Flow Length=276' Slope=0.0200 '/' Tc=14.0 min CN=71 Runoff=2.54 cfs 0.258 af

### Link 34P: Design Point #3: Flow to Acorn Street

Inflow=2.54 cfs 0.258 af

Primary=2.54 cfs 0.258 af

**Total Runoff Area = 3.525 ac Runoff Volume = 0.258 af Average Runoff Depth = 0.88"**  
**100.00% Pervious = 3.525 ac 0.00% Impervious = 0.000 ac**

## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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### Summary for Subcatchment 33P: P3

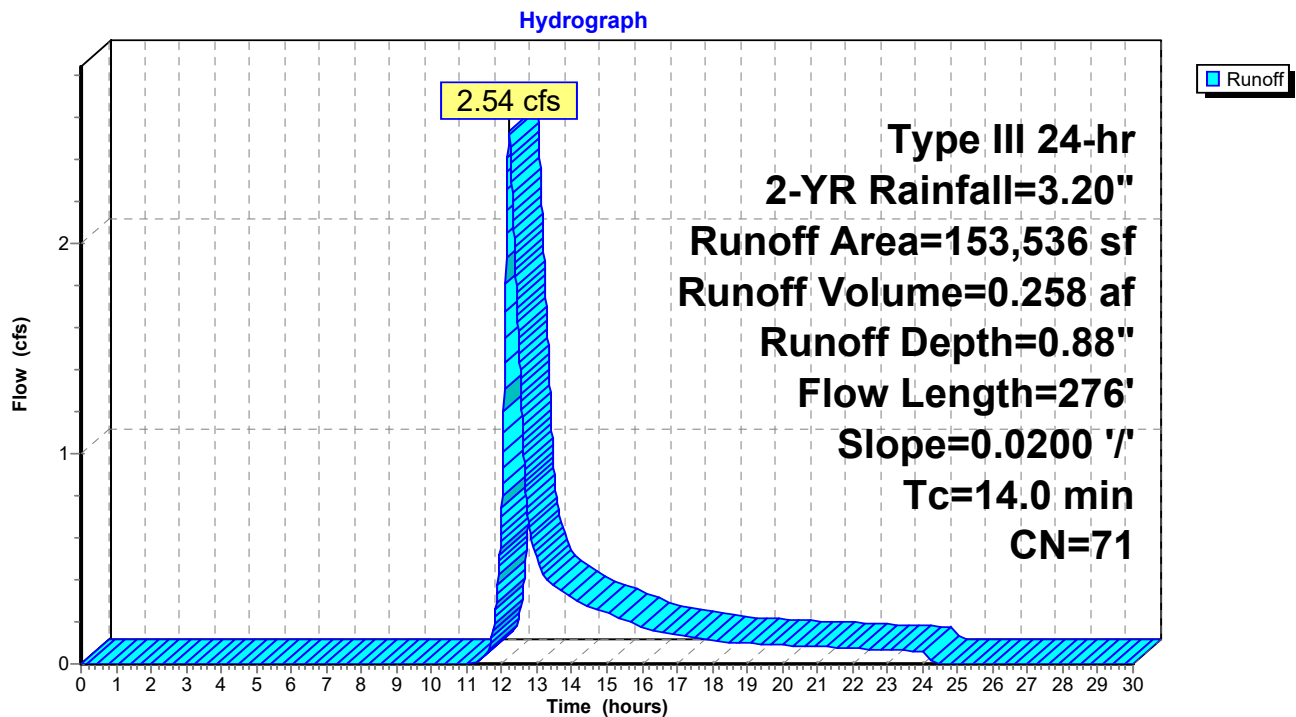
Runoff = 2.54 cfs @ 12.21 hrs, Volume= 0.258 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

	Area (sf)	CN	Description
*	1,392	74	Pervious Pavers, HSG C
	47,871	74	>75% Grass cover, Good, HSG C
	104,273	70	Woods, Good, HSG C
	153,536	71	Weighted Average
	153,536		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	226	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
14.0	276	Total			

### Subcatchment 33P: P3





## Stormwater Calculations

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Type III 24-hr 2-YR Rainfall=3.20"

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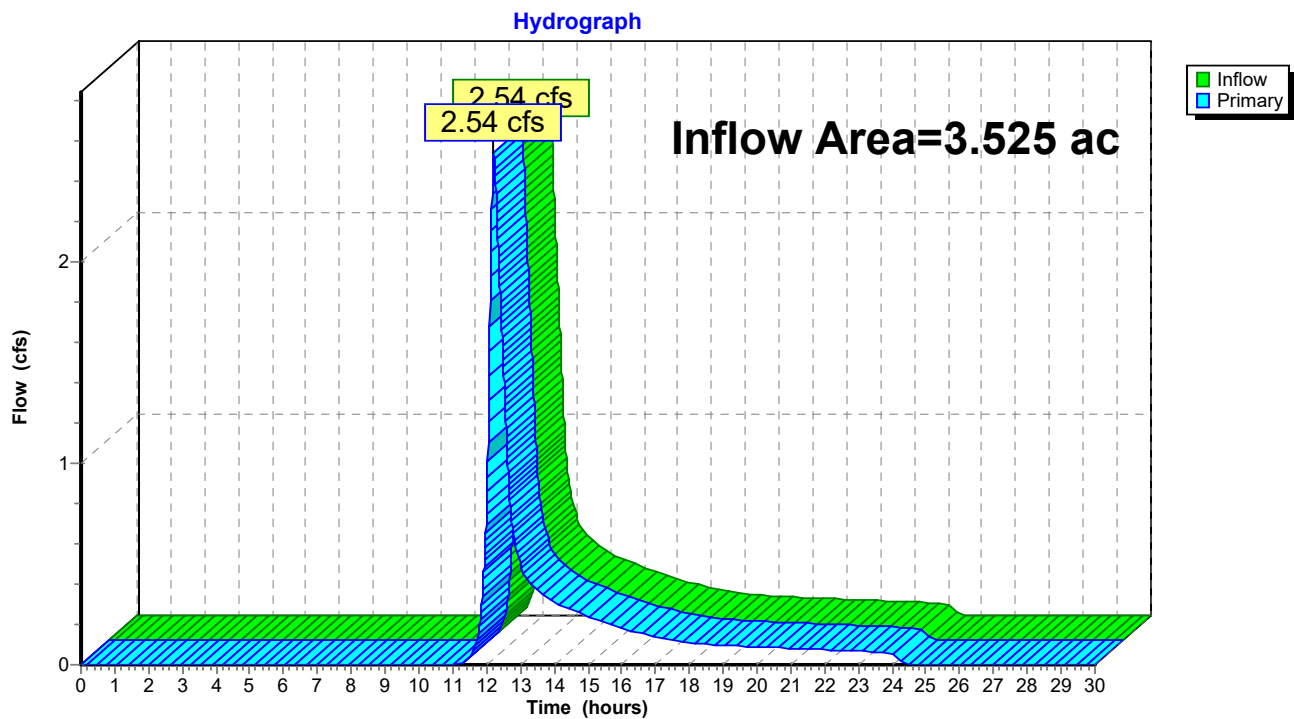
Page 8

### Summary for Link 34P: Design Point #3: Flow to Acorn Street

Inflow Area = 3.525 ac, 0.00% Impervious, Inflow Depth = 0.88" for 2-YR event  
Inflow = 2.54 cfs @ 12.21 hrs, Volume= 0.258 af  
Primary = 2.54 cfs @ 12.21 hrs, Volume= 0.258 af, Atten= 0%, Lag= 0.0 min

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

### Link 34P: Design Point #3: Flow to Acorn Street



## Stormwater Calculations

Type III 24-hr 10-YR Rainfall=4.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment33P: P3

Runoff Area=153,536 sf 0.00% Impervious Runoff Depth=1.89"

Flow Length=276' Slope=0.0200 '/' Tc=14.0 min CN=71 Runoff=5.93 cfs 0.556 af

### Link 34P: Design Point #3: Flow to Acorn Street

Inflow=5.93 cfs 0.556 af

Primary=5.93 cfs 0.556 af

**Total Runoff Area = 3.525 ac   Runoff Volume = 0.556 af   Average Runoff Depth = 1.89"**  
**100.00% Pervious = 3.525 ac   0.00% Impervious = 0.000 ac**

## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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### Summary for Subcatchment 33P: P3

Runoff = 5.93 cfs @ 12.20 hrs, Volume= 0.556 af, Depth= 1.89"

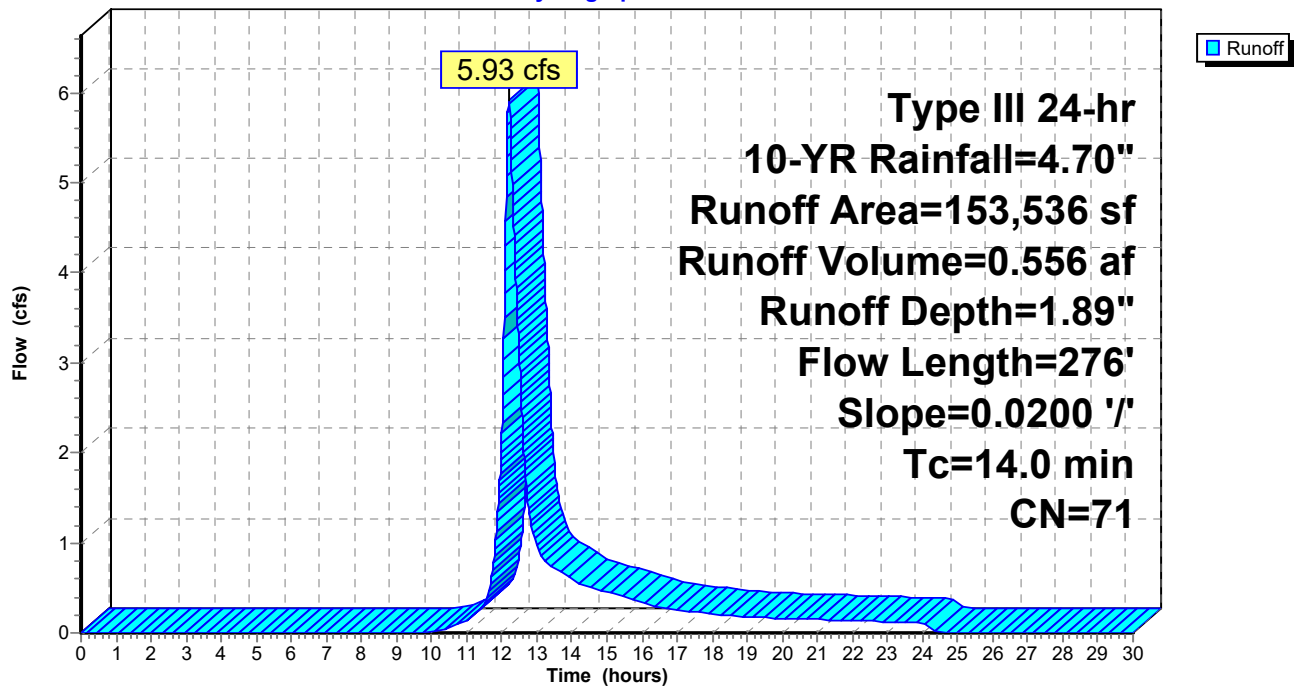
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

	Area (sf)	CN	Description
*	1,392	74	Pervious Pavers, HSG C
	47,871	74	>75% Grass cover, Good, HSG C
	104,273	70	Woods, Good, HSG C
	153,536	71	Weighted Average
	153,536		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	226	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
14.0	276	Total			

### Subcatchment 33P: P3

Hydrograph



## Stormwater Calculations

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Type III 24-hr 10-YR Rainfall=4.70"

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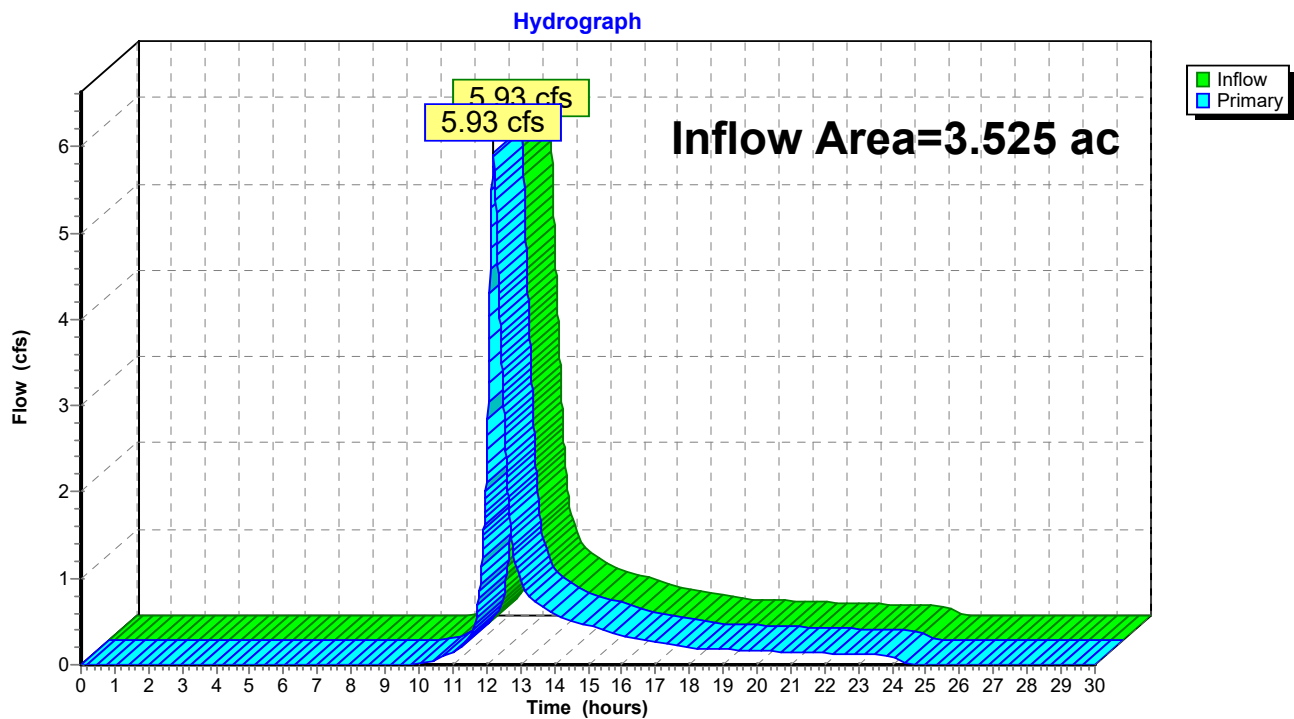
Page 11

### Summary for Link 34P: Design Point #3: Flow to Acorn Street

Inflow Area = 3.525 ac, 0.00% Impervious, Inflow Depth = 1.89" for 10-YR event  
Inflow = 5.93 cfs @ 12.20 hrs, Volume= 0.556 af  
Primary = 5.93 cfs @ 12.20 hrs, Volume= 0.556 af, Atten= 0%, Lag= 0.0 min

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

### Link 34P: Design Point #3: Flow to Acorn Street



## Stormwater Calculations

Type III 24-hr 50-YR Rainfall=6.10"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment33P: P3

Runoff Area=153,536 sf 0.00% Impervious Runoff Depth=2.98"

Flow Length=276' Slope=0.0200 '/' Tc=14.0 min CN=71 Runoff=9.51 cfs 0.875 af

### Link 34P: Design Point #3: Flow to Acorn Street

Inflow=9.51 cfs 0.875 af

Primary=9.51 cfs 0.875 af

**Total Runoff Area = 3.525 ac Runoff Volume = 0.875 af Average Runoff Depth = 2.98"**  
**100.00% Pervious = 3.525 ac 0.00% Impervious = 0.000 ac**

## Stormwater Calculations

Prepared by {enter your company name here}

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Type III 24-hr 50-YR Rainfall=6.10"

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### Summary for Subcatchment 33P: P3

Runoff = 9.51 cfs @ 12.20 hrs, Volume= 0.875 af, Depth= 2.98"

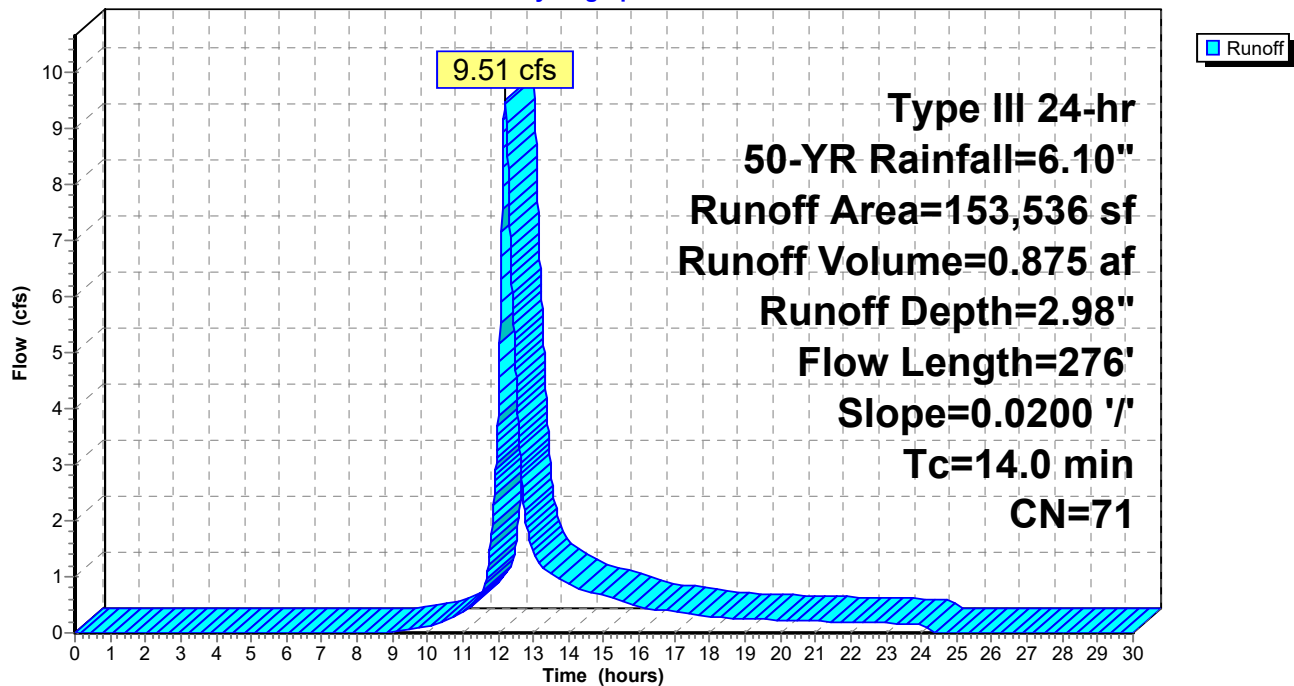
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 50-YR Rainfall=6.10"

	Area (sf)	CN	Description
*	1,392	74	Pervious Pavers, HSG C
	47,871	74	>75% Grass cover, Good, HSG C
	104,273	70	Woods, Good, HSG C
	153,536	71	Weighted Average
	153,536		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	226	0.0200	2.28		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
14.0	276	Total			

### Subcatchment 33P: P3

Hydrograph



## Stormwater Calculations

Prepared by {enter your company name here}

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Type III 24-hr 50-YR Rainfall=6.10"

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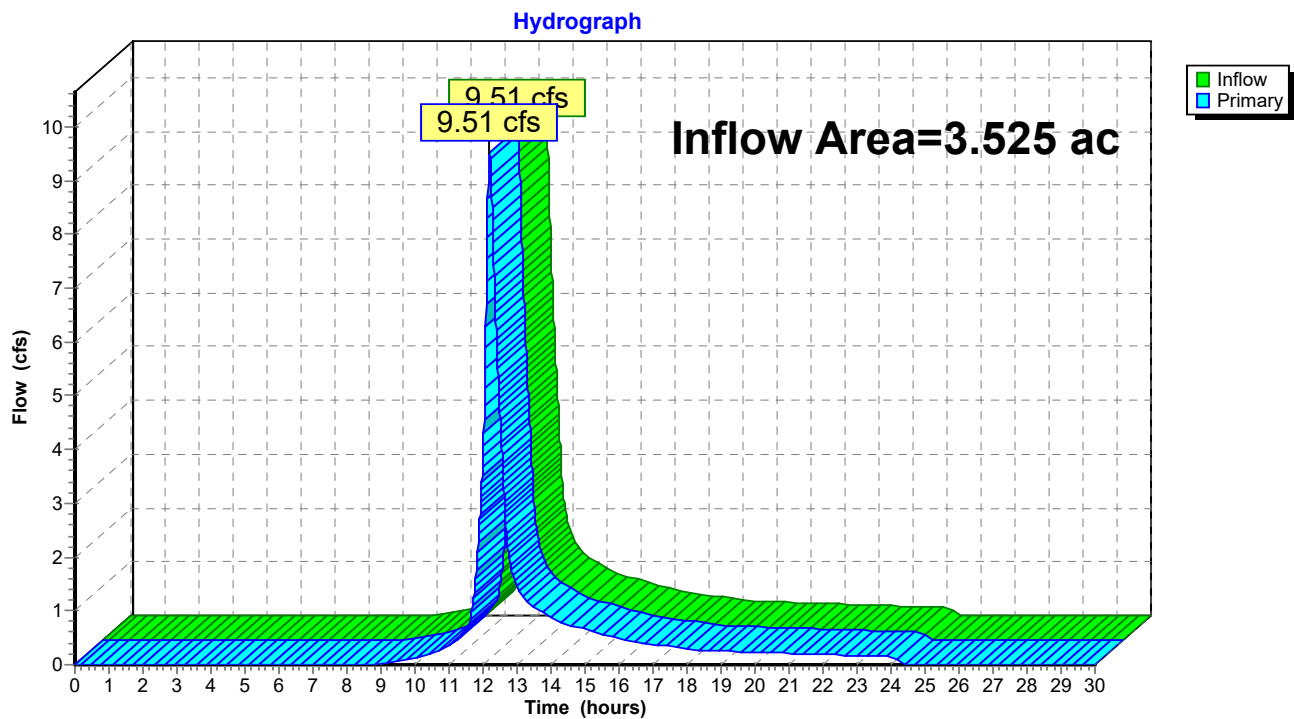
Page 14

### Summary for Link 34P: Design Point #3: Flow to Acorn Street

Inflow Area = 3.525 ac, 0.00% Impervious, Inflow Depth = 2.98" for 50-YR event  
Inflow = 9.51 cfs @ 12.20 hrs, Volume= 0.875 af  
Primary = 9.51 cfs @ 12.20 hrs, Volume= 0.875 af, Atten= 0%, Lag= 0.0 min

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

### Link 34P: Design Point #3: Flow to Acorn Street



## Stormwater Calculations

Type III 24-hr 100-YR Rainfall=6.70"

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Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

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

### Subcatchment33P: P3

Runoff Area=153,536 sf 0.00% Impervious Runoff Depth=3.47"

Flow Length=276' Slope=0.0200 '/' Tc=14.0 min CN=71 Runoff=11.12 cfs 1.020 af

### Link 34P: Design Point #3: Flow to Acorn Street

Inflow=11.12 cfs 1.020 af

Primary=11.12 cfs 1.020 af

**Total Runoff Area = 3.525 ac Runoff Volume = 1.020 af Average Runoff Depth = 3.47"**  
**100.00% Pervious = 3.525 ac 0.00% Impervious = 0.000 ac**



## Stormwater Calculations

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Type III 24-hr 100-YR Rainfall=6.70"

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### Summary for Subcatchment 33P: P3

Runoff = 11.12 cfs @ 12.19 hrs, Volume= 1.020 af, Depth= 3.47"

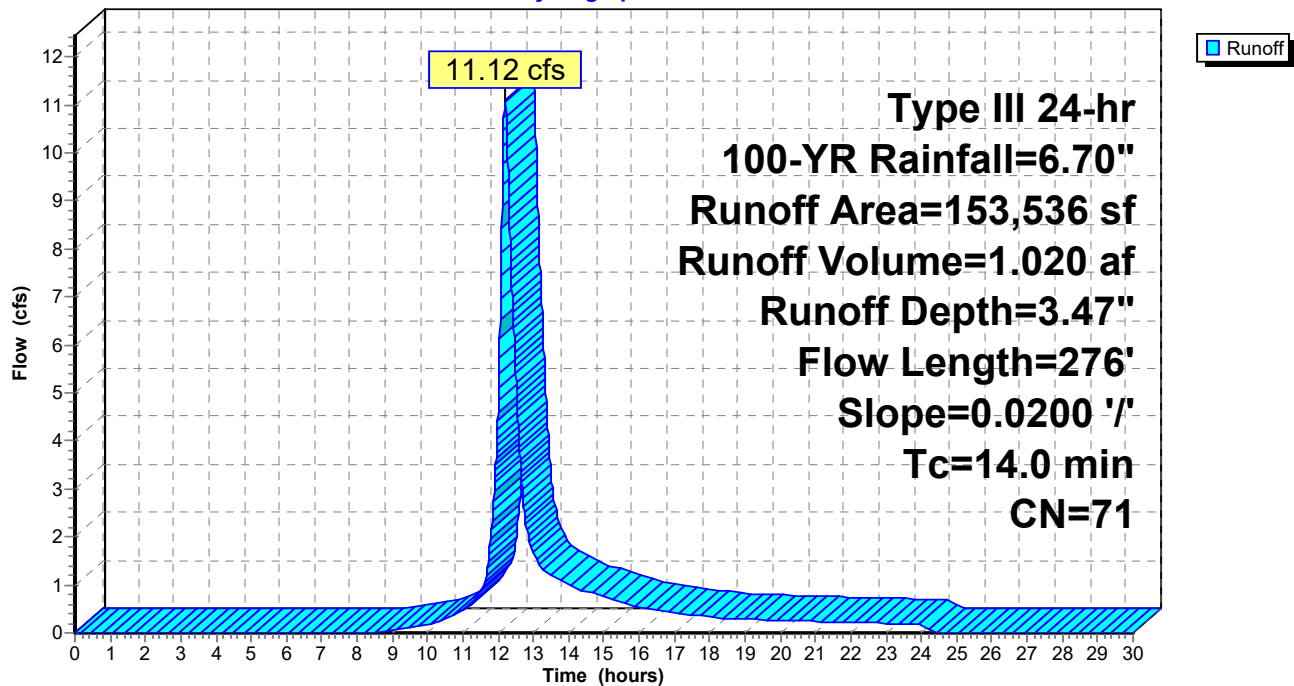
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

	Area (sf)	CN	Description
*	1,392	74	Pervious Pavers, HSG C
	47,871	74	>75% Grass cover, Good, HSG C
	104,273	70	Woods, Good, HSG C
	153,536	71	Weighted Average
	153,536		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	226	0.0200	2.28		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
14.0	276	Total			

### Subcatchment 33P: P3

Hydrograph



## Stormwater Calculations

Prepared by {enter your company name here}

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Type III 24-hr 100-YR Rainfall=6.70"

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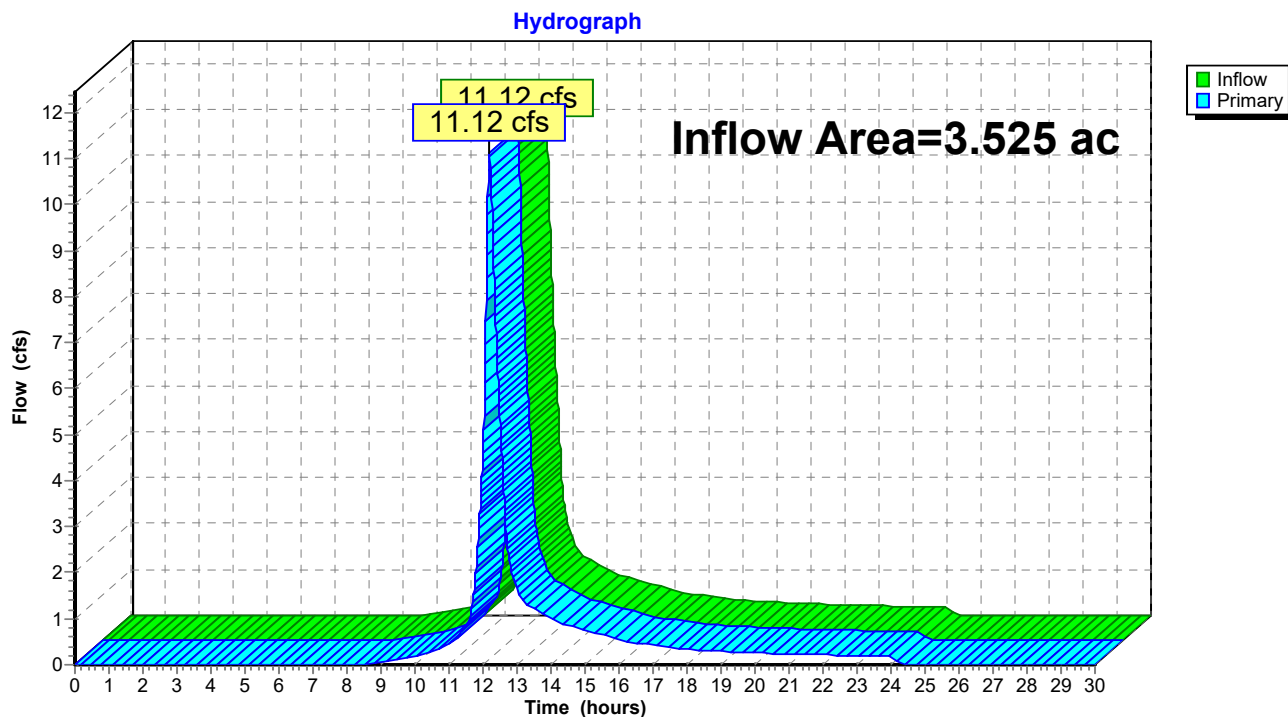
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### Summary for Link 34P: Design Point #3: Flow to Acorn Street

Inflow Area = 3.525 ac, 0.00% Impervious, Inflow Depth = 3.47" for 100-YR event  
Inflow = 11.12 cfs @ 12.19 hrs, Volume= 1.020 af  
Primary = 11.12 cfs @ 12.19 hrs, Volume= 1.020 af, Atten= 0%, Lag= 0.0 min

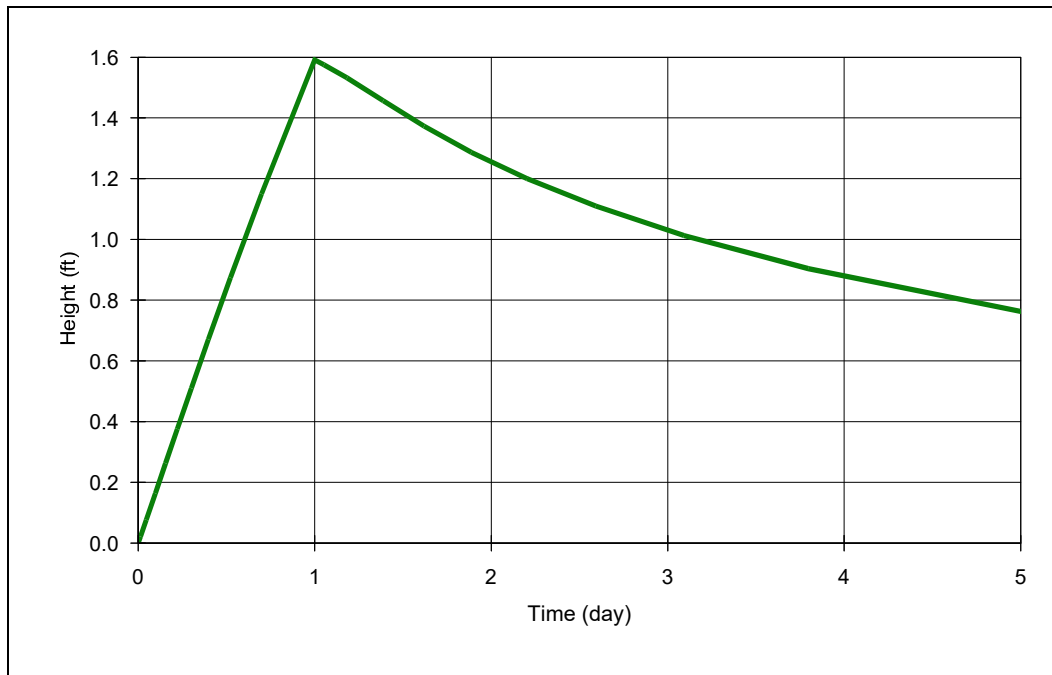
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 34P: Design Point #3: Flow to Acorn Street



## **ATTACHMENT L: MOUNDING CALCULATIONS**

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Merrikin Engineering

PROJECT: Infiltration Basin #1

ANALYST: Daniel J. Merrikin, P.E.

DATE: 7/17/2018 TIME: 9:11:34 AM

### INPUT PARAMETERS

Application rate: 0.34 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 2 ft/day

Initial saturated thickness: 30 ft

Length of application area: 190 ft

Width of application area: 67 ft

Constant head boundary used at: 200 ft

Groundwater mounding @

X coordinate: 0 ft

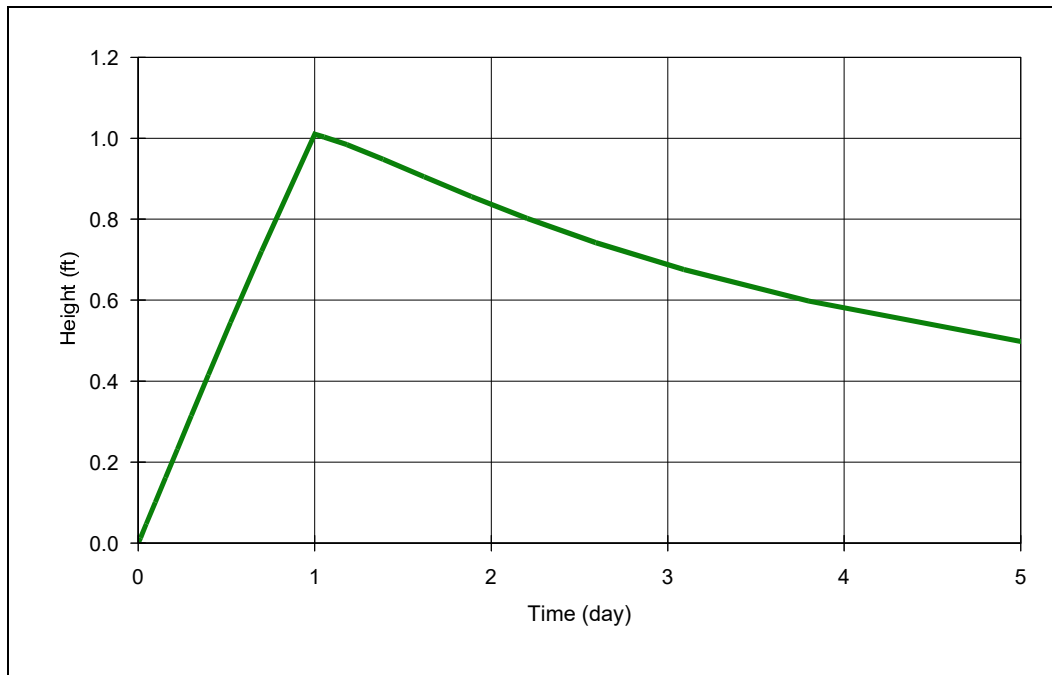
Y coordinate: 0 ft

Total volume applied: 4328.2 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.02
0	0.08
0.1	0.16
0.2	0.26
0.2	0.38
0.3	0.51
0.4	0.67
0.5	0.87
0.7	1.15
1	1.59
1.1	1.58
1.2	1.53
1.4	1.46
1.6	1.37
1.9	1.29
2.2	1.2
2.6	1.11
3.1	1.01
3.8	0.9
5	0.76

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Merrikin Engineering

PROJECT: Infiltration Basin #2

ANALYST: Daniel J. Merrikin, P.E.

DATE: 7/17/2018 TIME: 9:13:21 AM

### INPUT PARAMETERS

Application rate: 0.21 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 2 ft/day

Initial saturated thickness: 30 ft

Length of application area: 160 ft

Width of application area: 77 ft

Constant head boundary used at: 200 ft

Groundwater mounding @

X coordinate: 0 ft

Y coordinate: 0 ft

Total volume applied: 2587.2 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.01
0	0.05
0.1	0.1
0.2	0.16
0.2	0.23
0.3	0.32
0.4	0.42
0.5	0.55
0.7	0.72
1	1.01
1.1	1
1.2	0.98
1.4	0.95
1.6	0.9
1.9	0.86
2.2	0.8
2.6	0.74
3.1	0.68
3.8	0.6
5	0.5