DESIGN ENGINEERS, INC.

STORM WATER
DRAINAGE ANALYSIS
For
Solar Canopy and Ground Mount Project
50 Constitution Boulevard
Franklin, Massachusetts

Prepared for:

EMC Corporation
176 South Street
Hopkinton, MA 01748

Prepared by:

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February 6, 2025
ADE Project No. 3402.00

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APPENDICES

1.0 INTRODUCTION

The purpose of this drainage study is to analyze the stormwater drainage conditions that will occur as a result of the construction of the proposed Solar Canopy and Ground Mount Project along with associated infrastructure at 50 Constitution Boulevard, (Parcel 015 on the Town of Franklin Assessors Map 319). The project site is a 39.3±-acre parcel located in Franklin Industrial Park on the east side of Constitution Boulevard and to the west of Upper Union Street. The property is currently a fully developed site comprised of an industrial building, facility buildings, and paved parking lots. There is an existing stormwater management system in place consisting of catch basins, manholes, piping, swales/ditches, sediment forebays, and constructed wetlands.

The site does not lie within a DEP designated Zone II or a Town of Franklin designated Water Resource District per Town of Franklin Water Resource District maps. The site is not located within FEMA Flood Zone based upon a review of FEMA Flood Mapping. The property is not located within an Estimated Habitat of Rare Wildlife or Priority Habitat of Rare Species, as mapped by the Natural Heritage and Endangered Species Program (NHESP). The site is not located within an Area of Critical Environmental Concern (ACEC).

Based upon a review of the Web Soil Survey, the soil within the proposed development area has been identified as Woodbridge fine sandy loam, which has a hydrology soil group ranging from C through D.

HydroCAD Stormwater modeling software was used to analyze the hydrological impacts of the development of the solar project, specifically to calculate pre- and post-development runoff to the existing stormwater basins on the site. The Stormwater analysis and project design was completed in accordance with the requirements of the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards, and the Town of Franklin Stormwater Management Bylaw.

2.0 STORMWATER MANAGEMENT SYSTEM

The proposed development consists of a ground mounted solar array (±2.0-acres fenced-in area) over an existing grass sports field and a canopy mounted solar array (±0.2-acres) over an existing paved parking lot. The proposed solar development will not require grading or tree clearing. It will not significantly increase impervious area (±699 SF) or change existing on-site drainage patterns. All existing stormwater features will be unaffected by the project.

Stormwater runoff from the proposed development area will be captured using existing catch basins and directed to existing sediment forebays before entering existing constructed wetlands, which will prevent direct discharge of untreated stormwater to any wetland resource areas or offsite.

The only proposed stormwater management measure is a stone infiltration trench located within the ground mounted solar array perimeter fence. This infiltration trench accounts for the proposed impervious surface recharge and water quality volume requirements. Calculations have been provided in Appendix D.

Erosion control measures (sediment logs or approved equal) will be in place and maintained at the proposed limit of work throughout construction, until vegetation has stabilized, to protect the wetlands and existing stormwater management system.

3.0 COMPLIANCE WITH DEP STORMWATER MANAGEMENT STANDARDS

Standard 1: No New Untreated Discharges

There are no new impervious surfaces proposed as part of the solar project that will generate suspended solids or other measurable stormwater contaminants. The only measurable new impervious surface on the site is the concrete electrical equipment pads, ground mount beams, and concrete piers for canopy piers. These impervious surfaces will be limited to foot traffic only. Therefore, there will be no new untreated discharge and it is our opinion that Standard 1 has been met.

Standard 2: Peak Rate Attenuation

Pre- and Post-Development stormwater calculations were performed for the 2-, 10-, 25-, and 100-year storm events using the NRCC extreme precipitation tables. A comparison of the Pre- vs. Post-Development peak runoff rates and volumes for each storm event at the off-site design points is summarized in the tables below:

Design Point #1 – Towards Existing Constructed Wetlands (South)				
	Pre-Development		***Post-Development***	
Storm Event	***Rate***	***Volume***	***Rate***	***Volume***
2-year	49.34 cfs	146,738 cf	49.34 cfs	146,738 cf
10-year	82.82 cfs	251,417 cf	82.82 cfs	251,417 cf
25-year	108.79 cfs	334,989 cf	108.79 cfs	334,989 cf
100-year	161.93 cfs	510,259 cf	161.93 cfs	510,259 cf

Design Point #2 – Towards Existing Constructed Wetlands (North)				
	Pre-Development		***Post-Development***	
Storm Event	***Rate***	***Volume***	***Rate***	***Volume***
2-year	53.38 cfs	181,430 cf	53.38 cfs	181,430 cf
10-year	86.09 cfs	300,022 cf	86.09 cfs	300,022 cf
25-year	111.23 cfs	393,466 cf	111.23 cfs	393,466 cf
100-year	162.61 cfs	587,872 cf	162.61 cfs	587,872 cf

As shown in the tables, the peak rates and volumes for stormwater runoff generated under Post Development condition will be equal to the peak rates generated under Pre-Development conditions for the all storm events.

Complete runoff calculations for the 2-, 10-, 25-, and 100-year storm events including cover, soil types and times of concentration paths for the Pre-Development conditions and Post Development conditions are provided in Appendix B. Also watershed plans are provided in Appendix C.

Standard 3: Groundwater Recharge
Based upon a review of the Web Soil Survey, the proposed development area has been identified as a hydrological soil group ranging from C to D; therefore, we are choosing the least favorable hydrological soil group with the lowest infiltration rate. The groundwater recharge volume required for the proposed impervious surfaces is calculated by the following formula:

$$Rv = (F)(AIMP)$$

Rv = Required Recharge Volume
F=Target Depth Factor: 0.10 inch
AIMP = Proposed Impervious Area

The total area of new impervious is equal to ±699 SF. The calculations in Appendix D show that the BMP volume exceeds the required recharge volume. As a result, it is our opinion that Standard 3 has been met.

Standard 4: Water Quality Volume
The only measurable new impervious surface on the site is the concrete electrical equipment pads, ground mount beams, and concrete piers and those will be limited to foot traffic only.

Therefore, it is our opinion that Standard 4 has been met.

Standard 5: Land Uses with Higher Pollutant Loads (LUHPPLs)
The proposed solar development is not a LUHPPL and therefore Standard 5 is not applicable.

Standard 6: Critical Areas
The project does not have any discharges within a Zone II, Interim Wellhead Protection Areas or near or to any Critical Areas as defined by the Massachusetts Stormwater Handbook and therefore Standard 6 is not applicable.

Standard 7: Redevelopment Projects
The proposed project is not a redevelopment project and therefore Standard 7 is not applicable.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control
Construction Period Pollution Prevention and Erosion and Sedimentation Control
A Construction Period Erosion and Sedimentation Control Plan is provided on the Site plans along with notes/instructions for the contractor and details/location of all erosion control measures.

Standard 9: Post-Construction Long Term Stormwater Operation and Maintenance Plan
A Post-Construction Long Term Stormwater Operation and Maintenance Plan is provided in Appendix F.

Standard 10: Prohibition of Illicit Discharges
To our knowledge, there are no existing illicit discharges to existing stormwater systems on the Site and a statement preventing illicit discharges from the proposed development to proposed stormwater systems on the Site is included within the Post-Construction Long Term Pollution Prevention Plan.

4.0 COMPLIANCE WITH TOWN OF FRANKLIN STORMWATER MANAGEMENT BYLAW

There will be no grading at the site and all existing stormwater features will be unaffected by the project. Please note that the proposed land disturbance activity of the project will be less than one (1) acre (±699 SF), thus in our opinion, the Stormwater Management Permit will not be required.

APPENDIX A

MassDEP Checklist for Stormwater Report

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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 8[2]
- 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.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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.

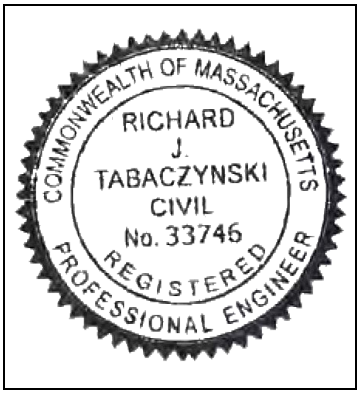
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the 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): Catch Basin, Sediment Forebay, Stone Infiltration Trench

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 Field[1]

☐ 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. (ON PLANS)

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

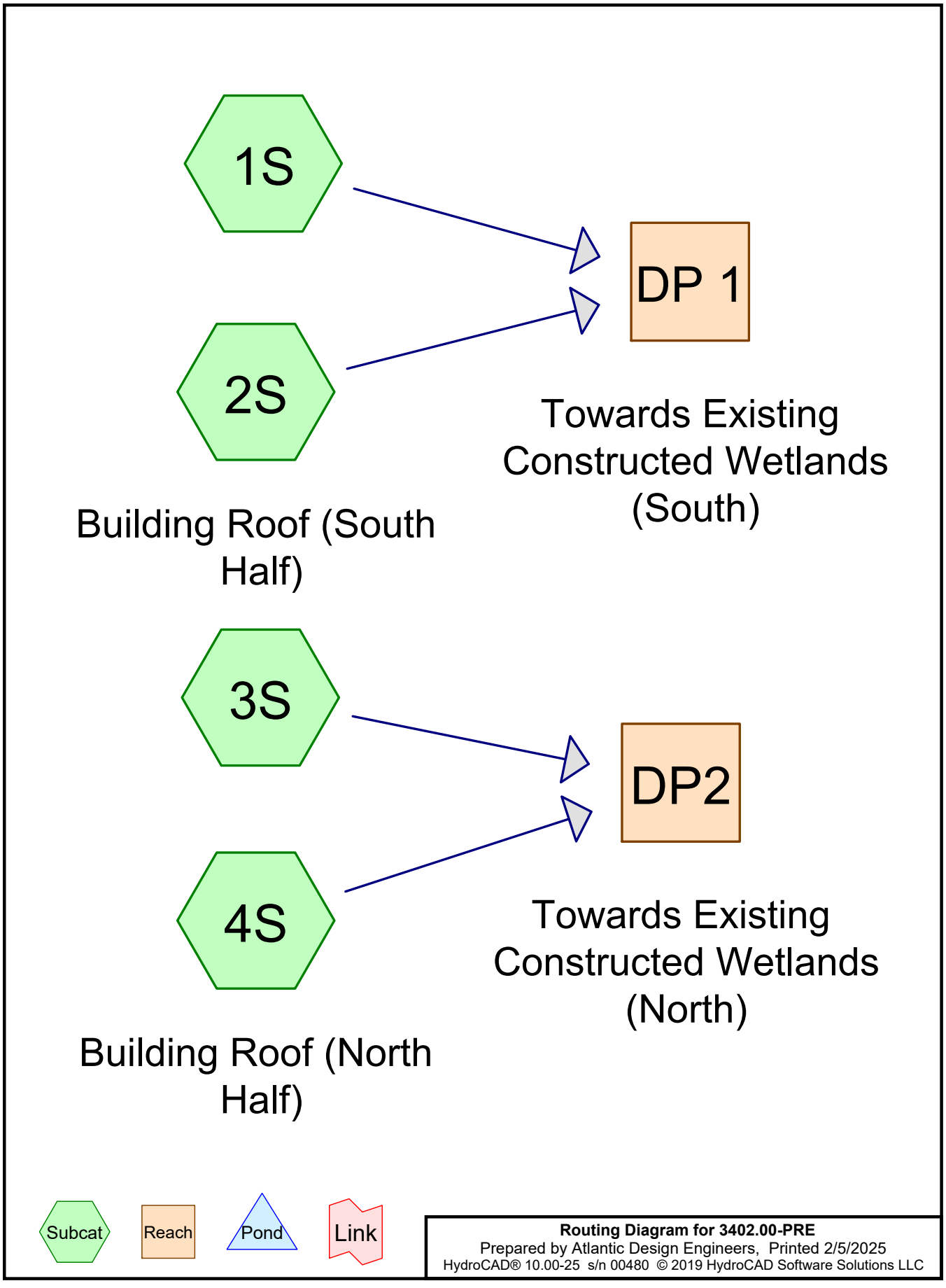
☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ 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.

APPENDIX B

Pre- and Post-Development HydroCAD Calculations



Routing Diagram for 3402.00-PRE
Prepared by Atlantic Design Engineers, Printed 2/5/2025

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
607,243	80	>75% Grass cover, Good, HSG D (1S, 3S)
749,946	98	Paved parking, HSG D (1S, 3S)
11,841	98	Roofs, HSG D (1S, 3S)
273,922	98	Unconnected roofs, HSG D (2S, 4S)
69,070	77	Woods, Good, HSG D (1S, 3S)
1,712,022	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
1,712,022	HSG D	1S, 2S, 3S, 4S
0	Other	
1,712,022		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	0	0	607,243	0	607,243	>75% Grass cover, Good	
0	0	0	749,946	0	749,946	Paved parking	
0	0	0	11,841	0	11,841	Roofs	
0	0	0	273,922	0	273,922	Unconnected roofs	
0	0	0	69,070	0	69,070	Woods, Good	
0	**0**	**0**	**1,712,022**	**0**	**1,712,022**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=680,289 sf 41.83% Impervious Runoff Depth=1.98"
Tc=6.0 min CN=87 Runoff=38.84 cfs 112,073 cf

Subcatchment 2S: Building Roof (South Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=3.04"
Tc=6.0 min CN=98 Runoff=10.50 cfs 34,665 cf

Subcatchment 3S: Runoff Area=757,811 sf 62.97% Impervious Runoff Depth=2.32"
Flow Length=959' Tc=9.2 min CN=91 Runoff=43.96 cfs 146,765 cf

Subcatchment 4S: Building Roof (North Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=3.04"
Tc=6.0 min CN=98 Runoff=10.50 cfs 34,665 cf

Reach DP 1: Towards Existing Constructed Wetlands (South) Inflow=49.34 cfs 146,738 cf
Outflow=49.34 cfs 146,738 cf

Reach DP2: Towards Existing Constructed Wetlands (North) Inflow=53.38 cfs 181,430 cf
Outflow=53.38 cfs 181,430 cf

Total Runoff Area = 1,712,022 sf Runoff Volume = 328,168 cf Average Runoff Depth = 2.30"
39.50% Pervious = 676,313 sf 60.50% Impervious = 1,035,709 sf

Summary for Subcatchment 1S:

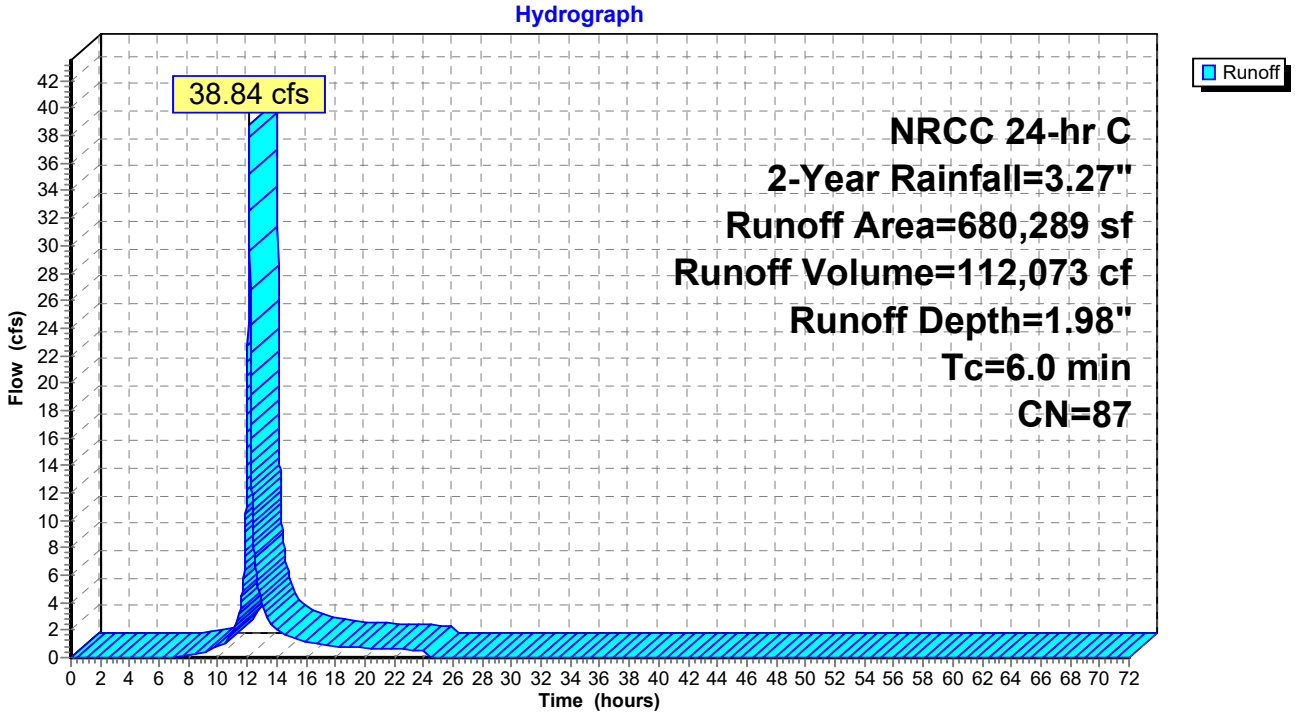
Runoff = 38.84 cfs @ 12.13 hrs, Volume= 112,073 cf, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.27"

Area (sf)	CN	Description
46,570	77	Woods, Good, HSG D
728	98	Roofs, HSG D
349,150	80	>75% Grass cover, Good, HSG D
283,841	98	Paved parking, HSG D
680,289	87	Weighted Average
395,720		58.17% Pervious Area
284,569		41.83% Impervious Area

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

Subcatchment 1S:



Summary for Subcatchment 2S: Building Roof (South Half)

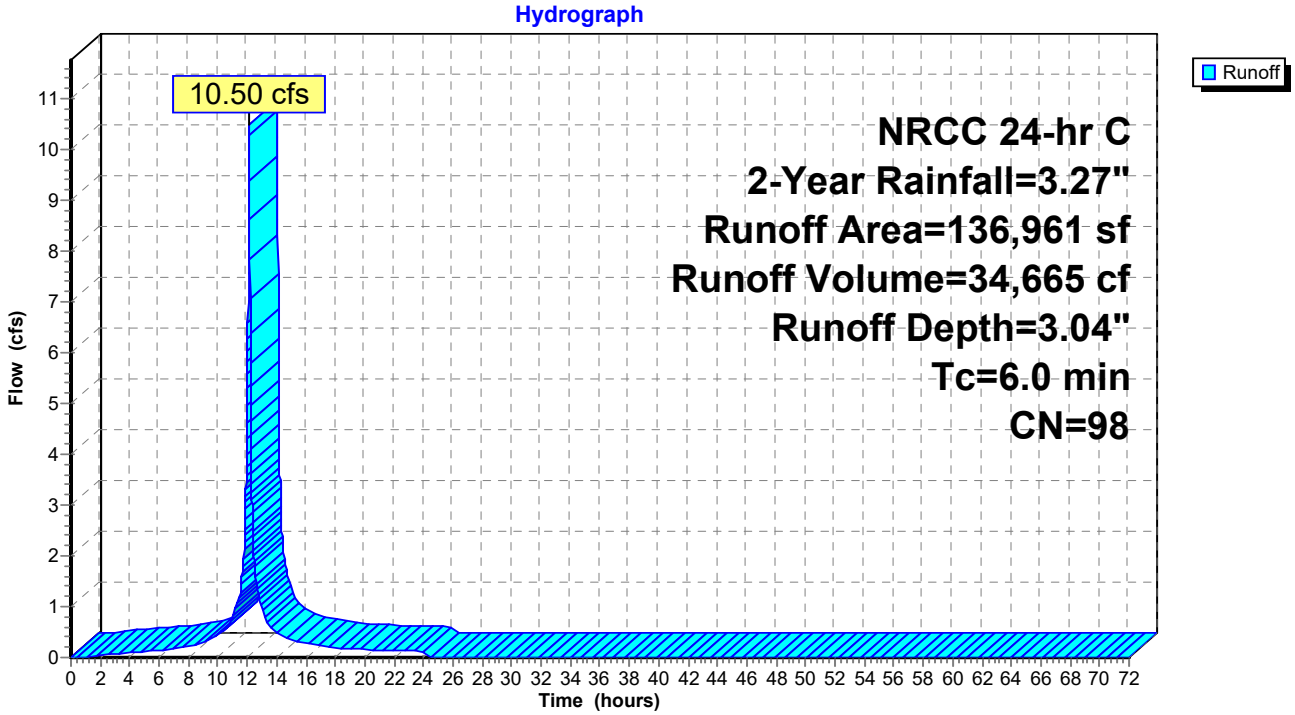
Runoff = 10.50 cfs @ 12.13 hrs, Volume= 34,665 cf, Depth= 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.27"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 2S: Building Roof (South Half)



Summary for Subcatchment 3S:

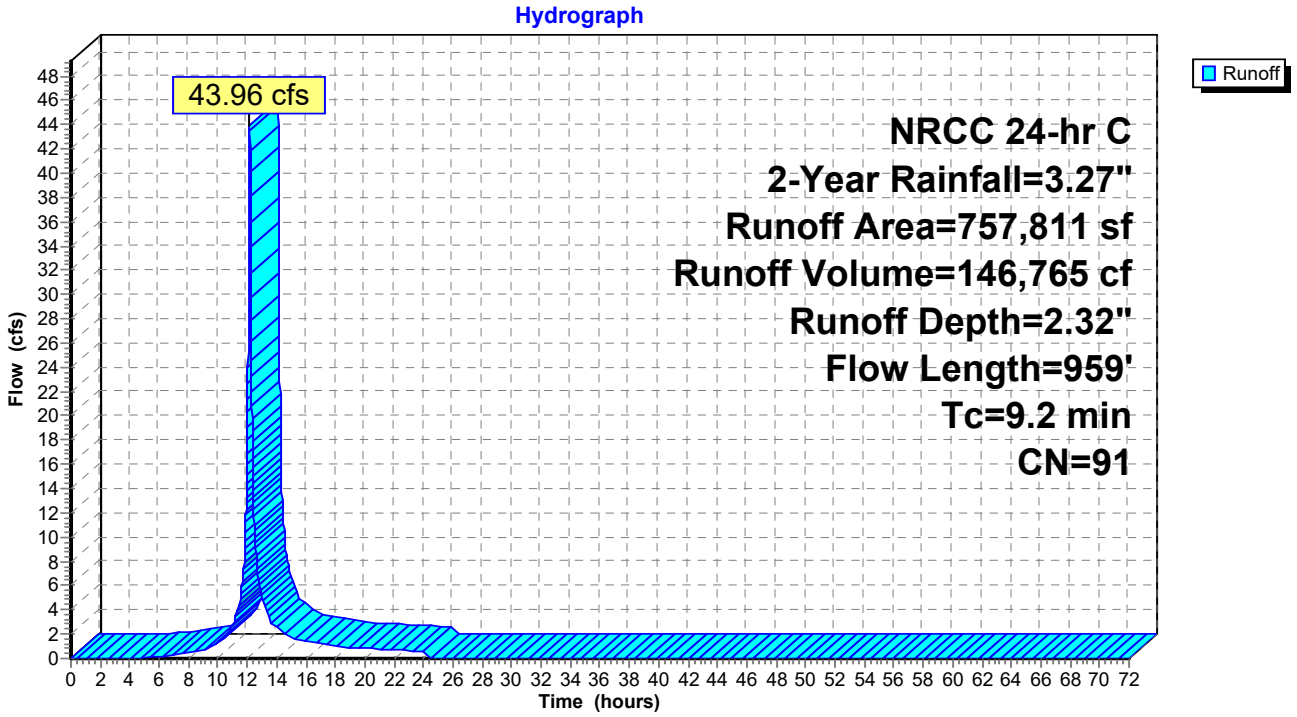
Runoff = 43.96 cfs @ 12.16 hrs, Volume= 146,765 cf, Depth= 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.27"

Area (sf)	CN	Description
22,500	77	Woods, Good, HSG D
11,113	98	Roofs, HSG D
258,093	80	>75% Grass cover, Good, HSG D
466,105	98	Paved parking, HSG D
757,811	91	Weighted Average
280,593		37.03% Pervious Area
477,218		62.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
3.3	590	0.0200	3.01	42.93	**Trap/Vee/Rect Channel Flow,** Bot.W=5.00' D=1.50' Z= 3.0 '/' Top.W=14.00' n= 0.069 Riprap, 6-inch
0.5	319	0.0130	9.70	30.48	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.2	959	Total			

Subcatchment 3S:



Summary for Subcatchment 4S: Building Roof (North Half)

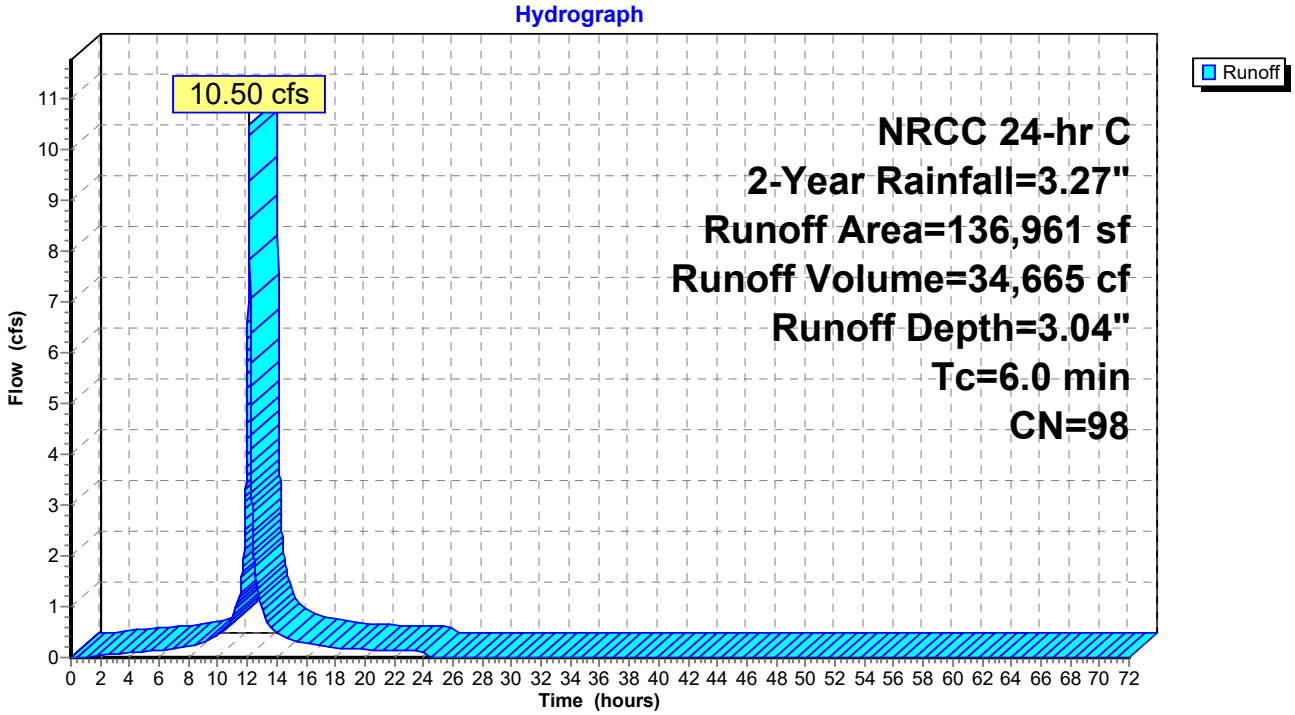
Runoff = 10.50 cfs @ 12.13 hrs, Volume= 34,665 cf, Depth= 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.27"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 4S: Building Roof (North Half)



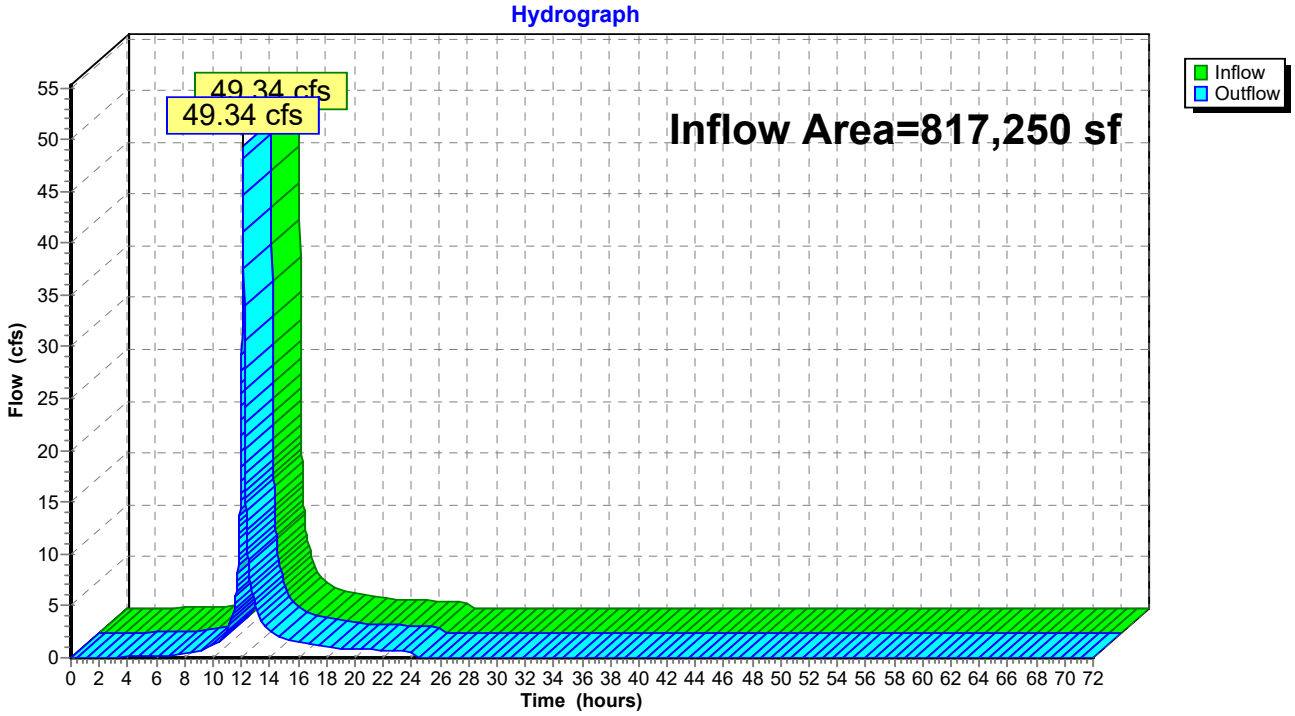
Summary for Reach DP 1: Towards Existing Constructed Wetlands (South)

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

Inflow Area = 817,250 sf, 51.58% Impervious, Inflow Depth = 2.15" for 2-Year event
Inflow = 49.34 cfs @ 12.13 hrs, Volume= 146,738 cf
Outflow = 49.34 cfs @ 12.13 hrs, Volume= 146,738 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Existing Constructed Wetlands (South)



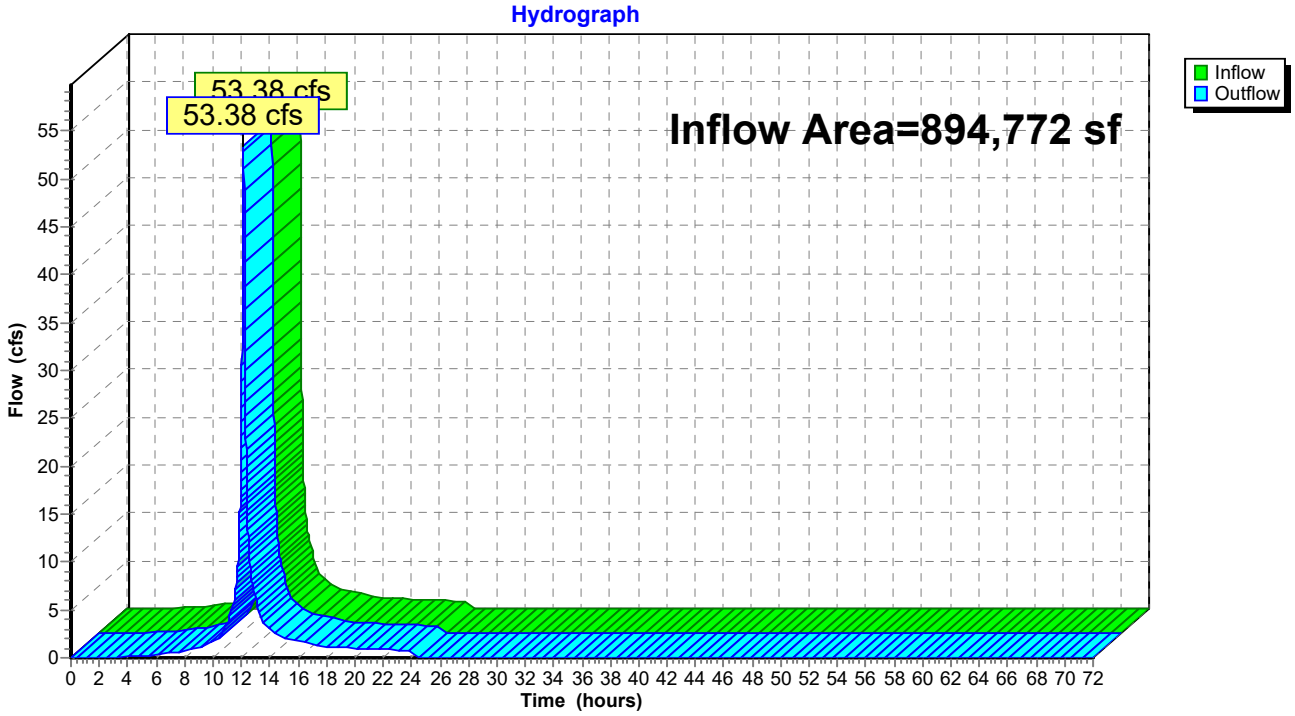
Summary for Reach DP2: Towards Existing Constructed Wetlands (North)

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

Inflow Area = 894,772 sf, 68.64% Impervious, Inflow Depth = 2.43" for 2-Year event
Inflow = 53.38 cfs @ 12.15 hrs, Volume= 181,430 cf
Outflow = 53.38 cfs @ 12.15 hrs, Volume= 181,430 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP2: Towards Existing Constructed Wetlands (North)



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=680,289 sf 41.83% Impervious Runoff Depth=3.49"
Tc=6.0 min CN=87 Runoff=66.92 cfs 197,964 cf

Subcatchment 2S: Building Roof (South Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=4.68"
Tc=6.0 min CN=98 Runoff=15.90 cfs 53,452 cf

Subcatchment 3S: Runoff Area=757,811 sf 62.97% Impervious Runoff Depth=3.90"
Flow Length=959' Tc=9.2 min CN=91 Runoff=71.77 cfs 246,570 cf

Subcatchment 4S: Building Roof (North Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=4.68"
Tc=6.0 min CN=98 Runoff=15.90 cfs 53,452 cf

Reach DP 1: Towards Existing Constructed Wetlands (South) Inflow=82.82 cfs 251,417 cf
Outflow=82.82 cfs 251,417 cf

Reach DP2: Towards Existing Constructed Wetlands (North) Inflow=86.09 cfs 300,022 cf
Outflow=86.09 cfs 300,022 cf

Total Runoff Area = 1,712,022 sf Runoff Volume = 551,439 cf Average Runoff Depth = 3.87"
39.50% Pervious = 676,313 sf 60.50% Impervious = 1,035,709 sf

Summary for Subcatchment 1S:

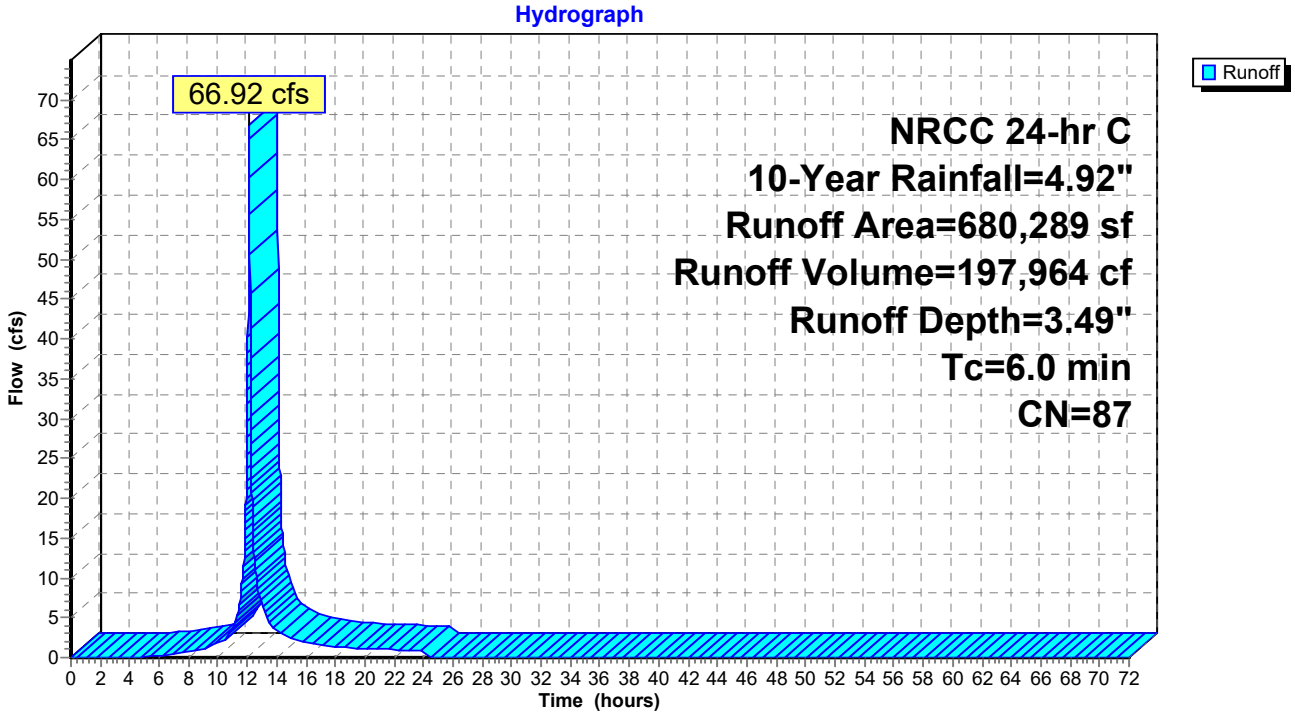
Runoff = 66.92 cfs @ 12.13 hrs, Volume= 197,964 cf, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.92"

Area (sf)	CN	Description
46,570	77	Woods, Good, HSG D
728	98	Roofs, HSG D
349,150	80	>75% Grass cover, Good, HSG D
283,841	98	Paved parking, HSG D
680,289	87	Weighted Average
395,720		58.17% Pervious Area
284,569		41.83% Impervious Area

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

Subcatchment 1S:



Summary for Subcatchment 2S: Building Roof (South Half)

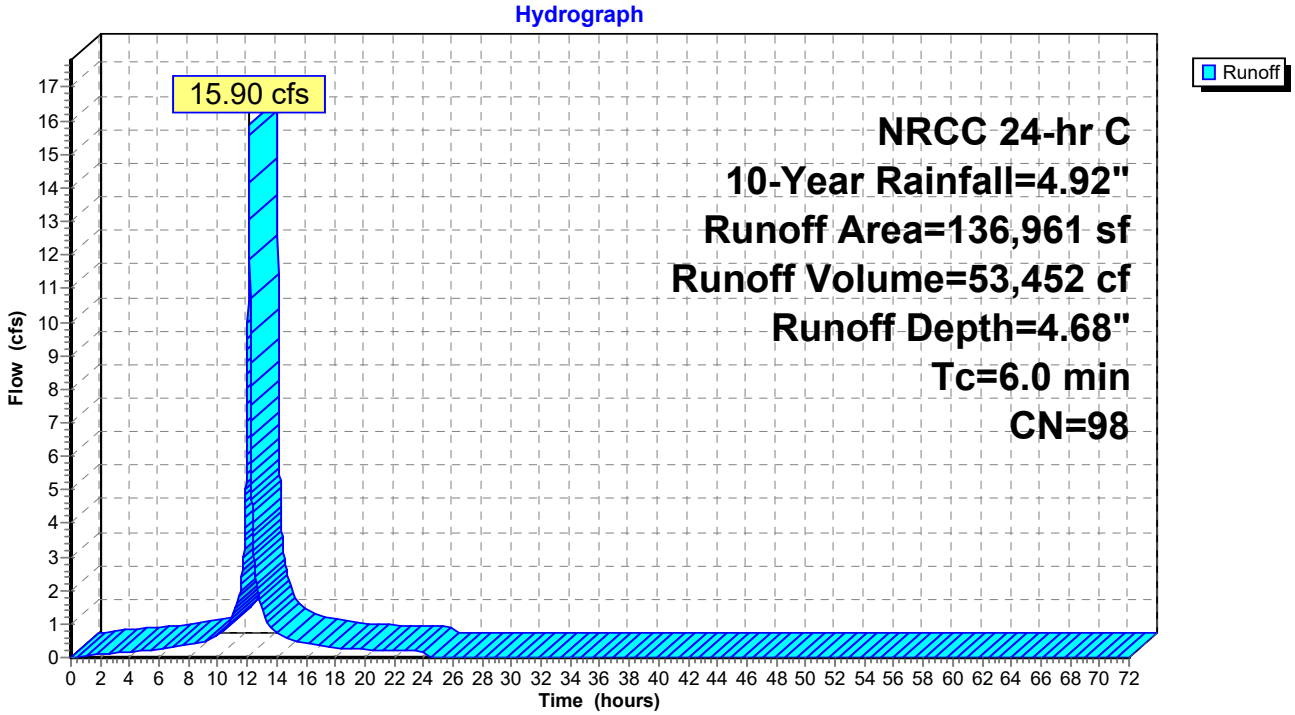
Runoff = 15.90 cfs @ 12.13 hrs, Volume= 53,452 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.92"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 2S: Building Roof (South Half)



Summary for Subcatchment 3S:

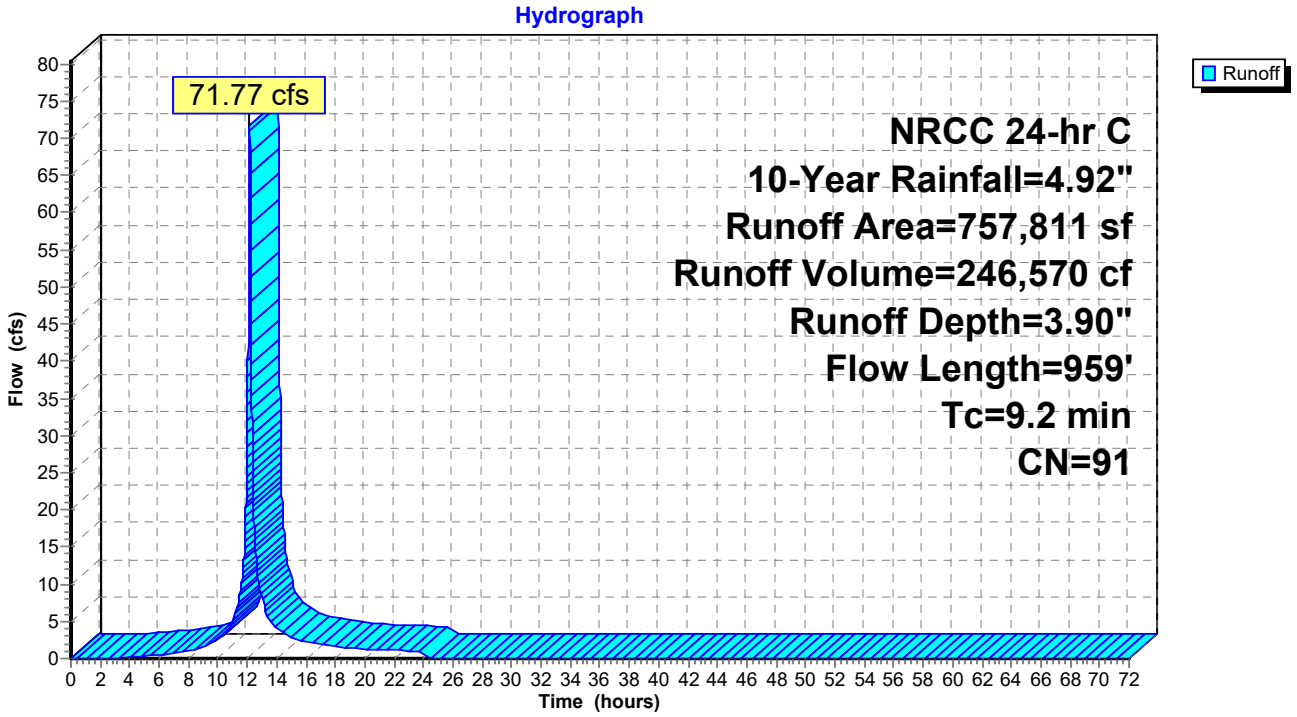
Runoff = 71.77 cfs @ 12.16 hrs, Volume= 246,570 cf, Depth= 3.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.92"

Area (sf)	CN	Description
22,500	77	Woods, Good, HSG D
11,113	98	Roofs, HSG D
258,093	80	>75% Grass cover, Good, HSG D
466,105	98	Paved parking, HSG D
757,811	91	Weighted Average
280,593		37.03% Pervious Area
477,218		62.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
3.3	590	0.0200	3.01	42.93	**Trap/Vee/Rect Channel Flow,** Bot.W=5.00' D=1.50' Z= 3.0 '/' Top.W=14.00' n= 0.069 Riprap, 6-inch
0.5	319	0.0130	9.70	30.48	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.2	959	Total			

Subcatchment 3S:



Summary for Subcatchment 4S: Building Roof (North Half)

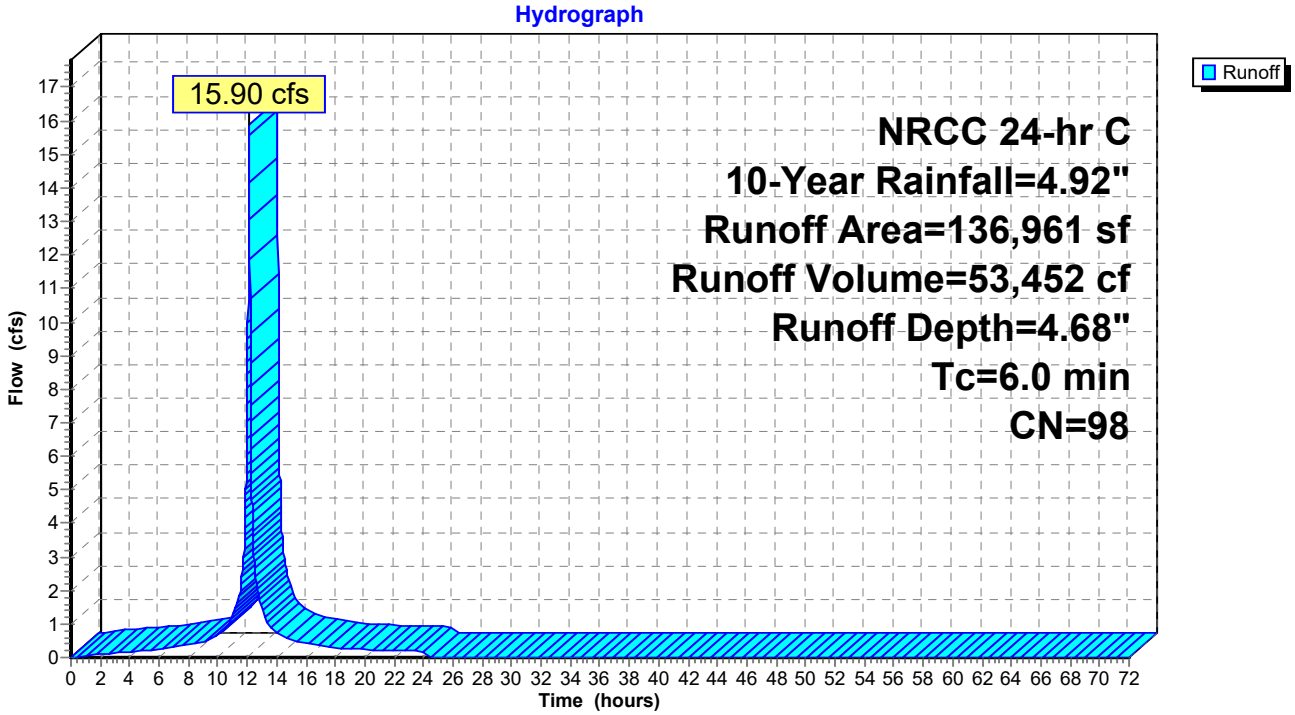
Runoff = 15.90 cfs @ 12.13 hrs, Volume= 53,452 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.92"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 4S: Building Roof (North Half)



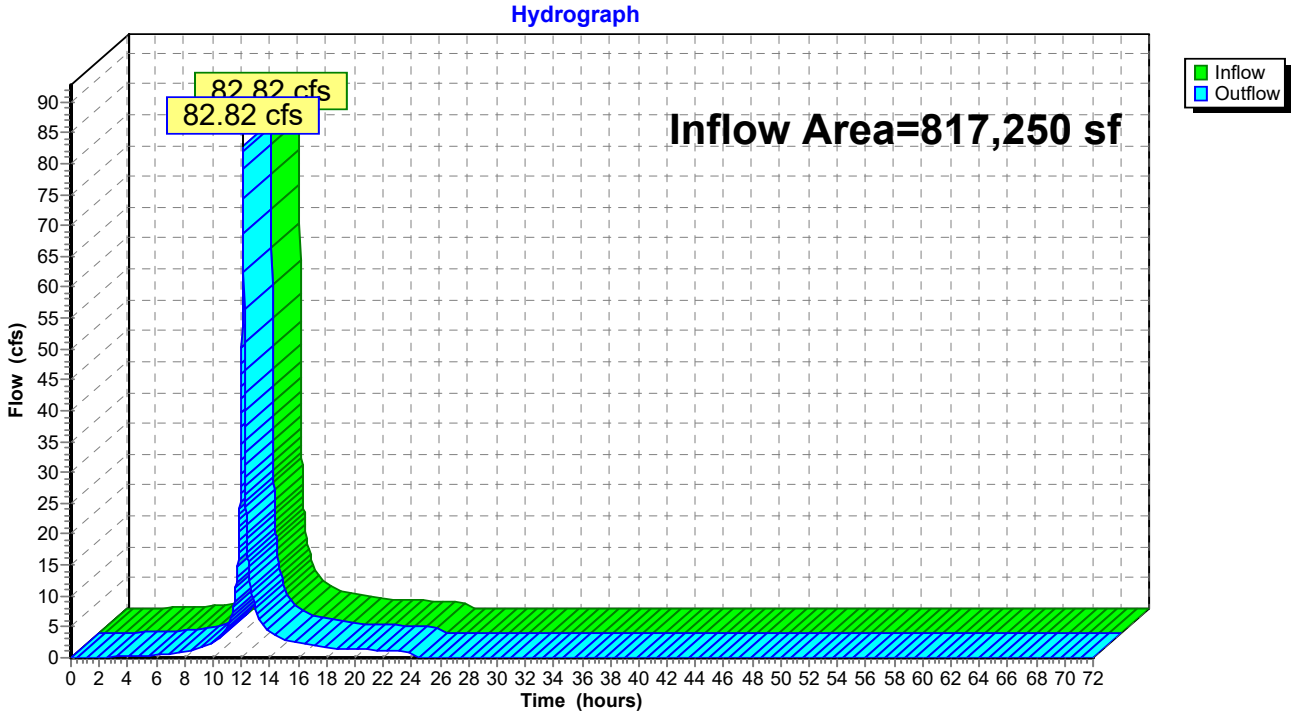
Summary for Reach DP 1: Towards Existing Constructed Wetlands (South)

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

Inflow Area = 817,250 sf, 51.58% Impervious, Inflow Depth = 3.69" for 10-Year event
Inflow = 82.82 cfs @ 12.13 hrs, Volume= 251,417 cf
Outflow = 82.82 cfs @ 12.13 hrs, Volume= 251,417 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Existing Constructed Wetlands (South)



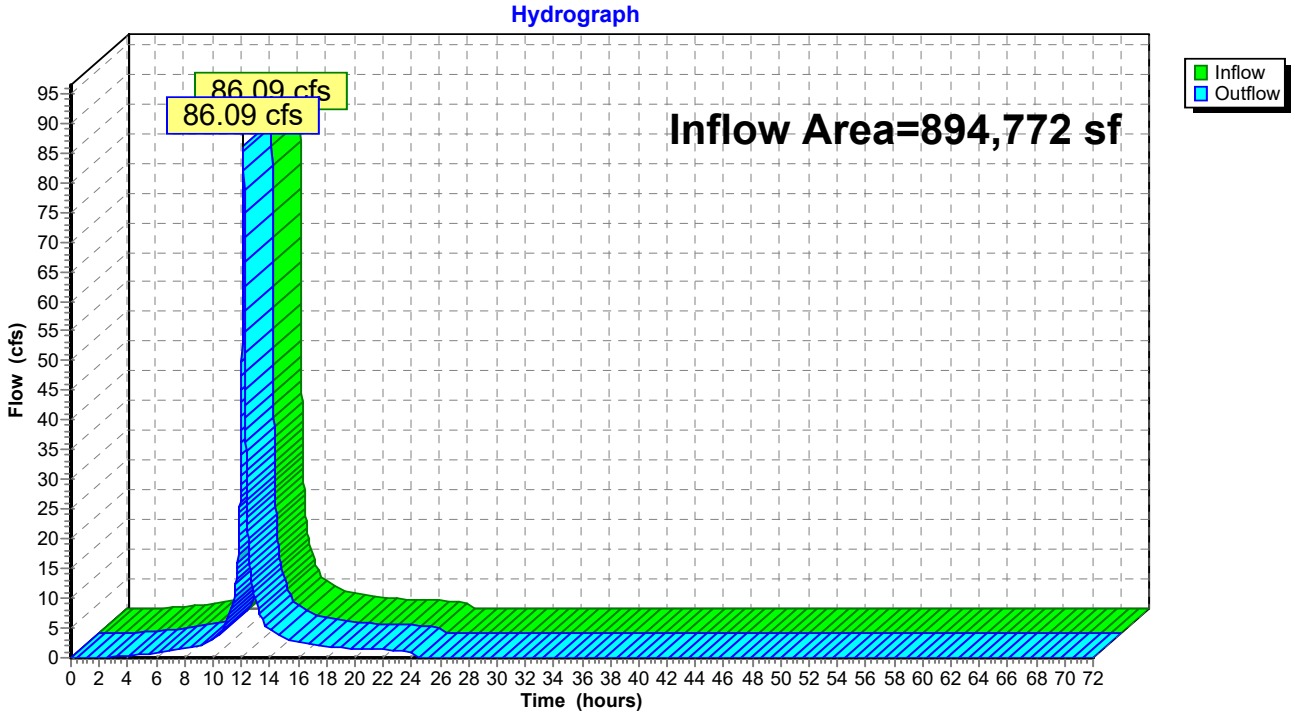
Summary for Reach DP2: Towards Existing Constructed Wetlands (North)

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

Inflow Area = 894,772 sf, 68.64% Impervious, Inflow Depth = 4.02" for 10-Year event
Inflow = 86.09 cfs @ 12.15 hrs, Volume= 300,022 cf
Outflow = 86.09 cfs @ 12.15 hrs, Volume= 300,022 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP2: Towards Existing Constructed Wetlands (North)



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=680,289 sf 41.83% Impervious Runoff Depth=4.71"
Tc=6.0 min CN=87 Runoff=88.71 cfs 266,946 cf

Subcatchment 2S: Building Roof (South Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=5.96"
Tc=6.0 min CN=98 Runoff=20.08 cfs 68,043 cf

Subcatchment 3S: Runoff Area=757,811 sf 62.97% Impervious Runoff Depth=5.15"
Flow Length=959' Tc=9.2 min CN=91 Runoff=93.13 cfs 325,423 cf

Subcatchment 4S: Building Roof (North Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=5.96"
Tc=6.0 min CN=98 Runoff=20.08 cfs 68,043 cf

Reach DP 1: Towards Existing Constructed Wetlands (South) Inflow=108.79 cfs 334,989 cf
Outflow=108.79 cfs 334,989 cf

Reach DP2: Towards Existing Constructed Wetlands (North) Inflow=111.23 cfs 393,466 cf
Outflow=111.23 cfs 393,466 cf

Total Runoff Area = 1,712,022 sf Runoff Volume = 728,454 cf Average Runoff Depth = 5.11"
39.50% Pervious = 676,313 sf 60.50% Impervious = 1,035,709 sf

Summary for Subcatchment 1S:

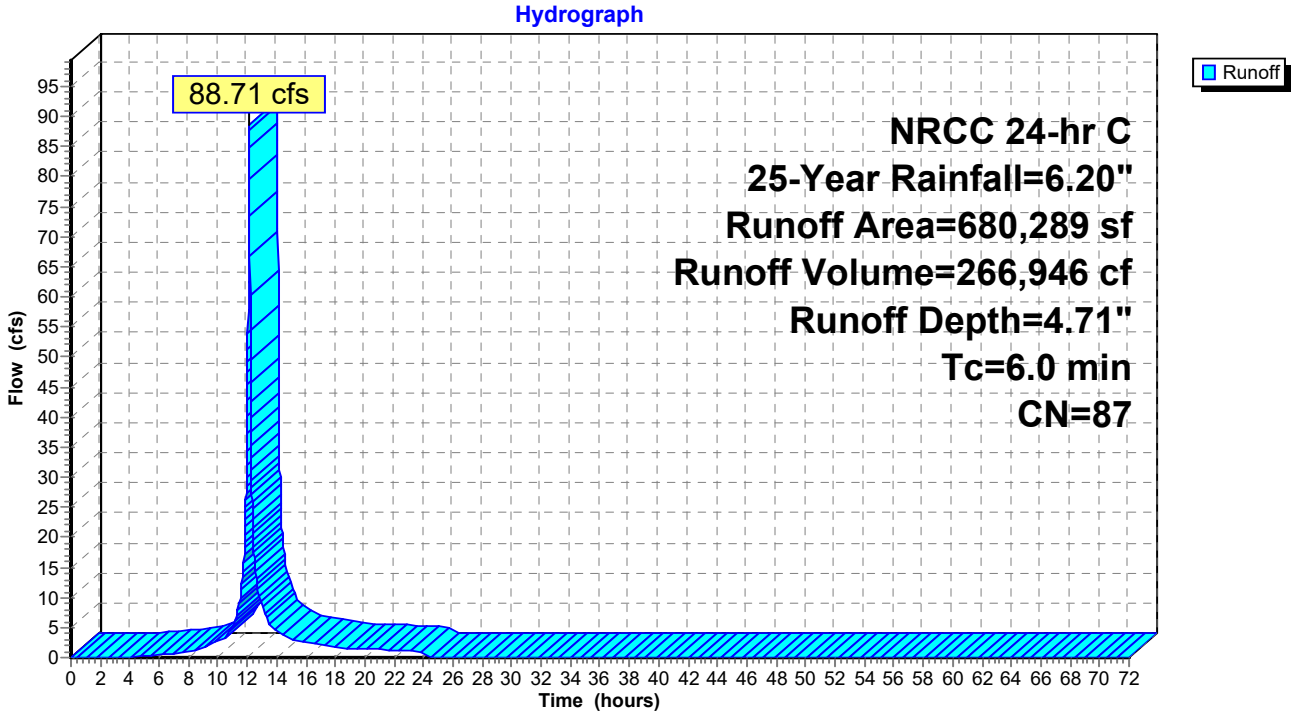
Runoff = 88.71 cfs @ 12.13 hrs, Volume= 266,946 cf, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.20"

Area (sf)	CN	Description
46,570	77	Woods, Good, HSG D
728	98	Roofs, HSG D
349,150	80	>75% Grass cover, Good, HSG D
283,841	98	Paved parking, HSG D
680,289	87	Weighted Average
395,720		58.17% Pervious Area
284,569		41.83% Impervious Area

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

Subcatchment 1S:



Summary for Subcatchment 2S: Building Roof (South Half)

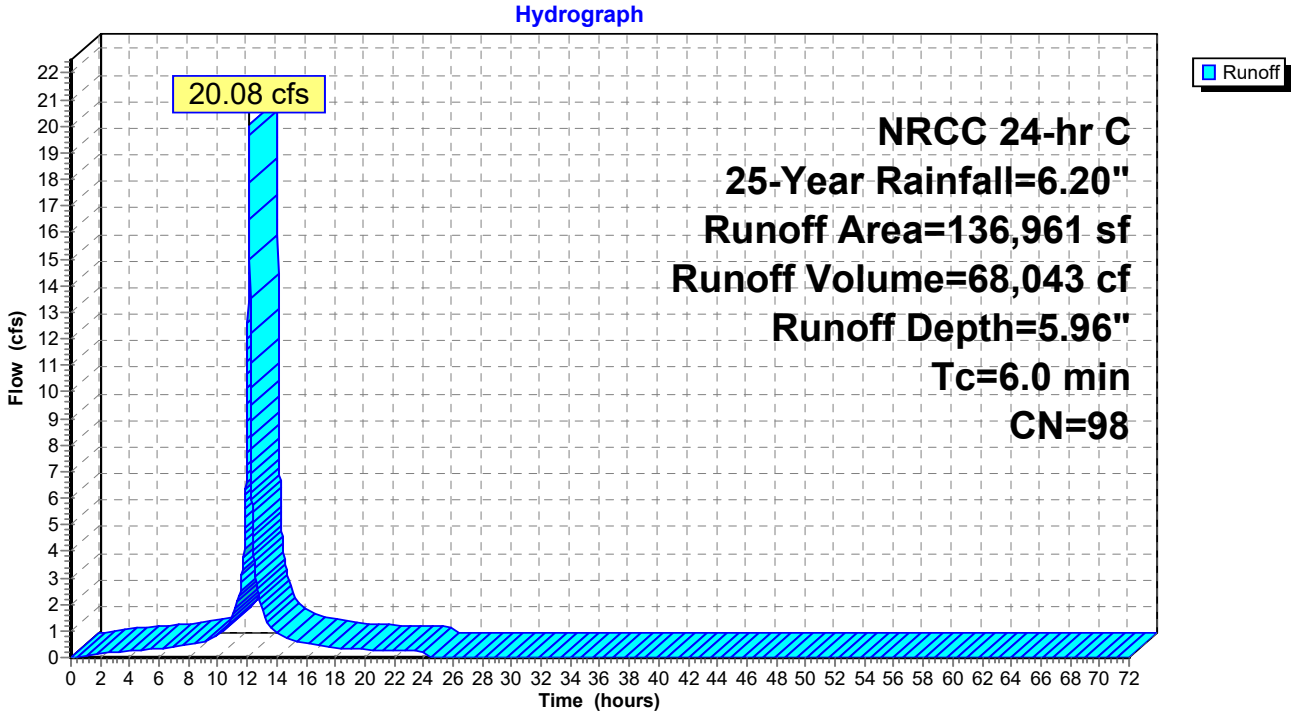
Runoff = 20.08 cfs @ 12.13 hrs, Volume= 68,043 cf, Depth= 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.20"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 2S: Building Roof (South Half)



Summary for Subcatchment 3S:

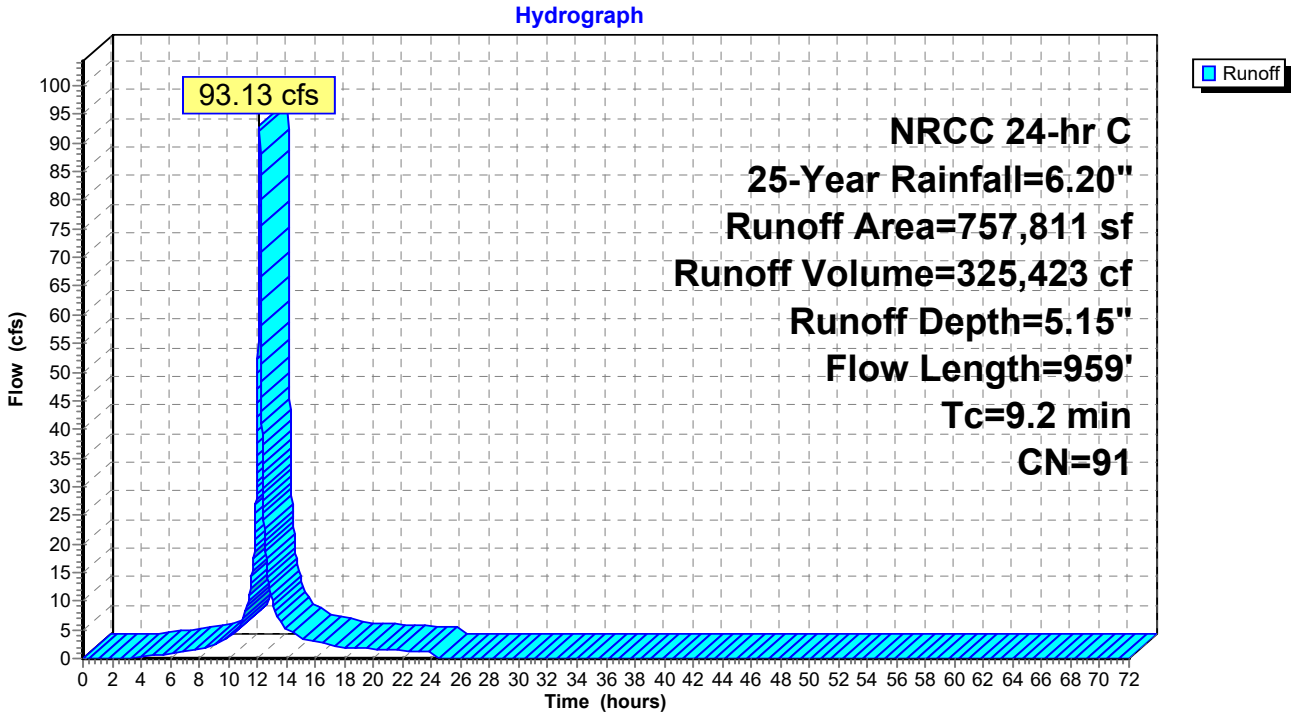
Runoff = 93.13 cfs @ 12.16 hrs, Volume= 325,423 cf, Depth= 5.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.20"

Area (sf)	CN	Description
22,500	77	Woods, Good, HSG D
11,113	98	Roofs, HSG D
258,093	80	>75% Grass cover, Good, HSG D
466,105	98	Paved parking, HSG D
757,811	91	Weighted Average
280,593		37.03% Pervious Area
477,218		62.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
3.3	590	0.0200	3.01	42.93	**Trap/Vee/Rect Channel Flow,** Bot.W=5.00' D=1.50' Z= 3.0 '/' Top.W=14.00' n= 0.069 Riprap, 6-inch
0.5	319	0.0130	9.70	30.48	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.2	959	Total			

Subcatchment 3S:



Summary for Subcatchment 4S: Building Roof (North Half)

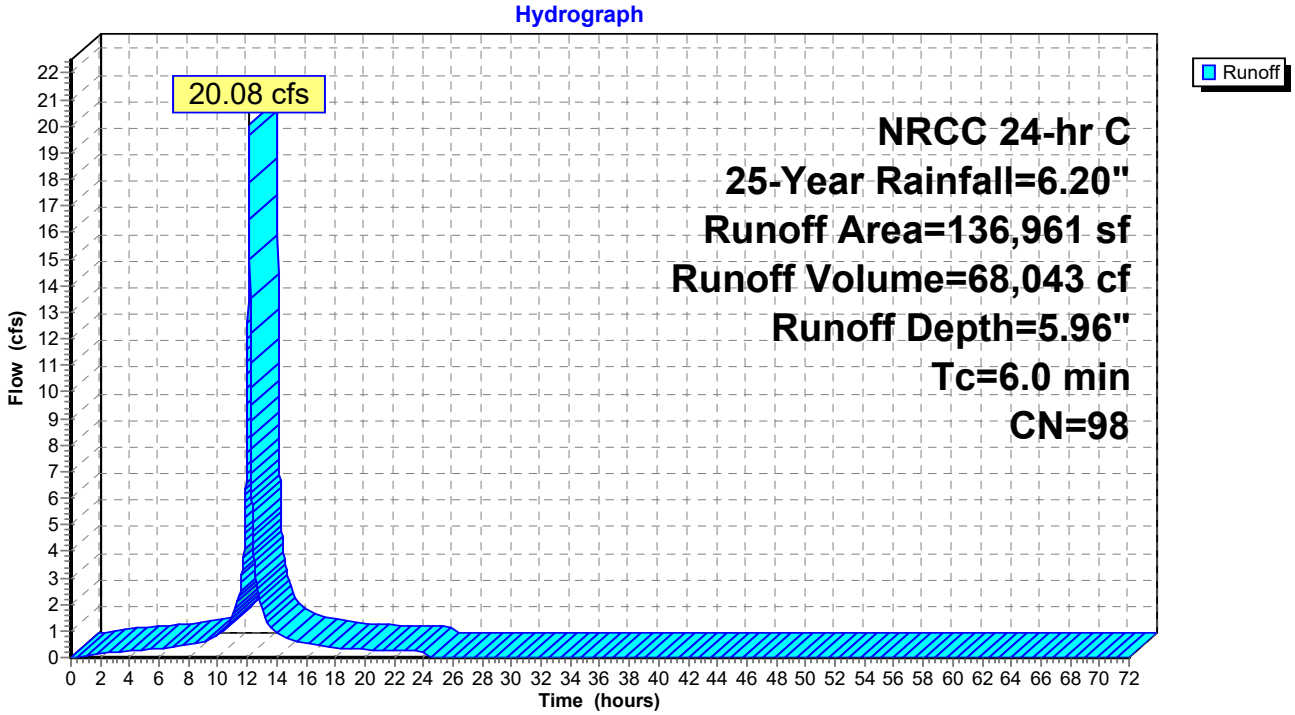
Runoff = 20.08 cfs @ 12.13 hrs, Volume= 68,043 cf, Depth= 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.20"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 4S: Building Roof (North Half)



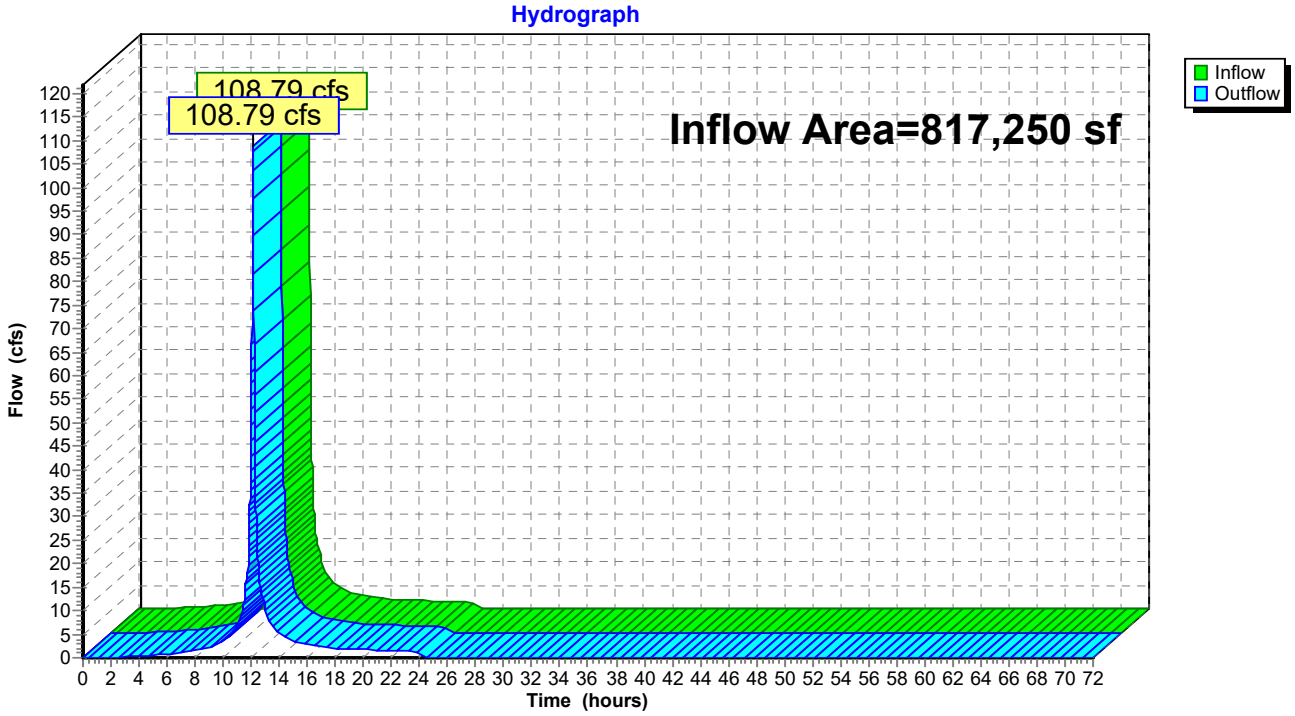
Summary for Reach DP 1: Towards Existing Constructed Wetlands (South)

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

Inflow Area = 817,250 sf, 51.58% Impervious, Inflow Depth = 4.92" for 25-Year event
Inflow = 108.79 cfs @ 12.13 hrs, Volume= 334,989 cf
Outflow = 108.79 cfs @ 12.13 hrs, Volume= 334,989 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Existing Constructed Wetlands (South)



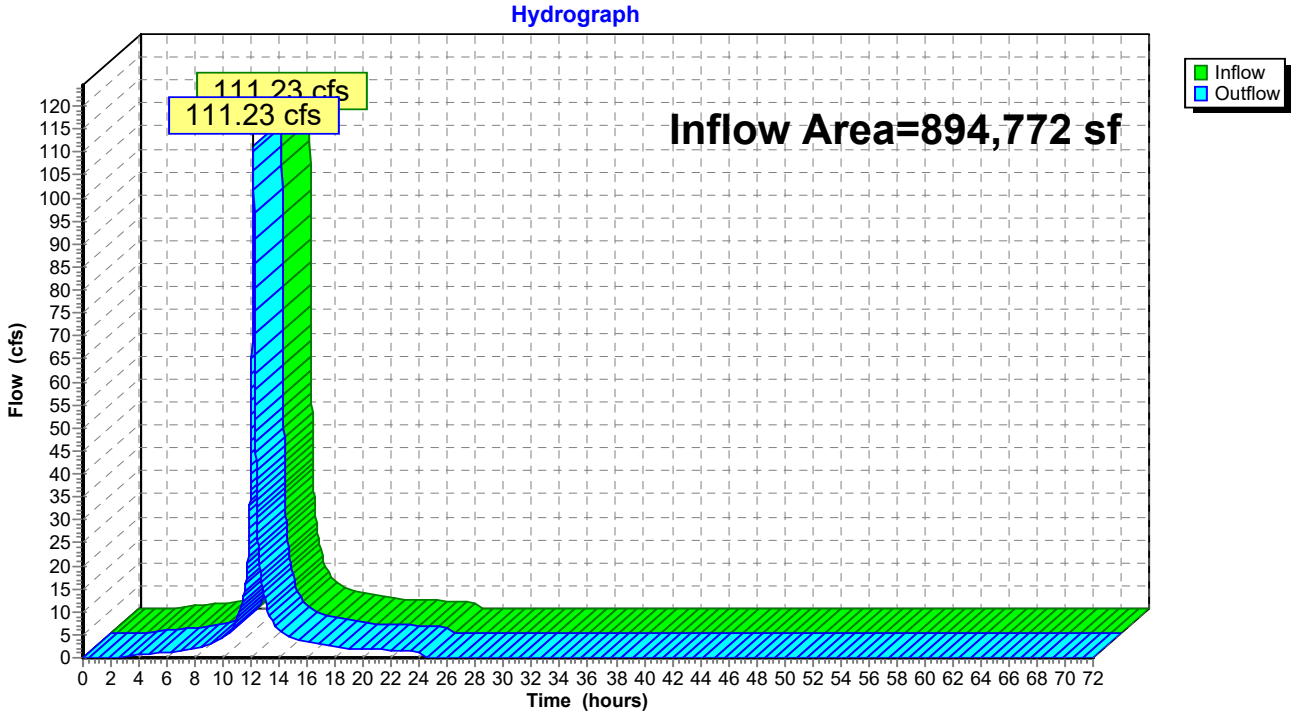
Summary for Reach DP2: Towards Existing Constructed Wetlands (North)

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

Inflow Area = 894,772 sf, 68.64% Impervious, Inflow Depth = 5.28" for 25-Year event
Inflow = 111.23 cfs @ 12.15 hrs, Volume= 393,466 cf
Outflow = 111.23 cfs @ 12.15 hrs, Volume= 393,466 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP2: Towards Existing Constructed Wetlands (North)



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=680,289 sf 41.83% Impervious Runoff Depth=7.27"
Tc=6.0 min CN=87 Runoff=133.26 cfs 412,107 cf

Subcatchment 2S: Building Roof (South Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=8.60"
Tc=6.0 min CN=98 Runoff=28.68 cfs 98,152 cf

Subcatchment 3S: Runoff Area=757,811 sf 62.97% Impervious Runoff Depth=7.75"
Flow Length=959' Tc=9.2 min CN=91 Runoff=136.70 cfs 489,719 cf

Subcatchment 4S: Building Roof (North Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=8.60"
Tc=6.0 min CN=98 Runoff=28.68 cfs 98,152 cf

Reach DP 1: Towards Existing Constructed Wetlands (South) Inflow=161.93 cfs 510,259 cf
Outflow=161.93 cfs 510,259 cf

Reach DP2: Towards Existing Constructed Wetlands (North) Inflow=162.61 cfs 587,872 cf
Outflow=162.61 cfs 587,872 cf

Total Runoff Area = 1,712,022 sf Runoff Volume = 1,098,131 cf Average Runoff Depth = 7.70"
39.50% Pervious = 676,313 sf 60.50% Impervious = 1,035,709 sf

Summary for Subcatchment 1S:

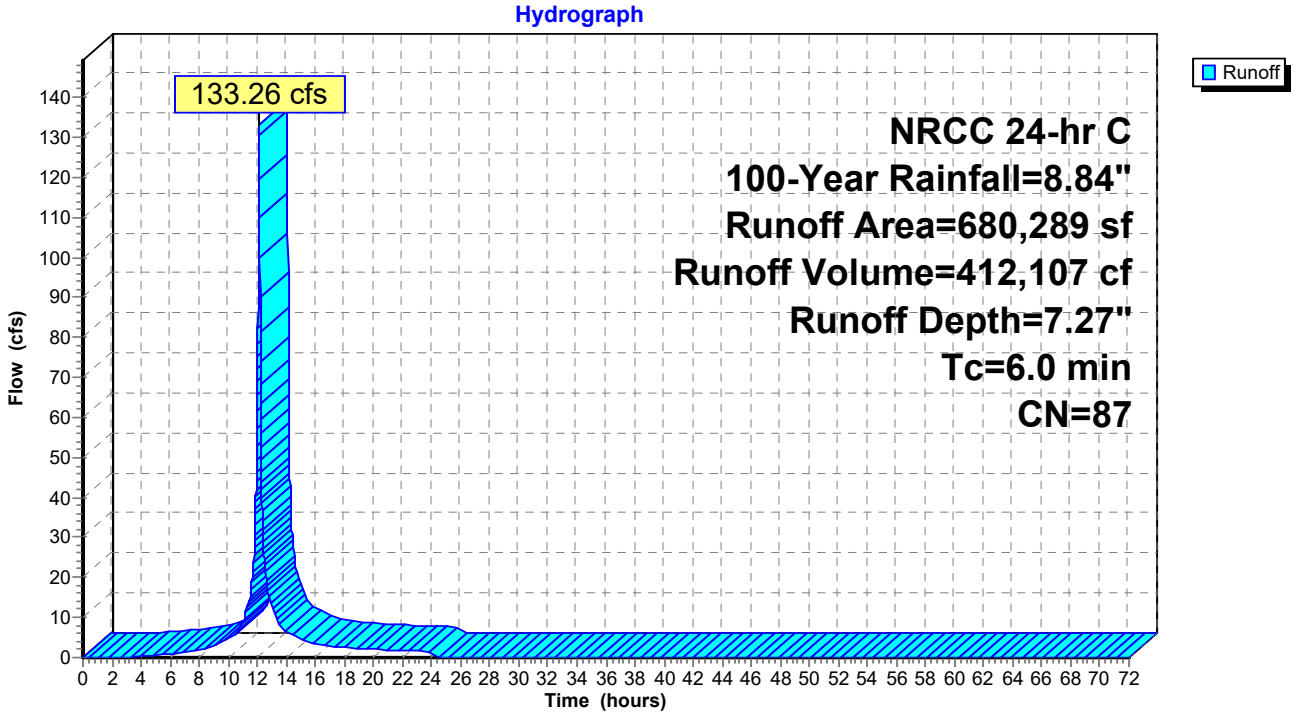
Runoff = 133.26 cfs @ 12.13 hrs, Volume= 412,107 cf, Depth= 7.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.84"

Area (sf)	CN	Description
46,570	77	Woods, Good, HSG D
728	98	Roofs, HSG D
349,150	80	>75% Grass cover, Good, HSG D
283,841	98	Paved parking, HSG D
680,289	87	Weighted Average
395,720		58.17% Pervious Area
284,569		41.83% Impervious Area

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

Subcatchment 1S:



Summary for Subcatchment 2S: Building Roof (South Half)

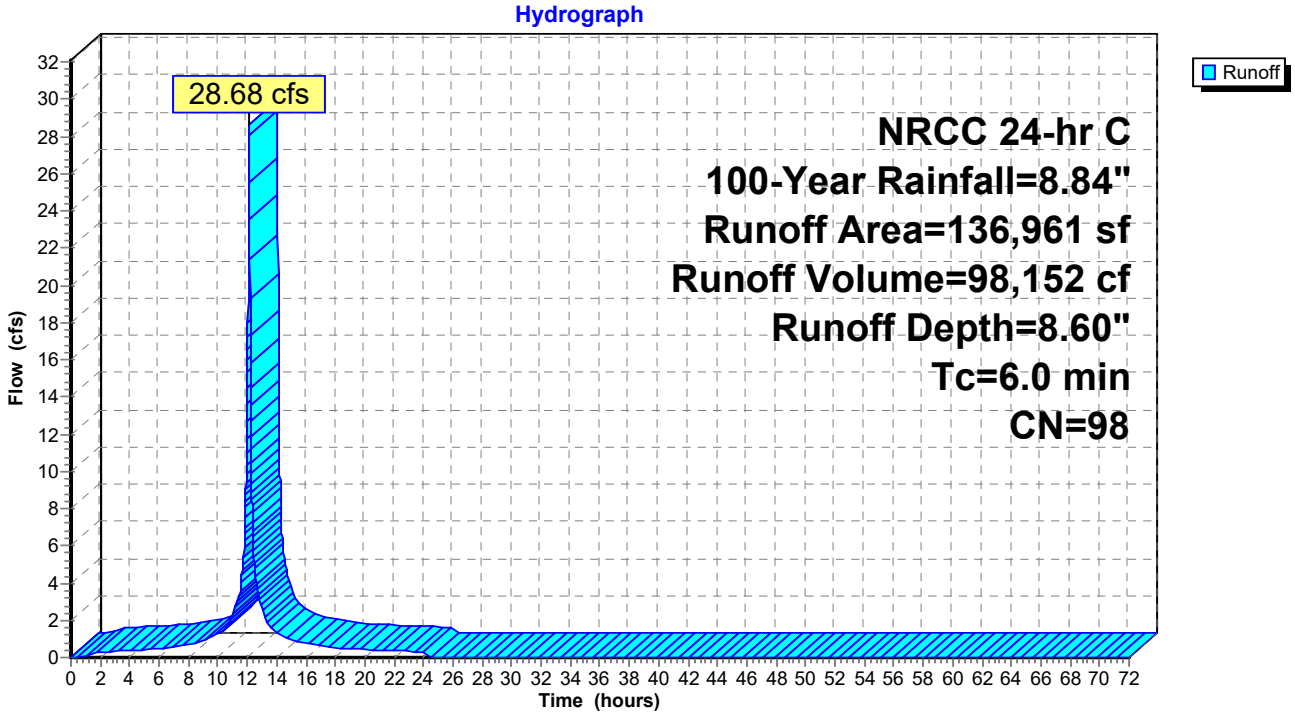
Runoff = 28.68 cfs @ 12.13 hrs, Volume= 98,152 cf, Depth= 8.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.84"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 2S: Building Roof (South Half)



Summary for Subcatchment 3S:

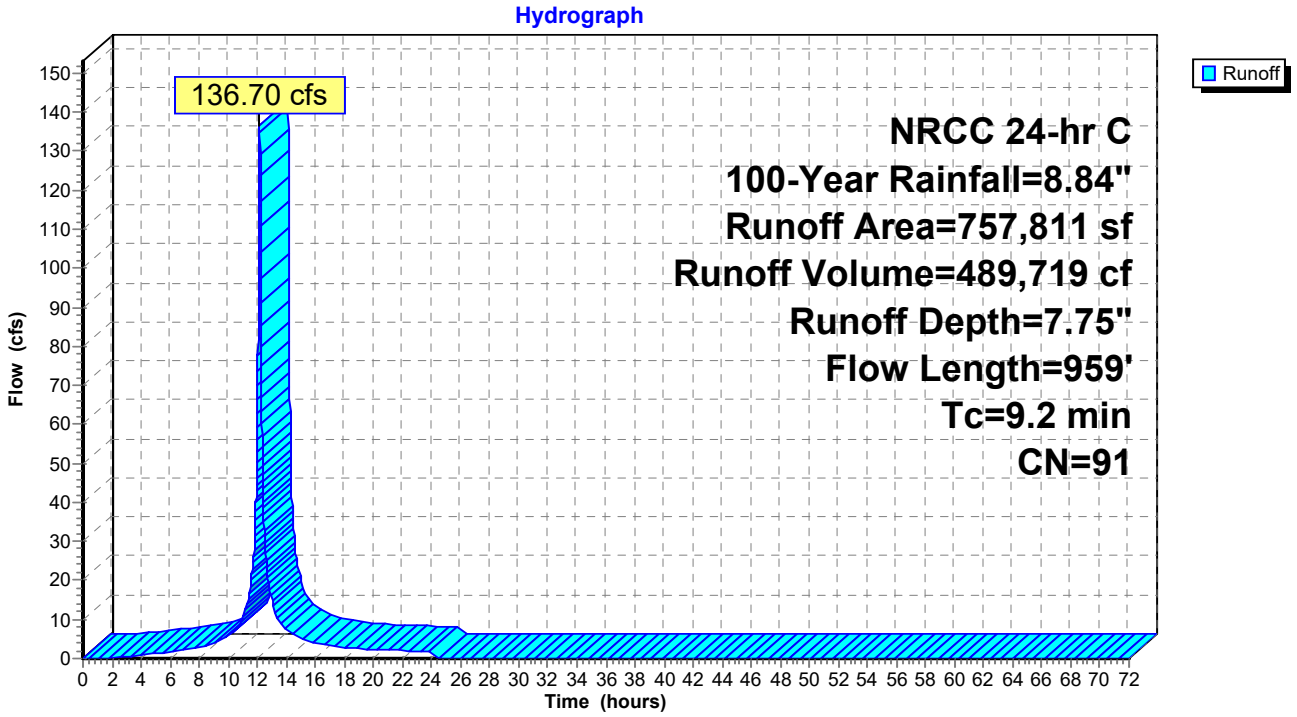
Runoff = 136.70 cfs @ 12.16 hrs, Volume= 489,719 cf, Depth= 7.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.84"

Area (sf)	CN	Description
22,500	77	Woods, Good, HSG D
11,113	98	Roofs, HSG D
258,093	80	>75% Grass cover, Good, HSG D
466,105	98	Paved parking, HSG D
757,811	91	Weighted Average
280,593		37.03% Pervious Area
477,218		62.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
3.3	590	0.0200	3.01	42.93	**Trap/Vee/Rect Channel Flow,** Bot.W=5.00' D=1.50' Z= 3.0 '/' Top.W=14.00' n= 0.069 Riprap, 6-inch
0.5	319	0.0130	9.70	30.48	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.2	959	Total			

Subcatchment 3S:



Summary for Subcatchment 4S: Building Roof (North Half)

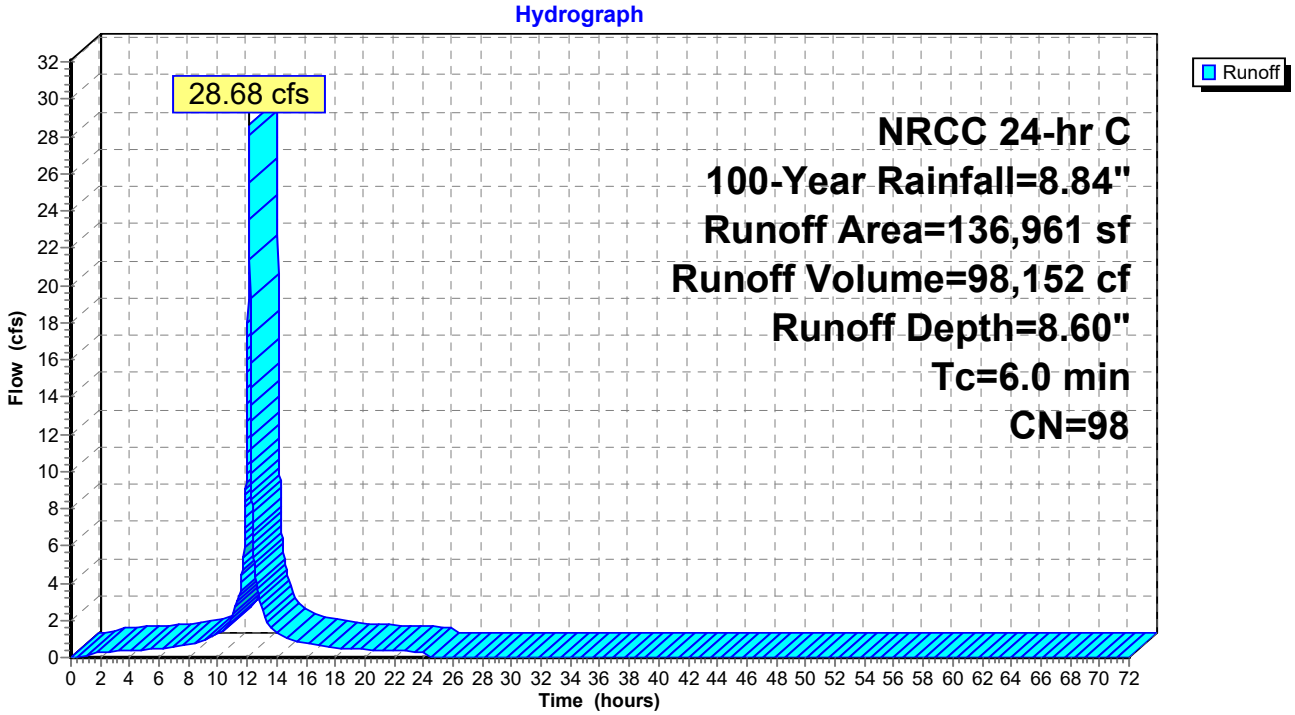
Runoff = 28.68 cfs @ 12.13 hrs, Volume= 98,152 cf, Depth= 8.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.84"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 4S: Building Roof (North Half)



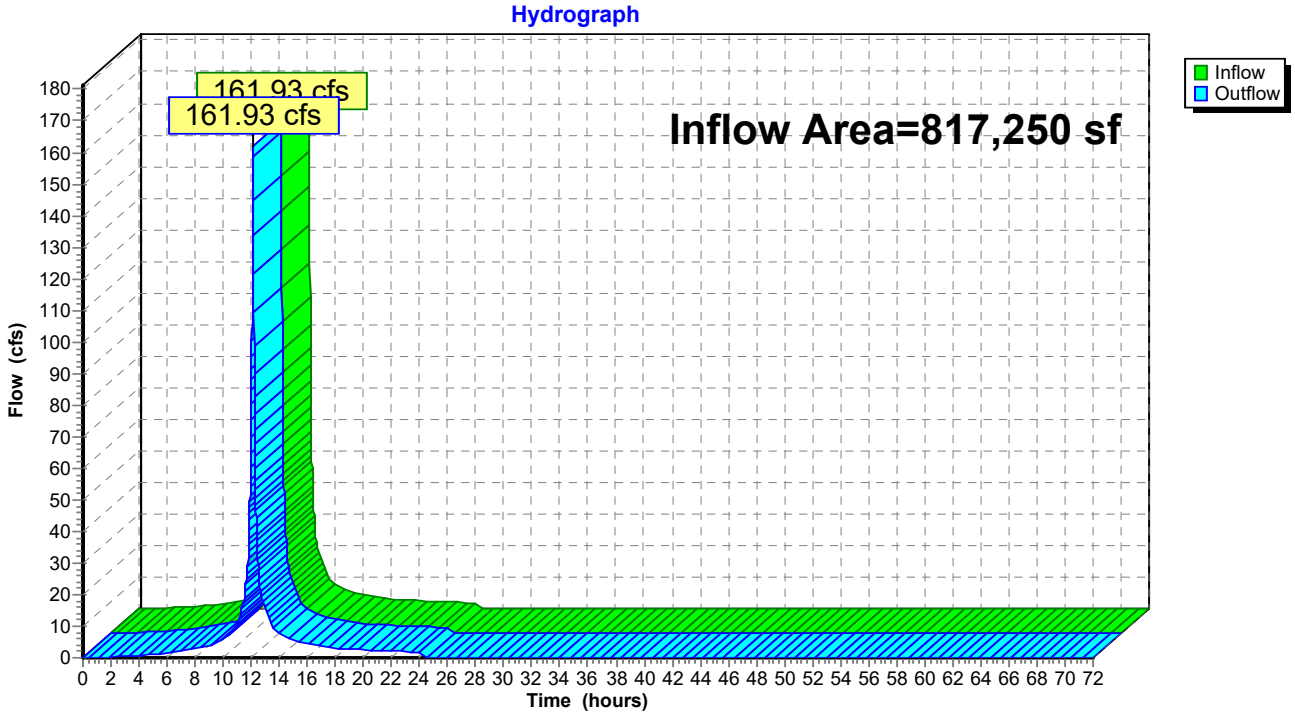
Summary for Reach DP 1: Towards Existing Constructed Wetlands (South)

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

Inflow Area = 817,250 sf, 51.58% Impervious, Inflow Depth = 7.49" for 100-Year event
Inflow = 161.93 cfs @ 12.13 hrs, Volume= 510,259 cf
Outflow = 161.93 cfs @ 12.13 hrs, Volume= 510,259 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Existing Constructed Wetlands (South)



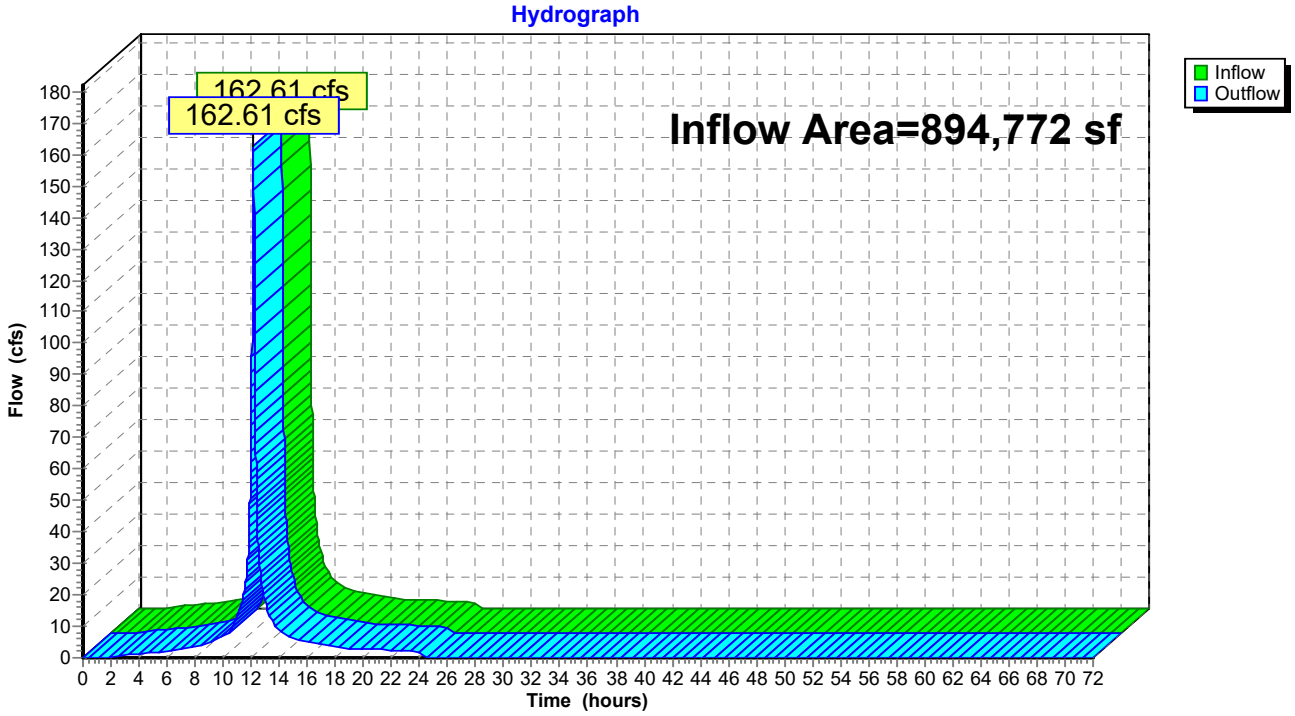
Summary for Reach DP2: Towards Existing Constructed Wetlands (North)

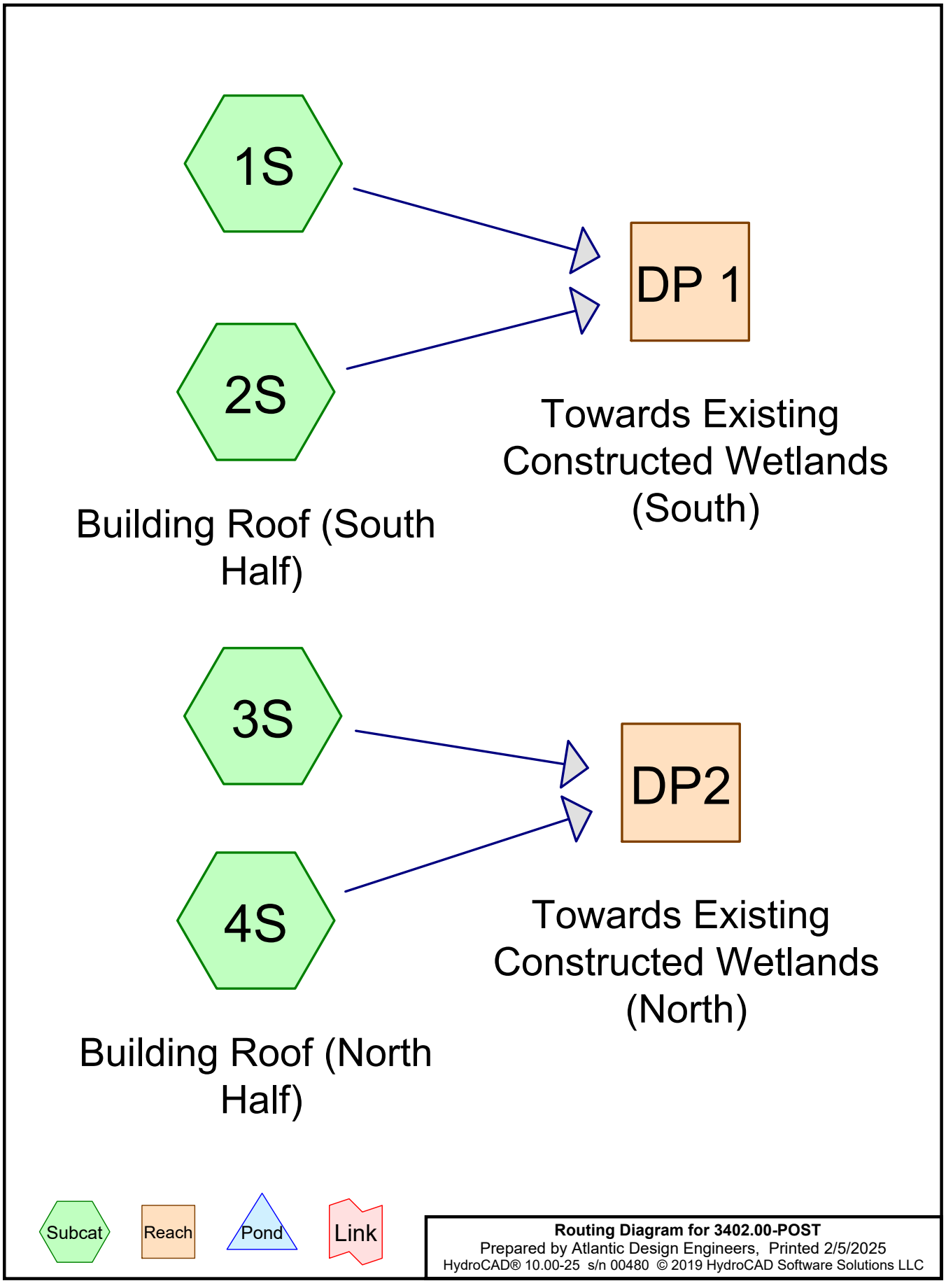
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 894,772 sf, 68.64% Impervious, Inflow Depth = 7.88" for 100-Year event
Inflow = 162.61 cfs @ 12.15 hrs, Volume= 587,872 cf
Outflow = 162.61 cfs @ 12.15 hrs, Volume= 587,872 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP2: Towards Existing Constructed Wetlands (North)





Routing Diagram for 3402.00-POST
Prepared by Atlantic Design Engineers, Printed 2/5/2025

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
606,544	80	>75% Grass cover, Good, HSG D (1S, 3S)
749,946	98	Paved parking, HSG D (1S, 3S)
11,841	98	Roofs, HSG D (1S, 3S)
699	98	Unconnected pavement, HSG D (1S, 3S)
273,922	98	Unconnected roofs, HSG D (2S, 4S)
69,070	77	Woods, Good, HSG D (1S, 3S)
1,712,022	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
1,712,022	HSG D	1S, 2S, 3S, 4S
0	Other	
1,712,022		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	0	0	606,544	0	606,544	>75% Grass cover, Good	
0	0	0	749,946	0	749,946	Paved parking	
0	0	0	11,841	0	11,841	Roofs	
0	0	0	699	0	699	Unconnected pavement	
0	0	0	273,922	0	273,922	Unconnected roofs	
0	0	0	69,070	0	69,070	Woods, Good	
0	**0**	**0**	**1,712,022**	**0**	**1,712,022**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=680,289 sf 41.93% Impervious Runoff Depth=1.98"
Tc=6.0 min CN=87 Runoff=38.84 cfs 112,073 cf

Subcatchment 2S: Building Roof (South Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=3.04"
Tc=6.0 min CN=98 Runoff=10.50 cfs 34,665 cf

Subcatchment 3S: Runoff Area=757,811 sf 62.97% Impervious Runoff Depth=2.32"
Flow Length=959' Tc=9.2 min CN=91 Runoff=43.96 cfs 146,765 cf

Subcatchment 4S: Building Roof (North Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=3.04"
Tc=6.0 min CN=98 Runoff=10.50 cfs 34,665 cf

Reach DP 1: Towards Existing Constructed Wetlands (South) Inflow=49.34 cfs 146,738 cf
Outflow=49.34 cfs 146,738 cf

Reach DP2: Towards Existing Constructed Wetlands (North) Inflow=53.38 cfs 181,430 cf
Outflow=53.38 cfs 181,430 cf

Total Runoff Area = 1,712,022 sf Runoff Volume = 328,168 cf Average Runoff Depth = 2.30"
39.46% Pervious = 675,614 sf 60.54% Impervious = 1,036,408 sf

Summary for Subcatchment 1S:

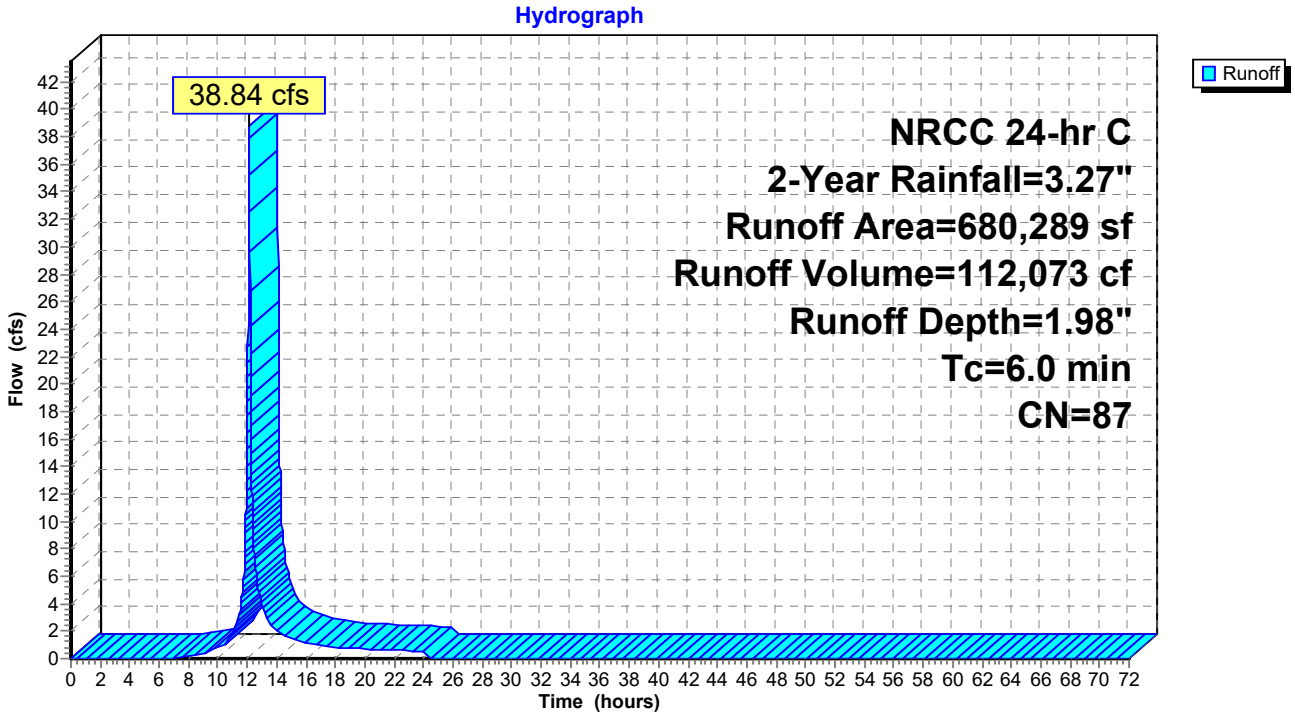
Runoff = 38.84 cfs @ 12.13 hrs, Volume= 112,073 cf, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.27"

Area (sf)	CN	Description
46,570	77	Woods, Good, HSG D
728	98	Roofs, HSG D
348,453	80	>75% Grass cover, Good, HSG D
283,841	98	Paved parking, HSG D
697	98	Unconnected pavement, HSG D
680,289	87	Weighted Average
395,023		58.07% Pervious Area
285,266		41.93% Impervious Area
697		0.24% Unconnected

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

Subcatchment 1S:



Summary for Subcatchment 2S: Building Roof (South Half)

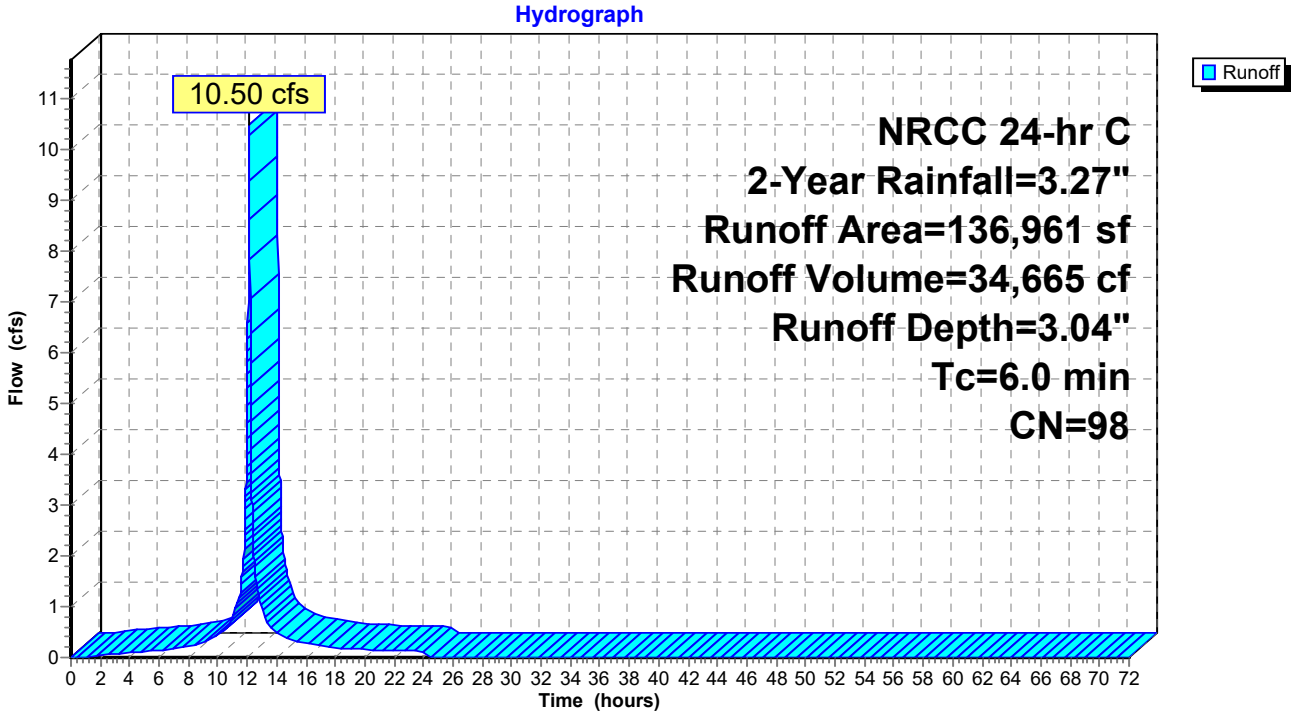
Runoff = 10.50 cfs @ 12.13 hrs, Volume= 34,665 cf, Depth= 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.27"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 2S: Building Roof (South Half)



Summary for Subcatchment 3S:

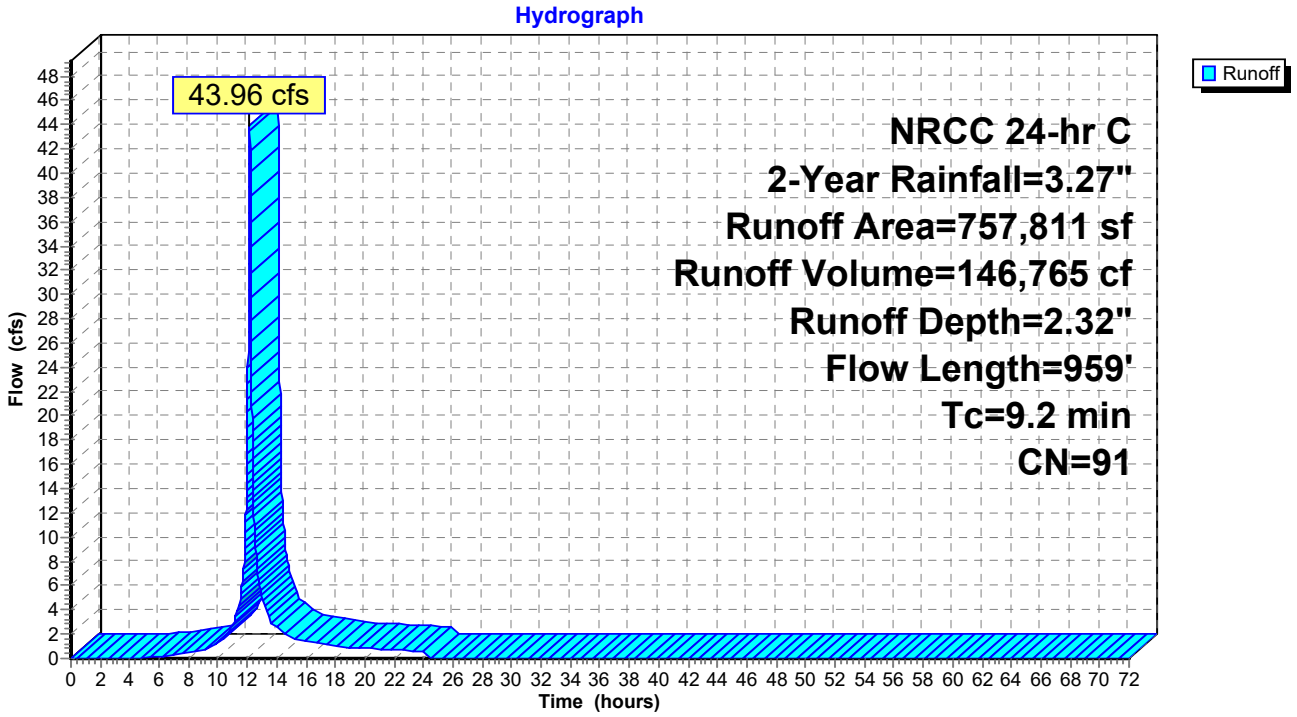
Runoff = 43.96 cfs @ 12.16 hrs, Volume= 146,765 cf, Depth= 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.27"

Area (sf)	CN	Description
22,500	77	Woods, Good, HSG D
11,113	98	Roofs, HSG D
258,091	80	>75% Grass cover, Good, HSG D
466,105	98	Paved parking, HSG D
2	98	Unconnected pavement, HSG D
757,811	91	Weighted Average
280,591		37.03% Pervious Area
477,220		62.97% Impervious Area
2		0.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
3.3	590	0.0200	3.01	42.93	**Trap/Vee/Rect Channel Flow,** Bot.W=5.00' D=1.50' Z= 3.0 '/' Top.W=14.00' n= 0.069 Riprap, 6-inch
0.5	319	0.0130	9.70	30.48	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.2	959	Total			

Subcatchment 3S:



Summary for Subcatchment 4S: Building Roof (North Half)

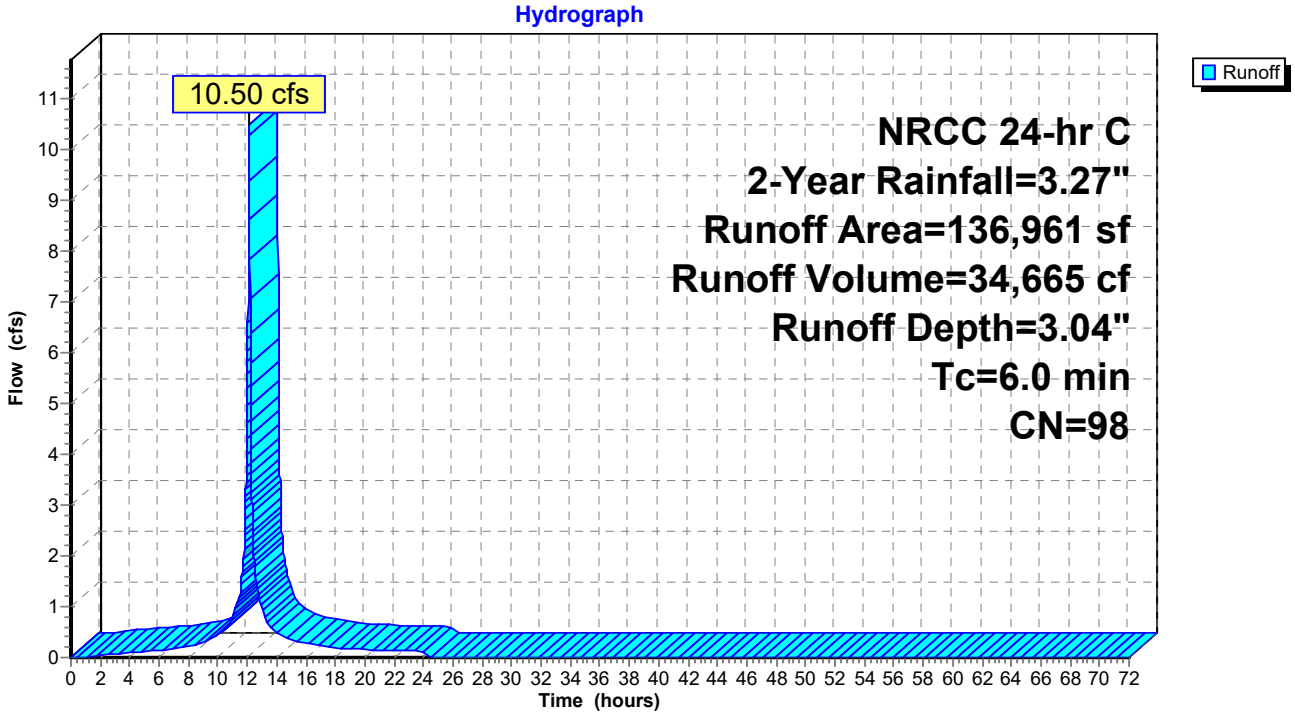
Runoff = 10.50 cfs @ 12.13 hrs, Volume= 34,665 cf, Depth= 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.27"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 4S: Building Roof (North Half)



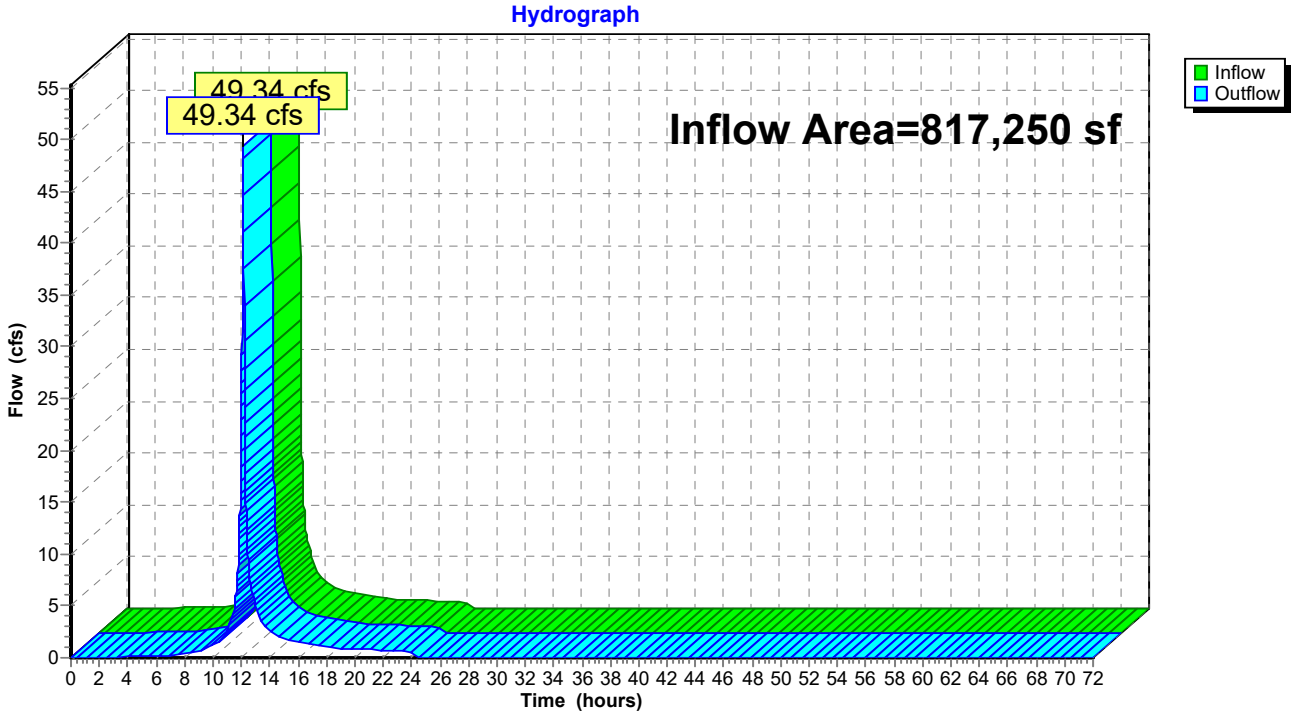
Summary for Reach DP 1: Towards Existing Constructed Wetlands (South)

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

Inflow Area = 817,250 sf, 51.66% Impervious, Inflow Depth = 2.15" for 2-Year event
Inflow = 49.34 cfs @ 12.13 hrs, Volume= 146,738 cf
Outflow = 49.34 cfs @ 12.13 hrs, Volume= 146,738 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Existing Constructed Wetlands (South)



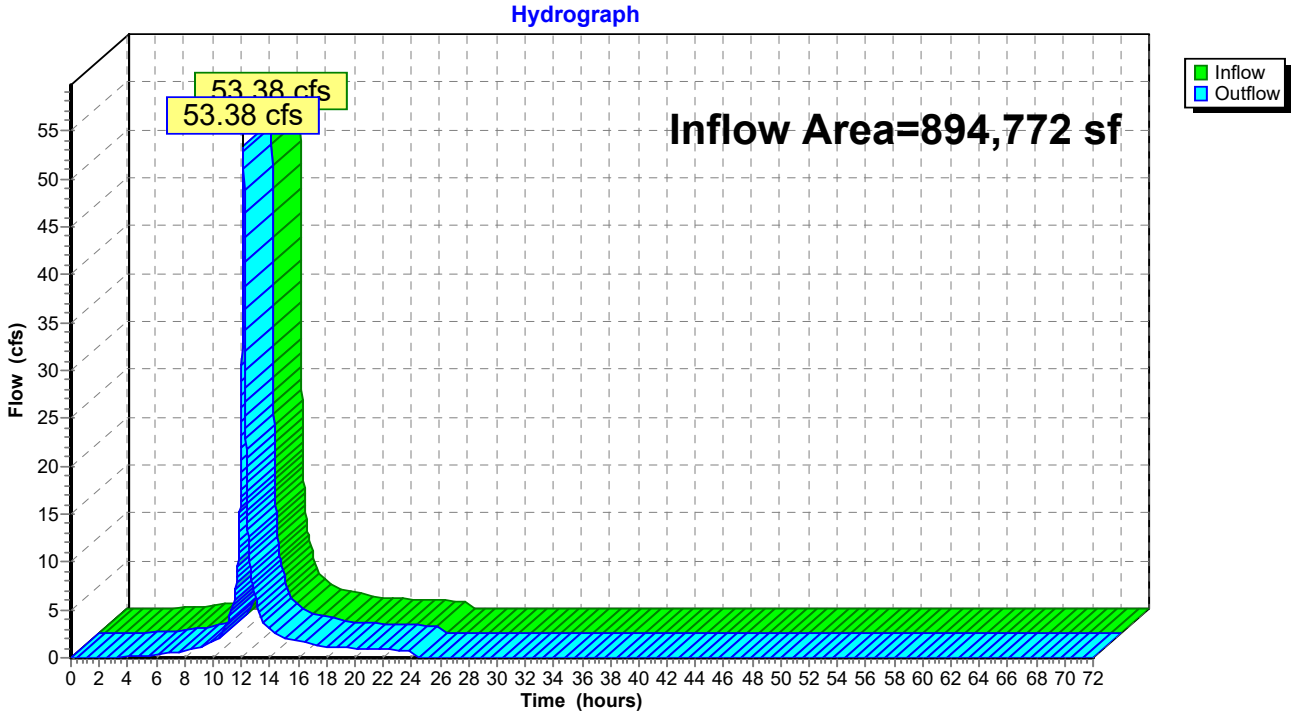
Summary for Reach DP2: Towards Existing Constructed Wetlands (North)

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

Inflow Area = 894,772 sf, 68.64% Impervious, Inflow Depth = 2.43" for 2-Year event
Inflow = 53.38 cfs @ 12.15 hrs, Volume= 181,430 cf
Outflow = 53.38 cfs @ 12.15 hrs, Volume= 181,430 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP2: Towards Existing Constructed Wetlands (North)



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=680,289 sf 41.93% Impervious Runoff Depth=3.49"
Tc=6.0 min CN=87 Runoff=66.92 cfs 197,964 cf

Subcatchment 2S: Building Roof (South Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=4.68"
Tc=6.0 min CN=98 Runoff=15.90 cfs 53,452 cf

Subcatchment 3S: Runoff Area=757,811 sf 62.97% Impervious Runoff Depth=3.90"
Flow Length=959' Tc=9.2 min CN=91 Runoff=71.77 cfs 246,570 cf

Subcatchment 4S: Building Roof (North Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=4.68"
Tc=6.0 min CN=98 Runoff=15.90 cfs 53,452 cf

Reach DP 1: Towards Existing Constructed Wetlands (South) Inflow=82.82 cfs 251,417 cf
Outflow=82.82 cfs 251,417 cf

Reach DP2: Towards Existing Constructed Wetlands (North) Inflow=86.09 cfs 300,022 cf
Outflow=86.09 cfs 300,022 cf

Total Runoff Area = 1,712,022 sf Runoff Volume = 551,439 cf Average Runoff Depth = 3.87"
39.46% Pervious = 675,614 sf 60.54% Impervious = 1,036,408 sf

Summary for Subcatchment 1S:

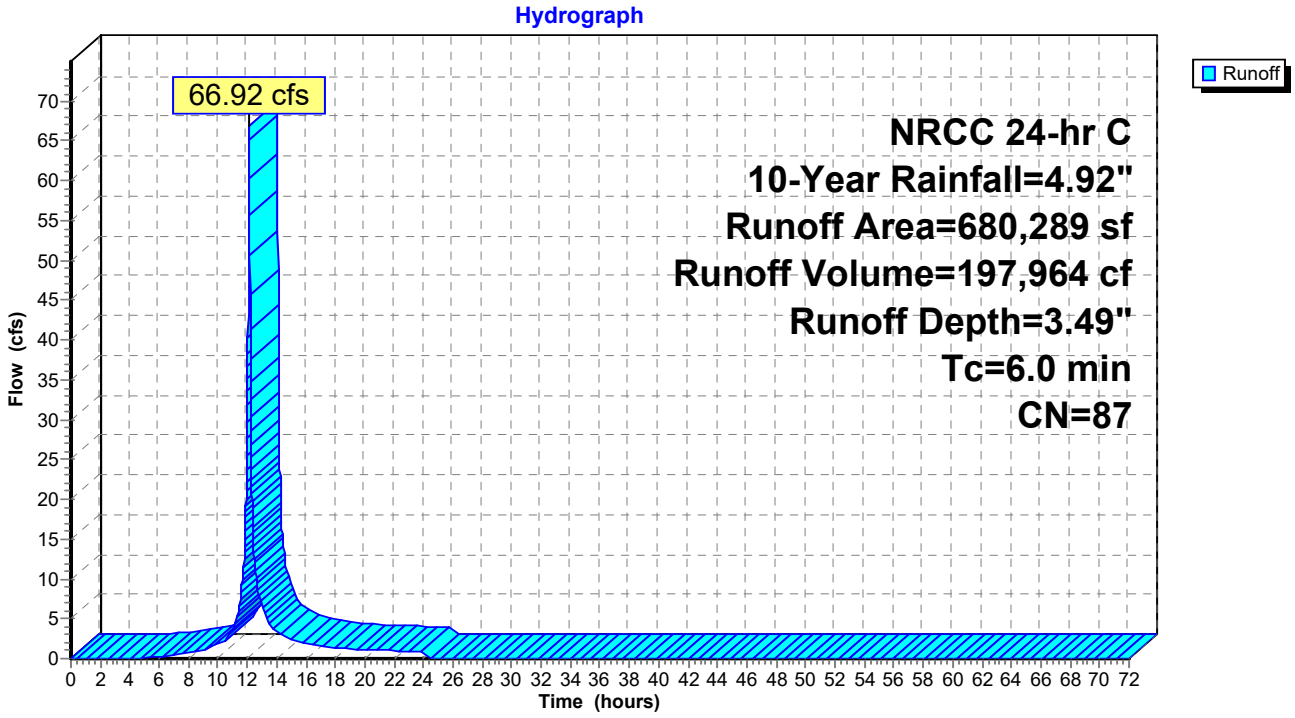
Runoff = 66.92 cfs @ 12.13 hrs, Volume= 197,964 cf, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.92"

Area (sf)	CN	Description
46,570	77	Woods, Good, HSG D
728	98	Roofs, HSG D
348,453	80	>75% Grass cover, Good, HSG D
283,841	98	Paved parking, HSG D
697	98	Unconnected pavement, HSG D
680,289	87	Weighted Average
395,023		58.07% Pervious Area
285,266		41.93% Impervious Area
697		0.24% Unconnected

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

Subcatchment 1S:



Summary for Subcatchment 2S: Building Roof (South Half)

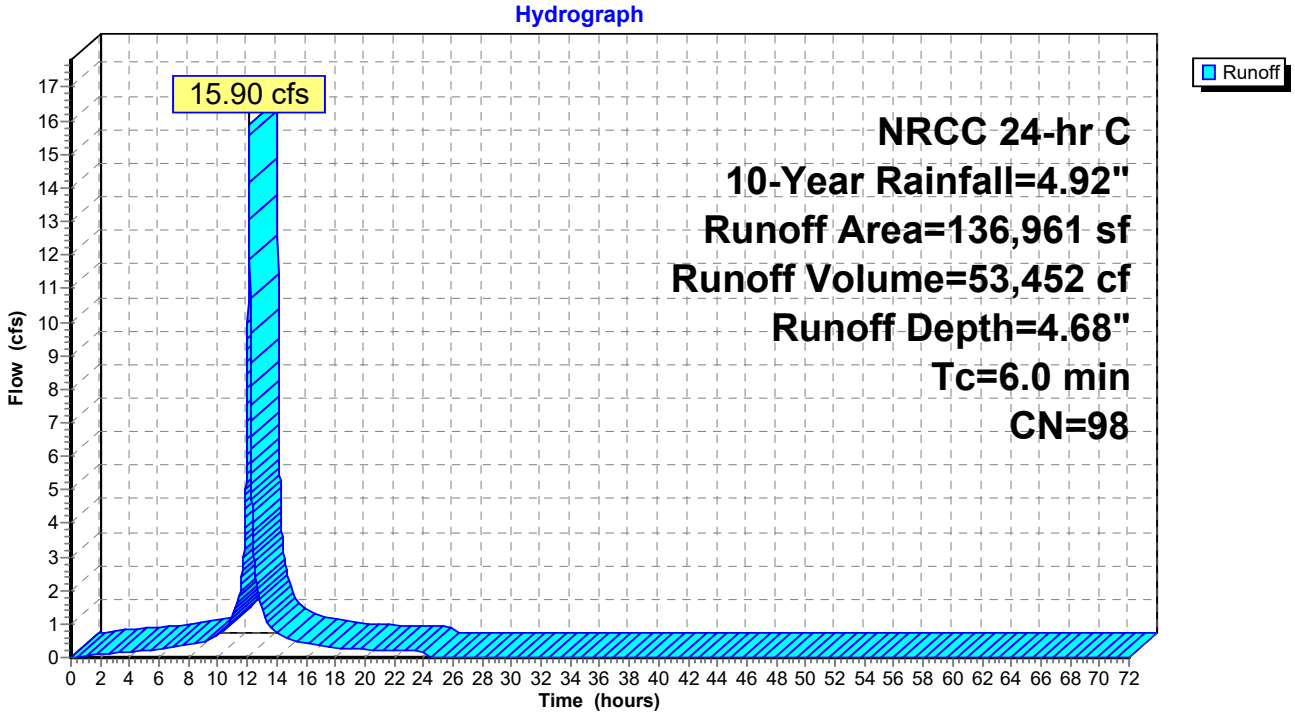
Runoff = 15.90 cfs @ 12.13 hrs, Volume= 53,452 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.92"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 2S: Building Roof (South Half)



Summary for Subcatchment 3S:

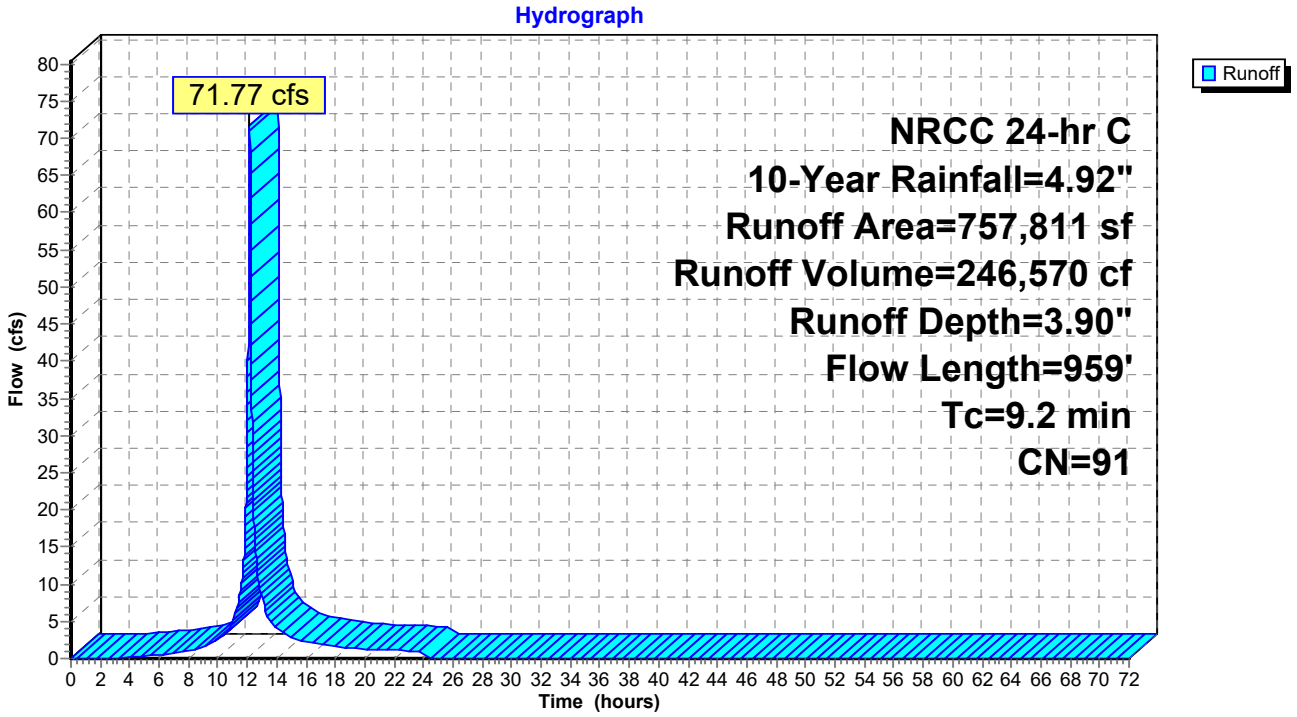
Runoff = 71.77 cfs @ 12.16 hrs, Volume= 246,570 cf, Depth= 3.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.92"

Area (sf)	CN	Description
22,500	77	Woods, Good, HSG D
11,113	98	Roofs, HSG D
258,091	80	>75% Grass cover, Good, HSG D
466,105	98	Paved parking, HSG D
2	98	Unconnected pavement, HSG D
757,811	91	Weighted Average
280,591		37.03% Pervious Area
477,220		62.97% Impervious Area
2		0.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
3.3	590	0.0200	3.01	42.93	**Trap/Vee/Rect Channel Flow,** Bot.W=5.00' D=1.50' Z= 3.0 '/' Top.W=14.00' n= 0.069 Riprap, 6-inch
0.5	319	0.0130	9.70	30.48	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.2	959	Total			

Subcatchment 3S:



Summary for Subcatchment 4S: Building Roof (North Half)

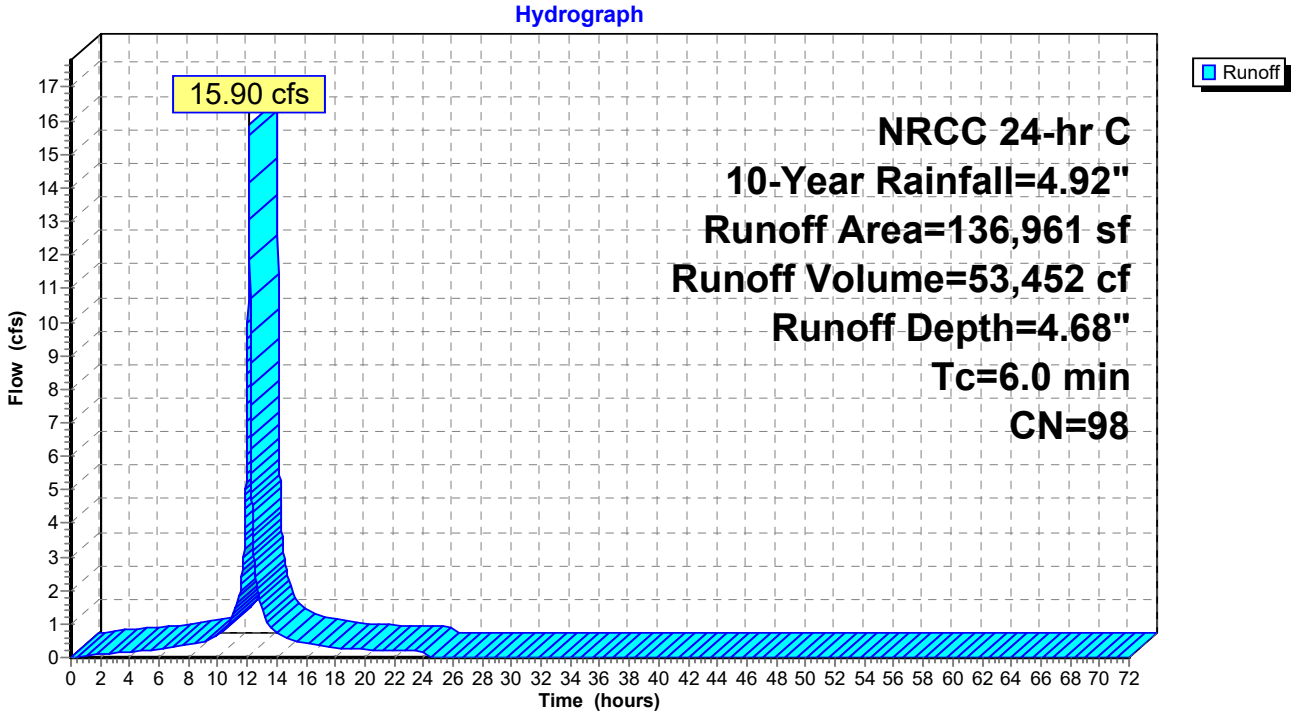
Runoff = 15.90 cfs @ 12.13 hrs, Volume= 53,452 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.92"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 4S: Building Roof (North Half)



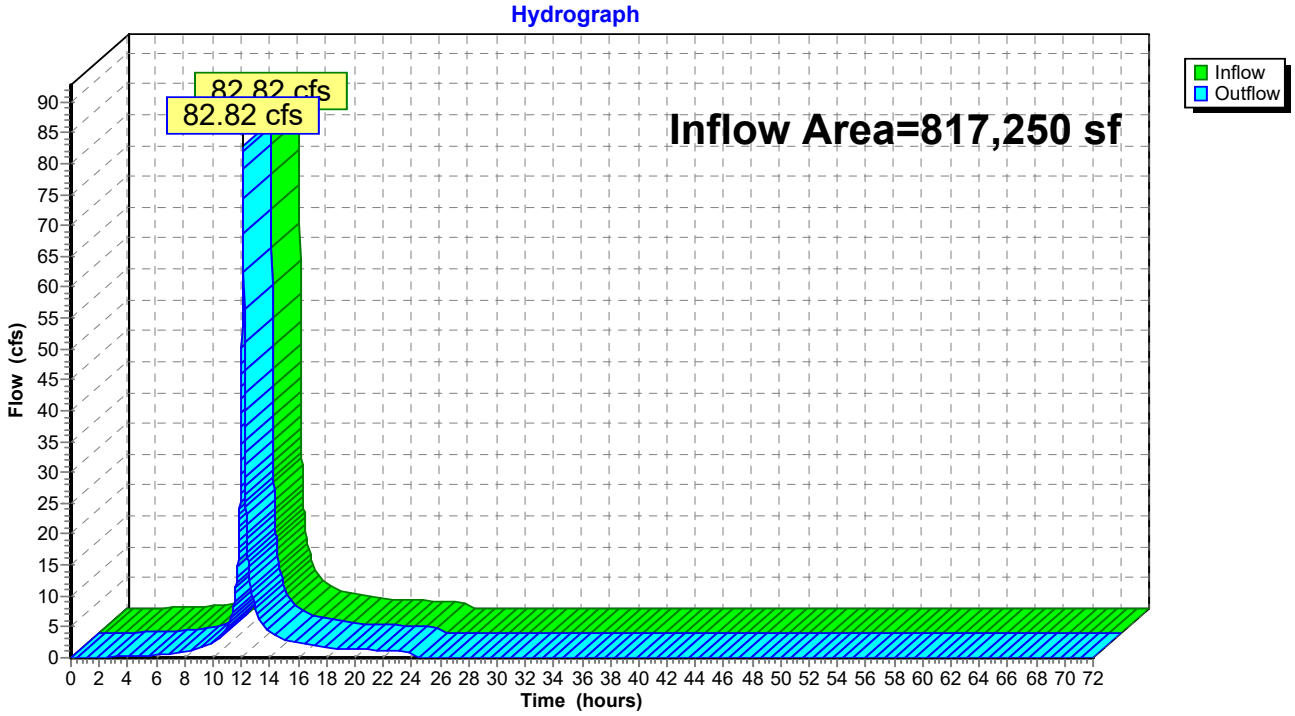
Summary for Reach DP 1: Towards Existing Constructed Wetlands (South)

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

Inflow Area = 817,250 sf, 51.66% Impervious, Inflow Depth = 3.69" for 10-Year event
Inflow = 82.82 cfs @ 12.13 hrs, Volume= 251,417 cf
Outflow = 82.82 cfs @ 12.13 hrs, Volume= 251,417 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Existing Constructed Wetlands (South)



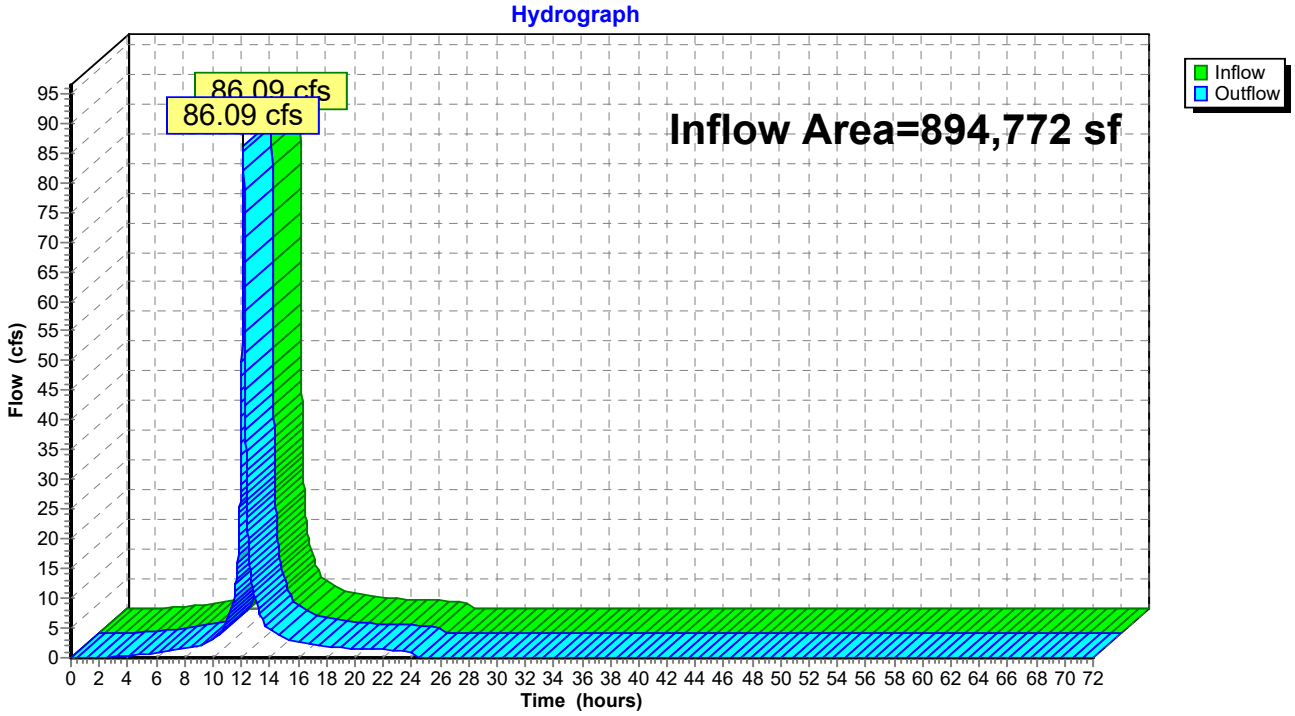
Summary for Reach DP2: Towards Existing Constructed Wetlands (North)

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

Inflow Area = 894,772 sf, 68.64% Impervious, Inflow Depth = 4.02" for 10-Year event
Inflow = 86.09 cfs @ 12.15 hrs, Volume= 300,022 cf
Outflow = 86.09 cfs @ 12.15 hrs, Volume= 300,022 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP2: Towards Existing Constructed Wetlands (North)



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=680,289 sf 41.93% Impervious Runoff Depth=4.71"
Tc=6.0 min CN=87 Runoff=88.71 cfs 266,946 cf

Subcatchment 2S: Building Roof (South Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=5.96"
Tc=6.0 min CN=98 Runoff=20.08 cfs 68,043 cf

Subcatchment 3S: Runoff Area=757,811 sf 62.97% Impervious Runoff Depth=5.15"
Flow Length=959' Tc=9.2 min CN=91 Runoff=93.13 cfs 325,423 cf

Subcatchment 4S: Building Roof (North Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=5.96"
Tc=6.0 min CN=98 Runoff=20.08 cfs 68,043 cf

Reach DP 1: Towards Existing Constructed Wetlands (South) Inflow=108.79 cfs 334,989 cf
Outflow=108.79 cfs 334,989 cf

Reach DP2: Towards Existing Constructed Wetlands (North) Inflow=111.23 cfs 393,466 cf
Outflow=111.23 cfs 393,466 cf

Total Runoff Area = 1,712,022 sf Runoff Volume = 728,454 cf Average Runoff Depth = 5.11"
39.46% Pervious = 675,614 sf 60.54% Impervious = 1,036,408 sf

Summary for Subcatchment 1S:

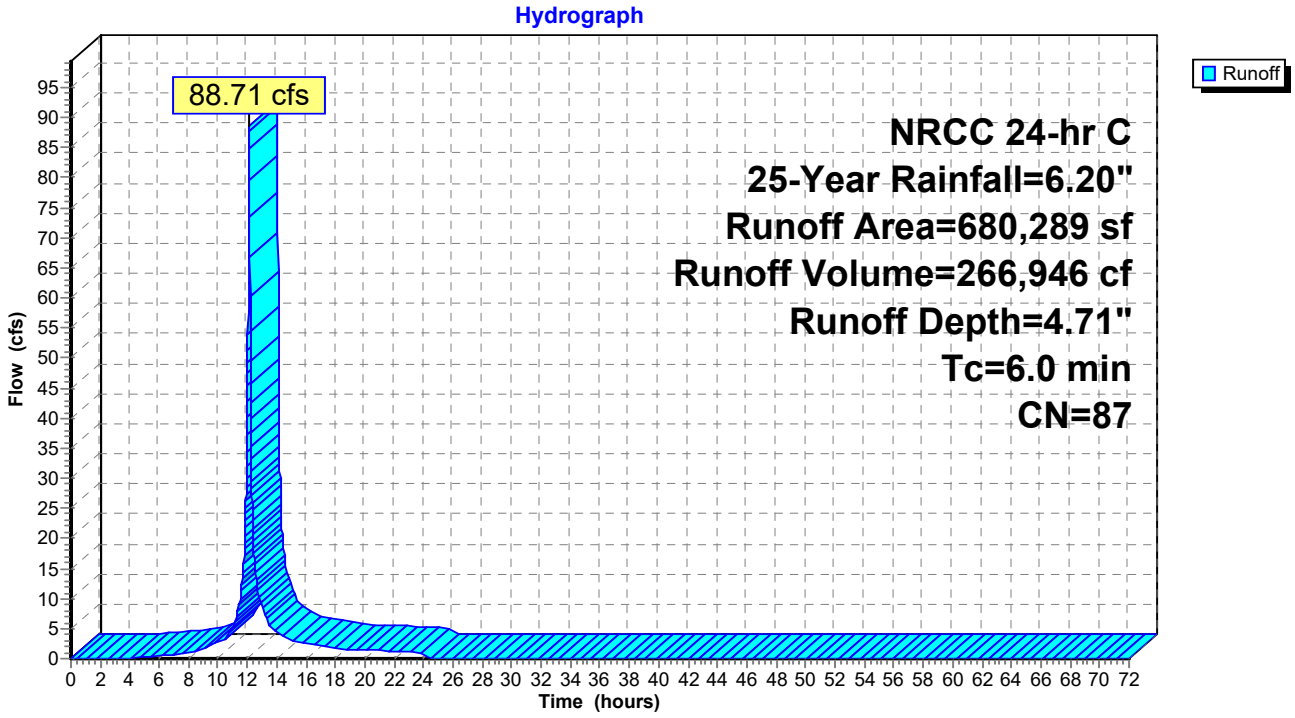
Runoff = 88.71 cfs @ 12.13 hrs, Volume= 266,946 cf, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.20"

Area (sf)	CN	Description
46,570	77	Woods, Good, HSG D
728	98	Roofs, HSG D
348,453	80	>75% Grass cover, Good, HSG D
283,841	98	Paved parking, HSG D
697	98	Unconnected pavement, HSG D
680,289	87	Weighted Average
395,023		58.07% Pervious Area
285,266		41.93% Impervious Area
697		0.24% Unconnected

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

Subcatchment 1S:



Summary for Subcatchment 2S: Building Roof (South Half)

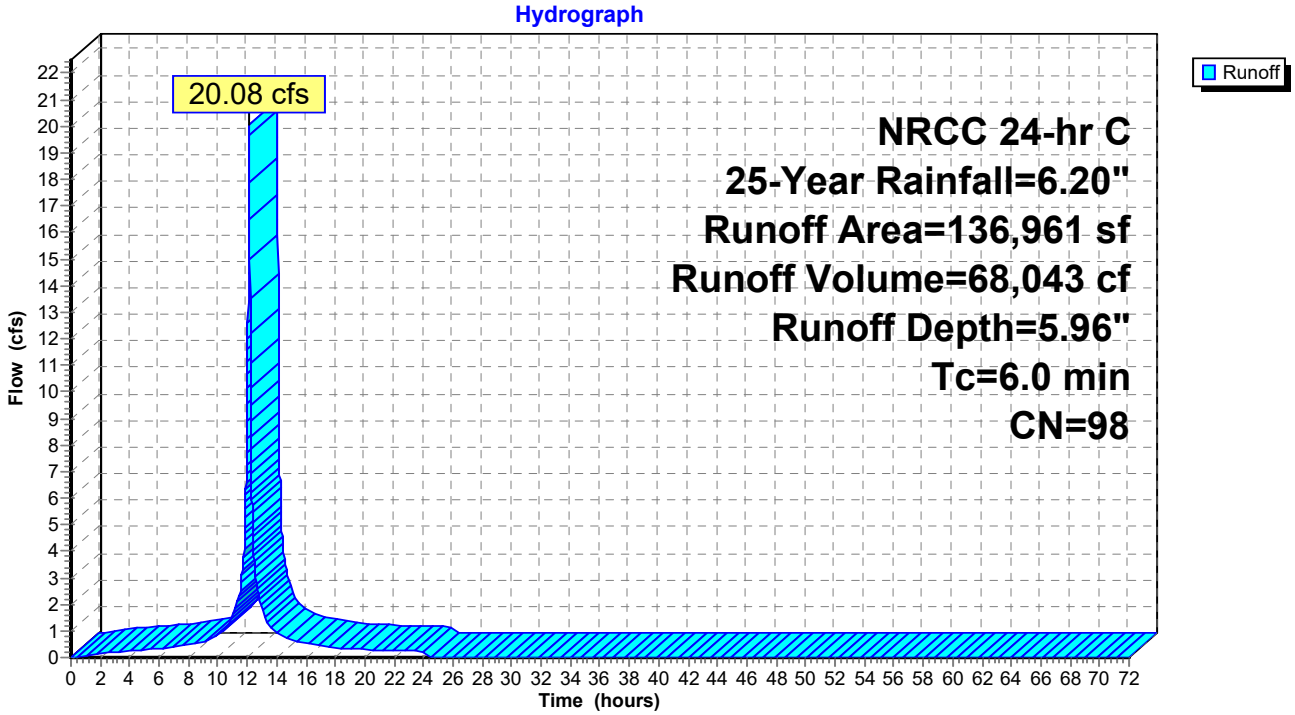
Runoff = 20.08 cfs @ 12.13 hrs, Volume= 68,043 cf, Depth= 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.20"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 2S: Building Roof (South Half)



Summary for Subcatchment 3S:

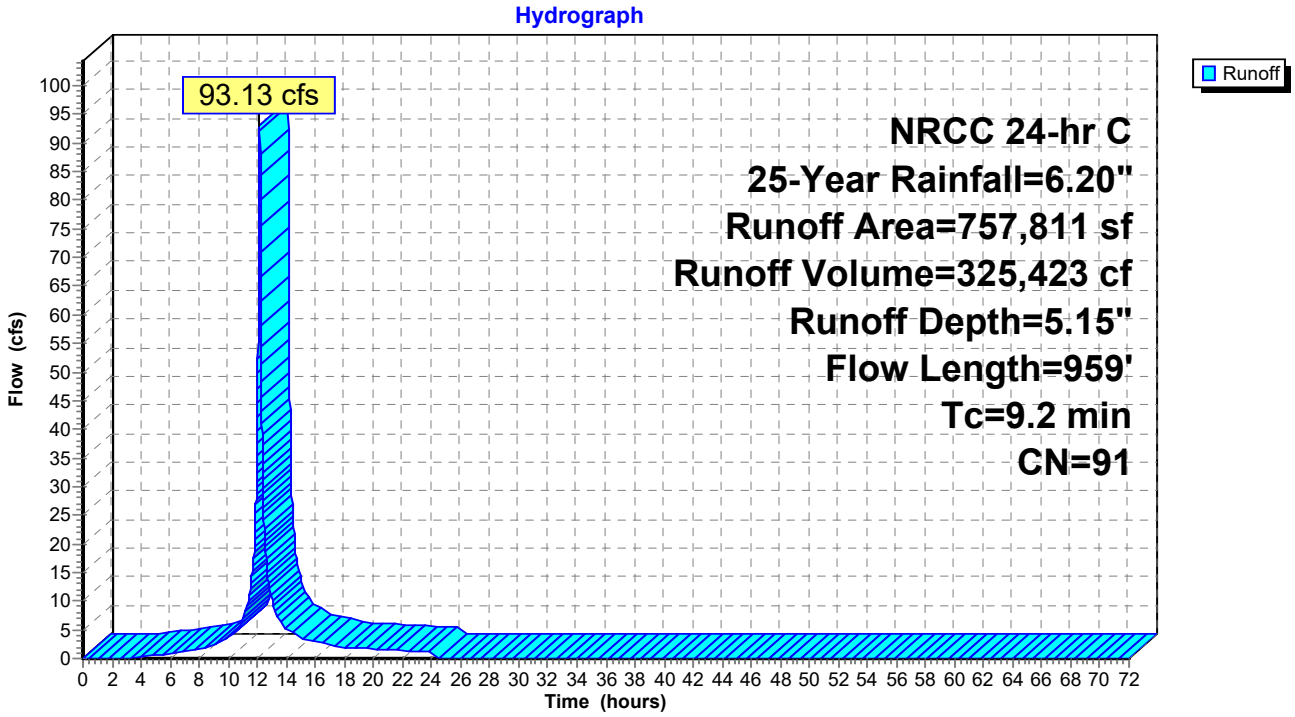
Runoff = 93.13 cfs @ 12.16 hrs, Volume= 325,423 cf, Depth= 5.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.20"

Area (sf)	CN	Description
22,500	77	Woods, Good, HSG D
11,113	98	Roofs, HSG D
258,091	80	>75% Grass cover, Good, HSG D
466,105	98	Paved parking, HSG D
2	98	Unconnected pavement, HSG D
757,811	91	Weighted Average
280,591		37.03% Pervious Area
477,220		62.97% Impervious Area
2		0.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
3.3	590	0.0200	3.01	42.93	**Trap/Vee/Rect Channel Flow,** Bot.W=5.00' D=1.50' Z= 3.0 '/' Top.W=14.00' n= 0.069 Riprap, 6-inch
0.5	319	0.0130	9.70	30.48	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.2	959	Total			

Subcatchment 3S:



Summary for Subcatchment 4S: Building Roof (North Half)

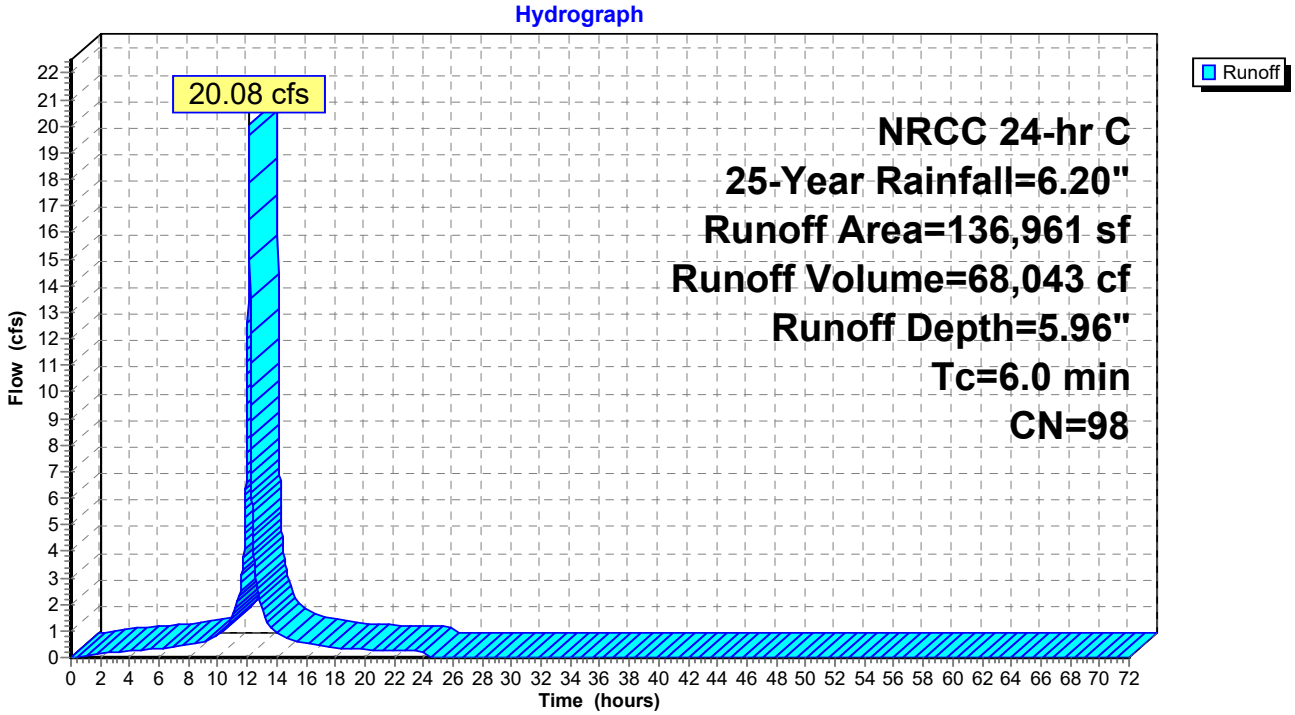
Runoff = 20.08 cfs @ 12.13 hrs, Volume= 68,043 cf, Depth= 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.20"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 4S: Building Roof (North Half)



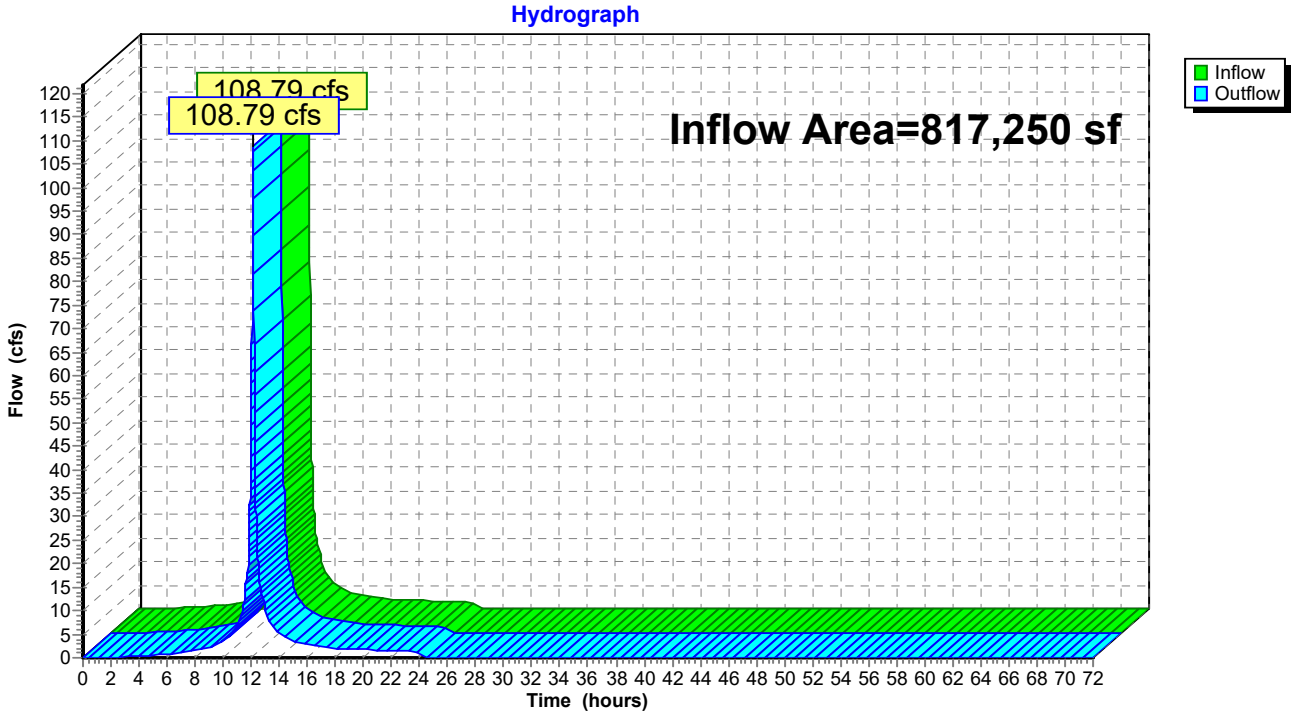
Summary for Reach DP 1: Towards Existing Constructed Wetlands (South)

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

Inflow Area = 817,250 sf, 51.66% Impervious, Inflow Depth = 4.92" for 25-Year event
Inflow = 108.79 cfs @ 12.13 hrs, Volume= 334,989 cf
Outflow = 108.79 cfs @ 12.13 hrs, Volume= 334,989 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Existing Constructed Wetlands (South)



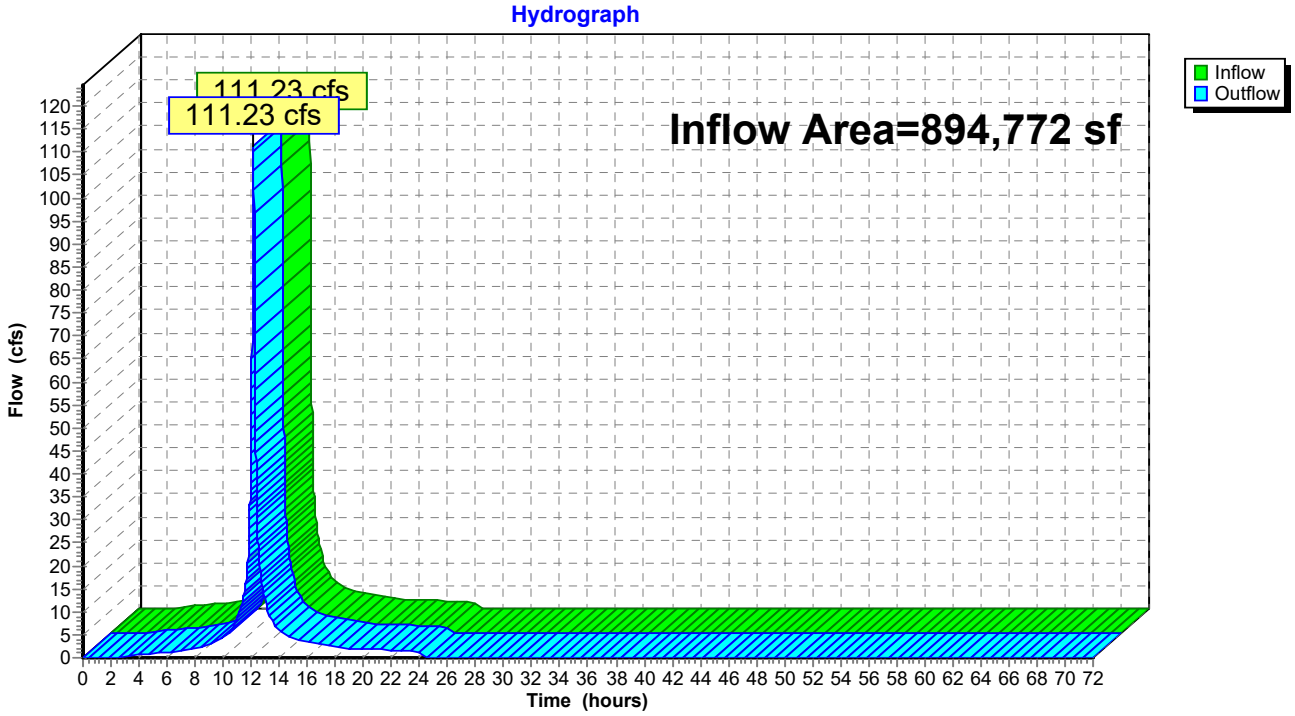
Summary for Reach DP2: Towards Existing Constructed Wetlands (North)

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

Inflow Area = 894,772 sf, 68.64% Impervious, Inflow Depth = 5.28" for 25-Year event
Inflow = 111.23 cfs @ 12.15 hrs, Volume= 393,466 cf
Outflow = 111.23 cfs @ 12.15 hrs, Volume= 393,466 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP2: Towards Existing Constructed Wetlands (North)



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=680,289 sf 41.93% Impervious Runoff Depth=7.27"
Tc=6.0 min CN=87 Runoff=133.26 cfs 412,107 cf

Subcatchment 2S: Building Roof (South Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=8.60"
Tc=6.0 min CN=98 Runoff=28.68 cfs 98,152 cf

Subcatchment 3S: Runoff Area=757,811 sf 62.97% Impervious Runoff Depth=7.75"
Flow Length=959' Tc=9.2 min CN=91 Runoff=136.70 cfs 489,719 cf

Subcatchment 4S: Building Roof (North Runoff Area=136,961 sf 100.00% Impervious Runoff Depth=8.60"
Tc=6.0 min CN=98 Runoff=28.68 cfs 98,152 cf

Reach DP 1: Towards Existing Constructed Wetlands (South) Inflow=161.93 cfs 510,259 cf
Outflow=161.93 cfs 510,259 cf

Reach DP2: Towards Existing Constructed Wetlands (North) Inflow=162.61 cfs 587,872 cf
Outflow=162.61 cfs 587,872 cf

Total Runoff Area = 1,712,022 sf Runoff Volume = 1,098,131 cf Average Runoff Depth = 7.70"
39.46% Pervious = 675,614 sf 60.54% Impervious = 1,036,408 sf

Summary for Subcatchment 1S:

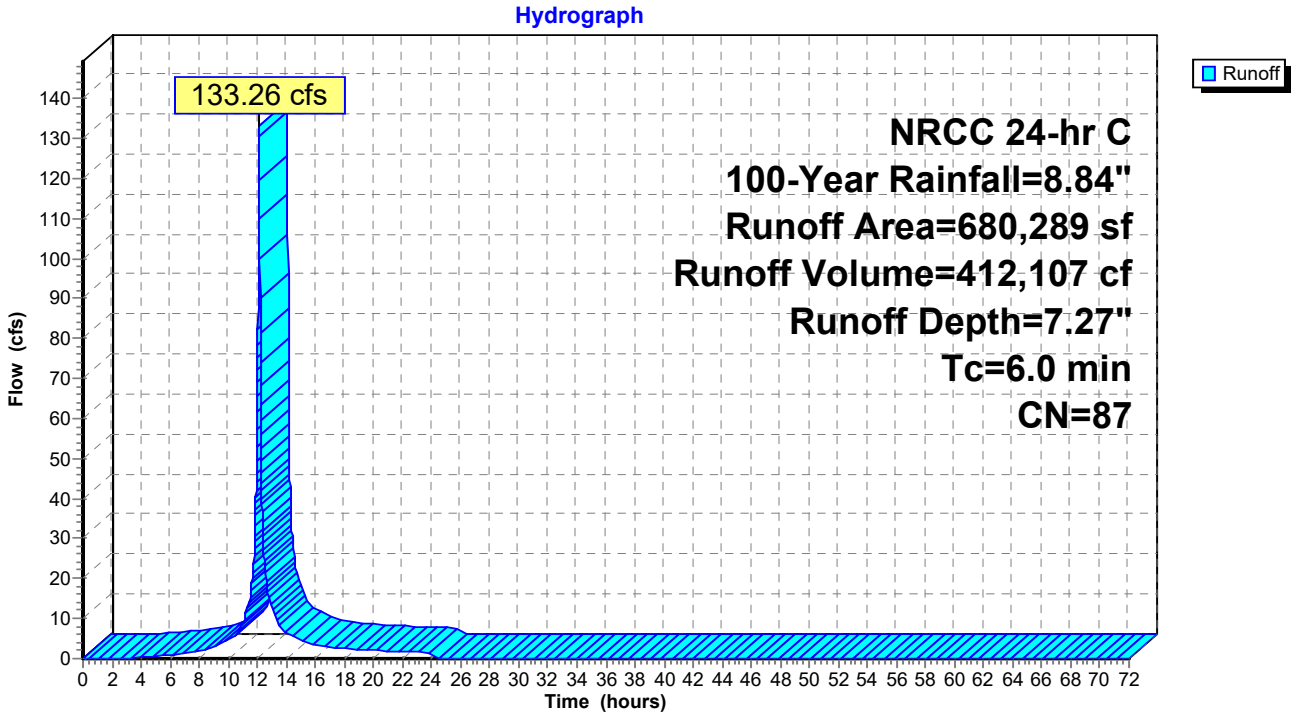
Runoff = 133.26 cfs @ 12.13 hrs, Volume= 412,107 cf, Depth= 7.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.84"

Area (sf)	CN	Description
46,570	77	Woods, Good, HSG D
728	98	Roofs, HSG D
348,453	80	>75% Grass cover, Good, HSG D
283,841	98	Paved parking, HSG D
697	98	Unconnected pavement, HSG D
680,289	87	Weighted Average
395,023		58.07% Pervious Area
285,266		41.93% Impervious Area
697		0.24% Unconnected

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

Subcatchment 1S:



Summary for Subcatchment 2S: Building Roof (South Half)

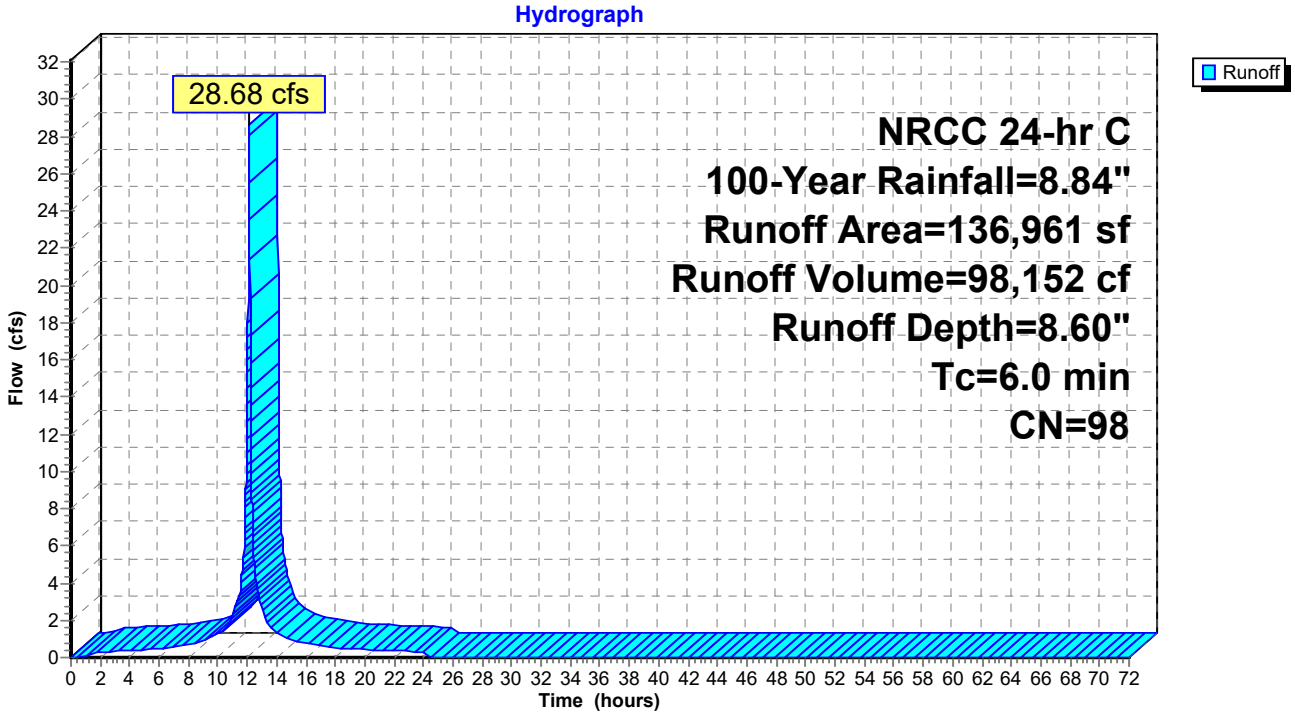
Runoff = 28.68 cfs @ 12.13 hrs, Volume= 98,152 cf, Depth= 8.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.84"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 2S: Building Roof (South Half)



Summary for Subcatchment 3S:

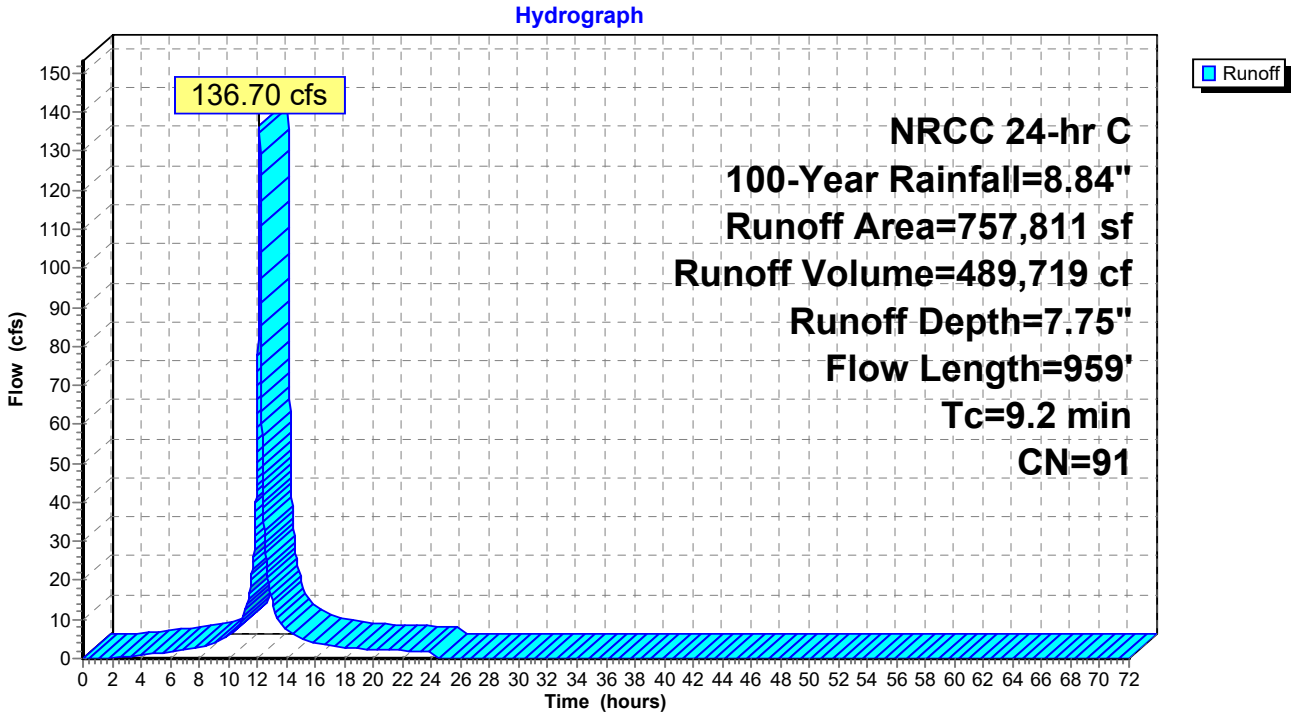
Runoff = 136.70 cfs @ 12.16 hrs, Volume= 489,719 cf, Depth= 7.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.84"

Area (sf)	CN	Description
22,500	77	Woods, Good, HSG D
11,113	98	Roofs, HSG D
258,091	80	>75% Grass cover, Good, HSG D
466,105	98	Paved parking, HSG D
2	98	Unconnected pavement, HSG D
757,811	91	Weighted Average
280,591		37.03% Pervious Area
477,220		62.97% Impervious Area
2		0.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
3.3	590	0.0200	3.01	42.93	**Trap/Vee/Rect Channel Flow,** Bot.W=5.00' D=1.50' Z= 3.0 '/' Top.W=14.00' n= 0.069 Riprap, 6-inch
0.5	319	0.0130	9.70	30.48	**Pipe Channel, RCP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011 Concrete pipe, straight & clean
9.2	959	Total			

Subcatchment 3S:



Summary for Subcatchment 4S: Building Roof (North Half)

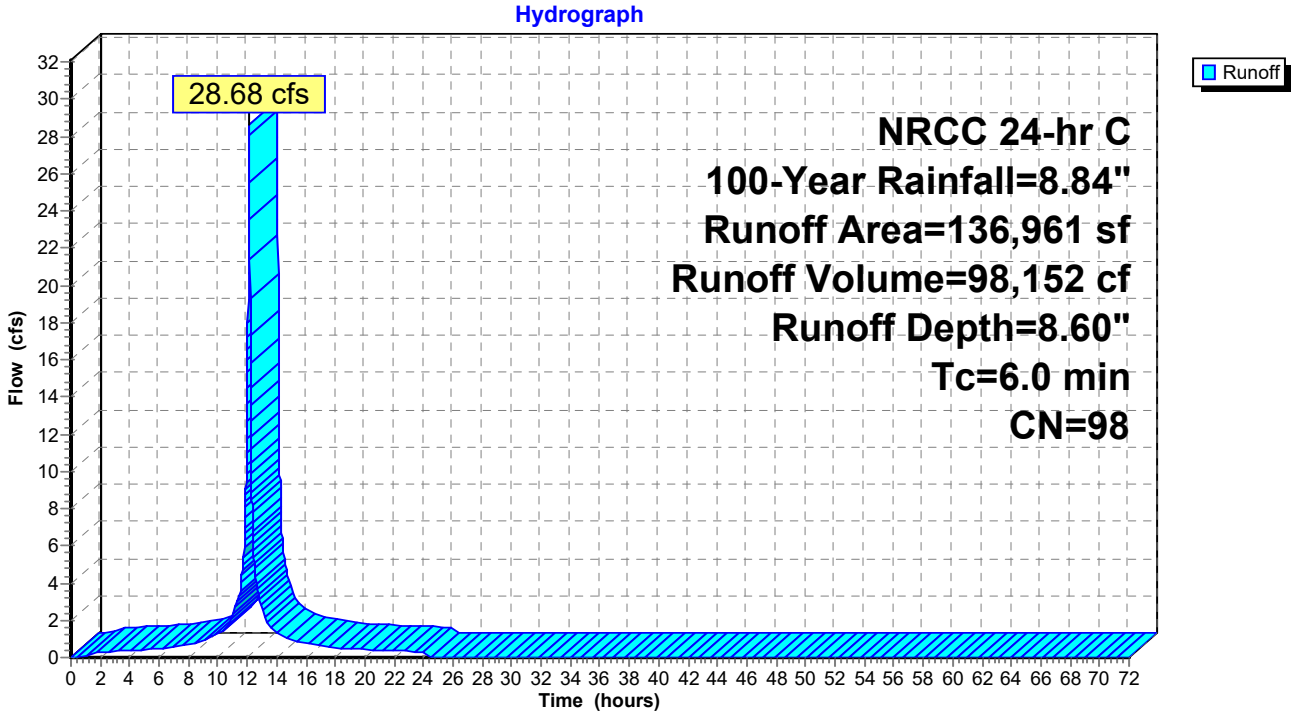
Runoff = 28.68 cfs @ 12.13 hrs, Volume= 98,152 cf, Depth= 8.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.84"

Area (sf)	CN	Description
136,961	98	Unconnected roofs, HSG D
136,961		100.00% Impervious Area
136,961		100.00% Unconnected

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

Subcatchment 4S: Building Roof (North Half)



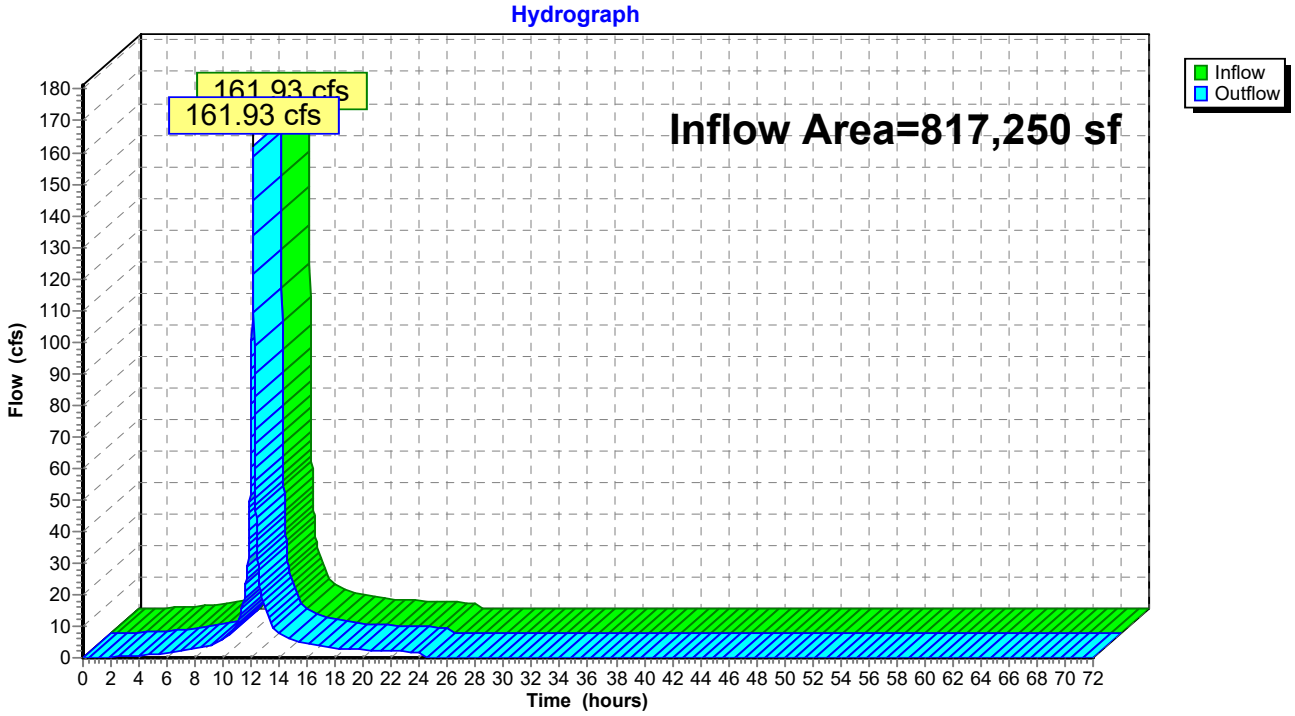
Summary for Reach DP 1: Towards Existing Constructed Wetlands (South)

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

Inflow Area = 817,250 sf, 51.66% Impervious, Inflow Depth = 7.49" for 100-Year event
Inflow = 161.93 cfs @ 12.13 hrs, Volume= 510,259 cf
Outflow = 161.93 cfs @ 12.13 hrs, Volume= 510,259 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Existing Constructed Wetlands (South)



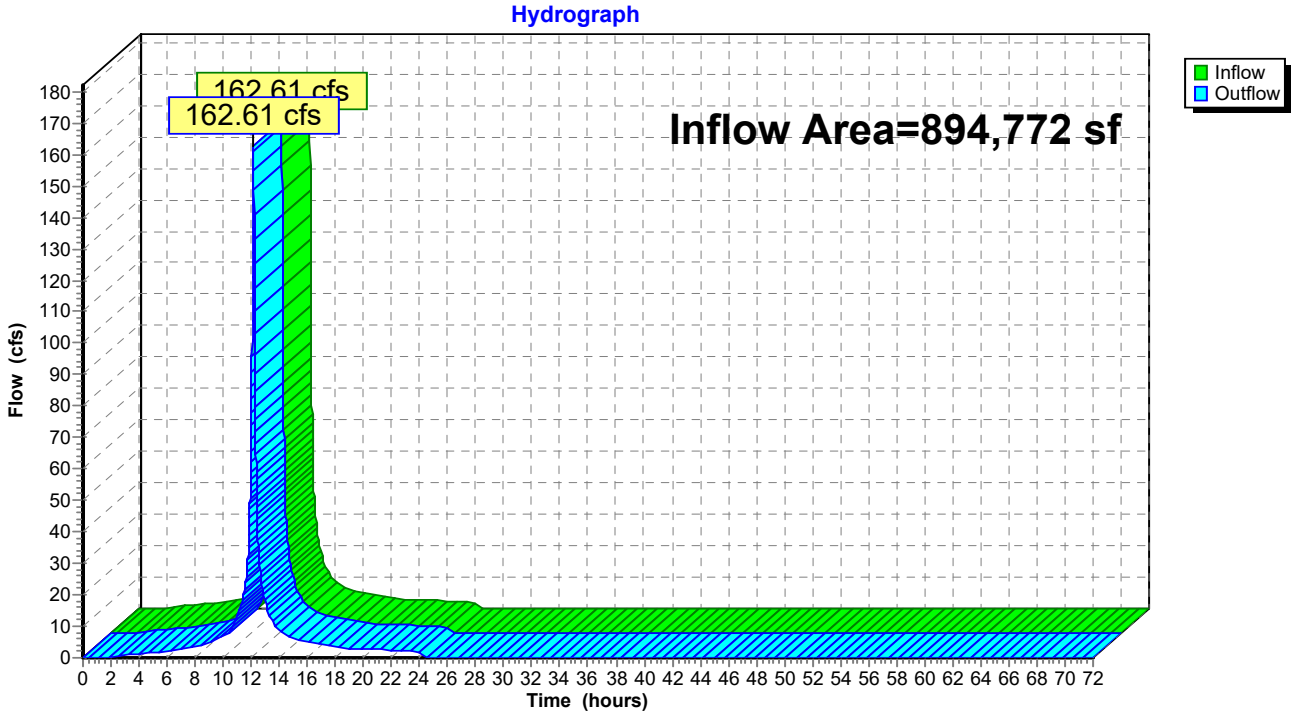
Summary for Reach DP2: Towards Existing Constructed Wetlands (North)

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

Inflow Area = 894,772 sf, 68.64% Impervious, Inflow Depth = 7.88" for 100-Year event
Inflow = 162.61 cfs @ 12.15 hrs, Volume= 587,872 cf
Outflow = 162.61 cfs @ 12.15 hrs, Volume= 587,872 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP2: Towards Existing Constructed Wetlands (North)



APPENDIX C

Pre- and Post-Development Watershed Plans

MA STATE PLANE NAD83

N/F
MORGAN GRAINGER LP
8042/24

N/F
AERIE REALTY LLC
29282/533

N/F
LRF2 BOS CONSTITUTION
38817/304

N/F
NEW ENGLAND POWER CO.
37128-248

EXISTING 15' WIDE UTILITY EASEMENT
EXISTING 15' WIDE UTILITY EASEMENT

ACCESS & UTILITY EASEMENT

TC PATH FOLLOWS EX. ROCK SWALE

4S

2S

JDG
EXISTING
3 STORY
COMMERCIAL OFFICE
BUILDING
(DELL COMPUTER)

3S

1S

312B
"D"

TC PATH FOLLOWS EX. DRAINAGE SYSTEM

EX. DRAINAGE

LIMIT OF DRAINAGE EASEMENT

100' WETLAND BUFFER

50' WETLAND BUFFER

25' WETLAND BUFFER

EXISTING DETENTION BASIN

DP1

DP2

EXISTING SEWER EASEMENT

310B
"D"

CONSTITUTION BOULEVARD (PUBLIC 56' WIDE)

71B
"D"

310B
"D"

N/F
NBPIV CONSTITUTION II LLC
41644/287

N/F
101 CONSTITUTION BLVD LLC
3297/87

LIBERTY WAY (PUBLIC-56' WIDE)

LOCUS

LOCUS MAP
1" = 1000'

LEGEND

1S	SUBCATCHMENT AREA
DP1	DESIGN POINT
	Tc PATH
	SUBCATCHMENT BOUNDARY
312B "D"	SOIL GROUP CLASSIFICATION

FILE: 3402-WSHD

Atlantic® DESIGN ENGINEERS, INC.
P.O. Box 1051, Sandwich, MA 02563 (508) 888 - 9282

Designed by :
Drawn by :
Checked by :
Survey chk. by :
Approved by :

SCALE
SCALE 1" = 80'
0 20 40 80 160

COMMONWEALTH OF MASSACHUSETTS
RICHARD J. TARKOWSKI
CIVIL
No. 33748
REGISTERED PROFESSIONAL ENGINEER

DATE

NO.	BY	DATE	REVISION

PREPARED FOR:
EMC CORPORATION
176 SOUTH STREET
HOPKINTON, MA 01748

PRE DEVELOPMENT WATERSHED PLAN
FOR
SOLAR CANOPY & GROUND MOUNT PROJECT
DELL CAMPUS - 50 CONSTITUTION BLVD, FRANKLIN, MA
FEBRUARY 6, 2025

Sheet 1 of 2
JOB NUMBER 3402.00

MA STATE PLANE NAD83

N/F
MORGAN GRAINGER LP
8042/24

N/F
AERIE REALTY LLC
29282/533

N/F
LRF2 BOS CONSTITUTION
38817/304

N/F
NEW ENGLAND POWER CO.
37128-248

EXISTING 15' WIDE UTILITY EASEMENT
EXISTING 15' WIDE UTILITY EASEMENT

ACCESS & UTILITY EASEMENT

TC PATH FOLLOWS EX. GRASS SWALE

TC PATH FOLLOWS EX. DRAINAGE SYSTEM

4S

2S

3S

1S

312B "D"

310B "D"

71B "D"

310B "D"

JDG EXISTING 3 STORY COMMERCIAL OFFICE BUILDING (DELL COMPUTER)

91.4'

100' WETLAND BUFFER

25' WETLAND BUFFER

84.4'

LIMIT OF DRAINAGE EASEMENT

EXISTING DETENTION BASIN

DP1

DP2

EXISTING SEWER EASEMENT

CONSTITUTION BOULEVARD (PUBLIC 56' WIDE)

N/F
101 CONSTITUTION BLVD LLC
32977/87

N/F
NBPIV CONSTITUTION II LLC
41644/287

LIBERTY WAY (PUBLIC-56' WIDE)

LOCUS MAP
1" = 1000'

LOCUS

FRANKLIN

LEGEND

1S	SUBCATCHMENT AREA
DP1	DESIGN POINT
	Tc PATH
	SUBCATCHMENT BOUNDARY
312B "D"	SOIL GROUP CLASSIFICATION

FILE: 3402-WSHD

Atlantic® DESIGN ENGINEERS, INC.
P.O. Box 1051, Sandwich, MA 02563 (508) 888 - 9282

Designed by :
Drawn by :
Checked by :
Survey chk. by :
Approved by :

SCALE
SCALE 1" = 80'
0 20 40 80 160

COMMONWEALTH OF MASSACHUSETTS
RICHARD J. FABRYZINSKI
No. 33748
REGISTERED PROFESSIONAL ENGINEER

DATE

NO.	BY	DATE	REVISION

PREPARED FOR:
EMC CORPORATION
176 SOUTH STREET
HOPKINTON, MA 01748

POST DEVELOPMENT WATERSHED PLAN
FOR
SOLAR CANOPY & GROUND MOUNT PROJECT
DELL CAMPUS - 50 CONSTITUTION BLVD, FRANKLIN, MA
FEBRUARY 6, 2025

Sheet 2 of 2
JOB NUMBER 3402.00

APPENDIX D
Miscellaneous Calculations

Required Recharge Volume

Design Engineer:	Atlantic Design Engineers, Inc	Job No.:	3402.00
Project Name:	Solar Canopy and Ground Mount Project	Calc'd By:	BSK
Location:	50 Constitution Blvd, Franklin, MA	Original Date:	2/5/2025

The groundwater recharge volume is required for the proposed equipment pad **impervious area.**

Rv = (F) (Aimp)
Rv = Required Recharge Volume
Aimp= Impervious Area on site
F = Target Depth Factor: 0.1 inch for D soils

Infiltration Trench (40'L x 2'W x 2'D @ 40% Voids)

Total New Impervious Area =	699 sf	
Required Recharge Volume (Rv)=	699 *0.1"* (1/12)=	**6 cf**
Recharge Volume Provided		
Infiltration Trench	80 SF*2 FT *(40%)=	**64 cf**
Proposed Volume Provided in Infiltration Trench=		**64 cf**

Total Required Recharge Volume on Site= 6 cf

Proposed Recharge Volume Provided in Infiltration Trench= 64 cf

64 > 6

Standard is Met

TSS REMOVAL CALCULATION SHEET

Design Engineer:	Atlantic Design Engineers, Inc	Job No.:	3402.00
Project Name:	Solar Canopy and Ground Mount Project	Calc'd By:	BSK
Location:	50 Constitution Blvd, Franklin, MA	Date:	2/5/2025

New Impervious Area (EQ pads, Piers)

BMP	Removal Rate	Starting TSS Load	TSS Removed	Remaining Load
Deep Sump Catch Basins	25%	100%	25%	75%
Sediment Forebay	25%	75%	19%	56%
Constructed Wetlands	80%	56%	45%	11%
Total Removed			**89%**	

Water Quality Calulation Sheet*

Design Engineer:	Atlantic Design Engineers, Inc	Job No.:	3402.00
Project Name:	Solar Canopy and Ground Mount Project	Calc'd By:	BSK
Location:	50 Constitution Blvd, Franklin, MA	Date:	2/5/2025

The required water quality treatment volume is calculated as follows:

Vwq = (Dwq)*(Aimp)
Vwq =Required Water Quality Volume
Dwq =Water Quality Depth * **1”**
Aimp=Area of Impervious

Subcatchment Area: 1S & 2S

New Impervious Area (EQ pads, piers, ground mount beams)=	699	sf			
Total Impervious Area for the Subcatchment=	699	sf			
Water Quality Volume Required (Vwq)=	699		* 1" * (1/12)=	58	cf
Volume Provided via Infiltrating Stone Trench=				64	cf
Volume Required=	58.3		<	64	**Water Quality Volume is met**

Total Impervious Area on the Site=	699	sf
Total Volume Quality Required=	58	cf
Total Volume Provided=	64	cf

* The purpose of these calculations is to show compliance with the Town of Franklin Stormwater Management Bylaw Chapter 153, specifically Section153-16.B.(1).(a)

APPENDIX E

NRCS Soil Survey Maps and Soil Group Descriptions

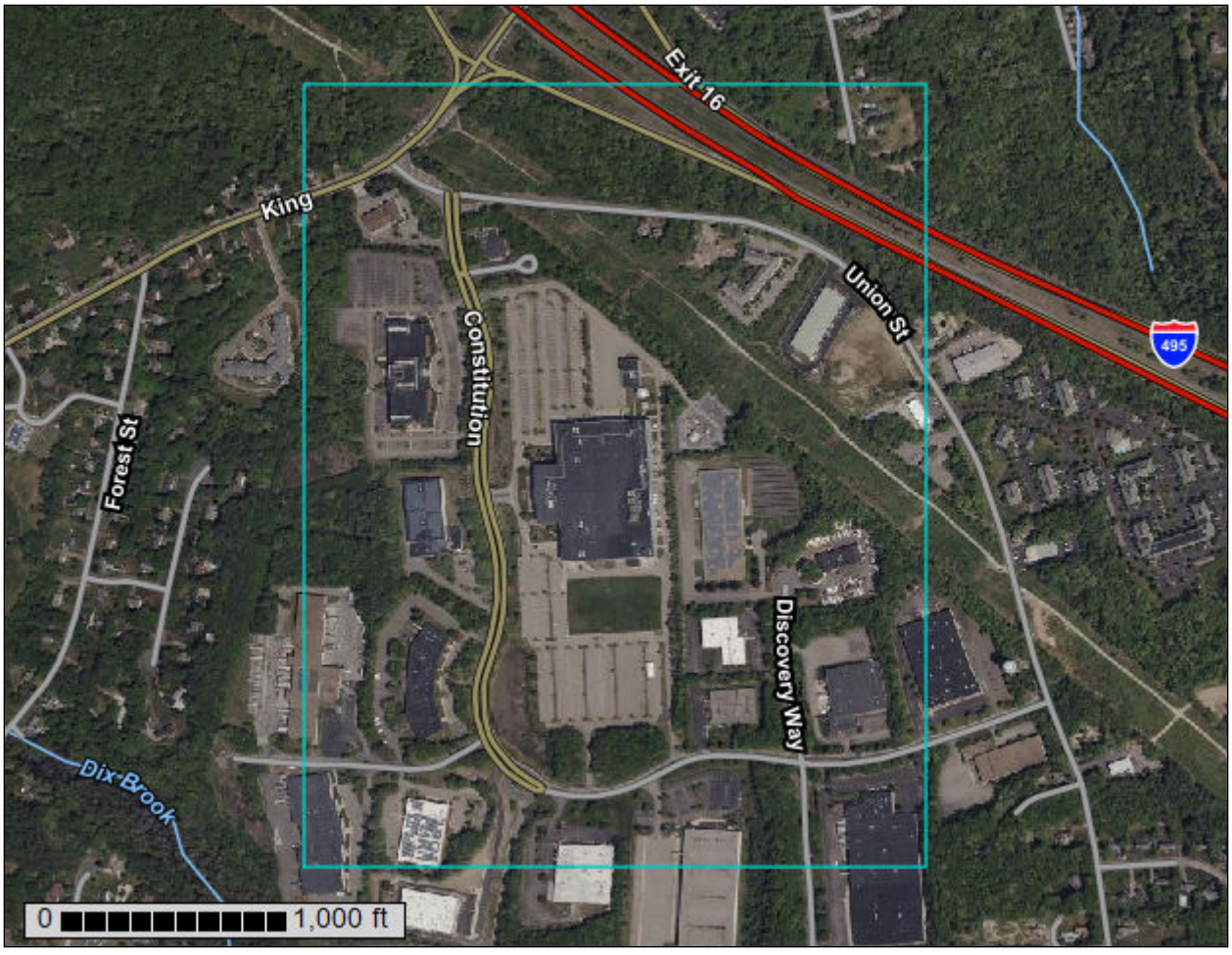
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts



January 30, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

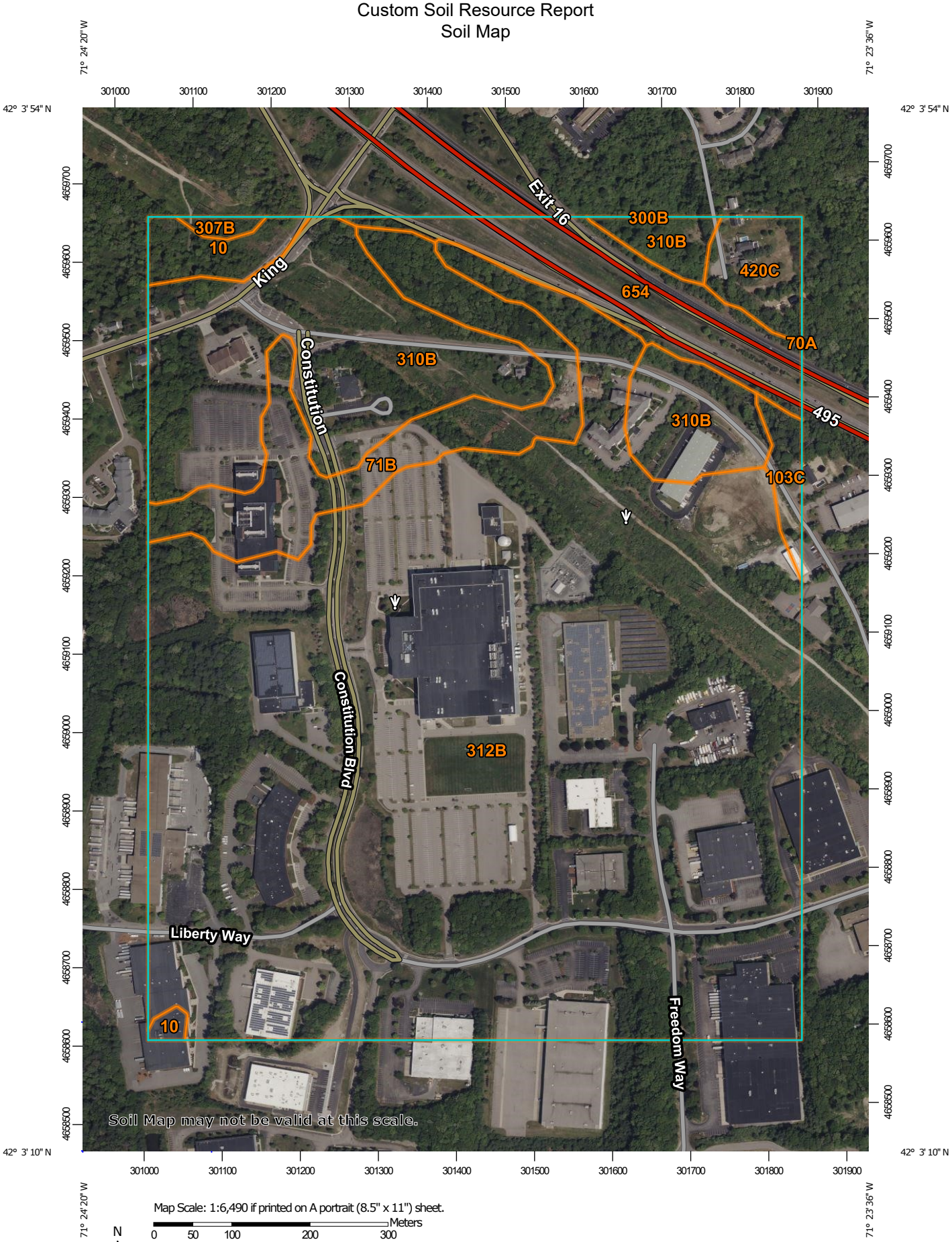
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:6,490 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 300 600 1200 1800

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 20, Aug 27, 2024

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	3.3	1.5%
70A	Ridgebury fine sandy loam, 0 to 3 percent slopes	0.0	0.0%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	15.3	7.0%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	1.8	0.8%
300B	Montauk fine sandy loam, 3 to 8 percent slopes	0.0	0.0%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	0.6	0.3%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	33.0	15.1%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	149.7	68.6%
420C	Canton fine sandy loam, 8 to 15 percent slopes	3.8	1.8%
654	Udorthents, loamy	10.6	4.9%
Totals for Area of Interest		**218.1**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called

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

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

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

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

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

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

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

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

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can

be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

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

Norfolk and Suffolk Counties, Massachusetts

10—Scarboro and Birdsall soils, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vkxw
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 65 percent
Birdsall and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 9 inches: mucky fine sandy loam
H2 - 9 to 60 inches: stratified loamy fine sand to gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Description of Birdsall

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Soft coarse-silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: very fine sandy loam
H2 - 8 to 16 inches: very fine sandy loam
H3 - 16 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 12.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 5 percent
Landform: Bogs
Hydric soil rating: Yes

Raynham

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Walpole

Percent of map unit: 2 percent
Landform: Terraces
Hydric soil rating: Yes

70A—Ridgebury fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2w69f
Elevation: 0 to 1,480 feet

Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Ridgebury and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ridgebury

Setting

Landform: Ground moraines, hills, drumlins, depressions, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam
Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Woodbridge

Percent of map unit: 9 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Base slope, crest
Down-slope shape: Convex
Across-slope shape: Linear

Hydric soil rating: No

Whitman

Percent of map unit: 5 percent
Landform: Hills, drainageways, drumlins, ground moraines, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Leicester

Percent of map unit: 1 percent
Landform: Ground moraines, hills, drainageways, depressions
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

71B—Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w69c
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Ridgebury, extremely stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ridgebury, Extremely Stony

Setting

Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam

Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony

Percent of map unit: 10 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Whitman, extremely stony

Percent of map unit: 8 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton, extremely stony

Percent of map unit: 2 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

103C—Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2wzp1
Elevation: 0 to 1,390 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton, extremely stony, and similar soils: 50 percent
Hollis, extremely stony, and similar soils: 20 percent
Rock outcrop: 10 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Hollis, Extremely Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Ridges, hills
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

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

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Woodbridge, extremely stony

Percent of map unit: 8 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Canton, extremely stony

Percent of map unit: 5 percent
Landform: Moraines, hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Chatfield, extremely stony

Percent of map unit: 5 percent
Landform: Ridges, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 2 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

300B—Montauk fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyrh
Elevation: 0 to 1,030 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Montauk and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Montauk

Setting

Landform: Recessionial moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 4 inches: fine sandy loam
Bw1 - 4 to 26 inches: fine sandy loam
Bw2 - 26 to 34 inches: sandy loam
2Cd - 34 to 72 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 6 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Canton

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 4 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

307B—Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w675
Elevation: 0 to 1,580 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Paxton, extremely stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton, Extremely Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, extremely stony

Percent of map unit: 10 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Charlton, extremely stony

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex

Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 4 percent
Landform: Drumlins, drainageways, depressions, ground moraines, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman, extremely stony

Percent of map unit: 1 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

310B—Woodbridge fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2ql
Elevation: 0 to 1,470 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodbridge, fine sandy loam, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Fine Sandy Loam

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton

Percent of map unit: 10 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 8 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

312B—Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2t2qs
Elevation: 0 to 1,580 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Woodbridge, extremely stony, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Extremely Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 9 inches: fine sandy loam
Bw1 - 9 to 20 inches: fine sandy loam
Bw2 - 20 to 32 inches: fine sandy loam
Cd - 32 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 19 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton, extremely stony

Percent of map unit: 10 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 8 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

420C—Canton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w817
Elevation: 0 to 1,330 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Hills, moraines, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Montauk

Percent of map unit: 6 percent
Landform: Moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Scituate

Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Newfields

Percent of map unit: 4 percent
Landform: Ground moraines, hills, moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

654—Udorthents, loamy

Map Unit Setting

National map unit symbol: vkyb
Elevation: 0 to 3,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Riser, tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Excavated and filled coarse-loamy human transported material

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Udorthents,sandy

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Udorthents,wet substr.

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Urban land

Percent of map unit: 4 percent
Hydric soil rating: Unranked

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

APPENDIX F

Post-Construction Long Term Stormwater Operation and Maintenance Plan

Solar Canopy and Ground Mount Project
At
50 Constitution Boulevard – Franklin, MA
Post-Construction Long Term Stormwater Operation & Maintenance Plan
February 5, 2025
ADE Job #3402.00

A. GENERAL NOTES

1. Upon completion of construction, the operation and maintenance of all components of the stormwater management system will be the responsibility (financially and otherwise) of the system owner (responsible party):

EMC Corporation
176 South Street
Hopkinton, MA 01748

_____ _____
Signature **Date**

2. The responsible party shall file an inspection report with the Town of Franklin DPW following each site inspection as recommended in the Operation & Maintenance (O&M) Schedule. The inspection report shall identify the date of inspection, name, and contact number of responsible party, specific structures inspected, specific maintenance and/or repairs required and general observations. Any deficiencies noted in the inspection report shall be corrected to the Town of Franklin's DPW's satisfaction.

3. Disposal of accumulated sediment and hydrocarbons to be in accordance with the applicable local, state, and federal guidelines and regulations.

4. There shall be no illicit discharge of any waste or waste water into the stormwater management system. The maintenance of the facility shall be undertaken in such a manner as to prevent any discharge of waste or waste water into the stormwater management system. Any waste oil or other waste products generated during the maintenance shall be properly disposed of offsite.

EMC Corporation
176 South Street
Hopkinton, MA 01748

_____ _____
Signature **Date**

5. The Town will be notified of changes in project ownership or assignment of operation and maintenance financial responsibility.

6. The maintenance schedule in this operation and maintenance (O&M) Plan will only be amended by mutual agreement of the Town and the responsible party. Amendments will be made in writing and signed by the responsible party.

B. STORMWATER SYSTEM/BMPS

Stone Infiltration Trench:
Inspect after every major storm event (2" or greater) for the first few months after construction and at least twice per year thereafter during wet weather to ensure the system is working properly. Check for accumulation of sediment, debris, weed growth and leaf litter and clean out as required, including replacement of top layer of stone.

C. ESTIMATED ANNUAL BUDGET

The estimated annual budget for the activities required in this Post-Construction Long Term Stormwater Operation and Maintenance Plan is $1,000.00.

D. SAMPLE OPERATION AND MAINTENANCE LOG (next page)

SAMPLE OPERATION AND MAINTENANCE LOG

SOLAR CANOPY AND GROUND MOUNT PROJECT - FRANKLIN, MASSACHUSETTS

POST-CONSTRUCTION

LONG TERM STORMWATER OPERATION & MAINTENANCE PLAN

Date: _____ **Personnel Present:** _____

_____

Inspectors Name: _____

Inspectors Contact Information: _____

_____

_____

Signature: _____

O&M ITEM:	**COMMENTS, CORRECTIVE ACTION NEEDED, AND NOTES:**
Stone Infiltration Trench	