STORMWATER MANAGEMENT REPORT
PROPOSED RESIDENTIAL DEVELOPMENT
1012-1022 AVENUE C
BLOCK 64 LOTS 2 & 3
BAYONNE, NEW JERSEY

SUBMITTED TO

BAYONNE PLANNING BOARD

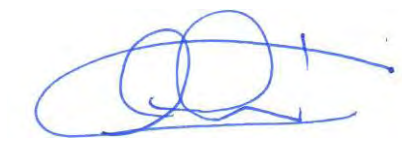
SUBMITTED BY

JOHN & MARYAN LLC

PREPARED BY

DAL DESIGN GROUP
11 WEST 8TH STREET
BAYONNE, NEW JERSEY 07002

SEPTEMBER 30, 2025
REVISED APRIL 30, 2026



A. Sambade, P.E., Lic. No. 24GE02958400

TABLE OF CONTENTS

STORMWATER MANAGEMENT REPORT
PROPOSED RESIDENTIAL DEVELOPMENT
1012-1022 AVENUE C
BLOCK 64 LOTS 2 & 3
BAYONNE, NEW JERSEY

1. INTRODUCTION

This report has been prepared to analyze the impacts of the proposed development and to determine the operational capability of the proposed stormwater management detention system as well as compliance with the 1012-1022 Avenue C Redevelopment Plan requirements governing this site.

The project consists of the construction of a five-story residential building containing 40 units, a 44-space parking garage containing surface parking and semi-automated units, building support spaces, approximately 1,150 square feet of building amenity and recreational space in a roof terrace, and green roofs with an area of 2,595 square feet.

This project does not meet the definition of a "major development" under the State of New Jersey Stormwater Management Regulations (NJAC 7:8). The project is not subject to NJDEP water quality standards for TSS because it will disturb less than an acre of land and not add more than ¼ acre of additional impervious surface. The project is also exempt from NJDEP groundwater recharge requirements because the project is considered an "urban redevelopment area."

The Redevelopment Plan for this site requires stormwater reductions such that post-construction peak runoff rates for the two-, ten-, and one-hundred-year design storm events are 50%, 75%, and 80%, respectively, of the pre-construction peak runoff rates. The limit of disturbance for the project is 12,474 sq. ft. with approximately 51% of this area comprised of impervious pavement and roof surfaces under pre-existing conditions. Under the proposed conditions, the project area will be comprised of approximately 73% roof surfaces, 21% green roofs, and 6% pervious pavers.

2. METHODOLOGY AND DESIGN

Models were developed for this analysis based on USDA Soil Conservation Service (SCS) Unit Hydrograph Methodologies and the SCS TR-20 runoff method. Runoff Hydrographs were developed for the purpose of this analysis based on Region D rainfall distribution for a 24-hour period.

Three separate storms (2-year, 10-year, and 100-year frequencies) were modeled to determine pre-development flows. The stormwater management system for the project was designed to generate post-development peak runoff rates for the 2, 10, and 100-year design storm events no greater than the pre-construction peak runoff rates. The three storms were modeled in the post-development condition to assess compliance with the Redevelopment Plan requirements.

2.1 Soils

Based on the Hudson County Soils Survey information available from the USDA Natural Resources Conservation Service WebSoil Surveys, the soil native to the site consists of urban land, till substratum, 0 to 8 percent slopes (URTILB) with no hydrologic soil group specified. Per Chapter 12 of the NJ BMP Manual, HSG B is used for pre-development analysis and HSG D for post-development analysis. See Appendix B.

2.2 Runoff Curve Numbers

Table 9–5 Runoff curve numbers for urban areas [1/]

Cover description cover type and hydrologic condition	Average percent impervious area [2/]	-- CN for hydrologic soil group -- A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89

SOURCE: NEH – PART 630 – CHAPTER 9

2.3 Rainfall Intensity

Rainfall data used in the stormwater calculations of this report is based on NOAA Atlas 14 Point Precipitation Frequency Estimates for Hudson County, NJ. The complete PF Tabular point precipitation frequency estimates are shown in Appendix C. A portion of Appendix C is provided below:

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.334 (0.305-0.367)	0.398 (0.364-0.438)	0.471 (0.430-0.518)	0.525 (0.478-0.577)	0.594 (0.539-0.653)	0.642 (0.579-0.706)	0.690 (0.618-0.758)	0.733 (0.653-0.808)	0.788 (0.693-0.872)	0.832 (0.726-0.925)
10-min	0.531 (0.485-0.583)	0.635 (0.581-0.698)	0.752 (0.687-0.828)	0.837 (0.762-0.920)	0.940 (0.853-1.03)	1.01 (0.915-1.12)	1.09 (0.975-1.20)	1.15 (1.03-1.27)	1.24 (1.09-1.37)	1.29 (1.13-1.44)
15-min	0.662 (0.605-0.727)	0.795 (0.727-0.874)	0.948 (0.865-1.04)	1.05 (0.960-1.16)	1.19 (1.08-1.31)	1.28 (1.16-1.41)	1.37 (1.23-1.51)	1.45 (1.29-1.60)	1.55 (1.37-1.72)	1.62 (1.42-1.80)
30-min	0.904 (0.827-0.993)	1.09 (1.00-1.20)	1.34 (1.22-1.47)	1.52 (1.38-1.67)	1.75 (1.58-1.92)	1.92 (1.73-2.11)	2.09 (1.87-2.29)	2.24 (2.00-2.47)	2.45 (2.16-2.71)	2.60 (2.27-2.89)
60-min	1.12 (1.03-1.24)	1.37 (1.25-1.50)	1.71 (1.56-1.88)	1.97 (1.80-2.17)	2.32 (2.10-2.55)	2.59 (2.33-2.84)	2.86 (2.56-3.15)	3.13 (2.79-3.45)	3.50 (3.08-3.88)	3.78 (3.30-4.20)
2-hr	1.38 (1.26-1.53)	1.68 (1.54-1.86)	2.13 (1.94-2.36)	2.48 (2.25-2.74)	2.96 (2.67-3.27)	3.35 (3.00-3.70)	3.76 (3.34-4.15)	4.18 (3.69-4.62)	4.77 (4.16-5.29)	5.24 (4.52-5.82)
3-hr	1.54 (1.40-1.70)	1.87 (1.71-2.07)	2.37 (2.16-2.62)	2.76 (2.51-3.04)	3.30 (2.98-3.64)	3.75 (3.36-4.13)	4.20 (3.74-4.63)	4.69 (4.13-5.17)	5.36 (4.66-5.92)	5.89 (5.07-6.53)
6-hr	1.98 (1.81-2.18)	2.40 (2.19-2.65)	3.03 (2.76-3.33)	3.53 (3.20-3.88)	4.25 (3.83-4.66)	4.85 (4.33-5.31)	5.47 (4.85-6.00)	6.14 (5.40-6.75)	7.10 (6.14-7.82)	7.88 (6.73-8.71)
12-hr	2.42 (2.21-2.66)	2.93 (2.68-3.22)	3.72 (3.39-4.07)	4.37 (3.97-4.77)	5.31 (4.79-5.78)	6.12 (5.47-6.65)	6.98 (6.16-7.59)	7.92 (6.92-8.63)	9.30 (7.97-10.1)	10.5 (8.83-11.4)
24-hr	2.72 (2.51-2.96)	3.29 (3.04-3.58)	4.21 (3.88-4.57)	4.99 (4.59-5.41)	6.16 (5.63-6.66)	7.16 (6.50-7.74)	8.27 (7.44-8.94)	9.50 (8.46-10.3)	11.3 (9.94-12.3)	12.9 (11.2-14.1)

Per NJAC 7:8-5.7© and (d) and Tables 5-5 and 5-6, the NOAA Atlas 14 data is adjusted as noted below:

Design Storm Event (years)	NOAA Atlas 14 rainfall depth (inches)	Current Adjusted rainfall depth (inches)	Future Adjusted rainfall depth (inches)
2	3.29	3.39	3.92
10	4.99	5.24	5.94
100	8.27	9.01	10.17

2.4 Time of Concentration

Rainfall intensities utilized in hydrologic analyses are based on the time of concentration of the drainage area being analyzed. Time of concentration is defined as the time for runoff to travel from the hydraulically most distant point of a watershed to a point of interest. Values of the time of concentration were determined using the methods described in the *National Engineering Handbook – Part 630 Hydrology – Chapter 15 Time of Concentration* and calculated in the National Resource Conservation Service (NRCS) *TR-55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)*. Based on input values for surface roughness coefficients, land slope, rainfall, T_c flow path length from drainage area maps (Appendices D and E), and other criteria, the T_t for various segments of flow were calculated and combined to determine the T_c for pre- and post-development conditions. The TR-55 Worksheets for current and future adjusted rainfall depths are provided in Appendix F.

2.5 Calculation Software

The calculations shown in this report include hydrologic analysis utilizing HydroCAD® 10.20.8.1 developed by HydroCAD® Software Solutions, LLC. The HydroCad® software was utilized to develop pre- and post-development hydrographs for comparative analysis purposes to assess compliance with the Redevelopment Plan requirement that post-construction peak runoff rates for the 2-, 10-, and 100-year design storm events are 50%, 75%, and 80%, respectively, of the pre-construction peak runoff rates.

3. PRE-DEVELOPMENT CONDITIONS

The pre-development site area consists of a 3-story former synagogue and attached 2-story building. A Pre-Development Drainage Map, showing drainage areas, HSG group, and time of concentration flow paths is shown in Appendix D of this report. A hydrologic diagram for the pre-development condition is shown in Appendix G.

3.1 Surface Coverage/Pre-Development

Existing Drainage Area 1, D_{E1} includes pre-existing building roofs that drain to roof drains leaders and directly to the municipal sewer in the bed of Avenue C. D_{E1} has an area of 5,355 sq. ft. A time of concentration of 1.2 minutes has been calculated for this drainage area at both current and future adjusted rainfall depths. A hydraulic curve number of CN=98 has been utilized. Per NJDEP BMP, HSG B has been utilized for this drainage area.

Existing Drainage Area 2, D_{E2} includes the pre-existing on-site landscaped areas behind and to the south of the buildings that drains from a high point to the municipal inlet on West 49th Street and Avenue C. D_{E2} has an area of 4,318 sq. ft. A time of concentration of 3.6 minutes has been calculated for this drainage area at current adjusted rainfall depth and 3.0 minutes at future adjusted rainfall depth. A hydraulic curve number of CN=79 has been utilized. Per NJDEP BMP, HSG B has been utilized for this drainage area.

Existing Drainage Area 3, D_{E3} includes paved areas that drain to the municipal inlet on West 49th Street and Avenue C. D_{E3} has an area of 1,028 sq. ft. A time of concentration of 1.8 minutes has been calculated for this drainage area at current adjusted rainfall depth and 1.2 minutes at future adjusted rainfall depth. A hydraulic curve number of CN=98 has been utilized. Per NJDEP BMP, HSG B has been utilized for this drainage area.

Existing Drainage Area 4, D_{E4} includes the pre-existing on-site landscaped areas at the rear of the property that drain to the ROW line of West 49th Street (POI-1).

D_{E4} has an area of 1,773 sq. ft. A time of concentration of 1.2 minutes has been calculated for this drainage area at both current and future adjusted rainfall criteria. A hydraulic curve number of CN=79 has been utilized. Per NJDEP BMP, HSG B has been utilized for this drainage area.

3.2 Hydrologic Conditions

Pre-development hydrograph reports for the 2 -, 10- and 100-year storm events are provided in Appendix H.

4. POST-DEVELOPMENT CONDITIONS

The post-development site area consists of six distinct drainage areas as described below. A Post-Development Drainage Map, showing drainage areas, HSG group, and time of concentration flow paths is shown in Appendix E of this report. A hydrologic routing diagram for the post-development condition is shown in Appendix G.

4.1 Surface Coverage/Post-Development

Proposed Drainage Area 1A, D_{P1A} includes green roof area on the proposed building main roof. The project proposes to use the HydroTech© intensive green roof assembly with 4" media depth and GR-10 garden drain. Stormwater generated on these green roof systems will be collected and conveyed to the proposed stormwater detention system where stormwater will be detained and released at a controlled rate to the municipal sewer system. A time of concentration of 6.0 minutes has been calculated for this drainage area at current adjusted rainfall depth and 5.2 minutes at future adjusted rainfall depth. Per NJDEP BMP, HSG D has been utilized for this drainage area. D_{P1A} has a total area of 2,270 sq. ft. Hydraulic curve numbers have been determined to be CN=87, CN=88, and CN=89 under current adjusted rainfall criteria and CN=88, CN=92, and CN=90 under future adjusted rainfall data for the 2-, 10-, and 100-year storms, respectively, consistent with NJDEP BMP methodology – see Appendix J.

Proposed Drainage Area 1B, D_{P1B} includes the conventional higher roof system located at the roof level located above the 5th floor. Stormwater generated on this roof will be collected and conveyed to the proposed underground stormwater detention system where stormwater will be detained and released at a controlled rate to the municipal sewer system. A time of concentration of 0.6 minutes has been calculated for this drainage area at both current and future adjusted rainfall depth. Per NJDEP BMP, HSG D has been utilized for this drainage area. D_{1B} has an area of 7,770 sq. ft. A hydraulic curve number of CN=98 has been utilized.

Proposed Drainage Area 2, D_{P2} includes the conventional lower roof system located at the roof level located above the 1st floor/garage level. Stormwater generated on this roof will be collected and conveyed to the proposed underground stormwater detention system where stormwater will be detained and released at a controlled rate to the municipal sewer system. A time of concentration of 0.6 minutes has been calculated for this drainage area at both current and future adjusted rainfall depths. Per NJDEP BMP, HSG D has been utilized for this drainage area. D_{P2} has an area of 1,408 sq. ft. A hydraulic curve number of CN=98 has been utilized.

Proposed Drainage Area 3, D_{P3} includes green roof area on the proposed building lower roof. The project proposes to use the HydroTech© intensive green roof assembly with 4" media depth and GR-10 garden drain. Stormwater generated on these green roof systems will be collected and conveyed to the proposed stormwater detention system where stormwater will be detained and released at a controlled rate to the municipal sewer system. A time of concentration of 4.2 minutes has been calculated for this drainage area at both current and future adjusted rainfall depths. Per NJDEP BMP, HSG D has been utilized for this drainage area. D_{P3} has a total area of 325 sq. ft. Hydraulic curve numbers have been determined to be CN=87, CN=88, and CN=90 under current adjusted rainfall criteria and CN=88, CN=90, and CN=90 under future adjusted rainfall data for the 2-, 10-, and 100-year storms, respectively, consistent with NJDEP BMP methodology – see Appendix J.

Proposed Drainage Area 4, D_{P43} includes pervious pavement draining to the curb ROW line at West 49th Street (POI-1). A time of concentration of 4.2 minutes has been calculated for this drainage area at current adjusted rainfall depth and 3.6 minutes at future adjusted rainfall depth. Per NJDEP BMP, HSG D has been utilized for this drainage area. D_{P4} has an area of 701 sq. ft. A hydraulic curve number of CN=89 has been utilized.

4.2 Hydrologic Conditions

Post-development hydrograph reports for the 2 -, 10- and 100-year storm events are provided in Appendix I.

5. STORMWATER MANAGEMENT SYSTEM DESIGN

5.1 Stormwater Detention System

All stormwater runoff from the upper/lower building roofs and the green roofs will be routed, via the direct connection of roof leaders and storm drains, to a stormwater detention system that consists of two sections of 42" diameter ADS N-12 pipe, each

72 feet in length. Outlet control is provided by five separate outlets on the interior wall of the outlet control structure (see Outlet Connectivity below). Storm water exiting the detention system discharges via a 10″ PVC sewer to the combined sewer in the bed of Avenue C. Typical performance of a 5″ roof drain at future adjusted 100-yr. rainfall is provided in Appendix K.

Outlet Connectivity

STRUCTRE	ELEVATION
Orifice (2.5″ diam.)	43.80
Orifice (2.5″ diam.)	44.40
Orifice (6.0″ diam.)	45.50
Orifice (3.0″ diam.)	46.70
Weir	48.10
Maximum Elevation	49.40
10″ Storm Sewer Outfall	43.80

The storm sewer outfall contains a 10″ Tideflex Technologies Checkmate In-Line Valve. The performance of this valve has been modeled into the system hydraulic calculations utilizing independent hydraulic testing (head loss vs. flow rate) provided by the manufacturer. Performance hydrograph for this valve is provided in Appendix I (for future adjusted rainfall 100-yr design storm).

The hydraulic calculations have also assumed that the 24″ brick municipal sewer in the bed of Avenue C is flowing full, i.e., tailwater elevation set at 39.60.

6. STORMWATER QUANTITY COMPARATIVE ANALYSIS

A comparative analysis of pre-development and post-development hydrographs for the 2-, 10- and 100-year storm events utilizing current adjusted and future adjusted rainfall data is presented below to demonstrate compliance with the design methodology intent.

Peak Runoff Summary and Compliance – Current Adjusted Rainfall

MUNICIPAL SEWER – Pre vs Post – Current Adjusted Runoff Rates				
Design Storm (years)	Peak pre-development (cfs)	Peak post-development (cfs)	Post-development percent of pre-development	Conformance with RDP
2	0.67	0.33	49.2 %	✓
10	1.13	0.76	67.2 %	✓
100	2.11	1.55	73.4 %	✓

POA-1 – Pre vs Post – Current Adjusted Runoff Rates				
Design Storm (years)	Peak pre-development (cfs)	Peak post-development (cfs)	Post-development percent of pre-development	Conformance with RDP
2	0.07	0.03	42.8 %	✓
10	0.14	0.06	42.8%	✓
100	0.31	0.13	41.9 %	✓

TOTAL SITE RUNOFF – Pre vs Post – Current Adjusted Runoff Rates				
Design Storm (years)	Peak pre-development (cfs)	Peak post-development (cfs)	Post-development percent of pre-development	Conformance with RDP
2	0.74	0.36	46.8 %	✓
10	1.27	0.82	64.6%	✓
100	2.42	1.68	69.4 %	✓

Peak Runoff Summary and Compliance – Future Adjusted Rainfall

MUNICIPAL SEWER – Pre vs Post – Future Adjusted Runoff Rates				
Design Storm (years)	Peak pre-development (cfs)	Peak post-development (cfs)	Post-development percent of pre-development	Conformance with RDP
2	0.80	0.37	46.2 %	✓
10	1.31	0.97	74.0%	✓
100	2.42	1.86	76.8 %	✓

POA-1 – Pre vs Post – Future Adjusted Runoff Rates				
Design Storm (years)	Peak pre-development (cfs)	Peak post-development (cfs)	Post-development percent of pre-development	Conformance with RDP
2	0.09	0.04	44.4 %	✓
10	0.17	0.08	47.0%	✓
100	0.36	0.15	41.7 %	✓

TOTAL SITE RUNOFF – Pre vs Post – Future Adjusted Runoff Rates				
Design Storm (years)	Peak pre-development (cfs)	Peak post-development (cfs)	Post-development percent of pre-development	Conformance with RDP
2	0.89	0.41	46.0 %	✓
10	1.48	1.05	70.9%	✓
100	2.78	2.01	72.3 %	✓

7. STORM SEWER LATERAL DESIGN

Maximum Capacity of Storm Sewer Lateral using Manning's Formula

$$Q = \left(\frac{1.49}{n}\right) AR^{2/3}\sqrt{S}$$

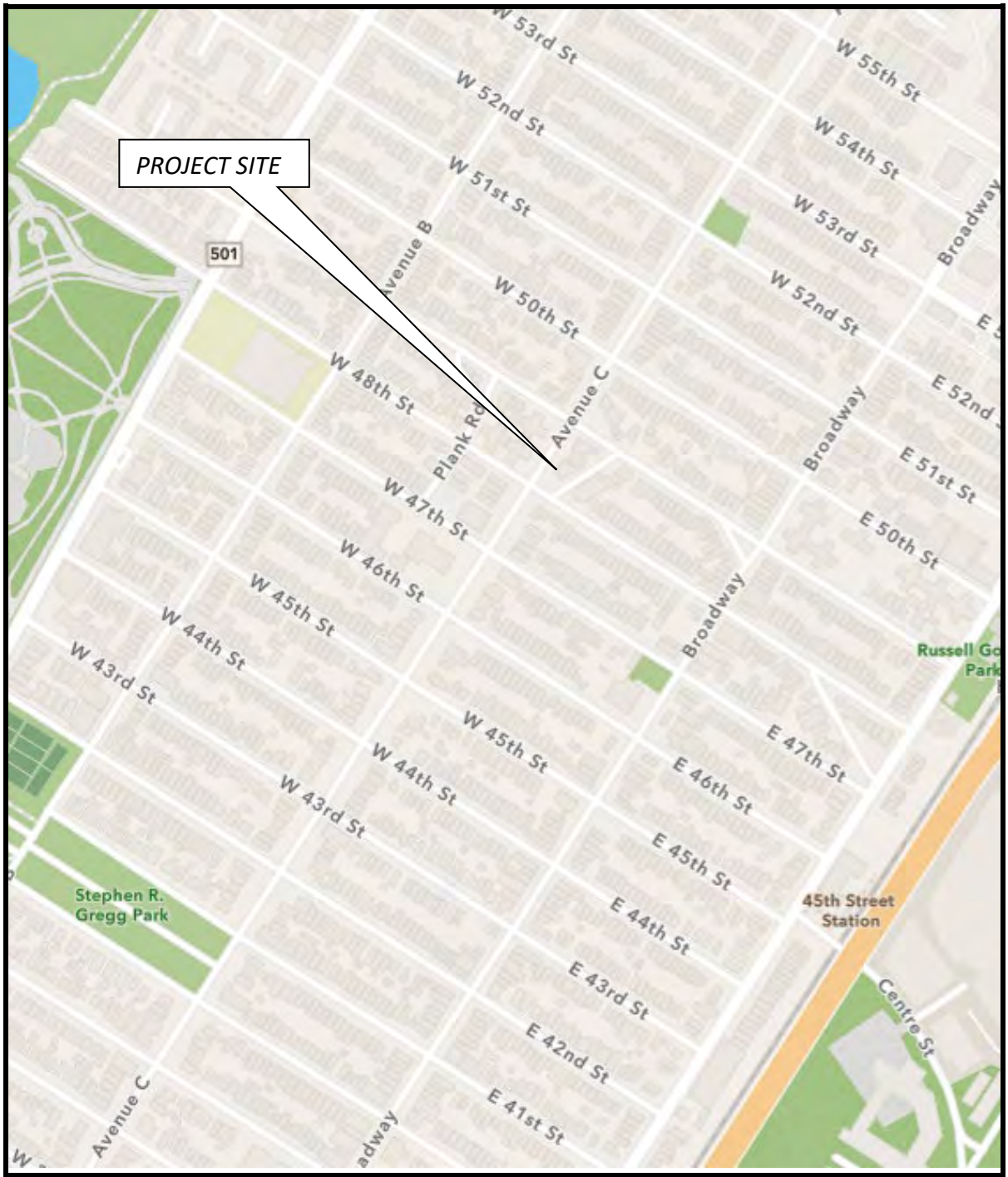
where: Q = flow rate (cfs)
n = Manning's Coefficient = 0.010
A = Flow Area = 0.554 sq. ft. (flowing full)
R = Hydraulic Radius = 0.351 sq. ft. (flowing full)
S = Slope = 0.02 ft./ft.

Solving the equation for Q yields a flowing full capacity of 4.03 cfs. This capacity exceeds the future adjusted 100-year storm peak post-development flow of 2.80 cfs assuming failure of the detention system. The calculation demonstrates that the proposed pipe has sufficient capacity to convey runoff from the 100-year design storm.

8. CONCLUSIONS

Based on the analysis, the proposed stormwater detention system complies with the minimum requirement that post-construction peak runoff rates for the two-, ten-, and one-hundred-year design storm events are 50%, 75%, and 80%, respectively, of the pre-construction peak runoff rates, both calculated for current adjusted and future adjusted rainfall depths.

APPENDIX A – VICINTY MAP



Scale: 1″ = 1000 ft.

Source:
NJDEP ARCGIS/GEO-WEB

PROPOSED RESIDENTIAL DEVELOPMENT
1012-1022 Avenue C
BLOCK 64 LOTS 2 and 3
CITY OF BAYONNE
HUDSON COUNTY, NJ

DAL design group
Architecture • Engineering • Planning
11 West 8th Street
Bayonne, NJ 07002

Date: September 2025

APPENDIX B – CUSTOM SOIL SOURCE REPORT

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 Hudson County, New Jersey

1012-1022 Avenue C, Bayonne

September 20, 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.

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: 1:386 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 15 30 60 90

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:12,000.

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: Hudson County, New Jersey
Survey Area Data: Version 13, Aug 29, 2023

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

Date(s) aerial images were photographed: Oct 9, 2022—Oct 16, 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
URTILB	Urban land, till substratum, 0 to 8 percent slopes	0.6	100.0%
Totals for Area of Interest		**0.6**	**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.

Hudson County, New Jersey

URTILB—Urban land, till substratum, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2qjwr
Elevation: 0 to 520 feet
Mean annual precipitation: 30 to 56 inches
Mean annual air temperature: 47 to 63 degrees F
Frost-free period: 179 to 217 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land, till substratum: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land, Till Substratum

Setting

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Asphalt over human-transported material

Typical profile

M - 0 to 15 inches: material
2^C - 15 to 79 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Calcium carbonate, maximum content: 10 percent
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): 8s
Hydric soil rating: Unranked

Minor Components

Greenbelt

Percent of map unit: 10 percent
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, base slope, crest, talf
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

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 C – NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY

NOAA Atlas 14, Volume 2, Version 3
Location name: Bayonne, New Jersey, USA*
Latitude: 40.6829°, Longitude: -74.1052°
Elevation: 53 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.334 (0.305-0.367)	0.398 (0.364-0.438)	0.471 (0.430-0.518)	0.525 (0.478-0.577)	0.594 (0.539-0.653)	0.642 (0.579-0.706)	0.690 (0.618-0.758)	0.733 (0.653-0.808)	0.788 (0.693-0.872)	0.832 (0.726-0.925)
10-min	0.531 (0.485-0.583)	0.635 (0.581-0.698)	0.752 (0.687-0.828)	0.837 (0.762-0.920)	0.940 (0.853-1.03)	1.01 (0.915-1.12)	1.09 (0.975-1.20)	1.15 (1.03-1.27)	1.24 (1.09-1.37)	1.29 (1.13-1.44)
15-min	0.662 (0.605-0.727)	0.795 (0.727-0.874)	0.948 (0.865-1.04)	1.05 (0.960-1.16)	1.19 (1.08-1.31)	1.28 (1.16-1.41)	1.37 (1.23-1.51)	1.45 (1.29-1.60)	1.55 (1.37-1.72)	1.62 (1.42-1.80)
30-min	0.904 (0.827-0.993)	1.09 (1.00-1.20)	1.34 (1.22-1.47)	1.52 (1.38-1.67)	1.75 (1.58-1.92)	1.92 (1.73-2.11)	2.09 (1.87-2.29)	2.24 (2.00-2.47)	2.45 (2.16-2.71)	2.60 (2.27-2.89)
60-min	1.12 (1.03-1.24)	1.37 (1.25-1.50)	1.71 (1.56-1.88)	1.97 (1.80-2.17)	2.32 (2.10-2.55)	2.59 (2.33-2.84)	2.86 (2.56-3.15)	3.13 (2.79-3.45)	3.50 (3.08-3.88)	3.78 (3.30-4.20)
2-hr	1.38 (1.26-1.53)	1.68 (1.54-1.86)	2.13 (1.94-2.36)	2.48 (2.25-2.74)	2.96 (2.67-3.27)	3.35 (3.00-3.70)	3.76 (3.34-4.15)	4.18 (3.69-4.62)	4.77 (4.16-5.29)	5.24 (4.52-5.82)
3-hr	1.54 (1.40-1.70)	1.87 (1.71-2.07)	2.37 (2.16-2.62)	2.76 (2.51-3.04)	3.30 (2.98-3.64)	3.75 (3.36-4.13)	4.20 (3.74-4.63)	4.69 (4.13-5.17)	5.36 (4.66-5.92)	5.89 (5.07-6.53)
6-hr	1.98 (1.81-2.18)	2.40 (2.19-2.65)	3.03 (2.76-3.33)	3.53 (3.20-3.88)	4.25 (3.83-4.66)	4.85 (4.33-5.31)	5.47 (4.85-6.00)	6.14 (5.40-6.75)	7.10 (6.14-7.82)	7.88 (6.73-8.71)
12-hr	2.42 (2.21-2.66)	2.93 (2.68-3.22)	3.72 (3.39-4.07)	4.37 (3.97-4.77)	5.31 (4.79-5.78)	6.12 (5.47-6.65)	6.98 (6.16-7.59)	7.92 (6.92-8.63)	9.30 (7.97-10.1)	10.5 (8.83-11.4)
24-hr	2.72 (2.51-2.96)	3.29 (3.04-3.58)	4.21 (3.88-4.57)	4.99 (4.59-5.41)	6.16 (5.63-6.66)	7.16 (6.50-7.74)	8.27 (7.44-8.94)	9.50 (8.46-10.3)	11.3 (9.94-12.3)	12.9 (11.2-14.1)
2-day	3.17 (2.92-3.46)	3.84 (3.53-4.20)	4.90 (4.50-5.34)	5.79 (5.30-6.31)	7.10 (6.46-7.73)	8.22 (7.43-8.95)	9.44 (8.46-10.3)	10.8 (9.57-11.8)	12.8 (11.2-14.0)	14.4 (12.4-15.9)
3-day	3.35 (3.09-3.65)	4.06 (3.74-4.42)	5.16 (4.75-5.62)	6.09 (5.58-6.62)	7.44 (6.78-8.08)	8.58 (7.78-9.32)	9.83 (8.83-10.7)	11.2 (9.96-12.2)	13.2 (11.6-14.4)	14.8 (12.8-16.3)
4-day	3.54 (3.26-3.84)	4.28 (3.95-4.65)	5.43 (5.00-5.90)	6.39 (5.87-6.93)	7.78 (7.11-8.43)	8.95 (8.13-9.70)	10.2 (9.20-11.1)	11.6 (10.4-12.6)	13.6 (12.0-14.9)	15.3 (13.3-16.8)
7-day	4.14 (3.84-4.47)	4.97 (4.61-5.37)	6.20 (5.74-6.69)	7.21 (6.66-7.78)	8.67 (7.97-9.35)	9.89 (9.03-10.7)	11.2 (10.1-12.1)	12.6 (11.3-13.6)	14.6 (12.9-15.9)	16.2 (14.2-17.8)
10-day	4.68 (4.36-5.03)	5.59 (5.21-6.01)	6.86 (6.39-7.38)	7.91 (7.35-8.50)	9.41 (8.70-10.1)	10.6 (9.78-11.4)	11.9 (10.9-12.9)	13.3 (12.1-14.4)	15.3 (13.7-16.6)	16.9 (14.9-18.4)
20-day	6.29 (5.90-6.70)	7.46 (7.00-7.96)	8.92 (8.36-9.50)	10.1 (9.42-10.7)	11.6 (10.8-12.4)	12.8 (11.9-13.7)	14.1 (13.0-15.0)	15.3 (14.1-16.4)	17.0 (15.5-18.2)	18.3 (16.5-19.7)
30-day	7.87 (7.43-8.34)	9.29 (8.77-9.84)	10.9 (10.3-11.5)	12.1 (11.4-12.8)	13.7 (12.9-14.5)	14.9 (14.0-15.8)	16.1 (15.0-17.1)	17.3 (16.0-18.3)	18.7 (17.3-20.0)	19.8 (18.2-21.2)
45-day	10.0 (9.48-10.6)	11.8 (11.1-12.4)	13.6 (12.9-14.4)	15.0 (14.2-15.8)	16.8 (15.8-17.7)	18.1 (17.1-19.2)	19.4 (18.2-20.5)	20.7 (19.3-21.9)	22.2 (20.7-23.6)	23.4 (21.7-24.9)
60-day	12.0 (11.4-12.6)	14.1 (13.3-14.8)	16.1 (15.2-16.9)	17.6 (16.7-18.5)	19.5 (18.4-20.5)	20.9 (19.7-22.0)	22.2 (20.9-23.4)	23.4 (22.0-24.7)	24.9 (23.3-26.3)	25.9 (24.2-27.5)

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

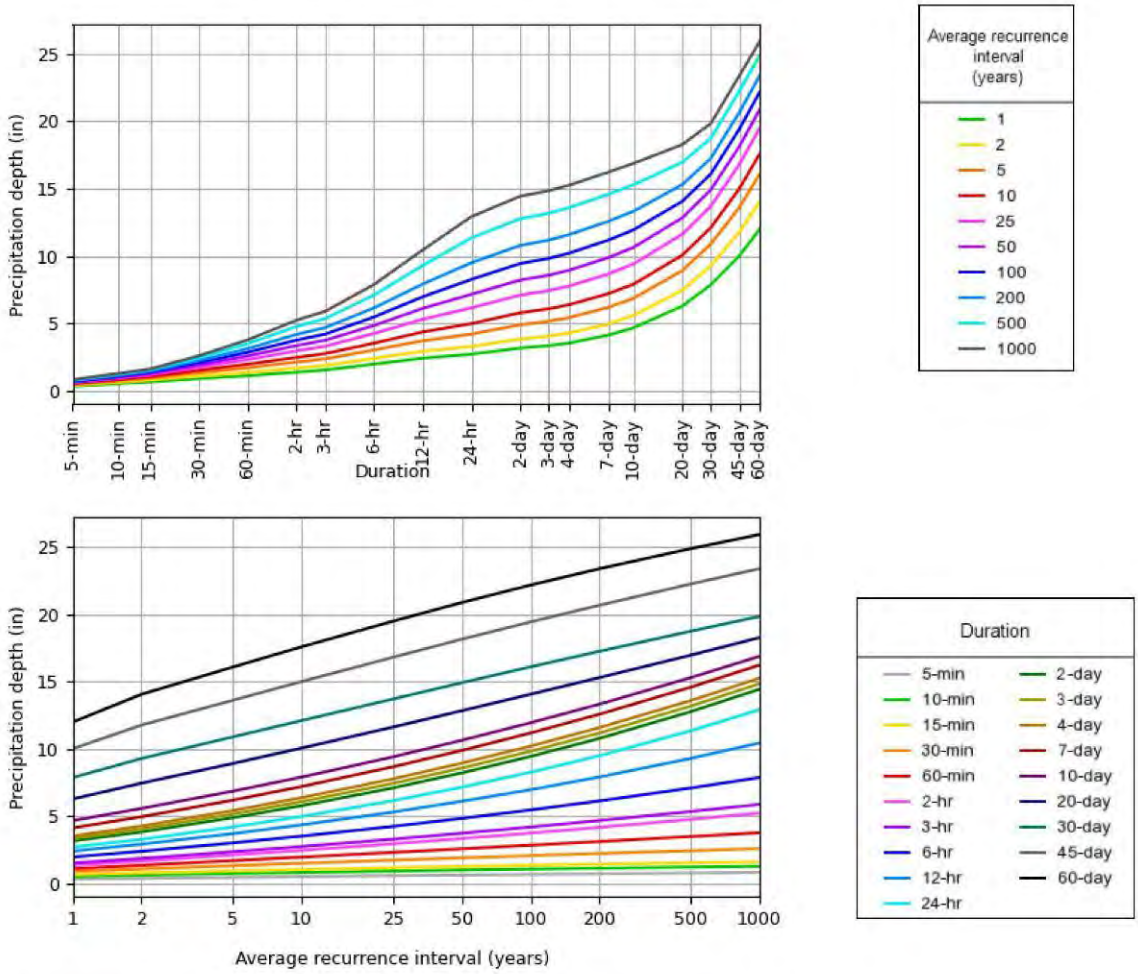
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 40.6829°, Longitude: -74.1052°



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Fri Sep 26 14:45:02 2025

Back to Top

Maps & aerials

Small scale terrain

Large scale terrain

Large scale map

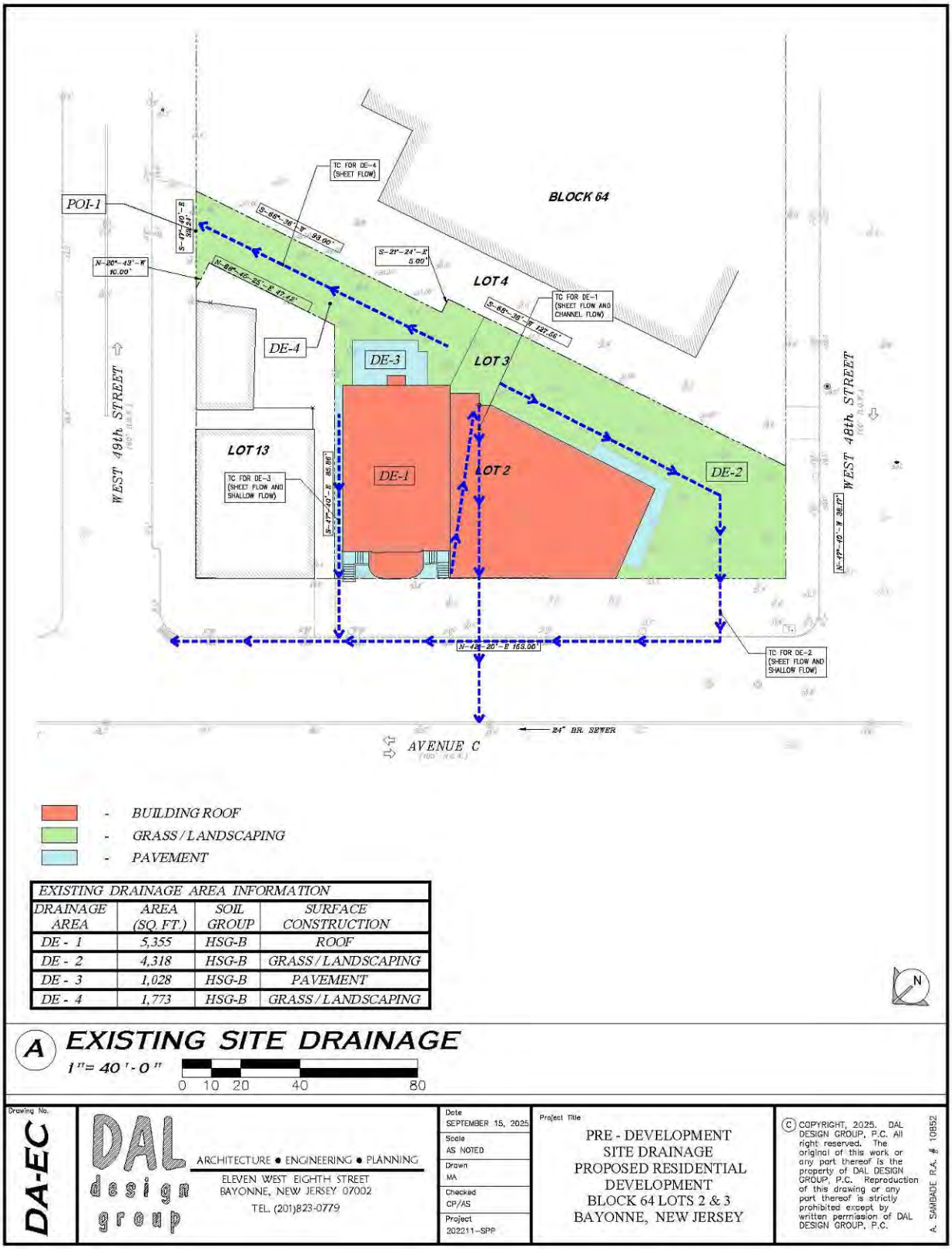
Large scale aerial

Back to Top

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

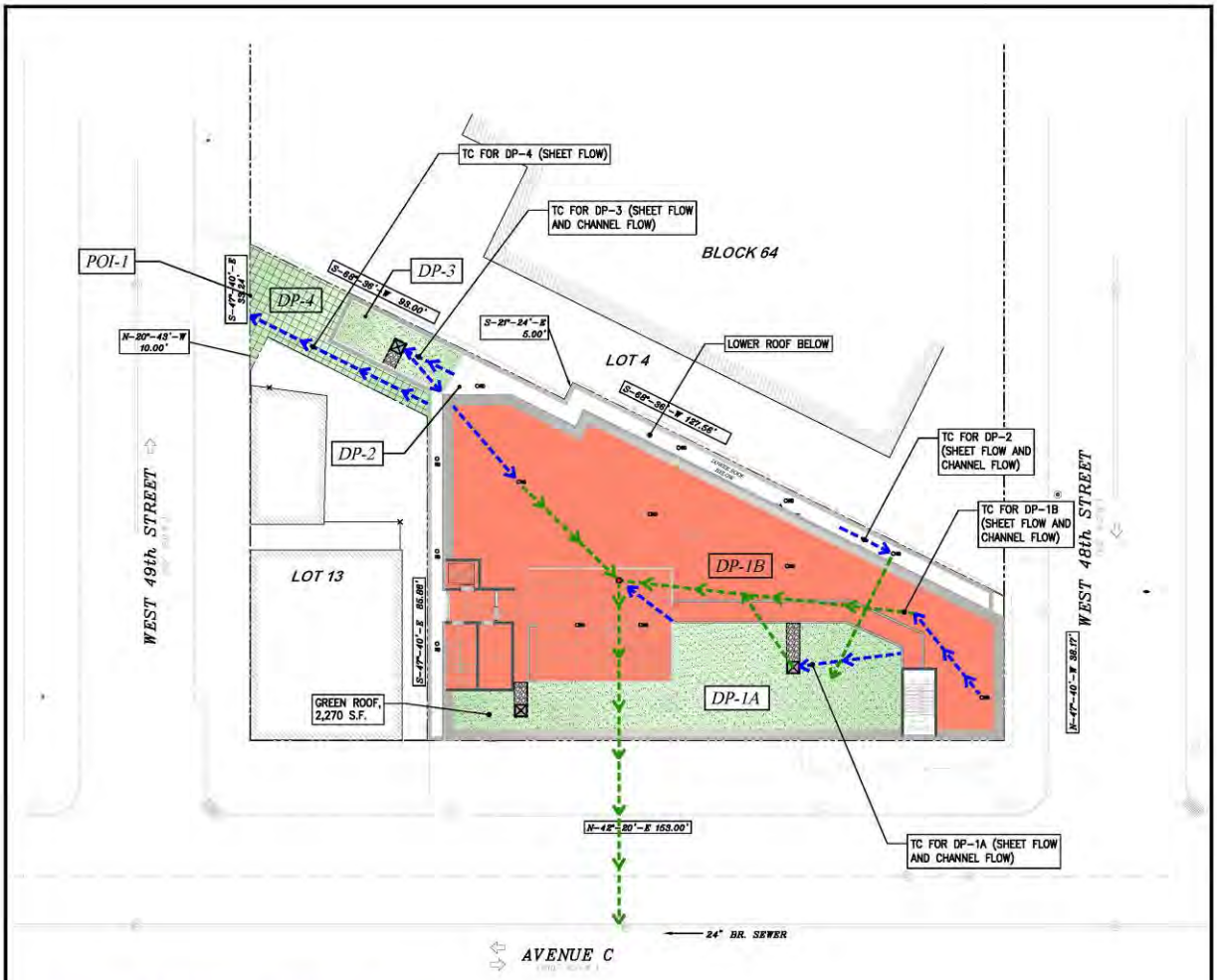
Disclaimer

APPENDIX D – PRE-DEVELOPMENT DRAINAGE MAP



EXISTING DRAINAGE AREA INFORMATION			
DRAINAGE AREA	AREA (SQ. FT.)	SOIL GROUP	SURFACE CONSTRUCTION
DE - 1	5,355	HSG-B	ROOF
DE - 2	4,318	HSG-B	GRASS / LANDSCAPING
DE - 3	1,028	HSG-B	PAVEMENT
DE - 4	1,773	HSG-B	GRASS / LANDSCAPING

APPENDIX E – POST-DEVELOPMENT DRAINAGE MAP



PROPOSED DRAINAGE AREA INFORMATION			
DRAINAGE AREA	AREA (SQ. FT.)	SOIL GROUP	SURFACE CONSTRUCTION
DP - 1A	2,270	HSG-D	GREEN ROOF
DP - 1B	7,770	HSG-D	BUILDING ROOF
DP - 2	1,408	HSG-D	LOWER BUILDING ROOF
DP - 3	325	HSG-D	LOWER GREEN ROOF
DP - 4	701	HSG-D	PERVIOUS PAVEMENT

A **PROPOSED SITE DRAINAGE**
1"= 40'-0"
0 10 20 40 80

Drawing No. DA-P

DAL design group
ARCHITECTURE • ENGINEERING • PLANNING
ELEVEN WEST EIGHTH STREET
BAYONNE, NEW JERSEY 07002
TEL. (201)823-0779

Date SEPTEMBER 15, 2025
Scale AS NOTED
Drawn MA
Checked CP/AS
Project 202211-SPP

Project Title
POST - DEVELOPMENT SITE DRAINAGE
PROPOSED RESIDENTIAL DEVELOPMENT
BLOCK 64 LOTS 2 & 3
BAYONNE, NEW JERSEY

A. SAMBADE R.A. # 10852

APPENDIX F – TR-55 TIME OF CONCENTRATION WORK SHEETS

(CURRENT ADJUSTED AND FUTURE ADJUSTED)

CURRENT ADJUSTED

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: ✓ Present Developed

Check one: ✓ T_c T_t through subarea DE-1 (current adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DE-1a				
1. Surface description (Table 3-1)		building roof				
2. Manning's roughness coeff., n (Table 3-1)		0.01				
3. Flow length, L (total L ≤ 100 ft)	ft	58				
4. Two-year 24-hour rainfall, P_2	in	3.4				
5. Land slope, s	ft/ft	0.010				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.02	+		=	0.02
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
Channel Flow	Segment ID	DE-1b				
12. Cross sectional flow area, a	ft^2	0.2				
13. Wetted perimeter, P_w	ft	1.6				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft	0.1				
15. Channel Slope, s	ft/ft	0.020				
16. Manning's Roughness Coeff., n		0.01				
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s	4.8				
18. Flow length, L	ft	107				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.01	+		=	0.01
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.02

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: ✓ Present Developed

Check one: ✓ T_c T_t through subarea DE-2 (current adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DE-2a			
1. Surface description (Table 3-1)		grass/LS			
2. Manning's roughness coeff., n (Table 3-1)		0.02			
3. Flow length, L (total L ≤ 100 ft)	ft	100			
4. Two-year 24-hour rainfall, P_2	in	3.4			
5. Land slope, s	ft/ft	0.016			
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.03	+		= 0.03

Shallow Concetrated Flow	Segment ID	DE-2b			
7. Surface description (paved or unpaved)		grass/LS	pavement		
8. Flow length, L	ft	6	204		
9. Watercourse slope, s	ft/ft	0.100	0.016		
10. Average velocity, V (Figure 3-1)	ft/s	0.7	2.5		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.00	0.02	+	= 0.03

Channel Flow	Segment ID				
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, P_w	ft				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft				
15. Channel Slope, s	ft/ft				
16. Manning's Roughness Coeff., n					
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s				
18. Flow length, L	ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr			+	=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 0.06

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: Date:

Check one: ✓ Present Developed

Check one: ✓ T_c T_t through subarea DE-3 (current adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)		Segment ID	DE-3			
1. Surface description (Table 3-1)			pavement			
2. Manning's roughness coeff., n (Table 3-1)			0.01			
3. Flow length, L (total L ≤ 100 ft)	ft		90			
4. Two-year 24-hour rainfall, P_2	in		3.4			
5. Land slope, s	ft/ft		0.007			
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.03	+		= 0.03

Shallow Concetrated Flow		Segment ID				
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=

Channel Flow		Segment ID				
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, P_w	ft					
14. Hydraulic radius, $r = \frac{a}{P_w}$	Compute r	ft				
15. Channel Slope, s	ft/ft					
16. Manning's Roughness Coeff., n						
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$	Compute V	ft/s				
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 0.03

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: ✓ Present Developed

Check one: ✓ T_c T_t through subarea DE-4 (current adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DE-4				
1. Surface description (Table 3-1)		grass/LS				
2. Manning's roughness coeff., n (Table 3-1)		0.02				
3. Flow length, L (total L ≤ 100 ft)	ft	95				
4. Two-year 24-hour rainfall, P_2	in	3.4				
5. Land slope, s	ft/ft	0.060				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.02	+		=	0.02
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
Channel Flow	Segment ID					
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, P_w	ft					
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft					
15. Channel Slope, s	ft/ft					
16. Manning's Roughness Coeff., n						
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s					
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.02

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: Date:

Check one: Present ✓ Developed

Check one: ✓ T_c T_t through subarea DP-1A (current adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DP-1A			
1. Surface description (Table 3-1)		green roof			
2. Manning's roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L ≤ 100 ft) ft		25			
4. Two-year 24-hour rainfall, P_2 in		3.4			
5. Land slope, s ft/ft		0.010			
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t hr	0.10	+	=	0.10

Shallow Concetrated Flow	Segment ID				
7. Surface description (paved or unpaved)					
8. Flow length, L ft					
9. Watercourse slope, s ft/ft					
10. Average velocity, V (Figure 3-1) ft/s					
11. $T_t = \frac{L}{3600 V}$	Compute T_t hr		+	=	

Channel Flow	Segment ID				
12. Cross sectional flow area, a ft^2					
13. Wetted perimeter, P_w ft					
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r ft					
15. Channel Slope, s ft/ft					
16. Manning's Roughness Coeff., n					
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$	Compute V ft/s				
18. Flow length, L ft					
19. $T_t = \frac{L}{3600 V}$	Compute T_t hr		+	=	

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19 hr: 0.10

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: Date:

Check one: Present ✓ Developed

Check one: ✓ T_c T_t through subarea DP-1B (current adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DP-1B				
1. Surface description (Table 3-1)		building roof				
2. Manning's roughness coeff., n (Table 3-1)		0.01				
3. Flow length, L (total L ≤ 100 ft)	ft	25				
4. Two-year 24-hour rainfall, P_2	in	3.4				
5. Land slope, s	ft/ft	0.010				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t hr	0.01	+		=	0.01
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600 V}$	Compute T_t hr		+		=	
Channel Flow	Segment ID	DP-1B				
12. Cross sectional flow area, a	ft^2	0.2				
13. Wetted perimeter, P_w	ft	1.6				
14. Hydraulic radius, $r = \frac{a}{P_w}$	Compute r ft	0.1				
15. Channel Slope, s	ft/ft	0.010				
16. Manning's Roughness Coeff., n		0.01				
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$	Compute V ft/s	3.4				
18. Flow length, L	ft	125				
19. $T_t = \frac{L}{3600 V}$	Compute T_t hr	0.01	+		=	0.01
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.01

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: Date:

Check one: Present ✓ Developed

Check one: ✓ T_c T_t through subarea DP-2 (current adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DP-2A				
1. Surface description (Table 3-1)		lower roof				
2. Manning's roughness coeff., n (Table 3-1)		0.01				
3. Flow length, L (total L ≤ 100 ft)	ft	35				
4. Two-year 24-hour rainfall, P_2	in	3.4				
5. Land slope, s	ft/ft	0.010				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t hr	0.01	+		=	0.01
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600 V}$	Compute T_t hr		+		=	
Channel Flow	Segment ID	DP-2B				
12. Cross sectional flow area, a	ft^2	0.2				
13. Wetted perimeter, P_w	ft	1.6				
14. Hydraulic radius, $r = \frac{a}{P_w}$	Compute r ft	0.1				
15. Channel Slope, s	ft/ft	0.010				
16. Manning's Roughness Coeff., n		0.01				
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$	Compute V ft/s	3.4				
18. Flow length, L	ft	50				
19. $T_t = \frac{L}{3600 V}$	Compute T_t hr	0.00	+		=	0.00
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.01

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: Present ✓ Developed

Check one: ✓ T_c T_t through subarea DP-3 (current adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DP-3A				
1. Surface description (Table 3-1)		green roof				
2. Manning's roughness coeff., n (Table 3-1)		0.24				
3. Flow length, L (total L ≤ 100 ft)	ft	15				
4. Two-year 24-hour rainfall, P_2	in	3.4				
5. Land slope, s	ft/ft	0.010				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.07	+		=	0.07
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
Channel Flow	Segment ID	DP-3B				
12. Cross sectional flow area, a	ft^2	0.2				
13. Wetted perimeter, P_w	ft	1.6				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft	0.1				
15. Channel Slope, s	ft/ft	0.010				
16. Manning's Roughness Coeff., n		0.01				
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s	3.4				
18. Flow length, L	ft	82				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.01	+		=	0.01
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.07

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: Present ✓ Developed

Check one: ✓ T_c T_t through subarea DP-4 (current adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DP-4				
1. Surface description (Table 3-1)		pervious pvmt.				
2. Manning's roughness coeff., n (Table 3-1)		0.24				
3. Flow length, L (total L ≤ 100 ft)	ft	50				
4. Two-year 24-hour rainfall, P_2	in	3.4				
5. Land slope, s	ft/ft	0.100				
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.07	+		=	0.07
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		+		=	
Channel Flow	Segment ID					
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, P_w	ft					
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft					
15. Channel Slope, s	ft/ft					
16. Manning's Roughness Coeff., n						
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s					
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		+		=	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.07

Print Form Reset Form Save Form

FUTURE ADJUSTED

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: ✓ Present Developed

Check one: ✓ T_c T_t through subarea DE-1 (future adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DE-1a				
1. Surface description (Table 3-1)		building roof				
2. Manning's roughness coeff., n (Table 3-1)		0.01				
3. Flow length, L (total L ≤ 100 ft)	ft	58				
4. Two-year 24-hour rainfall, P_2	in	3.9				
5. Land slope, s	ft/ft	0.010				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.02	+		=	0.02
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
Channel Flow	Segment ID	DE-1b				
12. Cross sectional flow area, a	ft^2	0.2				
13. Wetted perimeter, P_w	ft	1.6				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft	0.1				
15. Channel Slope, s	ft/ft	0.020				
16. Manning's Roughness Coeff., n		0.01				
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s	4.8				
18. Flow length, L	ft	107				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.01	+		=	0.01
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.02

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: ✓ Present Developed

Check one: ✓ T_c T_t through subarea DE-2 (future adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DE-2a				
1. Surface description (Table 3-1)		grass/LS				
2. Manning's roughness coeff., n (Table 3-1)		0.02				
3. Flow length, L (total L ≤ 100 ft)	ft	100				
4. Two-year 24-hour rainfall, P_2	in	3.9				
5. Land slope, s	ft/ft	0.016				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.03	+		=	0.03
Shallow Concetrated Flow	Segment ID	DE-2b				
7. Surface description (paved or unpaved)		grass/LS		pavement		
8. Flow length, L	ft	6		204		
9. Watercourse slope, s	ft/ft	0.100		0.016		
10. Average velocity, V (Figure 3-1)	ft/s	0.7		2.5		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.00	+	0.02	=	0.03
Channel Flow	Segment ID					
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, P_w	ft					
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft					
15. Channel Slope, s	ft/ft					
16. Manning's Roughness Coeff., n						
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s					
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.05

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: ✓ Present Developed

Check one: ✓ T_c T_t through subarea DE-3 (future adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DE-3				
1. Surface description (Table 3-1)		pavement				
2. Manning's roughness coeff., n (Table 3-1)		0.01				
3. Flow length, L (total L ≤ 100 ft)	ft	90				
4. Two-year 24-hour rainfall, P_2	in	3.9				
5. Land slope, s	ft/ft	0.007				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.02	+		=	0.02
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
Channel Flow	Segment ID					
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, P_w	ft					
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft					
15. Channel Slope, s	ft/ft					
16. Manning's Roughness Coeff., n						
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s					
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.02

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: ✓ Present Developed

Check one: ✓ T_c T_t through subarea DE-4 (future adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DE-4				
1. Surface description (Table 3-1)		grass/LS				
2. Manning's roughness coeff., n (Table 3-1)		0.02				
3. Flow length, L (total L ≤ 100 ft)	ft	95				
4. Two-year 24-hour rainfall, P_2	in	3.9				
5. Land slope, s	ft/ft	0.060				
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.02	+		=	0.02
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		+		=	
Channel Flow	Segment ID					
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, P_w	ft					
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft					
15. Channel Slope, s	ft/ft					
16. Manning's Roughness Coeff., n						
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s					
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		+		=	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.02

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: Present ✓ Developed

Check one: ✓ T_c T_t through subarea DP-1A (future adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)		Segment ID	DP-1A			
1. Surface description (Table 3-1)			green roof			
2. Manning's roughness coeff., n (Table 3-1)			0.24			
3. Flow length, L (total L ≤ 100 ft)	ft		25			
4. Two-year 24-hour rainfall, P_2	in		3.9			
5. Land slope, s	ft/ft		0.010			
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.09	+		= 0.09
Shallow Concetrated Flow		Segment ID				
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=
Channel Flow		Segment ID				
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, P_w	ft					
14. Hydraulic radius, $r = \frac{a}{P_w}$	Compute r	ft				
15. Channel Slope, s	ft/ft					
16. Manning's Roughness Coeff., n						
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$	Compute V	ft/s				
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19		hr				0.09

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: Present ✓ Developed

Check one: ✓ T_c T_t through subarea DP-1B (future adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DP-1B				
1. Surface description (Table 3-1)		building roof				
2. Manning's roughness coeff., n (Table 3-1)		0.01				
3. Flow length, L (total L ≤ 100 ft)	ft	25				
4. Two-year 24-hour rainfall, P_2	in	3.9				
5. Land slope, s	ft/ft	0.010				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.01	+		=	0.01
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
Channel Flow	Segment ID	DP-1B				
12. Cross sectional flow area, a	ft^2	0.2				
13. Wetted perimeter, P_w	ft	1.6				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft	0.1				
15. Channel Slope, s	ft/ft	0.010				
16. Manning's Roughness Coeff., n		0.01				
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s	3.4				
18. Flow length, L	ft	125				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.01	+		=	0.01
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.01

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: Present ✓ Developed

Check one: ✓ T_c T_t through subarea DP-2 (future adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DP-2A				
1. Surface description (Table 3-1)		lower roof				
2. Manning's roughness coeff., n (Table 3-1)		0.01				
3. Flow length, L (total L ≤ 100 ft)	ft	35				
4. Two-year 24-hour rainfall, P_2	in	3.9				
5. Land slope, s	ft/ft	0.010				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.01	+		=	0.01
Shallow Concetrated Flow	Segment ID					
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	
Channel Flow	Segment ID	DP-2B				
12. Cross sectional flow area, a	ft^2	0.2				
13. Wetted perimeter, P_w	ft	1.6				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft	0.1				
15. Channel Slope, s	ft/ft	0.010				
16. Manning's Roughness Coeff., n		0.01				
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s	3.4				
18. Flow length, L	ft	50				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.00	+		=	0.00
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr					0.01

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: Present ✓ Developed

Check one: ✓ T_c T_t through subarea DP-3 (future adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)		Segment ID	DP-3A			
1. Surface description (Table 3-1)			green roof			
2. Manning's roughness coeff., n (Table 3-1)			0.24			
3. Flow length, L (total L ≤ 100 ft)	ft		15			
4. Two-year 24-hour rainfall, P_2	in		3.9			
5. Land slope, s	ft/ft		0.010			
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.06	+		= 0.06
Shallow Concetrated Flow		Segment ID				
7. Surface description (paved or unpaved)						
8. Flow length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (Figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr		+		=
Channel Flow		Segment ID	DP-3B			
12. Cross sectional flow area, a	ft^2		0.2			
13. Wetted perimeter, P_w	ft		1.6			
14. Hydraulic radius, $r = \frac{a}{P_w}$	Compute r	ft	0.1			
15. Channel Slope, s	ft/ft		0.010			
16. Manning's Roughness Coeff., n			0.01			
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$	Compute V	ft/s	3.4			
18. Flow length, L	ft		82			
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.01	+		= 0.01
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19		hr				0.07

Print Form Reset Form Save Form

U.S. Department of Agriculture
Natural Resources Conservation Service

FL-ENG-21B
06/04

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: 1012-1022 Avenue C Designed By: AS Date: 9/20/25

Location: Bayonne, NJ Checked By: _____ Date: _____

Check one: Present ✓ Developed

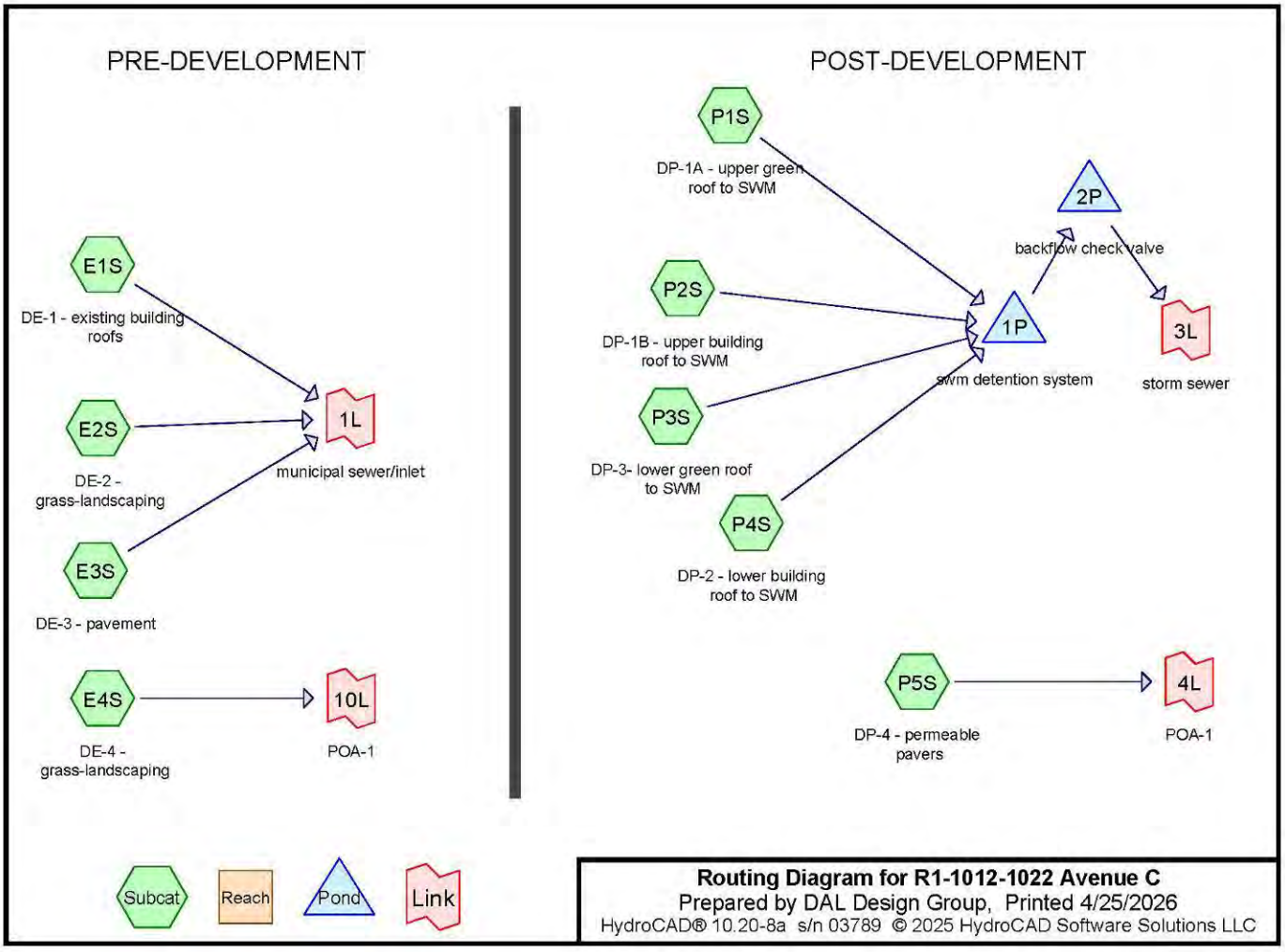
Check one: ✓ T_c T_t through subarea DP-4 (future adjusted rainfall)

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only)	Segment ID	DP-4			
1. Surface description (Table 3-1)		pervious pvmt.			
2. Manning's roughness coeff., n (Table 3-1)		0.24			
3. Flow length, L (total L ≤ 100 ft)	ft	50			
4. Two-year 24-hour rainfall, P_2	in	3.9			
5. Land slope, s	ft/ft	0.100			
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.06	+	=	0.06
Shallow Concetrated Flow	Segment ID				
7. Surface description (paved or unpaved)					
8. Flow length, L	ft				
9. Watercourse slope, s	ft/ft				
10. Average velocity, V (Figure 3-1)	ft/s				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=	
Channel Flow	Segment ID				
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, P_w	ft				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft				
15. Channel Slope, s	ft/ft				
16. Manning's Roughness Coeff., n					
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s				
18. Flow length, L	ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=	
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19	hr				0.06

Print Form Reset Form Save Form

APPENDIX G – ROUTING DIAGRAMS



APPENDIX H – PRE-DEVELOPMENT HYDROGRAPH REPORTS (CURRENT AND FUTURE ADJUSTED)

CURRENT ADJUSTED – PRE-DEVELOPMENT

Summary for Subcatchment E1S: DE-1 - existing building roofs

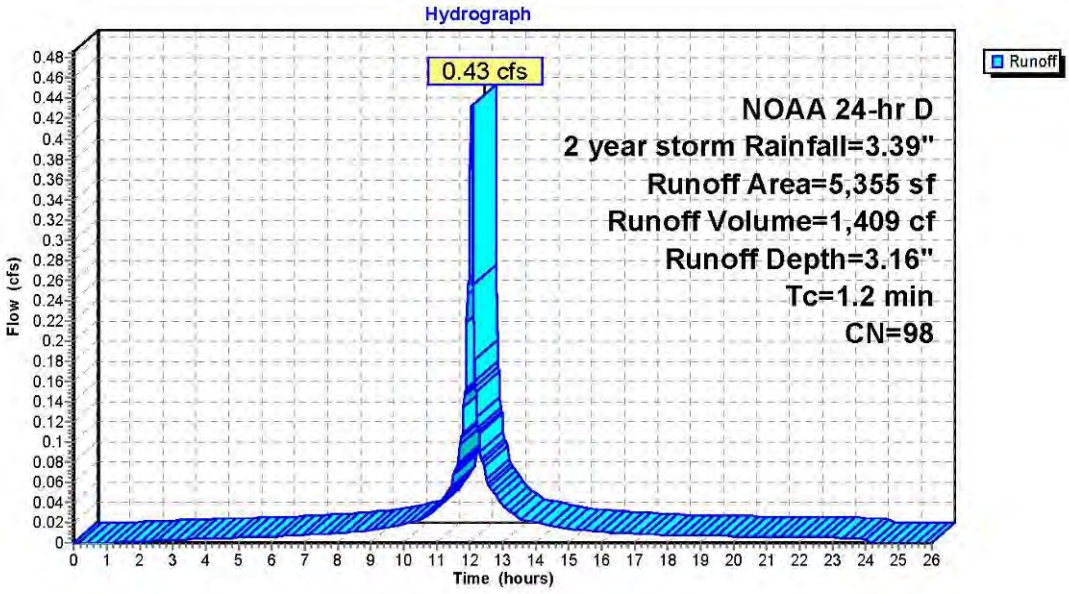
Runoff = 0.43 cfs @ 12.09 hrs, Volume= 1,409 cf, Depth= 3.16"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.39"

Area (sf)	CN	Description
5,355	98	Roofs, HSG B
5,355	98	100.00% Impervious Area

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

Subcatchment E1S: DE-1 - existing building roofs



Summary for Subcatchment E1S: DE-1 - existing building roofs

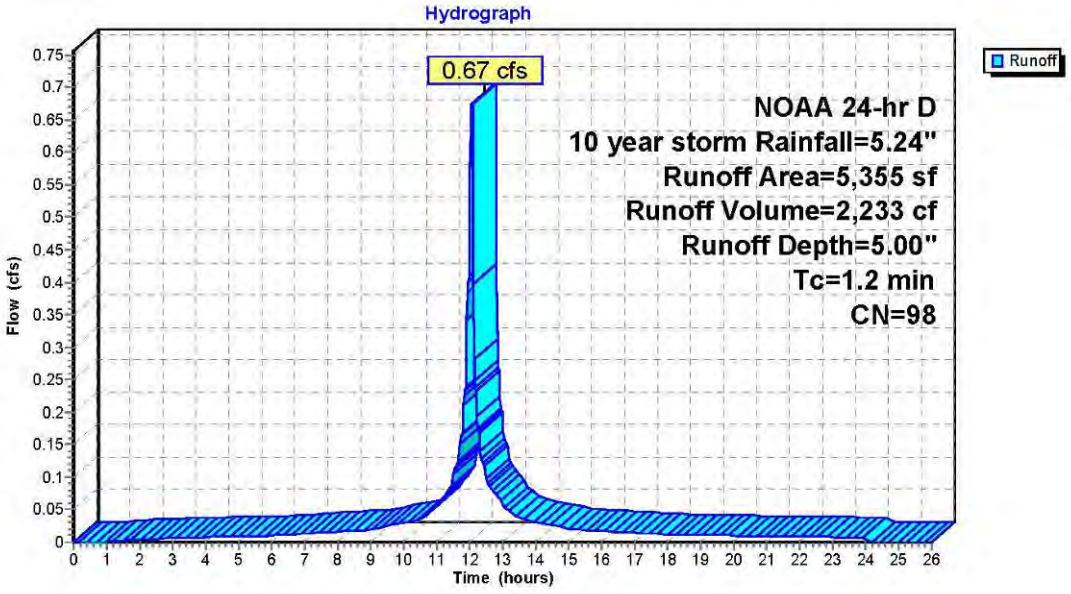
Runoff = 0.67 cfs @ 12.09 hrs, Volume= 2,233 cf, Depth= 5.00"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.24"

Area (sf)	CN	Description
5,355	98	Roofs, HSG B
5,355	98	100.00% Impervious Area

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

Subcatchment E1S: DE-1 - existing building roofs



Summary for Subcatchment E1S: DE-1 - existing building roofs

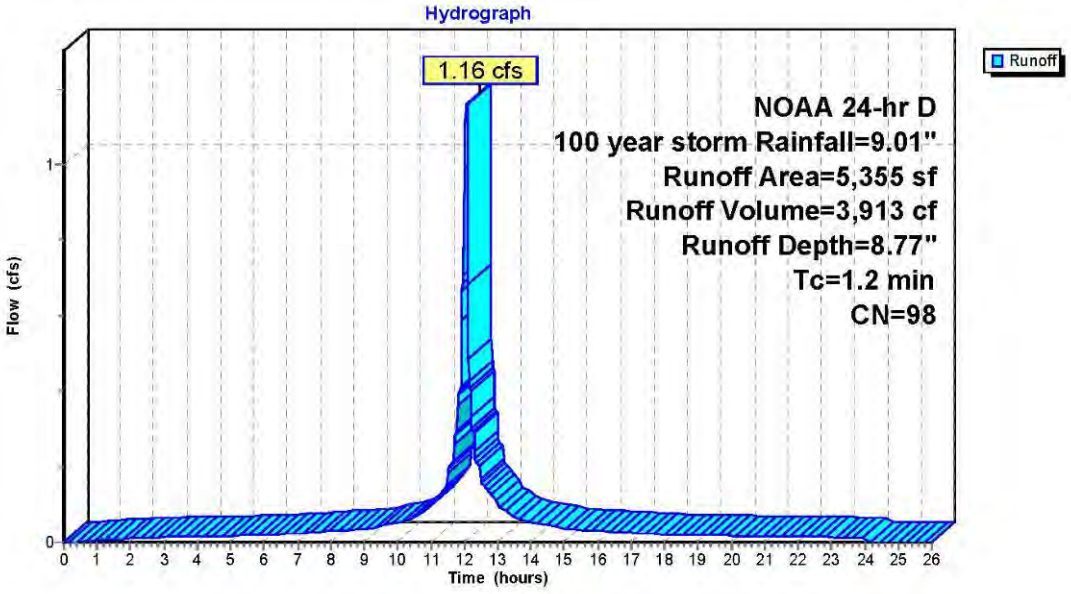
Runoff = 1.16 cfs @ 12.09 hrs, Volume= 3,913 cf, Depth= 8.77"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=9.01"

Area (sf)	CN	Description
5,355	98	Roofs, HSG B
5,355	98	100.00% Impervious Area

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

Subcatchment E1S: DE-1 - existing building roofs



Summary for Subcatchment E2S: DE-2 - grass-landscaping

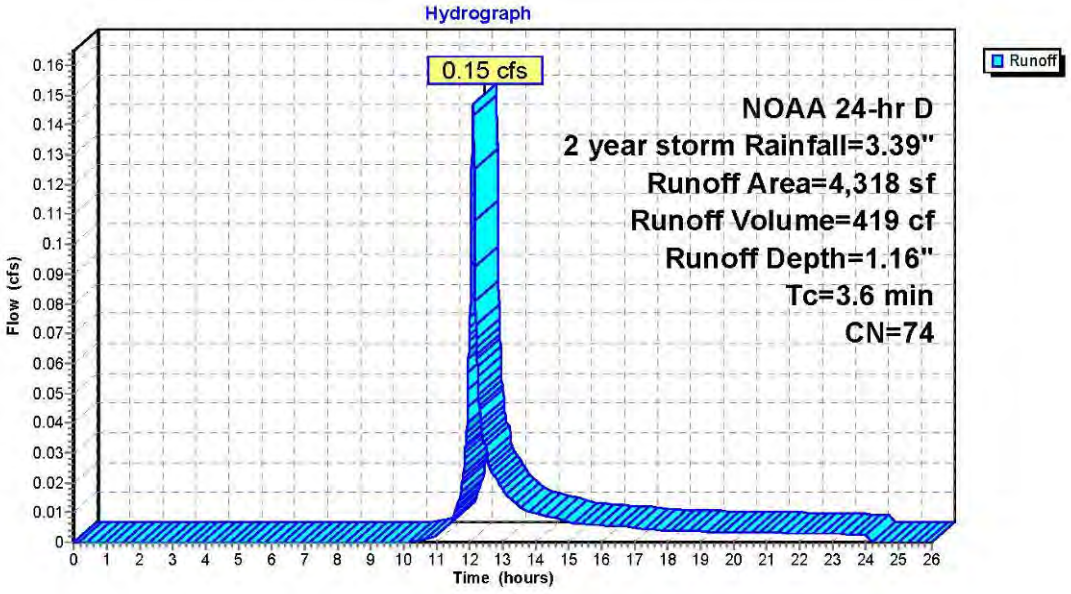
Runoff = 0.15 cfs @ 12.11 hrs, Volume= 419 cf, Depth= 1.16"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.39"

	Area (sf)	CN	Description
*	4,318	74	<50% Grass cover, Poor, HSG B
	4,318	74	100.00% Pervious Area

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

Subcatchment E2S: DE-2 - grass-landscaping



Summary for Subcatchment E2S: DE-2 - grass-landscaping

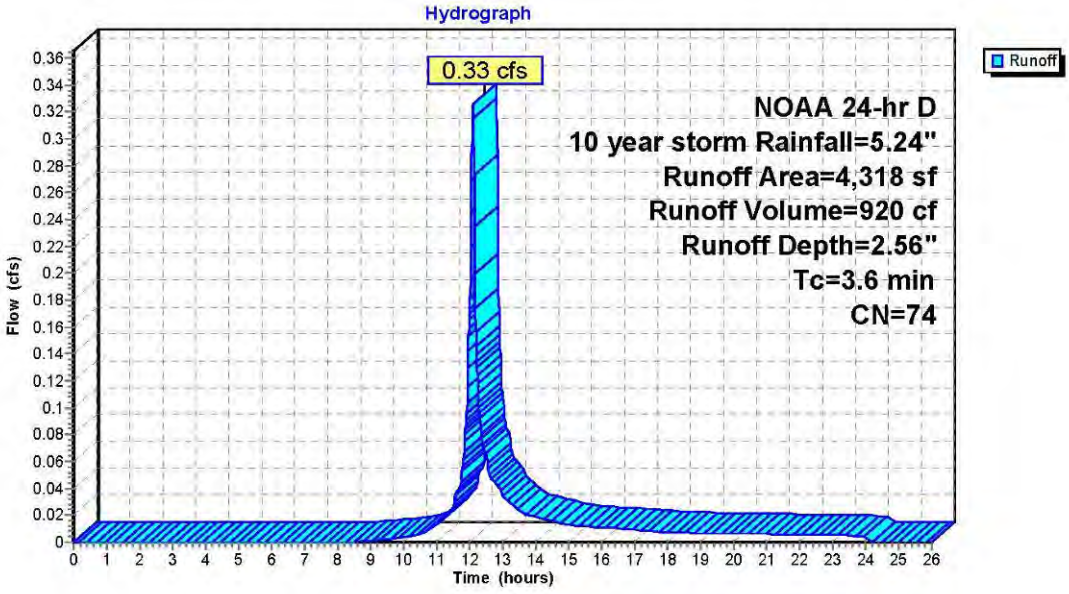
Runoff = 0.33 cfs @ 12.11 hrs, Volume= 920 cf, Depth= 2.56"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.24"

	Area (sf)	CN	Description
*	4,318	74	<50% Grass cover, Poor, HSG B
	4,318	74	100.00% Pervious Area

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

Subcatchment E2S: DE-2 - grass-landscaping



Summary for Subcatchment E2S: DE-2 - grass-landscaping

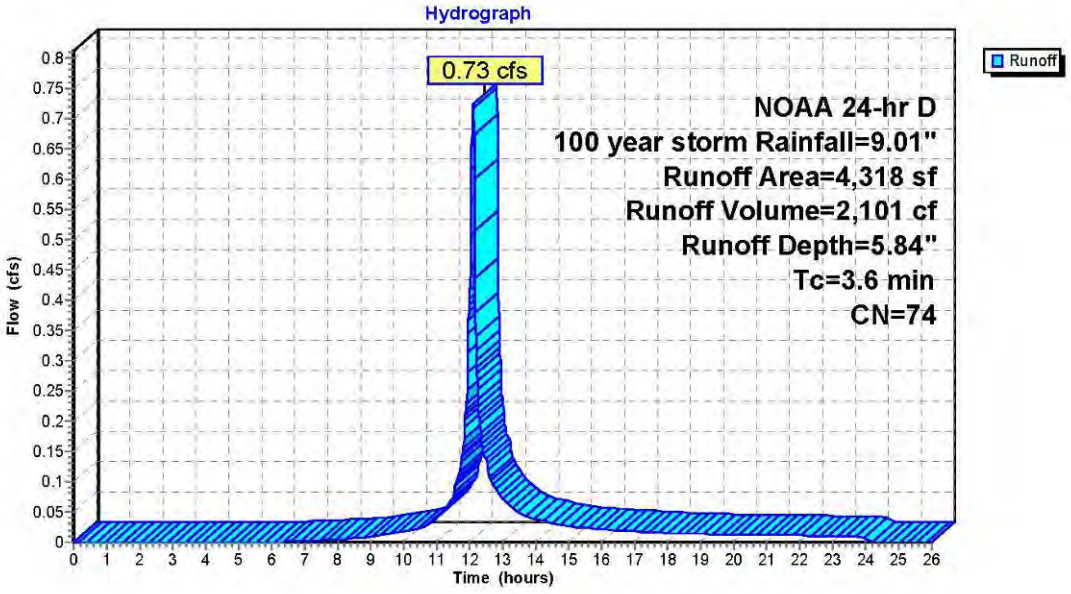
Runoff = 0.73 cfs @ 12.11 hrs, Volume= 2,101 cf, Depth= 5.84"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=9.01"

	Area (sf)	CN	Description
*	4,318	74	<50% Grass cover, Poor, HSG B
	4,318	74	100.00% Pervious Area

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

Subcatchment E2S: DE-2 - grass-landscaping



Summary for Subcatchment E3S: DE-3 - pavement

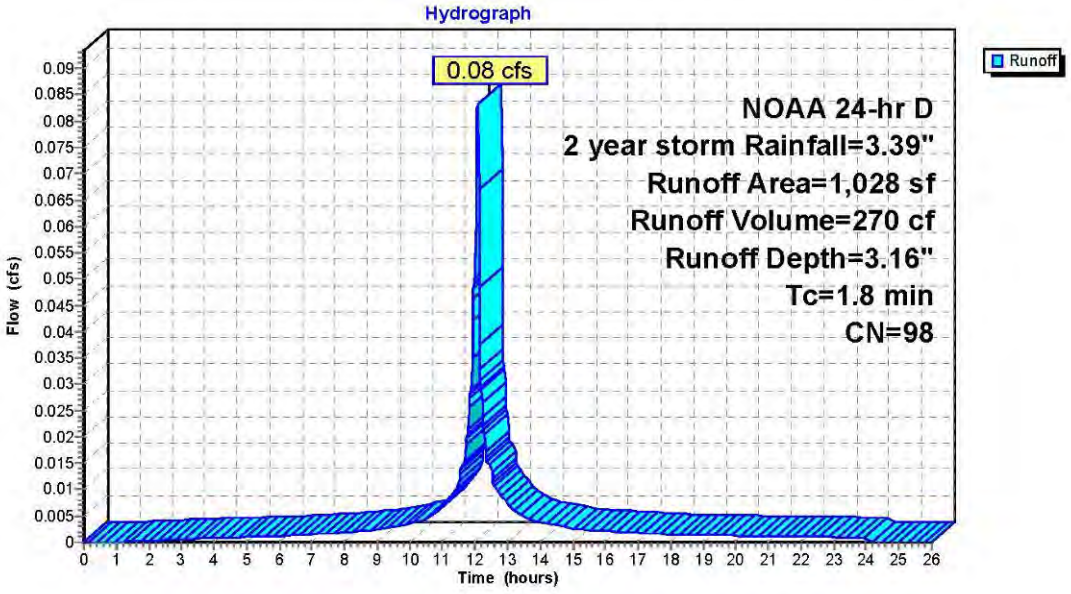
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 270 cf, Depth= 3.16"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.39"

Area (sf)	CN	Description
1,028	98	Paved parking, HSG B
1,028	98	100.00% Impervious Area

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

Subcatchment E3S: DE-3 - pavement



Summary for Subcatchment E3S: DE-3 - pavement

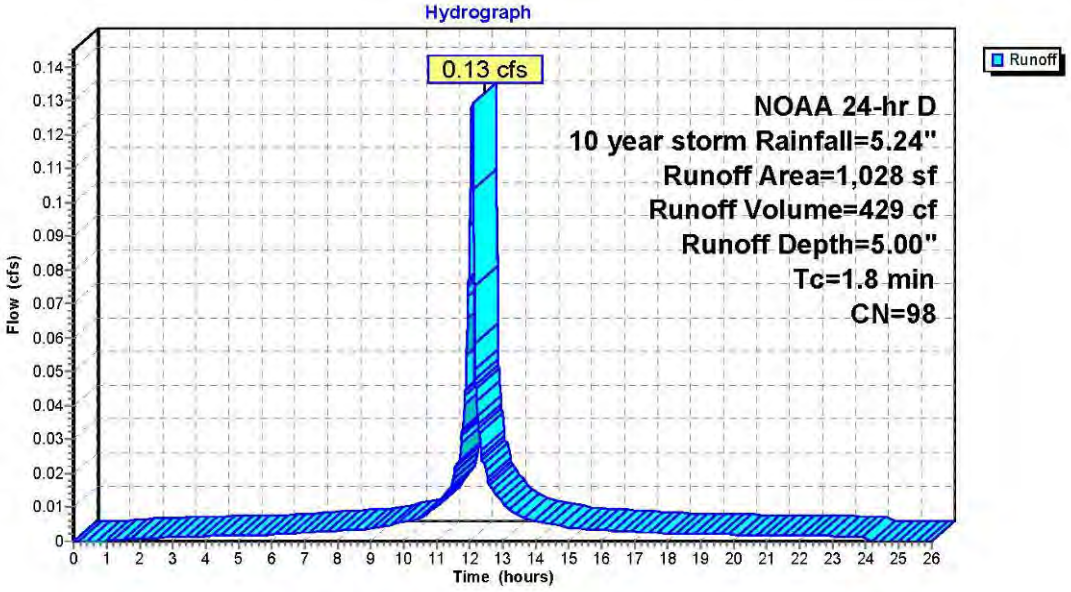
Runoff = 0.13 cfs @ 12.10 hrs, Volume= 429 cf, Depth= 5.00"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.24"

Area (sf)	CN	Description
1,028	98	Paved parking, HSG B
1,028	98	100.00% Impervious Area

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

Subcatchment E3S: DE-3 - pavement



Summary for Subcatchment E3S: DE-3 - pavement

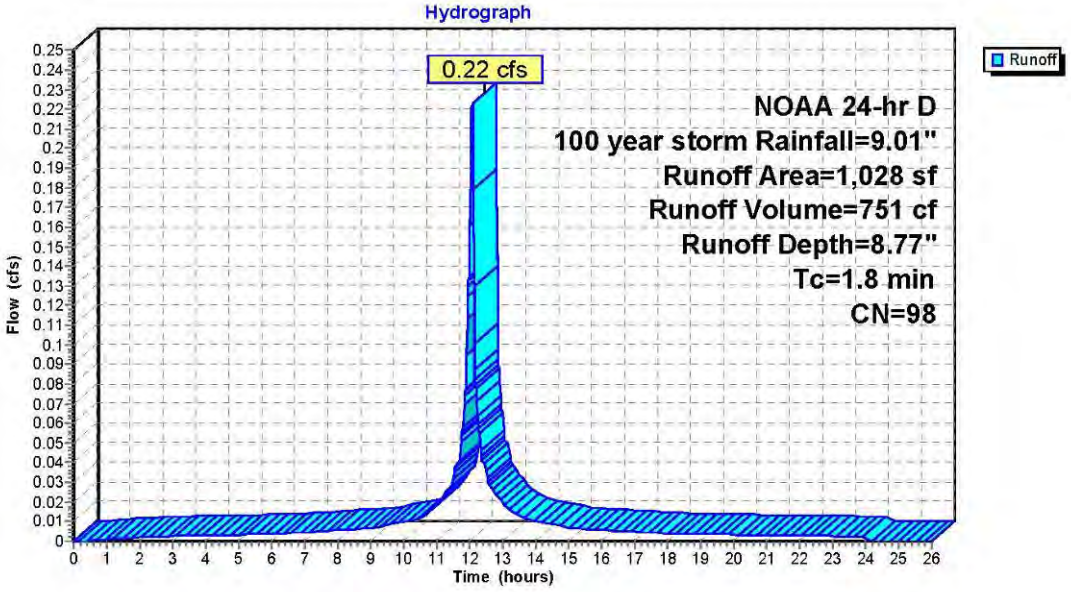
Runoff = 0.22 cfs @ 12.10 hrs, Volume= 751 cf, Depth= 8.77"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=9.01"

Area (sf)	CN	Description
1,028	98	Paved parking, HSG B
1,028	98	100.00% Impervious Area

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

Subcatchment E3S: DE-3 - pavement



Summary for Subcatchment E4S: DE-4 - grass-landscaping

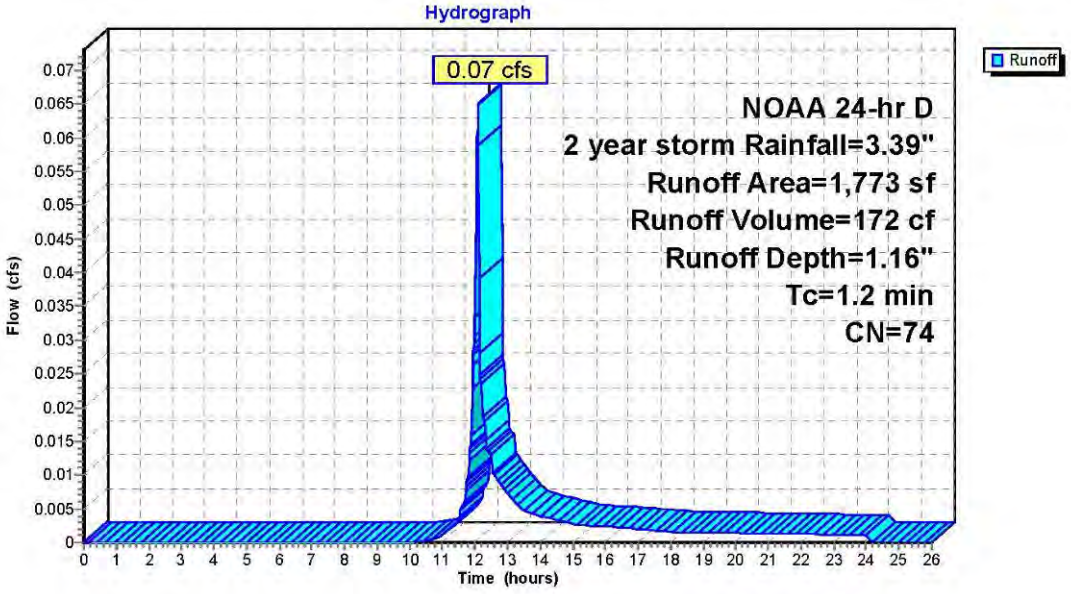
Runoff = 0.07 cfs @ 12.10 hrs, Volume= 172 cf, Depth= 1.16"
Routed to Link 10L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.39"

	Area (sf)	CN	Description
*	1,773	74	<50% Grass cover, Poor, HSG B
	1,773	74	100.00% Pervious Area

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

Subcatchment E4S: DE-4 - grass-landscaping



Summary for Subcatchment E4S: DE-4 - grass-landscaping

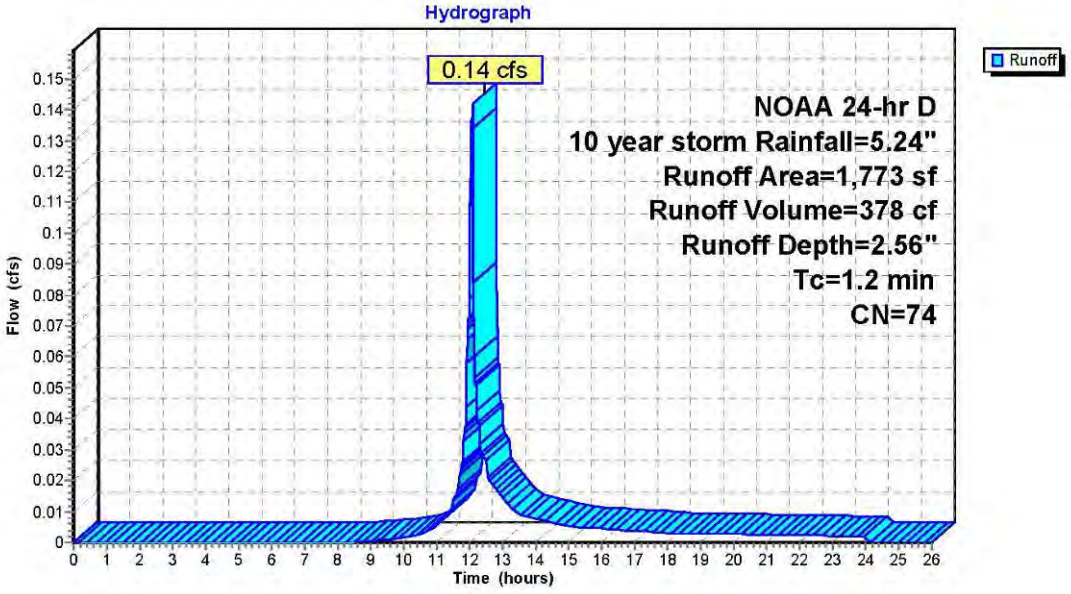
Runoff = 0.14 cfs @ 12.10 hrs, Volume= 378 cf, Depth= 2.56"
Routed to Link 10L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.24"

	Area (sf)	CN	Description
*	1,773	74	<50% Grass cover, Poor, HSG B
	1,773	74	100.00% Pervious Area

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

Subcatchment E4S: DE-4 - grass-landscaping



Summary for Subcatchment E4S: DE-4 - grass-landscaping

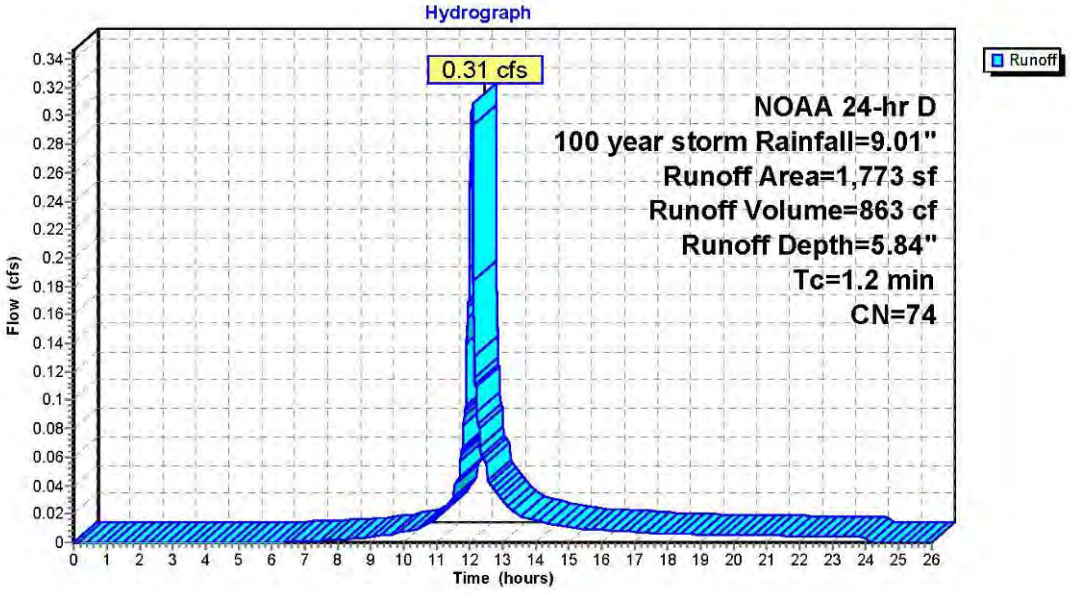
Runoff = 0.31 cfs @ 12.10 hrs, Volume= 863 cf, Depth= 5.84"
Routed to Link 10L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=9.01"

	Area (sf)	CN	Description
*	1,773	74	<50% Grass cover, Poor, HSG B
	1,773	74	100.00% Pervious Area

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

Subcatchment E4S: DE-4 - grass-landscaping



FUTURE ADJUSTED – PRE-DEVELOPMENT

Summary for Subcatchment E1S: DE-1 - existing building roofs

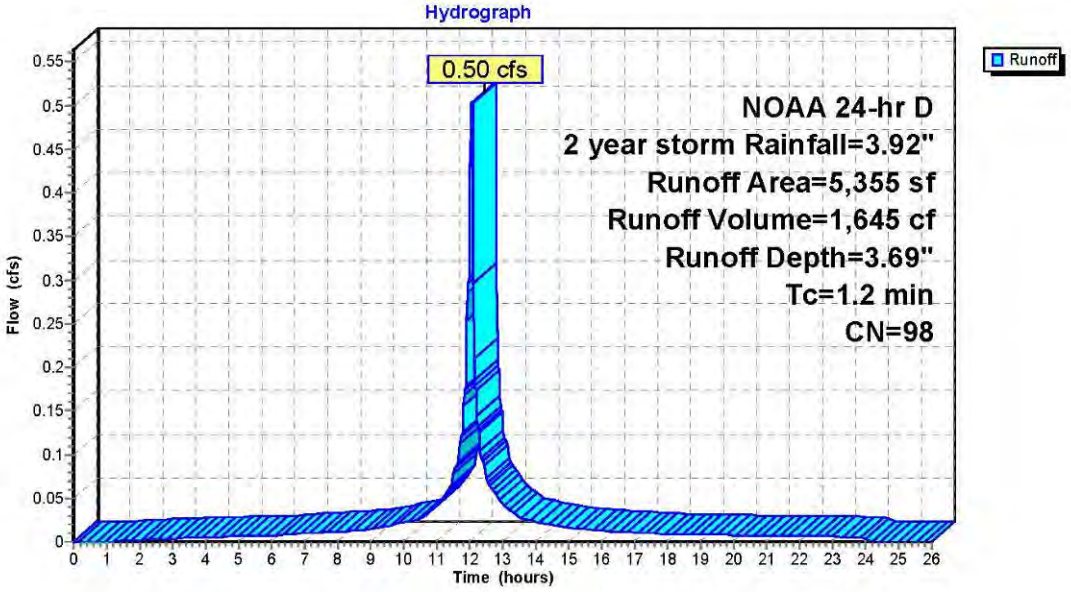
Runoff = 0.50 cfs @ 12.09 hrs, Volume= 1,645 cf, Depth= 3.69"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.92"

Area (sf)	CN	Description
5,355	98	Roofs, HSG B
5,355	98	100.00% Impervious Area

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

Subcatchment E1S: DE-1 - existing building roofs



Summary for Subcatchment E1S: DE-1 - existing building roofs

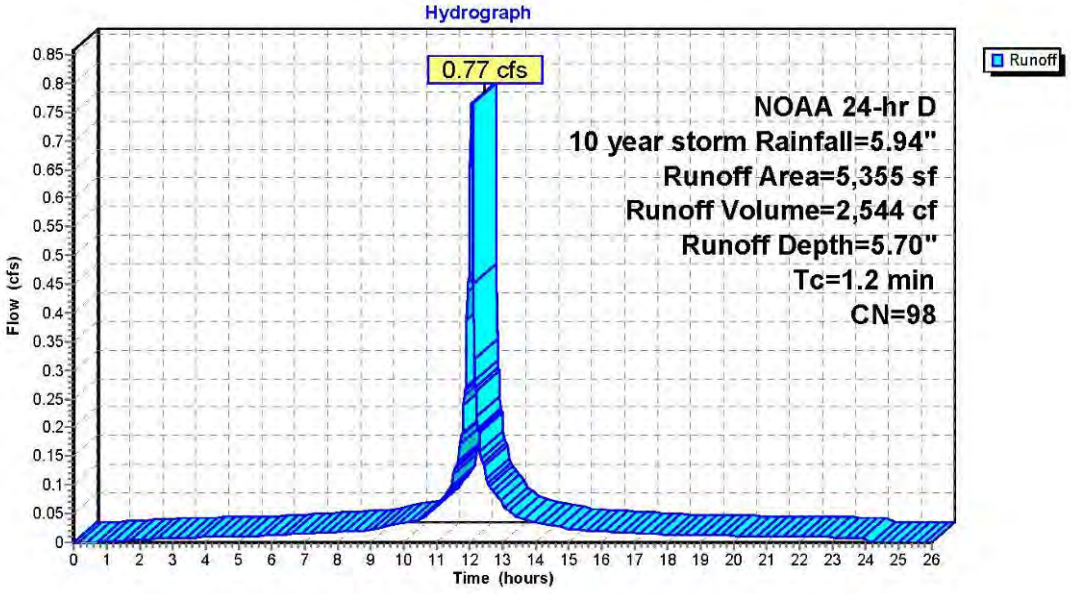
Runoff = 0.77 cfs @ 12.09 hrs, Volume= 2,544 cf, Depth= 5.70"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.94"

Area (sf)	CN	Description
5,355	98	Roofs, HSG B
5,355	98	100.00% Impervious Area

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

Subcatchment E1S: DE-1 - existing building roofs



Summary for Subcatchment E1S: DE-1 - existing building roofs

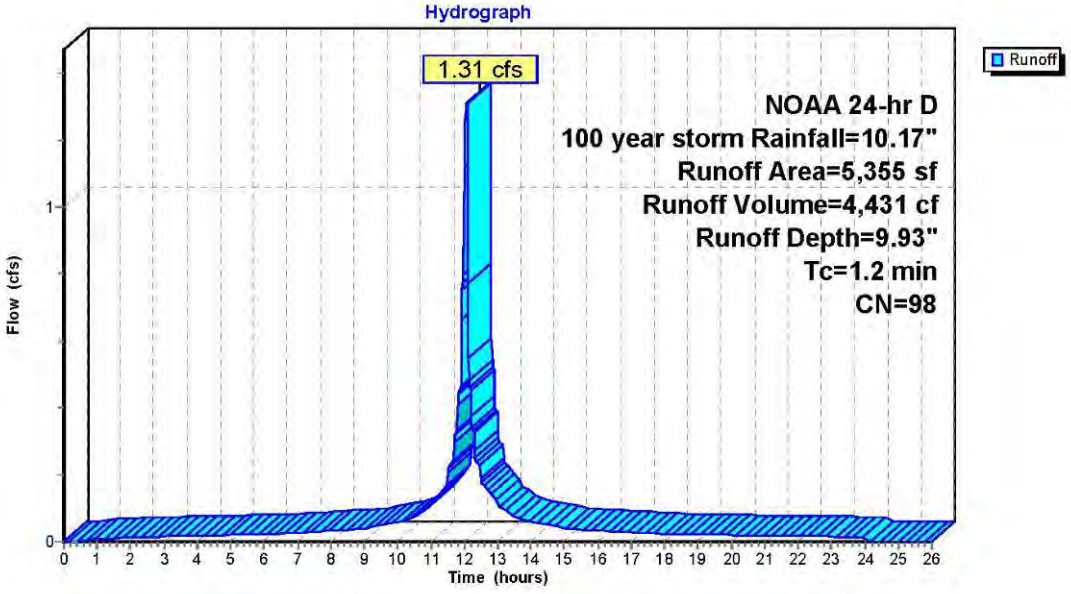
Runoff = 1.31 cfs @ 12.09 hrs, Volume= 4,431 cf, Depth= 9.93"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=10.17"

Area (sf)	CN	Description
5,355	98	Roofs, HSG B
5,355	98	100.00% Impervious Area

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

Subcatchment E1S: DE-1 - existing building roofs



Summary for Subcatchment E2S: DE-2 - grass-landscaping

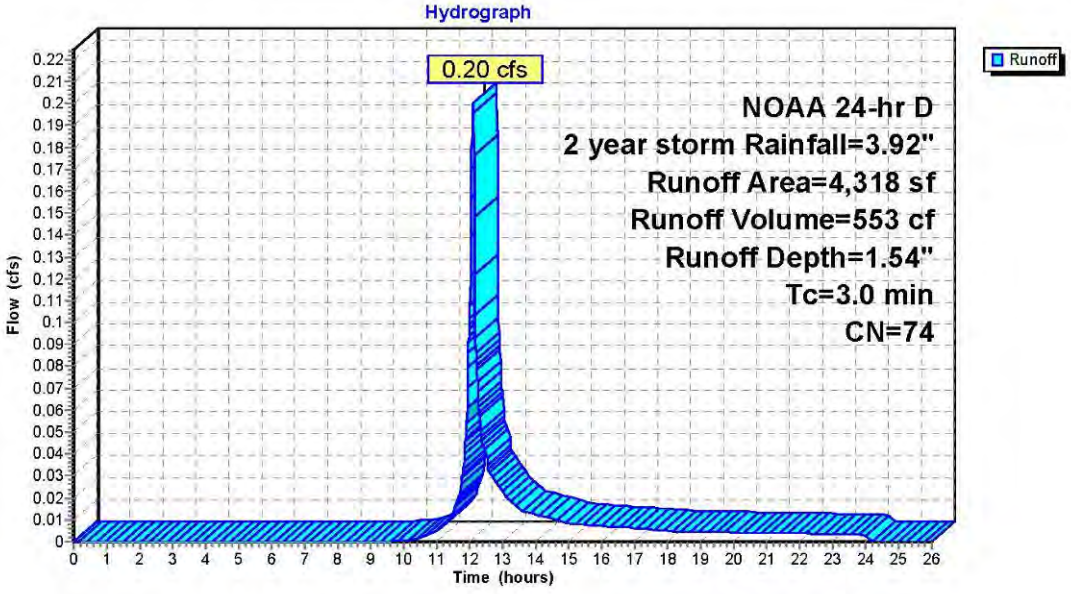
Runoff = 0.20 cfs @ 12.11 hrs, Volume= 553 cf, Depth= 1.54"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.92"

	Area (sf)	CN	Description
*	4,318	74	<50% Grass cover, Poor, HSG B
	4,318	74	100.00% Pervious Area

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

Subcatchment E2S: DE-2 - grass-landscaping



Summary for Subcatchment E2S: DE-2 - grass-landscaping

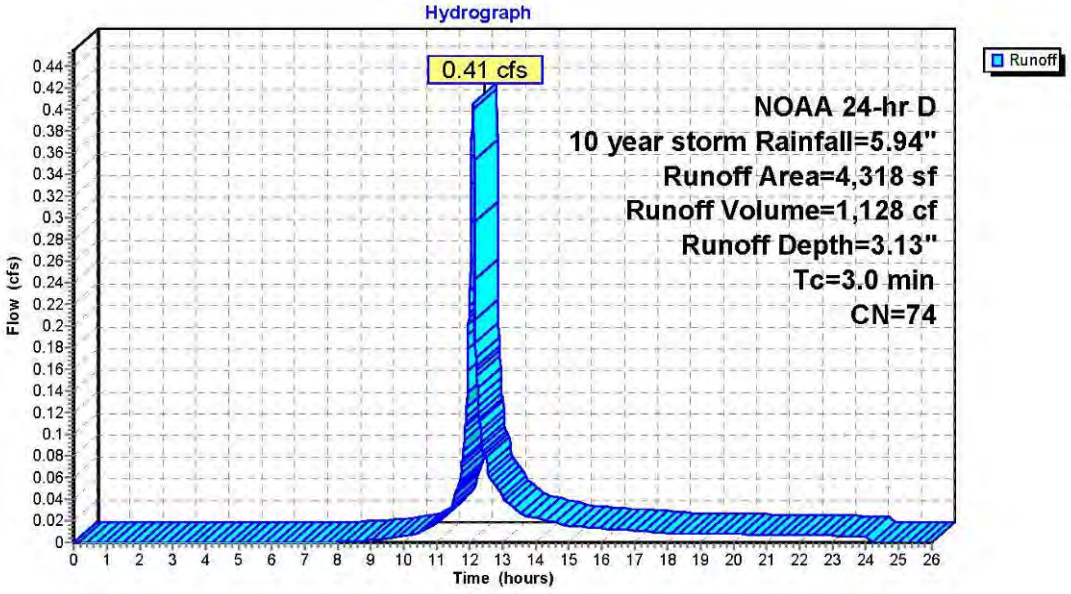
Runoff = 0.41 cfs @ 12.11 hrs, Volume= 1,128 cf, Depth= 3.13"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.94"

	Area (sf)	CN	Description
*	4,318	74	<50% Grass cover, Poor, HSG B
	4,318	74	100.00% Pervious Area

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

Subcatchment E2S: DE-2 - grass-landscaping



Summary for Subcatchment E2S: DE-2 - grass-landscaping

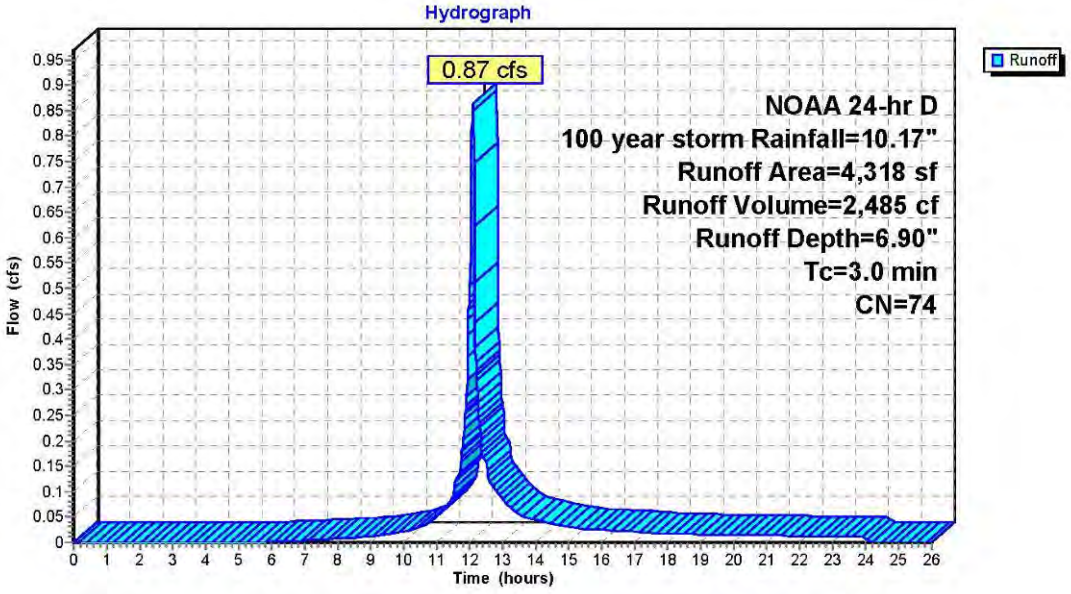
Runoff = 0.87 cfs @ 12.11 hrs, Volume= 2,485 cf, Depth= 6.90"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=10.17"

	Area (sf)	CN	Description
*	4,318	74	<50% Grass cover, Poor, HSG B
	4,318	74	100.00% Pervious Area

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

Subcatchment E2S: DE-2 - grass-landscaping



Summary for Subcatchment E3S: DE-3 - pavement

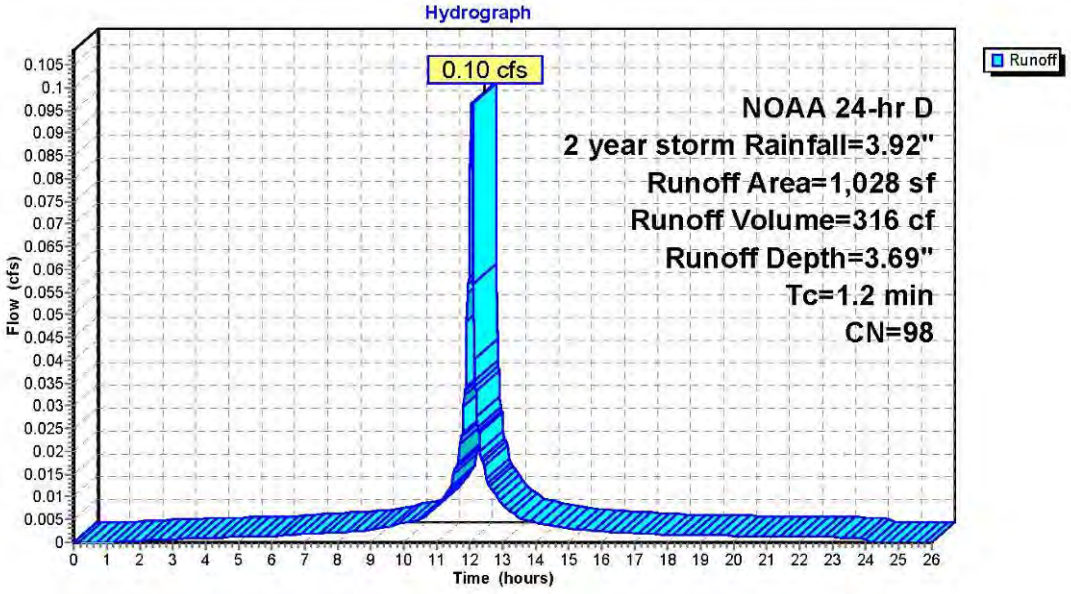
Runoff = 0.10 cfs @ 12.09 hrs, Volume= 316 cf, Depth= 3.69"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.92"

Area (sf)	CN	Description
1,028	98	Paved parking, HSG B
1,028	98	100.00% Impervious Area

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

Subcatchment E3S: DE-3 - pavement



Summary for Subcatchment E3S: DE-3 - pavement

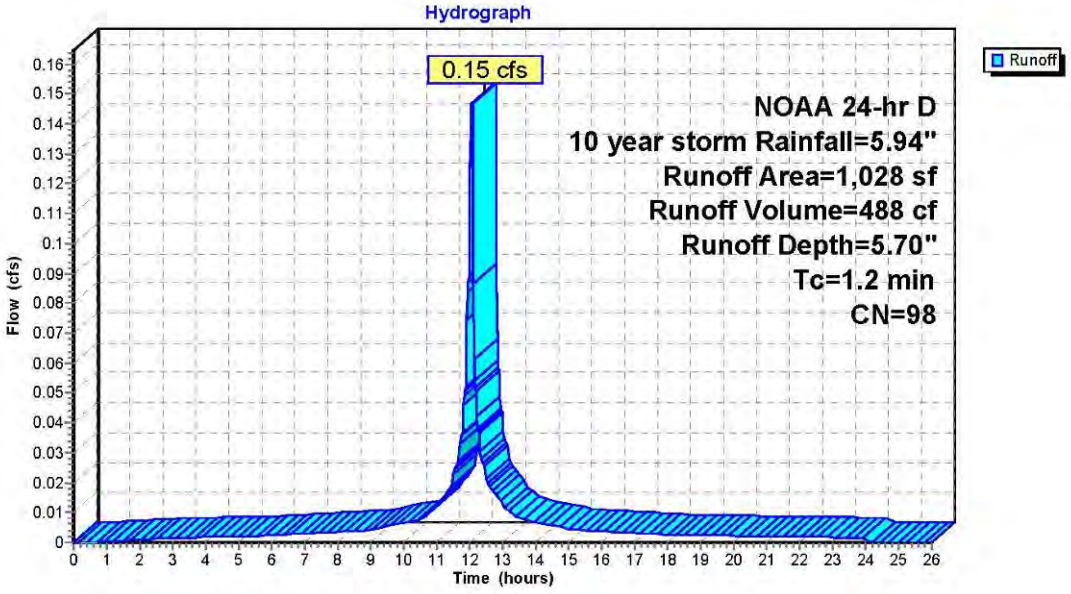
Runoff = 0.15 cfs @ 12.09 hrs, Volume= 488 cf, Depth= 5.70"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.94"

Area (sf)	CN	Description
1,028	98	Paved parking, HSG B
1,028	98	100.00% Impervious Area

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

Subcatchment E3S: DE-3 - pavement



Summary for Subcatchment E3S: DE-3 - pavement

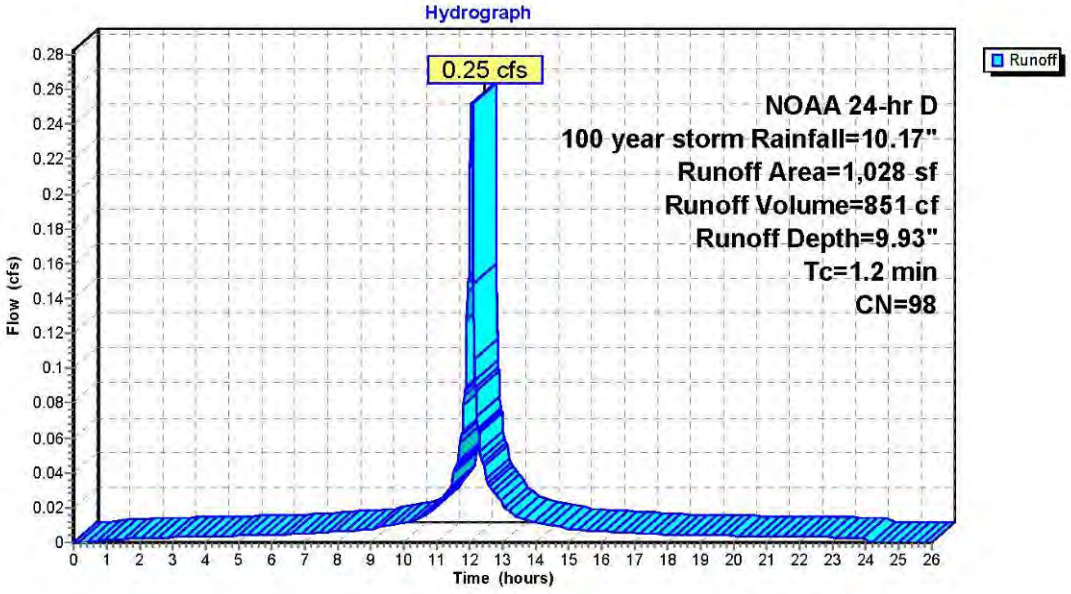
Runoff = 0.25 cfs @ 12.09 hrs, Volume= 851 cf, Depth= 9.93"
Routed to Link 1L : municipal sewer/inlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=10.17"

Area (sf)	CN	Description
1,028	98	Paved parking, HSG B
1,028	98	100.00% Impervious Area

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

Subcatchment E3S: DE-3 - pavement



Summary for Subcatchment E4S: DE-4 - grass-landscaping

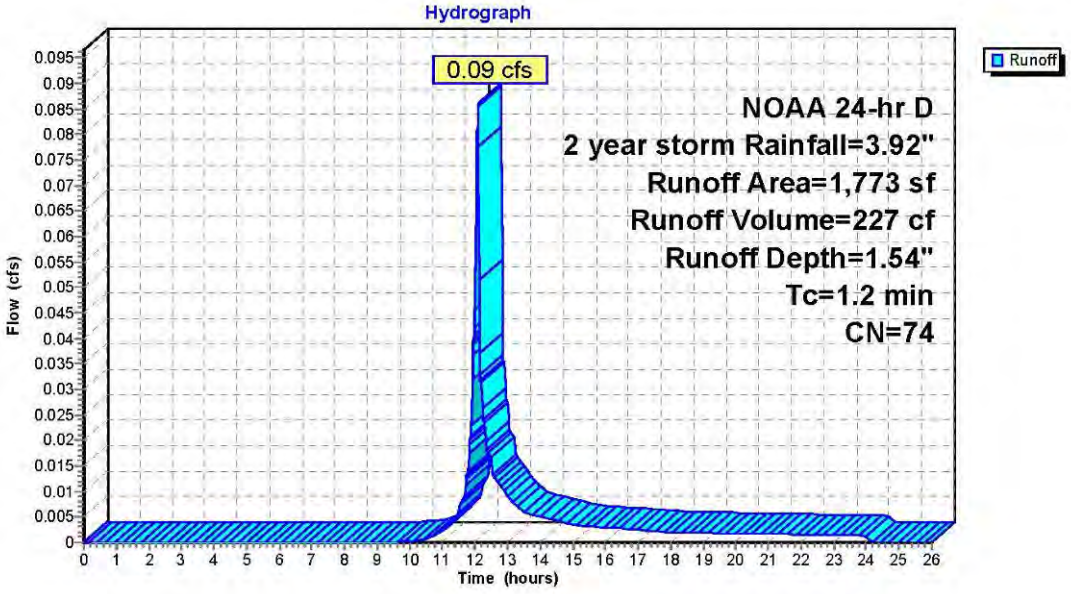
Runoff = 0.09 cfs @ 12.10 hrs, Volume= 227 cf, Depth= 1.54"
Routed to Link 10L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.92"

	Area (sf)	CN	Description
*	1,773	74	<50% Grass cover, Poor, HSG B
	1,773	74	100.00% Pervious Area

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

Subcatchment E4S: DE-4 - grass-landscaping



Summary for Subcatchment E4S: DE-4 - grass-landscaping

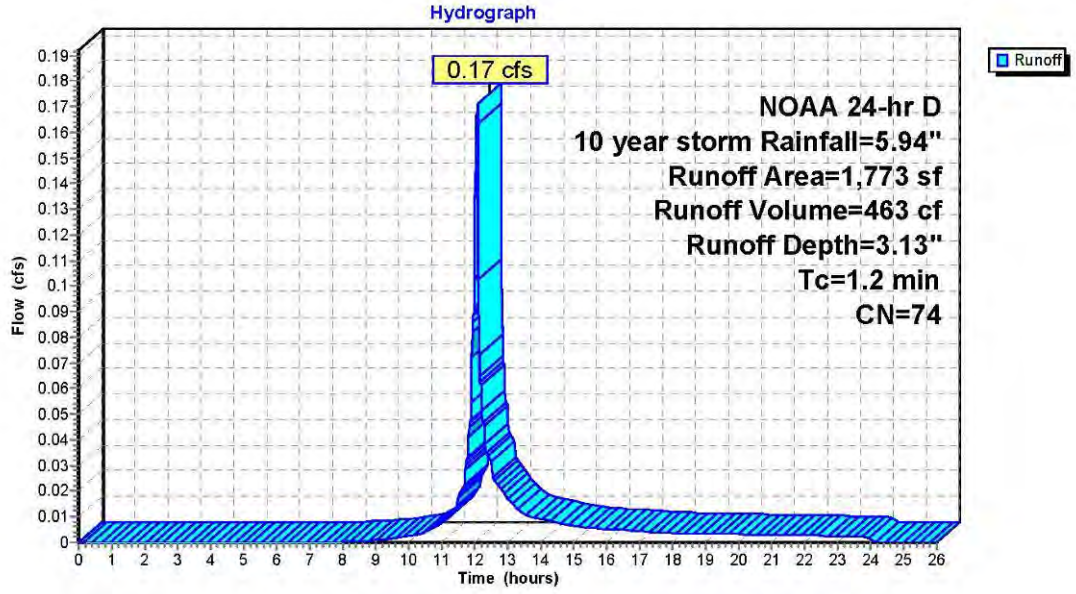
Runoff = 0.17 cfs @ 12.10 hrs, Volume= 463 cf, Depth= 3.13"
Routed to Link 10L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.94"

	Area (sf)	CN	Description
*	1,773	74	<50% Grass cover, Poor, HSG B
	1,773	74	100.00% Pervious Area

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

Subcatchment E4S: DE-4 - grass-landscaping



Summary for Subcatchment E4S: DE-4 - grass-landscaping

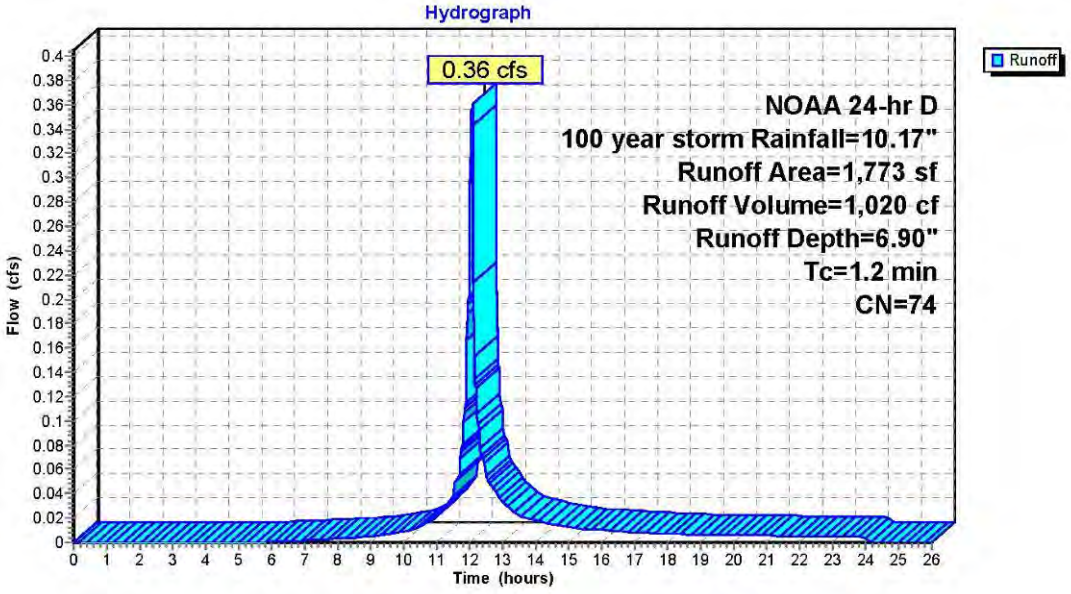
Runoff = 0.36 cfs @ 12.10 hrs, Volume= 1,020 cf, Depth= 6.90"
Routed to Link 10L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=10.17"

	Area (sf)	CN	Description
*	1,773	74	<50% Grass cover, Poor, HSG B
	1,773	74	100.00% Pervious Area

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

Subcatchment E4S: DE-4 - grass-landscaping



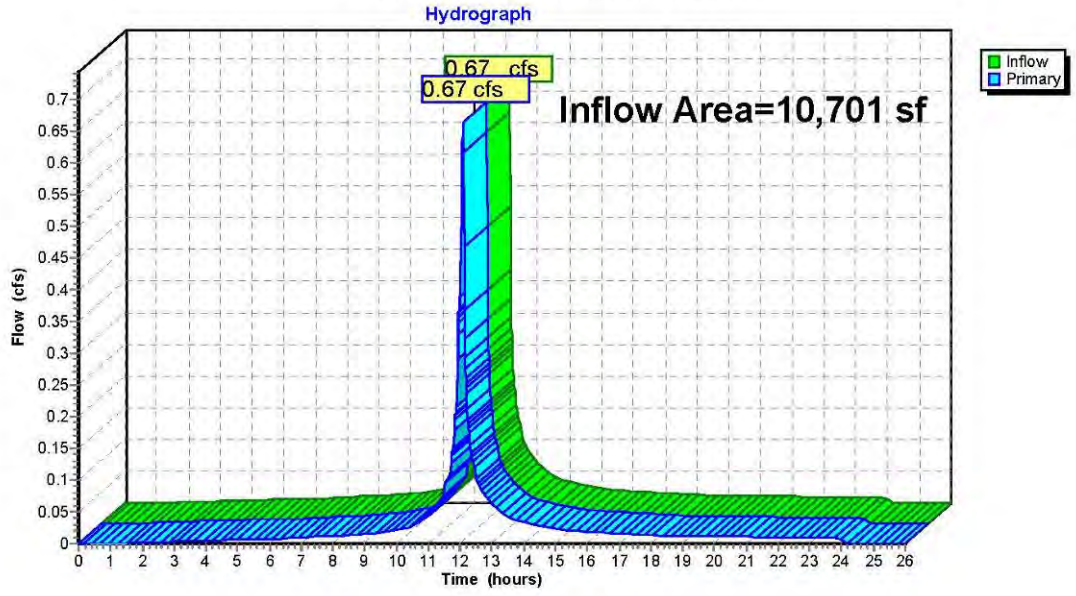
TOTAL – CURRENT ADJUSTED – PRE-DEVELOPMENT

Summary for Link 1L: municipal sewer/inlet

Inflow Area = 10,701 sf, 59.65% Impervious, Inflow Depth = 2.35" for 2 year storm event
Inflow = 0.67 cfs @ 12.10 hrs, Volume= 2,098 cf
Primary = 0.67 cfs @ 12.10 hrs, Volume= 2,098 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 1L: municipal sewer/inlet

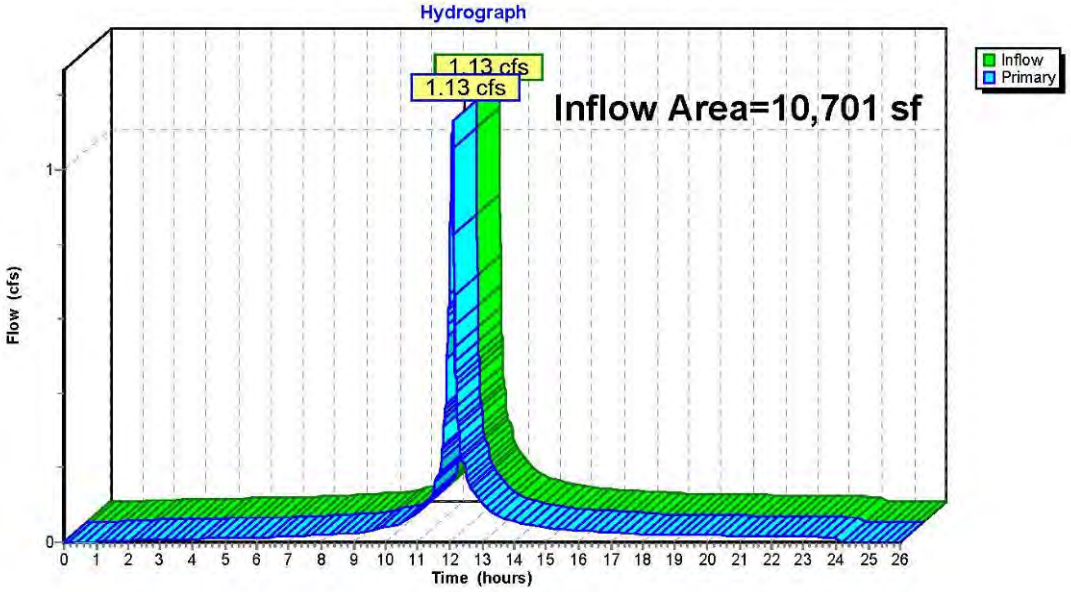


Summary for Link 1L: municipal sewer/inlet

Inflow Area = 10,701 sf, 59.65% Impervious, Inflow Depth = 4.02" for 10 year storm event
Inflow = 1.13 cfs @ 12.10 hrs, Volume= 3,581 cf
Primary = 1.13 cfs @ 12.10 hrs, Volume= 3,581 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 1L: municipal sewer/inlet

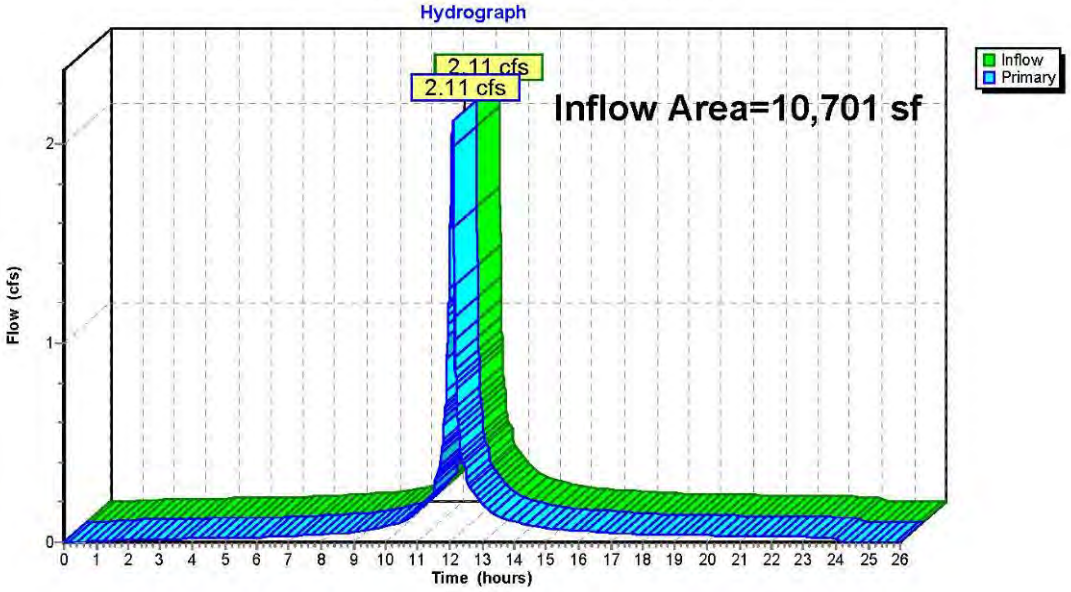


Summary for Link 1L: municipal sewer/inlet

Inflow Area = 10,701 sf, 59.65% Impervious, Inflow Depth = 7.59" for 100 year storm event
Inflow = 2.11 cfs @ 12.10 hrs, Volume= 6,765 cf
Primary = 2.11 cfs @ 12.10 hrs, Volume= 6,765 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 1L: municipal sewer/inlet

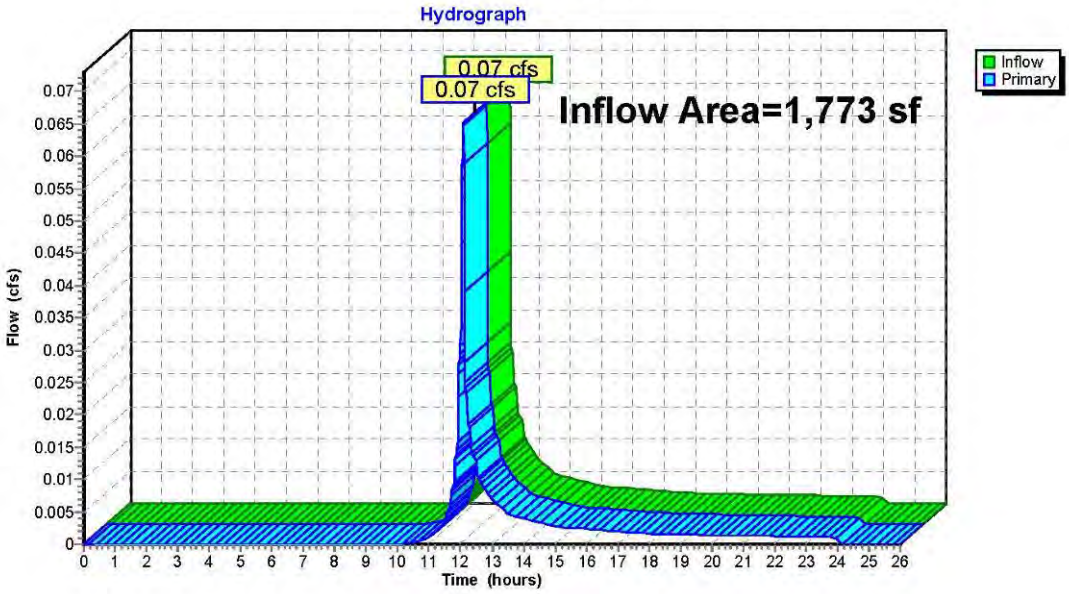


Summary for Link 10L: POA-1

Inflow Area = 1,773 sf, 0.00% Impervious, Inflow Depth = 1.16" for 2 year storm event
Inflow = 0.07 cfs @ 12.10 hrs, Volume= 172 cf
Primary = 0.07 cfs @ 12.10 hrs, Volume= 172 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 10L: POA-1

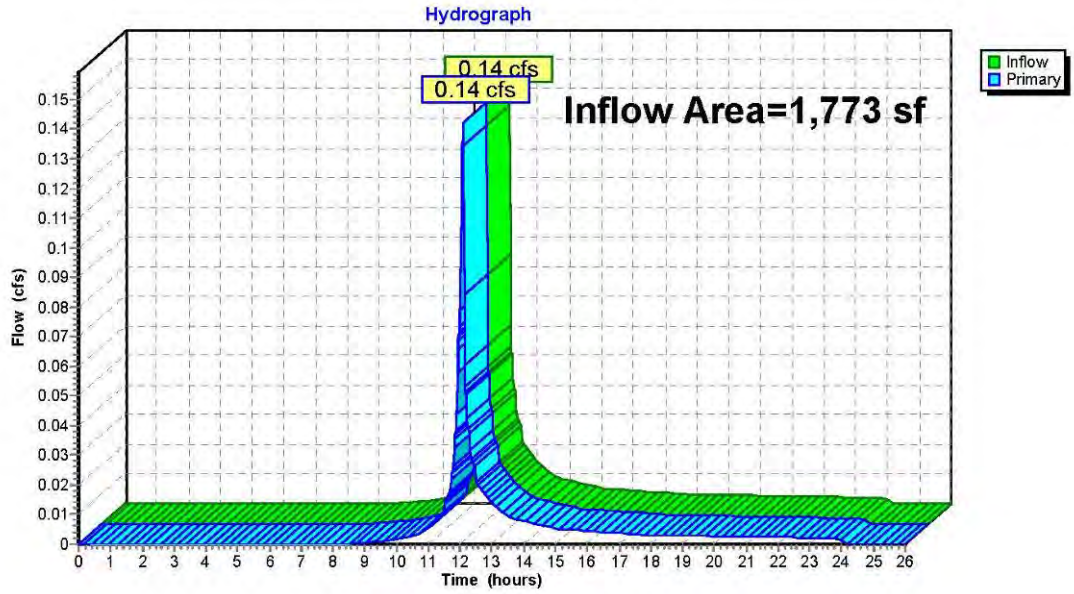


Summary for Link 10L: POA-1

Inflow Area = 1,773 sf, 0.00% Impervious, Inflow Depth = 2.56" for 10 year storm event
Inflow = 0.14 cfs @ 12.10 hrs, Volume= 378 cf
Primary = 0.14 cfs @ 12.10 hrs, Volume= 378 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 10L: POA-1

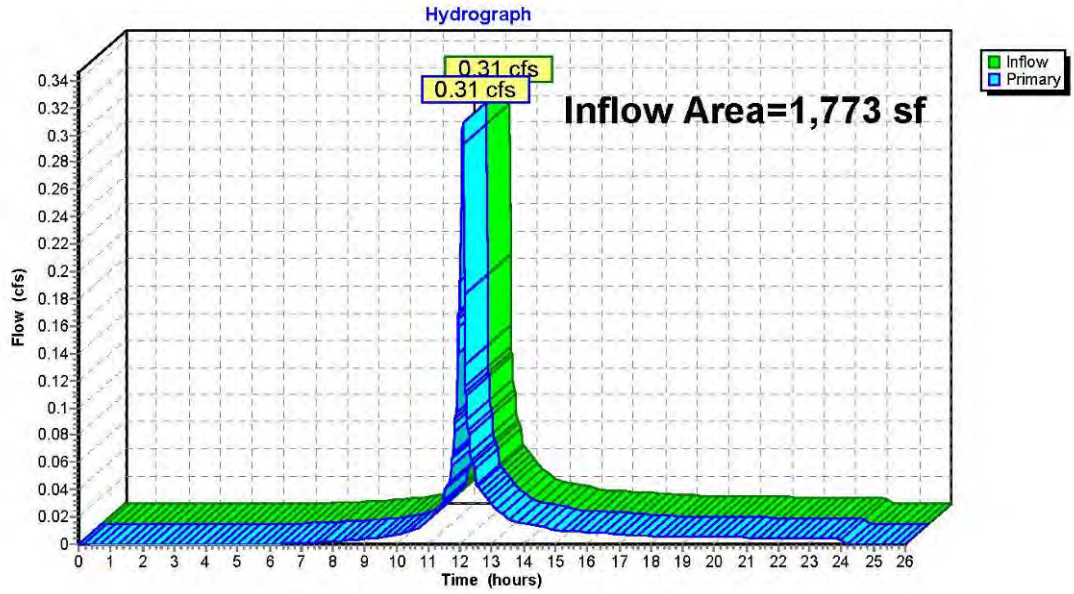


Summary for Link 10L: POA-1

Inflow Area = 1,773 sf, 0.00% Impervious, Inflow Depth = 5.84" for 100 year storm event
Inflow = 0.31 cfs @ 12.10 hrs, Volume= 863 cf
Primary = 0.31 cfs @ 12.10 hrs, Volume= 863 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 10L: POA-1



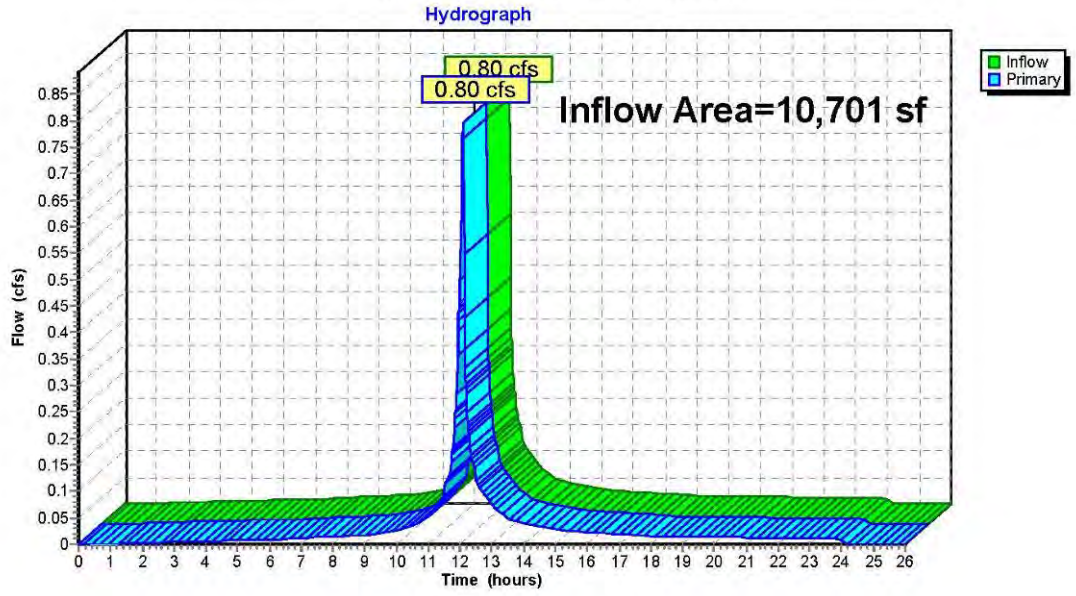
TOTAL – FUTURE ADJUSTED – PRE-DEVELOPMENT

Summary for Link 1L: municipal sewer/inlet

Inflow Area = 10,701 sf, 59.65% Impervious, Inflow Depth = 2.82" for 2 year storm event
Inflow = 0.80 cfs @ 12.10 hrs, Volume= 2,514 cf
Primary = 0.80 cfs @ 12.10 hrs, Volume= 2,514 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 1L: municipal sewer/inlet

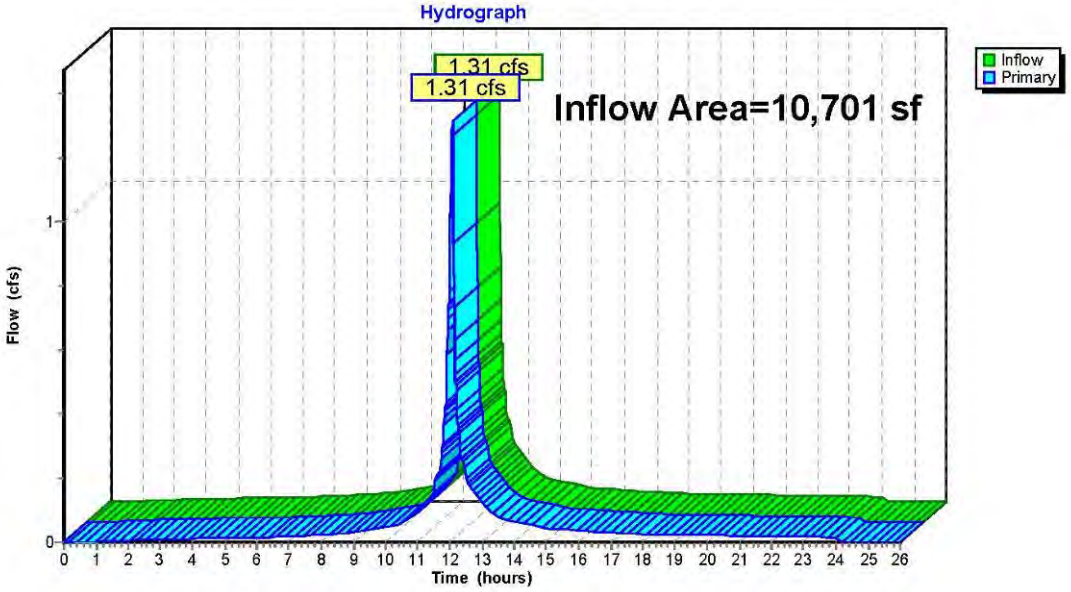


Summary for Link 1L: municipal sewer/inlet

Inflow Area = 10,701 sf, 59.65% Impervious, Inflow Depth = 4.67" for 10 year storm event
Inflow = 1.31 cfs @ 12.10 hrs, Volume= 4,161 cf
Primary = 1.31 cfs @ 12.10 hrs, Volume= 4,161 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 1L: municipal sewer/inlet

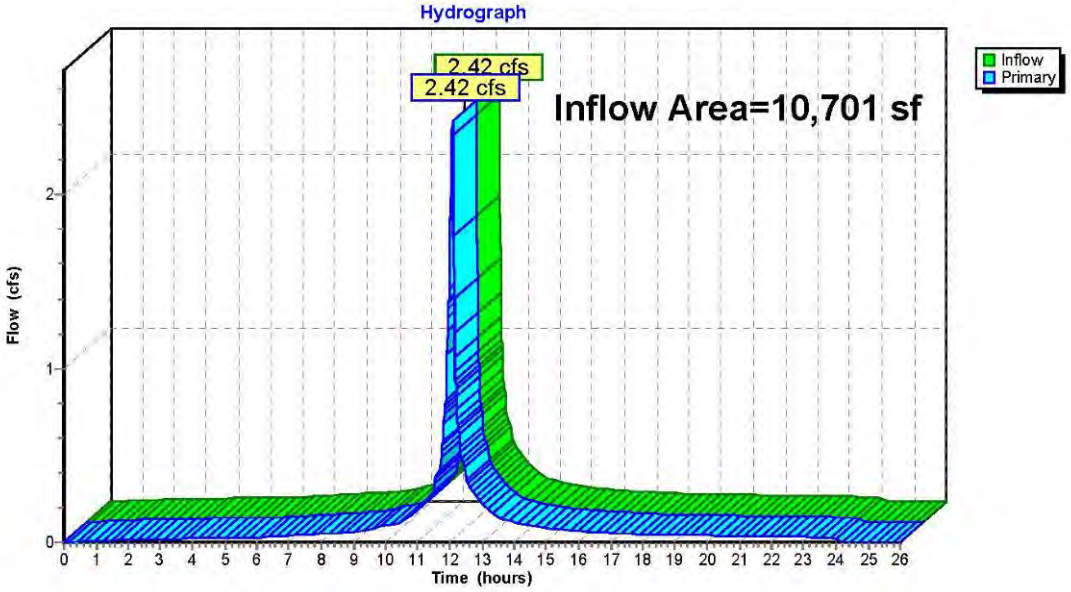


Summary for Link 1L: municipal sewer/inlet

Inflow Area = 10,701 sf, 59.65% Impervious, Inflow Depth = 8.71" for 100 year storm event
Inflow = 2.42 cfs @ 12.10 hrs, Volume= 7,766 cf
Primary = 2.42 cfs @ 12.10 hrs, Volume= 7,766 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 1L: municipal sewer/inlet

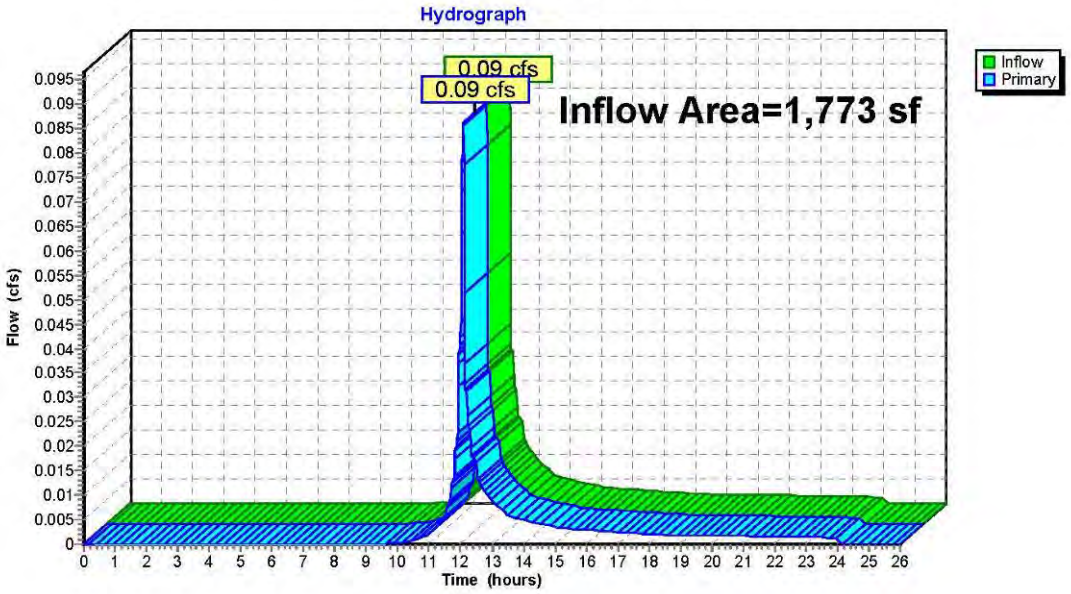


Summary for Link 10L: POA-1

Inflow Area = 1,773 sf, 0.00% Impervious, Inflow Depth = 1.54" for 2 year storm event
Inflow = 0.09 cfs @ 12.10 hrs, Volume= 227 cf
Primary = 0.09 cfs @ 12.10 hrs, Volume= 227 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 10L: POA-1

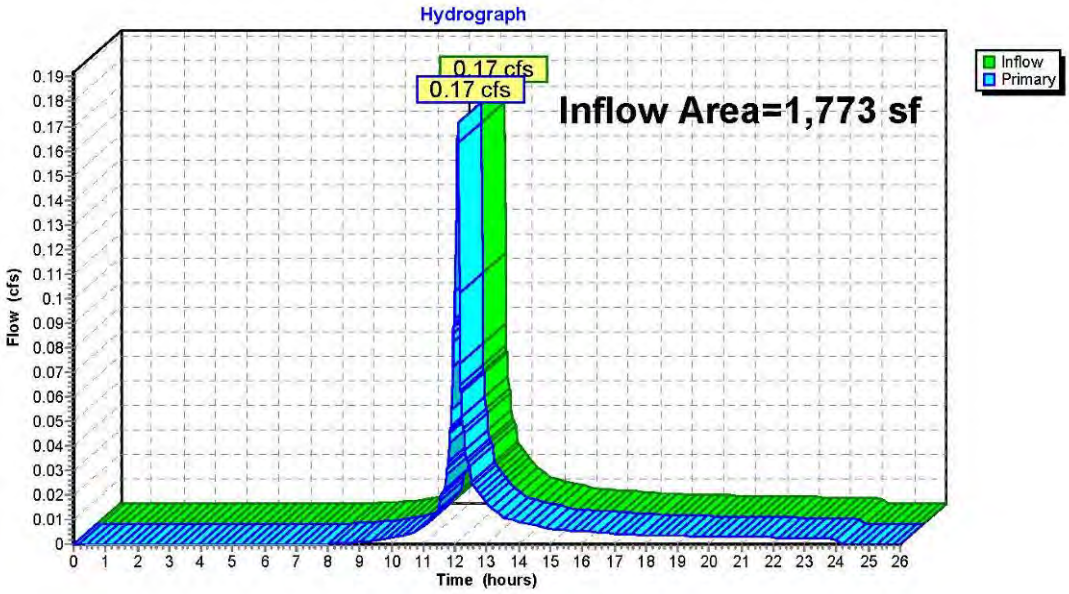


Summary for Link 10L: POA-1

Inflow Area = 1,773 sf, 0.00% Impervious, Inflow Depth = 3.13" for 10 year storm event
Inflow = 0.17 cfs @ 12.10 hrs, Volume= 463 cf
Primary = 0.17 cfs @ 12.10 hrs, Volume= 463 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 10L: POA-1

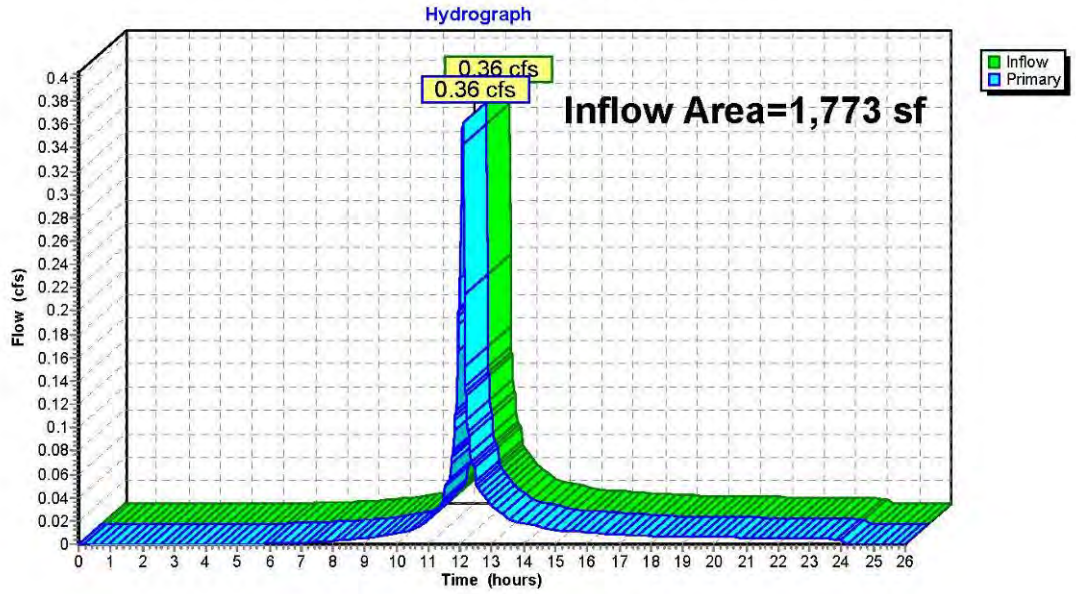


Summary for Link 10L: POA-1

Inflow Area = 1,773 sf, 0.00% Impervious, Inflow Depth = 6.90" for 100 year storm event
Inflow = 0.36 cfs @ 12.10 hrs, Volume= 1,020 cf
Primary = 0.36 cfs @ 12.10 hrs, Volume= 1,020 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 10L: POA-1



APPENDIX I – POST-DEVELOPMENT HYDROGRAPH REPORTS

CURRENT ADJUSTED – POST-DEVELOPMENT

Summary for Subcatchment P1S: DP-1A - upper green roof to SWM

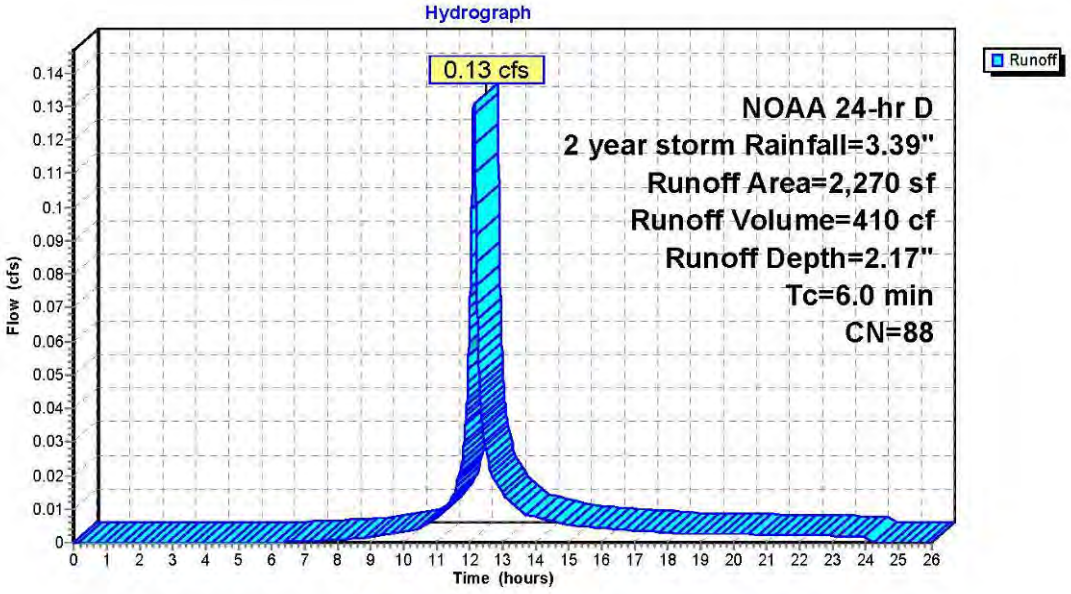
Runoff = 0.13 cfs @ 12.13 hrs, Volume= 410 cf, Depth= 2.17"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.39"

	Area (sf)	CN	Description
*	2,270	88	Roofs, HSG D
	2,270	88	100.00% Pervious Area

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

Subcatchment P1S: DP-1A - upper green roof to SWM



Summary for Subcatchment P1S: DP-1A - upper green roof to SWM

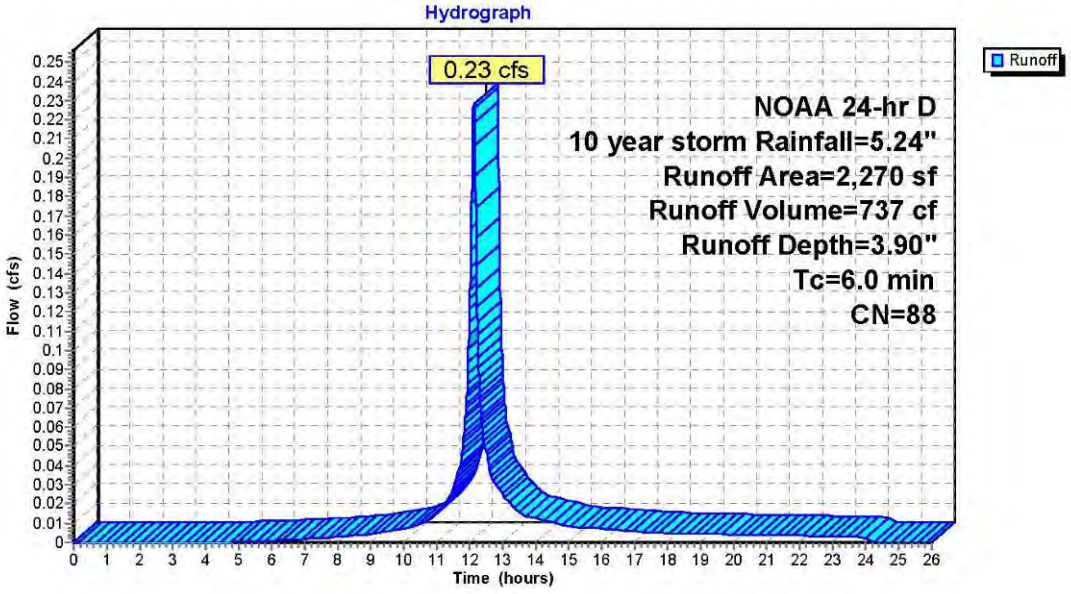
Runoff = 0.23 cfs @ 12.13 hrs, Volume= 737 cf, Depth= 3.90"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.24"

	Area (sf)	CN	Description
*	2,270	88	Roofs, HSG D
	2,270	88	100.00% Pervious Area

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

Subcatchment P1S: DP-1A - upper green roof to SWM



Summary for Subcatchment P1S: DP-1A - upper green roof to SWM

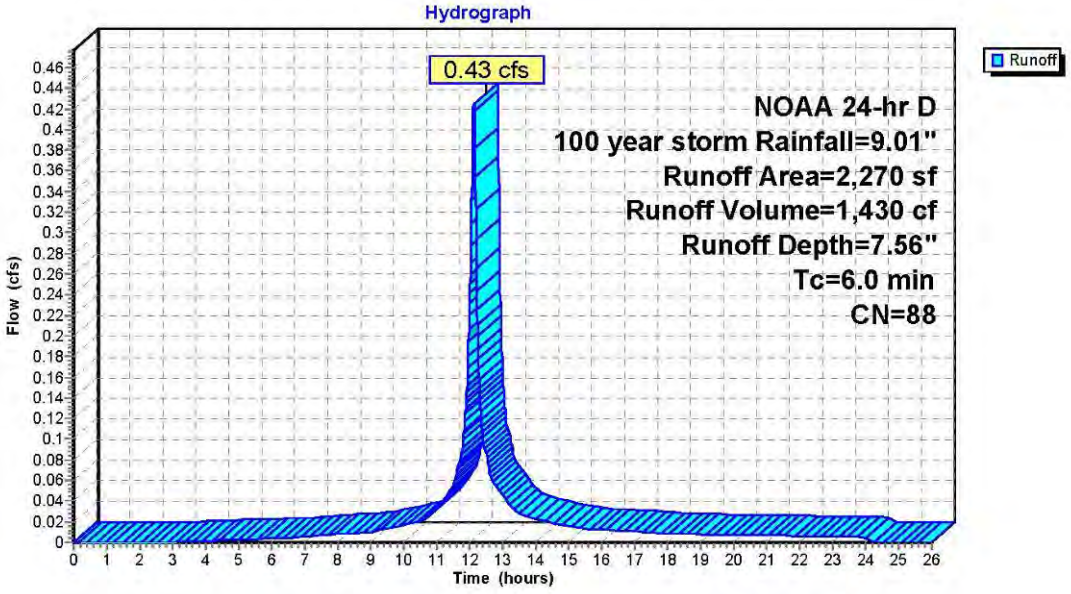
Runoff = 0.43 cfs @ 12.13 hrs, Volume= 1,430 cf, Depth= 7.56"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=9.01"

	Area (sf)	CN	Description
*	2,270	88	Roofs, HSG D
	2,270	88	100.00% Pervious Area

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

Subcatchment P1S: DP-1A - upper green roof to SWM



Summary for Subcatchment P2S: DP-1B - upper building roof to SWM

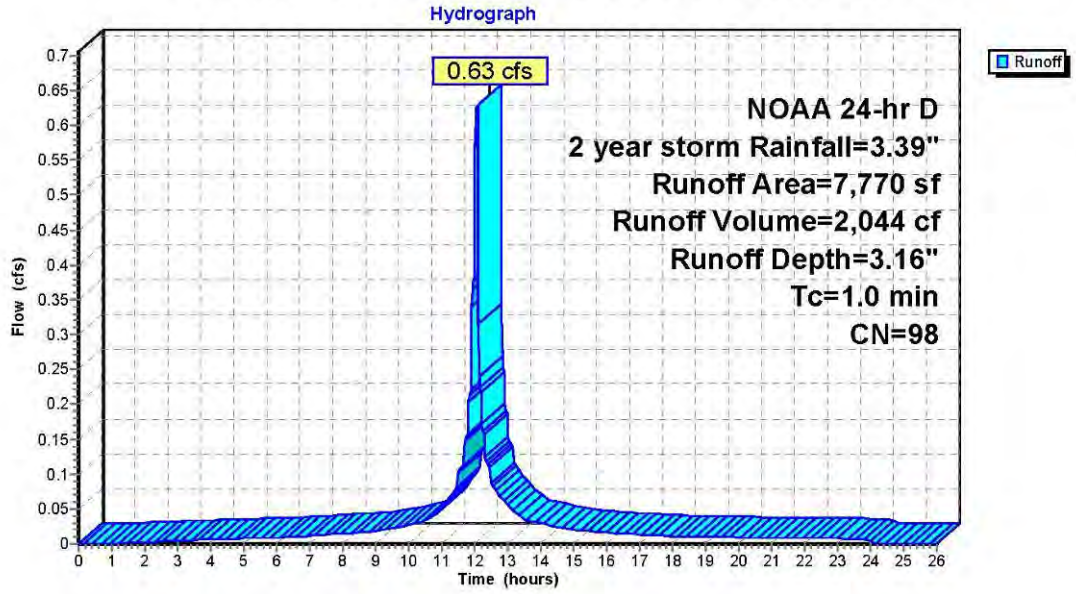
Runoff = 0.63 cfs @ 12.09 hrs, Volume= 2,044 cf, Depth= 3.16"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.39"

Area (sf)	CN	Description
7,770	98	Roofs, HSG D
7,770	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P2S: DP-1B - upper building roof to SWM



Summary for Subcatchment P2S: DP-1B - upper building roof to SWM

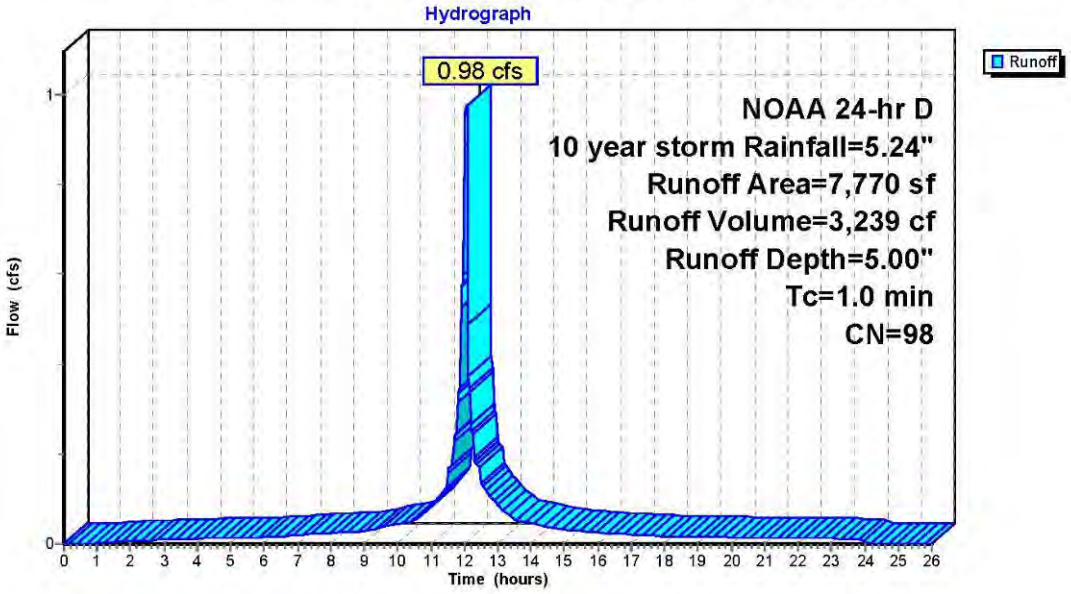
Runoff = 0.98 cfs @ 12.09 hrs, Volume= 3,239 cf, Depth= 5.00"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.24"

Area (sf)	CN	Description
7,770	98	Roofs, HSG D
7,770	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P2S: DP-1B - upper building roof to SWM



Summary for Subcatchment P2S: DP-1B - upper building roof to SWM

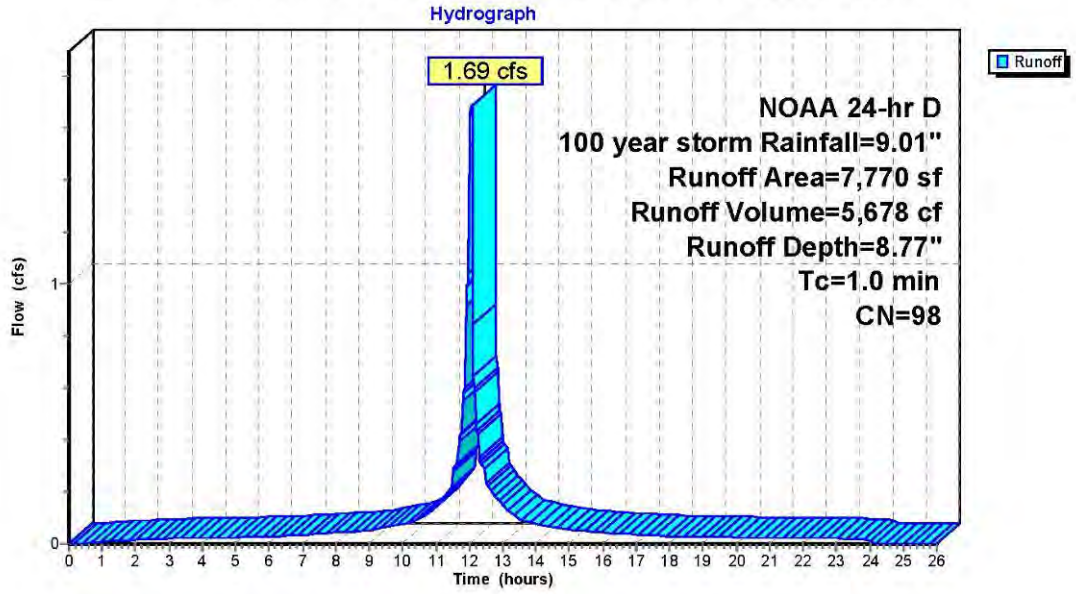
Runoff = 1.69 cfs @ 12.09 hrs, Volume= 5,678 cf, Depth= 8.77"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=9.01"

Area (sf)	CN	Description
7,770	98	Roofs, HSG D
7,770	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P2S: DP-1B - upper building roof to SWM



Summary for Subcatchment P4S: DP-2 - lower building roof to SWM

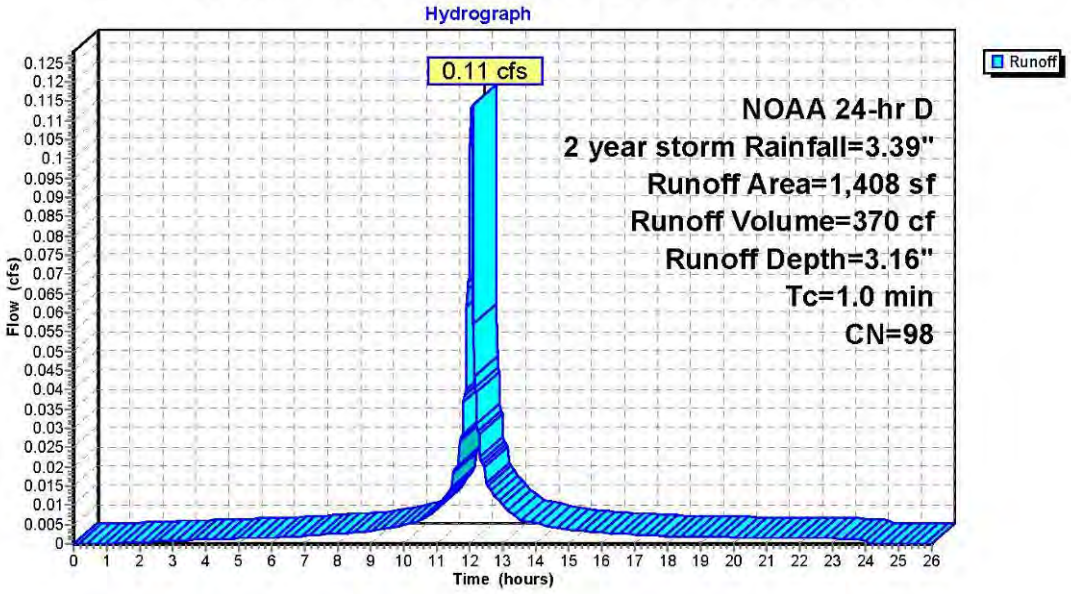
Runoff = 0.11 cfs @ 12.09 hrs, Volume= 370 cf, Depth= 3.16"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.39"

Area (sf)	CN	Description
1,408	98	Roofs, HSG D
1,408	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P4S: DP-2 - lower building roof to SWM



Summary for Subcatchment P4S: DP-2 - lower building roof to SWM

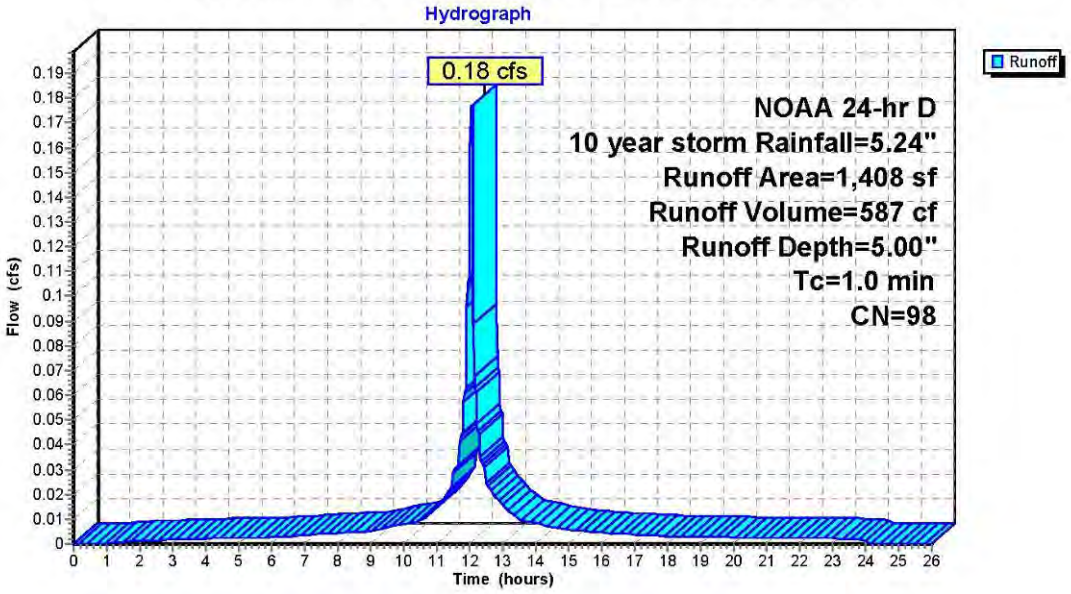
Runoff = 0.18 cfs @ 12.09 hrs, Volume= 587 cf, Depth= 5.00"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.24"

Area (sf)	CN	Description
1,408	98	Roofs, HSG D
1,408	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P4S: DP-2 - lower building roof to SWM



Summary for Subcatchment P4S: DP-2 - lower building roof to SWM

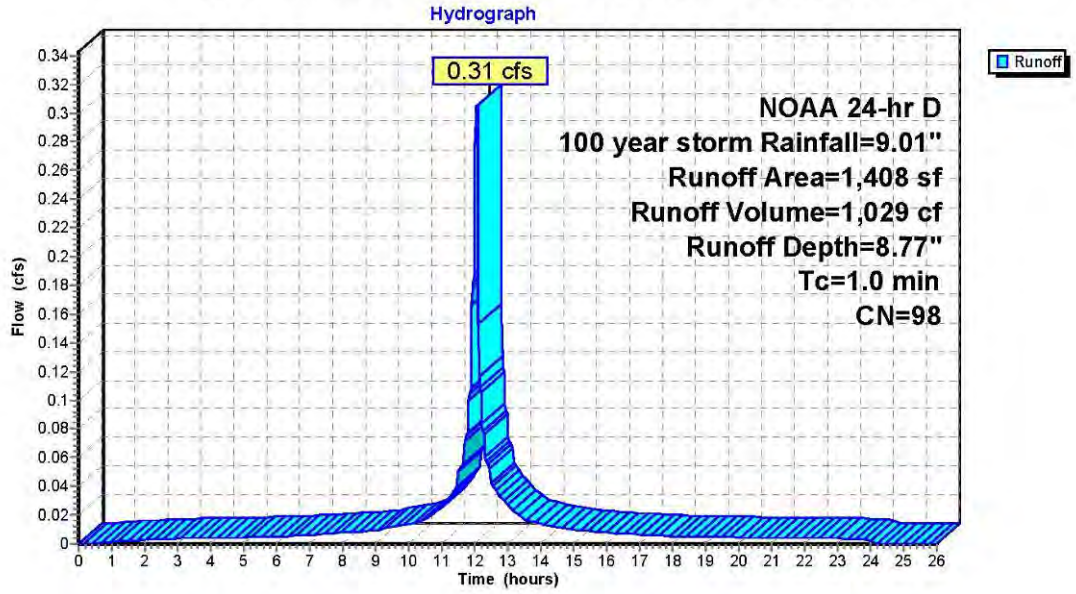
Runoff = 0.31 cfs @ 12.09 hrs, Volume= 1,029 cf, Depth= 8.77"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=9.01"

Area (sf)	CN	Description
1,408	98	Roofs, HSG D
1,408	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P4S: DP-2 - lower building roof to SWM



Summary for Subcatchment P3S: DP-3- lower green roof to SWM

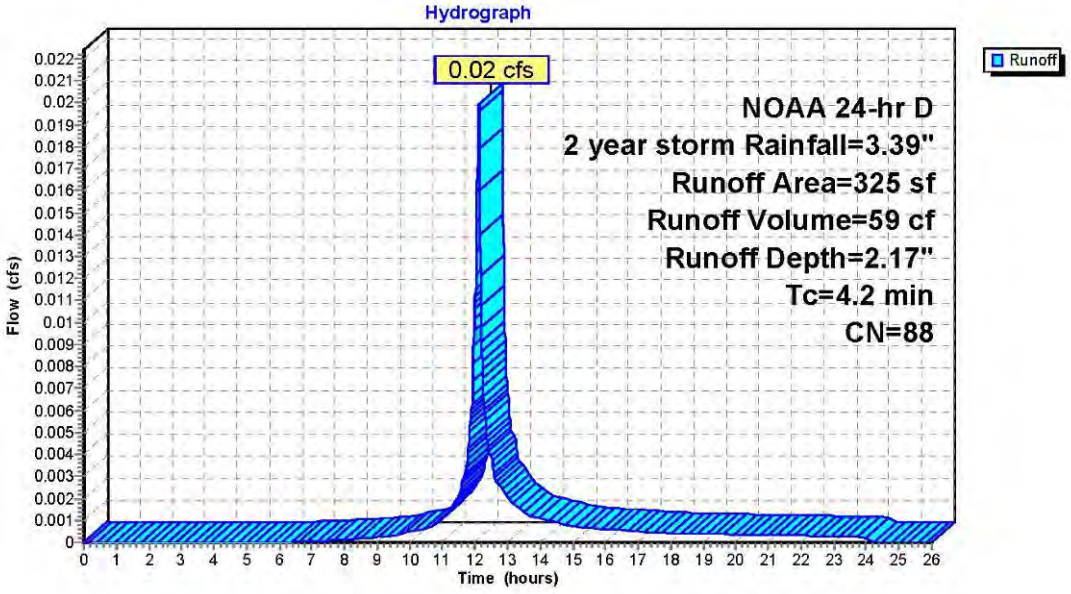
Runoff = 0.02 cfs @ 12.12 hrs, Volume= 59 cf, Depth= 2.17"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.39"

	Area (sf)	CN	Description
*	325	88	Roofs, HSG D
	325	88	100.00% Pervious Area

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

Subcatchment P3S: DP-3- lower green roof to SWM



Summary for Subcatchment P3S: DP-3- lower green roof to SWM

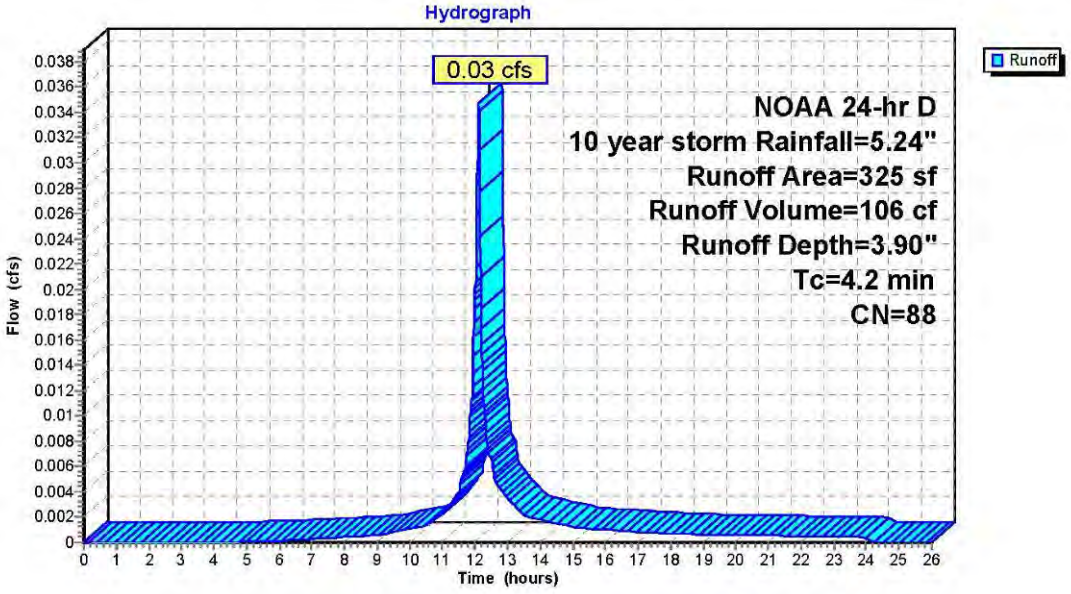
Runoff = 0.03 cfs @ 12.11 hrs, Volume= 106 cf, Depth= 3.90"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.24"

	Area (sf)	CN	Description
*	325	88	Roofs, HSG D
	325	88	100.00% Pervious Area

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

Subcatchment P3S: DP-3- lower green roof to SWM



Summary for Subcatchment P3S: DP-3- lower green roof to SWM

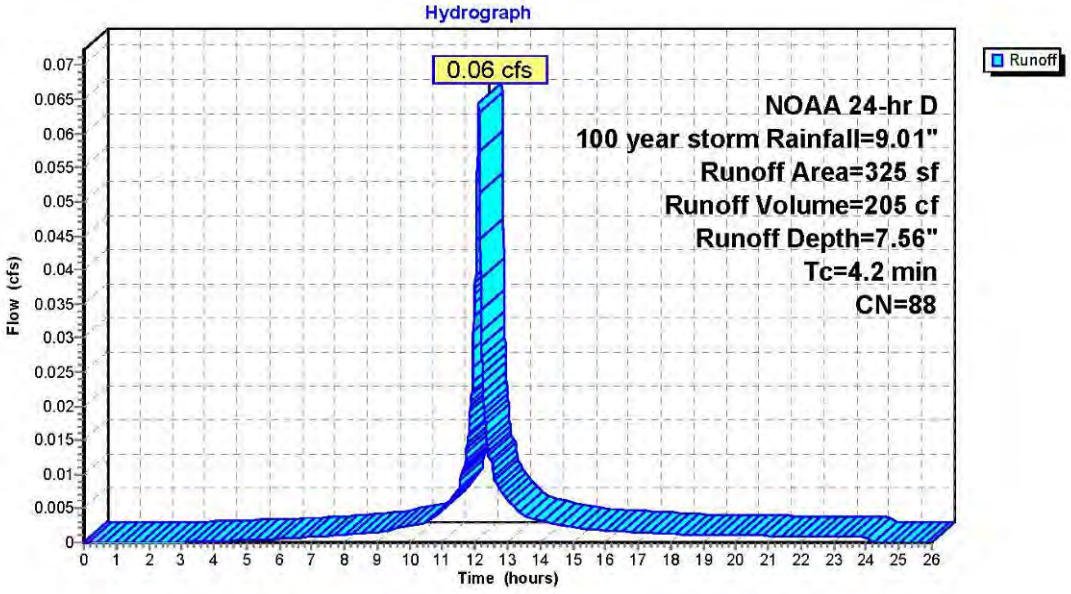
Runoff = 0.06 cfs @ 12.11 hrs, Volume= 205 cf, Depth= 7.56"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=9.01"

	Area (sf)	CN	Description
*	325	88	Roofs, HSG D
	325	88	100.00% Pervious Area

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

Subcatchment P3S: DP-3- lower green roof to SWM



Summary for Subcatchment P5S: DP-4 - permeable pavers

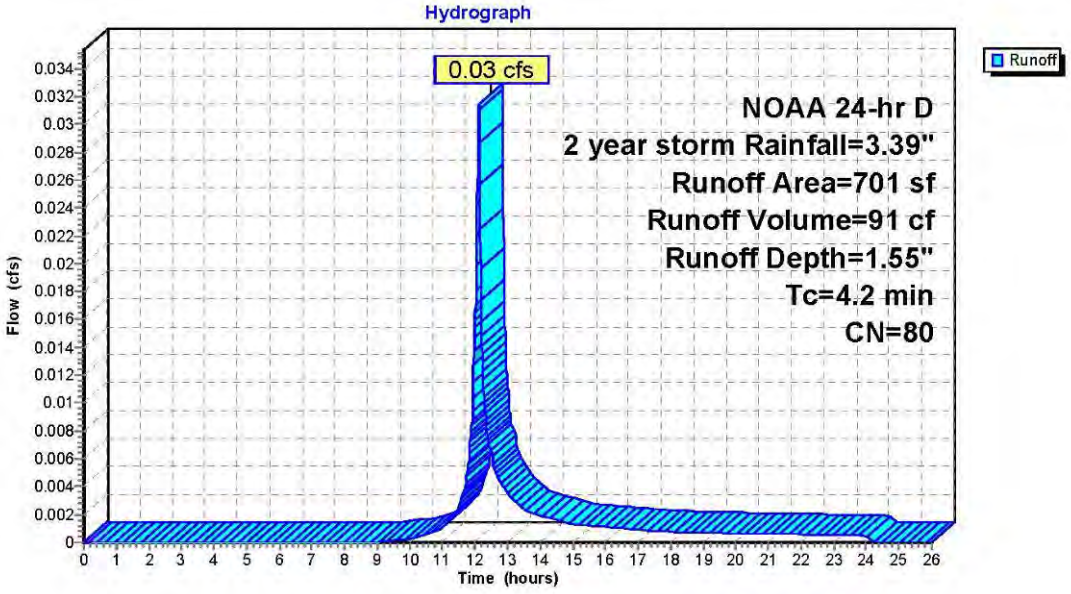
Runoff = 0.03 cfs @ 12.12 hrs, Volume= 91 cf, Depth= 1.55"
Routed to Link 4L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.39"

Area (sf)	CN	Description
701	80	>75% Grass cover, Good, HSG D
701	80	100.00% Pervious Area

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

Subcatchment P5S: DP-4 - permeable pavers



Summary for Subcatchment P5S: DP-4 - permeable pavers

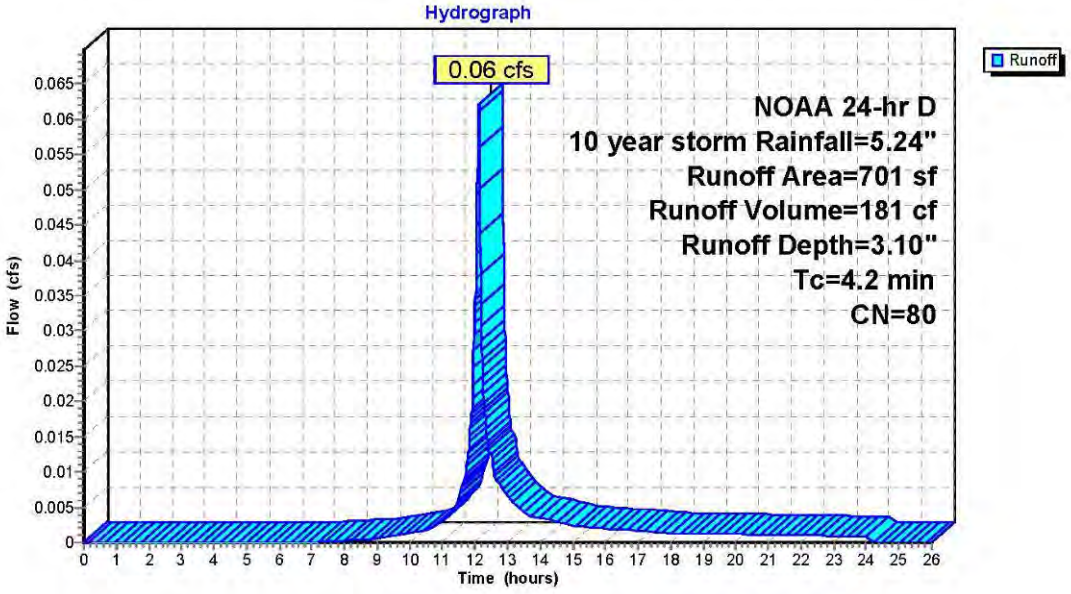
Runoff = 0.06 cfs @ 12.12 hrs, Volume= 181 cf, Depth= 3.10"
Routed to Link 4L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.24"

Area (sf)	CN	Description
701	80	>75% Grass cover, Good, HSG D
701	80	100.00% Pervious Area

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

Subcatchment P5S: DP-4 - permeable pavers



Summary for Subcatchment P5S: DP-4 - permeable pavers

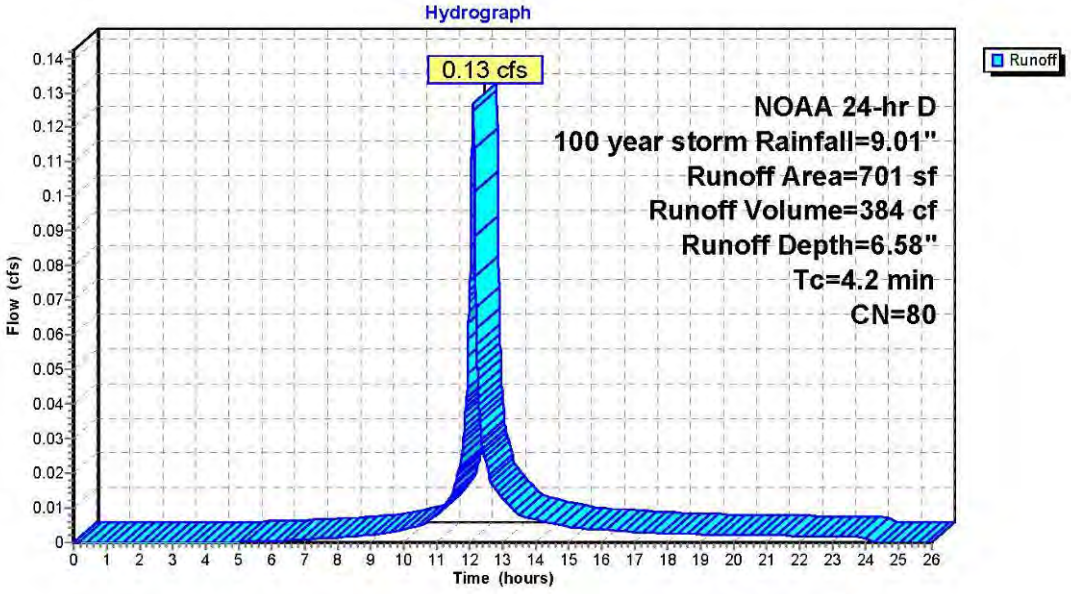
Runoff = 0.13 cfs @ 12.11 hrs, Volume= 384 cf, Depth= 6.58"
Routed to Link 4L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=9.01"

Area (sf)	CN	Description
701	80	>75% Grass cover, Good, HSG D
701	80	100.00% Pervious Area

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

Subcatchment P5S: DP-4 - permeable pavers



FUTURE ADJUSTED – POST-DEVELOPMENT

Summary for Subcatchment P1S: DP-1A - upper green roof to SWM

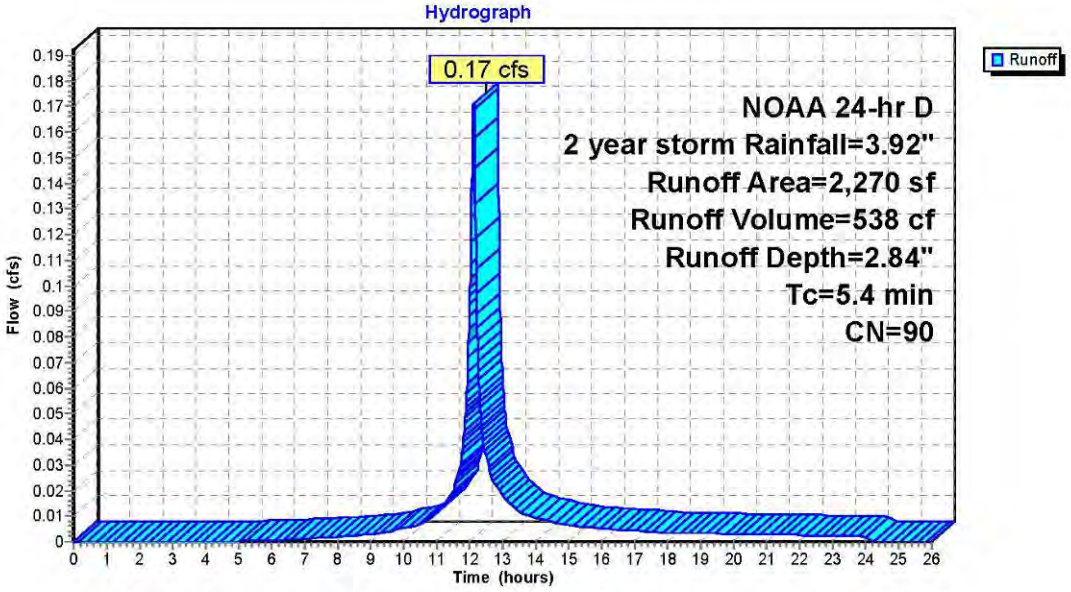
Runoff = 0.17 cfs @ 12.13 hrs, Volume= 538 cf, Depth= 2.84"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.92"

	Area (sf)	CN	Description
*	2,270	90	Roofs, HSG D
	2,270	90	100.00% Pervious Area

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

Subcatchment P1S: DP-1A - upper green roof to SWM



Summary for Subcatchment P1S: DP-1A - upper green roof to SWM

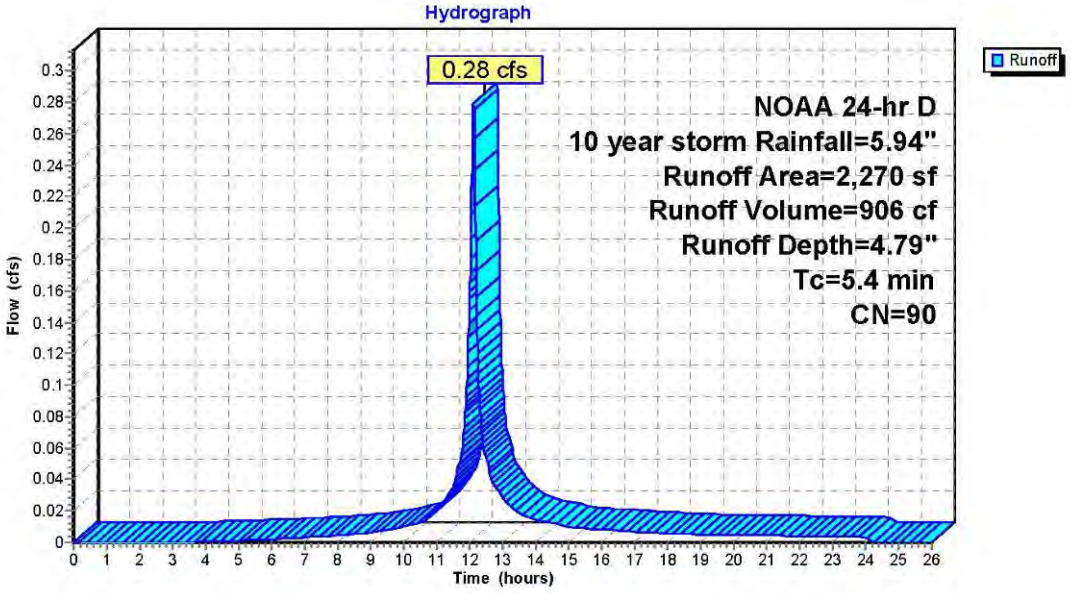
Runoff = 0.28 cfs @ 12.12 hrs, Volume= 906 cf, Depth= 4.79"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.94"

	Area (sf)	CN	Description
*	2,270	90	Roofs, HSG D
	2,270	90	100.00% Pervious Area

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

Subcatchment P1S: DP-1A - upper green roof to SWM



Summary for Subcatchment P1S: DP-1A - upper green roof to SWM

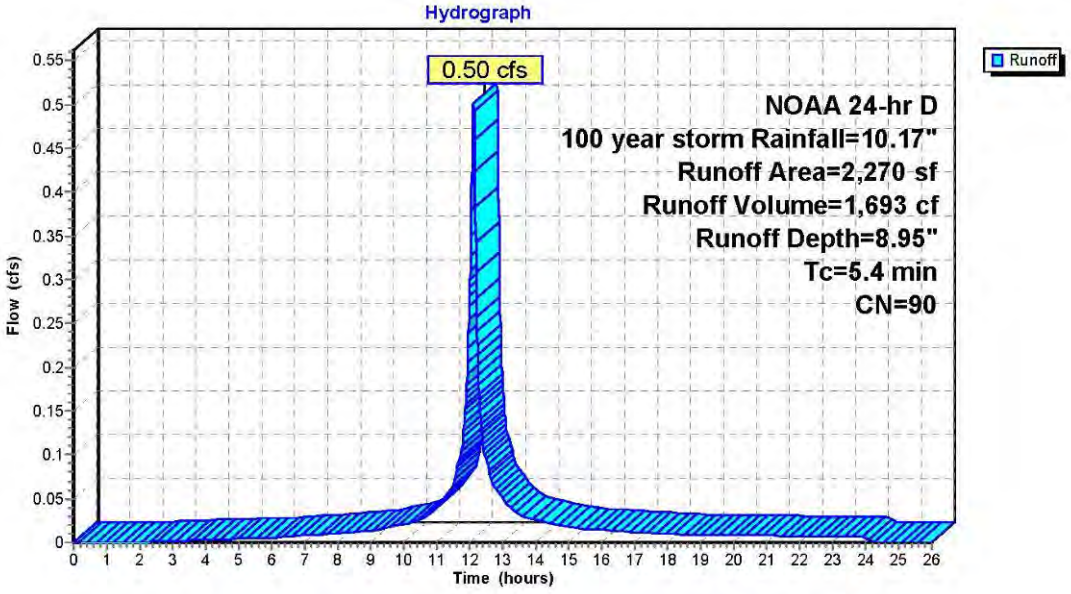
Runoff = 0.50 cfs @ 12.12 hrs, Volume= 1,693 cf, Depth= 8.95"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=10.17"

	Area (sf)	CN	Description
*	2,270	90	Roofs, HSG D
	2,270	90	100.00% Pervious Area

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

Subcatchment P1S: DP-1A - upper green roof to SWM



Summary for Subcatchment P2S: DP-1B - upper building roof to SWM

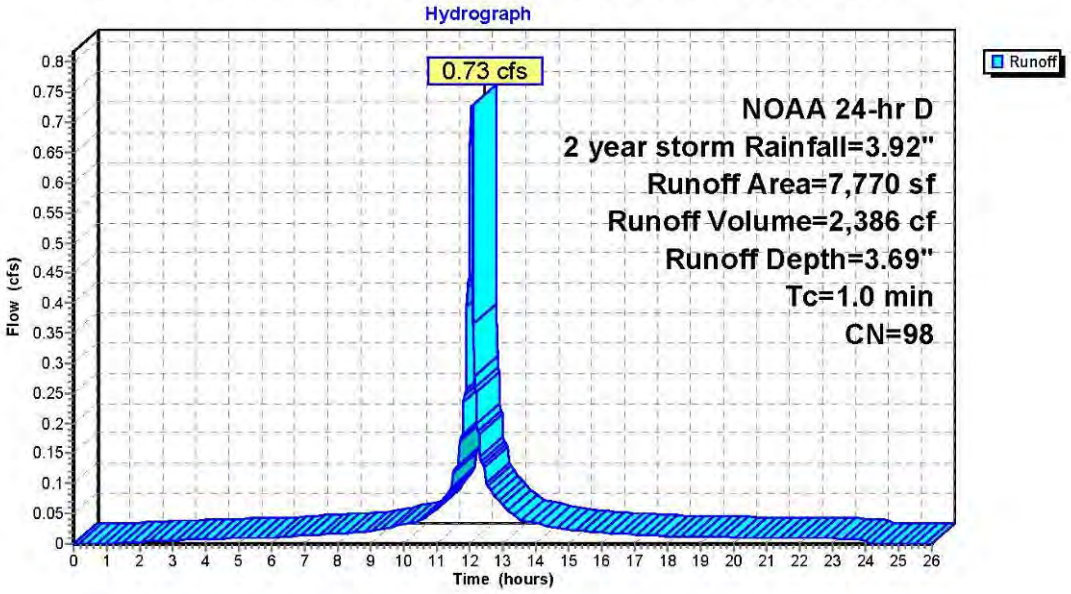
Runoff = 0.73 cfs @ 12.09 hrs, Volume= 2,386 cf, Depth= 3.69"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.92"

Area (sf)	CN	Description
7,770	98	Roofs, HSG D
7,770	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P2S: DP-1B - upper building roof to SWM



Summary for Subcatchment P2S: DP-1B - upper building roof to SWM

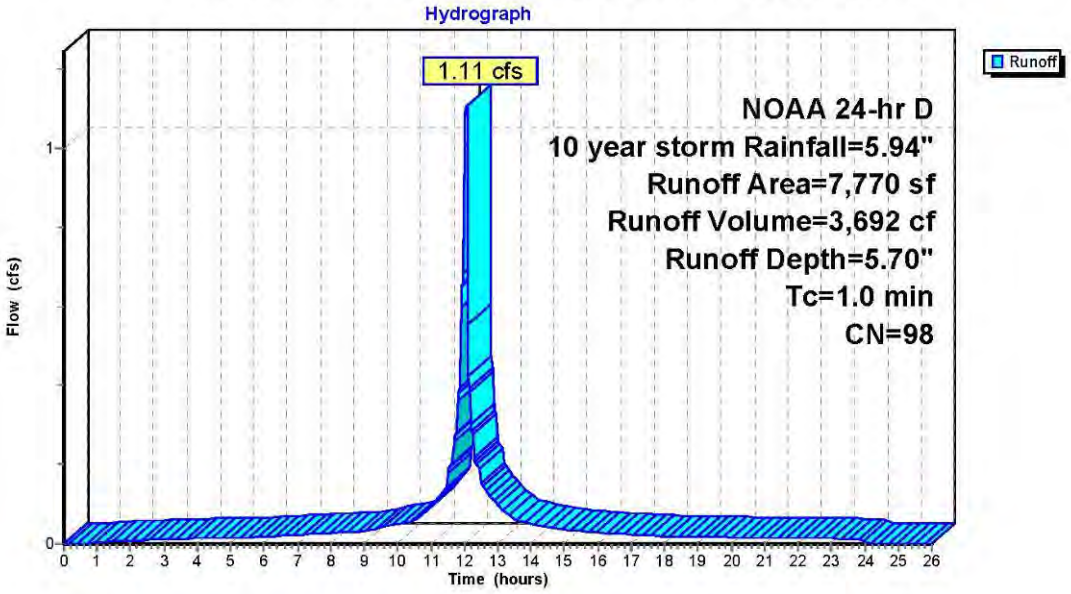
Runoff = 1.11 cfs @ 12.09 hrs, Volume= 3,692 cf, Depth= 5.70"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.94"

Area (sf)	CN	Description
7,770	98	Roofs, HSG D
7,770	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P2S: DP-1B - upper building roof to SWM



Summary for Subcatchment P2S: DP-1B - upper building roof to SWM

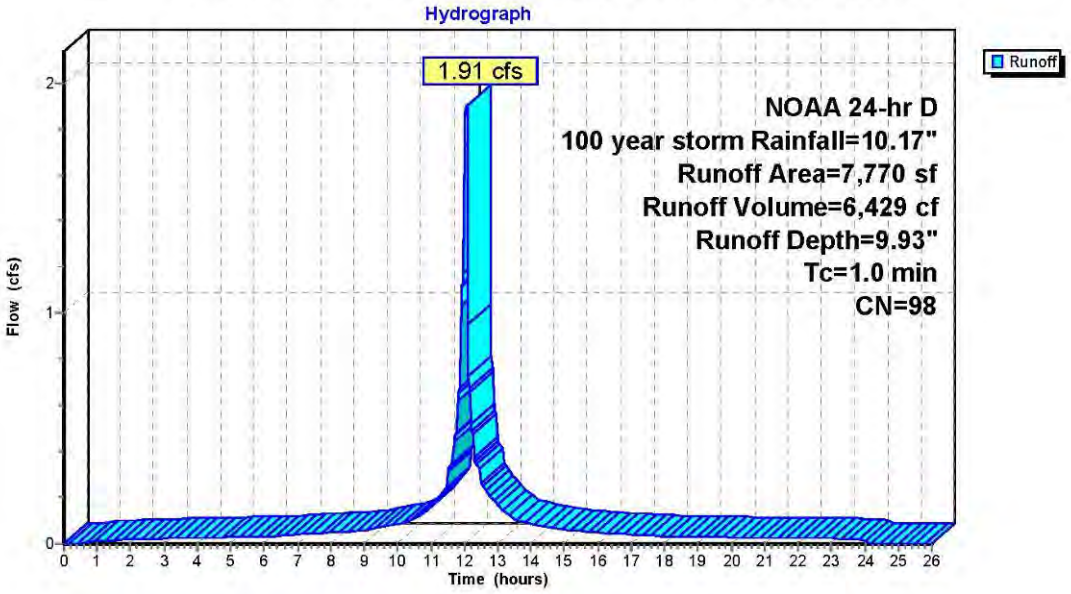
Runoff = 1.91 cfs @ 12.09 hrs, Volume= 6,429 cf, Depth= 9.93"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=10.17"

Area (sf)	CN	Description
7,770	98	Roofs, HSG D
7,770	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P2S: DP-1B - upper building roof to SWM



Summary for Subcatchment P4S: DP-2 - lower building roof to SWM

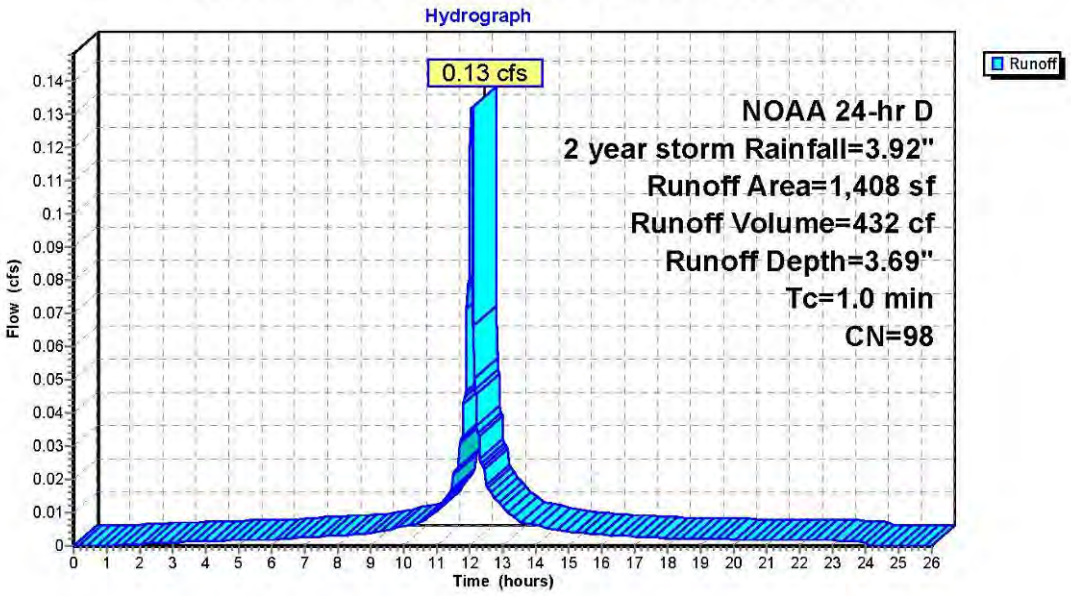
Runoff = 0.13 cfs @ 12.09 hrs, Volume= 432 cf, Depth= 3.69"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.92"

Area (sf)	CN	Description
1,408	98	Roofs, HSG D
1,408	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P4S: DP-2 - lower building roof to SWM



Summary for Subcatchment P4S: DP-2 - lower building roof to SWM

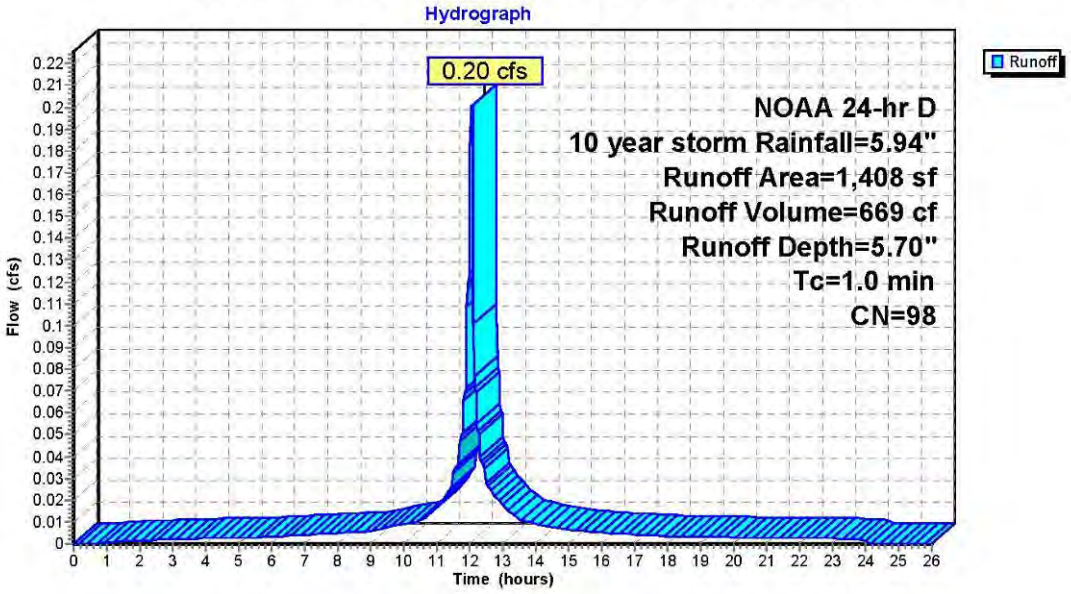
Runoff = 0.20 cfs @ 12.09 hrs, Volume= 669 cf, Depth= 5.70"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.94"

Area (sf)	CN	Description
1,408	98	Roofs, HSG D
1,408	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P4S: DP-2 - lower building roof to SWM



Summary for Subcatchment P4S: DP-2 - lower building roof to SWM

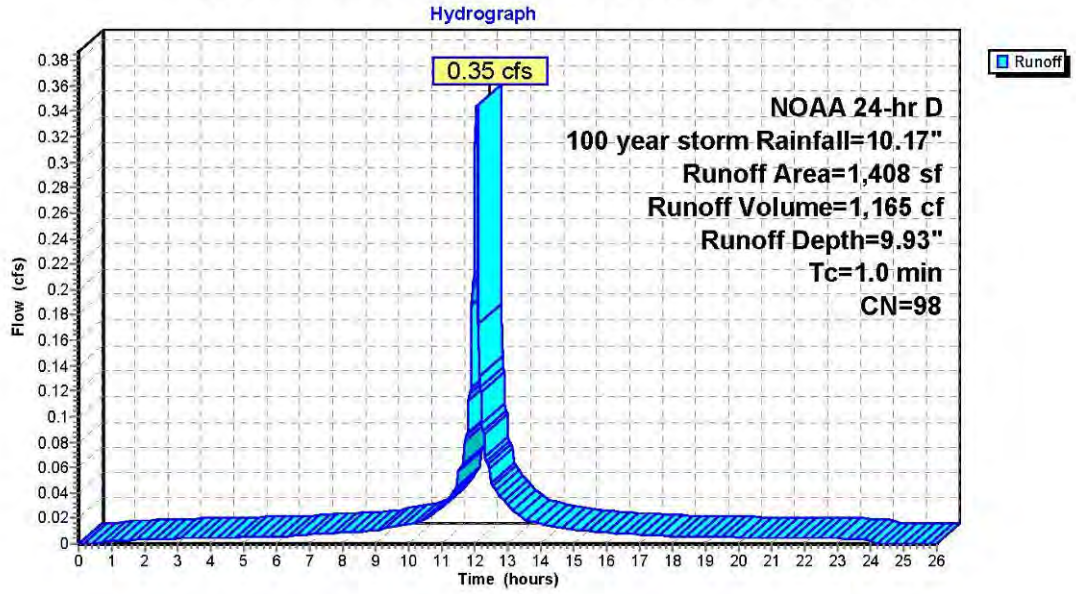
Runoff = 0.35 cfs @ 12.09 hrs, Volume= 1,165 cf, Depth= 9.93"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=10.17"

Area (sf)	CN	Description
1,408	98	Roofs, HSG D
1,408	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6					Direct Entry,
0.6	0	Total, Increased to minimum Tc = 1.0 min			

Subcatchment P4S: DP-2 - lower building roof to SWM



Summary for Subcatchment P3S: DP-3- lower green roof to SWM

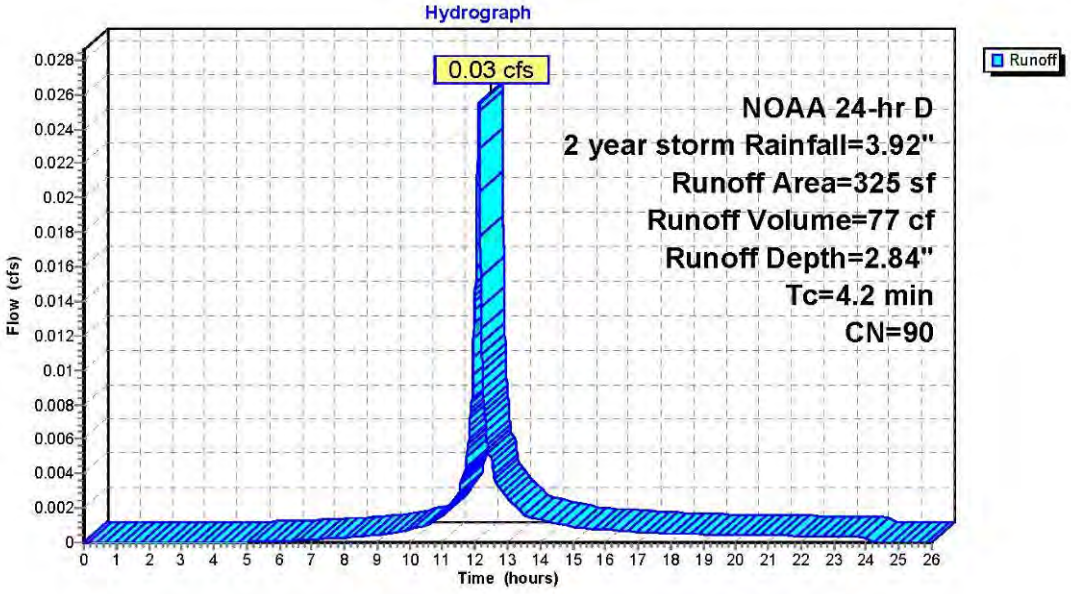
Runoff = 0.03 cfs @ 12.11 hrs, Volume= 77 cf, Depth= 2.84"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.92"

	Area (sf)	CN	Description
*	325	90	Roofs, HSG D
	325	90	100.00% Pervious Area

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

Subcatchment P3S: DP-3- lower green roof to SWM



Summary for Subcatchment P3S: DP-3- lower green roof to SWM

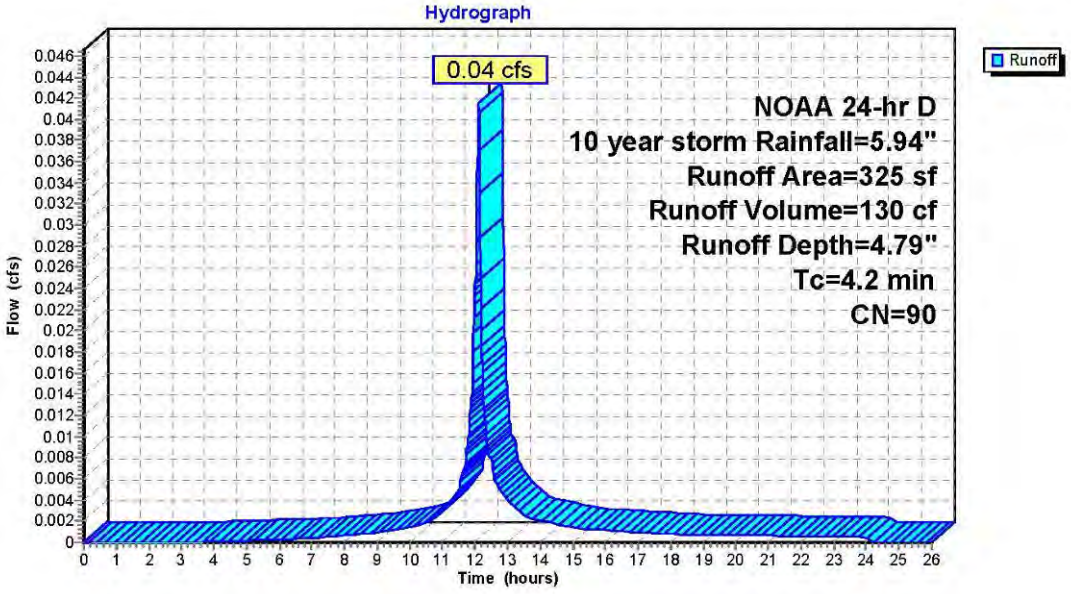
Runoff = 0.04 cfs @ 12.11 hrs, Volume= 130 cf, Depth= 4.79"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.94"

	Area (sf)	CN	Description
*	325	90	Roofs, HSG D
	325	90	100.00% Pervious Area

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

Subcatchment P3S: DP-3- lower green roof to SWM



Summary for Subcatchment P3S: DP-3- lower green roof to SWM

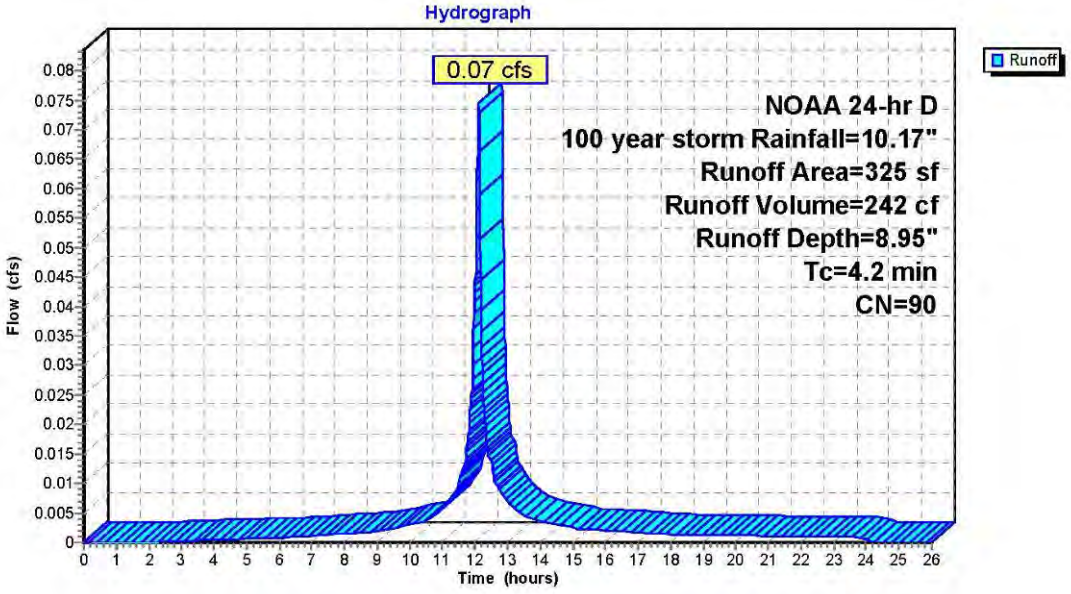
Runoff = 0.07 cfs @ 12.11 hrs, Volume= 242 cf, Depth= 8.95"
Routed to Pond 1P : swm detention system

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=10.17"

	Area (sf)	CN	Description
*	325	90	Roofs, HSG D
	325	90	100.00% Pervious Area

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

Subcatchment P3S: DP-3- lower green roof to SWM



Summary for Subcatchment P5S: DP-4 - permeable pavers

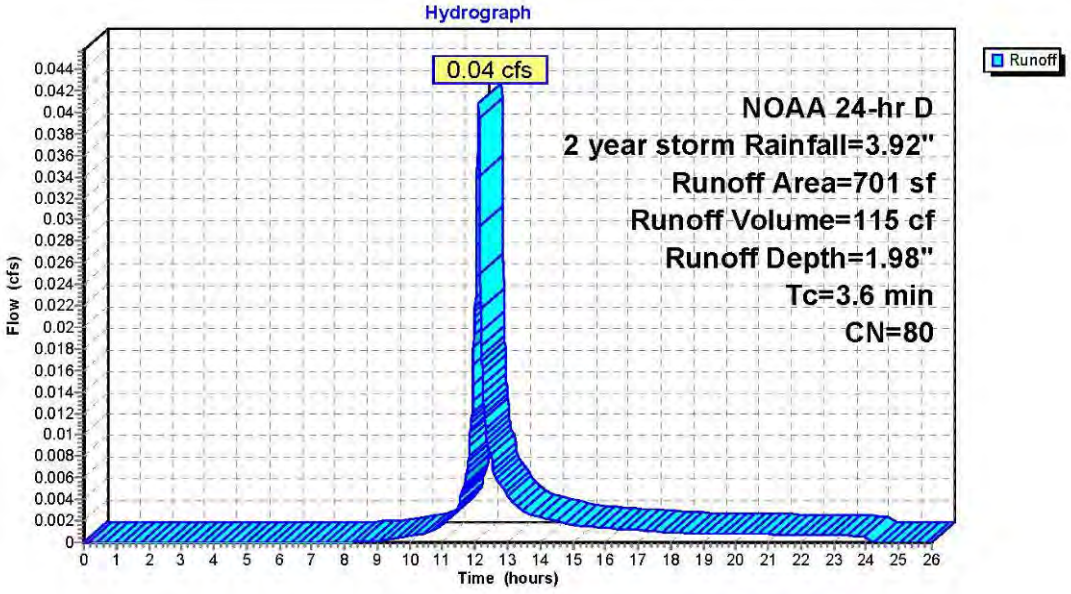
Runoff = 0.04 cfs @ 12.11 hrs, Volume= 115 cf, Depth= 1.98"
Routed to Link 4L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2 year storm Rainfall=3.92"

Area (sf)	CN	Description
701	80	>75% Grass cover, Good, HSG D
701	80	100.00% Pervious Area

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

Subcatchment P5S: DP-4 - permeable pavers



Summary for Subcatchment P5S: DP-4 - permeable pavers

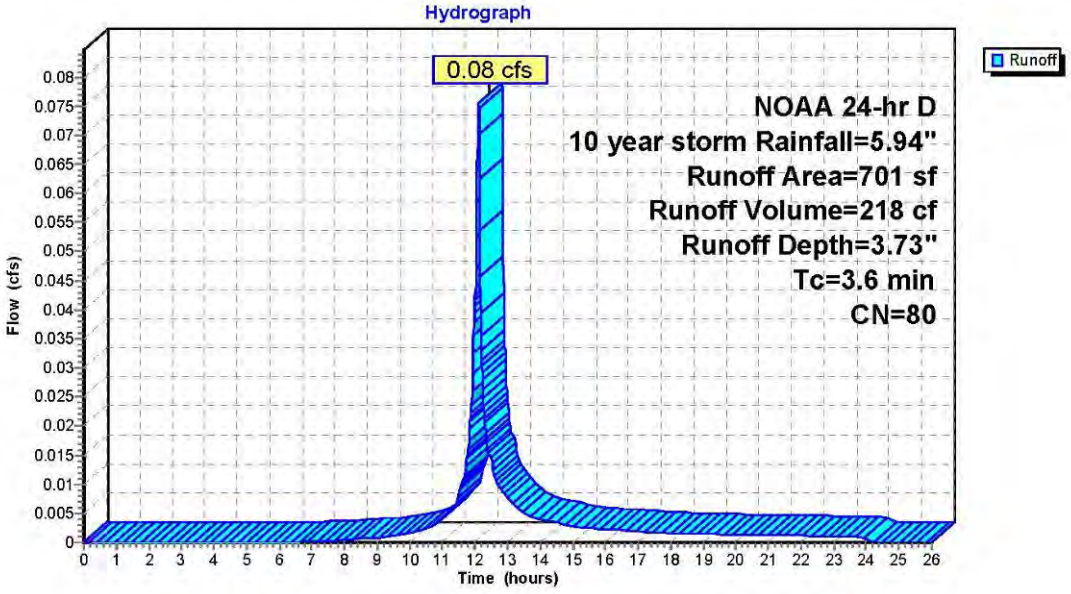
Runoff = 0.08 cfs @ 12.11 hrs, Volume= 218 cf, Depth= 3.73"
Routed to Link 4L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10 year storm Rainfall=5.94"

Area (sf)	CN	Description
701	80	>75% Grass cover, Good, HSG D
701	80	100.00% Pervious Area

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

Subcatchment P5S: DP-4 - permeable pavers



Summary for Subcatchment P5S: DP-4 - permeable pavers

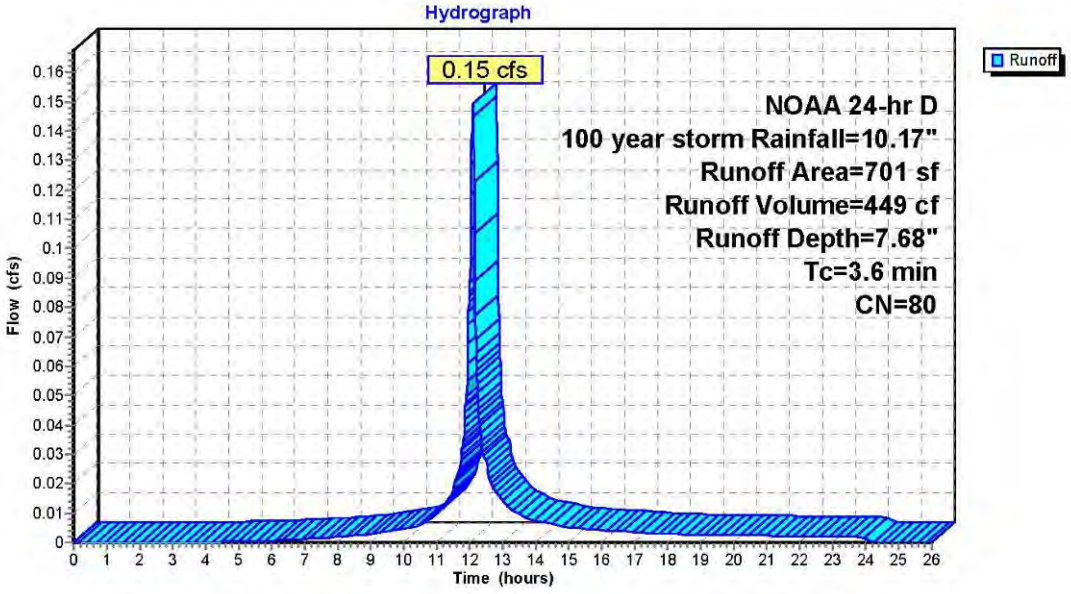
Runoff = 0.15 cfs @ 12.11 hrs, Volume= 449 cf, Depth= 7.68"
Routed to Link 4L : POA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100 year storm Rainfall=10.17"

Area (sf)	CN	Description
701	80	>75% Grass cover, Good, HSG D
701	80	100.00% Pervious Area

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

Subcatchment P5S: DP-4 - permeable pavers



CURRENT ADJUSTED – DETENTION SYSTEM

Summary for Pond 1P: swm detention system

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 2.94" for 2 year storm event
Inflow = 0.88 cfs @ 12.10 hrs, Volume= 2,883 cf
Outflow = 0.33 cfs @ 12.21 hrs, Volume= 2,823 cf, Atten= 62%, Lag= 6.4 min
Primary = 0.33 cfs @ 12.21 hrs, Volume= 2,823 cf
Routed to Pond 2P : backflow check valve

Routing by Dyn-Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
Peak Elev= 45.29' @ 12.21 hrs Surf.Area= 497 sf Storage= 562 cf

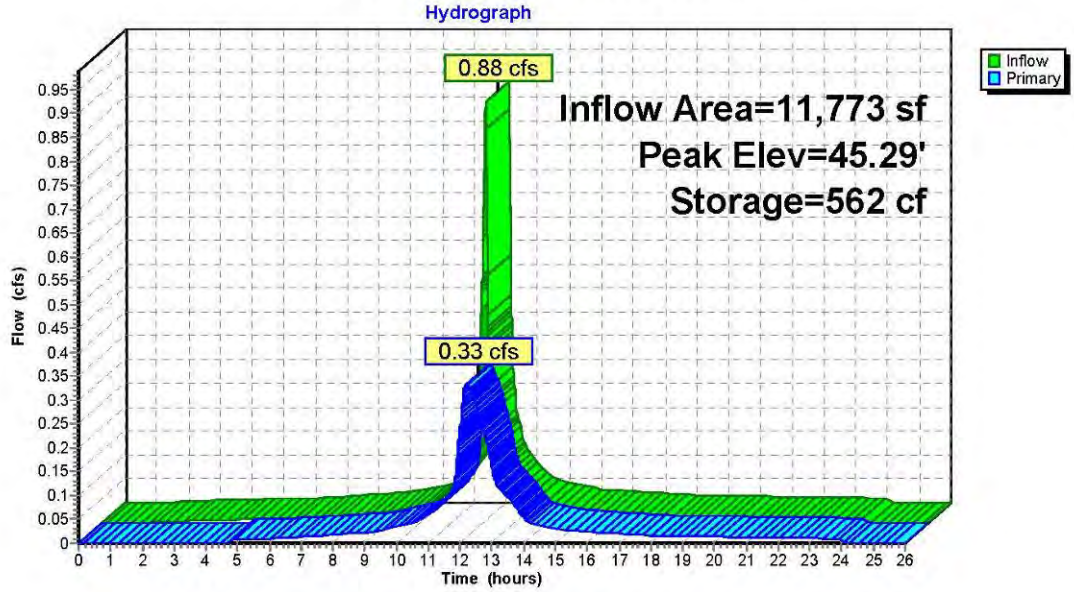
Plug-Flow detention time= 37.5 min calculated for 2,822 cf (98% of inflow)
Center-of-Mass det. time= 24.1 min (787.6 - 763.5)

Volume	Invert	Avail.Storage	Storage Description
#1	41.80'	98 cf	**4.00'D x 7.80'H Vertical Cone/Cylinder**
#2	43.80'	693 cf	**42.0" Round Pipe Storage** L= 72.0' S= 0.0050 '/'
#3	41.80'	136 cf	**3.50'W x 5.00'L x 7.80'H Prismatoid**
#4	43.80'	635 cf	**42.0" Round Pipe Storage** L= 66.0' S= 0.0050 '/'
		1,562 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	43.80'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	46.70'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	48.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Primary	45.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	44.40'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.33 cfs @ 12.21 hrs HW=45.29' TW=43.98' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 0.19 cfs @ 5.51 fps)
- **2=Orifice/Grate** (Controls 0.00 cfs)
- **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Orifice/Grate** (Controls 0.00 cfs)
- **5=Orifice/Grate** (Orifice Controls 0.15 cfs @ 4.27 fps)

Pond 1P: swm detention system



Summary for Pond 1P: swm detention system

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 4.76" for 10 year storm event
Inflow = 1.40 cfs @ 12.10 hrs, Volume= 4,669 cf
Outflow = 0.76 cfs @ 12.12 hrs, Volume= 4,609 cf, Atten= 46%, Lag= 1.5 min
Primary = 0.76 cfs @ 12.12 hrs, Volume= 4,609 cf
Routed to Pond 2P : backflow check valve

Routing by Dyn-Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
Peak Elev= 45.90' @ 12.13 hrs Surf.Area= 510 sf Storage= 870 cf

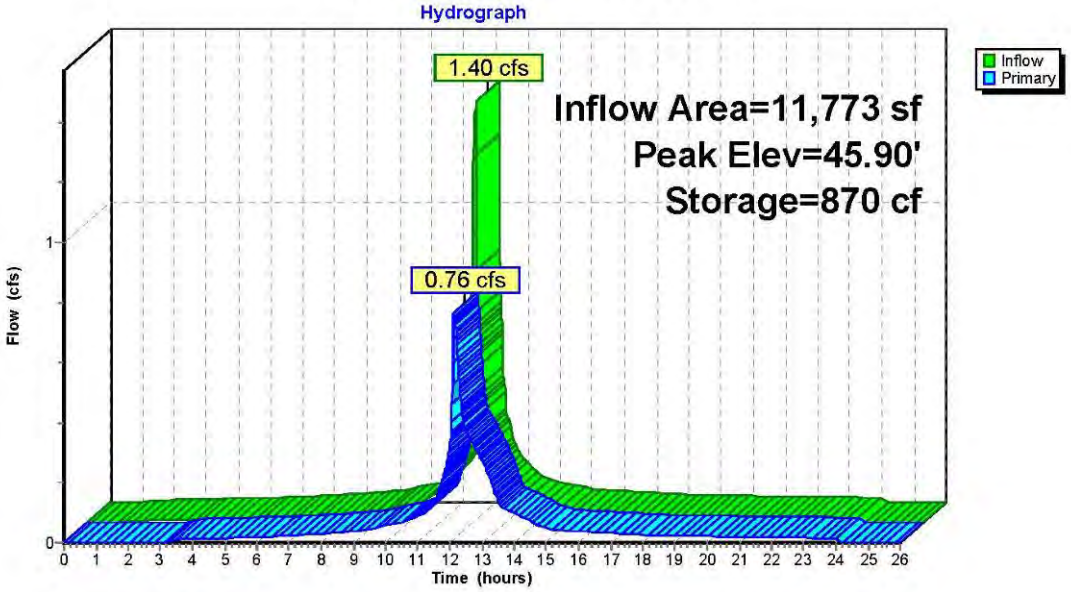
Plug-Flow detention time= 30.4 min calculated for 4,607 cf (99% of inflow)
Center-of-Mass det. time= 21.9 min (776.2 - 754.4)

Volume	Invert	Avail.Storage	Storage Description
#1	41.80'	98 cf	**4.00'D x 7.80'H Vertical Cone/Cylinder**
#2	43.80'	693 cf	**42.0" Round Pipe Storage** L= 72.0' S= 0.0050 '/'
#3	41.80'	136 cf	**3.50'W x 5.00'L x 7.80'H Prismatoid**
#4	43.80'	635 cf	**42.0" Round Pipe Storage** L= 66.0' S= 0.0050 '/'
		1,562 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	43.80'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	46.70'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	48.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Primary	45.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	44.40'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.76 cfs @ 12.12 hrs HW=45.89' TW=44.28' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 0.21 cfs @ 6.12 fps)
- **2=Orifice/Grate** (Controls 0.00 cfs)
- **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Orifice/Grate** (Orifice Controls 0.36 cfs @ 2.14 fps)
- **5=Orifice/Grate** (Orifice Controls 0.19 cfs @ 5.68 fps)

Pond 1P: swm detention system



Summary for Pond 1P: swm detention system

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 8.50" for 100 year storm event
Inflow = 2.45 cfs @ 12.10 hrs, Volume= 8,342 cf
Outflow = 1.56 cfs @ 12.12 hrs, Volume= 8,281 cf, Atten= 37%, Lag= 1.1 min
Primary = 1.56 cfs @ 12.12 hrs, Volume= 8,281 cf
Routed to Pond 2P : backflow check valve

Routing by Dyn-Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
Peak Elev= 46.93' @ 12.12 hrs Surf.Area= 377 sf Storage= 1,350 cf

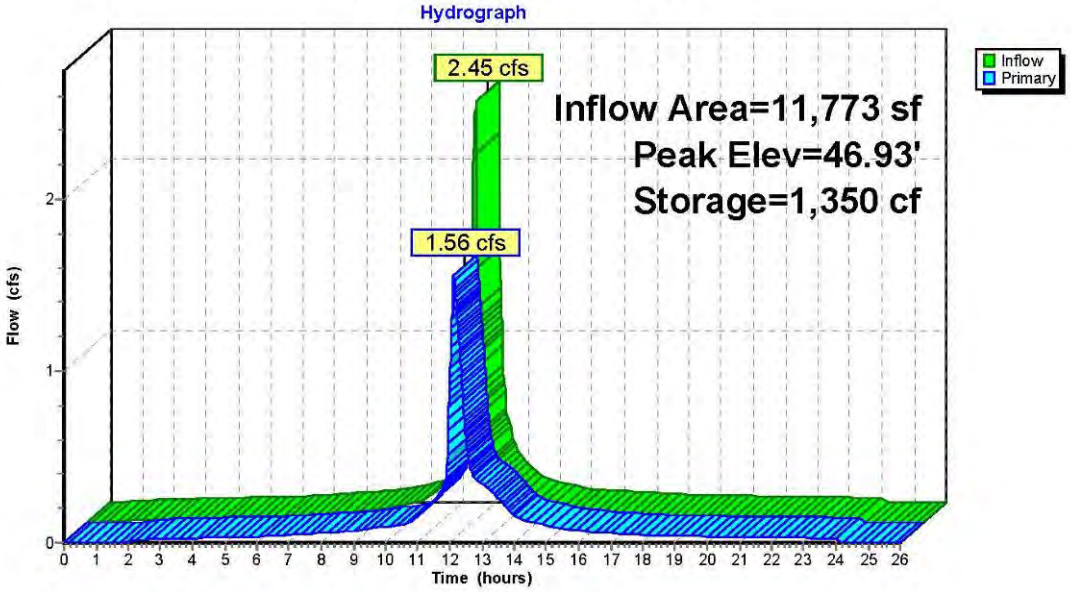
Plug-Flow detention time= 23.8 min calculated for 8,278 cf (99% of inflow)
Center-of-Mass det. time= 18.9 min (763.9 - 745.0)

Volume	Invert	Avail.Storage	Storage Description
#1	41.80'	98 cf	**4.00'D x 7.80'H Vertical Cone/Cylinder**
#2	43.80'	693 cf	**42.0" Round Pipe Storage** L= 72.0' S= 0.0050 '/'
#3	41.80'	136 cf	**3.50'W x 5.00'L x 7.80'H Prismatoid**
#4	43.80'	635 cf	**42.0" Round Pipe Storage** L= 66.0' S= 0.0050 '/'
		1,562 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	43.80'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	46.70'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	48.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Primary	45.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	44.40'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.55 cfs @ 12.12 hrs HW=46.93' TW=45.10' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 0.22 cfs @ 6.51 fps)
- **2=Orifice/Grate** (Orifice Controls 0.08 cfs @ 1.63 fps)
- **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Orifice/Grate** (Orifice Controls 1.03 cfs @ 5.23 fps)
- **5=Orifice/Grate** (Orifice Controls 0.22 cfs @ 6.51 fps)

Pond 1P: swm detention system



FUTURE ADJUSTED – DETENTION SYSTEM

Summary for Pond 1P: swm detention system

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 3.50" for 2 year storm event
Inflow = 1.05 cfs @ 12.10 hrs, Volume= 3,434 cf
Outflow = 0.37 cfs @ 12.21 hrs, Volume= 3,373 cf, Atten= 64%, Lag= 6.6 min
Primary = 0.37 cfs @ 12.21 hrs, Volume= 3,373 cf
Routed to Pond 2P : backflow check valve

Routing by Dyn-Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
Peak Elev= 45.54' @ 12.21 hrs Surf.Area= 510 sf Storage= 687 cf

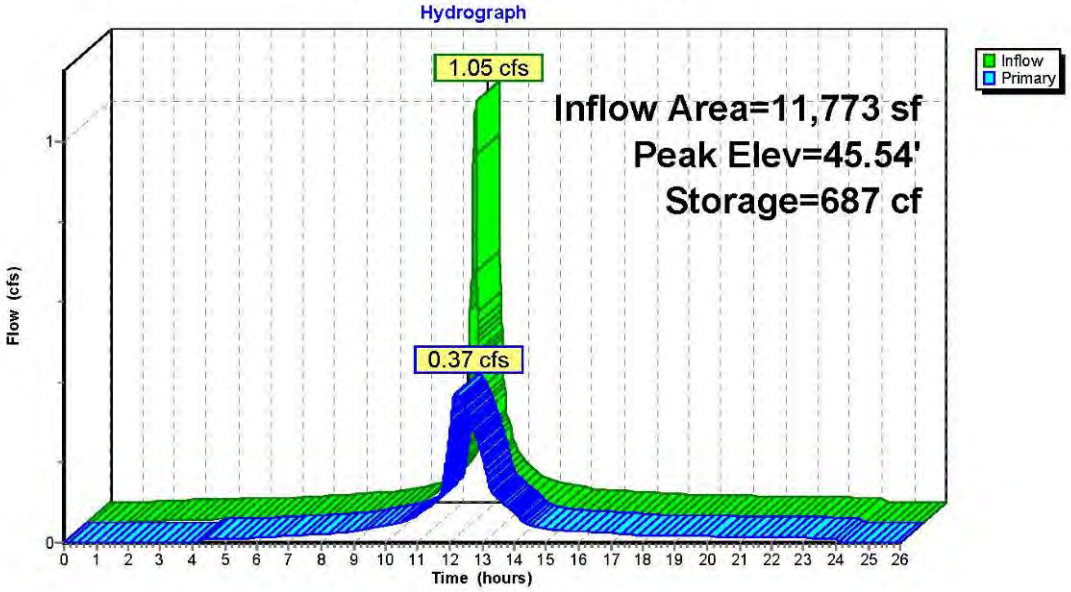
Plug-Flow detention time= 35.1 min calculated for 3,372 cf (98% of inflow)
Center-of-Mass det. time= 23.8 min (783.1 - 759.3)

Volume	Invert	Avail.Storage	Storage Description
#1	41.80'	98 cf	**4.00'D x 7.80'H Vertical Cone/Cylinder**
#2	43.80'	693 cf	**42.0" Round Pipe Storage** L= 72.0' S= 0.0050 '/'
#3	41.80'	136 cf	**3.50'W x 5.00'L x 7.80'H Prismatoid**
#4	43.80'	635 cf	**42.0" Round Pipe Storage** L= 66.0' S= 0.0050 '/'
		1,562 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	43.80'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	46.70'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	48.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Primary	45.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	44.40'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.37 cfs @ 12.21 hrs HW=45.54' TW=44.00' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 0.20 cfs @ 5.97 fps)
- **2=Orifice/Grate** (Controls 0.00 cfs)
- **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.66 fps)
- **5=Orifice/Grate** (Orifice Controls 0.17 cfs @ 4.89 fps)

Pond 1P: swm detention system



Summary for Pond 1P: swm detention system

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 5.50" for 10 year storm event
Inflow = 1.62 cfs @ 12.10 hrs, Volume= 5,396 cf
Outflow = 0.97 cfs @ 12.12 hrs, Volume= 5,336 cf, Atten= 40%, Lag= 1.3 min
Primary = 0.97 cfs @ 12.12 hrs, Volume= 5,336 cf
Routed to Pond 2P : backflow check valve

Routing by Dyn-Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
Peak Elev= 46.09' @ 12.12 hrs Surf.Area= 501 sf Storage= 971 cf

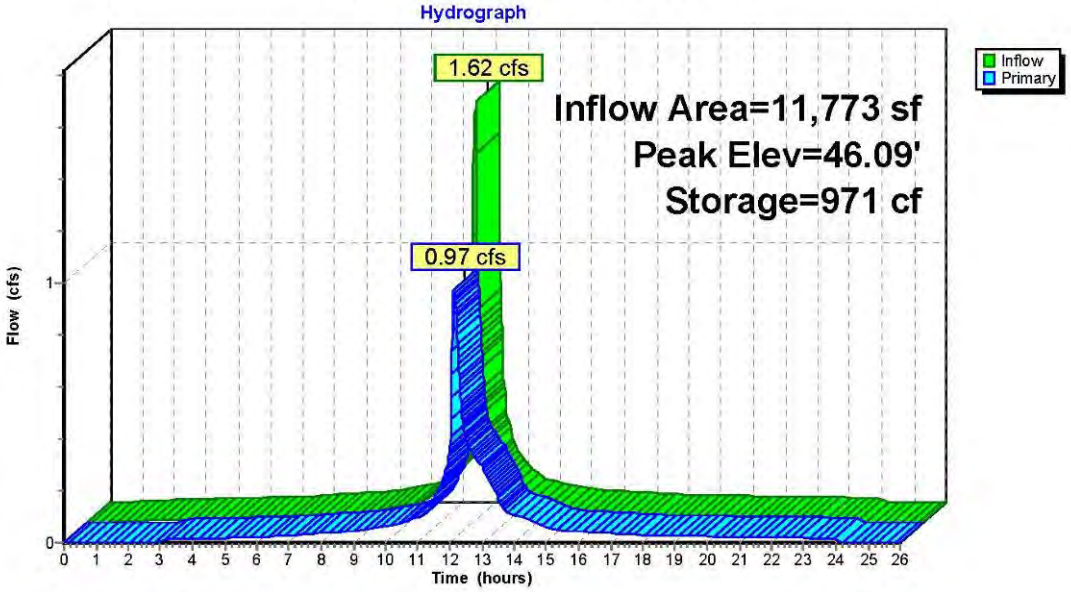
Plug-Flow detention time= 28.3 min calculated for 5,334 cf (99% of inflow)
Center-of-Mass det. time= 20.9 min (771.7 - 750.8)

Volume	Invert	Avail.Storage	Storage Description
#1	41.80'	98 cf	**4.00'D x 7.80'H Vertical Cone/Cylinder**
#2	43.80'	693 cf	**42.0" Round Pipe Storage** L= 72.0' S= 0.0050 '/'
#3	41.80'	136 cf	**3.50'W x 5.00'L x 7.80'H Prismatoid**
#4	43.80'	635 cf	**42.0" Round Pipe Storage** L= 66.0' S= 0.0050 '/'
		1,562 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	43.80'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	46.70'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	48.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Primary	45.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	44.40'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.97 cfs @ 12.12 hrs HW=46.09' TW=44.47' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 0.21 cfs @ 6.13 fps)
- **2=Orifice/Grate** (Controls 0.00 cfs)
- **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Orifice/Grate** (Orifice Controls 0.55 cfs @ 2.82 fps)
- **5=Orifice/Grate** (Orifice Controls 0.21 cfs @ 6.07 fps)

Pond 1P: swm detention system



Summary for Pond 1P: swm detention system

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 9.71" for 100 year storm event
Inflow = 2.80 cfs @ 12.10 hrs, Volume= 9,529 cf
Outflow = 1.88 cfs @ 12.12 hrs, Volume= 9,469 cf, Atten= 33%, Lag= 1.1 min
Primary = 1.88 cfs @ 12.12 hrs, Volume= 9,469 cf
Routed to Pond 2P : backflow check valve

Routing by Dyn-Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
Peak Elev= 47.43' @ 12.12 hrs Surf.Area= 125 sf Storage= 1,489 cf

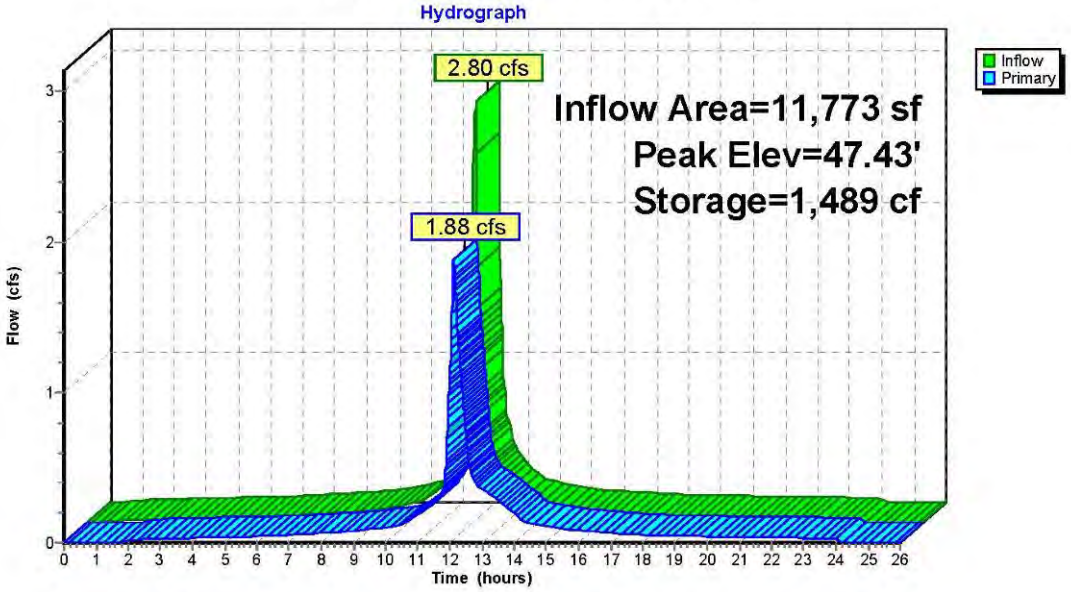
Plug-Flow detention time= 22.8 min calculated for 9,469 cf (99% of inflow)
Center-of-Mass det. time= 18.5 min (760.5 - 742.0)

Volume	Invert	Avail.Storage	Storage Description
#1	41.80'	98 cf	**4.00'D x 7.80'H Vertical Cone/Cylinder**
#2	43.80'	693 cf	**42.0" Round Pipe Storage** L= 72.0' S= 0.0050 '/'
#3	41.80'	136 cf	**3.50'W x 5.00'L x 7.80'H Prismatoid**
#4	43.80'	635 cf	**42.0" Round Pipe Storage** L= 66.0' S= 0.0050 '/'
		1,562 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	43.80'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	46.70'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	48.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Primary	45.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	44.40'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.86 cfs @ 12.12 hrs HW=47.42' TW=45.47' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 0.23 cfs @ 6.72 fps)
- **2=Orifice/Grate** (Orifice Controls 0.18 cfs @ 3.72 fps)
- **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Orifice/Grate** (Orifice Controls 1.22 cfs @ 6.23 fps)
- **5=Orifice/Grate** (Orifice Controls 0.23 cfs @ 6.72 fps)

Pond 1P: swm detention system



BACKFLOW DEVOCE PERFORMANCE

Summary for Pond 2P: backflow check valve

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 9.65" for 100 year storm event
Inflow = 1.88 cfs @ 12.12 hrs, Volume= 9,469 cf
Outflow = 1.86 cfs @ 12.12 hrs, Volume= 9,469 cf, Atten= 1%, Lag= 0.3 min
Primary = 1.86 cfs @ 12.12 hrs, Volume= 9,469 cf
Routed to Link 3L : storm sewer

Routing by Dyn-Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
Peak Elev= 45.49' @ 12.12 hrs Surf.Area= 18 sf Storage= 30 cf

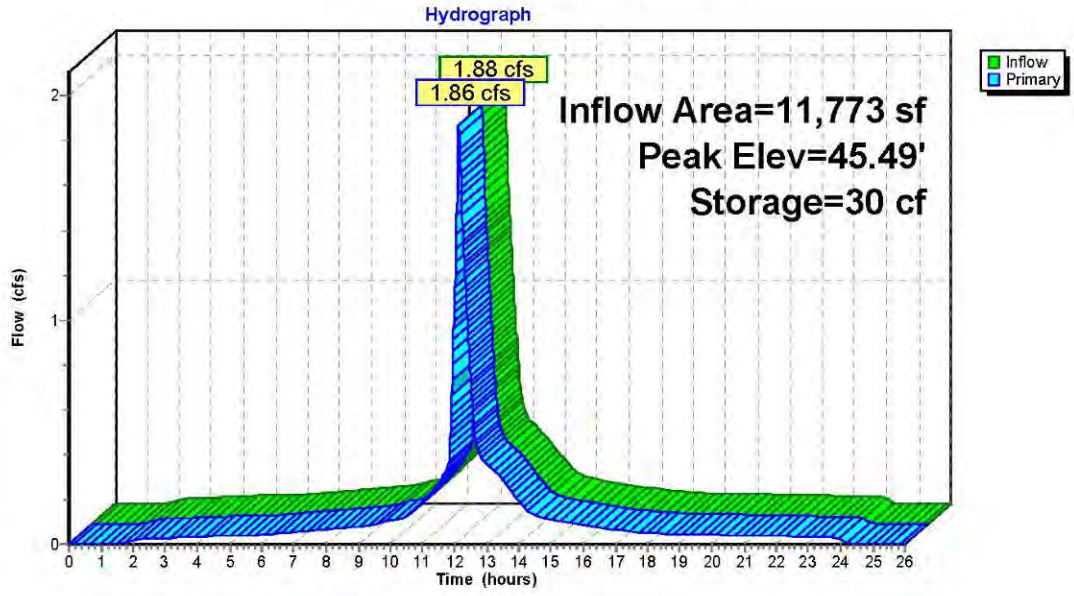
Plug-Flow detention time= 0.2 min calculated for 9,469 cf (100% of inflow)
Center-of-Mass det. time= 0.2 min (760.7 - 760.5)

Volume	Invert	Avail.Storage	Storage Description
#1	43.80'	98 cf	**3.50'W x 5.00'L x 5.60'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	43.80'	**Special & User-Defined** Loss (feet) 0.00 0.30 0.80 1.45 2.15 3.05 4.00 5.10 Disch. (cfs) 0.000 0.560 1.110 1.670 2.230 2.780 3.340 3.900

Primary OutFlow Max=1.86 cfs @ 12.12 hrs HW=45.48' TW=39.60' (Dynamic Tailwater)
↑—**1=Special & User-Defined** (Custom Controls 1.86 cfs)

Pond 2P: backflow check valve



TOTAL – CURRENT ADJUSTED – POST-DEVELOPMENT

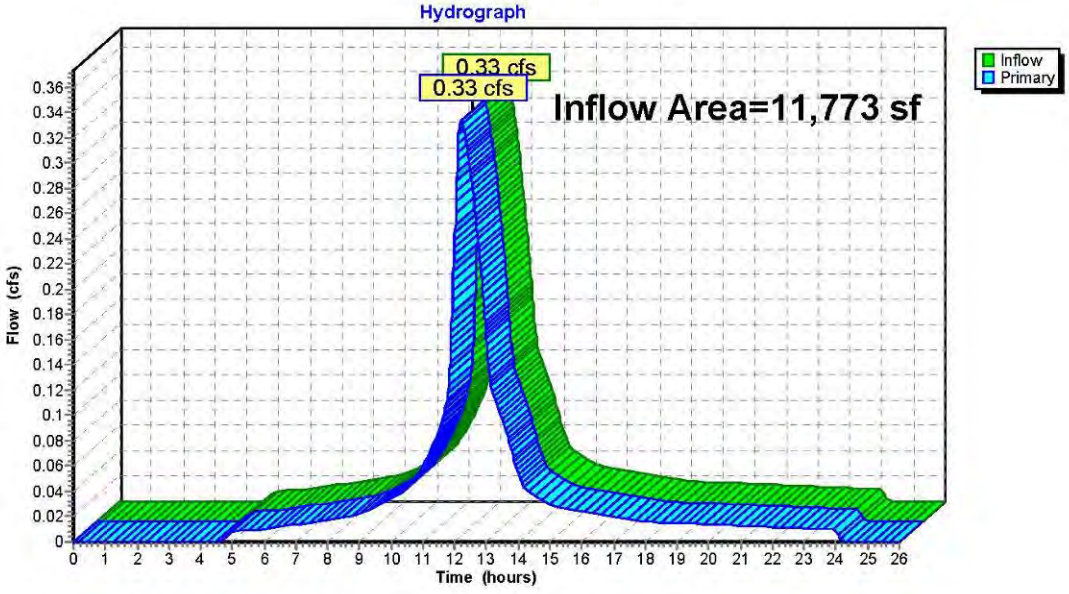
Summary for Link 3L: storm sewer

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 2.88" for 2 year storm event
Inflow = 0.33 cfs @ 12.21 hrs, Volume= 2,823 cf
Primary = 0.33 cfs @ 12.21 hrs, Volume= 2,823 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 39.60'

Link 3L: storm sewer



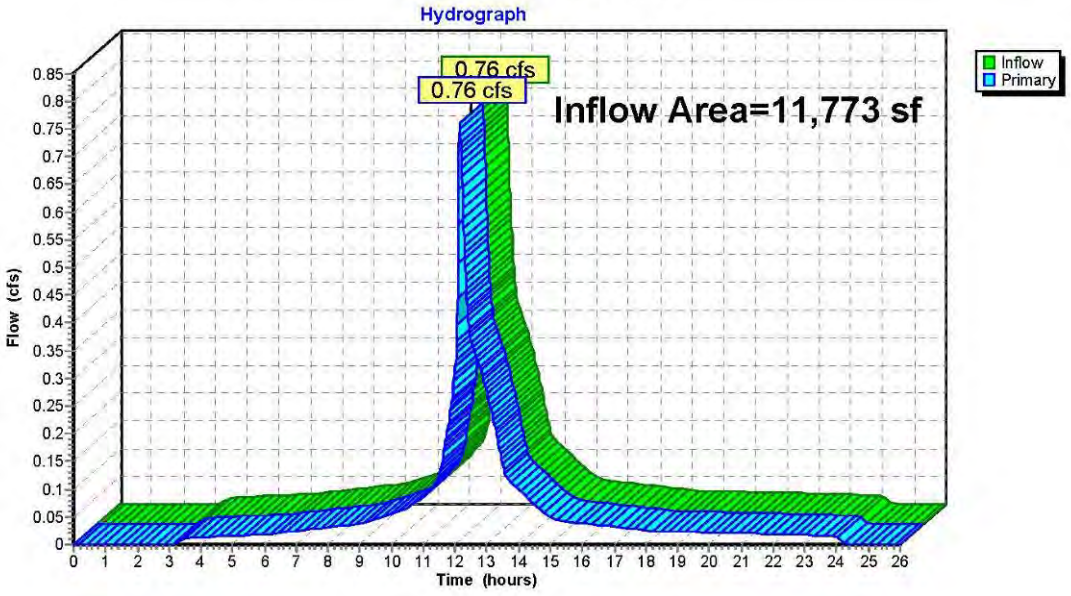
Summary for Link 3L: storm sewer

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 4.70" for 10 year storm event
Inflow = 0.76 cfs @ 12.13 hrs, Volume= 4,609 cf
Primary = 0.76 cfs @ 12.13 hrs, Volume= 4,609 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 39.60'

Link 3L: storm sewer



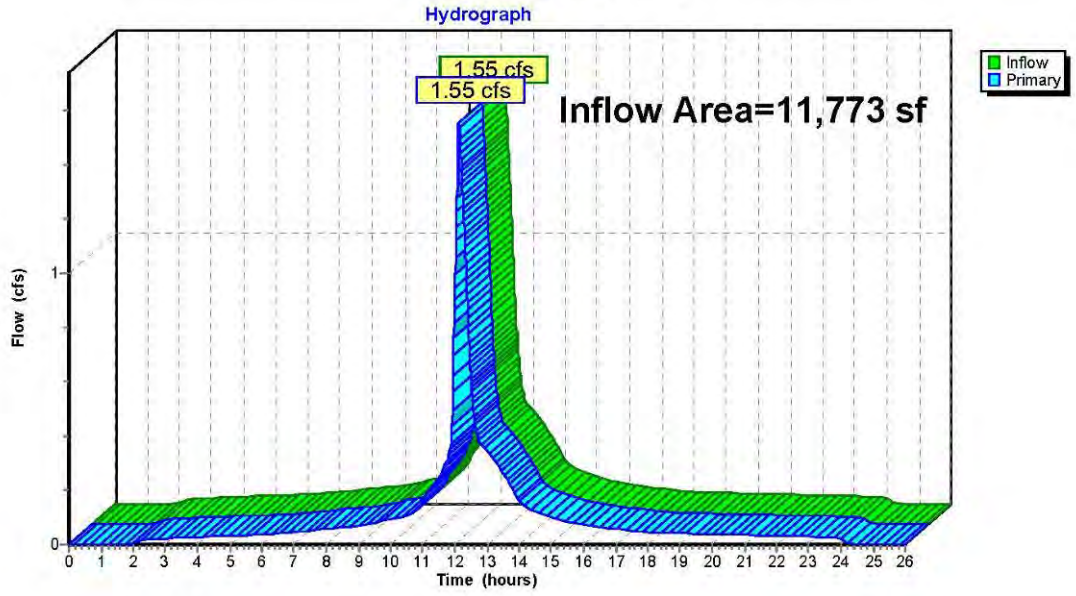
Summary for Link 3L: storm sewer

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 8.44" for 100 year storm event
Inflow = 1.55 cfs @ 12.12 hrs, Volume= 8,281 cf
Primary = 1.55 cfs @ 12.12 hrs, Volume= 8,281 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 39.60'

Link 3L: storm sewer

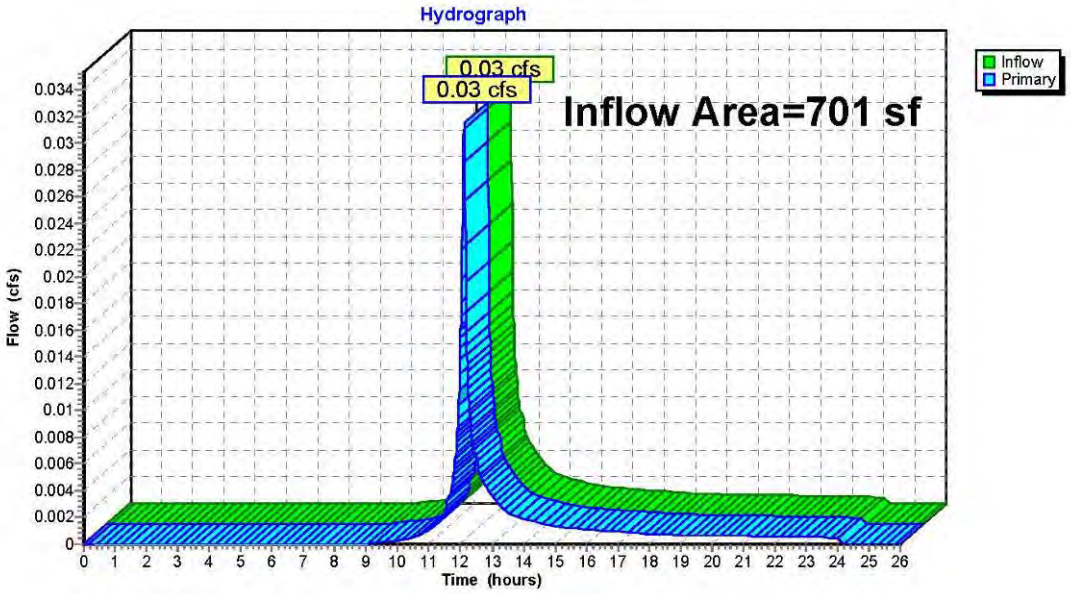


Summary for Link 4L: POA-1

Inflow Area = 701 sf, 0.00% Impervious, Inflow Depth = 1.55" for 2 year storm event
Inflow = 0.03 cfs @ 12.12 hrs, Volume= 91 cf
Primary = 0.03 cfs @ 12.12 hrs, Volume= 91 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 4L: POA-1

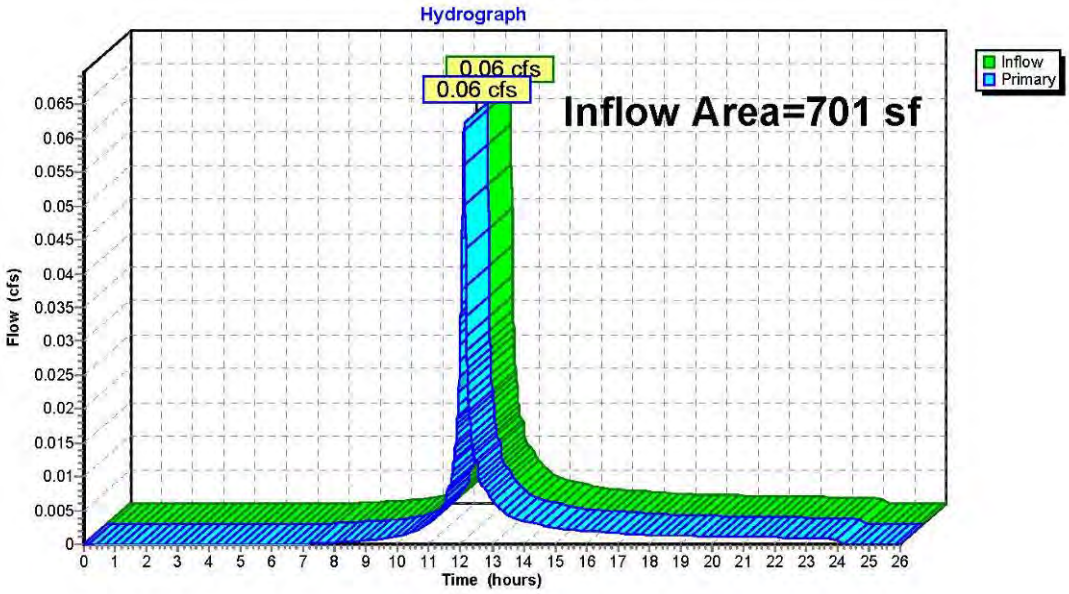


Summary for Link 4L: POA-1

Inflow Area = 701 sf, 0.00% Impervious, Inflow Depth = 3.10" for 10 year storm event
Inflow = 0.06 cfs @ 12.12 hrs, Volume= 181 cf
Primary = 0.06 cfs @ 12.12 hrs, Volume= 181 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 4L: POA-1

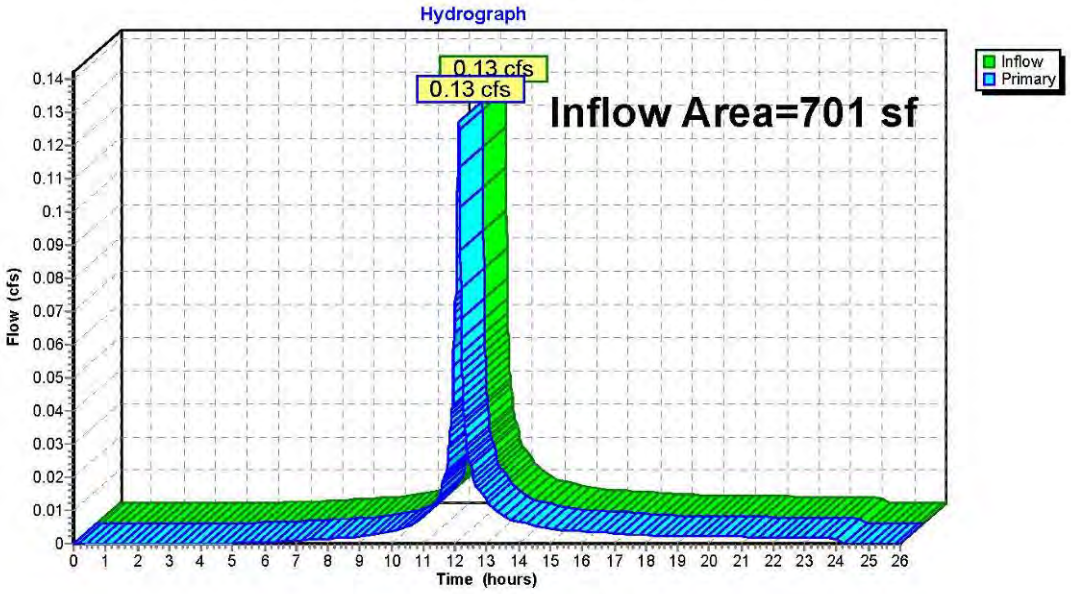


Summary for Link 4L: POA-1

Inflow Area = 701 sf, 0.00% Impervious, Inflow Depth = 6.58" for 100 year storm event
Inflow = 0.13 cfs @ 12.11 hrs, Volume= 384 cf
Primary = 0.13 cfs @ 12.11 hrs, Volume= 384 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 4L: POA-1



TOTAL – FUTURE ADJUSTED – POST-DEVELOPMENT

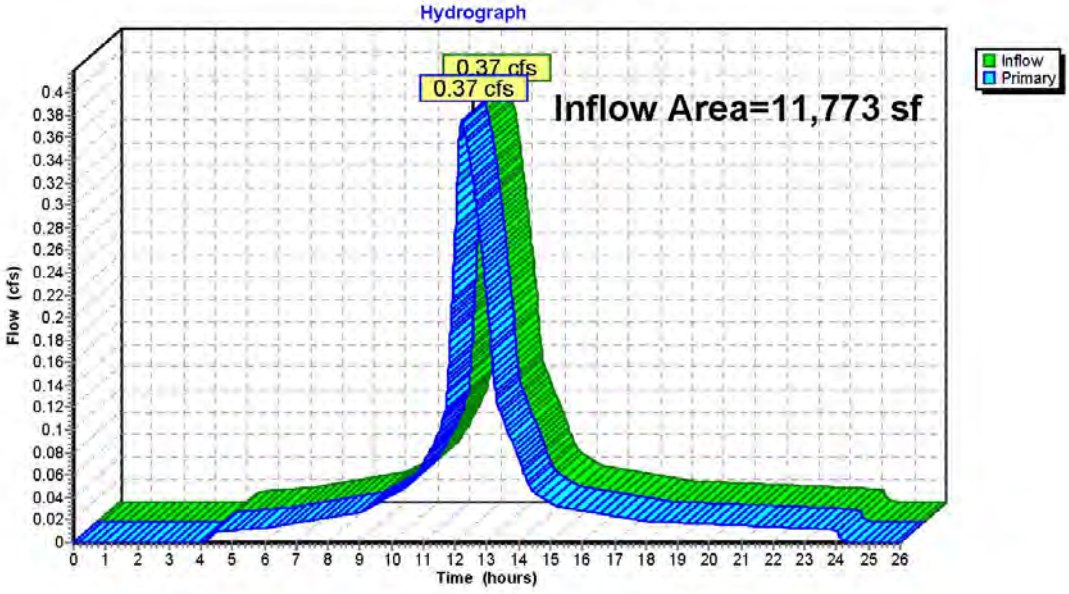
Summary for Link 3L: storm sewer

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 3.44" for 2 year storm event
Inflow = 0.37 cfs @ 12.21 hrs, Volume= 3,373 cf
Primary = 0.37 cfs @ 12.21 hrs, Volume= 3,373 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 39.60'

Link 3L: storm sewer



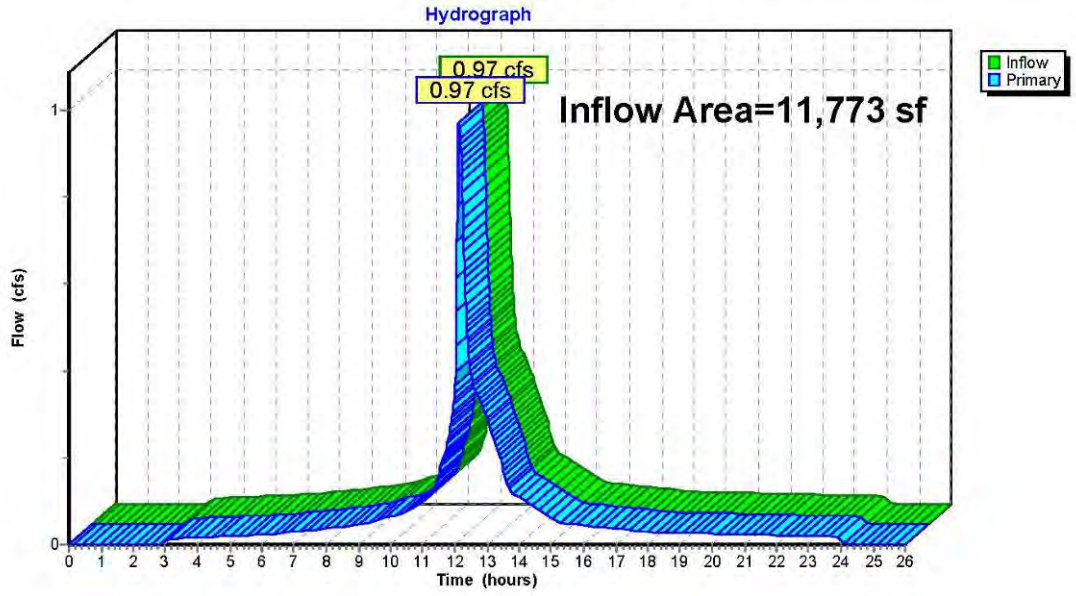
Summary for Link 3L: storm sewer

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 5.44" for 10 year storm event
Inflow = 0.97 cfs @ 12.13 hrs, Volume= 5,336 cf
Primary = 0.97 cfs @ 12.13 hrs, Volume= 5,336 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 39.60'

Link 3L: storm sewer



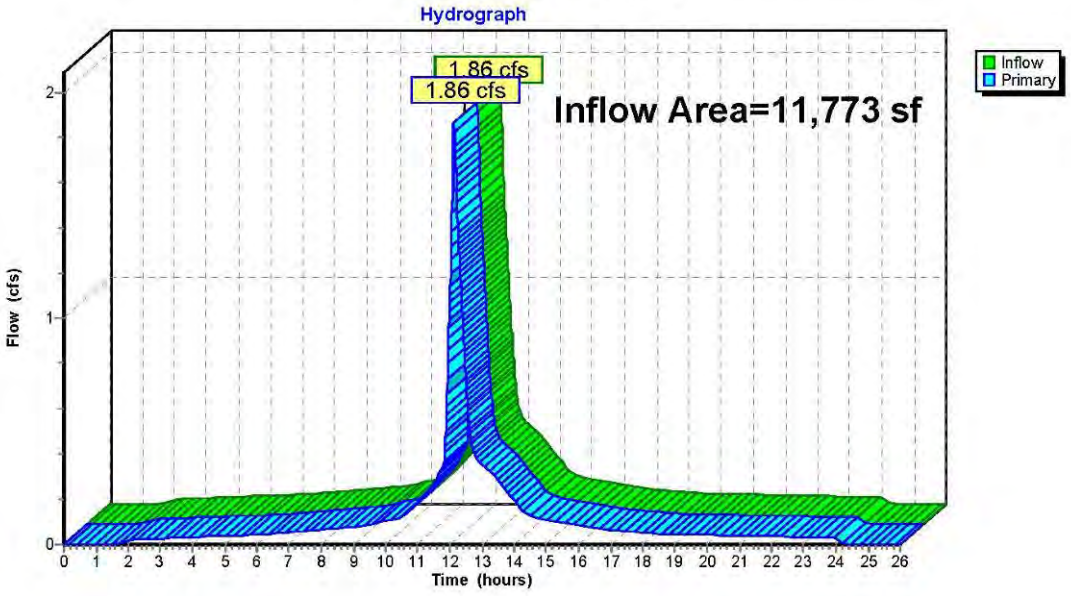
Summary for Link 3L: storm sewer

Inflow Area = 11,773 sf, 77.96% Impervious, Inflow Depth = 9.65" for 100 year storm event
Inflow = 1.86 cfs @ 12.12 hrs, Volume= 9,469 cf
Primary = 1.86 cfs @ 12.12 hrs, Volume= 9,469 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 39.60'

Link 3L: storm sewer

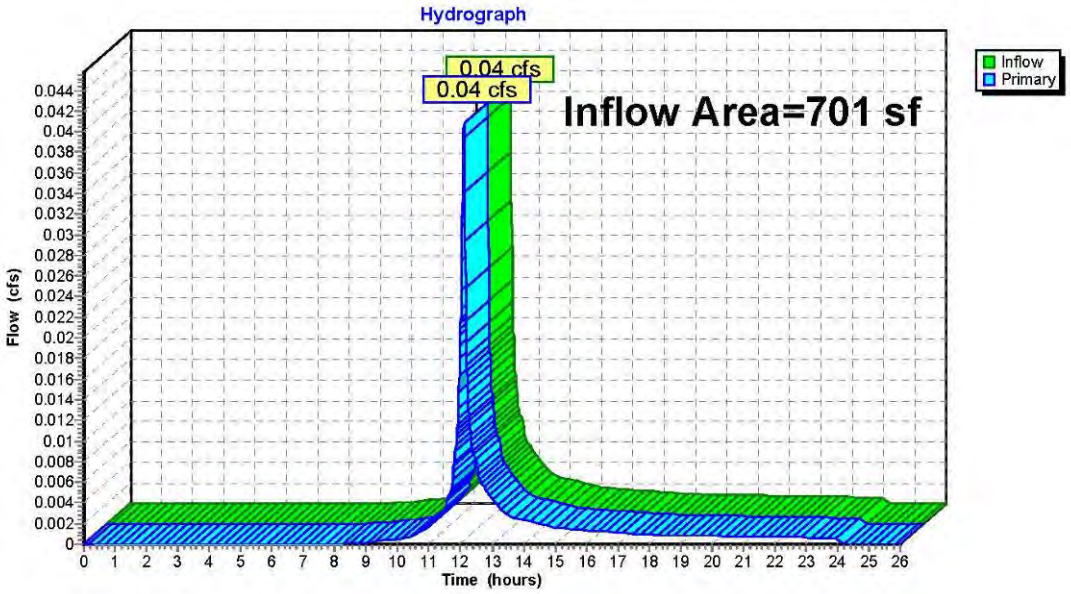


Summary for Link 4L: POA-1

Inflow Area = 701 sf, 0.00% Impervious, Inflow Depth = 1.98" for 2 year storm event
Inflow = 0.04 cfs @ 12.11 hrs, Volume= 115 cf
Primary = 0.04 cfs @ 12.11 hrs, Volume= 115 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 4L: POA-1

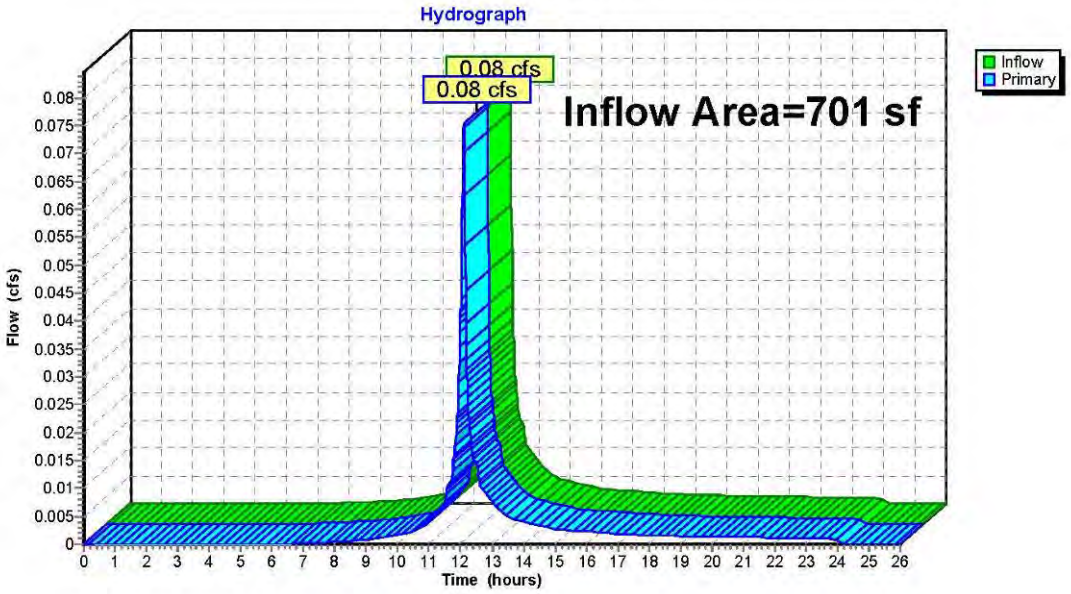


Summary for Link 4L: POA-1

Inflow Area = 701 sf, 0.00% Impervious, Inflow Depth = 3.73" for 10 year storm event
Inflow = 0.08 cfs @ 12.11 hrs, Volume= 218 cf
Primary = 0.08 cfs @ 12.11 hrs, Volume= 218 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 4L: POA-1

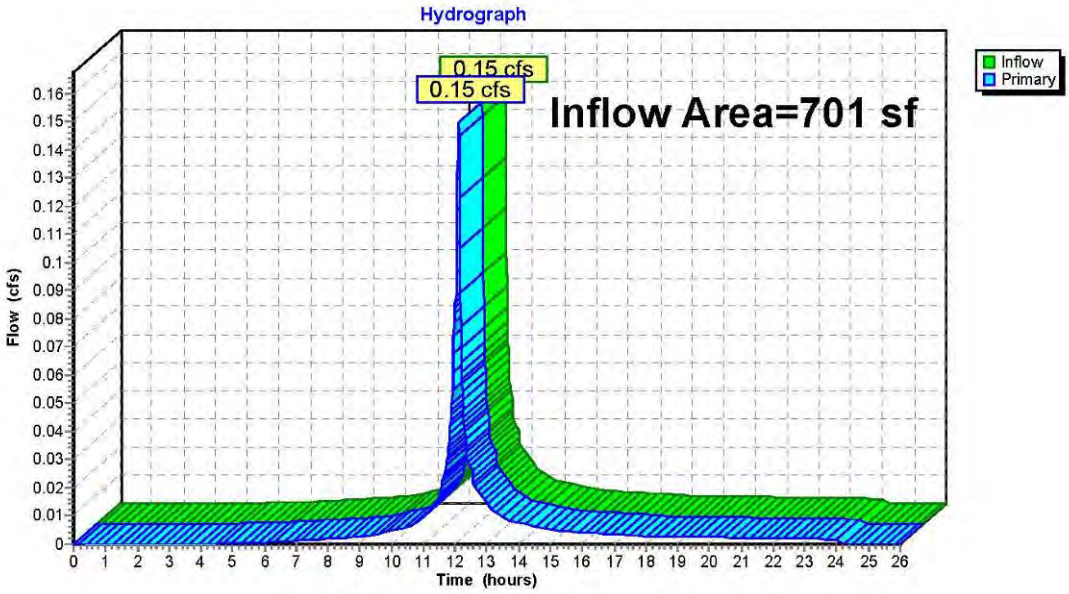


Summary for Link 4L: POA-1

Inflow Area = 701 sf, 0.00% Impervious, Inflow Depth = 7.68" for 100 year storm event
Inflow = 0.15 cfs @ 12.11 hrs, Volume= 449 cf
Primary = 0.15 cfs @ 12.11 hrs, Volume= 449 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs

Link 4L: POA-1



APPENDIX J – GREEN ROOF CALCULATIONS

DESIGN OF GREEN ROOF

The site design includes two green roof areas. These green roofs are designed to allow stormwater to infiltrate through a growing medium. This process results in reduced curve number values for the portion of the roofs that contain green roof areas. Infiltrated stormwater is routed through a drainage layer to the roof drainage system and to the on-site stormwater detention system. All excess stormwater not infiltrated through the growing medium is directed to overflow drains that also connect to the stormwater detention system.

The selected green roof system is:

HydroTech® extensive GR10 + 4″ LiteTop engineered growing media

- 20% 1-7 mm pumice
- 60% 4-10 mm pumice
- 20% composted pine bark fines

The green roof system has been designed per NJAC 7:8 and the New Jersey Stormwater Best Management Practices.

The following calculations determine green roof criteria for use in hydraulic calculations for:

- Using Current Adjusted Rainfall Data
  - main green roof
  - lower green roof
- Using Future Adjusted Rainfall Data
  - main green roof
  - lower green roof

MAIN GREEN ROOF – CURRENT ADJUSTED

Green Roof Area = 2,270 sf

Hydraulic Computations:

Calculation of runoff retention of the proposed Green Roof:

$$S_v = \frac{SA\ x\ [(d\ x\ \eta_1)+(DL\ x\ \eta_2)]}{12}, \text{ where:}$$

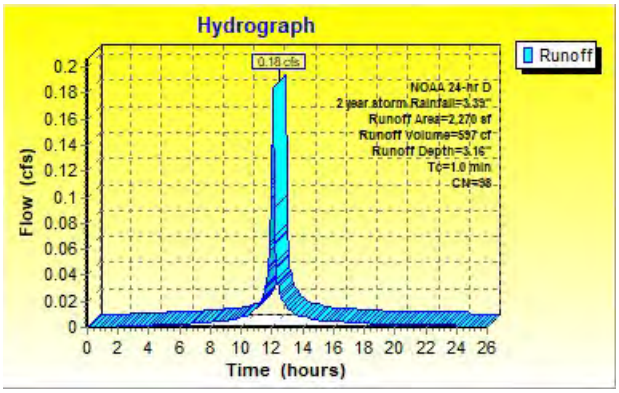
S_v = storage volume (cf)
SA = green roof area (sf)
d = media depth (in)
η_1 = available water capacity for runoff retention
DL = drainage layer depth (in)
η_2 = drainage layer field capacity

SA = 2,270 sf
d = 4 in
n_1 = 0.231 (NJ-BMP 9.4, page 13)
DL = 4 in
n_2 = 0.02 (reduced for back-to-back storm condition)

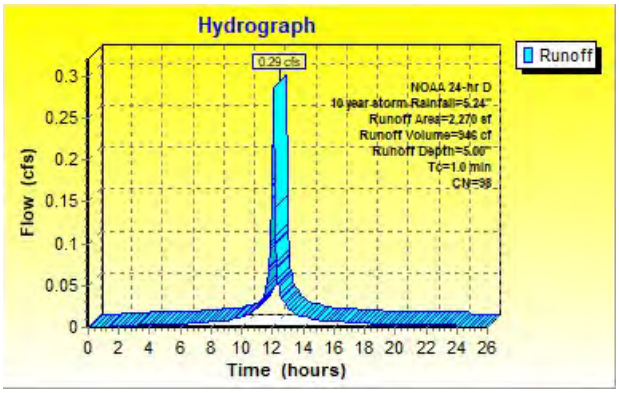
S_v = 2270 x [(4 x 0.231) + (4 x 0.02)]/12 = 190 cf

Calculation of discharged runoff volume from the roof area for 2, 10 and 100-year storms for impervious roof with 2,270 sf area under current adjusted rainfall data:

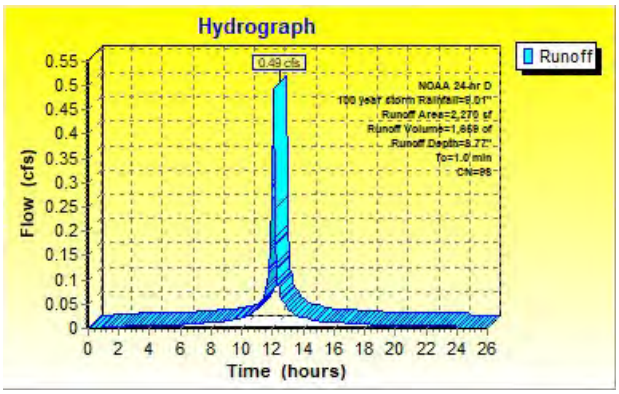
Discharged Runoff Volumes for NOAA 24-hr region D rainfall distribution without green roof (HydroCAD® 10.20-7a software):



IMPERVIOUS ROOF RUNOFF – 2-yr STORM



IMPERVIOUS ROOF RUNOFF – 10-yr STORM



IMPERVIOUS ROOF RUNOFF – 100-yr STORM

Storm Event	(A) Runoff Volume (cf) (Impervious Surface)	(B) Storage Volume (cf)	(A)-(B) Discharged Runoff Volume (cf) (Green Roof)
2-year	597	190	407
10-year	946	190	756
100-year	1,659	190	1,469

Calculation of direct runoff depth for green roof:

Direct runoff depth, *Q*, is calculated by multiplying the green roof discharged runoff volume (cf) by 12 in/ft and dividing by the green roof area:

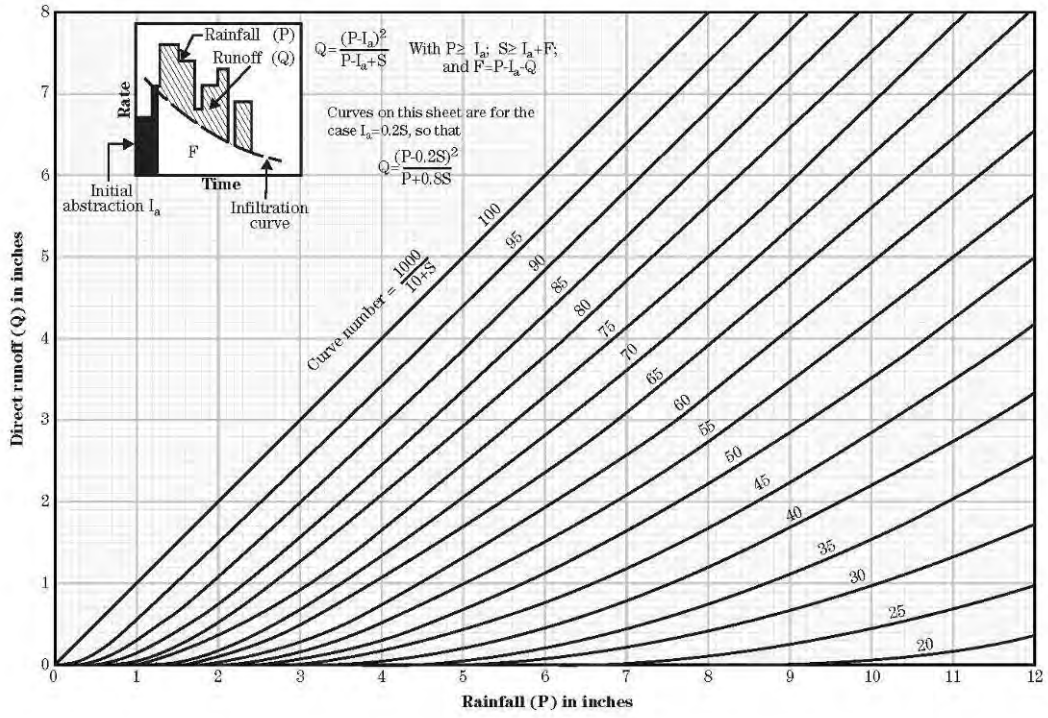
Storm Event	Discharged Runoff Volume (cf) (green roof)	Green Roof Area (sf)	Direct Runoff Depth (in) (Green Roof)
2-year	407	2,270	2.15
10-year	756	2,270	4.00
100-year	1,469	2,270	7.76

Determination of Adjusted Curve Number:

Utilizing Figure 10-2 from NEH Part 630 (see below), the adjusted curve number for the 2-, 10-, and 100-year storms are calculated, as depicted below:

Storm Event	Rainfall Depth (in)	Direct Runoff Depth (in)	Adjusted Curve Number
2-year	3.39	2.15	87
10-year	5.24	4.00	88
100-year	9.01	7.76	89

Figure 10–2 ES–1001 graphical solution of the equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$



LOWER GREEN ROOF – CURRENT ADJUSTED

Green Roof Area = 325 sf

Hydraulic Computations:

Calculation of runoff retention of the proposed Green Roof:

$$S_v = \frac{SA\ x\ [(d\ x\ \eta_1)+(DL\ x\ \eta_2)]}{12}, \text{ where:}$$

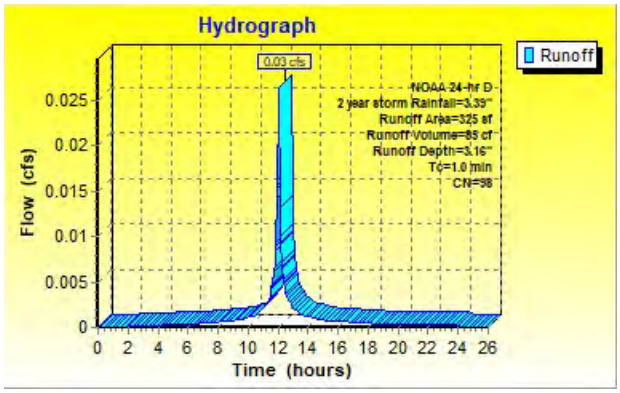
S_v = storage volume (cf)
SA = green roof area (sf)
d = media depth (in)
η_1 = available water capacity for runoff retention
DL = drainage layer depth (in)
η_2 = drainage layer field capacity

SA = 325 sf
d = 4 in
n_1 = 0.231 (NJ-BMP 9.4, page 13)
DL = 4 in
n_2 = 0.02 (reduced for back-to-back storm condition)

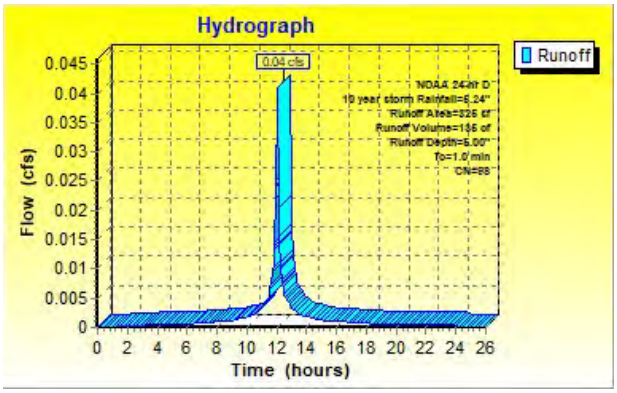
S_v = 3250 x [(4 x 0.231) + (4 x 0.02)]/12 = 27 cf

Calculation of discharged runoff volume from the roof area for 2, 10 and 100-year storms for impervious roof with 2,270 sf area under current adjusted rainfall data:

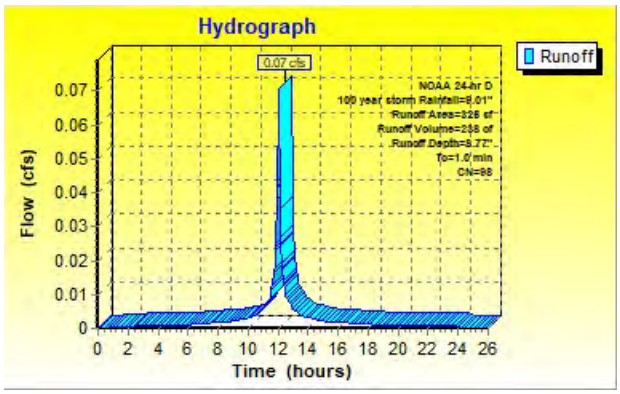
Discharged Runoff Volumes for NOAA 24-hr region D rainfall distribution without green roof (HydroCAD® 10.20-7a software):



IMPERVIOUS ROOF RUNOFF – 2-yr STORM



IMPERVIOUS ROOF RUNOFF – 10-yr STORM



IMPERVIOUS ROOF RUNOFF – 100-yr STORM

Storm Event	(A) Runoff Volume (cf) (Impervious Surface)	(B) Storage Volume (cf)	(A)-(B) Discharged Runoff Volume (cf) (Green Roof)
2-year	85	27	58
10-year	135	27	108
100-year	238	27	211

Calculation of direct runoff depth for green roof:

Direct runoff depth, *Q*, is calculated by multiplying the green roof discharged runoff volume (cf) by 12 in/ft and dividing by the green roof area:

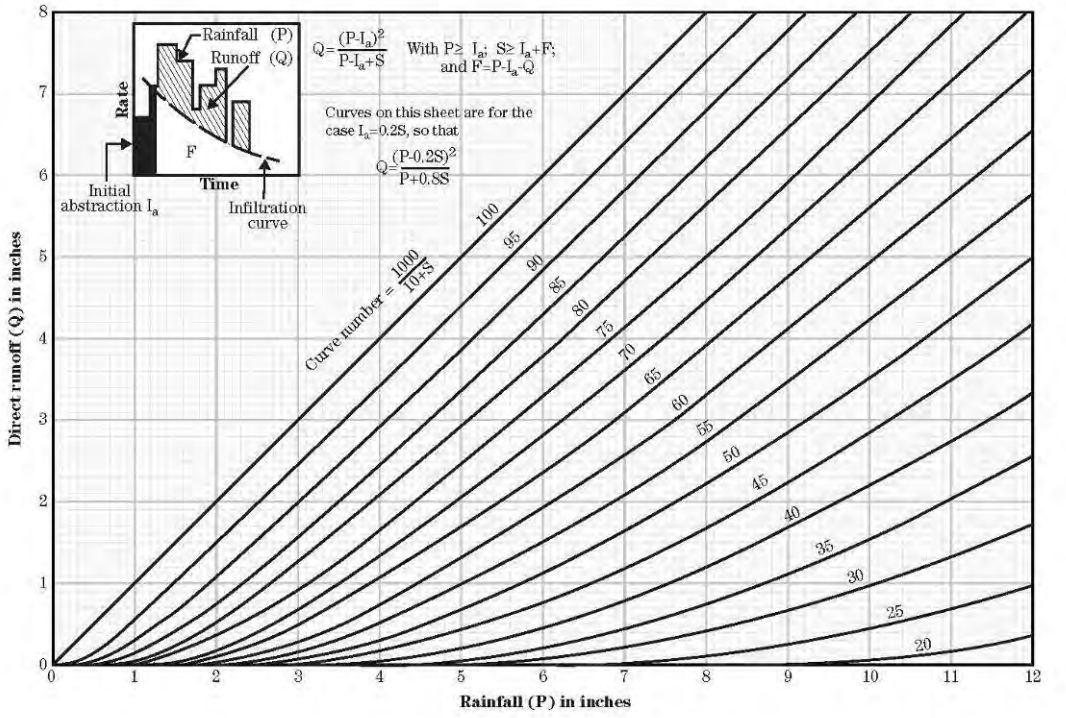
Storm Event	Discharged Runoff Volume (cf) (green roof)	Green Roof Area (sf)	Direct Runoff Depth (in) (Green Roof)
2-year	58	325	2.14
10-year	108	325	3.99
100-year	211	325	7.79

Determination of Adjusted Curve Number:

Utilizing Figure 10-2 from NEH Part 630 (see below), the adjusted curve number for the 2-, 10-, and 100-year storms are calculated, as depicted below:

Storm Event	Rainfall Depth (in)	Direct Runoff Depth (in)	Adjusted Curve Number
2-year	3.39	2.14	87
10-year	5.24	3.99	88
100-year	9.01	7.79	90

Figure 10–2 ES–1001 graphical solution of the equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$



MAIN GREEN ROOF – FUTURE ADJUSTED

Green Roof Area = 2,270 sf

Hydraulic Computations:

Calculation of runoff retention of the proposed Green Roof:

$$S_v = \frac{SA\ x\ [(d\ x\ \eta_1)+(DL\ x\ \eta_2)]}{12}, \text{ where:}$$

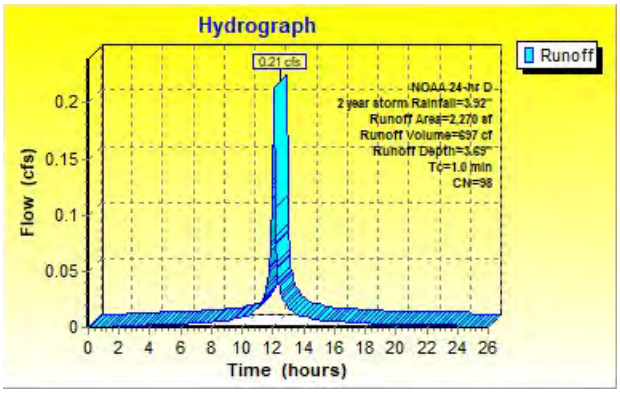
S_v = storage volume (cf)
SA = green roof area (sf)
d = media depth (in)
η_1 = available water capacity for runoff retention
DL = drainage layer depth (in)
η_2 = drainage layer field capacity

SA = 2,270 sf
d = 4 in
n_1 = 0.231 (NJ-BMP 9.4, page 13)
DL = 4 in
n_2 = 0.02 (reduced for back-to-back storm condition)

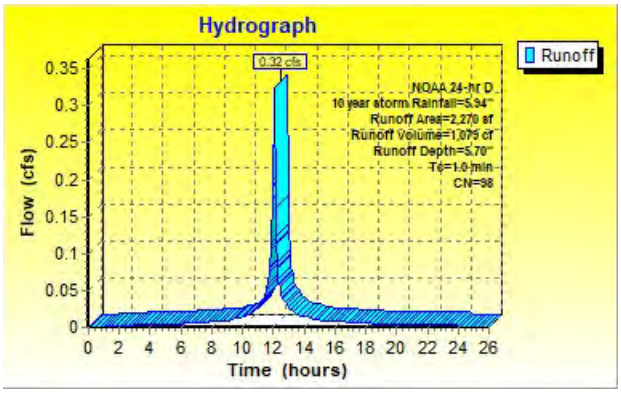
S_v = 2270 x [(4 x 0.231) + (4 x 0.02)]/12 = 190 cf

Calculation of discharged runoff volume from the roof area for 2, 10 and 100-year storms for impervious roof with 2,270 sf area under current adjusted rainfall data:

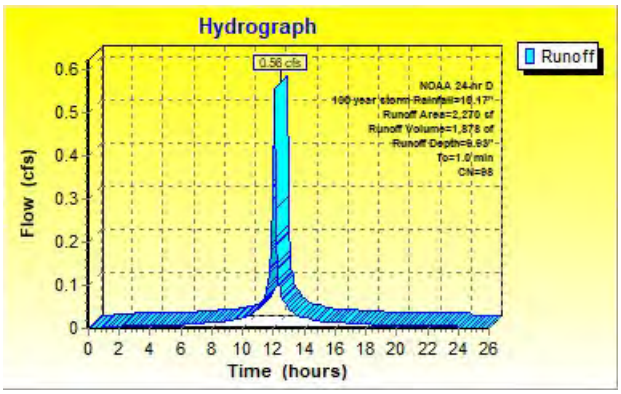
Discharged Runoff Volumes for NOAA 24-hr region D rainfall distribution without green roof (HydroCAD® 10.20-7a software):



IMPERVIOUS ROOF RUNOFF – 2-yr STORM



IMPERVIOUS ROOF RUNOFF – 10-yr STORM



IMPERVIOUS ROOF RUNOFF – 100-yr STORM

Storm Event	(A) Runoff Volume (cf) (Impervious Surface)	(B) Storage Volume (cf)	(A)-(B) Discharged Runoff Volume (cf) (Green Roof)
2-year	697	190	507
10-year	1,079	190	889
100-year	1,878	190	1,688

Calculation of direct runoff depth for green roof:

Direct runoff depth, *Q*, is calculated by multiplying the green roof discharged runoff volume (cf) by 12 in/ft and dividing by the green roof area:

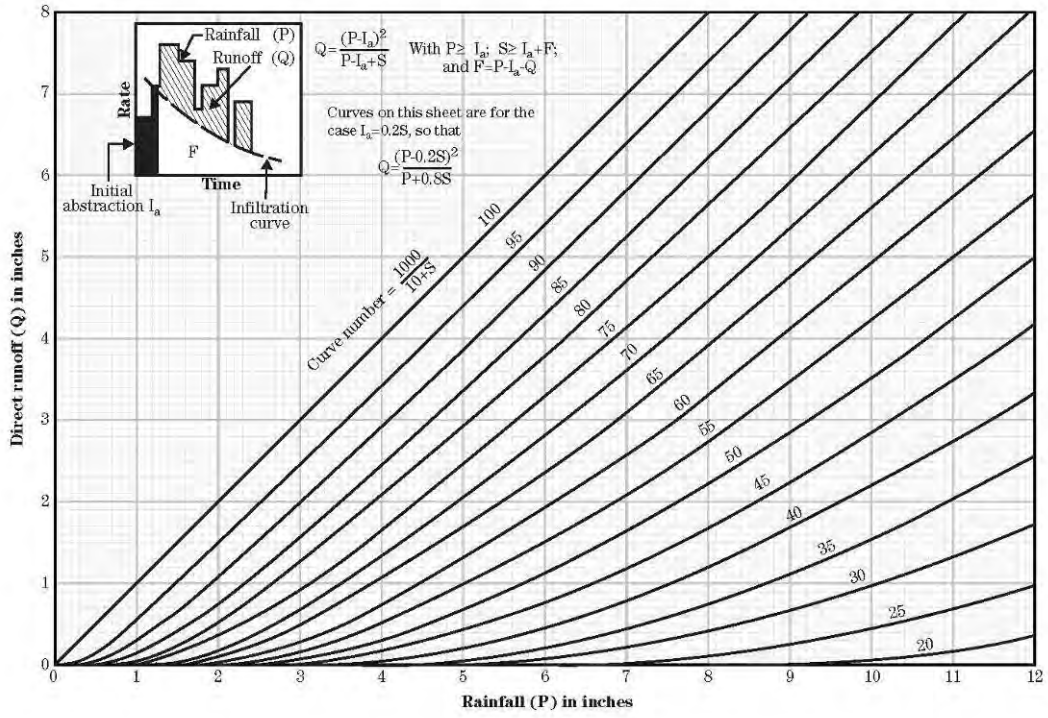
Storm Event	Discharged Runoff Volume (cf) (green roof)	Green Roof Area (sf)	Direct Runoff Depth (in) (Green Roof)
2-year	507	2,270	2.68
10-year	889	2,270	4.70
100-year	1,688	2,270	8.92

Determination of Adjusted Curve Number:

Utilizing Figure 10-2 from NEH Part 630 (see below), the adjusted curve number for the 2-, 10-, and 100-year storms are calculated, as depicted below:

Storm Event	Rainfall Depth (in)	Direct Runoff Depth (in)	Adjusted Curve Number
2-year	3.92	2.68	88
10-year	5.94	4.70	89
100-year	10.17	8.92	90

Figure 10–2 ES–1001 graphical solution of the equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$



LOWER GREEN ROOF – FUTURE ADJUSTED

Green Roof Area = 325 sf

Hydraulic Computations:

Calculation of runoff retention of the proposed Green Roof:

$$S_v = \frac{SA\ x\ [(d\ x\ \eta_1)+(DL\ x\ \eta_2)]}{12}, \text{ where:}$$

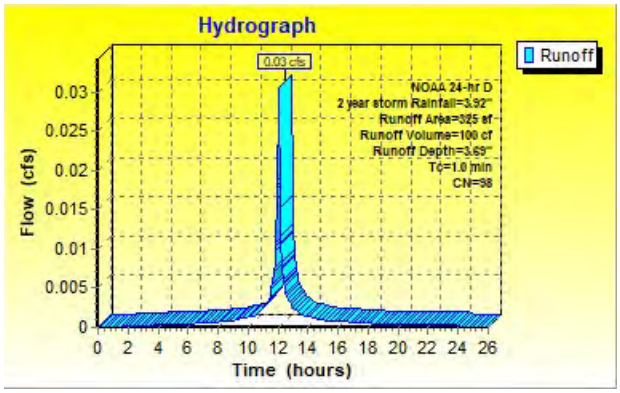
S_v = storage volume (cf)
SA = green roof area (sf)
d = media depth (in)
η_1 = available water capacity for runoff retention
DL = drainage layer depth (in)
η_2 = drainage layer field capacity

SA = 325 sf
d = 4 in
n_1 = 0.231 (NJ-BMP 9.4, page 13)
DL = 4 in
n_2 = 0.02 (reduced for back-to-back storm condition)

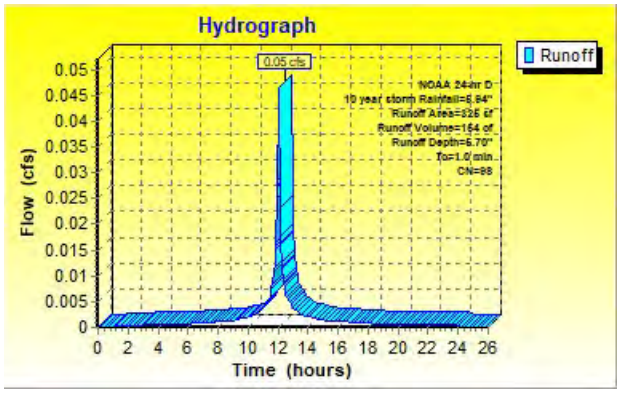
S_v = 3250 x [(4 x 0.231) + (4 x 0.02)]/12 = 27 cf

Calculation of discharged runoff volume from the roof area for 2, 10 and 100-year storms for impervious roof with 2,270 sf area under current adjusted rainfall data:

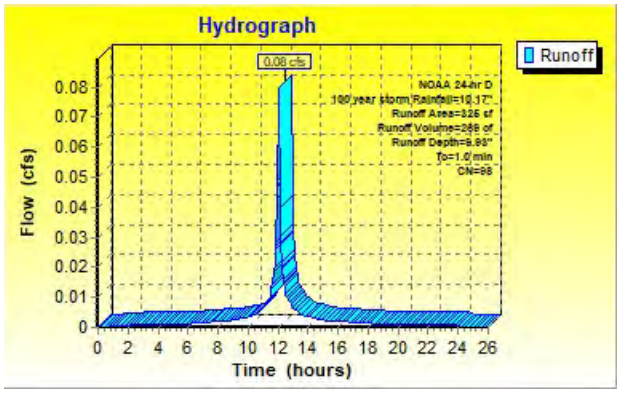
Discharged Runoff Volumes for NOAA 24-hr region D rainfall distribution without green roof (HydroCAD® 10.20-7a software):



IMPERVIOUS ROOF RUNOFF – 2-yr STORM



IMPERVIOUS ROOF RUNOFF – 10-yr STORM



IMPERVIOUS ROOF RUNOFF – 100-yr STORM

Storm Event	(A) Runoff Volume (cf) (Impervious Surface)	(B) Storage Volume (cf)	(A)-(B) Discharged Runoff Volume (cf) (Green Roof)
2-year	100	27	73
10-year	164	27	137
100-year	269	27	242

Calculation of direct runoff depth for green roof:

Direct runoff depth, *Q*, is calculated by multiplying the green roof discharged runoff volume (cf) by 12 in/ft and dividing by the green roof area:

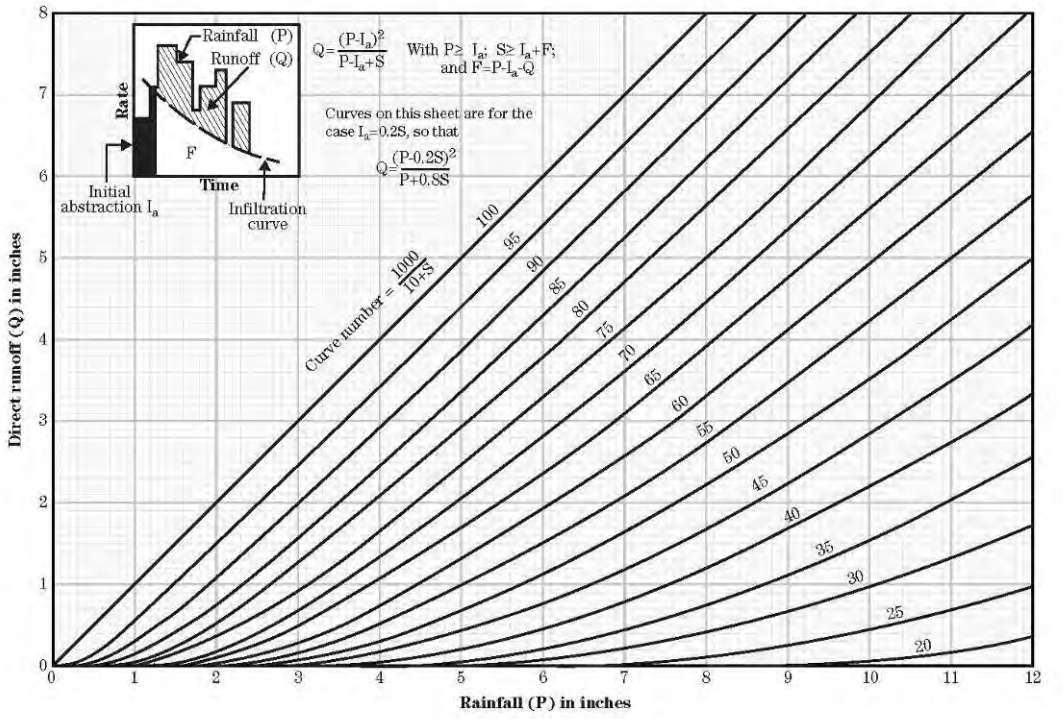
Storm Event	Discharged Runoff Volume (cf) (green roof)	Green Roof Area (sf)	Direct Runoff Depth (in) (Green Roof)
2-year	73	325	2.69
10-year	137	325	5.06
100-year	242	325	8.93

Determination of Adjusted Curve Number:

Utilizing Figure 10-2 from NEH Part 630 (see below), the adjusted curve number for the 2-, 10-, and 100-year storms are calculated, as depicted below:

Storm Event	Rainfall Depth (in)	Direct Runoff Depth (in)	Adjusted Curve Number
2-year	3.92	2.69	88
10-year	5.94	5.06	89
100-year	10.17	8.93	90

Figure 10–2 ES–1001 graphical solution of the equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$



APPENDIX K – ROOF DRAIN PERFORMANCE

Roof Drain Analysis for 1012-1022 Avenue C, Bayonne, NJ

ASSUMPTIONS

- Typical roof drain drainage area = 1,600 sq. ft.
- 100-yr. design storm: rainfall intensity = 10.17 in.
- CN = 98
- T_C = 0

CONCLUSIONS

Based on the attached Hydrocad Roof Drain Performance Report:

1. Peak Runoff = 0.39 cfs = 175 gpm

2. Per NSPC Table 13.6.1 – Size of Vertical Storm Drain Piping:

   A 5” diameter vertical storm drain stack flowing 7/34 full has a capacity of 261 gpm and is therefore adequately sized to accommodate the 100-yr future adjusted design storm

3. Per the hydrograph and table, the analyzed roof will drain in 15-hours

Summary for Pond 11P: Roof Drain

Inflow Area = 1,600 sf,100.00% Impervious, Inflow Depth = 9.93" for 100 year storm event
Inflow = 0.39 cfs @ 12.09 hrs, Volume= 1,324 cf
Outflow = 0.18 cfs @ 12.11 hrs, Volume= 1,324 cf, Atten= 53%, Lag= 1.1 min
Primary = 0.18 cfs @ 12.11 hrs, Volume= 1,324 cf

Routing by Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
Peak Elev= 0.29' @ 12.11 hrs Surf.Area= 1,536 sf Storage= 222 cf

Plug-Flow detention time= 17.3 min calculated for 1,323 cf (100% of inflow)
Center-of-Mass det. time= 17.3 min (750.9 - 733.5)

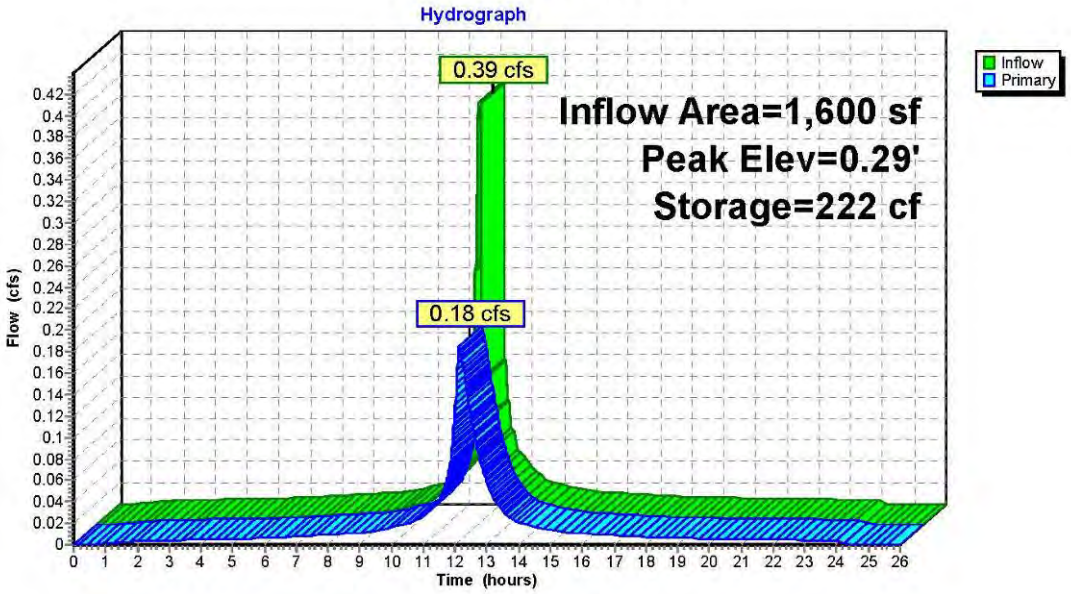
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	241 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4	0	0
0.30	1,600	241	241

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**5.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.18 cfs @ 12.11 hrs HW=0.29' (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.18 cfs @ 1.83 fps)

Pond 11P: Roof Drain



Hydrograph for Pond 11P: Roof Drain

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	0.00	0.00
0.10	0.00	0	0.00	0.00
0.20	0.00	0	0.00	0.00
0.30	0.00	0	0.00	0.00
0.40	0.00	0	0.00	0.00
0.50	0.00	0	0.01	0.00
0.60	0.00	0	0.01	0.00
0.70	0.00	1	0.01	0.00
0.80	0.00	1	0.02	0.00
0.90	0.00	1	0.02	0.00
1.00	0.00	1	0.02	0.00
1.10	0.00	2	0.02	0.00
1.20	0.00	2	0.03	0.00
1.30	0.00	2	0.03	0.00
1.40	0.00	2	0.03	0.00
1.50	0.00	2	0.03	0.00
1.60	0.00	3	0.03	0.00
1.70	0.00	3	0.03	0.00
1.80	0.00	3	0.03	0.00
1.90	0.00	3	0.03	0.00
2.00	0.00	3	0.03	0.00
2.10	0.00	3	0.03	0.00
2.20	0.00	3	0.04	0.00
2.30	0.00	4	0.04	0.00
2.40	0.00	4	0.04	0.00
2.50	0.00	4	0.04	0.00
2.60	0.00	4	0.04	0.00
2.70	0.00	4	0.04	0.00
2.80	0.00	4	0.04	0.00
2.90	0.00	4	0.04	0.00
3.00	0.00	4	0.04	0.00
3.10	0.00	4	0.04	0.00
3.20	0.00	4	0.04	0.00
3.30	0.00	4	0.04	0.00
3.40	0.00	5	0.04	0.00
3.50	0.00	5	0.04	0.00
3.60	0.01	5	0.04	0.00
3.70	0.01	5	0.04	0.00
3.80	0.01	5	0.04	0.00
3.90	0.01	5	0.04	0.01
4.00	0.01	5	0.04	0.01
4.10	0.01	5	0.04	0.01
4.20	0.01	5	0.04	0.01
4.30	0.01	5	0.04	0.01
4.40	0.01	5	0.04	0.01
4.50	0.01	5	0.04	0.01
4.60	0.01	5	0.04	0.01
4.70	0.01	5	0.04	0.01
4.80	0.01	5	0.04	0.01
4.90	0.01	5	0.04	0.01
5.00	0.01	6	0.04	0.01
5.10	0.01	6	0.05	0.01

Hydrograph for Pond 11P: Roof Drain (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
5.20	0.01	6	0.05	0.01
5.30	0.01	6	0.05	0.01
5.40	0.01	6	0.05	0.01
5.50	0.01	6	0.05	0.01
5.60	0.01	6	0.05	0.01
5.70	0.01	6	0.05	0.01
5.80	0.01	6	0.05	0.01
5.90	0.01	6	0.05	0.01
6.00	0.01	6	0.05	0.01
6.10	0.01	6	0.05	0.01
6.20	0.01	6	0.05	0.01
6.30	0.01	6	0.05	0.01
6.40	0.01	7	0.05	0.01
6.50	0.01	7	0.05	0.01
6.60	0.01	7	0.05	0.01
6.70	0.01	7	0.05	0.01
6.80	0.01	7	0.05	0.01
6.90	0.01	7	0.05	0.01
7.00	0.01	7	0.05	0.01
7.10	0.01	8	0.05	0.01
7.20	0.01	8	0.05	0.01
7.30	0.01	8	0.05	0.01
7.40	0.01	8	0.05	0.01
7.50	0.01	8	0.06	0.01
7.60	0.01	8	0.06	0.01
7.70	0.01	9	0.06	0.01
7.80	0.01	9	0.06	0.01
7.90	0.01	9	0.06	0.01
8.00	0.01	9	0.06	0.01
8.10	0.01	9	0.06	0.01
8.20	0.01	9	0.06	0.01
8.30	0.01	10	0.06	0.01
8.40	0.01	10	0.06	0.01
8.50	0.01	10	0.06	0.01
8.60	0.01	10	0.06	0.01
8.70	0.01	10	0.06	0.01
8.80	0.01	10	0.06	0.01
8.90	0.01	11	0.06	0.01
9.00	0.01	11	0.06	0.01
9.10	0.01	11	0.06	0.01
9.20	0.01	11	0.06	0.01
9.30	0.01	12	0.07	0.01
9.40	0.01	12	0.07	0.01
9.50	0.01	13	0.07	0.01
9.60	0.02	14	0.07	0.01
9.70	0.02	14	0.07	0.01
9.80	0.02	15	0.07	0.01
9.90	0.02	15	0.07	0.02
10.00	0.02	16	0.08	0.02
10.10	0.02	16	0.08	0.02
10.20	0.02	17	0.08	0.02
10.30	0.02	18	0.08	0.02

Hydrograph for Pond 11P: Roof Drain (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
10.40	0.02	18	0.08	0.02
10.50	0.02	19	0.08	0.02
10.60	0.02	20	0.09	0.02
10.70	0.03	21	0.09	0.02
10.80	0.03	23	0.09	0.02
10.90	0.03	25	0.10	0.02
11.00	0.03	27	0.10	0.03
11.10	0.04	29	0.10	0.03
11.20	0.04	32	0.11	0.03
11.30	0.04	35	0.11	0.04
11.40	0.05	39	0.12	0.04
11.50	0.06	43	0.13	0.04
11.60	0.07	51	0.14	0.05
11.70	0.08	58	0.15	0.06
11.80	0.12	71	0.16	0.07
11.90	0.19	93	0.19	0.09
12.00	**0.31**	140	0.23	0.12
12.10	**0.26**	**221**	**0.29**	**0.18**
12.20	0.12	**208**	**0.28**	**0.17**
12.30	0.09	184	0.26	0.16
12.40	0.07	157	0.24	0.14
12.50	0.06	135	0.22	0.12
12.60	0.05	113	0.21	0.10
12.70	0.04	95	0.19	0.09
12.80	0.04	81	0.17	0.08
12.90	0.04	70	0.16	0.07
13.00	0.03	60	0.15	0.06
13.10	0.03	52	0.14	0.05
13.20	0.03	45	0.13	0.04
13.30	0.03	40	0.12	0.04
13.40	0.02	36	0.11	0.04
13.50	0.02	32	0.11	0.03
13.60	0.02	28	0.10	0.03
13.70	0.02	26	0.10	0.03
13.80	0.02	24	0.09	0.02
13.90	0.02	22	0.09	0.02
14.00	0.02	21	0.09	0.02
14.10	0.02	20	0.09	0.02
14.20	0.02	19	0.08	0.02
14.30	0.02	18	0.08	0.02
14.40	0.02	17	0.08	0.02
14.50	0.01	17	0.08	0.02
14.60	0.01	16	0.08	0.02
14.70	0.01	15	0.07	0.02
14.80	0.01	15	0.07	0.01
14.90	0.01	14	0.07	0.01
15.00	0.01	13	0.07	0.01
15.10	0.01	13	0.07	0.01
15.20	0.01	12	0.07	0.01
15.30	0.01	12	0.07	0.01
15.40	0.01	12	0.07	0.01
15.50	0.01	11	0.06	0.01

Hydrograph for Pond 11P: Roof Drain (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
15.60	0.01	11	0.06	0.01
15.70	0.01	11	0.06	0.01
15.80	0.01	11	0.06	0.01
15.90	0.01	10	0.06	0.01
16.00	0.01	10	0.06	0.01
16.10	0.01	10	0.06	0.01
16.20	0.01	10	0.06	0.01
16.30	0.01	10	0.06	0.01
16.40	0.01	10	0.06	0.01
16.50	0.01	9	0.06	0.01
16.60	0.01	9	0.06	0.01
16.70	0.01	9	0.06	0.01
16.80	0.01	9	0.06	0.01
16.90	0.01	9	0.06	0.01
17.00	0.01	9	0.06	0.01
17.10	0.01	8	0.06	0.01
17.20	0.01	8	0.05	0.01
17.30	0.01	8	0.05	0.01
17.40	0.01	8	0.05	0.01
17.50	0.01	8	0.05	0.01
17.60	0.01	8	0.05	0.01
17.70	0.01	7	0.05	0.01
17.80	0.01	7	0.05	0.01
17.90	0.01	7	0.05	0.01
18.00	0.01	7	0.05	0.01
18.10	0.01	7	0.05	0.01
18.20	0.01	7	0.05	0.01
18.30	0.01	7	0.05	0.01
18.40	0.01	6	0.05	0.01
18.50	0.01	6	0.05	0.01
18.60	0.01	6	0.05	0.01
18.70	0.01	6	0.05	0.01
18.80	0.01	6	0.05	0.01
18.90	0.01	6	0.05	0.01
19.00	0.01	6	0.05	0.01
19.10	0.01	6	0.05	0.01
19.20	0.01	6	0.05	0.01
19.30	0.01	6	0.05	0.01
19.40	0.01	6	0.05	0.01
19.50	0.01	6	0.05	0.01
19.60	0.01	6	0.05	0.01
19.70	0.01	6	0.05	0.01
19.80	0.01	6	0.05	0.01
19.90	0.01	6	0.05	0.01
20.00	0.01	6	0.05	0.01
20.10	0.01	6	0.05	0.01
20.20	0.01	6	0.05	0.01
20.30	0.01	6	0.05	0.01
20.40	0.01	6	0.04	0.01
20.50	0.01	6	0.04	0.01
20.60	0.01	5	0.04	0.01
20.70	0.01	5	0.04	0.01

Hydrograph for Pond 11P: Roof Drain (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
20.80	0.01	5	0.04	0.01
20.90	0.01	5	0.04	0.01
21.00	0.01	5	0.04	0.01
21.10	0.01	5	0.04	0.01
21.20	0.01	5	0.04	0.01
21.30	0.01	5	0.04	0.01
21.40	0.01	5	0.04	0.01
21.50	0.01	5	0.04	0.01
21.60	0.01	5	0.04	0.01
21.70	0.01	5	0.04	0.01
21.80	0.01	5	0.04	0.01
21.90	0.00	5	0.04	0.01
22.00	0.00	5	0.04	0.01
22.10	0.00	5	0.04	0.01
22.20	0.00	5	0.04	0.00
22.30	0.00	5	0.04	0.00
22.40	0.00	5	0.04	0.00
22.50	0.00	5	0.04	0.00
22.60	0.00	5	0.04	0.00
22.70	0.00	5	0.04	0.00
22.80	0.00	5	0.04	0.00
22.90	0.00	5	0.04	0.00
23.00	0.00	4	0.04	0.00
23.10	0.00	4	0.04	0.00
23.20	0.00	4	0.04	0.00
23.30	0.00	4	0.04	0.00
23.40	0.00	4	0.04	0.00
23.50	0.00	4	0.04	0.00
23.60	0.00	4	0.04	0.00
23.70	0.00	4	0.04	0.00
23.80	0.00	4	0.04	0.00
23.90	0.00	4	0.04	0.00
24.00	0.00	4	0.04	0.00
24.10	0.00	3	0.03	0.00
24.20	0.00	2	0.03	0.00
24.30	0.00	1	0.02	0.00
24.40	0.00	1	0.02	0.00
24.50	0.00	1	0.01	0.00
24.60	0.00	0	0.01	0.00
24.70	0.00	0	0.01	0.00
24.80	0.00	0	0.01	0.00
24.90	0.00	0	0.01	0.00
25.00	0.00	0	0.01	0.00
25.10	0.00	0	0.00	0.00
25.20	0.00	0	0.00	0.00
25.30	0.00	0	0.00	0.00
25.40	0.00	0	0.00	0.00
25.50	0.00	0	0.00	0.00
25.60	0.00	0	0.00	0.00
25.70	0.00	0	0.00	0.00
25.80	0.00	0	0.00	0.00
25.90	0.00	0	0.00	0.00

Hydrograph for Pond 11P: Roof Drain (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
26.00	0.00	0	0.00	0.00