

# STORMWATER REPORT

FOR

*DOVER HOMES*

TROUT BROOK ROAD  
& EDGEWATER DRIVE  
DOVER, MA 02030

*PROPOSED RESIDENTIAL DEVELOPMENT*

JUNE 7, 2023  
REVISED NOVEMBER 15, 2023  
REVISED JANUARY 8, 2024

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VOLUME 1 OF 1

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## REVISIONS

### November 15, 2023

The November 15, 2023 revisions of the Stormwater Report reflect the following changes to the site:

- Lots were regraded to reflect new survey data;
- Front walkways were added to each lot; and
- A portion of the roof on lot 45 is no longer routed to the proposed infiltration field due to site constraints.

The proposed stormwater system is unchanged. Calculations were updated to reflect the updated design information.

### January 8, 2024

The January 8, 2024 revisions of the Stormwater Report reflect the changes made to the site in response to comments from the peer reviewer. Note the following:

- The driveway runoff is no longer proposed to be captured. The stormwater facilities now capture and treat a greater volume of the roof runoff; and
- Drainage patterns have been clarified along the roadway.

## INTRODUCTION

This report presents a description along with supporting calculations for the stormwater runoff treatment and mitigation systems proposed for the residential development as presented on a plan set entitled "Dover Homes" prepared by Legacy Engineering LLC with an original date of May 2, 2023. The development consists of 4 new single-family dwellings.

## EXISTING SITE

The proposed development lies on four separate undeveloped parcels, three on Trout Brook Road and one on Edgewater Drive. All lots contain woods, wetlands, and flood plain.

### SOILS

The soils conservation service maps (see Attachment H) indicate that the site is comprised of various soils types as follows:

Lots 1, 2, & 4:

- Sudbury (Z60B): A class B soil.
- Raynham (30): A class C soil.

Lot 45:

- Deerfield (256B): A class A soil.
- Freetown (53): A class B/D soil.

A series of test pits have also been conducted across the site, which show very variable soil conditions. For the purposes of this report, the soils classes have been chosen based on the tests pits and the National Engineering Handbook.

## **GROUNDWATER CONDITIONS**

Groundwater testing varied across each of the sites. For groundwater elevations at each test pit location shown on the site plans, please refer to Attachment H of this report.

## **SOIL PERMEABILITY**

Although infiltration facilities will lie above or within sandy soil layers, a Rawls rate for loamy sand (2.41 inches per hour) is used for infiltration related calculations as a conservative measure due to less infiltrative soils found beneath the sandy soils layers.

## **FLOOD PLAIN**

Lots 1A, 2A, and 45 partially lie within a flood plain that extends up to elevation 107.6. Lot 4 lies in a flood plain that extends up to elevation 107.3. No work is proposed to be conducted within the flood plain.

## **WETLAND PROTECTION ACT**

All four lots contain wetlands. A Notice of Intent will be filed for proposed work within wetland jurisdictional areas.

## **PROPOSED DEVELOPMENT**

The proposed construction consists of four single family dwellings along with associated driveways, landscape areas, utility systems, and stormwater management systems.

## **MASSACHUSETTS STORMWATER MANAGEMENT STANDARDS**

As a small residential development located within a Zone II, the development is required to meet the Massachusetts Stormwater Management Standards to the maximum extent practicable. Due to the site being located within a Zone II, the focus of this stormwater design is to provide treatment and recharge by the standards. While it is not practicable to mitigate peak rate of runoff for this small development, increases are minor.

The stormwater management system is designed in accordance with the provisions of the DEP Stormwater Management Standards and Handbook to the maximum extent practicable, 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 Wetlands 1 – Concentrated flow to this design point will occur from overflow of the Lot 1A and Lot 2A infiltration fields. This overflow will be minor (<0.05 cfs in the 100-yr storm) and will flow from the rear downspouts over landscaped areas before entering the wetlands.
- Design Point #2: Flow to Wetlands 2 - Concentrated flow to this design point will occur from overflow of the Lot 4 infiltration field. This overflow will be minor (0.14 cfs in the 100-yr storm) and will flow from the rear downspouts over landscaped areas before entering the wetlands.
- Design Point #3: Flow to Wetlands 3 – No concentrated overflow is expected from the Lot 45 stormwater infiltration facilities.

### **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. The following theoretical storm events were used to model the site before and after the proposed activities occur<sup>1</sup>:

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<sup>1</sup> Rainfall depths are as specified by the MADEP's Hydrology Handbook for Conservation Commissions.

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

As a small residential project, this development is required to meet these standards only to the maximum extent practicable. Due to site constraints, it is not practicable to size infiltration or detention facilities large enough to reduce flow rate in any of the storms. The facilities proposed keep flow rate increases to a minimum to the maximum extent practicable.

#### DESIGN POINT #1: Flow to Wetlands 1

Description of Existing Conditions: In the existing condition, Watershed E1 represents uncontrolled overland flow from Lots 1A and 2A.

Description of Proposed Conditions: In the proposed condition, Watersheds P1a and P1b represent captured runoff from the proposed roofs on Lots 1A and 2A. Watershed P1c represents the remaining uncontrolled runoff from the yards of these two lots.

##### Summary of Peak Flow Rates to Design Point:

Design Storm (Year)	Peak Runoff Rate (cfs)	
	Existing	Proposed
2	0.98	1.25
10	1.80	2.26
100	3.02	3.80

#### DESIGN POINT #2: Flow to Wetlands 2

Description of Existing Conditions: In the existing condition, Watershed E2 represents uncontrolled overland flow from Lot 4.

Description of Proposed Conditions: In the proposed condition, Watershed P2a represents captured runoff from the proposed roof on Lot 4. Watershed P2b represents the remaining uncontrolled runoff from the yard of the lot.

##### Summary of Peak Flow Rates to Design Point:

Design Storm (Year)	Peak Runoff Rate (cfs)	
	Existing	Proposed
2	1.00	1.16
10	2.17	2.39
100	4.04	4.31

### DESIGN POINT #3: Flow to Wetlands 3

Description of Existing Conditions: In the existing condition, Watershed E3 represents uncontrolled overland flow from Lot 45.

Description of Proposed Conditions: In the proposed condition, Watershed P3a represents captured runoff from the proposed roof on Lot 45. Watershed P3b represents the remaining uncontrolled runoff from the yard of the lot.

Summary of Peak Flow Rates to Design Point:

Design Storm (Year)	Peak Runoff Rate (cfs)	
	Existing	Proposed
2	0.54	0.75
10	1.27	1.60
100	2.46	2.88

### 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.*

#### LID/ENVIRONMENTALLY SENSITIVE SITE DESIGN

The proposed stormwater system includes LID and environmentally sensitive site design. The techniques used for this site include :

- No disturbance to wetland areas; and
- Minimized disturbance to existing trees and shrubs

#### RECHARGE CALCULATIONS AND METHODS

The DEP Stormwater Management Standards typically require 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 FIELD 1A

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	2,078 s.f.	0 s.f.	0 s.f.	0 s.f.
Required Recharge Volume (Rv)	104 c.f.	0 c.f.	0 c.f.	0 c.f.
Total Rv	104 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 conservative inclusion of some of the recharge which occurs within the infiltration facility during the design storm in accordance with the following formula:

$$V - kTA = V'$$

Where

*V is the Required Recharge Volume. If the infiltration facility also treats the Water Quality Volume, the greater of the two values is used.*

*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*

*A is the field bottom area*

*V' is the minimum required storage volume of the infiltration facility when including 2 hours of recharge*

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 required storage volume is calculated using the Simple Dynamic method using the following values:

$$V - kTA = V'$$

$$V = 346 \text{ cubic feet (WQV)}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$T = 2 \text{ Hours}$$

$$A = 309 \text{ s.f.} \times 40\% \text{ voids} = 124 \text{ s.f.}$$

$$346 \text{ c.f.} - 0.20 \text{ ft/hr} \times 2 \text{ hr} \times 124 \text{ s.f.} = 297 \text{ c.f.}$$

Infiltration Field 1A has a storage volume of 442 c.f., which meets this requirement.

A secondary check is required to ensure that the Rv will recharge within at least 72 hours. The required WQV exceeds the Rv and is used for this calculation. A K value of 2.41 is used for drawdown design purposes. Using the following formula, the drawdown time is calculated:

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

Where:

$$WQV = 346 \text{ c.f.}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$\text{Bottom Area} = 124 \text{ s.f.}$$

It is concluded that the drawdown time for the infiltrated volume is 14.0 hours, which satisfies this requirement.

#### Mounding Analysis:

A mounding analysis has been conducted and can be found in attachment L. The bottom of Infiltration Field 1A is at elevation 108.4, with a seasonal high groundwater elevation below the field at approximately 103.9. The mound for the infiltration of the WQV of this field is 0.74 feet.

## STORMWATER INFILTRATION FIELD 2A

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	2,078 s.f.	0 s.f.	0 s.f.	0 s.f.
Required Recharge Volume (Rv)	104 c.f.	0 c.f.	0 c.f.	0 c.f.
Total Rv	104 c.f.			

For this infiltration facility, the required storage volume is calculated using the Simple Dynamic method using the following values:

$$V - kTA = V'$$

$$V = 346 \text{ cubic feet (WQV)}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$T = 2 \text{ Hours}$$

$$A = 355 \text{ s.f.} * 40\% \text{ voids} = 142 \text{ s.f.}$$

$$346 \text{ c.f.} - 0.20 \text{ ft/hr} * 2 \text{ hr} * 142 \text{ s.f.} = 289 \text{ c.f.}$$

Infiltration Field 2A has a storage volume of 461 c.f., which meets this requirement.

A secondary check is required to ensure that the Rv will recharge within at least 72 hours. The required WQV exceeds the Rv and is used for this calculation. A K value of 2.41 is used for drawdown design purposes. Using the following formula, the drawdown time is calculated:

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

Where:

$$WQV = 346 \text{ c.f.}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$\text{Bottom Area} = 142 \text{ s.f.}$$

It is concluded that the drawdown time for the infiltrated volume is 12.1 hours, which satisfies this requirement.

### Mounding Analysis:

A mounding analysis has been conducted and can be found in attachment L. The bottom of Infiltration Field 2A is at elevation 107.6, with a seasonal high

groundwater elevation below the field at approximately 104.5. The mound for the infiltration of the WQV of this field is 0.83 feet.

#### STORMWATER INFILTRATION FIELD 4

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.	1,485 s.f.	0 s.f.	593 s.f.
Required Recharge Volume (Rv)	0 c.f.	43 c.f.	0 c.f.	5 c.f.
Total Rv	48 c.f.			

For this infiltration facility, the required storage volume is calculated using the Simple Dynamic method using the following values:

$$V - kTA = V'$$

$$V = 346 \text{ cubic feet (WQV)}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$T = 2 \text{ Hours}$$

$$A = 350 \text{ s.f.} * 40\% \text{ voids} = 140 \text{ s.f.}$$

$$346 \text{ c.f.} - 0.20 \text{ ft/hr} * 2 \text{ hr} * 140 \text{ s.f.} = 290 \text{ c.f.}$$

Infiltration Field 4 has a storage volume of 375 c.f., which meets this requirement.

A secondary check is required to ensure that the Rv will recharge within at least 72 hours. The required WQV exceeds the Rv and is used for this calculation. A K value of 2.41 is used for drawdown design purposes. Using the following formula, the drawdown time is calculated:

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

Where:

$$WQV = 346 \text{ c.f.}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$\text{Bottom Area} = 140 \text{ s.f.}$$

It is concluded that the drawdown time for the infiltrated volume is 12.3 hours, which satisfies this requirement.

Mounding Analysis:

A mounding analysis has been conducted and can be found in attachment L. The bottom of Infiltration Field 4 is at elevation 108.5, with a seasonal high groundwater elevation below the field at approximately 105.9. The mound for the infiltration of the WQV of this field is 0.83 feet.

**STORMWATER INFILTRATION FIELD 45**

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.	1,607 s.f.	0 s.f.	0 s.f.
Required Recharge Volume (Rv)	0 c.f.	47 c.f.	0 c.f.	0 c.f.
Total Rv	47 c.f.			

For this infiltration facility, the required storage volume is calculated using the Simple Dynamic method using the following values:

$$V - kTA = V'$$

$$V = 268 \text{ cubic feet (WQV)}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$T = 2 \text{ Hours}$$

$$A = 321 \text{ s.f.} * 40\% \text{ voids} = 128 \text{ s.f.}$$

$$268 \text{ c.f.} - 0.20 \text{ ft/hr} * 2 \text{ hr} * 128 \text{ s.f.} = 216 \text{ c.f.}$$

Infiltration Field 45 has a storage volume of 349 c.f., which meets this requirement.

A secondary check is required to ensure that the Rv will recharge within at least 72 hours. The required WQV exceeds the Rv and is used for this calculation. A K value of 2.41 is used for drawdown design purposes. Using the following formula, the drawdown time is calculated:

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

Where:

$$WQV = 268 \text{ c.f.}$$

$$K = 2.41 \text{ inches per hour} = 0.20 \text{ feet per hour}$$

$$\text{Bottom Area} = 128 \text{ s.f.}$$

It is concluded that the drawdown time for the infiltrated volume is 10.4 hours, which satisfies this requirement.

Mounding Analysis:

A mounding analysis has been conducted and can be found in attachment L. The bottom of Infiltration Field 45 is at elevation 108.4, with a seasonal high groundwater elevation below the field at approximately 104.7. The mound for the infiltration of the WQV of this field is 0.74 feet.

Capture Area Adjustment: All new impervious surfaces are routed through infiltration BMPs except for each driveway. A capture area adjustment is provided as follows:

- |                                      |                 |
|--------------------------------------|-----------------|
| ➤ Total On-Site Impervious Coverage: | 13,998 s.f.     |
| ➤ Treated Impervious Coverage:       | 7,841 s.f.      |
| ➤ Percent to Infiltration BMP:       | 56.0%           |
| ➤ Ratio:                             | 1.79            |
| ➤ <u>Capture Area Adjusted Rv:</u>   | <u>541 c.f.</u> |

Although the infiltration fields recharge a total of 903 c.f., this requirement is not met because the ratio is greater than 1.54. Recharge is met to the maximum extent practicable with 2 inches of all roof runoff being treated.

## **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 impervious surfaces on the site. 0.5 inches is used except in sensitive

locations as described in the Stormwater Handbook. Since this site discharges to a Zone II for a public drinking water supply, the WQV is required to be based on 1.0 inch of runoff. However, 2 inches of WQV is proposed for all roof runoff to make up for removing the driveway runoff from treatment. 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:

Infiltration Field 1A

Required:  $WQV = (2,078 \text{ sq. ft.}) * (2 \text{ in.}) / (12 \text{ in/ft}) = 346 \text{ c.f.}$

Provided: 442 c.f.

Infiltration Field 2A

Required:  $WQV = (2,078 \text{ sq. ft.}) * (2 \text{ in.}) / (12 \text{ in/ft}) = 346 \text{ c.f.}$

Provided: 461 c.f.

Infiltration Field 4

Required:  $WQV = (2,078 \text{ sq. ft.}) * (2 \text{ in.}) / (12 \text{ in/ft}) = 346 \text{ c.f.}$

Provided: 375 c.f.

Infiltration Field 45

Required:  $WQV = (1,607 \text{ sq. ft.}) * (2 \text{ in.}) / (12 \text{ in/ft}) = 268 \text{ c.f.}$

Provided: 349 c.f.

Each infiltration facility is sized to treat more than the required treatment volume attributed to it as shown above. Not all impervious surfaces are treated however. Of the total 13,998 s.f. of proposed impervious surface, 6,157 s.f. is not treated. This untreated area consists of driveways, walkways, and a portion of the roof on Lot 45. As a small residential project, this development is required to meet these standards only to the maximum extent practicable. It is not practicable to capture all impervious runoff from each of these lots due to site limitations.

## PROPOSED BMP DESIGN

Deep Sump Area Drains:

All proposed deep sump area drains 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.

#### Underground Infiltration Systems:

The underground infiltration fields are constructed from gravel surrounded in filter fabric. Underground infiltration fields achieve 80% TSS removal when including a pretreatment facility. Pretreatment is not required when treating roof runoff.

#### **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.

#### Underground infiltration Fields:

The underground infiltration field does not require pretreatment when treating roof runoff. The field therefore provides a total of 80% TSS removal for all roof runoff.

#### **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 lies within a Zone II, which is considered a Critical Area. Stormwater infiltration BMPs are therefore preceded by pretreatment BMPs which achieve a minimum of 44% TSS removal.

### **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

## DOVER HOMES

TROUT BROOK ROAD  
& EDGEWATER DRIVE  
DOVER, MA 02030

### *PROPOSED RESIDENTIAL DEVELOPMENT*

JUNE 7, 2023  
REVISED NOVEMBER 15, 2023  
REVISED JANUARY 8, 2024

PREPARED BY:  
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VOLUME 1 OF 1

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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 development’s infrastructure. This O&M Plan includes the following provisions:

1. Stormwater System Operations and Maintenance
2. Integrated Pest Management Plan
3. Miscellaneous Provisions
4. 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

Dover Homes

## Project Location

0 Troutbrook Road  
0 Edgewater Drive  
Dover, MA 02030

## Operator Name and Address

Robert Recchia  
16 Putnam Lane  
Grafton, MA 01519

## References

This O&M Plan references other documents as follows:

Site Plan - Plans entitled “Dover Homes Plan of Land in Dover, MA” with an original date of June 7, 2023 (as may be amended), and prepared by Legacy Engineering LLC, hereinafter referred to as the “Site Plan”.

Stormwater Report – Report entitled “Stormwater Report for Dover Homes” prepared by Legacy Engineering LLC with an original date of June 7, 2023 (as may be amended).

## Site Description

The site consists of four proposed residential buildings on four separate lots along Trout Brook Road and Edgewater Drive and includes all appurtenant utility systems, landscape areas, and stormwater management systems. Those land areas are collectively referred to herein as the “Development.”

## Site Usage and Activities

Single family residential buildings and associated appurtenances.

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

In order to maximize the continued effectiveness of the Stormwater Management BMP's for the development, 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.

## **Easement Areas**

An existing drainage easement owned and operated by the Town of Dover runs through Lot 45.

## **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**

### Underground Infiltration Field:

1. Perform all pretreatment BMP maintenance, structural and non-structural, as required herein.
2. Inspect the infiltration field at least twice per year, approximately 2-4 days after a rainfall event to ensure that water is not still in the field (as it should have infiltrated into underlying soils by then). Should the infiltration field fail to infiltrate water sufficiently, the field system shall be excavated and replaced in accordance with the original design.

### 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: INTEGRATED PEST MANAGEMENT PLAN**

### **Applicability**

The Development shall adhere to this IPM in perpetuity, unless the conservation Commission releases the Operator from this obligation in writing.

### **Lawn Preparation and Installation**

The following methods shall be employed for all lawn installation and replacements.

- Topsoil installed in lawn areas shall be installed to a minimum thickness of 4-inches. Installation shall be in a manner that minimizes compaction of the topsoil. Topsoil should include a minimum organic content of 18% in the top 4-inches. In areas where existing topsoil is limited or non-existent due to bedrock or hardpan, 6-24 inches of sandy loam topsoil should be spread with a minimum 18% organic content in the top 6-inches.
- Topsoil shall be tested for pH, organic content and mineral content including calcium, magnesium, potassium and sodium at the time of installation and supplements shall be added as recommended. Lime shall be added at the rates recommended by the soil test lab to bring topsoil pH within recommended levels.
- Seeding shall include at least three of the following turf types: Fine Fescue, Kentucky Bluegrass, Perennial Rye Grass, and Tall Fescue.
- Fertilizer application at the time of seeding shall not exceed 0.5 pounds per 1,000 square feet and shall be either organic or mineral.
- During the period of turf establishment (1-2 seasons after seeding), up to two broadleaf weed control applications per year may be applied to the entire lawn area to encourage the establishment of the turf and prevent weed infestations.

### **Mechanical Lawn Care Standards**

The following maintenance guidelines shall be generally applied to lawn care, although specific adherence to every standard is not necessary. Adherence to these mechanical lawn care standards will encourage the development of a thick, dense, and healthy turf system which will ultimately result in fewer Lawn Care Treatment requirements.

- Lawn cutting height should be adjusted according to the season using the following as guidance:
  - May – June: 2.5" Cut Height
  - July – August: 3-3.5" Cut Height
  - September: 2.5-3" Cut Height
  - October – November: 2" Cut Height



- Lawn mowing should be at sufficient frequency such that not more than 1/3 of the leaf blade height is cut off.
- Aerate the lawn generally once per year in the mid-summer to mid-fall period. A second aeration in the spring may be appropriate for compact soils conditions.
- Dethatching is generally not necessary unless the thatch layer exceed ¾”.

## **Core Lawn Care Treatment Program**

Each lawn shall adhere to the following lawn care practices and restrictions:

- A soil test shall be conducted at least once every two years to evaluate topsoil pH level and the necessary application of lime will be made to bring soil pH within recommended levels. Recommended topsoil pH levels are between 6.5 and 6.8. Soils testing shall also include organic content, mineral content, including calcium, magnesium, potassium and sodium, total cation exchange capacity, and hydrogen. Ideal base saturation percentages for these parameters are as follows:
  - Calcium: 68-70%
  - Magnesium: 15-20%
  - Potassium: 4.5-6%
  - Sodium: <3%
  - Other Bases: 4-8%
  - Hydrogen: 5-10%
- Fertilizer application shall be as-needed based on the results of the latest soils test, plant health, rooting characteristics, growth rate desired, and season. Fertilizer application shall not exceed five times per calendar year and the total quantity of fertilizer applied in any given year shall not result in the application of more than three pounds of nitrogen per 1,000 square feet with not more than one pound of nitrogen applied per 1,000 square feet in any single application. Nitrogen, in the form of fertilizer, should generally be applied in small increments to avoid nitrate leachate and runoff, undesired sprits in growth, and increase in pest population. Granular organic and/or organic/synthetic slow release fertilizers shall be used. The optimal use of fertilizers is to create an organic foundation for soil health and development which provides sufficient nutrients for controlled plant growth and avoiding subsurface and surface nutrient loss to groundwater or stormwater runoff.
- Except as noted below, only one application of crab-grass prevention product is permitted per year during March or April, and only in portions of the lawn in full sun which are prone to such infestations. The use of corn gluten (organic crab-grass control method) is permitted twice per year.
- At the time of fertilizer application, any accidental spillage onto impervious surfaces such as driveways, walkways, patios, and streets shall be swept up and either applied to the lawn or removed from the site.

### **Optional Maintenance Practices to be Applied as Needed**

- Where topsoil testing demonstrates a deficiency, mineral or organic micro-nutrients may be added to achieve recommended levels.
- Generally, chemical pesticides should be used as a final option and the minimum amount necessary to achieve the desired result should be used. Non chemical means of pest control should be tried first. In the event of suspected pest problem, a visual inspection shall first be made by qualified personnel to confirm the presence of stressed vegetation, wildlife activity, pathogens, and other similar indicators. Should a pest problem be identified, the condition shall be monitored periodically such that if the problem subsides, treatment methods can stop as soon as possible thereafter.
- Root bio-stimulants from organic sources (examples include Roots, Organica, or PHC type products, which are brand names and which may change depending on market conditions) may be used as needed.
- Compost topdressing (1/8" – 1/4" depth) may be applied as needed.
- Spot treatment of weeds and Crabgrass may be implemented at any time as needed, but only on a spot-treatment basis and only to those areas affected.
- Spot treatment for turf disease may be implemented at any time as needed, but only on a spot-treatment basis and only to those areas affected.
- Grub control products and similar products may be applied to localized areas only where grub activity is evident. Grub control may be applied when grub populations reach an average of 8 -10 grubs per square foot or if the plant/lawns are showing signs of stress from grub activity.
- One application of Imidacloprid (Merit) or similar products per year is permitted during June and July in areas where grub activity has historically occurred.
- Pesticides which are classified for Restricted Use pursuant to 333 CMR may only be applied by properly licensed or certified personnel or by individuals under the direct on-site supervision of properly licensed or certified personnel in accordance with 333 CMR.

## **PART 3: 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 shall be in accordance with manufacturer recommendations.
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.
5. At such time as snow accumulations exceed the capacity of on-site storage areas, such excess snow shall be removed from the site and disposed of in accordance with state, local, and federal laws and regulations.

### **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 \$50 per year per lot (2024 value).

## **PART 4: ACCIDENTAL SPILL AND EMERGENCY RESPONSE PLAN**

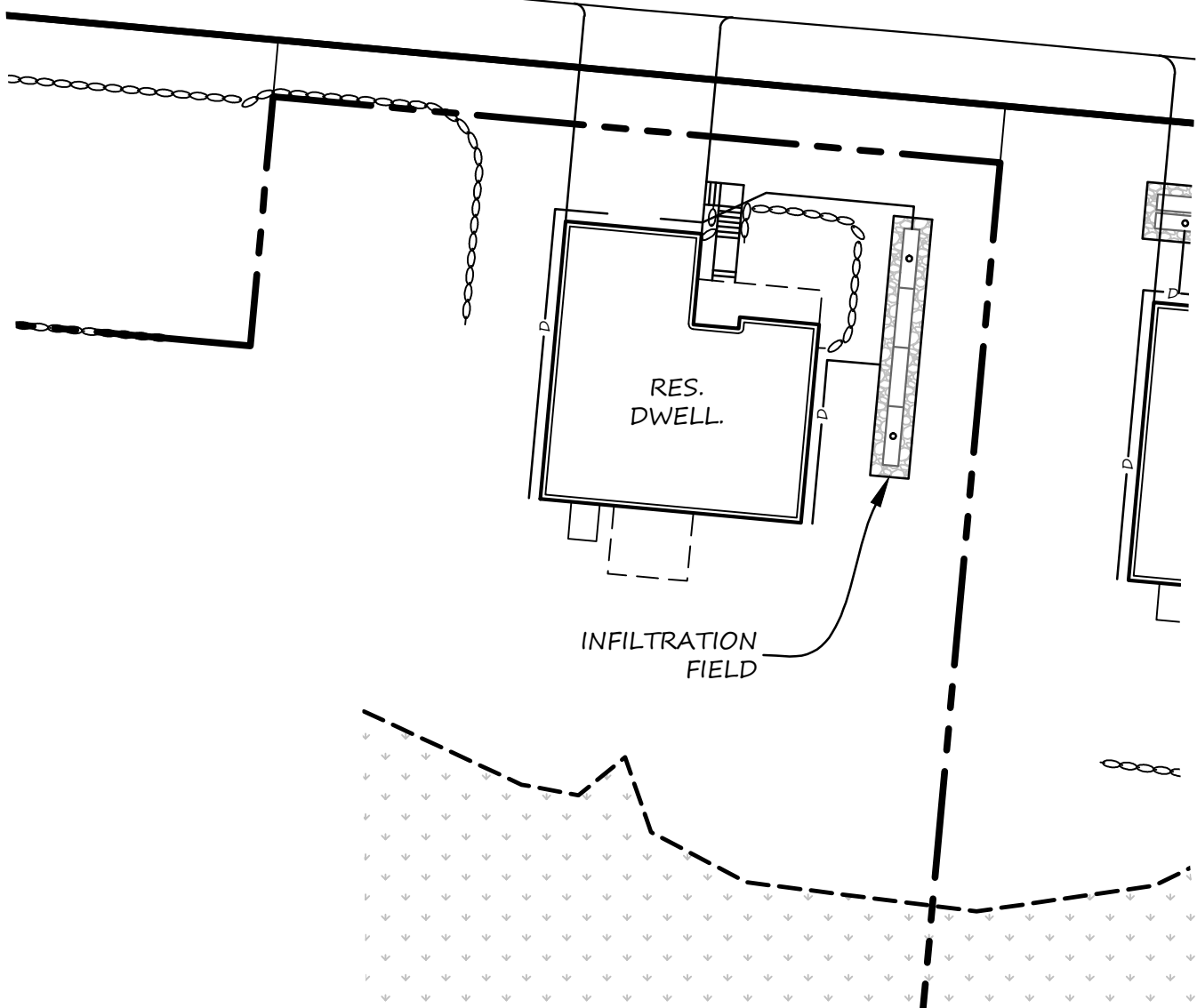
In the event of an accident within the boundaries of the Site, where significant gasoline or other petroleum products or other hazardous materials are released, the following procedure shall be followed in the order noted.

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:
  - Dover Fire Department at 508-785-1130,
  - Dover Board of Health at 508-785-0032 ext. 232,
  - Dover Conservation Commission at 508-785-0032,
  - Mass. Department of Environmental Protection (DEP) Northeast Region at (978)-694-3200 (address is 150 Presidential Way Woburn, MA 01801), 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



TROUT BROOK ROAD



730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)

SHEET 1 OF 1

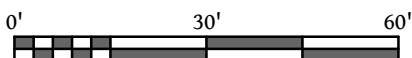


**LEGACY**  
ENGINEERING

DOVER HOMES  
LOT 1A  
O&M  
PLAN OF LAND IN  
DOVER, MA

PLAN DATE: JUNE 7, 2023

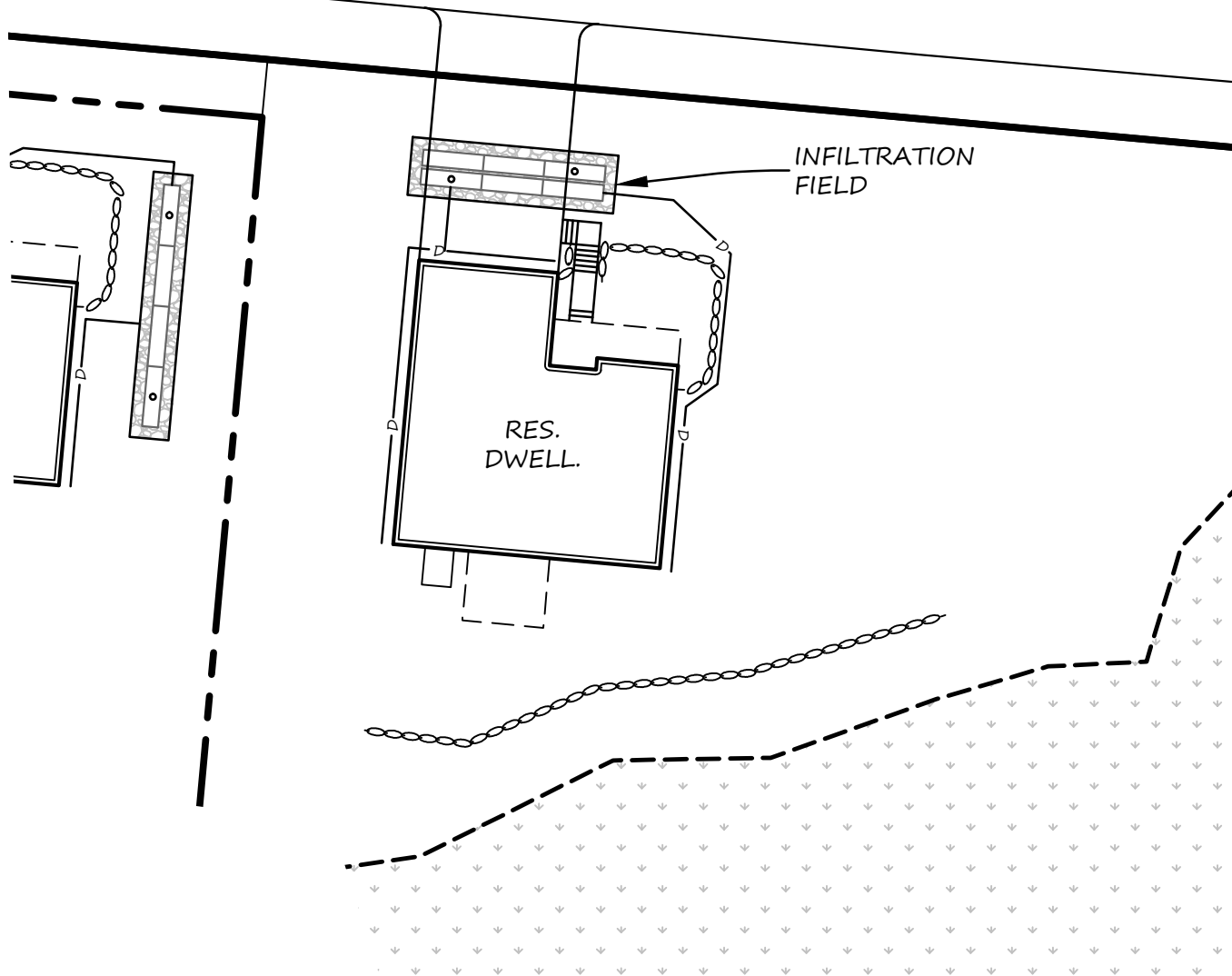
PLAN SCALE: 1"=30'



REVISION	DATE
REV. PER SURVEY	23-11-15
REV. TOWN COM.	24-01-08



TROUT BROOK ROAD



730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)

SHEET 1 OF 1

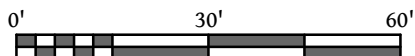


**LEGACY**  
ENGINEERING

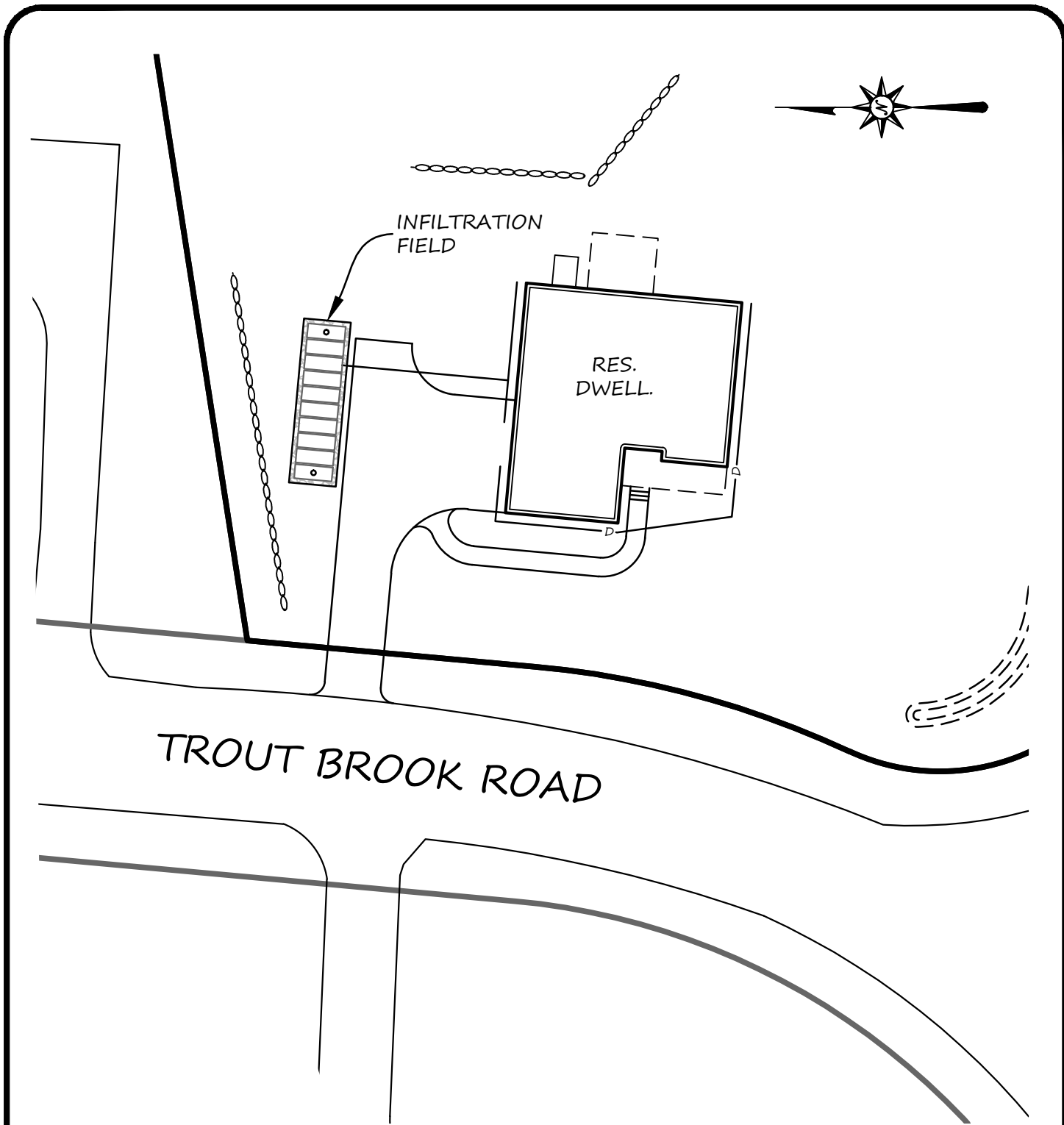
DOVER HOMES  
LOT 2A  
O&M  
PLAN OF LAND IN  
DOVER, MA

PLAN DATE: JUNE 7, 2023

PLAN SCALE: 1"=30'



REVISION	DATE
REV. PER SURVEY	23-11-15
REV. TOWN COM.	24-01-08



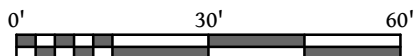
730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)  
SHEET 1 OF 1



**LEGACY**  
ENGINEERING

DOVER HOMES  
LOT 4  
O&M  
PLAN OF LAND IN  
DOVER, MA

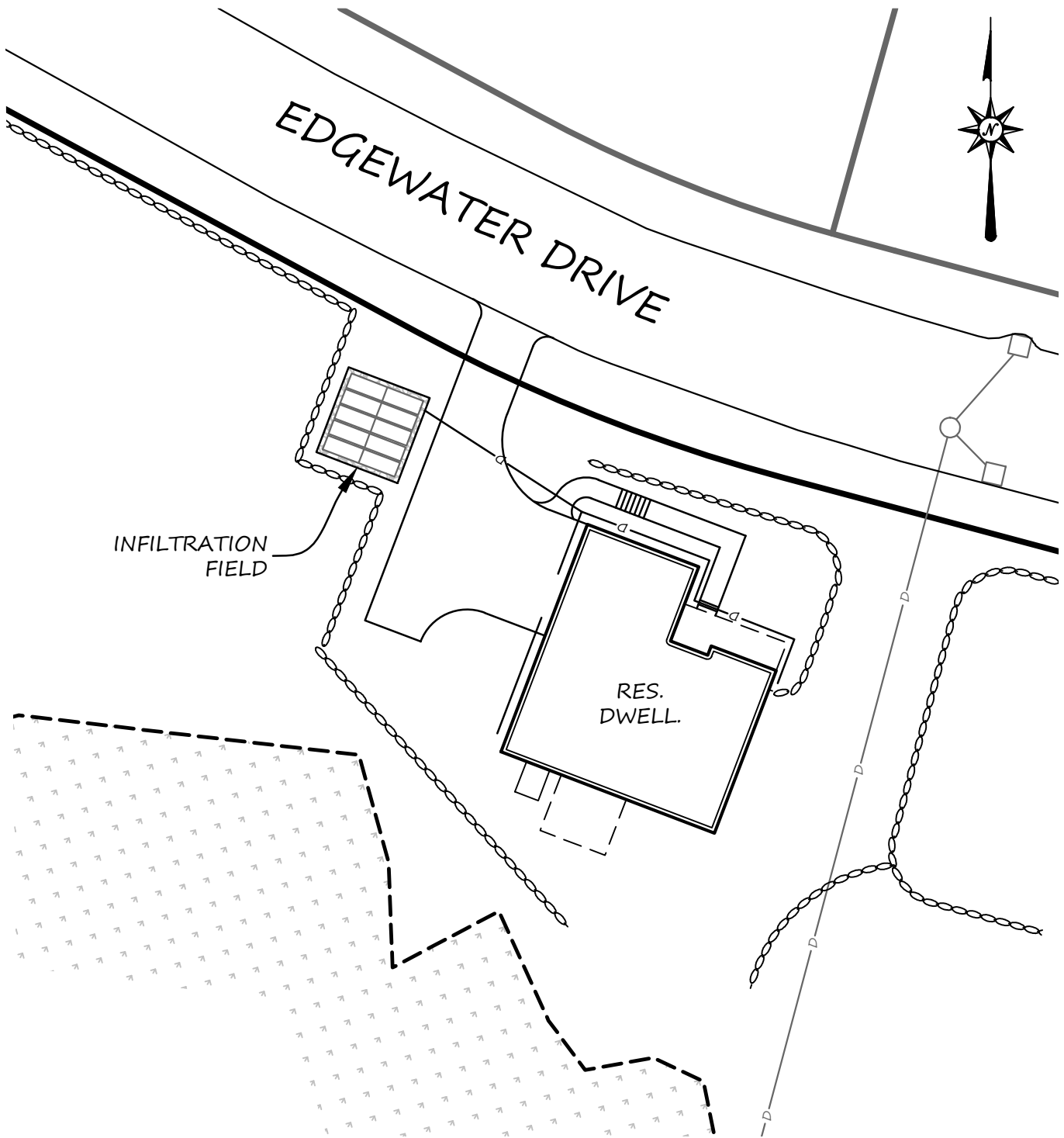
PLAN SCALE: 1"=30'



REVISION	DATE
REV. PER SURVEY	23-11-15
REV. TOWN COM.	24-01-08

PLAN DATE: JUNE 7, 2023





730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)  
SHEET 1 OF 1

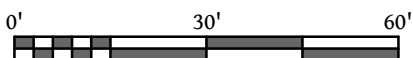


**LEGACY**  
ENGINEERING

DOVER HOMES  
LOT 45  
O&M  
PLAN OF LAND IN  
DOVER, MA

PLAN DATE: JUNE 7, 2023

PLAN SCALE: 1"=30'



REVISION	DATE
REV. PER SURVEY	23-11-15
REV. TOWN COM.	24-01-08

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

## Stormwater System Operations and Maintenance Log

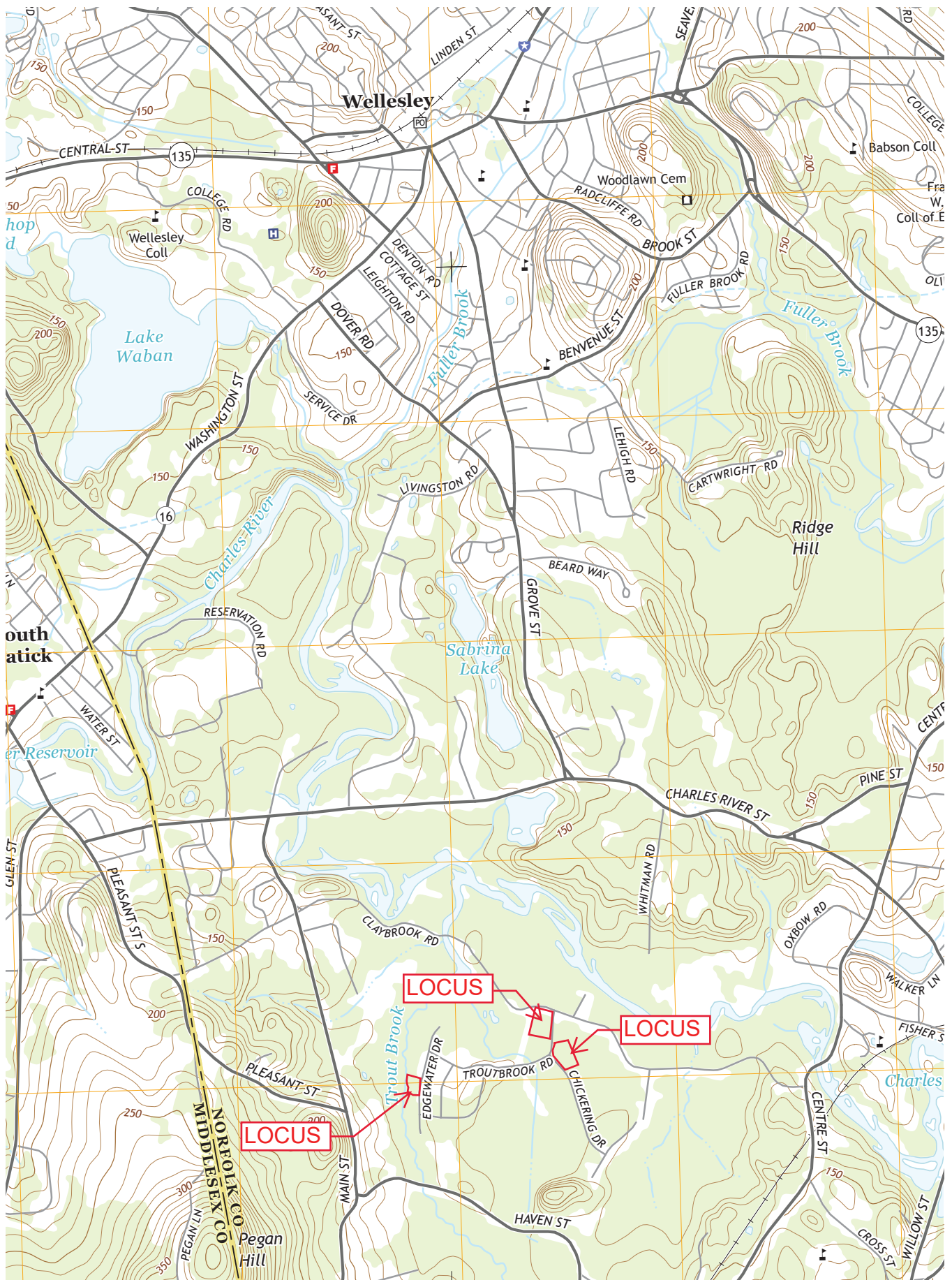
Year \_\_\_\_\_

General Information	
Project Name	Dover Homes
Site Location	Trout Brook Road & Edgewater Drive Dover, MA 02030
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
Underground Infiltration Field			
	1 <sup>st</sup> Annual Inspection		
	2 <sup>nd</sup> Annual inspection		
	System Repl. 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

Dover Homes  
Dover, 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: June 7, 2023

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



**Stormwater Pollution Prevention Plan (SWPPP)**

**For Construction Activities At:**

Dover Homes  
0 Trout Brook Road & Edgewater Drive  
Dover, MA 02030  
508-525-0726

**SWPPP Prepared For:**

[Insert Operator Company or Organization Name](#)

Robert Recchia  
16 Putnam Lane  
Grafton, MA 01519  
508-525-0726  
scott@goddardconsultingllc.com

**SWPPP Prepared By:**

Legacy Engineering, LLC  
730 Main Street, Suite 2C  
Millis, MA 02054  
508-376-8883  
dan@legacy-ce.com

**SWPPP Preparation Date:**

06/07/2023

**Estimated Project Dates:**

**Project Start Date:** [Insert Date](#)

**Project Completion Date:** [Insert Date](#)

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## SECTION 1: CONTACT INFORMATION/RESPONSIBLE PARTIES

### 1.1 Operator(s) / Subcontractor(s)

#### Operator(s):

Insert Company or Organization Name

Robert Recchia

16 Putnam Lane

Grafton, MA 01519

508-525-0726

scott@goddardconsultingllc.com

Insert area of control (if more than one operator at site)

*[Repeat as necessary.]*

#### Subcontractor(s):

To Be Determined Prior to Construction

Insert Name

Insert Address

Insert City, State, Zip Code

Insert Telephone Number

Insert Fax/Email

Insert area of control (if more than one operator at site)

*[Repeat as necessary.]*

#### Emergency 24-Hour Contact:

To Be Determined Prior to Construction

Insert Name

Insert Telephone Number

## 1.2 Stormwater Team

**Stormwater Team**

Name and/or Position, and Contact	Responsibilities	I Have Completed Training Required by CGP Part 6.2	I Have Read the CGP and Understand the Applicable Requirements
Daniel Merrikin, P.E. President 508-376-8883 dan@legacy-ce.com	Design of stormwater controls	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes Date: 3/1/2022
Insert Name of Responsible Person Insert Position Insert Telephone Number Insert Email	Inspections of stormwater controls	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes Date: <a href="#">Click here to enter a date.</a>
Insert Name of Responsible Person Insert Position Insert Telephone Number Insert Email	Installation, maintenance and/or repair of stormwater controls. Taking corrective actions	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes Date: <a href="#">Click here to enter a date.</a>

*[Insert or delete rows as necessary.]*

**Stormwater Team Members Who Conduct Inspections Pursuant to CGP Part 4**

Name and/or Position and Contact	Training(s) Received	Date Training(s) Completed	If Training is a Non-EPA Training, Confirm that it Satisfies the Minimum Elements of CGP Part 6.3.b
<a href="#">Insert Name of Responsible Person</a> <a href="#">Insert Position</a> <a href="#">Insert Telephone Number</a> <a href="#">Insert Email</a>	<a href="#">Insert Title of Training Received</a>	Date: <a href="#">Click here to enter a date.</a>	<input type="checkbox"/> Principles and practices of erosion and sediment control and pollution prevention practices at construction sites <input type="checkbox"/> Proper installation and maintenance of erosion and sediment controls and pollution prevention practices used at construction sites <input type="checkbox"/> Performance of inspections, including the proper completion of required reports and documentation, consistent with the requirements of Part 4
<a href="#">Insert Name of Responsible Person</a> <a href="#">Insert Position</a> <a href="#">Insert Telephone Number</a> <a href="#">Insert Email</a>	<a href="#">Insert Title of Training Received</a>	Date: <a href="#">Click here to enter a date.</a>	<input type="checkbox"/> Principles and practices of erosion and sediment control and pollution prevention practices at construction sites <input type="checkbox"/> Proper installation and maintenance of erosion and sediment controls and pollution prevention practices used at construction sites <input type="checkbox"/> Performance of inspections, including the proper completion of required reports and documentation, consistent with the requirements of Part 4
<a href="#">Insert Name of Responsible Person</a> <a href="#">Insert Position</a> <a href="#">Insert Telephone Number</a> <a href="#">Insert Email</a>	<a href="#">Insert Title of Training Received</a>	Date: <a href="#">Click here to enter a date.</a>	<input type="checkbox"/> Principles and practices of erosion and sediment control and pollution prevention practices at construction sites <input type="checkbox"/> Proper installation and maintenance of erosion and sediment controls and pollution prevention practices used at construction sites <input type="checkbox"/> Performance of inspections, including the proper completion of required reports and documentation, consistent with the requirements of Part 4

*[Insert or delete rows as necessary.]*

## SECTION 2: SITE EVALUATION, ASSESSMENT, AND PLANNING

### 2.1 Project/Site Information

#### Project Name and Address

Project/Site Name: Dover Homes

Street/Location: 0 Trout Brook Road & Edgewater Drive (05-011, 012, 023, & 078)

City: Dover

State: MA

ZIP Code: 02030

County or Similar Government Division: Norfolk

#### Project Latitude/Longitude

Latitude: 42.2606 ° N

Longitude: -71.2864 ° W

Latitude: 42.2595 ° N

Longitude: - 71.2859 ° W

Latitude: 42.2582 ° N

Longitude: - 71.2937 ° W

(decimal degrees)

(decimal degrees)

Latitude/longitude data source: ☒ Map ☐ GPS ☐ Other (please specify):

Horizontal Reference Datum: ☐ NAD 27 ☒ NAD 83 ☐ WGS 84

#### Additional Site Information

Is your site located on Indian country lands, or on a property of religious or cultural significance to an Indian Tribe? ☐ Yes ☒ No

If yes, provide the name of the Indian Tribe associated with the area of Indian country (including the name of Indian reservation if applicable), or if not in Indian country, provide the name of the Indian Tribe associated with the property: Not applicable

### 2.2 Discharge Information

Does your project/site discharge stormwater into a Municipal Separate Storm Sewer System (MS4)? ☒ Yes ☐ No

Are there any waters of the U.S. within 50 feet of your project's earth disturbances? ☐ Yes ☒ No

**For each point of discharge, provide a point of discharge ID (a unique 3-digit ID, e.g., 001, 002), the name of the first receiving water that receives stormwater directly from the point of discharge and/or from the MS4 that the point of discharge discharges to, and the following receiving water information, if applicable:**

Point of Discharge ID	Name of receiving water that receives stormwater discharge:	Is the receiving water impaired (on the CWA 303(d) list)?	If yes, list the pollutants that are causing the impairment:	Has a TMDL been completed for this receiving waterbody?	If yes, list TMDL Name and ID:	Pollutant(s) for which there is a TMDL:	Is this receiving water designated as a Tier 2, Tier 2.5, or Tier 3 water?	If yes, specify which Tier (2, 2.5, or 3)?
[001]	Trout Brook	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
[002]	Charles River	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
[003]	Insert Text Here	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No	[INSERT "Tier 2", "Tier 2.5", or "Tier 3"]
[004]	Insert Text Here	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No	[INSERT "Tier 2", "Tier 2.5", or "Tier 3"]
[005]	Insert Text Here	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No	[INSERT "Tier 2", "Tier 2.5", or "Tier 3"]
[006]	Insert Text Here	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Yes <input type="checkbox"/> No	[INSERT "Tier 2", "Tier 2.5", or "Tier 3"]

*[Include additional rows or delete as necessary.]*



## 2.3 Nature of the Construction Activities

### General Description of Project

Provide a general description of the nature of your construction activities, including the age or dates of past renovations for structures that are undergoing demolition:

Construction of four single-family dwellings located on 4 separate lots on Trout Brook Road and Edgewater Drive, along with all associated driveways, landscaped areas, utilities, and stormwater management facilities.

If you are conducting earth-disturbing activities in response to a public emergency, document the cause of the public emergency (*e.g., mud slides, earthquake, extreme flooding conditions, widespread disruption in essential public services*), information substantiating its occurrence (*e.g., State disaster declaration or similar State or local declaration*), and a description of the construction necessary to reestablish affected public services:

- The work is not related to a public emergency

Business days and hours for the project: Monday through Saturday, 6:00 am to 7:00 pm

### Size of Construction Site

Size of Property	Lot 1A – 1.02 Acres Lot 2A – 1.08 Acres Lot 4 – 1.30 Acres Lot 45 – 1.36 Acres
Total Area Expected to be Disturbed by Construction Activities	Lot 1A – 0.3 Acres Lot 2A – 0.4 Acres Lot 4 – 0.6 Acres Lot 45 – 0.5 Acres
Maximum Area Expected to be Disturbed at Any One Time, Including On-site and Off-site Construction Support Areas	1.8 Acres

*[Repeat as necessary for individual project phases.]*

### Type of Construction Site (check all that apply):

- ☒ Single-Family Residential  
 ☐ Multi-Family Residential  
 ☐ Commercial  
 ☐ Industrial  
☐ Institutional  
 ☐ Highway or Road  
 ☐ Utility  
 ☐ Other \_\_\_\_\_

Will you be discharging dewatering water from your site? ☐ Yes   ☒ No

If yes, will you be discharging dewatering water from a current or former Federal or State remediation site? ☐ Yes   ☒ No

### Pollutant-Generating Activities

List and describe all pollutant-generating activities and indicate for each activity the associated pollutants or pollutant constituents that could be discharged in stormwater from your construction site. Take into account where potential spills and leaks could occur that contribute pollutants to stormwater discharges, and any known hazardous or toxic substances, such as PCBs and asbestos, that will be disturbed during construction.

<b>Pollutant-Generating Activity</b> (e.g., paving operations; concrete, paint, and stucco washout and waste disposal; solid waste storage and disposal; and dewatering operations)	<b>Pollutants or Pollutant Constituents</b> (e.g., sediment, fertilizers, pesticides, paints, caulks, sealants, fluorescent light ballasts, contaminated substrates, solvents, fuels)
Paving operations	Asphalt
Concrete washout	Concrete byproducts
Solid waste storage and disposal	Solid waste, trash, construction debris, etc..

*[Include additional rows or delete as necessary.]*

### Construction Support Activities *(only provide if applicable)*

Describe any construction support activities for the project (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas):

1. Equipment staging yards, including construction equipment (trucks, excavators, rollers, etc..)
2. Material storage areas, including site-related construction materials (pipes, manholes, fittings, etc...) and building related materials (concrete, wood, lumber, trim, siding, steel, roofing materials, etc...), and
3. Earthen materials stockpiles, including items like soil, crushed stone, sand, general fill, topsoil, etc...

Contact information for construction support activity:

To be Determined

Insert Telephone No.

Insert Email

Insert Address And/Or Latitude/Longitude

*[Repeat as necessary.]*

## 2.4 Sequence and Estimated Dates of Construction Activities

### Phase I

Insert General Description of Phase	
Estimated Start Date of Construction Activities for this Phase	Insert Estimated Date
Estimated End Date of Construction Activities for this Phase	Insert Estimated Date
Estimated Date(s) of Application of Stabilization Measures for Areas of the Site Required to be Stabilized	Insert Estimated Date [Add additional dates as necessary]
Estimated Date(s) when Stormwater Controls will be Removed	Insert Estimated Date [Add additional dates as necessary]

### Phase II

Insert General Description of Phase	
Estimated Start Date of Construction Activities for this Phase	Insert Estimated Date
Estimated End Date of Construction Activities for this Phase	Insert Estimated Date
Estimated Date(s) of Application of Stabilization Measures for Areas of the Site Required to be Stabilized	Insert Estimated Date [Add additional dates as necessary]
Estimated Date(s) when Stormwater Controls will be Removed	Insert Estimated Date [Add additional dates as necessary]

[Repeat as needed.]

## 2.5 Authorized Non-Stormwater Discharges

### List of Authorized Non-Stormwater Discharges Present at the Site

Authorized Non-Stormwater Discharge	Will or May Occur at Your Site?
Discharges from emergency fire-fighting activities	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Fire hydrant flushings	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Landscape irrigation	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Water used to wash vehicles and equipment	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Water used to control dust	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Potable water including uncontaminated water line flushings	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
External building washdown (soaps/solvents are not used and external surfaces do not contain hazardous substances)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Pavement wash waters	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Uncontaminated air conditioning or compressor condensate	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Authorized Non-Stormwater Discharge	Will or May Occur at Your Site?
Uncontaminated, non-turbid discharges of ground water or spring water	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Foundation or footing drains	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Uncontaminated construction dewatering water	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

*(Note: You are required to identify the likely locations of these authorized non-stormwater discharges on your site map. See Section 2.6, below, of this SWPPP Template.)*

## 2.6 Site Maps

The project "Site Maps" are comprised of a variety of documents which cumulatively contain the information required by the SWPPP. These documents include the full detailed site or subdivision plans ("site plan") (as applicable) and the stormwater report (if applicable).

## SECTION 3: DOCUMENTATION OF COMPLIANCE WITH OTHER FEDERAL REQUIREMENTS

### 3.1 Endangered Species Protection

#### Eligibility Criterion

Following the process outlined in Appendix D, under which criterion are you eligible for coverage under this permit?

- ☒ **Criterion A:** No ESA-listed species and/or designated critical habitat present in action area.  
Using the process outlined in Appendix D of the CGP, you certify that ESA-listed species and designated critical habitat(s) under the jurisdiction of the USFWS or NMFS are not likely to occur in your site's "action area" as defined in Appendix A of the CGP. *Please Note: NMFS' jurisdiction includes ESA-listed marine and estuarine species that spawn in inland rivers.*
- ☒ Check to confirm you have provided documentation in your SWPPP as required by CGP Appendix D (Note: reliance on State resources is not acceptable; see CGP Appendix D).

**Documentation:** See appendix K.

### 3.2 Historic Property Screening Process

#### Appendix E, Step 1

Do you plan on installing any stormwater controls that require subsurface earth disturbance, including, but not limited to, any of the following stormwater controls at your site? Check all that apply below, and proceed to Appendix E, Step 2.

- ☐ Dike
- ☐ Berm
- ☐ Catch Basin
- ☐ Pond
- ☐ Constructed Site Drainage Feature (e.g., ditch, trench, perimeter drain, swale, etc.)
- ☐ Culvert
- ☐ Channel
- ☒ Other type of ground-disturbing stormwater control: Area drains, underground infiltration fields

(Note: If you will not be installing any subsurface earth-disturbing stormwater controls, no further documentation is required for Section 3.2 of the Template.)

### Appendix E, Step 2

If you answered yes in Step 1, have prior professional cultural resource surveys or other evaluations determined that historic properties do not exist, or have prior disturbances at the site have precluded the existence of historic properties? ☐ YES ☒ NO

- If yes, no further documentation is required for Section 3.2 of the Template and you may provide the prior documentation in your SWPPP.
  - Not applicable.
- If no, proceed to Appendix E, Step 3.

### Appendix E, Step 3

If you answered no in Step 2, have you determined that your installation of subsurface earth-disturbing stormwater controls will have no effect on historic properties? ☒ YES ☐ NO

- If yes, provide documentation of the basis for your determination. A search on the MA Historical Commission website did not return any results for the site.
- If no, proceed to Appendix E, Step 4.

## 3.3 Safe Drinking Water Act Underground Injection Control Requirements

Do you plan to install any of the following controls? Check all that apply below.

- ☐ Infiltration trenches (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)
- ☐ Commercially manufactured pre-cast or pre-built proprietary subsurface detention vaults, chambers, or other devices designed to capture and infiltrate stormwater flow
- ☐ Drywells, seepage pits, or improved sinkholes (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)

Construction-stage erosion controls do not include the items noted above.

## SECTION 4: EROSION AND SEDIMENT CONTROLS AND DEWATERING PRACTICES

### 4.1 Natural Buffers or Equivalent Sediment Controls

#### Buffer Compliance Alternatives

Are there any receiving waters within 50 feet of your project's earth disturbances? ☐ YES ☒ NO

(Note: If no, no further documentation is required for Section 4.1 in the SWPPP Template.  
Continue to Section 4.2.)

### 4.2 Perimeter Controls

#### General

- 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 perimeter erosion controls will provide adequate protection. The ends of the perimeter controls shall extend upslope at a 45-degree angle to prevent stormwater from circumnavigating the edge of the perimeter control. After a storm event, erosion controls are to be extended where evidence of circumventing or undercutting of the perimeter control is found.
- 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.

#### Specific Perimeter Controls

<b>Compost Sock &amp; Orange Snow Fence</b>	
<b>Description:</b> Compost sock & orange snow fence	
<b>Installation</b>	Insert approximate date of installation
<b>Maintenance Requirements</b>	Remove sediment before it has accumulated to one-half of the above-ground height of any perimeter control. After a storm event, if there is evidence of stormwater circumventing or undercutting the perimeter control, extend controls and/or repair undercut areas to fix the problem.
<b>Design Specifications</b>	Refer to details on Site Plan

*[Repeat as needed for individual perimeter controls.]*

### 4.3 Sediment Track-Out

#### General

- Construction vehicles will use designated entry points for each site. Crushed stone or rip-rap entry/construction apron(s) will be installed and properly maintained during construction until the site is paved. All construction access will be via the construction entrances noted on the Site Plan. At construction entrances and in their general vicinity, existing roads will be kept clean and swept as needed to minimize the tracking of soils and dust from the site.

#### Specific Track-Out Controls

<b>Construction Entrance</b>	
<b>Description:</b> Crushed stone or rip-rap construction entrance	
<b>Installation</b>	Insert approximate date of installation
<b>Maintenance Requirements</b>	Where sediment has been tracked-out from your site onto paved roads, sidewalks, or other paved areas outside of your site, remove the deposited sediment by the end of the same business day in which the track-out occurs or by the end of the next business day if track-out occurs on a non-business day. Remove the track-out by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. You are prohibited from hosing or sweeping tracked-out sediment into any constructed or natural site drainage feature, storm drain inlet, or receiving water.

<b>Construction Entrance</b>	
<b>Design Specifications</b>	Refer to details on Site Plan

*[Repeat as needed for individual track-out controls.]*

#### **4.4 Stockpiles or Land Clearing Debris Piles Comprised of Sediment or Soil**

##### **General**

- Soil stockpiles to be left in place more than 24 hours shall be surrounded with a line of compost sock 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 temporary stabilization provisions of this plan. Dust control measures shall be implemented to prevent wind erosion of the stockpiles.

##### **Specific Stockpile Controls**

<b>Stockpile Perimeter Controls</b>	
<b>Description:</b> Compost sock around stockpile area	
<b>Installation</b>	As Needed
<b>Maintenance Requirements</b>	Secure stockpiles to prevent erosion during rainfall events that may impact wetland resource areas. You are prohibited from hosing down or sweeping soil or sediment accumulated on pavement or other impervious surfaces into any constructed or natural site drainage feature, storm drain inlet, or receiving water.
<b>Design Specifications</b>	Refer to details on Site Plan

*[Repeat as needed for individual stockpile controls.]*

#### **4.5 Minimize Dust**

##### **General**

- 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.

##### **Specific Dust Controls**

<b>Water Application</b>	
<b>Description:</b> Use of a water truck to spray down dry areas of disturbed ground to prevent dust generation.	
<b>Installation</b>	As Needed
<b>Maintenance Requirements</b>	Apply as needed to prevent dust generation
<b>Design Specifications</b>	Water truck on-site

*[Repeat as needed for individual dust controls.]*

#### **4.6 Minimize Steep Slope Disturbances**



### General

- 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.

### Specific Steep Slope Controls

Erosion Control Blankets	
<b>Description:</b> Installation of erosion control blankets	
<b>Installation</b>	As Needed
<b>Maintenance Requirements</b>	Replace or reinforce as needed to prevent erosion.
<b>Design Specifications</b>	New England Wetland Plants, Inc. ECS-2B or equal

Hydroseed	
<b>Description:</b> Hydroseed with tackifier	
<b>Installation</b>	<a href="#">Insert approximate date of installation</a>
<b>Maintenance Requirements</b>	Ensure vegetation growth and supplement with additional hydroseed as needed.
<b>Design Specifications</b>	Slope control mix

*[Repeat as needed for individual steep slope controls.]*

## 4.7 Topsoil

### General

- 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.

### Specific Topsoil Controls

Preserve Topsoil	
<b>Description:</b> Stockpile all topsoil from work areas and reuse on site or truck off-site for use on other sites.	
<b>Installation</b>	As Needed
<b>Maintenance Requirements</b>	None
<b>Design Specifications</b>	None

*[Repeat as needed for individual topsoil controls.]*

## 4.8 Soil Compaction

### General

- 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.

### Specific Soil Compaction Controls

Access Restrictions	
<b>Description:</b> Prevent access by vehicles to areas that will be vegetated or used for stormwater infiltration once rough grading is complete.	
<b>Installation</b>	Various
<b>Maintenance Requirements</b>	Prevent vehicular access to affected areas
<b>Design Specifications</b>	None

Soil Conditioning	
<b>Description:</b> 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.	
<b>Installation</b>	<a href="#">Insert approximate date of installation</a>
<b>Maintenance Requirements</b>	Once conditioned, prevent re-compaction by excluding vehicular access
<b>Design Specifications</b>	None

*[Repeat as needed for individual soil compaction controls.]*

## 4.9 Storm Drain Inlets

### General

- 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.

### Specific Storm Drain Inlet Controls

Silt Sack	
<b>Description:</b> Install silt socks in downstream catch basin grates	
<b>Installation</b>	<a href="#">Insert approximate date of installation</a>
<b>Maintenance Requirements</b>	Clean, or remove and replace, the inlet protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection measure, remove the deposited sediment by the end of the same business day in which it is found or by the end of the following business day if removal by the same business day is not feasible.
<b>Design Specifications</b>	Siltsack or equal

*[Repeat as needed for individual storm drain inlet controls.]*

## 4.10 Constructed Site Drainage Feature

### General

- Where appropriate, temporary sediment traps will be installed at stormwater collection points. Each trap will include a rip-rap outlet apron to prevent discharge erosion.

### Specific Constructed Site Drainage Features

Temporary Sediment Trap	
<b>Description:</b> Where shown on the site plan or where determined appropriate in the field, provide temporary sediment traps to collect and control construction-stage stormwater runoff.	
<b>Installation</b>	<a href="#">Insert approximate date of installation</a>
<b>Maintenance Requirements</b>	Periodically inspect and remove accumulated sediments as needed to prevent the discharge of sediment from the traps. Remove accumulated sediment to maintain at least one-half of the design capacity and conduct all other appropriate maintenance to ensure the basin or impoundment remains in effective operating condition
<b>Design Specifications</b>	Refer to Site Plan

*[Repeat as needed for individual constructed site drainage features.]*

### 4.11 Sediment Basins or Similar Impoundments

#### General

- Where appropriate, temporary sediment traps will be installed at stormwater collection points. Each trap will include a rip-rap outlet apron to prevent discharge erosion.

#### Specific Sediment Basin Controls

Temporary Sediment Trap	
<b>Description:</b> Where shown on the site plan or where determined appropriate in the field, provide temporary sediment traps to collect and control construction-stage stormwater runoff.	
<b>Installation</b>	<a href="#">Insert approximate date of installation</a>
<b>Maintenance Requirements</b>	Periodically inspect and remove accumulated sediments as needed to prevent the discharge of sediment from the traps. Remove accumulated sediment to maintain at least one-half of the design capacity and conduct all other appropriate maintenance to ensure the basin or impoundment remains in effective operating condition
<b>Design Specifications</b>	Refer to Site Plan

*[Repeat as needed for individual sediment basin controls.]*

### 4.12 Chemical Treatment

#### Soil Types

List all the soil types including soil types expected to be exposed during construction in areas of the project that will drain to chemical treatment systems and those expected to be found in fill material:

- Not applicable. No chemical treatment expected.

#### Treatment Chemicals

List all treatment chemicals that will be used at the site and explain why these chemicals are suited to the soil characteristics:

- Not applicable

Describe the dosage of all treatment chemicals you will use at the site or the methodology you will use to determine dosage:

- Not applicable

Provide information from any applicable Safety Data Sheets (SDS):

- Not applicable

Describe how each of the chemicals will be stored consistent with CGP Part 2.2.13c:

- Not applicable

Include references to applicable State or local requirements affecting the use of treatment chemicals, and copies of applicable manufacturer's specifications regarding the use of your specific treatment chemicals and/or chemical treatment systems:

- Not applicable

#### **Special Controls for Cationic Treatment Chemicals** (if applicable)

If the applicable EPA Regional Office authorized you to use cationic treatment chemicals, include the official EPA authorization letter or other communication, and identify the specific controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will not lead to a discharge that does not meet water quality standards:

- Not applicable

#### **Schematic Drawings of Stormwater Controls/Chemical Treatment Systems**

Provide schematic drawings of any chemically-enhanced stormwater controls or chemical treatment systems to be used for application of treatment chemicals:

- Not applicable

#### **Training**

Describe the training that personnel who handle and apply chemicals have received prior to permit coverage, or will receive prior to the use of treatment chemicals:

- Not applicable

### **4.13 Dewatering Practices**

#### **General**

- Dewatering is not expected to be needed. However, should dewatering be required, it will be pumped into a temporary dewatering pit or designated dewatering area to prevent any discharge of dewatering water to receiving waters. Should the discharge of dewatering waters to receiving waters be required, the requirements of section 2.4 and 3.0 of the CGP shall be adhered to, including required testing and reporting.

#### **Specific Dewatering Practices**

<b>Temporary Dewatering Pit</b>	
<b>Description:</b> Construction of temporary dewatering pit of suitable size and volume to contain anticipated dewatering volume. The pit can be excavated or can be created by the installation of earthen berms to create a containment area.	
<b>Installation</b>	Insert approximate date of installation
<b>Maintenance Requirements</b>	Maintain volume of temporary area as needed to contain discharge volume. For backwash water, either haul it away for disposal or return it to the beginning of the treatment process; replace and clean the filter media used in dewatering devices when the pressure differential equals or exceeds the manufacturer's specifications.
<b>Design Specifications</b>	None

[Repeat as needed for individual dewatering practices.]

#### 4.14 Other Stormwater Controls

##### General

- None. Not applicable.

#### 4.15 Site Stabilization

##### Total Amount of Land Disturbance Occurring at Any One Time

- ☒ Five Acres or less  
☐ More than Five Acres

**Use this template box if you are not located in an arid, semi-arid, or drought-stricken area and are not discharging to a sediment- or nutrient-impaired water or Tier 2, Tier 2.5, or Tier 3 water.**

Temporary Vegetative Site Stabilization	
<input checked="" type="checkbox"/> Vegetative <input type="checkbox"/> Non-Vegetative <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	
<b>Description:</b> <ul style="list-style-type: none"> <li>▪ 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.</li> <li>▪ For disturbed areas less than 5 acres, initiate within 14 days of completion of work and complete stabilization within 14 days of the initiation of stabilization measures.</li> </ul>	
<b>Installation</b>	Insert approximate date of installation
<b>Completion</b>	Insert approximate completion date
<b>Maintenance Requirements</b>	Water periodically as needed to maintain vegetative cover
<b>Design Specifications</b>	Native grass seed mixture

Temporary Non-Vegetative Site Stabilization	
<input type="checkbox"/> Vegetative <input checked="" type="checkbox"/> Non-Vegetative <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	
<b>Description:</b> <ul style="list-style-type: none"> <li>▪ Apply erosion control blankets, mulch, straw or stump grindings to disturbed areas.</li> <li>▪ For disturbed areas less than 5 acres, initiate within 14 days of completion of work and complete stabilization within 14 days of the initiation of stabilization measures.</li> </ul>	
<b>Installation</b>	Insert approximate date of installation
<b>Completion</b>	Insert approximate completion date

Temporary Non-Vegetative Site Stabilization	
<b>Maintenance Requirements</b>	Maintain to ensure effective stabilization control
<b>Design Specifications</b>	Wood mulch, erosion control blankets, straw, and/or stump grindings.

Final Site Stabilization	
<input checked="" type="checkbox"/> Vegetative <input checked="" type="checkbox"/> Non-Vegetative <input type="checkbox"/> Temporary <input checked="" type="checkbox"/> Permanent	
<b>Description:</b> <ul style="list-style-type: none"> <li>Final site stabilization per the site plan including lawn and landscape areas, pavement, walkways and other final site features.</li> <li>For disturbed areas less than 5 acres, initiate within 14 days of completion of work and complete stabilization within 14 days of the initiation of stabilization measures.</li> </ul>	
<b>Installation</b>	Insert approximate date of installation
<b>Completion</b>	Insert approximate completion date
<b>Maintenance Requirements</b>	None
<b>Design Specifications</b>	Refer to site plan

[Repeat as needed for additional stabilization practices.]

**Use this template box if unforeseen circumstances have delayed the initiation and/or completion of vegetative stabilization.** Note: You will not be able to include this information in your initial SWPPP. If you are affected by circumstances such as those described in CGP Part 2.2.14.b.ii, you will need to modify your SWPPP to include this information.

Insert name of site stabilization practice	
<input type="checkbox"/> Vegetative <input type="checkbox"/> Non-Vegetative <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent	
<b>Description:</b> <ul style="list-style-type: none"> <li>Insert description of stabilization practice to be installed</li> <li>Note how design will meet requirements of Part 2.2.14.b.ii</li> </ul>	
<b>Justification</b>	Insert description of circumstances that prevent you from meeting the deadlines required in CGP CGP Parts 2.2.14.a
<b>Installation and completion schedule</b>	<b>Vegetative Measures:</b> Describe the schedule you will follow for initiating and completing vegetative stabilization <ul style="list-style-type: none"> <li>Approximate installation date: Insert approximate date</li> <li>Approximate completion date: Insert the approximate date</li> </ul>
	<b>Non-Vegetative Measures:</b> (Must be completed within 14 days of the cessation of construction if disturbing 5 acres or less; within 7 days if disturbing more than 5 acres) <ul style="list-style-type: none"> <li>Approximate installation date: Insert the approximate date</li> <li>Approximate completion date: Insert the approximate date</li> </ul>
<b>Maintenance Requirements</b>	Insert maintenance requirements for the stabilization practice

Insert name of site stabilization practice	
Design Specifications	Include copies of design specifications here

*[Repeat as needed for additional stabilization practices.]*

## SECTION 5: POLLUTION PREVENTION CONTROLS

### 5.1 Potential Sources of Pollution

#### Construction Site Pollutants

Insert text or use table below: To be determined at the time of construction

<b>Pollutant-Generating Activity</b>	<b>Pollutants or Pollutant Constituents</b> (That could be discharged if exposed to stormwater)	<b>Location on Site</b> (Or reference SWPPP site map where this is shown)

*[Include additional rows as necessary.]*



## **5.2 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:
  - Dover Fire Department at 508-785-1130,
  - Dover Board of Health at 508-785-0032 ext. 232,
  - Dover Conservation Commission at 508-785-0032,
  - Mass. Department of Environmental Protection (DEP) Northeast Region at (978)-694-3200 (address is 150 Presidential Way Woburn, MA 01801), 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.

## **5.3 Fueling and Maintenance of Equipment or Vehicles**

### **General**

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.

#### **5.4 Washing of Equipment and Vehicles**

##### **General**

- Vehicle or equipment washing is not allowed on-site.

#### **5.5 Storage, Handling, and Disposal of Building Products, Materials, and Wastes**

##### **5.5.1 Building Materials and Building Products**

(Note: Examples include asphalt sealants, copper flashing, roofing materials, adhesives, concrete admixtures, and gravel and mulch stockpiles.)

##### **General**

- 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 that may discharge pollutants if in contact with water 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.

##### **5.5.2 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials**

##### **General**

- 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.

##### **5.5.3 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals**

##### **General**

- Petroleum products may only be stored on-site in the limited quantities necessary for the ongoing work.
- All chemical containers must be watertight and closed, sealed, and secured when not in use.
- Outside storage must use a containment pallet or similar, to capture small leaks and spills.
- A spill kit must be readily available and in good working condition. Personnel must be available to respond immediately in the event of a leak or spill.
- Containers storing chemical with a storage capacity of 55 gallons or more must be stored more than 50 feet from receiving waters, drainage features, or inlets and must be provided with cover.

##### **5.5.4 Hazardous or Toxic Waste**

(Note: Examples include paints, caulks, sealants, fluorescent light ballasts, solvents, petroleum-based products, wood preservatives, additives, curing compounds, and acids.)

#### **General**

- 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.

#### **5.5.5 Construction and Domestic Waste**

(Note: Examples include packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, demolition debris, and other trash or discarded materials.)

#### **General**

- 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.
- Containers with lids shall be sealed at the end of each day. Containers without lids shall be covered with sheeting or a tarp. Cleanup trash and debris on the site at the end of each workday.

#### **5.5.6 Sanitary Waste**

#### **General**

- 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. The portable toilet shall be located away from receiving waters, storm drains, and constructed or natural site drainage features. Portable toilets will be positioned so that they are secure and will not be tipped or knocked over.

#### **5.6 Washing of Applicators and Containers used for Stucco, Paint, Concrete, Form Release Oils, Cutting Compounds, or Other Materials**

#### **General**

- 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.

- No liquid waste shall be allowed to enter drainage features and receiving waters or be allowed to infiltrate into the ground.
- 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.

### 5.7 Application of Fertilizers

#### General

- 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 constructed or natural site drainage features.
- Fertilizers are not to be applied within buffer zones or within the Zone II for drinking water.

### 5.8 Other Pollution Prevention Practices

#### Instructions:

Describe any additional pollution prevention practices that do not fit into the above categories.

#### General

- [Insert general description of the problem this control is designed to address](#)

#### Specific Pollution Prevention Practices

<a href="#">Insert name of pollution prevention practice</a>	
<b>Description:</b> <a href="#">Insert description of practice to be implemented</a>	
<b>Implementation</b>	<a href="#">Insert approximate date of implementation</a>
<b>Maintenance Requirements</b>	<a href="#">Insert maintenance requirements for the pollution prevention practice</a>
<b>Design Specifications</b>	<a href="#">If applicable include copies of design specifications here</a>

*[Repeat as needed.]*

## SECTION 6: INSPECTION, MAINTENANCE, AND CORRECTIVE ACTION

### 6.1 Inspection Personnel and Procedures

#### Site Inspection Schedule

Select the inspection frequency(ies) that applies, based on CGP Parts 4.2, 4.3, or 4.4

*(Note: you may be subject to different inspection frequencies in different areas of the site. Check all that apply and indicate which portion(s) of the site it applies to.)*

<b>Standard Frequency: FOR LOTS 1A, 2A, &amp; 4</b>
<div style="margin-bottom: 10px;"> <input type="checkbox"/> Every 7 calendar days         </div> <div> <input checked="" type="checkbox"/> Every 14 calendar days and within 24 hours of either:           <ul style="list-style-type: none"> <li>▪ A storm event that produces 0.25 inches or more of rain within a 24-hour period (including when there are multiple, smaller storms that alone produce less than 0.25 inches but together produce 0.25 inches or more in 24 hours), or</li> <li>▪ A storm event that produces 0.25 inches or more of rain within a 24-hour period on the first day of a storm and continues to produce 0.25 inches or more of rain on subsequent days (you conduct an inspection within 24 hours of the first day of the storm and within 24 hours after the last day of the storm that produces 0.25 inches or more of rain (i.e., only two inspections would be required for such a storm event)), or</li> <li>▪ A discharge caused by snowmelt from a storm event that produces 3.25 inches or more of snow within a 24-hour period.</li> </ul> </div>
<b>Increased Frequency (if applicable): FOR LOT 45</b>
<p><b>For areas of sites discharging to sediment or nutrient-impaired waters or to waters designated as Tier 2, Tier 2.5, or Tier 3</b></p> <div style="margin-bottom: 10px;"> <input type="checkbox"/> Every 7 days and within 24 hours of either:         </div> <div> <ul style="list-style-type: none"> <li>▪ A storm event that produces 0.25 inches or more of rain within a 24-hour period, or</li> <li>▪ A discharge caused by snowmelt from a storm event that produces 3.25 inches or more of snow within a 24-hour period.</li> </ul> </div>
<b>Reduced Frequency (if applicable)</b>
<p><b>For stabilized areas</b></p> <div style="margin-bottom: 10px;"> <input type="checkbox"/> Twice during first month, no more than 14 calendar days apart; then once per month after first month until permit coverage is terminated consistent with Part 9 in any area of your site where the stabilization steps in 2.2.14.a have been completed.         </div> <div> <ul style="list-style-type: none"> <li>▪ Specify locations where stabilization steps have been completed</li> <li>▪ Insert date that they were completed</li> </ul> <p><i>(Note: It is likely that you will not be able to include this in your initial SWPPP. If you qualify for this reduction (see CGP Part 4.4.1), you will need to modify your SWPPP to include this information. If construction activity resumes in this portion of the site at a later date, the inspection frequency immediately increases to that required in Parts 4.2 and 4.3, as applicable.)</i></p> </div>

**For frozen conditions where construction activities are being conducted**

- ☐ Once per month

Insert beginning and ending dates of frozen conditions on your site:

- Beginning date of frozen conditions: [Insert approximate date](#)
- Ending date of frozen conditions: [Insert approximate date](#)

**For frozen conditions where construction activities are suspended**

- ☐ Inspections are temporarily suspended

Insert beginning and ending dates of frozen conditions on your site:

- Beginning date of frozen conditions: [Insert approximate date](#)
- Ending date of frozen conditions: [Insert approximate date](#)

**Dewatering Inspection Schedule**

Select the inspection frequency that applies based on CGP Part 4.3.2

**Dewatering Inspection**

- ☐ Once per day on which the discharge of dewatering water occurs.

**Rain Gauge Location (if applicable)**

[Specify location\(s\) of rain gauge to be used for determining whether a rain event of 0.25 inches or greater has occurred \(only applies to inspections conducted for Part 4.2.2, 4.3, or 4.4.2\)](#)

**Inspection Report Forms**

Insert a copy of any inspection report forms you will use here or in Appendix D of this SWPPP template

(Note: EPA has developed a sample inspection form that CGP operators can use. The form is available at <https://www.epa.gov/npdes/stormwater-discharges-construction-activities#resources>)

## 6.2 Corrective Action

### Personnel Responsible for Corrective Actions

Insert names of personnel or types of personnel responsible for corrective actions

### Corrective Action Logs

See Appendix E

(Note: EPA has developed a sample corrective action log that CGP operators can use. The form is available at <https://www.epa.gov/npdes/stormwater-discharges-construction-activities#resources>)

## 6.3 Delegation of Authority

### Instructions:

- Identify the individual(s) or positions within the company who have been delegated authority to sign inspection reports.
- Attach a copy of the signed delegation of authority (see example in Appendix J of this SWPPP Template.)
- For more on this topic, see Appendix G, Subsection 11 of EPA's CGP.

### Duly Authorized Representative(s) or Position(s):

Insert Company or Organization Name

Robert Recchia

Insert Position

16 Putnam Lane

Grafton, MA 01519

508-525-0726

scott@goddardconsultingllc.com

## SECTION 7: TURBIDITY BENCHMARK MONITORING FOR DEWATERING DISCHARGES

### Instructions (see CGP Part 3.3 and 7.2.8):

- If you are required to comply with the Part 3.3 turbidity benchmark monitoring requirements, describe the procedures you will follow to:
  - ✓ Collect and evaluate samples,
  - ✓ Report results to EPA and keep records of monitoring information, and
  - ✓ Take corrective action when necessary.
- Include the specific type of turbidity meter you will use for monitoring, as well as any manuals or manufacturer instructions on how to operate and calibrate the meter.
- Describe any coordinating arrangement you may have with any other permitted operators on the same site with respect to compliance with the turbidity monitoring requirements, including which parties are tasked with specific responsibilities.
- If EPA has approved of an alternate turbidity benchmark pursuant to Part 3.3.2.b, include any data and other documentation you relied on to request use of the specific alternative benchmark.

### Procedures:

<b>Collecting and evaluating samples</b>	Describe how you will collect and evaluate samples
<b>Reporting results and keeping monitoring information records</b>	Describe how you will report results to EPA and keep monitoring information records
<b>Taking corrective action when necessary</b>	Describe how you will take corrective action when necessary

### Turbidity Meter:

<b>Type of turbidity meter</b>	Insert the type of turbidity meter
--------------------------------	------------------------------------

### Turbidity meter manuals and manufacturer instructions

Insert a copy of any manuals and manufacturer instructions in Appendix N of this SWPPP Template.

### Coordinating Arrangements for Turbidity Monitoring (if applicable):

<b>Permitted operator name</b>	Insert operator name
<b>Permitted operator NPDES ID</b>	Insert operator NPDES ID
<b>Coordinating Arrangement</b>	Describe the coordinating arrangement including which parties are tasked with specific responsibilities

[Repeat as necessary.]

### Alternate turbidity benchmark (if applicable):

<b>Alternate turbidity benchmark (NTU)</b>	Insert alternate turbidity benchmark
<b>Data and documentation used to request the alternate benchmark</b>	Insert the data and documentation that was submitted to EPA to request the alternate benchmark



## SECTION 8: CERTIFICATION AND NOTIFICATION

### Instructions (CGP Appendix G, Part G.11.2):

- The following certification statement must be signed and dated by a person who meets the requirements of Appendix G, Part G.11.2.
- This certification must be re-signed in the event of a SWPPP Modification.

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 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.

Name: \_\_\_\_\_ Title: \_\_\_\_\_

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

*[Repeat as needed for multiple construction operators at the site.]*

## **SWPPP APPENDICES**

Attach the following documentation to the SWPPP:

***Appendix A – Site Maps***

***Appendix B – Copy of 2022 CGP***

***Appendix C – NOI and EPA Authorization Email***

***Appendix D – Site Inspection Form and Dewatering Inspection Form (if applicable)***

***Appendix E – Corrective Action Log***

***Appendix F – SWPPP Amendment Log***

***Appendix G – Subcontractor Certifications/Agreements***

***Appendix H – Grading and Stabilization Activities Log***

***Appendix I – Training Documentation***

***Appendix J – Delegation of Authority***

***Appendix K – Endangered Species Documentation***

***Appendix L – Historic Preservation Documentation***

***Appendix M – Rainfall Gauge Recording***

***Appendix N – Turbidity Meter Manual and Manufacturer's Instructions***

## **Appendix A – Site Maps**

An overview site map is included below. For detailed information, refer to the detailed project Site Plan/Subdivision Plan and any associated stormwater report.

**Appendix B – Copy of 2022 CGP**

INSERT COPY OF 2022 CGP

**Appendix C – Copy of NOI and EPA Authorization Email**

INSERT COPY OF NOI AND EPA'S AUTHORIZATION EMAIL PROVIDING COVERAGE UNDER THE CGP

**Appendix D – Copy of Site and Dewatering Inspection Forms**

Not expected to be applicable. Should it become necessary, utilize the EPA template available at <https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates>

## Appendix E – Copy of Corrective Action Log

The following corrective action log form will be used and is available at  
<https://www.epa.gov/npdes/stormwater-discharges-construction-activities#resources>

## 2022 CGP Corrective Action Log

Project Name:

NPDES ID Number:

Section A – Individual Completing this Log	
Name:	Title:
Company Name:	Email:
Address:	Phone Number:
Section B – Details of the Problem (CGP Part 5.4.1.a)	
Complete this section <u>within 24 hours</u> of discovering the condition that triggered corrective action.	
Date problem was first identified:	Time problem was first identified:
What site conditions triggered this corrective action? <i>(Check the box that applies. See instructions for a description of each triggering condition (1 thru 6).)</i> <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5a <input type="checkbox"/> 5b <input type="checkbox"/> 6	
Specific location where problem identified:	
Provide a description of the specific condition that triggered the need for corrective action and the cause (if identifiable):	
Section C – Corrective Action Completion (CGP Part 5.4.1.b)	
Complete this section <u>within 24 hours</u> after completing the corrective action.	
For site condition # 1, 2, 3, 4, or 6 (those not related to a dewatering discharge) confirm that you met the following deadlines (CGP Part 5.2.1):	
<input type="checkbox"/> Immediately took all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events. <b>AND</b>	
<input type="checkbox"/> Completed corrective action by the close of the next business day, unless a new or replacement control, or significant repair, was required. <b>OR</b>	
<input type="checkbox"/> Completed corrective action within seven (7) calendar days from the time of discovery because a new or replacement control, or significant repair, was necessary to complete the installation of the new or modified control or complete the repair. <b>OR</b>	
<input type="checkbox"/> It was infeasible to complete the installation or repair within 7 calendar days from the time of discovery. Provide the following additional information:	

Explain why 7 calendar days was infeasible to complete the installation or repair:			
Provide your schedule for installing the stormwater control and making it operational as soon as feasible after the 7 calendar days:			
<p><b>For site condition # 5a, 5b, or 6 (those related to a dewatering discharge), confirm that you met the following deadlines:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Immediately took all reasonable steps to minimize or prevent the discharge of pollutants until a solution could be implemented, including shutting off the dewatering discharge as soon as possible depending on the severity of the condition taking safety considerations into account.</li> <li><input type="checkbox"/> Determined whether the dewatering controls were operating effectively and whether they were causing the conditions.</li> <li><input type="checkbox"/> Made any necessary adjustments, repairs, or replacements to the dewatering controls to lower the turbidity levels below the benchmark or remove the visible plume or sheen.</li> </ul>			
<b>Describe any modification(s) made as part of corrective action:</b> <i>(Insert additional rows below if applicable)</i>	<b>Date of completion:</b>	<b>SWPPP update necessary?</b>	<b>If yes, date SWPPP was updated:</b>
1.		<input type="checkbox"/> Yes <input type="checkbox"/> No	
2.		<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Section D - Signature and Certification (CGP Part 5.4.2)</b>			
<p>"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 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 contained 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."</p>			
<b>MANDATORY: Signature of Operator or "Duly Authorized Representative:"</b>			
<b>Signature:</b>	<b>Date:</b>		
<b>Printed Name:</b>	<b>Affiliation:</b>		
<b>OPTIONAL: Signature of Contractor or Subcontractor</b>			
<b>Signature:</b>	<b>Date:</b>		
<b>Printed Name:</b>	<b>Affiliation:</b>		



### **General Instructions**

This Corrective Action Log Template is provided to assist you creating a corrective action log that complies with the minimum reporting requirements of Part 5.4 of the EPA's Construction General Permit (CGP). For each triggering condition on your site, you will need to fill out a separate corrective action log.

The entire form must be completed to be compliant with the requirements of the permit. (Note: In Section C, if you do not need the number of rows provided in the corrective action log, you may delete these or cross them off. Alternatively, if you need more space to describe any modifications, you may insert additional rows in the electronic version of this form or use the bottom of the page in the field version of this form.)

If you are covered under a State CGP, this template may be helpful in developing a log that can be used for that permit; however, you will likely need to modify this form to meet the specific requirements of any State-issued permit. If your permitting authority requires you to use a specific corrective action log, you should not use this template.

### **Instructions for Section A**

**Individual completing this form** Enter the name of the person completing this log. Include the person's contact information (title, affiliated company name, address, email, and phone number).

### **Instructions for Section B**

You must complete Section B within 24 hours of discovering the condition that triggered corrective action. (CGP Part 5.4)

#### **When was the problem first discovered?**

Specify the date and time when the triggering condition was first discovered.

#### **What site conditions triggered this corrective action?** (CGP Parts 5.1 and 5.3)

Check the box corresponding to the numbered triggering condition below that applies to your site.

1. A stormwater control needs a significant repair or a new or replacement control is needed, or, in accordance with Part Error! Reference source not found., you find it necessary to repeatedly (i.e., 3 or more times) conduct the same routine maintenance fix to the same control at the same location (unless you document in your inspection report under Part Error! Reference source not found. that the specific reoccurrence of this same problem should still be addressed as a routine maintenance fix under Part Error! Reference source not found.);
2. A stormwater control necessary to comply with the requirements of this permit was never installed, or was installed incorrectly;
3. Your discharges are not meeting applicable water quality standards;
4. A prohibited discharge has occurred (see Part 1.3);
5. During discharge from site dewatering activities:
  - a. The weekly average of your turbidity monitoring results exceeds the 50 NTU benchmark (or alternate benchmark if approved by EPA pursuant to Part **Error! Reference source not found.**); or
  - b. You observe or you are informed by EPA, State, or local authorities of the presence of any of the following at the point of discharge to a receiving water flowing through or immediately adjacent to your site and/or to constructed or natural site drainage features or storm drain inlets:
    - sediment plume
    - suspended solids
    - unusual color
    - presence of odor
    - decreased clarity
    - presence of foam
    - visible sheen on the water surface or visible oily deposits on the bottom or shoreline of the receiving water

6. EPA requires corrective action as a result of permit violations found during an inspection carried out under Part 4.8.

**Provide a description of the problem** (CGP Part 5.4.1.a)

Provide a summary description of the condition you found that triggered corrective action, the cause of the problem (if identifiable), and the specific location where it was found. Be as specific as possible about the location; it is recommended that you refer to a precise point on your site map.

**Instructions for Section C**

You must complete Section C within 24 hours after completing the correction action. (CGP Part 5.4)

**Deadlines for completing corrective action for condition # 1, 2, 3, 4, or 6 (if not relating to a dewatering discharge)** (CGP Part 5.2.1)

Check the box to confirm that you met the deadlines that apply to each triggering condition. You are always required to check the first box (i.e., Immediately took all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events.). Only one of the next three boxes should be checked depending on the situation that applies to this corrective action.

Check the second box if the corrective action for this particular triggering condition does not require a new or replacement control, or a significant repair. These actions must be completed by the close of the next business day from the time of discovery of the condition.

Check the third box if the corrective action for this particular triggering condition requires a new or replacement control, or a significant repair. These actions must be completed by no later than seven calendar days from the time of discovery of the condition.

Check the fourth box if the corrective action for this particular triggering condition requires a new or replacement control, or a significant repair, and if it is infeasible to complete the work within seven calendar days. Additionally, you will need to fill out the table below the checkbox that requires:

1. An explanation as to why it was infeasible to complete the installation or repair within seven calendar days of discovering the condition.
2. Provide the schedule you will adhere to for installing the stormwater control and making it operational as soon as feasible after the seventh day following discovery.

Note: Per Part 5.2.1.c, where these actions result in changes to any of the stormwater controls or procedures documented in your SWPPP, you must modify your SWPPP accordingly within seven calendar days of completing this work.

**Deadlines for completing corrective action for condition # 5a, 5b, or 6 related to a dewatering discharge** (CGP Part 5.2.2)

These deadlines apply to conditions relating to construction dewatering activities. Check the box to confirm that you met the deadlines that apply to each triggering condition. You are required to check all of the boxes in this section to indicate your compliance with the corrective action deadlines.

**List of modification(s) to correct problem**

Provide a list of modifications you completed to correct the problem.

**Date of completion**

Enter the date you completed the modification. The work must be completed by the deadline you indicated above.

**SWPPP update necessary?**

Check "Yes" or "No" to indicate if a SWPPP update is necessary consistent with Part 7.4.1.a in order to reflect changes implemented at your site. If "Yes," then enter the date you updated your SWPPP. The

SWPPP updates must be made within seven calendar days of completing a corrective action. (CGP Part 5.2.1.c)

### **Instructions for Section D**

Each corrective action log entry must be signed and certified following completion of Section D to be considered complete. (CGP Part 5.4.2)

### **Operator or "Duly Authorized Representative" – MANDATORY** (CGP Appendix G Part G.11.2 and CGP Appendix H Section X)

At a minimum, the corrective action log must be signed by either (1) the person who signed the NOI, or (2) a duly authorized representative of that person. The following requirements apply:

If the signatory will be the person who signed the NOI for permit coverage, as a reminder, that person must be one of the following types of individuals:

- *For a corporation:* By a responsible corporate officer. For the purpose of this subsection, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
- *For a partnership or sole proprietorship:* By a general partner or the proprietor, respectively.
- *For a municipality, State, Federal, or other public agency:* By either a principal executive officer or ranking elected official. For purposes of this subsection, a principal executive officer of a Federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA).

If the signatory will be a duly authorized representative, the following requirements must be met:

- The authorization is made in writing by the person who signed the NOI (see above);
- The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and
- The signed and dated written authorization is included in the SWPPP. A copy must be submitted to EPA, if requested.

Sign, date and print your name and affiliation.

### **Contractor or Subcontractor - OPTIONAL**

Where you rely on a contractor or subcontractor to complete this log and the associated corrective action, you should consider requiring the individual(s) to sign and certify each log entry. Note that this does not relieve you, the permitted operator, of the requirement to sign and certify the log as well. If applicable, sign, date, and print your name and affiliation.

### **Recordkeeping**

Logs must be retained for at least 3 years from the date your permit coverage expires or is terminated. (CGP Part 5.4.4)

Keep copies of your signed corrective action log entries at the site or at an easily accessible location so that it can be made immediately available at the time of an on-site inspection or upon request by EPA. (CGP Part 5.4.3) Include a copy of the corrective action log in your SWPPP. (CGP Part 7.2.7.e)

**Note**

While EPA has made every effort to ensure the accuracy of all instructions contained in this template, it is the permit, not this template, that determines the actual obligations of regulated construction stormwater discharges. In the event of a conflict between this template and any corresponding provision of the CGP, you must abide by the requirements in the permit. EPA welcomes comments on this Corrective Action Log Template at any time and will consider those comments in any future revision. You may contact EPA for CGP-related inquiries at [cgp@epa.gov](mailto:cgp@epa.gov)

## Appendix F – SWPPP Amendment Log

**Instructions (see CGP Part 7.4):**

- Create a log here of changes and updates to the SWPPP. You may use the table below to track these modifications.
- SWPPP modifications are required pursuant to CGP Part 7.4.1 in the following circumstances:
  - ✓ Whenever new operators become active in construction activities on your site, or you make changes to your construction plans, stormwater controls, or other activities at your site that are no longer accurately reflected in your SWPPP (this includes changes made in response to corrective actions triggered under CGP Part 5);
  - ✓ To reflect areas on your site map where operational control has been transferred (and the date of transfer) since initiating permit coverage;
  - ✓ If inspections or investigations determine that SWPPP modifications are necessary for compliance with this permit;
  - ✓ Where EPA determines it is necessary to install and/or implement additional controls at your site in order to meet requirements of the permit;
  - ✓ To reflect any revisions to applicable Federal, State, Tribal, or local requirements that affect the stormwater control measures implemented at the site; and
  - ✓ If applicable, if a change in chemical treatment systems or chemically-enhanced stormwater control is made, including use of a different treatment chemical, different dosage rate, or different area of application.

[illegible]

**Appendix G – *Sample* Subcontractor Certifications/Agreements**

SUBCONTRACTOR CERTIFICATION  
STORMWATER POLLUTION PREVENTION PLAN

Project Number: \_\_\_\_\_

Project Title: \_\_\_\_\_

Operator(s): \_\_\_\_\_

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

**I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the practices described in the SWPPP.**

This certification is hereby signed in reference to the above named project:

Company: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Type of construction service to be provided: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Signature: \_\_\_\_\_

Title: \_\_\_\_\_

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

## Appendix H – Grading and Stabilization Activities Log

[illegible]

**Appendix I –Training Documentation**

INSERT DOCUMENTATION CONSISTENT WITH SWPPP TEMPLATE SECTION 1.2 AND CGP PART 7.2.2



## Appendix J – *Sample* Delegation of Authority Form

### Delegation of Authority

I, \_\_\_\_\_ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the EPA's Construction General Permit (CGP), at the \_\_\_\_\_ construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (name of person or position)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (company)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (address)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (city, State, zip)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in Appendix G of EPA's CGP, and that the designee above meets the definition of a "duly authorized representative" as set forth in Appendix G.

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 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.

**Name:** \_\_\_\_\_

**Company:** \_\_\_\_\_

**Title:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

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

**Appendix K – Endangered Species Documentation**

INSERT DOCUMENTATION CONSISTENT WITH SWPPP TEMPLATE SECTION 3.1 AND CGP APPENDIX D

#### **Appendix L – Historic Properties Documentation**

The attached image is from the MACRIS website map. There are no locations of historical significance in or around the site.

### Appendix M – Rainfall Gauge Recording

Not expected to be needed as it is expected that the Operator will rely on a weather station that is representative of the site location, but if this option is elected by the Operator, use the table below to record on-site rainfall gauge readings at the beginning and end of each work day.

Month/Year			Month/Year			Month/Year		
Day	Start time	End time	Day	Start time	End time	Day	Start time	End time
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
9			9			9		
10			10			10		
11			11			11		
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
17			17			17		
18			18			18		
19			19			19		
20			20			20		
21			21			21		
22			22			22		
23			23			23		
24			24			24		
25			25			25		
26			26			26		
27			27			27		
28			28			28		
29			29			29		
30			30			30		
31			31			31		

Example Rainfall Gauge Recording

April 2022			May 2022			June 2022		
Day	7:00 am	4:400 pm	Day	7:00 am	4:00 pm	Day	7:00 am	4:00 pm
1	--	--	1	0.2	0	1	0	0.4
2	--	--	2	0	0	2	0	0
3	0	0	3	0.1	0.3	3	--	--
4	0	0.3	4	0	0	4	--	--
5	0	0	5	0	0	5	0	0

In this example (for only partial months), 0.25-inch rainfall inspections would have been conducted on April 4 and June 1.

**Appendix N – Turbidity Monitoring Sampling Documentation**

INSERT DOCUMENTATION CONSISTENT WITH SWPPP TEMPLATE SECTION 7.2.8 AND CGP PART 3.3.4

# **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 Field

TSS Removal Calculation Worksheet

A	B	C	D	E
BMP1	TSS Removal Rate1	Starting TSS Load*	Amount Removed (B*C)	Remaining Load (C-D)
Infiltration Field (Roof Runoff)	80%	1.00	80%	20%

Total TSS Removal =

80%

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

Project: Dover Homes  
 Prepared By: Legacy Engineering LLC  
 Date: January 8, 2023

\*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.

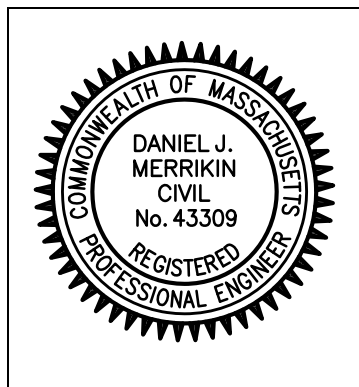
A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

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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.

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<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 propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

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

### Standard 6: Critical Areas

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



# Checklist for Stormwater Report

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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

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## 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

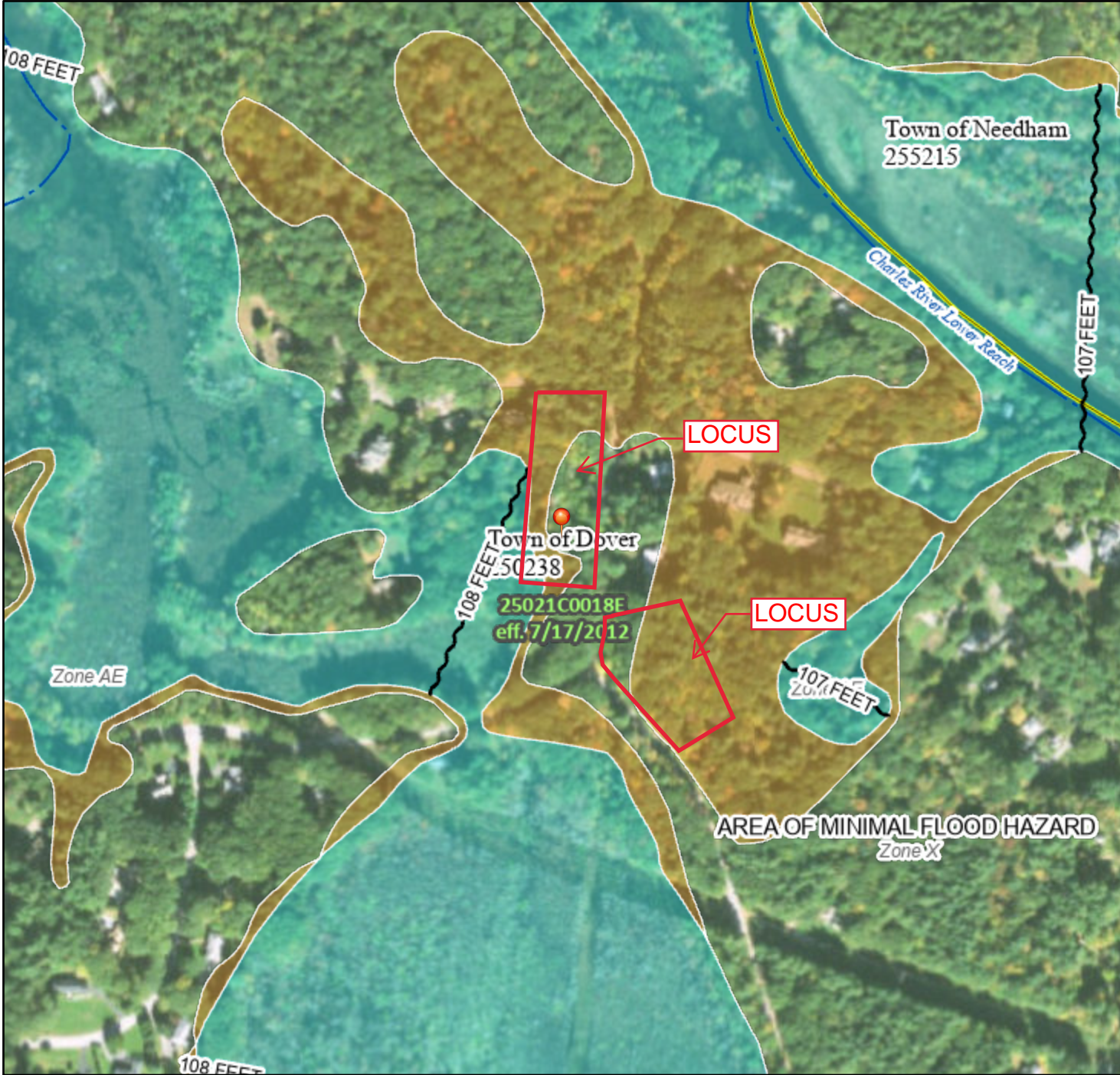
- ☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☒ An Illicit Discharge Compliance Statement is attached;
- ☐ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

## **ATTACHMENT G: FEMA FIRMETTE**

# National Flood Hazard Layer FIRMMette



71°17'30"W 42°15'51"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

## 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 Zone AE, AO, AH, VE, AR
		Regulatory Floodway
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 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
MAP PANELS		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **5/1/2023 at 2:54 PM** 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.

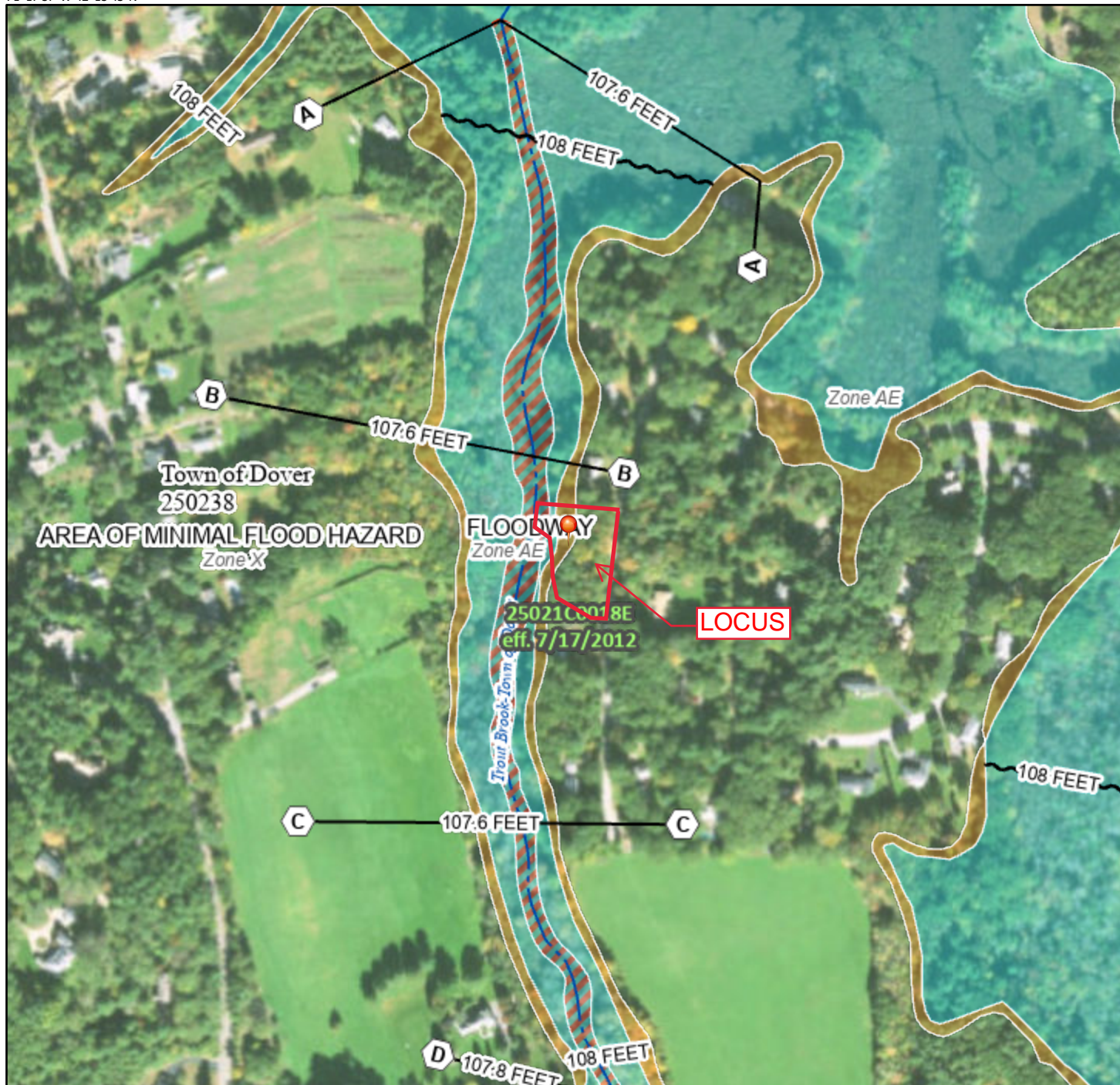
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory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



# National Flood Hazard Layer FIRMeTte



71°17'57"W 42°15'43"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

## 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 Zone AE, AO, AH, VE, AR
		Regulatory Floodway
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
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
OTHER FEATURES		Levee, Dike, or Floodwall
		Cross Sections with 1% Annual Chance Water Surface Elevation
MAP PANELS		Coastal Transect
		Base Flood Elevation Line (BFE)
OTHER FEATURES		Limit of Study
		Jurisdiction Boundary
OTHER FEATURES		Coastal Transect Baseline
		Profile Baseline
OTHER FEATURES		Hydrographic Feature
		Digital Data Available
MAP PANELS		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **5/1/2023 at 2:55 PM** 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: basemap 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.

## **ATTACHMENT H: SOILS DATA**



**Commonwealth of Massachusetts**  
**City/Town of Dover**

# **Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

## **C. On-Site Review** *(minimum of two holes required at every proposed primary and reserve disposal area)*

**Deep Observation Hole Number:** TP1-1 10/5/22 10:12AM Raining, high 50s 42.26097 -71.28645  
Hole # Date Time Weather Latitude Longitude

1. Land Use Woodland, vacant lot Trees and Shrubs None 1%  
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: east side of parcel (closer to Troutbrook Road)

2. Soil Parent Material: coarse-loamy eolian over sandy glaciofluvial deposits Outwash plains Plain  
Landform Position on Landscape (SU, SH, BS, FS, TS, Plain)

3. Distances from: Open Water Body 50+ feet Drainage Way 50+ feet Wetlands 50+ feet  
Property Line 10+ feet Drinking Water Well 100+ feet Other        feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes:        Depth to Weeping in Hole        Depth to Standing Water in Hole

### **Soil Log**

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-48	Fill	NA	NA		Cnc : Dpl:				NA	NA	
48-62	Ab	Sandy Loam	10YR2/1		Cnc : Dpl:				Granular	Friable	
62-80	C1	Medium Sand	5Y7/2	62	Cnc :7.5YR5/8 Dpl:	35%	20%		Single Grain	Loose	
80-110"	C2	Very Fine Loamy Sand	5Y7/1	80	Cnc :7.5YR5/8 Dpl:	25%			Massive	Very Friable	
					Cnc : Dpl:						

Additional Notes:

No Refusal. Alternatively the Fill layer would be deducted from the depth of the Soil Horizons.



**C. On-Site Review** (*minimum of two holes required at every proposed primary and reserve disposal area*)

1. Land Use	Woodland, vacant lot (e.g., woodland, agricultural field, vacant lot, etc.)	Trees and Shrubs Vegetation	None Surface Stones (e.g., cobbles, stones, boulders, etc.)	1% Slope (%)
Description of Location: East side of parcel				

3. Distances from:

Open Water Body	<u>50+</u> feet	Drainage Way	<u>50+</u> feet	Wetlands	<u>50+</u> feet
Property Line	<u>10+</u> feet	Drinking Water Well	<u>100+</u> feet	Other	_____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: \_\_\_\_\_ Depth to Weeping in Hole \_\_\_\_\_ Depth to Standing Water in Hole

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-46	Fill	Loose Gravel, No Structure	NA		Cnc :				NA	NA	
					Dpl:						
46-64	Ab	Sandy Loam	10YR2/1		Cnc :				Granular	Friable	
					Dpl:						
64-98	C1	Medium Sand	5Y7/2	64"	Cnc :7.5YR5/8	35%	20%		Single Grain	Loose	
					Dpl:						
98-115	C2	Sandy Loam	5Y7/1	98"	Cnc :7.5YR5/8	25%			Massive	Very Friable	
					Dpl:						

No Refusal. Alternatively the Fill layer would be deducted from the depth of the Soil Horizons.



Commonwealth of Massachusetts  
City/Town of Dover

## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP4-3      10/6/2022      9:30AM      Partly cloudy, low      42.25955      -71.28573  
Hole #      Date      Time      Weather      Latitude      Longitude

1. Land Use Woodland, vacant lot      Trees and Shrubs      None      1%  
(e.g., woodland, agricultural field, vacant lot, etc.)      Vegetation      Surface Stones (e.g., cobbles, stones, boulders, etc.)      Slope (%)

Description of Location: West side of parcel

2. Soil Parent Material: Hard coarse-silty glaciolacustrine deposits      Depressions      Plain  
Landform      Position on Landscape (SU, SH, BS, FS, TS, Plain)

3. Distances from:      Open Water Body 50+ feet      Drainage Way 50+ feet      Wetlands 50+ feet  
Property Line 10+ feet      Drinking Water Well 100+ feet      Other \_\_\_\_\_ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No      If Yes: ☐ Disturbed Soil/Fill Material      ☐ Weathered/Fractured Rock      ☐ Bedrock

5. Groundwater Observed: ☒ Yes      ☐ No      If yes: 84" Depth to Weeping in Hole      \_\_\_\_\_ Depth to Standing Water in Hole

#### Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-8	A	Sandy Loam	10YR2/1		Cnc : Dpl:				Granular	Friable	
8-20	B	Sandy Loam	10YR5/6		Cnc : Dpl:				Massive	Friable	
20-96	C	Fine Sand	5Y7/1	20"	Cnc :7.5YR5/8 Dpl:	35%			Single Grain	Loose	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:



# Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

**C. On-Site Review** (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP45-3	10/6/2022	12:13 PM	Partly cloudy, low	42.25824	-71.29384
Hole #	Date	Time	70s	Latitude	Longitude
			Weather		

1. Land Use	Woodland, vacant lot (e.g., woodland, agricultural field, vacant lot, etc.)	Trees and Shrubs Vegetation	None Surface Stones (e.g., cobbles, stones, boulders, etc.)	1% Slope (%)
-------------	--	--------------------------------	--	-----------------

Description of Location: East side of parcel

2. Soil Parent Material:	Sandy outwash derived from granite, gneiss, and/or quartzite	Outwash deltas/ terraces/ plains, kame terraces	Plain
		Landform	Position on Landscape (SU, SH, BS, FS, TS, Plain)

3. Distances from:

Open Water Body	<u>50+</u> feet	Drainage Way	<u>50+</u> feet	Wetlands	<u>50+</u> feet
Property Line	<u>10+</u> feet	Drinking Water Well	<u>100+</u> feet	Other	_____ feet

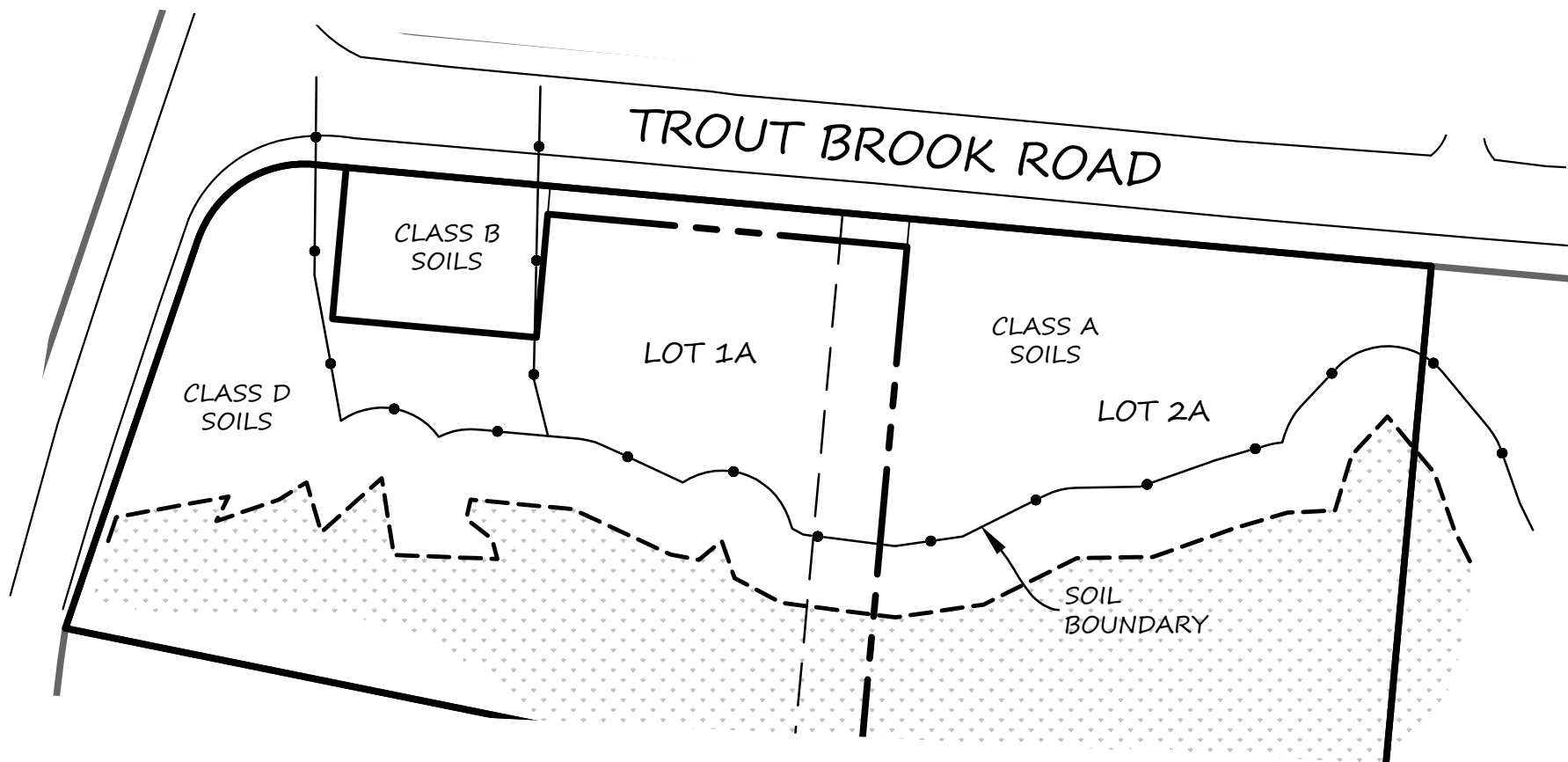
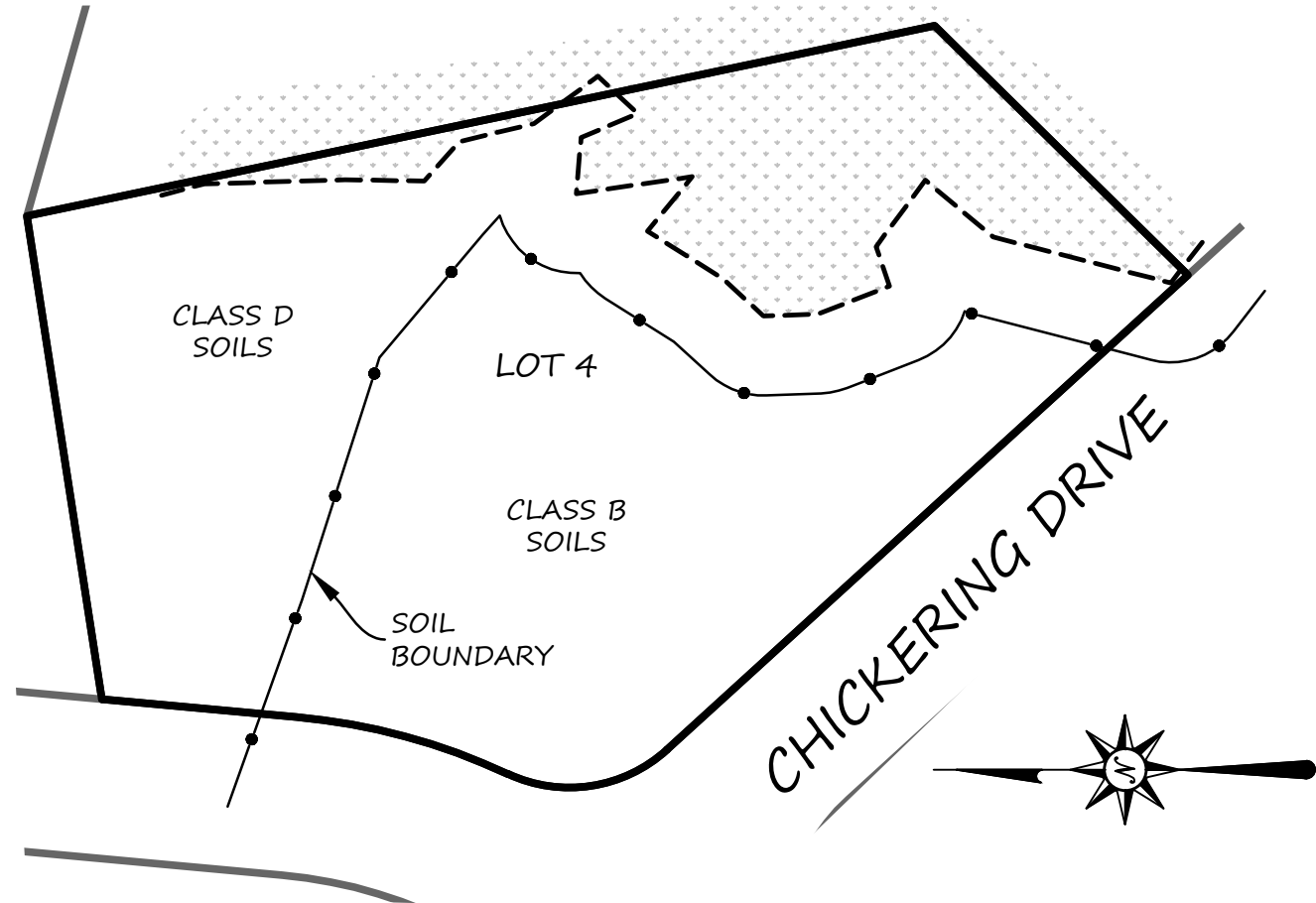
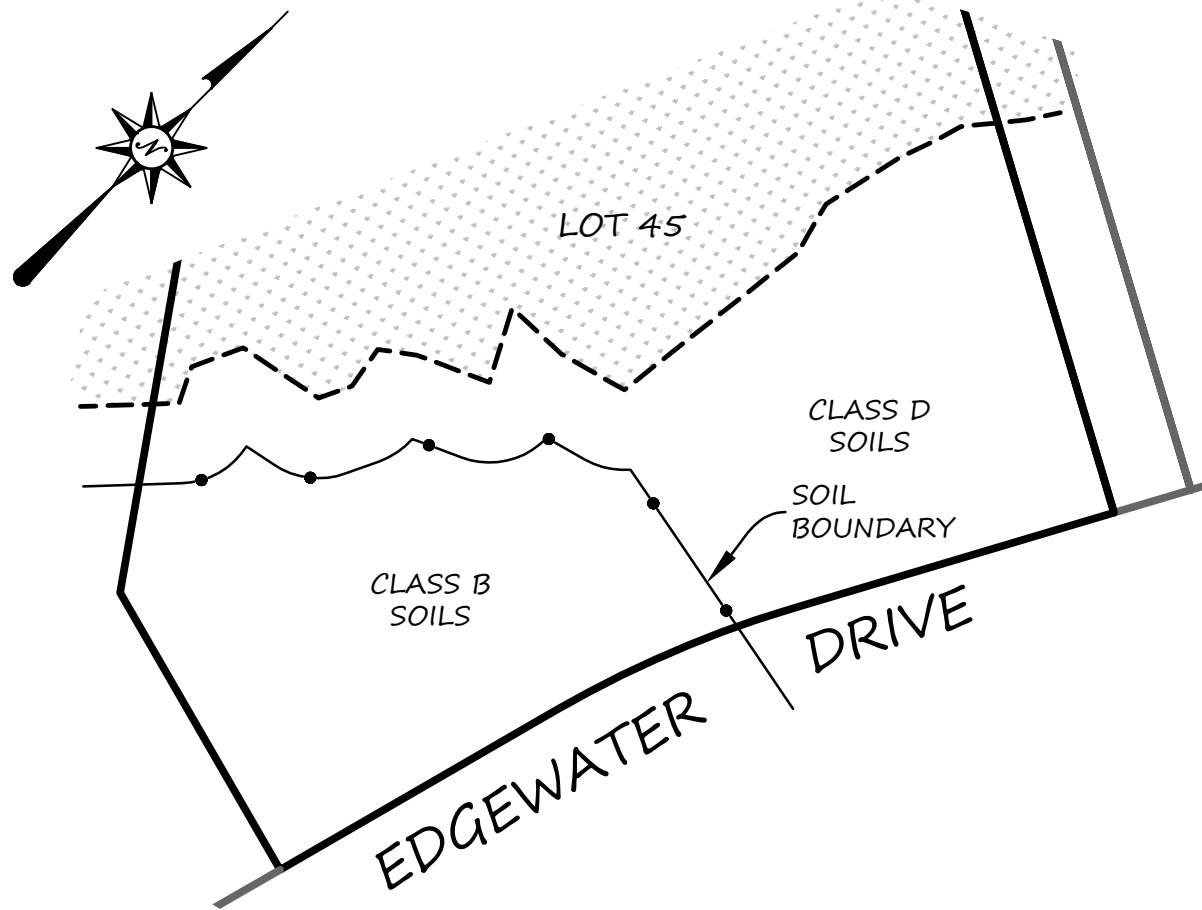
4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: \_\_\_\_\_ Depth to Weeping in Hole \_\_\_\_\_ Depth to Standing Water in Hole

## Soil Log

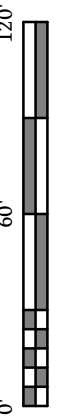
Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	A	Sandy Loam	10YR3/2		Cnc : Dpl:				Granular	Friable	
12-27	BW	Sandy Loam	10YR4/4		Cnc : Dpl:				Massive	Friable	
27-34	C1	Fine Sand	5Y7/2	27	Cnc :7.5Y5/8 Dpl:	20%			Single Grain	Loose	
34-110	C2	Very Fine Loamy Sand	5Y7/1	34	Cnc :5Y7/1 Dpl:	30%			Massive	Friable	
					Cnc: Dpl:						

Additional Notes:  
No Refusal.



NOTE: SOIL CLASSES ARE BASED ON ON-SITE TESTING AND THE NATIONAL ENGINEERING HANDBOOK.

PLAN SCALE: 1"=60'



PLAN DATE: JUNE 7, 2023

REVISION	DATE	BY
REVISIONS PER SURVEY	23-11-15	DJM

DOVER HOMES  
SOIL  
PLAN OF LAND  
IN  
DOVER, MA

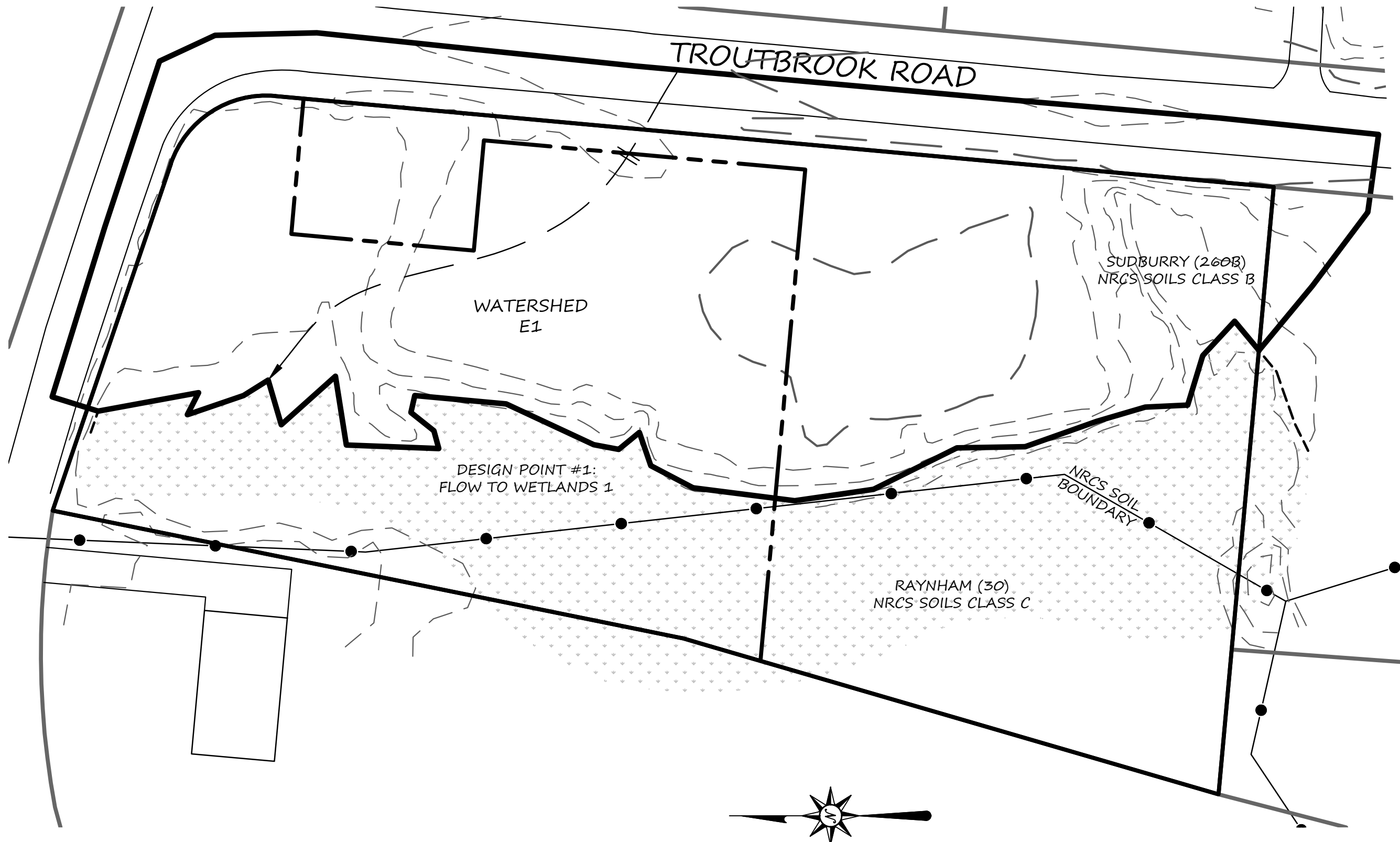
730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)

SHEET 1 OF 1

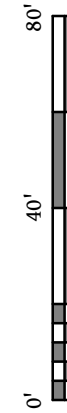


**LEGACY**  
ENGINEERING

# **ATTACHMENT I: EXISTING WATERSHED PLAN**



PLAN SCALE: 1"=40'



PLAN DATE: JUNE 7, 2023

REVISION	DATE	BY
REVISIONS PER SURVEY	23-11-15	DJM
REV. PER COMMENTS	24-01-08	DJM

DOVER HOMES  
LOTS 1A & 2A  
EXISTING WATERSHED  
PLAN OF LAND IN  
DOVER, MA

730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)  
SHEET 1 OF 3



LEGACY  
ENGINEERING



RAYNHAM (30)  
NRCS SOILS CLASS C

DESIGN POINT #2:  
FLOW TO WETLANDS 2

WATERSHED  
E2

NRCS SOIL  
BOUNDARY

CHICKERING DRIVE

TROUT BROOK  
ROAD

SUDBURY (260B)  
NRCS SOILS CLASS B

SUDBURY (260B)  
NRCS SOILS CLASS B

PLAN SCALE: 1"=40'



PLAN DATE: JUNE 7, 2023

REVISION	DATE	BY
REVISIONS PER SURVEY	23-11-15	DJM
REV. PER COMMENTS	24-01-08	DJM

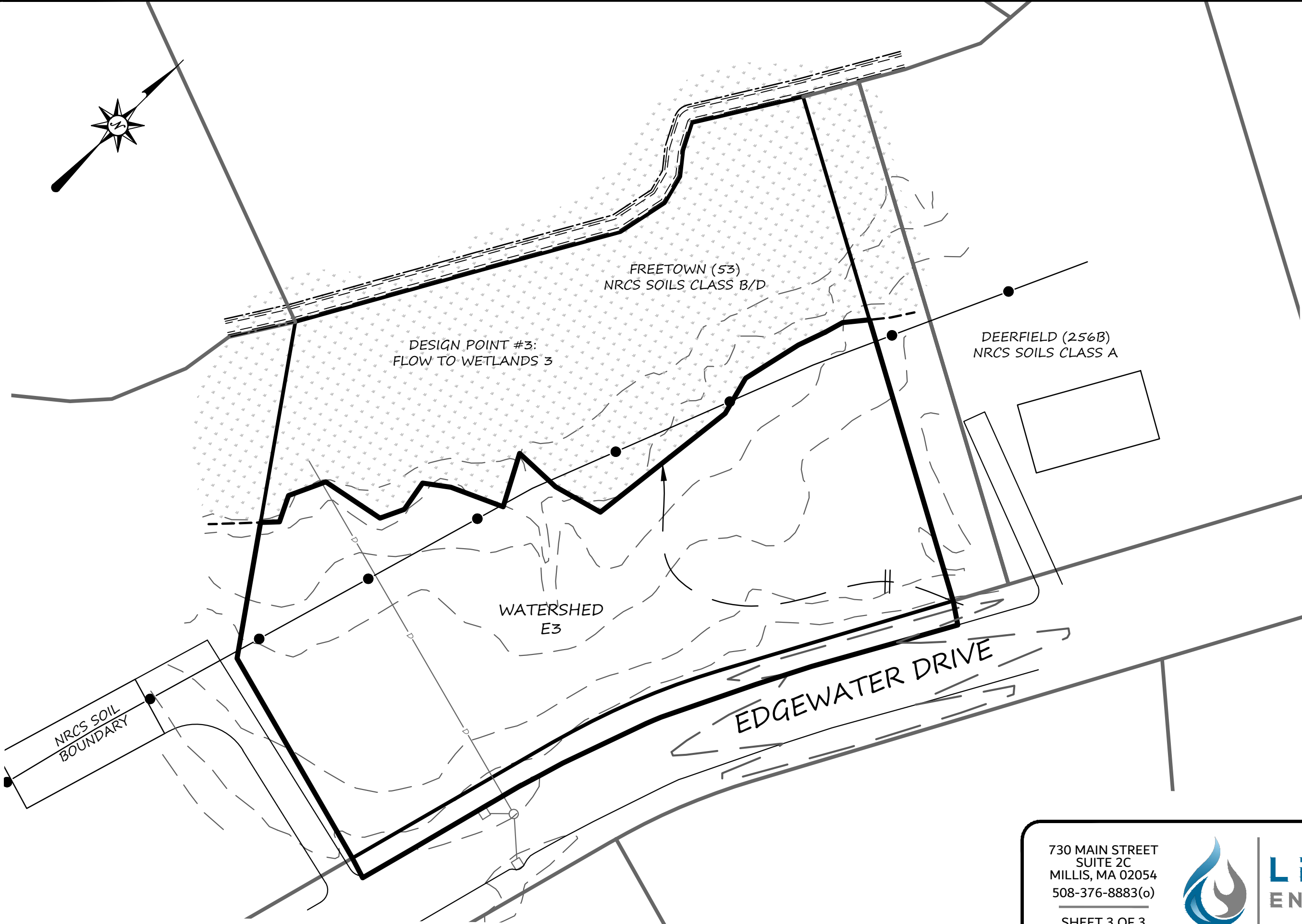
DOVER HOMES  
LOT 4  
EXISTING WATERSHED  
PLAN OF LAND IN  
DOVER, MA

730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)

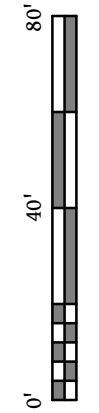
SHEET 2 OF 3



**LEGACY**  
ENGINEERING



PLAN SCALE: 1"=40'



PLAN DATE: JUNE 7, 2023

REVISION	DATE	BY
REVISIONS PER SURVEY	23-11-15	DJM
REV. PER COMMENTS	24-01-08	DJM

DOVER HOMES  
LOT 45  
EXISTING WATERSHED  
PLAN OF LAND IN  
DOVER, MA

730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)

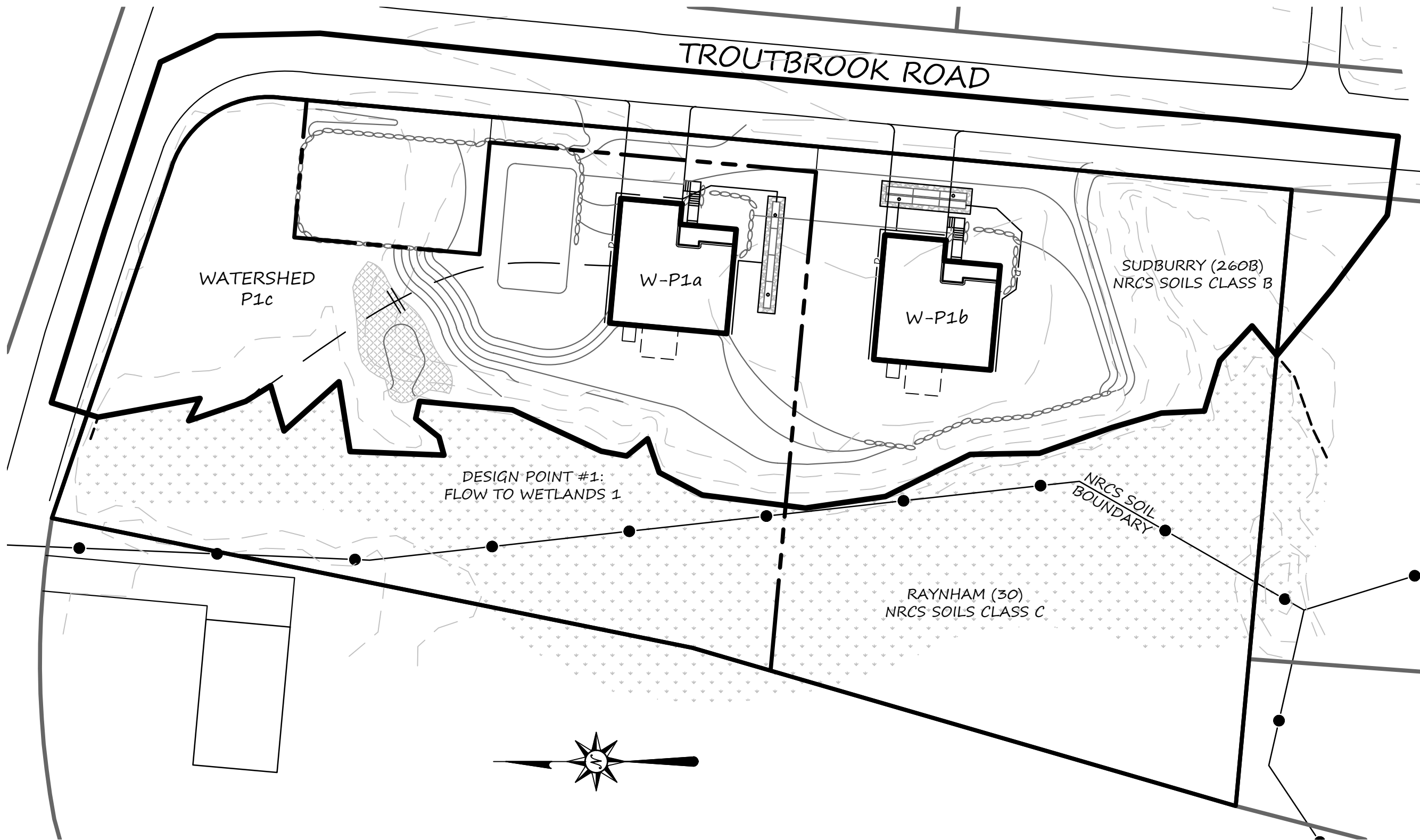
SHEET 3 OF 3



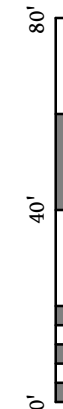
**LEGACY**  
ENGINEERING

# **ATTACHMENT J: PROPOSED WATERSHED PLAN**





PLAN SCALE: 1"=40'



PLAN DATE: JUNE 7, 2023

REVISION	DATE	BY
REVISIONS PER SURVEY	23-11-15	DJM
REV. PER COMMENTS	24-01-08	DJM

DOVER HOMES  
LOTS 1A & 2A  
PROPOSED WATERSHED  
PLAN OF LAND IN  
DOVER, MA

730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)

SHEET 1 OF 3



**LEGACY**  
ENGINEERING





RAYNHAM (30)  
NRCS SOILS CLASS C

DESIGN POINT #2:  
FLOW TO WETLANDS 2

WATERSHED  
P2b

W-P2a

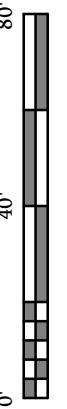
NRCS SOIL  
BOUNDARY

TROUT BROOK  
ROAD

SUDBURY (260B)  
NRCS SOILS CLASS B

CHICKERING DRIVE

PLAN SCALE: 1"=40'



PLAN DATE: JUNE 7, 2023

REVISION	DATE	BY
REVISIONS PER SURVEY	23-11-15	DJM
REV. PER COMMENTS	24-01-08	DJM

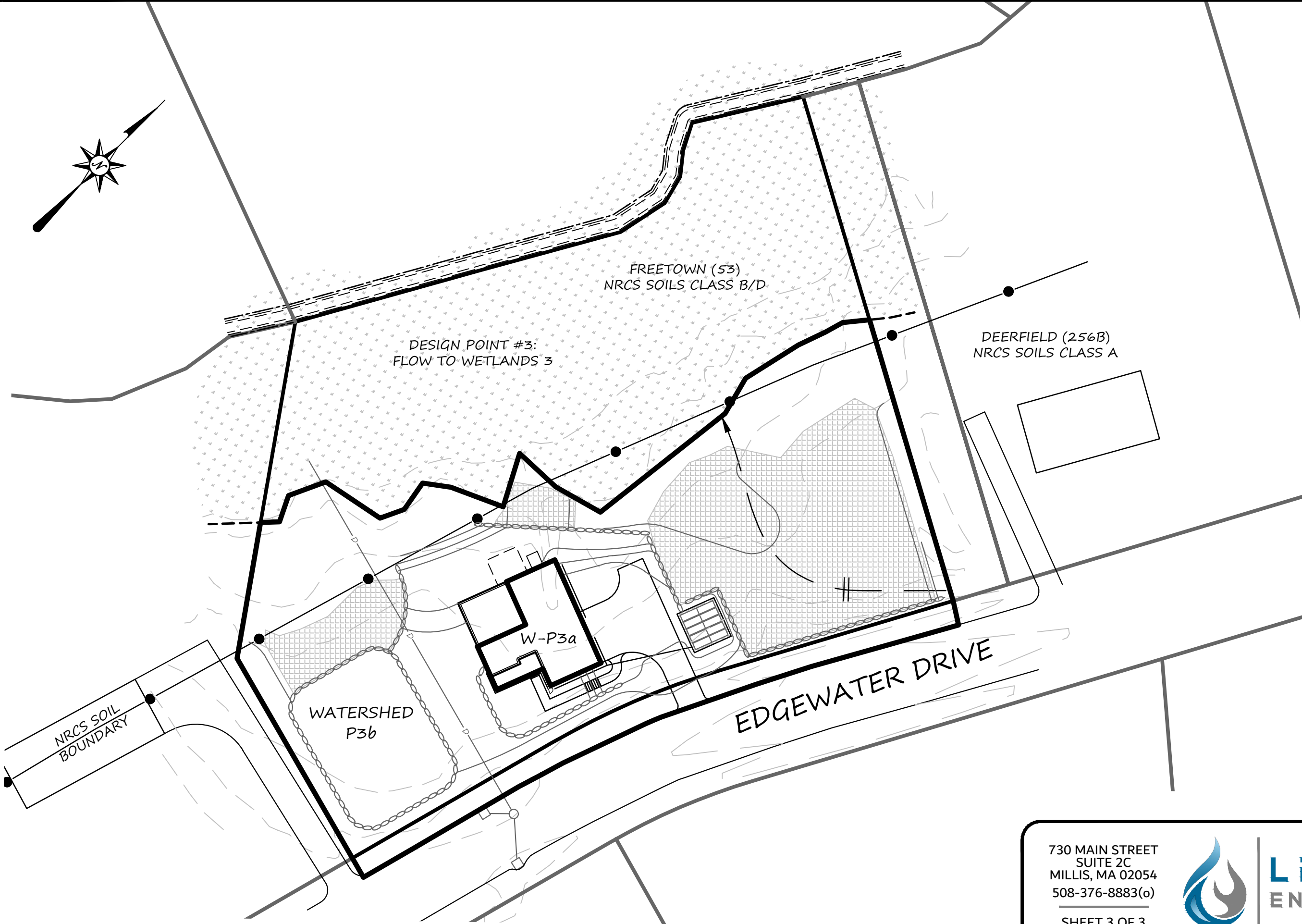
DOVER HOMES  
LOT 4  
PROPOSED WATERSHED  
PLAN OF LAND IN  
DOVER, MA

730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)

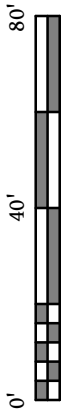
SHEET 2 OF 3



**LEGACY**  
ENGINEERING



PLAN SCALE: 1"=40'



PLAN DATE: JUNE 7, 2023

REVISION	DATE	BY
REVISIONS PER SURVEY	23-11-15	DJM
REV. PER COMMENTS	24-01-08	DJM

DOVER HOMES  
LOT 45  
PROPOSED WATERSHED  
PLAN OF LAND IN  
DOVER, MA

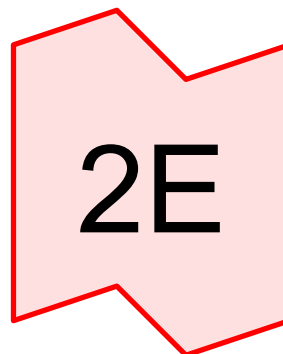
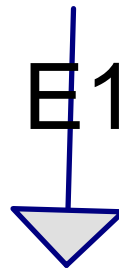
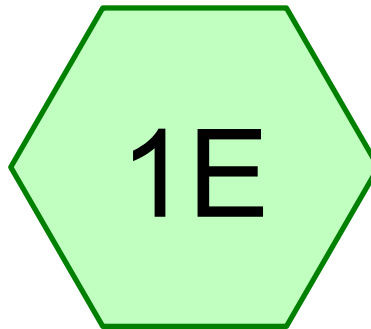
730 MAIN STREET  
SUITE 2C  
MILLIS, MA 02054  
508-376-8883(o)



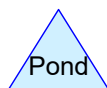
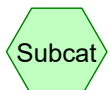
LEGACY  
ENGINEERING

# **ATTACHMENT K: HYDROCAD HYDROLOGY CALCULATIONS**

**DESIGN POINT #1: FLOW TO**  
**WETLANDS 1 EXISTING CONDITIONS**



## Design Point #1: Flow to Wetlands 1



### Routing Diagram for HydroCAD

Prepared by Legacy Engineering LLC, Printed 6/6/2023  
HydroCAD® 10.20-3c s/n 02346 © 2023 HydroCAD Software Solutions LLC

# HydroCAD

Prepared by Legacy Engineering LLC

HydroCAD® 10.20-3c s/n 02346 © 2023 HydroCAD Software Solutions LLC

Printed 6/6/2023

Page 2

## Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type III 24-hr		Default	24.00	1	3.20	2
2	10-YR	Type III 24-hr		Default	24.00	1	4.70	2
3	100-YR	Type III 24-hr		Default	24.00	1	6.70	2

## HydroCAD

Prepared by Legacy Engineering LLC

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Printed 6/6/2023

Page 3

### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.062	39	>75% Grass cover, Good HSG A (1E)
0.013	61	>75% Grass cover, Good HSG B (1E)
0.030	80	>75% Grass cover, Good HSG D (1E)
0.114	98	Paved parking HSG A (1E)
0.028	98	Paved parking HSG B (1E)
0.053	98	Paved parking HSG D (1E)
0.690	30	Woods, Good HSG A (1E)
0.161	55	Woods, Good HSG B (1E)
0.419	77	Woods, Good HSG D (1E)
<b>1.569</b>	<b>55</b>	<b>TOTAL AREA</b>

## HydroCAD

Prepared by Legacy Engineering LLC

HydroCAD® 10.20-3c s/n 02346 © 2023 HydroCAD Software Solutions LLC

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

Printed 6/6/2023

Page 4

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q

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

### Subcatchment 1E: E1

Runoff Area=68,366 sf 12.41% Impervious Runoff Depth=0.75"

Flow Length=214' Tc=13.5 min CN=WQ Runoff=0.98 cfs 0.098 af

### Link 2E: Design Point #1: Flow to Wetlands 1

Inflow=0.98 cfs 0.098 af

Primary=0.98 cfs 0.098 af

**Total Runoff Area = 1.569 ac Runoff Volume = 0.098 af Average Runoff Depth = 0.75"**  
**87.59% Pervious = 1.375 ac 12.41% Impervious = 0.195 ac**



**Summary for Subcatchment 1E: E1**

Runoff = 0.98 cfs @ 12.19 hrs, Volume= 0.098 af, Depth= 0.75"

Routed to Link 2E : Design Point #1: Flow to Wetlands 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

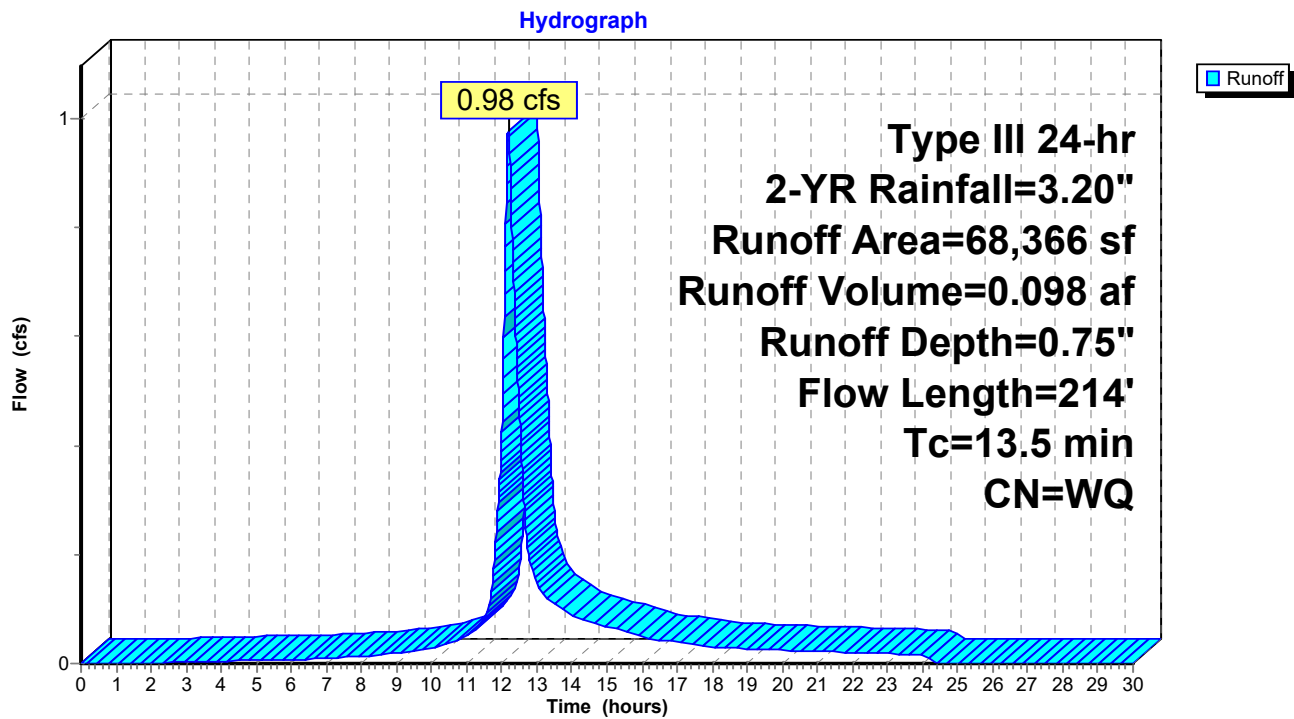
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
18,252	77	Woods, Good HSG D
7,028	55	Woods, Good HSG B
2,297	98	Paved parking HSG D
1,212	98	Paved parking HSG B
4,973	98	Paved parking HSG A
30,035	30	Woods, Good HSG A
2,693	39	>75% Grass cover, Good HSG A
550	61	>75% Grass cover, Good HSG B
1,326	80	>75% Grass cover, Good HSG D
68,366		Weighted Average
59,884		87.59% Pervious Area
8,482		12.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	15	0.0100	0.71		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
2.5	8	0.0100	0.05		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
6.5	16	0.0100	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	175	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.5	214	Total			

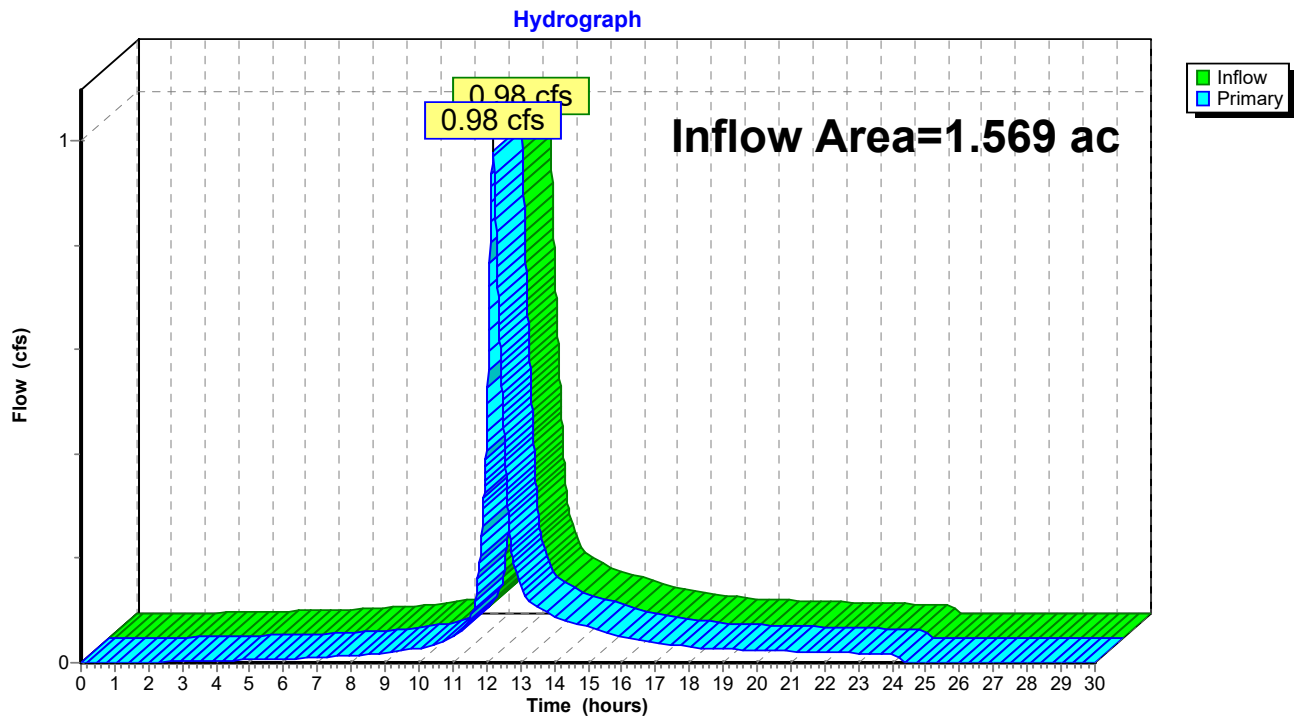
## Subcatchment 1E: E1



**Summary for Link 2E: Design Point #1: Flow to Wetlands 1**

Inflow Area = 1.569 ac, 12.41% Impervious, Inflow Depth = 0.75" for 2-YR event  
Inflow = 0.98 cfs @ 12.19 hrs, Volume= 0.098 af  
Primary = 0.98 cfs @ 12.19 hrs, Volume= 0.098 af, Atten= 0%, Lag= 0.0 min

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

**Link 2E: Design Point #1: Flow to Wetlands 1**

## HydroCAD

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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-Q

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

### Subcatchment 1E: E1

Runoff Area=68,366 sf 12.41% Impervious Runoff Depth=1.34"

Flow Length=214' Tc=13.5 min CN=WQ Runoff=1.80 cfs 0.175 af

### Link 2E: Design Point #1: Flow to Wetlands 1

Inflow=1.80 cfs 0.175 af

Primary=1.80 cfs 0.175 af

**Total Runoff Area = 1.569 ac Runoff Volume = 0.175 af Average Runoff Depth = 1.34"**  
**87.59% Pervious = 1.375 ac 12.41% Impervious = 0.195 ac**

**Summary for Subcatchment 1E: E1**

Runoff = 1.80 cfs @ 12.19 hrs, Volume= 0.175 af, Depth= 1.34"

Routed to Link 2E : Design Point #1: Flow to Wetlands 1

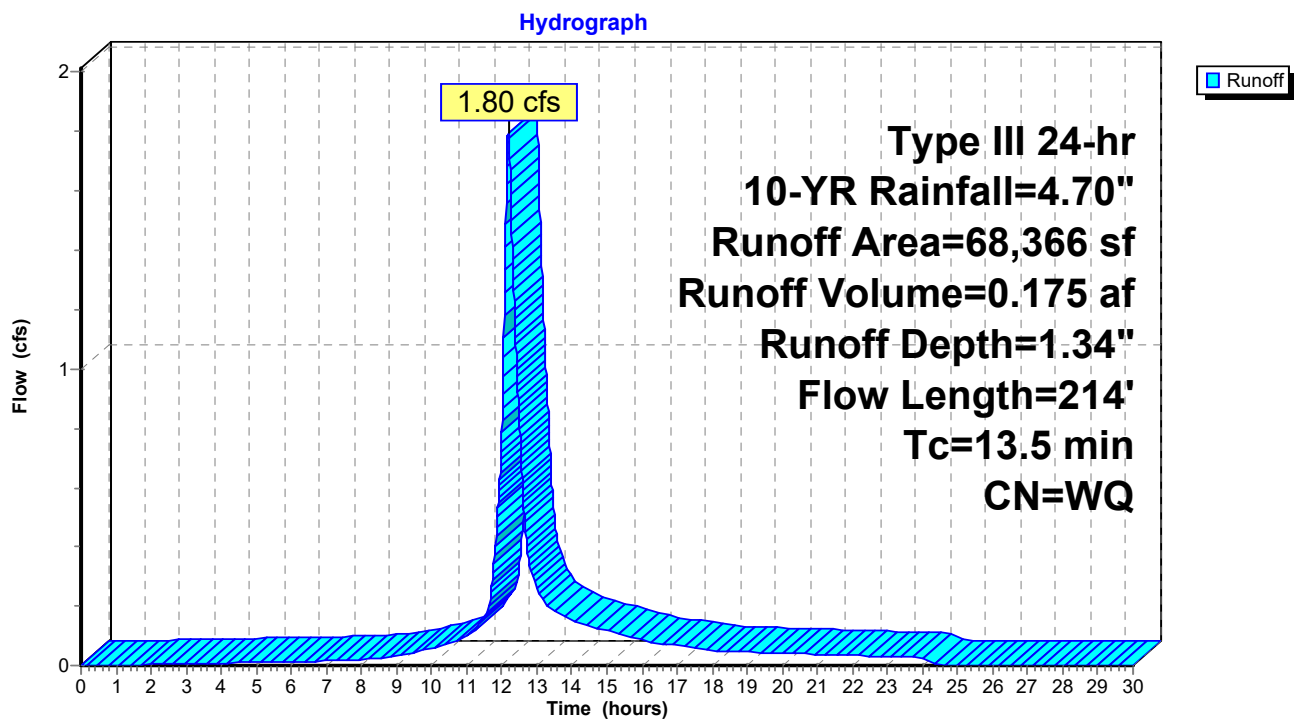
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
18,252	77	Woods, Good HSG D
7,028	55	Woods, Good HSG B
2,297	98	Paved parking HSG D
1,212	98	Paved parking HSG B
4,973	98	Paved parking HSG A
30,035	30	Woods, Good HSG A
2,693	39	>75% Grass cover, Good HSG A
550	61	>75% Grass cover, Good HSG B
1,326	80	>75% Grass cover, Good HSG D
68,366		Weighted Average
59,884		87.59% Pervious Area
8,482		12.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	15	0.0100	0.71		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
2.5	8	0.0100	0.05		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
6.5	16	0.0100	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	175	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.5	214	Total			

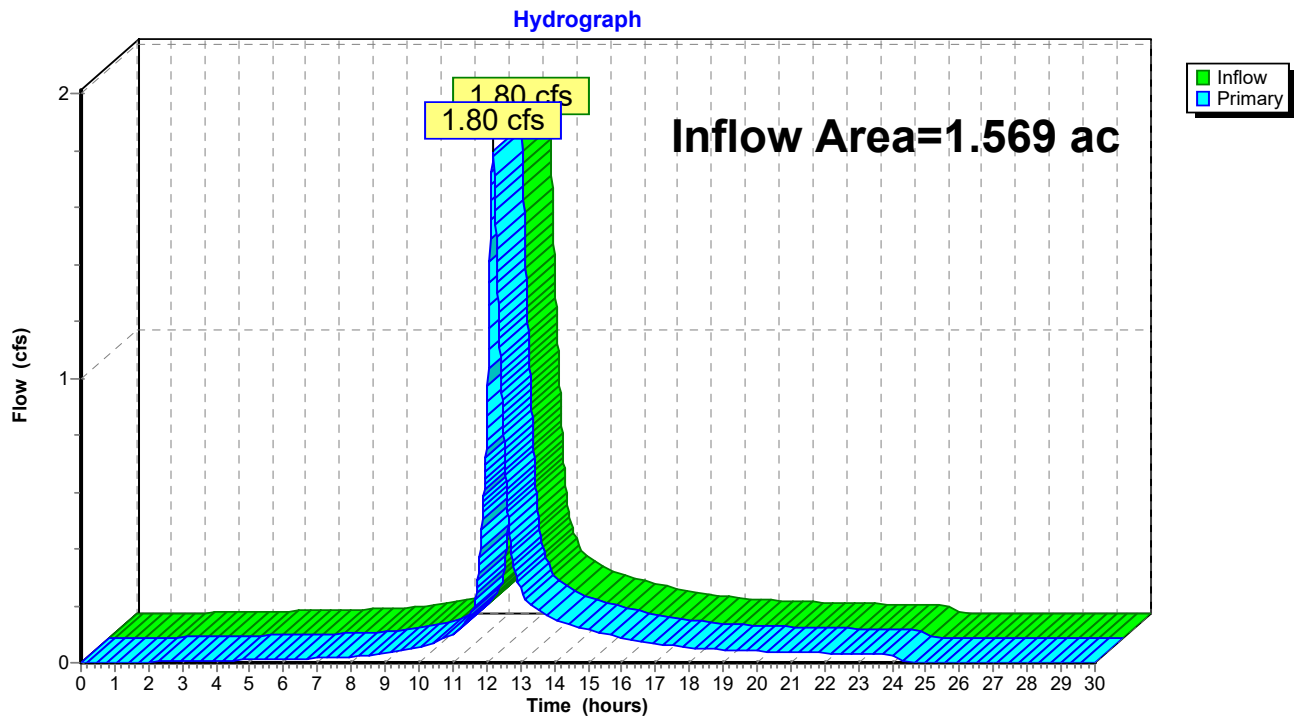
## Subcatchment 1E: E1



**Summary for Link 2E: Design Point #1: Flow to Wetlands 1**

Inflow Area = 1.569 ac, 12.41% Impervious, Inflow Depth = 1.34" for 10-YR event  
Inflow = 1.80 cfs @ 12.19 hrs, Volume= 0.175 af  
Primary = 1.80 cfs @ 12.19 hrs, Volume= 0.175 af, Atten= 0%, Lag= 0.0 min

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

**Link 2E: Design Point #1: Flow to Wetlands 1**

## HydroCAD

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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-Q

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

### Subcatchment 1E: E1

Runoff Area=68,366 sf 12.41% Impervious Runoff Depth=2.30"

Flow Length=214' Tc=13.5 min CN=WQ Runoff=3.02 cfs 0.301 af

### Link 2E: Design Point #1: Flow to Wetlands 1

Inflow=3.02 cfs 0.301 af

Primary=3.02 cfs 0.301 af

**Total Runoff Area = 1.569 ac Runoff Volume = 0.301 af Average Runoff Depth = 2.30"**  
**87.59% Pervious = 1.375 ac 12.41% Impervious = 0.195 ac**



**Summary for Subcatchment 1E: E1**

Runoff = 3.02 cfs @ 12.19 hrs, Volume= 0.301 af, Depth= 2.30"

Routed to Link 2E : Design Point #1: Flow to Wetlands 1

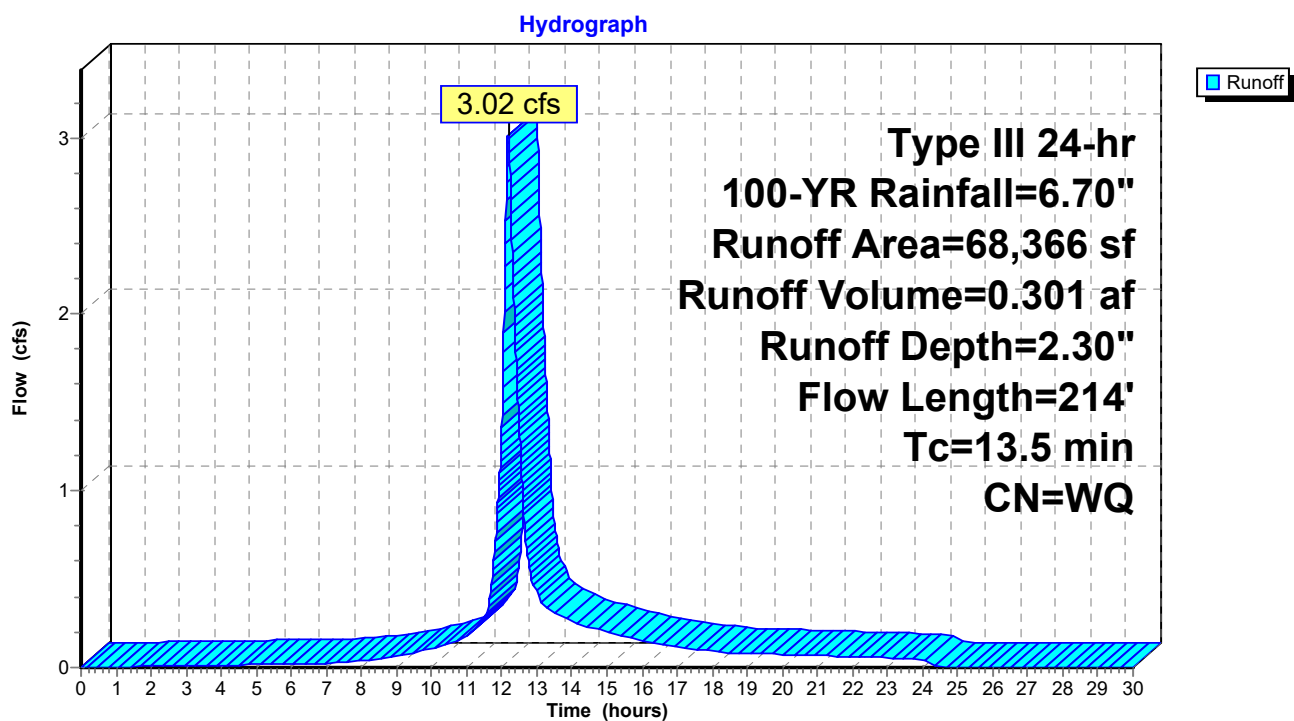
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
18,252	77	Woods, Good HSG D
7,028	55	Woods, Good HSG B
2,297	98	Paved parking HSG D
1,212	98	Paved parking HSG B
4,973	98	Paved parking HSG A
30,035	30	Woods, Good HSG A
2,693	39	>75% Grass cover, Good HSG A
550	61	>75% Grass cover, Good HSG B
1,326	80	>75% Grass cover, Good HSG D
68,366		Weighted Average
59,884		87.59% Pervious Area
8,482		12.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	15	0.0100	0.71		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
2.5	8	0.0100	0.05		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
6.5	16	0.0100	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	175	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.5	214	Total			

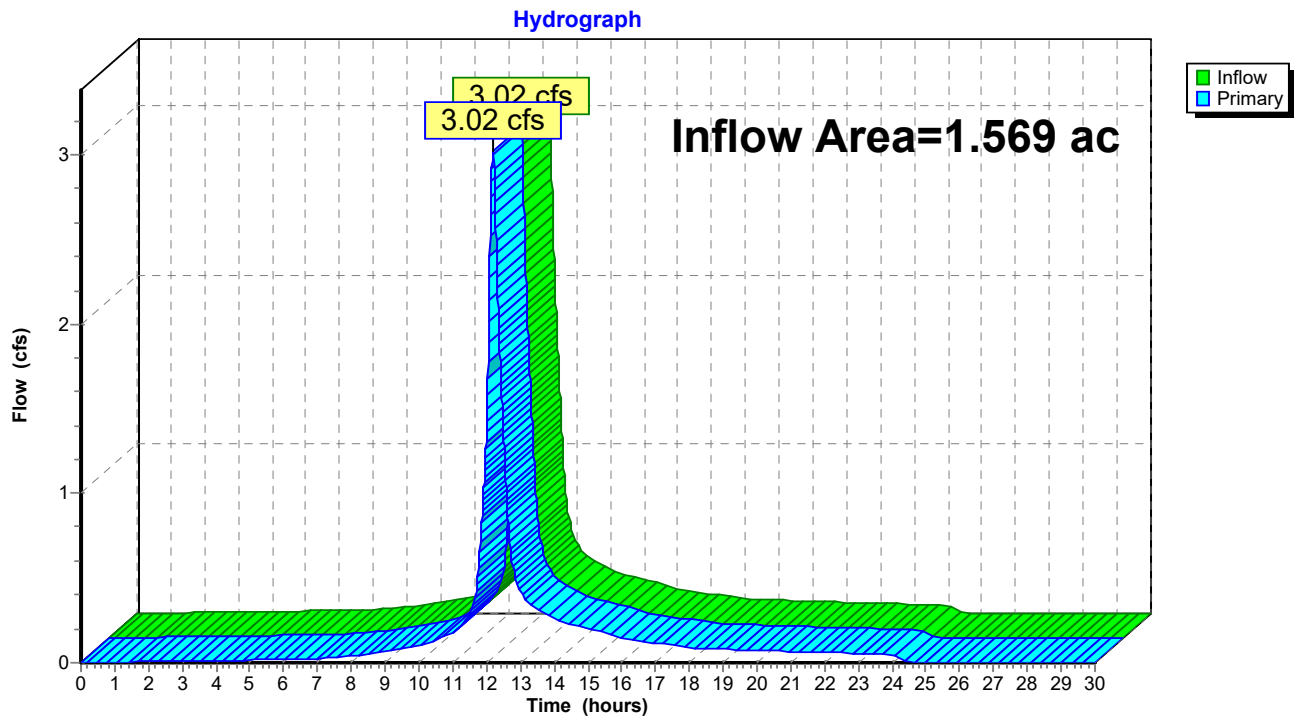
## Subcatchment 1E: E1



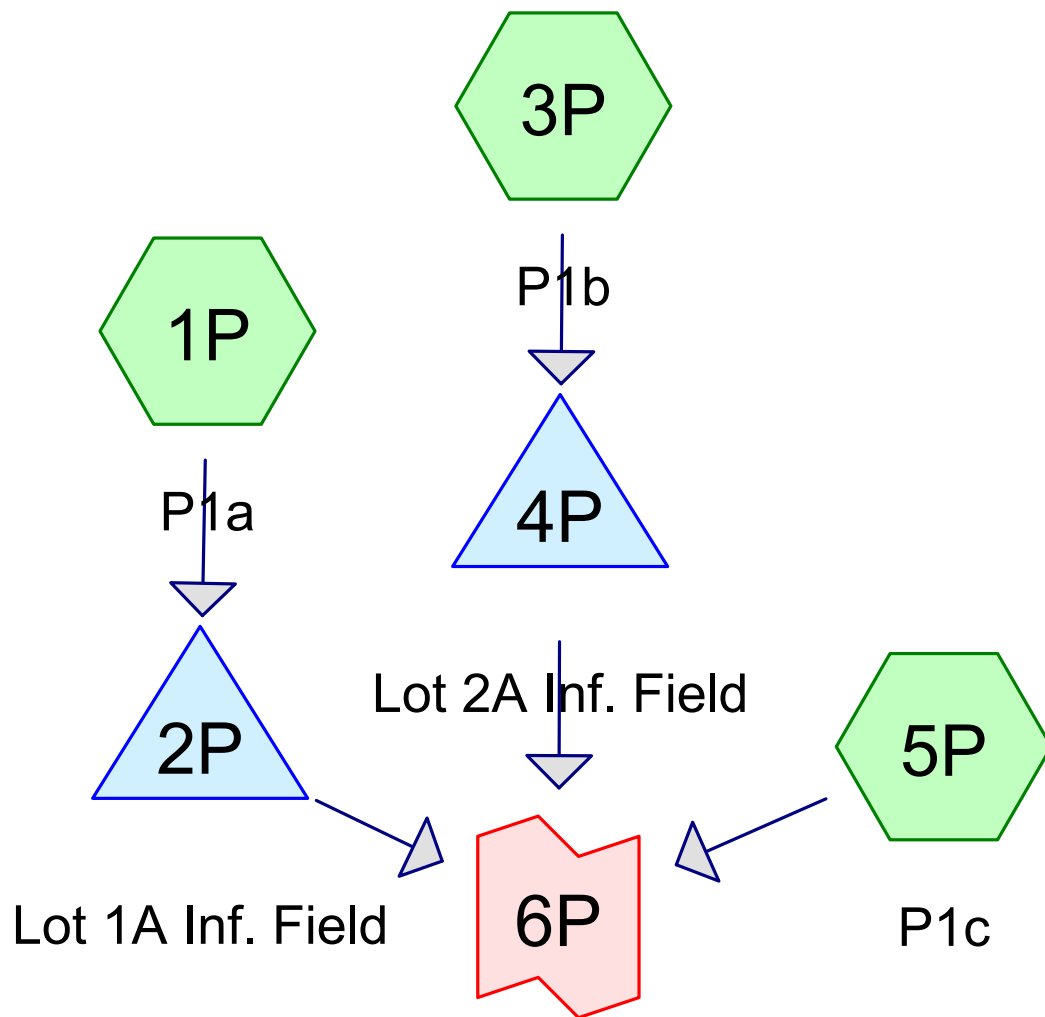
**Summary for Link 2E: Design Point #1: Flow to Wetlands 1**

Inflow Area = 1.569 ac, 12.41% Impervious, Inflow Depth = 2.30" for 100-YR event  
Inflow = 3.02 cfs @ 12.19 hrs, Volume= 0.301 af  
Primary = 3.02 cfs @ 12.19 hrs, Volume= 0.301 af, Atten= 0%, Lag= 0.0 min

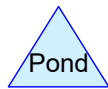
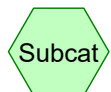
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 2E: Design Point #1: Flow to Wetlands 1**

**DESIGN POINT #1: FLOW TO**  
**WETLANDS 1 PROPOSED CONDITIONS**



Design Point #1: Flow to  
Wetlands 1



**Routing Diagram for HydroCAD3**

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## HydroCAD3

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### Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type III 24-hr		Default	24.00	1	3.20	2
2	10-YR	Type III 24-hr		Default	24.00	1	4.70	2
3	100-YR	Type III 24-hr		Default	24.00	1	6.70	2

## HydroCAD3

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.504	39	>75% Grass cover, Good HSG A (5P)
0.137	61	>75% Grass cover, Good HSG B (5P)
0.113	80	>75% Grass cover, Good HSG D (5P)
0.163	98	Paved parking HSG A (5P)
0.028	98	Paved parking HSG B (5P)
0.053	98	Paved parking HSG D (5P)
0.095	98	Roofs HSG A (1P, 3P)
0.103	30	Woods, Good HSG A (5P)
0.037	55	Woods, Good HSG B (5P)
0.336	77	Woods, Good HSG D (5P)
<b>1.569</b>	<b>65</b>	<b>TOTAL AREA</b>

# HydroCAD3

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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-Q

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

## Subcatchment1P: P1a

Runoff Area=2,078 sf 100.00% Impervious Runoff Depth=2.97"

Tc=2.0 min CN=98 Runoff=0.17 cfs 0.012 af

## Pond 2P: Lot 1A Inf. Field

Peak Elev=109.43' Storage=159 cf Inflow=0.17 cfs 0.012 af

Discarded=0.02 cfs 0.012 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.012 af

## Subcatchment3P: P1b

Runoff Area=2,078 sf 100.00% Impervious Runoff Depth=2.97"

Tc=2.0 min CN=98 Runoff=0.17 cfs 0.012 af

## Pond 4P: Lot 2A Inf. Field

Peak Elev=108.44' Storage=149 cf Inflow=0.17 cfs 0.012 af

Discarded=0.02 cfs 0.012 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.012 af

## Subcatchment5P: P1c

Runoff Area=64,208 sf 16.52% Impervious Runoff Depth=0.92"

Flow Length=141' Tc=10.2 min CN=WQ Runoff=1.25 cfs 0.113 af

## Link 6P: Design Point #1: Flow to Wetlands 1

Inflow=1.25 cfs 0.113 af

Primary=1.25 cfs 0.113 af

**Total Runoff Area = 1.569 ac Runoff Volume = 0.137 af Average Runoff Depth = 1.05"**  
**78.41% Pervious = 1.231 ac 21.59% Impervious = 0.339 ac**



**Summary for Subcatchment 1P: P1a**

Runoff = 0.17 cfs @ 12.03 hrs, Volume= 0.012 af, Depth= 2.97"  
 Routed to Pond 2P : Lot 1A Inf. Field

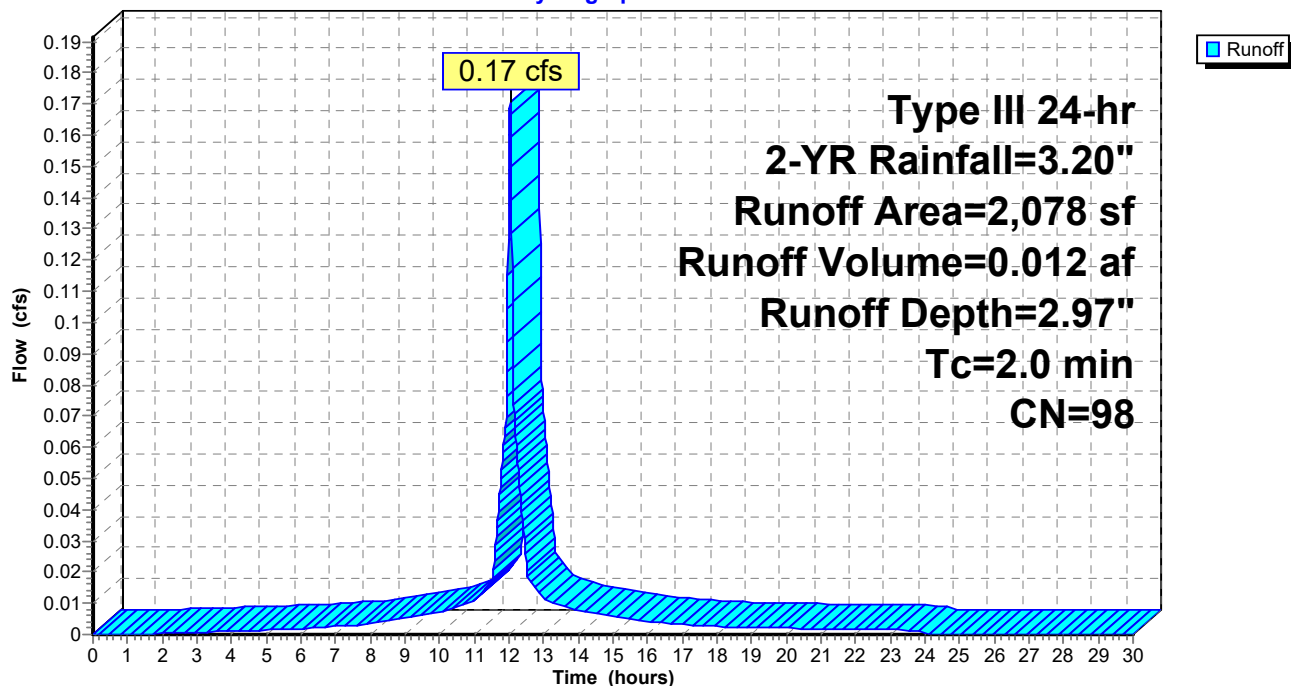
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
2,078	98	Roofs HSG A
2,078		100.00% Impervious Area

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

**Subcatchment 1P: P1a**

Hydrograph



**Summary for Pond 2P: Lot 1A Inf. Field**

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2-YR event  
 Inflow = 0.17 cfs @ 12.03 hrs, Volume= 0.012 af  
 Outflow = 0.02 cfs @ 11.70 hrs, Volume= 0.012 af, Atten= 90%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.70 hrs, Volume= 0.012 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Link 6P : Design Point #1: Flow to Wetlands 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 109.43' @ 12.60 hrs Surf.Area= 309 sf Storage= 159 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 57.2 min ( 809.9 - 752.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	108.40'	331 cf	<b>6.75'W x 45.75'L x 3.04'H Field A</b> 939 cf Overall - 111 cf Embedded = 829 cf x 40.0% Voids
#2A	108.90'	111 cf	<b>Cultec R-150XLHD x 4 Inside #1</b> Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 1 rows
#3	110.90'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
		444 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.40'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	111.50'	<b>4.0" Round Culvert X 2.00</b> L= 1.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.50' / 111.40' S= 0.1000 ' /' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 11.70 hrs HW=108.46' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=108.40' TW=0.00' (Dynamic Tailwater)

↑ **2=Culvert** ( Controls 0.00 cfs)

**Pond 2P: Lot 1A Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H =&gt; 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 1 rows

4 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 41.75' Row Length +24.0" End Stone x 2 = 45.75' Base Length

1 Rows x 33.0" Wide + 24.0" Side Stone x 2 = 6.75' Base Width

6.0" Stone Base + 18.5" Chamber Height + 12.0" Stone Cover = 3.04' Field Height

4 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 1 Rows = 110.6 cf Chamber Storage

939.3 cf Field - 110.6 cf Chambers = 828.7 cf Stone x 40.0% Voids = 331.5 cf Stone Storage

Chamber Storage + Stone Storage = 442.1 cf = 0.010 af

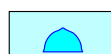
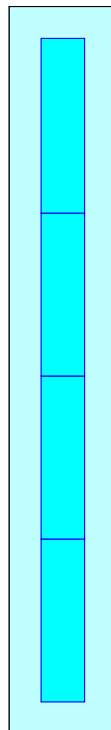
Overall Storage Efficiency = 47.1%

Overall System Size = 45.75' x 6.75' x 3.04'

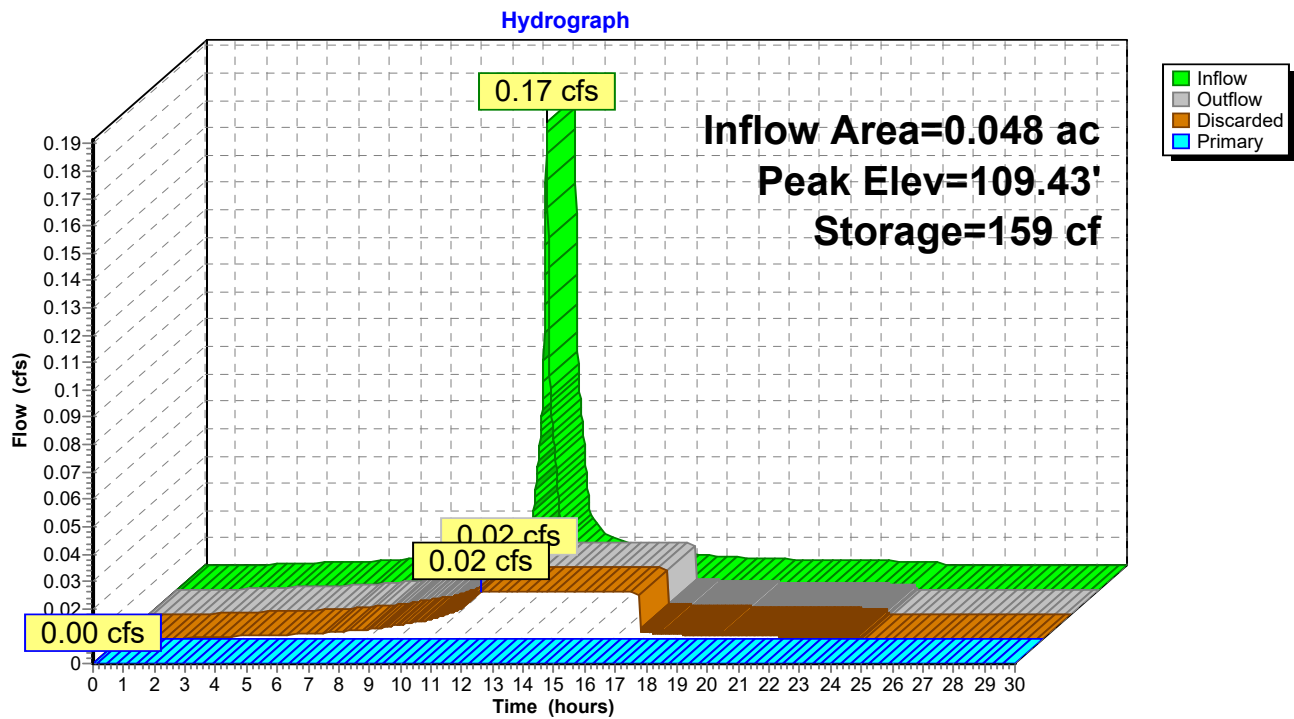
4 Chambers

34.8 cy Field

30.7 cy Stone



## Pond 2P: Lot 1A Inf. Field



**Summary for Subcatchment 3P: P1b**

Runoff = 0.17 cfs @ 12.03 hrs, Volume= 0.012 af, Depth= 2.97"  
 Routed to Pond 4P : Lot 2A Inf. Field

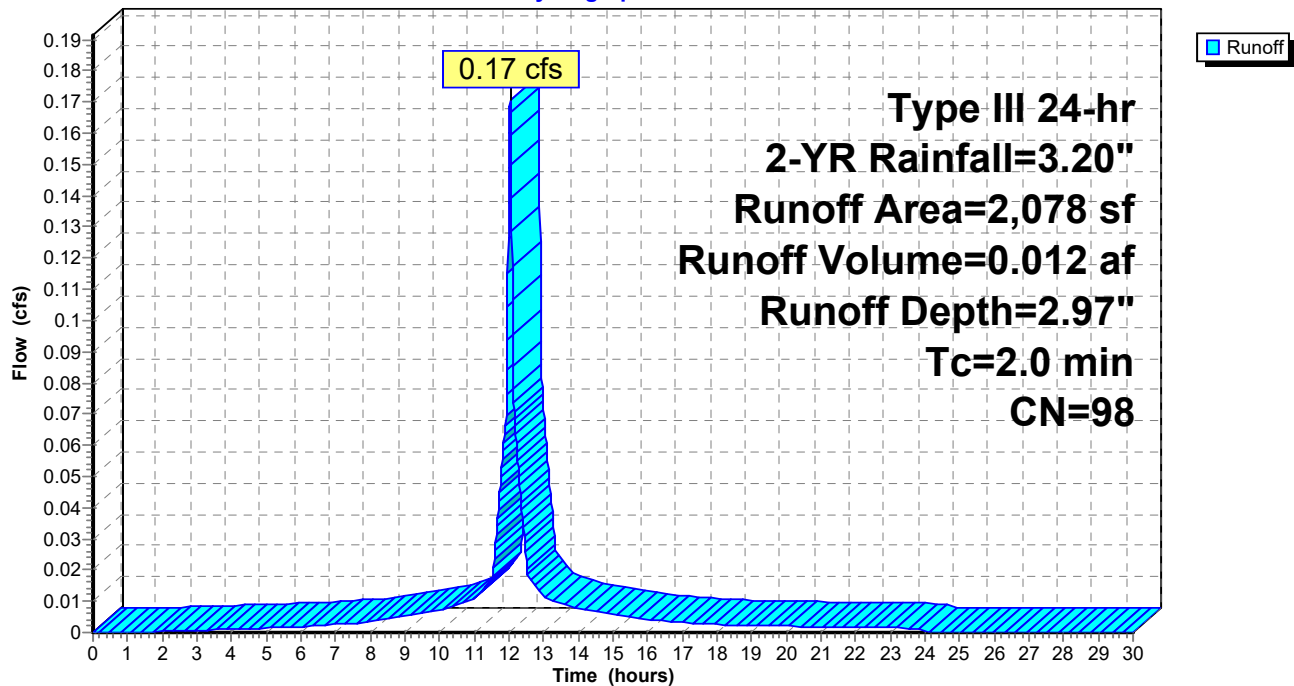
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
2,078	98	Roofs HSG A
2,078		100.00% Impervious Area

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

**Subcatchment 3P: P1b**

Hydrograph



**Summary for Pond 4P: Lot 2A Inf. Field**

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2-YR event  
 Inflow = 0.17 cfs @ 12.03 hrs, Volume= 0.012 af  
 Outflow = 0.02 cfs @ 11.73 hrs, Volume= 0.012 af, Atten= 88%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.73 hrs, Volume= 0.012 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Link 6P : Design Point #1: Flow to Wetlands 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 108.44' @ 12.52 hrs Surf.Area= 355 sf Storage= 149 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 44.1 min ( 796.8 - 752.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	110.10'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
#2A	107.60'	294 cf	<b>10.00'W x 35.50'L x 2.54'H Field A</b>
			902 cf Overall - 167 cf Embedded = 735 cf x 40.0% Voids
#3A	108.10'	167 cf	<b>Cultec R-150XLHD x 6 Inside #2</b>
			Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf
			Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap
			Row Length Adjustment= +0.75' x 2.65 sf x 2 rows
		463 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	107.60'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	112.20'	<b>4.0" Round Culvert X 2.00</b>
			L= 1.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 112.20' / 112.10' S= 0.1000 ' S= 0.1000 ' Cc= 0.900
			n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 11.73 hrs HW=107.66' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=107.60' TW=0.00' (Dynamic Tailwater)

↑ **2=Culvert** ( Controls 0.00 cfs)

## Pond 4P: Lot 2A Inf. Field - Chamber Wizard Field A

### Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)

Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 2 rows

33.0" Wide + 6.0" Spacing = 39.0" C-C Row Spacing

3 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 31.50' Row Length +24.0" End Stone x 2 = 35.50' Base Length

2 Rows x 33.0" Wide + 6.0" Spacing x 1 + 24.0" Side Stone x 2 = 10.00' Base Width

6.0" Stone Base + 18.5" Chamber Height + 6.0" Stone Cover = 2.54' Field Height

6 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 2 Rows = 166.9 cf Chamber Storage

902.3 cf Field - 166.9 cf Chambers = 735.4 cf Stone x 40.0% Voids = 294.2 cf Stone Storage

Chamber Storage + Stone Storage = 461.0 cf = 0.011 af

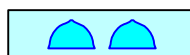
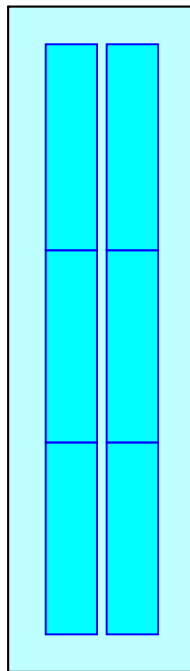
Overall Storage Efficiency = 51.1%

Overall System Size = 35.50' x 10.00' x 2.54'

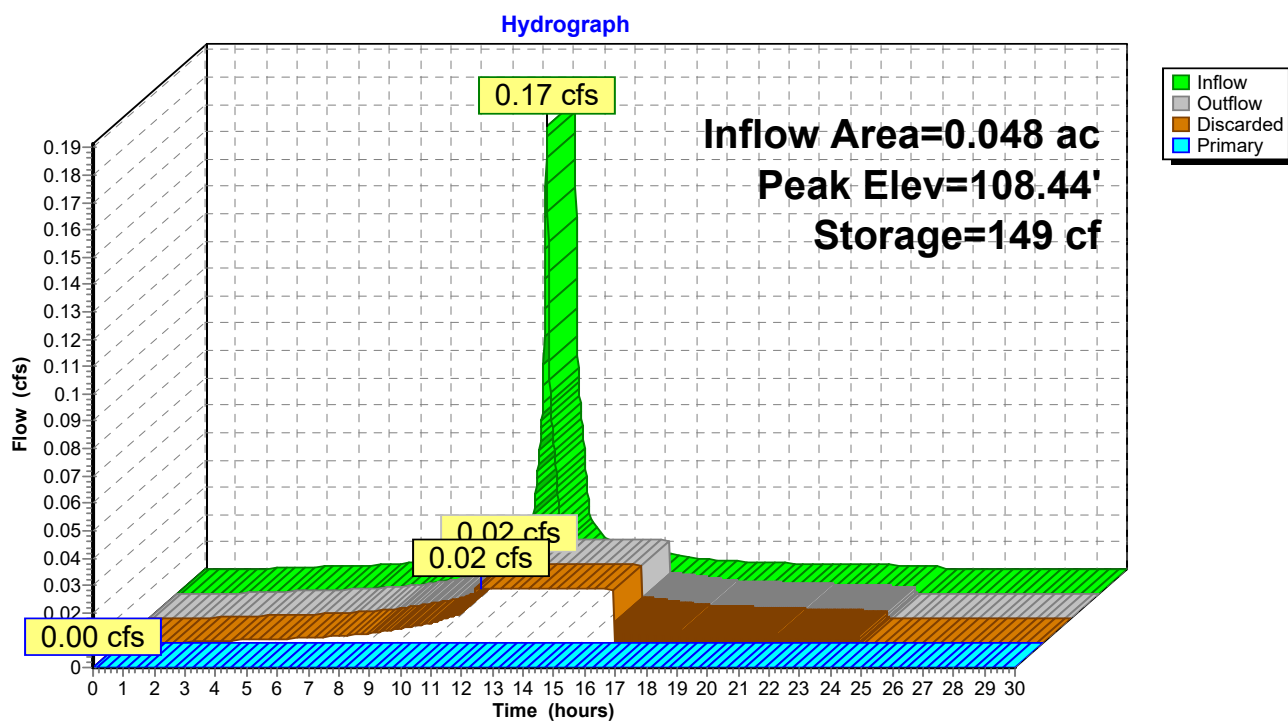
6 Chambers

33.4 cy Field

27.2 cy Stone



## Pond 4P: Lot 2A Inf. Field





**Summary for Subcatchment 5P: P1c**

Runoff = 1.25 cfs @ 12.14 hrs, Volume= 0.113 af, Depth= 0.92"

Routed to Link 6P : Design Point #1: Flow to Wetlands 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

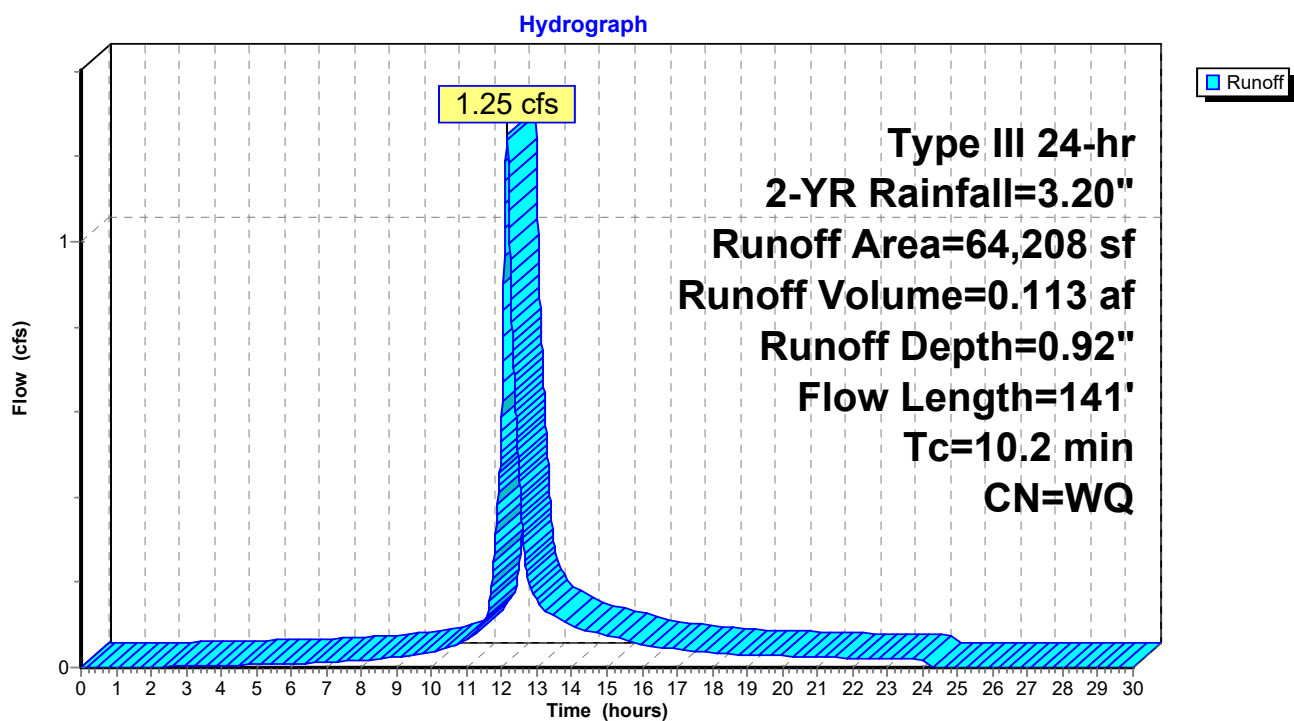
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
1,631	55	Woods, Good HSG B
14,651	77	Woods, Good HSG D
2,297	98	Paved parking HSG D
1,212	98	Paved parking HSG B
7,095	98	Paved parking HSG A
4,476	30	Woods, Good HSG A
21,973	39	>75% Grass cover, Good HSG A
5,947	61	>75% Grass cover, Good HSG B
4,926	80	>75% Grass cover, Good HSG D
64,208		Weighted Average
53,604		83.48% Pervious Area
10,604		16.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	79	0.0600	0.17		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.6	4	0.0200	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	58	0.0400	1.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
10.2	141	Total			

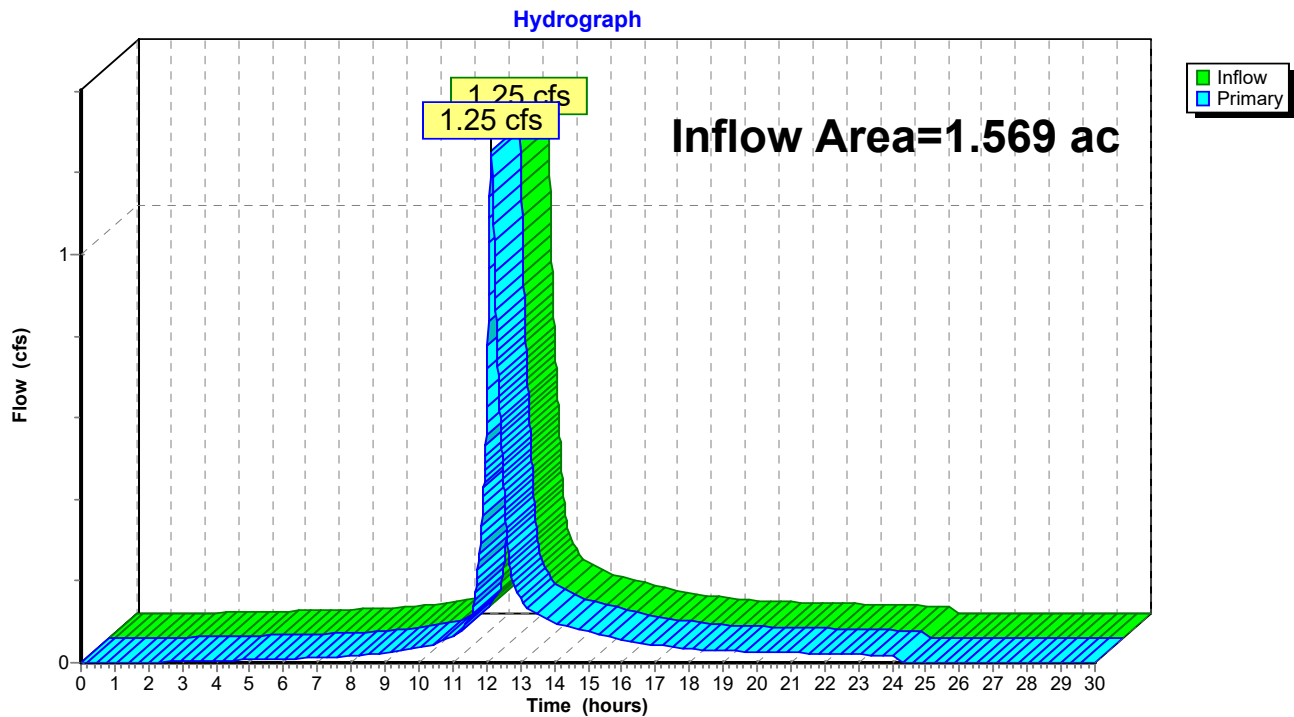
## Subcatchment 5P: P1c



**Summary for Link 6P: Design Point #1: Flow to Wetlands 1**

Inflow Area = 1.569 ac, 21.59% Impervious, Inflow Depth = 0.87" for 2-YR event  
Inflow = 1.25 cfs @ 12.14 hrs, Volume= 0.113 af  
Primary = 1.25 cfs @ 12.14 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min

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

**Link 6P: Design Point #1: Flow to Wetlands 1**

## HydroCAD3

Prepared by Legacy Engineering LLC

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

Printed 1/3/2024

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

### Subcatchment1P: P1a

Runoff Area=2,078 sf 100.00% Impervious Runoff Depth=4.46"  
Tc=2.0 min CN=98 Runoff=0.25 cfs 0.018 af

### Pond 2P: Lot 1A Inf. Field

Peak Elev=110.15' Storage=280 cf Inflow=0.25 cfs 0.018 af  
Discarded=0.02 cfs 0.018 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.018 af

### Subcatchment3P: P1b

Runoff Area=2,078 sf 100.00% Impervious Runoff Depth=4.46"  
Tc=2.0 min CN=98 Runoff=0.25 cfs 0.018 af

### Pond 4P: Lot 2A Inf. Field

Peak Elev=108.95' Storage=263 cf Inflow=0.25 cfs 0.018 af  
Discarded=0.02 cfs 0.018 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.018 af

### Subcatchment5P: P1c

Runoff Area=64,208 sf 16.52% Impervious Runoff Depth=1.66"  
Flow Length=141' Tc=10.2 min CN=WQ Runoff=2.26 cfs 0.204 af

### Link 6P: Design Point #1: Flow to Wetlands 1

Inflow=2.26 cfs 0.204 af  
Primary=2.26 cfs 0.204 af

**Total Runoff Area = 1.569 ac Runoff Volume = 0.240 af Average Runoff Depth = 1.83"**  
**78.41% Pervious = 1.231 ac 21.59% Impervious = 0.339 ac**

**Summary for Subcatchment 1P: P1a**

Runoff = 0.25 cfs @ 12.03 hrs, Volume= 0.018 af, Depth= 4.46"  
 Routed to Pond 2P : Lot 1A Inf. Field

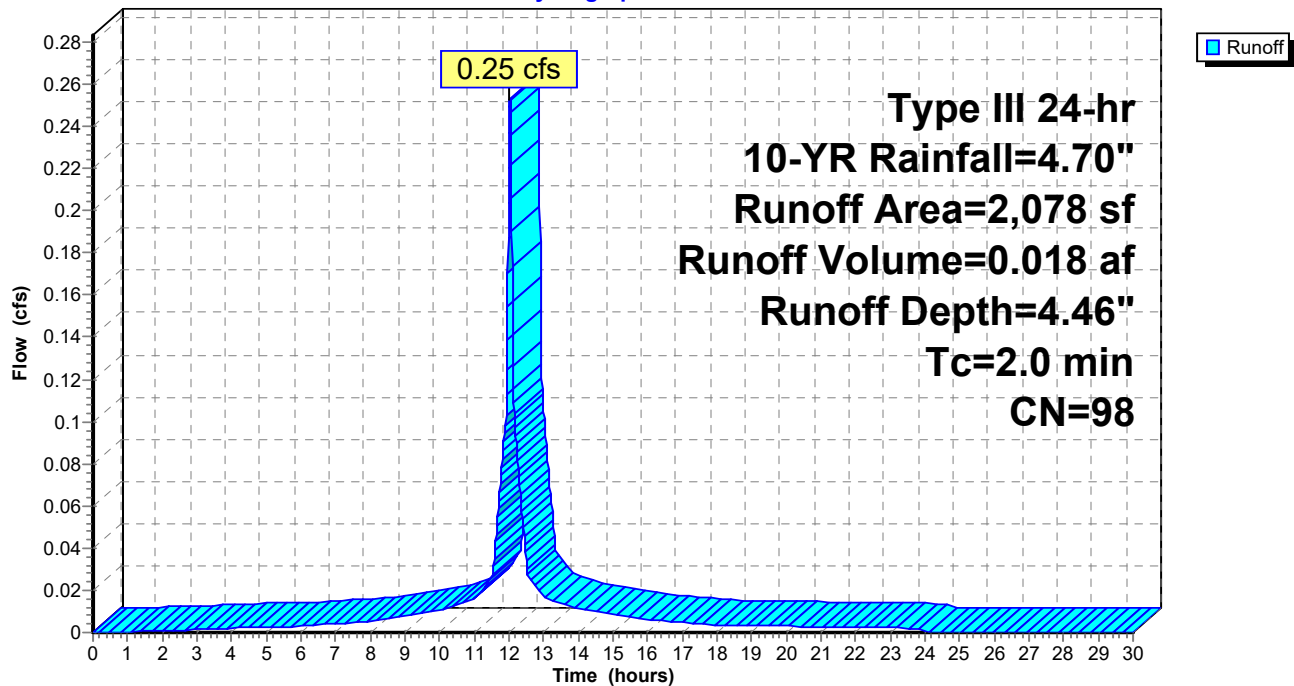
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
2,078	98	Roofs HSG A
2,078		100.00% Impervious Area

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

**Subcatchment 1P: P1a**

Hydrograph



**Summary for Pond 2P: Lot 1A Inf. Field**

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 4.46" for 10-YR event  
 Inflow = 0.25 cfs @ 12.03 hrs, Volume= 0.018 af  
 Outflow = 0.02 cfs @ 11.52 hrs, Volume= 0.018 af, Atten= 93%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.52 hrs, Volume= 0.018 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Link 6P : Design Point #1: Flow to Wetlands 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 110.15' @ 12.99 hrs Surf.Area= 309 sf Storage= 280 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 115.1 min ( 860.4 - 745.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	108.40'	331 cf	<b>6.75'W x 45.75'L x 3.04'H Field A</b> 939 cf Overall - 111 cf Embedded = 829 cf x 40.0% Voids
#2A	108.90'	111 cf	<b>Cultec R-150XLHD x 4 Inside #1</b> Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 1 rows
#3	110.90'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
		444 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.40'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	111.50'	<b>4.0" Round Culvert X 2.00</b> L= 1.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.50' / 111.40' S= 0.1000 ' /' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 11.52 hrs HW=108.46' (Free Discharge)  
 ↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=108.40' TW=0.00' (Dynamic Tailwater)  
 ↑ **2=Culvert** ( Controls 0.00 cfs)

**Pond 2P: Lot 1A Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H =&gt; 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 1 rows

4 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 41.75' Row Length +24.0" End Stone x 2 =  
45.75' Base Length

1 Rows x 33.0" Wide + 24.0" Side Stone x 2 = 6.75' Base Width

6.0" Stone Base + 18.5" Chamber Height + 12.0" Stone Cover = 3.04' Field Height

4 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 1 Rows = 110.6 cf Chamber Storage

939.3 cf Field - 110.6 cf Chambers = 828.7 cf Stone x 40.0% Voids = 331.5 cf Stone Storage

Chamber Storage + Stone Storage = 442.1 cf = 0.010 af

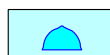
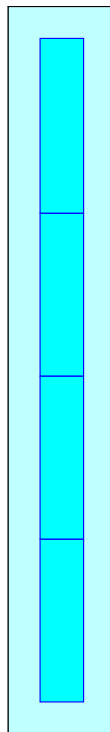
Overall Storage Efficiency = 47.1%

Overall System Size = 45.75' x 6.75' x 3.04'

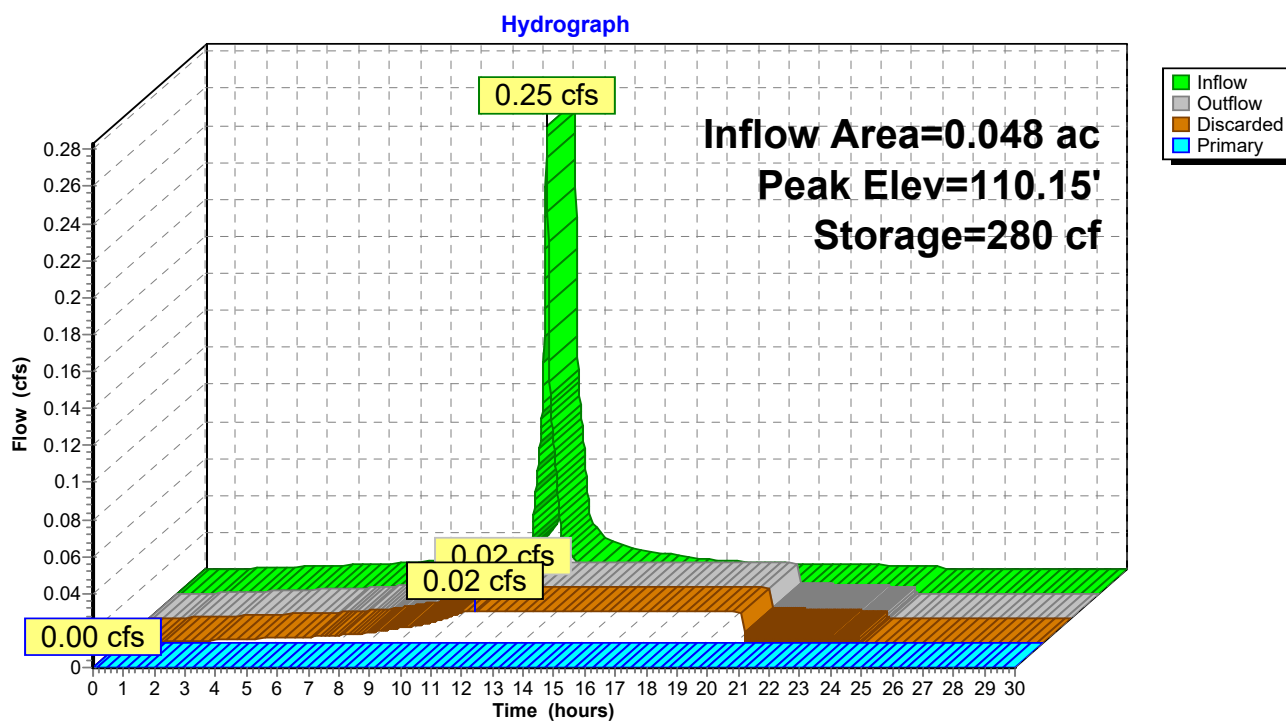
4 Chambers

34.8 cy Field

30.7 cy Stone



## Pond 2P: Lot 1A Inf. Field





**Summary for Subcatchment 3P: P1b**

Runoff = 0.25 cfs @ 12.03 hrs, Volume= 0.018 af, Depth= 4.46"  
 Routed to Pond 4P : Lot 2A Inf. Field

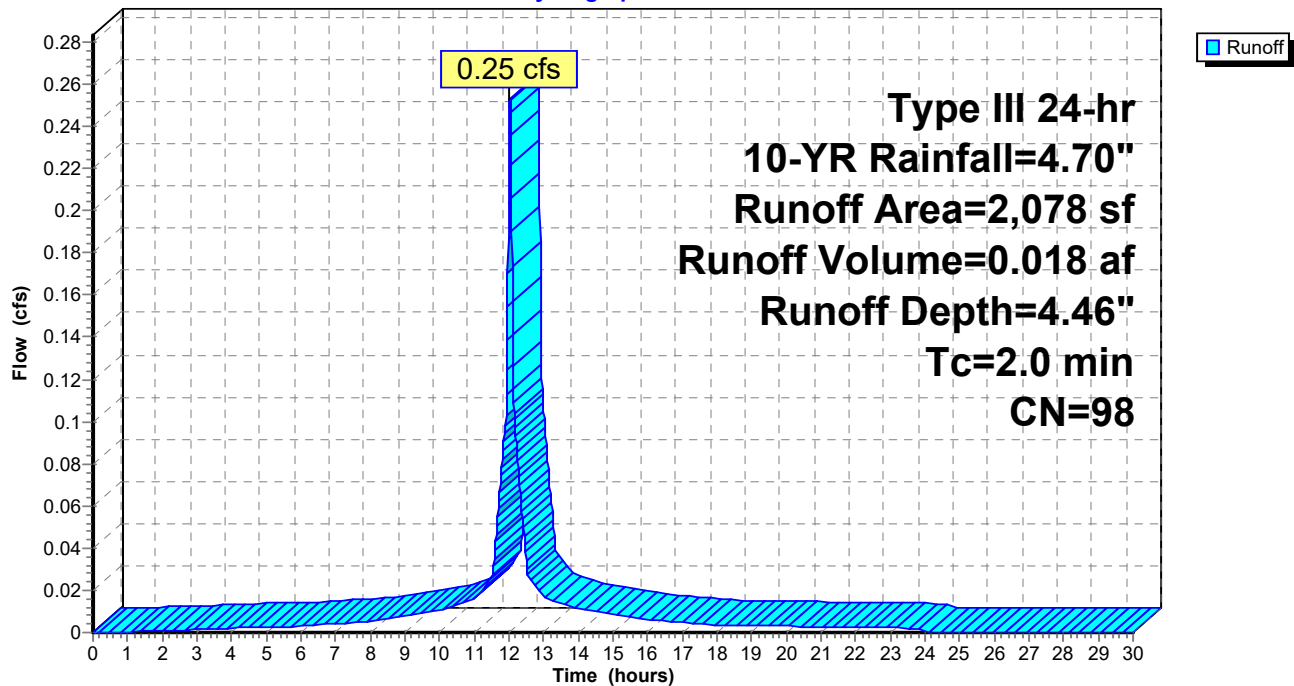
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
2,078	98	Roofs HSG A
2,078		100.00% Impervious Area

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

**Subcatchment 3P: P1b**

Hydrograph



**Summary for Pond 4P: Lot 2A Inf. Field**

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 4.46" for 10-YR event  
 Inflow = 0.25 cfs @ 12.03 hrs, Volume= 0.018 af  
 Outflow = 0.02 cfs @ 11.61 hrs, Volume= 0.018 af, Atten= 92%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.61 hrs, Volume= 0.018 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Link 6P : Design Point #1: Flow to Wetlands 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 108.95' @ 12.87 hrs Surf.Area= 355 sf Storage= 263 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 89.6 min ( 834.9 - 745.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	110.10'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
#2A	107.60'	294 cf	<b>10.00'W x 35.50'L x 2.54'H Field A</b>
			902 cf Overall - 167 cf Embedded = 735 cf x 40.0% Voids
#3A	108.10'	167 cf	<b>Cultec R-150XLHD x 6 Inside #2</b>
			Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf
			Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap
			Row Length Adjustment= +0.75' x 2.65 sf x 2 rows
		463 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	107.60'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	112.20'	<b>4.0" Round Culvert X 2.00</b>
			L= 1.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 112.20' / 112.10' S= 0.1000 ' S= 0.1000 ' Cc= 0.900
			n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 11.61 hrs HW=107.66' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=107.60' TW=0.00' (Dynamic Tailwater)

↑**2=Culvert** ( Controls 0.00 cfs)

**Pond 4P: Lot 2A Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H =&gt; 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 2 rows

33.0" Wide + 6.0" Spacing = 39.0" C-C Row Spacing

3 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 31.50' Row Length +24.0" End Stone x 2 = 35.50' Base Length

2 Rows x 33.0" Wide + 6.0" Spacing x 1 + 24.0" Side Stone x 2 = 10.00' Base Width

6.0" Stone Base + 18.5" Chamber Height + 6.0" Stone Cover = 2.54' Field Height

6 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 2 Rows = 166.9 cf Chamber Storage

902.3 cf Field - 166.9 cf Chambers = 735.4 cf Stone x 40.0% Voids = 294.2 cf Stone Storage

Chamber Storage + Stone Storage = 461.0 cf = 0.011 af

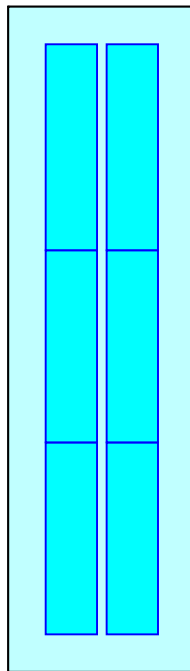
Overall Storage Efficiency = 51.1%

Overall System Size = 35.50' x 10.00' x 2.54'

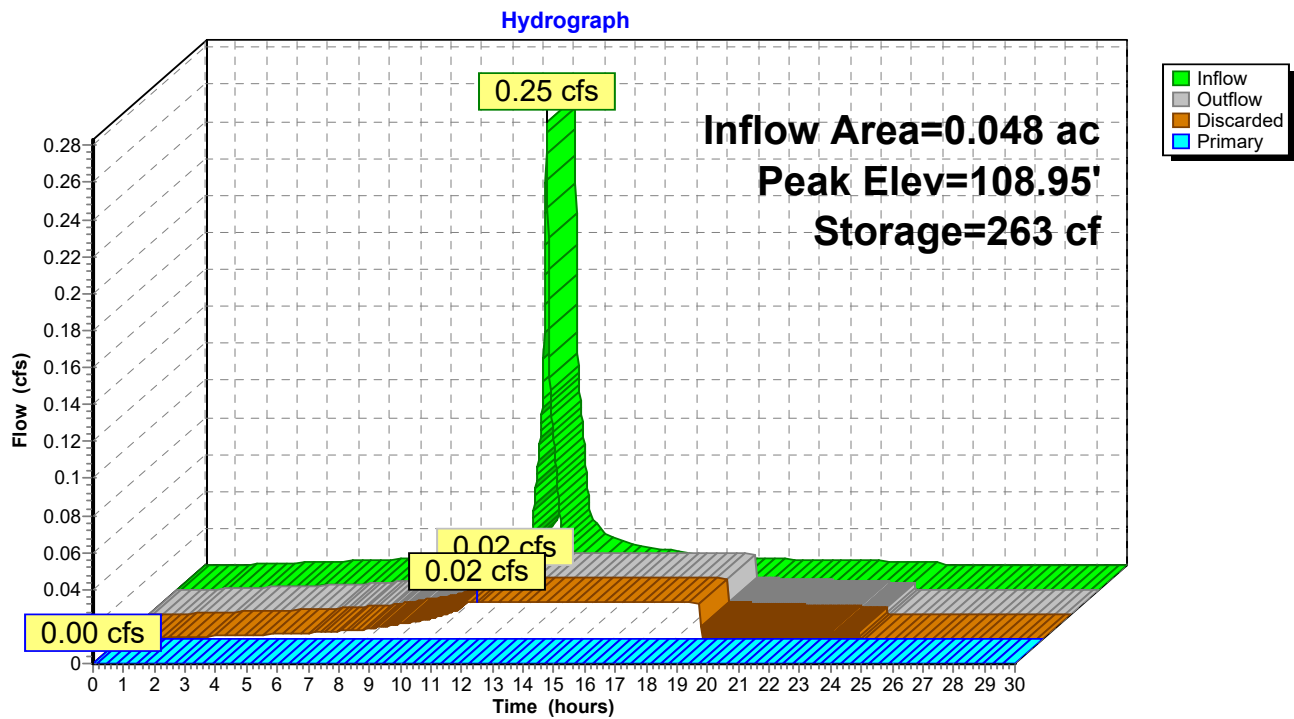
6 Chambers

33.4 cy Field

27.2 cy Stone



## Pond 4P: Lot 2A Inf. Field



**Summary for Subcatchment 5P: P1c**

Runoff = 2.26 cfs @ 12.14 hrs, Volume= 0.204 af, Depth= 1.66"

Routed to Link 6P : Design Point #1: Flow to Wetlands 1

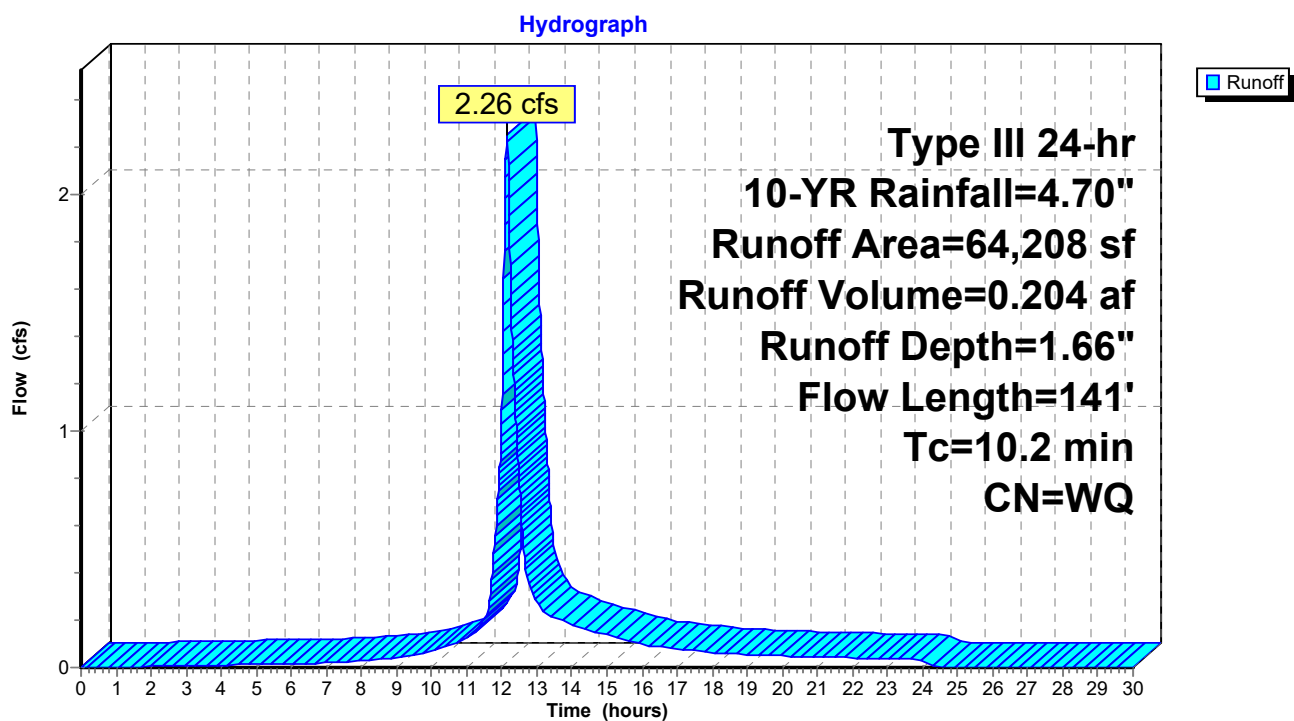
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
1,631	55	Woods, Good HSG B
14,651	77	Woods, Good HSG D
2,297	98	Paved parking HSG D
1,212	98	Paved parking HSG B
7,095	98	Paved parking HSG A
4,476	30	Woods, Good HSG A
21,973	39	>75% Grass cover, Good HSG A
5,947	61	>75% Grass cover, Good HSG B
4,926	80	>75% Grass cover, Good HSG D
64,208		Weighted Average
53,604		83.48% Pervious Area
10,604		16.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	79	0.0600	0.17		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.6	4	0.0200	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	58	0.0400	1.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
10.2	141	Total			

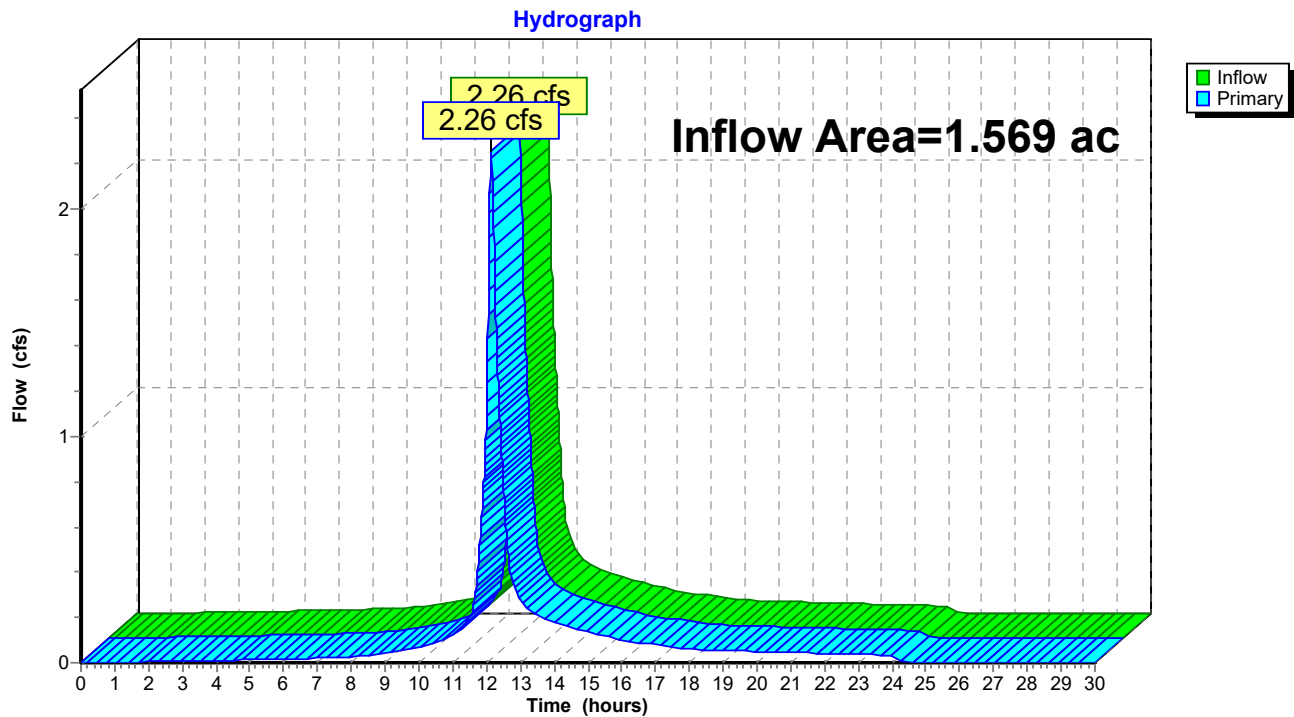
## Subcatchment 5P: P1c



**Summary for Link 6P: Design Point #1: Flow to Wetlands 1**

Inflow Area = 1.569 ac, 21.59% Impervious, Inflow Depth = 1.56" for 10-YR event  
Inflow = 2.26 cfs @ 12.14 hrs, Volume= 0.204 af  
Primary = 2.26 cfs @ 12.14 hrs, Volume= 0.204 af, Atten= 0%, Lag= 0.0 min

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

**Link 6P: Design Point #1: Flow to Wetlands 1**

**HydroCAD3**

Prepared by Legacy Engineering LLC

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

**Subcatchment1P: P1a**

Runoff Area=2,078 sf 100.00% Impervious Runoff Depth=6.46"  
Tc=2.0 min CN=98 Runoff=0.36 cfs 0.026 af

**Pond 2P: Lot 1A Inf. Field**

Peak Elev=111.56' Storage=443 cf Inflow=0.36 cfs 0.026 af  
Discarded=0.02 cfs 0.025 af Primary=0.02 cfs 0.001 af Outflow=0.04 cfs 0.026 af

**Subcatchment3P: P1b**

Runoff Area=2,078 sf 100.00% Impervious Runoff Depth=6.46"  
Tc=2.0 min CN=98 Runoff=0.36 cfs 0.026 af

**Pond 4P: Lot 2A Inf. Field**

Peak Elev=110.00' Storage=441 cf Inflow=0.36 cfs 0.026 af  
Discarded=0.02 cfs 0.026 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.026 af

**Subcatchment5P: P1c**

Runoff Area=64,208 sf 16.52% Impervious Runoff Depth=2.86"  
Flow Length=141' Tc=10.2 min CN=WQ Runoff=3.80 cfs 0.351 af

**Link 6P: Design Point #1: Flow to Wetlands 1**

Inflow=3.80 cfs 0.352 af  
Primary=3.80 cfs 0.352 af

**Total Runoff Area = 1.569 ac Runoff Volume = 0.403 af Average Runoff Depth = 3.08"**  
**78.41% Pervious = 1.231 ac 21.59% Impervious = 0.339 ac**



**Summary for Subcatchment 1P: P1a**

Runoff = 0.36 cfs @ 12.03 hrs, Volume= 0.026 af, Depth= 6.46"  
 Routed to Pond 2P : Lot 1A Inf. Field

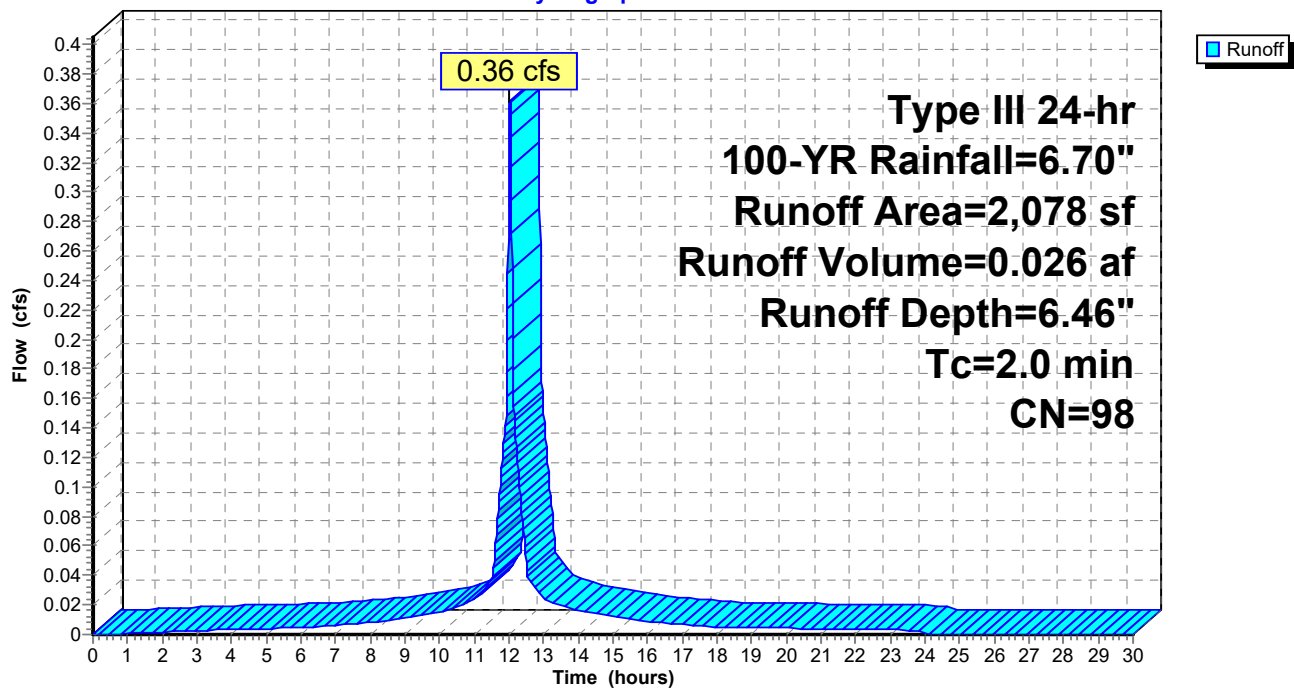
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
2,078	98	Roofs HSG A
2,078		100.00% Impervious Area

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

**Subcatchment 1P: P1a**

Hydrograph



**Summary for Pond 2P: Lot 1A Inf. Field**

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 6.46" for 100-YR event  
 Inflow = 0.36 cfs @ 12.03 hrs, Volume= 0.026 af  
 Outflow = 0.04 cfs @ 12.62 hrs, Volume= 0.026 af, Atten= 90%, Lag= 35.5 min  
 Discarded = 0.02 cfs @ 12.25 hrs, Volume= 0.025 af  
 Primary = 0.02 cfs @ 12.62 hrs, Volume= 0.001 af  
 Routed to Link 6P : Design Point #1: Flow to Wetlands 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 111.56' @ 12.62 hrs Surf.Area= 310 sf Storage= 443 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 195.8 min ( 935.6 - 739.8 )

Volume	Invert	Avail.Storage	Storage Description
#1A	108.40'	331 cf	<b>6.75'W x 45.75'L x 3.04'H Field A</b> 939 cf Overall - 111 cf Embedded = 829 cf x 40.0% Voids
#2A	108.90'	111 cf	<b>Cultec R-150XLHD x 4 Inside #1</b> Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 1 rows
#3	110.90'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
		444 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.40'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	111.50'	<b>4.0" Round Culvert X 2.00</b> L= 1.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.50' / 111.40' S= 0.1000 ' /' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 12.25 hrs HW=110.90' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.02 cfs @ 12.62 hrs HW=111.56' TW=0.00' (Dynamic Tailwater)

↑**2=Culvert** (Inlet Controls 0.02 cfs @ 0.85 fps)

**Pond 2P: Lot 1A Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H =&gt; 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 1 rows

4 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 41.75' Row Length +24.0" End Stone x 2 = 45.75' Base Length

1 Rows x 33.0" Wide + 24.0" Side Stone x 2 = 6.75' Base Width

6.0" Stone Base + 18.5" Chamber Height + 12.0" Stone Cover = 3.04' Field Height

4 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 1 Rows = 110.6 cf Chamber Storage

939.3 cf Field - 110.6 cf Chambers = 828.7 cf Stone x 40.0% Voids = 331.5 cf Stone Storage

Chamber Storage + Stone Storage = 442.1 cf = 0.010 af

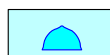
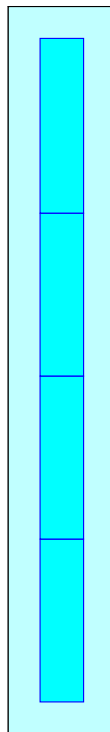
Overall Storage Efficiency = 47.1%

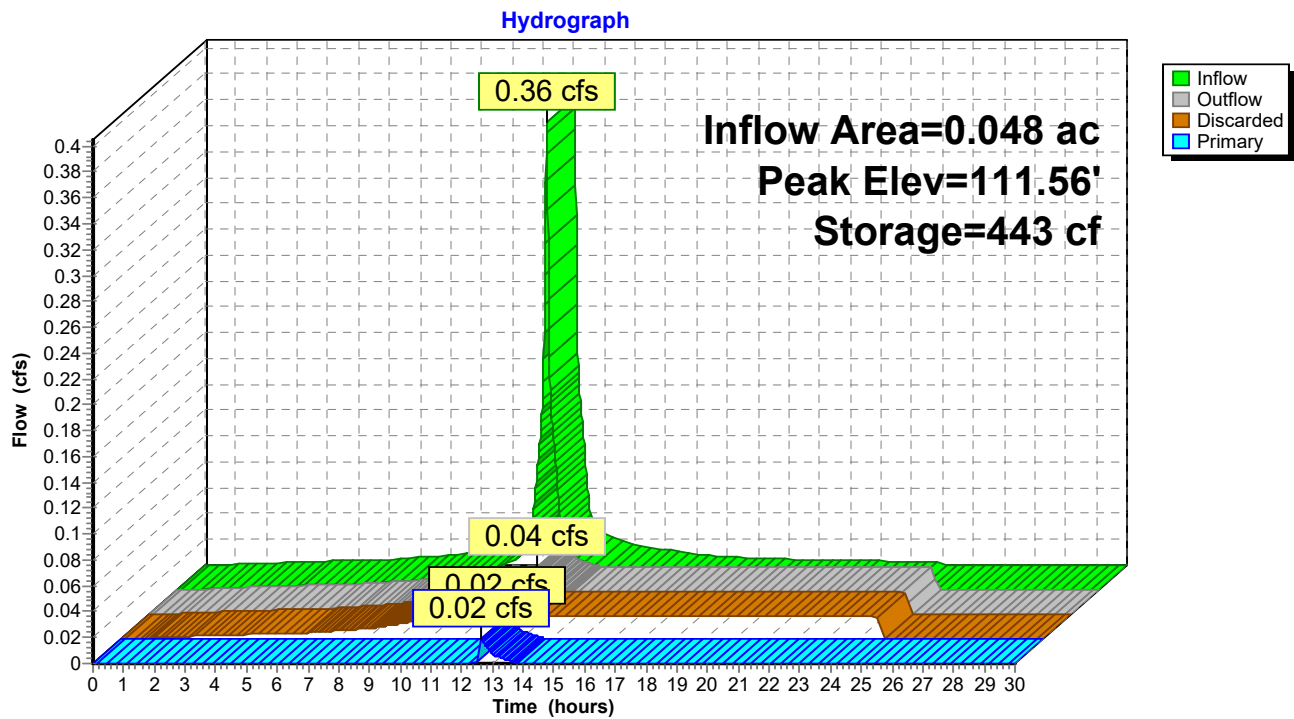
Overall System Size = 45.75' x 6.75' x 3.04'

4 Chambers

34.8 cy Field

30.7 cy Stone



**Pond 2P: Lot 1A Inf. Field**

**Summary for Subcatchment 3P: P1b**

Runoff = 0.36 cfs @ 12.03 hrs, Volume= 0.026 af, Depth= 6.46"  
 Routed to Pond 4P : Lot 2A Inf. Field

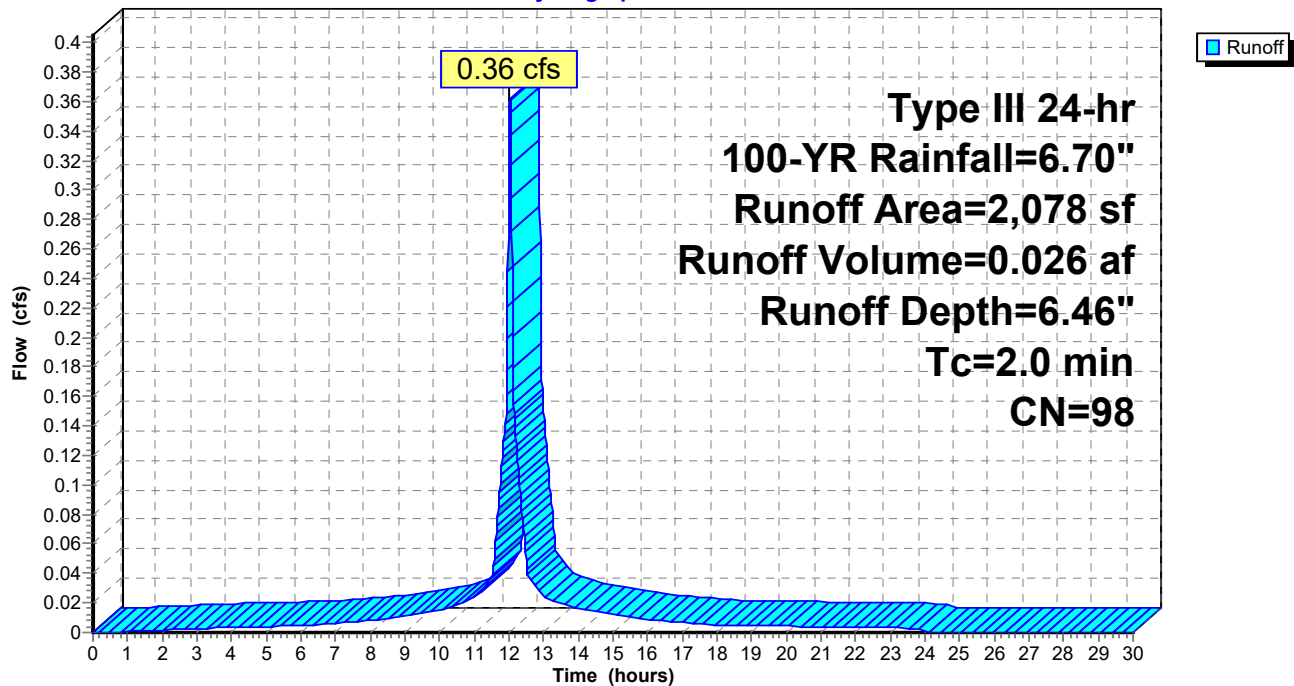
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
2,078	98	Roofs HSG A
2,078		100.00% Impervious Area

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

**Subcatchment 3P: P1b**

Hydrograph



**Summary for Pond 4P: Lot 2A Inf. Field**

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 6.46" for 100-YR event  
 Inflow = 0.36 cfs @ 12.03 hrs, Volume= 0.026 af  
 Outflow = 0.02 cfs @ 11.25 hrs, Volume= 0.026 af, Atten= 95%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.25 hrs, Volume= 0.026 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Link 6P : Design Point #1: Flow to Wetlands 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 110.00' @ 13.51 hrs Surf.Area= 355 sf Storage= 441 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 167.6 min ( 907.5 - 739.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	110.10'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
#2A	107.60'	294 cf	<b>10.00'W x 35.50'L x 2.54'H Field A</b>
			902 cf Overall - 167 cf Embedded = 735 cf x 40.0% Voids
#3A	108.10'	167 cf	<b>Cultec R-150XLHD x 6 Inside #2</b>
			Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf
			Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap
			Row Length Adjustment= +0.75' x 2.65 sf x 2 rows
		463 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	107.60'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	112.20'	<b>4.0" Round Culvert X 2.00</b>
			L= 1.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 112.20' / 112.10' S= 0.1000 ' S= 0.1000 ' Cc= 0.900
			n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 11.25 hrs HW=107.66' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=107.60' TW=0.00' (Dynamic Tailwater)

↑**2=Culvert** ( Controls 0.00 cfs)

**Pond 4P: Lot 2A Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H =&gt; 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 2 rows

33.0" Wide + 6.0" Spacing = 39.0" C-C Row Spacing

3 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 31.50' Row Length +24.0" End Stone x 2 = 35.50' Base Length

2 Rows x 33.0" Wide + 6.0" Spacing x 1 + 24.0" Side Stone x 2 = 10.00' Base Width

6.0" Stone Base + 18.5" Chamber Height + 6.0" Stone Cover = 2.54' Field Height

6 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 2 Rows = 166.9 cf Chamber Storage

902.3 cf Field - 166.9 cf Chambers = 735.4 cf Stone x 40.0% Voids = 294.2 cf Stone Storage

Chamber Storage + Stone Storage = 461.0 cf = 0.011 af

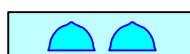
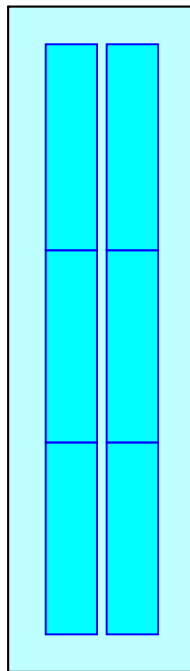
Overall Storage Efficiency = 51.1%

Overall System Size = 35.50' x 10.00' x 2.54'

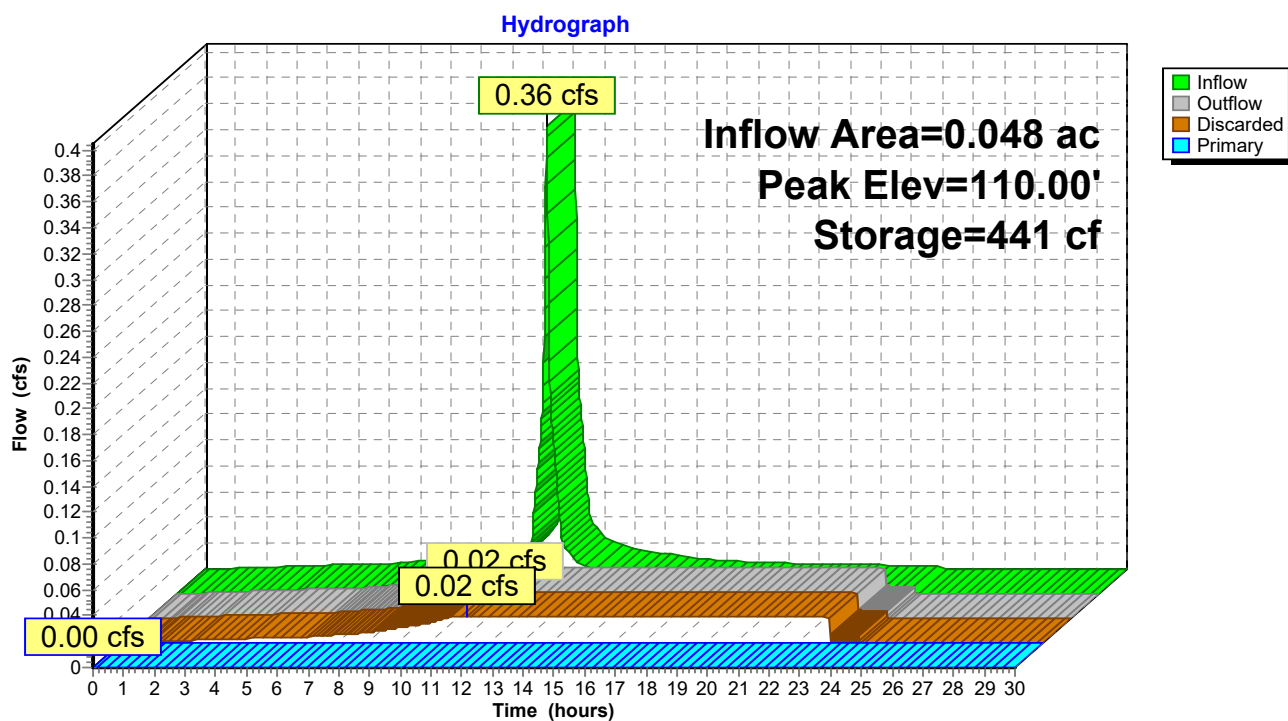
6 Chambers

33.4 cy Field

27.2 cy Stone



## Pond 4P: Lot 2A Inf. Field





**Summary for Subcatchment 5P: P1c**

Runoff = 3.80 cfs @ 12.14 hrs, Volume= 0.351 af, Depth= 2.86"

Routed to Link 6P : Design Point #1: Flow to Wetlands 1

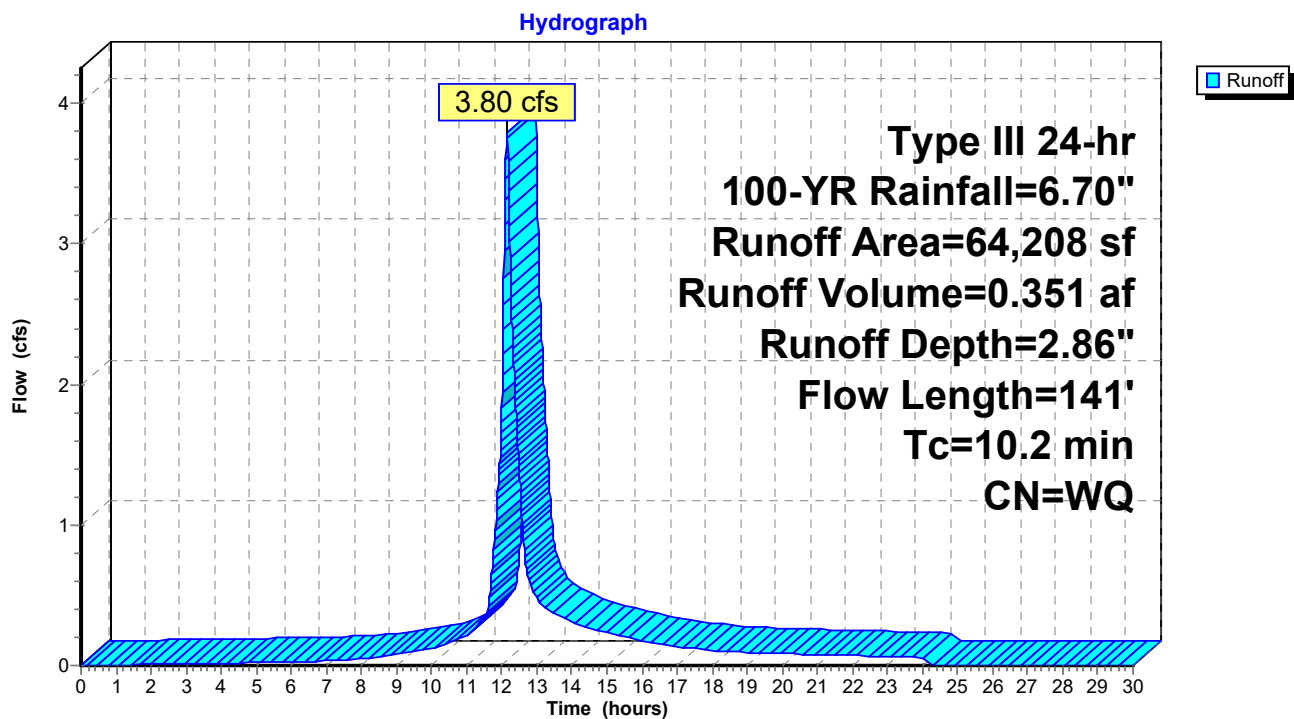
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
1,631	55	Woods, Good HSG B
14,651	77	Woods, Good HSG D
2,297	98	Paved parking HSG D
1,212	98	Paved parking HSG B
7,095	98	Paved parking HSG A
4,476	30	Woods, Good HSG A
21,973	39	>75% Grass cover, Good HSG A
5,947	61	>75% Grass cover, Good HSG B
4,926	80	>75% Grass cover, Good HSG D
64,208		Weighted Average
53,604		83.48% Pervious Area
10,604		16.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	79	0.0600	0.17		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
1.6	4	0.0200	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	58	0.0400	1.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
10.2	141	Total			

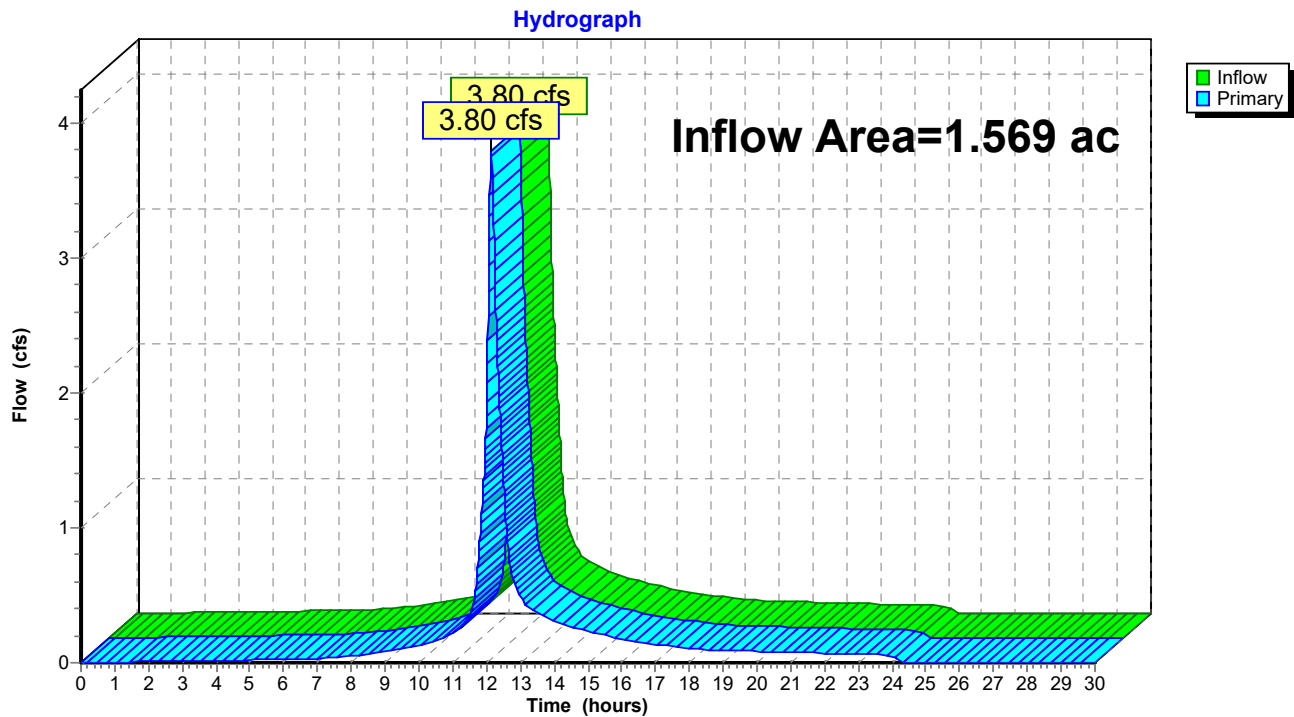
## Subcatchment 5P: P1c



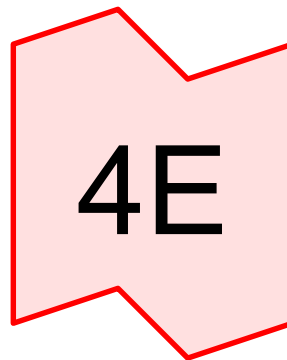
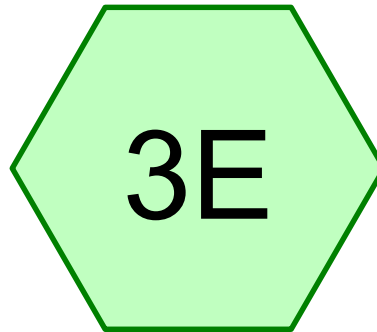
**Summary for Link 6P: Design Point #1: Flow to Wetlands 1**

Inflow Area = 1.569 ac, 21.59% Impervious, Inflow Depth = 2.69" for 100-YR event  
Inflow = 3.80 cfs @ 12.14 hrs, Volume= 0.352 af  
Primary = 3.80 cfs @ 12.14 hrs, Volume= 0.352 af, Atten= 0%, Lag= 0.0 min

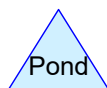
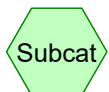
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 6P: Design Point #1: Flow to Wetlands 1**

**DESIGN POINT #2: FLOW TO**  
**WETLANDS 2 EXISTING CONDITIONS**



## Design Point #2: Flow to Wetlands 2



### Routing Diagram for HydroCAD

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# HydroCAD

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## Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type III 24-hr		Default	24.00	1	3.20	2
2	10-YR	Type III 24-hr		Default	24.00	1	4.70	2
3	100-YR	Type III 24-hr		Default	24.00	1	6.70	2

## HydroCAD

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.053	61	>75% Grass cover, Good HSG B (3E)
0.008	80	>75% Grass cover, Good HSG D (3E)
0.124	98	Paved parking HSG B (3E)
0.016	98	Paved parking HSG D (3E)
0.609	55	Woods, Good HSG B (3E)
0.534	77	Woods, Good HSG D (3E)
<b>1.343</b>	<b>69</b>	<b>TOTAL AREA</b>

## HydroCAD

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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-Q

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

### Subcatchment3E: E2

Runoff Area=58,497 sf 10.40% Impervious Runoff Depth=0.93"

Flow Length=181' Tc=12.1 min CN=WQ Runoff=1.00 cfs 0.104 af

### Link 4E: Design Point #2: Flow to Wetlands 2

Inflow=1.00 cfs 0.104 af

Primary=1.00 cfs 0.104 af

**Total Runoff Area = 1.343 ac Runoff Volume = 0.104 af Average Runoff Depth = 0.93"**  
**89.60% Pervious = 1.203 ac 10.40% Impervious = 0.140 ac**



**Summary for Subcatchment 3E: E2**

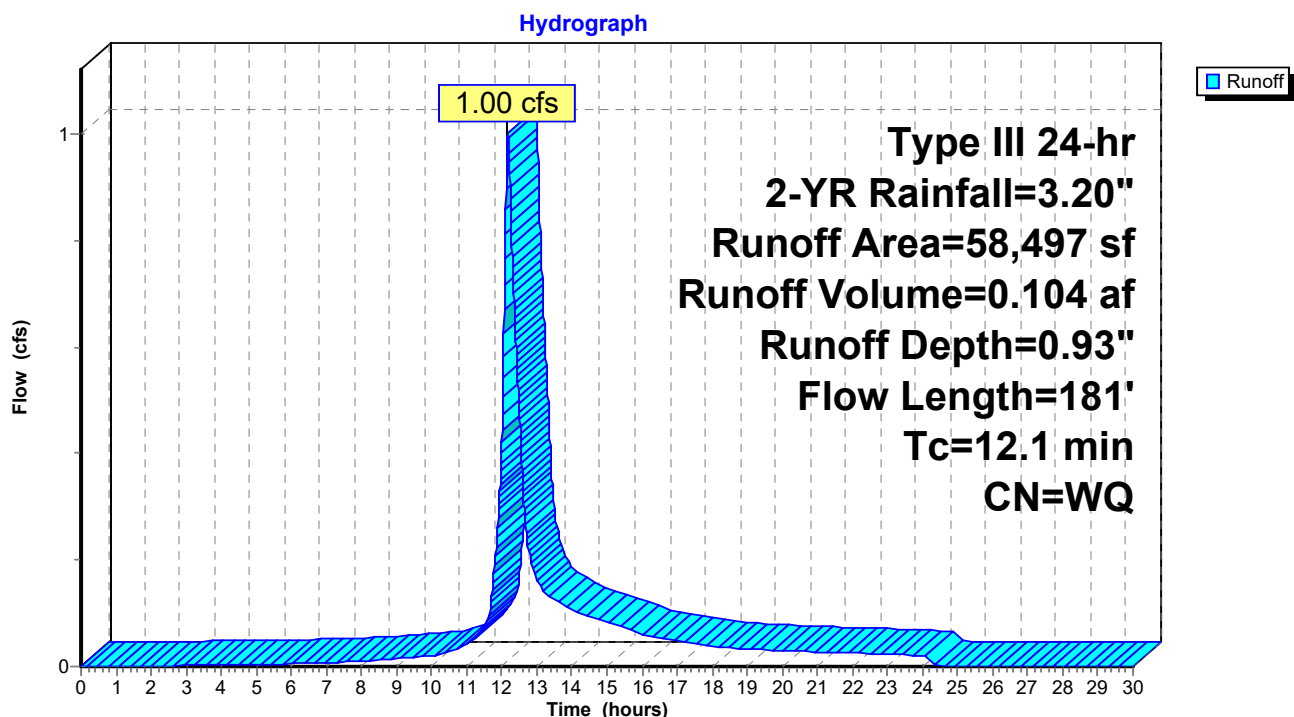
Runoff = 1.00 cfs @ 12.17 hrs, Volume= 0.104 af, Depth= 0.93"  
 Routed to Link 4E : Design Point #2: Flow to Wetlands 2

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

Area (sf)	CN	Description
5,380	98	Paved parking HSG B
26,512	55	Woods, Good HSG B
23,272	77	Woods, Good HSG D
705	98	Paved parking HSG D
2,297	61	>75% Grass cover, Good HSG B
331	80	>75% Grass cover, Good HSG D
58,497		Weighted Average
52,412		89.60% Pervious Area
6,085		10.40% Impervious Area

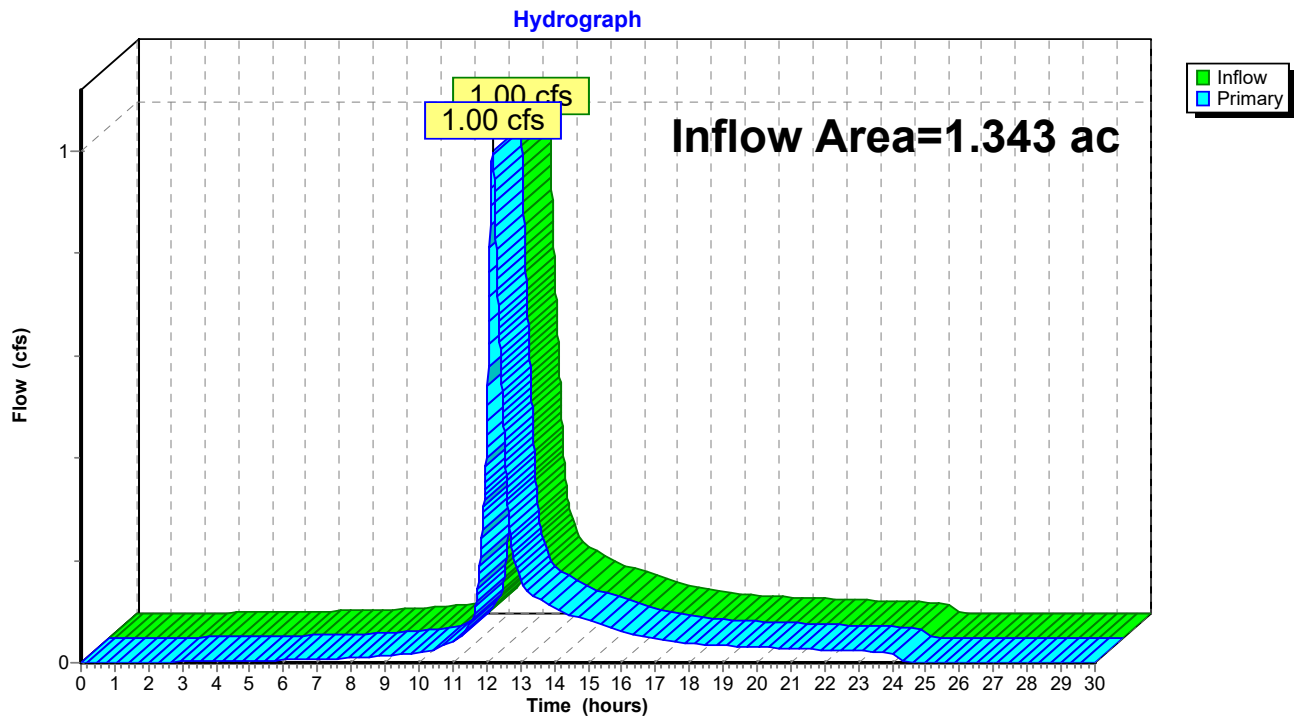
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	35	0.0200	0.06		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.8	146	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
12.1	181	Total			

**Subcatchment 3E: E2**

**Summary for Link 4E: Design Point #2: Flow to Wetlands 2**

Inflow Area = 1.343 ac, 10.40% Impervious, Inflow Depth = 0.93" for 2-YR event  
Inflow = 1.00 cfs @ 12.17 hrs, Volume= 0.104 af  
Primary = 1.00 cfs @ 12.17 hrs, Volume= 0.104 af, Atten= 0%, Lag= 0.0 min

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

**Link 4E: Design Point #2: Flow to Wetlands 2**

## HydroCAD

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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-Q

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

### Subcatchment3E: E2

Runoff Area=58,497 sf 10.40% Impervious Runoff Depth=1.85"

Flow Length=181' Tc=12.1 min CN=WQ Runoff=2.17 cfs 0.207 af

### Link 4E: Design Point #2: Flow to Wetlands 2

Inflow=2.17 cfs 0.207 af

Primary=2.17 cfs 0.207 af

**Total Runoff Area = 1.343 ac Runoff Volume = 0.207 af Average Runoff Depth = 1.85"**  
**89.60% Pervious = 1.203 ac 10.40% Impervious = 0.140 ac**

**Summary for Subcatchment 3E: E2**

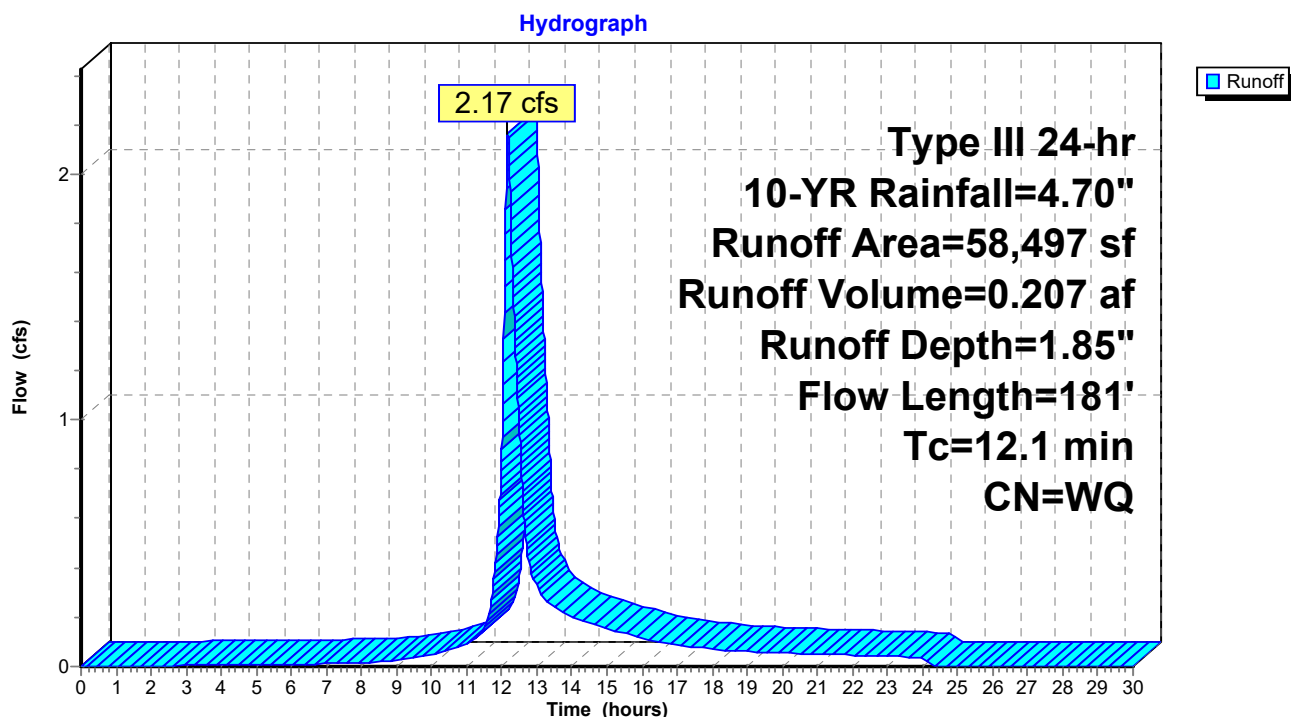
Runoff = 2.17 cfs @ 12.17 hrs, Volume= 0.207 af, Depth= 1.85"  
 Routed to Link 4E : Design Point #2: Flow to Wetlands 2

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

Area (sf)	CN	Description
5,380	98	Paved parking HSG B
26,512	55	Woods, Good HSG B
23,272	77	Woods, Good HSG D
705	98	Paved parking HSG D
2,297	61	>75% Grass cover, Good HSG B
331	80	>75% Grass cover, Good HSG D
58,497		Weighted Average
52,412		89.60% Pervious Area
6,085		10.40% Impervious Area

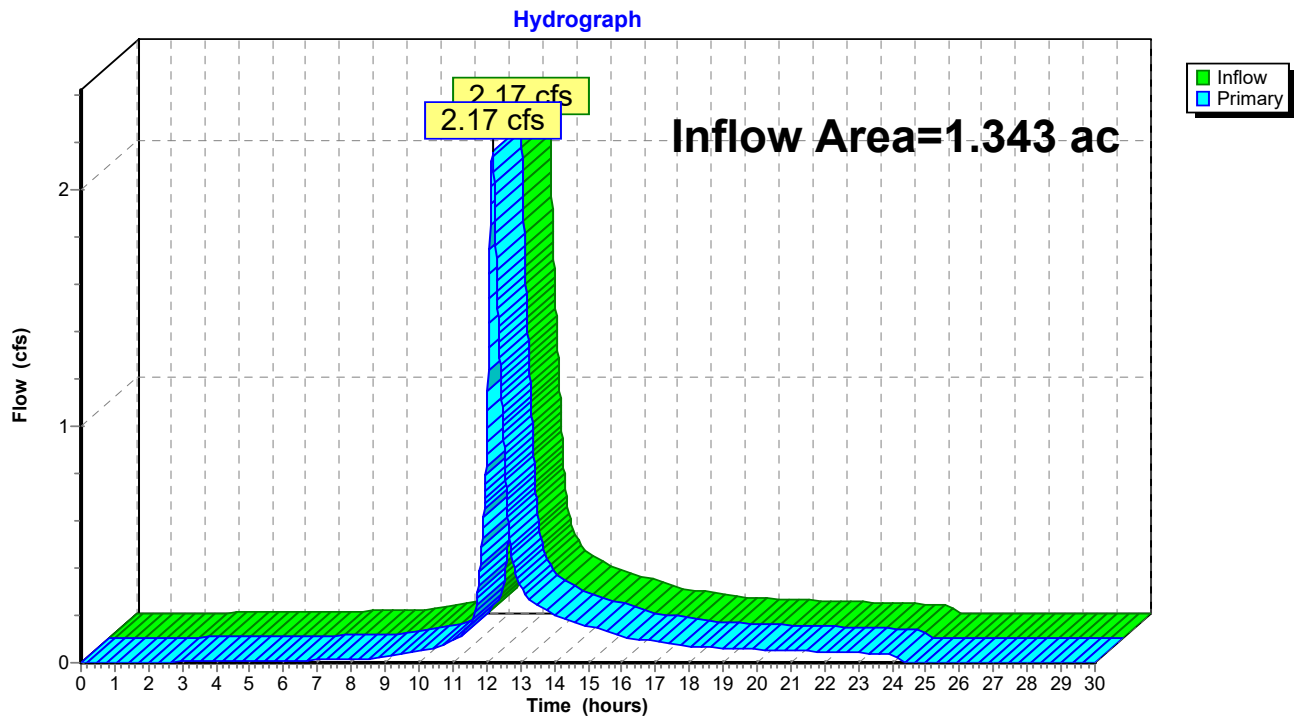
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	35	0.0200	0.06		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.8	146	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
12.1	181	Total			

**Subcatchment 3E: E2**

**Summary for Link 4E: Design Point #2: Flow to Wetlands 2**

Inflow Area = 1.343 ac, 10.40% Impervious, Inflow Depth = 1.85" for 10-YR event  
Inflow = 2.17 cfs @ 12.17 hrs, Volume= 0.207 af  
Primary = 2.17 cfs @ 12.17 hrs, Volume= 0.207 af, Atten= 0%, Lag= 0.0 min

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

**Link 4E: Design Point #2: Flow to Wetlands 2**

## HydroCAD

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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-Q

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

### Subcatchment3E: E2

Runoff Area=58,497 sf 10.40% Impervious Runoff Depth=3.30"

Flow Length=181' Tc=12.1 min CN=WQ Runoff=4.04 cfs 0.370 af

### Link 4E: Design Point #2: Flow to Wetlands 2

Inflow=4.04 cfs 0.370 af

Primary=4.04 cfs 0.370 af

**Total Runoff Area = 1.343 ac Runoff Volume = 0.370 af Average Runoff Depth = 3.30"**  
**89.60% Pervious = 1.203 ac 10.40% Impervious = 0.140 ac**

**Summary for Subcatchment 3E: E2**

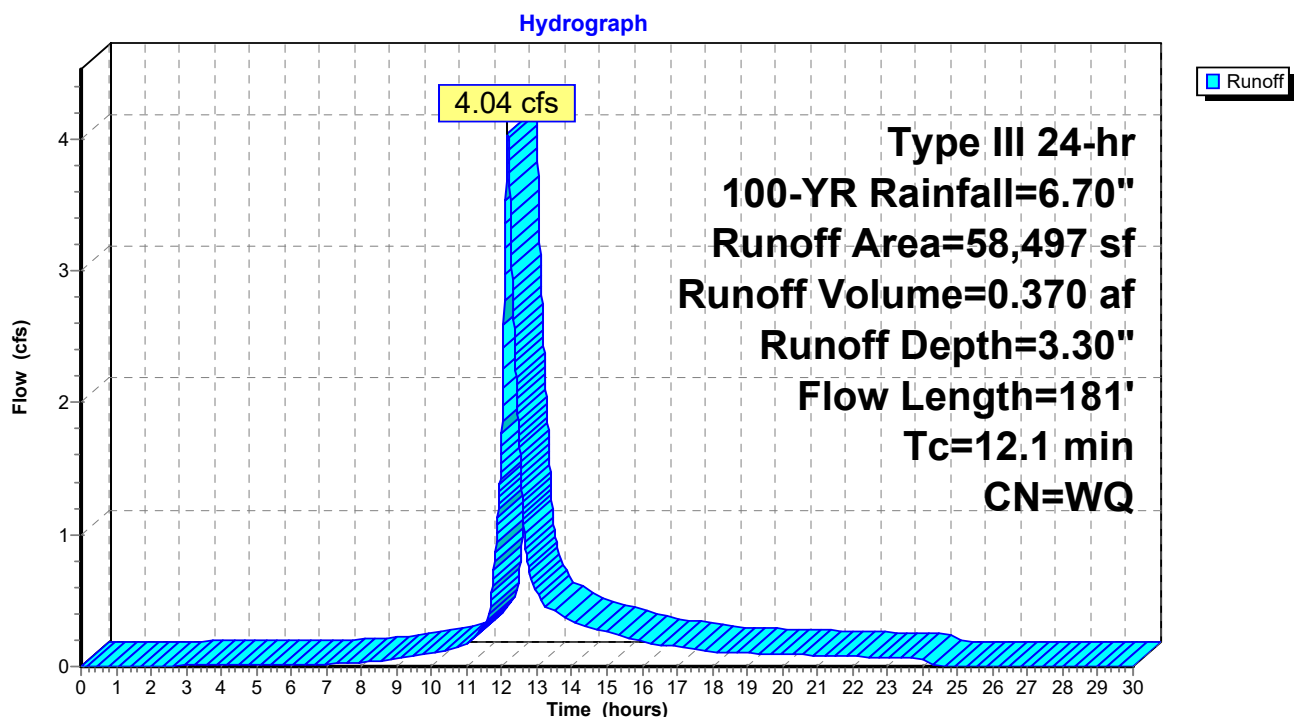
Runoff = 4.04 cfs @ 12.17 hrs, Volume= 0.370 af, Depth= 3.30"  
 Routed to Link 4E : Design Point #2: Flow to Wetlands 2

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

Area (sf)	CN	Description
5,380	98	Paved parking HSG B
26,512	55	Woods, Good HSG B
23,272	77	Woods, Good HSG D
705	98	Paved parking HSG D
2,297	61	>75% Grass cover, Good HSG B
331	80	>75% Grass cover, Good HSG D
58,497		Weighted Average
52,412		89.60% Pervious Area
6,085		10.40% Impervious Area

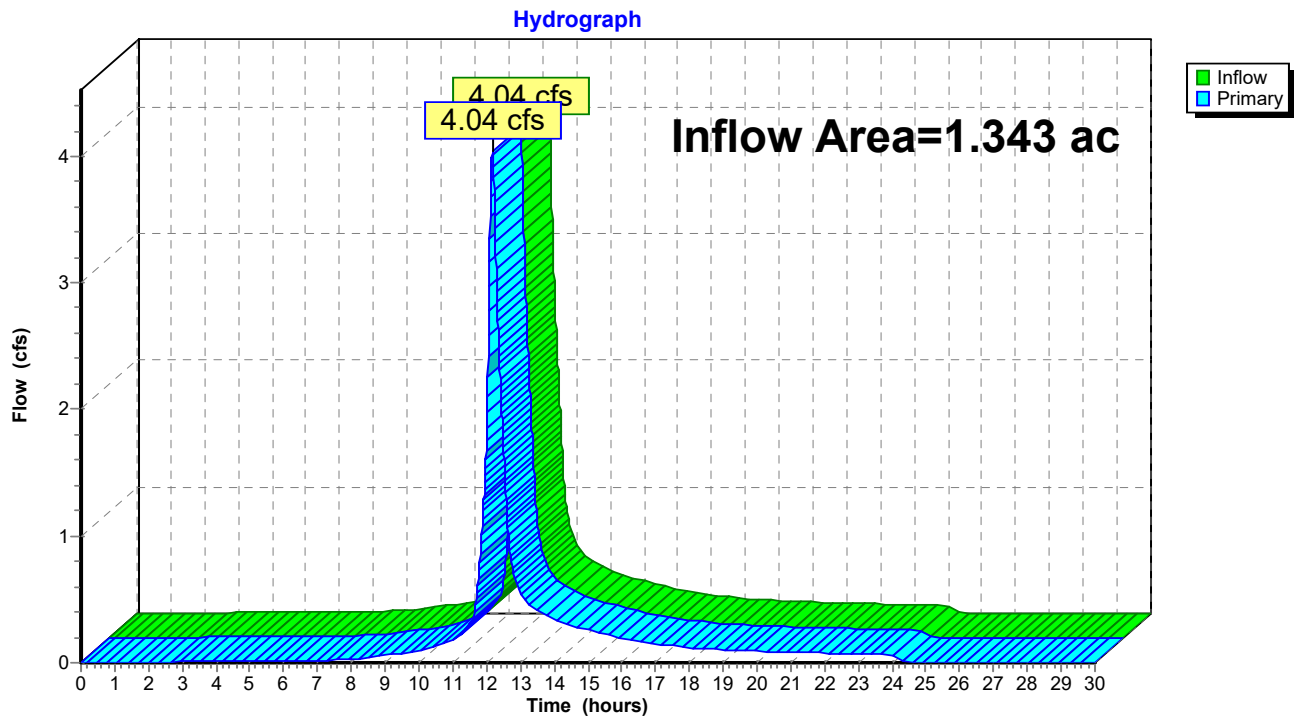
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	35	0.0200	0.06		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.8	146	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
12.1	181	Total			

**Subcatchment 3E: E2**

**Summary for Link 4E: Design Point #2: Flow to Wetlands 2**

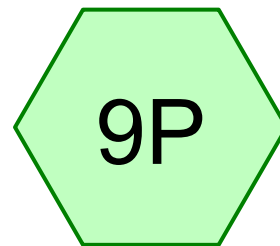
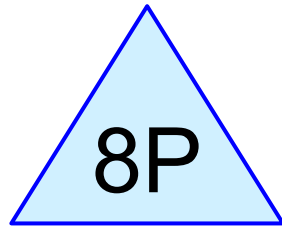
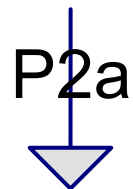
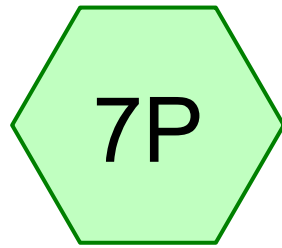
Inflow Area = 1.343 ac, 10.40% Impervious, Inflow Depth = 3.30" for 100-YR event  
Inflow = 4.04 cfs @ 12.17 hrs, Volume= 0.370 af  
Primary = 4.04 cfs @ 12.17 hrs, Volume= 0.370 af, Atten= 0%, Lag= 0.0 min

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

**Link 4E: Design Point #2: Flow to Wetlands 2**

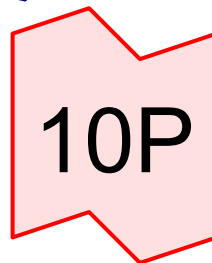
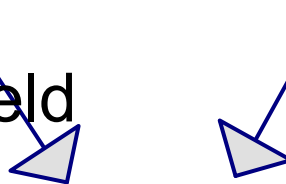


**DESIGN POINT #2: FLOW TO**  
**WETLANDS 2 PROPOSED CONDITIONS**

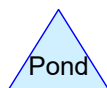
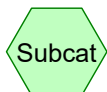


Lot 4 Inf. Field

P2b



Design Point #2: Flow to  
Wetlands 2



Routing Diagram for HydroCAD3

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## HydroCAD3

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### Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type III 24-hr		Default	24.00	1	3.20	2
2	10-YR	Type III 24-hr		Default	24.00	1	4.70	2
3	100-YR	Type III 24-hr		Default	24.00	1	6.70	2

## HydroCAD3

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.382	61	>75% Grass cover, Good HSG B (9P)
0.134	80	>75% Grass cover, Good HSG D (9P)
0.127	98	Paved parking HSG B (9P)
0.054	98	Paved parking HSG D (9P)
0.034	98	Roofs HSG B (7P)
0.014	98	Roofs HSG D (7P)
0.242	55	Woods, Good HSG B (9P)
0.356	77	Woods, Good HSG D (9P)
<b>1.343</b>	<b>72</b>	<b>TOTAL AREA</b>

## HydroCAD3

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

### Subcatchment7P: P2a

Runoff Area=2,078 sf 100.00% Impervious Runoff Depth=2.97"  
Tc=2.0 min CN=WQ Runoff=0.17 cfs 0.012 af

### Pond 8P: Lot 4 Inf. Field

Peak Elev=109.31' Storage=150 cf Inflow=0.17 cfs 0.012 af  
Discarded=0.02 cfs 0.012 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.012 af

### Subcatchment9P: P2b

Runoff Area=56,420 sf 13.95% Impervious Runoff Depth=1.07"  
Flow Length=180' Tc=11.5 min CN=WQ Runoff=1.16 cfs 0.116 af

### Link 10P: Design Point #2: Flow to Wetlands 2

Inflow=1.16 cfs 0.116 af  
Primary=1.16 cfs 0.116 af

**Total Runoff Area = 1.343 ac Runoff Volume = 0.127 af Average Runoff Depth = 1.14"**  
**82.99% Pervious = 1.114 ac 17.01% Impervious = 0.228 ac**

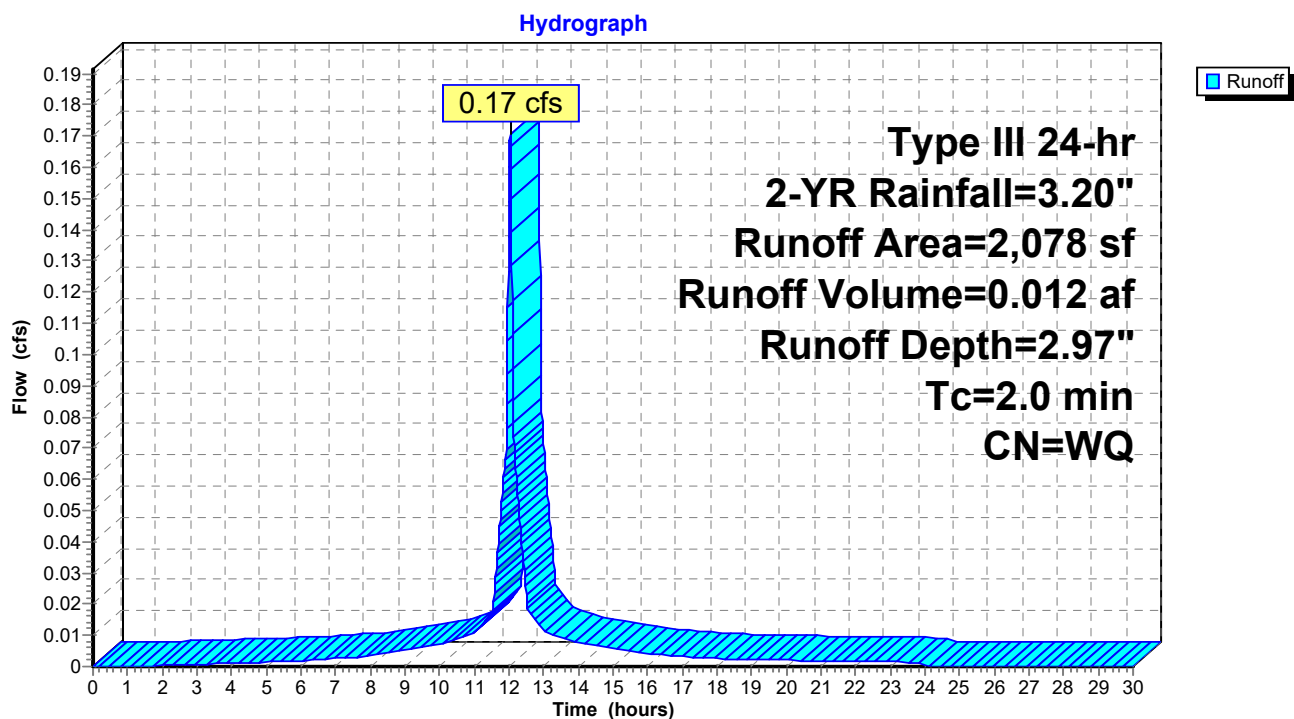
**Summary for Subcatchment 7P: P2a**

Runoff = 0.17 cfs @ 12.03 hrs, Volume= 0.012 af, Depth= 2.97"  
 Routed to Pond 8P : Lot 4 Inf. Field

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

Area (sf)	CN	Description
1,485	98	Roofs HSG B
593	98	Roofs HSG D
2,078		Weighted Average
2,078		100.00% Impervious Area

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

**Subcatchment 7P: P2a**

**Summary for Pond 8P: Lot 4 Inf. Field**

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2-YR event  
 Inflow = 0.17 cfs @ 12.03 hrs, Volume= 0.012 af  
 Outflow = 0.02 cfs @ 11.72 hrs, Volume= 0.012 af, Atten= 89%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.72 hrs, Volume= 0.012 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Link 10P : Design Point #2: Flow to Wetlands 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 109.31' @ 12.52 hrs Surf.Area= 350 sf Storage= 150 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 45.3 min ( 798.0 - 752.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	110.50'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
#2A	108.50'	226 cf	<b>35.00'W x 10.00'L x 2.04'H Field A</b> 715 cf Overall - 149 cf Embedded = 566 cf x 40.0% Voids
#3A	109.00'	149 cf	<b>Cultec C-100HD</b> x 10 Inside #2 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 10 rows
		378 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.50'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	113.00'	<b>4.0" Round Culvert</b> L= 1.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.00' / 112.90' S= 0.1000 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 11.72 hrs HW=108.55' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=108.50' TW=0.00' (Dynamic Tailwater)

↑**2=Culvert** ( Controls 0.00 cfs)

**Pond 8P: Lot 4 Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H =&gt; 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 10 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

1 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length

10 Rows x 36.0" Wide + 4.0" Spacing x 9 + 12.0" Side Stone x 2 = 35.00' Base Width

6.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.04' Field Height

10 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 10 Rows = 148.9 cf Chamber Storage

714.6 cf Field - 148.9 cf Chambers = 565.7 cf Stone x 40.0% Voids = 226.3 cf Stone Storage

Chamber Storage + Stone Storage = 375.2 cf = 0.009 af

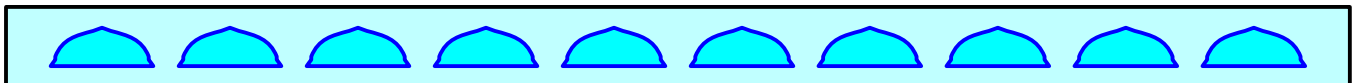
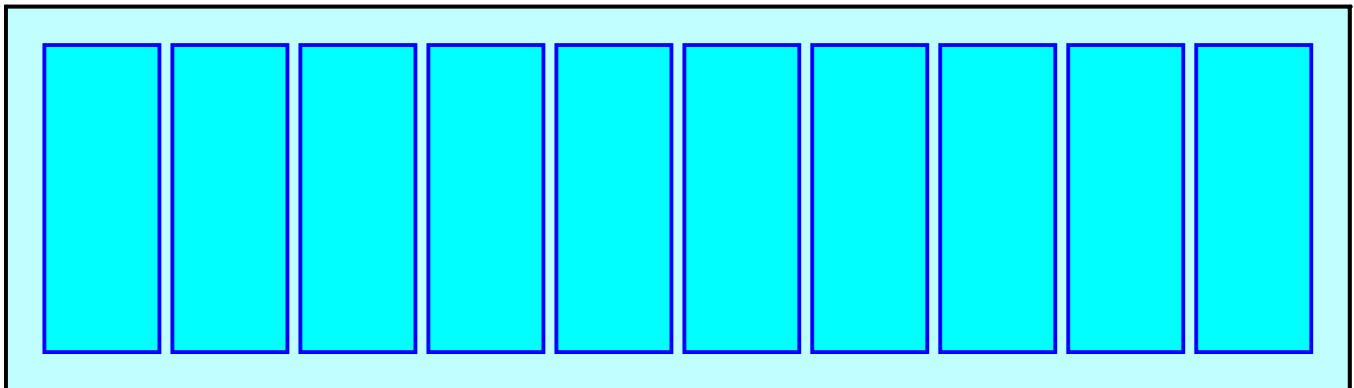
Overall Storage Efficiency = 52.5%

Overall System Size = 10.00' x 35.00' x 2.04'

10 Chambers

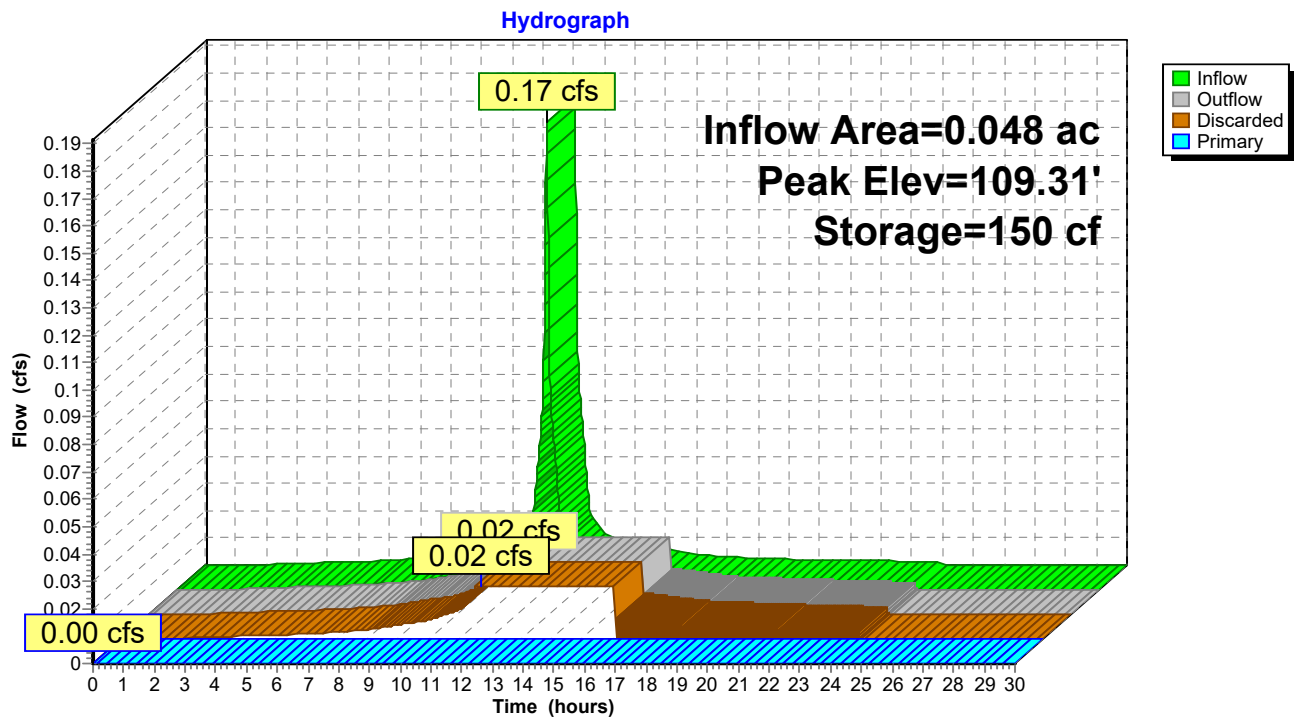
26.5 cy Field

21.0 cy Stone





## Pond 8P: Lot 4 Inf. Field



**Summary for Subcatchment 9P: P2b**

Runoff = 1.16 cfs @ 12.17 hrs, Volume= 0.116 af, Depth= 1.07"

Routed to Link 10P : Design Point #2: Flow to Wetlands 2

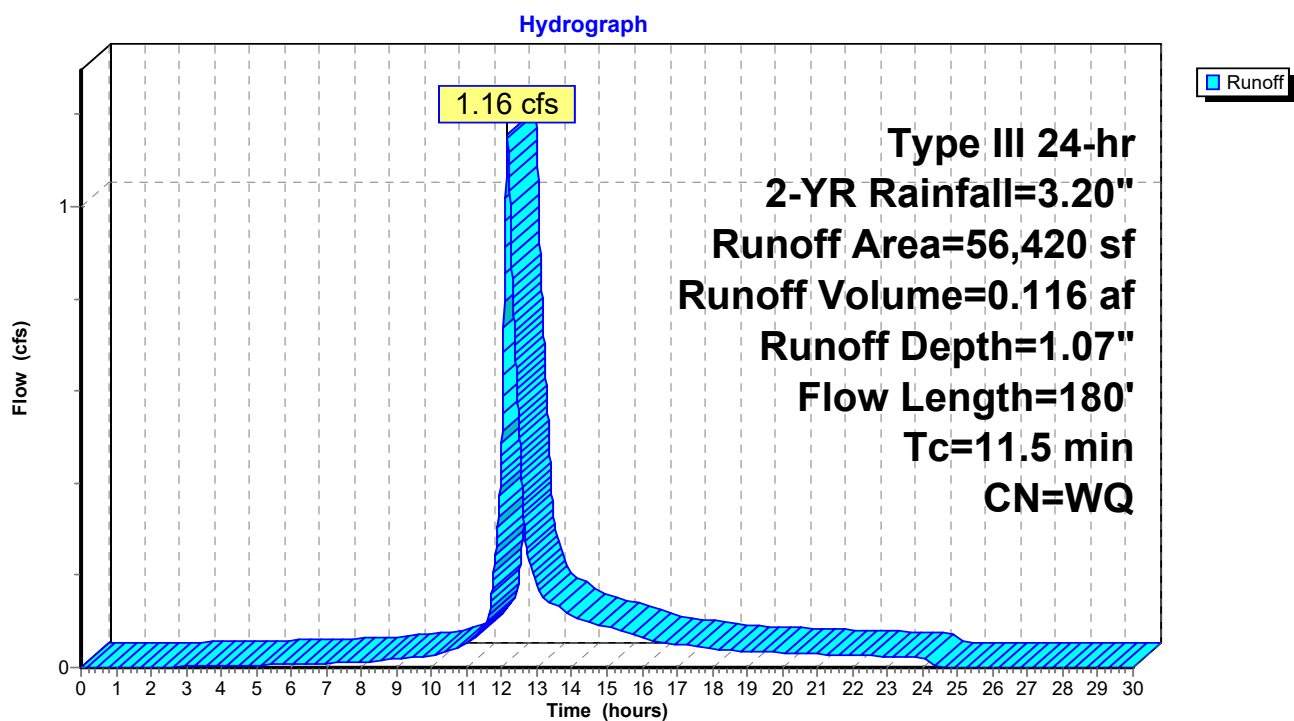
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
10,545	55	Woods, Good HSG B
5,524	98	Paved parking HSG B
2,349	98	Paved parking HSG D
15,512	77	Woods, Good HSG D
16,635	61	>75% Grass cover, Good HSG B
5,855	80	>75% Grass cover, Good HSG D
56,420		Weighted Average
48,547		86.05% Pervious Area
7,873		13.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	84	0.0800	0.20		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
2.3	6	0.0200	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.1	90	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.5	180	Total			

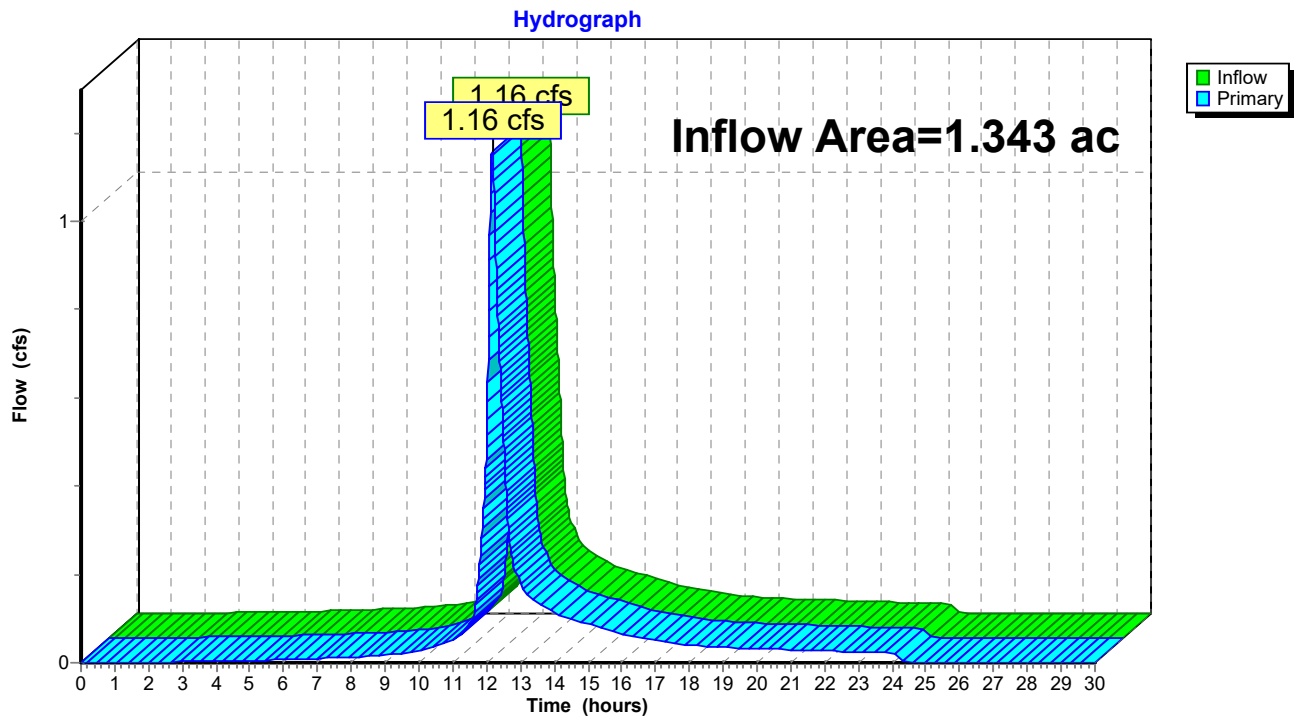
## Subcatchment 9P: P2b



**Summary for Link 10P: Design Point #2: Flow to Wetlands 2**

Inflow Area = 1.343 ac, 17.01% Impervious, Inflow Depth = 1.03" for 2-YR event  
Inflow = 1.16 cfs @ 12.17 hrs, Volume= 0.116 af  
Primary = 1.16 cfs @ 12.17 hrs, Volume= 0.116 af, Atten= 0%, Lag= 0.0 min

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

**Link 10P: Design Point #2: Flow to Wetlands 2**

**HydroCAD3**

Prepared by Legacy Engineering LLC

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

**Subcatchment7P: P2a**

Runoff Area=2,078 sf 100.00% Impervious Runoff Depth=4.46"  
Tc=2.0 min CN=WQ Runoff=0.25 cfs 0.018 af

**Pond 8P: Lot 4 Inf. Field**

Peak Elev=109.80' Storage=265 cf Inflow=0.25 cfs 0.018 af  
Discarded=0.02 cfs 0.018 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.018 af

**Subcatchment9P: P2b**

Runoff Area=56,420 sf 13.95% Impervious Runoff Depth=2.06"  
Flow Length=180' Tc=11.5 min CN=WQ Runoff=2.39 cfs 0.222 af

**Link 10P: Design Point #2: Flow to Wetlands 2**

Inflow=2.39 cfs 0.222 af  
Primary=2.39 cfs 0.222 af

**Total Runoff Area = 1.343 ac Runoff Volume = 0.240 af Average Runoff Depth = 2.14"**  
**82.99% Pervious = 1.114 ac 17.01% Impervious = 0.228 ac**

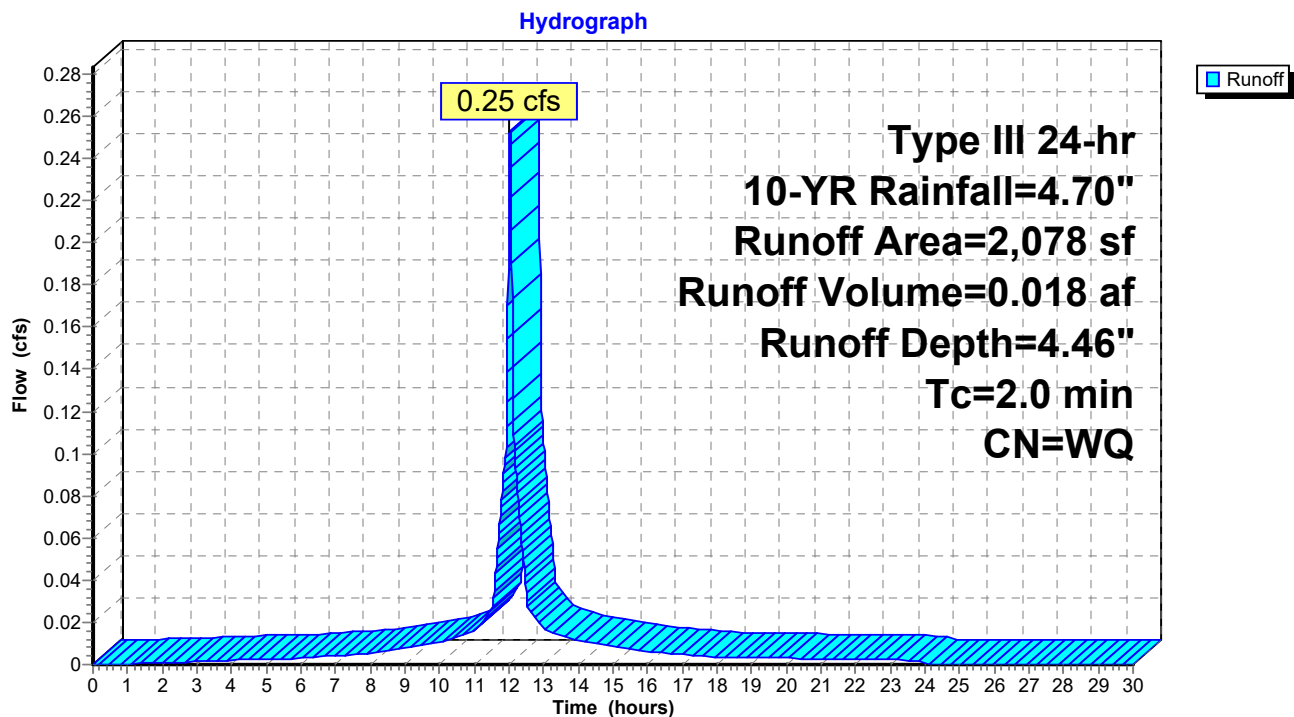
**Summary for Subcatchment 7P: P2a**

Runoff = 0.25 cfs @ 12.03 hrs, Volume= 0.018 af, Depth= 4.46"  
 Routed to Pond 8P : Lot 4 Inf. Field

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

Area (sf)	CN	Description
1,485	98	Roofs HSG B
593	98	Roofs HSG D
2,078		Weighted Average
2,078		100.00% Impervious Area

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

**Subcatchment 7P: P2a**

**Summary for Pond 8P: Lot 4 Inf. Field**

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 4.46" for 10-YR event  
 Inflow = 0.25 cfs @ 12.03 hrs, Volume= 0.018 af  
 Outflow = 0.02 cfs @ 11.60 hrs, Volume= 0.018 af, Atten= 92%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.60 hrs, Volume= 0.018 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Link 10P : Design Point #2: Flow to Wetlands 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 109.80' @ 12.88 hrs Surf.Area= 350 sf Storage= 265 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 91.9 min ( 837.3 - 745.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	110.50'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
#2A	108.50'	226 cf	<b>35.00'W x 10.00'L x 2.04'H Field A</b> 715 cf Overall - 149 cf Embedded = 566 cf x 40.0% Voids
#3A	109.00'	149 cf	<b>Cultec C-100HD</b> x 10 Inside #2 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 10 rows
		378 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.50'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	113.00'	<b>4.0" Round Culvert</b> L= 1.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 113.00' / 112.90' S= 0.1000 '/' Cc= 0.900 n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 11.60 hrs HW=108.55' (Free Discharge)  
 ↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=108.50' TW=0.00' (Dynamic Tailwater)  
 ↑**2=Culvert** ( Controls 0.00 cfs)

**Pond 8P: Lot 4 Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H =&gt; 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 10 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

1 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length

10 Rows x 36.0" Wide + 4.0" Spacing x 9 + 12.0" Side Stone x 2 = 35.00' Base Width

6.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.04' Field Height

10 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 10 Rows = 148.9 cf Chamber Storage

714.6 cf Field - 148.9 cf Chambers = 565.7 cf Stone x 40.0% Voids = 226.3 cf Stone Storage

Chamber Storage + Stone Storage = 375.2 cf = 0.009 af

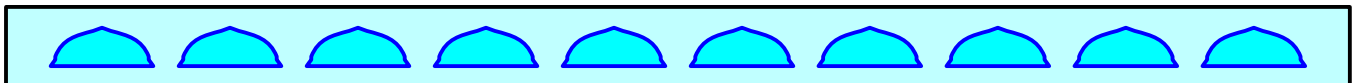
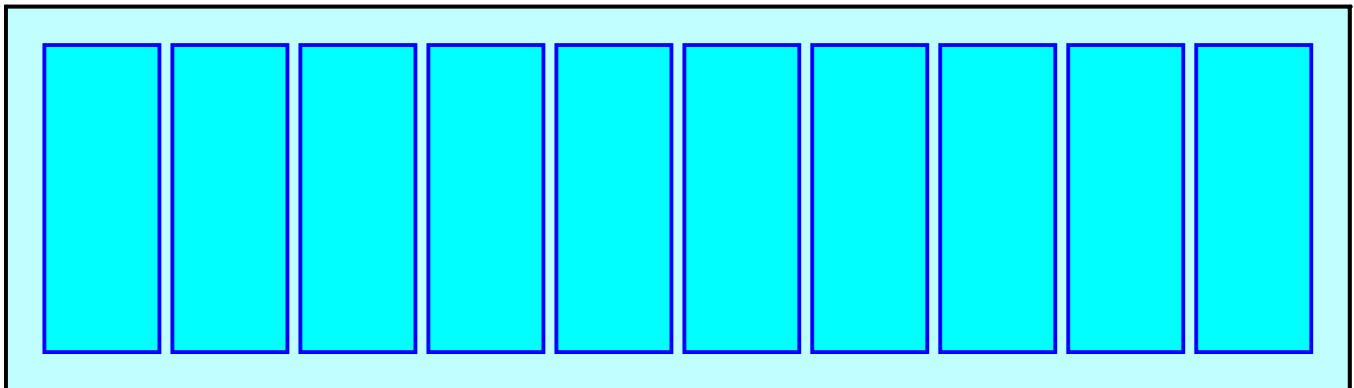
Overall Storage Efficiency = 52.5%

Overall System Size = 10.00' x 35.00' x 2.04'

10 Chambers

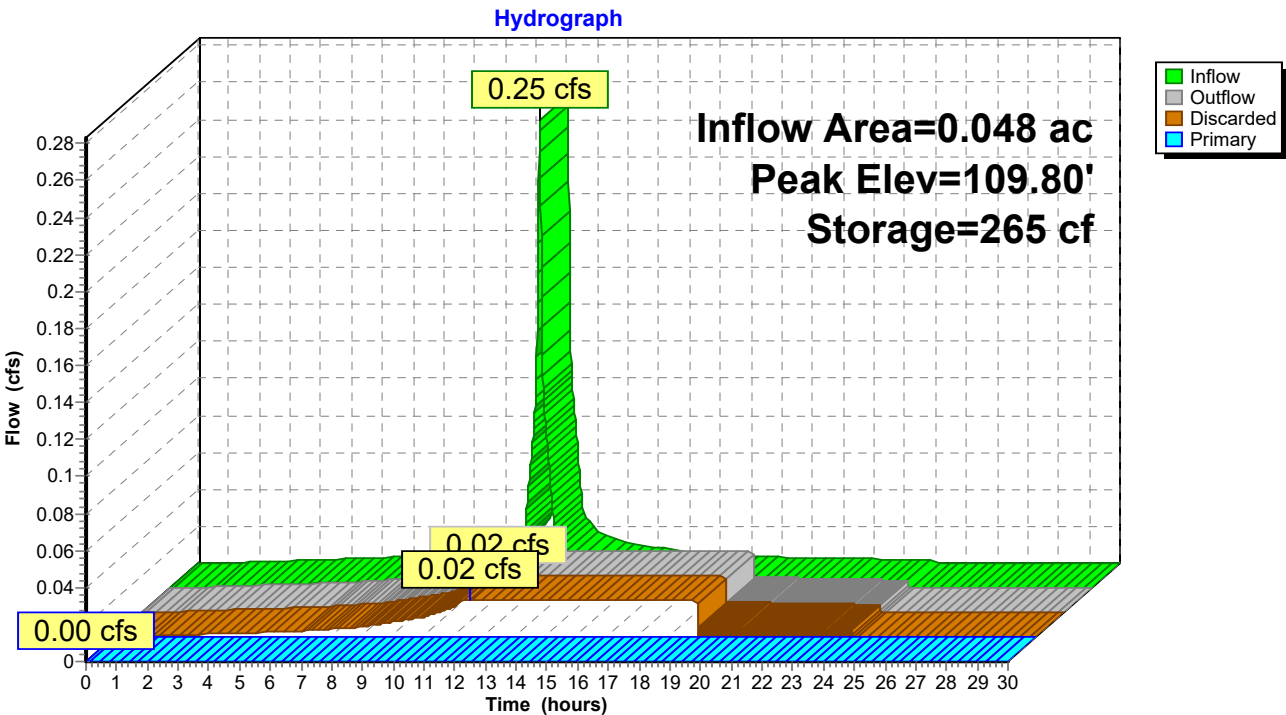
26.5 cy Field

21.0 cy Stone





Pond 8P: Lot 4 Inf. Field



**Summary for Subcatchment 9P: P2b**

Runoff = 2.39 cfs @ 12.16 hrs, Volume= 0.222 af, Depth= 2.06"

Routed to Link 10P : Design Point #2: Flow to Wetlands 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

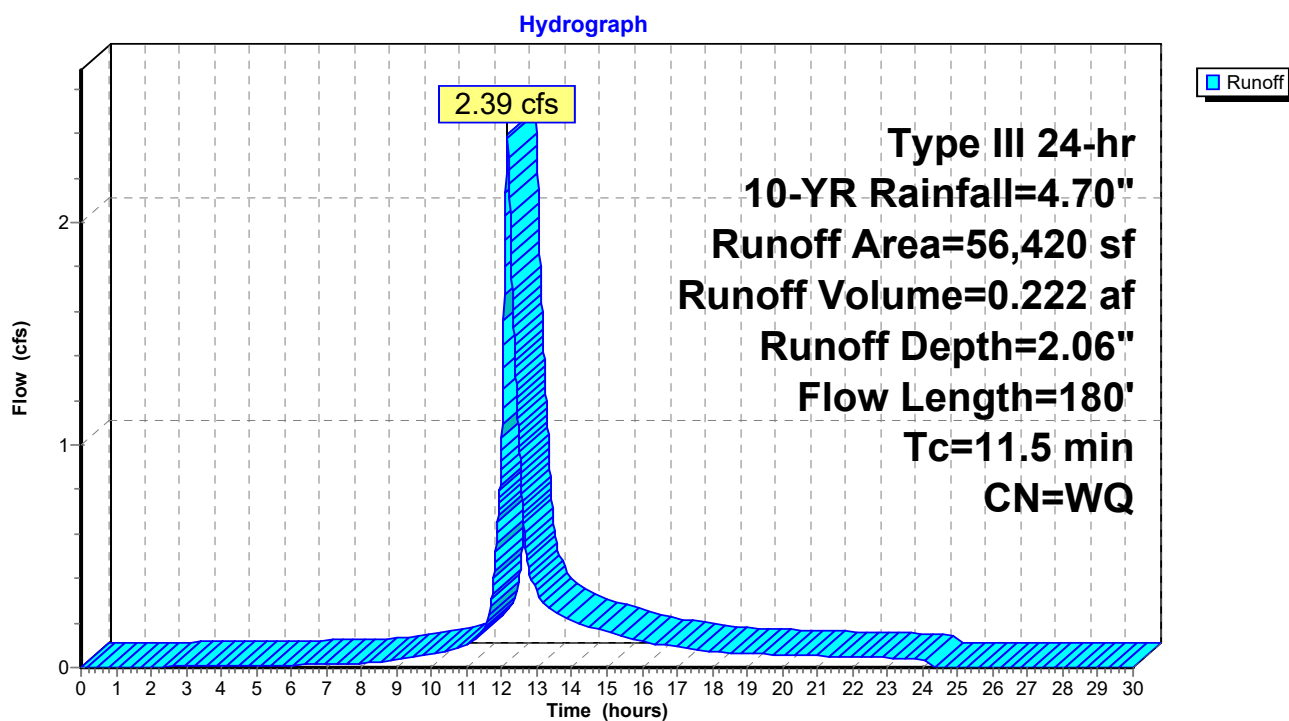
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
10,545	55	Woods, Good HSG B
5,524	98	Paved parking HSG B
2,349	98	Paved parking HSG D
15,512	77	Woods, Good HSG D
16,635	61	>75% Grass cover, Good HSG B
5,855	80	>75% Grass cover, Good HSG D
56,420		Weighted Average
48,547		86.05% Pervious Area
7,873		13.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	84	0.0800	0.20		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
2.3	6	0.0200	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.1	90	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.5	180	Total			

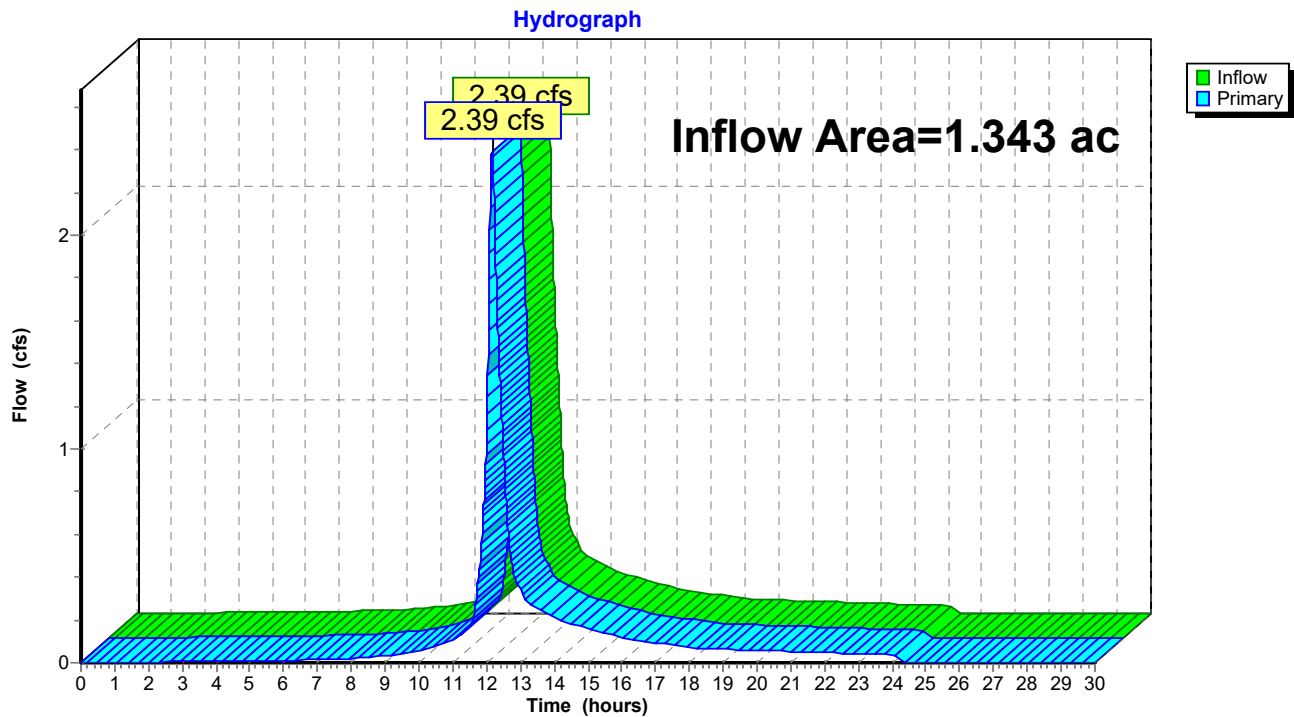
## Subcatchment 9P: P2b



**Summary for Link 10P: Design Point #2: Flow to Wetlands 2**

Inflow Area = 1.343 ac, 17.01% Impervious, Inflow Depth = 1.98" for 10-YR event  
Inflow = 2.39 cfs @ 12.16 hrs, Volume= 0.222 af  
Primary = 2.39 cfs @ 12.16 hrs, Volume= 0.222 af, Atten= 0%, Lag= 0.0 min

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

**Link 10P: Design Point #2: Flow to Wetlands 2**

## HydroCAD3

Prepared by Legacy Engineering LLC

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

### Subcatchment7P: P2a

Runoff Area=2,078 sf 100.00% Impervious Runoff Depth=6.46"  
Tc=2.0 min CN=WQ Runoff=0.36 cfs 0.026 af

### Pond 8P: Lot 4 Inf. Field

Peak Elev=113.28' Storage=377 cf Inflow=0.36 cfs 0.026 af  
Discarded=0.02 cfs 0.024 af Primary=0.14 cfs 0.002 af Outflow=0.16 cfs 0.026 af

### Subcatchment9P: P2b

Runoff Area=56,420 sf 13.95% Impervious Runoff Depth=3.58"  
Flow Length=180' Tc=11.5 min CN=WQ Runoff=4.31 cfs 0.387 af

### Link 10P: Design Point #2: Flow to Wetlands 2

Inflow=4.31 cfs 0.388 af  
Primary=4.31 cfs 0.388 af

**Total Runoff Area = 1.343 ac Runoff Volume = 0.412 af Average Runoff Depth = 3.68"**  
**82.99% Pervious = 1.114 ac 17.01% Impervious = 0.228 ac**

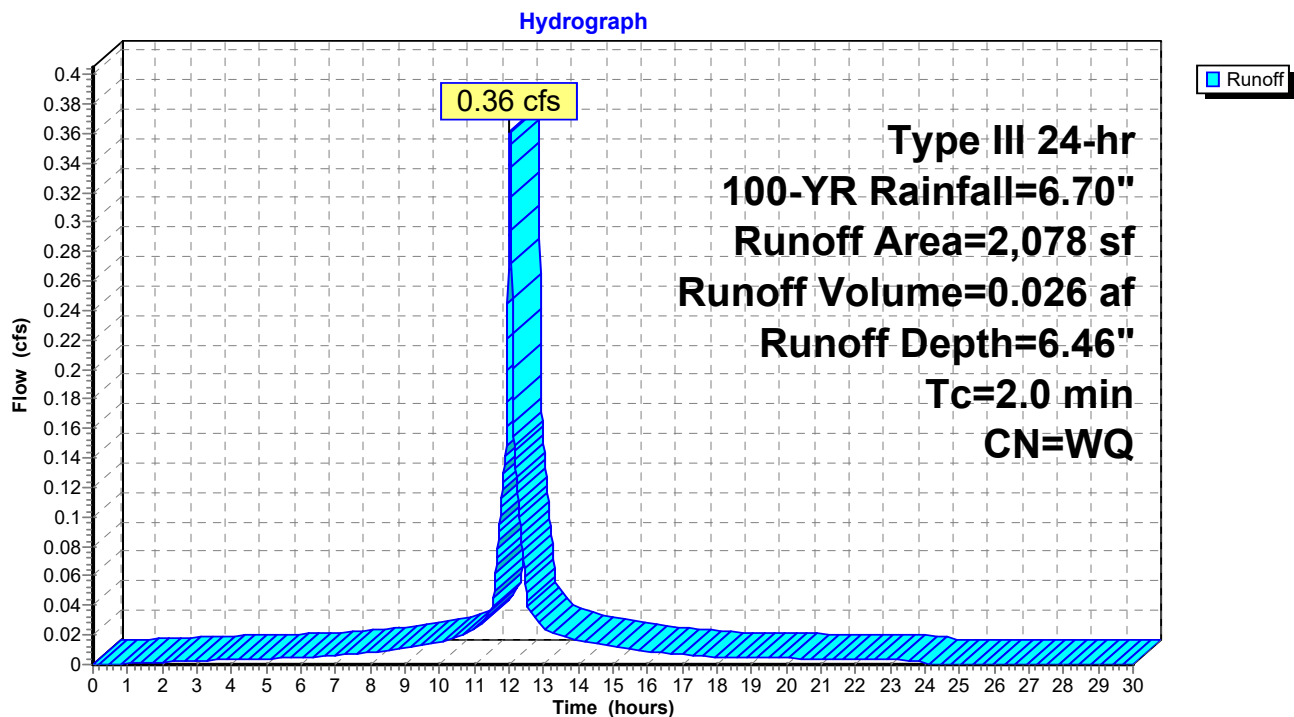
**Summary for Subcatchment 7P: P2a**

Runoff = 0.36 cfs @ 12.03 hrs, Volume= 0.026 af, Depth= 6.46"  
 Routed to Pond 8P : Lot 4 Inf. Field

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

Area (sf)	CN	Description
1,485	98	Roofs HSG B
593	98	Roofs HSG D
2,078		Weighted Average
2,078		100.00% Impervious Area

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

**Subcatchment 7P: P2a**

**Summary for Pond 8P: Lot 4 Inf. Field**

Inflow Area = 0.048 ac, 100.00% Impervious, Inflow Depth = 6.46" for 100-YR event  
 Inflow = 0.36 cfs @ 12.03 hrs, Volume= 0.026 af  
 Outflow = 0.16 cfs @ 12.31 hrs, Volume= 0.026 af, Atten= 56%, Lag= 16.9 min  
 Discarded = 0.02 cfs @ 12.28 hrs, Volume= 0.024 af  
 Primary = 0.14 cfs @ 12.31 hrs, Volume= 0.002 af  
 Routed to Link 10P : Design Point #2: Flow to Wetlands 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 113.28' @ 12.31 hrs Surf.Area= 351 sf Storage= 377 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 135.4 min ( 875.2 - 739.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	110.50'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
#2A	108.50'	226 cf	<b>35.00'W x 10.00'L x 2.04'H Field A</b>
			715 cf Overall - 149 cf Embedded = 566 cf x 40.0% Voids
#3A	109.00'	149 cf	<b>Cultec C-100HD</b> x 10 Inside #2
			Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
			Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
			Row Length Adjustment= +0.50' x 1.86 sf x 10 rows
		378 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.50'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	113.00'	<b>4.0" Round Culvert</b>
			L= 1.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 113.00' / 112.90' S= 0.1000 '/' Cc= 0.900
			n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 12.28 hrs HW=110.51' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.13 cfs @ 12.31 hrs HW=113.27' TW=0.00' (Dynamic Tailwater)

↑**2=Culvert** (Inlet Controls 0.13 cfs @ 1.76 fps)

**Pond 8P: Lot 4 Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H =&gt; 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 10 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

1 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length

10 Rows x 36.0" Wide + 4.0" Spacing x 9 + 12.0" Side Stone x 2 = 35.00' Base Width

6.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.04' Field Height

10 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 10 Rows = 148.9 cf Chamber Storage

714.6 cf Field - 148.9 cf Chambers = 565.7 cf Stone x 40.0% Voids = 226.3 cf Stone Storage

Chamber Storage + Stone Storage = 375.2 cf = 0.009 af

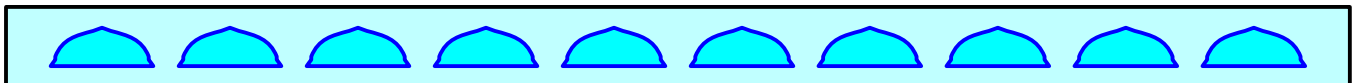
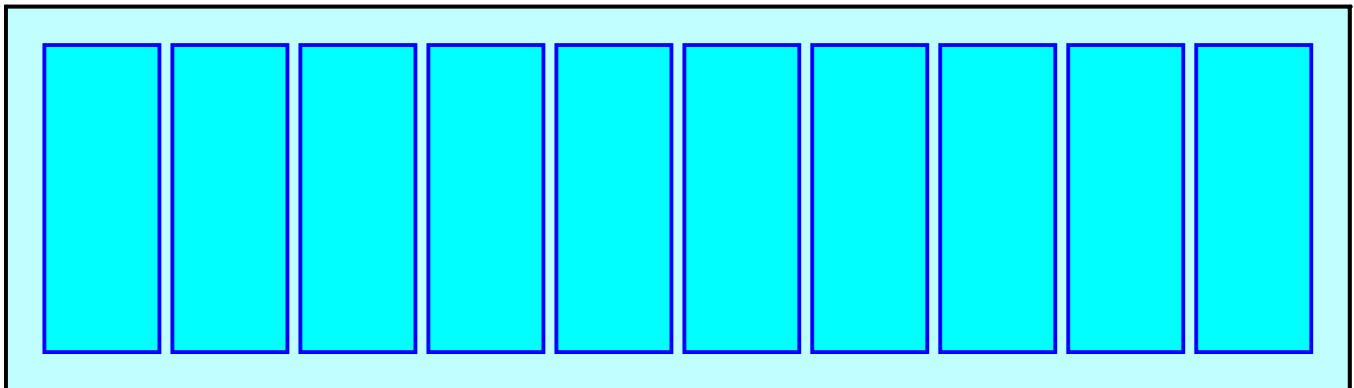
Overall Storage Efficiency = 52.5%

Overall System Size = 10.00' x 35.00' x 2.04'

10 Chambers

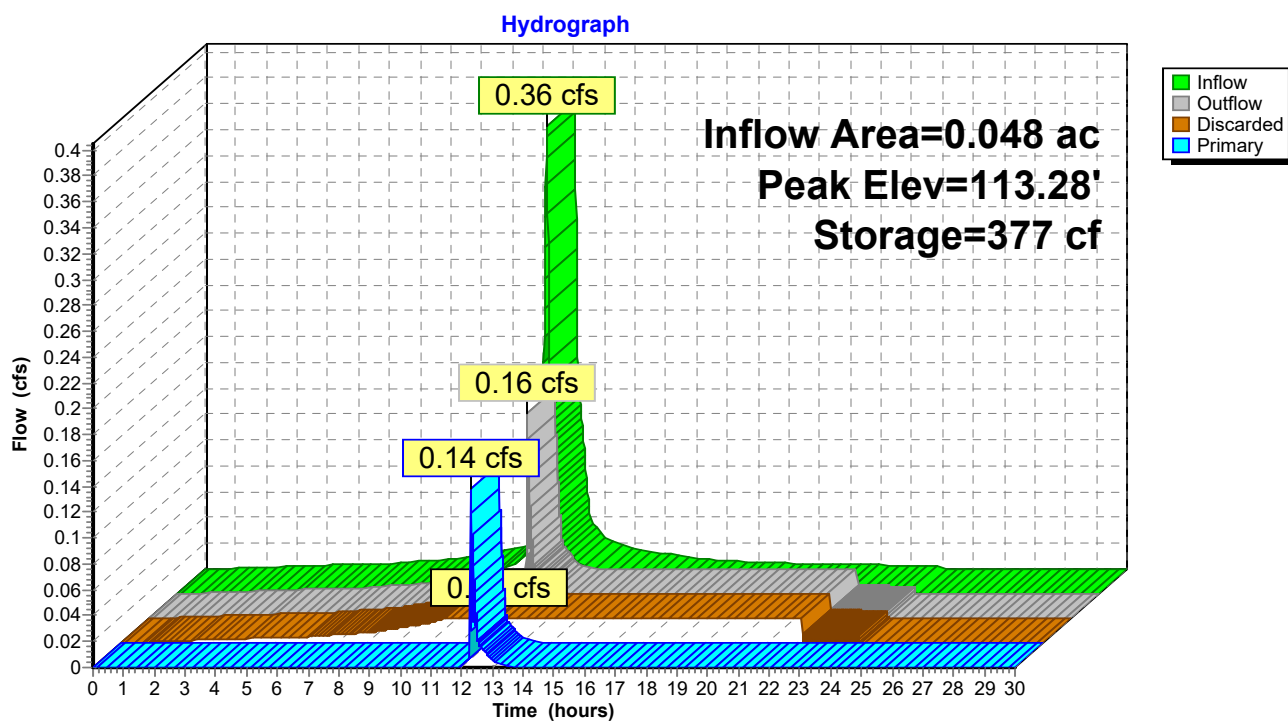
26.5 cy Field

21.0 cy Stone





## Pond 8P: Lot 4 Inf. Field



**Summary for Subcatchment 9P: P2b**

Runoff = 4.31 cfs @ 12.16 hrs, Volume= 0.387 af, Depth= 3.58"

Routed to Link 10P : Design Point #2: Flow to Wetlands 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

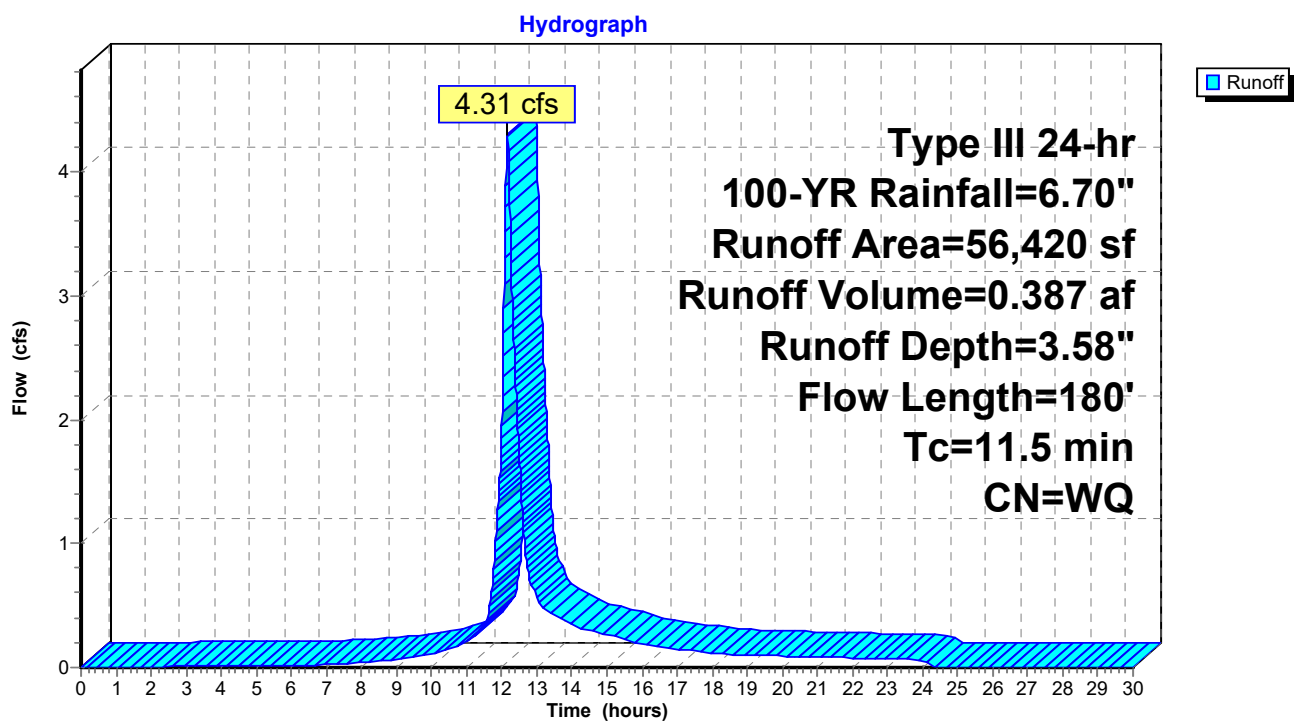
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
10,545	55	Woods, Good HSG B
5,524	98	Paved parking HSG B
2,349	98	Paved parking HSG D
15,512	77	Woods, Good HSG D
16,635	61	>75% Grass cover, Good HSG B
5,855	80	>75% Grass cover, Good HSG D
56,420		Weighted Average
48,547		86.05% Pervious Area
7,873		13.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	84	0.0800	0.20		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
2.3	6	0.0200	0.04		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.1	90	0.0200	0.71		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.5	180	Total			

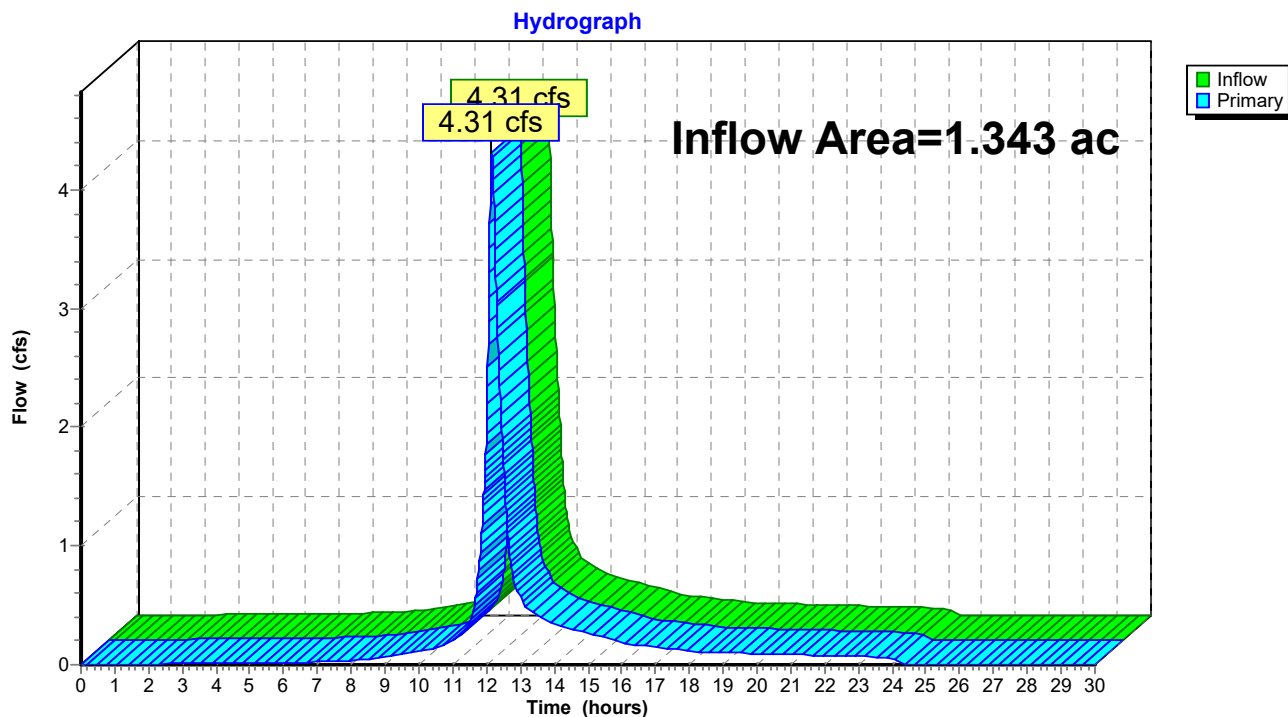
## Subcatchment 9P: P2b



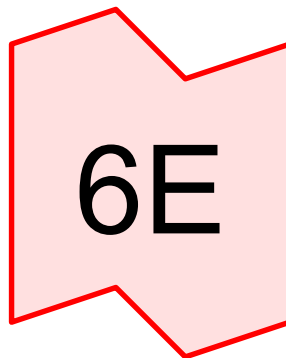
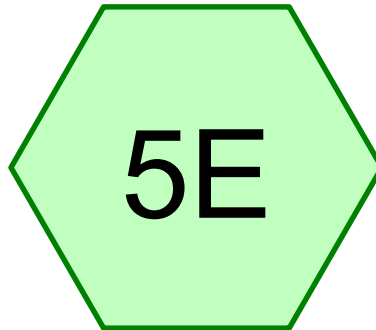
**Summary for Link 10P: Design Point #2: Flow to Wetlands 2**

Inflow Area = 1.343 ac, 17.01% Impervious, Inflow Depth = 3.47" for 100-YR event  
Inflow = 4.31 cfs @ 12.16 hrs, Volume= 0.388 af  
Primary = 4.31 cfs @ 12.16 hrs, Volume= 0.388 af, Atten= 0%, Lag= 0.0 min

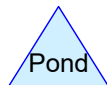
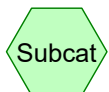
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 10P: Design Point #2: Flow to Wetlands 2**

**DESIGN POINT #3: FLOW TO**  
**WETLANDS 3 EXISTING CONDITIONS**



## Design Point #3: Flow to Wetlands 3



### Routing Diagram for HydroCAD

Prepared by Legacy Engineering LLC, Printed 6/6/2023  
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# HydroCAD

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## Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type III 24-hr		Default	24.00	1	3.20	2
2	10-YR	Type III 24-hr		Default	24.00	1	4.70	2
3	100-YR	Type III 24-hr		Default	24.00	1	6.70	2

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.026	61	>75% Grass cover, Good HSG B (5E)
0.017	80	>75% Grass cover, Good HSG D (5E)
0.369	55	Woods, Good HSG B (5E)
0.452	77	Woods, Good HSG D (5E)
<b>0.863</b>	<b>67</b>	<b>TOTAL AREA</b>



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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-Q

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

### Subcatchment 5E: E3

Runoff Area=37,597 sf 0.00% Impervious Runoff Depth=0.78"

Flow Length=193' Tc=13.0 min CN=WQ Runoff=0.54 cfs 0.056 af

### Link 6E: Design Point #3: Flow to Wetlands 3

Inflow=0.54 cfs 0.056 af

Primary=0.54 cfs 0.056 af

**Total Runoff Area = 0.863 ac   Runoff Volume = 0.056 af   Average Runoff Depth = 0.78"**  
**100.00% Pervious = 0.863 ac   0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 5E: E3**

Runoff = 0.54 cfs @ 12.19 hrs, Volume= 0.056 af, Depth= 0.78"

Routed to Link 6E : Design Point #3: Flow to Wetlands 3

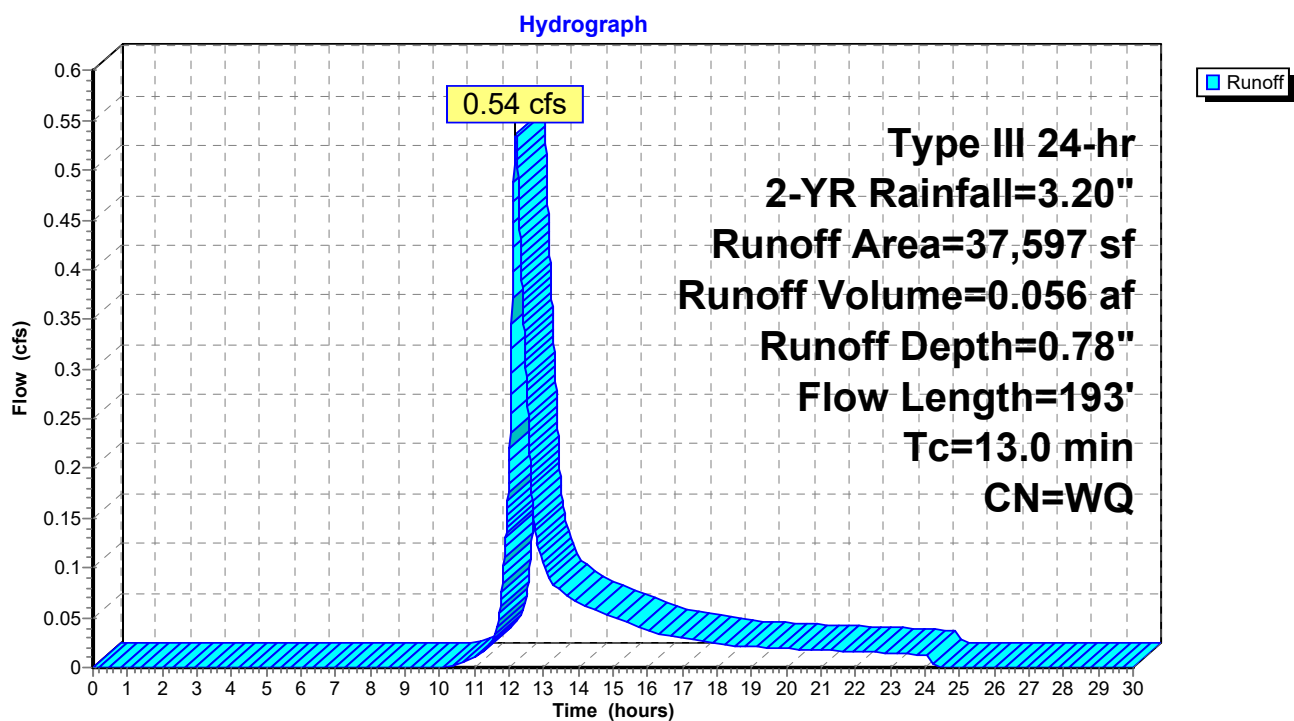
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
19,670	77	Woods, Good HSG D
16,064	55	Woods, Good HSG B
1,127	61	>75% Grass cover, Good HSG B
736	80	>75% Grass cover, Good HSG D
37,597		Weighted Average
37,597		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	12	0.0100	0.68		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
1.7	5	0.0100	0.05		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
7.3	41	0.0500	0.09		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
3.7	135	0.0150	0.61		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.0	193	Total			

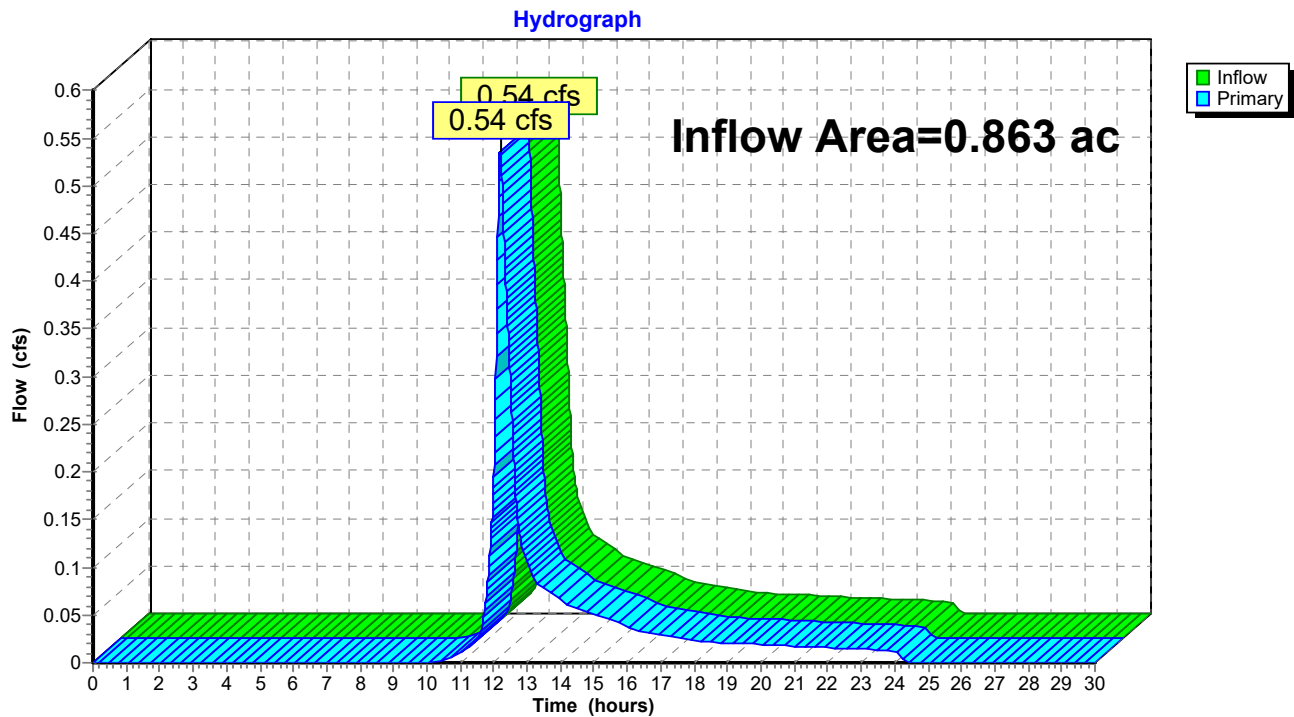
## Subcatchment 5E: E3



**Summary for Link 6E: Design Point #3: Flow to Wetlands 3**

Inflow Area = 0.863 ac, 0.00% Impervious, Inflow Depth = 0.78" for 2-YR event  
Inflow = 0.54 cfs @ 12.19 hrs, Volume= 0.056 af  
Primary = 0.54 cfs @ 12.19 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

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

**Link 6E: Design Point #3: Flow to Wetlands 3**

## HydroCAD

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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-Q

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

### Subcatchment 5E: E3

Runoff Area=37,597 sf 0.00% Impervious Runoff Depth=1.69"

Flow Length=193' Tc=13.0 min CN=WQ Runoff=1.27 cfs 0.121 af

### Link 6E: Design Point #3: Flow to Wetlands 3

Inflow=1.27 cfs 0.121 af

Primary=1.27 cfs 0.121 af

**Total Runoff Area = 0.863 ac Runoff Volume = 0.121 af Average Runoff Depth = 1.69"**  
**100.00% Pervious = 0.863 ac 0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 5E: E3**

Runoff = 1.27 cfs @ 12.19 hrs, Volume= 0.121 af, Depth= 1.69"

Routed to Link 6E : Design Point #3: Flow to Wetlands 3

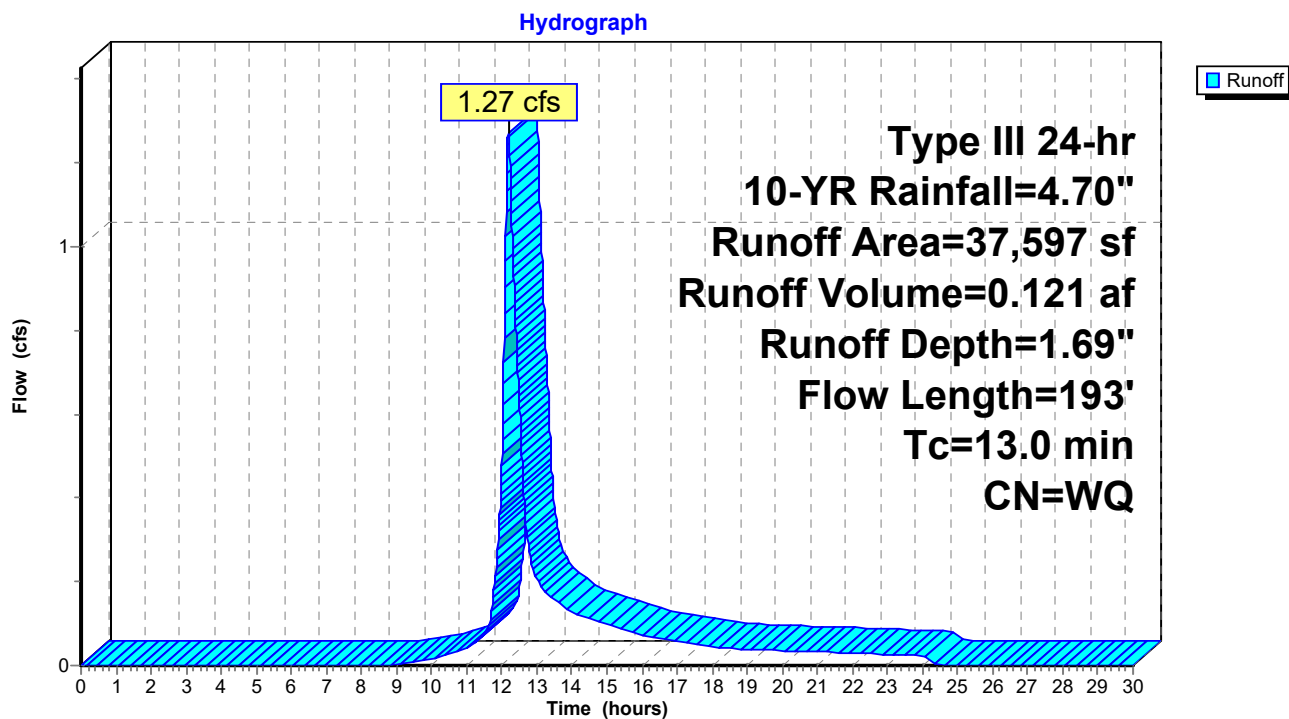
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
19,670	77	Woods, Good HSG D
16,064	55	Woods, Good HSG B
1,127	61	>75% Grass cover, Good HSG B
736	80	>75% Grass cover, Good HSG D
37,597		Weighted Average
37,597		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	12	0.0100	0.68		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
1.7	5	0.0100	0.05		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
7.3	41	0.0500	0.09		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
3.7	135	0.0150	0.61		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.0	193	Total			

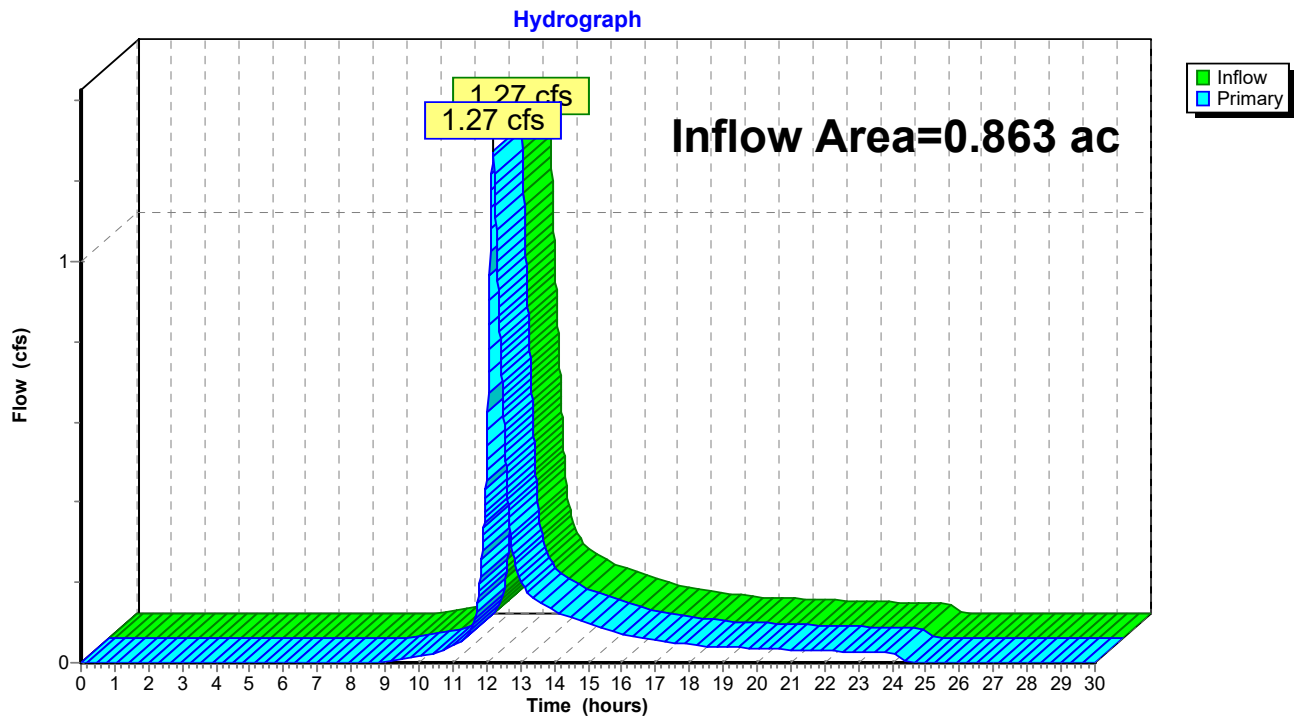
## Subcatchment 5E: E3



**Summary for Link 6E: Design Point #3: Flow to Wetlands 3**

Inflow Area = 0.863 ac, 0.00% Impervious, Inflow Depth = 1.69" for 10-YR event  
Inflow = 1.27 cfs @ 12.19 hrs, Volume= 0.121 af  
Primary = 1.27 cfs @ 12.19 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.0 min

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

**Link 6E: Design Point #3: Flow to Wetlands 3**



## HydroCAD

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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-Q

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

### Subcatchment 5E: E3

Runoff Area=37,597 sf 0.00% Impervious Runoff Depth=3.13"

Flow Length=193' Tc=13.0 min CN=WQ Runoff=2.47 cfs 0.225 af

### Link 6E: Design Point #3: Flow to Wetlands 3

Inflow=2.47 cfs 0.225 af

Primary=2.47 cfs 0.225 af

**Total Runoff Area = 0.863 ac Runoff Volume = 0.225 af Average Runoff Depth = 3.13"**  
**100.00% Pervious = 0.863 ac 0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 5E: E3**

Runoff = 2.47 cfs @ 12.18 hrs, Volume= 0.225 af, Depth= 3.13"

Routed to Link 6E : Design Point #3: Flow to Wetlands 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

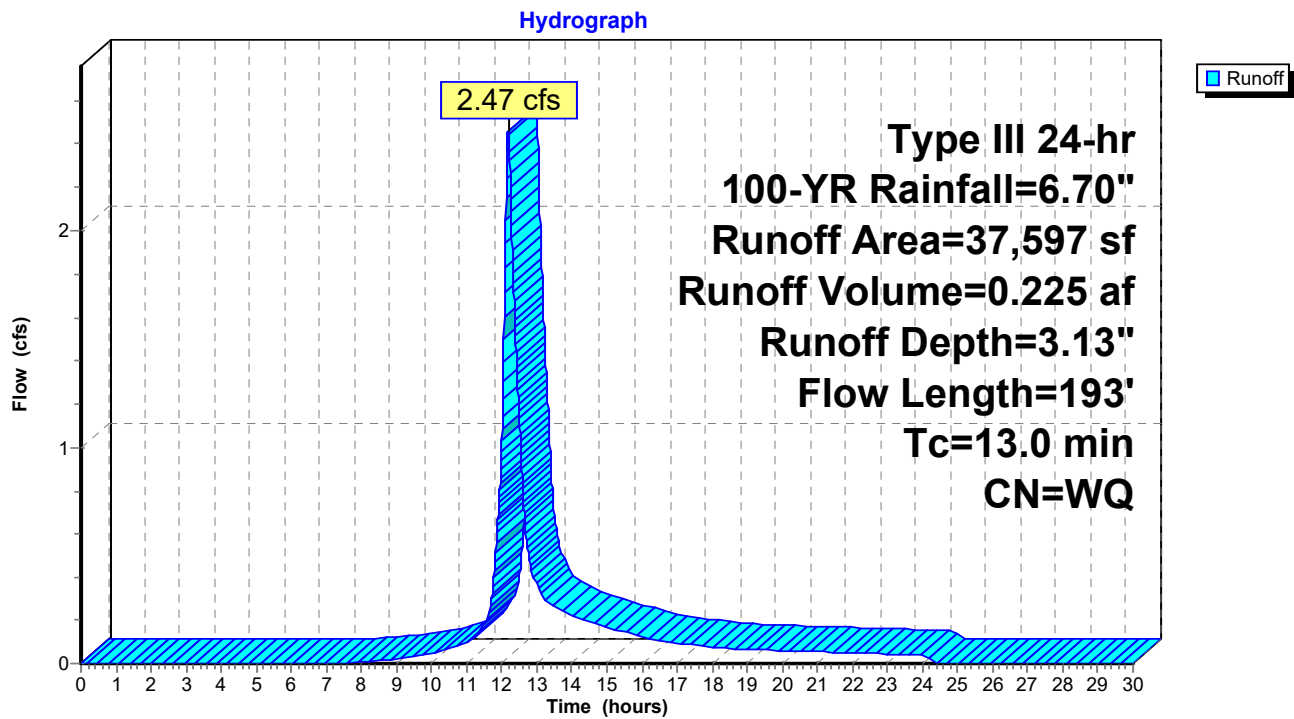
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
19,670	77	Woods, Good HSG D
16,064	55	Woods, Good HSG B
1,127	61	>75% Grass cover, Good HSG B
736	80	>75% Grass cover, Good HSG D
37,597		Weighted Average
37,597		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	12	0.0100	0.68		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.20"
1.7	5	0.0100	0.05		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.20"
7.3	41	0.0500	0.09		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
3.7	135	0.0150	0.61		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.0	193	Total			

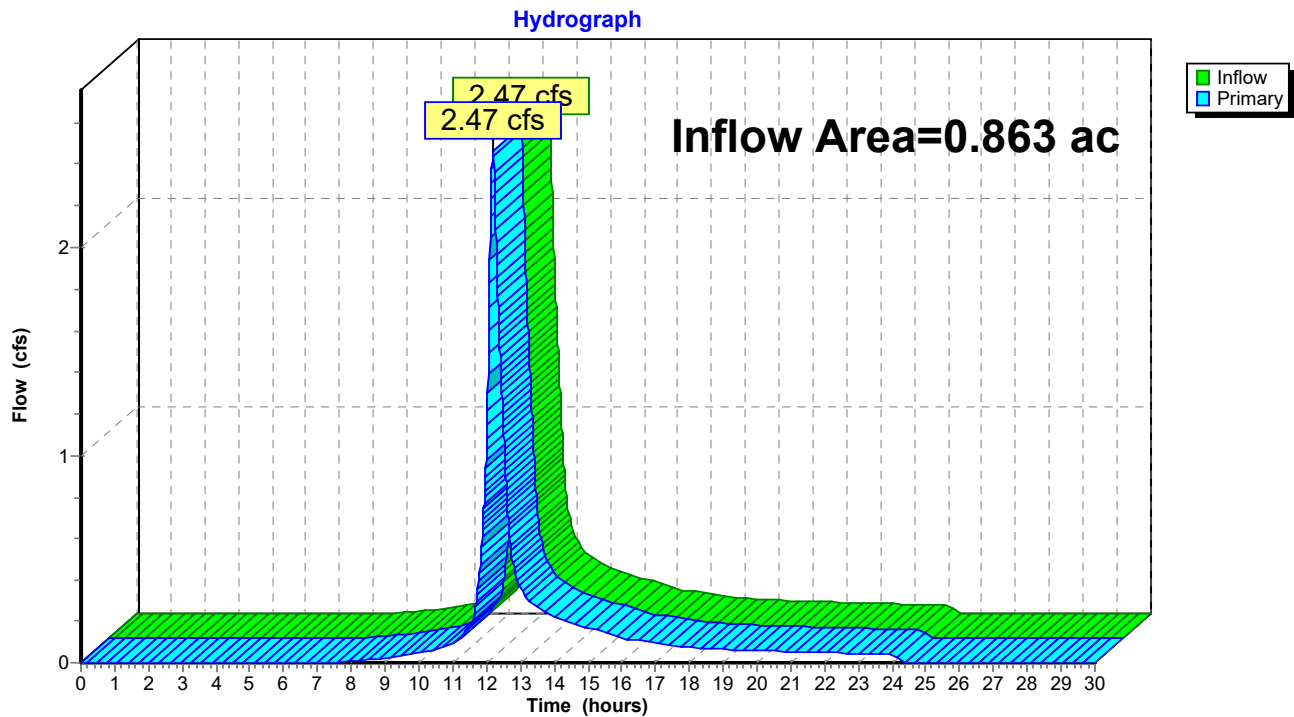
## Subcatchment 5E: E3



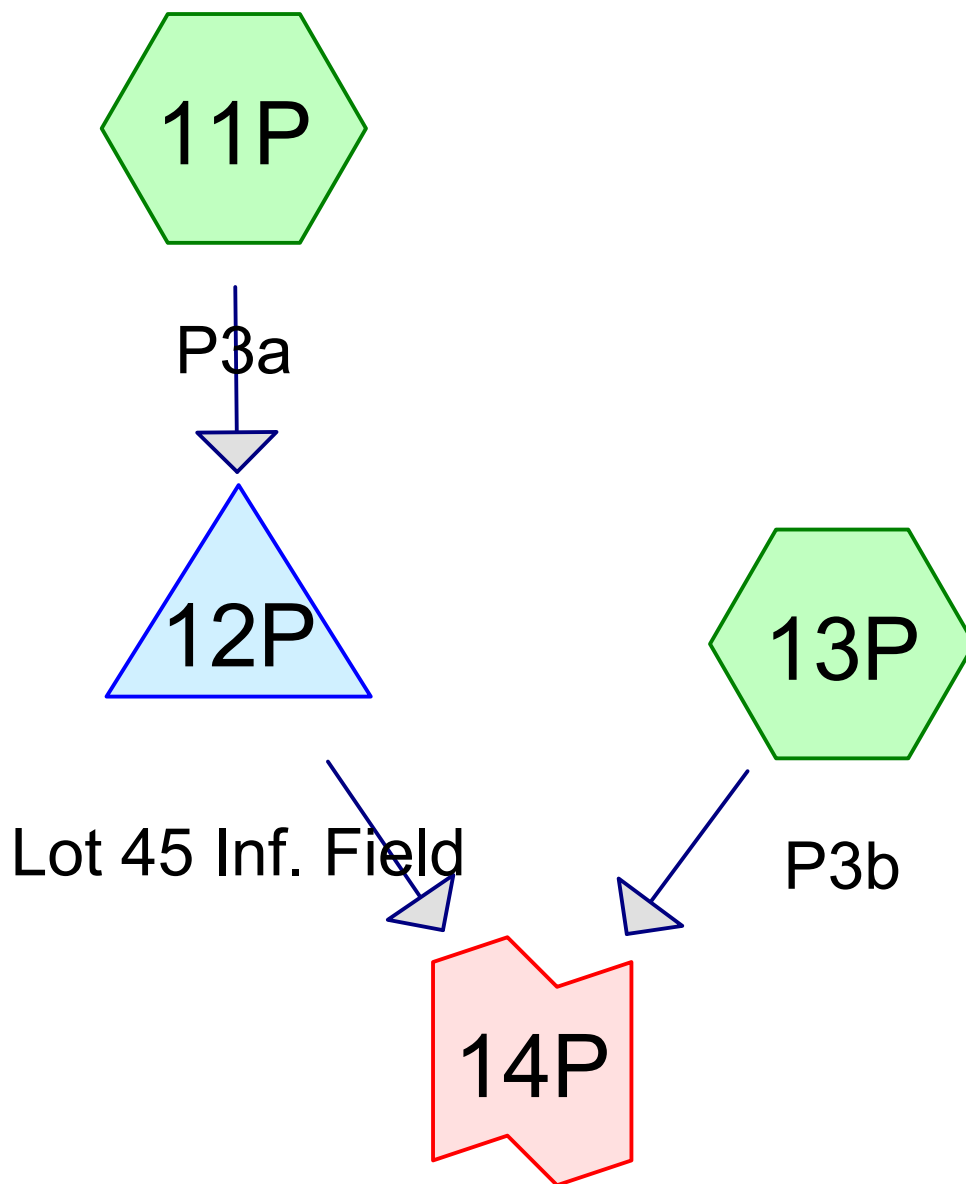
**Summary for Link 6E: Design Point #3: Flow to Wetlands 3**

Inflow Area = 0.863 ac, 0.00% Impervious, Inflow Depth = 3.13" for 100-YR event  
Inflow = 2.47 cfs @ 12.18 hrs, Volume= 0.225 af  
Primary = 2.47 cfs @ 12.18 hrs, Volume= 0.225 af, Atten= 0%, Lag= 0.0 min

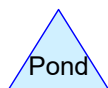
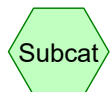
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 6E: Design Point #3: Flow to Wetlands 3**

**DESIGN POINT #3: FLOW TO**  
**WETLANDS 3 PROPOSED CONDITIONS**



## Design Point #3: Flow to Wetlands 3



### Routing Diagram for HydroCAD3

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## HydroCAD3

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### Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type III 24-hr		Default	24.00	1	3.20	2
2	10-YR	Type III 24-hr		Default	24.00	1	4.70	2
3	100-YR	Type III 24-hr		Default	24.00	1	6.70	2

**Area Listing (selected nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.262	61	>75% Grass cover, Good HSG B (13P)
0.106	80	>75% Grass cover, Good HSG D (13P)
0.022	98	Paved parking HSG B (13P)
0.016	98	Paved parking HSG D (13P)
0.037	98	Roofs HSG B (11P)
0.011	98	Roofs, HSG B (13P)
0.062	55	Woods, Good HSG B (13P)
0.346	77	Woods, Good HSG D (13P)
<b>0.862</b>	<b>73</b>	<b>TOTAL AREA</b>



## HydroCAD3

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

### Subcatchment 11P: P3a

Runoff Area=1,607 sf 100.00% Impervious Runoff Depth=2.97"  
Tc=2.0 min CN=98 Runoff=0.13 cfs 0.009 af

### Pond 12P: Lot 45 Inf. Field

Peak Elev=109.07' Storage=107 cf Inflow=0.13 cfs 0.009 af  
Discarded=0.02 cfs 0.009 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.009 af

### Subcatchment 13P: P3b

Runoff Area=35,955 sf 5.93% Impervious Runoff Depth=1.02"  
Flow Length=141' Tc=10.9 min CN=WQ Runoff=0.75 cfs 0.070 af

### Link 14P: Design Point #3: Flow to Wetlands 3

Inflow=0.75 cfs 0.070 af  
Primary=0.75 cfs 0.070 af

**Total Runoff Area = 0.862 ac Runoff Volume = 0.080 af Average Runoff Depth = 1.11"**  
**90.05% Pervious = 0.776 ac 9.95% Impervious = 0.086 ac**

**Summary for Subcatchment 11P: P3a**

Runoff = 0.13 cfs @ 12.03 hrs, Volume= 0.009 af, Depth= 2.97"  
 Routed to Pond 12P : Lot 45 Inf. Field

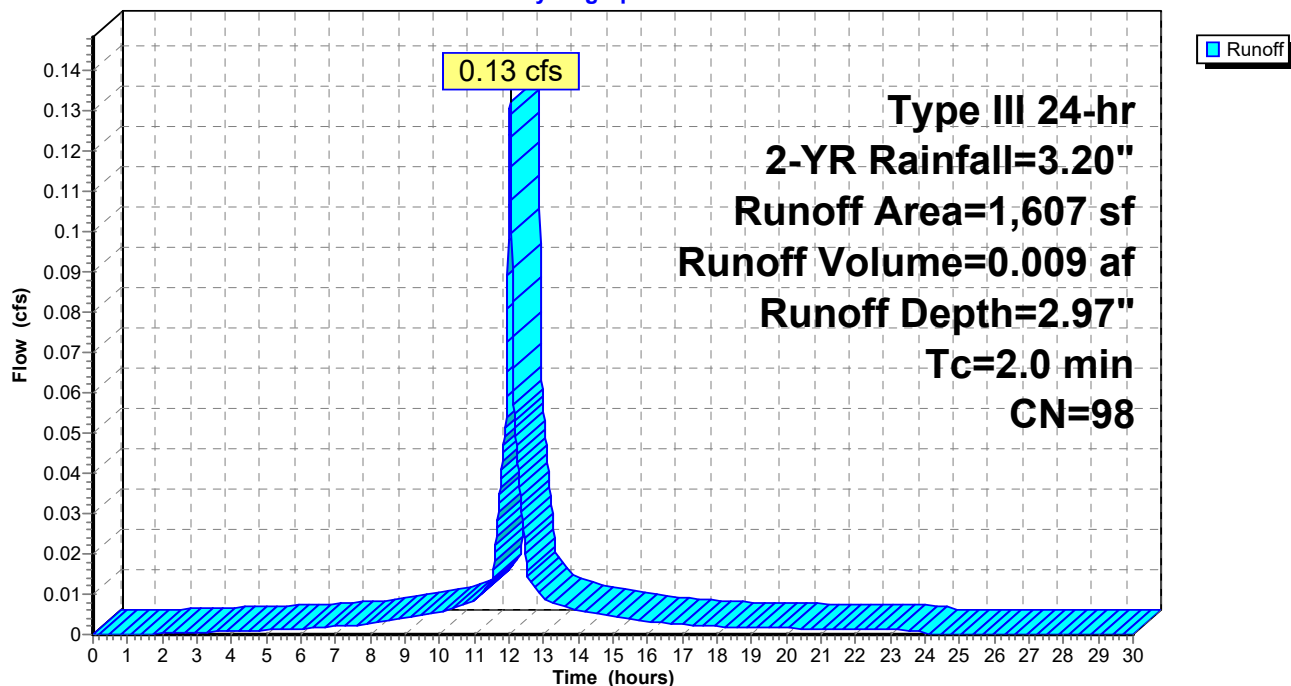
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
1,607	98	Roofs HSG B
1,607		100.00% Impervious Area

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

**Subcatchment 11P: P3a**

Hydrograph



**Summary for Pond 12P: Lot 45 Inf. Field**

Inflow Area = 0.037 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2-YR event  
 Inflow = 0.13 cfs @ 12.03 hrs, Volume= 0.009 af  
 Outflow = 0.02 cfs @ 11.76 hrs, Volume= 0.009 af, Atten= 86%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.76 hrs, Volume= 0.009 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Link 14P : Design Point #3: Flow to Wetlands 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 109.07' @ 12.49 hrs Surf.Area= 321 sf Storage= 107 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 32.4 min ( 785.1 - 752.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	110.40'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
#2A	108.40'	204 cf	<b>18.33'W x 17.50'L x 2.04'H Field A</b>
			655 cf Overall - 144 cf Embedded = 511 cf x 40.0% Voids
#3A	108.90'	144 cf	<b>Cultec C-100HD</b> x 10 Inside #2
			Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
			Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
			Row Length Adjustment= +0.50' x 1.86 sf x 5 rows
		351 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.40'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	112.00'	<b>4.0" Round Culvert</b>
			L= 1.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 112.00' / 111.90' S= 0.1000 ' /' Cc= 0.900
			n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 11.76 hrs HW=108.45' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=108.40' TW=0.00' (Dynamic Tailwater)

↑ **2=Culvert** ( Controls 0.00 cfs)

**Pond 12P: Lot 45 Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H =&gt; 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 5 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

2 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 15.50' Row Length +12.0" End Stone x 2 = 17.50' Base Length

5 Rows x 36.0" Wide + 4.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.33' Base Width

6.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.04' Field Height

10 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 5 Rows = 144.3 cf Chamber Storage

655.0 cf Field - 144.3 cf Chambers = 510.8 cf Stone x 40.0% Voids = 204.3 cf Stone Storage

Chamber Storage + Stone Storage = 348.6 cf = 0.008 af

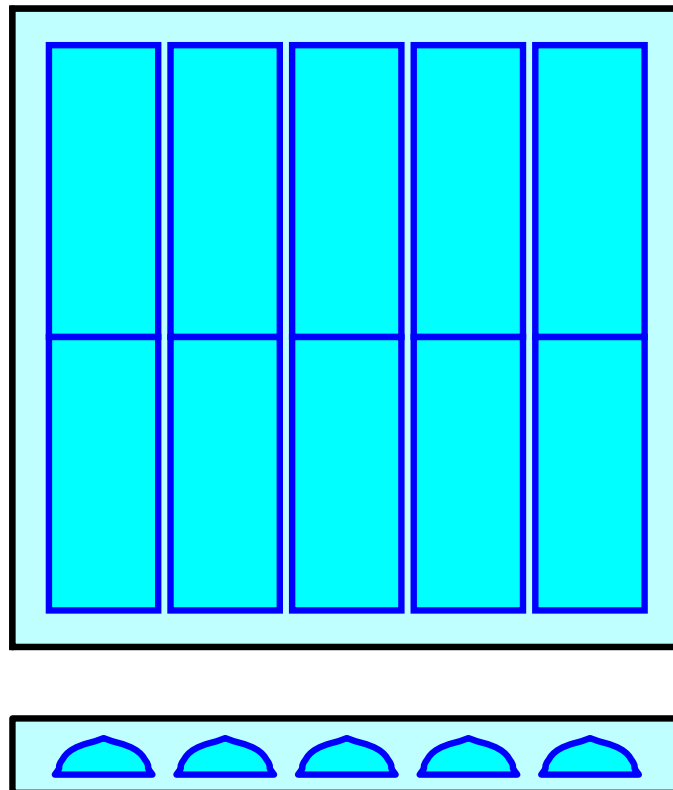
Overall Storage Efficiency = 53.2%

Overall System Size = 17.50' x 18.33' x 2.04'

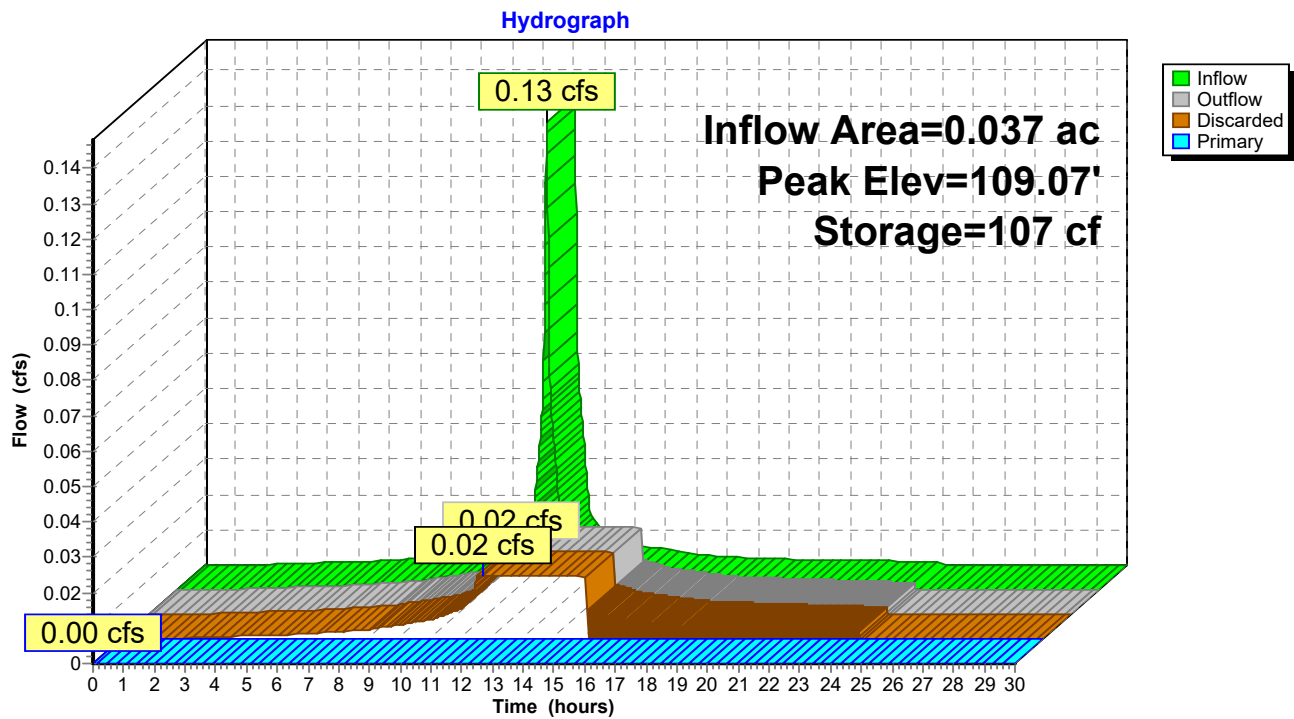
10 Chambers

24.3 cy Field

18.9 cy Stone



## Pond 12P: Lot 45 Inf. Field



**Summary for Subcatchment 13P: P3b**

Runoff = 0.75 cfs @ 12.16 hrs, Volume= 0.070 af, Depth= 1.02"

Routed to Link 14P : Design Point #3: Flow to Wetlands 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

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

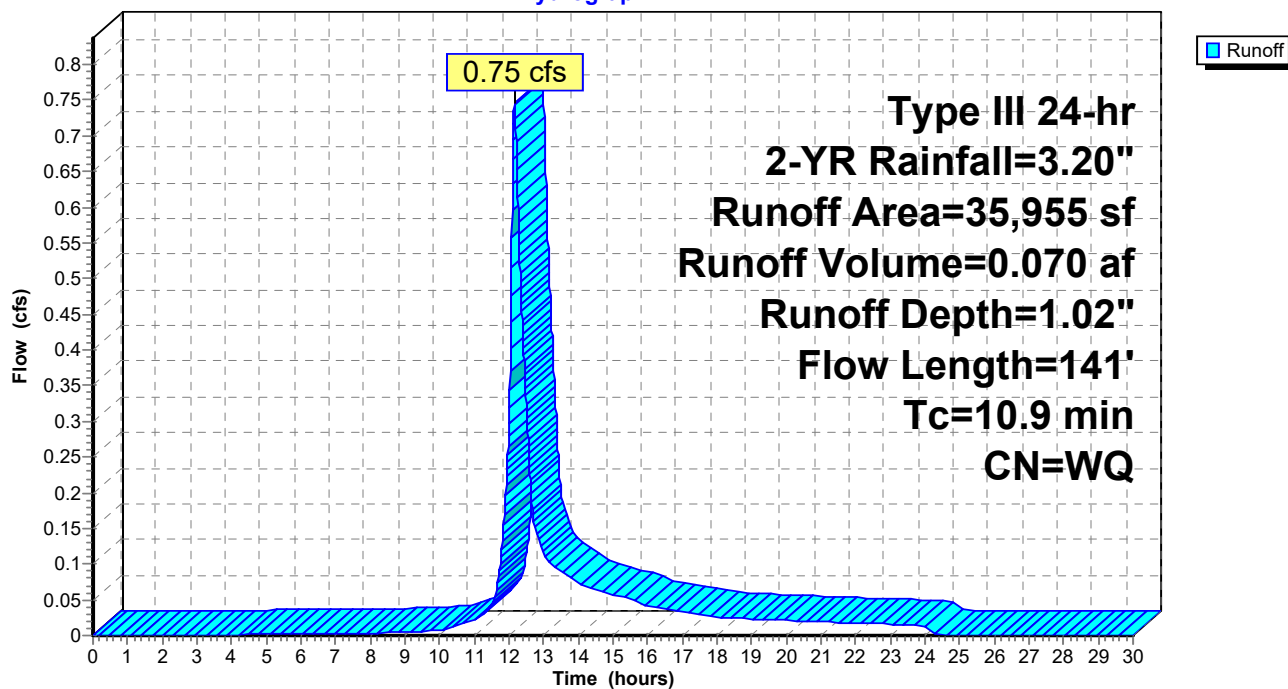
Area (sf)	CN	Description
697	98	Paved parking HSG D
15,064	77	Woods, Good HSG D
2,695	55	Woods, Good HSG B
963	98	Paved parking HSG B
11,425	61	>75% Grass cover, Good HSG B
4,639	80	>75% Grass cover, Good HSG D
472	98	Roofs, HSG B
35,955		Weighted Average
33,823		94.07% Pervious Area
2,132		5.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	43	0.0300	0.08		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.6	98	0.0400	1.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
10.9	141	Total			

## Subcatchment 13P: P3b

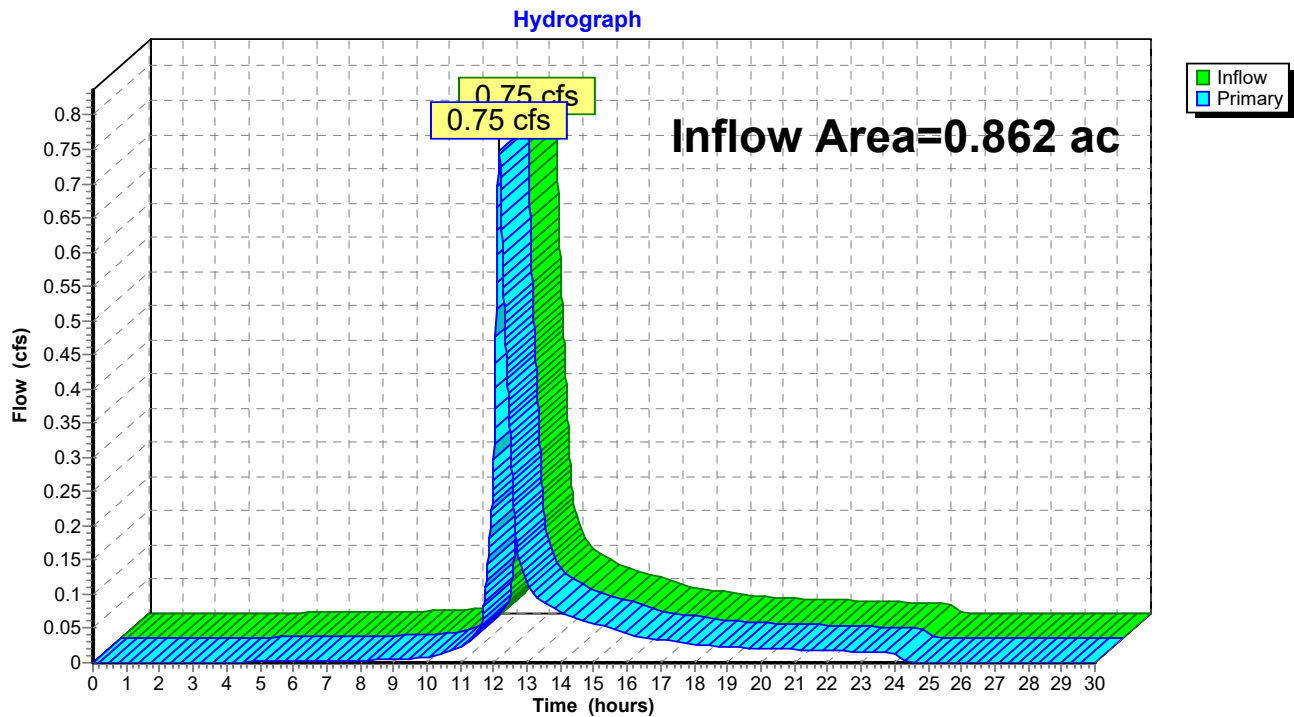
Hydrograph



**Summary for Link 14P: Design Point #3: Flow to Wetlands 3**

Inflow Area = 0.862 ac, 9.95% Impervious, Inflow Depth = 0.98" for 2-YR event  
Inflow = 0.75 cfs @ 12.16 hrs, Volume= 0.070 af  
Primary = 0.75 cfs @ 12.16 hrs, Volume= 0.070 af, Atten= 0%, Lag= 0.0 min

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

**Link 14P: Design Point #3: Flow to Wetlands 3**



## HydroCAD3

Prepared by Legacy Engineering LLC

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

### Subcatchment 11P: P3a

Runoff Area=1,607 sf 100.00% Impervious Runoff Depth=4.46"  
Tc=2.0 min CN=98 Runoff=0.20 cfs 0.014 af

### Pond 12P: Lot 45 Inf. Field

Peak Elev=109.42' Storage=190 cf Inflow=0.20 cfs 0.014 af  
Discarded=0.02 cfs 0.014 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.014 af

### Subcatchment 13P: P3b

Runoff Area=35,955 sf 5.93% Impervious Runoff Depth=2.04"  
Flow Length=141' Tc=10.9 min CN=WQ Runoff=1.60 cfs 0.140 af

### Link 14P: Design Point #3: Flow to Wetlands 3

Inflow=1.60 cfs 0.140 af  
Primary=1.60 cfs 0.140 af

**Total Runoff Area = 0.862 ac Runoff Volume = 0.154 af Average Runoff Depth = 2.14"**  
**90.05% Pervious = 0.776 ac 9.95% Impervious = 0.086 ac**

**Summary for Subcatchment 11P: P3a**

Runoff = 0.20 cfs @ 12.03 hrs, Volume= 0.014 af, Depth= 4.46"  
 Routed to Pond 12P : Lot 45 Inf. Field

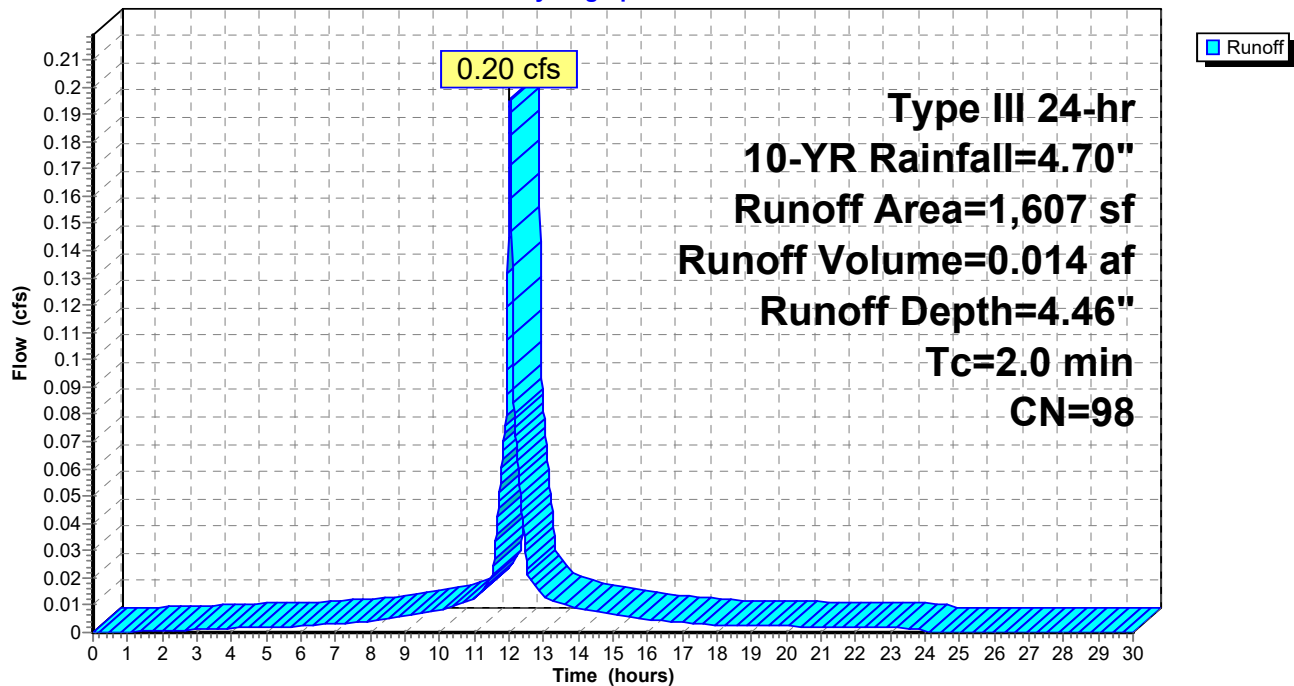
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
1,607	98	Roofs HSG B
1,607		100.00% Impervious Area

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

**Subcatchment 11P: P3a**

Hydrograph



**Summary for Pond 12P: Lot 45 Inf. Field**

Inflow Area = 0.037 ac, 100.00% Impervious, Inflow Depth = 4.46" for 10-YR event  
 Inflow = 0.20 cfs @ 12.03 hrs, Volume= 0.014 af  
 Outflow = 0.02 cfs @ 11.66 hrs, Volume= 0.014 af, Atten= 91%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.66 hrs, Volume= 0.014 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Link 14P : Design Point #3: Flow to Wetlands 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 109.42' @ 12.71 hrs Surf.Area= 321 sf Storage= 190 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 67.3 min ( 812.6 - 745.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	110.40'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
#2A	108.40'	204 cf	<b>18.33'W x 17.50'L x 2.04'H Field A</b>
			655 cf Overall - 144 cf Embedded = 511 cf x 40.0% Voids
#3A	108.90'	144 cf	<b>Cultec C-100HD x 10 Inside #2</b>
			Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
			Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
			Row Length Adjustment= +0.50' x 1.86 sf x 5 rows
		351 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.40'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	112.00'	<b>4.0" Round Culvert</b>
			L= 1.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 112.00' / 111.90' S= 0.1000 ' /' Cc= 0.900
			n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 11.66 hrs HW=108.45' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=108.40' TW=0.00' (Dynamic Tailwater)

↑ **2=Culvert** ( Controls 0.00 cfs)

**Pond 12P: Lot 45 Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H =&gt; 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 5 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

2 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 15.50' Row Length +12.0" End Stone x 2 = 17.50' Base Length

5 Rows x 36.0" Wide + 4.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.33' Base Width

6.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.04' Field Height

10 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 5 Rows = 144.3 cf Chamber Storage

655.0 cf Field - 144.3 cf Chambers = 510.8 cf Stone x 40.0% Voids = 204.3 cf Stone Storage

Chamber Storage + Stone Storage = 348.6 cf = 0.008 af

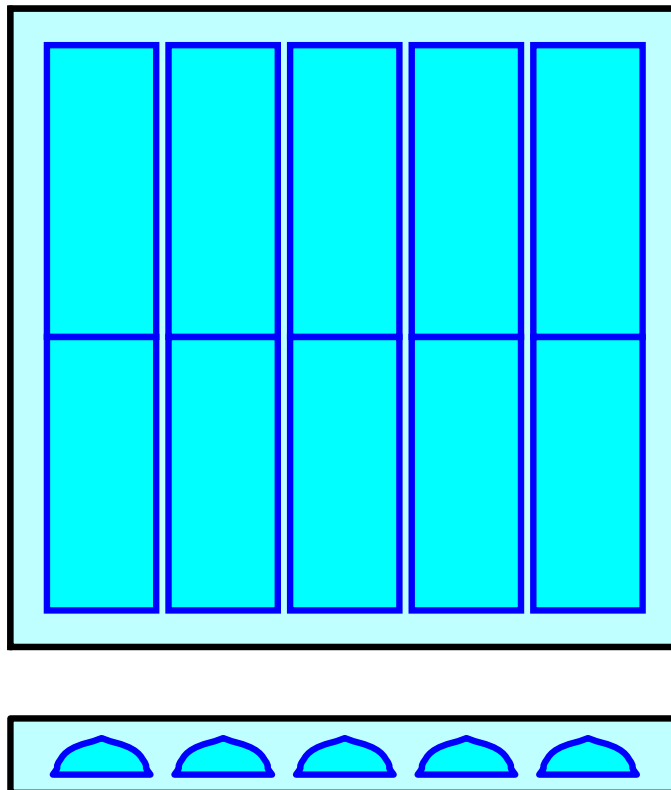
Overall Storage Efficiency = 53.2%

Overall System Size = 17.50' x 18.33' x 2.04'

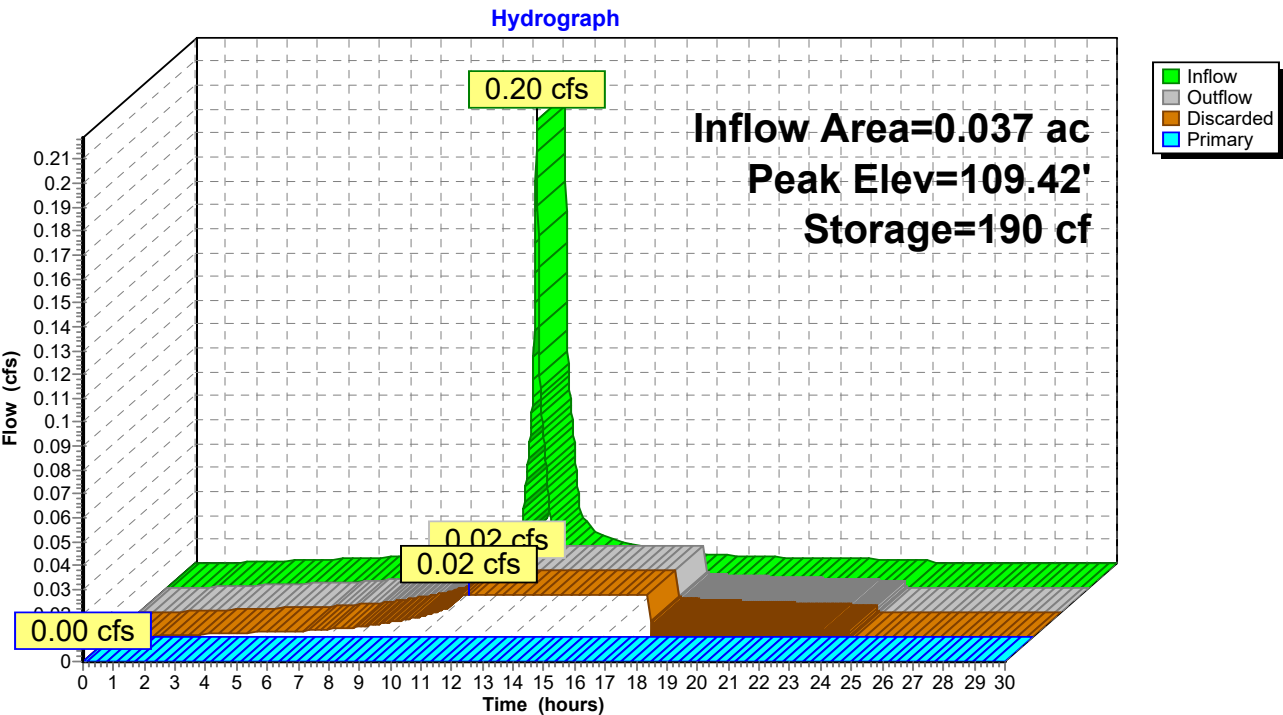
10 Chambers

24.3 cy Field

18.9 cy Stone



Pond 12P: Lot 45 Inf. Field



**Summary for Subcatchment 13P: P3b**

Runoff = 1.60 cfs @ 12.15 hrs, Volume= 0.140 af, Depth= 2.04"

Routed to Link 14P : Design Point #3: Flow to Wetlands 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

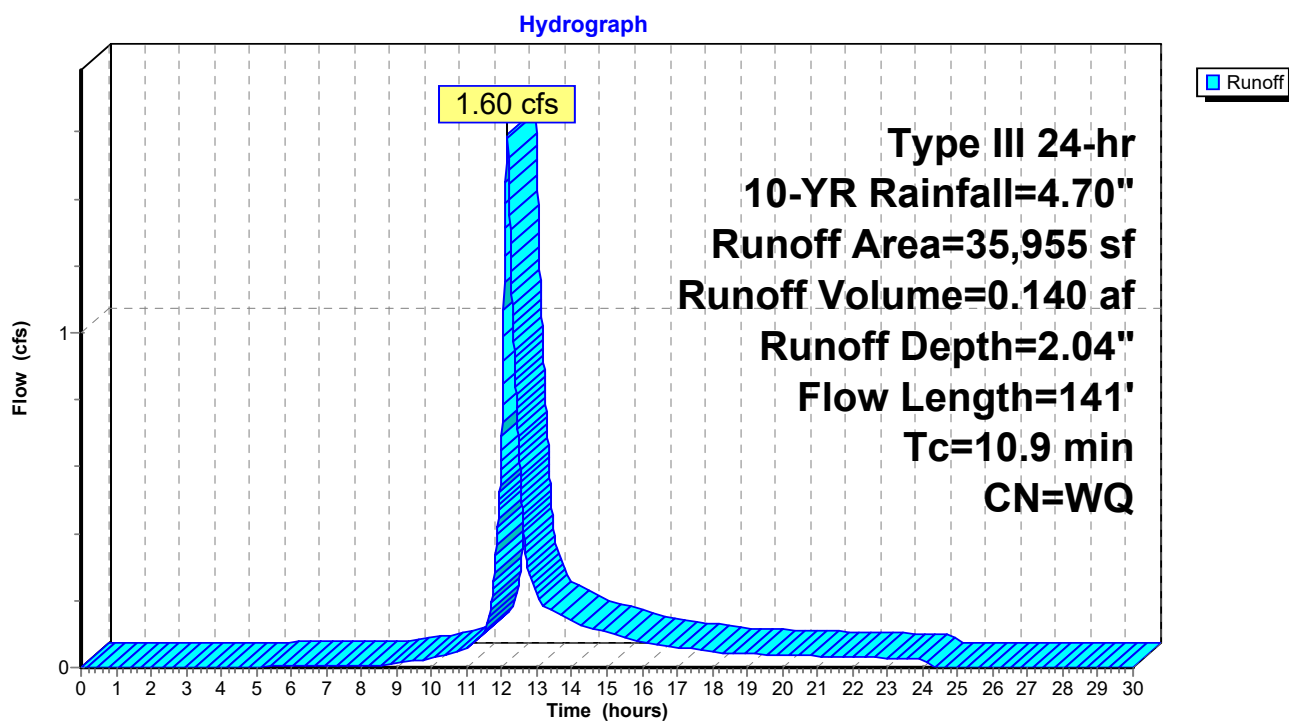
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
697	98	Paved parking HSG D
15,064	77	Woods, Good HSG D
2,695	55	Woods, Good HSG B
963	98	Paved parking HSG B
11,425	61	>75% Grass cover, Good HSG B
4,639	80	>75% Grass cover, Good HSG D
472	98	Roofs, HSG B
35,955		Weighted Average
33,823		94.07% Pervious Area
2,132		5.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	43	0.0300	0.08		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.6	98	0.0400	1.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
10.9	141	Total			

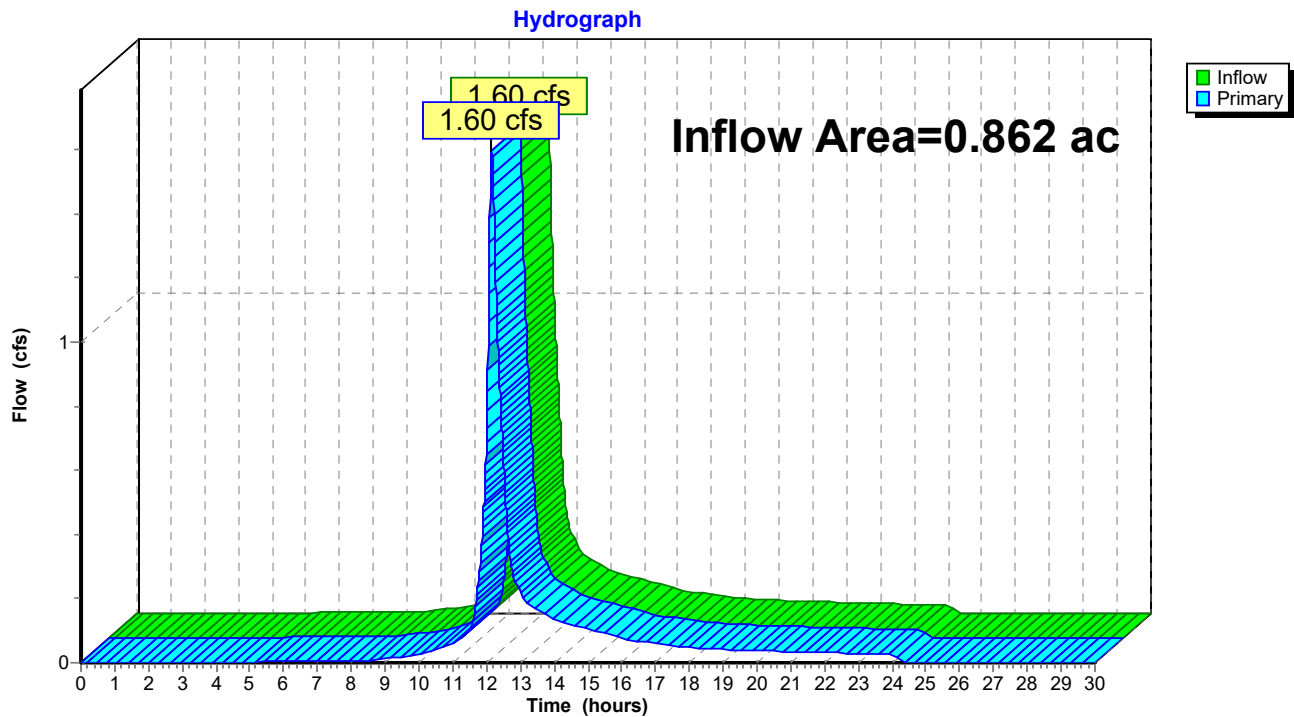
## Subcatchment 13P: P3b



**Summary for Link 14P: Design Point #3: Flow to Wetlands 3**

Inflow Area = 0.862 ac, 9.95% Impervious, Inflow Depth = 1.95" for 10-YR event  
Inflow = 1.60 cfs @ 12.15 hrs, Volume= 0.140 af  
Primary = 1.60 cfs @ 12.15 hrs, Volume= 0.140 af, Atten= 0%, Lag= 0.0 min

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

**Link 14P: Design Point #3: Flow to Wetlands 3**



## HydroCAD3

Prepared by Legacy Engineering LLC

HydroCAD® 10.20-3c s/n 02346 © 2023 HydroCAD Software Solutions LLC

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

Printed 1/3/2024

Page 20

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

### Subcatchment 11P: P3a

Runoff Area=1,607 sf 100.00% Impervious Runoff Depth=6.46"  
Tc=2.0 min CN=98 Runoff=0.28 cfs 0.020 af

### Pond 12P: Lot 45 Inf. Field

Peak Elev=110.20' Storage=318 cf Inflow=0.28 cfs 0.020 af  
Discarded=0.02 cfs 0.020 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.020 af

### Subcatchment 13P: P3b

Runoff Area=35,955 sf 5.93% Impervious Runoff Depth=3.61"  
Flow Length=141' Tc=10.9 min CN=WQ Runoff=2.88 cfs 0.248 af

### Link 14P: Design Point #3: Flow to Wetlands 3

Inflow=2.88 cfs 0.248 af  
Primary=2.88 cfs 0.248 af

**Total Runoff Area = 0.862 ac Runoff Volume = 0.268 af Average Runoff Depth = 3.73"**  
**90.05% Pervious = 0.776 ac 9.95% Impervious = 0.086 ac**

**Summary for Subcatchment 11P: P3a**

Runoff = 0.28 cfs @ 12.03 hrs, Volume= 0.020 af, Depth= 6.46"  
 Routed to Pond 12P : Lot 45 Inf. Field

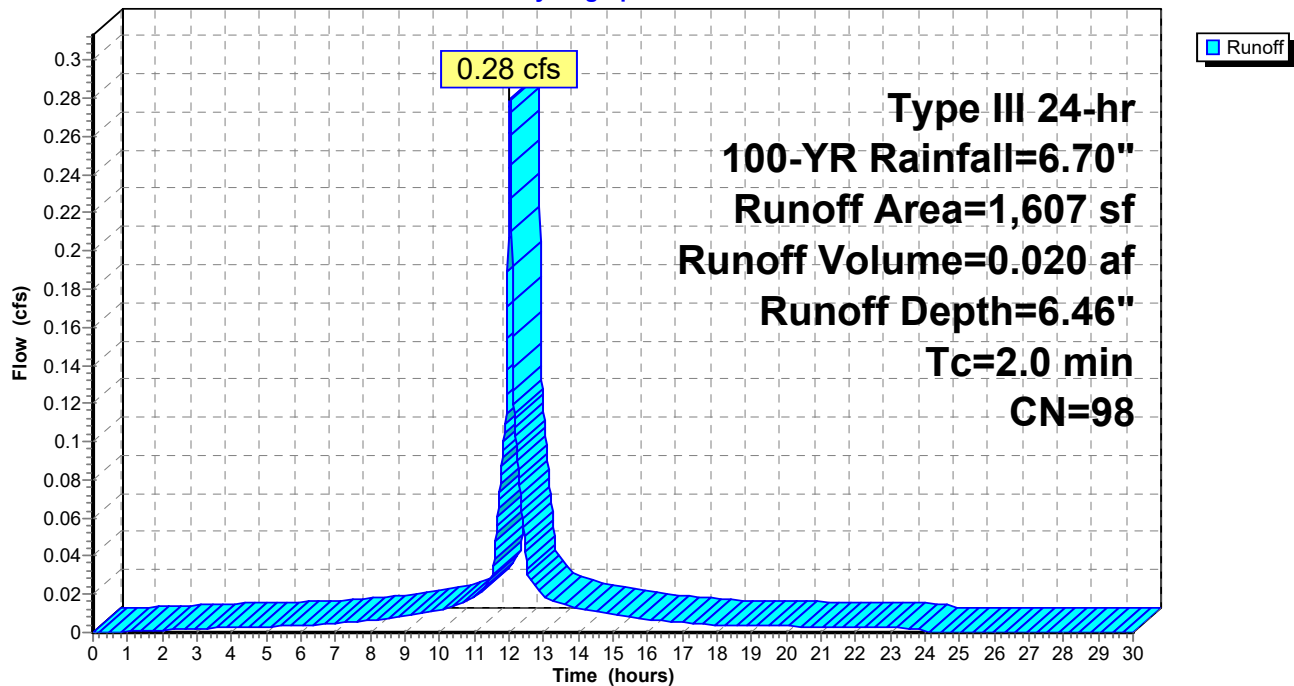
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
1,607	98	Roofs HSG B
1,607		100.00% Impervious Area

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

**Subcatchment 11P: P3a**

Hydrograph



**Summary for Pond 12P: Lot 45 Inf. Field**

Inflow Area = 0.037 ac, 100.00% Impervious, Inflow Depth = 6.46" for 100-YR event  
 Inflow = 0.28 cfs @ 12.03 hrs, Volume= 0.020 af  
 Outflow = 0.02 cfs @ 11.43 hrs, Volume= 0.020 af, Atten= 94%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.43 hrs, Volume= 0.020 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Link 14P : Design Point #3: Flow to Wetlands 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 110.20' @ 13.08 hrs Surf.Area= 321 sf Storage= 318 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 127.1 min ( 867.0 - 739.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	110.40'	2 cf	<b>1.00'D x 3.00'H Vertical Cone/Cylinder</b>
#2A	108.40'	204 cf	<b>18.33'W x 17.50'L x 2.04'H Field A</b>
			655 cf Overall - 144 cf Embedded = 511 cf x 40.0% Voids
#3A	108.90'	144 cf	<b>Cultec C-100HD x 10 Inside #2</b>
			Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
			Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
			Row Length Adjustment= +0.50' x 1.86 sf x 5 rows
		351 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	108.40'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Primary	112.00'	<b>4.0" Round Culvert</b>
			L= 1.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 112.00' / 111.90' S= 0.1000 ' /' Cc= 0.900
			n= 0.011, Flow Area= 0.09 sf

**Discarded OutFlow** Max=0.02 cfs @ 11.43 hrs HW=108.45' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=108.40' TW=0.00' (Dynamic Tailwater)

↑ **2=Culvert** ( Controls 0.00 cfs)

**Pond 12P: Lot 45 Inf. Field - Chamber Wizard Field A****Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)**

Effective Size= 32.1"W x 12.0"H =&gt; 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 5 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

2 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 15.50' Row Length +12.0" End Stone x 2 = 17.50' Base Length

5 Rows x 36.0" Wide + 4.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.33' Base Width

6.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.04' Field Height

10 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 5 Rows = 144.3 cf Chamber Storage

655.0 cf Field - 144.3 cf Chambers = 510.8 cf Stone x 40.0% Voids = 204.3 cf Stone Storage

Chamber Storage + Stone Storage = 348.6 cf = 0.008 af

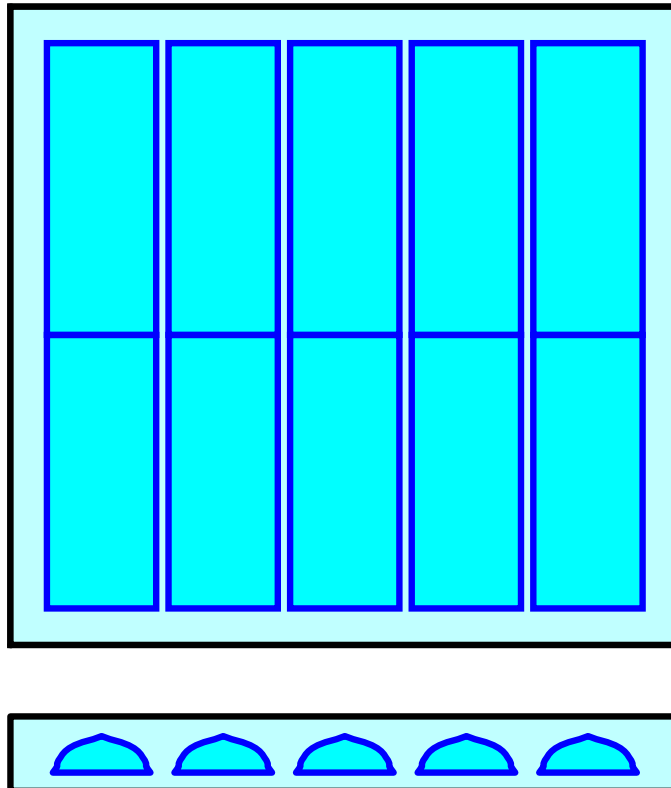
Overall Storage Efficiency = 53.2%

Overall System Size = 17.50' x 18.33' x 2.04'

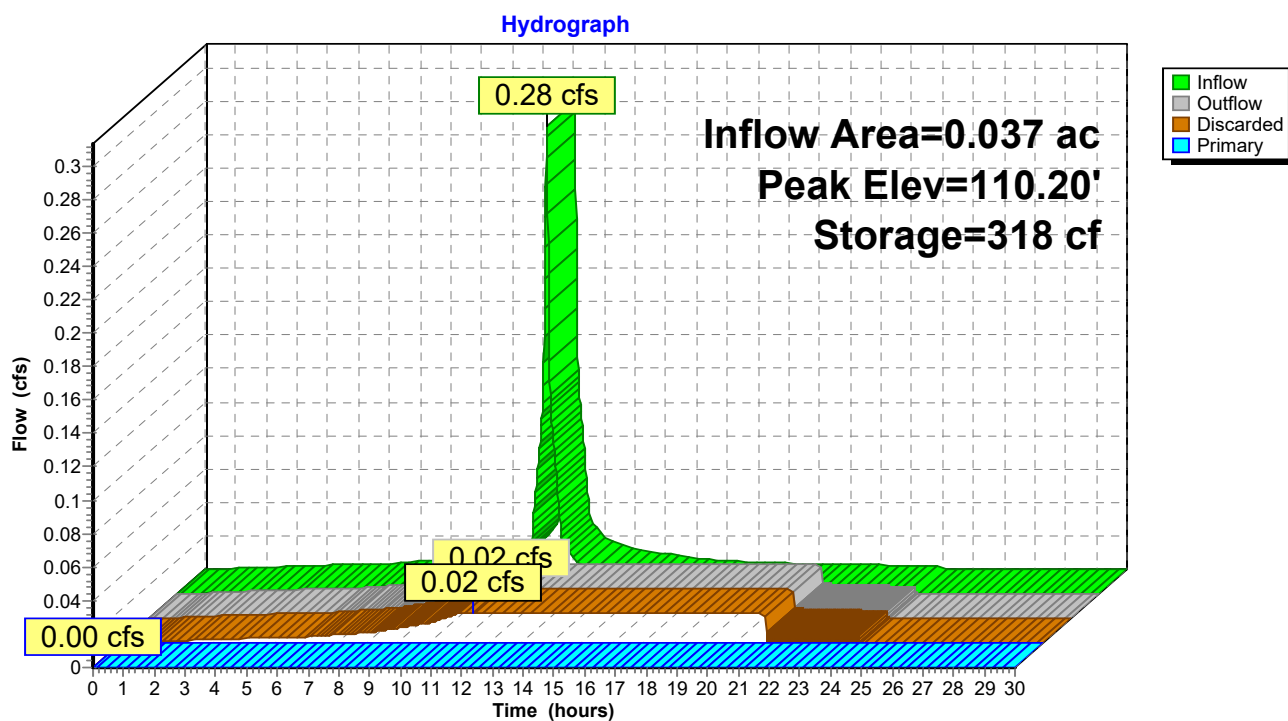
10 Chambers

24.3 cy Field

18.9 cy Stone



## Pond 12P: Lot 45 Inf. Field



**Summary for Subcatchment 13P: P3b**

Runoff = 2.88 cfs @ 12.15 hrs, Volume= 0.248 af, Depth= 3.61"

Routed to Link 14P : Design Point #3: Flow to Wetlands 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

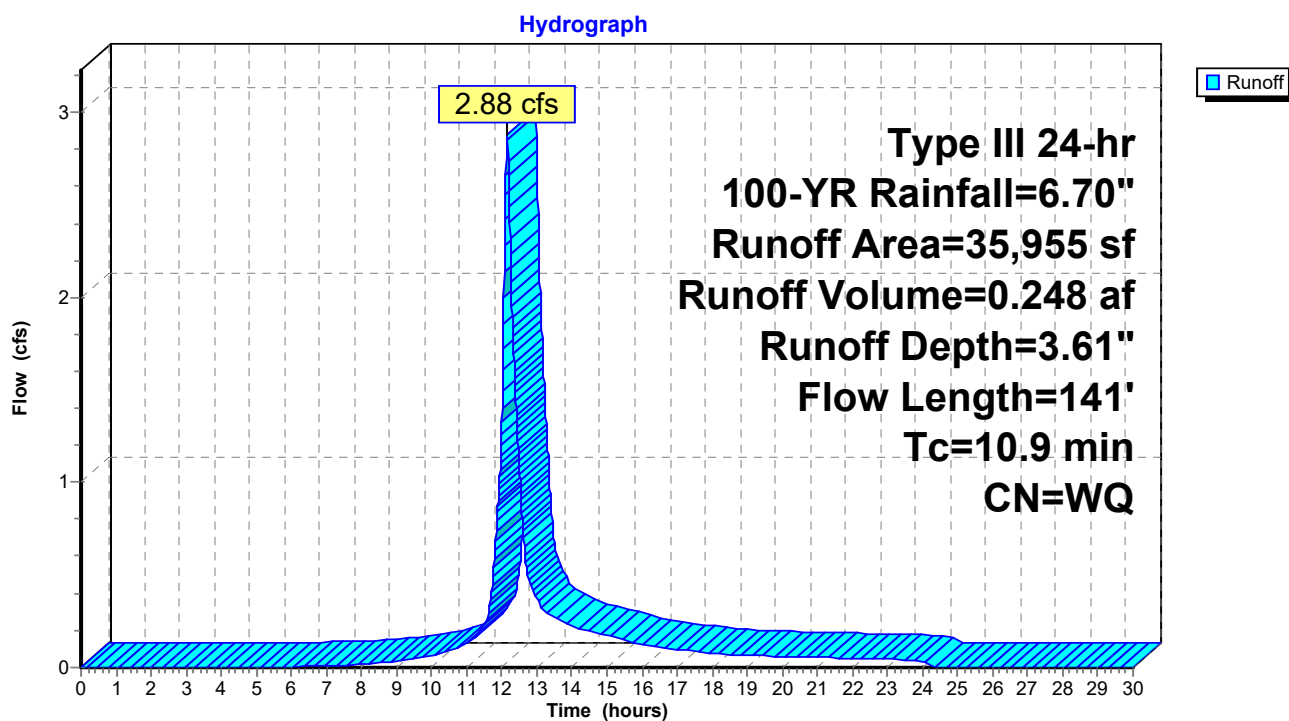
Type III 24-hr 100-YR Rainfall=6.70"

Area (sf)	CN	Description
697	98	Paved parking HSG D
15,064	77	Woods, Good HSG D
2,695	55	Woods, Good HSG B
963	98	Paved parking HSG B
11,425	61	>75% Grass cover, Good HSG B
4,639	80	>75% Grass cover, Good HSG D
472	98	Roofs, HSG B
35,955		Weighted Average
33,823		94.07% Pervious Area
2,132		5.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	43	0.0300	0.08		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.20"
1.6	98	0.0400	1.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
10.9	141	Total			

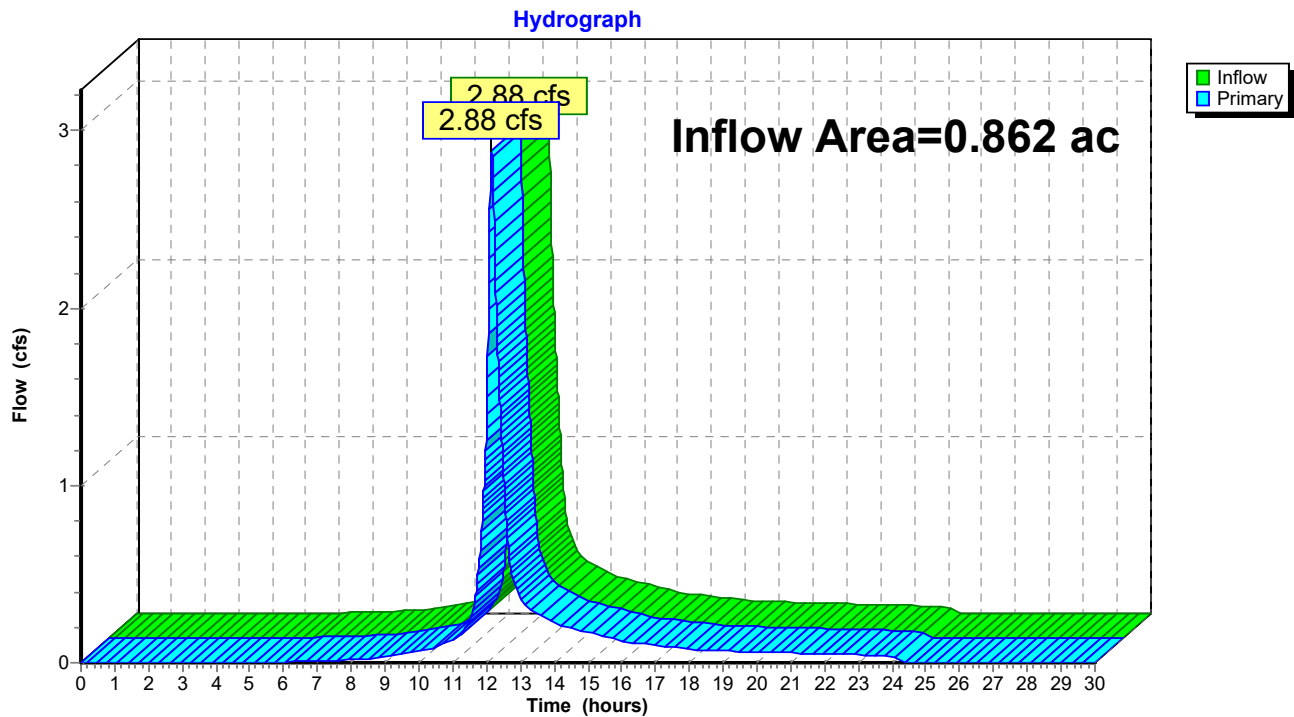
## Subcatchment 13P: P3b



**Summary for Link 14P: Design Point #3: Flow to Wetlands 3**

Inflow Area = 0.862 ac, 9.95% Impervious, Inflow Depth = 3.45" for 100-YR event  
Inflow = 2.88 cfs @ 12.15 hrs, Volume= 0.248 af  
Primary = 2.88 cfs @ 12.15 hrs, Volume= 0.248 af, Atten= 0%, Lag= 0.0 min

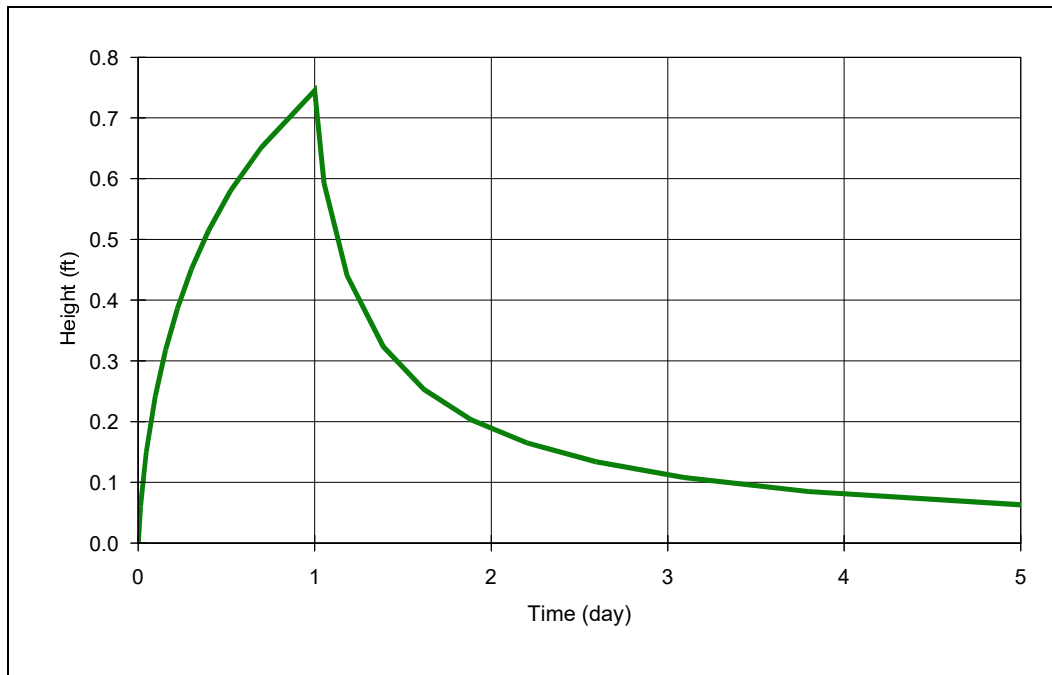
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 14P: Design Point #3: Flow to Wetlands 3**



# **ATTACHMENT L: MOUNDING CALCULATIONS**

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Legacy Engineering

PROJECT: Infiltration Field Lot 1A

ANALYST: Daniel J. Merrikin, P.E.

DATE: 1/3/2024 TIME: 9:32:05 AM

### INPUT PARAMETERS

Application rate: 1.12 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 4.8 ft/day

Initial saturated thickness: 20 ft

Length of application area: 45.8 ft

Width of application area: 6.8 ft

Constant head boundary used at: 200 ft

Groundwater mounding @

X coordinate: 0 ft

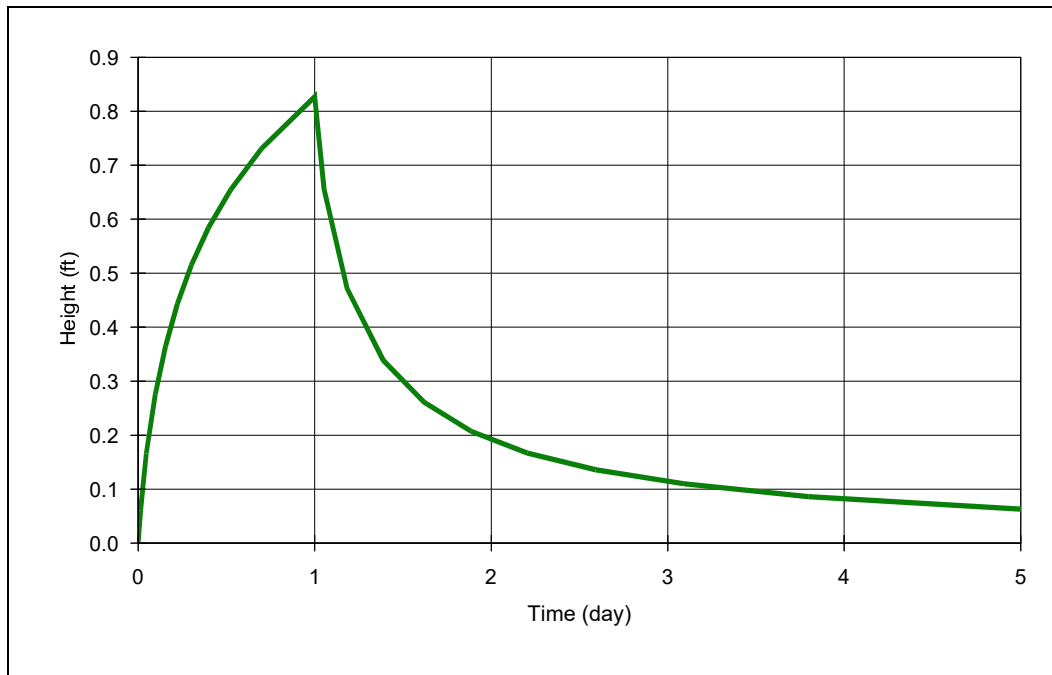
Y coordinate: 0 ft

Total volume applied: 348.8128 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.06
0	0.15
0.1	0.24
0.2	0.32
0.2	0.39
0.3	0.45
0.4	0.51
0.5	0.58
0.7	0.65
1	0.74
1.1	0.59
1.2	0.44
1.4	0.32
1.6	0.25
1.9	0.2
2.2	0.16
2.6	0.13
3.1	0.11
3.8	0.08
5	0.06

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Legacy Engineering

PROJECT: Infiltration Field 2A

ANALYST: Daniel J. Merrikin, P.E.

DATE: 1/3/2024 TIME: 9:33:11 AM

### INPUT PARAMETERS

Application rate: 0.98 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 4.8 ft/day

Initial saturated thickness: 20 ft

Length of application area: 35.5 ft

Width of application area: 10 ft

Constant head boundary used at: 200 ft

Groundwater mounding @

X coordinate: 0 ft

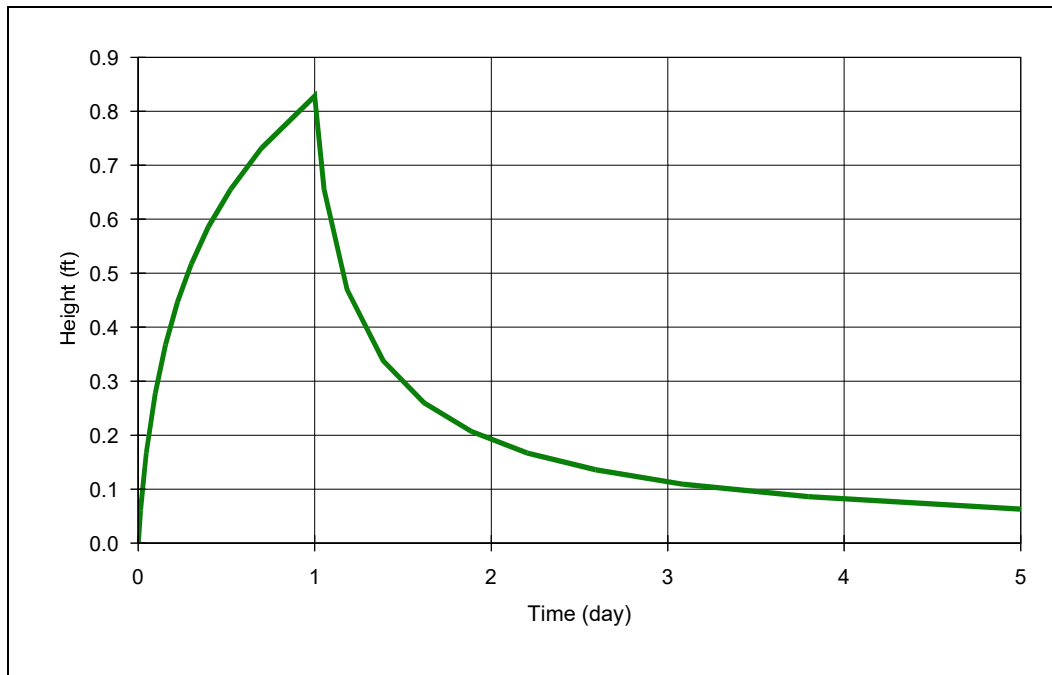
Y coordinate: 0 ft

Total volume applied: 347.9 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.06
0	0.17
0.1	0.28
0.2	0.36
0.2	0.44
0.3	0.52
0.4	0.58
0.5	0.65
0.7	0.73
1	0.83
1.1	0.66
1.2	0.47
1.4	0.34
1.6	0.26
1.9	0.21
2.2	0.17
2.6	0.14
3.1	0.11
3.8	0.09
5	0.06

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Legacy Engineering

PROJECT: Infiltration Field Lot 4

ANALYST: Daniel J. Merrikin, P.E.

DATE: 1/3/2024 TIME: 9:52:39 AM

### INPUT PARAMETERS

Application rate: 0.99 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 4.8 ft/day

Initial saturated thickness: 20 ft

Length of application area: 35 ft

Width of application area: 10 ft

Constant head boundary used at: 200 ft

Groundwater mounding @

X coordinate: 0 ft

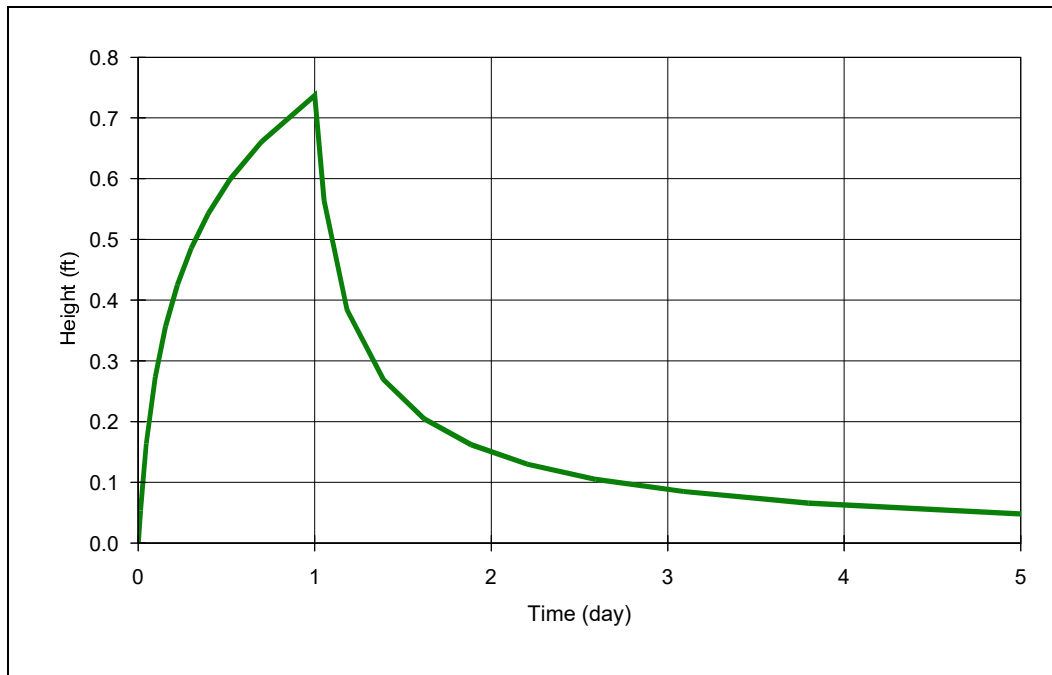
Y coordinate: 0 ft

Total volume applied: 346.5 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.06
0	0.17
0.1	0.28
0.2	0.37
0.2	0.45
0.3	0.52
0.4	0.59
0.5	0.66
0.7	0.73
1	0.83
1.1	0.66
1.2	0.47
1.4	0.34
1.6	0.26
1.9	0.21
2.2	0.17
2.6	0.14
3.1	0.11
3.8	0.09
5	0.06

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Legacy Engineering

PROJECT: Infiltration Field Lot 45

ANALYST: Daniel J. Merrikin, P.E.

DATE: 1/3/2024 TIME: 9:58:00 AM

### INPUT PARAMETERS

Application rate: 0.83 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 5 day

Fillable porosity: 0.2

Hydraulic conductivity: 4.8 ft/day

Initial saturated thickness: 20 ft

Length of application area: 18.3 ft

Width of application area: 17.5 ft

Constant head boundary used at: 200 ft

Groundwater mounding @

X coordinate: 0 ft

Y coordinate: 0 ft

Total volume applied: 265.8075 cft

### MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.05
0	0.16
0.1	0.27
0.2	0.36
0.2	0.42
0.3	0.49
0.4	0.54
0.5	0.6
0.7	0.66
1	0.74
1.1	0.56
1.2	0.38
1.4	0.27
1.6	0.2
1.9	0.16
2.2	0.13
2.6	0.1
3.1	0.08
3.8	0.07
5	0.05