DRAINAGE CALCULATIONS AND STORMWATER MANAGEMENT PLAN

For:

SITE DEVELOPMENT
ASSESSORS PARCEL NUMBER 3-O-2.1
300 POND STREET
RANDOLPH, MASSACHUSETTS

Located:

300 POND STREET
RANDOLPH, MASSACHUSETTS

Submitted to:

TOWN OF RANDOLPH

Prepared For:

EMERSON – SWAN FLEXCON
300 POND STREET
RANDOLPH, MASSACHUSETTS

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

June 11, 2024

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Drainage Calculations and Stormwater Management Plan
300 Pond Street
Randolph, Massachusetts

Project Summary

The project proponent, Emerson – Swan Flexcon proposes to construct an addition to the existing building located at 300 Pond Street in Randolph, Massachusetts consisting of one (1) parcel as shown on the Randolph Assessor's Map 3, Block O, Lot 2.1 comprising of approximately 10.0 acres (the Site). The Site is located within Town of Randolph's Great Pond Commerce Center Overlay District.

The proposed development will consist of the construction of an approximately 52,300 s.f. addition to the existing building, along with the construction of a subsurface stormwater management systems, utilities, site grading and landscaping. A portion of the existing structure consisting of 21,850 s.f. of office space will be converted to a manufacturing use and included as part of the new addition.

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, 300 Pond Street, Randolph, Massachusetts", prepared by McKenzie Engineering Group, Inc. dated June 11, 2024.

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

Pre-Development Condition

The parcel is currently developed and consists of an existing ±180,600 s.f. industrial (office, manufacturing and warehouse use) building with related site infrastucture inlcuding bituminous concrete parking area, loading docks, storwmwater management system, closed-drainage system and utilities. The topography of the site ranges in elevation from approximately 144 ft. (NAVD 88) adjacent to Pacella Park Drive west of the exsiting building, to an elevation of approximately 128 ft. along Pond Street, south of the existing building. Runoff emanating from the eastern and southern portions of the site generally flows in a southerly direction toward Pond Street. Portions of runoff emanating from the western portion of the site generally are captured by the existing leaching pits and crushed stone depression area. Runoff emanating from the northwestern and northeastern portions of the site are captured by the existing stormwater management system are conveyed to the outlet structure located adjacent to the northern property line. A bordering vegetated wetland complex is located offsite across Pond Street to the south, the limit of bordering vegetated wetland resource area was delineated by Environmental Consulting and Restoration, LLC on December 1, 2023. Refer to Appendix F: - Wetland Delineation Report for supporting data.

A review of available environmental databases such as MassGIS reveals that a portion of the Site is located within a MassDEP Zone A - Surface Water Protection Area. The Site is not located within a MassDEP Zone II Wellhead Protection Area or Town of Randolph Aquifer Protection District Zone.

The site is located within the Zone X of the Flood Insurance Rate Map, as shown on the current FEMA Flood Insurance Rate Map Panel No. 25021C0208E with an effective date of July 17, 2012. Refer to Figure 2 – FEMA Flood Map.

The soil types as identified by the Soil Survey, Norfolk County, MA prepared by the NRCS Soil Conservation Service (NRCS) are classified as 104C-Hollis-Rock Outcrop-Charlton Complex, 0 to 15 percent slopes, with hydrologic soil group (HSG) D; 422B-Canton Fine Sandy Loam, 0 to 8 percent slopes, extremely stony with hydrologic soil group (HSG) B, and 654-Udorthents Loamy, with hydrologic soil group (HSG) A. Soil testing conducted by McKenzie Engineering Group, Inc. (MEG) on December 22, 2023 identified the site to be comprised of ledge at approximately 16" depth.

Refer to Figure 3 - Soil Map for the NRCS delineation of soil types and Appendix E – Soil Testing Results for supporting data.

In the pre- and post- development stormwater analysis, the watershed area analyzed was approximately 10.23 acres consisting of the subject parcel to be developed and offsite tributary areas to the west. The watershed consists of four (4) design points 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 development will consist of the construction of an approximately 52,300 s.f. addition to the existing building, along with the construction of a subsurface stormwater management systems, utilities, site grading and landscaping. A portion of the existing structure consisting of 21,850 s.f. of office space will be converted to a manufacturing use and included as part of the new addition. The area of the existing bituminous concrete parking area has been reduced as a result of the proposed development. The stormwater management system and will be designed to fully comply with all standards of the Department of Environment Protection's Stormwater Management Regulations.

Watershed areas were analyzed in the post-development condition to design low impact stormwater management facilities to mitigate impacts resulting from developing 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 pre-development rates at the design points.

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 roof runoff collection system and stormwater detention system to capture, and regulate the flow of the runoff associated with the proposed addition. The stormwater detention system includes an overflow connection to the

existing closed-drainage system onsite and utilizes the existing headwall and outlet structure located north of the existing building. The infiltration tank systems were designed to accommodate peak flows generated by all storms up to the 100-year storm event. 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.

A comparison of the pre-development and post-development peak rates of runoff indicate that the peak rates of runoff for the post-development condition at all Design Points will be less than the pre-development condition for all storm events.

Stormwater Best Management Practices (BMP's)

Runoff from the proposed building addition is considered “clean” and therefore does not require removal of Total Suspended Solids (TSS). Runoff from the proposed building addition will be conveyed directly to the stormwater detention system and the proposed rain garden. Approximately 25% of the proposed roof addition will be directed to the rain garden, the remaining 75% of the roof addition will be directed to the stormwater detention system. The stormwater detention system will release runoff from the proposed addition at a regulated rate while utilizing the existing outlet structure onsite. The proposed rain garden will recharge runoff into the surrounding native soils, and includes an overflow rip-rap spillway directed at the existing parking area.

The existing treatment stream for the development which consists of deep sump hooded catch basins and infiltration drywells, and captures runoff from the bituminous concrete parking areas and adjacent landscaping, will be maintained.

Erosion and Sedimentation Controls

Compost filter tube (Silt sock) erosion control barriers will be placed at the limit of work prior to the commencement of any construction activity. The integrity of the silt sock will be maintained by periodic inspection and replacement as necessary. Refer to the Erosion Control details on the Site Development Plans and BMP Operation and Maintenance Plan for proposed erosion control measures to be employed for the project.

Compliance with Stormwater Management Standards

Standard 1 – No New Untreated Discharges

The proposed development will not introduce any new untreated discharges to a wetland area or waters of the Commonwealth of Massachusetts. All discharges from the site will be treated through proposed stormwater quality controls such as deep sump hooded catch basins, pre-treatment structures and subsurface infiltration tank systems including the establishment of proper maintenance procedures.

Standard 2 – Peak Rate Attenuation

In the pre- and post- development stormwater analysis, the watershed area analyzed was approximately 10.23 acres consisting of the subject parcel to be developed and offsite tributary areas to the west. Refer to Existing Watershed Delineation Plan WS-1 for

a delineation of drainage subareas for the pre-development design condition and refer to Post-Development Watershed Delineation Plan WS-2 for a delineation of drainage subareas for the post-development design condition.

Drainage calculations were performed by employing SCS TR-20 methods for the 1, 2, 10, 25, and 100-year Type III storm events. Refer to Appendix A and B for computer results. All drainage structures will be designed employing the Rational Method to accommodate peak flows generated by a minimum of a 25-year storm event or a 100-year storm event where applicable. The stormwater management systems were designed to accommodate peak flows generated by a 100-year storm event.

The peak rates of runoff are as follows:

Pre-Development vs. Post-Development Peak Rates of Runoff

Design Point	2 Year Storm **(3.29 Inches)**		10 Year Storm **(4.92 Inches)**		25 Year Storm **(6.19 Inches)**		100 Year Storm **(8.79 Inches)**	
	Exist. (CFS)	**Prop. (CFS)**	**Exist. (CFS)**	**Prop. (CFS)**	**Exist. (CFS)**	**Prop. (CFS)**	**Exist. (CFS)**	**Prop. (CFS)**
Design Point 1	*2.98*	2.84	*7.72*	6.90	*11.96*	10.47	*21.37*	18.25
Design Point 2	*0.11*	0.11	*0.37*	0.37	*0.61*	0.61	*1.17*	1.17
Design Point 3	*4.34*	4.34	*6.82*	6.82	*8.77*	8.77	*12.76*	12.76
Design Point 4	*12.08*	11.15	*19.37*	18.33	*25.13*	23.96	*36.95*	35.55

A comparison of the pre-development and post-development peak rates of runoff indicates that the peak rates of runoff for the post-development condition will be equal or less than the pre-development condition for all storm events.

The peak volumes of runoff are as follows:

Pre-Development vs. Post-Development Volumes of Runoff

Design Point	2 Year Storm **(3.29 Inches)**		10 Year Storm **(4.92 Inches)**		25 Year Storm **(6.19 Inches)**		100 Year Storm **(8.79 Inches)**	
	Exist. (ACRE-FT.)	**Prop. (ACRE-FT.)**	**Exist. (ACRE-FT.)**	**Prop. (ACRE-FT.)**	**Exist. (ACRE-FT.)**	**Prop. (ACRE-FT.)**	**Exist. (ACRE-FT.)**	**Prop. (ACRE-FT.)**
Design Point 1	*0.247*	0.227	*0.575*	0.523	*0.874*	0.805	*1.549*	1.432
Design Point 2	*0.011*	0.011	*0.029*	0.029	*0.046*	0.046	*0.085*	0.085
Design Point 3	*0.342*	0.342	*0.540*	0.540	*0.697*	0.697	*1.019*	1.019
Design								

Point 4	*0.949*	1.033	*1.523*	1.659	*1.980*	2.156	*2.927*	3.185

Standard 3 – Groundwater Recharge

Runoff will be recharged by the proposed rain garden, which will meet the Stormwater Guidelines for infiltration.

Groundwater Recharge Volume

Stormwater System	Soil Type	Target Depth Factor (F) (in)	Total Impervious Area (sf)	Required Recharge Volume (cf)[1]	Provided Recharge Volume (cf)[2]
	A	0.60	52,300	2,615	
1P					0
2P					4,365
				2,615 (2,615 ADJ.)	**4,365**

1. Required Recharge Volume = Target Depth Factor x Impervious Area / (d+Kt) (Refer to supplemental calculations in Appendix D)
2. Provided Recharge Volume = Volume Provided from Bottom of System to invert of overflow pipe.

Per Standard 3, if stormwater runoff from less than 100% of the site's impervious cover is directed to the BMP intended to infiltrate the Required Recharge Volume, then the storage capacity of the infiltration BMP needs to be increased so that the BMP can capture more of the runoff from the impervious surfaces located with the contributing drainage area. The impervious cover of the proposed addition directed towards the stormwater management system is 100.0%; therefore, a capture area adjustment was not required. Refer to Appendix D for Capture Area Adjustment calculations.

The proposed rain garden will provide both water quality treatment and recharge. Per Standard 4, Water Quality, the BMP must be sized to treat or hold the Target Volume, the larger of the Required Water Quality Volume and the Required Recharge Volume. The Required Water Quality Volume is based on the one-inch of runoff and the Required Recharge Volume is based on 0.60-inches (Soil Type A); therefore the Target Volume is the Required Water Quality Volume of 4,358 cubic feet. Refer to Appendix D supplemental calculations.

The proposed rain garden has been designed to completely drain within 72 hours. The drawdown analysis is based on the required recharge volume exfiltrating at the Rawls Rates based on the soil textural analysis conducted at the proposed exfiltration location. Refer to Appendix D for calculations.

Standard 4 – Water Quality

The Long-Term Pollution Prevention Plan has been incorporated into the Post-

Development Operation and Maintenance Plan. Refer to Appendix F for BMP Operation and Maintenance Plans.

The stormwater management system will be designed to be in full compliance with the Standards of the DEP Stormwater Management Policy. Runoff from the proposed building addition is considered "clean" and therefore does not require removal of Total Suspended Solids (TSS). Runoff from the proposed building addition will be conveyed directly to the stormwater detention system and the proposed rain garden. Approximately 25% of the proposed roof addition will be directed to the rain garden, the remaining 75% of the roof addition will be directed to the stormwater detention system. The stormwater detention system will release runoff from the proposed addition at a regulated rate while utilizing the existing outlet structure onsite. The proposed rain garden will recharge runoff into the surrounding native soils and includes an overflow rip-rap spillway directed at the existing parking area.

The existing treatment stream for the development which consists of deep sump hooded catch basins and infiltration drywells, and captures runoff from the bituminous concrete parking areas and adjacent landscaping, will be maintained.

The Water Quality Volume (WQV) to be treated is equal to the proposed impervious area draining to a water quality device multiplied by one half inch. The table below shows the volume required and provided with the proposed development. Refer to Appendix D for further calculations.

Water Quality Treatment Volume

Basin	**Required WQ Volume (cf)**	**Proposed WQ Volume (cf)**	
P-2	4,358	4,365	Rain Garden
	4,358	**4,365**	

Standard 5 – Land Use with Higher Potential Pollutant Loads (LUHPPL)

The proposed project does not include land uses with higher potential pollutant loads. Not Applicable.

Standard 6 – Critical Areas

The proposed project does not discharge to any critical areas. Not Applicable.

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

The proposed project is not a redevelopment project. Not Applicable.

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

The project will require a NPDES Construction General Permit but the Stormwater Pollution Prevention Plan (SWPPP) has not been submitted. The SWPPP will be submitted prior to any proposed construction. A Construction Phase BMP Operation and Maintenance Plan will be provided as a basis for the SWPPP during final design.

Standard 9 – Operation and Maintenance 5Plan

The Long-Term Operation and Maintenance Plan is provided in Appendix F.

Standard 10 – Prohibition of Illicit Discharges

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.

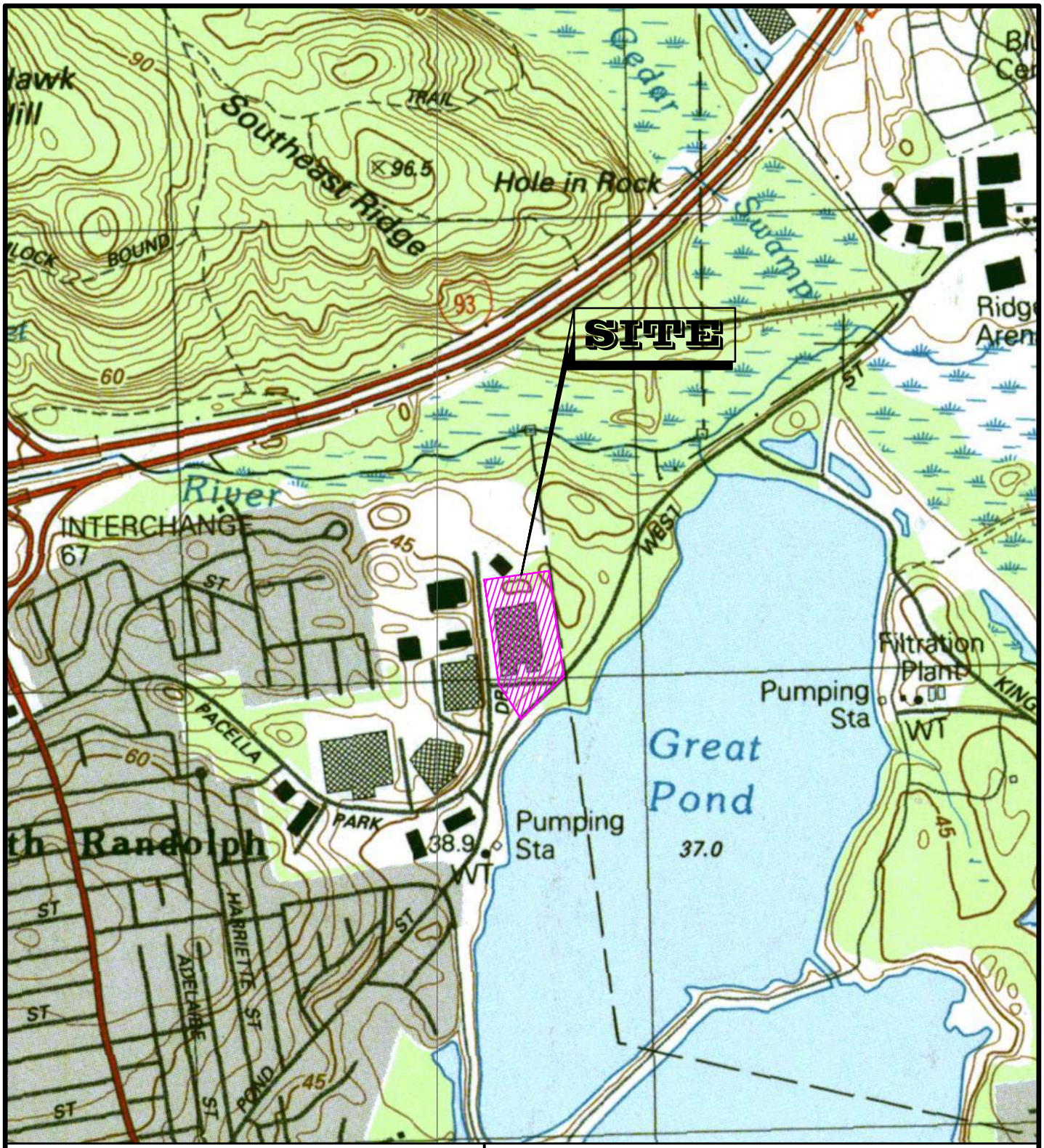

FIGURE - 1

0 1000' 2000' 2500'

U.S. GEOLOGICAL SURVEY
7.5 X 15 MINUTE SERIES

DATE: APRIL 4, 2024

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Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.0333
www.mckeng.com

USGS LOCUS MAP

300 POND STREET
ASSESSOR'S PARCEL NUMBER 3-O-2.1
RANDOLPH, MASSACHUSETTS

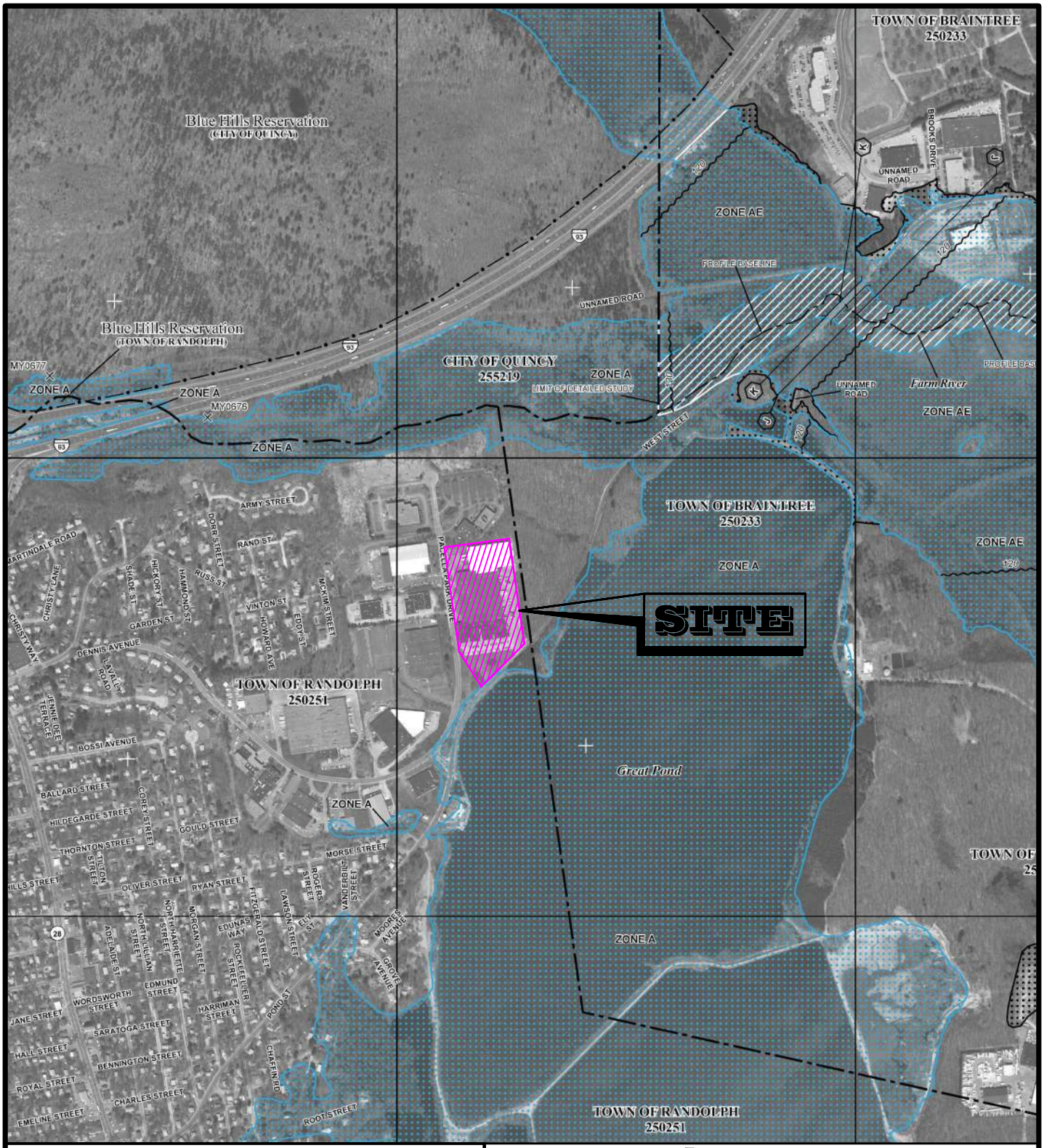

FIGURE - 2

0 250’ 500’ 625’

COMMUNITY PANEL NO: 25021C0208E
EFFECTIVE DATE: JULY 17, 2012

DATE: APRIL 4, 2024

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150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.0333
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FEMA FLOOD MAP

300 POND STREET
ASSESSOR'S PARCEL NUMBER 3-O-2.1
RANDOLPH, MASSACHUSETTS

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
104C	HOLLIS–ROCK OUTCROP–CHARLTON COMPLEX, 0–15% SLOPES	D
422B	CANTON FINE SANDY LOAM, 0–8% SLOPES, EXTREMELY STONY	B
654	UDORTHENTS, LOAMY	A

FIGURE - 3

0 500' 1000' 1250'

NRCS SOIL SURVEY
NORFOLK COUNTY

DATE: APRIL 4, 2024

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150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.0333
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NRCS SOILS MAP

300 POND STREET
ASSESSOR'S PARCEL NUMBER 3-O-2.1
RANDOLPH, MASSACHUSETTS

FIGURE - 4

0 500' 1000' 1250'

Google Earth Imagery
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AERIAL PHOTOGRAPH

300 POND STREET
ASSESSOR'S PARCEL NUMBER 3-O-2.1
RANDOLPH, MASSACHUSETTS

FIGURE - 5

0 500' 1000' 1250'

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NATIONAL HERITAGE AND ENDANGERED SPECIES MAP

300 POND STREET
ASSESSOR'S PARCEL NUMBER 3-O-2.1
RANDOLPH, MASSACHUSETTS

A P P E N D I X A

Pre-Development Condition

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Metadata for Point

Smoothing	Yes
State	
Location	
Latitude	42.203 degrees North
Longitude	71.05 degrees West
Elevation	40 feet
Date/Time	Thu Nov 16 2023 11:48:40 GMT-0500 (Eastern Standard Time)

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day
1yr	0.29	0.44	0.54	0.71	0.89	1.12	**1yr**	0.77	1.07	1.30	1.66	2.12	2.72	3.03	**1yr**	2.41	2.91
2yr	0.36	0.55	0.69	0.90	1.14	1.43	**2yr**	0.98	1.32	1.66	2.08	2.62	3.29	3.66	**2yr**	2.91	3.52
5yr	0.43	0.67	0.84	1.13	1.44	1.84	**5yr**	1.25	1.66	2.13	2.67	3.33	4.14	4.66	**5yr**	3.66	4.48
10yr	0.49	0.77	0.98	1.33	1.73	2.21	**10yr**	1.49	1.97	2.57	3.21	3.98	4.92	5.60	**10yr**	4.35	5.39
25yr	0.59	0.93	1.19	1.65	2.19	2.83	**25yr**	1.89	2.47	3.29	4.11	5.07	6.19	7.14	**25yr**	5.48	6.87
50yr	0.68	1.09	1.40	1.96	2.63	3.41	**50yr**	2.27	2.94	3.98	4.95	6.08	7.37	8.59	**50yr**	6.53	8.26
100yr	0.78	1.27	1.64	2.32	3.16	4.12	**100yr**	2.73	3.50	4.80	5.97	7.29	8.79	10.33	**100yr**	7.78	9.94
200yr	0.91	1.48	1.92	2.75	3.80	4.97	**200yr**	3.28	4.16	5.81	7.20	8.74	10.48	12.44	**200yr**	9.27	11.96
500yr	1.12	1.84	2.40	3.47	4.85	6.37	**500yr**	4.19	5.24	7.44	9.19	11.12	13.23	15.90	**500yr**	11.71	15.29

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day
1yr	0.25	0.38	0.47	0.63	0.77	0.89	**1yr**	0.67	0.87	1.10	1.42	1.85	2.51	2.82	**1yr**	2.22	2.71
2yr	0.34	0.53	0.65	0.88	1.08	1.29	**2yr**	0.94	1.26	1.48	1.97	2.56	3.20	3.56	**2yr**	2.83	3.43
5yr	0.40	0.61	0.76	1.04	1.33	1.55	**5yr**	1.15	1.51	1.77	2.31	2.98	3.87	4.34	**5yr**	3.43	4.17
10yr	0.45	0.69	0.85	1.19	1.53	1.77	**10yr**	1.32	1.73	2.01	2.60	3.33	4.47	5.03	**10yr**	3.96	4.84
25yr	0.52	0.79	0.98	1.40	1.84	2.10	**25yr**	1.59	2.05	2.38	3.04	3.87	5.41	6.13	**25yr**	4.79	5.89
50yr	0.58	0.88	1.09	1.57	2.12	2.39	**50yr**	1.83	2.34	2.71	3.43	4.34	6.26	7.11	**50yr**	5.54	6.84
100yr	0.65	0.98	1.23	1.78	2.44	2.72	**100yr**	2.11	2.65	3.07	3.86	4.86	7.25	8.23	**100yr**	6.42	7.92
200yr	0.73	1.10	1.39	2.02	2.82	3.09	**200yr**	2.43	3.02	3.49	4.34	5.44	8.40	9.56	**200yr**	7.44	9.19
500yr	0.86	1.28	1.64	2.39	3.39	3.66	**500yr**	2.93	3.58	4.13	5.08	6.31	10.27	11.63	**500yr**	9.09	11.18

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day
1yr	0.32	0.49	0.59	0.80	0.98	1.17	**1yr**	0.85	1.14	1.36	1.81	2.35	2.91	3.29	**1yr**	2.58	3.17
2yr	0.37	0.58	0.71	0.96	1.18	1.40	**2yr**	1.02	1.37	1.61	2.13	2.75	3.40	3.80	**2yr**	3.01	3.65
5yr	0.48	0.73	0.91	1.25	1.59	1.84	**5yr**	1.37	1.80	2.13	2.75	3.51	4.41	5.00	**5yr**	3.90	4.81
10yr	0.59	0.90	1.12	1.56	2.02	2.29	**10yr**	1.74	2.24	2.63	3.35	4.23	5.41	6.20	**10yr**	4.79	5.96
25yr	0.78	1.18	1.47	2.10	2.76	3.04	**25yr**	2.38	2.97	3.50	4.36	5.42	7.08	8.22	**25yr**	6.27	7.91
50yr	0.95	1.45	1.80	2.59	3.49	3.78	**50yr**	3.01	3.69	4.34	5.31	6.55	8.68	10.19	**50yr**	7.68	9.80
100yr	1.18	1.79	2.24	3.23	4.43	4.69	**100yr**	3.82	4.59	5.40	6.46	7.91	10.64	12.63	**100yr**	9.42	12.14
200yr	1.46	2.20	2.79	4.03	5.62	5.83	**200yr**	4.85	5.70	6.72	7.89	9.55	13.03	15.67	**200yr**	11.53	15.07
500yr	1.95	2.90	3.74	5.43	7.72	7.77	**500yr**	6.66	7.59	8.98	10.27	12.28	17.04	20.84	**500yr**	15.08	20.04

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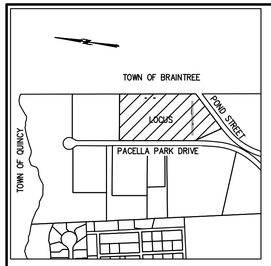
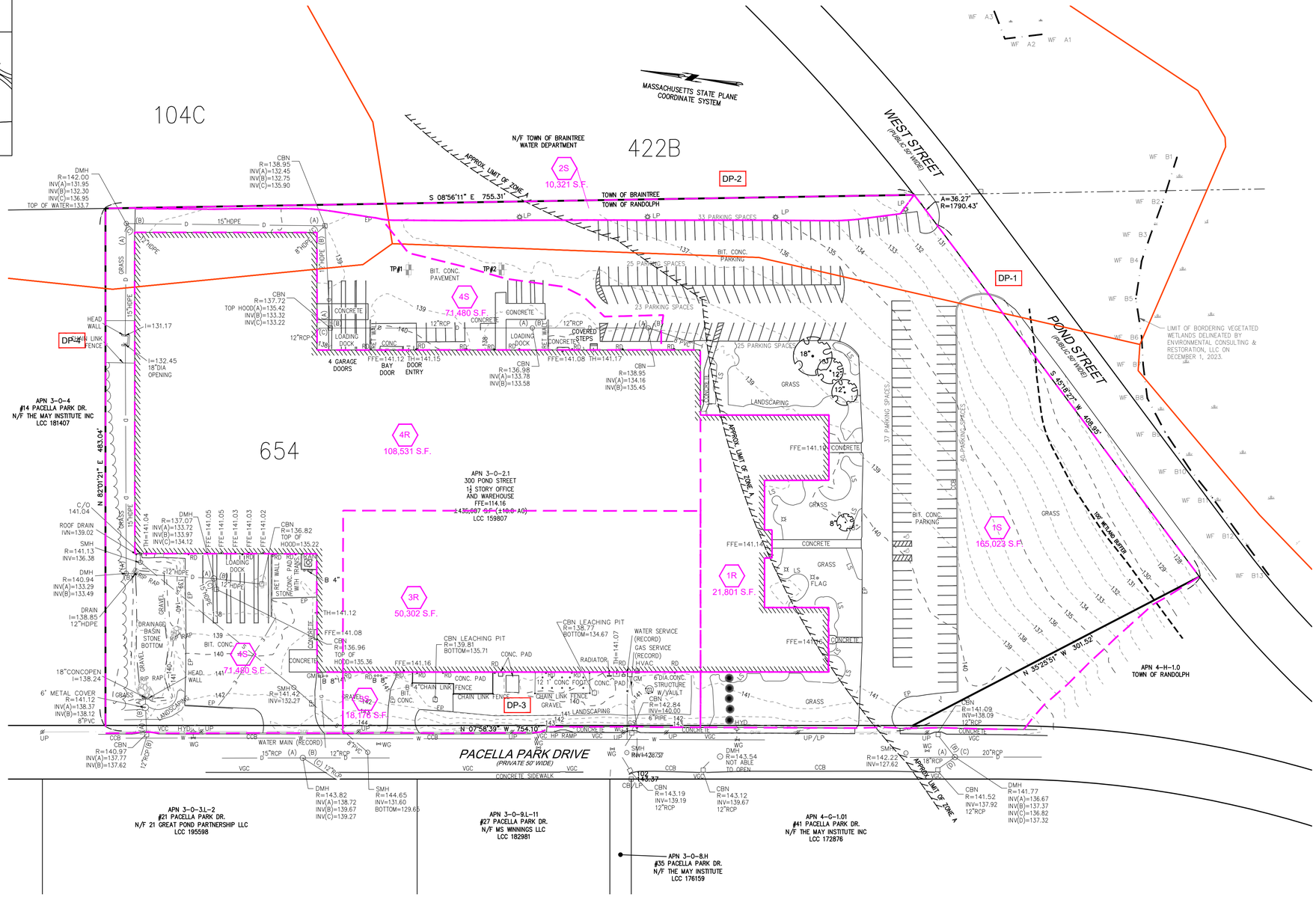
Northeast Regional Climate Center



LOCUS MAP
Not to Scale



LEGEND

SURVEY SYMBOLS

CB/DH	□	CONCRETE BOUND WITH DRILL HOLE
SB	□	STONE BOUND
SB/DH	□	STONE BOUND

UTILITY SYMBOLS

	TRANSFORMER
	WATER GATE
EMH	ELECTRIC MANHOLE
SMH	SEWER MANHOLE
DMH	DRAIN MANHOLE
TMH	TELEPHONE MANHOLE
CBN	DRAINAGE CATCH BASIN
	HYDRANT
	UTILITY POLE
	BOLLARD
	SIGN

LINE DESIGNATORS

W	WATER MAIN
OHW	OVERHEAD WIRES
G	GAS LINE
WS	WATER SERVICE
E	UNDERGROUND ELECTRIC
D	STORM DRAIN LINE
S	SANITARY SEWER LINE
	DRAINAGE SWALE
X	CHAIN LINK FENCE

ABBREVIATIONS

FFE	FIRST FLOOR ELEVATION
BIT CONC.	BITUMINOUS CONCRETE PAVEMENT
CCB	CAPE COD BERM
EP	EDGE OF PAVEMENT
BC	BITUMINOUS CONCRETE CURB
RET WALL	RETAINING WALL
CONC.	CONCRETE
VGC	VERTICAL GRANITE CURB
VCC	VERTICAL CONCRETE CURB
FOOT	CONCRETE FOOTING

SURVEY NOTES:

1. LOCUS IS SHOWN AS PARCEL NUMBER 03-0-2.1 ON THE TOWN OF RANDOLPH ASSESSORS MAPS.
2. DEED TO LOCUS IS RECORDED IN THE NORFOLK COUNTY REGISTRY OF DEEDS LAND COURT AT CERTIFICATE #159807.
3. THIS SURVEY WAS MADE ON THE GROUND IN NOVEMBER OF 2022 AND UPDATED IN SEPTEMBER AND DECEMBER OF 2023 BY MCKENZIE ENGINEERING GROUP, INC.
4. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
5. WETLAND RESOURCE AREAS WERE DELINEATED BY ENVIRONMENTAL CONSULTING & RESTORATION, LLC ON DECEMBER 1, 2023.
6. LOCUS IS SITUATED IN ZONE X AS SHOWN ON F.I.R.M. No 25021C0208E, EFFECTIVE 7/17/2012.
7. LOCUS IS NOT LOCATED IN A DEP ZONE 2 OR TOWN OF RANDOLPH AQUIFER PROTECTION DISTRICT ZONE. A PORTION OF THE SITE IS LOCATED WITHIN A DEP ZONE A SURFACE WATER SUPPLY PROTECTION AREA.
8. UTILITY INFORMATION FROM ABOVE GROUND OBSERVED EVIDENCE IN CONJUNCTION WITH DIG SAFE MARKINGS AND RECORD PLANS. THE LAND SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN HEREON COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE LAND SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. BEFORE CONSTRUCTION CALL DIG SAFE SYSTEMS, INC. AT 1-888-344-7233.

7 PLAN REFERENCES: LCP 34183A
#953 OF 1963
#393 OF 1927 (POND STREET LAYOUT)
#256 OF 1923 (WEST STREET LAYOUT)

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
104C	HOLLIS-ROCK OUTCROP-CHARLTON COMPLEX, 0-15% SLOPES	D
422B	CANTON FINE SANDY LOAM, 0-8% SLOPES EXTREMELY STONY	B
654	UDORTHENTS, LOAMY	A

LEGEND

LIMIT OF WATERSHED

TIME OF CONCENTRATION FLOW PATH

LIMIT OF NRCS SOIL MAPPING

0 50 100 150

REV	DATE	DESCRIPTION	BY	APP

MCKENZIE ENGINEERING GROUP
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.0333
www.mckeng.com

EXISTING CONDITIONS PLAN
300 POND STREET
RANDOLPH, MASSACHUSETTS

PROFESSIONAL SURVEYOR:

OWNERS/APPLICANT:
EMERSON - SWAN FLEXCON
300 POND STREET
RANDOLPH, MASSACHUSETTS

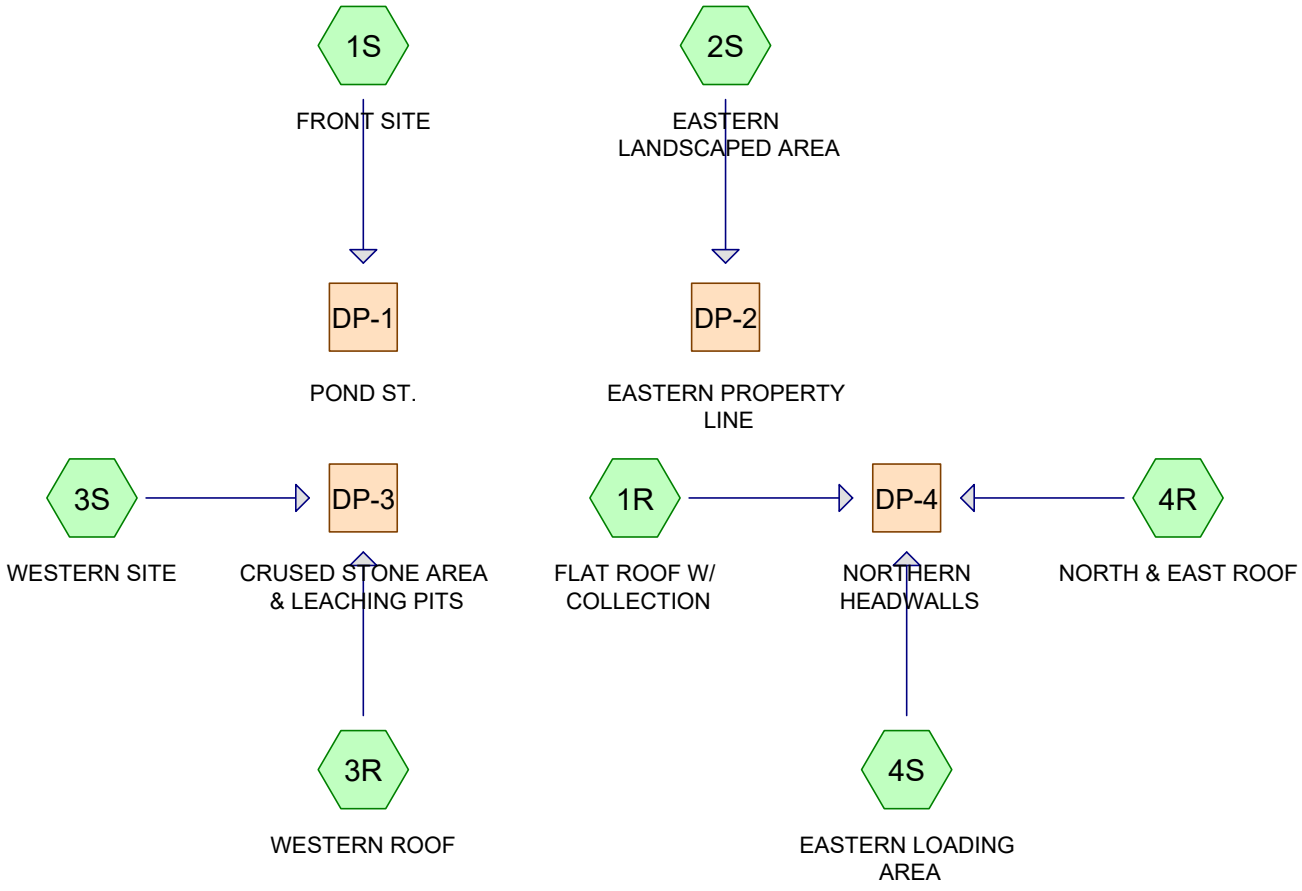
NOT FOR CONSTRUCTION

DRAWN BY:	ESS
DESIGNED BY:	ESS
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	APRIL 12, 2024
SCALE:	1"=50'
PROJECT NO.:	222-209

DWG. TITLE:
PRE-DEV. WATERSHED PLAN

DWG. NO:
WS-1

M:\MEG\2022 PROJECTS\222-209 EMERSON SWAN-FLEXCON - 300 POND ST, RANDOLPH\DWGS\222-209 WS-1.DWG



Subcat Reach Pond Link

Routing Diagram for 222-209 PRE DEVELOPMENT
Prepared by McKenzie Engineering Group, Inc., Printed 4/22/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.29	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.92	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.19	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.79	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.428	39	>75% Grass cover, Good, HSG A (1S, 3S, 4S)
0.233	61	>75% Grass cover, Good, HSG B (1S, 2S)
0.023	80	>75% Grass cover, Good, HSG D (2S)
0.270	96	Gravel surface, HSG A (3S, 4S)
2.280	98	Paved parking, HSG A (1S, 4S)
0.471	98	Paved parking, HSG B (1S, 4S)
0.156	98	Paved parking, HSG D (4S)
4.147	98	Roofs, HSG A (1R, 3R, 4R)
0.077	98	Unconnected pavement, HSG A (3S)
0.099	30	Woods, Good, HSG A (4S)
0.047	77	Woods, Good, HSG D (4S)
10.230	**82**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
9.301	HSG A	1R, 1S, 3R, 3S, 4R, 4S
0.703	HSG B	1S, 2S, 4S
0.000	HSG C	
0.226	HSG D	2S, 4S
0.000	Other	
10.230		**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
2.428	0.233	0.000	0.023	0.000	2.684	>75% Grass cover, Good	1S, 2S, 3S, 4S
0.270	0.000	0.000	0.000	0.000	0.270	Gravel surface	3S, 4S
2.280	0.471	0.000	0.156	0.000	2.906	Paved parking	1S, 4S
4.147	0.000	0.000	0.000	0.000	4.147	Roofs	1R, 3R, 4R
0.077	0.000	0.000	0.000	0.000	0.077	Unconnected pavement	3S
0.099	0.000	0.000	0.047	0.000	0.146	Woods, Good	4S
9.301	**0.703**	**0.000**	**0.226**	**0.000**	**10.230**	**TOTAL AREA**	

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1R: FLAT ROOF W/ Runoff Area=21,801 sf 100.00% Impervious Runoff Depth>3.00"
Tc=6.0 min CN=98 Runoff=1.56 cfs 0.125 af

Subcatchment1S: FRONT SITE Runoff Area=165,023 sf 48.15% Impervious Runoff Depth=0.78"
Tc=6.0 min CN=68 Runoff=2.98 cfs 0.247 af

Subcatchment2S: EASTERN Runoff Area=10,320 sf 0.00% Impervious Runoff Depth=0.56"
Tc=6.0 min CN=63 Runoff=0.11 cfs 0.011 af

Subcatchment3R: WESTERN ROOF Runoff Area=50,302 sf 100.00% Impervious Runoff Depth>3.00"
Tc=6.0 min CN=98 Runoff=3.60 cfs 0.289 af

Subcatchment3S: WESTERN SITE Runoff Area=18,176 sf 18.54% Impervious Runoff Depth=1.54"
Tc=6.0 min UI Adjusted CN=81 Runoff=0.74 cfs 0.054 af

Subcatchment4R: NORTH & EAST Runoff Area=108,531 sf 100.00% Impervious Runoff Depth>3.00"
Tc=6.0 min CN=98 Runoff=7.78 cfs 0.623 af

Subcatchment4S: EASTERN LOADING Runoff Area=71,480 sf 65.94% Impervious Runoff Depth=1.47"
Tc=6.0 min CN=80 Runoff=2.76 cfs 0.201 af

Reach DP-1: POND ST. Inflow=2.98 cfs 0.247 af
Outflow=2.98 cfs 0.247 af

Reach DP-2: EASTERN PROPERTY LINE Inflow=0.11 cfs 0.011 af
Outflow=0.11 cfs 0.011 af

Reach DP-3: CRUSED STONE AREA & LEACHING PITS Inflow=4.34 cfs 0.342 af
Outflow=4.34 cfs 0.342 af

Reach DP-4: NORTHERN HEADWALLS Inflow=12.08 cfs 0.949 af
Outflow=12.08 cfs 0.949 af

Total Runoff Area = 10.230 ac Runoff Volume = 1.549 af Average Runoff Depth = 1.82"
30.30% Pervious = 3.100 ac 69.70% Impervious = 7.130 ac

Summary for Subcatchment 1R: FLAT ROOF W/ COLLECTION

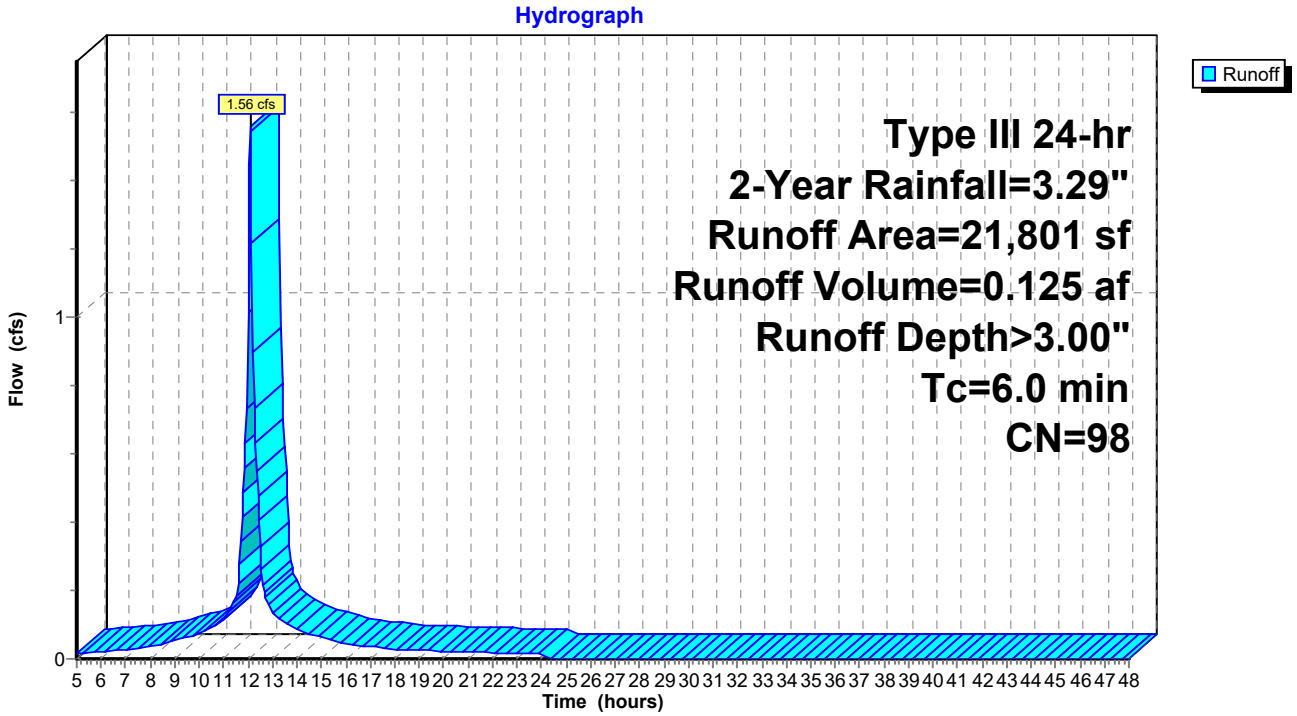
Runoff = 1.56 cfs @ 12.09 hrs, Volume= 0.125 af, Depth> 3.00"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=3.29"

Area (sf)	CN	Description
21,801	98	Roofs, HSG A
21,801		100.00% Impervious Area

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

Subcatchment 1R: FLAT ROOF W/ COLLECTION



Summary for Subcatchment 1S: FRONT SITE

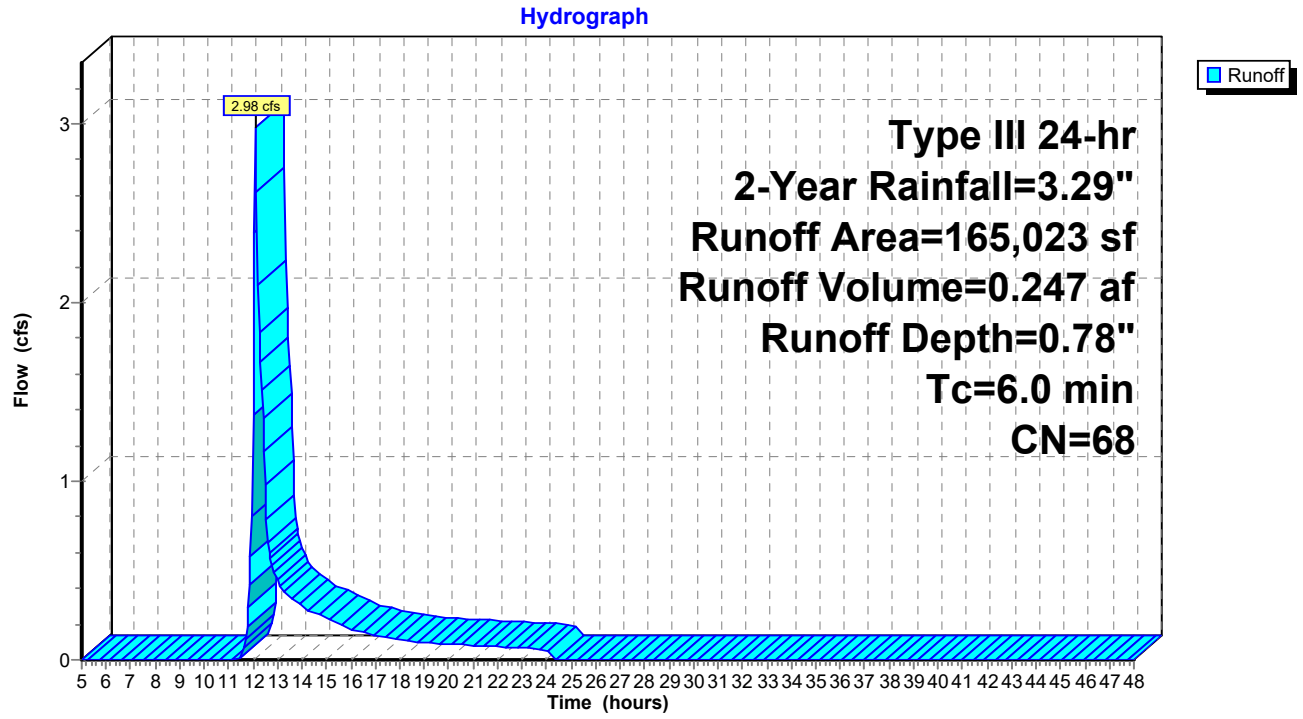
Runoff = 2.98 cfs @ 12.11 hrs, Volume= 0.247 af, Depth= 0.78"
Routed to Reach DP-1 : POND ST.

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=3.29"

Area (sf)	CN	Description
84,758	39	>75% Grass cover, Good, HSG A
809	61	>75% Grass cover, Good, HSG B
20,445	98	Paved parking, HSG B
59,011	98	Paved parking, HSG A
165,023	68	Weighted Average
85,567		51.85% Pervious Area
79,456		48.15% Impervious Area

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

Subcatchment 1S: FRONT SITE



Summary for Subcatchment 2S: EASTERN LANDSCAPED AREA

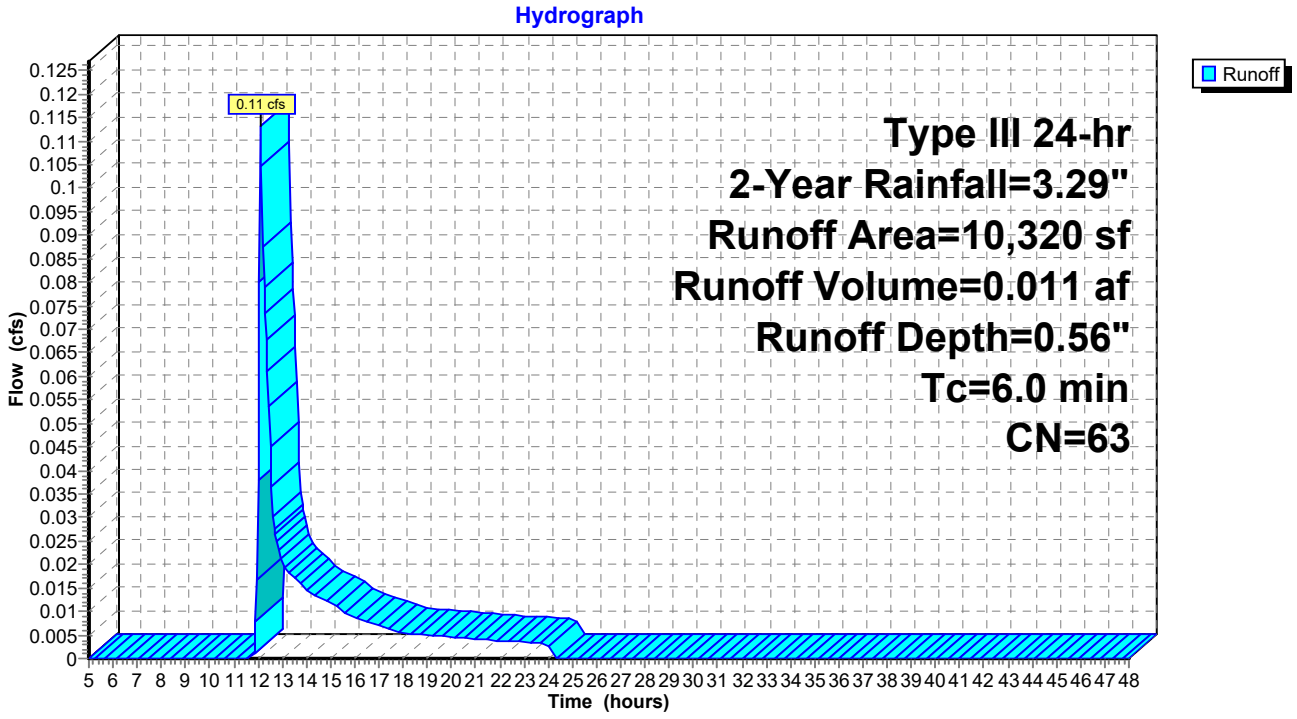
Runoff = 0.11 cfs @ 12.12 hrs, Volume= 0.011 af, Depth= 0.56"
Routed to Reach DP-2 : EASTERN PROPERTY LINE

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=3.29"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
1,000	80	>75% Grass cover, Good, HSG D
10,320	63	Weighted Average
10,320		100.00% Pervious Area

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

Subcatchment 2S: EASTERN LANDSCAPED AREA



Summary for Subcatchment 3R: WESTERN ROOF

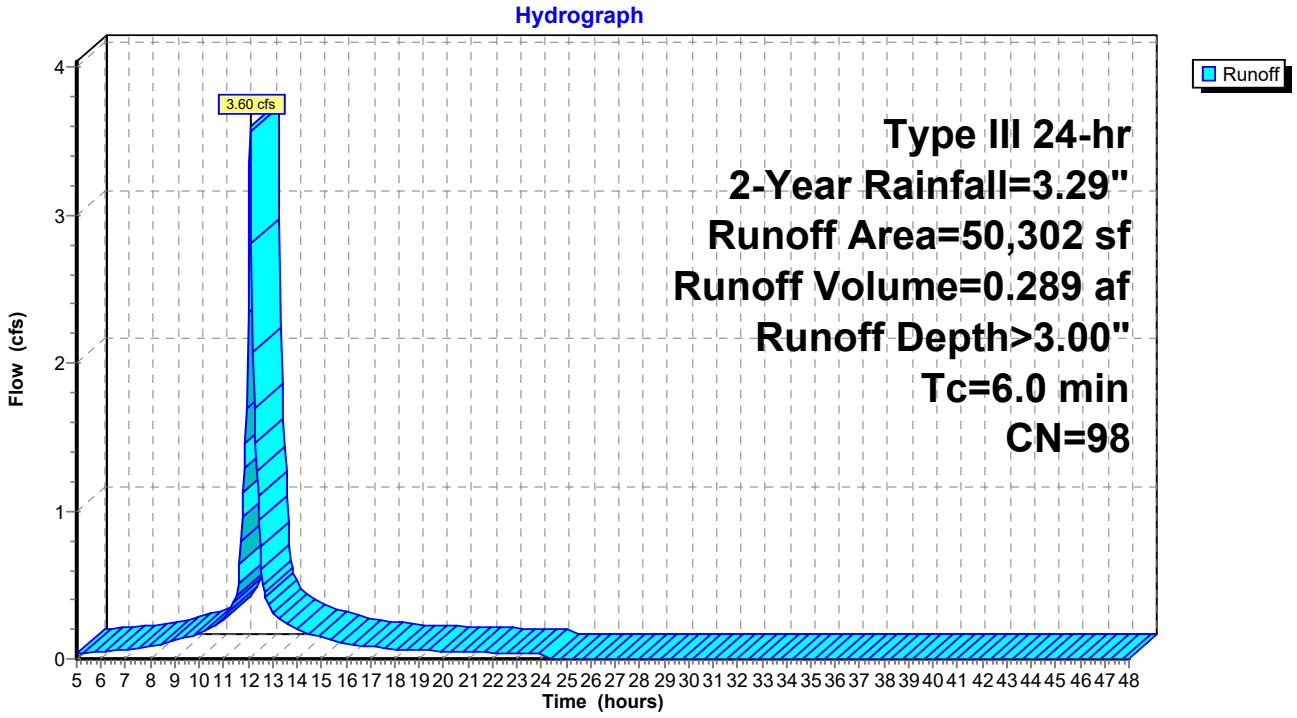
Runoff = 3.60 cfs @ 12.09 hrs, Volume= 0.289 af, Depth> 3.00"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=3.29"

Area (sf)	CN	Description
50,302	98	Roofs, HSG A
50,302		100.00% Impervious Area

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

Subcatchment 3R: WESTERN ROOF



Summary for Subcatchment 3S: WESTERN SITE

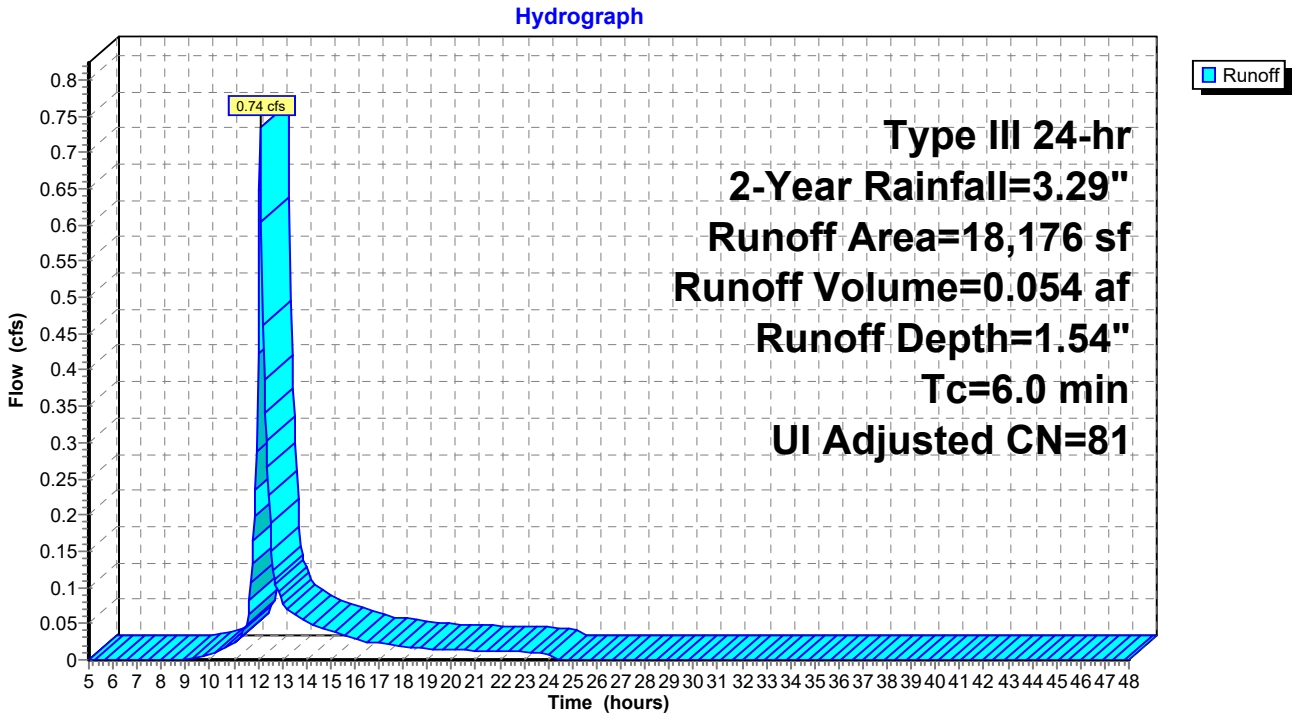
Runoff = 0.74 cfs @ 12.09 hrs, Volume= 0.054 af, Depth= 1.54"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=3.29"

Area (sf)	CN	Adj	Description
3,370	98		Unconnected pavement, HSG A
10,363	96		Gravel surface, HSG A
4,443	39		>75% Grass cover, Good, HSG A
18,176	82	81	Weighted Average, UI Adjusted
14,806			81.46% Pervious Area
3,370			18.54% Impervious Area
3,370			100.00% Unconnected

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

Subcatchment 3S: WESTERN SITE



Summary for Subcatchment 4R: NORTH & EAST ROOF

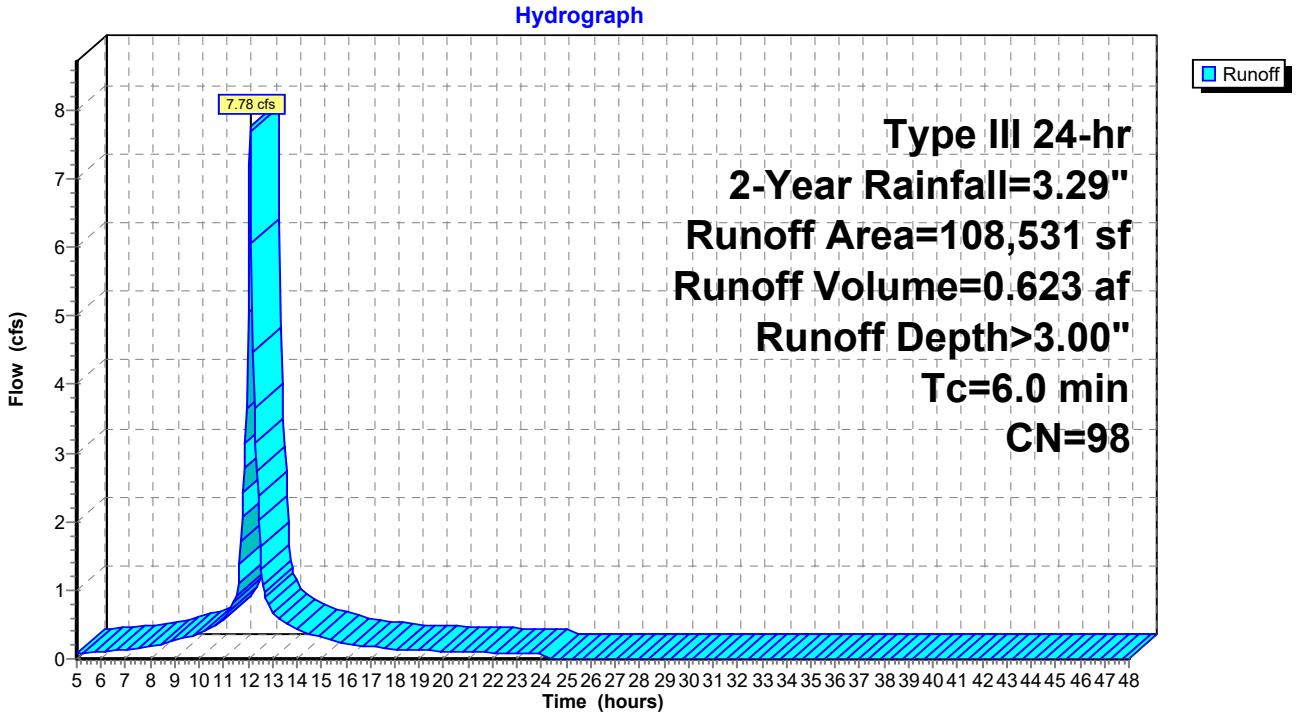
Runoff = 7.78 cfs @ 12.09 hrs, Volume= 0.623 af, Depth> 3.00"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=3.29"

Area (sf)	CN	Description
108,531	98	Roofs, HSG A
108,531		100.00% Impervious Area

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

Subcatchment 4R: NORTH & EAST ROOF



Summary for Subcatchment 4S: EASTERN LOADING AREA

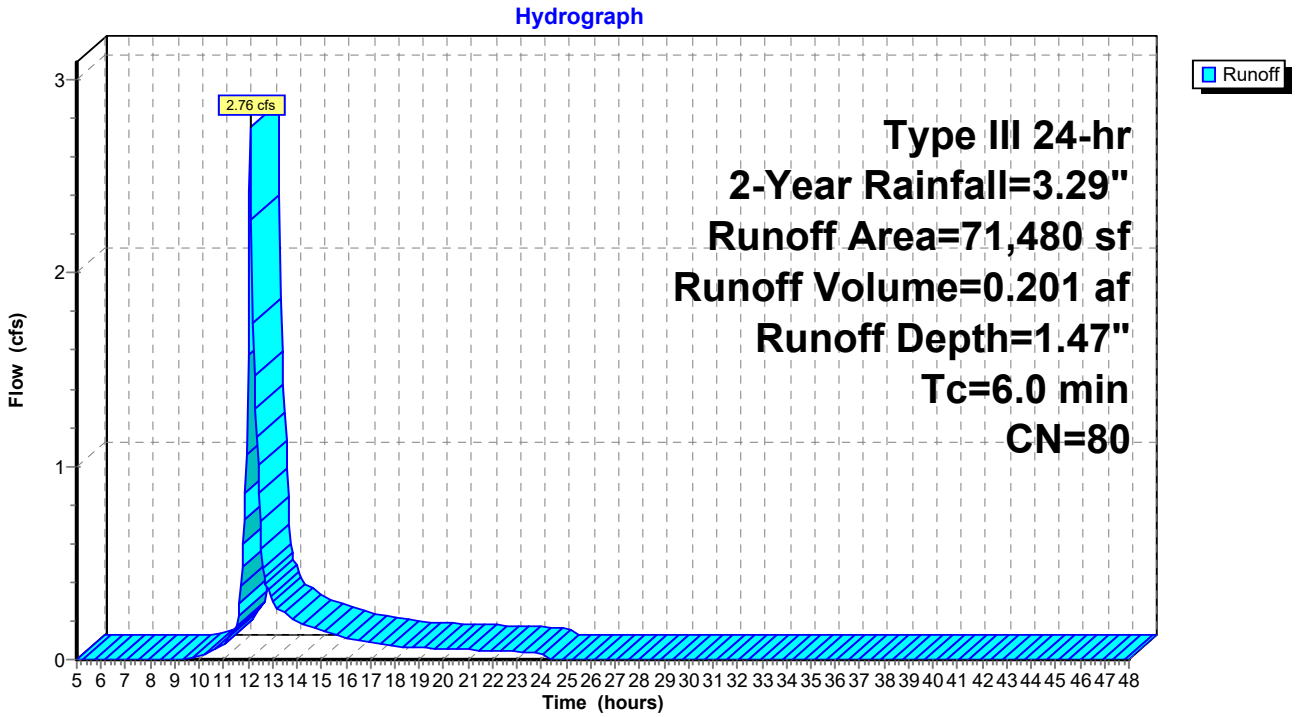
Runoff = 2.76 cfs @ 12.10 hrs, Volume= 0.201 af, Depth= 1.47"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=3.29"

Area (sf)	CN	Description
40,295	98	Paved parking, HSG A
55	98	Paved parking, HSG B
6,783	98	Paved parking, HSG D
4,315	30	Woods, Good, HSG A
2,050	77	Woods, Good, HSG D
16,572	39	>75% Grass cover, Good, HSG A
1,410	96	Gravel surface, HSG A
71,480	80	Weighted Average
24,347		34.06% Pervious Area
47,133		65.94% Impervious Area

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

Subcatchment 4S: EASTERN LOADING AREA



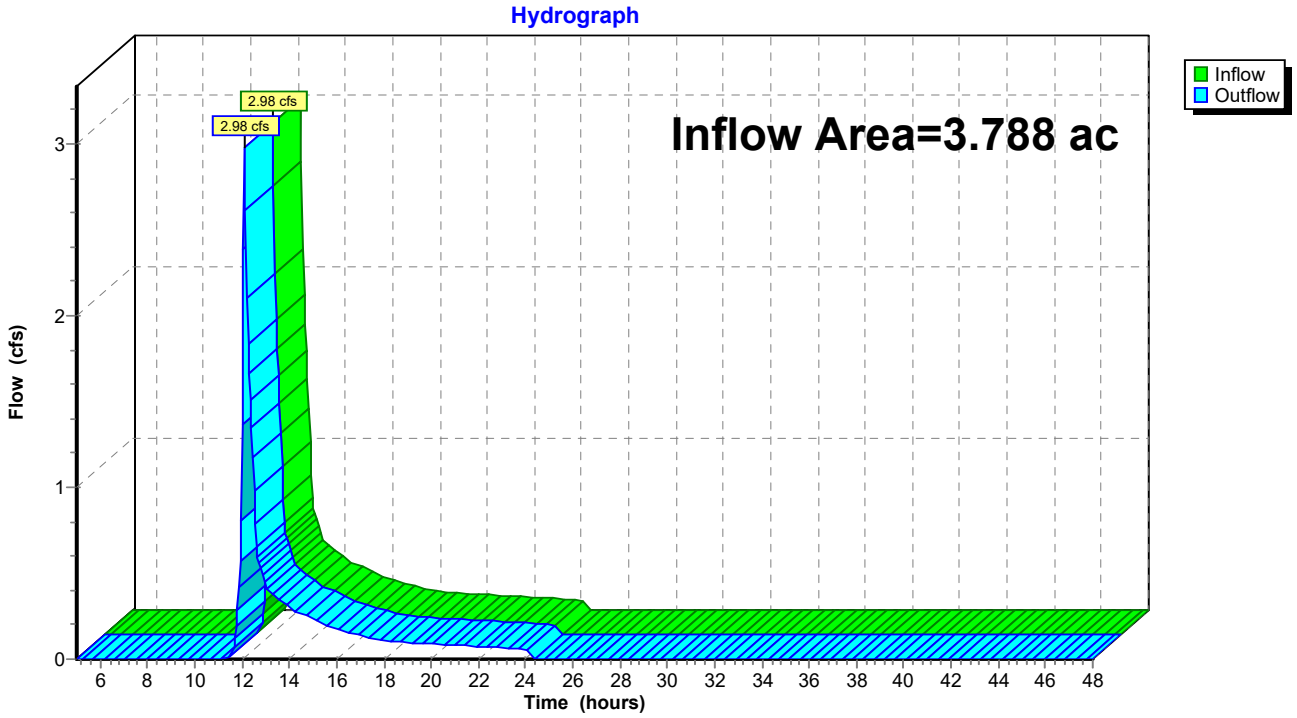
Summary for Reach DP-1: POND ST.

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

Inflow Area = 3.788 ac, 48.15% Impervious, Inflow Depth = 0.78" for 2-Year event
Inflow = 2.98 cfs @ 12.11 hrs, Volume= 0.247 af
Outflow = 2.98 cfs @ 12.11 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-1: POND ST.



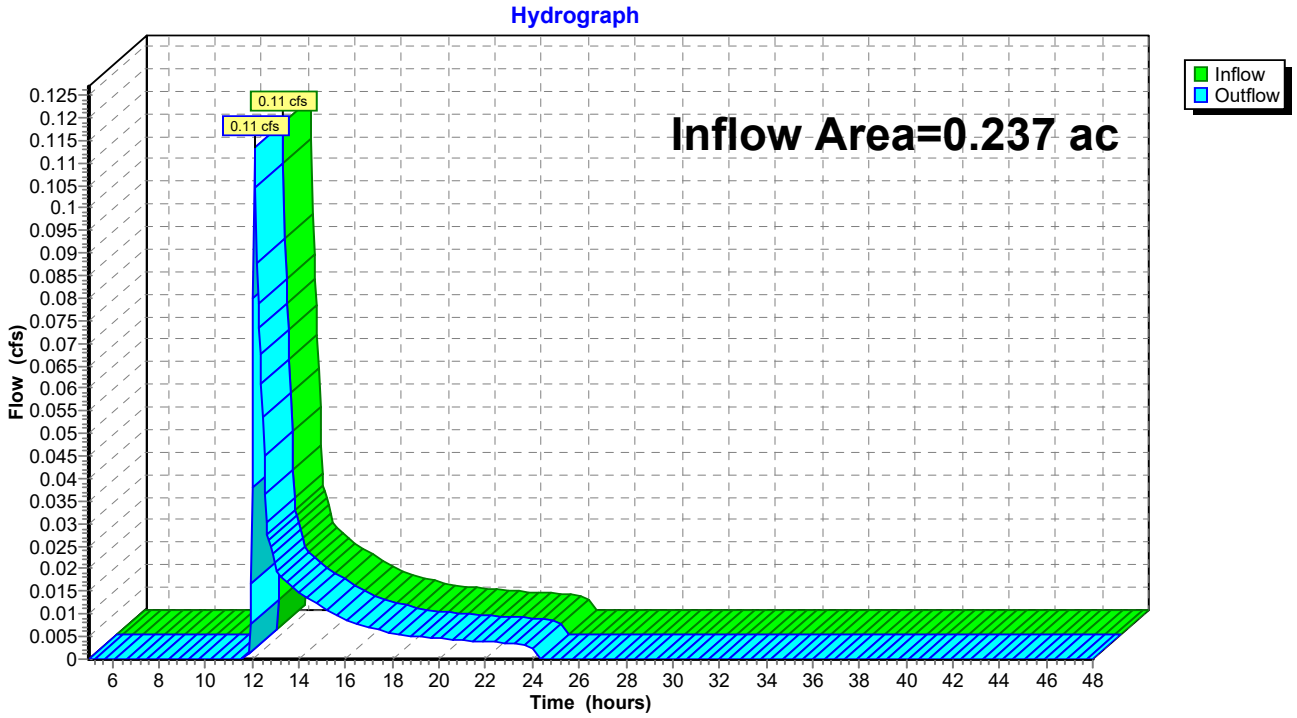
Summary for Reach DP-2: EASTERN PROPERTY LINE

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

Inflow Area = 0.237 ac, 0.00% Impervious, Inflow Depth = 0.56" for 2-Year event
Inflow = 0.11 cfs @ 12.12 hrs, Volume= 0.011 af
Outflow = 0.11 cfs @ 12.12 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-2: EASTERN PROPERTY LINE



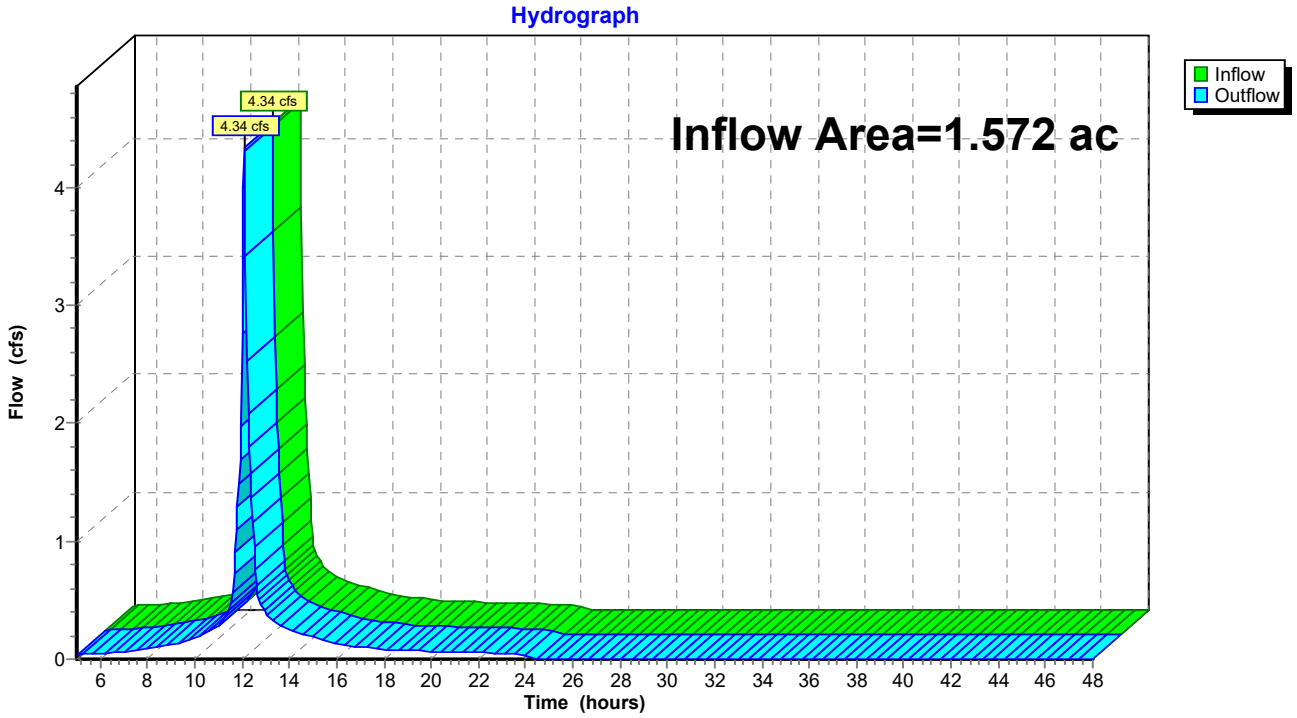
Summary for Reach DP-3: CRUSED STONE AREA & LEACHING PITS

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

Inflow Area = 1.572 ac, 78.38% Impervious, Inflow Depth > 2.61" for 2-Year event
Inflow = 4.34 cfs @ 12.09 hrs, Volume= 0.342 af
Outflow = 4.34 cfs @ 12.09 hrs, Volume= 0.342 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-3: CRUSED STONE AREA & LEACHING PITS



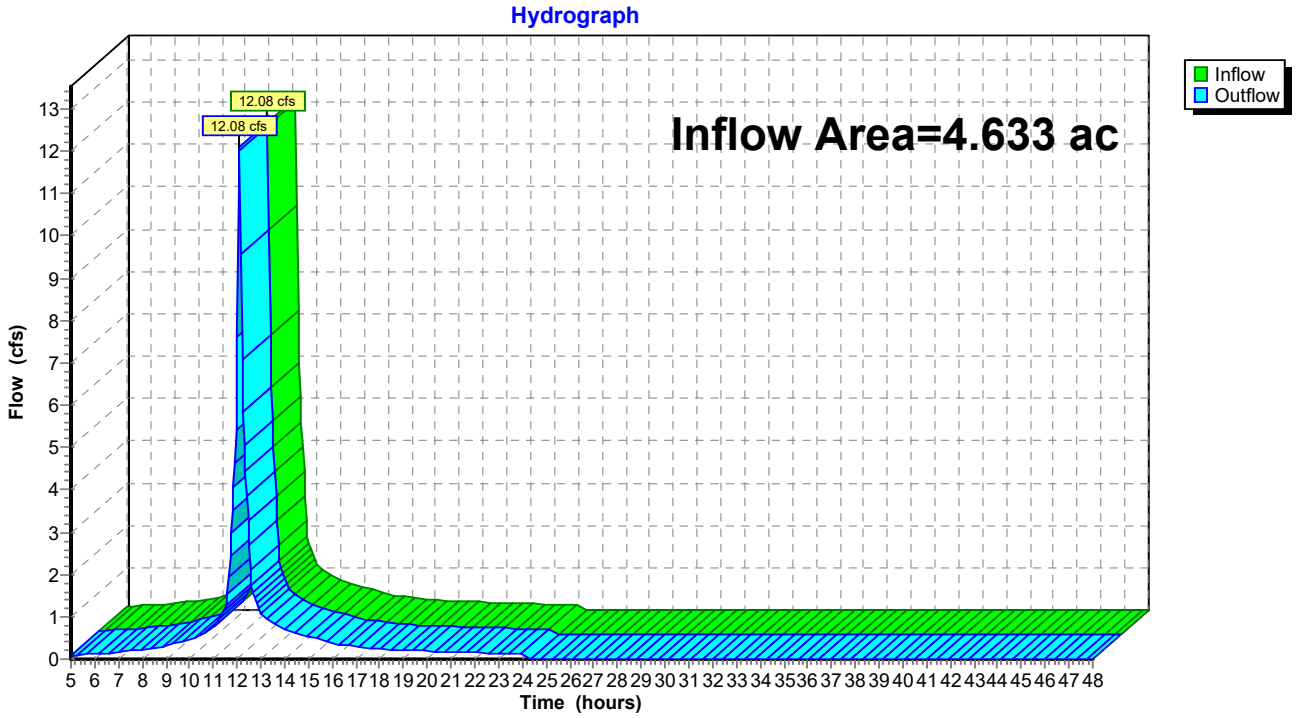
Summary for Reach DP-4: NORTHERN HEADWALLS

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

Inflow Area = 4.633 ac, 87.94% Impervious, Inflow Depth > 2.46" for 2-Year event
Inflow = 12.08 cfs @ 12.09 hrs, Volume= 0.949 af
Outflow = 12.08 cfs @ 12.09 hrs, Volume= 0.949 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-4: NORTHERN HEADWALLS



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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1R: FLAT ROOF W/ Runoff Area=21,801 sf 100.00% Impervious Runoff Depth>4.56"
Tc=6.0 min CN=98 Runoff=2.35 cfs 0.190 af

Subcatchment1S: FRONT SITE Runoff Area=165,023 sf 48.15% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=68 Runoff=7.72 cfs 0.575 af

Subcatchment2S: EASTERN Runoff Area=10,320 sf 0.00% Impervious Runoff Depth=1.46"
Tc=6.0 min CN=63 Runoff=0.37 cfs 0.029 af

Subcatchment3R: WESTERN ROOF Runoff Area=50,302 sf 100.00% Impervious Runoff Depth>4.56"
Tc=6.0 min CN=98 Runoff=5.43 cfs 0.439 af

Subcatchment3S: WESTERN SITE Runoff Area=18,176 sf 18.54% Impervious Runoff Depth=2.91"
Tc=6.0 min UI Adjusted CN=81 Runoff=1.40 cfs 0.101 af

Subcatchment4R: NORTH & EAST Runoff Area=108,531 sf 100.00% Impervious Runoff Depth>4.56"
Tc=6.0 min CN=98 Runoff=11.71 cfs 0.947 af

Subcatchment4S: EASTERN LOADING Runoff Area=71,480 sf 65.94% Impervious Runoff Depth=2.82"
Tc=6.0 min CN=80 Runoff=5.32 cfs 0.386 af

Reach DP-1: POND ST. Inflow=7.72 cfs 0.575 af
Outflow=7.72 cfs 0.575 af

Reach DP-2: EASTERN PROPERTY LINE Inflow=0.37 cfs 0.029 af
Outflow=0.37 cfs 0.029 af

Reach DP-3: CRUSED STONE AREA & LEACHING PITS Inflow=6.82 cfs 0.540 af
Outflow=6.82 cfs 0.540 af

Reach DP-4: NORTHERN HEADWALLS Inflow=19.37 cfs 1.523 af
Outflow=19.37 cfs 1.523 af

Total Runoff Area = 10.230 ac Runoff Volume = 2.668 af Average Runoff Depth = 3.13"
30.30% Pervious = 3.100 ac 69.70% Impervious = 7.130 ac

Summary for Subcatchment 1R: FLAT ROOF W/ COLLECTION

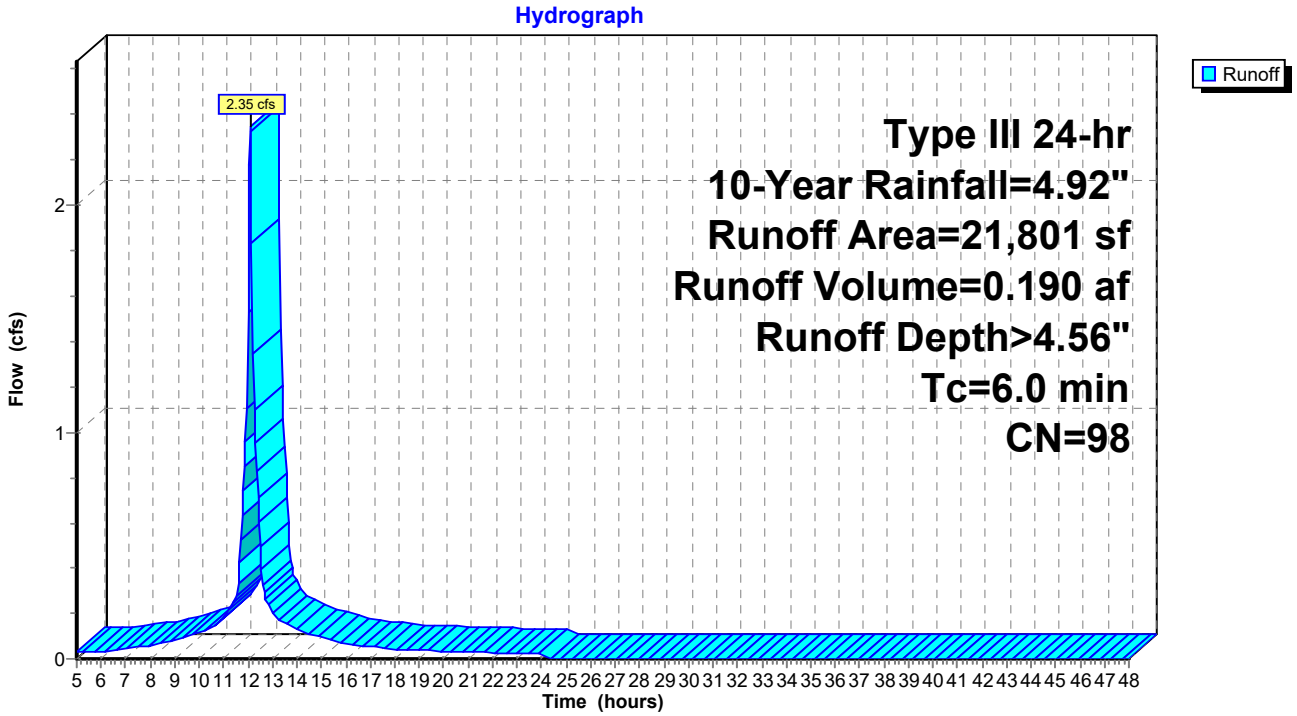
Runoff = 2.35 cfs @ 12.09 hrs, Volume= 0.190 af, Depth> 4.56"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=4.92"

Area (sf)	CN	Description
21,801	98	Roofs, HSG A
21,801		100.00% Impervious Area

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

Subcatchment 1R: FLAT ROOF W/ COLLECTION



Summary for Subcatchment 1S: FRONT SITE

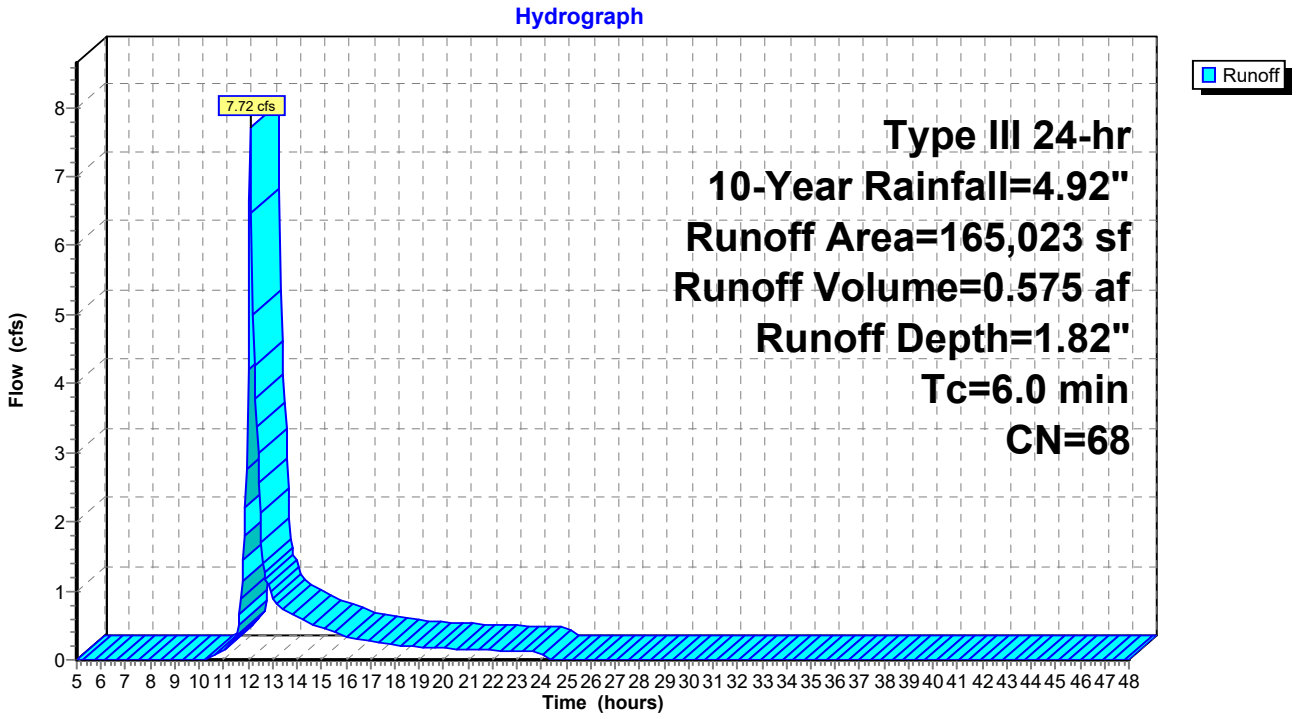
Runoff = 7.72 cfs @ 12.10 hrs, Volume= 0.575 af, Depth= 1.82"
Routed to Reach DP-1 : POND ST.

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=4.92"

Area (sf)	CN	Description
84,758	39	>75% Grass cover, Good, HSG A
809	61	>75% Grass cover, Good, HSG B
20,445	98	Paved parking, HSG B
59,011	98	Paved parking, HSG A
165,023	68	Weighted Average
85,567		51.85% Pervious Area
79,456		48.15% Impervious Area

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

Subcatchment 1S: FRONT SITE



Summary for Subcatchment 2S: EASTERN LANDSCAPED AREA

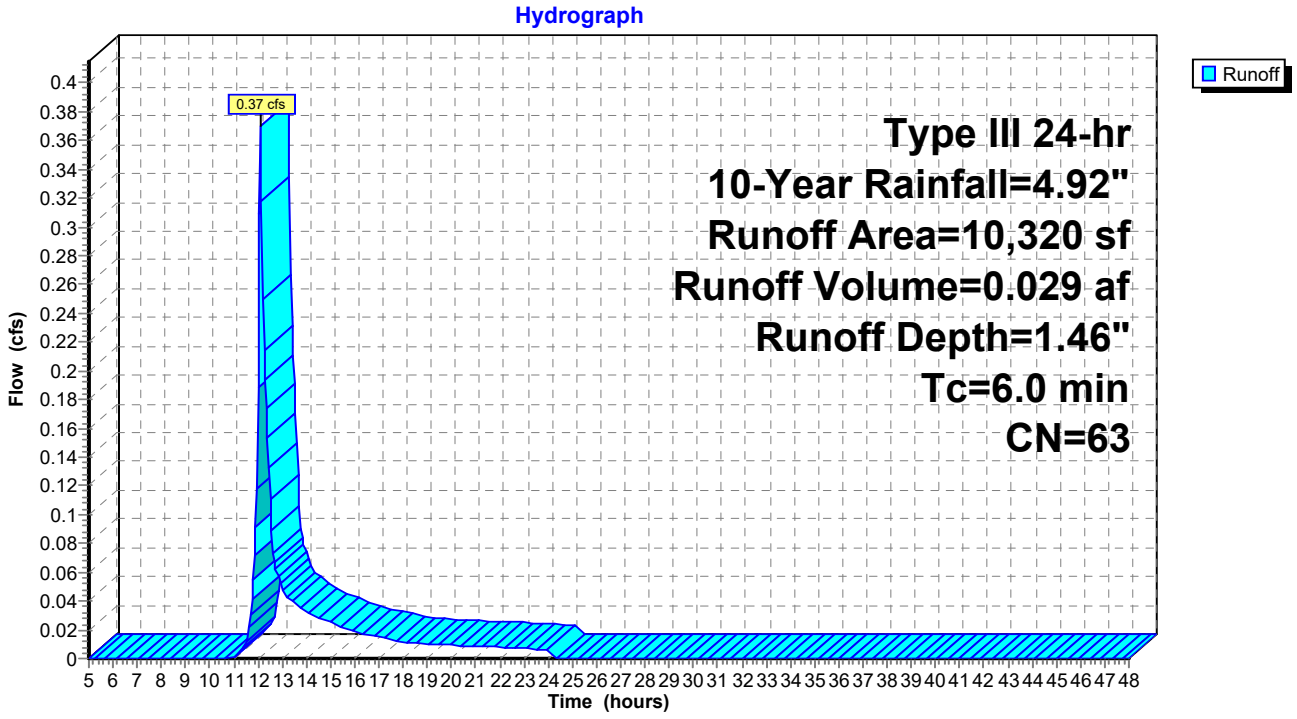
Runoff = 0.37 cfs @ 12.10 hrs, Volume= 0.029 af, Depth= 1.46"
Routed to Reach DP-2 : EASTERN PROPERTY LINE

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=4.92"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
1,000	80	>75% Grass cover, Good, HSG D
10,320	63	Weighted Average
10,320		100.00% Pervious Area

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

Subcatchment 2S: EASTERN LANDSCAPED AREA



Summary for Subcatchment 3R: WESTERN ROOF

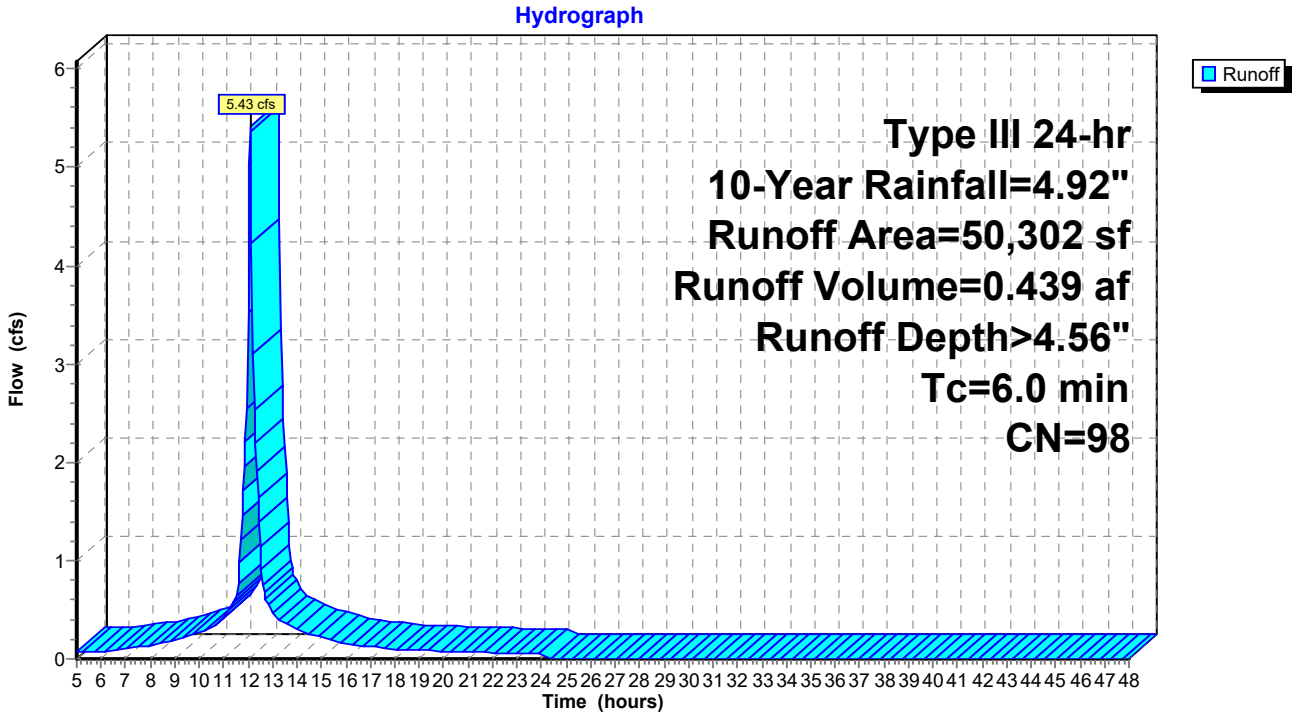
Runoff = 5.43 cfs @ 12.09 hrs, Volume= 0.439 af, Depth> 4.56"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=4.92"

Area (sf)	CN	Description
50,302	98	Roofs, HSG A
50,302		100.00% Impervious Area

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

Subcatchment 3R: WESTERN ROOF



Summary for Subcatchment 3S: WESTERN SITE

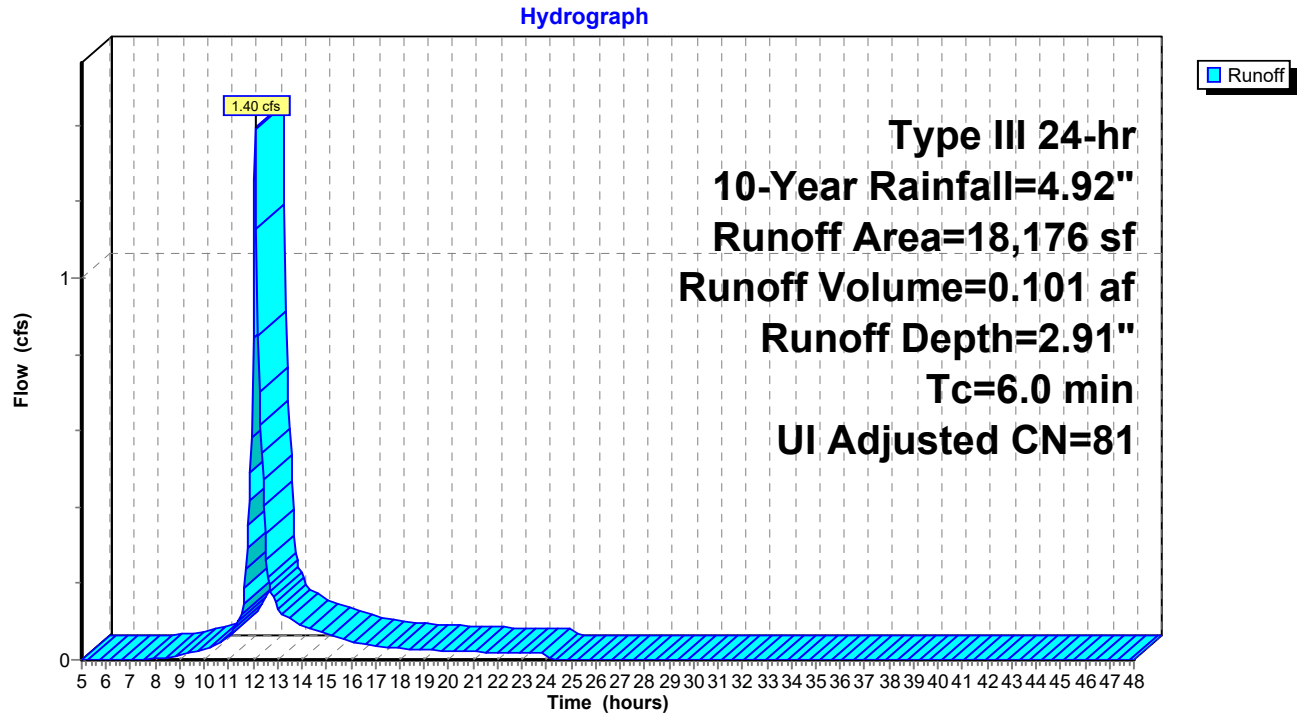
Runoff = 1.40 cfs @ 12.09 hrs, Volume= 0.101 af, Depth= 2.91"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=4.92"

Area (sf)	CN	Adj	Description
3,370	98		Unconnected pavement, HSG A
10,363	96		Gravel surface, HSG A
4,443	39		>75% Grass cover, Good, HSG A
18,176	82	81	Weighted Average, UI Adjusted
14,806			81.46% Pervious Area
3,370			18.54% Impervious Area
3,370			100.00% Unconnected

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

Subcatchment 3S: WESTERN SITE



Summary for Subcatchment 4R: NORTH & EAST ROOF

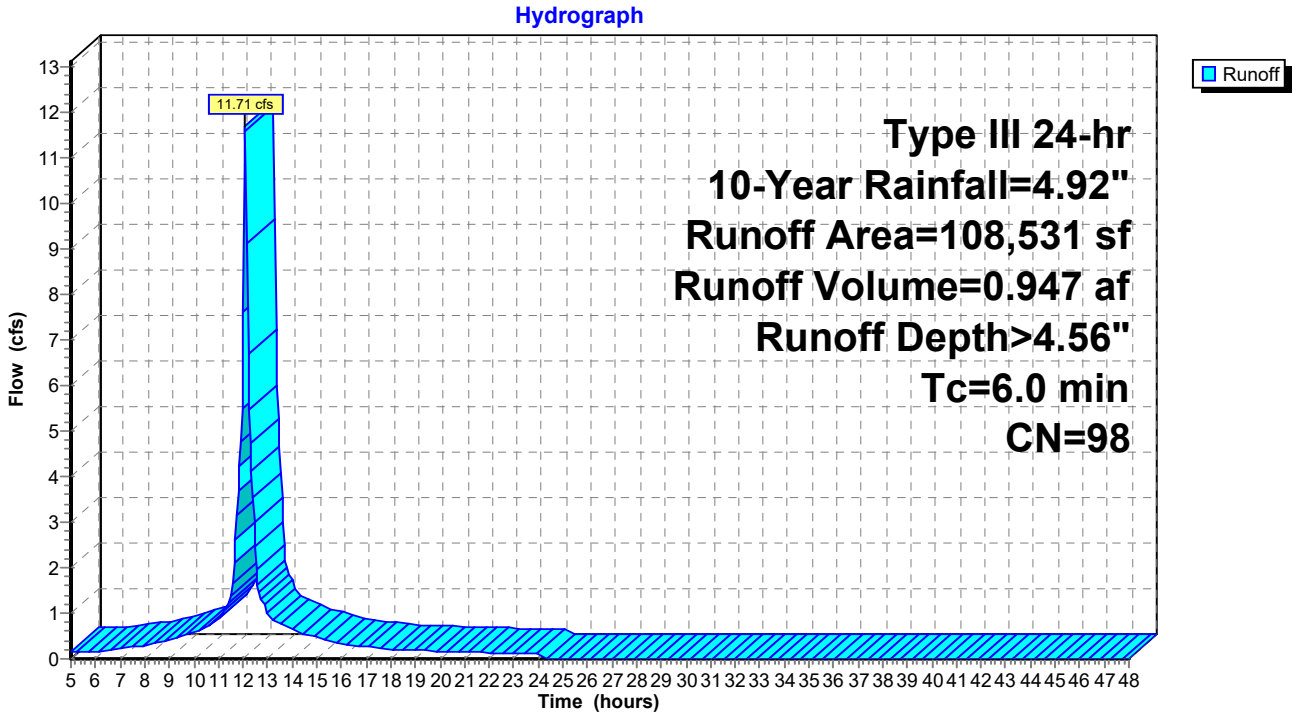
Runoff = 11.71 cfs @ 12.09 hrs, Volume= 0.947 af, Depth> 4.56"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=4.92"

Area (sf)	CN	Description
108,531	98	Roofs, HSG A
108,531		100.00% Impervious Area

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

Subcatchment 4R: NORTH & EAST ROOF



Summary for Subcatchment 4S: EASTERN LOADING AREA

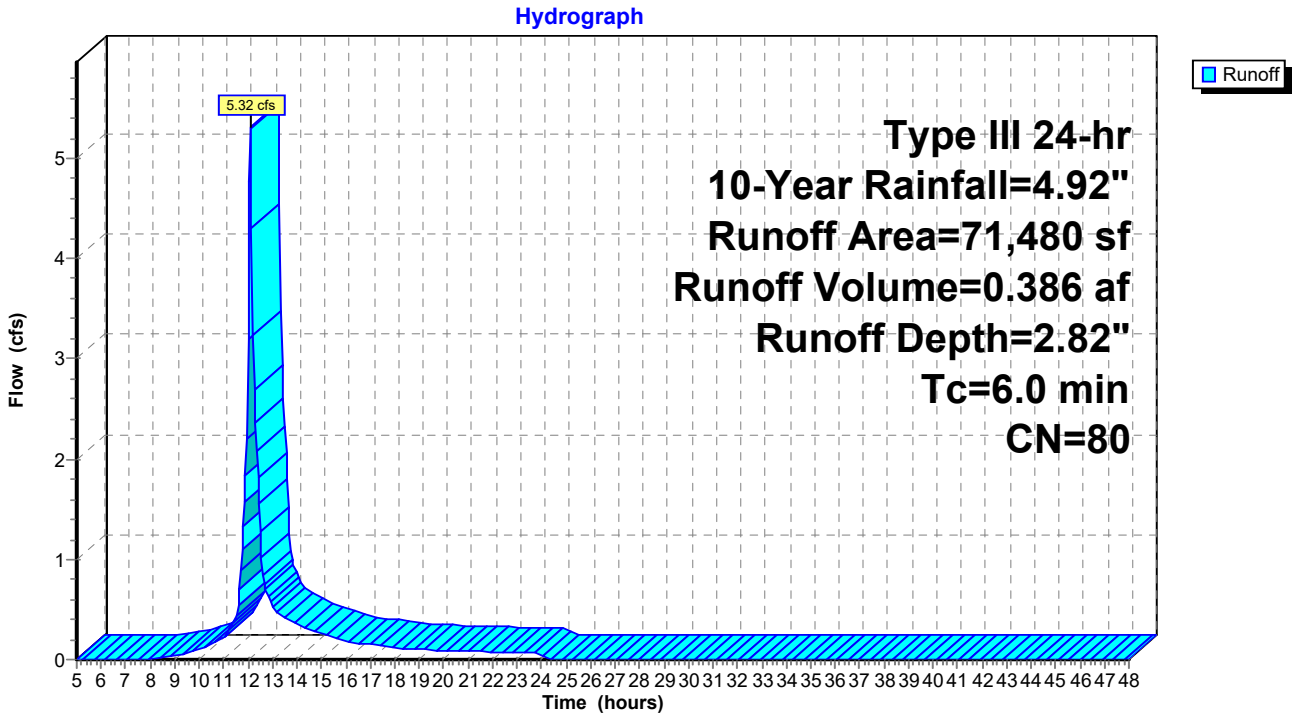
Runoff = 5.32 cfs @ 12.09 hrs, Volume= 0.386 af, Depth= 2.82"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=4.92"

Area (sf)	CN	Description
40,295	98	Paved parking, HSG A
55	98	Paved parking, HSG B
6,783	98	Paved parking, HSG D
4,315	30	Woods, Good, HSG A
2,050	77	Woods, Good, HSG D
16,572	39	>75% Grass cover, Good, HSG A
1,410	96	Gravel surface, HSG A
71,480	80	Weighted Average
24,347		34.06% Pervious Area
47,133		65.94% Impervious Area

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

Subcatchment 4S: EASTERN LOADING AREA



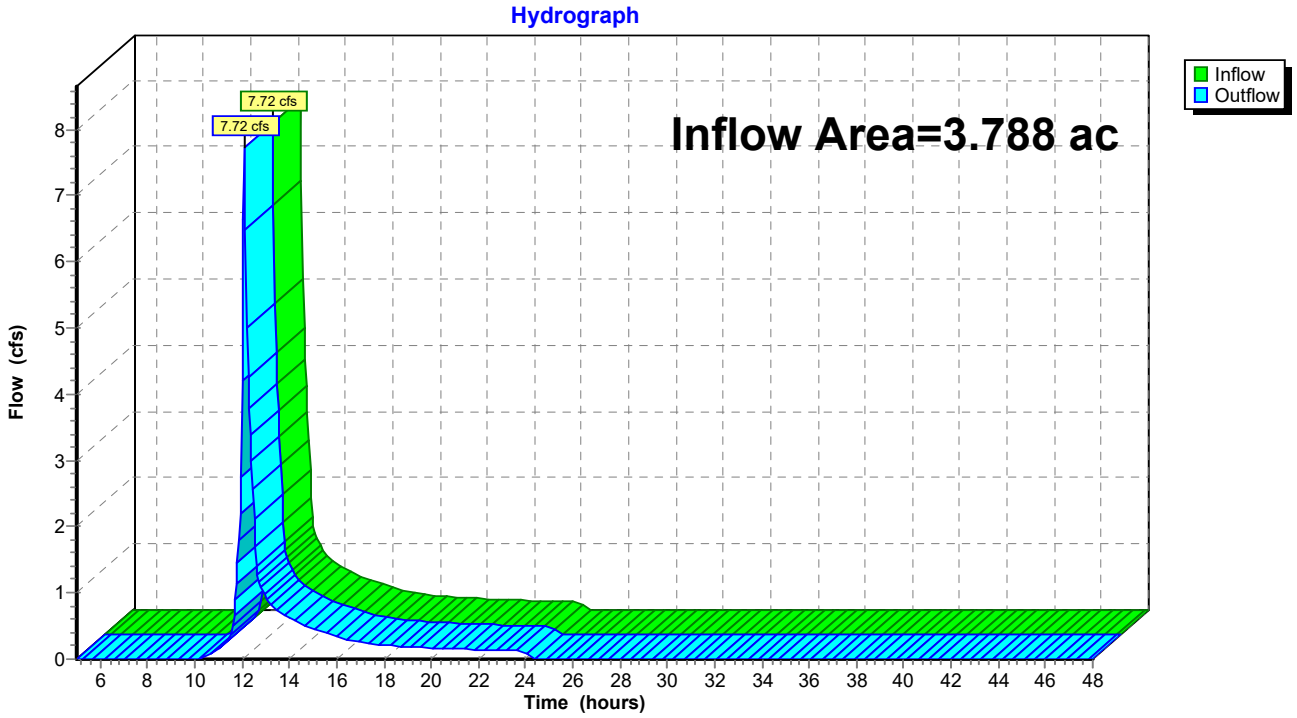
Summary for Reach DP-1: POND ST.

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

Inflow Area = 3.788 ac, 48.15% Impervious, Inflow Depth = 1.82" for 10-Year event
Inflow = 7.72 cfs @ 12.10 hrs, Volume= 0.575 af
Outflow = 7.72 cfs @ 12.10 hrs, Volume= 0.575 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-1: POND ST.



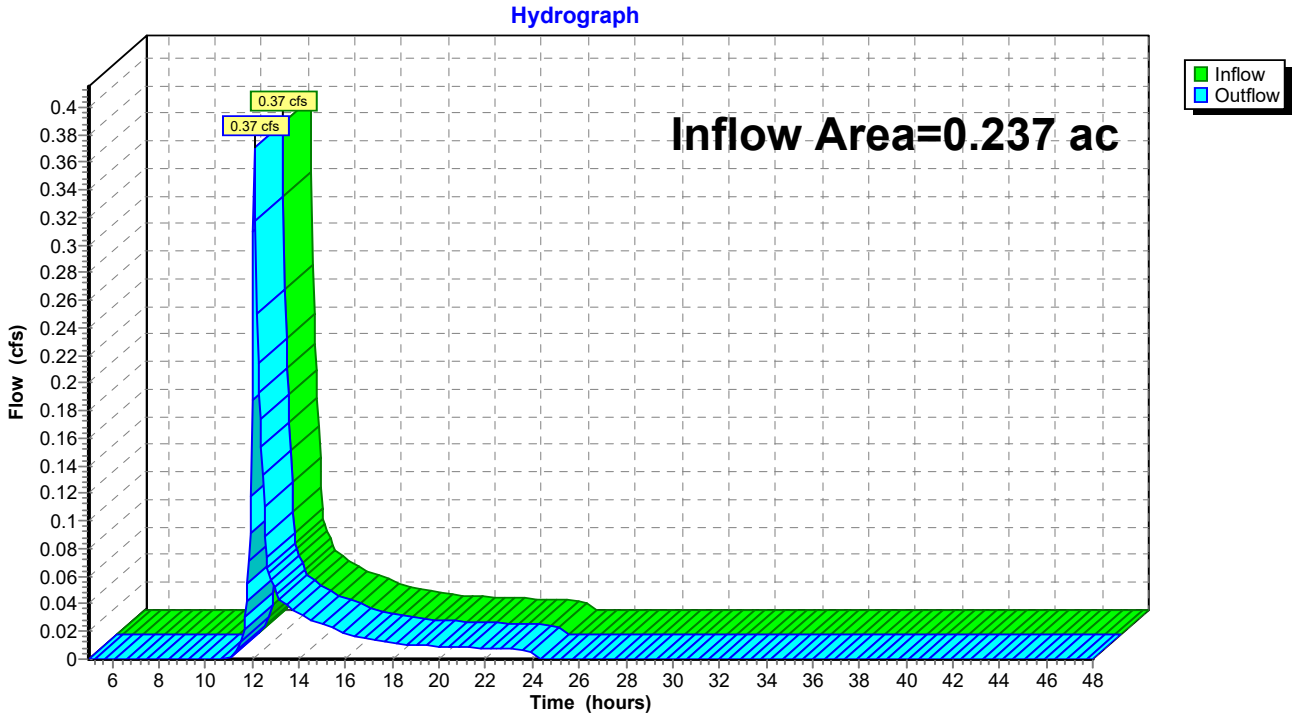
Summary for Reach DP-2: EASTERN PROPERTY LINE

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

Inflow Area = 0.237 ac, 0.00% Impervious, Inflow Depth = 1.46" for 10-Year event
Inflow = 0.37 cfs @ 12.10 hrs, Volume= 0.029 af
Outflow = 0.37 cfs @ 12.10 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-2: EASTERN PROPERTY LINE



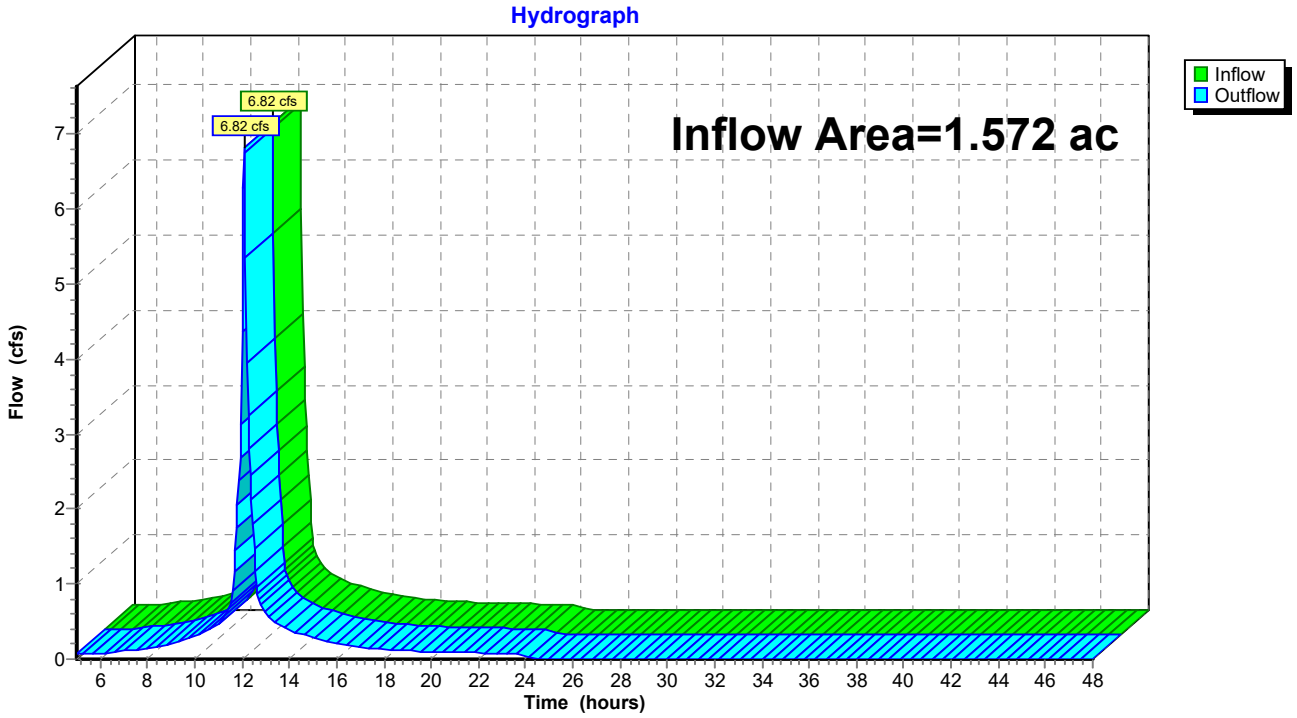
Summary for Reach DP-3: CRUSED STONE AREA & LEACHING PITS

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

Inflow Area = 1.572 ac, 78.38% Impervious, Inflow Depth > 4.12" for 10-Year event
Inflow = 6.82 cfs @ 12.09 hrs, Volume= 0.540 af
Outflow = 6.82 cfs @ 12.09 hrs, Volume= 0.540 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-3: CRUSED STONE AREA & LEACHING PITS



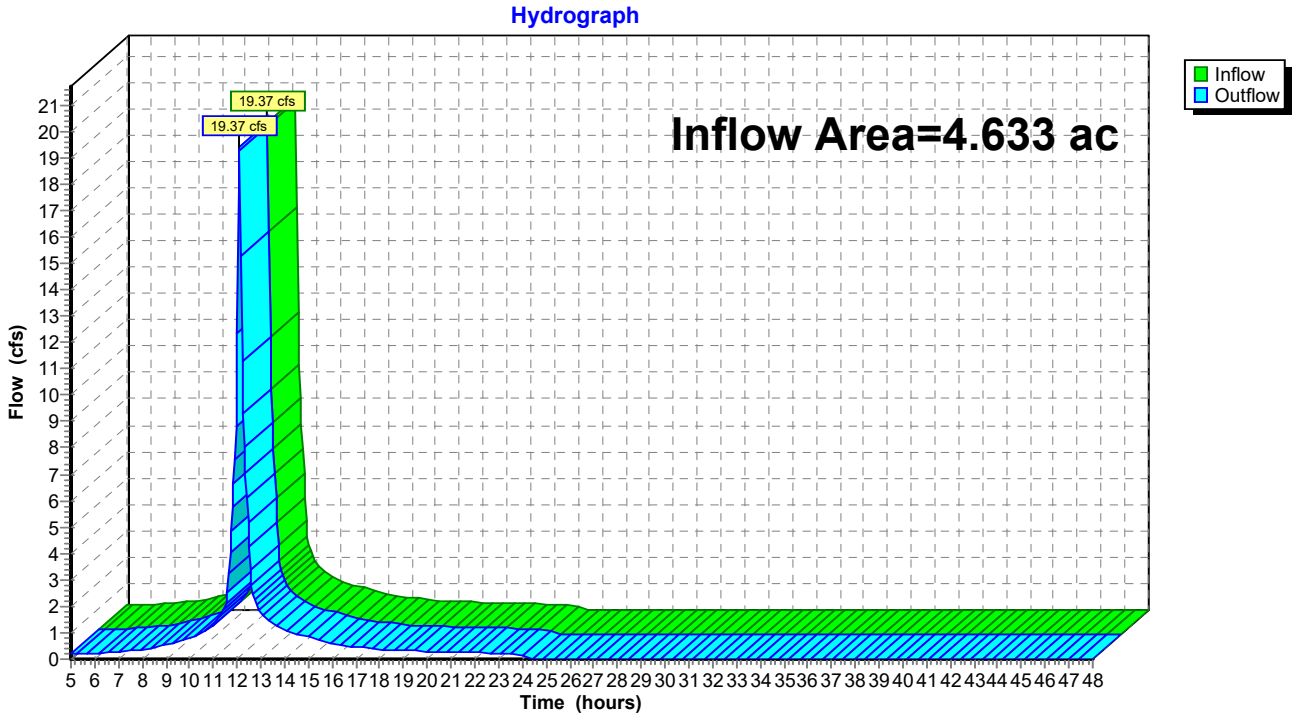
Summary for Reach DP-4: NORTHERN HEADWALLS

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

Inflow Area = 4.633 ac, 87.94% Impervious, Inflow Depth > 3.95" for 10-Year event
Inflow = 19.37 cfs @ 12.09 hrs, Volume= 1.523 af
Outflow = 19.37 cfs @ 12.09 hrs, Volume= 1.523 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-4: NORTHERN HEADWALLS



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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1R: FLAT ROOF W/ Runoff Area=21,801 sf 100.00% Impervious Runoff Depth>5.77"
Tc=6.0 min CN=98 Runoff=2.97 cfs 0.241 af

Subcatchment1S: FRONT SITE Runoff Area=165,023 sf 48.15% Impervious Runoff Depth=2.77"
Tc=6.0 min CN=68 Runoff=11.96 cfs 0.874 af

Subcatchment2S: EASTERN Runoff Area=10,320 sf 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=63 Runoff=0.61 cfs 0.046 af

Subcatchment3R: WESTERN ROOF Runoff Area=50,302 sf 100.00% Impervious Runoff Depth>5.77"
Tc=6.0 min CN=98 Runoff=6.84 cfs 0.556 af

Subcatchment3S: WESTERN SITE Runoff Area=18,176 sf 18.54% Impervious Runoff Depth=4.06"
Tc=6.0 min UI Adjusted CN=81 Runoff=1.93 cfs 0.141 af

Subcatchment4R: NORTH & EAST Runoff Area=108,531 sf 100.00% Impervious Runoff Depth>5.77"
Tc=6.0 min CN=98 Runoff=14.76 cfs 1.199 af

Subcatchment4S: EASTERN LOADING Runoff Area=71,480 sf 65.94% Impervious Runoff Depth=3.95"
Tc=6.0 min CN=80 Runoff=7.41 cfs 0.541 af

Reach DP-1: POND ST. Inflow=11.96 cfs 0.874 af
Outflow=11.96 cfs 0.874 af

Reach DP-2: EASTERN PROPERTY LINE Inflow=0.61 cfs 0.046 af
Outflow=0.61 cfs 0.046 af

Reach DP-3: CRUSED STONE AREA & LEACHING PITS Inflow=8.77 cfs 0.697 af
Outflow=8.77 cfs 0.697 af

Reach DP-4: NORTHERN HEADWALLS Inflow=25.13 cfs 1.980 af
Outflow=25.13 cfs 1.980 af

Total Runoff Area = 10.230 ac Runoff Volume = 3.596 af Average Runoff Depth = 4.22"
30.30% Pervious = 3.100 ac 69.70% Impervious = 7.130 ac

Summary for Subcatchment 1R: FLAT ROOF W/ COLLECTION

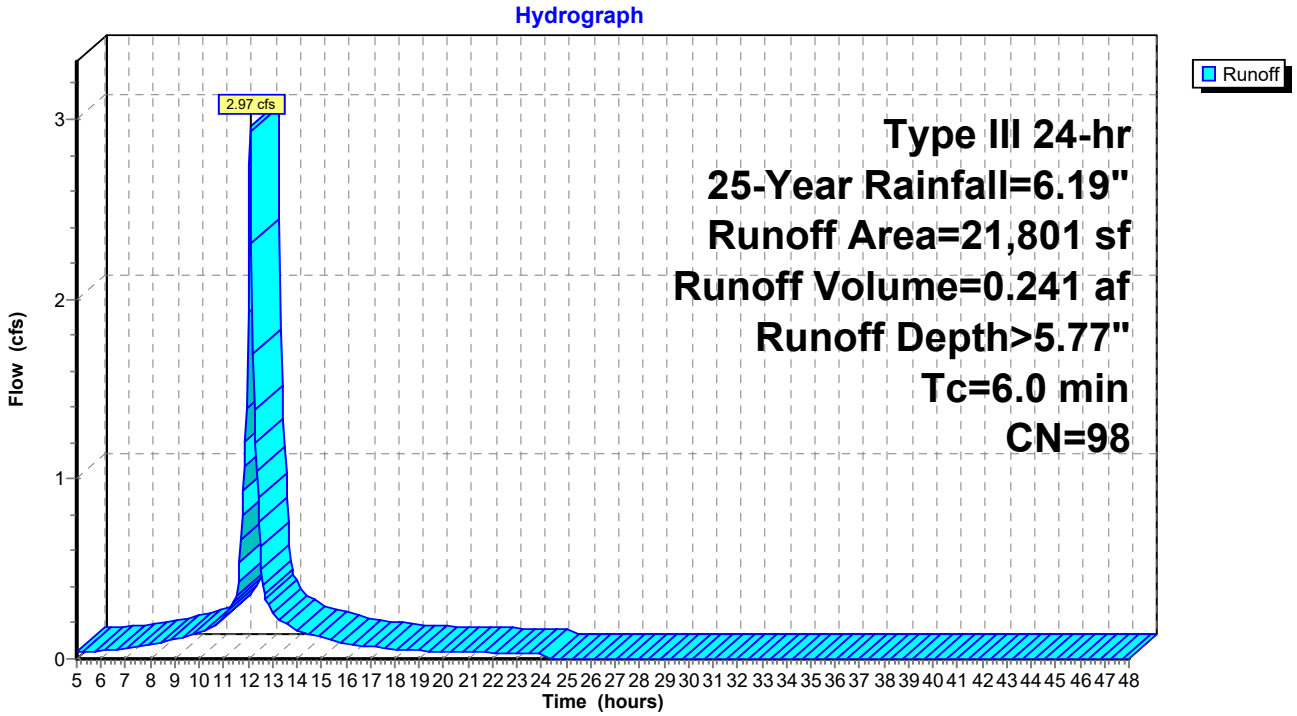
Runoff = 2.97 cfs @ 12.09 hrs, Volume= 0.241 af, Depth> 5.77"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=6.19"

Area (sf)	CN	Description
21,801	98	Roofs, HSG A
21,801		100.00% Impervious Area

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

Subcatchment 1R: FLAT ROOF W/ COLLECTION



Summary for Subcatchment 1S: FRONT SITE

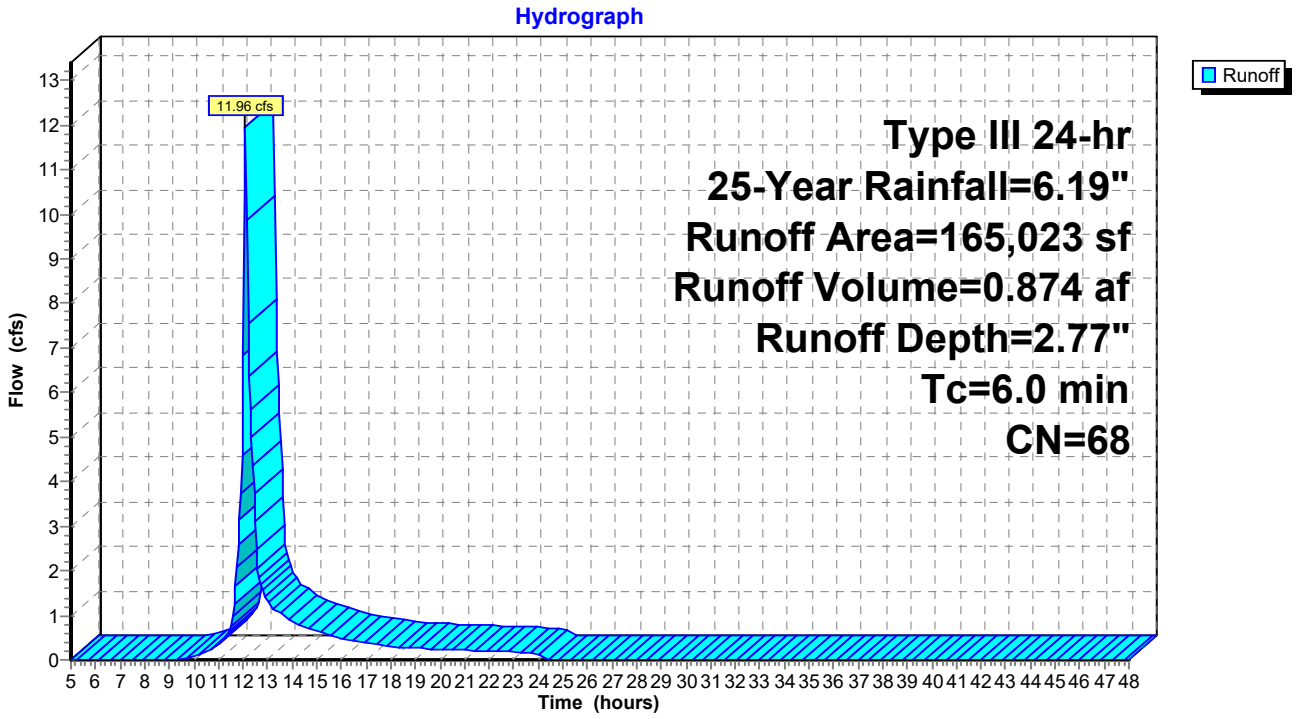
Runoff = 11.96 cfs @ 12.10 hrs, Volume= 0.874 af, Depth= 2.77"
Routed to Reach DP-1 : POND ST.

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=6.19"

Area (sf)	CN	Description
84,758	39	>75% Grass cover, Good, HSG A
809	61	>75% Grass cover, Good, HSG B
20,445	98	Paved parking, HSG B
59,011	98	Paved parking, HSG A
165,023	68	Weighted Average
85,567		51.85% Pervious Area
79,456		48.15% Impervious Area

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

Subcatchment 1S: FRONT SITE



Summary for Subcatchment 2S: EASTERN LANDSCAPED AREA

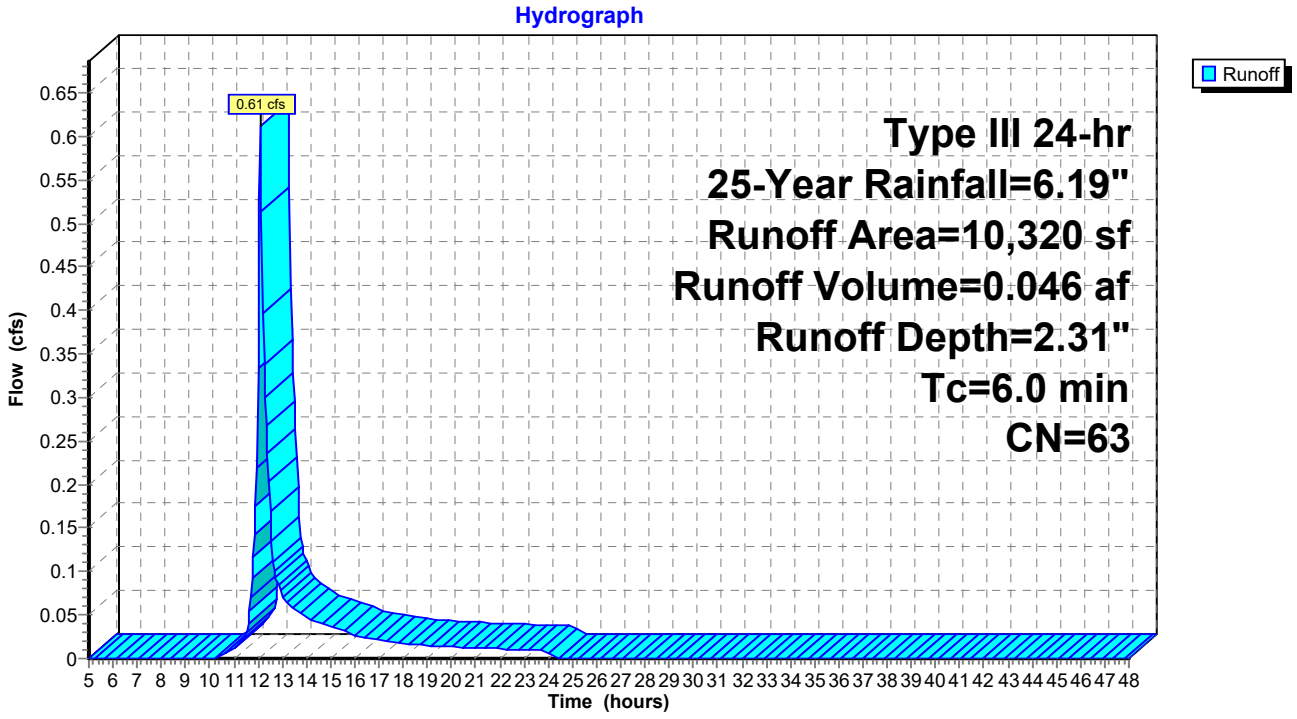
Runoff = 0.61 cfs @ 12.10 hrs, Volume= 0.046 af, Depth= 2.31"
Routed to Reach DP-2 : EASTERN PROPERTY LINE

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=6.19"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
1,000	80	>75% Grass cover, Good, HSG D
10,320	63	Weighted Average
10,320		100.00% Pervious Area

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

Subcatchment 2S: EASTERN LANDSCAPED AREA



Summary for Subcatchment 3R: WESTERN ROOF

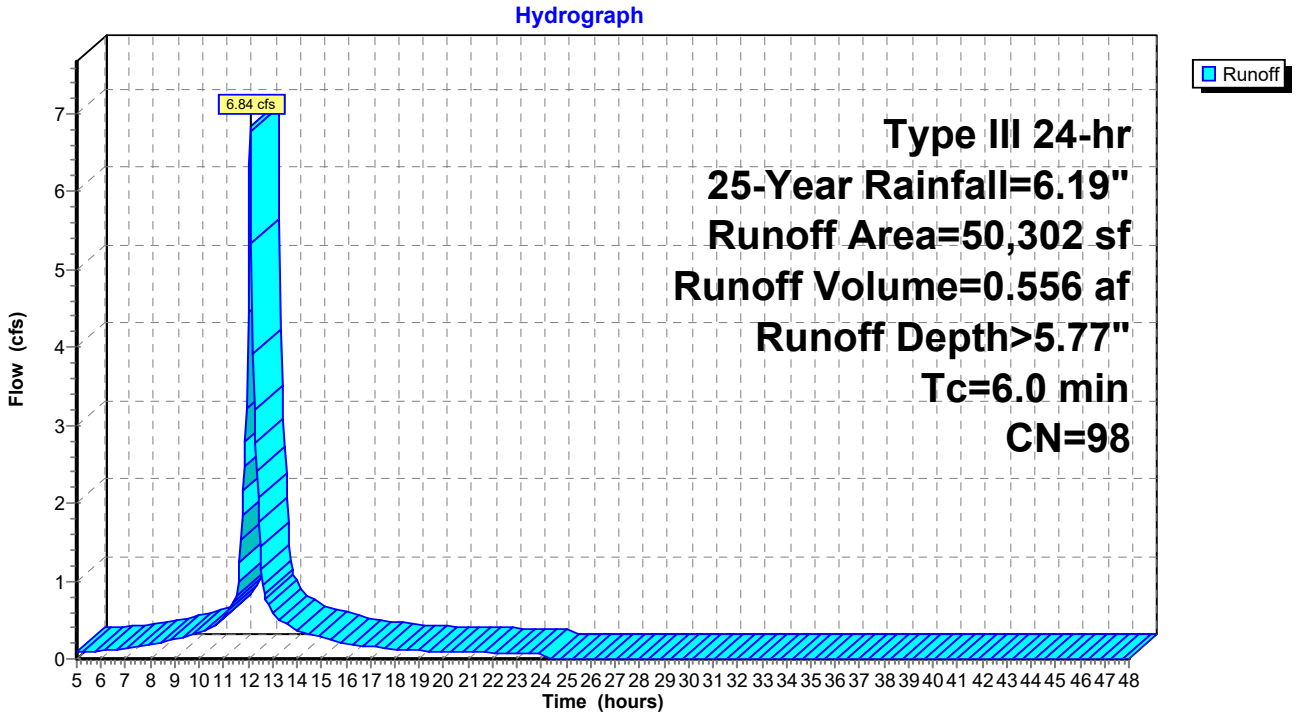
Runoff = 6.84 cfs @ 12.09 hrs, Volume= 0.556 af, Depth> 5.77"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=6.19"

Area (sf)	CN	Description
50,302	98	Roofs, HSG A
50,302		100.00% Impervious Area

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

Subcatchment 3R: WESTERN ROOF



Summary for Subcatchment 3S: WESTERN SITE

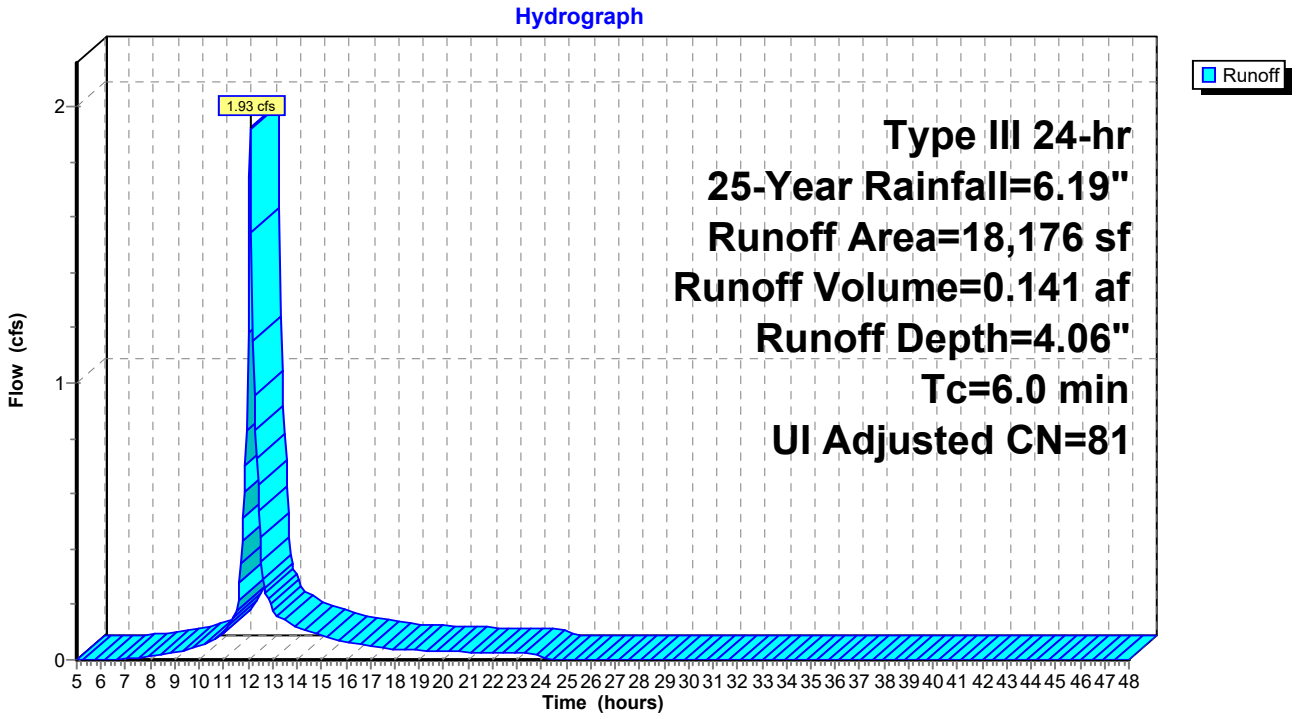
Runoff = 1.93 cfs @ 12.09 hrs, Volume= 0.141 af, Depth= 4.06"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=6.19"

Area (sf)	CN	Adj	Description
3,370	98		Unconnected pavement, HSG A
10,363	96		Gravel surface, HSG A
4,443	39		>75% Grass cover, Good, HSG A
18,176	82	81	Weighted Average, UI Adjusted
14,806			81.46% Pervious Area
3,370			18.54% Impervious Area
3,370			100.00% Unconnected

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

Subcatchment 3S: WESTERN SITE



Summary for Subcatchment 4R: NORTH & EAST ROOF

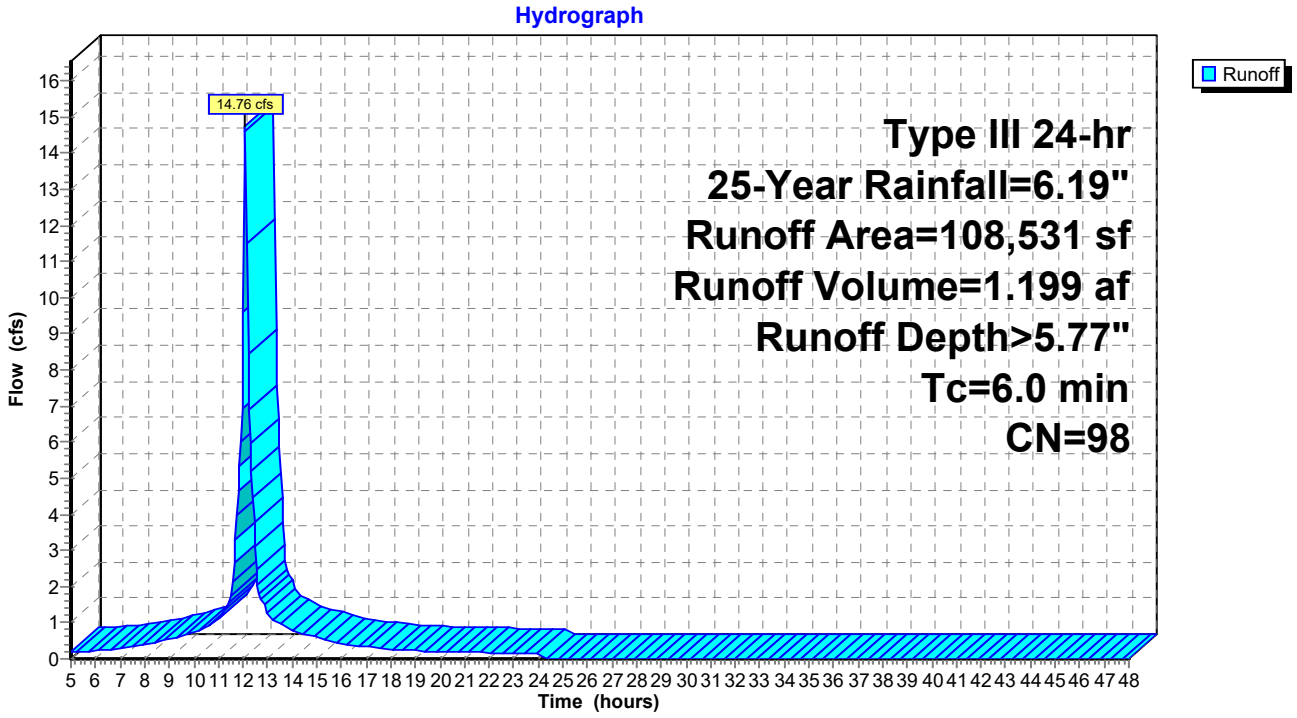
Runoff = 14.76 cfs @ 12.09 hrs, Volume= 1.199 af, Depth> 5.77"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=6.19"

Area (sf)	CN	Description
108,531	98	Roofs, HSG A
108,531		100.00% Impervious Area

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

Subcatchment 4R: NORTH & EAST ROOF



Summary for Subcatchment 4S: EASTERN LOADING AREA

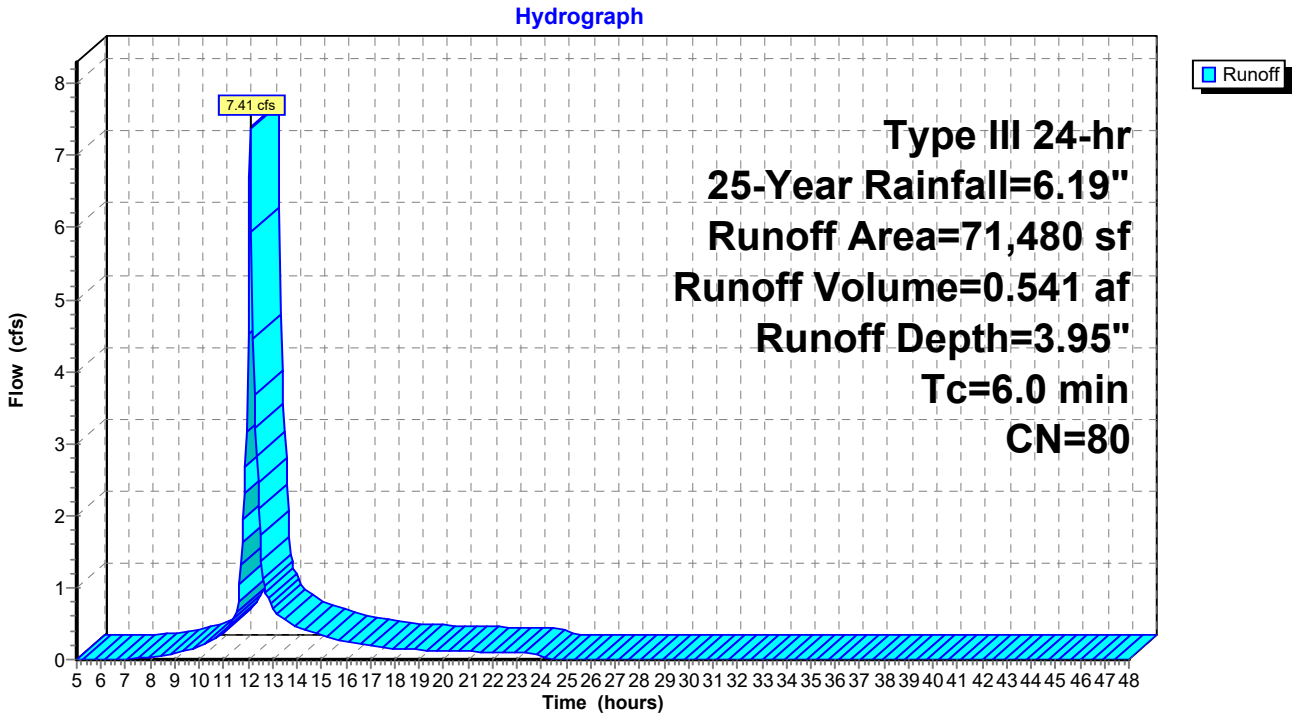
Runoff = 7.41 cfs @ 12.09 hrs, Volume= 0.541 af, Depth= 3.95"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=6.19"

Area (sf)	CN	Description
40,295	98	Paved parking, HSG A
55	98	Paved parking, HSG B
6,783	98	Paved parking, HSG D
4,315	30	Woods, Good, HSG A
2,050	77	Woods, Good, HSG D
16,572	39	>75% Grass cover, Good, HSG A
1,410	96	Gravel surface, HSG A
71,480	80	Weighted Average
24,347		34.06% Pervious Area
47,133		65.94% Impervious Area

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

Subcatchment 4S: EASTERN LOADING AREA



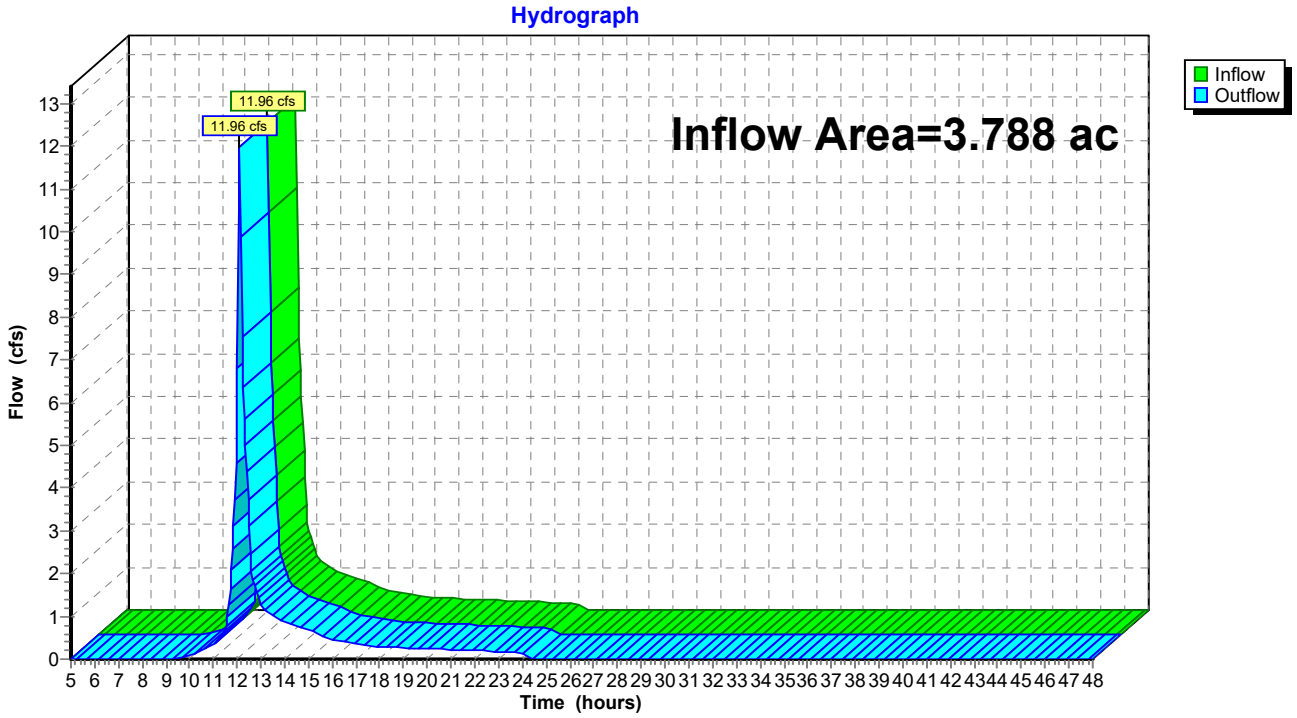
Summary for Reach DP-1: POND ST.

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

Inflow Area = 3.788 ac, 48.15% Impervious, Inflow Depth = 2.77" for 25-Year event
Inflow = 11.96 cfs @ 12.10 hrs, Volume= 0.874 af
Outflow = 11.96 cfs @ 12.10 hrs, Volume= 0.874 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-1: POND ST.



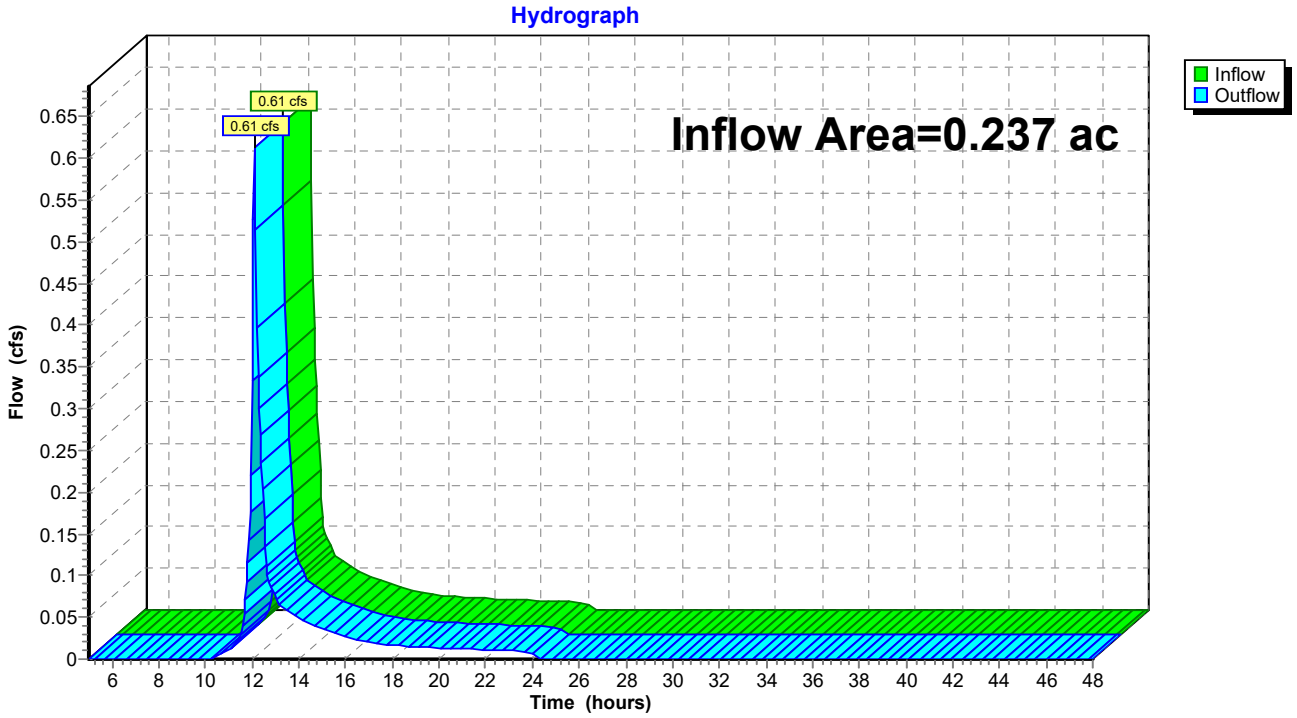
Summary for Reach DP-2: EASTERN PROPERTY LINE

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

Inflow Area = 0.237 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-Year event
Inflow = 0.61 cfs @ 12.10 hrs, Volume= 0.046 af
Outflow = 0.61 cfs @ 12.10 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-2: EASTERN PROPERTY LINE



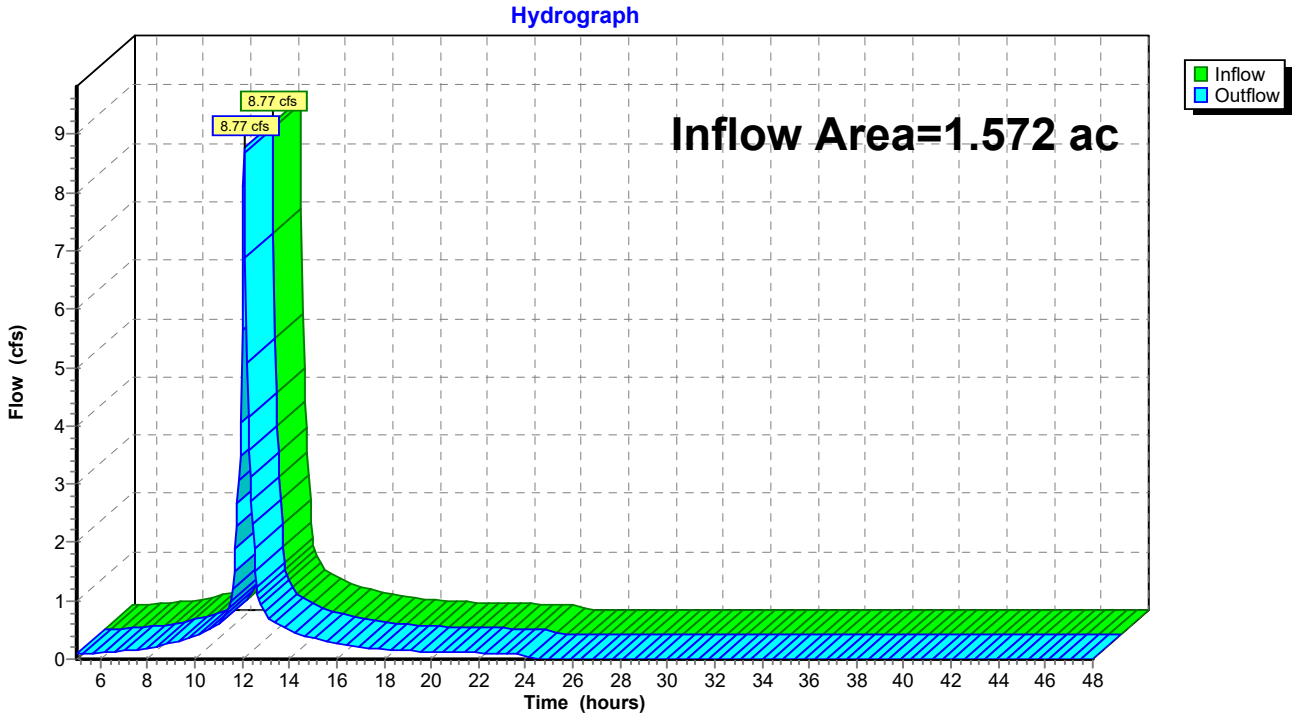
Summary for Reach DP-3: CRUSED STONE AREA & LEACHING PITS

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

Inflow Area = 1.572 ac, 78.38% Impervious, Inflow Depth > 5.32" for 25-Year event
Inflow = 8.77 cfs @ 12.09 hrs, Volume= 0.697 af
Outflow = 8.77 cfs @ 12.09 hrs, Volume= 0.697 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-3: CRUSED STONE AREA & LEACHING PITS



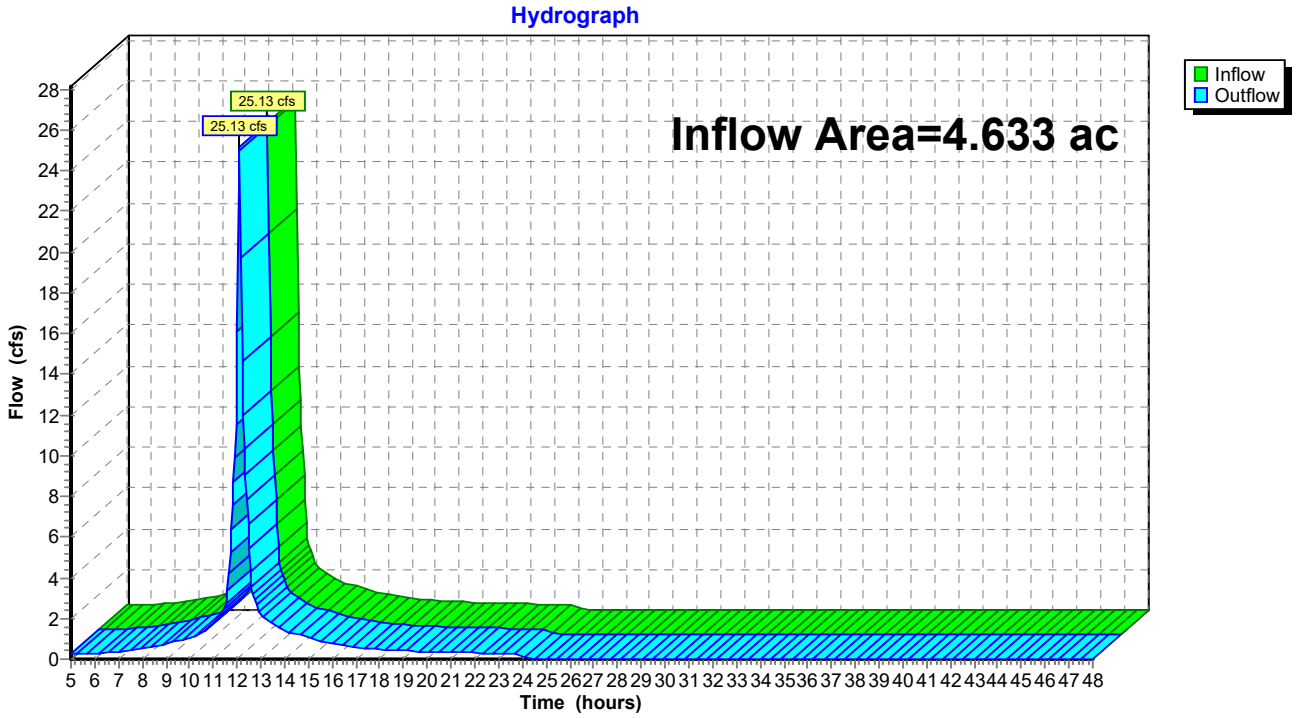
Summary for Reach DP-4: NORTHERN HEADWALLS

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

Inflow Area = 4.633 ac, 87.94% Impervious, Inflow Depth > 5.13" for 25-Year event
Inflow = 25.13 cfs @ 12.09 hrs, Volume= 1.980 af
Outflow = 25.13 cfs @ 12.09 hrs, Volume= 1.980 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-4: NORTHERN HEADWALLS



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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1R: FLAT ROOF W/ Runoff Area=21,801 sf 100.00% Impervious Runoff Depth>8.25"
Tc=6.0 min CN=98 Runoff=4.22 cfs 0.344 af

Subcatchment1S: FRONT SITE Runoff Area=165,023 sf 48.15% Impervious Runoff Depth=4.91"
Tc=6.0 min CN=68 Runoff=21.37 cfs 1.549 af

Subcatchment2S: EASTERN Runoff Area=10,320 sf 0.00% Impervious Runoff Depth=4.30"
Tc=6.0 min CN=63 Runoff=1.17 cfs 0.085 af

Subcatchment3R: WESTERN ROOF Runoff Area=50,302 sf 100.00% Impervious Runoff Depth>8.25"
Tc=6.0 min CN=98 Runoff=9.73 cfs 0.794 af

Subcatchment3S: WESTERN SITE Runoff Area=18,176 sf 18.54% Impervious Runoff Depth>6.49"
Tc=6.0 min UI Adjusted CN=81 Runoff=3.03 cfs 0.226 af

Subcatchment4R: NORTH & EAST Runoff Area=108,531 sf 100.00% Impervious Runoff Depth>8.25"
Tc=6.0 min CN=98 Runoff=21.00 cfs 1.712 af

Subcatchment4S: EASTERN LOADING Runoff Area=71,480 sf 65.94% Impervious Runoff Depth=6.37"
Tc=6.0 min CN=80 Runoff=11.73 cfs 0.871 af

Reach DP-1: POND ST. Inflow=21.37 cfs 1.549 af
Outflow=21.37 cfs 1.549 af

Reach DP-2: EASTERN PROPERTY LINE Inflow=1.17 cfs 0.085 af
Outflow=1.17 cfs 0.085 af

Reach DP-3: CRUSED STONE AREA & LEACHING PITS Inflow=12.76 cfs 1.019 af
Outflow=12.76 cfs 1.019 af

Reach DP-4: NORTHERN HEADWALLS Inflow=36.95 cfs 2.927 af
Outflow=36.95 cfs 2.927 af

Total Runoff Area = 10.230 ac Runoff Volume = 5.580 af Average Runoff Depth = 6.55"
30.30% Pervious = 3.100 ac 69.70% Impervious = 7.130 ac

Summary for Subcatchment 1R: FLAT ROOF W/ COLLECTION

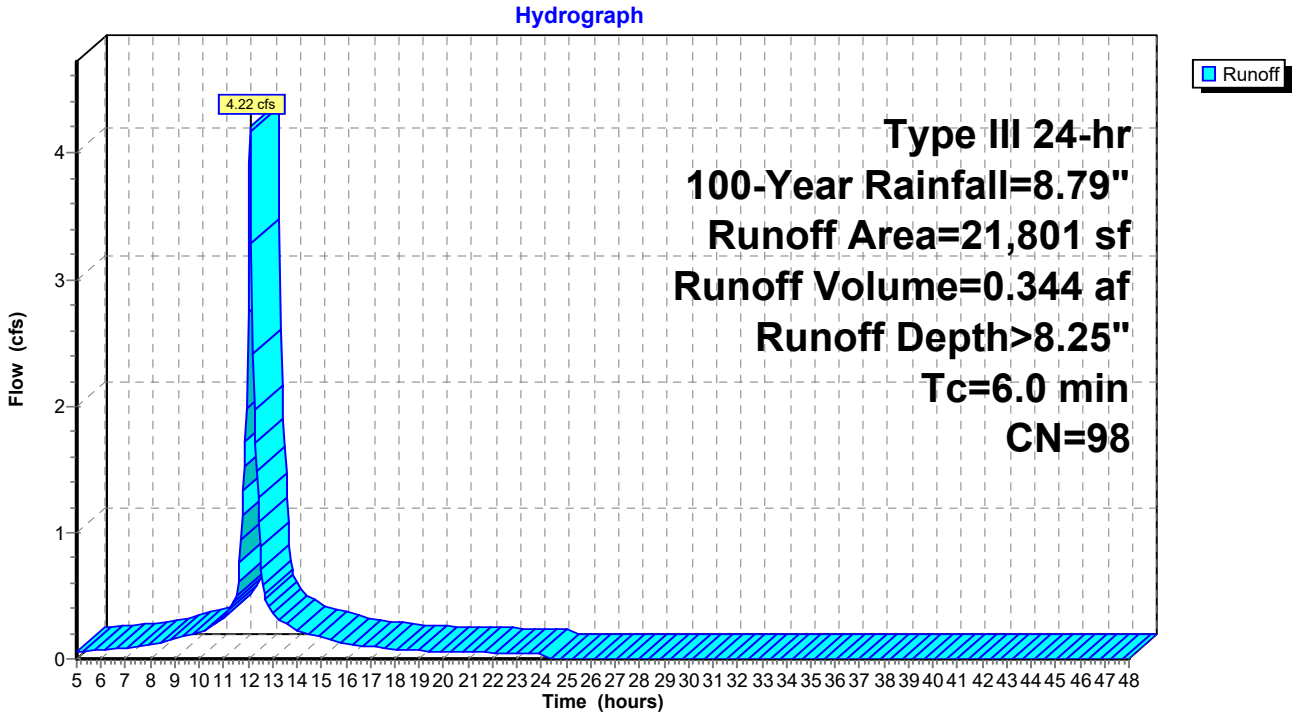
Runoff = 4.22 cfs @ 12.09 hrs, Volume= 0.344 af, Depth> 8.25"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=8.79"

Area (sf)	CN	Description
21,801	98	Roofs, HSG A
21,801		100.00% Impervious Area

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

Subcatchment 1R: FLAT ROOF W/ COLLECTION



Summary for Subcatchment 1S: FRONT SITE

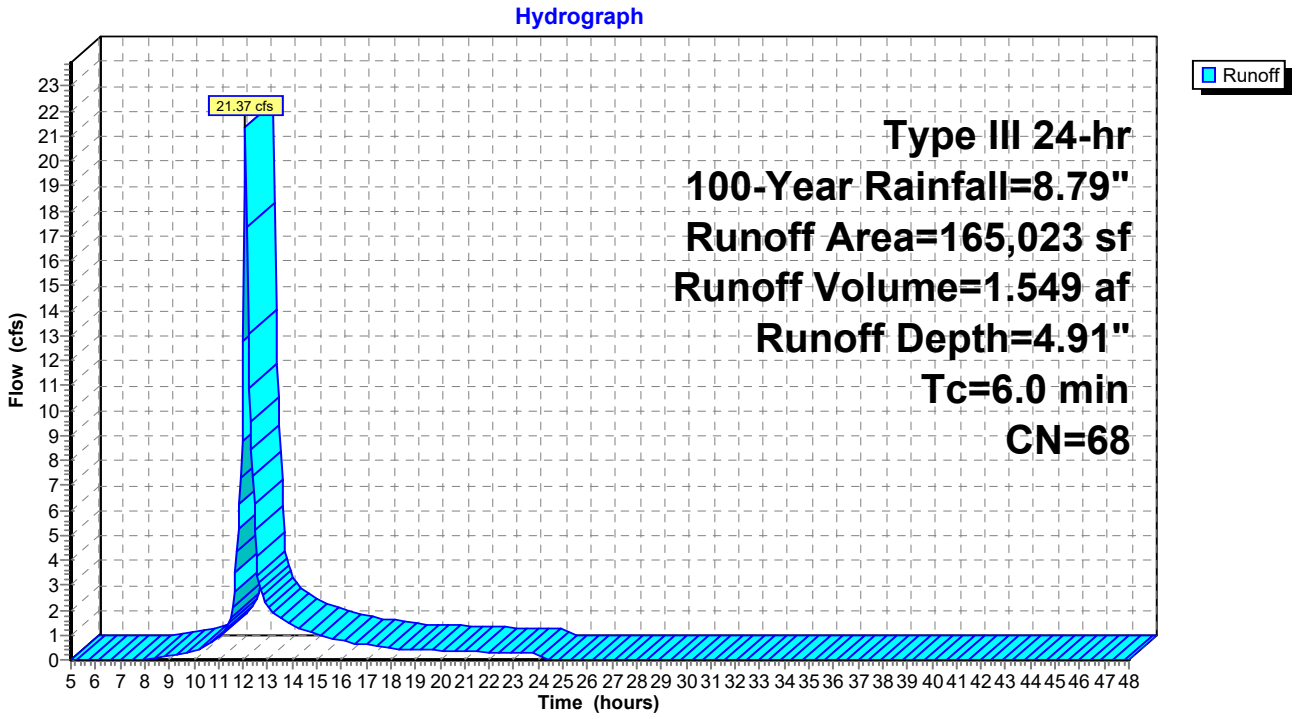
Runoff = 21.37 cfs @ 12.09 hrs, Volume= 1.549 af, Depth= 4.91"
Routed to Reach DP-1 : POND ST.

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=8.79"

Area (sf)	CN	Description
84,758	39	>75% Grass cover, Good, HSG A
809	61	>75% Grass cover, Good, HSG B
20,445	98	Paved parking, HSG B
59,011	98	Paved parking, HSG A
165,023	68	Weighted Average
85,567		51.85% Pervious Area
79,456		48.15% Impervious Area

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

Subcatchment 1S: FRONT SITE



Summary for Subcatchment 2S: EASTERN LANDSCAPED AREA

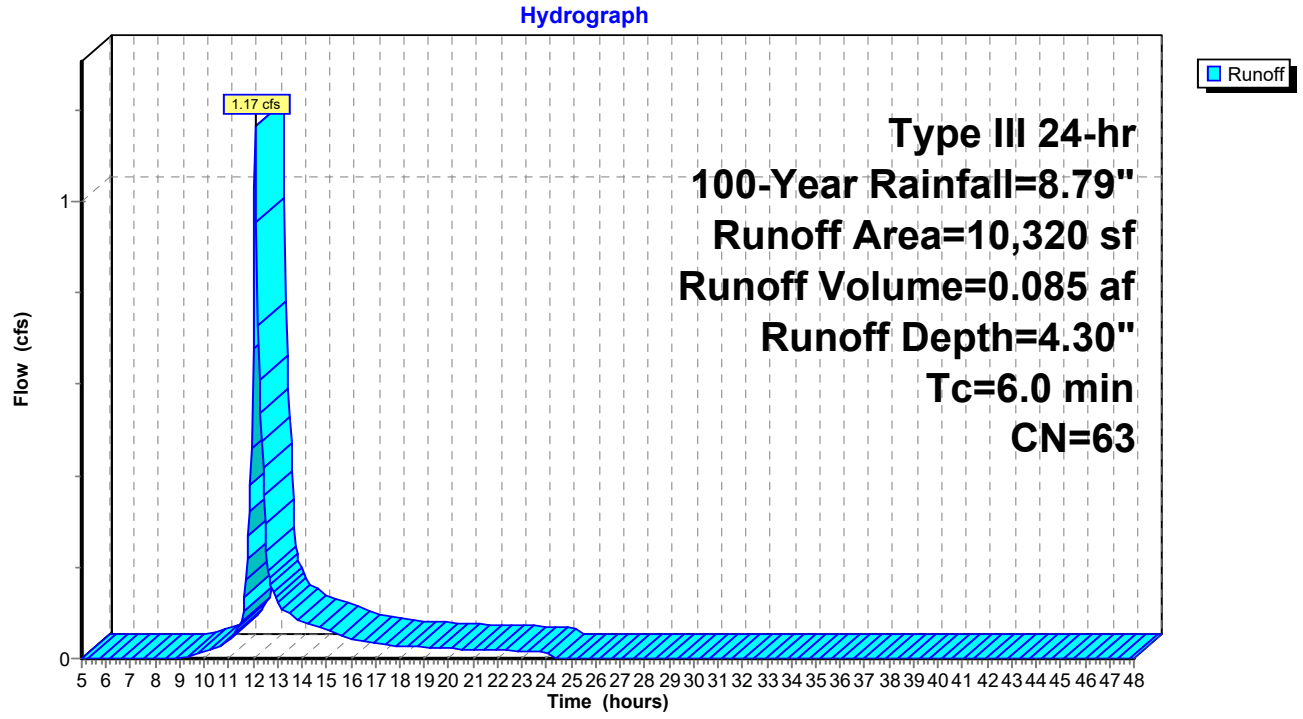
Runoff = 1.17 cfs @ 12.09 hrs, Volume= 0.085 af, Depth= 4.30"
Routed to Reach DP-2 : EASTERN PROPERTY LINE

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=8.79"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
1,000	80	>75% Grass cover, Good, HSG D
10,320	63	Weighted Average
10,320		100.00% Pervious Area

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

Subcatchment 2S: EASTERN LANDSCAPED AREA



Summary for Subcatchment 3R: WESTERN ROOF

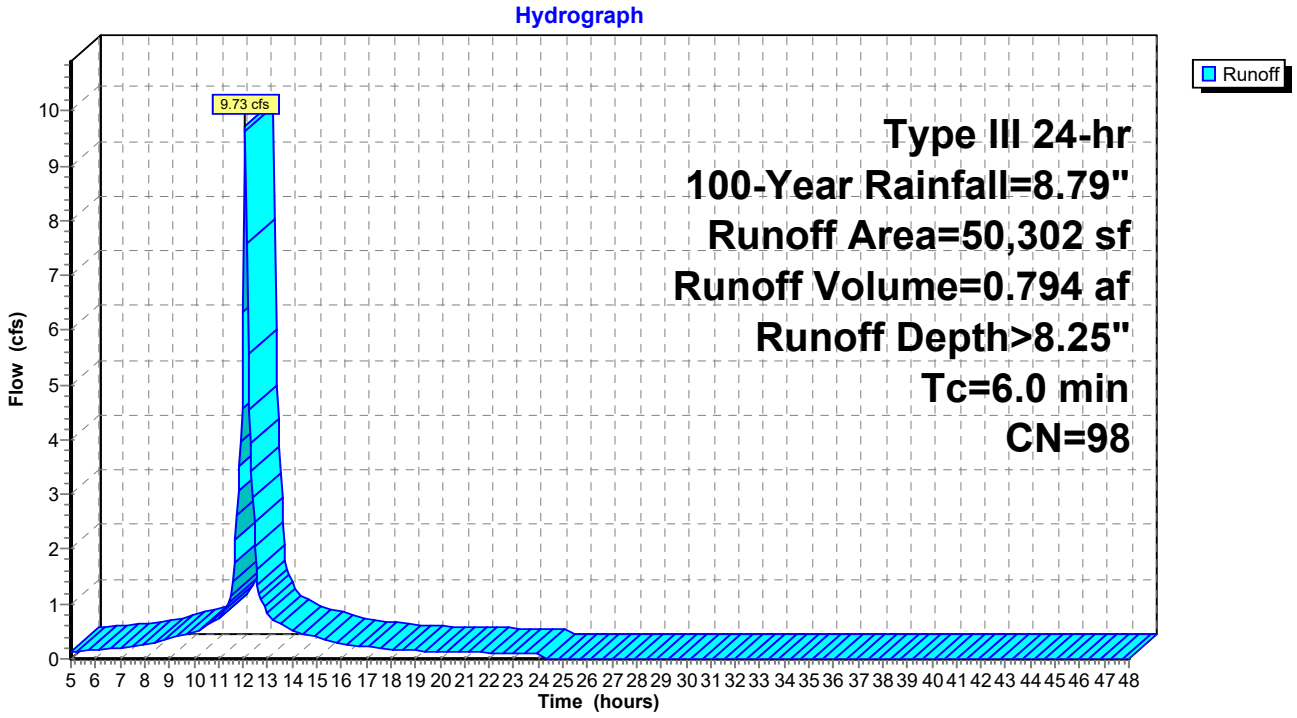
Runoff = 9.73 cfs @ 12.09 hrs, Volume= 0.794 af, Depth> 8.25"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=8.79"

Area (sf)	CN	Description
50,302	98	Roofs, HSG A
50,302		100.00% Impervious Area

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

Subcatchment 3R: WESTERN ROOF



Summary for Subcatchment 3S: WESTERN SITE

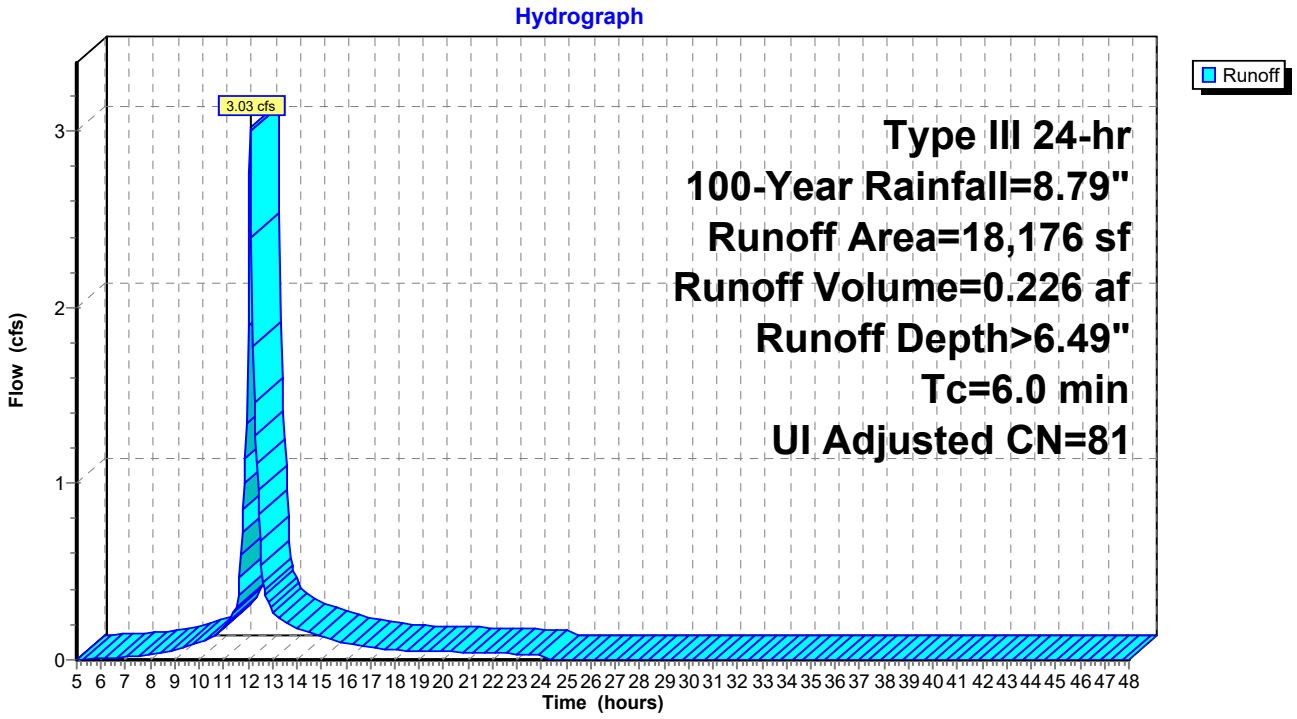
Runoff = 3.03 cfs @ 12.09 hrs, Volume= 0.226 af, Depth> 6.49"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=8.79"

Area (sf)	CN	Adj	Description
3,370	98		Unconnected pavement, HSG A
10,363	96		Gravel surface, HSG A
4,443	39		>75% Grass cover, Good, HSG A
18,176	82	81	Weighted Average, UI Adjusted
14,806			81.46% Pervious Area
3,370			18.54% Impervious Area
3,370			100.00% Unconnected

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

Subcatchment 3S: WESTERN SITE



Summary for Subcatchment 4R: NORTH & EAST ROOF

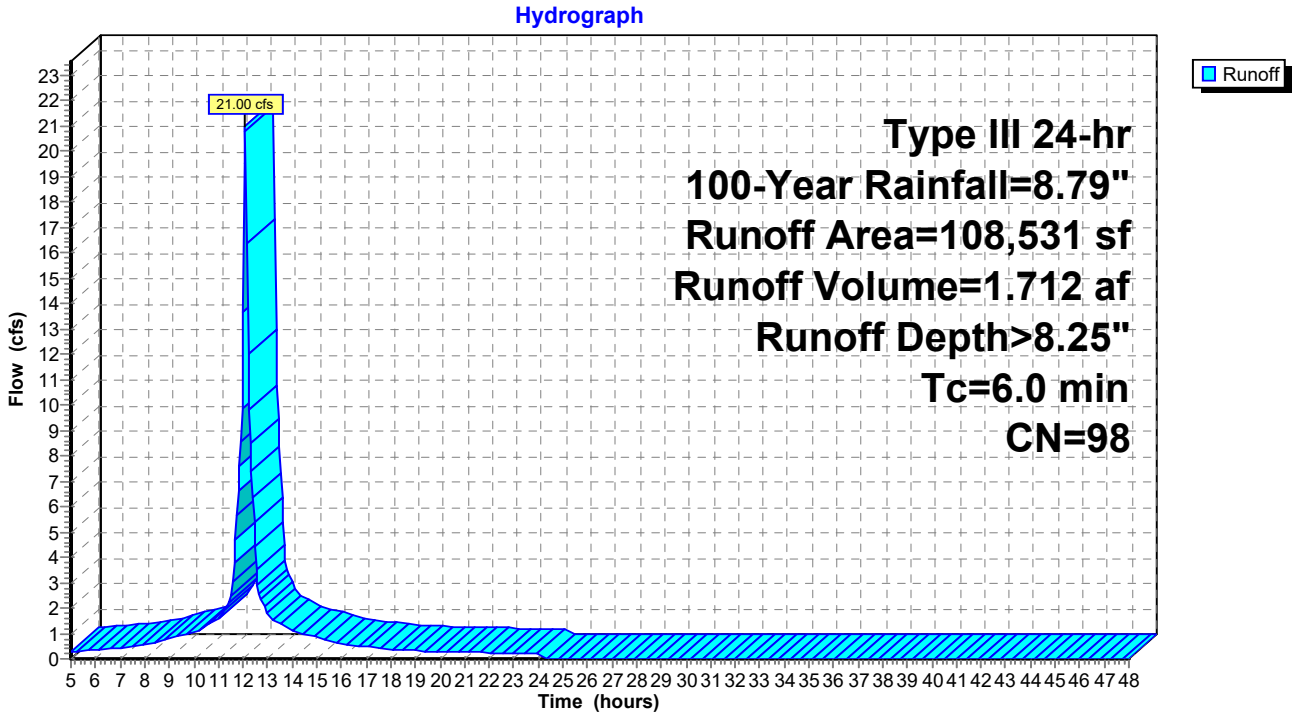
Runoff = 21.00 cfs @ 12.09 hrs, Volume= 1.712 af, Depth> 8.25"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=8.79"

Area (sf)	CN	Description
108,531	98	Roofs, HSG A
108,531		100.00% Impervious Area

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

Subcatchment 4R: NORTH & EAST ROOF



Summary for Subcatchment 4S: EASTERN LOADING AREA

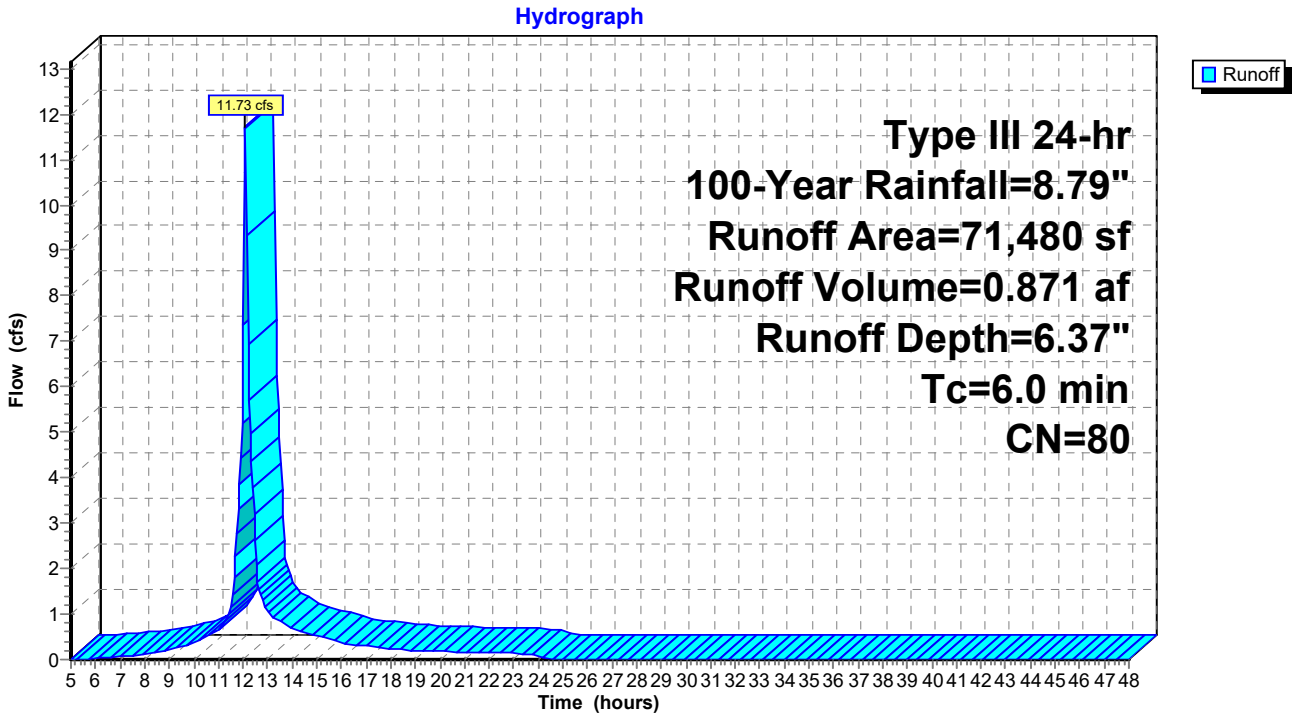
Runoff = 11.73 cfs @ 12.09 hrs, Volume= 0.871 af, Depth= 6.37"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=8.79"

Area (sf)	CN	Description
40,295	98	Paved parking, HSG A
55	98	Paved parking, HSG B
6,783	98	Paved parking, HSG D
4,315	30	Woods, Good, HSG A
2,050	77	Woods, Good, HSG D
16,572	39	>75% Grass cover, Good, HSG A
1,410	96	Gravel surface, HSG A
71,480	80	Weighted Average
24,347		34.06% Pervious Area
47,133		65.94% Impervious Area

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

Subcatchment 4S: EASTERN LOADING AREA



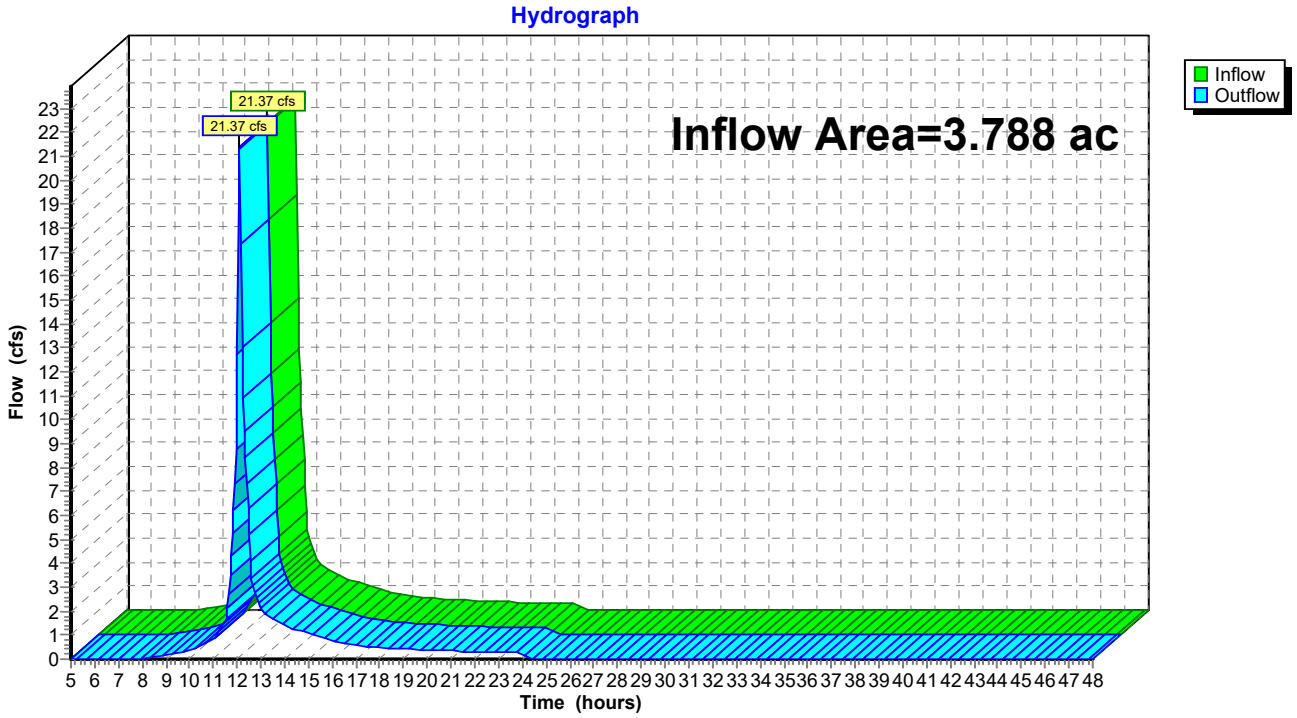
Summary for Reach DP-1: POND ST.

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

Inflow Area = 3.788 ac, 48.15% Impervious, Inflow Depth = 4.91" for 100-Year event
Inflow = 21.37 cfs @ 12.09 hrs, Volume= 1.549 af
Outflow = 21.37 cfs @ 12.09 hrs, Volume= 1.549 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-1: POND ST.



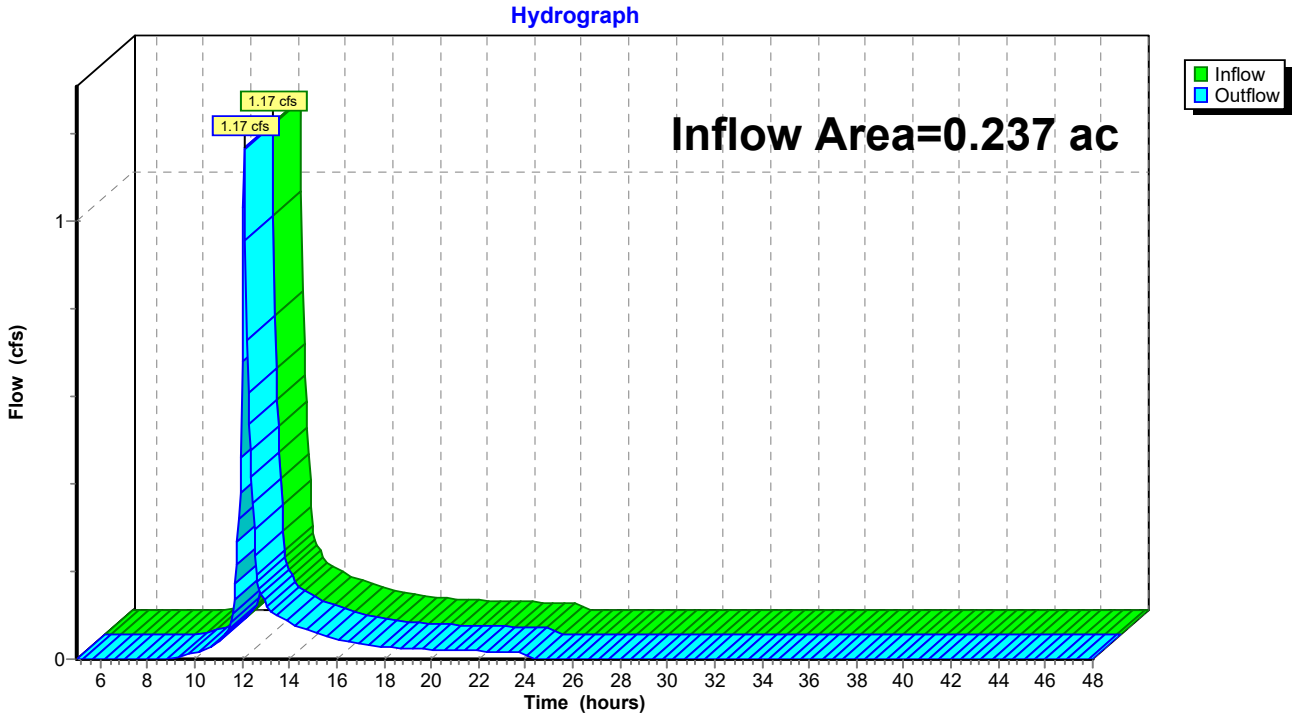
Summary for Reach DP-2: EASTERN PROPERTY LINE

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

Inflow Area = 0.237 ac, 0.00% Impervious, Inflow Depth = 4.30" for 100-Year event
Inflow = 1.17 cfs @ 12.09 hrs, Volume= 0.085 af
Outflow = 1.17 cfs @ 12.09 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-2: EASTERN PROPERTY LINE



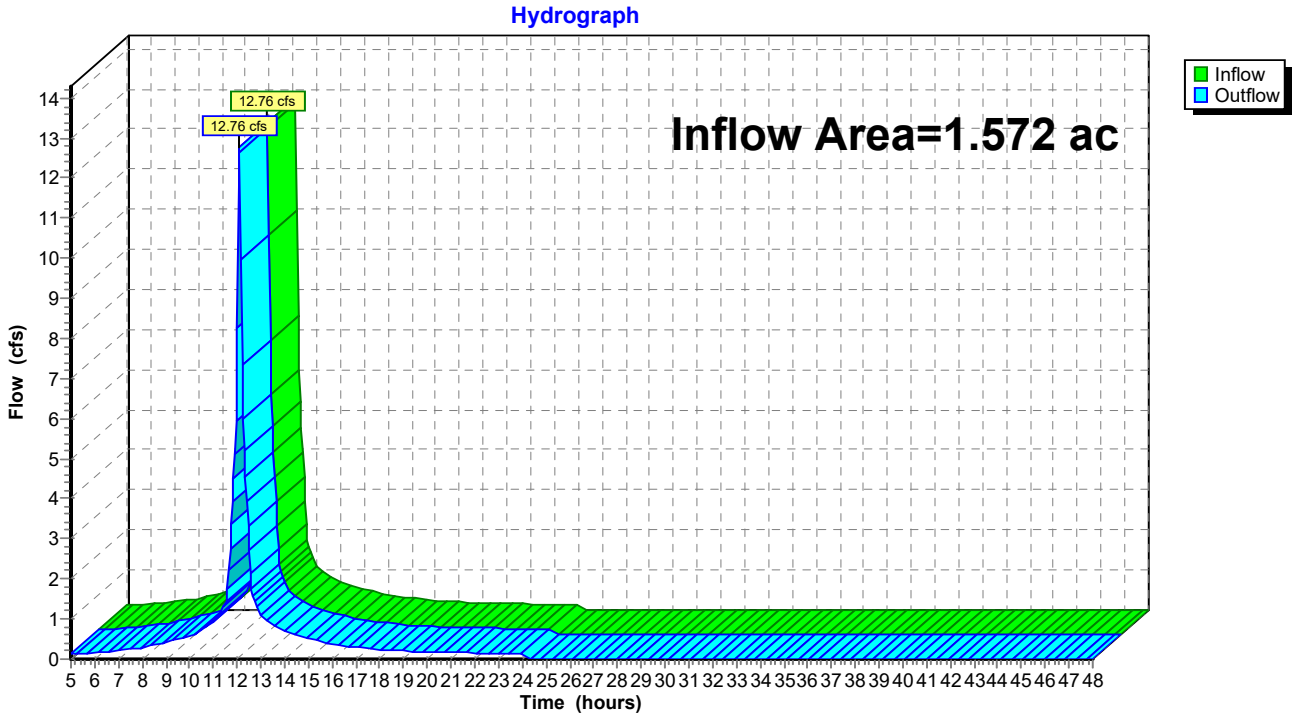
Summary for Reach DP-3: CRUSED STONE AREA & LEACHING PITS

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

Inflow Area = 1.572 ac, 78.38% Impervious, Inflow Depth > 7.78" for 100-Year event
Inflow = 12.76 cfs @ 12.09 hrs, Volume= 1.019 af
Outflow = 12.76 cfs @ 12.09 hrs, Volume= 1.019 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-3: CRUSED STONE AREA & LEACHING PITS



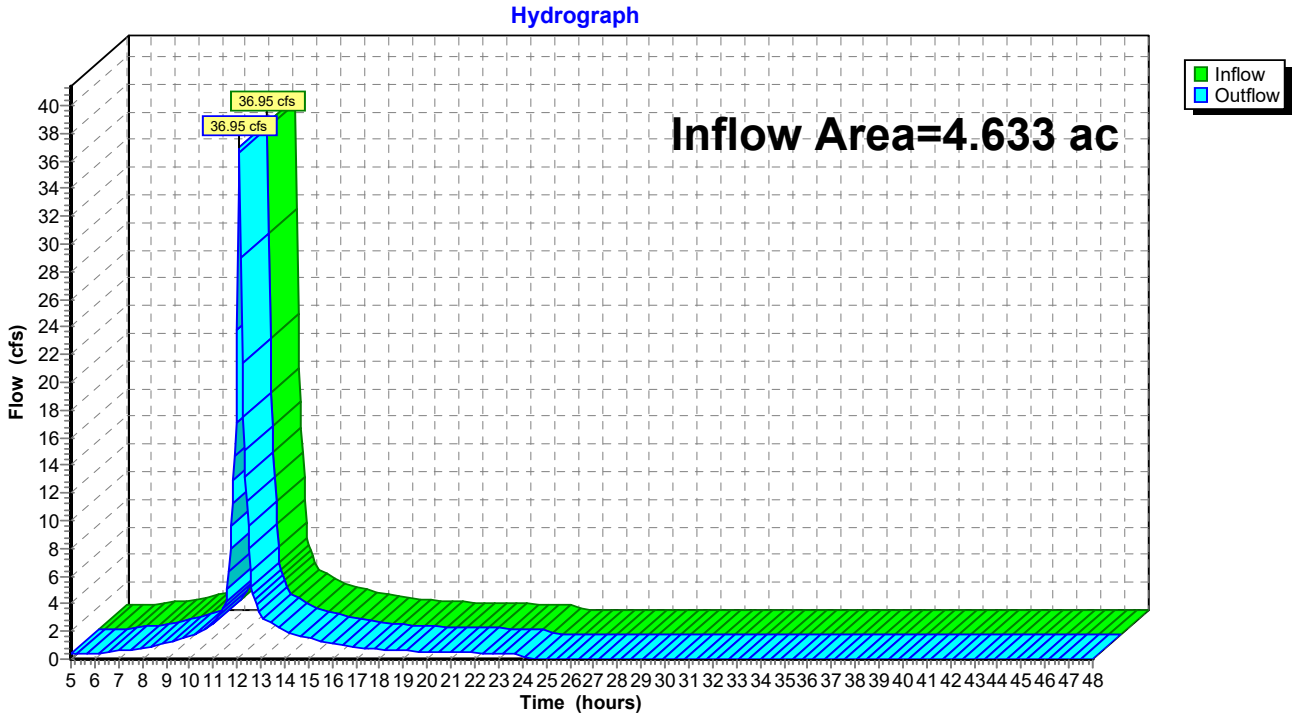
Summary for Reach DP-4: NORTHERN HEADWALLS

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

Inflow Area = 4.633 ac, 87.94% Impervious, Inflow Depth > 7.58" for 100-Year event
Inflow = 36.95 cfs @ 12.09 hrs, Volume= 2.927 af
Outflow = 36.95 cfs @ 12.09 hrs, Volume= 2.927 af, Atten= 0%, Lag= 0.0 min

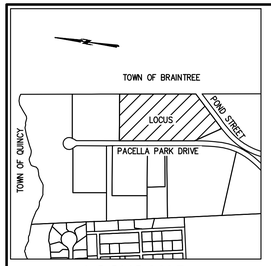
Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: NORTHERN HEADWALLS

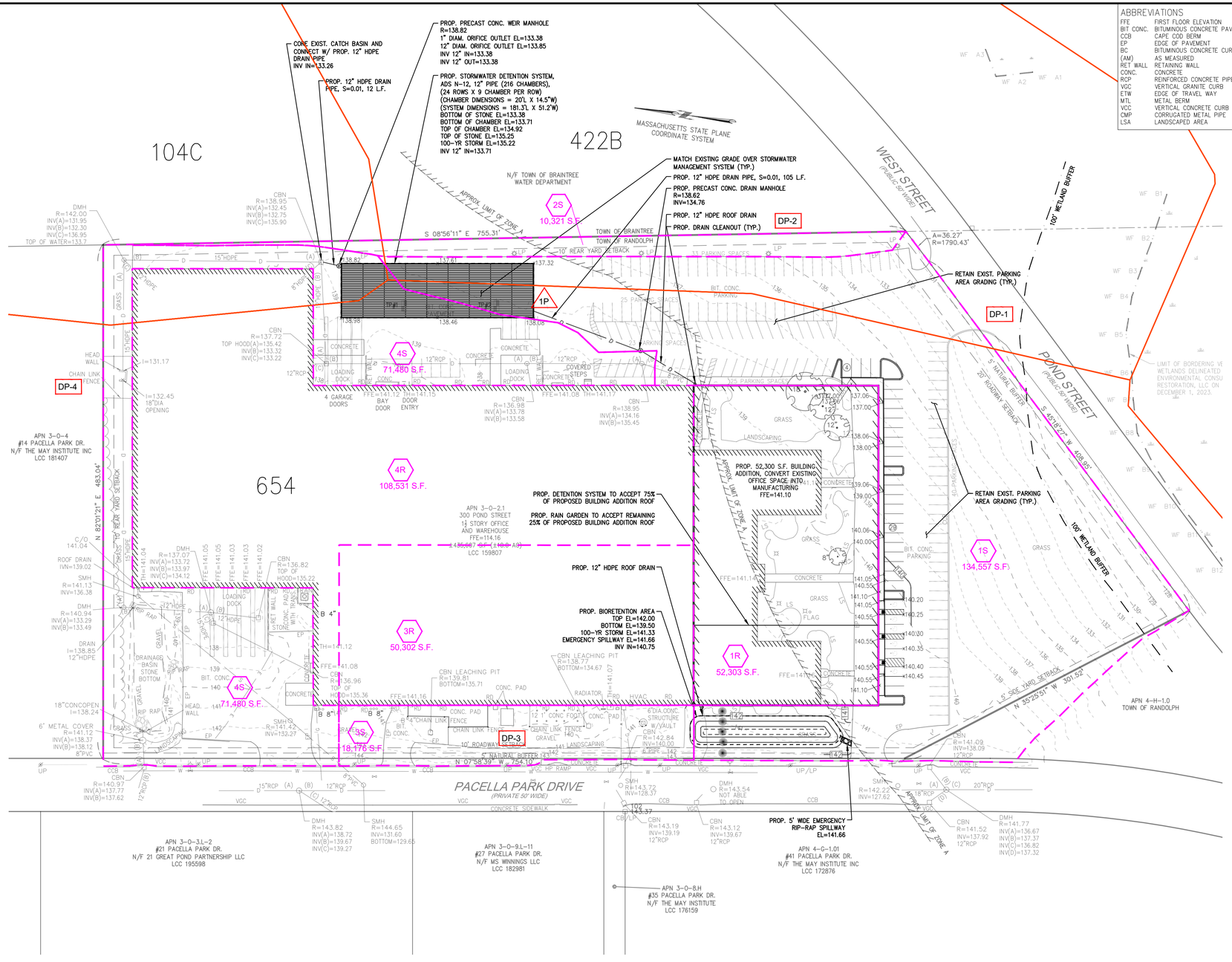


A P P E N D I X B

Post-Development Condition



LOCUS MAP
Not to Scale



ABBREVIATIONS

FFE	FIRST FLOOR ELEVATION
BIT CONC.	BITUMINOUS CONCRETE PAVEMENT
CCB	CAPE COD BERM
EP	EDGE OF PAVEMENT
BC	BITUMINOUS CONCRETE CURB
(AM)	AS MEASURED
RET WALL	RETAINING WALL
CONC.	CONCRETE
RCP	REINFORCED CONCRETE PIPE
VGC	VERTICAL GRANITE CURB
ETW	EDGE OF TRAVEL WAY
MTL	METAL BERM
VCC	VERTICAL CONCRETE CURB
CMP	CORRUGATED METAL PIPE
LSA	LANDSCAPED AREA

LEGEND

- REBAR
- CONCRETE BOUND WITH DRILL HOLE
- STONE BOUND
- STONE BOUND

UTILITY SYMBOLS

- ELECTRIC HAND HOLE
- GUY POLE
- GUY WIRE
- HVAC UNIT
- TRANSFORMER
- WATER GATE
- ELECTRIC MANHOLE
- SEWER MANHOLE
- DRAIN MANHOLE
- TELEPHONE MANHOLE
- DRAINAGE CATCH BASIN
- HYDRANT
- POST INDICATER VALVE
- UTILITY POLE
- BOLLARD
- SIGN
- DECIDUOUS TREE
- CONIFEROUS TREE

LINE DESIGNATORS

- W — WATER MAIN
- OHW — OVERHEAD WIRES
- G — GAS LINE
- WS — WATER SERVICE
- E — UNDERGROUND ELECTRIC
- D — STORM DRAIN LINE
- S — SANITARY SEWER LINE
- DRAINAGE SWALE
- CHAIN LINK FENCE

SURVEY NOTES:

1. LOCUS IS SHOWN AS PARCEL NUMBER 03-0-2.1 ON THE TOWN OF RANDOLPH ASSESSORS MAPS.
2. DEED TO LOCUS IS RECORDED IN THE NORFOLK COUNTY REGISTRY OF DEEDS LAND COURT AT CERTIFICATE #159807.
3. THIS SURVEY WAS MADE ON THE GROUND IN NOVEMBER OF 2022 AND UPDATED IN SEPTEMBER AND DECEMBER OF 2023 BY MCKENZIE ENGINEERING GROUP, INC.
4. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
5. WETLAND RESOURCE AREAS WERE DELINEATED BY ENVIRONMENTAL CONSULTING & RESTORATION, LLC ON DECEMBER 1, 2023.
6. LOCUS IS SITUATED IN ZONE X AS SHOWN ON F.I.R.M. No 25021C0208E, EFFECTIVE 7/17/2012.
7. LOCUS IS NOT LOCATED IN A DEP ZONE 2 OR TOWN OF RANDOLPH AQUIFER PROTECTION DISTRICT ZONE. A PORTION OF THE SITE IS LOCATED WITHIN A DEP ZONE A SURFACE WATER SUPPLY PROTECTION AREA.
8. UTILITY INFORMATION FROM ABOVE GROUND OBSERVED EVIDENCE IN CONJUNCTION WITH DIG SAFE MARKINGS AND RECORD PLANS. THE LAND SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN HEREON COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE LAND SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. BEFORE CONSTRUCTION CALL DIG SAFE SYSTEMS, INC. AT 1-888-344-7233.
7. PLAN REFERENCES: LCP 34183A
   #953 OF 1963
   #393 OF 1927 (POND STREET LAYOUT)
   #256 OF 1923 (WEST STREET LAYOUT)

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
104C	HOLLIS-ROCK OUTCROP-CHARLTON COMPLEX, 0-15% SLOPES	D
422B	CANTON FINE SANDY LOAM, 0-8% SLOPES EXTREMELY STONY	B
654	UDORTHENTS, LOAMY	A

LEGEND

- LIMIT OF WATERSHED
- TIME OF CONCENTRATION FLOW PATH
- LIMIT OF NRCS SOIL MAPPING

0 50 100 150

REV	DATE	DESCRIPTION	BY	APP
1				

MCKENZIE ENGINEERING GROUP
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.0333
www.mckeng.com

POST-DEVELOPMENT WATERSHED PLAN

300 POND STREET

RANDOLPH, MASSACHUSETTS

PROFESSIONAL ENGINEER:

OWNERS/APPLICANT:
EMERSON - SWAN FLEXCON
300 POND STREET
RANDOLPH, MASSACHUSETTS

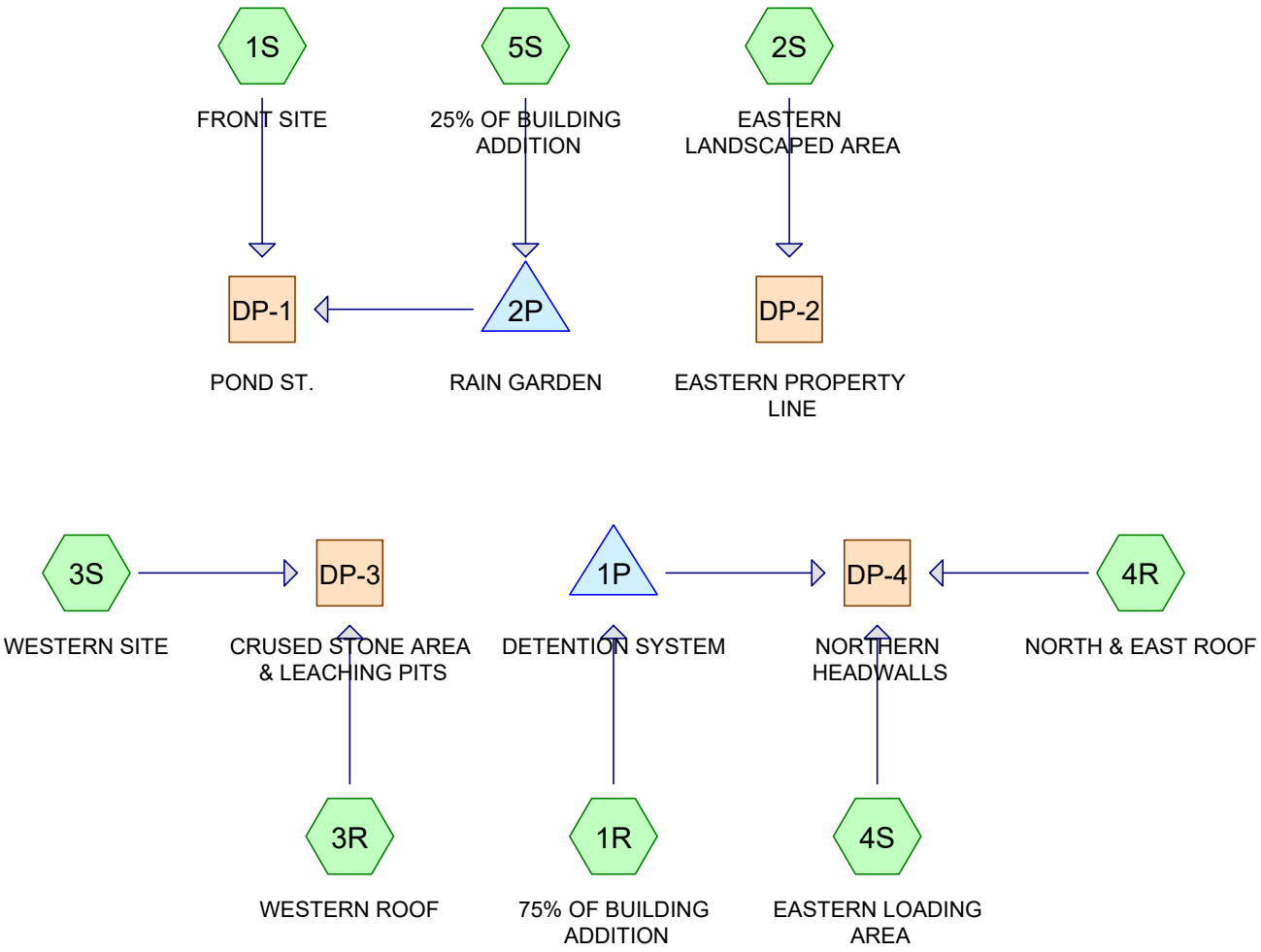
PERMIT PLAN SET

DRAWN BY:	ESS
DESIGNED BY:	ESS
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	NOVEMBER 8, 2023
SCALE:	1"=50'
PROJECT NO.:	222-209

DWG. TITLE:
POST-DEV. WATERSHED PLAN

DWG. NO:
WS-2

M:\MEG\2022 PROJECTS\222-209 EMERSON SWAN-FLEXCON - 300 POND ST., RANDOLPH\DWGS\222-209 WS-2.DWG



Subcat Reach Pond Link

Routing Diagram for 222-209 POST DEVELOPMENT
Prepared by McKenzie Engineering Group, Inc., Printed 4/24/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.29	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.92	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.19	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.79	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.951	39	>75% Grass cover, Good, HSG A (1S, 3S, 4S)
0.233	61	>75% Grass cover, Good, HSG B (1S, 2S)
0.023	80	>75% Grass cover, Good, HSG D (2S)
0.270	96	Gravel surface, HSG A (3S, 4S)
2.058	98	Paved parking, HSG A (1S, 4S)
0.471	98	Paved parking, HSG B (1S, 4S)
0.156	98	Paved parking, HSG D (4S)
4.847	98	Roofs, HSG A (1R, 3R, 4R, 5S)
0.077	98	Unconnected pavement, HSG A (3S)
0.099	30	Woods, Good, HSG A (4S)
0.047	77	Woods, Good, HSG D (4S)
10.231	**85**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
9.302	HSG A	1R, 1S, 3R, 3S, 4R, 4S, 5S
0.703	HSG B	1S, 2S, 4S
0.000	HSG C	
0.226	HSG D	2S, 4S
0.000	Other	
10.231		**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
1.951	0.233	0.000	0.023	0.000	2.206	>75% Grass cover, Good	1S, 2S, 3S, 4S
0.270	0.000	0.000	0.000	0.000	0.270	Gravel surface	3S, 4S
2.058	0.471	0.000	0.156	0.000	2.684	Paved parking	1S, 4S
4.847	0.000	0.000	0.000	0.000	4.847	Roofs	1R, 3R, 4R, 5S
0.077	0.000	0.000	0.000	0.000	0.077	Unconnected pavement	3S
0.099	0.000	0.000	0.047	0.000	0.146	Woods, Good	4S
9.302	**0.703**	**0.000**	**0.226**	**0.000**	**10.231**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	1P	133.38	133.26	12.0	0.0100	0.013	0.0	12.0	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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1R: 75% OF BUILDING Runoff Area=39,227 sf 100.00% Impervious Runoff Depth>3.00"
Tc=6.0 min CN=98 Runoff=2.81 cfs 0.225 af

Subcatchment1S: FRONT SITE Runoff Area=134,557 sf 51.87% Impervious Runoff Depth=0.88"
Tc=6.0 min CN=70 Runoff=2.84 cfs 0.227 af

Subcatchment2S: EASTERN Runoff Area=10,320 sf 0.00% Impervious Runoff Depth=0.56"
Tc=6.0 min CN=63 Runoff=0.11 cfs 0.011 af

Subcatchment3R: WESTERN ROOF Runoff Area=50,302 sf 100.00% Impervious Runoff Depth>3.00"
Tc=6.0 min CN=98 Runoff=3.60 cfs 0.289 af

Subcatchment3S: WESTERN SITE Runoff Area=18,176 sf 18.54% Impervious Runoff Depth=1.54"
Tc=6.0 min UI Adjusted CN=81 Runoff=0.74 cfs 0.054 af

Subcatchment4R: NORTH & EAST Runoff Area=108,531 sf 100.00% Impervious Runoff Depth>3.00"
Tc=6.0 min CN=98 Runoff=7.78 cfs 0.623 af

Subcatchment4S: EASTERN LOADING Runoff Area=71,480 sf 65.94% Impervious Runoff Depth=1.47"
Tc=6.0 min CN=80 Runoff=2.76 cfs 0.201 af

Subcatchment5S: 25% OF BUILDING Runoff Area=13,075 sf 100.00% Impervious Runoff Depth>3.00"
Tc=6.0 min CN=98 Runoff=0.94 cfs 0.075 af

Reach DP-1: POND ST. Inflow=2.84 cfs 0.227 af
Outflow=2.84 cfs 0.227 af

Reach DP-2: EASTERN PROPERTY LINE Inflow=0.11 cfs 0.011 af
Outflow=0.11 cfs 0.011 af

Reach DP-3: CRUSED STONE AREA & LEACHING PITS Inflow=4.34 cfs 0.342 af
Outflow=4.34 cfs 0.342 af

Reach DP-4: NORTHERN HEADWALLS Inflow=11.15 cfs 1.033 af
Outflow=11.15 cfs 1.033 af

Pond 1P: DETENTION SYSTEM Peak Elev=134.36' Storage=4,576 cf Inflow=2.81 cfs 0.225 af
Outflow=1.00 cfs 0.209 af

Pond 2P: RAIN GARDEN Peak Elev=141.33' Storage=3,269 cf Inflow=0.94 cfs 0.075 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 10.231 ac Runoff Volume = 1.704 af Average Runoff Depth = 2.00"
25.63% Pervious = 2.623 ac 74.37% Impervious = 7.609 ac

Summary for Subcatchment 1R: 75% OF BUILDING ADDITION

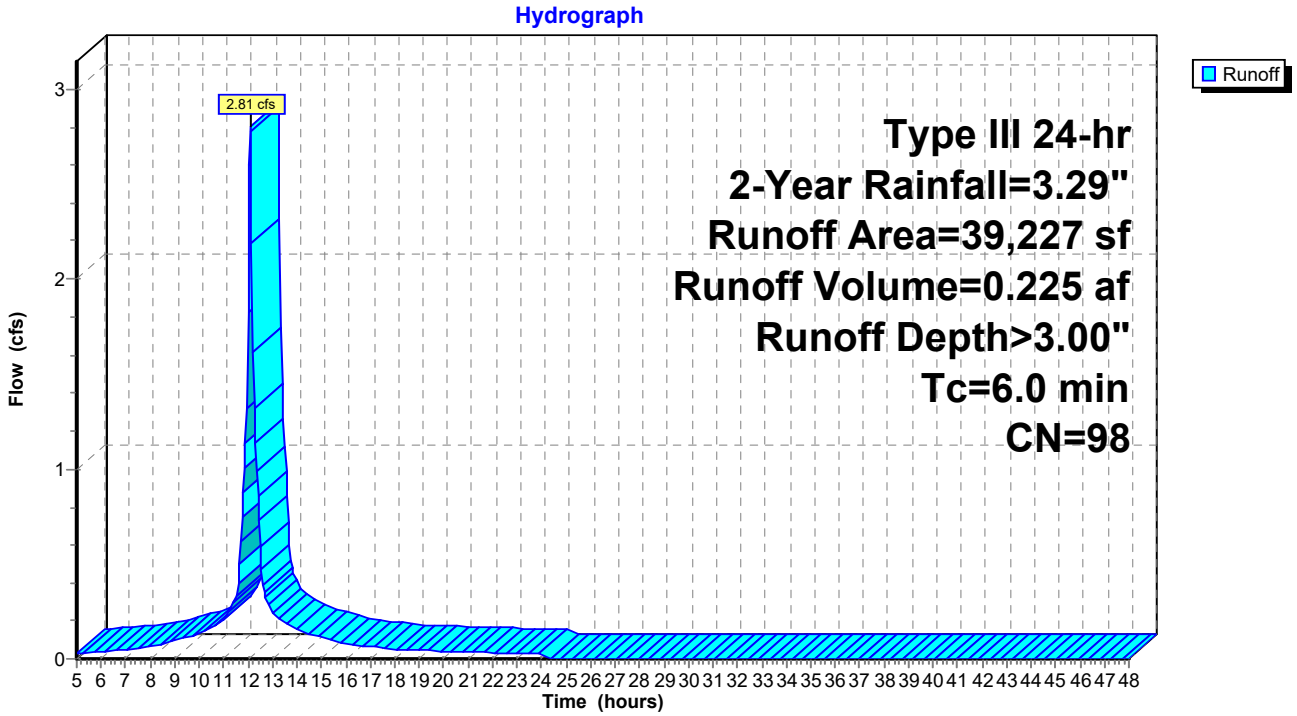
Runoff = 2.81 cfs @ 12.09 hrs, Volume= 0.225 af, Depth> 3.00"
Routed to Pond 1P : DETENTION SYSTEM

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=3.29"

Area (sf)	CN	Description
39,227	98	Roofs, HSG A
39,227		100.00% Impervious Area

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

Subcatchment 1R: 75% OF BUILDING ADDITION



Summary for Subcatchment 1S: FRONT SITE

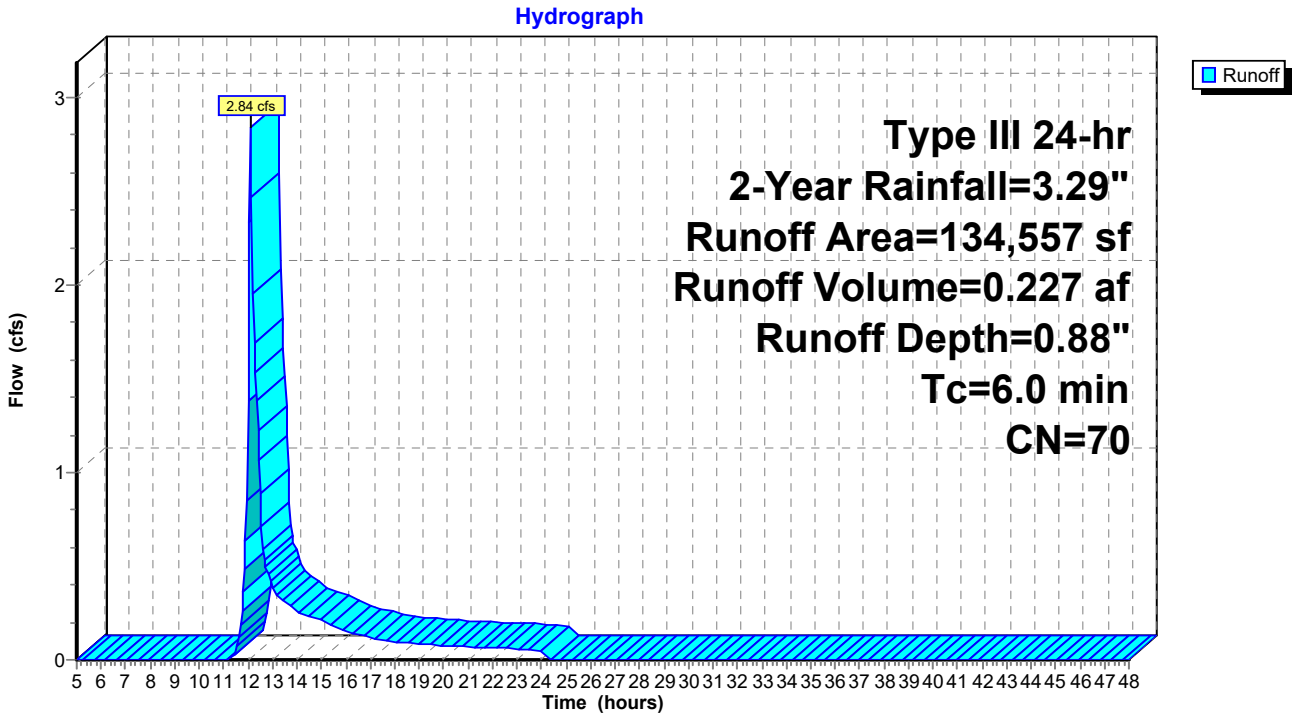
Runoff = 2.84 cfs @ 12.10 hrs, Volume= 0.227 af, Depth= 0.88"
Routed to Reach DP-1 : POND ST.

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=3.29"

Area (sf)	CN	Description
63,959	39	>75% Grass cover, Good, HSG A
809	61	>75% Grass cover, Good, HSG B
20,445	98	Paved parking, HSG B
49,344	98	Paved parking, HSG A
134,557	70	Weighted Average
64,768		48.13% Pervious Area
69,789		51.87% Impervious Area

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

Subcatchment 1S: FRONT SITE



Summary for Subcatchment 2S: EASTERN LANDSCAPED AREA

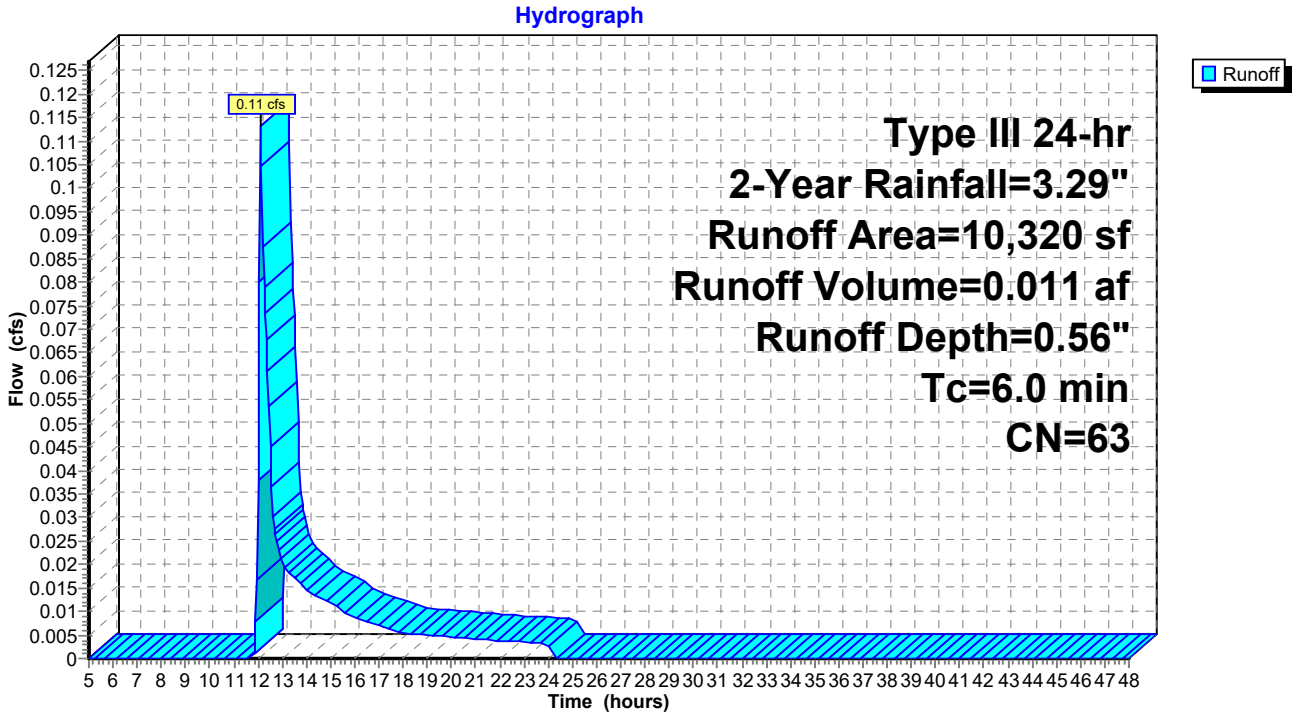
Runoff = 0.11 cfs @ 12.12 hrs, Volume= 0.011 af, Depth= 0.56"
Routed to Reach DP-2 : EASTERN PROPERTY LINE

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=3.29"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
1,000	80	>75% Grass cover, Good, HSG D
10,320	63	Weighted Average
10,320		100.00% Pervious Area

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

Subcatchment 2S: EASTERN LANDSCAPED AREA



Summary for Subcatchment 3R: WESTERN ROOF

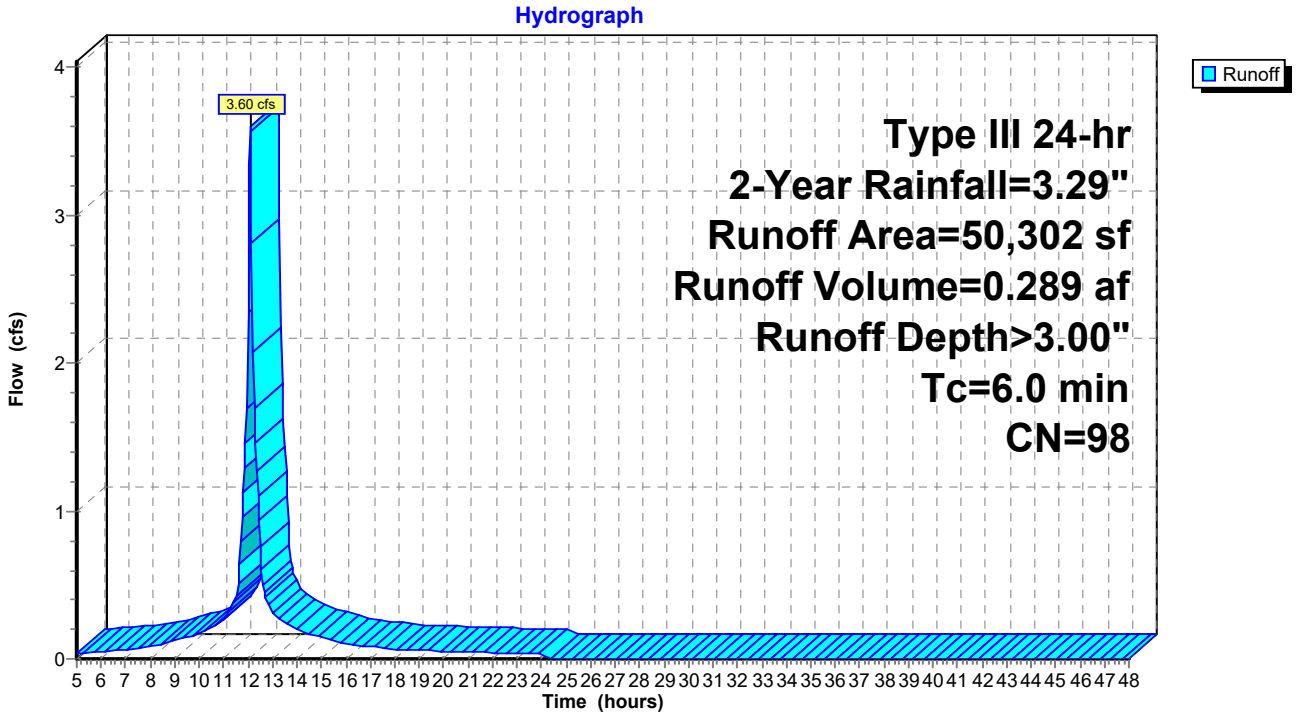
Runoff = 3.60 cfs @ 12.09 hrs, Volume= 0.289 af, Depth> 3.00"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=3.29"

Area (sf)	CN	Description
50,302	98	Roofs, HSG A
50,302		100.00% Impervious Area

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

Subcatchment 3R: WESTERN ROOF



Summary for Subcatchment 3S: WESTERN SITE

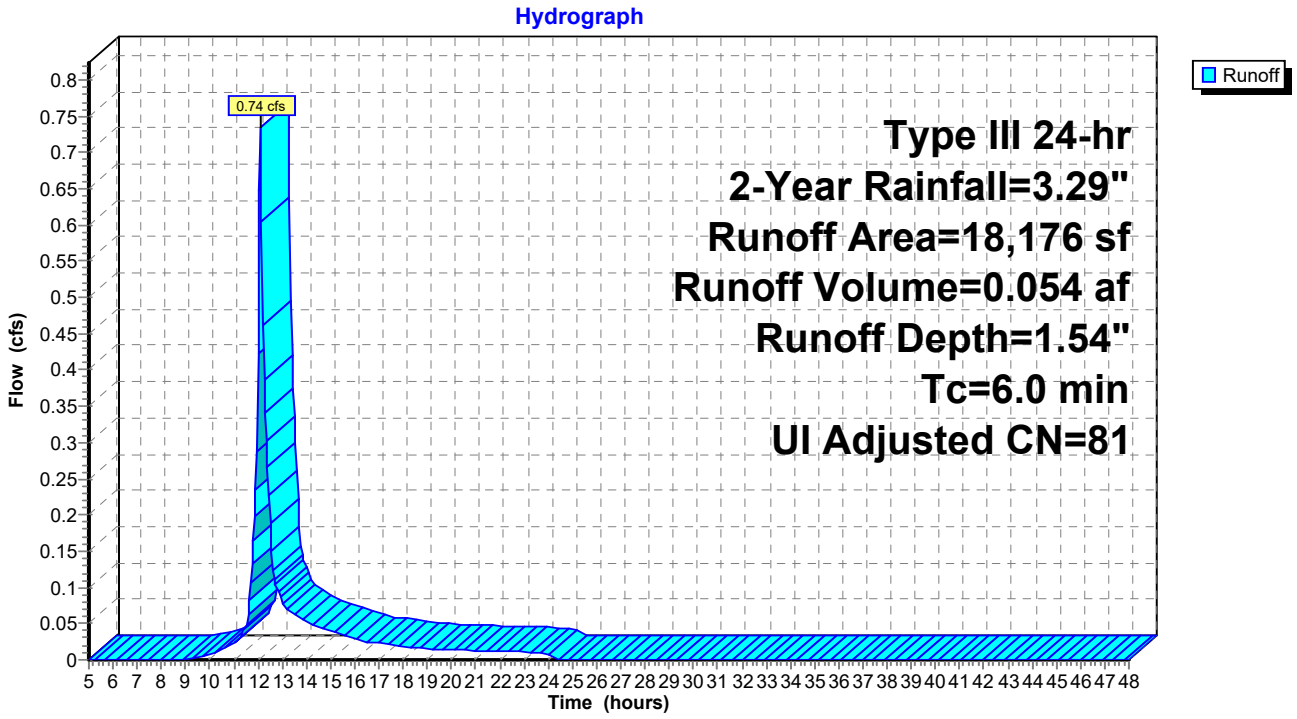
Runoff = 0.74 cfs @ 12.09 hrs, Volume= 0.054 af, Depth= 1.54"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=3.29"

Area (sf)	CN	Adj	Description
3,370	98		Unconnected pavement, HSG A
10,363	96		Gravel surface, HSG A
4,443	39		>75% Grass cover, Good, HSG A
18,176	82	81	Weighted Average, UI Adjusted
14,806			81.46% Pervious Area
3,370			18.54% Impervious Area
3,370			100.00% Unconnected

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

Subcatchment 3S: WESTERN SITE



Summary for Subcatchment 4R: NORTH & EAST ROOF

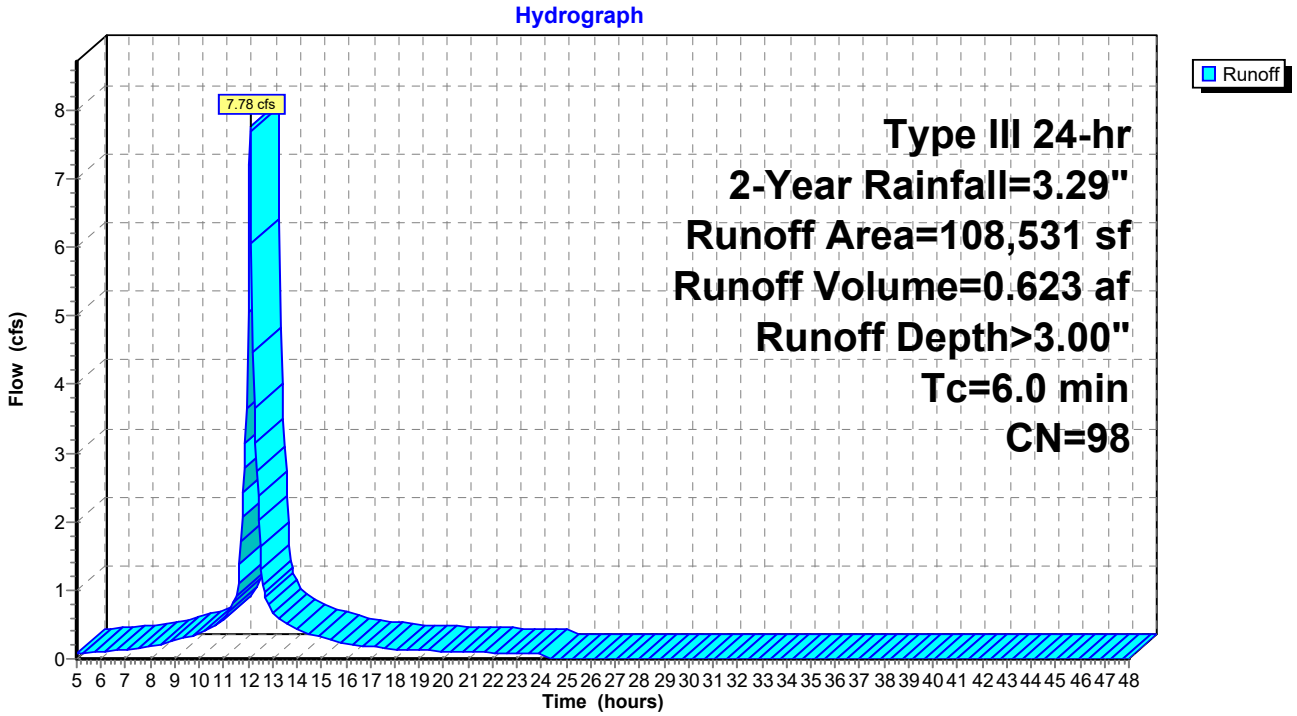
Runoff = 7.78 cfs @ 12.09 hrs, Volume= 0.623 af, Depth> 3.00"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=3.29"

Area (sf)	CN	Description
108,531	98	Roofs, HSG A
108,531		100.00% Impervious Area

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

Subcatchment 4R: NORTH & EAST ROOF



Summary for Subcatchment 4S: EASTERN LOADING AREA

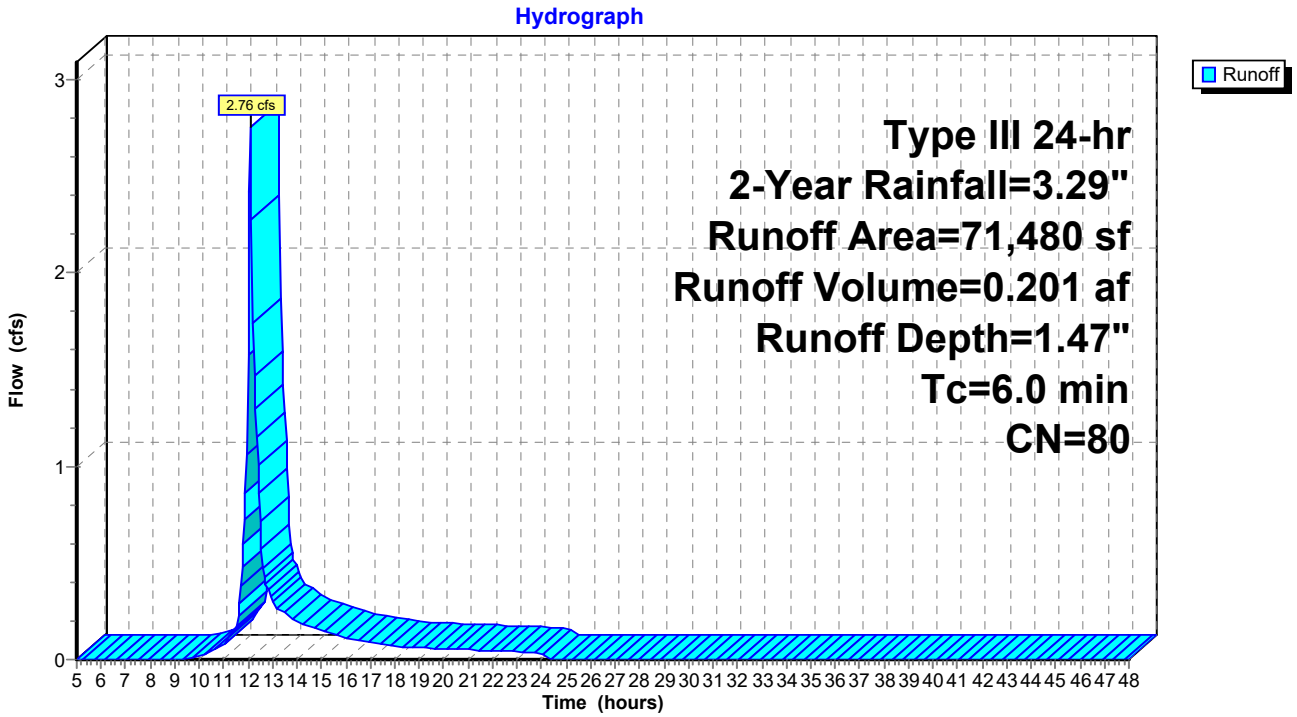
Runoff = 2.76 cfs @ 12.10 hrs, Volume= 0.201 af, Depth= 1.47"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=3.29"

Area (sf)	CN	Description
40,295	98	Paved parking, HSG A
55	98	Paved parking, HSG B
6,783	98	Paved parking, HSG D
4,315	30	Woods, Good, HSG A
2,050	77	Woods, Good, HSG D
16,572	39	>75% Grass cover, Good, HSG A
1,410	96	Gravel surface, HSG A
71,480	80	Weighted Average
24,347		34.06% Pervious Area
47,133		65.94% Impervious Area

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

Subcatchment 4S: EASTERN LOADING AREA



Summary for Subcatchment 5S: 25% OF BUILDING ADDITION

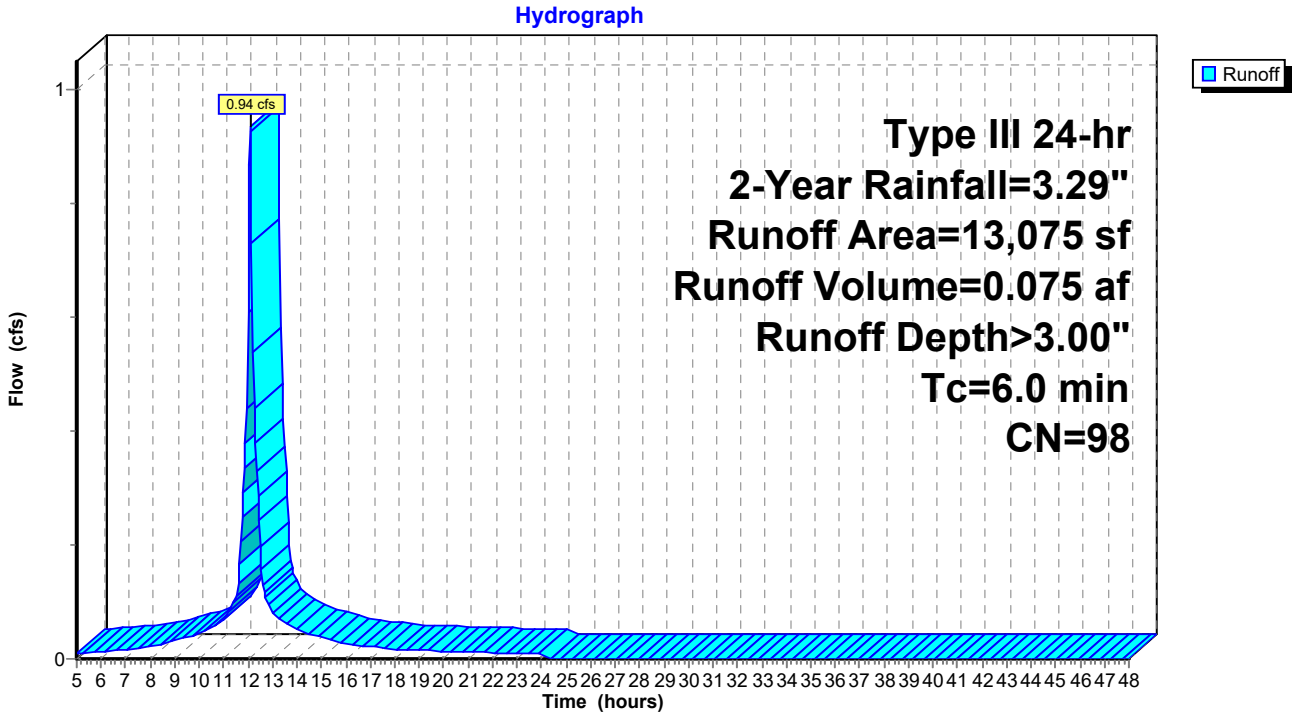
Runoff = 0.94 cfs @ 12.09 hrs, Volume= 0.075 af, Depth> 3.00"
Routed to Pond 2P : RAIN GARDEN

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=3.29"

Area (sf)	CN	Description
13,075	98	Roofs, HSG A
13,075		100.00% Impervious Area

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

Subcatchment 5S: 25% OF BUILDING ADDITION



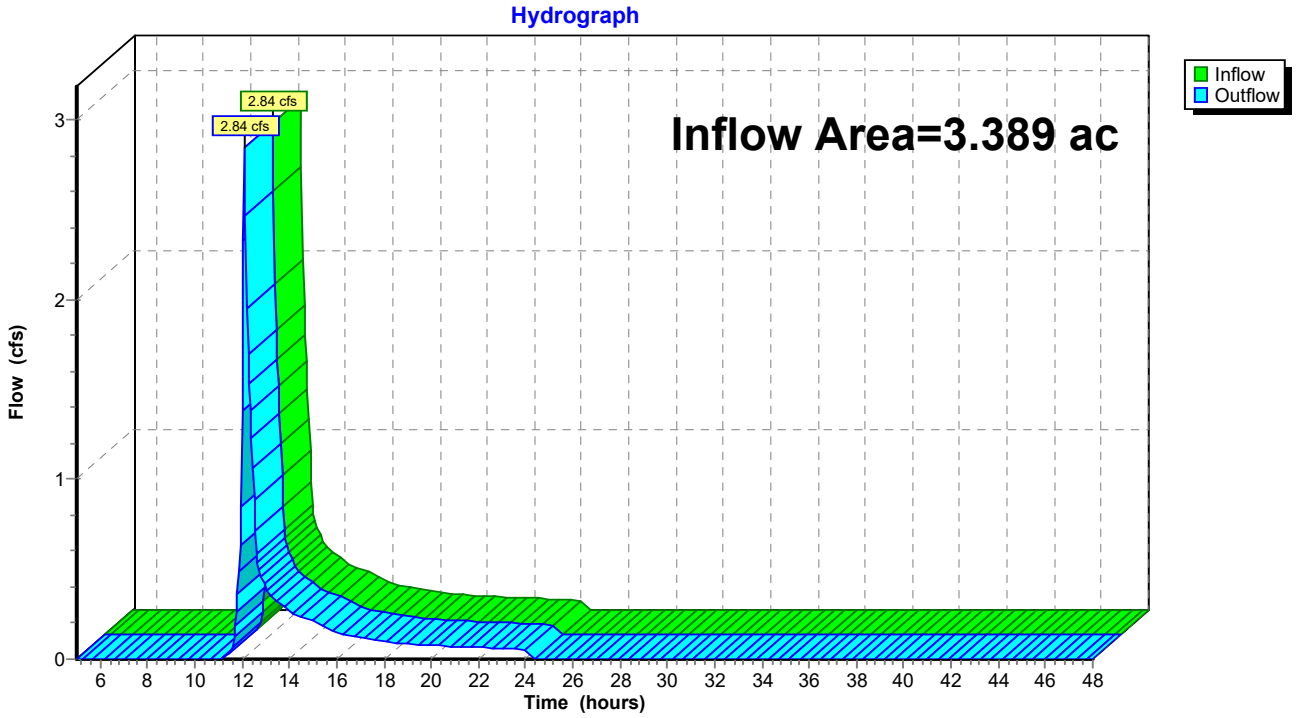
Summary for Reach DP-1: POND ST.

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

Inflow Area = 3.389 ac, 56.13% Impervious, Inflow Depth = 0.80" for 2-Year event
Inflow = 2.84 cfs @ 12.10 hrs, Volume= 0.227 af
Outflow = 2.84 cfs @ 12.10 hrs, Volume= 0.227 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-1: POND ST.



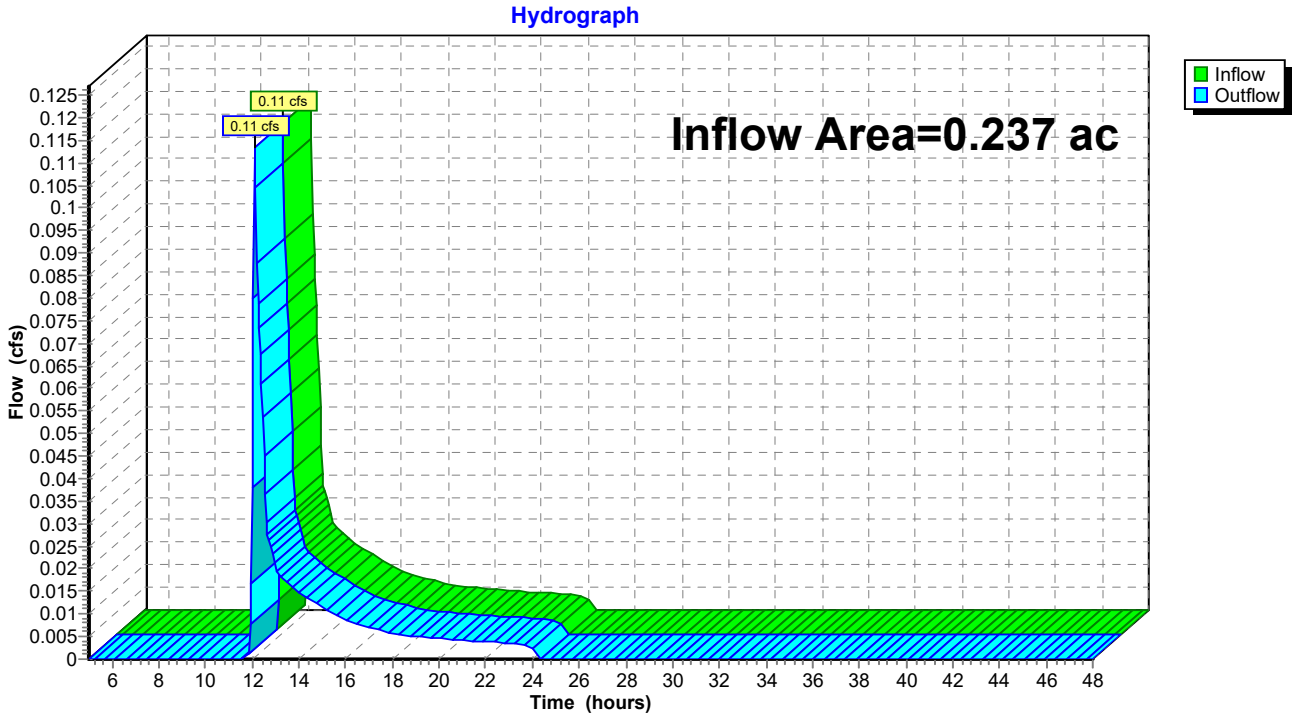
Summary for Reach DP-2: EASTERN PROPERTY LINE

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

Inflow Area = 0.237 ac, 0.00% Impervious, Inflow Depth = 0.56" for 2-Year event
Inflow = 0.11 cfs @ 12.12 hrs, Volume= 0.011 af
Outflow = 0.11 cfs @ 12.12 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-2: EASTERN PROPERTY LINE



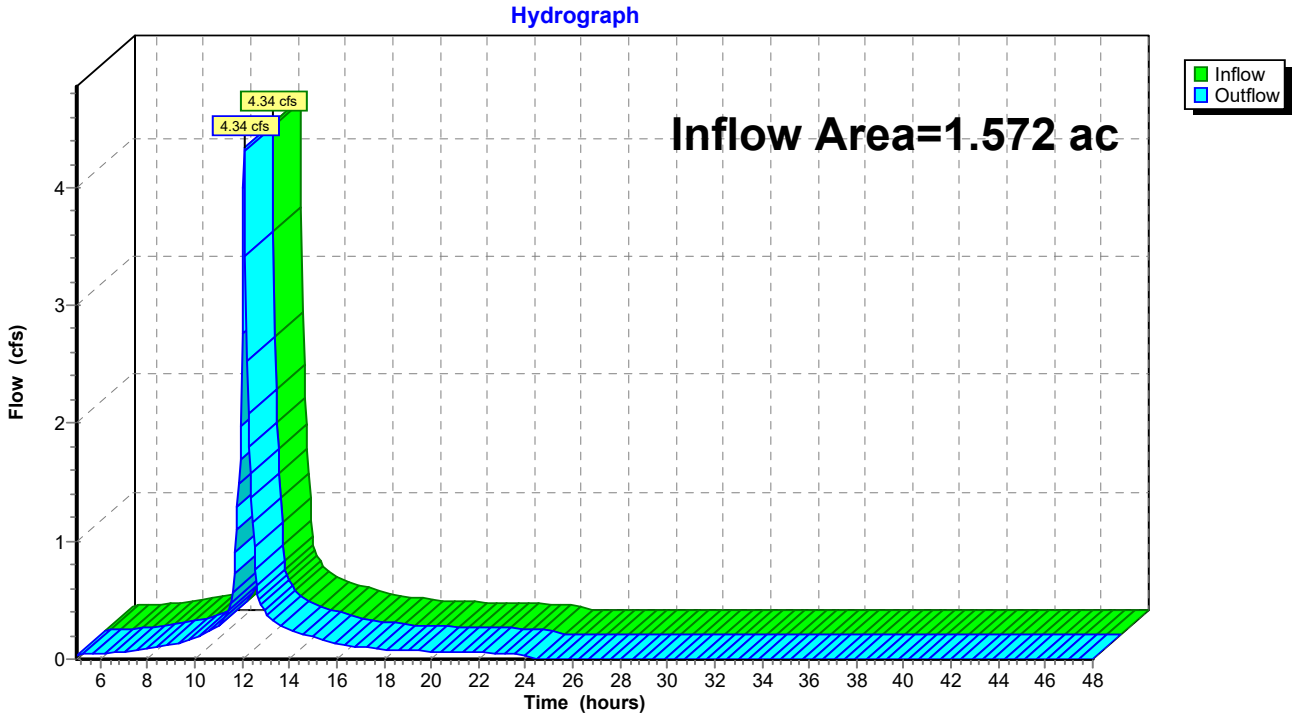
Summary for Reach DP-3: CRUSED STONE AREA & LEACHING PITS

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

Inflow Area = 1.572 ac, 78.38% Impervious, Inflow Depth > 2.61" for 2-Year event
Inflow = 4.34 cfs @ 12.09 hrs, Volume= 0.342 af
Outflow = 4.34 cfs @ 12.09 hrs, Volume= 0.342 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-3: CRUSED STONE AREA & LEACHING PITS



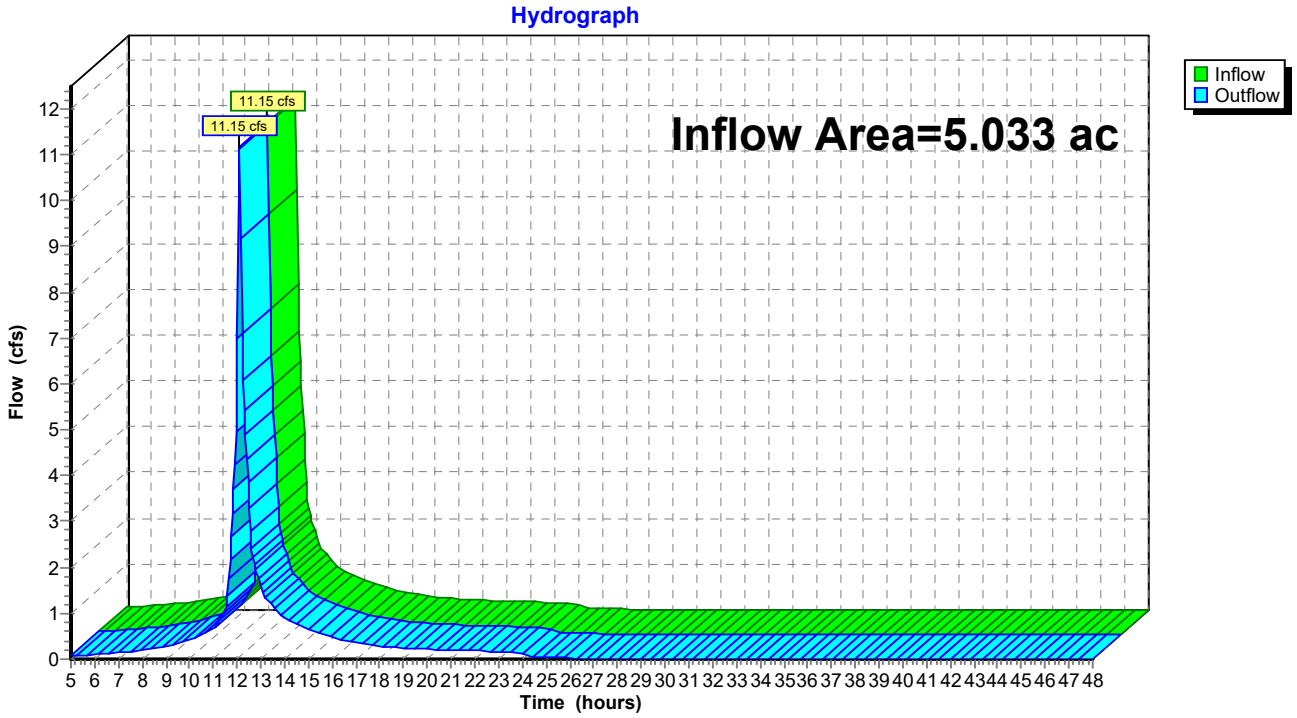
Summary for Reach DP-4: NORTHERN HEADWALLS

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

Inflow Area = 5.033 ac, 88.89% Impervious, Inflow Depth > 2.46" for 2-Year event
Inflow = 11.15 cfs @ 12.09 hrs, Volume= 1.033 af
Outflow = 11.15 cfs @ 12.09 hrs, Volume= 1.033 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-4: NORTHERN HEADWALLS



Summary for Pond 1P: DETENTION SYSTEM

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.901 ac,100.00% Impervious, Inflow Depth > 3.00" for 2-Year event
Inflow = 2.81 cfs @ 12.09 hrs, Volume= 0.225 af
Outflow = 1.00 cfs @ 12.35 hrs, Volume= 0.209 af, Atten= 65%, Lag= 15.8 min
Primary = 1.00 cfs @ 12.35 hrs, Volume= 0.209 af
Routed to Reach DP-4 : NORTHERN HEADWALLS

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 134.36' @ 12.35 hrs Surf.Area= 9,291 sf Storage= 4,576 cf

Plug-Flow detention time= 305.0 min calculated for 0.209 af (93% of inflow)
Center-of-Mass det. time= 268.9 min (1,034.8 - 765.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.38'	5,162 cf	**51.24'W x 181.33'L x 1.88'H Field A** 17,426 cf Overall - 4,522 cf Embedded = 12,904 cf x 40.0% Voids
#2A	133.71'	3,499 cf	**ADS N-12 12"** x 216 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf 216 Chambers in 24 Rows
		8,661 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	133.38'	**12.0" Round Culvert** L= 12.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 133.38' / 133.26' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	133.38'	**1.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	133.85'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.00 cfs @ 12.35 hrs HW=134.36' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.00 cfs of 2.02 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 4.66 fps)
  └─**3=Orifice/Grate** (Orifice Controls 0.97 cfs @ 2.43 fps)

Pond 1P: DETENTION SYSTEM - Chamber Wizard Field A

Chamber Model = ADS N-12 12" (ADS N-12® Pipe)
Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf
Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 10.9" Spacing = 25.4" C-C Row Spacing

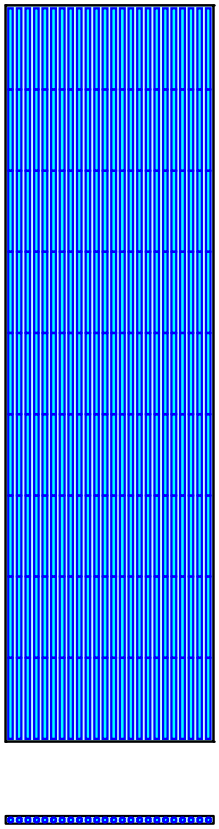
9 Chambers/Row x 20.00' Long = 180.00' Row Length +8.0" End Stone x 2 = 181.33' Base Length
24 Rows x 14.5" Wide + 10.9" Spacing x 23 + 8.0" Side Stone x 2 = 51.24' Base Width
4.0" Stone Base + 14.5" Chamber Height + 4.0" Stone Cover = 1.88' Field Height

216 Chambers x 16.2 cf = 3,499.2 cf Chamber Storage
216 Chambers x 20.9 cf = 4,522.0 cf Displacement

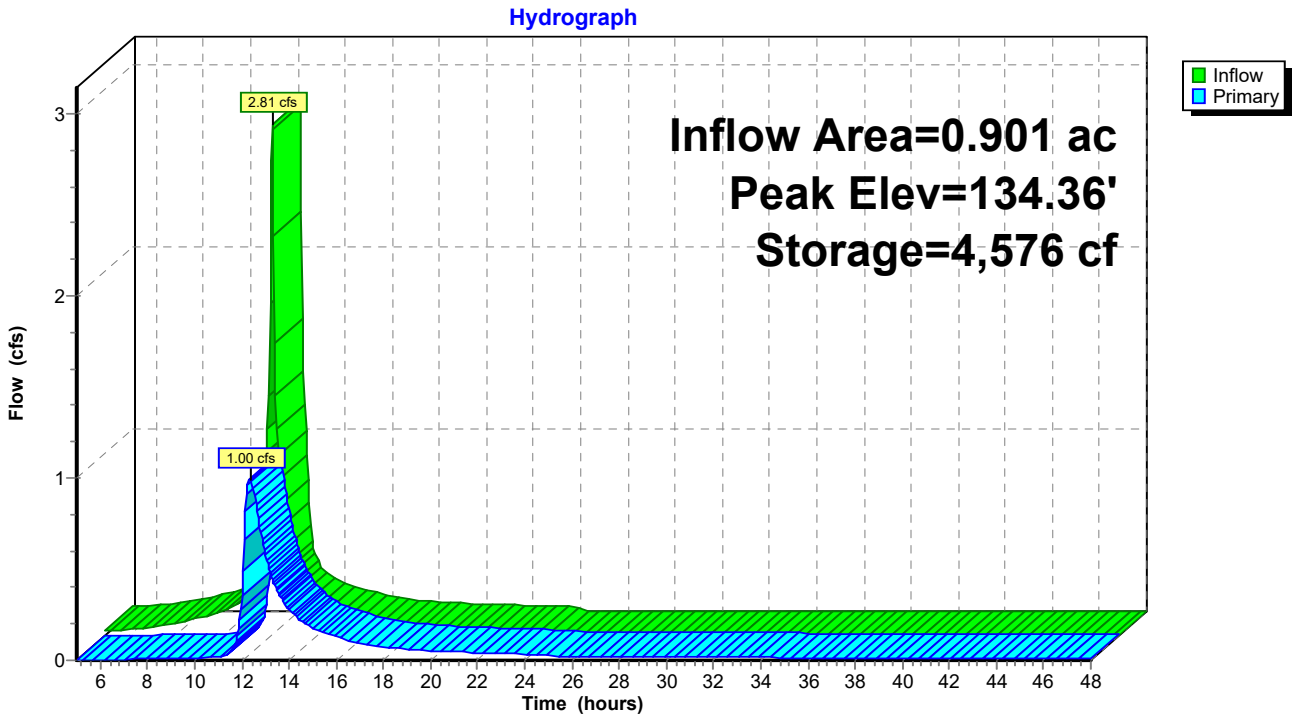
17,426.0 cf Field - 4,522.0 cf Chambers = 12,903.9 cf Stone x 40.0% Voids = 5,161.6 cf Stone Storage

Chamber Storage + Stone Storage = 8,660.8 cf = 0.199 af
Overall Storage Efficiency = 49.7%
Overall System Size = 181.33' x 51.24' x 1.88'

216 Chambers
645.4 cy Field
477.9 cy Stone



Pond 1P: DETENTION SYSTEM



Summary for Pond 2P: RAIN GARDEN

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.300 ac,100.00% Impervious, Inflow Depth > 3.00" for 2-Year event
Inflow = 0.94 cfs @ 12.09 hrs, Volume= 0.075 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Reach DP-1 : POND ST.

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 141.33' @ 24.40 hrs Surf.Area= 3,097 sf Storage= 3,269 cf

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

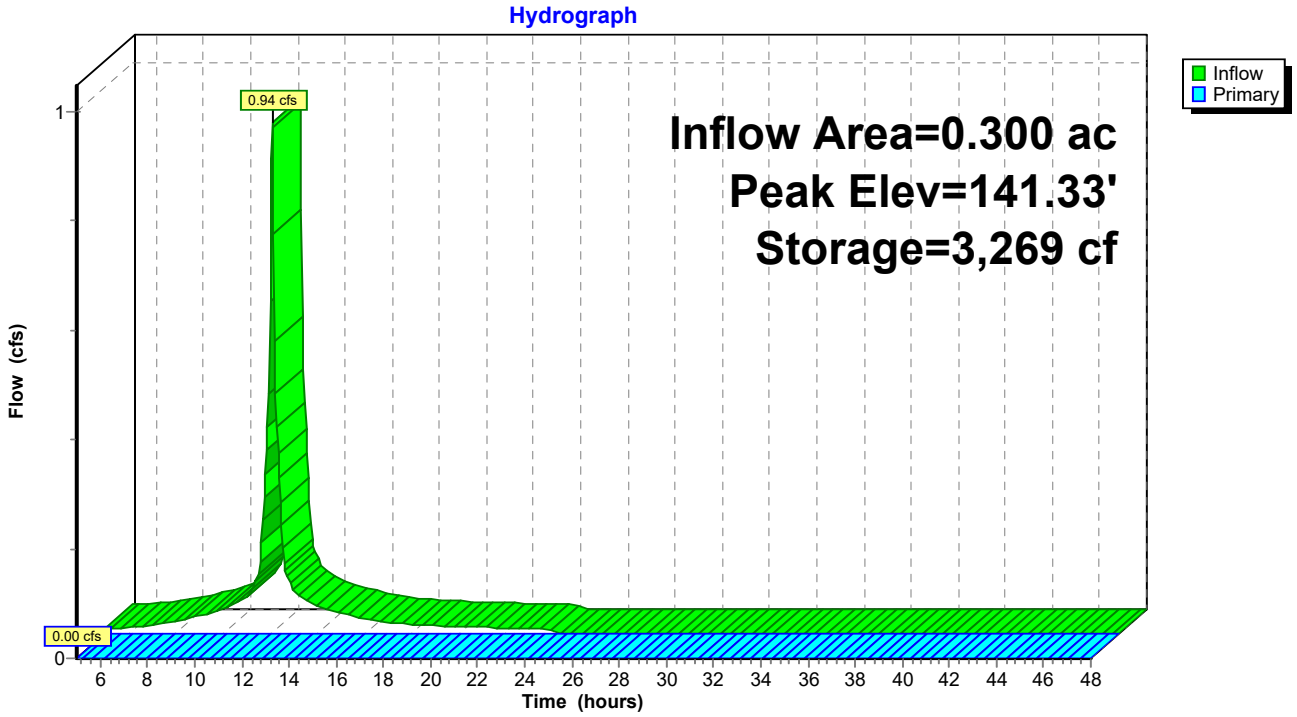
Volume	Invert	Avail.Storage	Storage Description
#1	139.50'	5,680 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
139.50	562	0	0
140.00	1,190	438	438
141.00	2,582	1,886	2,324
142.00	4,130	3,356	5,680

Device	Routing	Invert	Outlet Devices
#1	Primary	141.66'	**5.0' long x 3.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.41 2.56 2.69 2.67 2.66 2.66 2.65 2.67 2.67 2.70 2.77 2.83 2.87 2.93 3.10 3.19 3.32

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=139.50' TW=0.00' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 2P: RAIN GARDEN



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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1R: 75% OF BUILDING Runoff Area=39,227 sf 100.00% Impervious Runoff Depth>4.56"
Tc=6.0 min CN=98 Runoff=4.23 cfs 0.342 af

Subcatchment1S: FRONT SITE Runoff Area=134,557 sf 51.87% Impervious Runoff Depth=1.98"
Tc=6.0 min CN=70 Runoff=6.90 cfs 0.509 af

Subcatchment2S: EASTERN Runoff Area=10,320 sf 0.00% Impervious Runoff Depth=1.46"
Tc=6.0 min CN=63 Runoff=0.37 cfs 0.029 af

Subcatchment3R: WESTERN ROOF Runoff Area=50,302 sf 100.00% Impervious Runoff Depth>4.56"
Tc=6.0 min CN=98 Runoff=5.43 cfs 0.439 af

Subcatchment3S: WESTERN SITE Runoff Area=18,176 sf 18.54% Impervious Runoff Depth=2.91"
Tc=6.0 min UI Adjusted CN=81 Runoff=1.40 cfs 0.101 af

Subcatchment4R: NORTH & EAST Runoff Area=108,531 sf 100.00% Impervious Runoff Depth>4.56"
Tc=6.0 min CN=98 Runoff=11.71 cfs 0.947 af

Subcatchment4S: EASTERN LOADING Runoff Area=71,480 sf 65.94% Impervious Runoff Depth=2.82"
Tc=6.0 min CN=80 Runoff=5.32 cfs 0.386 af

Subcatchment5S: 25% OF BUILDING Runoff Area=13,075 sf 100.00% Impervious Runoff Depth>4.56"
Tc=6.0 min CN=98 Runoff=1.41 cfs 0.114 af

Reach DP-1: POND ST. Inflow=6.90 cfs 0.523 af
Outflow=6.90 cfs 0.523 af

Reach DP-2: EASTERN PROPERTY LINE Inflow=0.37 cfs 0.029 af
Outflow=0.37 cfs 0.029 af

Reach DP-3: CRUSED STONE AREA & LEACHING PITS Inflow=6.82 cfs 0.540 af
Outflow=6.82 cfs 0.540 af

Reach DP-4: NORTHERN HEADWALLS Inflow=18.33 cfs 1.659 af
Outflow=18.33 cfs 1.659 af

Pond 1P: DETENTION SYSTEM Peak Elev=134.58' Storage=5,911 cf Inflow=4.23 cfs 0.342 af
Outflow=1.81 cfs 0.326 af

Pond 2P: RAIN GARDEN Peak Elev=141.68' Storage=4,430 cf Inflow=1.41 cfs 0.114 af
Outflow=0.03 cfs 0.014 af

Total Runoff Area = 10.231 ac Runoff Volume = 2.868 af Average Runoff Depth = 3.36"
25.63% Pervious = 2.623 ac 74.37% Impervious = 7.609 ac

Summary for Subcatchment 1R: 75% OF BUILDING ADDITION

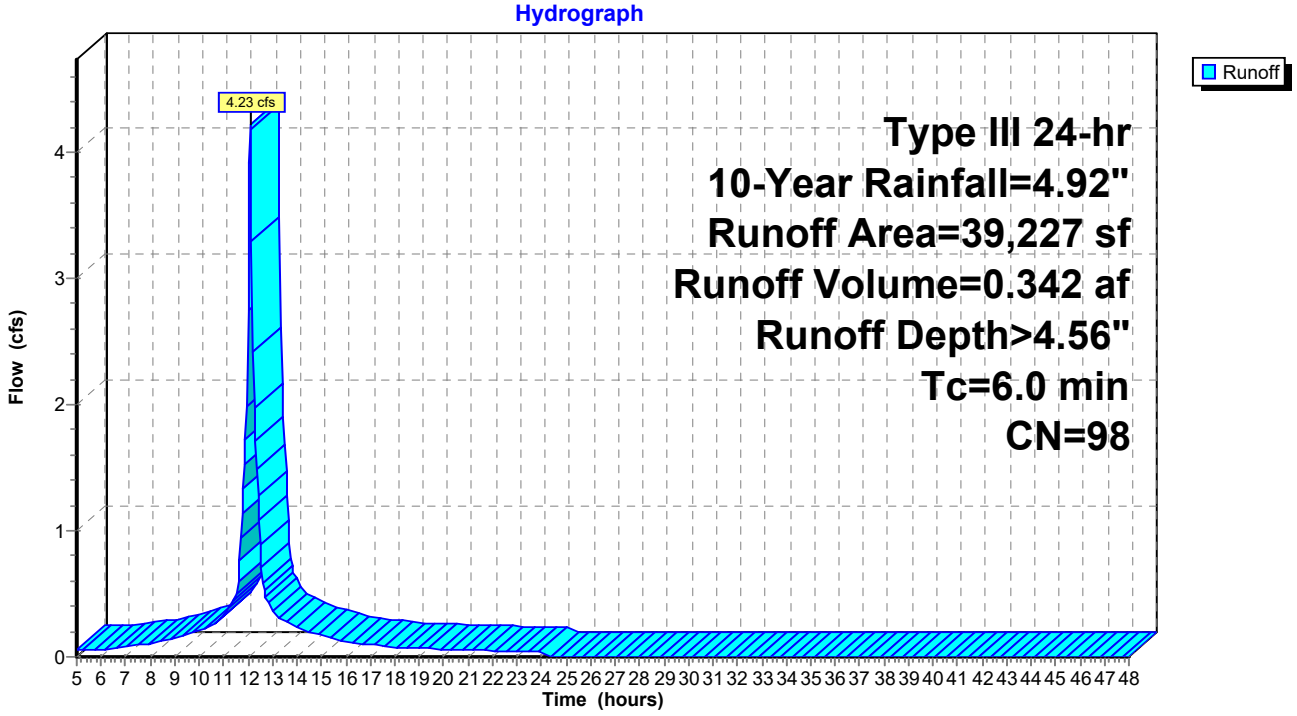
Runoff = 4.23 cfs @ 12.09 hrs, Volume= 0.342 af, Depth> 4.56"
Routed to Pond 1P : DETENTION SYSTEM

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=4.92"

Area (sf)	CN	Description
39,227	98	Roofs, HSG A
39,227		100.00% Impervious Area

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

Subcatchment 1R: 75% OF BUILDING ADDITION



Summary for Subcatchment 1S: FRONT SITE

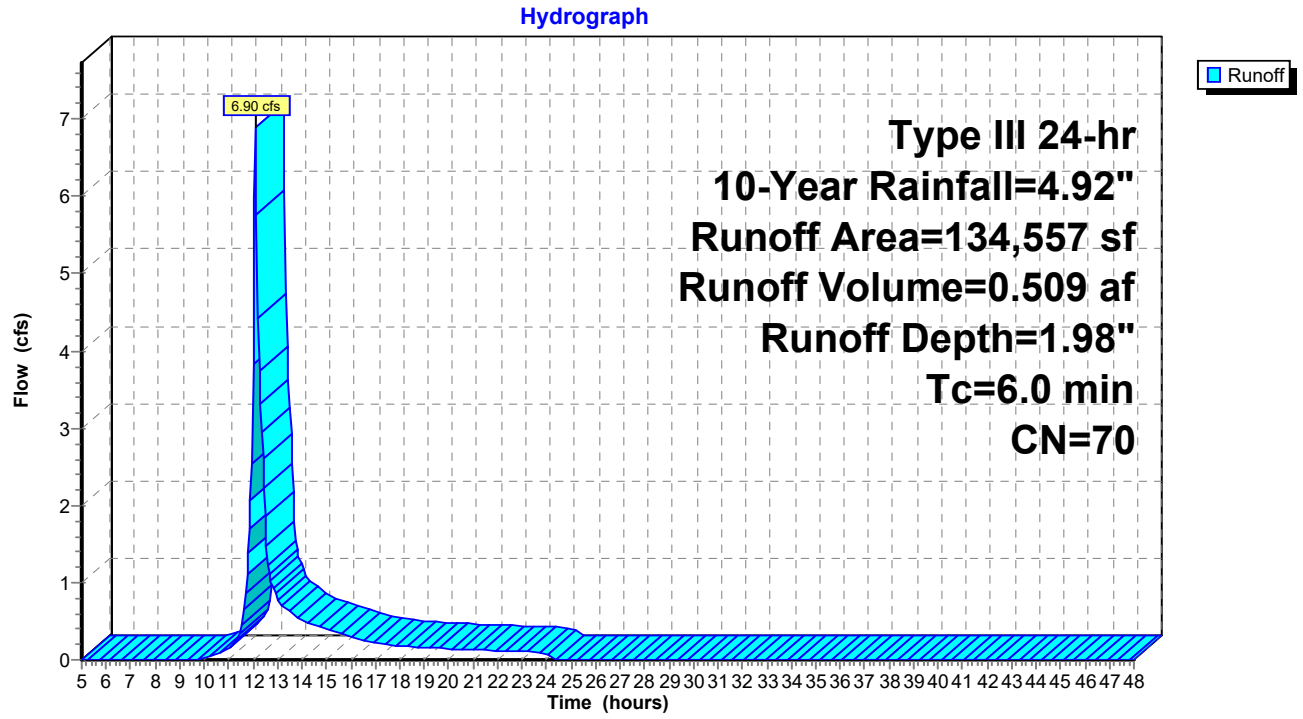
Runoff = 6.90 cfs @ 12.10 hrs, Volume= 0.509 af, Depth= 1.98"
Routed to Reach DP-1 : POND ST.

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=4.92"

Area (sf)	CN	Description
63,959	39	>75% Grass cover, Good, HSG A
809	61	>75% Grass cover, Good, HSG B
20,445	98	Paved parking, HSG B
49,344	98	Paved parking, HSG A
134,557	70	Weighted Average
64,768		48.13% Pervious Area
69,789		51.87% Impervious Area

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

Subcatchment 1S: FRONT SITE



Summary for Subcatchment 2S: EASTERN LANDSCAPED AREA

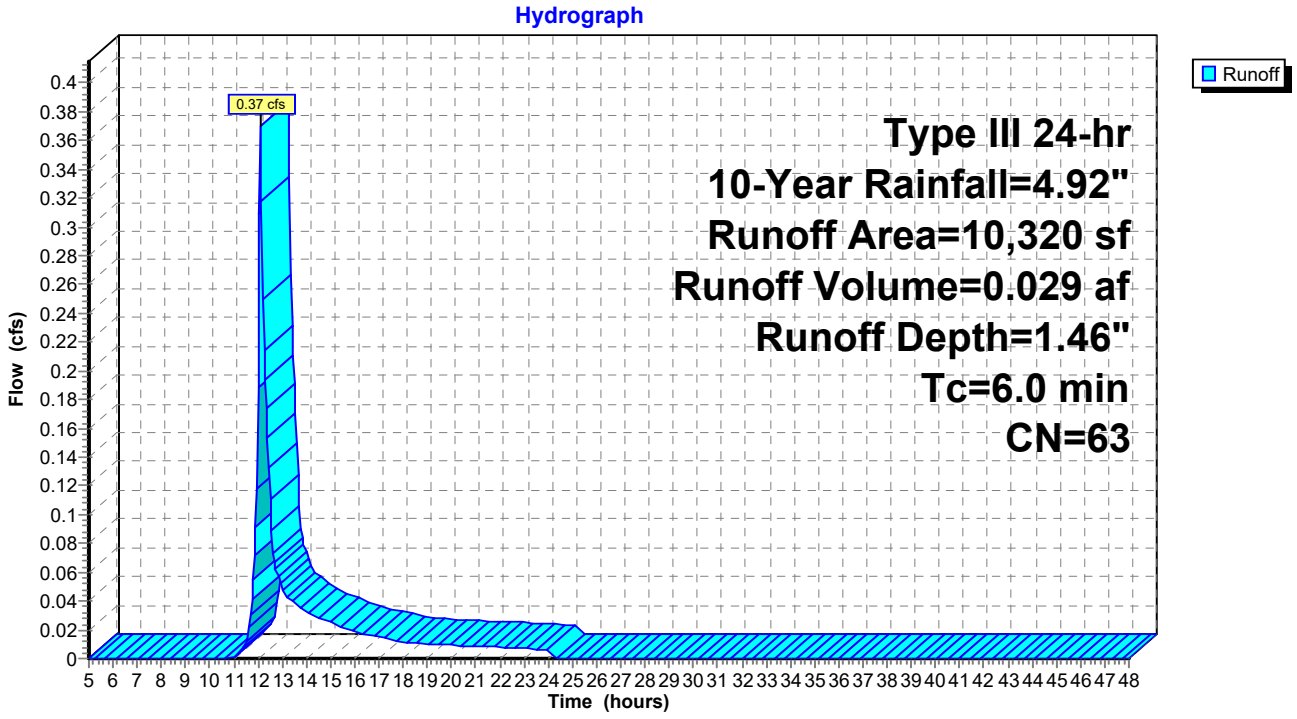
Runoff = 0.37 cfs @ 12.10 hrs, Volume= 0.029 af, Depth= 1.46"
Routed to Reach DP-2 : EASTERN PROPERTY LINE

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=4.92"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
1,000	80	>75% Grass cover, Good, HSG D
10,320	63	Weighted Average
10,320		100.00% Pervious Area

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

Subcatchment 2S: EASTERN LANDSCAPED AREA



Summary for Subcatchment 3R: WESTERN ROOF

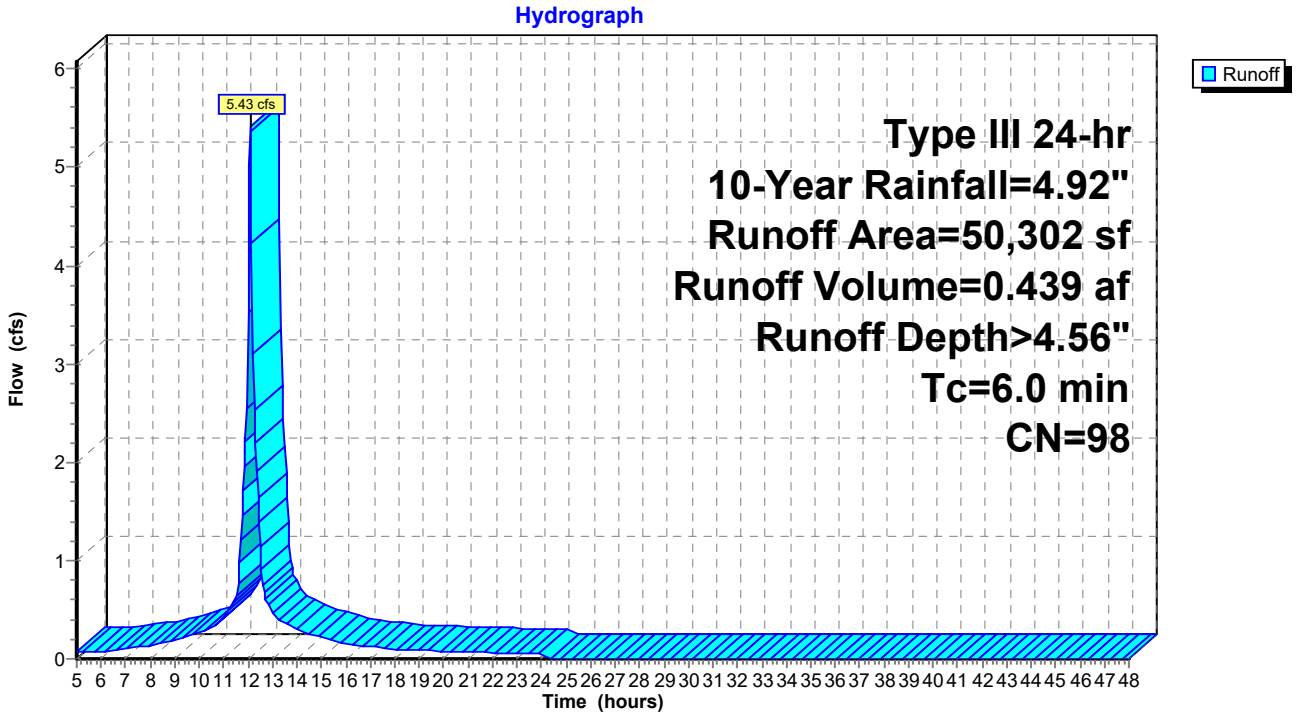
Runoff = 5.43 cfs @ 12.09 hrs, Volume= 0.439 af, Depth> 4.56"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=4.92"

Area (sf)	CN	Description
50,302	98	Roofs, HSG A
50,302		100.00% Impervious Area

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

Subcatchment 3R: WESTERN ROOF



Summary for Subcatchment 3S: WESTERN SITE

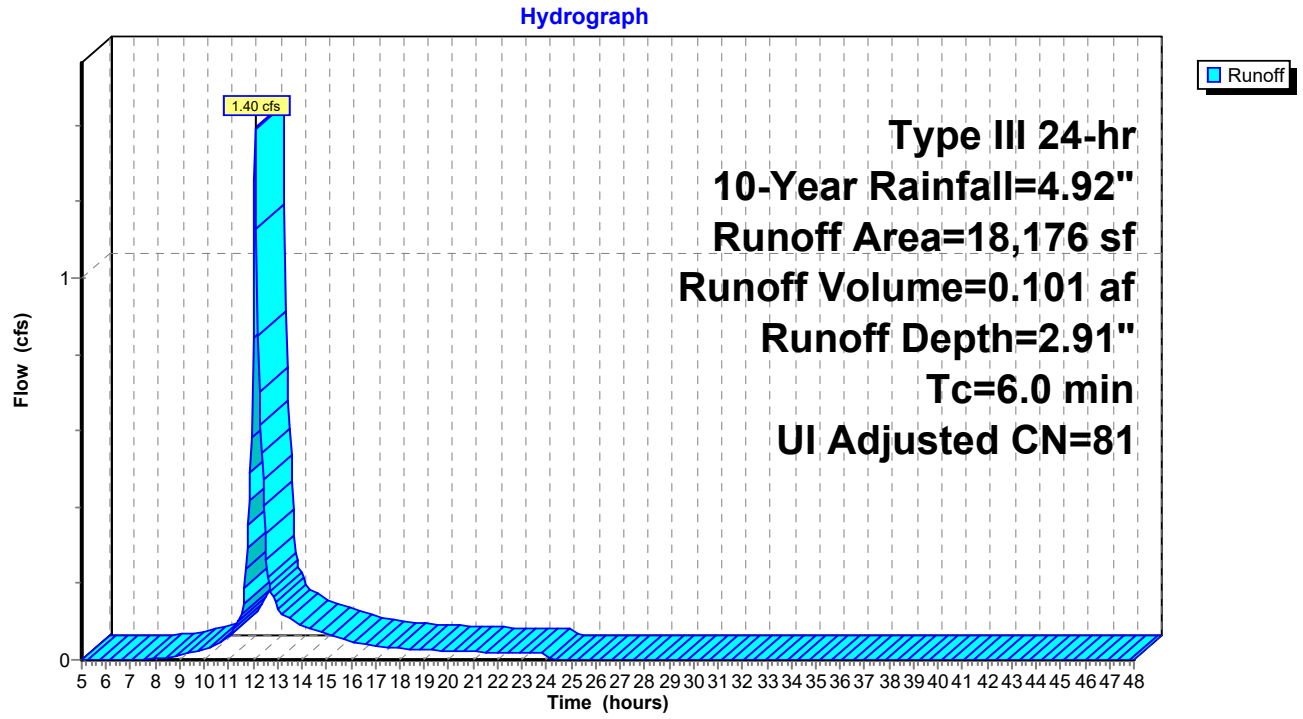
Runoff = 1.40 cfs @ 12.09 hrs, Volume= 0.101 af, Depth= 2.91"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=4.92"

Area (sf)	CN	Adj	Description
3,370	98		Unconnected pavement, HSG A
10,363	96		Gravel surface, HSG A
4,443	39		>75% Grass cover, Good, HSG A
18,176	82	81	Weighted Average, UI Adjusted
14,806			81.46% Pervious Area
3,370			18.54% Impervious Area
3,370			100.00% Unconnected

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

Subcatchment 3S: WESTERN SITE



Summary for Subcatchment 4R: NORTH & EAST ROOF

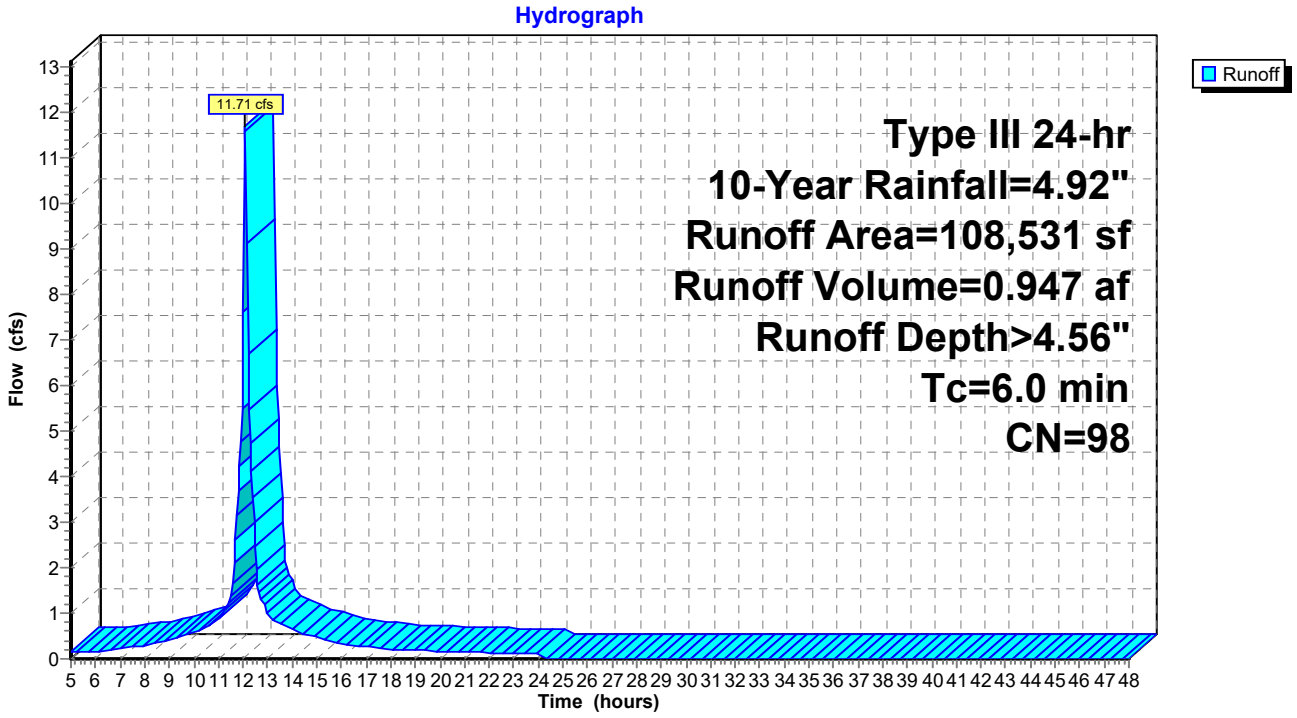
Runoff = 11.71 cfs @ 12.09 hrs, Volume= 0.947 af, Depth> 4.56"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=4.92"

Area (sf)	CN	Description
108,531	98	Roofs, HSG A
108,531		100.00% Impervious Area

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

Subcatchment 4R: NORTH & EAST ROOF



Summary for Subcatchment 4S: EASTERN LOADING AREA

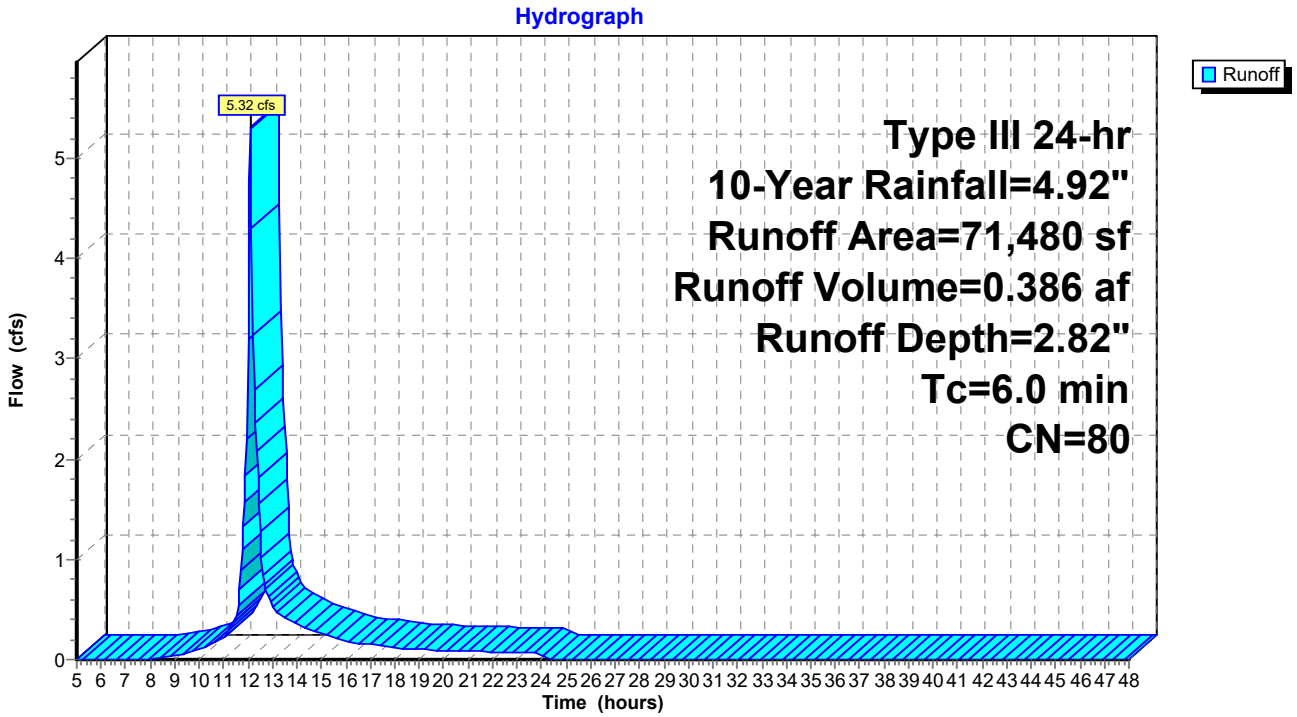
Runoff = 5.32 cfs @ 12.09 hrs, Volume= 0.386 af, Depth= 2.82"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=4.92"

Area (sf)	CN	Description
40,295	98	Paved parking, HSG A
55	98	Paved parking, HSG B
6,783	98	Paved parking, HSG D
4,315	30	Woods, Good, HSG A
2,050	77	Woods, Good, HSG D
16,572	39	>75% Grass cover, Good, HSG A
1,410	96	Gravel surface, HSG A
71,480	80	Weighted Average
24,347		34.06% Pervious Area
47,133		65.94% Impervious Area

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

Subcatchment 4S: EASTERN LOADING AREA



Summary for Subcatchment 5S: 25% OF BUILDING ADDITION

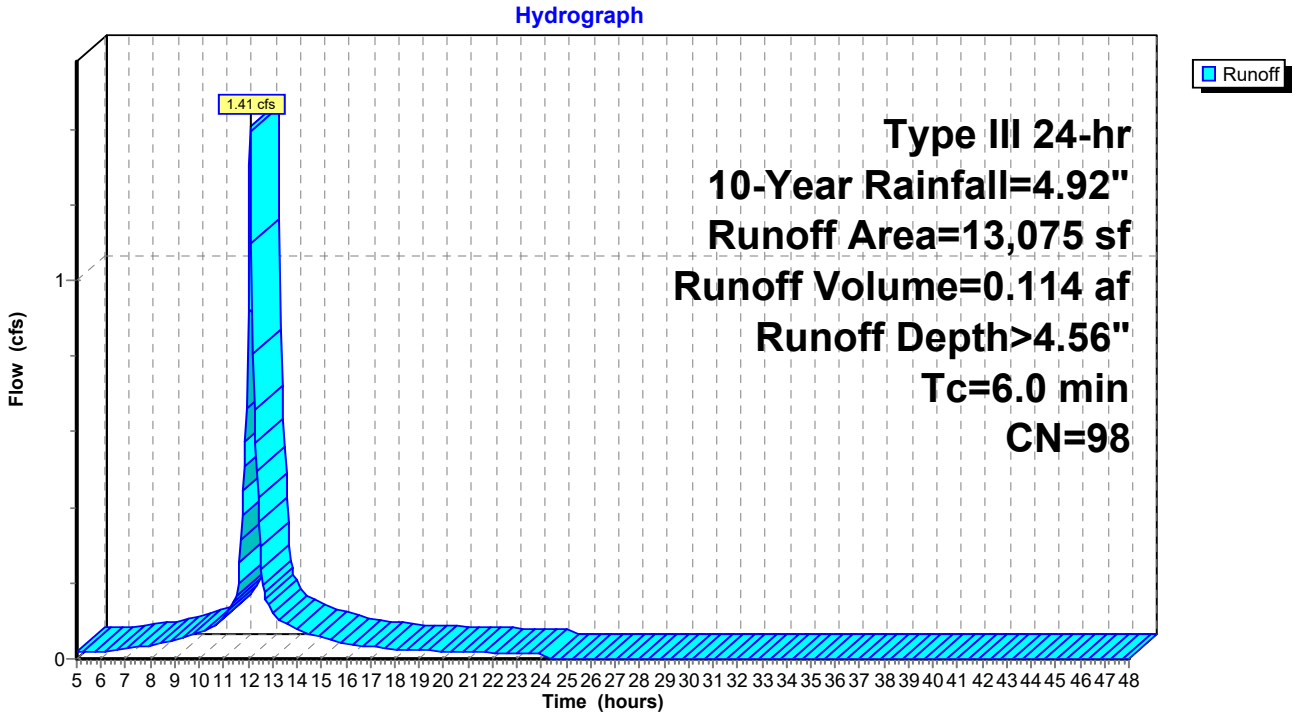
Runoff = 1.41 cfs @ 12.09 hrs, Volume= 0.114 af, Depth> 4.56"
Routed to Pond 2P : RAIN GARDEN

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=4.92"

Area (sf)	CN	Description
13,075	98	Roofs, HSG A
13,075		100.00% Impervious Area

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

Subcatchment 5S: 25% OF BUILDING ADDITION



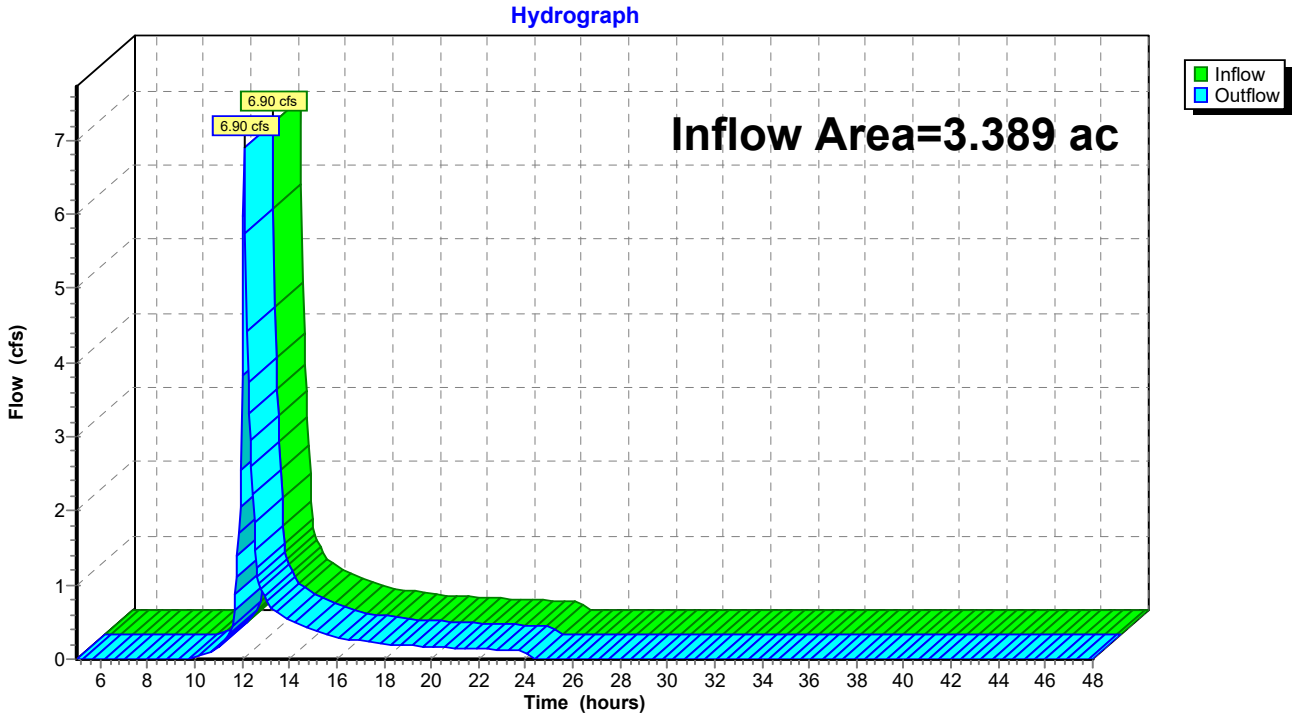
Summary for Reach DP-1: POND ST.

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

Inflow Area = 3.389 ac, 56.13% Impervious, Inflow Depth = 1.85" for 10-Year event
Inflow = 6.90 cfs @ 12.10 hrs, Volume= 0.523 af
Outflow = 6.90 cfs @ 12.10 hrs, Volume= 0.523 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-1: POND ST.



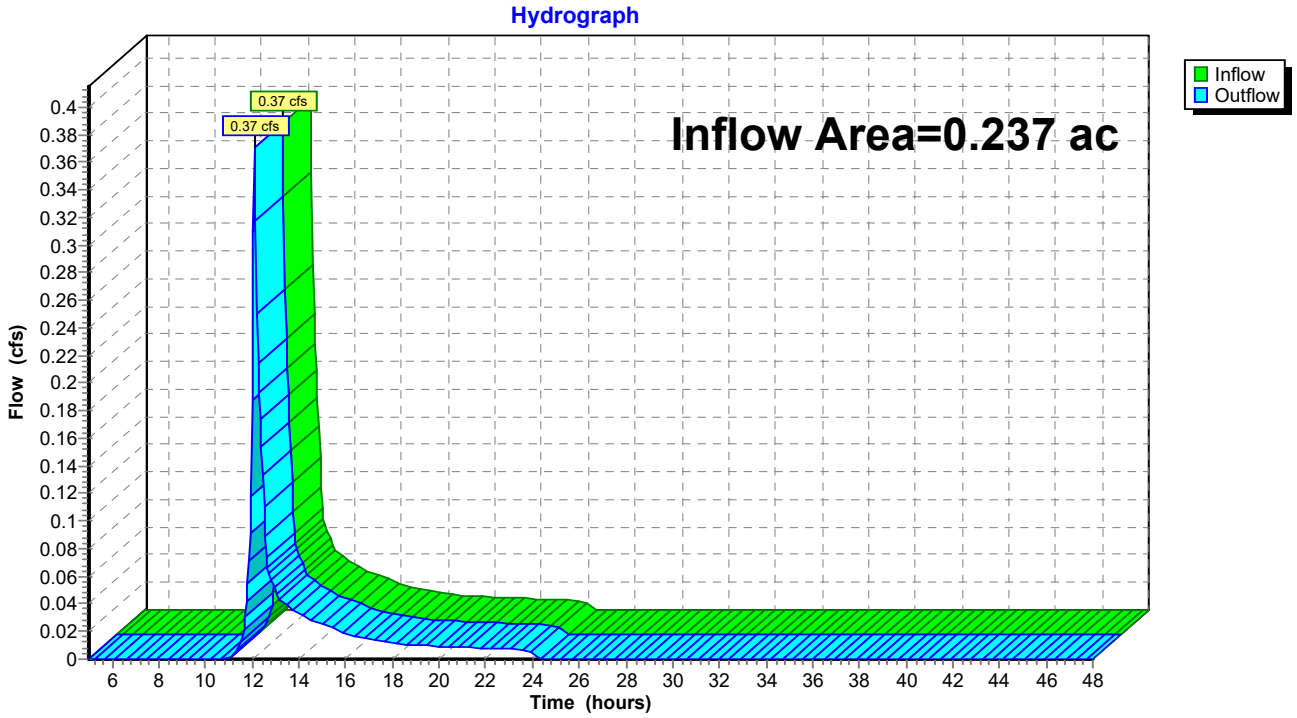
Summary for Reach DP-2: EASTERN PROPERTY LINE

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

Inflow Area = 0.237 ac, 0.00% Impervious, Inflow Depth = 1.46" for 10-Year event
Inflow = 0.37 cfs @ 12.10 hrs, Volume= 0.029 af
Outflow = 0.37 cfs @ 12.10 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-2: EASTERN PROPERTY LINE



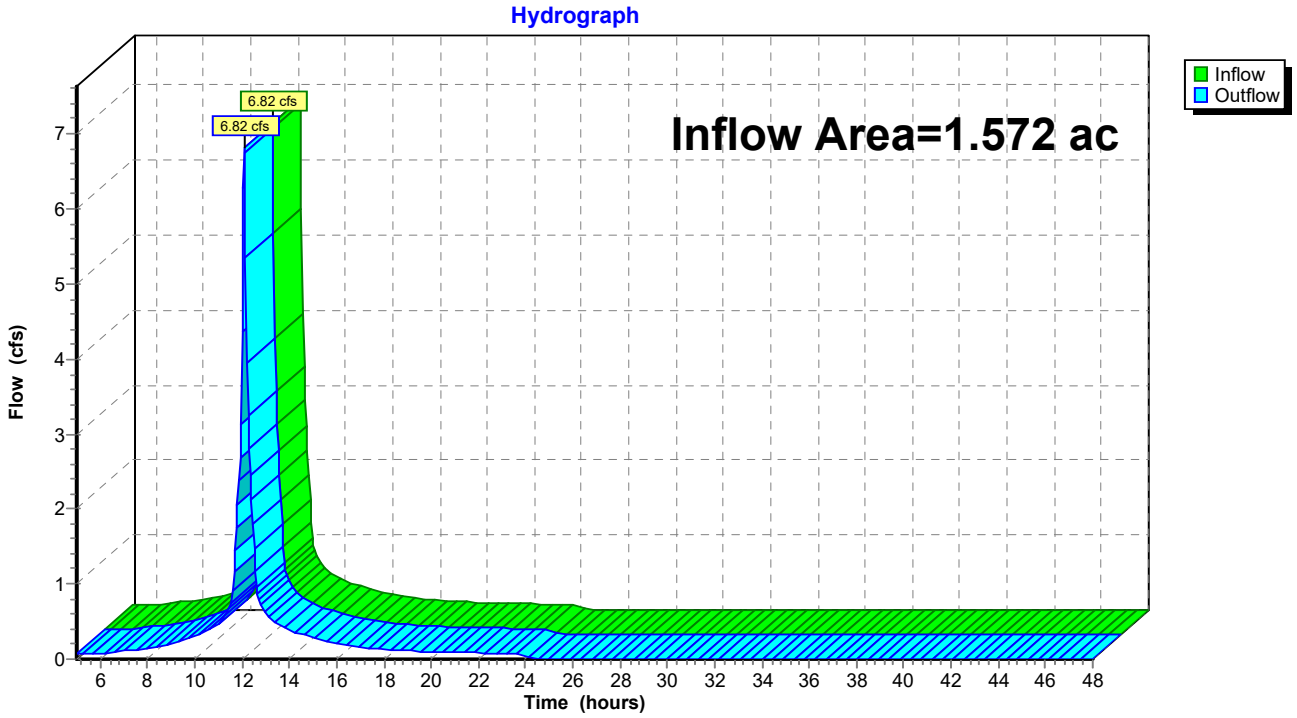
Summary for Reach DP-3: CRUSED STONE AREA & LEACHING PITS

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

Inflow Area = 1.572 ac, 78.38% Impervious, Inflow Depth > 4.12" for 10-Year event
Inflow = 6.82 cfs @ 12.09 hrs, Volume= 0.540 af
Outflow = 6.82 cfs @ 12.09 hrs, Volume= 0.540 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-3: CRUSED STONE AREA & LEACHING PITS



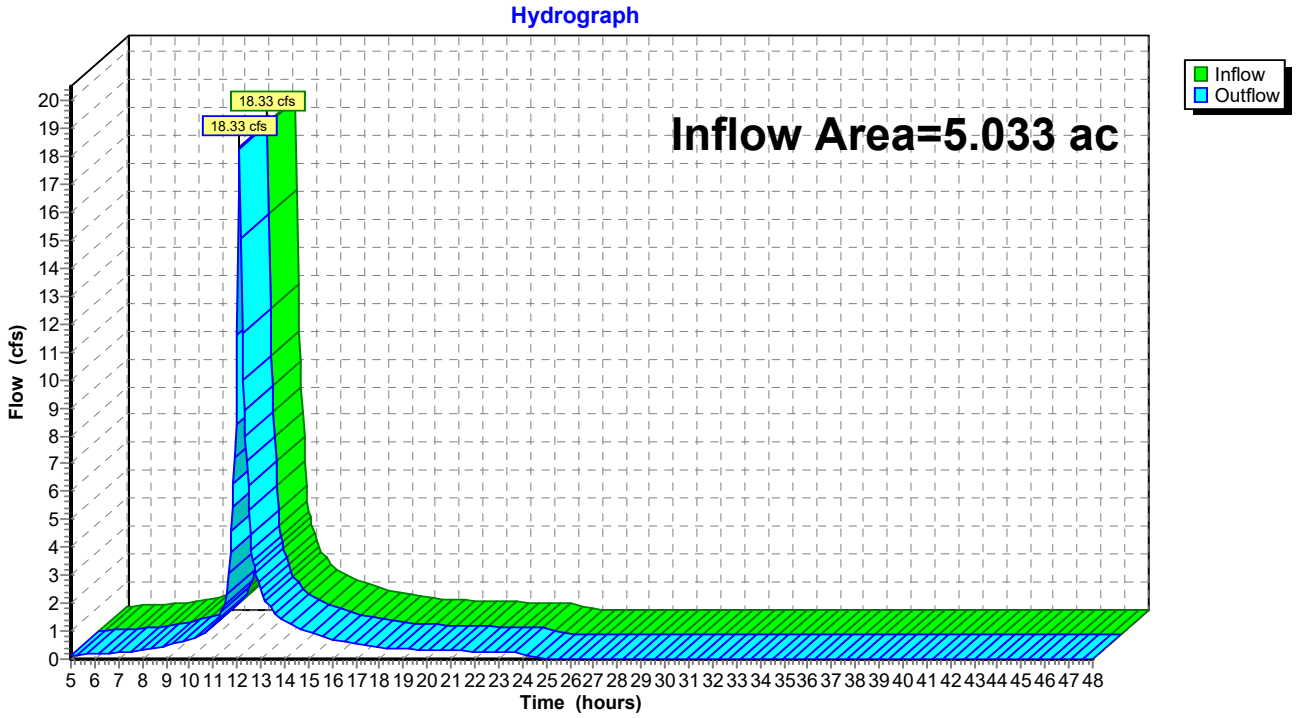
Summary for Reach DP-4: NORTHERN HEADWALLS

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

Inflow Area = 5.033 ac, 88.89% Impervious, Inflow Depth > 3.96" for 10-Year event
Inflow = 18.33 cfs @ 12.09 hrs, Volume= 1.659 af
Outflow = 18.33 cfs @ 12.09 hrs, Volume= 1.659 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-4: NORTHERN HEADWALLS



Summary for Pond 1P: DETENTION SYSTEM

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.901 ac,100.00% Impervious, Inflow Depth > 4.56" for 10-Year event
Inflow = 4.23 cfs @ 12.09 hrs, Volume= 0.342 af
Outflow = 1.81 cfs @ 12.28 hrs, Volume= 0.326 af, Atten= 57%, Lag= 11.8 min
Primary = 1.81 cfs @ 12.28 hrs, Volume= 0.326 af
Routed to Reach DP-4 : NORTHERN HEADWALLS

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 134.58' @ 12.28 hrs Surf.Area= 9,291 sf Storage= 5,911 cf

Plug-Flow detention time= 225.9 min calculated for 0.326 af (95% of inflow)
Center-of-Mass det. time= 197.9 min (960.5 - 762.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.38'	5,162 cf	**51.24'W x 181.33'L x 1.88'H Field A** 17,426 cf Overall - 4,522 cf Embedded = 12,904 cf x 40.0% Voids
#2A	133.71'	3,499 cf	**ADS N-12 12"** x 216 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf 216 Chambers in 24 Rows
		8,661 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	133.38'	**12.0" Round Culvert** L= 12.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 133.38' / 133.26' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	133.38'	**1.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	133.85'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.81 cfs @ 12.28 hrs HW=134.58' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.81 cfs of 2.49 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 5.18 fps)
  └─**3=Orifice/Grate** (Orifice Controls 1.78 cfs @ 2.90 fps)

Pond 1P: DETENTION SYSTEM - Chamber Wizard Field A

Chamber Model = ADS N-12 12" (ADS N-12® Pipe)
Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf
Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 10.9" Spacing = 25.4" C-C Row Spacing

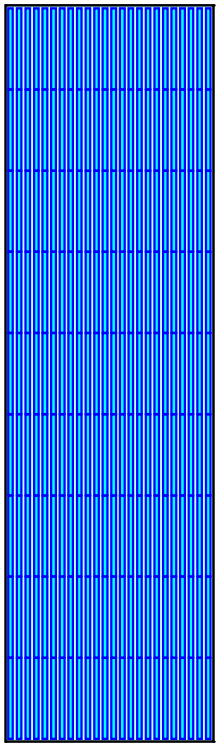
9 Chambers/Row x 20.00' Long = 180.00' Row Length +8.0" End Stone x 2 = 181.33' Base Length
24 Rows x 14.5" Wide + 10.9" Spacing x 23 + 8.0" Side Stone x 2 = 51.24' Base Width
4.0" Stone Base + 14.5" Chamber Height + 4.0" Stone Cover = 1.88' Field Height

216 Chambers x 16.2 cf = 3,499.2 cf Chamber Storage
216 Chambers x 20.9 cf = 4,522.0 cf Displacement

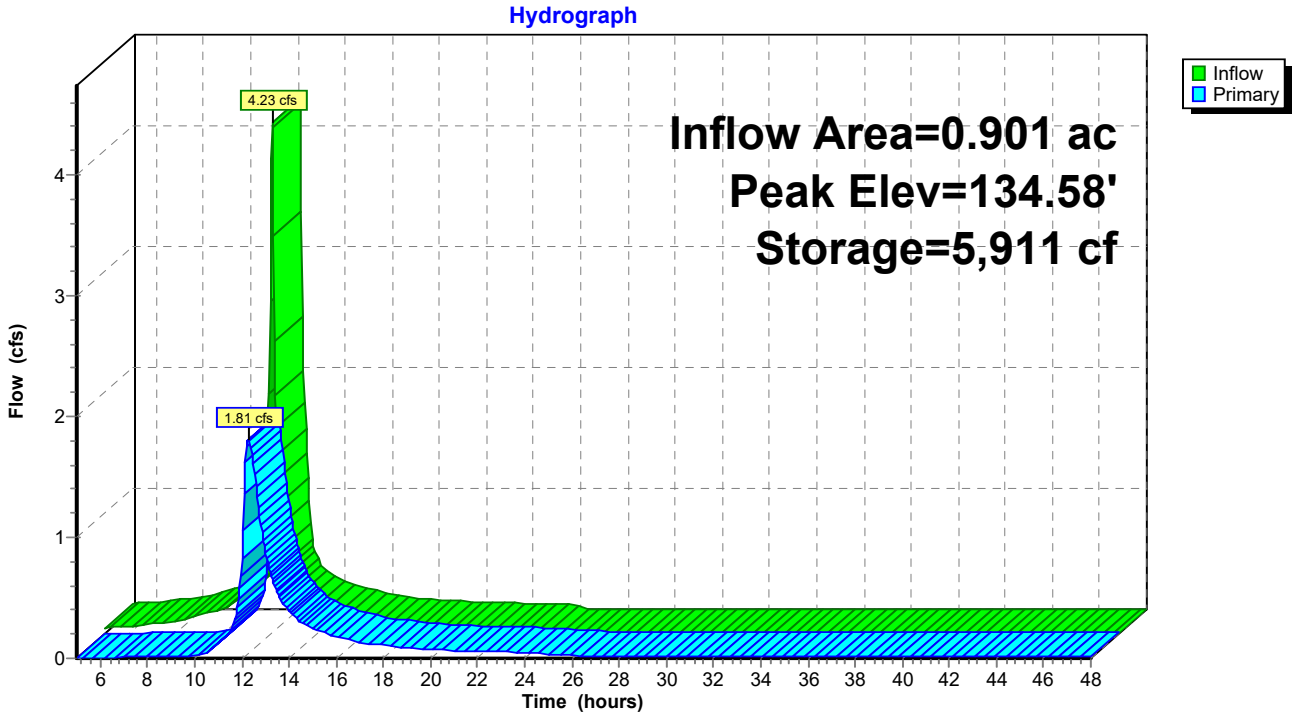
17,426.0 cf Field - 4,522.0 cf Chambers = 12,903.9 cf Stone x 40.0% Voids = 5,161.6 cf Stone Storage

Chamber Storage + Stone Storage = 8,660.8 cf = 0.199 af
Overall Storage Efficiency = 49.7%
Overall System Size = 181.33' x 51.24' x 1.88'

216 Chambers
645.4 cy Field
477.9 cy Stone



Pond 1P: DETENTION SYSTEM



Summary for Pond 2P: RAIN GARDEN

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.300 ac,100.00% Impervious, Inflow Depth > 4.56" for 10-Year event
Inflow = 1.41 cfs @ 12.09 hrs, Volume= 0.114 af
Outflow = 0.03 cfs @ 17.40 hrs, Volume= 0.014 af, Atten= 98%, Lag= 318.8 min
Primary = 0.03 cfs @ 17.40 hrs, Volume= 0.014 af
Routed to Reach DP-1 : POND ST.

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 141.68' @ 17.40 hrs Surf.Area= 3,631 sf Storage= 4,430 cf

Plug-Flow detention time= 728.8 min calculated for 0.014 af (12% of inflow)
Center-of-Mass det. time= 447.7 min (1,210.3 - 762.6)

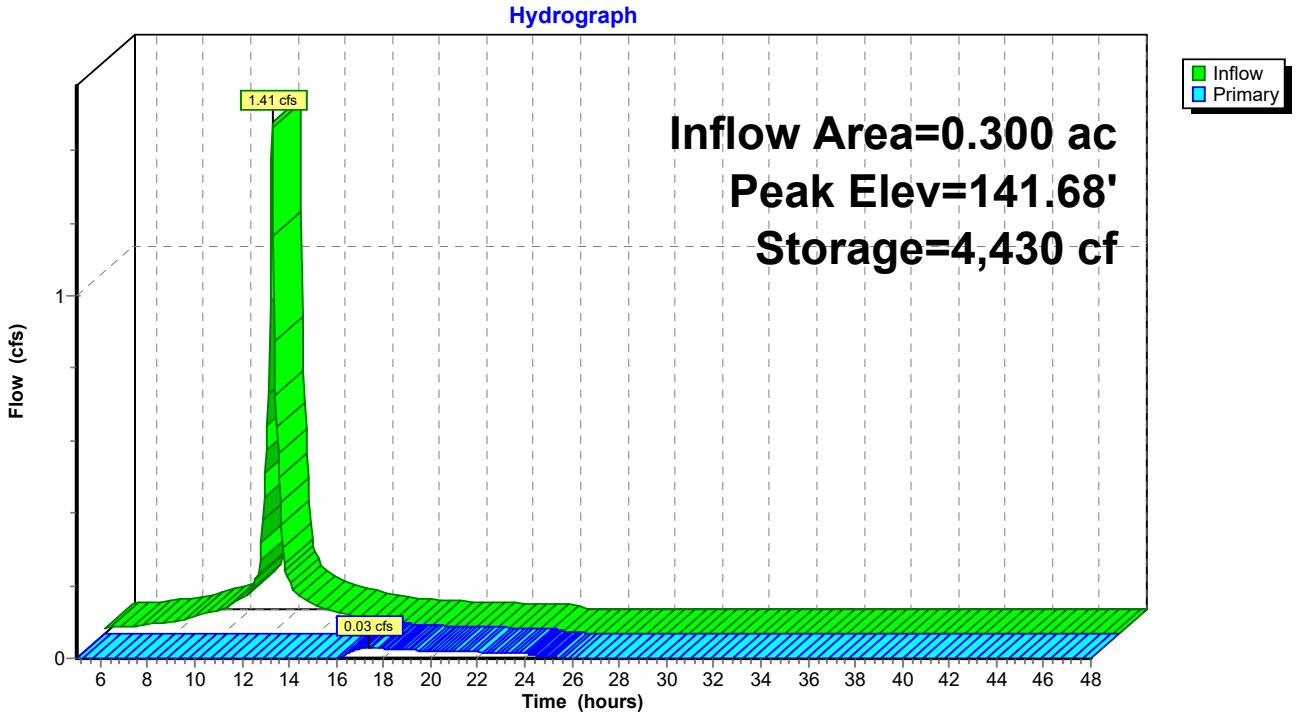
Volume	Invert	Avail.Storage	Storage Description
#1	139.50'	5,680 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
139.50	562	0	0
140.00	1,190	438	438
141.00	2,582	1,886	2,324
142.00	4,130	3,356	5,680

Device	Routing	Invert	Outlet Devices
#1	Primary	141.66'	**5.0' long x 3.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.41 2.56 2.69 2.67 2.66 2.66 2.65 2.67 2.67 2.70 2.77 2.83 2.87 2.93 3.10 3.19 3.32

Primary OutFlow Max=0.03 cfs @ 17.40 hrs HW=141.68' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.03 cfs @ 0.32 fps)

Pond 2P: RAIN GARDEN



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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1R: 75% OF BUILDING Runoff Area=39,227 sf 100.00% Impervious Runoff Depth>5.77"
Tc=6.0 min CN=98 Runoff=5.34 cfs 0.433 af

Subcatchment1S: FRONT SITE Runoff Area=134,557 sf 51.87% Impervious Runoff Depth=2.96"
Tc=6.0 min CN=70 Runoff=10.47 cfs 0.761 af

Subcatchment2S: EASTERN Runoff Area=10,320 sf 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=63 Runoff=0.61 cfs 0.046 af

Subcatchment3R: WESTERN ROOF Runoff Area=50,302 sf 100.00% Impervious Runoff Depth>5.77"
Tc=6.0 min CN=98 Runoff=6.84 cfs 0.556 af

Subcatchment3S: WESTERN SITE Runoff Area=18,176 sf 18.54% Impervious Runoff Depth=4.06"
Tc=6.0 min UI Adjusted CN=81 Runoff=1.93 cfs 0.141 af

Subcatchment4R: NORTH & EAST Runoff Area=108,531 sf 100.00% Impervious Runoff Depth>5.77"
Tc=6.0 min CN=98 Runoff=14.76 cfs 1.199 af

Subcatchment4S: EASTERN LOADING Runoff Area=71,480 sf 65.94% Impervious Runoff Depth=3.95"
Tc=6.0 min CN=80 Runoff=7.41 cfs 0.541 af

Subcatchment5S: 25% OF BUILDING Runoff Area=13,075 sf 100.00% Impervious Runoff Depth>5.77"
Tc=6.0 min CN=98 Runoff=1.78 cfs 0.144 af

Reach DP-1: POND ST. Inflow=10.47 cfs 0.805 af
Outflow=10.47 cfs 0.805 af

Reach DP-2: EASTERN PROPERTY LINE Inflow=0.61 cfs 0.046 af
Outflow=0.61 cfs 0.046 af

Reach DP-3: CRUSED STONE AREA & LEACHING PITS Inflow=8.77 cfs 0.697 af
Outflow=8.77 cfs 0.697 af

Reach DP-4: NORTHERN HEADWALLS Inflow=23.96 cfs 2.156 af
Outflow=23.96 cfs 2.156 af

Pond 1P: DETENTION SYSTEM Peak Elev=134.75' Storage=6,803 cf Inflow=5.34 cfs 0.433 af
Outflow=2.42 cfs 0.417 af

Pond 2P: RAIN GARDEN Peak Elev=141.71' Storage=4,536 cf Inflow=1.78 cfs 0.144 af
Outflow=0.12 cfs 0.044 af

Total Runoff Area = 10.231 ac Runoff Volume = 3.820 af Average Runoff Depth = 4.48"
25.63% Pervious = 2.623 ac 74.37% Impervious = 7.609 ac

Summary for Subcatchment 1R: 75% OF BUILDING ADDITION

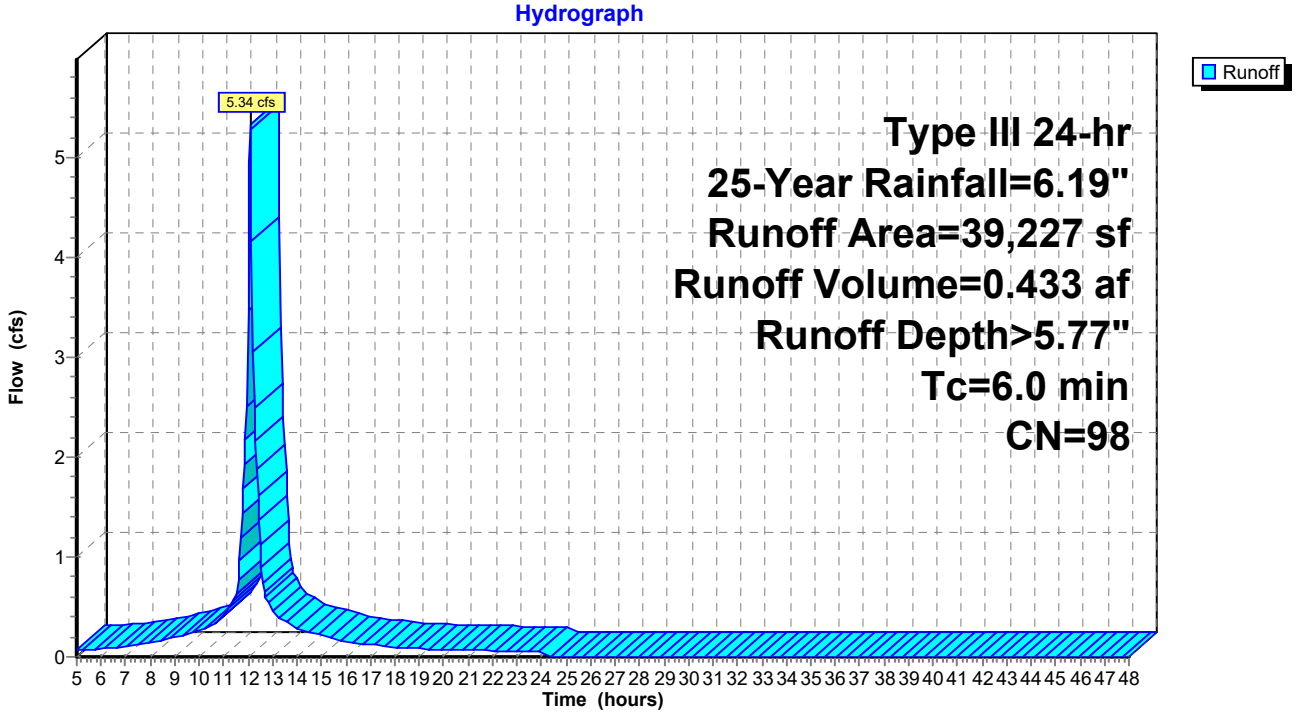
Runoff = 5.34 cfs @ 12.09 hrs, Volume= 0.433 af, Depth> 5.77"
Routed to Pond 1P : DETENTION SYSTEM

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=6.19"

Area (sf)	CN	Description
39,227	98	Roofs, HSG A
39,227		100.00% Impervious Area

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

Subcatchment 1R: 75% OF BUILDING ADDITION



Summary for Subcatchment 1S: FRONT SITE

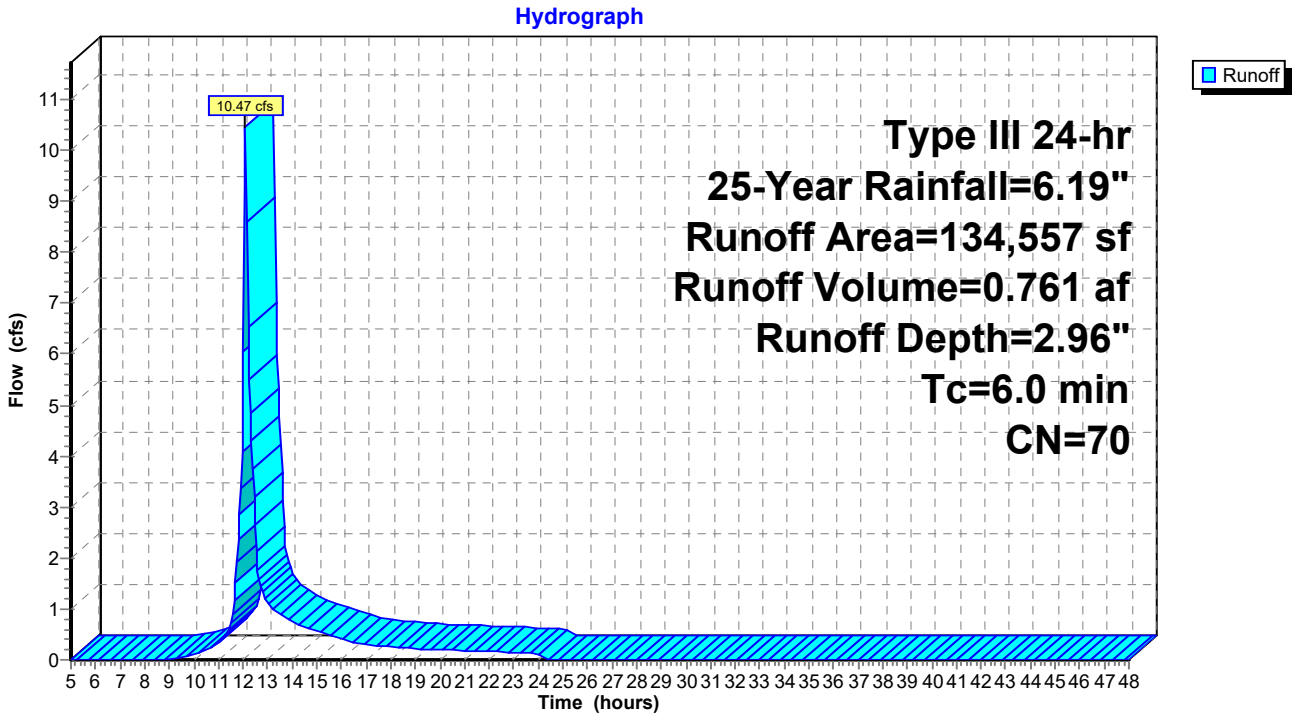
Runoff = 10.47 cfs @ 12.09 hrs, Volume= 0.761 af, Depth= 2.96"
Routed to Reach DP-1 : POND ST.

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=6.19"

Area (sf)	CN	Description
63,959	39	>75% Grass cover, Good, HSG A
809	61	>75% Grass cover, Good, HSG B
20,445	98	Paved parking, HSG B
49,344	98	Paved parking, HSG A
134,557	70	Weighted Average
64,768		48.13% Pervious Area
69,789		51.87% Impervious Area

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

Subcatchment 1S: FRONT SITE



Summary for Subcatchment 2S: EASTERN LANDSCAPED AREA

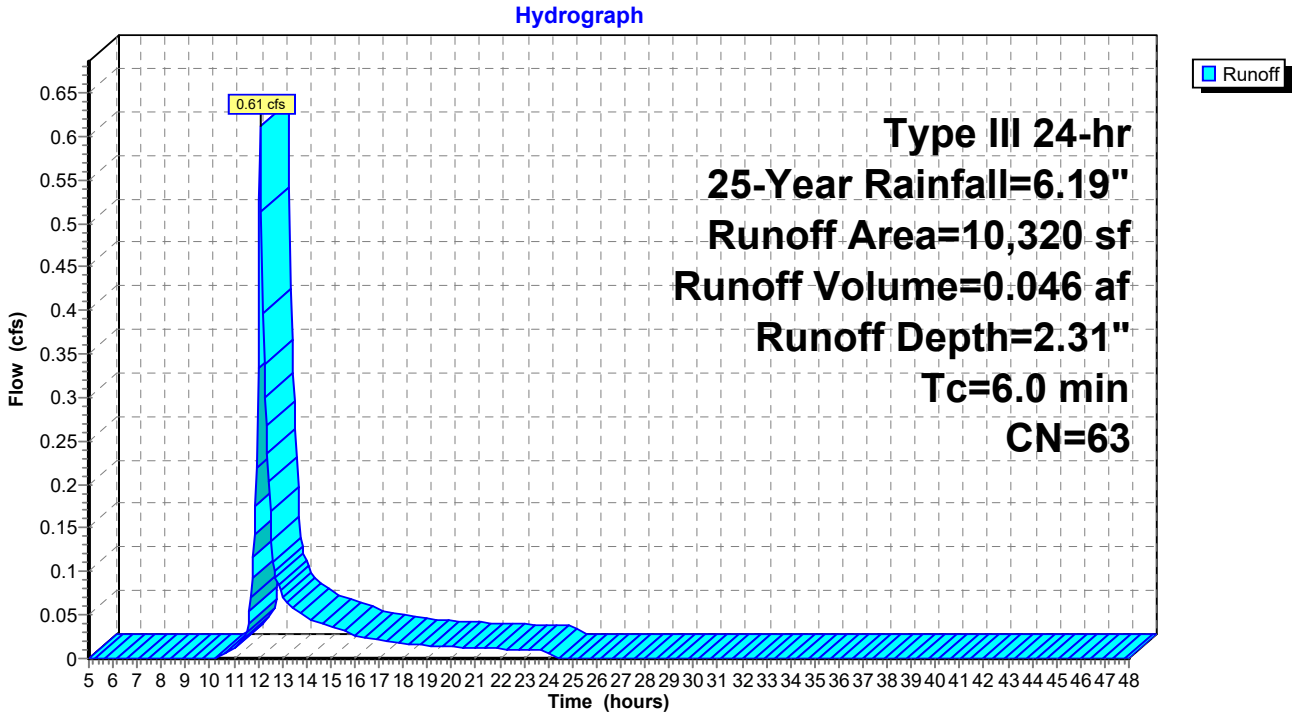
Runoff = 0.61 cfs @ 12.10 hrs, Volume= 0.046 af, Depth= 2.31"
Routed to Reach DP-2 : EASTERN PROPERTY LINE

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=6.19"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
1,000	80	>75% Grass cover, Good, HSG D
10,320	63	Weighted Average
10,320		100.00% Pervious Area

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

Subcatchment 2S: EASTERN LANDSCAPED AREA



Summary for Subcatchment 3R: WESTERN ROOF

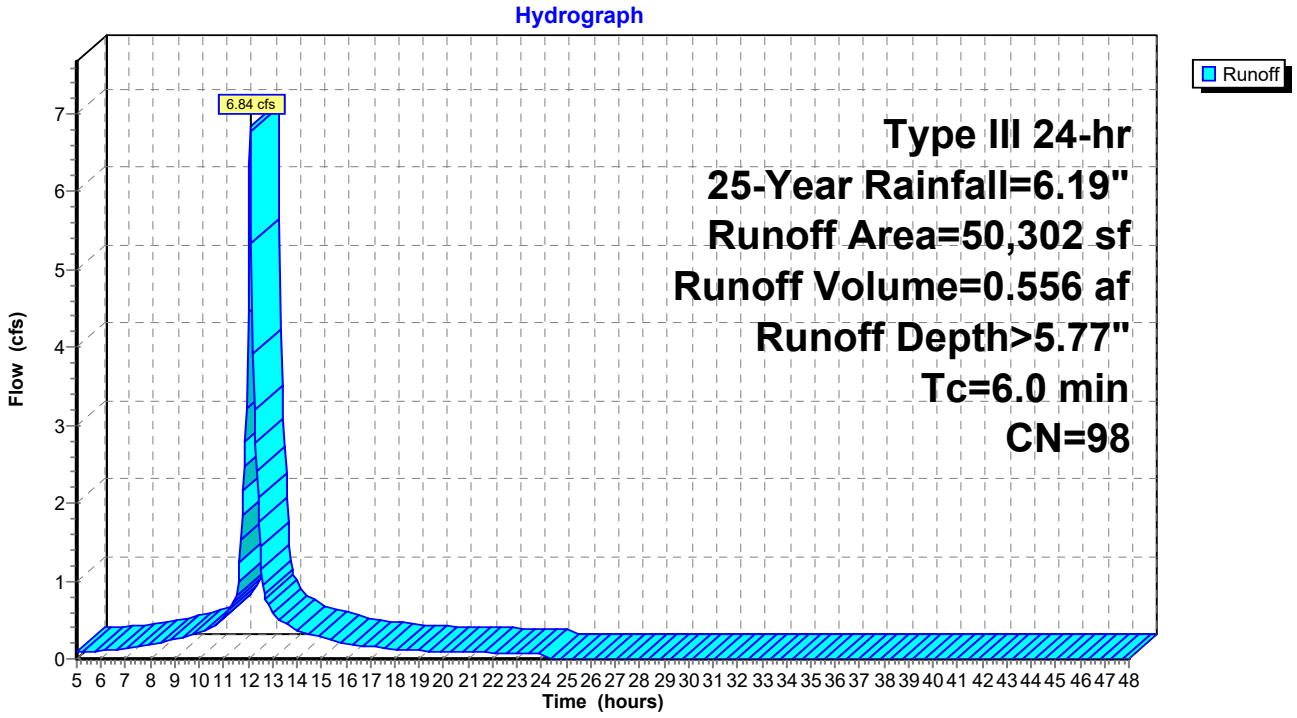
Runoff = 6.84 cfs @ 12.09 hrs, Volume= 0.556 af, Depth> 5.77"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=6.19"

Area (sf)	CN	Description
50,302	98	Roofs, HSG A
50,302		100.00% Impervious Area

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

Subcatchment 3R: WESTERN ROOF



Summary for Subcatchment 3S: WESTERN SITE

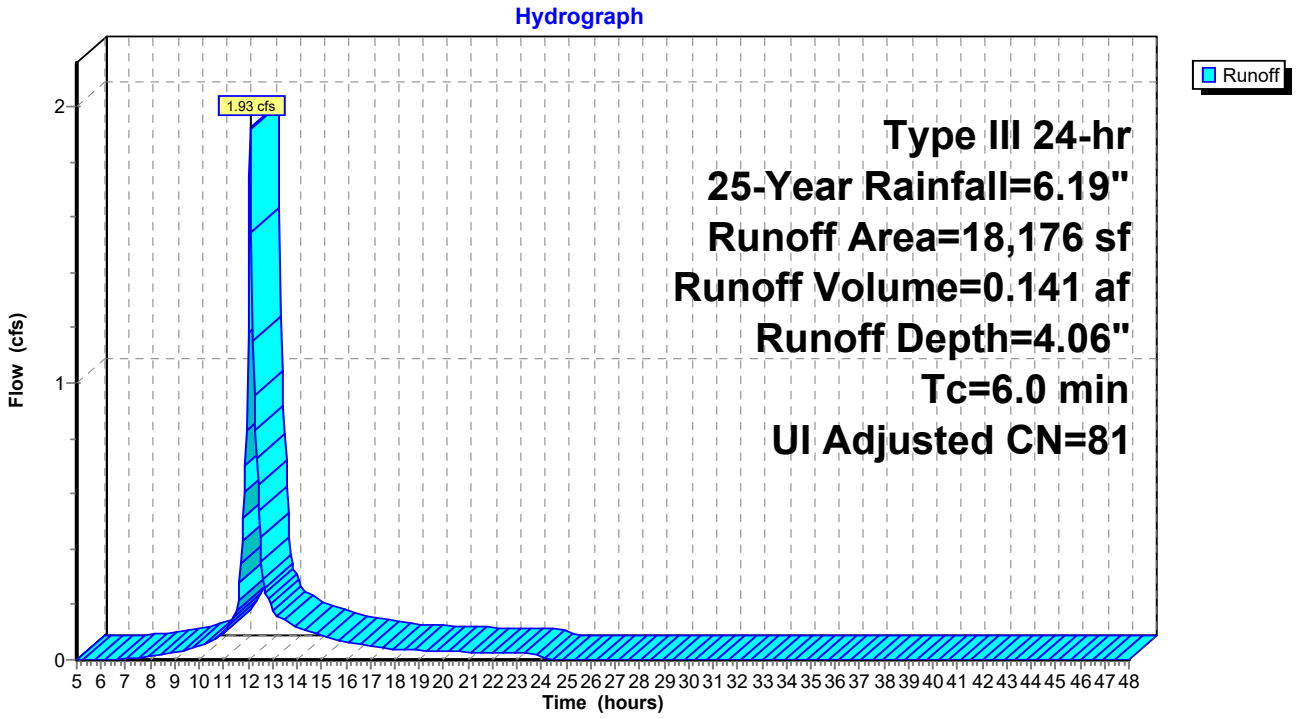
Runoff = 1.93 cfs @ 12.09 hrs, Volume= 0.141 af, Depth= 4.06"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=6.19"

Area (sf)	CN	Adj	Description
3,370	98		Unconnected pavement, HSG A
10,363	96		Gravel surface, HSG A
4,443	39		>75% Grass cover, Good, HSG A
18,176	82	81	Weighted Average, UI Adjusted
14,806			81.46% Pervious Area
3,370			18.54% Impervious Area
3,370			100.00% Unconnected

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

Subcatchment 3S: WESTERN SITE



Summary for Subcatchment 4R: NORTH & EAST ROOF

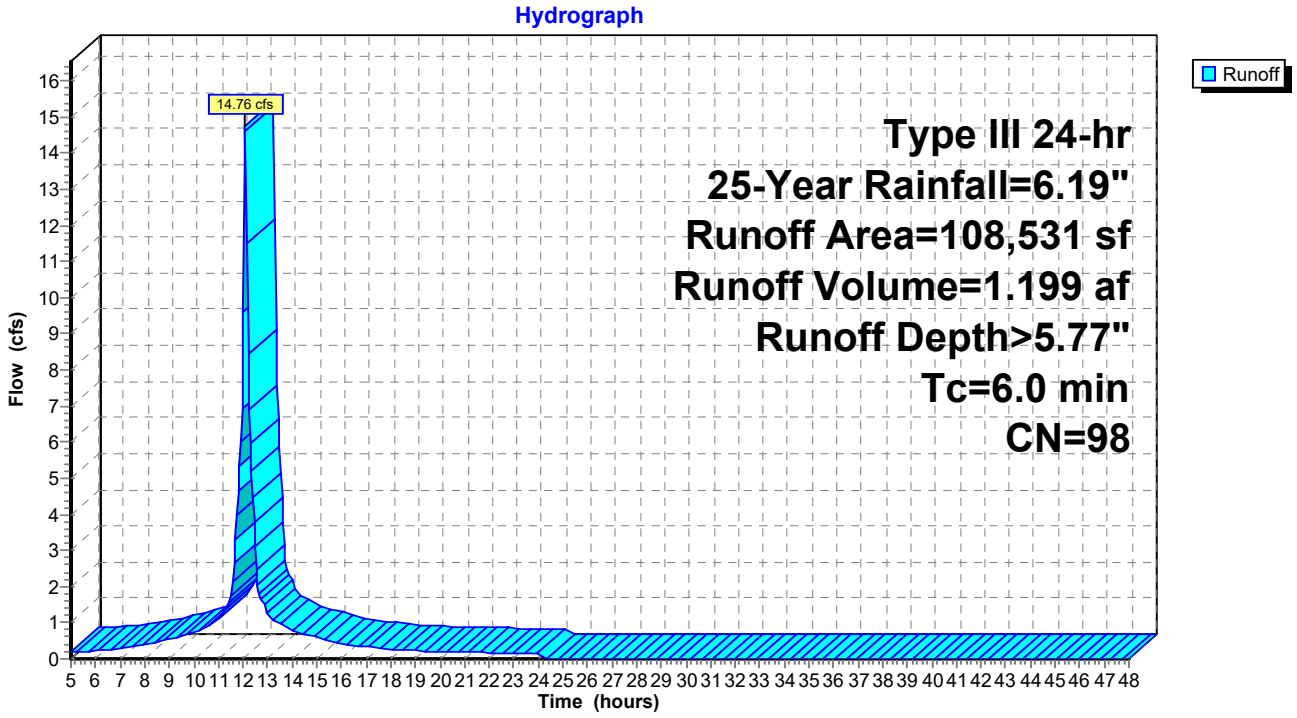
Runoff = 14.76 cfs @ 12.09 hrs, Volume= 1.199 af, Depth> 5.77"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=6.19"

Area (sf)	CN	Description
108,531	98	Roofs, HSG A
108,531		100.00% Impervious Area

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

Subcatchment 4R: NORTH & EAST ROOF



Summary for Subcatchment 4S: EASTERN LOADING AREA

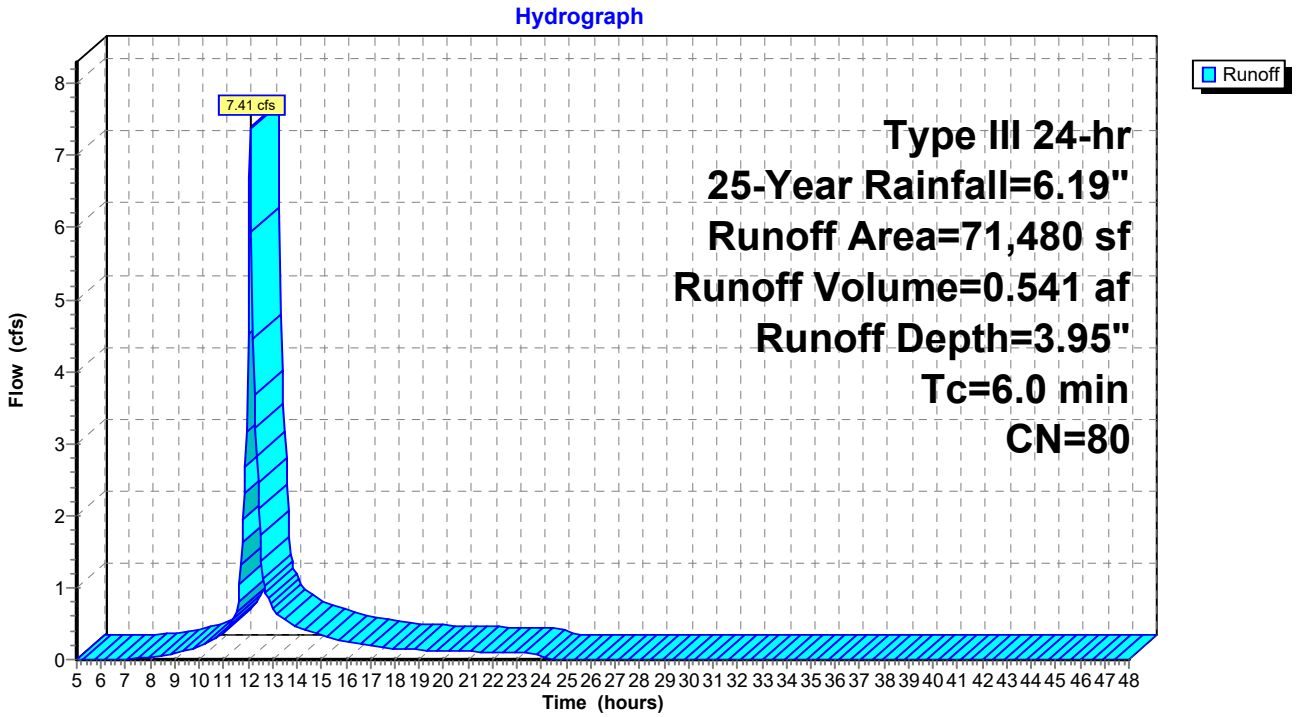
Runoff = 7.41 cfs @ 12.09 hrs, Volume= 0.541 af, Depth= 3.95"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=6.19"

Area (sf)	CN	Description
40,295	98	Paved parking, HSG A
55	98	Paved parking, HSG B
6,783	98	Paved parking, HSG D
4,315	30	Woods, Good, HSG A
2,050	77	Woods, Good, HSG D
16,572	39	>75% Grass cover, Good, HSG A
1,410	96	Gravel surface, HSG A
71,480	80	Weighted Average
24,347		34.06% Pervious Area
47,133		65.94% Impervious Area

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

Subcatchment 4S: EASTERN LOADING AREA



Summary for Subcatchment 5S: 25% OF BUILDING ADDITION

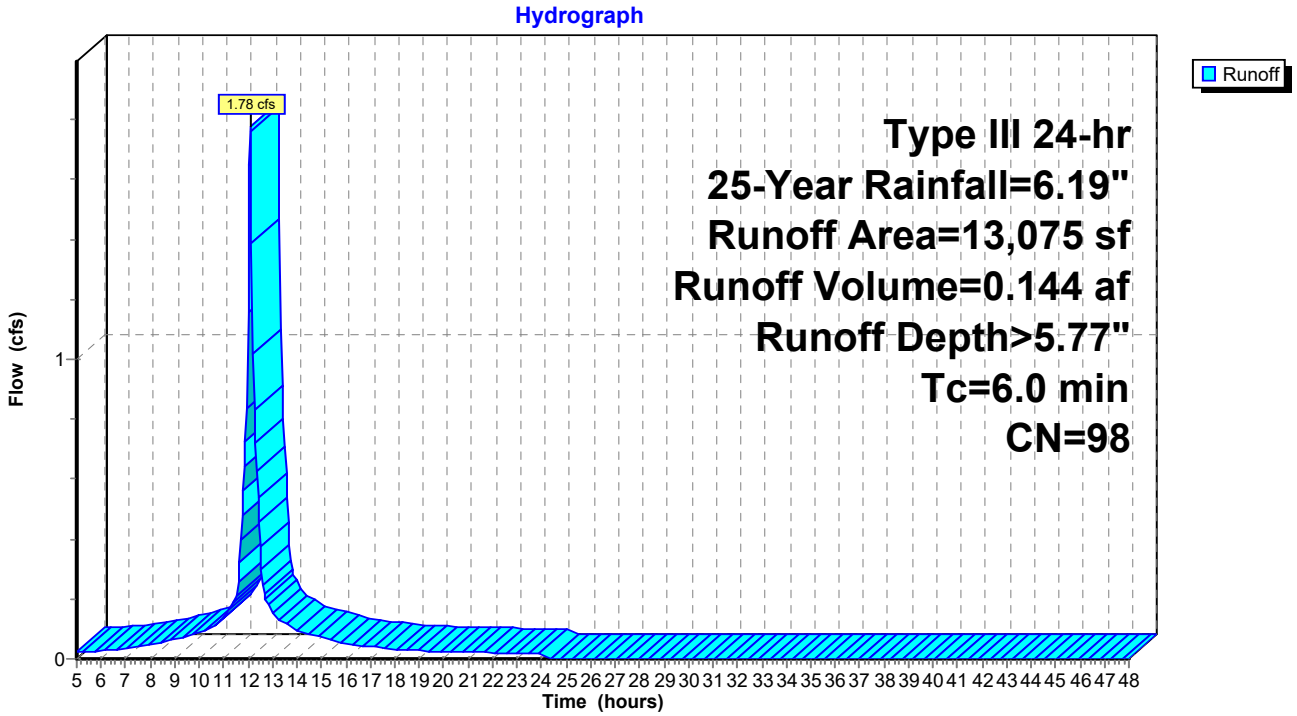
Runoff = 1.78 cfs @ 12.09 hrs, Volume= 0.144 af, Depth> 5.77"
Routed to Pond 2P : RAIN GARDEN

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=6.19"

Area (sf)	CN	Description
13,075	98	Roofs, HSG A
13,075		100.00% Impervious Area

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

Subcatchment 5S: 25% OF BUILDING ADDITION



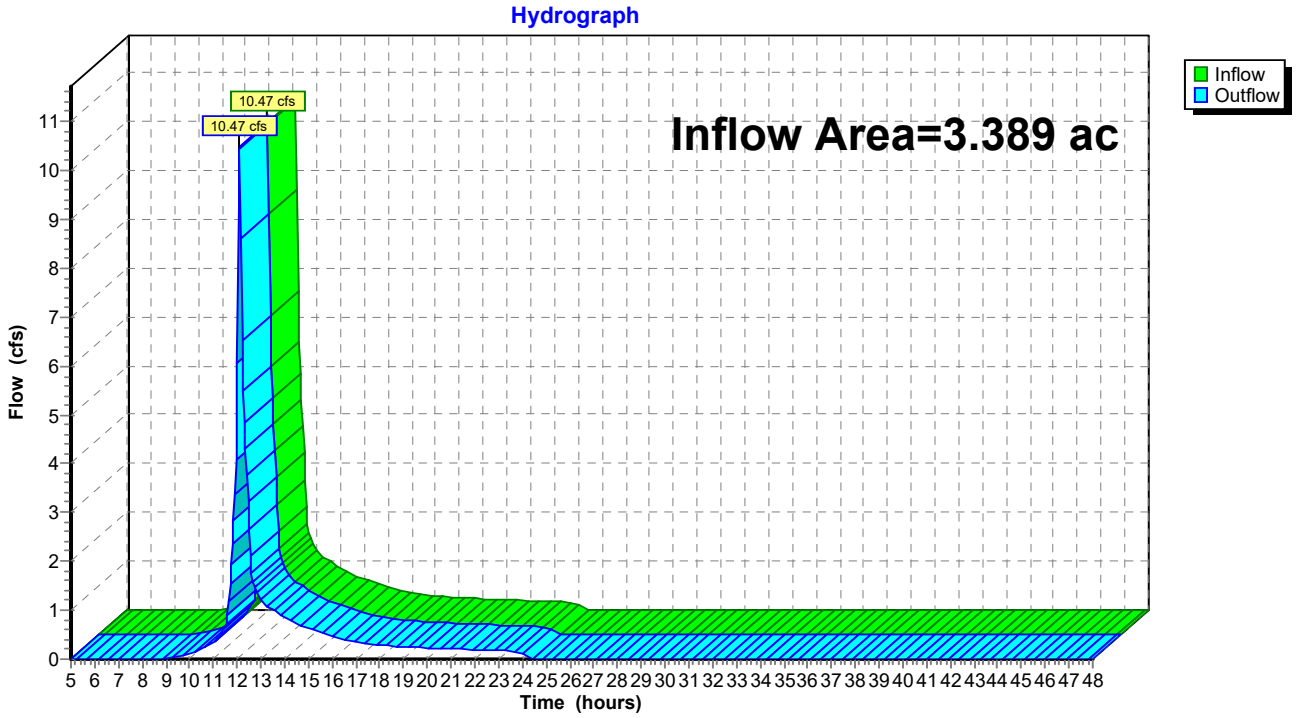
Summary for Reach DP-1: POND ST.

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

Inflow Area = 3.389 ac, 56.13% Impervious, Inflow Depth = 2.85" for 25-Year event
Inflow = 10.47 cfs @ 12.09 hrs, Volume= 0.805 af
Outflow = 10.47 cfs @ 12.09 hrs, Volume= 0.805 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-1: POND ST.



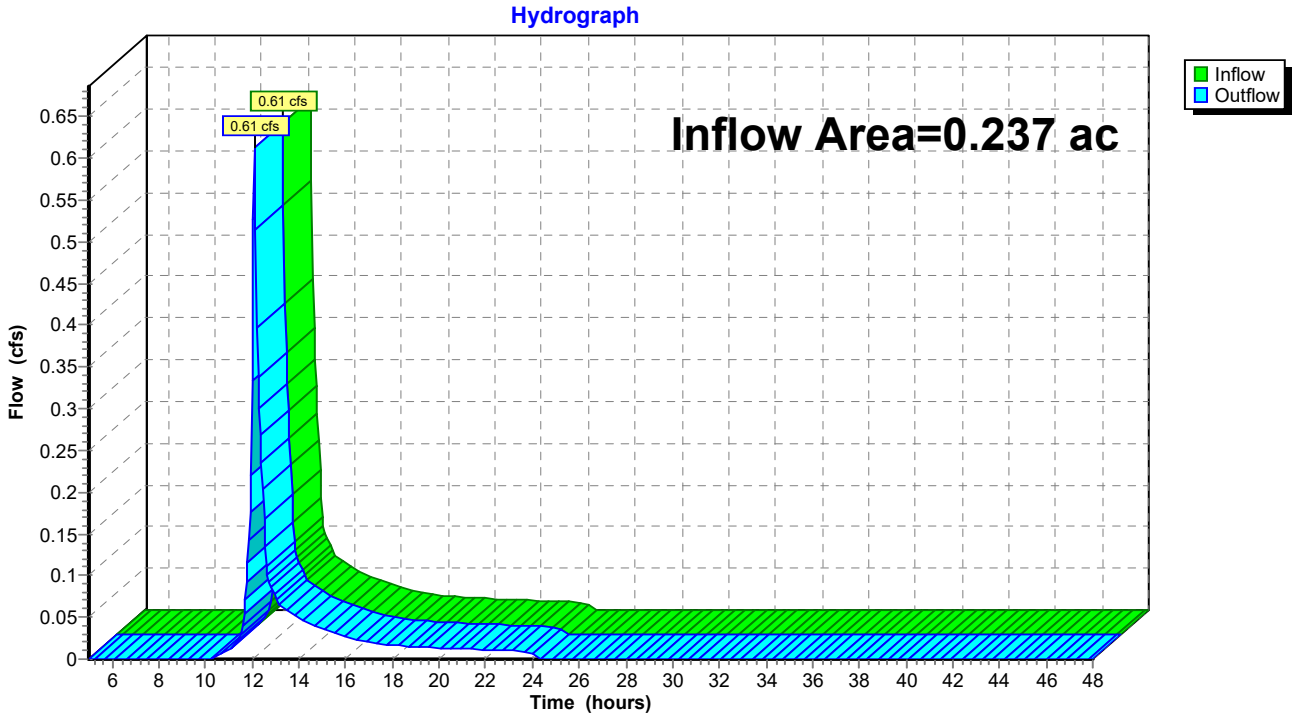
Summary for Reach DP-2: EASTERN PROPERTY LINE

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

Inflow Area = 0.237 ac, 0.00% Impervious, Inflow Depth = 2.31" for 25-Year event
Inflow = 0.61 cfs @ 12.10 hrs, Volume= 0.046 af
Outflow = 0.61 cfs @ 12.10 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-2: EASTERN PROPERTY LINE



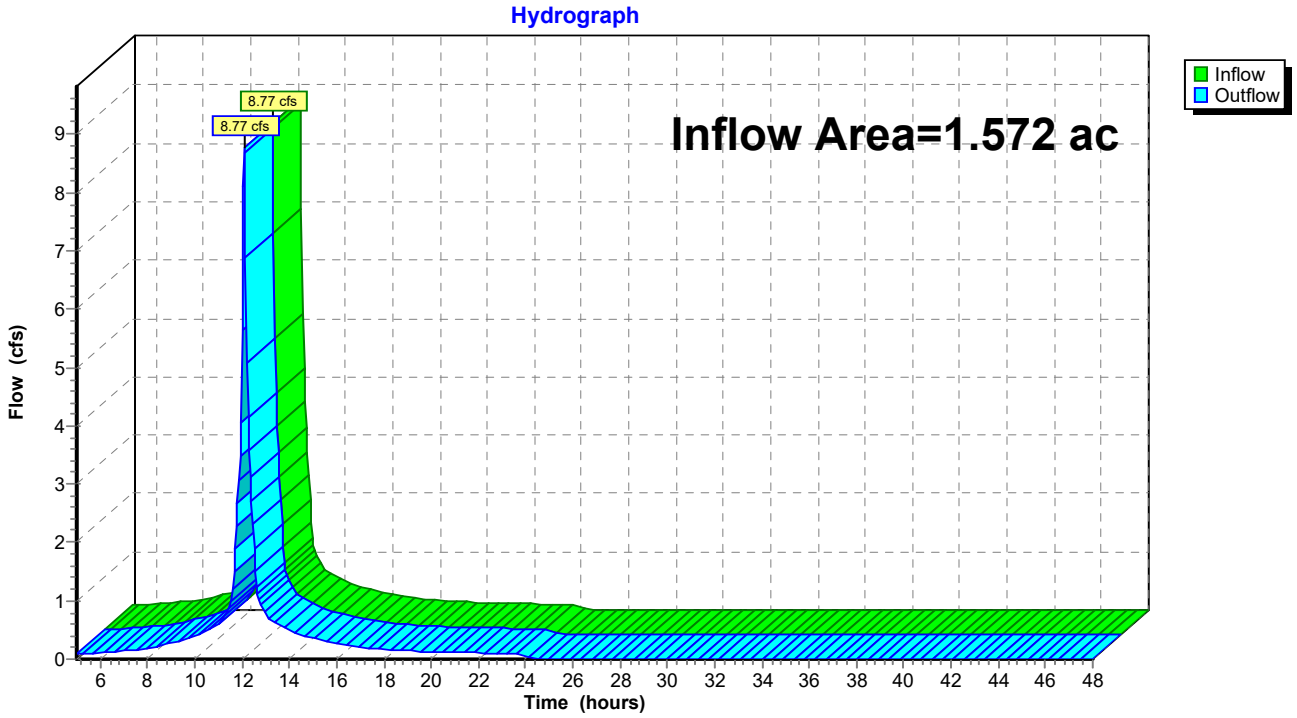
Summary for Reach DP-3: CRUSED STONE AREA & LEACHING PITS

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

Inflow Area = 1.572 ac, 78.38% Impervious, Inflow Depth > 5.32" for 25-Year event
Inflow = 8.77 cfs @ 12.09 hrs, Volume= 0.697 af
Outflow = 8.77 cfs @ 12.09 hrs, Volume= 0.697 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-3: CRUSED STONE AREA & LEACHING PITS



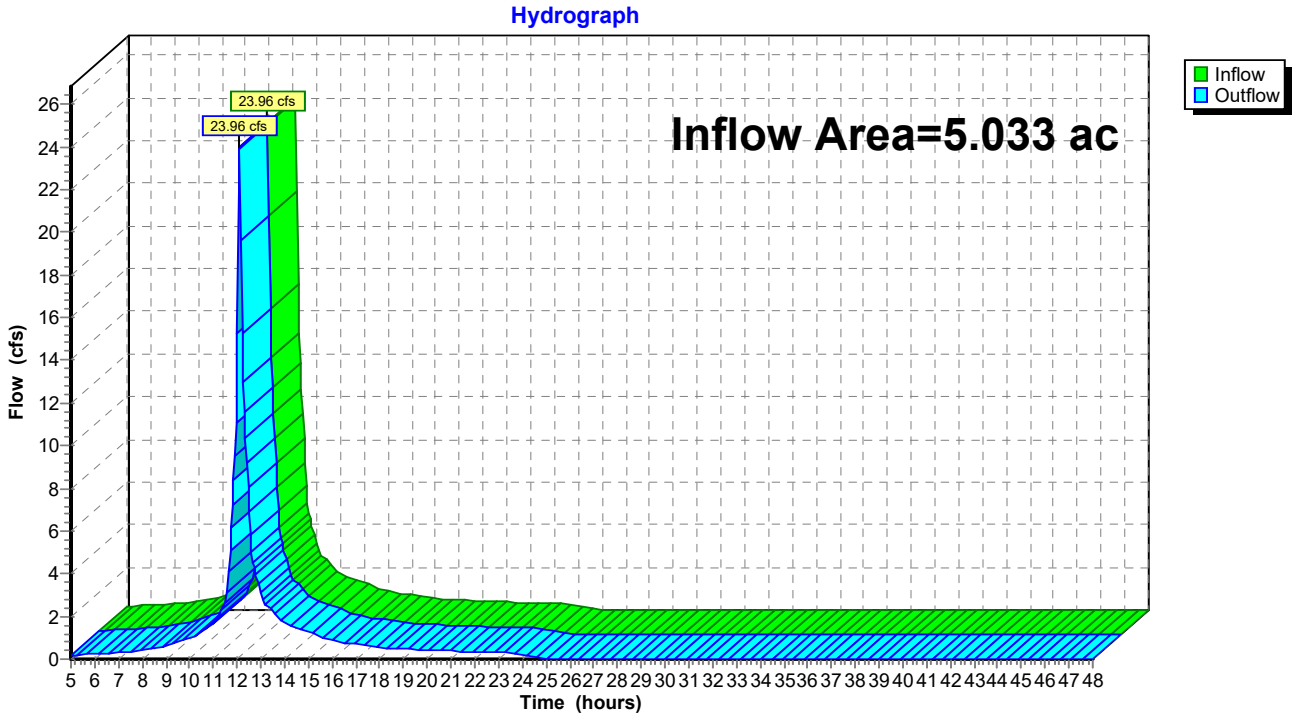
Summary for Reach DP-4: NORTHERN HEADWALLS

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

Inflow Area = 5.033 ac, 88.89% Impervious, Inflow Depth > 5.14" for 25-Year event
Inflow = 23.96 cfs @ 12.09 hrs, Volume= 2.156 af
Outflow = 23.96 cfs @ 12.09 hrs, Volume= 2.156 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-4: NORTHERN HEADWALLS



Summary for Pond 1P: DETENTION SYSTEM

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.901 ac,100.00% Impervious, Inflow Depth > 5.77" for 25-Year event
Inflow = 5.34 cfs @ 12.09 hrs, Volume= 0.433 af
Outflow = 2.42 cfs @ 12.27 hrs, Volume= 0.417 af, Atten= 55%, Lag= 10.7 min
Primary = 2.42 cfs @ 12.27 hrs, Volume= 0.417 af
Routed to Reach DP-4 : NORTHERN HEADWALLS

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 134.75' @ 12.27 hrs Surf.Area= 9,291 sf Storage= 6,803 cf

Plug-Flow detention time= 189.4 min calculated for 0.416 af (96% of inflow)
Center-of-Mass det. time= 167.7 min (929.0 - 761.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.38'	5,162 cf	**51.24'W x 181.33'L x 1.88'H Field A** 17,426 cf Overall - 4,522 cf Embedded = 12,904 cf x 40.0% Voids
#2A	133.71'	3,499 cf	**ADS N-12 12"** x 216 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf 216 Chambers in 24 Rows
		8,661 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	133.38'	**12.0" Round Culvert** L= 12.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 133.38' / 133.26' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	133.38'	**1.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	133.85'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.42 cfs @ 12.27 hrs HW=134.74' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 2.42 cfs of 2.78 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 5.54 fps)
  └─**3=Orifice/Grate** (Orifice Controls 2.39 cfs @ 3.22 fps)

Pond 1P: DETENTION SYSTEM - Chamber Wizard Field A

Chamber Model = ADS N-12 12" (ADS N-12® Pipe)
Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf
Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 10.9" Spacing = 25.4" C-C Row Spacing

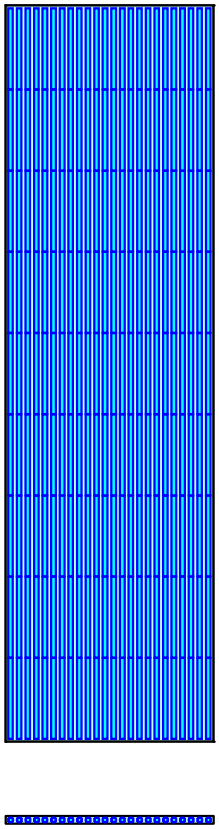
9 Chambers/Row x 20.00' Long = 180.00' Row Length +8.0" End Stone x 2 = 181.33' Base Length
24 Rows x 14.5" Wide + 10.9" Spacing x 23 + 8.0" Side Stone x 2 = 51.24' Base Width
4.0" Stone Base + 14.5" Chamber Height + 4.0" Stone Cover = 1.88' Field Height

216 Chambers x 16.2 cf = 3,499.2 cf Chamber Storage
216 Chambers x 20.9 cf = 4,522.0 cf Displacement

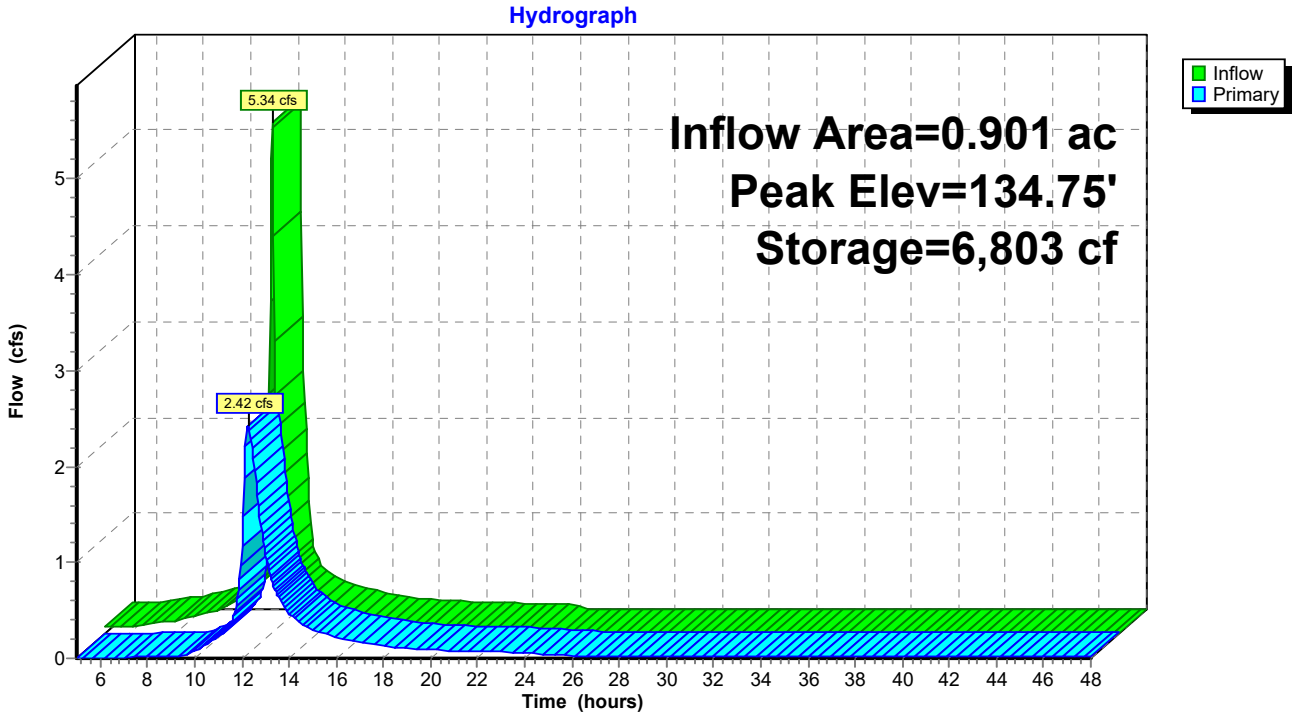
17,426.0 cf Field - 4,522.0 cf Chambers = 12,903.9 cf Stone x 40.0% Voids = 5,161.6 cf Stone Storage

Chamber Storage + Stone Storage = 8,660.8 cf = 0.199 af
Overall Storage Efficiency = 49.7%
Overall System Size = 181.33' x 51.24' x 1.88'

216 Chambers
645.4 cy Field
477.9 cy Stone



Pond 1P: DETENTION SYSTEM



Summary for Pond 2P: RAIN GARDEN

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.300 ac,100.00% Impervious, Inflow Depth > 5.77" for 25-Year event
Inflow = 1.78 cfs @ 12.09 hrs, Volume= 0.144 af
Outflow = 0.12 cfs @ 13.42 hrs, Volume= 0.044 af, Atten= 93%, Lag= 79.9 min
Primary = 0.12 cfs @ 13.42 hrs, Volume= 0.044 af
Routed to Reach DP-1 : POND ST.

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 141.71' @ 13.42 hrs Surf.Area= 3,676 sf Storage= 4,536 cf

Plug-Flow detention time= 411.7 min calculated for 0.044 af (31% of inflow)
Center-of-Mass det. time= 241.3 min (1,002.6 - 761.3)

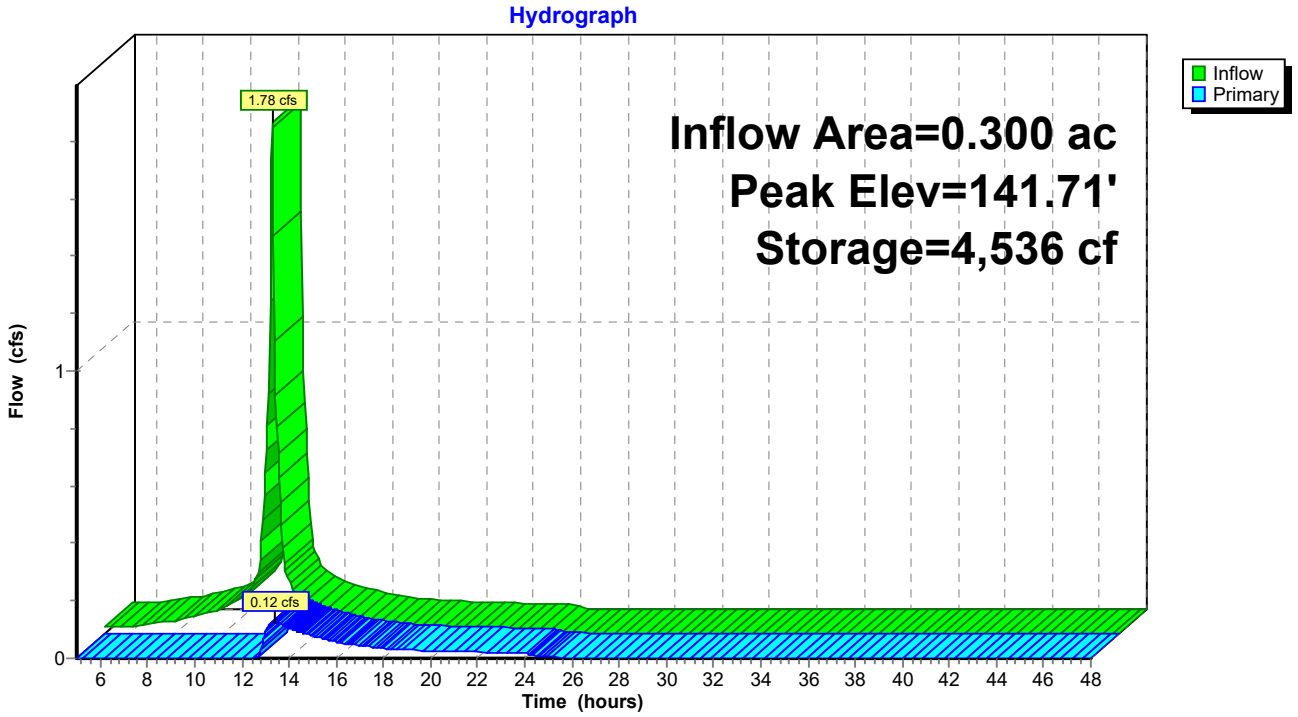
Volume	Invert	Avail.Storage	Storage Description
#1	139.50'	5,680 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
139.50	562	0	0
140.00	1,190	438	438
141.00	2,582	1,886	2,324
142.00	4,130	3,356	5,680

Device	Routing	Invert	Outlet Devices
#1	Primary	141.66'	**5.0' long x 3.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.41 2.56 2.69 2.67 2.66 2.66 2.65 2.67 2.67 2.70 2.77 2.83 2.87 2.93 3.10 3.19 3.32

Primary OutFlow Max=0.12 cfs @ 13.42 hrs HW=141.71' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.12 cfs @ 0.52 fps)

Pond 2P: RAIN GARDEN



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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1R: 75% OF BUILDING Runoff Area=39,227 sf 100.00% Impervious Runoff Depth>8.25"
Tc=6.0 min CN=98 Runoff=7.59 cfs 0.619 af

Subcatchment1S: FRONT SITE Runoff Area=134,557 sf 51.87% Impervious Runoff Depth=5.15"
Tc=6.0 min CN=70 Runoff=18.26 cfs 1.326 af

Subcatchment2S: EASTERN Runoff Area=10,320 sf 0.00% Impervious Runoff Depth=4.30"
Tc=6.0 min CN=63 Runoff=1.17 cfs 0.085 af

Subcatchment3R: WESTERN ROOF Runoff Area=50,302 sf 100.00% Impervious Runoff Depth>8.25"
Tc=6.0 min CN=98 Runoff=9.73 cfs 0.794 af

Subcatchment3S: WESTERN SITE Runoff Area=18,176 sf 18.54% Impervious Runoff Depth>6.49"
Tc=6.0 min UI Adjusted CN=81 Runoff=3.03 cfs 0.226 af

Subcatchment4R: NORTH & EAST Runoff Area=108,531 sf 100.00% Impervious Runoff Depth>8.25"
Tc=6.0 min CN=98 Runoff=21.00 cfs 1.712 af

Subcatchment4S: EASTERN LOADING Runoff Area=71,480 sf 65.94% Impervious Runoff Depth=6.37"
Tc=6.0 min CN=80 Runoff=11.73 cfs 0.871 af

Subcatchment5S: 25% OF BUILDING Runoff Area=13,075 sf 100.00% Impervious Runoff Depth>8.25"
Tc=6.0 min CN=98 Runoff=2.53 cfs 0.206 af

Reach DP-1: POND ST. Inflow=18.25 cfs 1.432 af
Outflow=18.25 cfs 1.432 af

Reach DP-2: EASTERN PROPERTY LINE Inflow=1.17 cfs 0.085 af
Outflow=1.17 cfs 0.085 af

Reach DP-3: CRUSED STONE AREA & LEACHING PITS Inflow=12.76 cfs 1.019 af
Outflow=12.76 cfs 1.019 af

Reach DP-4: NORTHERN HEADWALLS Inflow=35.55 cfs 3.185 af
Outflow=35.55 cfs 3.185 af

Pond 1P: DETENTION SYSTEM Peak Elev=135.22' Storage=8,539 cf Inflow=7.59 cfs 0.619 af
Outflow=3.46 cfs 0.602 af

Pond 2P: RAIN GARDEN Peak Elev=141.84' Storage=5,040 cf Inflow=2.53 cfs 0.206 af
Outflow=0.92 cfs 0.106 af

Total Runoff Area = 10.231 ac Runoff Volume = 5.838 af Average Runoff Depth = 6.85"
25.63% Pervious = 2.623 ac 74.37% Impervious = 7.609 ac

Summary for Subcatchment 1R: 75% OF BUILDING ADDITION

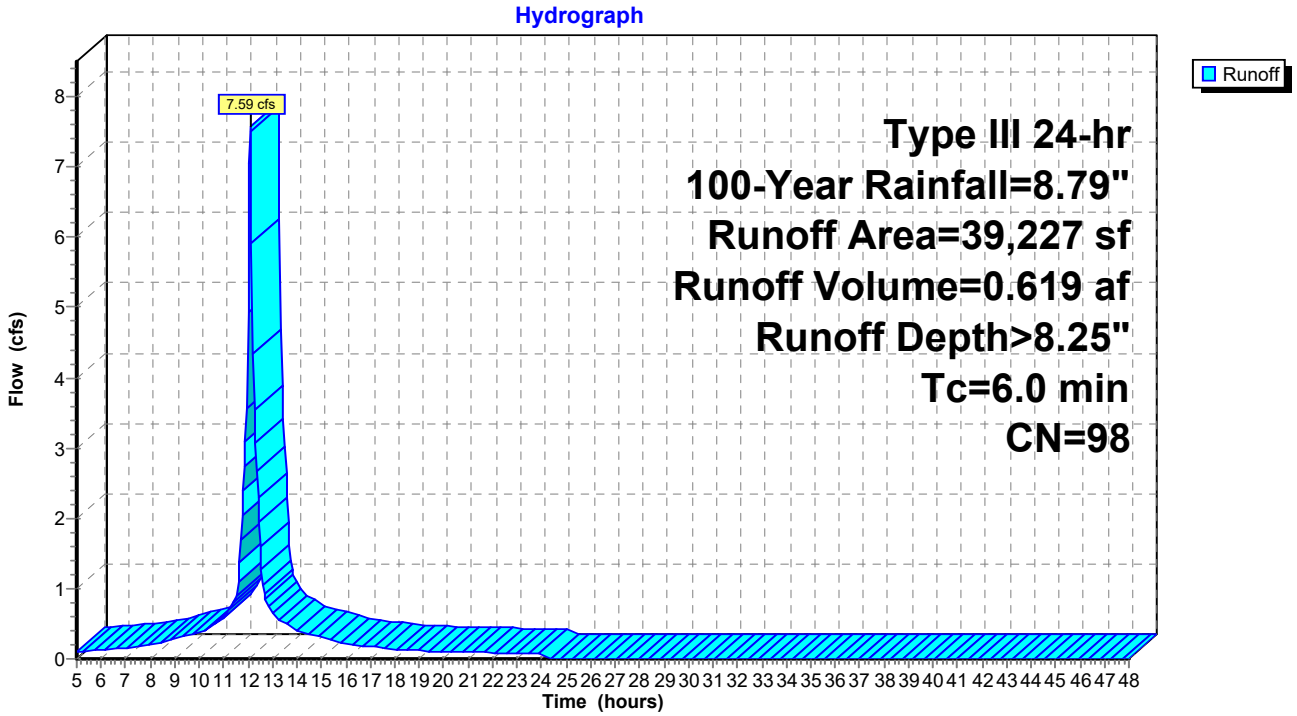
Runoff = 7.59 cfs @ 12.09 hrs, Volume= 0.619 af, Depth> 8.25"
Routed to Pond 1P : DETENTION SYSTEM

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=8.79"

Area (sf)	CN	Description
39,227	98	Roofs, HSG A
39,227		100.00% Impervious Area

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

Subcatchment 1R: 75% OF BUILDING ADDITION



Summary for Subcatchment 1S: FRONT SITE

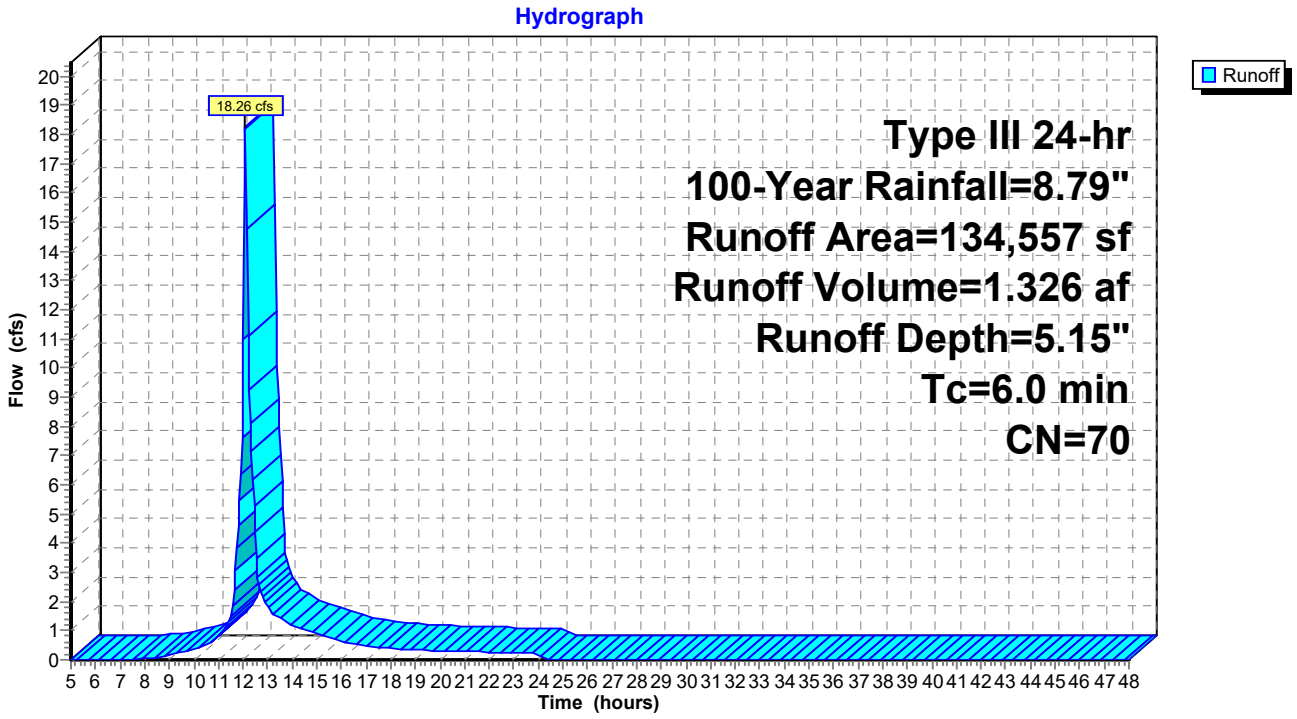
Runoff = 18.26 cfs @ 12.09 hrs, Volume= 1.326 af, Depth= 5.15"
Routed to Reach DP-1 : POND ST.

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=8.79"

Area (sf)	CN	Description
63,959	39	>75% Grass cover, Good, HSG A
809	61	>75% Grass cover, Good, HSG B
20,445	98	Paved parking, HSG B
49,344	98	Paved parking, HSG A
134,557	70	Weighted Average
64,768		48.13% Pervious Area
69,789		51.87% Impervious Area

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

Subcatchment 1S: FRONT SITE



Summary for Subcatchment 2S: EASTERN LANDSCAPED AREA

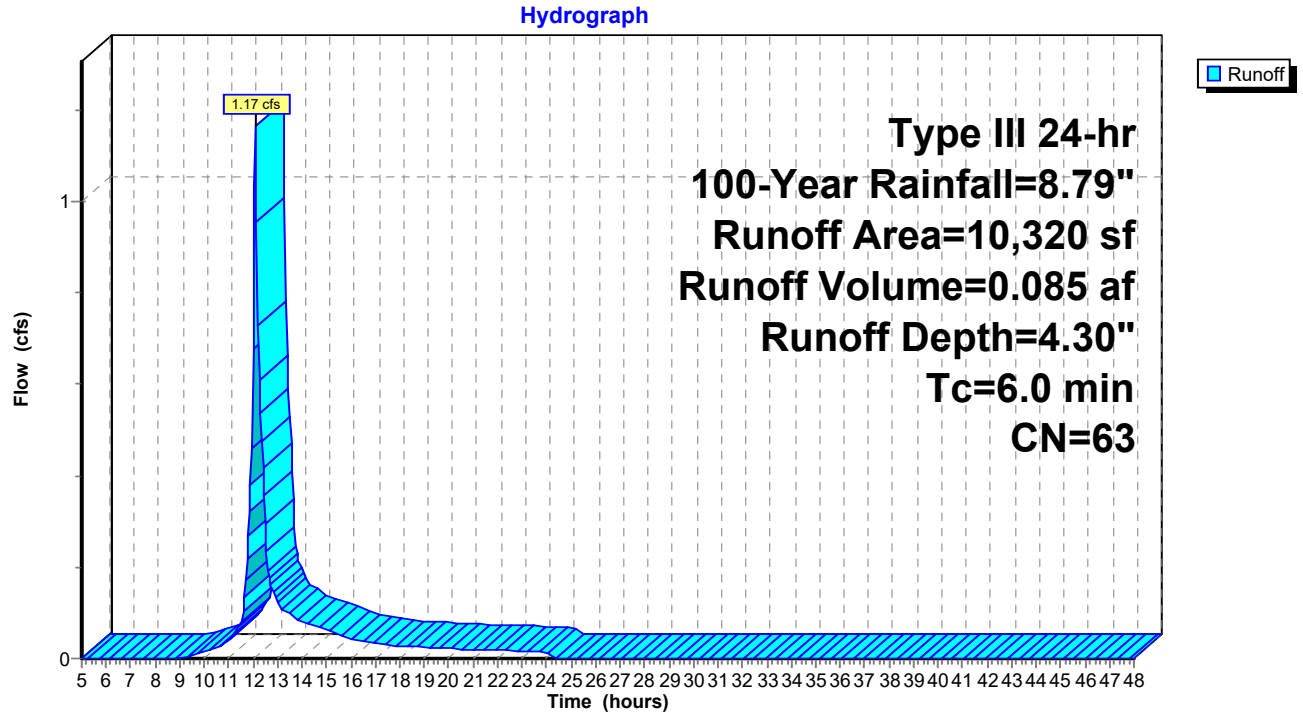
Runoff = 1.17 cfs @ 12.09 hrs, Volume= 0.085 af, Depth= 4.30"
Routed to Reach DP-2 : EASTERN PROPERTY LINE

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=8.79"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
1,000	80	>75% Grass cover, Good, HSG D
10,320	63	Weighted Average
10,320		100.00% Pervious Area

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

Subcatchment 2S: EASTERN LANDSCAPED AREA



Summary for Subcatchment 3R: WESTERN ROOF

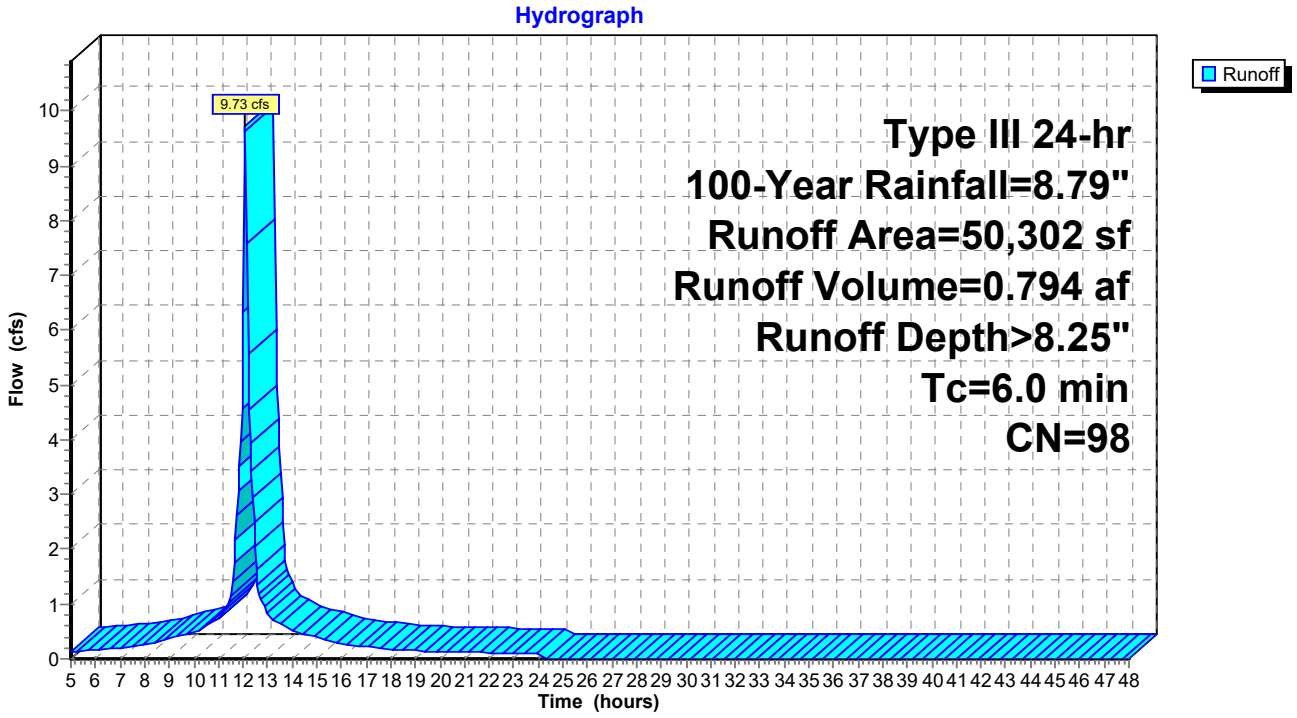
Runoff = 9.73 cfs @ 12.09 hrs, Volume= 0.794 af, Depth> 8.25"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=8.79"

Area (sf)	CN	Description
50,302	98	Roofs, HSG A
50,302		100.00% Impervious Area

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

Subcatchment 3R: WESTERN ROOF



Summary for Subcatchment 3S: WESTERN SITE

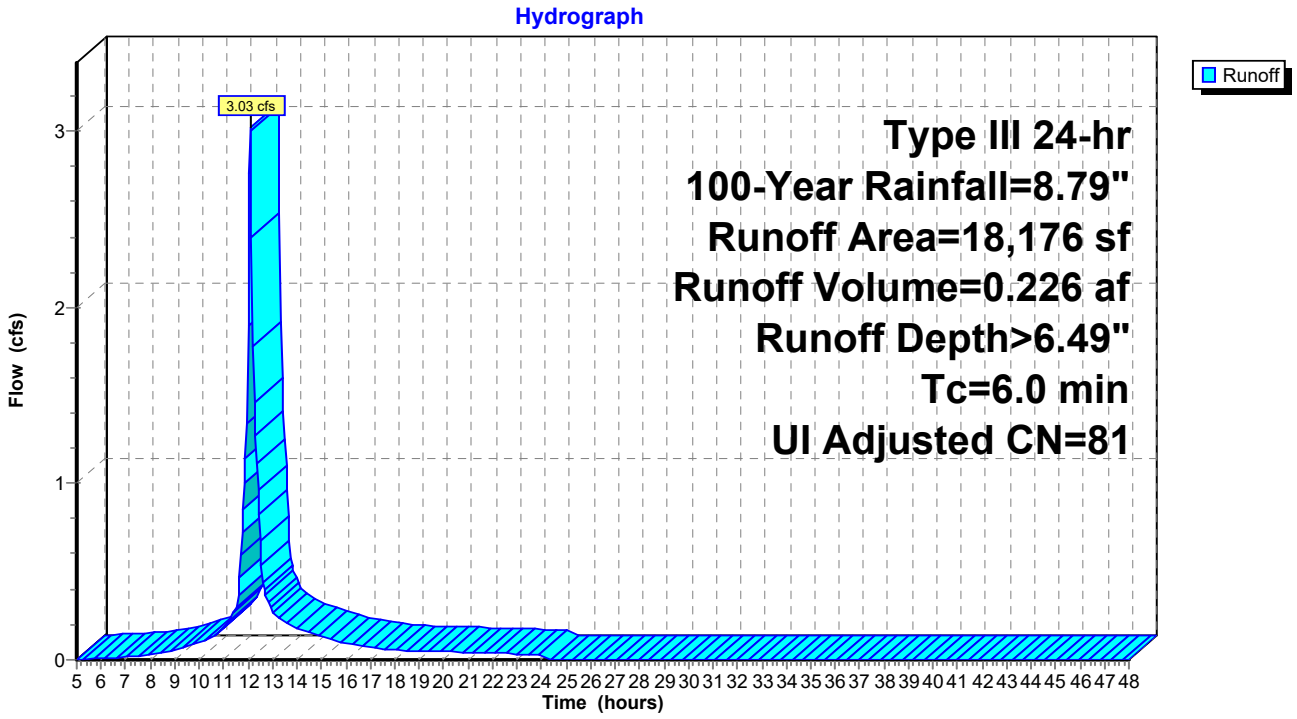
Runoff = 3.03 cfs @ 12.09 hrs, Volume= 0.226 af, Depth> 6.49"
Routed to Reach DP-3 : CRUSED STONE AREA & LEACHING PITS

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=8.79"

Area (sf)	CN	Adj	Description
3,370	98		Unconnected pavement, HSG A
10,363	96		Gravel surface, HSG A
4,443	39		>75% Grass cover, Good, HSG A
18,176	82	81	Weighted Average, UI Adjusted
14,806			81.46% Pervious Area
3,370			18.54% Impervious Area
3,370			100.00% Unconnected

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

Subcatchment 3S: WESTERN SITE



Summary for Subcatchment 4R: NORTH & EAST ROOF

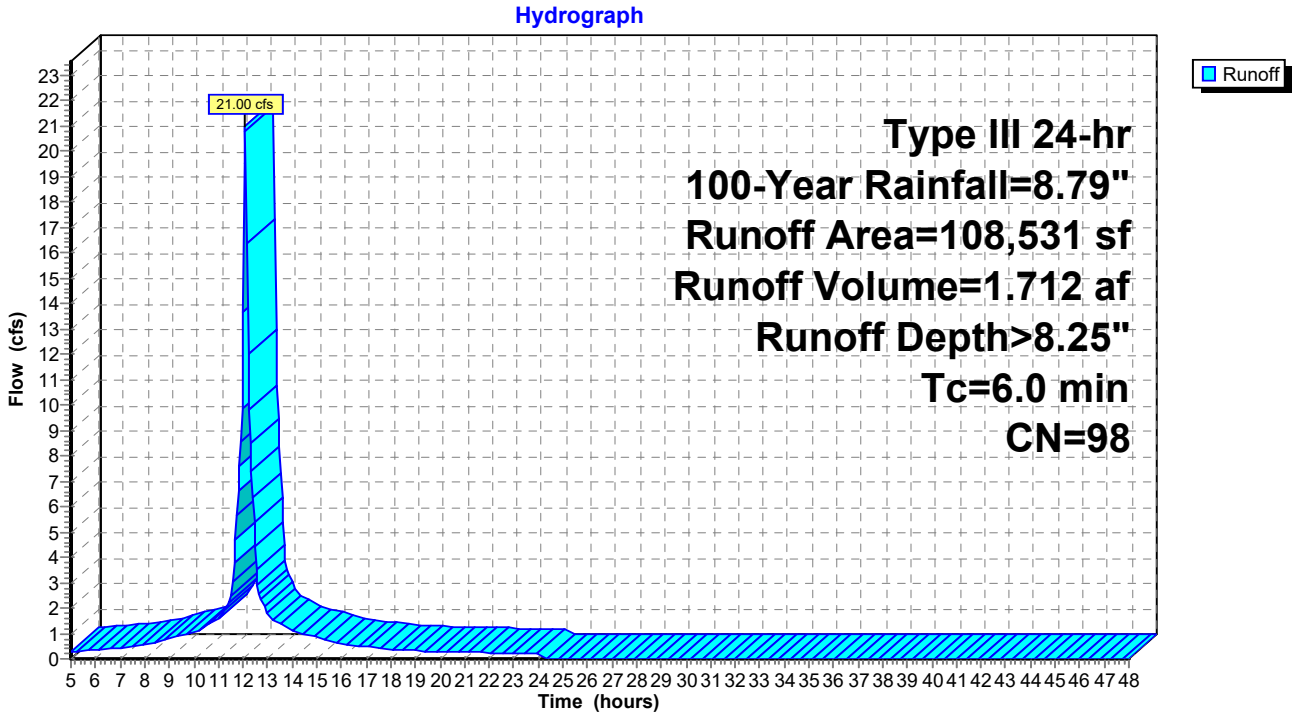
Runoff = 21.00 cfs @ 12.09 hrs, Volume= 1.712 af, Depth> 8.25"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=8.79"

Area (sf)	CN	Description
108,531	98	Roofs, HSG A
108,531		100.00% Impervious Area

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

Subcatchment 4R: NORTH & EAST ROOF



Summary for Subcatchment 4S: EASTERN LOADING AREA

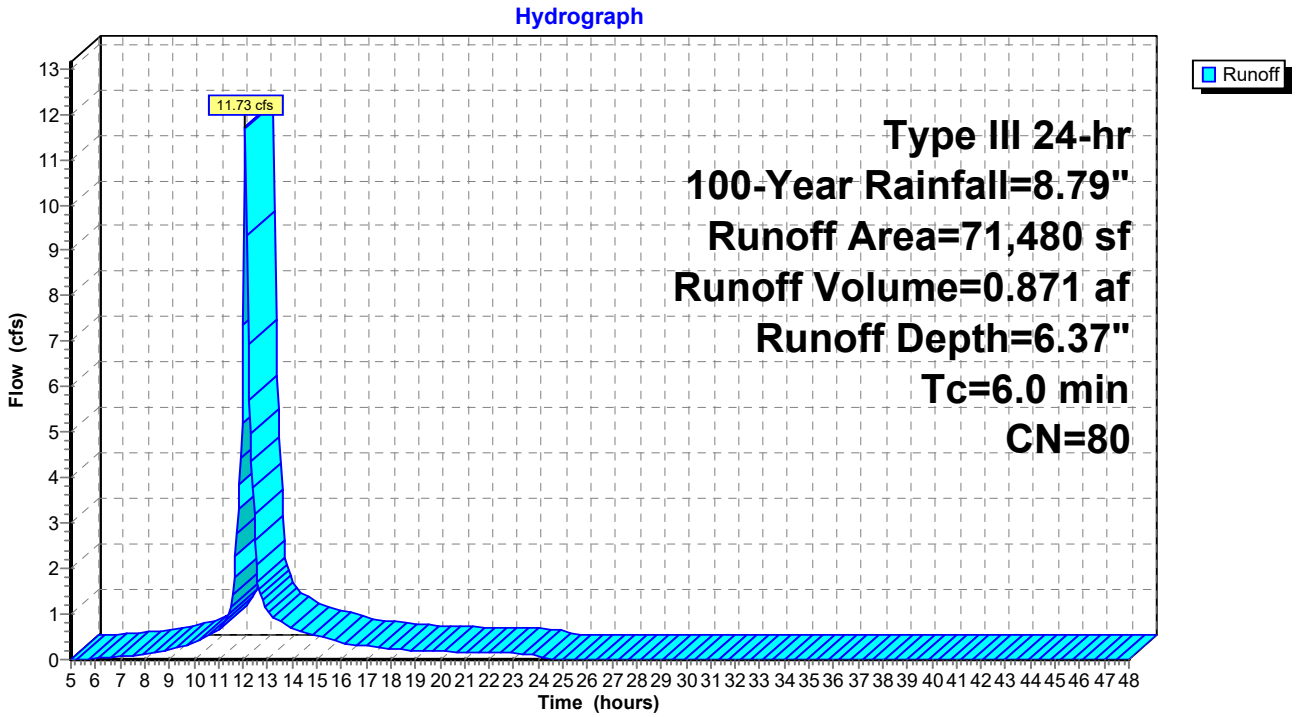
Runoff = 11.73 cfs @ 12.09 hrs, Volume= 0.871 af, Depth= 6.37"
Routed to Reach DP-4 : NORTHERN HEADWALLS

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=8.79"

Area (sf)	CN	Description
40,295	98	Paved parking, HSG A
55	98	Paved parking, HSG B
6,783	98	Paved parking, HSG D
4,315	30	Woods, Good, HSG A
2,050	77	Woods, Good, HSG D
16,572	39	>75% Grass cover, Good, HSG A
1,410	96	Gravel surface, HSG A
71,480	80	Weighted Average
24,347		34.06% Pervious Area
47,133		65.94% Impervious Area

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

Subcatchment 4S: EASTERN LOADING AREA



Summary for Subcatchment 5S: 25% OF BUILDING ADDITION

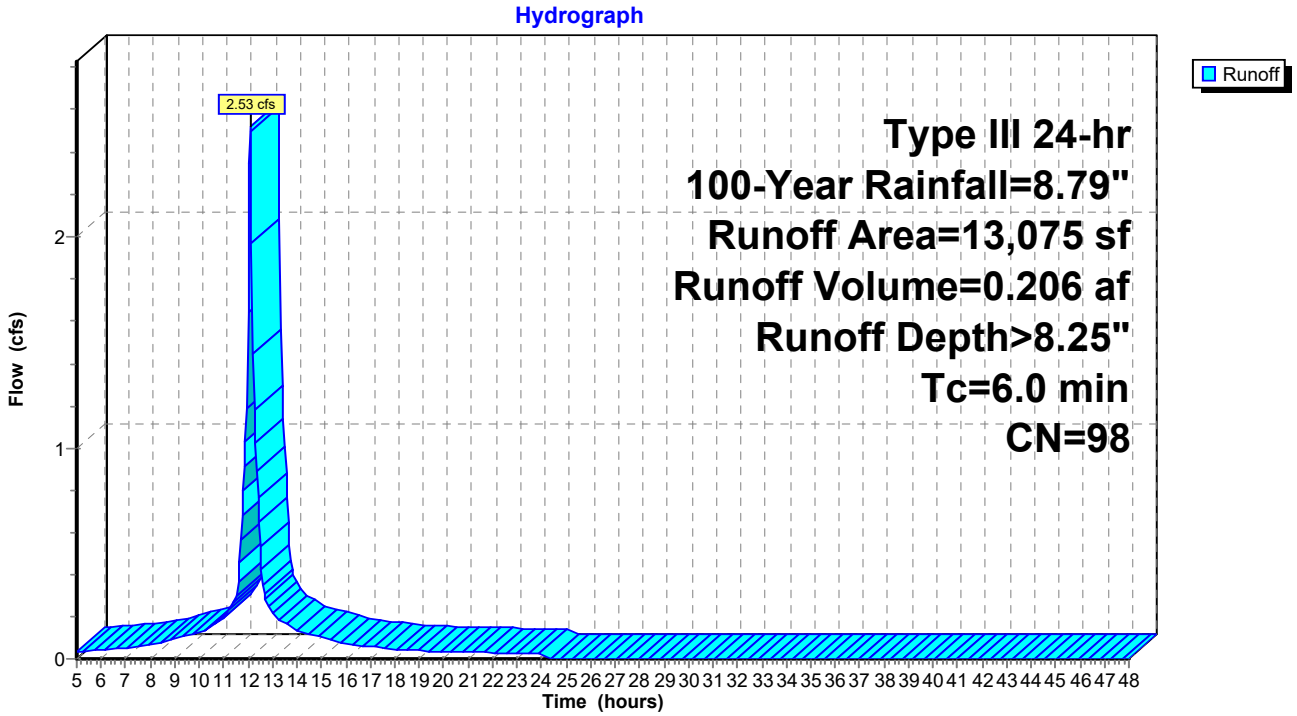
Runoff = 2.53 cfs @ 12.09 hrs, Volume= 0.206 af, Depth> 8.25"
Routed to Pond 2P : RAIN GARDEN

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=8.79"

Area (sf)	CN	Description
13,075	98	Roofs, HSG A
13,075		100.00% Impervious Area

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

Subcatchment 5S: 25% OF BUILDING ADDITION



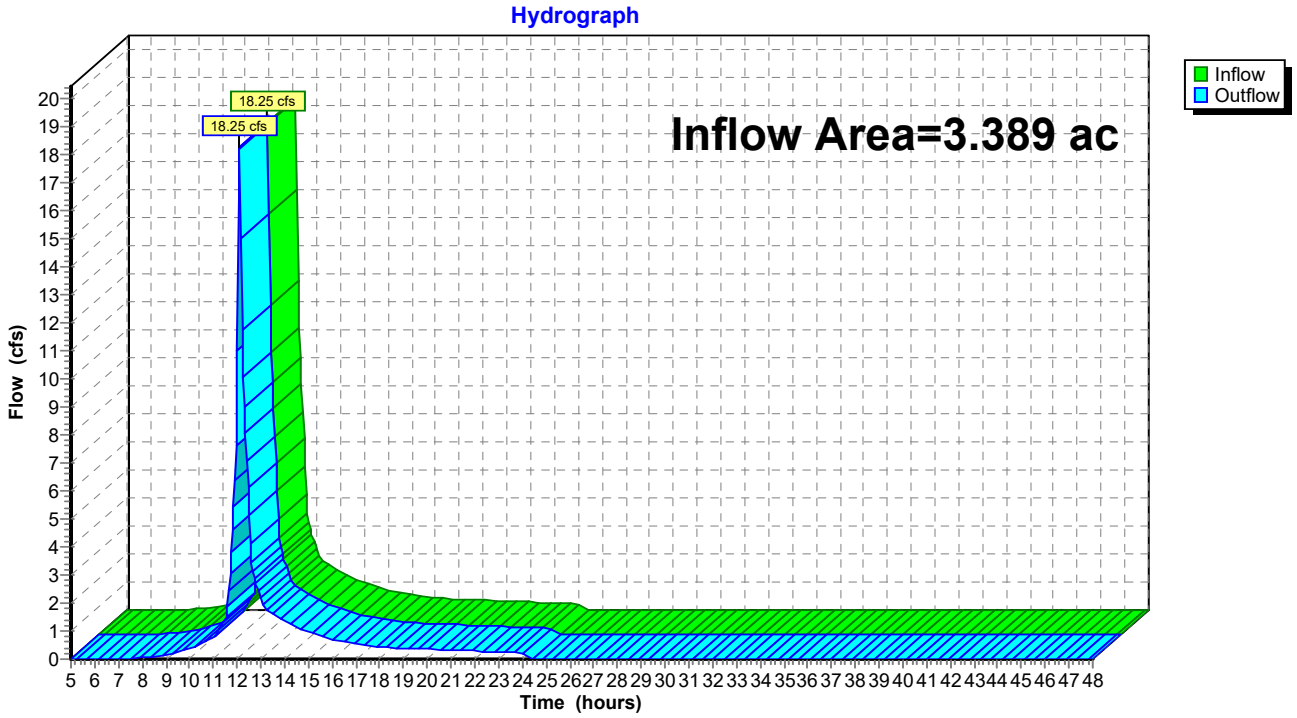
Summary for Reach DP-1: POND ST.

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

Inflow Area = 3.389 ac, 56.13% Impervious, Inflow Depth = 5.07" for 100-Year event
Inflow = 18.25 cfs @ 12.09 hrs, Volume= 1.432 af
Outflow = 18.25 cfs @ 12.09 hrs, Volume= 1.432 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-1: POND ST.



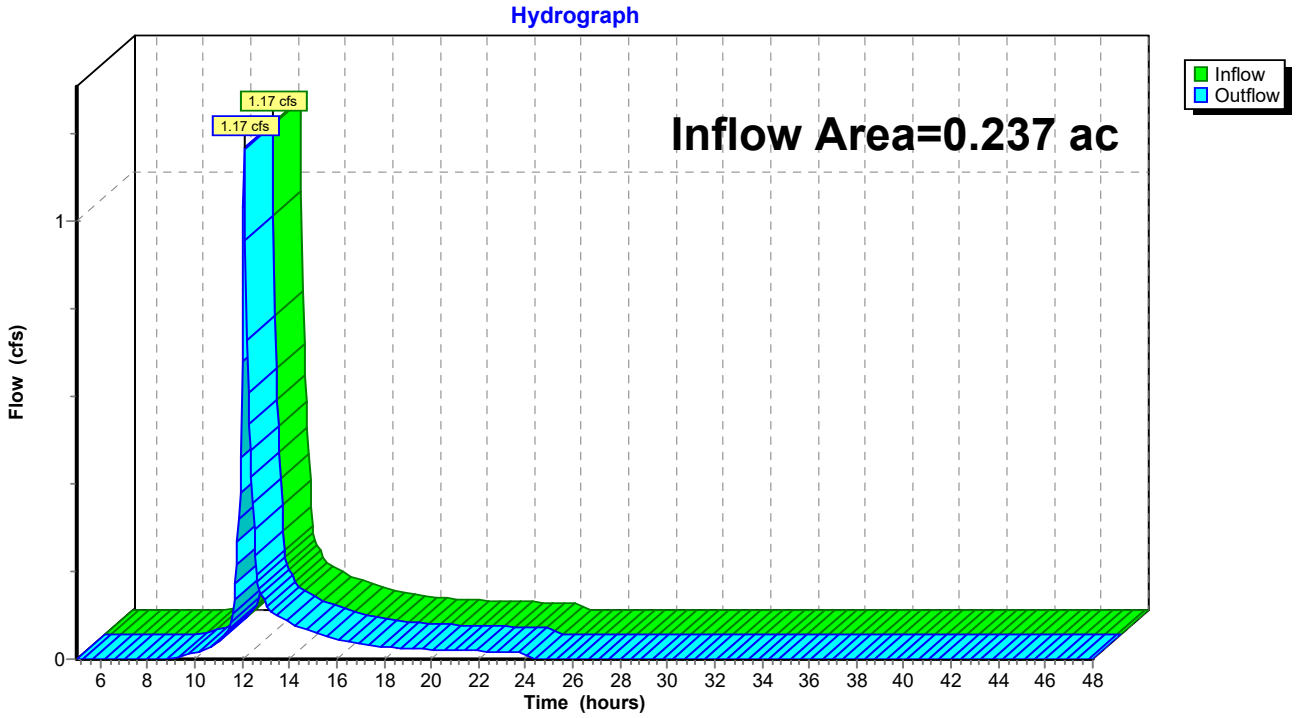
Summary for Reach DP-2: EASTERN PROPERTY LINE

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

Inflow Area = 0.237 ac, 0.00% Impervious, Inflow Depth = 4.30" for 100-Year event
Inflow = 1.17 cfs @ 12.09 hrs, Volume= 0.085 af
Outflow = 1.17 cfs @ 12.09 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-2: EASTERN PROPERTY LINE



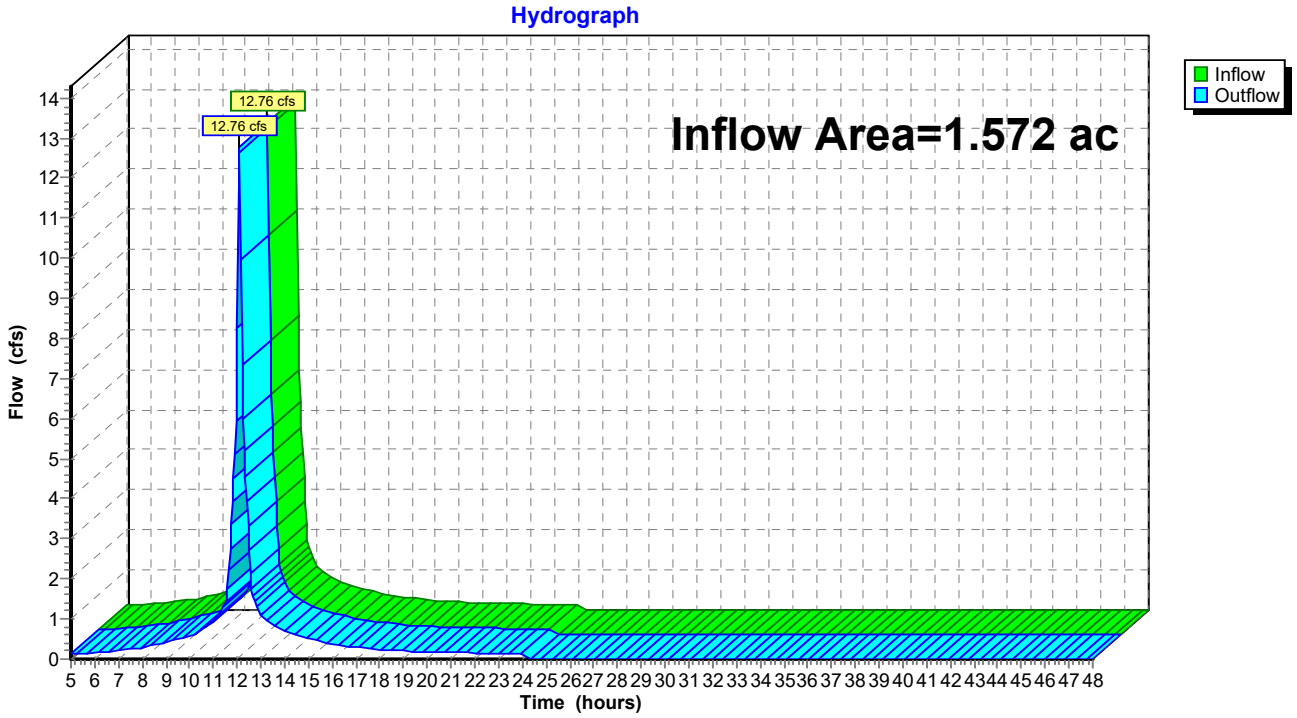
Summary for Reach DP-3: CRUSED STONE AREA & LEACHING PITS

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

Inflow Area = 1.572 ac, 78.38% Impervious, Inflow Depth > 7.78" for 100-Year event
Inflow = 12.76 cfs @ 12.09 hrs, Volume= 1.019 af
Outflow = 12.76 cfs @ 12.09 hrs, Volume= 1.019 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-3: CRUSED STONE AREA & LEACHING PITS



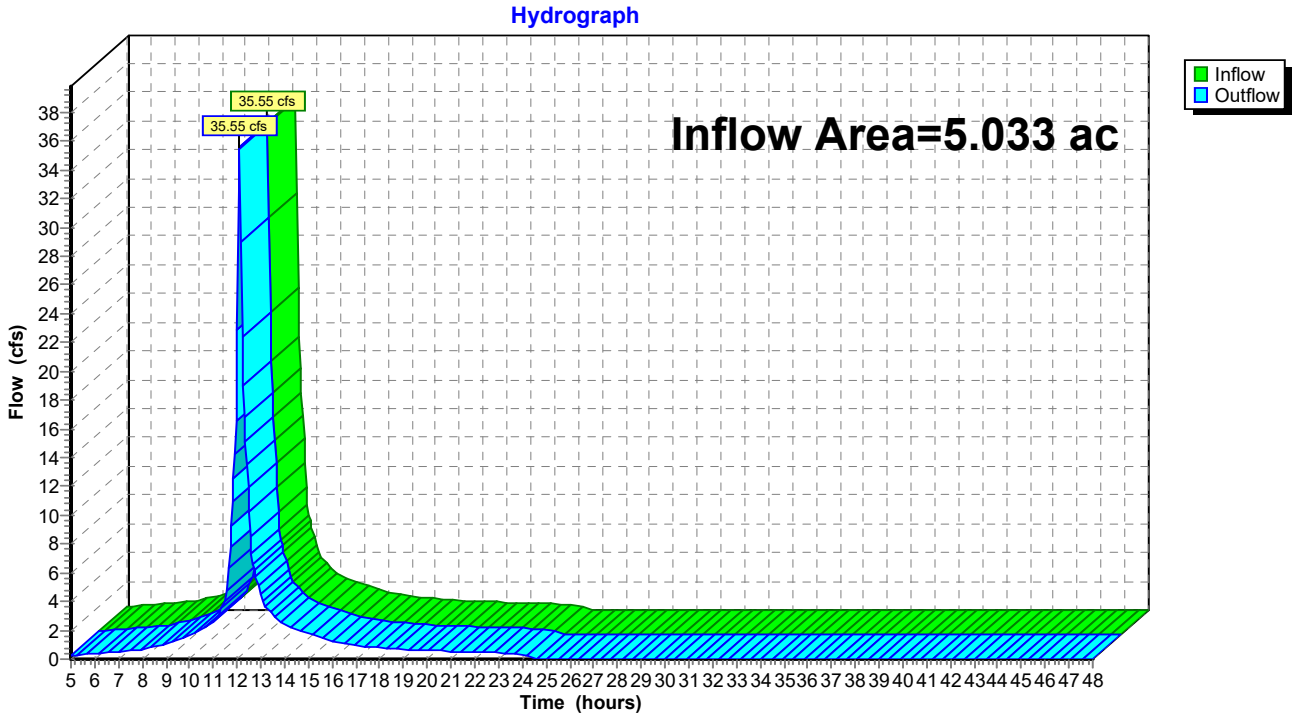
Summary for Reach DP-4: NORTHERN HEADWALLS

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

Inflow Area = 5.033 ac, 88.89% Impervious, Inflow Depth > 7.59" for 100-Year event
Inflow = 35.55 cfs @ 12.09 hrs, Volume= 3.185 af
Outflow = 35.55 cfs @ 12.09 hrs, Volume= 3.185 af, Atten= 0%, Lag= 0.0 min

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

Reach DP-4: NORTHERN HEADWALLS



Summary for Pond 1P: DETENTION SYSTEM

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.901 ac,100.00% Impervious, Inflow Depth > 8.25" for 100-Year event
Inflow = 7.59 cfs @ 12.09 hrs, Volume= 0.619 af
Outflow = 3.46 cfs @ 12.26 hrs, Volume= 0.602 af, Atten= 54%, Lag= 10.6 min
Primary = 3.46 cfs @ 12.26 hrs, Volume= 0.602 af
Routed to Reach DP-4 : NORTHERN HEADWALLS

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 135.22' @ 12.26 hrs Surf.Area= 9,291 sf Storage= 8,539 cf

Plug-Flow detention time= 147.5 min calculated for 0.601 af (97% of inflow)
Center-of-Mass det. time= 131.6 min (891.6 - 760.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.38'	5,162 cf	**51.24'W x 181.33'L x 1.88'H Field A** 17,426 cf Overall - 4,522 cf Embedded = 12,904 cf x 40.0% Voids
#2A	133.71'	3,499 cf	**ADS N-12 12"** x 216 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf 216 Chambers in 24 Rows
		8,661 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	133.38'	**12.0" Round Culvert** L= 12.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 133.38' / 133.26' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	133.38'	**1.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	133.85'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.46 cfs @ 12.26 hrs HW=135.22' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 3.46 cfs @ 4.40 fps)
├─**2=Orifice/Grate** (Passes < 0.04 cfs potential flow)
└─**3=Orifice/Grate** (Passes < 3.53 cfs potential flow)

Pond 1P: DETENTION SYSTEM - Chamber Wizard Field A

Chamber Model = ADS N-12 12" (ADS N-12® Pipe)
Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf
Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 10.9" Spacing = 25.4" C-C Row Spacing

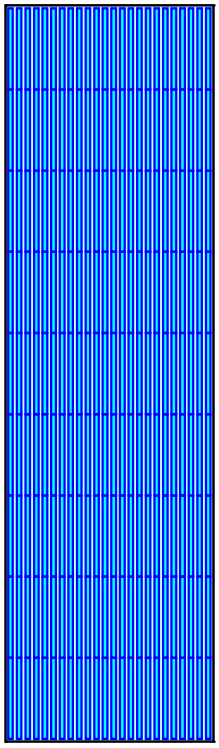
9 Chambers/Row x 20.00' Long = 180.00' Row Length +8.0" End Stone x 2 = 181.33' Base Length
24 Rows x 14.5" Wide + 10.9" Spacing x 23 + 8.0" Side Stone x 2 = 51.24' Base Width
4.0" Stone Base + 14.5" Chamber Height + 4.0" Stone Cover = 1.88' Field Height

216 Chambers x 16.2 cf = 3,499.2 cf Chamber Storage
216 Chambers x 20.9 cf = 4,522.0 cf Displacement

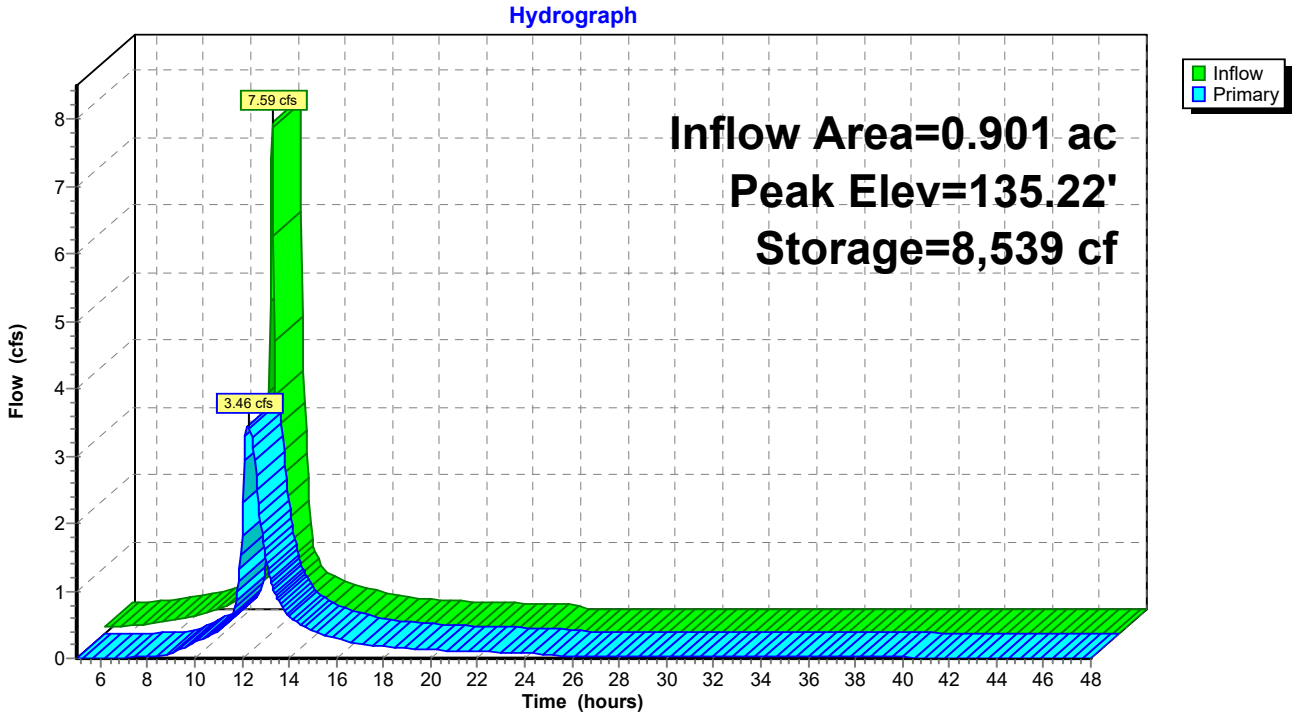
17,426.0 cf Field - 4,522.0 cf Chambers = 12,903.9 cf Stone x 40.0% Voids = 5,161.6 cf Stone Storage

Chamber Storage + Stone Storage = 8,660.8 cf = 0.199 af
Overall Storage Efficiency = 49.7%
Overall System Size = 181.33' x 51.24' x 1.88'

216 Chambers
645.4 cy Field
477.9 cy Stone



Pond 1P: DETENTION SYSTEM



Summary for Pond 2P: RAIN GARDEN

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.300 ac,100.00% Impervious, Inflow Depth > 8.25" for 100-Year event
Inflow = 2.53 cfs @ 12.09 hrs, Volume= 0.206 af
Outflow = 0.92 cfs @ 12.34 hrs, Volume= 0.106 af, Atten= 64%, Lag= 15.3 min
Primary = 0.92 cfs @ 12.34 hrs, Volume= 0.106 af
Routed to Reach DP-1 : POND ST.

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 141.84' @ 12.34 hrs Surf.Area= 3,883 sf Storage= 5,040 cf

Plug-Flow detention time= 256.5 min calculated for 0.106 af (51% of inflow)
Center-of-Mass det. time= 138.1 min (898.1 - 760.0)

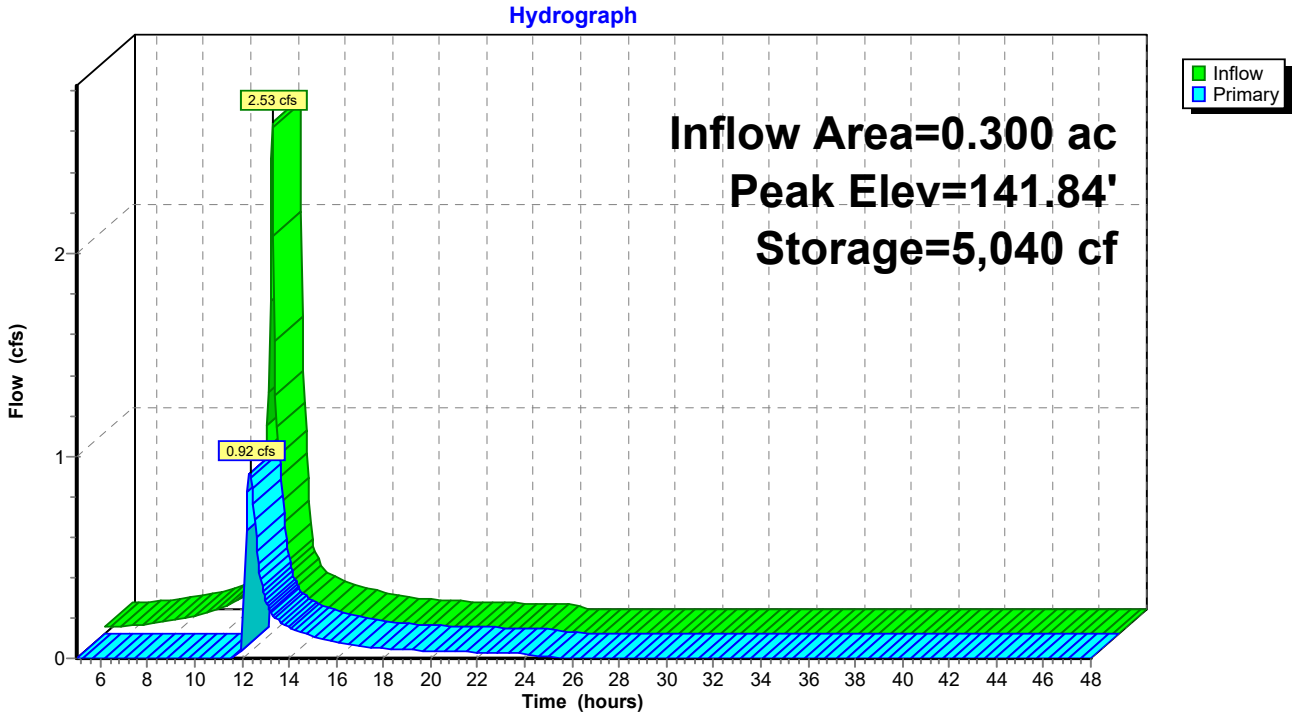
Volume	Invert	Avail.Storage	Storage Description
#1	139.50'	5,680 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
139.50	562	0	0
140.00	1,190	438	438
141.00	2,582	1,886	2,324
142.00	4,130	3,356	5,680

Device	Routing	Invert	Outlet Devices
#1	Primary	141.66'	**5.0' long x 3.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.41 2.56 2.69 2.67 2.66 2.66 2.65 2.67 2.67 2.70 2.77 2.83 2.87 2.93 3.10 3.19 3.32

Primary OutFlow Max=0.92 cfs @ 12.34 hrs HW=141.84' TW=0.00' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.92 cfs @ 1.02 fps)

Pond 2P: RAIN GARDEN



A P P E N D I X C

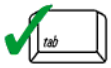
Checklist for Stormwater Report

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

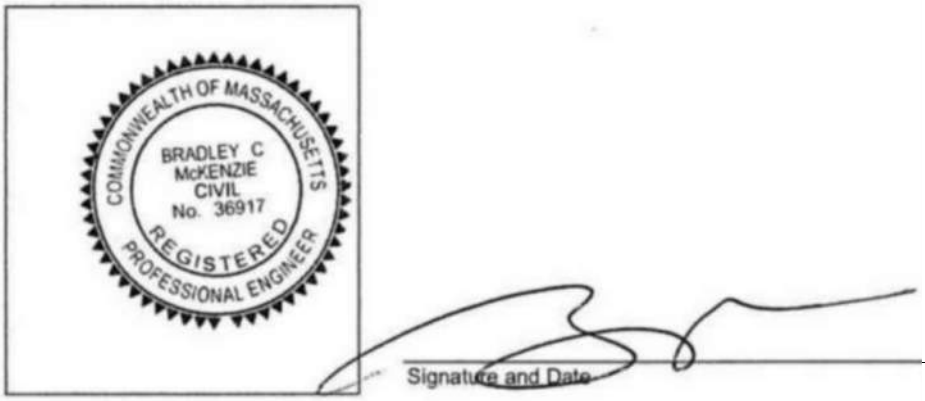
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



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): Detention System

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.

A P P E N D I X D

Illicit Discharge Compliance Statement
Supplemental BMP Calculations

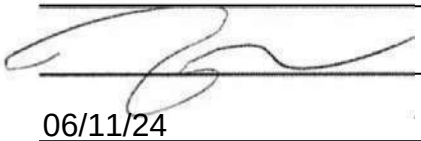
Illicit Discharge Compliance Statement

I, Bradley C. McKenzie, P.E., hereby notify the Randolph Conservation Commission that I have not witnessed, nor am aware of any existing illicit discharges at the site known as 300 Pond Street (Assessor's Parcel Number 3-O-2.1) in Randolph, Massachusetts. I also hereby certify that the development of said property as illustrated on the final plans entitled “Site Development Plan, (Assessor's Parcel Number 3-O-2.1), 300 Pond Street, Randolph, Massachusetts,” prepared by McKenzie Engineering Group. Inc. dated June 11, 2024 and as revised and approved by the Randolph Conservation Commission and maintenance thereof in accordance with the “Construction Phase Operations and Maintenance Plan” and “Long-Term Operations and Maintenance Plan” prepared by McKenzie Engineering Group, Inc. dated June 11, 2024 and as revised and approved by the Randolph Conservation Commission will not create any new illicit discharges. There is no warranty implied regarding future illicit discharges that may occur as a result of improper construction or maintenance of the stormwater management system or unforeseen accidents.

Name: Bradley C. McKenzie, P.E.

Company: McKenzie Engineering Group, Inc.

Title: President

Signature: 

Date: 06/11/24

MCKENZIE ENGINEERING GROUP

Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

300 POND STREET
RANDOLPH, MA

4/16/2024

WATER QUALITY VOLUME ANALYSIS

POND	IMPERVIOUS AREA (SF) CN=98	PRECIPITATION (IN)	WATER QUALITY VOLUME REQUIRED (CF)	TREATMENT VOLUME PROVIDED (CF) UP TO INVERT ELEVATION	NET TREATMENT VOLUME PROVIDED (CF)
2P	52,300	1.00	4,358	4,365	7
TOTAL	**52,300**		**4,358**	**4,365**	**7**

WATER QUALITY VOLUME ANALYSIS - PROPRIETARY STORMWATER TREATMENT UNITS (FIRST DEFENSE UNITS)*

	IMPERVIOUS AREA (SF) CN=98	PRECIPITATION (IN)	qu (Fig 4) Tc 6 min. (CSM/IN)	AREA (SM)	WATER QUALITY REQUIRED (CFS)
2P	52,300	0.50	774	1.876E-03	0.726

*Use 4' Diameter First Defense Units

MCKENZIE ENGINEERING GROUP

Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

300 POND STREET
RANDOLPH, MA

4/16/2024

REQUIRED RECHARGE VOLUME (CF) *"STATIC METHOD"*

WATERSHED #	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) A SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) B SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) C SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) D SOIL		REQUIRED RECHARGE VOLUME (CF)
TOTAL SITE	52,300	0.60		0.35		0.25		0.10		2,615
		0.60		0.35		0.25		0.10		0
		0.60		0.35		0.25		0.10		0
							TOTAL			**2,615**

CAPTURE ADJUSTMENT

WATERSHED #	TOTAL IMPERVIOUS AREA (SF)	TOTAL IMPERVIOUS COLLECTED	% DIRECTED TOWARDS INFILTRATION SYSTEM	STANDARD NO. 3 <100% - > 65% CAPTURED	CAPTURE ADJUSTMENT	ADJUSTED REQUIRED RECHARGE VOLUME (CF)
TOTAL SITE	52,300	52,300	100.00%	**CAPTURE ADJUSTMENT REQUIRED**	1.00	2,615

* Required Water Quality Volume based on 0.5 inches of runoff; Required Recharge Volume based on 0.60 inches Target Volume is Required Water Quality Volume of 4,358 CF

PROVIDED RECHARGE VOLUME (CF)

BELOW LOWEST INVERT

	REQUIRED RECHARGE VOLUME (CF)	POND	STORAGE VOLUME PROVIDED (CF)	NET STORAGE VOLUME PROVIDED (CF)
	2,615	2P	4,365	1,750
TOTAL	**2,615**		**4,365**	**1,750**

MCKENZIE
ENGINEERING GROUP

Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

300 POND STREET
RANDOLPH, MA

4/16/2024

DRAWDOWN WITHIN 72 HOURS ANALYSIS

POND	RAWLS RATE (IN/HR)	STORAGE VOLUME PROVIDED (CF)	BOTTOM AREA (FT2)	DRAWDOWN (HR)
2P	8.27	5,680	562	15

A P P E N D I X E

Soil Testing Data

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Emerson - Swan Flexcon
Owner Name

300 Pond Street
Street Address

3-0-2.1
Map/Lot #

Randolph
City

MA
State

02368
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: NRCS (Source) 654 (Soil Map Unit)

udorthents, loamy
Soil Name

N/A
Soil Limitations

excavated and filled coarse-loamy human transported material
Soil Parent material

shoulder, summit
Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: USGS/2018 (Year Published/Source) thin till (Map Unit)

nonsorted, nonstratified matrix of sand, some silt, and little clay containing pebble, cobble, boulder clasts.
Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer: _____ (Wetland Type)

7. Current Water Resource Conditions (USGS): 12/21/23 (Month/Day/ Year) Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed: _____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 1 (Hole #) | 12/22/23 (Date) | 7AM (Time) | sunny, cold (Weather) | 42.202802 (Latitude) | -71.049873 (Longitude:)

1. Land Use: manufacturing building and parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | none (Vegetation) | large boulders and ledge (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2 (Slope (%))

   Description of Location: parking lot, rear of building

2. Soil Parent Material: ledge and stone outcropping | shoulder, summit (Landform) | SH (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Wetlands >100 feet
   Property Line >50 feet | Drinking Water Well _____ feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 52 Depth Weeping from Pit | 82 Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-16		fill					10	5			
16-34	C1	ledge	2.5YR 6/4					80	BLOCKY	RIGID	mostly Ledge, some SL between rock
34-84	C2	Clay	10YR 7/2	52	10YR 6/6	5		10	MASSIVE	FRIABLE	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 2 (Hole #) | 12/22/23 (Date) | 8AM (Time) | sunny, cold (Weather) | 42.202802 (Latitude) | -71.049873 (Longitude:)

1. Land Use: manufacturing building and parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | none (Vegetation) | large boulders and ledge (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2 (Slope (%))

   Description of Location: parking lot, rear of building

2. Soil Parent Material: ledge and stone outcropping | shoulder, summit (Landform) | SH (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Wetlands >100 feet
   Property Line >50 feet | Drinking Water Well _____ feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-16		fill					10	5			
16-40	C1	ledge	2.5YR 6/4					80	BLOCKY	RIGID	BEDROCK, CANNOT PENETRATE

Additional Notes:
REFUSAL AT 40"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # 1	Obs. Hole # 2
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☒ Depth weeping from side of observation hole	52 inches	_____ inches
☐ Depth to soil redoximorphic features (mottles)	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number

_____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

12/22/23
Date

Erik Schoumaker / SE14264
Typed or Printed Name of Soil Evaluator / License #

6/30/24
Expiration Date of License

Name of Approving Authority Witness

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

A P P E N D I X F

Best Management Practices
Operation and Maintenance Plans

CONSTRUCTION PHASE POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN (BEST MANAGEMENT PRACTICES OPERATION AND MAINTENANCE PLAN)

for

Site Development Plan
300 Pond Street

In

Randolph, Massachusetts
(Assessor's Parcel Number 3-O-2.1)

Submitted to:

TOWN OF RANDOLPH

Prepared for:

Emerson – Swan Flexcon
300 Pond Street, Randolph, MA 02368

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

April 26, 2024

TABLE OF CONTENTS

Construction Phase Best Management Practices (BMP's)

Erosion and Sedimentation will be controlled at the site by utilizing Structural Practices, Stabilization Practices, and Dust Control. These practices correspond with plans entitled "Site Development Plan, (Assessor's Parcel Number 3-O-2.1), 300 Pond Street, Randolph, Massachusetts", issued June 11, 2024 and as revised hereinafter referred to as the Site Plans.

Responsible Party Contact Information:

Stormwater Management System Owner:
Emerson – Swan Flexcon
300 Pond Street
Randolph, MA 02368
Phone: (339) 793-3196

Town of Randolph Contact Information:

Randolph Department of Public Works
Paul Scott
41 South Main Street
Randolph, MA 02368
Phone: (781) 961-0940

Randolph Conservation Commission
Joe Dunn
41 South Main Street
Randolph, MA 02368
Phone: (781) 961-1519

Randolph Building Department
Ronald Lum
41 South Main Street
Randolph, MA 02368
Phone: (781) 961-0980

Structural Practices:

1) **Compost Filter Tube Barrier Controls** – A compost filter tube barrier will be constructed along downward slopes at the limit of work in locations shown on the plans. This control will be installed prior to major soil disturbance on the site. The sediment silt sack barrier should be installed as shown on the Construction Detail Plan.

   Compost Filter Tube Design/Installation Requirements *

   a) Locate the compost filter tube where identified on the plans.

   b) The compost filter tube line should be nearly level through most of its length to impound a broad, temporary pool. The last 10 to 20 feet at each end of the silt sack should be swung slightly uphill (approximately 0.5 feet in elevation) to provide storage capacity.

c) The compost filter tube shall be staked every 8 linear feet with 1-inch by 1-inch stakes.

d) Compost filter tubes should be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized through one growing season. Retained sediment must be removed and properly disposed of, or mulched and seeded.

Compost Filter Tube Inspection/Maintenance *

a) Compost filter tubes should be inspected immediately after each rainfall event of 1-inch or greater, and at least daily during prolonged rainfall. Inspect the depth of sediment, fabric tears, and to see that the fence posts are firmly in the ground. Repair or replace as necessary.

b) Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the fence. Sediment will be removed from behind the sediment fence when it becomes about ½ foot deep at the compost filter tube. Take care to avoid undermining fence during cleanout.

c) If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.

d) Remove all compost filter tube materials after the contributing drainage area has been properly stabilized. Sediment deposits remaining after the fabric has been removed should be graded to conform with the existing topography and vegetated.

2) **Sediment Fence Controls** – A sediment fence will be constructed along the limit of work as needed to prevent the spreading of fine sediments from the site. This control will be installed prior to major soil disturbance on the site. The sediment fence should be installed as shown on the Erosion Control Detail Plan and be Amoco woven polypropylene 1198 or equivalent.

Sediment Fence Design/Installation Requirements *

e) Locate the fence upland of the hay bale barriers and where identified on the plans.

f) The fence line should be nearly level through most of its length to impound a broad, temporary pool. The last 10 to 20 feet at each end of the fence should be swung slightly uphill (approximately 0.5 feet in elevation) to provide storage capacity.

g) Excavate a trench approximately 8 inches deep and 4 inches wide, or a V-trench; along the line of the fence, upslope side.

h) Fasten support wire fence (14 gauge with 6-inch mesh) securely to the upslope side of the fence posts with wire ties or staples. Wire should extend 6 inches into the trench.

i) Attach continuous length of fabric to upslope side of fence posts. Avoid joints, particularly at low points in the fence line. Where joints are necessary, fasten fabric securely to support posts and overlap to the next post.

j) Place the bottom one foot of fabric in the trench. Backfill with compacted earth or gravel.

k) Filter cloth shall be fastened securely to the woven wire fence with ties spaced every 24 inches at the top, mid-section, and bottom.

l) Sediment fences should be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized through one growing season and only following approval by the Engineering Department or their representative. Retained sediment must be removed and properly disposed of, or mulched and seeded.

Sediment Fence Inspection/Maintenance *

e) Silt fences should be inspected immediately after each rainfall event of 1-inch or greater, and at least daily during prolonged rainfall. Inspect the depth of sediment, fabric tears, if the fabric is securely attached to the fence posts, and to see that the fence posts are firmly in the ground. Repair or replace as necessary.

f) Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the fence. Sediment will be removed from behind the sediment fence when it becomes about ½ foot deep at the fence. Take care to avoid undermining fence during cleanout.

g) If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.

h) Remove all fencing materials after the contributing drainage area has been properly stabilized. Sediment deposits remaining after the fabric has been removed should be graded to conform to the existing topography and vegetation.

3) **Stabilized Construction Entrance** – A stabilized construction entrance will be placed at the proposed entrance at Pond Street. The construction entrance will keep mud and sediment from being tracked off the construction site onto Pond Street by vehicles leaving the site. The stabilized construction entrance will be installed immediately after the clear and grubbing of the roadway entrance and associated roadway fill to maintain access to the site are completed. The stormwater runoff from the entrance will be diverted to a temporary sedimentation basin.

Construction Entrance Design/Construction Requirements *

a) Grade foundation for positive drainage towards the temporary sedimentation basin.

b) Stone for a stabilized construction entrance shall consist of 1 to 3-inch stone placed on a stable foundation.

c) Pad dimensions: The minimum length of the gravel pad should be 50 feet. The pad should extend the full width of the proposed roadway, or wide enough so that the largest construction vehicle will fit in the entrance with room to spare; whichever is greater.

d) A geotextile filter fabric shall be placed between the stone fill and the earth surface below the pad to reduce the migration of soil particles from the underlying soil into the stone and vice versa. The filter fabric should be Amoco woven polypropylene 1198 or equivalent.

e) Washing: If the site conditions are such that the majority of mud is not removed from the vehicle tires by the gravel pad, then the tires should be washed before the vehicle enters the street. The wash area shall be located at the stabilized construction entrance.

f) Water employed in the washing process shall be directed to the temporary sedimentation basin/dewatering area as shown on the plans prior to discharge. Sediment should be prevented from entering any watercourses.

<u>Construction Entrance Inspection/Maintenance *</u>

a) The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto Pond Street. This may require periodic topdressing with additional stone.

b) The construction entrance and sediment disposal area shall be inspected weekly and after heavy rains or heavy use.

c) Mud and sediment tracked or washed onto public road shall be immediately removed by sweeping.

d) Once mud and soil particles clog the voids in the gravel and the effectiveness of the gravel pad is no longer satisfactory, the pad must be topdressed with new stone. Replacement of the entire pad may be necessary when the pad becomes completely clogged.

e) If washing facilities are used, the temporary sedimentation basin/dewatering area should be cleaned out as often as necessary to assure that adequate trapping efficiency and storage volume is available. Any water pumped from the temporary sedimentation basin shall be directed into a sediment dirt bag or equivalent inlet protection prior to discharge. Discharge should not be across the disturbed construction site but rather to undisturbed areas.

f) The pad shall be reshaped as needed for drainage and runoff control.

g) Broken road pavement on Pond Street shall be repaired immediately.

h) All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed and only following approval by the Public Works Department or their representative. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal shall be permanently stabilized.

Stabilization Practices:

Stabilization measures shall be implemented as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased, with the following exceptions.

- Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures shall be initiated as soon as practicable.

- Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.

- The contractor shall provide erosion control measures around all soil stockpiles.

1) **Temporary Seeding** – Temporary seeding will allow a short-term vegetative cover on disturbed site areas that may be in danger of erosion. Temporary seeding will be done at stock piles and disturbed portions of the site where construction activity will temporarily cease for at least 21 days. The temporary seedings will stabilize cleared and unvegetated areas that will not be brought into final grade for several weeks or months.

Temporary Seeding Planting Procedures *

a) Planting should preferably be done between April 1st and June 30th, and September 1st through September 31st. If planting is done in the months of July and August, irrigation may be required. If planting is done between October 1st and March 31st, mulching should be applied immediately after planting. If seeding is done during the summer months, irrigation of some sort will probably be necessary.

b) Before seeding, install structural practice controls. Utilize Amoco supergro or equivalent.

c) Select the appropriate seed species for temporary cover from the following table.

Species	Seeding Rate (lbs/1,000 sq.ft.)	Seeding Rate (lbs/acre)	Recommended Seeding Dates	Seed Cover required

Annual Ryegrass	1	40	April 1st to June 1st August 15th to Sept. 15th	¼ inch
Foxtail Millet	0.7	30	May 1st to June 30th	½ to ¾ inch
Oats	2	80	April 1st to July 1st August 15th to Sept. 15th	1 to 1-½ inch
Winter Rye	3	120	August 15th to Oct. 15th	1 to 1-½ inch

Apply the seed uniformly by hydroseeding, broadcasting, or by hand.

d) Use effective mulch tacked and/or tied with netting to protect seedbed and encourage plant growth.

Temporary Seeding Inspection/Maintenance *

a) Inspect within 6 weeks of planting to see if stands are adequate. Check for damage within 24 hours of the end to a heavy rainfall, defined as a 2-year storm event (i.e., 3.2 inches of rainfall within a twenty-four hour period). Stands should be uniform and dense. Reseed and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary.

b) Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.

2) **Geotextiles** - Geotextiles such as jute netting will be used in combination with other practices such as mulching to stabilize slopes. The following geotextile materials or equivalent are to be utilized for structural and nonstructural controls as shown in the following table.

Practice	Manufacturer	Product	Remarks
Sediment Fence	Amoco	Woven polypropylene 1198 or equivalent	0.425 mm opening
Construction Entrance	Amoco	Woven polypropylene 2002 or equivalent	0.300 mm opening
Outlet Protection	Amoco	Nonwoven polypropylene 4551 or equivalent	0.150 mm opening
Erosion Control (slope stability)	Amoco	Supergro or equivalent	Erosion control revegetation mix, open polypropylene fiber on degradable polypropylene net scrim

Amoco may be reached at (800) 445-7732

Geotextile Installation

a) Netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

Geotextile Inspection/Maintenance *

a) In the field, regular inspections should be made to check for cracks, tears, or breaches in the fabric. The appropriate repairs should be made.

3) **Mulching and Netting** – Mulching will provide immediate protection to exposed soils during the period of short construction delays, or over winter months through the application of plant residues, or other suitable materials, to exposed soil areas. In areas, which have been seeded either for temporary or permanent cover, mulching should immediately follow seeding. On steep slopes, mulch must be supplemented with netting.

Mulch Maintenance *

a) Inspect after rainstorms to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, repair surface, reseed, remulch, and install new netting.

b) Grass mulches that blow or wash away should be repaired promptly.

c) If plastic netting is used to anchor mulch, care should be taken during initial mowings to keep the mower height high. Otherwise, the netting can wrap up on the mower blade shafts. After a period of time, the netting degrades and becomes less of a problem.

d) Continue inspections until vegetation is well established.

4) **Land Grading** – Grading on fill slopes, cut slopes, and stockpile areas will be done with full siltation controls in place.

Land Grading Design/Installation Requirements

a) Areas to be graded should be cleared and grubbed of all timber, logs, brush, rubbish, and vegetated matter that will interfere with the grading operation. Topsoil should be stripped and stockpiled for use on critical disturbed areas for establishment of vegetation. Cut slopes to be topsoiled should be thoroughly scarified to a minimum depth of 3-inches prior to placement of topsoil.

b) Fill materials should be generally free of brush, rubbish, rocks, and stumps. Frozen materials or soft and easily compressible materials should not be used in fills intended to support buildings, parking lots, roads, conduits, or other structures.

c) Earth fill intended to support structural measures should be compacted to a minimum of 90 percent of Standard Proctor Test density with proper moisture control, or as otherwise specified by the engineer responsible for the design. Compaction of other fills should be to the density required to control sloughing, erosion or excessive moisture content. Maximum thickness of fill layers prior to compaction should not exceed 9 inches.

d) The uppermost one foot of fill slopes should be compacted to at least 85 percent of the maximum unit weight (based on the modified AASHTO compaction test). This is usually accomplished by running heavy equipment over the fill.

e) Fill should consist of material from borrow areas and excess cut will be stockpiled in areas shown on the Site Plans. All disturbed areas should be free draining, left with a neat and finished appearance, and should be protected from erosion.

f) Infiltration basins shall be excavated, graded and shaped to subgrade elevation and shall then be suitably protected with installation of erosion control measures to prevent sediment-laden runoff from washing into the basins. The basins shall also be protected from heavy equipment activity from this point forward. Prior to application of loam and seed to infiltration basin surfaces, the contractor shall remove any unsuitable soil such as silt or clay that may have been deposited during construction. The surface shall be scarified with a York rake or other small tractor mounted equipment. The loam and seed shall then be applied as required by this document.

Land Grading Stabilization Inspection/Maintenance *

a) All slopes should be checked periodically to see that vegetation is in good condition. Any rills or damage from erosion and animal burrowing should be repaired immediately to avoid further damage.

b) If seeps develop on the slopes, the area should be evaluated to determine if the seep will cause an unstable condition. Subsurface drains or a gravel mulch may be required to solve seep problems. However, no seeps are anticipated.

c) Areas requiring revegetation should be repaired immediately. Control undesirable vegetation such as weeds and woody growth to avoid bank stability problems in the future.

5) **Topsoiling *** – Topsoiling will help establish vegetation on all disturbed areas throughout the site during the seeding process. The soil texture of the topsoil to be used will be a sandy loam to a silt loam texture with 15% to 20% organic content.

Topsoiling Placement

a) Topsoil should not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed seeding.

b) Do not place topsoil on slopes steeper than 2.5:1, as it will tend to erode.

c) If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method is to actually work the topsoil into the layer below for a depth of at least 6 inches.

6) **Permanent Seeding** – Permanent Seeding should be done immediately after the final design grades are achieved. Native species of plants should be used to establish perennial vegetative cover on disturbed areas. The revegetation should be

done early enough in the fall so that a good cover is established before cold weather comes and growth stops until the spring. A good cover is defined as vegetation covering 75 percent or more of the ground surface.

Permanent Seeding Seedbed Preparation

a) In infertile or coarse-textured subsoil, it is best to stockpile topsoil and re-spread it over the finished slope at a minimum 2 to 6-inch depth and roll it to provide a firm seedbed. The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content. If construction fill operations have left soil exposed with a loose, rough, or irregular surface, smooth with blade and roll.

b) Loosen the soil to a depth of 3-5 inches with suitable agricultural or construction equipment.

c) Areas not to receive topsoil shall be treated to firm the seedbed after incorporation of the lime and fertilizer so that it is depressed no more than ½ - 1 inch when stepped on with a shoe. Areas to receive topsoil shall not be firmed until after topsoiling and lime and fertilizer is applied and incorporated, at which time it shall be treated to firm the seedbed as described above.

Permanent Seeding Grass Selection/Application

a) Select an appropriate cool or warm season grass based on site conditions and seeding date. Apply the seed uniformly by hydro-seeding, broadcasting, or by hand. Uniform seed distribution is essential. On steep slopes, hydroseeding may be the most effective seeding method. Surface roughening is particularly important when preparing slopes for hydroseeding.

b) Lime and fertilize. Organic fertilizer shall be utilized in areas within the 100 foot buffer zone to a wetland resource area.

c) Mulch the seedings. Anchor the mulch with erosion control netting or fabric on sloping areas. Amoco supergro or equivalent should be utilized.

Permanent Seeding Inspection/Maintenance *

a) Frequently inspect seeded areas for failure and make necessary repairs and reseed immediately. Conduct or follow-up survey after one year and replace failed plants where necessary.

b) If vegetative cover is inadequate to prevent rill erosion, overseed and fertilize in accordance with soil test results.

c) If a stand has less than 40% cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand following seedbed preparation and seeding recommendations, omitting lime and fertilizer in the absence of soil test results. If the season prevents resowing, mulch or jute netting is an effective temporary cover.

d) Seeded areas should be fertilized during the second growing season. Lime and fertilize thereafter at periodic intervals, as needed.

Fueling and Maintenance of Equipment and Vehicles:

1. Refueling/maintenance Rules – The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. This document shall include language that shall permit the maintenance of vehicles only in designated locations on the job site. In the event of mechanical failure of a vehicle, the vehicle shall be moved to the designated maintenance area on the site to perform maintenance. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. Refueling for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

2. Installation Schedule: Prior to start of Work

3. Maintenance and Inspection: The site supervisor shall maintain a log of individuals receiving these instructions.

4. Specific Pollution Prevention Practices

   Pollution Prevention Practice # 1

   a. Description: Fueling operations shall take place in designated area(s) as shown on site maps. Provide temporary drip protection during fueling operations which take place outside of designated area(s). Materials necessary to address a spill shall be made readily available in a location known to the site supervisor or his/her designee.

   b. Installation: Fueling operation procedures shall be in effect throughout the project duration.

   c. Maintenance Requirements: All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

Dust Control:

Dust control will be utilized throughout the entire construction process of the site. For example, keeping disturbed surfaces moist during windy periods will be an effective control measure, especially for construction access roads. The use of dust control will prevent the movement of soil to offsite areas. However, care must be taken to not

create runoff from excessive use of water to control dust. The following are methods of Dust Control that may be used on-site:

- Vegetative Cover – The most practical method for disturbed areas not subject to traffic.
- Calcium Chloride – Calcium chloride may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage.
- Sprinkling – The site may be sprinkled until the surface is wet. Sprinkling will be effective for dust control on haul roads and other traffic routes.
- Stone – Stone will be used to stabilize construction roads; will also be effective for dust control.

The general contractor shall employ an on-site water vehicle for the control of dust as necessary.

Non-Stormwater Discharges:

The construction de-watering and all non-stormwater discharges will be directed into a sediment dirt bag (or equivalent inlet protection) or a sediment basin. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

The developer and site general contractor will comply with the E.P.A.'s Final General Permit for Construction De-watering Discharges, (N.P.D.E.S., Section 402 and 40 C.F.R. 122.26(b)(14)(x).

Soil Stockpiling:

Topsoil and subsoil from the driveway grading will be stockpiled in locations shown on the plans.

Stockpile Material Construction Procedure

1) Topsoil and subsoil that are stripped will be stockpiled for later distribution on disturbed areas.
2) The stockpiles will be located as shown on the plans. These locations will allow them to not interfere with work on the site.
3) Seed the stockpiles with a temporary erosion control mix if the stockpile is to remain undisturbed for more than 30 days. The stockpiles must be stable and the side slopes should not exceed 2:1.
4) Sediment Fence/Hay Bale Barrier erosion control measures should be placed surrounding each stockpile.
5) As needed, the stockpiled topsoil and subsoil are redistributed throughout the site.

Anticipated Construction Schedule:

To prevent excessive erosion and silting, the following construction sequence coupled with other widely accepted principals for reducing erosion and sedimentation shall be implemented in the development of the site.

1. Obtain all plan approvals and other applicable permits.
2. Flag the work limits and mark trees and buffer areas for protection.
3. Hold a pre-construction meeting prior to any construction activity.
4. Install stabilization practices for erosion and sediment control prior to commencing construction activities. Refer to "Erosion and Sedimentation Control Plan" and place siltation fence and haybale barriers at locations indicated on the site plans.
5. Clear and grub up as required for the construction of the addition and related infrastructure.
6. Construct stabilized construction entrance.
7. Excavate topsoil and subsoil from cut and fill areas and stockpile on site in locations shown on the plan. consideration should be given to locating stockpiles on the uphill side of disturbed areas, where possible, to act as temporary diversions.
8. Construct cut and fill areas, installing haybale check dams at toes of all 3:1 or greater slopes, and at ends of all cut areas. All fill will be installed using 12" maximum compaction lifts. Place all slope protection where indicated on the plan. the stormwater extended detention basin shall be constructed immediately after the addition rough grading is completed and the area has been cleared of vegetation.
9. Install closed drainage system and other utilities. All catch basins shall be covered with siltsack or equivalent inlet protection.
10. Grade parking area to subgrade elevation and construct side slopes. Apply temporary stabilization measures where warranted. Refer to "Erosion and Sedimentation Control Plan".
11. Place gravel subbase.
12. Place the bituminous concrete binder course on parking lot.
13. Grade slopes and stabilize cut areas at toe of slopes. blend all slopes into existing topography and loam and seed all disturbed areas. slopes greater than 3:1 shall be stabilized with jute mesh.
14. Place the final wearing course of pavement.
15. Complete fine grading of shoulders and place pavement in miscellaneous areas.
16. Remove temporary erosion control devices once adequate growth is established. adequate growth is defined as vegetation covering 75% or more of the ground surface.

Inspection/Maintenance:

Operator personnel must inspect the construction site at least once every 14 calendar days and within 24 hours of a storm event of ½-inch or greater. The applicant shall be responsible to secure the services of a design professional or similar professional (inspector) on an on-going basis throughout all phases of the project. Refer to the

Inspection/Maintenance Requirements presented earlier in the "Structural and Stabilization Practices." The inspector should review the erosion and sediment controls with respect to the following:

- Whether or not the measure was installed/performed correctly.
- Whether or not there has been damage to the measure since it was installed or performed.
- What should be done to correct any problems with the measure.

The inspector should complete the Stormwater Management Construction Phase BMP Inspection Schedule and Evaluation Checklist, as attached, for documenting the findings and should request the required maintenance or repair for the pollution prevention measures when the inspector finds that it is necessary for the measure to be effective. The inspector should notify the appropriate person to make the changes and submit copies of the form to the Randolph Highway Department.

Project Location: 300 Pond Street, Randolph, MA **Date:**
Stormwater Management – Construction Phase
Best Management Practices – Inspection Schedule and Evaluation Checklist

Construction Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed: (List Items)	Date of Cleaning/ Repair	Performed by
Silt Sock and Sediment Fence Controls	After heavy rainfall events (minimum weekly)			1. Sediment Fence Design/Installation Requirements 2. Sediment Fence Inspection/Maintenance	☐yes ☐no		
Stabilized Construction Entrance	After heavy rainfall events (minimum weekly)			1. Construction Entrance Design/ Construction Requirements 2. Construction Entrance Inspection/ Maintenance	☐yes ☐no		
Temporary Sedimentation Basins	After heavy rainfall events (minimum weekly)			1. Sediment Basin Inspection/ Maintenance	☐yes ☐no		
Temporary Seeding	After heavy rainfall events (minimum weekly)			1. Temporary Seeding Planting Procedures 2. Temporary Seeding Inspection/ Maintenance	☐yes ☐no		
Geotextiles	After heavy rainfall events (minimum weekly)			1. Geotextile Inspection/Maintenance	☐yes ☐no		
Mulching & Netting	After heavy rainfall events (minimum weekly)			1. Mulch Maintenance	☐yes ☐no		
Land Grading	After heavy rainfall events (minimum weekly)			1. Land Grading Stabilization Inspection/ Maintenance	☐yes ☐no		

Permanent Seeding	After heavy rainfall events (minimum weekly)			1. Permanent Seeding Inspection/ Maintenance	☐**yes** ☐**no**		
Dust Control	After heavy rainfall events (minimum weekly)				☐**yes** ☐**no**		
Soil Stockpiling	After heavy rainfall events (minimum weekly)				☐**yes** ☐**no**		

(1) Refer to the Massachusetts Stormwater Handbook issued January 2, 2008.

Notes (Include deviations from : Definitive Subdivision Decision and Special Conditions and Approved Plan):

Stormwater Control Manager _____

Spill Containment and Management Plan

December 20, 2023

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name)	Anthony Palaza Emerson – Swan Flexcon
Facility Manager (phone)	339-793-3196

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact:	Phone Number:
Fire Department:	911
Police Department:	911
Department of Public Works:	(781) 961-0940
Board of Health Phone:	(781) 961-0924
Conservation Commission Phone:	(781) 961-1519

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

HAZARDOUS WASTE / OIL SPILL REPORT

Date____/_____/_____ Time_____ AM / PM

Exact location (Transformer #)_____

Type of equipment_____Make_____Size_____

S / N_____Weather Conditions_____

On or near water ☐ Yes If yes, name of body of water_____
☐ No

Type of chemical / oil spilled_____

Amount of chemical / oil spilled_____

Cause of spill_____

_____

_____

Measures taken to contain or clean up spill_____

_____

_____

Amount of chemical / oil recovered_____Method_____

Material collected as a result of clean up

_____drums containing_____

_____drums containing_____

_____drums containing_____

Location and method of debris disposal_____

_____

Name and address of any person, firm, or corporation suffering damages_____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring____

_____

Spill reported to General Office by_____Time_____AM / PM

Spill reported to DEP / National Response Center by_____

DEP Date____/_____/_____ Time_____ AM / PM Inspector_____

NRC Date____/_____/_____ Time_____ AM / PM Inspector_____

Additional comments_____

_____

_____

EMERGENCY RESPONSE EQUIPMENT
INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	5
--	SPEEDI-DRI ABSORBENT	2 – 40LB BAGS
--	12” INFLATABLE PIPE PLUG	1
--	SQUARE END SHOVELS	1
--	PRY BAR	1
--	CATCH BASIN COVER	1

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
   NAME: Anthony Palaza ____ BEEPER: _____
   PHONE: 339-793-3196 _____ CELL PHONE: _____

   ALTERNATE:
   NAME: _____ BEEPER: N/A _____
   PHONE: 781-986-2424 _____ CEL PHONE: N/A _____

2. FIRE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (781) 963-3131

   POLICE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (781) 963-1212

   DEPARTMENT OF PUBLIC WORKS
   CONTACT: Paul Scott
   BUSINESS: (781) 961-0940
   ALTERNATE:

   CONSERVATION COMMISSION
   CONTACT: Joe Dunn
   BUSINESS: (781) 961-1519

   BOARD OF HEALTH
   CONTACT: Gerard Cody
   BUSINESS: (781) 961-0924

3. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
   EMERGENCY: (978) 694-3200
   SOUTHEAST REGION - LAKEVILLE OFFICE: (508) 946-2700

4. NATIONAL RESPONSE CENTER
   PHONE: (800) 424-8802

   ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY
   EMERGENCY: (617) 223-7265
   BUSINESS: (617) 860-4300

POST-DEVELOPMENT BEST MANAGEMENT PRACTICE
OPERATION AND MAINTENANCE PLAN & LONG-TERM POLLUTION PREVENTION PLAN

for

Site Development Plan
(Assessor's Parcel Number 3-O-2.1)
300 Pond Street
Randolph, Massachusetts

Submitted to:

TOWN OF RANDOLPH

Prepared for:

Emerson – Swan Flexcon
300 Pond Street, Randolph, MA 02368

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

April 26, 2024

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Operation and Maintenance Plan &
Long-Term Pollution Prevention Plan

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

Responsible Party/Property Owner/Developer contact information:

Property Owner: Emerson – Swan Flexcon
300 Pond Street
Randolph, MA 02368
Phone: (339) 793-3196

Developer Contact Information:

Emerson – Swan Flexcon
Anthony Palaza, Manager
300 Pond Street
Randolph, MA 02368
Phone: (339) 793-3196

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:

- Paved areas maintenance
- Subsurface detention system
- Restrictions on the use of pesticides and herbicides within the 100-foot buffer zone
- Snow removal
- Drainage weir manhole
- Bioretention Area/Rain garden

Operation:

Once the stormwater management systems and roof leaders have been constructed, the operation of the stormwater management system will function as intended. Clean stormwater runoff from the proposed building addition will be conveyed to the subsurface detention system and the bioretention area. The stormwater management systems have been designed to attenuate peak flows for the 2-year through 100-year storm events.

Maintenance:

1. **Paved Areas** –Sweepers shall sweep paved areas periodically during dry weather to remove excess sediments and to reduce the amount of sediments that the drainage

system shall have to remove from the runoff. The sweeping shall be conducted primarily between March 15th and November 15th. Special attention should be made to sweeping paved surfaces in March and April before spring rains wash residual sand into the drainage system.

The frequency of sweeping shall average:

- Monthly if by a high-efficiency vacuum sweeper
- Bi-weekly if by a regenerative air sweeper
- Weekly if by a mechanical sweeper

Salt used for de-icing on the parking lot during winter months shall be limited as much as possible as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities.

Cost: The property owner should consult local sweeping contractors for detailed cost estimates.

2. **Subsurface Detention System** – Proper maintenance of the subsurface detention system is essential to the long-term effectiveness. The subsurface detention system shall have inspection ports and additional inspections should be scheduled during the first few months to ensure proper stabilization and function. Thereafter, they shall be checked semiannually and following heavy rainfalls, defined as a 1-year storm event exceeding 2.5 inches of rainfall within a twenty-four-hour period. Water levels in the chambers shall be checked to verify proper drainage. If water remains within the chambers after 48-hours following a storm event, steps to restore the outlet function shall be taken, as directed by a qualified stormwater management professional. Sediment and material removed from the system shall be disposed of in accordance with all applicable local, state, and federal regulations. Please refer to the Manufacturer's Manual for additional detail on proper inspection and maintenance of the subsurface detention system.

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

3. **Pesticides, Herbicides, and Fertilizers -** Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.

   All structural BMP's as identified on the site plans will be owned and maintained by the property owner of the development and shall run with the title of the property.

   Cost: Included in the routine landscaping maintenance schedule. The Owner should consult local landscaping contractors for details.

4. **Snow Removal -** Snow accumulations removed from driveway and parking areas should be placed in upland areas only, where sand and other debris will remain after snowmelt for later removal. Excess snow should be removed from the site and properly disposed of in an approved snow disposal facility. Care must be exercised not to deposit snow in the following areas: in the rain gardens, bioswales, and where sand and debris can get into the watercourse.

   Cost: The owner should consult local snow removal contractors for a detailed cost estimate.

5. **Bioretention Area/Rain Garden** –Proper maintenance of the bioretention area is essential to the long-term effectiveness of the infiltration function. The rain garden shall be inspected monthly and additional inspections should be scheduled during the first few months to ensure proper stabilization and function. Thereafter, they shall be checked semiannually and following heavy rainfalls. Water levels in the bioretention area shall be checked to verify proper drainage. Ponding water in the bioretention area indicates failure from the bottom. If water remains within the bioretention area after 48-hours following a storm event, steps to restore the infiltration function shall be taken, as directed by a qualified stormwater management professional. In order to rectify the problem, accumulated sediment must be removed from the bottom of the bioretention area. The soil media and mulch must be removed and replaced and the underlying soil layer must be scarified to encourage proper infiltration. Material removed from the system shall be disposed of in accordance with all applicable local, state, and federal regulations. Soil media and hardwood mulch layers of the bioretention area shall be maintained annually. Maintenance shall include inspecting and replacing the hardwood mulch layer and soil media as necessary. Any accumulated debris, leaves, sediment and trash shall be removed from the hardwood mulch and soil media layers of the rain garden in order to encourage proper infiltration.

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

6. **Outlet Protection** - All outfall protection structures shall be inspected quarterly and following major storm events defined as a storm event exceeding one inch of rainfall within a twenty-four-hour period to check for signs for erosion. Any necessary repairs shall be performed promptly and cleaned to remove accumulated sediment as necessary. Material removed shall be disposed of in accordance with all applicable local, state, and federal regulations. Rip-Rap overflow structure shall be weeded and cleaned on a quarterly basis to ensure that water overflowing the spillway will not become obstructed by debris.

7. **Drainage Weir Manhole –** Drainage weir manhole shall be checked quarterly and following heavy rainfalls to verify that the weir openings are not clogged by debris. Debris shall be removed from the structure and disposed of properly. Drainage weir manhole shall be inspected and cleaned bi-annually of all accumulated sediments. Material shall be removed from the Drainage weir manhole and disposed of in accordance with all applicable regulations.

   Cost: Estimated $50 - $100 per cleaning as needed. The property owner should consult local vacuum cleaning contractors for detailed cost estimates.

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.

Long-Term Pollution Prevention Plan

Good Housekeeping:

To develop and implement an operation and maintenance program with the goal of preventing or reducing pollutant runoff by keeping potential pollutants from coming into contact with stormwater or being transported off site without treatment, the following efforts will be made:

- Property Management awareness and training on how to incorporate pollution prevention techniques into maintenance operations.
- Follow appropriate best management practices (BMPs) by proper maintenance and inspection procedures.

Storage and Disposal of Household Waste and Toxics:

This management measure involves educating the general public on the management considerations for hazardous materials. Failure to properly store hazardous materials dramatically increases the probability that they will end up in local waterways. Many people have hazardous chemicals stored throughout their homes, especially in garages and storage sheds. Practices such as covering hazardous materials or even storing them properly, can have dramatic impacts. Property owners are encouraged to support the household hazardous product collection events sponsored by the Town of Randolph.

MADEP has prepared several materials for homeowners on how to properly use and dispose of household hazardous materials:

http://www.mass.gov/dep/recycle/reduce/househol.htm

For consumer questions on household hazardous waste call the following number:

DEP Household Hazardous Waste Hotline 800-343-3420

The following is a list of management considerations for hazardous materials as outlined by the EPA:

- Ensuring sufficient aisle space to provide access for inspections and to improve the ease of material transport;
- Storing materials well away from high-traffic areas to reduce the likelihood of accidents that might cause spills or damage to drums, bags, or containers.
- Stacking containers in accordance with the manufacturers' directions to avoid damaging the container or the product itself;
- Storing containers on pallets or equivalent structures. This facilitates inspection for leaks and prevents the containers from coming into contact with wet floors, which can cause corrosion. This consideration also reduces the incidence of damage by pests.

The following is a list of commonly used hazardous materials used in the household:

Batteries – automotive and rechargeable
.....nickel cadmium batteries
.....(no alkaline batteries)
Disinfectant
Drain clog dissolvers
Driveway sealer

Gasoline
Oil-based paints
Fluorescent light bulbs and lamps
Pool chemicals
Propane tanks
Lawn chemicals,
fertilizers and weed killers
Turpentine
Bug sprays
Antifreeze
Paint thinners, strippers, varnishes and stains
Arts and crafts chemicals
Charcoal lighter fluid
Flea dips, sprays and collars
Houseplant insecticides
Metal polishes
Mothballs
Motor oil and filters
Muriatic acid (concrete cleaner)
Nail polishes and nail polish removers
Oven cleaner
Household pest and rat poisons
Rug and upholstery cleaners
Shoe polish
Windshield wiper fluid

Vehicle Washing:

This management measure involves educating the general public on the water quality impacts of the outdoor washing of automobiles and how to avoid allowing polluted runoff to enter the storm drain system. Outdoor car washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions in many watersheds, as the detergent-rich water used to wash the grime off our cars flows down the street and into the storm drain. The following management practices will be encouraged:

- Washing cars on gravel, grass, or other permeable surfaces.
- Blocking off the storm drain during car washing and redirecting wash water onto grass or landscaping to provide filtration.
- Using hoses with nozzles that automatically turn off when left unattended.
- Using only biodegradable soaps.
- Minimize the amounts of soap and water used. Wash cars less frequently.
- Promote use of commercial car wash services.

Landscape Maintenance:

This management measure seeks to control the storm water impacts of landscaping and lawn care practices through education and outreach on methods that reduce nutrient loadings and the amount of storm water runoff generated from lawns. Nutrient loads generated by fertilizer use on suburban lawns can be significant, and recent research has shown that lawns produce more surface runoff than previously thought.

Using proper landscaping techniques can effectively increase the value of a property while benefiting the environment. These practices can benefit the environment by reducing water use; decreasing energy use (because less water pumping and treatment is required); minimizing runoff of storm and irrigation water that transports soils, fertilizers, and pesticides; and creating additional habitat for plants and wildlife. The following lawn and landscaping management practices will be encouraged:

- Mow lawns at the highest recommended height.
- Minimize lawn size and maintain existing native vegetation.
- Collect rainwater for landscaping/gardening needs (rain barrels and cisterns to capture roof runoff).
- Raise public awareness for promoting the water efficient maintenance practices by informing users of water efficient irrigation techniques and other innovative approaches to water conservation.
- Abide by water restrictions and other conservation measures implemented by the Town of Randolph.
- Water only when necessary.
- Use automatic irrigation systems to reduce water use.

Integrated Pest Management (IPM):

This management measure seeks to limit the adverse impacts of insecticides and herbicides by providing information on alternative pest control techniques other than chemicals or explaining how to determine the correct dosages needed to manage pests.

The presence of pesticides in stormwater runoff has a direct impact on the health of aquatic organisms and can present a threat to humans through contamination of drinking water supplies. The pesticides of greatest concern are insecticides, such as diazinon and chloropyrifos, which even at very low levels can be harmful to aquatic life. The major source of pesticides to urban steams is home application of products designed to kill insects and weeds in the lawn and garden. The following IPM practices will be encouraged:

- Lawn care and landscaping management programs including appropriate pesticide use management as part of program.
- Raise public awareness by referring homeowners to "A Homeowner's Guide to Environmentally Sound Lawncare, Maintaining a Healthy Lawn the IPM Way", Massachusetts Department of Food and Agriculture, Pesticide Bureau or link **http://www.mass.gov/dep/water/resources/nonpoint.htm#megaman>**

Pet Waste Management:

Pet waste management involves using a combination of pet waste collection programs, pet awareness and education, to alert residents to the proper disposal techniques for pet droppings. The following management practices will be encouraged:

- Raise awareness of homeowners that are also pet owners that they are encouraged to pick up after their pets and dispose of the waste either in the trash, including on their own lawns and walking trails.
- Provide signage along walking trails.

Proper Management of Deicing Chemicals and Snow:

Roadways shall be maintained by the Developer/Property Owners. The following deicing chemicals and snow storage practices will be encouraged:

- Select effective snow disposal sites adjacent to or on pervious surfaces in upland areas away from water resources and wells. At these locations, the snow meltwater can filter in to the soil, leaving behind sand and debris, which can be removed in the springtime.
- No roadway deicing materials shall be stockpiled on site unless all storage areas are protected from exposure to rain, snow, snowmelt and runoff.
- Avoid dumping snow into any waterbody, including wetlands, cranberry bogs, detention/infiltration basins, and grassed swales/channels.
- Avoid disposing of snow on top of storm drain catch basins.

Project Location: 300 Pond Street, Randolph, 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
Street Sweeping Maintenance	4-times annually - specifically in Spring and Fall			1. Sediment build-up 2. Trash and debris 3. Minor Spills (vehicular)			
Subsurface Detention System	After heavy rainfall events (minimum semi-annually)			1. Sediment build-up 2. Standing water greater than 48 hours			
Outlet Protection	After heavy rainfall events (minimum quarterly)			1. Sediment build-up 2. Trash and debris 3. Displacement of rip-rap 4. Excess Vegetation			
Bioretention Area	After heavy rainfall events (minimum monthly, cleaned quarterly)			1. Sediment build-up 2. Standing water greater than 48 hours 3. Remove/replace dead vegetation 4. Trash and debris			
Drainage Weir Manhole	After heavy rainfall events (minimum quarterly)			1. Sediment levels exceed 8” 2. Trash and debris 3. Floatable oils or hydrocarbons 4. Weir or outlet blockages			

(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:

Spill Containment and Management Plan

December 20, 2023

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name)	Anthony Palaza Emerson – Swan Flexcon
Facility Manager (phone)	339-793-3196

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact:	Phone Number:
Fire Department:	911
Police Department:	911
Department of Public Works:	(781) 961-0940
Board of Health Phone:	(781) 961-0924
Conservation Commission Phone:	(781) 961-1519

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

HAZARDOUS WASTE / OIL SPILL REPORT

Date____/_____/_____ Time_____ AM / PM

Exact location (Transformer #)_____

Type of equipment_____Make_____Size_____

S / N_____Weather Conditions_____

On or near water ☐ Yes If yes, name of body of water_____
☐ No

Type of chemical / oil spilled_____

Amount of chemical / oil spilled_____

Cause of spill_____

_____

_____

Measures taken to contain or clean up spill_____

_____

_____

Amount of chemical / oil recovered_____Method_____

Material collected as a result of clean up

_____drums containing_____

_____drums containing_____

_____drums containing_____

Location and method of debris disposal_____

_____

Name and address of any person, firm, or corporation suffering damages_____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring____

_____

Spill reported to General Office by_____Time_____AM / PM

Spill reported to DEP / National Response Center by_____

DEP Date____/_____/_____ Time_____ AM / PM Inspector_____

NRC Date____/_____/_____ Time_____ AM / PM Inspector_____

Additional comments_____

_____

_____

EMERGENCY RESPONSE EQUIPMENT
INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	5
--	SPEEDI-DRI ABSORBENT	2 – 40LB BAGS
--	12” INFLATABLE PIPE PLUG	1
--	SQUARE END SHOVELS	1
--	PRY BAR	1
--	CATCH BASIN COVER	1

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
   NAME: Anthony Palaza ____ BEEPER: _____
   PHONE: 339-793-3196 _____ CELL PHONE: _____

   ALTERNATE:
   NAME: _____ BEEPER: N/A _____
   PHONE: 781-986-2424 _____ CEL PHONE: N/A _____

2. FIRE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (781) 963-3131

   POLICE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (781) 963-1212

   DEPARTMENT OF PUBLIC WORKS
   CONTACT: Paul Scott
   BUSINESS: (781) 961-0940
   ALTERNATE:

   CONSERVATION COMMISSION
   CONTACT: Joe Dunn
   BUSINESS: (781) 961-1519

   BOARD OF HEALTH
   CONTACT: Gerard Cody
   BUSINESS: (781) 961-0924

3. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
   EMERGENCY: (978) 694-3200
   SOUTHEAST REGION - LAKEVILLE OFFICE: (508) 946-2700

4. NATIONAL RESPONSE CENTER
   PHONE: (800) 424-8802

   ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY
   EMERGENCY: (617) 223-7265
   BUSINESS: (617) 860-4300