Merrill
Engineers and Land Surveyors

October 16, 2023

Stormwater Management Report

Town of Hanover

#2053, 2055, 2057 & 2103 Washington Street

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Definitive Site Plan
Merchant's Row Expansion
#2053, 2055, 2057 & 2103 Washington Street
Hanover, Massachusetts

October 16, 2023

STORMWATER MANAGEMENT REPORT AND HYDROLOGIC-HYDRAULIC ANALYSIS

Project Summary

The project proponent, 2103 Washington Street LLC, proposed to redevelop the existing 0.79± acre parcel of land at 2103 Washington Street, on the corner abutting Washington and Webster Street. The scope of this project includes razing of the existing commercial use building and parking lot, and construction of the proposed retail and bank building, parking lot space, sidewalks, landscaping areas, stormwater management facilities, site utilities, and associated infrastructure. The proposed building will have a gross floor area of 7,500 SF, with 45 parking spaces associated on site. The existing driveway curb cuts along Washington and Webster Streets will be closed and access will be established from the abutting Merchant's Row development.

The locus property has a parcel identification of Map 5, Lot 16, per the Hanover assessors tax maps. The property is located within the Commercial Zoning District, with Adult Use, Medical Marijuana, and Telecommunications District Overlays. Abutting areas include Merchants Row (2053, 2055, 2057 Washington Street), Webster Street, and Washington Street. Refer to the USGS Locus Map from **Figure 1** for site location. The FEMA Flood Map located in **Figure 2** of this report indicates that the site is located within a Zone "X" of the Flood Insurance Rate Map, as shown in the Community Map No. 25023C0111k, with an effective date of July 6, 2021, and is not in a special flood hazard area. According to Massachusetts GIS information, 2103 Washington Street has no wetland resources or associated buffers.

Hydrologic Methodology

To compute stormwater runoff flow rates, and compute the proposed drainage requirements, HydroCAD® software was used, with guidance using the SCS TR-20 runoff method, and a Type III 24 HR storm model. This software was used to model existing and proposed subcatchment runoff data for 2103 Washington Street. Sketches of the existing and proposed watershed areas with HydroCAD® reports can be found in Appendices A & B respectively.

Existing Site Conditions

The existing commercial building on the locus property was built in the year 1900 and has a building footprint area of approximately 5,192 SF with multiple accessory porches and decks. Most of the lot area is covered by pavement for parking spaces and site driveways. There are sidewalks on Washington Street abutting the property. The topographic slopes range from approximately 0-3% for a majority of the site. This can be considered a relatively flat site with gentle sloping. There are areas of landscaping located on the northeast and southeast sides of the lot, and on the western face of the building.

Soil test holes were performed by Merrill Engineers and Land Surveyors on April 13, 2023. The test hole results show that most of the soil observed was classified as either fill material or sandy loam. Fill material cannot be identified by the National Resources Conservation Service (NRCS) for a hydrologic soil group, but Sandy Loam is classified as group B soil. Additional information for NRCS identified soils and test hole information can be found in **Figure 3** or **Appendix E** – Soil Testing Results.

There are currently no stormwater Best Management Practices (BMP) implemented on the site, but there are catch basins abutting the property on Washington Street, Webster Street, and on the northeast face of the lot line. This would imply that nearly all stormwater runoff will flow into the abuttting right of ways stormwater management systems. The total runoff for the existing conditions hydrologic analysis will be called Design Point 1 or (DP1-E).

Proposed Site Conditions

The proposed layout and drainage facilities for this project will provide the opportunity for stormwater management improvements on this site in terms of recharge and water quality. Runoff from the building rooftop and parking lot will respectively flow into roofdrains and catchbasins. Nearly all stormwater runofff from the site will flow through First Defense Units for pretreatment purposes, then into 2 Stormtech infiltration chamber systems (IC-A, IC-B) installed below the proposed parking lot. The model for these Stormtech systems will be SC-740 with end caps. Infiltration chamber system 1 (IC-A) will consist on 2 chamber systems tied in together to maximim treatement volume and will be installed in the Western area of the lot. Infiltration chamber system 2 (IC-B) will consist of 1 chamber system to be installed on the Northeastern part of the lot. Runoff from the landcape abutting the Washington Street and Webster Street areas will flow into existing catchbasins out of the project lot. Runoff flowing off site will be drastically decreased from the existing conditions due to the new proposed stormwater management systems, which will provide a substantial volume for stormwater flow to recharge into the ground, and be properly treated to remove various contaminants such as sediment and grease. Stormwater management systems were designed to be in compliance with the DEP Stormwater Management Regulations (SMR) to the best extent possible.

Compliance with stormwater Mangement Standards

Standard 1- No New Untreated Discharges

There will be no untreated discharges eroding wetland areas. All stormwater flow will either be captured and infiltrate the ground via infiltration chambers, or will be captured in abutting stormwater management systems.

Standard 2- Peak Rate Attenuation

Peak Rates of runoff were calculated by using the SCS TR-20 methodology developed by the NRCS computer based program, HydroCAD (refer to appendices A & B) for a type III 24 hr storm, with runnoff flow rates taken from the "Extreme Precipitation in New York & New England" for 2-year, 10-year, 25 year, and 100 year storm events. As the proposed project scope will entail a larger building, with a parking lot providing adequate parking and driveway entry points connecting to existing abutting properties, the resulting proposed watershed area is approximately 875 SF larger than the existing watershed area. Also, the impervious area for the proposed watershed will increase by approximately 999 SF. Although the increase in watershed size and impervious results in a slightly higher runoff flow rate for the new watershed plan, proposed pre-treatment devices and infiltration chambers will allow stormwater runoff from the site to collect in the respective system, treated and infiltrate into the soil to the best extent possible.

The existing watershed data has Flow moving off site, mostly to Washington Street & Webster Street. This flow path is labeled as Design Pont 1 (DP1-E). The proposed watershed data has flow going to DP-1, as well as 2 underground infiltration chamber systems labeled IC-A and IC-B on the proposed watershed plan. Stormwater drainage facilities were designed based on known specifications, following Massahusetts DEP stormwater guidelines. The following is a summary of pre- and post-contruction rates of runoff:

	Peak Rates of Runoff	
	Design point 1 (DP-1)	
	EXISTING (cfs)	PROPOSED (cfs)
2-YR	2.38	0.04
10-YR	3.86	0.15
25-YR	5.00	0.25
100-YR	7.29	0.48

Standard 3- Groundwater Recharge

Runoff will be infiltrated via Stormtech model SC-740 Infiltration chambers. The bottom of the infiltration chamber systems will be 2 feet above the estimated seasonal high groundwater table based on in field soil surveys. The hydraulic conductivity used in the stormwater design was based on soil conditions found on the site via soil testing, which provided an infiltration rate for site soils based on Rawls Rates; values developed by Rawls, Brakensiek, and Saxton, 1982. The soil composition used in this design was sandy loam, with a relative infiltration rate of 1.02 in/hr. Evidence of sandy loam was found on site during soil testing, and near the site in the NRCS web soil survey. Through knowledge of site soils and proposed drainage, recharge volume and drawdown times were calculated to be adequate to meet this standard in the Massacgusetts Sotrmwater handbook. Please refer to **Appendix E** for further information regarding the soil testing and site soil data as well as **Appendix C** for recharge volume, and drawdown time calculations.

Standard 4 - Water Quality

A Long Term Pollution Prevention Plan has been incorporated into the Operations and Maintenance Plan. Refer to **Appendix D** for BMP Operation and Maintenance Plans. The water quality volume was calculated using the 1 inch rule. The total reequired water quality treatement volume was calculated as 2,664 cubic feet. The proposed water quality treatment provided within the subsurface infiltration chambers is approximately 16,561 cubic feet. Refer to Appendix E for required water quality calculations.

Total Suspended Solids (TSS) calculations were completed in acordance with the guidelines of the Stormwater Management policy by using the MassDEP Removal Calculations Excel sheet. Calculations for each treatment train in the proposed project resulted in a TSS removal rate of 80% or greater, which complies with required removal rates. Treatment trains consist of a first defense pretreament inlet units to subsurface infiltration chambers with a TSS removal rate of 92%. To see TSS removal calculations refer to **Appendix C**.

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

The overall Merchant's Row development including the project site does include land uses with higher potential pollutant loads as the existing retail and restaurant uses will likely generate more than 1,000 trips per day. The one-inch rule has been utilized in the water quality volume calculations and pretreatment units with grease and oil containment have been provided.

Standard 6 – Critical Areas

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

Standard 7 – Redevelopment and Other Projects Subject to the Standards only to the maximum extent practicable.

The project site is currently developed with an existing building and parking lot. The proposed project details include the razing and redevelopment of a building on site, which will contain more

gross floor space than the existing building. There will be improvements to the parking lot, drainage facilities, site grading, landscaping, and utilites. This proposed project is considered a Redevlopment Project and has met the standards to the extent practicable.

Standard 8 – Construction perioid Pollutions prevention and Erosion and Sedimentation Control

Silt Socks will be placed along the limit of work as erosion control barriers prior to commencement of any construction activity. A Construction Operation and Maintenance Plan and Construction Pollution Prevention Plan are provided in **Appendix D.** Refer to the Site Plan constrcution details for erosion control details.

Standard 9 – Operation and Maintenance Plan

The Long Term Operation and Maintenance Plan / Pollution Prevention Plan is also provided within **Appendix D**.

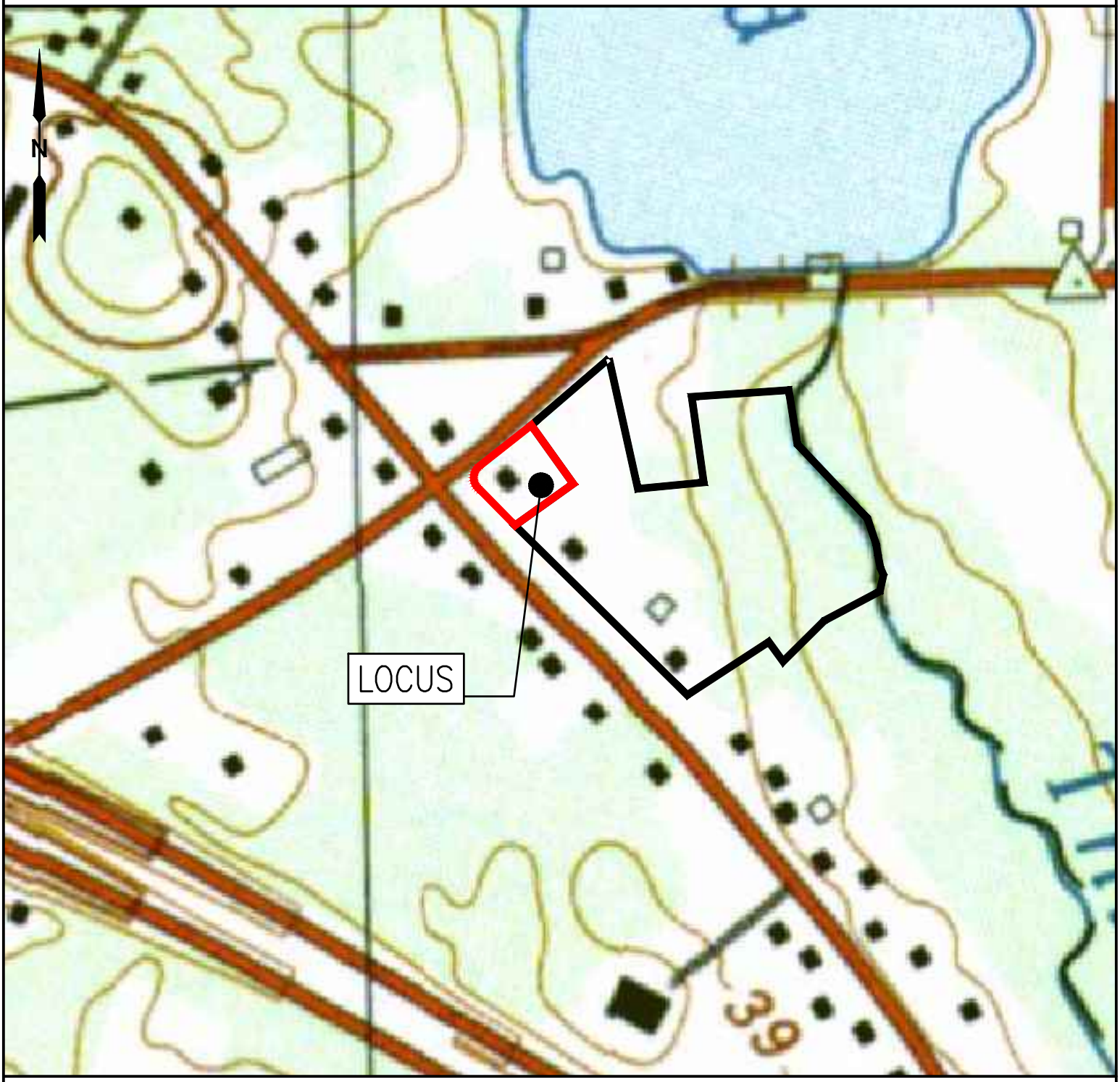
Standard 10 – Prohibition of Illicit Discharges

No illicit discharges are anticipated on site. Measures to prvenet illicit discharges are included in the Long-Term Operation and Maintenance / Pollution Prevenetion Plan referenced in **Appendix D.**

Figures

FIGURE 1

USGS LOCUS MAP



2103 WASHINGTON STREET, HANOVER, MA

Merrill
Engineers and Land Surveyors

N

427 Columbia Road
Hanover, MA 02339
781-826-9200

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CLIENT:

2103 WASHINGTON STREET LLC
552 ADAMS STREET
MILTON, MA, 02186

MERRILL PROJECT #:	22-188
SCALE:	NOT TO SCALE
DATE:	09/25/2023
DRAWN BY:	NC

FIGURE 2

FEMA FLOOD INSURANCE RATE MAP

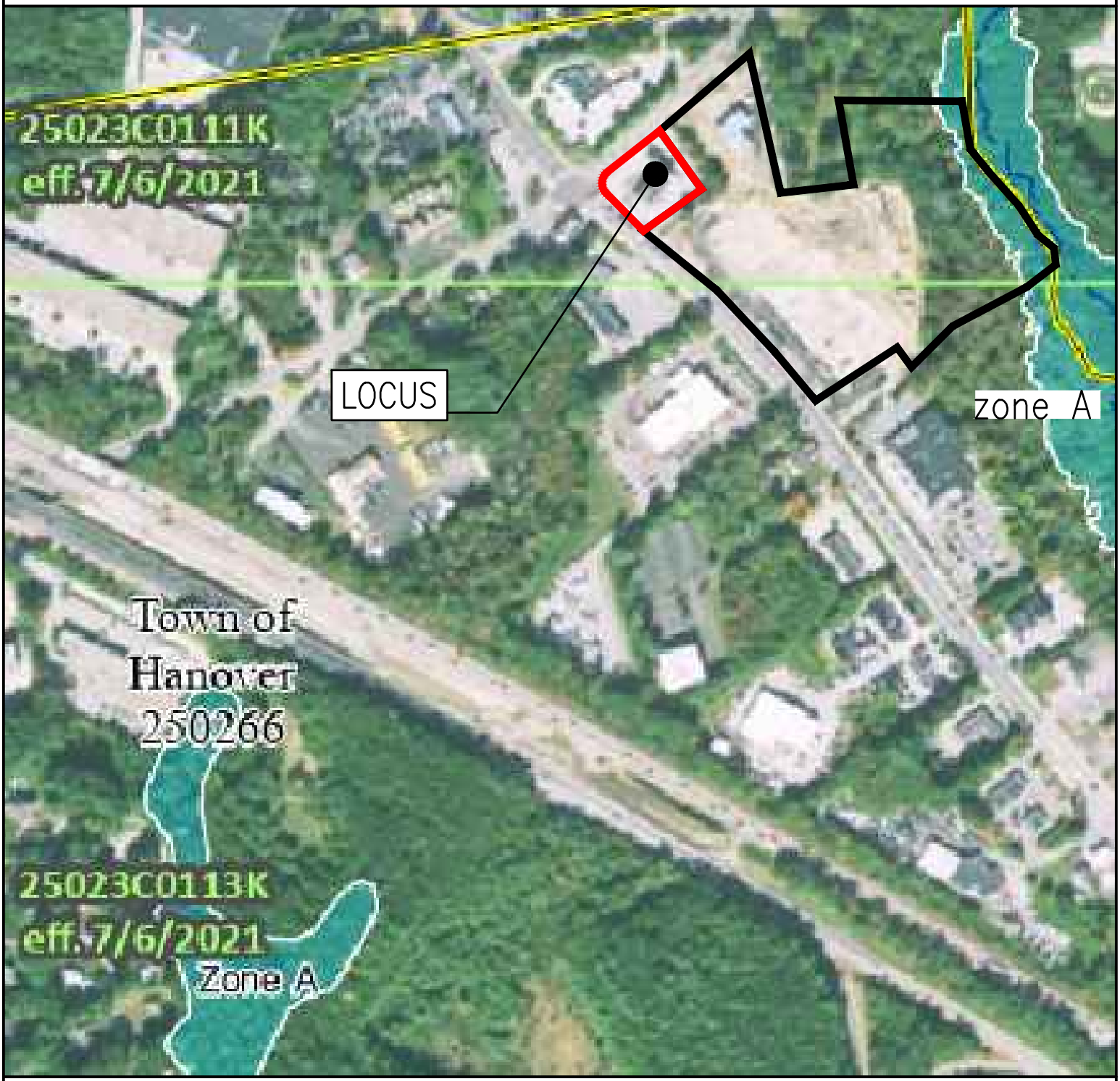

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FIGURE 3

NRCS SOILS MAP

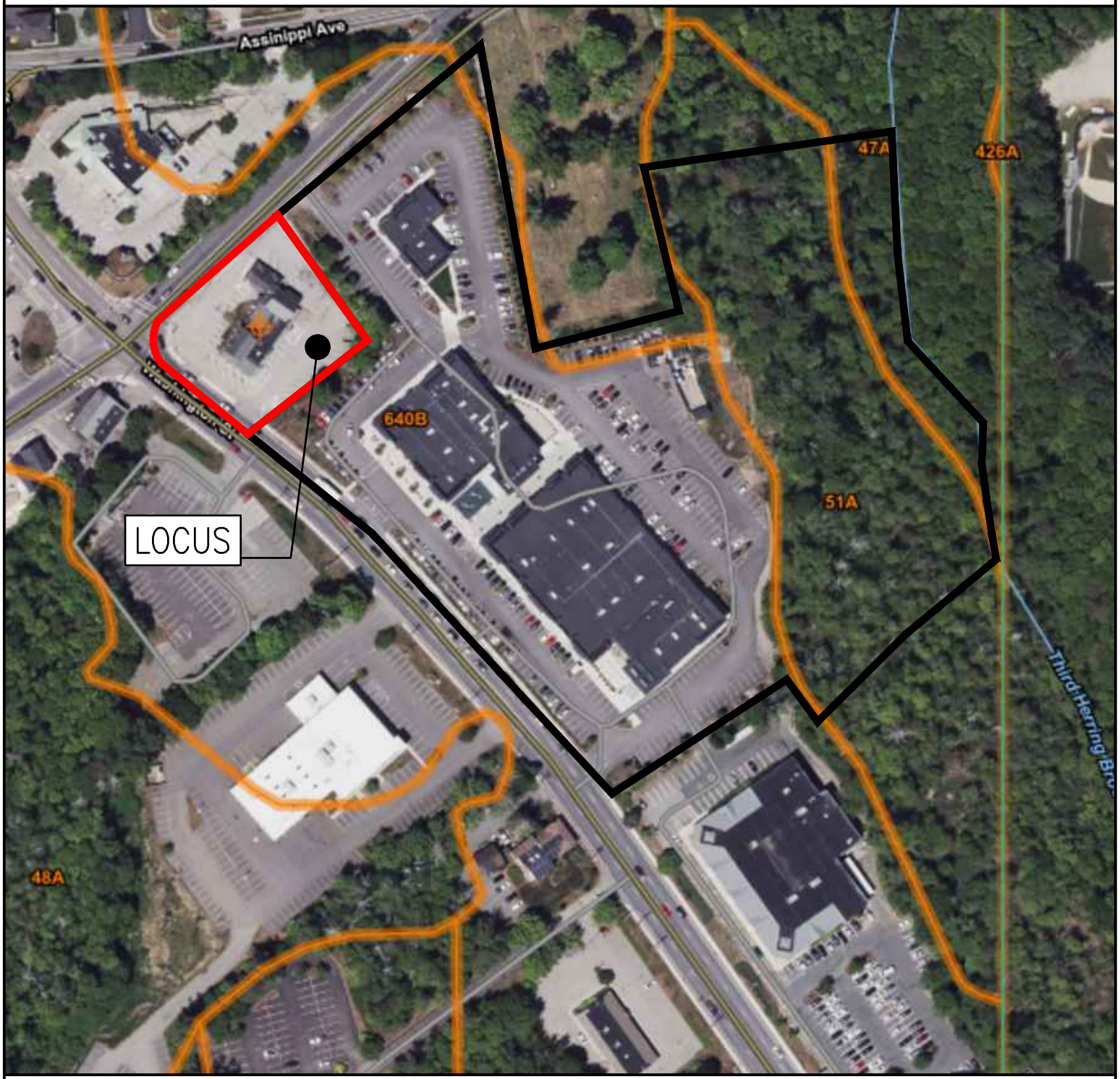

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FIGURE 4

2021 AERIAL IMAGERY

2103 WASHINGTON STREET, HANOVER, MA

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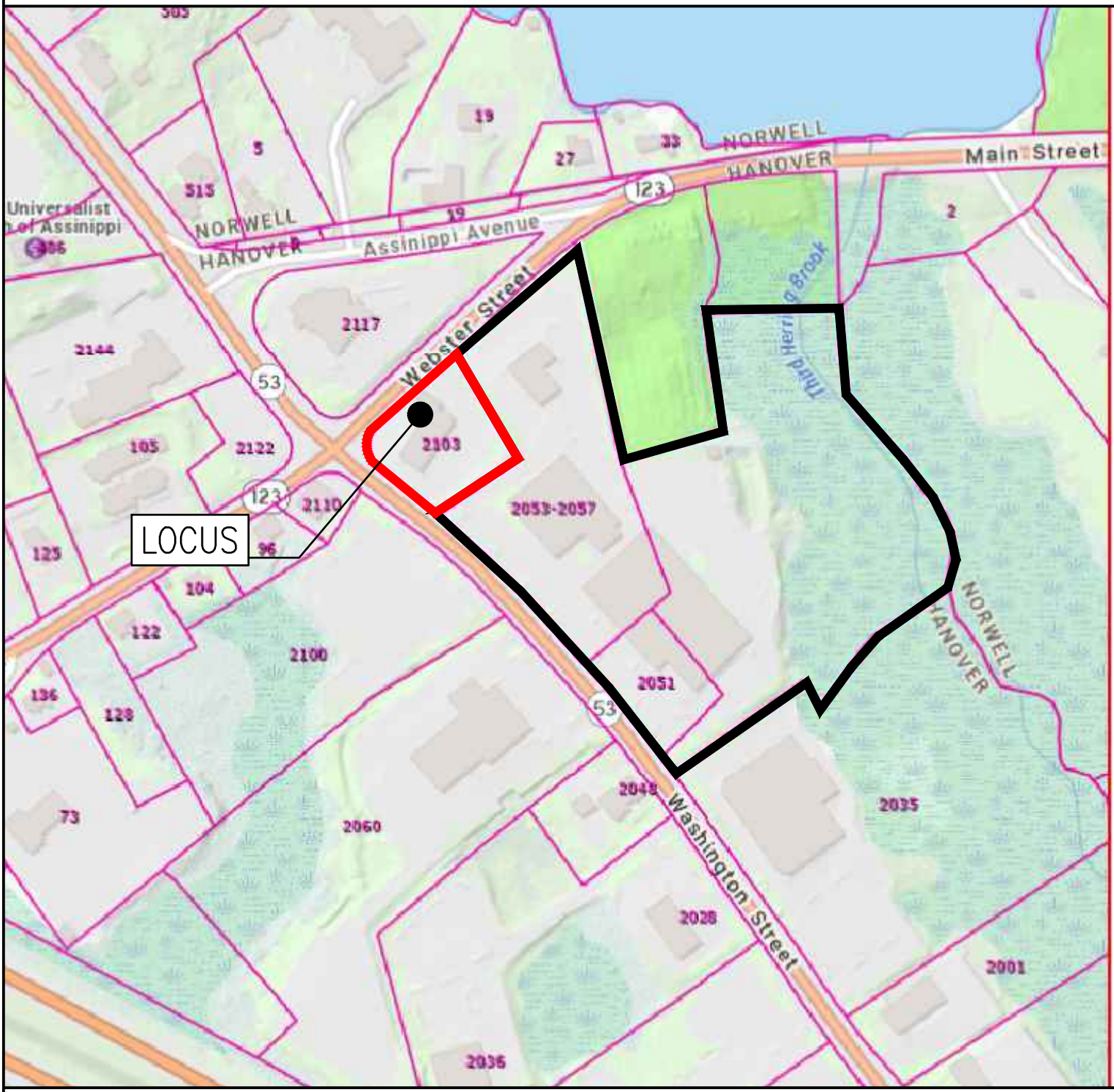
FIGURE 5

NHESP INVENTORY & WETLANDS -MASSGIS



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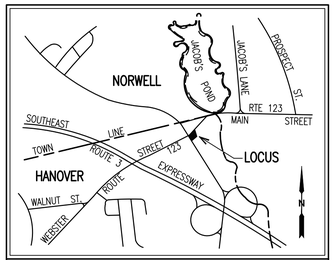
DRAWN BY:	NC

Appendix A

Existing Conditions

2, 10, 25 and 100-year return storms



LOCATION MAP SCALE: 1" = 2000'±

EXISTING WATERSHED DATA:

TOTAL SUBCATCHMENT AREA= 39,749 SF±
TOTAL IMPERVIOUS AREA=30,961 SF±

SUBCATCHMENT 1 [SC1-E]:

BLDG AREA= 5,192 SF
PAVEMENT= 24,752 SF
OTHER IMPERVIOUS (DECK, PORCH, ETC) = 1,017 SF
TOTAL IMPERVIOUS = 5,192 SF + 24,752 SF + 1,017 SF = 30,961 SF
LAWN (GOOD)= 923 SF + 7,739 SF + 42 SF + 84 SF = 8,788 SF

DESIGN POINT 1 [DP1-E]:

RECIEVES ALL FLOW FROM SUBCATCHMENT 1 AT WASHINGTON STREET AND WEBSTER STREET ABUTTING AREAS.

= LIMIT OF WATERSHED AREA

= TIME OF CONCENTRATION PATH

EXISTING BUILDING

MA MAINLAND STATE PLANE, GRID NAD 1983

WEBSTER STREET (PUBLIC ROUTE 123 - 50' WIDE)

WASHINGTON STREET (PUBLIC - ROUTE 53 - VARIABLE WIDTH)

EXISTING BUILDING 2103 WASHINGTON STREET

BLDG 5,192 S.F

PAVEMENT 24,752 S.F

[DP1-E]

[SC1-E]

TIME OF CONCENTRATION

BENCHMARK: HYDRANT SPINDLE EL=126.65 (NAVD88)

STOP LINE

CROSS WALK

ONLY

20 0 20 40 60

SCALE IN FEET

merrillinc.com

REVISIONS:

DRAWN BY: NC

DESIGNED BY: DWK

CHECKED BY: DWK

SCALE: 1" = 20'

STAMP:

COMMONWEALTH OF MASSACHUSETTS
DEBORAH W. KELLIER
CIVIL
No. 45674
REGISTERED PROFESSIONAL ENGINEER

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448 N. Falmouth Highway
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Marine Division:
26 Union Street
Plymouth, MA 02360
508-746-6060

PROJECT #: 22-188

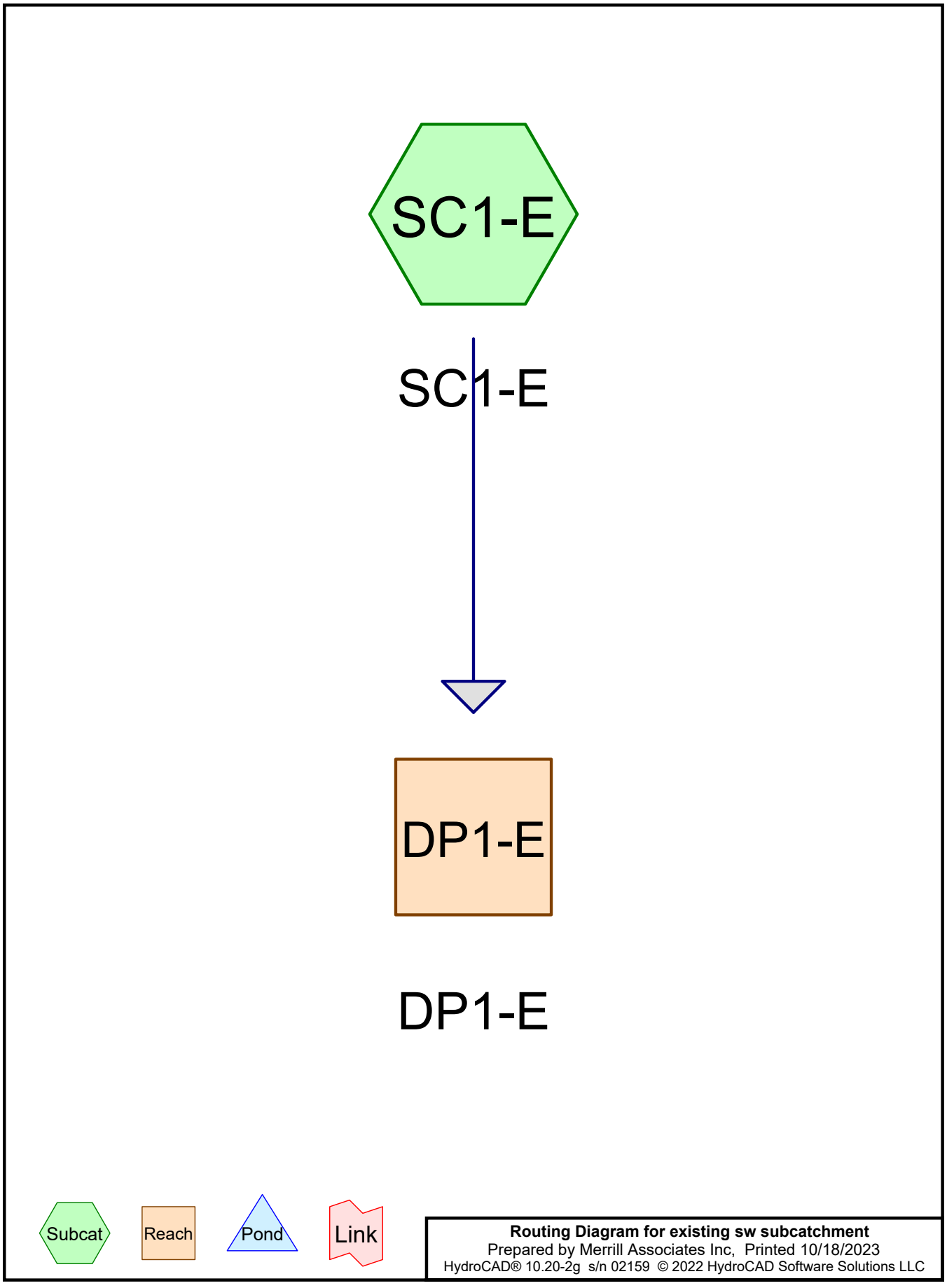
PROJECT:
DEFINITIVE SITE PLAN
2053, 2055, 2057 & 2103 WASHINGTON STREET
HANOVER, MASSACHUSETTS

CLIENT:
2103 WASHINGTON ST LLC
552 ADAMS STREET
MILTON, MA 02186
(781) 982-1144

DRAWING PATH: H:\22-188\DESIGN\22-188 ESC, PSC.DWG

DATE: OCTOBER 16, 2023

EXISTING SUBCATCHMENT PLAN



Routing Diagram for existing sw subcatchment
Prepared by Merrill Associates Inc, Printed 10/18/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.202	61	>75% Grass cover, Good, HSG B (SC1-E)
0.711	98	all impervious surfaces (SC1-E)
0.913	**90**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SC1-E: SC1-E Runoff Area=39,749 sf 77.89% Impervious Runoff Depth=2.31"
Flow Length=201' Tc=6.0 min CN=90 Runoff=2.38 cfs 0.175 af

Reach DP1-E: DP1-E Inflow=2.38 cfs 0.175 af
Outflow=2.38 cfs 0.175 af

Total Runoff Area = 0.913 ac Runoff Volume = 0.175 af Average Runoff Depth = 2.31"
22.11% Pervious = 0.202 ac 77.89% Impervious = 0.711 ac

Summary for Subcatchment SC1-E: SC1-E

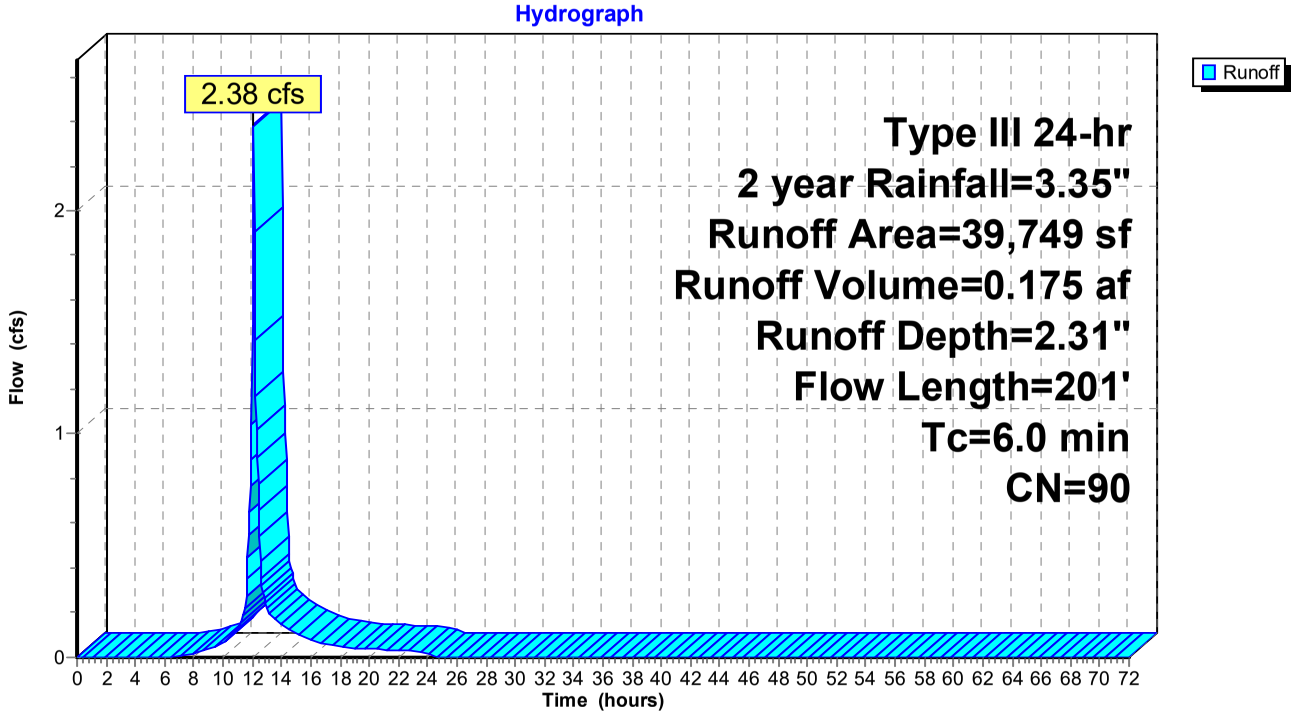
Runoff = 2.38 cfs @ 12.09 hrs, Volume= 0.175 af, Depth= 2.31"
Routed to Reach DP1-E : DP1-E

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.35"

	Area (sf)	CN	Description
*	30,961	98	all impervious surfaces
	8,788	61	>75% Grass cover, Good, HSG B
	39,749	90	Weighted Average
	8,788		22.11% Pervious Area
	30,961		77.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0340	1.51		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.35"
1.1	151	0.0120	2.22		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	201	Total, Increased to minimum Tc = 6.0 min			

Subcatchment SC1-E: SC1-E

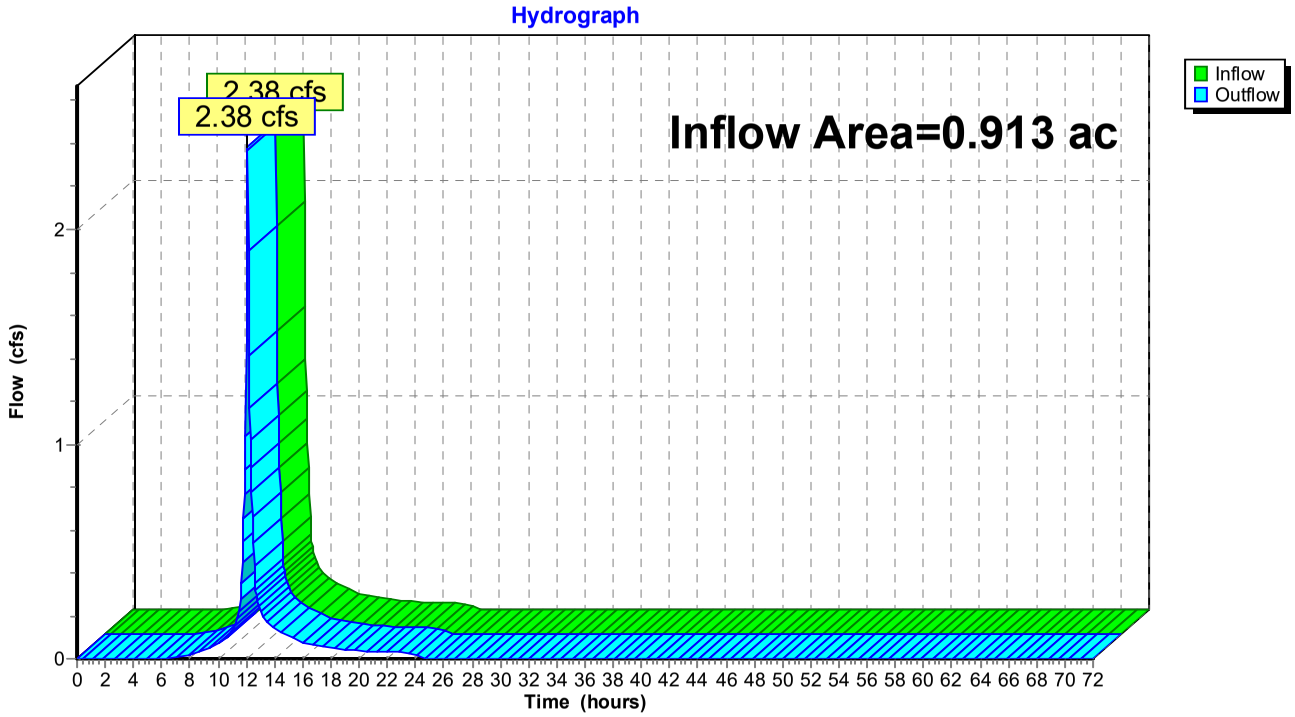


Summary for Reach DP1-E: DP1-E

Inflow Area = 0.913 ac, 77.89% Impervious, Inflow Depth = 2.31" for 2 year event
Inflow = 2.38 cfs @ 12.09 hrs, Volume= 0.175 af
Outflow = 2.38 cfs @ 12.09 hrs, Volume= 0.175 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1-E: DP1-E



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SC1-E: SC1-E Runoff Area=39,749 sf 77.89% Impervious Runoff Depth=3.83"
Flow Length=201' Tc=6.0 min CN=90 Runoff=3.86 cfs 0.291 af

Reach DP1-E: DP1-E Inflow=3.86 cfs 0.291 af
Outflow=3.86 cfs 0.291 af

Total Runoff Area = 0.913 ac Runoff Volume = 0.291 af Average Runoff Depth = 3.83"
22.11% Pervious = 0.202 ac 77.89% Impervious = 0.711 ac

Summary for Subcatchment SC1-E: SC1-E

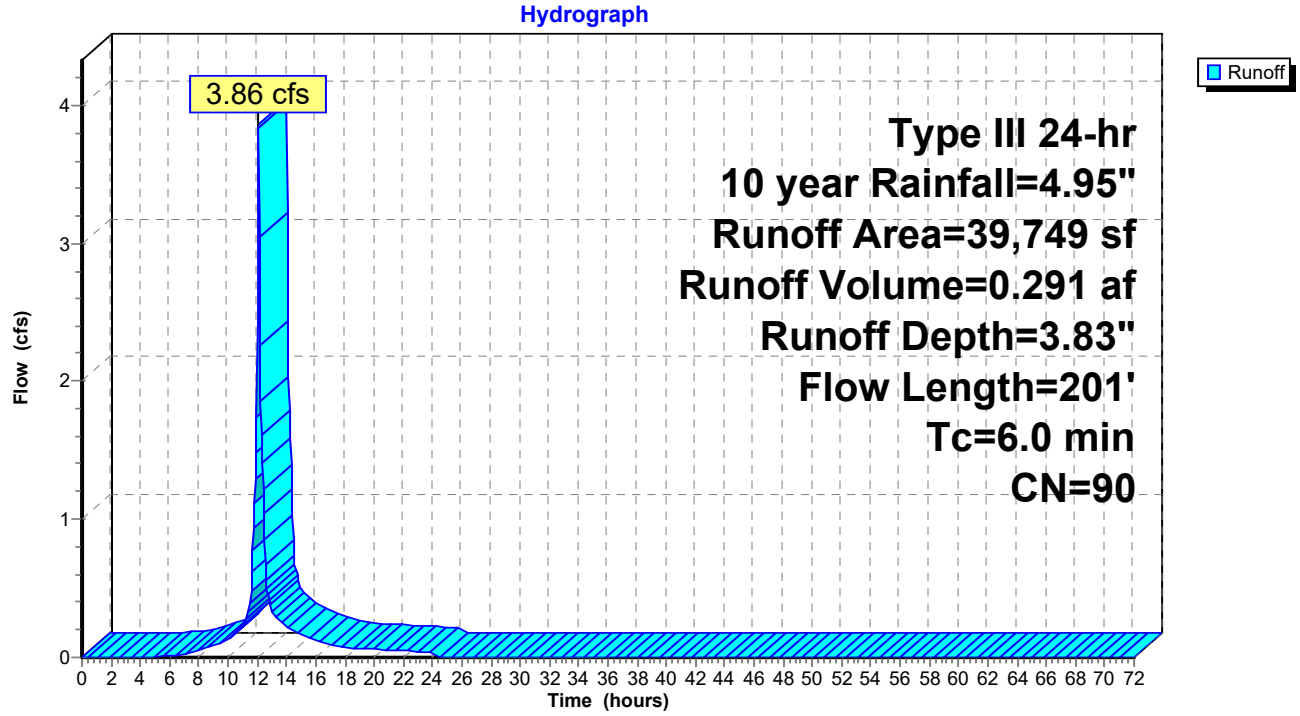
Runoff = 3.86 cfs @ 12.09 hrs, Volume= 0.291 af, Depth= 3.83"
Routed to Reach DP1-E : DP1-E

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.95"

	Area (sf)	CN	Description
*	30,961	98	all impervious surfaces
	8,788	61	>75% Grass cover, Good, HSG B
	39,749	90	Weighted Average
	8,788		22.11% Pervious Area
	30,961		77.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0340	1.51		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.35"
1.1	151	0.0120	2.22		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	201	Total, Increased to minimum Tc = 6.0 min			

Subcatchment SC1-E: SC1-E

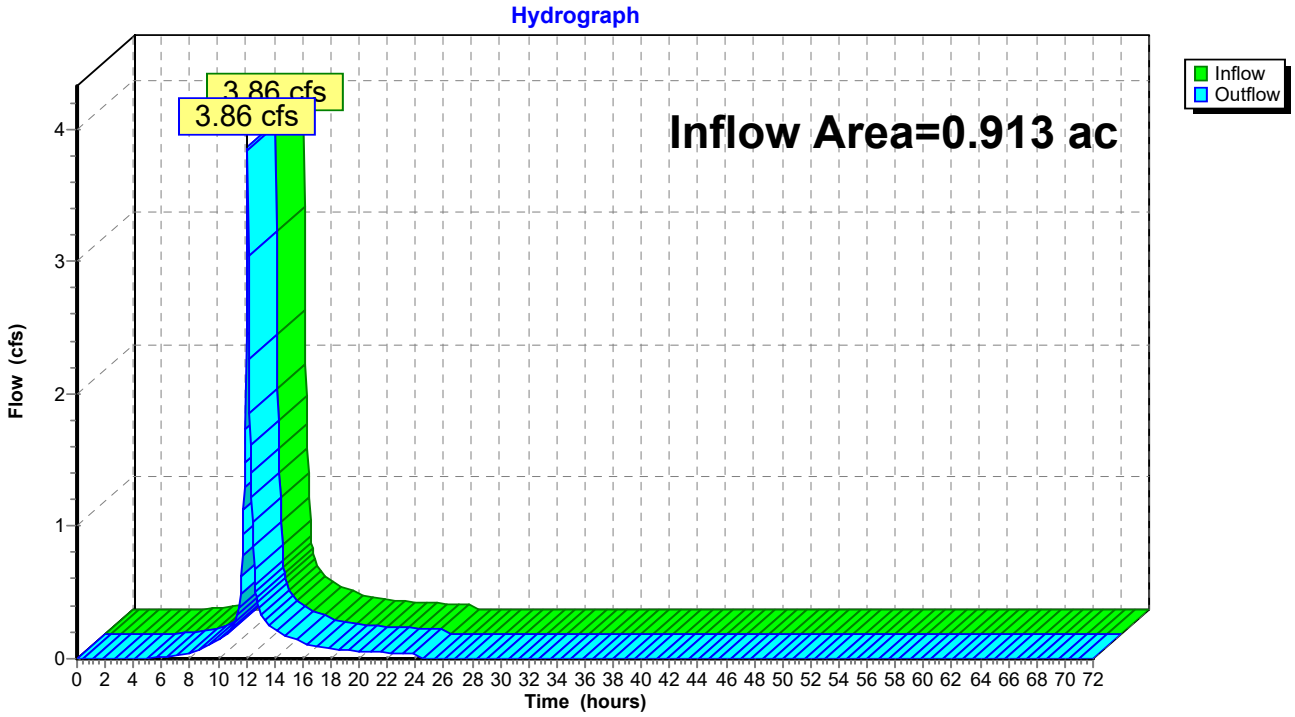


Summary for Reach DP1-E: DP1-E

Inflow Area = 0.913 ac, 77.89% Impervious, Inflow Depth = 3.83" for 10 year event
Inflow = 3.86 cfs @ 12.09 hrs, Volume= 0.291 af
Outflow = 3.86 cfs @ 12.09 hrs, Volume= 0.291 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1-E: DP1-E



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SC1-E: SC1-E Runoff Area=39,749 sf 77.89% Impervious Runoff Depth=5.03"
Flow Length=201' Tc=6.0 min CN=90 Runoff=5.00 cfs 0.383 af

Reach DP1-E: DP1-E Inflow=5.00 cfs 0.383 af
Outflow=5.00 cfs 0.383 af

Total Runoff Area = 0.913 ac Runoff Volume = 0.383 af Average Runoff Depth = 5.03"
22.11% Pervious = 0.202 ac 77.89% Impervious = 0.711 ac

Summary for Subcatchment SC1-E: SC1-E

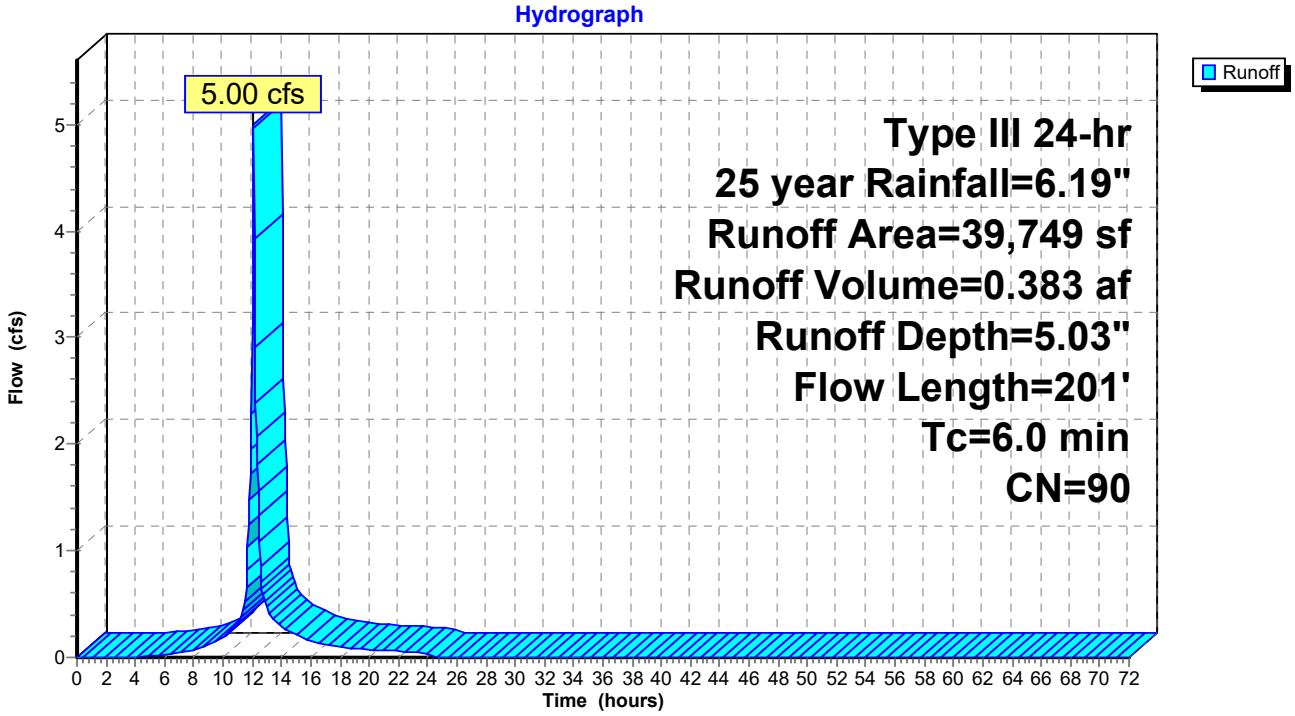
Runoff = 5.00 cfs @ 12.09 hrs, Volume= 0.383 af, Depth= 5.03"
Routed to Reach DP1-E : DP1-E

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=6.19"

	Area (sf)	CN	Description
*	30,961	98	all impervious surfaces
	8,788	61	>75% Grass cover, Good, HSG B
	39,749	90	Weighted Average
	8,788		22.11% Pervious Area
	30,961		77.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0340	1.51		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.35"
1.1	151	0.0120	2.22		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	201	Total, Increased to minimum Tc = 6.0 min			

Subcatchment SC1-E: SC1-E

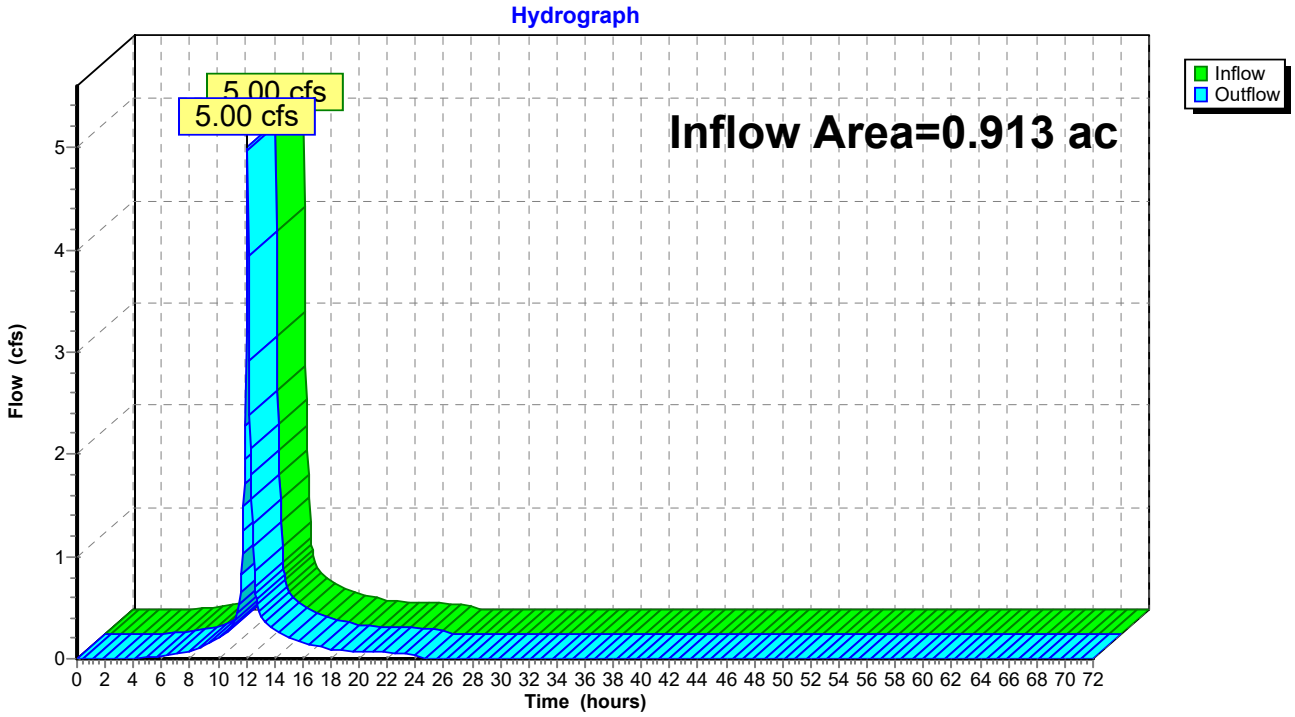


Summary for Reach DP1-E: DP1-E

Inflow Area = 0.913 ac, 77.89% Impervious, Inflow Depth = 5.03" for 25 year event
Inflow = 5.00 cfs @ 12.09 hrs, Volume= 0.383 af
Outflow = 5.00 cfs @ 12.09 hrs, Volume= 0.383 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1-E: DP1-E



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SC1-E: SC1-E Runoff Area=39,749 sf 77.89% Impervious Runoff Depth=7.51"
Flow Length=201' Tc=6.0 min CN=90 Runoff=7.29 cfs 0.571 af

Reach DP1-E: DP1-E Inflow=7.29 cfs 0.571 af
Outflow=7.29 cfs 0.571 af

Total Runoff Area = 0.913 ac Runoff Volume = 0.571 af Average Runoff Depth = 7.51"
22.11% Pervious = 0.202 ac 77.89% Impervious = 0.711 ac

Summary for Subcatchment SC1-E: SC1-E

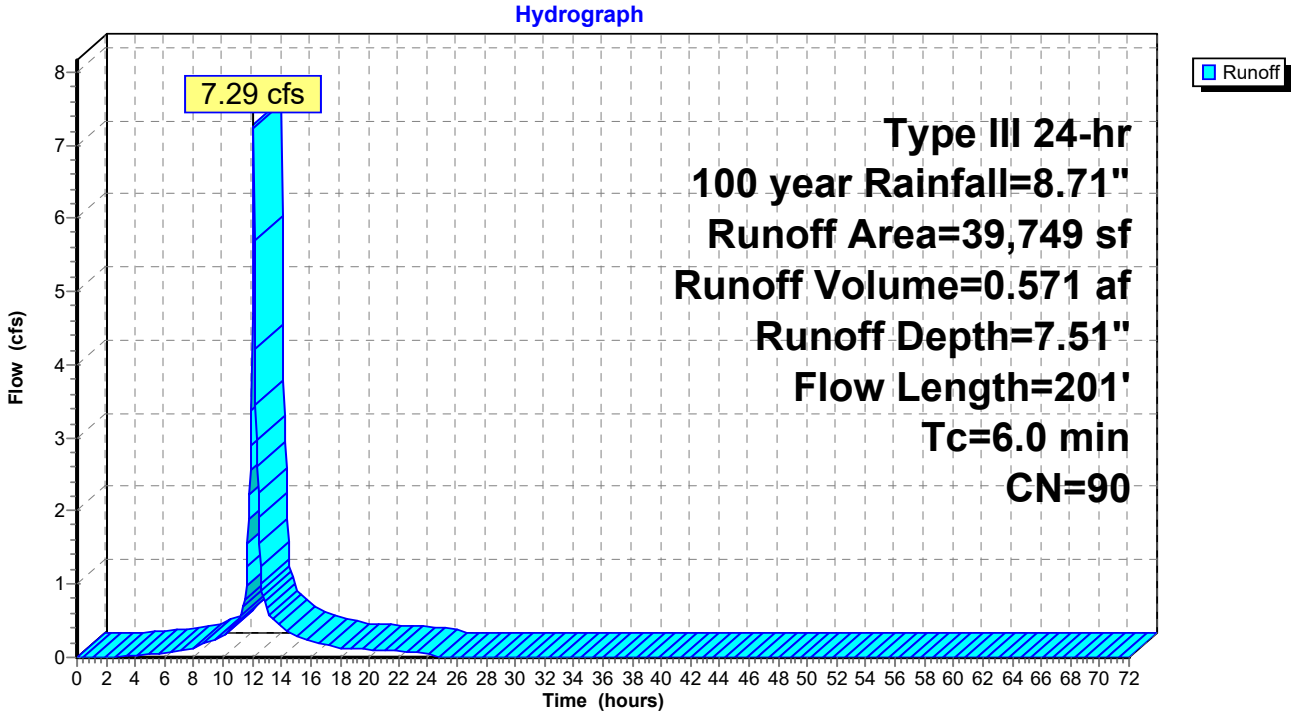
Runoff = 7.29 cfs @ 12.09 hrs, Volume= 0.571 af, Depth= 7.51"
Routed to Reach DP1-E : DP1-E

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 year Rainfall=8.71"

	Area (sf)	CN	Description
*	30,961	98	all impervious surfaces
	8,788	61	>75% Grass cover, Good, HSG B
	39,749	90	Weighted Average
	8,788		22.11% Pervious Area
	30,961		77.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0340	1.51		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.35"
1.1	151	0.0120	2.22		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	201	Total, Increased to minimum Tc = 6.0 min			

Subcatchment SC1-E: SC1-E

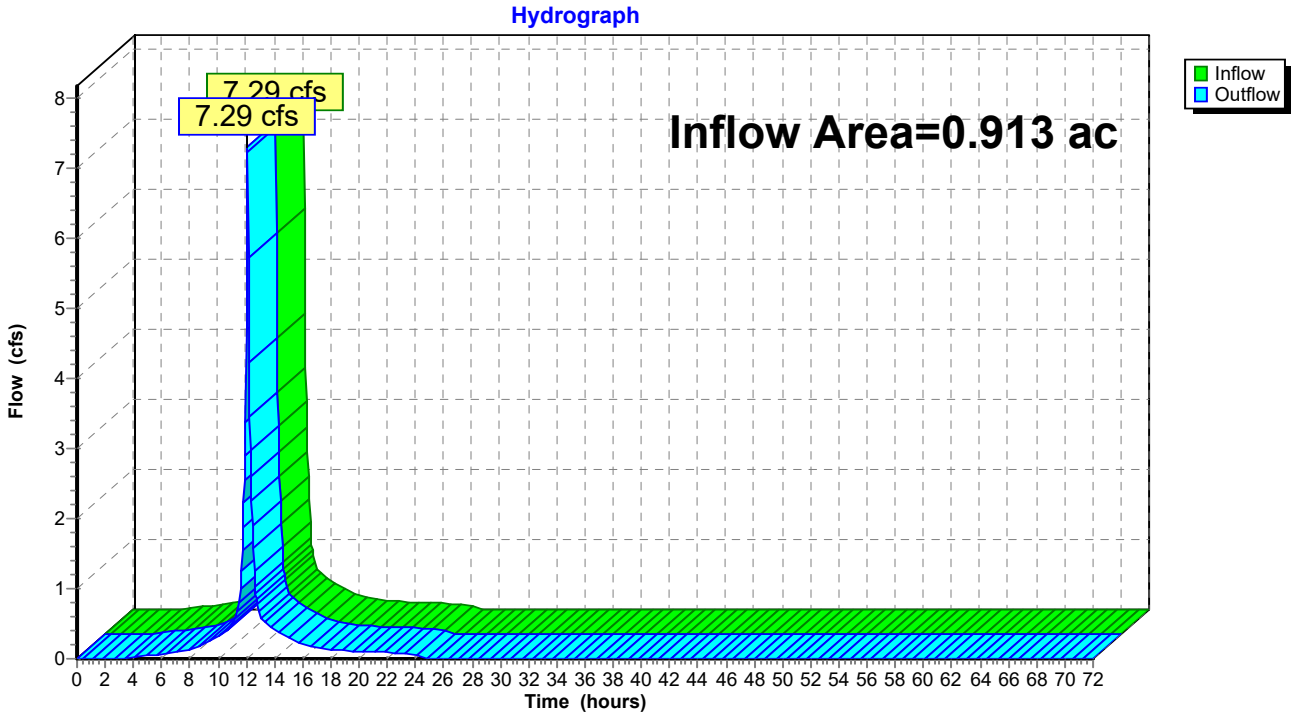


Summary for Reach DP1-E: DP1-E

Inflow Area = 0.913 ac, 77.89% Impervious, Inflow Depth = 7.51" for 100 year event
Inflow = 7.29 cfs @ 12.09 hrs, Volume= 0.571 af
Outflow = 7.29 cfs @ 12.09 hrs, Volume= 0.571 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

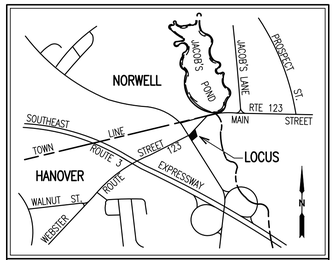
Reach DP1-E: DP1-E



Appendix B

Proposed Conditions

2, 10, 25 and 100-year return storms



LOCATION MAP SCALE: 1" = 2000'±

PROPOSED WATERSHED DATA

TOTAL SITE CATCHMENT AREA = 39,878 SF±
PROPOSED INCREASE IN SITE SUBCATCH AREA =
39,878 SF – 39,749 SF = 129 SF±

TOTAL IMPERVIOUS AREA = 31,960 SF±
PROPOSED INCREASE IN IMPERVIOUS AREA =
32,392 SF – 30,961 SF = 1,431 SF±

SUBCATCHMENT 1 AREA [SC–1] = 12,696 SF±

BLDG AREA= 3,750 SF (ROOF DRAIN)
PAVEMENT AREA= 6,381 SF
OTHER IMPERVIOUS AREA= 820 SF + 167 = 987 SF
TOTAL IMPERVIOUS AREA= 3,750 SF 6,381 SF + 987 SF = 11,118 SF
LAWN (GOOD)= 512 SF + 184 SF + 11 SF + 871 SF = 1,578 SF

SUBCATCHMENT 2 AREA [SC–2] = 6,329 SF±

BLDG AREA= 0 S.F
PAVEMENT AREA= 4,872 SF
OTHER IMPERVIOUS= 405 SF + 303 SF = 708 SF
TOTAL IMPERVIOUS AREA= 4,872 SF + 708 SF = 5,580 SF
LAWN (GOOD)= 114 SF + 635 SF = 749 SF

SUBCATCHMENT 3 AREA [SC–3] = 7,964 SF±

BLDG AREA= 0 SF
PAVEMENT AREA= 6,031 SF
OTHER IMPERVIOUS AREA= 401 SF + 784 SF = 1,185 SF
TOTAL IMPERVIOUS AREA= 6,031 SF + 1,185 SF = 7,216 SF
LAWN (GOOD)= 708 SF + 40 SF = 748 SF

SUBCATCHMENT 4 AREA [SC–4] = 8,981 SF±

BLDG AREA= 3,750 SF (ROOF DRAIN)
PAVEMENT AREA= 4,341 SF
OTHER IMPERVIOUS AREA= 97 SF + 290 SF = 387 SF
TOTAL IMPERVIOUS AREA= 3,750 SF + 4,341 SF + 387 SF = 8,478 SF
LAWN (GOOD)= 46 SF + 82 SF + 212 SF + 163 SF = 503 SF

SUBCATCHMENT 5 AREA [SC–5] = 2,137 SF±

LAWN (GOOD) = 1,122 S.F + 1,015 S.F = 2,137 SF

SUBCATCHMENT 6 AREA [SC–6] = 1,771 SF±

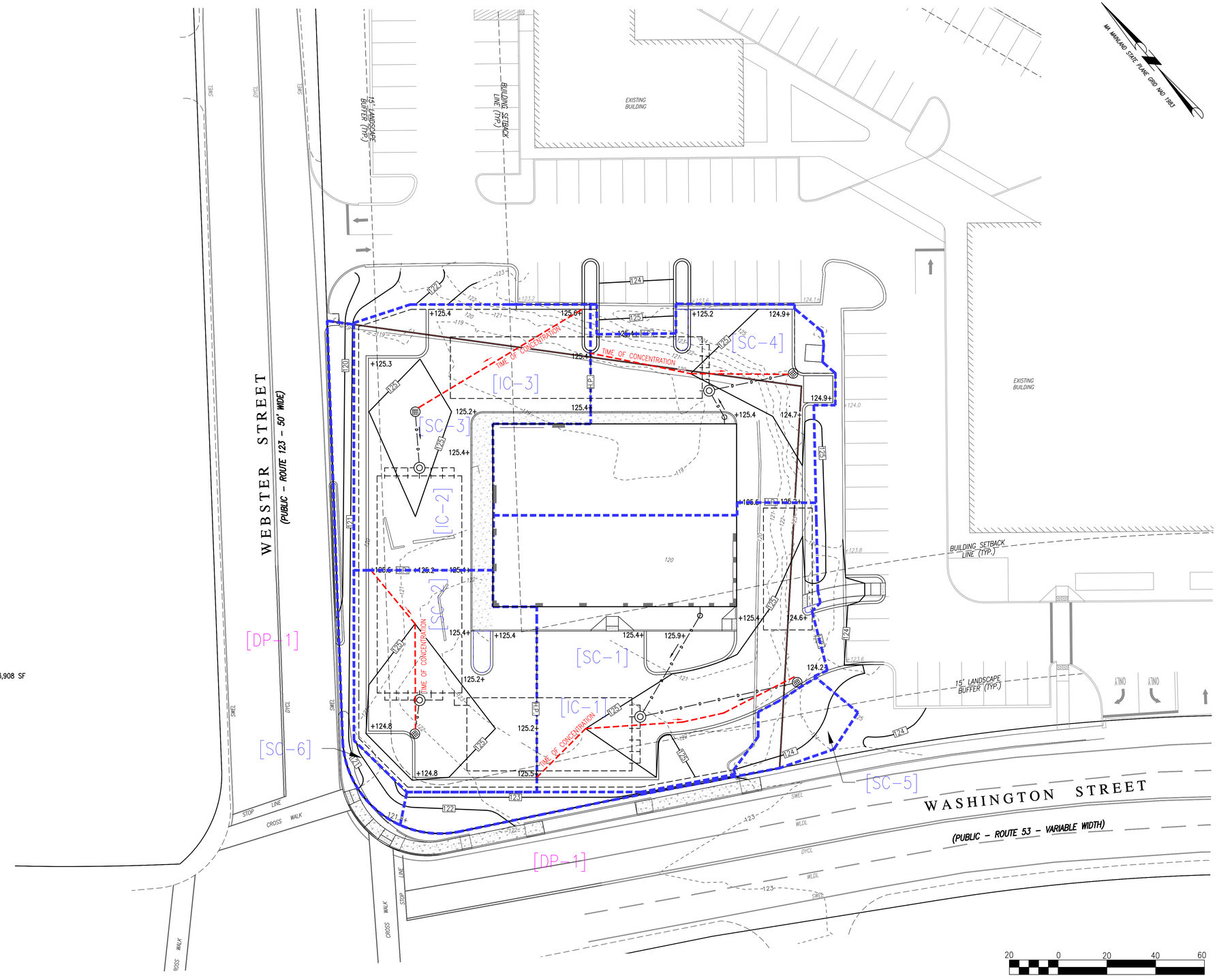
LAWN (GOOD) = 1,771 SF

DESIGN POINT 1 [DP–1] RECEIVES FLOW FROM SC–5, SC–6 = 3,908 SF

ALL LAWN AREA

= LIMIT OF WATERSHED AREA

= TIME OF CONCENTRATION PATH



merrillinc.com

REVISIONS:

DRAWN BY: NC

DESIGNED BY: DWK

CHECKED BY: DWK

SCALE: 1" = 20'

STAMP:

COMMONWEALTH OF MASSACHUSETTS
DEBORAH W. KELLIER
CIVIL
No. 45874
REGISTERED PROFESSIONAL ENGINEER

Merrill
Engineers and Land Surveyors
427 Columbia Road
Hanover, MA 02339
781–826–9200

40 Court Street, Suite 2A
Plymouth, MA 02360
508–746–6060

448 N. Falmouth Highway
North Falmouth, MA 02556
508–563–2183

Marine Division:
26 Union Street
Plymouth, MA 02360
508–746–6060

PROJECT #: 22–188

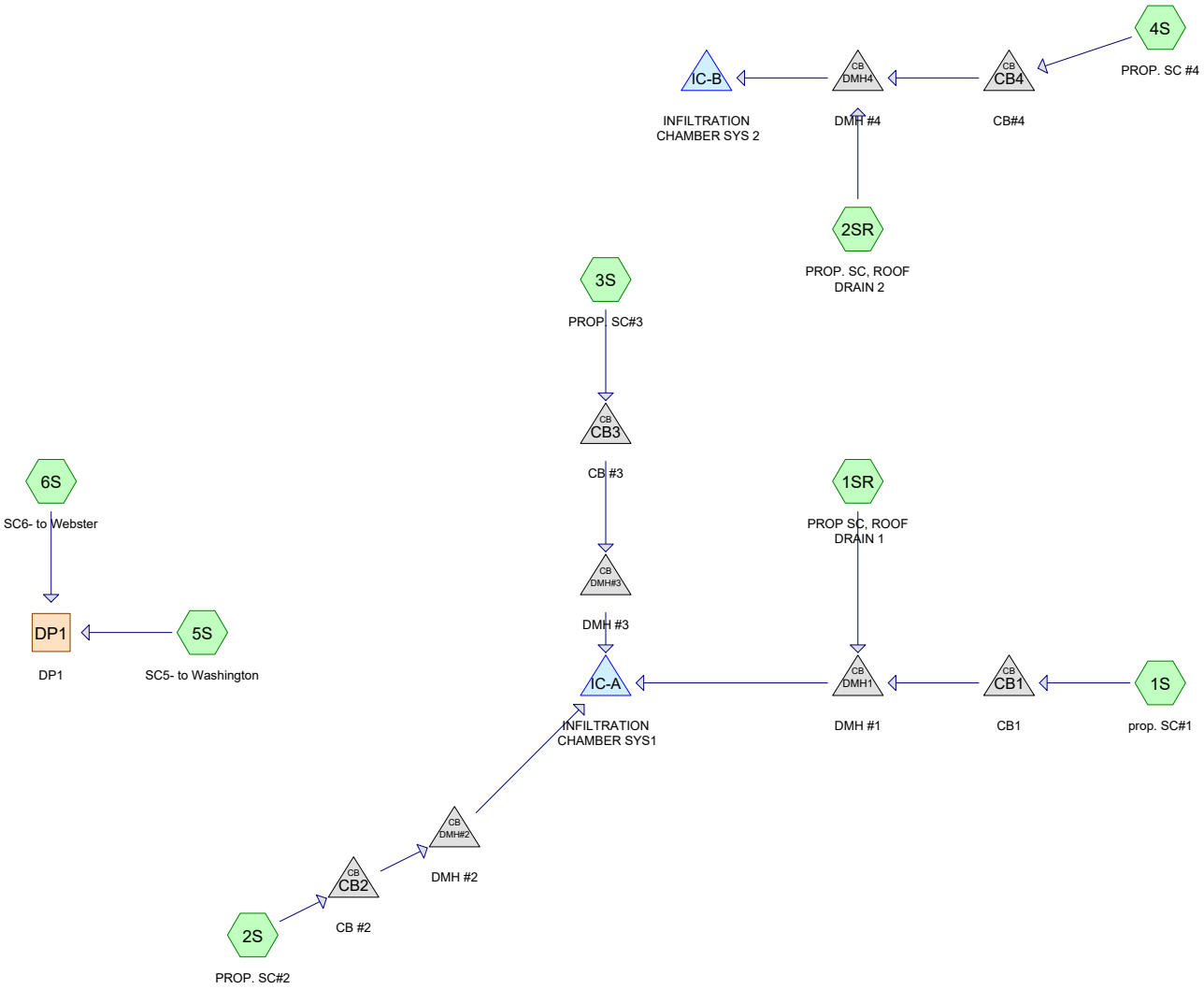
PROJECT:
DEFINITIVE SITE PLAN
2053, 2055, 2057 & 2103 WASHINGTON STREET
HANOVER, MASSACHUSETTS

CLIENT:
2103 WASHINGTON ST LLC
552 ADAMS STREET
MILTON, MA 02186
(781) 982–1144

DRAWING PATH: H:\22–188\DESIGN\22–188 ESC, PSC.DWG

DATE: OCTOBER 16, 2023

PROPOSED SUBCATCHMENT PLAN



Subcat Reach Pond Link

Routing Diagram for proposed sw subcatchment
Prepared by Merrill Associates Inc, Printed 10/18/2023
HydroCAD® 10.20-2g s/n 02159 © 2022 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.172	61	>75% Grass cover, Good, HSG B (1S, 2S, 3S, 4S, 5S, 6S)
0.100	98	Paved parking, HSG B (4S)
0.397	98	pavement area (1S, 2S, 3S)
0.172	98	roof area (1SR, 2SR)
0.066	98	sidewalk & retaining wall (1S, 2S, 3S)
0.009	98	sidewalk and other impervious (4S)
0.915	**91**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: prop. SC#1 Runoff Area=8,946 sf 82.36% Impervious Runoff Depth=2.40"
Flow Length=152' Tc=6.0 min CN=91 Runoff=0.55 cfs 0.041 af

Subcatchment 1SR: PROP SC, ROOF Runoff Area=3,750 sf 100.00% Impervious Runoff Depth=3.12"
Tc=0.0 min CN=98 Runoff=0.32 cfs 0.022 af

Subcatchment 2S: PROP. SC#2 Runoff Area=6,329 sf 88.17% Impervious Runoff Depth=2.69"
Flow Length=152' Tc=6.0 min CN=94 Runoff=0.43 cfs 0.033 af

Subcatchment 2SR: PROP. SC, ROOF Runoff Area=3,750 sf 100.00% Impervious Runoff Depth=3.12"
Tc=0.0 min CN=98 Runoff=0.32 cfs 0.022 af

Subcatchment 3S: PROP. SC#3 Runoff Area=7,964 sf 90.61% Impervious Runoff Depth=2.79"
Flow Length=152' Tc=6.0 min CN=95 Runoff=0.55 cfs 0.043 af

Subcatchment 4S: PROP. SC #4 Runoff Area=5,231 sf 90.38% Impervious Runoff Depth=2.69"
Flow Length=81' Tc=6.0 min CN=94 Runoff=0.35 cfs 0.027 af

Subcatchment 5S: SC5- to Washington Runoff Area=2,137 sf 0.00% Impervious Runoff Depth=0.51"
Tc=0.0 min CN=61 Runoff=0.02 cfs 0.002 af

Subcatchment 6S: SC6- to Webster Runoff Area=1,770 sf 0.00% Impervious Runoff Depth=0.51"
Tc=0.0 min CN=61 Runoff=0.02 cfs 0.002 af

Reach DP1: DP1 Inflow=0.04 cfs 0.004 af
Outflow=0.04 cfs 0.004 af

Pond CB1: CB1 Peak Elev=121.72' Inflow=0.55 cfs 0.041 af
12.0" Round Culvert n=0.013 L=62.0' S=0.0065 '/' Outflow=0.55 cfs 0.041 af

Pond CB2: CB #2 Peak Elev=121.47' Inflow=0.43 cfs 0.033 af
12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.43 cfs 0.033 af

Pond CB3: CB #3 Peak Elev=121.52' Inflow=0.55 cfs 0.043 af
12.0" Round Culvert n=0.013 L=20.0' S=0.0100 '/' Outflow=0.55 cfs 0.043 af

Pond CB4: CB#4 Peak Elev=121.59' Inflow=0.35 cfs 0.027 af
12.0" Round Culvert n=0.013 L=32.0' S=0.0125 '/' Outflow=0.35 cfs 0.027 af

Pond DMH#2: DMH #2 Peak Elev=121.25' Inflow=0.43 cfs 0.033 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.43 cfs 0.033 af

Pond DMH#3: DMH #3 Peak Elev=121.31' Inflow=0.55 cfs 0.043 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.55 cfs 0.043 af

Pond DMH1: DMH #1 Peak Elev=121.39' Inflow=0.75 cfs 0.063 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.75 cfs 0.063 af

Pond DMH4: DMH #4 Peak Elev=121.21' Inflow=0.57 cfs 0.049 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.57 cfs 0.049 af

Pond IC-A: INFILTRATION CHAMBER SYS1 Peak Elev=120.83' Storage=2,529 cf Inflow=1.70 cfs 0.139 af
Outflow=0.13 cfs 0.139 af

Pond IC-B: INFILTRATION CHAMBER SYS 2 Peak Elev=120.62' Storage=776 cf Inflow=0.57 cfs 0.049 af
Outflow=0.06 cfs 0.049 af

Total Runoff Area = 0.915 ac Runoff Volume = 0.192 af Average Runoff Depth = 2.51"
18.77% Pervious = 0.172 ac 81.23% Impervious = 0.744 ac

Summary for Subcatchment 1S: prop. SC#1

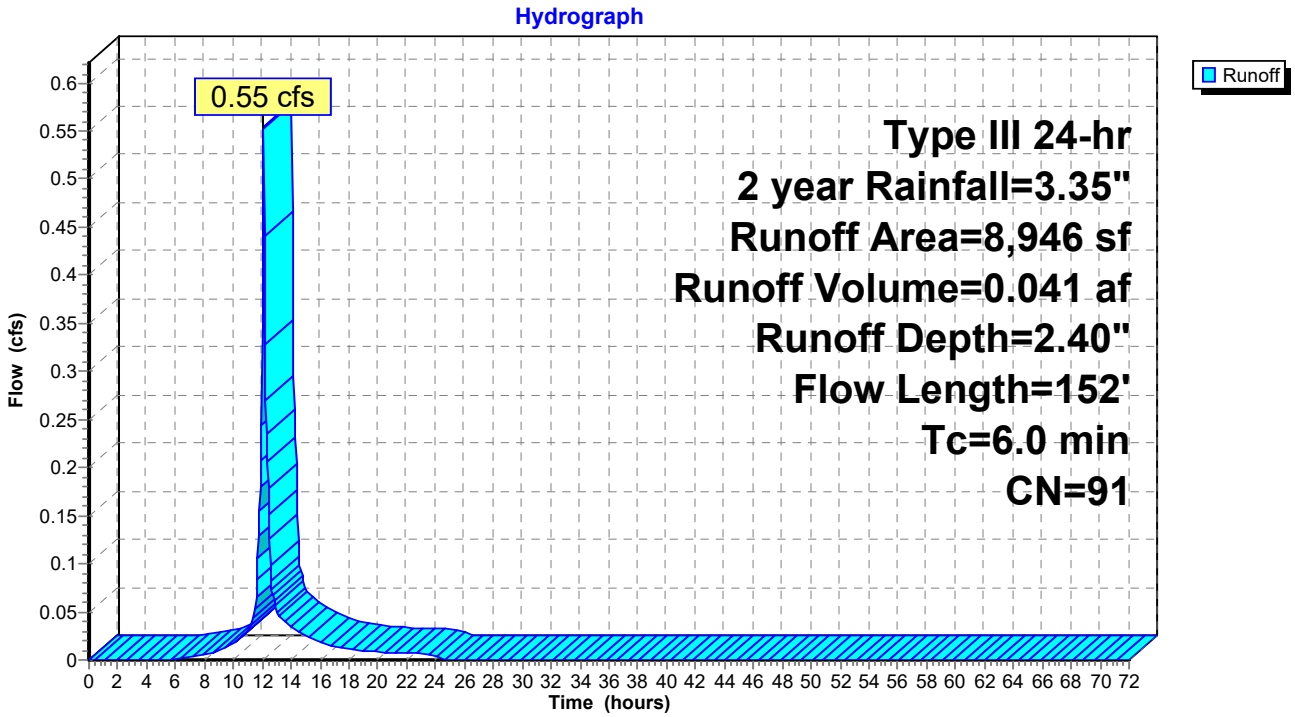
Runoff = 0.55 cfs @ 12.09 hrs, Volume= 0.041 af, Depth= 2.40"
Routed to Pond CB1 : CB1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.35"

	Area (sf)	CN	Description
*	6,381	98	pavement area
*	987	98	sidewalk & retaining wall
	1,578	61	>75% Grass cover, Good, HSG B
	8,946	91	Weighted Average
	1,578		17.64% Pervious Area
	7,368		82.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: prop. SC#1



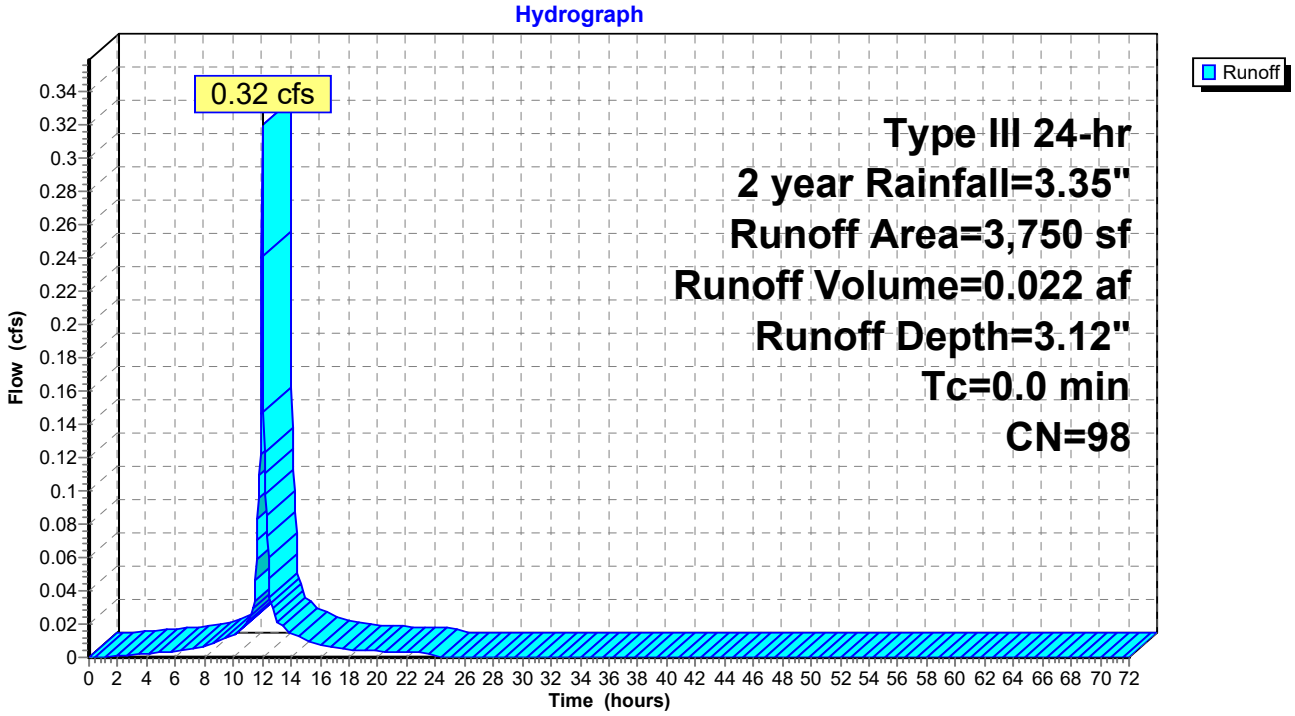
Summary for Subcatchment 1SR: PROP SC, ROOF DRAIN 1

Runoff = 0.32 cfs @ 12.00 hrs, Volume= 0.022 af, Depth= 3.12"
Routed to Pond DMH1 : DMH #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.35"

	Area (sf)	CN	Description
*	3,750	98	roof area
	3,750		100.00% Impervious Area

Subcatchment 1SR: PROP SC, ROOF DRAIN 1



Summary for Subcatchment 2S: PROP. SC#2

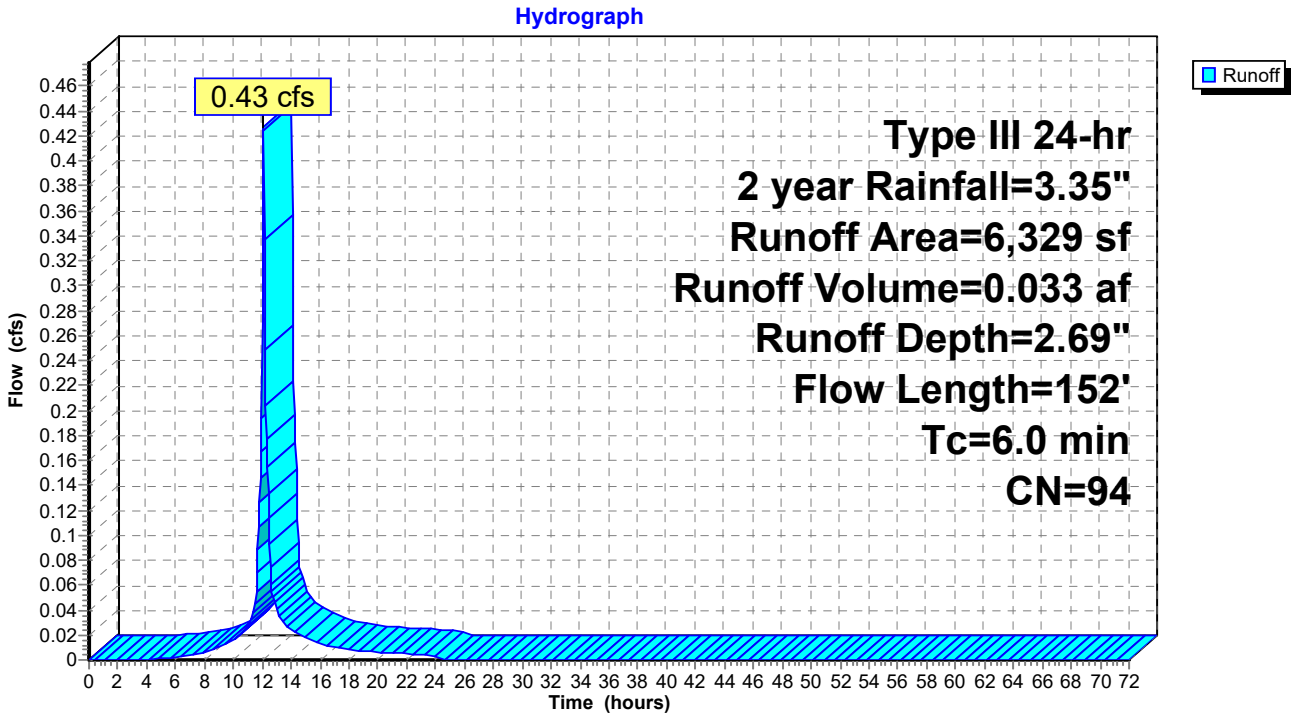
Runoff = 0.43 cfs @ 12.09 hrs, Volume= 0.033 af, Depth= 2.69"
Routed to Pond CB2 : CB #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.35"

	Area (sf)	CN	Description
*	4,872	98	pavement area
*	708	98	sidewalk & retaining wall
	749	61	>75% Grass cover, Good, HSG B
	6,329	94	Weighted Average
	749		11.83% Pervious Area
	5,580		88.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: PROP. SC#2



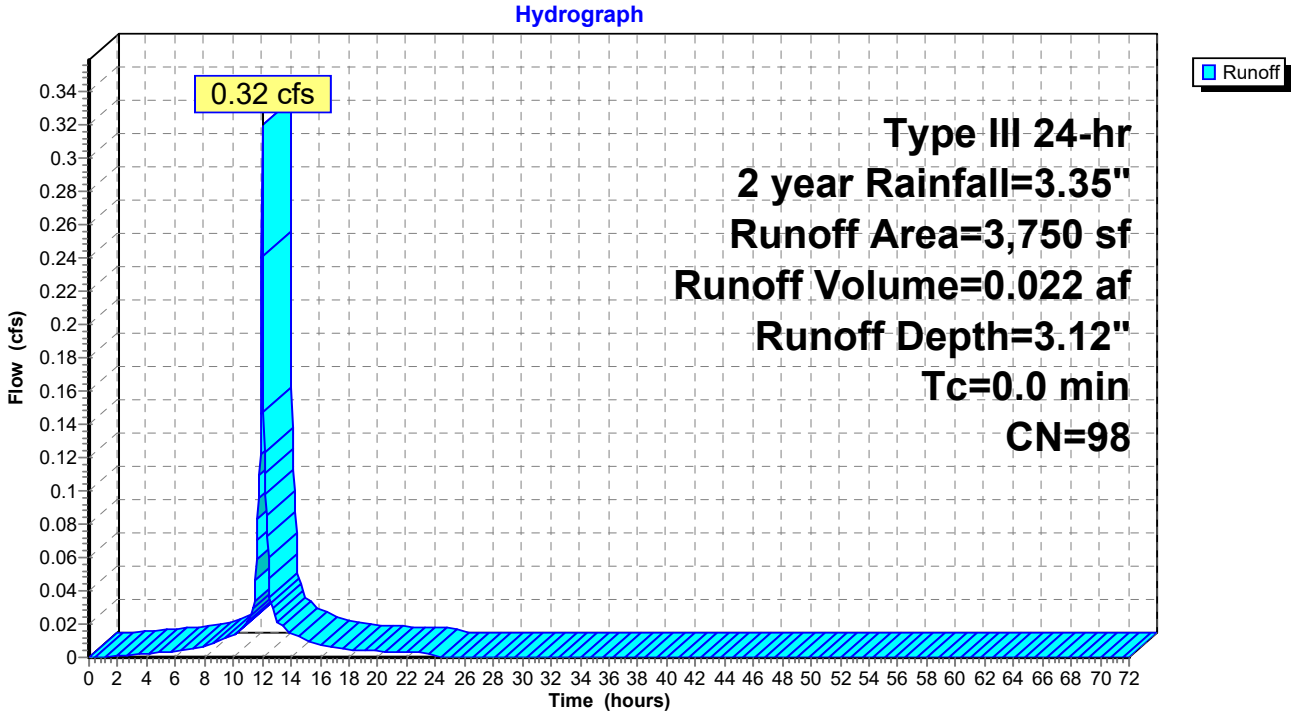
Summary for Subcatchment 2SR: PROP. SC, ROOF DRAIN 2

Runoff = 0.32 cfs @ 12.00 hrs, Volume= 0.022 af, Depth= 3.12"
Routed to Pond DMH4 : DMH #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.35"

	Area (sf)	CN	Description
*	3,750	98	roof area
	3,750		100.00% Impervious Area

Subcatchment 2SR: PROP. SC, ROOF DRAIN 2



Summary for Subcatchment 3S: PROP. SC#3

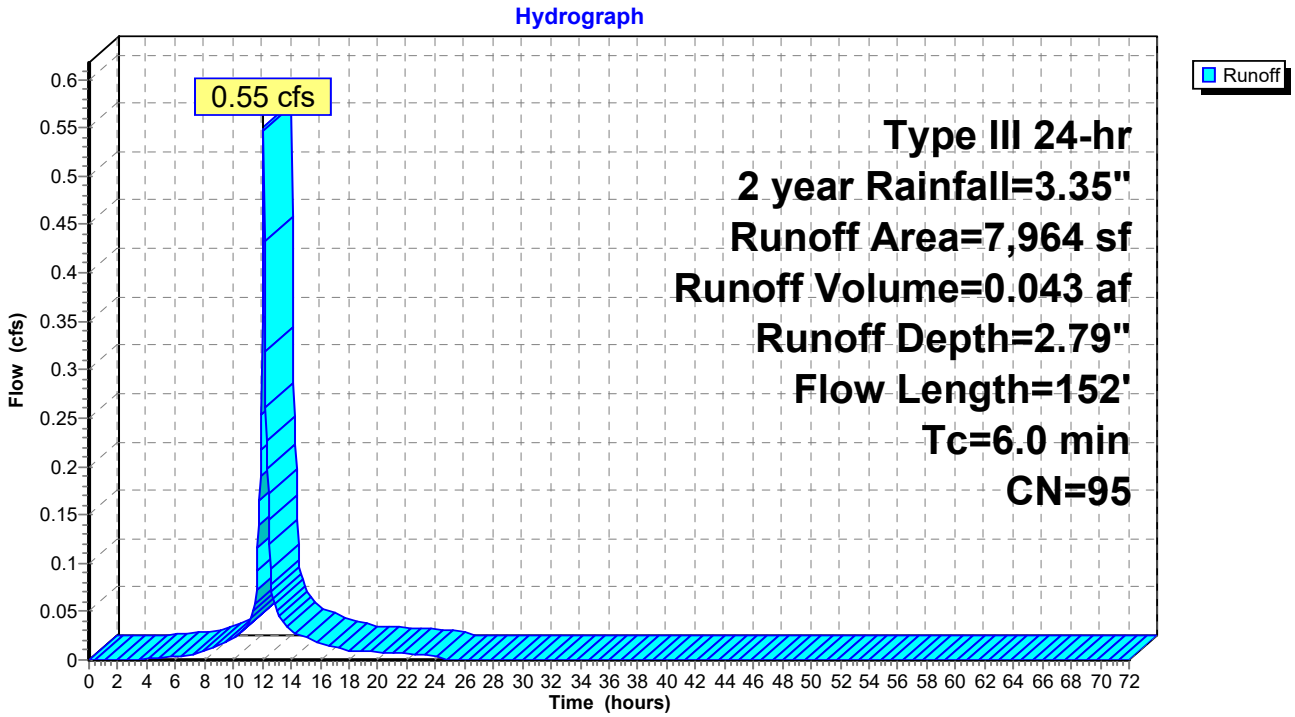
Runoff = 0.55 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 2.79"
Routed to Pond CB3 : CB #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.35"

	Area (sf)	CN	Description
*	6,031	98	pavement area
*	1,185	98	sidewalk & retaining wall
	748	61	>75% Grass cover, Good, HSG B
	7,964	95	Weighted Average
	748		9.39% Pervious Area
	7,216		90.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 3S: PROP. SC#3



Summary for Subcatchment 4S: PROP. SC #4

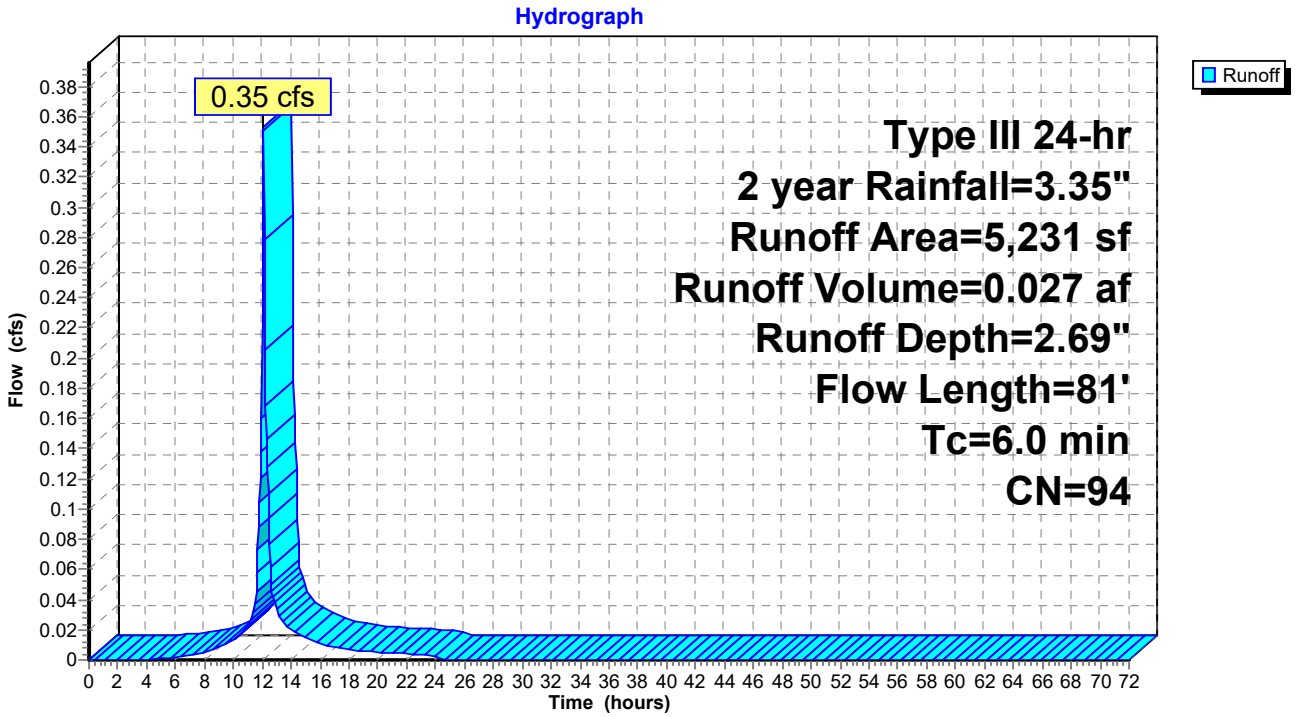
Runoff = 0.35 cfs @ 12.09 hrs, Volume= 0.027 af, Depth= 2.69"
Routed to Pond CB4 : CB#4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.35"

	Area (sf)	CN	Description
	4,341	98	Paved parking, HSG B
*	387	98	sidewalk and other impervious
	503	61	>75% Grass cover, Good, HSG B
	5,231	94	Weighted Average
	503		9.62% Pervious Area
	4,728		90.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	50	0.1350	2.65		**Sheet Flow, sheet flow 50 ft** Smooth surfaces n= 0.011 P2= 3.40"
0.3	31	0.0100	2.03		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
0.6	81	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 4S: PROP. SC #4



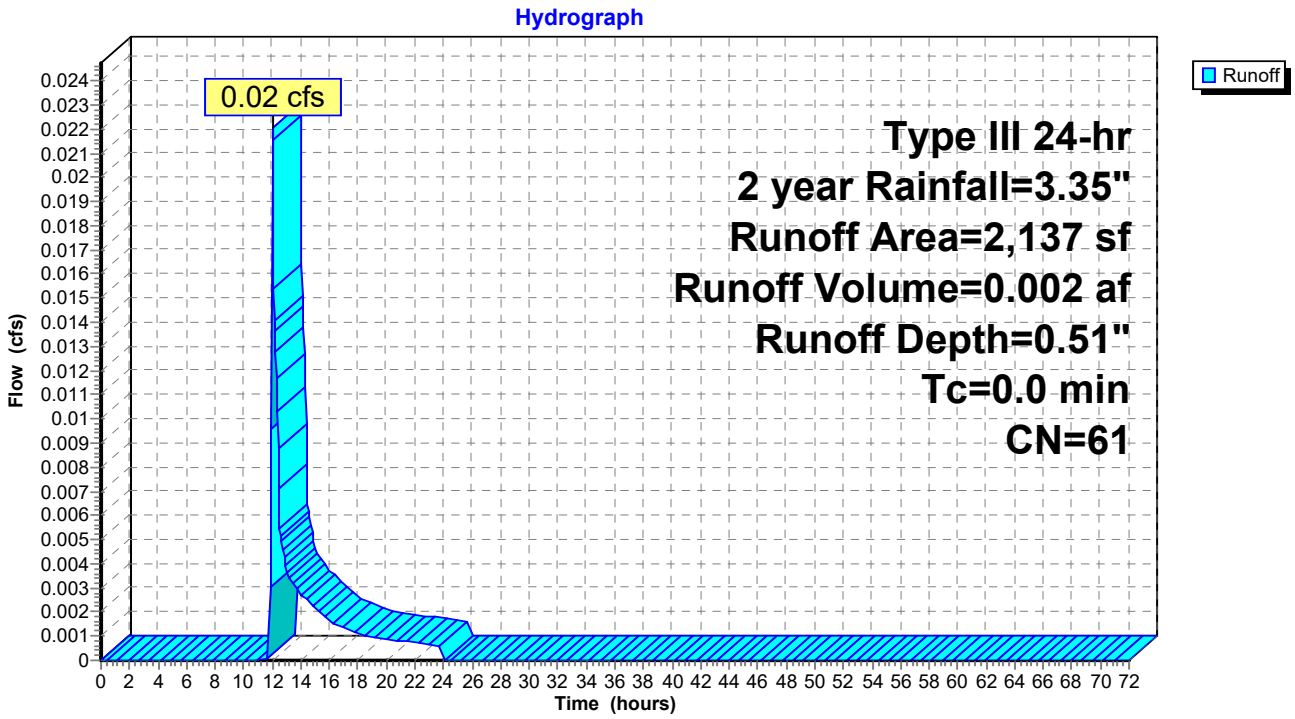
Summary for Subcatchment 5S: SC5- to Washington

Runoff = 0.02 cfs @ 12.03 hrs, Volume= 0.002 af, Depth= 0.51"
Routed to Reach DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.35"

Area (sf)	CN	Description
2,137	61	>75% Grass cover, Good, HSG B
2,137		100.00% Pervious Area

Subcatchment 5S: SC5- to Washington



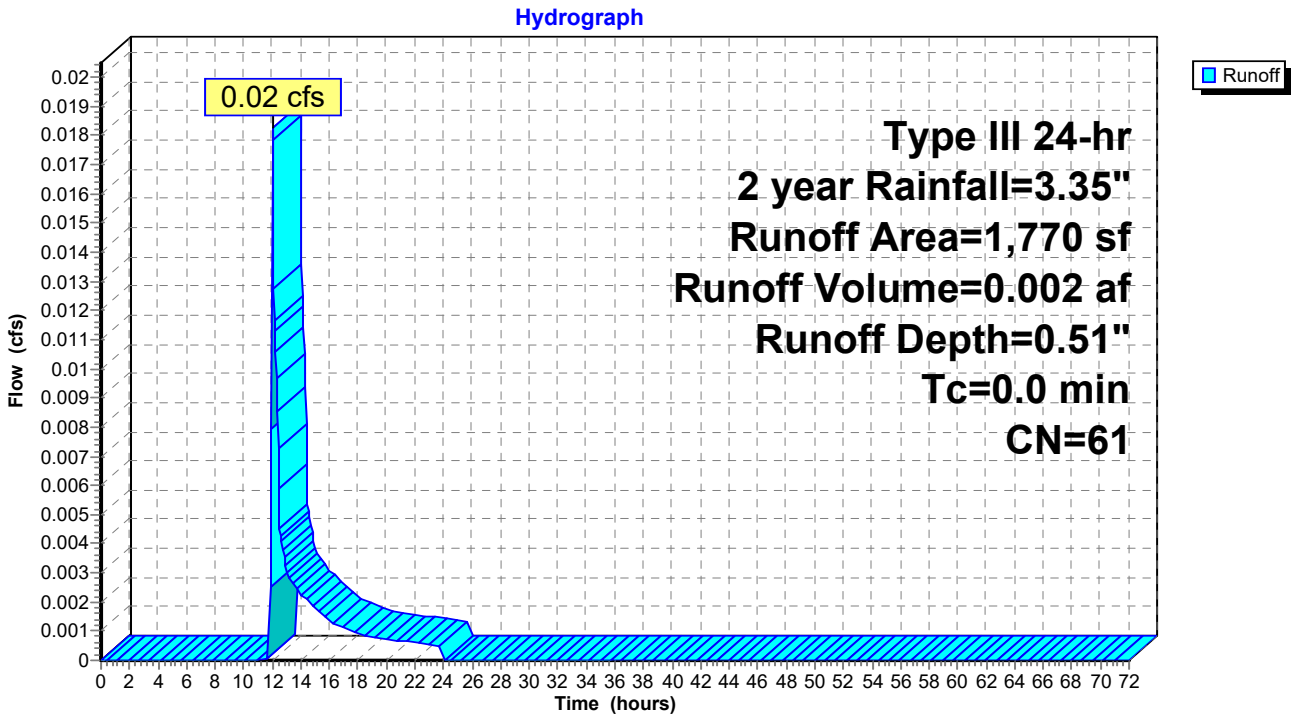
Summary for Subcatchment 6S: SC6- to Webster

Runoff = 0.02 cfs @ 12.03 hrs, Volume= 0.002 af, Depth= 0.51"
Routed to Reach DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.35"

Area (sf)	CN	Description
1,770	61	>75% Grass cover, Good, HSG B
1,770		100.00% Pervious Area

Subcatchment 6S: SC6- to Webster

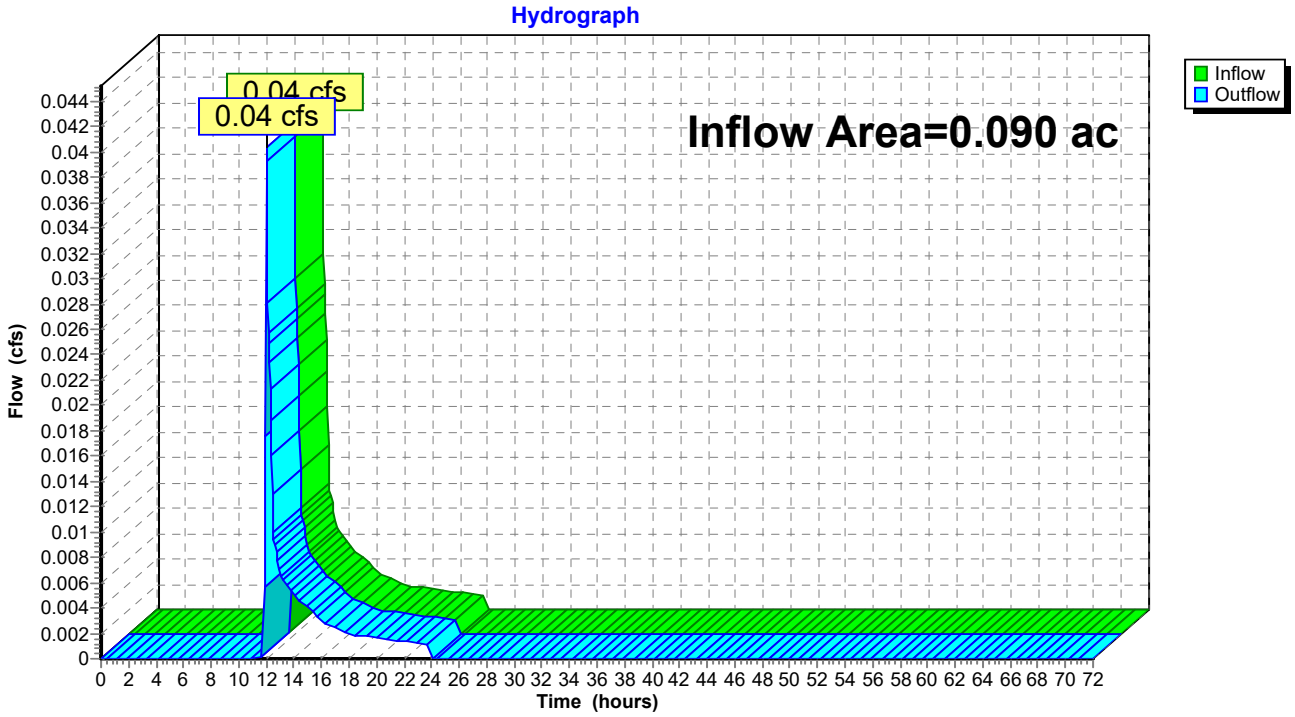


Summary for Reach DP1: DP1

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 0.51" for 2 year event
Inflow = 0.04 cfs @ 12.03 hrs, Volume= 0.004 af
Outflow = 0.04 cfs @ 12.03 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: DP1



Summary for Pond CB1: CB1

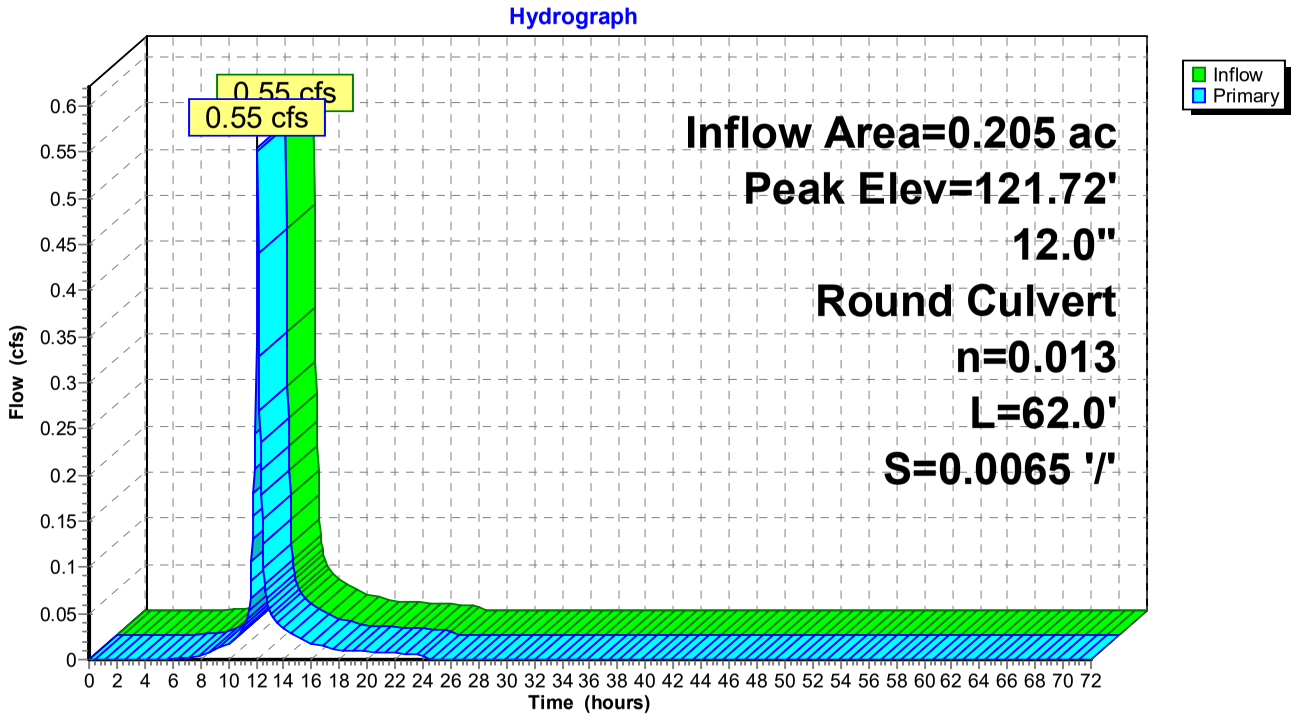
Inflow Area = 0.205 ac, 82.36% Impervious, Inflow Depth = 2.40" for 2 year event
Inflow = 0.55 cfs @ 12.09 hrs, Volume= 0.041 af
Outflow = 0.55 cfs @ 12.09 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min
Primary = 0.55 cfs @ 12.09 hrs, Volume= 0.041 af
Routed to Pond DMH1 : DMH #1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.72' @ 12.09 hrs
Flood Elev= 124.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.30'	**12.0" Round Culvert** L= 62.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 121.30' / 120.90' S= 0.0065 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.54 cfs @ 12.09 hrs HW=121.71' (Free Discharge)
1=Culvert (Barrel Controls 0.54 cfs @ 2.64 fps)

Pond CB1: CB1



Summary for Pond CB2: CB #2

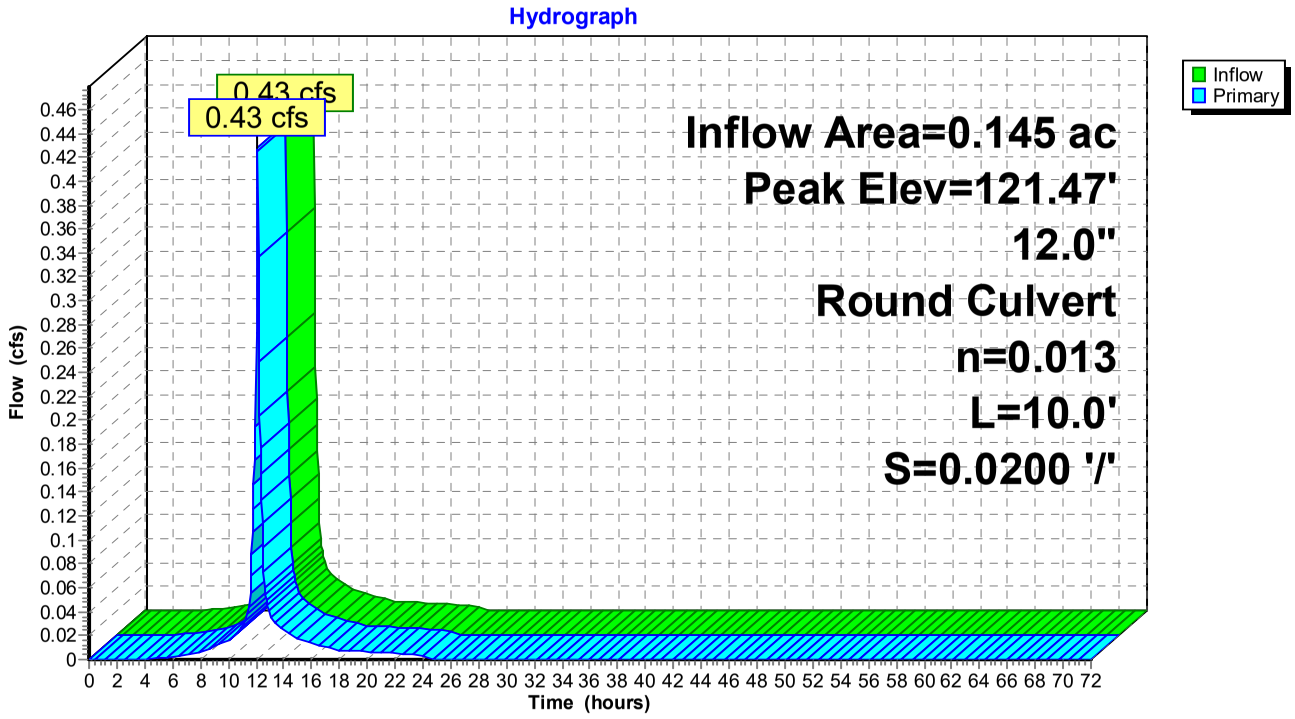
Inflow Area = 0.145 ac, 88.17% Impervious, Inflow Depth = 2.69" for 2 year event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 0.033 af
Outflow = 0.43 cfs @ 12.09 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min
Primary = 0.43 cfs @ 12.09 hrs, Volume= 0.033 af
Routed to Pond DMH#2 : DMH #2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.47' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.10'	**12.0" Round PIPE** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 121.10' / 120.90' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.42 cfs @ 12.09 hrs HW=121.46' (Free Discharge)
1=PIPE (Inlet Controls 0.42 cfs @ 1.62 fps)

Pond CB2: CB #2



Summary for Pond CB3: CB #3

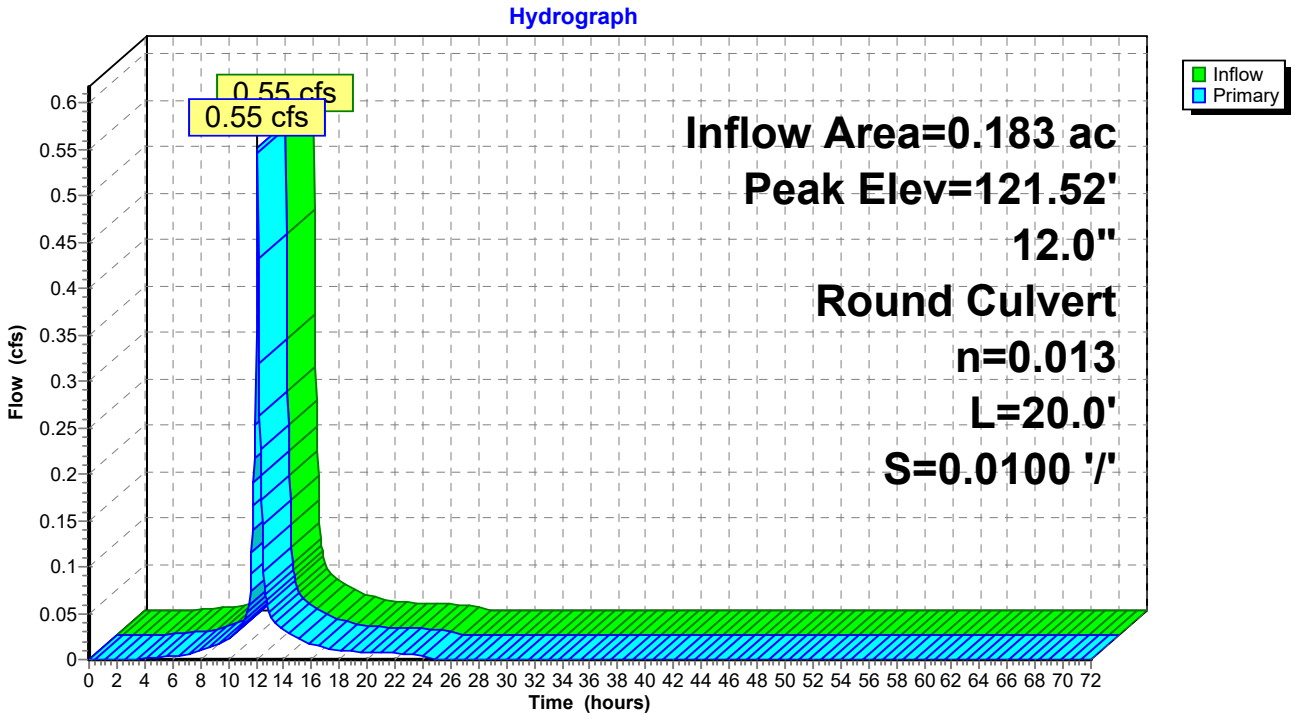
Inflow Area = 0.183 ac, 90.61% Impervious, Inflow Depth = 2.79" for 2 year event
Inflow = 0.55 cfs @ 12.09 hrs, Volume= 0.043 af
Outflow = 0.55 cfs @ 12.09 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min
Primary = 0.55 cfs @ 12.09 hrs, Volume= 0.043 af
Routed to Pond DMH#3 : DMH #3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.52' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.10'	**12.0" Round PIPE** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 121.10' / 120.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.54 cfs @ 12.09 hrs HW=121.52' (Free Discharge)
1=PIPE (Inlet Controls 0.54 cfs @ 1.73 fps)

Pond CB3: CB #3



Summary for Pond CB4: CB#4

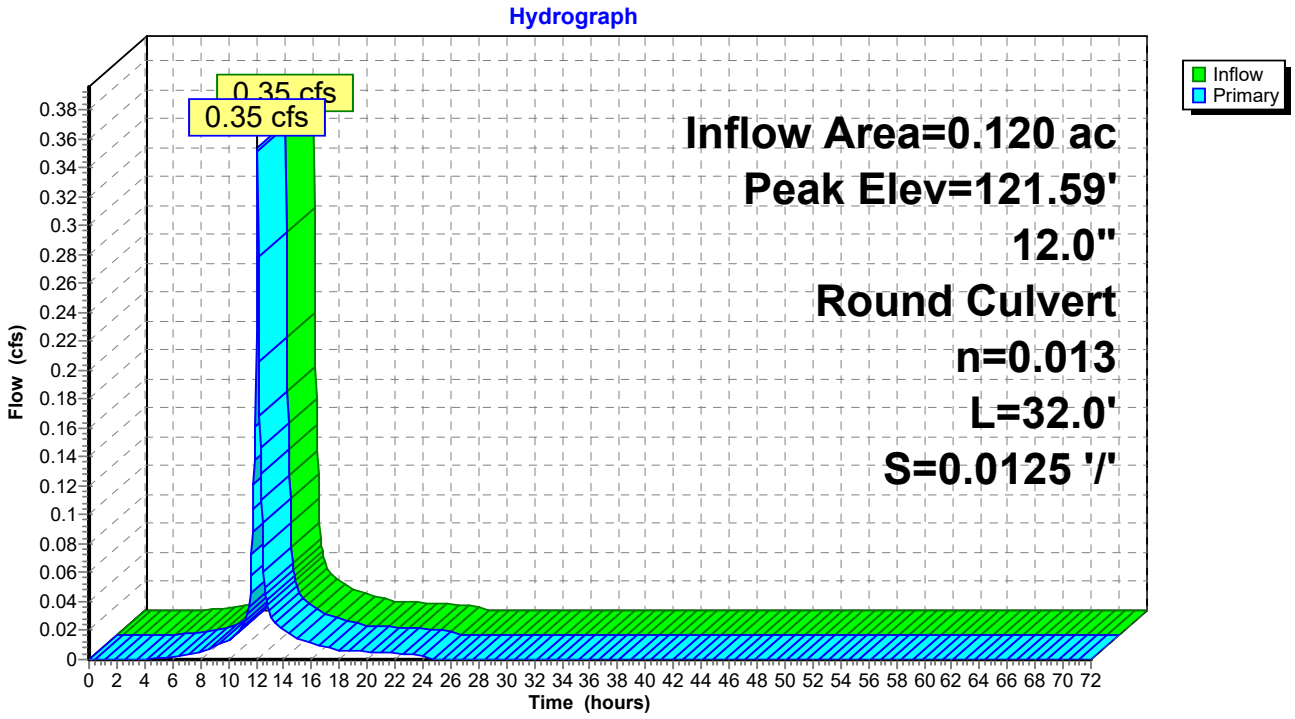
Inflow Area = 0.120 ac, 90.38% Impervious, Inflow Depth = 2.69" for 2 year event
Inflow = 0.35 cfs @ 12.09 hrs, Volume= 0.027 af
Outflow = 0.35 cfs @ 12.09 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.0 min
Primary = 0.35 cfs @ 12.09 hrs, Volume= 0.027 af
Routed to Pond DMH4 : DMH #4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.59' @ 12.09 hrs
Flood Elev= 124.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.30'	**12.0" Round PIPE** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 121.30' / 120.90' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.34 cfs @ 12.09 hrs HW=121.59' (Free Discharge)
1=PIPE (Inlet Controls 0.34 cfs @ 1.83 fps)

Pond CB4: CB#4



Summary for Pond DMH#2: DMH #2

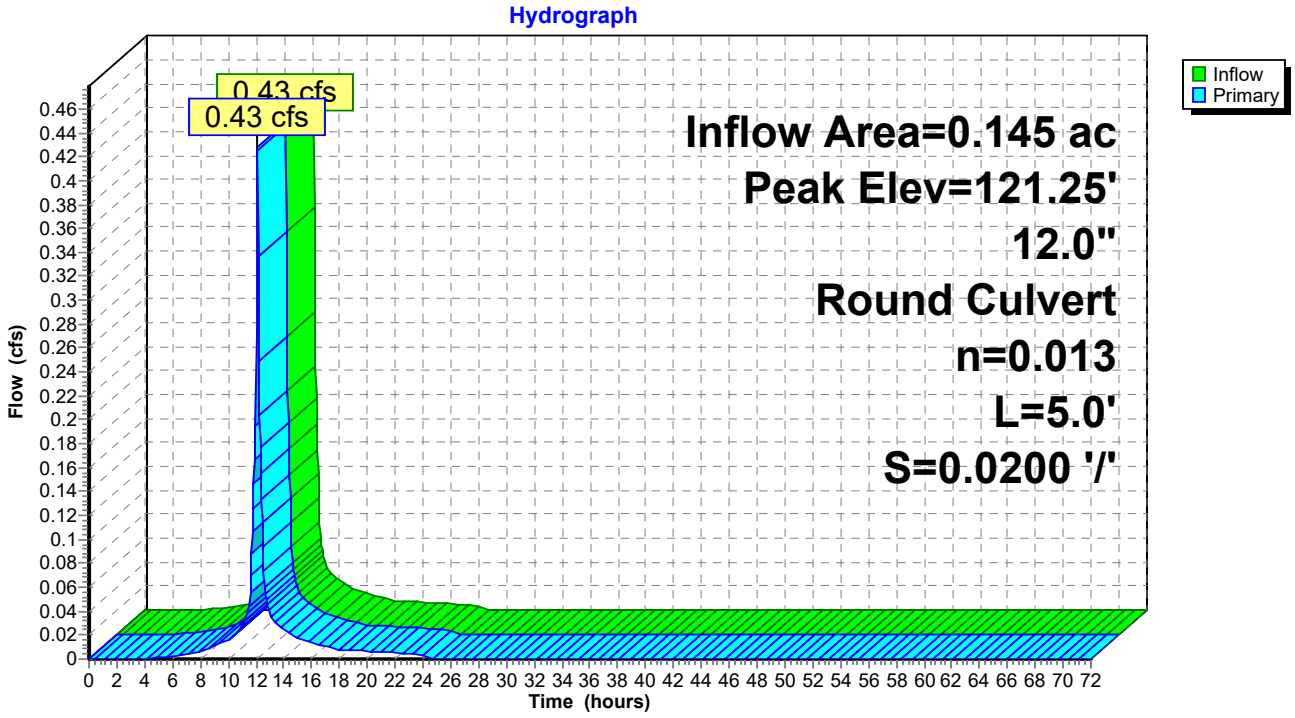
Inflow Area = 0.145 ac, 88.17% Impervious, Inflow Depth = 2.69" for 2 year event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 0.033 af
Outflow = 0.43 cfs @ 12.09 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min
Primary = 0.43 cfs @ 12.09 hrs, Volume= 0.033 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.25' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.42 cfs @ 12.09 hrs HW=121.25' (Free Discharge)
1=PIPE (Barrel Controls 0.42 cfs @ 2.58 fps)

Pond DMH#2: DMH #2



Summary for Pond DMH#3: DMH #3

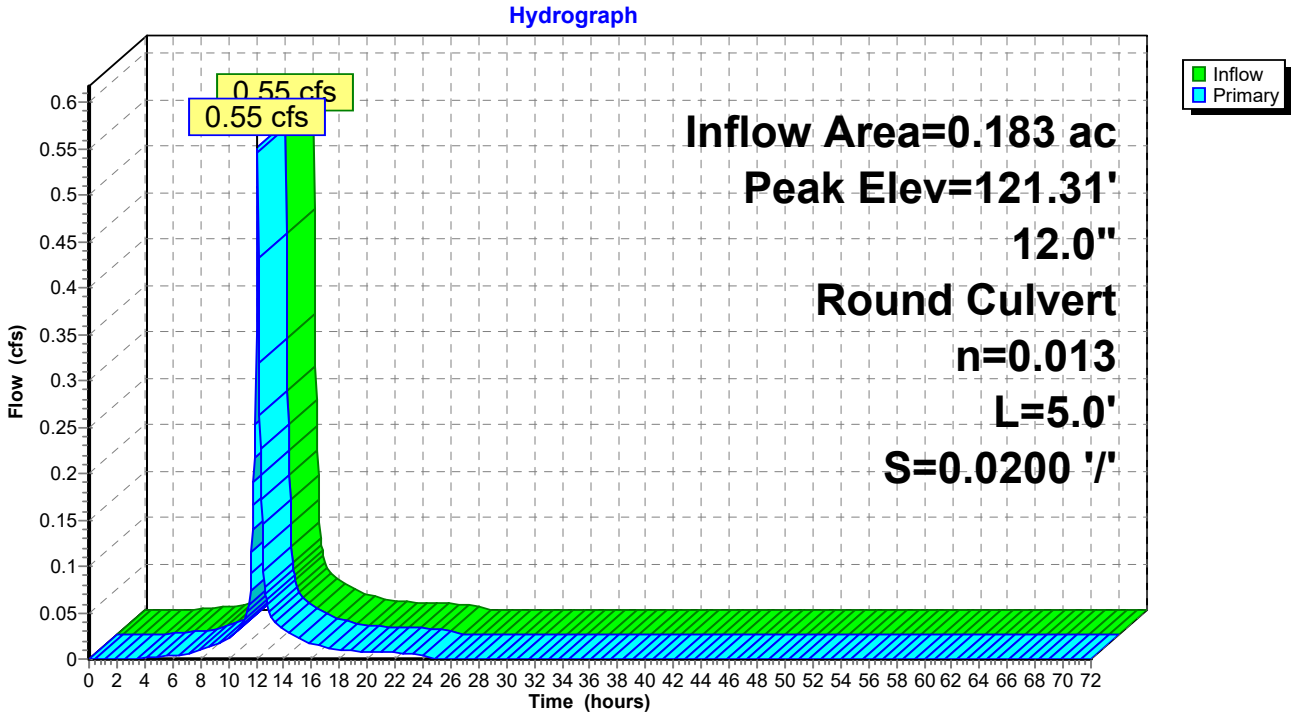
Inflow Area = 0.183 ac, 90.61% Impervious, Inflow Depth = 2.79" for 2 year event
Inflow = 0.55 cfs @ 12.09 hrs, Volume= 0.043 af
Outflow = 0.55 cfs @ 12.09 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min
Primary = 0.55 cfs @ 12.09 hrs, Volume= 0.043 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.31' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.54 cfs @ 12.09 hrs HW=121.30' (Free Discharge)
1=PIPE (Barrel Controls 0.54 cfs @ 2.71 fps)

Pond DMH#3: DMH #3



Summary for Pond DMH1: DMH #1

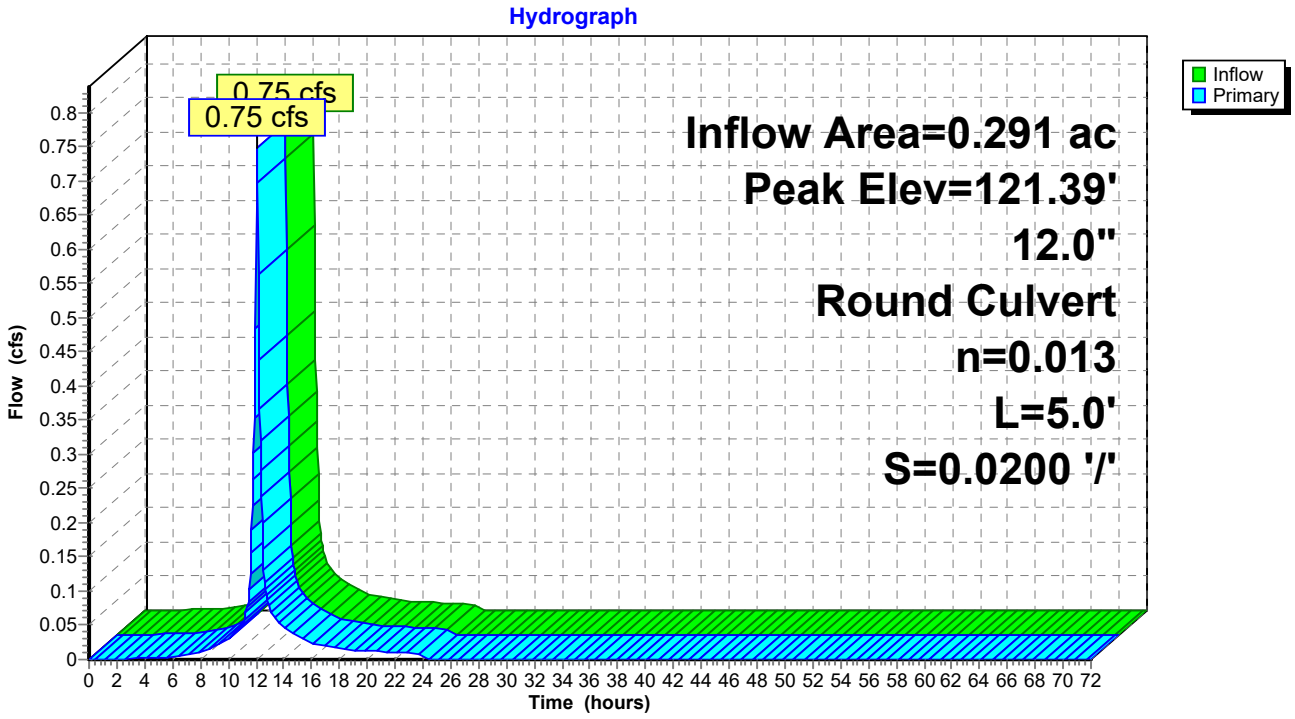
Inflow Area = 0.291 ac, 87.57% Impervious, Inflow Depth = 2.61" for 2 year event
Inflow = 0.75 cfs @ 12.06 hrs, Volume= 0.063 af
Outflow = 0.75 cfs @ 12.06 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min
Primary = 0.75 cfs @ 12.06 hrs, Volume= 0.063 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.39' @ 12.06 hrs
Flood Elev= 124.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round DMH 1 OUTLET** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.74 cfs @ 12.06 hrs HW=121.38' (Free Discharge)
1=DMH 1 OUTLET (Barrel Controls 0.74 cfs @ 2.88 fps)

Pond DMH1: DMH #1



Summary for Pond DMH4: DMH #4

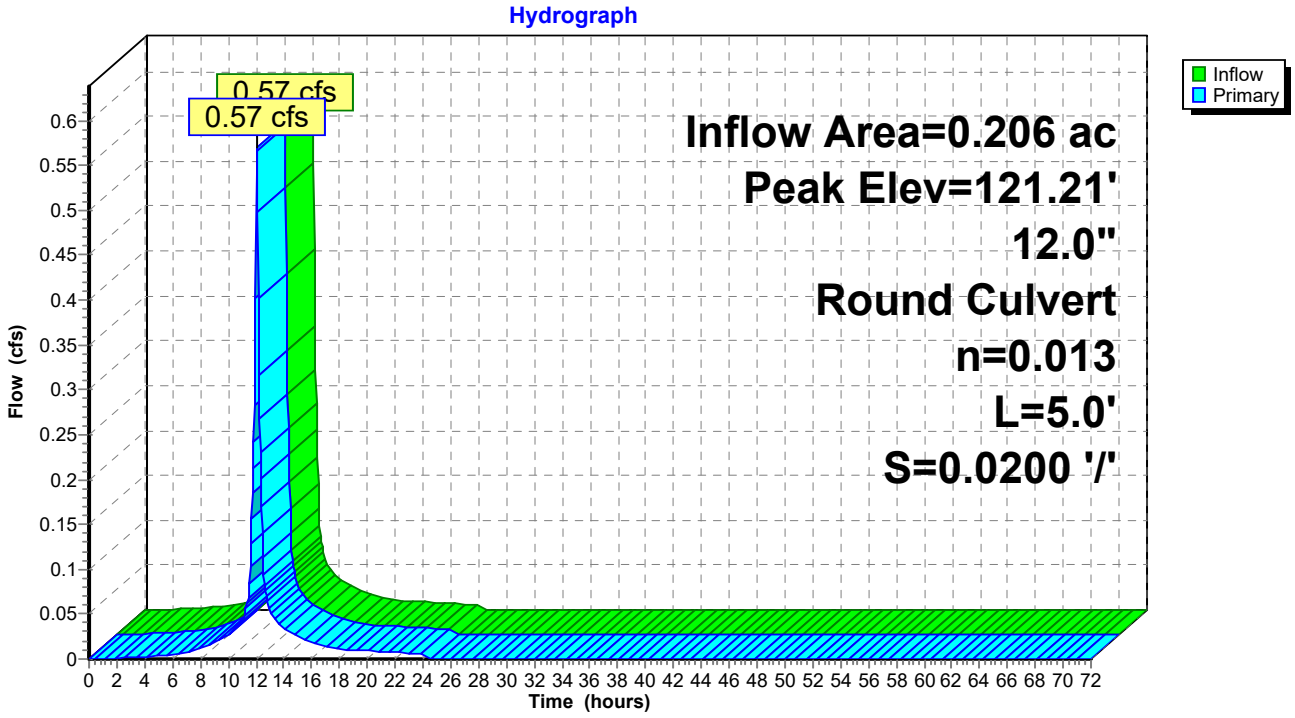
Inflow Area = 0.206 ac, 94.40% Impervious, Inflow Depth = 2.87" for 2 year event
Inflow = 0.57 cfs @ 12.04 hrs, Volume= 0.049 af
Outflow = 0.57 cfs @ 12.04 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min
Primary = 0.57 cfs @ 12.04 hrs, Volume= 0.049 af
Routed to Pond IC-B : INFILTRATION CHAMBER SYS 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.21' @ 12.04 hrs
Flood Elev= 124.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.80'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.80' / 120.70' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.56 cfs @ 12.04 hrs HW=121.21' (Free Discharge)
1=PIPE (Barrel Controls 0.56 cfs @ 2.73 fps)

Pond DMH4: DMH #4



Summary for Pond IC-A: INFILTRATION CHAMBER SYS1

Inflow Area = 0.620 ac, 88.61% Impervious, Inflow Depth = 2.68" for 2 year event
Inflow = 1.70 cfs @ 12.08 hrs, Volume= 0.139 af
Outflow = 0.13 cfs @ 11.30 hrs, Volume= 0.139 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.13 cfs @ 11.30 hrs, Volume= 0.139 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 120.83' @ 13.47 hrs Surf.Area= 5,373 sf Storage= 2,529 cf

Plug-Flow detention time= 167.0 min calculated for 0.138 af (100% of inflow)
Center-of-Mass det. time= 166.9 min (949.4 - 782.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	120.00'	3,007 cf	**34.75'W x 96.18'L x 3.50'H Field A** 11,697 cf Overall - 4,181 cf Embedded = 7,517 cf x 40.0% Voids
#2A	120.50'	4,181 cf	**ADS_StormTech SC-740 +Cap** x 91 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 91 Chambers in 7 Rows
#3B	120.00'	1,851 cf	**30.00'W x 67.70'L x 3.50'H Field B** 7,108 cf Overall - 2,481 cf Embedded = 4,627 cf x 40.0% Voids
#4B	120.50'	2,481 cf	**ADS_StormTech SC-740 +Cap** x 54 Inside #3 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 54 Chambers in 6 Rows
		11,519 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	120.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.13 cfs @ 11.30 hrs HW=120.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Pond IC-A: INFILTRATION CHAMBER SYS1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

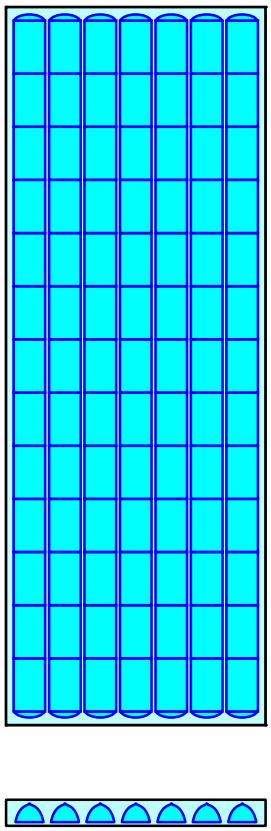
13 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 94.18' Row Length +12.0" End Stone x 2 = 96.18' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 34.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

91 Chambers x 45.9 cf = 4,180.5 cf Chamber Storage

11,697.5 cf Field - 4,180.5 cf Chambers = 7,516.9 cf Stone x 40.0% Voids = 3,006.8 cf Stone Storage

Chamber Storage + Stone Storage = 7,187.3 cf = 0.165 af
Overall Storage Efficiency = 61.4%
Overall System Size = 96.18' x 34.75' x 3.50'

91 Chambers
433.2 cy Field
278.4 cy Stone



Pond IC-A: INFILTRATION CHAMBER SYS1 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

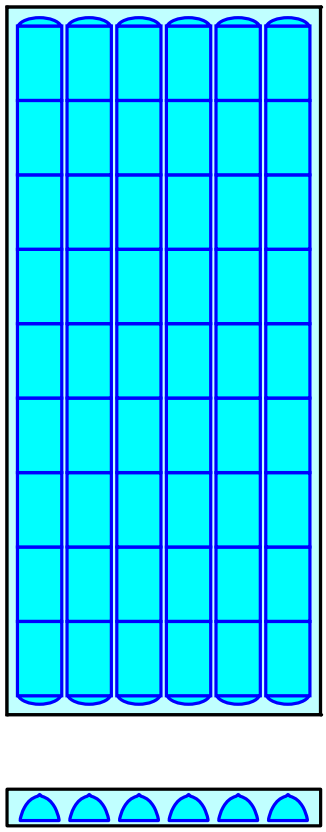
9 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 65.70' Row Length +12.0" End Stone x 2 = 67.70' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

54 Chambers x 45.9 cf = 2,480.8 cf Chamber Storage

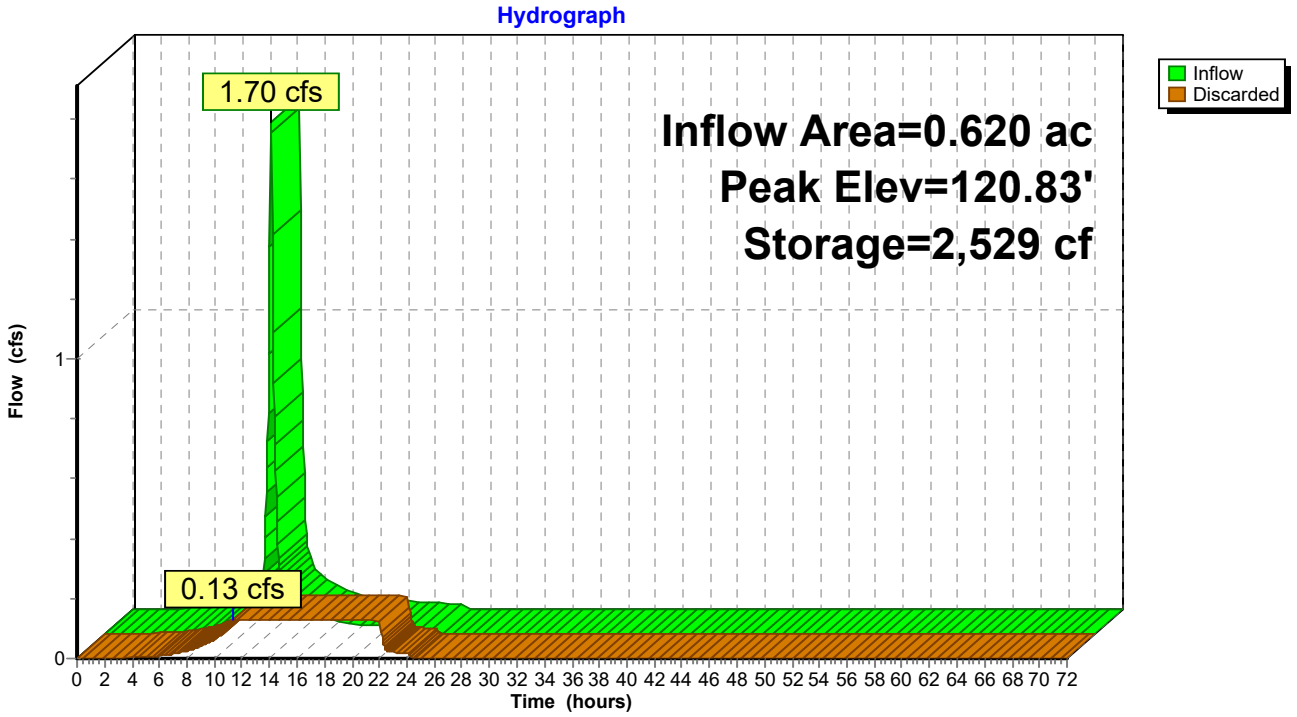
7,108.2 cf Field - 2,480.8 cf Chambers = 4,627.4 cf Stone x 40.0% Voids = 1,851.0 cf Stone Storage

Chamber Storage + Stone Storage = 4,331.7 cf = 0.099 af
Overall Storage Efficiency = 60.9%
Overall System Size = 67.70' x 30.00' x 3.50'

54 Chambers
263.3 cy Field
171.4 cy Stone



Pond IC-A: INFILTRATION CHAMBER SYS1



Summary for Pond IC-B: INFILTRATION CHAMBER SYS 2

Inflow Area = 0.206 ac, 94.40% Impervious, Inflow Depth = 2.87" for 2 year event
Inflow = 0.57 cfs @ 12.04 hrs, Volume= 0.049 af
Outflow = 0.06 cfs @ 11.55 hrs, Volume= 0.049 af, Atten= 89%, Lag= 0.0 min
Discarded = 0.06 cfs @ 11.55 hrs, Volume= 0.049 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 120.62' @ 12.86 hrs Surf.Area= 2,608 sf Storage= 776 cf

Plug-Flow detention time= 93.9 min calculated for 0.049 af (100% of inflow)
Center-of-Mass det. time= 93.8 min (863.2 - 769.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	120.00'	2,365 cf	**25.25'W x 103.30'L x 3.50'H Field A** 9,129 cf Overall - 3,216 cf Embedded = 5,913 cf x 40.0% Voids
#2A	120.50'	3,216 cf	**ADS_StormTech SC-740 +Cap** x 70 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 70 Chambers in 5 Rows
		5,581 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	120.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 11.55 hrs HW=120.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond IC-B: INFILTRATION CHAMBER SYS 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

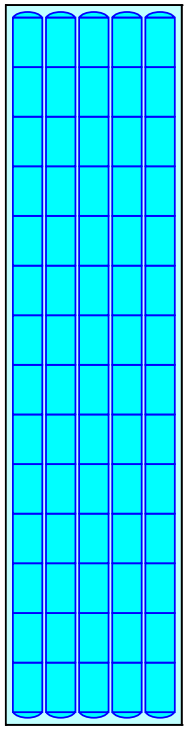
14 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 101.30' Row Length +12.0" End Stone x 2 = 103.30' Base Length
5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

70 Chambers x 45.9 cf = 3,215.8 cf Chamber Storage

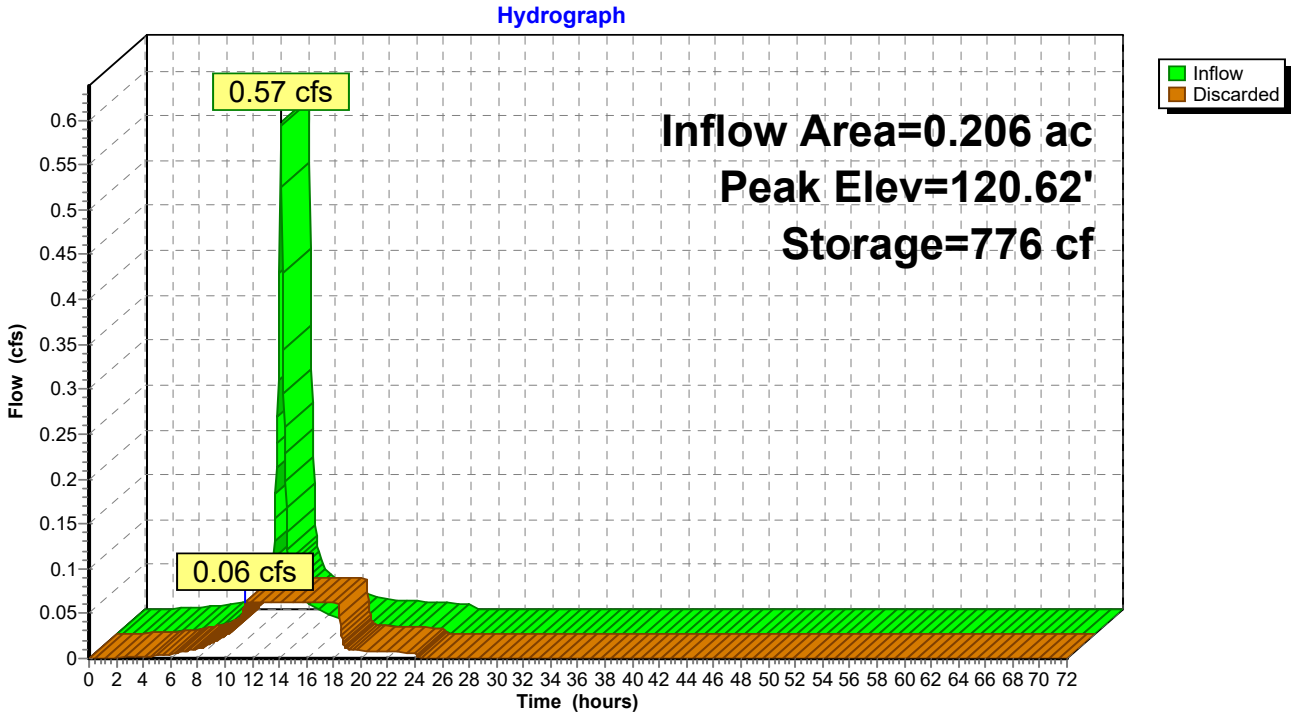
9,128.8 cf Field - 3,215.8 cf Chambers = 5,913.0 cf Stone x 40.0% Voids = 2,365.2 cf Stone Storage

Chamber Storage + Stone Storage = 5,581.0 cf = 0.128 af
Overall Storage Efficiency = 61.1%
Overall System Size = 103.30' x 25.25' x 3.50'

70 Chambers
338.1 cy Field
219.0 cy Stone



Pond IC-B: INFILTRATION CHAMBER SYS 2



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: prop. SC#1 Runoff Area=8,946 sf 82.36% Impervious Runoff Depth=3.93"
Flow Length=152' Tc=6.0 min CN=91 Runoff=0.89 cfs 0.067 af

Subcatchment 1SR: PROP SC, ROOF Runoff Area=3,750 sf 100.00% Impervious Runoff Depth=4.71"
Tc=0.0 min CN=98 Runoff=0.48 cfs 0.034 af

Subcatchment 2S: PROP. SC#2 Runoff Area=6,329 sf 88.17% Impervious Runoff Depth=4.26"
Flow Length=152' Tc=6.0 min CN=94 Runoff=0.66 cfs 0.052 af

Subcatchment 2SR: PROP. SC, ROOF Runoff Area=3,750 sf 100.00% Impervious Runoff Depth=4.71"
Tc=0.0 min CN=98 Runoff=0.48 cfs 0.034 af

Subcatchment 3S: PROP. SC#3 Runoff Area=7,964 sf 90.61% Impervious Runoff Depth=4.37"
Flow Length=152' Tc=6.0 min CN=95 Runoff=0.84 cfs 0.067 af

Subcatchment 4S: PROP. SC #4 Runoff Area=5,231 sf 90.38% Impervious Runoff Depth=4.26"
Flow Length=81' Tc=6.0 min CN=94 Runoff=0.54 cfs 0.043 af

Subcatchment 5S: SC5- to Washington Runoff Area=2,137 sf 0.00% Impervious Runoff Depth=1.34"
Tc=0.0 min CN=61 Runoff=0.08 cfs 0.005 af

Subcatchment 6S: SC6- to Webster Runoff Area=1,770 sf 0.00% Impervious Runoff Depth=1.34"
Tc=0.0 min CN=61 Runoff=0.07 cfs 0.005 af

Reach DP1: DP1 Inflow=0.15 cfs 0.010 af
Outflow=0.15 cfs 0.010 af

Pond CB1: CB1 Peak Elev=121.84' Inflow=0.89 cfs 0.067 af
12.0" Round Culvert n=0.013 L=62.0' S=0.0065 '/' Outflow=0.89 cfs 0.067 af

Pond CB2: CB #2 Peak Elev=121.57' Inflow=0.66 cfs 0.052 af
12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.66 cfs 0.052 af

Pond CB3: CB #3 Peak Elev=121.64' Inflow=0.84 cfs 0.067 af
12.0" Round Culvert n=0.013 L=20.0' S=0.0100 '/' Outflow=0.84 cfs 0.067 af

Pond CB4: CB#4 Peak Elev=121.67' Inflow=0.54 cfs 0.043 af
12.0" Round Culvert n=0.013 L=32.0' S=0.0125 '/' Outflow=0.54 cfs 0.043 af

Pond DMH#2: DMH #2 Peak Elev=121.35' Inflow=0.66 cfs 0.052 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.66 cfs 0.052 af

Pond DMH#3: DMH #3 Peak Elev=121.42' Inflow=0.84 cfs 0.067 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.84 cfs 0.067 af

Pond DMH1: DMH #1 Peak Elev=121.54' Inflow=1.18 cfs 0.101 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=1.18 cfs 0.101 af

Pond DMH4: DMH #4 Peak Elev=121.33' Inflow=0.87 cfs 0.076 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.87 cfs 0.076 af

Pond IC-A: INFILTRATION CHAMBER SYS1 Peak Elev=121.34' Storage=4,719 cf Inflow=2.64 cfs 0.219 af
Outflow=0.13 cfs 0.219 af

Pond IC-B: INFILTRATION CHAMBER SYS 2 Peak Elev=120.91' Storage=1,393 cf Inflow=0.87 cfs 0.076 af
Outflow=0.06 cfs 0.076 af

Total Runoff Area = 0.915 ac Runoff Volume = 0.306 af Average Runoff Depth = 4.01"
18.77% Pervious = 0.172 ac 81.23% Impervious = 0.744 ac

Summary for Subcatchment 1S: prop. SC#1

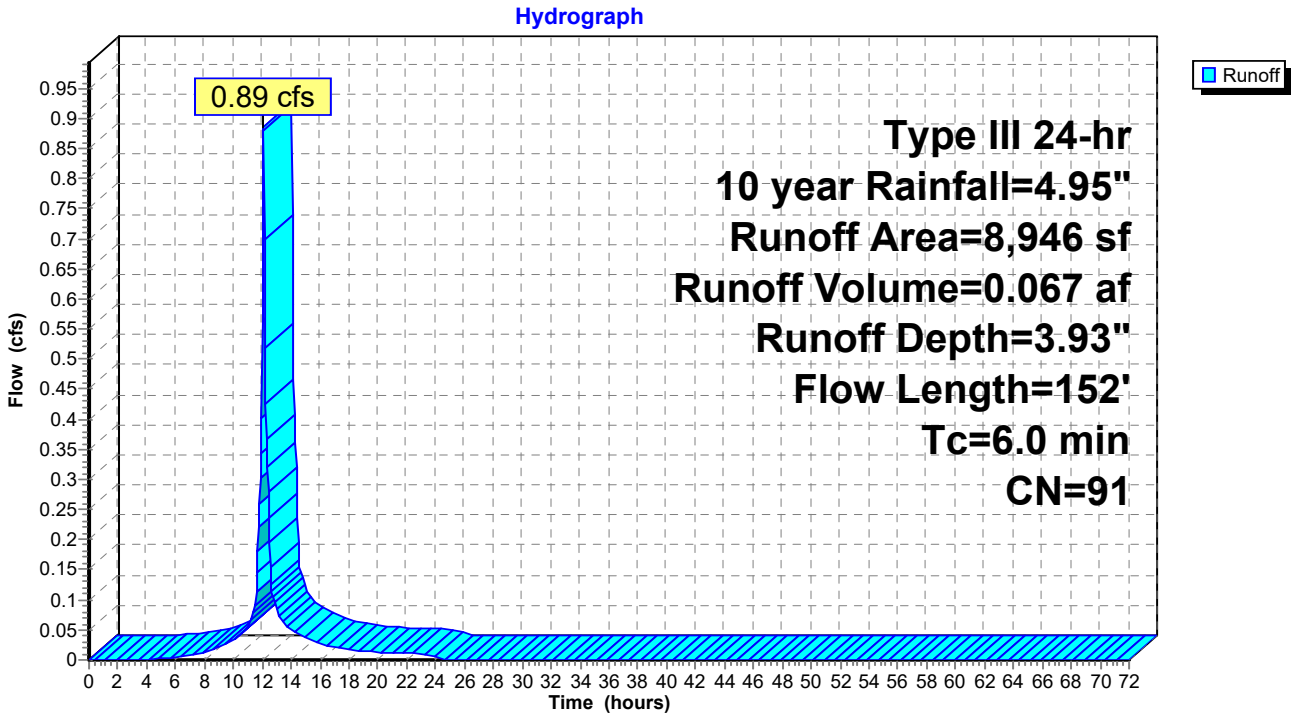
Runoff = 0.89 cfs @ 12.09 hrs, Volume= 0.067 af, Depth= 3.93"
Routed to Pond CB1 : CB1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.95"

	Area (sf)	CN	Description
*	6,381	98	pavement area
*	987	98	sidewalk & retaining wall
	1,578	61	>75% Grass cover, Good, HSG B
	8,946	91	Weighted Average
	1,578		17.64% Pervious Area
	7,368		82.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: prop. SC#1



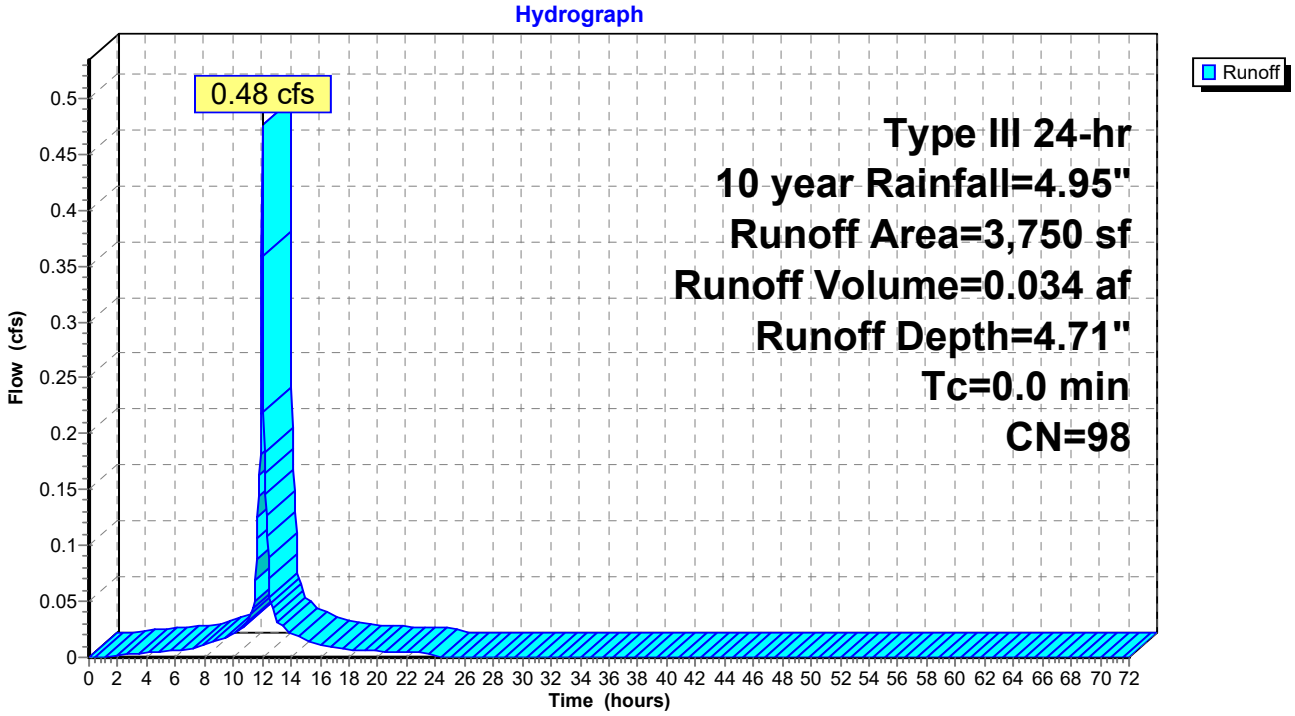
Summary for Subcatchment 1SR: PROP SC, ROOF DRAIN 1

Runoff = 0.48 cfs @ 12.00 hrs, Volume= 0.034 af, Depth= 4.71"
Routed to Pond DMH1 : DMH #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.95"

	Area (sf)	CN	Description
*	3,750	98	roof area
	3,750		100.00% Impervious Area

Subcatchment 1SR: PROP SC, ROOF DRAIN 1



Summary for Subcatchment 2S: PROP. SC#2

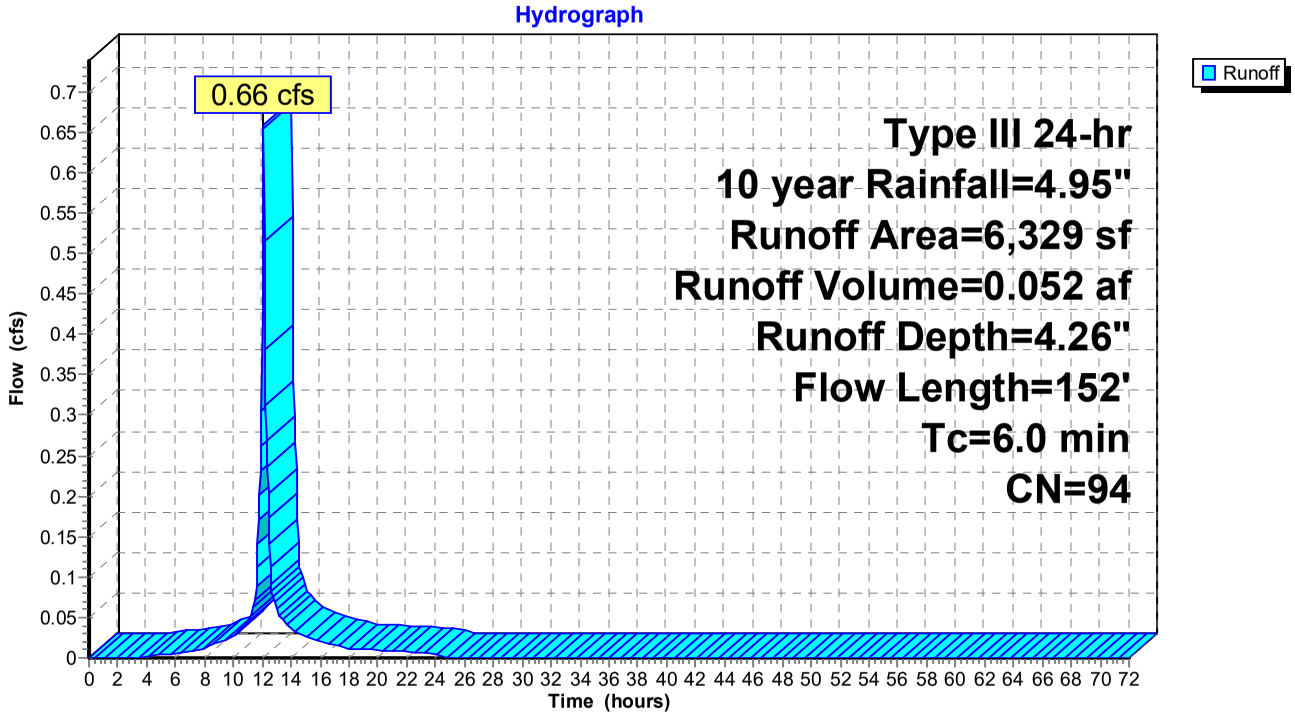
Runoff = 0.66 cfs @ 12.09 hrs, Volume= 0.052 af, Depth= 4.26"
Routed to Pond CB2 : CB #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.95"

	Area (sf)	CN	Description
*	4,872	98	pavement area
*	708	98	sidewalk & retaining wall
	749	61	>75% Grass cover, Good, HSG B
	6,329	94	Weighted Average
	749		11.83% Pervious Area
	5,580		88.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: PROP. SC#2



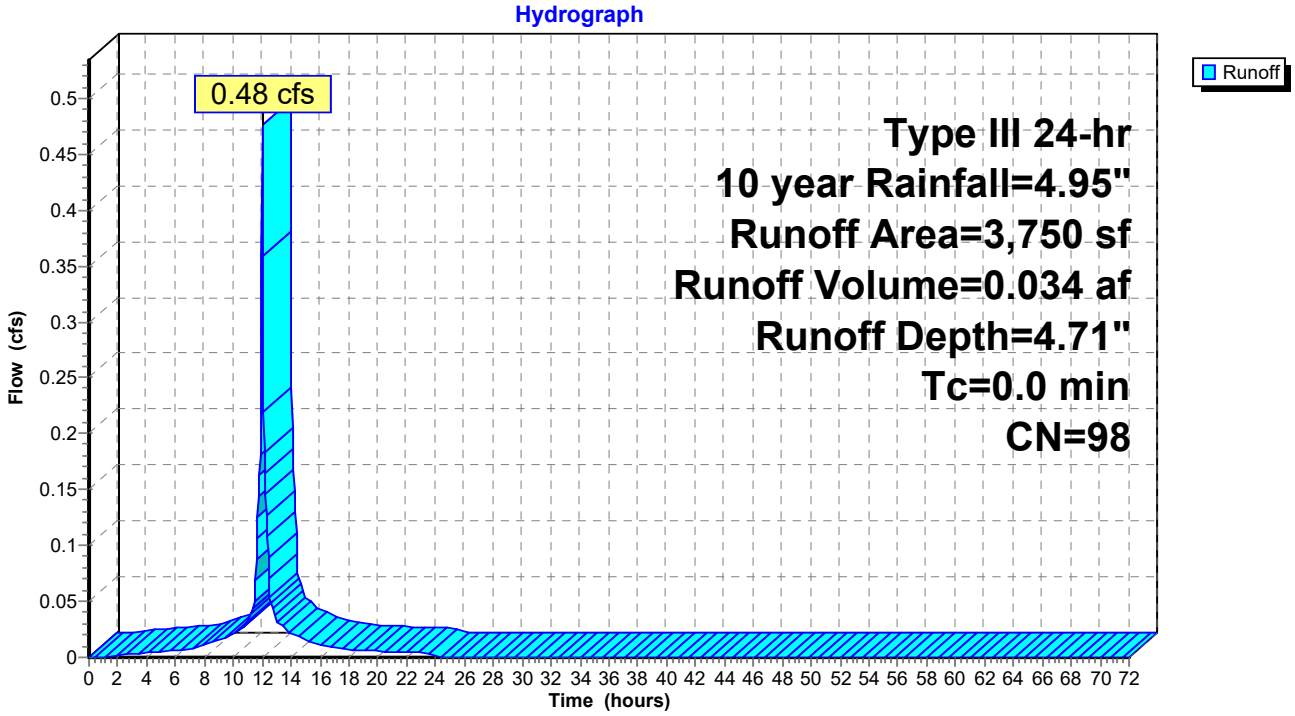
Summary for Subcatchment 2SR: PROP. SC, ROOF DRAIN 2

Runoff = 0.48 cfs @ 12.00 hrs, Volume= 0.034 af, Depth= 4.71"
Routed to Pond DMH4 : DMH #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.95"

	Area (sf)	CN	Description
*	3,750	98	roof area
	3,750		100.00% Impervious Area

Subcatchment 2SR: PROP. SC, ROOF DRAIN 2



Summary for Subcatchment 3S: PROP. SC#3

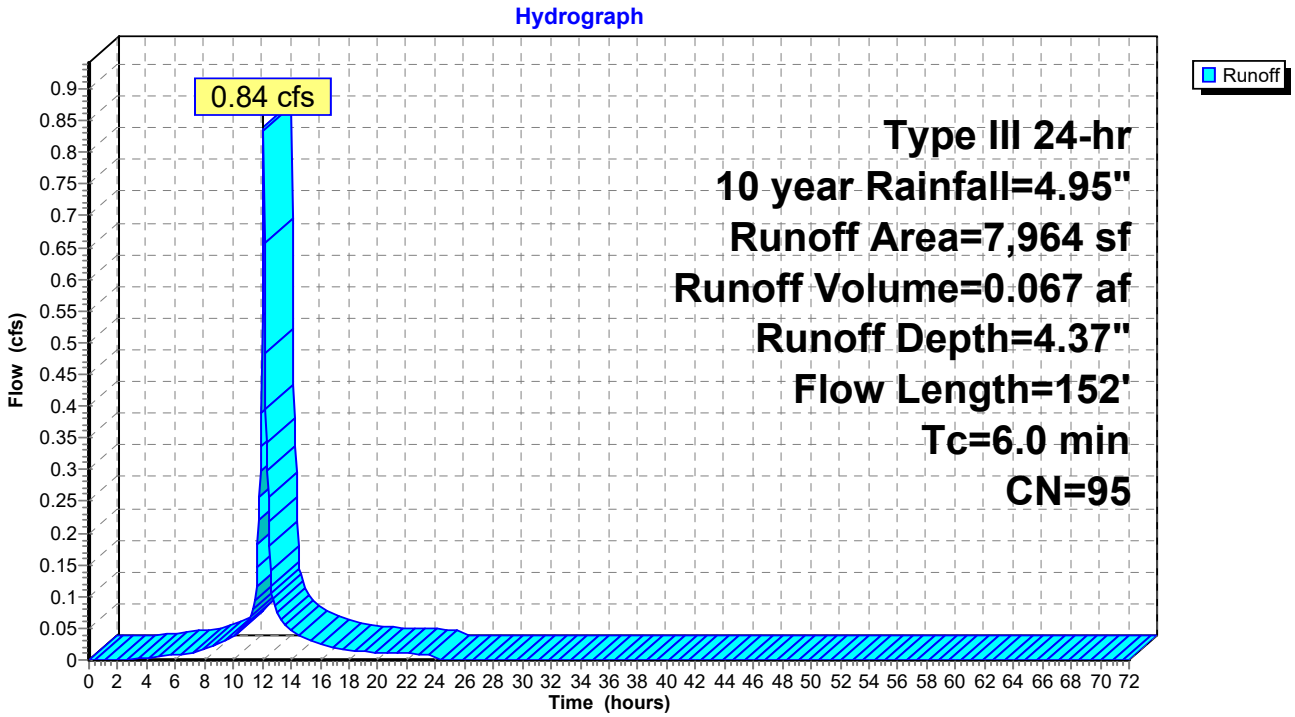
Runoff = 0.84 cfs @ 12.09 hrs, Volume= 0.067 af, Depth= 4.37"
Routed to Pond CB3 : CB #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.95"

	Area (sf)	CN	Description
*	6,031	98	pavement area
*	1,185	98	sidewalk & retaining wall
	748	61	>75% Grass cover, Good, HSG B
	7,964	95	Weighted Average
	748		9.39% Pervious Area
	7,216		90.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 3S: PROP. SC#3



Summary for Subcatchment 4S: PROP. SC #4

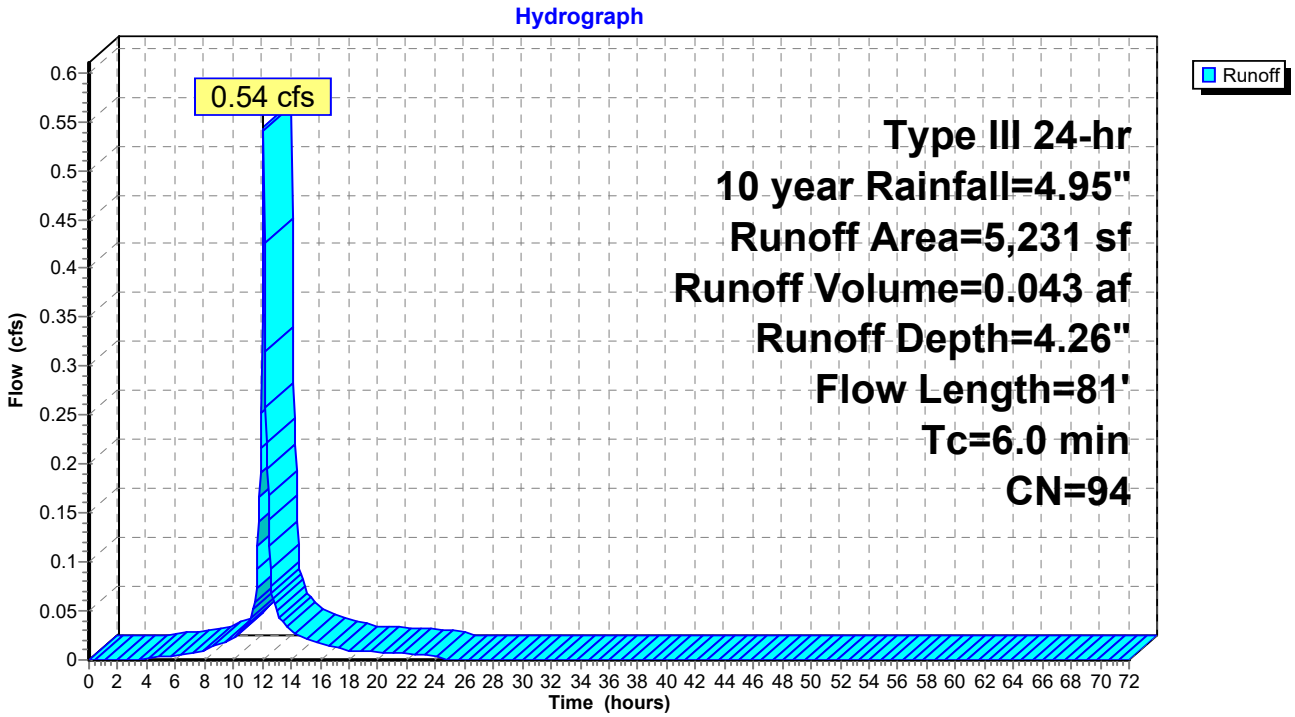
Runoff = 0.54 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 4.26"
Routed to Pond CB4 : CB#4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.95"

	Area (sf)	CN	Description
	4,341	98	Paved parking, HSG B
*	387	98	sidewalk and other impervious
	503	61	>75% Grass cover, Good, HSG B
	5,231	94	Weighted Average
	503		9.62% Pervious Area
	4,728		90.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	50	0.1350	2.65		**Sheet Flow, sheet flow 50 ft** Smooth surfaces n= 0.011 P2= 3.40"
0.3	31	0.0100	2.03		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
0.6	81	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 4S: PROP. SC #4



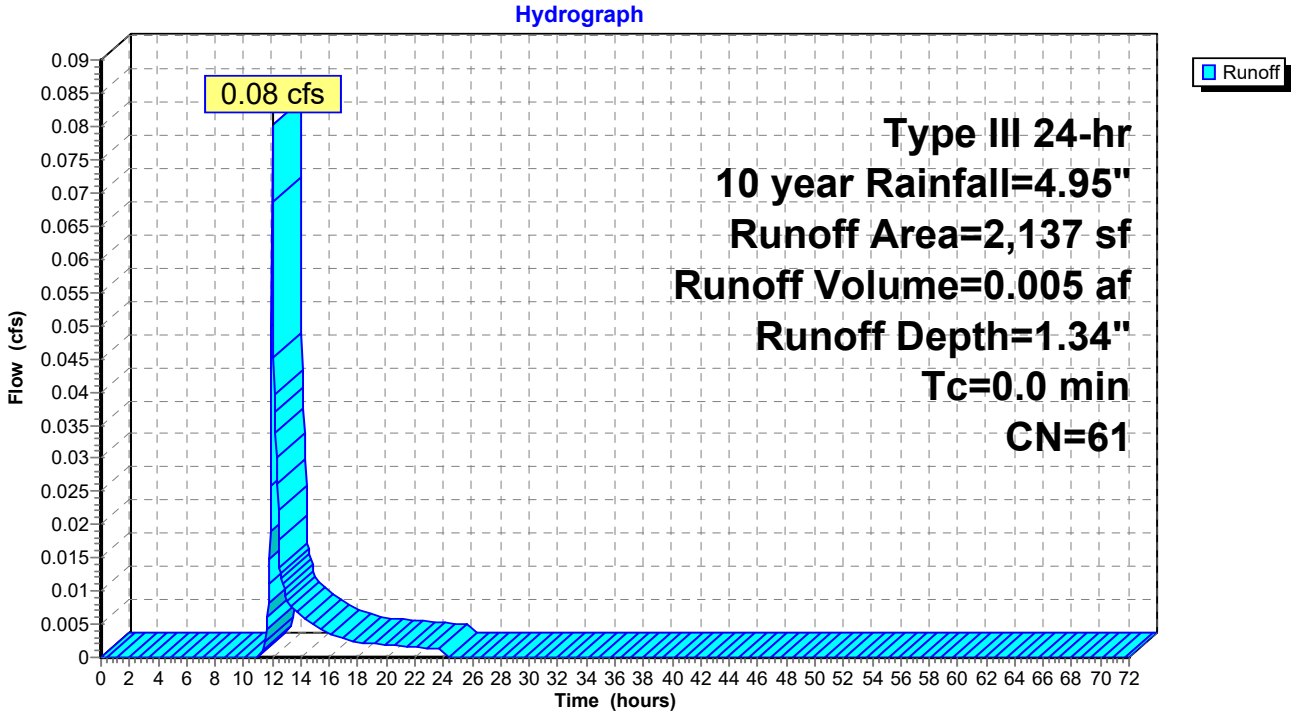
Summary for Subcatchment 5S: SC5- to Washington

Runoff = 0.08 cfs @ 12.01 hrs, Volume= 0.005 af, Depth= 1.34"
Routed to Reach DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.95"

Area (sf)	CN	Description
2,137	61	>75% Grass cover, Good, HSG B
2,137		100.00% Pervious Area

Subcatchment 5S: SC5- to Washington



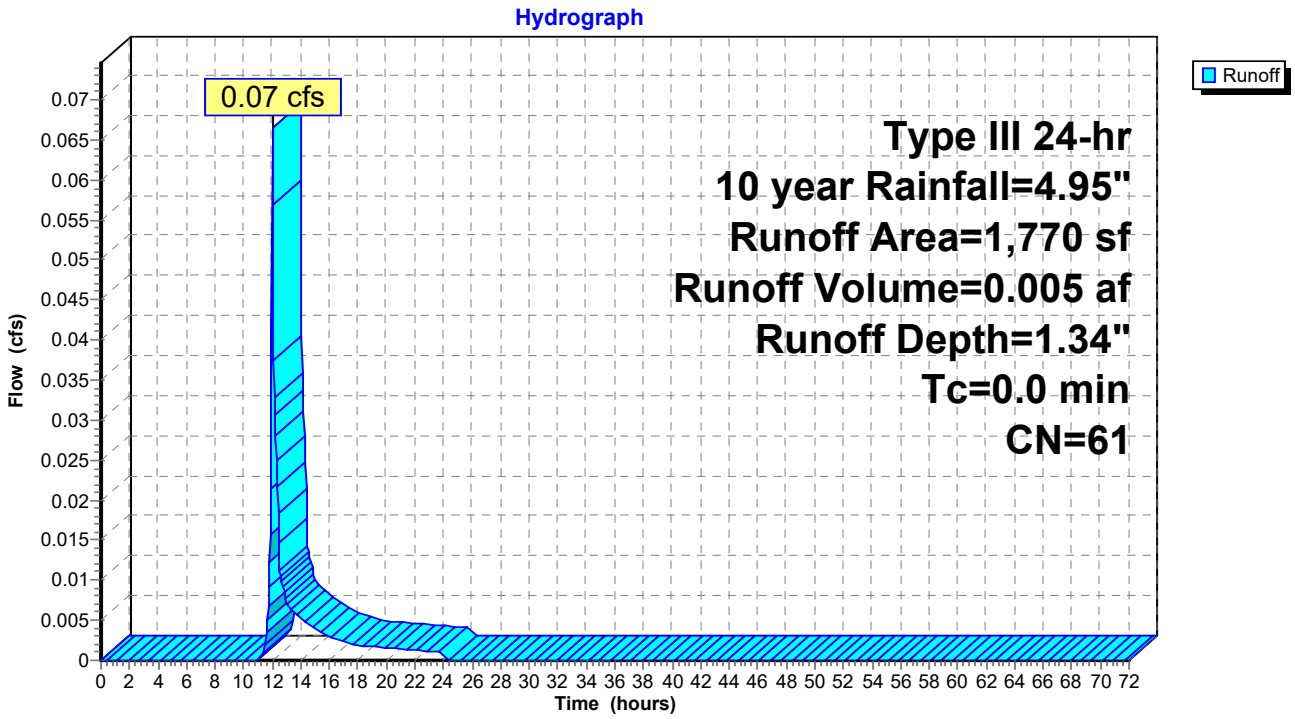
Summary for Subcatchment 6S: SC6- to Webster

Runoff = 0.07 cfs @ 12.01 hrs, Volume= 0.005 af, Depth= 1.34"
Routed to Reach DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.95"

Area (sf)	CN	Description
1,770	61	>75% Grass cover, Good, HSG B
1,770		100.00% Pervious Area

Subcatchment 6S: SC6- to Webster

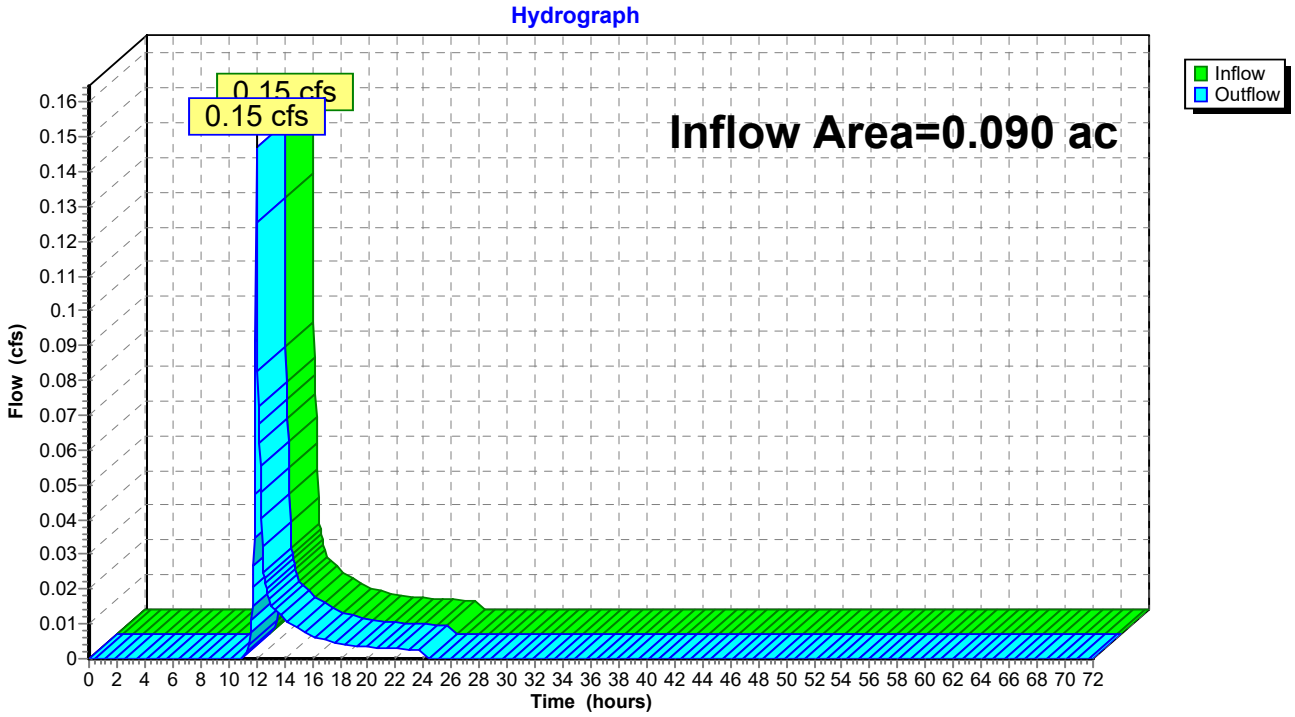


Summary for Reach DP1: DP1

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 1.34" for 10 year event
Inflow = 0.15 cfs @ 12.01 hrs, Volume= 0.010 af
Outflow = 0.15 cfs @ 12.01 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: DP1



Summary for Pond CB1: CB1

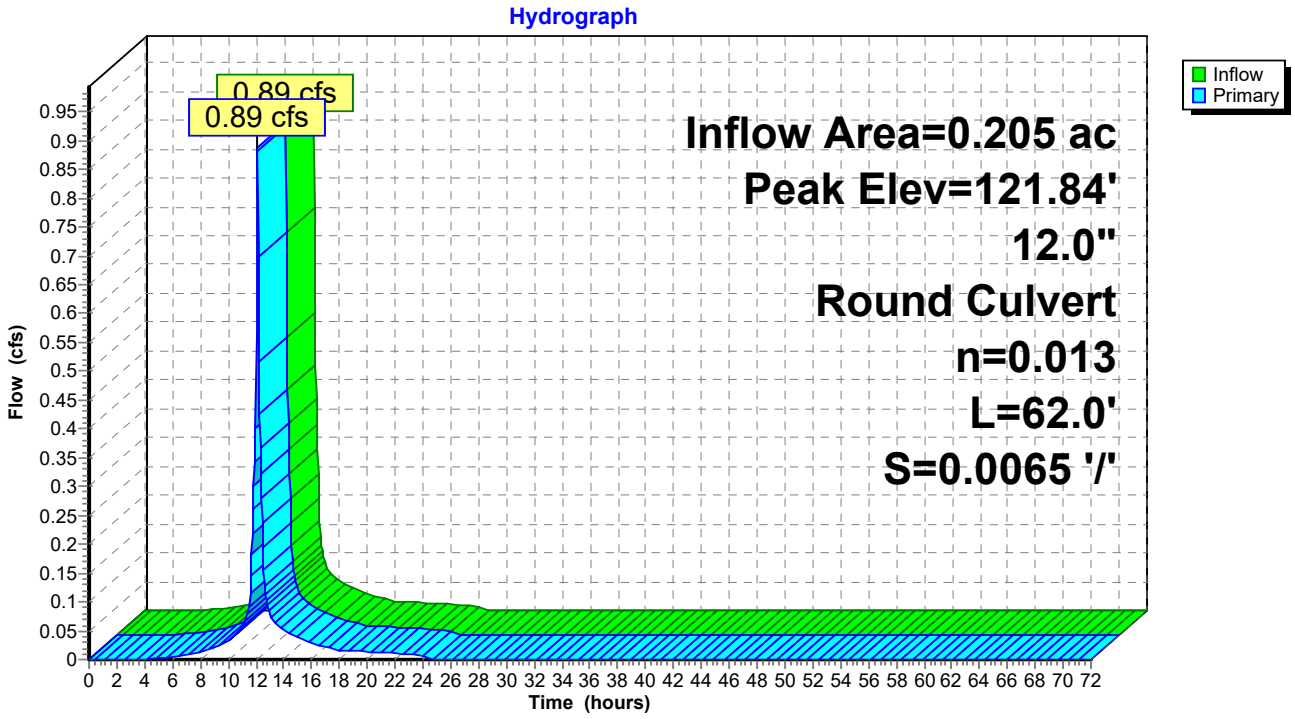
Inflow Area = 0.205 ac, 82.36% Impervious, Inflow Depth = 3.93" for 10 year event
Inflow = 0.89 cfs @ 12.09 hrs, Volume= 0.067 af
Outflow = 0.89 cfs @ 12.09 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.0 min
Primary = 0.89 cfs @ 12.09 hrs, Volume= 0.067 af
Routed to Pond DMH1 : DMH #1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.84' @ 12.09 hrs
Flood Elev= 124.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.30'	**12.0" Round Culvert** L= 62.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 121.30' / 120.90' S= 0.0065 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.86 cfs @ 12.09 hrs HW=121.83' (Free Discharge)
1=Culvert (Barrel Controls 0.86 cfs @ 2.96 fps)

Pond CB1: CB1



Summary for Pond CB2: CB #2

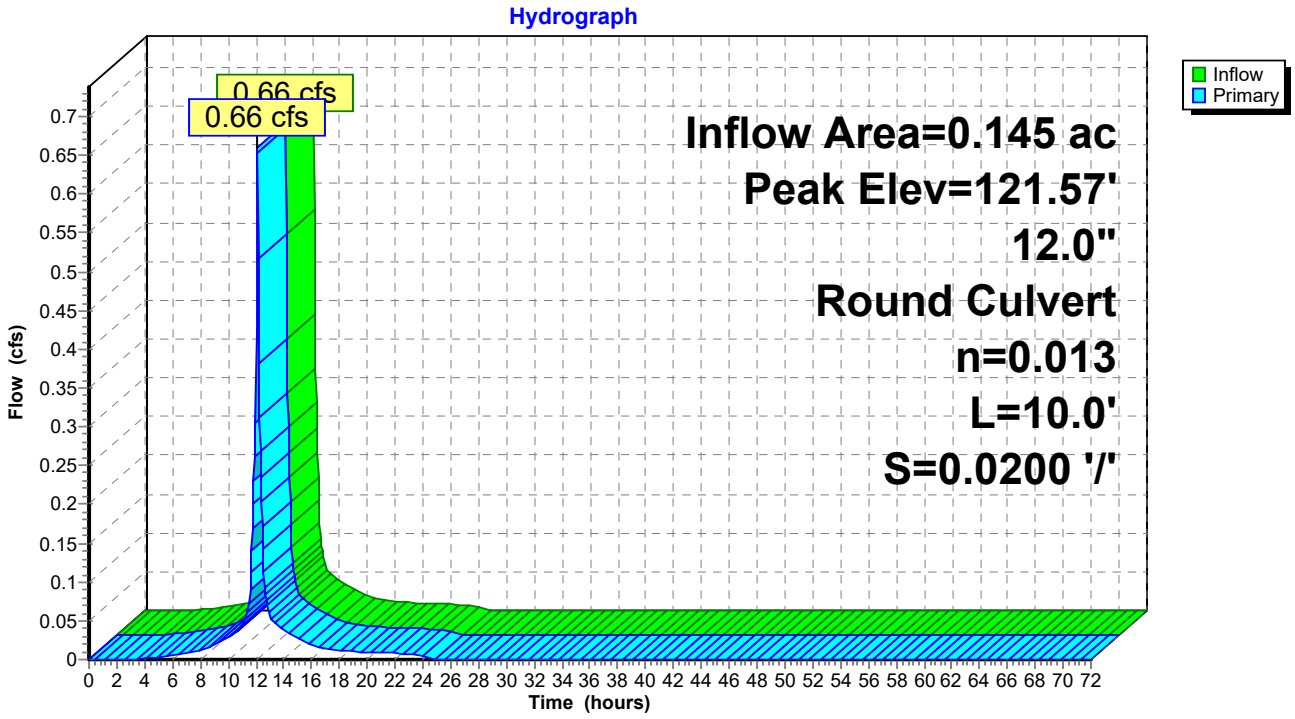
Inflow Area = 0.145 ac, 88.17% Impervious, Inflow Depth = 4.26" for 10 year event
Inflow = 0.66 cfs @ 12.09 hrs, Volume= 0.052 af
Outflow = 0.66 cfs @ 12.09 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min
Primary = 0.66 cfs @ 12.09 hrs, Volume= 0.052 af
Routed to Pond DMH#2 : DMH #2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.57' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.10'	**12.0" Round PIPE** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 121.10' / 120.90' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.64 cfs @ 12.09 hrs HW=121.56' (Free Discharge)
1=PIPE (Inlet Controls 0.64 cfs @ 1.82 fps)

Pond CB2: CB #2



Summary for Pond CB3: CB #3

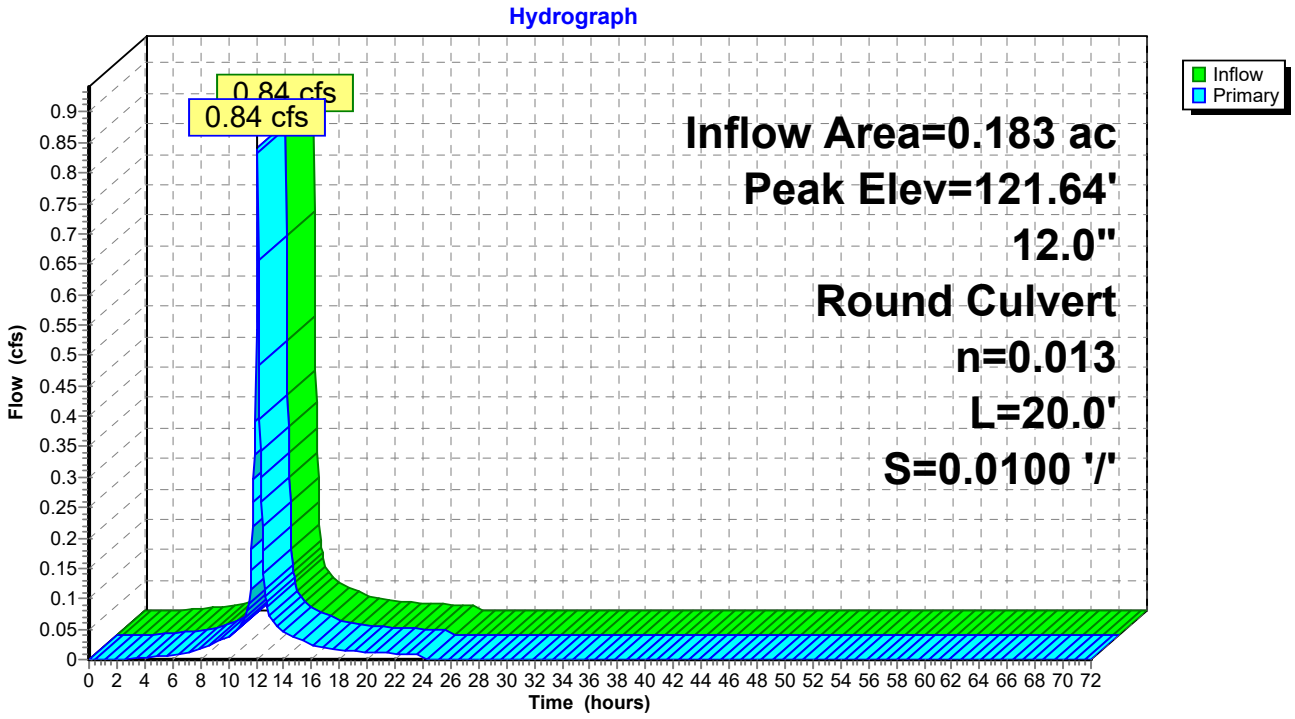
Inflow Area = 0.183 ac, 90.61% Impervious, Inflow Depth = 4.37" for 10 year event
Inflow = 0.84 cfs @ 12.09 hrs, Volume= 0.067 af
Outflow = 0.84 cfs @ 12.09 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.0 min
Primary = 0.84 cfs @ 12.09 hrs, Volume= 0.067 af
Routed to Pond DMH#3 : DMH #3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.64' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.10'	**12.0" Round PIPE** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 121.10' / 120.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.82 cfs @ 12.09 hrs HW=121.63' (Free Discharge)
1=PIPE (Barrel Controls 0.82 cfs @ 2.83 fps)

Pond CB3: CB #3



Summary for Pond CB4: CB#4

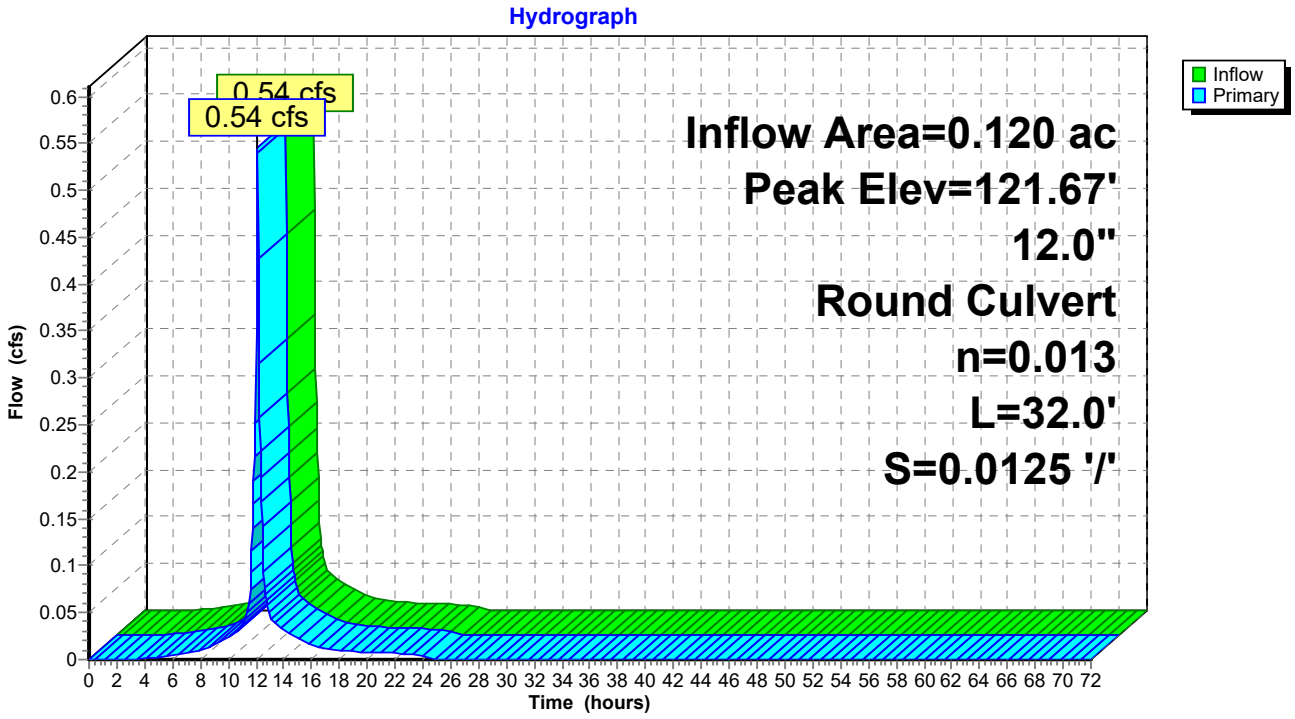
Inflow Area = 0.120 ac, 90.38% Impervious, Inflow Depth = 4.26" for 10 year event
Inflow = 0.54 cfs @ 12.09 hrs, Volume= 0.043 af
Outflow = 0.54 cfs @ 12.09 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min
Primary = 0.54 cfs @ 12.09 hrs, Volume= 0.043 af
Routed to Pond DMH4 : DMH #4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.67' @ 12.09 hrs
Flood Elev= 124.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.30'	**12.0" Round PIPE** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 121.30' / 120.90' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.53 cfs @ 12.09 hrs HW=121.66' (Free Discharge)
1=PIPE (Inlet Controls 0.53 cfs @ 2.05 fps)

Pond CB4: CB#4



Summary for Pond DMH#2: DMH #2

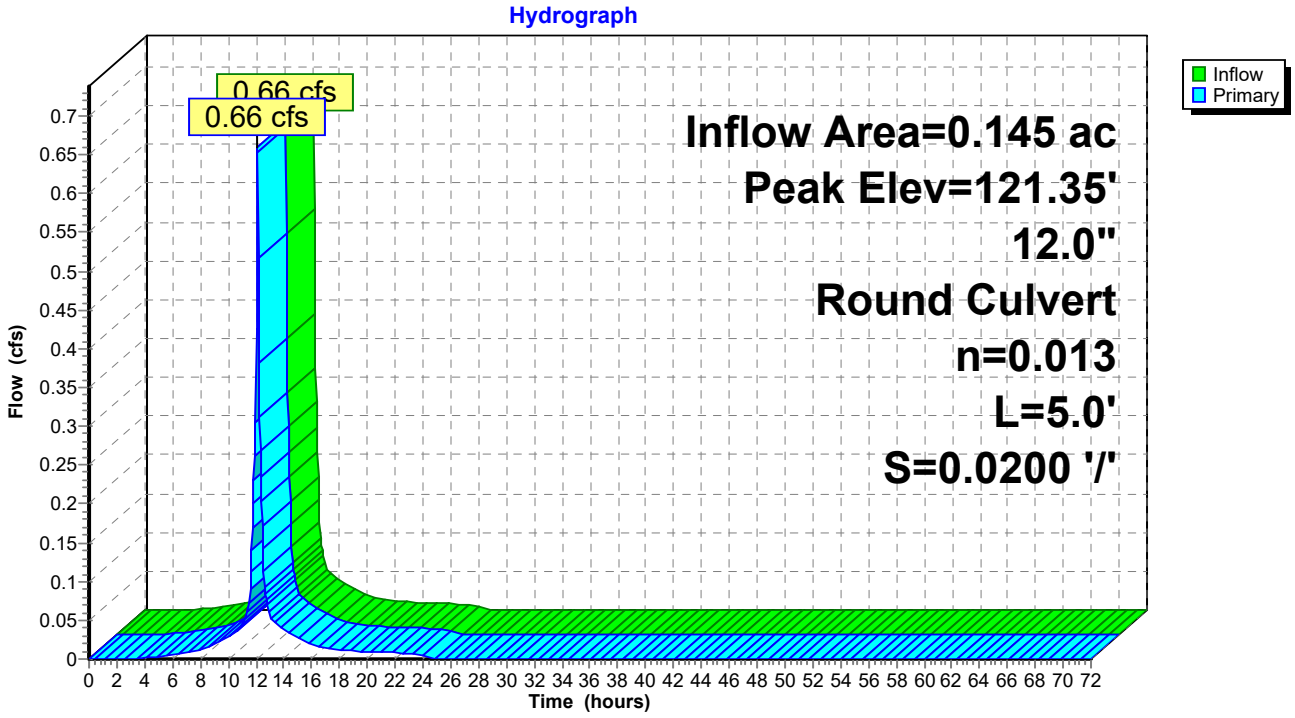
Inflow Area = 0.145 ac, 88.17% Impervious, Inflow Depth = 4.26" for 10 year event
Inflow = 0.66 cfs @ 12.09 hrs, Volume= 0.052 af
Outflow = 0.66 cfs @ 12.09 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min
Primary = 0.66 cfs @ 12.09 hrs, Volume= 0.052 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.35' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.64 cfs @ 12.09 hrs HW=121.34' (Free Discharge)
1=PIPE (Barrel Controls 0.64 cfs @ 2.80 fps)

Pond DMH#2: DMH #2



Summary for Pond DMH#3: DMH #3

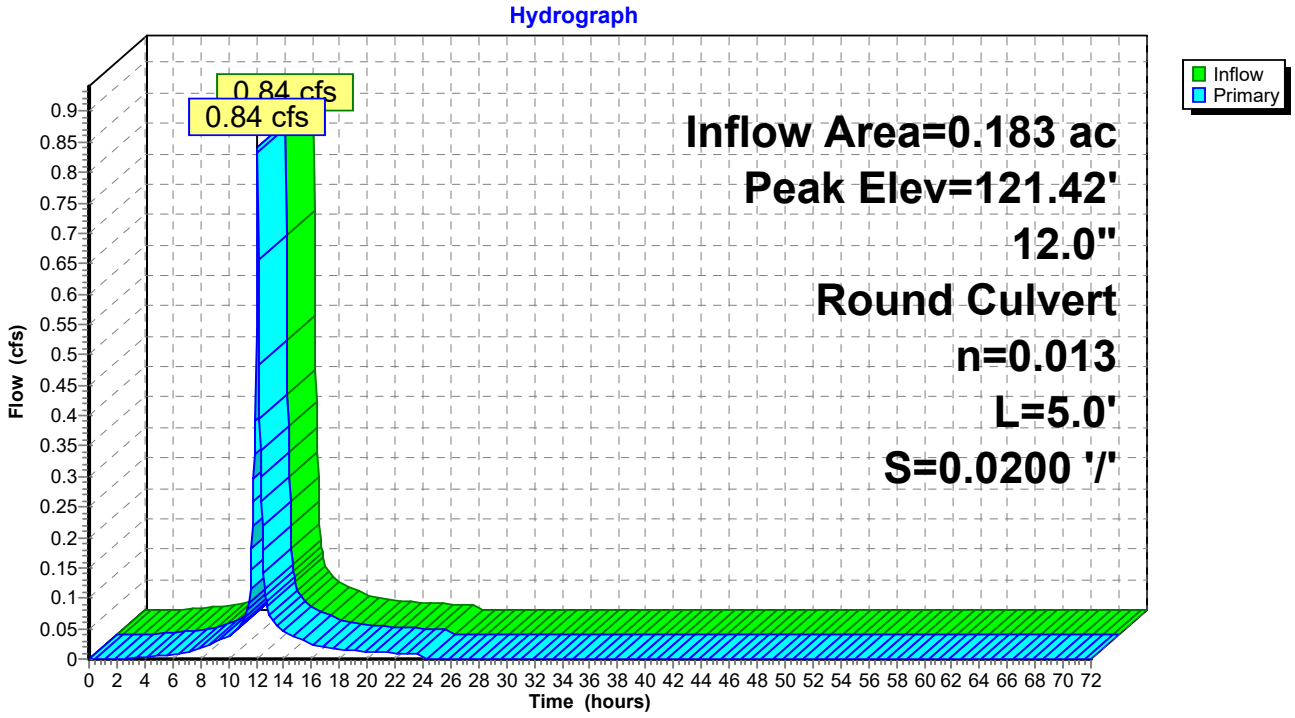
Inflow Area = 0.183 ac, 90.61% Impervious, Inflow Depth = 4.37" for 10 year event
Inflow = 0.84 cfs @ 12.09 hrs, Volume= 0.067 af
Outflow = 0.84 cfs @ 12.09 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.0 min
Primary = 0.84 cfs @ 12.09 hrs, Volume= 0.067 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.42' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.82 cfs @ 12.09 hrs HW=121.41' (Free Discharge)
1=PIPE (Barrel Controls 0.82 cfs @ 2.94 fps)

Pond DMH#3: DMH #3



Summary for Pond DMH1: DMH #1

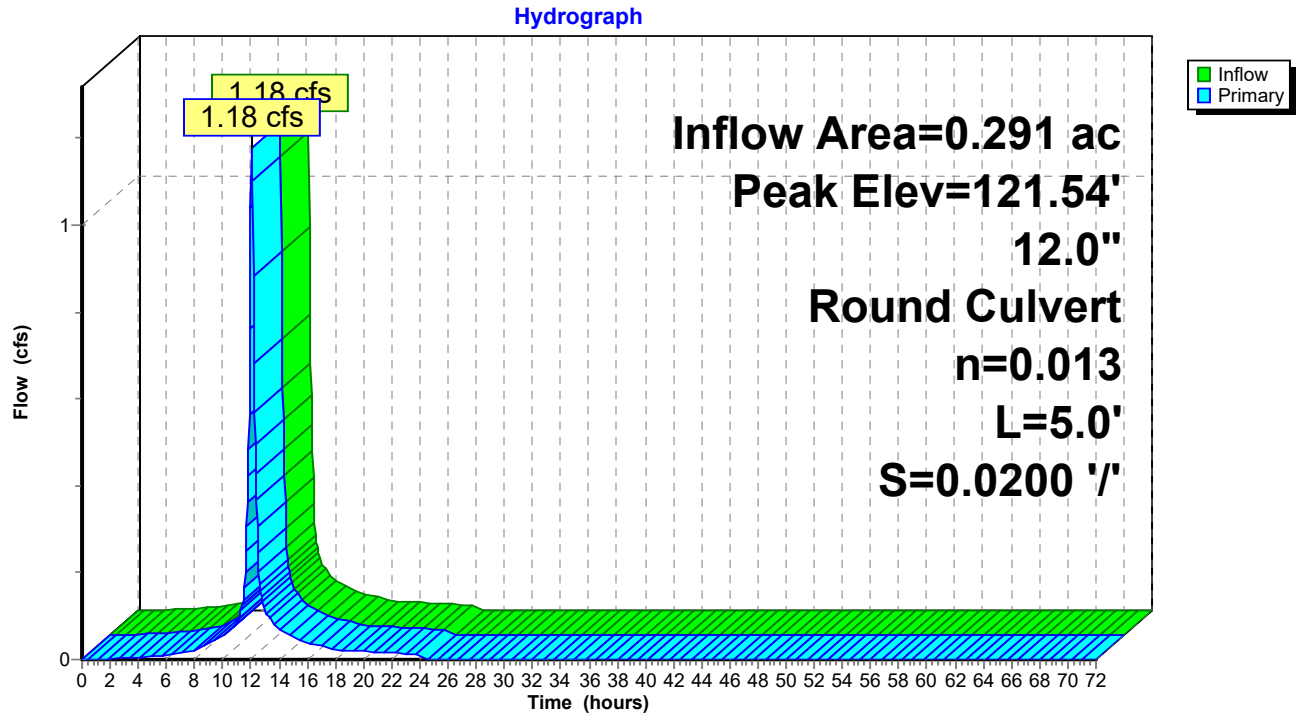
Inflow Area = 0.291 ac, 87.57% Impervious, Inflow Depth = 4.16" for 10 year event
Inflow = 1.18 cfs @ 12.06 hrs, Volume= 0.101 af
Outflow = 1.18 cfs @ 12.06 hrs, Volume= 0.101 af, Atten= 0%, Lag= 0.0 min
Primary = 1.18 cfs @ 12.06 hrs, Volume= 0.101 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.54' @ 12.06 hrs
Flood Elev= 124.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round DMH 1 OUTLET** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.16 cfs @ 12.06 hrs HW=121.53' (Free Discharge)
1=DMH 1 OUTLET (Barrel Controls 1.16 cfs @ 3.16 fps)

Pond DMH1: DMH #1



Summary for Pond DMH4: DMH #4

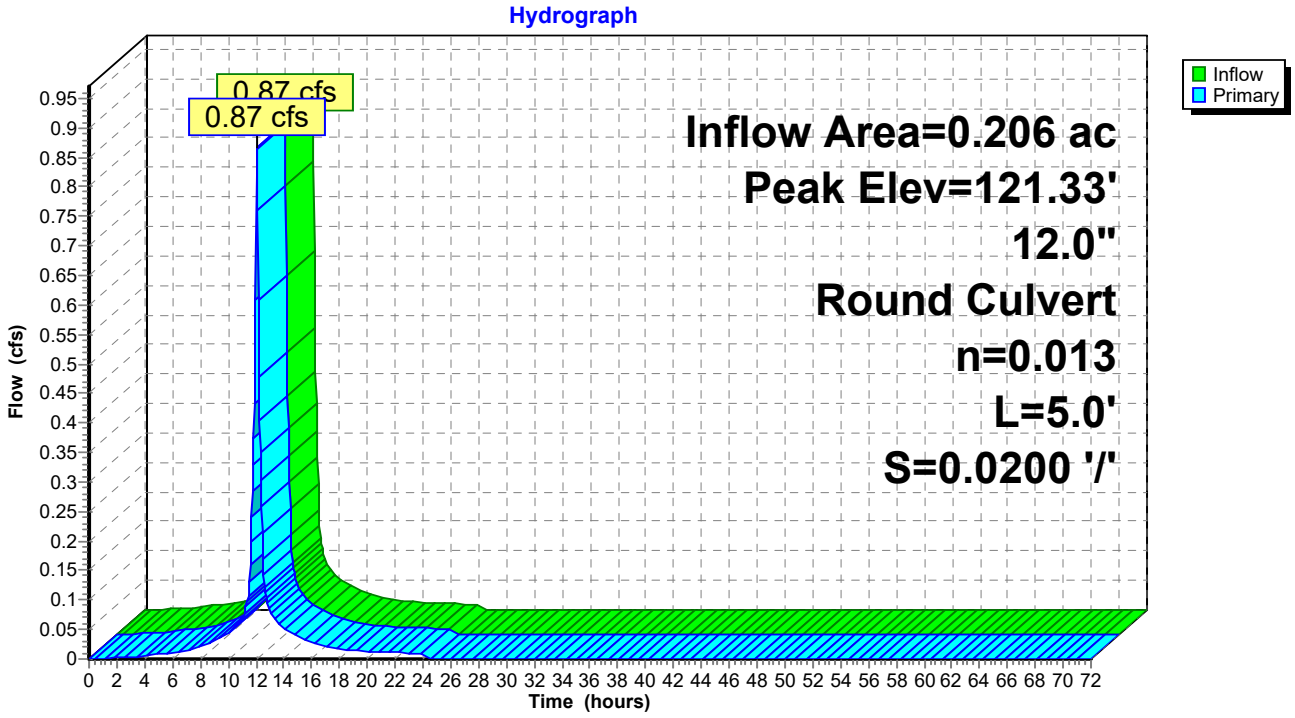
Inflow Area = 0.206 ac, 94.40% Impervious, Inflow Depth = 4.45" for 10 year event
Inflow = 0.87 cfs @ 12.04 hrs, Volume= 0.076 af
Outflow = 0.87 cfs @ 12.04 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min
Primary = 0.87 cfs @ 12.04 hrs, Volume= 0.076 af
Routed to Pond IC-B : INFILTRATION CHAMBER SYS 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.33' @ 12.04 hrs
Flood Elev= 124.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.80'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.80' / 120.70' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.85 cfs @ 12.04 hrs HW=121.33' (Free Discharge)
1=PIPE (Barrel Controls 0.85 cfs @ 2.96 fps)

Pond DMH4: DMH #4



Summary for Pond IC-A: INFILTRATION CHAMBER SYS1

Inflow Area = 0.620 ac, 88.61% Impervious, Inflow Depth = 4.25" for 10 year event
Inflow = 2.64 cfs @ 12.08 hrs, Volume= 0.219 af
Outflow = 0.13 cfs @ 10.35 hrs, Volume= 0.219 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.13 cfs @ 10.35 hrs, Volume= 0.219 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.34' @ 14.69 hrs Surf.Area= 5,373 sf Storage= 4,719 cf

Plug-Flow detention time= 327.7 min calculated for 0.219 af (100% of inflow)
Center-of-Mass det. time= 327.7 min (1,099.1 - 771.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	120.00'	3,007 cf	**34.75'W x 96.18'L x 3.50'H Field A** 11,697 cf Overall - 4,181 cf Embedded = 7,517 cf x 40.0% Voids
#2A	120.50'	4,181 cf	**ADS_StormTech SC-740 +Cap** x 91 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 91 Chambers in 7 Rows
#3B	120.00'	1,851 cf	**30.00'W x 67.70'L x 3.50'H Field B** 7,108 cf Overall - 2,481 cf Embedded = 4,627 cf x 40.0% Voids
#4B	120.50'	2,481 cf	**ADS_StormTech SC-740 +Cap** x 54 Inside #3 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 54 Chambers in 6 Rows
		11,519 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	120.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.13 cfs @ 10.35 hrs HW=120.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Pond IC-A: INFILTRATION CHAMBER SYS1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

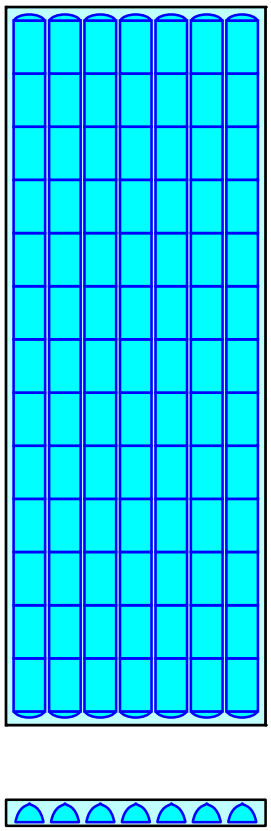
13 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 94.18' Row Length +12.0" End Stone x 2 = 96.18' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 34.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

91 Chambers x 45.9 cf = 4,180.5 cf Chamber Storage

11,697.5 cf Field - 4,180.5 cf Chambers = 7,516.9 cf Stone x 40.0% Voids = 3,006.8 cf Stone Storage

Chamber Storage + Stone Storage = 7,187.3 cf = 0.165 af
Overall Storage Efficiency = 61.4%
Overall System Size = 96.18' x 34.75' x 3.50'

91 Chambers
433.2 cy Field
278.4 cy Stone



Pond IC-A: INFILTRATION CHAMBER SYS1 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

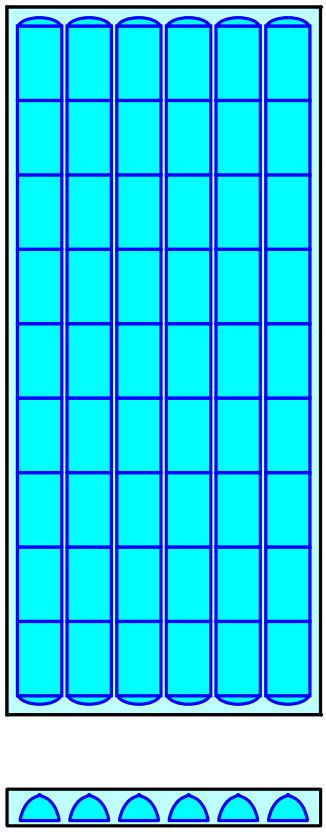
9 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 65.70' Row Length +12.0" End Stone x 2 = 67.70' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

54 Chambers x 45.9 cf = 2,480.8 cf Chamber Storage

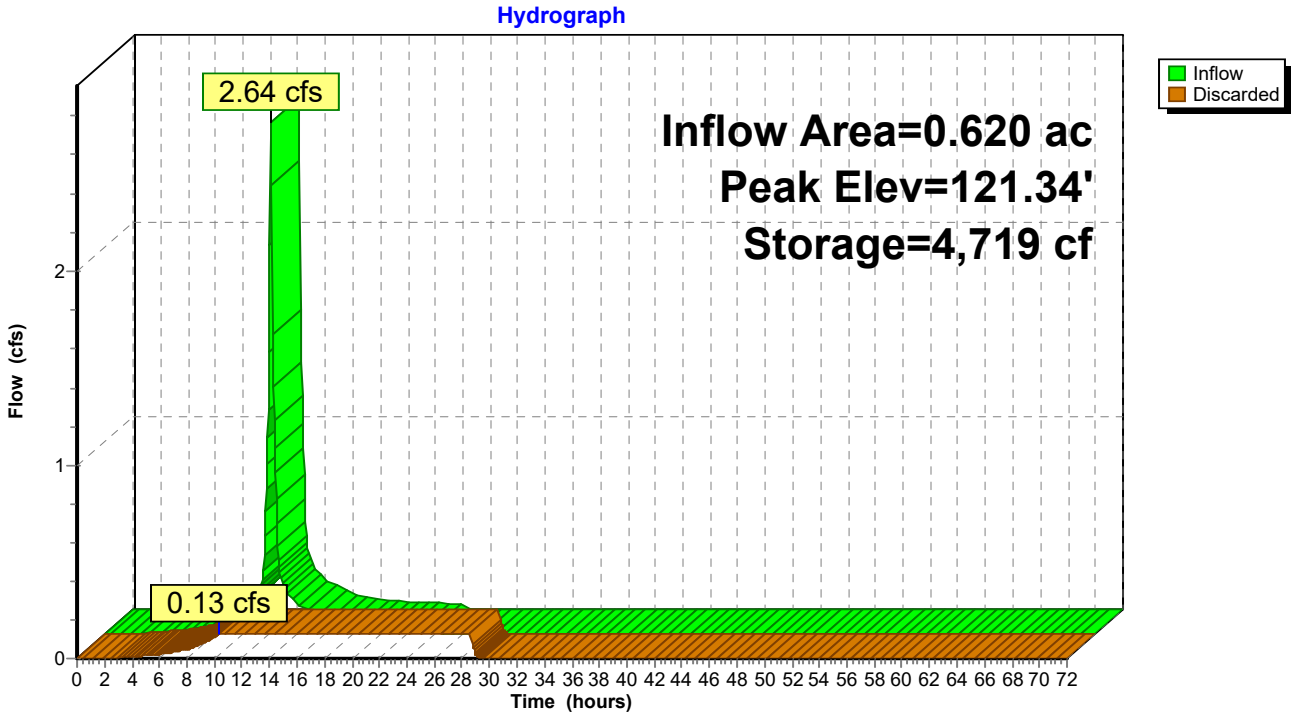
7,108.2 cf Field - 2,480.8 cf Chambers = 4,627.4 cf Stone x 40.0% Voids = 1,851.0 cf Stone Storage

Chamber Storage + Stone Storage = 4,331.7 cf = 0.099 af
Overall Storage Efficiency = 60.9%
Overall System Size = 67.70' x 30.00' x 3.50'

54 Chambers
263.3 cy Field
171.4 cy Stone



Pond IC-A: INFILTRATION CHAMBER SYS1



Summary for Pond IC-B: INFILTRATION CHAMBER SYS 2

Inflow Area = 0.206 ac, 94.40% Impervious, Inflow Depth = 4.45" for 10 year event
Inflow = 0.87 cfs @ 12.04 hrs, Volume= 0.076 af
Outflow = 0.06 cfs @ 10.95 hrs, Volume= 0.076 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.06 cfs @ 10.95 hrs, Volume= 0.076 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 120.91' @ 13.57 hrs Surf.Area= 2,608 sf Storage= 1,393 cf

Plug-Flow detention time= 183.2 min calculated for 0.076 af (100% of inflow)
Center-of-Mass det. time= 183.1 min (943.1 - 760.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	120.00'	2,365 cf	**25.25'W x 103.30'L x 3.50'H Field A** 9,129 cf Overall - 3,216 cf Embedded = 5,913 cf x 40.0% Voids
#2A	120.50'	3,216 cf	**ADS_StormTech SC-740 +Cap** x 70 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 70 Chambers in 5 Rows
		5,581 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	120.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 10.95 hrs HW=120.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond IC-B: INFILTRATION CHAMBER SYS 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

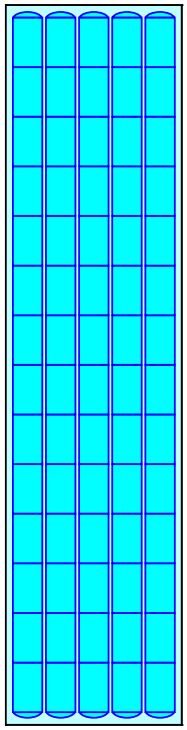
14 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 101.30' Row Length +12.0" End Stone x 2 = 103.30' Base Length
5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

70 Chambers x 45.9 cf = 3,215.8 cf Chamber Storage

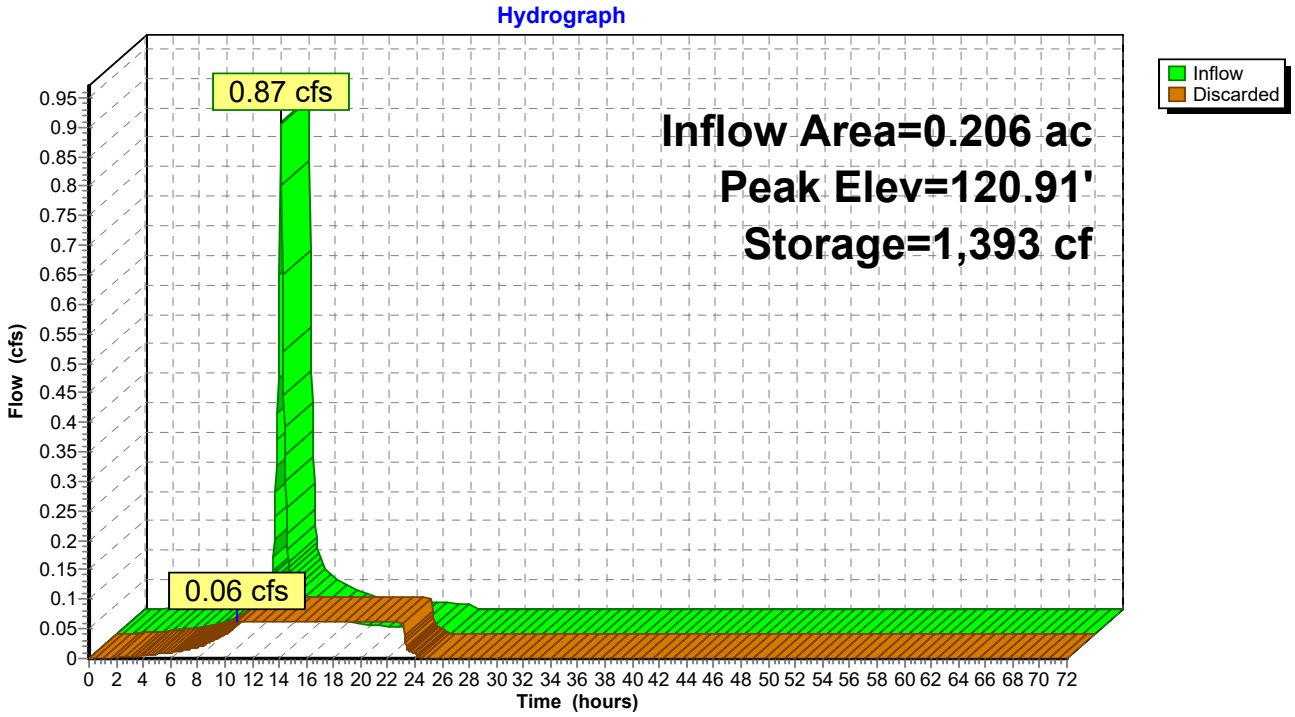
9,128.8 cf Field - 3,215.8 cf Chambers = 5,913.0 cf Stone x 40.0% Voids = 2,365.2 cf Stone Storage

Chamber Storage + Stone Storage = 5,581.0 cf = 0.128 af
Overall Storage Efficiency = 61.1%
Overall System Size = 103.30' x 25.25' x 3.50'

70 Chambers
338.1 cy Field
219.0 cy Stone



Pond IC-B: INFILTRATION CHAMBER SYS 2



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: prop. SC#1 Runoff Area=8,946 sf 82.36% Impervious Runoff Depth=5.14"
Flow Length=152' Tc=6.0 min CN=91 Runoff=1.14 cfs 0.088 af

Subcatchment 1SR: PROP SC, ROOF Runoff Area=3,750 sf 100.00% Impervious Runoff Depth=5.95"
Tc=0.0 min CN=98 Runoff=0.60 cfs 0.043 af

Subcatchment 2S: PROP. SC#2 Runoff Area=6,329 sf 88.17% Impervious Runoff Depth=5.48"
Flow Length=152' Tc=6.0 min CN=94 Runoff=0.84 cfs 0.066 af

Subcatchment 2SR: PROP. SC, ROOF Runoff Area=3,750 sf 100.00% Impervious Runoff Depth=5.95"
Tc=0.0 min CN=98 Runoff=0.60 cfs 0.043 af

Subcatchment 3S: PROP. SC#3 Runoff Area=7,964 sf 90.61% Impervious Runoff Depth=5.60"
Flow Length=152' Tc=6.0 min CN=95 Runoff=1.06 cfs 0.085 af

Subcatchment 4S: PROP. SC #4 Runoff Area=5,231 sf 90.38% Impervious Runoff Depth=5.48"
Flow Length=81' Tc=6.0 min CN=94 Runoff=0.69 cfs 0.055 af

Subcatchment 5S: SC5- to Washington Runoff Area=2,137 sf 0.00% Impervious Runoff Depth=2.13"
Tc=0.0 min CN=61 Runoff=0.14 cfs 0.009 af

Subcatchment 6S: SC6- to Webster Runoff Area=1,770 sf 0.00% Impervious Runoff Depth=2.13"
Tc=0.0 min CN=61 Runoff=0.11 cfs 0.007 af

Reach DP1: DP1 Inflow=0.25 cfs 0.016 af
Outflow=0.25 cfs 0.016 af

Pond CB1: CB1 Peak Elev=121.92' Inflow=1.14 cfs 0.088 af
12.0" Round Culvert n=0.013 L=62.0' S=0.0065 '/' Outflow=1.14 cfs 0.088 af

Pond CB2: CB #2 Peak Elev=121.63' Inflow=0.84 cfs 0.066 af
12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=0.84 cfs 0.066 af

Pond CB3: CB #3 Peak Elev=121.72' Inflow=1.06 cfs 0.085 af
12.0" Round Culvert n=0.013 L=20.0' S=0.0100 '/' Outflow=1.06 cfs 0.085 af

Pond CB4: CB#4 Peak Elev=121.72' Inflow=0.69 cfs 0.055 af
12.0" Round Culvert n=0.013 L=32.0' S=0.0125 '/' Outflow=0.69 cfs 0.055 af

Pond DMH#2: DMH #2 Peak Elev=121.42' Inflow=0.84 cfs 0.066 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=0.84 cfs 0.066 af

Pond DMH#3: DMH #3 Peak Elev=121.50' Inflow=1.06 cfs 0.085 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=1.06 cfs 0.085 af

Pond DMH1: DMH #1 Peak Elev=121.64' Inflow=1.51 cfs 0.131 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=1.51 cfs 0.131 af

Pond DMH4: DMH #4 Peak Elev=121.41' Inflow=1.09 cfs 0.098 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=1.09 cfs 0.098 af

Pond IC-A: INFILTRATION CHAMBER SYS1 Peak Elev=121.82' Storage=6,670 cf Inflow=3.36 cfs 0.282 af
Outflow=0.13 cfs 0.282 af

Pond IC-B: INFILTRATION CHAMBER SYS 2 Peak Elev=121.17' Storage=1,950 cf Inflow=1.09 cfs 0.098 af
Outflow=0.06 cfs 0.098 af

Total Runoff Area = 0.915 ac Runoff Volume = 0.396 af Average Runoff Depth = 5.19"
18.77% Pervious = 0.172 ac 81.23% Impervious = 0.744 ac

Summary for Subcatchment 1S: prop. SC#1

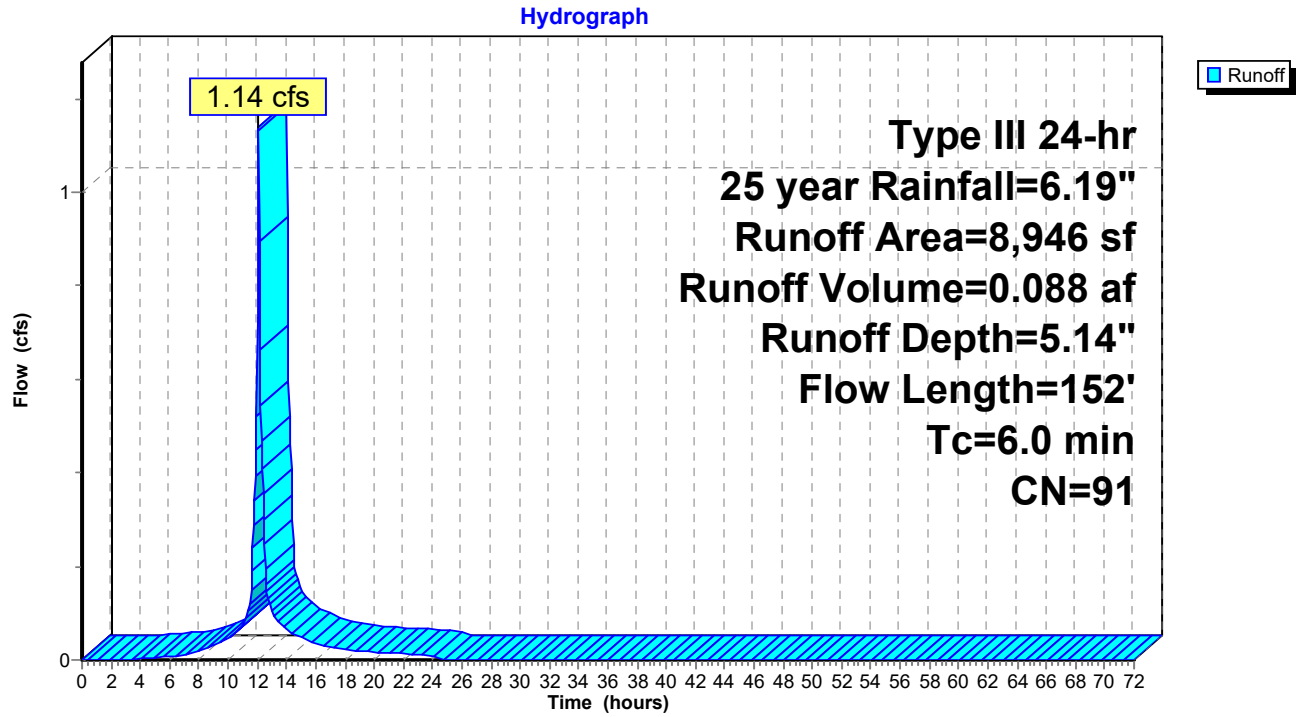
Runoff = 1.14 cfs @ 12.09 hrs, Volume= 0.088 af, Depth= 5.14"
Routed to Pond CB1 : CB1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=6.19"

	Area (sf)	CN	Description
*	6,381	98	pavement area
*	987	98	sidewalk & retaining wall
	1,578	61	>75% Grass cover, Good, HSG B
	8,946	91	Weighted Average
	1,578		17.64% Pervious Area
	7,368		82.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: prop. SC#1



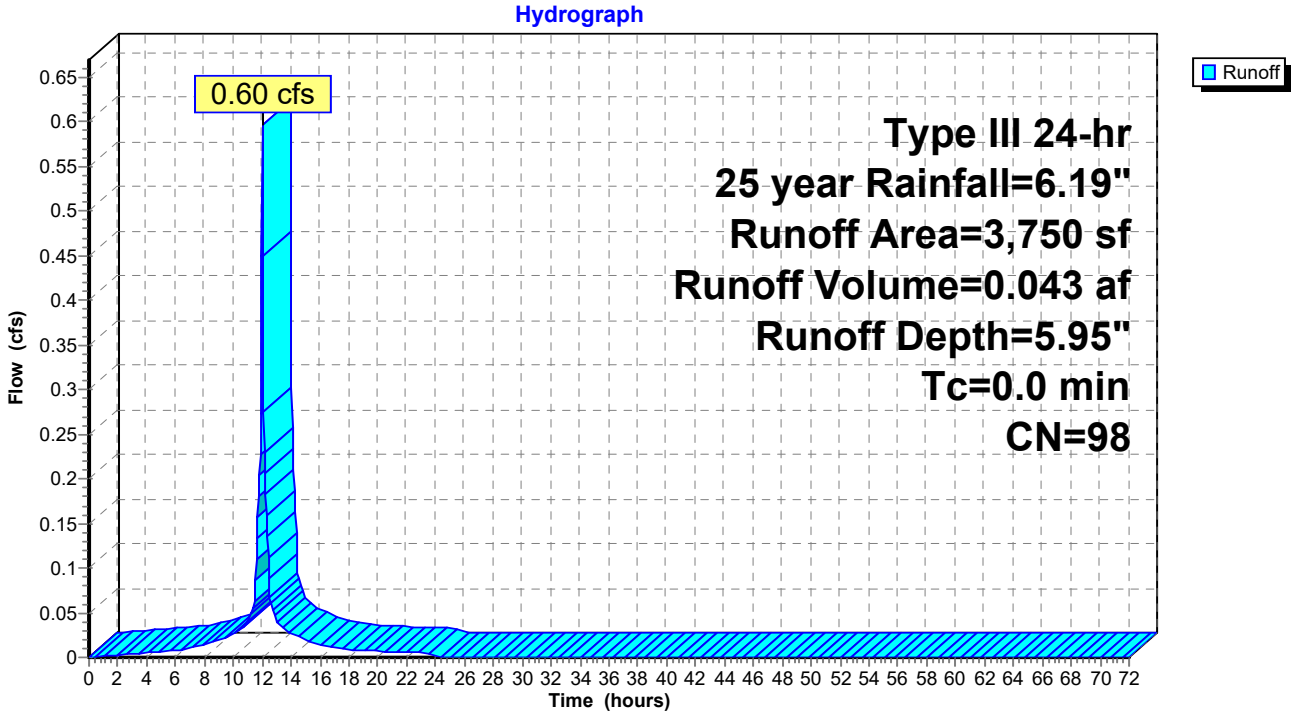
Summary for Subcatchment 1SR: PROP SC, ROOF DRAIN 1

Runoff = 0.60 cfs @ 12.00 hrs, Volume= 0.043 af, Depth= 5.95"
Routed to Pond DMH1 : DMH #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=6.19"

	Area (sf)	CN	Description
*	3,750	98	roof area
	3,750		100.00% Impervious Area

Subcatchment 1SR: PROP SC, ROOF DRAIN 1



Summary for Subcatchment 2S: PROP. SC#2

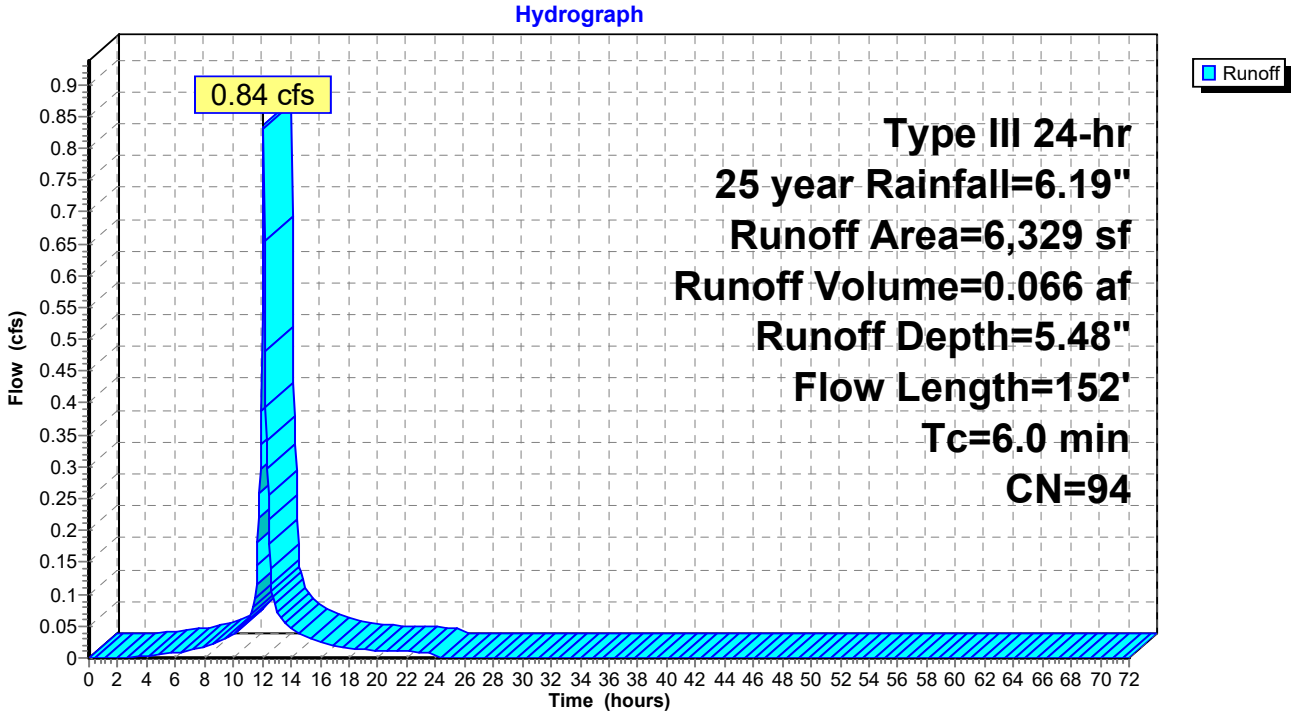
Runoff = 0.84 cfs @ 12.09 hrs, Volume= 0.066 af, Depth= 5.48"
Routed to Pond CB2 : CB #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=6.19"

	Area (sf)	CN	Description
*	4,872	98	pavement area
*	708	98	sidewalk & retaining wall
	749	61	>75% Grass cover, Good, HSG B
	6,329	94	Weighted Average
	749		11.83% Pervious Area
	5,580		88.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: PROP. SC#2



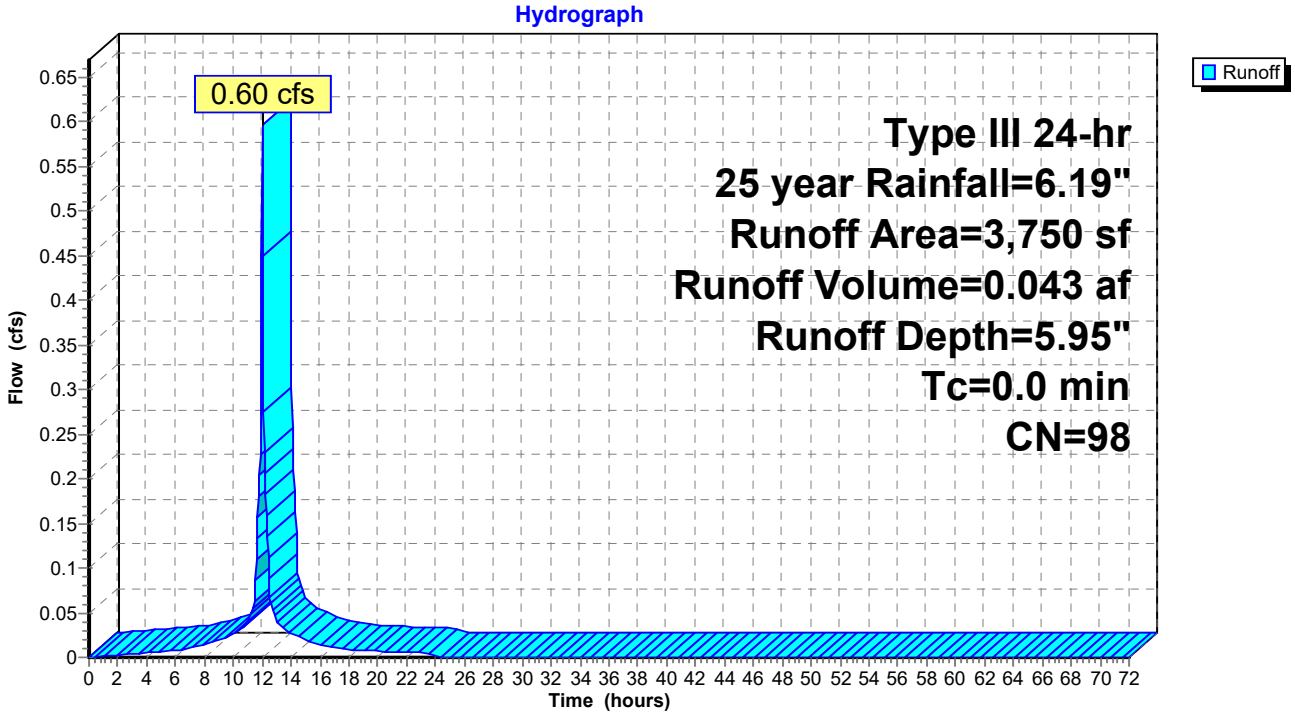
Summary for Subcatchment 2SR: PROP. SC, ROOF DRAIN 2

Runoff = 0.60 cfs @ 12.00 hrs, Volume= 0.043 af, Depth= 5.95"
Routed to Pond DMH4 : DMH #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=6.19"

	Area (sf)	CN	Description
*	3,750	98	roof area
	3,750		100.00% Impervious Area

Subcatchment 2SR: PROP. SC, ROOF DRAIN 2



Summary for Subcatchment 3S: PROP. SC#3

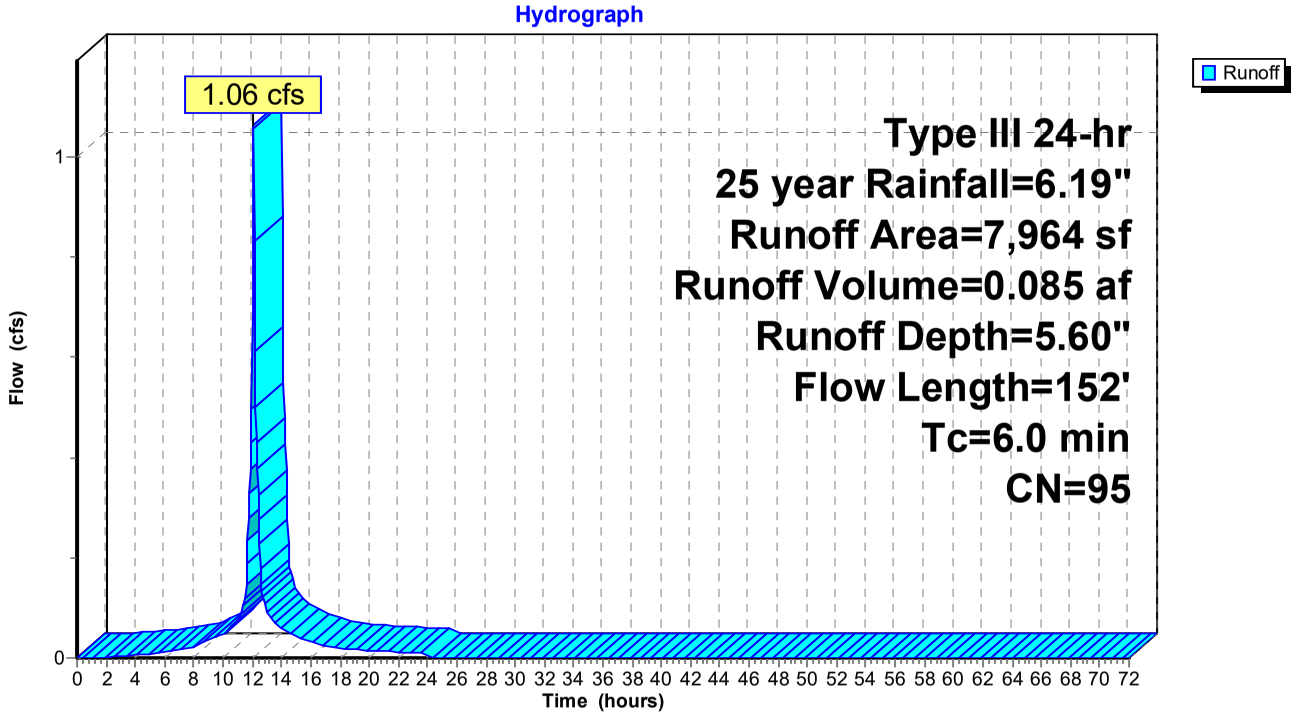
Runoff = 1.06 cfs @ 12.09 hrs, Volume= 0.085 af, Depth= 5.60"
Routed to Pond CB3 : CB #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=6.19"

	Area (sf)	CN	Description
*	6,031	98	pavement area
*	1,185	98	sidewalk & retaining wall
	748	61	>75% Grass cover, Good, HSG B
	7,964	95	Weighted Average
	748		9.39% Pervious Area
	7,216		90.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 3S: PROP. SC#3



Summary for Subcatchment 4S: PROP. SC #4

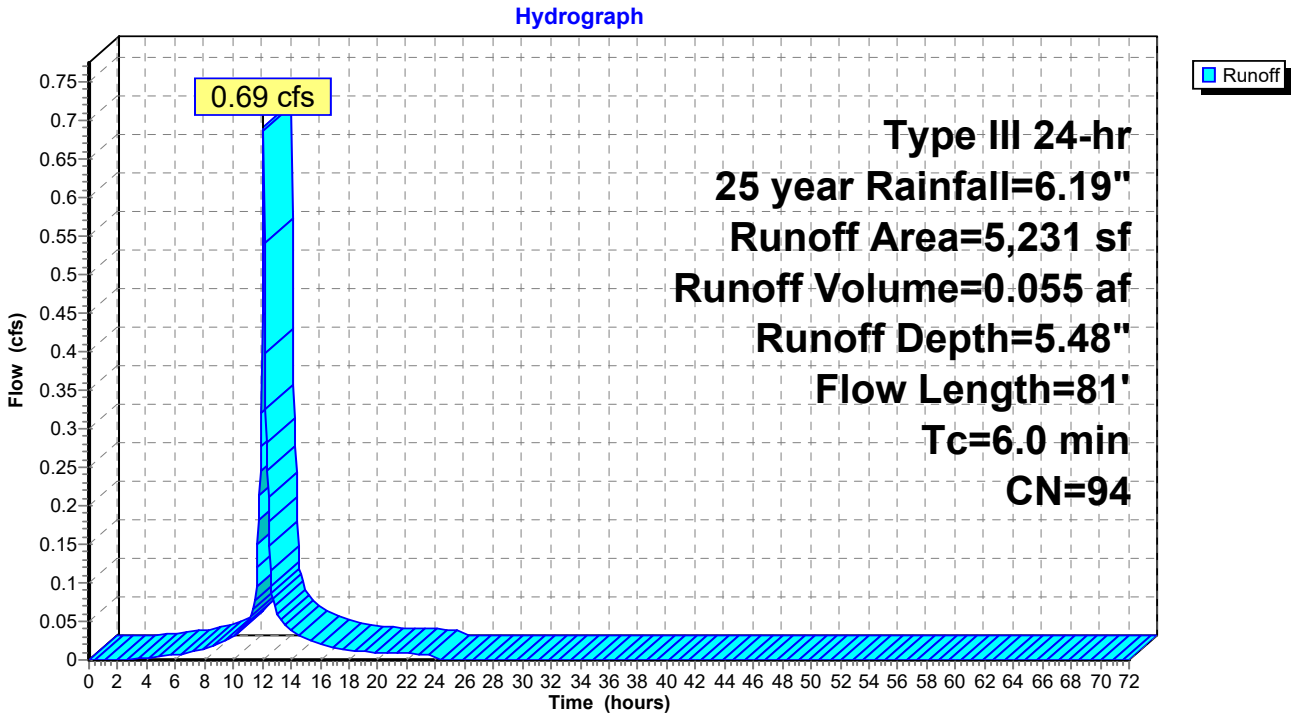
Runoff = 0.69 cfs @ 12.09 hrs, Volume= 0.055 af, Depth= 5.48"
Routed to Pond CB4 : CB#4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=6.19"

	Area (sf)	CN	Description
	4,341	98	Paved parking, HSG B
*	387	98	sidewalk and other impervious
	503	61	>75% Grass cover, Good, HSG B
	5,231	94	Weighted Average
	503		9.62% Pervious Area
	4,728		90.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	50	0.1350	2.65		**Sheet Flow, sheet flow 50 ft** Smooth surfaces n= 0.011 P2= 3.40"
0.3	31	0.0100	2.03		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
0.6	81	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 4S: PROP. SC #4



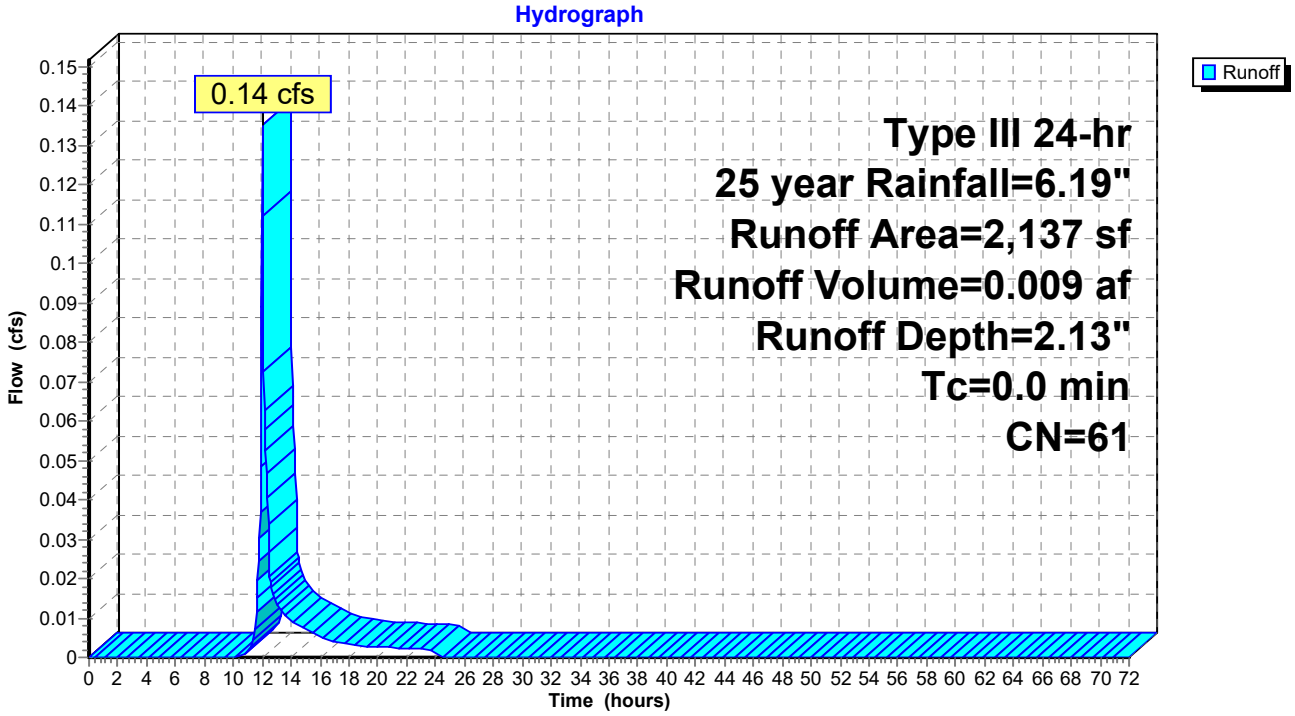
Summary for Subcatchment 5S: SC5- to Washington

Runoff = 0.14 cfs @ 12.01 hrs, Volume= 0.009 af, Depth= 2.13"
Routed to Reach DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=6.19"

Area (sf)	CN	Description
2,137	61	>75% Grass cover, Good, HSG B
2,137		100.00% Pervious Area

Subcatchment 5S: SC5- to Washington



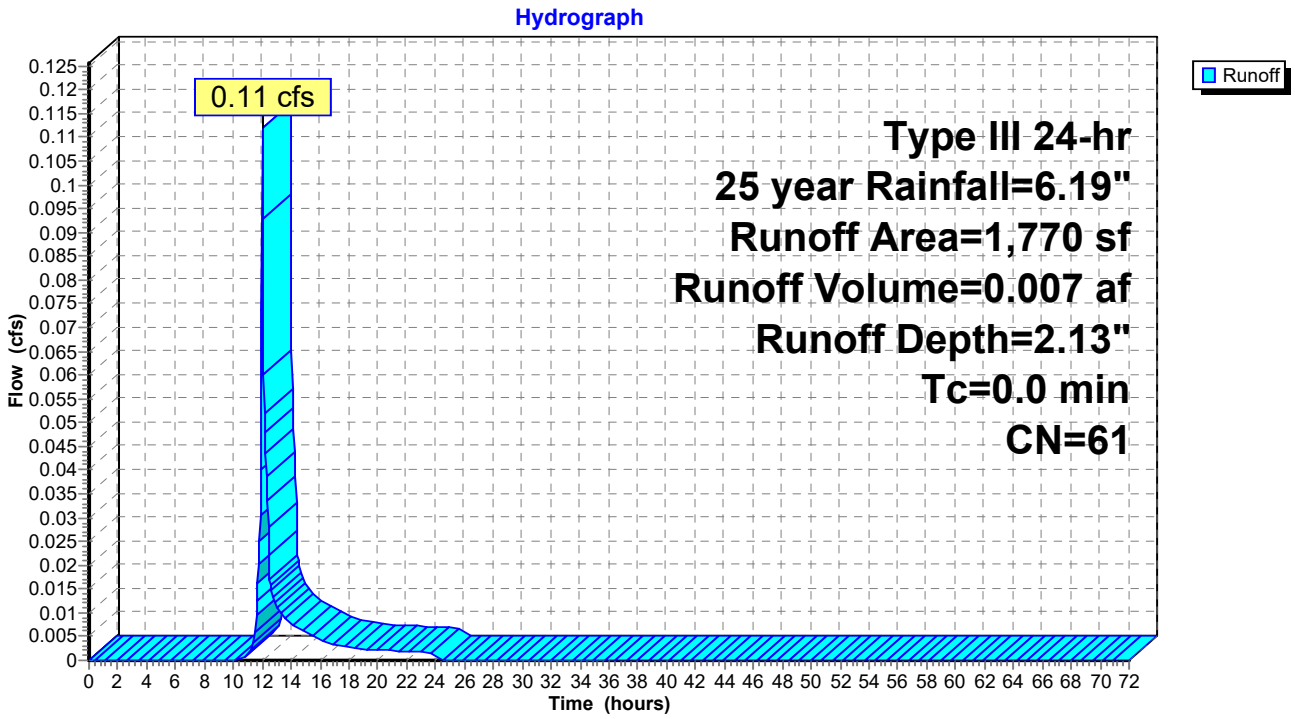
Summary for Subcatchment 6S: SC6- to Webster

Runoff = 0.11 cfs @ 12.01 hrs, Volume= 0.007 af, Depth= 2.13"
Routed to Reach DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=6.19"

Area (sf)	CN	Description
1,770	61	>75% Grass cover, Good, HSG B
1,770		100.00% Pervious Area

Subcatchment 6S: SC6- to Webster

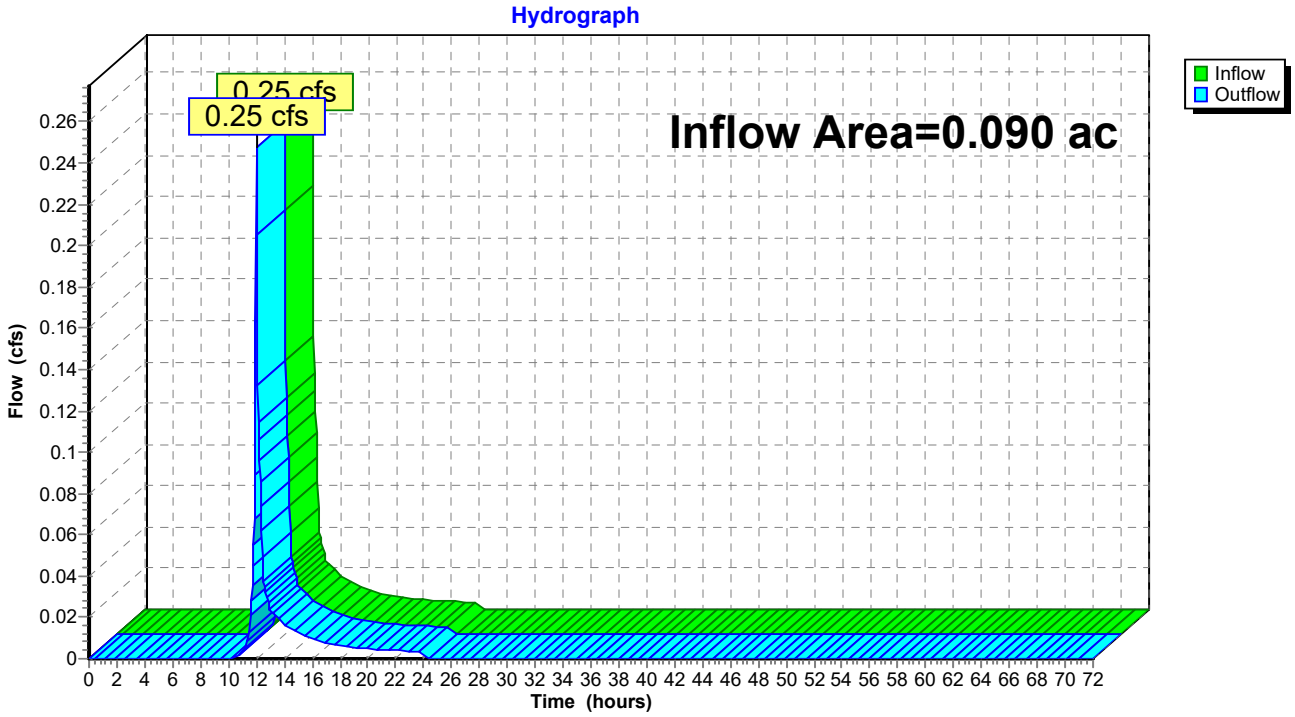


Summary for Reach DP1: DP1

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 2.13" for 25 year event
Inflow = 0.25 cfs @ 12.01 hrs, Volume= 0.016 af
Outflow = 0.25 cfs @ 12.01 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: DP1



Summary for Pond CB1: CB1

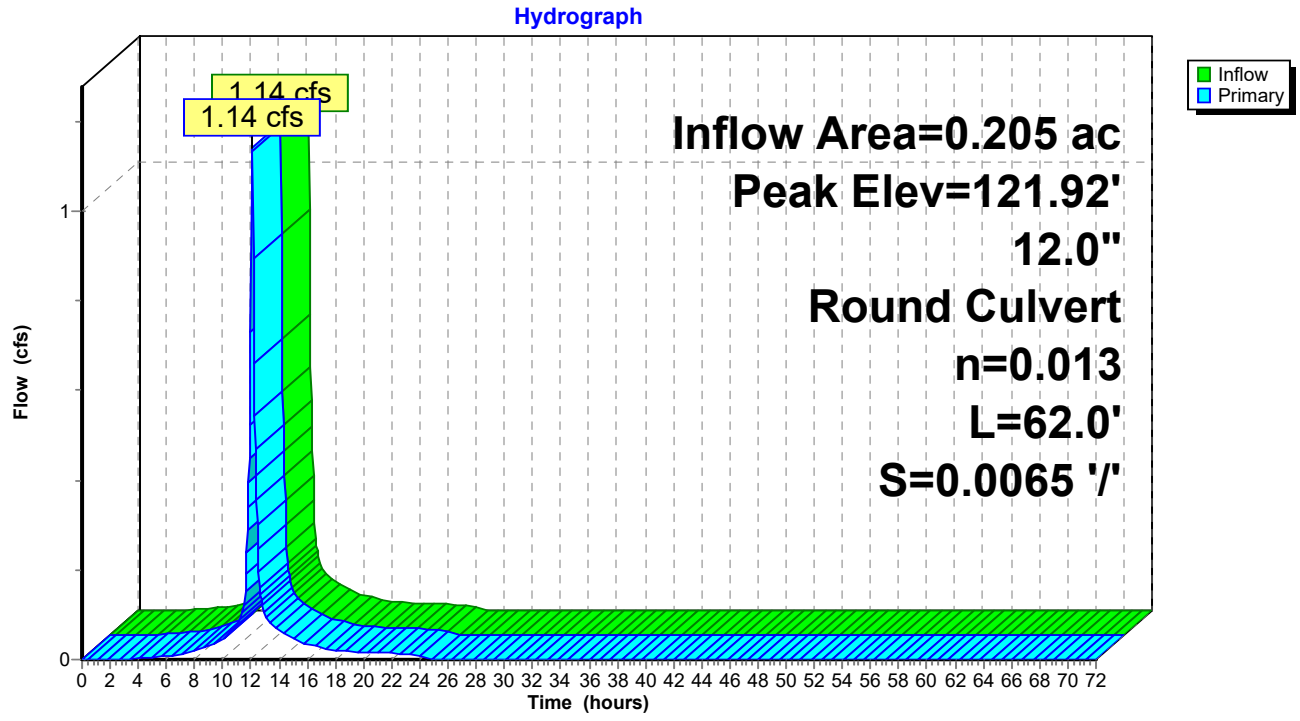
Inflow Area = 0.205 ac, 82.36% Impervious, Inflow Depth = 5.14" for 25 year event
Inflow = 1.14 cfs @ 12.09 hrs, Volume= 0.088 af
Outflow = 1.14 cfs @ 12.09 hrs, Volume= 0.088 af, Atten= 0%, Lag= 0.0 min
Primary = 1.14 cfs @ 12.09 hrs, Volume= 0.088 af
Routed to Pond DMH1 : DMH #1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.92' @ 12.09 hrs
Flood Elev= 124.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.30'	**12.0" Round Culvert** L= 62.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 121.30' / 120.90' S= 0.0065 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.11 cfs @ 12.09 hrs HW=121.91' (Free Discharge)
1=Culvert (Barrel Controls 1.11 cfs @ 3.15 fps)

Pond CB1: CB1



Summary for Pond CB2: CB #2

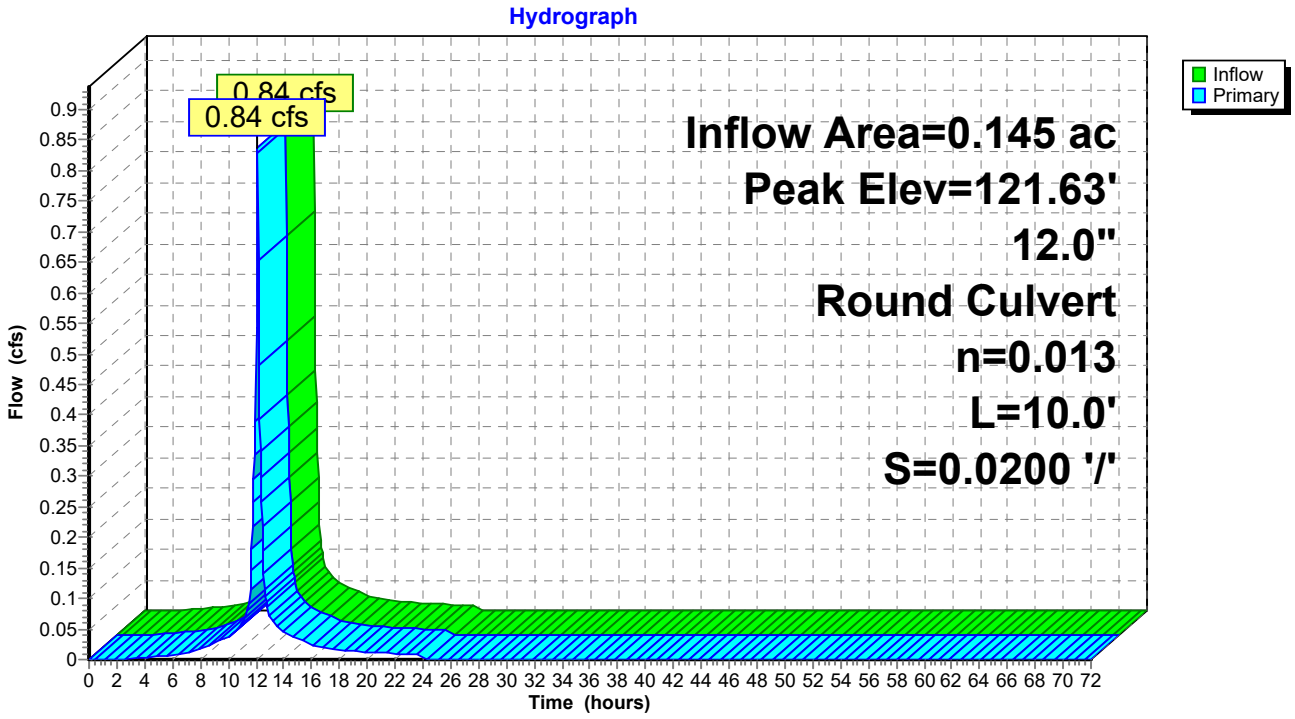
Inflow Area = 0.145 ac, 88.17% Impervious, Inflow Depth = 5.48" for 25 year event
Inflow = 0.84 cfs @ 12.09 hrs, Volume= 0.066 af
Outflow = 0.84 cfs @ 12.09 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min
Primary = 0.84 cfs @ 12.09 hrs, Volume= 0.066 af
Routed to Pond DMH#2 : DMH #2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.63' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.10'	**12.0" Round PIPE** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 121.10' / 120.90' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.81 cfs @ 12.09 hrs HW=121.63' (Free Discharge)
1=PIPE (Inlet Controls 0.81 cfs @ 1.95 fps)

Pond CB2: CB #2



Summary for Pond CB3: CB #3

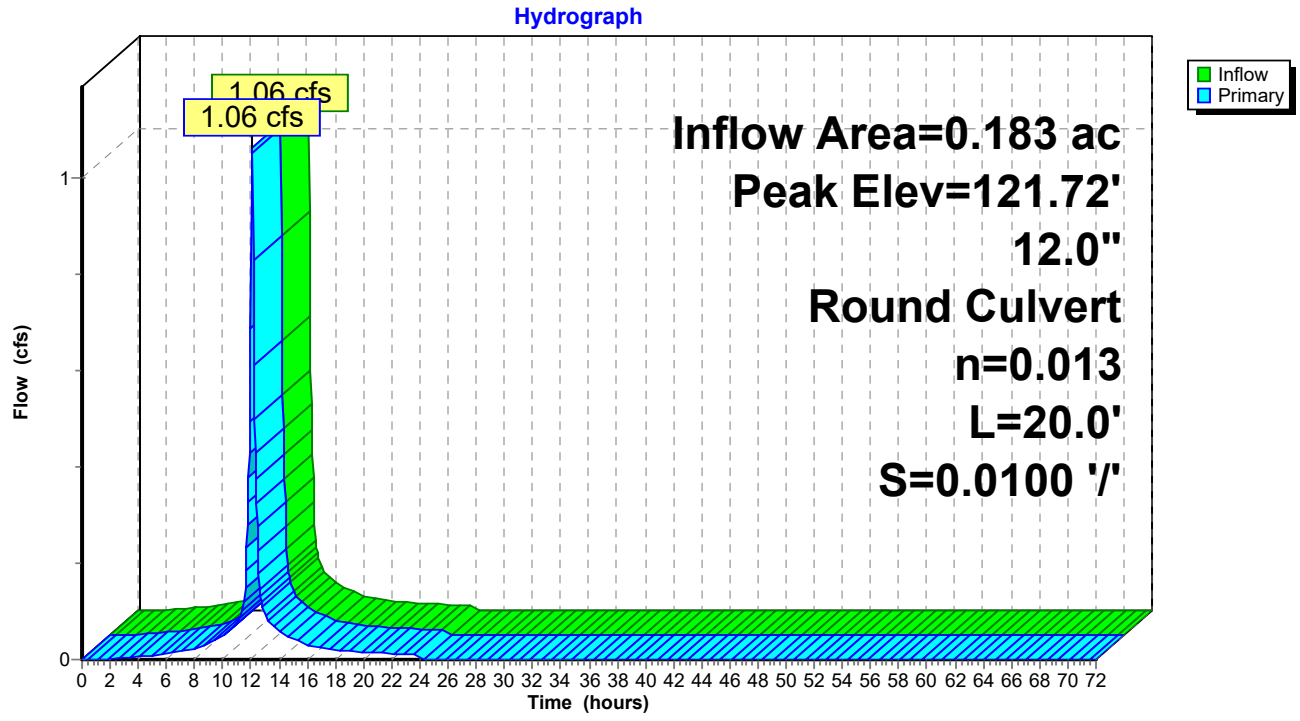
Inflow Area = 0.183 ac, 90.61% Impervious, Inflow Depth = 5.60" for 25 year event
Inflow = 1.06 cfs @ 12.09 hrs, Volume= 0.085 af
Outflow = 1.06 cfs @ 12.09 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min
Primary = 1.06 cfs @ 12.09 hrs, Volume= 0.085 af
Routed to Pond DMH#3 : DMH #3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.72' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.10'	**12.0" Round PIPE** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 121.10' / 120.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.03 cfs @ 12.09 hrs HW=121.71' (Free Discharge)
1=PIPE (Barrel Controls 1.03 cfs @ 2.96 fps)

Pond CB3: CB #3



Summary for Pond CB4: CB#4

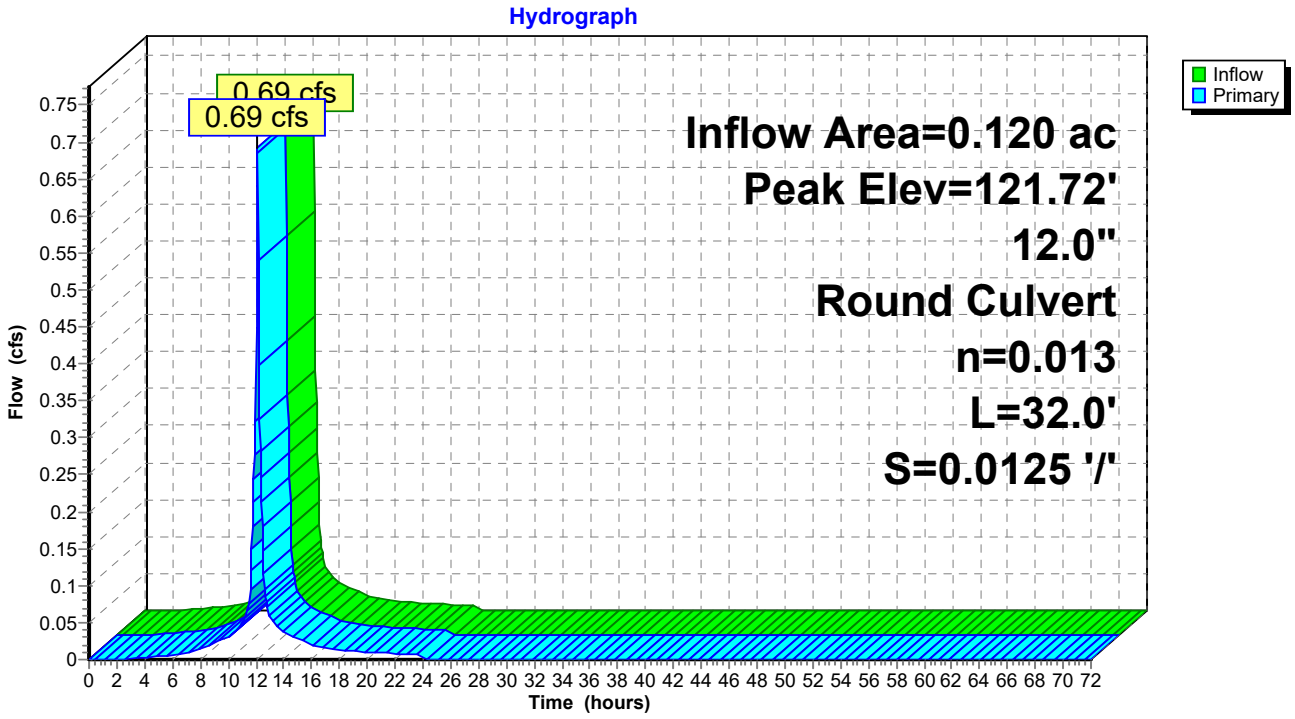
Inflow Area = 0.120 ac, 90.38% Impervious, Inflow Depth = 5.48" for 25 year event
Inflow = 0.69 cfs @ 12.09 hrs, Volume= 0.055 af
Outflow = 0.69 cfs @ 12.09 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.0 min
Primary = 0.69 cfs @ 12.09 hrs, Volume= 0.055 af
Routed to Pond DMH4 : DMH #4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.72' @ 12.09 hrs
Flood Elev= 124.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.30'	**12.0" Round PIPE** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 121.30' / 120.90' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.67 cfs @ 12.09 hrs HW=121.71' (Free Discharge)
1=PIPE (Barrel Controls 0.67 cfs @ 3.23 fps)

Pond CB4: CB#4



Summary for Pond DMH#2: DMH #2

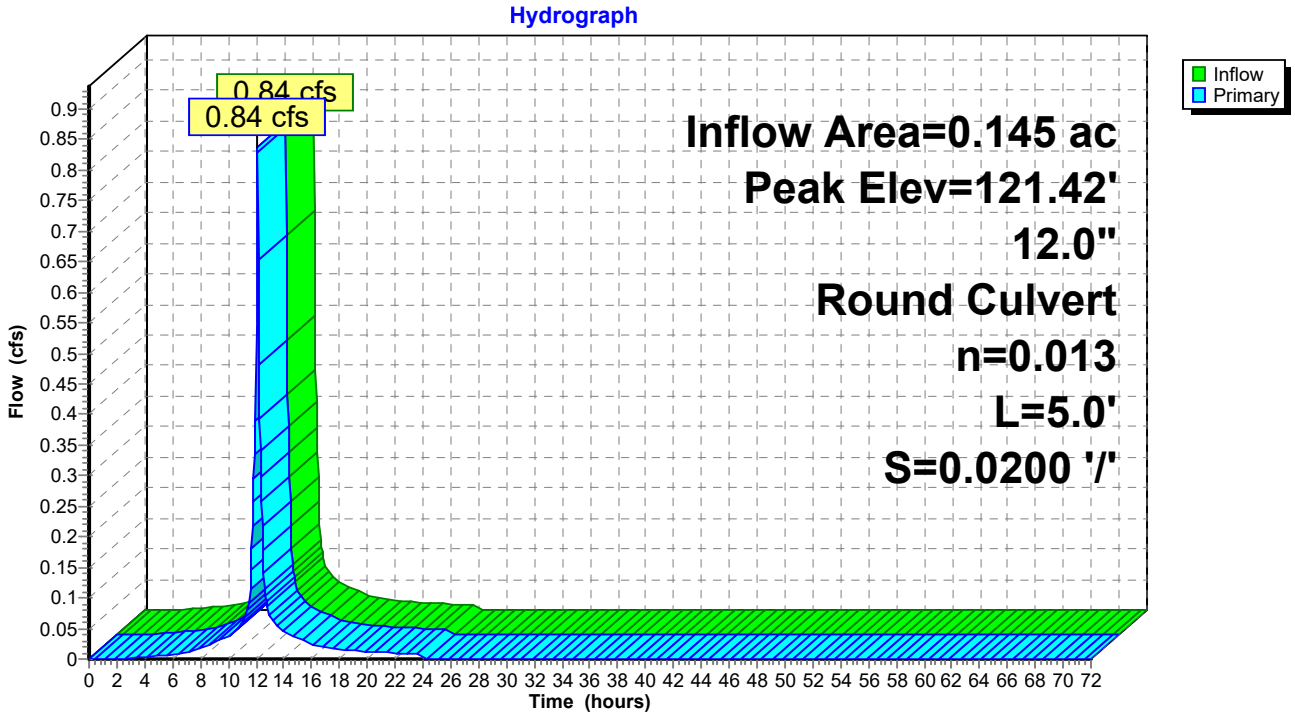
Inflow Area = 0.145 ac, 88.17% Impervious, Inflow Depth = 5.48" for 25 year event
Inflow = 0.84 cfs @ 12.09 hrs, Volume= 0.066 af
Outflow = 0.84 cfs @ 12.09 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min
Primary = 0.84 cfs @ 12.09 hrs, Volume= 0.066 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.42' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.81 cfs @ 12.09 hrs HW=121.41' (Free Discharge)
1=PIPE (Barrel Controls 0.81 cfs @ 2.94 fps)

Pond DMH#2: DMH #2



Summary for Pond DMH#3: DMH #3

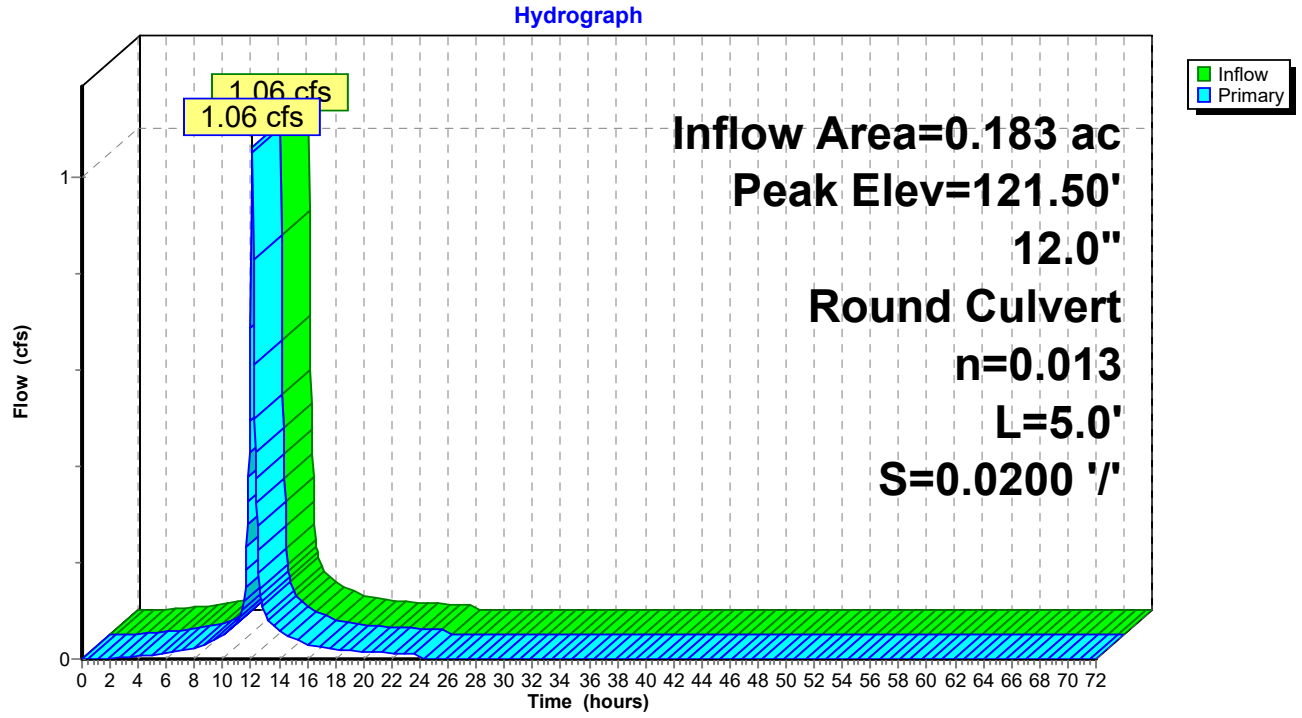
Inflow Area = 0.183 ac, 90.61% Impervious, Inflow Depth = 5.60" for 25 year event
Inflow = 1.06 cfs @ 12.09 hrs, Volume= 0.085 af
Outflow = 1.06 cfs @ 12.09 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min
Primary = 1.06 cfs @ 12.09 hrs, Volume= 0.085 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.50' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.03 cfs @ 12.09 hrs HW=121.49' (Free Discharge)
1=PIPE (Barrel Controls 1.03 cfs @ 3.08 fps)

Pond DMH#3: DMH #3



Summary for Pond DMH1: DMH #1

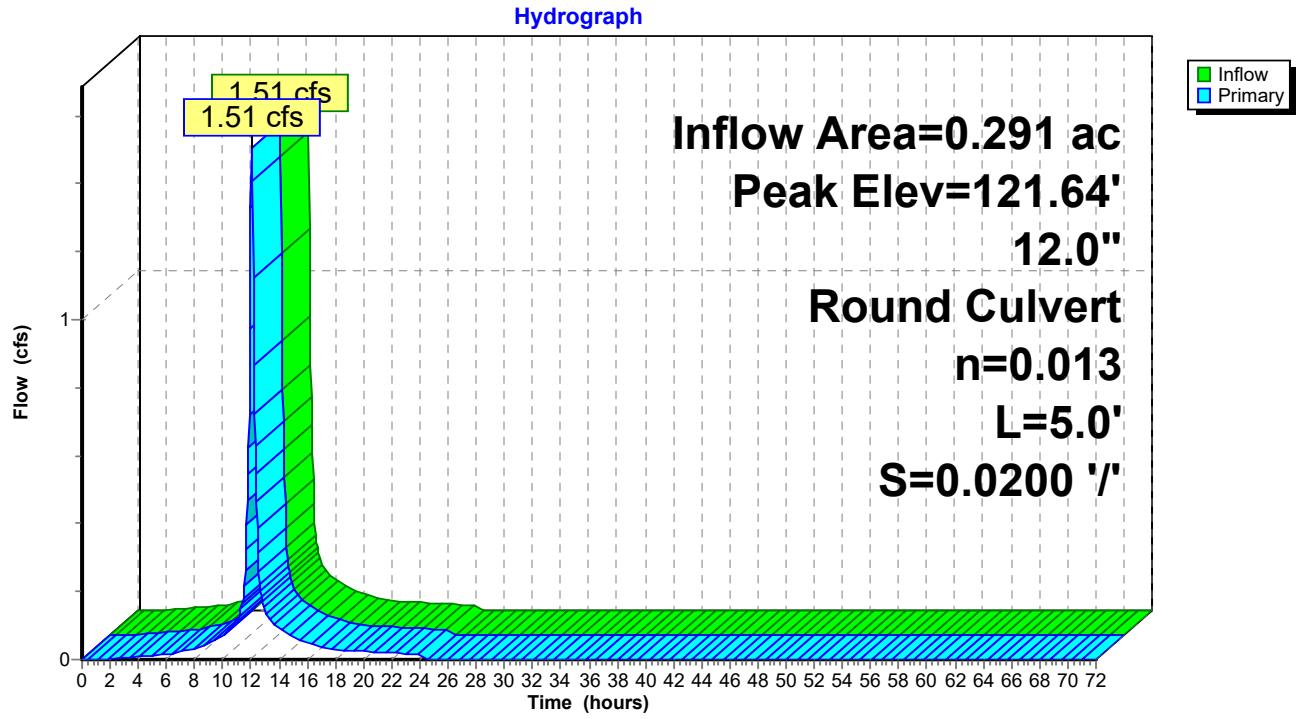
Inflow Area = 0.291 ac, 87.57% Impervious, Inflow Depth = 5.38" for 25 year event
Inflow = 1.51 cfs @ 12.06 hrs, Volume= 0.131 af
Outflow = 1.51 cfs @ 12.06 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min
Primary = 1.51 cfs @ 12.06 hrs, Volume= 0.131 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.64' @ 12.06 hrs
Flood Elev= 124.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round DMH 1 OUTLET** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.49 cfs @ 12.06 hrs HW=121.64' (Free Discharge)
1=DMH 1 OUTLET (Barrel Controls 1.49 cfs @ 3.34 fps)

Pond DMH1: DMH #1



Summary for Pond DMH4: DMH #4

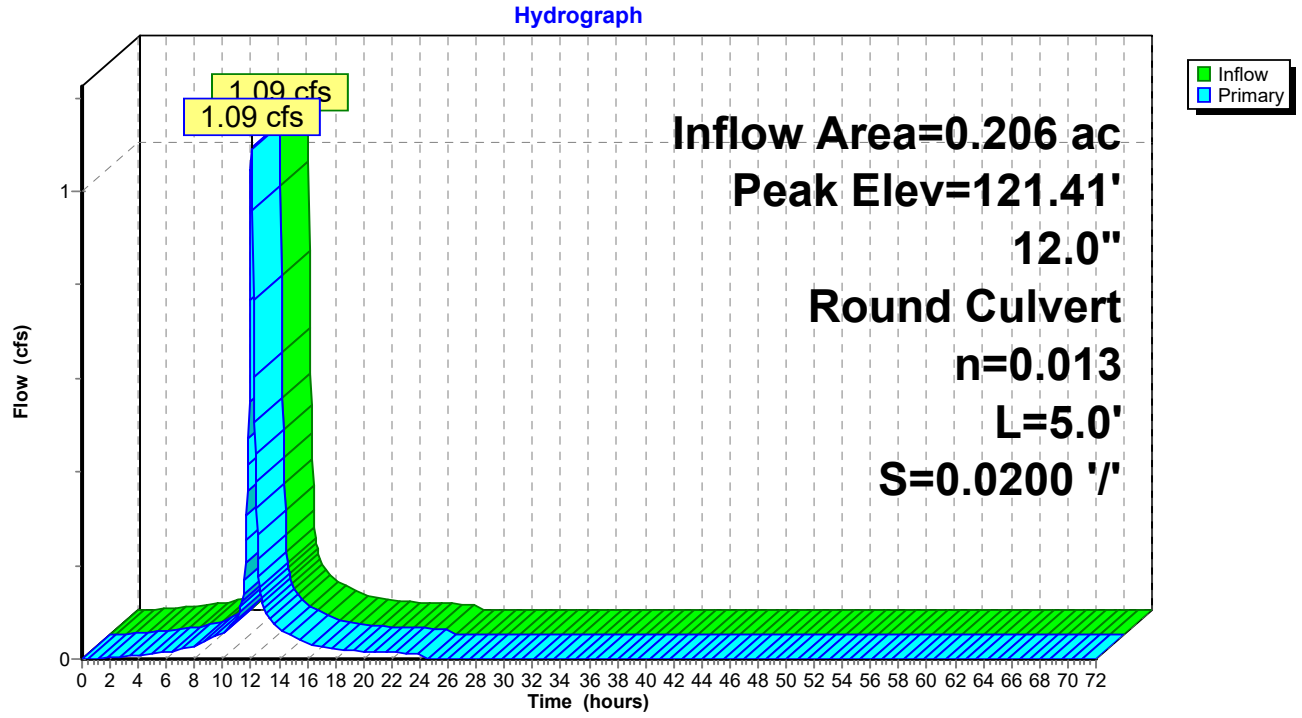
Inflow Area = 0.206 ac, 94.40% Impervious, Inflow Depth = 5.68" for 25 year event
Inflow = 1.09 cfs @ 12.04 hrs, Volume= 0.098 af
Outflow = 1.09 cfs @ 12.04 hrs, Volume= 0.098 af, Atten= 0%, Lag= 0.0 min
Primary = 1.09 cfs @ 12.04 hrs, Volume= 0.098 af
Routed to Pond IC-B : INFILTRATION CHAMBER SYS 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.41' @ 12.04 hrs
Flood Elev= 124.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.80'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.80' / 120.70' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.08 cfs @ 12.04 hrs HW=121.41' (Free Discharge)
1=PIPE (Barrel Controls 1.08 cfs @ 3.11 fps)

Pond DMH4: DMH #4



Summary for Pond IC-A: INFILTRATION CHAMBER SYS1

Inflow Area = 0.620 ac, 88.61% Impervious, Inflow Depth = 5.47" for 25 year event
Inflow = 3.36 cfs @ 12.08 hrs, Volume= 0.282 af
Outflow = 0.13 cfs @ 9.55 hrs, Volume= 0.282 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.13 cfs @ 9.55 hrs, Volume= 0.282 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.82' @ 15.45 hrs Surf.Area= 5,373 sf Storage= 6,670 cf

Plug-Flow detention time= 463.8 min calculated for 0.282 af (100% of inflow)
Center-of-Mass det. time= 463.9 min (1,229.7 - 765.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	120.00'	3,007 cf	**34.75'W x 96.18'L x 3.50'H Field A** 11,697 cf Overall - 4,181 cf Embedded = 7,517 cf x 40.0% Voids
#2A	120.50'	4,181 cf	**ADS_StormTech SC-740 +Cap** x 91 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 91 Chambers in 7 Rows
#3B	120.00'	1,851 cf	**30.00'W x 67.70'L x 3.50'H Field B** 7,108 cf Overall - 2,481 cf Embedded = 4,627 cf x 40.0% Voids
#4B	120.50'	2,481 cf	**ADS_StormTech SC-740 +Cap** x 54 Inside #3 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 54 Chambers in 6 Rows
		11,519 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	120.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.13 cfs @ 9.55 hrs HW=120.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Pond IC-A: INFILTRATION CHAMBER SYS1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

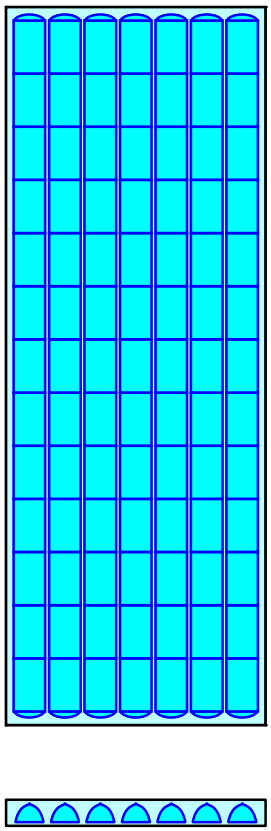
13 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 94.18' Row Length +12.0" End Stone x 2 = 96.18' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 34.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

91 Chambers x 45.9 cf = 4,180.5 cf Chamber Storage

11,697.5 cf Field - 4,180.5 cf Chambers = 7,516.9 cf Stone x 40.0% Voids = 3,006.8 cf Stone Storage

Chamber Storage + Stone Storage = 7,187.3 cf = 0.165 af
Overall Storage Efficiency = 61.4%
Overall System Size = 96.18' x 34.75' x 3.50'

91 Chambers
433.2 cy Field
278.4 cy Stone



Pond IC-A: INFILTRATION CHAMBER SYS1 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

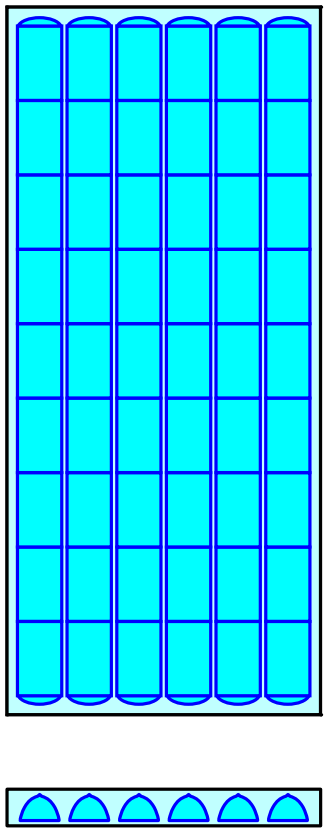
9 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 65.70' Row Length +12.0" End Stone x 2 = 67.70' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

54 Chambers x 45.9 cf = 2,480.8 cf Chamber Storage

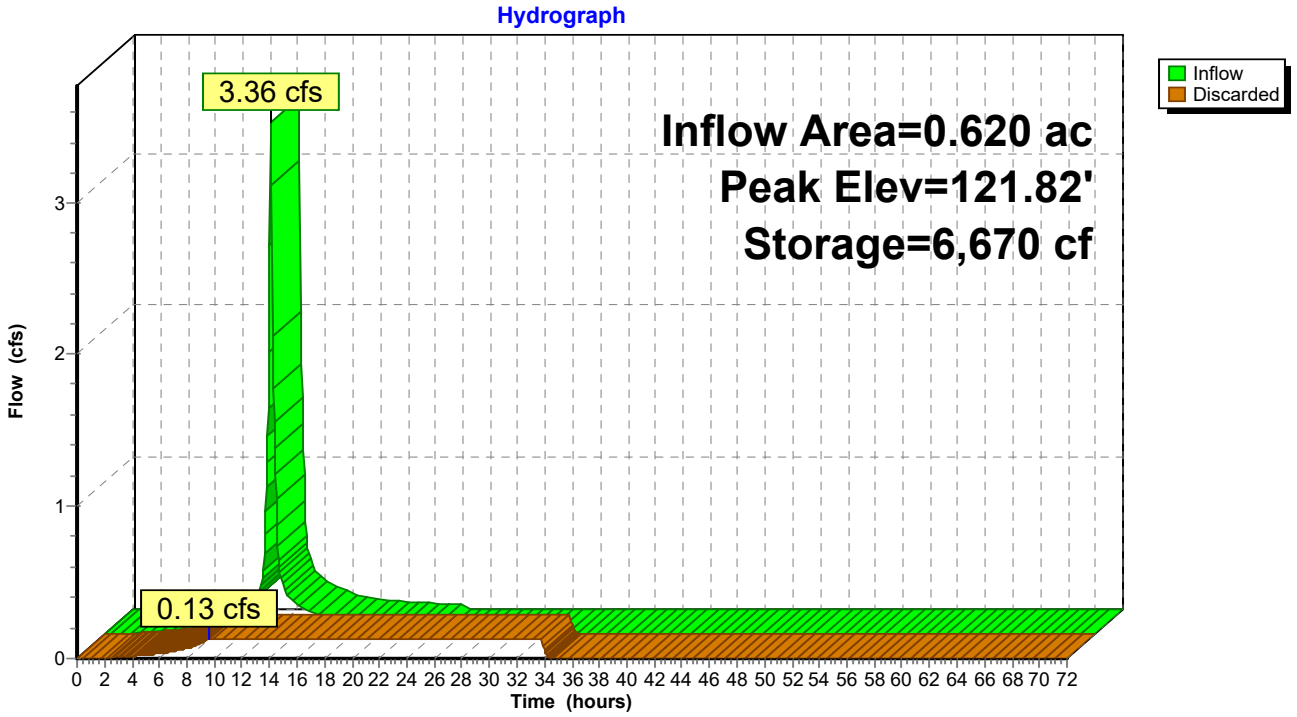
7,108.2 cf Field - 2,480.8 cf Chambers = 4,627.4 cf Stone x 40.0% Voids = 1,851.0 cf Stone Storage

Chamber Storage + Stone Storage = 4,331.7 cf = 0.099 af
Overall Storage Efficiency = 60.9%
Overall System Size = 67.70' x 30.00' x 3.50'

54 Chambers
263.3 cy Field
171.4 cy Stone



Pond IC-A: INFILTRATION CHAMBER SYS1



Summary for Pond IC-B: INFILTRATION CHAMBER SYS 2

Inflow Area = 0.206 ac, 94.40% Impervious, Inflow Depth = 5.68" for 25 year event
Inflow = 1.09 cfs @ 12.04 hrs, Volume= 0.098 af
Outflow = 0.06 cfs @ 10.40 hrs, Volume= 0.098 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.06 cfs @ 10.40 hrs, Volume= 0.098 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.17' @ 14.12 hrs Surf.Area= 2,608 sf Storage= 1,950 cf

Plug-Flow detention time= 266.2 min calculated for 0.098 af (100% of inflow)
Center-of-Mass det. time= 266.1 min (1,021.3 - 755.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	120.00'	2,365 cf	**25.25'W x 103.30'L x 3.50'H Field A** 9,129 cf Overall - 3,216 cf Embedded = 5,913 cf x 40.0% Voids
#2A	120.50'	3,216 cf	**ADS_StormTech SC-740 +Cap** x 70 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 70 Chambers in 5 Rows
		5,581 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	120.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 10.40 hrs HW=120.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond IC-B: INFILTRATION CHAMBER SYS 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

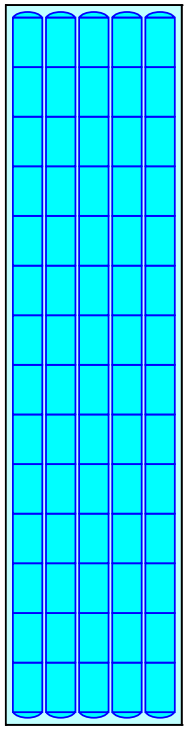
14 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 101.30' Row Length +12.0" End Stone x 2 = 103.30' Base Length
5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

70 Chambers x 45.9 cf = 3,215.8 cf Chamber Storage

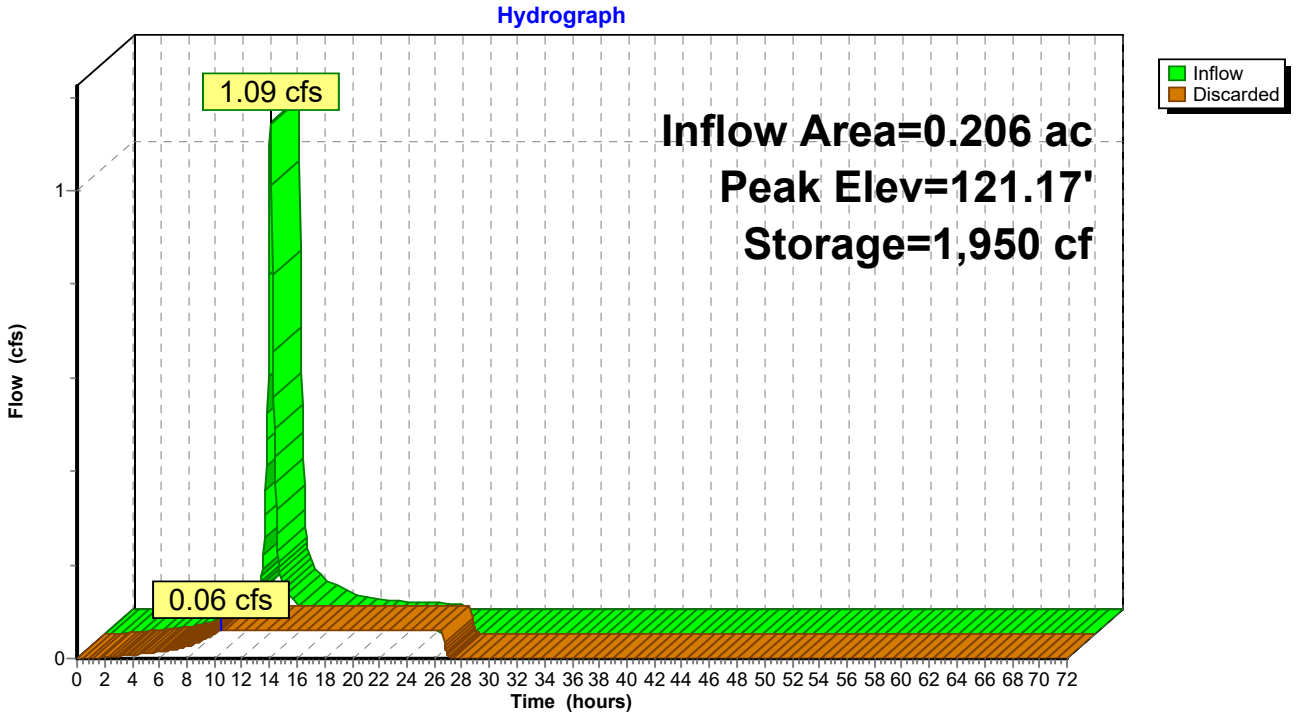
9,128.8 cf Field - 3,215.8 cf Chambers = 5,913.0 cf Stone x 40.0% Voids = 2,365.2 cf Stone Storage

Chamber Storage + Stone Storage = 5,581.0 cf = 0.128 af
Overall Storage Efficiency = 61.1%
Overall System Size = 103.30' x 25.25' x 3.50'

70 Chambers
338.1 cy Field
219.0 cy Stone



Pond IC-B: INFILTRATION CHAMBER SYS 2



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: prop. SC#1 Runoff Area=8,946 sf 82.36% Impervious Runoff Depth=7.63"
Flow Length=152' Tc=6.0 min CN=91 Runoff=1.65 cfs 0.131 af

Subcatchment 1SR: PROP SC, ROOF Runoff Area=3,750 sf 100.00% Impervious Runoff Depth=8.47"
Tc=0.0 min CN=98 Runoff=0.84 cfs 0.061 af

Subcatchment 2S: PROP. SC#2 Runoff Area=6,329 sf 88.17% Impervious Runoff Depth=7.99"
Flow Length=152' Tc=6.0 min CN=94 Runoff=1.19 cfs 0.097 af

Subcatchment 2SR: PROP. SC, ROOF Runoff Area=3,750 sf 100.00% Impervious Runoff Depth=8.47"
Tc=0.0 min CN=98 Runoff=0.84 cfs 0.061 af

Subcatchment 3S: PROP. SC#3 Runoff Area=7,964 sf 90.61% Impervious Runoff Depth=8.11"
Flow Length=152' Tc=6.0 min CN=95 Runoff=1.51 cfs 0.124 af

Subcatchment 4S: PROP. SC #4 Runoff Area=5,231 sf 90.38% Impervious Runoff Depth=7.99"
Flow Length=81' Tc=6.0 min CN=94 Runoff=0.99 cfs 0.080 af

Subcatchment 5S: SC5- to Washington Runoff Area=2,137 sf 0.00% Impervious Runoff Depth=3.99"
Tc=0.0 min CN=61 Runoff=0.26 cfs 0.016 af

Subcatchment 6S: SC6- to Webster Runoff Area=1,770 sf 0.00% Impervious Runoff Depth=3.99"
Tc=0.0 min CN=61 Runoff=0.22 cfs 0.014 af

Reach DP1: DP1 Inflow=0.48 cfs 0.030 af
Outflow=0.48 cfs 0.030 af

Pond CB1: CB1 Peak Elev=122.08' Inflow=1.65 cfs 0.131 af
12.0" Round Culvert n=0.013 L=62.0' S=0.0065 '/' Outflow=1.65 cfs 0.131 af

Pond CB2: CB #2 Peak Elev=121.76' Inflow=1.19 cfs 0.097 af
12.0" Round Culvert n=0.013 L=10.0' S=0.0200 '/' Outflow=1.19 cfs 0.097 af

Pond CB3: CB #3 Peak Elev=121.87' Inflow=1.51 cfs 0.124 af
12.0" Round Culvert n=0.013 L=20.0' S=0.0100 '/' Outflow=1.51 cfs 0.124 af

Pond CB4: CB#4 Peak Elev=121.82' Inflow=0.99 cfs 0.080 af
12.0" Round Culvert n=0.013 L=32.0' S=0.0125 '/' Outflow=0.99 cfs 0.080 af

Pond DMH#2: DMH #2 Peak Elev=121.54' Inflow=1.19 cfs 0.097 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=1.19 cfs 0.097 af

Pond DMH#3: DMH #3 Peak Elev=121.65' Inflow=1.51 cfs 0.124 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=1.51 cfs 0.124 af

Pond DMH1: DMH #1 Peak Elev=121.84' Inflow=2.17 cfs 0.191 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=2.17 cfs 0.191 af

Pond DMH4: DMH #4 Peak Elev=121.56' Inflow=1.56 cfs 0.141 af
12.0" Round Culvert n=0.013 L=5.0' S=0.0200 '/' Outflow=1.56 cfs 0.141 af

Pond IC-A: INFILTRATION CHAMBER SYS1 Peak Elev=123.26' Storage=11,001 cf Inflow=4.82 cfs 0.412 af
Outflow=0.13 cfs 0.412 af

Pond IC-B: INFILTRATION CHAMBER SYS 2 Peak Elev=121.83' Storage=3,241 cf Inflow=1.56 cfs 0.141 af
Outflow=0.06 cfs 0.141 af

Total Runoff Area = 0.915 ac Runoff Volume = 0.582 af Average Runoff Depth = 7.63"
18.77% Pervious = 0.172 ac 81.23% Impervious = 0.744 ac

Summary for Subcatchment 1S: prop. SC#1

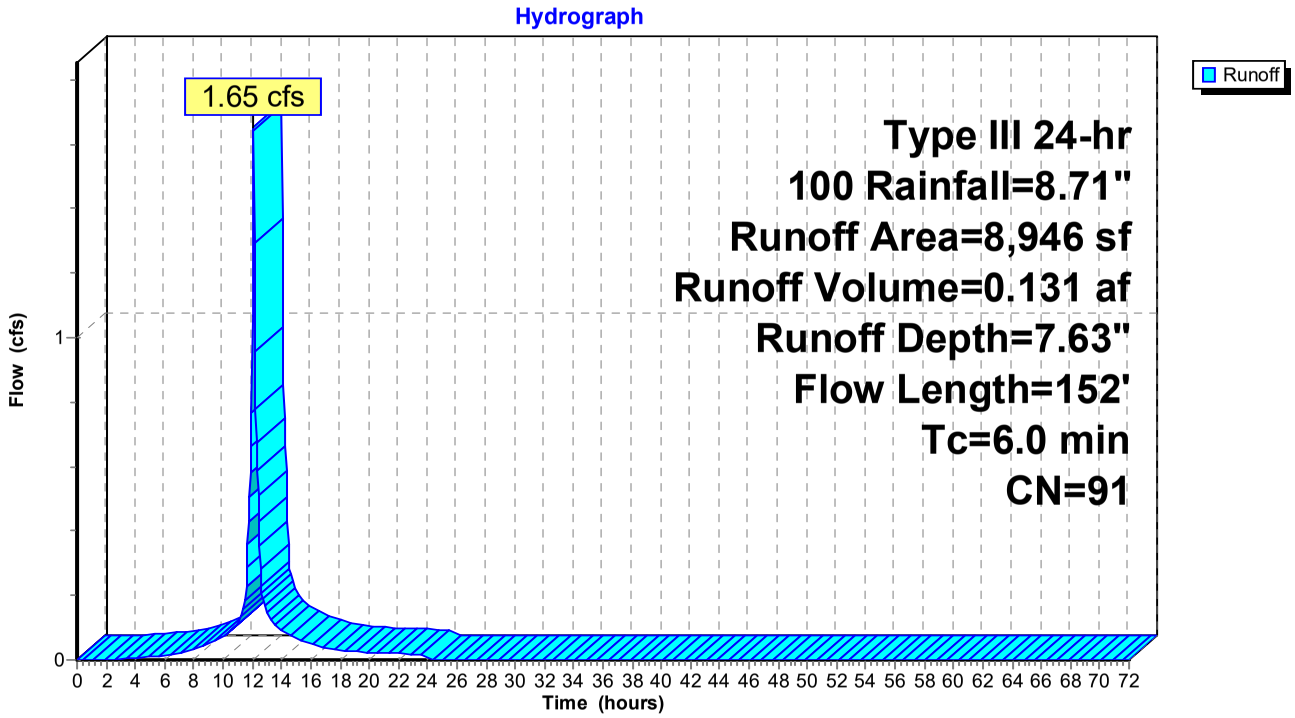
Runoff = 1.65 cfs @ 12.09 hrs, Volume= 0.131 af, Depth= 7.63"
Routed to Pond CB1 : CB1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=8.71"

	Area (sf)	CN	Description
*	6,381	98	pavement area
*	987	98	sidewalk & retaining wall
	1,578	61	>75% Grass cover, Good, HSG B
	8,946	91	Weighted Average
	1,578		17.64% Pervious Area
	7,368		82.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: prop. SC#1



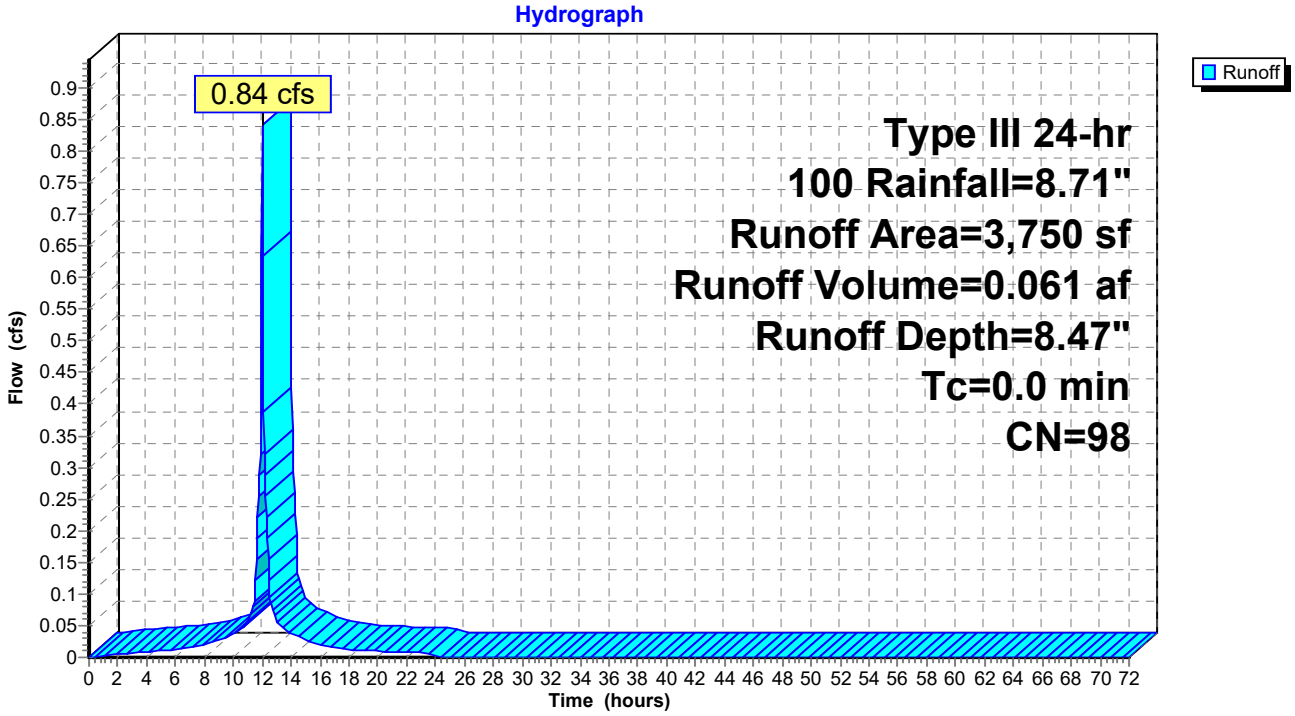
Summary for Subcatchment 1SR: PROP SC, ROOF DRAIN 1

Runoff = 0.84 cfs @ 12.00 hrs, Volume= 0.061 af, Depth= 8.47"
Routed to Pond DMH1 : DMH #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=8.71"

	Area (sf)	CN	Description
*	3,750	98	roof area
	3,750		100.00% Impervious Area

Subcatchment 1SR: PROP SC, ROOF DRAIN 1



Summary for Subcatchment 2S: PROP. SC#2

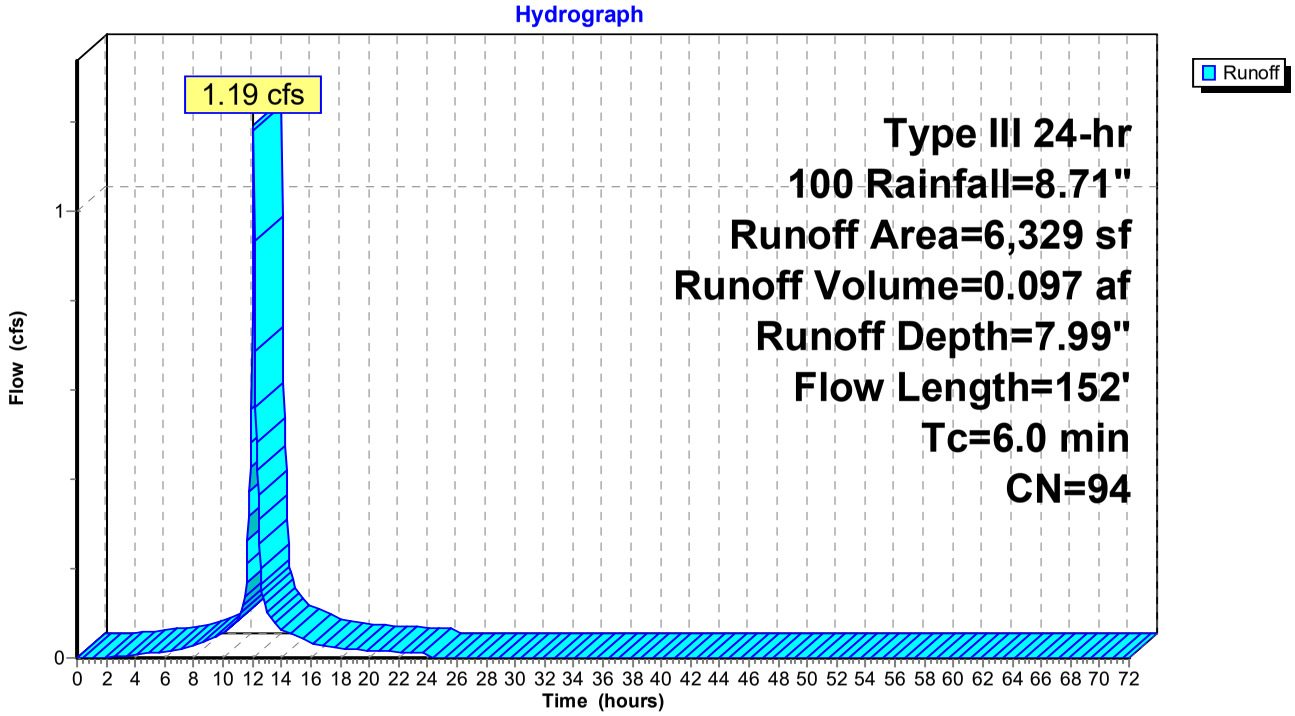
Runoff = 1.19 cfs @ 12.09 hrs, Volume= 0.097 af, Depth= 7.99"
Routed to Pond CB2 : CB #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=8.71"

	Area (sf)	CN	Description
*	4,872	98	pavement area
*	708	98	sidewalk & retaining wall
	749	61	>75% Grass cover, Good, HSG B
	6,329	94	Weighted Average
	749		11.83% Pervious Area
	5,580		88.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: PROP. SC#2



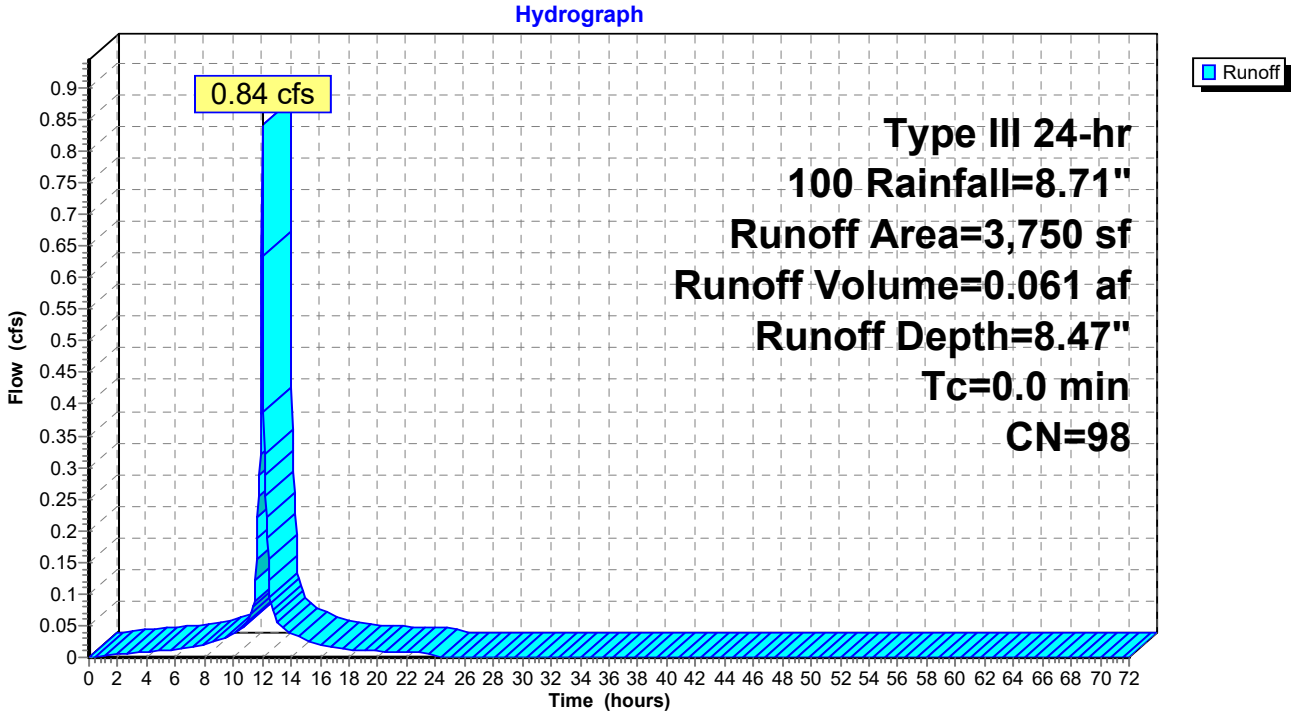
Summary for Subcatchment 2SR: PROP. SC, ROOF DRAIN 2

Runoff = 0.84 cfs @ 12.00 hrs, Volume= 0.061 af, Depth= 8.47"
Routed to Pond DMH4 : DMH #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=8.71"

	Area (sf)	CN	Description
*	3,750	98	roof area
	3,750		100.00% Impervious Area

Subcatchment 2SR: PROP. SC, ROOF DRAIN 2



Summary for Subcatchment 3S: PROP. SC#3

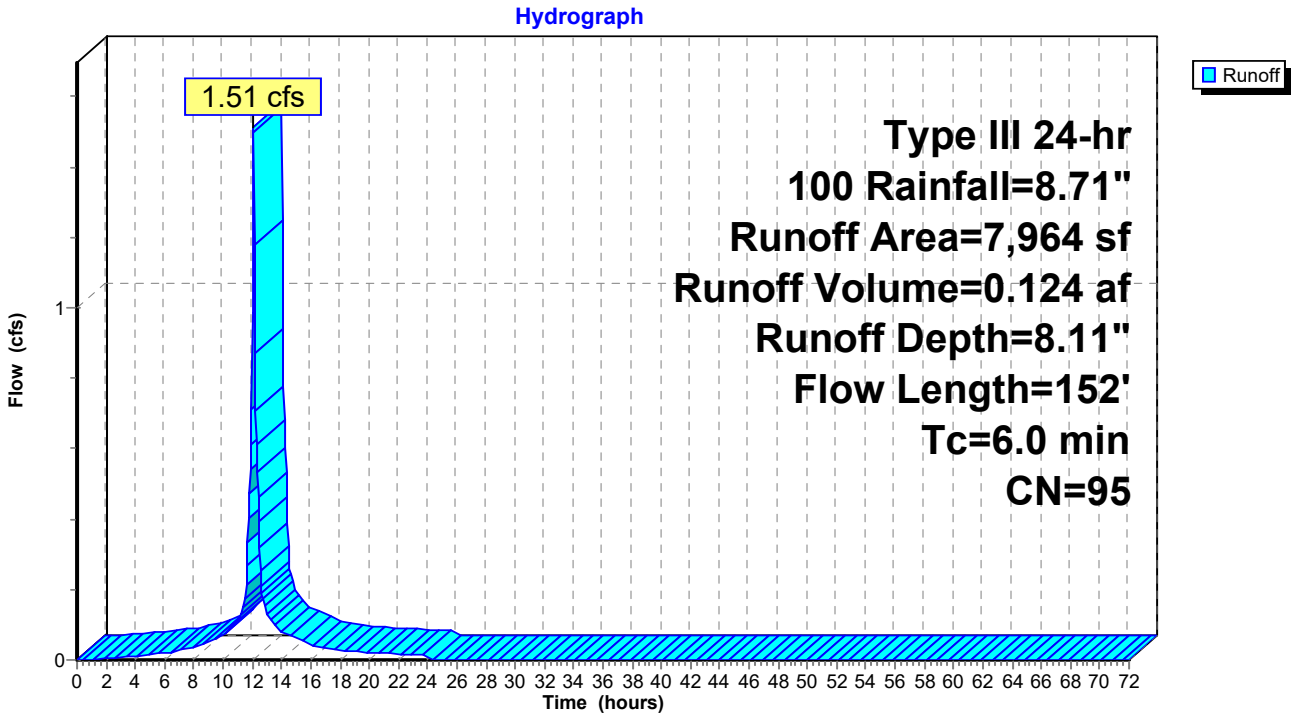
Runoff = 1.51 cfs @ 12.09 hrs, Volume= 0.124 af, Depth= 8.11"
Routed to Pond CB3 : CB #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=8.71"

	Area (sf)	CN	Description
*	6,031	98	pavement area
*	1,185	98	sidewalk & retaining wall
	748	61	>75% Grass cover, Good, HSG B
	7,964	95	Weighted Average
	748		9.39% Pervious Area
	7,216		90.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0110	0.97		**Sheet Flow, 50 ft Sheet** Smooth surfaces n= 0.011 P2= 3.40"
0.6	102	0.0170	2.65		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
1.5	152	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 3S: PROP. SC#3



Summary for Subcatchment 4S: PROP. SC #4

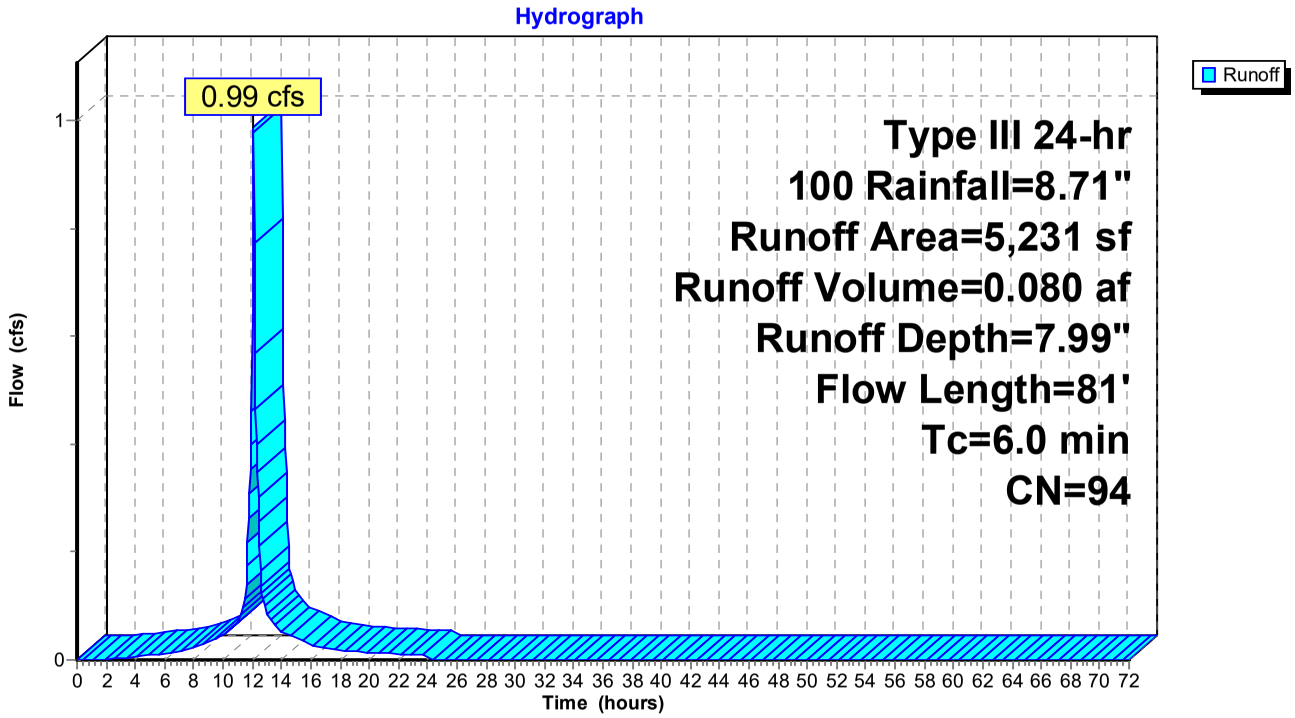
Runoff = 0.99 cfs @ 12.09 hrs, Volume= 0.080 af, Depth= 7.99"
Routed to Pond CB4 : CB#4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=8.71"

	Area (sf)	CN	Description
	4,341	98	Paved parking, HSG B
*	387	98	sidewalk and other impervious
	503	61	>75% Grass cover, Good, HSG B
	5,231	94	Weighted Average
	503		9.62% Pervious Area
	4,728		90.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	50	0.1350	2.65		**Sheet Flow, sheet flow 50 ft** Smooth surfaces n= 0.011 P2= 3.40"
0.3	31	0.0100	2.03		**Shallow Concentrated Flow, shallow conc flow** Paved Kv= 20.3 fps
0.6	81	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 4S: PROP. SC #4



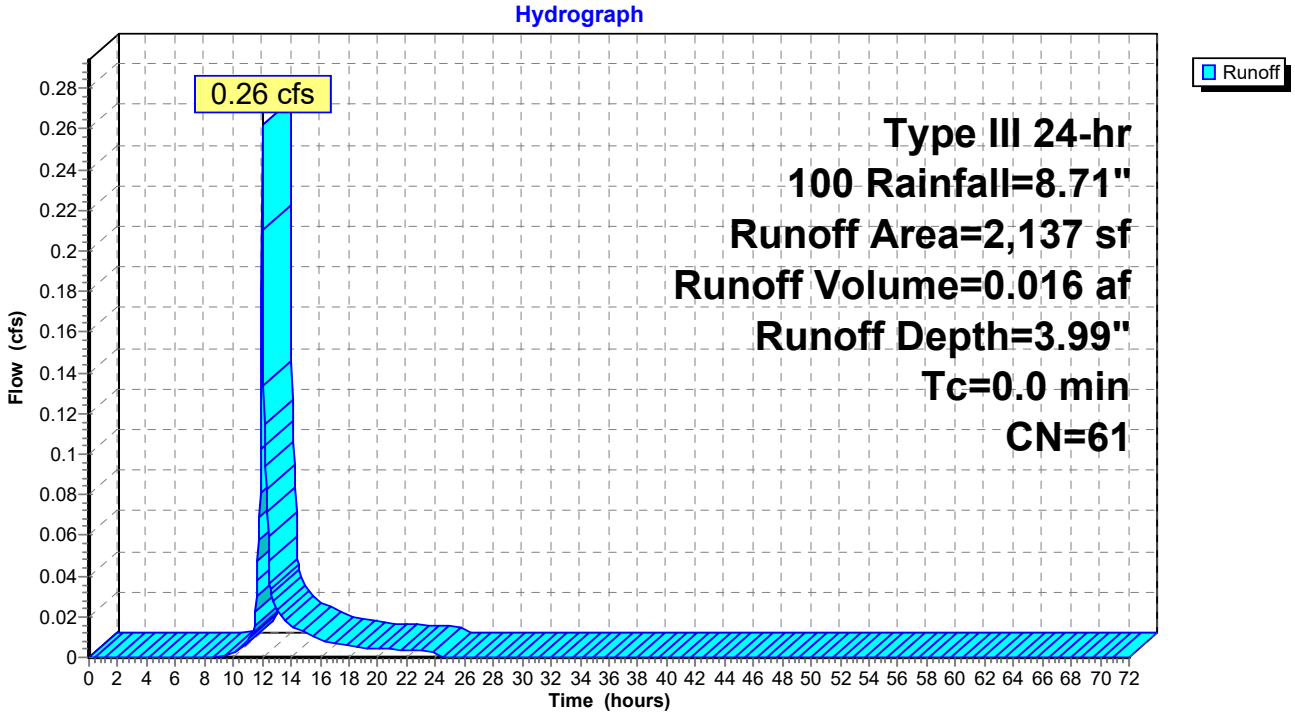
Summary for Subcatchment 5S: SC5- to Washington

Runoff = 0.26 cfs @ 12.01 hrs, Volume= 0.016 af, Depth= 3.99"
Routed to Reach DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=8.71"

Area (sf)	CN	Description
2,137	61	>75% Grass cover, Good, HSG B
2,137		100.00% Pervious Area

Subcatchment 5S: SC5- to Washington



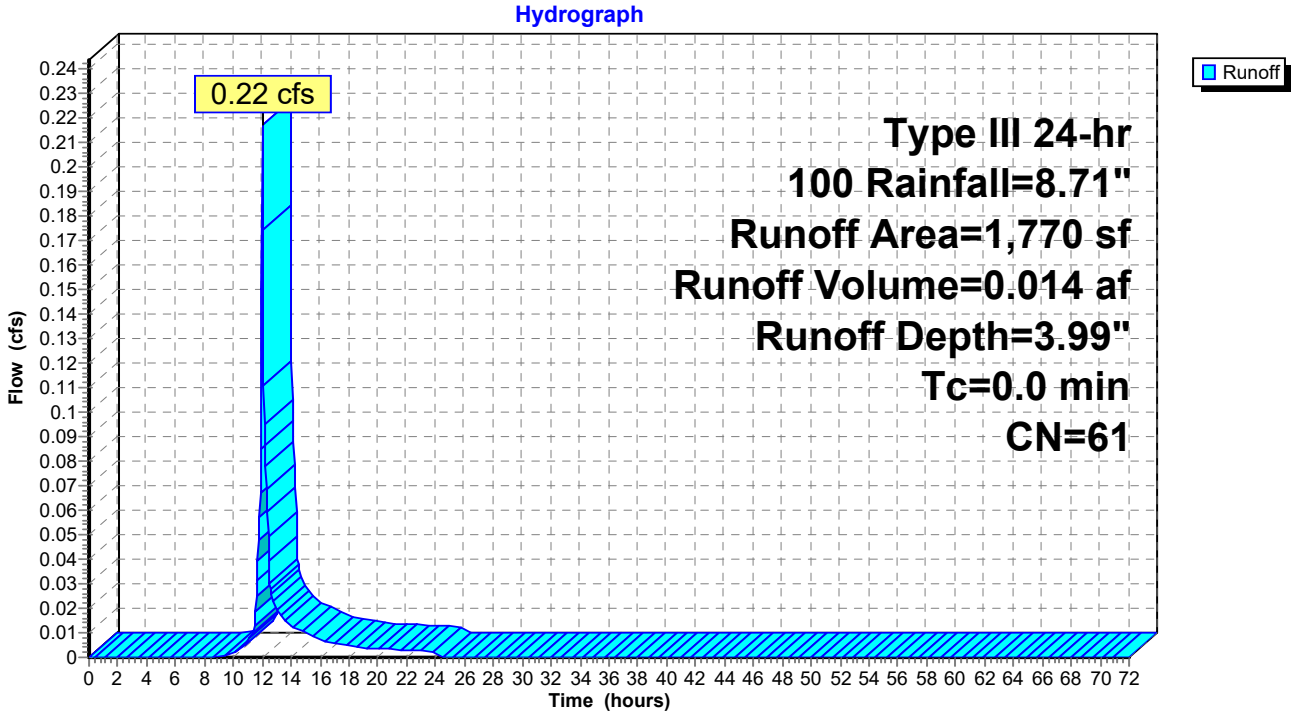
Summary for Subcatchment 6S: SC6- to Webster

Runoff = 0.22 cfs @ 12.01 hrs, Volume= 0.014 af, Depth= 3.99"
Routed to Reach DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Rainfall=8.71"

Area (sf)	CN	Description
1,770	61	>75% Grass cover, Good, HSG B
1,770		100.00% Pervious Area

Subcatchment 6S: SC6- to Webster

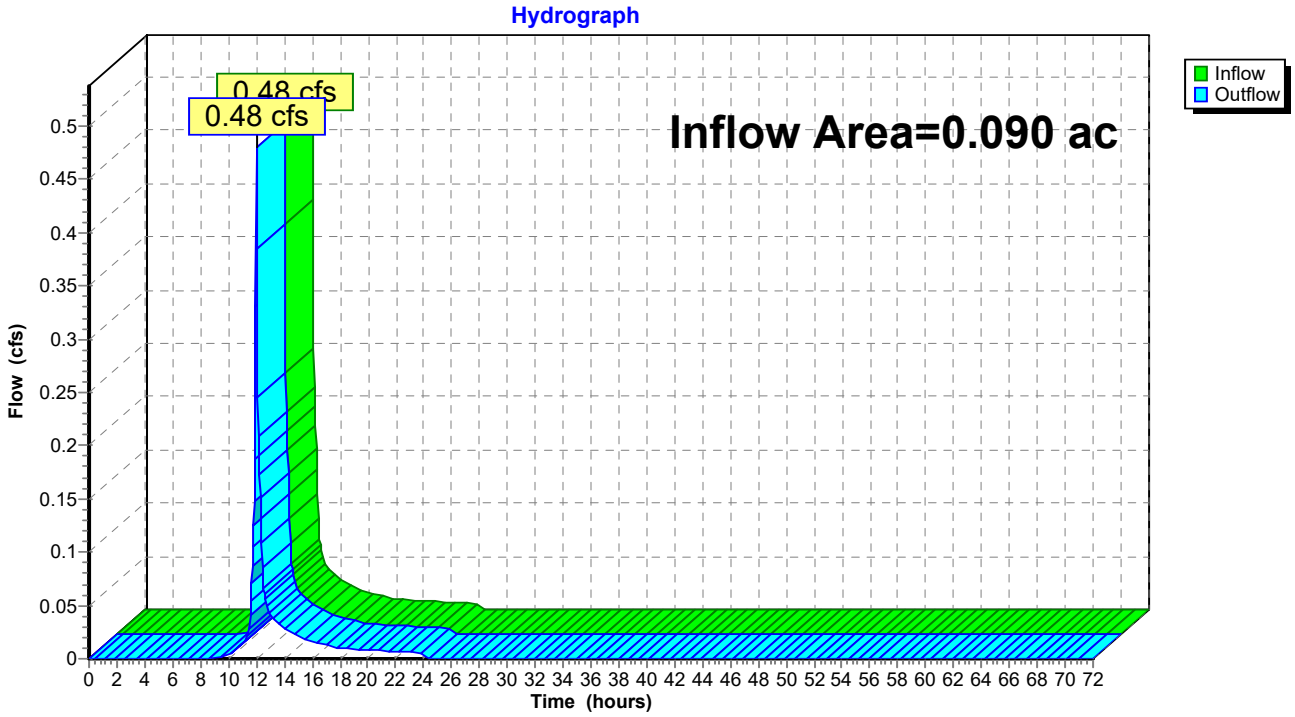


Summary for Reach DP1: DP1

Inflow Area = 0.090 ac, 0.00% Impervious, Inflow Depth = 3.99" for 100 event
Inflow = 0.48 cfs @ 12.01 hrs, Volume= 0.030 af
Outflow = 0.48 cfs @ 12.01 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: DP1



Summary for Pond CB1: CB1

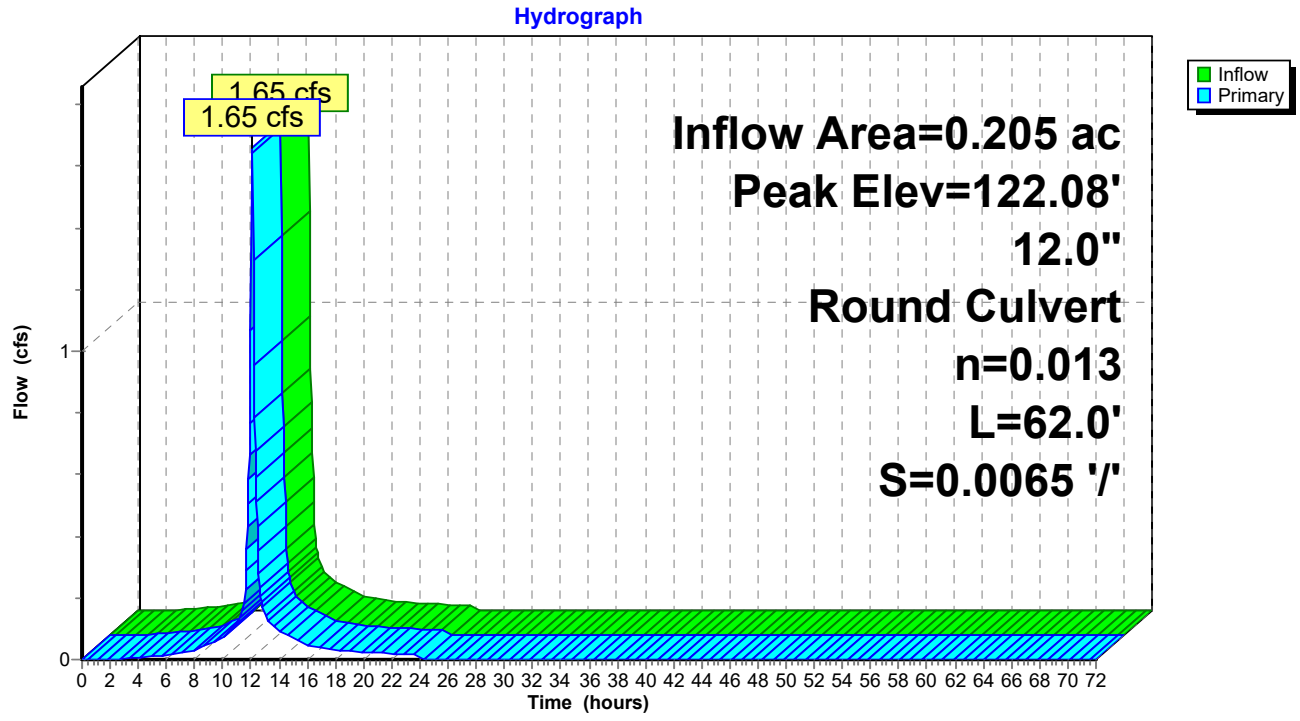
Inflow Area = 0.205 ac, 82.36% Impervious, Inflow Depth = 7.63" for 100 event
Inflow = 1.65 cfs @ 12.09 hrs, Volume= 0.131 af
Outflow = 1.65 cfs @ 12.09 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min
Primary = 1.65 cfs @ 12.09 hrs, Volume= 0.131 af
Routed to Pond DMH1 : DMH #1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 122.08' @ 12.09 hrs
Flood Elev= 124.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.30'	**12.0" Round Culvert** L= 62.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 121.30' / 120.90' S= 0.0065 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.61 cfs @ 12.09 hrs HW=122.07' (Free Discharge)
1=Culvert (Barrel Controls 1.61 cfs @ 3.43 fps)

Pond CB1: CB1



Summary for Pond CB2: CB #2

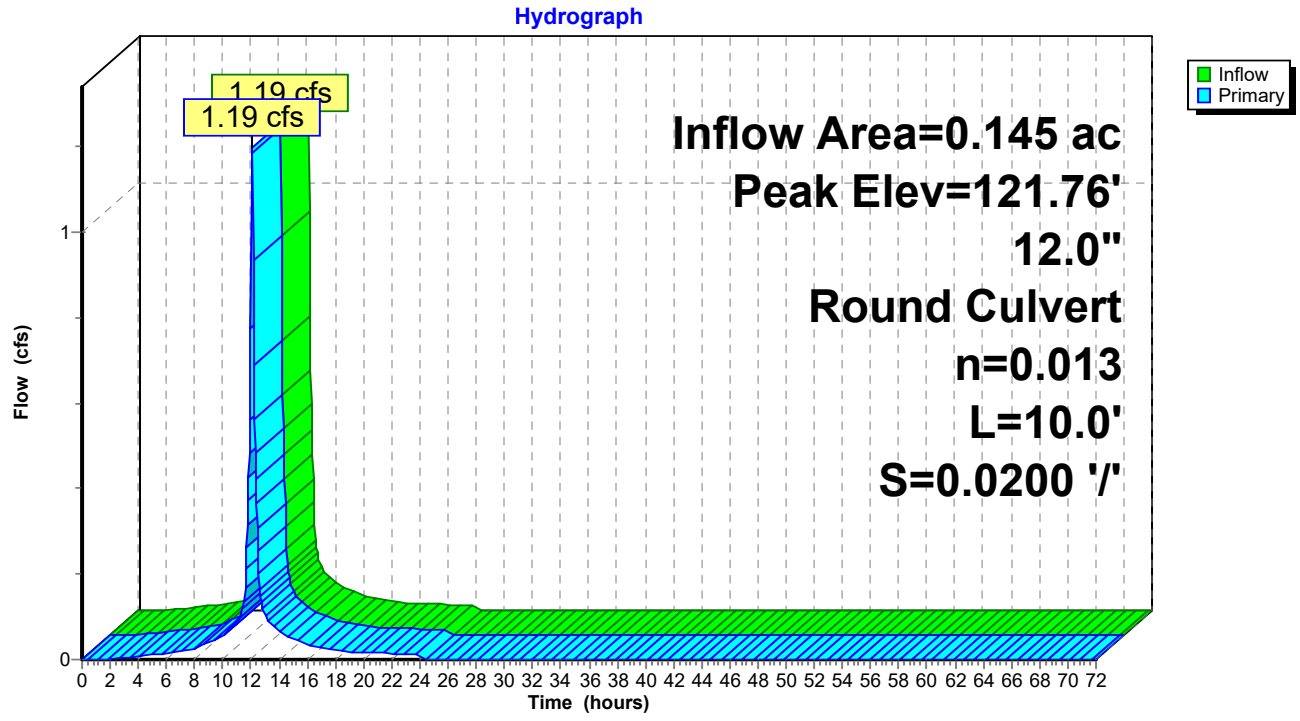
Inflow Area = 0.145 ac, 88.17% Impervious, Inflow Depth = 7.99" for 100 event
Inflow = 1.19 cfs @ 12.09 hrs, Volume= 0.097 af
Outflow = 1.19 cfs @ 12.09 hrs, Volume= 0.097 af, Atten= 0%, Lag= 0.0 min
Primary = 1.19 cfs @ 12.09 hrs, Volume= 0.097 af
Routed to Pond DMH#2 : DMH #2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.76' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.10'	**12.0" Round PIPE** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 121.10' / 120.90' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.16 cfs @ 12.09 hrs HW=121.75' (Free Discharge)
1=PIPE (Inlet Controls 1.16 cfs @ 2.16 fps)

Pond CB2: CB #2



Summary for Pond CB3: CB #3

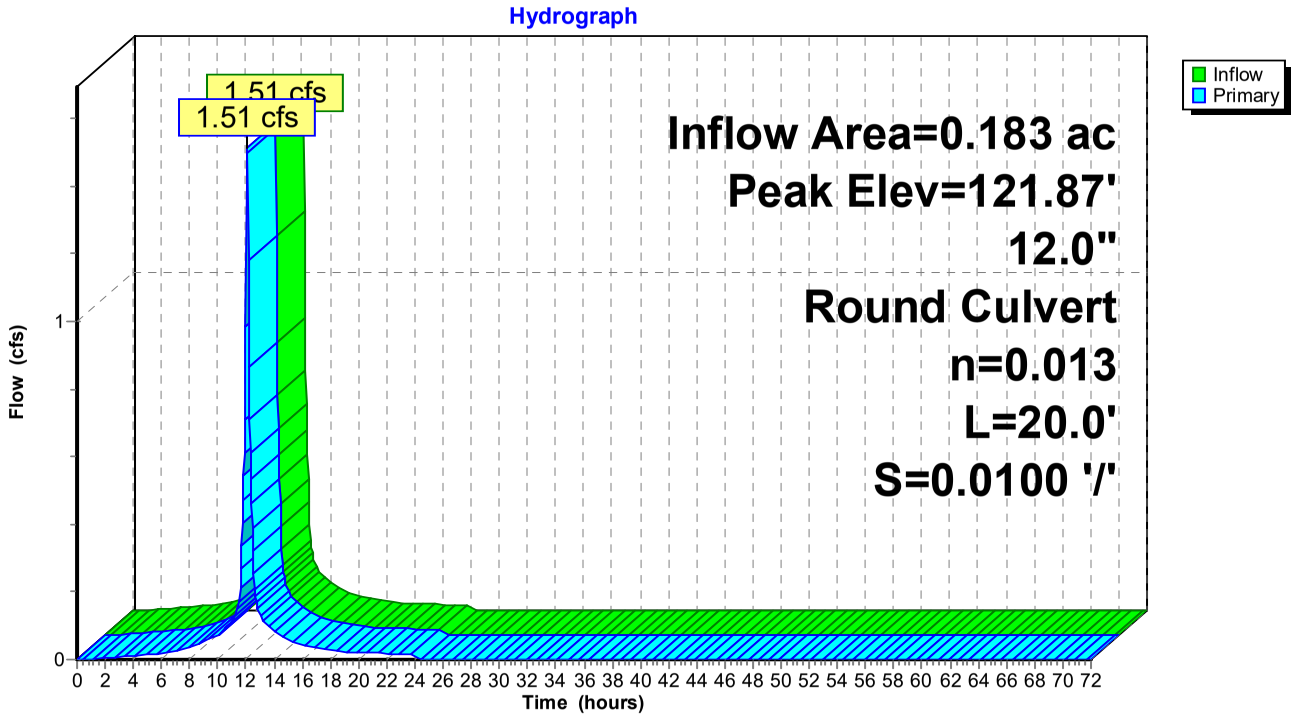
Inflow Area = 0.183 ac, 90.61% Impervious, Inflow Depth = 8.11" for 100 event
Inflow = 1.51 cfs @ 12.09 hrs, Volume= 0.124 af
Outflow = 1.51 cfs @ 12.09 hrs, Volume= 0.124 af, Atten= 0%, Lag= 0.0 min
Primary = 1.51 cfs @ 12.09 hrs, Volume= 0.124 af
Routed to Pond DMH#3 : DMH #3

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.87' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.10'	**12.0" Round PIPE** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 121.10' / 120.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.47 cfs @ 12.09 hrs HW=121.86' (Free Discharge)
1=PIPE (Barrel Controls 1.47 cfs @ 3.19 fps)

Pond CB3: CB #3



Summary for Pond CB4: CB#4

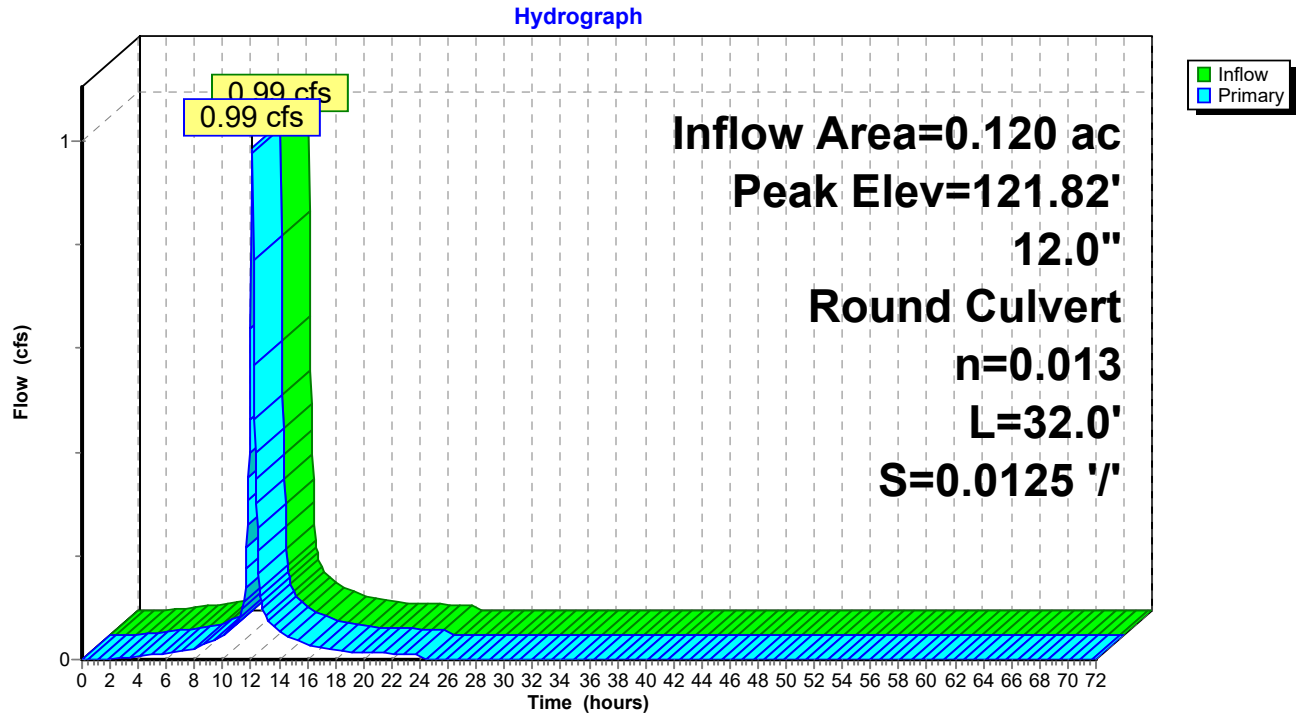
Inflow Area = 0.120 ac, 90.38% Impervious, Inflow Depth = 7.99" for 100 event
Inflow = 0.99 cfs @ 12.09 hrs, Volume= 0.080 af
Outflow = 0.99 cfs @ 12.09 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min
Primary = 0.99 cfs @ 12.09 hrs, Volume= 0.080 af
Routed to Pond DMH4 : DMH #4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.82' @ 12.09 hrs
Flood Elev= 124.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	121.30'	**12.0" Round PIPE** L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 121.30' / 120.90' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.96 cfs @ 12.09 hrs HW=121.81' (Free Discharge)
1=PIPE (Barrel Controls 0.96 cfs @ 3.49 fps)

Pond CB4: CB#4



Summary for Pond DMH#2: DMH #2

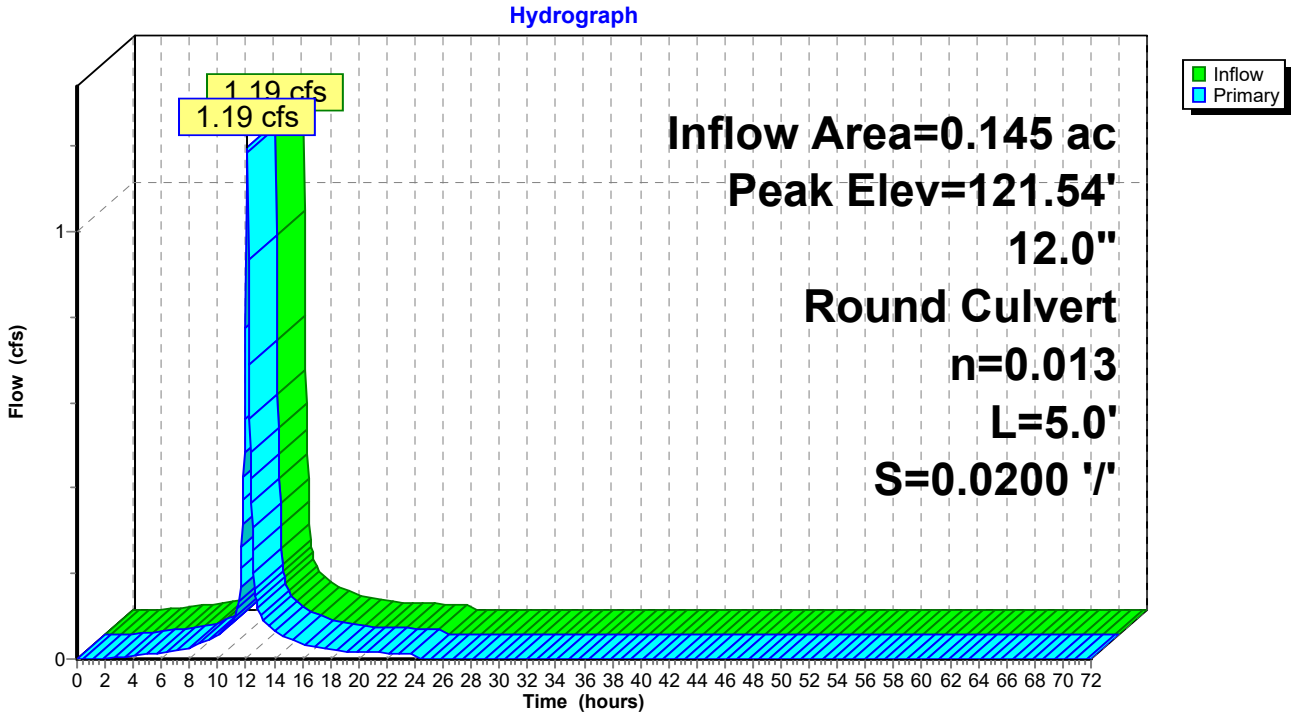
Inflow Area = 0.145 ac, 88.17% Impervious, Inflow Depth = 7.99" for 100 event
Inflow = 1.19 cfs @ 12.09 hrs, Volume= 0.097 af
Outflow = 1.19 cfs @ 12.09 hrs, Volume= 0.097 af, Atten= 0%, Lag= 0.0 min
Primary = 1.19 cfs @ 12.09 hrs, Volume= 0.097 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.54' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.16 cfs @ 12.09 hrs HW=121.53' (Free Discharge)
1=PIPE (Barrel Controls 1.16 cfs @ 3.16 fps)

Pond DMH#2: DMH #2



Summary for Pond DMH#3: DMH #3

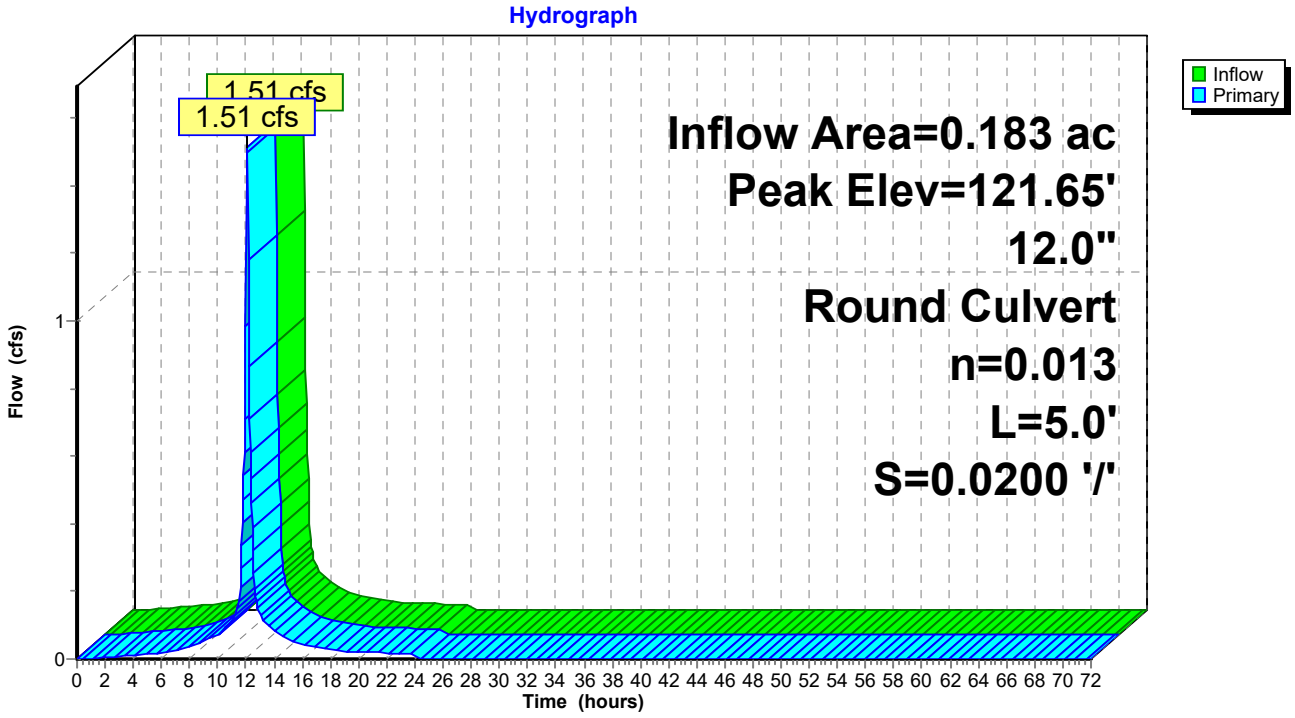
Inflow Area = 0.183 ac, 90.61% Impervious, Inflow Depth = 8.11" for 100 event
Inflow = 1.51 cfs @ 12.09 hrs, Volume= 0.124 af
Outflow = 1.51 cfs @ 12.09 hrs, Volume= 0.124 af, Atten= 0%, Lag= 0.0 min
Primary = 1.51 cfs @ 12.09 hrs, Volume= 0.124 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.65' @ 12.09 hrs
Flood Elev= 124.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.47 cfs @ 12.09 hrs HW=121.63' (Free Discharge)
1=PIPE (Barrel Controls 1.47 cfs @ 3.33 fps)

Pond DMH#3: DMH #3



Summary for Pond DMH1: DMH #1

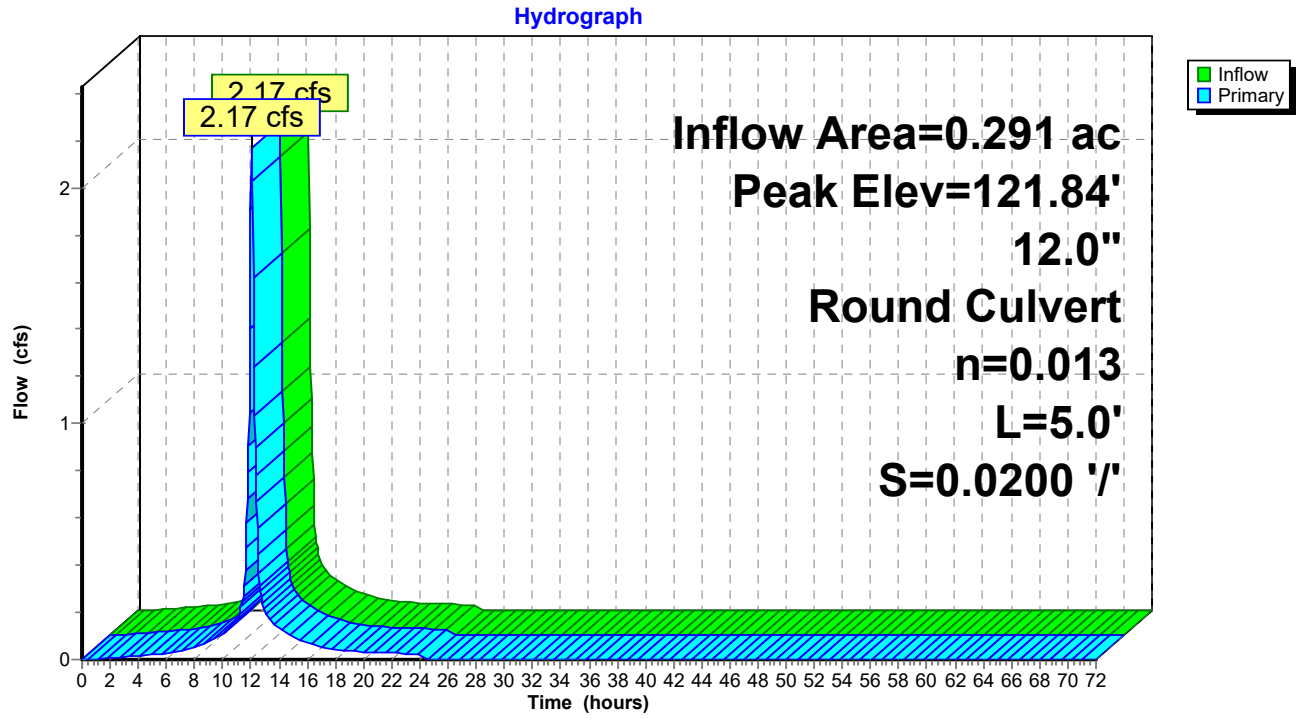
Inflow Area = 0.291 ac, 87.57% Impervious, Inflow Depth = 7.88" for 100 event
Inflow = 2.17 cfs @ 12.06 hrs, Volume= 0.191 af
Outflow = 2.17 cfs @ 12.06 hrs, Volume= 0.191 af, Atten= 0%, Lag= 0.0 min
Primary = 2.17 cfs @ 12.06 hrs, Volume= 0.191 af
Routed to Pond IC-A : INFILTRATION CHAMBER SYS1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.84' @ 12.06 hrs
Flood Elev= 124.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.90'	**12.0" Round DMH 1 OUTLET** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.90' / 120.80' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.14 cfs @ 12.06 hrs HW=121.84' (Free Discharge)
1=DMH 1 OUTLET (Barrel Controls 2.14 cfs @ 3.64 fps)

Pond DMH1: DMH #1



Summary for Pond DMH4: DMH #4

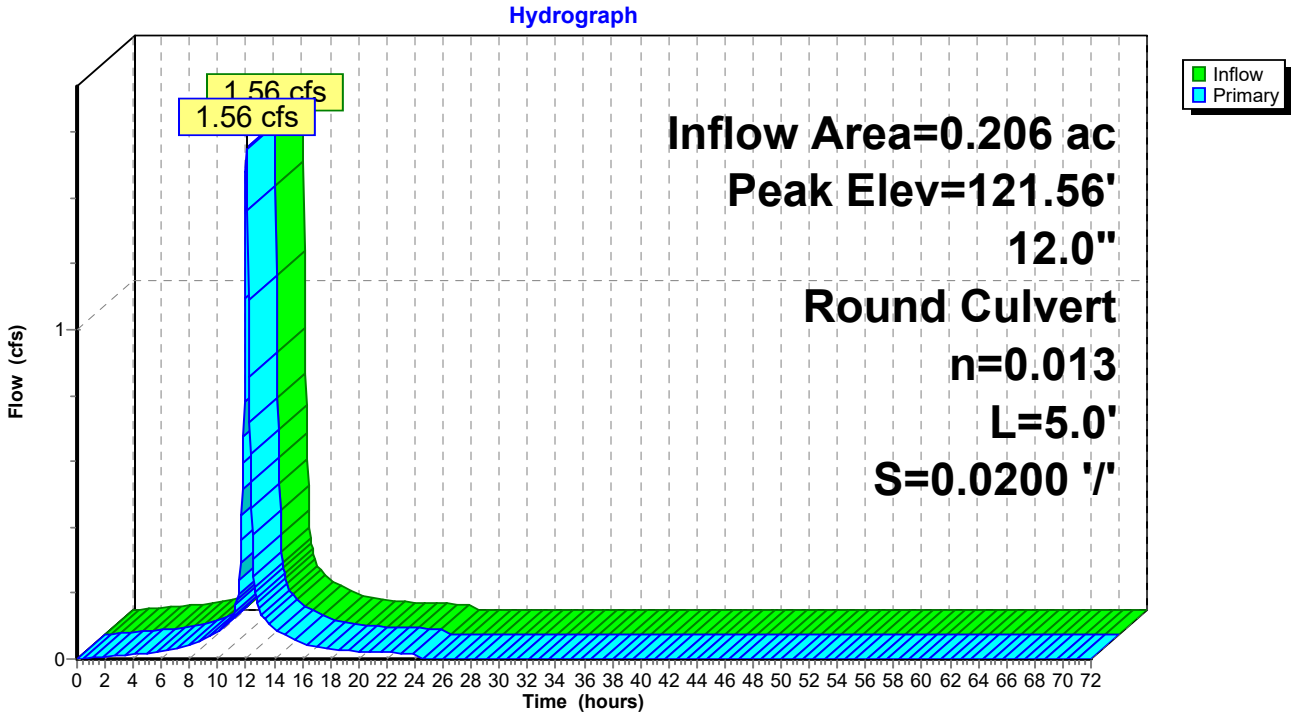
Inflow Area = 0.206 ac, 94.40% Impervious, Inflow Depth = 8.19" for 100 event
Inflow = 1.56 cfs @ 12.04 hrs, Volume= 0.141 af
Outflow = 1.56 cfs @ 12.04 hrs, Volume= 0.141 af, Atten= 0%, Lag= 0.0 min
Primary = 1.56 cfs @ 12.04 hrs, Volume= 0.141 af
Routed to Pond IC-B : INFILTRATION CHAMBER SYS 2

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.56' @ 12.04 hrs
Flood Elev= 124.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	120.80'	**12.0" Round PIPE** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 120.80' / 120.70' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.53 cfs @ 12.04 hrs HW=121.55' (Free Discharge)
1=PIPE (Barrel Controls 1.53 cfs @ 3.36 fps)

Pond DMH4: DMH #4



Summary for Pond IC-A: INFILTRATION CHAMBER SYS1

Inflow Area = 0.620 ac, 88.61% Impervious, Inflow Depth = 7.97" for 100 event
Inflow = 4.82 cfs @ 12.08 hrs, Volume= 0.412 af
Outflow = 0.13 cfs @ 8.45 hrs, Volume= 0.412 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.13 cfs @ 8.45 hrs, Volume= 0.412 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 123.26' @ 16.58 hrs Surf.Area= 5,373 sf Storage= 11,001 cf

Plug-Flow detention time= 760.5 min calculated for 0.411 af (100% of inflow)
Center-of-Mass det. time= 760.9 min (1,518.9 - 758.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	120.00'	3,007 cf	**34.75'W x 96.18'L x 3.50'H Field A** 11,697 cf Overall - 4,181 cf Embedded = 7,517 cf x 40.0% Voids
#2A	120.50'	4,181 cf	**ADS_StormTech SC-740 +Cap** x 91 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 91 Chambers in 7 Rows
#3B	120.00'	1,851 cf	**30.00'W x 67.70'L x 3.50'H Field B** 7,108 cf Overall - 2,481 cf Embedded = 4,627 cf x 40.0% Voids
#4B	120.50'	2,481 cf	**ADS_StormTech SC-740 +Cap** x 54 Inside #3 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 54 Chambers in 6 Rows
		11,519 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	120.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.13 cfs @ 8.45 hrs HW=120.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Pond IC-A: INFILTRATION CHAMBER SYS1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

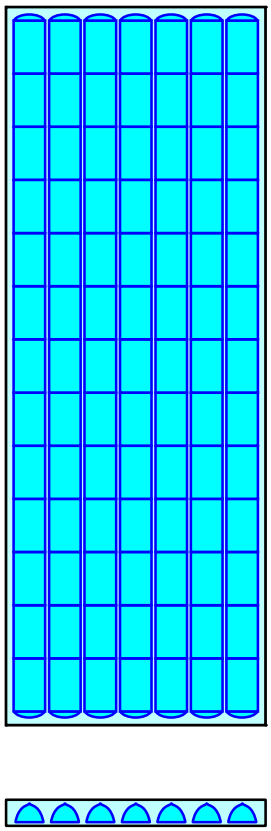
13 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 94.18' Row Length +12.0" End Stone x 2 = 96.18' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 34.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

91 Chambers x 45.9 cf = 4,180.5 cf Chamber Storage

11,697.5 cf Field - 4,180.5 cf Chambers = 7,516.9 cf Stone x 40.0% Voids = 3,006.8 cf Stone Storage

Chamber Storage + Stone Storage = 7,187.3 cf = 0.165 af
Overall Storage Efficiency = 61.4%
Overall System Size = 96.18' x 34.75' x 3.50'

91 Chambers
433.2 cy Field
278.4 cy Stone



Pond IC-A: INFILTRATION CHAMBER SYS1 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

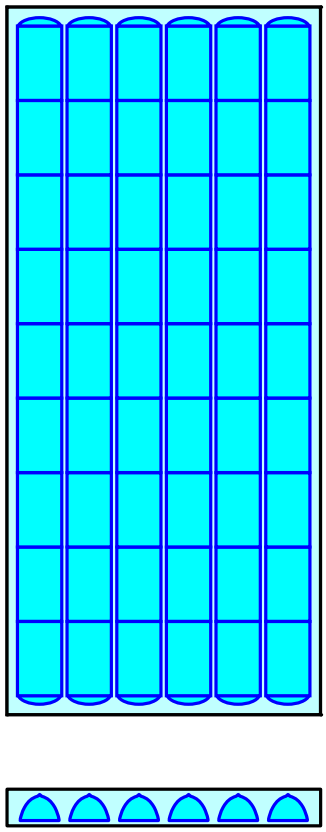
9 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 65.70' Row Length +12.0" End Stone x 2 = 67.70' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

54 Chambers x 45.9 cf = 2,480.8 cf Chamber Storage

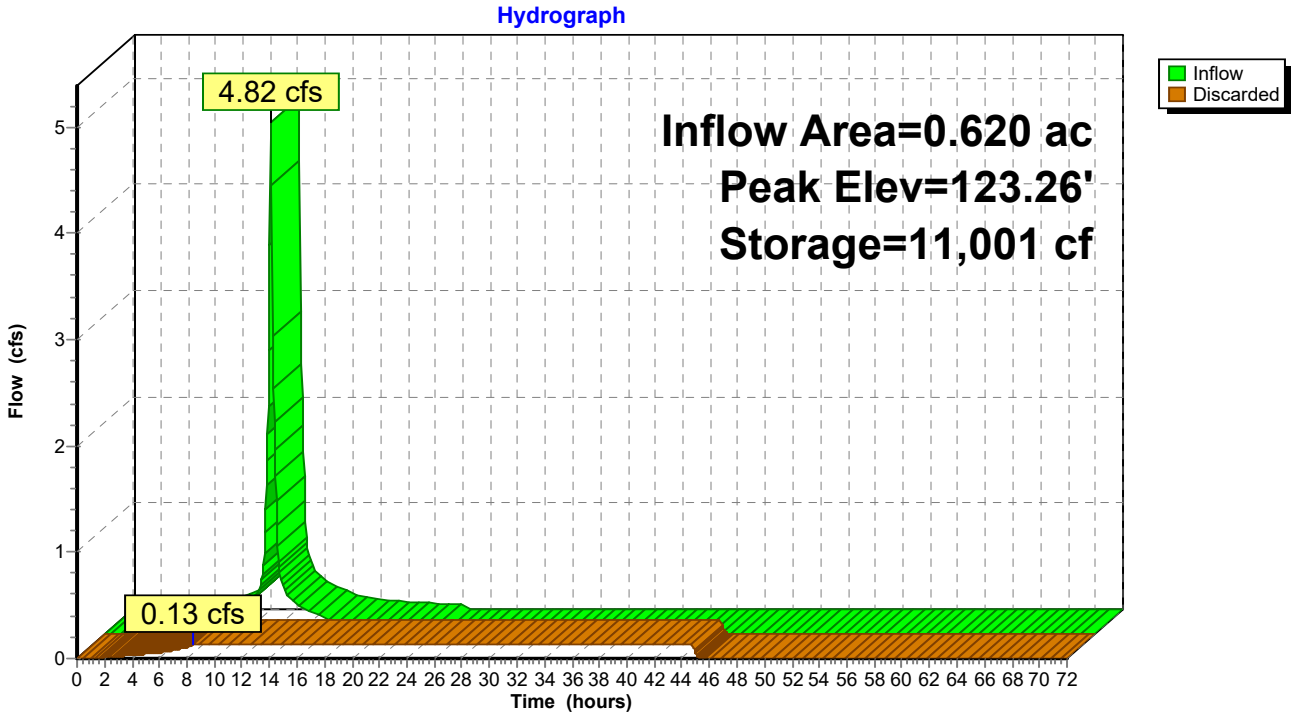
7,108.2 cf Field - 2,480.8 cf Chambers = 4,627.4 cf Stone x 40.0% Voids = 1,851.0 cf Stone Storage

Chamber Storage + Stone Storage = 4,331.7 cf = 0.099 af
Overall Storage Efficiency = 60.9%
Overall System Size = 67.70' x 30.00' x 3.50'

54 Chambers
263.3 cy Field
171.4 cy Stone



Pond IC-A: INFILTRATION CHAMBER SYS1



Summary for Pond IC-B: INFILTRATION CHAMBER SYS 2

Inflow Area = 0.206 ac, 94.40% Impervious, Inflow Depth = 8.19" for 100 event
Inflow = 1.56 cfs @ 12.04 hrs, Volume= 0.141 af
Outflow = 0.06 cfs @ 9.20 hrs, Volume= 0.141 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.06 cfs @ 9.20 hrs, Volume= 0.141 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 121.83' @ 15.35 hrs Surf.Area= 2,608 sf Storage= 3,241 cf

Plug-Flow detention time= 450.8 min calculated for 0.141 af (100% of inflow)
Center-of-Mass det. time= 450.9 min (1,199.6 - 748.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	120.00'	2,365 cf	**25.25'W x 103.30'L x 3.50'H Field A** 9,129 cf Overall - 3,216 cf Embedded = 5,913 cf x 40.0% Voids
#2A	120.50'	3,216 cf	**ADS_StormTech SC-740 +Cap** x 70 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 70 Chambers in 5 Rows
		5,581 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	120.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 9.20 hrs HW=120.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Pond IC-B: INFILTRATION CHAMBER SYS 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

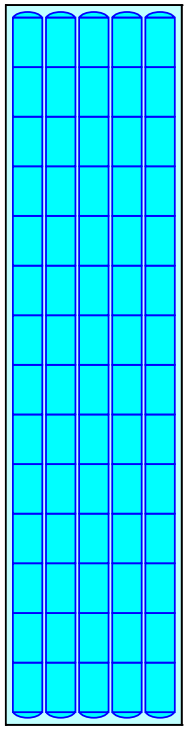
14 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 101.30' Row Length +12.0" End Stone x 2 = 103.30' Base Length
5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

70 Chambers x 45.9 cf = 3,215.8 cf Chamber Storage

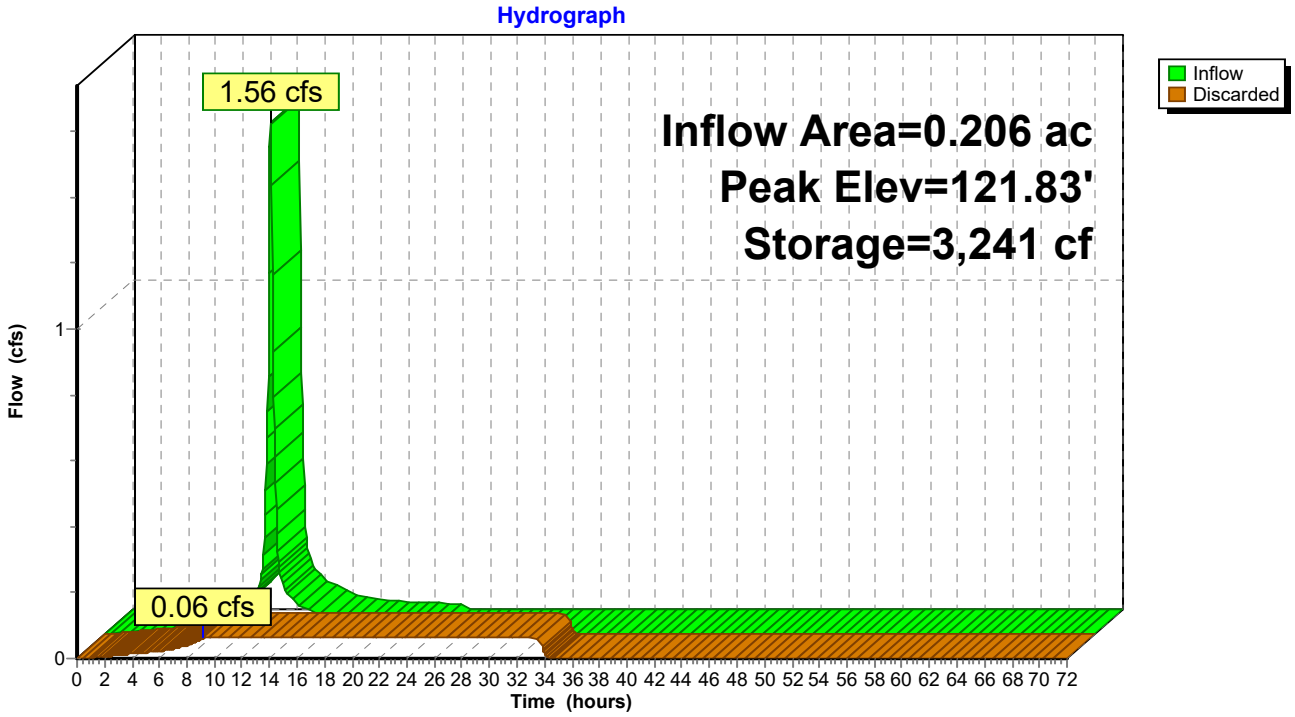
9,128.8 cf Field - 3,215.8 cf Chambers = 5,913.0 cf Stone x 40.0% Voids = 2,365.2 cf Stone Storage

Chamber Storage + Stone Storage = 5,581.0 cf = 0.128 af
Overall Storage Efficiency = 61.1%
Overall System Size = 103.30' x 25.25' x 3.50'

70 Chambers
338.1 cy Field
219.0 cy Stone



Pond IC-B: INFILTRATION CHAMBER SYS 2



Appendix C

Stormwater Management Design Calculations:

1. **GW Recharge Volumes Calculations**
2. **Drawdown Calculations**
3. **Water Quality Volume**
4. **TSS Removal Calculations**

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GROUNDWATER RECHARGE VOLUMES (STANDARD#3)

**Impervious area marked as roads, roofs, sidewalk, drives*

Location: 2103 Washington Street

Total site area, watershed (SF)=	40,624
Total Impervious Area, A Soils (SF)=	0
Total Impervious Area, B Soils (SF)=	31960
Total Impervious Area, C Soils (SF)=	0

Recharge Equation: R_v =F x Imp. Area ***Static Method***

Where: F is "Target Depth factor", R_v is "Recharge"

NRCS HYDROLOGIC SOIL TYPE	APPROX. SOIL TEXTURE	TARGET DEPTH FACTOR (F)
A	Sand	0.6-Inch
B	Loam	0.35-Inch
C	Silty Loam	0.25-Inch

Target Depth Factor (F), inches	Impervious Area, SF	Recharge Volume Required	
0.35	31,960	11,186.00	SF-Inch
		932.17	CF

SUBSURFACE INFILTRATION CHAMBER SYSTEM A

PROPOSED STORMWATER RECHARGE (V1+V2) = 10,980 CF

SUBSURFACE INFILTRATION CHAMBER SYSTEM 2

PROPOSED STORMWATER RECHARGE (V3) = 5,581 CF

TOTAL PROPOSED RECHARGE VOLUME (V1 + V2 + V3) 16,561 CF

16,561 CF	>	932.17 CF	*THEREFORE, PROPOSED RECHARGE COMPLIES WITH STANDARD 3*

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DRAWDOWN TIME CALCUALTIONS (STANDARD #3)

Location: 2103 Washington Street

DRAWDOWN TIME CALCULATIONS FOR INFILTRATION SYSTEMS

Drawdown Time = R_v/((k)(Bottom Basin Area)

Required draw down time is 72 hours or less

* R_v will be the total storage volume below pipe inverts or outlets

SUBSURFACE INFILTRATION CHAMBER A

R_v = 10,980 CF

k = 1.02 (IN/HR) ** convert in/hr to ft/hr*

Bot. Area= 5125.84 SF

Drawdown Time=			
	25.20 HRS	<	72 HRS

SUBSURFACE INFILTRATION CHAMBER B

R_v = 5,581 CF

k = 1.02 (IN/HR) ** convert in/hr to ft/hr*

Bot. Area= 2608.33 SF

Drawdown Time=			
	25.17 HRS	<	72 HRS

THEREFORE, DRAWDOWN TIME COMPLIES WITH STANDARD 3

Stage-Area-Storage for Pond IC-A: INFILTRATION CHAMBER SYS1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
120.00	**5,126**	0
120.05	5,126	103
120.10	5,126	205
120.15	5,126	308
120.20	5,126	410
120.25	5,126	513
120.30	5,126	615
120.35	5,126	718
120.40	5,126	820
120.45	5,126	923
120.50	5,126	1,025
120.55	5,126	1,237
120.60	5,126	1,449
120.65	5,126	1,661
120.70	5,126	1,872
120.75	5,126	2,083
120.80	5,126	2,292
120.85	5,126	2,502
120.90	5,126	2,710
120.95	5,126	2,917
121.00	5,126	3,124
121.05	5,126	3,330
121.10	5,126	3,535
121.15	5,126	3,739
121.20	5,126	3,942
121.25	5,126	4,144
121.30	5,126	4,345
121.35	5,126	4,544
121.40	5,126	4,743
121.45	5,126	4,941
121.50	5,126	5,137
121.55	5,126	5,332
121.60	5,126	5,525
121.65	5,126	5,718
121.70	5,126	5,908
121.75	5,126	6,097
121.80	5,126	6,285
121.85	5,126	6,471
121.90	5,126	6,655
121.95	5,126	6,837
122.00	5,126	7,018
122.05	5,126	7,196
122.10	5,126	7,373
122.15	5,126	7,547
122.20	5,126	7,719
122.25	5,126	7,888
122.30	5,126	8,054
122.35	5,126	8,218
122.40	5,126	8,379
122.45	5,126	8,537
122.50	5,126	8,692
122.55	5,126	8,842
122.60	5,126	8,989
122.65	5,126	9,131
122.70	5,126	9,267
122.75	5,126	9,396
122.80	5,126	9,517
122.85	5,126	9,632
122.90	5,126	9,743
122.95	5,126	9,850
123.00	5,126	9,955
123.05	5,126	10,057
123.10	5,126	10,160
123.15	5,126	10,262
123.20	5,126	10,365
123.25	5,126	10,467
123.30	5,126	10,570
123.35	5,126	10,672
123.40	5,126	10,775
123.45	5,126	10,877
123.50	5,126	**10,980**

Stage-Area-Storage for Pond IC-B: INFILTRATION CHAMBER SYS 2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
120.00	**2,608**	0
120.05	2,608	52
120.10	2,608	104
120.15	2,608	156
120.20	2,608	209
120.25	2,608	261
120.30	2,608	313
120.35	2,608	365
120.40	2,608	417
120.45	2,608	469
120.50	2,608	522
120.55	2,608	629
120.60	2,608	737
120.65	2,608	845
120.70	2,608	952
120.75	2,608	1,059
120.80	2,608	1,165
120.85	2,608	1,272
120.90	2,608	1,378
120.95	2,608	1,483
121.00	2,608	1,588
121.05	2,608	1,693
121.10	2,608	1,797
121.15	2,608	1,900
121.20	2,608	2,003
121.25	2,608	2,106
121.30	2,608	2,208
121.35	2,608	2,310
121.40	2,608	2,411
121.45	2,608	2,511
121.50	2,608	2,611
121.55	2,608	2,710
121.60	2,608	2,808
121.65	2,608	2,906
121.70	2,608	3,003
121.75	2,608	3,099
121.80	2,608	3,194
121.85	2,608	3,288
121.90	2,608	3,382
121.95	2,608	3,475
122.00	2,608	3,566
122.05	2,608	3,657
122.10	2,608	3,747
122.15	2,608	3,835
122.20	2,608	3,923
122.25	2,608	4,009
122.30	2,608	4,093
122.35	2,608	4,176
122.40	2,608	4,258
122.45	2,608	4,338
122.50	2,608	4,417
122.55	2,608	4,494
122.60	2,608	4,568
122.65	2,608	4,641
122.70	2,608	4,710
122.75	2,608	4,775
122.80	2,608	4,837
122.85	2,608	4,895
122.90	2,608	4,952
122.95	2,608	5,006
123.00	2,608	5,059
123.05	2,608	5,112
123.10	2,608	5,164
123.15	2,608	5,216
123.20	2,608	5,268
123.25	2,608	5,320
123.30	2,608	5,372
123.35	2,608	5,425
123.40	2,608	5,477
123.45	2,608	5,529
123.50	2,608	**5,581**

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Water Quality Volume (standard #4)

Location: 2103 Washington Street

Western Lot Area

First Defense Unit 1 (FD-3HC)

Proprietary Treatment Unit: Q=(qu)(A)(WQV)

qu for Tc of 6 min. (1 inch) =	774	(csm/in)
Impervious Area: AC*0.0015625 mi^2/AC =	0.000465	mi^2
WQV Treated =	1	inches
Q (peak flow rate for 1" WQV) =	0.360008	cfs
Prop. FD-3HC Max. Treated flow Rate=	0.84	cfs

12,967 SF

Northern Lot Area

First Defense Unit 2 (FD-3HC)

Proprietary Treatment Unit: Q=(qu)(A)(WQV)

qu for Tc of 6 min. (1 inch) =	774	(csm/in)
Impervious Area: AC*0.0015625 mi^2/AC =	0.000324	mi^2
WQV Treated =	1	inches
Q (peak flow rate for 1" WQV) =	0.25062	cfs
Prop. FD-3HC Max. Treated flow Rate=	0.84	cfs

9,027 SF

Northeastern Lot Area

First Defense Unit 3 (FD-3HC)

Proprietary Treatment Unit: Q=(qu)(A)(WQV)

qu for Tc of 6 min. =	774	(csm/in)
Impervious Area: AC*0.0015625 mi^2/AC =	0.000357	mi^2
WQV Treated =	1	inches
Q (peak flow rate for 0.5" WQV) =	0.27669	cfs
Prop. FD-3HC Max. Treated flow Rate=	0.84	cfs

9,966 SF

** All Proposed First Defense Units will provide adequate treated flow rate*

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Water Quality volume - Total Site Improvements

Total Water Quality Volume Equation: $Vwq = (Dwq)/(A_{impervious})$

Where:
- Vwq = water quality volume (CF)
- Dwq = Water Quality depth (inches)
- $A_{impervious}$ = impervious Area (SF)

Total Impervious Area =	31,960	SF	
Water Quality Depth =	1	inches	*convert to ft
Vwq =	2663.333	CF	
Prop. Infiltration recharge =	16,561	CF	

** The water quality provided by subsurface infiltration is adequate*

First Defense®

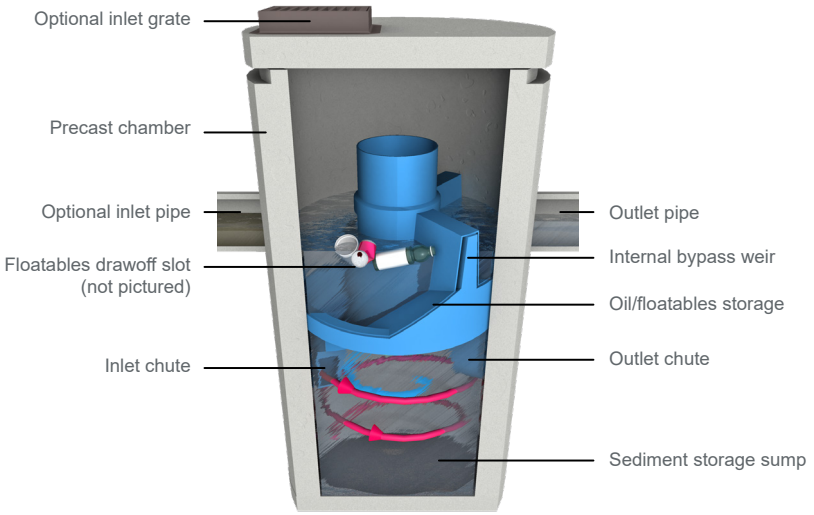
Advanced Hydrodynamic Separator

Product Summary

A Simple Solution for the Trickiest Sites

First Defense is a versatile stormwater separator with some of the highest approved flow rates in the United States. Engineers and contractors can save site space and reduce project costs by using the smallest possible footprint. It works with single or multiple inlet pipes and inlet grates. An internal bypass conveys infrequent peak flows directly to the outlet, efficiently capturing pollutants and preventing washouts.

Features



Contaminated stormwater runoff enters the inlet chute from a surface grate and/or inlet pipe. The inlet chute introduces flow into the chamber tangentially to create a low energy vortex flow regime (magenta arrow) that directs sediment into the sump while oils, floating trash and debris rise to the surface.

Treated stormwater exits through a submerged outlet chute located opposite to the direction of the rotating flow (blue arrow). Enhanced vortex separation is provided by forcing the rotating flow within the vessel to follow the longest path possible rather than directly from inlet to outlet.

Higher flows bypass the treatment chamber to prevent turbulence and washout of captured pollutants. An internal bypass conveys infrequent peak flows directly to the outlet eliminating the need for, and expense of, external bypass control structures. A floatables draw off slot functions to convey floatables into the treatment chamber prior to bypass.

Applications

- Areas requiring a minimum of 50% TSS removal
- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Highways, parking lots, industrial areas and urban developments
- Pre-treatment to ponds, storage systems, green infrastructure

Benefits

Highest Flow Through the Smallest Footprint

- **Smaller Footprint, Lower Costs**
  First Defense provides space-saving, easy-to-install surface water treatment in standard size chambers/manholes.
- **Adapt to Site Limitations**
  Variable configurations will help you effectively slip First Defense into a tight spot. It also works well with large pipes, multiple inlet pipes and inlet grates.
- **Reduce Installation Time & Costs**
  Every First Defense unit is delivered to site pre-assembled and ready for install.
- **Online System Configuration**
  First Defense eliminates the need for separate structures with its integrated internal bypass.
- **Designed with Maintenance in Mind**
  Easy vactor hose access through the center shaft of the system makes for quick sump cleanout, saving time and reducing long-term operational cost.

Sizing & Specifications

First Defense units are available in **six diameters** to fit standard chamber and manhole sizes. The dimensions below are common across all model numbers.

Diameter	Peak Online Flow Rate	Maximum Pipe Diameter[1]	Typical Sediment Storage Capacity[2]	Minimum Distance from Outlet Invert to Top of Rim[3]	Standard Distance from Outlet Invert to Sump Floor
(ft / m)	(cfs / L/s)	(in / mm)	(yd^3 / m^3)	(ft / m)	(ft / m)
3 / 0.9	15 / 424	18 / 450	0.4 / 0.3	2.0 - 2.5 / 0.61 - 0.76	3.71 / 1.13
4 / 1.2	18 / 510	24 / 600	0.7 / 0.5	2.0 - 3.0 / 0.61 - 0.91	4.97 / 1.5
5 / 1.5	20 / 566	24 / 600	1.1 / .84	2.0 - 3.7 / 0.61 - 1.13	5.83 / 1.5
6 / 1.8	32 / 906	30 / 750	1.6 / 1.2	2.0 - 4.1 / 0.61 - 1.25	5.97 / 1.8
8 / 2.4	50 / 1415	48 / 1200	2.8 / 2.1	2.4 - 5.4 / 0.73 -1.65	7.40 / 2.2
10 / 3.0	50 / 1415	48 / 1200	4.4 / 3.3	2.4 - 6.8 / 0.73 - 2.07	10.25 / 3.12

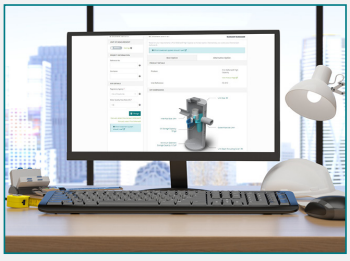
Hydro International offers First Defense units in **two versions** that conform to the performance requirements of different states' water quality regulations.[4]

First Defense High Capacity Model Number	Typical TSS Treatment Flow Rates	
	NJDEP Certified[4]	110µm
	(cfs / L/s)	(cfs / L/s)
FDHC-3	0.84 / 23.7	1.06 / 30.0
FDHC-4	1.50 / 42.4	1.88 / 53.2
FDHC-5	2.35 / 66.2	2.94 / 83.2
FDHC-6	3.38 / 95.7	4.23 / 119.8
FDHC-8	6.00 / 169.9	7.52 / 212.9
FDHC-10	9.38 / 265.6	11.75 / 332.7

First Defense Optimum Model Number	NJDEP Certified Treatment Flow Rates[4]
	(cfs / L/s)
FDO-3	1.02 / 28.9
FDO-4	1.81 / 51.3
FDO-5	2.83 / 80.0
FDO-6	4.07 / 115.2
FDO-8	7.23 / 204.7
FDO-10	11.33 / 320.6

[1]Contact Hydro International when larger pipe sizes are required.
[2]Contact Hydro International when custom sediment storage capacity is required.
[3]These are guidlines only. Minimum distance is based on pipe diameter and headloss at assumed flow rates, contact Hydro for detailed design.
[4]NJDEP Certified / NJCAT Verified, based on one inlet pipe and no inlet grate.

Also available in a screened configuration for Full Trash Capture!



Free Online Design Tool

This free online sizing tool will recommend the best separator, model size and online or offline configuration based on site-specific data entered by the user.

Upon completion, users have the option to submit the design to Hydro International for a free review by our engineering team.

Go to hydro-int.com/sizing to access the tool.

Hydro International

Hydro International, 94 Hutchins Drive, Portland, ME 04102
Tel: (207) 756-6200
Email: stormwaterinquiry@hydro-int.com
Web: www.hydro-int.com/firstdefense

FD_SS_B_2203

Download Drawings:
→ hydro-int.com/fddrawings

Operation & Maintenance Manual:
→ hydro-int.com/fd-om

TSS Removal Calculation Worksheet

For Pretreatment: First Defense Unit

Proj. No.: 22-188

Date: 10/11/2023

Location: 2103 Washington Street, Hanover MA

Computed by: NC

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
First Defense Unit	60	1.00	0.6	0.40
Subsurface Infiltration Structure	80	0.40	0.32	0.08

Total TSS Removal= **92%**

Notes:

*Starting TSS Load for first BMP= 1.00. TSS load for subsequent BMP's is equal to the Remaining Load (E) from the previous BMP.

Appendix D

Operations & Maintenance Plans:

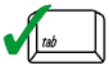
1. **Stormwater Report Checklist**
2. **Construction Operation and Maintenance Plan & Pollution Prevention Plan**
3. **Long Term Operation and Maintenance Plan & Pollution Prevention Plan**

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

Deborah W Keller October 16, 2023

Signature and Date

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

- [X] 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
- [X] Other (describe): Subsuface infiltration systems

Standard 1: No New Untreated Discharges

- [X] 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.

CONSTRUCTION OPERATION AND MAINTENANCE PLAN
CONSTRUCTION POLLUTION PREVENTION PLAN

Dated: January 3, 2018
Revised: October 16, 2023

Merchant's Row
#2053, 2055, 2057 and 2103
Washington Street Hanover, MA

The structural and stabilization practices utilized on site correspond with plans entitled "Merchant's Row, Definitive Site Plan, 2053, 2061, 2071 Washington Street (Assessor's Map 5, Lots 13, 18 & 75), Hanover, Massachusetts", dated January 3, 2018 as revised hereinafter referred to as the Site Plans.

Revision: All Operations and Maintenance practices listed in the following pages will also correspond with a new plan set titled "Merchant's Row, Definitive Site Plan, 2053, 2055, 2057 & 2103 Washington Street (Assessor's Map 5 Lot 16), Hanover Massachusetts", dated October 16, 2023 as revised hereinafter referred to as the Site Plans.

Responsible Party's for Operation and Maintenance Contact Information:

1. ANGORA Marketplace, LLC
   (Owner)
   100 Ledgewood Place, Suite 301
   Rockland, MA 02370
   P: 781-982-1144
2. 2103 Washington Street, LLC (Owner)
   552 Adams Street
   Milton, MA 02186
   P: 781-982-1144

Source of Funding:

Operation and Maintenance of this stormwater management system will be the responsibility of the property owner to include its successor and/or assigns, as the same may appear on record with the appropriate register of deeds.

Project Description:

The project proponent, AGORA Marketplace, LLC, proposes to redevelop an approximate 10.06± acre parcel of land on the corner of Washington Street (Route 53) and Webster Street (Route 123), known as Merchant's Row in Hanover, Massachusetts. The proposed redevelopment consists of razing the existing building, closure of several driveway entrances, construction of three (3) proposed buildings consisting of retail and restaurant space with approximately 61,028 GFA, outdoor community space, associated parking areas, stormwater management facilities, wastewater treatment plant improvements, utility service connections and associated infrastructure.

The subject property is located on the east side of Washington Street (Route 53) and the

south side of Webster Street (Route 123) and consists of three (3) parcels identified as Map 5, Lots 13, 18, and 75 as shown on the Town of Hanover Tax maps. The property is located within the Commercial District and the Adult Use, Medical Marijuana, and Wireless Telecommunications Overlay Districts. The property is bordered by developed commercially zoned properties to the north, west and south including the Union cemetery to the north and Third Herring Brook to the east. Refer the Figure-1 USGS Locus Map for the location of the parcel. The property consists of a total of 10.06± acres of which approximately 6.85± acres is upland. The easterly undeveloped portion of the site is located within a Zone A, or Bordering Land Subject to Flooding resource area as shown on the current FEMA Flood Map (25023C0111J & 25023C0113J, dated July 17, 2012). Refer to Figure-2 FEMA Flood Map. Review of the MassGIS mapping of DEP wetland resource area inventory in conjunction with a site inspection indicates that the site contains bordering vegetated wetlands and riverfront area associated with the Third Herring Brook within the eastern portion of the site.

Revision October 16, 2023: The project proponent, 2103 Washington Street LLC, proposed to redevelop the existing 0.79± acre parcel of land at 2103 Washington Street, on the corner abutting Washington and Webster Street. The scope of this project includes razing of the existing commercial use building and parking lot, and construction of the proposed retail and bank building, parking lot space, sidewalks, landscaping areas, stormwater management facilities, site utilities, and associated infrastructure. The proposed building will have a gross floor area of 7,500 SF, with 43 parking spaces associated on site. Driveways will be established from the two side lots abutting the existing Merchant's Row lot. Existing driveways on Washington and Webster Street will require curb cut for additional sidewalk and landscaping installation.

The locus property has a parcel identification of Map 5, Lot 16, per the Hanover assessors tax maps. The property is located within the Commercial District, with Adult Use, Medical Marijuana, and Telecommunications District Overlays. Abutting areas include Merchants Row (2053, 2055, 2057 Washington Street), Webster Street, and Washington Street. Refer to the USGS Locus Map from **Figure 1** for site location. The FEMA Flood Map located in **Figure 2** of this report indicated that the site is in zone "x" of the Flood Insurance Rate Map, as shown in the Community Map No. 25023C0111k, with an effective date of July 6, 2021, and is not in a special flood hazard area. According to Massachusetts GIS information, 2103 Washington street has no wetland buffers, or any other area of environmental concern.

Pre-Development Condition

The site presently consists of an approximate 96,362 square feet GFA retail/restaurant multi-level building centrally located with site parking surrounding the building on all sides. The remainder of the site is comprised of wooded areas mainly within the northeasterly portion of the property. The site's topography is gentle to moderate with slopes ranging from 0 to 15 percent draining towards Webster Street to the north and on-site wetland resource areas to the east. The site has frontage along Washington Street and Webster Street with three access drives off Washington Street and two access drives off Webster Street.

Soil types were obtained from NRCS mapping and were found to be hydrologic soil group (HSG) B/D soils. In order to confirm the soil class and groundwater depth characteristics of these soils, test pits were performed by Merrill Engineers and Land

Surveyors in December of 2017. Based on soil textures encountered at the time of testing, the overall site was found to be consistent with a B/D soils. Sand to fine sandy loam within the upland areas with silt loam muck within the wetland areas. Refer to Figure-4 NRCS Soils Map and Appendix E – Soil Testing Results for supporting documentation.

Revision October 16, 2023: The existing commercial building on the locus property was built in the year 1900 and has a building footprint area of approximately 5,192 SF with multiple accessory porches and decks. Most of the lot area is covered by pavement for parking spaces and site driveways. There are sidewalks on Washington Street abutting the property. The topographic slopes range from approximately 0-3% for a majority of the site. This can be considered a relatively flat site with gentle sloping. There are areas of landscaping located on the Northeast and Southeast sides of the lot, and on the western face of the building.

Soil test holes were performed by Merrill Engineers and land Surveyors on April 13, 2023. The test hole results showed that most of the soil observed was classified as either fill material and sandy loam. Fill material cannot be identified by the National Resources Conservation Service (NRCS) for a hydrologic soil group, but Sandy Loam is classified as group B soil. Additional information for NRCS identified soils and test hole information can be found in **Figure 3** or **Appendix E** – Soil Testing Results.

Post-Development Condition

Under the post development condition, the proposed building roof runoff will be discharged into multiple infiltration systems, either subsurface chambers or open infiltration basin. These systems will also collect and treat the proposed parking areas surrounding the proposed buildings through first defense pre-treatment units prior to discharge to the infiltration facilities. As portions of the project are located within an area subject to protection under the Wetlands Protection Act, M.G.L. c. 131, Section 40 and is considered a redevelopment project, the stormwater management systems were designed to be in compliance with the DEP Stormwater Management Regulations (SMR) to the extent practicable.

Revision October 16, 2023: The post development conditions for 2103 Washington Street will result in the building roof runoff discharging to subsurface infiltration chambers. These infiltration systems will have first defense units acting as pretreatment. The stormwater facility systems used for this development will help protect the parking lot and building areas from runoff and treat runoff prior to recharging below the subsurface systems. As listed in the above paragraph, stormwater management systems were designed to be in compliance with the DEP Stormwater Management Regulations (SMR) to the extent practicable.

Erosion Sediment Control Best Management Practices:

Structural Practices:

1) **Silt Sock Erosion Control Barrier** – A silt sock 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 sock barrier should be installed as shown on the Construction Detail Plan.

Silt Sock Installation Requirements

a) Locate the silt sock where identified on the plans.

b) The silt sock 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 silt sock shall be staked every 8 linear feet with 1-inch by 1-inch stakes.

d) Sediment silt socks 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.

Silt Sock Maintenance

a) Silt socks 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 stakes 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 silt sock. 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 silt sock 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) **Stabilized Construction Entrance** – A stabilized construction entrance will be placed at the existing entrances along Washington and Webster Streets. The construction entrances will keep mud and sediment from being tracked off the construction site onto surrounding streets by vehicles leaving the site. The stabilized construction entrance will be installed prior to any major soil disturbance on site. The construction entrances will be graded to contain stormwater runoff from the entrance to prevent sediment from washing onto the adjacent ground surface. The stabilized construction entrances shall be constructed as shown on the Site Plans.

Construction Entrance Installation Requirements

a) Grade foundation of construction entrance with slightly concave shape to contain runoff within the entrance to prevent sediment from washing onto the adjacent ground surface.

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 30 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 road or 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 Maintenance</u>

a) The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto Washington Street and Webster 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 Washington Street and Webster 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 Engineering Department or their representative. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal shall be permanently stabilized.

3) **Inlet Protection** – Inlet Protection will be utilized around the existing catch basin grates as shown on the site plans. The inlet protection will prevent any sediment from entering the street(s) and or site's closed drainage system. Siltsack or equivalent will be utilized for the inlet protection. Siltsack is manufactured by ACF Environmental. The telephone number is 1-800-437-6746. Regular flow siltsack will be utilized, and if it does not allow enough storm water flow, hi-flow siltsack will be utilized.

Silt Sack (or equivalent) Inlet Protection Maintenance Requirements

a) The silt sack trapping device and the catch basin should be inspected after every rain storm and repairs made as necessary.

b) Sediment should be removed from the silt sack after the sediment has reached a maximum depth of one-half the depth of the trap.

c) Sediment should be disposed of in a suitable area and protected from erosion by either structural or vegetative means. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

d) The silt sack must be replaced if it is ripped or torn in any way.

e) Temporary traps should be removed and the area repaired as soon as the contributing drainage area to the inlet has been completely stabilized.

4) **Temporary Sediment Basins** – Temporary sediment basins shall be constructed near the stabilized construction entrances and as determined by the site contractor. The temporary sediment basins will handle stormwater, filtering out sediment until the permanent stormwater drainage system is functioning properly. The basins will be lined with sediment erosion control barrier controls.

Sediment Basin Maintenance Requirements

a) The sediment basins should be readily accessible for maintenance and sediment removal. The basins should remain in operation and be properly maintained until the area is permanently stabilized by vegetation and/or when permanent structures are in place.

b) Inspect the sediment basins weekly and after each significant rainfall.

c) Remove and properly dispose of sediment when it accumulated to one-half design volume (level marked by reference stake). The effectiveness of a sediment basin is based more on the regular sediment removal than its size.

d) Check embankment and outlet for erosion damage such as settlement, seepage, or slumping along the toe. Repair immediately. Remove trash and other debris from principal outlet and basin area.

e) Clean or replace gravel when sediment pool does not drain properly.

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, then stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.

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

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

e) Use effective mulch, such as clean grain straw; tacked and/or tied with netting to protect seedbed and encourage plant growth.

Temporary Seeding 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., 3.35 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 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. The preferred mulching material is straw.

Mulch (Straw) Installation

a) Straw has been found to be one of the most effective organic mulch materials. The specifications for straw are described below, but other material may be appropriate. The straw should be air-dried; free of undesirable seeds & coarse materials. The application rate per 1,000 sq.ft. is 90-100 lbs. (2-3 bales) and the application rate per acre is 2 tons (100-120 bales). The application should cover about 90% of the surface. The use of straw mulch is appropriate where mulch is maintained for more than three months. Straw mulch is subject to wind blowing unless anchored, is the most commonly used mulching material, and has the best microenvironment for germinating seeds.

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) Straw or 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 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.

Land Grading Stabilization 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 with straw applied at the rate of ½ tons per acre. Anchor the mulch with erosion control netting or fabric on sloping areas. Amoco supergro or equivalent should be utilized.

Permanent Seeding 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. Organic fertilizer shall be utilized in areas within the 100-foot buffer zone to a wetland resource area.

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 along vehicle circulation paths. 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 roadway 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 erosion control measures should be placed surrounding each stockpile.
5) As needed, the stockpiled topsoil and subsoil are redistributed throughout the site.

Pollution Prevention:

Spill Prevention and Response:

The site supervisor or their representative shall be present on the job site at all times during the course of work and shall be present during the delivery, removal of any liquid/chemical materials to or from the job site. They will also be present during any refueling practices. All subcontractors will be notified of their responsibilities in writing. In the event a spill occurs, the site supervisor shall be notified immediately.
The site supervisor shall have in place a spill prevention plan and resources to contain and clean up any potential spills in a timely manner. Refer to the attached Spill Containment & Management Plan, including Spill Report, Emergency Response Equipment Inventory, and Emergency Notification and phone numbers.

Fueling and Maintenance of Equipment or Vehicles:

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. 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.

Several types of vehicles and equipment will be used on-site throughout the project, including graders, scrapers, excavators, loaders, paving equipment, rollers, trucks and trailers, backhoes, and forklifts. Vehicles requiring refueling or lubrication shall be brought to a designated portion of the site away from environmentally sensitive areas (such as storm drains, steep slopes, etc.) or shall utilize temporary drip protection measures at the location of fueling. The operator shall take precautions to ensure that drips, spills or seeps do not enter the ground. The use of absorbent towels beneath the fuel tank is recommended. Absorbent, spill cleanup materials and spill kits should be kept on site. Refueling or maintenance of equipment in locations other than those designated for such activity shall be performed under the supervision of the site supervisor or his/her designee. 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.

1. 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.
2. Fueling operation procedures shall be in effect throughout the project duration.

Maintenance Requirements -

1. Vehicles and equipment will be inspected on each day of use. Leaks will be repaired immediately, or the problem vehicle or equipment will be removed from the project site.
2. 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.

Washing of Equipment and Vehicles:

The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. 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. This document shall include language that shall not permit vehicle washing on the job site. Concrete trucks shall be exempt from this rule. Concrete truck cleaning shall be confined within the work area and conducted in a manner to prevent water drainage beyond the specified area of work.

Concrete truck washout shall be conducted in designated areas only and shall not be discharged in areas which would allow wash water to leave the site or enter protected areas.

Maintenance Requirements -

1. The site supervisor shall maintain a log of individuals receiving these instructions.

Storage, Handling, and Disposal of Construction Products, Materials, and Wastes:

Building products stored on site shall be kept in designated materials storage areas as shown on the site map(s). Storage areas shall properly contain materials and prevent materials or their containers/wrappers from being strewn about the site. Any leaking containers shall be removed and properly disposed of immediately. Weather sensitive materials shall be safely stored in closed temporary containers as necessary.

1. Place all materials being stored for future use in designated storage areas.
2. Place all weather sensitive materials in closed temporary containers as necessary. Care should be taken to store materials in accordance with manufacturer's recommendations and to avoid storing combinations of materials which may cause a noxious, volatile or otherwise dangerous condition.
3. All non-hazardous solid waste shall be disposed of in a trash receptacle (dumpster) which shall be removed and disposed of at an approved land fill.

Maintenance Requirements -

1. The site supervisor shall inspect the designated storage areas weekly and after storn events as well as any portions of the site under construction to ensure that all materials are properly stored. The storage areas will be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.

Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

The use of pesticides and herbicides is not currently anticipated for this site. Fertilizers and landscape materials will be used to stabilize slopes and other disturbed areas.

1. Store all fertilizers and landscape materials in designated secure locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.

Maintenance Requirements

1. The site supervisor shall inspect the designated storage areas weekely as well as any portions of the site under construction to ensure that all materials are properly stored. Storage issues shall be immediately addressed.

Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

Storage of diesel fuel, oil hydraulic fluids and other petroleum projecuts/chemicals shall be in a secure area protected from the outside elements.

Refueling and maintenance for vehicles or equipment shall occur either within the designated area or shall utilize temporary drip protection measures at the location of fueling. 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.

Refueling or maintenance of equipment in locations other than those designated for such activity shall be performed under the supervision of the site supervisor or his/her designee and shall employ drip pans or other suitable means of preventing fuel, hydraulic fluid, etc. from spilling or being otherwise carried offsite or into protected areas.

Hazardous or Toxic Waste

(Note: Examples include paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids.)

Hazardous or toxic waste associated with paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids shall be stored in sealed containers to prevent leakage and corrosion, and which are labeled in accordance with applicable Resource Conservation and Recover Act (RCRA) and all other applicable federal, state and local requirements.

Hazardous or toxic waste shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations.

Hazardous and toxic waste shall not be disposed of in solid waste containers intended for non-hazardous construction debris.

Maintenance Requirements

1. The site supervisor shall inspect all portions of the project under construction weekly and after storm events to ensure that all hazardous or toxic materials are stored and disposed of in accordance with the practices detailed above and shall immediately correct any improper storage or disposal practices.

Construction and Domestic Waste:

(Note: Examples include packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, and other trash or building materials.)

All construction and domestic waste shall be collected and disposed of into dumpsters. Dumpsters will be placed away from stormwater conveyances and drains, and meet all federal, state, and municipal regulations. Only trash and construction debris from the site will be deposited in the dumpster. No construction materials will be buried on-site. Any overflow from containers/dumpsters shall be cleaned up immediately. All personnel will be instructed regarding the correct disposal of trash and construction debris. Notices that state these practices will be posted in the job site trailer and the individual who manages day-to-day operations will be responsible for seeing that these practices are followed.

Recyclable waste material shall be stored in an appropriate container or in a designated location on site until it can be removed.

1. Dumpsters and recyclable waste material containers shall be located as needed throughout the site.

Maintenance Requirements

1. The site supervisor shall inspect all dumpsters and containers to confirm that construction and domestic waste is properly contained, and shall also ascertain that waste is being picked up in a timely manner to ensure that no receptacles are overflowing. Pick-up schedules shall be modified or the number of receptacles shall be increased as needed.

Sanitary Waste

Sanitary facilities (portable toilets) will be provided at the site throughout the construction phase. The portable toilets will be located away from a concentrated flow paths or traffic flow.

Sanitary facilities will be brought to the site at the start of construction.

Maintenance Requirements

1. If necessary, the site supervisor shall execute a contract with a vendor to supply and maintain portable toilets throughout the site for the project duration. The portable toilets shall be inspected weekly for evidence of leaking holding tanks. Toilets with leaking holding tanks will be removed from the site and replaced with new portable toilets. The site supervisor shall determine if a sufficient number of toilets are present to meet staffing levels and shall ensure that the toilets are regularly and properly maintained.

Washing of Applicators and Containers used for Paint, Concrete or Other Materials

Concrete washout shall be restricted to designated areas only. Paints, form release oils, curing compounds, etc. shall be recycled and/or disposed of utilizing appropriate containers in accordance with manufacturer's recommendations and EPA guidelines.

1. Direct all washwater into a leak-proof container or leak-proof pit at the appropriate designated location. The washout location shall be designated before concrete pours commence. The container or pit must be designed so that no overflow can occur due to inadequate sizing or precipitation. Concrete trucks shall wash out only at washout pit or container such as a portable roll-off washout pit.

2. Signs will be posted marking the location of the washout area to ensure that the concrete and other equipment operators use the proper facility. Concrete pours or other material application will not be conducted during or before an anticipated storm event.
3. Provide suitable containers for recycling or disposal for cleanup of paints, form release oils, curing compounds, etc.

Maintenance Requirements

1. The site supervisor shall inspect concrete washout pits (or other acceptable facility) daily to ensure that they are properly maintained. Washout pits shall be cleaned out when the area is filled to 75% of holding capacity. If necessary, wash water in a washout pit shall be vacuumed off and the hardened concrete broken up and recycled. Wash water and broken up concrete shall be properly disposed of at a suitable facility. If necessary the washout pit shall be repaired and relined with plastic prior to continued use.
2. Containers for waste paint, form release oil, curing compounds, etc. shall be sealed and removed from the site and properly disposed of at a suitable facility. Empty containers shall replace those being removed for disposal.

Fertilizers

Fertilizers shall be used only as necessary to establish vegetative stabilized slopes and disturbed areas. Apply at recommended rates. Use only slow release fertilizers to minimize discharge of nitrogen or phosphorous.

1. Store all fertilizers in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.
2. To prevent accidental release of fertilizers, the site supervisor shall attempt to coordinate delivery of fertilizers to coincide with application and reduce the need to warehouse large quantities on-site.
3. Avoid applying before heavy rains that could cause excess nutrients to be discharged.
4. Never apply to frozen ground or apply to stormwater conveyance channels with flowing water.
5. Follow all other federal, state, and local requirements regarding fertilizer applications.

Maintenance Requirements

1. Site supervisor shall make regular inspections to ensure that fertilizer is being applied at proper rates and that all perimeter controls are in place and properly maintained to control runoff which may contain fertilizer.

Inspection and Corrective Action:

Operator personnel must inspect the construction site at least once every 7 calendar days and within 24 hours of a storm event of ½-inch or greater. The owner shall be responsible to secure the services of a design professional or similar "qualified person"

(inspector) on an on-going basis throughout all phases of the project. 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 or ineffective controls since it was installed or performed.
- What corrective actions should be done to correct any problems with the measure.

The inspector should complete the Stormwater Management Best Management Practices Inspection Schedule and Evaluation Checklist – Construction Phase, as attached or provided in the Site's Stormwater Pollution Prevention Plan, 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.

It is essential that the inspector document the inspection of the pollution prevention measures. These records will be used to request maintenance and repair and to prove that the inspection and maintenance were performed.

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES
INSPECTION SCHEDULE AND EVALUATION CHECKLIST – CONSTRUCTION PHASE

PROJECT LOCATION: **Merchant's Row, Washington Street, Hanover, MA** Latest Revision: _____

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List items	Date of Cleaning/Repair	Performed By	Water Level in System
Silt Sock Erosion Control Barrier	Weekly or after every major storm event – minimum weekly			Check sediment levels and remove when reaches ¼ to ½ the height of sock				
Stabilized Construction Entrance	Weekly or after every major storm event – minimum weekly			Check sediment levels in stone				
Temporary Sedimentation Basin	Weekly or after every major storm event – minimum weekly			Check sediment levels				
Catch Basin & Pre-treatment Structure (Inlet Protection)	Weekly or after every major storm event – minimum weekly			Check silt sack for sediment levels, tears or any damage				
Stockpiles	Weekly or after every major storm event – minimum weekly			Ensure surrounding erosion control measure are intact				
Temp/Prop Seeding for Stabilization	Weekly or after every major storm event – minimum weekly							
Geotextiles/ Mulching & Netting	Weekly or after every major storm event – minimum weekly							

Dust Control	Weekly							

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

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.
Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

Stormwater Control Manager: _____ **Stamp**

LONG TERM OPERATION AND MAINTENANCE PLAN / POLLUTION PREVENTION PLAN

Date: January 3, 2018
Revised Date: January 31, 2018
Revised Date: October 16, 2023

Merchant's Row
#2053, 2055, 2057 & 2103 Washington Street
Hanover, MA

Responsible Party's for Operation and Maintenance Contact Information:

1. ANGORA Marketplace, LLC, (Owner)
   100 Ledgewood Place, Suite 301
   Rockland, MA 02370
   P: 781-982-1144
2. 2103 Washington Street, LLC, (Owner)
   552 Adams Street
   Milton, MA 02186
   P: 781-982-1144

General Conditions:

1. The property owner shall be responsible for scheduling regular inspections and maintenance of the stormwater BMP's as illustrated on the design plans and detailed in the following long-term operations and maintenance plan.
2. All Stormwater BMP's shall be operated and maintained in accordance with the design plans and the following Long-Term Operations and Maintenance Plan.
3. The owner shall:
   a. Maintain an Operation and Maintenance Log (see Attachment A). The Log shall include all BMP inspections, repairs, replacement activities and disposal activities (disposal material and disposal location shall be included in the Log);
   b. Retain inspection and maintenance logs for a period of three years, on an ongoing basis;
   c. Make the log available to the Town of Hanover upon request;
   d. Allow members and agents of the Hanover DPW and Conservation Commission to enter the premises and ensure that the Owner has complied with the Operation and Maintenance Plan requirements for each BMP.
4. An inspection and maintenance schedule should be adhered to at a minimum for the first year of service of all BMP's referenced in this document. After the first year of service, a more accurate inspection/maintenance schedule should be determined based on the level of service for this site.

Operation and Maintenance:

1.0 Vehicle Washing Controls

There will be no vehicle washing operations on the site.

2.0 Requirements for Routine Inspections and Maintenance of Stormwater Best Management Practices

Note: The Town shall be notified immediately if a change in ownership or maintenance responsibility occurs at the site.

Parking Lot Areas

Sweepers shall sweep the parking or 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 be a minimum of four times per year.

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.

Drain lines

After construction, the drainlines shall be inspected after every major storm for the first few months to ensure proper functions. Presence of accumulated sand and silt would indicate more frequent maintenance of the pre-treatment devices is required. Thereafter, the drainlines shall be inspected at least once per year.

Deep sump and hooded Catch Basins

Catch basin grates shall be checked quarterly and following heavy rainfalls to verify that the inlet openings are not clogged by debris. Debris shall be removed from the grates and disposed of properly. Deep sump catch basins shall be inspected and cleaned bi-annually of all accumulated sediments. Catch basins with hoods shall be inspected annually to check oil build-up and outlet obstructions. Material shall be removed from catch basins and disposed of in accordance with all applicable regulations.

Pre-treatment Structures – First Defense FD-3HC and FD-4HC

The proprietary pretreatment units shall be inspected and maintained from the surface, without entry into the unit biannually and following heavy rain events defined as a storm event exceeding one inch of rainfall within a twenty-four hour period to verify that the inlet opening is not clogged by debris.

During the first year of installation, perform inspection regularly, so an accurate maintenance schedule can be established. Perform oil and floatables removal once per year and immediately in the event of a spill. Oil shall be removed by using a small portable pump and disposed of properly. Perform sediment removal once per year or as needed and following a spill event. Sediment shall be removed from the unit using a vacuum truck. The requirements for the disposal

from the units should be in compliance with all local, state and federal regulations.

Please refer to the attached manufacturer's maintenance manual for additional detail on proper inspection and maintenance of the First Defense units.

Subsurface Infiltration Chamber Systems

Proper maintenance of the subsurface infiltration systems is essential to the long-term effectiveness of the infiltration function. After construction, the subsurface infiltration chamber systems shall be inspected for proper function after every major storm event until the site is completely developed and stabilized. After the site has been stabilized, the subsurface infiltration chamber systems shall be inspected at least twice per year or if lack of performance is observed and perform necessary corrective measures to maintain infiltration capacity; as required by the Stormwater Management Policy.

The systems shall have inspection ports for proper inspections. Inspections shall include checking the water level in the system after a major storm event, and performing necessary corrective action if water is observed 72 hours following the storm. The owner shall retain a qualified stormwater professional to assess the cause of this condition and develop a corrective action plan for restoring the infiltration function. The owner shall immediately implement the corrective action to restore the infiltration function. Documentation of these actions shall be maintained in the inspection and maintenance records.

Inspection & Maintenance Steps

Accumulated sediment must be removed from the bottom of the chambers. Material removed from the systems shall be disposed of in accordance with all applicable local, state, and federal regulations.

Step 1. Inspect chamber rows for sediment and water levels

7.0 Inspection Ports

a. Remove/open lid on nyloplast inspection port
b. Remove and clean flexstorm filter if installed
c. Using a flashlight and stadia rod, measure depth of sediment or water level and record on maintenance log
d. Lower camera into chamber row for visual inspection of sediment or water levels (optional)
e. If water is observed 72 hours following a storm event, proceed to Step 3. If not, proceed to Step 4

8.0 Clean out locations

8.1 Remove clean out cover

8.2 Using a flashlight, inspect down the chamber row through the manifold pipe

8.3 If sediment is at, or above 3” at inlet chambers, proceed to Step 2. If not, proceed to Step 4.

Step 2. Clean out inlet chambers (first 12.5 ft. only) using the jetvac process if sediment build up is observed

   a. A fixed culvert cleaning nozzle with rear facing spread of 45" or more is preferred
   b. Apply multiple passes of jetvac until backflush water is clean
   c. Vacuum structure sump as required

Step 3. Repair chamber system when water levels do not infiltrate after 72 hours. A corrective action plan shall be prepared by a qualified stormwater professional and immediately implemented.

Step 4. Replace all covers, grates, filters, and lids; record observations and actions.

Step 5. Inspect and clean basins and manholes upstream of the chamber system.

Please refer to the attached manufacturer's maintenance manual for additional detail on proper inspection and maintenance of the StormTech chamber systems.

Stormwater Infiltration Basin

After construction, the stormwater infiltration basin shall be inspected for proper function after every major storm event until the site is completely developed and stabilized. After the site has been stabilized the stormwater infiltration system shall be inspected at least twice per year or if lack of performance is observed and perform necessary corrective measures to maintain infiltration capacity; as required by the Stormwater Management Policy. Inspections shall include checking the water level in the system after a major storm event, and performing necessary corrective action if water is observed 72 hours following the storm.

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

Inspections shall be performed by qualified professionals of the basin bottoms and outlet control structure. The embankments should also be inspected for signs of settlement, significant erosion, animal burrows, growth of woody vegetation, and other conditions that could affect embankment integrity. Repairs should be made immediately based on these inspections.

The bottoms and sides of the stormwater basin should be mowed, limed, aerated, and overseeded along with the regular maintenance of other loamed & seeded areas on the project site. Liming shall be limited to once per year.

Basin Repair and Renovation Plan

In the event that the time for the stormwater basin to drain exceeds 72 hours, the basin shall be renovated. The following procedure shall be followed:

1. The Conservation Commission shall be notified of the status of the drainage facility.

2. An evaluation and determination for the slow drain time shall be performed by a Professional Engineer. The following shall be considered:
    a. Higher sediment loading than anticipated
    b. Extreme hydrologic events
    c. Poor installation (i.e., excessive compaction of soils and low spots)
    d. Poor maintenance.
3. In the case of higher than anticipated sediment loading, the schedule for maintenance shall be increased from the recommended yearly cleaning to bi-annual. For all other failures, the repair and renovation shall be made in accordance with the original approved plan and the inspection shall remain the same as specified in the Operation and Maintenance Plan.
4. Prior to construction, the contractor shall secure all necessary State, municipal and other utility permits and verify the existing locations of the utilities with the utility companies.
5. The contractor shall notify "Digsafe" (1.888.344.7233) at least four days prior to construction.
6. The work shall be performed in accordance with the specifications of the appropriate department. The contractor shall notify the Planning Board at least four days prior to construction.
7. Install erosion control barriers along limit of construction and at the following locations:
    a. At the interface between the silt trap-erosion control pad and the bottom of the basin.
    b. At the interface between the bottom of the basin and the outlet control structure.
8. A Professional Engineer shall develop a plan for handling stormwater during repair and renovation.
    a. The plan shall include the use of temporary basins, swales with check dams, additional water quality controls prior to discharge, etc.
    b. The plan should be based on the specific circumstances of where and how the basin failed
9. The repair and renovation shall proceed as follows:
    a. Construction shall not take place until the floor of the basin is thoroughly dry
    b. Prior to tilling, grass clippings and accumulated organic matter should be removed to prevent the formation of an impervious organic mat. Trash and debris should also be removed at this time.
    c. Light equipment which will not compact the underlying soils should be used to remove the top layer and replace with loam as required. The remaining soils should be deeply tilled and re-vegetated as soon as possible.

10. The basin to be inspected weekly and after every storm event and maintained until grass has stabilized disturbed areas.

11. At the completion of all construction, the contractor is to remove the erosion control barrier and re-establish flows to the drainage basin.

3.0 Inspections

The owner shall be responsible to secure the services of a Licensed Engineer or similar professional (inspector) on an on-going basis. The inspector shall review the project with respect to the following:

- Proper installation and performance of the Stormwater Management System.
- Review of the controls to determine any damaged or ineffective controls.
- Corrective actions.

The inspector shall prepare a report documenting the findings and should request the required maintenance or repair for the pollution prevention controls when the inspector finds that it is necessary for the control to be effective.

If hydrocarbons or any petroleum products are detected in any stormwater structure during an inspection, immediate measures shall be taken to remove and dispose of the material in accordance with all applicable regulations. The inspector shall notify the Owner to make the changes.

The owner shall be responsible for retaining the inspection and maintenance records for a period of three years, on an ongoing basis.

For additional information, refer to Performance, Standards and Guidelines for Stormwater Management in Massachusetts, published by the Department of Environmental Protection.

4.0 Snow Disposal and Plowing Plans

Salt used for de-icing on the parking area and driveway 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.

1. Site Selection

   Snow disposal is to be located adjacent to or on pervious surfaces to the extent practicable. At these locations, the snow meltwater can filter in to the soil, leaving behind sand and debris which can be removed in the springtime.

   Never plow or store snow in the stormwater basin.

2. Site Preparation and Maintenance

It is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- Some form of a barrier should be placed securely on any down gradient side of the snow disposal site, to prevent snow from migrating beyond the designated disposal area, or over property lines.
- Debris should be cleared from the site prior to using the site for snow disposal.
- Debris should be cleared from the site and properly disposed of at the end of the snow season and no later than May 15.

Any snow that cannot be properly disposed of as outlined above, shall be removed from the site and disposed off in accordance with state, federal, and local regulations.

5.0 Solid Waste Management

Solid Waste shall be picked up by a private firm, and solid waste disposed of in accordance with state, federal, and local regulations. The dumpsters will be located on-site, covered, and placed well away from the wetland resource areas and catch basins as possible. All machinery will be operated and maintained so as to limit impacts to drainage systems by avoiding leakage of fuel.

6.0 Spill Prevention

The Owner shall be aware of, educate occupants of, and enforce the following spill prevention measures:

Material Management Practices
The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff.

Good Housekeeping:
The following good housekeeping practices will be followed onsite during the construction project and shall apply to normal practices for parking areas, as well as handling deliveries, shipping, and transfers between buildings:

- An effort will be made to store only enough product required to do the job.
- All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
- Products will be kept in their original containers with the original manufacturer's label.
- Substances will not be mixed with one another unless recommended by the manufacturer.

- Whenever possible, all of a product will be used up before disposing of the container
- Manufacturer's recommendations for proper use and disposal will be followed
- All materials on site will be stored and handled inside the existing or new buildings.

Hazardous Products

These practices are used to reduce the risks associated with hazardous materials:

- Exterior storage of deicing chemicals, fertilizers, herbicides, pesticides, or other hazardous materials shall be prohibited.
- Products will be kept in original containers unless they are not resalable.
- Original labels and material safety data will be retained; they contain important product information.
- If surplus product must be disposed of, manufacturers' or local State recommended methods for proper disposal will be followed.

Product Specific Practices

The following product specific practices will be followed onsite:

Petroleum Products

All onsite vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers which are clearly labeled. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations.

Fertilizers

If used, fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. Storage will be in a covered shed; exterior storage shall be prohibited. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

Paints

All containers will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewer system but will be properly disposed of according to manufacturers' instructions or State and local regulations.

Spill Control Practices

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage area onsite. Equipment and materials will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose. Refer to the spill prevention plan.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate State or local government agency, protective clothing, regardless of the size.
- The spill prevention plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what cause it, and the cleanup measures will also be included.

7.0 Landscape Maintenance

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 lawn areas at the highest recommended height.
- Minimize lawn size and maintain existing native vegetation.
- Abide by water restrictions and other conservation measures implemented by the Town of Hanover.
- Water only when necessary.
- Use automatic irrigation systems to reduce water use.

8.0 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 chlorpyrifos, which even at very low levels can be harmful to aquatic life.

The following IPM practices will be encouraged:

- Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.
- Lawn care and landscaping management programs including appropriate pesticide use management as part of program.

9.0 Illicit Discharge Statement

Illicit discharges are non-stormwater discharges to the storm drain system which typically contain bacteria or other pollutants. All illicit discharges are prohibited. Any illicit discharges should be reported to MassDOT and/or the DPW as applicable to be addressed in accordance with their respective policies.

Allowable Non-Stormwater Discharges

The following non-stormwater discharges are authorized provided it has been determined by the permittee that they are not significant contributors of pollutants to the MS4. If these discharges are identified as significant contributors to the MS4, they must be addressed in the Illicit Discharge Detection and Elimination minimum control measure described in Parts II, III, IV and V.

1. water line flushing,
2. landscape irrigation,
3. diverted stream flows,
4. rising ground waters,
5. uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)),
6. uncontaminated pumped ground water,
7. discharge from potable water sources,
8. foundation drains,
9. air conditioning condensation,
10. irrigation water, springs,
11. water from crawl space pumps,
12. footing drains,
13. lawn watering,
14. flows from riparian habitats and wetlands,
15. dechlorinated swimming pool discharges,
16. street wash water, and
17. discharges or flows from fire fighting activities occur during emergency situations. The permittee is not expected to evaluate fire fighting discharges with regard to pollutant contributions. Therefore, these discharges are authorized as allowable non-storm water discharges, unless identified, by EPA, as significant sources of pollutants to Waters of the U.S..

Spill Containment and Management Plan

January 3, 2018

Initial Notification

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

Facility Managers (name) _____

_____

Facility Manager (phone) _____

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) 826-3189
Board of Health Phone:	(781) 826-5000 ext. 1077
Conservation Commission Phone:	(781) 826-5000 ex. 1019

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 ☐ No If yes, name of body of water_____

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	1 – 40LB BAGS
--	12” INFLATABLE PIPE PLUG	1
--	24” INFLATABLE PIPE PLUG	1
--	SQUARE END SHOVELS	1
--	PRY BAR	1

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
   NAME: _____ BEEPER: _____
   PHONE: _____ CELL PHONE: _____

   ALTERNATE:
   NAME: _____ BEEPER: N/A
   PHONE: _____ CEL PHONE: _____

2. FIRE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (781) 826-3151

3. POLICE DEPARTMENT
   EMERGENCY: 911
   BUSINESS: (781) 826-3231

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
   EMERGENCY: (888) 340-1133
   SOUTHEAST REGION - LAKEVILLE OFFICE: (508) 946-2700

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

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

6. DEPARTMENT OF PUBLIC WORKS
   CONTACT: Victor J. Diniak, Director of Public Works
   PHONE: (781) 826-3189

7. CONSERVATION COMMISSION
   CONTACT: Sandra D. MacFarlane, Conservation Agent
   PHONE: (781) 826-5000 ext. 1020

8. BOARD OF HEALTH
   PHONE: (871) 826-5000 ext. 1077

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES
INSPECTION SCHEDULE AND EVALUATION CHECKLIST – POST CONSTRUCTION PHASE

PROJECT LOCATION: **Merchant's Row, Washington Street, Hanover, MA** Latest Revision:_____

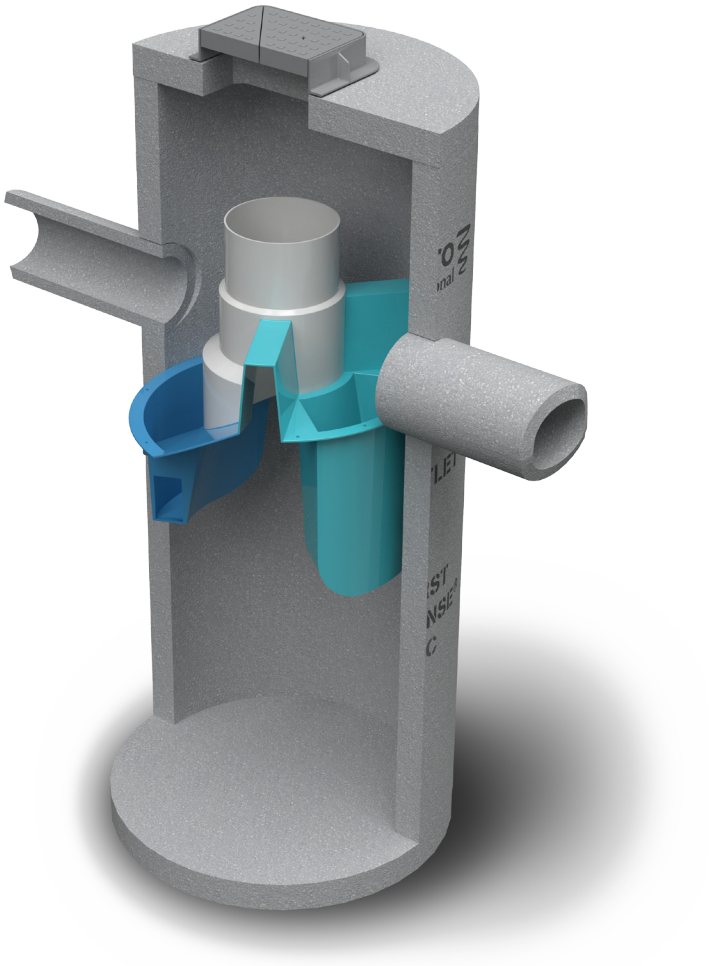
Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List items	Date of Cleaning/Repair	Performed By	Water Level in Detention System
Parking Lot Maintenance	Quarterly			-Sediment build-up -Trash and debris - Minor spills (vehicular)				
Deep Sump Hooded Catch Basins	Quarterly			-Sediment level exceeds 8" -Trach and debris - Floatable oils or hydrocarbon - Grate or outlet blockage				
Pre-Treatment Structure (First Defense Units)	Quarterly			-Sediment not to exceed 18" -Floating contaminates shall be removed by vacuum pump prior to sediment removal -Outlet blockages				
Infiltration Basin	Twice a Year			-Sediment build-up -Trash and debris -Dead vegetation -Standing water greater than 72 hours				
Subsurface Infiltration Chamber Systems	Twice a Year			-Sediment buildup -Standing water greater than 48 hours				
Outlet Protection	Twice a Year			-Check for clogging -Remove sediment buildup -Inspect for signs of settlement or erosion				

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

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.
Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

Stormwater Control Manager: _____ **Stamp**

Hydro International



Operation and Maintenance Manual

First Defense® and First Defense® High Capacity

Vortex Separator for Stormwater Treatment

Table of Contents

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations (refer to *Section II. Model Sizes & Configurations*, page 4) to accommodate a wide range of pipe sizes, peak flows and depth constraints.

Operation

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

Pollutant Capture and Retention

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

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

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

Applications

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

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for "offline" arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 500% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

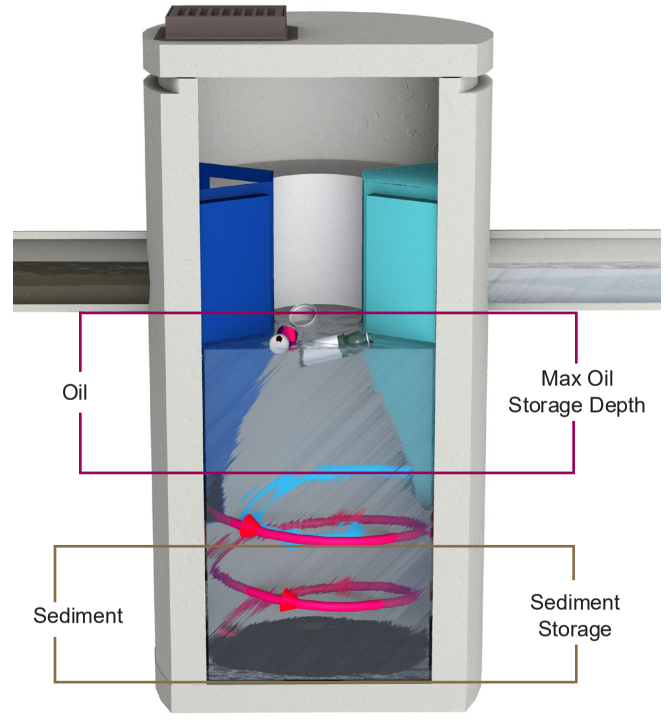


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components of the First Defense®-4HC and First Defense®-6HC have modified geometries as to allow greater design flexibility needed to accommodate various site constraints.

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

First Defense® Components

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

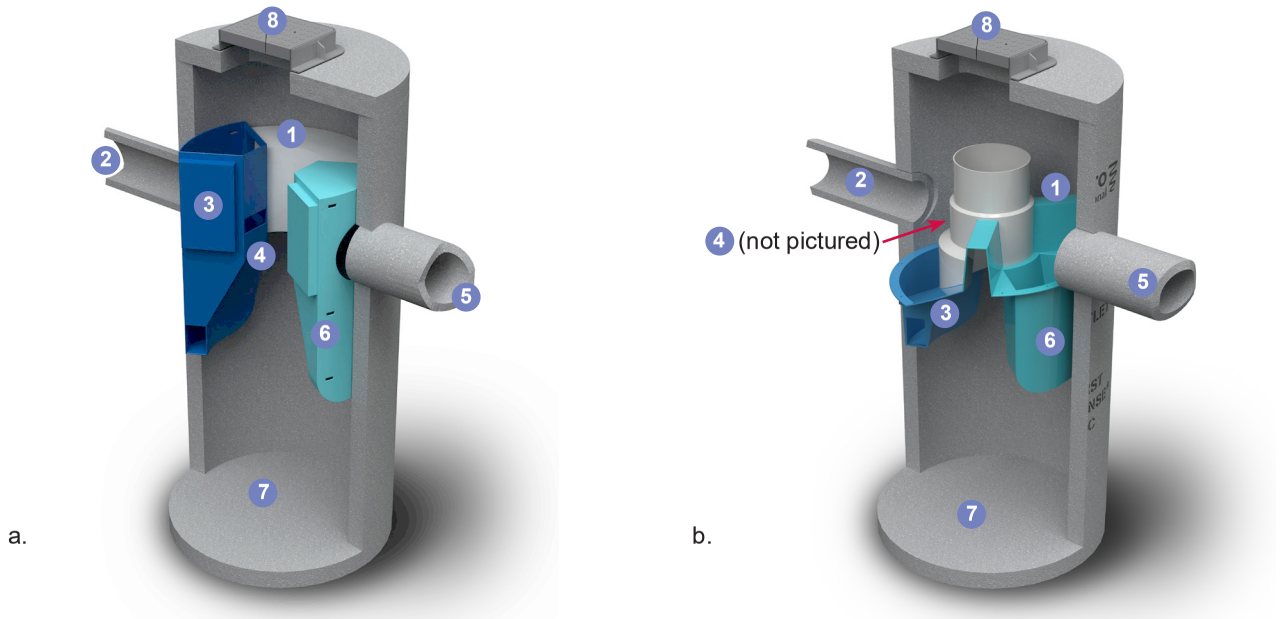


Fig.2a) First Defense®-4 and First Defense®-6; b) First Defense®-4HC and First Defense®-6HC, with higher capacity dual internal bypass and larger maximum pipe diameter.

First Defense® High Capacity Model Number	Diameter	Typical TSS Treatment Flow Rates NJDEP Certified	Peak Online Flow Rate	Maximum Pipe Diameter[1]	Oil Storage Capacity	Typical Sediment Storage Capacity[2]	Minimum Distance from Outlet Invert to Top of Rim[3]	Chamber Depth
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd^3 / m^3)	(ft / m)	(ft / m)
FD-3HC	3 / 0.9	0.85 / 24.0	15 / 424	18 / 457	125 / 473	0.4 / 0.3	2.0 - 3.5 / 0.6 - 1.0	3.75 / 1.14
FD-4HC	4 / 1.2	1.50 / 42.4	18 / 510	24 / 600	191 / 723	0.7 / 0.5	2.3 - 3.9 / 0.7 - 1.2	5.00 / 1.52
FD-5HC	5 / 1.5	2.35 / 66.2	20 / 566	24 / 609	300 / 1135	1.1 / .84	2.5 - 4.5 / 0.7 - 1.3	5.25 / 1.60
FD-6HC	6 / 1.8	3.38 / 95.7	32 / 906	30 / 750	496 / 1878	1.6 / 1.2	3.0 - 5.1 / 0.9 - 1.6	6.25 / 1.90
FD-7HC	7 / 2.1	4.60 / 130.2	40 / 1133	42 / 1067	750 / 2839	2.1 / 1.9	3.0 - 5.5 / 0.9 - 1.7	7.25 / 2.20
FD-8HC	8 / 2.4	6.00 / 169.9	50 / 1,415	48 / 1219	1120 / 4239	2.8 / 2.1	3.0 - 6.0 / 0.9 -1.8	8.00 / 2.43

[1]Contact Hydro International when larger pipe sizes are required.
[2]Contact Hydro International when custom sediment storage capacity is required.
[3]Minimum distance for models depends on pipe diameter.

III. Maintenance

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

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

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

Maintenance Equipment Considerations

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

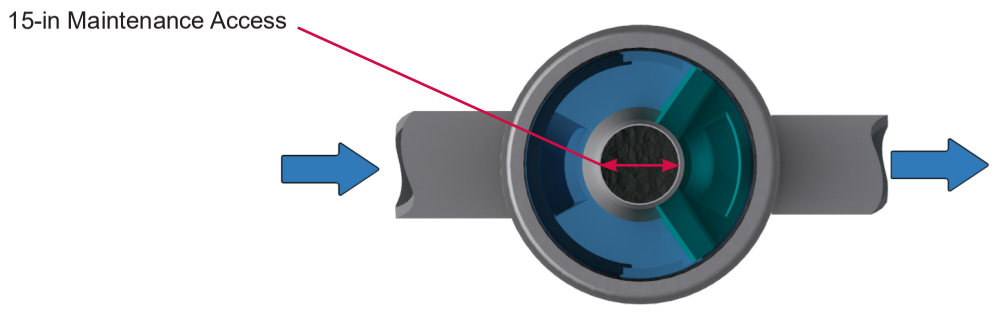


Fig.3 The central opening to the sump of the First Defense®-HC is 15 inches in diameter.

Determining Your Maintenance Schedule

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

The vactor procedure, including both sediment and oil / flotables removal, for a 6-ft First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

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

2. Remove the grate or lid to the manhole.

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

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

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

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

7. Securely replace the grate or lid.

8. Take down safety equipment.

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

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.5).

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

Scheduling

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

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

Fig.4 Floatables are removed with a vactor hose (First Defense model FD-4, shown).

Recommended Equipment

- Safety Equipment (traffic cones, etc)

- Crow bar or other tool to remove grate or lid

- Pole with skimmer or net (if only floatables are being removed)

- Sediment probe (such as a Sludge Judge®)

- Vactor truck (flexible hose recommended)

- First Defense® Maintenance Log

Floatables and sediment Clean Out Procedures

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

2. Remove the grate or lid to the manhole.

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

4. Remove oil and floatables stored on the surface of the water with the vactor hose (Fig.5) or with the skimmer or net (not pictured).

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

6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor (Fig.5).

7. Retract the vactor hose from the vessel.

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

9. Securely replace the grate or lid.

Fig.5 Sediment is removed with a vactor hose (First Defense model FD-4, shown).

Maintenance at a Glance

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

First Defense® Installation Log

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

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): **FD-3HC** **FD-4** **FD-4HC** **FD-5HC** **FD-6** **FD-6HC** **FD-7HC** **FD-8HC**

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

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

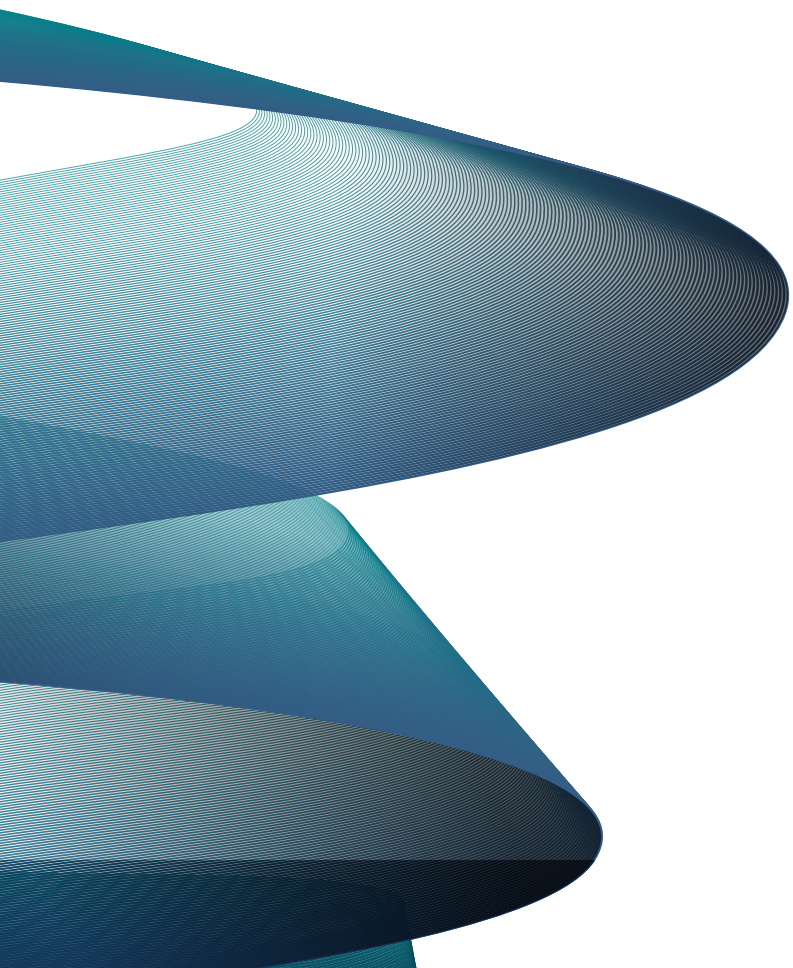
First Defense® Inspection and Maintenance Log

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

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

Notes

Hydro International®



Stormwater Solutions

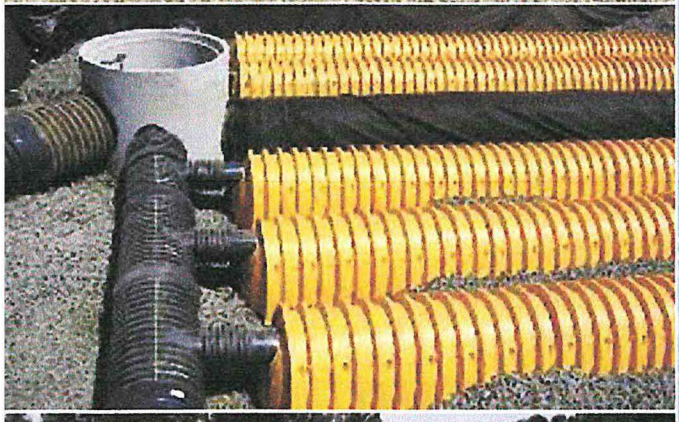
94 Hutchins Drive
Portland, ME 04102

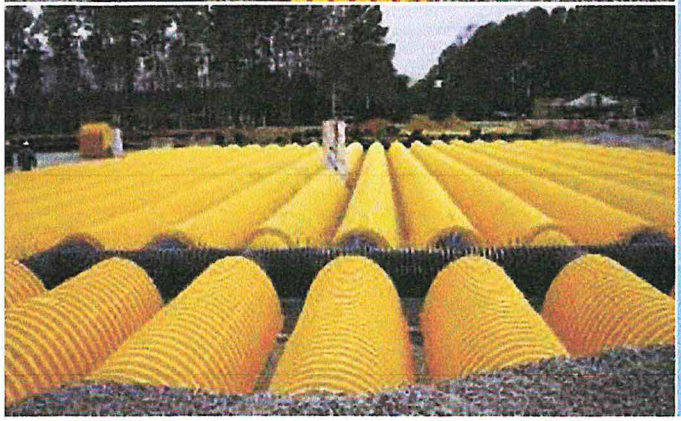
Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

FDHC_O+M_H_1703





SC-310 / SC-740 / DC-780

StormTech®

Detention • Retention • Water Quality

Design Manual

StormTech® Chamber Systems
for Stormwater Management

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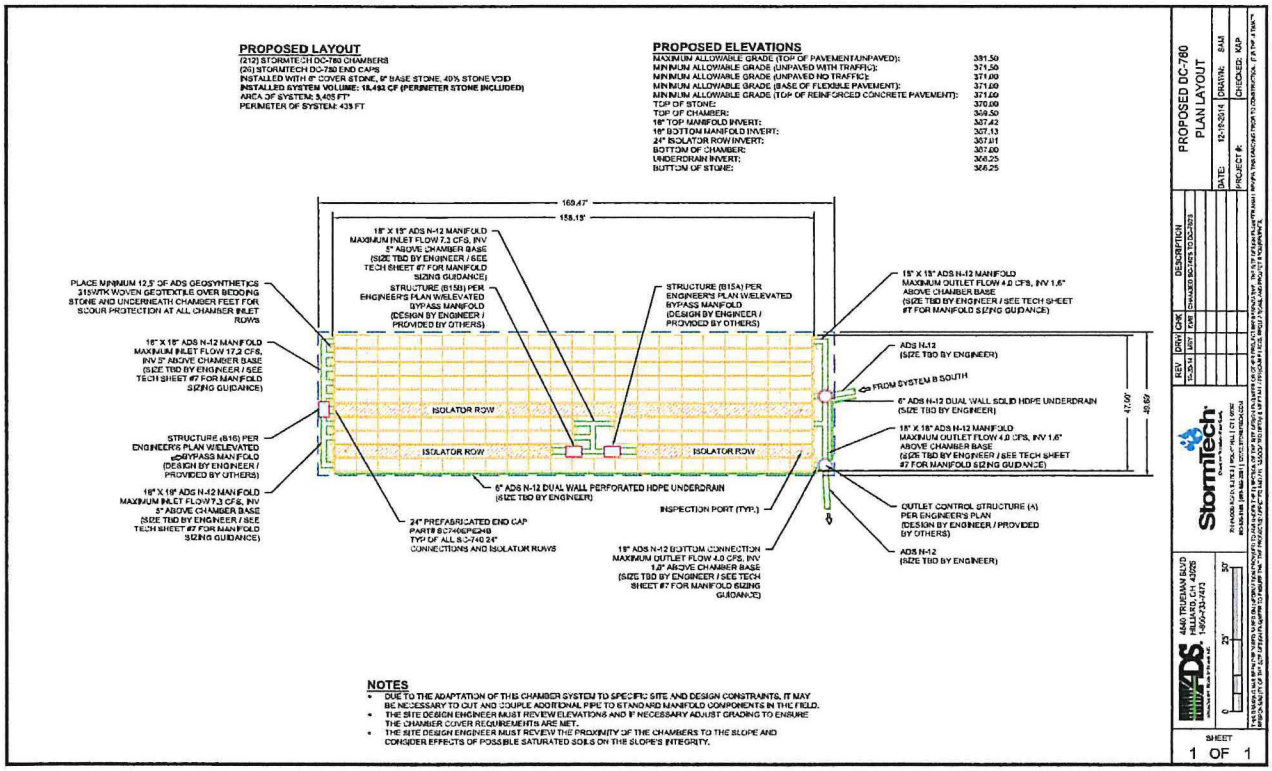
* For MC-3500 and MC-4500 designs, please refer to the MC-3500/MC-4500 Design Manual

The StormTech Technical Services Department assists design professionals in specifying StormTech stormwater systems. This assistance includes the layout of chambers to meet the engineer's volume requirements and the connections to and from the chambers. The Technical Department can also assist converting and cost engineering projects currently specified with ponds, pipe, concrete and other manufactured stormwater detention/retention products. Please note that it is the responsibility of the design engineer to ensure that the chamber bed layout meets all design requirements and is in compliance with applicable laws and regulations governing this project.



This manual is exclusively intended to assist engineers in the design of subsurface stormwater systems using StormTech chambers.

1.1 INTRODUCTION

StormTech stormwater management systems allow stormwater professionals to create more profitable, environmentally sound developments. Compared with other subsurface systems, StormTech systems offer lower overall installed cost, superior design flexibility and enhanced performance. Applications include commercial, residential, agricultural and highway drainage.

StormTech has invested over $10 million and many years in the development of StormTech chambers. These innovative products exceed the rigorous requirements of the standards governing the design of thermoplastic structures.

1.2 THE GOLD STANDARD IN STORMWATER MANAGEMENT

The advanced designs of StormTech chambers were created by implementing an aggressive research, development, design and manufacturing protocol. StormTech chamber products establish the new gold standard in stormwater management through:

- Collaborations with experts in the field of buried plastic structures and polyolefin materials
- The development and utilization of new testing methods and proprietary test methods
- The use of thermoformed prototypes to verify engineering models, perform in-ground testing and install observation sites
- The investment in custom-designed, injection molding equipment
- The utilization of polypropylene and polyethylene as manufacturing materials
- The design of molded-in features not possible with traditional thermoformed chambers

Section 3.0 of this design manual, *Structural Capabilities*, provides a detailed description of the research, development and design process.

Many of StormTech's unique chamber features can benefit a site developer, stormwater system designer, and installer. Where applicable, StormTech Product Specifications are referenced throughout this design manual. If StormTech's unique product benefits are important to a stormwater system design, consider including the applicable StormTech Product Specifications on the site plans. This can prevent substitutions with inferior products. Refer to Section 14.0, *StormTech Product Specifications*.

1.3 PRODUCT QUALITY AND DESIGN TO INTERNATIONAL STANDARDS

StormTech chambers are designed to meet the full scope of design requirements of Section 12.12 of the AASHTO LRFD Bridge Design Specifications and produced to the requirements of the American Society of Testing Materials (ASTM) International specifications F2418 (polypropylene chambers) and F2922 (polyethylene chambers).

StormTech chambers provide the full AASHTO safety factors for live loads and permanent earth loads. The two ASTM standards mentioned previously are linked to the AASHTO LRFD Bridge Design Specifications Section 12.12 design standard. Both ASTM standards require that the safety factors included in the AASHTO guidance are achieved as a prerequisite to meeting either ASTM F2418 or ASTM F2922. StormTech chambers are also designed in accordance with ASTM F2787, "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers" which provides specific guidance on how to design thermoplastic chambers in accordance with AASHTO Section 12.12. These standards provide both the assurance of product quality and safe structural design.

For non-proprietary specifications for public bids that ensure high product quality and safe design, consider including the specification in Section 15.0 Chamber Specifications for Contract Documents.

1.4 TECHNICAL SUPPORT FOR PLAN REVIEWS

StormTech's in-house technical support staff is available to review proposed plans that incorporate StormTech chamber systems. They are also available to assist with plan conversions from existing products to StormTech. Not all plan sheets are necessary for StormTech's review. Required sheets include plan view sheet(s) with design contours, cross sections of the stormwater system including catch basins and drainage details.

When specifying StormTech chambers it is recommended that the following items are included in project plans: StormTech chamber system General Notes, applicable StormTech chamber illustrations and StormTech chamber system Product Specifications. These items are available in various formats and can be obtained by contacting StormTech at **1-860-529-8188** or may be downloaded at **www.stormtech.com.**

StormTech's plan review is limited to the sole purpose of determining whether plans meet StormTech chamber systems' minimum requirements. **It is the ultimate responsibility of the design engineer to assure that the stormwater system's design is in full compliance with all applicable laws and regulations.** StormTech products must be designed and installed in accordance with StormTech's minimum requirements.

SEND PLANS TO:

StormTech, Plan Review, 70 Inwood Road, Suite 3, Rocky Hill, CT 06067 E-mail: info@stormtech.com. File size should not exceed 10 MB.

2.1 PRODUCT APPLICATIONS

StormTech chamber systems may function as stormwater detention, retention, first-flush storage, or some combination of these. The StormTech chambers can be used for commercial, municipal, industrial, recreational, and residential applications especially for installations under parking lots and commercial roadways.

One of the key advantages of the StormTech chamber system is its design flexibility. Chambers may be configured into beds or trenches of various sizes or shapes. They can be centralized or decentralized, and fit on nearly all sites. Chamber lengths enhance the ability to develop on both existing and pre-developed projects. The systems can be designed easily and efficiently around utilities, natural or man-made structures and any other limiting boundaries.

2.2 CHAMBERS FOR STORMWATER DETENTION

Chamber systems have been used effectively for stormwater detention for over 15 years. A detention system temporarily holds water while it is released at a defined rate through an outlet. While some infiltration may occur in a detention system, it is often considered an environmental benefit and a storage safety factor. Over 70% of StormTech's installations are non-watertight detention systems. There are only a few uncommon situations where a detention system might need to limit infiltration: the subgrade soil's bearing capacity is significantly affected by saturation such as with expansive clays or karst soils, and; in sensitive aquifer areas where the depth to groundwater does not meet local guidelines. Adequate pretreatment could eliminate concerns for the latter case. A thermoplastic liner may be considered for both situations to limit infiltration.

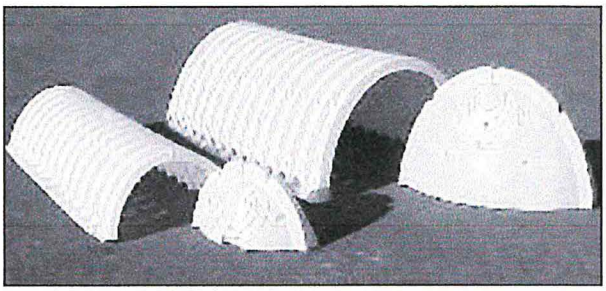
2.3 STONE POROSITY ASSUMPTION

A StormTech chamber system requires the application of clean, crushed, angular stone below, between and above the chambers. This stone serves as a structural component while allowing conveyance and storage of stormwater. Storage volume examples throughout this Design Manual are calculated with an assumption that the stone has an industry standard porosity of 40%. Actual stone porosity may vary. Contact StormTech for information on calculating stormwater volumes with varying stone porosity assumptions.

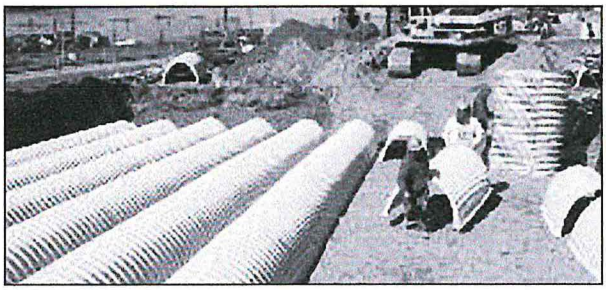
2.4 CHAMBER SELECTION

Primary considerations when selecting between the SC-310™, SC-740™ and DC-780™ chambers are the depth to restrictive layer, available area for subsurface storage, cover height and outfall restrictions.

The StormTech SC-310 chamber shown on page 4 is ideal for systems requiring low-rise and wide-span solutions. This low profile chamber allows the storage of large volumes, 1.3 ft³/ft² (0.40 m³/m²) [minimum], at minimum depths.



The SC-310 and SC-740 chambers and end plates.



StormTech systems can be integrated into retrofit and new construction projects.

Like the Stormtech SC-310, the StormTech SC-310-3 found on page 6 allows for a design option for sites with both limited cover and limited space. With only 3" of spacing between the chambers, the SC-310-3 still provides 1.3 ft³/ft² (0.40 m³/m²) [minimum] of storage.

The StormTech SC-740 chamber shown on page 8 optimizes storage volumes in relatively small footprints. By providing 2.2 ft³/ft² (0.67 m³/m²) [minimum] of storage, the SC-740 chambers can minimize excavation, backfill and associated costs.

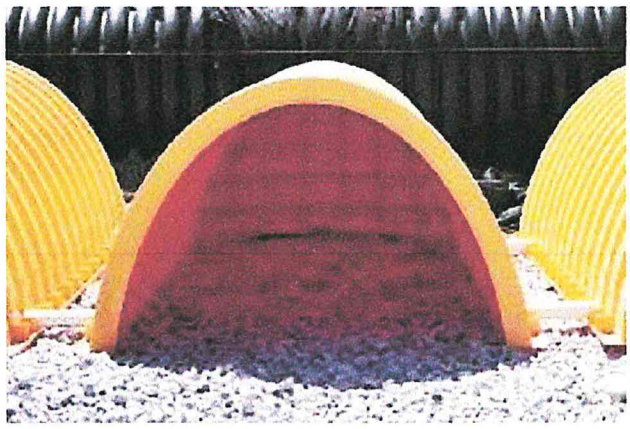
The DC-780 chamber shown on page 10 has been developed for those applications which exceed the maximum 8 ft (2.44 m) burial depth of the SC-740 and SC-310 chambers. The DC-780 is a modified version of the SC-740 allowing it to reach a maximum burial depth of 12 ft (3.66 m). The design of the DC-780 chamber, like other StormTech chambers, is designed and manufactured in accordance with the AASHTO LRFD Bridge Design Specifications as well as ASTM F 2418 and ASTM F 2787 ensuring structural adequacy for deeper systems.

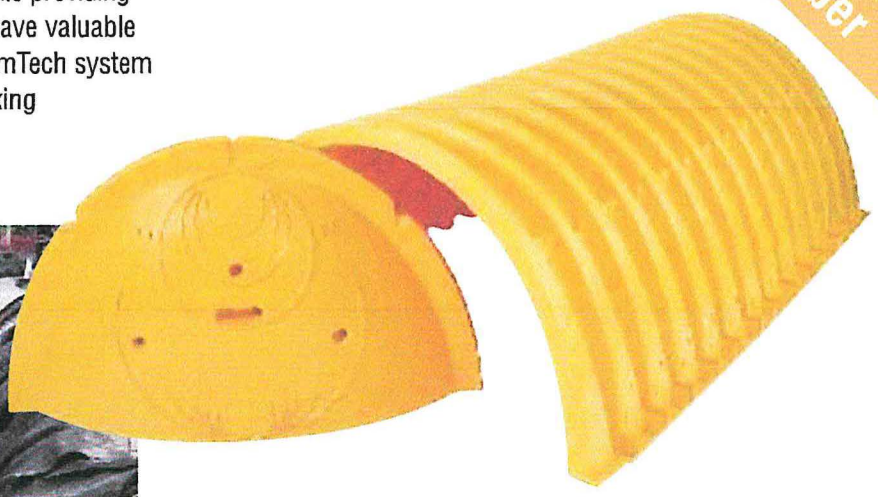
The end corrugations of the DC-780 chamber have not been modified in order to allow connections to the SC-740 chamber. This will allow hybrid systems utilizing both chambers in one system design.

StormTech SC-740 Chamber

SC-740 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots thus maximizing land usage for commercial and municipal applications.





StormTech SC-740 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	85.4" x 51.0" x 30.0" (2170 x 1295 x 762 mm)
Chamber Storage	45.9 ft³ (1.30 m³)
Min. Installed Storage*	74.9 ft³ (2.12 m³)
Weight	74.0 lbs (33.6 kg)

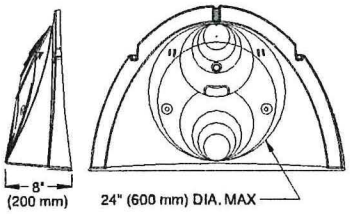
*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.

Shipping

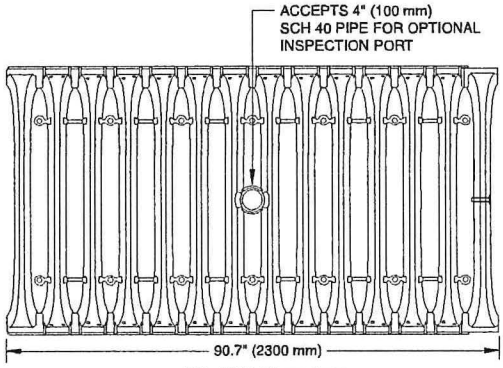
30 chambers/pallet

60 end caps/pallet

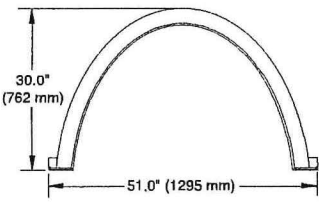
12 pallets/truck

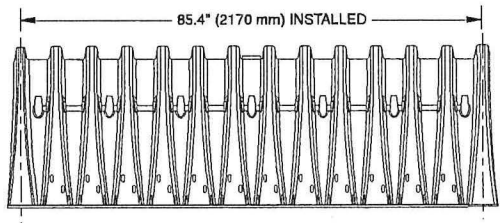


SC-740 End Cap



SC-740 Chamber





StormTech SC-740 Chamber

SC-740 Cumulative Storage Volumes Per Chamber

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under the Chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage Ft³ (m³)	Total System Cumulative Storage Ft³ (m³)
42 (1067)	45.90 (1.300)	74.90 (2.121)
41 (1041)	45.90 (1.300)	73.77 (2.089)
40 (1016)	45.90 (1.300)	72.64 (2.057)
39 (991)	45.90 (1.300)	71.52 (2.025)
38 (965)	45.90 (1.300)	70.39 (1.993)
37 (948)	45.90 (1.300)	69.26 (1.961)
36 (914)	45.90 (1.300)	68.14 (1.929)
35 (889)	45.85 (1.298)	66.98 (1.897)
34 (864)	45.69 (1.294)	65.75 (1.862)
33 (838)	45.41 (1.286)	64.46 (1.825)
32 (813)	44.81 (1.269)	62.97 (1.783)
31 (787)	44.01 (1.246)	61.36 (1.737)
30 (762)	43.06 (1.219)	59.66 (1.689)
29 (737)	41.98 (1.189)	57.89 (1.639)
28 (711)	40.80 (1.155)	56.05 (1.587)
27 (686)	39.54 (1.120)	54.17 (1.534)
26 (660)	38.18 (1.081)	52.23 (1.479)
25 (635)	36.74 (1.040)	50.23 (1.422)
24 (610)	35.22 (0.977)	48.19 (1.365)
23 (584)	33.64 (0.953)	46.11 (1.306)
22 (559)	31.99 (0.906)	44.00 (1.246)
21 (533)	30.29 (0.858)	41.85 (1.185)
20 (508)	28.54 (0.808)	39.67 (1.123)
19 (483)	26.74 (0.757)	37.47 (1.061)
18 (457)	24.89 (0.705)	35.23 (0.997)
17 (432)	23.00 (0.651)	32.96 (0.939)
16 (406)	21.06 (0.596)	30.68 (0.869)
15 (381)	19.09 (0.541)	28.36 (0.803)
14 (356)	17.08 (0.484)	26.03 (0.737)
13 (330)	15.04 (0.426)	23.68 (0.670)
12 (305)	12.97 (0.367)	21.31 (0.608)
11 (279)	10.87 (0.309)	18.92 (0.535)
10 (254)	8.74 (0.247)	16.51 (0.468)
9 (229)	6.58 (0.186)	14.09 (0.399)

SC-740 Cumulative Storage Volumes Per Chamber (cont.)

Depth of Water in System Inches (mm)	Cumulative Chamber Storage Ft³ (m³)	Total System Cumulative Storage Ft³ (m³)
8 (203)	4.41 (0.125)	11.66 (0.330)
7 (178)	2.21 (0.063)	9.21 (0.264)
6 (152)	0	6.76 (0.191)
5 (127)	0	5.63 (0.160)
4 (102)	Stone Foundation 0	4.51 (0.125)
3 (76)	0	3.38 (0.095)
2 (51)	0	2.25 (0.064)
1 (25)	0	1.13 (0.032)

Note: Add 1.13 cu. ft. (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume Per Chamber ft³ (m³)

	Bare Chamber Storage	Chamber and Stone Foundation Depth in. (mm)		
	ft³ (m³)	6 (150)	12 (300)	18 (450)
StormTech SC-740	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6" (150 mm) of stone above chambers, 6" (150 mm) row spacing and 40% porosity.

Amount of Stone Per Chamber

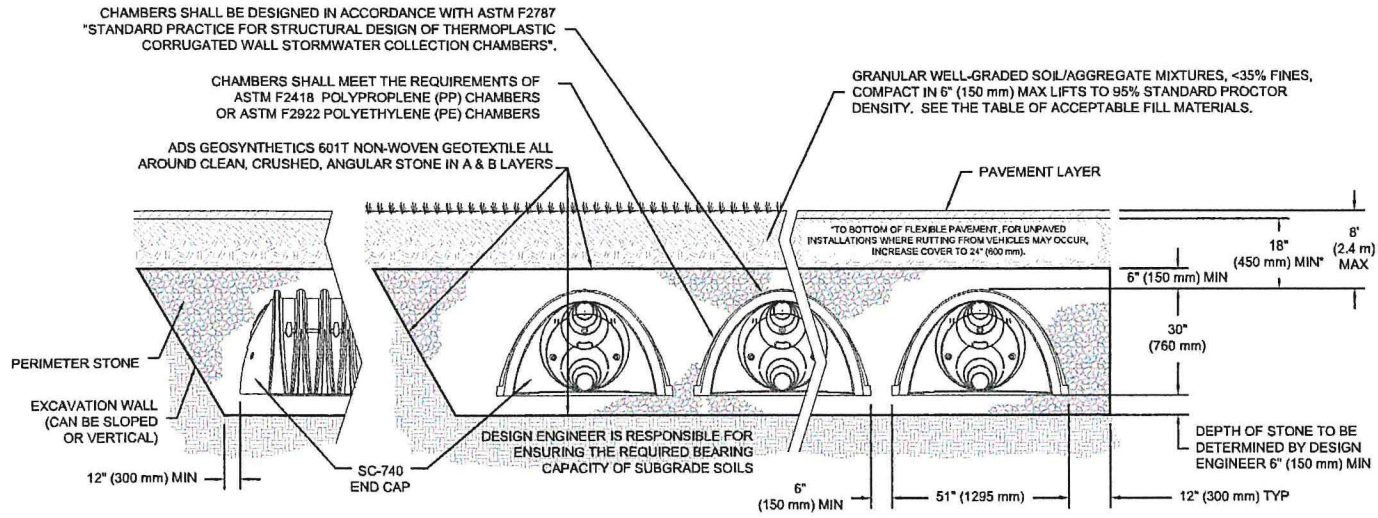
	Stone Foundation Depth		
ENGLISH TONS (yd³)	6"	12"	18"
StormTech SC-740	3.8 (2.8 yd³)	4.6 (3.3 yd³)	5.5 (3.9 yd³)
METRIC KILOGRAMS (m³)	150 mm	300 mm	450 mm
StormTech SC-740	3450 (2.1 m³)	4170 (2.5 m³)	4490 (3.0 m³)

Note: Assumes 6" (150 mm) of stone above, and between chambers.

Volume of Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth		
	6" (150 mm)	12" (300 mm)	18" (450 mm)
StormTech SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. Volume of excavation will vary as depth of cover increases.



THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.

12.1 ISOLATOR ROW INSPECTION

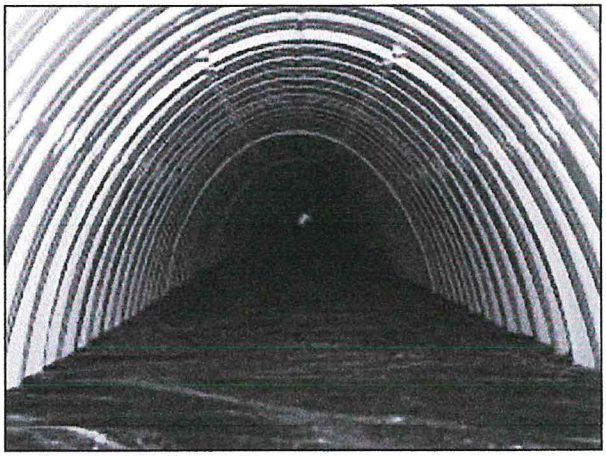
Regular inspection and maintenance are essential to assure a properly functioning stormwater system. Inspection is easily accomplished through the manhole or optional inspection ports of an Isolator Row. Please follow local and OSHA rules for a confined space entry.

Inspection ports can allow inspection to be accomplished completely from the surface without the need for a confined space entry. Inspection ports provide visual access to the system with the use of a flashlight. A stadia rod may be inserted to determine the depth of sediment. If upon visual inspection it is found that sediment has accumulated to an average depth exceeding 3" (76 mm), cleanout is required.

A StormTech Isolator Row should initially be inspected immediately after completion of the site's construction. While every effort should be made to prevent sediment from entering the system during construction, it is during this time that excess amounts of sediments are most likely to enter any stormwater system. Inspection and maintenance, if necessary, should be performed prior to passing responsibility over to the site's owner. Once in normal service, a StormTech Isolator Row should be inspected bi-annually until an understanding of the sites characteristics is developed. The site's maintenance manager can then revise the inspection schedule based on experience or local requirements.

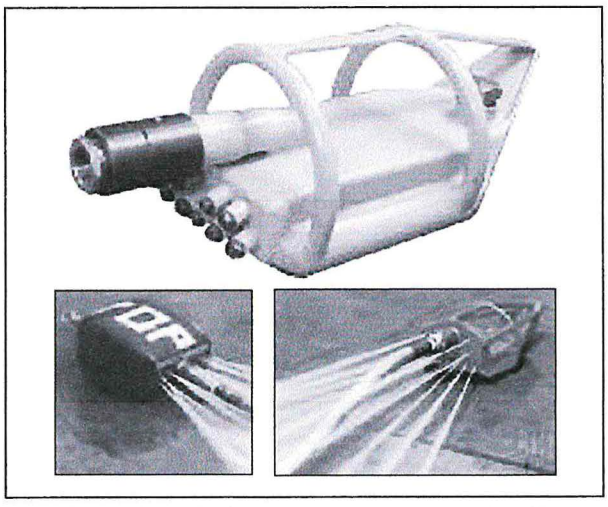
12.2 ISOLATOR ROW MAINTENANCE

JetVac maintenance is recommended if sediment has been collected to an average depth of 3" (76 mm) inside the Isolator Row. More frequent maintenance may be required to maintain minimum flow rates through the Isolator Row. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, a wave of suspended sediments is flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/ JetVac combination vehicles. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" (1143 mm) are best. The JetVac process shall only be performed on StormTech Rows that have AASHTO class 1 woven geotextile over the foundation stone (ADS 315ST or equal).



Looking down the Isolator Row.

A typical JetVac truck. (This is not a StormTech product.)



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

12.0 Inspection & Maintenance

STORMTECH ISOLATOR™ ROW - STEP-BY-STEP MAINTENANCE PROCEDURES

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment

iv. If sediment is at, or above, 3" (76 mm) depth proceed to Step 2. If not proceed to Step 3.

B) All Isolator Rows

i. Remove cover from manhole at upstream end of Isolator Row

ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Follow OSHA regulations for confined space entry if entering manhole

2. Mirrors on poles or cameras may be used to avoid a confined space entry

iii. If sediment is at or above the lower row of sidewall holes [approximately 3" (76 mm)] proceed to Step 2. If not proceed to Step 3.

Step 2) Clean out Isolator Row using the JetVac process

A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45" (1143 mm) or more is preferable

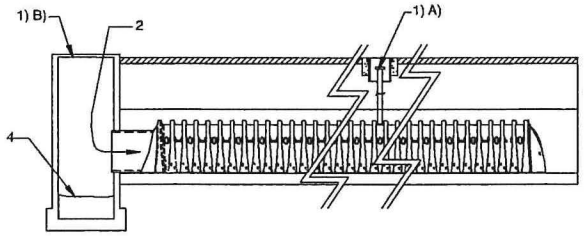
B) Apply multiple passes of JetVac until back-flush water is clean

C) Vacuum manhole sump as required during jetting

Step 3) Replace all caps, lids and covers

Step 4) Inspect and clean catch basins and manholes upstream of the StormTech system following local guidelines.

Figure 20 – StormTech Isolator Row (not to scale)



12.3 ECCENTRIC PIPE HEADER INSPECTION

Theses guidelines do not supercede a pipe manufacturer's recommended I&M procedures. Consult with the manufacturer of the pipe header system for specific I&M procedures. Inspection of the header system should be carried out quarterly. On sites which generate higher levels of sediment more frequent inspections may be necessary. Headers may be accessed through risers, access ports or manholes. Measurement of sediment may be taken with a stadia rod or similar device. Clean-out of sediment should occur when the sediment volume has reduced the storage area by 25% or the depth of sediment has reached approximately 25% of the diameter of the structure.

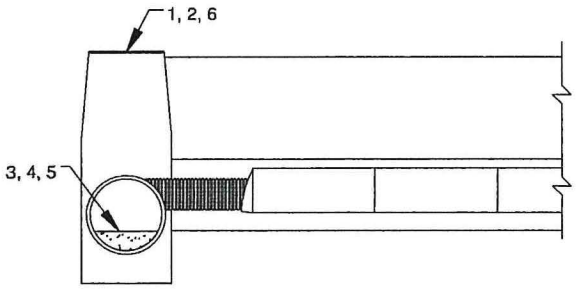
12.4 ECCENTRIC PIPE MANIFOLD MAINTENANCE

Cleanout of accumulated material should be accomplished by vacuum pumping the material from the header. Cleanout should be accomplished during dry weather. Care should be taken to avoid flushing sediments out through the outlet pipes and into the chamber rows.

Eccentric Header Step-by-Step Maintenance Procedures

1. Locate manholes connected to the manifold system
2. Remove grates or covers
3. Using a stadia rod, measure the depth of sediment
4. If sediment is at a depth of about 25% pipe volume or 25% pipe diameter proceed to step 5. If not proceed to step 6.
5. Vacuum pump the sediment. Do not flush sediment out inlet pipes.
6. Replace grates and covers
7. Record depth and date and schedule next inspection

Figure 21 – Eccentric Manifold Maintenance



Please contact StormTech's Technical Services Department at 888-892-2894 for a spreadsheet to estimate cleaning intervals.

13.0 General Notes

1. StormTech ("StormTech") requires installing contractors to use and understand StormTech's latest Installation Instructions prior to beginning system installation.
2. Our Technical Services Department offers installation consultations to installing contractors. Contact our Technical Service Representatives at least 30 days prior to system installation to arrange a pre-installation consultation. Our representatives can then answer questions or address comments on the StormTech chamber system and inform the Installing contractor of the minimum installation requirements before beginning the system's construction. Call **860-529-8188** to speak to a Technical Service Representative or visit **www.stormtech.com** to receive a copy of our Installation Instructions.
3. StormTech's requirements for systems with pavement design (asphalt, concrete pavers, etc.): Minimum cover for the SC-740, DC-780 and SC-310 chambers is 18" (457 mm) not including pavement; Maximum cover for the SC-740 and SC-310 chambers is 96" (2.4 m) including pavement design; Maximum cover for the DC-780 chamber is 12' (3.6 m) including pavement design. For installations that do not include pavement, where rutting from vehicles may occur, minimum required cover is 24" (610 mm), maximum cover is as stated above.
4. The contractor must report any discrepancies with the bearing capacity of the chamber foundation materials to the design engineer.
5. AASHTO M288 Class 2 non-woven geotextile (filter fabric) must be used as indicated in the project plans.
6. Stone placement between chamber rows and around perimeter must follow instructions as indicated in the most current version of StormTech's Installation Instructions.
7. Backfilling over the chambers must follow requirements as indicated in the most current version of StormTech's Installation Instructions.
8. The contractor must refer to StormTech's Installation Instructions for a Table of Acceptable Vehicle Loads at various depths of cover. This information is also available at StormTech's website: **www.stormtech.com.** The contractor is responsible for preventing vehicles that exceed StormTech's requirements from traveling across or parking over the stormwater system. Temporary fencing, warning tape and appropriately located signs are commonly used to prevent unauthorized vehicles from entering sensitive construction areas.
9. The contractor must apply erosion and sediment control measures to protect the stormwater system during all phases of site construction per local codes and design engineer's specifications.
10. STORMTECH PRODUCT WARRANTY IS LIMITED. Contact StormTech for warranty information.

14.0 StormTech Product Specifications

1.0 GENERAL

1.1 StormTech chambers are designed to control stormwater runoff. As a subsurface retention system, StormTech chambers retain and allow effective infiltration of water into the soil. As a subsurface detention system, StormTech chambers detain and allow for the metered flow of water to an outfall.

2.0 CHAMBER PARAMETERS

2.1 The Chamber shall be injection molded of an impact modified polypropylene or polyethylene copolymer to maintain adequate stiffness through higher temperatures experienced during installation and service.

2.2 The nominal chamber dimensions of the StormTech SC-740 and DC-780 shall be 30.0" (762 mm) tall, 51.0" (1295 mm) wide and 90.7" (2304 mm) long. The nominal chamber dimensions of the StormTech SC-310 shall be 16.0" (406 mm) tall, 34.0" (864 mm) wide and 90.7" (2304 mm) long. The installed length of a joined chamber shall be 85.4" (2169 mm).

2.3 The chamber shall have a continuously curved section profile.

2.4 The chamber shall be open-bottomed.

2.5 The chamber shall incorporate an overlapping corrugation joint system to allow chamber rows of almost any length to be created. The overlapping corrugation joint system shall be effective while allowing a chamber to be trimmed to shorten its overall length.

2.6 The nominal storage volume of all StormTech chambers includes the volume of the clean, crushed, angular stone with an assumed 40% porosity. The nominal storage volume of a joined StormTech SC-740 chamber shall be 74.9 ft^3 (2.1 m^3) per chamber when installed per StormTech's typical details. This equates to a storage volume per unit area of bed of 2.2 ft^3/ft^2 (0.67 m^3/m^2). The nominal storage volume of a joined StormTech DC-780 chamber shall be 78.4 ft^3 (2.2 m^3) per chamber when installed per StormTech's typical details. This equates to a storage volume per unit area of bed of 2.3 ft^3/ft^2 (0.70 m^3/m^2). The nominal storage volume of a joined StormTech SC-310 chamber shall be 31.0 ft^3 (0.88 m^3) per chamber when installed per StormTech's typical details. This equates to a storage volume per unit area of bed of 1.3 ft^3/ft^2 (0.40 m^3/m^2).

2.7 The SC-740 and SC-310 chambers shall have forty-eight orifices penetrating the sidewalls to allow for lateral conveyance of water.

2.8 The chamber shall have two orifices near its top to allow for equalization of air pressure between its interior and exterior.

2.9 The chamber shall have both of its ends open to allow for unimpeded hydraulic flows and visual inspections down a row's entire length.

2.10 The chamber shall have 14 corrugations.

2.11 The chamber shall have a circular, indented, flat surface on the top of the chamber for an optional 4" (100 mm) diameter (maximum) inspection port.

2.12 The chamber shall be analyzed and designed using AASHTO methods for thermoplastic culverts contained in the LRFD Bridge Design Specifications, 2nd Edition, including Interim Specifications through 2001. Design live load shall be the AASHTO design truck. Design shall consider earth and live loads as appropriate for the minimum to maximum specified depth of fill.

2.13 The chamber shall be manufactured in an ISO 9001:2000 certified facility.

3.0 END CAP PARAMETERS

3.1 The end cap shall be designed to fit into any corrugation of a chamber, which allows: capping a chamber that has its length trimmed; segmenting rows into storage basins of various lengths.

3.2 The end cap shall have saw guides to allow easy cutting for various diameters of pipe that may be used to inlet the system.

3.3 The end cap shall have excess structural adequacies to allow cutting an orifice of any size at any invert elevation.

3.4 The primary face of an end cap shall be curved outward to resist horizontal loads generated near the edges of beds.

3.5 The end cap shall be manufactured in an ISO 9001:2000 certified facility.

APPENDIX E

Soil Testing Results & Site Soil Data

Map Scale: 1:1,460 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

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

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

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

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 15, Sep 9, 2022

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
48A	Brockton sandy loam, 0 to 3 percent slopes, extremely stony	0.4	3.8%
420B	Canton fine sandy loam, 3 to 8 percent slopes	0.7	7.0%
640B	Urban land, till substratum, 0 to 8 percent slopes	8.4	89.2%
Totals for Area of Interest		**9.4**	**100.0%**

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FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 23-01 DATE: 4/13/2023 TIME: 9:00 WEATHER: Sunny 75°-80°
SITE ADDRESS or MAP/LOT #: 2103 Washington Street, Hanover Map 5 Lot
OWNER: Frank Giglio (2103 Washington Street LLC) JOB NO.: 22-188
LOCATION (Identify on Plan): See Attached Plan GROUND ELEVATION AT SURFACE OF HOLE: 121.5±

LAND USE: Commercial SURFACE STONES: Yes: [ ] No: [X] SLOPE (%): 5-8%

VEGETATION: parking lot/pavement LANDFORM:

DISTANCES FROM:
OPEN WATER BODY: ft PROPERTY LINE: ft POSSIBLE WET AREA: ft DRAINAGEWAY: ft
DRINKING WATER WELL: ft OTHER:

DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-2"	pvmt	pvmt	-	-	Fill
2-40"	Fill	Fill	-	36"	Fill
40-120"	Sandy Loam	2.5y 6/3			Massive, Friable 10% gravel, saturated

PARENT MATERIAL: Till Unsuitable Material Present? Yes: [ ] No: [X] If Yes:
Disturbed Soil: [ ] Fill Mat'l: [X] Impervious Layer(s): [ ] Weathered/Fractured Rock: [ ] Bedrock: [ ]

GROUNDWATER OBSERVED: Yes: [ ] No: [ ] If Yes: What is the depth of Groundwater:
Standing in Hole: 56" Weeping from Face: 40" Saturating the Face: 38" Mottling: 36"
Estimated Depth to Seasonal High Ground Water : 36"

PERCOLATION TEST

Percolation Hole #:	23-01		Percolation Hole #:		
Test Date:	4/13/2023		Test Date:		
Depth of Perc:	40-58"		Depth of Perc:		
Start of Presoak:	9:59 AM		Start of Presoak:		
End of Presoak:	10:14 AM		End of Presoak:		
Time @ 12":	10:14 AM		Time @ 12":		
Time @ 9":	-		Time @ 9":		
Time Elapse:(12"-9")	abandoned	ground water	Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):			Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Paul Louderback Witnessed By: William Barrett Mach./Oper.: John Tassinari
Comments: C layer pockets of silty loam.
Did not get to 11" over 60 mins. - groundwater too high.

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

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FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 23-02 DATE: 4/13/2023 TIME: 11:00 WEATHER: Sunny 75°-80°
SITE ADDRESS or MAP/LOT #: 2103 Washington Street, Hanover Map 5 Lot
OWNER: Frank Giglio (2103 Washington Street LLC) JOB NO.: 22-188
LOCATION (Identify on Plan): See Attached Plan GROUND ELEVATION AT SURFACE OF HOLE: 122.0±

LAND USE: Commercial SURFACE STONES: Yes: [ ] No: [X] SLOPE (%): 3-5%

VEGETATION: parking lot/pavement LANDFORM:

DISTANCES FROM:
OPEN WATER BODY: ft PROPERTY LINE: ft POSSIBLE WET AREA: ft DRAINAGEWAY: ft
DRINKING WATER WELL: ft OTHER:

DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-2"	pvmt	pvmt	-	-	pvmt
2-60"	Fill	Fill	-	-	Bricks, pipes, broken structures, gasoline smell

PARENT MATERIAL: Unsuitable Material Present? Yes: [X] No: [ ] If Yes:
Disturbed Soil: [ ] Fill Mat'l: [X] Impervious Layer(s): [ ] Weathered/Fractured Rock: [ ] Bedrock: [ ]

GROUNDWATER OBSERVED: Yes: [ ] No: [ ] If Yes: What is the depth of Groundwater:
Standing in Hole: 48" Weeping from Face: 48" Saturating the Face: 48" Mottling: N/A
Estimated Depth to Seasonal High Ground Water : unknown- hit water line @ 24". Hole filling, could be ground water @ 48"

PERCOLATION TEST

Percolation Hole #:	N/A		Percolation Hole #:		
Test Date:			Test Date:		
Depth of Perc:			Depth of Perc:		
Start of Presoak:			Start of Presoak:		
End of Presoak:			End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):			Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Paul Louderback Witnessed By: William Barrett Mach./Oper.: John Tassinari
Comments: Hit water line @24". Water dept shut off. Bricks, large structure debris - abandoned hole @60" from water, strange odors.

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

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FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 23-03 DATE: 4/13/2023 TIME: 12:00 WEATHER: Sunny 75°-80°
SITE ADDRESS or MAP/LOT #: 2103 Washington Street, Hanover Map 5 Lot
OWNER: Frank Giglio (2103 Washington Street LLC) JOB NO.: 22-188
LOCATION (Identify on Plan): See Attached Plan GROUND ELEVATION AT SURFACE OF HOLE: 121±

LAND USE: Commercial/ Business SURFACE STONES: Yes: [ ] No: [X] SLOPE (%): 8-10%

VEGETATION: short grass, lawn slope on side of parking lot LANDFORM:

DISTANCES FROM:
OPEN WATER BODY: ft PROPERTY LINE: ft POSSIBLE WET AREA: ft DRAINAGEWAY: ft
DRINKING WATER WELL: ft OTHER:

DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-20"	A	Loamy Sand	10Yr 4/2	-	Massive, Friable
20-40"	B	Loamy Sand	10Yr 5/6	-	Massive, Friable 5% gravel
40-60"	C1	Loamy Sand	2.5 y 5/3	48"	Massive, Friable 5% gravel, saturated
60-120"	C2	Fine Sand	2.5 y 5/2		Loose single grain, saturated

PARENT MATERIAL: Till Unsuitable Material Present? Yes: [ ] No: [X] If Yes:
Disturbed Soil: [ ] Fill Mat'l: [X] Impervious Layer(s): [ ] Weathered/Fractured Rock: [ ] Bedrock: [ ]

GROUNDWATER OBSERVED: Yes: [X] No: [ ] If Yes: What is the depth of Groundwater:
Standing in Hole: 62" Weeping from Face: 52" Saturating the Face: 50" Mottling: 48"
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:	N/A - groundwat		Percolation Hole #:		
Test Date:			Test Date:		
Depth of Perc:			Depth of Perc:		
Start of Presoak:			Start of Presoak:		
End of Presoak:			End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):			Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Paul Louderback Witnessed By: William Barrett Mach./Oper.: John Tassinari
Comments: Took sample of fine sand @72"

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

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FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 23-04 DATE: 4/13/2023 TIME: 1:00 WEATHER: Sunny 75°-80°
SITE ADDRESS or MAP/LOT #: 2103 Washington Street, Hanover Map 5 Lot
OWNER: Frank Giglio (2103 Washington Street LLC) JOB NO.: 22-188
LOCATION (Identify on Plan): See Attached Plan GROUND ELEVATION AT SURFACE OF HOLE: 118.7±

LAND USE: Commercial/ Business SURFACE STONES: Yes: [ ] No: [X] SLOPE (%): 3-5%

VEGETATION: parking lot / pavement LANDFORM:

DISTANCES FROM:
OPEN WATER BODY: ft PROPERTY LINE: ft POSSIBLE WET AREA: ft DRAINAGEWAY: ft
DRINKING WATER WELL: ft OTHER:

DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-2"	pvmt	pavement	-	-	parking lot pavement
2-16"	Fill	Fill	-	-	Fill
16-36"	C1	Loamy Sand	10Yr 6/2	none observed	Massive, Friable 10% gravel, saturated @ 24"
39-72"	C2	Sandy Loam	2.5 y 5/3		Massive, Friable 10% gravel, saturated
72-84"	C3	Silty Loam	2.5 y 5/3	-	Massive, Friable, no gravel, saturated

PARENT MATERIAL: Till Unsuitable Material Present? Yes: [ ] No: [X] If Yes:
Disturbed Soil: [ ] Fill Mat'l: [X] Impervious Layer(s): [ ] Weathered/Fractured Rock: [ ] Bedrock: [ ]

GROUNDWATER OBSERVED: Yes: [X] No: [ ] If Yes: What is the depth of Groundwater:
Standing in Hole: - Weeping from Face: 36" Saturating the Face: 24" Mottling: none observed
Estimated Depth to Seasonal High Ground Water : 24"

PERCOLATION TEST

Percolation Hole #:	N/A - drainage		Percolation Hole #:		
Test Date:			Test Date:		
Depth of Perc:			Depth of Perc:		
Start of Presoak:			Start of Presoak:		
End of Presoak:			End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):			Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Paul Louderback Witnessed By: William Barrett Mach./Oper.: John Tassinari
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

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FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 23-05 DATE: 4/13/2023 TIME: 2:00 WEATHER: Sunny 75°-80°
SITE ADDRESS or MAP/LOT #: 2103 Washington Street, Hanover Map 5 Lot
OWNER: Frank Giglio (2103 Washington Street LLC) JOB NO.: 22-188
LOCATION (Identify on Plan): See Attached Plan GROUND ELEVATION AT SURFACE OF HOLE: 119.2±

LAND USE: Commercial/ Business SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 3-5%

VEGETATION: parking lot / pavement LANDFORM:

DISTANCES FROM:
OPEN WATER BODY: ft PROPERTY LINE: ft POSSIBLE WET AREA: ft DRAINAGEWAY: ft
DRINKING WATER WELL: ft OTHER:

DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-2"	pvmt	pavement			pavement
2-60"	Fill	Fill - large stones	-	12"	water filling hole @38"

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☐ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☒ No: ☐ If Yes: What is the depth of Groundwater:
Standing in Hole: 38" Weeping from Face: 35" Saturating the Face: 30" Mottling: 12"
Estimated Depth to Seasonal High Ground Water : 12"

PERCOLATION TEST

Percolation Hole #:	N/A - drainage		Percolation Hole #:		
Test Date:			Test Date:		
Depth of Perc:			Depth of Perc:		
Start of Presoak:			Start of Presoak:		
End of Presoak:			End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):			Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Paul Louderback Witnessed By: William Barrett Mach./Oper.: John Tassinari
Comments: water filling hole @38" - could only dig to 60"

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

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