DRAINAGE REPORT

For

DALY KENNEY GROUP, LLC

PROPOSED

"DUNKIN' DONUTS FACILITY"

101 Belleville Avenue
New Bedford, Massachusetts
Bristol County

Prepared by:

BOHLER ENGINEERING
352 Turnpike Road
Southborough, MA 01772
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Massachusetts P.E. Lic. # 41717

BOHLER ENGINEERING

September 17, 2018

BE #W181069

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the development of a proposed fast-food restaurant with drive-thru located on the corner of Belleville Avenue and Cedar Grove Street in the City of New Bedford, Massachusetts. The site, which contains approximately 0.46 acres of land, contains an existing "Buttonwood Auto" automobile sales and rentals building with associated paved parking area and sparsely grassed area with gravel on the west side of the site.

The proposed project includes the construction of a new freestanding "Dunkin' Donuts" fast-food restaurant with drive-thru, along with new paved parking areas, landscaping, a new storm water management system and associated utilities. This report addresses a comparative analysis of the pre- and post-development site runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans prepared by Bohler Engineering. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

II. EXISTING SITE CONDITIONS

The majority of the soils at the site are mapped as "urban land". Confirmatory test pits were performed on site, resulting in a soil determination of sandy loam which is classified by the Natural Resource Conservation Service (NRCS) as Hydrologic Soil Group (HSG) "B" (test pit data has been provided within the appendices of this report). Slopes on the site range from 1%-5% with on-site elevations ranging from 12 in the northwestern corner of the site to 9 in the southeastern corner of the site.

For the purposes of this analysis, in order to provide a comparison of pre- and post-development drainage conditions, one (1) "Design Point" (DP-1) has been designated for the site. The site drains overland across the site to the southeast corner, culminating in the municipal drainage system in Belleville Avenue, defined as Design Point 1 (DP-1) for the purposes of this report. Under existing conditions, this "Design Point" receives stormwater flows from approximately 0.48 acres of land, designated as watershed "E-1". This watershed includes areas of pavement, grass, and gravel, with a weighted CN value of 87.

The pre-development peak rates of runoff associated with this property have been presented in Table 2.1 below (for additional information, refer to the Appendices of this report):

Table 2.1 – Pre-Development Runoff Rates to Design Points (cubic feet per second)

Design Point	2-Year Storm Event	10-Year Storm Event	25-Year Storm Event	100-Year Storm Event
Design Point #1	1.09	1.74	2.11	2.76

III. PROPOSED SITE CONDITIONS

The proposed project consists of the construction of a new 1,067 SF freestanding "Dunkin' Donuts" fast food restaurant with drive-thru, associated paved parking areas, landscaping, utilities, and a new stormwater management system. The site, including the proposed parking areas, has been designed to drain to deep sump hooded catch basins. The catch basins will capture and convey stormwater runoff, via an underground pipe system, to one of two proposed underground infiltration systems. Pretreatment of stormwater runoff will be provided by deep sump hooded catch basins prior to discharge into the proposed infiltration basins. "Clean" rooftop runoff has been designed to flow to the underground infiltration system as well.

The proposed drainage system has been designed to provide at least 80% removal of Total Suspended Solids (TSS) in accordance with the Massachusetts DEP Stormwater Handbook. Per the New Bedford Stormwater Bylaw, 1" of runoff over all impervious area on the site is proposed to infiltrate from the proposed stormwater management system. In addition, the project has been designed to maintain existing drainage watersheds to the greatest extent possible, with the same Design Points described in Section II above. The post-development peak rates of runoff associated with this property have been presented in Table 3.1 below (refer to Appendices at the end of this report for additional information):

Table 3.1 – Post-Development Runoff Rates to Design Points (cubic feet per second)

Design Point	2-Year Storm Event	10-Year Storm Event	25-Year Storm Event	100-Year Storm Event
Design Point #1	0.21	1.00	1.47	2.32

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meet the total suspended solid (TSS) removal requirements as set forth in the Massachusetts Department of Environmental Protection Stormwater Handbook standards. In addition, a Stormwater Operation and Maintenance (O&M) Plan has been developed which includes scheduled pavement sweepings, and periodic inspections of stormwater management structures (i.e. catch basins and infiltration basin).

IV. METHODOLOGY

Peak Flow Calculations

Methodology utilized to design the proposed stormwater management system includes compliance with the guidelines set forth in the latest edition of Massachusetts DEP Stormwater Handbook. The pre- and post-development runoff rates being discharged from the site were computed using the HydroCAD computer program. The drainage area and outlet information were entered into the program, which routes storm flows based on NRCS TR-20 and TR-55 methods. The other components of the model were determined following standard NRCS procedures for Curve Numbers (CNs) and times of concentrations documented in the Appendices of this Report. The following rainfall data was utilized in the calculations:

Frequency	2 year	10 year	25 year	100 year
Rainfall (inches)	3.40	4.80	5.60	7.00

The project's compliance with the MADEP Stormwater Management standards is described further below:

Standard #1: No New Untreated Discharges:

The project has been designed so that proposed impervious areas, including the building roof and paved parking/driveway areas, shall be collected and passed through the proposed drainage system for treatment. Therefore no new untreated discharges are proposed.

Standard 2: Peak Rate Attenuation

As outlined in Tables 2.1 and 3.1 above, the development of the site and the proposed stormwater management system, have been designed so that post-development peak rates of runoff are below pre-

development conditions for the 2-, 10-, 25- and 100-year storm events at Design Point DP-1. Calculations are provided in the appendices of this report.

Standard 3: Recharge

The stormwater runoff from the project will be collected and diverted to a proposed underground infiltration system. The project as proposed will involve the creation of 0.04 acres of new impervious area and is required to infiltrate 56 cubic feet of stormwater as defined in Stormwater Standard 3. The proposed underground infiltration system will provide 1,300 cubic feet of volume below the lowest outlet for groundwater recharge. Additional calculations are included in the Appendices of this Report (Per the City of New Bedford Stormwater Management Rules and Regulations, the site has been designed to retain and infiltrate the first one (1) inch of runoff from all impervious cover on site, or 1,198 CF).

The DEP Stormwater Standards require that the infiltration BMP drains completely within 72 hours of the end of the storm event. Calculations showing that the proposed infiltration basin will drain within 72 hours are included in the Appendices of this report.

Standard #4 Water Quality:

Water quality treatment is provided via deep sump catch basins and underground infiltration systems. TSS removal Calculations are included in the Appendices of this report. The project as proposed will involve the creation of 0.04 acres of new impervious area and is required to treat 1,198 cubic feet of water quality volume as defined in Stormwater Standard 4. The proposed underground infiltration system will provide 1,300 cubic feet of water quality volume below the lowest outlet for water quality treatment. Additional calculations are included in the Appendices of this Report. Per the City of New Bedford Stormwater Management Rules and Regulations, the site has been designed to retain and infiltrate the first one (1) inch of runoff from all impervious cover on site, (1,198 CF).

Standard #5 Land Uses with Higher Potential Pollutant Loads

Not Applicable for this project.

Standard 6: Critical Areas

Not Applicable for this project.

Standard 7: Redevelopment

This Project consists of a portion of redevelopment as defined under Standard 7, however it has been designed in accordance with all Massachusetts Stormwater management standards for new development.

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

The proposed project will provide construction period erosion and sedimentation controls as indicated within the site plan set provided for this project. This includes a proposed construction entrance, protection for stormwater inlets, protection around temporary material stock piles and various other techniques as outlined on the erosion and sediment control sheets. As this project proposes to disturb less than one acre of land, the project is not required to file a Notice of Intent with the US EPA and implement a Stormwater Pollution Prevention Plan (SWPPP) during the construction period.

Standard 9: Operation and Maintenance (O&M) Plan

An Operation and Maintenance (O&M) Plan for this site has been prepared and is included within this report. The O&M Plan outlines procedures and time tables for the long term operation and maintenance of the proposed site stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M Plan includes a list of responsible parties and an estimated budget for inspections and maintenance.

Standard 10: Prohibition of Illicit Discharges

The proposed stormwater system will only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensates, etc.) and will not contain any illicit discharges from prohibited sources. An Illicit Discharge Statement is included in the Appendices of this report.

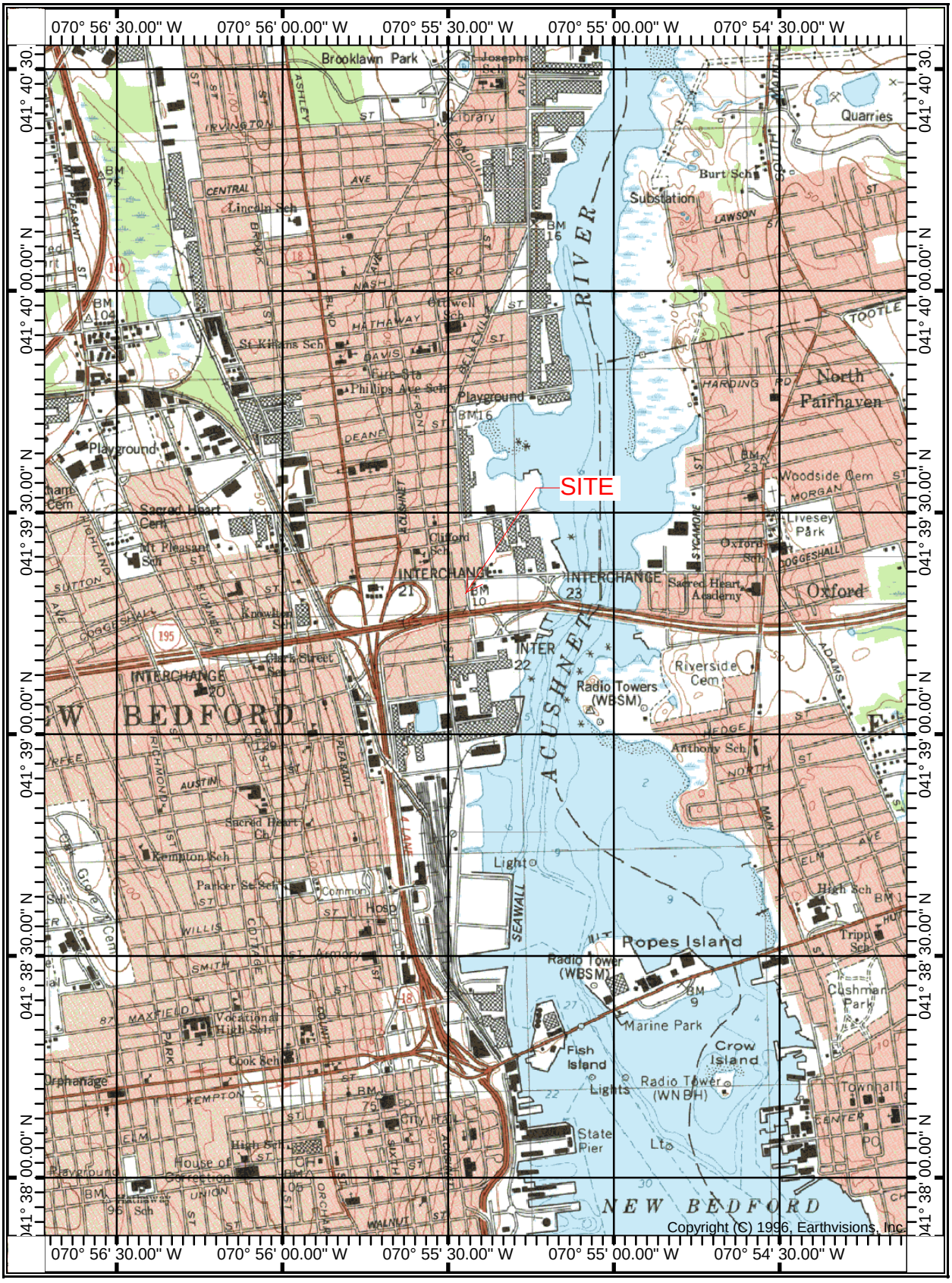
V. SUMMARY

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler Engineering results in a reduction in peak rates of runoff from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies. In addition, the proposed best management practices will result in an effective removal of total suspended solids from the post-development runoff. The pre-development versus post-development peak discharge rates comparisons are contained within Tables 5.1 below:

Table 5.1 – Runoff Rates to Design Point #1 (cubic feet per second)

Frequency (yrs)	Existing Flow	Proposed Flow	Change in Flow
2	1.09	0.21	-0.88 (-80.7%)
10	1.74	1.00	-0.74 (-42.5%)
25	2.11	1.47	-0.64 (-30.3%)
100	2.76	2.32	-0.44 (-15.9%)

APPENDIX A – PROJECT MAPS AND SOIL DATA



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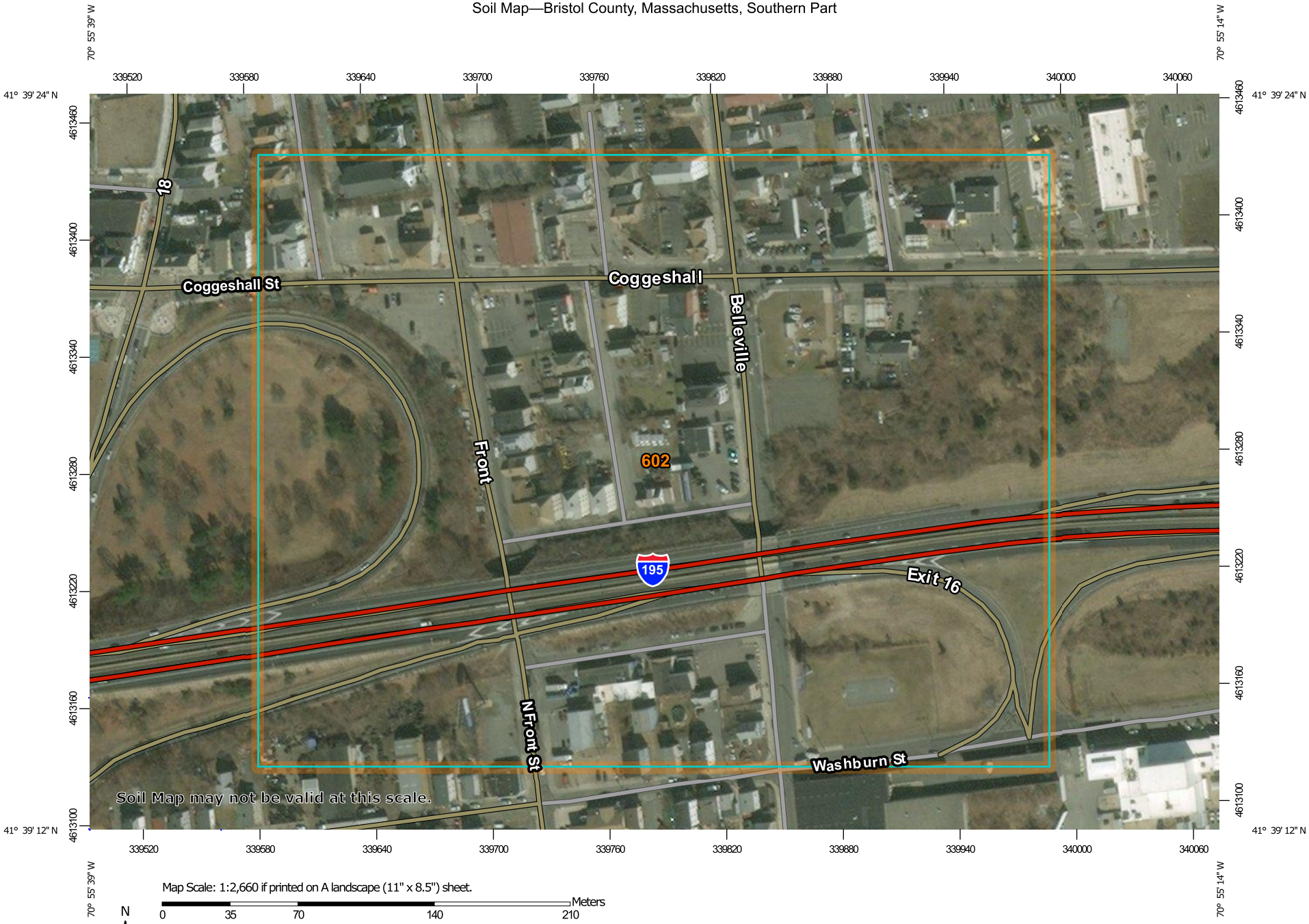
FEET



Map Scale: 1:2,660 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

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

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Bristol County, Massachusetts, Southern Part
Survey Area Data: Version 11, Oct 6, 2017

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

Date(s) aerial images were photographed: Dec 31, 2009—Jun 7, 2016

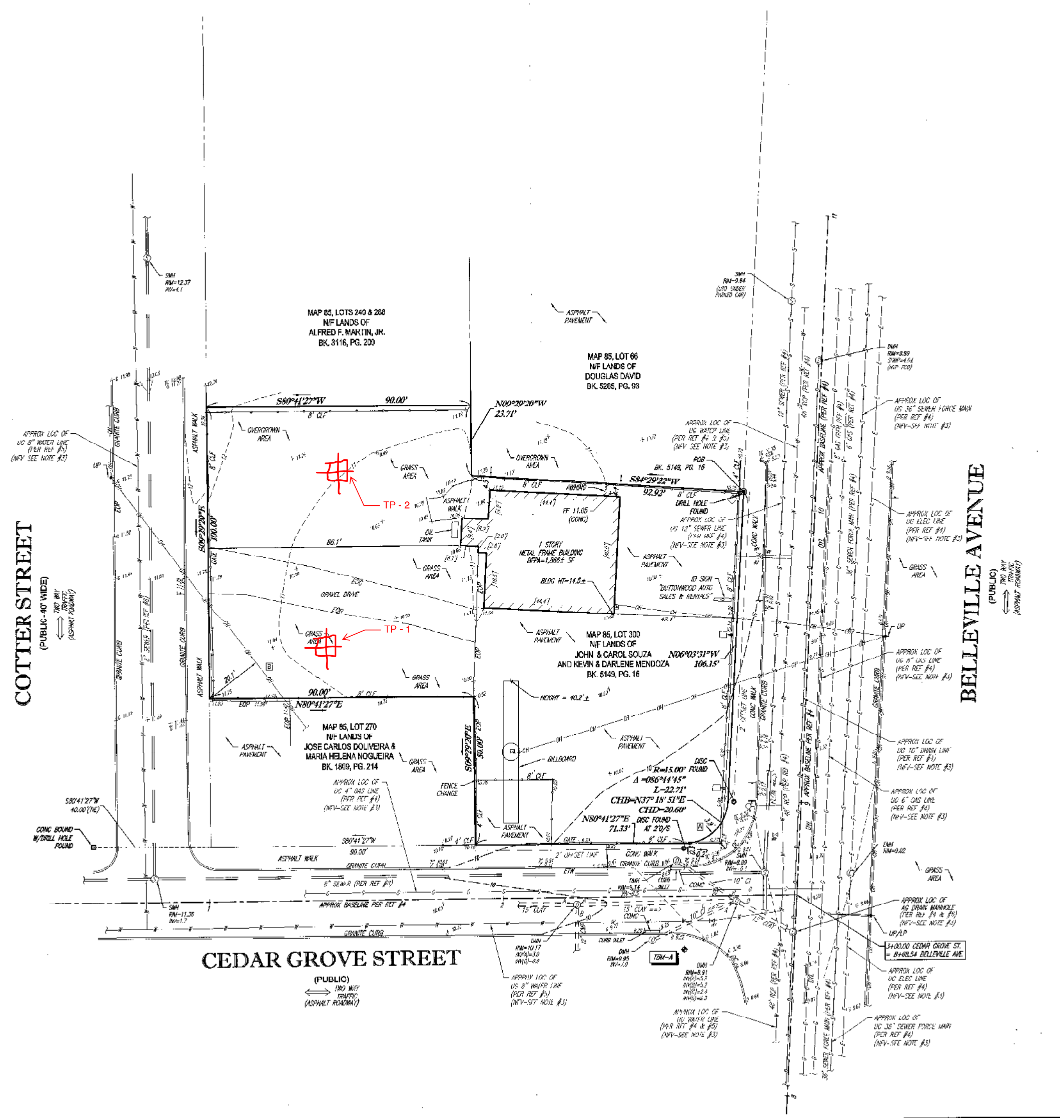
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

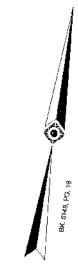
Map Unit Legend

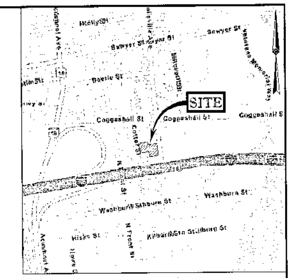
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	31.6	100.0%
Totals for Area of Interest		**31.6**	**100.0%**

LEGEND

Symbol	Description
— — 124 — — / — — 125 — —	EXISTING CONTOUR
× 123.45	EXISTING SPOT ELEVATION
× TC 123.45	EXISTING TOP OF CURB ELEVATION
× G 122.95	EXISTING GUTTER ELEVATION
× FF 123.45	EXISTING FINISHED FLOOR ELEVATION
	HYDRANT
WV	WATER VALVE
GV	GAS VALVE
EM	ELECTRIC METER
— OH —	OVERHEAD WIRES
— G —	APPROX. LOC. UNDERGROUND GAS LINE
— E —	APPROX. LOC. UNDERGROUND ELECTRIC LINE
— D —	APPROX. LOC. UNDERGROUND DRAINAGE LINE
— S —	APPROX. LOC. UNDERGROUND SANITARY / SEWER LINE
— W —	APPROX. LOC. UNDERGROUND WATER LINE
UP	UTILITY POLE
UPLP	UTILITY POLE/LIGHT POLE
	AREA LIGHT
	SIGN
DMH	DRAINAGE/STORM MANHOLE
EMH	ELECTRIC MANHOLE
SMH	SANITARY/SEWER MANHOLE
MH	UNKNOWN MANHOLE
CB	CATCH BASIN OR INLET
	DEPRESSED CURB
CLF	CHAIN LINK FENCE
DC	DEPRESSED CURB
EOC	EDGE OF CONCRETE
EOP	EDGE OF PAVEMENT
(TYP)	TYPICAL
DYL	DOUBLE YELLOW LINE
HT	HEIGHT
BLDG	BUILDING
BFPA	BUILDING FOOTPRINT AREA
SBDH	STONE BOUND w/DRILL HOLE
CI	CAST IRON PIPE
INV	INVERT ELEVATION
GRT	GRATE ELEVATION
[44.4']	BUILDING DIMENSIONS
ETW	EDGE OF TRAVELED WAY
EOG	EDGE OF GRAVEL
1.0'	OFFSET OF STRUCTURE AT GROUND LEVEL RELATIVE TO PROPERTY LINE
NVP	NO VISIBLE PIPES
FOD	FULL OF DEBRIS







LOCUS MAP
©2013 ESRI WORLD STREET MAPS

NOTES:

1. PROPERTY KNOWN AS LOT 300 AS SHOWN ON THE CITY OF NEW BEDFORD, BRISTOL COUNTY, COMMONWEALTH OF MASSACHUSETTS; ASSESSOR'S MAP NO. 85.
2. AREA = 19,947 SQUARE FEET OR 0.458 ACRES
3. LOCATION OF UNDERGROUND UTILITIES ARE APPROXIMATE. LOCATIONS AND SIZES ARE BASED ON UTILITY MARK-OUTS, ABOVE GROUND STRUCTURES THAT WERE VISIBLE & ACCESSIBLE IN THE FIELD, AND THE MAPS AS LISTED IN THE REFERENCES AVAILABLE AT THE TIME OF THE SURVEY. AVAILABLE AS-BUILT PLANS AND UTILITY MARKOUT DOES NOT ENSURE MAPPING OF ALL UNDERGROUND UTILITIES AND STRUCTURES. BEFORE ANY EXCAVATION IS TO BEGIN, ALL UNDERGROUND UTILITIES SHOULD BE VERIFIED AS TO THEIR LOCATION, SIZE AND TYPE BY THE PROPER UTILITY COMPANIES. CONTROL POINT ASSOCIATES, INC. DOES NOT GUARANTEE THE UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA EITHER IN SERVICE OR ABANDONED.
4. THIS PLAN IS BASED ON INFORMATION PROVIDED BY A SURVEY PREPARED IN THE FIELD BY CONTROL POINT ASSOCIATES, INC. AND OTHER REFERENCE MATERIAL AS LISTED HEREON.
5. THIS SURVEY WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND IS SUBJECT TO THE RESTRICTIONS, COVENANTS AND/OR EASEMENTS THAT MAY BE CONTAINED THEREIN.
6. BY GRAPHIC PLOTTING ONLY PROPERTY IS LOCATED IN FLOOD HAZARD ZONE X-SHADED(AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE FLOOD) PER REF. #2
7. ELEVATIONS REFER TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), BASED ON GPS OBSERVATIONS UTILIZING THE KEYSTONE VRS NETWORK (KEYNETGPS).

   TEMPORARY BENCH MARKS SET:
   TBM-A: MAG NAIL SET IN CONCRETE SIDEWALK - ELEVATION = 9.86'

   PRIOR TO CONSTRUCTION IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THAT THE BENCHMARKS ILLUSTRATED ON THIS SKETCH HAVE NOT BEEN DISTURBED AND THEIR ELEVATIONS HAVE BEEN CONFIRMED. ANY CONFLICTS MUST BE REPORTED PRIOR TO CONSTRUCTION.
8. THE OFFSETS SHOWN ARE NOT TO BE USED FOR THE CONSTRUCTION OF ANY STRUCTURE, FENCE, PERMANENT ADDITION, ETC.
9. THE EXISTENCE OF UNDERGROUND STORAGE TANKS, IF ANY, WAS NOT KNOWN AT THE TIME OF THE FIELD SURVEY.

REFERENCES:

1. THE TAX ASSESSOR'S MAP OF NEW BEDFORD, BRISTOL COUNTY, MASSACHUSETTS, SHEET #85.
2. MAP ENTITLED "NATIONAL FLOOD INSURANCE PROGRAM, FIRM, FLOOD INSURANCE RATE MAP, BRISTOL COUNTY, MASSACHUSETTS (ALL JURISDICTIONS), PANEL 393 OF 550," MAP NUMBER 25005C0393G, MAP REVISED: JULY 16, 2014.
3. MAP ENTITLED "PLAN OF LAND IN NEW BEDFORD, MA PREPARED FOR THE ESTATE OF DAVID P. DAVID," PREPARED BY KENNETH R. FERREIRA ENGINEERING, INC., DATED JUNE 20, 2001, RECORDED IN THE BRISTOL COUNTY SOUTHERN DISTRICT REGISTRY OF DEEDS IN PLAN BOOK 148, PAGE 18.
4. MAP ENTITLED "THE COMMONWEALTH OF MASSACHUSETTS, MASSACHUSETTS HIGHWAY DEPARTMENT PLAN AND PROFILE OF BELLEVILLE AVENUE IN THE CITY OF NEW BEDFORD, BRISTOL COUNTY," PREPARED BY TIBBETTS ENGINEERING CORP., DATED JANUARY 31, 1995. SHEET 5 OF 131.
5. UNDERGROUND WATER FACILITY MAPPING PROVIDED BY THE CITY OF NEW BEDFORD ENGINEERING DEPARTMENT.
6. UNDERGROUND SEWER FACILITY MAPPING PROVIDED BY THE CITY OF NEW BEDFORD ENGINEERING DEPARTMENT.

TABLE OF APPARENT ENCROACHMENTS

[A] FENCE/CURB INTO BELLEVILLE AVE RIGHT OF WAY 3.9'

[B] OVERHEAD WIRE OVER PROPERTY LINE 20.1'

NOTE: THESE ARE THE POSSIBLE ENCROACHMENTS OBSERVED DURING THE FIELD SURVEY. THERE MAY BE OTHERS NOT RECOGNIZED BY THE SURVEYOR.

UTILITIES.

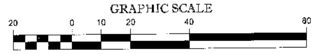
THE FOLLOWING COMPANIES WERE NOTIFIED BY MASSACHUSETTS ONE-CALL SYSTEM (1-888-344-7233) AND REQUESTED TO MARK OUT UNDERGROUND FACILITIES AFFECTING AND SERVICING THIS SITE. THE UNDERGROUND UTILITY INFORMATION SHOWN HEREON IS BASED UPON THE UTILITY COMPANIES RESPONSE TO THIS REQUEST SERIAL NUMBER(S). 20182604407

UTILITY COMPANY	PHONE NUMBER
AT&T TRANSMISSION	800-331-0500
EVERSOURCE - ELECTRIC	800-662-7764
NSTAR GAS	800-592-2000
VERIZON	800-922-0204

(1-888-344-7233) STOP - CALL BEFORE YOU DIG!

THE COMMONWEALTH OF MASSACHUSETTS REQUIRES NOTIFICATION BY EXCAVATORS, DESIGNERS, OR ANY PERSON PREPARING TO DISTURB THE EARTH'S SURFACE ANYWHERE IN THE COMMONWEALTH.

GRAPHIC SCALE



(IN FEET)
1 inch = 20 ft.

THIS SURVEY HAS BEEN PERFORMED IN THE FIELD UNDER MY SUPERVISION, AND TO THE BEST OF MY KNOWLEDGE, BELIEF, AND INFORMATION, THIS SURVEY HAS BEEN PERFORMED IN ACCORDANCE WITH CURRENTLY ACCEPTED ACCURACY STANDARDS.

NOT A VALID ORIGINAL DOCUMENT UNLESS EMBOSSED WITH RAISED IMPRESSION OR STAMPED WITH A BLUE INK SEAL

COMMONWEALTH OF MASSACHUSETTS — GERRY L. HOLDRIGHT NO. 49211 — REGISTERED PROFESSIONAL LAND SURVEYOR

7-10-18
DATE

GERRY L. HOLDRIGHT, PLS
MASSACHUSETTS PROFESSIONAL LAND SURVEYOR #49211

FIELD DATE	6-27-18
FIELD BOOK NO.	18-08
FIELD BOOK PG.	73
FIELD CREW	B.S.B.
DRAWN:	R.J.K.
REVIEWED:	S.P.P.

BOUNDARY & TOPOGRAPHIC SURVEY
DUNKIN DONUTS

101 BELLEVILLE AVENUE
LOT 300, MAP 85
CITY OF NEW BEDFORD, BRISTOL COUNTY
COMMONWEALTH OF MASSACHUSETTS

CONTROL POINT ASSOCIATES, INC.
352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
508.948.3000 - 508.948.3003 FAX
ALBANY, NY 5182175010
CHALFONT, PA 2157129800
MANHATTAN, NY 6467800411
MT LAUREL, NJ 6008572099
WARREN, NJ 9086680099

APPROVED:	DATE	SCALE	FILE NO	DWG. NO.
G.L.H.	7-10-18	1"=20'	03-180107	1 OF 1

Site Location or lot #	101 Belleville Avenue, New Bedford, MA Map #85, Lot #300				DEEP HOLE # TP-01
Applicant/owner:	Cumberland Farms (applicant)				
DATE:	8/24/18	WEATHER:	Clear	TEMP: 80º	
LOCATION: (Refer to sketch attached)	In grass area southwest of existing building				
PERFORMED BY:	James A. Bernardino, PE				
WITNESSED BY:					
Land Use:	Commercial		Landform:		
Vegetation:	Grass / landscaping/gravel		Slope:	1% +/-	
Stone Walls:	☐ Y ☒ N		Surface Stones:	☐ Y ☒ N	

Distance from:			
Open Water Bodies:	>100 ft.	Possible Wet Area:	>100 ft.
Drinking Water Well:	>100 ft.	Drainageway:	>100 ft.
Property Line:	17 +/- ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0”-30”	Fill		N/A	N/A
30”-47”	Fill		N/A	Mixed fill and trash (bottles, debris)
47”-108”	C	Sandy Loam	N/A	N/A
@100				Slight mottling/not distinct

Parent Material (geologic):		Depth to Bedrock:	None found
Depth to Groundwater:	Standing Water in Hole:	Not observed	
	Weeping from Pit Face:	Not observed	
	Estimated Seasonal High Groundwater:		100”

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:			100”		
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes:	Existing Grade @ 10.9 +/- (ESHGWT @ 2.4 +/-)

Site Location or lot #	101 Belleville Avenue, New Bedford, MA Map #85, Lot #300				DEEP HOLE # TP-02
Applicant/owner:	Cumberland Farms (applicant)				
DATE:	8/24/18	WEATHER:	Clear	TEMP: 80º	
LOCATION: (Refer to sketch attached)	In grass area northwest of existing building				
PERFORMED BY:	James A. Bernardino, PE				
WITNESSED BY:					
Land Use:	Commercial		Landform:		
Vegetation:	Grass / landscaping/gravel		Slope:	1.5% +/-	
Stone Walls:	☐ Y ☒ N		Surface Stones:	☐ Y ☒ N	

Distance from:			
Open Water Bodies:	>100 ft.	Possible Wet Area:	>100 ft.
Drinking Water Well:	>100 ft.	Drainageway:	>100 ft.
Property Line:	22 +/- ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0”-2”	Top soil	Loam	N/A	Top soils—loam
2”-24”	B	Sandy Loam	brown	
47”-108”	C	Sandy Loam	N/A	
@66				Mottling at 66”

Parent Material (geologic):		Depth to Bedrock:	None found
Depth to Groundwater:	Standing Water in Hole:	Not observed	
	Weeping from Pit Face:	Not observed	
	Estimated Seasonal High Groundwater:		66”

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:			66”		
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes:	Existing Grade @ 11.0 +/- (ESHGWT @ 5.5 +/-)

APPENDIX B – PRE DEVELOPMENT WATERSHEDS MAP

TOTAL SITE AREA: 0.48 Acres
Total Impervious Coverage: 0.28 Acres
Total Pervious Coverage: 0.20 Acres

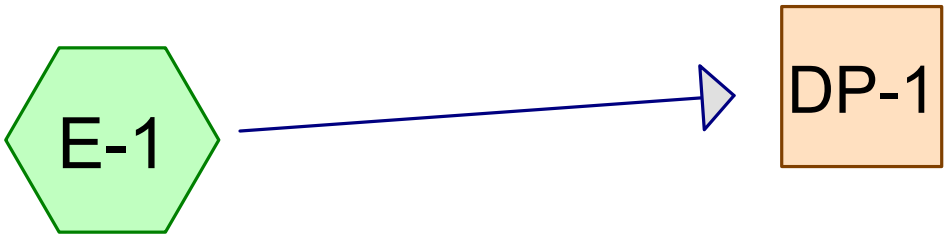
EXISTING DRAINAGE TRIBUTARY MAP

101 BELLEVILLE AVENUE
CITY OF NEW BEDFORD
BRISTOL COUNTY
MASSACHUSETTS

PREPARED BY
BOHLER ENGINEERING

NOT TO SCALE

APPENDIX C – PRE DEVELOPMENT STORMWATER ATTENUATION CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for New Bedford Existing
Prepared by Bohler Engineering, Printed 9/10/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.170	69	50-75% Grass cover, Fair, HSG B (E-1)
0.030	85	Gravel roads, HSG B (E-1)
0.280	98	Impervious (E-1)
0.480	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.200	HSG B	E-1
0.000	HSG C	
0.000	HSG D	
0.280	Other	E-1
0.480		**TOTAL AREA**

Summary for Subcatchment E-1:

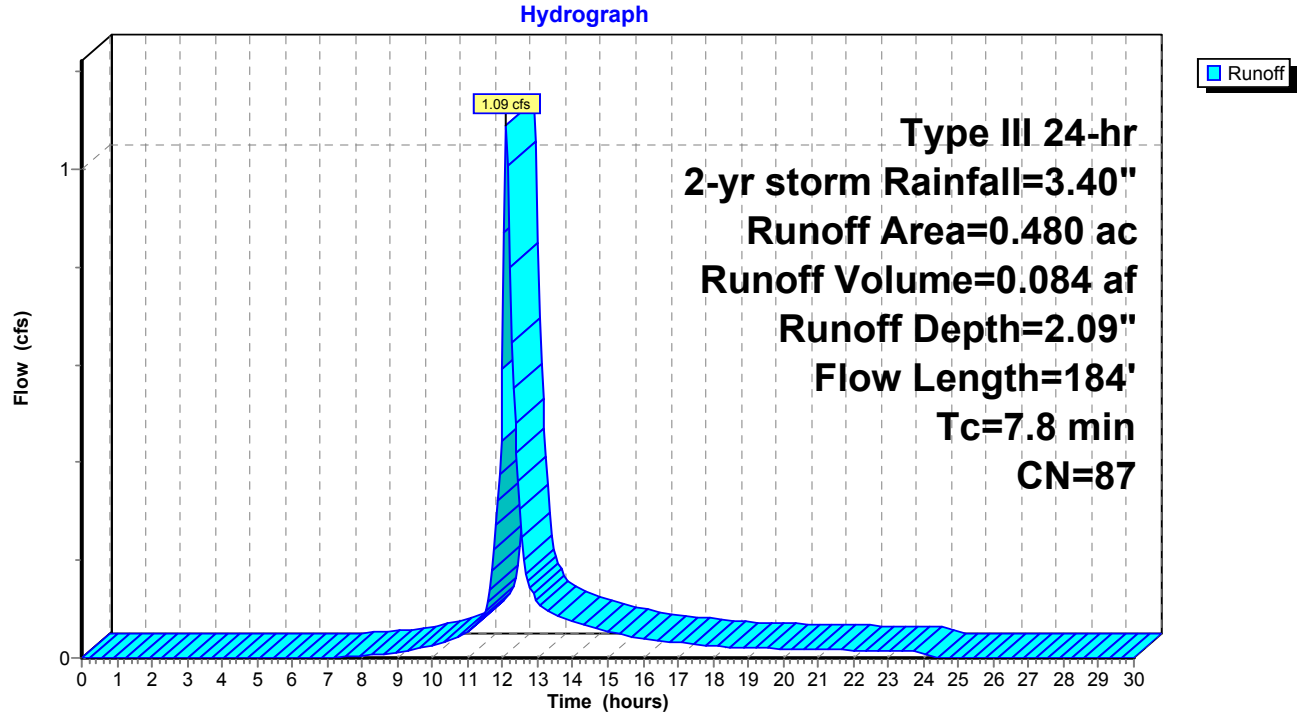
Runoff = 1.09 cfs @ 12.11 hrs, Volume= 0.084 af, Depth= 2.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

	Area (ac)	CN	Description
*	0.280	98	Impervious
	0.170	69	50-75% Grass cover, Fair, HSG B
	0.030	85	Gravel roads, HSG B
	0.480	87	Weighted Average
	0.200		41.67% Pervious Area
	0.280		58.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0194	0.15		**Sheet Flow, 1 - Sheet Flow** Grass: Short n= 0.150 P2= 3.40"
1.7	45	0.0040	0.44		**Shallow Concentrated Flow, 2 - Shallow land** Short Grass Pasture Kv= 7.0 fps
0.6	89	0.0140	2.40		**Shallow Concentrated Flow, 3 - Shallow impv** Paved Kv= 20.3 fps
7.8	184	Total			

Subcatchment E-1:

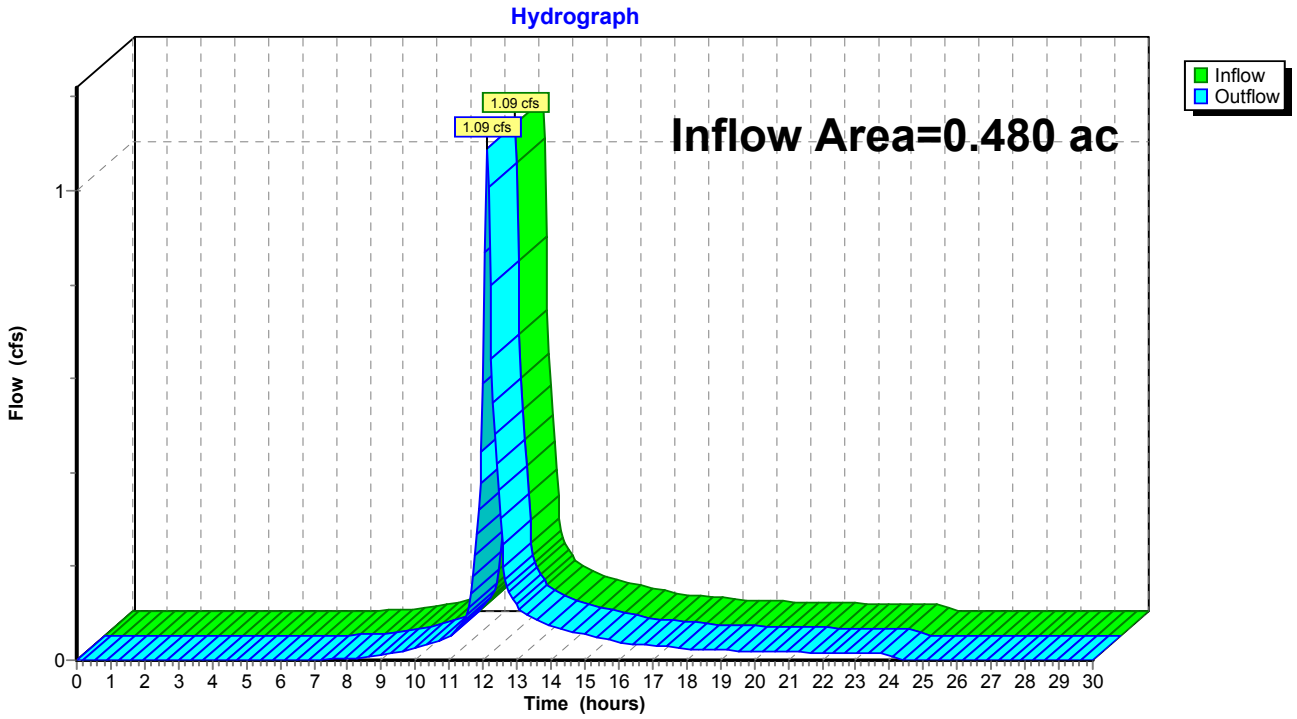


Summary for Reach DP-1:

Inflow Area = 0.480 ac, 58.33% Impervious, Inflow Depth = 2.09" for 2-yr storm event
Inflow = 1.09 cfs @ 12.11 hrs, Volume= 0.084 af
Outflow = 1.09 cfs @ 12.11 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1:



Summary for Subcatchment E-1:

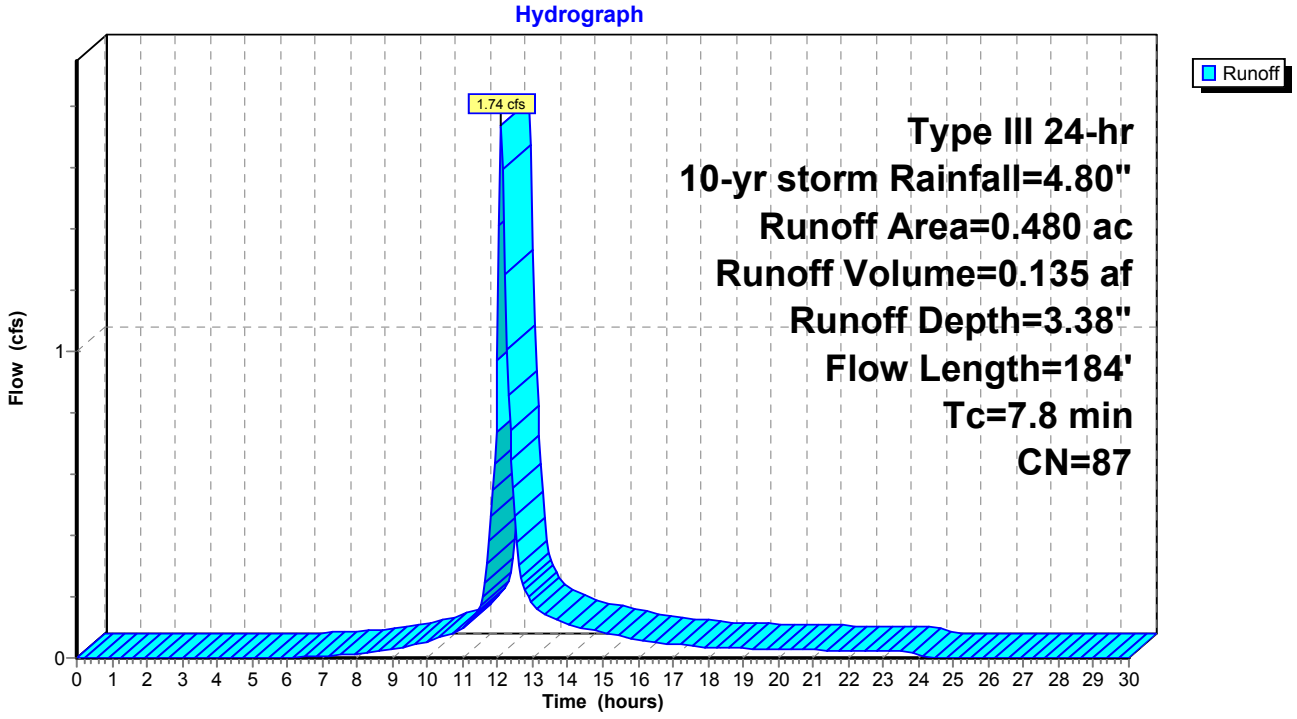
Runoff = 1.74 cfs @ 12.11 hrs, Volume= 0.135 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

	Area (ac)	CN	Description
*	0.280	98	Impervious
	0.170	69	50-75% Grass cover, Fair, HSG B
	0.030	85	Gravel roads, HSG B
	0.480	87	Weighted Average
	0.200		41.67% Pervious Area
	0.280		58.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0194	0.15		**Sheet Flow, 1 - Sheet Flow** Grass: Short n= 0.150 P2= 3.40"
1.7	45	0.0040	0.44		**Shallow Concentrated Flow, 2 - Shallow land** Short Grass Pasture Kv= 7.0 fps
0.6	89	0.0140	2.40		**Shallow Concentrated Flow, 3 - Shallow impv** Paved Kv= 20.3 fps
7.8	184	Total			

Subcatchment E-1:

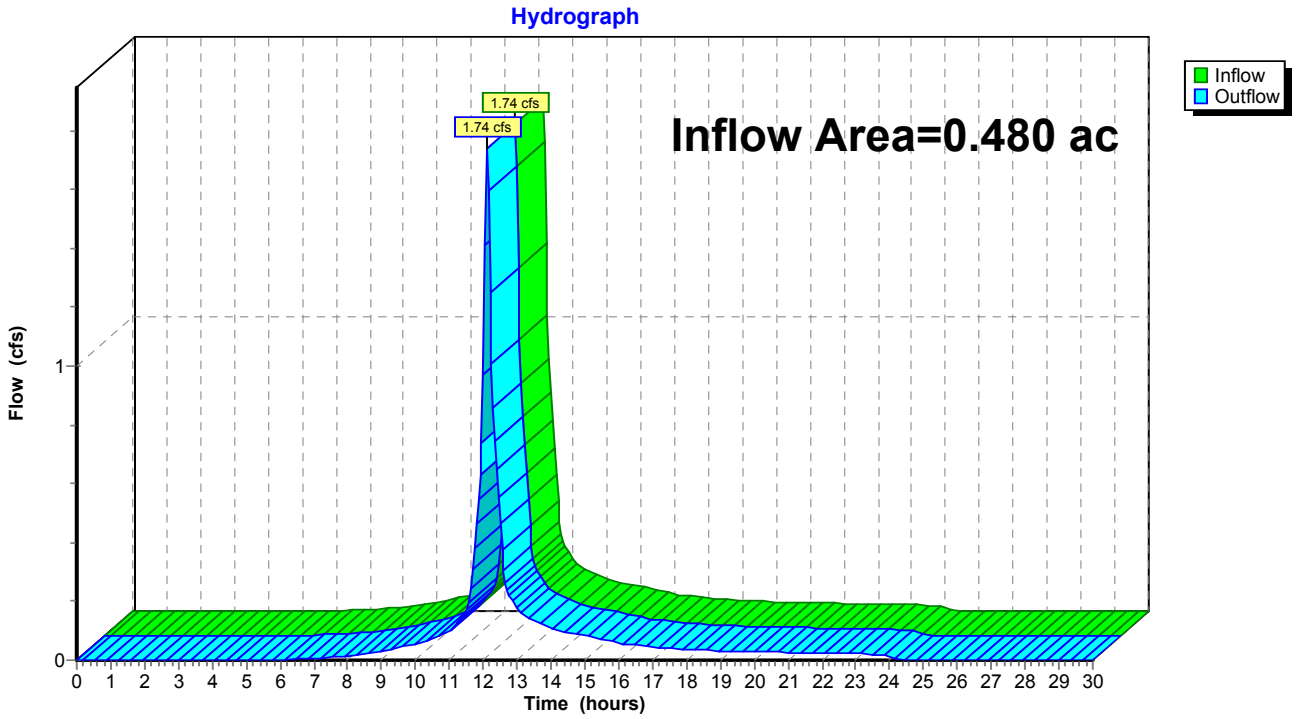


Summary for Reach DP-1:

Inflow Area = 0.480 ac, 58.33% Impervious, Inflow Depth = 3.38" for 10-yr storm event
Inflow = 1.74 cfs @ 12.11 hrs, Volume= 0.135 af
Outflow = 1.74 cfs @ 12.11 hrs, Volume= 0.135 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1:



Summary for Subcatchment E-1:

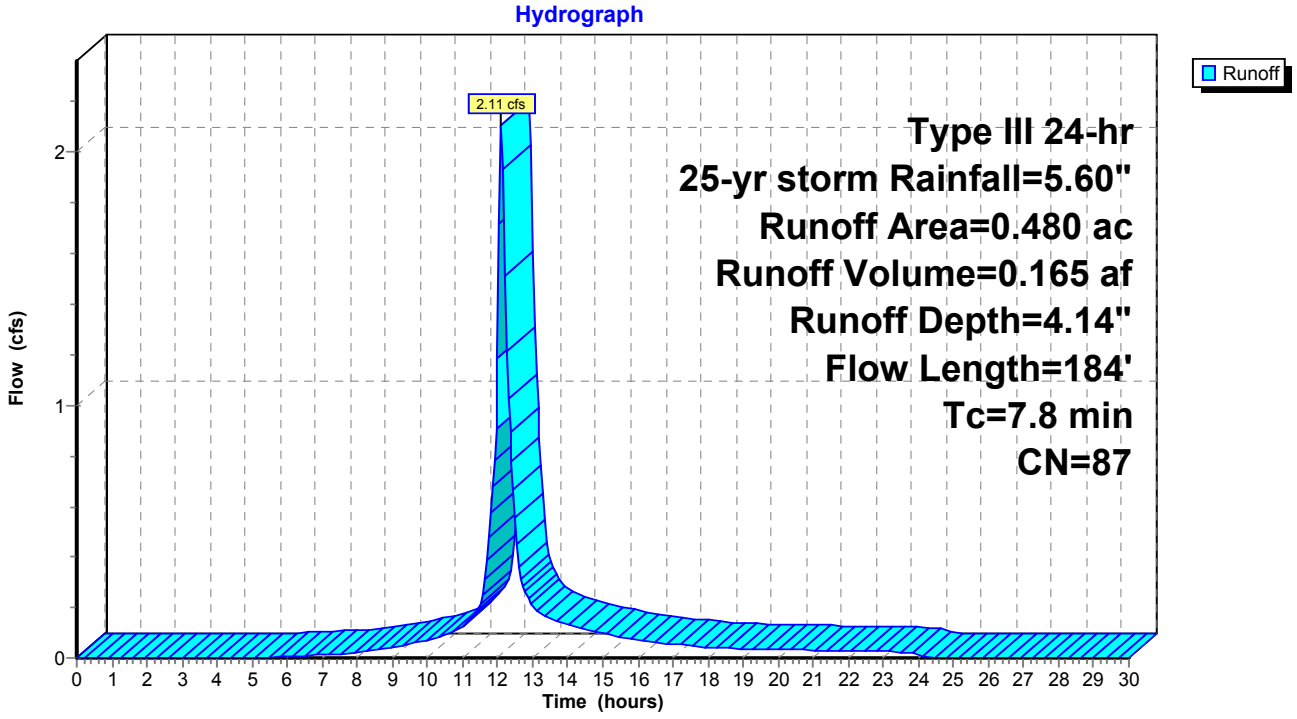
Runoff = 2.11 cfs @ 12.11 hrs, Volume= 0.165 af, Depth= 4.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

	Area (ac)	CN	Description
*	0.280	98	Impervious
	0.170	69	50-75% Grass cover, Fair, HSG B
	0.030	85	Gravel roads, HSG B
	0.480	87	Weighted Average
	0.200		41.67% Pervious Area
	0.280		58.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0194	0.15		**Sheet Flow, 1 - Sheet Flow** Grass: Short n= 0.150 P2= 3.40"
1.7	45	0.0040	0.44		**Shallow Concentrated Flow, 2 - Shallow land** Short Grass Pasture Kv= 7.0 fps
0.6	89	0.0140	2.40		**Shallow Concentrated Flow, 3 - Shallow impv** Paved Kv= 20.3 fps
7.8	184	Total			

Subcatchment E-1:

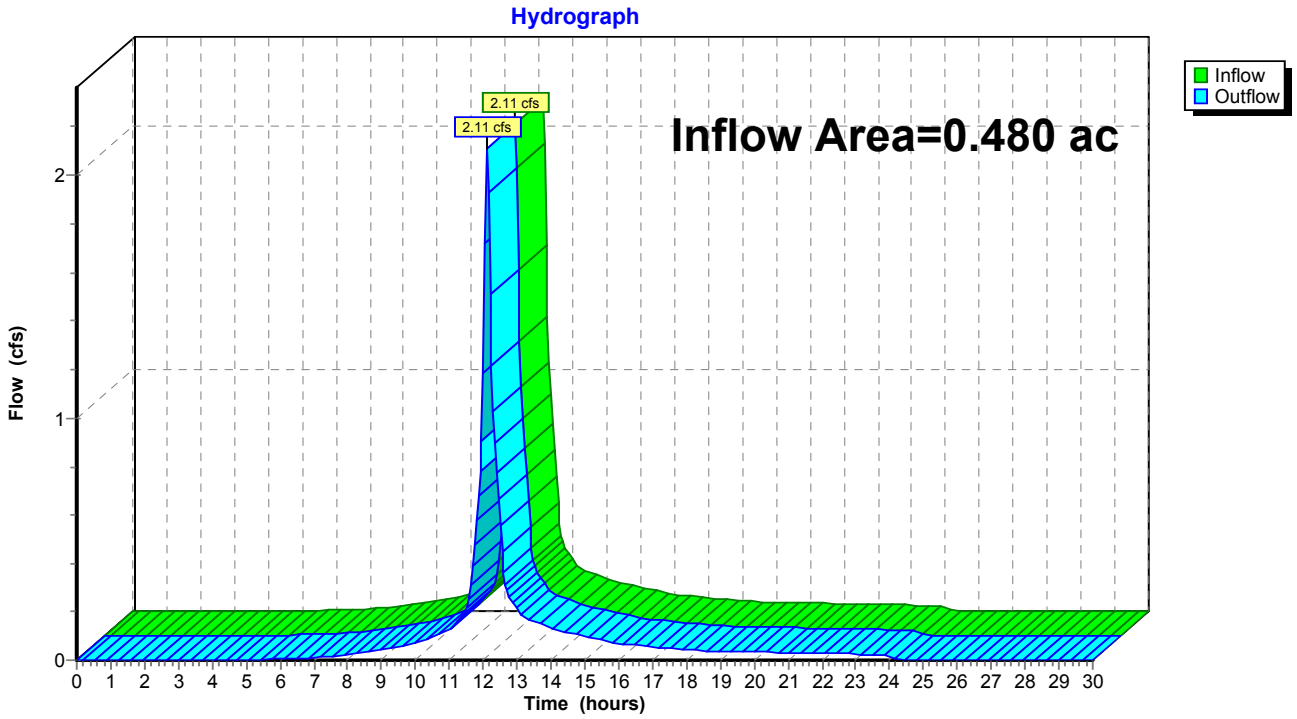


Summary for Reach DP-1:

Inflow Area = 0.480 ac, 58.33% Impervious, Inflow Depth = 4.14" for 25-yr storm event
Inflow = 2.11 cfs @ 12.11 hrs, Volume= 0.165 af
Outflow = 2.11 cfs @ 12.11 hrs, Volume= 0.165 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1:



Summary for Subcatchment E-1:

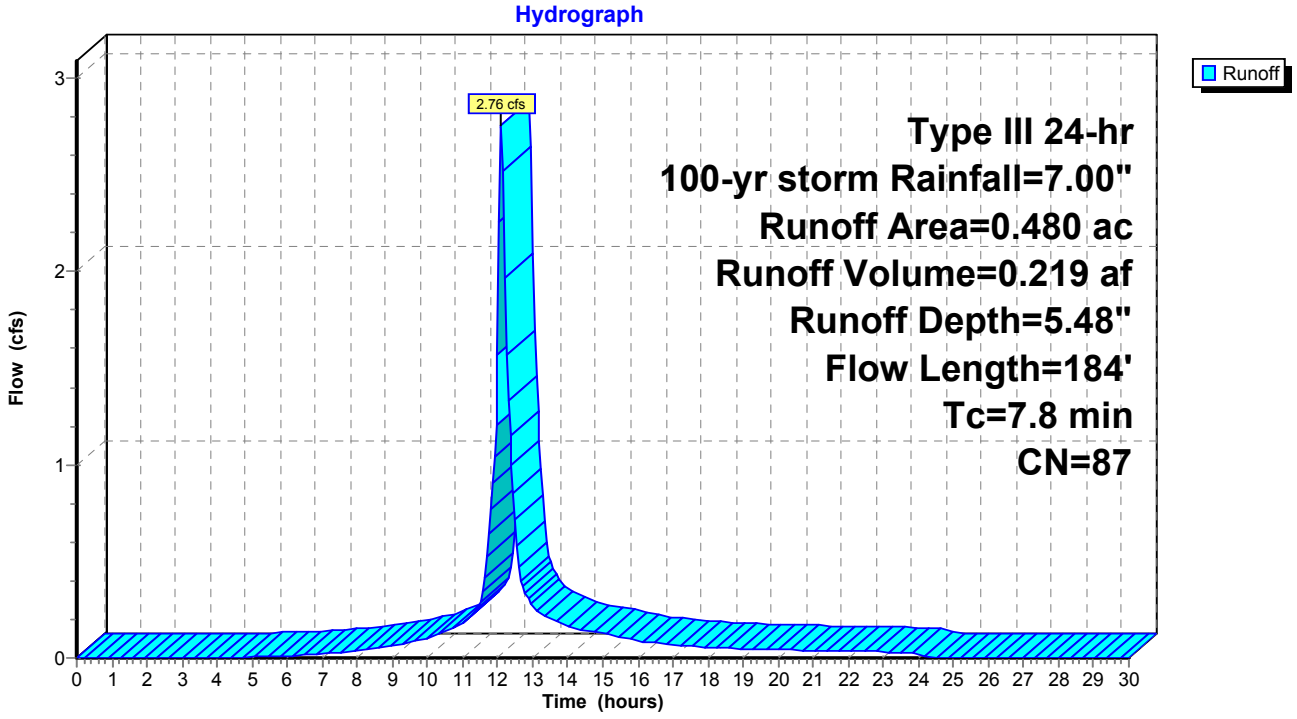
Runoff = 2.76 cfs @ 12.11 hrs, Volume= 0.219 af, Depth= 5.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

	Area (ac)	CN	Description
*	0.280	98	Impervious
	0.170	69	50-75% Grass cover, Fair, HSG B
	0.030	85	Gravel roads, HSG B
	0.480	87	Weighted Average
	0.200		41.67% Pervious Area
	0.280		58.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0194	0.15		**Sheet Flow, 1 - Sheet Flow** Grass: Short n= 0.150 P2= 3.40"
1.7	45	0.0040	0.44		**Shallow Concentrated Flow, 2 - Shallow land** Short Grass Pasture Kv= 7.0 fps
0.6	89	0.0140	2.40		**Shallow Concentrated Flow, 3 - Shallow impv** Paved Kv= 20.3 fps
7.8	184	Total			

Subcatchment E-1:

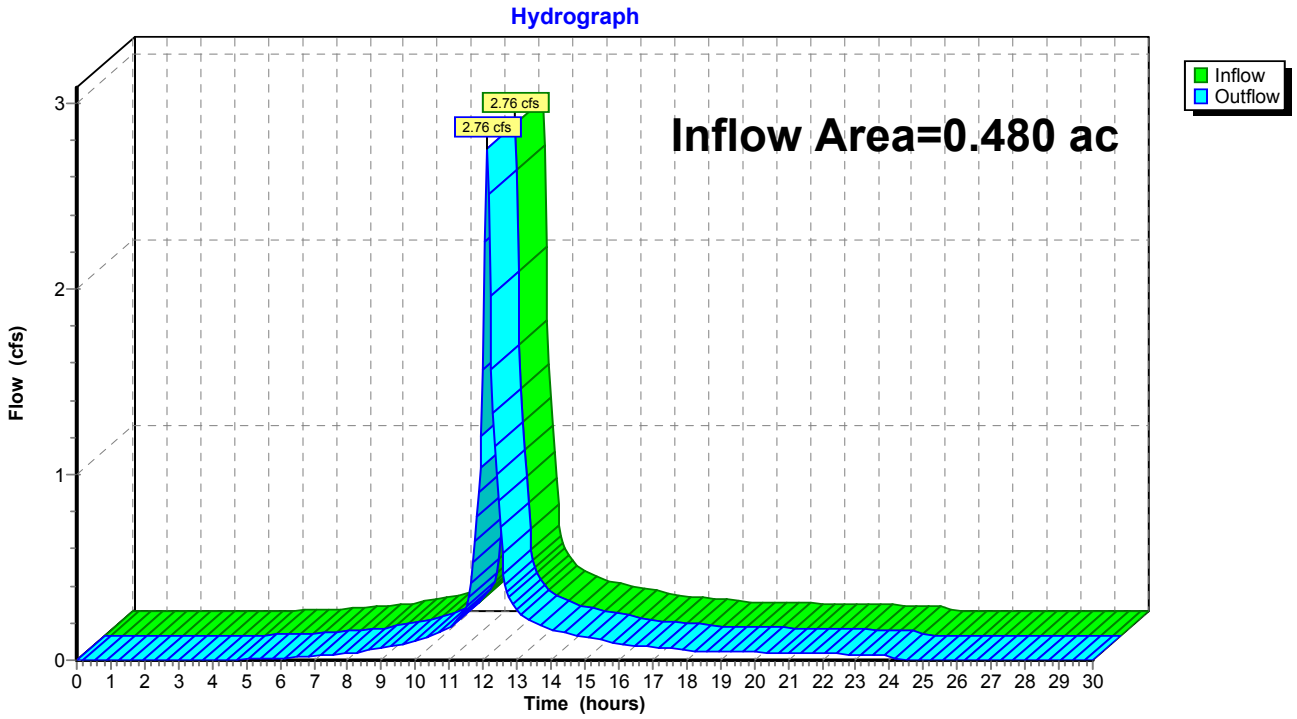


Summary for Reach DP-1:

Inflow Area = 0.480 ac, 58.33% Impervious, Inflow Depth = 5.48" for 100-yr storm event
Inflow = 2.76 cfs @ 12.11 hrs, Volume= 0.219 af
Outflow = 2.76 cfs @ 12.11 hrs, Volume= 0.219 af, Atten= 0%, Lag= 0.0 min

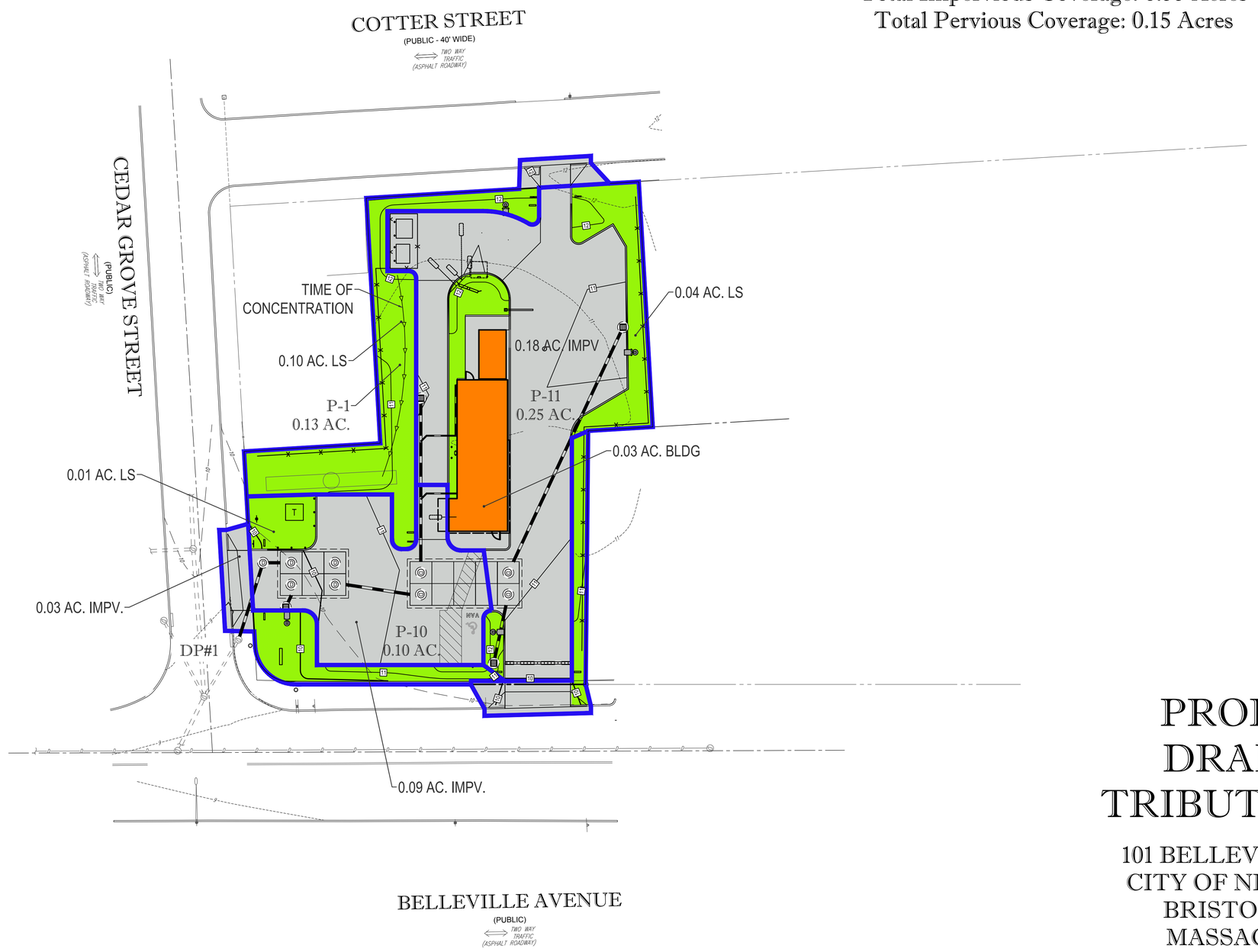
Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP-1:



APPENDIX D – POST DEVELOPMENT WATERSHEDS MAP

TOTAL SITE AREA: 0.48 Acres
Total Impervious Coverage: 0.33 Acres
Total Pervious Coverage: 0.15 Acres



PROPOSED DRAINAGE TRIBUTARY MAP

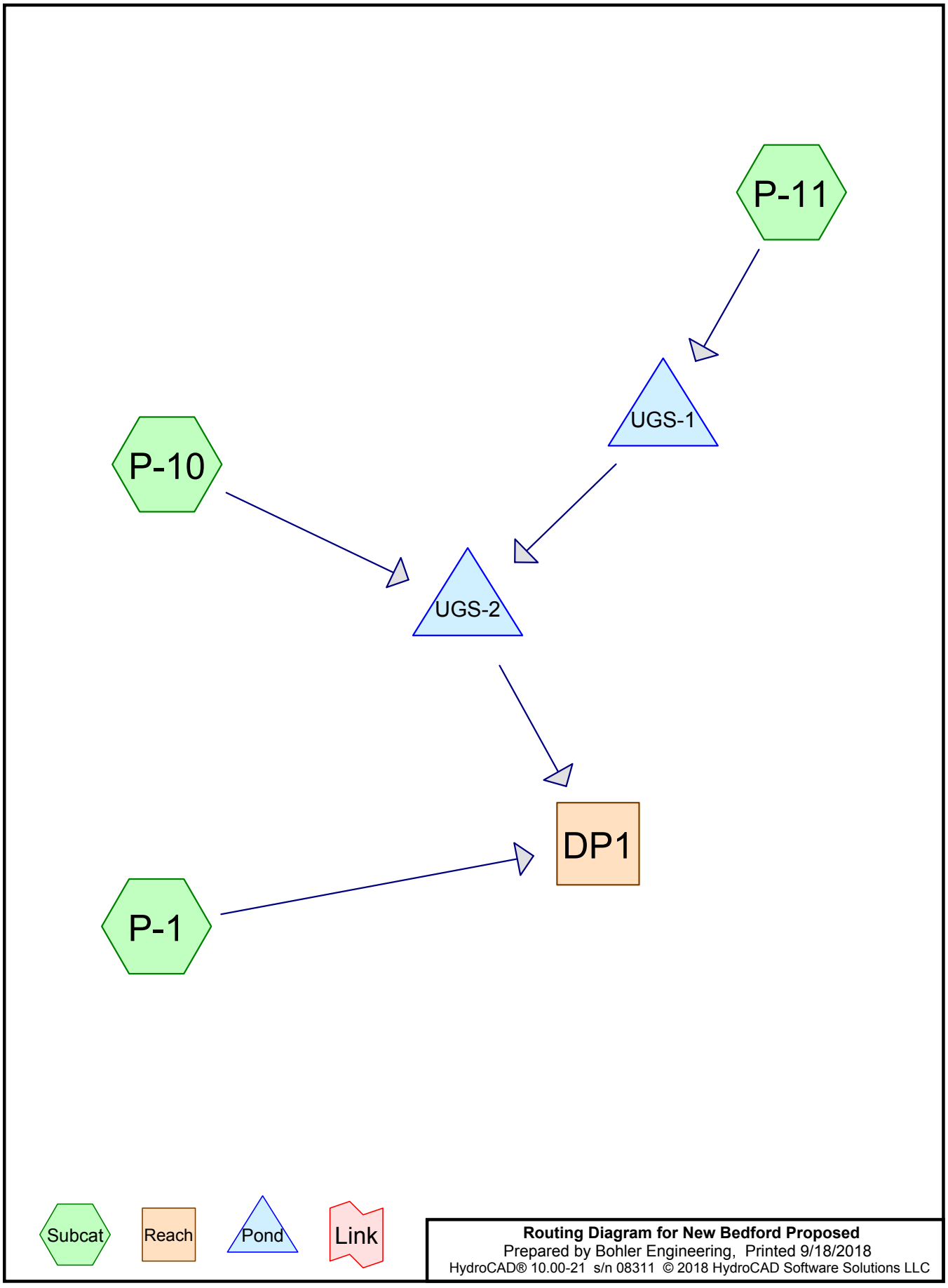
101 BELLEVILLE AVENUE
CITY OF NEW BEDFORD
BRISTOL COUNTY
MASSACHUSETTS

PREPARED BY

BOHLER ENGINEERING

NOT TO SCALE

APPENDIX E – POST DEVELOPMENT STORMWATER ATTENUATION CALCULATIONS



Routing Diagram for New Bedford Proposed
Prepared by Bohler Engineering, Printed 9/18/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.150	61	>75% Grass cover, Good, HSG B (P-1, P-10, P-11)
0.180	98	Impervious (P-11)
0.120	98	Paved parking, HSG B (P-1, P-10)
0.030	98	roof (P-11)
0.480	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.270	HSG B	P-1, P-10, P-11
0.000	HSG C	
0.000	HSG D	
0.210	Other	P-11
0.480		**TOTAL AREA**

Summary for Subcatchment P-1:

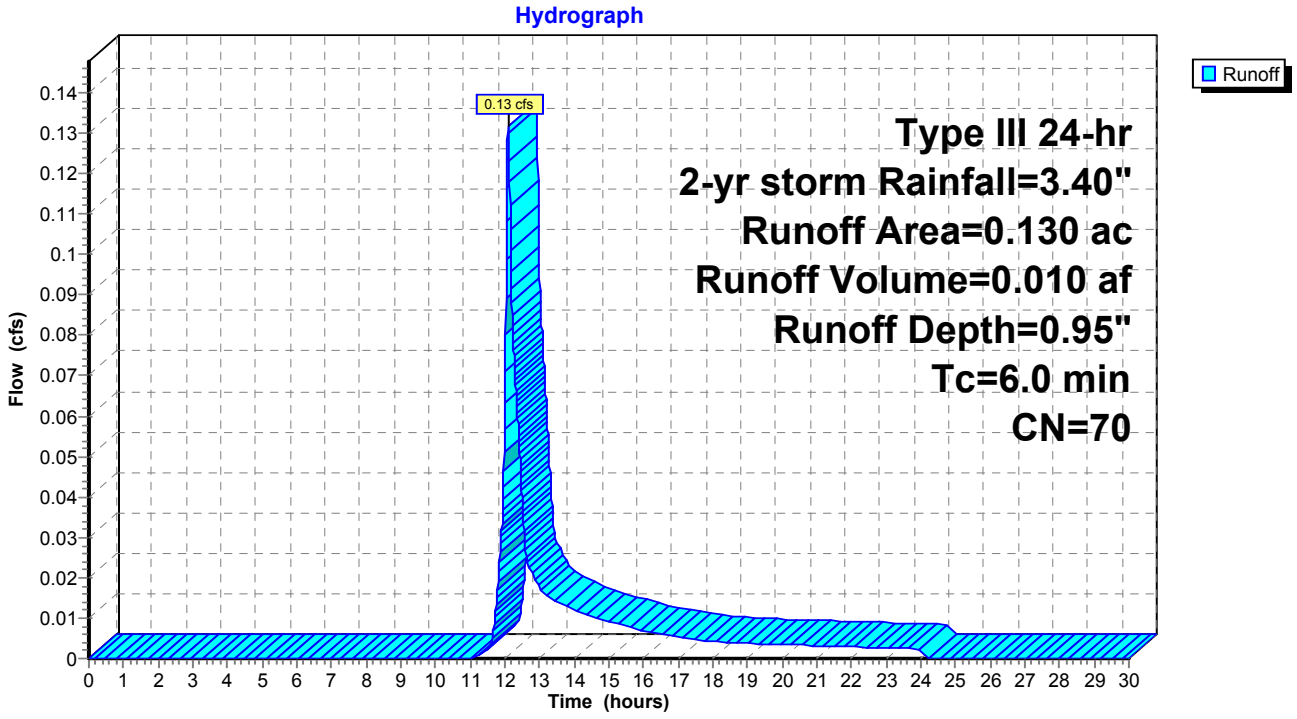
Runoff = 0.13 cfs @ 12.10 hrs, Volume= 0.010 af, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

Area (ac)	CN	Description
0.100	61	>75% Grass cover, Good, HSG B
0.030	98	Paved parking, HSG B
0.130	70	Weighted Average
0.100		76.92% Pervious Area
0.030		23.08% Impervious Area

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

Subcatchment P-1:



Summary for Subcatchment P-10:

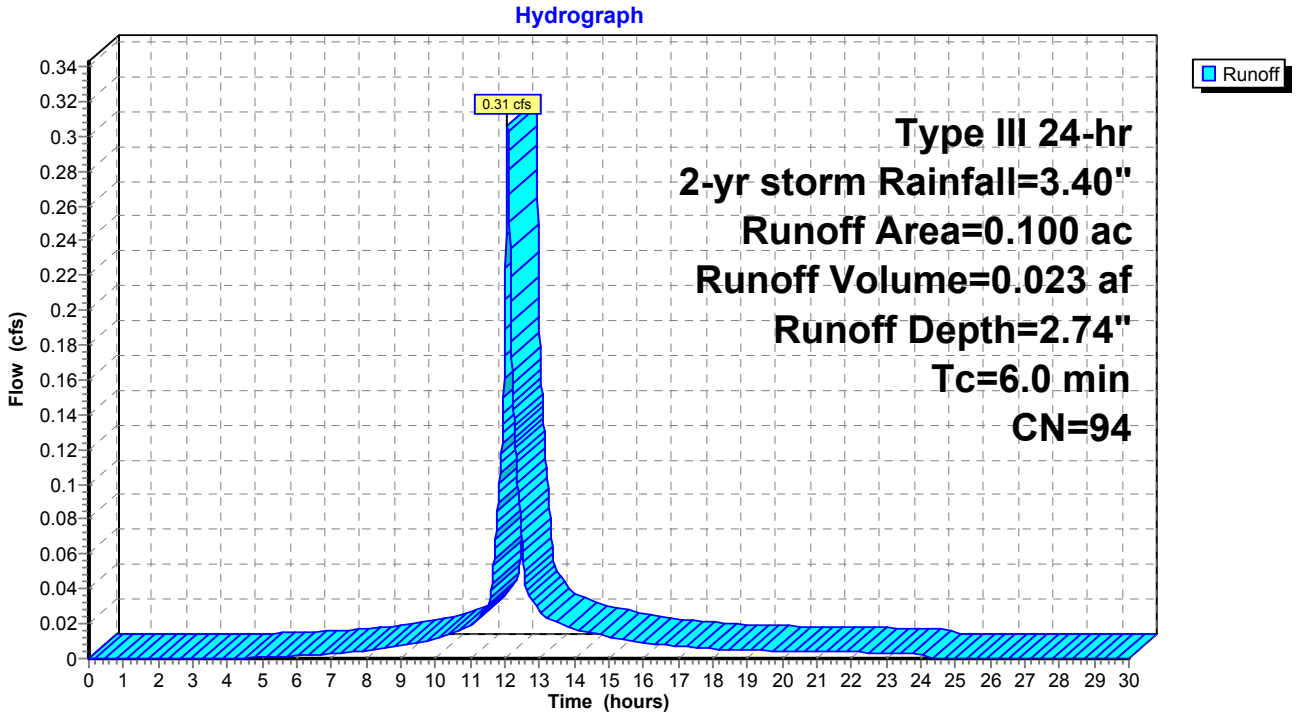
Runoff = 0.31 cfs @ 12.08 hrs, Volume= 0.023 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

Area (ac)	CN	Description
0.010	61	>75% Grass cover, Good, HSG B
0.090	98	Paved parking, HSG B
0.100	94	Weighted Average
0.010		10.00% Pervious Area
0.090		90.00% Impervious Area

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

Subcatchment P-10:



Summary for Subcatchment P-11:

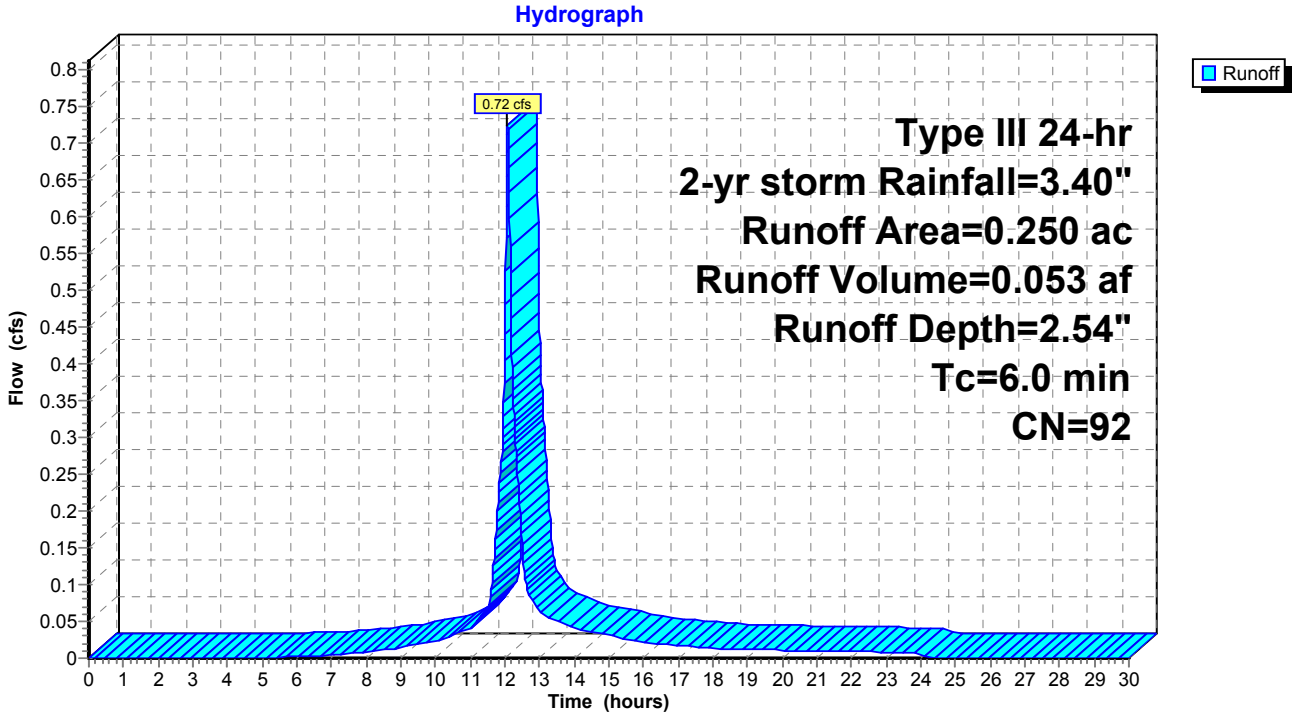
Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.053 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

	Area (ac)	CN	Description
*	0.030	98	roof
*	0.180	98	Impervious
	0.040	61	>75% Grass cover, Good, HSG B
	0.250	92	Weighted Average
	0.040		16.00% Pervious Area
	0.210		84.00% Impervious Area

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

Subcatchment P-11:

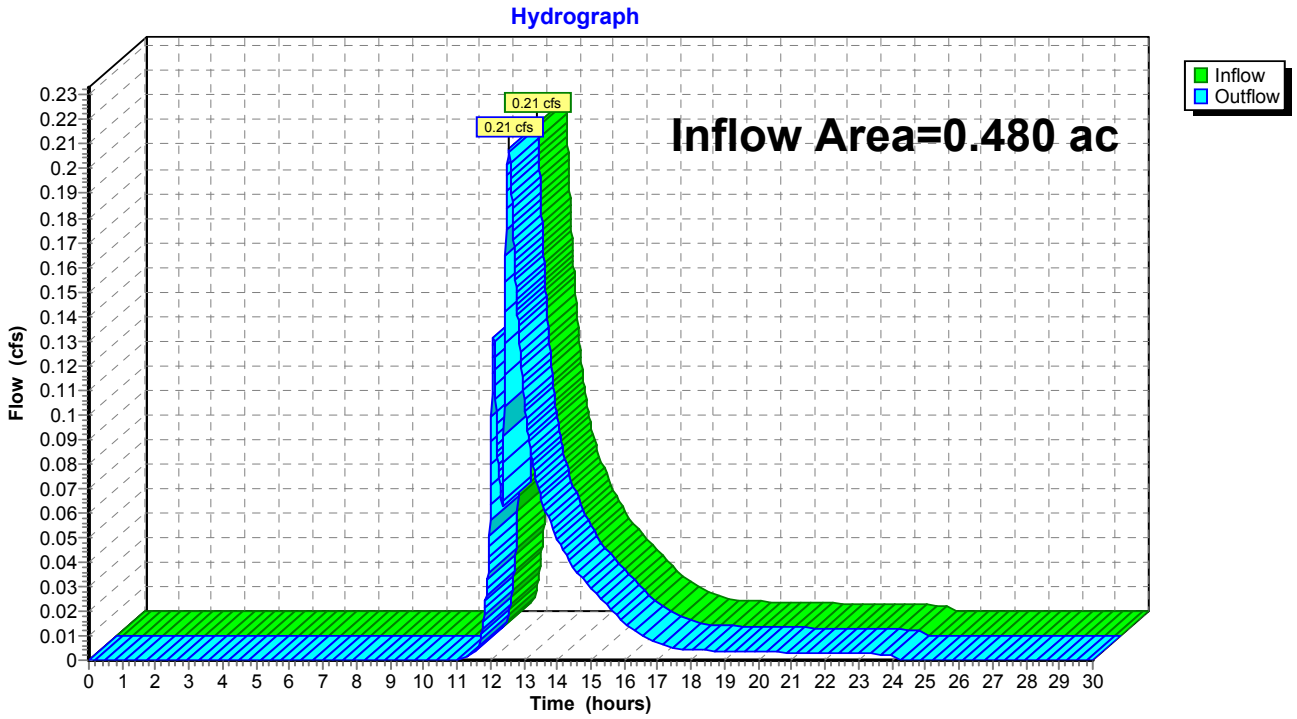


Summary for Reach DP1:

Inflow Area = 0.480 ac, 68.75% Impervious, Inflow Depth = 0.63" for 2-yr storm event
Inflow = 0.21 cfs @ 12.54 hrs, Volume= 0.025 af
Outflow = 0.21 cfs @ 12.54 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1:



Summary for Pond UGS-1:

Inflow Area = 0.250 ac, 84.00% Impervious, Inflow Depth = 2.54" for 2-yr storm event
Inflow = 0.72 cfs @ 12.09 hrs, Volume= 0.053 af
Outflow = 0.17 cfs @ 12.48 hrs, Volume= 0.045 af, Atten= 76%, Lag= 23.6 min
Discarded = 0.02 cfs @ 10.66 hrs, Volume= 0.033 af
Primary = 0.15 cfs @ 12.48 hrs, Volume= 0.013 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 8.72' @ 12.48 hrs Surf.Area= 756 sf Storage= 1,012 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 247.6 min (1,043.2 - 795.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	752 cf	**18.00'W x 42.00'L x 5.17'H Field A** 3,906 cf Overall - 2,027 cf Embedded = 1,879 cf x 40.0% Voids
#2A	7.00'	1,358 cf	**retain_it retain_it 2.5'** x 10 Inside #1 Inside= 84.0"W x 30.0"H => 17.56 sf x 8.00'L = 140.4 cf Outside= 96.0"W x 38.0"H => 25.33 sf x 8.00'L = 202.7 cf 2 Rows adjusted for 46.2 cf perimeter wall
		2,110 cf	Total Available Storage

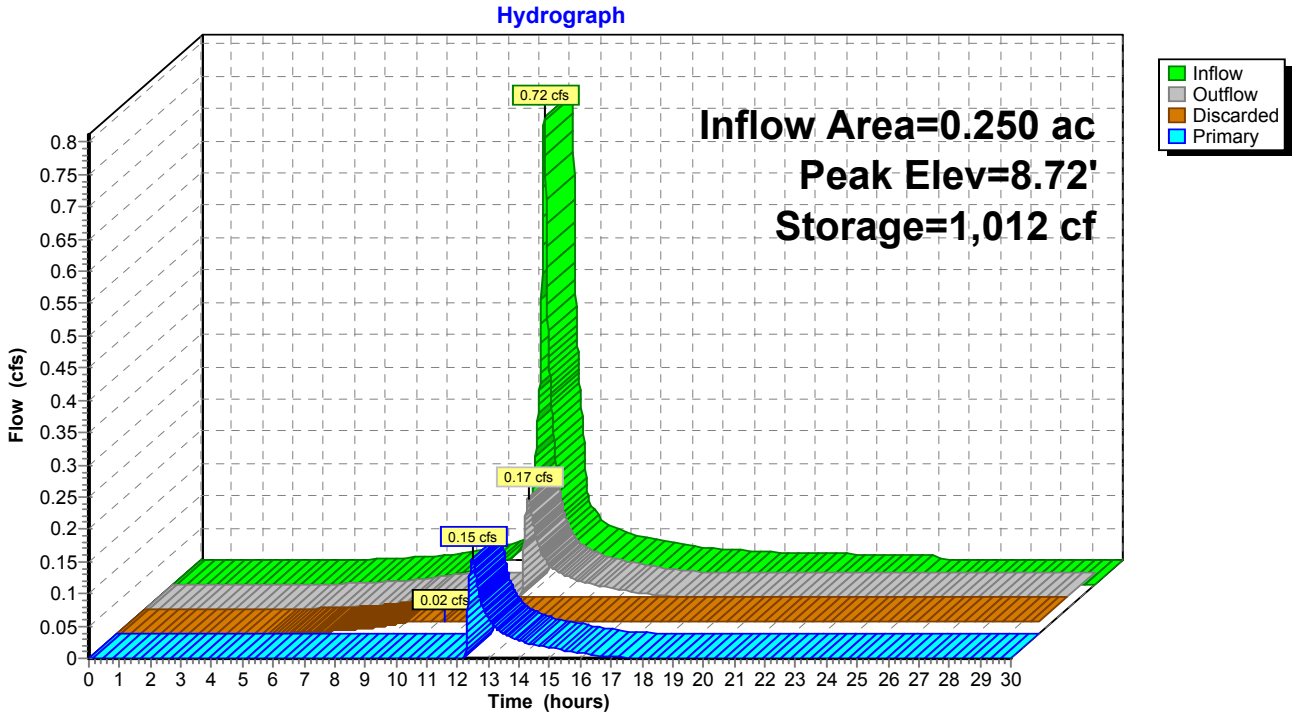
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	8.50'	**8.0" Round Culvert** L= 24.0' Ke= 0.500 Inlet / Outlet Invert= 8.50' / 7.42' S= 0.0450 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

Discarded OutFlow Max=0.02 cfs @ 10.66 hrs HW=7.05' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.15 cfs @ 12.48 hrs HW=8.72' TW=7.62' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.15 cfs @ 1.58 fps)

Pond UGS-1:


Hydrograph
Inflow Area=0.250 ac
Peak Elev=8.72'
Storage=1,012 cf
0.72 cfs
0.17 cfs
0.15 cfs
0.02 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Stage-Area-Storage for Pond UGS-1:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
7.00	**756**	0
7.10	756	59
7.20	756	118
7.30	756	177
7.40	756	236
7.50	756	295
7.60	756	354
7.70	756	413
7.80	756	472
7.90	756	531
8.00	756	590
8.10	756	649
8.20	756	708
8.30	756	767
8.40	756	826
8.50	756	885
8.60	756	943
8.70	756	1,002
8.80	756	1,061
8.90	756	1,120
9.00	756	1,179
9.10	756	1,238
9.20	756	1,297
9.30	756	1,356
9.40	756	1,415
9.50	756	1,474
9.60	756	1,479
9.70	756	1,483
9.80	756	1,488
9.90	756	1,493
10.00	756	1,497
10.10	756	1,502
10.20	756	1,515
10.30	756	1,545
10.40	756	1,576
10.50	756	1,606
10.60	756	1,636
10.70	756	1,666
10.80	756	1,697
10.90	756	1,727
11.00	756	1,757
11.10	756	1,787
11.20	756	1,818
11.30	756	1,848
11.40	756	1,878
11.50	756	1,908
11.60	756	1,939
11.70	756	1,969
11.80	756	1,999
11.90	756	2,029
12.00	756	2,060
12.10	756	**2,090**

Summary for Pond UGS-2:

Inflow Area = 0.350 ac, 85.71% Impervious, Inflow Depth = 1.22" for 2-yr storm event
Inflow = 0.31 cfs @ 12.08 hrs, Volume= 0.036 af
Outflow = 0.19 cfs @ 12.56 hrs, Volume= 0.035 af, Atten= 39%, Lag= 28.7 min
Discarded = 0.01 cfs @ 11.11 hrs, Volume= 0.020 af
Primary = 0.18 cfs @ 12.56 hrs, Volume= 0.015 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 7.65' @ 12.56 hrs Surf.Area= 468 sf Storage= 498 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 204.0 min (997.2 - 793.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	6.25'	464 cf	**18.00'W x 26.00'L x 4.67'H Field A** 2,184 cf Overall - 1,024 cf Embedded = 1,160 cf x 40.0% Voids
#2A	6.25'	643 cf	**retain_it retain_it 2.0'** x 6 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 2 Rows adjusted for 18.9 cf perimeter wall
		1,107 cf	Total Available Storage

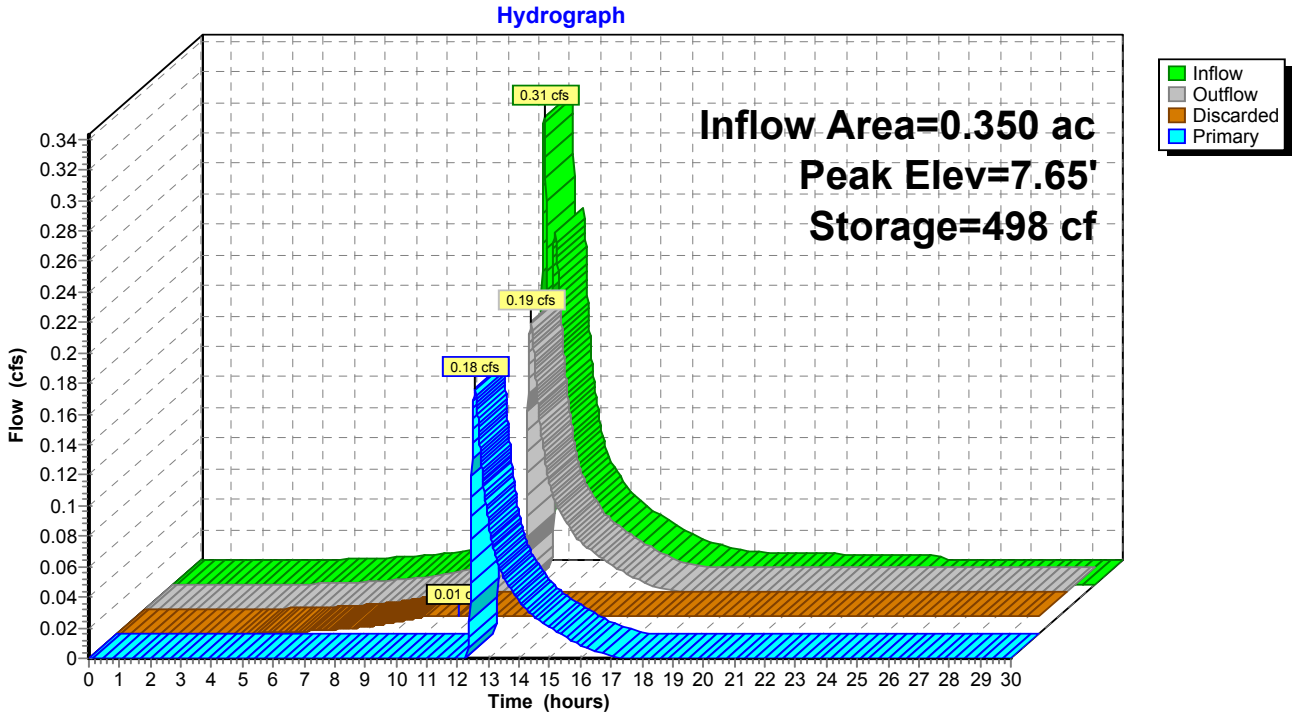
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	7.42'	**8.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 7.42' / 7.00' S= 0.0700 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#2	Discarded	6.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 11.11 hrs HW=6.30' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.18 cfs @ 12.56 hrs HW=7.65' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.18 cfs @ 1.64 fps)

Pond UGS-2:


Hydrograph
Inflow Area=0.350 ac
Peak Elev=7.65'
Storage=498 cf
0.31 cfs
0.19 cfs
0.18 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)

Stage-Area-Storage for Pond UGS-2:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
6.25	**468**	0
6.30	468	18
6.35	468	35
6.40	468	53
6.45	468	71
6.50	468	89
6.55	468	106
6.60	468	124
6.65	468	142
6.70	468	160
6.75	468	177
6.80	468	195
6.85	468	213
6.90	468	231
6.95	468	248
7.00	468	266
7.05	468	284
7.10	468	302
7.15	468	319
7.20	468	337
7.25	468	355
7.30	468	373
7.35	468	390
7.40	468	408
7.45	468	426
7.50	468	444
7.55	468	461
7.60	468	479
7.65	468	497
7.70	468	515
7.75	468	532
7.80	468	550
7.85	468	568
7.90	468	586
7.95	468	603
8.00	468	621
8.05	468	639
8.10	468	657
8.15	468	674
8.20	468	692
8.25	468	710
8.30	468	712
8.35	468	713
8.40	468	715
8.45	468	717
8.50	468	718
8.55	468	720
8.60	468	722
8.65	468	723
8.70	468	725
8.75	468	727
8.80	468	728
8.85	468	730
8.90	468	732
8.95	468	739
9.00	468	748
9.05	468	757
9.10	468	767
9.15	468	776
9.20	468	785
9.25	468	795
9.30	468	804
9.35	468	813
9.40	468	823
9.45	468	832
9.50	468	842
9.55	468	851
9.60	468	860
9.65	468	870
9.70	468	879
9.75	468	888
9.80	468	898
9.85	468	907
9.90	468	916
9.95	468	926
10.00	468	935
10.05	468	945
10.10	468	954
10.15	468	963
10.20	468	973
10.25	468	982
10.30	468	991
10.35	468	1,001
10.40	468	1,010
10.45	468	1,019
10.50	468	1,029
10.55	468	1,038
10.60	468	1,047
10.65	468	1,057
10.70	468	1,066
10.75	468	1,076
10.80	468	1,085
10.85	468	1,094
10.90	468	**1,104**

Summary for Subcatchment P-1:

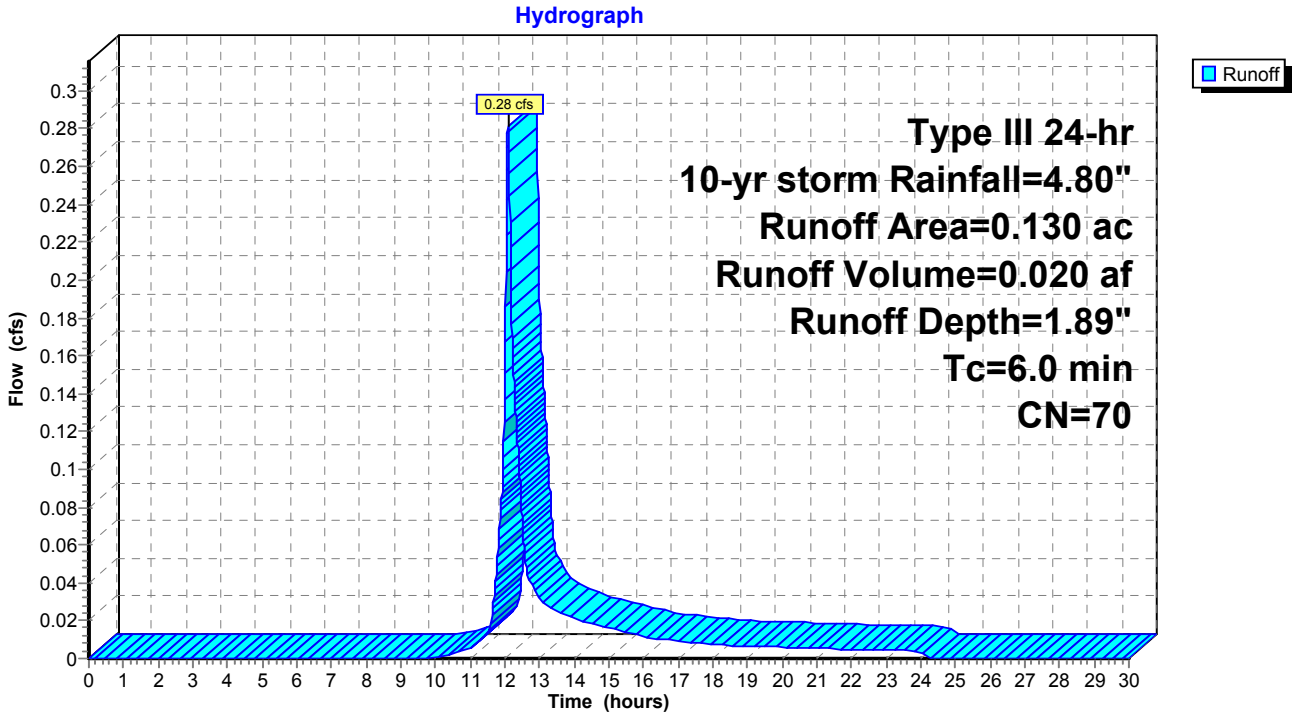
Runoff = 0.28 cfs @ 12.09 hrs, Volume= 0.020 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

Area (ac)	CN	Description
0.100	61	>75% Grass cover, Good, HSG B
0.030	98	Paved parking, HSG B
0.130	70	Weighted Average
0.100		76.92% Pervious Area
0.030		23.08% Impervious Area

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

Subcatchment P-1:



Summary for Subcatchment P-10:

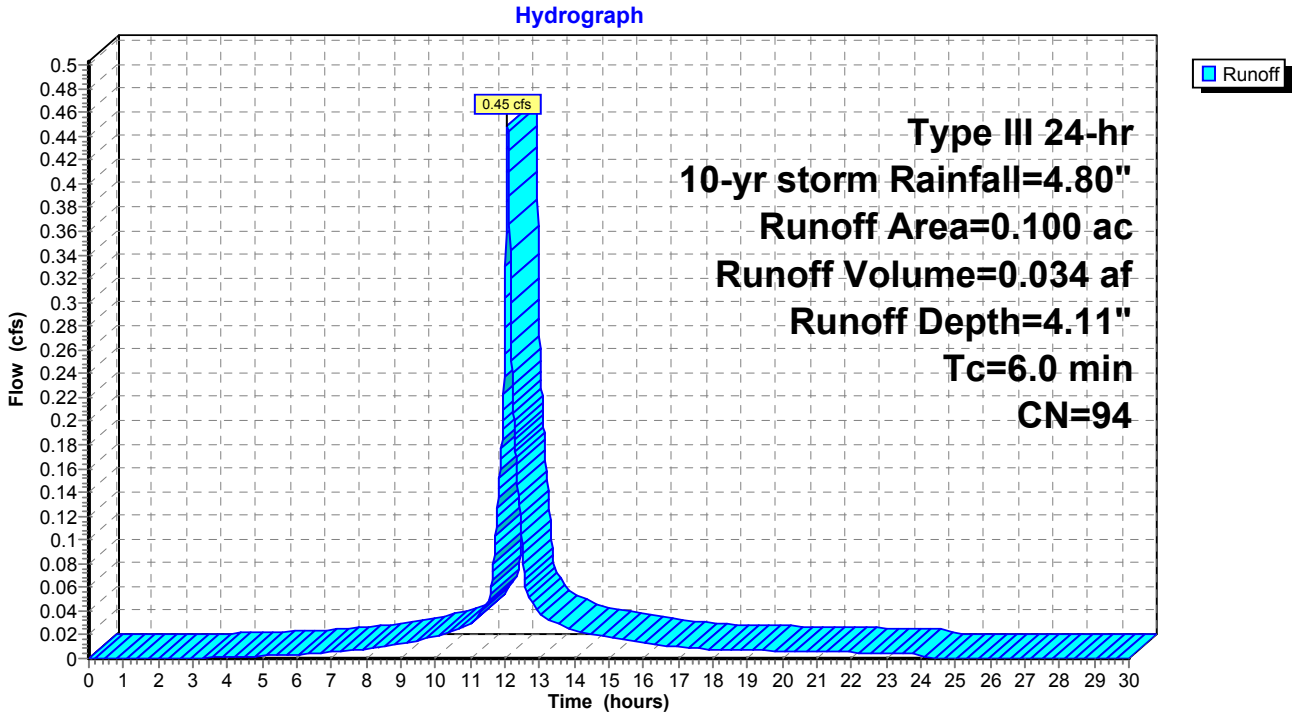
Runoff = 0.45 cfs @ 12.08 hrs, Volume= 0.034 af, Depth= 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

Area (ac)	CN	Description
0.010	61	>75% Grass cover, Good, HSG B
0.090	98	Paved parking, HSG B
0.100	94	Weighted Average
0.010		10.00% Pervious Area
0.090		90.00% Impervious Area

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

Subcatchment P-10:



Summary for Subcatchment P-11:

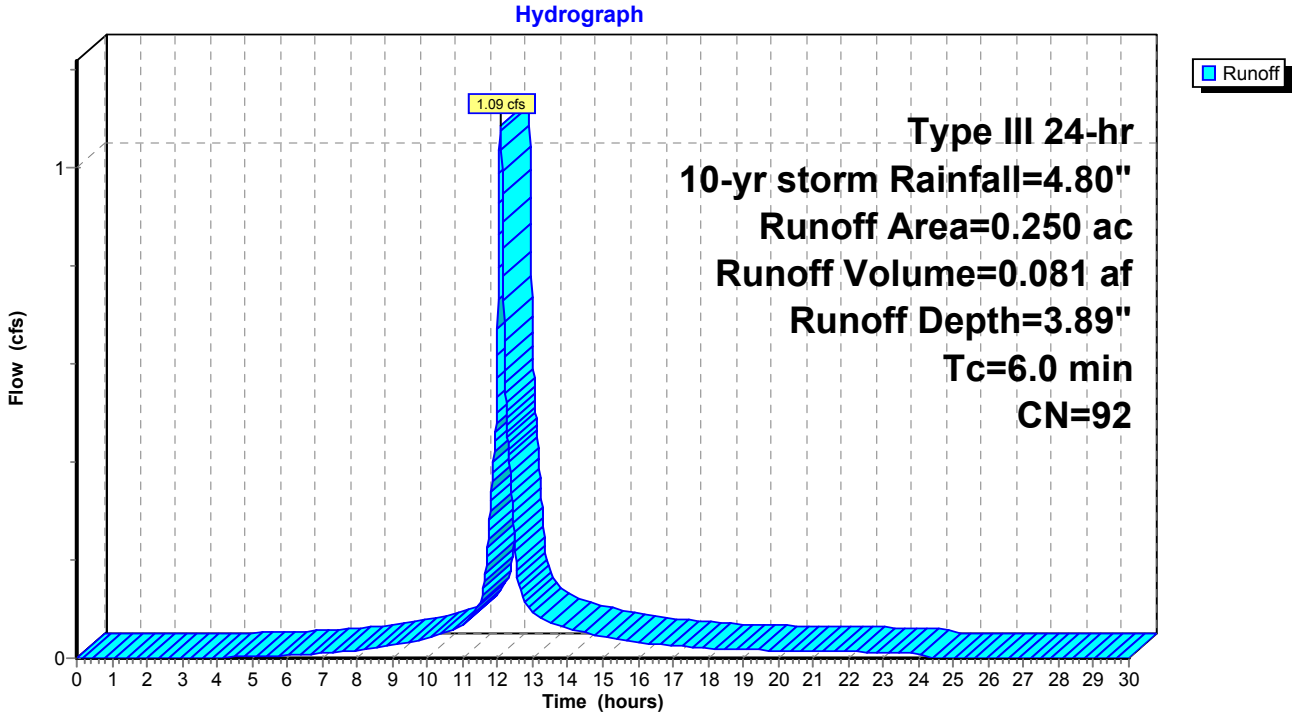
Runoff = 1.09 cfs @ 12.08 hrs, Volume= 0.081 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

	Area (ac)	CN	Description
*	0.030	98	roof
*	0.180	98	Impervious
	0.040	61	>75% Grass cover, Good, HSG B
	0.250	92	Weighted Average
	0.040		16.00% Pervious Area
	0.210		84.00% Impervious Area

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

Subcatchment P-11:

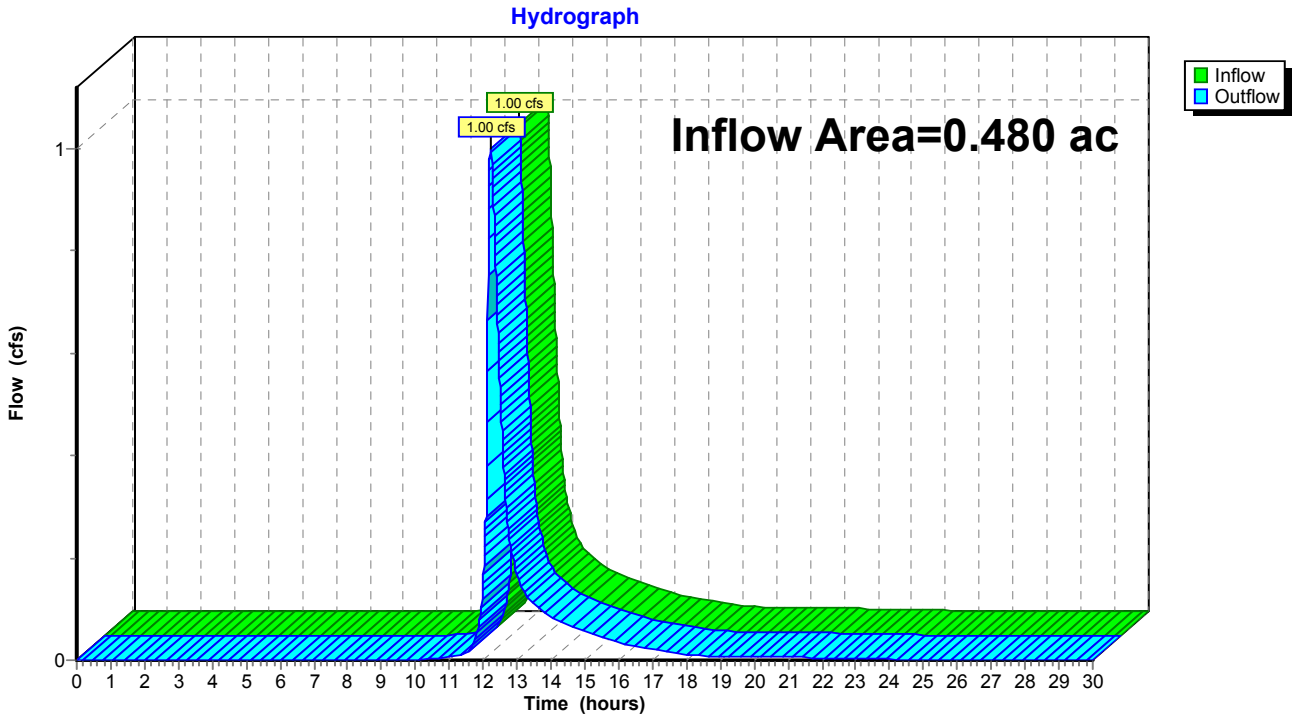


Summary for Reach DP1:

Inflow Area = 0.480 ac, 68.75% Impervious, Inflow Depth = 1.70" for 10-yr storm event
Inflow = 1.00 cfs @ 12.22 hrs, Volume= 0.068 af
Outflow = 1.00 cfs @ 12.22 hrs, Volume= 0.068 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1:



Summary for Pond UGS-1:

Inflow Area = 0.250 ac, 84.00% Impervious, Inflow Depth = 3.89" for 10-yr storm event
Inflow = 1.09 cfs @ 12.08 hrs, Volume= 0.081 af
Outflow = 0.69 cfs @ 12.18 hrs, Volume= 0.071 af, Atten= 37%, Lag= 5.7 min
Discarded = 0.02 cfs @ 9.46 hrs, Volume= 0.035 af
Primary = 0.67 cfs @ 12.18 hrs, Volume= 0.037 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 9.00' @ 12.18 hrs Surf.Area= 756 sf Storage= 1,177 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 152.9 min (936.9 - 784.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	752 cf	**18.00'W x 42.00'L x 5.17'H Field A** 3,906 cf Overall - 2,027 cf Embedded = 1,879 cf x 40.0% Voids
#2A	7.00'	1,358 cf	**retain_it retain_it 2.5'** x 10 Inside #1 Inside= 84.0"W x 30.0"H => 17.56 sf x 8.00'L = 140.4 cf Outside= 96.0"W x 38.0"H => 25.33 sf x 8.00'L = 202.7 cf 2 Rows adjusted for 46.2 cf perimeter wall
		2,110 cf	Total Available Storage

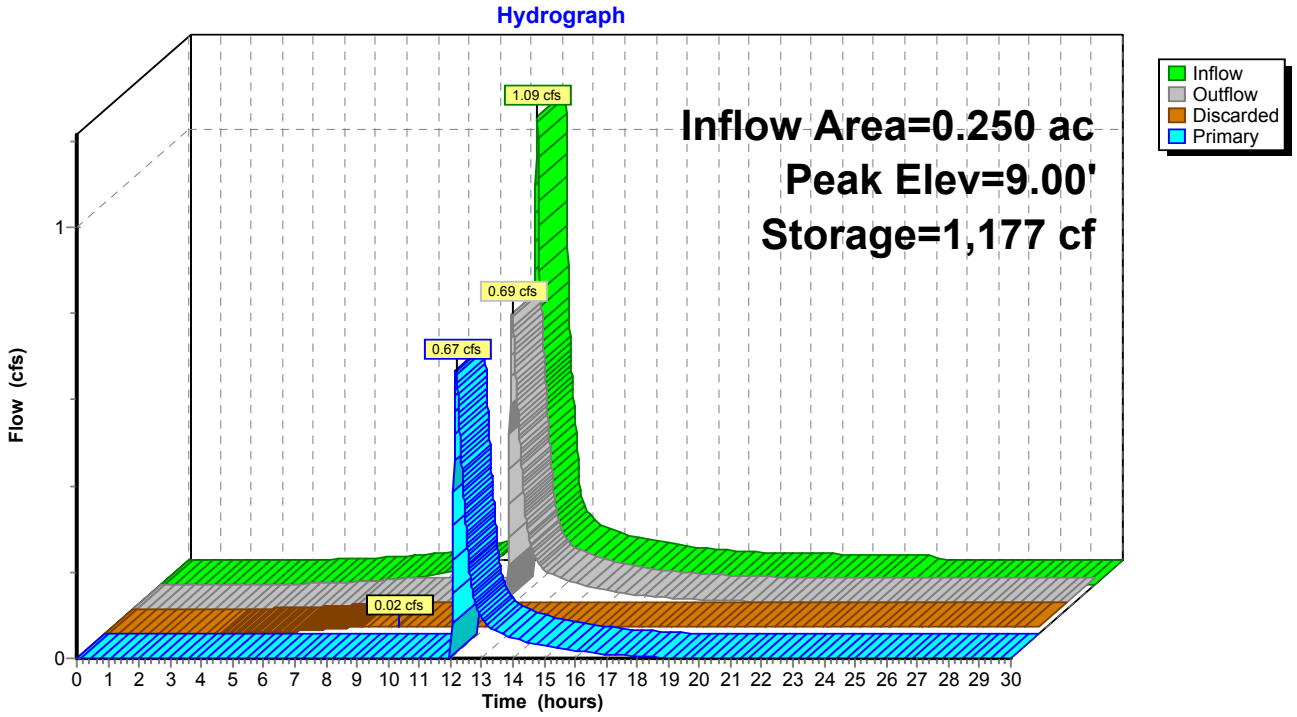
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	8.50'	**8.0" Round Culvert** L= 24.0' Ke= 0.500 Inlet / Outlet Invert= 8.50' / 7.42' S= 0.0450 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

Discarded OutFlow Max=0.02 cfs @ 9.46 hrs HW=7.05' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.67 cfs @ 12.18 hrs HW=9.00' TW=7.96' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.67 cfs @ 2.40 fps)

Pond UGS-1:


Hydrograph
Inflow Area=0.250 ac
Peak Elev=9.00'
Storage=1,177 cf
1.09 cfs
0.69 cfs
0.67 cfs
0.02 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Time (hours)

Stage-Area-Storage for Pond UGS-1:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
7.00	**756**	0
7.10	756	59
7.20	756	118
7.30	756	177
7.40	756	236
7.50	756	295
7.60	756	354
7.70	756	413
7.80	756	472
7.90	756	531
8.00	756	590
8.10	756	649
8.20	756	708
8.30	756	767
8.40	756	826
8.50	756	885
8.60	756	943
8.70	756	1,002
8.80	756	1,061
8.90	756	1,120
9.00	756	1,179
9.10	756	1,238
9.20	756	1,297
9.30	756	1,356
9.40	756	1,415
9.50	756	1,474
9.60	756	1,479
9.70	756	1,483
9.80	756	1,488
9.90	756	1,493
10.00	756	1,497
10.10	756	1,502
10.20	756	1,515
10.30	756	1,545
10.40	756	1,576
10.50	756	1,606
10.60	756	1,636
10.70	756	1,666
10.80	756	1,697
10.90	756	1,727
11.00	756	1,757
11.10	756	1,787
11.20	756	1,818
11.30	756	1,848
11.40	756	1,878
11.50	756	1,908
11.60	756	1,939
11.70	756	1,969
11.80	756	1,999
11.90	756	2,029
12.00	756	2,060
12.10	756	**2,090**

Summary for Pond UGS-2:

Inflow Area = 0.350 ac, 85.71% Impervious, Inflow Depth = 2.43" for 10-yr storm event
Inflow = 0.98 cfs @ 12.15 hrs, Volume= 0.071 af
Outflow = 0.85 cfs @ 12.23 hrs, Volume= 0.069 af, Atten= 14%, Lag= 4.8 min
Discarded = 0.01 cfs @ 10.00 hrs, Volume= 0.021 af
Primary = 0.84 cfs @ 12.23 hrs, Volume= 0.048 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 8.00' @ 12.23 hrs Surf.Area= 468 sf Storage= 621 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 101.1 min (882.9 - 781.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	6.25'	464 cf	**18.00'W x 26.00'L x 4.67'H Field A** 2,184 cf Overall - 1,024 cf Embedded = 1,160 cf x 40.0% Voids
#2A	6.25'	643 cf	**retain_it retain_it 2.0'** x 6 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 2 Rows adjusted for 18.9 cf perimeter wall
		1,107 cf	Total Available Storage

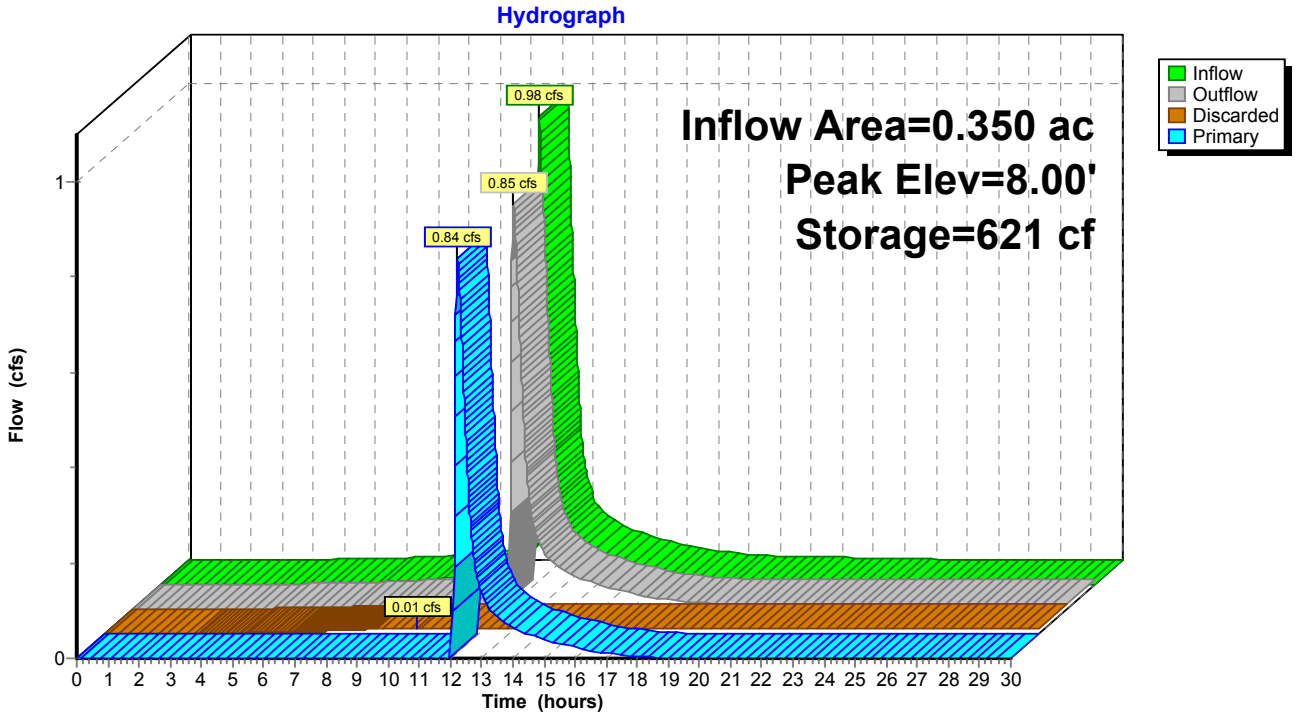
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	7.42'	**8.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 7.42' / 7.00' S= 0.0700 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#2	Discarded	6.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 10.00 hrs HW=6.30' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.84 cfs @ 12.23 hrs HW=8.00' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.84 cfs @ 2.59 fps)

Pond UGS-2:


Hydrograph
Inflow Area=0.350 ac
Peak Elev=8.00'
Storage=621 cf
0.98 cfs
0.85 cfs
0.84 cfs
0.01 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Stage-Area-Storage for Pond UGS-2:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
6.25	**468**	0
6.30	468	18
6.35	468	35
6.40	468	53
6.45	468	71
6.50	468	89
6.55	468	106
6.60	468	124
6.65	468	142
6.70	468	160
6.75	468	177
6.80	468	195
6.85	468	213
6.90	468	231
6.95	468	248
7.00	468	266
7.05	468	284
7.10	468	302
7.15	468	319
7.20	468	337
7.25	468	355
7.30	468	373
7.35	468	390
7.40	468	408
7.45	468	426
7.50	468	444
7.55	468	461
7.60	468	479
7.65	468	497
7.70	468	515
7.75	468	532
7.80	468	550
7.85	468	568
7.90	468	586
7.95	468	603
8.00	468	621
8.05	468	639
8.10	468	657
8.15	468	674
8.20	468	692
8.25	468	710
8.30	468	712
8.35	468	713
8.40	468	715
8.45	468	717
8.50	468	718
8.55	468	720
8.60	468	722
8.65	468	723
8.70	468	725
8.75	468	727
8.80	468	728
8.85	468	730
8.90	468	732
8.95	468	739
9.00	468	748
9.05	468	757
9.10	468	767
9.15	468	776
9.20	468	785
9.25	468	795
9.30	468	804
9.35	468	813
9.40	468	823
9.45	468	832
9.50	468	842
9.55	468	851
9.60	468	860
9.65	468	870
9.70	468	879
9.75	468	888
9.80	468	898
9.85	468	907
9.90	468	916
9.95	468	926
10.00	468	935
10.05	468	945
10.10	468	954
10.15	468	963
10.20	468	973
10.25	468	982
10.30	468	991
10.35	468	1,001
10.40	468	1,010
10.45	468	1,019
10.50	468	1,029
10.55	468	1,038
10.60	468	1,047
10.65	468	1,057
10.70	468	1,066
10.75	468	1,076
10.80	468	1,085
10.85	468	1,094
10.90	468	**1,104**

Summary for Subcatchment P-1:

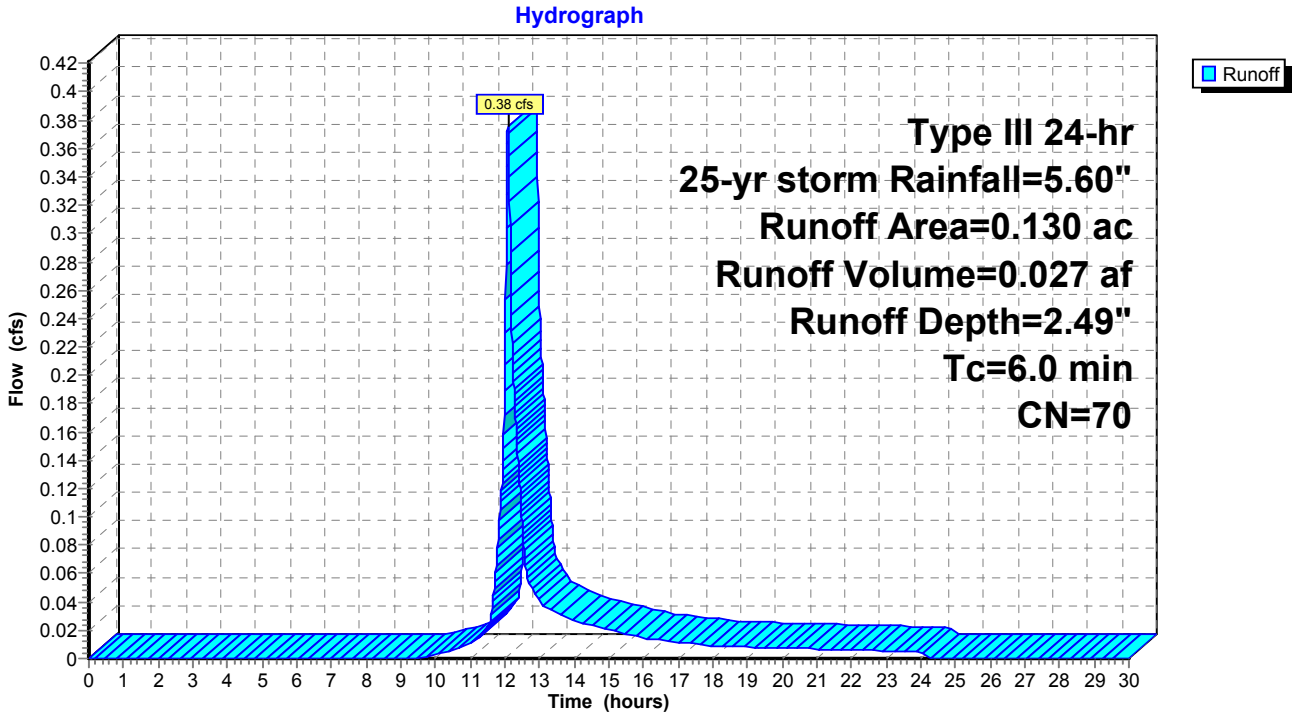
Runoff = 0.38 cfs @ 12.09 hrs, Volume= 0.027 af, Depth= 2.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

Area (ac)	CN	Description
0.100	61	>75% Grass cover, Good, HSG B
0.030	98	Paved parking, HSG B
0.130	70	Weighted Average
0.100		76.92% Pervious Area
0.030		23.08% Impervious Area

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

Subcatchment P-1:



Summary for Subcatchment P-10:

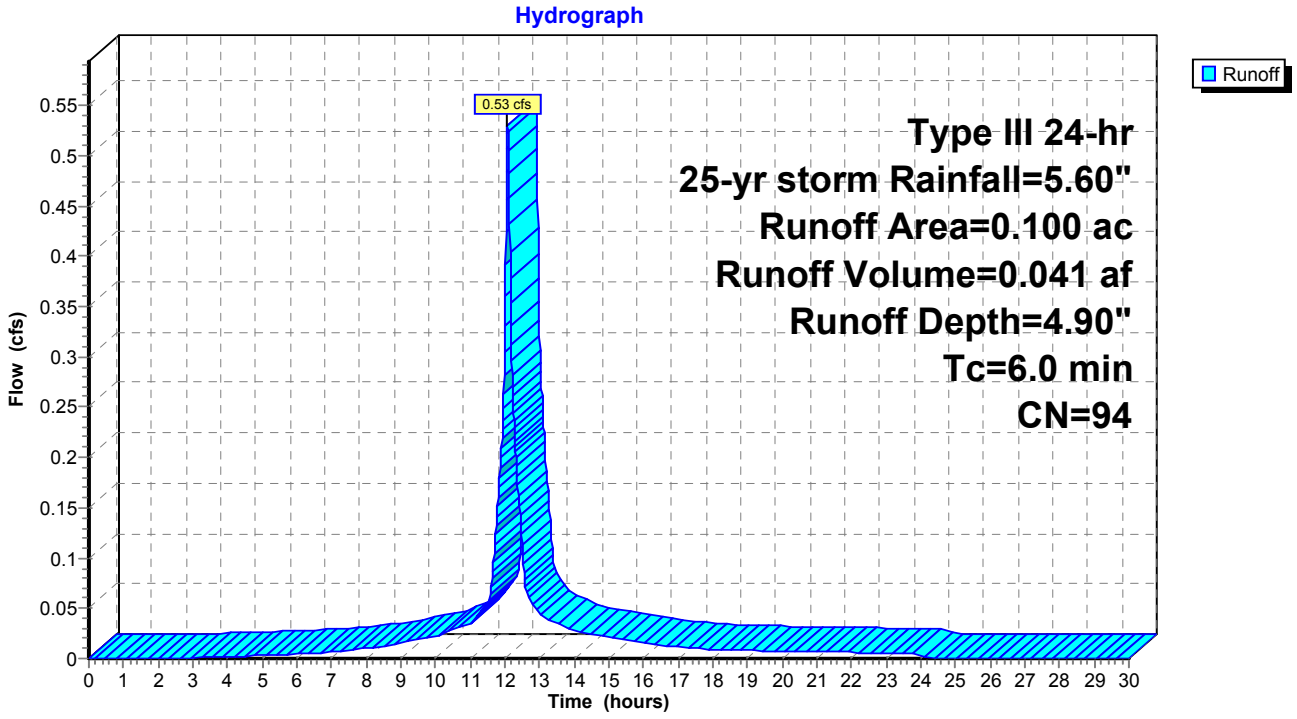
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.041 af, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

Area (ac)	CN	Description
0.010	61	>75% Grass cover, Good, HSG B
0.090	98	Paved parking, HSG B
0.100	94	Weighted Average
0.010		10.00% Pervious Area
0.090		90.00% Impervious Area

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

Subcatchment P-10:



Summary for Subcatchment P-11:

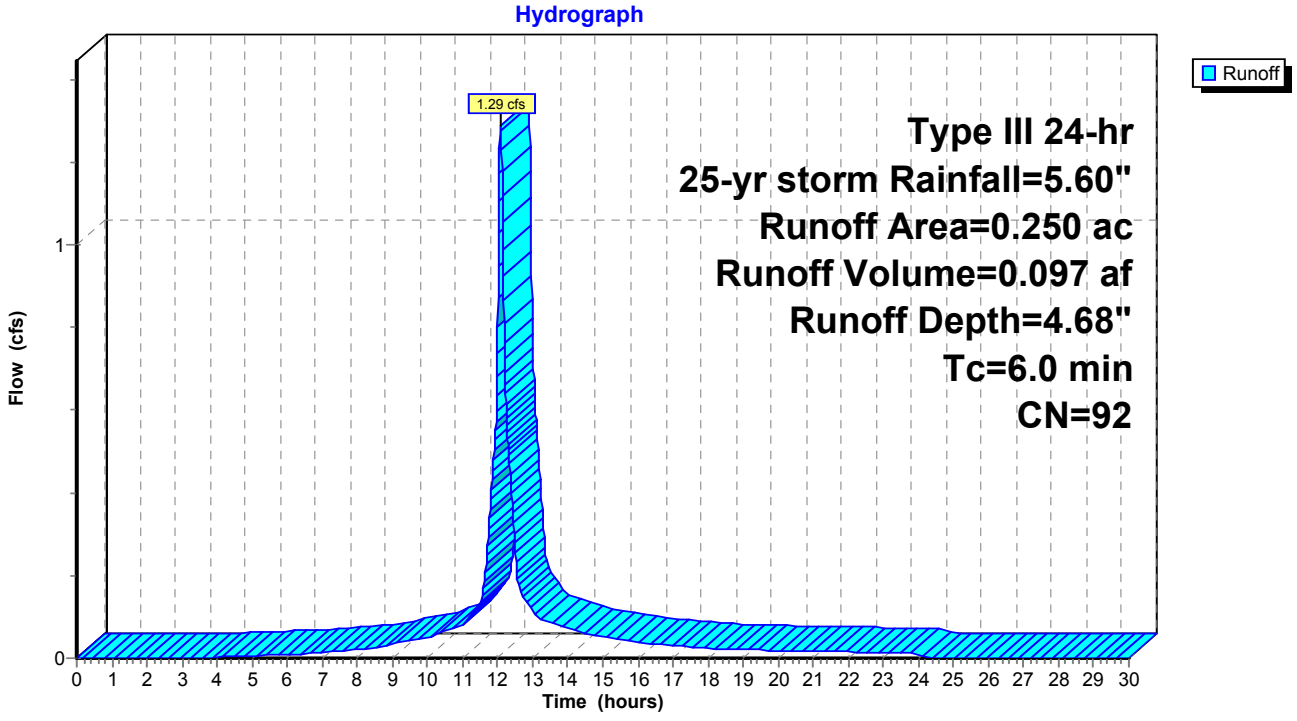
Runoff = 1.29 cfs @ 12.08 hrs, Volume= 0.097 af, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

	Area (ac)	CN	Description
*	0.030	98	roof
*	0.180	98	Impervious
	0.040	61	>75% Grass cover, Good, HSG B
	0.250	92	Weighted Average
	0.040		16.00% Pervious Area
	0.210		84.00% Impervious Area

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

Subcatchment P-11:

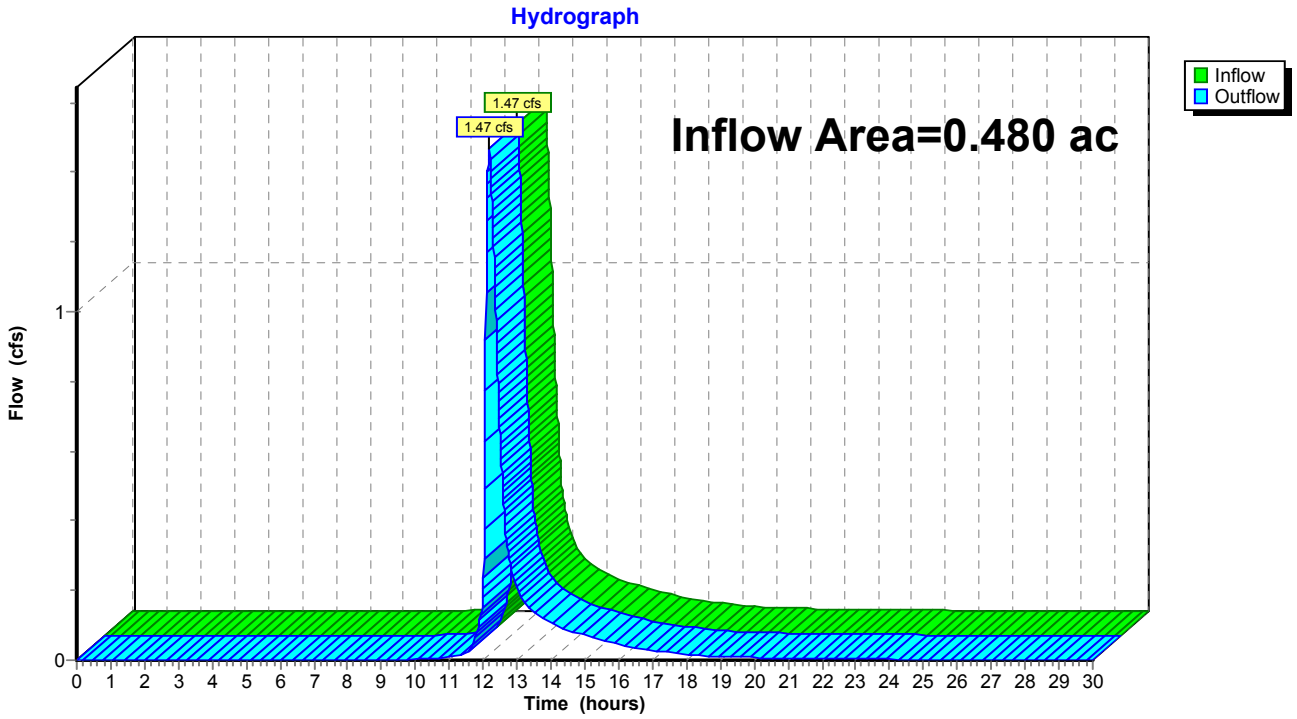


Summary for Reach DP1:

Inflow Area = 0.480 ac, 68.75% Impervious, Inflow Depth = 2.36" for 25-yr storm event
Inflow = 1.47 cfs @ 12.19 hrs, Volume= 0.094 af
Outflow = 1.47 cfs @ 12.19 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1:



Summary for Pond UGS-1:

Inflow Area = 0.250 ac, 84.00% Impervious, Inflow Depth = 4.68" for 25-yr storm event
Inflow = 1.29 cfs @ 12.08 hrs, Volume= 0.097 af
Outflow = 0.97 cfs @ 12.15 hrs, Volume= 0.087 af, Atten= 25%, Lag= 4.1 min
Discarded = 0.02 cfs @ 8.95 hrs, Volume= 0.036 af
Primary = 0.95 cfs @ 12.15 hrs, Volume= 0.051 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 9.15' @ 12.15 hrs Surf.Area= 756 sf Storage= 1,269 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 125.7 min (905.0 - 779.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	752 cf	**18.00'W x 42.00'L x 5.17'H Field A** 3,906 cf Overall - 2,027 cf Embedded = 1,879 cf x 40.0% Voids
#2A	7.00'	1,358 cf	**retain_it retain_it 2.5'** x 10 Inside #1 Inside= 84.0"W x 30.0"H => 17.56 sf x 8.00'L = 140.4 cf Outside= 96.0"W x 38.0"H => 25.33 sf x 8.00'L = 202.7 cf 2 Rows adjusted for 46.2 cf perimeter wall
		2,110 cf	Total Available Storage

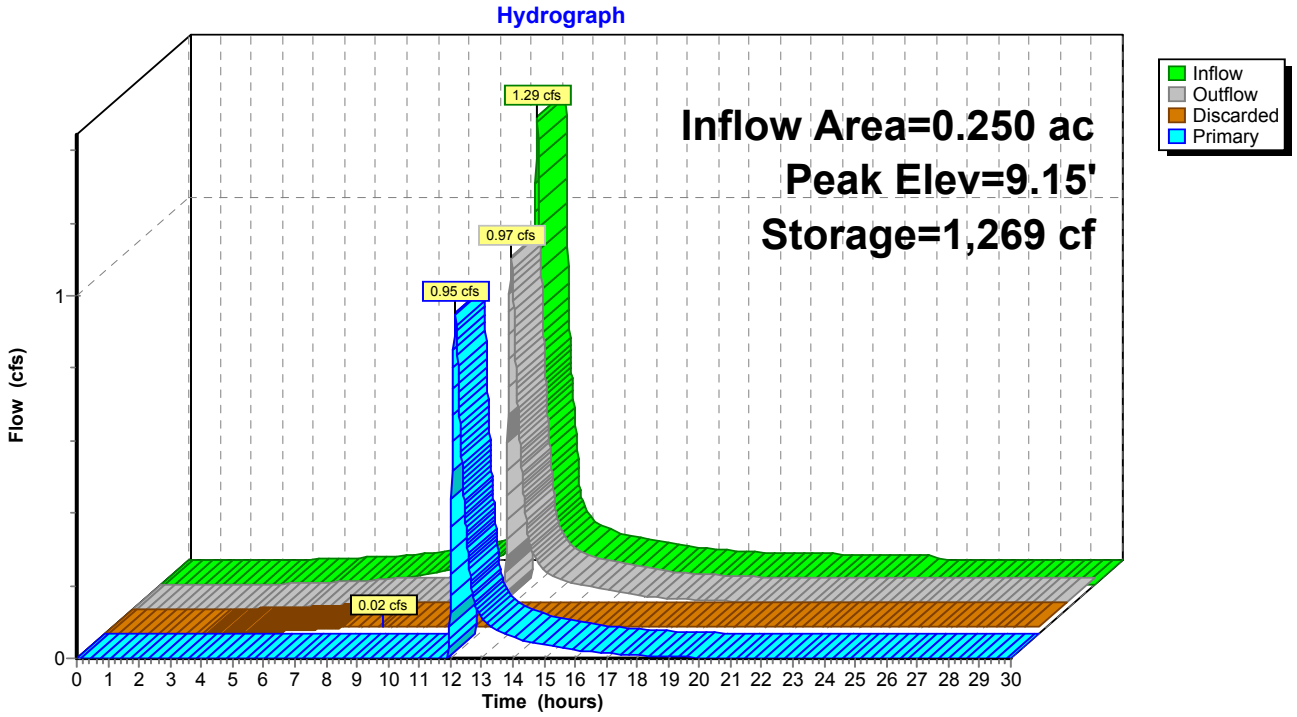
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	8.50'	**8.0" Round Culvert** L= 24.0' Ke= 0.500 Inlet / Outlet Invert= 8.50' / 7.42' S= 0.0450 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

Discarded OutFlow Max=0.02 cfs @ 8.95 hrs HW=7.05' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.95 cfs @ 12.15 hrs HW=9.15' TW=8.21' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.95 cfs @ 2.75 fps)

Pond UGS-1:


Hydrograph
Inflow Area=0.250 ac
Peak Elev=9.15'
Storage=1,269 cf
1.29 cfs
0.97 cfs
0.95 cfs
0.02 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Stage-Area-Storage for Pond UGS-1:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
7.00	**756**	0
7.10	756	59
7.20	756	118
7.30	756	177
7.40	756	236
7.50	756	295
7.60	756	354
7.70	756	413
7.80	756	472
7.90	756	531
8.00	756	590
8.10	756	649
8.20	756	708
8.30	756	767
8.40	756	826
8.50	756	885
8.60	756	943
8.70	756	1,002
8.80	756	1,061
8.90	756	1,120
9.00	756	1,179
9.10	756	1,238
9.20	756	1,297
9.30	756	1,356
9.40	756	1,415
9.50	756	1,474
9.60	756	1,479
9.70	756	1,483
9.80	756	1,488
9.90	756	1,493
10.00	756	1,497
10.10	756	1,502
10.20	756	1,515
10.30	756	1,545
10.40	756	1,576
10.50	756	1,606
10.60	756	1,636
10.70	756	1,666
10.80	756	1,697
10.90	756	1,727
11.00	756	1,757
11.10	756	1,787
11.20	756	1,818
11.30	756	1,848
11.40	756	1,878
11.50	756	1,908
11.60	756	1,939
11.70	756	1,969
11.80	756	1,999
11.90	756	2,029
12.00	756	2,060
12.10	756	**2,090**

Summary for Pond UGS-2:

Inflow Area = 0.350 ac, 85.71% Impervious, Inflow Depth = 3.15" for 25-yr storm event
Inflow = 1.40 cfs @ 12.12 hrs, Volume= 0.092 af
Outflow = 1.24 cfs @ 12.19 hrs, Volume= 0.089 af, Atten= 12%, Lag= 4.3 min
Discarded = 0.01 cfs @ 9.47 hrs, Volume= 0.022 af
Primary = 1.23 cfs @ 12.19 hrs, Volume= 0.067 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 8.29' @ 12.19 hrs Surf.Area= 468 sf Storage= 711 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 76.9 min (856.6 - 779.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	6.25'	464 cf	**18.00'W x 26.00'L x 4.67'H Field A** 2,184 cf Overall - 1,024 cf Embedded = 1,160 cf x 40.0% Voids
#2A	6.25'	643 cf	**retain_it retain_it 2.0'** x 6 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 2 Rows adjusted for 18.9 cf perimeter wall
		1,107 cf	Total Available Storage

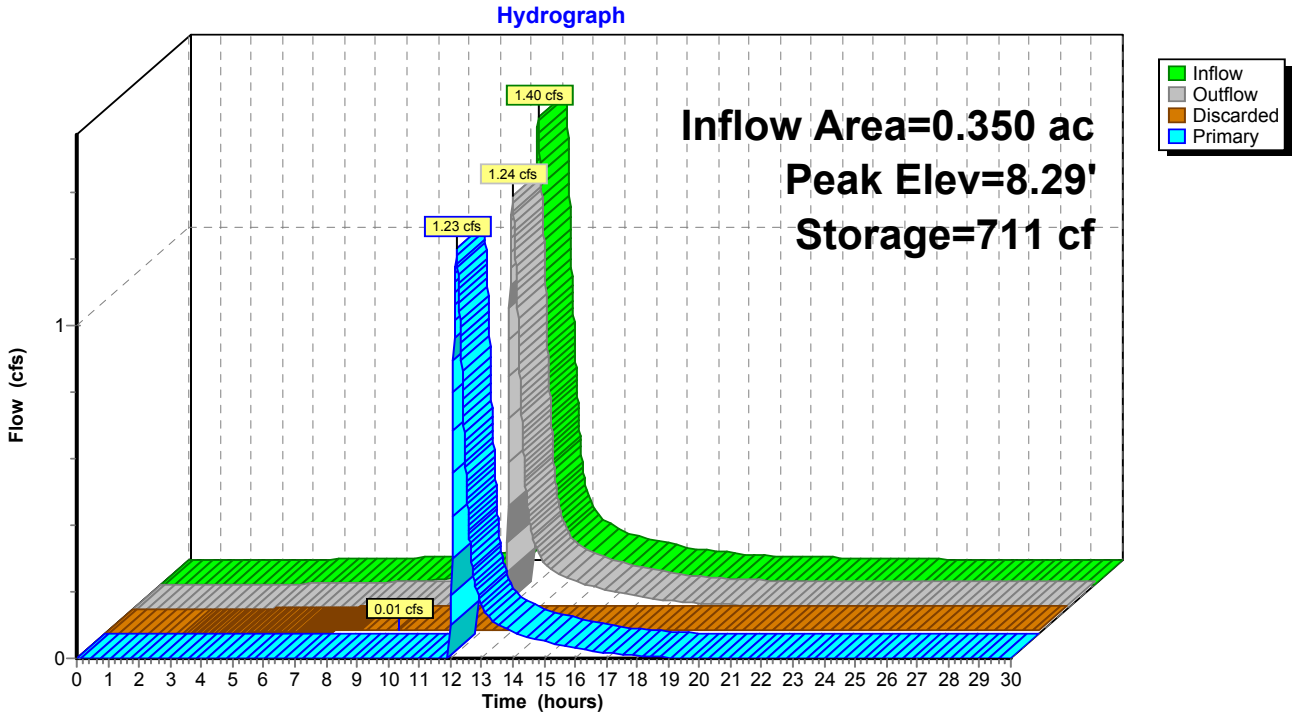
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	7.42'	**8.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 7.42' / 7.00' S= 0.0700 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#2	Discarded	6.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 9.47 hrs HW=6.30' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.22 cfs @ 12.19 hrs HW=8.28' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.22 cfs @ 3.51 fps)

Pond UGS-2:


Hydrograph
Inflow Area=0.350 ac
Peak Elev=8.29'
Storage=711 cf
1.40 cfs
1.24 cfs
1.23 cfs
0.01 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Time (hours)

Stage-Area-Storage for Pond UGS-2:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
6.25	**468**	0
6.30	468	18
6.35	468	35
6.40	468	53
6.45	468	71
6.50	468	89
6.55	468	106
6.60	468	124
6.65	468	142
6.70	468	160
6.75	468	177
6.80	468	195
6.85	468	213
6.90	468	231
6.95	468	248
7.00	468	266
7.05	468	284
7.10	468	302
7.15	468	319
7.20	468	337
7.25	468	355
7.30	468	373
7.35	468	390
7.40	468	408
7.45	468	426
7.50	468	444
7.55	468	461
7.60	468	479
7.65	468	497
7.70	468	515
7.75	468	532
7.80	468	550
7.85	468	568
7.90	468	586
7.95	468	603
8.00	468	621
8.05	468	639
8.10	468	657
8.15	468	674
8.20	468	692
8.25	468	710
8.30	468	712
8.35	468	713
8.40	468	715
8.45	468	717
8.50	468	718
8.55	468	720
8.60	468	722
8.65	468	723
8.70	468	725
8.75	468	727
8.80	468	728
8.85	468	730
8.90	468	732
8.95	468	739
9.00	468	748
9.05	468	757
9.10	468	767
9.15	468	776
9.20	468	785
9.25	468	795
9.30	468	804
9.35	468	813
9.40	468	823
9.45	468	832
9.50	468	842
9.55	468	851
9.60	468	860
9.65	468	870
9.70	468	879
9.75	468	888
9.80	468	898
9.85	468	907
9.90	468	916
9.95	468	926
10.00	468	935
10.05	468	945
10.10	468	954
10.15	468	963
10.20	468	973
10.25	468	982
10.30	468	991
10.35	468	1,001
10.40	468	1,010
10.45	468	1,019
10.50	468	1,029
10.55	468	1,038
10.60	468	1,047
10.65	468	1,057
10.70	468	1,066
10.75	468	1,076
10.80	468	1,085
10.85	468	1,094
10.90	468	**1,104**

Summary for Subcatchment P-1:

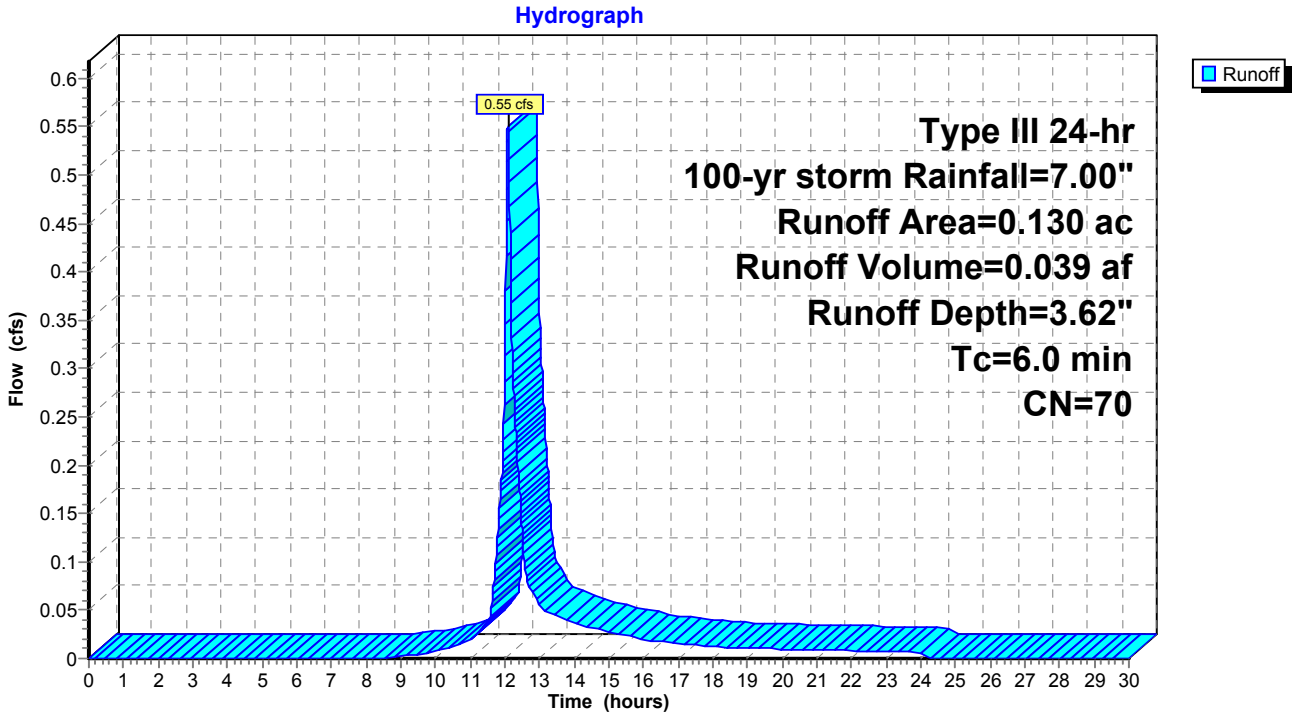
Runoff = 0.55 cfs @ 12.09 hrs, Volume= 0.039 af, Depth= 3.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

Area (ac)	CN	Description
0.100	61	>75% Grass cover, Good, HSG B
0.030	98	Paved parking, HSG B
0.130	70	Weighted Average
0.100		76.92% Pervious Area
0.030		23.08% Impervious Area

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

Subcatchment P-1:



Summary for Subcatchment P-10:

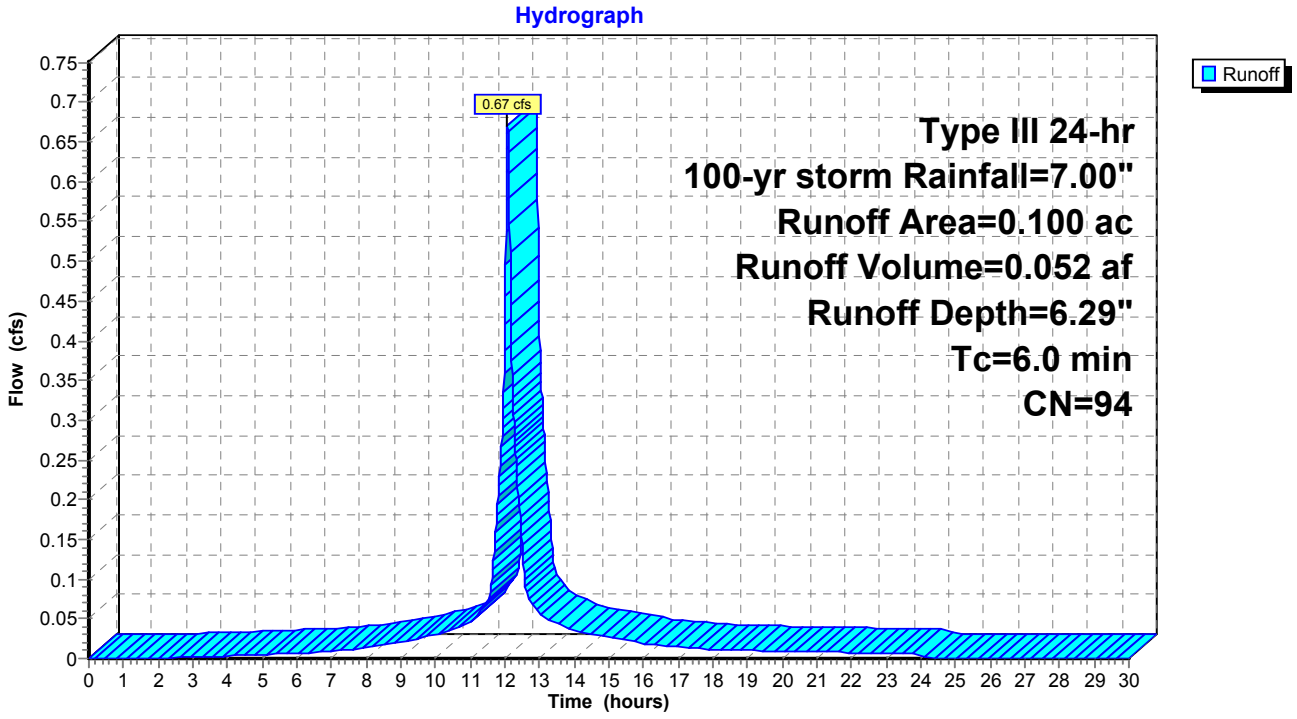
Runoff = 0.67 cfs @ 12.08 hrs, Volume= 0.052 af, Depth= 6.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

Area (ac)	CN	Description
0.010	61	>75% Grass cover, Good, HSG B
0.090	98	Paved parking, HSG B
0.100	94	Weighted Average
0.010		10.00% Pervious Area
0.090		90.00% Impervious Area

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

Subcatchment P-10:



Summary for Subcatchment P-11:

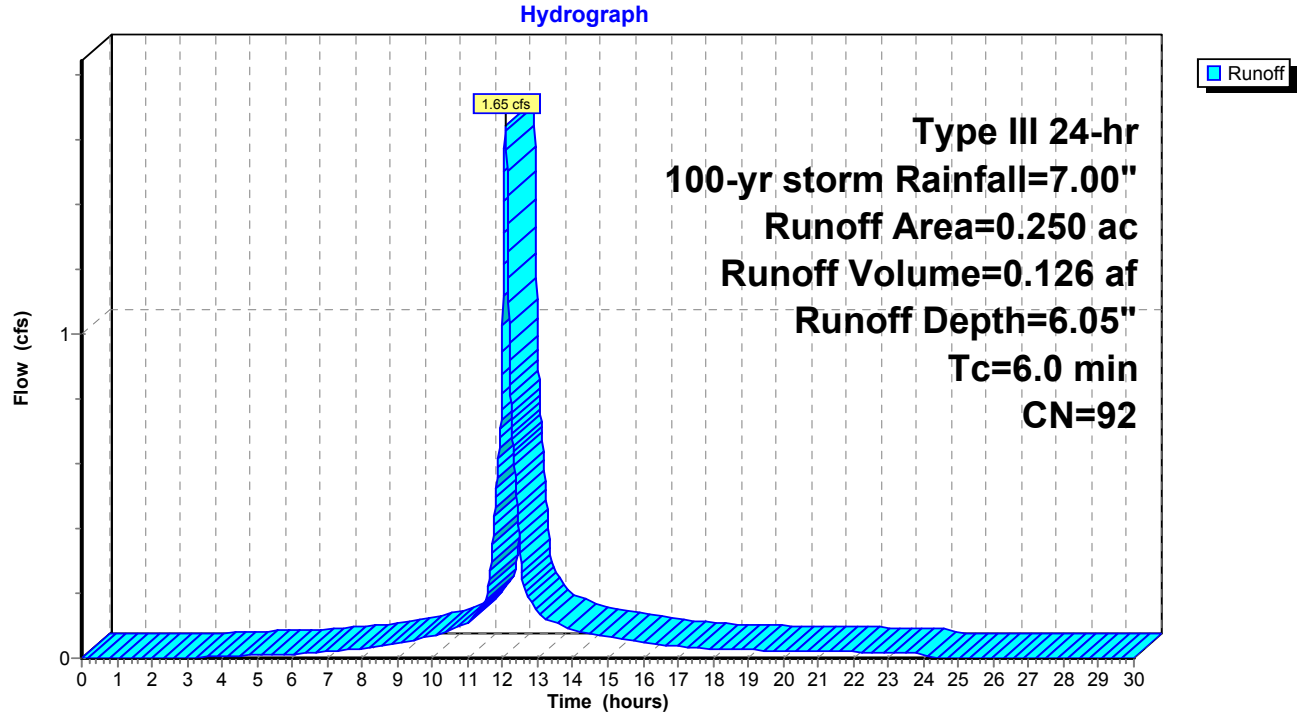
Runoff = 1.65 cfs @ 12.08 hrs, Volume= 0.126 af, Depth= 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

	Area (ac)	CN	Description
*	0.030	98	roof
*	0.180	98	Impervious
	0.040	61	>75% Grass cover, Good, HSG B
	0.250	92	Weighted Average
	0.040		16.00% Pervious Area
	0.210		84.00% Impervious Area

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

Subcatchment P-11:

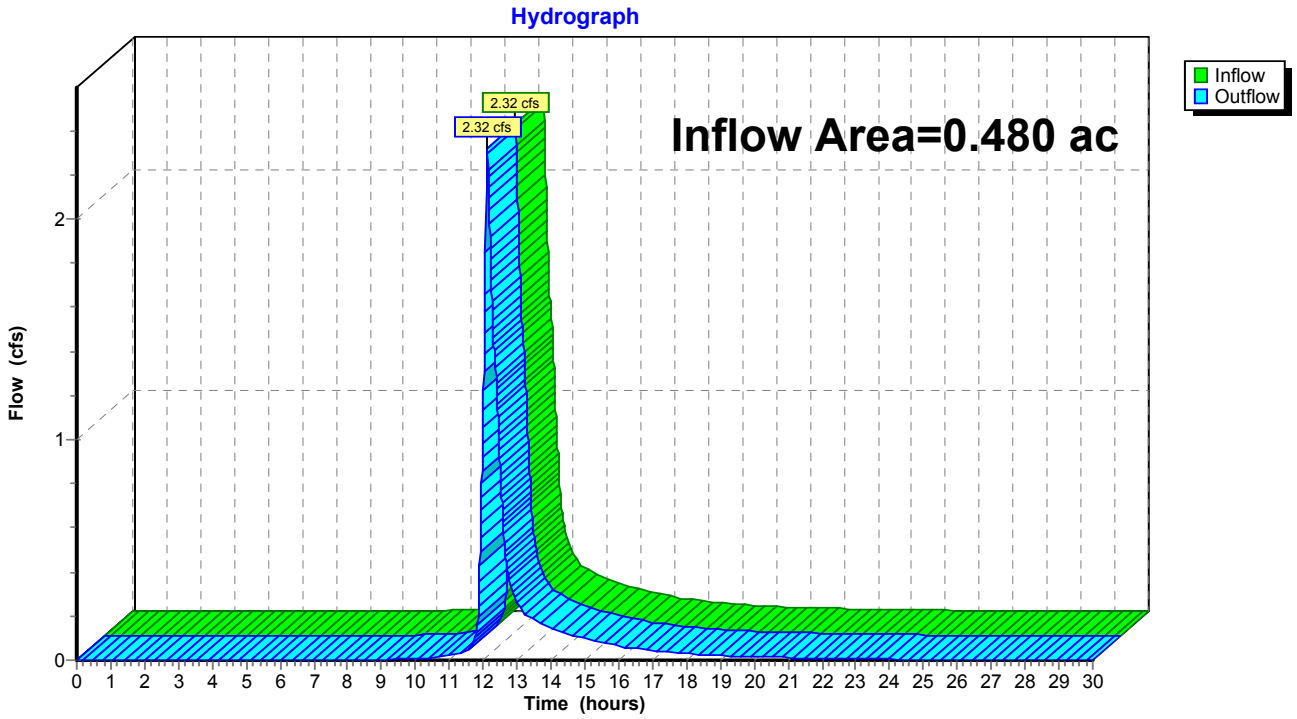


Summary for Reach DP1:

Inflow Area = 0.480 ac, 68.75% Impervious, Inflow Depth = 3.57" for 100-yr storm event
Inflow = 2.32 cfs @ 12.11 hrs, Volume= 0.143 af
Outflow = 2.32 cfs @ 12.11 hrs, Volume= 0.143 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1:



Summary for Pond UGS-1:

Inflow Area = 0.250 ac, 84.00% Impervious, Inflow Depth = 6.05" for 100-yr storm event
Inflow = 1.65 cfs @ 12.08 hrs, Volume= 0.126 af
Outflow = 1.26 cfs @ 12.16 hrs, Volume= 0.115 af, Atten= 24%, Lag= 4.6 min
Discarded = 0.02 cfs @ 8.09 hrs, Volume= 0.037 af
Primary = 1.24 cfs @ 12.16 hrs, Volume= 0.077 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 9.38' @ 12.15 hrs Surf.Area= 756 sf Storage= 1,404 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 99.0 min (871.7 - 772.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	752 cf	**18.00'W x 42.00'L x 5.17'H Field A** 3,906 cf Overall - 2,027 cf Embedded = 1,879 cf x 40.0% Voids
#2A	7.00'	1,358 cf	**retain_it retain_it 2.5'** x 10 Inside #1 Inside= 84.0"W x 30.0"H => 17.56 sf x 8.00'L = 140.4 cf Outside= 96.0"W x 38.0"H => 25.33 sf x 8.00'L = 202.7 cf 2 Rows adjusted for 46.2 cf perimeter wall
		2,110 cf	Total Available Storage

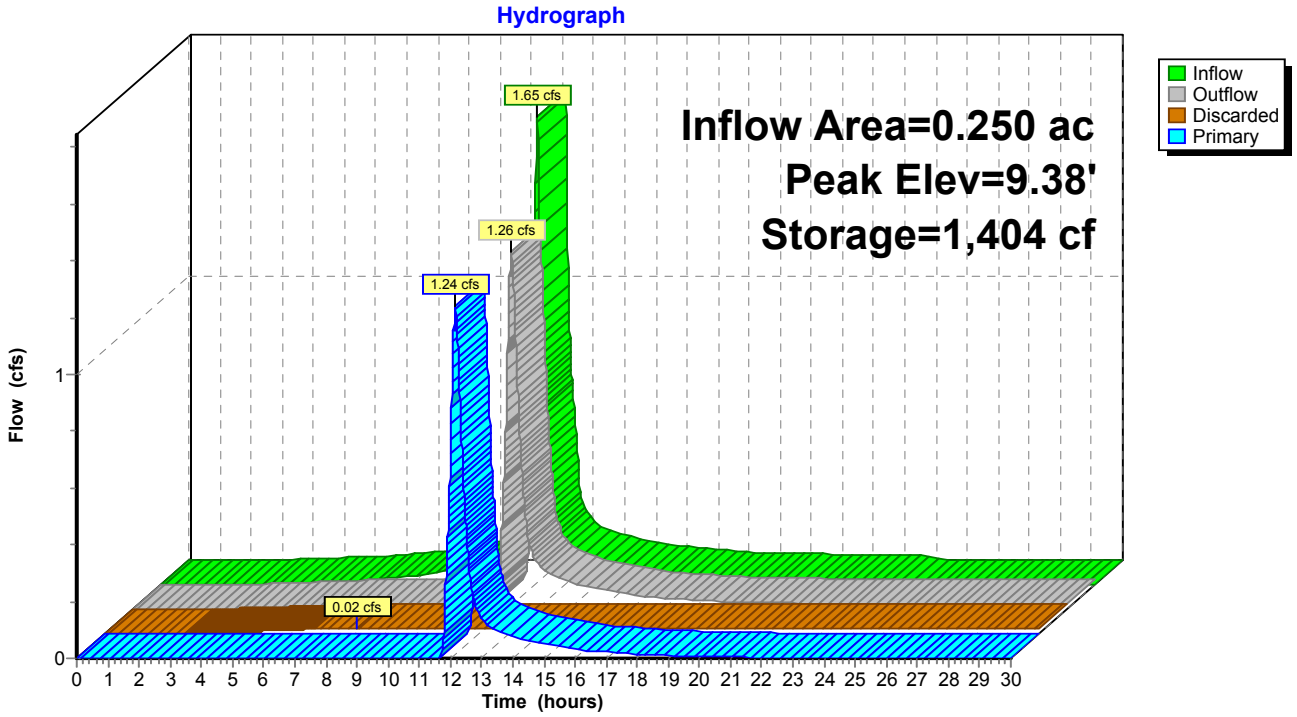
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	8.50'	**8.0" Round Culvert** L= 24.0' Ke= 0.500 Inlet / Outlet Invert= 8.50' / 7.42' S= 0.0450 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

Discarded OutFlow Max=0.02 cfs @ 8.09 hrs HW=7.05' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.24 cfs @ 12.16 hrs HW=9.38' TW=8.81' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 1.24 cfs @ 3.55 fps)

Pond UGS-1:


Hydrograph
Inflow Area=0.250 ac
Peak Elev=9.38'
Storage=1,404 cf
1.65 cfs
1.26 cfs
1.24 cfs
0.02 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
0
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Time (hours)

Stage-Area-Storage for Pond UGS-1:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
7.00	**756**	0
7.10	756	59
7.20	756	118
7.30	756	177
7.40	756	236
7.50	756	295
7.60	756	354
7.70	756	413
7.80	756	472
7.90	756	531
8.00	756	590
8.10	756	649
8.20	756	708
8.30	756	767
8.40	756	826
8.50	756	885
8.60	756	943
8.70	756	1,002
8.80	756	1,061
8.90	756	1,120
9.00	756	1,179
9.10	756	1,238
9.20	756	1,297
9.30	756	1,356
9.40	756	1,415
9.50	756	1,474
9.60	756	1,479
9.70	756	1,483
9.80	756	1,488
9.90	756	1,493
10.00	756	1,497
10.10	756	1,502
10.20	756	1,515
10.30	756	1,545
10.40	756	1,576
10.50	756	1,606
10.60	756	1,636
10.70	756	1,666
10.80	756	1,697
10.90	756	1,727
11.00	756	1,757
11.10	756	1,787
11.20	756	1,818
11.30	756	1,848
11.40	756	1,878
11.50	756	1,908
11.60	756	1,939
11.70	756	1,969
11.80	756	1,999
11.90	756	2,029
12.00	756	2,060
12.10	756	**2,090**

Summary for Pond UGS-2:

Inflow Area = 0.350 ac, 85.71% Impervious, Inflow Depth = 4.45" for 100-yr storm event
Inflow = 1.82 cfs @ 12.11 hrs, Volume= 0.130 af
Outflow = 1.79 cfs @ 12.12 hrs, Volume= 0.126 af, Atten= 1%, Lag= 0.5 min
Discarded = 0.01 cfs @ 8.74 hrs, Volume= 0.023 af
Primary = 1.78 cfs @ 12.12 hrs, Volume= 0.103 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 8.88' @ 12.12 hrs Surf.Area= 468 sf Storage= 731 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 53.5 min (832.6 - 779.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	6.25'	464 cf	**18.00'W x 26.00'L x 4.67'H Field A** 2,184 cf Overall - 1,024 cf Embedded = 1,160 cf x 40.0% Voids
#2A	6.25'	643 cf	**retain_it retain_it 2.0'** x 6 Inside #1 Inside= 84.0"W x 24.0"H => 13.78 sf x 8.00'L = 110.3 cf Outside= 96.0"W x 32.0"H => 21.33 sf x 8.00'L = 170.7 cf 2 Rows adjusted for 18.9 cf perimeter wall
		1,107 cf	Total Available Storage

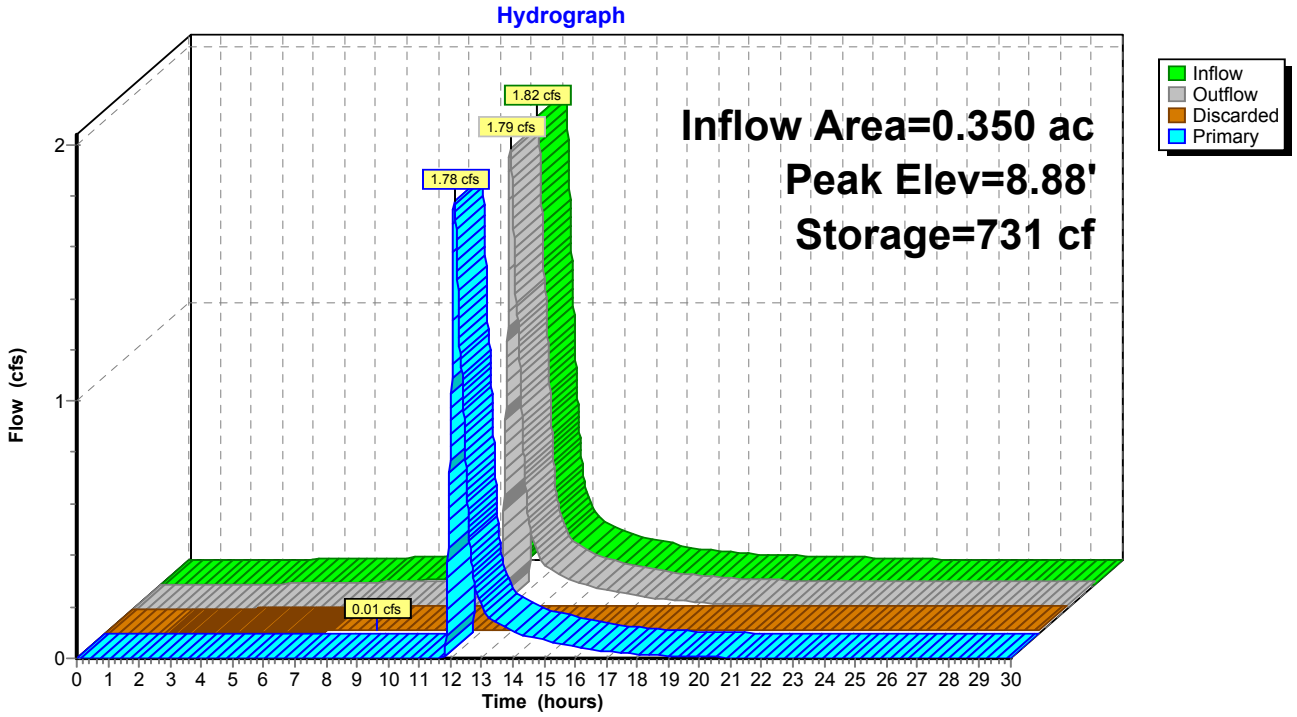
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	7.42'	**8.0" Round Culvert** L= 6.0' Ke= 0.500 Inlet / Outlet Invert= 7.42' / 7.00' S= 0.0700 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#2	Discarded	6.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 8.74 hrs HW=6.30' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.78 cfs @ 12.12 hrs HW=8.88' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.78 cfs @ 5.10 fps)

Pond UGS-2:


Hydrograph
Inflow Area=0.350 ac
Peak Elev=8.88'
Storage=731 cf
1.82 cfs
1.79 cfs
1.78 cfs
0.01 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
0 1 2

Stage-Area-Storage for Pond UGS-2:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
6.25	**468**	0
6.30	468	18
6.35	468	35
6.40	468	53
6.45	468	71
6.50	468	89
6.55	468	106
6.60	468	124
6.65	468	142
6.70	468	160
6.75	468	177
6.80	468	195
6.85	468	213
6.90	468	231
6.95	468	248
7.00	468	266
7.05	468	284
7.10	468	302
7.15	468	319
7.20	468	337
7.25	468	355
7.30	468	373
7.35	468	390
7.40	468	408
7.45	468	426
7.50	468	444
7.55	468	461
7.60	468	479
7.65	468	497
7.70	468	515
7.75	468	532
7.80	468	550
7.85	468	568
7.90	468	586
7.95	468	603
8.00	468	621
8.05	468	639
8.10	468	657
8.15	468	674
8.20	468	692
8.25	468	710
8.30	468	712
8.35	468	713
8.40	468	715
8.45	468	717
8.50	468	718
8.55	468	720
8.60	468	722
8.65	468	723
8.70	468	725
8.75	468	727
8.80	468	728
8.85	468	730
8.90	468	732
8.95	468	739
9.00	468	748
9.05	468	757
9.10	468	767
9.15	468	776
9.20	468	785
9.25	468	795
9.30	468	804
9.35	468	813
9.40	468	823
9.45	468	832
9.50	468	842
9.55	468	851
9.60	468	860
9.65	468	870
9.70	468	879
9.75	468	888
9.80	468	898
9.85	468	907
9.90	468	916
9.95	468	926
10.00	468	935
10.05	468	945
10.10	468	954
10.15	468	963
10.20	468	973
10.25	468	982
10.30	468	991
10.35	468	1,001
10.40	468	1,010
10.45	468	1,019
10.50	468	1,029
10.55	468	1,038
10.60	468	1,047
10.65	468	1,057
10.70	468	1,066
10.75	468	1,076
10.80	468	1,085
10.85	468	1,094
10.90	468	**1,104**

APPENDIX F – STORMWATER MANAGEMENT CALCULATIONS

Proposed Dunkin' Donuts
101 Belleville Avenue
New Bedford, MA
Bohler Job Number: W181069
September 17, 2018

MA DEP Standard 3: Recharge Volume Calculations

Required Recharge Volume - A Soils (0.60 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

Required Recharge Volume - B Soils (0.35 in.)	
Existing Site Impervious Area (ac)	0.290
Proposed Site Impervious Area (ac)	0.330
Proposed Increase in Site Impervious Area (ac)	0.040
Recharge Volume Required (cf)	**51**

Required Recharge Volume - C Soils (0.25 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

Required Recharge Volume - D Soils (0.10 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

Total Recharge Volume Required (cf)	**51**

Recharge Volume Adjustment Factor	
Impervious Area Directed to Infiltration BMP (ac)	**0.300**
%Impervious Directed to Infiltration BMP	91%
Adjustment Factor	1.10
Adjusted Total Recharge Volume Required (cf)	**56**

Provided Recharge Volume*	
BMP #1 Pond 1	885
BMP #2 Pond 2	415
Total Recharge Volume Provided (cf)	**1,300**

Provided greater than or Equal to Required

*Volume provided below lowest outlet in cubic feet (cf)

Prepared By:
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Proposed Dunkin' Donuts
101 Belleville Avenue
New Bedford, MA
Bohler Job Number: W181069
September 17, 2018

MA DEP Standard 3: Drawdown Time Calculations

Drawdown Time - BMP #1 Pond 1	
Volume below outlet pipe (Rv) (cf)	885
Soil Type	Sandy Loam - B
Infiltration rate (K)*	1.02
Bottom Area (sf)	756
Drawdown time (Hours)*	13.8

Drawdown Time -	
Volume below outlet pipe (Rv) (cf)	415
Soil Type	Sandy Loam - B
Infiltration rate (K)*	1.02
Bottom Area (sf)	468
Drawdown time (Hours)*	10.4

*Infiltration Rates taken from Rawls Table
**Drawdown time = Rv / (K) x (bottom area)

Prepared By:
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352 Turnpike Road
Southborough, MA 01772
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Proposed Dunkin' Donuts
101 Belleville Avenue
New Bedford, MA
Bohler Job Number: W181069
September 17, 2018

MA DEP Standard 4: Water Quality Volume Calculations

Water Quality Volume Required	
Water Quality Volume runoff (in.)*	1.0
Total Post Development Impervious Area (sf)	14,375
Required Water Quality Volume (cf)	1,198

*Water Quality volume runoff is equal to 1.0 inches of runoff times the total impervious area of the post development project site.

Water Quality Volume Provided*	
BMP #1 Pond 1	885
BMP #2 Pond 2	415
Total Provided Water Quality Volume (cf)	1,300

Provided greater than or Equal to Required

*Volume provided below lowest outlet pipe in cubic feet (cf)

Prepared By:
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Stage-Area-Storage for Pond UGS-1:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
7.00	**756**	0	8.04	756	613
7.02	756	12	8.06	756	625
7.04	756	24	8.08	756	637
7.06	756	35	8.10	756	649
7.08	756	47	8.12	756	660
7.10	756	59	8.14	756	672
7.12	756	71	8.16	756	684
7.14	756	83	8.18	756	696
7.16	756	94	8.20	756	708
7.18	756	106	8.22	756	719
7.20	756	118	8.24	756	731
7.22	756	130	8.26	756	743
7.24	756	142	8.28	756	755
7.26	756	153	8.30	756	767
7.28	756	165	8.32	756	778
7.30	756	177	8.34	756	790
7.32	756	189	8.36	756	802
7.34	756	200	8.38	756	814
7.36	756	212	8.40	756	826
7.38	756	224	8.42	756	837
7.40	756	236	8.44	756	849
7.42	756	248	8.46	756	861
7.44	756	259	8.48	756	873
7.46	756	271	8.50	756	885
7.48	756	283	8.52	756	896
7.50	756	295	8.54	756	908
7.52	756	307	8.56	756	920
7.54	756	318	8.58	756	932
7.56	756	330	8.60	756	943
7.58	756	342	8.62	756	955
7.60	756	354	8.64	756	967
7.62	756	366	8.66	756	979
7.64	756	377	8.68	756	991
7.66	756	389	8.70	756	1,002
7.68	756	401	8.72	756	1,014
7.70	756	413	8.74	756	1,026
7.72	756	425	8.76	756	1,038
7.74	756	436	8.78	756	1,050
7.76	756	448	8.80	756	1,061
7.78	756	460	8.82	756	1,073
7.80	756	472	8.84	756	1,085
7.82	756	484	8.86	756	1,097
7.84	756	495	8.88	756	1,109
7.86	756	507	8.90	756	1,120
7.88	756	519	8.92	756	1,132
7.90	756	531	8.94	756	1,144
7.92	756	543	8.96	756	1,156
7.94	756	554	8.98	756	1,168
7.96	756	566	9.00	756	1,179
7.98	756	578	9.02	756	1,191
8.00	756	590	9.04	756	1,203
8.02	756	601	9.06	756	1,215

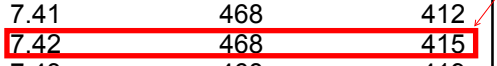
elevation of lowest outlet invert

Stage-Area-Storage for Pond UGS-2:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
6.25	**468**	0	6.77	468	185
6.26	468	4	6.78	468	188
6.27	468	7	6.79	468	192
6.28	468	11	6.80	468	195
6.29	468	14	6.81	468	199
6.30	468	18	6.82	468	202
6.31	468	21	6.83	468	206
6.32	468	25	6.84	468	209
6.33	468	28	6.85	468	213
6.34	468	32	6.86	468	217
6.35	468	35	6.87	468	220
6.36	468	39	6.88	468	224
6.37	468	43	6.89	468	227
6.38	468	46	6.90	468	231
6.39	468	50	6.91	468	234
6.40	468	53	6.92	468	238
6.41	468	57	6.93	468	241
6.42	468	60	6.94	468	245
6.43	468	64	6.95	468	248
6.44	468	67	6.96	468	252
6.45	468	71	6.97	468	256
6.46	468	75	6.98	468	259
6.47	468	78	6.99	468	263
6.48	468	82	7.00	468	266
6.49	468	85	7.01	468	270
6.50	468	89	7.02	468	273
6.51	468	92	7.03	468	277
6.52	468	96	7.04	468	280
6.53	468	99	7.05	468	284
6.54	468	103	7.06	468	288
6.55	468	106	7.07	468	291
6.56	468	110	7.08	468	295
6.57	468	114	7.09	468	298
6.58	468	117	7.10	468	302
6.59	468	121	7.11	468	305
6.60	468	124	7.12	468	309
6.61	468	128	7.13	468	312
6.62	468	131	7.14	468	316
6.63	468	135	7.15	468	319
6.64	468	138	7.16	468	323
6.65	468	142	7.17	468	327
6.66	468	146	7.18	468	330
6.67	468	149	7.19	468	334
6.68	468	153	7.20	468	337
6.69	468	156	7.21	468	341
6.70	468	160	7.22	468	344
6.71	468	163	7.23	468	348
6.72	468	167	7.24	468	351
6.73	468	170	7.25	468	355
6.74	468	174	7.26	468	359
6.75	468	177	7.27	468	362
6.76	468	181	7.28	468	366

Stage-Area-Storage for Pond UGS-2: (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
7.29	468	369
7.30	468	373
7.31	468	376
7.32	468	380
7.33	468	383
7.34	468	387
7.35	468	390
7.36	468	394
7.37	468	398
7.38	468	401
7.39	468	405
7.40	468	408
7.41	468	412
7.42	468	415
7.43	468	419
7.44	468	422
7.45	468	426
7.46	468	430
7.47	468	433
7.48	468	437
7.49	468	440
7.50	468	444
7.51	468	447
7.52	468	451
7.53	468	454
7.54	468	458
7.55	468	461
7.56	468	465
7.57	468	469
7.58	468	472
7.59	468	476
7.60	468	479
7.61	468	483
7.62	468	486
7.63	468	490
7.64	468	493
7.65	468	497
7.66	468	501
7.67	468	504
7.68	468	508
7.69	468	511
7.70	468	515
7.71	468	518
7.72	468	522
7.73	468	525
7.74	468	529
7.75	468	532
7.76	468	536
7.77	468	540
7.78	468	543
7.79	468	547
7.80	468	550
7.81	468	554
7.82	468	557
7.83	468	561
7.84	468	564
7.85	468	568
7.86	468	572
7.87	468	575
7.88	468	579
7.89	468	582
[illegible]	[illegible]8	586
[illegible]	[illegible]8	589
[illegible]	[illegible]8	593
7.93	468	596
7.94	468	600
7.95	468	603
7.96	468	607
7.97	468	611
7.98	468	614
7.99	468	618
8.00	468	621
8.01	468	625
8.02	468	628
8.03	468	632
8.04	468	635
8.05	468	639
8.06	468	643
8.07	468	646
8.08	468	650
8.09	468	653
8.10	468	657
8.11	468	660
8.12	468	664
8.13	468	667
8.14	468	671
8.15	468	674
8.16	468	678
8.17	468	682
8.18	468	685
8.19	468	689
8.20	468	692
8.21	468	696
8.22	468	699
8.23	468	703
8.24	468	706
8.25	468	710
8.26	468	710
8.27	468	711
8.28	468	711
8.29	468	711
8.30	468	712
8.31	468	712
8.32	468	712



Stage-Area-Storage for Pond UGS-2: (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
8.33	468	713
8.34	468	713
8.35	468	713
8.36	468	714
8.37	468	714
8.38	468	714
8.39	468	715
8.40	468	715
8.41	468	715
8.42	468	716
8.43	468	716
8.44	468	716
8.45	468	717
8.46	468	717
8.47	468	717
8.48	468	718
8.49	468	718
8.50	468	718
8.51	468	719
8.52	468	719
8.53	468	719
8.54	468	720
8.55	468	720
8.56	468	720
8.57	468	721
8.58	468	721
8.59	468	721
8.60	468	722
8.61	468	722
8.62	468	722
8.63	468	723
8.64	468	723
8.65	468	723
8.66	468	724
8.67	468	724
8.68	468	724
8.69	468	725
8.70	468	725
8.71	468	725
8.72	468	726
8.73	468	726
8.74	468	726
8.75	468	727
8.76	468	727
8.77	468	727
8.78	468	728
8.79	468	728
8.80	468	728
8.81	468	729
8.82	468	729
8.83	468	729
8.84	468	730
8.85	468	730
8.86	468	730
8.87	468	731
8.88	468	731
8.89	468	731
8.90	468	732
8.91	468	732
8.92	468	733
8.93	468	735
8.94	468	737
8.95	468	739
8.96	468	740
8.97	468	742
8.98	468	744
8.99	468	746
9.00	468	748
9.01	468	750
9.02	468	752
9.03	468	754
9.04	468	755
9.05	468	757
9.06	468	759
9.07	468	761
9.08	468	763
9.09	468	765
9.10	468	767
9.11	468	769
9.12	468	770
9.13	468	772
9.14	468	774
9.15	468	776
9.16	468	778
9.17	468	780
9.18	468	782
9.19	468	784
9.20	468	785
9.21	468	787
9.22	468	789
9.23	468	791
9.24	468	793
9.25	468	795
9.26	468	797
9.27	468	799
9.28	468	800
9.29	468	802
9.30	468	804
9.31	468	806
9.32	468	808
9.33	468	810
9.34	468	812
9.35	468	813
9.36	468	815

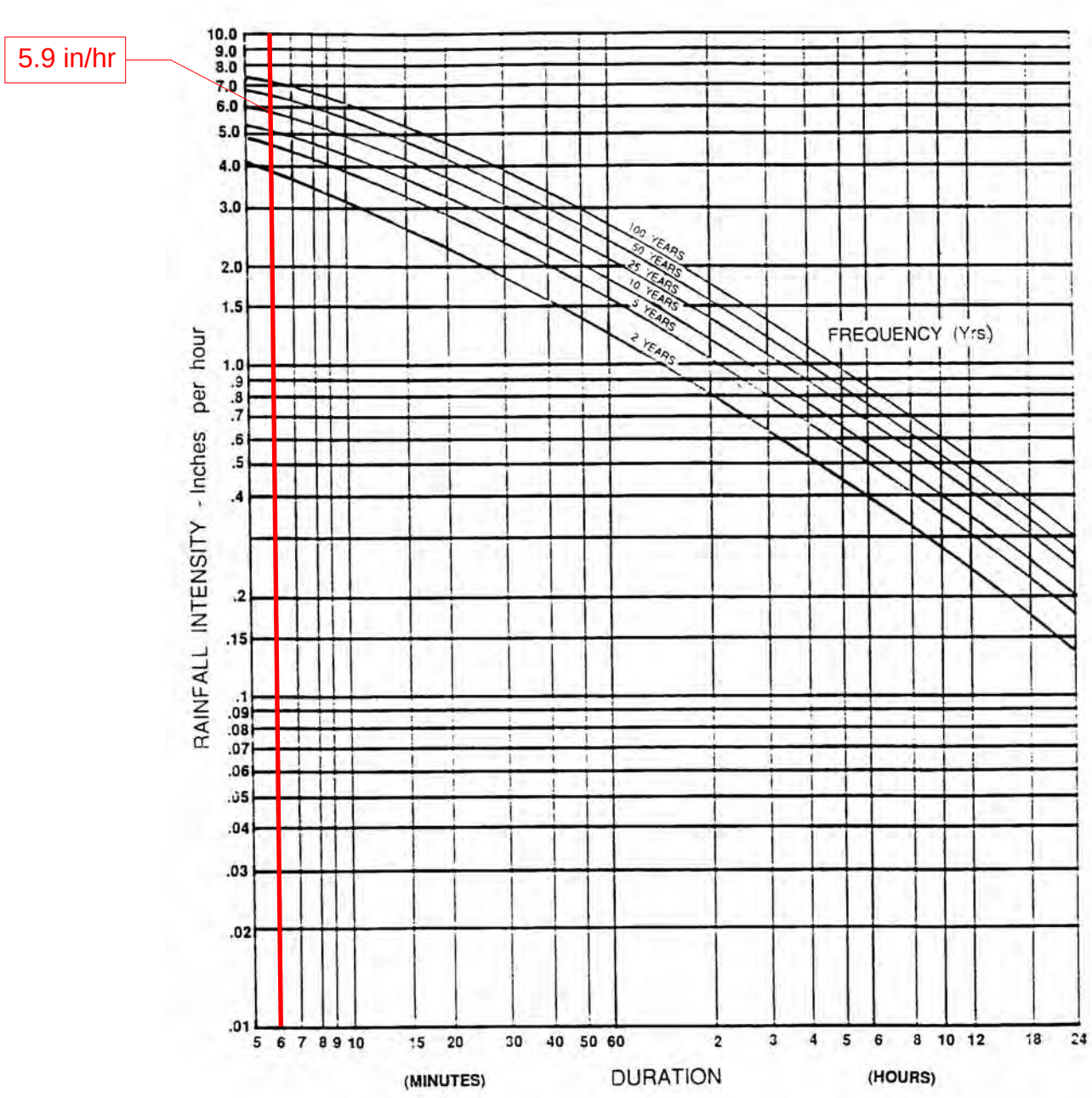
Stage-Area-Storage for Pond UGS-2: (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
9.37	468	817	9.89	468	915
9.38	468	819	9.90	468	916
9.39	468	821	9.91	468	918
9.40	468	823	9.92	468	920
9.41	468	825	9.93	468	922
9.42	468	827	9.94	468	924
9.43	468	828	9.95	468	926
9.44	468	830	9.96	468	928
9.45	468	832	9.97	468	930
9.46	468	834	9.98	468	931
9.47	468	836	9.99	468	933
9.48	468	838	10.00	468	935
9.49	468	840	10.01	468	937
9.50	468	842	10.02	468	939
9.51	468	843	10.03	468	941
9.52	468	845	10.04	468	943
9.53	468	847	10.05	468	945
9.54	468	849	10.06	468	946
9.55	468	851	10.07	468	948
9.56	468	853	10.08	468	950
9.57	468	855	10.09	468	952
9.58	468	857	10.10	468	954
9.59	468	858	10.11	468	956
9.60	468	860	10.12	468	958
9.61	468	862	10.13	468	960
9.62	468	864	10.14	468	961
9.63	468	866	10.15	468	963
9.64	468	868	10.16	468	965
9.65	468	870	10.17	468	967
9.66	468	872	10.18	468	969
9.67	468	873	10.19	468	971
9.68	468	875	10.20	468	973
9.69	468	877	10.21	468	974
9.70	468	879	10.22	468	976
9.71	468	881	10.23	468	978
9.72	468	883	10.24	468	980
9.73	468	885	10.25	468	982
9.74	468	887	10.26	468	984
9.75	468	888	10.27	468	986
9.76	468	890	10.28	468	988
9.77	468	892	10.29	468	989
9.78	468	894	10.30	468	991
9.79	468	896	10.31	468	993
9.80	468	898	10.32	468	995
9.81	468	900	10.33	468	997
9.82	468	901	10.34	468	999
9.83	468	903	10.35	468	1,001
9.84	468	905	10.36	468	1,003
9.85	468	907	10.37	468	1,004
9.86	468	909	10.38	468	1,006
9.87	468	911	10.39	468	1,008
9.88	468	913	10.40	468	1,010

Stage-Area-Storage for Pond UGS-2: (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
10.41	468	1,012
10.42	468	1,014
10.43	468	1,016
10.44	468	1,018
10.45	468	1,019
10.46	468	1,021
10.47	468	1,023
10.48	468	1,025
10.49	468	1,027
10.50	468	1,029
10.51	468	1,031
10.52	468	1,033
10.53	468	1,034
10.54	468	1,036
10.55	468	1,038
10.56	468	1,040
10.57	468	1,042
10.58	468	1,044
10.59	468	1,046
10.60	468	1,047
10.61	468	1,049
10.62	468	1,051
10.63	468	1,053
10.64	468	1,055
10.65	468	1,057
10.66	468	1,059
10.67	468	1,061
10.68	468	1,062
10.69	468	1,064
10.70	468	1,066
10.71	468	1,068
10.72	468	1,070
10.73	468	1,072
10.74	468	1,074
10.75	468	1,076
10.76	468	1,077
10.77	468	1,079
10.78	468	1,081
10.79	468	1,083
10.80	468	1,085
10.81	468	1,087
10.82	468	1,089
10.83	468	1,091
10.84	468	1,092
10.85	468	1,094
10.86	468	1,096
10.87	468	1,098
10.88	468	1,100
10.89	468	1,102
10.90	468	1,104
10.91	468	1,106
10.92	468	**1,107**

Exhibit 8-13
Intensity - Duration - Frequency Curve for Barnstable, MA



Source: TR55 - Urban Hydrology for Small Wetlands, NRCS

F-1. Rainfall Data for Massachusetts from *Rainfall Frequency Atlas of the United States* (TP-40)

- Users of this Handbook should note that current MA DEP written guidance (see DEP Waterlines newsletter -- Fall 2000) requires the use of TP-40 Rainfall Data for calculations under the Wetlands Protection Regulations and the Stormwater Management Policy. More stringent design storms may be used under a local bylaw or ordinance. However, DEP will continue to require the use of TP-40 in any case it reviews under the Wetlands Protection Act and Stormwater Management Policy.

Adjusted Technical Paper 40 Design Storms for 24-hour Event by County

County Name	1-yr 24-hr	2-yr 24-hr	5-yr 24-hr	10-yr 24-hr	25-yr 24-hr	50-yr 24-hr	100-yr 24-hr
Barnstable	2.5	3.6	4.5	4.8	5.7	6.4	7.1
Berkshire	2.5	2.9	3.8	4.4	5.1	5.9	6.4
Bristol	2.5	3.4	4.3	4.8	5.6	6.3	7.0
Dukes	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Essex	2.5	3.1	3.9	4.5	5.4	5.9	6.5
Franklin	2.5	2.9	3.8	4.3	5.1	5.8	6.2
Hampden	2.5	3.0	4.0	4.6	5.3	6.0	6.5
Hampshire	2.5	3.0	3.9	4.5	5.2	5.9	6.4
Middlesex	2.5	3.1	4.0	4.5	5.3	5.9	6.5
Nantucket	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Norfolk	2.5	3.2	4.1	4.7	5.5	6.1	6.7
Plymouth	2.5	3.4	4.3	4.7	5.6	6.2	7.0
Suffolk	2.5	3.2	4.0	4.6	5.5	6.0	6.6
Worcester	2.5	3.0	4.0	4.5	5.3	5.9	6.5

Note: Not used - for reference only.

Proposed Dunkin' Donuts
101 Belleville Avenue
New Bedford, MA
Bohler Job Number: W181069
September 17, 2018

Rational Pipe Sizing Calculations

Design Period Storm:		**25**	**Year**	**Design Period Intensity***			**5.9**	**in/hr**								
LOCATION		IMPERVIOUS			OTHER			SUM CA	Tc (min)	I (in/hr)	Q (cfs)	D (in)	S (ft/ft)	Material	n	Q Full (cfs)	V Full (fps)
FROM	TO	A	C	CA	A	C	CA										
CB-1	UGS-1	0.08	0.95	0.08	0.02	0.30	0.01	0.09	6	5.9	0.50	8	0.005	HDPE	0.012	0.93	2.65
CB-3	WYE-1	0.04	0.95	0.04	0.01	0.30	0.00	0.04	6	5.9	0.23	8	0.005	HDPE	0.012	0.93	2.65
BLDG-1	WYE-1	0.01	0.95	0.01	0.00	0.30	0.00	0.01	6	5.9	0.07	6	0.010	PVC	0.010	0.73	3.71
WYE-1	WYE-2								6	6	0.30	8	0.005	HDPE	0.012	0.93	2.65
BLDG-2	WYE-2	0.01	0.95	0.01	0.00	0.30	0.00	0.01	6	5.9	0.07	6	0.010	PVC	0.010	0.73	3.71
WYE-2	UGS-1								6	6	0.36	8	0.005	HDPE	0.012	0.93	2.65
TD-1	CB-4	0.05	0.95	0.05	0.00	0.30	0.00	0.05	6	5.9	0.30	8	0.020	HDPE	0.012	1.85	5.30
CB-4	UGS-1								6	6	0.30	8	0.005	HDPE	0.012	0.93	2.65
UGS-1	UGS-2								6	6	1.17	8	0.045	HDPE	0.012	2.78	7.96
CB-2	UGS-2	0.09	0.95	0.09	0.01	0.30	0.00	0.09	6	5.9	0.54	8	0.005	HDPE	0.012	0.93	2.65
UGS-2	DMH-1								6	6	1.70	8	0.070	HDPE	0.012	3.46	9.92
DMH-1	EXIST.								6	6	1.70	10	0.015	HDPE	0.012	2.91	5.33

*Rainfall intesity provided by TR-55

Prepared By:
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

TSS Removal Calculation Worksheet

Location: 101 Belleville Avenue New Bedford, MA

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Infiltration Basin	**0.80**	**0.75**	**0.60**	**0.15**

Total TSS Removal = **85%**

Project:	**New Bedford, Dunkin' Donuts**
Prepared By:	**Bohler Engineering**
Date:	**9/10/2018**

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

Prepared By:
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

APPENDIX G – OPERATIONS AND MAINTENANCE PLAN

STORMWATER OPERATION & MAINTENANCE PLAN

Daly Kenney Group, LLC
Belleville Avenue
New Bedford, MA

RESPONSIBLE PARTY:

Daly Kenney Group, LLC
P.O Box 51147
New Bedford, MA 02745

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the Erosion and Sedimentation Control Plan. Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Upon proper notice to the property owner, the City of New Bedford or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots and on-site driveways shall be swept at least twice per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of off site in accordance with MADEP and other applicable requirements. BUDGET: $1,000/yr

2. Catch basins, yard drains, trench drains, manholes and piping: Inspect two (2) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned two (2) times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off site in accordance with MADEP and other applicable requirements. BUDGET $500/yr per structure.

3. Underground Infiltration System: The underground infiltration systems shall be inspected after every major storm event during the first three months of operation at minimum and once per year thereafter to ensure that they are operating as intended and that all components are stable and in working order. Inspect structures to ensure proper functioning after every major storm event (generally equal to or greater than 3.0 inches in 24 hours) for the first three months. The chambers shall be inspected and if the depth of sediment is 3 inches deep or greater the sediment shall be removed, but no less than once annually. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

LONG-TERM POLLUTION PREVENTION PLAN

Daly Kenney Group, LLC
Belleville Avenue
New Bedford, MA

RESPONSIBLE PARTY:

Daly Kenney Group, LLC
P.O Box 51147
New Bedford, MA 02745

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

1. No outdoor maintenance or washing of vehicles allowed.
2. The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc.
3. Proper storage and removal of solid waste (dumpsters).
4. Regular sweeping of the parking lot pavement areas, as indicated in the "O&M Plan".
5. Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
6. Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges listed below are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Type of Allowable Non-Stormwater Discharge	**Likely to be Present at Your Site?**
Discharges from emergency fire-fighting activities	☐ YES ☒ NO
Fire hydrant flushings	☐ YES ☒ NO
Landscape irrigation	☒ YES ☐ NO
Waters used to wash vehicles and equipment	☐ YES ☒ NO
Water used to control dust	☒ YES ☐ NO
Potable water including uncontaminated water line flushings	☒ YES ☐ NO
Routine external building wash down	☐ YES ☒ NO
Pavement wash waters	☐ YES ☒ NO
Uncontaminated air conditioning or compressor condensate	☐ YES ☒ NO
Uncontaminated, non-turbid discharges of ground water or spring water	☐ YES ☒ NO
Foundation or footing drains	☐ YES ☒ NO
Construction dewatering water	☐ YES ☒ NO

SPILL PREVENTION AND RESPONSE PROCEDURES (POST-CONSTRUCTION)

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on site.

3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.

4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)

2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

3. For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill , the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).

4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

STORMWATER MANAGEMENT SYSTEM
POST-CONSTRUCTION INSPECTION REPORT

LOCATION:
Dunkin' Donuts Fast Food Restaurant
Belleville Avenue
New Bedford, Massachusetts

RESPONSIBLE PARTY:
Daly Kenney Group, LLC
P.O Box 51147
New Bedford, MA 02745

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Catch Basins:	
Drain Manholes:	
Trench Drain:	
Underground Infiltration System(s):	
Other:	
Note Actions taken on the Following (sediment and/or debris removal, repairs, etc.):	

STORMWATER MANAGEMENT SYSTEM
POST-CONSTRUCTION INSPECTION REPORT

Catch Basins:
Yard Drain:
Drainage Manholes:
Underground Infiltration System(s):
Other:
Comments:

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Duly Acknowledged:

Name & Title:

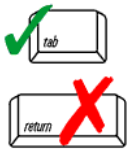
APPENDIX H – STORMWATER MANAGEMENT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☒ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☒ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.