
NOTICE OF INTENT

Filing Under the Massachusetts Wetlands Protection Act M.G.L. Chapter 131, Section 40 and the City of New Bedford Wetlands Protection Ordinance

Nemasket Street Soccer Field Project New Bedford, Massachusetts

May 2018

Prepared for:

The City of New Bedford
Department of Environmental Stewardship
133 William Street
New Bedford, Massachusetts 02740

Prepared by:



TRC Environmental Corporation
650 Suffolk Street
Lowell, Massachusetts 01854

TABLE OF CONTENTS

WPA FORM 3 – NOTICE OF INTENT ABUTTER INFORMATION PROPERTY DEED

PROJECT NARRATIVE

1.0	INTRODUCTION	1
1.1	Purpose and Need	1
2.0	EXISTING RESOURCES	2
2.1	Wetland Resources and Surface Waters	2
2.2	Massachusetts Natural Heritage and Endangered Species Program	3
3.0	AFFECTED RESOURCE AREAS AND IMPACTS	3
3.1	Wetland Buffer Zone Impacts	3
3.2	Filling of Isolated Vegetated Wetland	3
4.0	CONSTRUCTION SEQUENCE, AVOIDANCE AND MINIMIZATION, AND MITIGATION	3
4.1	Vegetation Clearing	5
4.2	Soil Management	5
4.3	Groundwater Management	5
4.4	Erosion and Sedimentation Control Measures	5
4.5	Environmental Compliance and Monitoring	6
4.6	Stormwater Management	6

LIST OF ATTACHMENTS

ATTACHMENT A – FIGURES & PLANS

FIGURE 1: SITE LOCATION MAP

FIGURE 2: NEMASKET STREET LOTS

FIGURE 3: CURRENT SITE CONDITIONS

FIGURE 4: EARTHWORK PLAN

ATTACHMENT B – DRAWINGS

ATTACHMENT C – 2010 DETERMINATION OF APPLICABILITY

ATTACHMENT D – WETLAND PHOTOGRAPHS

ATTACHMENT E – STORMWATER MANAGEMENT REPORT AND CHECKLIST

ATTACHMENT F – CORRESPONDENCE (TRACEY COMMENTS)

WPA FORM 3 – NOTICE OF INTENT



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford

City/Town

Important:

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



Note:
Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

Ruggles Street and Hathaway Boulevard

a. Street Address

New Bedford

b. City/Town

02740

c. Zip Code

Latitude and Longitude:

41.64 N

d. Latitude

-70.95 W

e. Longitude

69

f. Assessors Map/Plat Number

86, 88-93, 96-100, and 125

g. Parcel /Lot Number

2. Applicant:

N/A

a. First Name

N/A

b. Last Name

City of New Bedford, Department of Environmental Stewardship

c. Organization

133 William Street

d. Street Address

New Bedford

e. City/Town

MA

f. State

02740

g. Zip Code

h. Phone Number

i. Fax Number

j. Email Address

3. Property owner (required if different from applicant): ☐ Check if more than one owner

N/A

a. First Name

N/A

b. Last Name

City of New Bedford, Department of Environmental Stewardship

c. Organization

133 William Street

d. Street Address

New Bedford

e. City/Town

MA

f. State

02740

g. Zip Code

h. Phone Number

i. Fax Number

j. Email address

4. Representative (if any):

Scott

a. First Name

Heim

b. Last Name

TRC

c. Company

650 Suffolk Street

d. Street Address

Lowell

e. City/Town

MA

f. State

01854

g. Zip Code

(978) 656-3583

h. Phone Number

(978) 453-1995

i. Fax Number

SHeim@trcsolutions.com

j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

Fee Exempt

a. Total Fee Paid

Fee Exempt

b. State Fee Paid

Fee Exempt

c. City/Town Fee Paid



WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford

City/Town

A. General Information (continued)

6. General Project Description:

This project is comprised of construction of a soccer field as a component of site remediation that is required to achieve Site closure under the Massachusetts Contingency Plan.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

- | | |
|---|---|
| 1. <input type="checkbox"/> Single Family Home | 2. <input type="checkbox"/> Residential Subdivision |
| 3. <input type="checkbox"/> Commercial/Industrial | 4. <input type="checkbox"/> Dock/Pier |
| 5. <input type="checkbox"/> Utilities | 6. <input type="checkbox"/> Coastal engineering Structure |
| 7. <input type="checkbox"/> Agriculture (e.g., cranberries, forestry) | 8. <input type="checkbox"/> Transportation |
| 9. <input checked="" type="checkbox"/> Other | |

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☐ Yes ☒ No If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR 10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

a. County

b. Certificate # (if registered land)

c. Book

d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☒ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
2. ☐ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford

City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. <input type="checkbox"/> Bank	1. linear feet	2. linear feet
b. <input type="checkbox"/> Bordering Vegetated Wetland	1. square feet	2. square feet
c. <input type="checkbox"/> Land Under Waterbodies and Waterways	1. square feet	2. square feet
	3. cubic yards dredged	

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. <input type="checkbox"/> Bordering Land Subject to Flooding	1. square feet	2. square feet
	3. cubic feet of flood storage lost	4. cubic feet replaced
e. <input type="checkbox"/> Isolated Land Subject to Flooding	1. square feet	
	2. cubic feet of flood storage lost	3. cubic feet replaced
f. <input type="checkbox"/> Riverfront Area	1. Name of Waterway (if available) - specify coastal or inland	

2. Width of Riverfront Area (check one):

- ☐ 25 ft. - Designated Densely Developed Areas only
- ☐ 100 ft. - New agricultural projects only
- ☐ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: _____ square feet

4. Proposed alteration of the Riverfront Area:

a. total square feet _____ b. square feet within 100 ft. _____ c. square feet between 100 ft. and 200 ft. _____

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☐ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f.** above.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford

City/Town

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users:
Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

<u>Resource Area</u>	<u>Size of Proposed Alteration</u>	<u>Proposed Replacement (if any)</u>
a. <input type="checkbox"/> Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. <input type="checkbox"/> Land Under the Ocean	1. square feet	
	2. cubic yards dredged	
c. <input type="checkbox"/> Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. <input type="checkbox"/> Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. <input type="checkbox"/> Coastal Dunes	1. square feet	2. cubic yards dune nourishment
	<u>Size of Proposed Alteration</u>	<u>Proposed Replacement (if any)</u>
f. <input type="checkbox"/> Coastal Banks	1. linear feet	
g. <input type="checkbox"/> Rocky Intertidal Shores	1. square feet	
h. <input type="checkbox"/> Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. <input type="checkbox"/> Land Under Salt Ponds	1. square feet	
	2. cubic yards dredged	
j. <input type="checkbox"/> Land Containing Shellfish	1. square feet	
k. <input type="checkbox"/> Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above	
	1. cubic yards dredged	
l. <input type="checkbox"/> Land Subject to Coastal Storm Flowage	1. square feet	
4. <input type="checkbox"/> Restoration/Enhancement	If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.	
	a. square feet of BVW	b. square feet of Salt Marsh
5. <input type="checkbox"/> Project Involves Stream Crossings		
	a. number of new stream crossings	b. number of replacement stream crossings



WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford

City/Town

C. Other Applicable Standards and Requirements

- ☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

- a. ☐ Yes ☒ No **If yes, include proof of mailing or hand delivery of NOI to:**

Natural Heritage and Endangered Species Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

November 2017

b. Date of map

If yes, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

- c. Submit Supplemental Information for Endangered Species Review*

1. ☐ Percentage/acreage of property to be altered:

(a) within wetland Resource Area

percentage/acreage

(b) outside Resource Area

percentage/acreage

2. ☐ Assessor's Map or right-of-way plan of site

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

(a) ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

(b) ☐ Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see <http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/>). Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford

City/Town

C. Other Applicable Standards and Requirements (cont'd)

- (c) ☐ MESA filing fee (fee information available at http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/ mesa/ mesa_fee_schedule.htm).
Make check payable to "Commonwealth of Massachusetts - NHESP" and **mail to NHESP** at above address

Projects altering 10 or more acres of land, also submit:

- (d) ☐ Vegetation cover type map of site
- (e) ☐ Project plans showing Priority & Estimated Habitat boundaries
- (f) OR Check One of the Following
1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/ mesa/ mesa_exemptions.htm; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)
2. ☐ Separate MESA review ongoing. a. NHESP Tracking # _____ b. Date submitted to NHESP _____
3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.
3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?
- a. ☒ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
1213 Purchase Street – 3rd Floor
New Bedford, MA 02740-6694
Email: DMF.EnvReview-South@state.ma.us

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: DMF.EnvReview-North@state.ma.us

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford

City/Town

Online Users:

Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

C. Other Applicable Standards and Requirements (cont'd)

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?
- a. ☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.
- b. ACEC
5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?
- a. ☐ Yes ☒ No
6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?
- a. ☐ Yes ☒ No
7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?
- a. ☐ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:
1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)
 2. ☐ A portion of the site constitutes redevelopment
 3. ☐ Proprietary BMPs are included in the Stormwater Management System.
- b. ☒ No. Check why the project is exempt:
1. ☐ Single-family house
 2. ☐ Emergency road repair
 3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

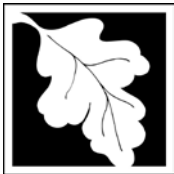
D. Additional Information

- ☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☐ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)
2. ☐ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

New Bedford

City/Town

D. Additional Information (cont'd)

3. ☐ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☐ List the titles and dates for all plans and other materials submitted with this NOI.

Nemasket Street Recreation Area - Drawings 1 through 6

a. Plan Title

TRC

b. Prepared By

04/10/18

d. Final Revision Date

c. Signed and Stamped by

1" = 20'

e. Scale

f. Additional Plan or Document Title

g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.
6. ☐ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.
7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.
8. ☒ Attach NOI Wetland Fee Transmittal Form
9. ☒ Attach Stormwater Report, if needed.

E. Fees

1. ☒ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

2. Municipal Check Number

3. Check date

4. State Check Number

5. Check date

6. Payor name on check: First Name

7. Payor name on check: Last Name



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent


Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

New Bedford
City/Town

F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.


1. Signature of Applicant

5/24/18
2. Date

3. Signature of Property Owner (if different)

4. Date

5. Signature of Representative (if any)

6. Date

For Conservation Commission:

Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:

One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:

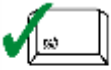
If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
NOI Wetland Fee Transmittal Form
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

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



A. Applicant Information

1. Location of Project:

Ruggles Street and Hathaway Boulevard

a. Street Address

N/A

c. Check number

New Bedford

b. City/Town

Fee Exempt

d. Fee amount

2. Applicant Mailing Address:

N/A

a. First Name

N/A

b. Last Name

City of New Bedford, Department of Environmental Stewardship

c. Organization

133 William Street

d. Mailing Address

New Bedford

e. City/Town

MA

f. State

02740

g. Zip Code

h. Phone Number

i. Fax Number

j. Email Address

3. Property Owner (if different):

N/A

a. First Name

N/A

b. Last Name

City of New Bedford, Department of Environmental Stewardship

c. Organization

133 William Street

d. Mailing Address

New Bedford

e. City/Town

MA

f. State

02740

g. Zip Code

h. Phone Number

i. Fax Number

j. Email Address

B. Fees

Fee should be calculated using the following process & worksheet. **Please see Instructions before filling out worksheet.**

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract \$12.50. To calculate the city/town share of the fee, divide the total fee in half and add \$12.50.

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).



Massachusetts Department of Environmental Protection

Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
Fee Exempt			
Step 5/Total Project Fee:			Fee Exempt

Step 6/Fee Payments:

Total Project Fee:	<div>Fee Exempt</div> <hr/> <div>a. Total Fee from Step 5</div>
State share of filing Fee:	<div>N/A</div> <hr/> <div>b. 1/2 Total Fee less \$12.50</div>
City/Town share of filling Fee:	<div>N/A</div> <hr/> <div>c. 1/2 Total Fee plus \$12.50</div>

C. Submittal Requirements

- a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

- b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

ABUTTER INFORMATION

**Notification to Abutters Under the
Massachusetts Wetlands Protection Act
And the City of New Bedford Wetlands Ordinance**

In accordance with the second paragraph of the Massachusetts General Laws Chapter 131, Section 40, and the City of New Bedford Wetlands Ordinance (Section 15-101 through 15-112) you are hereby notified of the following.

- A. The name of the applicant is: The New Bedford Office of Environmental Stewardship
- B. The applicant has filed a Notice of Intent with the Conservation Commission for the municipality of New Bedford, Massachusetts seeking permission to remove, fill dredge or alter an Area Subject to Protection Under the Wetlands Protection Act (General Laws Chapter 131, Section 40) and the City of New Bedford Wetlands Ordinance (Section 15-101 through 15-112).
- C. The address of the lot where the activity is proposed is: Nemasket Street Lots. Assessors Map 69 blocks 86 through 93, and 96 through 100
- D. Copies of the Notice of Intent may be examined at New Bedford Conservation Commission, 133 William St. Rm. # 304, New Bedford, MA 02740 between the hours of 8:00AM- 4:00 PM, Monday- Friday. For more information, call (508) 991-6188.

Check one: This is the Applicant____, Representative____, or other **X** specify: *New Bedford Conservation Commission Office*

- E. Copies of the Notice of Intent may be obtained from either (check one) the applicant **X** or the applicant's representative_, by calling this telephone number 508-400-2967 between the hours of 8 and 4 on the following days of the week: Monday- Friday.
- F. Information regarding the date, time, and place of the public hearing may be obtained from New Bedford Conservation Commission by calling this telephone number (508) 991-6188 between the hours of 8:00AM-4:00PM Monday- Friday.

Check one: This is the Applicant____, Representative____, or other **X** (specify):
New Bedford Conservation Commission.

Note: Notice of the Public hearing, including its date, time and place, will be published at least five (5) days in advance in The Standard-Times.

Note: Notice of the public hearing, including its date, time and place will be posted in the City Hall not less than forty-eight (48) hours in advance.

Note: You also may contact your local Conservation Commission or the Southeast Region of the Department of Environmental Protection for more information about this publication or the Wetlands Protection Act.
To Contact DEP Call: Southeast Region: (508) 946-2700
New Bedford Conservation Commission (508) 991-6188

PROPERTY DEED

Quitclaim Deed

The BETHEL A.M.E. CHURCH, a Massachusetts religious institution pursuant to G.L. c. 180, of 532 County Street, New Bedford, Bristol County, Massachusetts, for consideration given and in full consideration of the forgiveness of the present outstanding real estate tax liability on the herein conveyed property. No stamps are required since this is a conveyance to the City of New Bedford.

grants to the **CITY OF NEW BEDFORD**, a municipal corporation duly existing under the laws of the Commonwealth of Massachusetts, 133 William Street, Bristol County, Massachusetts


with **Quitclaim Covenants**

the land in New Bedford, Bristol County, Massachusetts with buildings thereon described as follows:

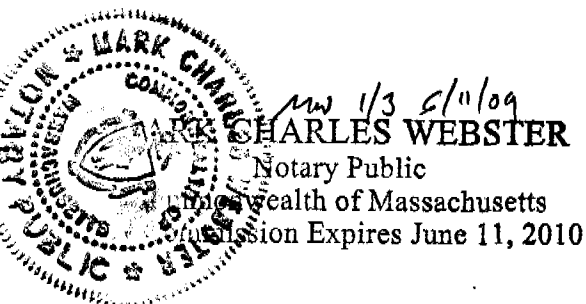
See Exhibit "A"


Being the same premises conveyed to the Grantor by deed dated January 18, 1965 and recorded in the Bristol County (S.D.) Registry of Deeds in Book 1473, Page 45.

Bethel A.M.E. Church
By:


Rev, Milna I. Johnson, Pastor and President of
The Board of Trustees, duly authorized

6/11/09




Rev. Daylan K. Greer, Sr., Vice Chairman, New
England Conference Trustees, duly authorized

Dated:

COMMONWEALTH OF MASSACHUSETTS

Middlesex, ss6/11, 2009

On this 11th day of June, before me, the undersigned Notary Public, personally appeared Melba T. Johnson
 proved to me by satisfactory evidence of identification, being (check whichever applies): ☒ driver's license or other state or federal governmental document bearing a photographic image, ☐ oath or affirmation of a credible witness known to me who knows the above signatory, or ☐ my own personal knowledge of the identity of the signatory, to be the person whose name is signed above, and acknowledged the foregoing to be his/her free act and deed and signed by him/her voluntarily for its stated purpose.



Mark Charles Webster
 Print Name of Notary Public: Notary Public
 My Commission Expires: Commonwealth of Massachusetts
 Qualified in the Commonwealth of Massachusetts My Commission Expires June 11, 2010

STATE OF CONNECTICUT

Jennifer Little-Greer, ss7/16, 2009

On this 16th day of July, before me, the undersigned Notary Public, personally appeared Daphne Greer
 proved to me by satisfactory evidence of identification, being (check whichever applies): ☐ driver's license or other state or federal governmental document bearing a photographic image, ☐ oath or affirmation of a credible witness known to me who knows the above signatory, or ☐ my own personal knowledge of the identity of the signatory, to be the person whose name is signed above, and acknowledged the foregoing to be his/her free act and deed and signed by him/her voluntarily for its stated purpose.

Jennifer Little-Greer
 Print Name of Notary Public: JENNIFER LITTLE-GREER
 My Commission Expires: NOTARY PUBLIC
 Qualified in the State of Connecticut MY COMMISSION EXPIRES DEC. 31, 2012

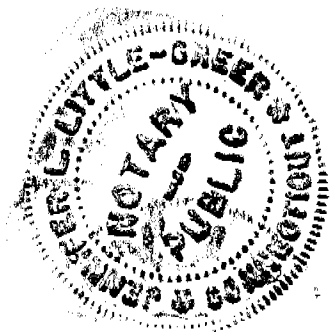


EXHIBIT "A"

Beginning at a point in the northerly line of Ruggles Street, distant easterly therein ninety (90) feet more or less from the easterly line of Summit Street;

Thence continuing easterly in said northerly line of Ruggles Street, a distance of three hundred (300) feet more or less to a point;

Thence northerly by land now or formerly belonging to Nanette A. Sullivan, a distance of forty-five (45) feet more or less to a point;

Thence easterly by land of said Nanette A. Sullivan, a distance of ninety (90) feet more or less to a point in the westerly line of Hathaway Boulevard;

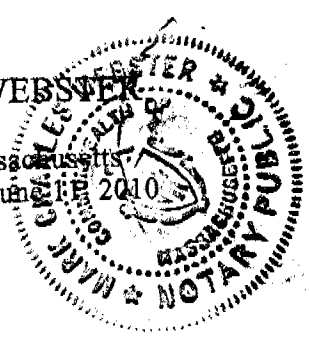
Thence northerly in said westerly line of Hathaway Boulevard a distance of one hundred thirty-five (135) feet more or less to a point in the southerly line of Nemasket Street;

Thence westerly in said southerly line of Nemasket Street, a distance of three hundred ninety (390) feet more or less to a point;

Thence southerly by land now or formerly belonging to Robert A. Watkins, Jr., a distance of one hundred eighty (180) feet more or less to the point of beginning, containing 243.00 square rods, more or less. Being Lots 86, 87, 88, 89, 90, 91, 93, 96, 97, 98, 99, 100, 101, 102 and 103 on Plat 69 of Assessor's Plans of City of new Bedford.

For Grantor's title see Bristol County S.D. Registry of Deeds Book 1473, Page 45.

MD 3/3 6/11/09
MARK CHARLES WEBSTER
 Notary Public
 Commonwealth of Massachusetts
 My Commission Expires June 11, 2010



PROJECT NARRATIVE

1.0 INTRODUCTION

The City of New Bedford Department of Environmental Stewardship (hereafter “the City”) proposes to complete planned remedial activities and construct an athletic facility (the Nemasket Street Recreation Area) at the following Nemasket Street parcels: map 69, blocks 86, 88, 91 through 93, and blocks 96 through 100 and portions of block 125 (hereinafter “the Site”, Figure 1, Attachment A). These parcels are owned by the City and have never been residentially or commercially developed. The Site is located on the eastern end of Ruggles Street at the intersection of Hathaway Boulevard. The topography is generally level with shallow slopes leading to an Isolated Vegetated Wetland (“IVW”) in the western portion and a Bordering Vegetated Wetland (“BVW”) adjacent to the northern portion of the Site.

The Site was initially cleared in October 2010 to facilitate environmental investigation activities but vegetation (primarily grass, weeds and small brush) has since reestablished itself. The coordinates for the Site are 41.64°N, -70.95°W Latitude/Longitude and the Site is identified on Figure 2 (Attachment A).

The selected remedial action includes brush and tree clearing within the 100-foot wetland buffer zone. Site remediation includes construction of an exposure barrier (synthetic turf system, concrete, and soil, depending on location at the Site) and implementation of an Activity and Use Limitation (AUL). This alternative would employ a §761.61(c) approach under TSCA regulations and would require review and approval by the US Environmental Protection Agency (EPA).

The remediation activities at the Site incorporate the City’s plan to develop the Nemasket Street Lots into a soccer field. The current plans for the field will include a synthetic turf soccer field and landscaped areas. Construction of the field will include importing fill, grading, and construction of a retaining wall.

This Notice of Intent (“NOI”) is being filed with the City of New Bedford Conservation Commission pursuant to the Massachusetts Wetlands Protection Act (“WPA”) M.G.L.C. 131, § 40 and its implementing regulations at 310 CMR 10.00, and the New Bedford Wetland Protection Ordinance (Section 15-101), for construction activities associated with the development of an soccer field (described herein) that will partially take place within the 100-foot buffer zone to a BVW (Drawings 1 through 6, Attachment B).

A NOI was previously submitted to the New Bedford Conservation Commission on June 7, 2016, however subsequent changes in the scope of the athletic complex resulted in withdrawal of the NOI. At the time the Conservation Commission expressed concerns about having a permeable cap allowing water to infiltrate through contaminated soils. Because this design is replicated in the current submittal, TRC has included as Attachment F, correspondence on this issue and the finding by the Conservation Commission’s consultant (Tracey Environmental) that the permeable cap design will not adversely impact groundwater at the site.

1.1 Purpose and Need

The Project is designed to address both necessary remedial activities adjacent to the Keith Middle School (KMS) and to develop a soccer field that enhances the athletic potential of KMS students and members of the public, as well as improve community aesthetics.

2.0 EXISTING RESOURCES

The following section provides a summary of resource areas in and adjacent to the Site in New Bedford. Proposed impacts to wetland buffer zones associated with remedial and construction activities are discussed in Section 3.0.

2.1 Wetland Resources and Surface Waters

Prior to conducting a field investigation, wetland scientists from TRC Environmental Corporation (“TRC”) reviewed data sources including U.S. Geological Survey (“USGS”) topographic mapping, aerial photographs, and Massachusetts Geographic Information System (“MassGIS”) data layers for the presence of wetlands, streams, 100-year floodplain, hydric soils, certified or potential vernal pools, priority and estimated habitats of rare species, and historic properties. Following the database review, TRC conducted field surveys in the vicinity of the Nemasket Street Lots to delineate and map federal, state, and local jurisdictional wetlands and waterways. The field surveys were conducted in accordance with the U.S. Army Corps of Engineers (“USACE”) *North Central and Northeast Regional Supplement* (2009) and *Delineating Bordering Vegetated Wetlands under the Massachusetts Wetlands Protection Act*. Sequentially-numbered alpha-numeric flagging were used to demarcate the boundaries of wetlands and locations of flags were surveyed by a Massachusetts Licensed Surveyor. Please see Attachment C for the 2010 Wetland Determination of Applicability and Attachment D for wetland photographs.

TRC personnel identified one IVW on the Site and a BVW adjacent to the Site.

Isolated Vegetated Wetland

TRC identified one IVW on the western end of the Site (Drawing 1, Attachment B). This IVW is located within a depression bound by steep slopes, which rise to meet the elevation of the surrounding properties and streets. The IVW is characterized by red maple (*Acer rubrum*), multiflora rose (*Rosa multiflora*), spicebush (*Lindera benzoin*), bittersweet (*Celastrus orbiculatus*), and poison ivy (*Toxicodendron radicans*). Soils within the IVW consist of low chroma fine sandy loam, overlaying an organic layer of muck. Signs of hydrology include water-stained leaves and saturated soils. The size of the IVW is approximately 2,800 square feet.

The IVW is separated from a BVW located to the north by an earthen berm located within the Nemasket Street right-of-way that bounds the Site to the north, separating it from the adjacent Keith Middle School. A site investigation revealed that there were no hydrological connections between the IVW and the nearby BVW (Attachment C). In addition, no water marks were observed on rocks or vegetation, suggesting that water does not pool within the IVW. No evidence was observed that the IVW functions as a vernal pool or vernal pool habitat. Because the IVW was located within a depression, The City performed a topographical survey and drainage calculations in order to determine if the depression functioned as Isolated Land Subject to Flooding (“ILSF”) in accordance with 310 CMR 10.57(2)(b). As stated above, no evidence was observed suggesting that water pooled within the IVW. Based on drainage calculations performed in accordance with the WPA and the MassDEP’s Wetlands Program Policy 85-2 this depression did not meet the criteria of ILSF (Attachment C).

100-foot Buffer Zone

One red maple (*Acer rubrum*) palustrine forested wetland BVW was identified north of the Site at the base of the slope from the Nemasket Street right-of-way and the Keith Middle School parking lot (Drawing 1, Attachment B). The 100-foot buffer zone of the BVW on-site consists of heavily vegetated uplands characterized by thick scrub-shrub growth and the aforementioned IVW.

2.2 Massachusetts Natural Heritage and Endangered Species Program

During TRC's investigative activities, no designated Massachusetts Natural Heritage and Endangered Species Program ("MassNHESP") priority or estimated habitats of rare species, nor potential or certified vernal pools, have been identified in or near the work area. Additionally, the Project is not located within an Outstanding Resource Water ("ORW") or Area of Critical Environmental Concern ("ACEC").

3.0 AFFECTED RESOURCE AREAS AND IMPACTS

Construction of the proposed Project in the City of New Bedford will involve activities within jurisdictional buffer zones protected under the WPA and the New Bedford Wetlands Protection Ordinance. Due to the Site's location near existing wetland resource areas, construction of the proposed Project will result in unavoidable permanent alterations of the buffer zone necessary for remedial and construction activities.

3.1 Wetland Buffer Zone Impacts

Approximately 16,040 square feet (0.37 ac) of total disturbance will take place within the 100-foot wetland buffer to the BVW (Figure 1, Attachment B).

3.2 Filling of Isolated Vegetated Wetland

The 2,839 square foot isolated wetland (0.07 ac) will be filled with excavated or imported clean soil. A 2,297 square foot portion of the total fill is also located within the BVW 100-foot buffer zone and is accounted for within the buffer zone impacts present above (Figure 4, Attachment A). This work is authorized under Army Corps Massachusetts Programmatic General Permit 8 (self-verification). The Project does not require an individual 401 Water Quality Certification permit from the MassDEP (314 CMR 9.03 (5)).

4.0 CONSTRUCTION SEQUENCE, AVOIDANCE AND MINIMIZATION, AND MITIGATION

As work is located within the wetland buffer zone, appropriate Best Management Practices (BMPs) and erosion controls will be in place for the duration of construction and the effect of disturbance associated with construction of the Project is expected to be minimal. Remediation and construction will occur in phases following the general procedures listed below, including methods to avoid and minimize disturbance to the extent practicable.

A compressible peat layer is present across the site at a depth of approximately 10 feet. Construction of the turf field will include installing up to 4 feet of fill across the site (Figure 4 – Attachment A). Installation of this material will cause the peat to compress which will impact final grades and drainage. To address this, the construction will take place in two phases. The first phase will include the placement and rough grading of the fill (the top layers consists of 12” of 1¼-inch gravel overlain by 10” of 1-inch washed gravel – Drawing 2A in Attachment B) and covering the fill with a geotextile to minimize dust emissions/deposition on the clean gravel. The rough grade is indicated in Drawing 2A of Attachment B. The material will remain in that condition for approximately three months to one year to allow compaction of the peat. The second phase will include re-grading the area and installation of the turf field and appurtenances. Drawings 1 through 6 of Attachment B provide the design and construction elements. The following provides the anticipated construction sequence.

Premobilization

- Field flag wetland boundary prior to construction (completed);

Mobilization

- Install erosion control devices, such as straw wattles and siltation fencing, as shown on approved plans and permit conditions specified by the City of New Bedford Conservation Commission in their Order of Conditions. Proposed control measures are included in Drawing 5 (Attachment B);
- Establish equipment staging and laydown areas outside of the wetland boundary and buffer zone;

Site Preparation/Rough Grading

- Clear and grub vegetation and remove geotechnically unsuitable material. General excavation of the estimated top 6 inches of topsoil (vegetative matter will be removed by screening and disposed of off-site);
- Excavate peat from bottom of isolated wetland
- Install subbase components and grade to induce geotechnical compaction of remaining subsurface peat. Import of soils and grading for exposure barrier construction (excavated and stockpiled soils would be utilized for sub-grading the Site);
- Exposed soils will be wetted and stabilized as necessary to suppress dust generation during construction;
- Construct retaining wall;
- Allow peat compaction (between 3 months and 1 year). During compaction period, soil will be covered with a geotextile fabric to eliminate dust emissions and limit vegetative regrowth. The covered area will be surrounded by a temporary perimeter V-ditch to manage possible runoff.

Install Turf Field

- Regrade site as necessary
- Install Turf Field
- Install synthetic turf system for a soccer field; and
- Following construction, restore the buffer zones in compliance with applicable permit conditions and in accordance with applicable BMPs:
 - Restoration efforts following construction generally will include removing temporary erosion control devices following the stabilization of disturbed areas, re-grading of ruts, and seeding and mulching as necessary. All construction debris will be removed from the

Project site and disposed of properly. All disturbed areas around structures and other graded locations will be covered with a maintenance free surface (e.g. gravel underlain by a permeable weed barrier) and/or mulched to stabilize the soils. Pre-existing fences will generally be restored to their former condition.

4.1 Vegetation Clearing

Existing vegetation shall be cleared and grubbed at the Site in areas targeted for remediation or the facility construction. Above-grade parts of the vegetation will likely be able to be disposed of off-site without treatment; the Contractor shall determine requirements. Stumps and other vegetative matter will be separated from the soil by screening. The vegetative matter shall be stockpiled on site and cleaned and tested as necessary for off-site disposal.

4.2 Soil Management

Peat excavated from the bottom of the isolated wetland and geotechnically unsuitable top soil shall be properly managed from point of excavation through disposal or reuse. It is anticipated that the peat will be loaded into a dewatering roll-off located within the area of contamination prior to being transported off site. Geotechnically unsuitable material will be stored in roll-offs outside of the wetland buffer zones. Soil and peat shall be transported off site under a Massachusetts Contingency Plan (MCP) Bill of Lading to a licensed disposal facility. Dewatering liquids shall not be recharged without LSP approval and treatment to remove constituents of concern. If deemed to be compliant with applicable regulations by the LSP, dewatering liquids will be returned to the isolated wetland.

4.3 Groundwater Management

Groundwater is not anticipated to be encountered during remedial or construction activities onsite. Test pits results indicated groundwater is located at least nine (9) feet below the surface. If groundwater is encountered during excavation it will be discharged to a lined dewatering pit located in an upland area and will be sent off site for disposal. Groundwater or dewatering liquids shall not be recharged to an open excavation or a groundwater monitoring well without LSP approval and treatment to remove constituents of concern.

4.4 Erosion and Sedimentation Control Measures

Erosion and sedimentation control measures shall be installed as shown in Drawings 5 and 6 (Attachment B). The sedimentation and erosion controls shall be constructed prior to commencement of vegetative clearing or grading/fill activities. Areas in need of repair during construction activities shall be repaired and shall be maintained for the duration of the project. Sedimentation areas shall be inspected daily to maintain compliance and to avoid siltation of surface water. Erosion and sediment controls for temporary on-site soil stockpiles shall include perimeter hay bales or straw waddles and covers and liners. At the completion of remedial activities, all sedimentation and erosion control measures shall be removed and the area restored to its existing condition.

The following describes installation of the erosion and sedimentation control measures.

Filter Fabric

The filter fabric shall be constructed of a non-rotting, ultraviolet light resistant woven polyester geotextile with sufficient strength for their intended purpose. For catch basins, the filter fabric shall be placed just beneath the catch basin grate. The catch basin grate will be used to secure the filter fabric in place.

Straw Wattles

Straw wattles shall be placed in a single row with the ends of adjacent wattles tightly abutting one another. The wattles shall be securely anchored. The straw wattles shall consist of straw from acceptable grasses and legumes, free from weeds, reeds, twigs, chaff, debris and other objectionable material or excessive amounts of seeds and grains.

4.5 Environmental Compliance and Monitoring

The contractor's Construction Supervisor will be responsible for daily inspections of work areas during the both the remediation and construction period and will address potential concerns related to the environment (i.e., erosion and sediment control, spill prevention and control, etc.). The Construction Supervisor will be on-site daily to perform inspections and will have "stop work" authority to address observed or reported infractions of the standards and procedures. Construction crews also will be trained prior to the start of work to recognize and respond to changing field conditions protecting resource areas, and preventing sedimentation and stormwater runoff.

A level of construction oversight will be provided by the Project's Environmental Monitor, a qualified environmental professional, designated by TRC to monitor on-site construction conditions and compliance with permit and other regulatory requirements. At a minimum, weekly inspections will be performed by the Environmental Monitor to evaluate potential erosion and/or sedimentation hazards until "final stabilization" has been achieved (i.e., 75 percent vegetative cover within the disturbed areas). Photographic documentation of wetlands, buffer zone, and Project progress will also be performed. The Environmental Monitor will provide weekly inspection reports to TRC and the Construction Supervisor, and will also have "stop work" authority. The Project is expected to start in July of 2019 and last approximately two (2) months.

4.6 Stormwater Management

State and local regulations state that post-development peak discharge runoff rates should not exceed pre-development peak discharge rates at development sites. The proposed modifications to the site will result in a net decrease of impervious area.

A stormwater analysis of pre-development and post-development conditions using the same cover-type comparison method indicates a new stormwater management detention system would not be necessary at the Site. Using the gravel fill layers underneath the field turf provides adequate storage and infiltration for the site improvements. Please see Attachment E for the Stormwater Management Report.

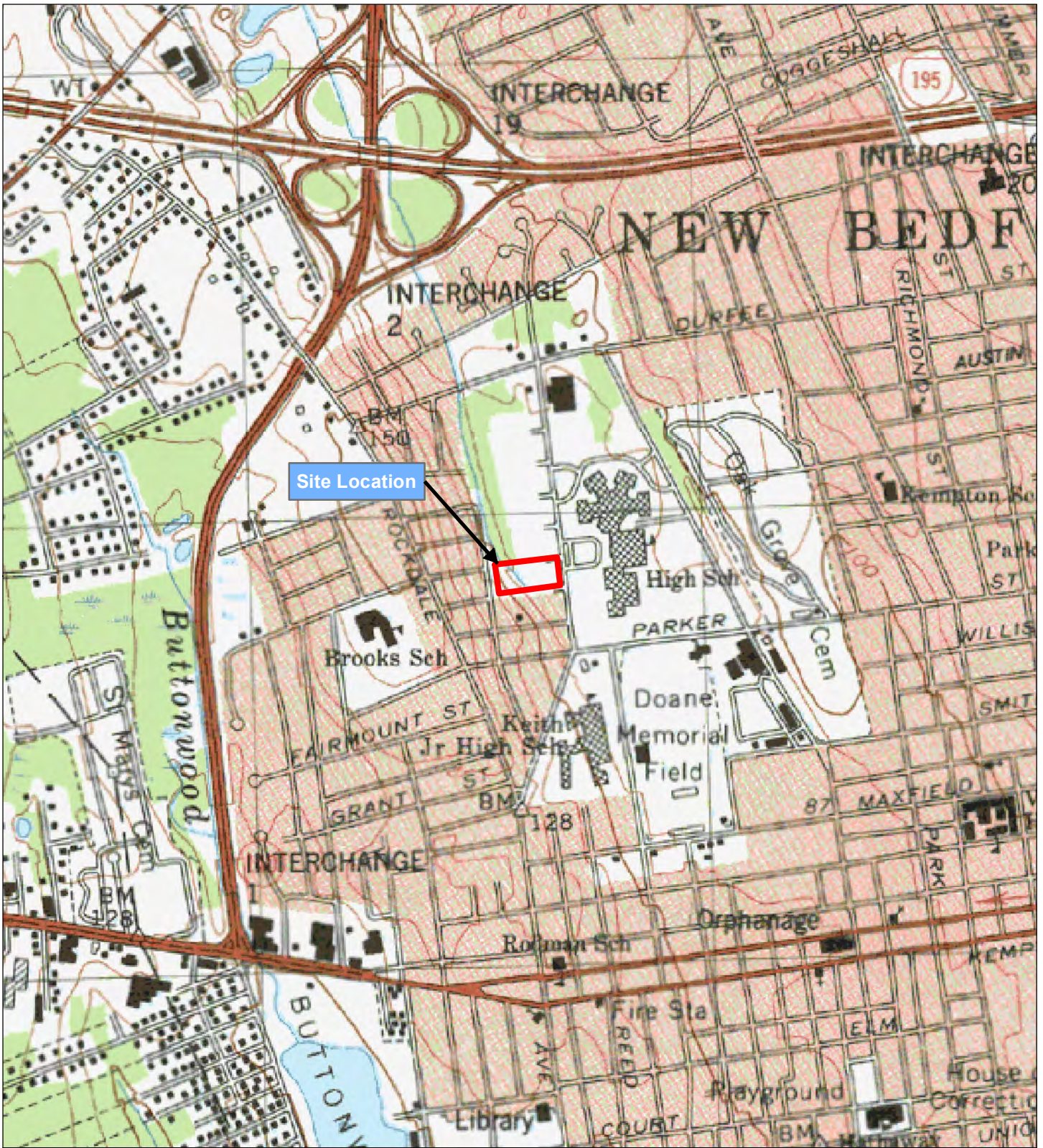
A Stormwater Pollution Prevention Plan (SWPPP) will be required during remedy implementation to comply with the EPA's National Pollutant Discharge Elimination System (NPDES) regulations. A Notice of Intent (NOI) will be filed with the EPA prior to construction to obtain coverage under EPA's NPDES General Permit for Stormwater Discharges from Construction Activities.

The selected contractor will implement the erosion control measures to prevent impacts to wetland resource areas as a result of stormwater runoff during construction.

ATTACHMENT A

Figures and Plans

R:\Projects\GIS_2010\115058_Nemasket_Lots\2014\mxd\Fig1_Site_Location_Nemasket_2.mxd



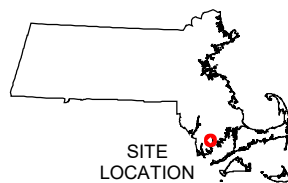
— Site Boundary

0 500 1,000 Feet



Wannalancit Mills
650 Suffolk Street
Lowell, MA 01854
978-970-5600

MASSACHUSETTS



SITE LOCATION MAP

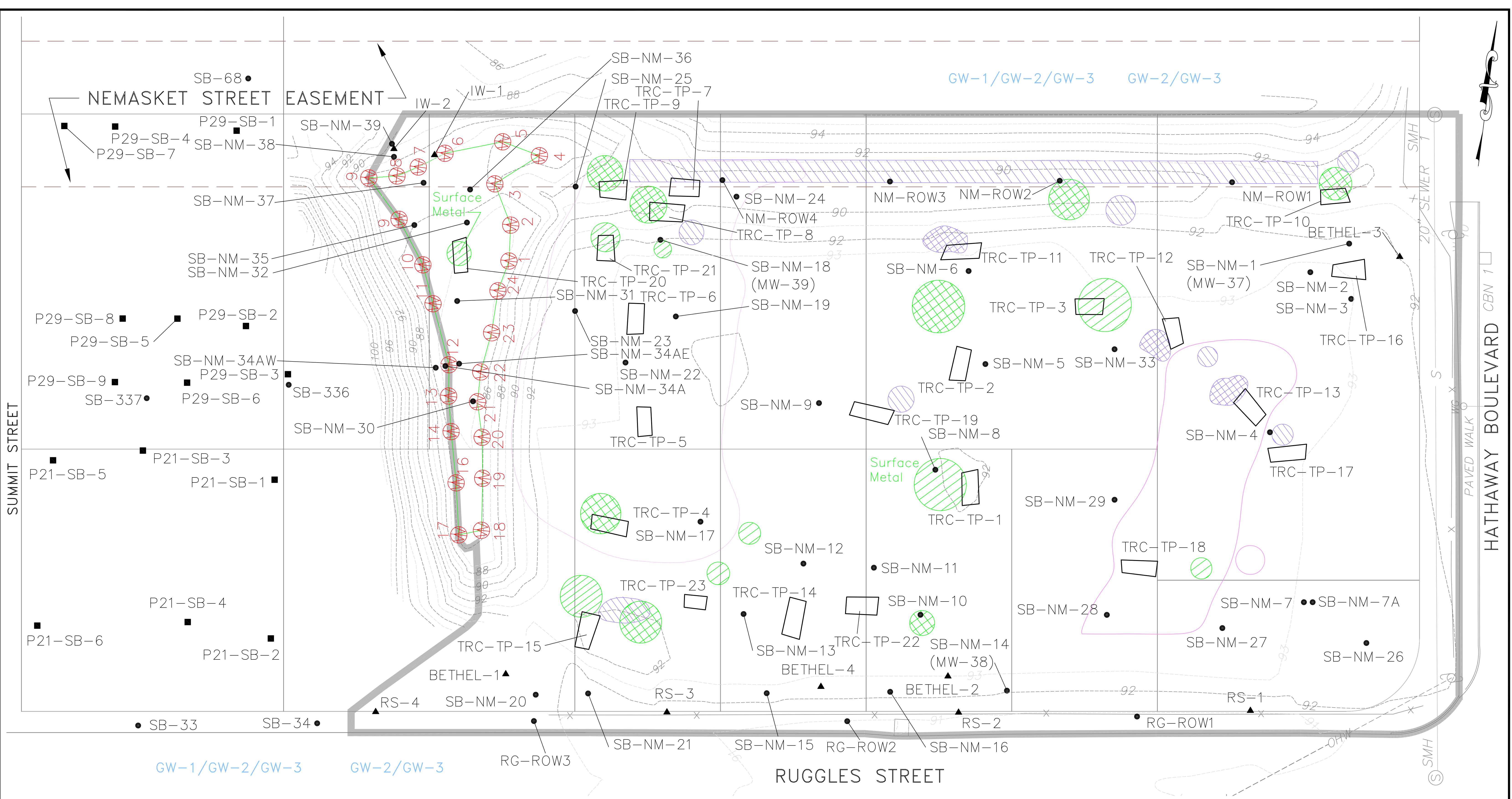
**NEMASKET STREET LOTS
NEW BEDFORD, MA**

FIGURE 1

JAN 2018

Base map: USGS 7.5 Minute Topographic Quadrangle: New Bedford

FILE: \\lowell-gis\gis\test\E_CAD\115058\NEMASKET ST LOT BORINGS 8-12-11.dwg



NOTES:

1. EM AND GPR RESULTS BASED ON "COMBINED EM AND GPR RESULTS, NEMASKET STREET LOT, NEW BEDFORD, MA" BY HAGER GEOSCIENCE, INC. WOBURN, MA DATED NOVEMBER 2010.
2. BETA INFORMATION DERIVED FROM "PERIPHERAL AREAS SOUTH OF McCOY FIELD" UNDATED AND "BETHEL A.M.E. SOIL SAMPLE LOCATION PLAN" DATED 9-9-2005, BOTH FROM BETA GROUP, INC. OF NORWOOD MA.

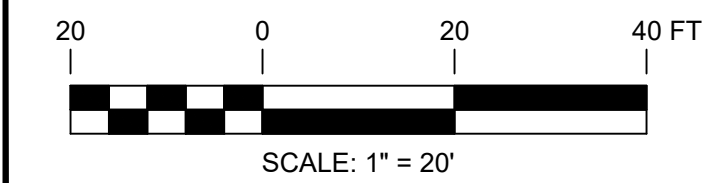
LEGEND:

- | | | | |
|--|------------------------------------|--|----------------------------------|
| | TEST PIT LOCATION | | EM METAL ANOMALY |
| | TRC SOIL BORING LOCATION | | EM METAL ANOMALY MARKED IN FIELD |
| | PREVIOUS BETA SOIL BORING LOCATION | | EM SOIL CONDUCTIVITY ANOMALY |
| | EPA SOIL BORING LOCATION | | LOT LINES |
| | GPR ANOMALY | | NEMASKET STREET EASEMENT |
| | GPR ANOMALY MARKED IN FIELD | | SITE BOUNDARY |
| | WETLAND FLAGS | | |

APPROXIMATE GRAPHIC SCALE

0' 5' 10' 15' 30'

ENVIRONMENTAL INVESTIGATION AND RELATED ENVIRONMENTAL CONSULTING SERVICES NEW BEDFORD HIGH SCHOOL & SURROUNDING NEIGHBORHOOD NEW BEDFORD, MASSACHUSETTS	
NEMASKET STREET LOTS SAMPLE LOCATIONS	
 Wannalancit Mills 650 Suffolk Street Lowell, MA 01854 (978) 970-5600	FIGURE 2
DRAWN BY: HWB CHECKED BY: DNP	DATE: AUG 2011



LEGEND

- 1' 2' 3' 4' CUT
- 1' 2' 3' 4' FILL
- CONCRETE CURB
- UNDERDRAIN
- LIMITS OF DISTURBANCE
- C.O. CLEANOUT
- B-1 TEST BORING



249 WESTERN AVENUE
AUGUSTA, ME 04330

PROJECT NO: 115058

REV	DESCRIPTION	DATE	DES	CHK	APP
A	ISSUED FOR CLIENT REVIEW	01/15/18	TRC	TRC	

PGT
DESIGNED
CMW
DRAWN
PGT
CHECKED
APPROVED

EARTHWORK PLAN
NEMASKET STREET
RECREATION AREA

NEW BEDFORD

MA

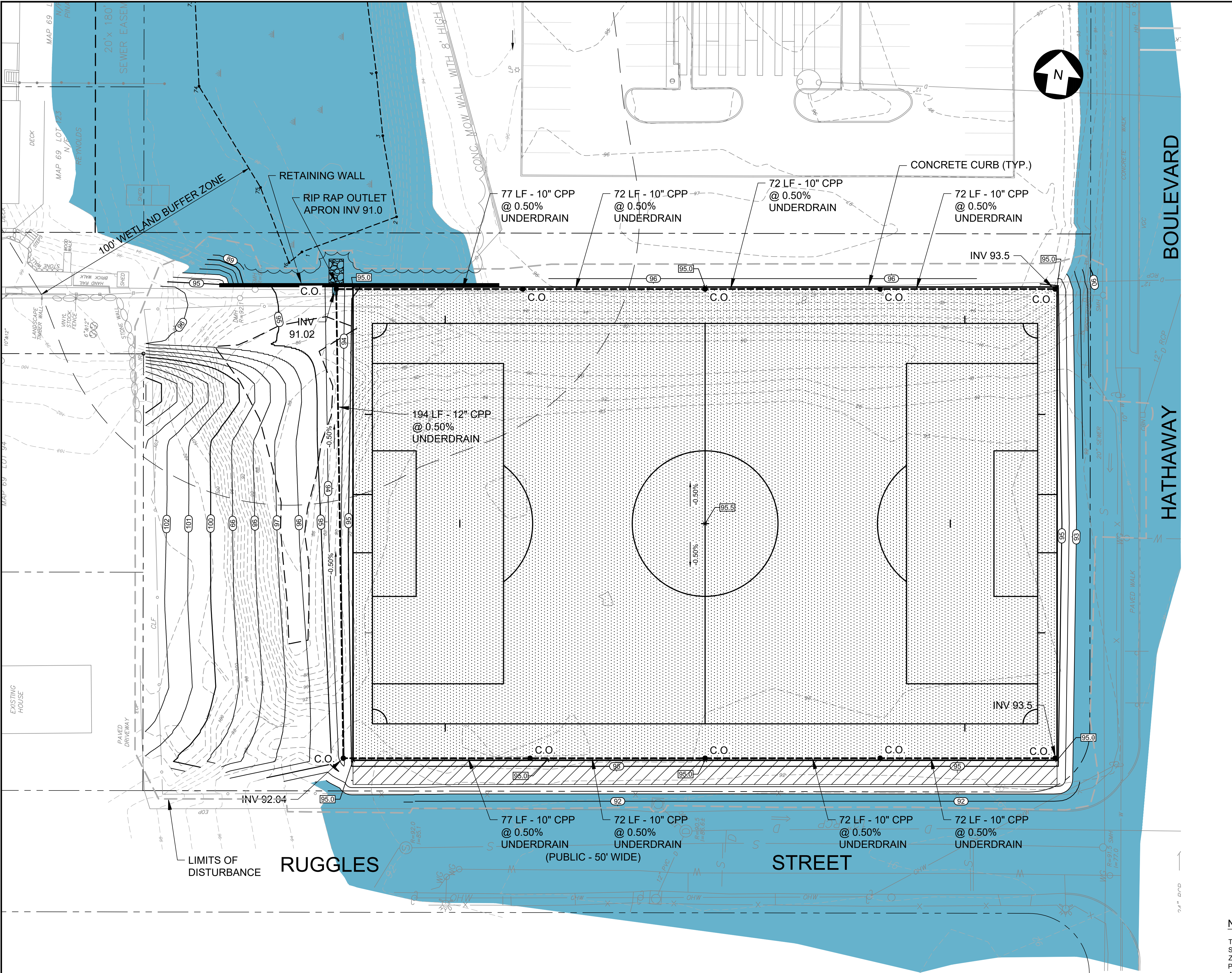
REVIEW 1
REVIEW 2

03/28/16
DATE
1" = 20'
SCALE



FIGURE 4

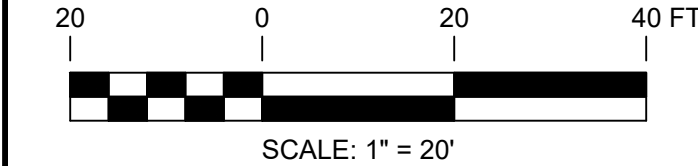
REV.
A



LEGEND

- FIELD TURF (SYNTHETIC)
- AREA BELOW ELEVATION 93.0 FT
- CONCRETE CURB
- UNDERDRAIN
- LIMITS OF DISTURBANCE
- C.O. CLEANOUT

NOTE:
THE PROJECT SITE SHOWN ON THIS DRAWING IS NOT LOCATED IN A SPECIAL FLOOD HAZARD AREA. THIS PROJECT SITE FALLS WITHIN ZONE "X" "OTHER AREAS" AS DESIGNATED ON THE FLOOD INSURANCE PANEL NUMBER 25005C0389F DATED JULY 7, 2009. ZONE X IS THE AREA DETERMINED TO BE OUTSIDE THE 500 YEAR FLOOD PLAIN.



249 WESTERN AVENUE
AUGUSTA, ME 04330

PROJECT NO: 115058

REV	DESCRIPTION	DATE	DES	CHK	APP

PGT
DESIGNED
CMW
DRAWN
PGT
CHECKED
APPROVED

FLOOD MAP
NEMASKET STREET
RECREATION AREA

NEW BEDFORD

MA

REVIEW 1
REVIEW 2

03/28/16
DATE
1" = 20'
SCALE

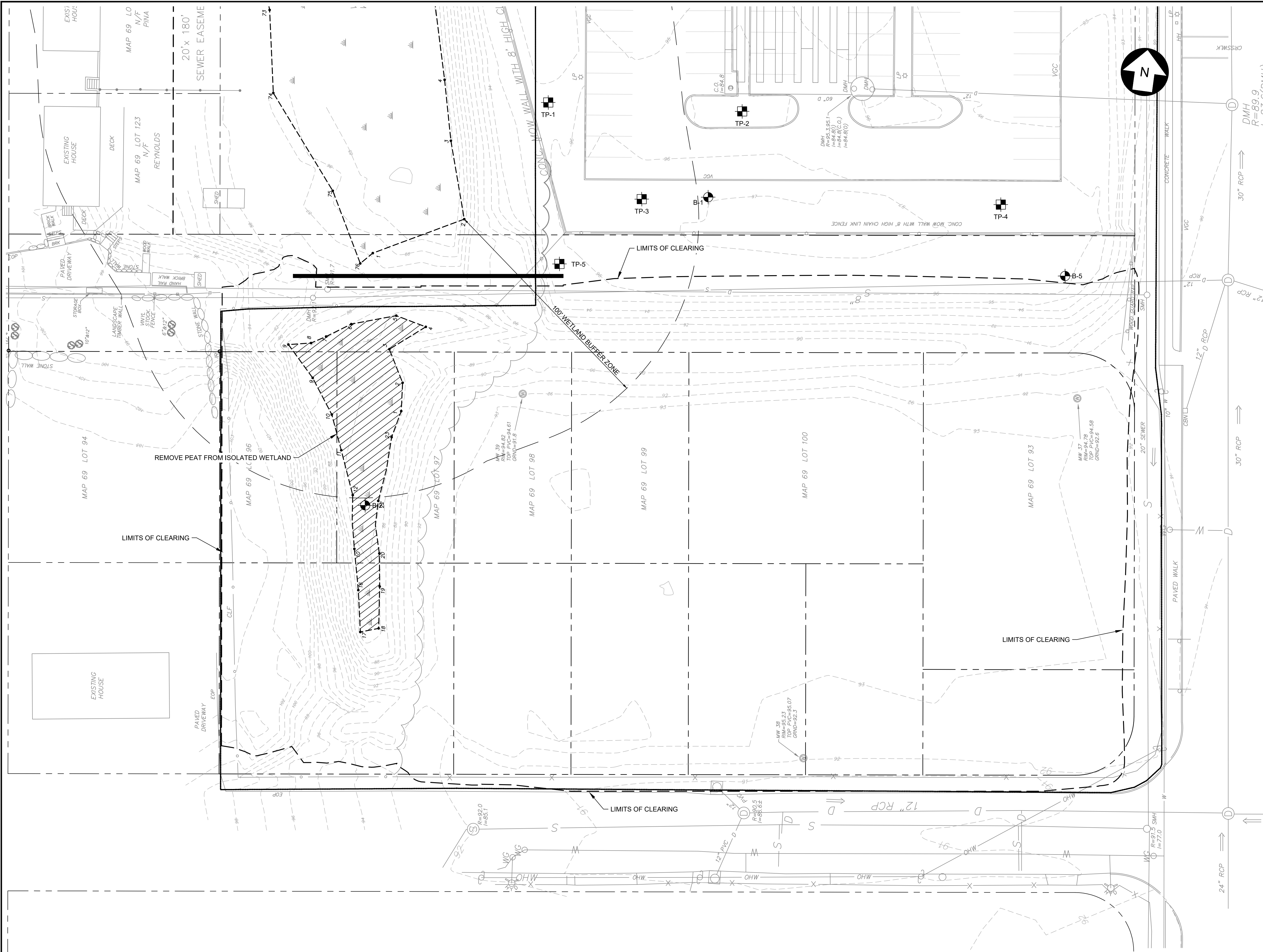


FIGURE 5

REV.
-

ATTACHMENT B

Drawings

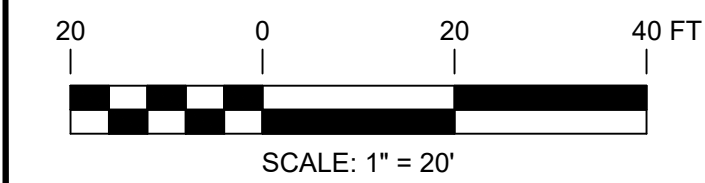


NOTES

1. BASE MAP TAKEN FROM "EXISTING CONDITIONS PLAN NEMASKET STREET NEW BEDFORD, MA BY LAND PLANNING INC. DATED 3/10/2016.
2. HORIZONTAL DATUM: MASSACHUSETTS STATE PLANE, MAINLAND ZONE, NAD83, US SURVEY FEET. VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM, 1988 (NAVD88), US FEET
3. THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND COMPILED FROM PROPOSED PLAN INFORMATION. TRC MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA EITHER IN SERVICE OR ABANDONED. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING THE LOCATIONS OF ALL UTILITIES. PRIOR TO WORK, THE CONTRACTOR SHALL, AT A MINIMUM, CONTACT "DIG SAFE" 1-888-344-7233 TO IDENTIFY OR VERIFY SIZE, DEPTH AND LOCATIONS OF ALL UNDERGROUND UTILITIES WITHIN THE VICINITY OF THE WORK AREA.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR SITE SECURITY AND JOB SAFETY. CONSTRUCTION ACTIVITIES SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA), AND STANDARDS SET FORTH BY THE CITY OF NEW BEDFORD.
5. IF NECESSARY, CONTRACTOR SHALL COORDINATE WITH THE CITY TO SECURE SITE ACCESS AGREEMENTS FROM ABUTTING PROPERTY OWNERS PRIOR TO ENTERING ABUTTING PROPERTIES.
6. CONTRACTOR SHALL INSPECT AND MAINTAIN EROSION CONTROL MEASURES AND REMOVE ACCUMULATED SEDIMENT IN ACCORDANCE WITH THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) FOR THIS PROJECT.
7. TEMPORARY 6-FOOT CHAIN-LINK FENCE WILL ALREADY BE INSTALLED AS INDICATED ON THIS PLAN. FENCE SECTIONS WILL HAVE SUPPORT FEET AND WILL NOT PENETRATE THE GROUND.
8. TRUCKS SHALL USE EXISTING CURB CUTS FOR PROPERTY ACCESS, OR STEEL PLATING SHALL BE UTILIZED IF NECESSARY TO AVOID DAMAGE TO EXISTING CURBING.
9. PRIOR TO COMMENCING SITE WORK, THE CONTRACTOR SHALL INSTALL TYPICAL CONSTRUCTION ENTRANCE/EXIT PAD(S) AT ONE OR MORE OF THE ACCESS GATES ON HATHAWAY BOULEVARD, RUGGLES STREET, AND THE KEITH MIDDLE SCHOOL PARKING LOT.
10. CONTRACTOR SHALL ENSURE THAT NO SOILS ARE TRACKED OFF-SITE ON TRUCKS OR HEAVY MACHINERY BY BRUSHING OFF TIRES AND VEHICLE BODIES PRIOR TO LEAVING THE SITE.
11. CONTRACTOR SHALL ENSURE THAT NO SITE SOILS ARE OTHERWISE SPREAD ONTO THE STREET OR ABUTTING PROPERTIES AT ANY POINT DURING INSTALLATION OF THE FIELD.
9. TRAFFIC FLOW PATTERN TO BE APPROVED BY CITY OF NEW BEDFORD POLICE DEPARTMENT, AND INCORPORATED INTO A CONTRACTOR'S HAUL ROUTES AND STAGING AREAS PLAN.
10. NECESSARY EXCAVATION, BACKFILLING, GRADING AND COMPACTION FOR PREPARATION OF SUBBASE WILL BE PERFORMED BY THE CITY PRIOR TO FIELD INSTALLATION. CONTRACTOR SHALL MINIMIZE AND REPAIR ANY DISTURBANCE OF EXISTING SITE SOILS.
11. IF NECESSARY, A STORMWATER DRAINAGE SYSTEM WILL BE INSTALLED IN THE SUBBASE BY THE CITY PRIOR TO FIELD INSTALLATION. CONTRACTOR SHALL ENSURE THAT STORMWATER STRUCTURES ARE NOT DAMAGED DURING INSTALLATION OF THE SYNTHETIC TURF SYSTEM.
12. SUBBASE ELEVATIONS IDENTIFIED ON THIS PLAN SHALL BE CONFIRMED AND PROPERTY CORNERS AND POINTS OF TANGENCY IDENTIFIED ON THIS PLAN SHALL BE LOCATED AND MARKED BY A LICENSED PROFESSIONAL LAND SURVEYOR PRIOR TO THE START OF WORK.

LEGEND

- PROPERTY BOUNDARY
- WETLAND BUFFER ZONE
- EXISTING BUILDING
- STONE WALL
- FENCE
- GUARD RAIL
- CONTOUR
- SOILS
- WETLAND BOUNDARY
- WETLAND MARKER
- WETLAND SYMBOL
- SHRUB / TREE
- TREELINE
- WATERLINE
- WATER GATE VALVE
- HYDRANT
- SANITARY SEWER LINE
- SANITARY MANHOLE
- STORM DRAIN LINE
- STORM DRAIN MANHOLE
- CATCH BASIN
- CLEAN OUT
- OVERHEAD WIRE
- UTILITY POLE
- LIGHT POLE
- ELECTRIC HANDHOLE
- LIMITS OF CLEARING
- TEST PIT
- TEST BORING



REFERENCE ITEMS		REV	DESCRIPTION	DATE	DES	CHK	APP
		B	REVISED SOCCER FIELD LAYOUT	11/11/17	TRC	TRC	
		A	ISSUED FOR CLIENT REVIEW	05/17/16	TRC	TRC	



249 WESTERN AVENUE
AUGUSTA, ME 04330

PROJECT NO: 115058

PGT
DESIGNED
CMW
DRAWN
PGT
CHECKED
APPROVED

EXISTING CONDITIONS & REMOVALS PLAN
NEMASKET STREET
RECREATION AREA

NEW BEDFORD

MA

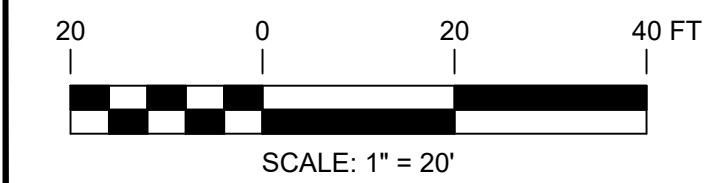
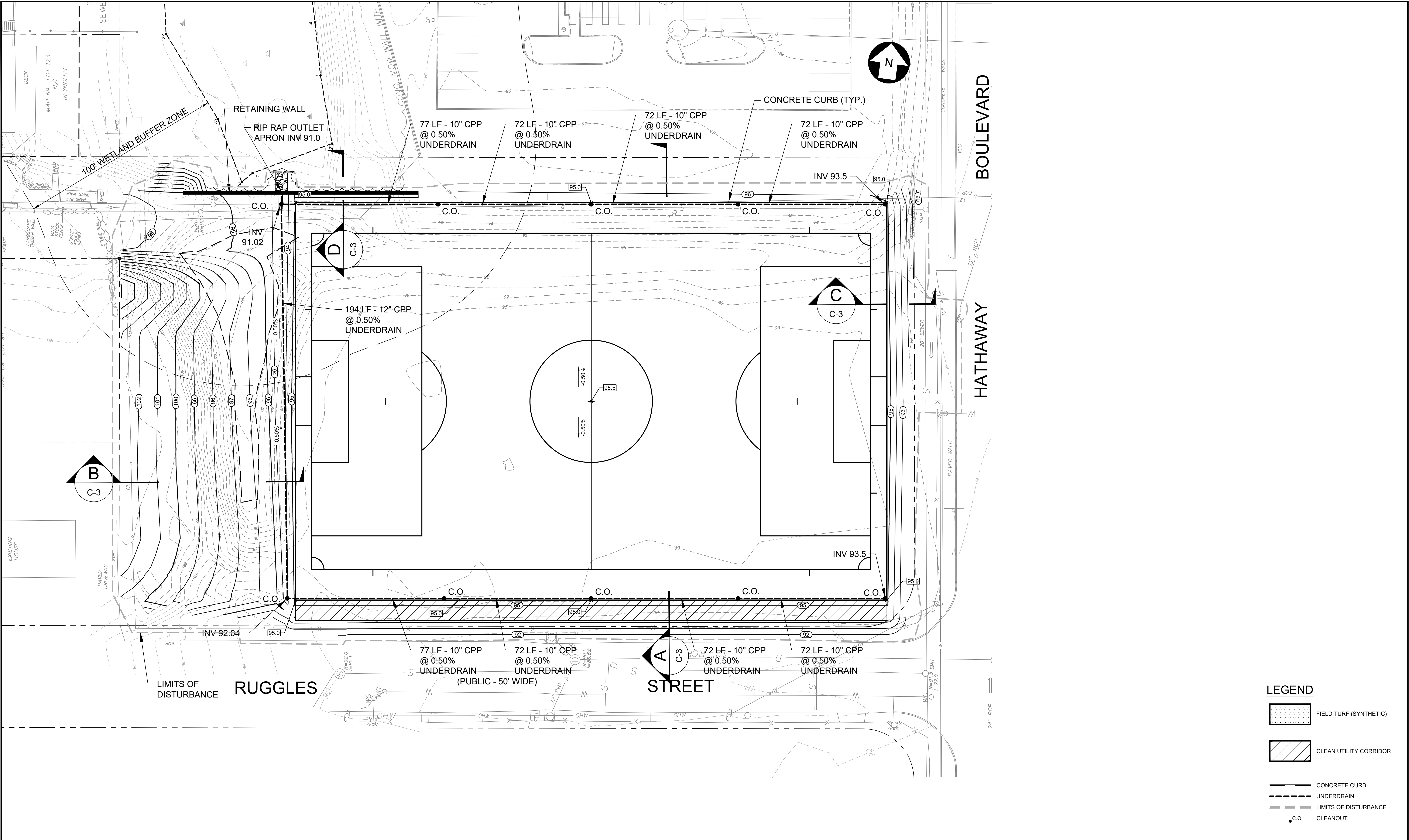
REVIEW 1
REVIEW 2


03/28/16
DATE
1" = 20'
SCALE




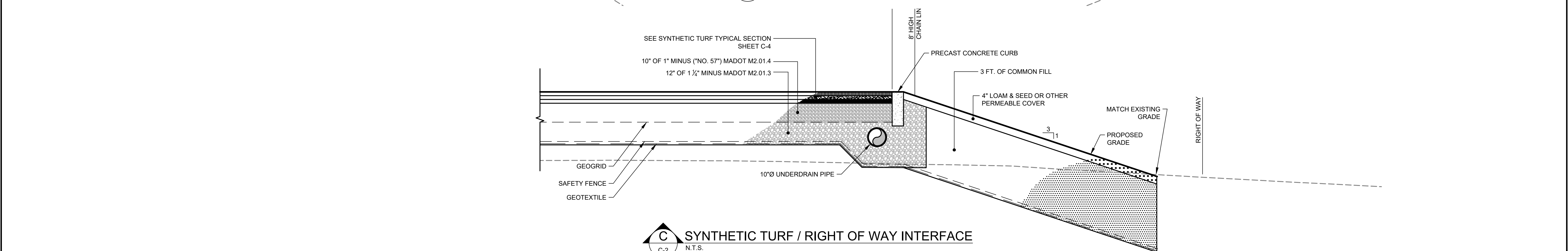
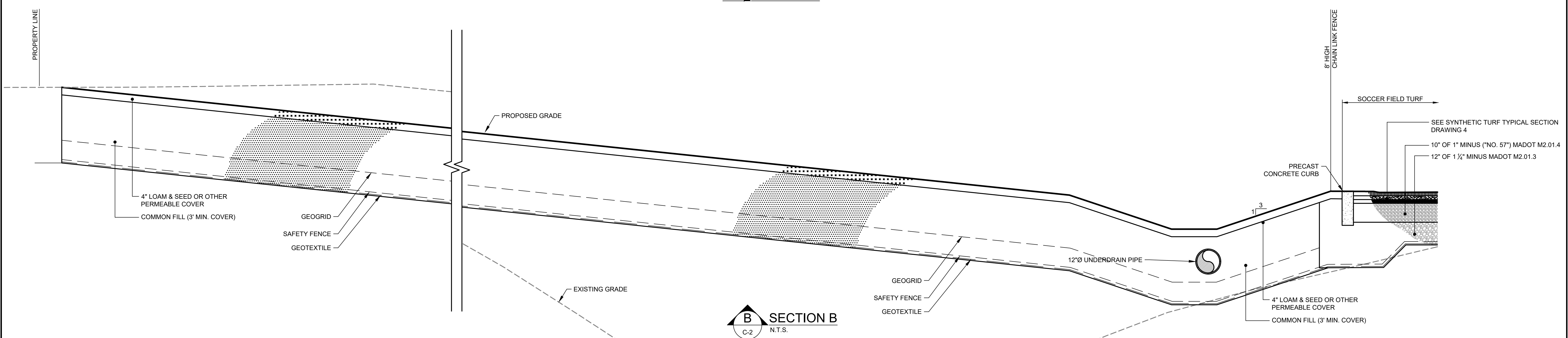
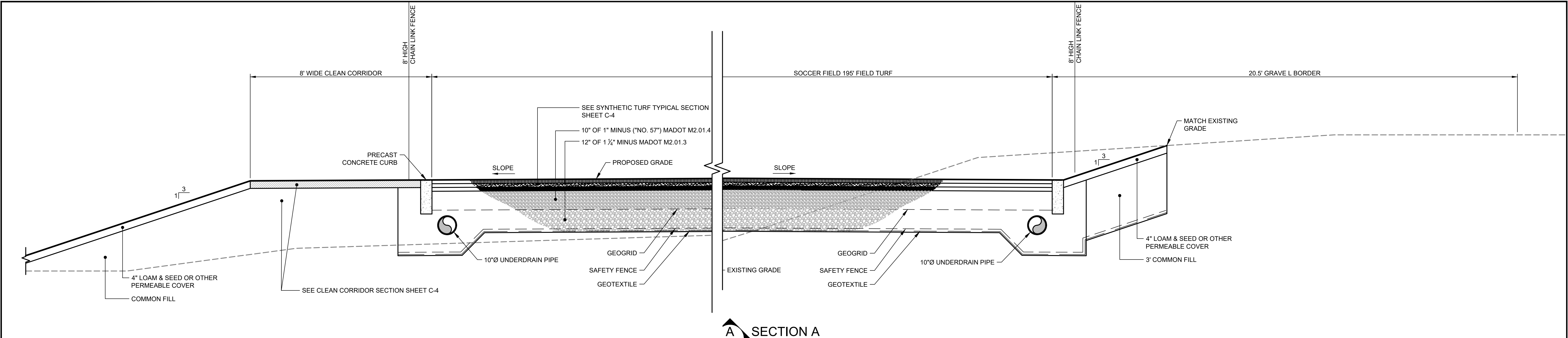
DRAWING 1

REV.
B



		249 WESTERN AVENUE AUGUSTA, ME 04330		PROJECT NO: 115058	
REV	DESCRIPTION	DATE	DES	CHK	APP
B	REVISED SOCCER FIELD LAYOUT	11/17/17	TRC	TRC	
A	ISSUED FOR CLIENT REVIEW	05/17/16	TRC	TRC	

PGT DESIGNED	NEW BEDFORD MA		DRAWING 2	REV. B
CMW DRAWN				
PGT CHECKED				
APPROVED				
REVIEW 1	03/28/16 DATE			
REVIEW 2	1" = 20' SCALE			



249 WESTERN AVENUE
AUGUSTA, ME 04330

PROJECT NO: 115058

REV	DESCRIPTION	DATE	DES	CHK	APP
B	REVISED SOCCER FIELD LAYOUT	11/17/17	TRC	TRC	
A	ISSUED FOR CLIENT REVIEW	05/17/16	TRC	TRC	

PGT
DESIGNED
CMW
DRAWN
PGT
CHECKED
APPROVED

SITE GRADING SECTIONS & DETAILS I
NEMASKET STREET
RECREATION AREA

NEW BEDFORD

MA

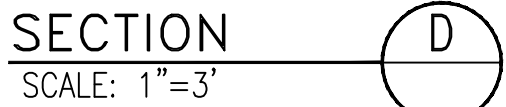
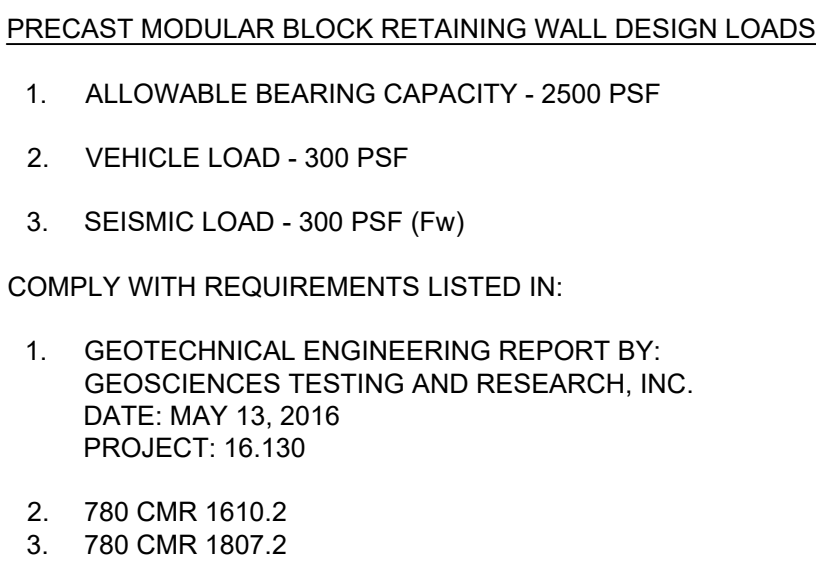
REVIEW 1
REVIEW 2


05/05/16
DATE
AS NOTED
SCALE



DRAWING 3

REV.
B



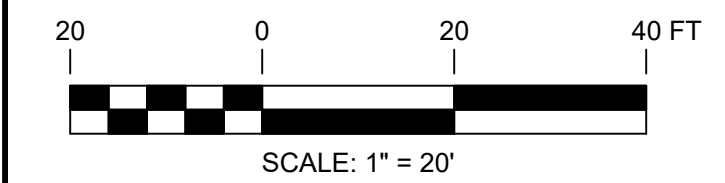
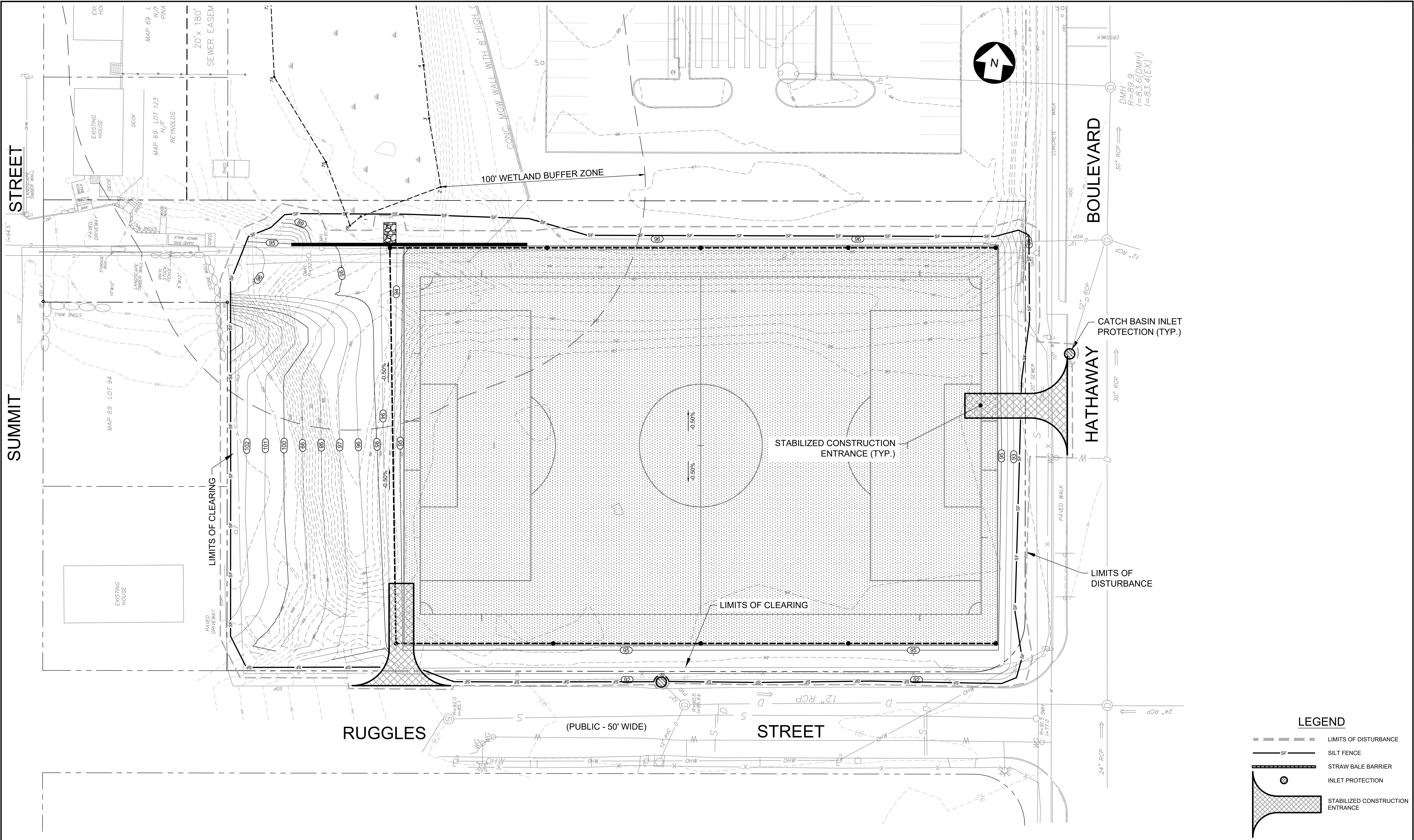


249 WESTERN AVENUE
AUGUSTA, ME 04330

PROJECT NO: 115058


REFERENCE ITEMS	REV	DESCRIPTION	DATE	DES	CHK	APP
	B	REVISED SOCCER FIELD LAYOUT	11/17/17	TRC	TRC	
	A	ISSUED FOR CLIENT REVIEW	05/17/16	TRC	TRC	

PGT DESIGNED CMW DRAWN PGT CHECKED APPROVED	SITE GRADING & DRAINAGE DETAILS NEMASKET STREET RECREATION AREA NEW BEDFORD			MA
REVIEW 1 REVIEW 2	03/28/16 DATE AS NOTED SCALE		DRAWING 4	REV. B



DRAFT

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION



249 WESTERN AVENUE
AUGUSTA, ME 04330

PROJECT NO: 115058

REV	DESCRIPTION	DATE	DES	CHK	APP
B	REVISED SOCCER FIELD LAYOUT	11/17/17	TRC	TRC	
A	ISSUED FOR CLIENT REVIEW	05/17/16	TRC	TRC	

PGT
DESIGNED

CMW
DRAWN

PGT
CHECKED

APPROVED


REVIEW 1
DATE
03/28/16
1" = 20'
SCALE

REVIEW 2

EROSION CONTROL PLAN
NEMASKET STREET
RECREATION AREA

NEW BEDFORD

MA



DRAWING 5

REV.
B

MULCH AND SEED SPECIFICATIONS

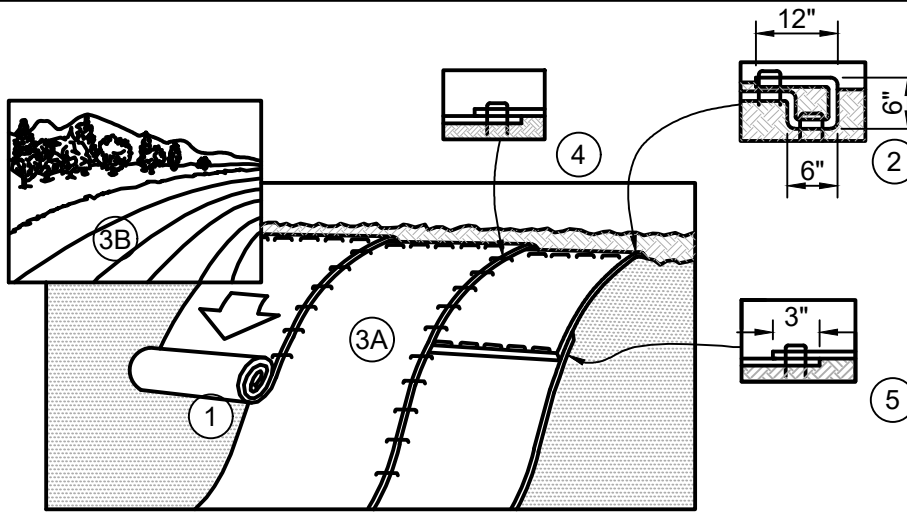
SUMMARY OF TEMPORARY AND PERMANENT MULCH APPLICATION REQUIREMENTS	
TEMPORARY	
WITHIN 100 FEET OF WETLANDS AND WATERBODIES	APPLY "STRAW MULCH AT A MINIMUM OF 70 LBS/1000 S.F. OF EXPOSED SOIL." MUST BE DONE WITHIN 48 HOURS OF INITIAL SOIL DISTURBANCE AND BEFORE FORECASTED STORM EVENTS, UNLESS OTHERWISE SPECIFIED. IF FINAL RESTORATION IS NOT SCHEDULED WITHIN 30 DAYS, APPLY ANNUAL RYEGRASS AT 1LB/1000 S.F.
OTHER AREAS OF EXPOSED SOIL WITH SLOPES LESS THAN 8% AND SOILS STOCKPILES	IF NO ACTIVITY IS SCHEDULED WITHIN 30 DAYS, APPLY "STRAW MULCH AT A MINIMUM OF 70 LBS/1000 S.F. OF EXPOSED SOIL," UNLESS SPECIFIED OTHERWISE. ECM** MAY BE USED. "STRAW MULCH MAY ALSO BE SUPPLEMENTED BY TEMPORARY SEEDING WITH ANNUAL RYEGRASS AT 1 LB/1000 S.F. FOR AREAS WHERE ADDITIONAL ACTIVITY IS NOT EXPECTED FOR SEVERAL MORE WEEKS. AN EROSION CONTROL BARRIER MUST BE INSTALLED AROUND SOIL STOCKPILES THAT ARE EXPECTED TO REMAIN UNDISTURBED FOR MORE THAN 48 HOURS, OR PRIOR TO A STORM EVENT.
OTHER AREAS OF EXPOSED SOIL WITH SLOPES GREATER THAN 8%	IF FINAL RESTORATION IS NOT SCHEDULED WITHIN 30 DAYS OR PRIOR TO A STORM EVENT, APPLY "STRAW MULCH AT THE ABOVE RATES." HAY OR STRAW MUST BE ANCHORED, UNLESS SPECIFIC SITE CONDITIONS DO NOT REQUIRE USE OF ANCHORING. ECM** OR MATTING MAY ALSO BE USED. TEMPORARY SEEDING WITH ANNUAL RYEGRASS AT 1LB/1000 S.F. IS ALSO RECOMMENDED FOR AREAS WHERE FINAL STABILIZATION IS NOT EXPECTED FOR SEVERAL MORE WEEKS.
TEMPORARY SEEDBED PREPARATION	APPLY LIMESTONE AND FERTILIZER (UPLANDS ONLY) ACCORDING TO SOIL TEST DATA. IF SOIL TEST IS NOT POSSIBLE, 10-0-10 FERTILIZER MAY BE APPLIED AT A RATE OF 600 LBS/ACRE AND LIMESTONE AT 3 TONS/ACRE. LOOSEN COMPACTED SOILS.
TEMPORARY SEEDING IN WETLANDS	IF REQUIRED, APPLY ANNUAL RYEGRASS AT A RATE OF 1 LB/1000 S.F. AND COVER WITH STRAW MULCH. DO NOT ADD LIME OR FERTILIZER TO WETLANDS.
FINAL RESTORATION	
PERMANENT MULCHING	EROSION CONTROL MIX (ECM) CAN BE USED AS A TEMPORARY OR PERMANENT SLOPE REINFORCEMENT AND LEFT TO RE-VEGETATE TO NEAR NATURAL CONDITIONS. IT IS NOT USED WHERE GRASS VEGETATION IS REQUIRED. RE-VEGETATION CAN BE ENHANCED BY SEEDING, WHICH IS ENCOURAGED IF USED AS A PERMANENT STABILIZATION MEASURE. PERMANENT MULCH MUST NOT BE USED IN AREAS OF CONCENTRATED WATER FLOWS AND EVIDENCE OF GROUNDWATER SEEPAGE ON SLOPES MAY REQUIRE THE ECM TO BE REPLACED WITH RIPRAP. ON SLOPES THAT ARE 3H:1V OR LESS, ECM SHALL BE APPLIED AT A MINIMUM OF 2 INCHES THICK PLUS AN ADDITIONAL 1/2 INCH PER 20 FEET OF SLOPE UP TO 100 FEET (E.G. 3 INCHES THICK FOR 60 FEET OF SLOPE; 4 INCHES THICK FOR 100 FEET OF SLOPE). FOR SLOPES BETWEEN 3H:1V AND 2H:1V, ECM WILL BE APPLIED 4 INCHES THICK PLUS AN ADDITIONAL 1/2 INCH PER 20 FEET OF SLOPE UP TO 100 FEET (E.G. 5 INCHES THICK FOR 60 FEET OF SLOPE; 6 INCHES THICK FOR 100 FEET OF SLOPE) ECM MUST BE SPREAD EVENLY AND MUST PROVIDE 100 PERCENT SOIL COVERAGE.
PERMANENT RE-VEGETATION	PERMANENT SEEDING SHALL BE USED ON ALL EXPOSED SOIL THAT IS NOT PERMANENTLY STABILIZED BY ROCK, GRAVEL OR ECM. THE FOLLOWING PERMANENT SEEDING MIX SPECIFICATIONS ARE BETWEEN APRIL 16 AND OCTOBER 31, HOWEVER WINTER RYE WILL BE ADDED TO THE PERMANENT SEED MIX AFTER OCTOBER 1. PERMANENT SEEDING IS NOT REQUIRED DURING THE WINTER CONSTRUCTION SEASON, ALTHOUGH DORMANT SEEDING MAY BE PERFORMED
THE CONTRACTOR WILL BE RESPONSIBLE FOR THE PROPER MAINTENANCE OF ALL RE-VEGETATED AREAS UNTIL THE PROJECT HAS BEEN COMPLETED AND ACCEPTED. FOLLOWING FINAL SEEDING THE CONTRACTOR WILL INSPECT RESTORED AREAS EVERY 30 DAYS UNTIL 75 PERCENT VEGETATIVE COVER HAS BEEN ESTABLISHED UNLESS ADJACENT, UNDISTURBED AREAS INDICATE THAT ACHIEVING THAT LEVEL OF VEGETATION IN THE AREA IS UNLIKELY. WHERE SEEDING AREAS HAVE BECOME DAMAGED BY CONSTRUCTION OPERATIONS, OR WHERE POOR GERMINATION OBSERVED, THE AFFECTED AREAS WILL BE PROMPTLY RE-GRADED, LIMED, FERTILIZED, AND RE-SEEDING AS NEEDED UNTIL THE ABOVE CRITERIA ARE MET. THE CONTRACTOR MAY BE REQUIRED TO RE-SEED DURING THE FOLLOWING SPRING IN ORDER TO ACHIEVE THE REQUIRED VEGETATIVE COVER.	
* MULCH APPLICATION RATES SHALL BE DOUBLED FOR WINTER CONSTRUCTION **MINIMUM ECM THICKNESS IS 4 INCHES FOR WINTER CONSTRUCTION	

PERMANENT SEED MIX SPECIFICATIONS				
	SOIL AMENDMENTS	SEED MIX VARIETIES	SEED RATE, LB/ACRE	MULCH, TONS/ACRE
UPLAND	APPLY GROUND LIMESTONE @ 3 TONS/ACRE	CREeping RED FESCUE / (PENNLAWN, ENSYLA, WINTERGREEN)	20	1.5-2 (90-100 BALES)
	APPLY 10-20-20 FERTILIZER @ 800 LBS/ACRE	REDTOP / (ANY NATIVE SPECIES)	2	
WETLAND	NONE	TALL FESCUE / (KENTUCKY 31)	20	
		ANNUAL RYEGRASS, IF REQUIRED FOR TEMPORARY STABILIZATION / (WETLAND SEED MIX)	40	1.5-2 (90-100 BALES)
• INCREASE SEEDING RATES BY 10% WHEN HYDROSEEDING.				
• ADD WINTER RYE TO THE UPLAND MIX AT A RATE OF 120 LB/ACRE AFTER OCTOBER 1				
• SEED OR MULCH WETLANDS ONLY WHERE REQUIRED BY THE EI OR 3PI, OR WHEN RESTORATION OCCURS AFTER OCTOBER 1. TYPICALLY, REPLACING THE ORIGINAL WETLAND SOIL ON THE RESTORED SURFACE WILL PROVIDE AN ADEQUATE SEED BED.				
• DO NOT LIME OR FERTILIZE ANY AREAS WITHIN THE WATER BODY BUFFERS OR WETLANDS.				
• MULCH WETLANDS WITH WEED-FREE STRAW ONLY.				

GENERAL EROSION CONTROL NOTES

INSTALL EROSION CONTROL MEASURES IN ACCORDANCE WITH THE SPECIFICATIONS HEREIN AND IN ACCORDANCE WITH ALL MASSACHUSETTS REGULATIONS.

1. INSTALL ALL PERIMETER CONTROLS PRIOR TO COMMENCEMENT OF EARTH MOVING ACTIVITIES.
2. PRIOR TO THE INITIATION OF GRADING OPERATIONS, CONSTRUCT AND STABILIZE TEMPORARY DRAINAGE SWALES, CHECK DAMS, AND PLUNGE POOLS AS NEEDED TO EFFECTIVELY CONTROL EROSION AND PREVENT TRANSPORT OF SEDIMENT INTO REGULATED RESOURCES OR OFF-SITE.
3. DRAINAGE CHANNELS SHALL BE STABILIZED PRIOR TO RECEIVING RUNOFF. STABILIZE ROAD DITCHES WITH LOAM, SEED, EROSION CONTROL BLANKETS OR RIPRAP (DEPENDING ON SLOPE) WITHIN 24 HOURS OF FINAL GRADING.
4. INSTALL STONE CHECK DAMS WITHIN 24 HOURS OF ROUGH OR FINISH GRADING ANY SECTION OF DITCH, AS SHOWN ON THE PROJECT PLANS AND AT OTHER LOCATIONS AS NEEDED.
5. ALL ROADWAYS AND CUT/FILL SLOPES SHALL BE STABILIZED WITHIN 72 HOURS OF ACHIEVING FINISHED GRADE.
6. ONCE A WEEK, OR AFTER RAINSTORMS PRODUCING AT LEAST 1/2 INCH OF RAINFALL, WHICHEVER IS MORE FREQUENT, INSPECT ALL AREAS WHERE TEMPORARY NON-STRUCTURAL MEASURES ARE USED. THE INSPECTION SCHEDULE WILL BE INCREASED TO DAILY DURING THE WINTER CONSTRUCTION PERIOD.
7. AFTER GRADING AND PRIOR TO FINAL STABILIZATION PROVIDE PERIODIC APPLICATION OF WATER OR CALCIUM CHLORIDE AS NEEDED TO CONTROL EXCESSIVE DUST.
8. REMOVE TEMPORARY EROSION CONTROL MEASURES ONCE AN AREA OF THE SITE IS PERMANENTLY STABILIZED.
9. MONITOR PUBLIC ROADS FOR SIGNS OF MUD TRACKING OR SPILLAGE OF SPOIL MATERIAL. CLEAN ROADWAYS AS NEEDED.

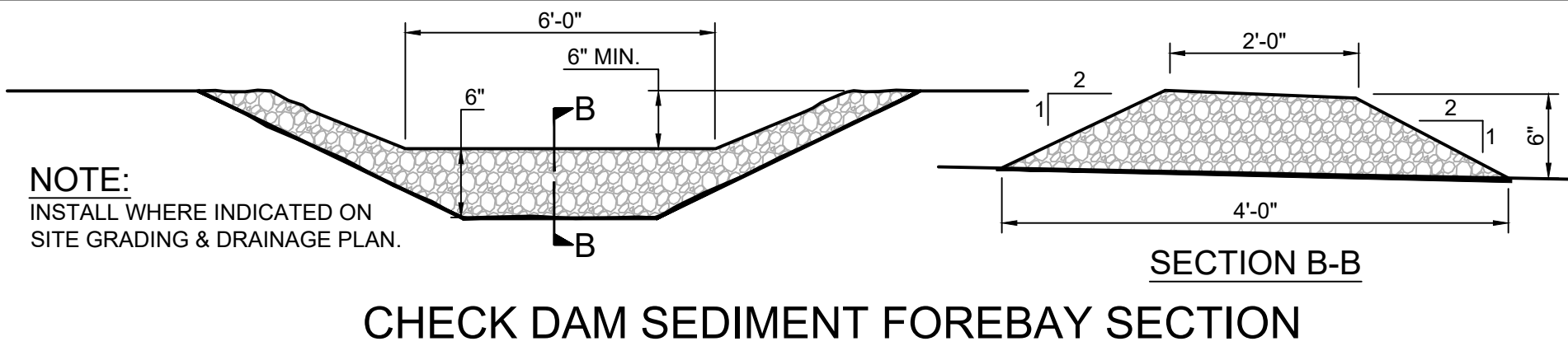


1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL-O- SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF BLANKET EXTENDED BEYOND THE UP SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.
3. ROLL THE BLANKETS (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING OPTIONAL DOT SYSTEM, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH APPROXIMATELY 2"-5" OVERLAP DEPENDING ON BLANKET TYPE. TO ENSURE PROPER SEAM ALIGNMENT, PLACE THE EDGE OF THE OVERLAPPING BLANKET (BLANKET BEING INSTALLED ON TOP) EVEN WITH THE COLORED SEAM STITCH ON THE PREVIOUSLY INSTALLED BLANKET.
5. CONSECUTIVE BLANKETS SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART ACROSS ENTIRE BLANKET WIDTH.

NOTE: *IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY SECURE THE BLANKETS.

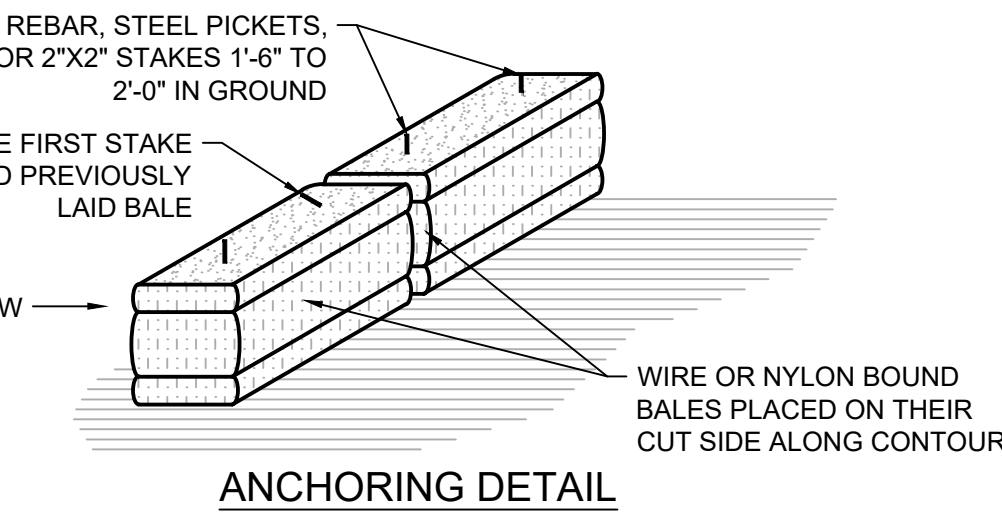
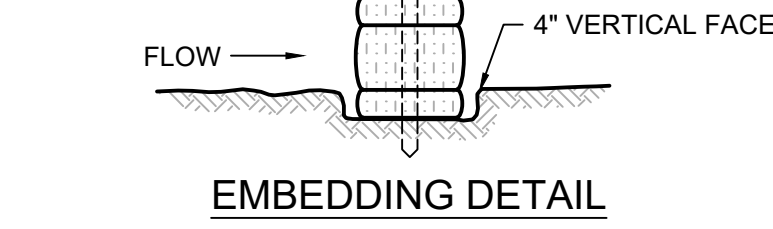
EROSION CONTROL BLANKET INSTALLATION

N.T.S.



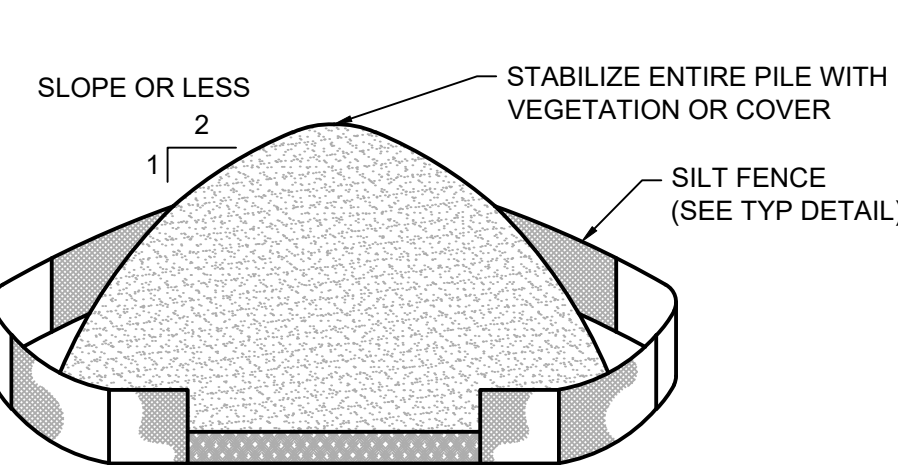
CHECK DAM SEDIMENT FOREBAY SECTION

N.T.S.



STRAW BALE BARRIER DETAIL

N.T.S.

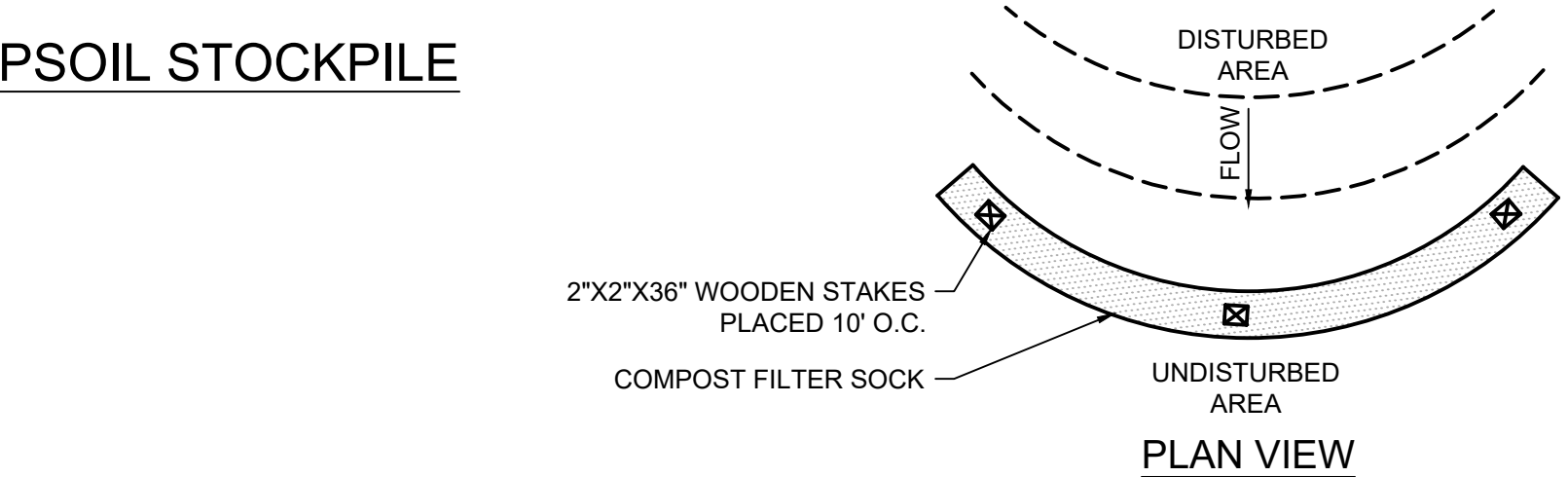


INSTALLATION NOTES:

1. AREA CHOSEN FOR STOCKPILING OPERATIONS SHALL BE DRY AND STABLE.
2. MAXIMUM SLOPE OF STOCKPILE SHALL BE 2H:1V.
3. UPON COMPLETION OF SOIL STOCKPILING, EACH PILE SHALL BE SURROUNDED WITH EITHER SILT FENCING OR STRAW BALES, THEN STABILIZED WITH VEGETATION OR COVERED.

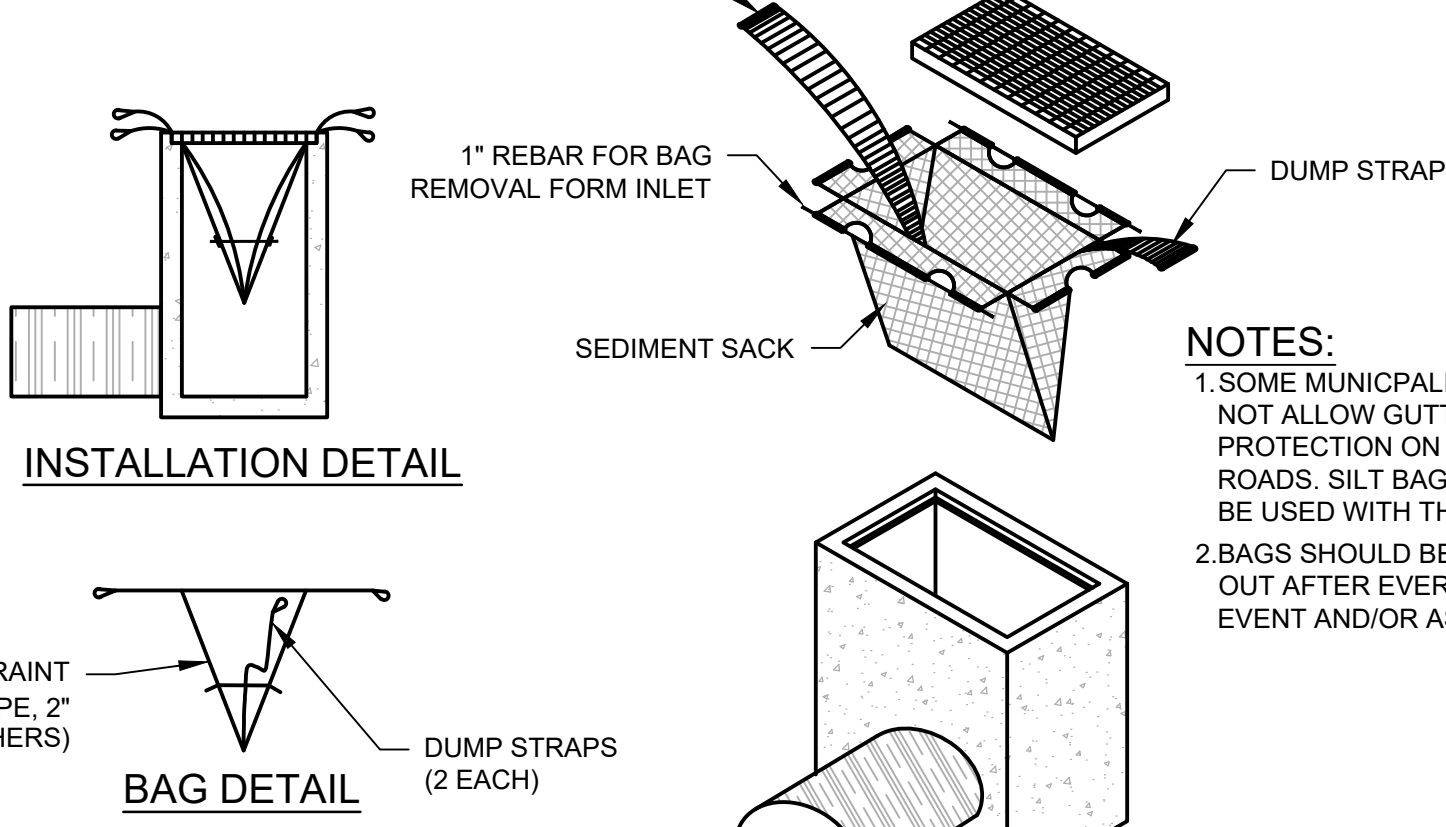
TYPICAL TOPSOIL STOCKPILE

N.T.S.



COMPOST FILTER SOCK DETAIL

N.T.S.



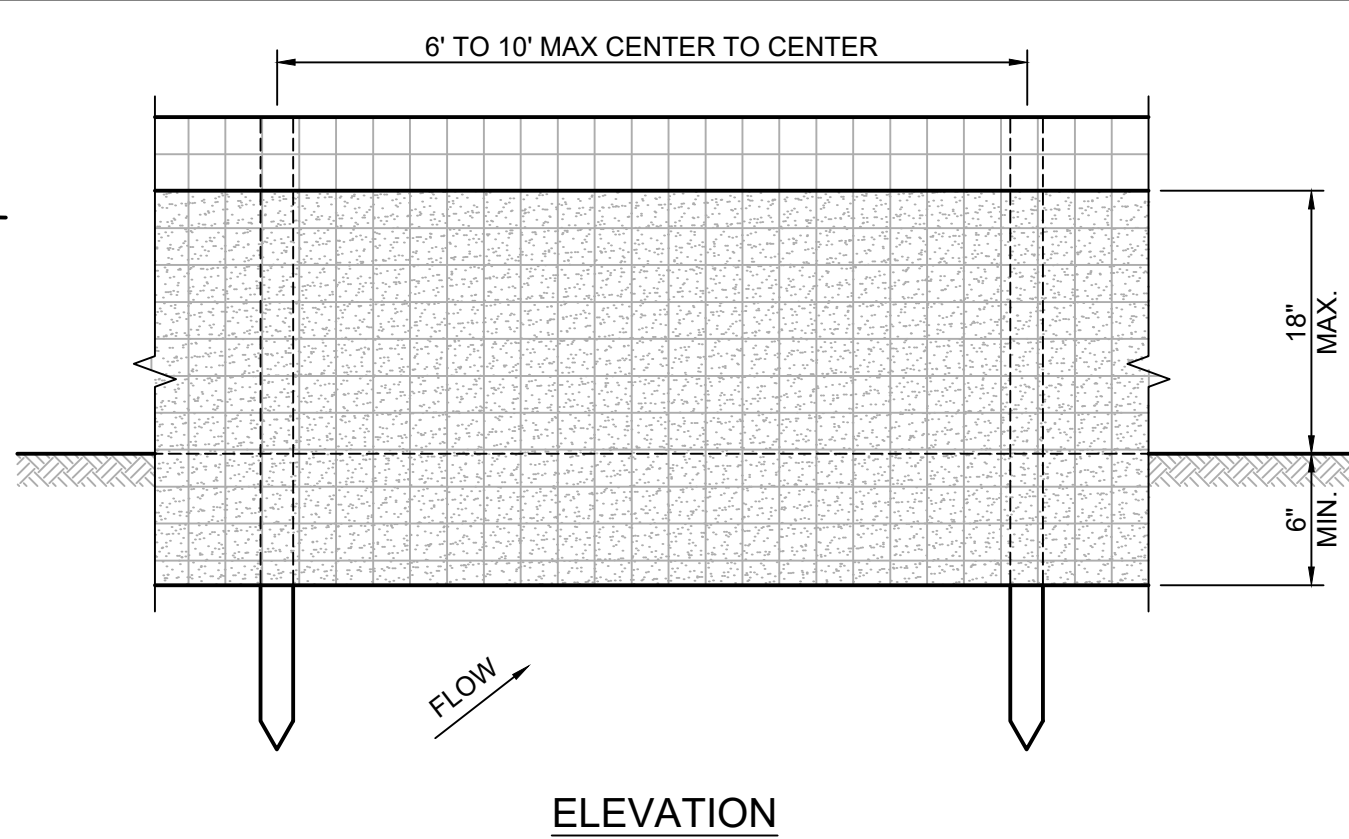
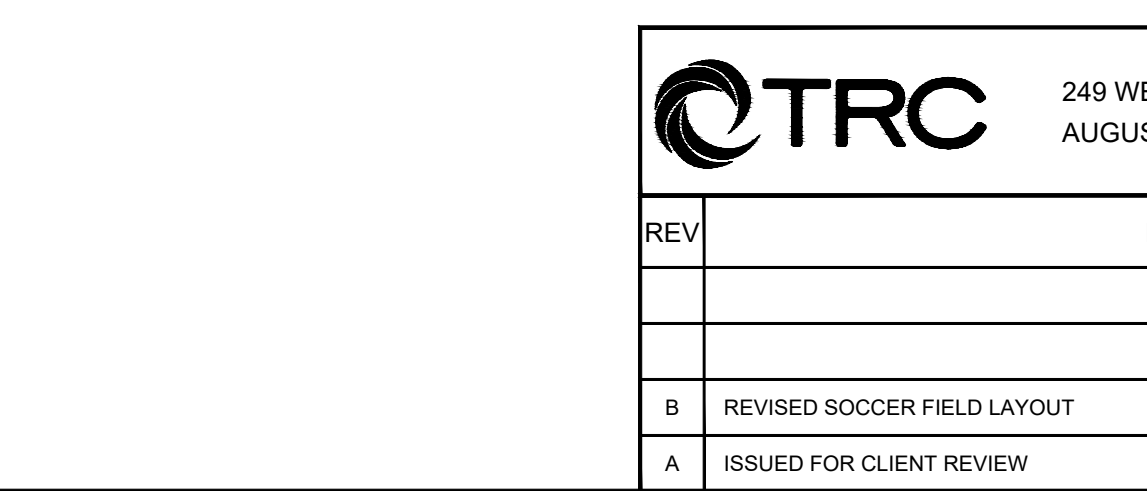
INSTALLATION DETAIL

N.T.S.



SILT BAG - CATCH BASIN INLET

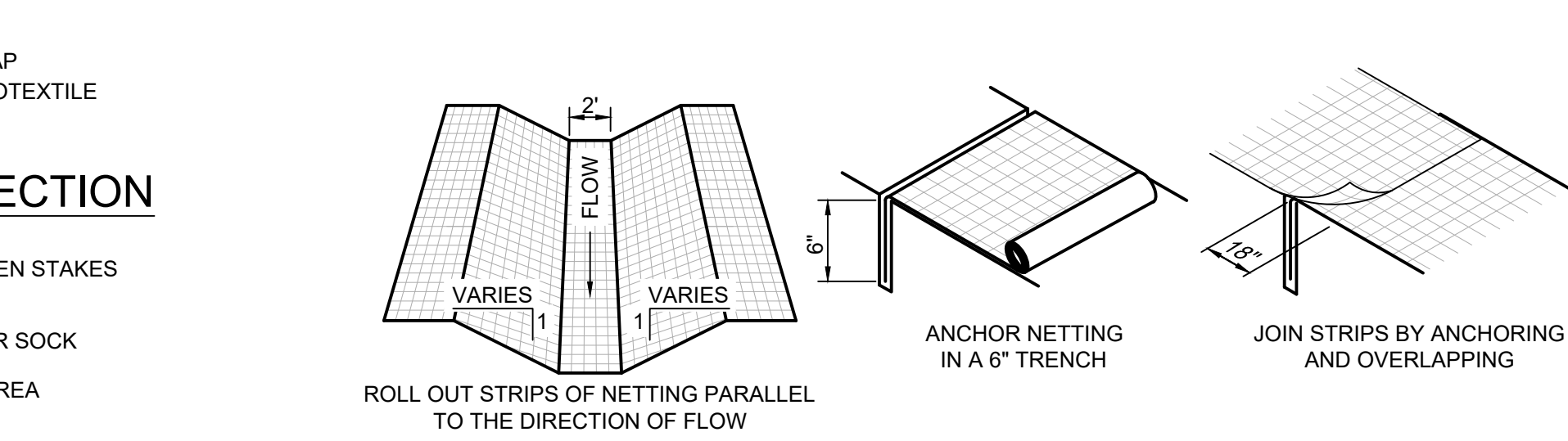
N.T.S.



1. WOVEN WIRE FENCE TO BE FASTENED TO FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MIDSECTION.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY 6" AND FOLDED.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN BUILD-UP REACHES 1/2 THE HEIGHT OF THE FENCE.

SILT FENCE DETAILS

N.T.S.



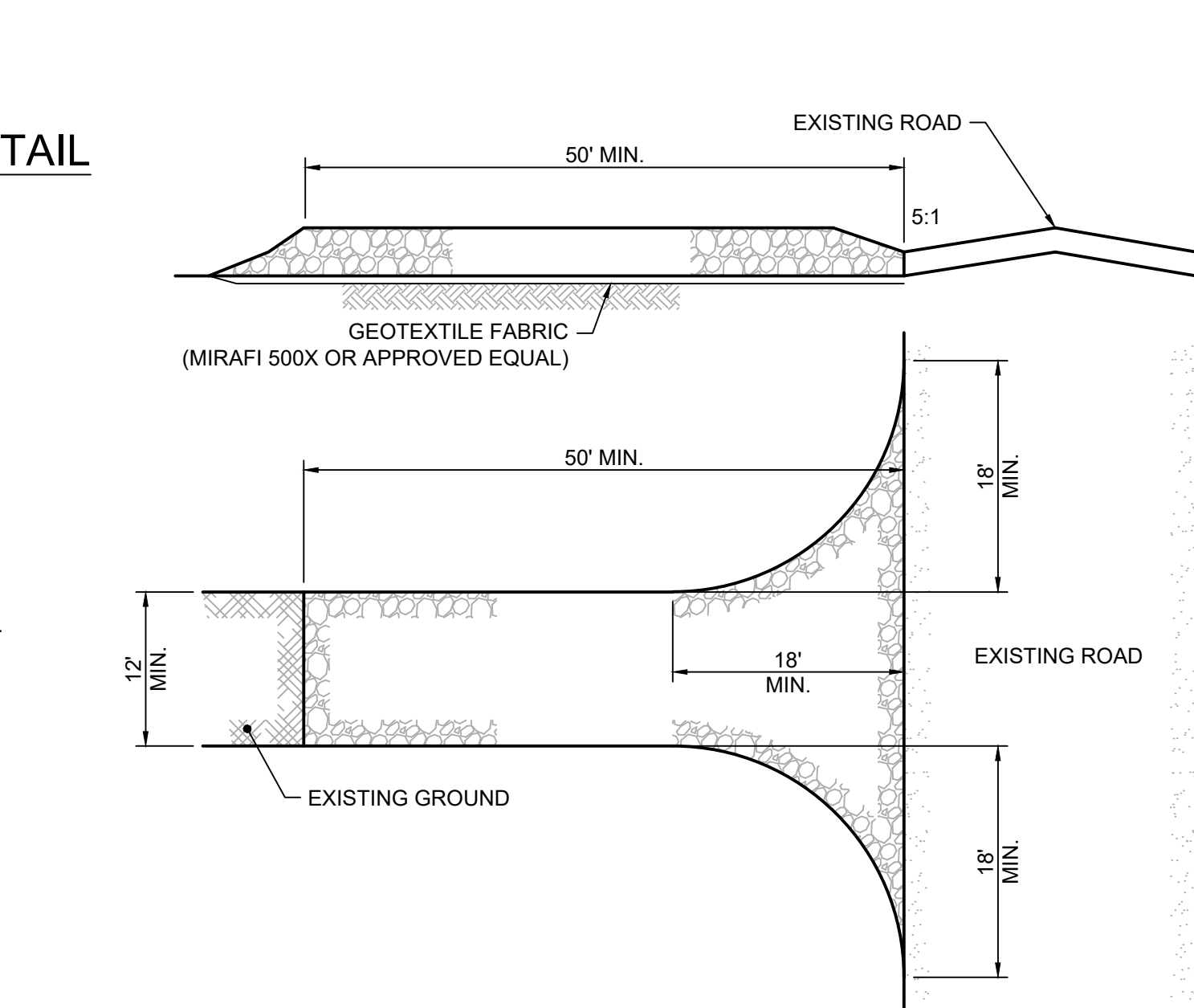
NOTES

1. EXCAVATE THE CHANNEL AND SHAPE IT TO AN EVEN CROSS-SECTION AS SHOWN. WHEN STAKING INDICATE A 0.2' OVERCUT AROUND THE CHANNEL PERIMETER FOR SILTING AND BULKING.
2. GRADE SOIL AWAY FROM CHANNEL SO THAT SURFACE WATER MAY ENTER FREELY.
3. APPLY LIME, FERTILIZER AND SEED TO THE CHANNEL AND ADJOINING AREAS IN ACCORDANCE WITH THE EROSION CONTROL PLAN.
4. SPREAD STRAW MULCH AT THE RATE OF 100LB/1000 SF.
5. HOLD MULCH IN PLACE IMMEDIATELY AFTER SPREADING WITH A PLASTIC NETTING INSTALLED AS SHOWN.

6. START LAYING THE NET FROM THE TOP OF THE UPSTREAM END OF THE CHANNEL AND UNROLL IT DOWN GRADE. DO NOT STRETCH THE NETTING.
7. BURY THE UP SLOPE END AND STAPLE THE NET EVERY 12" ACROSS THE TOP END, EVERY 3" AROUND THE EDGES AND ACROSS THE NET SO THAT THE STRAW IS HELD CLOSELY AGAINST THE SOIL. HOWEVER, DO NOT STRETCH THE NETTING WHEN STAPLING.
8. NETTING STRIPS SHOULD BE JOINED TOGETHER ALONG THE SIDES WITH A 3" OVERLAP AND STAPLED TOGETHER.
9. TO JOIN ENDS OF STRIPS, INSERT A NEW ROLL OF NET IN A TRENCH AS WITH THE UP SLOPE END AND OVERLAP IT 18" WITH THE PREVIOUSLY LAID UPPER ROLL. TURN UNDER 6" OF THE 18" OVERLAP AND STAPLE EVERY 12" ACROSS THE END.


GRASS LINED SWALE

N.T.S.



STABILIZED CONSTRUCTION ENTRANCE

N.T.S.

PROJECT NO: 115058					PGT DESIGNED		EROSION CONTROL NOTES & DETAILS NEMASKET STREET RECREATION AREA						
					CMW DRAWN								
PGT CHECKED													
APPROVED													
					NEW BEDFORD				MA				
					REVIEW 1		03/28/16 DATE				DRAWING 6		REV. B
					REVIEW 2		1" = 30' SCALE						
					</								

ATTACHMENT C

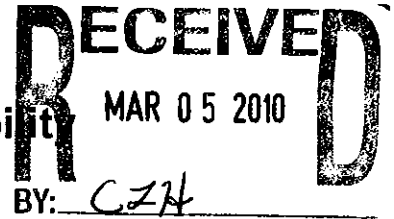
2010 Determination of Applicability



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

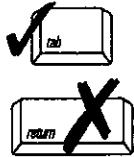
WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40



A. General Information

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



From:

New Bedford
Conservation Commission

To: Applicant

City of New Bedford - Dept. of Environmental
Stewardship c/o Cheryl Henlin
133 William Street

Mailing Address

New Bedford MA 02740
City/Town State Zip Code

Property Owner (if different from applicant):

Name

Mailing Address

City/Town State Zip Code

1. Title and Date (or Revised Date if applicable) of Final Plans and Other Documents:

Fig 2. Nemasket Streets Lots, New Bedford, MA, Map 69, Lots 86, 88-93
and 96-100.

stamp date received
2/3/2010

Title

Date

Title

Date

2. Date Request Filed:

2/3/2010

B. Determination

Pursuant to the authority of M.G.L. c. 131, § 40, the Conservation Commission considered your Request for Determination of Applicability, with its supporting documentation, and made the following Determination.

Project Description (if applicable):

Applicant requests a Determination as to whether the wetland on site is subject to the MA Wetlands Protection Act. The Applicant also knows the work location is within the Buffer Zone to a Bordering Vegetated Wetland located to the north of the site and they are requesting approval to work in that Buffer Zone as well. The work involves clearing vegetation, soil sampling and subsurface investigation and the applicant requests to know if this work requires the filing of a Notice of Intent.

Project Location:

Ruggles Street and Hathaway Boulevard
Street Address
Map 69
Assessors Map/Plat Number

New Bedford
City/Town
Lots 86, 88, 91, 92, 93, 97, 99 & 100
Parcel/Lot Number



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Determination (cont.)

The following Determination(s) is/are applicable to the proposed site and/or project relative to the Wetlands Protection Act and regulations:

Positive Determination

Note: No work within the jurisdiction of the Wetlands Protection Act may proceed until a final Order of Conditions (issued following submittal of a Notice of Intent or Abbreviated Notice of Intent) or Order of Resource Area Delineation (issued following submittal of Simplified Review ANRAD) has been received from the issuing authority (i.e., Conservation Commission or the Department of Environmental Protection).

☐ 1. The area described on the referenced plan(s) is an area subject to protection under the Act. Removing, filling, dredging, or altering of the area requires the filing of a Notice of Intent.

☐ 2a. The boundary delineations of the following resource areas described on the referenced plan(s) are confirmed as accurate. Therefore, the resource area boundaries confirmed in this Determination are binding as to all decisions rendered pursuant to the Wetlands Protection Act and its regulations regarding such boundaries for as long as this Determination is valid.

☐ 2b. The boundaries of resource areas listed below are not confirmed by this Determination, regardless of whether such boundaries are contained on the plans attached to this Determination or to the Request for Determination.

☐ 3. The work described on referenced plan(s) and document(s) is within an area subject to protection under the Act and will remove, fill, dredge, or alter that area. Therefore, said work requires the filing of a Notice of Intent.

☐ 4. The work described on referenced plan(s) and document(s) is within the Buffer Zone and will alter an Area subject to protection under the Act. Therefore, said work requires the filing of a Notice of Intent or ANRAD Simplified Review (if work is limited to the Buffer Zone).

☐ 5. The area and/or work described on referenced plan(s) and document(s) is subject to review and approval by:

Name of Municipality

Pursuant to the following municipal wetland ordinance or bylaw:

Name

Ordinance or Bylaw Citation



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Determination (cont.)

- ☐ 6. The following area and/or work, if any, is subject to a municipal ordinance or bylaw but not subject to the Massachusetts Wetlands Protection Act:

- ☐ 7. If a Notice of Intent is filed for the work in the Riverfront Area described on referenced plan(s) and document(s), which includes all or part of the work described in the Request, the applicant must consider the following alternatives. (Refer to the wetland regulations at 10.58(4)c. for more information about the scope of alternatives requirements):

- ☐ Alternatives limited to the lot on which the project is located.
- ☐ Alternatives limited to the lot on which the project is located, the subdivided lots, and any adjacent lots formerly or presently owned by the same owner.
- ☐ Alternatives limited to the original parcel on which the project is located, the subdivided parcels, any adjacent parcels, and any other land which can reasonably be obtained within the municipality.
- ☐ Alternatives extend to any sites which can reasonably be obtained within the appropriate region of the state.

Negative Determination

Note: No further action under the Wetlands Protection Act is required by the applicant. However, if the Department is requested to issue a Superseding Determination of Applicability, work may not proceed on this project unless the Department fails to act on such request within 35 days of the date the request is post-marked for certified mail or hand delivered to the Department. Work may then proceed at the owner's risk only upon notice to the Department and to the Conservation Commission. Requirements for requests for Superseding Determinations are listed at the end of this document.

- ☒ 1. The area described in the Request is not an area subject to protection under the Act or the Buffer Zone.
- ☒ 2. The work described in the Request is within an area subject to protection under the Act, but will not remove, fill, dredge, or alter that area. Therefore, said work does not require the filing of a Notice of Intent.
- ☐ 3. The work described in the Request is within the Buffer Zone, as defined in the regulations, but will not alter an Area subject to protection under the Act. Therefore, said work does not require the filing of a Notice of Intent, subject to the following conditions (if any).

- ☐ 4. The work described in the Request is not within an Area subject to protection under the Act (including the Buffer Zone). Therefore, said work does not require the filing of a Notice of Intent, unless and until said work alters an Area subject to protection under the Act.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Determination (cont.)

- ☐ 5. The area described in the Request is subject to protection under the Act. Since the work described therein meets the requirements for the following exemption, as specified in the Act and the regulations, no Notice of Intent is required:

Exempt Activity (site applicable statutory/regulatory provisions)

- ☐ 6. The area and/or work described in the Request is not subject to review and approval by:

Name of Municipality

Pursuant to a municipal wetlands ordinance or bylaw.

Name

Ordinance or Bylaw Citation

C. Authorization

This Determination is issued to the applicant and delivered as follows:

☒ by hand delivery on

☐ by certified mail, return receipt requested on

Date

3/5/10

Date

This Determination is valid for **three years** from the date of issuance (except Determinations for Vegetation Management Plans which are valid for the duration of the Plan). This Determination does not relieve the applicant from complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.

This Determination must be signed by a majority of the Conservation Commission. A copy must be sent to the appropriate DEP Regional Office (see <http://www.mass.gov/dep/about/region.findyour.htm>) and the property owner (if different from the applicant).

Signatures:

[Handwritten signatures of three Conservation Commission members]

[Handwritten signature of John S. Manning]

Date

2/16/10



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

D. Appeals

The applicant, owner, any person aggrieved by this Determination, any owner of land abutting the land upon which the proposed work is to be done, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate Department of Environmental Protection Regional Office (see <http://www.mass.gov/dep/about/region.findyour.htm>) to issue a Superseding Determination of Applicability. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and Fee Transmittal Form (see Request for Departmental Action Fee Transmittal Form) as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Determination. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant if he/she is not the appellant. The request shall state clearly and concisely the objections to the Determination which is being appealed. To the extent that the Determination is based on a municipal ordinance or bylaw and not on the Massachusetts Wetlands Protection Act or regulations, the Department of Environmental Protection has no appellate jurisdiction.

ATTACHMENT D

Wetland Photographs

City of New Bedford
Nemasket Street Lots

Site Photographs, January, 2010



Photo 1: View of isolated vegetated wetland ("IVW") looking north toward Keith Middle School.



Photo 2: View south of IVW and 100-foot buffer zone of BVW from Nemasket Street right-of-way.



Photo 3: View of the 100-foot buffer zone near the IVW on west end of Site.



Photo 4: Typical view of upland vegetation on the Site.

ATTACHMENT E

Stormwater Management Report and Checklist

STORMWATER MANAGEMENT REPORT

NEMASKET STREET RECREATIONAL AREA **225 HATHAWAY BOULEVARD**

PREPARED FOR:

**CITY OF NEW BEDFORD
133 WILLIAM STREET, ROOM 304
NEW BEDFORD MA 02740**

PREPARED BY:



**TRC ENGINEERS, INC
650 SUFFOLK STREET
LOWELL, MA 01854
TEL: 978-656-3680**

MAY 2016

REVISED MARCH 2018

TABLE OF CONTENTS

Section I Project Information.....	2
1. Project Description	2
3. Water Resources	3
Section III Stormwater Management	4
1. Protection of Wetlands, No Untreated Discharges.....	4
2. Peak Rate Attenuation	5
4. Water Quality	9
6. Critical Areas.....	9
7. Redevelopment	10
8. Construction Period Controls	10
9. Operation and Maintenance Plan	11
10. Illicit Discharge Statement	11
Section IV Conclusion	11

TABLES

Table I List of Drawings for the Nemasket street Recreation Area	3
Table II Table of Soil Characteristics.....	3
Table III-1 Pre-Development Drainage Areas (acres)	6
Table III-2 Precipitation Frequency Estimates (inches).....	6
Table III-3 Pre-Development Peak Rates of Runoff (cfs).....	6
Table III-4 Post-Development Drainage Areas (acres).....	7
Table III-5 Post-Development Peak Rates of Runoff (cfs)	7
Table III-6 Pre- to Post-Development Change in Peak Rates of Runoff (cfs)	8
Table III-7 Node 3P - Pre- to Post-Development Change in elevation (ft.).....	8

ATTACHMENTS

Attachment A – NRCS Soils Data and Support Information
Attachment B – Water Quality Calculations
Attachment C – Pre-and Post-Development HydroCAD Routings and Calculations
Attachment D – BMP Long-Term Operations and Maintenance Plan
Attachment E – Checklist for Stormwater Report
Attachment F – Permit Drawing Set

Section I Project Information

1. Project Description

The Nemasket Street Recreation Area will be located on the corner of Ruggles Street and Hathaway Boulevard, in the City of New Bedford, Bristol County, Massachusetts. The soccer field is just to the south of the existing middle school building.

The proposed improvements consist of a new artificial field turf soccer field. A portion of the soccer field will be constructed on top of a section of the existing school parking lot. All improvements will be constructed on a portion of the middle school property and on parcels owned by the City of New Bedford, approximately 2.15-acres on the northwest corner of Ruggles street and Hathaway Boulevard in New Bedford, Bristol County, Massachusetts (Site).

The proposed improvements will result in a no net increase in impervious area.

A total of 1.89 acres of disturbed area is anticipated, including the construction activities associated with the soccer field and associated grading activities.

All work will take place within the proposed property limits, with minimal impact to wetlands. A Notice of Intent will also be filed on behalf of the City of New Bedford to account for the proposed areas of the site improvements within the 100-foot Buffer per Wetlands Protection Act (WPA).

This Stormwater Report includes the calculations, runoff modeling, and engineering analysis required to evaluate the pre-development and post-development conditions associated with the proposed soccer field and associated site improvements.

The property for the proposed soccer field encompasses approximately 2.15-acres. The site is currently vacant residential properties that have a good amount of vegetated cover. The land use cover surrounding the site is predominantly residential with a few wetland areas. The wooded areas are a mix of evergreens and deciduous trees with very light undergrowth. A fence separates Keith Middle School parking lot from the residential parcels.

The impervious surfaces will be kept to the minimum practical. This design reduces the drainage detention infrastructure and utilizes the gravel cap material and artificial field turf as an alternative infiltration best management practice (BMP). Upon completion of the soccer field, the disturbed areas around the perimeter of the site will either be revegetated or covered by a permeable stone layer. The stormwater design also incorporates temporary and permanent erosion and sediment control measures to prevent off-site transport of sediment and protect existing wetlands throughout construction phases. The following table summarizes the list of civil engineering drawings pertinent to MassDEP and City of New Bedford requirements.

Table I List of Drawings for the Nemasket street Recreation Area	
Drawing No.	Drawing Title
1	Existing Conditions & Removals Plan
2	Site Grading Plan
3	Site Grading Sections & Details I
4	Site Grading Sections & Details II
5	Erosion Control Plan
6	Erosion Control Notes & Details
SW-1	Pre-development Watershed Plan
SW-2	Post-development Watershed Plan

2. Soil Types

The Natural Resources Conservation Service (NRCS) Web Soil Survey data identified three (3) principal soil types on or adjacent to the site. Table II provides a listing of soil types present. A copy of the NRCS Soils Map and other key soil characteristics are included in Attachment A.

Table II Table of Soil Characteristics			
Map Unit	Soil Name	Slopes	Hydrologic Soils Group
73A	Whitman fine sandy loam	0-3%	D
602	Urban Land	0-3%	A(assumed)
651	Udorthents, smoothed	0-3%	A
Source: USDA Natural Resource Conservation Service Web Soil Survey, Bristol County, Massachusetts, Southern Part.			

A subsurface soil evaluation was conducted on April 20, 2016 by TRC Engineers Inc. Their findings indicate that the soil conditions were consistent with the NRCS soil survey and those observed during the site visit. See Attachment A for the soils information.

3. Water Resources

The soccer field will be constructed on the City of New Bedford 2.15-acre parcel area. Elevations within the site range from approximately 103 to 88 feet above mean sea level. This unimproved site generally slopes from east to west, while the existing parking lot is generally flat. Existing site slopes range from approximately 35 percent in steep sections near the isolated wetland to the west to nearly flat within the eastern portion of the site.

The project is located in the Buzzards Bay Watershed. The runoff from the site flows into an adjacent wetland feeding into an unnamed tributary eventually feeding into the Paskamanset River.

The site is not located within the 100-year floodplain. See Attachment A for firmette based on Community Panels 25005C0389F.

Section III

Stormwater Management

The stormwater management system associated with the proposed soccer field will utilize the proposed grading, infiltration and revegetation to prevent an increase of runoff and impacts to wetlands and perennial riverfronts during precipitation events. In accordance with MassDEP requirements, the site grading and revegetation plans were developed such that the total post-development peak flows generated by 2-year, 10-year, and 100-year return period design storms will be less than those of the pre-development condition. No new impervious surfaces will be created. The surrounding disturbed areas of the site will either be revegetated or covered by a permeable stone layer. The soccer field will be constructed of 24 inches of a well-draining gravel material capped with a field turf. This configuration will minimize natural resource impacts as much as practicable. Following construction activities, long-term stormwater and erosion controls will be maintained through the Stormwater Management Operation and Maintenance Plan.

The following sections address the ten (10) standards for stormwater design from the MassDEP Stormwater Handbook.

1. Protection of Wetlands, No Untreated Discharges

In accordance with Standard 1, stormwater runoff from impervious areas will be treated on-site and will not be directly discharged to adjacent wetlands or natural resource areas. Prior to any earth disturbing activities, combination silt fence/hay bale erosion control BMPs will be installed around the perimeter of the disturbance areas. During site preparation and earthwork activities, runoff will be intercepted by the silt fence before reaching the adjacent wetlands. Upon completion of construction activities, the disturbed areas and yard embankment slopes of the site will either be revegetated or covered by a permeable stone layer such that runoff will sheet flow from the developed areas, and will not cause erosion in wetlands or waters of the Commonwealth. The permeable low maintenance cover type will also serve as a filter strip, attenuating stormwater runoff further and providing some measure of TSS treatment.

No outlets, outfalls or structures discharge runoff from the site directly to wetlands or resource areas. The supporting calculations, consistent with the requirements of Volume 2, Chapter 3 of the Massachusetts Stormwater Handbook for this engineering analysis, are provided in Attachment C.

2. Peak Rate Attenuation

Peak rate attenuation is achieved with a combination of infiltration surfaces, site grading and permeable low maintenance cover type. The stormwater runoff model was developed using HydroCAD software, which employs TR-55 and TR-20 methodology to calculate peak flows.

Modeling assumptions, inputs, and outputs for the pre- and post-development routing calculations are provided with Attachment C. Total post-development peak flows are attenuated to less than the pre-development peak flows for the 2-year, 10-year, 25-year, and 100-year, 24-hour storm events.

Analysis of Pre-Development Stormwater Runoff

This section presents hydrologic data and information to demonstrate that total peak rates of stormwater runoff under post-development conditions will not exceed those under pre-development conditions during the 2-year, 10-year, 25-year, and 100-year, 24-hour rainfall events.

Pre-development runoff rates were determined by dividing the site, based on existing topography, into four (4) subcatchments, labeled 1S, 2S, 3S, and 4S. The boundaries of the subcatchments are based on property lines, land use and topography. Existing land cover for the project site was determined by aerial photography and field investigation. Cover types are summarized in Table III-1 below. The Pre-Development Stormwater Management Plan is included in Attachment C.

Precipitation events with a 24-hour duration and a Type III distribution were used in this analysis. Rainfall return frequencies of 2, 10, 25, and 100 years were applied. Storm event precipitation depths were obtained from NOAA Atlas 14 Precipitation Data Server for New Bedford Massachusetts.

Proposed land use within each drainage area is summarized in Table III-1.

Table III-1 Pre-Development Drainage Areas (acres)						
LAND COVER	CN	1S	2S	3S	4S	Totals
Pavement	98	0.000	0.000	0.000	0.040	0.040
Grass, HSG A	39	0.000	0.000	0.014	0.139	0.153
Brush, HSG A	48	0.572	0.732	0.166	0.082	1.552
Brush, HSG D	78	0.028	0.059	0.000	0.000	0.087
Woods, HSG A	45	0.000	0.021	0.000	0.000	0.021
Woods, HSG D	83	0.030	0.338	0.000	0.000	0.368
Total Area		0.630	1.150	0.180	0.261	2.221
Composite CN		51	48	47	51	

Table III-2 Precipitation Frequency Estimates (inches)				
Duration	Average Recurrence Interval (years)			
	2-year	10-year	25-year	100-year
24-hours	3.4 inches	5.01 inches	6.02 inches	7.58 inches

For each subcatchment, the time of concentration (Tc) was determined using the hydraulically longest flow path. The Tc flow paths are identified on the Pre-Development Stormwater Management Plan. In the pre-development model, the maximum sheet flow length used is 50 feet, per MassDEP recommendations. In subcatchment 4S, a minimum time of concentration of 6 minutes was used for this area. Curve numbers (CNs) were generated for the subcatchments based on hydrologic soil group and land cover type. Peak rates of runoff were evaluated for each subcatchment. HydroCAD output for pre-development conditions for the 2-year, 10-year, 25-year, and 100-year, 24-hour storm events are included in Attachment C and is summarized in Table III-3.

Table III-3 Pre-Development Peak Rates of Runoff (cfs)			
Storm Event	SP1	SP2	Total Site SP3
2-year	0.05	0.00	0.05
10-year	0.42	0.00	0.42
25-year	0.81	0.00	0.81
100-year	1.55	0.00	1.55

Analysis of Post-Development Stormwater Runoff

Post-development runoff rates were determined using the same approach. The project area was divided into five (5) subcatchments, labeled 1S, 2S, 2SA, 3S, and 4S as shown in Attachment E – Post Development Stormwater Watershed Plan. The post-development runoff pattern will remain generally unchanged from the pre-development pattern.

Proposed land use within each drainage area is summarized in Table III-4.

Table III-4 Post-Development Drainage Areas (acres)							
<u>LAND COVER</u>	CN	1S	2S	2SA	3S	4S	Totals
Pavement	98	0.000	0.000	0.000	0.000	0.040	0.040
Field turf	68	0.000	0.000	1.300	0.000	0.000	1.300
*Grass, HSG A	39	0.155	0.210	0.000	0.120	0.179	0.664
*Grass, HSG D	80	0.041	0.260	0.000	0.000	0.000	0.301
Woods, HSG A	45	0.000	0.000	0.000	0.000	0.000	0.000
Woods, HSG D	83	0.000	0.000	0.000	0.000	0.000	0.000
Total Area		0.196	0.470	1.300	0.120	0.219	2.305
Composite CN		48	62	96	39	50	

*Grass may be substituted with a permeable low maintenance cover type.

As in the pre-development analysis, the time of concentration (Tc) was determined using the hydraulically longest flow path. The Tc flow paths for each subcatchment are identified on the Post-Development Stormwater Watershed Plan located in Attachment E. A maximum sheet flow length of 50 feet was used in the time of concentration calculations. In all cases a minimum time of concentration of 6 minutes was used for the post development subcatchments. HydroCAD output for Post-Development conditions for the 2-year, 10-year, 25-year, and 100-year, 24-hour storm events are included in Attachment C and summarized in Table III-5.

Table III-5 Post-Development Peak Rates of Runoff (cfs)			
Storm Event	SP1	SP2	Total Site SP3
2-year	0.01	0.00	0.01
10-year	0.18	0.00	0.18
25-year	0.41	0.00	0.41
100-year	0.88	0.00	0.88

Table III-7 provides a comparison between pre-development and post-development runoff conditions for each design storm.

Table III-6 Pre- to Post-Development Change in Peak Rates of Runoff (cfs)			
Storm Event	Pre- Development Total	Post- Development Total	Total Site SP3
2-year	0.05	0.01	(-)0.04
10-year	0.42	0.18	(-)0.24
25-year	0.81	0.41	(-)0.40
100-year	1.55	0.88	(-)0.67

Peak Rates of Runoff

The results of the analyses indicate that a decrease in the peak rates of runoff from all storm events is anticipated. The limited amount of runoff directed to Ruggles Street and Hathaway Boulevard in the post-development model is identified as node (SP1) which is less than that of the pre-development rates.

The wetland north of the site modeled as (Node 3P), is the outfall for the existing parcel is modeled as on-site storage. In the post-development model, contributing Runoff from the westerly embankment slope, Node 2S, will be contained within this wetland and will not impact any downstream properties. The peak stages is summarized in Table III-7

Table III-7 Node 3P - Pre- to Post-Development Change in elevation (ft.)			
Storm Event	Pre- Development Elevation	Post- Development Elevation	Difference in Elevation
2-year	85.00	85.11	0.11
10-year	85.00	85.28	0.28
25-year	85.00	85.40	0.40
100-year	85.00	85.57	0.57

3. Groundwater Recharge

Annual recharge to groundwater will be maintained through the use of environmentally sensitive site design, low impact development techniques, BMPs, and long-term effective operation and maintenance. In general, the Soccer field is low impact and the removal of existing pavement exceeds the extent of new impervious surfaces. The annual recharge requirements will be met under the post-development conditions based on recharge volume calculations, consistent with MassDEP standards. MassDEP standards for stormwater recharge are achieved through the stormwater management system as designed.

The intent of these standards is to ensure that the infiltration volume of precipitation into the ground under post-development conditions is at least as much as the infiltration volume under pre-development conditions. Infiltration is proposed for the soccer field but it's not considered impervious. The Dynamic Field Method, as outlined within the Massachusetts Stormwater Handbook provides the basis for the recharge volume calculation. Because the Dynamic Field Method was employed, a field infiltration evaluation was performed using a double ring infiltrometer. The Site visit and soil observations were utilized as a supplement to existing soils information given by the Natural Resources Conservation Service website. The report and calculations provided within Attachment A demonstrate compliance with the following MassDEP criteria.

- Infiltration BMPs will drain in 72 hours;
- Runoff from the soccer field is infiltrated into gravel subbase layers just below the surface of the field.

The Dynamic Field Method was used to determine the infiltration rates. There were a total of 6 in-situ hydraulic conductivity tests. The results of the field testing ranged from 0.67 to 6.85 inches per hour. For the soccer field we chose to use the most conservative test of 0.67 inches per hour as the infiltration rate. See the infiltration test results included in Attachment A for in-situ hydraulic conductivity test results.

4. Water Quality

The Infiltration Volume Calculation worksheets in Attachment B show the calculations for both the recharge volume and water quality volume based on the impervious area created by the soccer field. The required water quality equals one inch times the total impervious area of the post-development project site.

5. Higher Potential Pollutant Loads

The soccer field and associated stormwater BMPs will not result in higher potential pollutant loads. Source control and pollution prevention will be implemented in accordance with the Long-Term BMP Operations and Maintenance Plan, which was developed in accordance with the Massachusetts Stormwater Handbook to eliminate untreated off-site discharge of stormwater and associated TSS impacts. A National Pollutant Discharge Elimination System (NPDES) Construction General Permit will be submitted prior to the site preparation activities and building construction activities. The Long-Term Pollution Prevention measures will be summarized within the Long-Term BMP Operations and Maintenance Plan.

6. Critical Areas

The stormwater BMPs for the Site have been designed to prevent untreated stormwater discharges from new impervious areas. Standard 6 stipulates that for stormwater treatment in critical areas, all runoff effluent must achieve 80% total suspended solids (TSS) removal. The requirements also stipulate that 44% TSS removal must be

performed via “pre-treatment” prior to discharge to the infiltration structure. The pre-treatment options include physical separators or a vegetated filter strip. Physical separators are not a viable option as they only provide 25% pre-treatment and treat limited areas, and each one requires its own outfall. A project with multiple outfalls in wetlands are not recommended by regulatory bodies. This leaves only a vegetated filter strip, for which there is simply no space for. Per the TSS removal efficiencies table, in order to achieve the 44% pre-treatment the vegetated filter strip will need to be 50 feet in width.

The Soccer field is an atypical land use, without a higher pollutant load. The site design benefits from the application of field turf over a 2 feet thick gravel base material over most of the site. This surfacing captures the runoff water, treating it as a large surface filter, releasing any runoff to the wetlands dispersed evenly in the form of sheet flow. The treatment of stormwater through this gravel infiltration system meets the final TSS requirements of the Stormwater standards.

Justification for waiving the pre-treatment requirement for the Recreation area would include the fact that this site has no roadway construction as part of the design.

7. Redevelopment

A portion of the existing parking lot will be impacted due to the soccer field construction to the south. Some of the existing pavement will be removed from the current middle school parking lot. This project is considered a new stand-alone development project and is not considered a redevelopment project.

8. Construction Period Controls

A plan will be developed by the construction contractor to identify potential construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities. Land disturbance and construction activities will be implemented in a manner which limits off-site TSS transport through the installation of silt fencing down-gradient of the limit of disturbance. A NPDES permit will be submitted to EPA by the construction contractor prior to site preparation and land disturbance. The NPDES permit will include a Stormwater Pollution Prevention Plan (SWPPP), which will comply with the requirements of Standard 8.

The SWPPP will address all stormwater management activities necessary during land disturbance and construction, including source control and pollution prevention measures, BMPs to address erosion and sedimentation, stabilization measures, and procedures for operating and maintaining the BMPs. The SWPPP will also include a schedule for sequencing construction and stormwater management activities that minimize land disturbance and expedite restoration activities. The construction sequence will begin with the installation of silt fencing, filter fabric, the construction

entrance and any additional erosion and sediment BMPs. Once all temporary BMPs are in place, the site improvements will commence concurrent with clearing and grubbing of the expansion areas, general earthwork activities, followed by the construction of the building. Disturbed areas will be stabilized with hydro-seed, mulch and tack coat. After final stabilization has been achieved, temporary erosion and sediment control BMPs will be removed.

9. Operation and Maintenance Plan

The construction period controls are addressed in the SWPPP developed as part of NPDES permitting activities. The Operations and Maintenance Plan will address the stormwater management systems and required post-construction maintenance activities. The stormwater management system BMPs will be maintained by the City of New Bedford. The Operations and Maintenance Plan provides emergency contact information for personnel to be notified during routine and non-routine maintenance tasks to be undertaken after construction is complete. The proposed schedule for implementing stormwater operation and maintenance is also summarized within the plan.

10. Illicit Discharge Statement

The stormwater management system was designed to convey, treat and infiltrate all stormwater on-site generated during a 25 year, 24-hour design storm. The site grading and stormwater BMPs have also been designed to store runoff on-site in excess of this design standard. There will be minimum off-site discharges or discharges to storm and sanitary sewers. Precipitation from the design storm and storms in excess of this standard will be confined within the areas of disturbance and the developed site footprint. The Site will be surrounded by fencing and access to the Site will be further limited by locked gates to limit the probability of illicit discharges to the Site stormwater BMPs. Stormwater operation and maintenance will be performed according to the BMP Long Term Operations and Maintenance Plan and implement all specified pollution prevention measures.

Section IV Conclusion

The Nemasket Street Recreational Area Project will disturb approximately 1.89 acres. The post development stormwater management controls for this project have been designed to address flooding, groundwater recharge and water quality as required by the MassDEP. It is TRC's professional opinion that the proposed improvements to the Site have been designed in accordance with these requirements and can be constructed without negatively impacting offsite drainage.

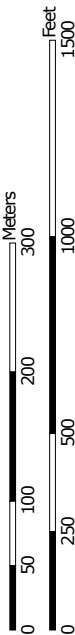
ATTACHMENTS

**Attachment A
NRCS Soils Data and Support Information**



Map Scale: 1:5,860 if printed on A landscape (11" x 8.5") sheet.

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



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

C

C/D

D

Not rated or not available

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Bristol County, Massachusetts, Southern Part
Survey Area Data: Version 9, Sep 28, 2015

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

Date(s) aerial images were photographed: Mar 30, 2011—Oct 8, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Bristol County, Massachusetts, Southern Part (MA603)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	B/D	1.0	0.8%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	8.8	6.9%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	0.0	0.0%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	C	18.3	14.4%
602	Urban land		84.9	66.6%
651	Udorthents, smoothed	A	14.4	11.3%
Totals for Area of Interest			127.5	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



NOAA Atlas 14, Volume 10, Version 2
Location name: New Bedford, Massachusetts,
USA*

Latitude: 41.644°, Longitude: -70.9493°

Elevation: 94.87 ft**

* source: ESRI Maps

** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.293 (0.240-0.358)	0.364 (0.298-0.445)	0.481 (0.392-0.589)	0.577 (0.467-0.710)	0.710 (0.554-0.914)	0.812 (0.621-1.07)	0.914 (0.679-1.25)	1.07 (0.734-1.47)	1.27 (0.837-1.80)	1.43 (0.914-2.05)
10-min	0.416 (0.340-0.507)	0.516 (0.422-0.631)	0.681 (0.555-0.834)	0.817 (0.661-1.01)	1.00 (0.785-1.30)	1.15 (0.879-1.51)	1.30 (0.961-1.77)	1.51 (1.04-2.08)	1.80 (1.19-2.55)	2.02 (1.30-2.91)
15-min	0.489 (0.400-0.597)	0.607 (0.497-0.742)	0.801 (0.653-0.982)	0.962 (0.778-1.18)	1.18 (0.924-1.52)	1.35 (1.03-1.78)	1.52 (1.13-2.09)	1.78 (1.22-2.44)	2.12 (1.39-3.00)	2.38 (1.52-3.42)
30-min	0.699 (0.573-0.854)	0.869 (0.710-1.06)	1.15 (0.933-1.40)	1.38 (1.11-1.69)	1.69 (1.32-2.18)	1.93 (1.48-2.55)	2.18 (1.62-2.98)	2.54 (1.75-3.49)	3.03 (1.99-4.28)	3.40 (2.17-4.88)
60-min	0.910 (0.745-1.11)	1.13 (0.924-1.38)	1.49 (1.21-1.83)	1.79 (1.45-2.20)	2.20 (1.72-2.83)	2.52 (1.92-3.31)	2.83 (2.10-3.87)	3.31 (2.27-4.54)	3.94 (2.59-5.56)	4.41 (2.82-6.34)
2-hr	1.24 (1.02-1.51)	1.54 (1.27-1.87)	2.04 (1.67-2.48)	2.44 (1.99-2.99)	3.00 (2.36-3.83)	3.43 (2.65-4.48)	3.87 (2.89-5.23)	4.51 (3.13-6.12)	5.36 (3.57-7.49)	6.01 (3.89-8.52)
3-hr	1.47 (1.22-1.78)	1.82 (1.50-2.20)	2.39 (1.97-2.90)	2.86 (2.34-3.48)	3.51 (2.78-4.46)	4.01 (3.11-5.20)	4.51 (3.40-6.07)	5.25 (3.67-7.08)	6.23 (4.18-8.64)	6.97 (4.56-9.82)
6-hr	1.91 (1.59-2.29)	2.33 (1.94-2.80)	3.02 (2.50-3.64)	3.59 (2.96-4.34)	4.38 (3.49-5.51)	4.98 (3.89-6.39)	5.59 (4.24-7.42)	6.47 (4.58-8.62)	7.63 (5.18-10.4)	8.50 (5.63-11.8)
12-hr	2.39 (2.00-2.84)	2.86 (2.40-3.42)	3.65 (3.04-4.36)	4.30 (3.56-5.16)	5.19 (4.17-6.47)	5.88 (4.62-7.46)	6.57 (5.02-8.60)	7.53 (5.40-9.92)	8.80 (6.06-11.9)	9.76 (6.65-13.4)
24-hr	2.84 (2.39-3.36)	3.38 (2.85-4.01)	4.27 (3.58-5.07)	5.01 (4.18-5.97)	6.02 (4.87-7.42)	6.80 (5.39-8.52)	7.58 (5.83-9.78)	8.61 (6.25-11.2)	9.96 (6.95-13.3)	11.0 (7.48-14.9)
2-day	3.26 (2.76-3.83)	3.88 (3.29-4.56)	4.89 (4.14-5.77)	5.74 (4.82-6.79)	6.90 (5.61-8.42)	7.79 (6.21-9.65)	8.66 (6.72-11.0)	9.76 (7.19-12.6)	11.2 (7.94-14.8)	12.3 (8.52-16.5)
3-day	3.57 (3.05-4.18)	4.22 (3.59-4.95)	5.28 (4.48-6.20)	6.16 (5.20-7.26)	7.37 (6.02-8.94)	8.30 (6.65-10.2)	9.23 (7.18-11.6)	10.3 (7.66-13.2)	11.8 (8.43-15.5)	12.9 (9.01-17.2)
4-day	3.85 (3.29-4.50)	4.51 (3.85-5.27)	5.59 (4.76-6.55)	6.49 (5.49-7.62)	7.72 (6.33-9.33)	8.67 (6.97-10.6)	9.62 (7.51-12.1)	10.7 (7.99-13.7)	12.2 (8.76-15.9)	13.3 (9.34-17.6)
7-day	4.57 (3.92-5.31)	5.26 (4.51-6.11)	6.39 (5.46-7.44)	7.32 (6.23-8.56)	8.61 (7.10-10.3)	9.60 (7.76-11.6)	10.6 (8.31-13.1)	11.7 (8.77-14.7)	13.1 (9.49-16.8)	14.1 (10.0-18.5)
10-day	5.24 (4.52-6.06)	5.95 (5.13-6.90)	7.12 (6.11-8.26)	8.09 (6.91-9.42)	9.42 (7.80-11.2)	10.4 (8.47-12.6)	11.5 (9.02-14.1)	12.5 (9.47-15.6)	13.9 (10.1-17.7)	14.9 (10.6-19.3)
20-day	7.26 (6.30-8.35)	8.04 (6.97-9.25)	9.31 (8.05-10.7)	10.4 (8.91-12.0)	11.8 (9.85-13.9)	12.9 (10.6-15.4)	14.1 (11.1-16.9)	15.0 (11.5-18.6)	16.3 (12.1-20.6)	17.3 (12.5-22.1)
30-day	8.95 (7.80-10.2)	9.79 (8.52-11.2)	11.2 (9.68-12.8)	12.3 (10.6-14.1)	13.9 (11.6-16.2)	15.1 (12.4-17.8)	16.3 (12.9-19.4)	17.2 (13.3-21.1)	18.5 (13.8-23.1)	19.4 (14.2-24.6)
45-day	11.1 (9.67-12.6)	12.0 (10.5-13.7)	13.5 (11.8-15.4)	14.7 (12.8-16.9)	16.5 (13.9-19.1)	17.8 (14.7-20.8)	19.1 (15.3-22.7)	20.1 (15.7-24.5)	21.4 (16.1-26.6)	22.4 (16.5-28.1)
60-day	12.8 (11.2-14.6)	13.8 (12.1-15.7)	15.5 (13.5-17.6)	16.8 (14.6-19.2)	18.7 (15.8-21.7)	20.2 (16.7-23.5)	21.6 (17.3-25.5)	22.6 (17.7-27.4)	24.0 (18.2-29.6)	25.0 (18.5-31.2)

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

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

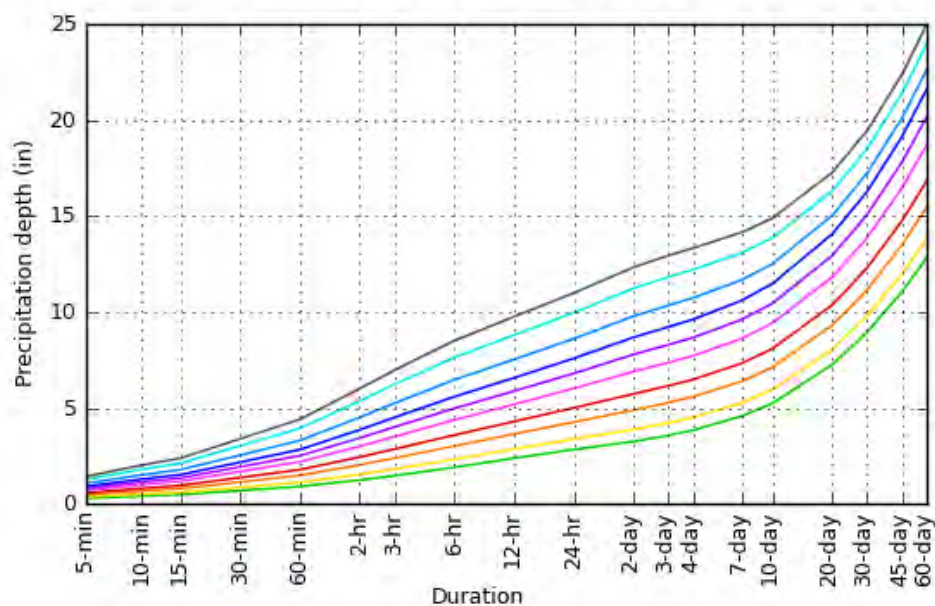
Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

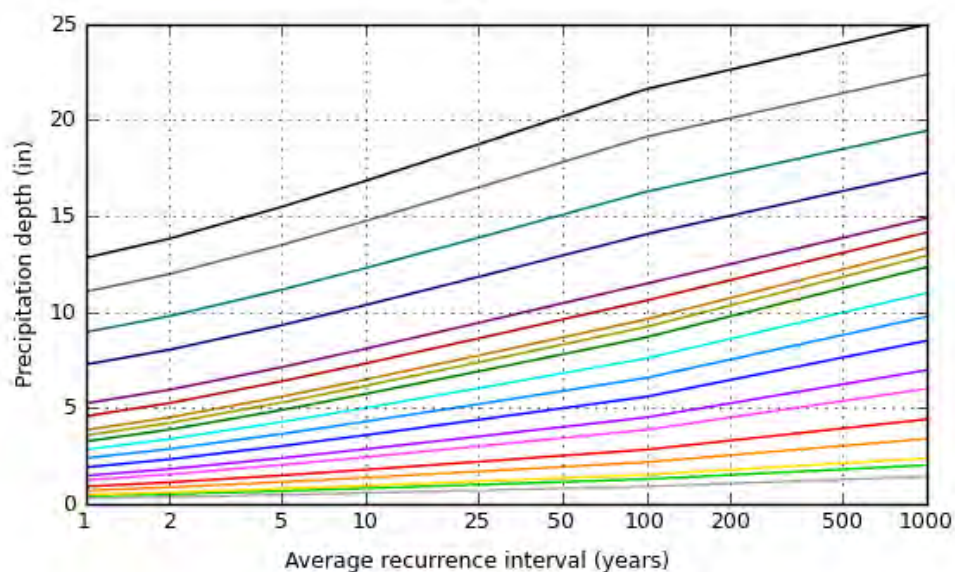
PF graphical

PDS-based depth-duration-frequency (DDF) curves

Latitude: 41.6440°, Longitude: -70.9493°



Average recurrence interval (years)
1
2
5
10
25
50
100
200
500
1000



Duration	
5-min	2-day
10-min	3-day
15-min	4-day
30-min	7-day
60-min	10-day
2-hr	20-day
3-hr	30-day
6-hr	45-day
12-hr	60-day
24-hr	

NOAA Atlas 14, Volume 10, Version 2

Created (GMT): Thu Mar 1 14:35:16 2018

[Back to Top](#)

Maps & aerials

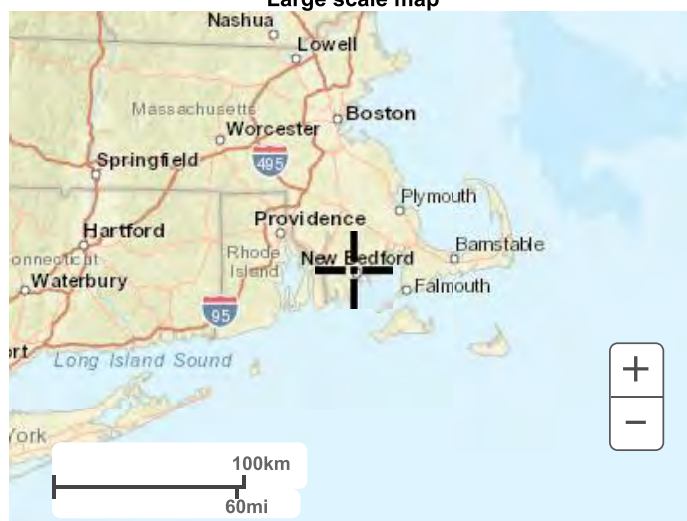
Small scale terrain



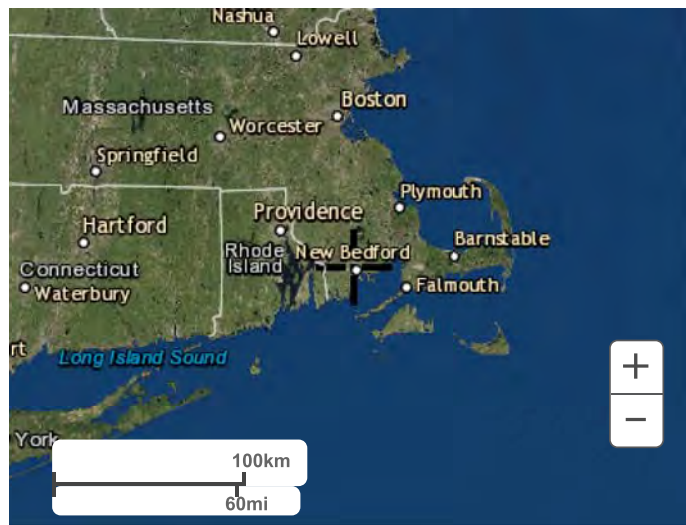
Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)

[US Department of Commerce](#)
[National Oceanic and Atmospheric Administration](#)
[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)

Stormwater Infiltration Testing Narrative

From April 13-15, 2016, TRC performed an in-situ stormwater vertical infiltration study on site soils at the Nemasket Street Lots (the Site) in accordance with the double-ring infiltrometer method described in ASTM Standard D3385-09. Infiltration tests were performed in six discrete locations to assess the permeability of the subgrade material that will underlie the proposed athletic field. Four test locations were placed in the area of the proposed synthetic turf soccer field, one location was placed in the area of the proposed concrete basketball court and one location was placed in the area of the proposed natural grass landscape. All tests were located outside of former soil-disturbing investigation activities so as to be representative of the soil structure and condition over the majority of the Site.

Prior to the execution of each test, six to twelve inches of topsoil were hand cleared to expose the underlying fill material on which the athletic field will be constructed. For each individual test, an aluminum alloy outer ring of twenty inches in height and twenty-four inches in diameter was driven three to four inches into the ground and leveled. Then an aluminum alloy inner ring of twenty inches in height and twelve inches in diameter was driven two to three inches into the ground and leveled in the center of the larger outer ring. The abundance of glass, brick and metal fragments in the fill material prevented the rings from being driven any farther into the ground. Rings were driven using an aluminum alloy driving cap, a wooden block and a heavy sledge hammer.

The City of New Bedford (the City) provided access to the fire hydrant at 98 Ruggles Street to provide water to the Site from the municipal water supply. The water was added to the rings to a head height of three to four and a half inches and maintained constant and equal between the inner and outer rings for the duration of each test by measurement with hook gauges. The volume of water needed to maintain a constant head was tracked with graduated containers and recorded on field forms. Test durations ranged from four to six hours depending on the time it took to obtain relatively constant infiltration rates.

The results of the infiltration rates are summarized in the table below. Test locations INF-1 through INF-4 were placed in the area of the proposed synthetic turf soccer field, test location INF-5 was placed in the area of the proposed concrete basketball court, and INF-6 was placed in the area of proposed natural grass cover.

Test	Incremental Infiltration Rates (Inner Ring)		
	Lowest	Average	Approximate Maximum-Steady State
	(in/hr)	(in/hr)	(in/hr)
INF-1	6.47	9.69	6.47
INF-2	0.81	2.82	1.89
INF-3	5.18	6.88	6.85
INF-4	0.00	1.37	0.67
INF-5	5.23	6.75	5.23
INF-6	2.70	3.94	2.97

According to the ASTM Standards, “The maximum-steady state or average incremental infiltration velocity, depending on the purpose/application of the test is equivalent to the infiltration rate.” Both are included for comparison. The maximum-steady state results are an interpretation of the data. The lowest rates are included for comparison.

Seasonal High Water Table Observation Narrative

On April 20th and 21st, 2016 TRC oversaw investigative test pitting in ten discrete locations at the Nemasket Street Lots and the Keith Middle School (KMS) property. In addition to collecting geotechnical soil samples, TRC inspected the test pits for evidence of a seasonal high water table.

Soil mottling was difficult to identify in the landfill material; however, in two test pits (TP-6 and TP-7 in the Nemasket Lots, see site plan figure) mottling was suspected between 6-7 feet below grade. See photo of potential mottling at TP-7.

At the KMS property, potential mottling was observed in TP-2 below the peat layer at approximately 7 feet below grade. However, it should be noted that this observation may be influenced by potential groundwater mounding from the stormwater management structure located adjacent to the test pit.

It is assumed that the groundwater elevation shouldn't change much between Nemasket and KMS. Using the Nemasket data, TRC estimated that the most conservative seasonal high water table would be six feet below grade, or at an elevation of 87 feet based on an approximate ground elevation of 93 feet in the location of TP-6. In addition, historic groundwater elevations as measured through the three monitoring wells installed on the Nemasket Street Lots show the site groundwater elevation ranging from approximately 82 to 84 feet.

Double-Ring Infiltrometer Field Record Form

Project Identification: Nemasket Street, New Bedford, MA
Test Location: TP-1
Liquid Used: City water
Tested by: BM Liquid level maintained using: Graduated buckets
Deptwater to water table: 9.6 ft Penetration of rings Inner: 3 in Outer: 4 in

Constants	Area (in ²)	Depth of Liquid (in)	Liquid No.
Inner Ring	113.1	3.94	1
Annular Space	339.3	3.94	2
Duration of Test (hours) 5 Date: <u>4/14/2016</u>			

Trial No.		Time (hr:min)	Elapsed Time:		Flow Readings						Incremental Infiltration Rate		Remarks
			Δ/total (min)	Δ/total (hr)	Inner Reading			Annular Space			**Inner (in/h)	***Annular (in/h)	Weather conditions, etc.
					Reading (Liters)	Flow (Liters)	Flow (in ³)	Reading (Liters)	Flow (Liters)	Flow (in ³)			
1	S	10:15	15	0.25	14	9.1	555.32	32	25.8	1574.41	19.64	18.56	Sunny, slight wind, Hi 48°F
	E	10:30	15		4.9			6.2					
2	S	10:30	15	0.25	7	5.5	335.63	24	18.7	1141.14	11.87	13.45	
	E	10:45	30		1.5			5.3					
3	S	10:45	15	0.25	7	4.8	292.91	16	15.8	964.17	10.36	11.37	
	E	11:00	45		2.2			0.2					
4	S	11:00	15	0.25	7	4.1	250.20	16	14.9	909.25	8.85	10.72	
	E	11:15	60		2.9			1.1					
5	S	11:15	30	0.5	14	7.6	463.78	32	26.4	1611.03	8.20	9.50	
	E	11:45	90		6.4			5.6					
6	S	11:45	30	0.5	14	7.3	445.47	32	26.0	1586.62	7.88	9.35	
	E	12:15	120		6.7			6					
7	S	12:15	60	1	14	13.7	836.02	48	47.6	2904.73	7.39	8.56	
	E	13:15	180		0.3			0.4					
8	S	13:15	60	1	14	12.2	744.49	48	42.1	2569.10	6.58	7.57	
	E	14:15	240		1.8			5.9					
9	S	14:15	60	1	14	12	732.28	40	38.5	2349.41	6.47	6.92	
	E	15:15	300		2			1.5					
10	S												
	E												
11	S												
	E												
12	S												
	E												
13	S												
	E												
14	S												
	E												
15	S												
	E												
16	S												
	E												
17	S												
	E												
18	S												
	E												

Notes:

- * Calculated from the difference of the elevation of the infiltration test to measured groundwater on 4/13/16
- ** To calculate the inner ring incremental infiltration velocity in in/hr:

$$V(ir) = \Delta V(ir) / (A(ir) * \Delta t)$$

Where:

V(ir) = inner ring incremental infiltration velocity, in/h,
ΔV(ir) = volume of liquid used during time interval to maintain constant head in the inner ring, in3,
A(ir) = internal area of inner ring, in2, and
Δt = time interval, h.

- *** To calculate the annular space incremental infiltration velocity in in/hr:

$$V(a) = \Delta V(a) / (A(a) * \Delta t)$$

Where:

V(a) = inner ring incremental infiltration velocity, in/h,
ΔV(a) = volume of liquid used during time interval to maintain constant head in the inner ring, in3,
A(a) = internal area of inner ring, in2, and
Δt = time interval, h.

Double-Ring Infiltrometer Field Record Form

Project Identification:	Nemasket Street, New Bedford, MA		Constants		Area (in ²)	Depth of Liquid (in)	Liquid No.
Test Location:	TP-2						
Liquid Used:	City water		Inner Ring		113.1	3.5	1
Tested by:	CR	Liquid level maintained using: Graduated buckets	Annular Space		339.3	3.5	2
Deptwater to water table:	5.9 ft	Penetration of rings	Inner: 3 in	Outer: 4 in	Duration of Test (hours) 6		Date: 4/14/2016

Trial No.		Time (hr:min)	Elapsed Time:		Flow Readings						Incremental Infiltration Rate		Remarks
			Δ/total (min)	Δ/total (hr)	Inner Reading			Annular Space			**Inner (in/h)	***Annular (in/h)	Weather conditions, etc.
					Reading (Liters)	Flow (Liters)	Flow (in ³)	Reading (Liters)	Flow (Liters)	Flow (in ³)			
1	S	10:00	20	0.33	4	1	61.02	8	8	488.19	1.62	4.32	Sunny, slight wind, Hi 48°F
	E	10:20	20		3			0					
2	S	10:20	20	0.33	3	3	183.07	8	5	305.12	4.86	2.70	
	E	10:40	40		0			3					
3	S	10:40	20	0.33	6	3.5	213.58	8	4.5	274.61	5.67	2.43	
	E	11:00	60		2.5			3.5					
4	S	11:00	30	0.50	6	4	244.09	16	10.5	640.75	4.32	3.78	
	E	11:30	90		2			5.5					
5	S	11:30	30	0.50	6	2.5	152.56	14	9	549.21	2.70	3.24	
	E	12:00	120		3.5			5					
6	S	12:00	60	1.00	6	1.5	91.54	28	26.0	1586.62	0.81	4.68	
	E	13:00	180		4.5			2					
7	S	13:00	60	1.00	6	3.5	213.58	28	23	1403.55	1.89	4.14	
	E	14:00	240		2.5			5					
8	S	14:00	60	1.00	6	3	183.07	28	20	1220.47	1.62	3.60	
	E	15:00	300		3			8					
9	S	15:00	60	1.00	6	3.5	213.58	28	20.5	1250.99	1.89	3.69	
	E	16:00	360		2.5			7.5					
10	S												
	E												
11	S												
	E												
12	S												
	E												
13	S												
	E												
14	S												
	E												
15	S												
	E												
16	S												
	E												
17	S												
	E												
18	S												
	E												

Notes:

* Calculated from the difference of the elevation of the infiltration test to measured groundwater on 4/13/16

** To calculate the inner ring incremental infiltration velocity in in/hr:

$$V(ir) = \Delta V(ir) / (A(ir) * \Delta t)$$

Where:

V(ir) = inner ring incremental infiltration velocity, in/h,

ΔV(ir) = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(ir) = internal area of inner ring, in², and

Δt = time interval, h.

*** To calculate the annular space incremental infiltration velocity in in/hr:

$$V(a) = \Delta V(a) / (A(a) * \Delta t)$$

Where:

V(a) = inner ring incremental infiltration velocity, in/h,

ΔV(a) = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(a) = internal area of inner ring, in², and

Δt = time interval, h.

Double-Ring Infiltrometer Field Record Form

Project Identification:	Nemasket Street, New Bedford, MA		Constants		Area (in^2)	Depth of Liquid (in)	Liquid No.
Test Location:	TP-3						
Liquid Used:	City water		Inner Ring		113.1	4.3	1
Tested by:	BM	Liquid level maintained using: Graduated buckets	Annular Space		339.3	4.3	2
Deptwater to water table:	8.8 ft	Penetration of rings	Inner: 2 in	Outer: 3 in	Duration of Test (hours) 4		Date: 4/13/2016

Trial No.		Time (hr:min)	Elapsed Time:		Flow Readings						Incremental Infiltration Rate		Remarks
					Inner Reading			Annular Space			Rate		Weather conditions, etc.
			Δ/total (min)	Δ/total (hr)	Reading (Liters)	Flow (Liters)	Flow (in^3)	Reading (Liters)	Flow (Liters)	Flow (in^3)	**Inner (in/h)	***Annular (in/h)	
1	S	13:30	15	0.25	7	2.4	146.46	7	7	427.17	5.18	5.04	Sunny, slight wind, Hi 52°F
	E	13:45	15		4.6			0					
2	S	13:45	15	0.25	5	4.5	274.61	14	10	610.24	9.71	7.19	
	E	14:00	30		0.5			4					
3	S	14:00	15	0.25	7	4.4	268.50	16	15.5	945.87	9.50	11.15	
	E	14:15	45		2.6			0.5					
4	S	14:15	15	0.25	7	2.6	158.66	8	8	488.19	5.61	5.76	
	E	14:30	60		4.4			0					
5	S	14:30	30	0.50	7	5.2	317.32	24	18.2	1110.63	5.61	6.55	
	E	15:00	90		1.8			5.8					
6	S	15:00	30	0.50	7	5.4	329.53	24	18.3	1116.73	5.83	6.58	
	E	15:30	120		1.6			5.7					
7	S	15:30	60	1.00	14	12.5	762.80	40	33.9	2068.70	6.74	6.10	
	E	16:30	180		1.5			6.1					
8	S	16:30	60	1.00	14	12.7	775.00	32	30.8	1879.53	6.85	5.54	
	E	17:30	240		1.3			1.2					
9	S												
	E												
10	S												
	E												
11	S												
	E												
12	S												
	E												
13	S												
	E												
14	S												
	E												
15	S												
	E												
16	S												
	E												
17	S												
	E												
18	S												
	E												

Notes:

* Calculated from the difference of the elevation of the infiltration test to measured groundwater on 4/13/16

** To calculate the inner ring incremental infiltration velocity in in/hr:

$$V(ir) = \Delta V(ir) / (A(ir) * \Delta t)$$

Where:

V(ir) = inner ring incremental infiltration velocity, in/h,

$\Delta V(ir)$ = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(ir) = internal area of inner ring, in², and

Δt = time interval, h.

*** To calculate the annular space incremental infiltration velocity in in/hr:

$$V(a) = \Delta V(a) / (A(a) * \Delta t)$$

Where:

V(a) = inner ring incremental infiltration velocity, in/h,

$\Delta V(a)$ = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(a) = internal area of inner ring, in², and

Δt = time interval, h.

Double-Ring Infiltrometer Field Record Form

Project Identification:	Nemasket Street, New Bedford, MA		Constants		Area (in ²)	Depth of Liquid (in)	Liquid No.
Test Location:	TP-4						
Liquid Used:	City water		Inner Ring		113.1	3.5	1
Tested by:	CR	Liquid level maintained using: Graduated buckets	Annular Space		339.3	3.5	2
Deptwater to water table:	8.5 ft	Penetration of rings	Inner: 3 in	Outer: 3 in	Duration of Test (hours) 4		Date: 4/13/2016

Trial No.		Time (hr:min)	Elapsed Time:		Flow Readings						Incremental Infiltration Rate		Remarks
			Δ/total (min)	Δ/total (hr)	Inner Reading			Annular Space			**Inner (in/h)	***Annular (in/h)	Weather conditions, etc.
					Reading (Liters)	Flow (Liters)	Flow (in ³)	Reading (Liters)	Flow (Liters)	Flow (in ³)			
1	S	14:35	15	0.25	5	0.0	0.00	7	5.5	335.63	0.00	3.96	Sunny, slight wind, Hi 52°F
	E	14:50	15		5			1.5					
2	S	15:00	15	0.25	5	0.5	30.51	8	6.0	366.14	1.08	4.32	
	E	15:15	30		4.5			2					
3	S	15:15	15	0.25	4.5	1.5	91.54	8	5.0	305.12	3.24	3.60	
	E	15:30	45		3			3					
4	S	15:30	15	0.25	3	1.0	61.02	8	4.5	274.61	2.16	3.24	
	E	15:45	60		2			3.5					
5	S	15:45	30	0.50	7	3.0	183.07	9	8.0	488.19	3.24	2.88	
	E	16:15	90		4			1					
6	S	16:15	30	0.50	4	0.5	30.51	18	12.0	732.28	0.54	4.32	
	E	16:45	120		3.5			6					
7	S	16:45	60	1.00	3.5	1.25	76.28	18	13.0	793.31	0.67	2.34	
	E	17:45	180		2.25			5					
8	S	17:45	60	1.00	4	0.0	0.00	26	25.0	1525.59	0.00	4.50	
	E	18:45	240		4			1					
9	S												
	E												
10	S												
	E												
11	S												
	E												
12	S												
	E												
13	S												
	E												
14	S												
	E												
15	S												
	E												
16	S												
	E												
17	S												
	E												
18	S												
	E												

Notes:

* Calculated from the difference of the elevation of the infiltration test to measured groundwater on 4/13/16

** To calculate the inner ring incremental infiltration velocity in in/hr:

$$V(ir) = \Delta V(ir) / (A(ir) * \Delta t)$$

Where:

V(ir) = inner ring incremental infiltration velocity, in/h,

ΔV(ir) = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(ir) = internal area of inner ring, in², and

Δt = time interval, h.

*** To calculate the annular space incremental infiltration velocity in in/hr:

$$V(a) = \Delta V(a) / (A(a) * \Delta t)$$

Where:

V(a) = inner ring incremental infiltration velocity, in/h,

ΔV(a) = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(a) = internal area of inner ring, in², and

Δt = time interval, h.

Double-Ring Infiltrometer Field Record Form

Project Identification:	Nemasket Street, New Bedford, MA		Constants		Area (in ²)	Depth of Liquid (in)	Liquid No.
Test Location:	TP-5						
Liquid Used:	City water		Inner Ring	113.1	3.94	1	
Tested by:	BM	Liquid level maintained using:	Annular Space	339.3	3.94	2	
Deptwater to water table:	9.9 ft	Penetration of rings: Inner:	3 in	Outer:	4 in	Duration of Test (hours)	5
						Date:	4/15/2016

Trial No.		Time (hr:min)	Elapsed Time:		Flow Readings						Incremental Infiltration Rate		Remarks
					Inner Reading			Annular Space			Rate		Weather conditions, etc.
			Δ/total (min)	Δ/total (hr)	Reading (Liters)	Flow (Liters)	Flow (in^3)	Reading (Liters)	Flow (Liters)	Flow (in^3)	**Inner (in/h)	***Annular (in/h)	
1	S	10:15	15	0.25	7	4.5	274.61	16	14	854.33	9.71	10.07	Sunny, slight wind, Hi 52°F
	E	10:30	15		2.5			2					
2	S	10:30	15	0.25	7	3.6	219.69	16	12.9	787.21	7.77	9.28	
	E	10:45	30		3.4			3.1					
3	S	10:45	15	0.25	7	3.9	237.99	16	11.6	707.87	8.42	8.35	
	E	11:00	45		3.1			4.4					
4	S	11:00	15	0.25	7	2.9	176.97	16	9.9	604.13	6.26	7.12	
	E	11:15	60		4.1			6.1					
5	S	11:15	30	0.5	7	5.8	353.94	24	17.6	1074.02	6.26	6.33	
	E	11:45	90		1.2			6.4					
6	S	11:45	30	0.5	7	5.4	329.53	24	16.7	1019.10	5.83	6.01	
	E	12:15	120		1.6			7.3					
7	S	12:15	60	1	14	10.9	665.16	40	34.7	2117.52	5.88	6.24	
	E	13:15	180		3.1			5.3					
8	S	13:15	60	1	14	10.0	610.24	32	32.0	1952.76	5.40	5.76	
	E	14:15	240		4			0					
9	S	14:15	60	1	14	9.7	591.93	32	29.7	1812.40	5.23	5.34	
	E	15:15	300		4.3			2.3					
10	S												
	E												
11	S												
	E												
12	S												
	E												
13	S												
	E												
14	S												
	E												
15	S												
	E												
16	S												
	E												
17	S												
	E												
18	S												
	E												

Notes:

* Calculated from the difference of the elevation of the infiltration test to measured groundwater on 4/13/16

** To calculate the inner ring incremental infiltration velocity in in/hr:

$$V(ir) = \Delta V(ir) / (A(ir) * \Delta t)$$

Where:

V(ir) = inner ring incremental infiltration velocity, in/h,

ΔV(ir) = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(ir) = internal area of inner ring, in², and

Δt = time interval, h.

*** To calculate the annular space incremental infiltration velocity in in/hr:

$$V(a) = \Delta V(a) / (A(a) * \Delta t)$$

Where:

V(a) = inner ring incremental infiltration velocity, in/h,

ΔV(a) = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(a) = internal area of inner ring, in², and

Δt = time interval, h.

V(a) = inner ring incremental infiltration velocity, in/h,

ΔV(a) = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(a) = internal area of inner ring, in², and

Δt = time interval, h.

Double-Ring Infiltrometer Field Record Form

Project Identification:	Nemasket Street, New Bedford, MA		Constants		Area (in ²)	Depth of Liquid (in)	Liquid No.
Test Location:	TP-6						
Liquid Used:	City water		Inner Ring		113.1	3.0	1
Tested by:	CR	Liquid level maintained using: Graduated buckets	Annular Space		339.3	3.0	2
Deptwater to water table:	9.0 ft	Penetration of rings	Inner: 3 in	Outer: 4 in	Duration of Test (hours)	5.83	Date: 4/15/2016

Trial No.		Time (hr:min)	Elapsed Time:		Flow Readings						Incremental Infiltration Rate		Remarks
			Δ/total (min)	Δ/total (hr)	Inner Reading			Annular Space			**Inner (in/h)	***Annular (in/h)	Weather conditions, etc.
					Reading (Liters)	Flow (Liters)	Flow (in ³)	Reading (Liters)	Flow (Liters)	Flow (in ³)			
1	S	9:10	20	0.33	5	3.75	228.84	24	21.5	1312.01	6.07	11.60	Sunny, slight wind, Hi 52°F
	E	9:30	20		1.25			2.5					
2	S	9:30	15	0.25	6	2.5	152.56	14	14.0	854.33	5.40	10.07	
	E	9:45	35		3.5			0					
3	S	9:45	15	0.25	6	1.25	76.28	26	17.0	1037.40	2.70	12.23	
	E	10:00	50		4.75			9					
4	S	10:00	30	0.50	6	4.5	274.61	28	28.0	1708.66	4.86	10.07	
	E	10:30	80		1.5			0					
5	S	10:30	30	0.50	6	2.5	152.56	28	27.0	1647.64	2.70	9.71	
	E	11:00	110		3.5			1					
6	S	11:00	60	1.00	13	8.5	518.70	40	40.0	2440.95	4.59	7.19	
	E	12:00	170		4.5			0					
7	S	12:00	60	1.00	7	6.0	366.14	42	34.5	2105.32	3.24	6.20	
	E	13:00	230		1			7.5					
8	S	13:00	60	1.00	7	5.5	335.63	28	28.0	1708.66	2.97	5.04	
	E	14:00	290		1.5			0					
9	S	14:00	60	1.00	7	5.5	335.63	40	27.0	1647.64	2.97	4.86	
	E	15:00	350		1.5			13					
10	S												
	E												
11	S												
	E												
12	S												
	E												
13	S												
	E												
14	S												
	E												
15	S												
	E												
16	S												
	E												
17	S												
	E												
18	S												
	E												

Notes:

* Calculated from the difference of the elevation of the infiltration test to measured groundwater on 4/13/16

** To calculate the inner ring incremental infiltration velocity in in/hr:

$$V(ir) = \Delta V(ir) / (A(ir) * \Delta t)$$

Where:

V(ir) = inner ring incremental infiltration velocity, in/h,

ΔV(ir) = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(ir) = internal area of inner ring, in², and

Δt = time interval, h.

*** To calculate the annular space incremental infiltration velocity in in/hr:

$$V(a) = \Delta V(a) / (A(a) * \Delta t)$$

Where:

V(a) = inner ring incremental infiltration velocity, in/h,

ΔV(a) = volume of liquid used during time interval to maintain constant head in the inner ring, in³,

A(a) = internal area of inner ring, in², and

Δt = time interval, h.

Seasonal High Groundwater Table Test Pit Photos




Photo 1: TP-2



Photo 2: TP-6



Photo 3: TP-7

TRC Job No.	Photographs Taken By:	Page No.	Client:	Site Name & Address:	
115058	Chris Ragnelli	1 of 1	City of New Bedford	Nemasket Street Lots New Bedford, MA	

TRC
249 Western Ave
Augusta, ME 04330

Main 207.620.3800
Fax 207.621.7001

Minutes of Meeting

Project: Nemasket Street Soccer Field Design Meeting Date: April 25, 2016

Project No.: 115058 Date Prepared: April 26, 2016

Prepared By: Pete Trottier
Senior Civil Engineer

Participants: TRC –Jim Doherty, David Sullivan, Matthew Oliveria
Nitsch Engineering –Scott Turner
City of New Bedford – Ray Holberger, Sara Porter

Purpose: Permitting Meeting

1. Questions:

- a. If necessary and additional capacity is available, is it acceptable to incorporate the underground stormwater system in the Keith Middle School Parking lot into the soccer field SWM?

Response - Scot has several versions of the middle school stormwater calculations and will try to find the approved calculations. He stated that if there is any additional capacity in the existing underground system it can be used for this project.

- b. Groundwater recharge requirements - Can we take a credit for the impervious surface (parking lot pavement) we are removing as a result of the soccer field displacing a portion of the lot.

Response: Credit can be taken for the reduction in impervious surfaces. Scot stated that the state regulations indicate groundwater recharge is not required for sites with contaminated soil. Dave stated that the capping material is mainly a separation barrier and not an impermeable barrier to restrict infiltration. Due to the type of contaminated materials on-site there is no risk of groundwater contamination. Using infiltration will not contribute to groundwater contamination and that ongoing groundwater monitoring is occurring.

- c. If the Soccer field is considered “a pervious surface” What is an acceptable curve

number to represent the soccer field for runoff modeling purposes?

Response: The soccer field can be considered pervious surface.

- d. If the turf manufacturer requires underdrain system for the soccer fields can it still qualify as an infiltration BMP?

Response: Underdrain system is acceptable. Scott said because of soil contamination at the site, infiltration for groundwater recharge is not required.

- e. The current design does not call for any construction of roadways or parking. What will be the TSS requirements for a soccer field and basketball court?

Response: Scott understands the proposed cover types have a minimal potential for pollutant loading. The city stated that the soccer field will not be used for snow storage. Scott recommended a shallow perimeter swale around the soccer field to collect any crumb rubber materials from leaving the site and entering the wetland.

- f. Pre/Post analysis – currently a major portion of the site drains into an on-site isolated wetland and then outlets to the wetland on the west side of the school. Reducing the 2-yr and 10-yr peak rates should not be a problem. If there is a minor increase in the 100-year peak rate is this acceptable? Otherwise a much larger subsurface detention storage system will probably be needed.

Response: Post development peak runoff rates to be controlled to pre development peaks rates. No waiver for peak rate increases is likely to be granted.

2. Other Issues:

- a. It is likely that the NOI will be submitted prior to submittal of the Remedy Implementation Plan so EPA approval will not be in-place at the time of the NOI. However, the EPA has approved the Phase III report which selected the proposed turf field configuration and conceptual drainage plan.
- b. As part of the submittal package, TRC will provide written documentation that the LSP for the site has approved on-site infiltration of stormwater if necessary.



Wannalancit Mills
650 Suffolk Street
Lowell, MA 01854

978.970.5600 PHONE
978.453.1995 FAX

www.TRCSolutions.com

TRC Reference Number: 115058

May 12, 2016

Mr. Scott Turner, PE, AICP, LEED AP ND
Nitsch Engineering
2 Center Plaza, Suite 430
Boston, Massachusetts 02108

**Subject: Influence of Storm Water Infiltration on Impacted Fill
Nemasket Street Lots - Parker Street Waste Site
New Bedford, Massachusetts
Release Tracking Number 4-15685**

Dear Mr. Turner:

As you are aware, TRC Environmental Corporation (TRC) is working with the City of New Bedford, Massachusetts to implement a remedial alternative under the Massachusetts Contingency Plan (MCP) that involves the following Nemasket Street properties: map 69, blocks 86 through 93, and blocks 96 through 100, hereafter referred to as "the Site". The Phase II Comprehensive Site Assessment (Phase II) that was completed in January 2012, indicates that fill material was placed at the Site sometime during the period between the 1940s and the 1970s. The fill consists of sandy soil intermingled with ash, coal fragments, asphalt, rubber, slag, brick, concrete, porcelain, glass, fabric, plastic and metal, and is present across the Site and overlies native peat and glaciofluvial deposits. The chemical quality of the fill has been extensively characterized through laboratory analysis. Samples collected and analyzed as part of the Phase II found that the fill material contains certain metals (i.e., arsenic, barium, cadmium, chromium, lead and nickel), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and dioxins above Massachusetts Department of Environmental Protection (MassDEP) soil cleanup standards which consider the potential mobility of these analytes for protection of groundwater.

The remedy for the Site involves the targeted removal of localized fill that contains greater than 100 milligrams per kilogram (mg/kg) total PCBs and redeveloping the Site as a community athletic complex that principally includes a soccer field and basketball courts. The fill will be covered with three feet of clean soil and three types of exposure barriers will be used to limit the potential for direct contact with residual constituents present in the fill. Since two of the three types of exposure barriers (i.e., artificial turf and clean soil) that will be used over the vast majority of the Site are pervious and will allow for continued infiltration of precipitation through the fill, the New Bedford Conservation Commission has requested information from the Licensed Site Professional (LSP) of Record that infiltration is appropriate at this Site given the nature of the impacted fill. This letter provides the requested documentation.

Infiltration is considered appropriate for the Site since the constituents of interest in the fill exhibit a low potential for mobility. As noted above, the fill contains concentrations of certain PAHs, PCBs, dioxins, and metals that are above Massachusetts soil cleanup standards, which take into consideration the potential migration of these constituents from soil to groundwater. Note that the fill materials at the Site contain significant quantities of ash, decomposing wood and cinders which are an abundant source of organic carbon¹.

TRC estimated the maximum theoretical concentration of the PAHs, PCBs, and dioxins that could potentially partition from the soil into water that percolates through the fill (see Attachment 1) using the following equation (Freeze and Cherry, 1979)² and site-specific values of organic carbon:

$$C_w = C_s / (K_{oc} * f_{oc})$$

Where: C_w = the maximum equilibrium concentration of the analyte in water that can partition from soil containing the analyte, mass/volume;
 C_s = the concentration of the analyte of interest in soil, mass/mass;
 K_{oc} = Organic carbon partitioning coefficient, volume/mass; and
 f_{oc} = the fraction of organic carbon in the soil/fill.

To provide a conservative worst-case estimate, the maximum concentrations of PAHs, PCBs, and dioxins detected in the fill were used to estimate the concentration of the analytes in water that contacts the fill. As shown in Attachment 1, the maximum concentrations of PAHs, PCBs and dioxins that could leach from the fill and migrate to groundwater are orders of magnitude lower than the applicable GW-2 or GW-3 groundwater cleanup standards that apply to the Site. These data indicate that the fill material is not capable of contributing dissolved PAHs, PCBs, or dioxins to groundwater at levels that could pose a risk to potential receptors. It should be noted that the calculated concentrations do not account for attenuation processes in the subsurface that would further reduce concentrations of these analytes in groundwater.

Unlike organic substances (e.g., PAHs, PCBs, and dioxins), the mobility of the metals of interest (i.e., arsenic, barium, cadmium, chromium, lead, and nickel) is influenced primarily by adsorption of these metals onto minerals that exist within soil or fill, the stability of these minerals, and redox reactions that occur in response to precipitation and storm water infiltration through the fill. These processes, and thus metals mobility, are controlled largely by the pH of the precipitation and storm water. As previously noted, the fill will be covered with precharacterized clean soil that would be below applicable Massachusetts soil cleanup standards and synthetic turf and pavement which are inert. These materials will not significantly alter the pH or chemical characteristics of precipitation or storm water, which has been percolating through the fill for over 30 years. Based on the most current groundwater data which was presented in the Phase II, metals concentrations in wells located at and immediately downgradient of the Site meet the GW-3 groundwater criteria that apply to the Site as well as the more stringent GW-1 criteria³. Since the pH and chemical characteristics of the storm water and precipitation is anticipated to be similar to existing conditions, the geochemical reactions and stability of

¹ The average fraction of organic carbon in the soil/fill measured during the Phase II ranged from 0.094 and ranged from 0.0735 to 0.1149.

² Freeze, R.A. and J.A. Cherry, 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.

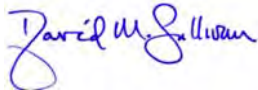
³ GW-2 standards apply to compounds that could potentially volatilize from groundwater to soil gas and cause a vapor intrusion concern to indoor air. Since metals do not volatilize, GW-2 criteria do not apply to metals.

minerals that currently limit the mobility of metals are not expected to change. Therefore, there is no basis to conclude that concentrations of metals in groundwater will increase to a level that would pose a risk to potential receptors as a result of infiltration.

If you have any questions or comments, please do not hesitate to contact me at 978-656-3565.

Sincerely,

TRC



David M. Sullivan, LSP
Senior Project Manager

Attachment

Attachment 1
Estimated Maximum Theoretical Concentrations of Organic Constituents of Interest
That Could Leach from Fill
Nemasket Street Properties
New Bedford, Massachusetts

Statement of Problem:

Estimate the theoretical maximum concentration of organic constituents in water infiltrating the fill as the Nemasket Street properties for those constituents exceeding Massachusetts Contingency Plan (MC) generic Method 1 Soil Standards that consider protection of groundwater.

Approach:

The theoretical equilibrium concentration of a constituent that can partition from soil into water contained in the soil pore space is a linear process that is characterized by the Freundlich Isotherm and can be mathmatically expressed by the following equation:

$$C_w = C_g / K_d$$

Where: C_w = Theoretical concentration of constituent in sporewater infiltration through the soil/fill, mass/volume;

C_g = Concentration of constituent in the soil/fill, mass/volume;

K_d = Soil distribution coefficient = $K_{oc} * f_{oc}$, volume/mass;

K_{oc} = organic carbon partitioning coefficient; and

f_{oc} = fraction of organic carbon in the soil/fill, unitless.

Organic carbon partitioning coefficients for organic constituents are established in the scientific literature and were presented in the Phase II Investigation Report (TRC, 2012). The average fraction organic carbon content of thesoil/ fill based on samples analyzed as part of the Phase II Investigation of the Nemasket Street Properties to be 0.094. The organic carbon content is consistent with the presence ash, cinders, wood debris and other sources of organic carbon within the fill. Based on these data and the maximum concentrations of constituents detected in the soil, the maximum theoretical concentrations the the constituents that could be expected to partition from the fill to stormwater or precipitation infiltrating the fill was conservatively estimated in the following table.

Compound	Maximum Concentration in Fill (mg/Kg)	Organic Carbon Partitioning Coefficient, K _{oc} (L/Kg)	Fraction of Organic Carbon, f _{oc} (unitless)	Distribution Coefficient, K _d (L/Kg)	Theoretical Maximum		Applicable MCP Groundwater Criteria	
					Pore Water Concentration, C _w		GW-2 (µg/L)	GW-3 (µg/L)
					(mg/L)	(µg/L)		
Organic Analytes								
Acenaphthylene	13	4,786	0.094	451	0.029	29	10000	40
Benzo(a)anthracene	120	358,000	0.094	33,759	0.004	4	NA	1,000
Benzo(a)pyrene	93	969,000	0.094	91,377	0.001	1	NA	500
Benzo(b)fluoranthene	130	1,230,000	0.094	115,989	0.001	1	NA	400
Chrysene	130	398,000	0.094	37,531	0.003	3	NA	70
Dibenz(a,h)anthracene	15	1,790,000	0.094	168,797	8.89E-05	0.1	NA	40
ideno(1.2.3-cd)pyrene	53	3,470,000	0.094	327,221	1.62E-04	0.2	NA	100
PCBs	95.295	309,000	0.094	29,139	0.003270393	3	5	10
Dioxins (TEQ)	0.41	1,584,893	0.094	148979.942	2.75E-06	2.75E-03	NA	0.04

As shown in the table above, the maximum concentration of organic constituents of interest would not exceed the groundwater standards that apply to the Site.

Notes:

1. mg/Kg = milligrams per kilogram
2. L/Kg = Liters per kilogram.
3. mg/L = Milligrams per liter.
4. µg/liter.

**Attachment B
Water Quality Calculations**

PROJECT: Newmarket	Calculated By: PGT
New Bedford, MA	Checked By: PMM
Proj. No.: 115058	Date: March 2, 2018
	Sheet: 1 of 1

Infiltration Volume Calculations

Impervious Area Calculations: **2SA** Soccer field area (195' x 290')

Existing Impervious Area Removed, A _{EX} :	0	sq.ft
New Impervious Area Created, A _{NEW} :	56,550	sq.ft
Net Increase of Impervious Area, A _{TOTAL} :	56,550	sq.ft

Massachusetts Stormwater Handbook, Volume 1, Standard 3 "Groundwater Recharge" - "The intent of this standard is to ensure that the infiltration volume of precipitation into the ground under post-development conditions is at least as much as the infiltration volume under pre-development conditions."

The volume is calculated by multiplying the new impervious area for each hydrologic soil group by the infiltration coefficient for that soil group.

For this project, all new impervious area is located on HSG A soils.

HSG	Coefficient (inches)	Imp.Area (sf)
A	0.60	56,550
B	0.35	0
C	0.25	0
D	0.10	0

$$\text{Vol.} = (\text{Area}_A * 0.60) + (\text{Area}_B * 0.35) + (\text{Area}_C * 0.25) + (\text{Area}_D * 0.01) / 12 \text{ cf}$$

$$\text{Vol.} = 2,828 \text{ cf}$$

Massachusetts Stormwater Handbook, Volume 1, Standard 4 "Water Quality Volume" - "Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS)."

For this project, the required Water Quality Volume (WQv) equals 1.0 inches of runoff times the new impervious area of the post-development site.

$$\text{WQv} = A_{\text{TOTAL}} * 1.0" / 12 \text{ cf}$$

$$\text{WQv} = 4713 \text{ cf}$$

A_{EX} includes part of the existing paved parking lot.

A_{NEW} includes soccer field.

Infiltration Volume Provided:

The soccer field infiltration provides 30,085 cubic feet of storage at a water surface elevation of 94.25 feet. See Pond Node 1P for stage storage table.

PROJECT: Newmasket New Bedford, MA Proj. No.: 115058	Calculated By: PGT Checked By: PMM Date: March 2, 2018 Sheet: 1 of 1
--	---

Drawdown Calculations for Infiltration BMP's

To determine whether an infiltration BMP will drain within 72 hours. The following formula must be used:

$$\text{Time}_d = \frac{R_v}{(K)(1\text{ft}/12\text{in})(BA)}$$

Where:

- R_v** = Storage volume
K = Saturated Hydraulic Conductivity For "Static" and "Simple Dynamic" Methods, use Rawls Rate (see Table 2.3.3).
For "Dynamic Field" Method, use 50% of the in-situ saturated hydraulic conductivity.
BA = Bottom Area of Recharge Structure

Massachusetts Stormwater Handbook, Volume 3, Chapter 1 Page 25 "Documenting Compliance with the Massachusetts Stormwater Management Standards"

Infiltration	R_v	K	BA	Time_d	Required
Id#	ft ³	(in/hr)	ft ²	hr	hr
3P	30,085	0.335	68544	15.8	72

Double Ring Infiltrometer field testing was performed on April 20th and 21st 2016.

Hydraulic conductivity values used for the infiltration design are as follows:

Test site	Approximate Maximum steady State	50% Saturated Hydraulic Conductivity
INF-4	0.67 in/hr	0.335
INF-5	5.23 in/hr	2.615

Attachment C
Pre- and Post-Development HydroCAD Routings and Calculations

PROJECT:	City of New Bedford MA	Calculated By:	PGT
	Newmarket St - Soccer Field	Date:	3/2/2018
Proj. No.:	115058.0000.00000	Checked By:	PMM
	Time of Concentration Summary	Date:	

Time of Concentration Equations:

- Where $T_t := \frac{0.007 \cdot (N \cdot L)^{0.8}}{P_2^{0.5} \cdot S^{0.4}}$ from SCS TR-55. For Sheet Flow (300 feet or less)
- Where $V := 20.3282 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Paved surfaces)
- Where $T_t := \frac{L}{3600 \cdot V}$ from the SCS Upland Method *Channel Flow Chart* Travel time equation
- Where $v := 16.1345 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Unpaved surfaces)
- Where: $v = 7 \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Short Grass Pasture)
- Where: $v = 5 \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Woodland)
- Where $v := 12 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Waterways and Swamps, No Channels
- Where $v := 15 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Grassed Waterways and Roadside Ditches
- Where $v := 21 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Small Tributary & Swamp w/Channels
- Where $v := 35 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Large Tributary
- Where $v := 60 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Main River
- Where $v := \frac{1.49 \cdot R^{0.667} \cdot \sqrt{S}}{N}$ For Channel Flow - Culvert Flow
- Where $P_2 = 2$ -Year, 24 Hour Rainfall (in) (Bristol, County: $P_2 = 3.4$ inches)

Mannings Roughness Coefficients Table

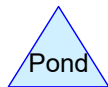
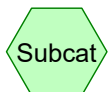
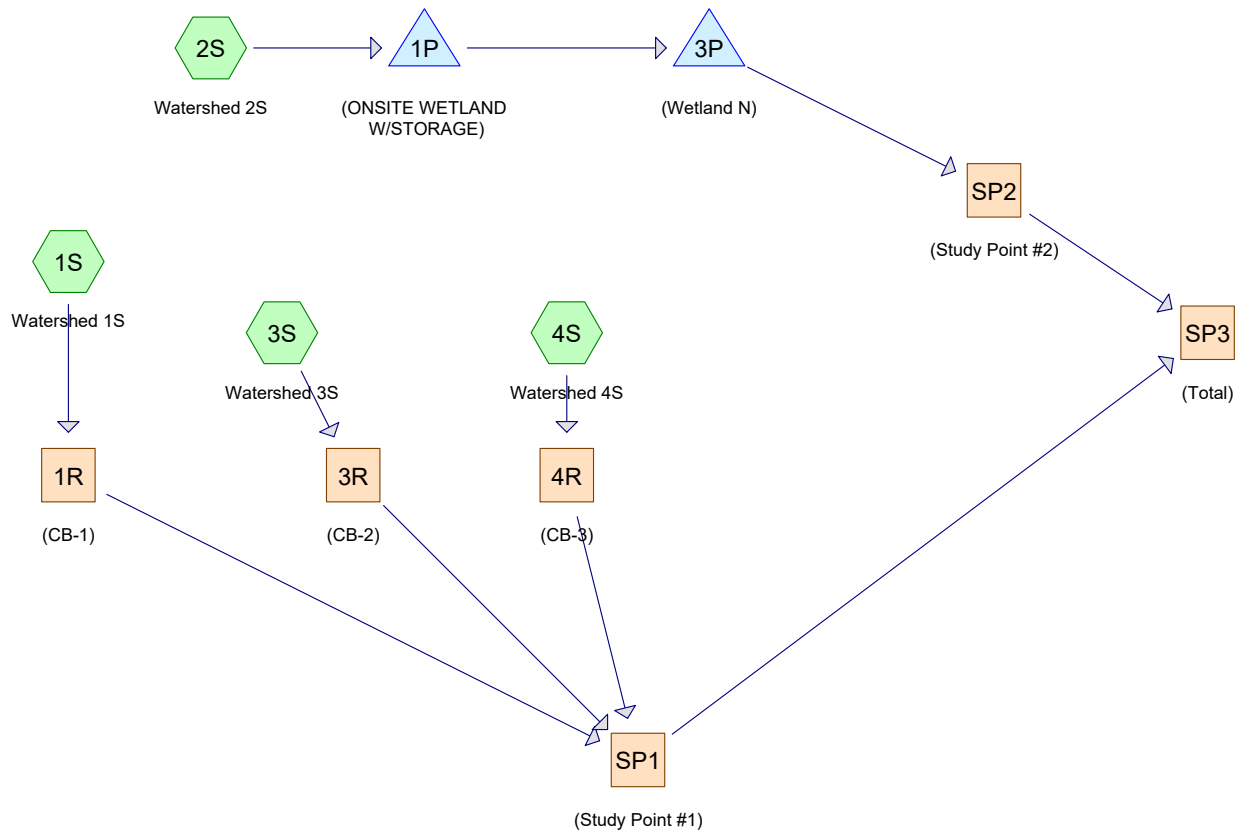
Surface Description	n - value
Smooth surfaces	0.011
Crush Stone/Substation Yards	0.025
Fallow	0.050
Cultivated: Residue<=20%	0.060
Cultivated: Residue>=20%	0.170
Grass: Short	0.150
Grass: Dense	0.240
Grass: Bermuda	0.410
Range	0.130
Woods: Light underbrush	0.400
Woods: Dense underbrush	0.800

PROJECT:	City of New Bedford MA		Calculated By:		PGT		
	Newmasket St - Soccer Field		Checked By:		PMM		
TRc Proj. No.:	115058.0000.00000		Date:		3/2/18		
Subcatchment:	Pre Dev 1S		Revised:				
Time of Concentration Determination Worksheet, SCS Methods							
	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	
	Seg 7	Seg 8					
SHEET FLOW							
Manning's No.	0.41						
Length, ft	50						
P2, in	3.4						
Slope, ft/ft	0.0085						
T _t ¹ , hr	0.286						0.2864
SHALLOW CONCENTRATED FLOW							
Paved							
Length, ft							
Slope, ft/ft							
Velocity ² , ft/sec							
T _t ³ , hr							0.0000
Unpaved							
Length, ft							
Slope, ft/ft							
Velocity ² , ft/sec							
T _t ³ , hr							0.0000
Short Grass Pasture							
Length, ft		49					
Slope, ft/ft		0.0429					
Velocity ⁴ , ft/sec		1.4499					
T _t ³ , hr		0.009					0.0094
Woodland							
Length, ft							
Slope, ft/ft							
Velocity ⁵ , ft/sec							
T _t ³ , hr							0.0000
CHANNEL FLOW							
Waterways & Swamps, No Channels							
Length, ft							
Slope, ft/ft							
Velocity ⁶ , ft/sec							
T _t ³ , hr							0.0000
Grassed Waterways/Roadside Ditches							
Length, ft							
Slope, ft/ft							
Velocity ⁷ , ft/sec							
T _t , hr							0.0000
Small Tributary & Swamp w/Channels							
Length, ft							
Slope, ft/ft							
Velocity ⁸ , ft/sec							
T _t , hr							0.0000
Large Tributary							
Length, ft							
Slope, ft/ft							
Velocity ⁹ , ft/sec							
T _t , hr							0.0000
Culvert							
Diameter, ft							
Area, ft ²							
Wetted Perimeter, ft							
Hydraulic Radius, R, ft							
Slope, ft/ft							
Manning's No.							
Velocity ¹² , ft/sec							
Length, L, ft							
T _t , hr							0.0000
						HR	0.296
						Min	17.75

PROJECT:	City of New Bedford MA		Calculated By:		PGT		
	Newmasket St - Soccer Field		Checked By:		PMM		
TRc Proj. No.:	115058.0000.00000		Date:		3/2/18		
Subcatchment:	Pre Dev 2S		Revised:				
Time of Concentration Determination Worksheet, SCS Methods							
	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	
	Seg 7	Seg 8					
SHEET FLOW							
Manning's No.	0.41						
Length, ft	50						
P2, in	3.4						
Slope, ft/ft	0.008						
T _t ¹ , hr	0.293						0.2934
SHALLOW CONCENTRATED FLOW							
Paved							
Length, ft							
Slope, ft/ft							
Velocity ² , ft/sec							
T _t ³ , hr							0.0000
Unpaved							
Length, ft							
Slope, ft/ft							
Velocity ² , ft/sec							
T _t ³ , hr							0.0000
Short Grass Pasture							
Length, ft		54					
Slope, ft/ft		0.0574					
Velocity ⁴ , ft/sec		1.6771					
T _t ³ , hr		0.009					0.0089
Woodland							
Length, ft							
Slope, ft/ft							
Velocity ⁵ , ft/sec							
T _t ³ , hr							0.0000
CHANNEL FLOW							
Waterways & Swamps, No Channels							
Length, ft							
Slope, ft/ft							
Velocity ⁶ , ft/sec							
T _t ³ , hr							0.0000
Grassed Waterways/Roadside Ditches							
Length, ft			217				
Slope, ft/ft			0.0184				
Velocity ⁷ , ft/sec			2.035				
T _t , hr			0.030				0.0296
Small Tributary & Swamp w/Channels							
Length, ft							
Slope, ft/ft							
Velocity ⁸ , ft/sec							
T _t , hr							0.0000
Large Tributary							
Length, ft							
Slope, ft/ft							
Velocity ⁹ , ft/sec							
T _t , hr							0.0000
Culvert							
Diameter, ft							
Area, ft ²							
Wetted Perimeter, ft							
Hydraulic Radius, R, ft							
Slope, ft/ft							
Manning's No.							
Velocity ¹² , ft/sec							
Length, L, ft							
T _t , hr							0.0000
						HR	0.332
						Min	19.92

PROJECT:	City of New Bedford MA		Calculated By:		PGT		
	Newmasket St - Soccer Field		Checked By:		PMM		
TRc Proj. No.:	115058.0000.00000		Date:		3/2/18		
Subcatchment:	Pre Dev 3S		Revised:				
Time of Concentration Determination Worksheet, SCS Methods							
	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	
	Seg 7	Seg 8					
SHEET FLOW							
Manning's No.	0.41						
Length, ft	50						
P2, in	3.4						
Slope, ft/ft	0.0358						
T _t ¹ , hr	0.161						0.1611
SHALLOW CONCENTRATED FLOW							
Paved							
Length, ft		13					
Slope, ft/ft		0.0538					
Velocity ² , ft/sec		4.7150908					
T _t ³ , hr		0.001					0.0008
Unpaved							
Length, ft							
Slope, ft/ft							
Velocity ² , ft/sec							
T _t ³ , hr							0.0000
Short Grass Pasture							
Length, ft							
Slope, ft/ft							
Velocity ⁴ , ft/sec							
T _t ³ , hr							0.0000
Woodland							
Length, ft							
Slope, ft/ft							
Velocity ⁵ , ft/sec							
T _t ³ , hr							0.0000
CHANNEL FLOW							
Waterways & Swamps, No Channels							
Length, ft							
Slope, ft/ft							
Velocity ⁶ , ft/sec							
T _t ³ , hr							0.0000
Grassed Waterways/Roadside Ditches							
Length, ft							
Slope, ft/ft							
Velocity ⁷ , ft/sec							
T _t , hr							0.0000
Small Tributary & Swamp w/Channels							
Length, ft							
Slope, ft/ft							
Velocity ⁸ , ft/sec							
T _t , hr							0.0000
Large Tributary							
Length, ft							
Slope, ft/ft							
Velocity ⁹ , ft/sec							
T _t , hr							0.0000
Culvert							
Diameter, ft							
Area, ft ²							
Wetted Perimeter, ft							
Hydraulic Radius, R, ft							
Slope, ft/ft							
Manning's No.							
Velocity ¹² , ft/sec							
Length, L, ft							
T _t , hr							0.0000
						HR	0.162
						Min	9.71

PROJECT:	Ngrid		Calculated By:		PGT		
	Newmasket St - Soccer Field		Checked By:		PMM		
TRc Proj. No.:	115058.0000.00000		Date:		3/2/18		
Subcatchment:	Post Dev 2S		Revised:				
Time of Concentration Determination Worksheet, SCS Methods							
	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	
	Seg 7	Seg 8					
SHEET FLOW							
Manning's No.	0.41						
Length, ft	82						
P2, in	3.4						
Slope, ft/ft	0.1158						
T _t ¹ , hr	0.150						0.1497
SHALLOW CONCENTRATED FLOW							
Paved							
Length, ft							
Slope, ft/ft							
Velocity ² , ft/sec							
T _t ³ , hr							0.0000
Unpaved							
Length, ft							
Slope, ft/ft							
Velocity ² , ft/sec							
T _t ³ , hr							0.0000
Short Grass Pasture							
Length, ft							
Slope, ft/ft							
Velocity ⁴ , ft/sec							
T _t ³ , hr							0.0000
Woodland							
Length, ft							
Slope, ft/ft							
Velocity ⁵ , ft/sec							
T _t ³ , hr							0.0000
CHANNEL FLOW							
Waterways & Swamps, No Channels							
Length, ft							
Slope, ft/ft							
Velocity ⁶ , ft/sec							
T _t ³ , hr							0.0000
Grassed Waterways/Roadside Ditches							
Length, ft	185						
Slope, ft/ft	0.0027						
Velocity ⁷ , ft/sec	0.779						
T _t , hr	0.066						0.0659
Small Tributary & Swamp w/Channels							
Length, ft							
Slope, ft/ft							
Velocity ⁸ , ft/sec							
T _t , hr							0.0000
Large Tributary							
Length, ft							
Slope, ft/ft							
Velocity ⁹ , ft/sec							
T _t , hr							0.0000
Culvert							
Diameter, ft							
Area, ft ²							
Wetted Perimeter, ft							
Hydraulic Radius, R, ft							
Slope, ft/ft							
Manning's No.							
Velocity ¹¹ , ft/sec							
Length, L, ft							
T _t , hr							0.0000
						HR	0.216
						Min	12.94



2018-02-28 - Nemasket Pre Dev Model

Prepared by TRC

Printed 3/2/2018

HydroCAD® 10.00-20 s/n 01728 © 2017 HydroCAD Software Solutions LLC

Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.153	39	>75% Grass cover, Good, HSG A (3S, 4S)
1.552	48	Brush, Poor, HSG A (1S, 2S, 3S, 4S)
0.087	83	Brush, Poor, HSG D (1S, 2S)
0.040	98	Paved parking, HSG A (4S)
0.030	77	Woods, Good, HSG D (1S)
0.021	45	Woods, Poor, HSG A (2S)
0.338	83	Woods, Poor, HSG D (2S)
2.221	55	TOTAL AREA

2018-02-28 - Nemasket Pre Dev Model

Prepared by TRC

Printed 3/2/2018

HydroCAD® 10.00-20 s/n 01728 © 2017 HydroCAD Software Solutions LLC

Page 3

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.766	HSG A	1S, 2S, 3S, 4S
0.000	HSG B	
0.000	HSG C	
0.455	HSG D	
0.000	Other	1S, 2S
2.221		TOTAL AREA

2018-02-28 - Nemasket Pre Dev Model

Prepared by TRC

Printed 3/2/2018

HydroCAD® 10.00-20 s/n 01728 © 2017 HydroCAD Software Solutions LLC

Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.153	0.000	0.000	0.000	0.000	0.153	>75% Grass cover, Good	3S, 4S
1.552	0.000	0.000	0.087	0.000	1.639	Brush, Poor	1S, 2S, 3S, 4S
0.040	0.000	0.000	0.000	0.000	0.040	Paved parking	4S
0.000	0.000	0.000	0.030	0.000	0.030	Woods, Good	1S
0.021	0.000	0.000	0.338	0.000	0.359	Woods, Poor	2S
1.766	0.000	0.000	0.455	0.000	2.221	TOTAL AREA	

2018-02-28 - Nemasket Pre Dev Model*Type III 24-hr 2YR-24HR Rainfall=3.40"*

Prepared by TRC

Printed 3/2/2018

HydroCAD® 10.00-20 s/n 01728 © 2017 HydroCAD Software Solutions LLC

Page 5

Time span=5.00-36.00 hrs, dt=0.05 hrs, 621 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Watershed 1S	Runoff Area=0.630 ac 0.00% Impervious Runoff Depth=0.20" Tc=17.7 min CN=51 Runoff=0.03 cfs 0.010 af
Subcatchment 2S: Watershed 2S	Runoff Area=1.150 ac 0.00% Impervious Runoff Depth=0.49" Tc=19.9 min CN=60 Runoff=0.30 cfs 0.047 af
Subcatchment 3S: Watershed 3S	Runoff Area=0.180 ac 0.00% Impervious Runoff Depth=0.11" Tc=9.7 min CN=47 Runoff=0.00 cfs 0.002 af
Subcatchment 4S: Watershed 4S	Runoff Area=0.261 ac 15.33% Impervious Runoff Depth=0.20" Tc=6.0 min CN=51 Runoff=0.02 cfs 0.004 af
Reach 1R: (CB-1)	Inflow=0.03 cfs 0.010 af Outflow=0.03 cfs 0.010 af
Reach 3R: (CB-2)	Inflow=0.00 cfs 0.002 af Outflow=0.00 cfs 0.002 af
Reach 4R: (CB-3)	Inflow=0.02 cfs 0.004 af Outflow=0.02 cfs 0.004 af
Reach SP1: (Study Point #1)	Inflow=0.05 cfs 0.016 af Outflow=0.05 cfs 0.016 af
Reach SP2: (Study Point #2)	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach SP3: (Total)	Inflow=0.05 cfs 0.016 af Outflow=0.05 cfs 0.016 af
Pond 1P: (ONSITE WETLAND W/STORAGE)	Peak Elev=85.98' Storage=2,042 cf Inflow=0.30 cfs 0.047 af Outflow=0.00 cfs 0.000 af
Pond 3P: (Wetland N)	Peak Elev=85.00' Storage=0 cf Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.221 ac Runoff Volume = 0.063 af Average Runoff Depth = 0.34"
98.20% Pervious = 2.181 ac 1.80% Impervious = 0.040 ac

Summary for Subcatchment 1S: Watershed 1S

Runoff = 0.03 cfs @ 12.57 hrs, Volume= 0.010 af, Depth= 0.20"

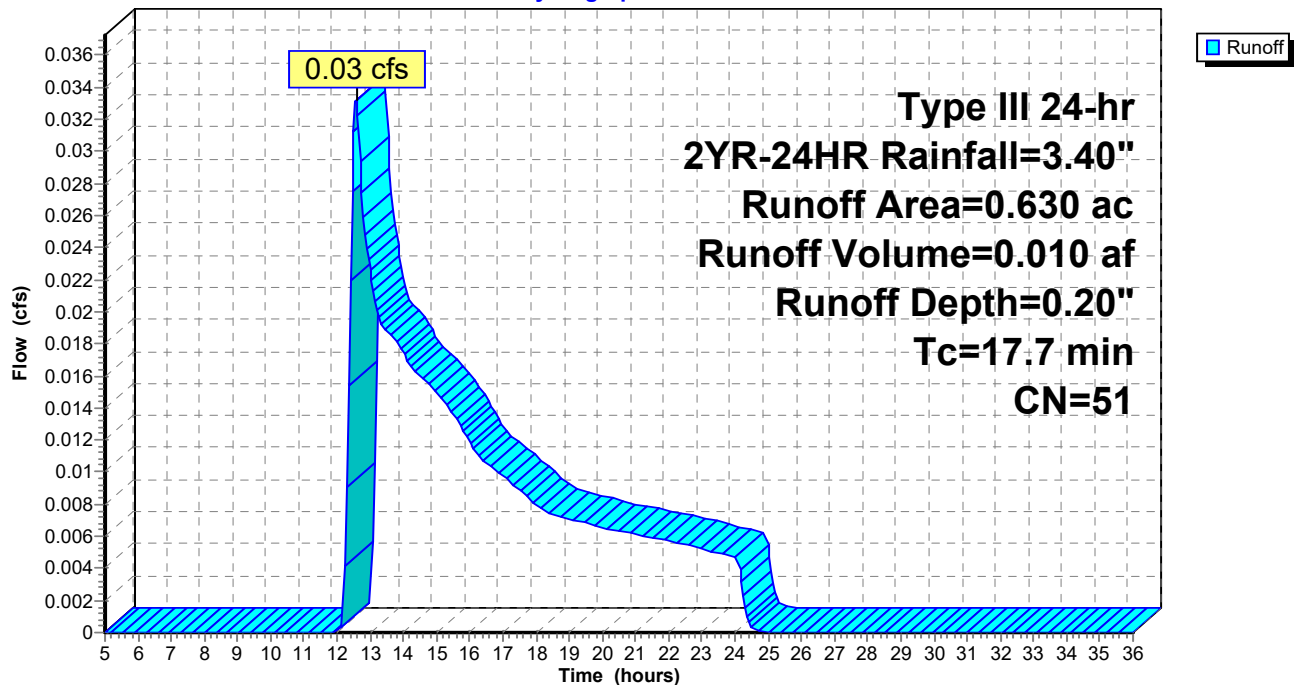
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-24HR Rainfall=3.40"

Area (ac)	CN	Description
0.030	77	Woods, Good, HSG D
0.572	48	Brush, Poor, HSG A
0.028	83	Brush, Poor, HSG D
0.630	51	Weighted Average
0.630		100.00% Pervious Area

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

Subcatchment 1S: Watershed 1S

Hydrograph



Summary for Subcatchment 2S: Watershed 2S

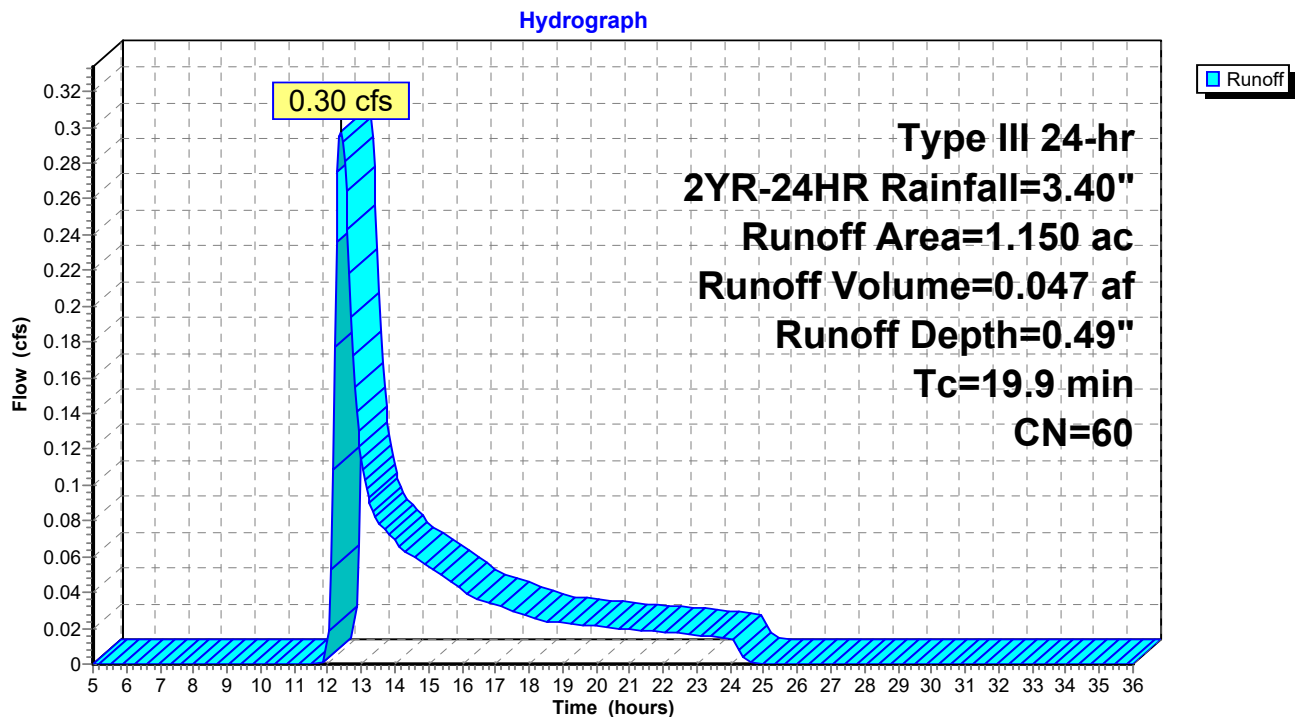
Runoff = 0.30 cfs @ 12.39 hrs, Volume= 0.047 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-24HR Rainfall=3.40"

Area (ac)	CN	Description
0.021	45	Woods, Poor, HSG A
0.338	83	Woods, Poor, HSG D
0.732	48	Brush, Poor, HSG A
0.059	83	Brush, Poor, HSG D
1.150	60	Weighted Average
1.150		100.00% Pervious Area

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

Subcatchment 2S: Watershed 2S



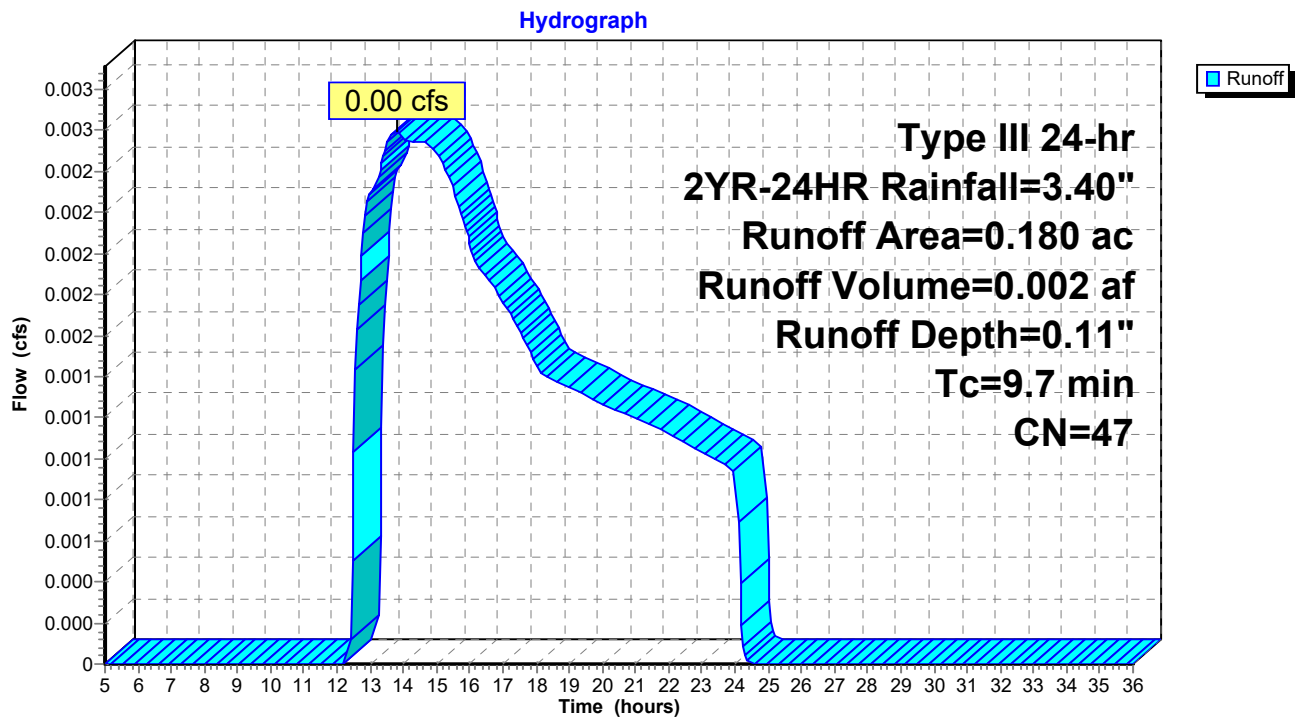
Summary for Subcatchment 3S: Watershed 3S

Runoff = 0.00 cfs @ 13.81 hrs, Volume= 0.002 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-24HR Rainfall=3.40"

Area (ac)	CN	Description
0.014	39	>75% Grass cover, Good, HSG A
0.166	48	Brush, Poor, HSG A
0.180	47	Weighted Average
0.180		100.00% Pervious Area

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

Subcatchment 3S: Watershed 3S

Summary for Subcatchment 4S: Watershed 4S

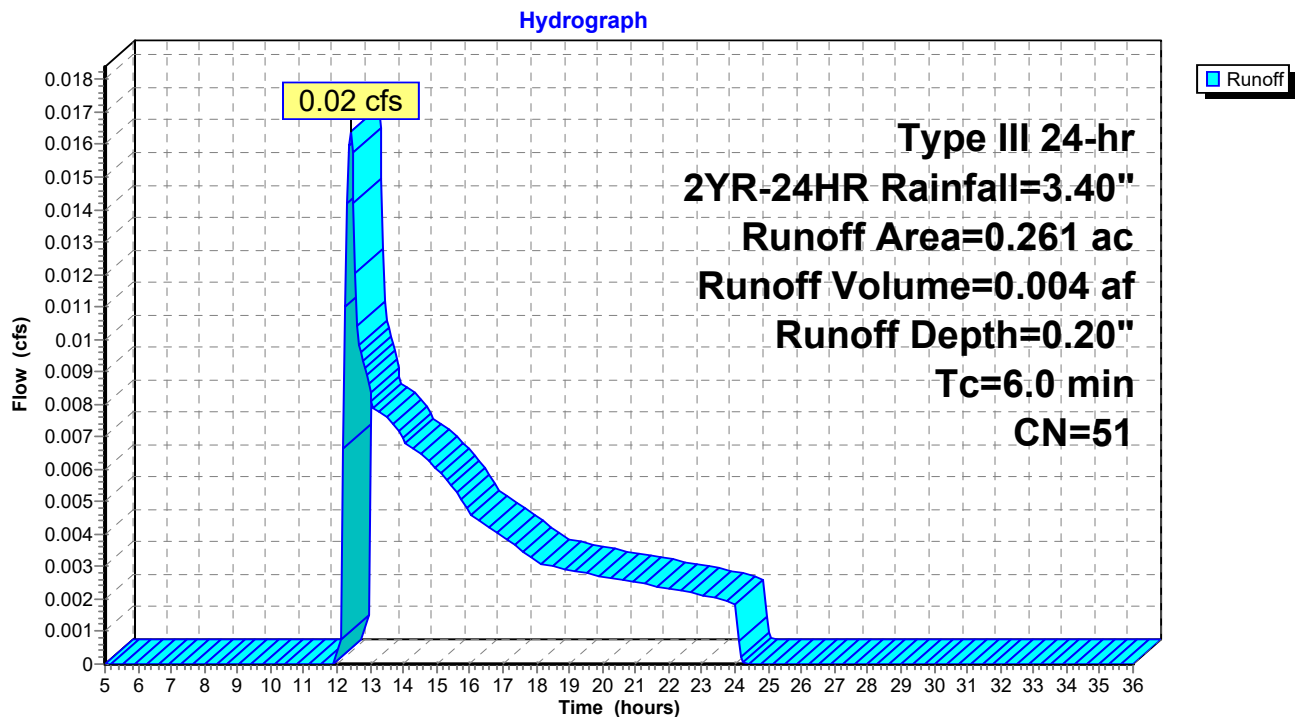
Runoff = 0.02 cfs @ 12.40 hrs, Volume= 0.004 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR-24HR Rainfall=3.40"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.139	39	>75% Grass cover, Good, HSG A
0.082	48	Brush, Poor, HSG A
0.261	51	Weighted Average
0.221		84.67% Pervious Area
0.040		15.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6 minutes - minimum

Subcatchment 4S: Watershed 4S

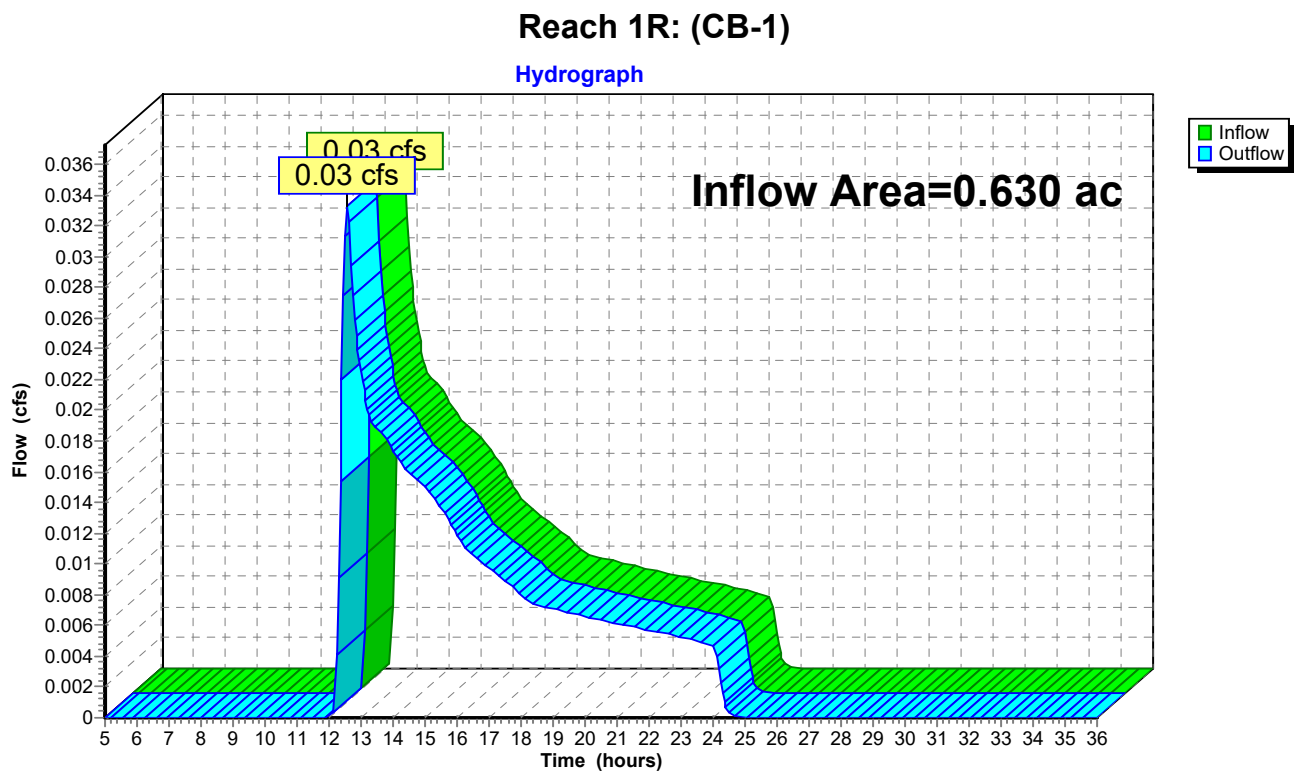


Summary for Reach 1R: (CB-1)

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

Inflow Area = 0.630 ac, 0.00% Impervious, Inflow Depth = 0.20" for 2YR-24HR event
Inflow = 0.03 cfs @ 12.57 hrs, Volume= 0.010 af
Outflow = 0.03 cfs @ 12.57 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

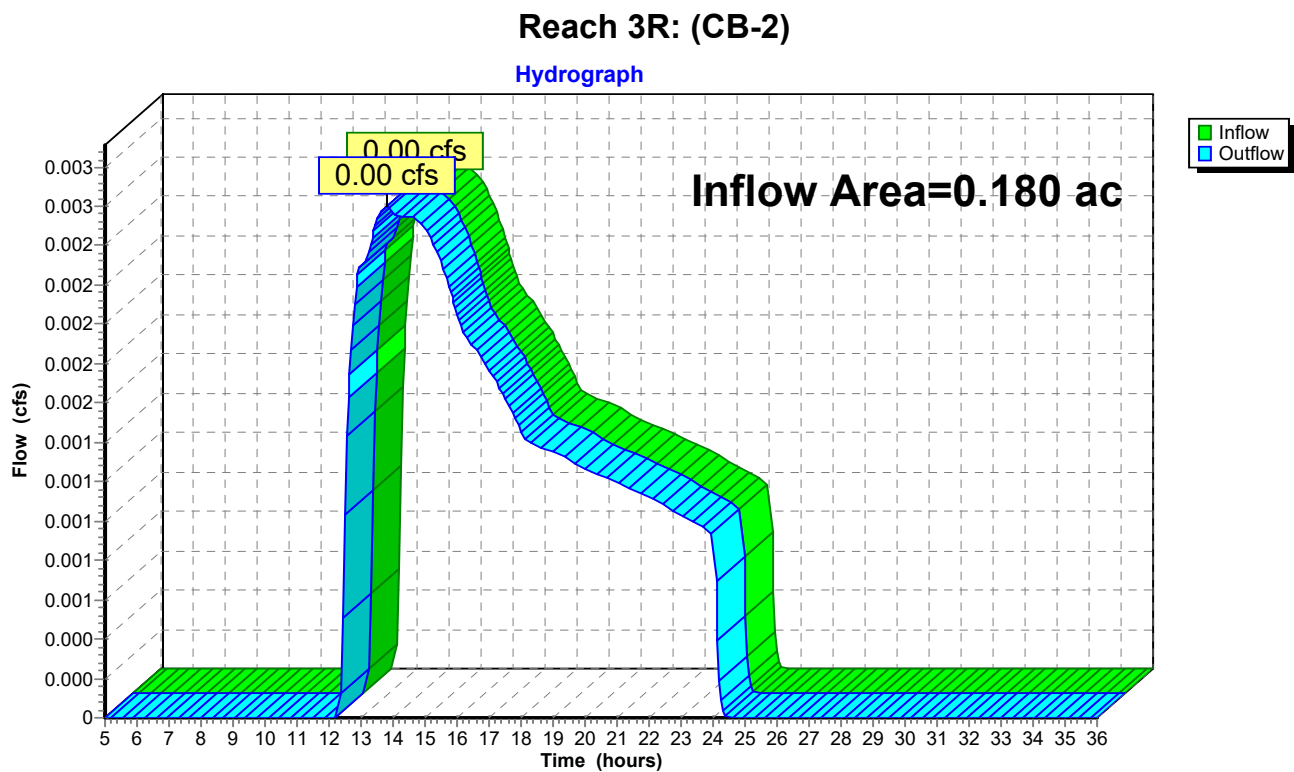


Summary for Reach 3R: (CB-2)

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

Inflow Area = 0.180 ac, 0.00% Impervious, Inflow Depth = 0.11" for 2YR-24HR event
Inflow = 0.00 cfs @ 13.81 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 13.81 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

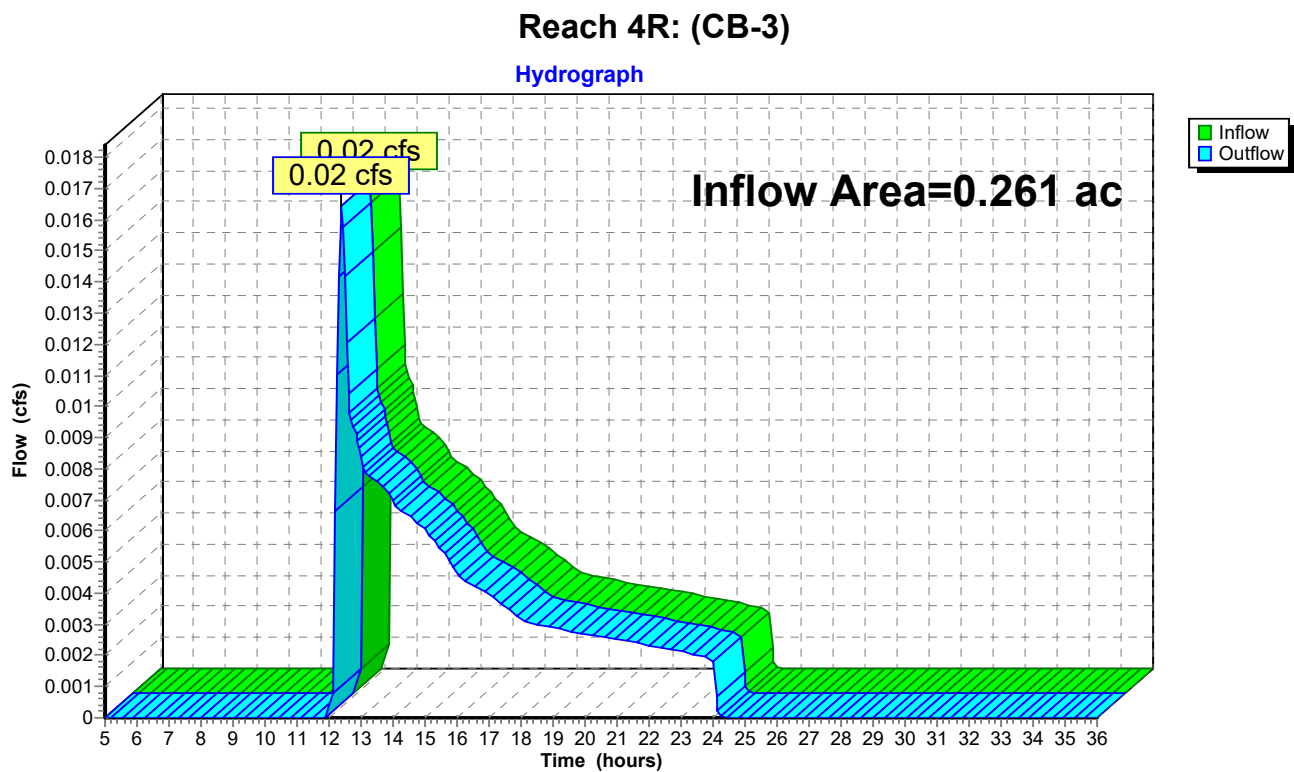


Summary for Reach 4R: (CB-3)

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

Inflow Area = 0.261 ac, 15.33% Impervious, Inflow Depth = 0.20" for 2YR-24HR event
Inflow = 0.02 cfs @ 12.40 hrs, Volume= 0.004 af
Outflow = 0.02 cfs @ 12.40 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

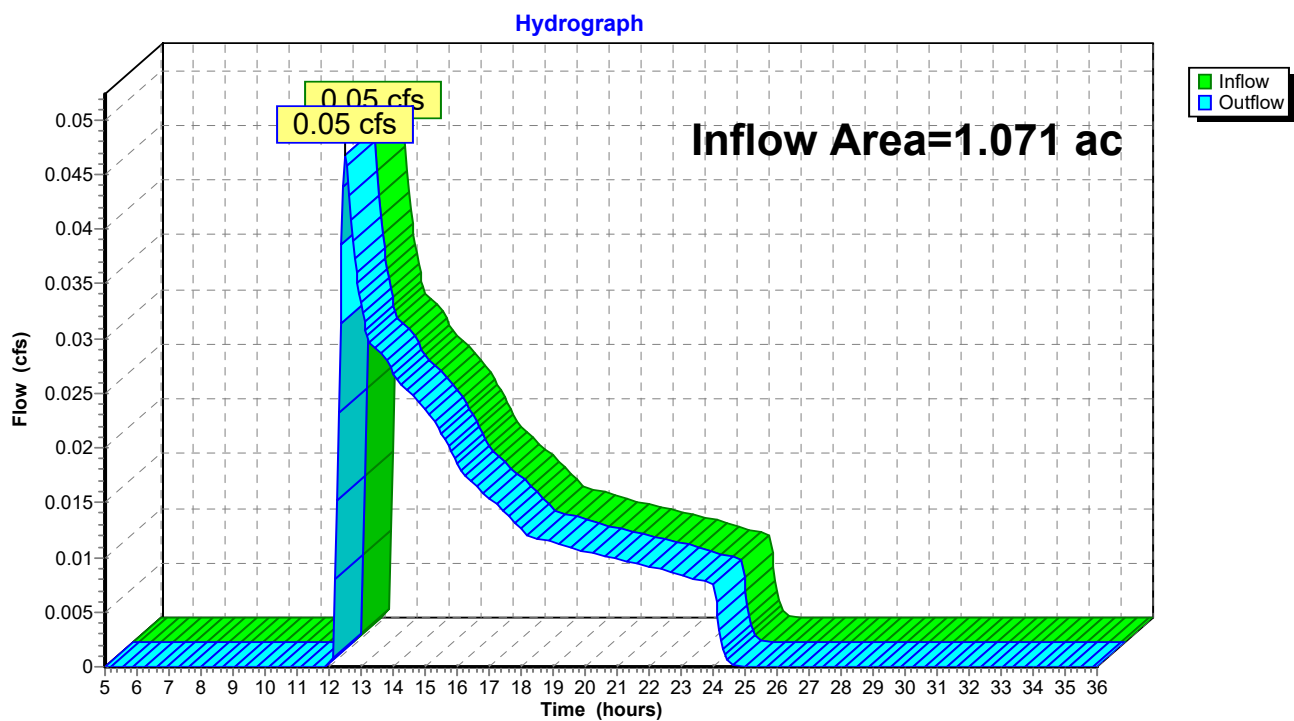


Summary for Reach SP1: (Study Point #1)

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

Inflow Area = 1.071 ac, 3.73% Impervious, Inflow Depth = 0.18" for 2YR-24HR event
Inflow = 0.05 cfs @ 12.53 hrs, Volume= 0.016 af
Outflow = 0.05 cfs @ 12.53 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

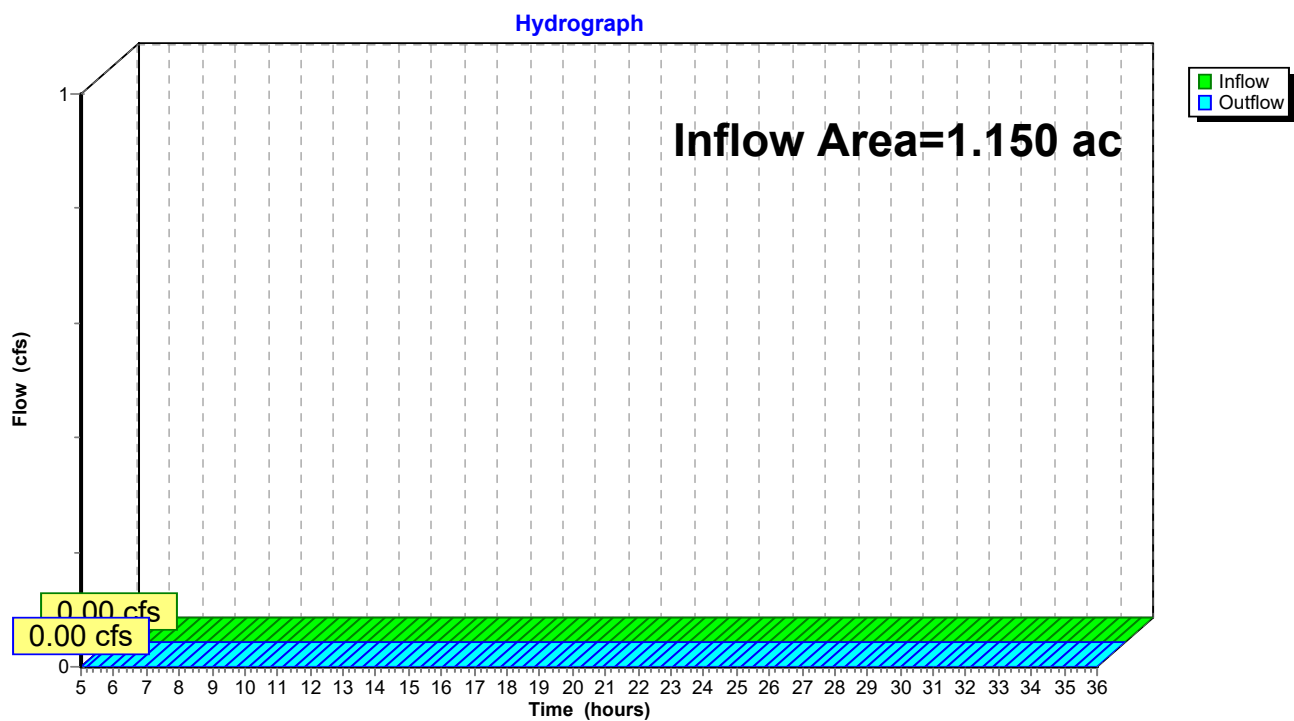
Reach SP1: (Study Point #1)

Summary for Reach SP2: (Study Point #2)

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

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2YR-24HR event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach SP2: (Study Point #2)

Summary for Reach SP3: (Total)

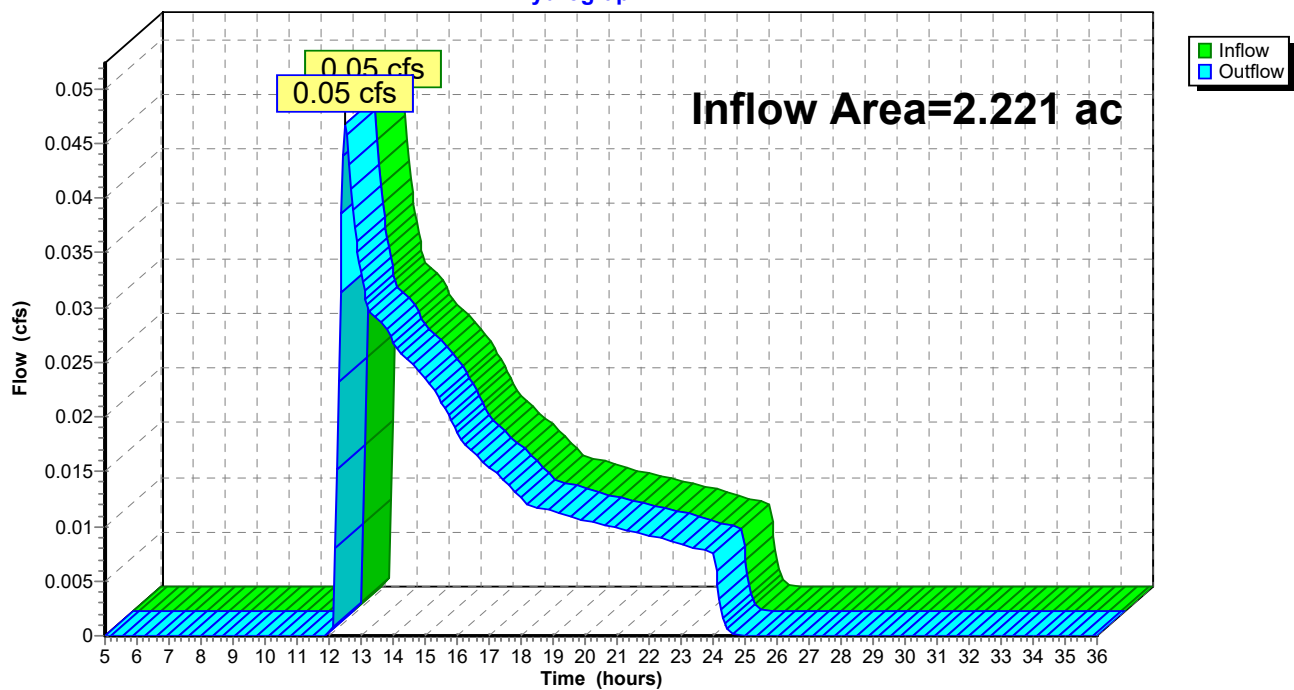
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.221 ac, 1.80% Impervious, Inflow Depth = 0.09" for 2YR-24HR event
Inflow = 0.05 cfs @ 12.53 hrs, Volume= 0.016 af
Outflow = 0.05 cfs @ 12.53 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach SP3: (Total)

Hydrograph



Summary for Pond 1P: (ONSITE WETLAND W/STORAGE)

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 0.49" for 2YR-24HR event
 Inflow = 0.30 cfs @ 12.39 hrs, Volume= 0.047 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 85.98' @ 25.15 hrs Surf.Area= 3,043 sf Storage= 2,042 cf
 Flood Elev= 89.50' Surf.Area= 6,808 sf Storage= 17,798 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	17,798 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

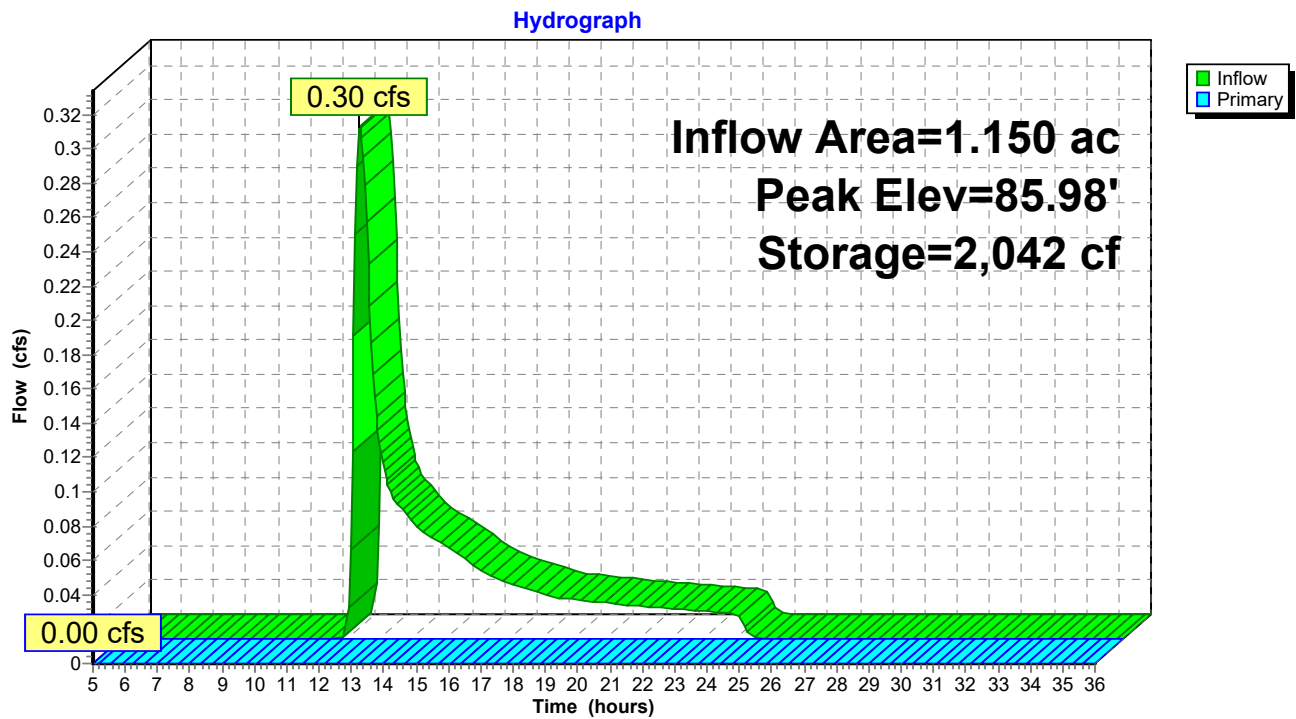
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	1,134	0	0
86.00	3,087	2,111	2,111
87.00	4,474	3,781	5,891
88.00	5,586	5,030	10,921
89.00	6,807	6,197	17,118
89.10	6,808	681	17,798

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	50.0' long x 2.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=85.00' TW=85.00' (Dynamic Tailwater)

↑1=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: (ONSITE WETLAND W/STORAGE)



Summary for Pond 3P: (Wetland N)

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2YR-24HR event
 Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

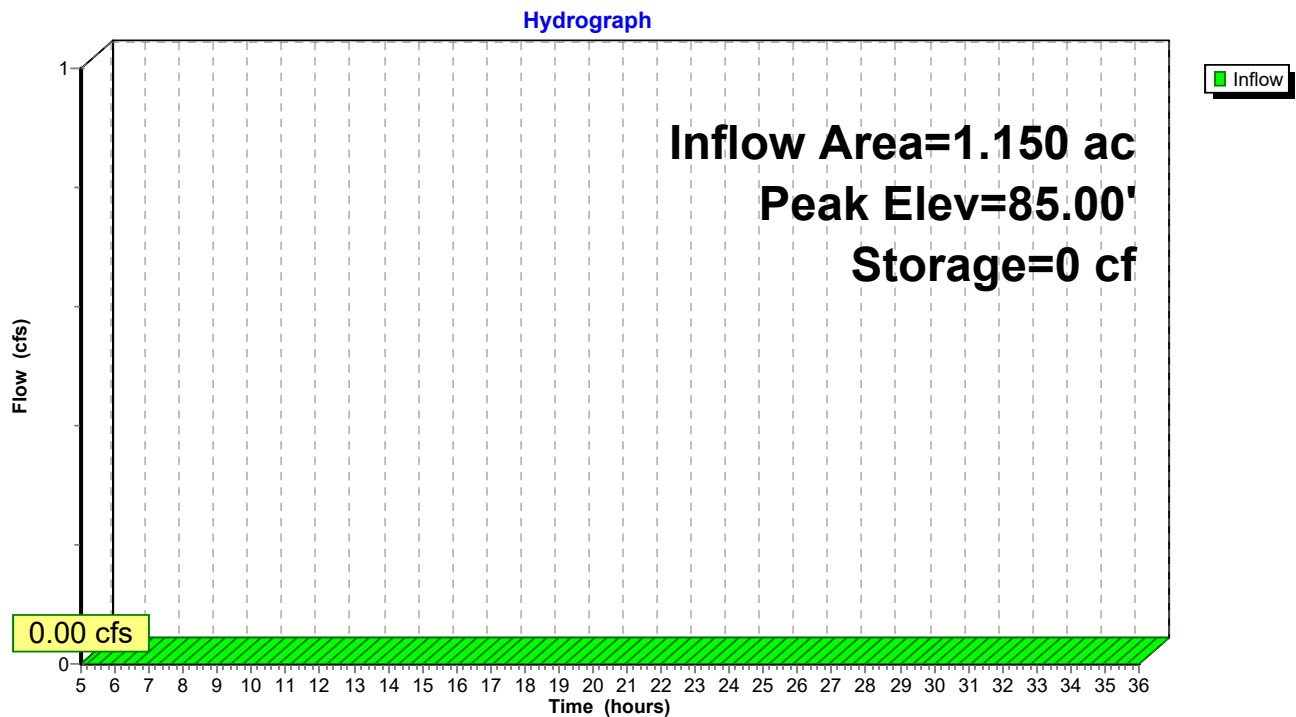
Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 85.00' @ 5.00 hrs Surf.Area= 7,068 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	222,599 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	7,068	0	0
86.00	15,444	11,256	11,256
87.00	29,379	22,412	33,668
88.00	39,332	34,356	68,023
89.00	50,902	45,117	113,140
90.00	54,452	52,677	165,817
91.00	59,112	56,782	222,599

Pond 3P: (Wetland N)



Time span=5.00-36.00 hrs, dt=0.05 hrs, 621 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Watershed 1S	Runoff Area=0.630 ac 0.00% Impervious Runoff Depth=0.75" Tc=17.7 min CN=51 Runoff=0.27 cfs 0.039 af
Subcatchment 2S: Watershed 2S	Runoff Area=1.150 ac 0.00% Impervious Runoff Depth=1.31" Tc=19.9 min CN=60 Runoff=1.06 cfs 0.125 af
Subcatchment 3S: Watershed 3S	Runoff Area=0.180 ac 0.00% Impervious Runoff Depth=0.54" Tc=9.7 min CN=47 Runoff=0.05 cfs 0.008 af
Subcatchment 4S: Watershed 4S	Runoff Area=0.261 ac 15.33% Impervious Runoff Depth=0.75" Tc=6.0 min CN=51 Runoff=0.15 cfs 0.016 af
Reach 1R: (CB-1)	Inflow=0.27 cfs 0.039 af Outflow=0.27 cfs 0.039 af
Reach 3R: (CB-2)	Inflow=0.05 cfs 0.008 af Outflow=0.05 cfs 0.008 af
Reach 4R: (CB-3)	Inflow=0.15 cfs 0.016 af Outflow=0.15 cfs 0.016 af
Reach SP1: (Study Point #1)	Inflow=0.42 cfs 0.064 af Outflow=0.42 cfs 0.064 af
Reach SP2: (Study Point #2)	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach SP3: (Total)	Inflow=0.42 cfs 0.064 af Outflow=0.42 cfs 0.064 af
Pond 1P: (ONSITE WETLAND W/STORAGE)	Peak Elev=86.90' Storage=5,456 cf Inflow=1.06 cfs 0.125 af Outflow=0.00 cfs 0.000 af
Pond 3P: (Wetland N)	Peak Elev=85.00' Storage=0 cf Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.221 ac Runoff Volume = 0.189 af Average Runoff Depth = 1.02"
98.20% Pervious = 2.181 ac 1.80% Impervious = 0.040 ac

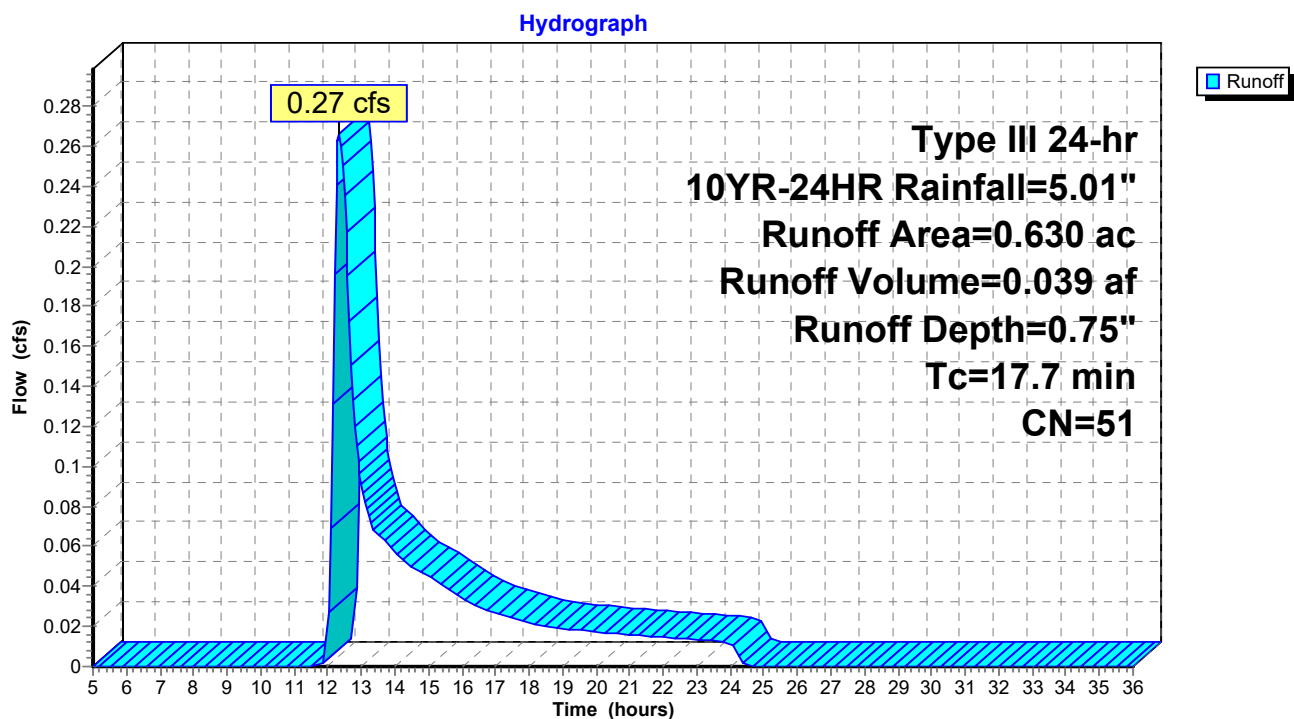
Summary for Subcatchment 1S: Watershed 1S

Runoff = 0.27 cfs @ 12.34 hrs, Volume= 0.039 af, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-24HR Rainfall=5.01"

Area (ac)	CN	Description
0.030	77	Woods, Good, HSG D
0.572	48	Brush, Poor, HSG A
0.028	83	Brush, Poor, HSG D
0.630	51	Weighted Average
0.630		100.00% Pervious Area

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

Subcatchment 1S: Watershed 1S

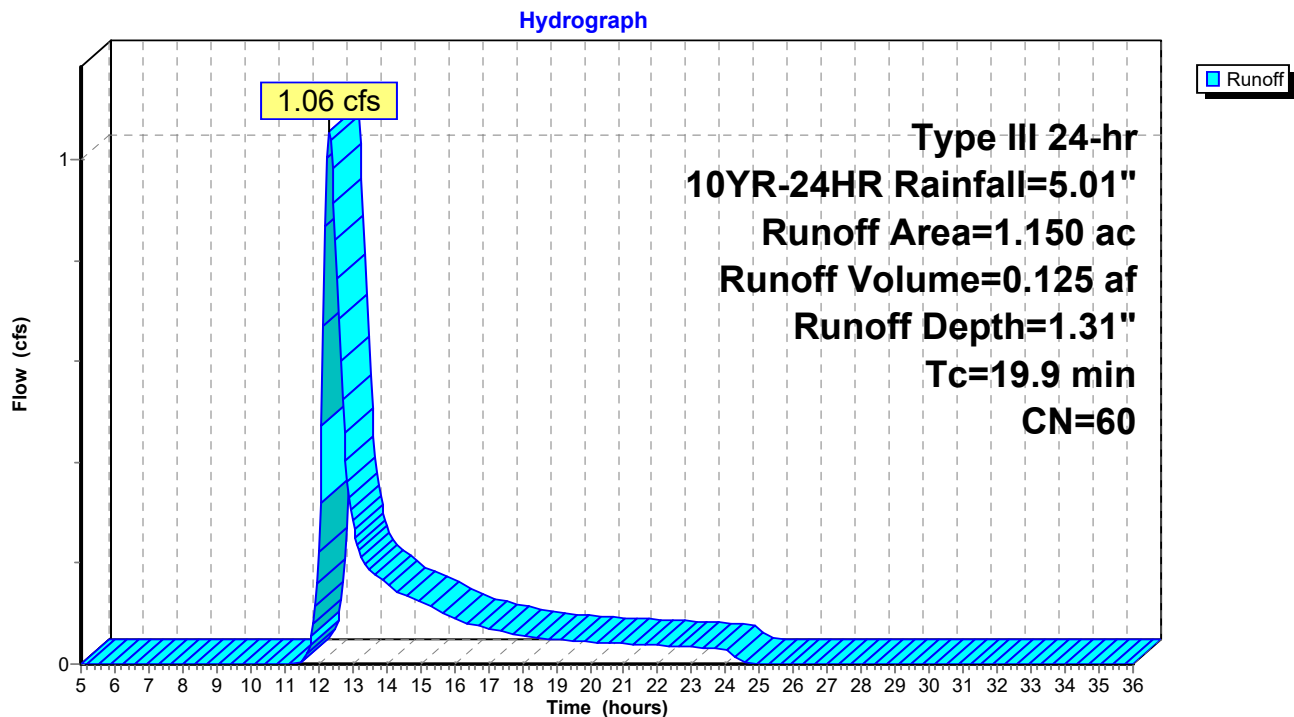
Summary for Subcatchment 2S: Watershed 2S

Runoff = 1.06 cfs @ 12.31 hrs, Volume= 0.125 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-24HR Rainfall=5.01"

Area (ac)	CN	Description
0.021	45	Woods, Poor, HSG A
0.338	83	Woods, Poor, HSG D
0.732	48	Brush, Poor, HSG A
0.059	83	Brush, Poor, HSG D
1.150	60	Weighted Average
1.150		100.00% Pervious Area

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

Subcatchment 2S: Watershed 2S

Summary for Subcatchment 3S: Watershed 3S

Runoff = 0.05 cfs @ 12.28 hrs, Volume= 0.008 af, Depth= 0.54"

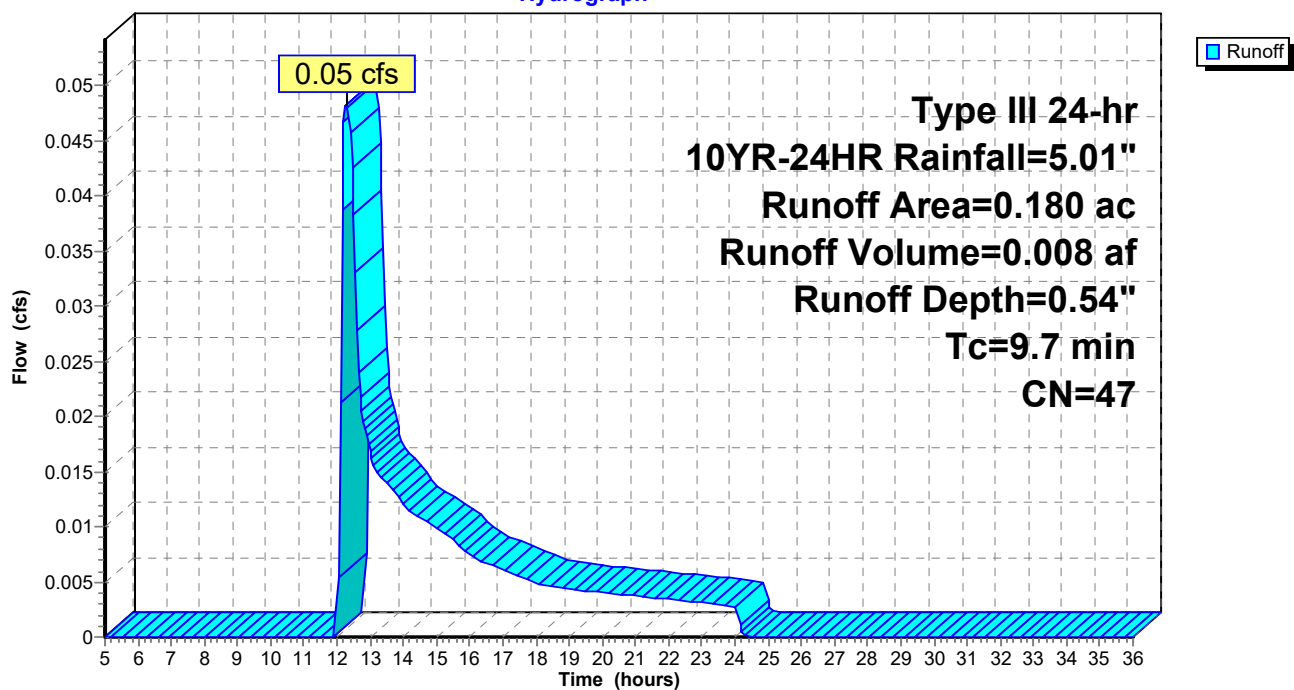
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-24HR Rainfall=5.01"

Area (ac)	CN	Description
0.014	39	>75% Grass cover, Good, HSG A
0.166	48	Brush, Poor, HSG A
0.180	47	Weighted Average
0.180		100.00% Pervious Area

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

Subcatchment 3S: Watershed 3S

Hydrograph



Summary for Subcatchment 4S: Watershed 4S

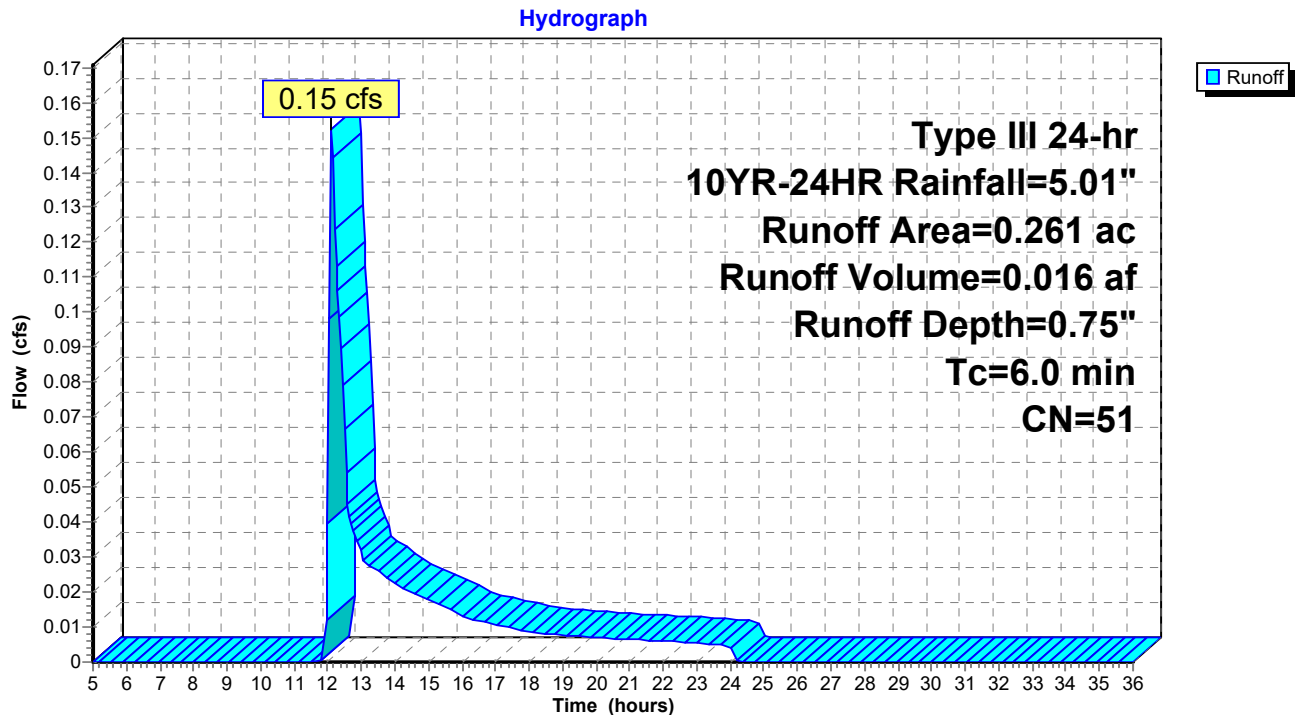
Runoff = 0.15 cfs @ 12.12 hrs, Volume= 0.016 af, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR-24HR Rainfall=5.01"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.139	39	>75% Grass cover, Good, HSG A
0.082	48	Brush, Poor, HSG A
0.261	51	Weighted Average
0.221		84.67% Pervious Area
0.040		15.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6 minutes - minimum

Subcatchment 4S: Watershed 4S



Summary for Reach 1R: (CB-1)

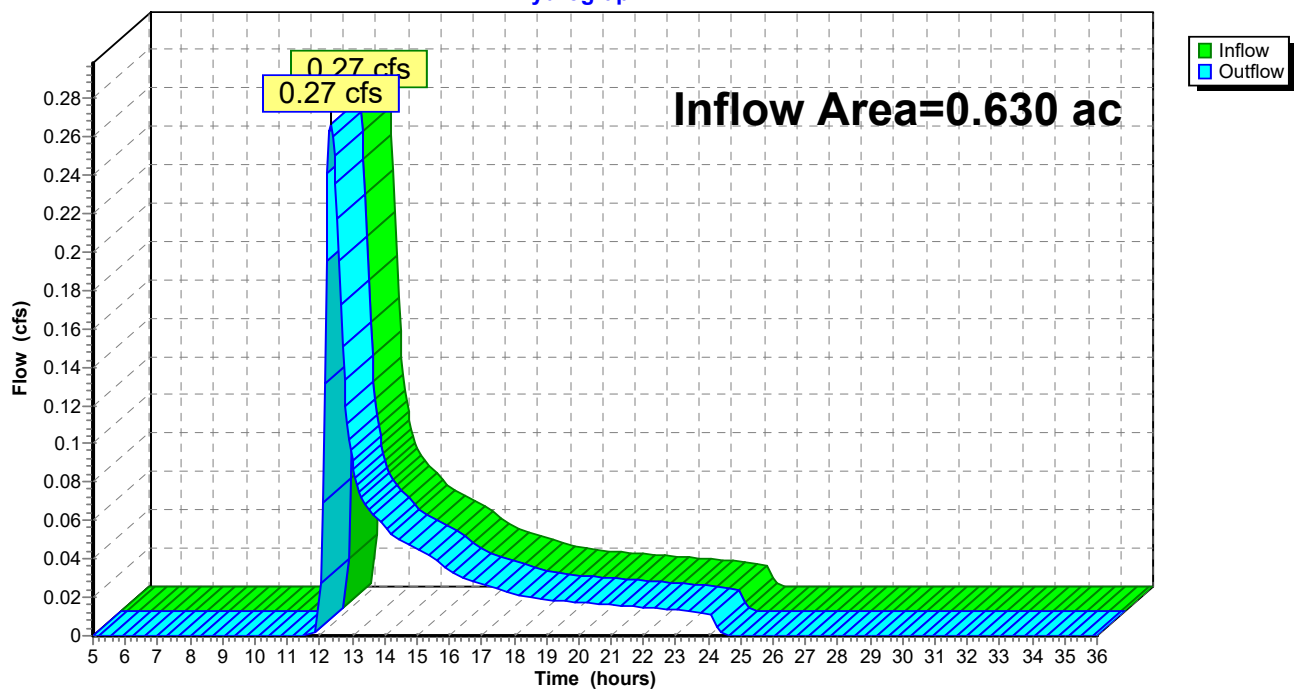
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.630 ac, 0.00% Impervious, Inflow Depth = 0.75" for 10YR-24HR event
Inflow = 0.27 cfs @ 12.34 hrs, Volume= 0.039 af
Outflow = 0.27 cfs @ 12.34 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach 1R: (CB-1)

Hydrograph

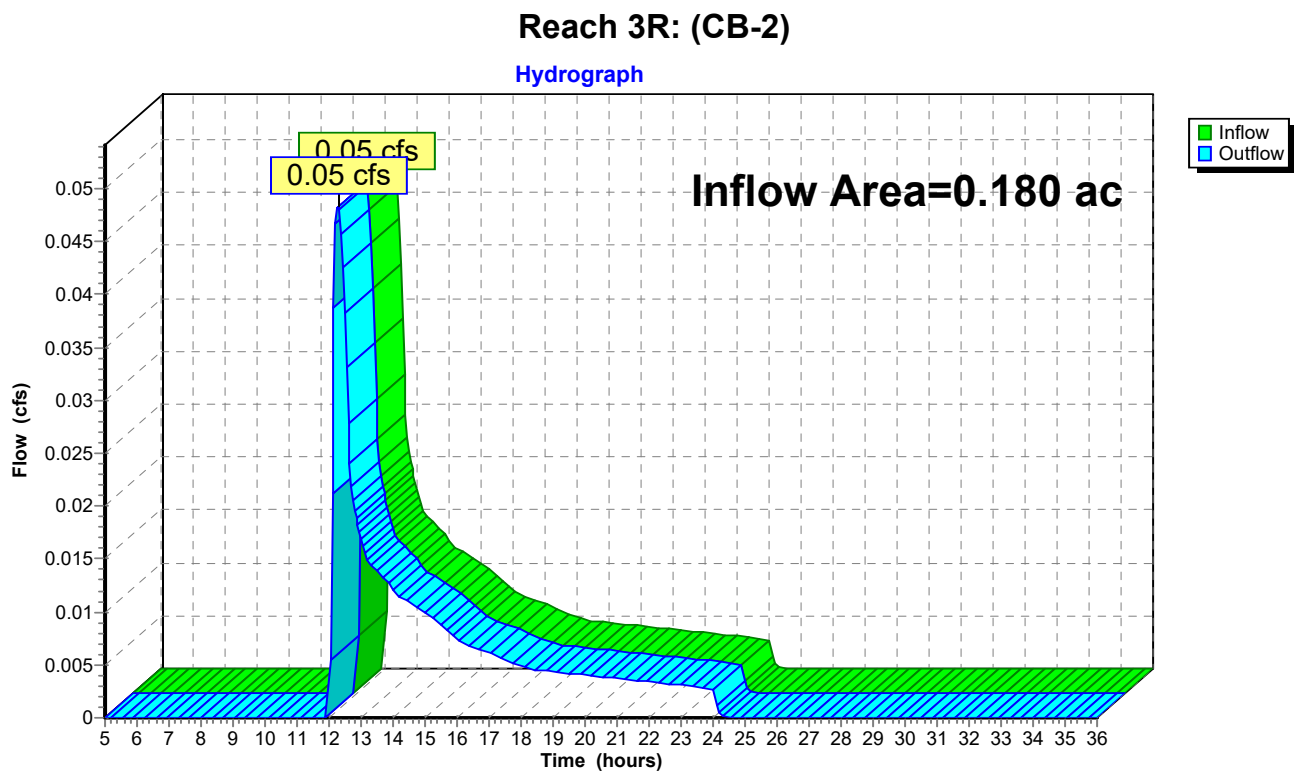


Summary for Reach 3R: (CB-2)

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

Inflow Area = 0.180 ac, 0.00% Impervious, Inflow Depth = 0.54" for 10YR-24HR event
Inflow = 0.05 cfs @ 12.28 hrs, Volume= 0.008 af
Outflow = 0.05 cfs @ 12.28 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

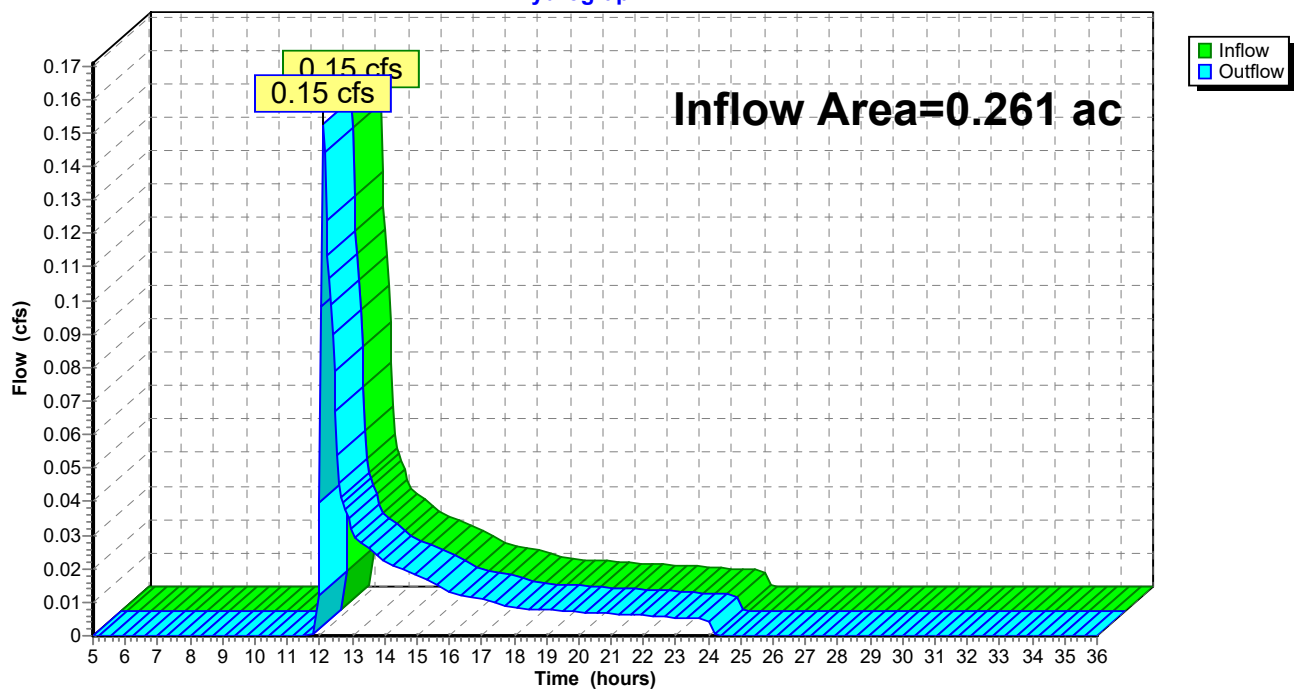


Summary for Reach 4R: (CB-3)

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

Inflow Area = 0.261 ac, 15.33% Impervious, Inflow Depth = 0.75" for 10YR-24HR event
Inflow = 0.15 cfs @ 12.12 hrs, Volume= 0.016 af
Outflow = 0.15 cfs @ 12.12 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach 4R: (CB-3)**Hydrograph**

Summary for Reach SP1: (Study Point #1)

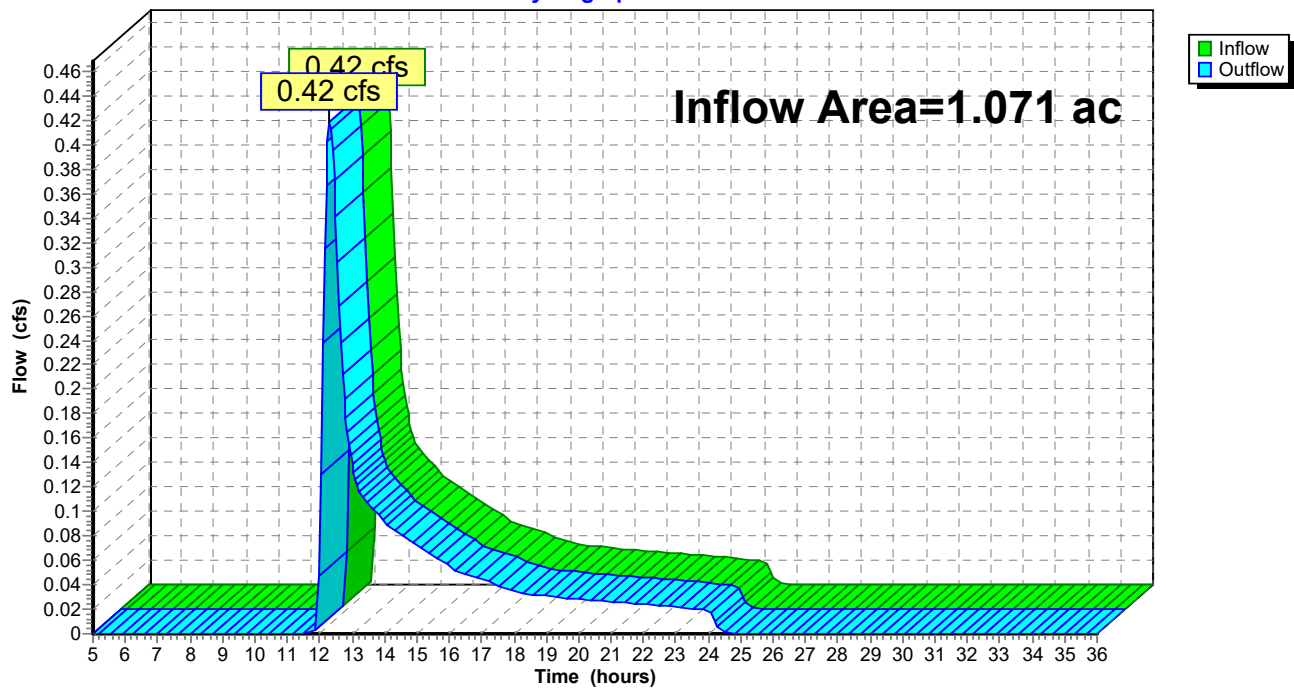
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.071 ac, 3.73% Impervious, Inflow Depth = 0.72" for 10YR-24HR event
Inflow = 0.42 cfs @ 12.31 hrs, Volume= 0.064 af
Outflow = 0.42 cfs @ 12.31 hrs, Volume= 0.064 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach SP1: (Study Point #1)

Hydrograph

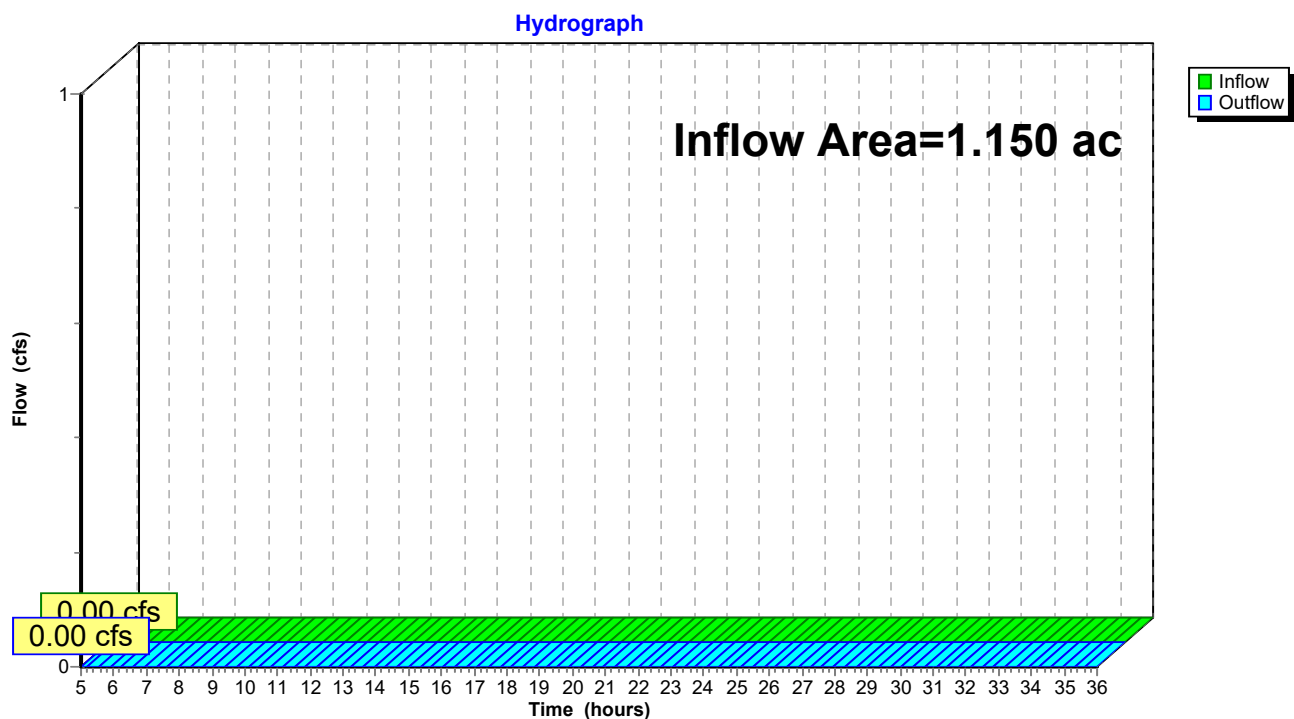


Summary for Reach SP2: (Study Point #2)

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

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10YR-24HR event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

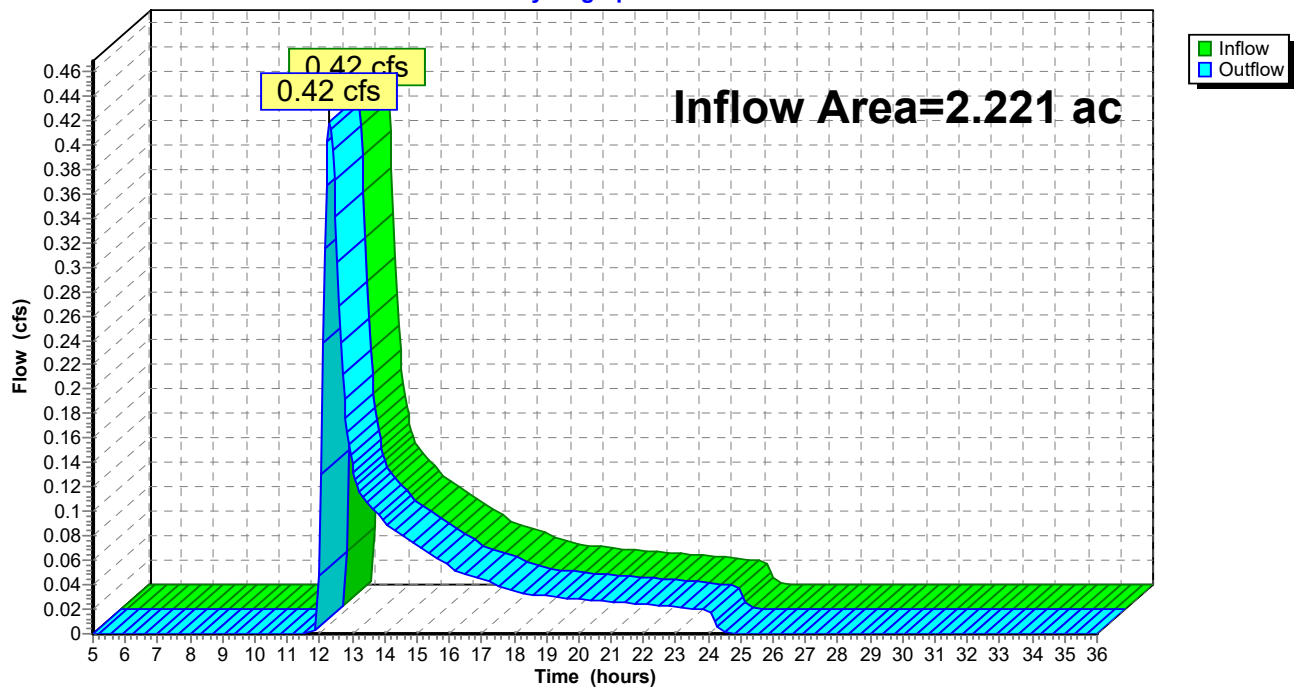
Reach SP2: (Study Point #2)

Summary for Reach SP3: (Total)

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

Inflow Area = 2.221 ac, 1.80% Impervious, Inflow Depth = 0.35" for 10YR-24HR event
Inflow = 0.42 cfs @ 12.31 hrs, Volume= 0.064 af
Outflow = 0.42 cfs @ 12.31 hrs, Volume= 0.064 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach SP3: (Total)**Hydrograph**

Summary for Pond 1P: (ONSITE WETLAND W/STORAGE)

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 1.31" for 10YR-24HR event
 Inflow = 1.06 cfs @ 12.31 hrs, Volume= 0.125 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 86.90' @ 25.15 hrs Surf.Area= 4,337 sf Storage= 5,456 cf
 Flood Elev= 89.50' Surf.Area= 6,808 sf Storage= 17,798 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	17,798 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

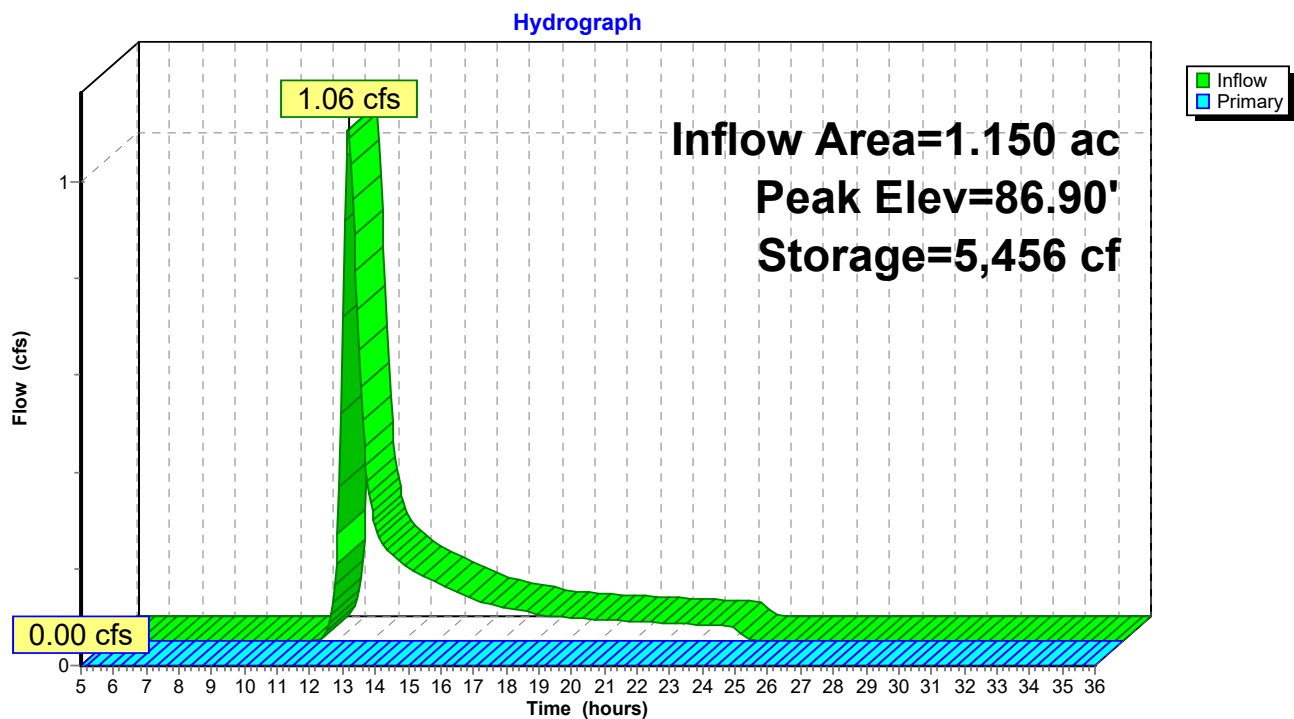
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	1,134	0	0
86.00	3,087	2,111	2,111
87.00	4,474	3,781	5,891
88.00	5,586	5,030	10,921
89.00	6,807	6,197	17,118
89.10	6,808	681	17,798

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	50.0' long x 2.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=85.00' TW=85.00' (Dynamic Tailwater)

↑1=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: (ONSITE WETLAND W/STORAGE)



Summary for Pond 3P: (Wetland N)

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10YR-24HR event
 Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

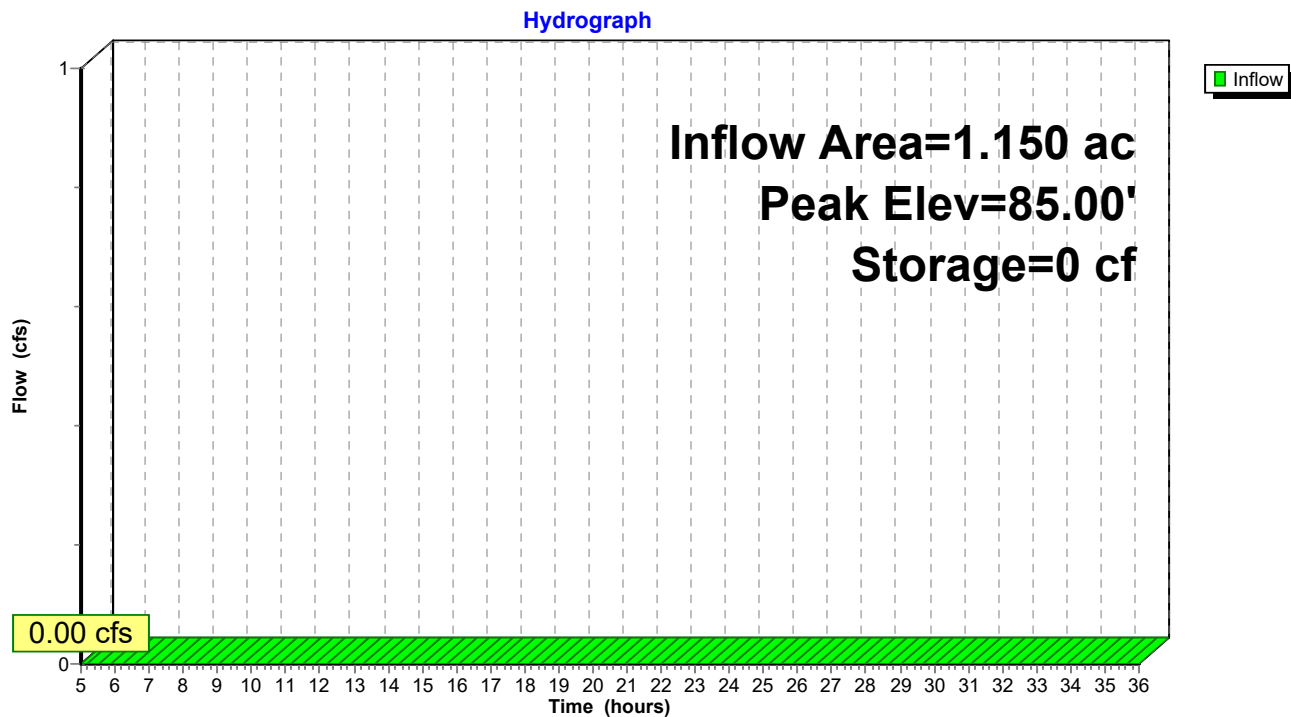
Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 85.00' @ 5.00 hrs Surf.Area= 7,068 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	222,599 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	7,068	0	0
86.00	15,444	11,256	11,256
87.00	29,379	22,412	33,668
88.00	39,332	34,356	68,023
89.00	50,902	45,117	113,140
90.00	54,452	52,677	165,817
91.00	59,112	56,782	222,599

Pond 3P: (Wetland N)

Time span=5.00-36.00 hrs, dt=0.05 hrs, 621 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Watershed 1S	Runoff Area=0.630 ac 0.00% Impervious Runoff Depth=1.23" Tc=17.7 min CN=51 Runoff=0.52 cfs 0.064 af
Subcatchment 2S: Watershed 2S	Runoff Area=1.150 ac 0.00% Impervious Runoff Depth=1.93" Tc=19.9 min CN=60 Runoff=1.65 cfs 0.185 af
Subcatchment 3S: Watershed 3S	Runoff Area=0.180 ac 0.00% Impervious Runoff Depth=0.94" Tc=9.7 min CN=47 Runoff=0.12 cfs 0.014 af
Subcatchment 4S: Watershed 4S	Runoff Area=0.261 ac 15.33% Impervious Runoff Depth=1.23" Tc=6.0 min CN=51 Runoff=0.30 cfs 0.027 af
Reach 1R: (CB-1)	Inflow=0.52 cfs 0.064 af Outflow=0.52 cfs 0.064 af
Reach 3R: (CB-2)	Inflow=0.12 cfs 0.014 af Outflow=0.12 cfs 0.014 af
Reach 4R: (CB-3)	Inflow=0.30 cfs 0.027 af Outflow=0.30 cfs 0.027 af
Reach SP1: (Study Point #1)	Inflow=0.81 cfs 0.105 af Outflow=0.81 cfs 0.105 af
Reach SP2: (Study Point #2)	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach SP3: (Total)	Inflow=0.81 cfs 0.105 af Outflow=0.81 cfs 0.105 af
Pond 1P: (ONSITE WETLAND W/STORAGE)	Peak Elev=87.46' Storage=8,076 cf Inflow=1.65 cfs 0.185 af Outflow=0.00 cfs 0.000 af
Pond 3P: (Wetland N)	Peak Elev=85.00' Storage=0 cf Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.221 ac Runoff Volume = 0.291 af Average Runoff Depth = 1.57"
98.20% Pervious = 2.181 ac 1.80% Impervious = 0.040 ac

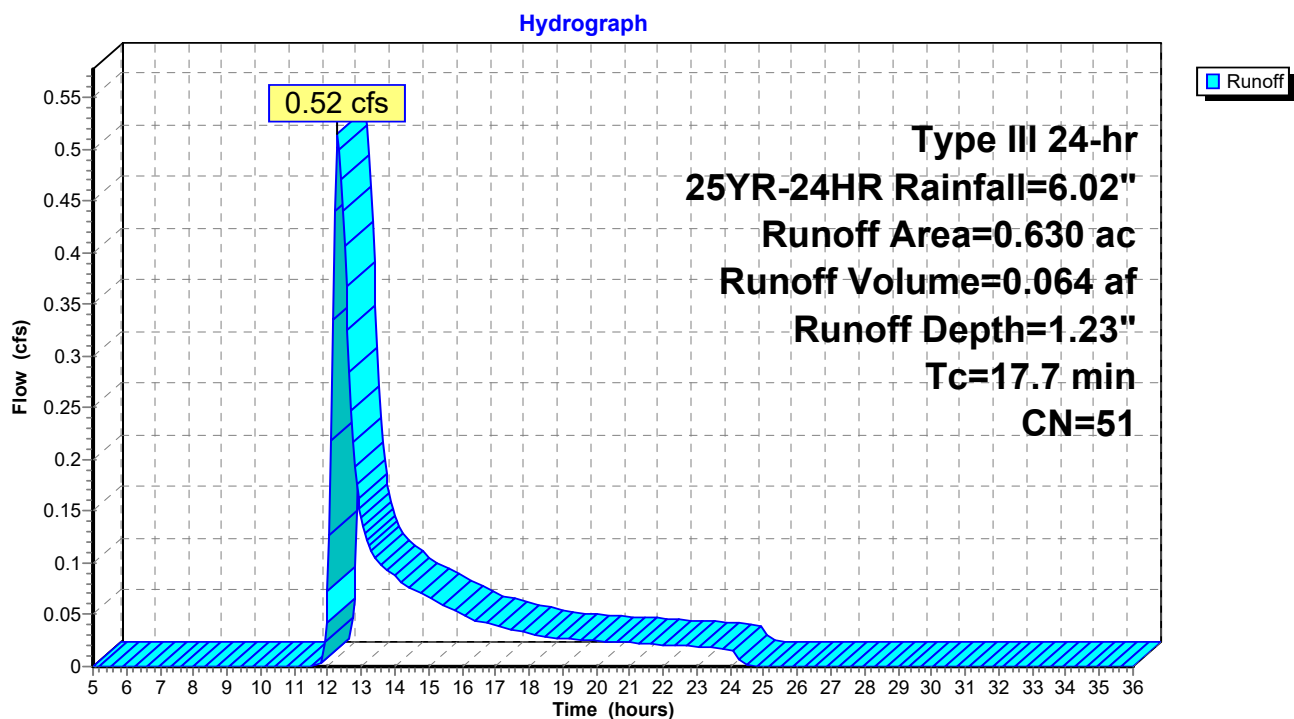
Summary for Subcatchment 1S: Watershed 1S

Runoff = 0.52 cfs @ 12.30 hrs, Volume= 0.064 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-24HR Rainfall=6.02"

Area (ac)	CN	Description
0.030	77	Woods, Good, HSG D
0.572	48	Brush, Poor, HSG A
0.028	83	Brush, Poor, HSG D
0.630	51	Weighted Average
0.630		100.00% Pervious Area

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

Subcatchment 1S: Watershed 1S

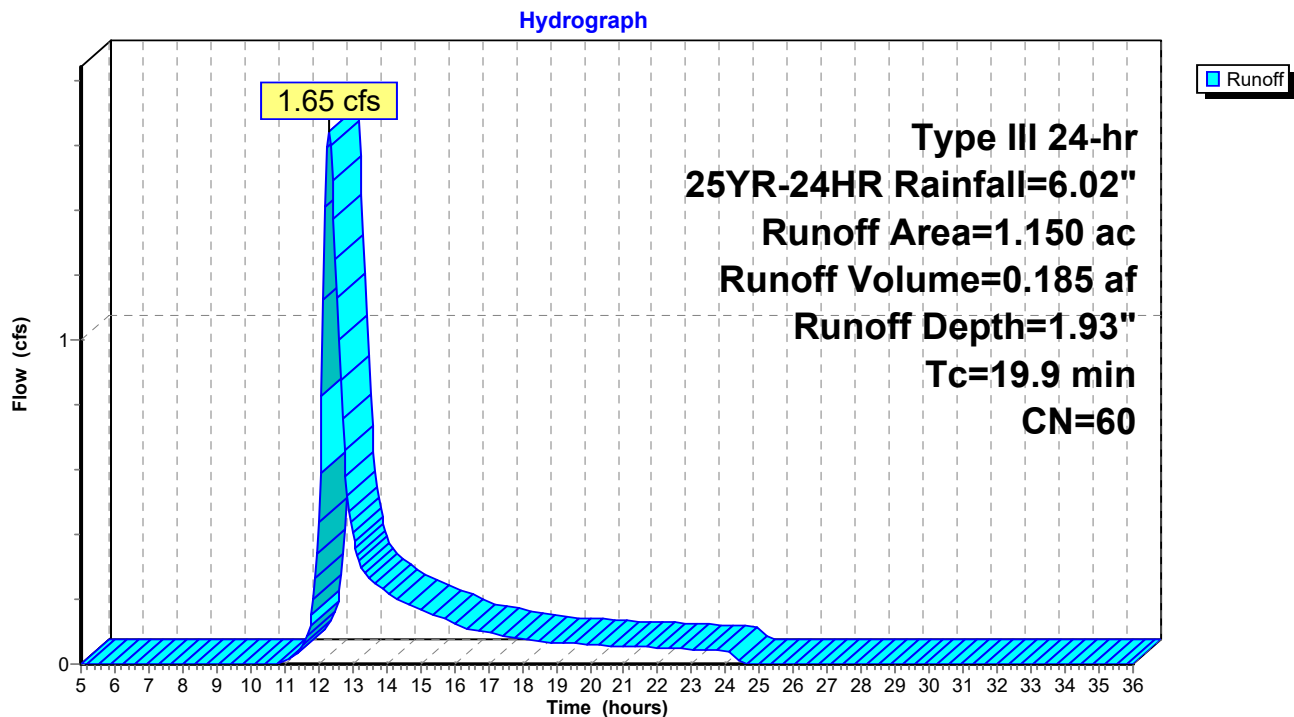
Summary for Subcatchment 2S: Watershed 2S

Runoff = 1.65 cfs @ 12.30 hrs, Volume= 0.185 af, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-24HR Rainfall=6.02"

Area (ac)	CN	Description
0.021	45	Woods, Poor, HSG A
0.338	83	Woods, Poor, HSG D
0.732	48	Brush, Poor, HSG A
0.059	83	Brush, Poor, HSG D
1.150	60	Weighted Average
1.150		100.00% Pervious Area

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

Subcatchment 2S: Watershed 2S

Summary for Subcatchment 3S: Watershed 3S

Runoff = 0.12 cfs @ 12.18 hrs, Volume= 0.014 af, Depth= 0.94"

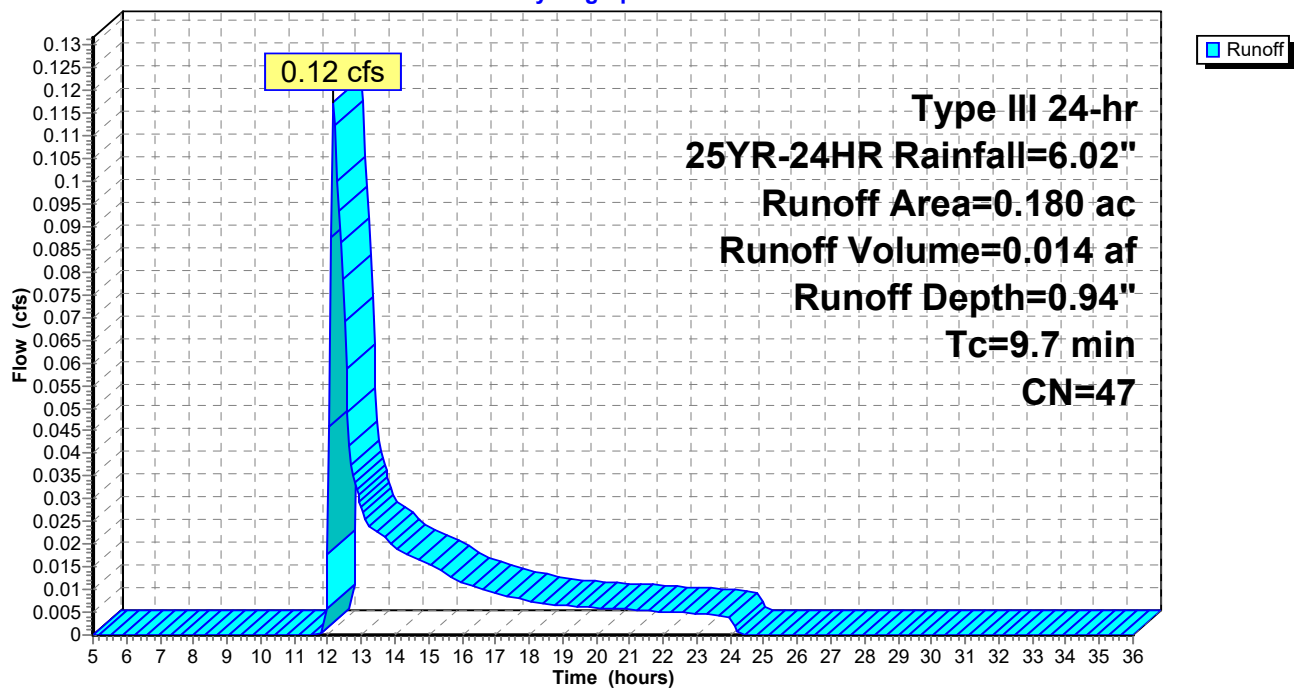
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-24HR Rainfall=6.02"

Area (ac)	CN	Description
0.014	39	>75% Grass cover, Good, HSG A
0.166	48	Brush, Poor, HSG A
0.180	47	Weighted Average
0.180		100.00% Pervious Area

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

Subcatchment 3S: Watershed 3S

Hydrograph



Summary for Subcatchment 4S: Watershed 4S

Runoff = 0.30 cfs @ 12.11 hrs, Volume= 0.027 af, Depth= 1.23"

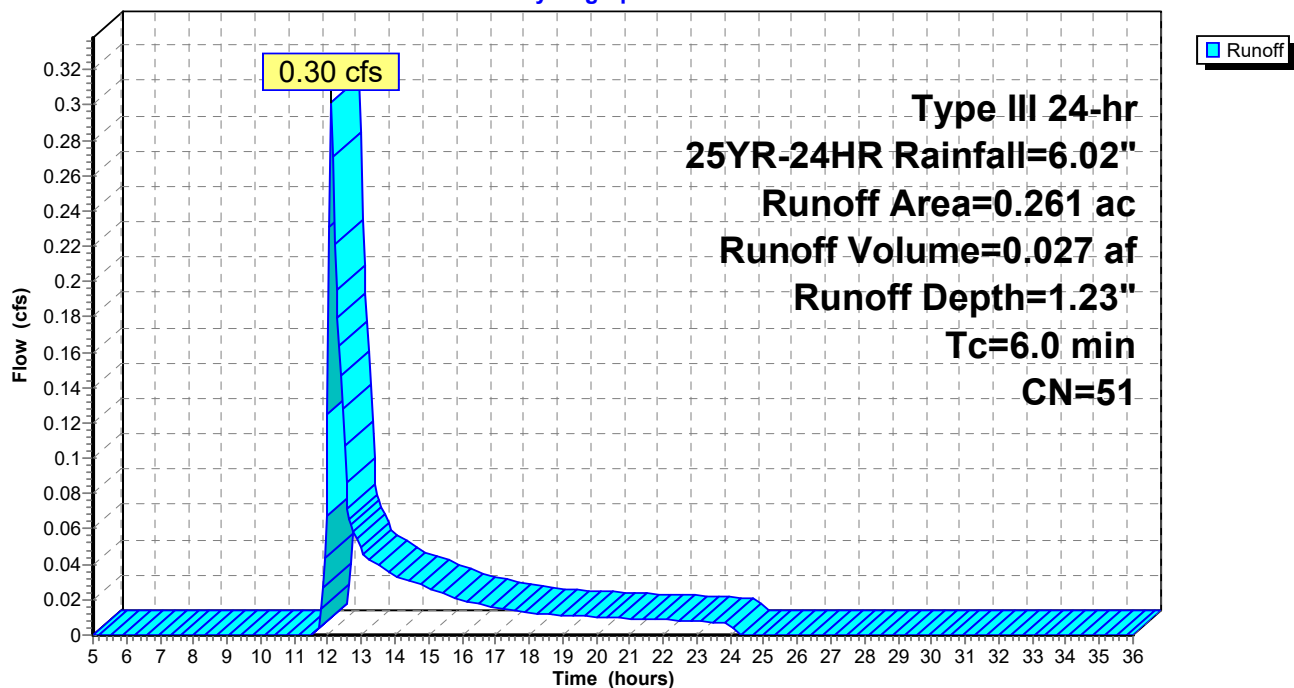
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR-24HR Rainfall=6.02"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.139	39	>75% Grass cover, Good, HSG A
0.082	48	Brush, Poor, HSG A
0.261	51	Weighted Average
0.221		84.67% Pervious Area
0.040		15.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6 minutes - minimum

Subcatchment 4S: Watershed 4S

Hydrograph



Summary for Reach 1R: (CB-1)

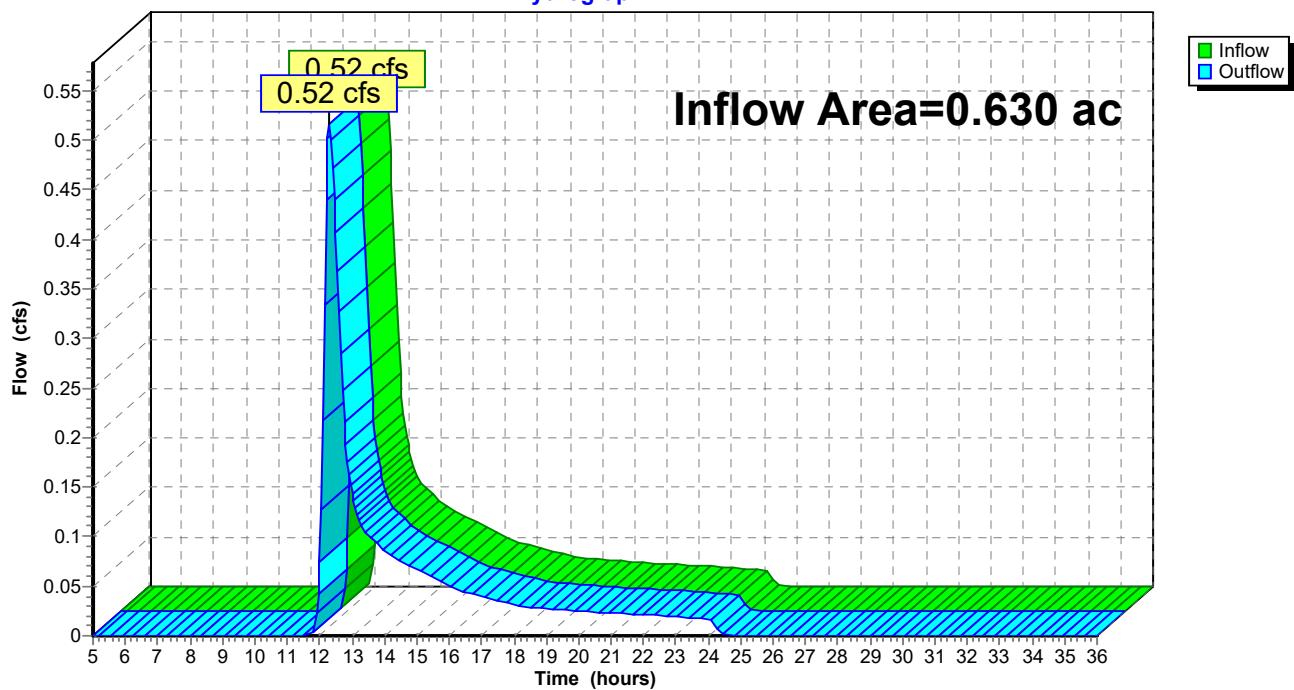
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.630 ac, 0.00% Impervious, Inflow Depth = 1.23" for 25YR-24HR event
Inflow = 0.52 cfs @ 12.30 hrs, Volume= 0.064 af
Outflow = 0.52 cfs @ 12.30 hrs, Volume= 0.064 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach 1R: (CB-1)

Hydrograph



Summary for Reach 3R: (CB-2)

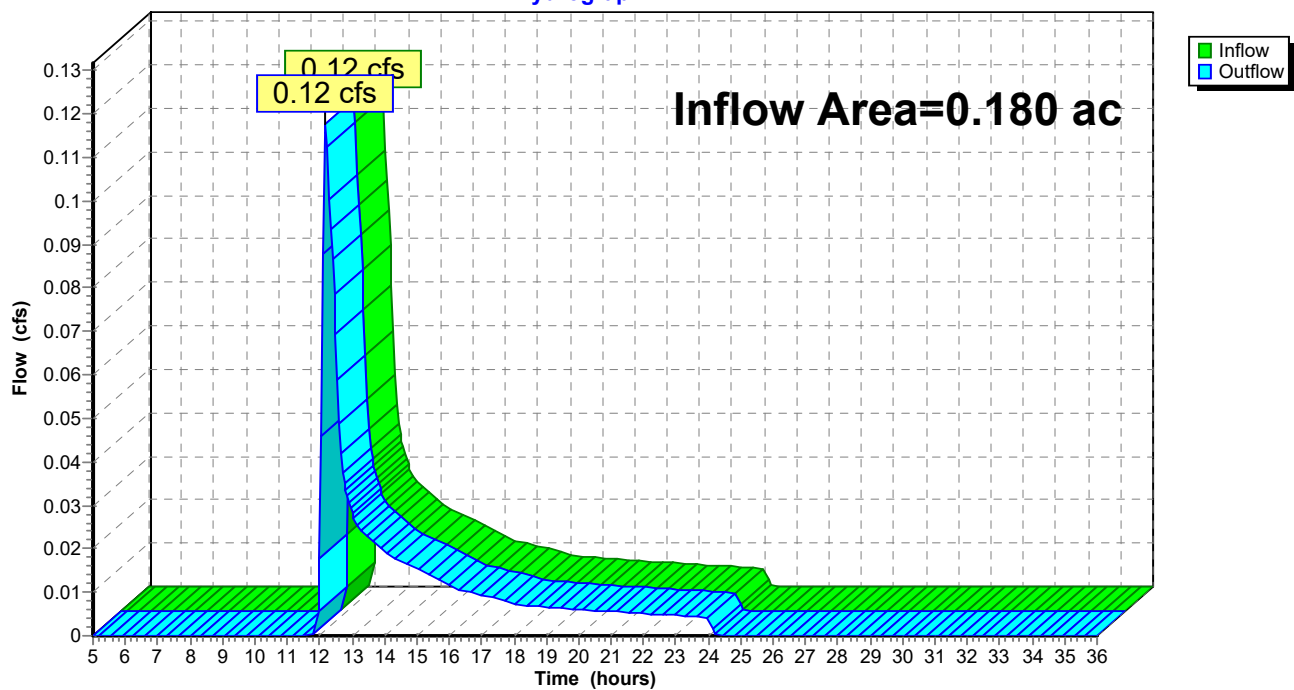
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.180 ac, 0.00% Impervious, Inflow Depth = 0.94" for 25YR-24HR event
Inflow = 0.12 cfs @ 12.18 hrs, Volume= 0.014 af
Outflow = 0.12 cfs @ 12.18 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach 3R: (CB-2)

Hydrograph



Summary for Reach 4R: (CB-3)

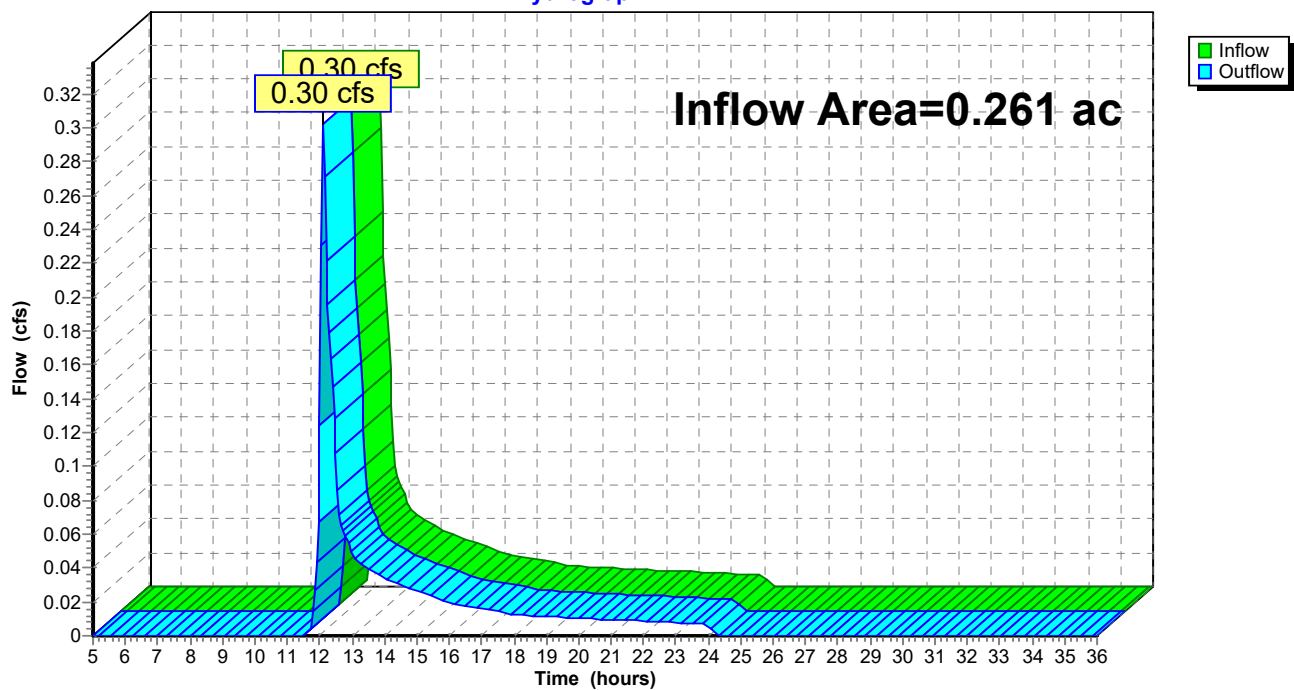
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.261 ac, 15.33% Impervious, Inflow Depth = 1.23" for 25YR-24HR event
Inflow = 0.30 cfs @ 12.11 hrs, Volume= 0.027 af
Outflow = 0.30 cfs @ 12.11 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach 4R: (CB-3)

Hydrograph



Summary for Reach SP1: (Study Point #1)

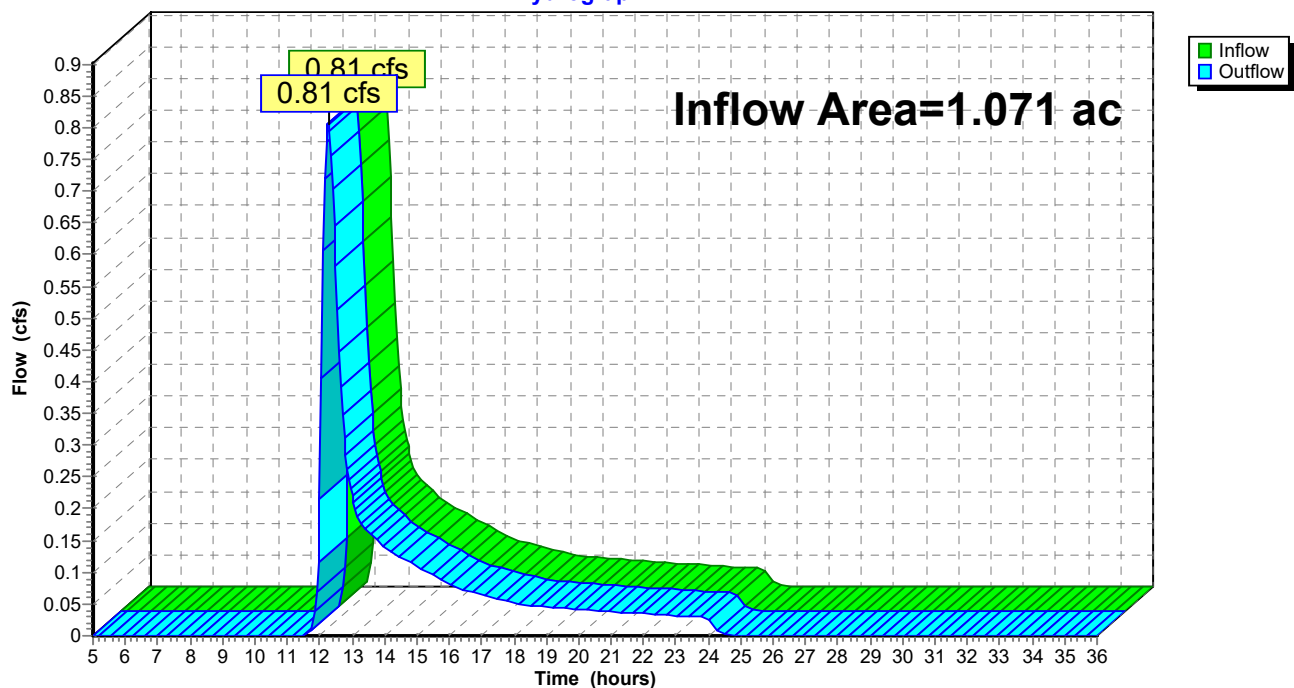
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.071 ac, 3.73% Impervious, Inflow Depth = 1.18" for 25YR-24HR event
Inflow = 0.81 cfs @ 12.26 hrs, Volume= 0.105 af
Outflow = 0.81 cfs @ 12.26 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach SP1: (Study Point #1)

Hydrograph

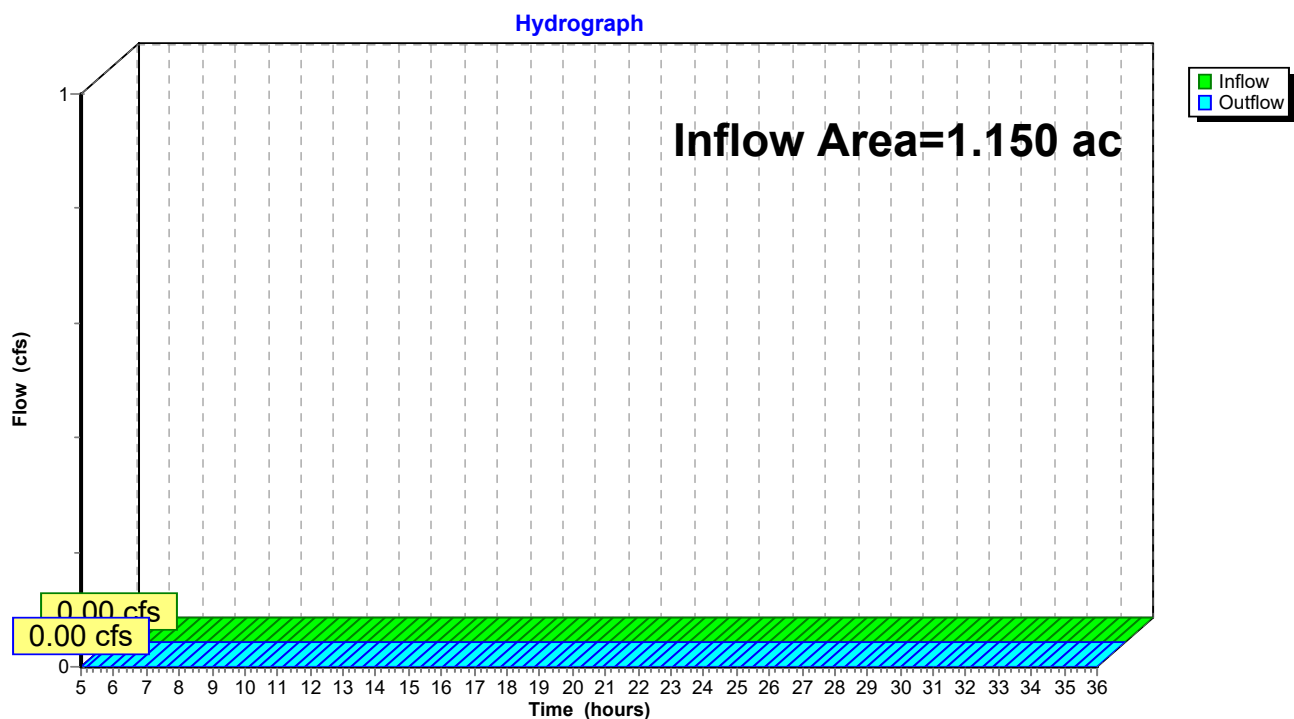


Summary for Reach SP2: (Study Point #2)

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

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 0.00" for 25YR-24HR event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach SP2: (Study Point #2)

Summary for Reach SP3: (Total)

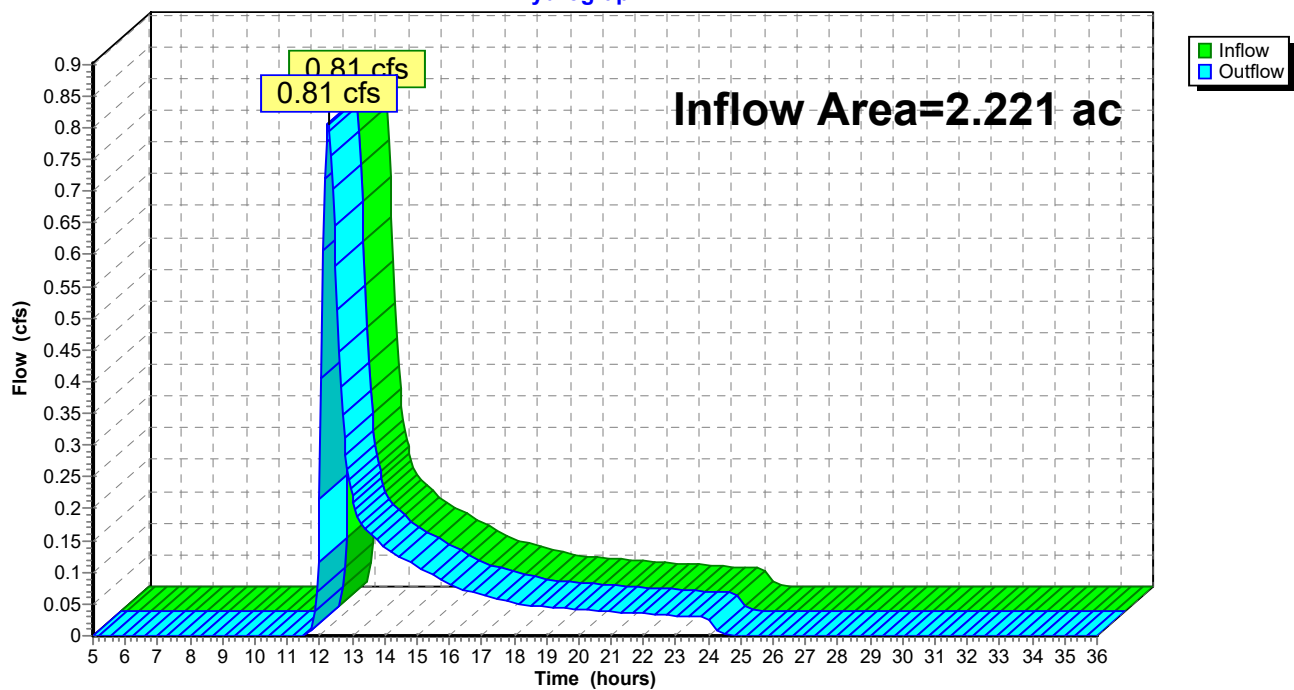
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.221 ac, 1.80% Impervious, Inflow Depth = 0.57" for 25YR-24HR event
Inflow = 0.81 cfs @ 12.26 hrs, Volume= 0.105 af
Outflow = 0.81 cfs @ 12.26 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach SP3: (Total)

Hydrograph



Summary for Pond 1P: (ONSITE WETLAND W/STORAGE)

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 1.93" for 25YR-24HR event
 Inflow = 1.65 cfs @ 12.30 hrs, Volume= 0.185 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 87.46' @ 25.15 hrs Surf.Area= 4,988 sf Storage= 8,076 cf
 Flood Elev= 89.50' Surf.Area= 6,808 sf Storage= 17,798 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	17,798 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

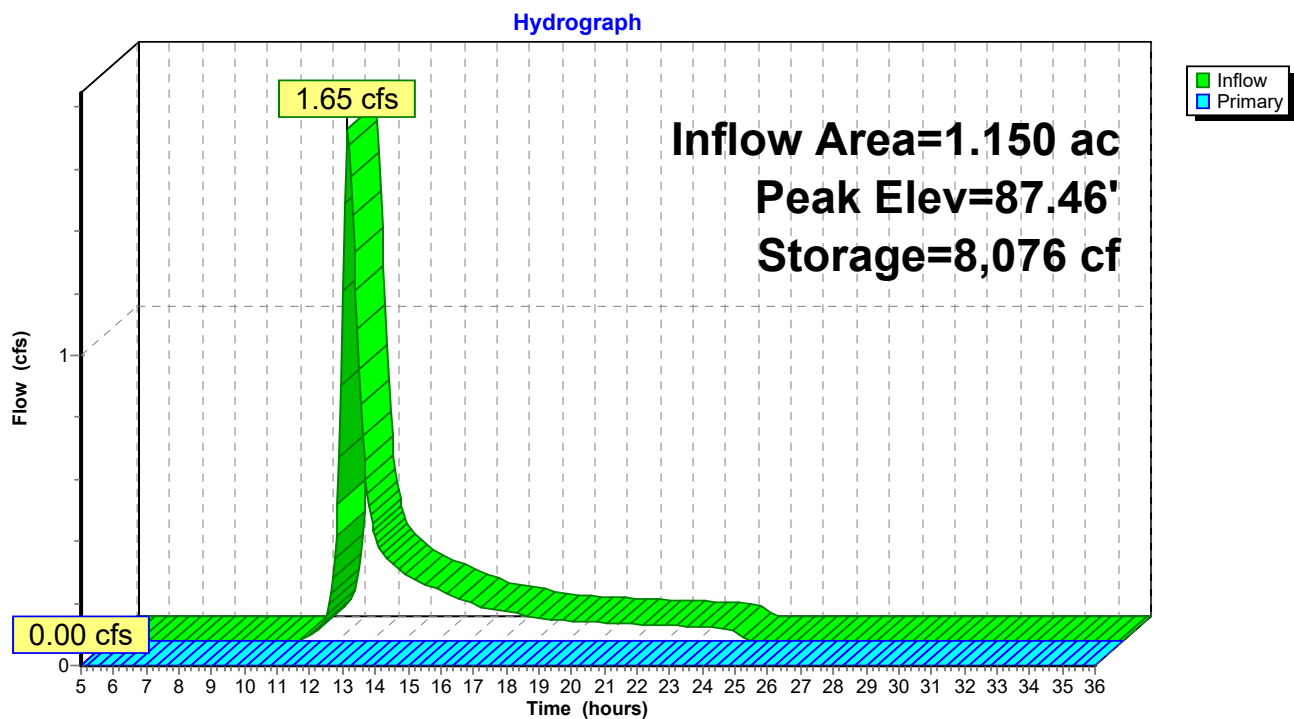
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	1,134	0	0
86.00	3,087	2,111	2,111
87.00	4,474	3,781	5,891
88.00	5,586	5,030	10,921
89.00	6,807	6,197	17,118
89.10	6,808	681	17,798

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	50.0' long x 2.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=85.00' TW=85.00' (Dynamic Tailwater)

↑1=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: (ONSITE WETLAND W/STORAGE)



Summary for Pond 3P: (Wetland N)

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 0.00" for 25YR-24HR event
 Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

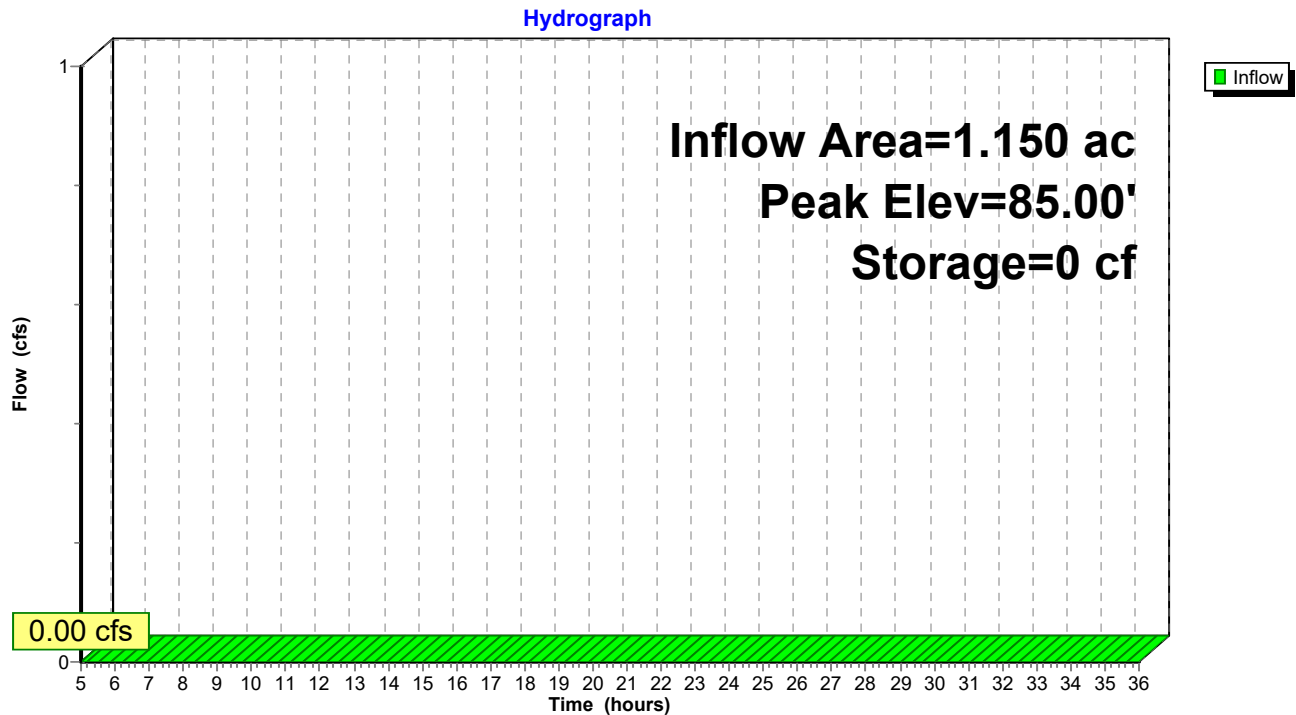
Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 85.00' @ 5.00 hrs Surf.Area= 7,068 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	222,599 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	7,068	0	0
86.00	15,444	11,256	11,256
87.00	29,379	22,412	33,668
88.00	39,332	34,356	68,023
89.00	50,902	45,117	113,140
90.00	54,452	52,677	165,817
91.00	59,112	56,782	222,599

Pond 3P: (Wetland N)



Time span=5.00-36.00 hrs, dt=0.05 hrs, 621 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Watershed 1S	Runoff Area=0.630 ac 0.00% Impervious Runoff Depth=2.10" Tc=17.7 min CN=51 Runoff=0.99 cfs 0.110 af
Subcatchment 2S: Watershed 2S	Runoff Area=1.150 ac 0.00% Impervious Runoff Depth=3.02" Tc=19.9 min CN=60 Runoff=2.67 cfs 0.290 af
Subcatchment 3S: Watershed 3S	Runoff Area=0.180 ac 0.00% Impervious Runoff Depth=1.71" Tc=9.7 min CN=47 Runoff=0.27 cfs 0.026 af
Subcatchment 4S: Watershed 4S	Runoff Area=0.261 ac 15.33% Impervious Runoff Depth=2.10" Tc=6.0 min CN=51 Runoff=0.58 cfs 0.046 af
Reach 1R: (CB-1)	Inflow=0.99 cfs 0.110 af Outflow=0.99 cfs 0.110 af
Reach 3R: (CB-2)	Inflow=0.27 cfs 0.026 af Outflow=0.27 cfs 0.026 af
Reach 4R: (CB-3)	Inflow=0.58 cfs 0.046 af Outflow=0.58 cfs 0.046 af
Reach SP1: (Study Point #1)	Inflow=1.55 cfs 0.181 af Outflow=1.55 cfs 0.181 af
Reach SP2: (Study Point #2)	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach SP3: (Total)	Inflow=1.55 cfs 0.181 af Outflow=1.55 cfs 0.181 af
Pond 1P: (ONSITE WETLAND W/STORAGE)	Peak Elev=88.29' Storage=12,614 cf Inflow=2.67 cfs 0.290 af Outflow=0.00 cfs 0.000 af
Pond 3P: (Wetland N)	Peak Elev=85.00' Storage=0 cf Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.221 ac Runoff Volume = 0.471 af Average Runoff Depth = 2.54"
98.20% Pervious = 2.181 ac 1.80% Impervious = 0.040 ac

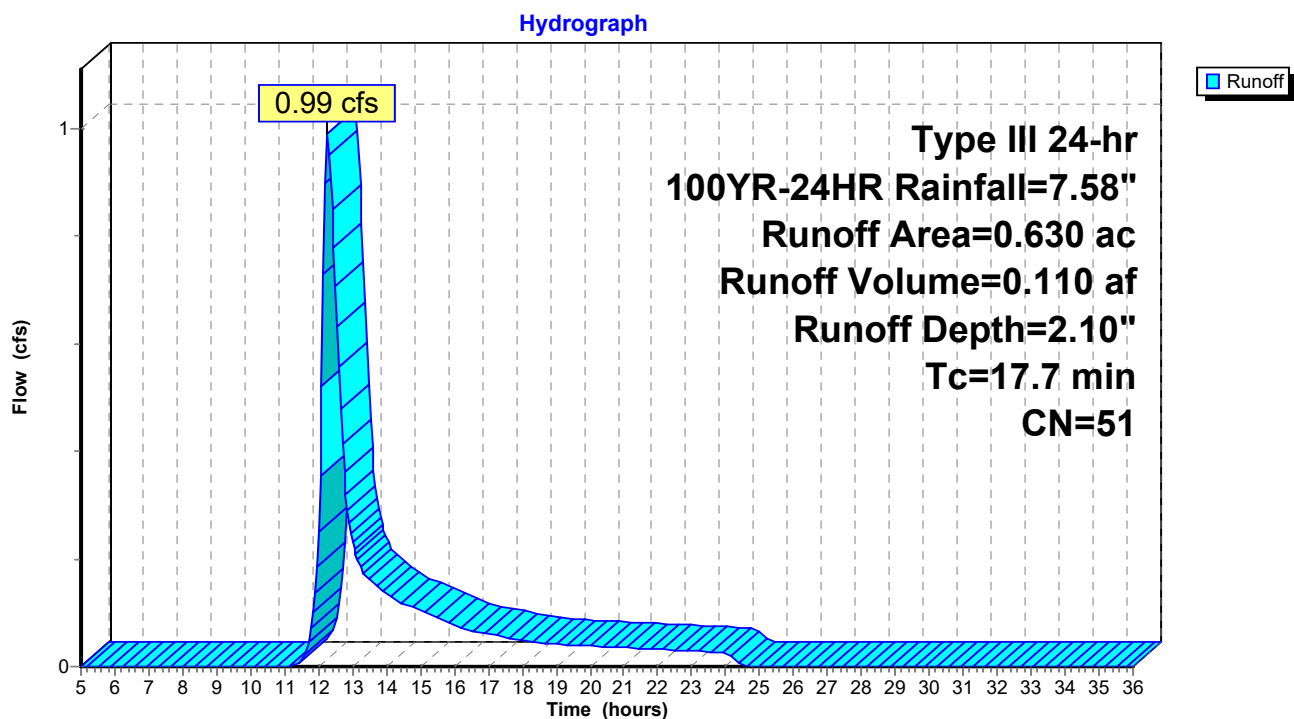
Summary for Subcatchment 1S: Watershed 1S

Runoff = 0.99 cfs @ 12.27 hrs, Volume= 0.110 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-24HR Rainfall=7.58"

Area (ac)	CN	Description
0.030	77	Woods, Good, HSG D
0.572	48	Brush, Poor, HSG A
0.028	83	Brush, Poor, HSG D
0.630	51	Weighted Average
0.630		100.00% Pervious Area

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

Subcatchment 1S: Watershed 1S

Summary for Subcatchment 2S: Watershed 2S

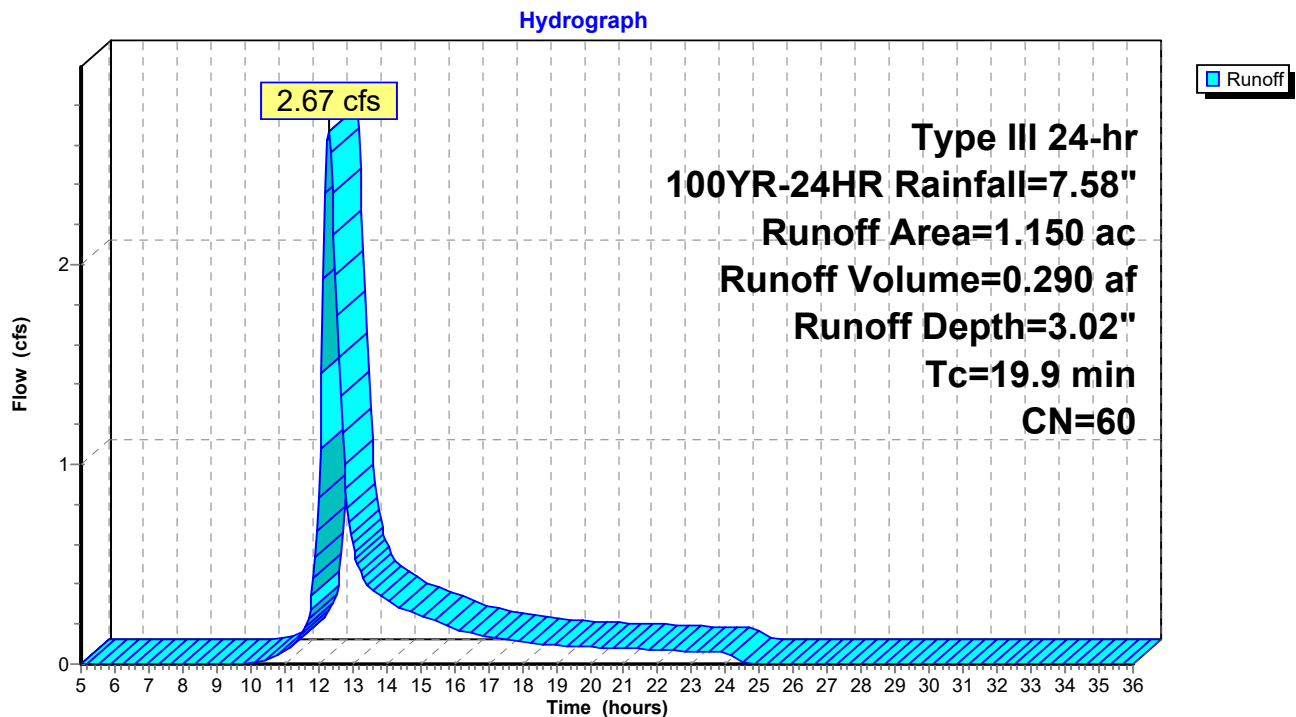
Runoff = 2.67 cfs @ 12.29 hrs, Volume= 0.290 af, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-24HR Rainfall=7.58"

Area (ac)	CN	Description
0.021	45	Woods, Poor, HSG A
0.338	83	Woods, Poor, HSG D
0.732	48	Brush, Poor, HSG A
0.059	83	Brush, Poor, HSG D
1.150	60	Weighted Average
1.150		100.00% Pervious Area

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

Subcatchment 2S: Watershed 2S



Summary for Subcatchment 3S: Watershed 3S

Runoff = 0.27 cfs @ 12.16 hrs, Volume= 0.026 af, Depth= 1.71"

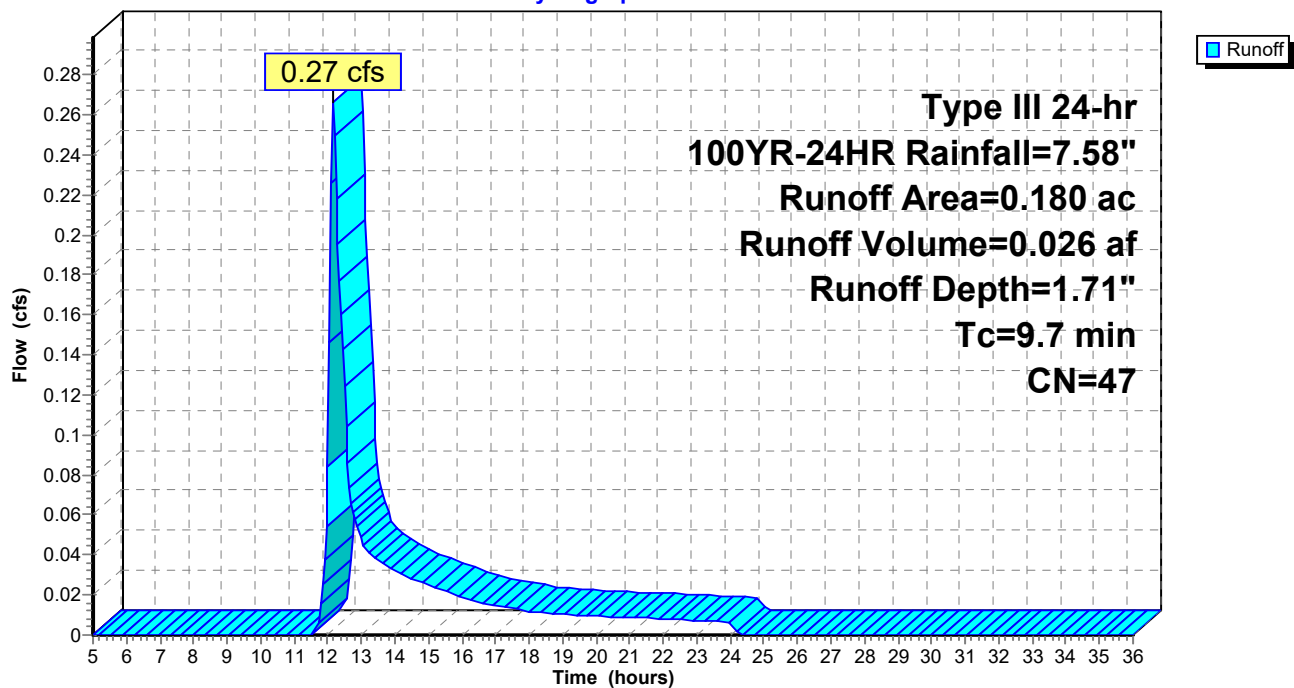
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-24HR Rainfall=7.58"

Area (ac)	CN	Description
0.014	39	>75% Grass cover, Good, HSG A
0.166	48	Brush, Poor, HSG A
0.180	47	Weighted Average
0.180		100.00% Pervious Area

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

Subcatchment 3S: Watershed 3S

Hydrograph



Summary for Subcatchment 4S: Watershed 4S

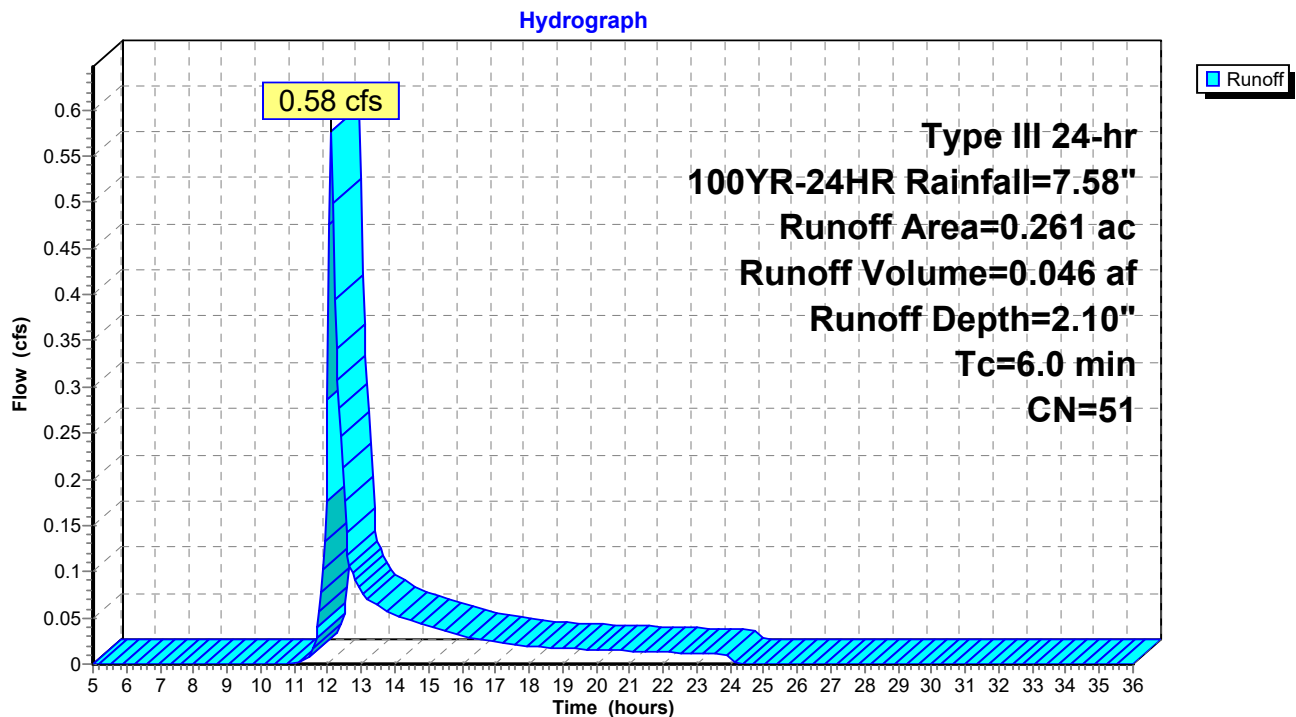
Runoff = 0.58 cfs @ 12.10 hrs, Volume= 0.046 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-24HR Rainfall=7.58"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.139	39	>75% Grass cover, Good, HSG A
0.082	48	Brush, Poor, HSG A
0.261	51	Weighted Average
0.221		84.67% Pervious Area
0.040		15.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6 minutes - minimum

Subcatchment 4S: Watershed 4S

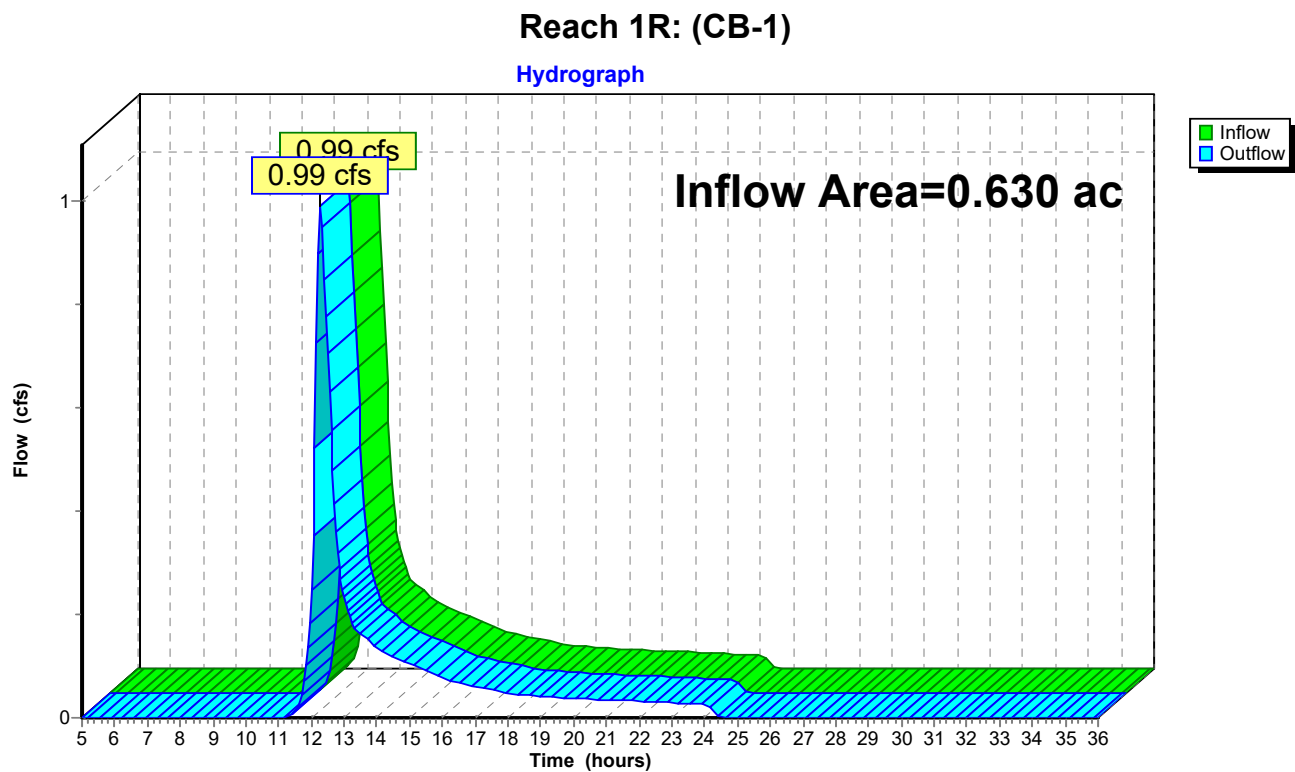


Summary for Reach 1R: (CB-1)

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

Inflow Area = 0.630 ac, 0.00% Impervious, Inflow Depth = 2.10" for 100YR-24HR event
Inflow = 0.99 cfs @ 12.27 hrs, Volume= 0.110 af
Outflow = 0.99 cfs @ 12.27 hrs, Volume= 0.110 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs



Summary for Reach 3R: (CB-2)

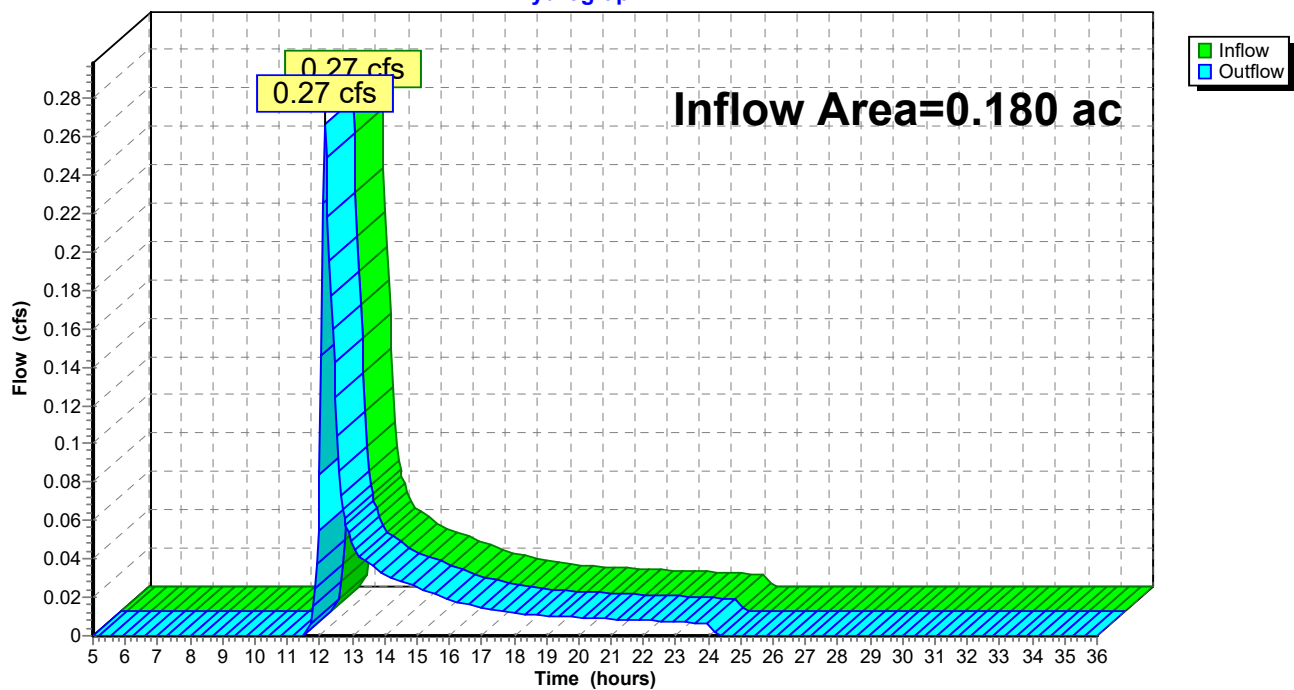
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.180 ac, 0.00% Impervious, Inflow Depth = 1.71" for 100YR-24HR event
Inflow = 0.27 cfs @ 12.16 hrs, Volume= 0.026 af
Outflow = 0.27 cfs @ 12.16 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach 3R: (CB-2)

Hydrograph



Summary for Reach 4R: (CB-3)

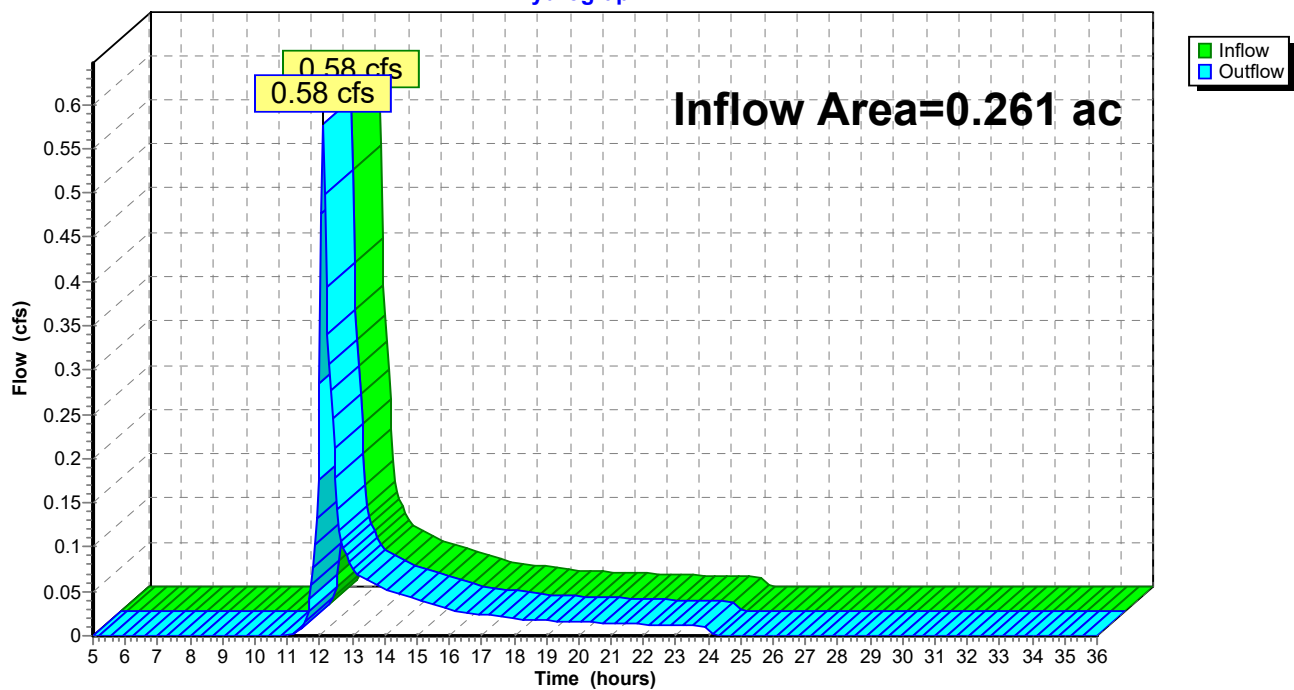
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.261 ac, 15.33% Impervious, Inflow Depth = 2.10" for 100YR-24HR event
Inflow = 0.58 cfs @ 12.10 hrs, Volume= 0.046 af
Outflow = 0.58 cfs @ 12.10 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach 4R: (CB-3)

Hydrograph



Summary for Reach SP1: (Study Point #1)

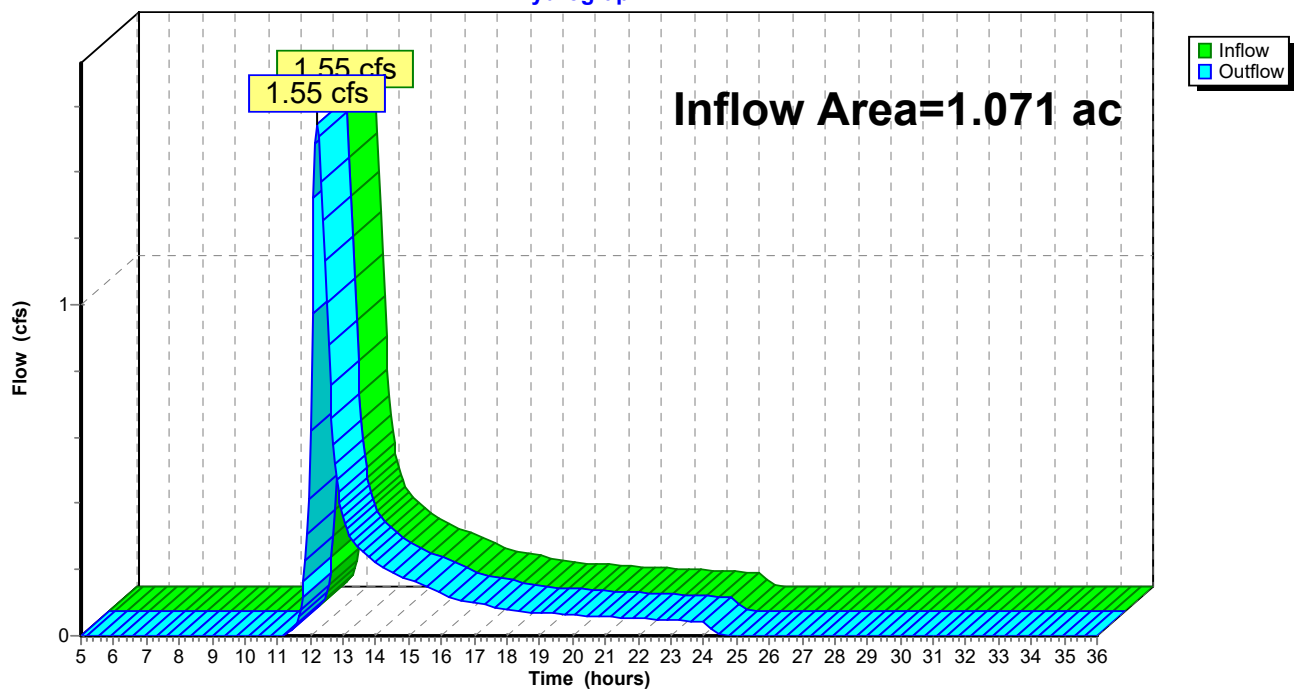
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.071 ac, 3.73% Impervious, Inflow Depth = 2.03" for 100YR-24HR event
Inflow = 1.55 cfs @ 12.22 hrs, Volume= 0.181 af
Outflow = 1.55 cfs @ 12.22 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach SP1: (Study Point #1)

Hydrograph

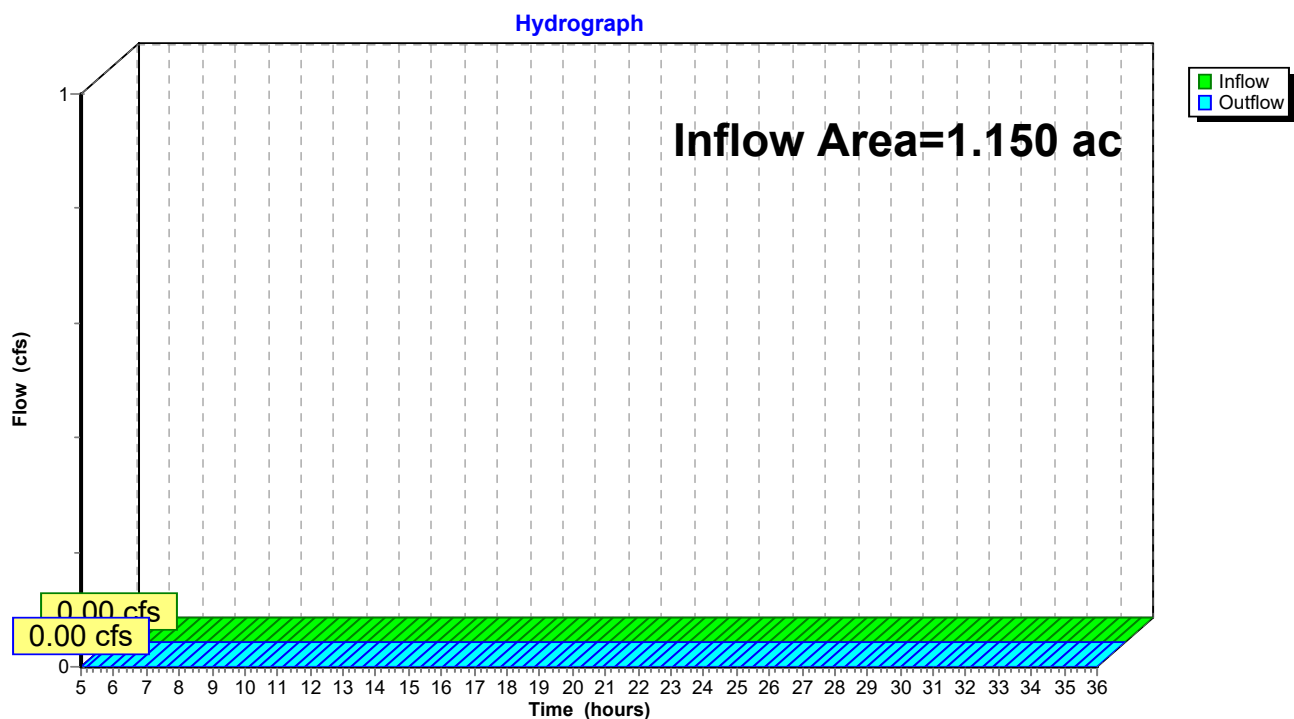


Summary for Reach SP2: (Study Point #2)

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

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 0.00" for 100YR-24HR event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach SP2: (Study Point #2)

Summary for Reach SP3: (Total)

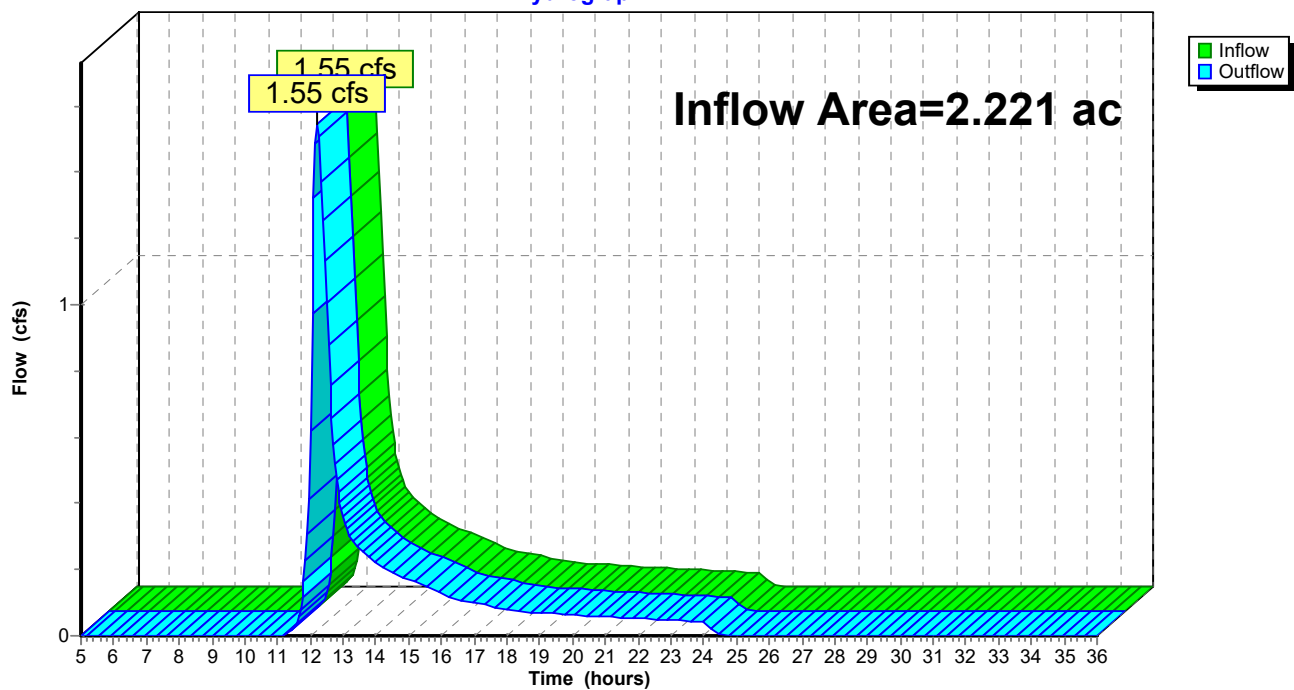
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.221 ac, 1.80% Impervious, Inflow Depth = 0.98" for 100YR-24HR event
Inflow = 1.55 cfs @ 12.22 hrs, Volume= 0.181 af
Outflow = 1.55 cfs @ 12.22 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs

Reach SP3: (Total)

Hydrograph



Summary for Pond 1P: (ONSITE WETLAND W/STORAGE)

Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 3.02" for 100YR-24HR event
 Inflow = 2.67 cfs @ 12.29 hrs, Volume= 0.290 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 88.29' @ 25.15 hrs Surf.Area= 5,945 sf Storage= 12,614 cf
 Flood Elev= 89.50' Surf.Area= 6,808 sf Storage= 17,798 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	17,798 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

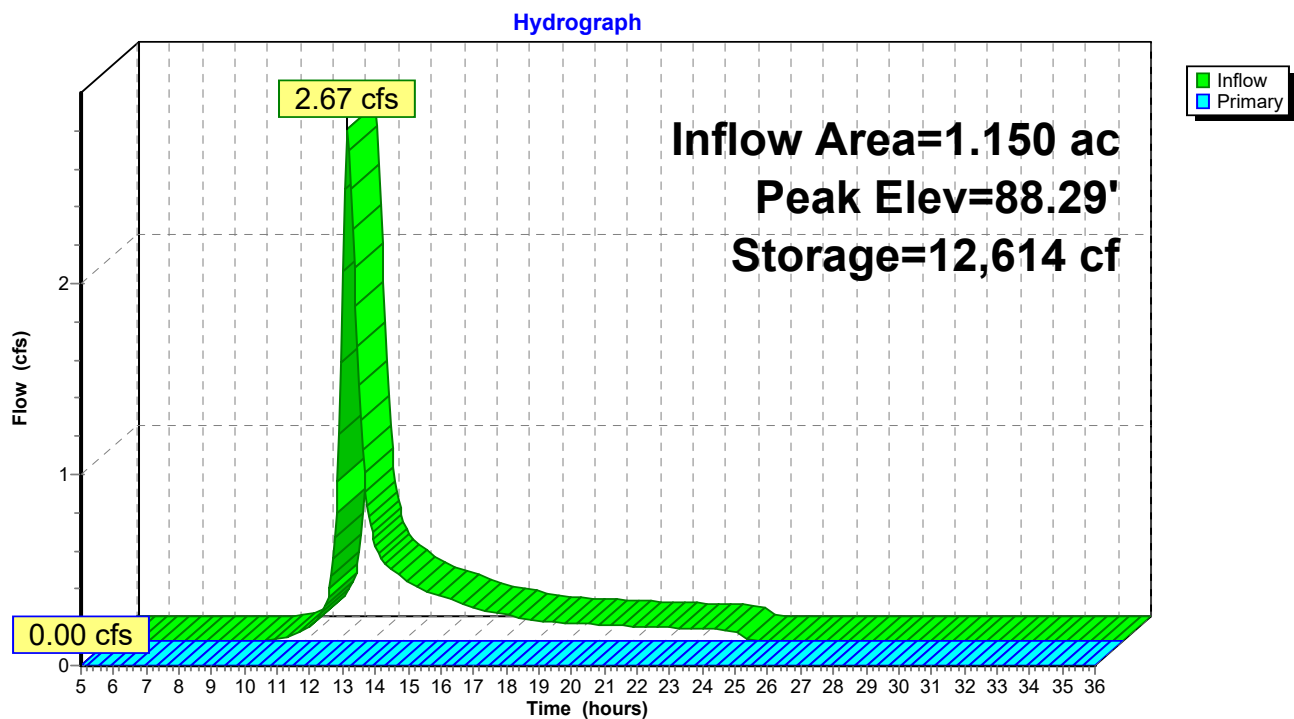
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	1,134	0	0
86.00	3,087	2,111	2,111
87.00	4,474	3,781	5,891
88.00	5,586	5,030	10,921
89.00	6,807	6,197	17,118
89.10	6,808	681	17,798

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	50.0' long x 2.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=85.00' TW=85.00' (Dynamic Tailwater)

↑1=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: (ONSITE WETLAND W/STORAGE)



Summary for Pond 3P: (Wetland N)

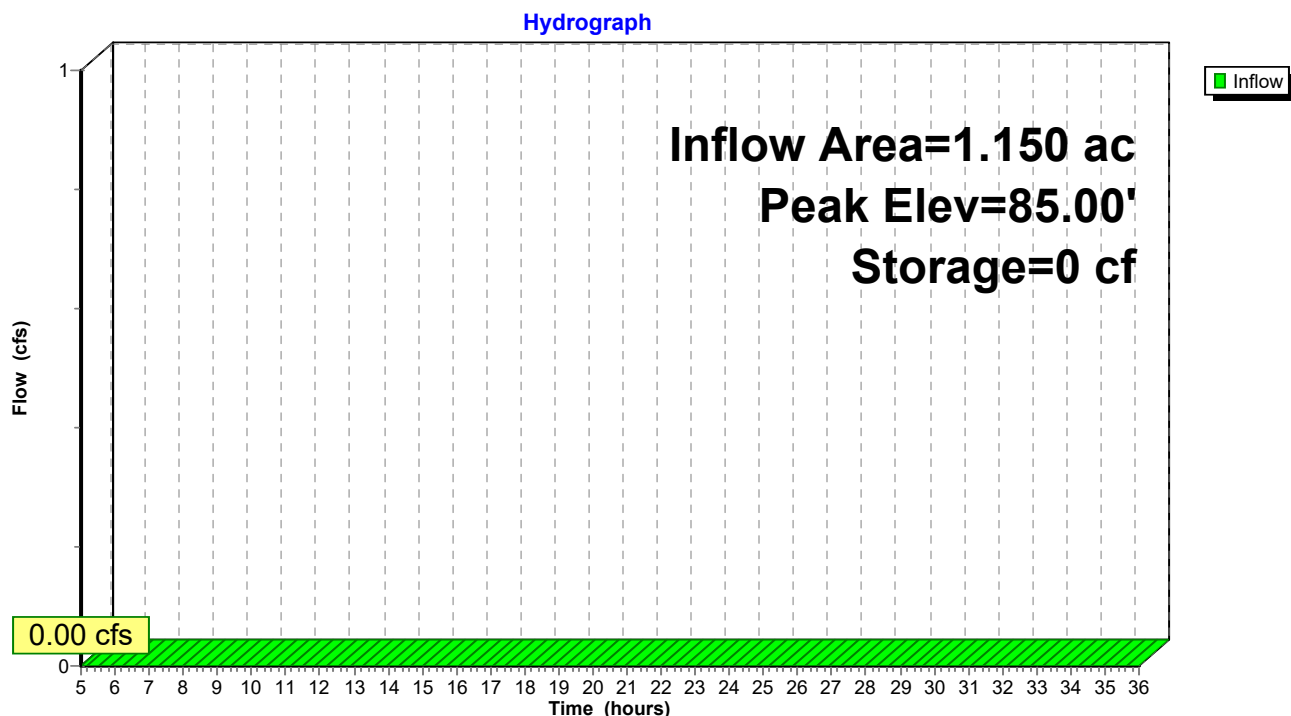
Inflow Area = 1.150 ac, 0.00% Impervious, Inflow Depth = 0.00" for 100YR-24HR event
 Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

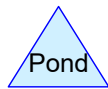
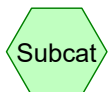
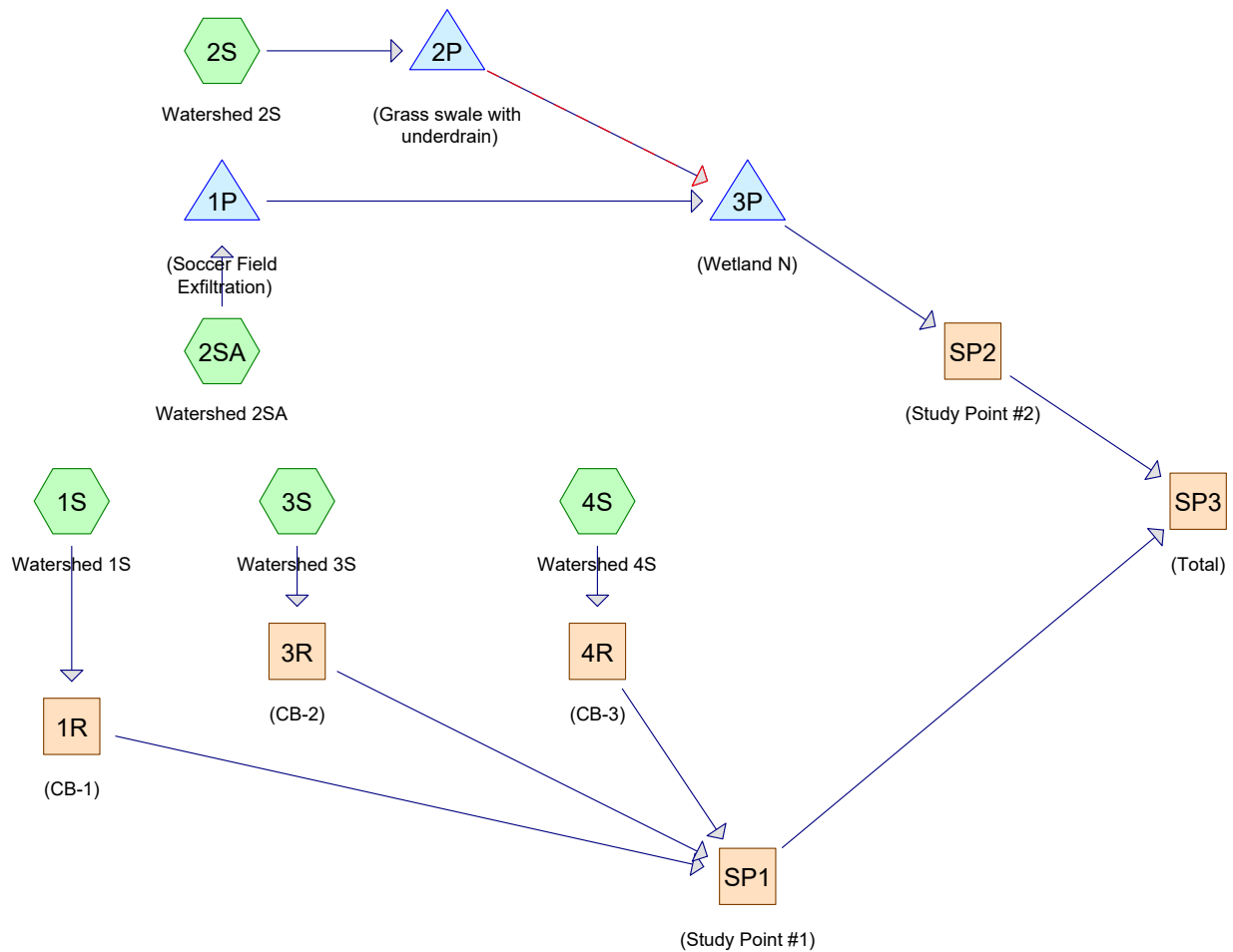
Routing by Dyn-Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 85.00' @ 5.00 hrs Surf.Area= 7,068 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	222,599 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	7,068	0	0
86.00	15,444	11,256	11,256
87.00	29,379	22,412	33,668
88.00	39,332	34,356	68,023
89.00	50,902	45,117	113,140
90.00	54,452	52,677	165,817
91.00	59,112	56,782	222,599

Pond 3P: (Wetland N)



Routing Diagram for 2018-02-28 - 115058 - Nemasket Post Dev Model

Prepared by TRC, Printed 3/2/2018

HydroCAD® 10.00-20 s/n 01728 © 2017 HydroCAD Software Solutions LLC

2018-02-28 - 115058 - Nemasket Post Dev Model

Prepared by TRC

Printed 3/2/2018

HydroCAD® 10.00-20 s/n 01728 © 2017 HydroCAD Software Solutions LLC

Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.664	39	>75% Grass cover, Good, HSG A (1S, 2S, 3S, 4S)
0.301	80	>75% Grass cover, Good, HSG D (1S, 2S)
1.300	96	Field Turf-Gravel surface, HSG A (2SA)
0.040	98	Paved parking, HSG A (4S)
2.305	78	TOTAL AREA

2018-02-28 - 115058 - Nemasket Post Dev Model

Prepared by TRC

Printed 3/2/2018

HydroCAD® 10.00-20 s/n 01728 © 2017 HydroCAD Software Solutions LLC

Page 3

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.004	HSG A	1S, 2S, 2SA, 3S, 4S
0.000	HSG B	
0.000	HSG C	
0.301	HSG D	
0.000	Other	1S, 2S
2.305		TOTAL AREA

2018-02-28 - 115058 - Nemasket Post Dev Model

Prepared by TRC

Printed 3/2/2018

HydroCAD® 10.00-20 s/n 01728 © 2017 HydroCAD Software Solutions LLC

Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.664	0.000	0.000	0.301	0.000	0.965	>75% Grass cover, Good	1S, 2S, 3S, 4S
1.300	0.000	0.000	0.000	0.000	1.300	Field Turf-Gravel surface	2SA
0.040	0.000	0.000	0.000	0.000	0.040	Paved parking	4S
2.004	0.000	0.000	0.301	0.000	2.305	TOTAL AREA	

2018-02-28 - 115058 - Nemasket Post Dev Model

Prepared by TRC

Printed 3/2/2018

HydroCAD® 10.00-20 s/n 01728 © 2017 HydroCAD Software Solutions LLC

Page 5

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2P	92.04	91.00	194.0	0.0054	0.013	12.0	0.0	0.0

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points x 2
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Watershed 1S	Runoff Area=0.196 ac 0.00% Impervious Runoff Depth=0.13" Tc=6.0 min CN=48 Runoff=0.00 cfs 0.002 af
Subcatchment 2S: Watershed 2S	Runoff Area=0.470 ac 0.00% Impervious Runoff Depth=0.57" Tc=6.0 min CN=62 Runoff=0.23 cfs 0.022 af
Subcatchment 2SA: Watershed 2SA	Runoff Area=1.300 ac 0.00% Impervious Runoff Depth=2.95" Tc=6.0 min CN=96 Runoff=4.13 cfs 0.319 af
Subcatchment 3S: Watershed 3S	Runoff Area=0.120 ac 0.00% Impervious Runoff Depth=0.00" Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af
Subcatchment 4S: Watershed 4S	Runoff Area=0.219 ac 18.26% Impervious Runoff Depth=0.17" Tc=6.0 min CN=50 Runoff=0.01 cfs 0.003 af
Reach 1R: (CB-1)	Inflow=0.00 cfs 0.002 af Outflow=0.00 cfs 0.002 af
Reach 3R: (CB-2)	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach 4R: (CB-3)	Inflow=0.01 cfs 0.003 af Outflow=0.01 cfs 0.003 af
Reach SP1: (Study Point #1)	Inflow=0.01 cfs 0.005 af Outflow=0.01 cfs 0.005 af
Reach SP2: (Study Point #2)	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach SP3: (Total)	Inflow=0.01 cfs 0.005 af Outflow=0.01 cfs 0.005 af
Pond 1P: (Soccer Field Exfiltration)	Peak Elev=93.53' Storage=13,905 cf Inflow=4.13 cfs 0.319 af Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Pond 2P: (Grass swale with underdrain)	Peak Elev=92.25' Storage=174 cf Inflow=0.23 cfs 0.022 af Primary=0.14 cfs 0.019 af Secondary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.019 af
Pond 3P: (Wetland N)	Peak Elev=85.11' Storage=845 cf Inflow=0.14 cfs 0.019 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.305 ac Runoff Volume = 0.347 af Average Runoff Depth = 1.81"
98.26% Pervious = 2.265 ac 1.74% Impervious = 0.040 ac

Summary for Subcatchment 1S: Watershed 1S

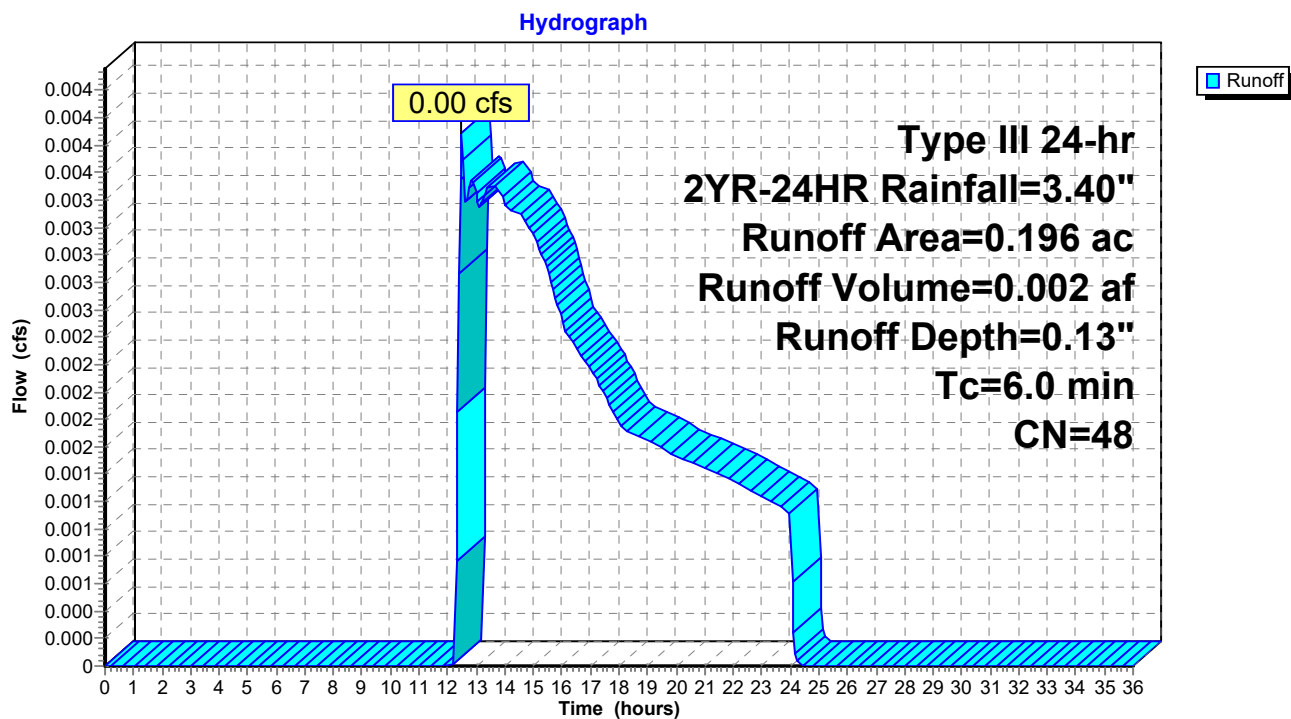
Runoff = 0.00 cfs @ 12.50 hrs, Volume= 0.002 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 2YR-24HR Rainfall=3.40"

Area (ac)	CN	Description
0.155	39	>75% Grass cover, Good, HSG A
0.041	80	>75% Grass cover, Good, HSG D
0.196	48	Weighted Average
0.196		100.00% Pervious Area

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

Subcatchment 1S: Watershed 1S



Summary for Subcatchment 2S: Watershed 2S

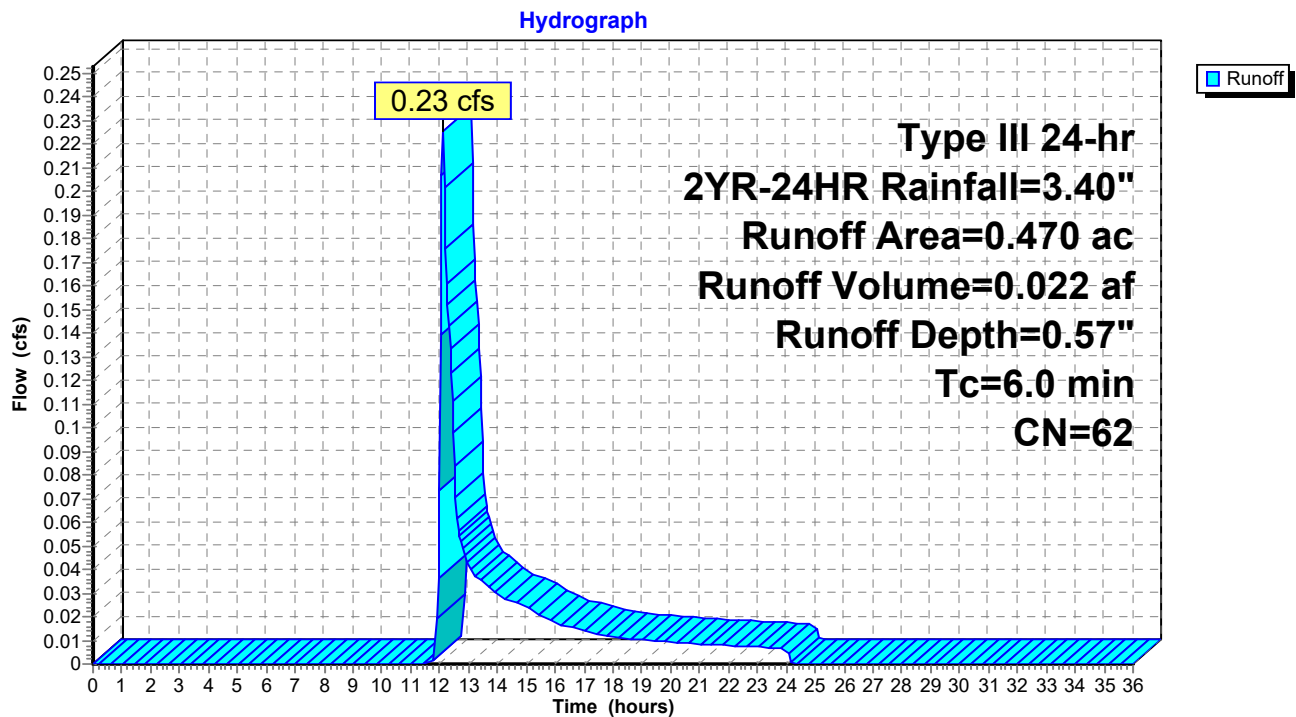
Runoff = 0.23 cfs @ 12.12 hrs, Volume= 0.022 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 2YR-24HR Rainfall=3.40"

Area (ac)	CN	Description
0.260	80	>75% Grass cover, Good, HSG D
0.210	39	>75% Grass cover, Good, HSG A
0.470	62	Weighted Average
0.470		100.00% Pervious Area

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

Subcatchment 2S: Watershed 2S



Summary for Subcatchment 2SA: Watershed 2SA

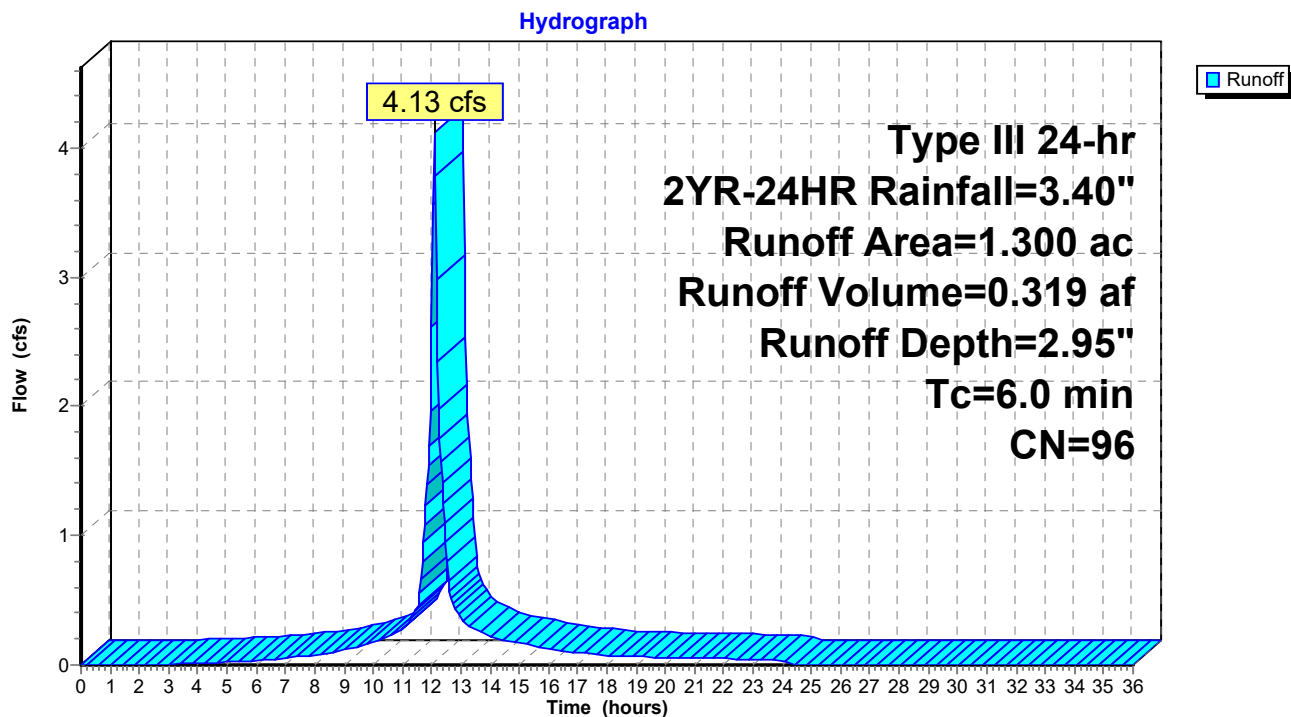
Runoff = 4.13 cfs @ 12.08 hrs, Volume= 0.319 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 2YR-24HR Rainfall=3.40"

Area (ac)	CN	Description
* 1.300	96	Field Turf-Gravel surface, HSG A
1.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Minimum Tc = 6 min.

Subcatchment 2SA: Watershed 2SA



Summary for Subcatchment 3S: Watershed 3S

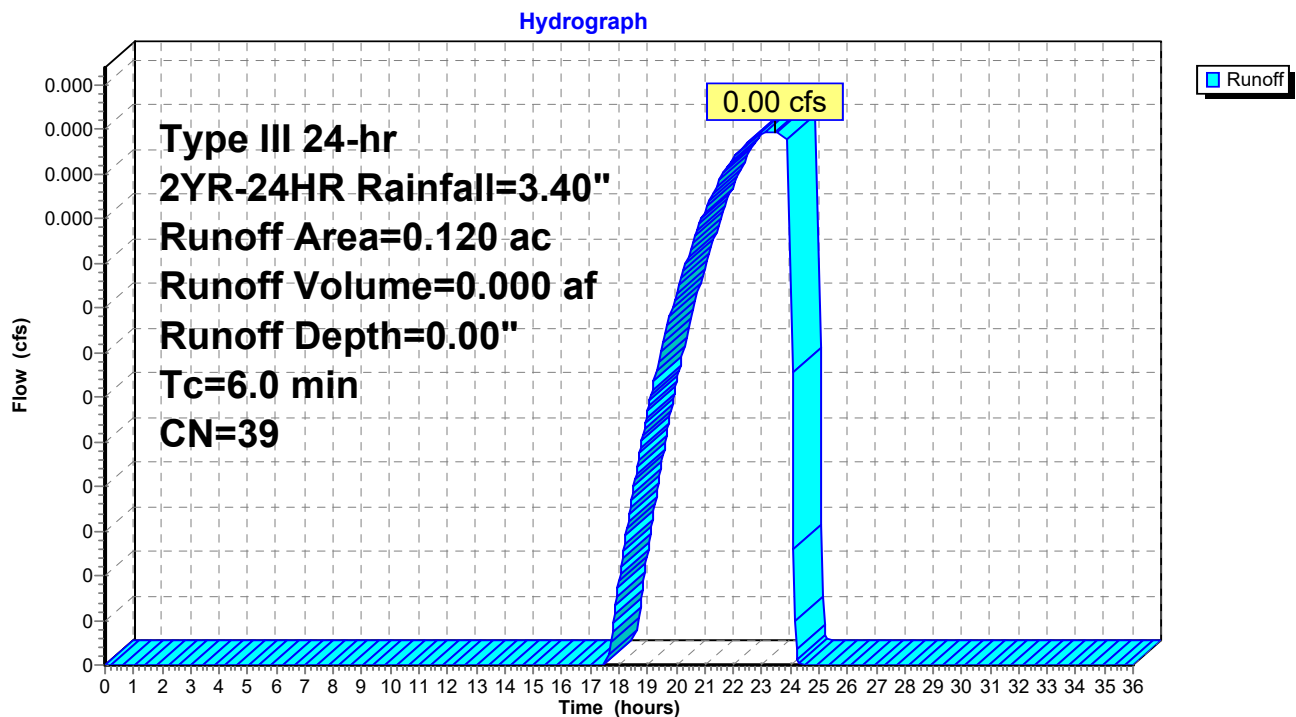
Runoff = 0.00 cfs @ 23.43 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2YR-24HR Rainfall=3.40"

Area (ac)	CN	Description
0.120	39	>75% Grass cover, Good, HSG A
0.120		100.00% Pervious Area

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

Subcatchment 3S: Watershed 3S



Summary for Subcatchment 4S: Watershed 4S

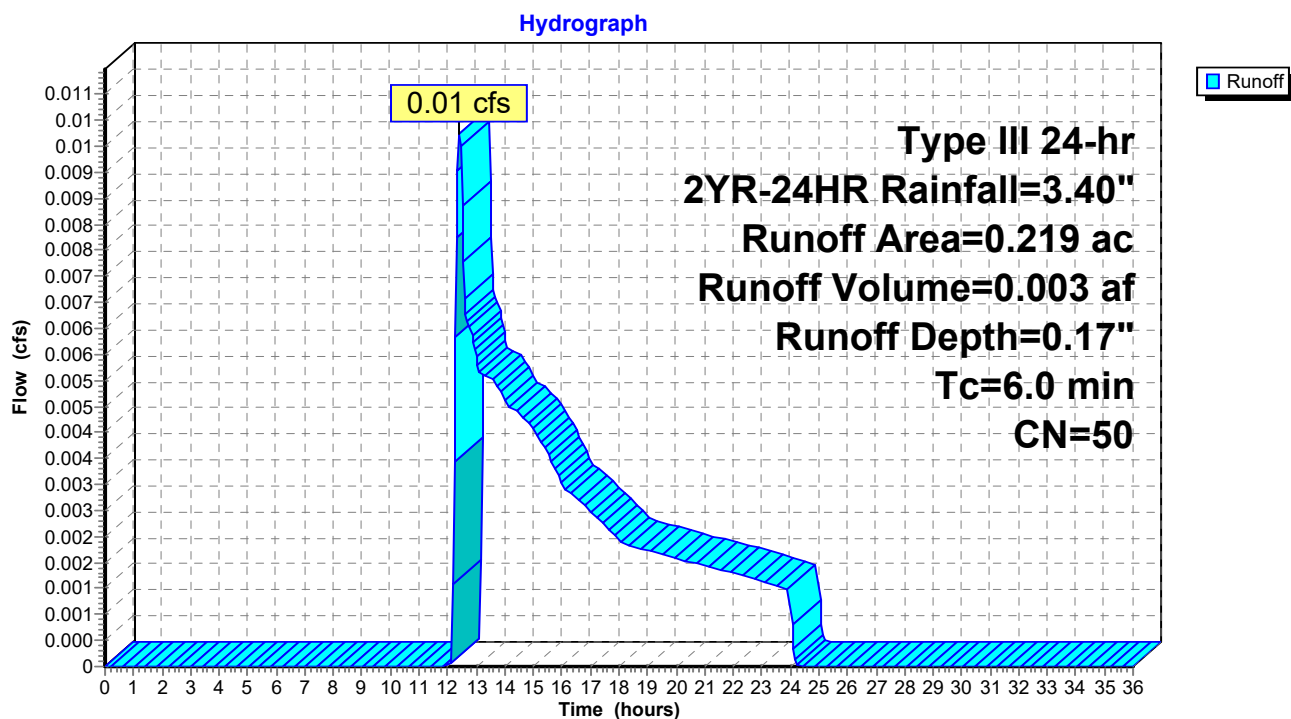
Runoff = 0.01 cfs @ 12.42 hrs, Volume= 0.003 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 2YR-24HR Rainfall=3.40"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.179	39	>75% Grass cover, Good, HSG A
0.219	50	Weighted Average
0.179		81.74% Pervious Area
0.040		18.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6 minutes - minimum

Subcatchment 4S: Watershed 4S

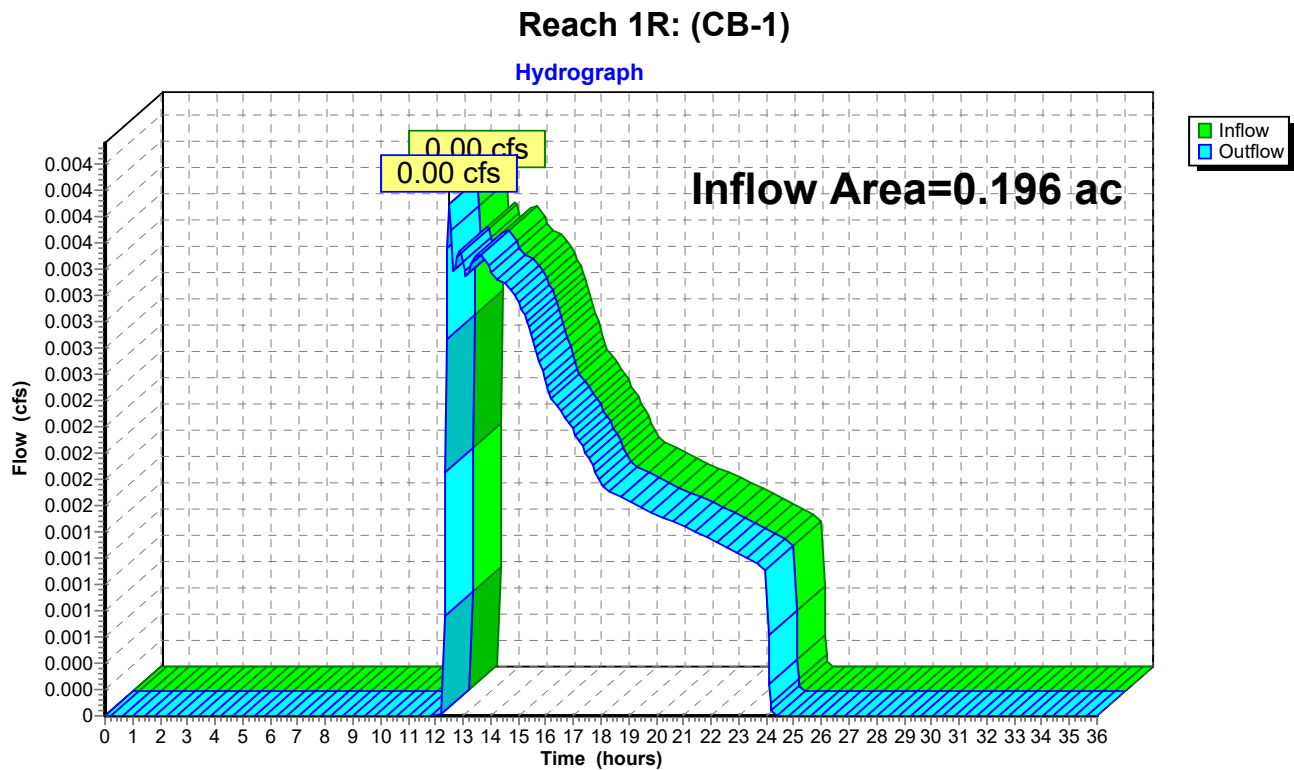


Summary for Reach 1R: (CB-1)

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

Inflow Area = 0.196 ac, 0.00% Impervious, Inflow Depth = 0.13" for 2YR-24HR event
Inflow = 0.00 cfs @ 12.50 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 12.50 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

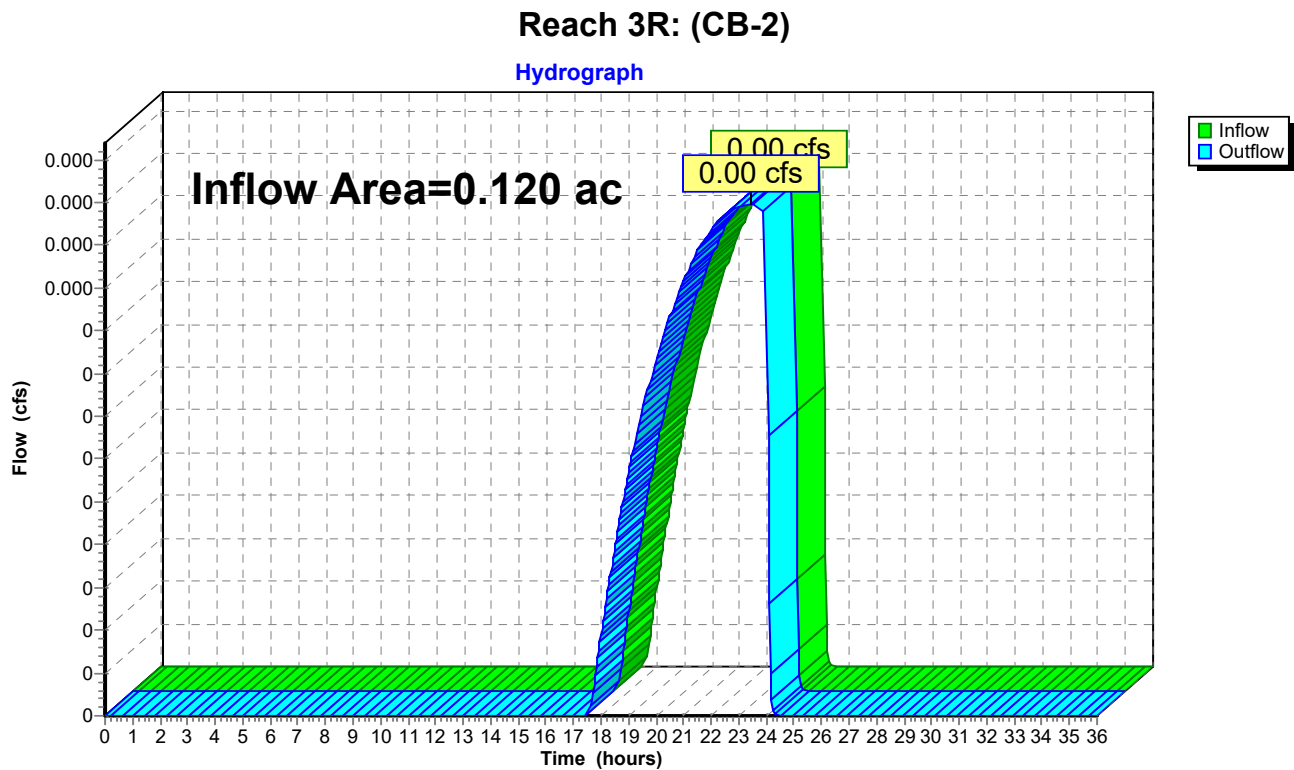


Summary for Reach 3R: (CB-2)

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

Inflow Area = 0.120 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2YR-24HR event
Inflow = 0.00 cfs @ 23.43 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 23.43 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

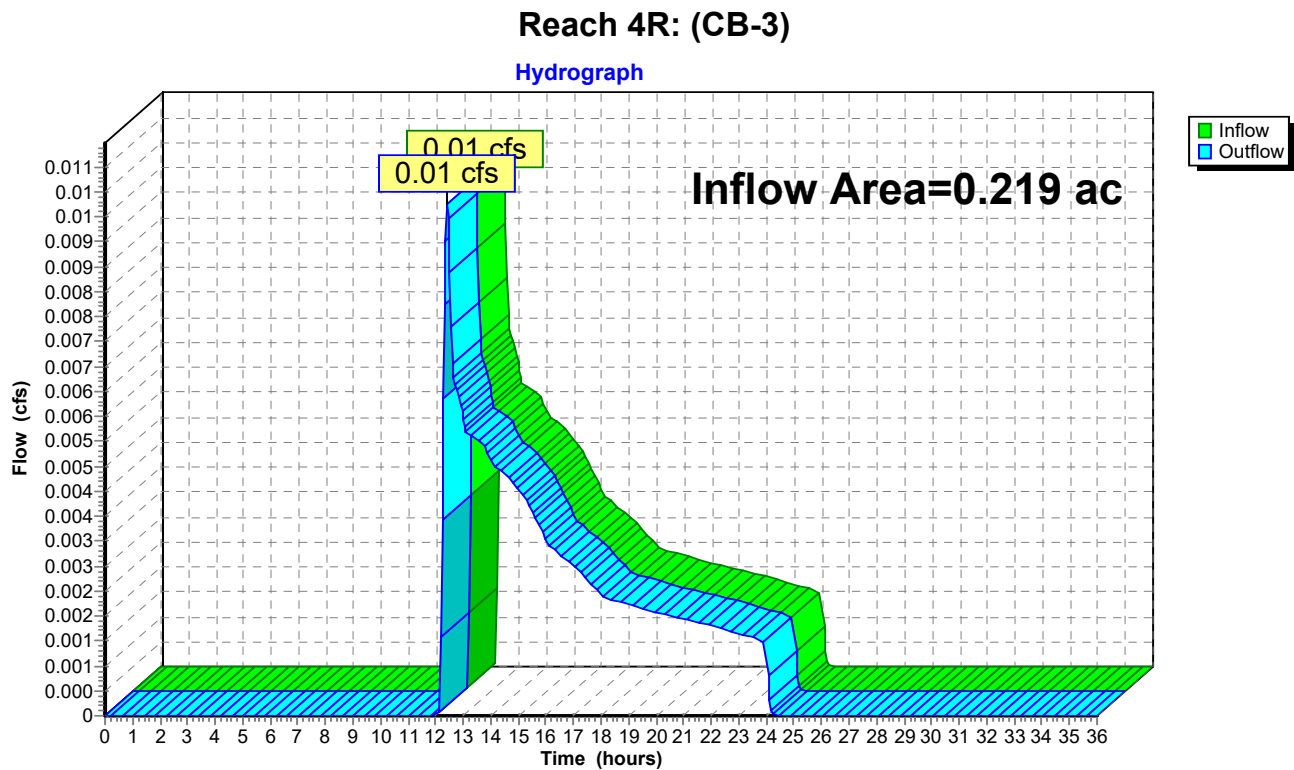


Summary for Reach 4R: (CB-3)

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

Inflow Area = 0.219 ac, 18.26% Impervious, Inflow Depth = 0.17" for 2YR-24HR event
Inflow = 0.01 cfs @ 12.42 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 12.42 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2



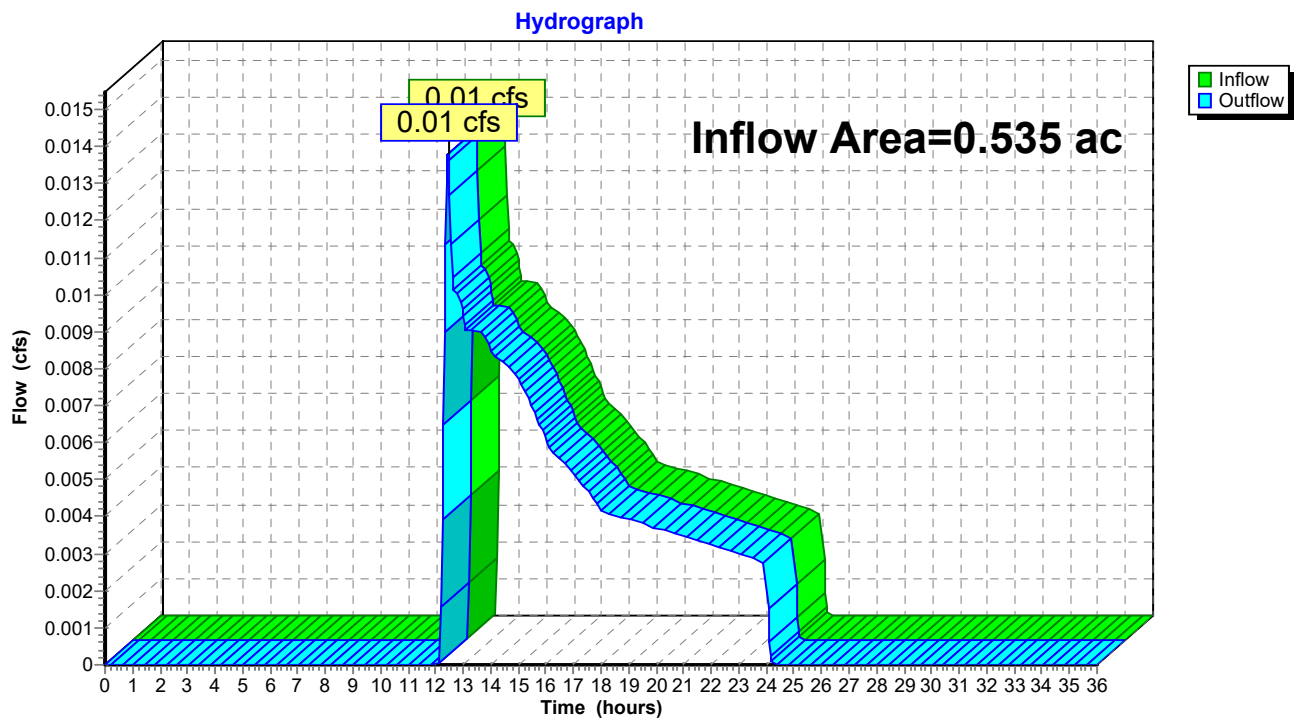
Summary for Reach SP1: (Study Point #1)

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

Inflow Area = 0.535 ac, 7.48% Impervious, Inflow Depth = 0.12" for 2YR-24HR event
Inflow = 0.01 cfs @ 12.45 hrs, Volume= 0.005 af
Outflow = 0.01 cfs @ 12.45 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Reach SP1: (Study Point #1)



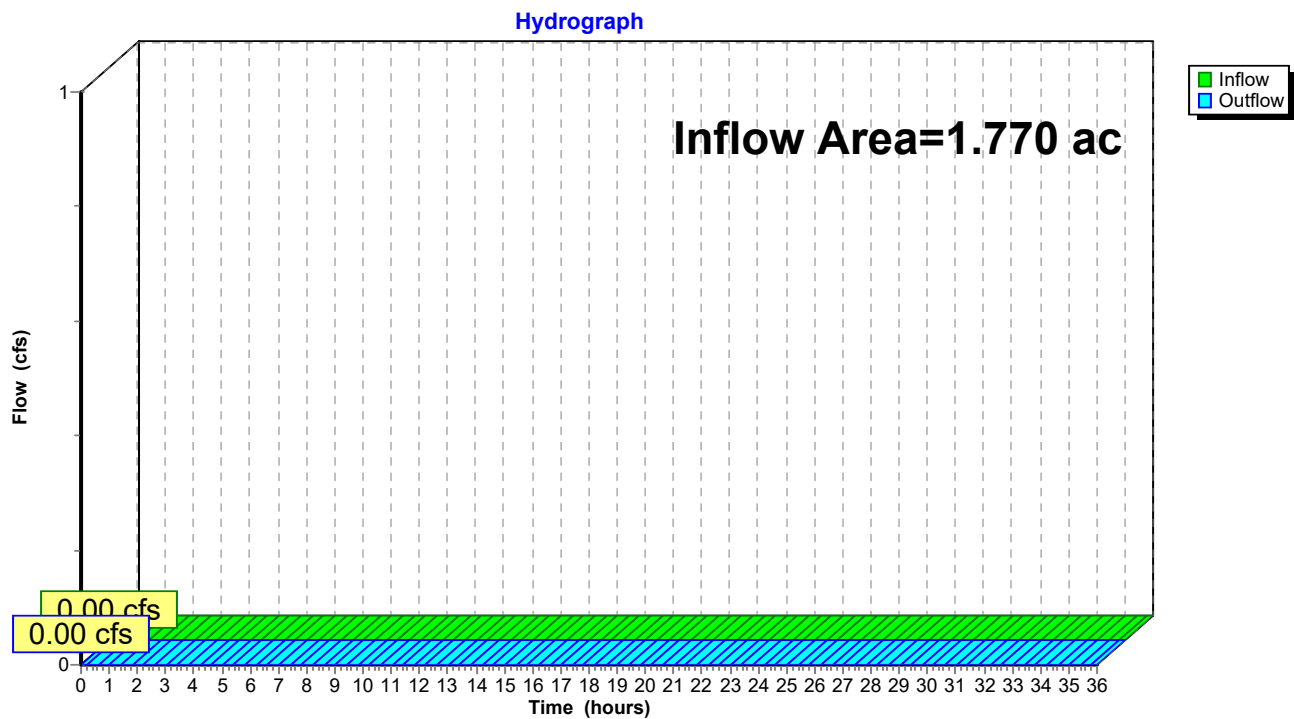
Summary for Reach SP2: (Study Point #2)

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

Inflow Area = 1.770 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2YR-24HR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Reach SP2: (Study Point #2)

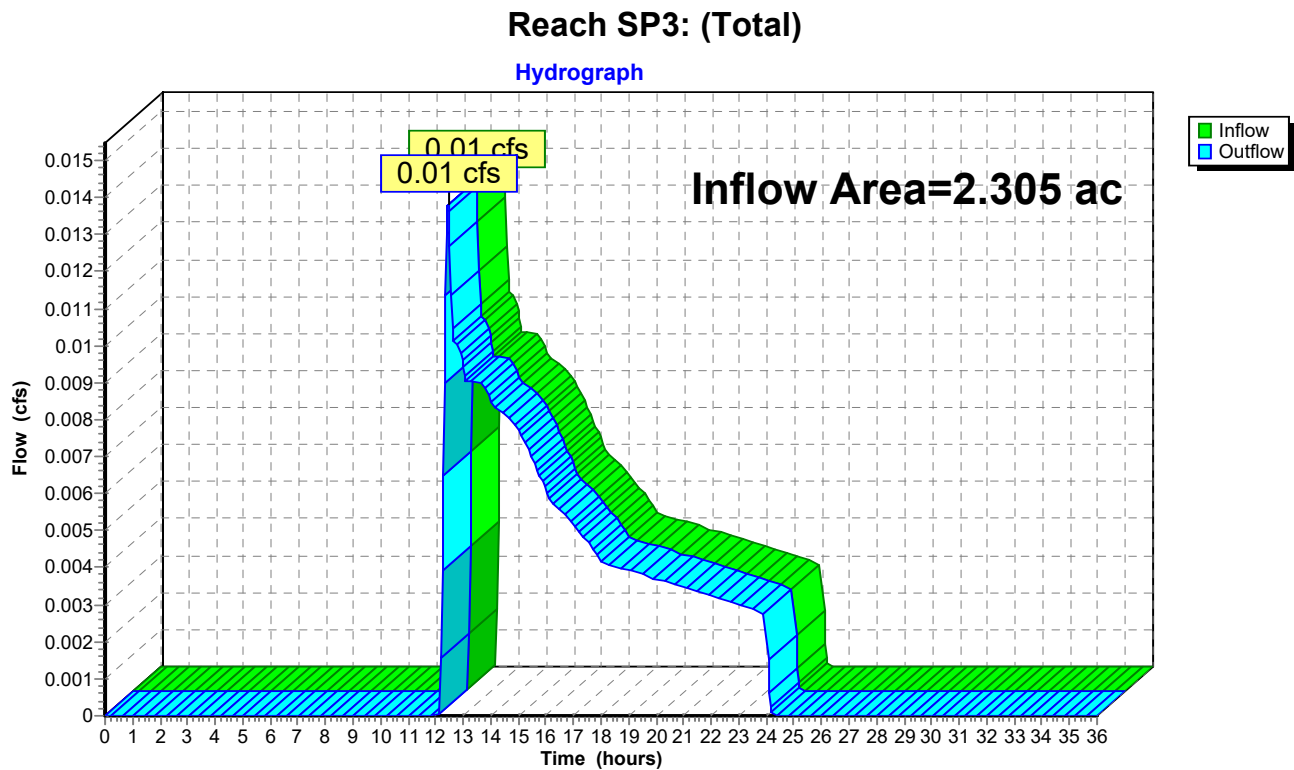


Summary for Reach SP3: (Total)

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

Inflow Area = 2.305 ac, 1.74% Impervious, Inflow Depth = 0.03" for 2YR-24HR event
Inflow = 0.01 cfs @ 12.45 hrs, Volume= 0.005 af
Outflow = 0.01 cfs @ 12.45 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2



Summary for Pond 1P: (Soccer Field Exfiltration)

Inflow Area = 1.300 ac, 0.00% Impervious, Inflow Depth = 2.95" for 2YR-24HR event
 Inflow = 4.13 cfs @ 12.08 hrs, Volume= 0.319 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
 Peak Elev= 93.53' @ 24.36 hrs Surf.Area= 56,550 sf Storage= 13,905 cf
 Flood Elev= 94.67' Surf.Area= 56,550 sf Storage= 39,585 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	92.92'	47,050 cf	Custom Stage Data (Prismatic) Listed below

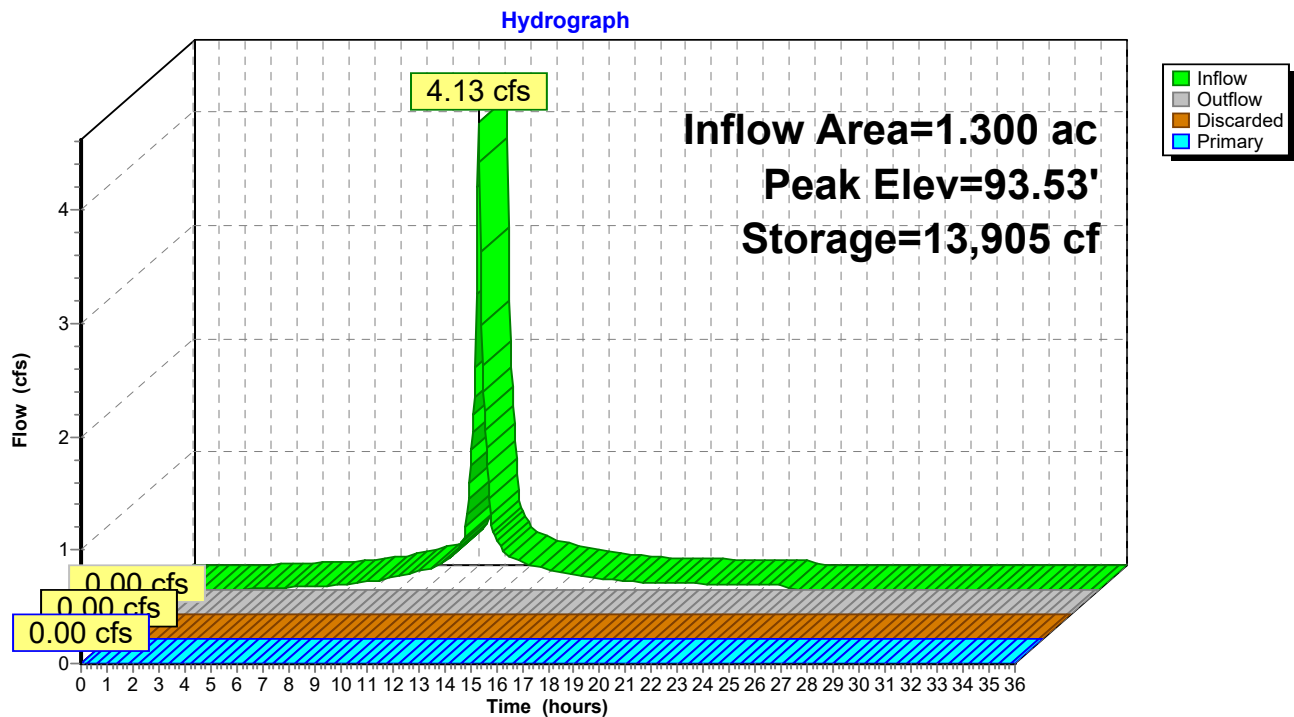
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
92.92	56,550	0.0	0	0
93.25	56,550	40.0	7,465	7,465
94.25	56,550	40.0	22,620	30,085
95.00	56,550	40.0	16,965	47,050

Device	Routing	Invert	Outlet Devices
#1	Primary	94.67'	336.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	94.17'	0.335 in/hr Exfiltration over Surface area above 94.17' Conductivity to Groundwater Elevation = 87.00' Excluded Surface area = 56,550 sf

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.92' (Free Discharge)
 ↳ **2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.92' TW=85.00' (Dynamic Tailwater)
 ↳ **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: (Soccer Field Exfiltration)



Summary for Pond 2P: (Grass swale with underdrain)

Inflow Area = 0.470 ac, 0.00% Impervious, Inflow Depth = 0.57" for 2YR-24HR event
 Inflow = 0.23 cfs @ 12.12 hrs, Volume= 0.022 af
 Outflow = 0.14 cfs @ 12.36 hrs, Volume= 0.019 af, Atten= 40%, Lag= 14.3 min
 Primary = 0.14 cfs @ 12.36 hrs, Volume= 0.019 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 92.25' @ 12.36 hrs Surf.Area= 582 sf Storage= 174 cf

Flood Elev= 94.67' Surf.Area= 990 sf Storage= 349 cf

Plug-Flow detention time= 101.9 min calculated for 0.019 af (87% of inflow)

Center-of-Mass det. time= 41.9 min (944.5 - 902.5)

Volume	Invert	Avail.Storage	Storage Description
#1	91.50'	349 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.50	582	0.0	0	0
92.00	582	40.0	116	116
93.00	582	40.0	233	349
94.00	970	0.0	0	349
95.00	1,000	0.0	0	349
95.50	1,001	0.0	0	349

Device	Routing	Invert	Outlet Devices
#1	Primary	92.04'	12.0" Round Culvert L= 194.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 92.04' / 91.00' S= 0.0054 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Secondary	95.00'	25.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

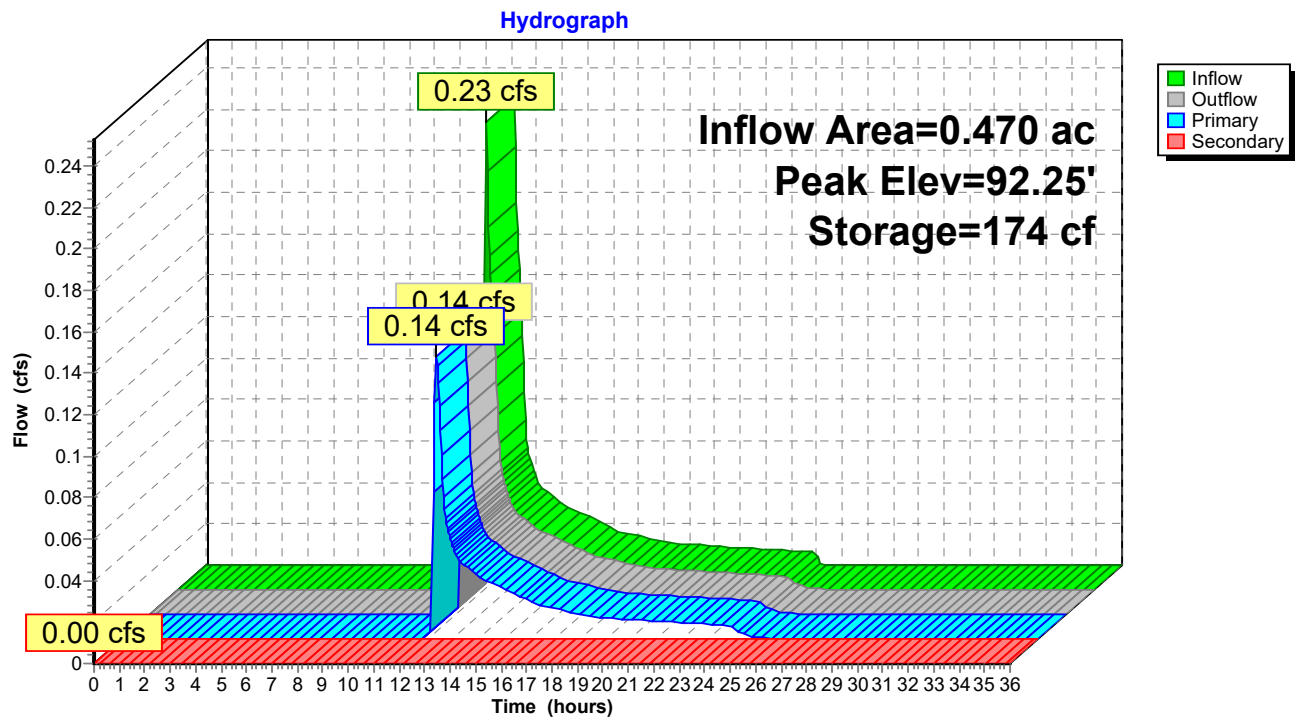
Primary OutFlow Max=0.14 cfs @ 12.36 hrs HW=92.25' TW=85.01' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 0.14 cfs @ 1.74 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=91.50' TW=85.00' (Dynamic Tailwater)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: (Grass swale with underdrain)



Summary for Pond 3P: (Wetland N)

Inflow Area = 1.770 ac, 0.00% Impervious, Inflow Depth = 0.13" for 2YR-24HR event
 Inflow = 0.14 cfs @ 12.36 hrs, Volume= 0.019 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

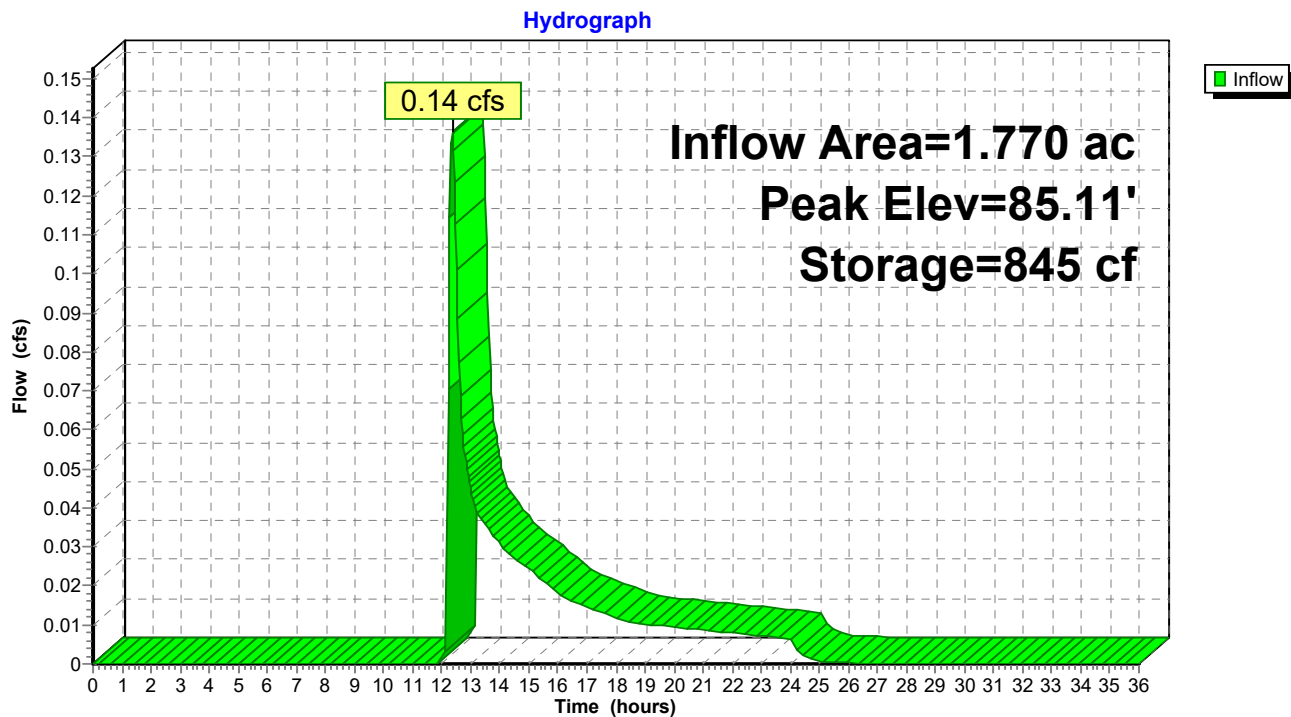
Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
 Peak Elev= 85.11' @ 36.00 hrs Surf.Area= 8,007 sf Storage= 845 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	220,938 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	7,068	0	0
86.00	15,444	11,256	11,256
87.00	29,379	22,412	33,668
88.00	39,282	34,331	67,998
89.00	50,533	44,908	112,906
90.00	53,770	52,152	165,057
91.00	57,991	55,881	220,938

Pond 3P: (Wetland N)



Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Watershed 1S	Runoff Area=0.196 ac 0.00% Impervious Runoff Depth=0.59" Tc=6.0 min CN=48 Runoff=0.07 cfs 0.010 af
Subcatchment 2S: Watershed 2S	Runoff Area=0.470 ac 0.00% Impervious Runoff Depth=1.44" Tc=6.0 min CN=62 Runoff=0.73 cfs 0.057 af
Subcatchment 2SA: Watershed 2SA	Runoff Area=1.300 ac 0.00% Impervious Runoff Depth=4.54" Tc=6.0 min CN=96 Runoff=6.21 cfs 0.492 af
Subcatchment 3S: Watershed 3S	Runoff Area=0.120 ac 0.00% Impervious Runoff Depth=0.20" Tc=6.0 min CN=39 Runoff=0.00 cfs 0.002 af
Subcatchment 4S: Watershed 4S	Runoff Area=0.219 ac 18.26% Impervious Runoff Depth=0.70" Tc=6.0 min CN=50 Runoff=0.11 cfs 0.013 af
Reach 1R: (CB-1)	Inflow=0.07 cfs 0.010 af Outflow=0.07 cfs 0.010 af
Reach 3R: (CB-2)	Inflow=0.00 cfs 0.002 af Outflow=0.00 cfs 0.002 af
Reach 4R: (CB-3)	Inflow=0.11 cfs 0.013 af Outflow=0.11 cfs 0.013 af
Reach SP1: (Study Point #1)	Inflow=0.18 cfs 0.024 af Outflow=0.18 cfs 0.024 af
Reach SP2: (Study Point #2)	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach SP3: (Total)	Inflow=0.18 cfs 0.024 af Outflow=0.18 cfs 0.024 af
Pond 1P: (Soccer Field Exfiltration)	Peak Elev=93.87' Storage=21,436 cf Inflow=6.21 cfs 0.492 af Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Pond 2P: (Grass swale with underdrain)	Peak Elev=92.52' Storage=237 cf Inflow=0.73 cfs 0.057 af Primary=0.70 cfs 0.054 af Secondary=0.00 cfs 0.000 af Outflow=0.70 cfs 0.054 af
Pond 3P: (Wetland N)	Peak Elev=85.28' Storage=2,338 cf Inflow=0.70 cfs 0.054 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.305 ac Runoff Volume = 0.573 af Average Runoff Depth = 2.98"
98.26% Pervious = 2.265 ac 1.74% Impervious = 0.040 ac

Summary for Subcatchment 1S: Watershed 1S

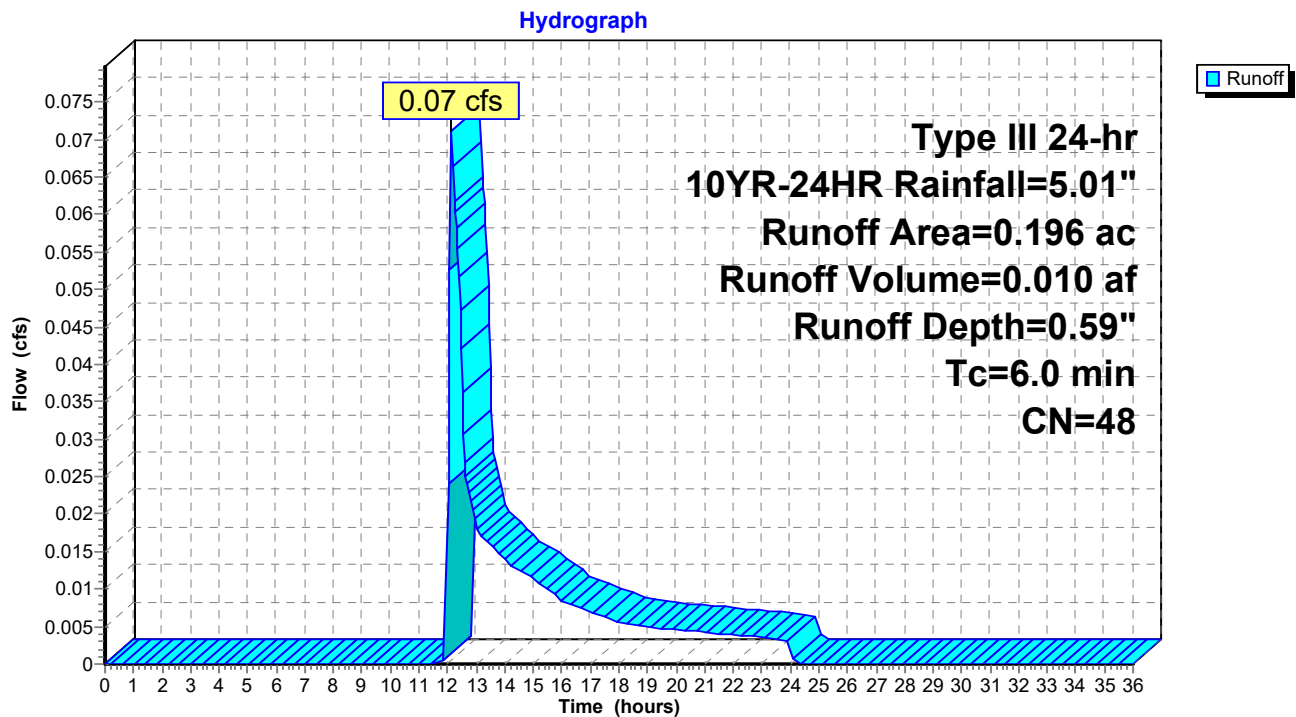
Runoff = 0.07 cfs @ 12.14 hrs, Volume= 0.010 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 10YR-24HR Rainfall=5.01"

Area (ac)	CN	Description
0.155	39	>75% Grass cover, Good, HSG A
0.041	80	>75% Grass cover, Good, HSG D
0.196	48	Weighted Average
0.196		100.00% Pervious Area

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

Subcatchment 1S: Watershed 1S



Summary for Subcatchment 2S: Watershed 2S

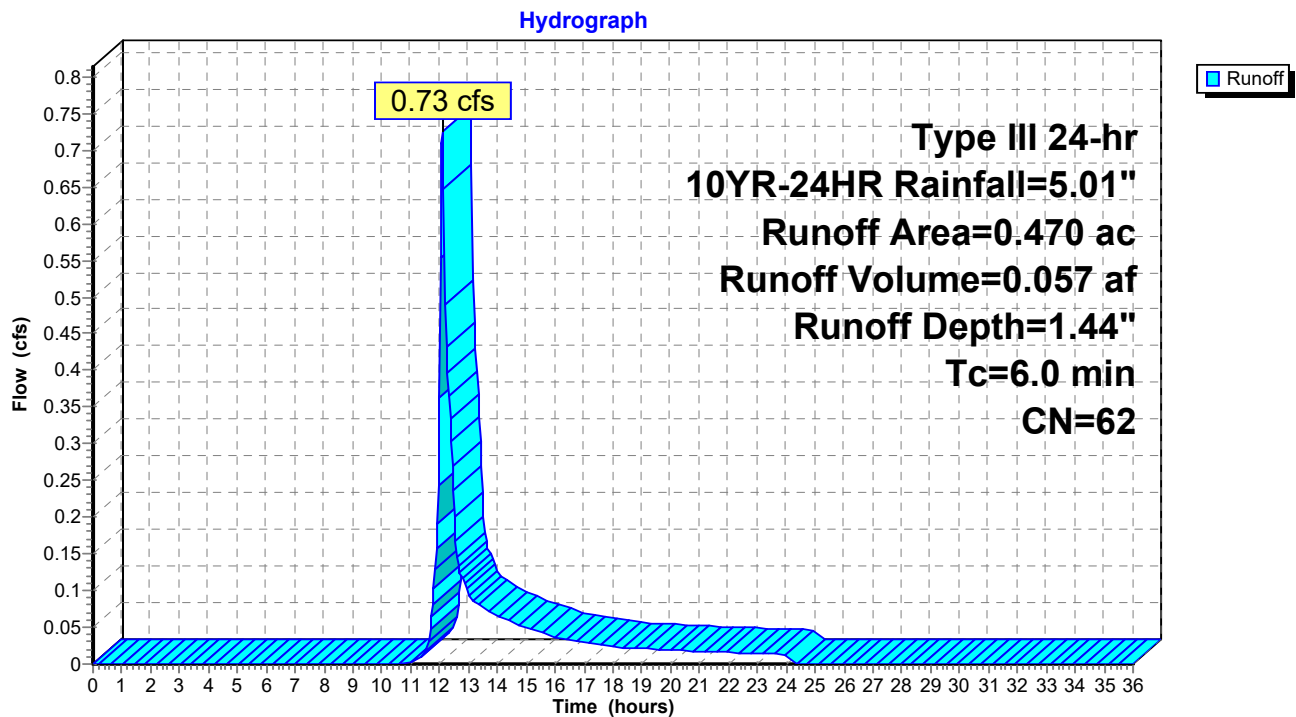
Runoff = 0.73 cfs @ 12.10 hrs, Volume= 0.057 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 10YR-24HR Rainfall=5.01"

Area (ac)	CN	Description
0.260	80	>75% Grass cover, Good, HSG D
0.210	39	>75% Grass cover, Good, HSG A
0.470	62	Weighted Average
0.470		100.00% Pervious Area

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

Subcatchment 2S: Watershed 2S



Summary for Subcatchment 2SA: Watershed 2SA

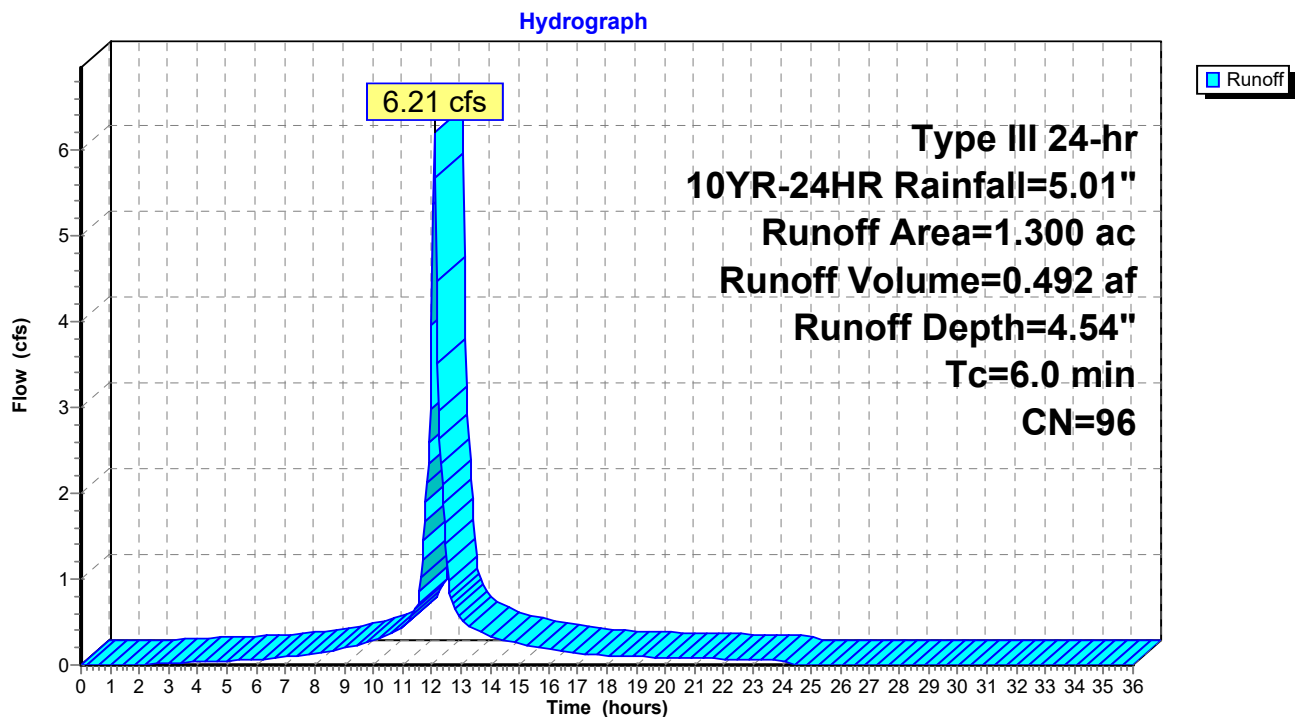
Runoff = 6.21 cfs @ 12.08 hrs, Volume= 0.492 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 10YR-24HR Rainfall=5.01"

Area (ac)	CN	Description
* 1.300	96	Field Turf-Gravel surface, HSG A
1.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Minimum Tc = 6 min.

Subcatchment 2SA: Watershed 2SA



Summary for Subcatchment 3S: Watershed 3S

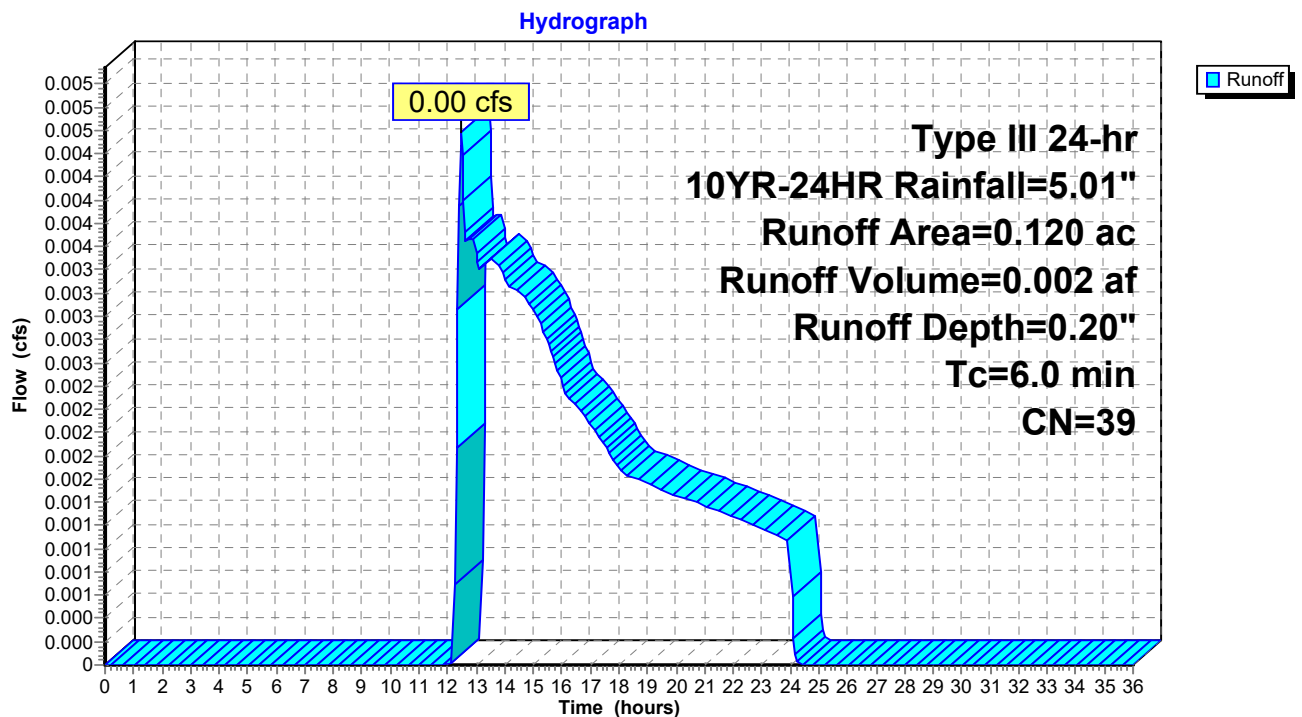
Runoff = 0.00 cfs @ 12.48 hrs, Volume= 0.002 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 10YR-24HR Rainfall=5.01"

Area (ac)	CN	Description
0.120	39	>75% Grass cover, Good, HSG A
0.120		100.00% Pervious Area

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

Subcatchment 3S: Watershed 3S



Summary for Subcatchment 4S: Watershed 4S

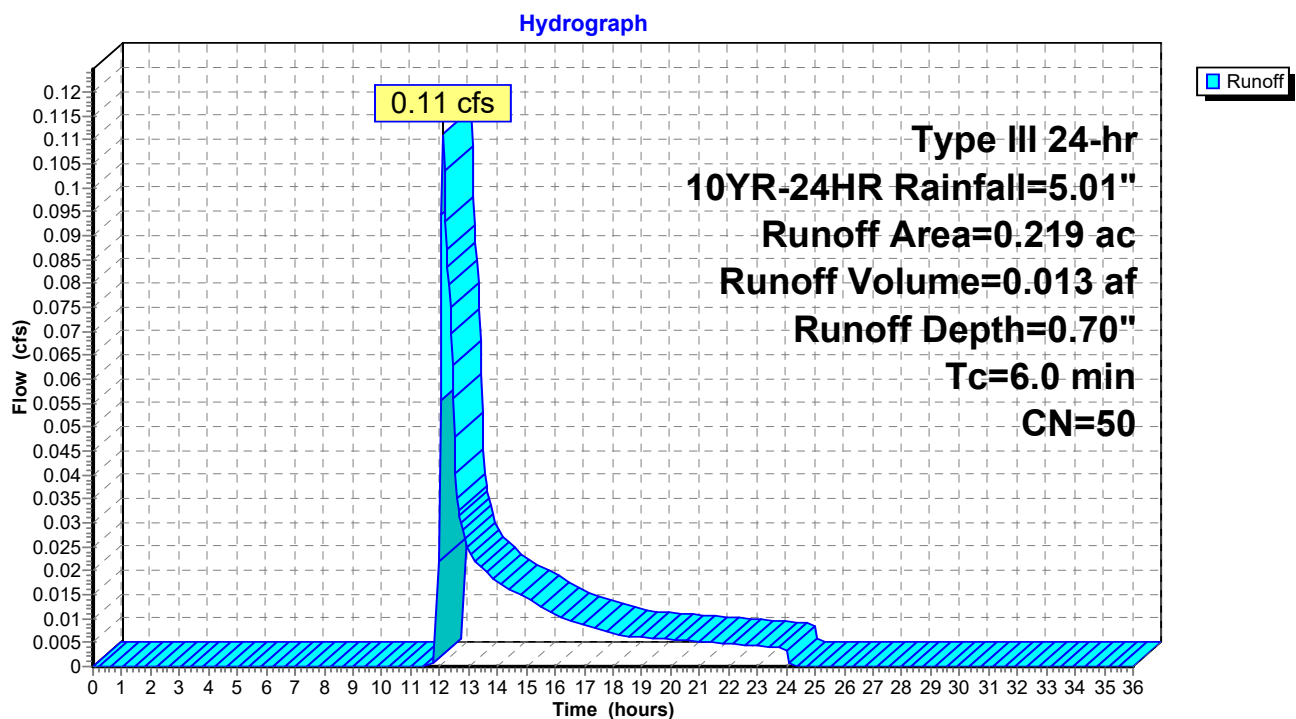
Runoff = 0.11 cfs @ 12.13 hrs, Volume= 0.013 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 10YR-24HR Rainfall=5.01"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.179	39	>75% Grass cover, Good, HSG A
0.219	50	Weighted Average
0.179		81.74% Pervious Area
0.040		18.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6 minutes - minimum

Subcatchment 4S: Watershed 4S

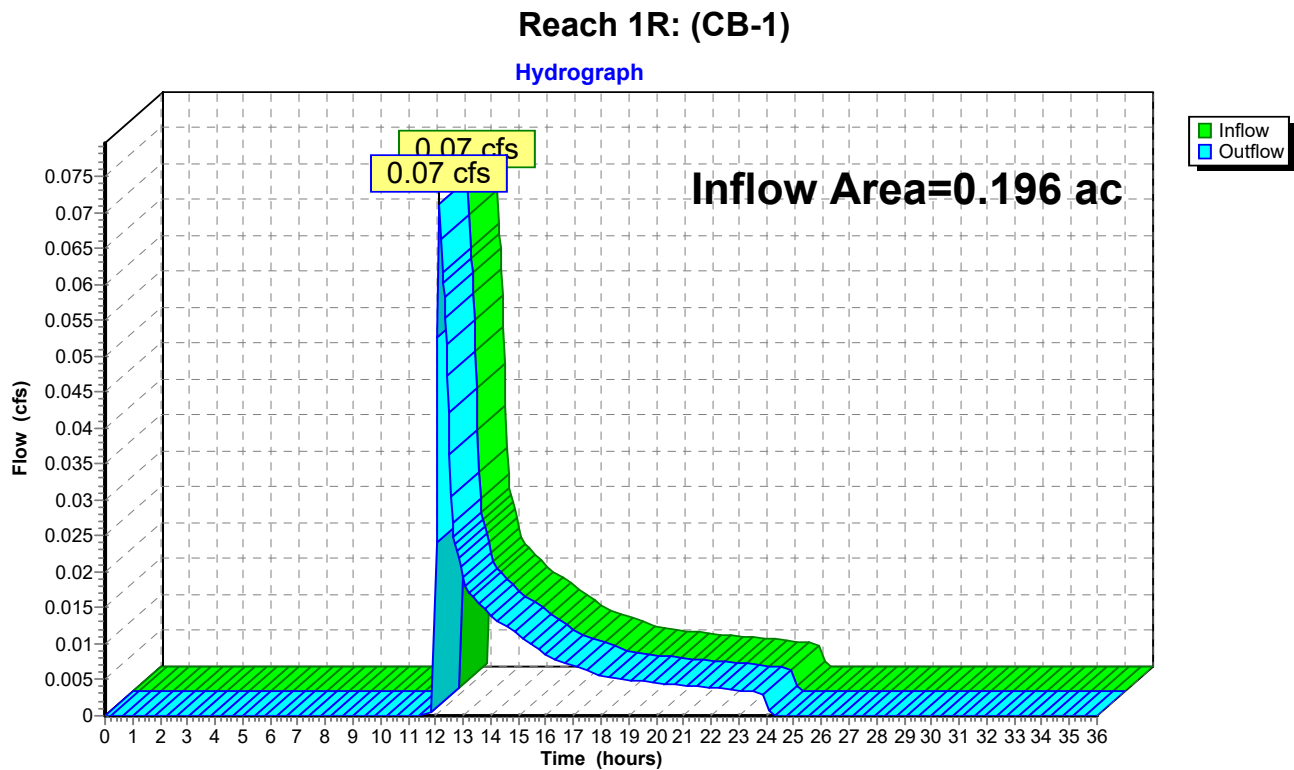


Summary for Reach 1R: (CB-1)

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

Inflow Area = 0.196 ac, 0.00% Impervious, Inflow Depth = 0.59" for 10YR-24HR event
Inflow = 0.07 cfs @ 12.14 hrs, Volume= 0.010 af
Outflow = 0.07 cfs @ 12.14 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

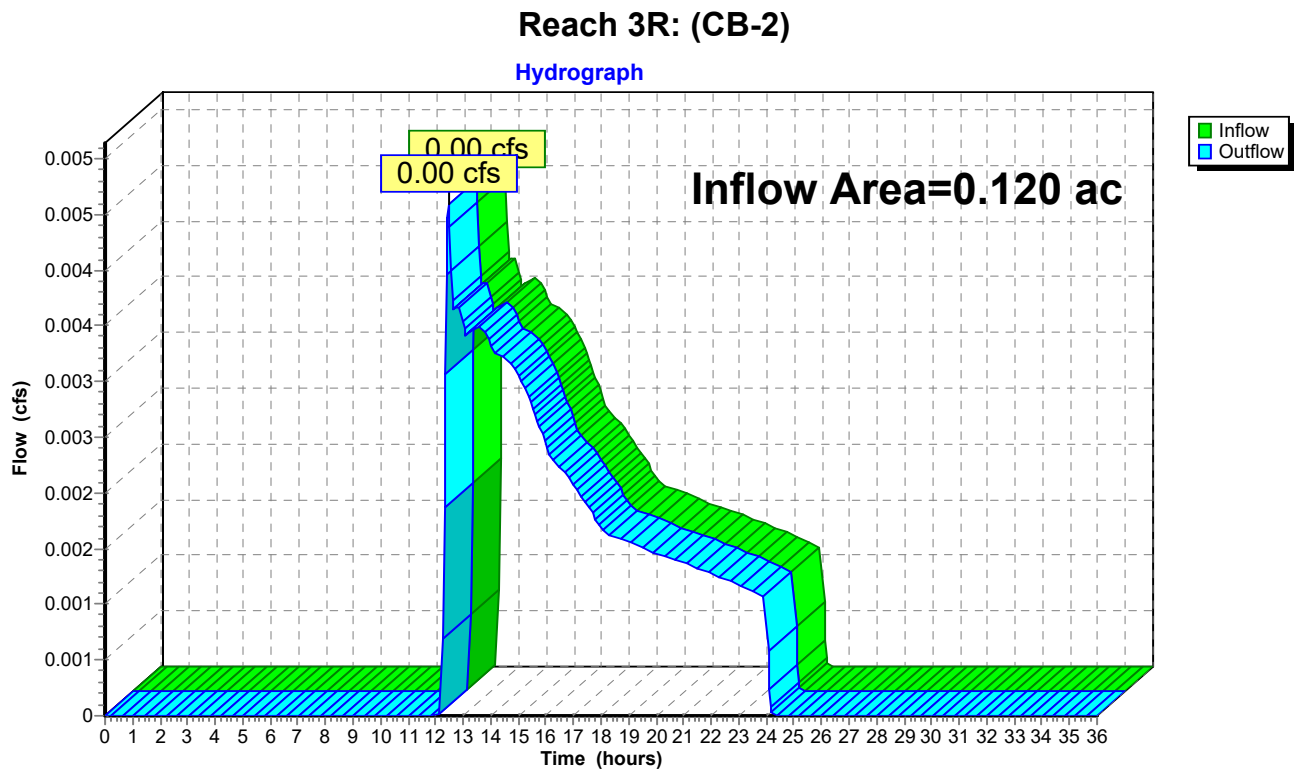


Summary for Reach 3R: (CB-2)

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

Inflow Area = 0.120 ac, 0.00% Impervious, Inflow Depth = 0.20" for 10YR-24HR event
Inflow = 0.00 cfs @ 12.48 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 12.48 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

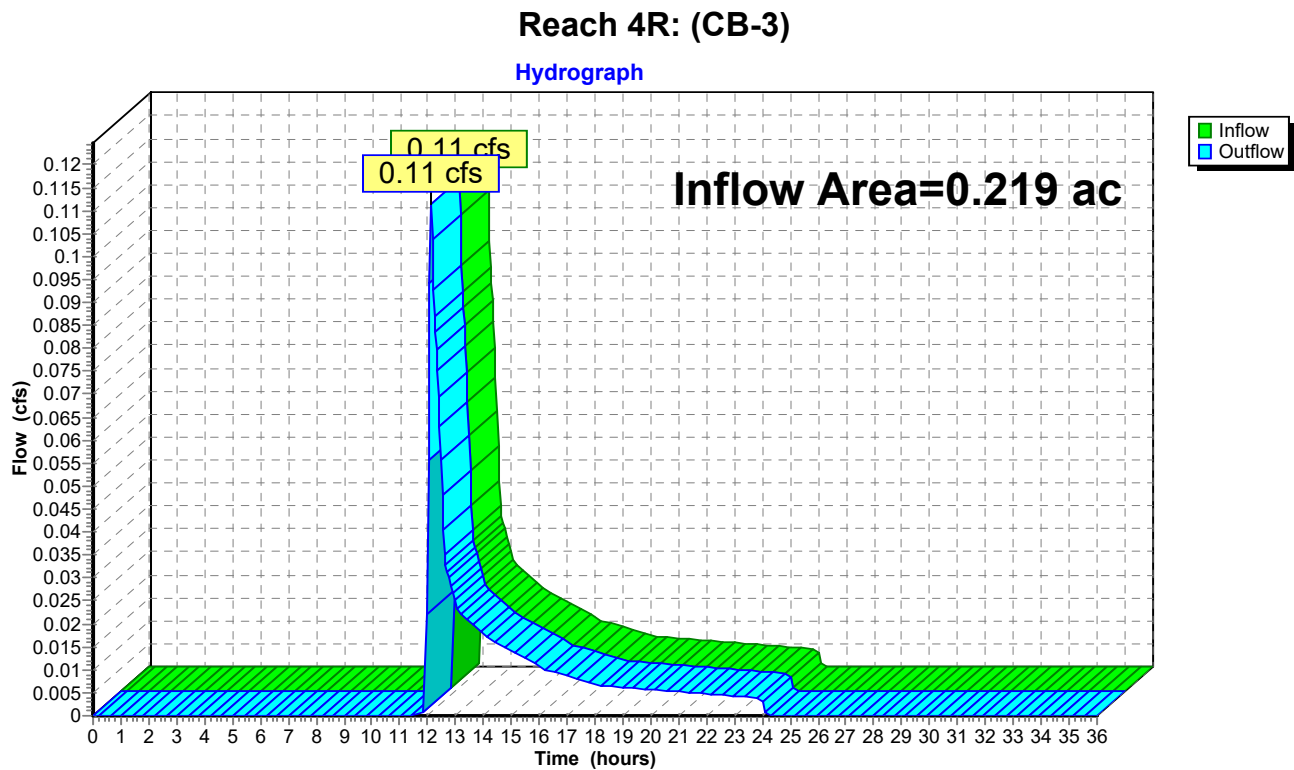


Summary for Reach 4R: (CB-3)

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

Inflow Area = 0.219 ac, 18.26% Impervious, Inflow Depth = 0.70" for 10YR-24HR event
Inflow = 0.11 cfs @ 12.13 hrs, Volume= 0.013 af
Outflow = 0.11 cfs @ 12.13 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2



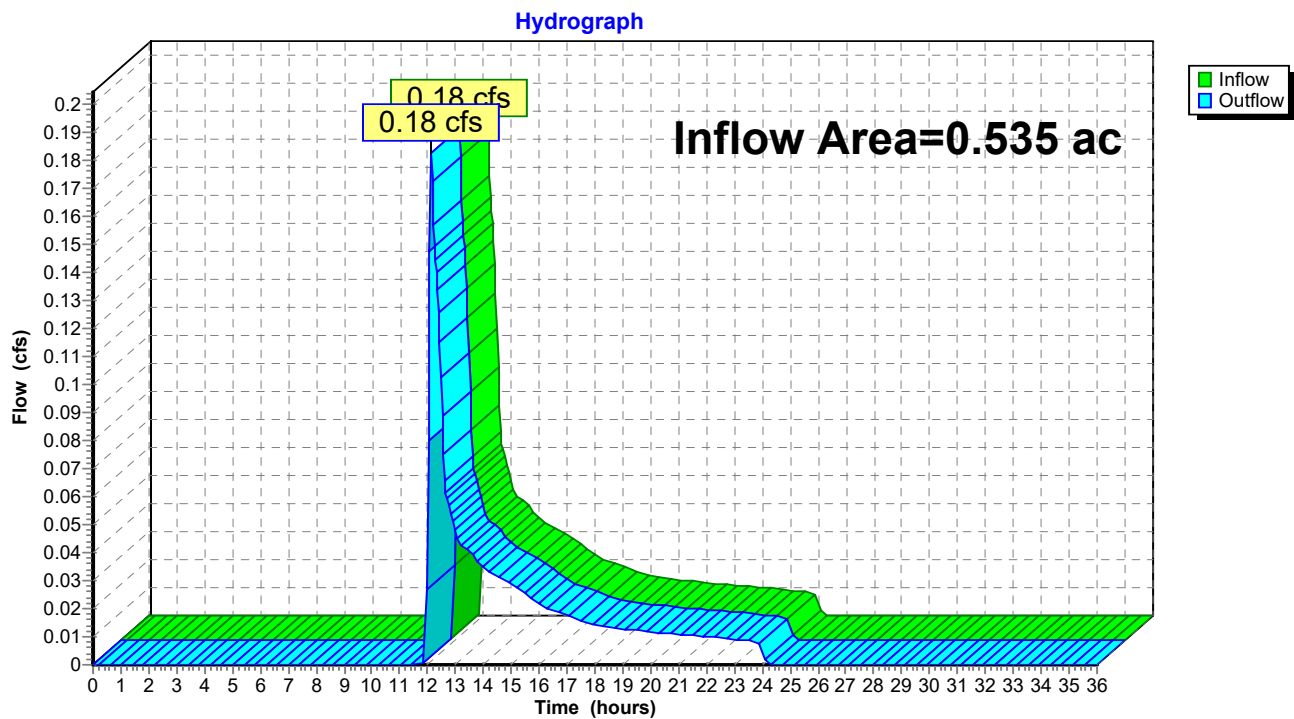
Summary for Reach SP1: (Study Point #1)

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

Inflow Area = 0.535 ac, 7.48% Impervious, Inflow Depth = 0.55" for 10YR-24HR event
Inflow = 0.18 cfs @ 12.13 hrs, Volume= 0.024 af
Outflow = 0.18 cfs @ 12.13 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Reach SP1: (Study Point #1)



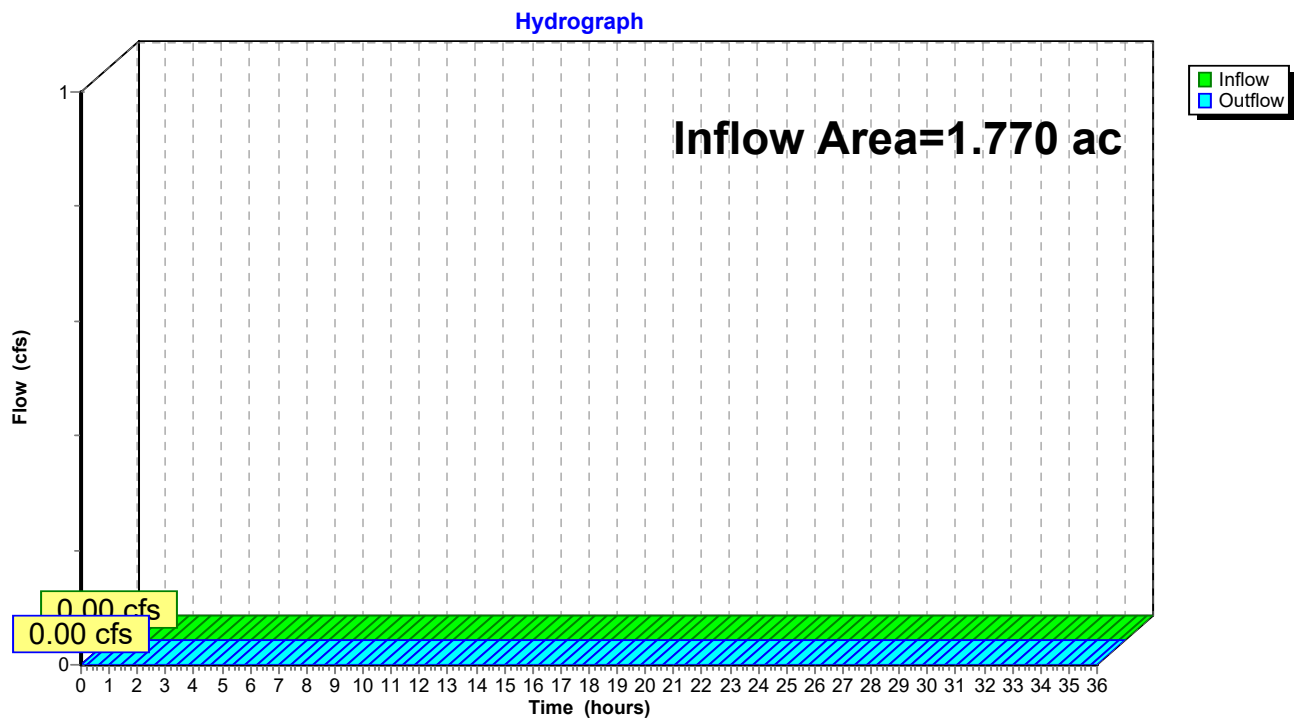
Summary for Reach SP2: (Study Point #2)

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

Inflow Area = 1.770 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10YR-24HR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Reach SP2: (Study Point #2)

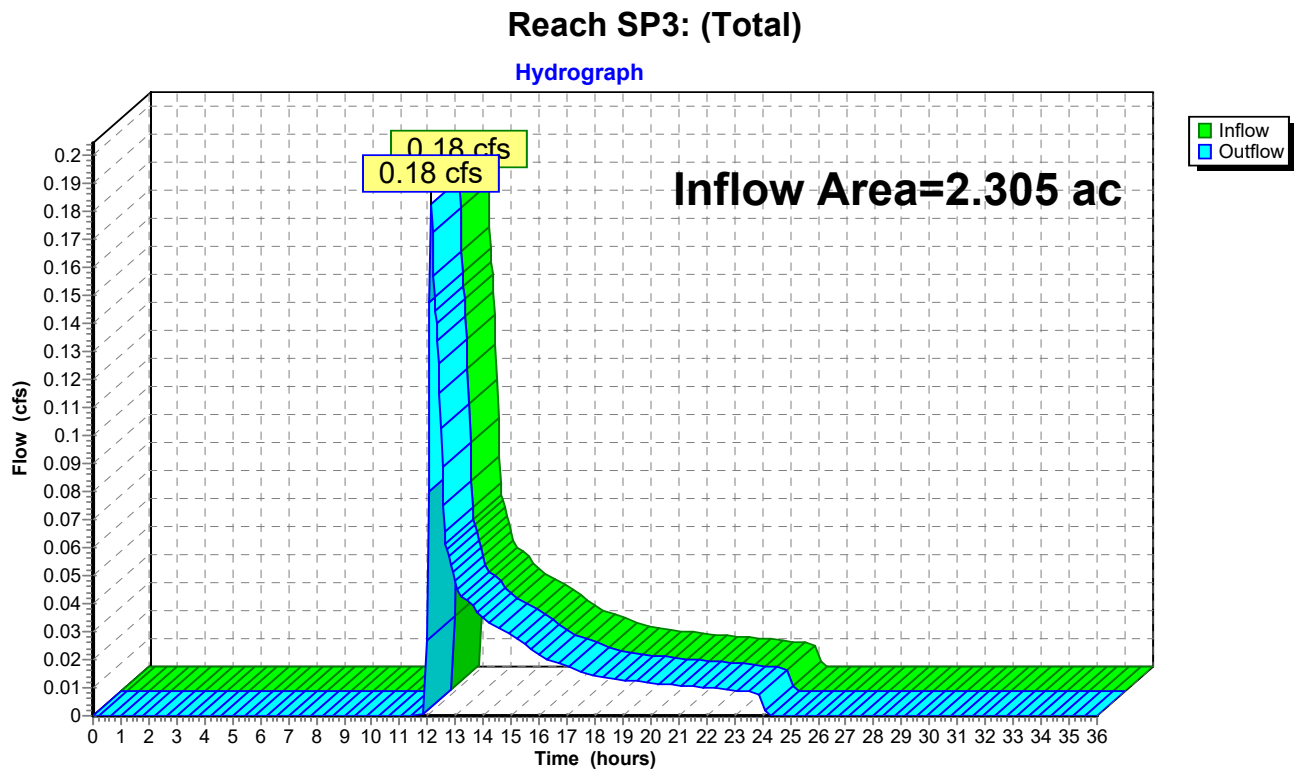


Summary for Reach SP3: (Total)

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

Inflow Area = 2.305 ac, 1.74% Impervious, Inflow Depth = 0.13" for 10YR-24HR event
Inflow = 0.18 cfs @ 12.13 hrs, Volume= 0.024 af
Outflow = 0.18 cfs @ 12.13 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2



Summary for Pond 1P: (Soccer Field Exfiltration)

Inflow Area = 1.300 ac, 0.00% Impervious, Inflow Depth = 4.54" for 10YR-24HR event
 Inflow = 6.21 cfs @ 12.08 hrs, Volume= 0.492 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 93.87' @ 24.36 hrs Surf.Area= 56,550 sf Storage= 21,436 cf

Flood Elev= 94.67' Surf.Area= 56,550 sf Storage= 39,585 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	92.92'	47,050 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
92.92	56,550	0.0	0	0
93.25	56,550	40.0	7,465	7,465
94.25	56,550	40.0	22,620	30,085
95.00	56,550	40.0	16,965	47,050

Device	Routing	Invert	Outlet Devices
#1	Primary	94.67'	336.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	94.17'	0.335 in/hr Exfiltration over Surface area above 94.17' Conductivity to Groundwater Elevation = 87.00' Excluded Surface area = 56,550 sf

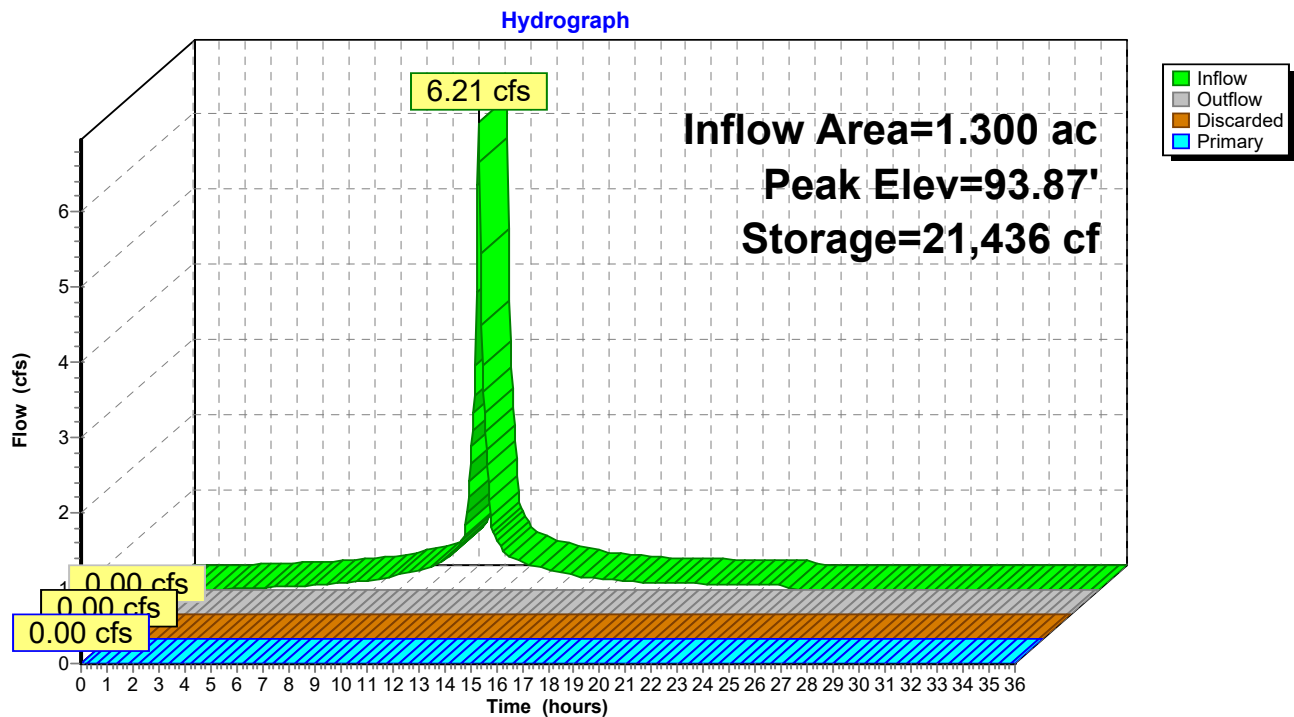
Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.92' (Free Discharge)

↑**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.92' TW=85.00' (Dynamic Tailwater)

↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: (Soccer Field Exfiltration)



Summary for Pond 2P: (Grass swale with underdrain)

Inflow Area = 0.470 ac, 0.00% Impervious, Inflow Depth = 1.44" for 10YR-24HR event
 Inflow = 0.73 cfs @ 12.10 hrs, Volume= 0.057 af
 Outflow = 0.70 cfs @ 12.13 hrs, Volume= 0.054 af, Atten= 4%, Lag= 1.8 min
 Primary = 0.70 cfs @ 12.13 hrs, Volume= 0.054 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
 Peak Elev= 92.52' @ 12.13 hrs Surf.Area= 582 sf Storage= 237 cf
 Flood Elev= 94.67' Surf.Area= 990 sf Storage= 349 cf

Plug-Flow detention time= 44.0 min calculated for 0.054 af (95% of inflow)
 Center-of-Mass det. time= 17.4 min (886.6 - 869.2)

Volume	Invert	Avail.Storage	Storage Description
#1	91.50'	349 cf	Custom Stage Data (Prismatic) Listed below

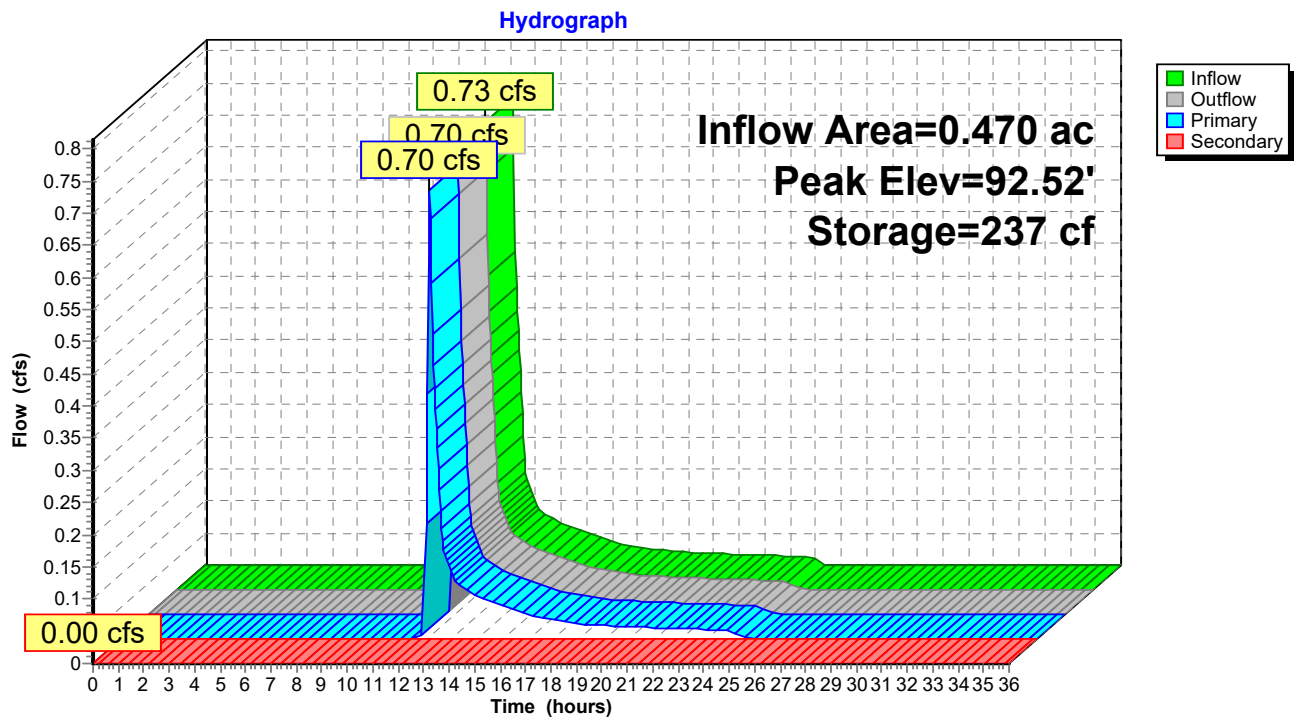
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.50	582	0.0	0	0
92.00	582	40.0	116	116
93.00	582	40.0	233	349
94.00	970	0.0	0	349
95.00	1,000	0.0	0	349
95.50	1,001	0.0	0	349

Device	Routing	Invert	Outlet Devices
#1	Primary	92.04'	12.0" Round Culvert L= 194.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 92.04' / 91.00' S= 0.0054 ' / ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Secondary	95.00'	25.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=0.69 cfs @ 12.13 hrs HW=92.51' TW=85.03' (Dynamic Tailwater)
 ↑**1=Culvert** (Barrel Controls 0.69 cfs @ 2.74 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=91.50' TW=85.00' (Dynamic Tailwater)
 ↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: (Grass swale with underdrain)



Summary for Pond 3P: (Wetland N)

Inflow Area = 1.770 ac, 0.00% Impervious, Inflow Depth = 0.36" for 10YR-24HR event
 Inflow = 0.70 cfs @ 12.13 hrs, Volume= 0.054 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

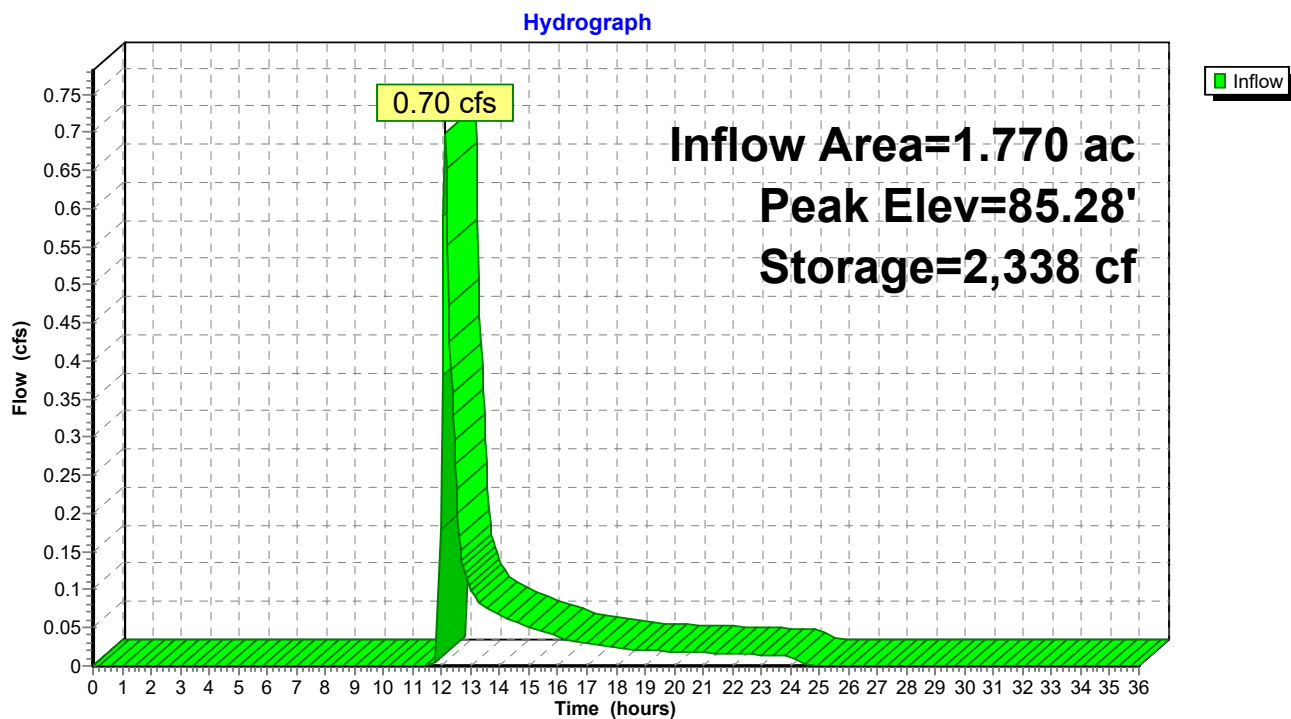
Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
 Peak Elev= 85.28' @ 36.00 hrs Surf.Area= 9,441 sf Storage= 2,338 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	220,938 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	7,068	0	0
86.00	15,444	11,256	11,256
87.00	29,379	22,412	33,668
88.00	39,282	34,331	67,998
89.00	50,533	44,908	112,906
90.00	53,770	52,152	165,057
91.00	57,991	55,881	220,938

Pond 3P: (Wetland N)



Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Watershed 1S	Runoff Area=0.196 ac 0.00% Impervious Runoff Depth=1.01" Tc=6.0 min CN=48 Runoff=0.17 cfs 0.017 af
Subcatchment 2S: Watershed 2S	Runoff Area=0.470 ac 0.00% Impervious Runoff Depth=2.10" Tc=6.0 min CN=62 Runoff=1.10 cfs 0.082 af
Subcatchment 2SA: Watershed 2SA	Runoff Area=1.300 ac 0.00% Impervious Runoff Depth=5.55" Tc=6.0 min CN=96 Runoff=7.51 cfs 0.601 af
Subcatchment 3S: Watershed 3S	Runoff Area=0.120 ac 0.00% Impervious Runoff Depth=0.45" Tc=6.0 min CN=39 Runoff=0.02 cfs 0.005 af
Subcatchment 4S: Watershed 4S	Runoff Area=0.219 ac 18.26% Impervious Runoff Depth=1.15" Tc=6.0 min CN=50 Runoff=0.23 cfs 0.021 af
Reach 1R: (CB-1)	Inflow=0.17 cfs 0.017 af Outflow=0.17 cfs 0.017 af
Reach 3R: (CB-2)	Inflow=0.02 cfs 0.005 af Outflow=0.02 cfs 0.005 af
Reach 4R: (CB-3)	Inflow=0.23 cfs 0.021 af Outflow=0.23 cfs 0.021 af
Reach SP1: (Study Point #1)	Inflow=0.41 cfs 0.042 af Outflow=0.41 cfs 0.042 af
Reach SP2: (Study Point #2)	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach SP3: (Total)	Inflow=0.41 cfs 0.042 af Outflow=0.41 cfs 0.042 af
Pond 1P: (Soccer Field Exfiltration)	Peak Elev=94.08' Storage=26,178 cf Inflow=7.51 cfs 0.601 af Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Pond 2P: (Grass swale with underdrain)	Peak Elev=92.65' Storage=267 cf Inflow=1.10 cfs 0.082 af Primary=1.07 cfs 0.080 af Secondary=0.00 cfs 0.000 af Outflow=1.07 cfs 0.080 af
Pond 3P: (Wetland N)	Peak Elev=85.40' Storage=3,464 cf Inflow=1.07 cfs 0.080 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.305 ac Runoff Volume = 0.725 af Average Runoff Depth = 3.78"
98.26% Pervious = 2.265 ac 1.74% Impervious = 0.040 ac

Summary for Subcatchment 1S: Watershed 1S

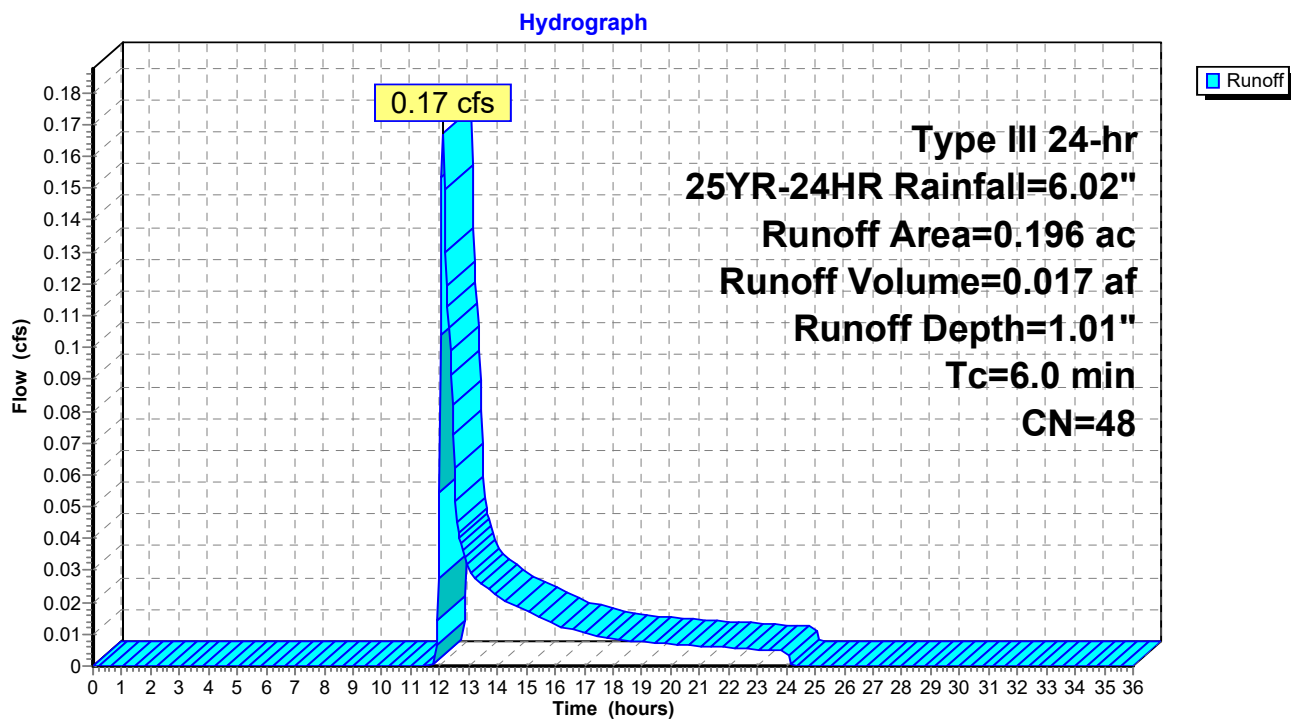
Runoff = 0.17 cfs @ 12.12 hrs, Volume= 0.017 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 25YR-24HR Rainfall=6.02"

Area (ac)	CN	Description
0.155	39	>75% Grass cover, Good, HSG A
0.041	80	>75% Grass cover, Good, HSG D
0.196	48	Weighted Average
0.196		100.00% Pervious Area

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

Subcatchment 1S: Watershed 1S



Summary for Subcatchment 2S: Watershed 2S

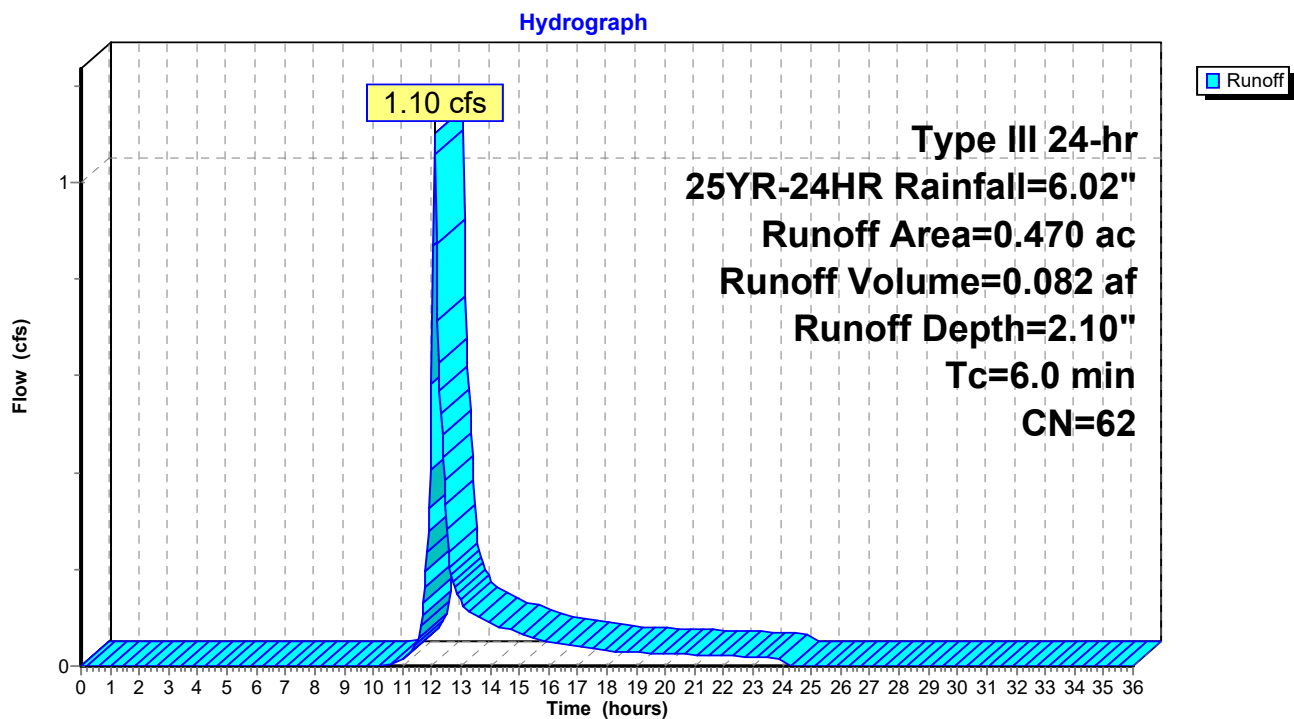
Runoff = 1.10 cfs @ 12.10 hrs, Volume= 0.082 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 25YR-24HR Rainfall=6.02"

Area (ac)	CN	Description
0.260	80	>75% Grass cover, Good, HSG D
0.210	39	>75% Grass cover, Good, HSG A
0.470	62	Weighted Average
0.470		100.00% Pervious Area

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

Subcatchment 2S: Watershed 2S



Summary for Subcatchment 2SA: Watershed 2SA

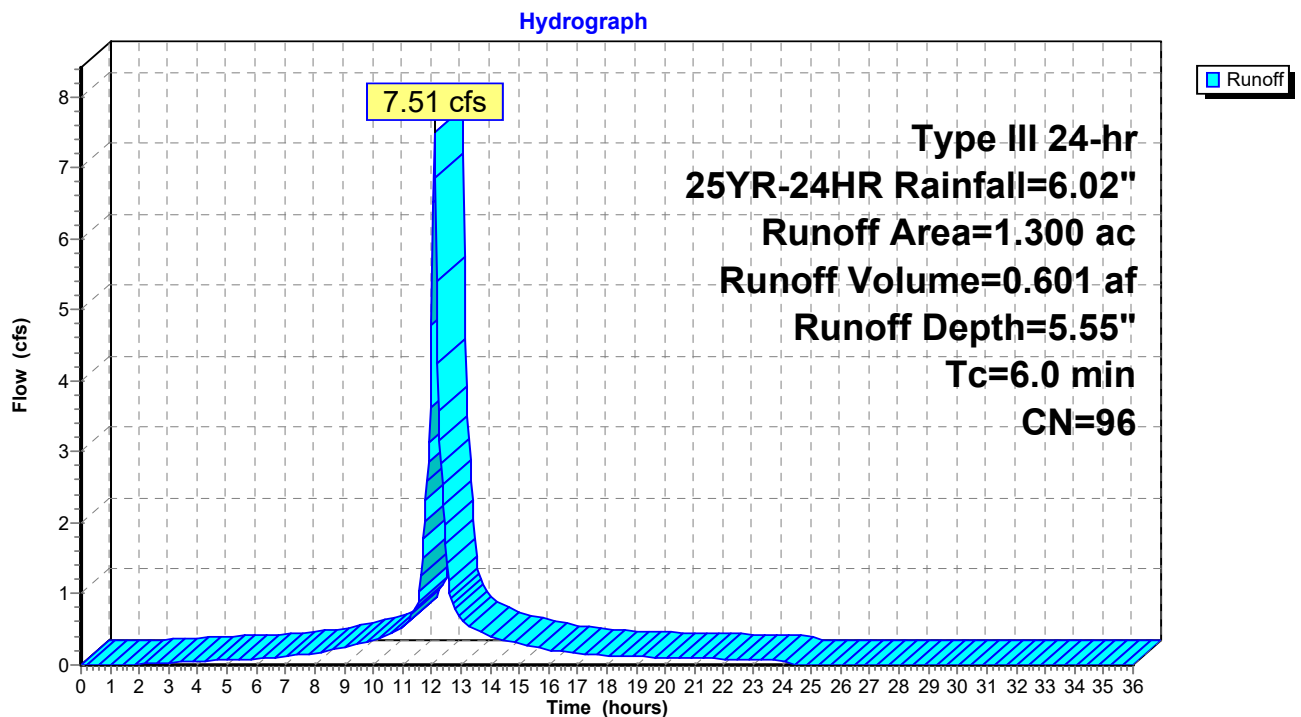
Runoff = 7.51 cfs @ 12.08 hrs, Volume= 0.601 af, Depth= 5.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 25YR-24HR Rainfall=6.02"

Area (ac)	CN	Description
* 1.300	96	Field Turf-Gravel surface, HSG A
1.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Minimum Tc = 6 min.

Subcatchment 2SA: Watershed 2SA



Summary for Subcatchment 3S: Watershed 3S

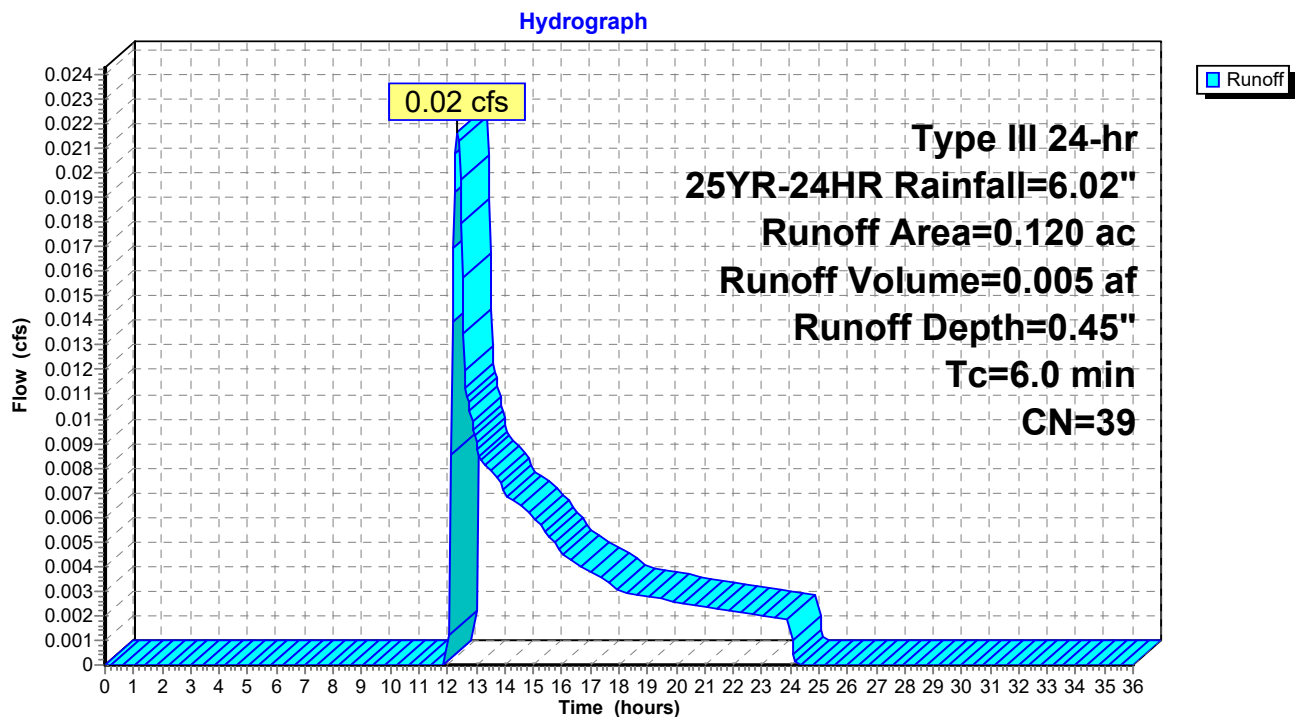
Runoff = 0.02 cfs @ 12.34 hrs, Volume= 0.005 af, Depth= 0.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 25YR-24HR Rainfall=6.02"

Area (ac)	CN	Description
0.120	39	>75% Grass cover, Good, HSG A
0.120		100.00% Pervious Area

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

Subcatchment 3S: Watershed 3S



Summary for Subcatchment 4S: Watershed 4S

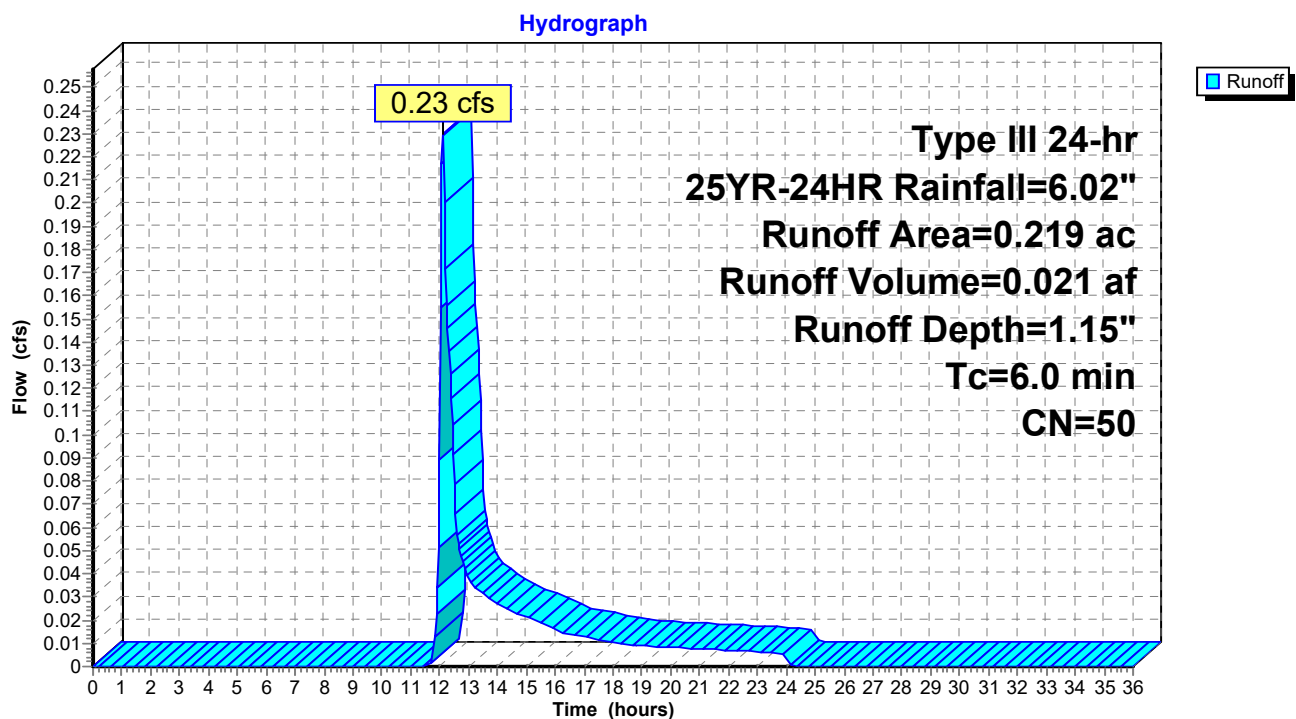
Runoff = 0.23 cfs @ 12.11 hrs, Volume= 0.021 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 25YR-24HR Rainfall=6.02"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.179	39	>75% Grass cover, Good, HSG A
0.219	50	Weighted Average
0.179		81.74% Pervious Area
0.040		18.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6 minutes - minimum

Subcatchment 4S: Watershed 4S

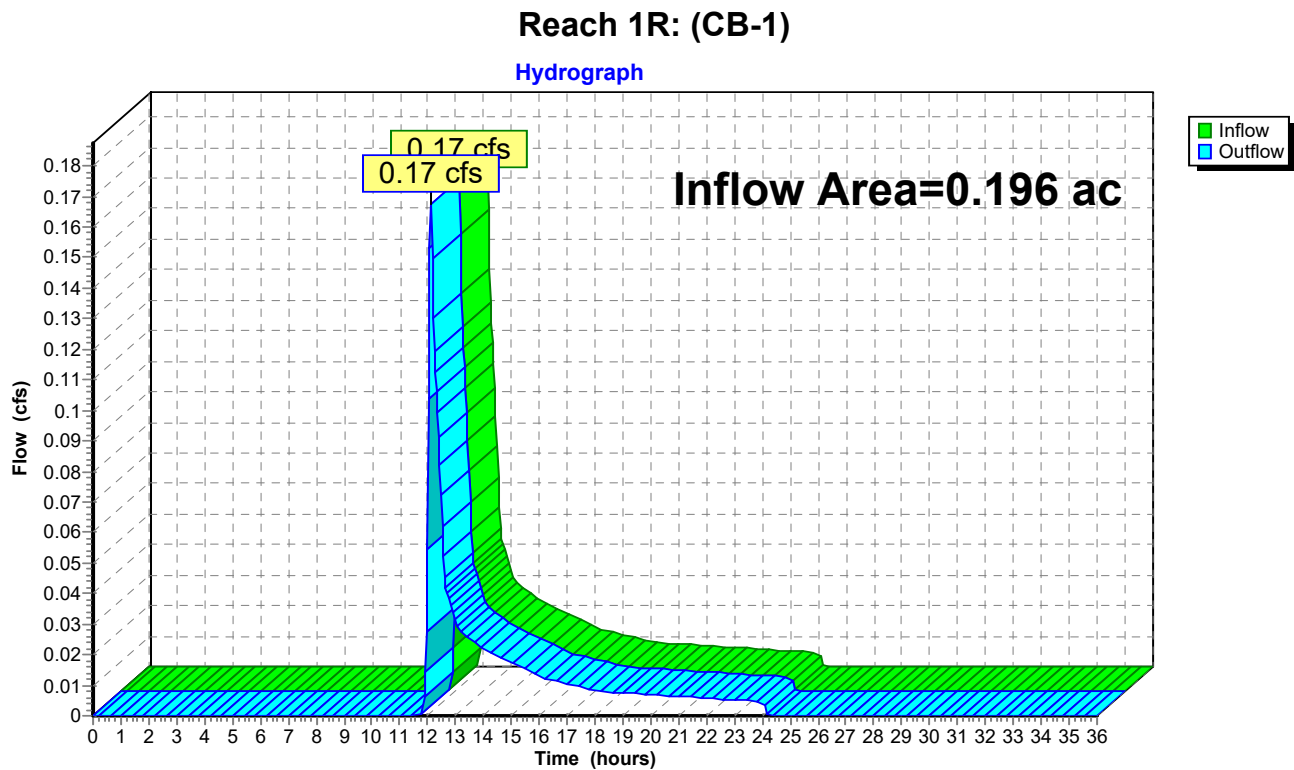


Summary for Reach 1R: (CB-1)

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

Inflow Area = 0.196 ac, 0.00% Impervious, Inflow Depth = 1.01" for 25YR-24HR event
Inflow = 0.17 cfs @ 12.12 hrs, Volume= 0.017 af
Outflow = 0.17 cfs @ 12.12 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

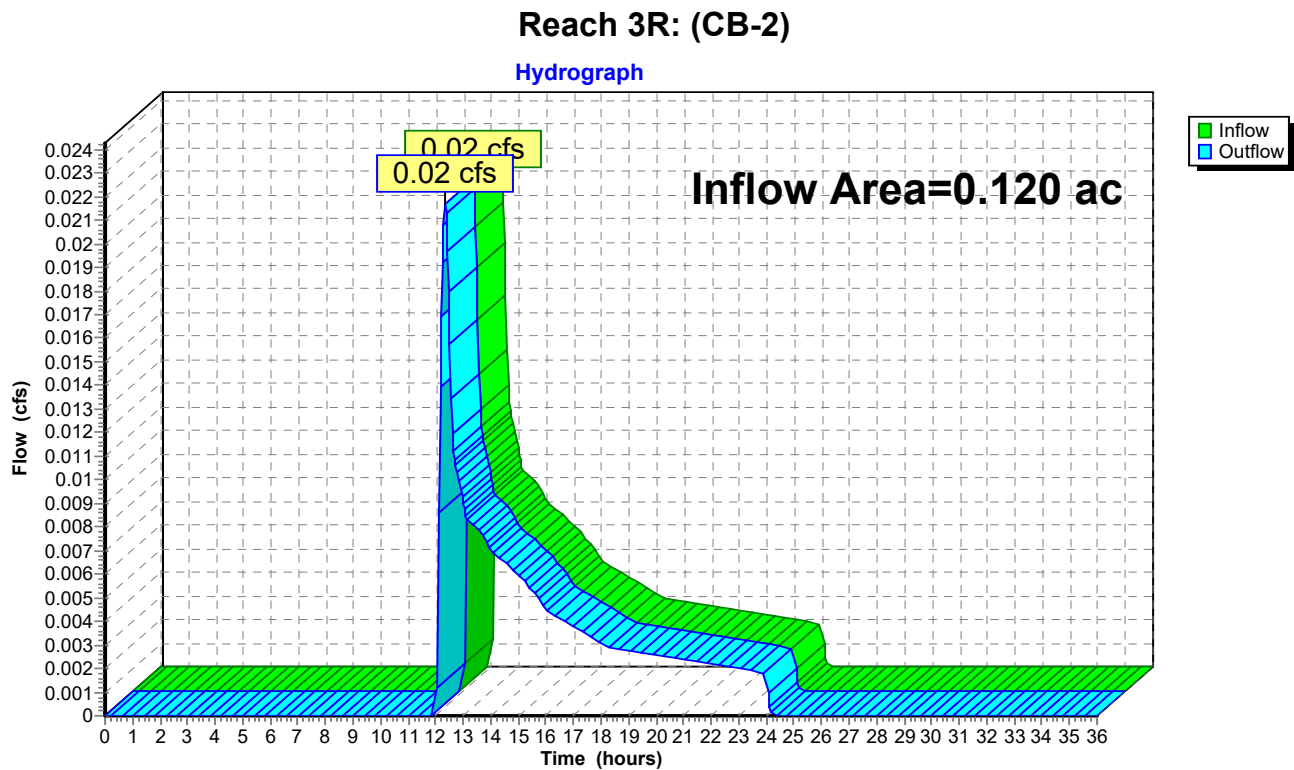


Summary for Reach 3R: (CB-2)

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

Inflow Area = 0.120 ac, 0.00% Impervious, Inflow Depth = 0.45" for 25YR-24HR event
Inflow = 0.02 cfs @ 12.34 hrs, Volume= 0.005 af
Outflow = 0.02 cfs @ 12.34 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

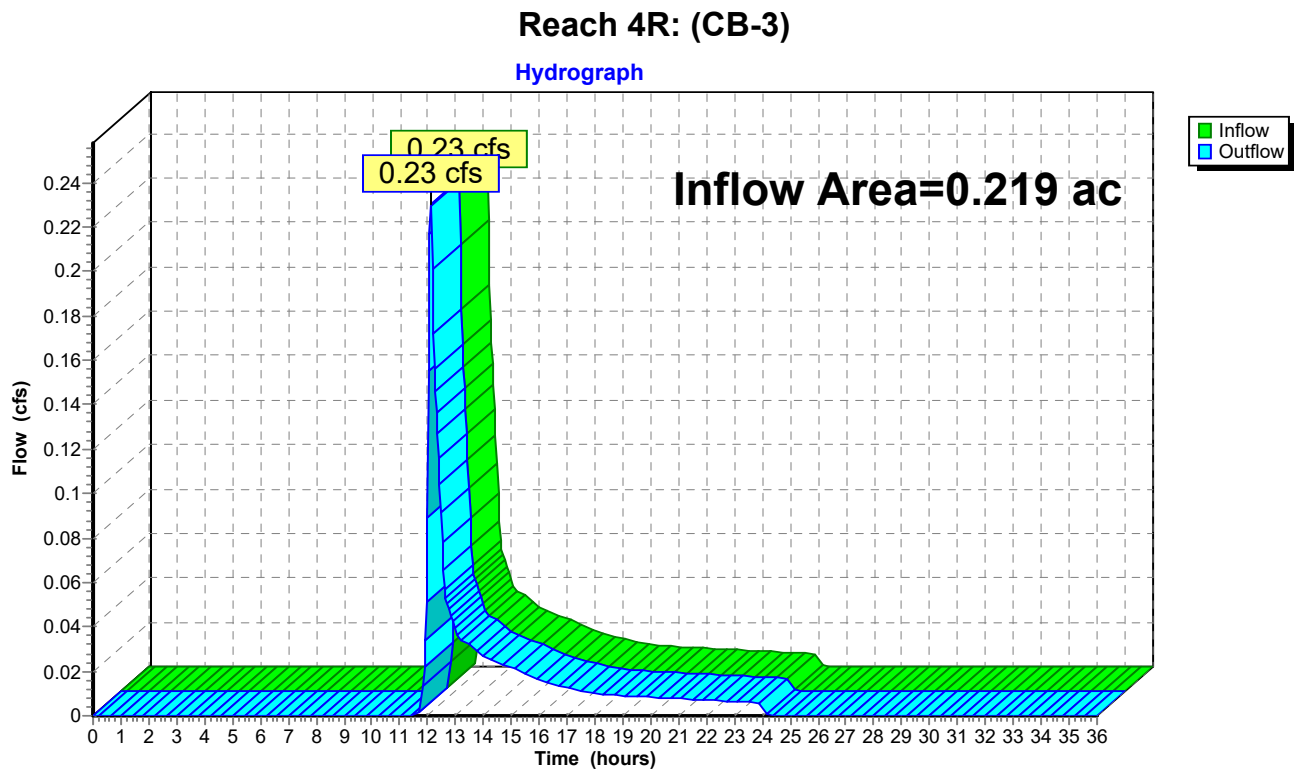


Summary for Reach 4R: (CB-3)

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

Inflow Area = 0.219 ac, 18.26% Impervious, Inflow Depth = 1.15" for 25YR-24HR event
Inflow = 0.23 cfs @ 12.11 hrs, Volume= 0.021 af
Outflow = 0.23 cfs @ 12.11 hrs, Volume= 0.021 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2



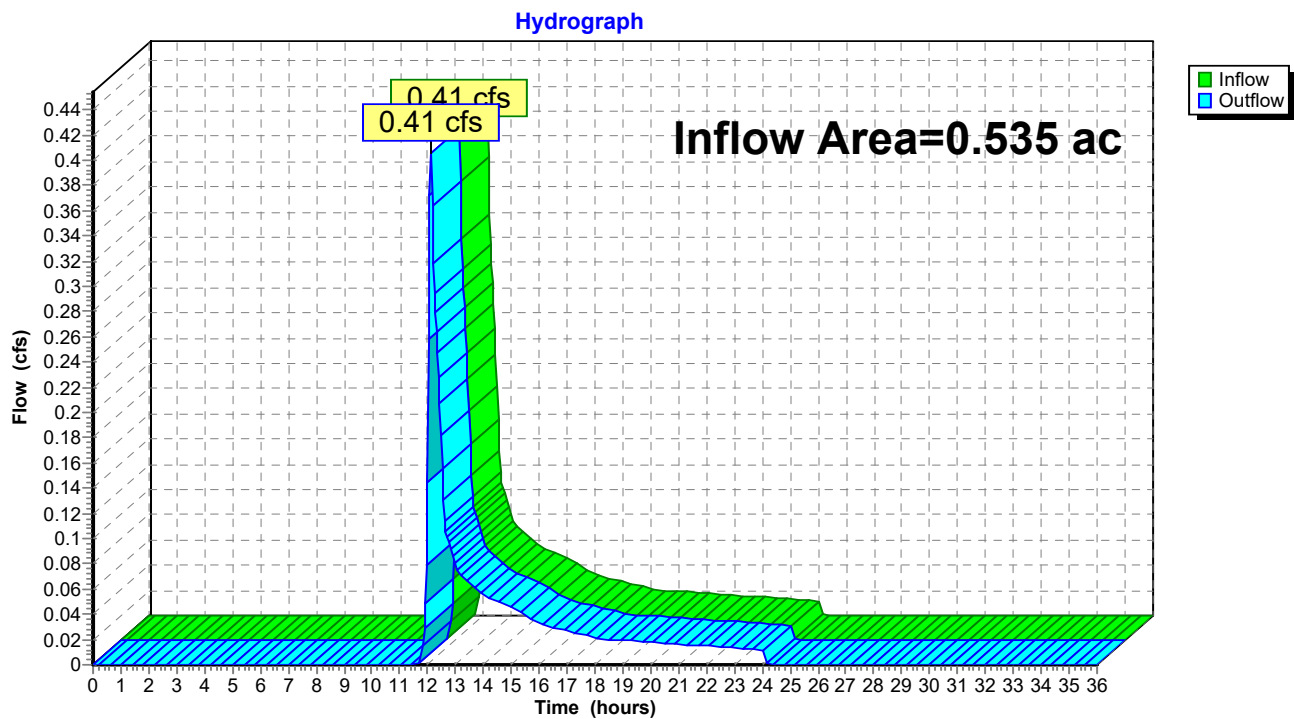
Summary for Reach SP1: (Study Point #1)

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

Inflow Area = 0.535 ac, 7.48% Impervious, Inflow Depth = 0.94" for 25YR-24HR event
Inflow = 0.41 cfs @ 12.12 hrs, Volume= 0.042 af
Outflow = 0.41 cfs @ 12.12 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Reach SP1: (Study Point #1)



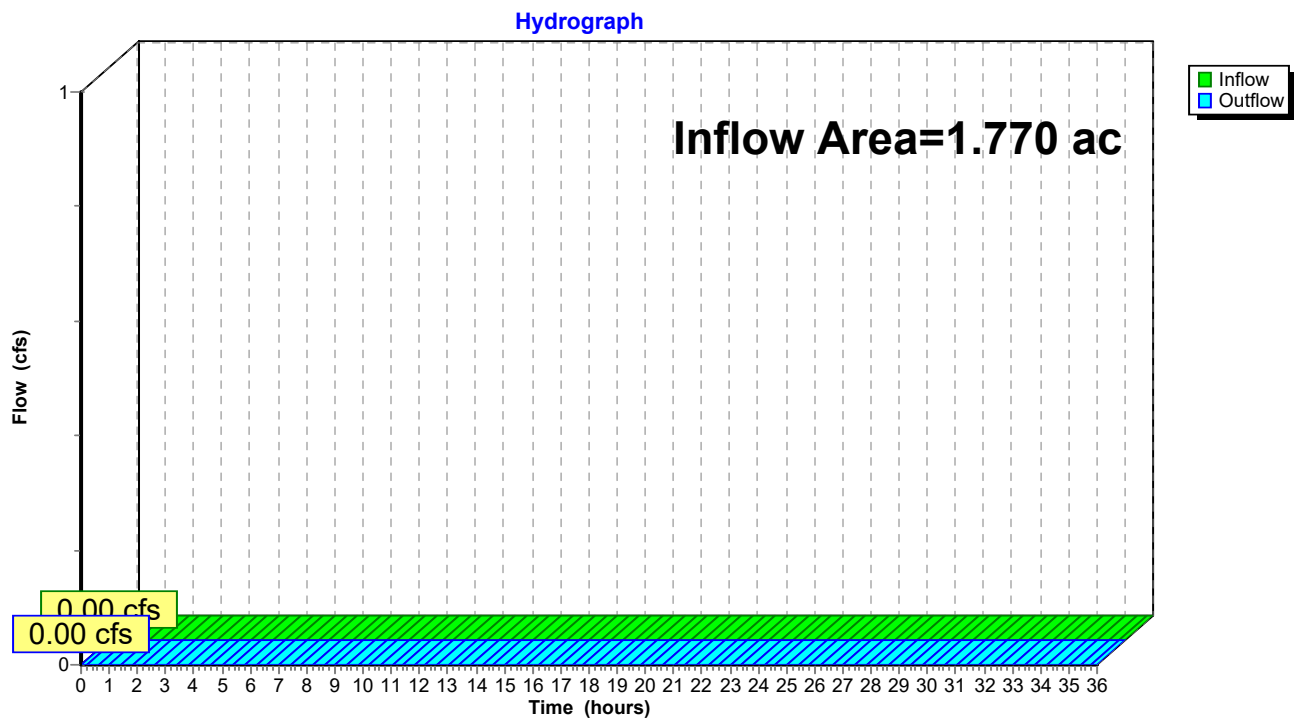
Summary for Reach SP2: (Study Point #2)

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

Inflow Area = 1.770 ac, 0.00% Impervious, Inflow Depth = 0.00" for 25YR-24HR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Reach SP2: (Study Point #2)

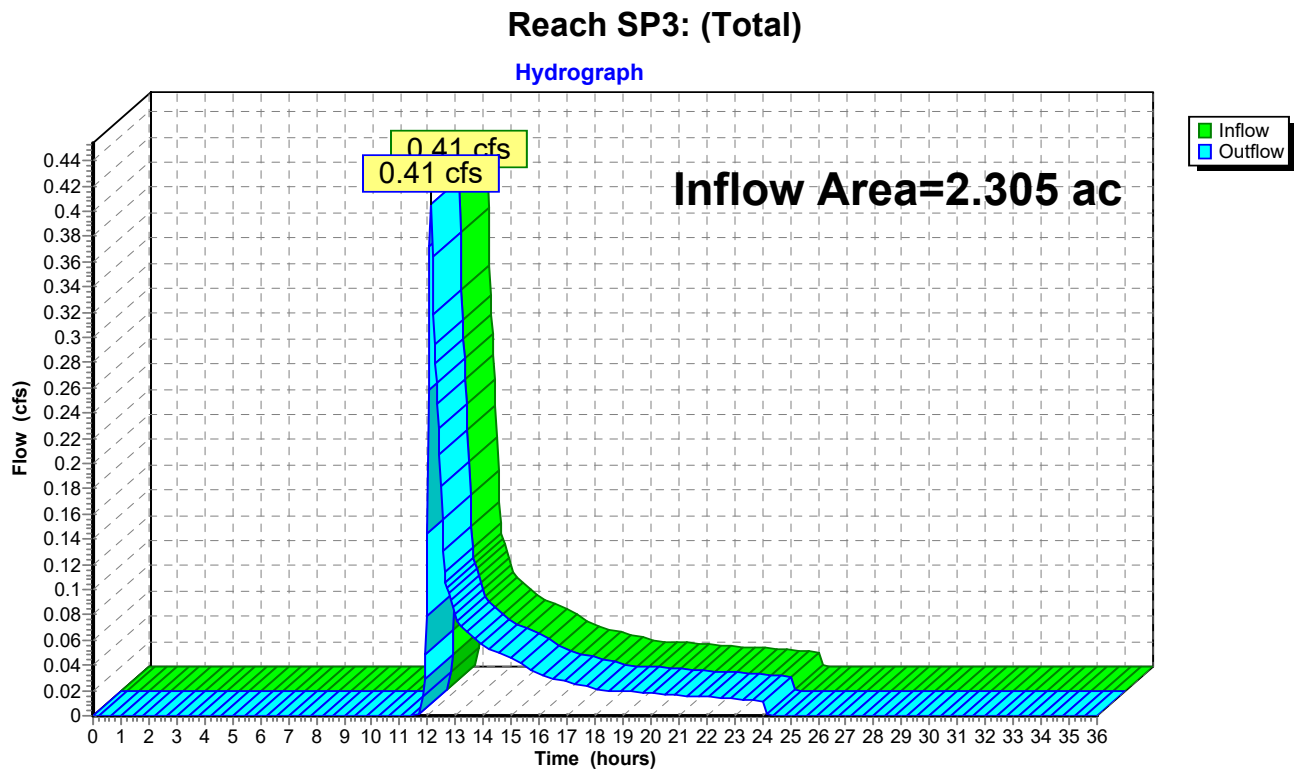


Summary for Reach SP3: (Total)

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

Inflow Area = 2.305 ac, 1.74% Impervious, Inflow Depth = 0.22" for 25YR-24HR event
Inflow = 0.41 cfs @ 12.12 hrs, Volume= 0.042 af
Outflow = 0.41 cfs @ 12.12 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2



Summary for Pond 1P: (Soccer Field Exfiltration)

Inflow Area = 1.300 ac, 0.00% Impervious, Inflow Depth = 5.55" for 25YR-24HR event
 Inflow = 7.51 cfs @ 12.08 hrs, Volume= 0.601 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
 Peak Elev= 94.08' @ 24.36 hrs Surf.Area= 56,550 sf Storage= 26,178 cf
 Flood Elev= 94.67' Surf.Area= 56,550 sf Storage= 39,585 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	92.92'	47,050 cf	Custom Stage Data (Prismatic) Listed below

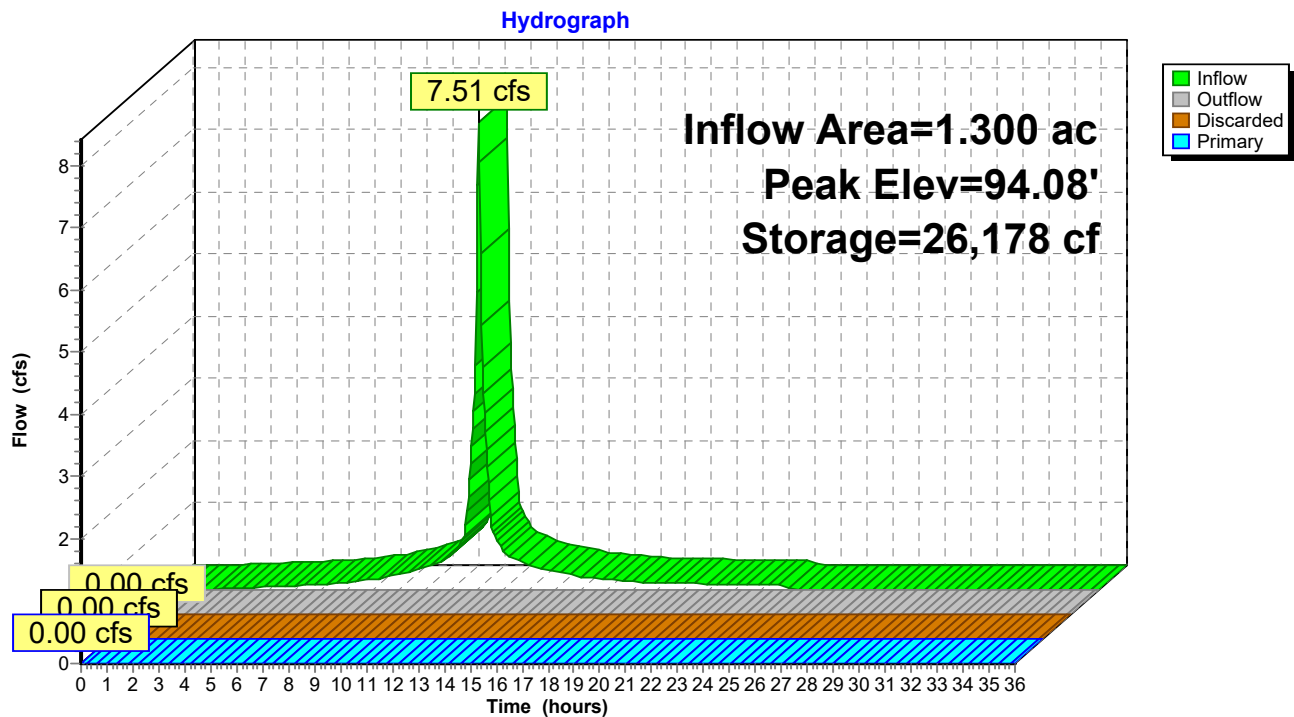
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
92.92	56,550	0.0	0	0
93.25	56,550	40.0	7,465	7,465
94.25	56,550	40.0	22,620	30,085
95.00	56,550	40.0	16,965	47,050

Device	Routing	Invert	Outlet Devices
#1	Primary	94.67'	336.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	94.17'	0.335 in/hr Exfiltration over Surface area above 94.17' Conductivity to Groundwater Elevation = 87.00' Excluded Surface area = 56,550 sf

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.92' (Free Discharge)
 ↑ **2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.92' TW=85.00' (Dynamic Tailwater)
 ↑ **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: (Soccer Field Exfiltration)



Summary for Pond 2P: (Grass swale with underdrain)

Inflow Area = 0.470 ac, 0.00% Impervious, Inflow Depth = 2.10" for 25YR-24HR event
 Inflow = 1.10 cfs @ 12.10 hrs, Volume= 0.082 af
 Outflow = 1.07 cfs @ 12.12 hrs, Volume= 0.080 af, Atten= 3%, Lag= 1.5 min
 Primary = 1.07 cfs @ 12.12 hrs, Volume= 0.080 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 92.65' @ 12.12 hrs Surf.Area= 582 sf Storage= 267 cf

Flood Elev= 94.67' Surf.Area= 990 sf Storage= 349 cf

Plug-Flow detention time= 32.2 min calculated for 0.079 af (96% of inflow)

Center-of-Mass det. time= 13.2 min (870.7 - 857.4)

Volume	Invert	Avail.Storage	Storage Description
#1	91.50'	349 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.50	582	0.0	0	0
92.00	582	40.0	116	116
93.00	582	40.0	233	349
94.00	970	0.0	0	349
95.00	1,000	0.0	0	349
95.50	1,001	0.0	0	349

Device	Routing	Invert	Outlet Devices
#1	Primary	92.04'	12.0" Round Culvert L= 194.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 92.04' / 91.00' S= 0.0054 ' /' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Secondary	95.00'	25.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

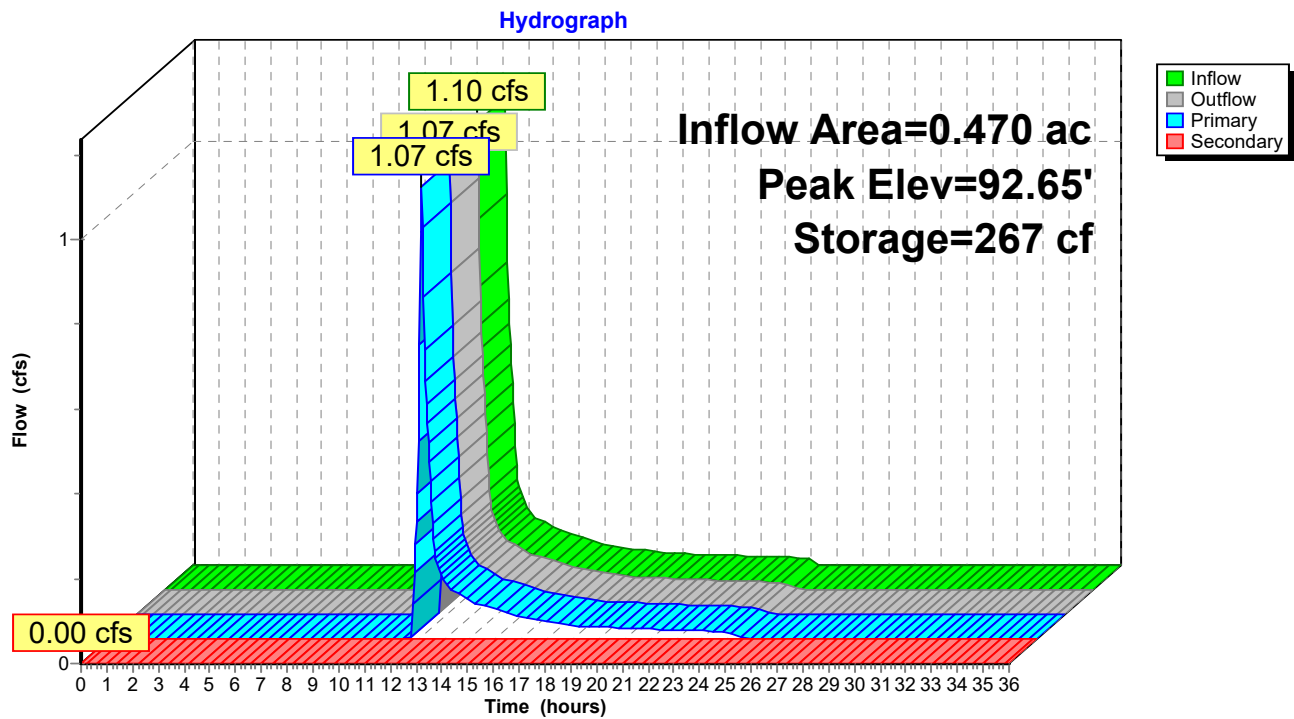
Primary OutFlow Max=1.07 cfs @ 12.12 hrs HW=92.65' TW=85.07' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 1.07 cfs @ 3.07 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=91.50' TW=85.00' (Dynamic Tailwater)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: (Grass swale with underdrain)



Summary for Pond 3P: (Wetland N)

Inflow Area = 1.770 ac, 0.00% Impervious, Inflow Depth = 0.54" for 25YR-24HR event
 Inflow = 1.07 cfs @ 12.12 hrs, Volume= 0.080 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

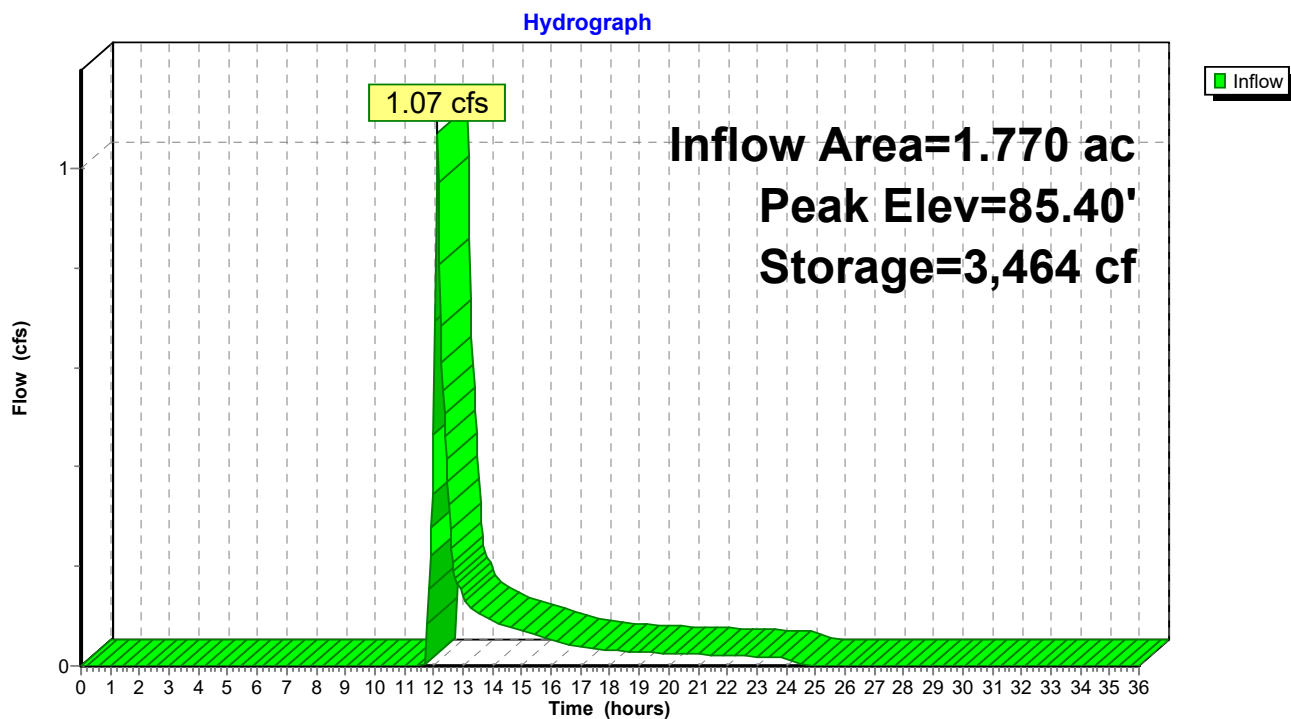
Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
 Peak Elev= 85.40' @ 36.00 hrs Surf.Area= 10,391 sf Storage= 3,464 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	220,938 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	7,068	0	0
86.00	15,444	11,256	11,256
87.00	29,379	22,412	33,668
88.00	39,282	34,331	67,998
89.00	50,533	44,908	112,906
90.00	53,770	52,152	165,057
91.00	57,991	55,881	220,938

Pond 3P: (Wetland N)



Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points x 2
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Watershed 1S	Runoff Area=0.196 ac 0.00% Impervious Runoff Depth=1.80" Tc=6.0 min CN=48 Runoff=0.35 cfs 0.029 af
Subcatchment 2S: Watershed 2S	Runoff Area=0.470 ac 0.00% Impervious Runoff Depth=3.23" Tc=6.0 min CN=62 Runoff=1.74 cfs 0.127 af
Subcatchment 2SA: Watershed 2SA	Runoff Area=1.300 ac 0.00% Impervious Runoff Depth=7.10" Tc=6.0 min CN=96 Runoff=9.51 cfs 0.769 af
Subcatchment 3S: Watershed 3S	Runoff Area=0.120 ac 0.00% Impervious Runoff Depth=0.99" Tc=6.0 min CN=39 Runoff=0.08 cfs 0.010 af
Subcatchment 4S: Watershed 4S	Runoff Area=0.219 ac 18.26% Impervious Runoff Depth=2.00" Tc=6.0 min CN=50 Runoff=0.45 cfs 0.036 af
Reach 1R: (CB-1)	Inflow=0.35 cfs 0.029 af Outflow=0.35 cfs 0.029 af
Reach 3R: (CB-2)	Inflow=0.08 cfs 0.010 af Outflow=0.08 cfs 0.010 af
Reach 4R: (CB-3)	Inflow=0.45 cfs 0.036 af Outflow=0.45 cfs 0.036 af
Reach SP1: (Study Point #1)	Inflow=0.88 cfs 0.076 af Outflow=0.88 cfs 0.076 af
Reach SP2: (Study Point #2)	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Reach SP3: (Total)	Inflow=0.88 cfs 0.076 af Outflow=0.88 cfs 0.076 af
Pond 1P: (Soccer Field Exfiltration)	Peak Elev=94.40' Storage=33,514 cf Inflow=9.51 cfs 0.769 af Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Pond 2P: (Grass swale with underdrain)	Peak Elev=92.84' Storage=312 cf Inflow=1.74 cfs 0.127 af Primary=1.69 cfs 0.124 af Secondary=0.00 cfs 0.000 af Outflow=1.69 cfs 0.124 af
Pond 3P: (Wetland N)	Peak Elev=85.57' Storage=5,392 cf Inflow=1.69 cfs 0.124 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.305 ac Runoff Volume = 0.972 af Average Runoff Depth = 5.06"
98.26% Pervious = 2.265 ac 1.74% Impervious = 0.040 ac

Summary for Subcatchment 1S: Watershed 1S

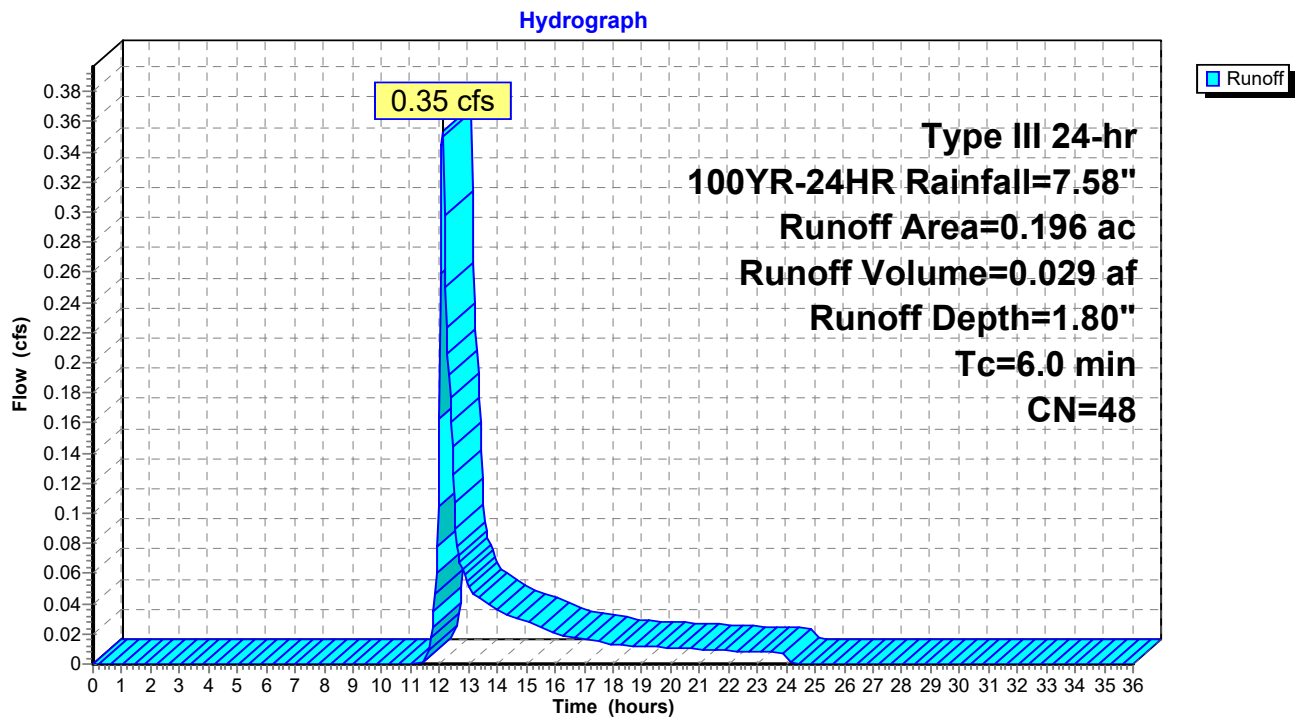
Runoff = 0.35 cfs @ 12.10 hrs, Volume= 0.029 af, Depth= 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 100YR-24HR Rainfall=7.58"

Area (ac)	CN	Description
0.155	39	>75% Grass cover, Good, HSG A
0.041	80	>75% Grass cover, Good, HSG D
0.196	48	Weighted Average
0.196		100.00% Pervious Area

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

Subcatchment 1S: Watershed 1S



Summary for Subcatchment 2S: Watershed 2S

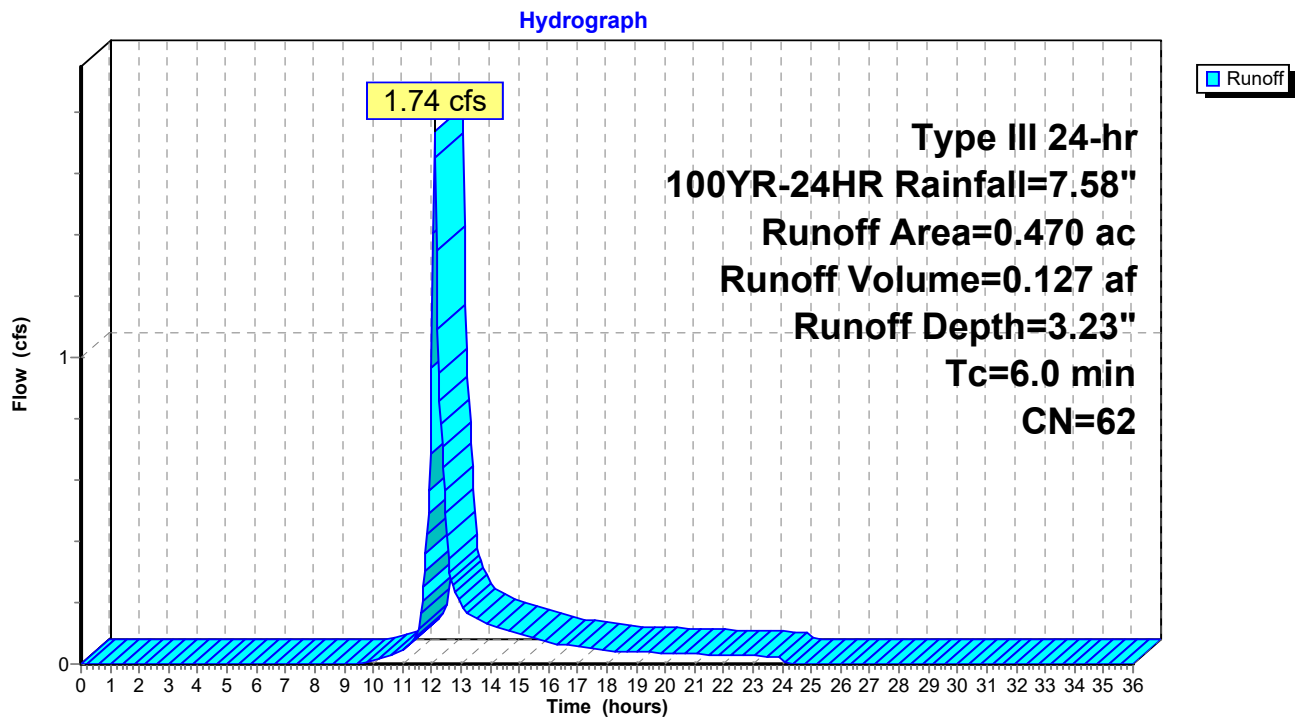
Runoff = 1.74 cfs @ 12.09 hrs, Volume= 0.127 af, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 100YR-24HR Rainfall=7.58"

Area (ac)	CN	Description
0.260	80	>75% Grass cover, Good, HSG D
0.210	39	>75% Grass cover, Good, HSG A
0.470	62	Weighted Average
0.470		100.00% Pervious Area

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

Subcatchment 2S: Watershed 2S



Summary for Subcatchment 2SA: Watershed 2SA

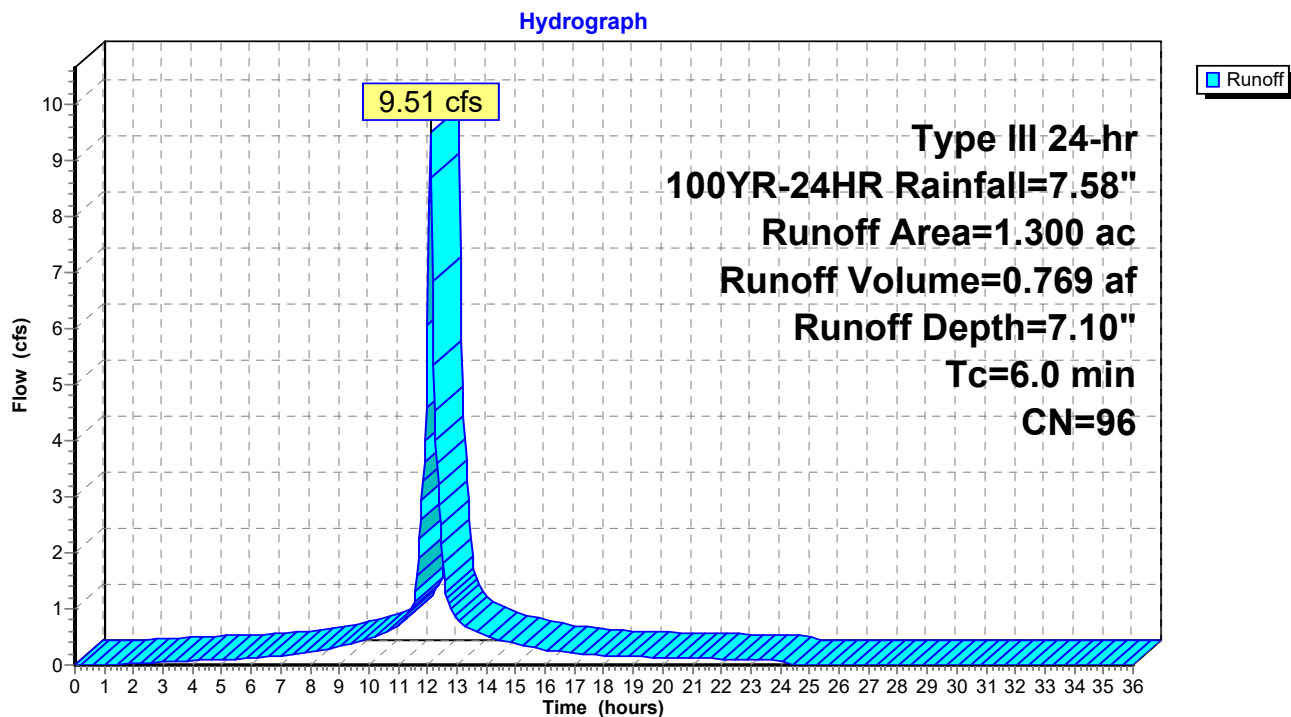
Runoff = 9.51 cfs @ 12.08 hrs, Volume= 0.769 af, Depth= 7.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 100YR-24HR Rainfall=7.58"

Area (ac)	CN	Description
* 1.300	96	Field Turf-Gravel surface, HSG A
1.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Minimum Tc = 6 min.

Subcatchment 2SA: Watershed 2SA



Summary for Subcatchment 3S: Watershed 3S

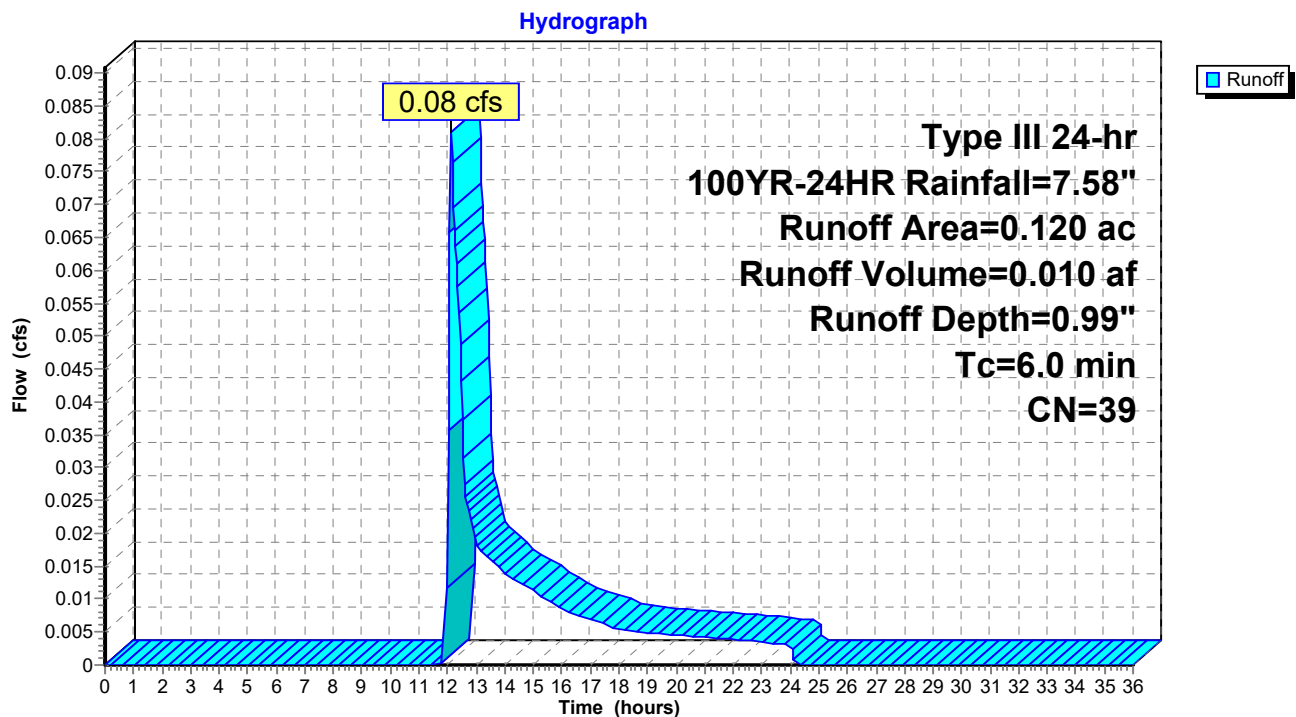
Runoff = 0.08 cfs @ 12.13 hrs, Volume= 0.010 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 100YR-24HR Rainfall=7.58"

Area (ac)	CN	Description
0.120	39	>75% Grass cover, Good, HSG A
0.120		100.00% Pervious Area

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

Subcatchment 3S: Watershed 3S



Summary for Subcatchment 4S: Watershed 4S

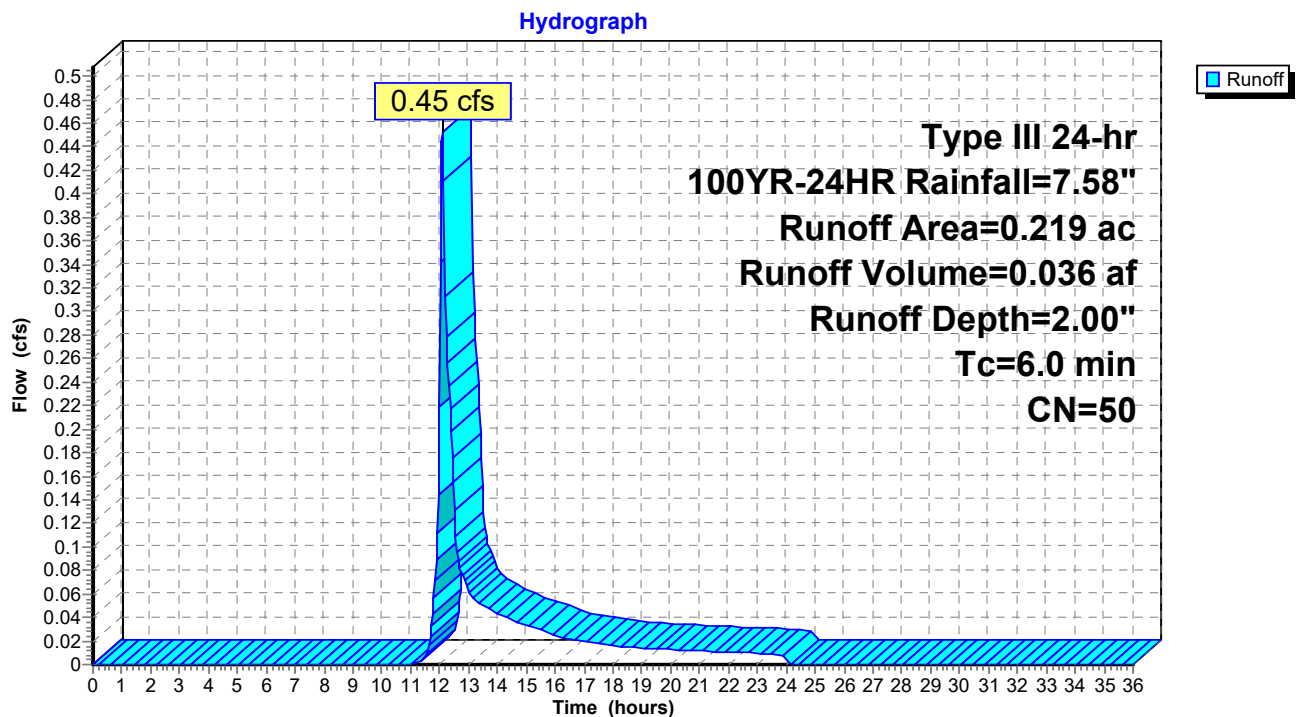
Runoff = 0.45 cfs @ 12.10 hrs, Volume= 0.036 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
 Type III 24-hr 100YR-24HR Rainfall=7.58"

Area (ac)	CN	Description
0.040	98	Paved parking, HSG A
0.179	39	>75% Grass cover, Good, HSG A
0.219	50	Weighted Average
0.179		81.74% Pervious Area
0.040		18.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6 minutes - minimum

Subcatchment 4S: Watershed 4S

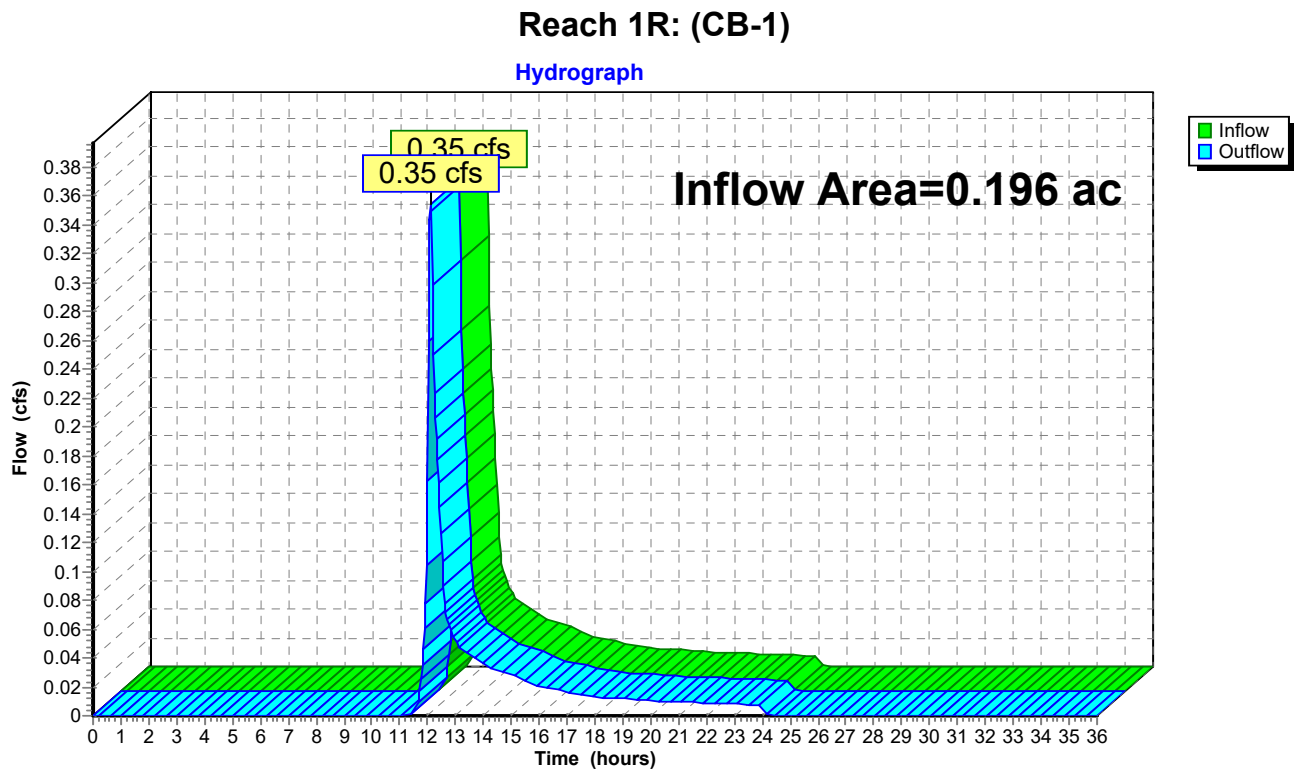


Summary for Reach 1R: (CB-1)

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

Inflow Area = 0.196 ac, 0.00% Impervious, Inflow Depth = 1.80" for 100YR-24HR event
Inflow = 0.35 cfs @ 12.10 hrs, Volume= 0.029 af
Outflow = 0.35 cfs @ 12.10 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

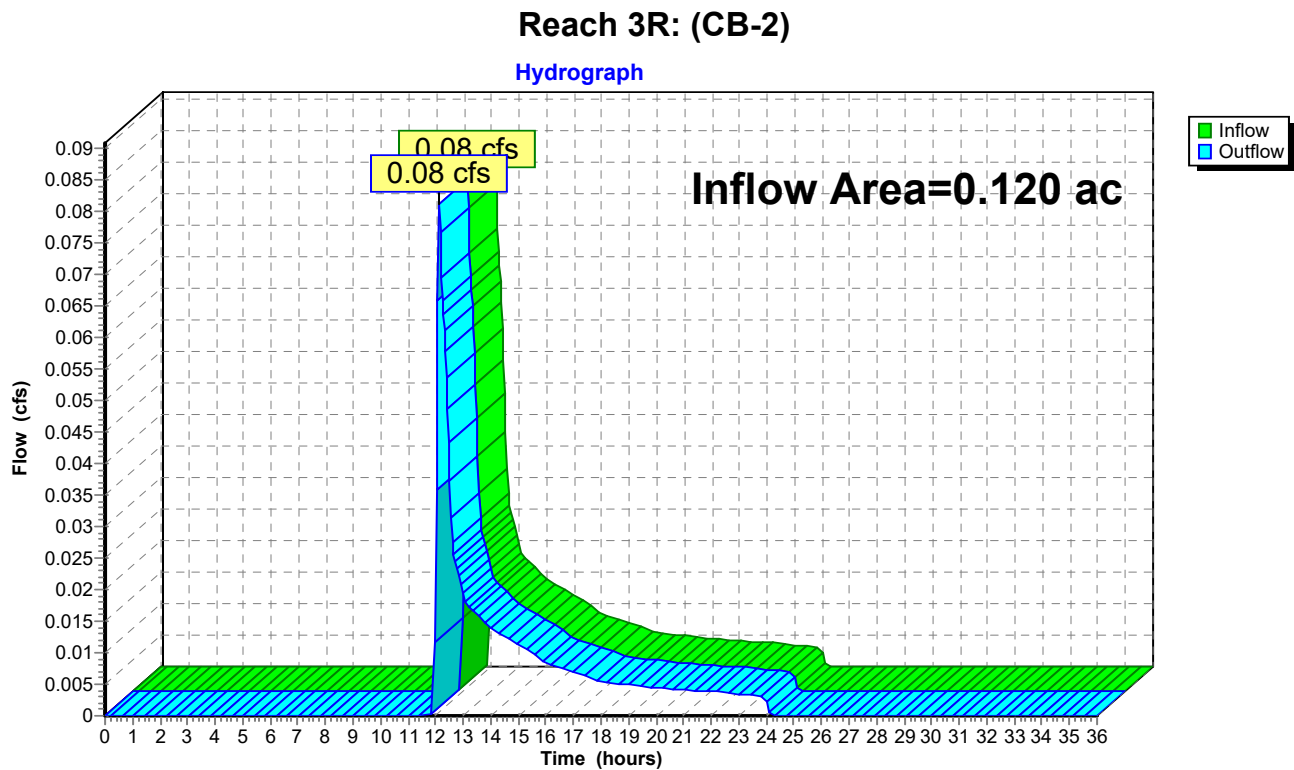


Summary for Reach 3R: (CB-2)

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

Inflow Area = 0.120 ac, 0.00% Impervious, Inflow Depth = 0.99" for 100YR-24HR event
Inflow = 0.08 cfs @ 12.13 hrs, Volume= 0.010 af
Outflow = 0.08 cfs @ 12.13 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

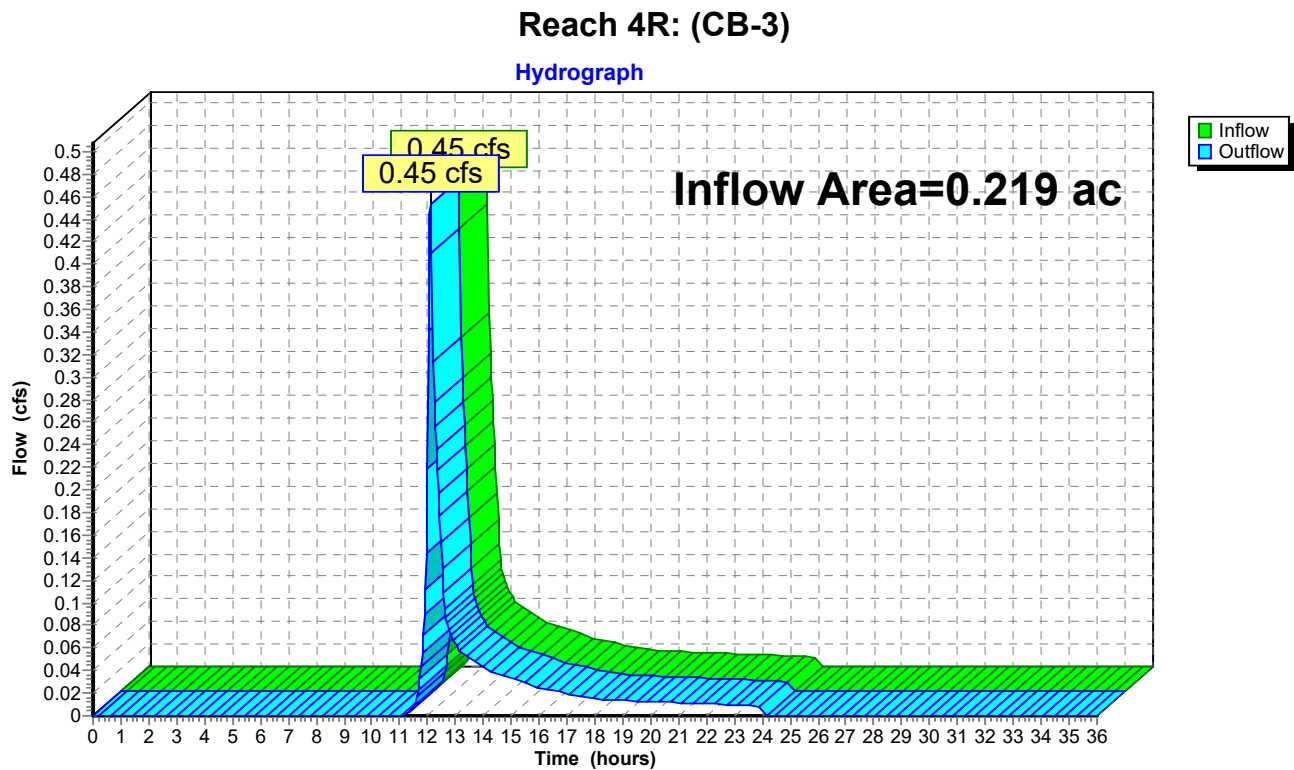


Summary for Reach 4R: (CB-3)

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

Inflow Area = 0.219 ac, 18.26% Impervious, Inflow Depth = 2.00" for 100YR-24HR event
Inflow = 0.45 cfs @ 12.10 hrs, Volume= 0.036 af
Outflow = 0.45 cfs @ 12.10 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2



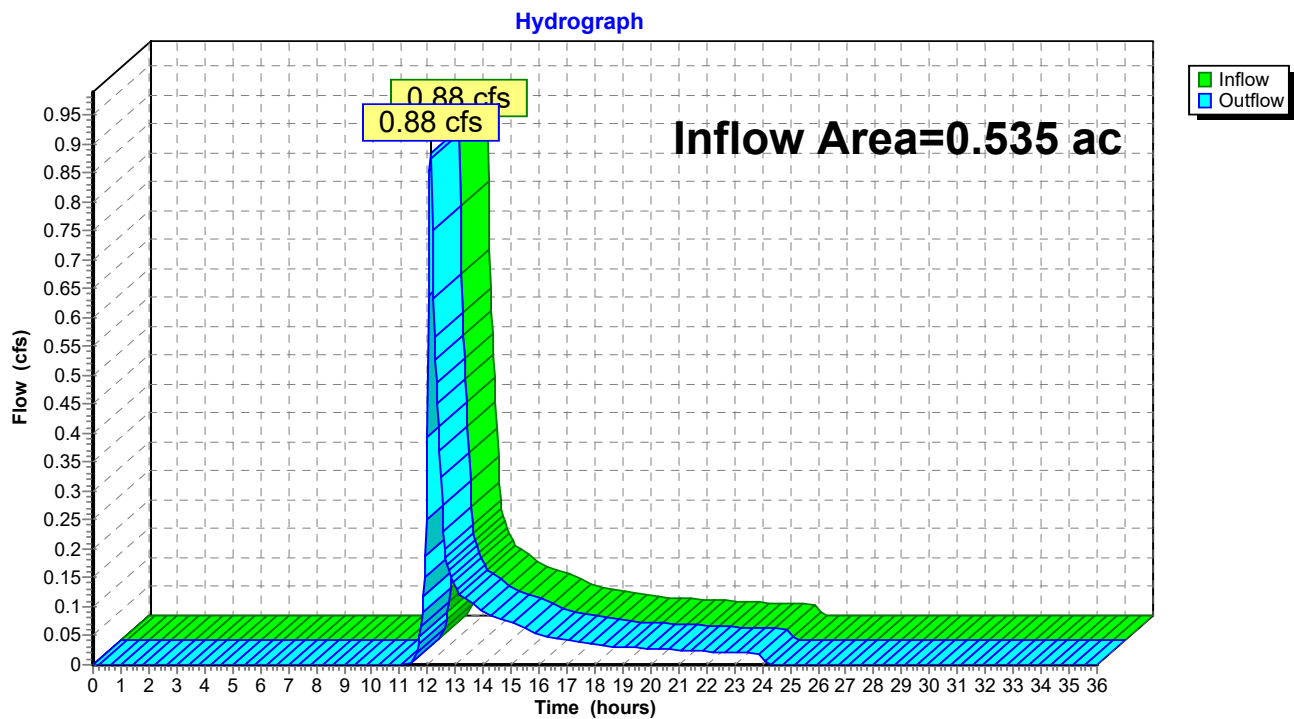
Summary for Reach SP1: (Study Point #1)

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

Inflow Area = 0.535 ac, 7.48% Impervious, Inflow Depth = 1.70" for 100YR-24HR event
Inflow = 0.88 cfs @ 12.11 hrs, Volume= 0.076 af
Outflow = 0.88 cfs @ 12.11 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Reach SP1: (Study Point #1)



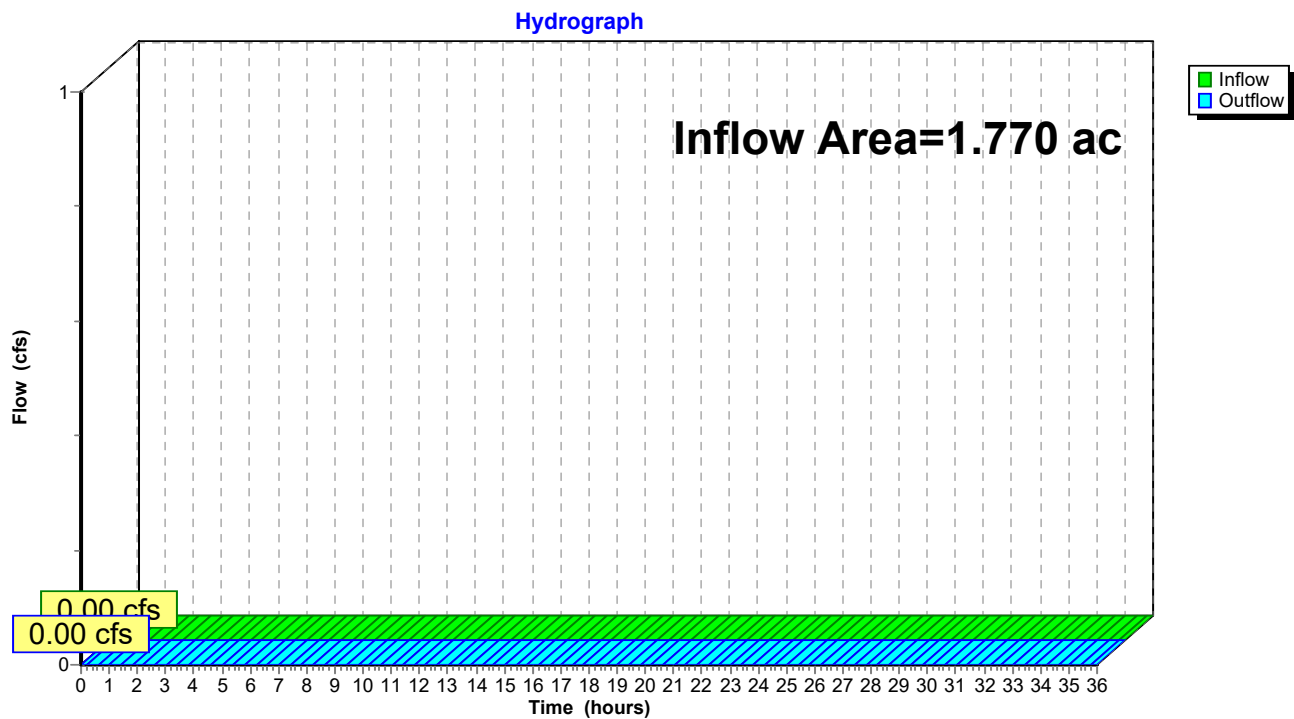
Summary for Reach SP2: (Study Point #2)

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

Inflow Area = 1.770 ac, 0.00% Impervious, Inflow Depth = 0.00" for 100YR-24HR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Reach SP2: (Study Point #2)

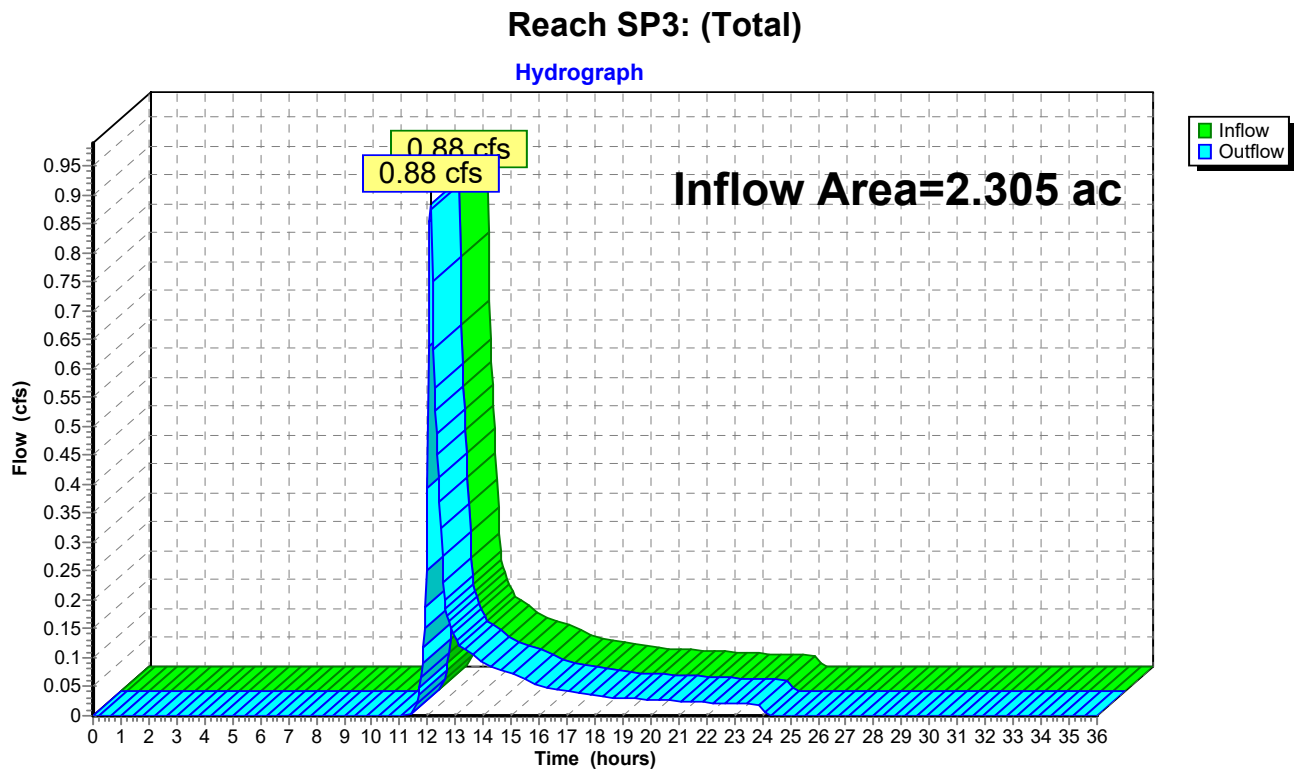


Summary for Reach SP3: (Total)

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

Inflow Area = 2.305 ac, 1.74% Impervious, Inflow Depth = 0.39" for 100YR-24HR event
Inflow = 0.88 cfs @ 12.11 hrs, Volume= 0.076 af
Outflow = 0.88 cfs @ 12.11 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2



Summary for Pond 1P: (Soccer Field Exfiltration)

Inflow Area = 1.300 ac, 0.00% Impervious, Inflow Depth = 7.10" for 100YR-24HR event
 Inflow = 9.51 cfs @ 12.08 hrs, Volume= 0.769 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
 Peak Elev= 94.40' @ 24.36 hrs Surf.Area= 56,550 sf Storage= 33,514 cf
 Flood Elev= 94.67' Surf.Area= 56,550 sf Storage= 39,585 cf

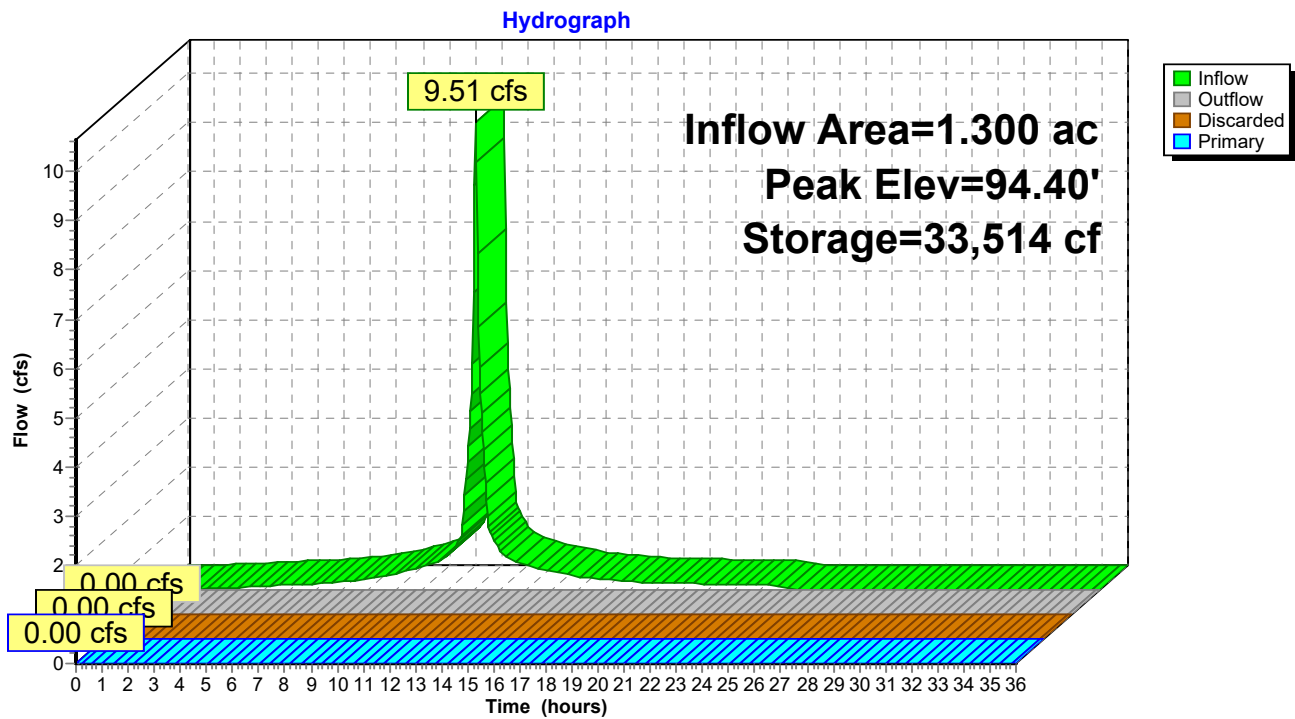
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description									
#1	92.92'	47,050 cf	Custom Stage Data (Prismatic) Listed below									
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)		Cum.Store (cubic-feet)							
92.92	56,550	0.0	0		0							
93.25	56,550	40.0	7,465		7,465							
94.25	56,550	40.0	22,620		30,085							
95.00	56,550	40.0	16,965		47,050							
Device	Routing	Invert	Outlet Devices									
#1	Primary	94.67'	336.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32									
#2	Discarded	94.17'	0.335 in/hr Exfiltration over Surface area above 94.17' Conductivity to Groundwater Elevation = 87.00' Excluded Surface area = 56,550 sf									

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.92' (Free Discharge)
 ↑ **2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.92' TW=85.00' (Dynamic Tailwater)
 ↑ **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: (Soccer Field Exfiltration)



Summary for Pond 2P: (Grass swale with underdrain)

Inflow Area = 0.470 ac, 0.00% Impervious, Inflow Depth = 3.23" for 100YR-24HR event
 Inflow = 1.74 cfs @ 12.09 hrs, Volume= 0.127 af
 Outflow = 1.69 cfs @ 12.12 hrs, Volume= 0.124 af, Atten= 3%, Lag= 1.4 min
 Primary = 1.69 cfs @ 12.12 hrs, Volume= 0.124 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 92.84' @ 12.12 hrs Surf.Area= 582 sf Storage= 312 cf

Flood Elev= 94.67' Surf.Area= 990 sf Storage= 349 cf

Plug-Flow detention time= 23.2 min calculated for 0.124 af (98% of inflow)

Center-of-Mass det. time= 10.4 min (854.9 - 844.6)

Volume	Invert	Avail.Storage	Storage Description
#1	91.50'	349 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.50	582	0.0	0	0
92.00	582	40.0	116	116
93.00	582	40.0	233	349
94.00	970	0.0	0	349
95.00	1,000	0.0	0	349
95.50	1,001	0.0	0	349

Device	Routing	Invert	Outlet Devices
#1	Primary	92.04'	12.0" Round Culvert L= 194.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 92.04' / 91.00' S= 0.0054 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Secondary	95.00'	25.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

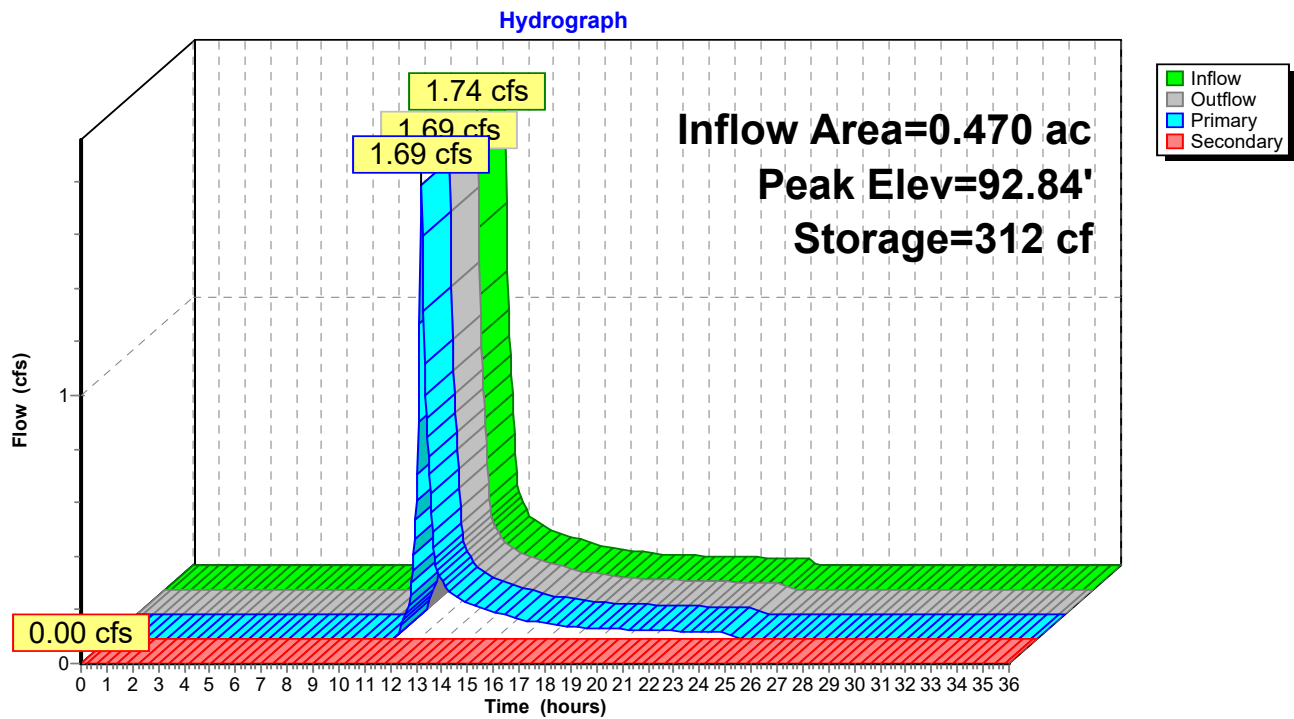
Primary OutFlow Max=1.68 cfs @ 12.12 hrs HW=92.84' TW=85.15' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 1.68 cfs @ 3.42 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=91.50' TW=85.00' (Dynamic Tailwater)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: (Grass swale with underdrain)



Summary for Pond 3P: (Wetland N)

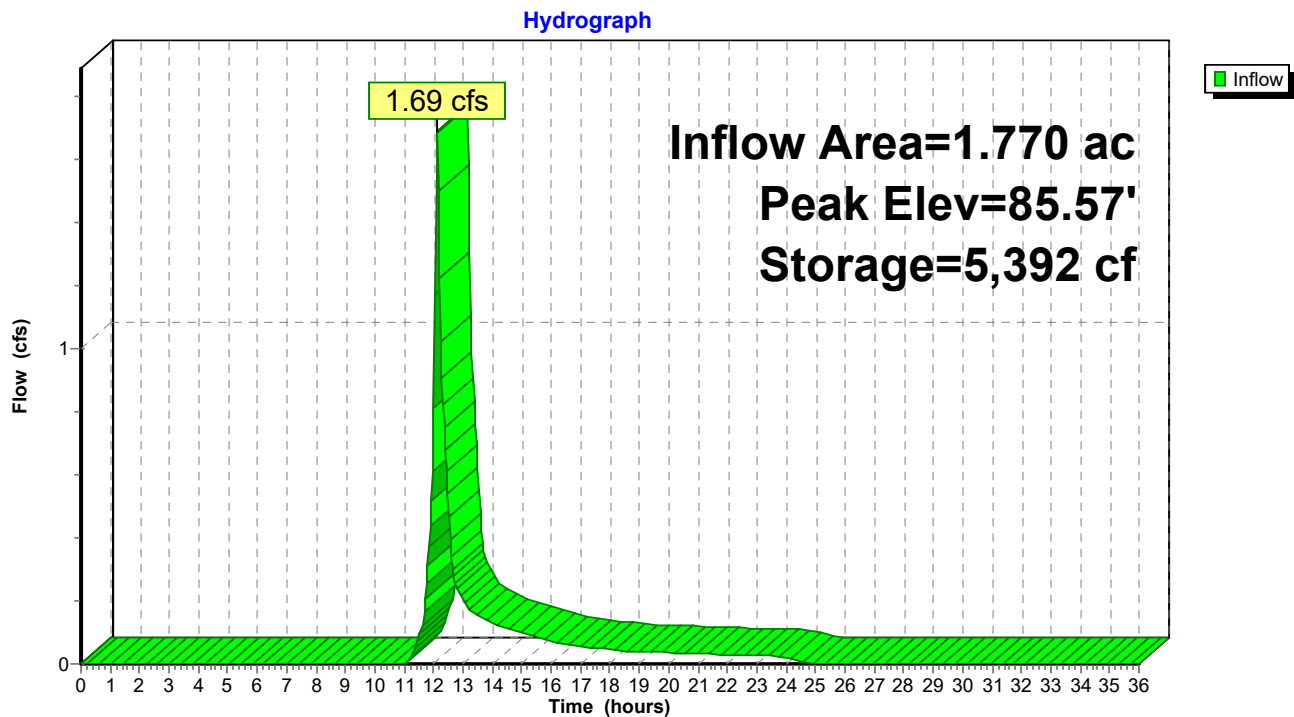
Inflow Area = 1.770 ac, 0.00% Impervious, Inflow Depth = 0.84" for 100YR-24HR event
 Inflow = 1.69 cfs @ 12.12 hrs, Volume= 0.124 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
 Peak Elev= 85.57' @ 36.00 hrs Surf.Area= 11,844 sf Storage= 5,392 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	220,938 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	7,068	0	0
86.00	15,444	11,256	11,256
87.00	29,379	22,412	33,668
88.00	39,282	34,331	67,998
89.00	50,533	44,908	112,906
90.00	53,770	52,152	165,057
91.00	57,991	55,881	220,938

Pond 3P: (Wetland N)



**Attachment D
BMP Long-Term Operations and Maintenance Plan**

**STORMWATER MANAGEMENT SYSTEM
OPERATION AND MAINTENANCE PLAN**

Prepared for the

NEMASKET STREET RECREATIONAL AREA

Location

**225 Hathaway Boulevard
New Bedford, Massachusetts**

Owner

**City of New Bedford
133 Williams Street, Room 304
New Bedford MA 02740**

Prepared by



**650 Suffolk Street
Lowell, MA 01854
(978) 656-3680**

May 2016

Revised March 2018

TABLE OF CONTENTS

1.0	Objective	1
2.0	Facilities to be Maintained	1
3.0	General Inspection and Maintenance Requirements	1
4.0	Maintenance Issues	2

Appendices

Appendix A - Stormwater Maintenance Log

1.0 Objective

This document is the Stormwater Operation and Maintenance Plan for the Nemasket Street Recreational Area. Per the Massachusetts stormwater requirements, The City of New Bedford is responsible for the long term maintenance of all components of the stormwater management system. These components must be periodically inspected and maintained in effective operating condition. This plan is designed to provide guidance to properly inspect and maintain the Nemasket Street Recreational Area stormwater facilities.

2.0 Facilities to be Maintained

The stormwater management facilities to be maintained at the Nemasket Street Recreational Area Project include:

- Infiltration trench and underdrains
- Other permeable cover areas and embankments;
- Field Turf Surface;

The Stormwater Management System Inspection & Maintenance Log is provided in Appendix A.

3.0 General Inspection and Maintenance Requirements

The components of the stormwater management system must be adequately maintained to ensure that the system operates as designed, and as approved by the state of Massachusetts. At a minimum, The City of New Bedford or its designated contractor will inspect stormwater conveyance, control and treatment structures at the site on a quarterly basis. Additional inspections may occur, as needed, depending on the results of routine inspections and site conditions. More frequent inspections will be made, as needed, by on-site personnel under the direction of the City of New Bedford. Stormwater system maintenance and repairs will be performed on an as-needed basis, in accordance with recommendations made by the site inspector. Routine maintenance will include, as needed: the immediate repair of newly-formed channels or gullies; reseeding or sodding of bare ground; removal of trash, leaves and sediment; and control of woody vegetation.

4.0 Maintenance Issues

Maintenance issues associated with specific areas and facilities at the site are identified in the following paragraphs.

Infiltration trench and underdrains

The infiltration trench and underdrains will be inspected annually. Routinely remove grass clippings leaves and accumulated sediment and debris from the surface of the trench. All sediment and debris will be removed and disposed of properly.

Field Turf Surface

The field turf surface will be inspected annually. This surface will typically require little on-going maintenance. Care and maintenance of the field turf should be per manufacturer recommendations. The surface will be kept free of trash and debris.

Revegetated Areas and Embankment Slopes

Revegetated areas and embankment slopes that are vegetated shall be inspected annually. Any signs of erosion, concentrated flow, or channelized flow will be repaired and reseeded as needed. Vegetation should be mown no less than three (3) inches tall.

APPENDIX A

**STORMWATER MANAGEMENT SYSTEM
INSPECTION & MAINTENANCE LOG**

Nemasket Street Recreation Area, New Bedford, MA				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		Inspector Initials and Date	Inspector Comments
	Quarterly Inspection	Maintenance		
Infiltration Trench and Underdrains:				
Inspect trench for excessive sediments and debris.	X	As Required		
Flush underdrains so all sediment and debris will be removed and disposed of properly.	X	As Required		
Field Turf Surface:				
Inspect stone surface for irregularities in the surface. Rake as rubber fill as necessary.	X	As Required		
Inspect for any rutting, trash or debris. Remove and correct as necessary.	X	As Required		

Appendix A

**Attachment E
Checklist for Stormwater Report**



Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- 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.

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

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



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

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



Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

Standard 3: Recharge

- ☐ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - ☐ Static
 - ☐ Simple Dynamic
 - ☒ Dynamic Field¹
- ☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
 - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
 - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

Standard 4: Water Quality

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

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



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

Standard 6: Critical Areas

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



Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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



Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 9: Operation and Maintenance Plan

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

Standard 10: Prohibition of Illicit Discharges

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

ATTACHMENT F

Correspondence (Tracey Comments)

TRC
650 Suffolk Street
Lowell, MA 01854

Main 978.9705600
Fax 978.453.1995

Memorandum

To: Raymond Holberger, City of New Bedford
From: David M. Sullivan, TRC Senior Consultant and Program Manager
Subject: Response to Comments - Nitsch Engineering Letter Dated June 21, 2016
Date: August 1, 2016
CC: M. Paul, City of New Bedford; Project Team – TRC Environmental

The purpose of this memorandum prepared by TRC Environmental Corporation (TRC) is to provide a response to comments posed by Nitsch Engineering regarding the following plans/documents entitled:

- "Nemasket Street Recreation Area, 225 Hathaway Boulevard, New Bedford, Massachusetts," prepared by TRC, dated May 2016
- "Notice of Intent, Nemasket Street Recreation Area Project, New Bedford, Massachusetts," prepared by TRC, dated May 2016
- Report entitled "Stormwater Management Report, Nemasket Street Recreational Area, 225 Hathaway Boulevard, New Bedford, Massachusetts," prepared by TRC, dated May 2016

The Nitsch Engineering comments are reiterated below, followed by TRC's response in italics.

- The project is a redevelopment project. Therefore, it is required to meet the Stormwater Management Guidelines to the maximum extent practicable.

Duly noted.

- The project includes the filling of approximately 2,519 square feet of isolated vegetated wetlands, the removal of existing pavement, and the construction of a synthetic turf soccer field and impervious basketball court.

The City of New Bedford has decided to change the site plan requirements. Currently the site is being redesigned along with the stormwater management system. The overall development footprint is being reduced to accommodate a new field turf soccer field that will be oriented east-west (instead of the originally proposed north-south configuration). The basketball court will be placed on the existing parking lot to the north of the Keith Middle School building. The impacts to the isolated wetland, approximately 2,519 square feet, will still remain the same.

- The plans include the lowering of an existing manhole approximately 2 feet below the grade of the proposed soccer field. Therefore, access to the manhole will require excavation of the soccer field.

The revised site layout will not disturb the existing manhole. Therefore access for maintenance will not be affected.

- The proposed stormwater model does not include a summary of total flows offsite. Flows are summarized by two design points. Flows to design point SP-01, which are flows to the wetlands to the west of the Keith Middle Schools, show an increase for all storms. The Applicant has summarized flows from both design points by adding the peak flows from both design points together. Typically, flows from separate reaches are routed together in the model. When adding the flows from the two design points together, there is an overall decrease in flows offsite.

Stormwater calculations are being revised to work with the updated site plan. All offsite flows will be combined to produce one peak discharge rate.

- We disagree with the curve numbers used for some of the proposed ground cover. For instance, the brick pavers should include a curve number of 98. It is unclear how the curve number of 68 was developed for the synthetic turf field. The Applicant should provide back-up information to document this curve number.

The revised stormwater calculations will include back-up information to document the curve number assumptions.

- The Applicant should provide additional information regarding the development of the infiltration rate north of the basketball court.

The new stormwater design will be solely limited to detention. No infiltration will penetrate the engineered cap

- During the initial discussions related to this project with the Applicant's engineer, we discussed the use of infiltrative drainage onsite. Typically, infiltrative drainage is not included on sites that contain contaminated materials, which this site does. Therefore, we cannot comment on the whether the use of infiltrative drainage on this site is appropriate based on the types of contaminated materials found onsite. This was a significant part of the discussion held on April 25, 2016. The Applicant's notes from that discussion do not reflect these conversations. At the time, our understanding was that there would be a significant infiltrative drainage system proposed as part of the project. The proposed infiltrative drainage facilities are not as significant as originally thought.

As noted above, no infiltration practices will be part of the stormwater system design. All increases in runoff will be controlled by an underground detention system.

Please contact TRC if we can be of any further service regarding this response.