DRAINAGE CALCULATIONS AND STORMWATER MANAGEMENT PLAN

For:

STORMWATER SYSTEM AND SITE IMPROVEMENTS
ASSESSORS PARCEL NO. B7-3-2
21 PARKER DRIVE
AVON, MASSACHUSETTS

Located:

21 PARKER DRIVE
AVON, MASSACHUSETTS

Submitted to:

TOWN OF AVON PLANNING BOARD

Prepared For:

ATLANTIC OLIVER II 21 PARKER DRIVE, LLC
C/O JOSEPH HENRY
125 HIGH STREET, SUITE 220
BOSTON, MASSACHUSETTS 02110

MCKENZIE ENGINEERING GROUP

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NOVEMBER 17, 2022

TABLE OF CONTENTS

Drainage Calculations and Stormwater Management Plan
21 Parker Drive
Avon, Massachusetts

Project Summary

The project proponent, Atlantic Oliver II 21 Parker Drive LLC, proposes to make site and stormwater system improvements at 21 Parker Drive, in Avon, Massachusetts. The site consists of a parcel shown as Avon Assessor's Parcel ID No. B7-3-2 comprising approximately 10.45 acres. The site is located within the Industrial Zoning District.

The proposed site improvements will consist of re-grading the existing gravel parking area at the northerly end of the property, installation of a proprietary stormwater management device, and paving of the parking area with hot mix asphalt.

This report contains stormwater runoff calculations for the pre-development and post-development conditions and includes the sizing of the proposed stormwater best management practices (BMPs). The proposed and existing site conditions are illustrated on the project *site plans* entitled "Site Development Plan 21 Parker Drive (Assessor's Parcel No. B7-3-2), Avon, Massachusetts", prepared by McKenzie Engineering Group, Inc. dated November 17, 2022.

Refer to Figure 1- USGS Locus Map for the location of the parcel.

Pre-Development Condition

The parcel is currently fully developed and is occupied by a 100,000 s.f. masonry and metal building, gravel and asphalt parking areas, walkways and landscaped areas. The topography of the site ranges in elevation from approximately 275 ft. (NAVD 88) at the easterly boundary to an elevation of approximately 228 ft. at the northwest corner of the subject property. The entire easterly boundary of the site is defined by a steep, heavily treed slope. The slope terminates in a ditch along the easterly edge of the pavement and gravel parking area. The northerly portion of the driveway easterly of the building also directs flow into the ditch. The ditch directs runoff from the driveway, slope and offsite areas northerly and westerly around the gravel parking area to a closed drainage system which conducts the runoff to offsite areas. Portions of runoff emanating from the southerly half of the site currently flow in a southeasterly and southwesterly direction via a closed drainage system to offsite areas. The gravel parking area slopes in a northwesterly direction toward and is partially captured by an existing stormwater basin at the westerly limit of the gravel area. The stormwater basin is drained by a 12" reinforce concrete pipe which directs flow into the closed drainage system toward Bodwell Street.

The site is located within the Zone X of the Flood Insurance Rate Map, as shown on the current FEMA Flood Insurance Rate Map No. 25021C0218E with an effective date of July 12, 2012. Refer to Figure 2 – FEMA Flood Map.

The soil types as identified by the Soil Survey, Middlesex County, MA prepared by the NRCS Soil Conservation Service (NRCS) are classified as 602-Urban Land.

Refer to Figure 3 - Soil Map for the NRCS delineation of soil types.

In the pre- and post- development stormwater analysis, the watershed area analyzed was approximately 2.83 acres consisting of the gravel parking area, roofs and grassed tributary areas. The watershed consists of two (2) sub-catchments. Refer to Pre-Development Watershed Delineation Plan WS-1 in Appendix A for a delineation of drainage subareas for the pre-development design condition.

The SCS Technical Release 20 (TR-20) and Technical Release 55 (TR-55) method-based program "HydroCAD" was employed to develop pre- and post-development peak flows. Drainage calculations were prepared for the pre-development condition for the 2, 10, 25 and 100-year, Type III storm events. Refer to Appendix A for computer results, soil characteristics, cover descriptions and times of concentrations for all subareas.

Post-Development Condition

The proposed site improvements will consist of re-grading the existing gravel parking area at the northerly end of the property, installation of a proprietary stormwater management device, and paving of the parking area with hot mix asphalt. Existing underground utilities will remain in place and not be affected. The stormwater management system will be designed to comply with all standards of the Department of Environment Protection's Stormwater Management Regulations to the maximum extent practicable. Existing drainage patterns will be maintained in the proposed condition. The site grading is designed to direct runoff from the parking area into the existing stormwater basin.

Watershed areas were analyzed in the post-development condition to design stormwater management facilities to mitigate and attenuate impacts resulting from runoff from the noted portion of the property. The objective in designing the proposed drainage facilities for the project was to maintain existing drainage patterns to the extent practicable and to ensure that the post-development rates of runoff are less than or equal to pre-development rates at the design points to the extent practicable.

Refer to the Post-Development Watershed Plan WS-2 in Appendix B for a delineation of post-development drainage subareas. The design points for the post-development design conditions correspond to those analyzed for the pre-development design condition.

The proposed system utilizes a proprietary stormwater treatment unit to treat runoff from the proposed paved surface prior to discharge into the existing stormwater basin. Refer to site plans for the drainage system design. All BMPs shall be supported by a comprehensive Construction Phase Pollution Prevention and Erosion Control Plan and Post-Development BMP Operation and Maintenance Plan.

Drainage calculations were prepared by employing the SCS TR-20 Methods for the 1, 2, 10, 25 and 100-year, Type III storm events. Refer to Appendix B for computer results.

Stormwater Best Management Practices (BMP's)

Treatment stream for the redevelopment shall consist of a proprietary stormwater treatment unit to address total suspended solids (TSS) and mitigate the anticipated pollutant loading.

No illicit discharges are anticipated on site. An Illicit Discharge Compliance Statement will be submitted prior to the discharge of any stormwater to the post-construction best management practices. Measures to prevent illicit discharges will be included in the Long-Term Pollution Prevention Plan.

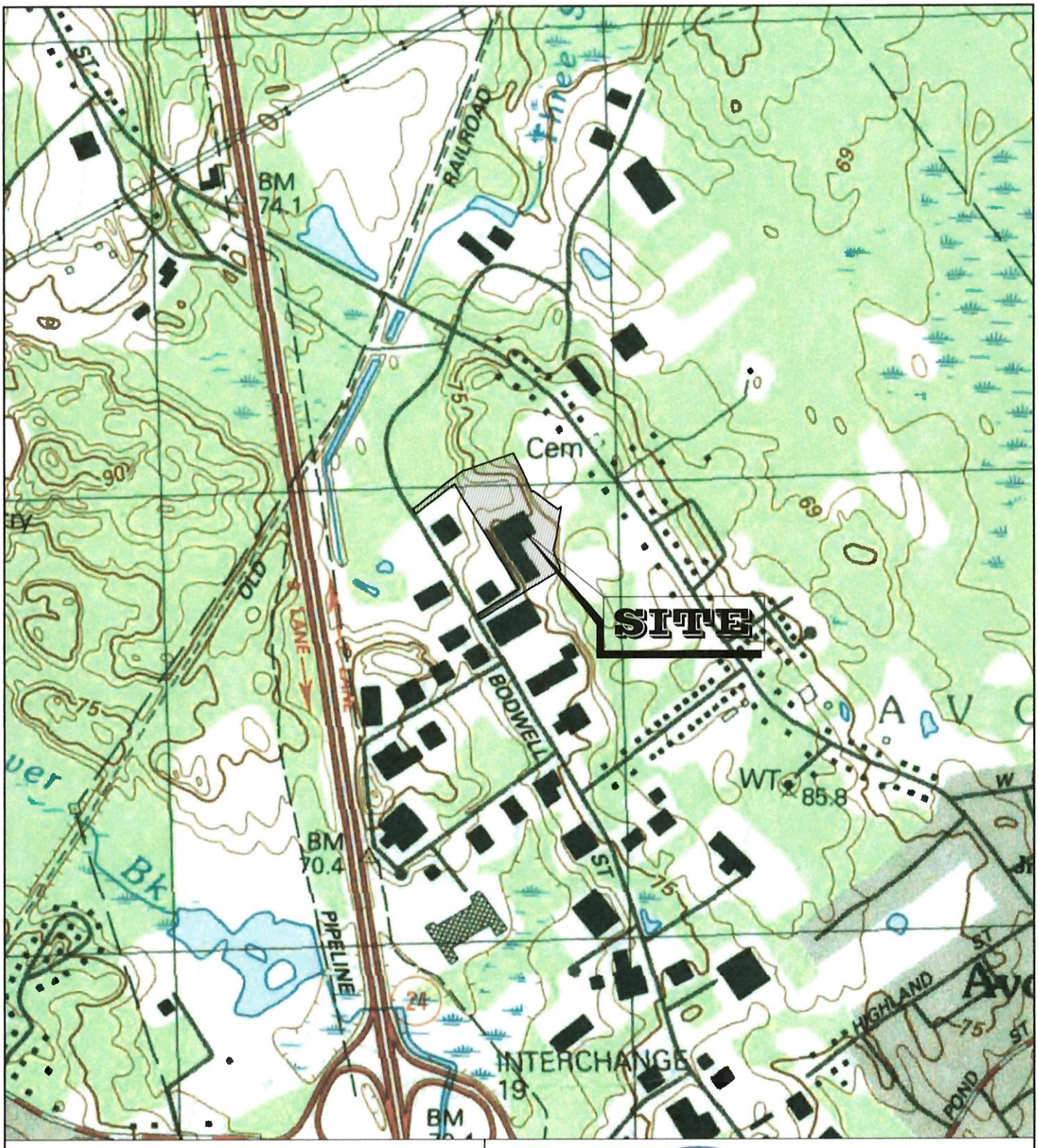

FIGURE - 1

0 1000' 2000' 2500'

U.S. GEOLOGICAL SURVEY
7.5 X 15 MINUTE SERIES

DATE: NOVEMBER 17, 2022

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USGS LOCUS MAP

21 PARKER DRIVE
ASSESSOR'S PARCELS B7-3-2
AVON, MASSACHUSETTS

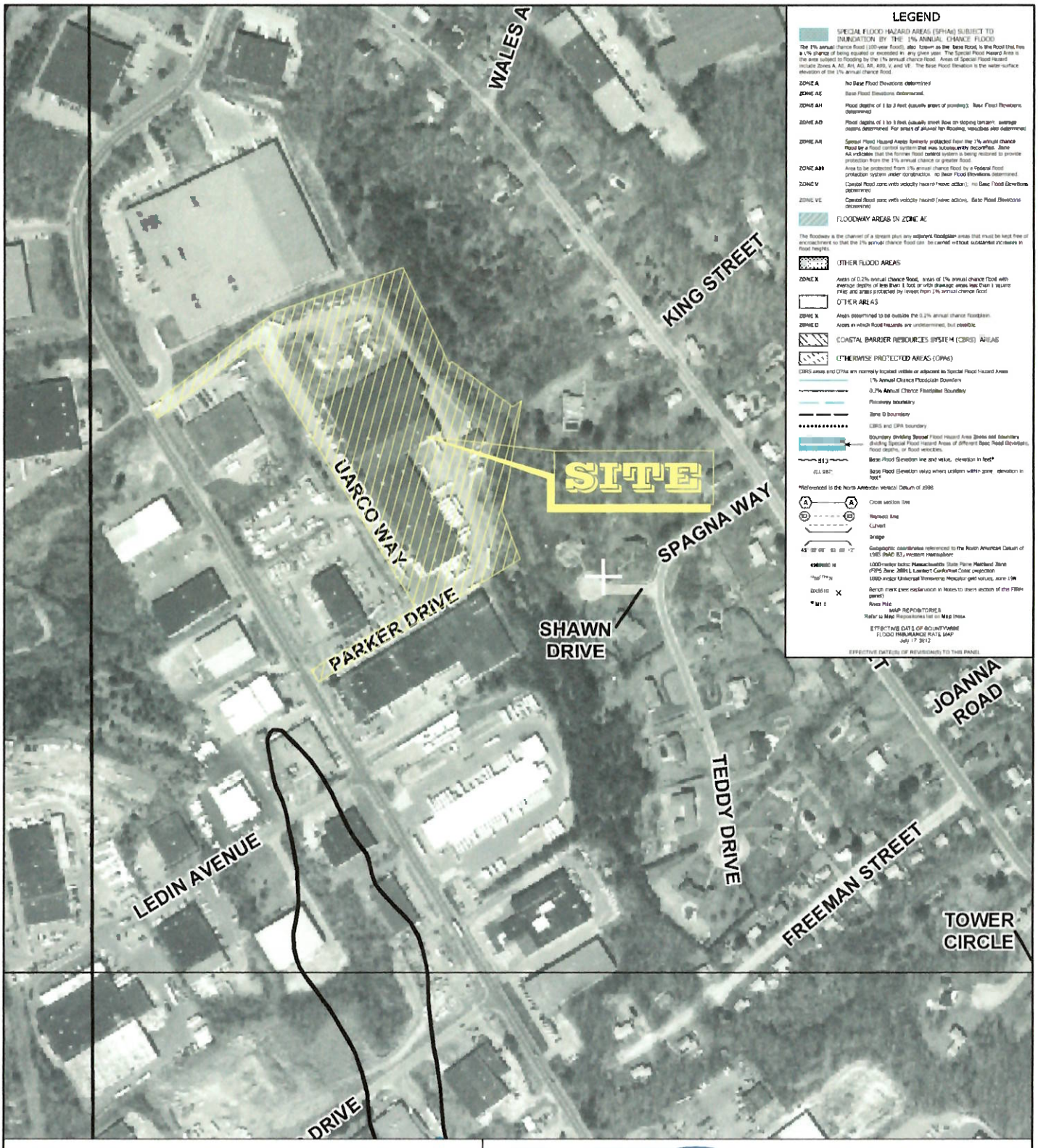

FIGURE - 2

0 400' 800' 1000'

F.I.R.M. MAP NO: 25021C0218E &
F.I.R.M. MAP NO: 25021C0214E
EFFECTIVE DATE: JULY 17, 2012

DATE: NOVEMBER 17, 2022

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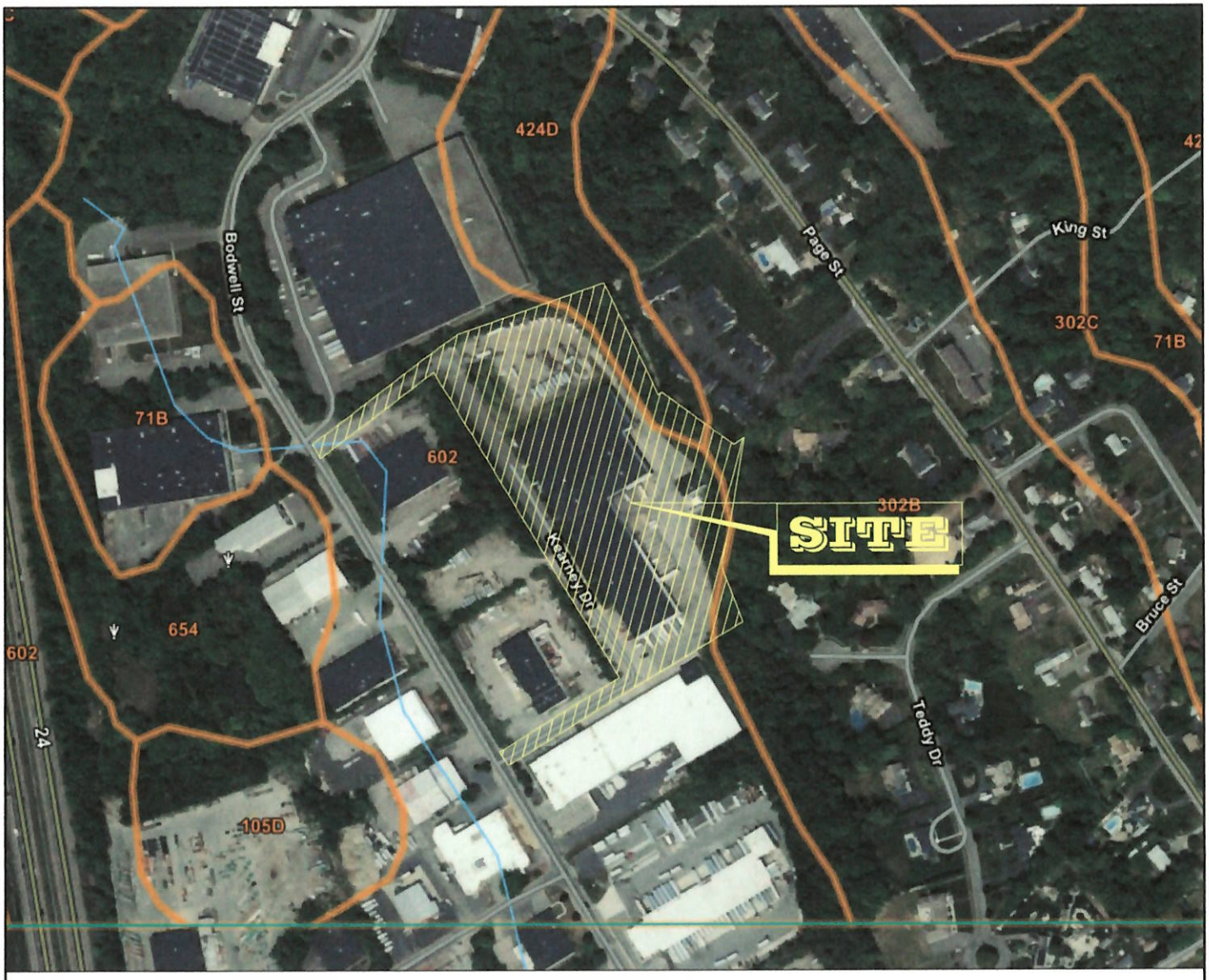
FEMA FLOOD MAP

21 PARKER DRIVE
ASSESSOR'S PARCELS B7-3-2
AVON, MASSACHUSETTS



SOIL KEY

SOIL CLASSIFICATION

	DESCRIPTION	HYDROLOGIC SOIL GROUP
71B	RIDGEBURY FINE SANDY LOAM	C
105D	ROCK OUTCROP	C/D
302B	MONTAUK FINE SANDY LOAM	C
302C	MONTAUK FINE SANDY LOAM	C
424D	CANTON FINE SANDY LOAM	B
602	URBAN LAND	
654	UDORTHENTS, LOAMY	

FIGURE - 3

0 400' 800' 1000'

NRCS SOIL SURVEY
NORFOLK COUNTY

DATE: NOVEMBER 17, 2022

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NRCS SOILS MAP

21 PARKER DRIVE
ASSESSOR'S PARCELS B7-3-2
AVON, MASSACHUSETTS

APPENDIX A

Pre-Development Condition

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
424D	CANTON FINE SANDY LOAM	B
602	URBAN LAND	C

LEGEND

- WATERSHED DIVIDE
- TIME OF CONCENTRATION FLOW PATH
- DP-1 — DESIGN POINT
- S1 — SUBCATCHMENT
- P1 — POND
- SOIL TYPE BOUNDARY
- 602 — SOIL MAP UNIT SYMBOL
- H.S.G. C — HYROLOGIC SOIL GROUP DESIGNATION

424D

602

S1

S2

P1

DP-1

DP-2

APN 87-3-14
000 PAGE STREET
N/F
PERRY O REARDEY JR
BK 2397 PG 117

APN 87-3-1
275 BODWELL STREET
N/F
WCV - 275 BODWELL LLC
BK 40058 PG 479

EXISTING PROPERTY LINE (TYP.)

N 70°42'E 394.87'

EXIST. SHRUB (TYP.)
EXISTING TREE LINE (TYP.)
EXISTING SPEED RAMP (TYP.)

GRAVEL

BIT. CONC.

CEM. CONC.

STAIRS

LIMIT OF EXISTING BUILDING (TYP.)

CHAIN LINK FENCE

CELL TOWER ENCLOSURE

#21 PARKER DRIVE
1 STORY
CONCRETE AND METAL

APN 87-3-2
LOT AREA
455,380 S.F.
10.45 ± AC

VINYL FENCE

CONC. PAD

JERSEY BARRIERS (TYP.)

CONC. BLOCKS (TYP.)

EXIST. BASIN

l=224.94
12"RCP

12" RCP CRVLT

WHITE PAVEMENT MARKING (TYP.)

N 31°27'30" W 697.02'

308.02'

PARKER (PRIVATE - 40' WIDE) DRIVE

GAS SERVICE

GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

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I:\MEG\2022 PROJECTS\222-208 ATL OLIVER II - 21 PARKER DRIVE, AVON\DWGS\222-208 SITE PLANS.DWG

REV	DATE	DESCRIPTION	BY	APP

MCKENZIE ENGINEERING GROUP
Assinippi Office Park
150 Longwater Drive Suite 101
Norwell, MA 02061
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SITE DEVELOPMENT PLAN
21 PARKER DRIVE
(ASSESSOR'S PARCEL NO. B7-3-2)
AVON, MASSACHUSETTS

PROFESSIONAL ENGINEER:

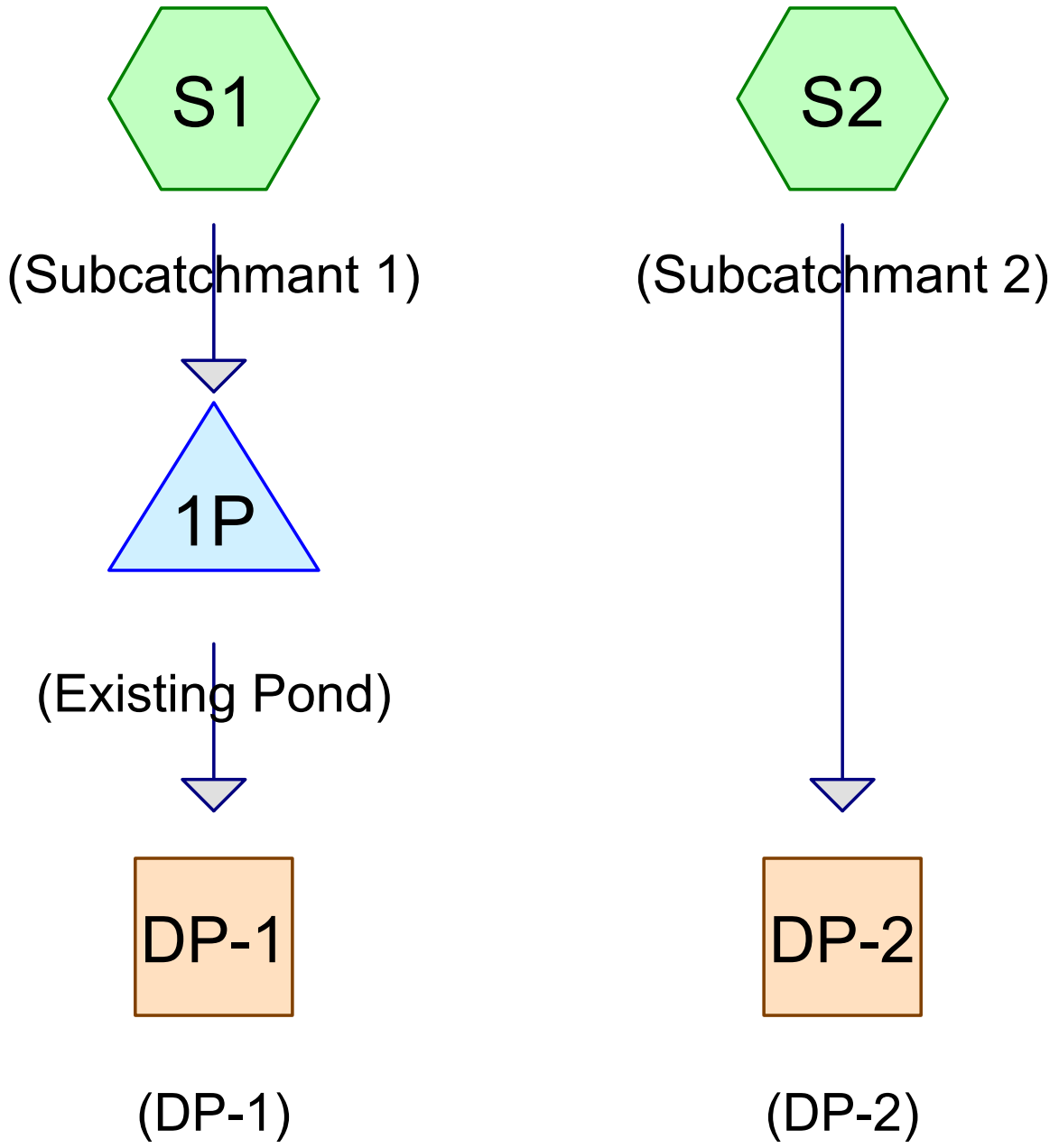
NOT FOR CONSTRUCTION

OWNER/APPLICANT:
ATLANTIC OLIVER II 21 PARKER DRIVE LLC
303 CONGRESS STREET
BOSTON, MASSACHUSETTS 02210

DRAWN BY:	AWB
DESIGNED BY:	AWL
CHECKED BY:	REK/JB
APPROVED BY:	BCM
DATE:	NOVEMBER 16, 2022
SCALE:	1"=20'
PROJECT NO.:	222-208

DWG. TITLE:
PRE-DEVELOPMENT WATERSHED PLAN

DWG. NO:
WS-1



Subcat Reach Pond Link

Routing Diagram for 222-206-PRE
Prepared by MCKENZIE ENGINEERING GROUP, INC., Printed 12/8/2022
HydroCAD® 10.00-21 s/n 00452 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.652	74	>75% Grass cover, Good, HSG C (S1, S2)
1.002	89	Gravel roads, HSG C (S1, S2)
0.084	98	Paved parking, HSG A (S1)
1.087	98	Roofs, HSG C (S1)
2.825	**89**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.084	HSG A	S1
0.000	HSG B	
2.741	HSG C	S1, S2
0.000	HSG D	
0.000	Other	
2.825		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.652	0.000	0.000	0.652	>75% Grass cover, Good	S1, S2
0.000	0.000	1.002	0.000	0.000	1.002	Gravel roads	S1, S2
0.084	0.000	0.000	0.000	0.000	0.084	Paved parking	S1
0.000	0.000	1.087	0.000	0.000	1.087	Roofs	S1
0.084	**0.000**	**2.741**	**0.000**	**0.000**	**2.825**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	224.94	223.94	100.0	0.0100	0.013	12.0	0.0	0.0

Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: (Subcatchmant1) Runoff Area=121,100 sf 42.11% Impervious Runoff Depth=2.27"
Tc=6.0 min CN=89 Runoff=7.19 cfs 0.527 af

SubcatchmentS2: (Subcatchmant2) Runoff Area=1,949 sf 0.00% Impervious Runoff Depth=2.10"
Tc=6.0 min CN=87 Runoff=0.11 cfs 0.008 af

Reach DP-1: (DP-1) Inflow=4.52 cfs 0.527 af
Outflow=4.52 cfs 0.527 af

Reach DP-2: (DP-2) Inflow=0.11 cfs 0.008 af
Outflow=0.11 cfs 0.008 af

Pond 1P: (Existing Pond) Peak Elev=227.33' Storage=1,431 cf Inflow=7.19 cfs 0.527 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=4.52 cfs 0.527 af

Total Runoff Area = 2.825 ac Runoff Volume = 0.535 af Average Runoff Depth = 2.27"
58.56% Pervious = 1.654 ac 41.44% Impervious = 1.171 ac

Summary for Subcatchment S1: (Subcatchmant 1)

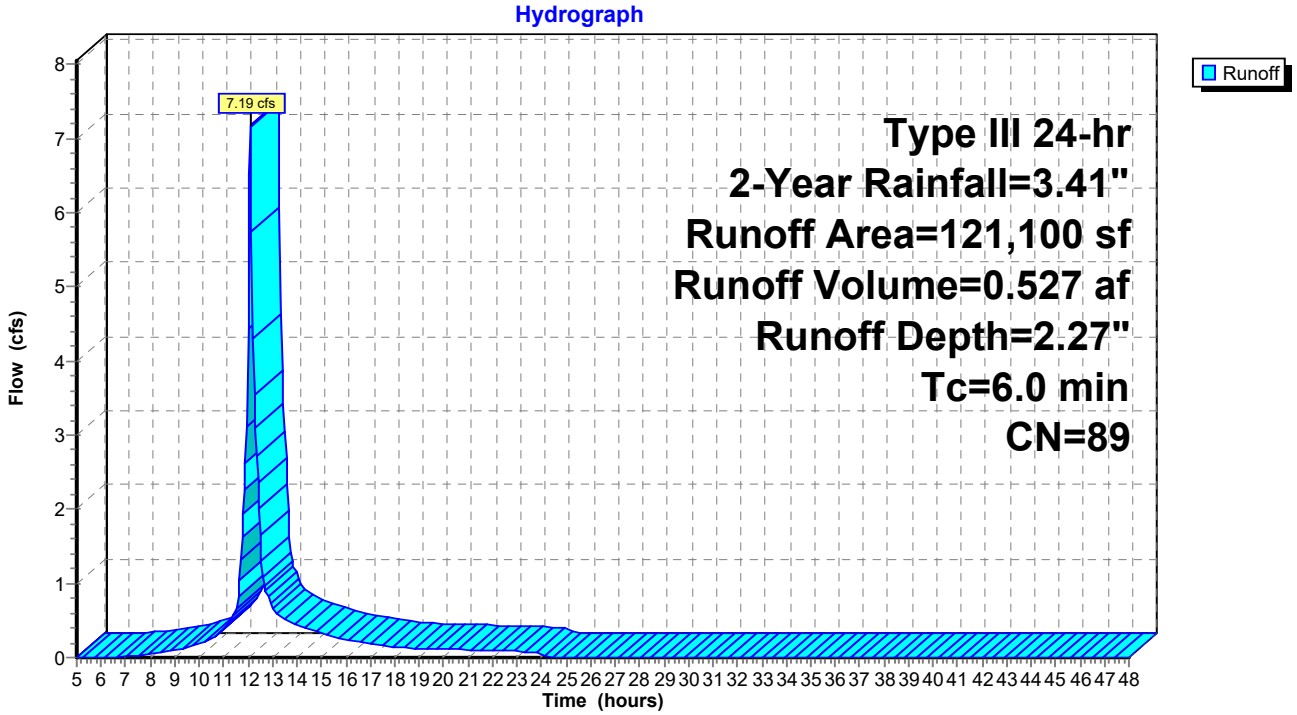
Runoff = 7.19 cfs @ 12.09 hrs, Volume= 0.527 af, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.41"

Area (sf)	CN	Description
3,662	98	Paved parking, HSG A
47,328	98	Roofs, HSG C
42,009	89	Gravel roads, HSG C
28,101	74	>75% Grass cover, Good, HSG C
121,100	89	Weighted Average
70,110		57.89% Pervious Area
50,990		42.11% Impervious Area

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

Subcatchment S1: (Subcatchmant 1)



Summary for Subcatchment S2: (Subcatchmant 2)

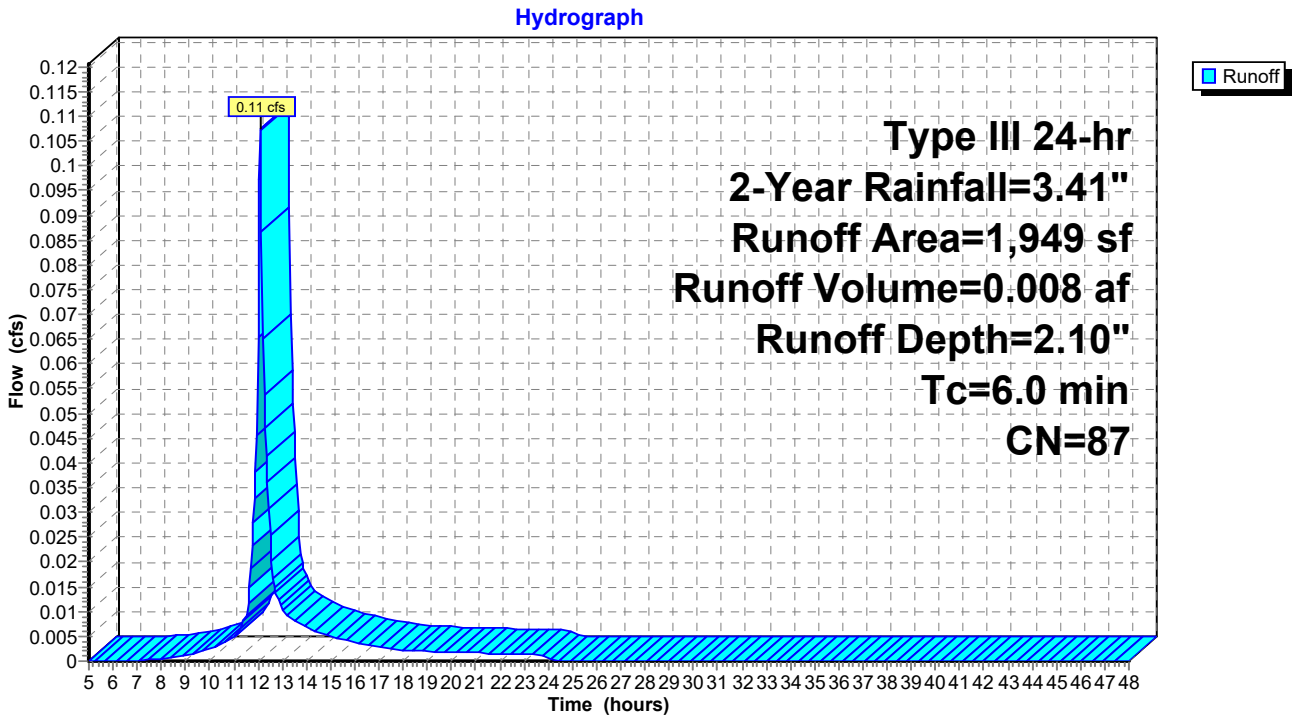
Runoff = 0.11 cfs @ 12.09 hrs, Volume= 0.008 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.41"

Area (sf)	CN	Description
1,645	89	Gravel roads, HSG C
304	74	>75% Grass cover, Good, HSG C
1,949	87	Weighted Average
1,949		100.00% Pervious Area

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

Subcatchment S2: (Subcatchmant 2)

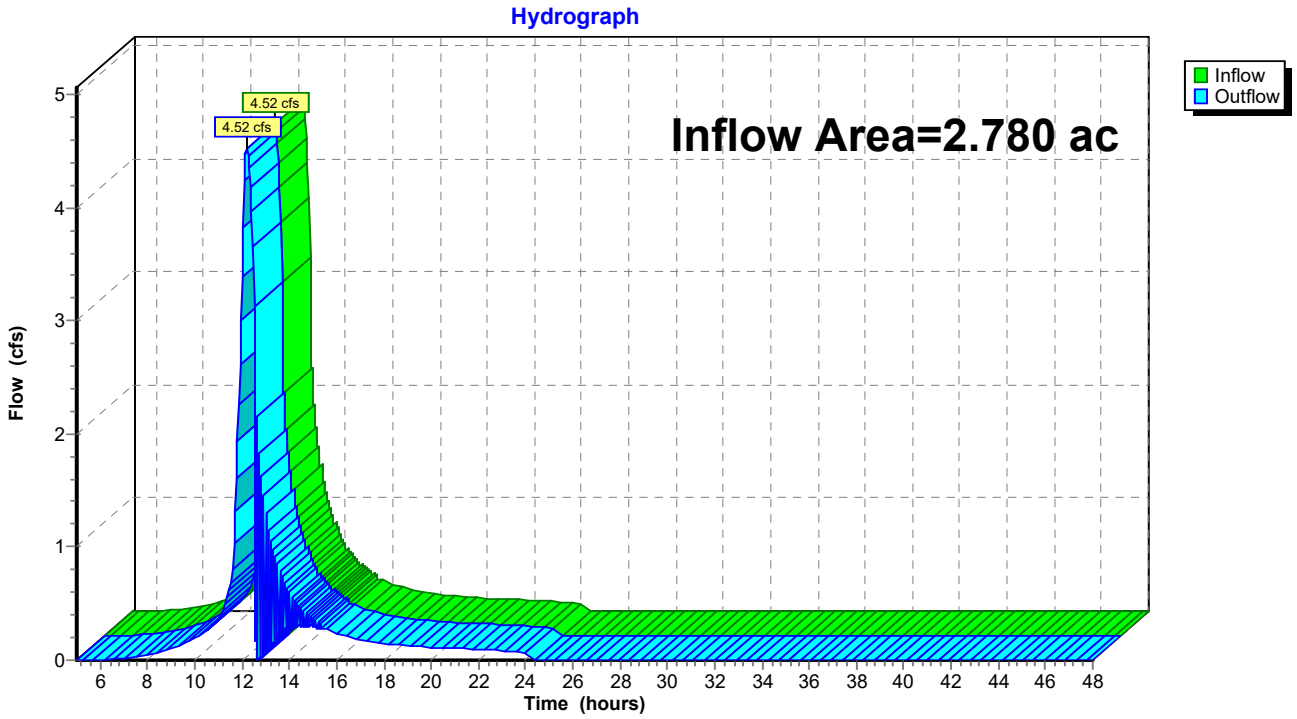


Summary for Reach DP-1: (DP-1)

Inflow Area = 2.780 ac, 42.11% Impervious, Inflow Depth = 2.27" for 2-Year event
Inflow = 4.52 cfs @ 12.20 hrs, Volume= 0.527 af
Outflow = 4.52 cfs @ 12.20 hrs, Volume= 0.527 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: (DP-1)

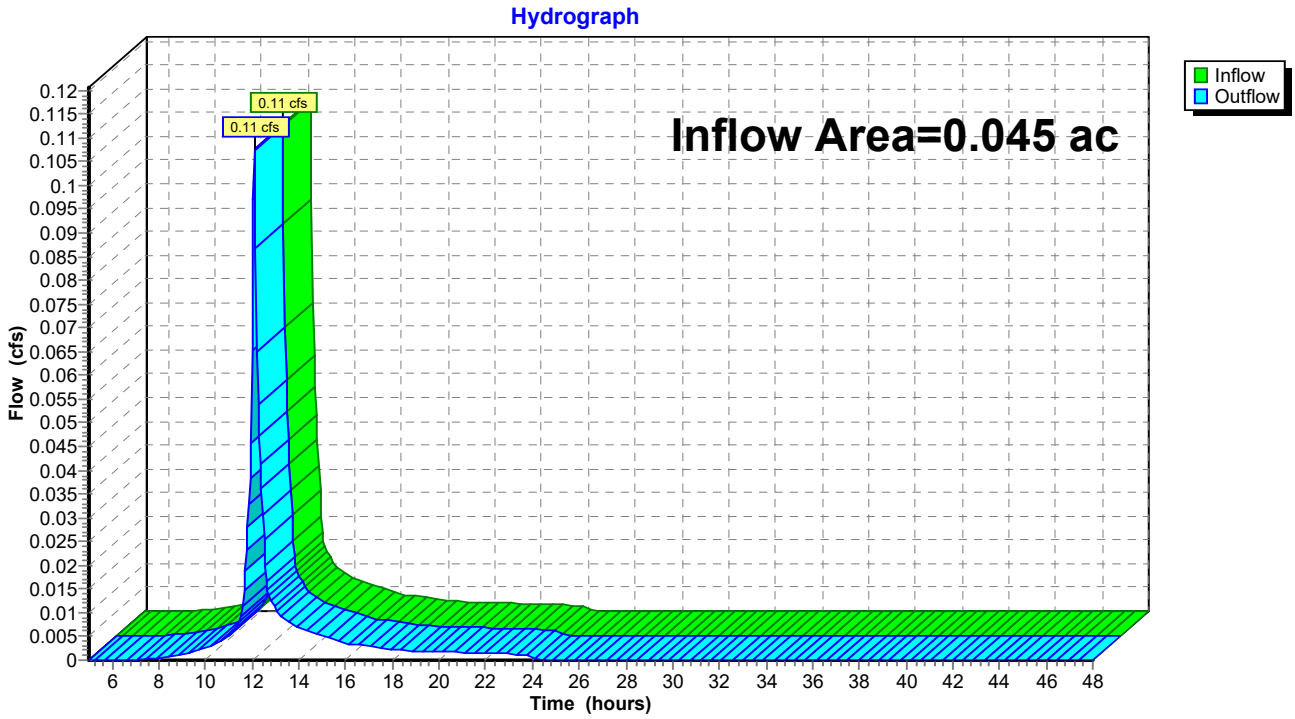


Summary for Reach DP-2: (DP-2)

Inflow Area = 0.045 ac, 0.00% Impervious, Inflow Depth = 2.10" for 2-Year event
Inflow = 0.11 cfs @ 12.09 hrs, Volume= 0.008 af
Outflow = 0.11 cfs @ 12.09 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: (DP-2)



Summary for Pond 1P: (Existing Pond)

Inflow Area = 2.780 ac, 42.11% Impervious, Inflow Depth = 2.27" for 2-Year event
Inflow = 7.19 cfs @ 12.09 hrs, Volume= 0.527 af
Outflow = 4.52 cfs @ 12.20 hrs, Volume= 0.527 af, Atten= 37%, Lag= 6.5 min
Primary = 4.52 cfs @ 12.20 hrs, Volume= 0.527 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 227.33' @ 12.20 hrs Surf.Area= 1,781 sf Storage= 1,431 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.2 min (809.7 - 808.6)

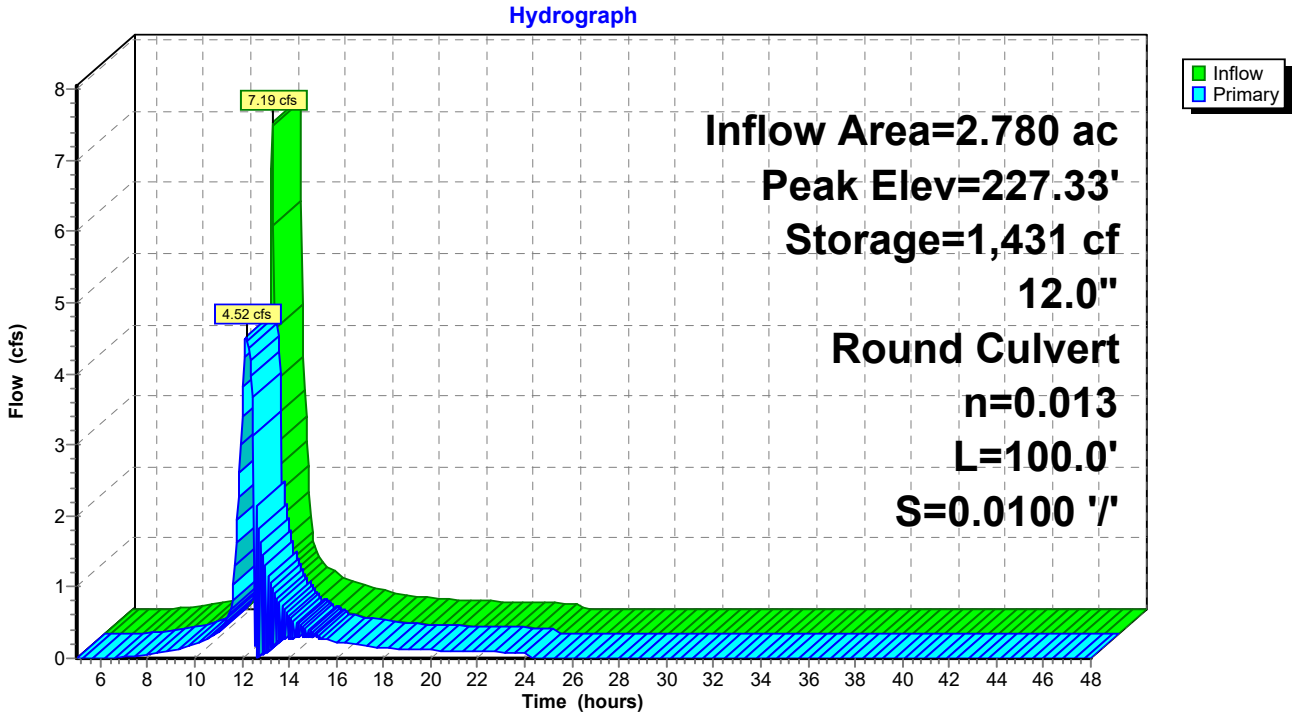
Volume	Invert	Avail.Storage	Storage Description
#1	224.94'	12,648 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.94	0	0	0
225.00	6	0	0
226.00	12	9	9
226.30	790	120	129
227.00	1,421	774	903
228.00	2,512	1,967	2,870
229.00	3,605	3,059	5,928
230.00	4,698	4,152	10,080
230.50	5,574	2,568	12,648

Device	Routing	Invert	Outlet Devices
#1	Primary	224.94'	**12.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 224.94' / 223.94' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf

Primary OutFlow Max=4.52 cfs @ 12.20 hrs HW=227.33' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 4.52 cfs @ 5.76 fps)

Pond 1P: (Existing Pond)



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: (Subcatchmant1) Runoff Area=121,100 sf 42.11% Impervious Runoff Depth>3.98"
Tc=6.0 min CN=89 Runoff=12.29 cfs 0.922 af

SubcatchmentS2: (Subcatchmant2) Runoff Area=1,949 sf 0.00% Impervious Runoff Depth=3.77"
Tc=6.0 min CN=87 Runoff=0.19 cfs 0.014 af

Reach DP-1: (DP-1) Inflow=5.66 cfs 0.923 af
Outflow=5.66 cfs 0.923 af

Reach DP-2: (DP-2) Inflow=0.19 cfs 0.014 af
Outflow=0.19 cfs 0.014 af

Pond 1P: (Existing Pond) Peak Elev=228.68' Storage=4,829 cf Inflow=12.29 cfs 0.922 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=5.66 cfs 0.923 af

Total Runoff Area = 2.825 ac Runoff Volume = 0.937 af Average Runoff Depth = 3.98"
58.56% Pervious = 1.654 ac 41.44% Impervious = 1.171 ac

Summary for Subcatchment S1: (Subcatchmant 1)

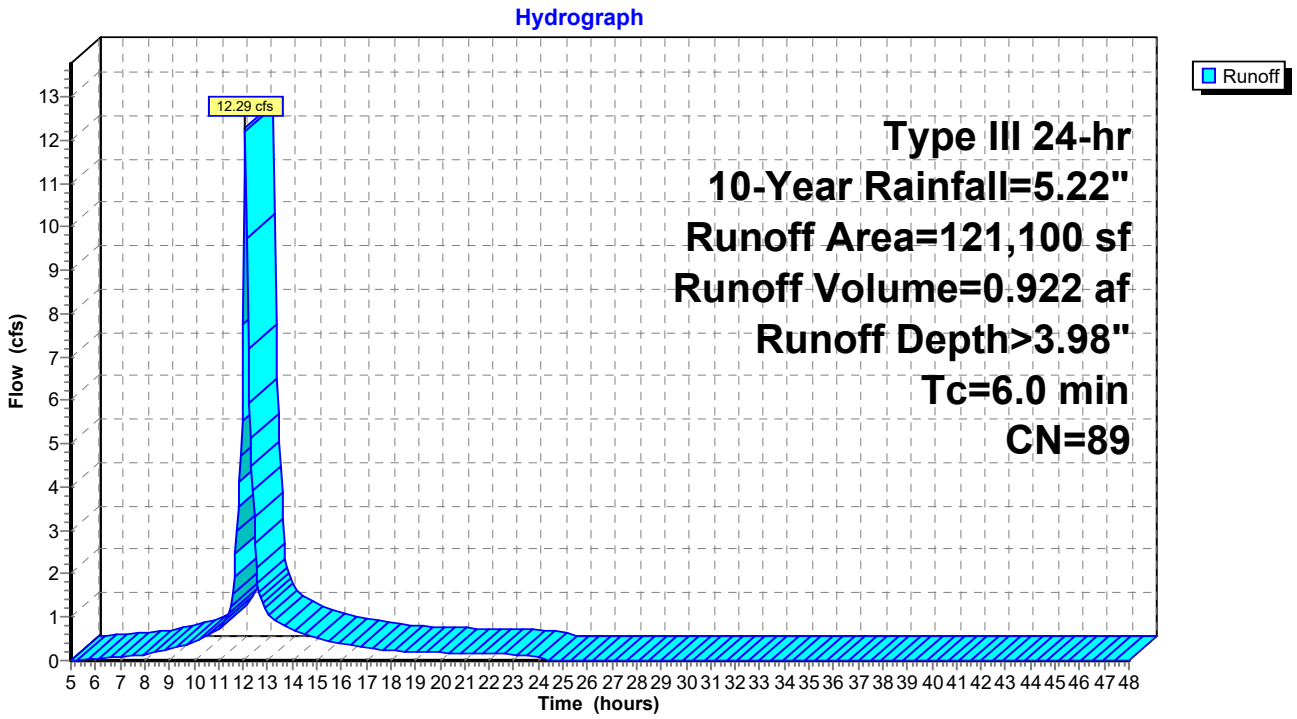
Runoff = 12.29 cfs @ 12.09 hrs, Volume= 0.922 af, Depth> 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.22"

Area (sf)	CN	Description
3,662	98	Paved parking, HSG A
47,328	98	Roofs, HSG C
42,009	89	Gravel roads, HSG C
28,101	74	>75% Grass cover, Good, HSG C
121,100	89	Weighted Average
70,110		57.89% Pervious Area
50,990		42.11% Impervious Area

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

Subcatchment S1: (Subcatchmant 1)



Summary for Subcatchment S2: (Subcatchmant 2)

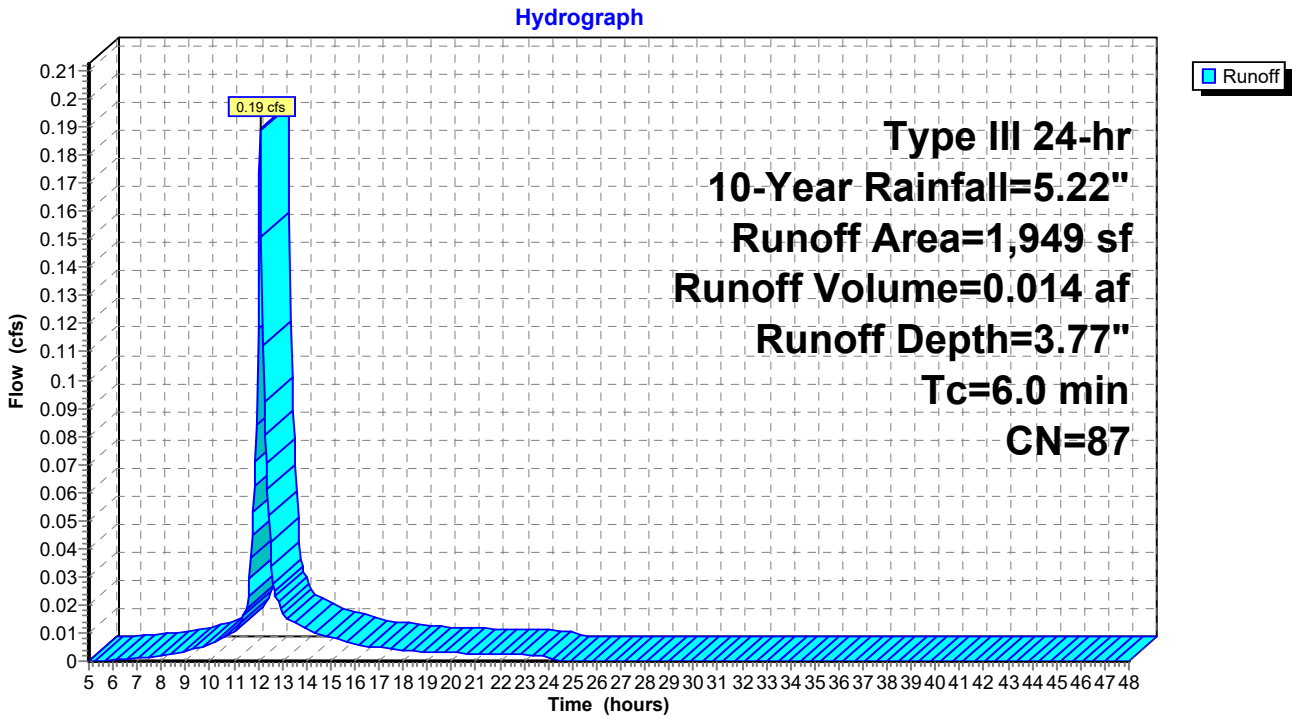
Runoff = 0.19 cfs @ 12.09 hrs, Volume= 0.014 af, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.22"

Area (sf)	CN	Description
1,645	89	Gravel roads, HSG C
304	74	>75% Grass cover, Good, HSG C
1,949	87	Weighted Average
1,949		100.00% Pervious Area

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

Subcatchment S2: (Subcatchmant 2)

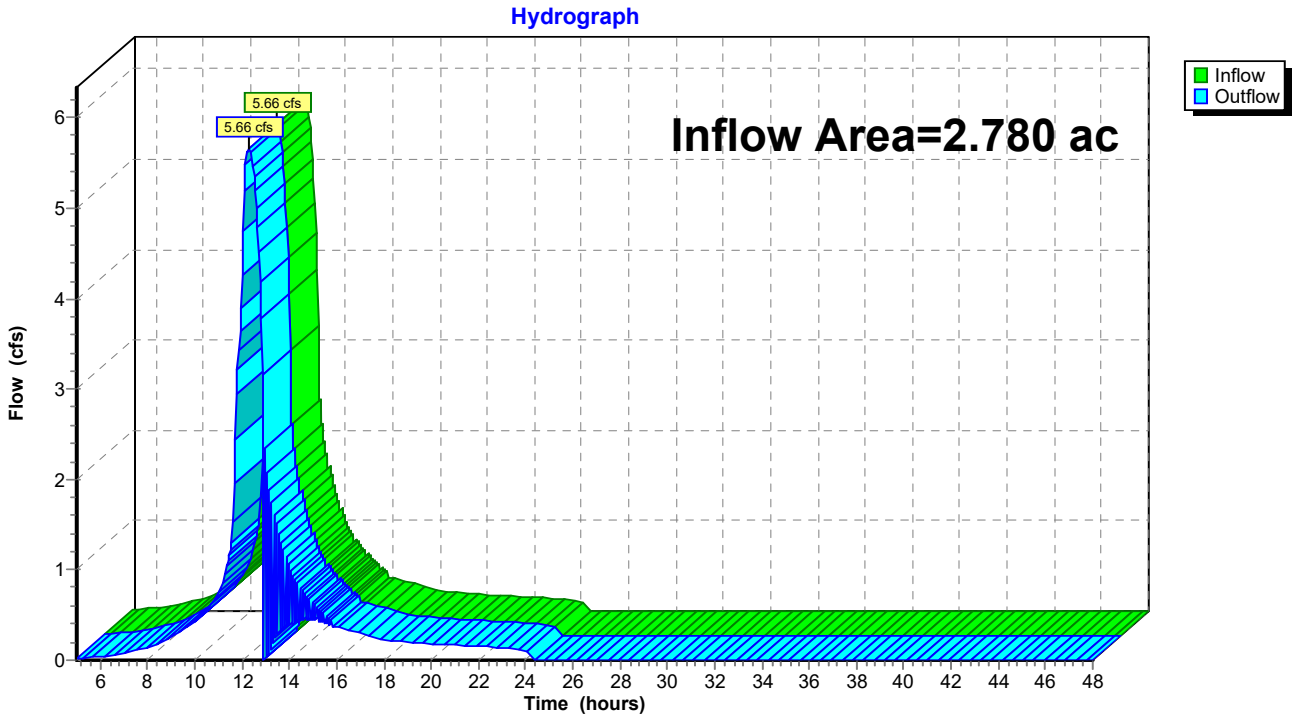


Summary for Reach DP-1: (DP-1)

Inflow Area = 2.780 ac, 42.11% Impervious, Inflow Depth > 3.98" for 10-Year event
Inflow = 5.66 cfs @ 12.27 hrs, Volume= 0.923 af
Outflow = 5.66 cfs @ 12.27 hrs, Volume= 0.923 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: (DP-1)

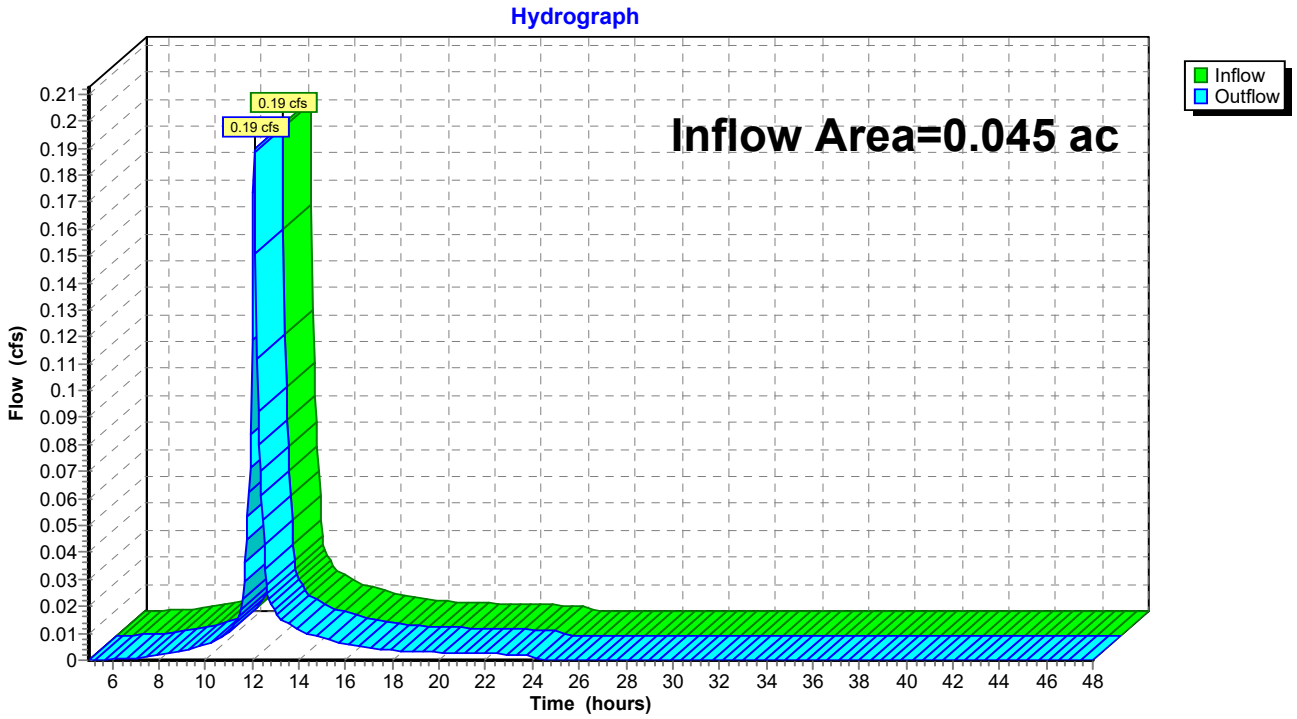


Summary for Reach DP-2: (DP-2)

Inflow Area = 0.045 ac, 0.00% Impervious, Inflow Depth = 3.77" for 10-Year event
Inflow = 0.19 cfs @ 12.09 hrs, Volume= 0.014 af
Outflow = 0.19 cfs @ 12.09 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: (DP-2)



Summary for Pond 1P: (Existing Pond)

Inflow Area = 2.780 ac, 42.11% Impervious, Inflow Depth > 3.98" for 10-Year event
Inflow = 12.29 cfs @ 12.09 hrs, Volume= 0.922 af
Outflow = 5.66 cfs @ 12.27 hrs, Volume= 0.923 af, Atten= 54%, Lag= 10.8 min
Primary = 5.66 cfs @ 12.27 hrs, Volume= 0.923 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 228.68' @ 12.27 hrs Surf.Area= 3,255 sf Storage= 4,829 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.0 min (797.0 - 793.1)

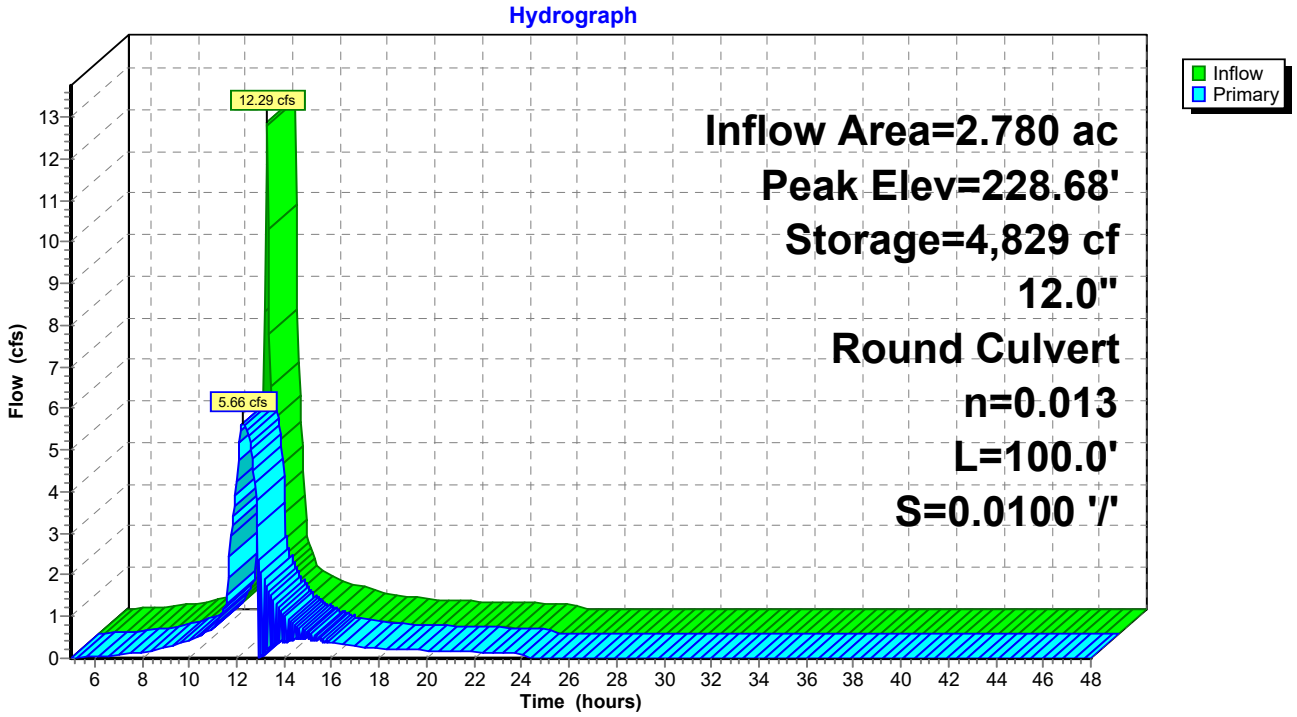
Volume	Invert	Avail.Storage	Storage Description
#1	224.94'	12,648 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.94	0	0	0
225.00	6	0	0
226.00	12	9	9
226.30	790	120	129
227.00	1,421	774	903
228.00	2,512	1,967	2,870
229.00	3,605	3,059	5,928
230.00	4,698	4,152	10,080
230.50	5,574	2,568	12,648

Device	Routing	Invert	Outlet Devices
#1	Primary	224.94'	**12.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 224.94' / 223.94' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf

Primary OutFlow Max=5.65 cfs @ 12.27 hrs HW=228.67' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 5.65 cfs @ 7.20 fps)

Pond 1P: (Existing Pond)



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: (Subcatchmant1) Runoff Area=121,100 sf 42.11% Impervious Runoff Depth>5.07"
Tc=6.0 min CN=89 Runoff=15.46 cfs 1.174 af

SubcatchmentS2: (Subcatchmant2) Runoff Area=1,949 sf 0.00% Impervious Runoff Depth>4.85"
Tc=6.0 min CN=87 Runoff=0.24 cfs 0.018 af

Reach DP-1: (DP-1) Inflow=6.20 cfs 1.174 af
Outflow=6.20 cfs 1.174 af

Reach DP-2: (DP-2) Inflow=0.24 cfs 0.018 af
Outflow=0.24 cfs 0.018 af

Pond 1P: (Existing Pond) Peak Elev=229.43' Storage=7,562 cf Inflow=15.46 cfs 1.174 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=6.20 cfs 1.174 af

Total Runoff Area = 2.825 ac Runoff Volume = 1.192 af Average Runoff Depth = 5.06"
58.56% Pervious = 1.654 ac 41.44% Impervious = 1.171 ac

Summary for Subcatchment S1: (Subcatchmant 1)

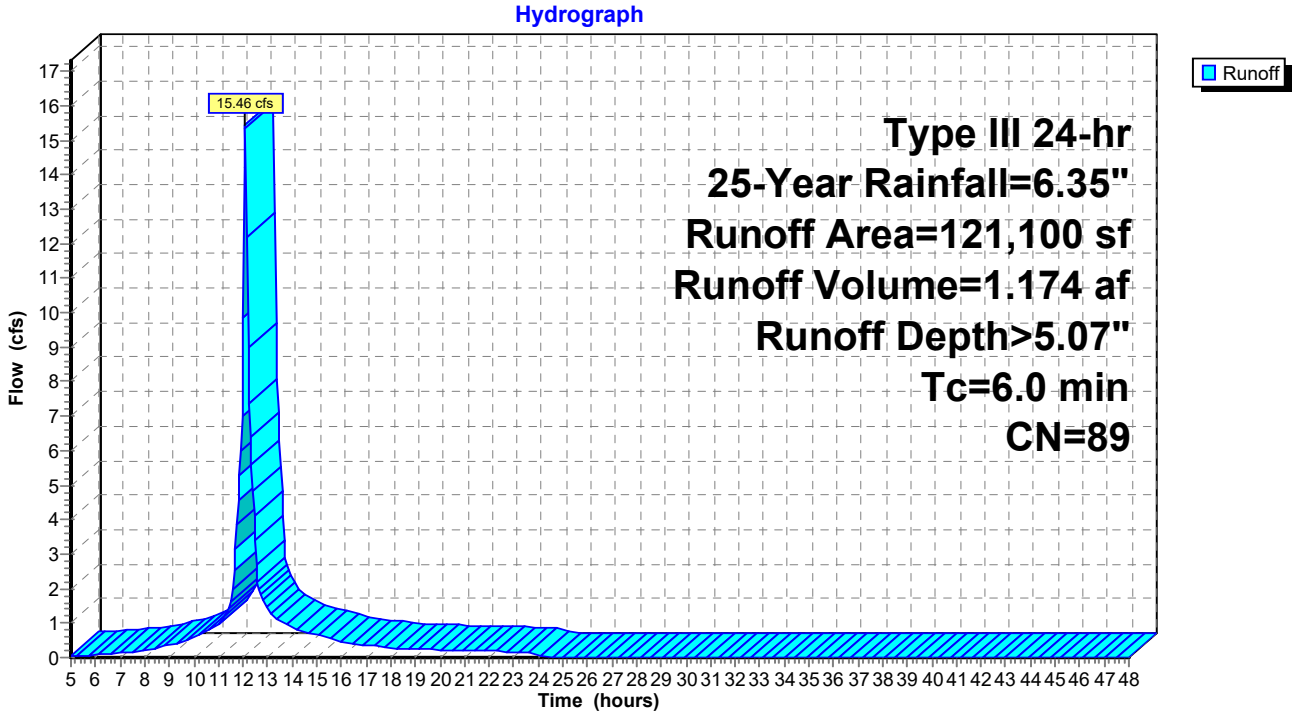
Runoff = 15.46 cfs @ 12.09 hrs, Volume= 1.174 af, Depth> 5.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
3,662	98	Paved parking, HSG A
47,328	98	Roofs, HSG C
42,009	89	Gravel roads, HSG C
28,101	74	>75% Grass cover, Good, HSG C
121,100	89	Weighted Average
70,110		57.89% Pervious Area
50,990		42.11% Impervious Area

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

Subcatchment S1: (Subcatchmant 1)



Summary for Subcatchment S2: (Subcatchmant 2)

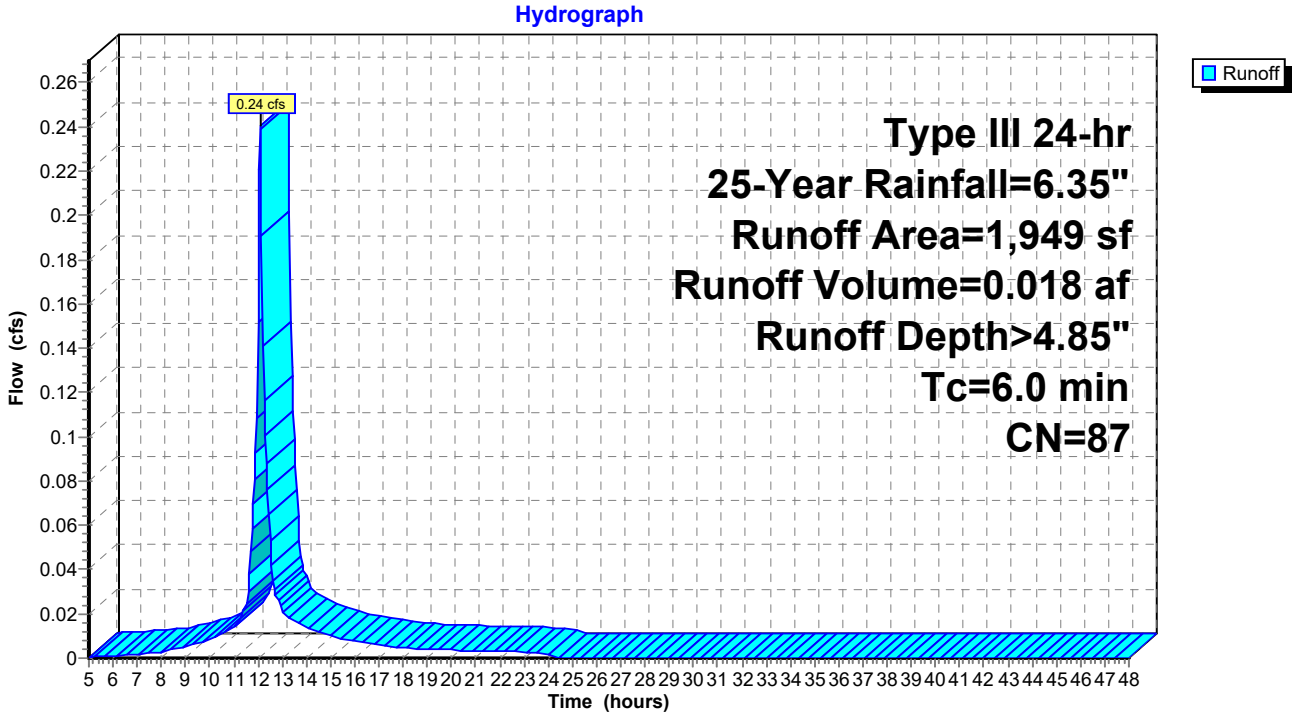
Runoff = 0.24 cfs @ 12.09 hrs, Volume= 0.018 af, Depth> 4.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
1,645	89	Gravel roads, HSG C
304	74	>75% Grass cover, Good, HSG C
1,949	87	Weighted Average
1,949		100.00% Pervious Area

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

Subcatchment S2: (Subcatchmant 2)

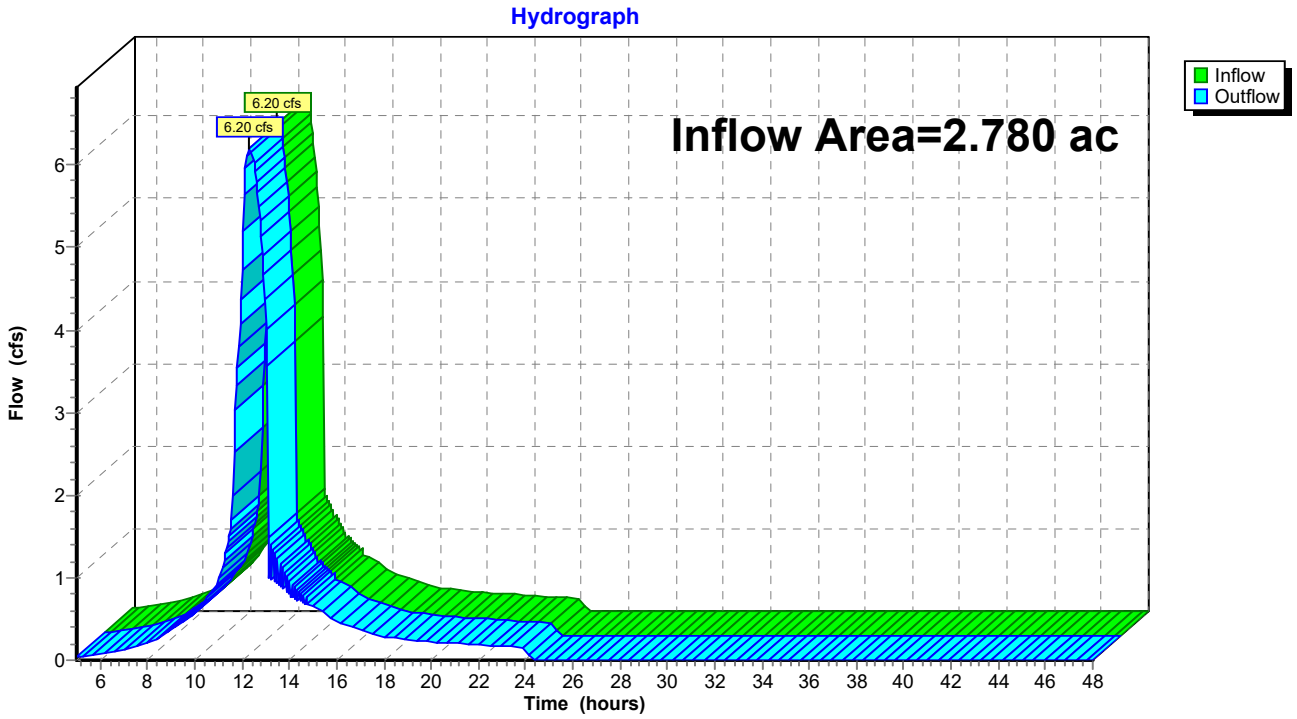


Summary for Reach DP-1: (DP-1)

Inflow Area = 2.780 ac, 42.11% Impervious, Inflow Depth > 5.07" for 25-Year event
Inflow = 6.20 cfs @ 12.31 hrs, Volume= 1.174 af
Outflow = 6.20 cfs @ 12.31 hrs, Volume= 1.174 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: (DP-1)

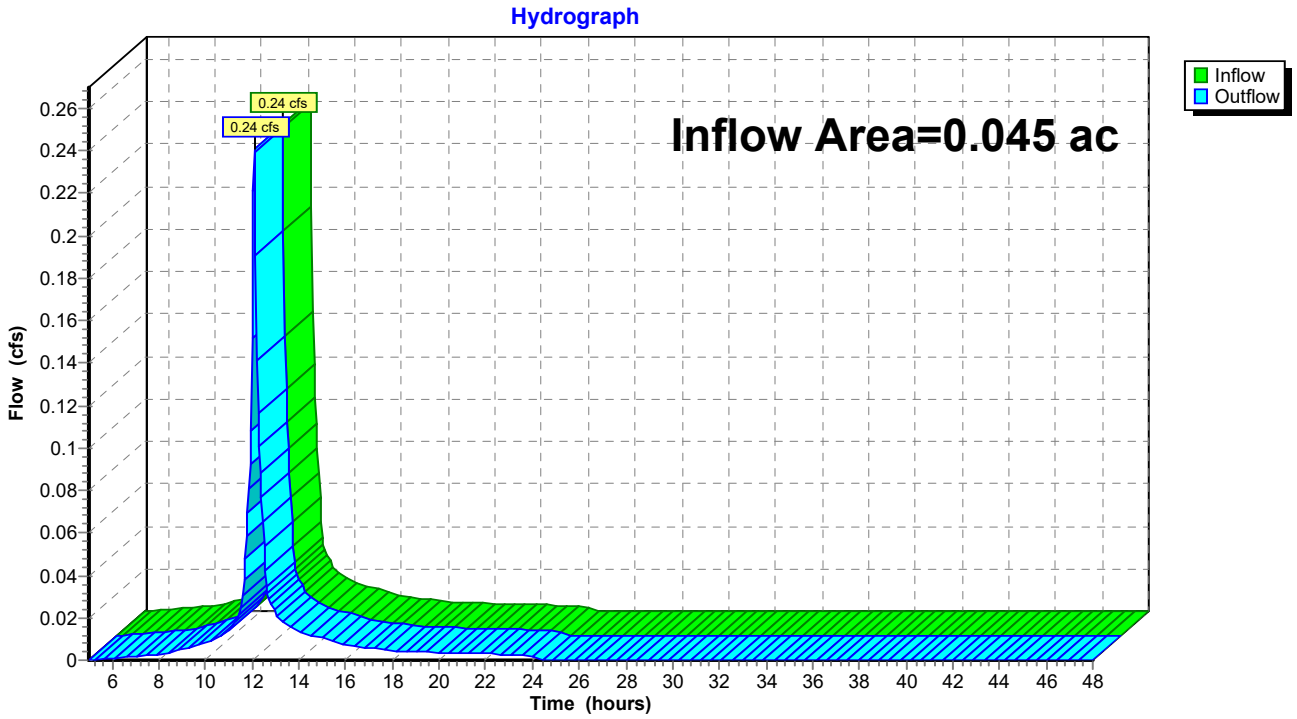


Summary for Reach DP-2: (DP-2)

Inflow Area = 0.045 ac, 0.00% Impervious, Inflow Depth > 4.85" for 25-Year event
Inflow = 0.24 cfs @ 12.09 hrs, Volume= 0.018 af
Outflow = 0.24 cfs @ 12.09 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: (DP-2)



Summary for Pond 1P: (Existing Pond)

Inflow Area = 2.780 ac, 42.11% Impervious, Inflow Depth > 5.07" for 25-Year event
Inflow = 15.46 cfs @ 12.09 hrs, Volume= 1.174 af
Outflow = 6.20 cfs @ 12.31 hrs, Volume= 1.174 af, Atten= 60%, Lag= 13.6 min
Primary = 6.20 cfs @ 12.31 hrs, Volume= 1.174 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 229.43' @ 12.31 hrs Surf.Area= 4,070 sf Storage= 7,562 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 6.0 min (793.1 - 787.1)

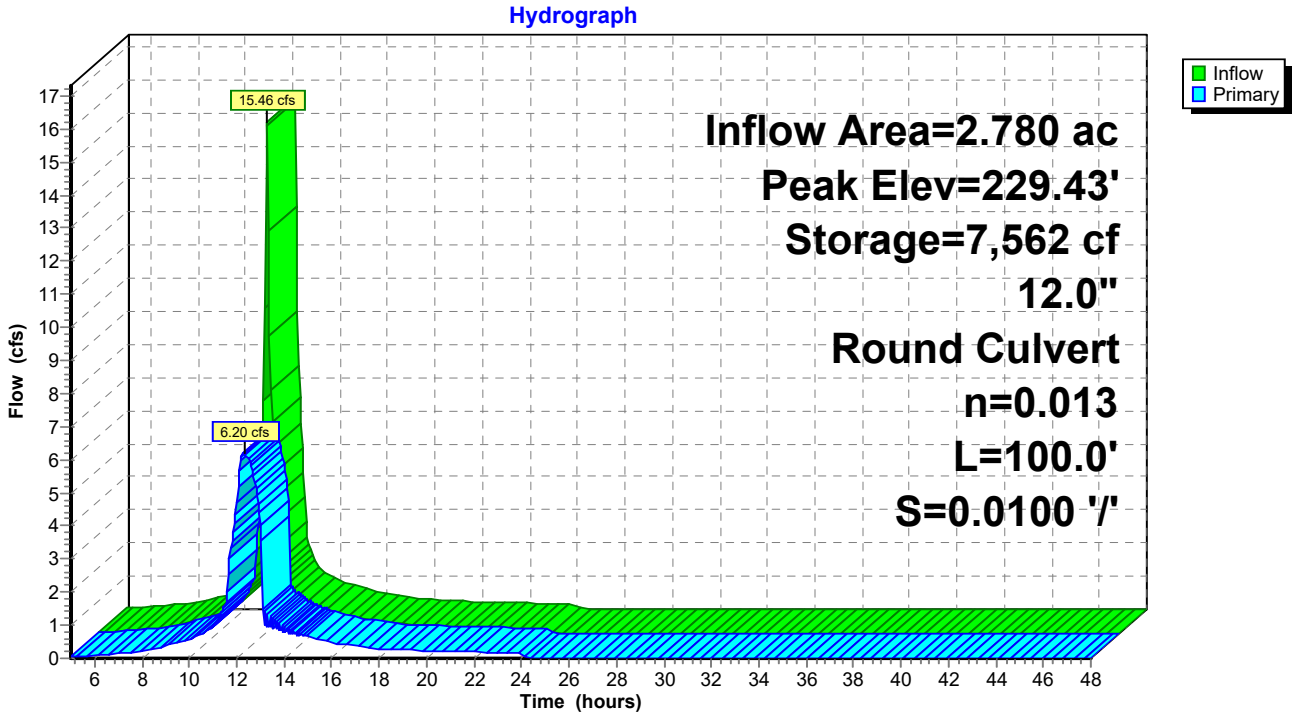
Volume	Invert	Avail.Storage	Storage Description
#1	224.94'	12,648 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.94	0	0	0
225.00	6	0	0
226.00	12	9	9
226.30	790	120	129
227.00	1,421	774	903
228.00	2,512	1,967	2,870
229.00	3,605	3,059	5,928
230.00	4,698	4,152	10,080
230.50	5,574	2,568	12,648

Device	Routing	Invert	Outlet Devices
#1	Primary	224.94'	**12.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 224.94' / 223.94' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf

Primary OutFlow Max=6.19 cfs @ 12.31 hrs HW=229.42' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 6.19 cfs @ 7.89 fps)

Pond 1P: (Existing Pond)



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: (Subcatchmant1) Runoff Area=121,100 sf 42.11% Impervious Runoff Depth>6.76"
Tc=6.0 min CN=89 Runoff=20.33 cfs 1.566 af

SubcatchmentS2: (Subcatchmant2) Runoff Area=1,949 sf 0.00% Impervious Runoff Depth>6.53"
Tc=6.0 min CN=87 Runoff=0.32 cfs 0.024 af

Reach DP-1: (DP-1) Inflow=6.87 cfs 1.566 af
Outflow=6.87 cfs 1.566 af

Reach DP-2: (DP-2) Inflow=0.32 cfs 0.024 af
Outflow=0.32 cfs 0.024 af

Pond 1P: (Existing Pond) Peak Elev=230.46' Storage=12,416 cf Inflow=20.33 cfs 1.566 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=6.87 cfs 1.566 af

Total Runoff Area = 2.825 ac Runoff Volume = 1.590 af Average Runoff Depth = 6.75"
58.56% Pervious = 1.654 ac 41.44% Impervious = 1.171 ac

Summary for Subcatchment S1: (Subcatchmant 1)

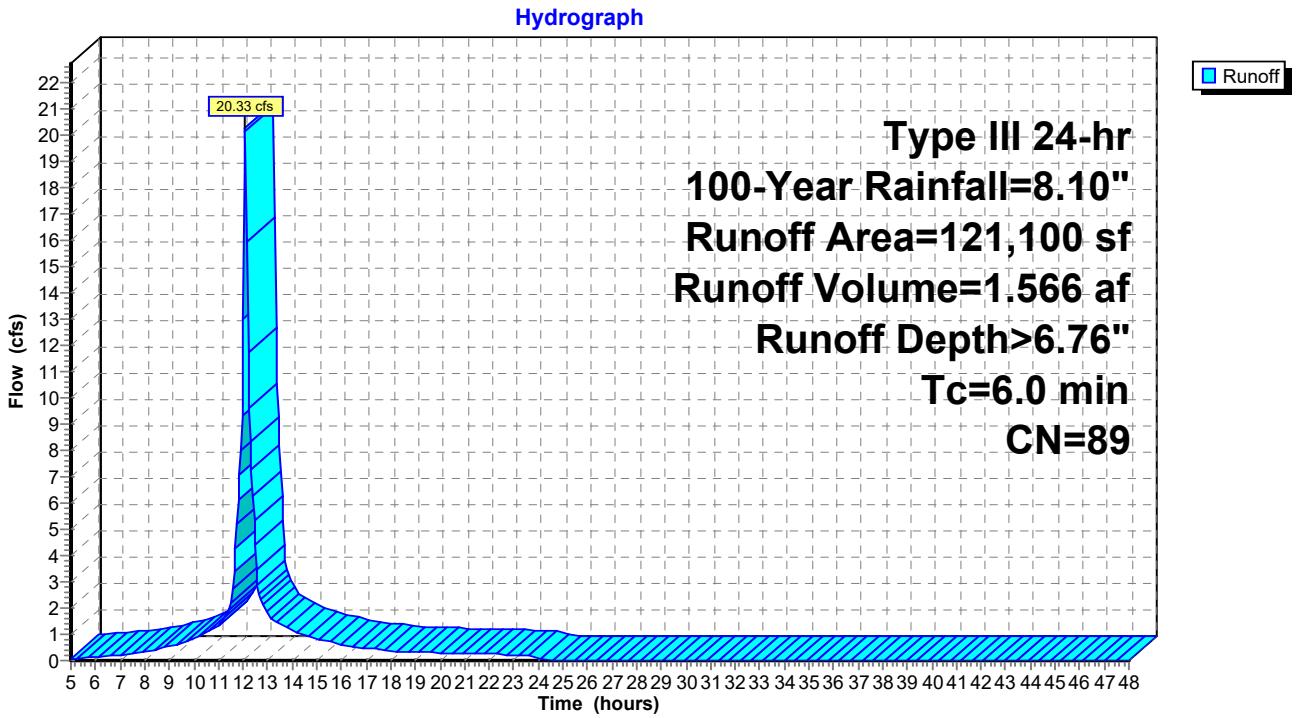
Runoff = 20.33 cfs @ 12.09 hrs, Volume= 1.566 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.10"

Area (sf)	CN	Description
3,662	98	Paved parking, HSG A
47,328	98	Roofs, HSG C
42,009	89	Gravel roads, HSG C
28,101	74	>75% Grass cover, Good, HSG C
121,100	89	Weighted Average
70,110		57.89% Pervious Area
50,990		42.11% Impervious Area

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

Subcatchment S1: (Subcatchmant 1)



Summary for Subcatchment S2: (Subcatchmant 2)

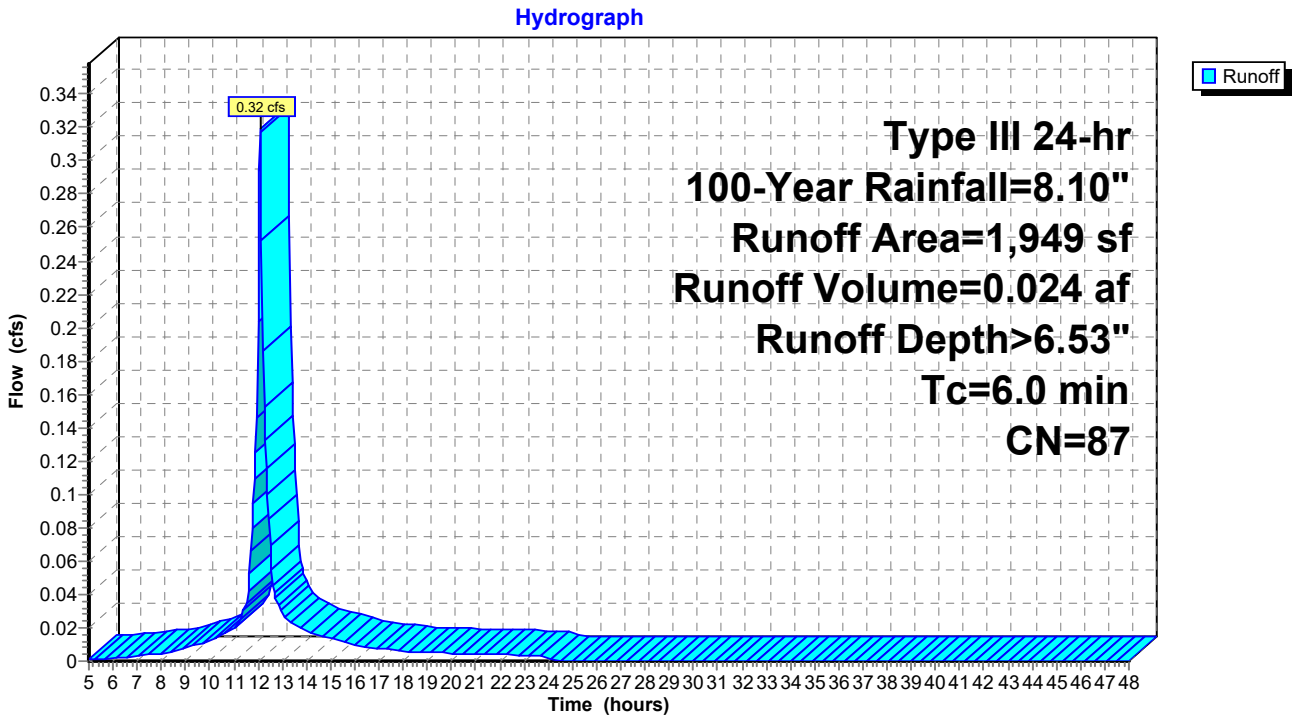
Runoff = 0.32 cfs @ 12.09 hrs, Volume= 0.024 af, Depth> 6.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.10"

Area (sf)	CN	Description
1,645	89	Gravel roads, HSG C
304	74	>75% Grass cover, Good, HSG C
1,949	87	Weighted Average
1,949		100.00% Pervious Area

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

Subcatchment S2: (Subcatchmant 2)

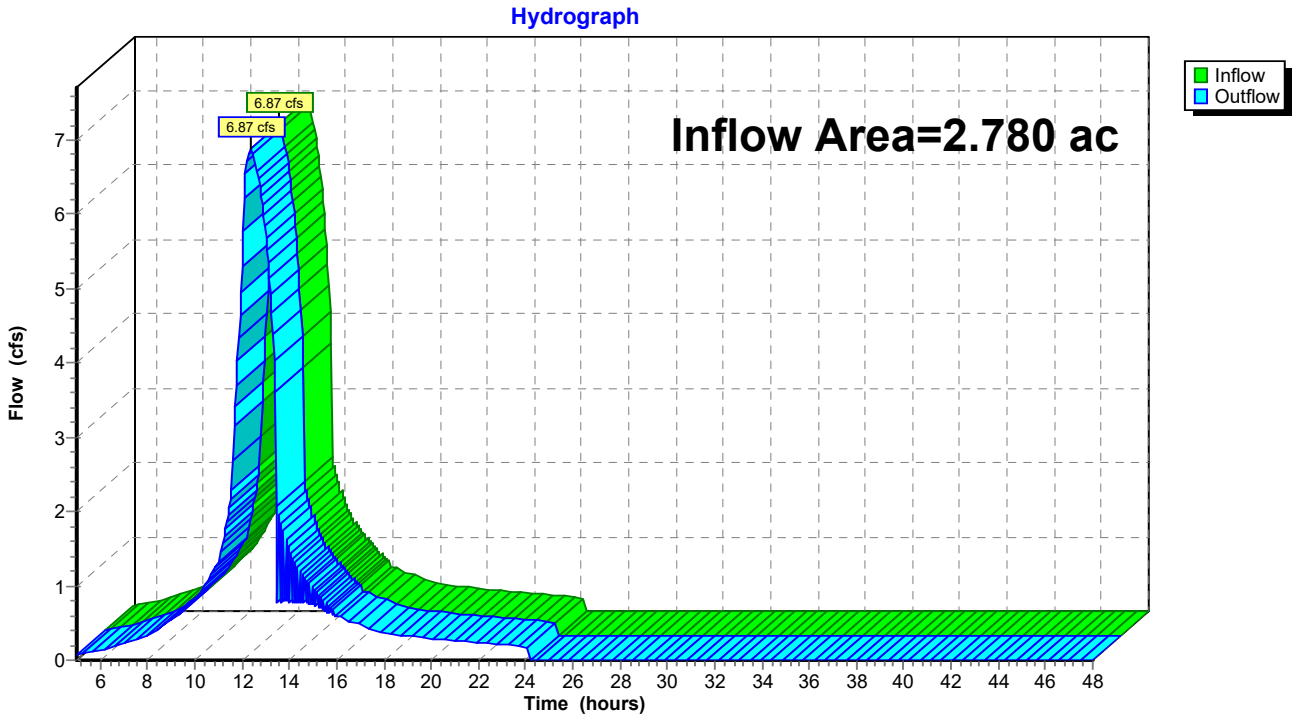


Summary for Reach DP-1: (DP-1)

Inflow Area = 2.780 ac, 42.11% Impervious, Inflow Depth > 6.76" for 100-Year event
Inflow = 6.87 cfs @ 12.37 hrs, Volume= 1.566 af
Outflow = 6.87 cfs @ 12.37 hrs, Volume= 1.566 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: (DP-1)

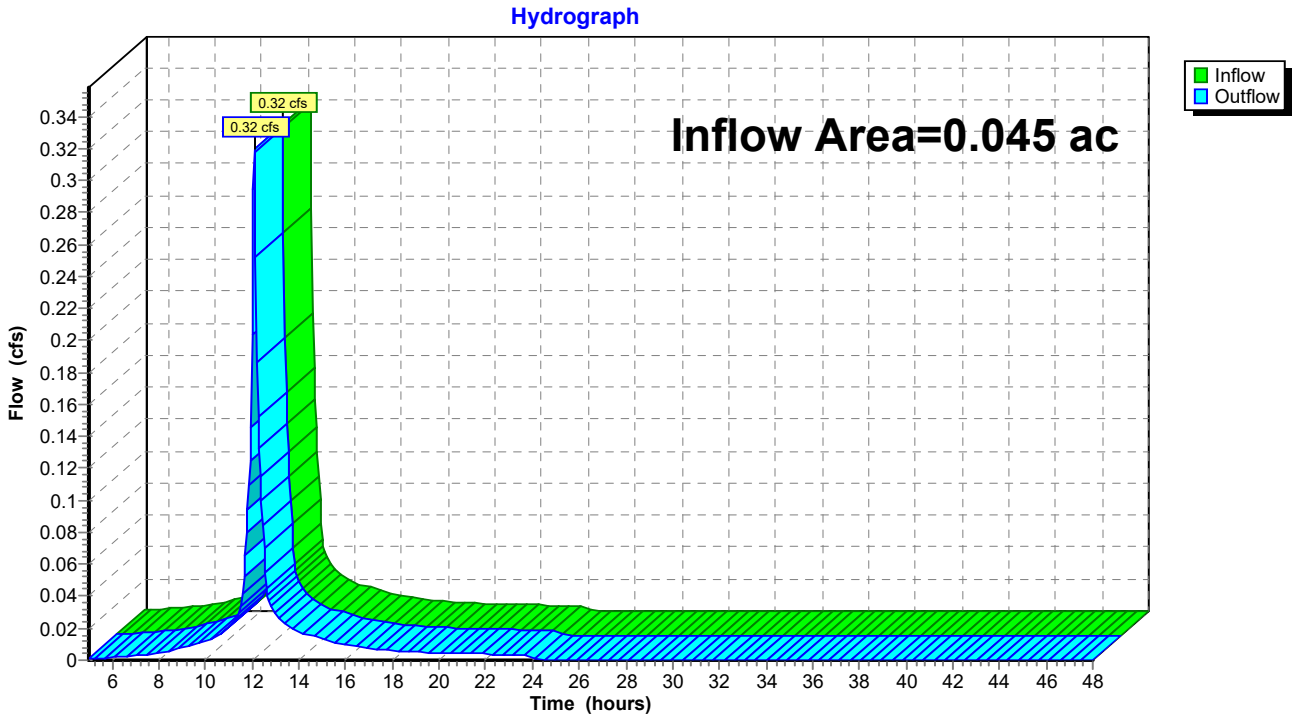


Summary for Reach DP-2: (DP-2)

Inflow Area = 0.045 ac, 0.00% Impervious, Inflow Depth > 6.53" for 100-Year event
Inflow = 0.32 cfs @ 12.09 hrs, Volume= 0.024 af
Outflow = 0.32 cfs @ 12.09 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: (DP-2)



Summary for Pond 1P: (Existing Pond)

Inflow Area = 2.780 ac, 42.11% Impervious, Inflow Depth > 6.76" for 100-Year event
Inflow = 20.33 cfs @ 12.09 hrs, Volume= 1.566 af
Outflow = 6.87 cfs @ 12.37 hrs, Volume= 1.566 af, Atten= 66%, Lag= 17.0 min
Primary = 6.87 cfs @ 12.37 hrs, Volume= 1.566 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 230.46' @ 12.37 hrs Surf.Area= 5,501 sf Storage= 12,416 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 9.5 min (790.3 - 780.8)

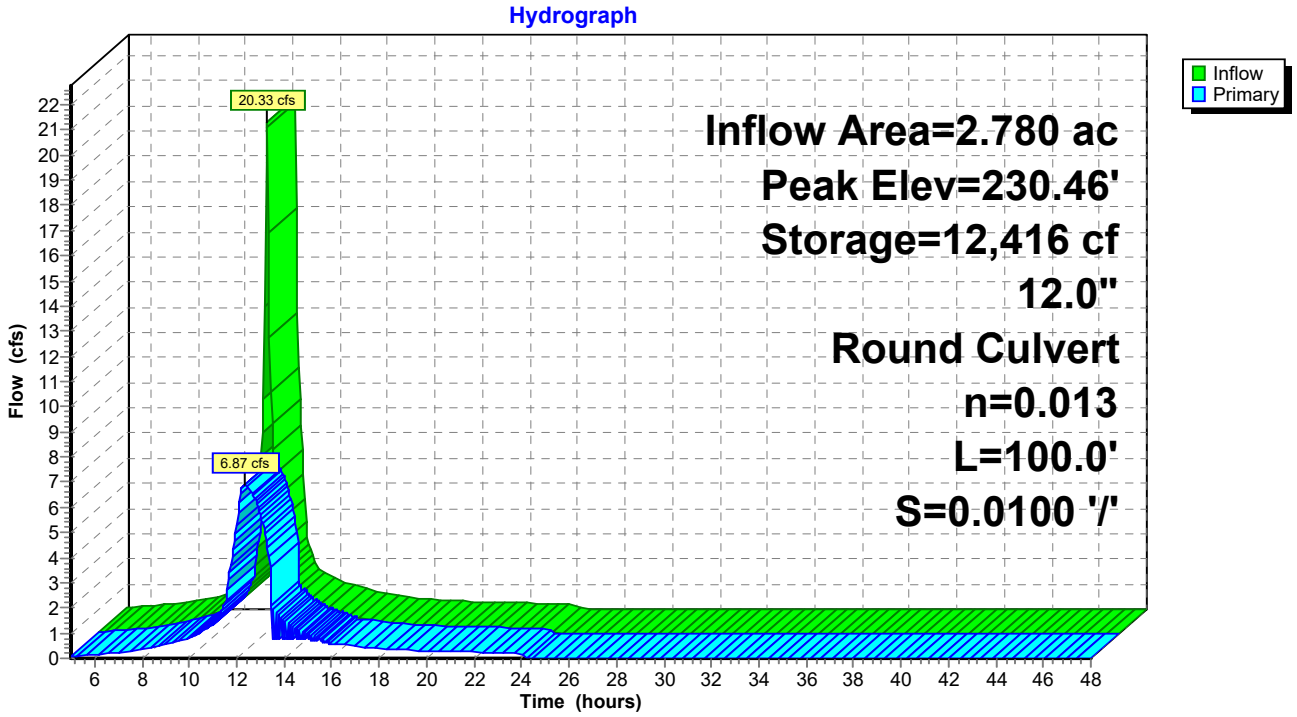
Volume	Invert	Avail.Storage	Storage Description
#1	224.94'	12,648 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.94	0	0	0
225.00	6	0	0
226.00	12	9	9
226.30	790	120	129
227.00	1,421	774	903
228.00	2,512	1,967	2,870
229.00	3,605	3,059	5,928
230.00	4,698	4,152	10,080
230.50	5,574	2,568	12,648

Device	Routing	Invert	Outlet Devices
#1	Primary	224.94'	**12.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 224.94' / 223.94' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf

Primary OutFlow Max=6.87 cfs @ 12.37 hrs HW=230.45' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 6.87 cfs @ 8.75 fps)

Pond 1P: (Existing Pond)



A P P E N D I X B

Post-Development Condition

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
424D	CANTON FINE SANDY LOAM	B
602	URBAN LAND	C

LEGEND

- WATERSHED DIVIDE
- TIME OF CONCENTRATION FLOW PATH
- DP-1 — DESIGN POINT
- S1 — SUBCATCHMENT
- P1 — POND
- SOIL TYPE BOUNDARY
- 629C — SOIL MAP UNIT SYMBOL
- H.S.G. A — HYROLOGIC SOIL GROUP DESIGNATION

424D

602

APN B7-3-16
609 PINE STREET
N/F
PERRY G REARDEY JR
BK 2397 PG 117

APN B7-3-1
276 BOSWELL STREET
N/F
WCV – 276 BOSWELL LLC
BK 49038 PG 476

EXISTING PROPERTY LINE (TYP.)

PROP. EDGE OF PAVEMENT (TYP.)

EXIST. SWALE (TYP.)

EXISTING TREE LINE (TYP.)

EXISTING SPEED BUMP (TYP.)

BIT. CONC.

CEM. CONC.

STAIRS

RET. WALL

LIMIT OF EXISTING BUILDING (TYP.)

GRAVEL

CELL TOWER ENCLOSURE

CHAIN LINK FENCE

S1

#21 PARKER DRIVE
1 STORY
CONCRETE AND METAL

CONC. PAD

APN B7-3-2
LOT AREA
456,366 8 F
10 45 ± AC

VINYL FENCE

PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL EXCAVATE TEST PITS TO A DEPTH OF 3 FT. TO CONFIRM SUITABILITY OF SUBBASE (TYP.)

JERSEY BARRIER (TYP.)

CONC. BLOCKS (TYP.)

P1

EXIST. BASIN

I=224.94
12"RCP

DP-1

S2

DP-2

12" RCP SMH

WHITE PAVEMENT MARKING (TYP.)

PARKER (PRIVATE - 40' WIDE) DRIVE

N 31°27'30" W 657.02'

GAS SERVICE

GRAPHIC SCALE
(IN FEET)
1 inch = 30 ft.

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N:\MEG\2022 PROJECTS\222-206 ATL OLIVER II - 21 PARKER DRIVE, AVON\dwg\222-206 SITE PLANS.dwg

REV	DATE	DESCRIPTION	BY	APP

MCKENZIE ENGINEERING GROUP
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3600
F: 781.792.0333
www.mckeng.com

SITE DEVELOPMENT PLAN

21 PARKER DRIVE
(ASSESSOR'S PARCEL NO. B7-3-2)
AVON, MASSACHUSETTS

PROFESSIONAL ENGINEER:

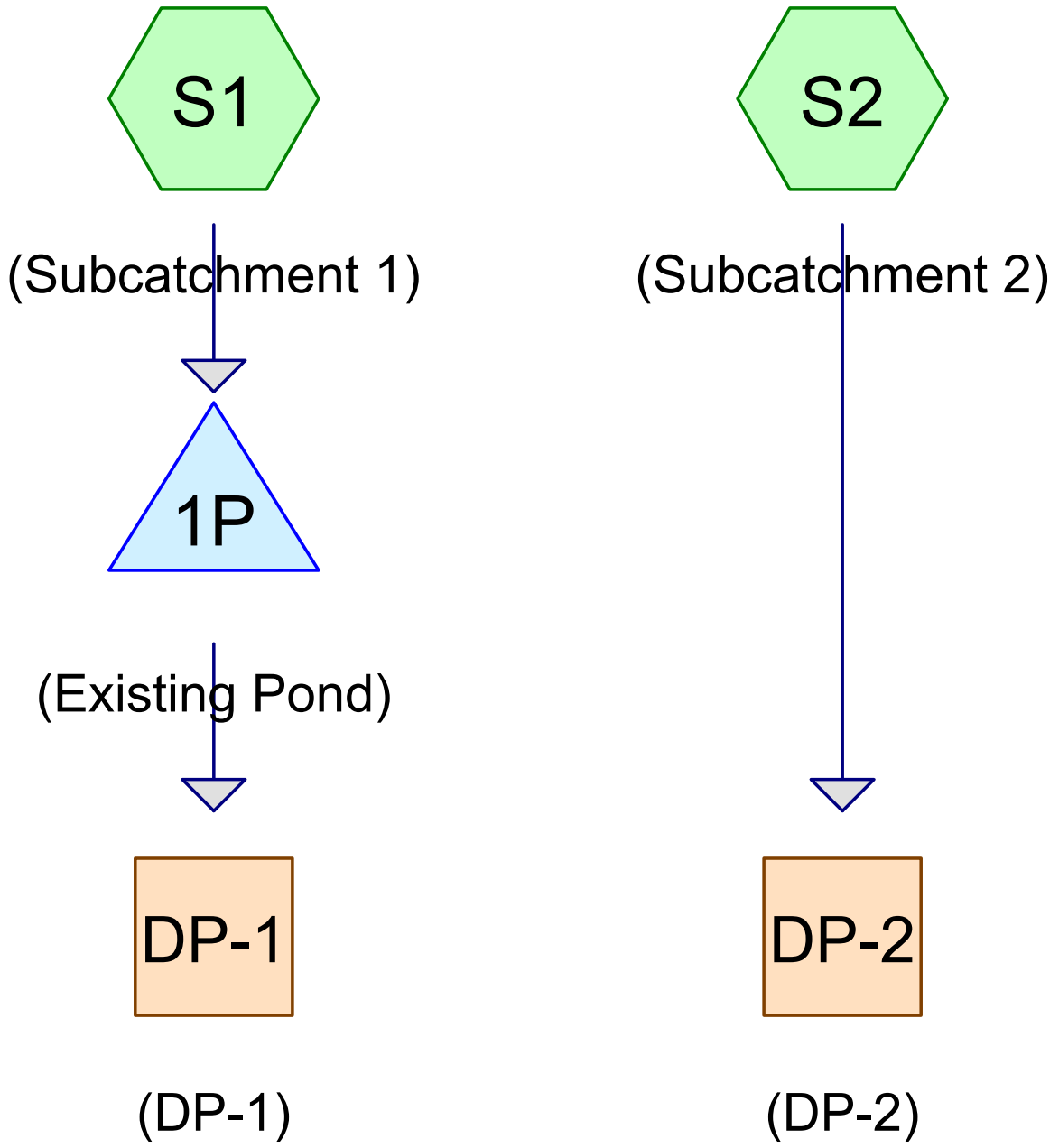
NOT FOR CONSTRUCTION

OWNER/APPLICANT:
ATLANTIC OLIVER II 21 PARKER DRIVE LLC
300 CONGRESS STREET
BOSTON, MASSACHUSETTS 02210

DRAWN BY:	ARB
DESIGNED BY:	AWL
CHECKED BY:	RKEM
APPROVED BY:	RCM
DATE:	NOVEMBER 18, 2022
SCALE:	1"=30'
PROJECT NO.:	222-206

DWG. TITLE:
POST-DEVELOPMENT WATERSHED PLAN

DWG. NO:
WS-2



Subcat Reach Pond Link

Routing Diagram for 222-206-POST
Prepared by MCKENZIE ENGINEERING GROUP, INC., Printed 12/8/2022
HydroCAD® 10.00-21 s/n 00452 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.584	74	>75% Grass cover, Good, HSG C (S1, S2)
0.057	89	Gravel roads, HSG C (S1)
1.081	98	Paved parking, HSG A (S1)
0.016	98	Paved parking, HSG C (S2)
1.087	98	Roofs, HSG C (S1)
2.825	**93**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.081	HSG A	S1
0.000	HSG B	
1.743	HSG C	S1, S2
0.000	HSG D	
0.000	Other	
2.825		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.584	0.000	0.000	0.584	>75% Grass cover, Good	S1, S2
0.000	0.000	0.057	0.000	0.000	0.057	Gravel roads	S1
1.081	0.000	0.016	0.000	0.000	1.097	Paved parking	S1, S2
0.000	0.000	1.087	0.000	0.000	1.087	Roofs	S1
1.081	**0.000**	**1.743**	**0.000**	**0.000**	**2.825**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	224.94	223.94	100.0	0.0100	0.013	12.0	0.0	0.0

Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: (Subcatchment1) Runoff Area=122,344 sf 77.19% Impervious Runoff Depth>2.65"
Tc=6.0 min CN=93 Runoff=8.22 cfs 0.619 af

SubcatchmentS2: (Subcatchment2) Runoff Area=705 sf 98.58% Impervious Runoff Depth>3.12"
Tc=6.0 min CN=98 Runoff=0.05 cfs 0.004 af

Reach DP-1: (DP-1) Inflow=5.01 cfs 0.619 af
Outflow=5.01 cfs 0.619 af

Reach DP-2: (DP-2) Inflow=0.05 cfs 0.004 af
Outflow=0.05 cfs 0.004 af

Pond 1P: (Existing Pond) Peak Elev=227.87' Storage=1,833 cf Inflow=8.22 cfs 0.619 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=5.01 cfs 0.619 af

Total Runoff Area = 2.825 ac Runoff Volume = 0.624 af Average Runoff Depth = 2.65"
22.69% Pervious = 0.641 ac 77.31% Impervious = 2.184 ac

Summary for Subcatchment S1: (Subcatchment 1)

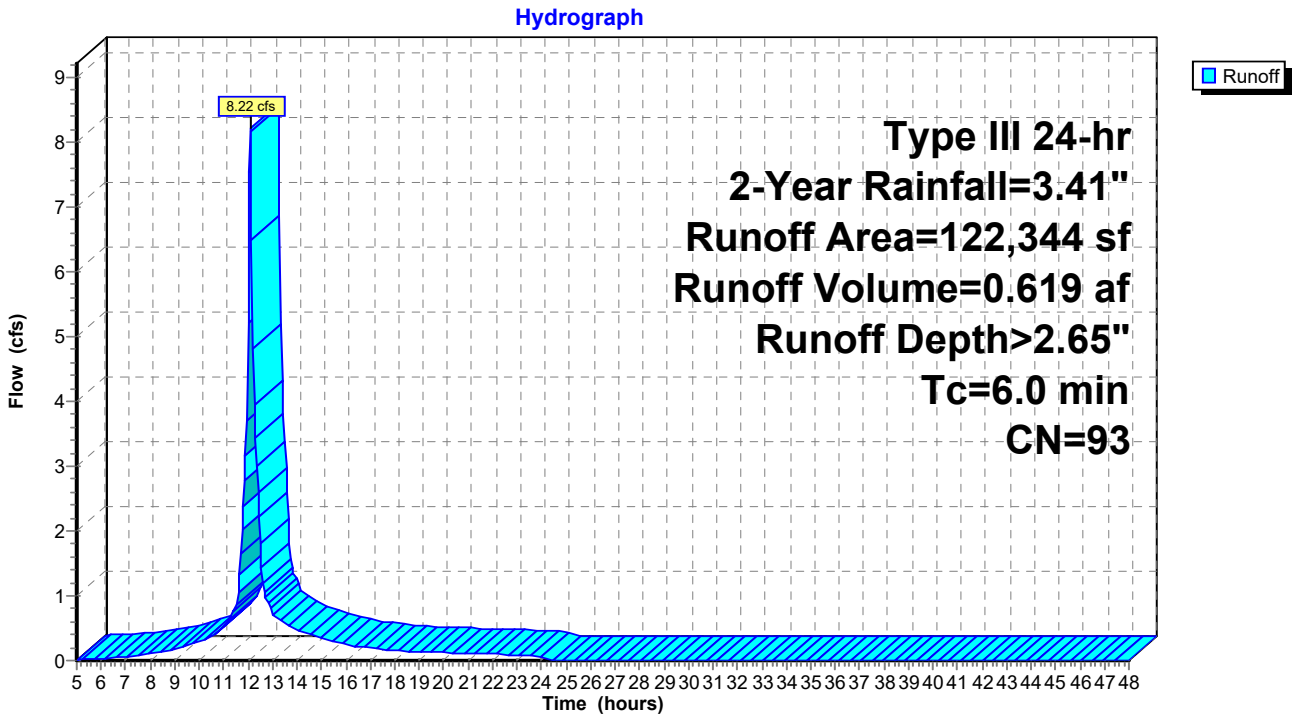
Runoff = 8.22 cfs @ 12.09 hrs, Volume= 0.619 af, Depth> 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.41"

Area (sf)	CN	Description
47,106	98	Paved parking, HSG A
47,328	98	Roofs, HSG C
2,491	89	Gravel roads, HSG C
25,419	74	>75% Grass cover, Good, HSG C
122,344	93	Weighted Average
27,910		22.81% Pervious Area
94,434		77.19% Impervious Area

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

Subcatchment S1: (Subcatchment 1)



Summary for Subcatchment S2: (Subcatchment 2)

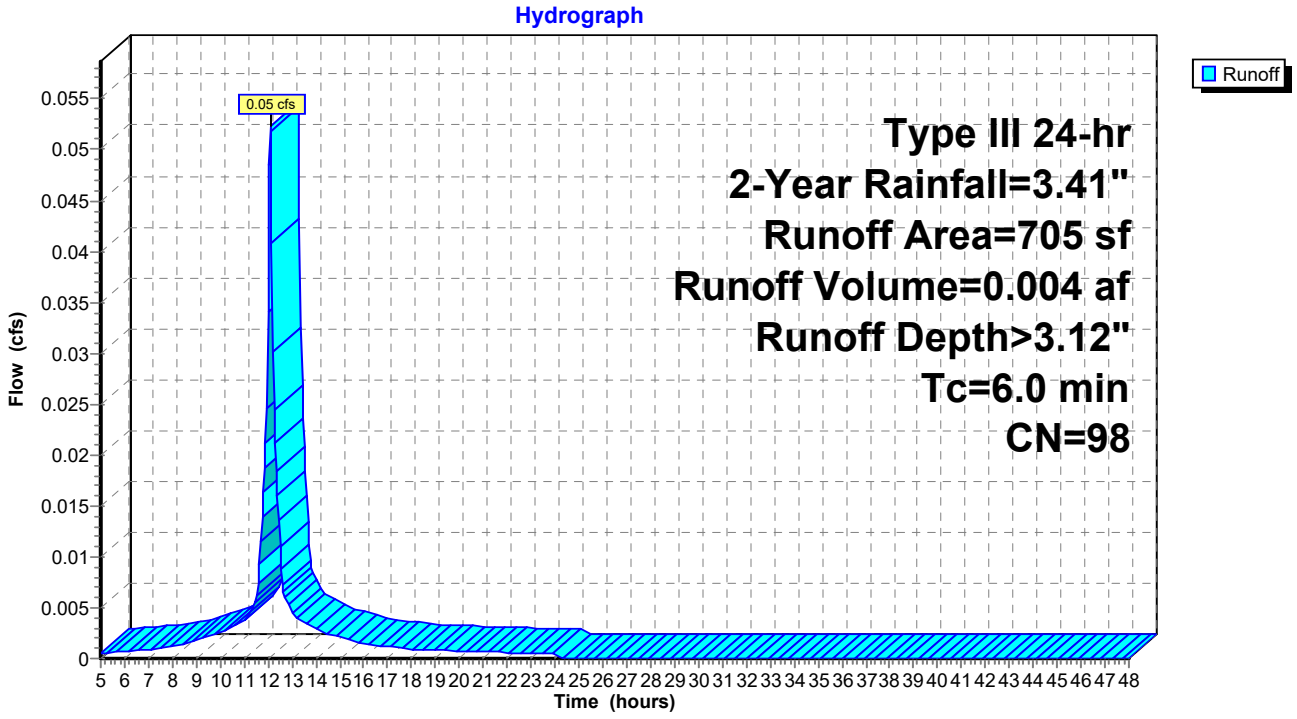
Runoff = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af, Depth> 3.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.41"

Area (sf)	CN	Description
695	98	Paved parking, HSG C
10	74	>75% Grass cover, Good, HSG C
705	98	Weighted Average
10		1.42% Pervious Area
695		98.58% Impervious Area

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

Subcatchment S2: (Subcatchment 2)

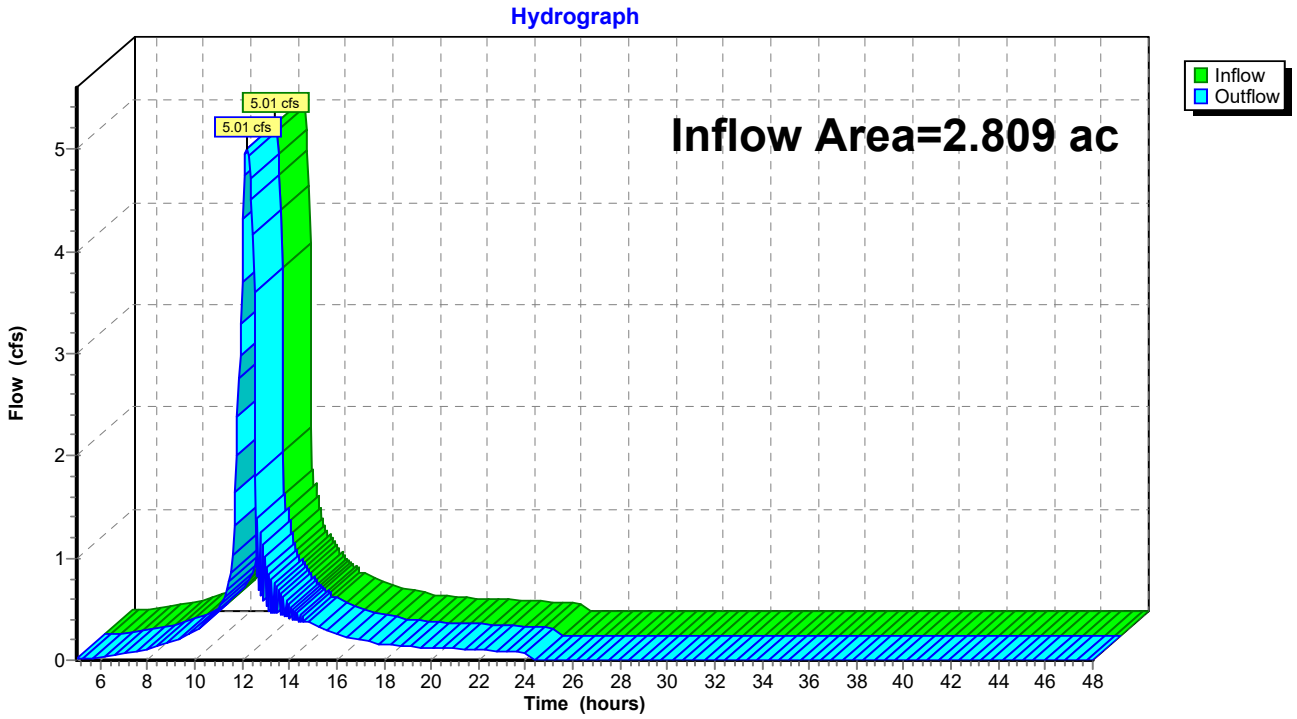


Summary for Reach DP-1: (DP-1)

Inflow Area = 2.809 ac, 77.19% Impervious, Inflow Depth > 2.65" for 2-Year event
Inflow = 5.01 cfs @ 12.20 hrs, Volume= 0.619 af
Outflow = 5.01 cfs @ 12.20 hrs, Volume= 0.619 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: (DP-1)

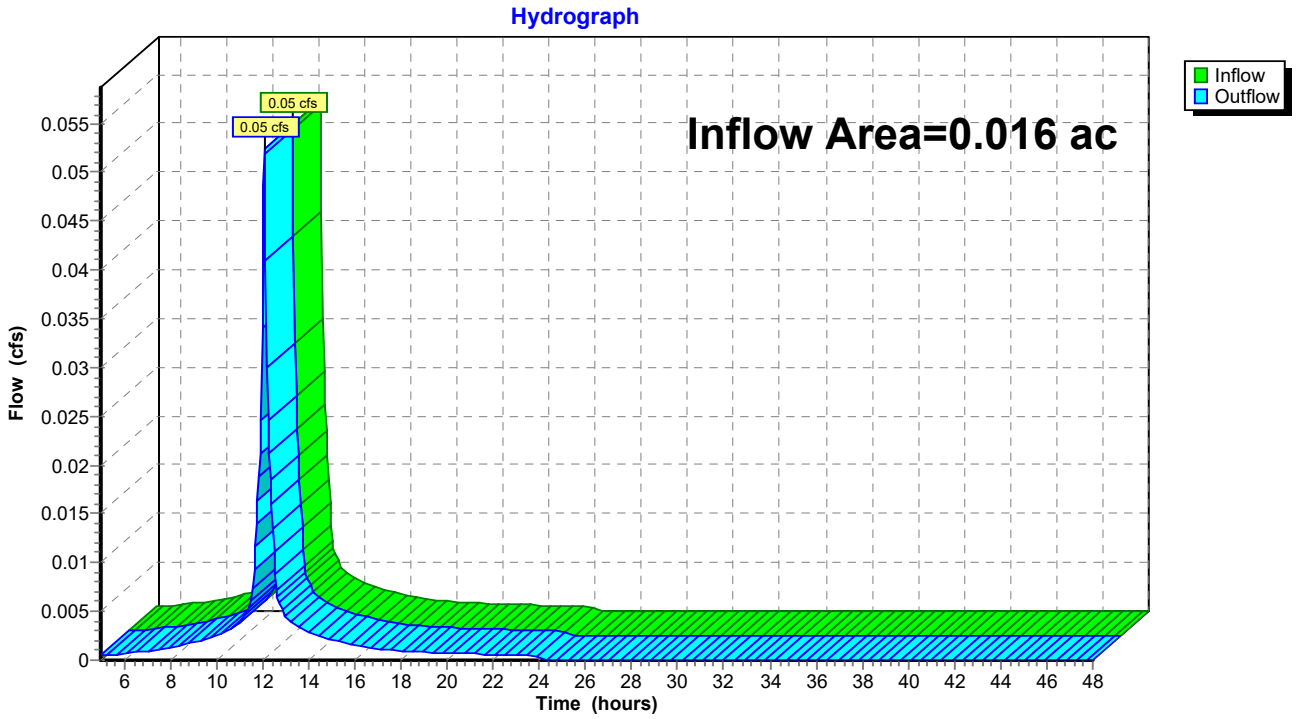


Summary for Reach DP-2: (DP-2)

Inflow Area = 0.016 ac, 98.58% Impervious, Inflow Depth > 3.12" for 2-Year event
Inflow = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af
Outflow = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: (DP-2)



Summary for Pond 1P: (Existing Pond)

Inflow Area = 2.809 ac, 77.19% Impervious, Inflow Depth > 2.65" for 2-Year event
Inflow = 8.22 cfs @ 12.09 hrs, Volume= 0.619 af
Outflow = 5.01 cfs @ 12.20 hrs, Volume= 0.619 af, Atten= 39%, Lag= 6.8 min
Primary = 5.01 cfs @ 12.20 hrs, Volume= 0.619 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 227.87' @ 12.20 hrs Surf.Area= 2,148 sf Storage= 1,833 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.4 min (792.2 - 790.8)

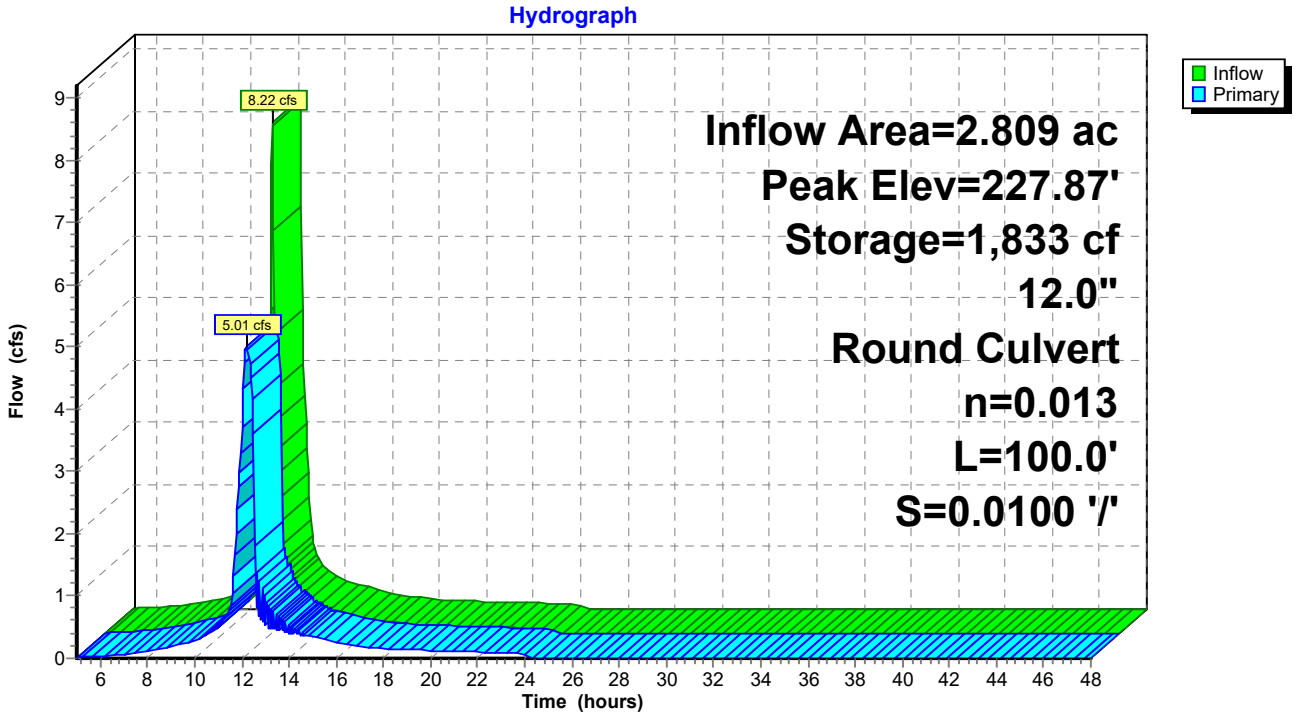
Volume	Invert	Avail.Storage	Storage Description
#1	224.94'	16,746 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.94	0	0	0
225.00	6	0	0
226.00	12	9	9
226.03	332	5	14
227.00	793	546	560
228.00	2,358	1,576	2,135
228.01	2,512	24	2,160
229.00	3,605	3,028	5,188
230.00	8,944	6,275	11,462
230.50	12,191	5,284	16,746

Device	Routing	Invert	Outlet Devices
#1	Primary	224.94'	**12.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 224.94' / 223.94' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf

Primary OutFlow Max=5.00 cfs @ 12.20 hrs HW=227.86' (Free Discharge)
1=Culvert (Barrel Controls 5.00 cfs @ 6.37 fps)

Pond 1P: (Existing Pond)



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: (Subcatchment1) Runoff Area=122,344 sf 77.19% Impervious Runoff Depth>4.39"
Tc=6.0 min CN=93 Runoff=13.31 cfs 1.028 af

SubcatchmentS2: (Subcatchment2) Runoff Area=705 sf 98.58% Impervious Runoff Depth>4.85"
Tc=6.0 min CN=98 Runoff=0.08 cfs 0.007 af

Reach DP-1: (DP-1) Inflow=5.94 cfs 1.028 af
Outflow=5.94 cfs 1.028 af

Reach DP-2: (DP-2) Inflow=0.08 cfs 0.007 af
Outflow=0.08 cfs 0.007 af

Pond 1P: (Existing Pond) Peak Elev=229.07' Storage=5,442 cf Inflow=13.31 cfs 1.028 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=5.94 cfs 1.028 af

Total Runoff Area = 2.825 ac Runoff Volume = 1.035 af Average Runoff Depth = 4.40"
22.69% Pervious = 0.641 ac 77.31% Impervious = 2.184 ac

Summary for Subcatchment S1: (Subcatchment 1)

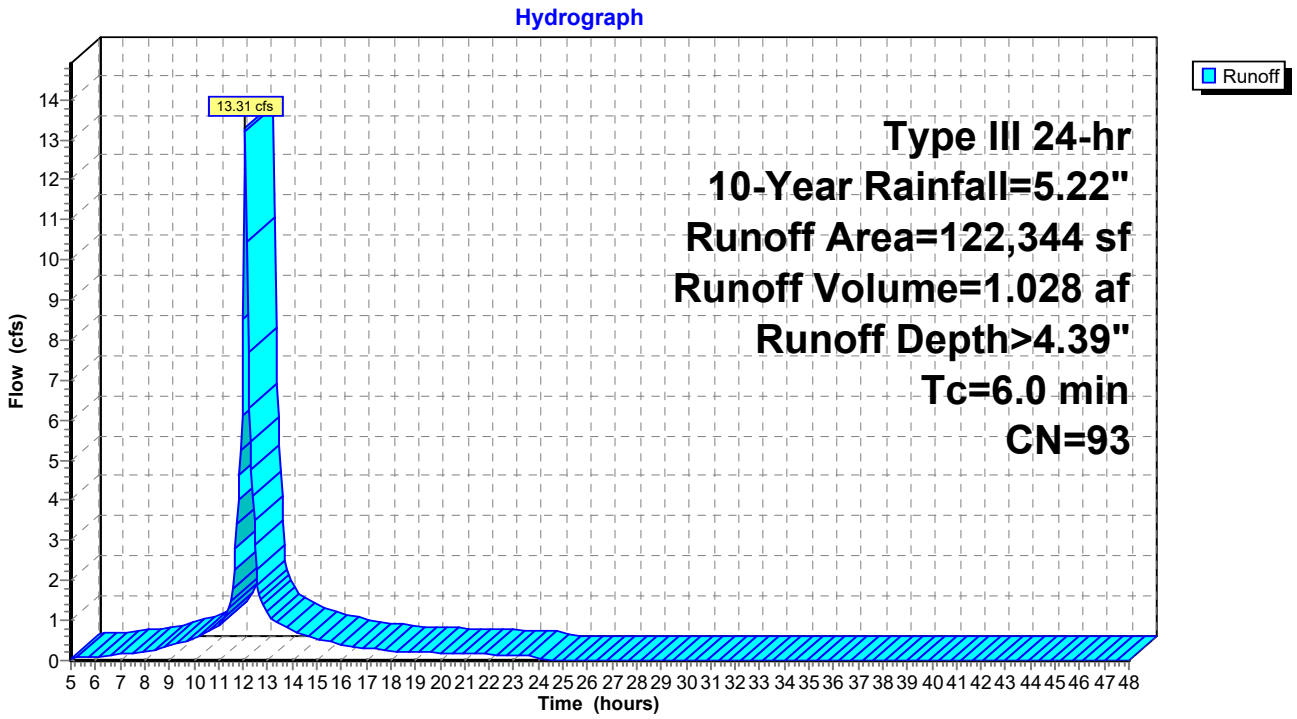
Runoff = 13.31 cfs @ 12.09 hrs, Volume= 1.028 af, Depth> 4.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.22"

Area (sf)	CN	Description
47,106	98	Paved parking, HSG A
47,328	98	Roofs, HSG C
2,491	89	Gravel roads, HSG C
25,419	74	>75% Grass cover, Good, HSG C
122,344	93	Weighted Average
27,910		22.81% Pervious Area
94,434		77.19% Impervious Area

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

Subcatchment S1: (Subcatchment 1)



Summary for Subcatchment S2: (Subcatchment 2)

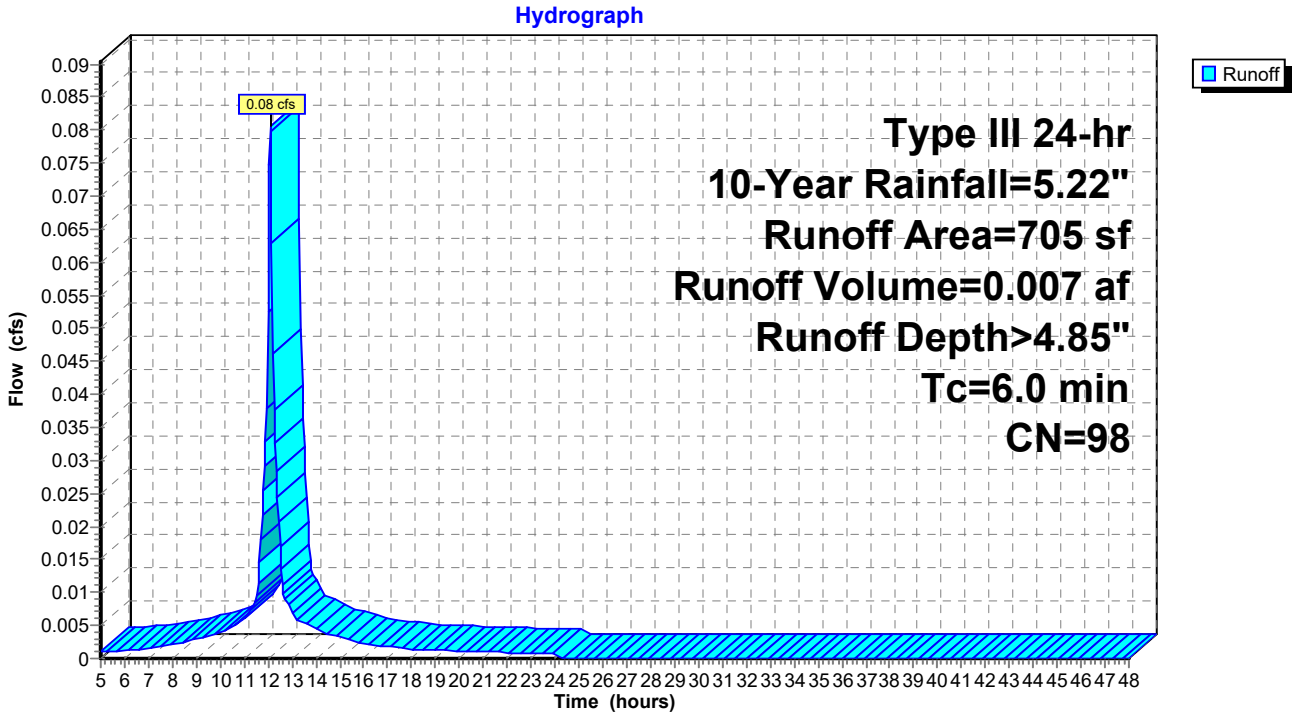
Runoff = 0.08 cfs @ 12.09 hrs, Volume= 0.007 af, Depth> 4.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.22"

Area (sf)	CN	Description
695	98	Paved parking, HSG C
10	74	>75% Grass cover, Good, HSG C
705	98	Weighted Average
10		1.42% Pervious Area
695		98.58% Impervious Area

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

Subcatchment S2: (Subcatchment 2)

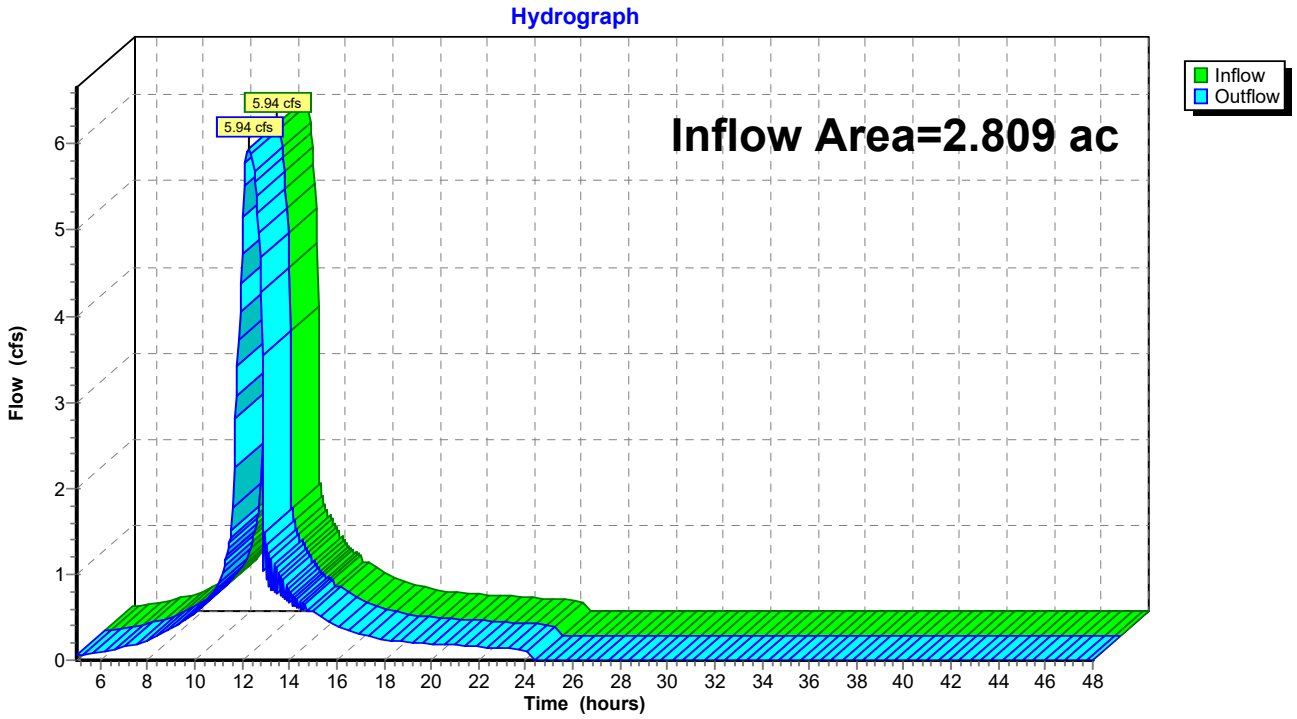


Summary for Reach DP-1: (DP-1)

Inflow Area = 2.809 ac, 77.19% Impervious, Inflow Depth > 4.39" for 10-Year event
Inflow = 5.94 cfs @ 12.27 hrs, Volume= 1.028 af
Outflow = 5.94 cfs @ 12.27 hrs, Volume= 1.028 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: (DP-1)

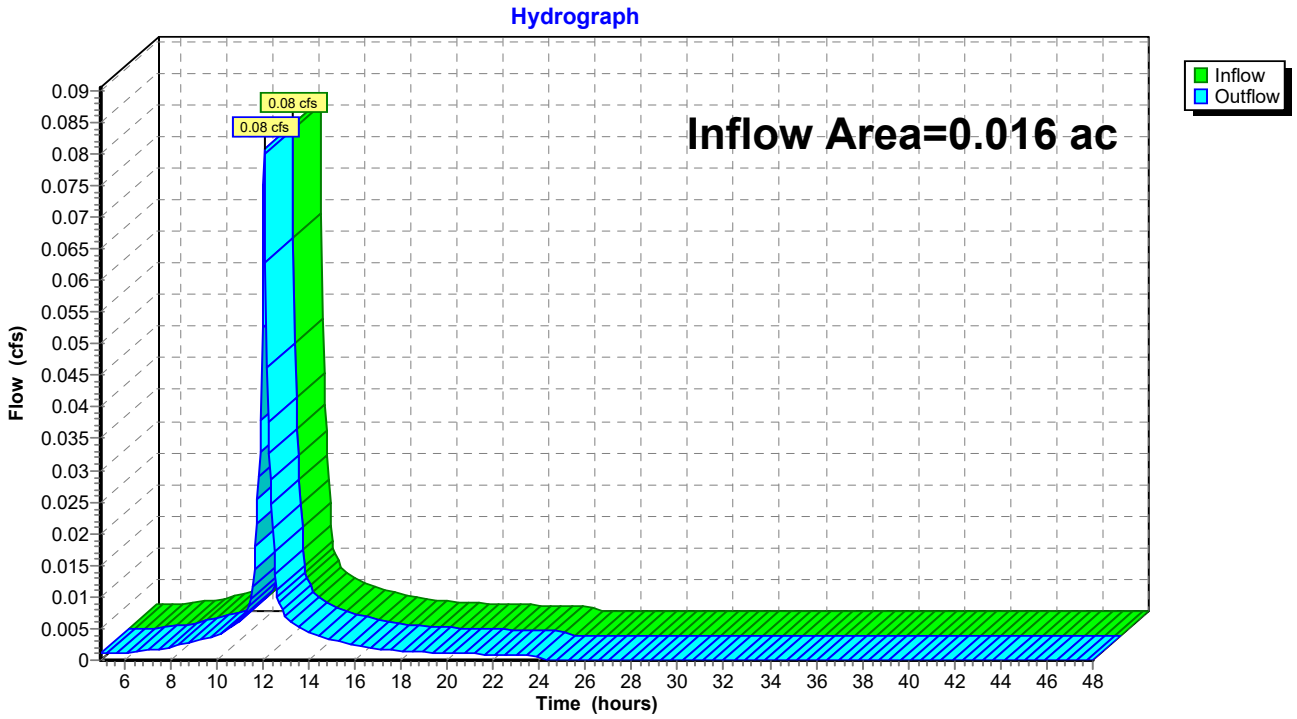


Summary for Reach DP-2: (DP-2)

Inflow Area = 0.016 ac, 98.58% Impervious, Inflow Depth > 4.85" for 10-Year event
Inflow = 0.08 cfs @ 12.09 hrs, Volume= 0.007 af
Outflow = 0.08 cfs @ 12.09 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: (DP-2)



Summary for Pond 1P: (Existing Pond)

Inflow Area = 2.809 ac, 77.19% Impervious, Inflow Depth > 4.39" for 10-Year event
Inflow = 13.31 cfs @ 12.09 hrs, Volume= 1.028 af
Outflow = 5.94 cfs @ 12.27 hrs, Volume= 1.028 af, Atten= 55%, Lag= 11.1 min
Primary = 5.94 cfs @ 12.27 hrs, Volume= 1.028 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 229.07' @ 12.27 hrs Surf.Area= 3,964 sf Storage= 5,442 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.1 min (783.6 - 779.5)

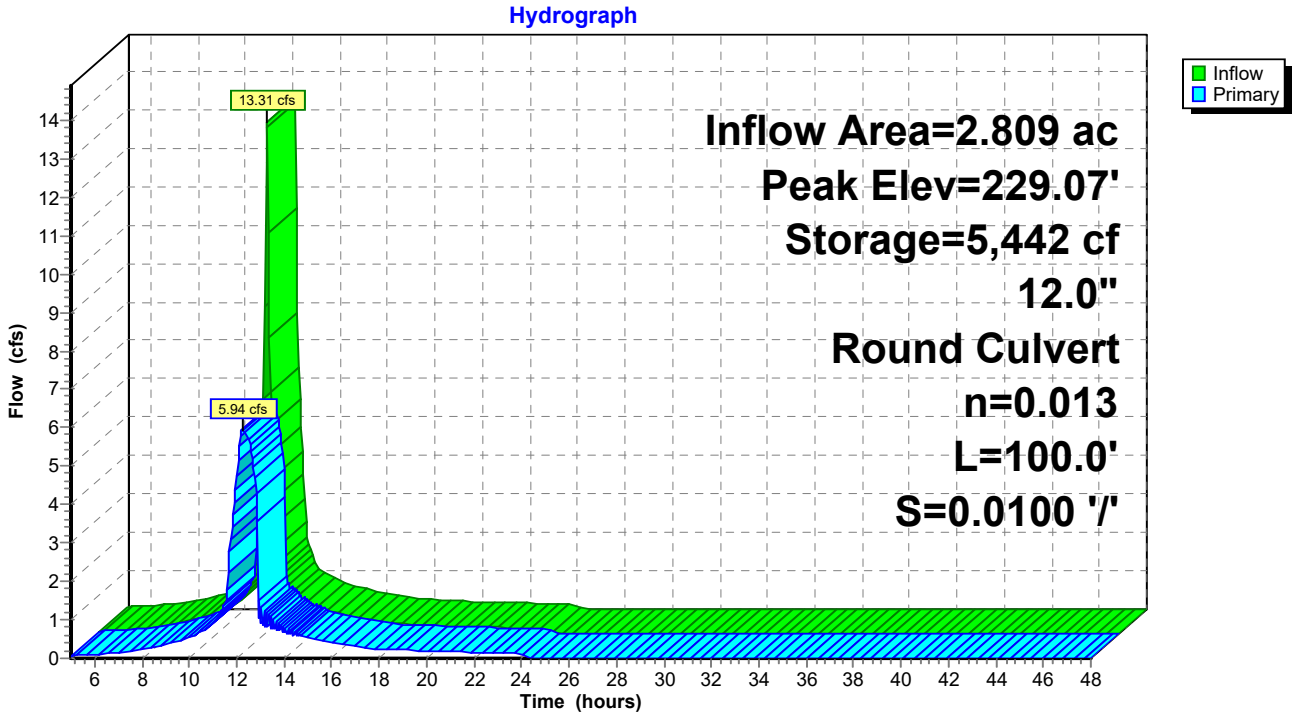
Volume	Invert	Avail.Storage	Storage Description
#1	224.94'	16,746 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.94	0	0	0
225.00	6	0	0
226.00	12	9	9
226.03	332	5	14
227.00	793	546	560
228.00	2,358	1,576	2,135
228.01	2,512	24	2,160
229.00	3,605	3,028	5,188
230.00	8,944	6,275	11,462
230.50	12,191	5,284	16,746

Device	Routing	Invert	Outlet Devices
#1	Primary	224.94'	**12.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 224.94' / 223.94' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf

Primary OutFlow Max=5.94 cfs @ 12.27 hrs HW=229.06' (Free Discharge)
1=Culvert (Barrel Controls 5.94 cfs @ 7.56 fps)

Pond 1P: (Existing Pond)



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: (Subcatchment1) Runoff Area=122,344 sf 77.19% Impervious Runoff Depth>5.49"
Tc=6.0 min CN=93 Runoff=16.45 cfs 1.284 af

SubcatchmentS2: (Subcatchment2) Runoff Area=705 sf 98.58% Impervious Runoff Depth>5.93"
Tc=6.0 min CN=98 Runoff=0.10 cfs 0.008 af

Reach DP-1: (DP-1) Inflow=6.32 cfs 1.284 af
Outflow=6.32 cfs 1.284 af

Reach DP-2: (DP-2) Inflow=0.10 cfs 0.008 af
Outflow=0.10 cfs 0.008 af

Pond 1P: (Existing Pond) Peak Elev=229.60' Storage=8,310 cf Inflow=16.45 cfs 1.284 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=6.32 cfs 1.284 af

Total Runoff Area = 2.825 ac Runoff Volume = 1.292 af Average Runoff Depth = 5.49"
22.69% Pervious = 0.641 ac 77.31% Impervious = 2.184 ac

Summary for Subcatchment S1: (Subcatchment 1)

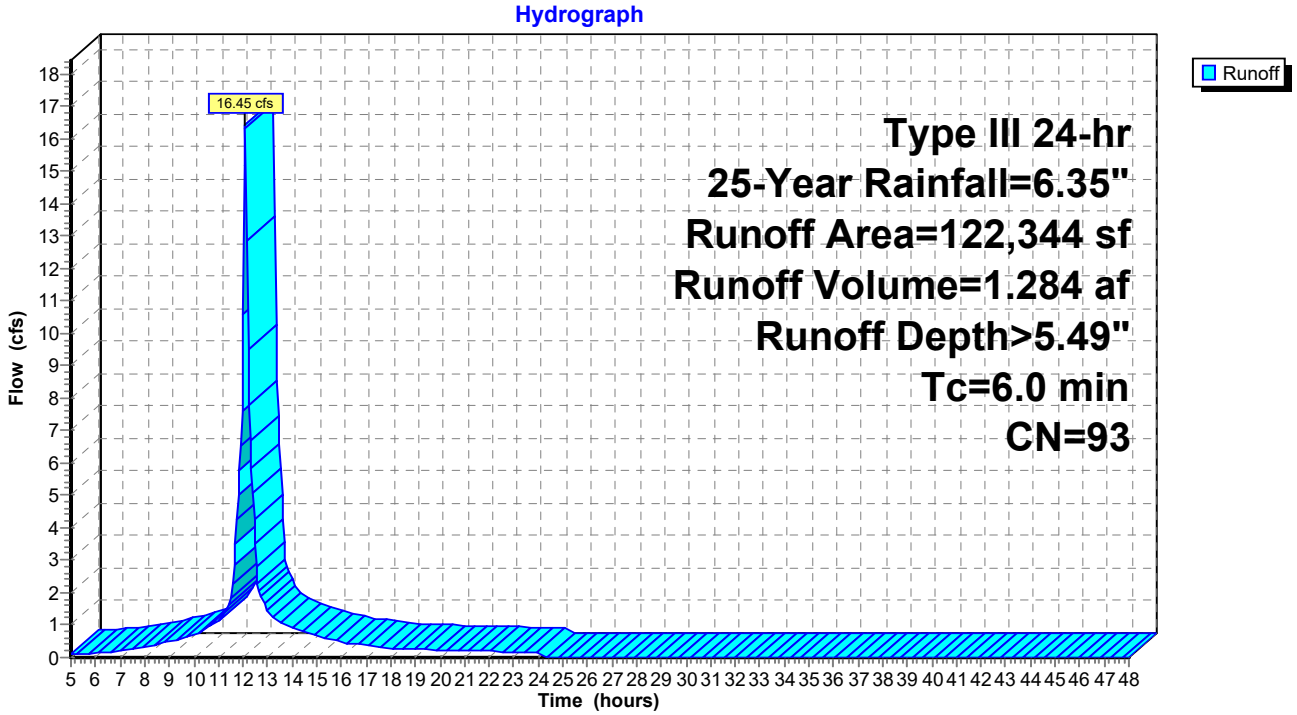
Runoff = 16.45 cfs @ 12.09 hrs, Volume= 1.284 af, Depth> 5.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
47,106	98	Paved parking, HSG A
47,328	98	Roofs, HSG C
2,491	89	Gravel roads, HSG C
25,419	74	>75% Grass cover, Good, HSG C
122,344	93	Weighted Average
27,910		22.81% Pervious Area
94,434		77.19% Impervious Area

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

Subcatchment S1: (Subcatchment 1)



Summary for Subcatchment S2: (Subcatchment 2)

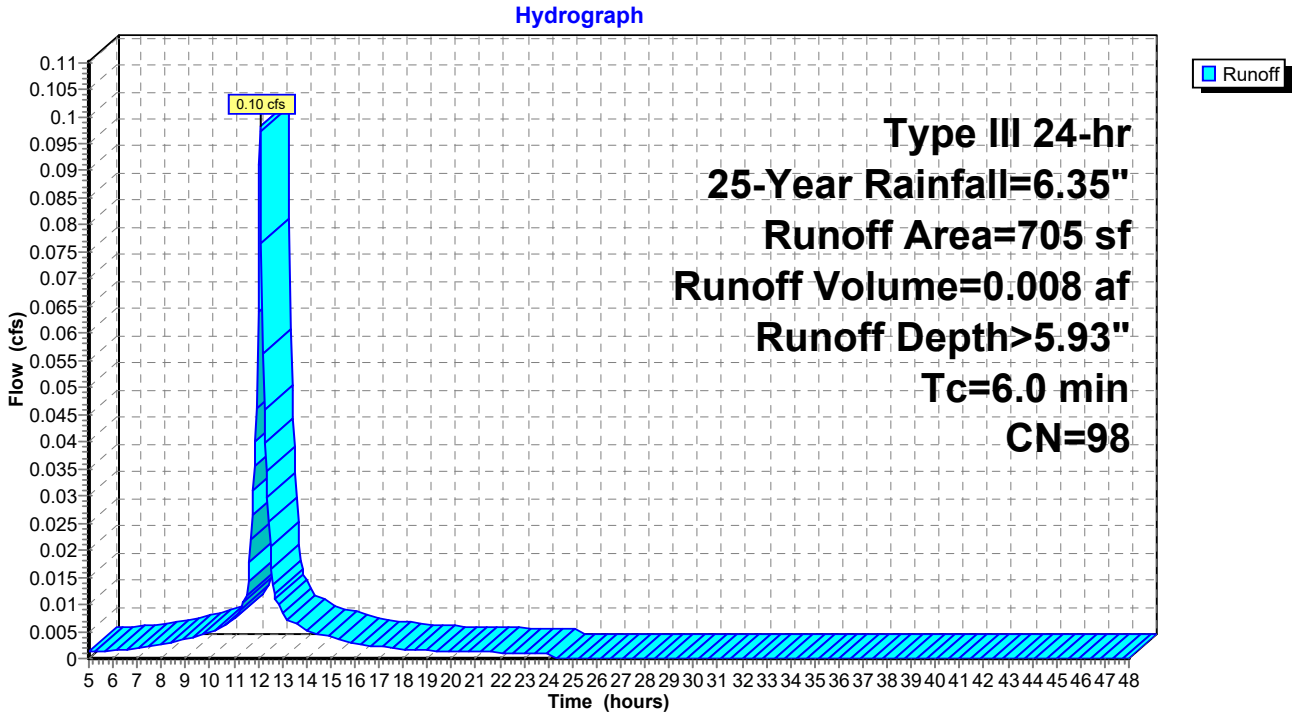
Runoff = 0.10 cfs @ 12.09 hrs, Volume= 0.008 af, Depth> 5.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.35"

Area (sf)	CN	Description
695	98	Paved parking, HSG C
10	74	>75% Grass cover, Good, HSG C
705	98	Weighted Average
10		1.42% Pervious Area
695		98.58% Impervious Area

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

Subcatchment S2: (Subcatchment 2)

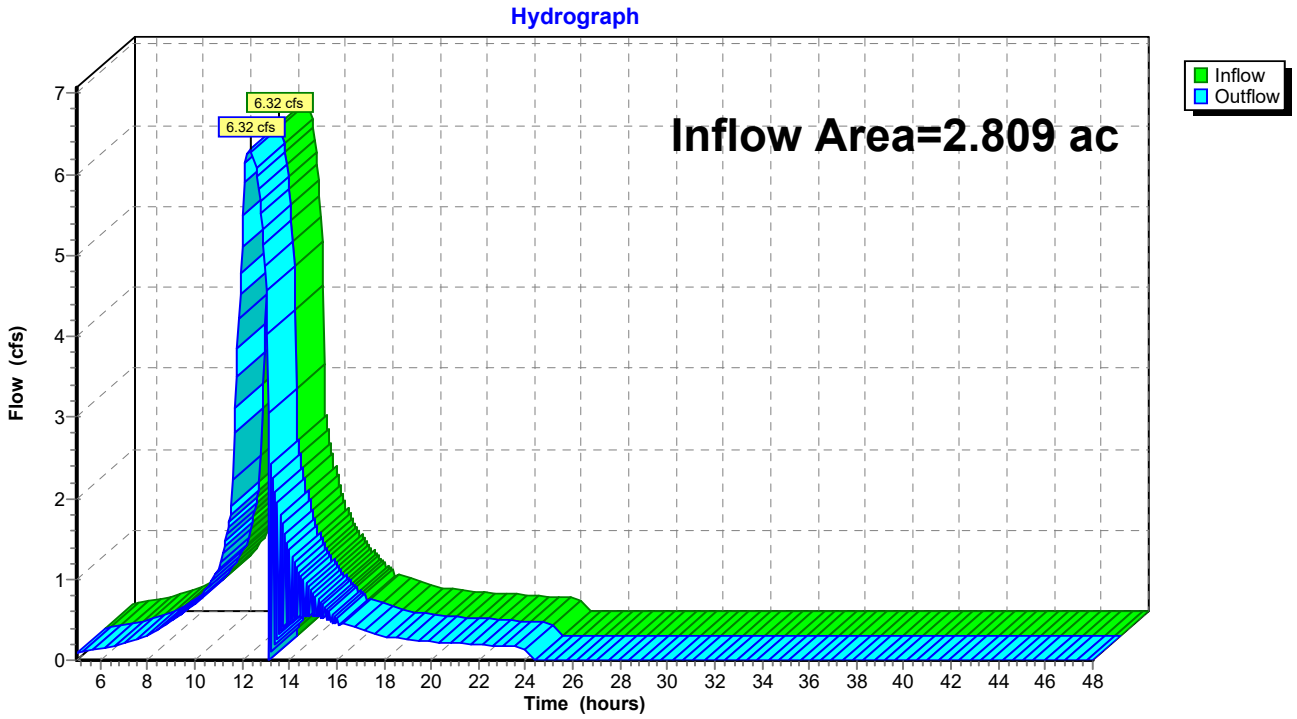


Summary for Reach DP-1: (DP-1)

Inflow Area = 2.809 ac, 77.19% Impervious, Inflow Depth > 5.49" for 25-Year event
Inflow = 6.32 cfs @ 12.32 hrs, Volume= 1.284 af
Outflow = 6.32 cfs @ 12.32 hrs, Volume= 1.284 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: (DP-1)

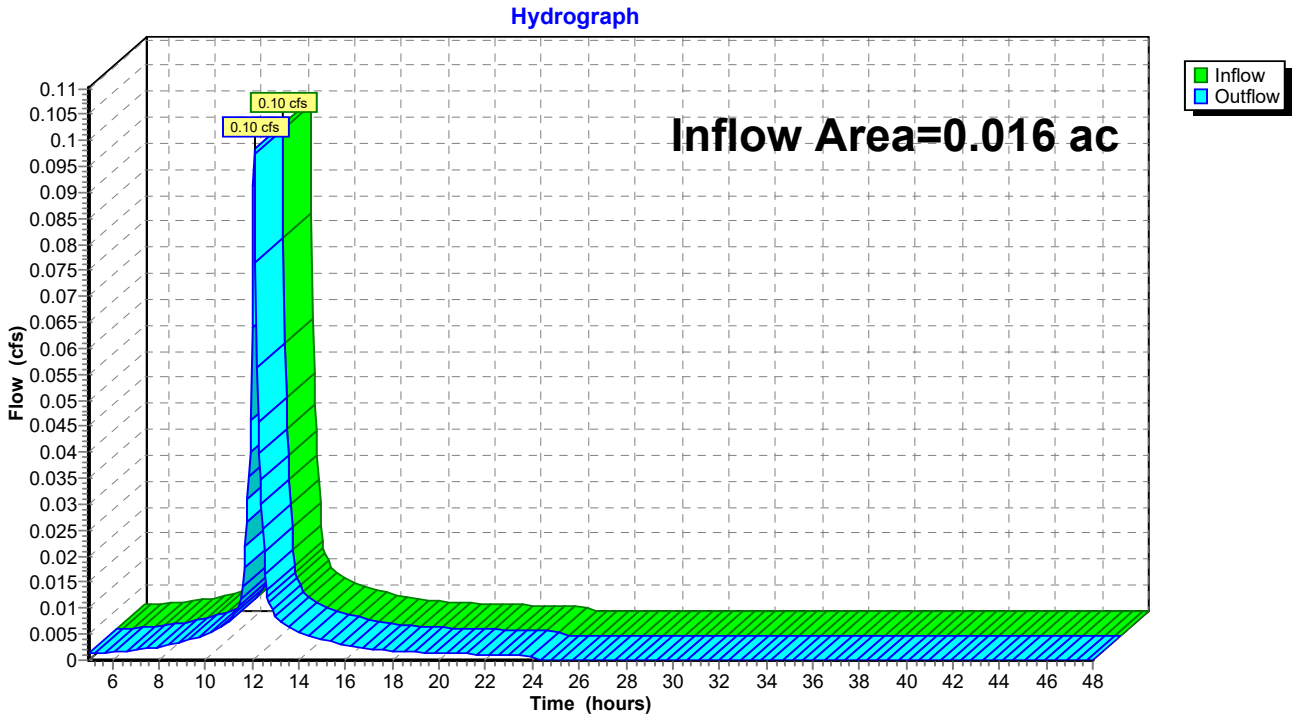


Summary for Reach DP-2: (DP-2)

Inflow Area = 0.016 ac, 98.58% Impervious, Inflow Depth > 5.93" for 25-Year event
Inflow = 0.10 cfs @ 12.09 hrs, Volume= 0.008 af
Outflow = 0.10 cfs @ 12.09 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: (DP-2)



Summary for Pond 1P: (Existing Pond)

Inflow Area = 2.809 ac, 77.19% Impervious, Inflow Depth > 5.49" for 25-Year event
Inflow = 16.45 cfs @ 12.09 hrs, Volume= 1.284 af
Outflow = 6.32 cfs @ 12.32 hrs, Volume= 1.284 af, Atten= 62%, Lag= 14.2 min
Primary = 6.32 cfs @ 12.32 hrs, Volume= 1.284 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 229.60' @ 12.32 hrs Surf.Area= 6,807 sf Storage= 8,310 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 6.2 min (781.6 - 775.4)

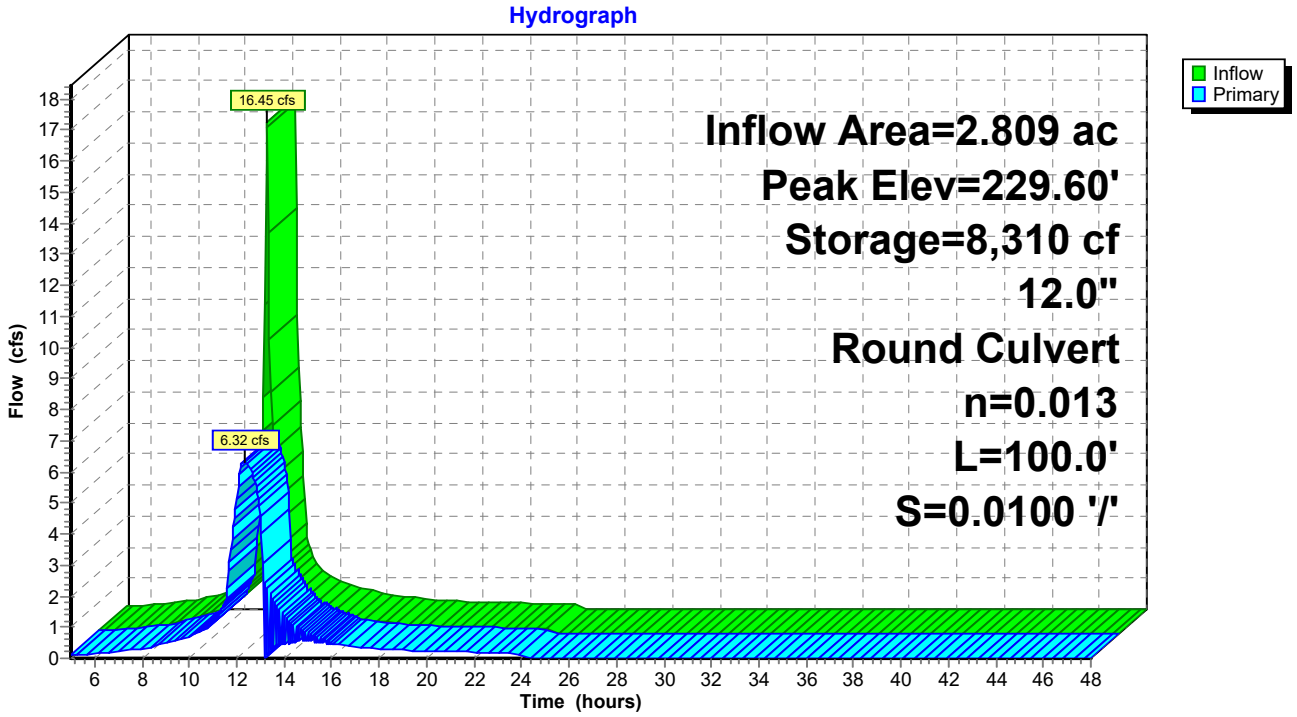
Volume	Invert	Avail.Storage	Storage Description
#1	224.94'	16,746 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.94	0	0	0
225.00	6	0	0
226.00	12	9	9
226.03	332	5	14
227.00	793	546	560
228.00	2,358	1,576	2,135
228.01	2,512	24	2,160
229.00	3,605	3,028	5,188
230.00	8,944	6,275	11,462
230.50	12,191	5,284	16,746

Device	Routing	Invert	Outlet Devices
#1	Primary	224.94'	**12.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 224.94' / 223.94' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf

Primary OutFlow Max=6.31 cfs @ 12.32 hrs HW=229.60' (Free Discharge)
1=Culvert (Barrel Controls 6.31 cfs @ 8.04 fps)

Pond 1P: (Existing Pond)



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: (Subcatchment1) Runoff Area=122,344 sf 77.19% Impervious Runoff Depth>7.18"
Tc=6.0 min CN=93 Runoff=21.28 cfs 1.680 af

SubcatchmentS2: (Subcatchment2) Runoff Area=705 sf 98.58% Impervious Runoff Depth>7.59"
Tc=6.0 min CN=98 Runoff=0.13 cfs 0.010 af

Reach DP-1: (DP-1) Inflow=6.72 cfs 1.680 af
Outflow=6.72 cfs 1.680 af

Reach DP-2: (DP-2) Inflow=0.13 cfs 0.010 af
Outflow=0.13 cfs 0.010 af

Pond 1P: (Existing Pond) Peak Elev=230.21' Storage=13,478 cf Inflow=21.28 cfs 1.680 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=6.72 cfs 1.680 af

Total Runoff Area = 2.825 ac Runoff Volume = 1.690 af Average Runoff Depth = 7.18"
22.69% Pervious = 0.641 ac 77.31% Impervious = 2.184 ac

Summary for Subcatchment S1: (Subcatchment 1)

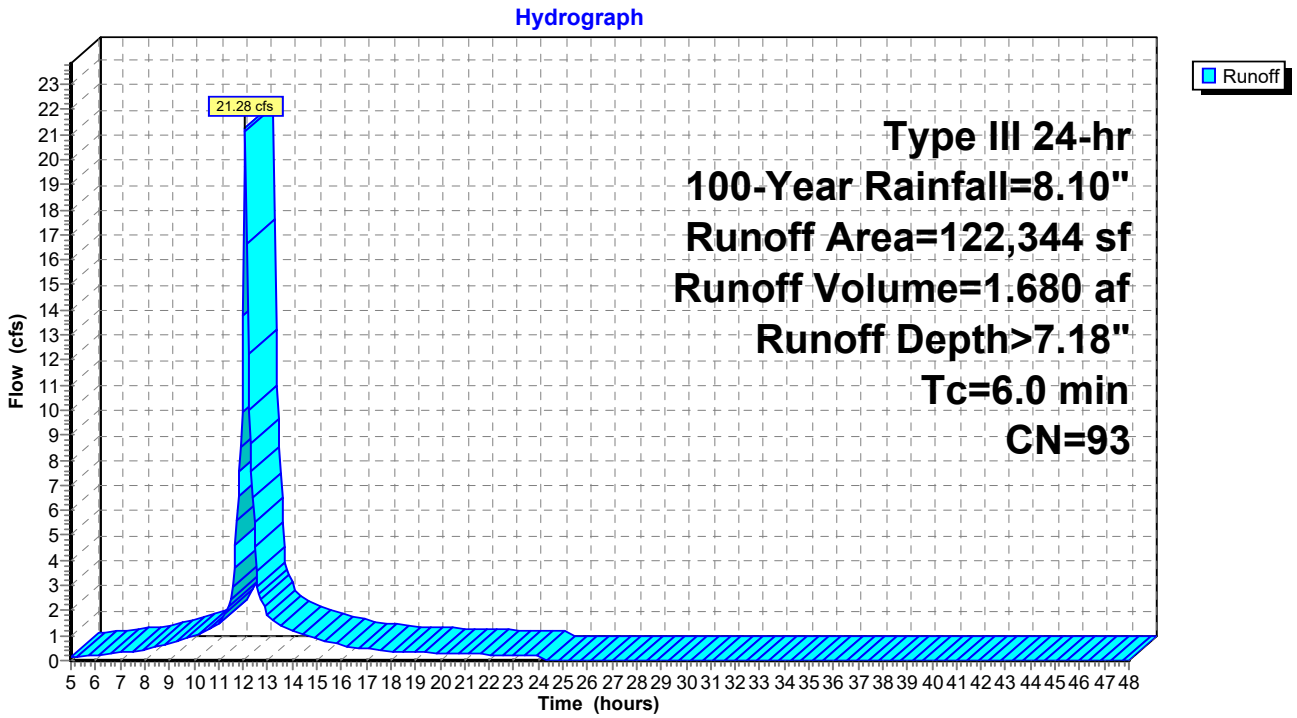
Runoff = 21.28 cfs @ 12.09 hrs, Volume= 1.680 af, Depth> 7.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.10"

Area (sf)	CN	Description
47,106	98	Paved parking, HSG A
47,328	98	Roofs, HSG C
2,491	89	Gravel roads, HSG C
25,419	74	>75% Grass cover, Good, HSG C
122,344	93	Weighted Average
27,910		22.81% Pervious Area
94,434		77.19% Impervious Area

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

Subcatchment S1: (Subcatchment 1)



Summary for Subcatchment S2: (Subcatchment 2)

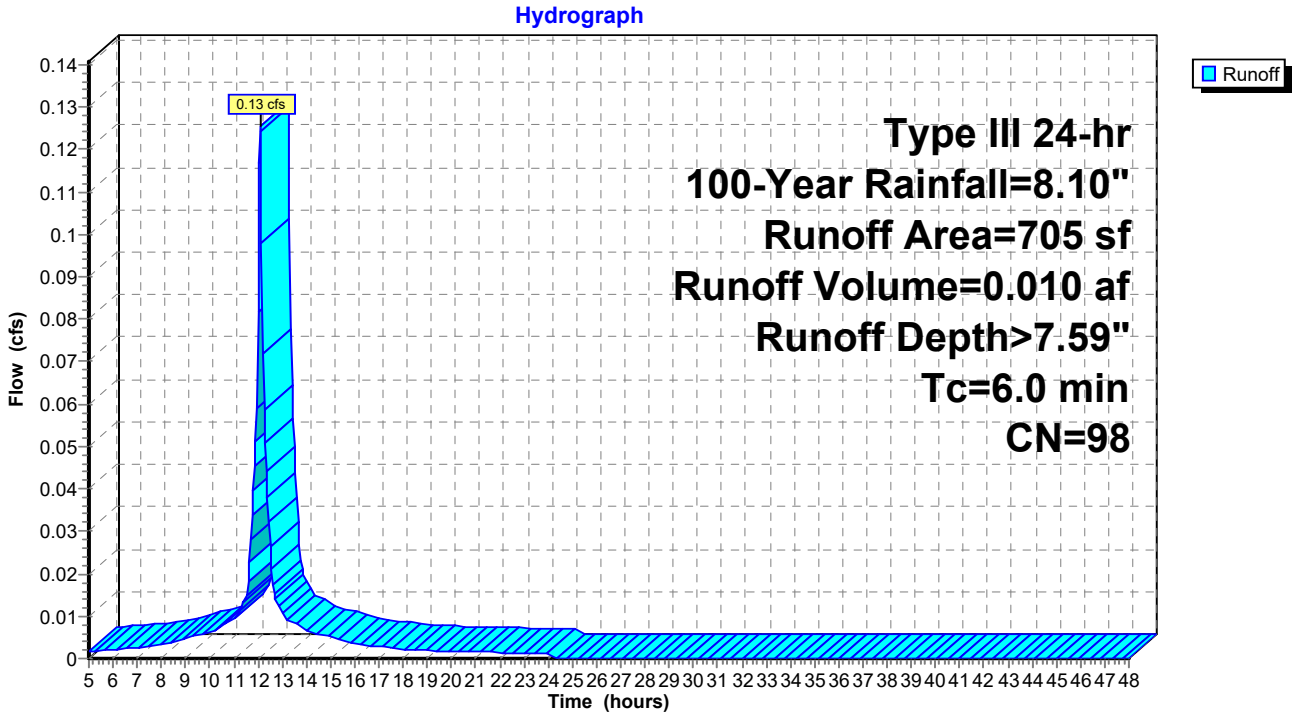
Runoff = 0.13 cfs @ 12.09 hrs, Volume= 0.010 af, Depth> 7.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.10"

Area (sf)	CN	Description
695	98	Paved parking, HSG C
10	74	>75% Grass cover, Good, HSG C
705	98	Weighted Average
10		1.42% Pervious Area
695		98.58% Impervious Area

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

Subcatchment S2: (Subcatchment 2)

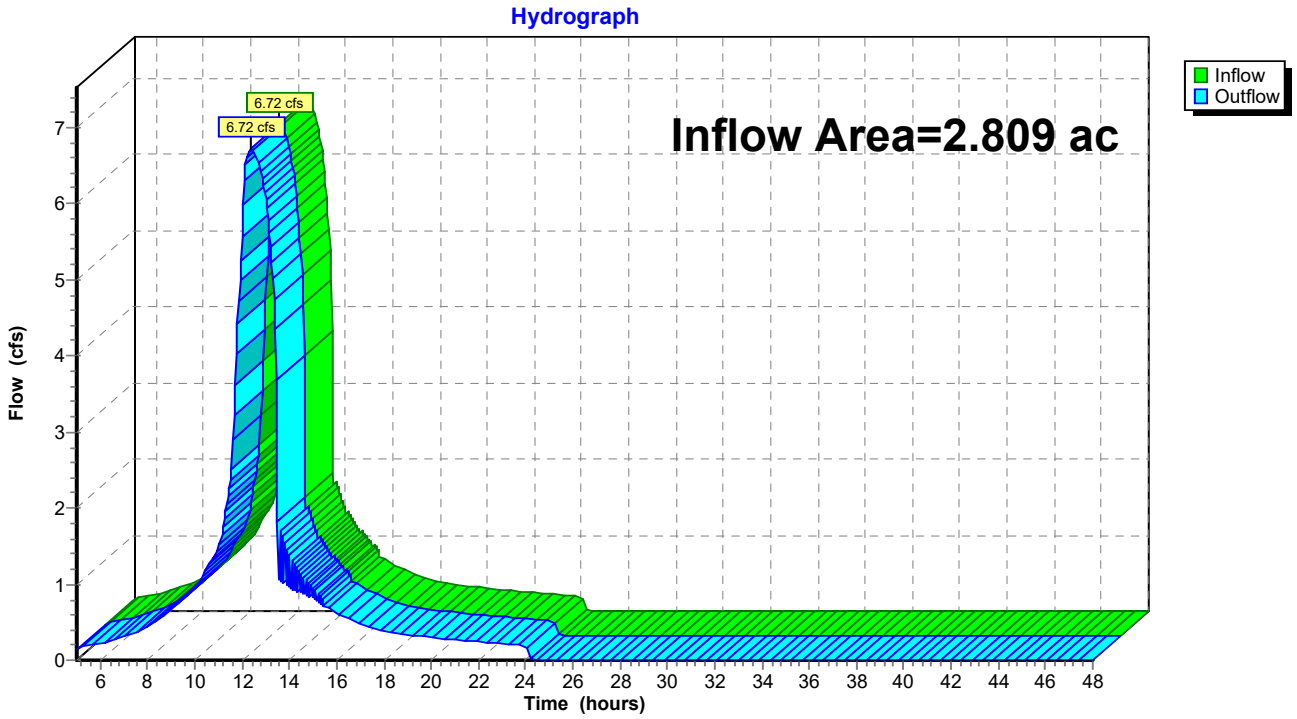


Summary for Reach DP-1: (DP-1)

Inflow Area = 2.809 ac, 77.19% Impervious, Inflow Depth > 7.18" for 100-Year event
Inflow = 6.72 cfs @ 12.39 hrs, Volume= 1.680 af
Outflow = 6.72 cfs @ 12.39 hrs, Volume= 1.680 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: (DP-1)

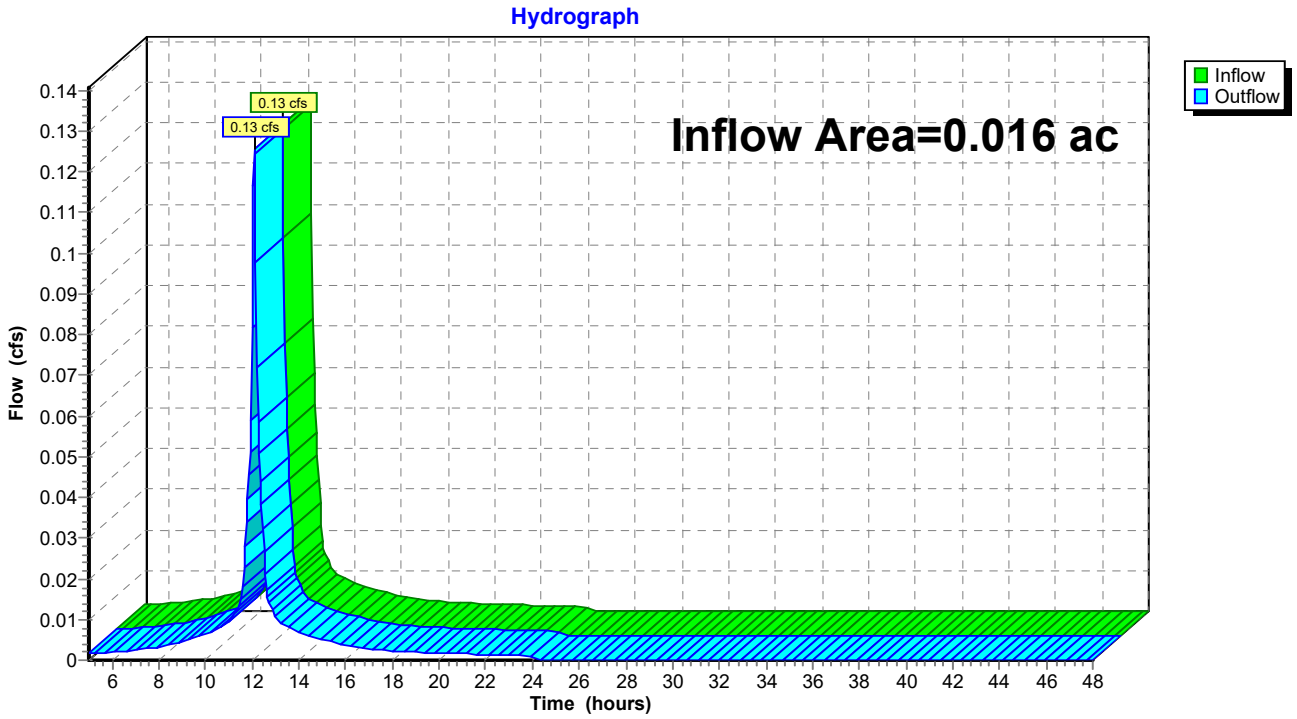


Summary for Reach DP-2: (DP-2)

Inflow Area = 0.016 ac, 98.58% Impervious, Inflow Depth > 7.59" for 100-Year event
Inflow = 0.13 cfs @ 12.09 hrs, Volume= 0.010 af
Outflow = 0.13 cfs @ 12.09 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: (DP-2)



Summary for Pond 1P: (Existing Pond)

Inflow Area = 2.809 ac, 77.19% Impervious, Inflow Depth > 7.18" for 100-Year event
Inflow = 21.28 cfs @ 12.09 hrs, Volume= 1.680 af
Outflow = 6.72 cfs @ 12.39 hrs, Volume= 1.680 af, Atten= 68%, Lag= 18.2 min
Primary = 6.72 cfs @ 12.39 hrs, Volume= 1.680 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 230.21' @ 12.39 hrs Surf.Area= 10,304 sf Storage= 13,478 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 10.0 min (781.2 - 771.1)

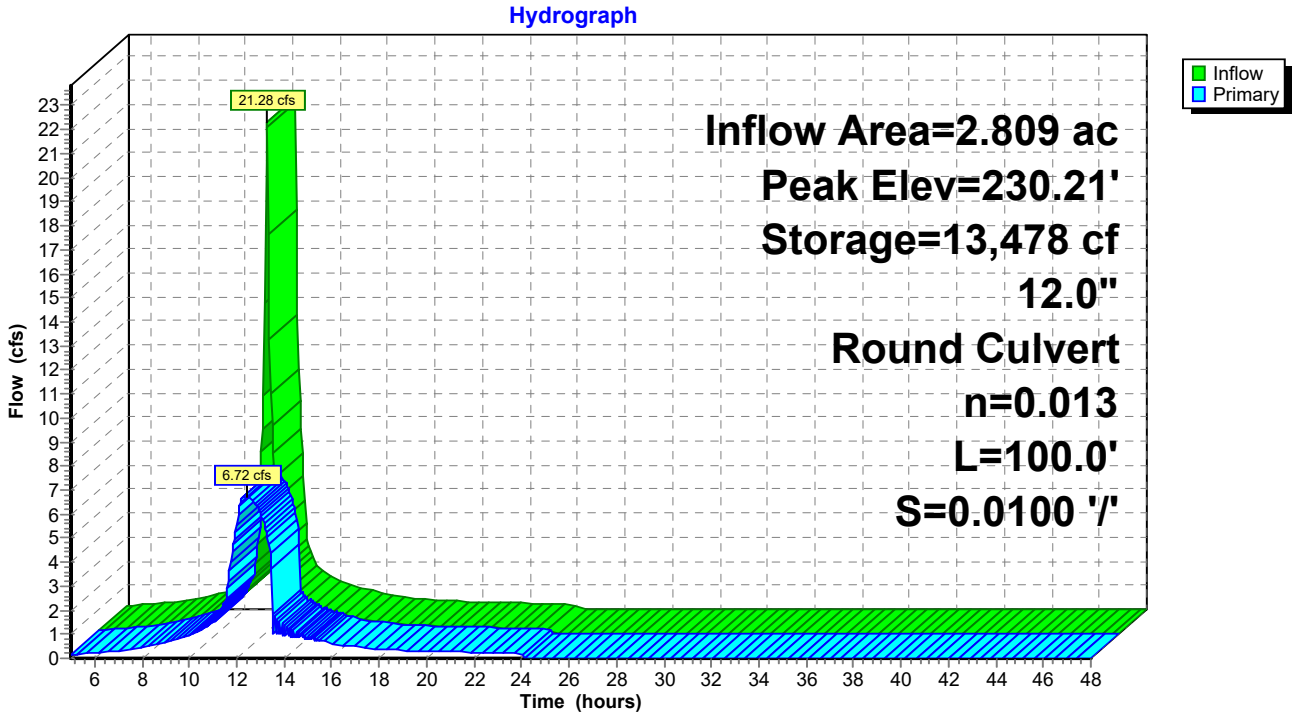
Volume	Invert	Avail.Storage	Storage Description
#1	224.94'	16,746 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.94	0	0	0
225.00	6	0	0
226.00	12	9	9
226.03	332	5	14
227.00	793	546	560
228.00	2,358	1,576	2,135
228.01	2,512	24	2,160
229.00	3,605	3,028	5,188
230.00	8,944	6,275	11,462
230.50	12,191	5,284	16,746

Device	Routing	Invert	Outlet Devices
#1	Primary	224.94'	**12.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 224.94' / 223.94' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf

Primary OutFlow Max=6.72 cfs @ 12.39 hrs HW=230.21' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 6.72 cfs @ 8.55 fps)

Pond 1P: (Existing Pond)



APPENDIX C

Best Management Practices
Operation and Maintenance Plans

POST-DEVELOPMENT BEST MANAGEMENT PRACTICE OPERATION AND MAINTENANCE PLAN

for

21 Parker Drive

In

Avon, Massachusetts
(Assessor's Parcel No. B7-3-2)

Submitted to:

TOWN OF AVON

Prepared for:

Atlantic Oliver II 21 Parker Drive LLC
125 High Street, Suite 220
Boston, Massachusetts 02110

Prepared by:

MCKENZIE ENGINEERING GROUP

Professional Civil Engineering • Project Management • Land Planning
150 Longwater Drive, Suite 101, Norwell, Massachusetts 02061
Tel.: (781) 792-3900 Facsimile: (781) 792-0333
www.mckeng.com

November 17, 2022

TABLE OF CONTENTS

Post-Development Best Management Practice Operation and Maintenance Plan

Post-Development Best Management Practices (BMPs) Operation and Maintenance Plan

Responsible Party/Property Owner/Developer contact information:
Property Owner: Atlantic Oliver II 21 Parker Drive, LLC
21 Parker Drive
Avon, MA 02322

Best Management Practices (BMPs) of the Commonwealth of Massachusetts Department of Environmental Protection's (DEP's) Stormwater Management Policy (SMP) have been implemented and utilized for the project. The following information provided is to be used as a guideline for monitoring and maintaining the performance of the drainage facilities and to ensure that the quality of water runoff meets the standards set forth by the SMP. The structural Best Management Practices (BMPs) shall be inspected during rainfall conditions during the first year of operation to verify functionality.

BMPs included in the design consist of the use of:

- Proprietary pretreatment unit
- Stormwater basin

Operation:

Once the stormwater management systems have been constructed and the driveway and parking lot has been permanently stabilized and put into action, the operation of the stormwater management system will function as intended. Stormwater runoff is directed into the First Defense pre-treatment catch basin units then to the subsurface infiltration systems. The subsurface stormwater management systems have been designed to attenuate peak flows for the 1-year through 100-year storm events.

Maintenance:

1. **Proprietary Pretreatment Unit** – The proprietary pretreatment unit shall be inspected and maintained from the surface, without entry into the unit a minimum of annually and following heavy rain events. Perform maintenance once the stored volume reaches 15% of the unit capacity, or immediately in the event of a spill. Perform Maintenance at quarterly intervals during the first year of installation, so an accurate maintenance schedule can be established. Sediment and debris should be removed through the 18-inch diameter outlet pipe. Alternatively, oil and floatables should be removed through the 12-inch oil inspection port. The requirements for the disposal from the units should be in compliance with all local, state and federal regulations. Please refer to the Manufacturer's Manual for additional detail on proper inspection and maintenance of the First Defense units.

   Cost: Cleaning should be included along with the routine maintenance of the catch basins. The property owner should consult local vacuum cleaning contractors for detailed cost estimates.

2. **Stormwater basin** – Proper maintenance of the stormwater basin is essential to the long-term effectiveness. The detention basin shall be checked for debris accumulation on a quarterly basis. Additional inspections should be scheduled during the first few months after construction to make sure that any new vegetation becomes adequately established. Trash, leaves, branches, etc. shall be removed from the basin. Silt, sand and sediment, if significant accumulation occurs, shall be removed by hand annually. Material removed from the basin or shall be disposed of in accordance with all applicable local, state, and federal regulations. The detention basin shall be kept free of woody vegetation by mowing at least once per year. Reseeding, weed control, and invasive species removal may need to be performed periodically to maintain healthy vegetation and maintain the pollutant removal efficiency of the facilities.

   Cost: The property owner should consult local landscape contractors for a detailed cost estimate.

Maintenance Responsibilities:

All post construction maintenance activities will be documented and kept on file in the form of an Evaluation Checklist, see attached form.

All structural BMPs as identified on the site plans will be owned and maintained by the developer or property owner. All post construction maintenance activities shall run with the title of the property.

Project Location: 21 Parker Drive, Assessor's Parcel No. B7-3-2, Avon, MA

Stormwater Management – Post Construction Phase

Best Management Practices – Inspection Schedule and Evaluation Checklist

Long Term Practices

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check (1)	Cleaning/Repair Needed: ☐yes ☐no (List Items)	Date of Cleaning/ Repair	Performed by
Proprietary Pretreatment Units	After heavy rainfall events (minimum annually)			1. Sediment level exceeds Manufacturer's specification 2. Trash and debris 3. Floatable oils or hydrocarbons 4. Outlet blockages			
Stormwater Basin	After heavy rainfall events (minimum semi-annually)			1. Sediment build-up 2. Trash and debris			

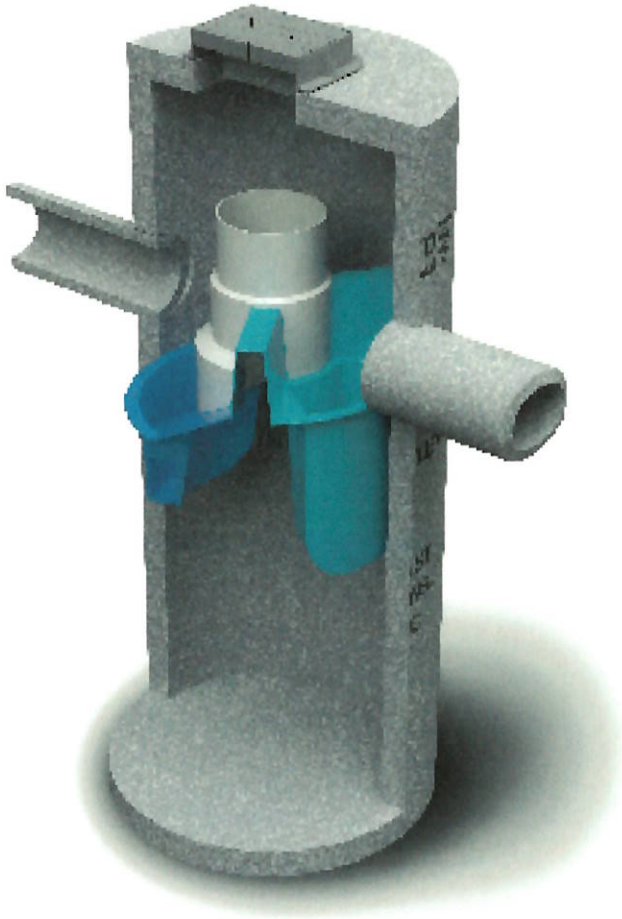
(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspection and maintenance of specific BMP's.

Notes (Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan):

1.

Stormwater Control Manager _____ Stamp:

Hydro International



Operation and Maintenance Manual

First Defense® High Capacity and First Defense®Optimum

Vortex Separator for Stormwater Treatment

Table of Contents

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints.

The two product models described in this guide are the First Defense® High Capacity and the First Defense® Optimum; they are inspected and maintained identically.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for "offline" arrangements using separate junction manholes
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

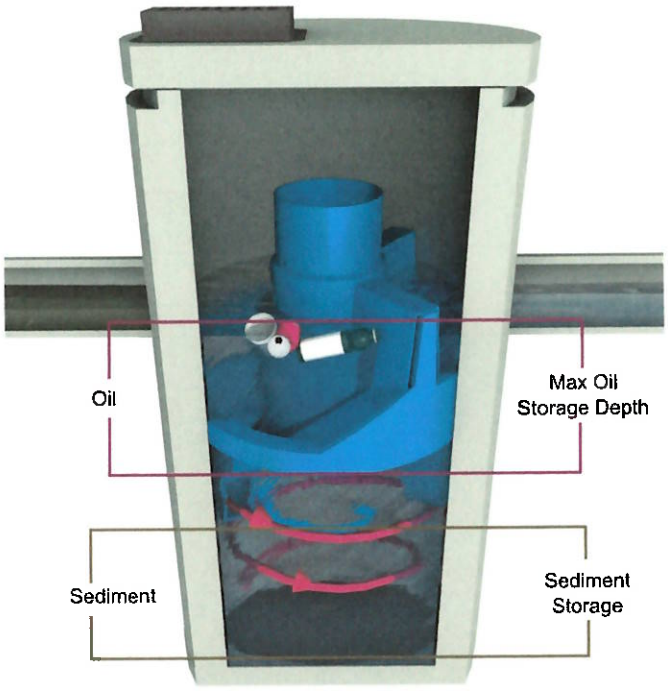


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components have modified geometries allowing greater design flexibility to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2). First Defense® model sizes (diameter) are shown in Table 1.

III. Maintenance

First Defense® Components

1. **Built-In Bypass**
2. **Inlet Pipe**
3. **Inlet Chute**
4. **Floatables Draw-off Port**
5. **Outlet Pipe**
6. **Floatables Storage**
7. **Sediment Storage**
8. **Inlet Grate or Cover**

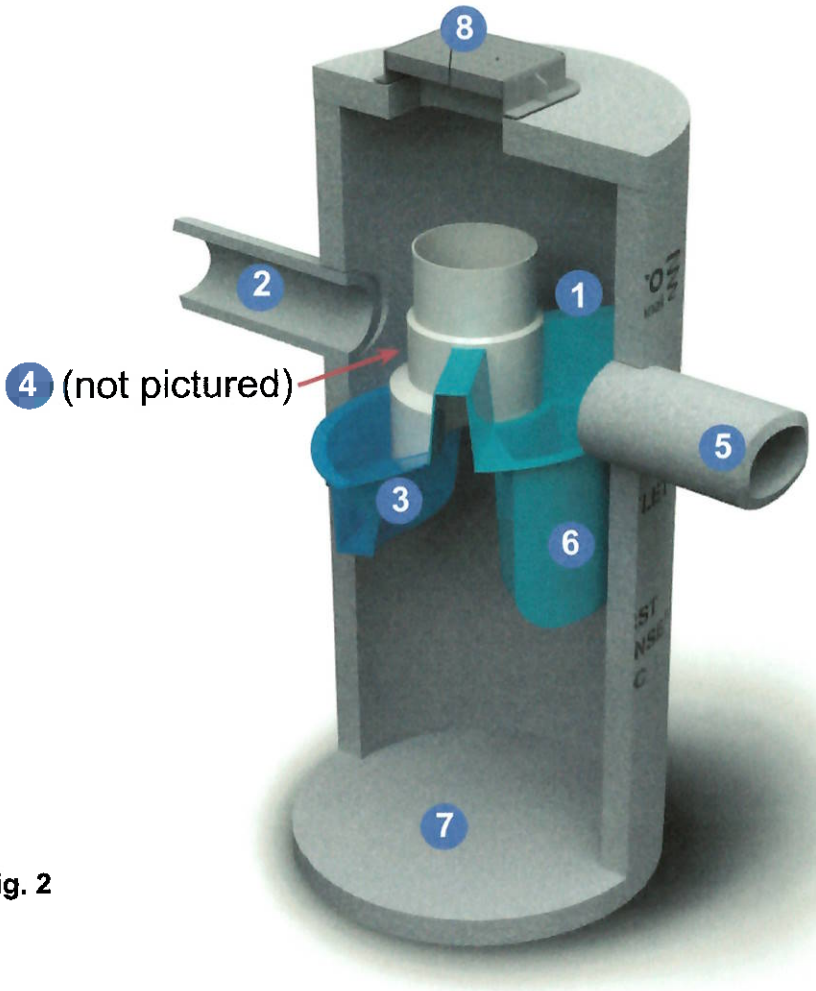


Fig. 2

Table 1

First Defense® Model Sizes
(ft / m) diameter
3 / 0.9
4 / 1.2
5 / 1.5
6 / 1.8
7 / 2.1
8 / 2.4
10 / 3.0

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense® have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

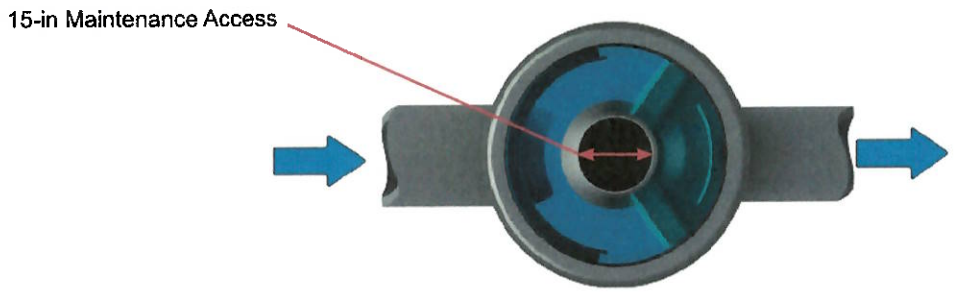


Fig.3 The central opening to the sump of the First Defense®is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / flotables removal, for First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.4).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.

- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.

Fig.4 Floatables are removed with a vactor hose

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and Sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Remove oil and floatables stored on the surface of the water with the vactor hose or with the skimmer or net

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).

6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.

9. Securely replace the grate or lid.

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.	

First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): [3-FT] [4-FT] [5-FT] [6-FT] [7-FT] [8-FT] [10-FT]

INLET (CIRCLE ALL THAT APPLY): GRATED INLET (CATCH BASIN) INLET PIPE (FLOW THROUGH)

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Hydro International

First Defense® Inspection and Maintenance Log

Date	Initials	Depth of Floatables and Oils	Sediment Depth Measured	Volume of Sediment Removed	Site Activity and Comments

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
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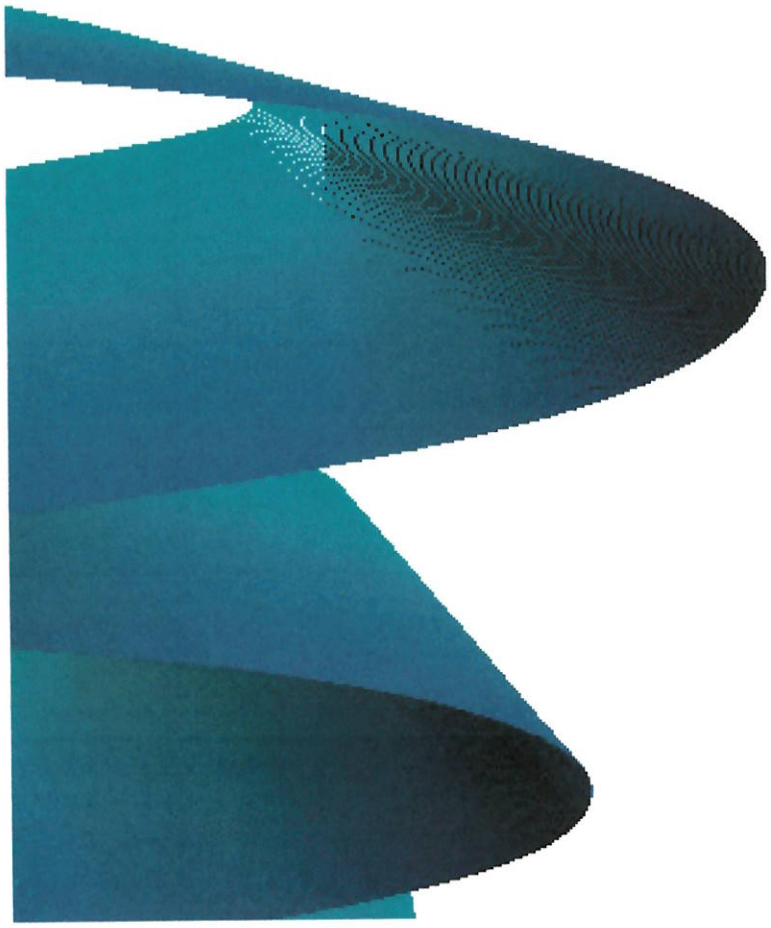
Hydro International



Stormwater Solutions

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Portland, ME 04102

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