Nitsch Engineering

April 15, 2019
Revised May 22, 2019
Revised June 19, 2019

FINAL

STORMWATER REPORT

For

W. EDWARD BALMER ELEMENTARY SCHOOL
21 Crescent Street
Northbridge, Massachusetts

Prepared for:

TOWN OF NORTHBRIDGE
Community Planning and Development Office
14 Hill Street
Whitinsville, MA 01588

Prepared by:

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120 Front Street
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Nitsch Project #12260

Nitsch Engineering

BALMER ELEMENTARY SCHOOL STORMWATER REPORT

Under the *Massachusetts Wetland Protection Act* (MGL c. 131, s. 40) and the Town of Northbridge Wetlands Bylaw and Regulations (Section 7-700)

Project Name:	Balmer Elementary School
Project Location:	21 Crescent Street Northbridge, MA
Prepared for:	Town of Northbridge
Nitsch Project #:	#12260
Date Prepared:	April 3, 2019 Revised April 14, 2019 Revised May 23, 2019, Revised June 19, 2019

ATTACHMENTS

Attachment A: **Precipitation and Stormwater Management Standards Documentation**
- Atlas 14 Volume 10 Precipitation Data for Site
- MassDEP Checklist for Stormwater Report
- Standard 3: 72-Hour Drawdown Recharge Calculation
- Standard 4: TSS Removal Calculations
- Standard 10: Illicit Discharge Compliance Statement

Attachment B: **Existing Conditions – HydroCAD Calculations**

Attachment C: **Proposed Conditions – HydroCAD Calculations**

Attachment D: **Closed Drainage System Design**

Attachment E: **Long-Term Pollution Prevention-Stormwater Operation and Maintenance Plan**

Attachment F: **Stormwater Pollution Prevention Plan (SWPPP)**

Attachment G: **Soil Investigations - NRCS Soil Maps and Descriptions and Soil Testing Logs**

Attachment H: **Methodology and Hydrocad Technical Information**

Attachment I: **Figures:** DR- EX Existing Watershed Areas and DR-PR Proposed Watershed Areas

Introduction:	Nitsch Engineering has prepared this Stormwater Report to support the Notice of Intent and Site Permit applications for the Balmer Elementary School (the Project). The Project site is located at 21 Crescent Street Northbridge, Massachusetts (subsequently referred to as the "Site"). The Project consists of the demolition of the existing elementary school and the construction of a new elementary school and associated site improvements at the existing Balmer Elementary site.
EXISTING STORMWATER CONDITIONS	
Existing Drainage Infrastructure:	The existing site's drainage system includes a closed drainage system that collects runoff from parking and landscape areas into a series of infrequent catch basins and inlets. The closed drainage system discharges to the Municipal drainage system in Crescent Street. There is overland flow to the Bordering Vegetated Wetlands (BVW) at the rear of the site and there is an existing 36" culvert at the southerly end of the BVW that runs across the Site to the Municipal drainage system in Crescent Street. Currently there are no detention systems and no water quality BMPs or Water Quality Structures on the site.
On-site Soil Investigations:	On-site Soil Testing was performed on April 9 and 10, 2019. NRCS soil information along with the on-site soil testing information were used for the4 stormwater management system design. The on-site testing confirmed the Soil Maps Hydrological Groups. In general, the majority of the development area soil's parent materials are a sandy-loams and fall within low permeability range (2.41 inch/hour) of Hydrological Soil Group A. The Seasonal High Ground Water (SHGW) was relatively shallow and generally within 36 inches of the surface except for areas near Crescent Street. See Drainage Area Plans for locations of test pits, SHGW elevations, and general soil descriptions. See soil logs in **Attachment G** for more detailed information.
NRSC Soils:	Soils (from NRCS Soils Map) on site include: • Udorthents, Smoothed – Hydrological Soil Group A • Canton fine sandy loam – Hydrological Soil Group B • Scituate fine sandy loam – Hydrological Soil Group C • Hinkley loamy sand – Hydrological Soil Group A • Montauk fine sandy loam – Hydrological Soil Group C • Merrimac fine sandy loam - Hydrological Soil Group A See NOI Report's **Attachment G - Figure 5** for locations of soil on the site.
FEMA Flood Zone:	There are no flood hazard zones on the project site. FIRM MAP Number 25027C1006E Effective Date July 4, 2011 See NOI Report's **Attachment E: Figure 4**.
Wetland Resource Areas:	The BVW and associated 100-foot buffer zone is located in the northern portion of the property. In addition, a BVW associated with Arcade Pond is located across Crescent Street from the project but a portion of the outer 100-foot buffer crosses the property line. An ORAD, dated January 16, 2019 was issued by the NCC confirming the wetland delineation indicated on the Existing Conditions Plan. See NOI Report's **Attachment B.**

Proposed Conditions

Project Description:

The Applicant is proposing to replace the existing elementary school with a new school building, vehicular and pedestrian circulations, athletic fields, play areas, and landscaping. See attached plans for extent of site improvements.

Land Use Table:

Table 1. Proposed land use (in acres)

Land Use	Existing Site (acres)	Proposed Site (acres)	Change
Buildings	1.36	1.70	0.34
Site Pavement	2.70	5.51	2.81
Other Altered Areas (Fields, etc.)	7.69	9.84	2.15
Undeveloped Areas (Woods)	18.33	13.03	-5.18
Total	30.08	30.08	

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Stormwater Management System Components

Deep Sump and Hooded Catch Basins; Deep sump and hooded catch basins are proposed to provide pretreatment in the impervious areas of the parking lot and driveways. Stormwater captured in the catch basins will be directed to another treatment or infiltration BMP prior to discharge.

Water Quality Inlet: Proprietary Water Quality Inlets (WQI) are being used at the entrance of the west driveway (WQI CBs) and before Underground Basin #2 and for driveway runoff not able to be treated by WQS or Bio-Basins.

Water Quality Swale: A water Quality Swale is proposed along the westerly main access. The 1,000+ linear feet swale has 3-foot bottom and is at a minimum of 12 inches deep. The swale will have check dams, underdrain, and the roadway runoff will be directed to the WQ swale via inlets and stone lined swale for pre-treatment.

Roof Infiltration System: Stormwater will be collected from roof areas (34,417 SF of the 74,001 SF of the roof will be collected) and infiltrated using 1 roof subsurface infiltration system and Underground Basin 3 at Crescent Street.

Bioretention Basins: Two Bioretention (BR) Basins are proposed. Each will collect runoff from paved areas. The water quality volume (0.5") from impervious area will be collected. The BR Basins will also provide recharge for the contributing impervious areas at BR#2 only. BR#1 does not have the needed two feet of separation from SHGW.

Underground Detention Basins

Three underground detention basins will mitigate increase rate of runoff from the increase in impervious. Only Underground Basin #3 includes recharge since SHGW is sufficiently low to maintain a 2-foot separation.

Surface Detention Basin: One surface detention basin will mitigate increase rate of runoff from the increase in impervious. No credit is be taken at these systems

SWM During Construction:	See **Attachment E.**

Stormwater Management Analysis

Methodology:	Nitsch Engineering completed a hydrologic analysis of the existing project site utilizing Soil Conservation Service (SCS) Runoff Curve Number (CN) methodology. **See Attachment I** for further information.
HydroCAD:	The HydroCAD computer program uses SCS and TR-20 methods to model the drainage systems. Nitsch Engineering utilizes HydroCAD in our design calculations. **See Attachments B and C** for further information.
Precipitation Data:	Nitsch Engineering, Inc. used Atlas 14 Volume 10 by the National Weather Service to estimate the rainfall for the 2-year, 10-year, 25-year and 100-year 24-hour storms. The rainfall values for the Site are as follows: **Strom Event** / **24 Hour Rainfall** 2-year: 3.31 10-year: 5.14 25-year: 6.28 100-year: 8.03 See **Attachment A** for more detailed precipitation information.
Existing Hydrological Design Points:	Design Point 1: Northern Wetlands Design Point 2: North Main Street Design Point 3: Crescent Street – Wetlands South of Crescent Street See **Figure DR-EX Existing Watershed Areas**.
Proposed Hydrological Design Points:	Design Point 1: Northern Wetlands Design Point 2: North Main Street Design Point 3: Crescent Street – Wetlands South of Crescent Street See **Figure DR-PR Proposed Watershed Areas**.

Peak Flow Rates:

Table 2: Preliminary Peak Rates of Runoff in Cubic Feet per Second (cfs)

	Storm Event	2-year	10-year	25-year	100-year
DP-1	Existing	0.10	1.91	4.05	8.28
	Proposed	0.08	1.57	3.39	7.11
DP-2	Existing	0.06	0.33	0.57	.99
	Proposed	0.06	0.33	0.57	.99
DP-3	Existing	4.28	18.61	30.81	52.08
	Proposed	2.16	16.40	27.21	48.56

See **Attachments B and C** for calculations.

Closed Drainage System:	The proposed closed drainage system consists of deep sump and hooded catch basins, drainage manholes, and proprietary water quality treatment units connected with corrugated polyethylene pipe. The closed drainage system was designed to convey the 25-year storm event using the Rational method. Refer to **Attachment D** for more information.
MASSDEP Stormwater Management Standards	
Standard 1	**No New Untreated Discharges:** The Project will not discharge any untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. Stormwater from the Site will be collected and treated in accordance with the MassDEP Stormwater Management Standards and stormwater outfalls will be stabilized to prevent erosion.
Standard 2	**Peak Rate Attenuation:** The proposed stormwater management system is designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. To prevent storm damage and downstream flooding, the proposed stormwater management practices will mitigate peak runoff rates for the 2-, 10-, 25- and 100-year, 24-hour storm events.
Standard 3	**Groundwater Recharge: The Site was designed using environmentally-sensitive site design, low impact development techniques, and stormwater BMP treatment trains to minimize the loss of annual recharge to groundwater. The annual recharge from the post-development site will approximate the annual recharge from pre-development conditions based on soil type using the guidelines provided in the MassDEP Stormwater Management Handbook. Infiltration systems are off-line and designed to capture the two-year storm for recharge. Infiltration systems have bypass manholes to allow for larger storms to pass. No mounding analysis is required.** A minimum 2 feet of separation has been maintained between the bottom of the infiltration system and seasonal high groundwater. Increase in Impervious Area in HSG A = 136,904 square feet (3.14 Acres) Rv (Recharge Volume) = 136,904 x 0.6 in. / (12 inches/ft) = 6,845 cubic feet The infiltration BMPs are sized to exceed the recharge volume required under the MassDEP Stormwater Management Standards. Table 3 –Impervious Areas to Infiltration Systems and Available Recharge Volumes

Infiltration BMP	Area (sf) of Impervious to System	Recharge Volume (cf)	Static Recharge Volume Available (cf)
Underground Basin #3	105,473	5,273	4,965
Roof Infiltration System #5	9,951	498	1,240
Bioretention Basin #2	36,094	1,804	2,621
Total	**151,518 (3.47 AC)**	**7,575**	**8,826**

All of the infiltration systems are off-line, and the inlet is lower than the overflow pipe in the Bypass Manhole. The overflow pipes in the Bypass Manholes are above the dead storage; therefore, storage will fill prior to the system overflowing.

Based on HydroCAD the 2-year storm will be diverted to the infiltrations exceeding the 0.6 inch recharge depth of the impervious area requirement for an A soils.

Table 4 –Infiltration Systems Elevations and Available Recharge Volumes

Infiltration BMP	Elevation of System	Overflow Elevation in Bypass MH	Volume Below Overflow
Underground Basin #3	Stone at 314.70 Chamber at 315.20	316.52	4,965
Underground Basin #5	Stone at 326.5 Chamber at 327.0	328.75	1,240
Bioretention Basin #2	Bottom at 314.0 Top at 315.0	315.15	2,621
Total			**8,826**

This is the static method approach where we are using the volume below the overflow and it is a conservative approach. To demonstrate how this approach is conservative, during the 1-year storm event the following volumes will be infiltration (from HydroCAD):

- UDB#3 calculated volume infiltrated is 6054 cubic feet
- UDB#5 calculated volume infiltrated is 1,916 cubic feet
- BR Basin #2 calculated volume infiltrated is 3,180 cubic feet

The proposed infiltration systems provide the required infiltration volume. The HydroCAD printouts provided in Appendix C indicate that all proposed infiltration BMPs will drain within 48 hours for the 2-year storm events, meeting the 72-hour MassDEP drawdown requirement. 72-hour draw down calculations have been provided in **Attachment A**.

Standard 4

Water Quality Treatment: The proposed stormwater management system will be designed to remove greater than 80% of the average annual post-construction load of Total Suspended Solids (TSS). Structural stormwater BMPs including deep sump and hooded catch basins, infiltration systems, water quality swales, and Stormceptor® water quality units (or equivalent) are sized to capture the required water quality volume (1 inch over the project site) and remove a minimum of 80% of total suspended solids. LID water quality has been maximized to the greatest extent practicable. See sketch of WQ Treatment Train in Attachment A.

TSS removal calculation spreadsheets and water quality structure sizing calculations are provided in **Attachment A**.

Source control and pollution prevention measures, such as vacuum cleaning, street sweeping, proper snow management, and stabilization of eroded surfaces, are included in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan (**Attachment E**).

Standard 5	**Water Quality Treatment - Land Uses with Higher Potential Pollutant Loads (LUHPPLs):** The project is considered a LUHPPL (>1000 trips per day) and therefore, water quality volume is based on 1-inch of runoff. Water Quality Treatment has been sized to treat the first inch of runoff and choice of gravel wetlands was based on the site being a LUHPPL. (This is based on number of students)
Standard 6	**Critical Areas:** The proposed work is not located within any critical areas. Therefore, this standard is not applicable.
Standard 7	**Redevelopments:** The Project is not considered a redevelopment under the MassDEP Stormwater Management Standards. The Project is a combination Redevelopment/New, to the greatest extent feasible, standards are being met.
Standard 8	**Construction Period Pollution Prevention and Sedimentation Control:** Because the Project will disturb more than one (1) acre of land, a Notice of Intent will be submitted to the Environmental Protection Agency (EPA) for coverage under the National Pollution Discharge Elimination System (NPDES) Construction General Permit. As part of this application the Applicant is required to prepare a Stormwater Pollution Prevention Plan (SWPPP) and implement the measures in the SWPPP. The SWPPP, which is to be kept on site, includes erosion and sediment controls (stabilization practices and structural practices), temporary and permanent stormwater management measures, Contractor inspection schedules and reporting of all SWPPP features, materials management, waste disposal, off-site vehicle tracking, spill prevention and response, sanitation, and non-stormwater discharges. A draft SWPPP is provided in **Attachment F**.
Standard 9	**Operation and Maintenance Plan:** A post-construction operation and maintenance plan has been prepared and will be implemented to ensure that stormwater management systems function as designed. Source control and stormwater BMP operation requirements for the Site are summarized in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan provided in **Attachment E**.
Standard 10	**Prohibition of Illicit Discharges:** There will be no illicit discharges to the stormwater management system associated with the Project. An Illicit Discharge Compliance Statement is provided in **Attachment A**.

Conclusion

In conclusion, the Project's stormwater management system will reduce or maintain peak runoff rates through the use of infiltration and detention basins and improve the water quality of stormwater being discharged from the Site. Environmentally sensitive site design and low-impact development techniques will be implemented throughout the Site. The Project is being designed to meet and exceed the MassDEP Stormwater Management Standards.

ATTACHMENT A

Stormwater Management Standards Documentation

Atlas 14 Volume 10 Precipitation Data for Site

MassDEP Checklist for Stormwater Report

Standard 3: 72-Hour Drawdown Recharge Calcs

Standard 4: TSS Removal Calculations and Sketch

Standard 10: Illicit Discharge Compliance Statement

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NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: MA

Data description

Data type: Precipitation depth **Units:** English **Time series type:** Partial duration

Select location

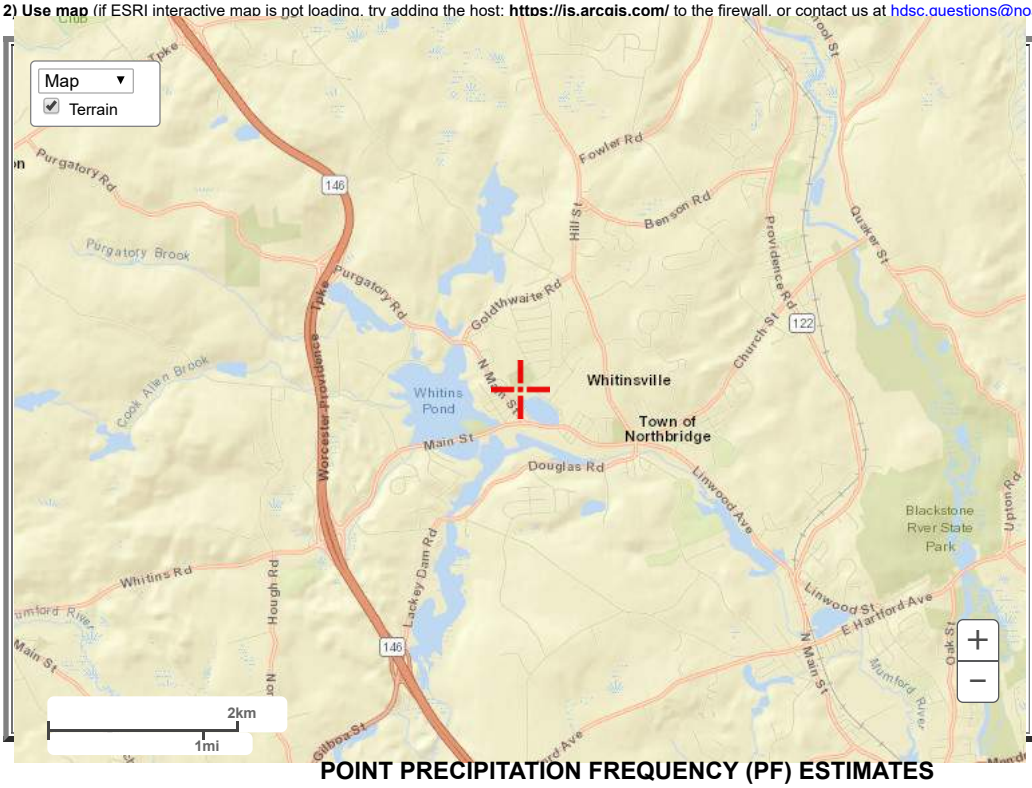
1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: Longitude: Submit

b) By station (list of MA stations): Select station

c) By address 21 Crescent St, Whitinsville, MA, 0158

2) Use map (if ESRI interactive map is not loading, try adding the host: **https://is.arcgis.com/** to the firewall, or contact us at hdsc.questions@noaa.gov):



a) Select location
Move crosshair or double click

b) Click on station icon
Show stations on map

Location information:
Name: Whitinsville, Massachusetts USA*
Latitude: 42.1155°
Longitude: -71.6797°
Elevation: 318.56 ft **

* Source: ESRI Maps
** Source: USGS

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 10, Version 2

PF tabular | PF graphical | Supplementary information | Print page

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.336** (0.266-0.417)	**0.400** (0.316-0.498)	**0.505** (0.398-0.631)	**0.593** (0.464-0.744)	**0.713** (0.538-0.936)	**0.805** (0.594-1.08)	**0.898** (0.641-1.25)	**1.01** (0.681-1.44)	**1.15** (0.747-1.71)	**1.26** (0.796-1.91)
10-min	**0.476** (0.377-0.591)	**0.567** (0.448-0.705)	**0.716** (0.564-0.894)	**0.839** (0.657-1.05)	**1.01** (0.763-1.33)	**1.14** (0.842-1.53)	**1.27** (0.908-1.77)	**1.43** (0.965-2.04)	**1.63** (1.06-2.42)	**1.78** (1.13-2.71)
15-min	**0.560** (0.443-0.695)	**0.667** (0.527-0.830)	**0.842** (0.664-1.05)	**0.988** (0.773-1.24)	**1.19** (0.897-1.56)	**1.34** (0.991-1.80)	**1.50** (1.07-2.08)	**1.68** (1.14-2.40)	**1.92** (1.25-2.85)	**2.10** (1.33-3.19)
30-min	**0.770** (0.610-0.957)	**0.918** (0.726-1.14)	**1.16** (0.914-1.45)	**1.36** (1.07-1.71)	**1.64** (1.24-2.15)	**1.85** (1.37-2.48)	**2.06** (1.47-2.87)	**2.31** (1.56-3.31)	**2.64** (1.72-3.93)	**2.89** (1.83-4.39)
60-min	**0.981** (0.777-1.22)	**1.17** (0.925-1.46)	**1.48** (1.16-1.85)	**1.73** (1.36-2.18)	**2.09** (1.58-2.74)	**2.36** (1.74-3.16)	**2.63** (1.88-3.66)	**2.94** (1.99-4.22)	**3.36** (2.18-5.00)	**3.68** (2.33-5.59)
2-hr	**1.27** (1.01-1.57)	**1.50** (1.20-1.86)	**1.89** (1.50-2.34)	**2.21** (1.74-2.76)	**2.65** (2.02-3.46)	**2.99** (2.22-4.00)	**3.33** (2.40-4.63)	**3.76** (2.55-5.35)	**4.33** (2.82-6.40)	**4.76** (3.02-7.18)
3-hr	**1.46** (1.17-1.80)	**1.74** (1.39-2.14)	**2.18** (1.74-2.70)	**2.55** (2.02-3.17)	**3.06** (2.34-3.99)	**3.45** (2.58-4.60)	**3.84** (2.78-5.34)	**4.36** (2.97-6.19)	**5.05** (3.30-7.44)	**5.57** (3.54-8.38)
6-hr	**1.85** (1.49-2.26)	**2.21** (1.78-2.70)	**2.79** (2.24-3.43)	**3.28** (2.61-4.05)	**3.94** (3.04-5.12)	**4.46** (3.36-5.93)	**4.97** (3.63-6.90)	**5.70** (3.89-8.04)	**6.66** (4.36-9.75)	**7.39** (4.71-11.0)
12-hr	**2.29**	**2.76**	**3.54**	**4.19**	**5.08**	**5.77**	**6.45**	**7.46**	**8.79**	**9.79**

	(1.85-2.78)	(2.24-3.36)	(2.86-4.32)	(3.36-5.14)	(3.94-6.56)	(4.37-7.64)	(4.75-8.93)	(5.11-10.5)	(5.77-12.8)	(6.27-14.5)
24-hr	**2.70** (2.21-3.26)	**3.31** (2.70-4.00)	**4.31** (3.50-5.22)	**5.14** (4.14-6.26)	**6.28** (4.90-8.07)	**7.16** (5.46-9.44)	**8.03** (5.96-11.1)	**9.37** (6.44-13.1)	**11.1** (7.33-16.1)	**12.5** (8.00-18.4)
2-day	**3.07** (2.53-3.68)	**3.81** (3.13-4.57)	**5.01** (4.09-6.03)	**6.00** (4.87-7.27)	**7.37** (5.79-9.43)	**8.43** (6.48-11.1)	**9.48** (7.09-13.0)	**11.1** (7.68-15.4)	**13.3** (8.79-19.1)	**15.0** (9.63-21.9)
3-day	**3.36** (2.77-4.01)	**4.15** (3.42-4.96)	**5.45** (4.47-6.53)	**6.52** (5.32-7.87)	**8.00** (6.31-10.2)	**9.14** (7.05-12.0)	**10.3** (7.71-14.1)	**12.1** (8.35-16.6)	**14.4** (9.53-20.6)	**16.2** (10.4-23.6)
4-day	**3.63** (3.00-4.31)	**4.46** (3.68-5.31)	**5.81** (4.79-6.95)	**6.94** (5.67-8.35)	**8.49** (6.70-10.8)	**9.69** (7.48-12.6)	**10.9** (8.16-14.8)	**12.7** (8.82-17.5)	**15.1** (10.0-21.6)	**17.0** (11.0-24.7)
7-day	**4.36** (3.63-5.16)	**5.26** (4.37-6.23)	**6.73** (5.57-8.00)	**7.95** (6.53-9.51)	**9.63** (7.63-12.1)	**10.9** (8.45-14.1)	**12.2** (9.15-16.5)	**14.1** (9.81-19.2)	**16.6** (11.0-23.5)	**18.4** (11.9-26.7)
10-day	**5.05** (4.22-5.96)	**5.99** (5.00-7.07)	**7.52** (6.24-8.91)	**8.78** (7.25-10.5)	**10.5** (8.36-13.2)	**11.9** (9.20-15.2)	**13.2** (9.89-17.6)	**15.1** (10.5-20.5)	**17.5** (11.7-24.7)	**19.3** (12.5-27.8)
20-day	**7.13** (6.00-8.36)	**8.11** (6.81-9.51)	**9.71** (8.12-11.4)	**11.0** (9.17-13.1)	**12.9** (10.3-15.9)	**14.3** (11.1-18.0)	**15.7** (11.7-20.5)	**17.3** (12.2-23.3)	**19.4** (13.0-27.2)	**21.0** (13.7-30.1)
30-day	**8.87** (7.49-10.3)	**9.87** (8.32-11.5)	**11.5** (9.66-13.5)	**12.9** (10.7-15.2)	**14.7** (11.8-18.0)	**16.2** (12.6-20.2)	**17.6** (13.1-22.7)	**19.0** (13.4-25.5)	**20.9** (14.1-29.1)	**22.3** (14.5-31.8)
45-day	**11.0** (9.37-12.8)	**12.1** (10.2-14.1)	**13.8** (11.6-16.1)	**15.2** (12.7-17.8)	**17.1** (13.7-20.8)	**18.6** (14.4-23.0)	**20.0** (14.9-25.6)	**21.3** (15.1-28.4)	**22.9** (15.5-31.7)	**24.1** (15.7-34.2)
60-day	**12.9** (11.0-14.9)	**13.9** (11.8-16.2)	**15.7** (13.3-18.3)	**17.1** (14.4-20.0)	**19.1** (15.3-23.1)	**20.6** (16.1-25.4)	**22.1** (16.4-28.1)	**23.2** (16.5-30.9)	**24.7** (16.7-34.1)	**25.8** (16.9-36.5)

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

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

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates ▼ Submit

Main Link Categories:
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Office of Water Prediction (OWP)
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Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Balmer School	Nitsch Project #: 12260
Location: Northbridge, MA	Checked by: **SAB**
Prepared by: JZ	Sheet No. 1 of **3**
Date: **April 14, 2019 Revised 5/23/2019**	**UNDERGROUND RECHARGE BASIN #3**

INSTRUCTIONS:
1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	*4965*	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	*3987*		
	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate	Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate	
4a		*2.41*	1.205	
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Loamy Sand	A	2.41	**Hours**
			$Time_{drawdown}$ =	6.20
	72-Hour Drawdown Requirement Check:			***OK***

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Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Balmer School	Nitsch Project #: 12260
Location: Northbridge, MA	Checked by: **SAB**
Prepared by: JZ	Sheet No. 2 of **3**
Date: **April 14, 2019 REVISED 5/23/2019**	**BIORETENTION BASIN #2**

INSTRUCTIONS:
1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step No.				
1	Method:	Static		
2	Required Recharge Volume (in cubic feet):	*2621*	as determined by the	Static Method
3	Bottom Area (in Sq.Ft.)	*2909*		

Step No.		Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate
4a	ONLY - If using Dynamic: In-Situ Method --> Enter Hydraulic Conductivity Rate	*2.41*	1.205

Step No.	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Loamy Sand	A	2.41	**Hours**

$Time_{drawdown}$ = 4.49

72-Hour Drawdown Requirement Check: ***OK***

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Form S3-G: Standard 3 – Recharge
72-Hour Drawdown Calculation

Project Name: Balmer School	Nitsch Project #: 12260
Location: Northbridge, MA	Checked by: **SAB**
Prepared by: JZ	Sheet No. 2 of **3**
Date: **April 14, 2019 Revised 5/23/19**	**Underground Detention Basin #5 (for Roof)**

INSTRUCTIONS:
1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. **For "Dynamic: In-Situ Method" ONLY** (if other go to 4b) Enter hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

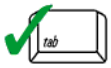
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)	
4b	Loamy Sand	A	2.41	**Hours**
			$Time_{drawdown}$ =	6.31
	72-Hour Drawdown Requirement Check:			***OK***

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.

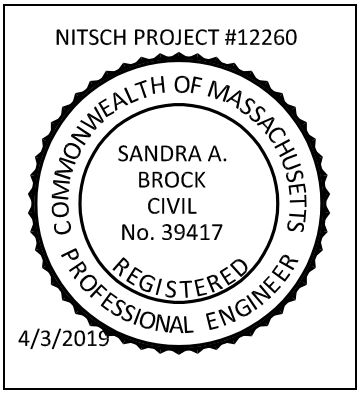
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



April 3, 2019

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

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

☒ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☒ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

ATTACHMENT A

Nitsch Engineering

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W. Edward Balmer Elementary School
WATER QUALITY TREATMENT SUMMARY (04/14/2019)

Nitsch Engineering has prepared this Water Quality Treatment Summary for the proposed Williams Inn. In compliance with MassDEP Stormwater Management Standard #4, the proposed stormwater management system is designed to remove at least 80% of the average annual post-construction load of TSS prior to discharge. The stormwater management system is designed to remove at least 44% of the average annual post-construction TSS load prior to discharge to the infiltration systems because the infiltration systems are located within areas where soils with rapid infiltration rates were observed.

A summary of treatment trains proposed to provide water quantity control and water quality improvement at the proposed project site is provided below.

Treatment Train A – Proprietary WQ Inlet
Catchment Areas: P1-2 (102S), P1-3 (103S), P3-3 (303S)
Deep Sump & Hooded Catch Basin → Water Quality Structure → Discharge

Treatment Train B- WQ Swale
Catchment Areas: P3-1 (301S)
Deep Sump & Hooded Catch Basin → Water Quality Structure → Discharge

Treatment Train C – Bioretention Basin
Catchment Areas: P3-2 (302S), P3-4 (304S)
Bioswale → Subsurface Infiltration System → Discharge

Williams Inn
Williamstown, MA
July 13, 2017

Nitsch Project No. 11709

Treatment Train A:
Rain Garden → Water Quality Structure → Discharge

Treatment Spreadsheet

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (C*D)	Remaining Load (D-E)
Rain Garden (With Stone Strip Pretreatment)	**0.90**	**1.00**	**0.90**	**0.10**

Total TSS Removal = **90%** **Meets 80% TSS removal requirement**

Williams Inn
Williamstown, MA
July 13, 2017

Nitsch Project No. 11709

Treatment Train B:
Deep Sump & Hooded Catch Basin → Water Quality Structure → Discharge

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump & Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**

Total TSS Removal = **25%**

Treatment Spreadsheet

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (C*D)	Remaining Load (D-E)
Water Quality Structure	**0.80**	**0.75**	**0.60**	**0.15**

Total TSS Removal = **85%** **Meets 80% TSS removal requirement**

Williams Inn
Williamstown, MA
July 13, 2017

Nitsch Project No. 11709

Treatment Train C:
Subsurface Infiltration System → Discharge

Treatment Spreadsheet

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (C*D)	Remaining Load (D-E)
Water Quality Swale (with Stone Strip Pre-Treatment and check dams)	**0.70**	**1.00**	**.70**	**.30**
Infiltration System (Basin #3)	**.80**	**.30**	**.24**	**.06**

Total TSS Removal = **94%**

Meets 80% TSS removal requirement

Nitsch Engineering

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www.nitscheng.com

STANDARD 10: Illicit Discharge Compliance Statement

Project Name: W. Edward Balmer Elementary School	Nitsch Project #: 12260
Location: Northbridge, MA	Checked by: SAB
Prepared by: JCZ	Sheet No. 1 of 1
Date: April 3, 2019	

Standard 10 states: All illicit discharges to the stormwater management system are prohibited.

This is to verify:

1. Based on the information available there are no known or suspected illicit discharges to the stormwater management system at the proposed W. Edward Balmer Elementary School site as defined in the MassDEP Stormwater Handbook.

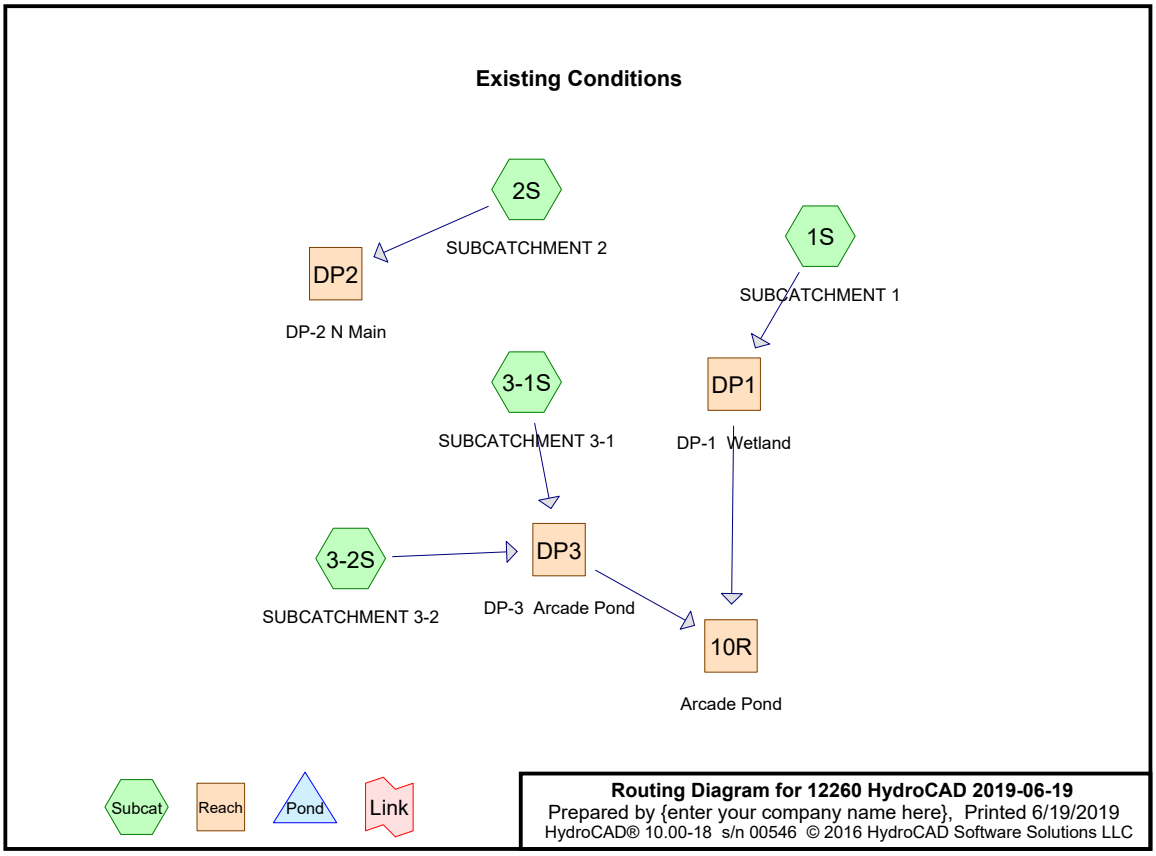
2. The design of the stormwater system includes no proposed illicit discharges.

Sandra Brock, PE

April 14, 2019
Date

ATTACHMENT B

Pre-Development Conditions – HydroCAD Calculations



Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
7.724	39	>75% Grass cover, Good, HSG A (1S, 3-1S, 3-2S)
0.106	61	>75% Grass cover, Good, HSG B (2S)
0.291	74	>75% Grass cover, Good, HSG C (1S, 3-1S)
4.062	98	Paved parking, HSG A (3-1S)
3.655	30	Woods, Good, HSG A (1S, 3-1S, 3-2S)
1.629	55	Woods, Good, HSG B (1S, 2S)
5.367	70	Woods, Good, HSG C (1S, 3-1S)
0.128	77	Woods, Good, HSG D (3-2S)
22.961	**57**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
15.440	HSG A	1S, 3-1S, 3-2S
1.735	HSG B	1S, 2S
5.658	HSG C	1S, 3-1S
0.128	HSG D	3-2S
0.000	Other	
22.961		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
7.724	0.106	0.291	0.000	0.000	8.120	>75% Grass cover, Good	1S, 2S, 3-1S, 3-2S
4.062	0.000	0.000	0.000	0.000	4.062	Paved parking	3-1S
3.655	1.629	5.367	0.128	0.000	10.778	Woods, Good	1S, 2S, 3-1S, 3-2S
15.440	**1.735**	**5.658**	**0.128**	**0.000**	**22.961**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: SUBCATCHMENT1 Runoff Area=233,154 sf 0.00% Impervious Runoff Depth>0.10"
Flow Length=525' Tc=19.5 min CN=49 Runoff=0.10 cfs 0.045 af

Subcatchment2S: SUBCATCHMENT2 Runoff Area=18,522 sf 0.00% Impervious Runoff Depth>0.27"
Flow Length=222' Tc=17.3 min CN=56 Runoff=0.06 cfs 0.009 af

Subcatchment3-1S: SUBCATCHMENT3-1 Runoff Area=711,452 sf 24.87% Impervious Runoff Depth>0.43"
Flow Length=1,370' Tc=20.7 min CN=61 Runoff=4.26 cfs 0.579 af

Subcatchment3-2S: SUBCATCHMENT3-2 Runoff Area=37,052 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=38 Runoff=0.00 cfs 0.000 af

Reach 10R: Arcade Pond Inflow=4.28 cfs 0.624 af
Outflow=4.28 cfs 0.624 af

Reach DP1: DP-1 Wetland Inflow=0.10 cfs 0.045 af
Outflow=0.10 cfs 0.045 af

Reach DP2: DP-2 N Main Inflow=0.06 cfs 0.009 af
Outflow=0.06 cfs 0.009 af

Reach DP3: DP-3 Arcade Pond Inflow=4.26 cfs 0.579 af
Outflow=4.26 cfs 0.579 af

Total Runoff Area = 22.961 ac Runoff Volume = 0.633 af Average Runoff Depth = 0.33"
82.31% Pervious = 18.899 ac 17.69% Impervious = 4.062 ac

Summary for Subcatchment 1S: SUBCATCHMENT 1

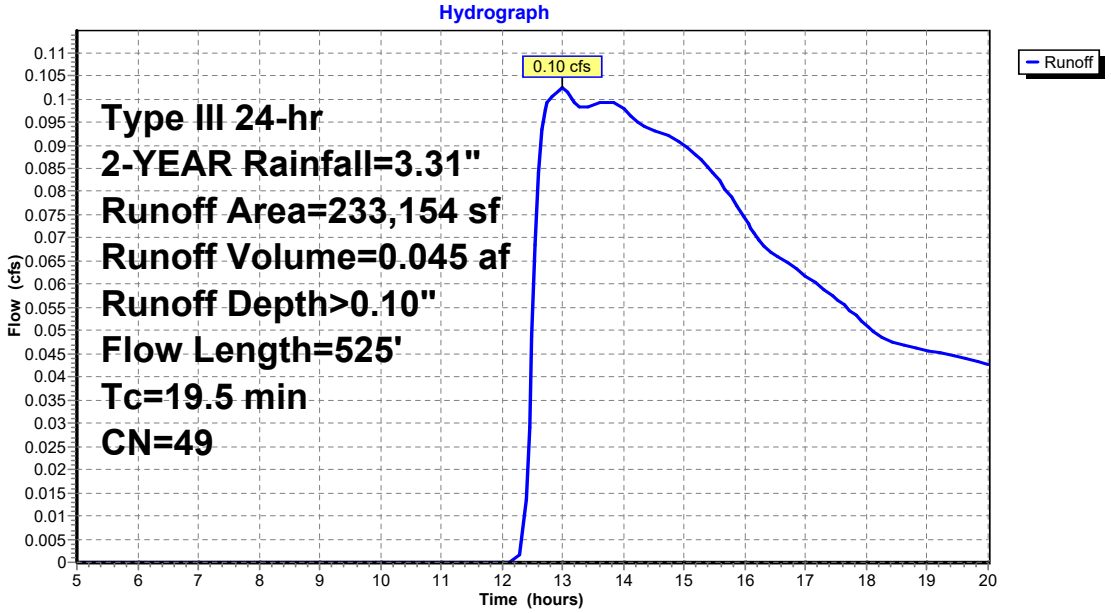
Runoff = 0.10 cfs @ 13.00 hrs, Volume= 0.045 af, Depth> 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
45,369	39	>75% Grass cover, Good, HSG A
66,266	30	Woods, Good, HSG A
0	32	Woods/grass comb., Good, HSG A
0	61	>75% Grass cover, Good, HSG B
57,049	55	Woods, Good, HSG B
0	58	Woods/grass comb., Good, HSG B
6,050	74	>75% Grass cover, Good, HSG C
58,420	70	Woods, Good, HSG C
0	72	Woods/grass comb., Good, HSG C
233,154	49	Weighted Average
233,154		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0400	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Dense underbrush n= 0.800 P2= 3.20"
3.2	475	0.0240	2.49		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
19.5	525	Total			

Subcatchment 1S: SUBCATCHMENT 1



Summary for Subcatchment 2S: SUBCATCHMENT 2

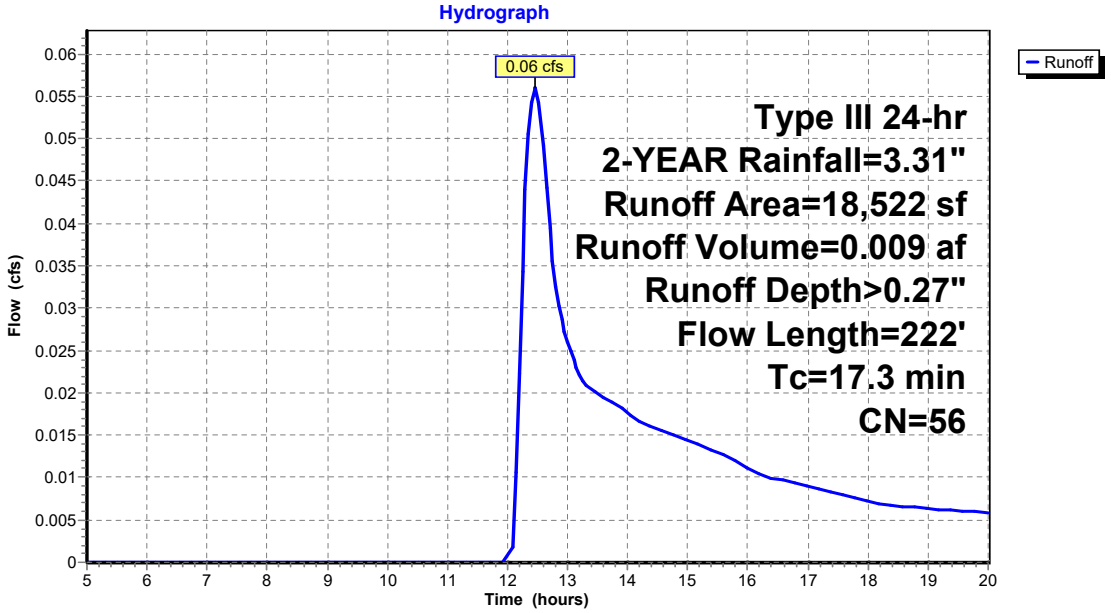
Runoff = 0.06 cfs @ 12.46 hrs, Volume= 0.009 af, Depth> 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,602	61	>75% Grass cover, Good, HSG B
13,920	55	Woods, Good, HSG B
0	74	>75% Grass cover, Good, HSG C
0	70	Woods, Good, HSG C
18,522	56	Weighted Average
18,522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	172	0.0340	2.97		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
17.3	222	Total			

Subcatchment 2S: SUBCATCHMENT 2



Summary for Subcatchment 3-1S: SUBCATCHMENT 3-1

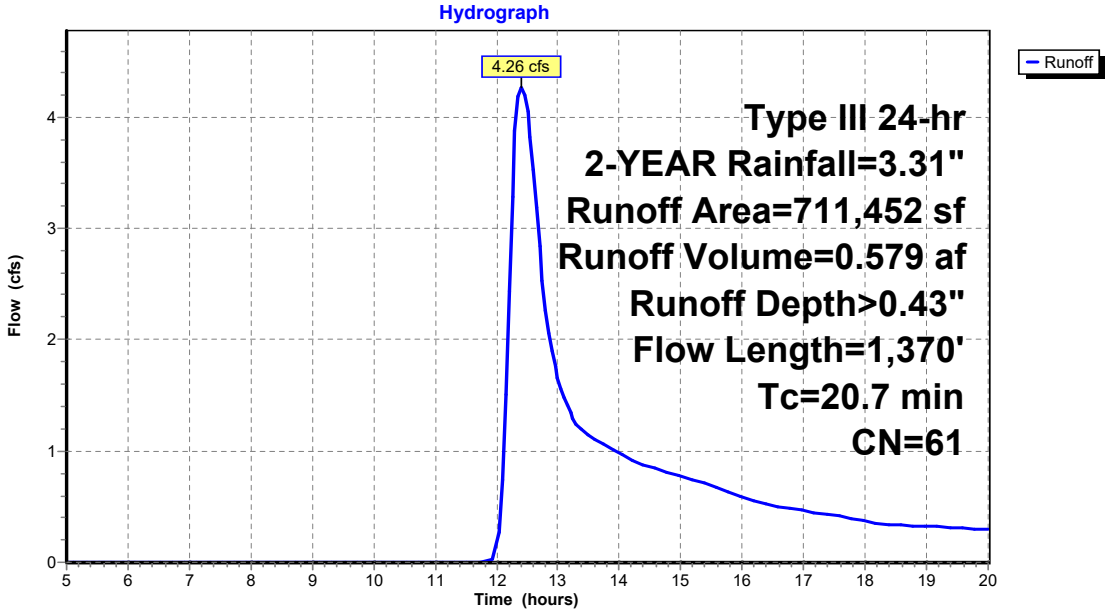
Runoff = 4.26 cfs @ 12.40 hrs, Volume= 0.579 af, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
286,060	39	>75% Grass cover, Good, HSG A
66,452	30	Woods, Good, HSG A
176,953	98	Paved parking, HSG A
0	61	>75% Grass cover, Good, HSG B
0	55	Woods, Good, HSG B
0	98	Paved parking, HSG B
6,637	74	>75% Grass cover, Good, HSG C
175,350	70	Woods, Good, HSG C
0	98	Paved parking, HSG C
711,452	61	Weighted Average
534,499		75.13% Pervious Area
176,953		24.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0220	0.07		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
4.9	752	0.0250	2.55		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
3.9	568	0.0230	2.44		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
20.7	1,370	Total			

Subcatchment 3-1S: SUBCATCHMENT 3-1



Summary for Subcatchment 3-2S: SUBCATCHMENT 3-2

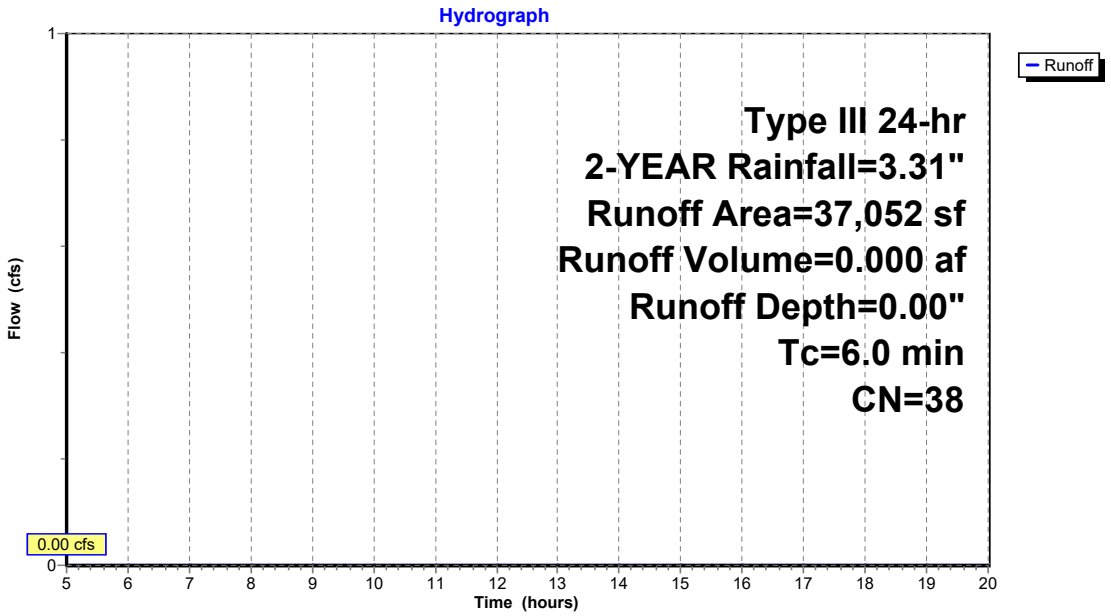
Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
5,009	39	>75% Grass cover, Good, HSG A
26,479	30	Woods, Good, HSG A
5,564	77	Woods, Good, HSG D
37,052	38	Weighted Average
37,052		100.00% Pervious Area

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

Subcatchment 3-2S: SUBCATCHMENT 3-2

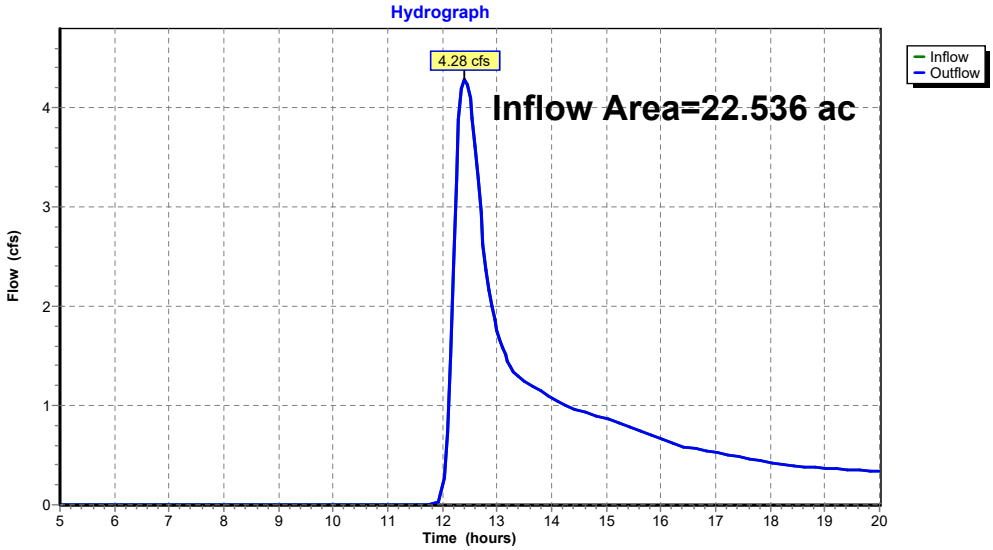


Summary for Reach 10R: Arcade Pond

Inflow Area = 22.536 ac, 18.03% Impervious, Inflow Depth > 0.33" for 2-YEAR event
Inflow = 4.28 cfs @ 12.41 hrs, Volume= 0.624 af
Outflow = 4.28 cfs @ 12.41 hrs, Volume= 0.624 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 10R: Arcade Pond

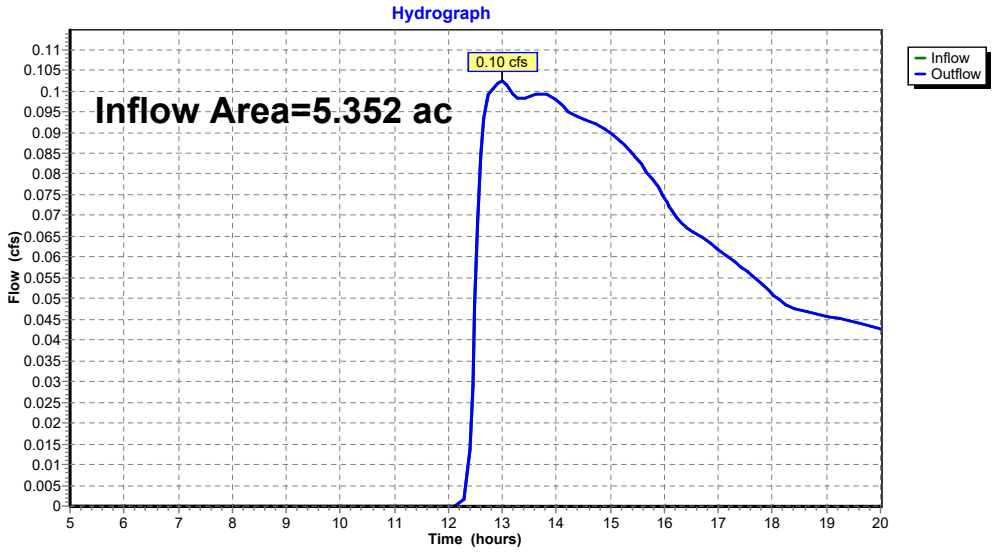


Summary for Reach DP1: DP-1 Wetland

Inflow Area = 5.352 ac, 0.00% Impervious, Inflow Depth > 0.10" for 2-YEAR event
Inflow = 0.10 cfs @ 13.00 hrs, Volume= 0.045 af
Outflow = 0.10 cfs @ 13.00 hrs, Volume= 0.045 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP1: DP-1 Wetland

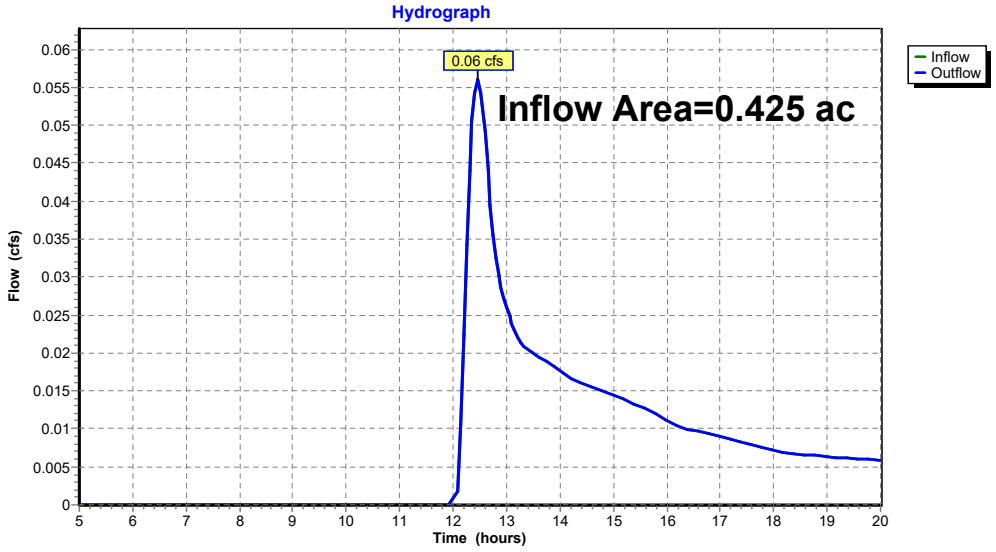


Summary for Reach DP2: DP-2 N Main

Inflow Area = 0.425 ac, 0.00% Impervious, Inflow Depth > 0.27" for 2-YEAR event
Inflow = 0.06 cfs @ 12.46 hrs, Volume= 0.009 af
Outflow = 0.06 cfs @ 12.46 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP2: DP-2 N Main

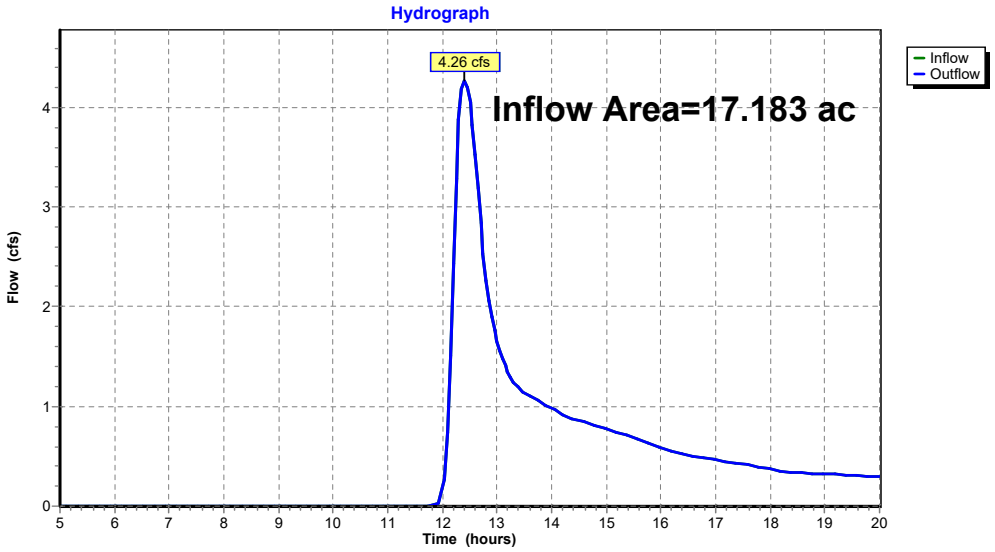


Summary for Reach DP3: DP-3 Arcade Pond

Inflow Area = 17.183 ac, 23.64% Impervious, Inflow Depth > 0.40" for 2-YEAR event
Inflow = 4.26 cfs @ 12.40 hrs, Volume= 0.579 af
Outflow = 4.26 cfs @ 12.40 hrs, Volume= 0.579 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP3: DP-3 Arcade Pond



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: SUBCATCHMENT1 Runoff Area=233,154 sf 0.00% Impervious Runoff Depth>0.60"
Flow Length=525' Tc=19.5 min CN=49 Runoff=1.91 cfs 0.268 af

Subcatchment2S: SUBCATCHMENT2 Runoff Area=18,522 sf 0.00% Impervious Runoff Depth>0.99"
Flow Length=222' Tc=17.3 min CN=56 Runoff=0.33 cfs 0.035 af

Subcatchment3-1S: SUBCATCHMENT3-1 Runoff Area=711,452 sf 24.87% Impervious Runoff Depth>1.31"
Flow Length=1,370' Tc=20.7 min CN=61 Runoff=16.83 cfs 1.781 af

Subcatchment3-2S: SUBCATCHMENT3-2 Runoff Area=37,052 sf 0.00% Impervious Runoff Depth>0.15"
Tc=6.0 min CN=38 Runoff=0.03 cfs 0.011 af

Reach 10R: Arcade Pond Inflow=18.61 cfs 2.060 af
Outflow=18.61 cfs 2.060 af

Reach DP1: DP-1 Wetland Inflow=1.91 cfs 0.268 af
Outflow=1.91 cfs 0.268 af

Reach DP2: DP-2 N Main Inflow=0.33 cfs 0.035 af
Outflow=0.33 cfs 0.035 af

Reach DP3: DP-3 Arcade Pond Inflow=16.84 cfs 1.792 af
Outflow=16.84 cfs 1.792 af

Total Runoff Area = 22.961 ac Runoff Volume = 2.095 af Average Runoff Depth = 1.09"
82.31% Pervious = 18.899 ac 17.69% Impervious = 4.062 ac

Summary for Subcatchment 1S: SUBCATCHMENT 1

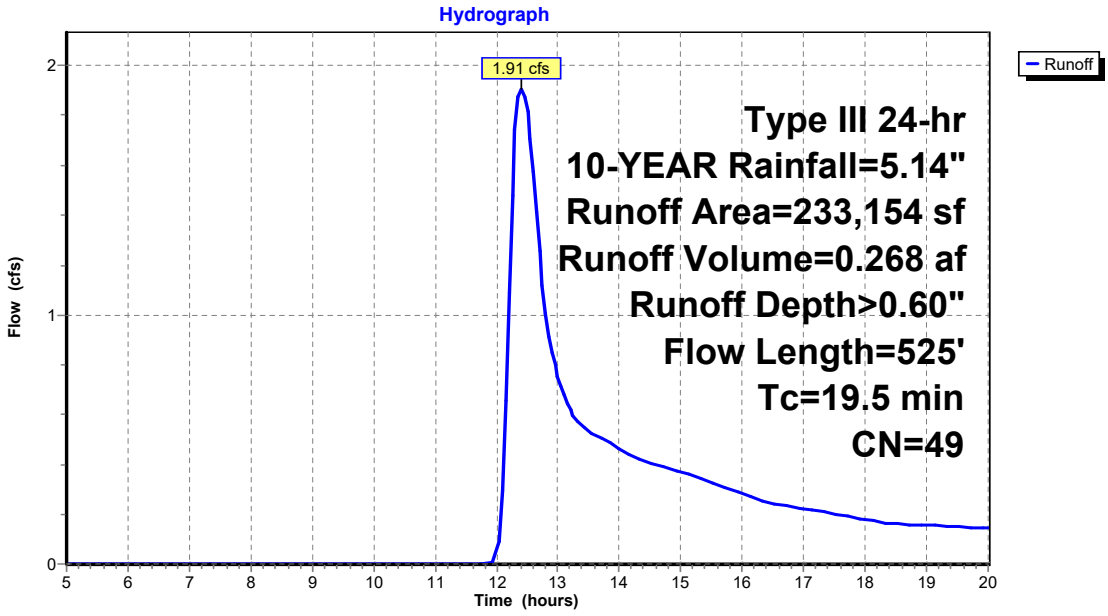
Runoff = 1.91 cfs @ 12.40 hrs, Volume= 0.268 af, Depth> 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
45,369	39	>75% Grass cover, Good, HSG A
66,266	30	Woods, Good, HSG A
0	32	Woods/grass comb., Good, HSG A
0	61	>75% Grass cover, Good, HSG B
57,049	55	Woods, Good, HSG B
0	58	Woods/grass comb., Good, HSG B
6,050	74	>75% Grass cover, Good, HSG C
58,420	70	Woods, Good, HSG C
0	72	Woods/grass comb., Good, HSG C
233,154	49	Weighted Average
233,154		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0400	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Dense underbrush n= 0.800 P2= 3.20"
3.2	475	0.0240	2.49		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
19.5	525	Total			

Subcatchment 1S: SUBCATCHMENT 1



Summary for Subcatchment 2S: SUBCATCHMENT 2

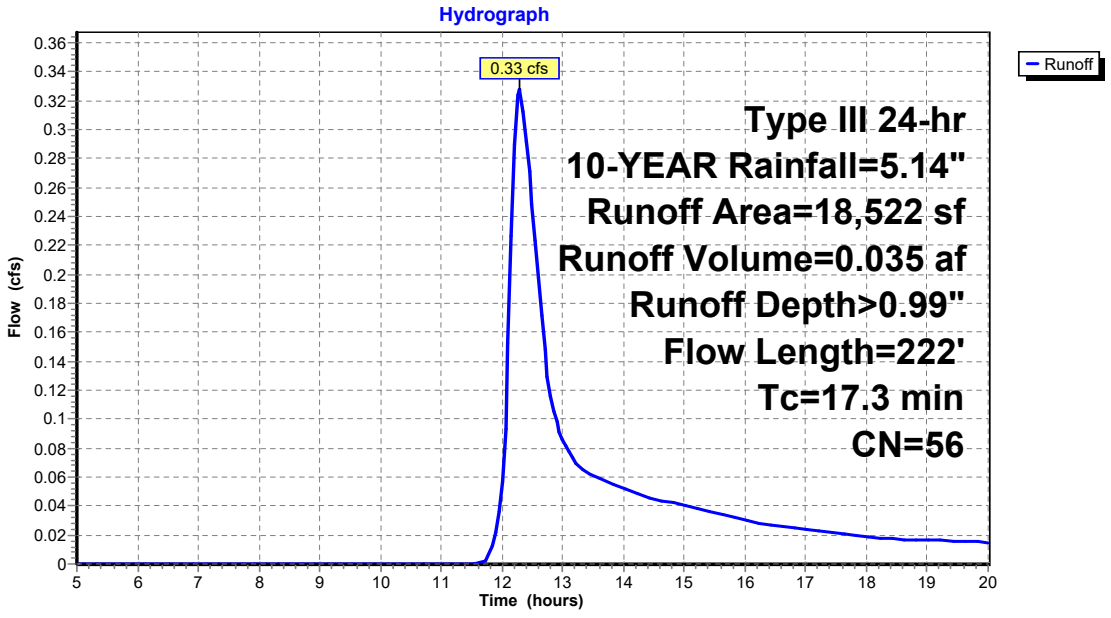
Runoff = 0.33 cfs @ 12.28 hrs, Volume= 0.035 af, Depth> 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,602	61	>75% Grass cover, Good, HSG B
13,920	55	Woods, Good, HSG B
0	74	>75% Grass cover, Good, HSG C
0	70	Woods, Good, HSG C
18,522	56	Weighted Average
18,522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	172	0.0340	2.97		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
17.3	222	Total			

Subcatchment 2S: SUBCATCHMENT 2



Summary for Subcatchment 3-1S: SUBCATCHMENT 3-1

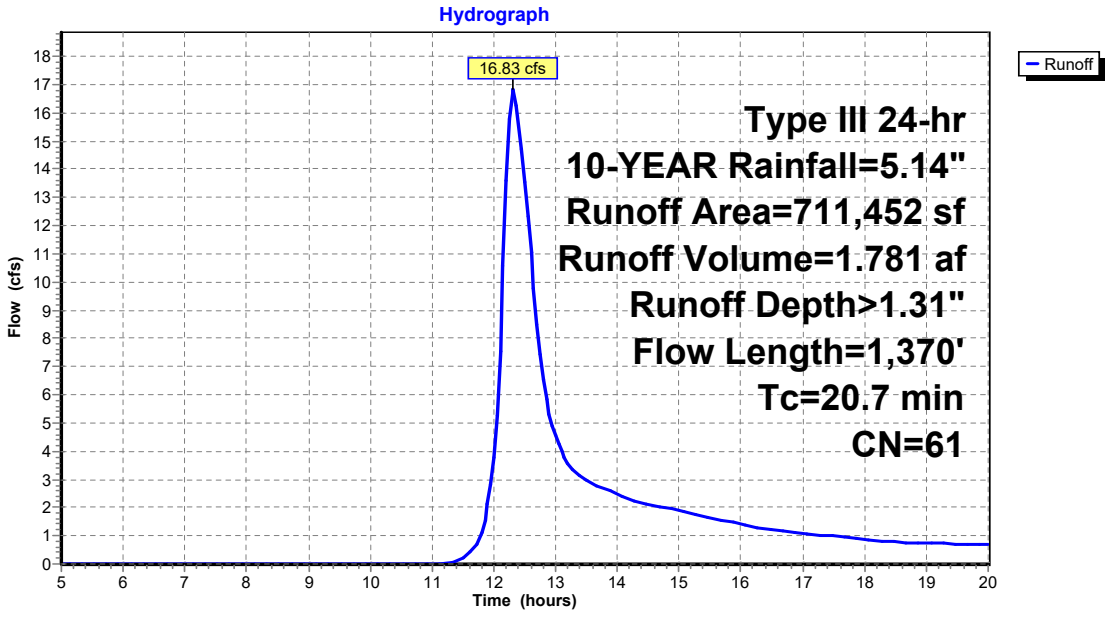
Runoff = 16.83 cfs @ 12.32 hrs, Volume= 1.781 af, Depth> 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
286,060	39	>75% Grass cover, Good, HSG A
66,452	30	Woods, Good, HSG A
176,953	98	Paved parking, HSG A
0	61	>75% Grass cover, Good, HSG B
0	55	Woods, Good, HSG B
0	98	Paved parking, HSG B
6,637	74	>75% Grass cover, Good, HSG C
175,350	70	Woods, Good, HSG C
0	98	Paved parking, HSG C
711,452	61	Weighted Average
534,499		75.13% Pervious Area
176,953		24.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0220	0.07		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
4.9	752	0.0250	2.55		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
3.9	568	0.0230	2.44		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
20.7	1,370	Total			

Subcatchment 3-1S: SUBCATCHMENT 3-1



Summary for Subcatchment 3-2S: SUBCATCHMENT 3-2

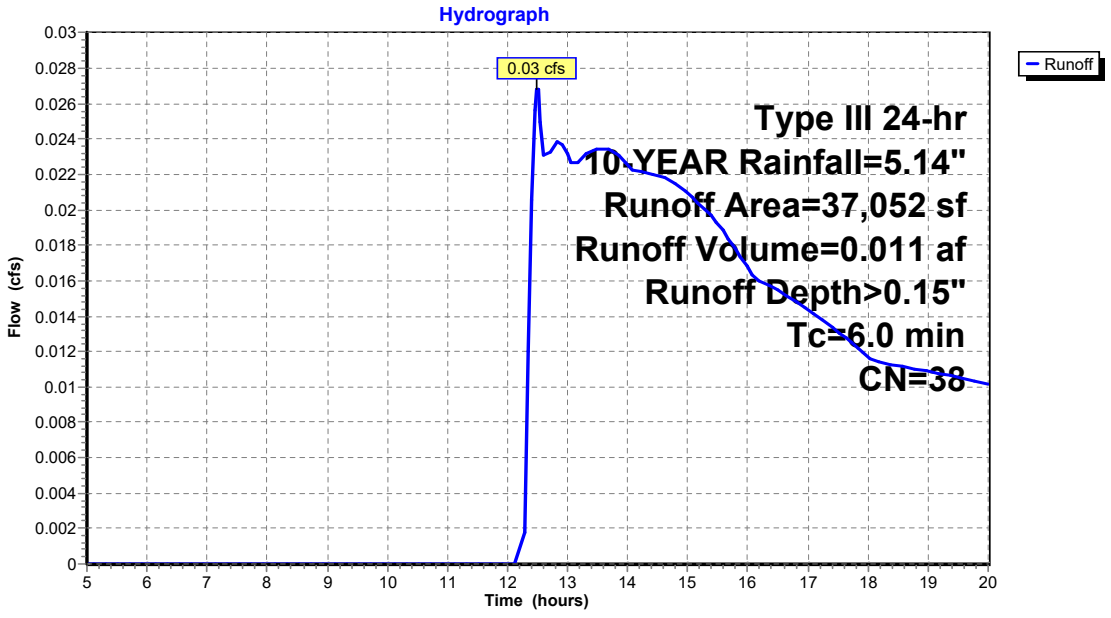
Runoff = 0.03 cfs @ 12.49 hrs, Volume= 0.011 af, Depth> 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
5,009	39	>75% Grass cover, Good, HSG A
26,479	30	Woods, Good, HSG A
5,564	77	Woods, Good, HSG D
37,052	38	Weighted Average
37,052		100.00% Pervious Area

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

Subcatchment 3-2S: SUBCATCHMENT 3-2

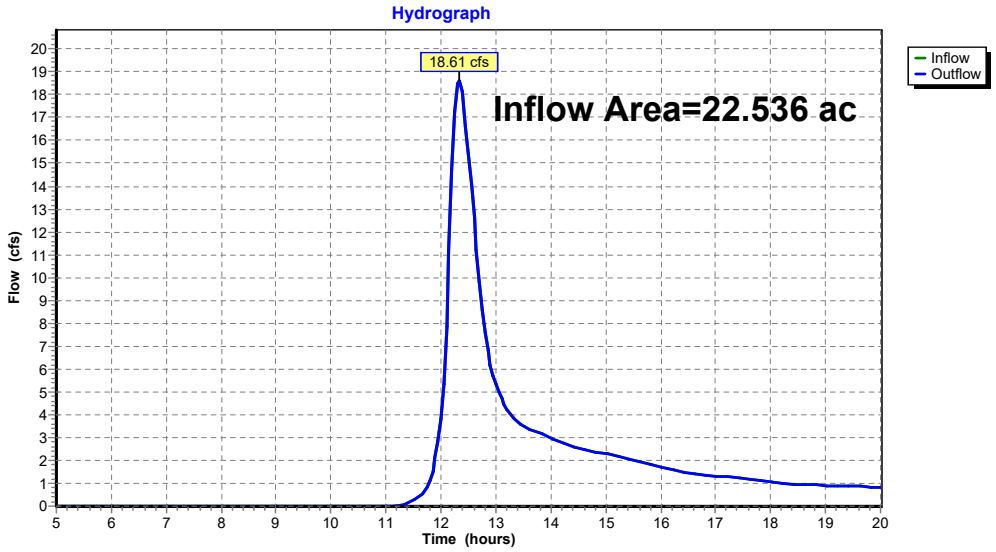


Summary for Reach 10R: Arcade Pond

Inflow Area = 22.536 ac, 18.03% Impervious, Inflow Depth > 1.10" for 10-YEAR event
Inflow = 18.61 cfs @ 12.33 hrs, Volume= 2.060 af
Outflow = 18.61 cfs @ 12.33 hrs, Volume= 2.060 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 10R: Arcade Pond

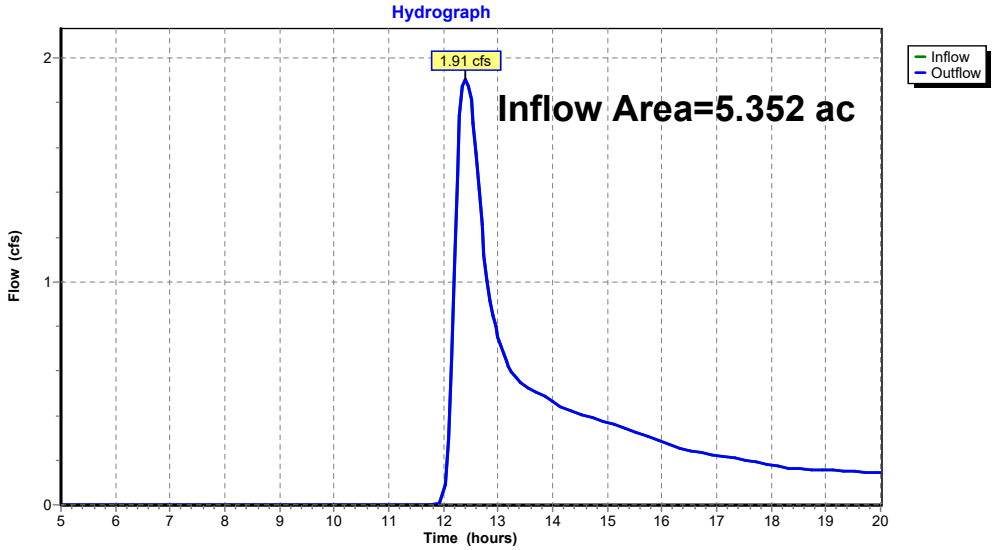


Summary for Reach DP1: DP-1 Wetland

Inflow Area = 5.352 ac, 0.00% Impervious, Inflow Depth > 0.60" for 10-YEAR event
Inflow = 1.91 cfs @ 12.40 hrs, Volume= 0.268 af
Outflow = 1.91 cfs @ 12.40 hrs, Volume= 0.268 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP1: DP-1 Wetland

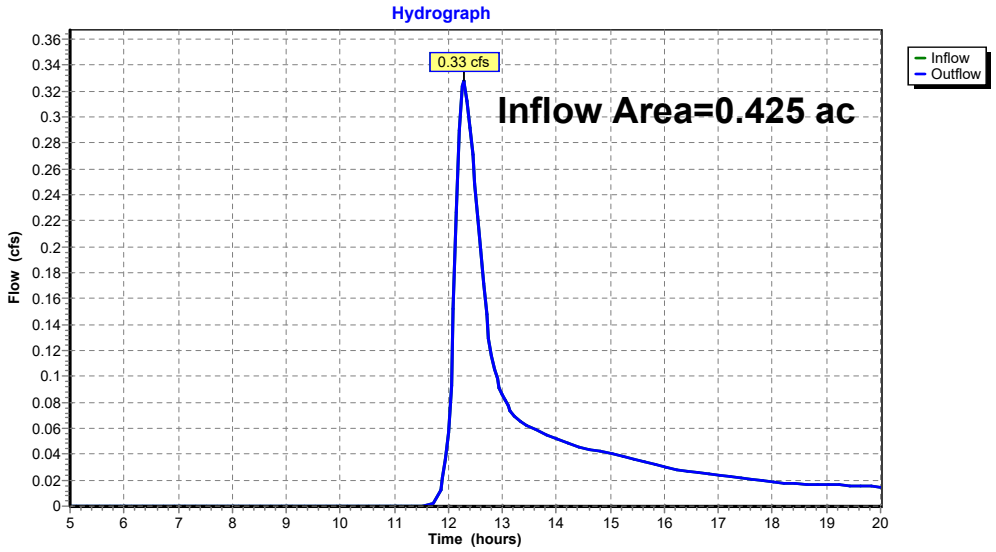


Summary for Reach DP2: DP-2 N Main

Inflow Area = 0.425 ac, 0.00% Impervious, Inflow Depth > 0.99" for 10-YEAR event
Inflow = 0.33 cfs @ 12.28 hrs, Volume= 0.035 af
Outflow = 0.33 cfs @ 12.28 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP2: DP-2 N Main

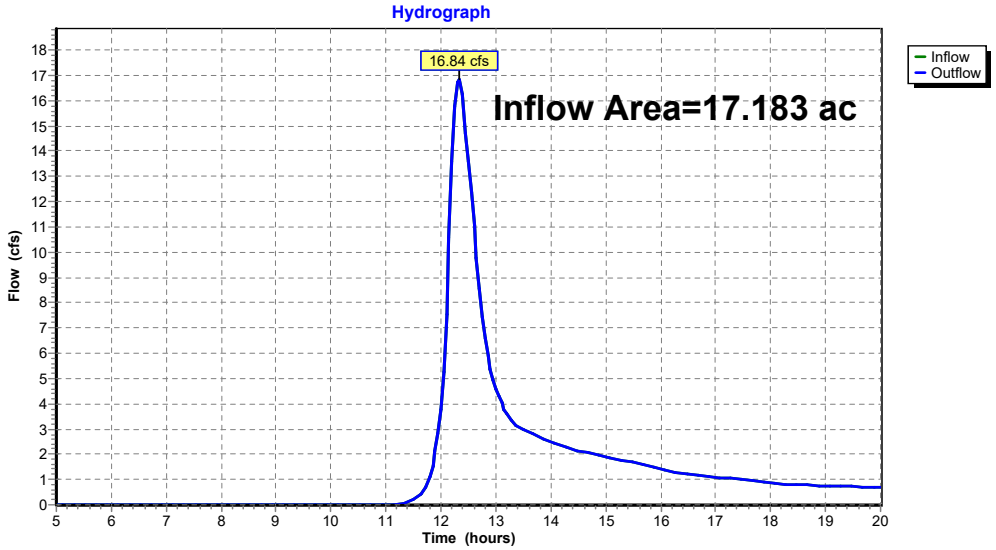


Summary for Reach DP3: DP-3 Arcade Pond

Inflow Area = 17.183 ac, 23.64% Impervious, Inflow Depth > 1.25" for 10-YEAR event
Inflow = 16.84 cfs @ 12.32 hrs, Volume= 1.792 af
Outflow = 16.84 cfs @ 12.32 hrs, Volume= 1.792 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP3: DP-3 Arcade Pond



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: SUBCATCHMENT1 Runoff Area=233,154 sf 0.00% Impervious Runoff Depth>1.07"
Flow Length=525' Tc=19.5 min CN=49 Runoff=4.05 cfs 0.475 af

Subcatchment2S: SUBCATCHMENT2 Runoff Area=18,522 sf 0.00% Impervious Runoff Depth>1.59"
Flow Length=222' Tc=17.3 min CN=56 Runoff=0.57 cfs 0.056 af

Subcatchment3-1S: SUBCATCHMENT3-1 Runoff Area=711,452 sf 24.87% Impervious Runoff Depth>2.00"
Flow Length=1,370' Tc=20.7 min CN=61 Runoff=26.62 cfs 2.716 af

Subcatchment3-2S: SUBCATCHMENT3-2 Runoff Area=37,052 sf 0.00% Impervious Runoff Depth>0.39"
Tc=6.0 min CN=38 Runoff=0.16 cfs 0.028 af

Reach 10R: Arcade Pond Inflow=30.81 cfs 3.220 af
Outflow=30.81 cfs 3.220 af

Reach DP1: DP-1 Wetland Inflow=4.05 cfs 0.475 af
Outflow=4.05 cfs 0.475 af

Reach DP2: DP-2 N Main Inflow=0.57 cfs 0.056 af
Outflow=0.57 cfs 0.056 af

Reach DP3: DP-3 Arcade Pond Inflow=26.78 cfs 2.744 af
Outflow=26.78 cfs 2.744 af

Total Runoff Area = 22.961 ac Runoff Volume = 3.276 af Average Runoff Depth = 1.71"
82.31% Pervious = 18.899 ac 17.69% Impervious = 4.062 ac

Summary for Subcatchment 1S: SUBCATCHMENT 1

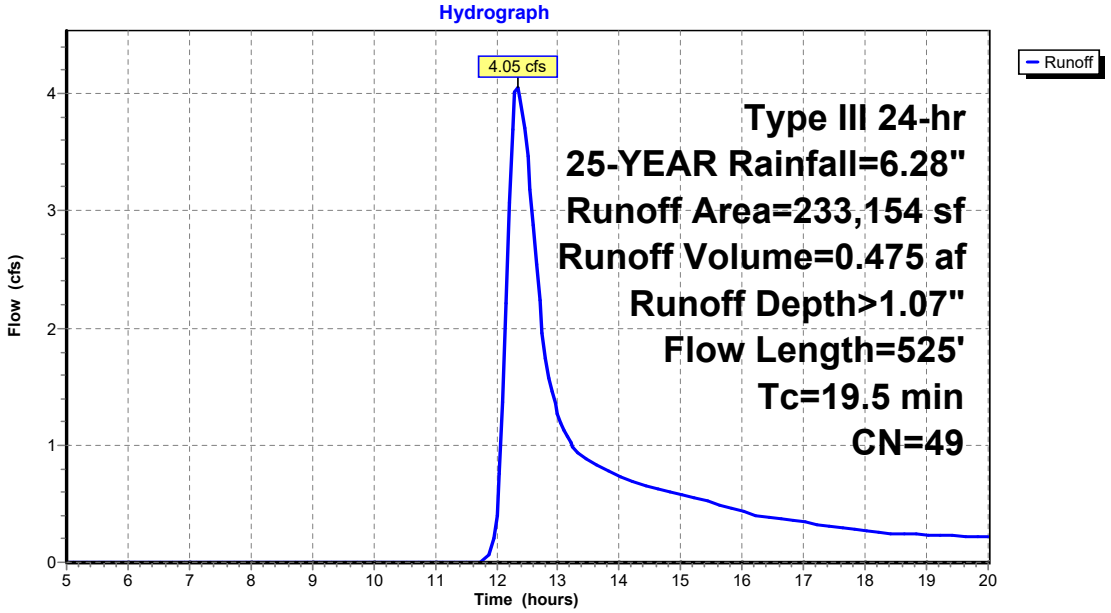
Runoff = 4.05 cfs @ 12.34 hrs, Volume= 0.475 af, Depth> 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
45,369	39	>75% Grass cover, Good, HSG A
66,266	30	Woods, Good, HSG A
0	32	Woods/grass comb., Good, HSG A
0	61	>75% Grass cover, Good, HSG B
57,049	55	Woods, Good, HSG B
0	58	Woods/grass comb., Good, HSG B
6,050	74	>75% Grass cover, Good, HSG C
58,420	70	Woods, Good, HSG C
0	72	Woods/grass comb., Good, HSG C
233,154	49	Weighted Average
233,154		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0400	0.05		**Sheet Flow, Sheet Flow 50 Ft**
					Woods: Dense underbrush n= 0.800 P2= 3.20"
3.2	475	0.0240	2.49		**Shallow Concentrated Flow, Shallow Flow**
					Unpaved Kv= 16.1 fps
19.5	525	Total			

Subcatchment 1S: SUBCATCHMENT 1



Summary for Subcatchment 2S: SUBCATCHMENT 2

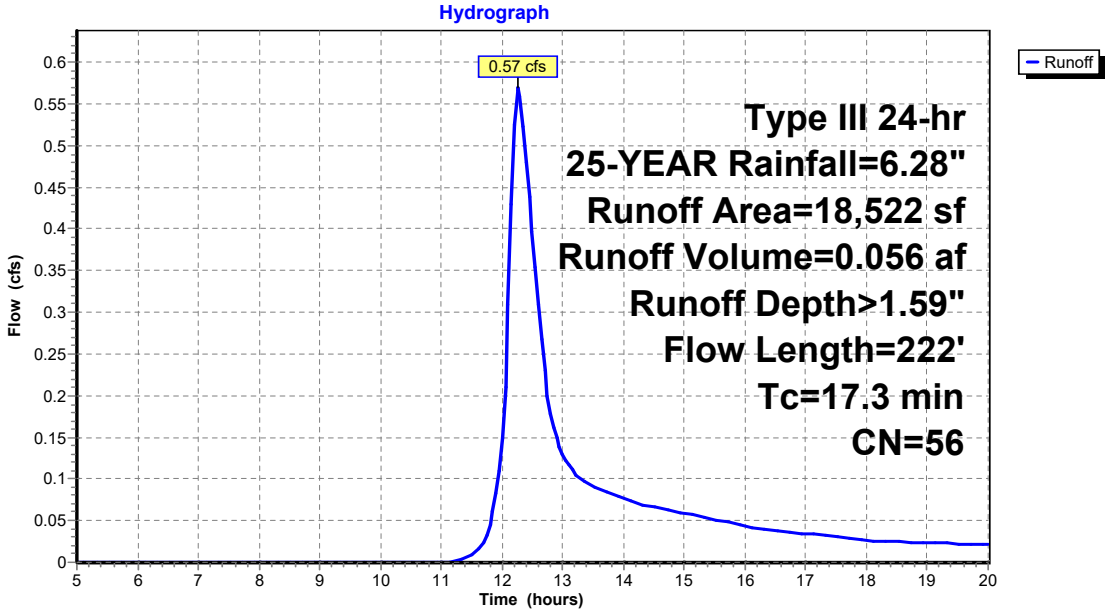
Runoff = 0.57 cfs @ 12.27 hrs, Volume= 0.056 af, Depth> 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,602	61	>75% Grass cover, Good, HSG B
13,920	55	Woods, Good, HSG B
0	74	>75% Grass cover, Good, HSG C
0	70	Woods, Good, HSG C
18,522	56	Weighted Average
18,522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	172	0.0340	2.97		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
17.3	222	Total			

Subcatchment 2S: SUBCATCHMENT 2



Summary for Subcatchment 3-1S: SUBCATCHMENT 3-1

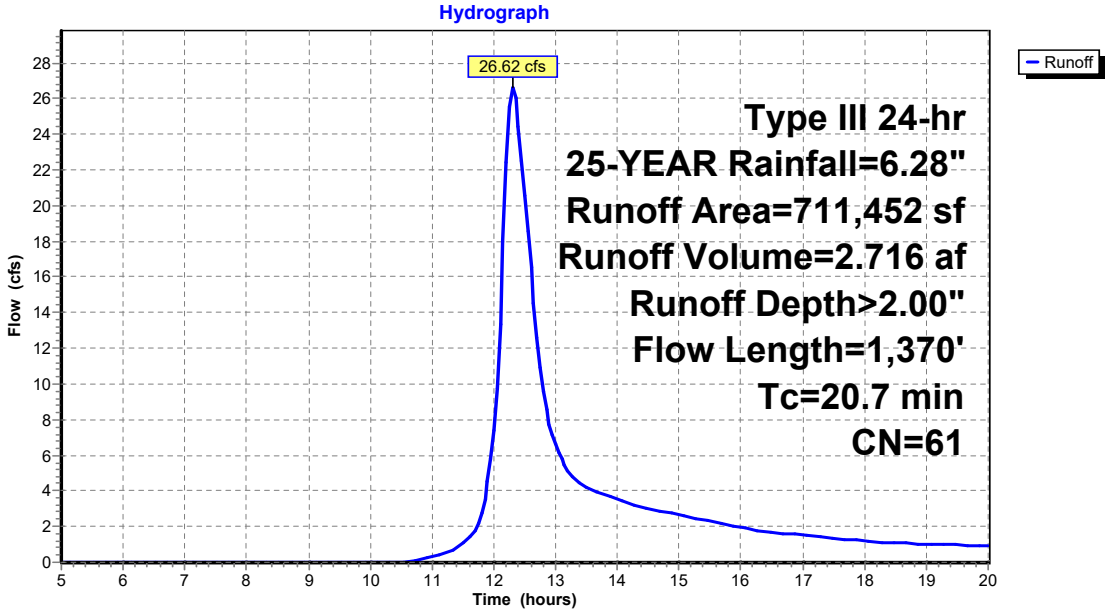
Runoff = 26.62 cfs @ 12.31 hrs, Volume= 2.716 af, Depth> 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
286,060	39	>75% Grass cover, Good, HSG A
66,452	30	Woods, Good, HSG A
176,953	98	Paved parking, HSG A
0	61	>75% Grass cover, Good, HSG B
0	55	Woods, Good, HSG B
0	98	Paved parking, HSG B
6,637	74	>75% Grass cover, Good, HSG C
175,350	70	Woods, Good, HSG C
0	98	Paved parking, HSG C
711,452	61	Weighted Average
534,499		75.13% Pervious Area
176,953		24.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0220	0.07		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
4.9	752	0.0250	2.55		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
3.9	568	0.0230	2.44		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
20.7	1,370	Total			

Subcatchment 3-1S: SUBCATCHMENT 3-1



Summary for Subcatchment 3-2S: SUBCATCHMENT 3-2

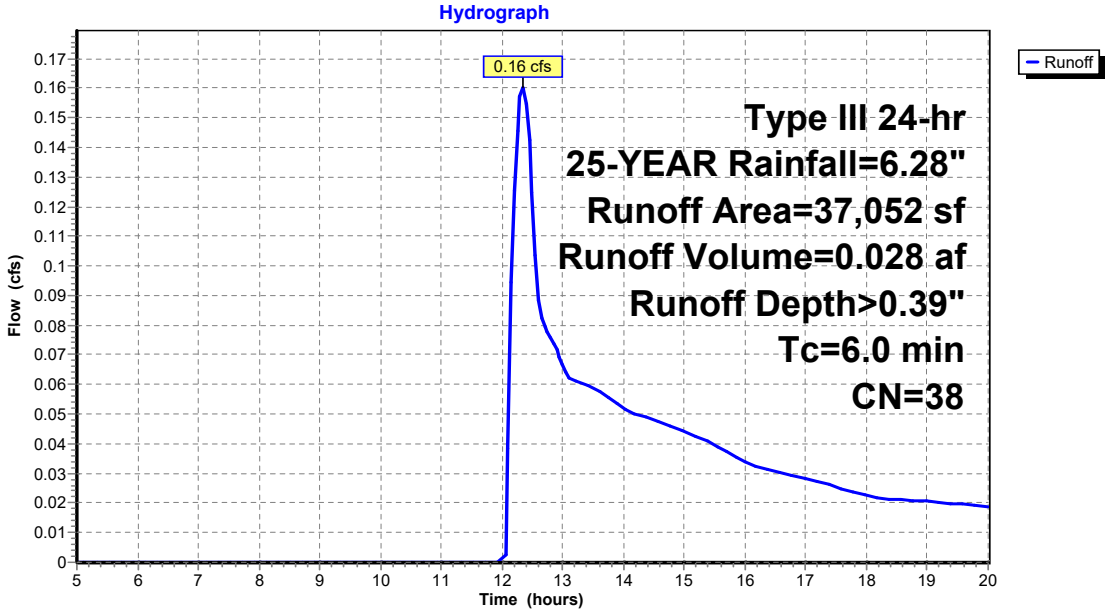
Runoff = 0.16 cfs @ 12.34 hrs, Volume= 0.028 af, Depth> 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
5,009	39	>75% Grass cover, Good, HSG A
26,479	30	Woods, Good, HSG A
5,564	77	Woods, Good, HSG D
37,052	38	Weighted Average
37,052		100.00% Pervious Area

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

Subcatchment 3-2S: SUBCATCHMENT 3-2

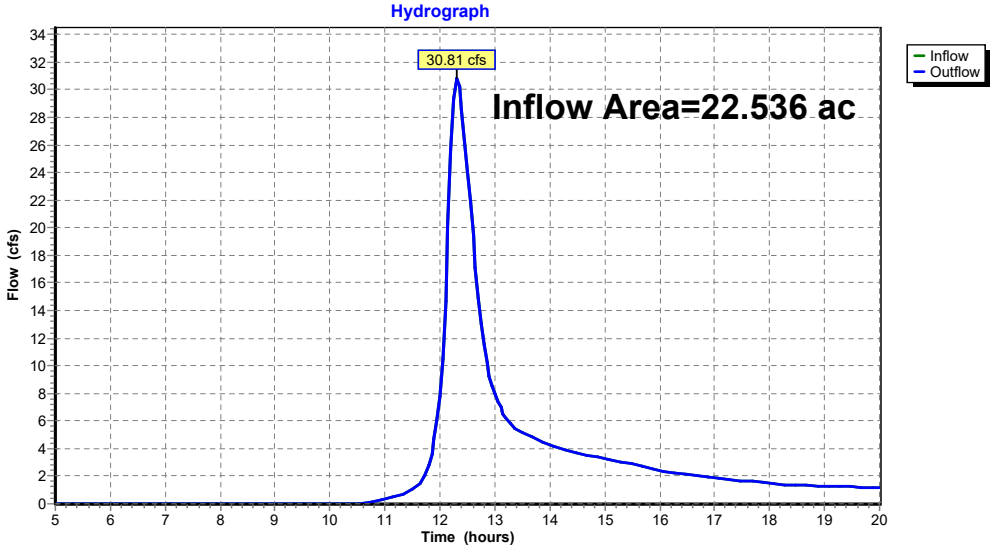


Summary for Reach 10R: Arcade Pond

Inflow Area = 22.536 ac, 18.03% Impervious, Inflow Depth > 1.71" for 25-YEAR event
Inflow = 30.81 cfs @ 12.31 hrs, Volume= 3.220 af
Outflow = 30.81 cfs @ 12.31 hrs, Volume= 3.220 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 10R: Arcade Pond

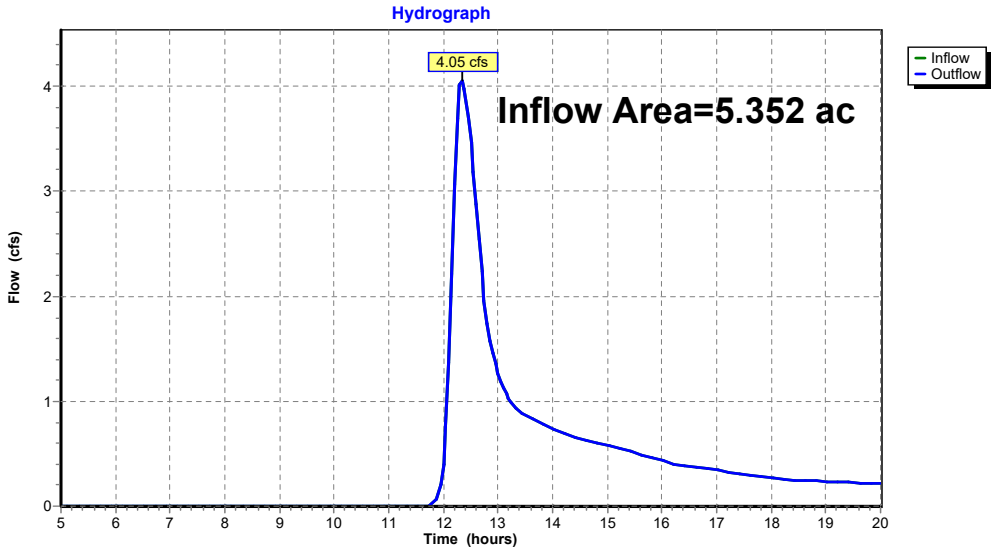


Summary for Reach DP1: DP-1 Wetland

Inflow Area = 5.352 ac, 0.00% Impervious, Inflow Depth > 1.07" for 25-YEAR event
Inflow = 4.05 cfs @ 12.34 hrs, Volume= 0.475 af
Outflow = 4.05 cfs @ 12.34 hrs, Volume= 0.475 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP1: DP-1 Wetland

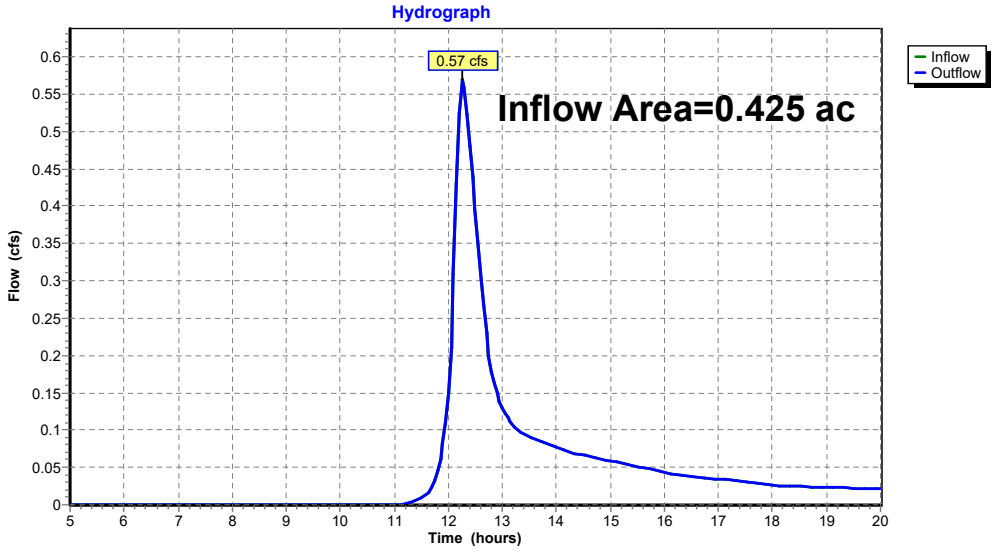


Summary for Reach DP2: DP-2 N Main

Inflow Area = 0.425 ac, 0.00% Impervious, Inflow Depth > 1.59" for 25-YEAR event
Inflow = 0.57 cfs @ 12.27 hrs, Volume= 0.056 af
Outflow = 0.57 cfs @ 12.27 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP2: DP-2 N Main

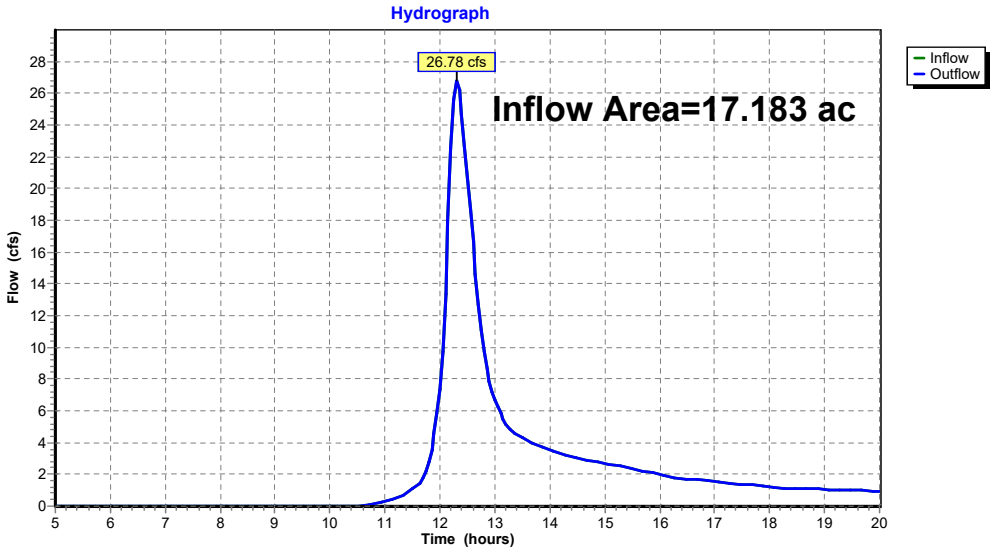


Summary for Reach DP3: DP-3 Arcade Pond

Inflow Area = 17.183 ac, 23.64% Impervious, Inflow Depth > 1.92" for 25-YEAR event
Inflow = 26.78 cfs @ 12.31 hrs, Volume= 2.744 af
Outflow = 26.78 cfs @ 12.31 hrs, Volume= 2.744 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP3: DP-3 Arcade Pond



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: SUBCATCHMENT1 Runoff Area=233,154 sf 0.00% Impervious Runoff Depth>1.94"
Flow Length=525' Tc=19.5 min CN=49 Runoff=8.28 cfs 0.867 af

Subcatchment2S: SUBCATCHMENT2 Runoff Area=18,522 sf 0.00% Impervious Runoff Depth>2.66"
Flow Length=222' Tc=17.3 min CN=56 Runoff=0.99 cfs 0.094 af

Subcatchment3-1S: SUBCATCHMENT3-1 Runoff Area=711,452 sf 24.87% Impervious Runoff Depth>3.18"
Flow Length=1,370' Tc=20.7 min CN=61 Runoff=43.31 cfs 4.332 af

Subcatchment3-2S: SUBCATCHMENT3-2 Runoff Area=37,052 sf 0.00% Impervious Runoff Depth>0.94"
Tc=6.0 min CN=38 Runoff=0.63 cfs 0.067 af

Reach 10R: Arcade Pond Inflow=52.08 cfs 5.265 af
Outflow=52.08 cfs 5.265 af

Reach DP1: DP-1 Wetland Inflow=8.28 cfs 0.867 af
Outflow=8.28 cfs 0.867 af

Reach DP2: DP-2 N Main Inflow=0.99 cfs 0.094 af
Outflow=0.99 cfs 0.094 af

Reach DP3: DP-3 Arcade Pond Inflow=43.80 cfs 4.398 af
Outflow=43.80 cfs 4.398 af

Total Runoff Area = 22.961 ac Runoff Volume = 5.359 af Average Runoff Depth = 2.80"
82.31% Pervious = 18.899 ac 17.69% Impervious = 4.062 ac

Summary for Subcatchment 1S: SUBCATCHMENT 1

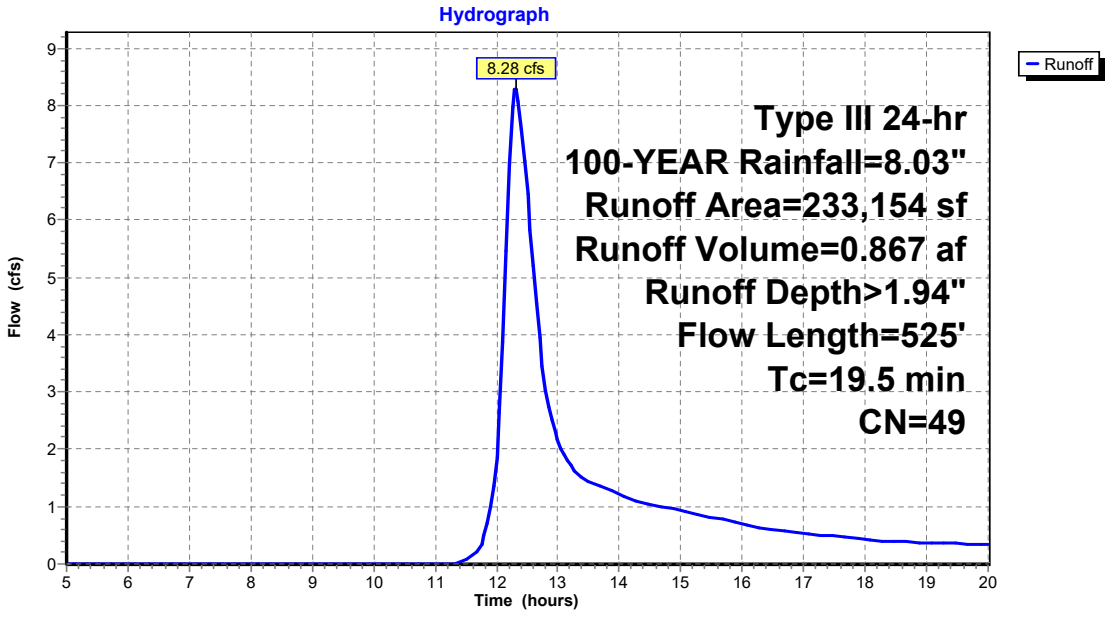
Runoff = 8.28 cfs @ 12.31 hrs, Volume= 0.867 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
45,369	39	>75% Grass cover, Good, HSG A
66,266	30	Woods, Good, HSG A
0	32	Woods/grass comb., Good, HSG A
0	61	>75% Grass cover, Good, HSG B
57,049	55	Woods, Good, HSG B
0	58	Woods/grass comb., Good, HSG B
6,050	74	>75% Grass cover, Good, HSG C
58,420	70	Woods, Good, HSG C
0	72	Woods/grass comb., Good, HSG C
233,154	49	Weighted Average
233,154		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0400	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Dense underbrush n= 0.800 P2= 3.20"
3.2	475	0.0240	2.49		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
19.5	525	Total			

Subcatchment 1S: SUBCATCHMENT 1



Summary for Subcatchment 2S: SUBCATCHMENT 2

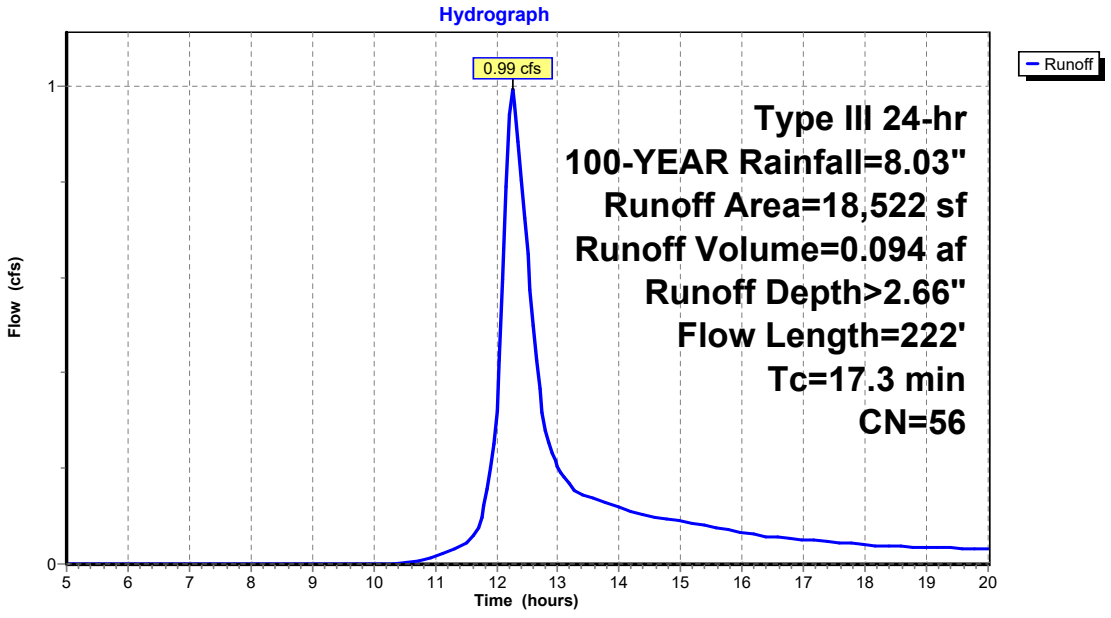
Runoff = 0.99 cfs @ 12.26 hrs, Volume= 0.094 af, Depth> 2.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,602	61	>75% Grass cover, Good, HSG B
13,920	55	Woods, Good, HSG B
0	74	>75% Grass cover, Good, HSG C
0	70	Woods, Good, HSG C
18,522	56	Weighted Average
18,522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	172	0.0340	2.97		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
17.3	222	Total			

Subcatchment 2S: SUBCATCHMENT 2



Summary for Subcatchment 3-1S: SUBCATCHMENT 3-1

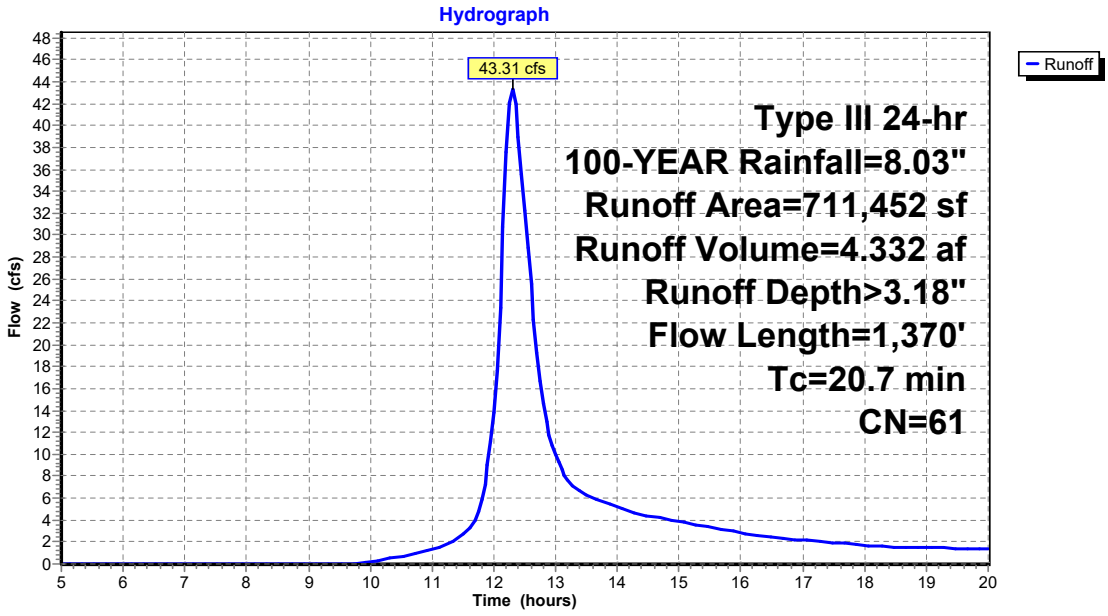
Runoff = 43.31 cfs @ 12.30 hrs, Volume= 4.332 af, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
286,060	39	>75% Grass cover, Good, HSG A
66,452	30	Woods, Good, HSG A
176,953	98	Paved parking, HSG A
0	61	>75% Grass cover, Good, HSG B
0	55	Woods, Good, HSG B
0	98	Paved parking, HSG B
6,637	74	>75% Grass cover, Good, HSG C
175,350	70	Woods, Good, HSG C
0	98	Paved parking, HSG C
711,452	61	Weighted Average
534,499		75.13% Pervious Area
176,953		24.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0220	0.07		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
4.9	752	0.0250	2.55		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
3.9	568	0.0230	2.44		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
20.7	1,370	Total			

Subcatchment 3-1S: SUBCATCHMENT 3-1



Summary for Subcatchment 3-2S: SUBCATCHMENT 3-2

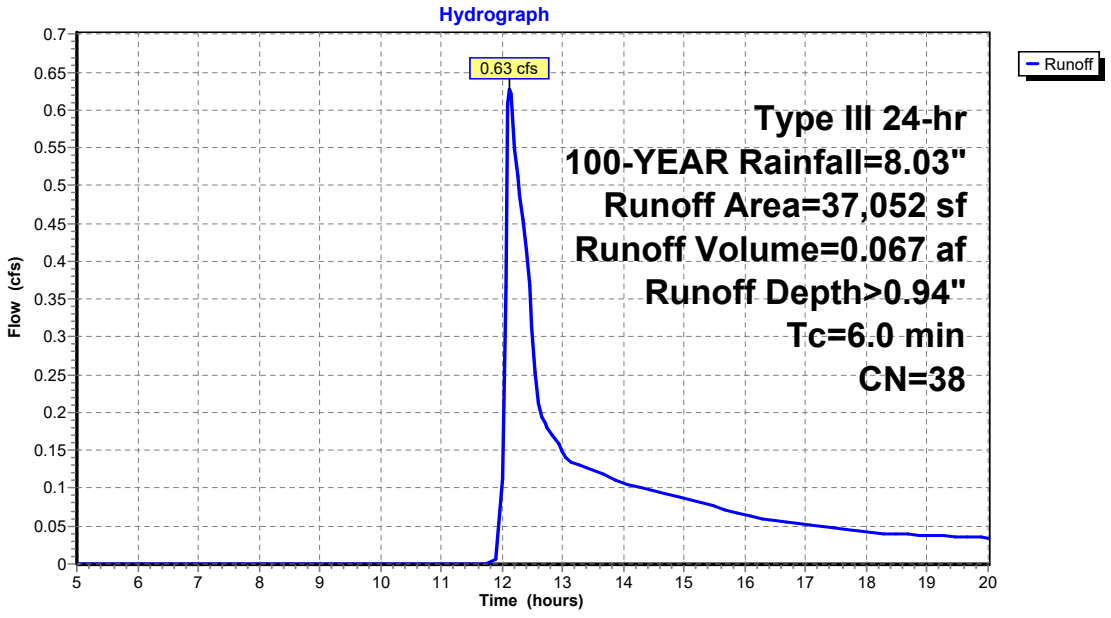
Runoff = 0.63 cfs @ 12.13 hrs, Volume= 0.067 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
5,009	39	>75% Grass cover, Good, HSG A
26,479	30	Woods, Good, HSG A
5,564	77	Woods, Good, HSG D
37,052	38	Weighted Average
37,052		100.00% Pervious Area

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

Subcatchment 3-2S: SUBCATCHMENT 3-2

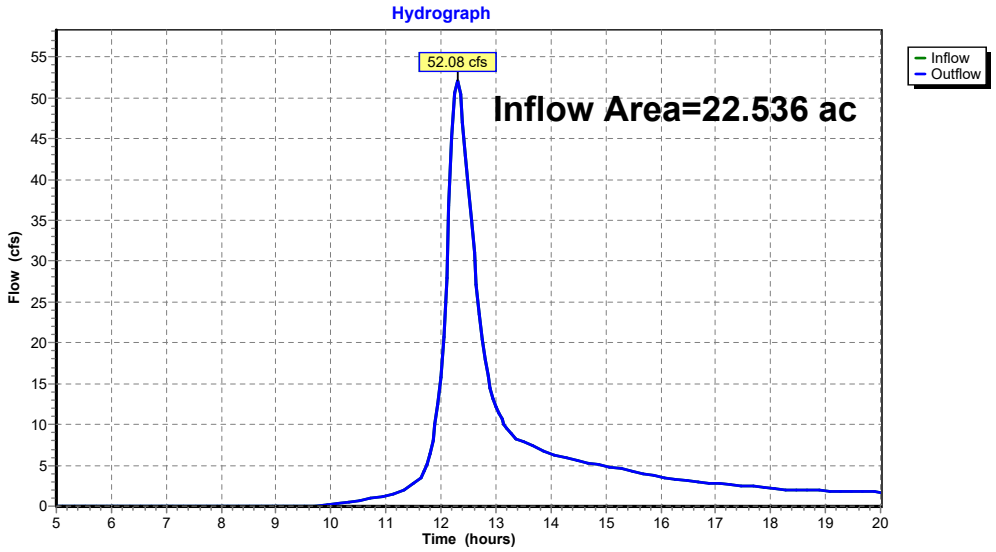


Summary for Reach 10R: Arcade Pond

Inflow Area = 22.536 ac, 18.03% Impervious, Inflow Depth > 2.80" for 100-YEAR event
Inflow = 52.08 cfs @ 12.30 hrs, Volume= 5.265 af
Outflow = 52.08 cfs @ 12.30 hrs, Volume= 5.265 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 10R: Arcade Pond

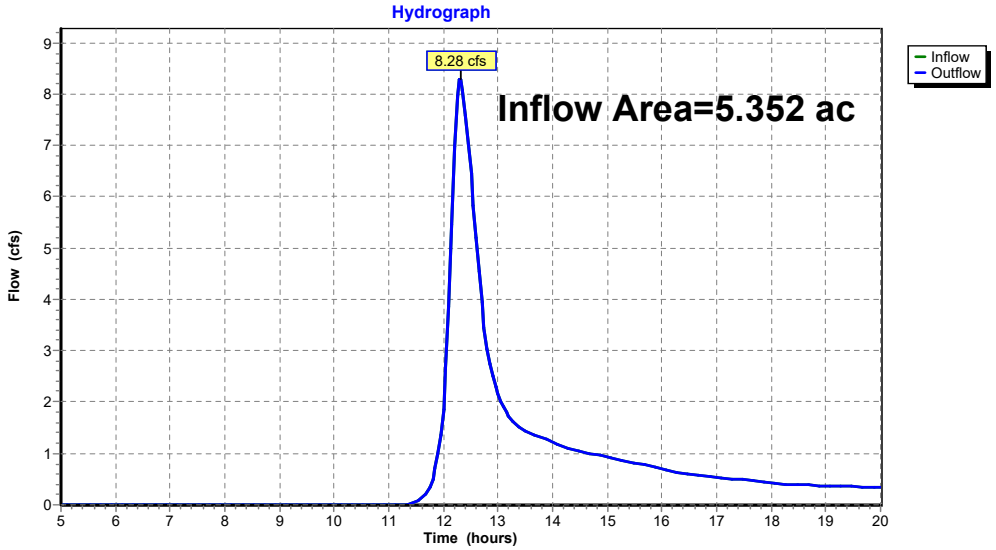


Summary for Reach DP1: DP-1 Wetland

Inflow Area = 5.352 ac, 0.00% Impervious, Inflow Depth > 1.94" for 100-YEAR event
Inflow = 8.28 cfs @ 12.31 hrs, Volume= 0.867 af
Outflow = 8.28 cfs @ 12.31 hrs, Volume= 0.867 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP1: DP-1 Wetland

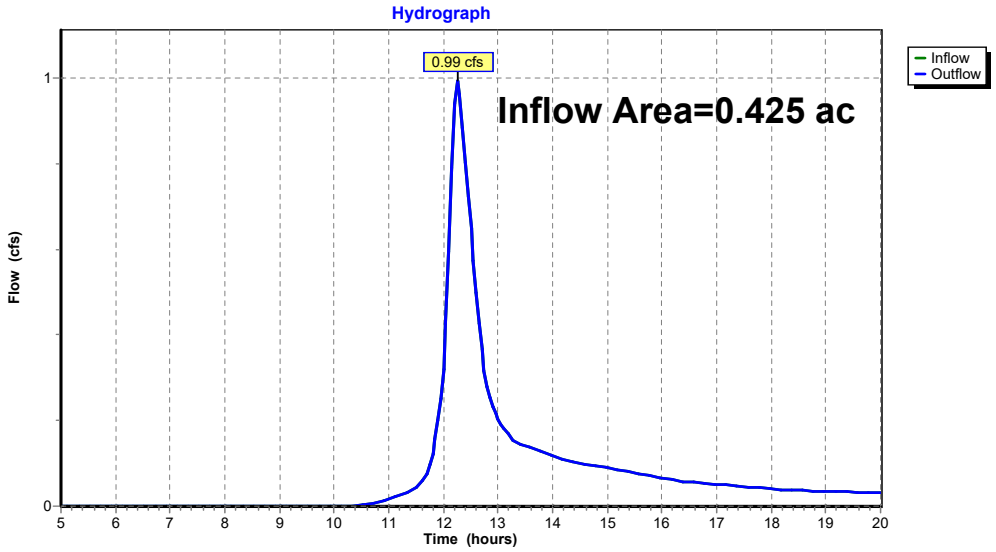


Summary for Reach DP2: DP-2 N Main

Inflow Area = 0.425 ac, 0.00% Impervious, Inflow Depth > 2.66" for 100-YEAR event
Inflow = 0.99 cfs @ 12.26 hrs, Volume= 0.094 af
Outflow = 0.99 cfs @ 12.26 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP2: DP-2 N Main

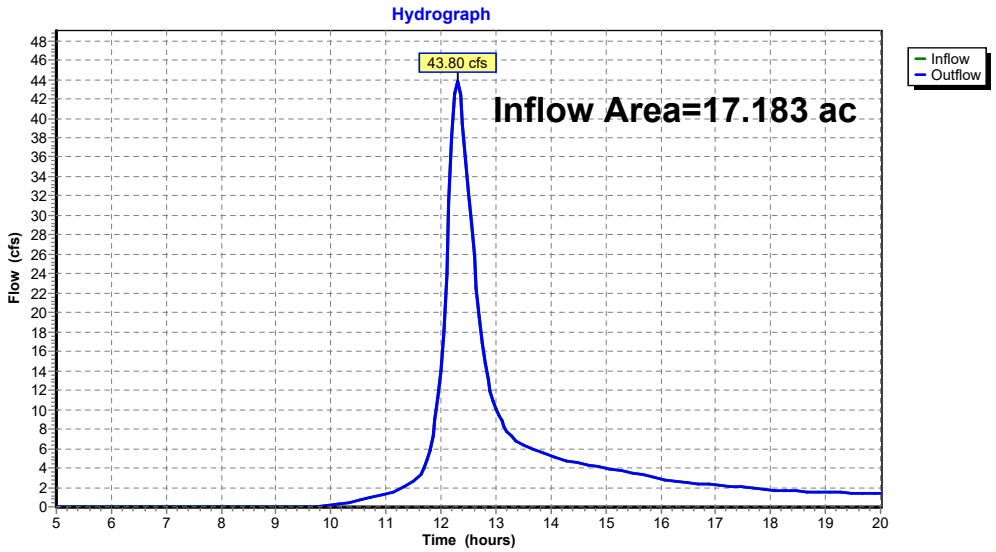


Summary for Reach DP3: DP-3 Arcade Pond

Inflow Area = 17.183 ac, 23.64% Impervious, Inflow Depth > 3.07" for 100-YEAR event
Inflow = 43.80 cfs @ 12.30 hrs, Volume= 4.398 af
Outflow = 43.80 cfs @ 12.30 hrs, Volume= 4.398 af, Atten= 0%, Lag= 0.0 min

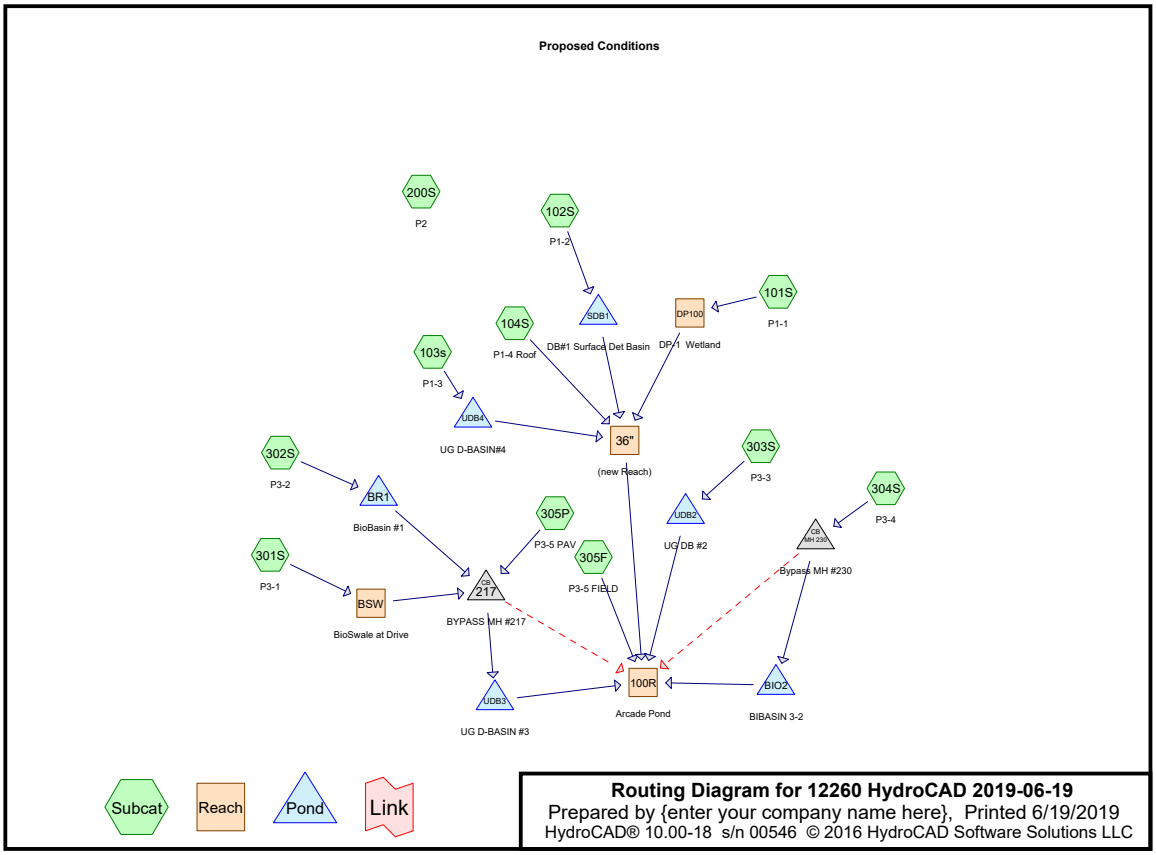
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP3: DP-3 Arcade Pond



ATTACHMENT C

Post-Development Conditions – HydroCAD Calculations



Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
7.426	39	>75% Grass cover, Good, HSG A (102S, 103s, 301S, 302S, 303S, 304S, 305F)
0.106	61	>75% Grass cover, Good, HSG B (200S)
2.340	74	>75% Grass cover, Good, HSG C (102S, 301S, 303S, 304S)
5.508	98	Paved parking, HSG A (102S, 103s, 301S, 302S, 303S, 304S, 305F, 305P)
1.228	98	Roofs, HSG A (102S, 301S, 303S)
0.470	98	Roofs, HSG C (104S)
2.993	30	Woods, Good, HSG A (101S, 301S)
1.631	55	Woods, Good, HSG B (101S, 200S)
1.256	70	Woods, Good, HSG C (101S, 301S)
22.957	**63**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
17.154	HSG A	101S, 102S, 103s, 301S, 302S, 303S, 304S, 305F, 305P
1.737	HSG B	101S, 200S
4.065	HSG C	101S, 102S, 104S, 301S, 303S, 304S
0.000	HSG D	
0.000	Other	
22.957		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
7.426	0.106	2.340	0.000	0.000	9.871	>75% Grass cover, Good	102S, 103s, 200S, 301S, 302S, 303S, 304S, 305F
5.508	0.000	0.000	0.000	0.000	5.508	Paved parking	102S, 103s, 301S, 302S, 303S, 304S, 305F, 305P
1.228	0.000	0.470	0.000	0.000	1.697	Roofs	102S, 104S, 301S, 303S
2.993	1.631	1.256	0.000	0.000	5.880	Woods, Good	101S, 200S, 301S
17.154	**1.737**	**4.065**	**0.000**	**0.000**	**22.957**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	36"	324.40	312.78	1,162.0	0.0100	0.015	36.0	0.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment101S: P1-1 Runoff Area=173,800 sf 0.00% Impervious Runoff Depth>0.10"
Flow Length=280' Tc=13.5 min CN=49 Runoff=0.08 cfs 0.034 af

Subcatchment102S: P1-2 Runoff Area=108,268 sf 32.75% Impervious Runoff Depth>1.44"
Flow Length=334' Tc=14.1 min CN=81 Runoff=3.47 cfs 0.298 af

Subcatchment103s: P1-3 Runoff Area=80,176 sf 62.34% Impervious Runoff Depth>1.12"
Flow Length=123' Slope=0.0200 '/' Tc=13.1 min CN=76 Runoff=2.02 cfs 0.172 af

Subcatchment104S: P1-4 Roof Runoff Area=20,457 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=1.47 cfs 0.112 af

Subcatchment200S: P2 Runoff Area=18,522 sf 0.00% Impervious Runoff Depth>0.27"
Flow Length=222' Tc=17.3 min CN=56 Runoff=0.06 cfs 0.009 af

Subcatchment301S: P3-1 Runoff Area=177,985 sf 34.44% Impervious Runoff Depth>0.33"
Flow Length=279' Tc=6.0 min CN=58 Runoff=0.91 cfs 0.112 af

Subcatchment302S: P3-2 Runoff Area=40,507 sf 72.71% Impervious Runoff Depth>1.51"
Flow Length=45' Slope=0.0500 '/' Tc=6.0 min CN=82 Runoff=1.74 cfs 0.117 af

Subcatchment303S: P3-3 Runoff Area=102,797 sf 64.58% Impervious Runoff Depth>1.44"
Flow Length=110' Tc=9.3 min CN=81 Runoff=3.76 cfs 0.283 af

Subcatchment304S: P3-4 Runoff Area=97,832 sf 36.89% Impervious Runoff Depth>0.67"
Flow Length=330' Tc=7.6 min CN=67 Runoff=1.53 cfs 0.125 af

Subcatchment305F: P3-5 FIELD Runoff Area=167,683 sf 1.64% Impervious Runoff Depth>0.00"
Flow Length=536' Slope=0.0200 '/' Tc=11.8 min CN=40 Runoff=0.00 cfs 0.001 af

Subcatchment305P: P3-5 PAV Runoff Area=11,973 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.86 cfs 0.066 af

Reach 36": (new Reach) Avg. Flow Depth=0.35' Max Vel=3.63 fps Inflow=1.87 cfs 0.549 af
36.0" Round Pipe n=0.015 L=1,162.0' S=0.0100 '/' Capacity=57.81 cfs Outflow=1.69 cfs 0.544 af

Reach 100R: Arcade Pond Inflow=2.16 cfs 0.759 af
Outflow=2.16 cfs 0.759 af

Reach BSW: BioSwale at Drive Avg. Flow Depth=0.16' Max Vel=1.11 fps Inflow=0.91 cfs 0.112 af
n=0.035 L=1,063.0' S=0.0094 '/' Capacity=18.42 cfs Outflow=0.62 cfs 0.107 af

Reach DP100: DP-1 Wetland Inflow=0.08 cfs 0.034 af
Outflow=0.08 cfs 0.034 af

Pond 217: BYPASS MH #217 Peak Elev=316.30' Inflow=1.15 cfs 0.246 af
Primary=1.15 cfs 0.246 af Secondary=0.00 cfs 0.000 af Outflow=1.15 cfs 0.246 af

Pond BIO2: BIBASIN 3-2 Peak Elev=314.85' Storage=2,141 cf Inflow=1.25 cfs 0.123 af
Discarded=0.17 cfs 0.106 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.106 af

Pond BR1: BioBasin #1 Peak Elev=328.68' Storage=2,207 cf Inflow=1.74 cfs 0.117 af
Outflow=0.68 cfs 0.073 af

Pond MH 230: Bypass MH #230 Peak Elev=328.99' Inflow=1.53 cfs 0.125 af
Primary=1.25 cfs 0.123 af Secondary=0.29 cfs 0.002 af Outflow=1.53 cfs 0.125 af

Pond SDB1: DB#1 Surface Det Basin Peak Elev=329.95' Storage=6,452 cf Inflow=3.47 cfs 0.298 af
Outflow=0.54 cfs 0.246 af

Pond UDB2: UG DB #2 Peak Elev=314.87' Storage=0.146 af Inflow=3.76 cfs 0.283 af
Outflow=0.49 cfs 0.212 af

Pond UDB3: UG D-BASIN #3 Peak Elev=316.55' Storage=0.100 af Inflow=1.15 cfs 0.246 af
Discarded=0.22 cfs 0.170 af Primary=0.01 cfs 0.000 af Outflow=0.23 cfs 0.170 af

Pond UDB4: UG D-BASIN#4 Peak Elev=326.02' Storage=0.057 af Inflow=2.02 cfs 0.172 af
Outflow=0.80 cfs 0.157 af

Total Runoff Area = 22.957 ac Runoff Volume = 1.329 af Average Runoff Depth = 0.69"
68.61% Pervious = 15.752 ac 31.39% Impervious = 7.205 ac

Summary for Subcatchment 101S: P1-1

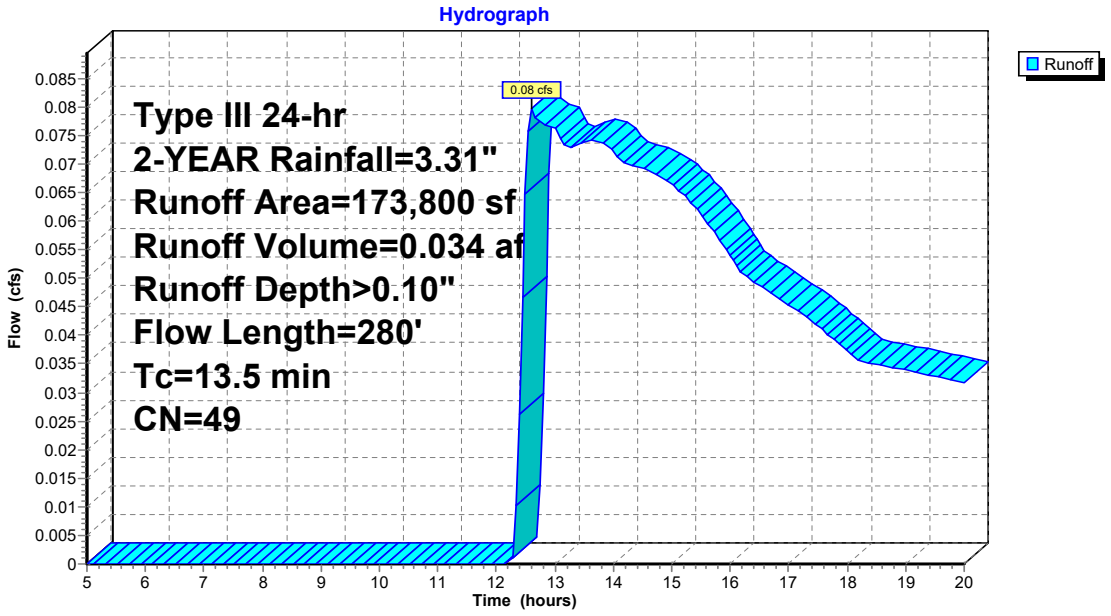
Runoff = 0.08 cfs @ 12.62 hrs, Volume= 0.034 af, Depth> 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
70,742	30	Woods, Good, HSG A
57,144	55	Woods, Good, HSG B
45,914	70	Woods, Good, HSG C
173,800	49	Weighted Average
173,800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	230	0.0380	3.14		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
13.5	280	Total			

Subcatchment 101S: P1-1



Summary for Subcatchment 102S: P1-2

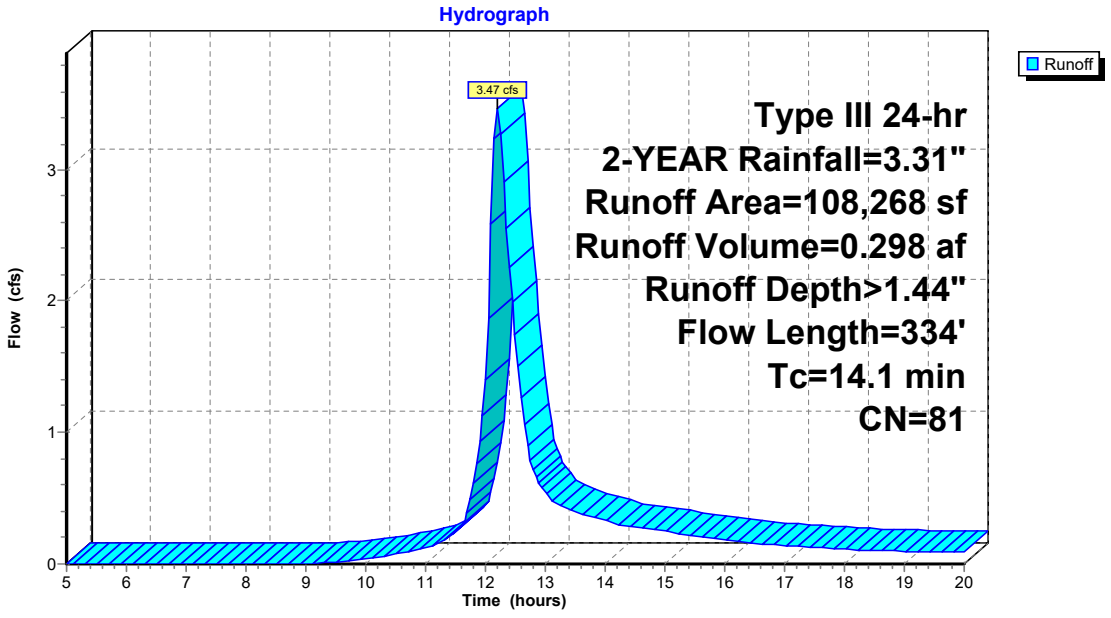
Runoff = 3.47 cfs @ 12.20 hrs, Volume= 0.298 af, Depth> 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
1,531	39	>75% Grass cover, Good, HSG A
71,278	74	>75% Grass cover, Good, HSG C
14,084	98	Paved parking, HSG A
21,375	98	Roofs, HSG A
108,268	81	Weighted Average
72,809		67.25% Pervious Area
35,459		32.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, Sheet Flow 50 Ft** Grass: Bermuda n= 0.410 P2= 3.20"
1.2	229	0.0380	3.14		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
0.3	55	0.0200	2.87		**Shallow Concentrated Flow, PARKING** Paved Kv= 20.3 fps
14.1	334	Total			

Subcatchment 102S: P1-2



Summary for Subcatchment 103s: P1-3

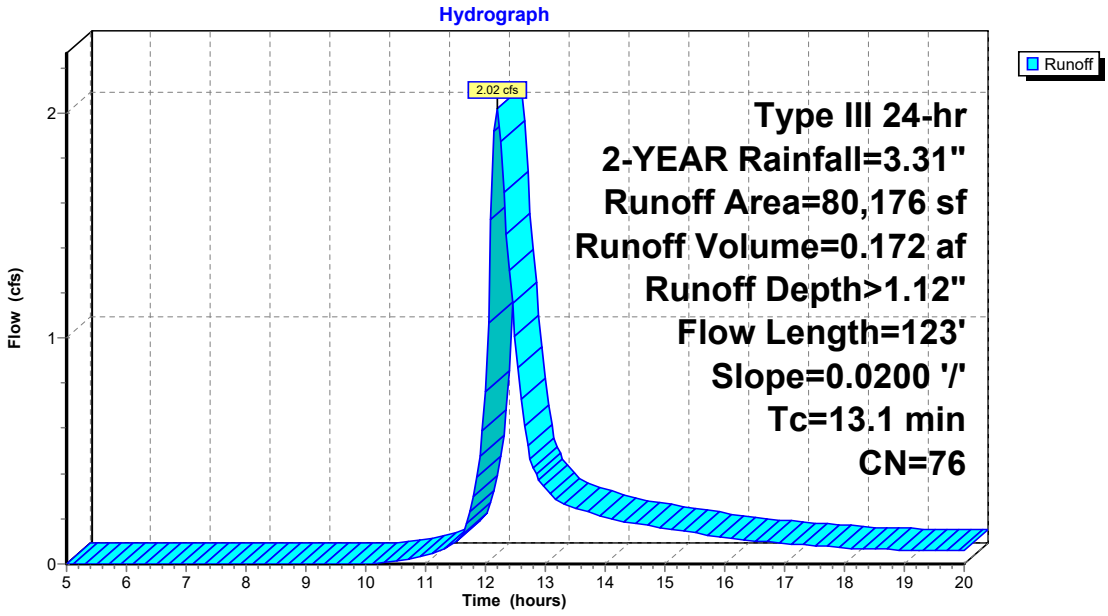
Runoff = 2.02 cfs @ 12.19 hrs, Volume= 0.172 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
30,191	39	>75% Grass cover, Good, HSG A
49,985	98	Paved parking, HSG A
80,176	76	Weighted Average
30,191		37.66% Pervious Area
49,985		62.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, Fields** Grass: Bermuda n= 0.410 P2= 3.20"
0.5	73	0.0200	2.28		**Shallow Concentrated Flow, Field** Unpaved Kv= 16.1 fps
13.1	123	Total			

Subcatchment 103s: P1-3



Summary for Subcatchment 104S: P1-4 Roof

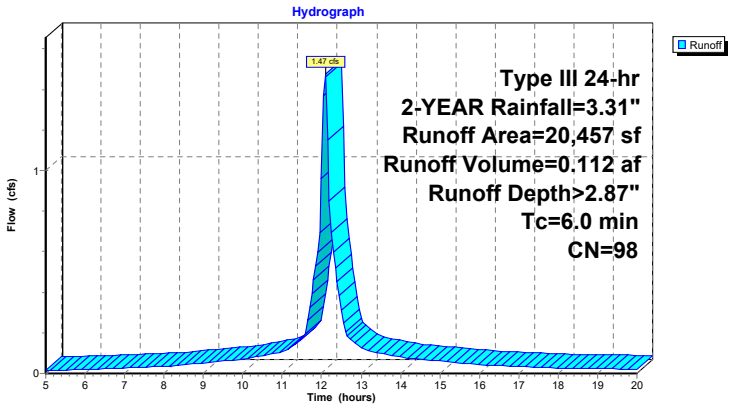
Runoff = 1.47 cfs @ 12.09 hrs, Volume= 0.112 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
20,457	98	Roofs, HSG C
20,457		100.00% Impervious Area

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

Subcatchment 104S: P1-4 Roof



Summary for Subcatchment 200S: P2

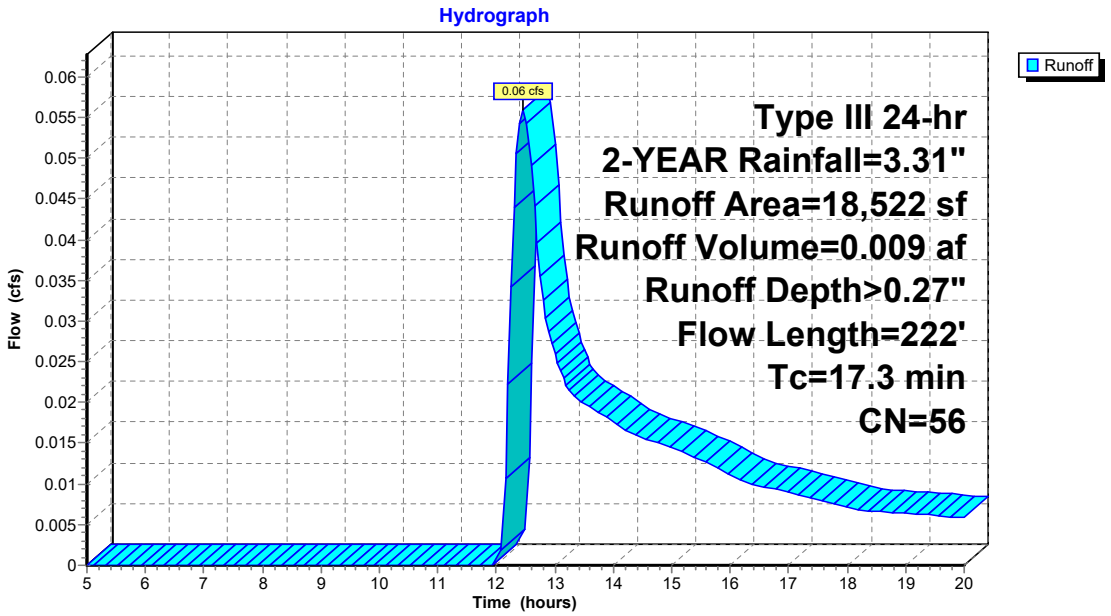
Runoff = 0.06 cfs @ 12.46 hrs, Volume= 0.009 af, Depth> 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,602	61	>75% Grass cover, Good, HSG B
13,920	55	Woods, Good, HSG B
0	74	>75% Grass cover, Good, HSG C
0	70	Woods, Good, HSG C
18,522	56	Weighted Average
18,522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	172	0.0340	2.97		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
17.3	222	Total			

Subcatchment 200S: P2



Summary for Subcatchment 301S: P3-1

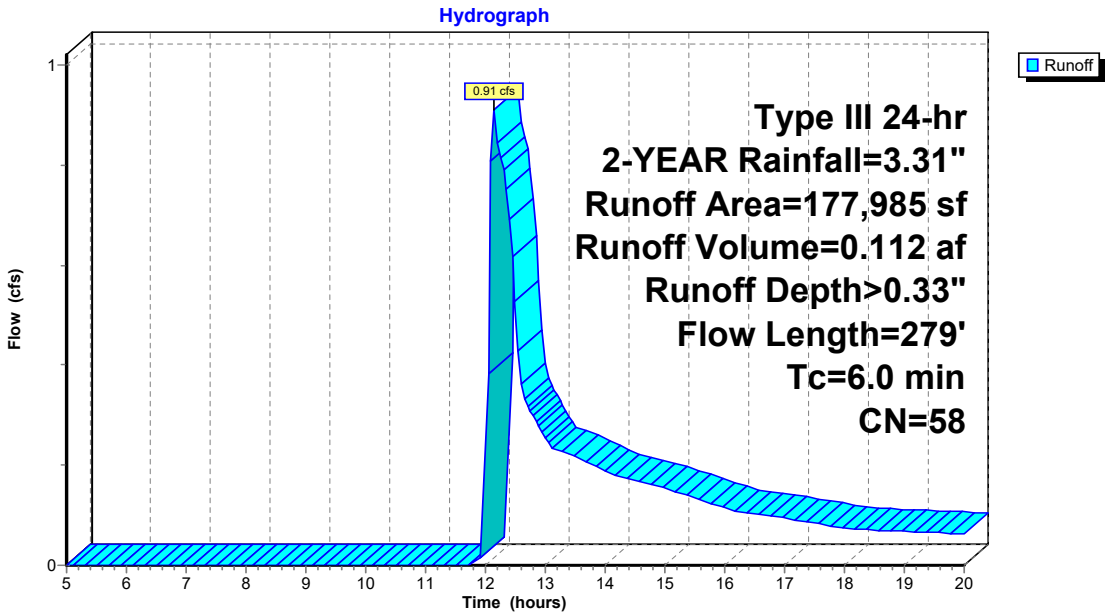
Runoff = 0.91 cfs @ 12.16 hrs, Volume= 0.112 af, Depth> 0.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
45,255	39	>75% Grass cover, Good, HSG A
39,144	98	Paved parking, HSG A
3,009	74	>75% Grass cover, Good, HSG C
59,632	30	Woods, Good, HSG A
8,798	70	Woods, Good, HSG C
22,147	98	Roofs, HSG A
177,985	58	Weighted Average
116,694		65.56% Pervious Area
61,291		34.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	44	0.0600	0.15		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
0.5	235	0.2500	8.05		**Shallow Concentrated Flow, HILL** Unpaved Kv= 16.1 fps
0.7					**Direct Entry, TO 6 MIN**
6.0	279	Total			

Subcatchment 301S: P3-1



Summary for Subcatchment 302S: P3-2

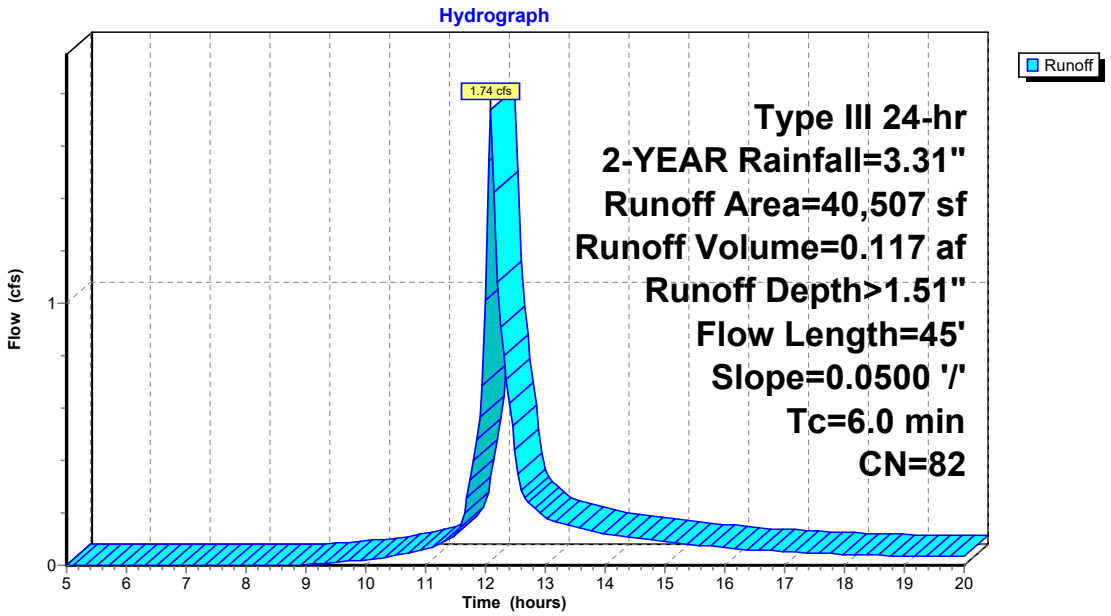
Runoff = 1.74 cfs @ 12.09 hrs, Volume= 0.117 af, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
11,056	39	>75% Grass cover, Good, HSG A
29,451	98	Paved parking, HSG A
40,507	82	Weighted Average
11,056		27.29% Pervious Area
29,451		72.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	45	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.8					**Direct Entry, DIRECT MAKE UP**
6.0	45	Total			

Subcatchment 302S: P3-2



Summary for Subcatchment 303S: P3-3

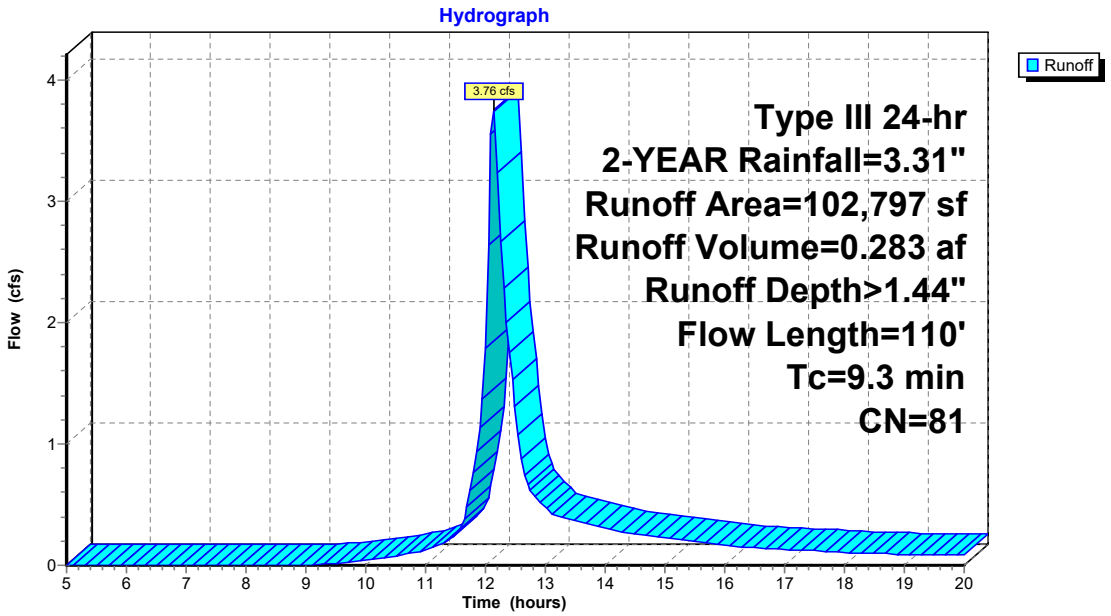
Runoff = 3.76 cfs @ 12.14 hrs, Volume= 0.283 af, Depth> 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
25,409	39	>75% Grass cover, Good, HSG A
11,002	74	>75% Grass cover, Good, HSG C
56,435	98	Paved parking, HSG A
9,951	98	Roofs, HSG A
102,797	81	Weighted Average
36,411		35.42% Pervious Area
66,386		64.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	50	0.0460	0.09		**Sheet Flow, Landscape Lawn** Grass: Bermuda n= 0.410 P2= 3.20"
0.3	60	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.3	110	Total			

Subcatchment 303S: P3-3



Summary for Subcatchment 304S: P3-4

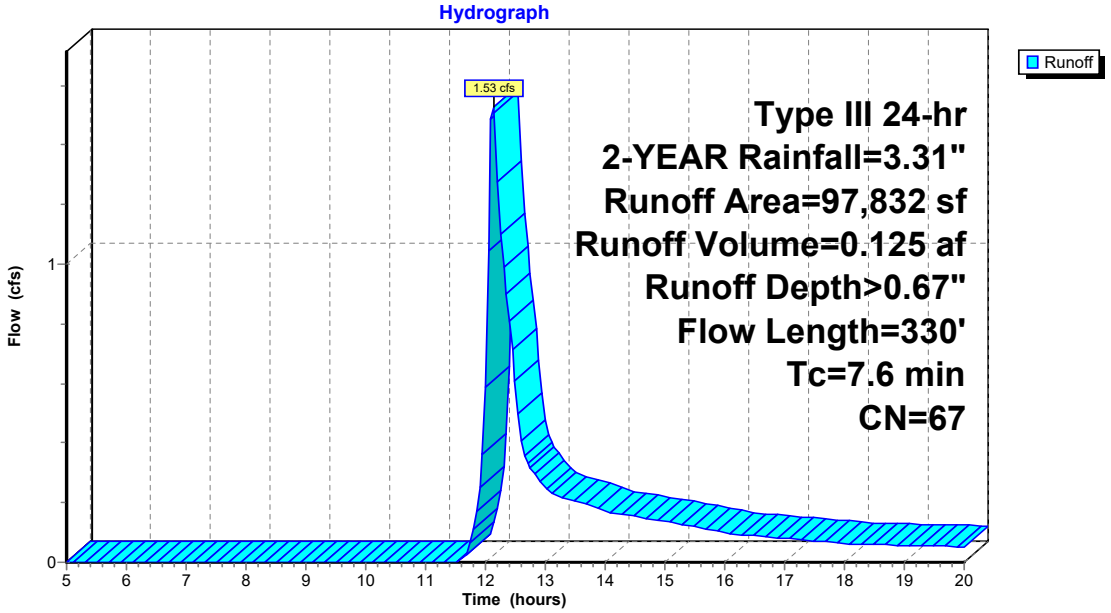
Runoff = 1.53 cfs @ 12.13 hrs, Volume= 0.125 af, Depth> 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
45,107	39	>75% Grass cover, Good, HSG A
16,631	74	>75% Grass cover, Good, HSG C
36,094	98	Paved parking, HSG A
97,832	67	Weighted Average
61,738		63.11% Pervious Area
36,094		36.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
1.4	280	0.0420	3.30		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
7.6	330	Total			

Subcatchment 304S: P3-4



Summary for Subcatchment 305F: P3-5 FIELD

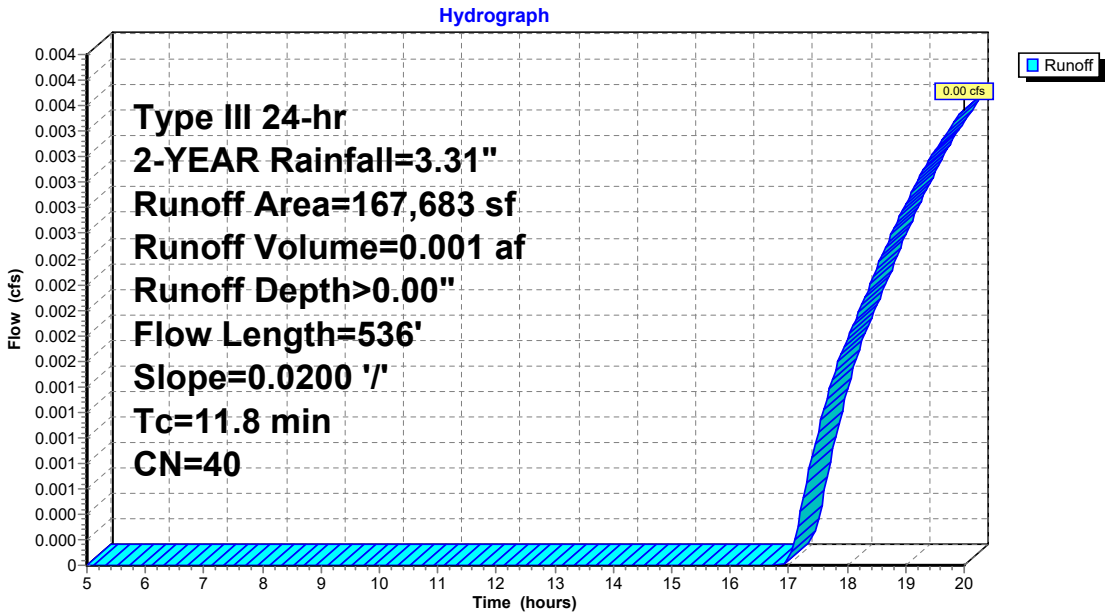
Runoff = 0.00 cfs @ 20.00 hrs, Volume= 0.001 af, Depth> 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
164,925	39	>75% Grass cover, Good, HSG A
2,758	98	Paved parking, HSG A
167,683	40	Weighted Average
164,925		98.36% Pervious Area
2,758		1.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
3.6	486	0.0200	2.28		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
11.8	536	Total			

Subcatchment 305F: P3-5 FIELD



Summary for Subcatchment 305P: P3-5 PAV

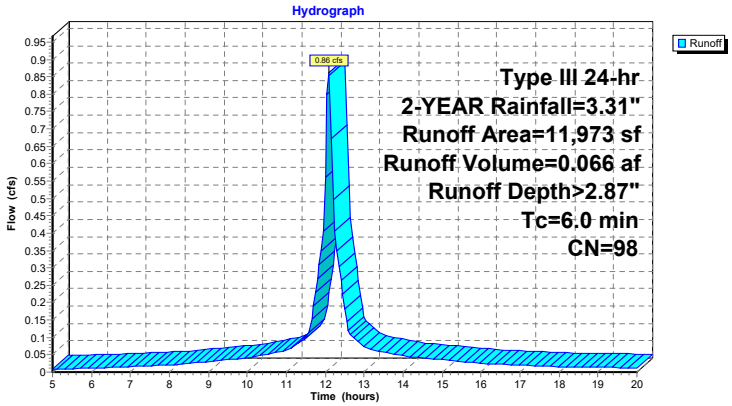
Runoff = 0.86 cfs @ 12.09 hrs, Volume= 0.066 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.31"

Area (sf)	CN	Description
11,973	98	Paved parking, HSG A
11,973		100.00% Impervious Area

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

Subcatchment 305P: P3-5 PAV



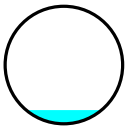
Summary for Reach 36": (new Reach)

Inflow Area = 8.786 ac, 27.67% Impervious, Inflow Depth > 0.75" for 2-YEAR event
Inflow = 1.87 cfs @ 12.11 hrs, Volume= 0.549 af
Outflow = 1.69 cfs @ 12.52 hrs, Volume= 0.544 af, Atten= 10%, Lag= 24.3 min

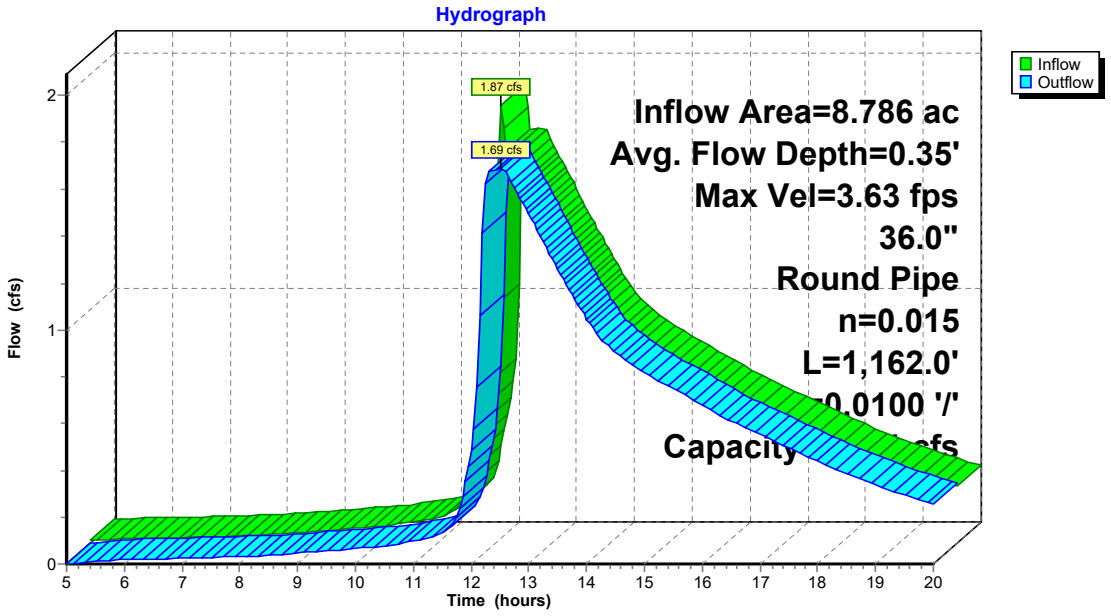
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.63 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 2.07 fps, Avg. Travel Time= 9.4 min

Peak Storage= 540 cf @ 12.43 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 57.81 cfs

36.0" Round Pipe
n= 0.015
Length= 1,162.0' Slope= 0.0100 '/'
Inlet Invert= 324.40', Outlet Invert= 312.78'



Reach 36": (new Reach)

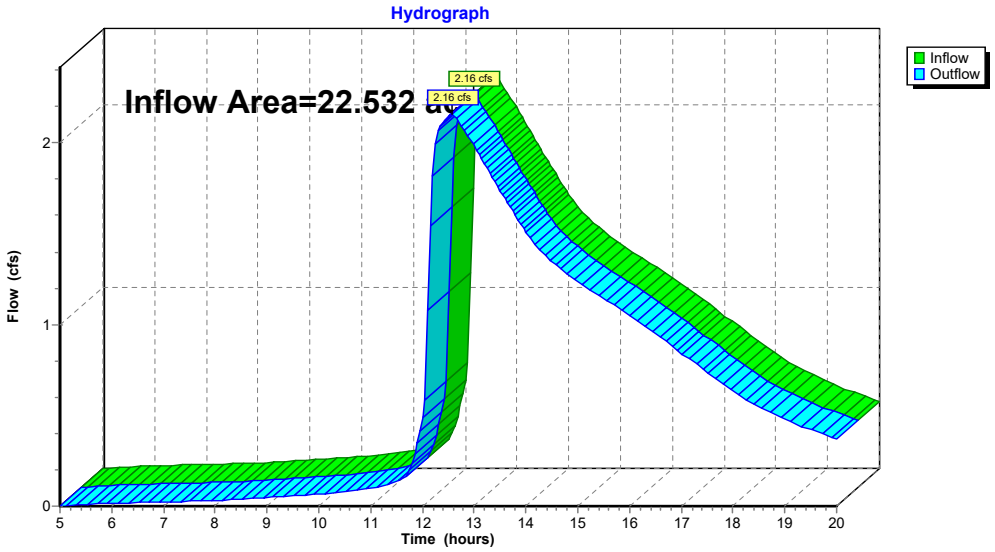


Summary for Reach 100R: Arcade Pond

Inflow Area = 22.532 ac, 31.98% Impervious, Inflow Depth > 0.40" for 2-YEAR event
Inflow = 2.16 cfs @ 12.56 hrs, Volume= 0.759 af
Outflow = 2.16 cfs @ 12.56 hrs, Volume= 0.759 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 100R: Arcade Pond



Summary for Reach BSW: BioSwale at Drive

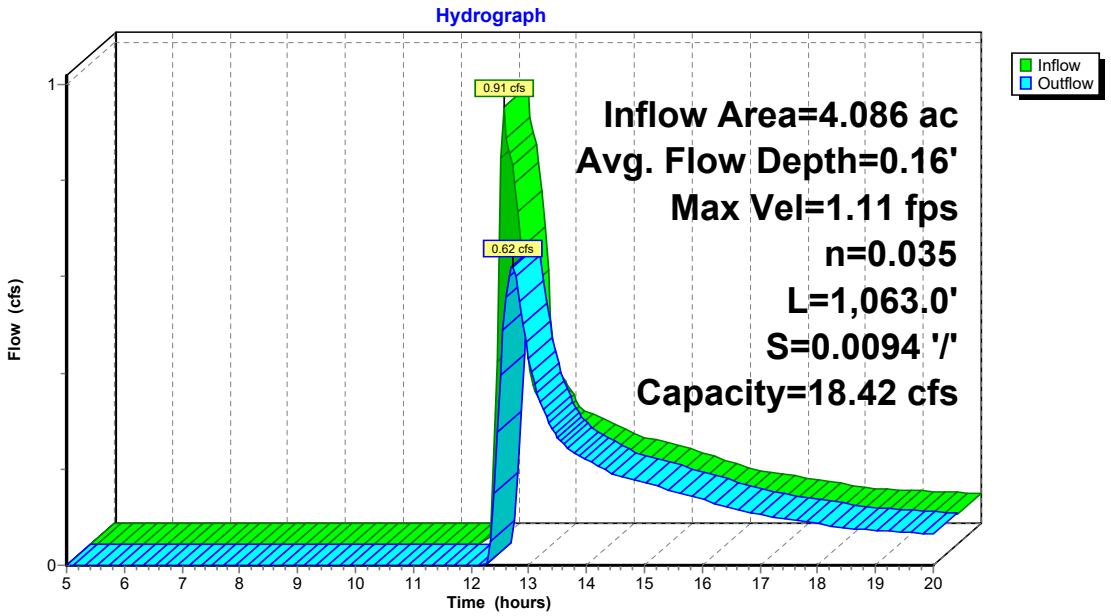
Inflow Area = 4.086 ac, 34.44% Impervious, Inflow Depth > 0.33" for 2-YEAR event
Inflow = 0.91 cfs @ 12.16 hrs, Volume= 0.112 af
Outflow = 0.62 cfs @ 12.71 hrs, Volume= 0.107 af, Atten= 32%, Lag= 33.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.11 fps, Min. Travel Time= 16.0 min
Avg. Velocity = 0.65 fps, Avg. Travel Time= 27.1 min

Peak Storage= 597 cf @ 12.45 hrs
Average Depth at Peak Storage= 0.16'
Defined Flood Depth= 1.25' Flow Area= 8.2 sf, Capacity= 27.79 cfs
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 18.42 cfs

3.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 '/' Top Width= 9.00'
Length= 1,063.0' Slope= 0.0094 '/'
Inlet Invert= 330.00', Outlet Invert= 320.00'

Reach BSW: BioSwale at Drive

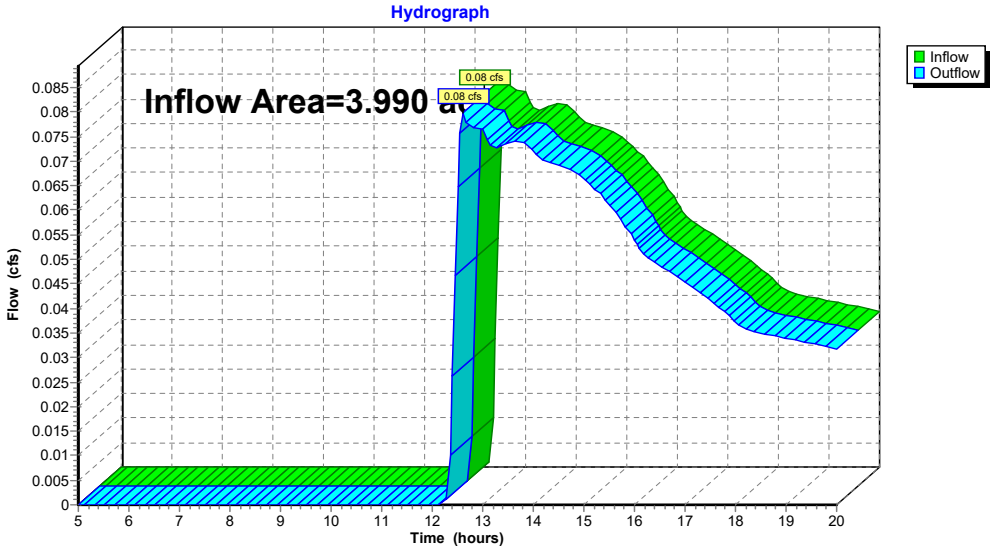


Summary for Reach DP100: DP-1 Wetland

Inflow Area = 3.990 ac, 0.00% Impervious, Inflow Depth > 0.10" for 2-YEAR event
Inflow = 0.08 cfs @ 12.62 hrs, Volume= 0.034 af
Outflow = 0.08 cfs @ 12.62 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP100: DP-1 Wetland



Summary for Pond 217: BYPASS MH #217

Inflow Area = 5.291 ac, 44.57% Impervious, Inflow Depth > 0.56" for 2-YEAR event
Inflow = 1.15 cfs @ 12.50 hrs, Volume= 0.246 af
Outflow = 1.15 cfs @ 12.50 hrs, Volume= 0.246 af, Atten= 0%, Lag= 0.0 min
Primary = 1.15 cfs @ 12.50 hrs, Volume= 0.246 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

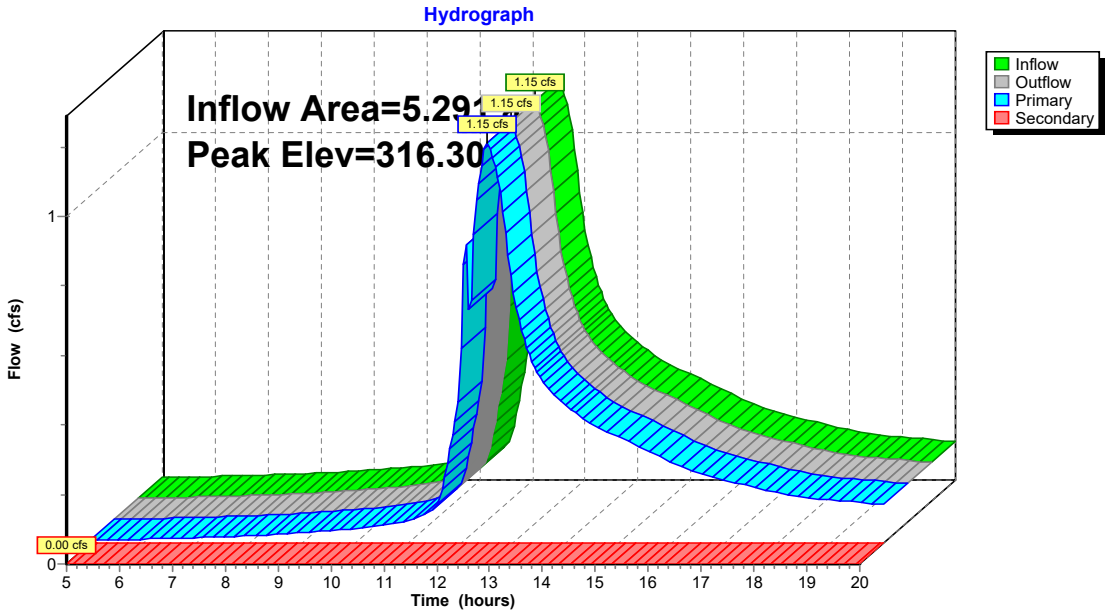
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 316.30' @ 12.50 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	315.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	316.52'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.15 cfs @ 12.50 hrs HW=316.30' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 1.15 cfs @ 3.29 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=315.55' (Free Discharge)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 217: BYPASS MH #217



Summary for Pond BIO2: BIBASIN 3-2

Inflow Area = 2.246 ac, 36.89% Impervious, Inflow Depth > 0.65" for 2-YEAR event
Inflow = 1.25 cfs @ 12.13 hrs, Volume= 0.123 af
Outflow = 0.17 cfs @ 14.06 hrs, Volume= 0.106 af, Atten= 86%, Lag= 116.0 min
Discarded = 0.17 cfs @ 14.06 hrs, Volume= 0.106 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 314.85' @ 14.06 hrs Surf.Area= 3,017 sf Storage= 2,141 cf

Plug-Flow detention time= 153.7 min calculated for 0.106 af (86% of inflow)
Center-of-Mass det. time= 112.8 min (950.6 - 837.9)

Volume	Invert	Avail.Storage	Storage Description
#1	314.00'	6,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

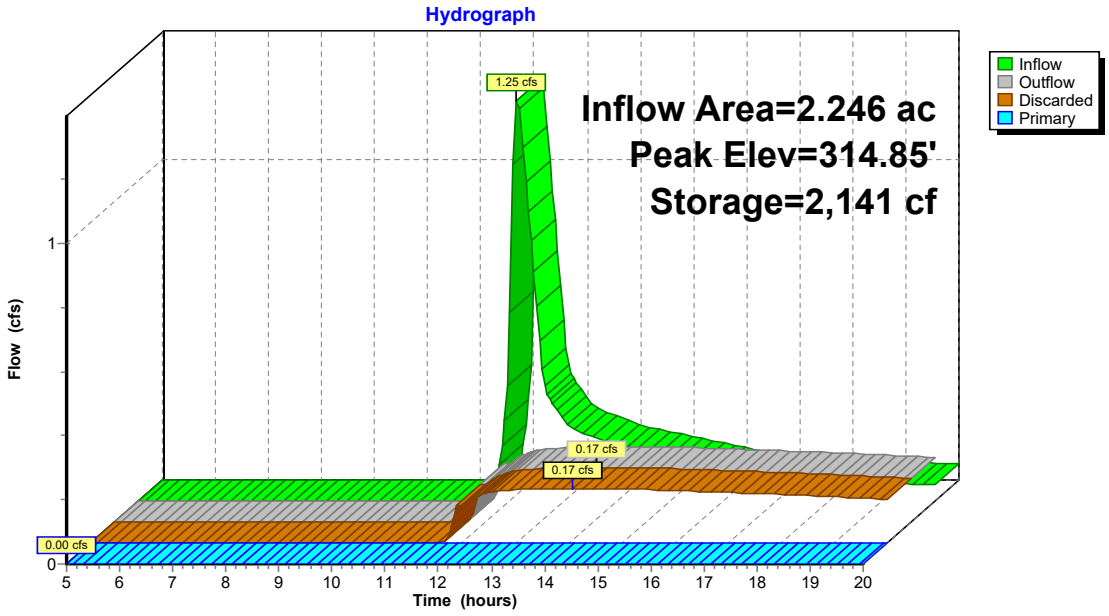
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
314.00	2,047	0	0
315.00	3,194	2,621	2,621
316.00	4,388	3,791	6,412

Device	Routing	Invert	Outlet Devices
#1	Primary	315.50'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#2	Discarded	314.00'	**2.410 in/hr Exfiltration over Horizontal area**
#3	Primary	315.00'	**24.0" Horiz. Orifice/Grate X 0.43** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.17 cfs @ 14.06 hrs HW=314.85' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=314.00' (Free Discharge)
└**1=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond BIO2: BIBASIN 3-2



Summary for Pond BR1: BioBasin #1

Inflow Area = 0.930 ac, 72.71% Impervious, Inflow Depth > 1.51" for 2-YEAR event
Inflow = 1.74 cfs @ 12.09 hrs, Volume= 0.117 af
Outflow = 0.68 cfs @ 12.37 hrs, Volume= 0.073 af, Atten= 61%, Lag= 16.4 min
Primary = 0.68 cfs @ 12.37 hrs, Volume= 0.073 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 328.68' @ 12.37 hrs Surf.Area= 1,897 sf Storage= 2,207 cf

Plug-Flow detention time= 137.2 min calculated for 0.073 af (62% of inflow)
Center-of-Mass det. time= 61.9 min (859.2 - 797.3)

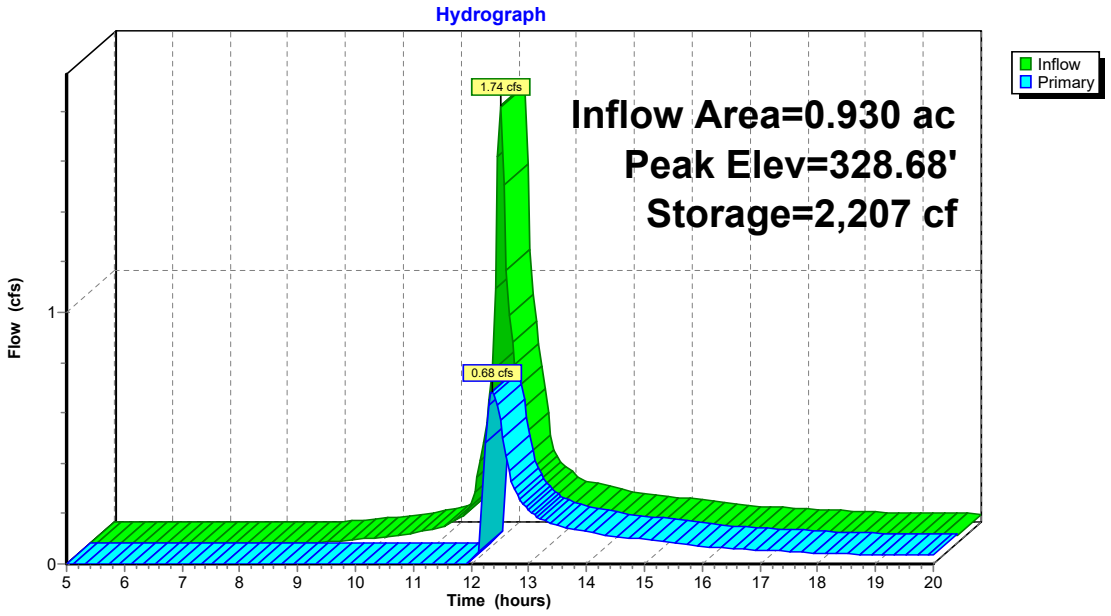
Volume	Invert	Avail.Storage	Storage Description
#1	327.00'	5,450 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
327.00	888	0	0
328.00	1,328	1,108	1,108
329.00	2,162	1,745	2,853
330.00	3,032	2,597	5,450

Device	Routing	Invert	Outlet Devices
#1	Primary	329.00'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#2	Primary	328.50'	**24.0" Horiz. Orifice/Grate X 0.43** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.68 cfs @ 12.37 hrs HW=328.68' (Free Discharge)
└**1=Orifice/Grate** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Weir Controls 0.68 cfs @ 0.60 fps)

Pond BR1: BioBasin #1



Summary for Pond MH 230: Bypass MH #230

Inflow Area = 2.246 ac, 36.89% Impervious, Inflow Depth > 0.67" for 2-YEAR event
Inflow = 1.53 cfs @ 12.13 hrs, Volume= 0.125 af
Outflow = 1.53 cfs @ 12.13 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.0 min
Primary = 1.25 cfs @ 12.13 hrs, Volume= 0.123 af
Secondary = 0.29 cfs @ 12.13 hrs, Volume= 0.002 af

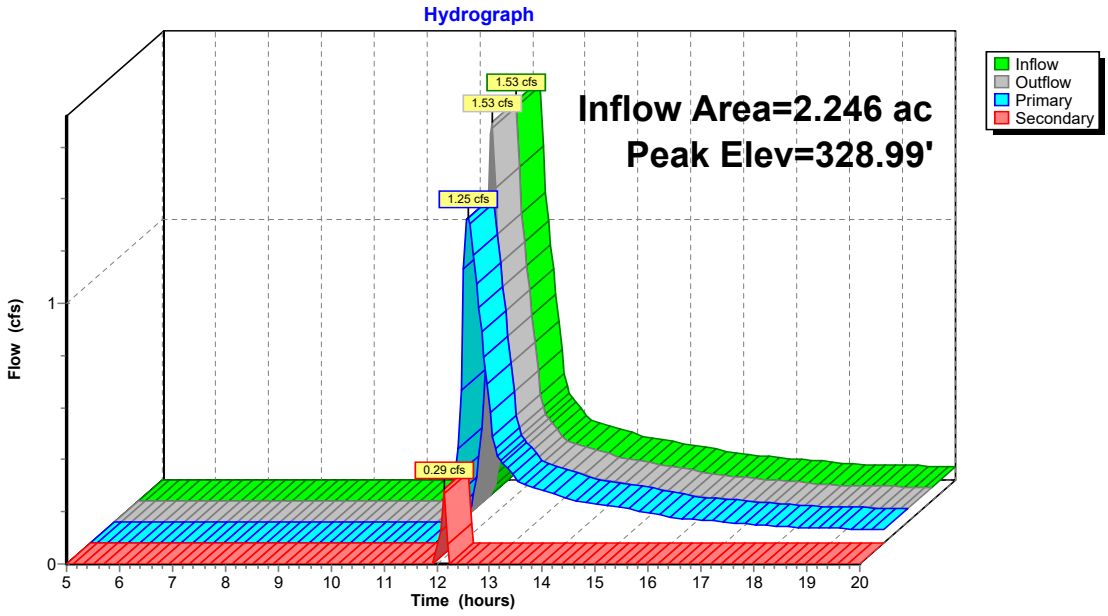
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 328.99' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	327.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	328.75'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.24 cfs @ 12.13 hrs HW=328.97' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 1.24 cfs @ 6.32 fps)

Secondary OutFlow Max=0.26 cfs @ 12.13 hrs HW=328.97' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 0.26 cfs @ 1.60 fps)

Pond MH 230: Bypass MH #230



Summary for Pond SDB1: DB#1 Surface Det Basin

Inflow Area = 2.485 ac, 32.75% Impervious, Inflow Depth > 1.44" for 2-YEAR event
Inflow = 3.47 cfs @ 12.20 hrs, Volume= 0.298 af
Outflow = 0.54 cfs @ 13.01 hrs, Volume= 0.246 af, Atten= 84%, Lag= 48.6 min
Primary = 0.54 cfs @ 13.01 hrs, Volume= 0.246 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 329.95' @ 13.01 hrs Surf.Area= 2,875 sf Storage= 6,452 cf

Plug-Flow detention time= 160.8 min calculated for 0.246 af (83% of inflow)
Center-of-Mass det. time= 113.7 min (919.9 - 806.2)

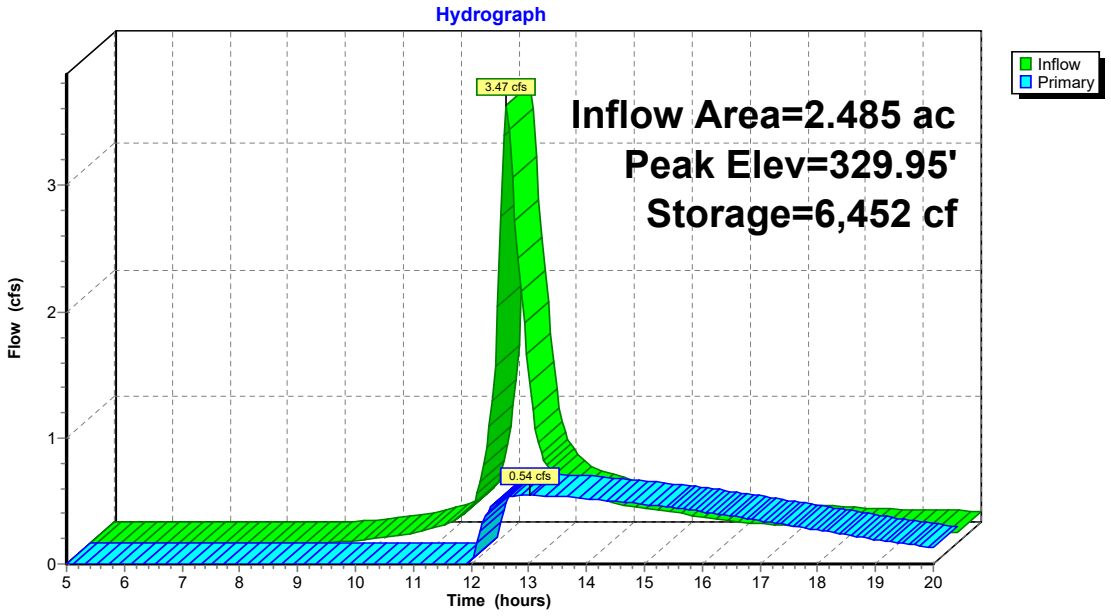
Volume	Invert	Avail.Storage	Storage Description
#1	327.00'	13,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
327.00	1,480	0	0
328.00	1,984	1,732	1,732
329.00	2,422	2,203	3,935
330.00	2,899	2,661	6,596
331.00	3,424	3,162	9,757
332.00	4,018	3,721	13,478

Device	Routing	Invert	Outlet Devices
#1	Primary	328.00'	**4.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	330.00'	**12.0" x 4.0" Horiz. Orifice/Grate** X 6 rows C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.54 cfs @ 13.01 hrs HW=329.95' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.54 cfs @ 6.50 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond SDB1: DB#1 Surface Det Basin



Summary for Pond UDB2: UG DB #2

Inflow Area = 2.360 ac, 64.58% Impervious, Inflow Depth > 1.44" for 2-YEAR event
Inflow = 3.76 cfs @ 12.14 hrs, Volume= 0.283 af
Outflow = 0.49 cfs @ 12.98 hrs, Volume= 0.212 af, Atten= 87%, Lag= 50.8 min
Primary = 0.49 cfs @ 12.98 hrs, Volume= 0.212 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 314.87' @ 12.98 hrs Surf.Area= 0.303 ac Storage= 0.146 af

Plug-Flow detention time= 171.6 min calculated for 0.212 af (75% of inflow)
Center-of-Mass det. time= 110.0 min (912.4 - 802.4)

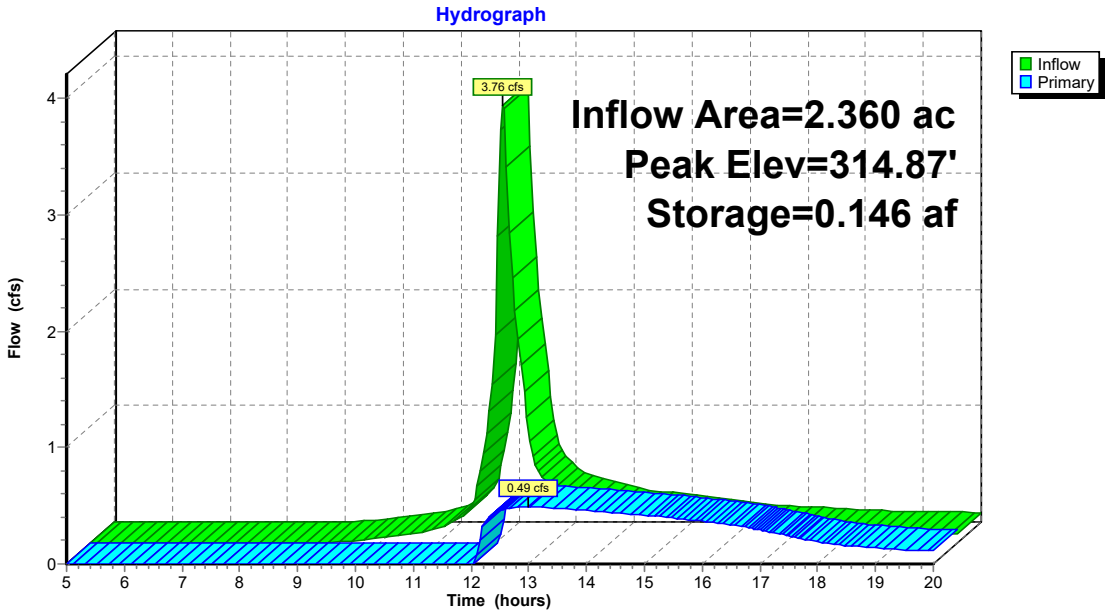
Volume	Invert	Avail.Storage	Storage Description
#1A	314.00'	0.233 af	**82.25'W x 160.26'L x 3.50'H Field A** 1.059 af Overall - 0.394 af Embedded = 0.665 af x 35.0% Voids
#2A	314.50'	0.394 af	**ADS_StormTech SC-740 +Cap**x 374 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 17 Rows of 22 Chambers
		0.627 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	314.50'	**6.0" x 4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	315.80'	**10.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.49 cfs @ 12.98 hrs HW=314.87' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.49 cfs @ 2.92 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond UDB2: UG DB #2



Summary for Pond UDB3: UG D-BASIN #3

Inflow Area = 5.291 ac, 44.57% Impervious, Inflow Depth > 0.56" for 2-YEAR event
Inflow = 1.15 cfs @ 12.50 hrs, Volume= 0.246 af
Outflow = 0.23 cfs @ 16.03 hrs, Volume= 0.170 af, Atten= 80%, Lag= 212.0 min
Discarded = 0.22 cfs @ 11.85 hrs, Volume= 0.170 af
Primary = 0.01 cfs @ 16.03 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 316.55' @ 16.03 hrs Surf.Area= 0.092 ac Storage= 0.100 af

Plug-Flow detention time= 152.9 min calculated for 0.169 af (69% of inflow)
Center-of-Mass det. time= 73.8 min (915.2 - 841.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	314.70'	0.064 af	**104.83'W x 38.04'L x 2.33'H Field A** 0.214 af Overall - 0.053 af Embedded = 0.161 af x 40.0% Voids
#2A	315.20'	0.053 af	**ADS_StormTech SC-310** x 155 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 31 rows
		0.117 af	Total Available Storage

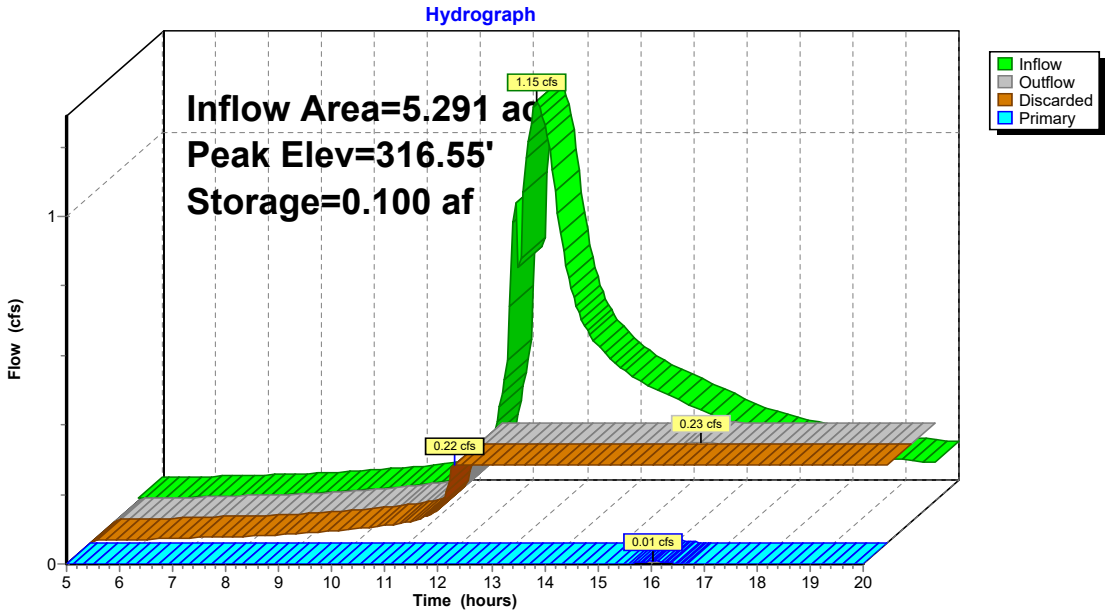
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	314.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	316.52'	**24.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.22 cfs @ 11.85 hrs HW=314.74' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=0.00 cfs @ 16.03 hrs HW=316.55' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.56 fps)

Pond UDB3: UG D-BASIN #3



Summary for Pond UDB4: UG D-BASIN#4

Inflow Area = 1.841 ac, 62.34% Impervious, Inflow Depth > 1.12" for 2-YEAR event
Inflow = 2.02 cfs @ 12.19 hrs, Volume= 0.172 af
Outflow = 0.80 cfs @ 12.58 hrs, Volume= 0.157 af, Atten= 61%, Lag= 22.9 min
Primary = 0.80 cfs @ 12.58 hrs, Volume= 0.157 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 326.02' @ 12.58 hrs Surf.Area= 0.080 ac Storage= 0.057 af

Plug-Flow detention time= 68.6 min calculated for 0.157 af (91% of inflow)
Center-of-Mass det. time= 39.4 min (856.9 - 817.4)

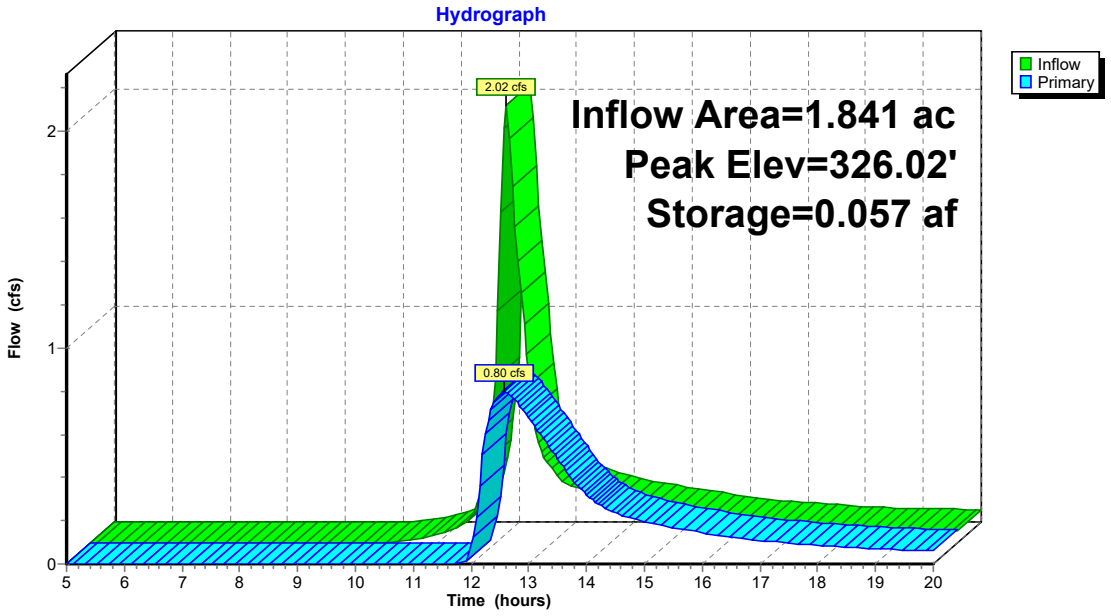
Volume	Invert	Avail.Storage	Storage Description
#1A	324.90'	0.071 af	**39.50'W x 87.88'L x 3.50'H Field A** 0.279 af Overall - 0.102 af Embedded = 0.177 af x 40.0% Voids
#2A	325.40'	0.102 af	**ADS_StormTech SC-740** x 96 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 8 rows
		0.173 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	325.30'	**8.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	326.00'	**12.0" W x 6.0" H Vert. 326** C= 0.600

Primary OutFlow Max=0.80 cfs @ 12.58 hrs HW=326.02' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.79 cfs @ 3.55 fps)
└**2=326** (Orifice Controls 0.01 cfs @ 0.40 fps)

Pond UDB4: UG D-BASIN#4



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment101S: P1-1 Runoff Area=173,800 sf 0.00% Impervious Runoff Depth>0.60"
Flow Length=280' Tc=13.5 min CN=49 Runoff=1.57 cfs 0.201 af

Subcatchment102S: P1-2 Runoff Area=108,268 sf 32.75% Impervious Runoff Depth>2.90"
Flow Length=334' Tc=14.1 min CN=81 Runoff=6.97 cfs 0.601 af

Subcatchment103s: P1-3 Runoff Area=80,176 sf 62.34% Impervious Runoff Depth>2.46"
Flow Length=123' Slope=0.0200 '/' Tc=13.1 min CN=76 Runoff=4.50 cfs 0.377 af

Subcatchment104S: P1-4 Roof Runoff Area=20,457 sf 100.00% Impervious Runoff Depth>4.55"
Tc=6.0 min CN=98 Runoff=2.31 cfs 0.178 af

Subcatchment200S: P2 Runoff Area=18,522 sf 0.00% Impervious Runoff Depth>0.99"
Flow Length=222' Tc=17.3 min CN=56 Runoff=0.33 cfs 0.035 af

Subcatchment301S: P3-1 Runoff Area=177,985 sf 34.44% Impervious Runoff Depth>1.12"
Flow Length=279' Tc=6.0 min CN=58 Runoff=5.16 cfs 0.382 af

Subcatchment302S: P3-2 Runoff Area=40,507 sf 72.71% Impervious Runoff Depth>3.00"
Flow Length=45' Slope=0.0500 '/' Tc=6.0 min CN=82 Runoff=3.41 cfs 0.233 af

Subcatchment303S: P3-3 Runoff Area=102,797 sf 64.58% Impervious Runoff Depth>2.91"
Flow Length=110' Tc=9.3 min CN=81 Runoff=7.54 cfs 0.572 af

Subcatchment304S: P3-4 Runoff Area=97,832 sf 36.89% Impervious Runoff Depth>1.74"
Flow Length=330' Tc=7.6 min CN=67 Runoff=4.53 cfs 0.326 af

Subcatchment305F: P3-5 FIELD Runoff Area=167,683 sf 1.64% Impervious Runoff Depth>0.22"
Flow Length=536' Slope=0.0200 '/' Tc=11.8 min CN=40 Runoff=0.27 cfs 0.069 af

Subcatchment305P: P3-5 PAV Runoff Area=11,973 sf 100.00% Impervious Runoff Depth>4.55"
Tc=6.0 min CN=98 Runoff=1.35 cfs 0.104 af

Reach 36": (new Reach) Avg. Flow Depth=0.89' Max Vel=6.29 fps Inflow=11.17 cfs 1.268 af
36.0" Round Pipe n=0.015 L=1,162.0' S=0.0100 '/' Capacity=57.81 cfs Outflow=10.95 cfs 1.260 af

Reach 100R: Arcade Pond Inflow=16.40 cfs 2.312 af
Outflow=16.40 cfs 2.312 af

Reach BSW: BioSwale at Drive Avg. Flow Depth=0.44' Max Vel=1.95 fps Inflow=5.16 cfs 0.382 af
n=0.035 L=1,063.0' S=0.0094 '/' Capacity=18.42 cfs Outflow=3.67 cfs 0.375 af

Reach DP100: DP-1 Wetland Inflow=1.57 cfs 0.201 af
Outflow=1.57 cfs 0.201 af

Pond 217: BYPASS MH #217 Peak Elev=317.35' Inflow=5.86 cfs 0.667 af
Primary=2.07 cfs 0.508 af Secondary=3.80 cfs 0.159 af Outflow=5.86 cfs 0.667 af

Pond BIO2: BIBASIN 3-2 Peak Elev=315.18' Storage=3,229 cf Inflow=1.44 cfs 0.259 af
Discarded=0.19 cfs 0.130 af Primary=0.70 cfs 0.081 af Outflow=0.89 cfs 0.210 af

Pond BR1: BioBasin #1 Peak Elev=328.97' Storage=2,790 cf Inflow=3.41 cfs 0.233 af
Outflow=2.85 cfs 0.188 af

Pond MH 230: Bypass MH #230 Peak Elev=329.58' Inflow=4.53 cfs 0.326 af
Primary=1.44 cfs 0.259 af Secondary=3.09 cfs 0.067 af Outflow=4.53 cfs 0.326 af

Pond SDB1: DB#1 Surface Det Basin Peak Elev=330.32' Storage=7,548 cf Inflow=6.97 cfs 0.601 af
Outflow=6.03 cfs 0.531 af

Pond UDB2: UG DB #2 Peak Elev=315.58' Storage=0.315 af Inflow=7.54 cfs 0.572 af
Outflow=0.83 cfs 0.450 af

Pond UDB3: UG D-BASIN #3 Peak Elev=317.00' Storage=0.116 af Inflow=2.07 cfs 0.508 af
Discarded=0.22 cfs 0.181 af Primary=1.34 cfs 0.227 af Outflow=1.57 cfs 0.408 af

Pond UDB4: UG D-BASIN#4 Peak Elev=326.70' Storage=0.099 af Inflow=4.50 cfs 0.377 af
Outflow=2.79 cfs 0.359 af

Total Runoff Area = 22.957 ac Runoff Volume = 3.078 af Average Runoff Depth = 1.61"
68.61% Pervious = 15.752 ac 31.39% Impervious = 7.205 ac

Summary for Subcatchment 101S: P1-1

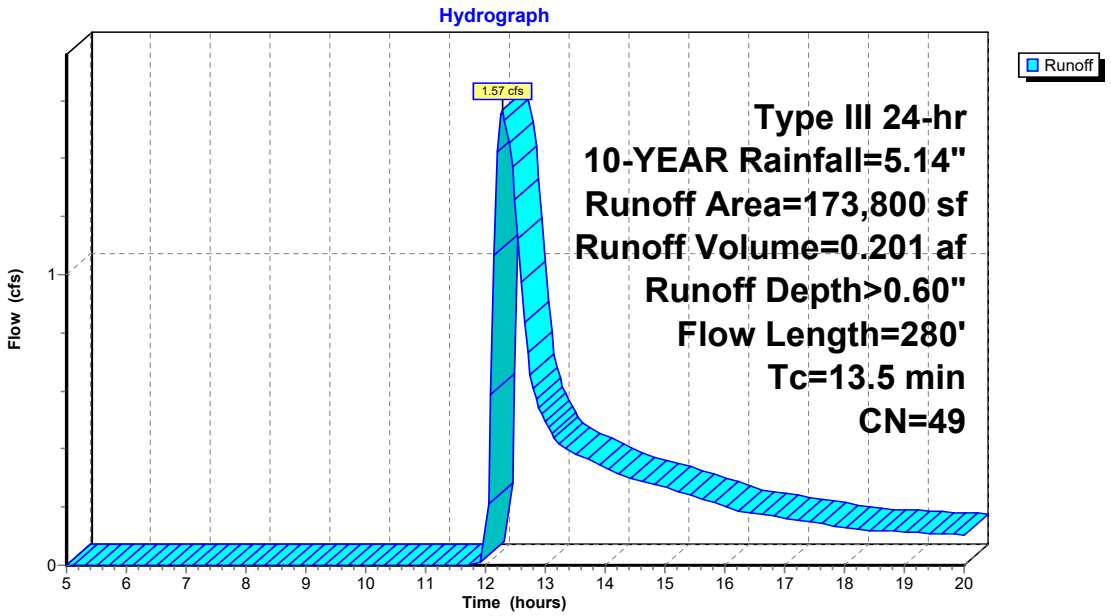
Runoff = 1.57 cfs @ 12.27 hrs, Volume= 0.201 af, Depth> 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
70,742	30	Woods, Good, HSG A
57,144	55	Woods, Good, HSG B
45,914	70	Woods, Good, HSG C
173,800	49	Weighted Average
173,800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	230	0.0380	3.14		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
13.5	280	Total			

Subcatchment 101S: P1-1



Summary for Subcatchment 102S: P1-2

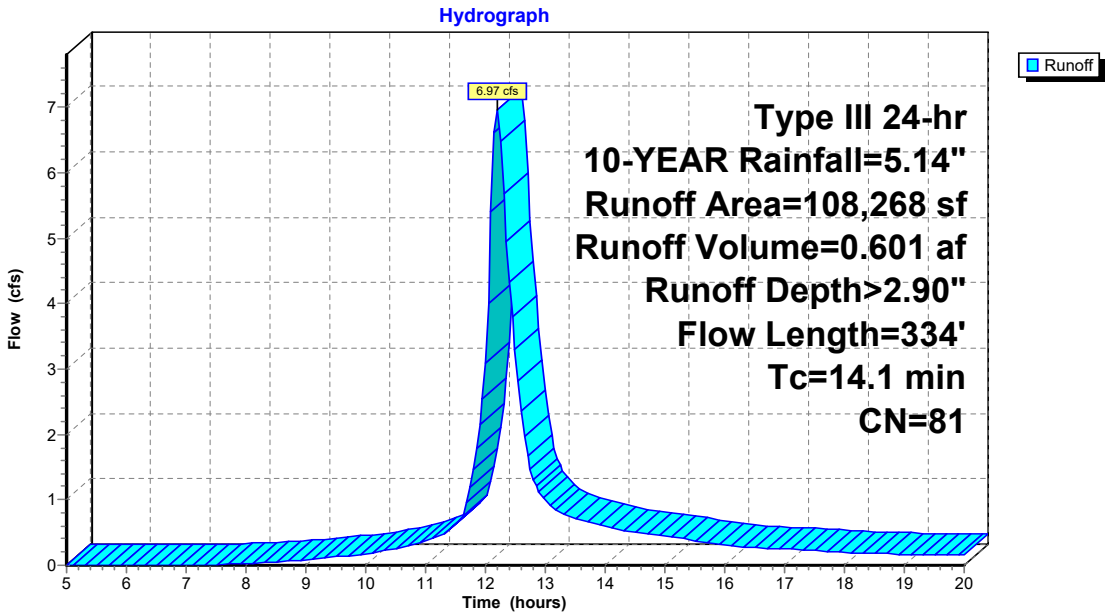
Runoff = 6.97 cfs @ 12.20 hrs, Volume= 0.601 af, Depth> 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
1,531	39	>75% Grass cover, Good, HSG A
71,278	74	>75% Grass cover, Good, HSG C
14,084	98	Paved parking, HSG A
21,375	98	Roofs, HSG A
108,268	81	Weighted Average
72,809		67.25% Pervious Area
35,459		32.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, Sheet Flow 50 Ft** Grass: Bermuda n= 0.410 P2= 3.20"
1.2	229	0.0380	3.14		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
0.3	55	0.0200	2.87		**Shallow Concentrated Flow, PARKING** Paved Kv= 20.3 fps
14.1	334	Total			

Subcatchment 102S: P1-2



Summary for Subcatchment 103s: P1-3

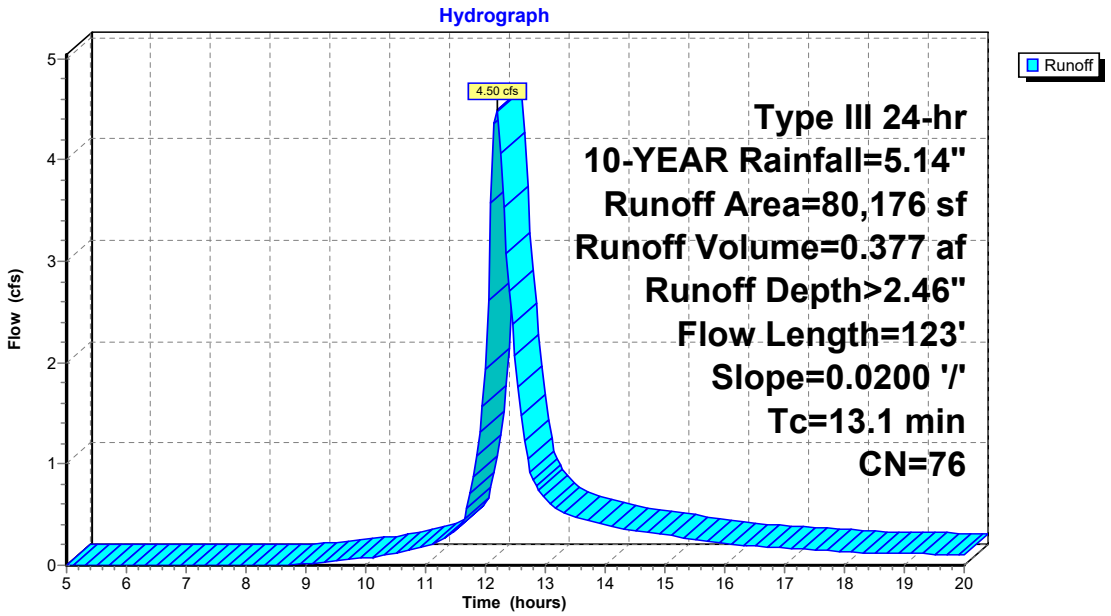
Runoff = 4.50 cfs @ 12.19 hrs, Volume= 0.377 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
30,191	39	>75% Grass cover, Good, HSG A
49,985	98	Paved parking, HSG A
80,176	76	Weighted Average
30,191		37.66% Pervious Area
49,985		62.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, Fields** Grass: Bermuda n= 0.410 P2= 3.20"
0.5	73	0.0200	2.28		**Shallow Concentrated Flow, Field** Unpaved Kv= 16.1 fps
13.1	123	Total			

Subcatchment 103s: P1-3



Summary for Subcatchment 104S: P1-4 Roof

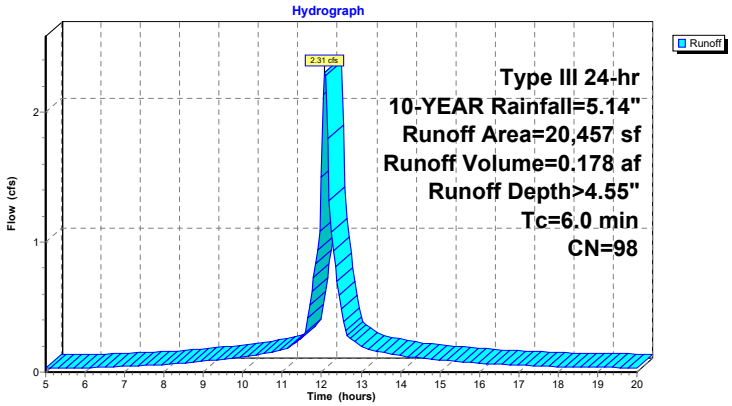
Runoff = 2.31 cfs @ 12.09 hrs, Volume= 0.178 af, Depth> 4.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
20,457	98	Roofs, HSG C
20,457		100.00% Impervious Area

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

Subcatchment 104S: P1-4 Roof



Summary for Subcatchment 200S: P2

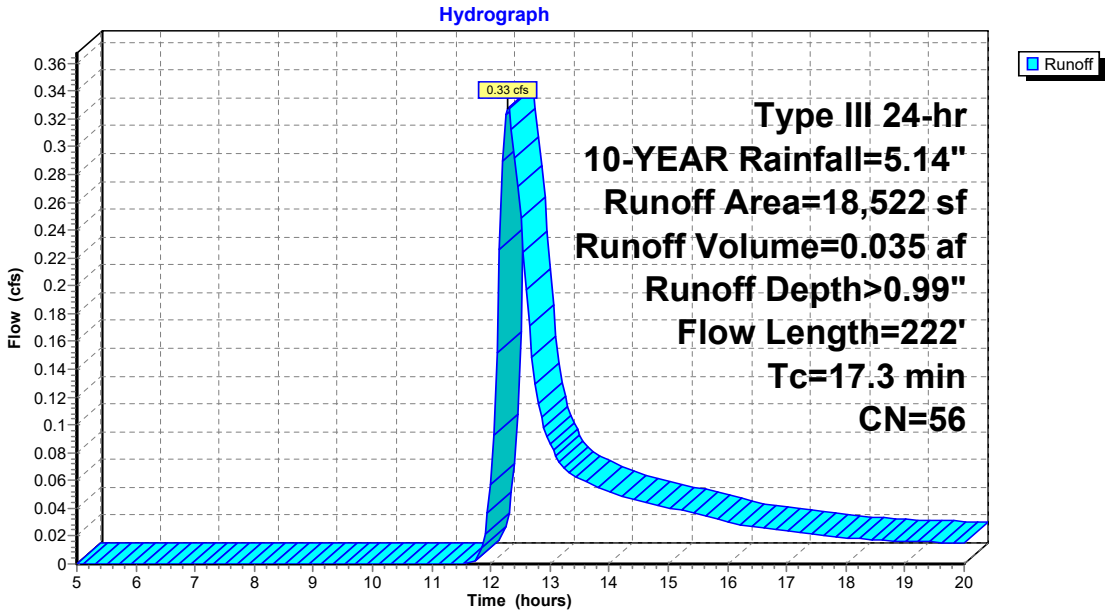
Runoff = 0.33 cfs @ 12.28 hrs, Volume= 0.035 af, Depth> 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,602	61	>75% Grass cover, Good, HSG B
13,920	55	Woods, Good, HSG B
0	74	>75% Grass cover, Good, HSG C
0	70	Woods, Good, HSG C
18,522	56	Weighted Average
18,522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	172	0.0340	2.97		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
17.3	222	Total			

Subcatchment 200S: P2



Summary for Subcatchment 301S: P3-1

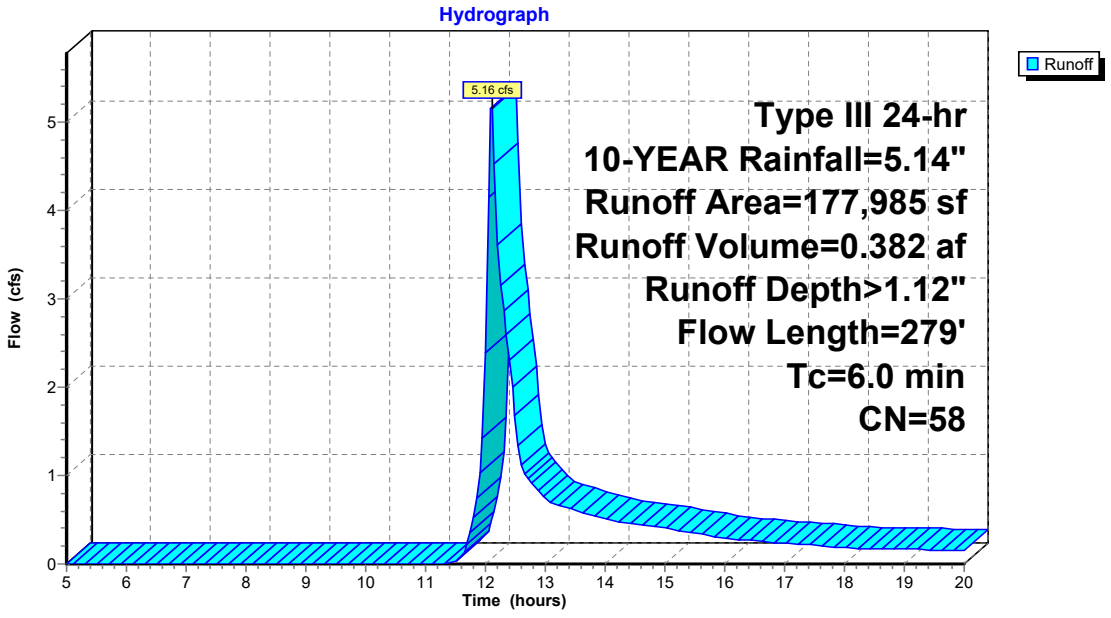
Runoff = 5.16 cfs @ 12.11 hrs, Volume= 0.382 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
45,255	39	>75% Grass cover, Good, HSG A
39,144	98	Paved parking, HSG A
3,009	74	>75% Grass cover, Good, HSG C
59,632	30	Woods, Good, HSG A
8,798	70	Woods, Good, HSG C
22,147	98	Roofs, HSG A
177,985	58	Weighted Average
116,694		65.56% Pervious Area
61,291		34.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	44	0.0600	0.15		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
0.5	235	0.2500	8.05		**Shallow Concentrated Flow, HILL** Unpaved Kv= 16.1 fps
0.7					**Direct Entry, TO 6 MIN**
6.0	279	Total			

Subcatchment 301S: P3-1



Summary for Subcatchment 302S: P3-2

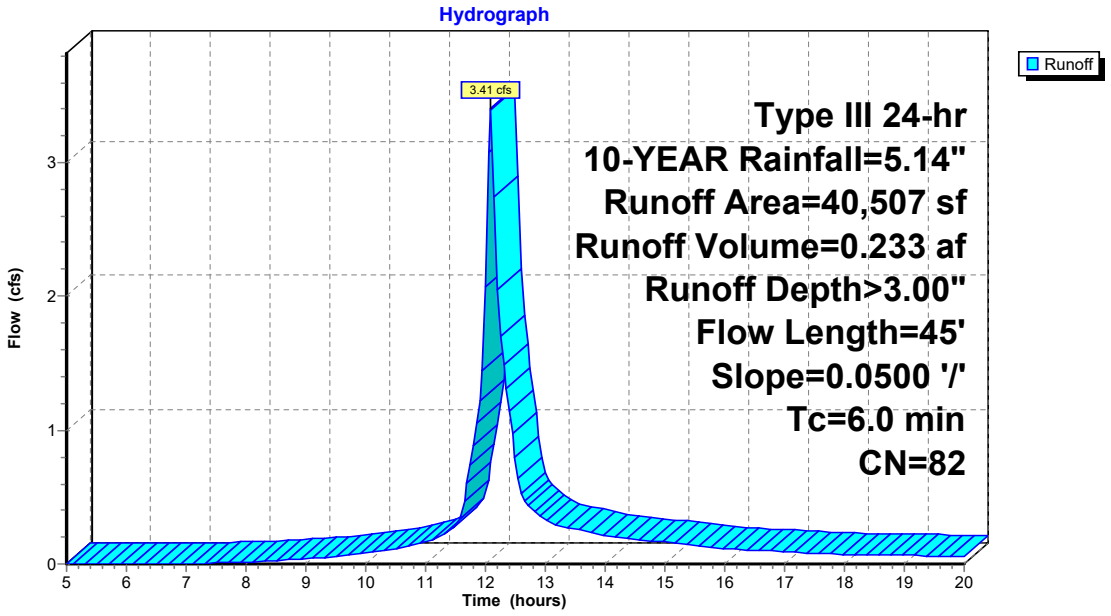
Runoff = 3.41 cfs @ 12.09 hrs, Volume= 0.233 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
11,056	39	>75% Grass cover, Good, HSG A
29,451	98	Paved parking, HSG A
40,507	82	Weighted Average
11,056		27.29% Pervious Area
29,451		72.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	45	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.8					**Direct Entry, DIRECT MAKE UP**
6.0	45	Total			

Subcatchment 302S: P3-2



Summary for Subcatchment 303S: P3-3

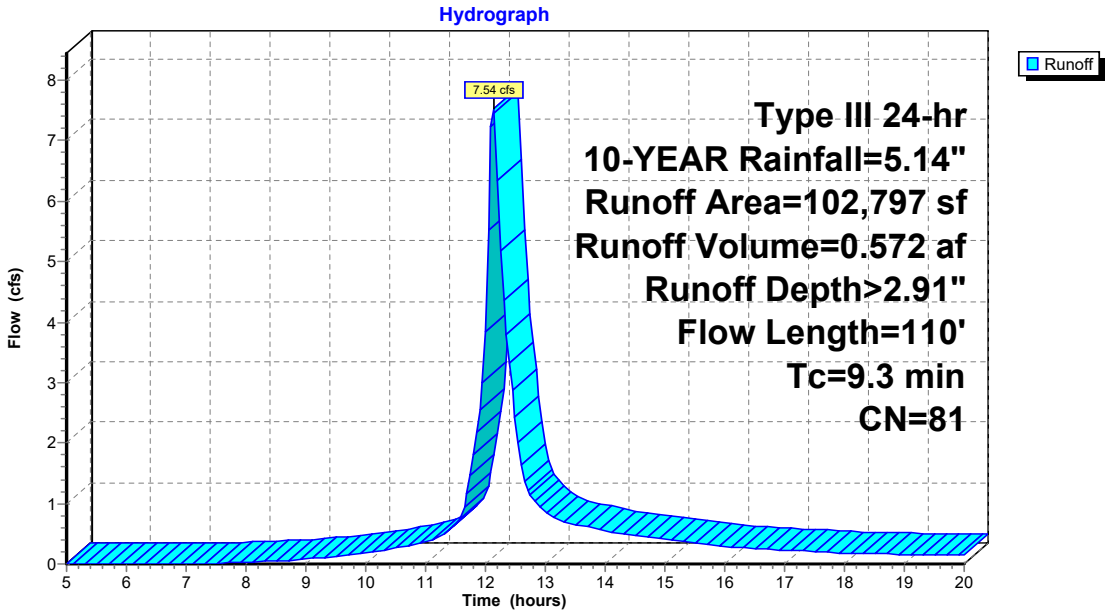
Runoff = 7.54 cfs @ 12.13 hrs, Volume= 0.572 af, Depth> 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
25,409	39	>75% Grass cover, Good, HSG A
11,002	74	>75% Grass cover, Good, HSG C
56,435	98	Paved parking, HSG A
9,951	98	Roofs, HSG A
102,797	81	Weighted Average
36,411		35.42% Pervious Area
66,386		64.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	50	0.0460	0.09		**Sheet Flow, Landscape Lawn** Grass: Bermuda n= 0.410 P2= 3.20"
0.3	60	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.3	110	Total			

Subcatchment 303S: P3-3



Summary for Subcatchment 304S: P3-4

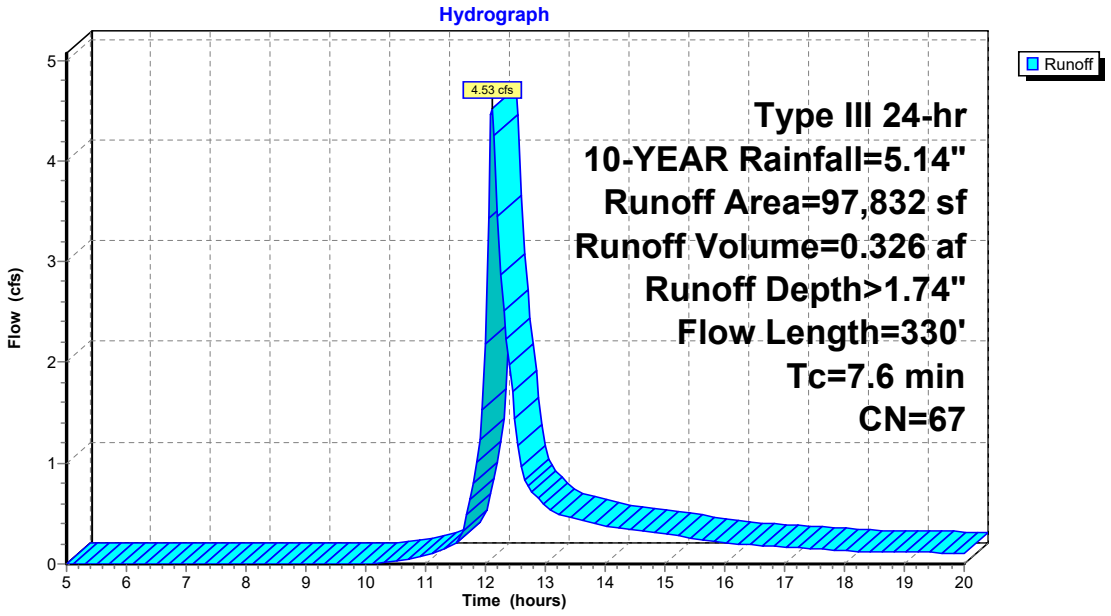
Runoff = 4.53 cfs @ 12.12 hrs, Volume= 0.326 af, Depth> 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
45,107	39	>75% Grass cover, Good, HSG A
16,631	74	>75% Grass cover, Good, HSG C
36,094	98	Paved parking, HSG A
97,832	67	Weighted Average
61,738		63.11% Pervious Area
36,094		36.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
1.4	280	0.0420	3.30		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
7.6	330	Total			

Subcatchment 304S: P3-4



Summary for Subcatchment 305F: P3-5 FIELD

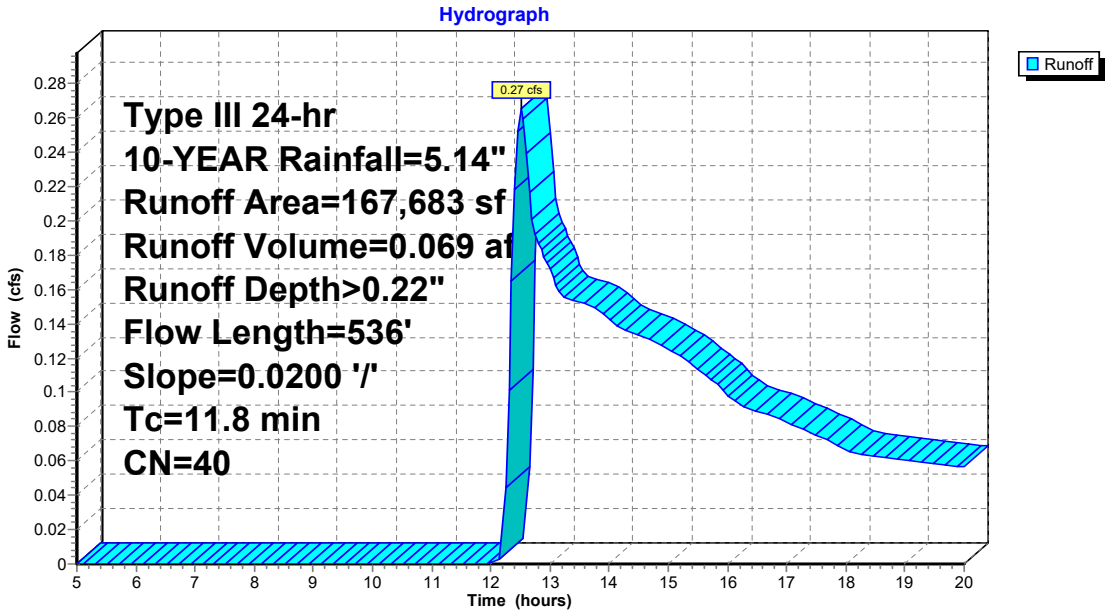
Runoff = 0.27 cfs @ 12.51 hrs, Volume= 0.069 af, Depth> 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
164,925	39	>75% Grass cover, Good, HSG A
2,758	98	Paved parking, HSG A
167,683	40	Weighted Average
164,925		98.36% Pervious Area
2,758		1.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
3.6	486	0.0200	2.28		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
11.8	536	Total			

Subcatchment 305F: P3-5 FIELD



Summary for Subcatchment 305P: P3-5 PAV

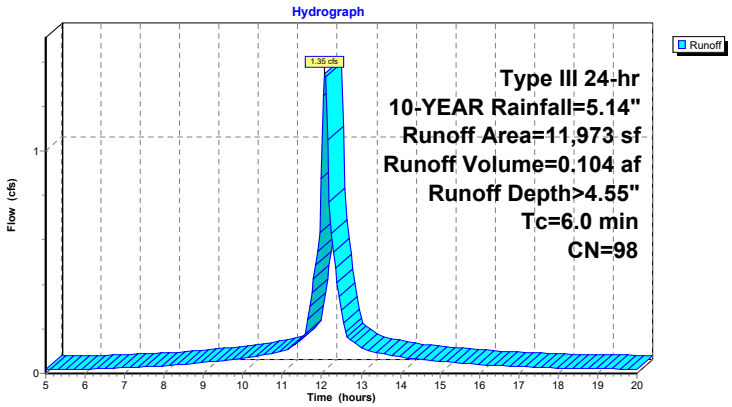
Runoff = 1.35 cfs @ 12.09 hrs, Volume= 0.104 af, Depth> 4.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=5.14"

Area (sf)	CN	Description
11,973	98	Paved parking, HSG A
11,973		100.00% Impervious Area

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

Subcatchment 305P: P3-5 PAV



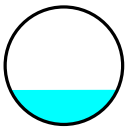
Summary for Reach 36": (new Reach)

Inflow Area = 8.786 ac, 27.67% Impervious, Inflow Depth > 1.73" for 10-YEAR event
Inflow = 11.17 cfs @ 12.29 hrs, Volume= 1.268 af
Outflow = 10.95 cfs @ 12.39 hrs, Volume= 1.260 af, Atten= 2%, Lag= 6.2 min

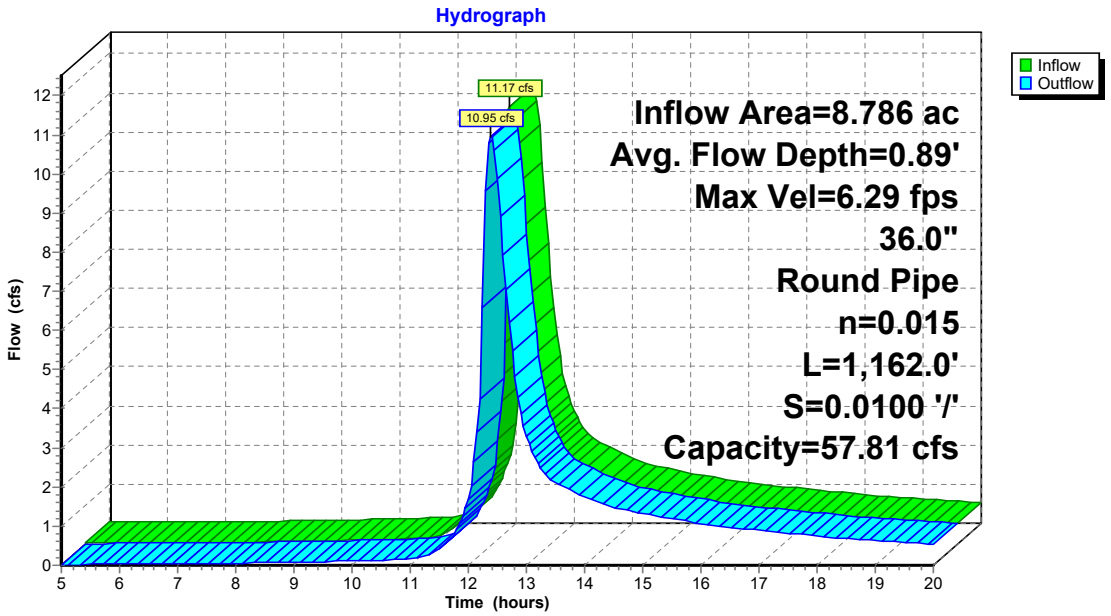
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.29 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 2.52 fps, Avg. Travel Time= 7.7 min

Peak Storage= 2,025 cf @ 12.34 hrs
Average Depth at Peak Storage= 0.89'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 57.81 cfs

36.0" Round Pipe
n= 0.015
Length= 1,162.0' Slope= 0.0100 '/'
Inlet Invert= 324.40', Outlet Invert= 312.78'



Reach 36": (new Reach)

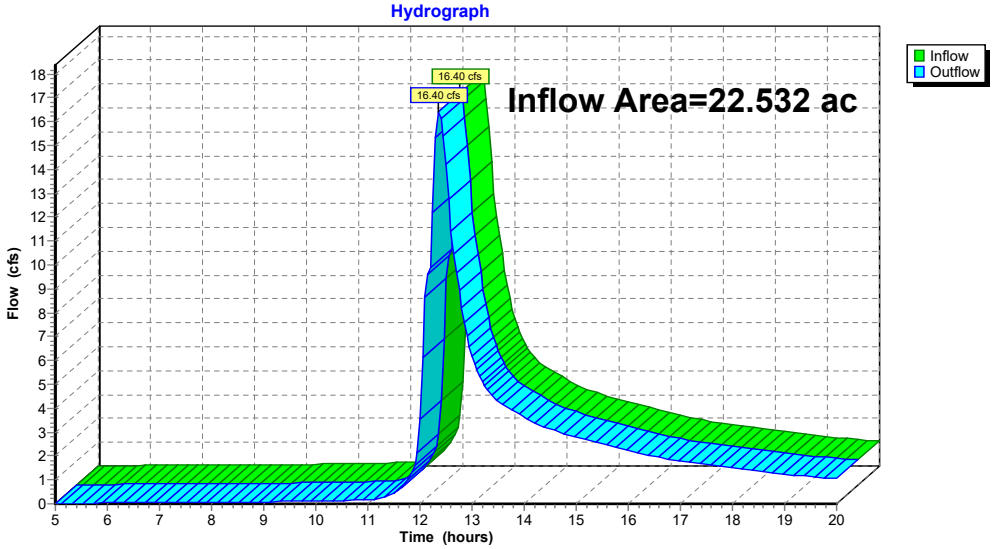


Summary for Reach 100R: Arcade Pond

Inflow Area = 22.532 ac, 31.98% Impervious, Inflow Depth > 1.23" for 10-YEAR event
Inflow = 16.40 cfs @ 12.37 hrs, Volume= 2.312 af
Outflow = 16.40 cfs @ 12.37 hrs, Volume= 2.312 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 100R: Arcade Pond



Summary for Reach BSW: BioSwale at Drive

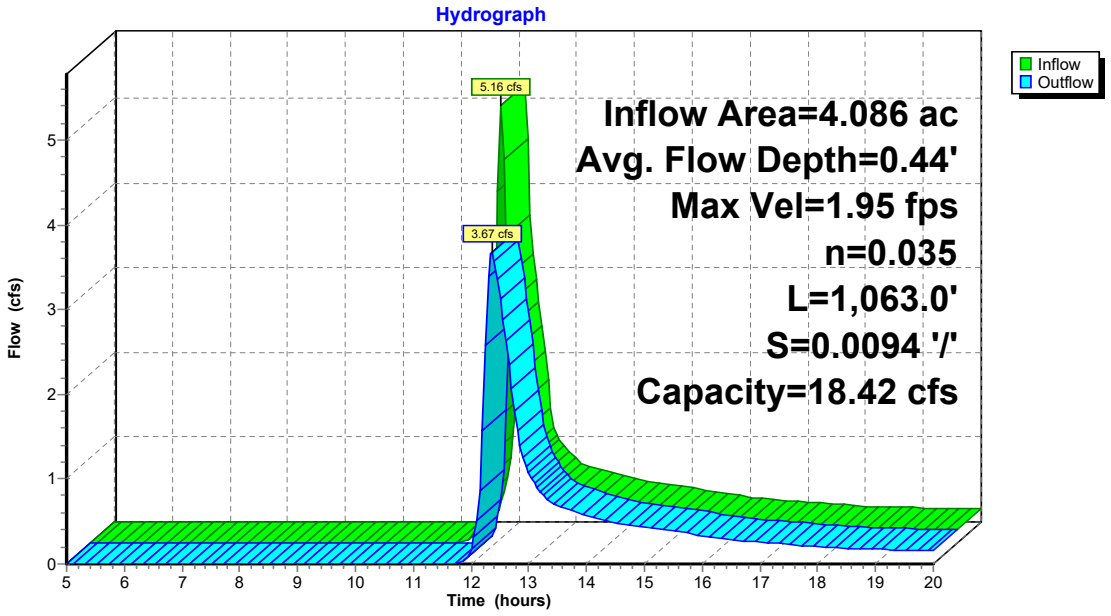
Inflow Area = 4.086 ac, 34.44% Impervious, Inflow Depth > 1.12" for 10-YEAR event
Inflow = 5.16 cfs @ 12.11 hrs, Volume= 0.382 af
Outflow = 3.67 cfs @ 12.36 hrs, Volume= 0.375 af, Atten= 29%, Lag= 15.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.95 fps, Min. Travel Time= 9.1 min
Avg. Velocity = 0.93 fps, Avg. Travel Time= 19.1 min

Peak Storage= 2,000 cf @ 12.21 hrs
Average Depth at Peak Storage= 0.44'
Defined Flood Depth= 1.25' Flow Area= 8.2 sf, Capacity= 27.79 cfs
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 18.42 cfs

3.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 '/' Top Width= 9.00'
Length= 1,063.0' Slope= 0.0094 '/'
Inlet Invert= 330.00', Outlet Invert= 320.00'

Reach BSW: BioSwale at Drive

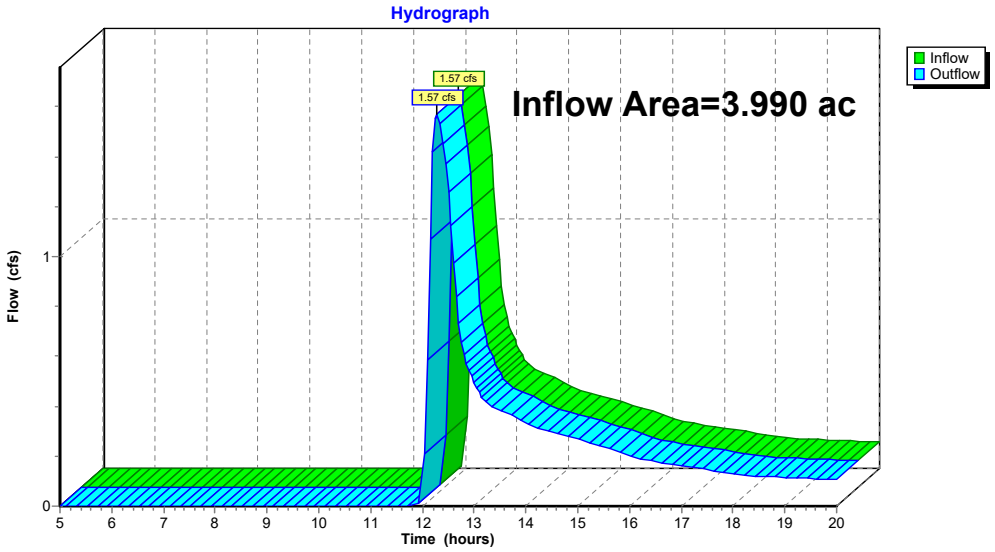


Summary for Reach DP100: DP-1 Wetland

Inflow Area = 3.990 ac, 0.00% Impervious, Inflow Depth > 0.60" for 10-YEAR event
Inflow = 1.57 cfs @ 12.27 hrs, Volume= 0.201 af
Outflow = 1.57 cfs @ 12.27 hrs, Volume= 0.201 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP100: DP-1 Wetland



Summary for Pond 217: BYPASS MH #217

Inflow Area = 5.291 ac, 44.57% Impervious, Inflow Depth > 1.51" for 10-YEAR event
Inflow = 5.86 cfs @ 12.32 hrs, Volume= 0.667 af
Outflow = 5.86 cfs @ 12.32 hrs, Volume= 0.667 af, Atten= 0%, Lag= 0.0 min
Primary = 2.07 cfs @ 12.32 hrs, Volume= 0.508 af
Secondary = 3.80 cfs @ 12.32 hrs, Volume= 0.159 af

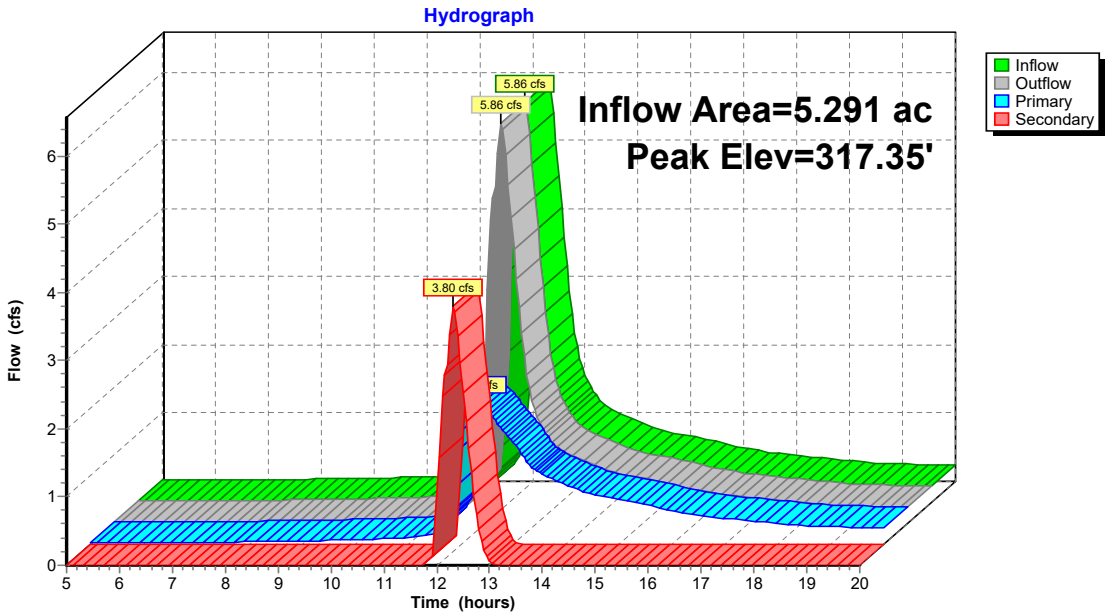
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 317.35' @ 12.32 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	315.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	316.52'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=2.06 cfs @ 12.32 hrs HW=317.34' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 2.06 cfs @ 5.91 fps)

Secondary OutFlow Max=3.75 cfs @ 12.32 hrs HW=317.34' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 3.75 cfs @ 3.08 fps)

Pond 217: BYPASS MH #217



Summary for Pond BIO2: BIBASIN 3-2

Inflow Area = 2.246 ac, 36.89% Impervious, Inflow Depth > 1.39" for 10-YEAR event
Inflow = 1.44 cfs @ 12.12 hrs, Volume= 0.259 af
Outflow = 0.89 cfs @ 12.63 hrs, Volume= 0.210 af, Atten= 38%, Lag= 31.0 min
Discarded = 0.19 cfs @ 12.63 hrs, Volume= 0.130 af
Primary = 0.70 cfs @ 12.63 hrs, Volume= 0.081 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 315.18' @ 12.63 hrs Surf.Area= 3,414 sf Storage= 3,229 cf

Plug-Flow detention time= 109.0 min calculated for 0.210 af (81% of inflow)
Center-of-Mass det. time= 55.8 min (890.4 - 834.7)

Volume	Invert	Avail.Storage	Storage Description
#1	314.00'	6,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

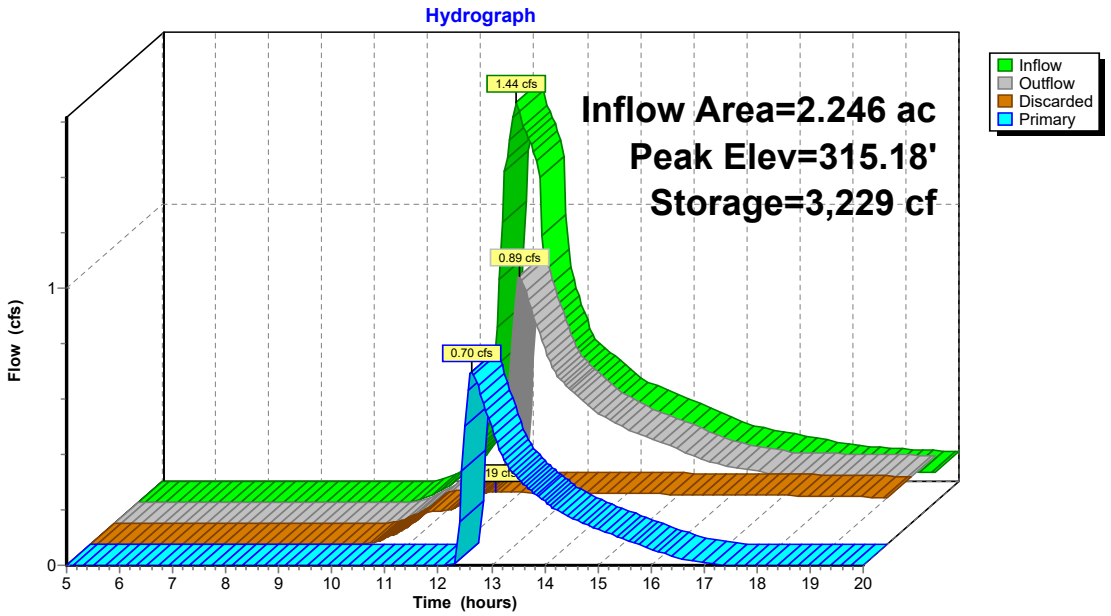
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
314.00	2,047	0	0
315.00	3,194	2,621	2,621
316.00	4,388	3,791	6,412

Device	Routing	Invert	Outlet Devices
#1	Primary	315.50'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#2	Discarded	314.00'	**2.410 in/hr Exfiltration over Horizontal area**
#3	Primary	315.00'	**24.0" Horiz. Orifice/Grate X 0.43** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 12.63 hrs HW=315.18' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.70 cfs @ 12.63 hrs HW=315.18' (Free Discharge)
├**1=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Weir Controls 0.70 cfs @ 0.60 fps)

Pond BIO2: BIBASIN 3-2



Summary for Pond BR1: BioBasin #1

Inflow Area = 0.930 ac, 72.71% Impervious, Inflow Depth > 3.00" for 10-YEAR event
Inflow = 3.41 cfs @ 12.09 hrs, Volume= 0.233 af
Outflow = 2.85 cfs @ 12.15 hrs, Volume= 0.188 af, Atten= 16%, Lag= 3.6 min
Primary = 2.85 cfs @ 12.15 hrs, Volume= 0.188 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 328.97' @ 12.15 hrs Surf.Area= 2,137 sf Storage= 2,790 cf

Plug-Flow detention time= 85.3 min calculated for 0.188 af (81% of inflow)
Center-of-Mass det. time= 35.0 min (816.5 - 781.5)

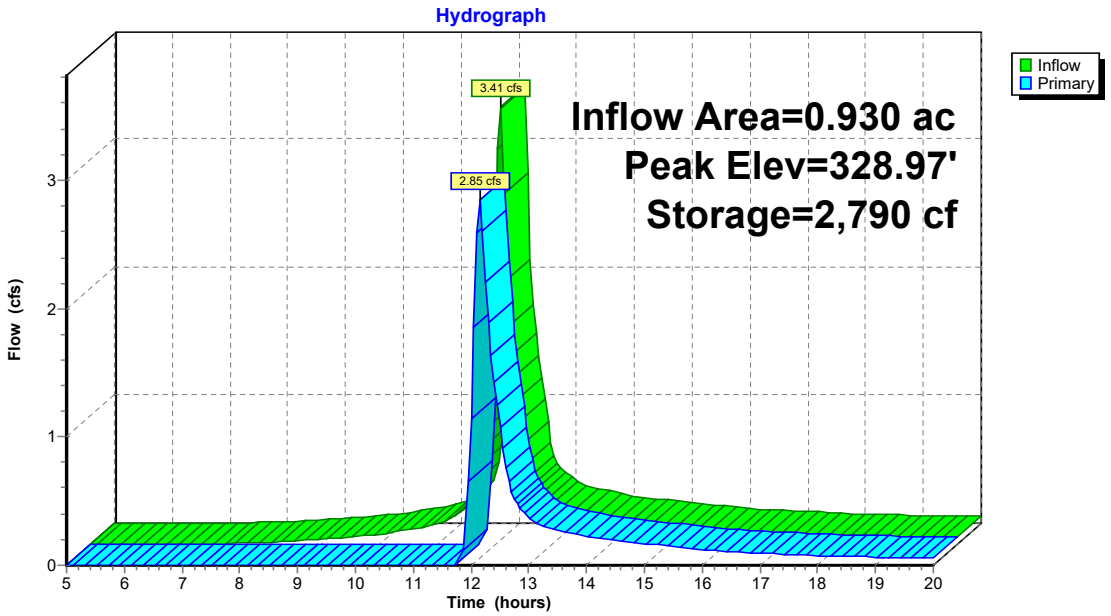
Volume	Invert	Avail.Storage	Storage Description
#1	327.00'	5,450 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
327.00	888	0	0
328.00	1,328	1,108	1,108
329.00	2,162	1,745	2,853
330.00	3,032	2,597	5,450

Device	Routing	Invert	Outlet Devices
#1	Primary	329.00'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#2	Primary	328.50'	**24.0" Horiz. Orifice/Grate X 0.43** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.85 cfs @ 12.15 hrs HW=328.97' (Free Discharge)
└**1=Orifice/Grate** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Weir Controls 2.85 cfs @ 0.96 fps)

Pond BR1: BioBasin #1



Summary for Pond MH 230: Bypass MH #230

Inflow Area = 2.246 ac, 36.89% Impervious, Inflow Depth > 1.74" for 10-YEAR event
Inflow = 4.53 cfs @ 12.12 hrs, Volume= 0.326 af
Outflow = 4.53 cfs @ 12.12 hrs, Volume= 0.326 af, Atten= 0%, Lag= 0.0 min
Primary = 1.44 cfs @ 12.12 hrs, Volume= 0.259 af
Secondary = 3.09 cfs @ 12.12 hrs, Volume= 0.067 af

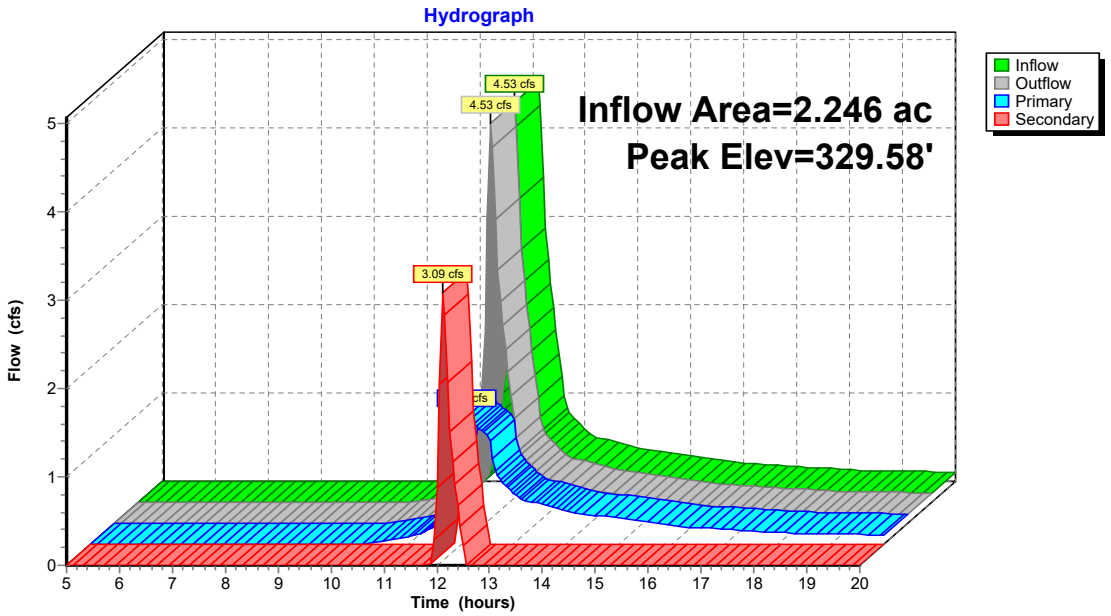
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 329.58' @ 12.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	327.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	328.75'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.44 cfs @ 12.12 hrs HW=329.56' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 1.44 cfs @ 7.31 fps)

Secondary OutFlow Max=2.96 cfs @ 12.12 hrs HW=329.56' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 2.96 cfs @ 3.06 fps)

Pond MH 230: Bypass MH #230



Summary for Pond SDB1: DB#1 Surface Det Basin

Inflow Area = 2.485 ac, 32.75% Impervious, Inflow Depth > 2.90" for 10-YEAR event
Inflow = 6.97 cfs @ 12.20 hrs, Volume= 0.601 af
Outflow = 6.03 cfs @ 12.28 hrs, Volume= 0.531 af, Atten= 13%, Lag= 5.1 min
Primary = 6.03 cfs @ 12.28 hrs, Volume= 0.531 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 330.32' @ 12.28 hrs Surf.Area= 3,067 sf Storage= 7,548 cf

Plug-Flow detention time= 105.8 min calculated for 0.531 af (88% of inflow)
Center-of-Mass det. time= 70.0 min (860.2 - 790.2)

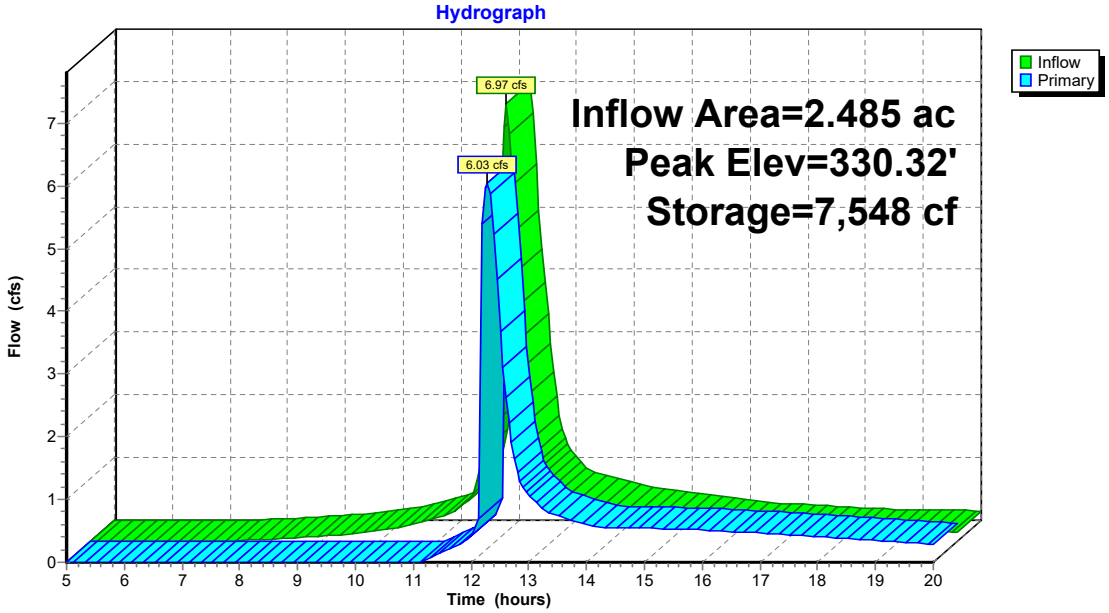
Volume	Invert	Avail.Storage	Storage Description
#1	327.00'	13,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
327.00	1,480	0	0
328.00	1,984	1,732	1,732
329.00	2,422	2,203	3,935
330.00	2,899	2,661	6,596
331.00	3,424	3,162	9,757
332.00	4,018	3,721	13,478

Device	Routing	Invert	Outlet Devices
#1	Primary	328.00'	**4.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	330.00'	**12.0" x 4.0" Horiz. Orifice/Grate** X 6 rows C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.00 cfs @ 12.28 hrs HW=330.31' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.59 cfs @ 7.12 fps)
2=Orifice/Grate (Orifice Controls 5.40 cfs @ 2.70 fps)

Pond SDB1: DB#1 Surface Det Basin



Summary for Pond UDB2: UG DB #2

Inflow Area = 2.360 ac, 64.58% Impervious, Inflow Depth > 2.91" for 10-YEAR event
Inflow = 7.54 cfs @ 12.13 hrs, Volume= 0.572 af
Outflow = 0.83 cfs @ 13.05 hrs, Volume= 0.450 af, Atten= 89%, Lag= 54.9 min
Primary = 0.83 cfs @ 13.05 hrs, Volume= 0.450 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 315.58' @ 13.05 hrs Surf.Area= 0.303 ac Storage= 0.315 af

Plug-Flow detention time= 201.6 min calculated for 0.448 af (78% of inflow)
Center-of-Mass det. time= 147.5 min (933.9 - 786.4)

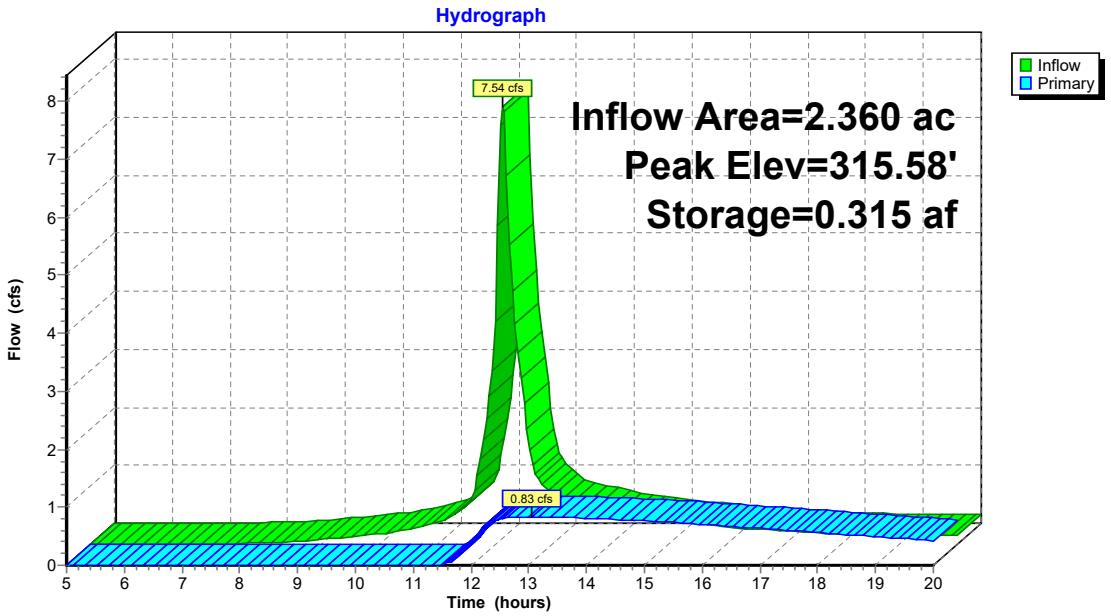
Volume	Invert	Avail.Storage	Storage Description
#1A	314.00'	0.233 af	**82.25'W x 160.26'L x 3.50'H Field A** 1.059 af Overall - 0.394 af Embedded = 0.665 af x 35.0% Voids
#2A	314.50'	0.394 af	**ADS_StormTech SC-740 +Cap**x 374 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 17 Rows of 22 Chambers
		0.627 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	314.50'	**6.0" x 4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	315.80'	**10.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.83 cfs @ 13.05 hrs HW=315.58' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.83 cfs @ 4.99 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond UDB2: UG DB #2



Summary for Pond UDB3: UG D-BASIN #3

Inflow Area = 5.291 ac, 44.57% Impervious, Inflow Depth > 1.15" for 10-YEAR event
Inflow = 2.07 cfs @ 12.32 hrs, Volume= 0.508 af
Outflow = 1.57 cfs @ 12.92 hrs, Volume= 0.408 af, Atten= 24%, Lag= 36.0 min
Discarded = 0.22 cfs @ 11.70 hrs, Volume= 0.181 af
Primary = 1.34 cfs @ 12.92 hrs, Volume= 0.227 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 317.00' @ 12.92 hrs Surf.Area= 0.092 ac Storage= 0.116 af

Plug-Flow detention time= 90.0 min calculated for 0.408 af (80% of inflow)
Center-of-Mass det. time= 34.3 min (880.7 - 846.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	314.70'	0.064 af	**104.83'W x 38.04'L x 2.33'H Field A** 0.214 af Overall - 0.053 af Embedded = 0.161 af x 40.0% Voids
#2A	315.20'	0.053 af	**ADS_StormTech SC-310** x 155 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 31 rows
		0.117 af	Total Available Storage

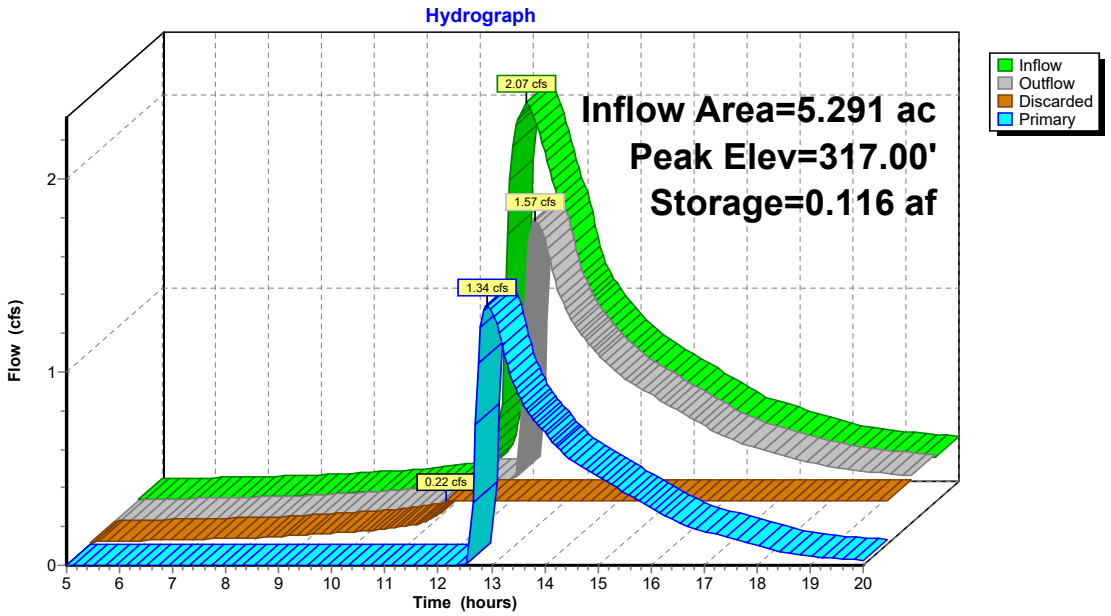
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	314.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	316.52'	**24.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.22 cfs @ 11.70 hrs HW=314.74' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=1.34 cfs @ 12.92 hrs HW=316.99' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 1.34 cfs @ 2.35 fps)

Pond UDB3: UG D-BASIN #3



Summary for Pond UDB4: UG D-BASIN#4

Inflow Area = 1.841 ac, 62.34% Impervious, Inflow Depth > 2.46" for 10-YEAR event
Inflow = 4.50 cfs @ 12.19 hrs, Volume= 0.377 af
Outflow = 2.79 cfs @ 12.39 hrs, Volume= 0.359 af, Atten= 38%, Lag= 12.3 min
Primary = 2.79 cfs @ 12.39 hrs, Volume= 0.359 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 326.70' @ 12.39 hrs Surf.Area= 0.080 ac Storage= 0.099 af

Plug-Flow detention time= 49.1 min calculated for 0.357 af (95% of inflow)
Center-of-Mass det. time= 31.9 min (832.0 - 800.0)

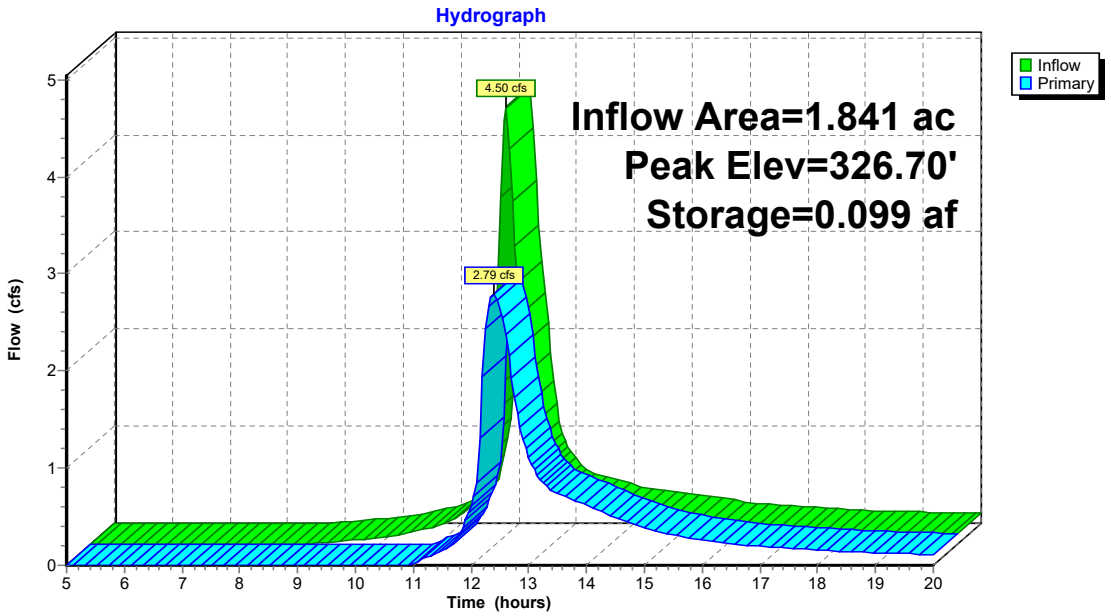
Volume	Invert	Avail.Storage	Storage Description
#1A	324.90'	0.071 af	**39.50'W x 87.88'L x 3.50'H Field A** 0.279 af Overall - 0.102 af Embedded = 0.177 af x 40.0% Voids
#2A	325.40'	0.102 af	**ADS_StormTech SC-740** x 96 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 8 rows
		0.173 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	325.30'	**8.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	326.00'	**12.0" W x 6.0" H Vert. 326** C= 0.600

Primary OutFlow Max=2.78 cfs @ 12.39 hrs HW=326.70' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 1.19 cfs @ 5.34 fps)
└**2=326** (Orifice Controls 1.59 cfs @ 3.19 fps)

Pond UDB4: UG D-BASIN#4



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment101S: P1-1 Runoff Area=173,800 sf 0.00% Impervious Runoff Depth>1.07"
Flow Length=280' Tc=13.5 min CN=49 Runoff=3.43 cfs 0.356 af

Subcatchment102S: P1-2 Runoff Area=108,268 sf 32.75% Impervious Runoff Depth>3.88"
Flow Length=334' Tc=14.1 min CN=81 Runoff=9.23 cfs 0.803 af

Subcatchment103s: P1-3 Runoff Area=80,176 sf 62.34% Impervious Runoff Depth>3.38"
Flow Length=123' Slope=0.0200 '/' Tc=13.1 min CN=76 Runoff=6.16 cfs 0.518 af

Subcatchment104S: P1-4 Roof Runoff Area=20,457 sf 100.00% Impervious Runoff Depth>5.58"
Tc=6.0 min CN=98 Runoff=2.82 cfs 0.219 af

Subcatchment200S: P2 Runoff Area=18,522 sf 0.00% Impervious Runoff Depth>1.59"
Flow Length=222' Tc=17.3 min CN=56 Runoff=0.57 cfs 0.056 af

Subcatchment301S: P3-1 Runoff Area=177,985 sf 34.44% Impervious Runoff Depth>1.76"
Flow Length=279' Tc=6.0 min CN=58 Runoff=8.55 cfs 0.599 af

Subcatchment302S: P3-2 Runoff Area=40,507 sf 72.71% Impervious Runoff Depth>3.99"
Flow Length=45' Slope=0.0500 '/' Tc=6.0 min CN=82 Runoff=4.48 cfs 0.309 af

Subcatchment303S: P3-3 Runoff Area=102,797 sf 64.58% Impervious Runoff Depth>3.88"
Flow Length=110' Tc=9.3 min CN=81 Runoff=9.98 cfs 0.764 af

Subcatchment304S: P3-4 Runoff Area=97,832 sf 36.89% Impervious Runoff Depth>2.53"
Flow Length=330' Tc=7.6 min CN=67 Runoff=6.67 cfs 0.474 af

Subcatchment305F: P3-5 FIELD Runoff Area=167,683 sf 1.64% Impervious Runoff Depth>0.50"
Flow Length=536' Slope=0.0200 '/' Tc=11.8 min CN=40 Runoff=1.00 cfs 0.160 af

Subcatchment305P: P3-5 PAV Runoff Area=11,973 sf 100.00% Impervious Runoff Depth>5.58"
Tc=6.0 min CN=98 Runoff=1.65 cfs 0.128 af

Reach 36": (new Reach) Avg. Flow Depth=1.07' Max Vel=6.98 fps Inflow=16.05 cfs 1.791 af
36.0" Round Pipe n=0.015 L=1,162.0' S=0.0100 '/' Capacity=57.81 cfs Outflow=15.86 cfs 1.782 af

Reach 100R: Arcade Pond Inflow=27.21 cfs 3.502 af
Outflow=27.21 cfs 3.502 af

Reach BSW: BioSwale at Drive Avg. Flow Depth=0.59' Max Vel=2.30 fps Inflow=8.55 cfs 0.599 af
n=0.035 L=1,063.0' S=0.0094 '/' Capacity=18.42 cfs Outflow=6.42 cfs 0.590 af

Reach DP100: DP-1 Wetland Inflow=3.43 cfs 0.356 af
Outflow=3.43 cfs 0.356 af

Pond 217: BYPASS MH #217 Peak Elev=317.70' Inflow=9.44 cfs 0.982 af
Primary=2.30 cfs 0.658 af Secondary=7.14 cfs 0.325 af Outflow=9.44 cfs 0.982 af

Pond BIO2: BIBASIN 3-2 Peak Elev=315.24' Storage=3,405 cf Inflow=1.53 cfs 0.343 af
Discarded=0.19 cfs 0.140 af Primary=1.01 cfs 0.146 af Outflow=1.20 cfs 0.286 af

Pond BR1: BioBasin #1 Peak Elev=329.04' Storage=2,940 cf Inflow=4.48 cfs 0.309 af
Outflow=4.11 cfs 0.265 af

Pond MH 230: Bypass MH #230 Peak Elev=329.88' Inflow=6.67 cfs 0.474 af
Primary=1.53 cfs 0.343 af Secondary=5.14 cfs 0.131 af Outflow=6.67 cfs 0.474 af

Pond SDB1: DB#1 Surface Det Basin Peak Elev=330.57' Storage=8,345 cf Inflow=9.23 cfs 0.803 af
Outflow=7.92 cfs 0.720 af

Pond UDB2: UG DB #2 Peak Elev=316.04' Storage=0.417 af Inflow=9.98 cfs 0.764 af
Outflow=1.31 cfs 0.591 af

Pond UDB3: UG D-BASIN #3 Peak Elev=317.08' Storage=0.117 af Inflow=2.30 cfs 0.658 af
Discarded=0.22 cfs 0.188 af Primary=1.83 cfs 0.366 af Outflow=2.05 cfs 0.554 af

Pond UDB4: UG D-BASIN#4 Peak Elev=327.21' Storage=0.128 af Inflow=6.16 cfs 0.518 af
Outflow=3.77 cfs 0.498 af

Total Runoff Area = 22.957 ac Runoff Volume = 4.386 af Average Runoff Depth = 2.29"
68.61% Pervious = 15.752 ac 31.39% Impervious = 7.205 ac

Summary for Subcatchment 101S: P1-1

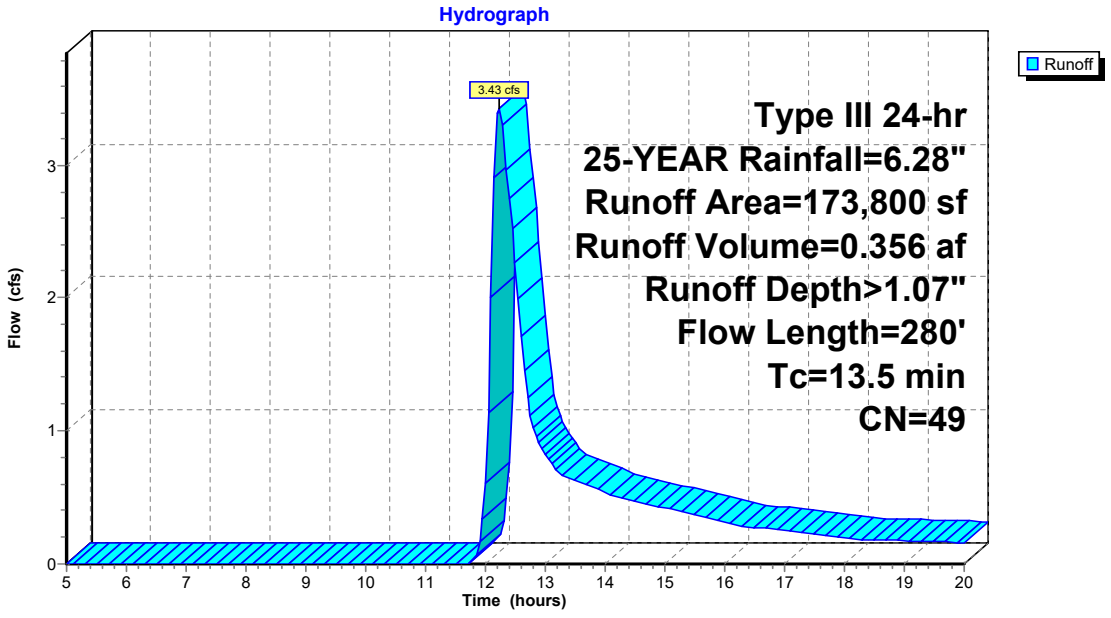
Runoff = 3.43 cfs @ 12.23 hrs, Volume= 0.356 af, Depth> 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
70,742	30	Woods, Good, HSG A
57,144	55	Woods, Good, HSG B
45,914	70	Woods, Good, HSG C
173,800	49	Weighted Average
173,800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	230	0.0380	3.14		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
13.5	280	Total			

Subcatchment 101S: P1-1



Summary for Subcatchment 102S: P1-2

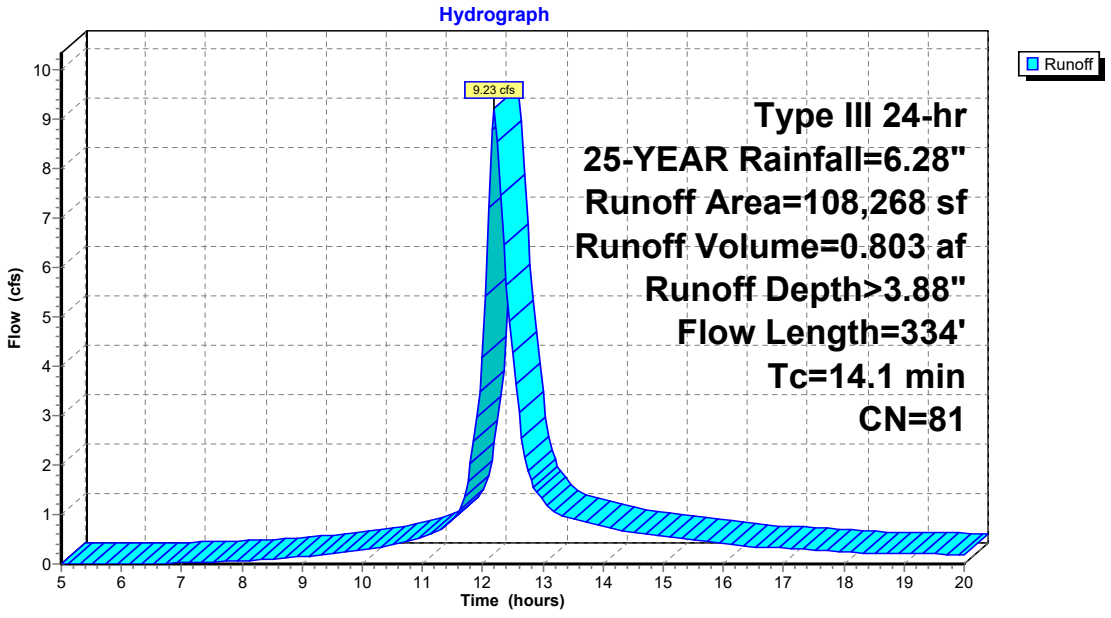
Runoff = 9.23 cfs @ 12.19 hrs, Volume= 0.803 af, Depth> 3.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
1,531	39	>75% Grass cover, Good, HSG A
71,278	74	>75% Grass cover, Good, HSG C
14,084	98	Paved parking, HSG A
21,375	98	Roofs, HSG A
108,268	81	Weighted Average
72,809		67.25% Pervious Area
35,459		32.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, Sheet Flow 50 Ft** Grass: Bermuda n= 0.410 P2= 3.20"
1.2	229	0.0380	3.14		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
0.3	55	0.0200	2.87		**Shallow Concentrated Flow, PARKING** Paved Kv= 20.3 fps
14.1	334	Total			

Subcatchment 102S: P1-2



Summary for Subcatchment 103s: P1-3

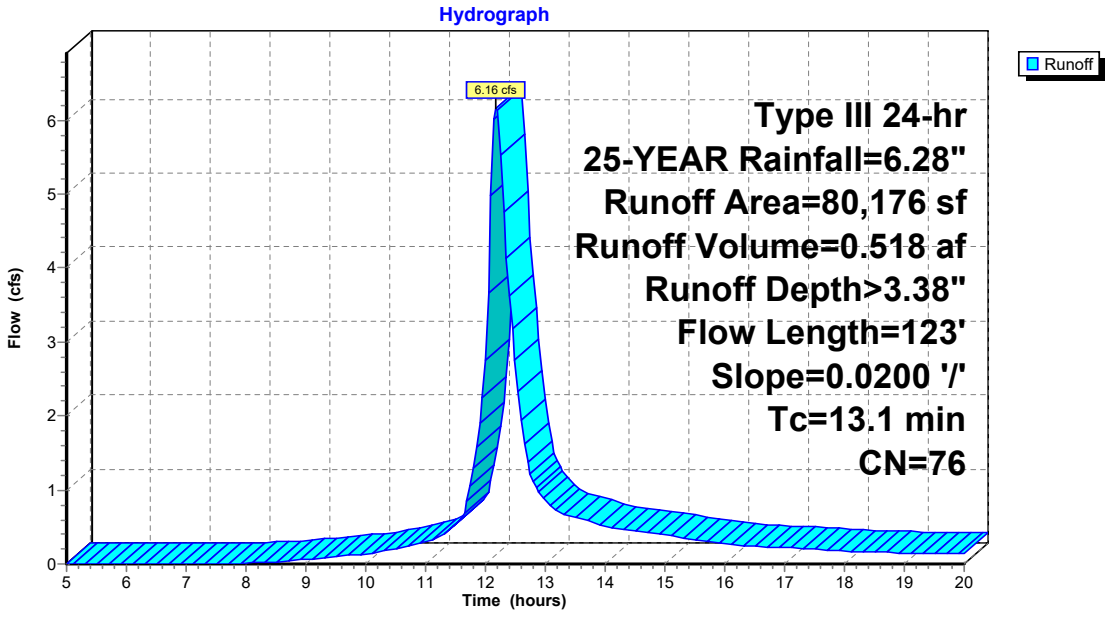
Runoff = 6.16 cfs @ 12.18 hrs, Volume= 0.518 af, Depth> 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
30,191	39	>75% Grass cover, Good, HSG A
49,985	98	Paved parking, HSG A
80,176	76	Weighted Average
30,191		37.66% Pervious Area
49,985		62.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, Fields** Grass: Bermuda n= 0.410 P2= 3.20"
0.5	73	0.0200	2.28		**Shallow Concentrated Flow, Field** Unpaved Kv= 16.1 fps
13.1	123	Total			

Subcatchment 103s: P1-3



Summary for Subcatchment 104S: P1-4 Roof

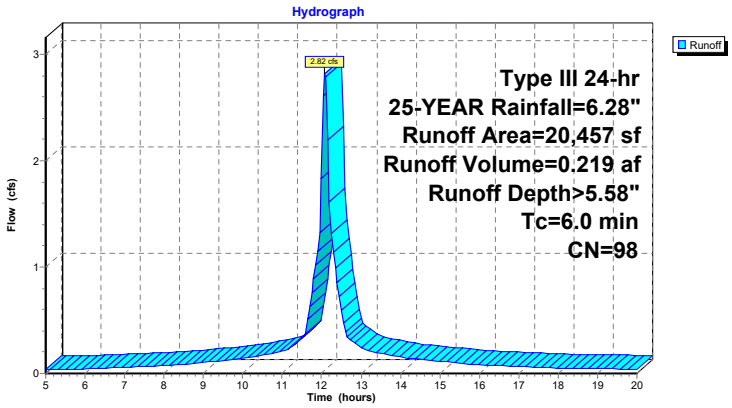
Runoff = 2.82 cfs @ 12.09 hrs, Volume= 0.219 af, Depth> 5.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
20,457	98	Roofs, HSG C
20,457		100.00% Impervious Area

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

Subcatchment 104S: P1-4 Roof



Summary for Subcatchment 200S: P2

Runoff = 0.57 cfs @ 12.27 hrs, Volume= 0.056 af, Depth> 1.59"

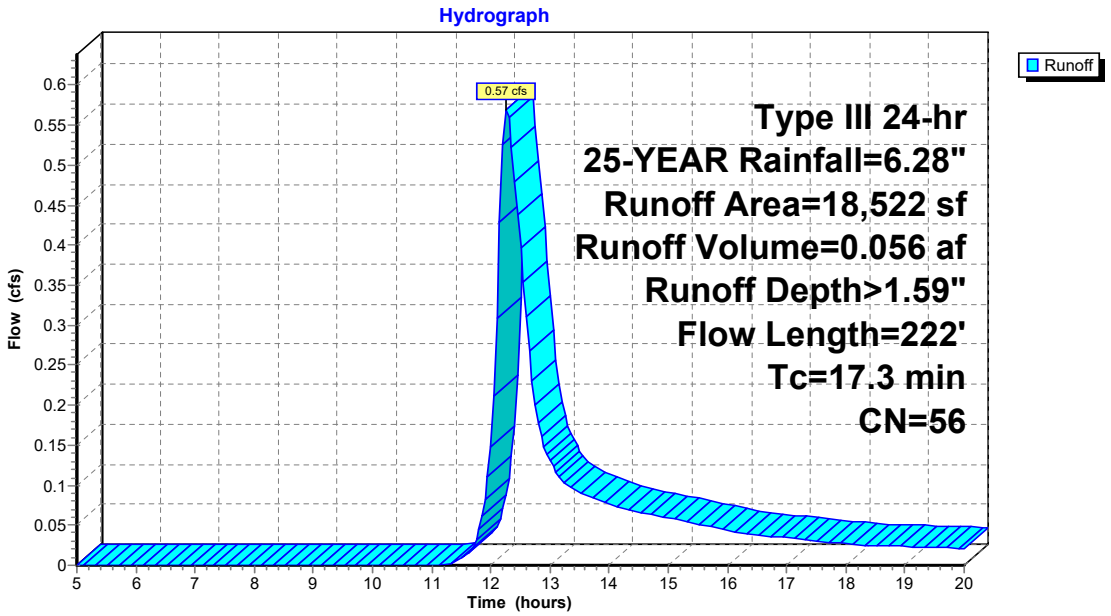
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,602	61	>75% Grass cover, Good, HSG B
13,920	55	Woods, Good, HSG B
0	74	>75% Grass cover, Good, HSG C
0	70	Woods, Good, HSG C
18,522	56	Weighted Average
18,522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	172	0.0340	2.97		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
17.3	222	Total			

Subcatchment 200S: P2

Hydrograph



Summary for Subcatchment 301S: P3-1

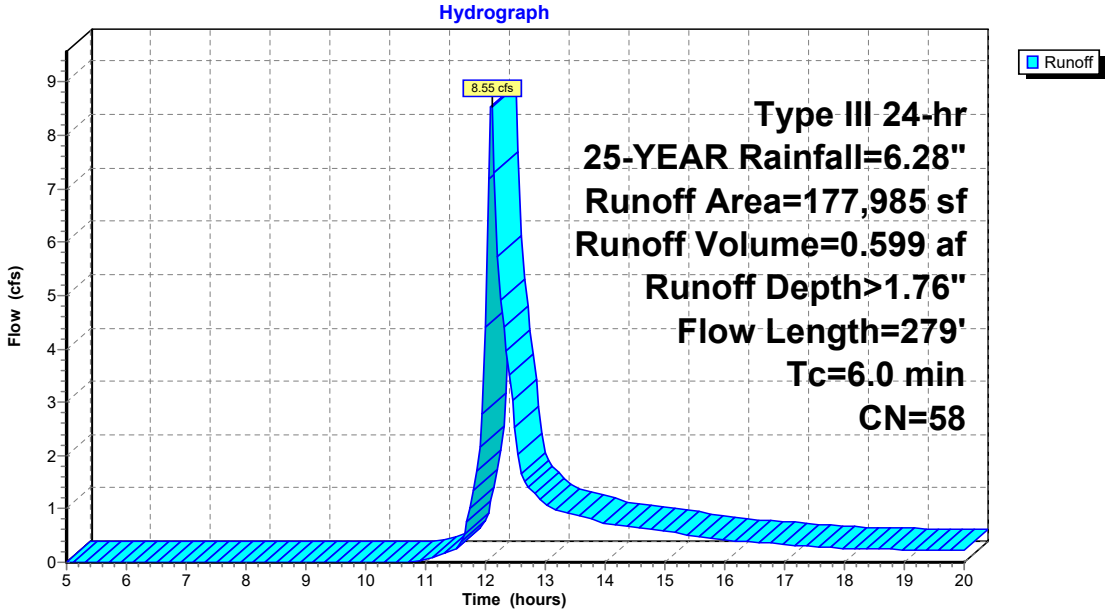
Runoff = 8.55 cfs @ 12.10 hrs, Volume= 0.599 af, Depth> 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
45,255	39	>75% Grass cover, Good, HSG A
39,144	98	Paved parking, HSG A
3,009	74	>75% Grass cover, Good, HSG C
59,632	30	Woods, Good, HSG A
8,798	70	Woods, Good, HSG C
22,147	98	Roofs, HSG A
177,985	58	Weighted Average
116,694		65.56% Pervious Area
61,291		34.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	44	0.0600	0.15		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
0.5	235	0.2500	8.05		**Shallow Concentrated Flow, HILL** Unpaved Kv= 16.1 fps
0.7					**Direct Entry, TO 6 MIN**
6.0	279	Total			

Subcatchment 301S: P3-1



Summary for Subcatchment 302S: P3-2

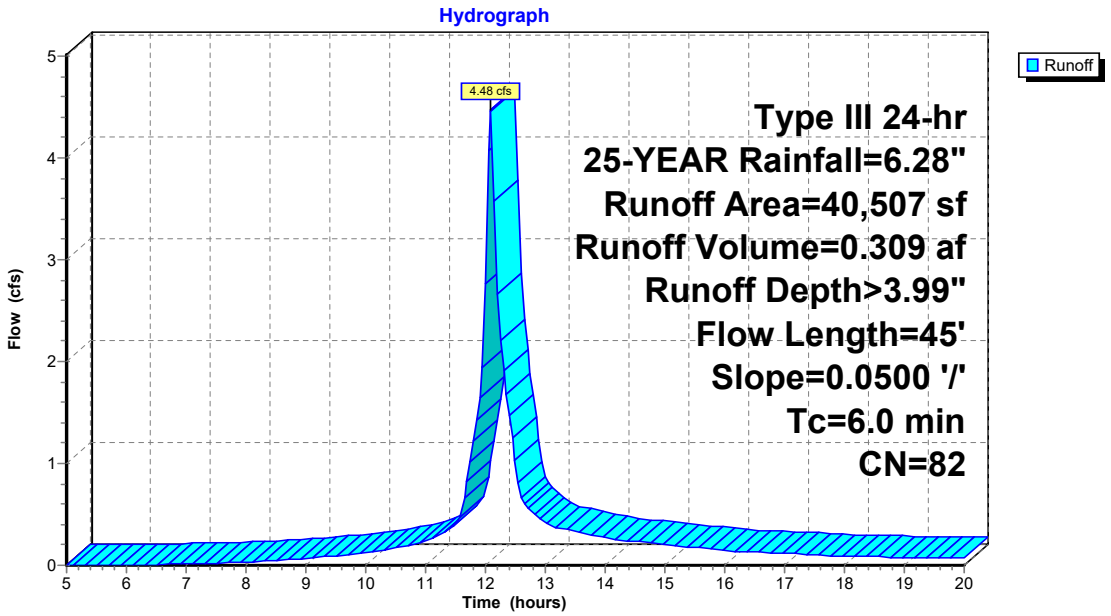
Runoff = 4.48 cfs @ 12.09 hrs, Volume= 0.309 af, Depth> 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
11,056	39	>75% Grass cover, Good, HSG A
29,451	98	Paved parking, HSG A
40,507	82	Weighted Average
11,056		27.29% Pervious Area
29,451		72.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	45	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.8					**Direct Entry, DIRECT MAKE UP**
6.0	45	Total			

Subcatchment 302S: P3-2



Summary for Subcatchment 303S: P3-3

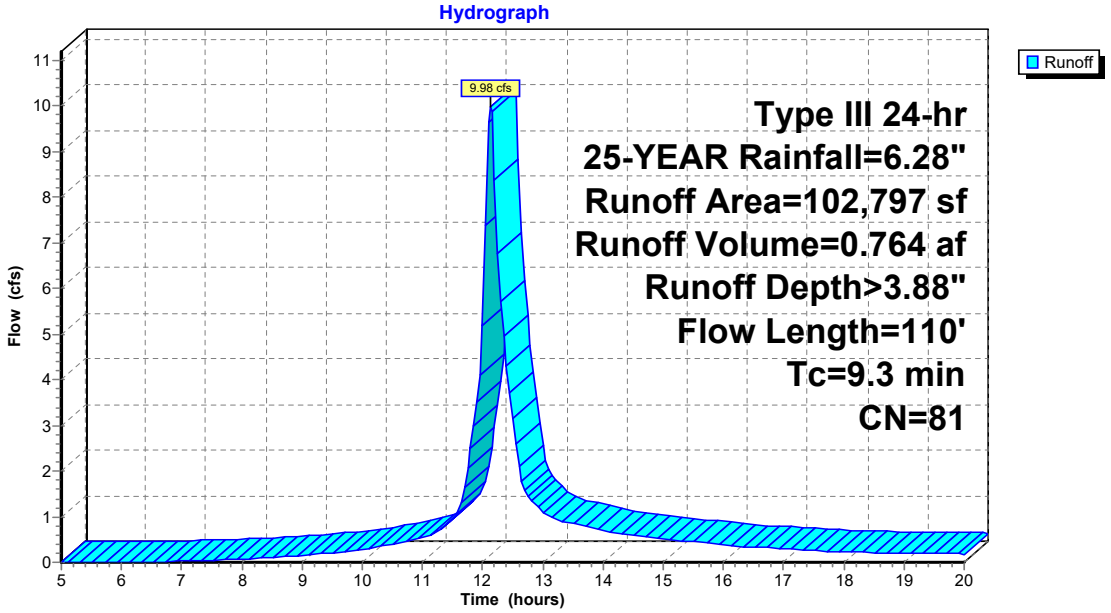
Runoff = 9.98 cfs @ 12.13 hrs, Volume= 0.764 af, Depth> 3.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
25,409	39	>75% Grass cover, Good, HSG A
11,002	74	>75% Grass cover, Good, HSG C
56,435	98	Paved parking, HSG A
9,951	98	Roofs, HSG A
102,797	81	Weighted Average
36,411		35.42% Pervious Area
66,386		64.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	50	0.0460	0.09		**Sheet Flow, Landscape Lawn** Grass: Bermuda n= 0.410 P2= 3.20"
0.3	60	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.3	110	Total			

Subcatchment 303S: P3-3



Summary for Subcatchment 304S: P3-4

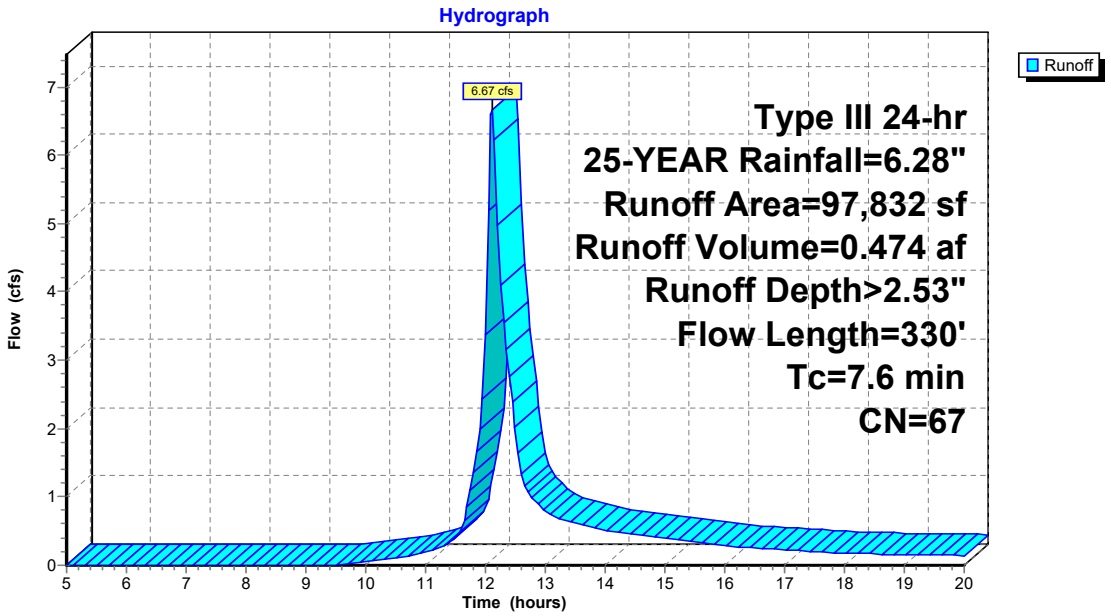
Runoff = 6.67 cfs @ 12.11 hrs, Volume= 0.474 af, Depth> 2.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
45,107	39	>75% Grass cover, Good, HSG A
16,631	74	>75% Grass cover, Good, HSG C
36,094	98	Paved parking, HSG A
97,832	67	Weighted Average
61,738		63.11% Pervious Area
36,094		36.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
1.4	280	0.0420	3.30		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
7.6	330	Total			

Subcatchment 304S: P3-4



Summary for Subcatchment 305F: P3-5 FIELD

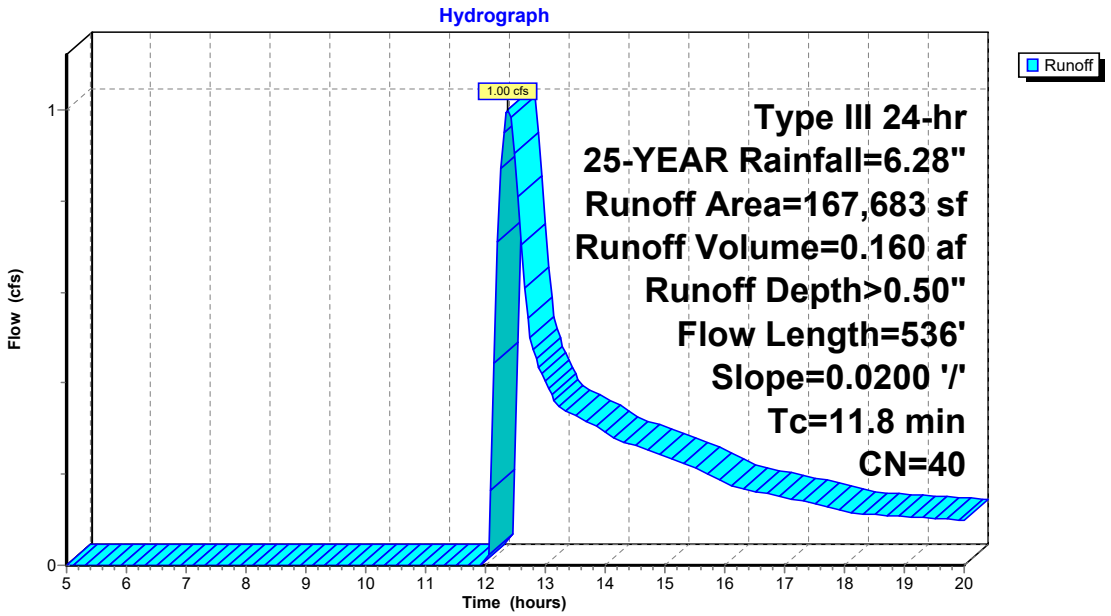
Runoff = 1.00 cfs @ 12.38 hrs, Volume= 0.160 af, Depth> 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
164,925	39	>75% Grass cover, Good, HSG A
2,758	98	Paved parking, HSG A
167,683	40	Weighted Average
164,925		98.36% Pervious Area
2,758		1.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
3.6	486	0.0200	2.28		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
11.8	536	Total			

Subcatchment 305F: P3-5 FIELD



Summary for Subcatchment 305P: P3-5 PAV

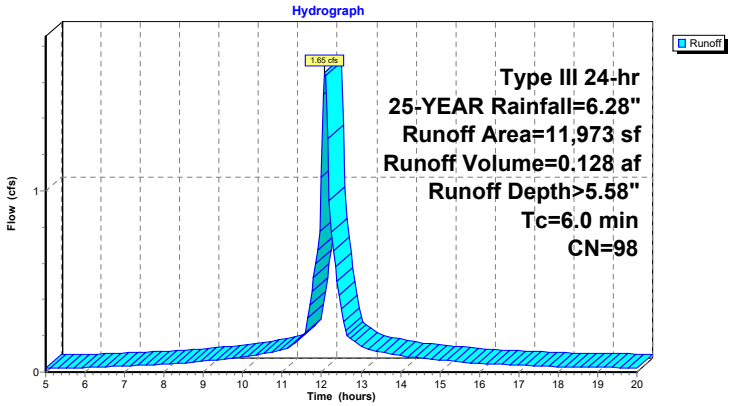
Runoff = 1.65 cfs @ 12.09 hrs, Volume= 0.128 af, Depth> 5.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=6.28"

Area (sf)	CN	Description
11,973	98	Paved parking, HSG A
11,973		100.00% Impervious Area

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

Subcatchment 305P: P3-5 PAV



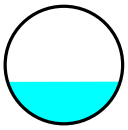
Summary for Reach 36": (new Reach)

Inflow Area = 8.786 ac, 27.67% Impervious, Inflow Depth > 2.45" for 25-YEAR event
Inflow = 16.05 cfs @ 12.27 hrs, Volume= 1.791 af
Outflow = 15.86 cfs @ 12.35 hrs, Volume= 1.782 af, Atten= 1%, Lag= 5.2 min

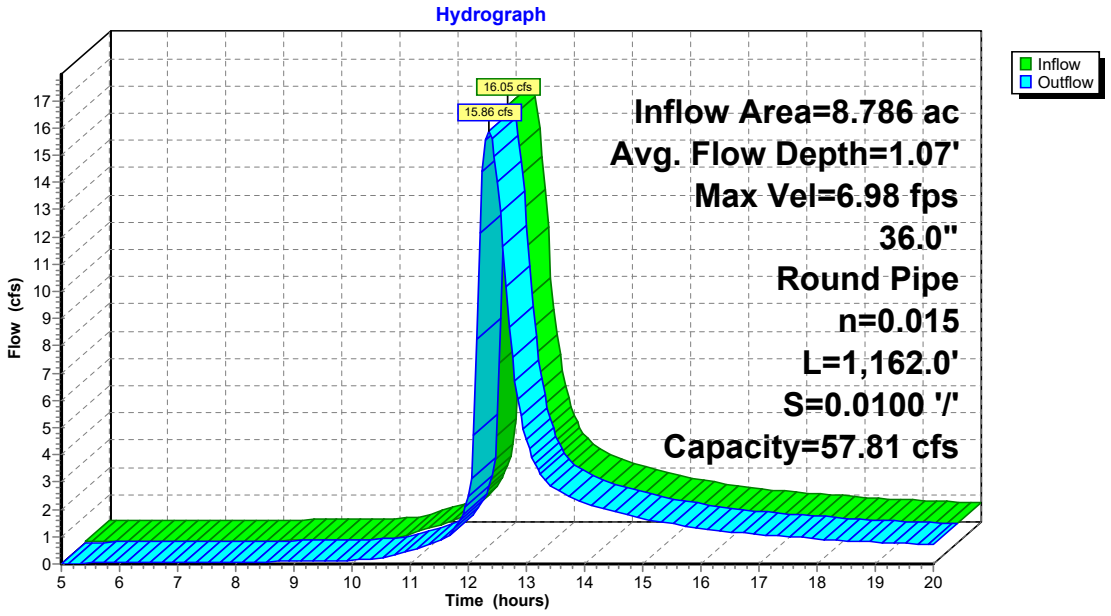
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.98 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 2.77 fps, Avg. Travel Time= 7.0 min

Peak Storage= 2,645 cf @ 12.31 hrs
Average Depth at Peak Storage= 1.07'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 57.81 cfs

36.0" Round Pipe
n= 0.015
Length= 1,162.0' Slope= 0.0100 '/'
Inlet Invert= 324.40', Outlet Invert= 312.78'



Reach 36": (new Reach)

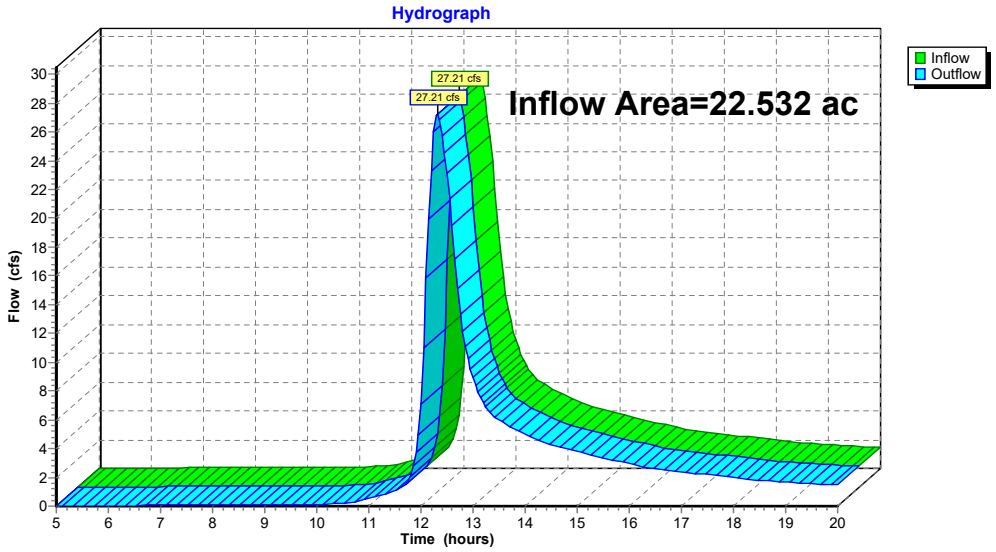


Summary for Reach 100R: Arcade Pond

Inflow Area = 22.532 ac, 31.98% Impervious, Inflow Depth > 1.87" for 25-YEAR event
Inflow = 27.21 cfs @ 12.31 hrs, Volume= 3.502 af
Outflow = 27.21 cfs @ 12.31 hrs, Volume= 3.502 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 100R: Arcade Pond



Summary for Reach BSW: BioSwale at Drive

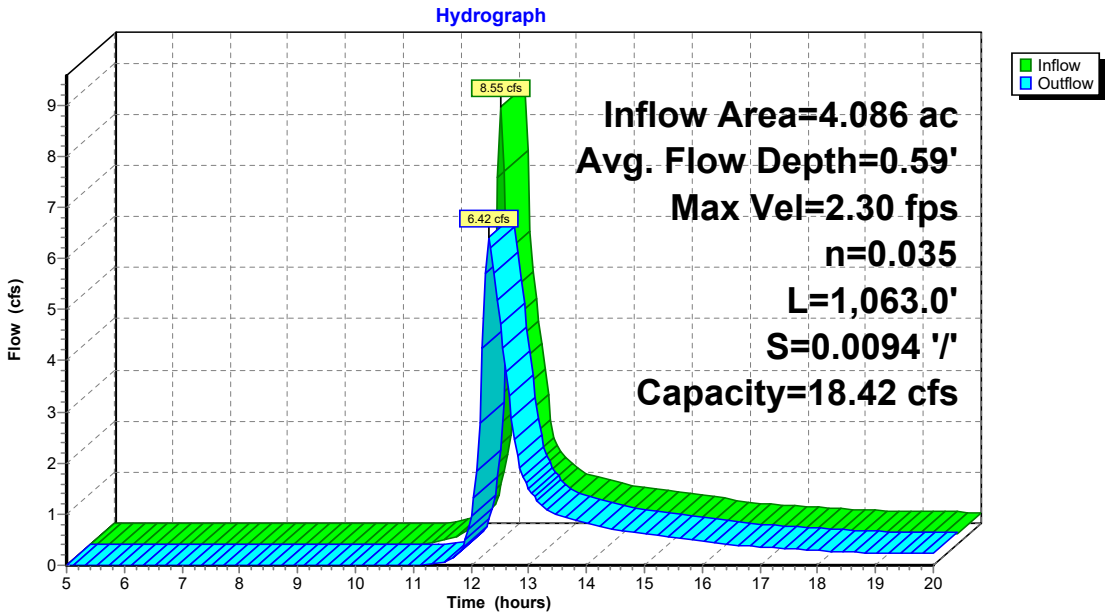
Inflow Area = 4.086 ac, 34.44% Impervious, Inflow Depth > 1.76" for 25-YEAR event
Inflow = 8.55 cfs @ 12.10 hrs, Volume= 0.599 af
Outflow = 6.42 cfs @ 12.32 hrs, Volume= 0.590 af, Atten= 25%, Lag= 12.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.30 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 1.02 fps, Avg. Travel Time= 17.3 min

Peak Storage= 2,984 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.59'
Defined Flood Depth= 1.25' Flow Area= 8.2 sf, Capacity= 27.79 cfs
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 18.42 cfs

3.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 '/' Top Width= 9.00'
Length= 1,063.0' Slope= 0.0094 '/'
Inlet Invert= 330.00', Outlet Invert= 320.00'

Reach BSW: BioSwale at Drive

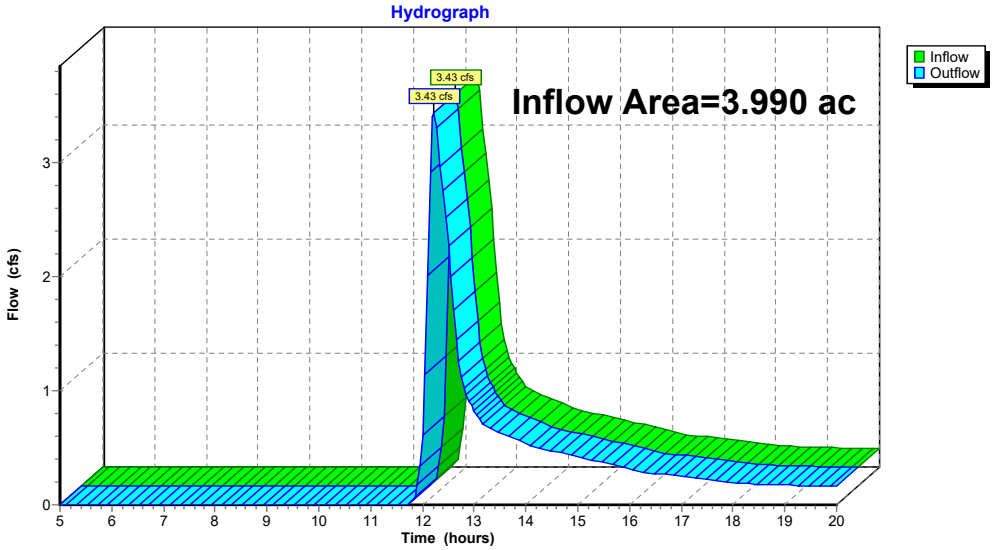


Summary for Reach DP100: DP-1 Wetland

Inflow Area = 3.990 ac, 0.00% Impervious, Inflow Depth > 1.07" for 25-YEAR event
Inflow = 3.43 cfs @ 12.23 hrs, Volume= 0.356 af
Outflow = 3.43 cfs @ 12.23 hrs, Volume= 0.356 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP100: DP-1 Wetland



Summary for Pond 217: BYPASS MH #217

Inflow Area = 5.291 ac, 44.57% Impervious, Inflow Depth > 2.23" for 25-YEAR event
Inflow = 9.44 cfs @ 12.29 hrs, Volume= 0.982 af
Outflow = 9.44 cfs @ 12.29 hrs, Volume= 0.982 af, Atten= 0%, Lag= 0.0 min
Primary = 2.30 cfs @ 12.29 hrs, Volume= 0.658 af
Secondary = 7.14 cfs @ 12.29 hrs, Volume= 0.325 af

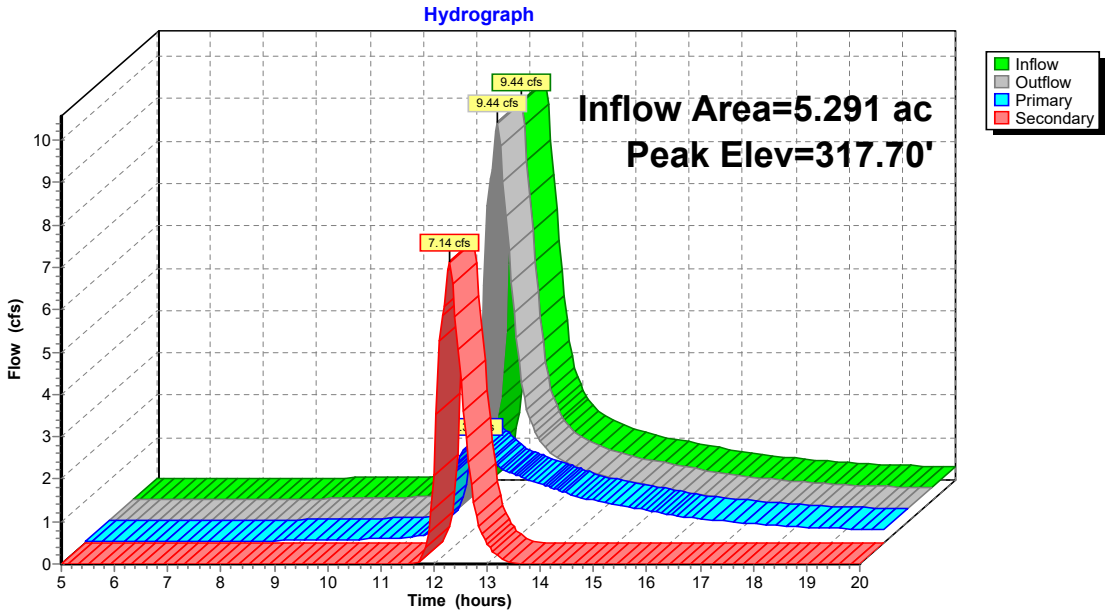
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 317.70' @ 12.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	315.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	316.52'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=2.29 cfs @ 12.29 hrs HW=317.69' (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 2.29 cfs @ 6.57 fps)

Secondary OutFlow Max=7.08 cfs @ 12.29 hrs HW=317.69' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 7.08 cfs @ 3.69 fps)

Pond 217: BYPASS MH #217



Summary for Pond BIO2: BIBASIN 3-2

Inflow Area = 2.246 ac, 36.89% Impervious, Inflow Depth > 1.83" for 25-YEAR event
Inflow = 1.53 cfs @ 12.11 hrs, Volume= 0.343 af
Outflow = 1.20 cfs @ 12.61 hrs, Volume= 0.286 af, Atten= 21%, Lag= 29.9 min
Discarded = 0.19 cfs @ 12.61 hrs, Volume= 0.140 af
Primary = 1.01 cfs @ 12.61 hrs, Volume= 0.146 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 315.24' @ 12.61 hrs Surf.Area= 3,475 sf Storage= 3,405 cf

Plug-Flow detention time= 87.6 min calculated for 0.286 af (83% of inflow)
Center-of-Mass det. time= 38.8 min (872.3 - 833.5)

Volume	Invert	Avail.Storage	Storage Description
#1	314.00'	6,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

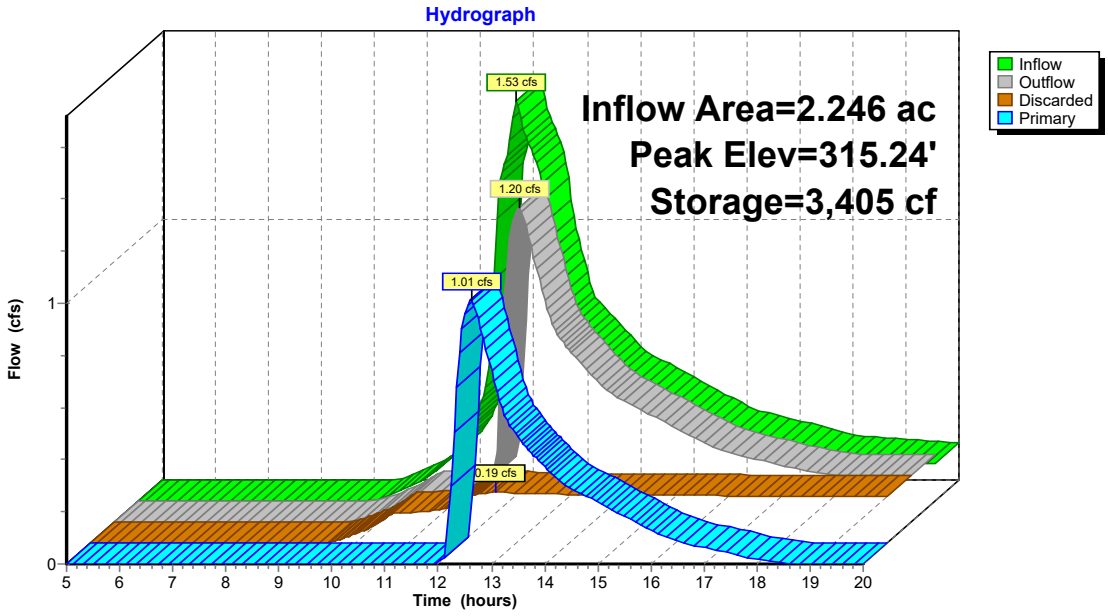
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
314.00	2,047	0	0
315.00	3,194	2,621	2,621
316.00	4,388	3,791	6,412

Device	Routing	Invert	Outlet Devices
#1	Primary	315.50'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#2	Discarded	314.00'	**2.410 in/hr Exfiltration over Horizontal area**
#3	Primary	315.00'	**24.0" Horiz. Orifice/Grate X 0.43** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 12.61 hrs HW=315.24' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=1.01 cfs @ 12.61 hrs HW=315.24' (Free Discharge)
├**1=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Weir Controls 1.01 cfs @ 0.68 fps)

Pond BIO2: BIBASIN 3-2



Summary for Pond BR1: BioBasin #1

Inflow Area = 0.930 ac, 72.71% Impervious, Inflow Depth > 3.99" for 25-YEAR event
Inflow = 4.48 cfs @ 12.09 hrs, Volume= 0.309 af
Outflow = 4.11 cfs @ 12.13 hrs, Volume= 0.265 af, Atten= 8%, Lag= 2.3 min
Primary = 4.11 cfs @ 12.13 hrs, Volume= 0.265 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 329.04' @ 12.13 hrs Surf.Area= 2,197 sf Storage= 2,940 cf

Plug-Flow detention time= 72.9 min calculated for 0.264 af (85% of inflow)
Center-of-Mass det. time= 31.2 min (806.0 - 774.8)

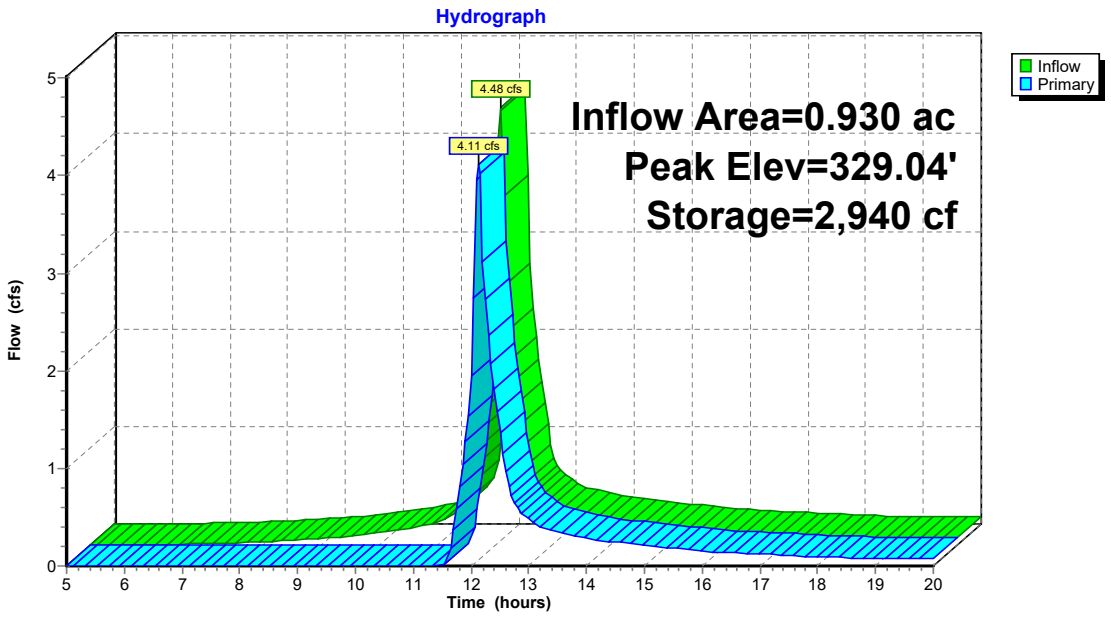
Volume	Invert	Avail.Storage	Storage Description
#1	327.00'	5,450 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
327.00	888	0	0
328.00	1,328	1,108	1,108
329.00	2,162	1,745	2,853
330.00	3,032	2,597	5,450

Device	Routing	Invert	Outlet Devices
#1	Primary	329.00'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#2	Primary	328.50'	**24.0" Horiz. Orifice/Grate X 0.43** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.97 cfs @ 12.13 hrs HW=329.04' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 0.52 cfs @ 0.61 fps)
└**2=Orifice/Grate** (Weir Controls 3.46 cfs @ 1.03 fps)

Pond BR1: BioBasin #1



Summary for Pond MH 230: Bypass MH #230

Inflow Area = 2.246 ac, 36.89% Impervious, Inflow Depth > 2.53" for 25-YEAR event
Inflow = 6.67 cfs @ 12.11 hrs, Volume= 0.474 af
Outflow = 6.67 cfs @ 12.11 hrs, Volume= 0.474 af, Atten= 0%, Lag= 0.0 min
Primary = 1.53 cfs @ 12.11 hrs, Volume= 0.343 af
Secondary = 5.14 cfs @ 12.11 hrs, Volume= 0.131 af

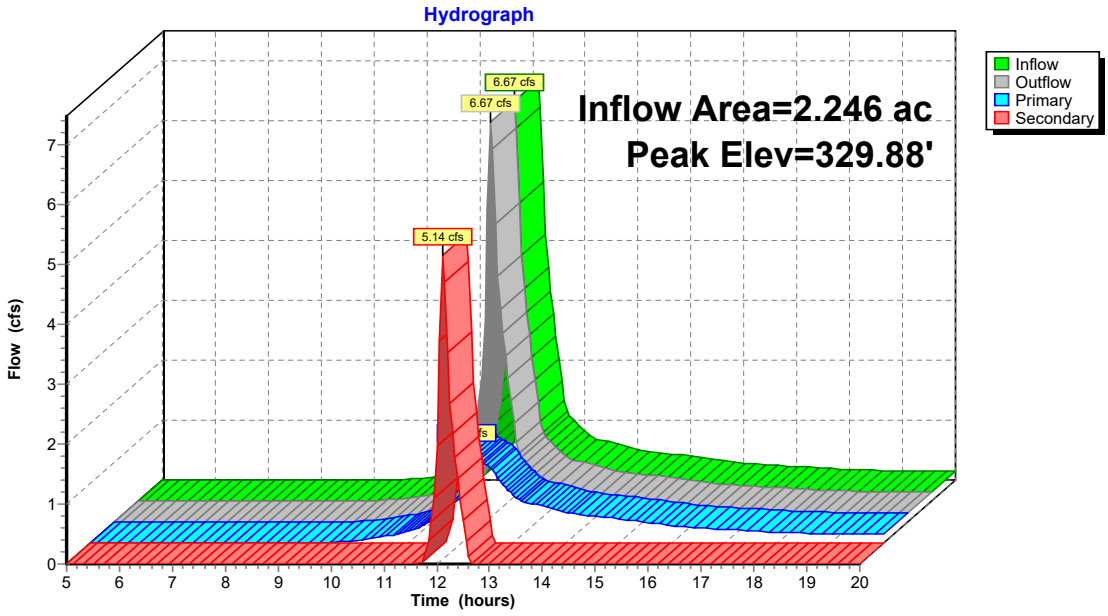
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 329.88' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	327.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	328.75'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.52 cfs @ 12.11 hrs HW=329.85' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 1.52 cfs @ 7.76 fps)

Secondary OutFlow Max=4.96 cfs @ 12.11 hrs HW=329.85' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 4.96 cfs @ 3.57 fps)

Pond MH 230: Bypass MH #230



Summary for Pond SDB1: DB#1 Surface Det Basin

Inflow Area = 2.485 ac, 32.75% Impervious, Inflow Depth > 3.88" for 25-YEAR event
Inflow = 9.23 cfs @ 12.19 hrs, Volume= 0.803 af
Outflow = 7.92 cfs @ 12.28 hrs, Volume= 0.720 af, Atten= 14%, Lag= 5.2 min
Primary = 7.92 cfs @ 12.28 hrs, Volume= 0.720 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 330.57' @ 12.28 hrs Surf.Area= 3,200 sf Storage= 8,345 cf

Plug-Flow detention time= 87.8 min calculated for 0.720 af (90% of inflow)
Center-of-Mass det. time= 54.9 min (838.4 - 783.5)

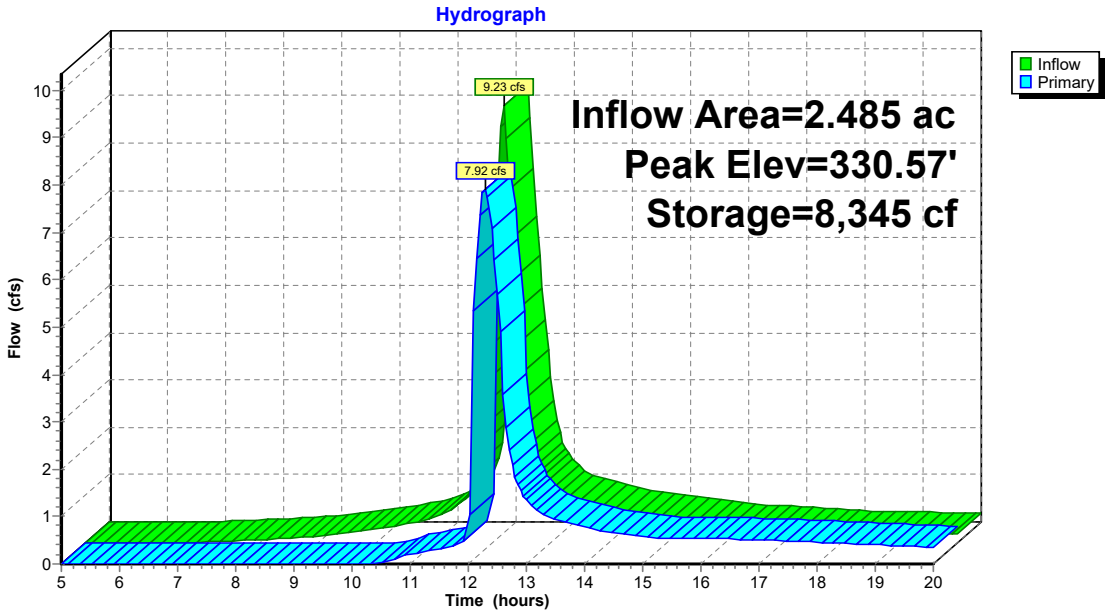
Volume	Invert	Avail.Storage	Storage Description
#1	327.00'	13,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
327.00	1,480	0	0
328.00	1,984	1,732	1,732
329.00	2,422	2,203	3,935
330.00	2,899	2,661	6,596
331.00	3,424	3,162	9,757
332.00	4,018	3,721	13,478

Device	Routing	Invert	Outlet Devices
#1	Primary	328.00'	**4.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	330.00'	**12.0" x 4.0" Horiz. Orifice/Grate** X 6 rows C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=7.88 cfs @ 12.28 hrs HW=330.57' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.63 cfs @ 7.52 fps)
└**2=Orifice/Grate** (Orifice Controls 7.25 cfs @ 3.63 fps)

Pond SDB1: DB#1 Surface Det Basin



Summary for Pond UDB2: UG DB #2

Inflow Area = 2.360 ac, 64.58% Impervious, Inflow Depth > 3.88" for 25-YEAR event
Inflow = 9.98 cfs @ 12.13 hrs, Volume= 0.764 af
Outflow = 1.31 cfs @ 12.84 hrs, Volume= 0.591 af, Atten= 87%, Lag= 42.7 min
Primary = 1.31 cfs @ 12.84 hrs, Volume= 0.591 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 316.04' @ 12.84 hrs Surf.Area= 0.303 ac Storage= 0.417 af

Plug-Flow detention time= 200.6 min calculated for 0.591 af (77% of inflow)
Center-of-Mass det. time= 144.2 min (923.8 - 779.6)

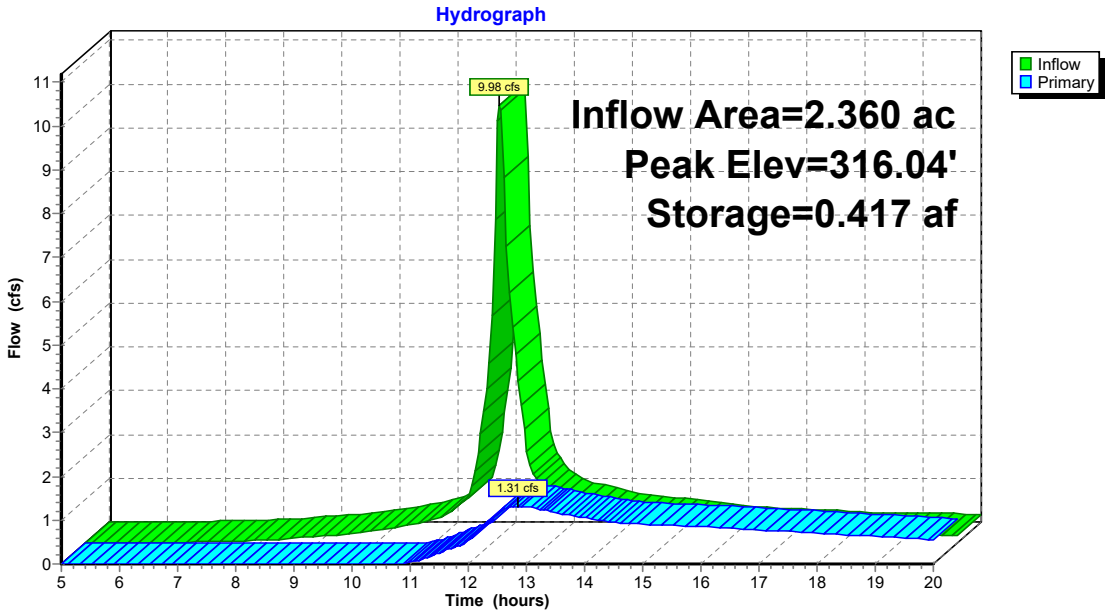
Volume	Invert	Avail.Storage	Storage Description
#1A	314.00'	0.233 af	**82.25'W x 160.26'L x 3.50'H Field A** 1.059 af Overall - 0.394 af Embedded = 0.665 af x 35.0% Voids
#2A	314.50'	0.394 af	**ADS_StormTech SC-740 +Cap** x 374 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 17 Rows of 22 Chambers
		0.627 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	314.50'	**6.0" x 4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	315.80'	**10.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.31 cfs @ 12.84 hrs HW=316.04' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 1.00 cfs @ 5.98 fps)
└**2=Orifice/Grate** (Orifice Controls 0.32 cfs @ 1.58 fps)

Pond UDB2: UG DB #2



Summary for Pond UDB3: UG D-BASIN #3

Inflow Area = 5.291 ac, 44.57% Impervious, Inflow Depth > 1.49" for 25-YEAR event
Inflow = 2.30 cfs @ 12.29 hrs, Volume= 0.658 af
Outflow = 2.05 cfs @ 12.61 hrs, Volume= 0.554 af, Atten= 11%, Lag= 19.4 min
Discarded = 0.22 cfs @ 11.55 hrs, Volume= 0.188 af
Primary = 1.83 cfs @ 12.61 hrs, Volume= 0.366 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 317.08' @ 12.61 hrs Surf.Area= 0.092 ac Storage= 0.117 af

Plug-Flow detention time= 74.6 min calculated for 0.554 af (84% of inflow)
Center-of-Mass det. time= 28.5 min (878.9 - 850.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	314.70'	0.064 af	**104.83'W x 38.04'L x 2.33'H Field A** 0.214 af Overall - 0.053 af Embedded = 0.161 af x 40.0% Voids
#2A	315.20'	0.053 af	**ADS_StormTech SC-310** x 155 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 31 rows
		0.117 af	Total Available Storage

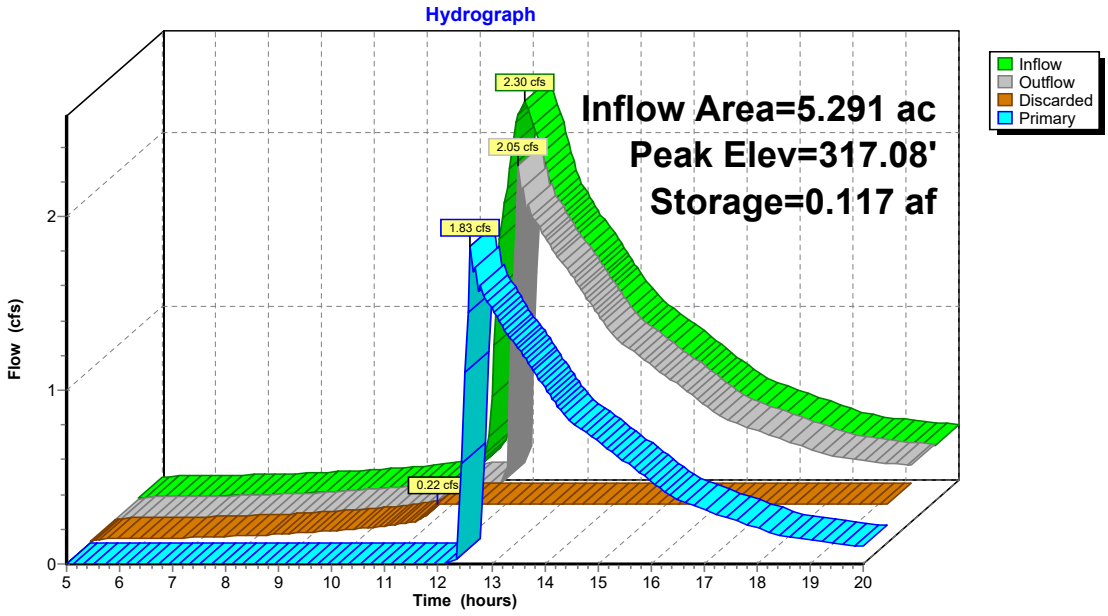
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	314.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	316.52'	**24.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.22 cfs @ 11.55 hrs HW=314.74' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=1.78 cfs @ 12.61 hrs HW=317.07' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 1.78 cfs @ 2.53 fps)

Pond UDB3: UG D-BASIN #3



Summary for Pond UDB4: UG D-BASIN#4

Inflow Area = 1.841 ac, 62.34% Impervious, Inflow Depth > 3.38" for 25-YEAR event
Inflow = 6.16 cfs @ 12.18 hrs, Volume= 0.518 af
Outflow = 3.77 cfs @ 12.39 hrs, Volume= 0.498 af, Atten= 39%, Lag= 12.3 min
Primary = 3.77 cfs @ 12.39 hrs, Volume= 0.498 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 327.21' @ 12.39 hrs Surf.Area= 0.080 ac Storage= 0.128 af

Plug-Flow detention time= 44.1 min calculated for 0.498 af (96% of inflow)
Center-of-Mass det. time= 29.8 min (822.6 - 792.8)

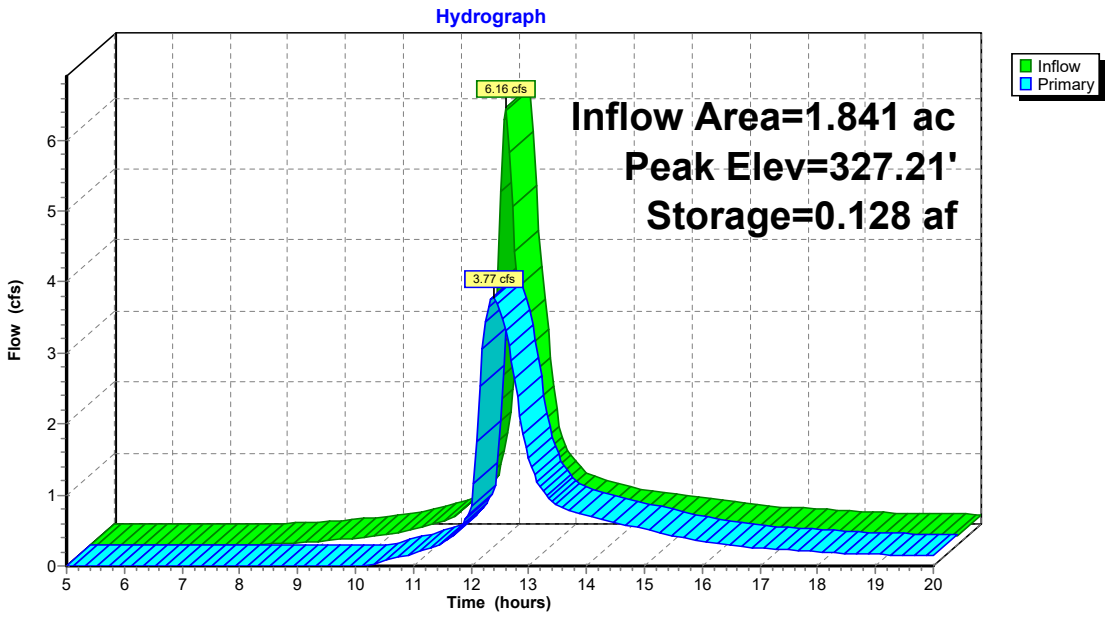
Volume	Invert	Avail.Storage	Storage Description
#1A	324.90'	0.071 af	**39.50'W x 87.88'L x 3.50'H Field A** 0.279 af Overall - 0.102 af Embedded = 0.177 af x 40.0% Voids
#2A	325.40'	0.102 af	**ADS_StormTech SC-740** x 96 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 8 rows
		0.173 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	325.30'	**8.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	326.00'	**12.0" W x 6.0" H Vert. 326** C= 0.600

Primary OutFlow Max=3.76 cfs @ 12.39 hrs HW=327.21' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 1.41 cfs @ 6.35 fps)
└**2=326** (Orifice Controls 2.35 cfs @ 4.70 fps)

Pond UDB4: UG D-BASIN#4



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment101S: P1-1 Runoff Area=173,800 sf 0.00% Impervious Runoff Depth>1.95"
Flow Length=280' Tc=13.5 min CN=49 Runoff=7.11 cfs 0.648 af

Subcatchment102S: P1-2 Runoff Area=108,268 sf 32.75% Impervious Runoff Depth>5.43"
Flow Length=334' Tc=14.1 min CN=81 Runoff=12.74 cfs 1.124 af

Subcatchment103s: P1-3 Runoff Area=80,176 sf 62.34% Impervious Runoff Depth>4.85"
Flow Length=123' Slope=0.0200 '/' Tc=13.1 min CN=76 Runoff=8.78 cfs 0.745 af

Subcatchment104S: P1-4 Roof Runoff Area=20,457 sf 100.00% Impervious Runoff Depth>7.17"
Tc=6.0 min CN=98 Runoff=3.62 cfs 0.281 af

Subcatchment200S: P2 Runoff Area=18,522 sf 0.00% Impervious Runoff Depth>2.66"
Flow Length=222' Tc=17.3 min CN=56 Runoff=0.99 cfs 0.094 af

Subcatchment301S: P3-1 Runoff Area=177,985 sf 34.44% Impervious Runoff Depth>2.88"
Flow Length=279' Tc=6.0 min CN=58 Runoff=14.42 cfs 0.981 af

Subcatchment302S: P3-2 Runoff Area=40,507 sf 72.71% Impervious Runoff Depth>5.55"
Flow Length=45' Slope=0.0500 '/' Tc=6.0 min CN=82 Runoff=6.13 cfs 0.430 af

Subcatchment303S: P3-3 Runoff Area=102,797 sf 64.58% Impervious Runoff Depth>5.43"
Flow Length=110' Tc=9.3 min CN=81 Runoff=13.76 cfs 1.069 af

Subcatchment304S: P3-4 Runoff Area=97,832 sf 36.89% Impervious Runoff Depth>3.85"
Flow Length=330' Tc=7.6 min CN=67 Runoff=10.19 cfs 0.721 af

Subcatchment305F: P3-5 FIELD Runoff Area=167,683 sf 1.64% Impervious Runoff Depth>1.11"
Flow Length=536' Slope=0.0200 '/' Tc=11.8 min CN=40 Runoff=3.23 cfs 0.355 af

Subcatchment305P: P3-5 PAV Runoff Area=11,973 sf 100.00% Impervious Runoff Depth>7.17"
Tc=6.0 min CN=98 Runoff=2.12 cfs 0.164 af

Reach 36": (new Reach) Avg. Flow Depth=1.33' Max Vel=7.74 fps Inflow=23.52 cfs 2.673 af
36.0" Round Pipe n=0.015 L=1,162.0' S=0.0100 '/' Capacity=57.81 cfs Outflow=23.26 cfs 2.662 af

Reach 100R: Arcade Pond Inflow=48.56 cfs 5.590 af
Outflow=48.56 cfs 5.590 af

Reach BSW: BioSwale at Drive Avg. Flow Depth=0.79' Max Vel=2.70 fps Inflow=14.42 cfs 0.981 af
n=0.035 L=1,063.0' S=0.0094 '/' Capacity=18.42 cfs Outflow=11.40 cfs 0.969 af

Reach DP100: DP-1 Wetland Inflow=7.11 cfs 0.648 af
Outflow=7.11 cfs 0.648 af

Pond 217: BYPASS MH #217 Peak Elev=318.24' Inflow=15.41 cfs 1.519 af
Primary=2.61 cfs 0.877 af Secondary=12.81 cfs 0.641 af Outflow=15.41 cfs 1.519 af

Pond BIO2: BIBASIN 3-2 Peak Elev=315.27' Storage=3,525 cf Inflow=1.70 cfs 0.469 af
Discarded=0.20 cfs 0.153 af Primary=1.24 cfs 0.255 af Outflow=1.43 cfs 0.408 af

Pond BR1: BioBasin #1 Peak Elev=329.11' Storage=3,100 cf Inflow=6.13 cfs 0.430 af
Outflow=5.86 cfs 0.385 af

Pond MH 230: Bypass MH #230 Peak Elev=330.49' Inflow=10.19 cfs 0.721 af
Primary=1.70 cfs 0.469 af Secondary=8.49 cfs 0.252 af Outflow=10.19 cfs 0.721 af

Pond SDB1: DB#1 Surface Det Basin Peak Elev=331.00' Storage=9,765 cf Inflow=12.74 cfs 1.124 af
Outflow=10.32 cfs 1.022 af

Pond UDB2: UG DB #2 Peak Elev=316.81' Storage=0.552 af Inflow=13.76 cfs 1.069 af
Outflow=2.45 cfs 0.854 af

Pond UDB3: UG D-BASIN #3 Peak Elev=317.25' Storage=0.117 af Inflow=2.61 cfs 0.877 af
Discarded=0.22 cfs 0.201 af Primary=3.06 cfs 0.571 af Outflow=3.28 cfs 0.772 af

Pond UDB4: UG D-BASIN#4 Peak Elev=328.45' Storage=0.173 af Inflow=8.78 cfs 0.745 af
Outflow=5.41 cfs 0.722 af

Total Runoff Area = 22.957 ac Runoff Volume = 6.612 af Average Runoff Depth = 3.46"
68.61% Pervious = 15.752 ac 31.39% Impervious = 7.205 ac

Summary for Subcatchment 101S: P1-1

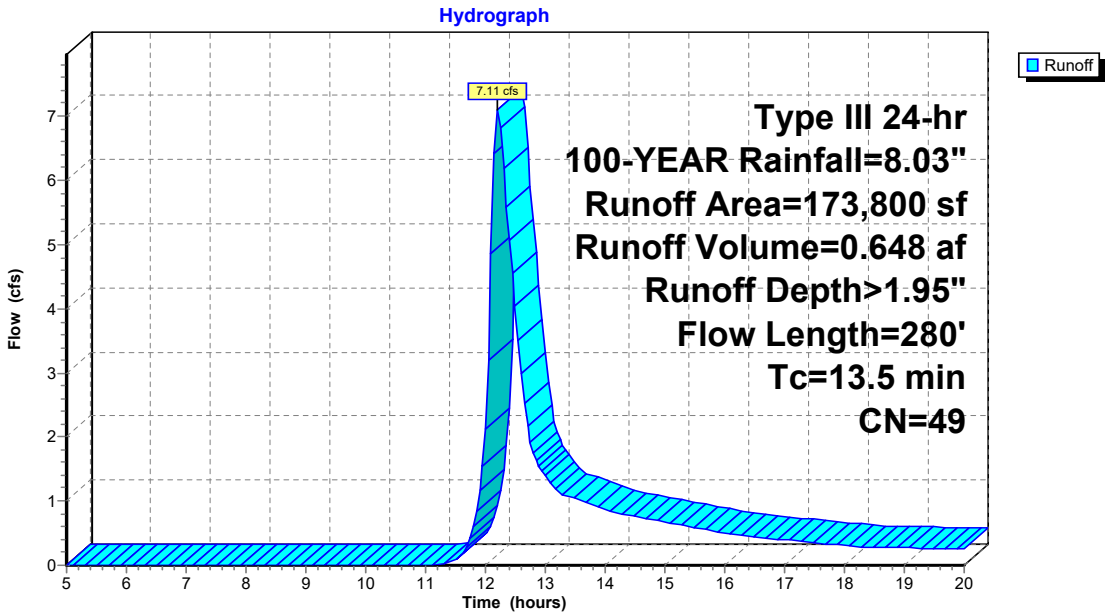
Runoff = 7.11 cfs @ 12.21 hrs, Volume= 0.648 af, Depth> 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
70,742	30	Woods, Good, HSG A
57,144	55	Woods, Good, HSG B
45,914	70	Woods, Good, HSG C
173,800	49	Weighted Average
173,800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	230	0.0380	3.14		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
13.5	280	Total			

Subcatchment 101S: P1-1



Summary for Subcatchment 102S: P1-2

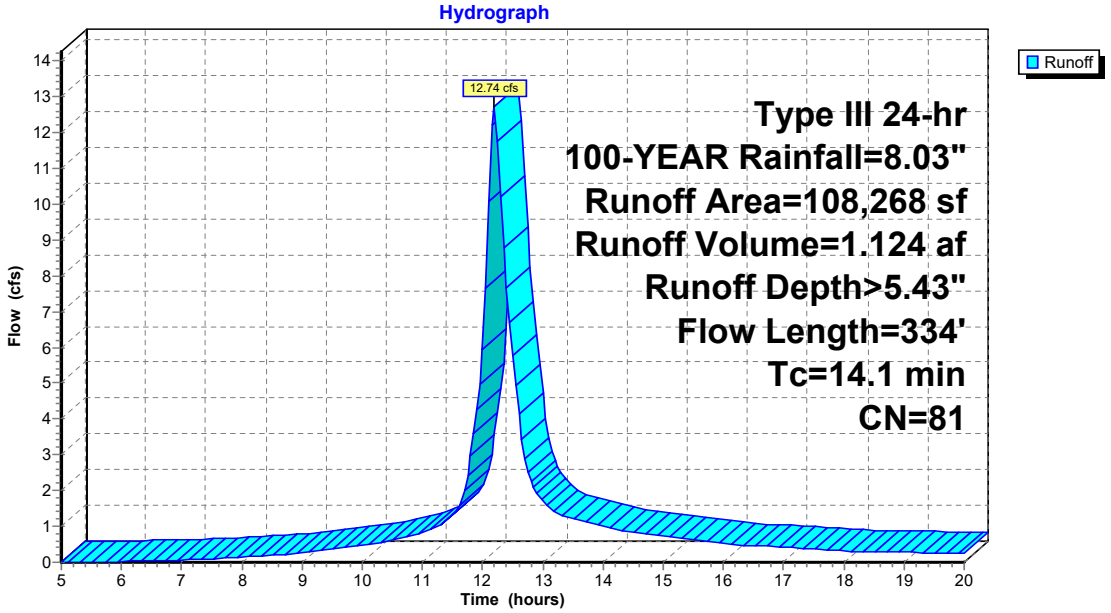
Runoff = 12.74 cfs @ 12.19 hrs, Volume= 1.124 af, Depth> 5.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
1,531	39	>75% Grass cover, Good, HSG A
71,278	74	>75% Grass cover, Good, HSG C
14,084	98	Paved parking, HSG A
21,375	98	Roofs, HSG A
108,268	81	Weighted Average
72,809		67.25% Pervious Area
35,459		32.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, Sheet Flow 50 Ft** Grass: Bermuda n= 0.410 P2= 3.20"
1.2	229	0.0380	3.14		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
0.3	55	0.0200	2.87		**Shallow Concentrated Flow, PARKING** Paved Kv= 20.3 fps
14.1	334	Total			

Subcatchment 102S: P1-2



Summary for Subcatchment 103s: P1-3

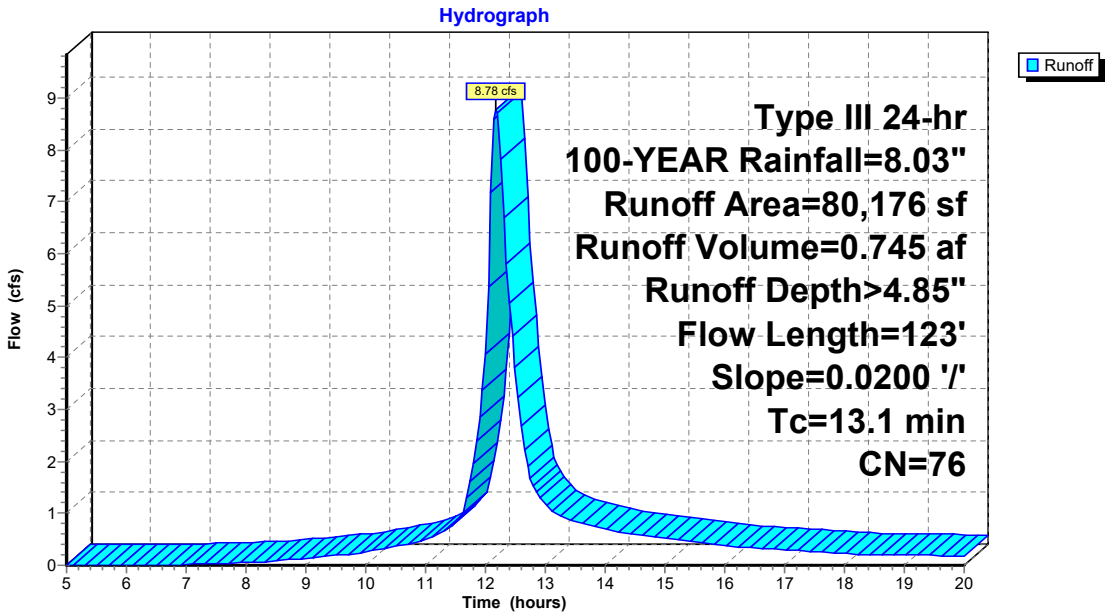
Runoff = 8.78 cfs @ 12.18 hrs, Volume= 0.745 af, Depth> 4.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
30,191	39	>75% Grass cover, Good, HSG A
49,985	98	Paved parking, HSG A
80,176	76	Weighted Average
30,191		37.66% Pervious Area
49,985		62.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, Fields** Grass: Bermuda n= 0.410 P2= 3.20"
0.5	73	0.0200	2.28		**Shallow Concentrated Flow, Field** Unpaved Kv= 16.1 fps
13.1	123	Total			

Subcatchment 103s: P1-3



Summary for Subcatchment 104S: P1-4 Roof

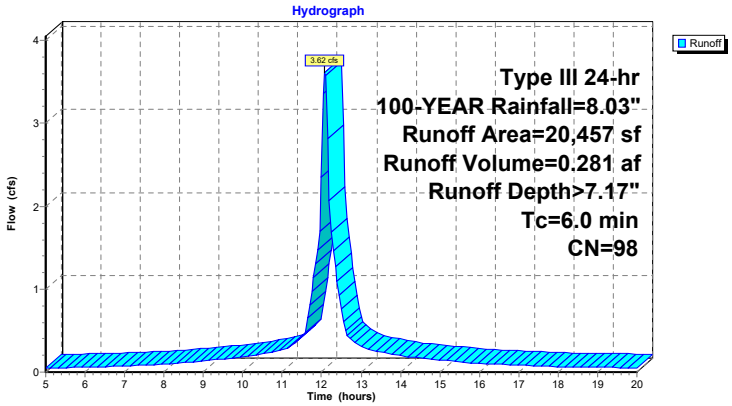
Runoff = 3.62 cfs @ 12.09 hrs, Volume= 0.281 af, Depth> 7.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
20,457	98	Roofs, HSG C
20,457		100.00% Impervious Area

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

Subcatchment 104S: P1-4 Roof



Summary for Subcatchment 200S: P2

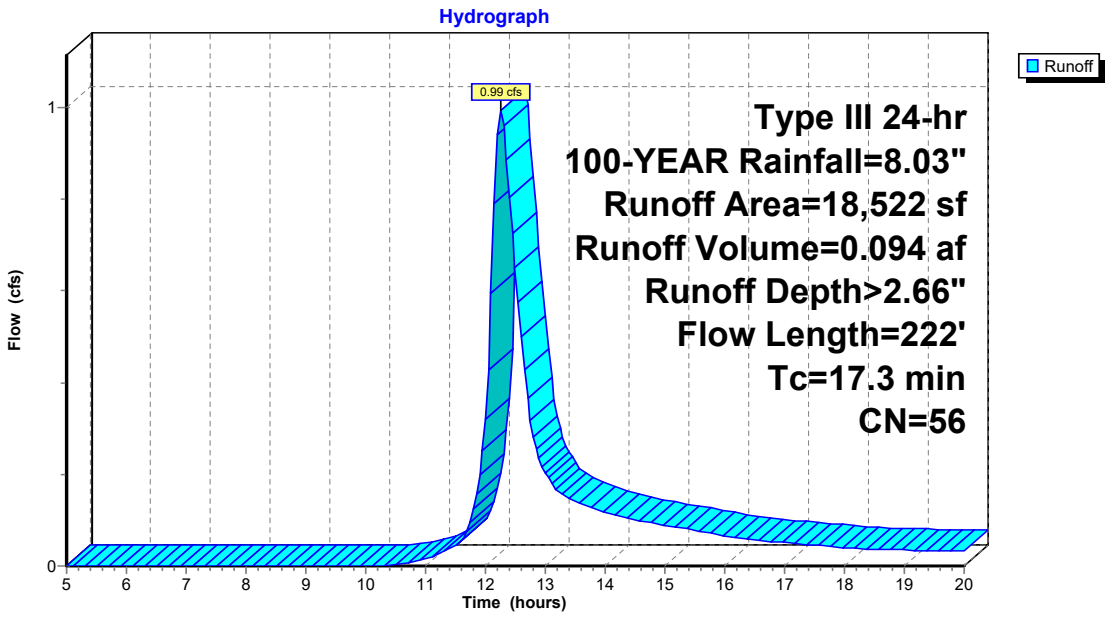
Runoff = 0.99 cfs @ 12.26 hrs, Volume= 0.094 af, Depth> 2.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,602	61	>75% Grass cover, Good, HSG B
13,920	55	Woods, Good, HSG B
0	74	>75% Grass cover, Good, HSG C
0	70	Woods, Good, HSG C
18,522	56	Weighted Average
18,522		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow, Sheet Flow 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	172	0.0340	2.97		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
17.3	222	Total			

Subcatchment 200S: P2



Summary for Subcatchment 301S: P3-1

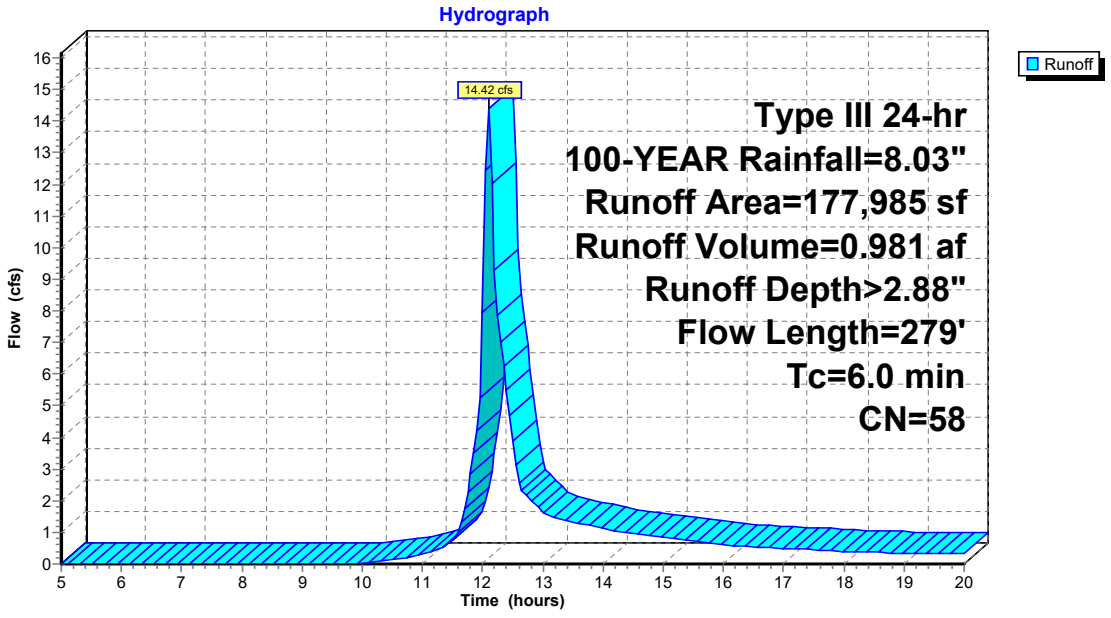
Runoff = 14.42 cfs @ 12.10 hrs, Volume= 0.981 af, Depth> 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
45,255	39	>75% Grass cover, Good, HSG A
39,144	98	Paved parking, HSG A
3,009	74	>75% Grass cover, Good, HSG C
59,632	30	Woods, Good, HSG A
8,798	70	Woods, Good, HSG C
22,147	98	Roofs, HSG A
177,985	58	Weighted Average
116,694		65.56% Pervious Area
61,291		34.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	44	0.0600	0.15		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
0.5	235	0.2500	8.05		**Shallow Concentrated Flow, HILL** Unpaved Kv= 16.1 fps
0.7					**Direct Entry, TO 6 MIN**
6.0	279	Total			

Subcatchment 301S: P3-1



Summary for Subcatchment 302S: P3-2

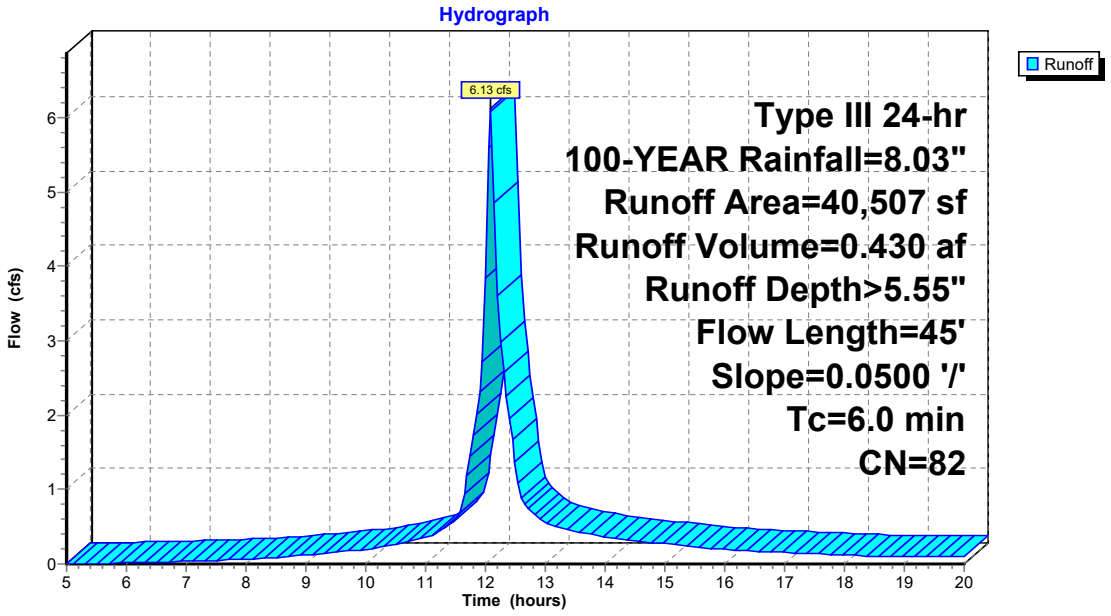
Runoff = 6.13 cfs @ 12.09 hrs, Volume= 0.430 af, Depth> 5.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
11,056	39	>75% Grass cover, Good, HSG A
29,451	98	Paved parking, HSG A
40,507	82	Weighted Average
11,056		27.29% Pervious Area
29,451		72.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	45	0.0500	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.8					**Direct Entry, DIRECT MAKE UP**
6.0	45	Total			

Subcatchment 302S: P3-2



Summary for Subcatchment 303S: P3-3

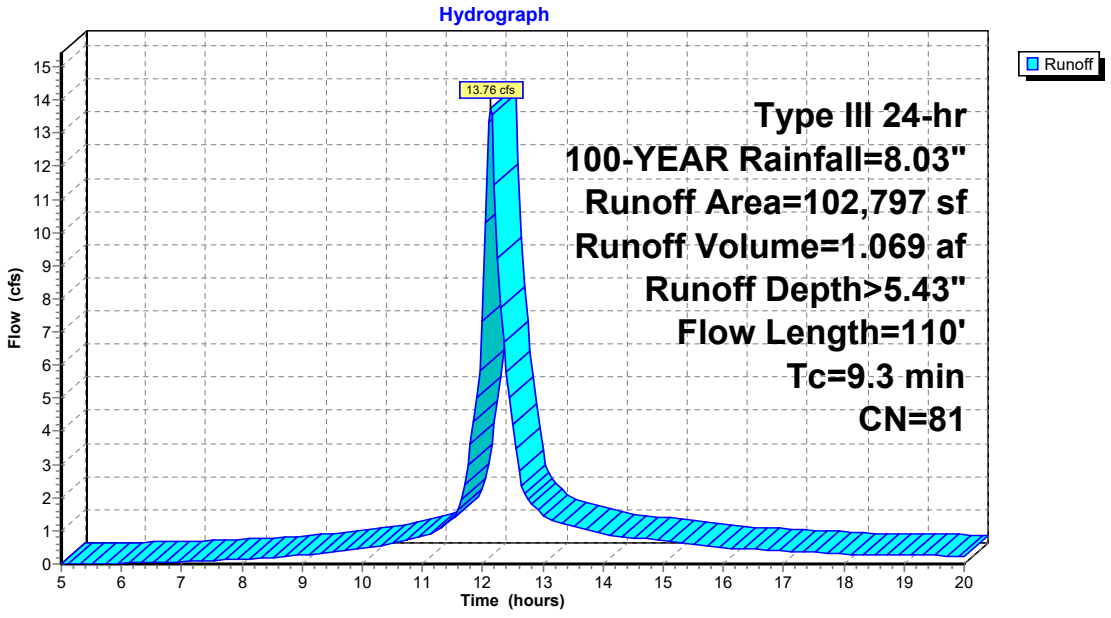
Runoff = 13.76 cfs @ 12.13 hrs, Volume= 1.069 af, Depth> 5.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
25,409	39	>75% Grass cover, Good, HSG A
11,002	74	>75% Grass cover, Good, HSG C
56,435	98	Paved parking, HSG A
9,951	98	Roofs, HSG A
102,797	81	Weighted Average
36,411		35.42% Pervious Area
66,386		64.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	50	0.0460	0.09		**Sheet Flow, Landscape Lawn** Grass: Bermuda n= 0.410 P2= 3.20"
0.3	60	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.3	110	Total			

Subcatchment 303S: P3-3



Summary for Subcatchment 304S: P3-4

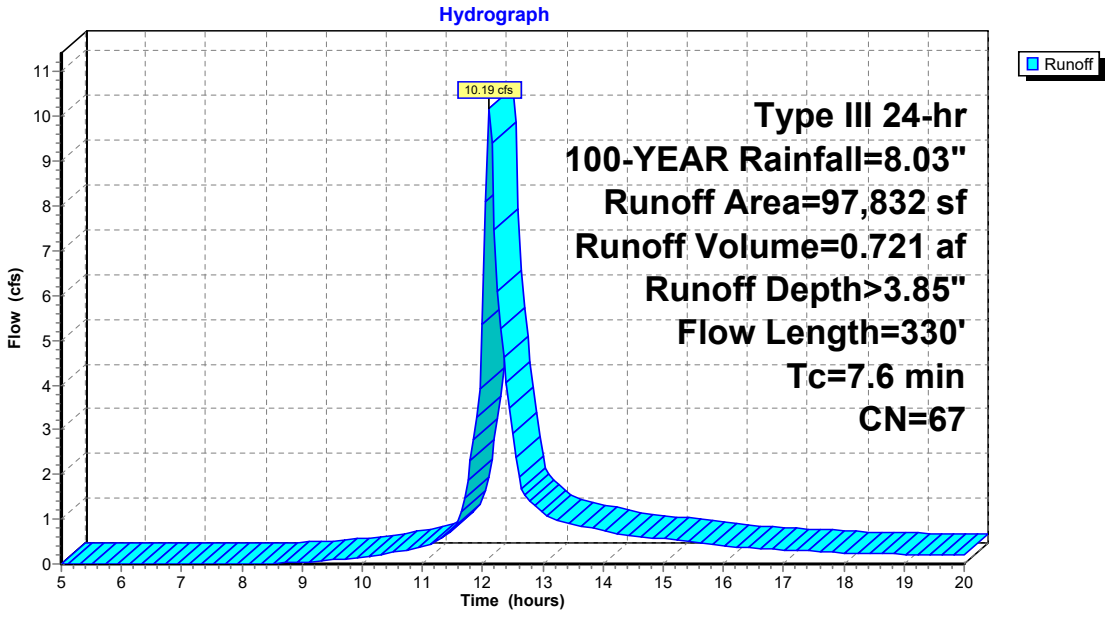
Runoff = 10.19 cfs @ 12.11 hrs, Volume= 0.721 af, Depth> 3.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
45,107	39	>75% Grass cover, Good, HSG A
16,631	74	>75% Grass cover, Good, HSG C
36,094	98	Paved parking, HSG A
97,832	67	Weighted Average
61,738		63.11% Pervious Area
36,094		36.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
1.4	280	0.0420	3.30		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
7.6	330	Total			

Subcatchment 304S: P3-4



Summary for Subcatchment 305F: P3-5 FIELD

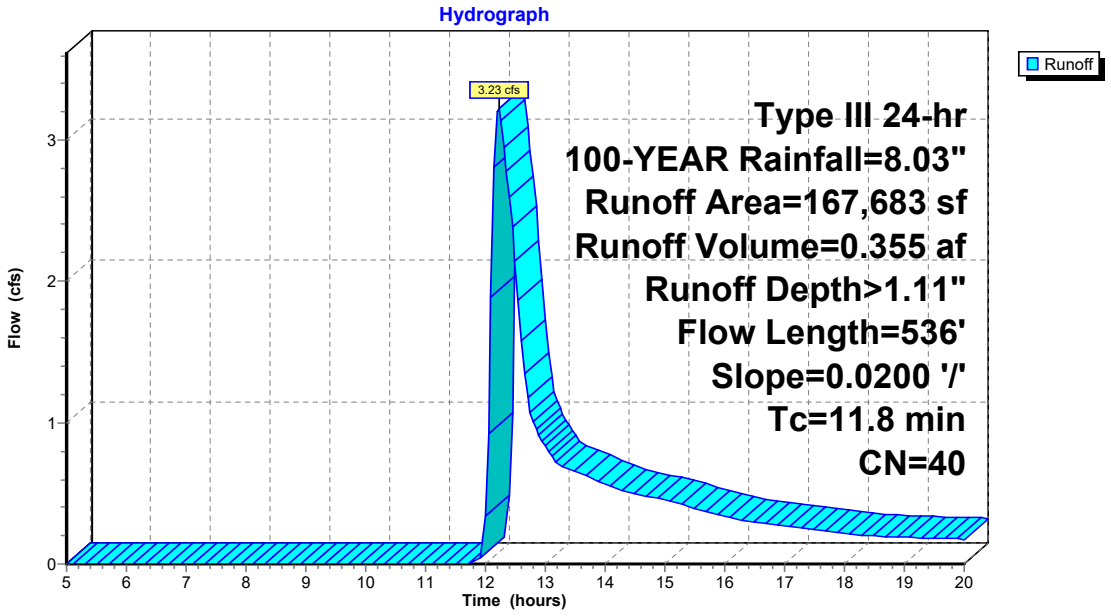
Runoff = 3.23 cfs @ 12.22 hrs, Volume= 0.355 af, Depth> 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
164,925	39	>75% Grass cover, Good, HSG A
2,758	98	Paved parking, HSG A
167,683	40	Weighted Average
164,925		98.36% Pervious Area
2,758		1.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, Sheet Flow 50 Ft** Grass: Dense n= 0.240 P2= 3.20"
3.6	486	0.0200	2.28		**Shallow Concentrated Flow, Shallow Flow** Unpaved Kv= 16.1 fps
11.8	536	Total			

Subcatchment 305F: P3-5 FIELD



Summary for Subcatchment 305P: P3-5 PAV

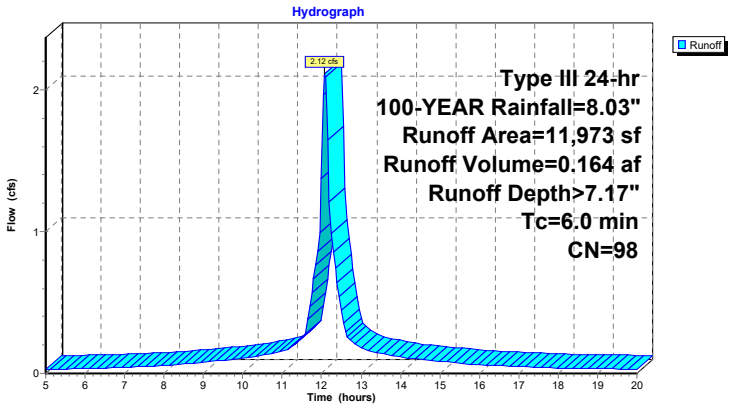
Runoff = 2.12 cfs @ 12.09 hrs, Volume= 0.164 af, Depth> 7.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=8.03"

Area (sf)	CN	Description
11,973	98	Paved parking, HSG A
11,973		100.00% Impervious Area

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

Subcatchment 305P: P3-5 PAV



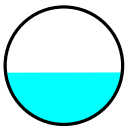
Summary for Reach 36": (new Reach)

Inflow Area = 8.786 ac, 27.67% Impervious, Inflow Depth > 3.65" for 100-YEAR event
Inflow = 23.52 cfs @ 12.26 hrs, Volume= 2.673 af
Outflow = 23.26 cfs @ 12.33 hrs, Volume= 2.662 af, Atten= 1%, Lag= 4.6 min

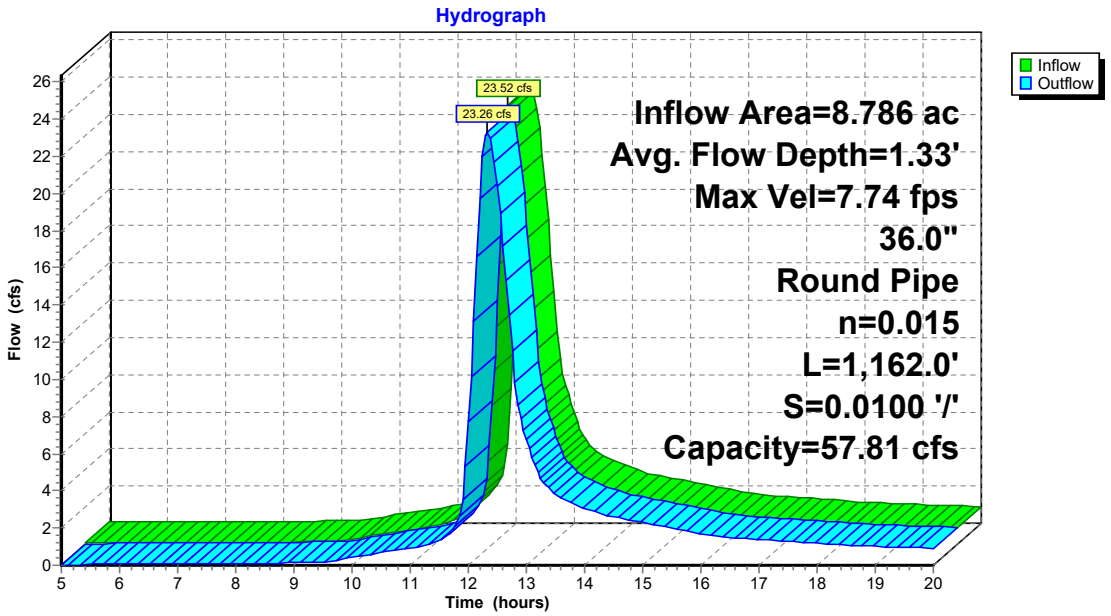
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.74 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 3.10 fps, Avg. Travel Time= 6.2 min

Peak Storage= 3,501 cf @ 12.29 hrs
Average Depth at Peak Storage= 1.33'
Bank-Full Depth= 3.00' Flow Area= 7.1 sf, Capacity= 57.81 cfs

36.0" Round Pipe
n= 0.015
Length= 1,162.0' Slope= 0.0100 '/'
Inlet Invert= 324.40', Outlet Invert= 312.78'



Reach 36": (new Reach)

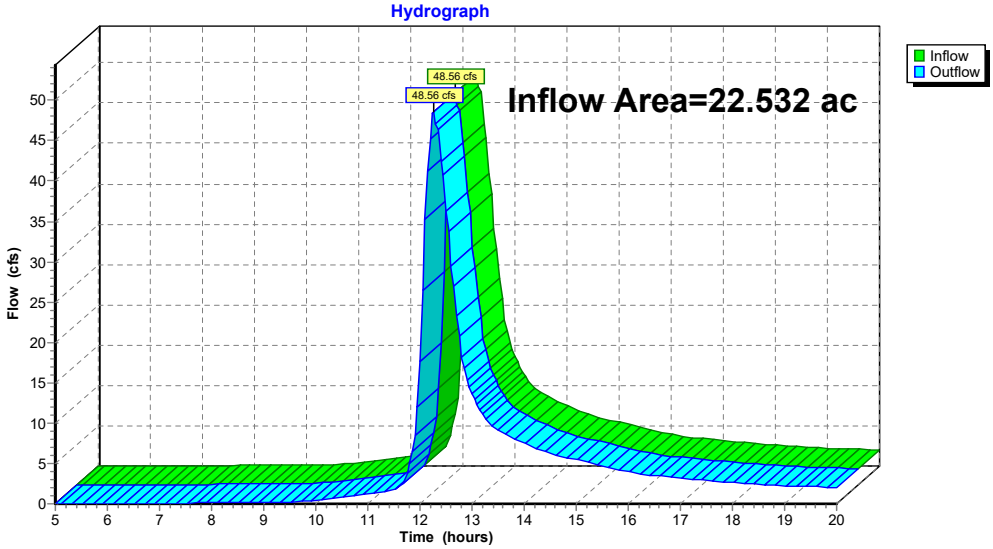


Summary for Reach 100R: Arcade Pond

Inflow Area = 22.532 ac, 31.98% Impervious, Inflow Depth > 2.98" for 100-YEAR event
Inflow = 48.56 cfs @ 12.26 hrs, Volume= 5.590 af
Outflow = 48.56 cfs @ 12.26 hrs, Volume= 5.590 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 100R: Arcade Pond



Summary for Reach BSW: BioSwale at Drive

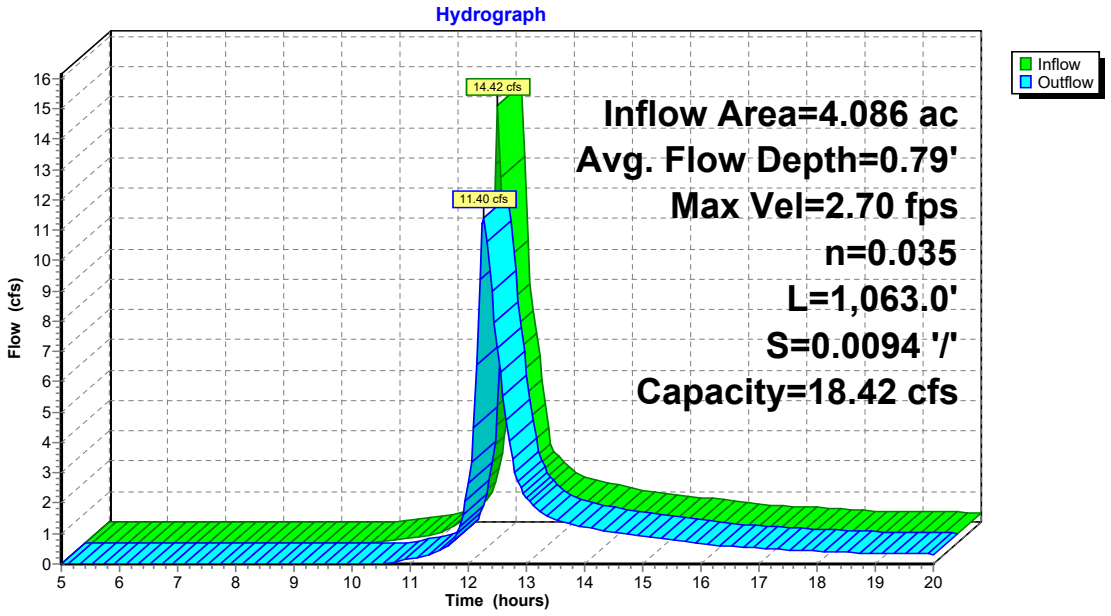
Inflow Area = 4.086 ac, 34.44% Impervious, Inflow Depth > 2.88" for 100-YEAR event
Inflow = 14.42 cfs @ 12.10 hrs, Volume= 0.981 af
Outflow = 11.40 cfs @ 12.27 hrs, Volume= 0.969 af, Atten= 21%, Lag= 10.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.70 fps, Min. Travel Time= 6.6 min
Avg. Velocity = 1.14 fps, Avg. Travel Time= 15.5 min

Peak Storage= 4,544 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.79'
Defined Flood Depth= 1.25' Flow Area= 8.2 sf, Capacity= 27.79 cfs
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 18.42 cfs

3.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 '/' Top Width= 9.00'
Length= 1,063.0' Slope= 0.0094 '/'
Inlet Invert= 330.00', Outlet Invert= 320.00'

Reach BSW: BioSwale at Drive

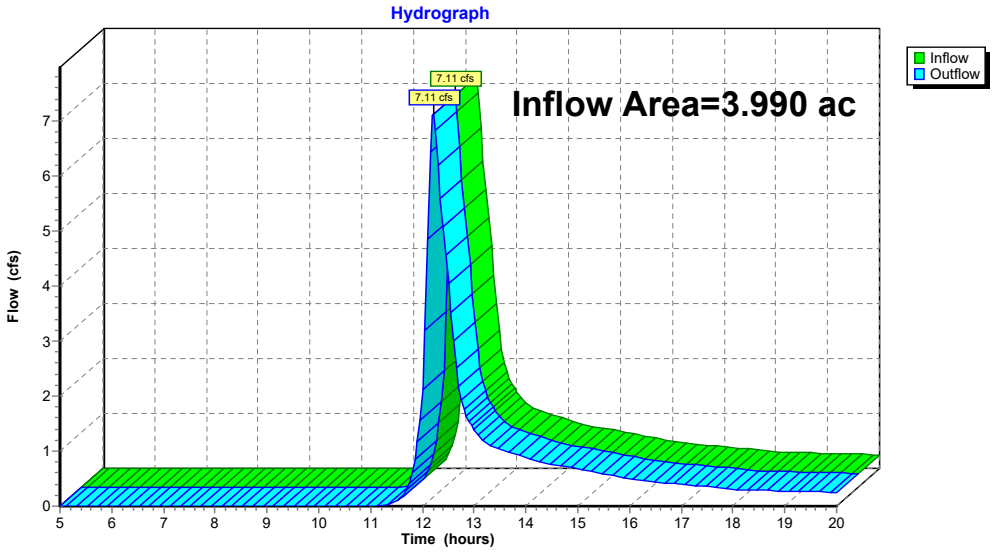


Summary for Reach DP100: DP-1 Wetland

Inflow Area = 3.990 ac, 0.00% Impervious, Inflow Depth > 1.95" for 100-YEAR event
Inflow = 7.11 cfs @ 12.21 hrs, Volume= 0.648 af
Outflow = 7.11 cfs @ 12.21 hrs, Volume= 0.648 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach DP100: DP-1 Wetland



Summary for Pond 217: BYPASS MH #217

Inflow Area = 5.291 ac, 44.57% Impervious, Inflow Depth > 3.44" for 100-YEAR event
Inflow = 15.41 cfs @ 12.25 hrs, Volume= 1.519 af
Outflow = 15.41 cfs @ 12.25 hrs, Volume= 1.519 af, Atten= 0%, Lag= 0.0 min
Primary = 2.61 cfs @ 12.25 hrs, Volume= 0.877 af
Secondary = 12.81 cfs @ 12.25 hrs, Volume= 0.641 af

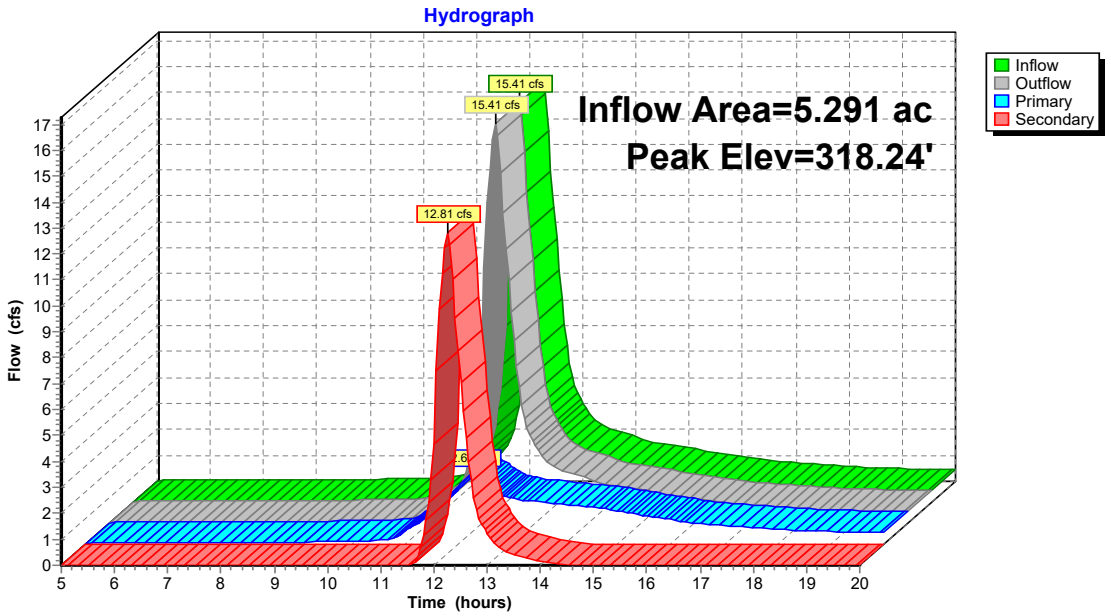
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 318.24' @ 12.25 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	315.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	316.52'	**24.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=2.60 cfs @ 12.25 hrs HW=318.23' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 2.60 cfs @ 7.46 fps)

Secondary OutFlow Max=12.78 cfs @ 12.25 hrs HW=318.23' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 12.78 cfs @ 4.46 fps)

Pond 217: BYPASS MH #217



Summary for Pond BIO2: BIBASIN 3-2

Inflow Area = 2.246 ac, 36.89% Impervious, Inflow Depth > 2.51" for 100-YEAR event
Inflow = 1.70 cfs @ 12.11 hrs, Volume= 0.469 af
Outflow = 1.43 cfs @ 12.38 hrs, Volume= 0.408 af, Atten= 16%, Lag= 15.9 min
Discarded = 0.20 cfs @ 12.38 hrs, Volume= 0.153 af
Primary = 1.24 cfs @ 12.38 hrs, Volume= 0.255 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 315.27' @ 12.38 hrs Surf.Area= 3,516 sf Storage= 3,525 cf

Plug-Flow detention time= 71.1 min calculated for 0.406 af (87% of inflow)
Center-of-Mass det. time= 30.6 min (861.2 - 830.6)

Volume	Invert	Avail.Storage	Storage Description
#1	314.00'	6,412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

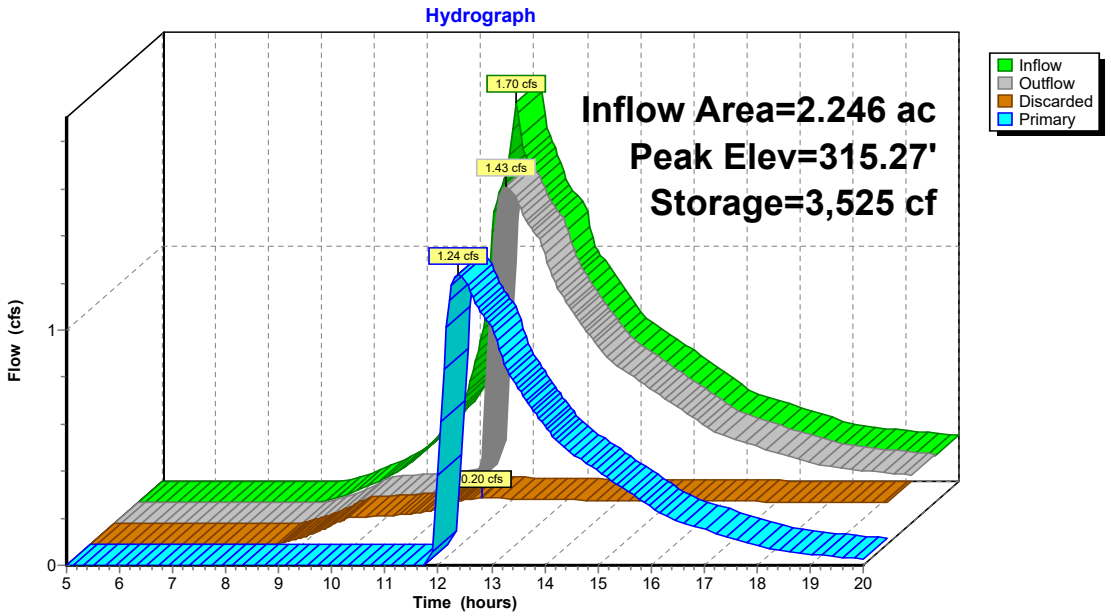
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
314.00	2,047	0	0
315.00	3,194	2,621	2,621
316.00	4,388	3,791	6,412

Device	Routing	Invert	Outlet Devices
#1	Primary	315.50'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#2	Discarded	314.00'	**2.410 in/hr Exfiltration over Horizontal area**
#3	Primary	315.00'	**24.0" Horiz. Orifice/Grate X 0.43** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.20 cfs @ 12.38 hrs HW=315.27' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.20 cfs)

Primary OutFlow Max=1.24 cfs @ 12.38 hrs HW=315.27' (Free Discharge)
├**1=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Weir Controls 1.24 cfs @ 0.73 fps)

Pond BIO2: BIBASIN 3-2



Summary for Pond BR1: BioBasin #1

Inflow Area = 0.930 ac, 72.71% Impervious, Inflow Depth > 5.55" for 100-YEAR event
Inflow = 6.13 cfs @ 12.09 hrs, Volume= 0.430 af
Outflow = 5.86 cfs @ 12.12 hrs, Volume= 0.385 af, Atten= 4%, Lag= 1.6 min
Primary = 5.86 cfs @ 12.12 hrs, Volume= 0.385 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 329.11' @ 12.11 hrs Surf.Area= 2,259 sf Storage= 3,100 cf

Plug-Flow detention time= 62.3 min calculated for 0.385 af (90% of inflow)
Center-of-Mass det. time= 28.1 min (794.9 - 766.9)

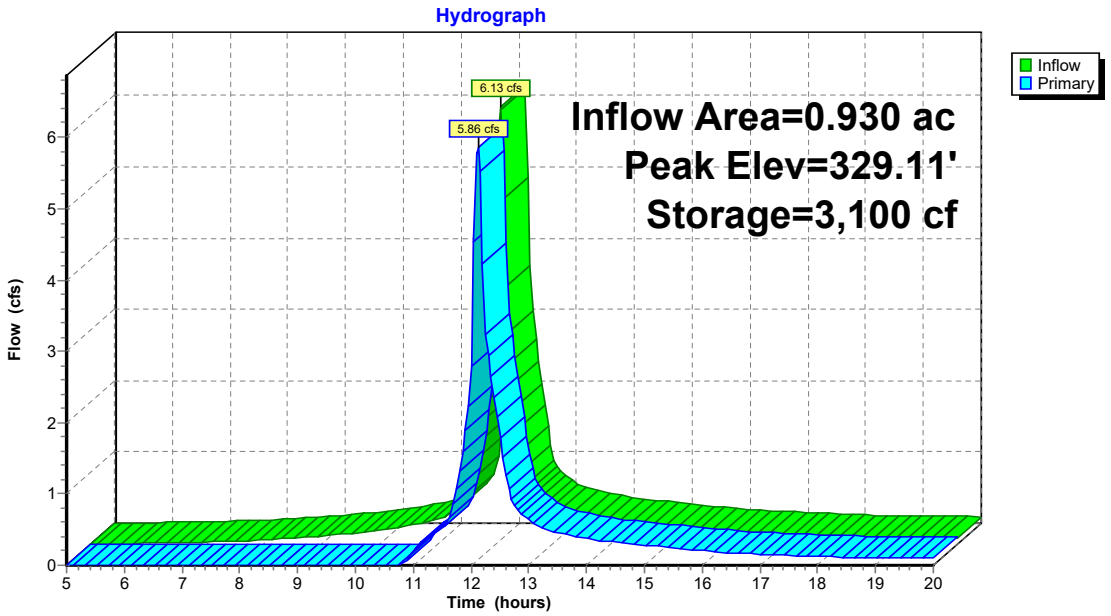
Volume	Invert	Avail.Storage	Storage Description
#1	327.00'	5,450 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
327.00	888	0	0
328.00	1,328	1,108	1,108
329.00	2,162	1,745	2,853
330.00	3,032	2,597	5,450

Device	Routing	Invert	Outlet Devices
#1	Primary	329.00'	**2.0" x 2.0" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#2	Primary	328.50'	**24.0" Horiz. Orifice/Grate X 0.43** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.70 cfs @ 12.12 hrs HW=329.10' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 1.55 cfs @ 1.55 fps)
└**2=Orifice/Grate** (Weir Controls 4.15 cfs @ 1.09 fps)

Pond BR1: BioBasin #1



Summary for Pond MH 230: Bypass MH #230

Inflow Area = 2.246 ac, 36.89% Impervious, Inflow Depth > 3.85" for 100-YEAR event
Inflow = 10.19 cfs @ 12.11 hrs, Volume= 0.721 af
Outflow = 10.19 cfs @ 12.11 hrs, Volume= 0.721 af, Atten= 0%, Lag= 0.0 min
Primary = 1.70 cfs @ 12.11 hrs, Volume= 0.469 af
Secondary = 8.49 cfs @ 12.11 hrs, Volume= 0.252 af

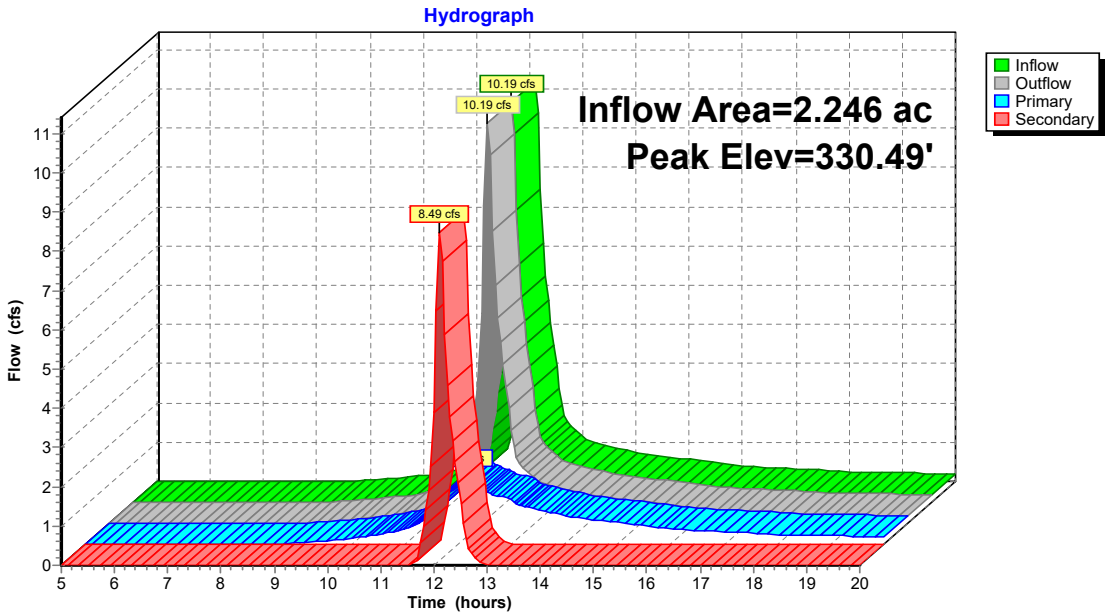
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 330.49' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	327.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	328.75'	**18.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.69 cfs @ 12.11 hrs HW=330.44' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 1.69 cfs @ 8.60 fps)

Secondary OutFlow Max=8.26 cfs @ 12.11 hrs HW=330.44' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 8.26 cfs @ 4.67 fps)

Pond MH 230: Bypass MH #230



Summary for Pond SDB1: DB#1 Surface Det Basin

Inflow Area = 2.485 ac, 32.75% Impervious, Inflow Depth > 5.43" for 100-YEAR event
Inflow = 12.74 cfs @ 12.19 hrs, Volume= 1.124 af
Outflow = 10.32 cfs @ 12.30 hrs, Volume= 1.022 af, Atten= 19%, Lag= 6.5 min
Primary = 10.32 cfs @ 12.30 hrs, Volume= 1.022 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 331.00' @ 12.30 hrs Surf.Area= 3,425 sf Storage= 9,765 cf

Plug-Flow detention time= 70.5 min calculated for 1.018 af (91% of inflow)
Center-of-Mass det. time= 41.2 min (816.7 - 775.5)

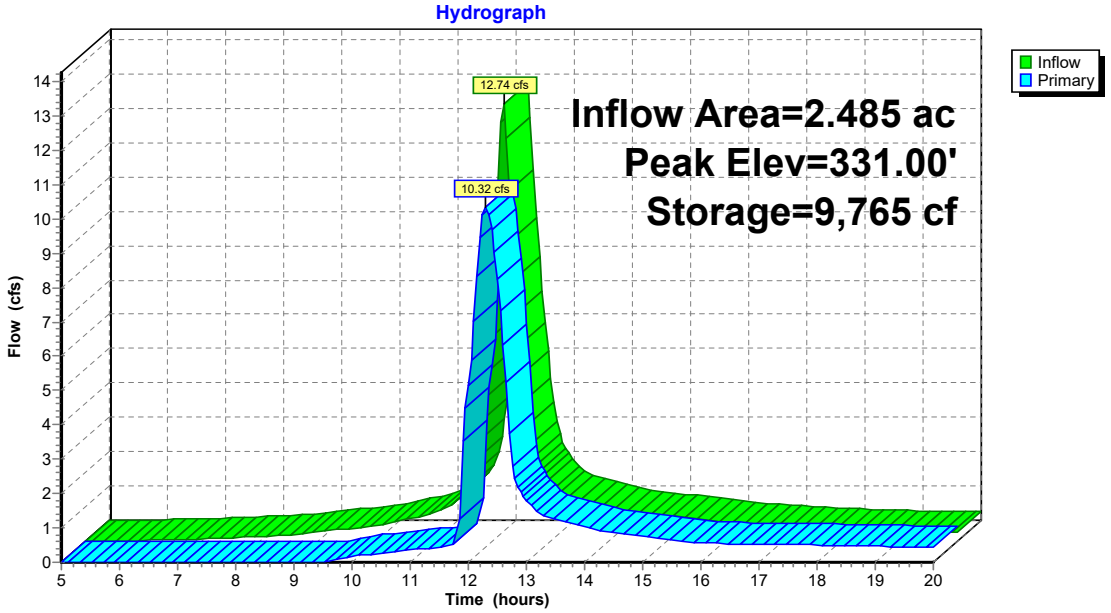
Volume	Invert	Avail.Storage	Storage Description
#1	327.00'	13,478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
327.00	1,480	0	0
328.00	1,984	1,732	1,732
329.00	2,422	2,203	3,935
330.00	2,899	2,661	6,596
331.00	3,424	3,162	9,757
332.00	4,018	3,721	13,478

Device	Routing	Invert	Outlet Devices
#1	Primary	328.00'	**4.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	330.00'	**12.0" x 4.0" Horiz. Orifice/Grate** X 6 rows C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=10.32 cfs @ 12.30 hrs HW=331.00' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.68 cfs @ 8.17 fps)
└**2=Orifice/Grate** (Orifice Controls 9.64 cfs @ 4.82 fps)

Pond SDB1: DB#1 Surface Det Basin



Summary for Pond UDB2: UG DB #2

Inflow Area = 2.360 ac, 64.58% Impervious, Inflow Depth > 5.43" for 100-YEAR event
Inflow = 13.76 cfs @ 12.13 hrs, Volume= 1.069 af
Outflow = 2.45 cfs @ 12.65 hrs, Volume= 0.854 af, Atten= 82%, Lag= 31.0 min
Primary = 2.45 cfs @ 12.65 hrs, Volume= 0.854 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 316.81' @ 12.65 hrs Surf.Area= 0.303 ac Storage= 0.552 af

Plug-Flow detention time= 173.3 min calculated for 0.854 af (80% of inflow)
Center-of-Mass det. time= 120.7 min (892.3 - 771.6)

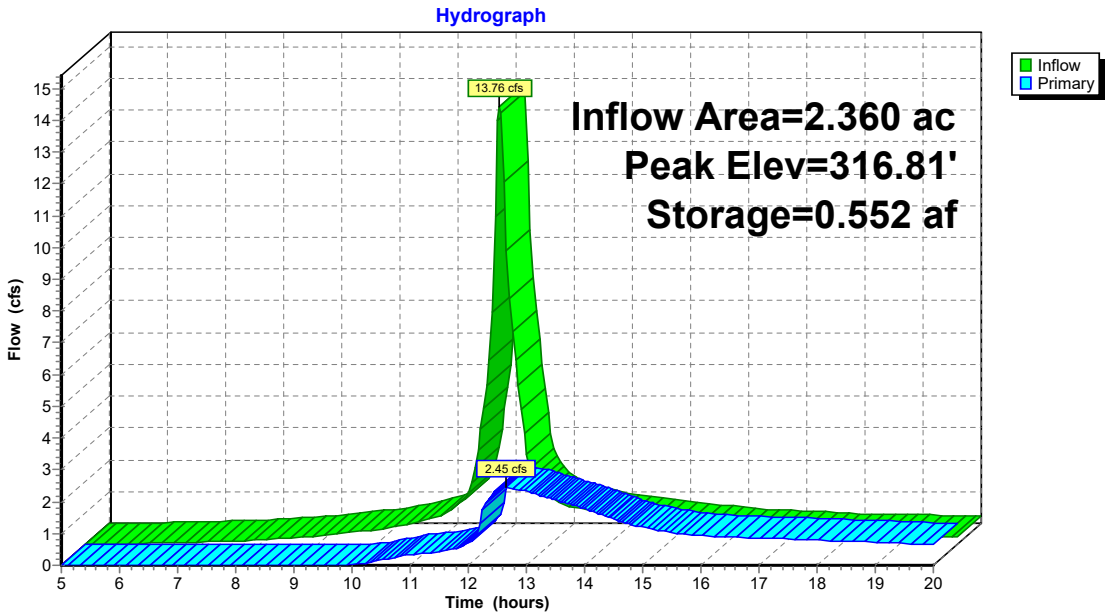
Volume	Invert	Avail.Storage	Storage Description
#1A	314.00'	0.233 af	**82.25'W x 160.26'L x 3.50'H Field A** 1.059 af Overall - 0.394 af Embedded = 0.665 af x 35.0% Voids
#2A	314.50'	0.394 af	**ADS_StormTech SC-740 +Cap**x 374 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 17 Rows of 22 Chambers
		0.627 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	314.50'	**6.0" x 4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	315.80'	**10.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=2.44 cfs @ 12.65 hrs HW=316.81' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 1.22 cfs @ 7.32 fps)
└**2=Orifice/Grate** (Orifice Controls 1.23 cfs @ 4.41 fps)

Pond UDB2: UG DB #2



Summary for Pond UDB3: UG D-BASIN #3

Inflow Area = 5.291 ac, 44.57% Impervious, Inflow Depth > 1.99" for 100-YEAR event
Inflow = 2.61 cfs @ 12.25 hrs, Volume= 0.877 af
Outflow = 3.28 cfs @ 12.25 hrs, Volume= 0.772 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.22 cfs @ 10.85 hrs, Volume= 0.201 af
Primary = 3.06 cfs @ 12.25 hrs, Volume= 0.571 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 317.25' @ 12.25 hrs Surf.Area= 0.092 ac Storage= 0.117 af

Plug-Flow detention time= 61.4 min calculated for 0.769 af (88% of inflow)
Center-of-Mass det. time= 24.6 min (876.3 - 851.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	314.70'	0.064 af	**104.83'W x 38.04'L x 2.33'H Field A** 0.214 af Overall - 0.053 af Embedded = 0.161 af x 40.0% Voids
#2A	315.20'	0.053 af	**ADS_StormTech SC-310** x 155 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 31 rows
		0.117 af	Total Available Storage

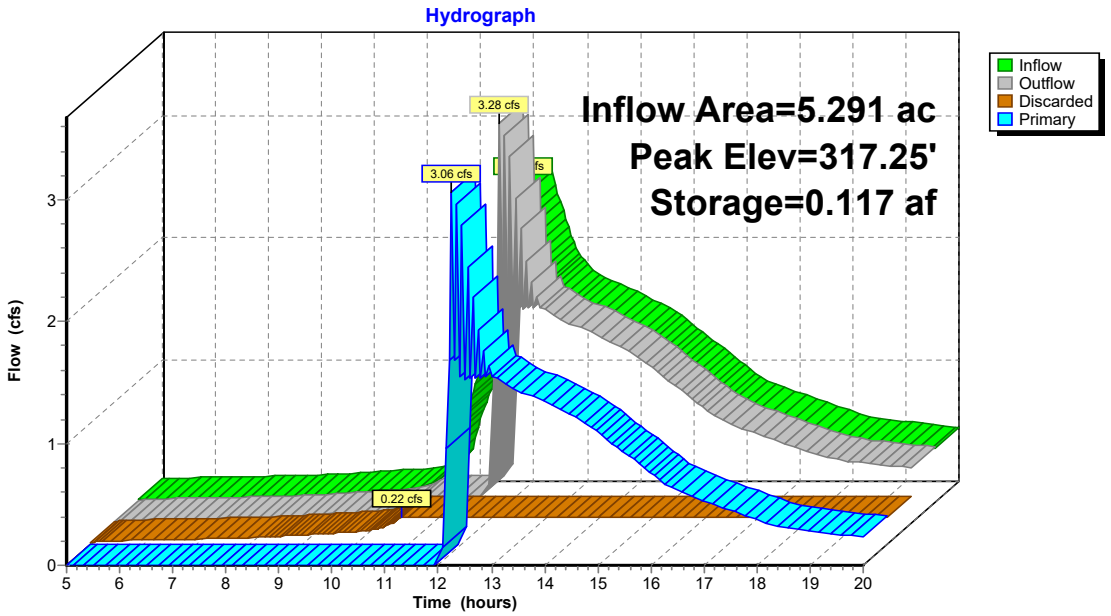
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	314.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	316.52'	**24.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.22 cfs @ 10.85 hrs HW=314.74' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=3.06 cfs @ 12.25 hrs HW=317.25' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 3.06 cfs @ 2.92 fps)

Pond UDB3: UG D-BASIN #3



Summary for Pond UDB4: UG D-BASIN#4

Inflow Area = 1.841 ac, 62.34% Impervious, Inflow Depth > 4.85" for 100-YEAR event
Inflow = 8.78 cfs @ 12.18 hrs, Volume= 0.745 af
Outflow = 5.41 cfs @ 12.39 hrs, Volume= 0.722 af, Atten= 38%, Lag= 12.5 min
Primary = 5.41 cfs @ 12.39 hrs, Volume= 0.722 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 328.45' @ 12.39 hrs Surf.Area= 0.080 ac Storage= 0.173 af

Plug-Flow detention time= 39.6 min calculated for 0.722 af (97% of inflow)
Center-of-Mass det. time= 28.1 min (812.5 - 784.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	324.90'	0.071 af	**39.50'W x 87.88'L x 3.50'H Field A** 0.279 af Overall - 0.102 af Embedded = 0.177 af x 40.0% Voids
#2A	325.40'	0.102 af	**ADS_StormTech SC-740** x 96 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 Row Length Adjustment= +0.44' x 6.45 sf x 8 rows
		0.173 af	Total Available Storage

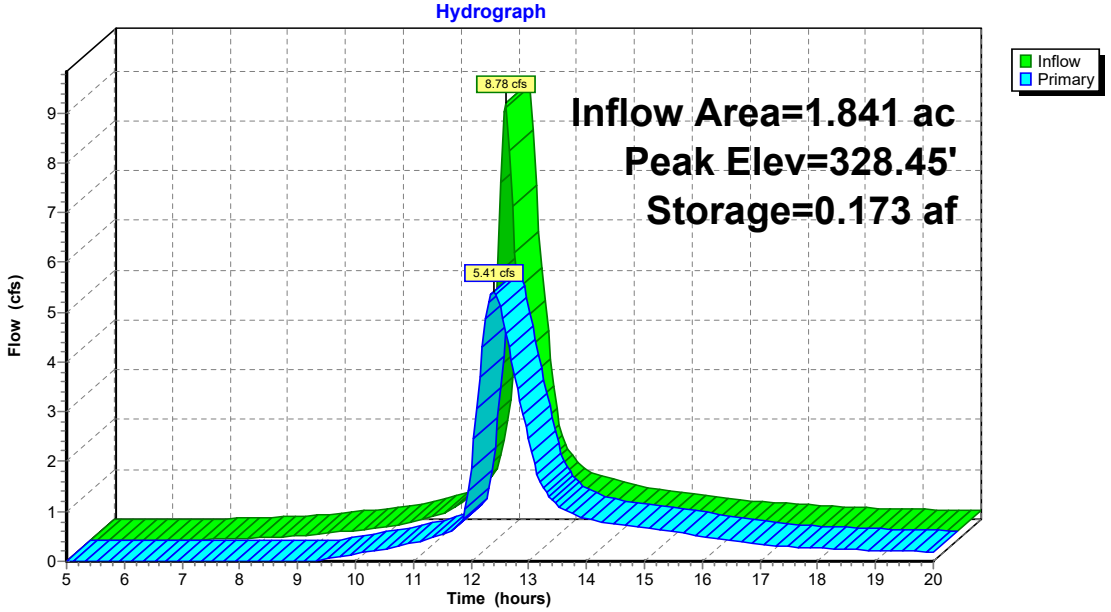
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	325.30'	**8.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600
#2	Primary	326.00'	**12.0" W x 6.0" H Vert. 326** C= 0.600

Primary OutFlow Max=5.40 cfs @ 12.39 hrs HW=328.43' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 1.84 cfs @ 8.29 fps)
└—**2=326** (Orifice Controls 3.55 cfs @ 7.11 fps)

Pond UDB4: UG D-BASIN#4

Hydrograph



ATTACHMENT D

Closed Drainage System Design

Project Description

File Name	12260-PR SSA Drainage Model_2019-05-23.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	May 24, 2019	00:00:00
End Analysis On	May 24, 2019	01:00:00
Start Reporting On	May 24, 2019	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	98
Nodes	288
Junctions	271
Outfalls	17
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	255
Channels	0
Pipes	255
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	25 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Sub-01	0.83	0.30	0.64	0.19	0.16	1.58	0 00:06:00
2	Sub-02	0.16	0.30	0.64	0.19	0.03	0.31	0 00:06:00
3	Sub-03	0.01	0.30	0.64	0.19	0.00	0.02	0 00:06:00
4	Sub-04	0.02	0.30	0.64	0.19	0.00	0.04	0 00:06:00
5	Sub-05	0.09	0.80	0.64	0.51	0.04	0.45	0 00:06:00
6	Sub-06	0.25	0.55	0.64	0.35	0.09	0.89	0 00:06:00
7	Sub-07	0.09	0.60	0.64	0.38	0.03	0.35	0 00:06:00
8	Sub-08	0.03	0.90	0.64	0.58	0.02	0.16	0 00:06:00
9	Sub-09	0.03	0.30	0.64	0.19	0.00	0.05	0 00:06:00
10	Sub-10	0.01	0.30	0.64	0.19	0.00	0.03	0 00:06:00
11	Sub-11	0.01	0.55	0.64	0.35	0.00	0.03	0 00:06:00
12	Sub-12	0.04	0.30	0.64	0.19	0.01	0.08	0 00:06:00
13	Sub-13	0.00	0.56	0.64	0.36	0.00	0.02	0 00:06:00
14	Sub-14	0.09	0.90	0.64	0.58	0.05	0.54	0 00:06:00
15	Sub-15	0.10	0.70	0.64	0.45	0.05	0.47	0 00:06:00
16	Sub-16	0.13	0.30	0.64	0.19	0.02	0.25	0 00:06:00
17	Sub-17	0.13	0.30	0.64	0.19	0.02	0.25	0 00:06:00
18	Sub-18	0.13	0.30	0.64	0.19	0.02	0.25	0 00:06:00
19	Sub-19	0.02	0.30	0.64	0.19	0.00	0.05	0 00:06:00
20	Sub-20	0.04	0.30	0.64	0.19	0.01	0.07	0 00:06:00
21	Sub-21	0.04	0.30	0.64	0.19	0.01	0.07	0 00:06:00
22	Sub-22	0.04	0.30	0.64	0.19	0.01	0.07	0 00:06:00
23	Sub-23	0.04	0.30	0.64	0.19	0.01	0.07	0 00:06:00
24	Sub-24	0.04	0.90	0.64	0.58	0.02	0.23	0 00:06:00
25	Sub-25	0.03	0.73	0.64	0.47	0.01	0.14	0 00:06:00
26	Sub-26	0.03	0.75	0.64	0.48	0.01	0.13	0 00:06:00
27	Sub-27	0.02	0.68	0.64	0.43	0.01	0.09	0 00:06:00
28	Sub-28	0.02	0.67	0.64	0.43	0.01	0.08	0 00:06:00
29	Sub-29	0.02	0.75	0.64	0.48	0.01	0.09	0 00:06:00
30	Sub-30	0.01	0.75	0.64	0.48	0.01	0.06	0 00:06:00
31	Sub-31	0.07	0.30	0.64	0.19	0.01	0.14	0 00:06:00
32	Sub-32	0.12	0.30	0.64	0.19	0.02	0.23	0 00:06:00
33	Sub-33	0.08	0.90	0.64	0.58	0.05	0.48	0 00:06:00
34	Sub-34	0.08	0.90	0.64	0.58	0.05	0.48	0 00:06:00
35	Sub-35	0.04	0.30	0.64	0.19	0.01	0.08	0 00:06:00
36	Sub-36	0.09	0.30	0.64	0.19	0.02	0.17	0 00:06:00
37	Sub-37	0.11	0.30	0.64	0.19	0.02	0.21	0 00:06:00
38	Sub-38	0.03	0.90	0.64	0.58	0.02	0.17	0 00:06:00
39	Sub-39	0.02	0.90	0.64	0.58	0.01	0.11	0 00:06:00
40	Sub-40	0.11	0.86	0.64	0.55	0.06	0.58	0 00:06:00
41	Sub-41	0.11	0.90	0.64	0.58	0.06	0.63	0 00:06:00
42	Sub-42	0.09	0.71	0.64	0.45	0.04	0.40	0 00:06:00
43	Sub-43	0.03	0.90	0.64	0.58	0.02	0.15	0 00:06:00
44	Sub-44	0.07	0.79	0.64	0.51	0.03	0.34	0 00:06:00
45	Sub-45	0.03	0.90	0.64	0.58	0.02	0.18	0 00:06:00
46	Sub-46	0.06	0.90	0.64	0.58	0.04	0.37	0 00:06:00
47	Sub-47	0.22	0.90	0.64	0.58	0.13	1.29	0 00:06:00
48	Sub-48	0.12	0.76	0.64	0.49	0.06	0.61	0 00:06:00
49	Sub-49	0.13	0.70	0.64	0.45	0.06	0.57	0 00:06:00
50	Sub-50	0.09	0.90	0.64	0.58	0.05	0.54	0 00:06:00
51	Sub-51	0.03	0.90	0.64	0.58	0.02	0.20	0 00:06:00
52	Sub-52	0.09	0.90	0.64	0.58	0.05	0.50	0 00:06:00
53	Sub-53	0.01	0.90	0.64	0.58	0.01	0.07	0 00:06:00
54	Sub-54	0.02	0.90	0.64	0.58	0.01	0.11	0 00:06:00
55	Sub-55	0.04	0.90	0.64	0.58	0.02	0.24	0 00:06:00
56	Sub-56	0.05	0.90	0.64	0.58	0.03	0.27	0 00:06:00
57	Sub-57	0.14	0.90	0.64	0.58	0.08	0.81	0 00:06:00
58	Sub-58	0.04	0.90	0.64	0.58	0.02	0.22	0 00:06:00
59	Sub-59	0.05	0.90	0.64	0.58	0.03	0.30	0 00:06:00
60	Sub-60	0.01	0.90	0.64	0.58	0.01	0.08	0 00:06:00
61	Sub-61	0.02	0.90	0.64	0.58	0.01	0.13	0 00:06:00
62	Sub-62	0.02	0.90	0.64	0.58	0.01	0.12	0 00:06:00
63	Sub-63	0.55	0.90	0.64	0.58	0.32	3.18	0 00:06:00
64	Sub-64	0.06	0.67	0.64	0.43	0.02	0.24	0 00:06:00
65	Sub-65	0.02	0.90	0.64	0.58	0.01	0.12	0 00:06:00
66	Sub-66	0.02	0.90	0.64	0.58	0.01	0.12	0 00:06:00
67	Sub-67	0.01	0.90	0.64	0.58	0.01	0.08	0 00:06:00
68	Sub-68	0.03	0.90	0.64	0.58	0.02	0.17	0 00:06:00
69	Sub-69	0.05	0.90	0.64	0.58	0.03	0.30	0 00:06:00
70	Sub-70	0.06	0.90	0.64	0.58	0.04	0.37	0 00:06:00
71	Sub-71	0.17	0.75	0.64	0.48	0.08	0.82	0 00:06:00
72	Sub-72	0.03	0.90	0.64	0.58	0.02	0.20	0 00:06:00
73	Sub-73	0.19	0.47	0.64	0.30	0.06	0.56	0 00:06:00
74	Sub-74	0.14	0.66	0.64	0.42	0.06	0.59	0 00:06:00
75	Sub-75	0.15	0.90	0.64	0.58	0.08	0.85	0 00:06:00
76	Sub-76	0.15	0.90	0.64	0.58	0.09	0.87	0 00:06:00
77	Sub-77	0.15	0.90	0.64	0.58	0.09	0.89	0 00:06:00
78	Sub-78	0.09	0.90	0.64	0.58	0.05	0.53	0 00:06:00
79	Sub-79	0.08	0.62	0.64	0.40	0.03	0.32	0 00:06:00
80	Sub-80	0.10	0.57	0.64	0.36	0.04	0.38	0 00:06:00
81	Sub-81	0.04	0.90	0.64	0.58	0.02	0.23	0 00:06:00
82	Sub-82	0.10	0.90	0.64	0.58	0.06	0.55	0 00:06:00

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
83	Sub-83	0.09	0.81	0.64	0.52	0.05	0.47	0 00:06:00
84	Sub-84	0.31	0.41	0.64	0.26	0.08	0.82	0 00:06:00
85	Sub-85	0.08	0.90	0.64	0.58	0.05	0.47	0 00:06:00
86	Sub-86	0.03	0.90	0.64	0.58	0.02	0.20	0 00:06:00
87	Sub-87	0.05	0.90	0.64	0.58	0.03	0.30	0 00:06:00
88	Sub-88	0.05	0.67	0.64	0.43	0.02	0.23	0 00:06:00
89	Sub-89	0.06	0.90	0.64	0.58	0.03	0.32	0 00:06:00
90	Sub-90	0.07	0.90	0.64	0.58	0.04	0.38	0 00:06:00
91	Sub-91	0.16	0.54	0.64	0.35	0.05	0.55	0 00:06:00
92	Sub-92	0.03	0.90	0.64	0.58	0.02	0.16	0 00:06:00
93	Sub-93	0.13	0.56	0.64	0.36	0.05	0.48	0 00:06:00
94	Sub-94	0.07	0.90	0.64	0.58	0.04	0.42	0 00:06:00
95	Sub-95	0.42	0.90	0.64	0.58	0.24	2.39	0 00:06:00
96	Sub-96	0.35	0.90	0.64	0.58	0.20	1.99	0 00:06:00
97	Sub-98	0.47	0.90	0.64	0.58	0.27	2.70	0 00:06:00
98	Sub-99	0.49	0.90	0.64	0.58	0.28	2.82	0 00:06:00

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
1	AB#299	335.75	338.92
2	AB#395	331.15	334.50
3	AB#398	329.45	332.86
4	AB#399	329.66	332.72
5	AD #400	330.00	332.34
6	AD #401	330.00	332.00
7	AD #406	330.00	332.12
8	AD #407	329.35	332.15
9	AD #408	339.90	341.92
10	AD #428	330.60	332.65
11	AD #432	330.80	332.77
12	AD#300	318.00	321.00
13	AD#313	323.50	328.50
14	AD#398	338.50	341.04
15	AD#399	331.50	335.56
16	AD#401	329.75	332.25
17	AD#402	329.50	332.74
18	AD#403	329.40	332.81
19	AD#404	329.90	332.40
20	AD#405	330.15	332.66
21	AD#406	329.60	332.12
22	AD#407	329.00	332.15
23	AD#408	336.18	336.75
24	AD#409	341.60	343.68
25	AD#411	329.00	332.07
26	AD#412	330.75	332.75
27	AD#413	338.70	341.70
28	AD#414	336.50	339.50
29	AD#415	333.50	336.50
30	AD#416	332.10	335.10
31	AD#417	328.70	331.24
32	AD#418	330.05	332.59
33	AD#419	329.80	332.30
34	AD#420	329.95	331.55
35	AD#421	329.30	330.93
36	AD#422	329.90	332.40
37	AD#423	329.90	332.40
38	AD#424	329.00	332.50
39	AD#425	330.00	332.50
40	AD#426	329.40	332.50
41	AD#427	329.00	332.56
42	AD#428	330.15	332.65
43	AD#429	329.80	332.43
44	AD#430	328.85	331.37
45	AD#431	330.75	332.75
46	AD#432	330.70	332.70
47	AD#433	331.40	333.93
48	AD#434	329.40	332.52
49	AD#435	313.00	315.00
50	AD#495	330.35	332.87
51	BYPASS MH#200	316.02	319.88
52	BYPASS MH#203	328.25	332.78
53	CB #315	328.50	331.20
54	CB #316	329.00	331.50
55	CB #320	329.00	332.50
56	CB #327	329.50	332.60
57	CB #336	330.00	333.80
58	CB #369	329.00	331.67
59	CB#310	326.50	330.03
60	CB#311	325.95	329.47
61	CB#312	323.17	329.00
62	CB#317	327.61	331.12
63	CB#318	327.50	331.01
64	CB#319	327.50	331.01
65	CB#321	327.15	330.68
66	CB#323	326.20	329.73
67	CB#324	311.64	315.14
68	CB#325	327.15	330.69
69	CB#326	327.20	330.70
70	CB#327	328.33	331.83
71	CB#328	328.38	331.88
72	CB#329	328.37	331.87
73	CB#331	327.98	331.48
74	CB#332	327.40	330.94
75	CB#333	327.15	330.68
76	CB#334	328.35	331.85
77	CB#335	328.35	331.85
78	CB#336	330.00	333.49
79	CB#337	330.15	333.64
80	CB#338	331.15	334.67
81	CB#339	327.11	331.17
82	CB#340	330.00	333.51

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
83	CB#342	329.00	332.51
84	CB#343	327.95	331.45
85	CB#344	327.75	331.29
86	CB#346	312.60	315.50
87	CB#347	325.30	328.82
88	CB#348	324.70	328.20
89	CB#349	315.25	318.78
90	CB#350	327.15	330.68
91	CB#351	315.50	318.77
92	CB#352	317.50	321.02
93	CB#353	323.65	327.18
94	CB#354	324.40	327.94
95	CB#355	325.60	329.15
96	CB#356	320.00	323.49
97	CB#357	320.50	324.05
98	CB#358	322.35	325.87
99	CB#359	322.50	326.00
100	CB#360	324.90	328.40
101	CB#361	325.75	329.28
102	CB#362	325.90	329.40
103	CB#363	317.50	321.00
104	CB#364	324.70	328.20
105	CB#365	326.50	330.06
106	CB#366	326.80	330.33
107	CB#367	322.55	326.09
108	CB#368	320.10	323.65
109	CB#369	328.15	331.66
110	CB#370	327.50	331.00
111	CB#371	328.15	331.68
112	CB#394	330.00	333.52
113	CB#XXX	315.25	318.75
114	CO#6	334.50	341.76
115	DB #3 OUT	311.60	313.79
116	DBL CB #300	318.00	320.00
117	DCB#301	326.80	330.32
118	DCO#1	341.85	343.86
119	DCO#10	333.50	335.55
120	DCO#11	331.95	334.56
121	DCO#2	340.25	342.27
122	DCO#20	328.25	329.60
123	DCO#21	327.00	328.18
124	DCO#22	322.95	324.48
125	DCO#3	341.25	343.28
126	DCO#4	339.85	341.88
127	DCO#5	340.75	342.78
128	DCO#7	333.50	334.07
129	DCO#8	333.30	335.37
130	DCO#9	334.50	341.66
131	DMH #203	318.40	332.88
132	DMH #214	318.00	323.60
133	DMH #224	328.10	332.40
134	DMH #226	327.00	331.00
135	DMH #242	323.30	332.50
136	DMH #254	319.04	323.80
137	DMH #260	324.30	332.63
138	DMH#200	327.30	332.40
139	DMH#200A	323.40	332.19
140	DMH#201	324.55	328.68
141	DMH#201A	322.50	332.43
142	DMH#202	314.65	319.16
143	DMH#202a	321.75	333.87
144	DMH#203	318.33	332.85
145	DMH#204	315.60	327.40
146	DMH#205	310.90	316.75
147	DMH#206	317.25	321.78
148	DMH#207	317.68	321.58
149	DMH#208	311.16	316.00
150	DMH#209	322.69	329.88
151	DMH#210	328.80	332.75
152	DMH#211	329.35	333.57
153	DMH#212	328.60	332.57
154	DMH#213	327.35	331.80
155	DMH#214	318.65	323.29
156	DMH#216	312.07	317.20
157	DMH#218	327.36	333.25
158	DMH#219	328.20	333.10
159	DMH#220	324.40	329.92
160	DMH#221	325.75	330.12
161	DMH#222	327.10	331.23
162	DMH#223	326.63	331.03
163	DMH#224	327.64	332.47
164	DMH#225	328.20	332.09

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
165	DMH#226	326.09	330.42
166	DMH#227	326.39	331.03
167	DMH#228	320.38	325.66
168	DMH#231	316.55	321.18
169	DMH#236	329.85	333.85
170	DMH#237	328.02	331.87
171	DMH#238	330.30	334.09
172	DMH#238A	327.45	332.20
173	DMH#240	330.10	333.72
174	DMH#241	328.75	332.83
175	DMH#242	326.90	332.38
176	DMH#243	325.90	331.49
177	DMH#244	324.25	330.89
178	DMH#245	323.60	329.71
179	DMH#248	322.35	326.58
180	DMH#249	324.00	328.40
181	DMH#251	324.30	328.91
182	DMH#252	326.10	330.60
183	DMH#253	314.70	320.12
184	DMH#254	319.30	323.81
185	DMH#255	322.00	326.10
186	DMH#257	325.40	332.54
187	DMH#260	324.35	332.59
188	DMH#287	327.27	331.91
189	DMH#289	313.23	318.45
190	DMH#290	329.05	332.68
191	DMH#296	320.50	325.61
192	DMH#297	322.50	328.37
193	DMH#298	328.50	332.59
194	DMH#391	312.40	318.00
195	DMH#395	327.90	332.00
196	FD#1	330.00	330.57
197	FD#2	333.00	333.39
198	FD#3	330.00	330.57
199	NS#1A	339.95	340.52
200	NS#1B	339.90	340.47
201	NS1	330.73	331.30
202	OCS DB #4	321.82	332.74
203	OCS#215	314.00	319.55
204	OCS#4	325.40	331.95
205	OCS#4 (1)	326.80	330.93
206	RD#1	329.76	333.00
207	RD#2	329.56	330.72
208	RD#3	329.50	330.66
209	RD#4	329.00	330.16
210	REDUCER#1	338.10	339.26
211	RW FD#1	333.25	333.82
212	SB OCS#1	325.00	333.00
213	Structure - (538)	315.33	315.90
214	Structure - (539)	313.96	314.52
215	Structure - (540)	313.65	314.22
216	Structure - (541)	313.29	313.86
217	Structure - (543)	312.87	313.43
218	Structure - (544)	312.66	313.22
219	Structure - (545)	312.09	312.66
220	Structure - (546)	311.95	312.52
221	Structure - (547)	311.63	312.20
222	Structure - (548)	310.47	311.04
223	Structure - (549)	310.14	310.71
224	Structure - (550)	309.96	310.53
225	Structure - (551)	309.79	310.36
226	Structure - (552)	309.61	310.18
227	Structure - (553)	309.35	309.92
228	Structure - (554)	309.12	309.68
229	Structure - (555)	308.86	309.42
230	Structure - (556)	308.64	309.20
231	Structure - (558)	308.21	308.78
232	Structure - (559)	307.75	308.31
233	Structure - (560)	307.58	308.15
234	Structure - (561)	307.34	307.91
235	Structure - (562)	306.70	307.27
236	Structure - (563)	305.85	306.41
237	Structure - (565)	328.19	328.75
238	Structure - (639)	339.00	339.57
239	Structure - (666)	330.54	331.11
240	Structure - (669)	330.50	331.07
241	TRENCH DRAIN	325.85	326.60
242	UD	327.13	327.70
243	UDB#2 OUT	314.50	316.77
244	UDB#3A	316.02	316.77
245	UDB#3B	315.55	316.30
246	UDB#4	325.40	327.12

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
247	WALL UD #1	327.00	-4.53
248	WALL UD #2	329.00	-3.15
249	WALL UD #6	331.00	0.32
250	WQI#314	317.78	321.28
251	WQI#322	318.05	321.55
252	WQI#330	311.55	315.05
253	WQS #401	327.25	332.32
254	WQS#401	325.70	331.56
255	WQS#402	324.20	329.95
256	WQS#403	319.25	324.50
257	WYE#1	339.50	340.07
258	WYE#10	329.65	330.81
259	WYE#11	329.48	330.64
260	WYE#12	328.82	329.98
261	WYE#13	328.30	329.46
262	WYE#14	327.70	328.86
263	WYE#2	338.00	339.16
264	WYE#3	337.00	338.16
265	WYE#30	329.30	330.47
266	WYE#30A	329.32	330.48
267	WYE#4	338.05	339.21
268	WYE#5	336.90	338.06
269	WYE#6	329.21	330.42
270	WYE#7	333.25	333.82
271	WYE#8	331.35	331.92

Link Summary

From (Inlet) Node	To (Outlet) Node	Pipe Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Pipe Slope (%)	Pipe Diameter (in)	Manning's Roughness	Peak Flow Q (cfs)	Design Flow Capacity Qf (cfs)	Q/Qf Ratio	Peak Flow Velocity V (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
AD #400	DMH#210	31.81	330.00	328.80	3.77	18	0.015	0.17	17.68	0.01	2.46	0.23	0.15
DMH#207	DMH#206	10.09	317.68	317.62	0.50	12	0.012	0.78	2.73	0.28	1.94	1.00	1.00
DMH#200A	DMH#201A	81.18	323.40	322.60	0.99	36	0.012	6.69	71.73	0.09	3.72	0.91	0.30
DMH#201A	DMH#202a	64.82	322.50	321.85	1.00	36	0.012	15.14	72.36	0.21	6.74	1.06	0.35
DMH#202a	DMH#203	333.60	321.75	318.43	1.00	36	0.012	15.07	72.08	0.21	7.60	0.97	0.32
DMH#203	DMH#204	225.50	318.33	315.70	1.17	36	0.012	15.05	78.03	0.19	7.88	0.95	0.32
DMH#204	DMH#205	370.38	315.60	311.25	1.17	36	0.012	15.03	78.31	0.19	5.17	1.46	0.49
DMH#205	Out-1Pipe - (164)	29.06	310.90	310.60	1.03	36	0.012	41.67	73.42	0.57	8.31	2.00	0.67
WQI#322	DMH#207	35.80	318.05	317.73	0.90	12	0.012	0.38	3.66	0.10	1.06	1.00	1.00
AD#300	DMH#206	36.86	318.00	317.65	0.95	18	0.012	6.83	11.09	0.62	5.59	1.44	0.96
WQI#314	DMH#207	10.99	317.78	317.73	0.50	12	0.012	0.38	2.73	0.14	1.37	1.00	1.00
AD#411	DMH#257	34.65	329.00	328.50	1.44	18	0.012	0.48	13.67	0.04	3.37	0.20	0.13
RD#2	AB#398	10.00	329.56	329.45	1.10	12	0.012	2.69	4.05	0.66	4.78	0.67	0.67
OCS#4	DMH#260	92.62	325.40	324.45	1.03	18	0.012	6.69	11.53	0.58	5.23	1.02	0.68
UDB#4	OCS#4	11.54	325.40	325.40	0.00	18	0.012	6.36	5.09	1.25	7.07	1.11	0.74
CB#332	OCS#4 (1)	11.22	327.40	326.90	4.46	12	0.012	0.46	8.15	0.06	4.74	0.18	0.18
CB#333	OCS#4 (1)	23.03	327.15	326.90	1.09	12	0.012	0.54	4.02	0.13	3.18	0.27	0.27
AD#420	AD#411	44.32	329.95	329.50	1.02	12	0.012	0.24	3.89	0.06	2.61	0.17	0.17
AD#421	Out-1Pipe - (183)	9.19	329.30	-0.50	3589.52	12	0.012	0.25	231.24	0.00	46.73	0.03	0.03
OCS#4 (1)	Out-1Pipe - (186) (2)	9.35	326.80	-0.50	3501.29	12	0.012	1.02	228.39	0.00	50.00	0.05	0.05
DMH#238	DMH#236	23.03	330.30	330.05	1.09	12	0.012	0.35	4.02	0.09	2.86	0.21	0.21
DMH#236	DMH#211	20.74	329.85	329.60	1.21	12	0.012	0.91	4.24	0.22	3.71	0.35	0.35
RD#4	BYPASS MH#203	14.94	329.00	328.85	1.00	12	0.012	2.37	3.87	0.61	3.59	0.78	0.78
RD#3	DMH#222	104.03	329.50	327.20	2.21	12	0.012	1.92	5.74	0.33	3.30	0.71	0.71
DMH#211	DMH#298	57.13	329.35	328.75	1.05	15	0.012	0.92	7.17	0.13	3.40	0.39	0.32
WQS #401	Out-1Pipe - (192)	24.39	327.25	327.00	1.02	18	0.012	6.23	11.52	0.54	5.45	0.92	0.62
DMH#238A	WQS #401	10.00	327.45	327.35	1.00	18	0.012	6.23	11.38	0.55	4.42	1.12	0.74
DMH#237	DMH#238A	16.16	328.02	327.85	1.05	12	0.012	1.20	3.96	0.30	3.10	0.81	0.81
CB#337	DMH#236	22.23	330.15	329.95	0.90	12	0.012	0.16	3.66	0.04	1.66	0.21	0.21
CB#336	DMH#211	7.40	330.00	329.90	1.35	12	0.012	0.00	4.49	0.00	0.00	0.00	0.00
CB#334	DMH#237	8.66	328.35	328.25	1.15	12	0.012	0.86	4.15	0.21	3.22	0.50	0.50
AD#433	AB#395	12.02	331.40	331.25	1.25	12	0.012	0.04	4.31	0.01	1.67	0.07	0.07
AB#395	DMH#240	25.56	331.15	330.20	3.72	12	0.012	0.04	7.44	0.01	2.43	0.06	0.06
CB#340	DMH#240	11.58	330.00	329.85	1.30	12	0.012	0.11	3.59	0.03	0.84	0.23	0.23
DMH#243	DMH#244	39.38	325.90	325.50	1.02	18	0.012	2.98	11.47	0.26	4.71	0.58	0.39
DMH#240	DMH#241	40.54	330.10	329.25	2.10	12	0.012	0.27	5.59	0.05	3.51	0.16	0.16
DMH#244	DMH#245	51.99	324.25	323.70	1.06	18	0.012	3.35	11.70	0.29	4.76	0.63	0.42
DMH#245	DMH#297	57.58	323.60	323.00	1.04	18	0.012	3.65	11.62	0.31	5.12	0.64	0.42
CB#347	DMH#251	6.39	325.30	324.90	6.26	12	0.012	0.82	9.66	0.08	5.49	0.24	0.24
DMH#251	DMH#297	33.00	324.30	323.85	1.36	18	0.012	3.83	13.29	0.29	5.43	0.63	0.42
CB#321	DMH#252	10.59	327.15	326.60	5.20	12	0.012	0.55	8.80	0.06	5.15	0.19	0.19
DMH#252	DMH#251	115.23	326.10	324.40	1.48	18	0.012	3.06	13.82	0.22	5.05	0.56	0.38
CB#350	DMH#252	21.10	327.15	326.60	2.61	12	0.012	0.16	6.23	0.03	3.07	0.12	0.12
CB#348	DMH#297	10.19	324.70	324.35	3.44	12	0.012	0.55	7.15	0.08	4.43	0.22	0.22
CB#323	DMH#245	15.76	326.20	325.70	3.17	12	0.012	0.36	6.88	0.05	4.11	0.17	0.17
CB#343	DMH#243	14.74	327.95	326.50	9.84	12	0.012	0.17	12.11	0.01	5.11	0.09	0.09
CB#344	DMH#243	14.26	327.75	326.50	8.76	12	0.012	0.29	11.43	0.03	5.66	0.12	0.12
CB#394	DMH#240	10.29	330.00	329.85	1.46	12	0.012	0.12	3.81	0.03	0.88	0.23	0.23
DMH#226	WQS#401	28.59	326.09	325.80	1.01	18	0.012	3.82	11.46	0.33	3.85	0.86	0.58
CB#325	DMH#223	20.84	327.15	326.90	1.20	12	0.012	0.55	4.23	0.13	3.01	0.47	0.47
CB#326	DMH#227	21.82	327.20	326.90	1.38	12	0.012	0.60	4.53	0.13	3.39	0.34	0.34
CB#329	DMH#225	12.63	328.37	328.25	0.95	12	0.012	0.34	3.76	0.09	1.77	0.31	0.31
AD#401	DMH#224	65.82	329.75	328.35	2.13	12	0.012	0.00	5.63	0.00	0.00	0.00	0.00
CB#319	DMH#222	10.70	327.50	327.20	2.80	12	0.012	0.37	6.46	0.06	2.77	0.38	0.38
DMH#225	DMH#224	50.61	328.20	327.69	1.01	12	0.012	1.04	3.87	0.27	3.78	0.38	0.38
DMH#222	DMH#221	123.01	327.10	325.85	1.02	12	0.012	2.41	3.89	0.62	4.74	0.62	0.62
DMH#221	DMH#220	110.15	325.75	324.65	1.00	12	0.012	2.80	3.86	0.72	4.97	0.67	0.67
DMH#224	DMH#287	31.17	327.64	327.32	1.03	12	0.012	1.03	3.91	0.26	3.73	0.38	0.38

Link Summary

From (Inlet) Node	To (Outlet) Node	Pipe Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Pipe Slope (%)	Pipe Diameter (in)	Manning's Roughness	Peak Flow Q (cfs)	Design Flow Capacity Qf (cfs)	Q/Qf Ratio	Peak Flow Velocity V (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
DMH#287	DMH#223	58.50	327.27	326.68	1.01	12	0.012	1.03	3.88	0.27	2.52	0.58	0.58
DMH#218	Out-1Pipe - (227)	78.95	327.36	327.00	0.46	18	0.012	0.55	7.68	0.07	2.41	0.28	0.19
CB #315	Out-1Pipe - (227) (1) (1)	13.13	328.50	327.00	11.42	12	0.012	0.12	13.05	0.01	4.88	0.07	0.07
CB #316	Out-1Pipe - (229)	31.00	329.00	327.00	6.45	12	0.012	3.17	9.80	0.32	9.31	0.45	0.45
CB #320	Out-1Pipe - (235)	30.89	329.00	327.00	6.47	12	0.012	0.23	9.82	0.02	4.86	0.11	0.11
CB#328	DMH#225	10.25	328.38	328.28	0.98	12	0.012	0.15	3.81	0.04	1.39	0.28	0.28
CB#318	DMH#222	11.28	327.50	327.20	2.66	12	0.012	0.18	6.29	0.03	2.18	0.38	0.38
DCB#301	DMH#226	10.26	326.80	326.65	1.46	12	0.012	1.28	4.67	0.28	4.06	0.42	0.42
DMH#227	DMH#226	24.20	326.39	326.14	1.03	12	0.012	2.68	3.92	0.68	3.75	0.86	0.86
WQS#401	DMH#257	24.95	325.70	325.45	1.00	18	0.012	3.80	11.39	0.33	3.02	1.01	0.68
CB#317	Out-1Pipe - (244)	124.98	327.61	327.00	0.49	12	0.012	0.11	2.70	0.04	1.67	0.13	0.13
CB#327	DMH#224	31.53	328.33	328.00	1.05	12	0.012	0.00	3.95	0.00	0.00	0.03	0.03
CB#310	DMH#220	17.82	326.50	325.90	3.37	12	0.012	0.08	7.08	0.01	2.86	0.08	0.08
CB#311	DMH#220	14.76	325.95	325.90	0.34	12	0.012	0.13	2.25	0.06	1.56	0.16	0.16
DMH#208	DMH#205	15.28	311.16	311.00	1.05	30	0.012	11.48	45.47	0.25	5.04	2.25	0.90
CB#324	DMH#208	9.61	311.64	311.54	1.04	12	0.012	0.39	3.94	0.10	1.45	1.00	1.00
DMH#391	DMH#208	97.40	312.40	311.40	1.03	30	0.012	6.79	45.02	0.15	5.79	1.50	0.60
CB#XXX	DMH#253	44.62	315.25	314.80	1.01	12	0.012	0.00	3.88	0.00	0.00	0.00	0.00
OCS#215	DMH#289	66.45	314.00	313.33	1.01	30	0.012	6.60	44.62	0.15	5.55	0.73	0.29
UDB#2 OUT	OCS#215	16.07	314.50	314.50	0.00	24	0.012	6.45	10.96	0.59	3.66	1.10	0.55
DMH#289	DMH#391	66.42	313.23	312.50	1.10	30	0.012	6.73	46.58	0.14	5.86	0.85	0.34
DMH#214	DMH#231	87.32	318.65	316.65	2.29	18	0.012	3.15	17.22	0.18	5.61	0.53	0.36
DMH#231	DMH#202	129.63	316.55	315.15	1.08	18	0.012	4.36	11.83	0.37	5.37	0.70	0.47
DMH#202	Out-1Pipe - (253)	22.59	314.65	314.40	1.11	6	0.012	0.99	0.64	1.55	5.09	0.48	0.97
DMH#253	OCS#215	59.88	314.70	314.10	1.00	12	0.012	0.09	3.86	0.02	0.36	0.39	0.39
CB#351	DMH#202	27.99	315.50	315.25	0.89	12	0.012	0.43	3.65	0.12	2.38	0.49	0.49
DMH#202	DMH#216	57.07	315.15	314.50	1.14	18	0.012	3.89	12.14	0.32	5.36	0.64	0.43
CB#349	DMH#202	7.88	315.25	315.25	0.00	12	0.012	0.17	1.73	0.10	1.21	0.61	0.61
DMH#255	DMH#254	127.38	322.00	319.80	1.73	12	0.012	2.07	5.07	0.41	5.81	0.46	0.46
DMH#254	DMH#214	25.94	319.30	318.75	2.12	18	0.012	2.93	16.57	0.18	5.78	0.49	0.33
CB#357	DMH#254	10.58	320.50	319.80	6.62	12	0.012	0.38	9.93	0.04	5.22	0.15	0.15
CB#353	DMH#248	11.80	323.65	322.55	9.32	12	0.012	0.85	11.78	0.07	5.85	0.33	0.33
DMH#249	DMH#248	91.74	324.00	322.55	1.58	12	0.012	1.71	4.85	0.35	4.99	0.45	0.45
DMH#248	DMH#296	25.63	322.35	321.60	2.93	12	0.012	3.07	6.60	0.46	6.66	0.57	0.57
WQS#403	Out-1Pipe - (259) (1) (4) (3) (1)	9.65	319.25	315.00	44.03	24	0.012	11.02	162.63	0.07	17.78	0.50	0.25
DMH#296	WQS#403	38.52	320.50	319.50	2.60	24	0.012	11.02	39.49	0.28	8.40	0.87	0.44
CB#354	DMH#249	21.48	324.40	324.10	1.40	12	0.012	0.87	4.56	0.19	3.50	0.35	0.35
CB#355	DMH#249	99.87	325.60	324.60	1.00	12	0.012	0.86	3.86	0.22	3.78	0.33	0.33
CB#356	DMH#254	18.71	320.00	319.80	1.07	12	0.012	0.54	3.99	0.14	3.12	0.27	0.27
CB#359	DMH#255	13.82	322.50	322.10	2.89	12	0.012	0.31	6.57	0.05	2.84	0.26	0.26
CB#358	DMH#255	12.85	322.35	322.10	1.95	12	0.012	0.53	5.38	0.10	2.94	0.32	0.32
CB#361	DMH#201	16.99	325.75	324.65	6.47	12	0.012	0.22	9.82	0.02	3.46	0.18	0.18
CB#360	DMH#201	17.14	324.90	324.65	1.46	12	0.012	0.30	4.66	0.06	2.41	0.23	0.23
CB#362	DMH#201	32.54	325.90	324.65	3.84	12	0.012	0.80	7.57	0.11	5.28	0.25	0.25
DMH#201	DMH#255	130.55	324.55	322.10	1.88	12	0.012	1.31	5.29	0.25	5.02	0.37	0.37
DMH#206	BYPASS MH#200	136.51	317.25	316.57	0.50	24	0.012	15.43	17.30	0.89	5.60	1.64	0.82
CB#346	DMH#216	53.33	312.60	312.17	0.81	12	0.012	1.43	3.47	0.41	3.75	1.00	1.00
DMH#216	DMH#208	69.63	312.07	311.35	1.04	18	0.012	5.04	11.59	0.43	2.91	1.50	1.00
BYPASS MH#200	DMH#205	259.88	316.52	311.90	1.78	24	0.012	15.44	32.68	0.47	8.88	1.21	0.60
CB#352	DMH#231	11.33	317.50	317.15	3.09	12	0.012	0.81	6.78	0.12	4.67	0.27	0.27
CB#363	DMH#231	12.70	317.50	317.15	2.76	12	0.012	0.46	6.41	0.07	4.04	0.20	0.20
DMH#223	DMH#227	18.10	326.63	326.44	1.05	12	0.012	2.15	3.95	0.54	3.07	0.86	0.86
AD#422	WYE#10	32.85	329.90	329.65	0.76	12	0.012	0.13	3.37	0.04	1.30	0.19	0.19
WYE#13	DMH#395	26.55	328.30	328.00	1.13	12	0.012	0.66	4.10	0.16	2.92	0.33	0.33
DMH#213	DMH#242	31.88	327.35	327.00	1.10	12	0.012	1.98	4.04	0.49	4.43	0.55	0.55
DMH#395	WYE#14	19.70	327.90	327.70	1.02	12	0.012	0.66	3.89	0.17	2.10	0.43	0.43
WYE#12	DMH#212	11.07	328.82	328.70	1.08	12	0.012	0.50	4.02	0.12	2.68	0.28	0.29
WYE#10	WYE#11	10.68	329.65	329.48	1.59	12	0.012	0.29	4.87	0.06	1.82	0.26	0.26

Link Summary

From (Inlet) Node	To (Outlet) Node	Pipe Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Pipe Slope (%)	Pipe Diameter (in)	Manning's Roughness	Peak Flow Q (cfs)	Design Flow Capacity Qf (cfs)	Q/Qf Ratio	Peak Flow Velocity V (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
DMH#290	WYE#12	21.48	329.05	328.82	1.07	12	0.012	0.42	3.99	0.10	2.23	0.29	0.29
WYE#11	DMH#290	21.21	329.48	329.15	1.56	12	0.012	0.33	4.81	0.07	2.51	0.22	0.22
AD#423	DMH#290	33.83	329.90	329.15	2.22	12	0.012	0.09	5.75	0.02	2.28	0.12	0.12
AD#424	WYE#12	3.13	329.00	328.82	5.74	12	0.012	0.17	9.25	0.02	2.33	0.23	0.24
AD#425	DMH#212	26.75	330.00	328.70	4.86	12	0.012	0.09	8.51	0.01	2.95	0.13	0.13
AD#418	DMH#213	65.27	330.05	328.30	2.68	12	0.012	0.23	6.32	0.04	3.71	0.13	0.13
AD#495	DMH#395	43.42	330.35	328.00	5.41	12	0.012	0.00	8.98	0.00	0.00	0.13	0.13
AD#432	DMH#238	27.18	330.70	330.40	1.10	12	0.012	0.00	4.06	0.00	0.00	0.06	0.06
AB#399	WYE#6	44.90	329.66	329.21	1.00	15	0.012	2.78	7.01	0.40	4.08	0.68	0.54
WYE#6	DMH#298	33.00	329.21	328.75	1.39	15	0.015	2.78	6.61	0.42	4.57	0.62	0.50
AD#412	DMH#238	42.10	330.75	330.40	0.83	12	0.012	0.03	3.52	0.01	1.19	0.09	0.09
AD#431	DMH#238	26.69	330.75	330.40	1.31	12	0.012	0.08	4.42	0.02	1.98	0.10	0.10
RD#1	AB#399	5.00	329.76	329.71	1.00	12	0.012	2.80	3.86	0.72	4.20	0.79	0.79
AD#426	WYE#6	13.32	329.40	329.21	1.43	15	0.012	0.07	8.36	0.01	0.42	0.58	0.47
WYE#30A	WYE#30	1.99	329.32	329.29	1.40	12	0.012	0.16	3.67	0.04	1.06	0.25	0.25
AD#402	WYE#30A	18.54	329.50	329.32	0.98	12	0.012	0.16	3.82	0.04	1.49	0.20	0.20
AD#407	DMH#237	55.46	329.00	328.45	0.99	12	0.012	0.00	3.84	0.00	0.00	0.16	0.16
AD#406	AD#407	53.96	329.60	329.00	1.11	12	0.012	0.00	4.07	0.00	0.00	0.00	0.00
AD#430	DMH#213	59.65	328.85	328.25	1.01	12	0.012	0.93	3.87	0.24	3.76	0.35	0.35
AD#417	WYE#14	8.16	328.70	327.70	12.26	12	0.012	0.23	13.51	0.02	4.03	0.29	0.29
AD#427	WYE#13	11.94	329.00	328.30	5.86	12	0.012	0.13	9.34	0.01	3.00	0.23	0.23
CB#342	DMH#241	13.37	329.00	328.85	1.12	12	0.012	0.07	4.09	0.02	1.74	0.11	0.11
DMH#241	DMH#242	39.81	328.75	328.35	1.00	12	0.012	0.34	3.87	0.09	2.85	0.21	0.21
DMH#242	DMH#243	79.14	326.90	326.00	1.14	18	0.012	2.58	12.14	0.21	4.56	0.54	0.36
CB#338	DMH#236	30.92	331.15	330.35	2.59	12	0.012	0.48	6.21	0.08	4.32	0.20	0.20
AD#399	DMH#238	42.47	331.50	330.50	2.35	12	0.012	0.27	5.92	0.05	3.66	0.15	0.15
AD#415	AD#416	48.93	333.50	332.10	2.86	12	0.012	0.20	6.53	0.03	4.03	0.11	0.11
AD#414	AD#415	57.31	336.50	333.50	5.23	12	0.012	0.13	8.83	0.02	2.94	0.11	0.11
AD#413	AD#414	35.24	338.70	336.50	6.24	12	0.012	0.07	9.64	0.01	2.64	0.07	0.07
AD#416	DMH#242	19.84	332.10	328.85	16.38	12	0.012	0.26	15.62	0.02	7.03	0.09	0.09
SB OCS#1	DMH#201A	16.17	325.00	324.00	6.19	24	0.012	9.05	60.95	0.15	9.51	0.69	0.35
AD#409	AD #408	168.51	341.60	339.90	1.01	6	0.012	0.00	0.61	0.00	0.00	0.10	0.20
AB#299	DMH#238A	53.52	335.75	328.70	13.17	12	0.012	1.57	14.01	0.11	11.06	0.24	0.24
AD#408	AD#399	40.79	336.18	333.50	6.57	6	0.012	0.27	1.56	0.17	2.88	0.26	0.52
AD #408	Structure - (639)	42.77	339.90	339.00	2.10	6	0.012	0.30	0.88	0.34	2.84	0.29	0.59
WALL UD #2	WALL UD #1	134.71	329.00	327.00	1.48	6	0.012	0.00	0.74	0.00	0.00	0.00	0.00
DCO#9	DCO#11	122.97	334.50	331.95	2.07	6	0.012	0.00	0.88	0.00	0.00	0.00	0.00
DCO#11	WYE#8	5.79	331.95	331.35	10.36	6	0.012	0.00	1.96	0.00	0.00	0.00	0.00
WYE#8	DMH#242	18.70	331.35	329.35	10.70	6	0.012	0.00	1.99	0.00	0.00	0.00	0.00
WQI#330	DMH#208	28.93	311.55	311.26	1.00	12	0.012	0.69	3.86	0.18	1.48	1.00	1.00
CB#364	DMH#297	20.72	324.70	324.35	1.69	12	0.012	0.20	5.02	0.04	2.87	0.14	0.14
AD#428	DMH#210	62.98	330.15	329.25	1.43	12	0.012	0.00	4.61	0.00	0.00	0.00	0.00
CB#365	DMH#221	11.66	326.50	326.10	3.43	12	0.012	0.24	7.15	0.03	3.27	0.24	0.24
CB#366	DMH#221	27.41	326.80	326.10	2.55	12	0.012	0.27	6.17	0.04	3.30	0.25	0.25
CB#367	DMH#248	8.22	322.55	322.45	1.22	12	0.012	0.57	4.26	0.13	2.25	0.52	0.52
CB#368	DMH#214	17.48	320.10	319.25	4.86	12	0.012	0.23	8.51	0.03	4.32	0.12	0.12
CB#369	DMH#287	21.52	328.15	327.90	1.16	12	0.012	0.00	4.16	0.00	0.00	0.00	0.00
CB#370	DMH#218	29.77	327.50	327.36	0.47	12	0.012	0.49	2.65	0.19	2.36	0.31	0.31
CB#371	DMH#200	67.59	328.15	327.40	1.11	12	0.012	0.19	4.07	0.05	2.29	0.17	0.17
DMH#200	DMH#223	53.65	327.30	326.75	1.03	12	0.012	0.71	3.91	0.18	2.10	0.51	0.51
AD#419	AD#430	46.29	329.80	328.85	2.05	12	0.012	0.48	5.53	0.09	2.59	0.28	0.28
CB#331	DMH#218	12.37	327.98	327.70	2.26	12	0.012	0.07	5.81	0.01	2.33	0.08	0.08
TRENCH DRAIN	DMH#244	67.83	325.85	325.10	1.11	8	0.012	0.38	1.38	0.28	2.53	0.32	0.49
WYE#3	AB#299	32.91	337.00	336.25	2.28	12	0.012	0.00	5.83	0.00	0.00	0.00	0.00
REDUCER#1	WYE#2	4.03	338.10	338.00	2.48	12	0.012	0.00	6.08	0.00	0.00	0.00	0.00
WYE#1	REDUCER#1	66.47	339.50	338.60	1.35	6	0.012	0.00	0.71	0.00	0.00	0.00	0.00
WYE#2	WYE#3	70.50	338.00	337.00	1.42	12	0.012	0.00	4.60	0.00	0.00	0.00	0.00
DCO#2	WYE#1	35.64	340.25	339.50	2.10	6	0.012	0.00	0.88	0.00	0.00	0.00	0.00

Link Summary

From (Inlet) Node	To (Outlet) Node	Pipe Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Pipe Slope (%)	Pipe Diameter (in)	Manning's Roughness	Peak Flow Q (cfs)	Design Flow Capacity Qf (cfs)	Q/Qf Ratio	Peak Flow Velocity V (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
DCO#3	WYE#2	135.60	341.25	338.50	2.03	6	0.012	0.00	0.87	0.00	0.00	0.00	0.00
AD#409	WYE#3	223.52	341.60	337.50	1.83	6	0.012	0.00	0.82	0.00	0.00	0.00	0.00
DCO#4	WYE#4	65.22	339.85	338.55	1.99	6	0.012	0.00	0.86	0.00	0.00	0.00	0.00
DMH#220	WQS#402	7.41	324.40	324.30	1.35	15	0.012	2.98	8.13	0.37	3.83	0.76	0.61
WQS#402	DMH#209	9.31	324.20	324.10	1.07	15	0.012	2.98	7.25	0.41	4.49	0.67	0.53
DMH#209	DMH#228	218.20	322.69	320.48	1.01	18	0.012	8.63	11.44	0.75	6.63	1.04	0.69
DMH#228	DMH#206	270.36	320.38	317.65	1.01	18	0.012	8.65	11.44	0.76	5.55	1.24	0.82
CB#312	DMH#209	37.80	323.17	322.79	1.00	12	0.012	6.13	3.86	1.59	7.82	1.00	1.00
DMH#210	DMH#219	46.14	328.80	328.30	1.08	12	0.012	0.21	4.02	0.05	1.78	0.60	0.60
AD#405	DMH#225	71.64	330.15	328.50	2.30	12	0.012	0.57	5.86	0.10	4.54	0.22	0.22
AD#404	WYE#11	14.76	329.90	329.48	2.85	12	0.012	0.08	6.51	0.01	2.10	0.17	0.17
AD#429	WYE#10	10.10	329.80	329.65	1.48	12	0.012	0.12	4.70	0.03	1.73	0.18	0.18
CB#339	DMH#200	76.39	327.11	328.00	-1.16	12	0.012	0.54	4.16	0.13	1.05	0.62	0.62
DMH#219	DMH#257	69.55	328.20	328.90	-1.01	12	0.012	0.34	3.87	0.09	0.72	0.58	0.58
AD#403	WYE#30	7.73	329.40	329.30	1.29	12	0.012	0.11	4.39	0.03	1.81	0.20	0.20
WYE#30	DMH#219	28.21	329.30	329.00	1.06	12	0.012	0.29	3.98	0.07	2.29	0.21	0.22
AD#434	DMH#260	22.13	329.40	329.00	1.81	12	0.012	0.01	5.19	0.00	1.42	0.04	0.04
DMH#260	DMH#200A	19.65	324.35	324.15	1.02	18	0.012	6.68	11.48	0.58	5.49	0.98	0.65
AD#435	CB#346	32.17	313.00	312.70	0.93	12	0.012	1.34	3.73	0.36	3.83	0.90	0.90
AD#313	CB#312	23.27	323.50	323.27	1.00	12	0.012	4.56	3.86	1.18	5.81	1.00	1.00
AB#398	OCS#4	58.64	329.45	327.95	2.56	12	0.012	2.66	6.17	0.43	6.77	0.50	0.50
BYPASS MH#203	DMH#252	37.69	328.75	326.60	5.70	12	0.012	2.36	9.22	0.26	8.59	0.38	0.38
Structure - (538)	Structure - (539)	137.38	315.33	313.96	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (539)	Structure - (540)	30.43	313.96	313.65	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (540)	Structure - (541)	36.12	313.65	313.29	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (541)	DCO#22	32.51	313.29	322.95	-29.71	6	0.012	0.00	3.31	0.00	0.00	0.00	0.00
DCO#22	Structure - (543)	10.10	322.95	312.87	99.81	6	0.012	0.00	6.07	0.00	0.00	0.00	0.00
Structure - (543)	Structure - (544)	20.93	312.87	312.66	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (544)	Structure - (545)	56.56	312.66	312.09	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (545)	Structure - (546)	13.87	312.09	311.95	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (546)	Structure - (547)	31.75	311.95	311.63	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (547)	Structure - (548)	116.21	311.63	310.47	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (548)	Structure - (549)	33.03	310.47	310.14	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (549)	Structure - (550)	17.80	310.14	309.96	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (550)	Structure - (551)	16.97	309.96	309.79	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (551)	Structure - (552)	18.52	309.79	309.61	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (552)	Structure - (553)	25.86	309.61	309.35	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (553)	Structure - (554)	23.43	309.35	309.12	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (554)	Structure - (555)	26.16	309.12	308.86	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (555)	Structure - (556)	30.03	308.86	308.64	0.73	6	0.012	0.00	0.52	0.00	0.00	0.00	0.00
Structure - (556)	DCO#21	19.37	308.64	327.00	-94.83	6	0.012	0.00	5.92	0.00	0.00	0.00	0.00
DCO#21	Structure - (558)	15.19	327.00	308.21	123.69	6	0.012	0.00	6.76	0.00	0.00	0.00	0.00
Structure - (558)	Structure - (559)	46.21	308.21	307.75	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (559)	Structure - (560)	16.49	307.75	307.58	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (560)	Structure - (561)	24.12	307.58	307.34	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (561)	Structure - (562)	63.80	307.34	306.70	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (562)	Structure - (563)	85.52	306.70	305.85	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (563)	Out-1Pipe - (412)	10.60	305.85	305.74	1.00	6	0.012	0.00	0.61	0.00	0.00	0.00	0.00
Structure - (565)	Out-1Pipe - (413)	12.69	328.19	328.13	0.43	6	0.012	0.00	0.40	0.00	0.00	0.00	0.00
DCO#20	Structure - (565)	14.96	328.25	328.19	0.43	6	0.012	0.00	0.40	0.00	0.00	0.00	0.00
UDB#3A	UDB#3B	94.00	316.02	315.55	0.50	8	0.012	0.00	0.93	0.00	0.00	0.00	0.00
UDB#3B	Out-1Pipe - (415) (1)	3.00	315.55	315.85	-10.00	8	0.012	0.00	4.14	0.00	0.00	0.00	0.00
AD#398	WYE#4	26.26	338.50	338.05	1.71	12	0.012	0.00	5.05	0.00	0.00	0.00	0.00
WYE#4	WYE#5	70.92	338.05	336.90	1.62	12	0.012	0.00	4.91	0.00	0.00	0.00	0.00
WYE#5	AB#299	37.82	336.90	336.25	1.72	12	0.012	0.00	5.06	0.00	0.00	0.00	0.00
DCO#1	NS#1A	133.58	341.85	339.95	1.42	6	0.012	0.00	0.72	0.00	0.00	0.00	0.00
NS#1A	NS#1B	2.00	339.95	339.90	2.50	6	0.012	0.00	0.96	0.00	0.00	0.00	0.00
NS#1B	WYE#1	25.72	339.90	339.50	1.56	6	0.012	0.00	0.76	0.00	0.00	0.00	0.00

Link Summary

From (Inlet) Node	To (Outlet) Node	Pipe Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Pipe Slope (%)	Pipe Diameter (in)	Manning's Roughness	Peak Flow Q (cfs)	Design Flow Capacity Qf (cfs)	Q/Qf Ratio	Peak Flow Velocity V (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
DCO#5	WYE#5	165.20	340.75	337.40	2.03	6	0.012	0.00	0.87	0.00	0.00	0.00	0.00
DMH#298	DMH#238A	56.28	328.50	327.90	1.07	18	0.012	3.68	11.75	0.31	4.68	0.77	0.51
DCO#7	DCO#8	75.47	333.50	333.30	0.26	6	0.012	0.00	0.31	0.00	0.00	0.00	0.00
DCO#10	WYE#8	127.07	333.50	331.35	1.69	6	0.012	0.00	0.79	0.00	0.00	0.00	0.00
Structure - (639)	AD#408	51.26	339.00	336.18	5.50	6	0.012	0.29	1.43	0.20	2.77	0.38	0.76
CB#335	DMH#237	22.63	328.35	328.12	1.02	12	0.012	0.39	3.89	0.10	1.96	0.54	0.54
FD#1	AD#434	9.07	330.00	329.90	1.10	6	0.012	0.00	0.64	0.00	0.00	0.00	0.00
CO#6	RW FD#1	79.13	334.50	333.25	1.58	6	0.012	0.00	0.76	0.00	0.00	0.00	0.00
RW FD#1	WYE#7	3.76	333.25	333.25	0.00	6	0.012	0.00	0.27	0.00	0.00	0.00	0.00
WYE#7	AD#399	8.87	333.25	333.10	1.69	6	0.012	0.00	0.79	0.00	0.00	0.00	0.00
DCO#8	WYE#7	5.30	333.30	333.25	0.94	6	0.012	0.00	0.59	0.00	0.00	0.00	0.00
DMH#212	WYE#13	27.65	328.60	328.30	1.09	12	0.012	0.55	4.02	0.14	2.35	0.34	0.34
WYE#14	DMH#213	22.74	327.70	327.45	1.10	12	0.012	0.88	4.05	0.22	2.73	0.50	0.50
FD#2	DMH#212	20.27	333.00	329.50	17.27	6	0.012	0.00	2.53	0.00	0.00	0.00	0.00
DMH#297	DMH#296	73.35	322.50	320.60	2.59	24	0.012	7.98	39.44	0.20	6.65	0.82	0.41
FD#3	AD#402	20.88	330.00	329.90	0.48	6	0.012	0.00	0.42	0.00	0.00	0.00	0.00
DMH#257	Out-1Pipe - (455)	1.82	325.40	325.40	0.00	18	0.012	4.52	5.09	0.89	3.77	0.96	0.64
NS1	Structure - (666)	37.50	330.73	330.54	0.50	6	0.012	0.00	0.43	0.00	0.00	0.00	0.00
NS1	UD	44.08	330.73	327.13	8.16	6	0.012	0.00	1.74	0.00	0.00	0.00	0.00
UD	AD#411	59.94	327.13	331.00	-6.45	6	0.012	0.00	1.54	0.00	0.00	0.00	0.00
NS1	AD#420	59.75	330.73	330.45	0.47	6	0.012	0.00	0.42	0.00	0.00	0.00	0.00
Structure - (666)	Structure - (669)	8.49	330.54	330.50	0.50	6	0.012	0.00	0.43	0.00	0.00	0.00	0.00
Structure - (669)	AD#421	53.66	330.50	329.80	1.31	6	0.012	0.00	0.69	0.00	0.00	0.00	0.00

ATTACHMENT E

Long-Term Pollution Prevention and Stormwater Operation and Maintenance Plan

INSPECTION CHECKLIST (BIORETENTION AREA)			
Location: **Date:** **Time:** **Date Since Last Rain Event:**			**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**		**Comments/Corrective Action**
Initial Inspection After Planting			
Plants are stable, roots not exposed	S	U	
Surface is at design level	S	U	
Overflow bypass/inlet is functional	S	U	
Debris Cleanup (2 times a year minimum, Spring & Fall)			
Litter, leaves, and dead vegetation removed from the system	S	U	
Prune perennial vegetation	S	U	
Standing Water (1 time a year, After large storm events)			
No evidence of standing water after 72 hours	S	U	
Short Circuiting & Erosion (1 time a year, After large storm events)			
No evidence of animal burrows or other holes	S	U	
No evidence of erosion	S	U	
Drought Conditions (As needed)			
Water plants as needed	S	U	
Dead or dying plants	S	U	
Overflow Bypass/Inlet Inspection (1 time a year, After large storm events)			
No evidence of blockage or accumulated leaves	S	U	
Good condition, no need for repair	S	U	
Vegetation Coverage (once a year)			
50% coverage established throughout system by first year	S	U	
Substantial coverage by year 2 or later	S	U	
Vegetation Health (once every 3 years)			
Dead or decaying plants removed from the system	S	U	
Corrective Action Needed			**Due Date**
1.			
2.			
3.			
4.			

INSPECTION CHECKLIST (UNDERGROUND DETENTION SYSTEM)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (1 time a year, After large storm events)		
Visual evidence of trash, debris or dumping	S U	
Evidence of oil, gasoline, contaminants, or other pollutants in manhole sumps	S U	
Condition of manholes. Is there a safety, function, or design problem (need for repair)	S U	
Grout fillet is separated or cracked wider than ½ inch and longer than 1 foot at the joint of inlet/outlet pipes; evidence of soil entering through cracks	S U	
Sediment observed in piping or manhole sumps	S U	
Trash or debris blocking inlet/outlet pipe	S U	
Condition of manhole frame and cover	S U	
Manhole rungs are determined to be unsafe (missing rungs, misaligned, cracked)		
Maintenance (1 time a year, After large storm events)		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Repair manholes (as necessary)	S U	
Replace manhole castings (as necessary)		
Corrective Action Needed		**Due Date**
1.		
2.		
3.		
4.		

INSPECTION CHECKLIST (WATER QUALITY UNITS)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (2 times a year minimum, Spring & Fall)		
Visual evidence of trash, debris or dumping	S U	
Evidence of oil, gasoline, contaminants, or other pollutants	S U	
Condition of structure. Is there a safety, function, or design problem (need for repair)	S U	
Condition of frame and cover	S U	
Sediment in the basin exceeds manufacturer recommended levels	S U	
Trash or debris blocking inlet/outlet pipe	S U	
Debris Cleanup (2 times a year minimum, Spring & Fall)		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Repair structure (as necessary)	S U	
Replace structure castings (as necessary)		
Corrective Action Needed		**Due Date**
1.		
2.		
3.		
4.		

INSPECTION CHECKLIST (AREA DRAINS)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (2 times a year minimum, Spring & Fall)		
Visual evidence of trash, debris or dumping	S U	
Dead animals or vegetation that could generate odors or gases and could cause complaints	S U	
Evidence of oil, gasoline, contaminants, or other pollutants	S U	
Condition of basin. Is there a safety, function, or design problem (need for repair)	S U	
Vegetation blocking more than 10% of the basin opening (lawn areas)	S U	
Trash and debris blocking more than 20% of grate surface inlet capacity	S U	
Missing grate, missing or broken grate members	S U	
Trash or debris in the basin exceeds 50% of the sump depth from the bottom of basin to invert of the outlet pipe; less than 6 inches clearance from the debris surface to the invert of the outlet pipe	S U	
Sediment in the basin exceeds 50% of the sump depth from the bottom of basin to invert of the outlet pipe; less than 6 inches clearance from the debris surface to the invert of the outlet pipe	S U	
Trash or debris blocking outlet pipe	S U	
Debris Cleanup (2 times a year minimum, Spring & Fall)		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Repair area drain (as necessary)	S U	
Replace area drain castings (as necessary)		
Controlling Run-On (2-4 times a year)		
Adjacent vegetated areas show no signs of erosion and run-on to area drain	S U	
Corrective Action Needed		**Due Date**
1.		
2.		
3.		
4.		

INSPECTION CHECKLIST (VEGETATED SWALES)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (2 times a year during first year after construction, then 1 time a year and after rain events larger than 3")		
Inspect the riprap on the channel bottom and side slopes for signs of erosion and formation of rills and gullies. Replace riprap as necessary.	S U	
Visual evidence of trash, debris or dumping	S U	
Inspect check dams after every significant rainfall event. Repair damage as needed. Remove sediment as needed.	S U	
Maintenance (2 times a year during first year after construction, then 1 time a year and after rain events larger than 3")		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Corrective Action Needed		**Due Date**
1.		
2.		
3.		

INSPECTION CHECKLIST (INFILTRATION BASINS)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (After major storm events during first 3 months of operation and 2 times a year thereafter, Spring & Fall)		
Visual evidence of trash, debris or dumping	S U	
During and after major storm events, the length of time standing water remains in the basin shall be recorded.	S U	
Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than the design velocity	S U	
Condition of basin. Is there a safety, function, or design problem (need for repair)	S U	
Identify areas of sediment accumulation, differential settlement, cracking, and erosion within the basin	S U	
Inspect embankments for leakage and tree growth	S U	
Examine the health of the vegetation within the basin and on the embankments	S U	
Debris Cleanup (After major storm events during first 3 months of operation and 2 times a year thereafter, Spring & Fall)		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Mow the buffer area and basin bottom and side slopes, if vegetated	S U	
Corrective Action Needed		**Due Date**
1.		
2.		
3.		
4.		

INSPECTION CHECKLIST (DETENTION BASINS)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (During and after major storm events, 1 time a year minimum)		
Visual evidence of trash, debris or dumping	S U	
Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than design flow.	S U	
Condition of basin. Is there a safety, function, or design problem (need for repair)	S U	
Identify areas of sediment accumulation, differential settlement, cracking, and erosion within the basin	S U	
Note any changes to the extended dry detention basin or the contributing watershed, because these could affect basin performance	S U	
Examine the health of the vegetation within the basin and on the embankments	S U	
Debris Cleanup (During and after major storm events, 1 time a year minimum)		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Mow the upper-stage, side slopes, embankment, and emergency spillway at least twice per year.	S U	
Remove sediment from the extended dry detention basin as necessary (at least once every 5 years)	S U	
Corrective Action Needed		**Due Date**
1.		
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INSPECTION CHECKLIST (STORMWATER OUTFALLS)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (1 time a year minimum, and after rain events larger than 2.5")		
Visual evidence of trash, debris or dumping	S U	
Condition of structure. Is there a safety, function, or design problem (need for repair)	S U	
Inspect flared end sections and associated riprap to ensure that the stability of the outlet area is maintained	S U	
Trash or debris blocking inlet/outlet pipe	S U	
Maintenance (1 time a year minimum, and after rain events larger than 2.5")		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Make repairs immediately if riprap displacement or downstream channel scour is observed	S U	
Corrective Action Needed		**Due Date**
1.		
2.		
3.		

INSPECTION CHECKLIST (OIL/WATER SEPERATORS)			
Location: **Date:** **Time:** **Date Since Last Rain Event:**			**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**		**Comments/Corrective Action**
Inspections (Once per month minimum)			
Visual evidence of trash, debris or dumping	S	U	
Debris Cleanup (Once per month minimum)			
Remove and legally dispose sediment, trash, and debris	S	U	
Remove and dispose of accumulated oil and grease and sediment using a vacuum truck	S	U	
Remove and legally dispose contaminants or pollutants	S	U	
Remove and legally dispose sediment, trash, and debris	S	U	
Cleaning (2 times a year minimum, Spring & Fall)			
Clean oil/water separators out at least twice per year. In the event of a hazardous waste spill, the oil/water separator should be cleaned immediately.	S	U	
Corrective Action Needed			**Due Date**
1.			
2.			
3.			
4.			

LONG-TERM POLLUTION PREVENTION PLAN AND STORMWATER OPERATION AND MAINTENANCE PLAN

W. Edward Balmer Elementary School, Northbridge, MA

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INTRODUCTION

The purpose of this document is to specify the pollution prevention measures and stormwater management system operation and maintenance for the W. Edward Elementary School site. The Responsible Party indicated below shall implement the management practices outlined in this document and proactively conduct operations at the project site in an environmentally responsible manner. Compliance with this Manual does not in any way dismiss the responsible party, owner, property manager, or occupants from compliance with other applicable federal, state or local laws.

Responsible Party: Town of Northbridge
7 Main Street, Northbridge, MA 01588

This Document has been prepared in compliance with Standards 4 and 9 of the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards, which state:

Standard 4:
The Long Term Pollution Prevention Plan shall include the proper procedures for the following:

- Good housekeeping
- Storing materials and waste products inside or under cover
- Vehicle washing
- Routine inspections of stormwater best management practices
- Spill prevention and response
- Maintenance of lawns, gardens, and other landscaped areas
- Pet waste management
- Operation and management of septic systems
- Proper management of deicing chemicals and snow

Standard 9:
The Long-Term Operation and Maintenance Plan shall at a minimum include:

- Stormwater management system(s) owner(s)
- The party or parties responsible for operation and maintenance, including how future property owners shall be notified of the presence of the stormwater management system and the requirement for operation and maintenance
- The routine and non-routine maintenance tasks to be undertaken after construction is complete and a schedule for implementing those tasks
- A plan that is drawn to scale and shows the location of all stormwater BMPs in each treatment train along with the discharge point
- A description of public safety features
- An estimated operations and maintenance budget

1.0 LONG-TERM POLLUTION PREVENTION PLAN

The Responsible Party shall implement the following good housekeeping procedures at the project site to reduce the possibility of accidental releases and to reduce safety hazards.

1.1 Storage of Hazardous Materials

To prevent leaks and spills, keep hazardous materials and waste products under cover or inside. Use drip pans or spill containment systems to prevent chemicals from entering the drainage system. Inspect storage areas for materials and waste products at least once per year to determine amount and type of the material on site, and if the material requires disposal.

Securely store liquid petroleum products and other liquid chemicals in federally- and state-approved containers. Restrict access to maintenance personnel and administrators.

1.2 Storage of Waste Products

Collect and store all waste materials in securely lidded dumpster(s) or other secure containers as applicable to the material. Keep dumpster lids closed and the areas around them clean. Do not fill the dumpsters with liquid waste or hose them out. Sweep areas around the dumpster regularly and put the debris in the garbage, instead of sweeping or hosing it into the parking lot. Legally dispose of collected waste on a regular basis.

Segregate liquid wastes, including motor oil, antifreeze, solvents, and lubricants, from solid waste and recycle through hazardous waste disposal companies, whenever possible. Separate oil filters, batteries, tires, and metal filings from grinding and polishing metal parts from common trash items and recycle. These items are not trash and are illegal to dump. Contact a hazardous waste hauler for proper disposal to a hazardous waste collection center.

1.3 Spill Prevention and Response

Implement spill response procedures for releases of significant materials such as fuels, oils, or chemical materials onto the ground or other area that could reasonably be expected to discharge to surface or groundwater.

- For minor spills, keep fifty (50) gallon spill control kits and Speedy Dry at all shop and work areas.
- Immediately contact applicable Federal, State, and local agencies for reportable quantities as required by law.
- Immediately perform applicable containment and cleanup procedures following a spill release.
- Promptly remove and dispose of all material collected during the response in accordance with Federal, State and local requirements. A licensed emergency response contractor may be required to assist in cleanup of releases depending on the amount of the release, and the ability of the Contractor to perform the required response.
- Reportable quantities of chemicals, fuels, or oils are established under the Clean Water Act and enforced through Massachusetts Department of Environmental Protection (DEP).

1.4 Minimize Soil Erosion

Soil erosion facilitates mechanical transport of nutrients, pathogens, and organic matter to surface water bodies. Repair all areas where erosion is occurring throughout the project site. Stabilize bare soil with riprap, seed, mulch, or vegetation.

1.5 Vehicle Washing

Vehicle washing will occur within the covered service area. The car wash will be a state-of-the art system that will reclaim and reuse water for the car wash operation. Eventual discharge of the wash water will be directed to the sanitary sewer.

1.6 Maintenance of Lawns, Gardens, and other Landscaped Areas

Pesticides and fertilizers shall not be used in the landscaped areas associated with the project site and shall not be stored on-site. Dumping of lawn wastes, brush or leaves or other materials or debris is not permitted in any Resource Area. Grass clippings, pruned branches and any other landscaped waste should be disposed of or composted in an appropriate location. No irrigation shall be used in the landscaped areas for this project.

1.7 Management of Deicing Chemicals and Snow

The qualified contractor selected for snow plowing and deicing shall be made fully aware of the requirements of this section.

No road salt (sodium chloride) shall be stored on-site. The use of magnesium chloride de-icing product with a 0.5 to 1.0 percent sodium chloride mix for snow and ice treatment is permitted. The product shall be stored in a locked room inside the building and shall be used at exterior stairs and walkways. The snow plow contractor shall adhere to these magnesium chloride use and storage requirements.

During typical snow plowing operations, snow shall be pushed to the designated snow removal areas noted on the Snow Storage Plan (Figure 2). Snow shall not be stockpiled in wetland resource areas or the 100-foot Buffer Zone, catch basins, or bioretention basins, . In severe conditions where snow cannot be stockpiled on site, the snow shall be removed from the site and properly disposed of in accordance with DEP Guideline BRP601-01.

Use of sand is permitted only for impervious roadways and parking areas. If sand is applied, the snow plowed from impervious areas shall not be stored on porous asphalt.

Porous asphalt areas are proposed throughout the site, as indicated on the Stormwater Management System Location Map (Figure 1). These areas will be delineated on-site using pavement markings. Porous asphalt performs well in cold climates and can reduce meltwater runoff during the snowmelt period; however there are specific winter management techniques that must be followed for porous asphalt systems.

The porous asphalt areas shall be maintained during snow events as provided below:

- Apply anti-icing treatments only when absolutely necessary (in extreme events). It is not anticipated that deicing chemicals will be required for typical winter events.
- Plow as needed after storm events. Avoid scarifying the porous asphalt surface. Special plow blades should be used whenever possible. Raised blade is not recommended.
- Apply the minimum amount of deicing agents during and after storms required to control compact snow and ice that are not removed by plowing.
- Do not apply sand in porous asphalt areas “No Sanding” signs shall be posted before the first snowfall and maintenance and snow removal contractors shall be made aware of this requirement.

Before winter begins, the property owner and the contractor shall review snow plowing, deicing, and stockpiling procedures. Areas designated for stockpiling should be cleaned of any debris. Street and parking lot sweeping should be followed in accordance with the Operation and Maintenance Plan.

1.8 Coordination with other Permits and Requirements

Certain conditions of other approvals affecting the long term management of the property shall be considered part of this Long Term Pollution Prevention Plan. The Owner shall become familiar with those documents and comply with the guidelines set forth in those documents.

2.0 STORMWATER MANAGEMENT SYSTEM OPERATION AND MAINTENANCE PLAN

2.1 Introduction

This Operation and Maintenance Plan (O&M Plan) for W. Edward Balmer Elementary School site is required under Standard 9 of the 2008 MassDEP Stormwater Handbook to provide best management practices for implementing maintenance activities for the stormwater management system in a manner that minimizes impacts to wetland resource areas.

The Owner shall implement this O&M Plan and proactively conduct operations at the site in an environmentally responsible manner. Compliance with this O&M Plan does not in any way dismiss the Owner from compliance with other applicable Federal, State or local laws.

Routine maintenance during construction and post-development phases of the project, as defined in the Operation and Maintenance Plan, shall be permitted without amendment to the Order of Conditions. A continuing condition in the Certificate of Compliance shall ensure that maintenance can be performed without triggering further filings under the Wetlands Protection Act.

All stormwater best management practices (BMPs) shall be operated and maintained in accordance with the design plans and the Operation and Maintenance Plan approved by the issuing authority. The Owner shall:

a. Maintain an operation and maintenance log for the last three years, including inspections, repairs, replacement and disposal (for disposal the log shall indicate the type of material and the disposal location). This is a rolling log in which the responsible party records all operation and maintenance activities for the past three years.

b. Make this log available to MassDEP and the Conservation Commissions upon request; and

c. Allow members and agents of the MassDEP and the Conservation Commissions to enter and inspect the premises to evaluate and ensure that the Owner complies with the Operation and Maintenance requirements for each BMP.

2.2 Stormwater Operation and Maintenance Requirements

Inspect and maintain the stormwater management system as directed below. Refer to the Stormwater Management System Location Map (Figure 1) for the location of each component of the system. Repairs to any component of the system shall be made as soon as possible to prevent any potential pollutants (including silt) from entering the resource areas.

<u>Porous Pavement</u>

Porous pavement areas are proposed throughout the site, as indicated on the Stormwater Management System Location Map (Figure 1). These areas will be delineated on-site using pavement markings.

Frequent cleaning and maintenance of the porous pavement surface is critical to prevent clogging. Frequent vacuum sweeping along with jet washing of porous pavement is required. No winter sanding shall be conducted on the porous surface. For proper maintenance:

- Minimize salt use during winter months.
- No winter sanding is allowed.
- Keep landscaped areas well maintained to prevent soil from being transported onto the pavement.
- Regularly monitor the porous pavement surface to check for deterioration and make sure that it drains properly after storm events.
- Clean the surface of each porous pavement area using vacuum sweeping as required to keep the pavement functioning as designed. At a minimum, the porous pavement shall be cleaned after the winter season and every three months thereafter. This requirement may be adjusted as needed, based on regular visual inspections of the porous pavement surface.

- Never reseal or repave with impermeable materials.
- Once per year, the infiltrative capacity of the porous pavement should be tested by running a hose over each porous pavement area for 30 minutes.
- Sections of damaged porous asphalt (rutting, etc.) can be repaired by heating and rerolling the asphalt.
- When infiltrative capacity of porous pavement is reduced to less than the design rate, the porous pavement shall be replaced by milling to the choker course.

Area Drains

Inspect area drains at least once per month and remove debris from the grate. Clean out accumulated sediments at least once per year and more frequently as necessary.

Water Quality Units (Proprietary Separators)

Maintain water quality units according the recommendations set forth by the manufacturer. General inspection and maintenance procedures for proprietary devices are provided below:

- Inspect units following completion of construction, prior to being put into service.
- Inspect units at least twice per year following installation and no less than once per year thereafter.
- Inspect units immediately after any oil, fuel or chemical spill.
- All inspections shall include checking the oil level and sediment depth in the unit. Removal of sediments/oils shall occur per manufacturer recommendations.
- A licensed waste management company shall remove captured petroleum waste products from any oil, chemical or fuel spills and dispose.
- OSHA confined space entry protocols shall be followed if entry into the unit is required.

Vegetated Swales

Vegetated swales shall be inspected twice per year during the first year after construction. In subsequent years, the swales shall be inspected annually and after rain events greater than 3 inches in 24 hours. Inspection and maintenance procedures for drainage channels are provided below:

- Inspect the riprap on the channel bottom and side slopes for signs of erosion and formation of rills and gullies. Replace riprap as necessary.
- Remove accumulated trash and debris.
- Remove sediment as needed. Use hand methods (i.e. a person with a shovel) when cleaning to minimize disturbance to vegetation and underlying soils.
- Check Dams: Inspect check dams after every significant rainfall event. Repair damage as needed. Remove sediment as needed.

Detention Basin

Inspect the detention basin at least once per year to ensure that the basin is operating as intended. Inspect the detention basin during and after major storms to determine if the basin is meeting the expected detention times.

- Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than design flow.
    - Potential problems that should be checked include: subsidence, erosion, cracking or tree growth on the embankment; damage to the emergency spillway; sediment accumulation around the outlet; inadequacy of the inlet/outlet channel erosion control measures; changes in the condition of the pilot channel; and erosion within the basin and banks. Make any necessary repairs immediately.
- During inspections, note any changes to the extended dry detention basin or the contributing watershed, because these could affect basin performance.
- Mow the upper-stage, side slopes, embankment, and emergency spillway at least twice per year. Also remove trash and debris at this time.

- Remove sediment from the extended dry detention basin as necessary, but at least once every 5 years. Providing an on-site sediment disposal area will reduce the overall sediment removal costs.

Bioretention Areas

Perform annual maintenance of all components of the bioretention area, including plants, soil, and mulch. Table 1, below, outlines recommended maintenance activities.

Table 1. Bioretention area maintenance recommendations

Location	Description	Frequency	Time of Year
Surface	Inspect and remove trash	Monthly	Year round
Soil	Inspect and repair erosion	Monthly	Year round
Organic Layer	Remulch void areas	Annually	Spring
	Remove previous mulch layer before applying new layer (optional)	Annually	Spring
Plants	Water vegetation at end of day for 14 consecutive days after planting	Immediately after planting	As needed
	Remove and replace all dead and diseased vegetation that cannot be treated	Annually	Spring
	Treat all diseased trees and shrubs	As needed	Variable

During and after storm events, record the length of time standing water remains in the bioretention areas. If the time is greater than 72 hours, thoroughly inspect the basins for signs of clogging and develop a corrective action plan. The corrective action plan, prepared by a qualified professional, will outline procedures to restore infiltrative function. The owner of the site shall take immediate action to implement these corrective measures.

Stormwater Outfalls

Inspect flared end sections and associated riprap spillways at least once per year and after major storm events (rainfall totals greater than 2.5 inches in 24 hours) to ensure that the stability of the outlet area is maintained. Keep the outfall area clear of debris such as trash, branches, and sediment. Make repairs immediately if riprap displacement or downstream channel scour is observed.

Oil/Water Separators

At a minimum, inspect oil/water separators monthly, and clean them out at least twice per year. In the event of a hazardous waste spill, the oil/water separator should be cleaned immediately. Cleaning involves the removal of accumulated oil and grease and sediment using a vacuum truck. Polluted water or sediments removed from the oil/water separators shall be disposed of in accordance with all applicable local, state, and federal laws and regulations, including M.G.L.c. 21C and 310 CMR 30.00.

2.3 Street Sweeping

Perform street sweeping at least twice per year, whenever there is significant debris present on roads and parking lots. Street sweeping shall occur in the spring and fall. Sweepings must be handled and disposed of properly according to the Northbridge Conservation Commissions.

2.4 Repair of the Stormwater Management System

The stormwater management system shall be maintained. The repair of any component of the system shall be made as soon as possible to prevent any potential pollutants including silt from entering the resource areas or the existing closed drainage system.

2.5 Reporting

The Owner shall maintain a record of drainage system inspections and maintenance (per this Plan) and submit a yearly report to the Northbridge Conservation Commissions.

STORMWATER MANAGEMENT SYSTEM INSPECTION FORM

W. Edward Balmer School – 21 Crescent Street Northbridge, MA		**by:**_____ **Date:**_____
Component	**Status/Inspection**	**Action Taken**
Deep Sump Catch Basins, Area Drains and Drain Manholes		
Bioretention Basin		
Subsurface Infiltration System		
Water Quality Units		
Oil/Water Separator		
Porous Asphalt		
Stormwater Outfalls & Level Spreaders		
General site conditions – evidence of erosion, etc.		

SUBMIT COPIES OF STORMWATER MANAGEMENT SYSTEM INSPECTION FORM TO THE NORTHBRIDGE CONSERVATION COMMISSIONS WITH THE YEARLY REPORT.

INSPECTION CHECKLIST (BIORETENTION AREA)			
Location: **Date:** **Time:** **Date Since Last Rain Event:**			**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**		**Comments/Corrective Action**
Initial Inspection After Planting			
Plants are stable, roots not exposed	S	U	
Surface is at design level	S	U	
Overflow bypass/inlet is functional	S	U	
Debris Cleanup (2 times a year minimum, Spring & Fall)			
Litter, leaves, and dead vegetation removed from the system	S	U	
Prune perennial vegetation	S	U	
Standing Water (1 time a year, After large storm events)			
No evidence of standing water after 72 hours	S	U	
Short Circuiting & Erosion (1 time a year, After large storm events)			
No evidence of animal burrows or other holes	S	U	
No evidence of erosion	S	U	
Drought Conditions (As needed)			
Water plants as needed	S	U	
Dead or dying plants	S	U	
Overflow Bypass/Inlet Inspection (1 time a year, After large storm events)			
No evidence of blockage or accumulated leaves	S	U	
Good condition, no need for repair	S	U	
Vegetation Coverage (once a year)			
50% coverage established throughout system by first year	S	U	
Substantial coverage by year 2 or later	S	U	
Vegetation Health (once every 3 years)			
Dead or decaying plants removed from the system	S	U	
Corrective Action Needed			**Due Date**
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INSPECTION CHECKLIST (UNDERGROUND DETENTION SYSTEM)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (1 time a year, After large storm events)		
Visual evidence of trash, debris or dumping	S U	
Evidence of oil, gasoline, contaminants, or other pollutants in manhole sumps	S U	
Condition of manholes. Is there a safety, function, or design problem (need for repair)	S U	
Grout fillet is separated or cracked wider than ½ inch and longer than 1 foot at the joint of inlet/outlet pipes; evidence of soil entering through cracks	S U	
Sediment observed in piping or manhole sumps	S U	
Trash or debris blocking inlet/outlet pipe	S U	
Condition of manhole frame and cover	S U	
Manhole rungs are determined to be unsafe (missing rungs, misaligned, cracked)		
Maintenance (1 time a year, After large storm events)		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Repair manholes (as necessary)	S U	
Replace manhole castings (as necessary)		
Corrective Action Needed		**Due Date**
1.		
2.		
3.		
4.		

INSPECTION CHECKLIST (WATER QUALITY UNITS)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (2 times a year minimum, Spring & Fall)		
Visual evidence of trash, debris or dumping	S U	
Evidence of oil, gasoline, contaminants, or other pollutants	S U	
Condition of structure. Is there a safety, function, or design problem (need for repair)	S U	
Condition of frame and cover	S U	
Sediment in the basin exceeds manufacturer recommended levels	S U	
Trash or debris blocking inlet/outlet pipe	S U	
Debris Cleanup (2 times a year minimum, Spring & Fall)		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Repair structure (as necessary)	S U	
Replace structure castings (as necessary)		
Corrective Action Needed		**Due Date**
1.		
2.		
3.		
4.		

INSPECTION CHECKLIST (AREA DRAINS)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (2 times a year minimum, Spring & Fall)		
Visual evidence of trash, debris or dumping	S U	
Dead animals or vegetation that could generate odors or gases and could cause complaints	S U	
Evidence of oil, gasoline, contaminants, or other pollutants	S U	
Condition of basin. Is there a safety, function, or design problem (need for repair)	S U	
Vegetation blocking more than 10% of the basin opening (lawn areas)	S U	
Trash and debris blocking more than 20% of grate surface inlet capacity	S U	
Missing grate, missing or broken grate members	S U	
Trash or debris in the basin exceeds 50% of the sump depth from the bottom of basin to invert of the outlet pipe; less than 6 inches clearance from the debris surface to the invert of the outlet pipe	S U	
Sediment in the basin exceeds 50% of the sump depth from the bottom of basin to invert of the outlet pipe; less than 6 inches clearance from the debris surface to the invert of the outlet pipe	S U	
Trash or debris blocking outlet pipe	S U	
Debris Cleanup (2 times a year minimum, Spring & Fall)		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Repair area drain (as necessary)	S U	
Replace area drain castings (as necessary)		
Controlling Run-On (2-4 times a year)		
Adjacent vegetated areas show no signs of erosion and run-on to area drain	S U	
Corrective Action Needed		**Due Date**
1.		
2.		
3.		
4.		

INSPECTION CHECKLIST (VEGETATED SWALES)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (2 times a year during first year after construction, then 1 time a year and after rain events larger than 3")		
Inspect the riprap on the channel bottom and side slopes for signs of erosion and formation of rills and gullies. Replace riprap as necessary.	S U	
Visual evidence of trash, debris or dumping	S U	
Inspect check dams after every significant rainfall event. Repair damage as needed. Remove sediment as needed.	S U	
Maintenance (2 times a year during first year after construction, then 1 time a year and after rain events larger than 3")		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Corrective Action Needed		**Due Date**
1.		
2.		
3.		

INSPECTION CHECKLIST (INFILTRATION BASINS)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (After major storm events during first 3 months of operation and 2 times a year thereafter, Spring & Fall)		
Visual evidence of trash, debris or dumping	S U	
During and after major storm events, the length of time standing water remains in the basin shall be recorded.	S U	
Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than the design velocity	S U	
Condition of basin. Is there a safety, function, or design problem (need for repair)	S U	
Identify areas of sediment accumulation, differential settlement, cracking, and erosion within the basin	S U	
Inspect embankments for leakage and tree growth	S U	
Examine the health of the vegetation within the basin and on the embankments	S U	
Debris Cleanup (After major storm events during first 3 months of operation and 2 times a year thereafter, Spring & Fall)		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Mow the buffer area and basin bottom and side slopes, if vegetated	S U	
Corrective Action Needed		**Due Date**
1.		
2.		
3.		
4.		

INSPECTION CHECKLIST (DETENTION BASINS)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (During and after major storm events, 1 time a year minimum)		
Visual evidence of trash, debris or dumping	S U	
Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than design flow.	S U	
Condition of basin. Is there a safety, function, or design problem (need for repair)	S U	
Identify areas of sediment accumulation, differential settlement, cracking, and erosion within the basin	S U	
Note any changes to the extended dry detention basin or the contributing watershed, because these could affect basin performance	S U	
Examine the health of the vegetation within the basin and on the embankments	S U	
Debris Cleanup (During and after major storm events, 1 time a year minimum)		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Mow the upper-stage, side slopes, embankment, and emergency spillway at least twice per year.	S U	
Remove sediment from the extended dry detention basin as necessary (at least once every 5 years)	S U	
Corrective Action Needed		**Due Date**
1.		
2.		
3.		
4.		

INSPECTION CHECKLIST (STORMWATER OUTFALLS)		
Location: **Date:** **Time:** **Date Since Last Rain Event:**		**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**	**Comments/Corrective Action**
Inspections (1 time a year minimum, and after rain events larger than 2.5")		
Visual evidence of trash, debris or dumping	S U	
Condition of structure. Is there a safety, function, or design problem (need for repair)	S U	
Inspect flared end sections and associated riprap to ensure that the stability of the outlet area is maintained	S U	
Trash or debris blocking inlet/outlet pipe	S U	
Maintenance (1 time a year minimum, and after rain events larger than 2.5")		
Remove and legally dispose sediment, trash, and debris	S U	
Remove and legally dispose contaminants or pollutants	S U	
Make repairs immediately if riprap displacement or downstream channel scour is observed	S U	
Corrective Action Needed		**Due Date**
1.		
2.		
3.		

INSPECTION CHECKLIST (OIL/WATER SEPERATORS)			
Location: **Date:** **Time:** **Date Since Last Rain Event:**			**Inspector:** **Site Conditions:**
Inspection Items	**Satisfactory (S) or Unsatisfactory (U)**		**Comments/Corrective Action**
Inspections (Once per month minimum)			
Visual evidence of trash, debris or dumping	S	U	
Debris Cleanup (Once per month minimum)			
Remove and legally dispose sediment, trash, and debris	S	U	
Remove and dispose of accumulated oil and grease and sediment using a vacuum truck	S	U	
Remove and legally dispose contaminants or pollutants	S	U	
Remove and legally dispose sediment, trash, and debris	S	U	
Cleaning (2 times a year minimum, Spring & Fall)			
Clean oil/water separators out at least twice per year. In the event of a hazardous waste spill, the oil/water separator should be cleaned immediately.	S	U	
Corrective Action Needed			**Due Date**
1.			
2.			
3.			
4.			

ATTACHMENT F

DRAFT Stormwater Pollution Prevention Plan (SWPPP)

NOTE
FINAL SWPPP
Submitted as a Separate File

ATTACHMENT G

Soil Investigations

NRCS Soil Maps and Descriptions

MARC GABRIEL, PE SOIL EVALUATOR #2879
NITSCH ENGINEERING

Commonwealth of Massachusetts
~~City~~/Town of Northbridge Drainage Purposes Only
Form 11 - Soil Suitability Assessment for ~~On-Site Sewage Disposal~~

A. Facility Information

Northbridge School District
Owner Name

21 Crescent St.
Street Address

Map/Lot #

Whittinsville | MA | 01588
City | State | Zip Code

B. Site Information

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

2. Soil Survey Available? ☒ Yes ☐ No If yes: Web Soil Survey (Source) 651 (Soil Map Unit)

Udorthents, smoothed
Soil Name

Soil Limitations

Geologic/Parent Material

Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2008 (Year Published/Source) 1:24,000 (Publication Scale) Coarse Deposits (Map Unit)

4. Flood Rate Insurance Map

Above the 500-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5.

Within the 100-year flood boundary? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☒ Yes ☐ No

MassGIS Wetland Data Layer: Wooded Swamp Deciduous (Wetland Type)

7. Current Water Resource Conditions (USGS): Range: ☐ Above Normal ☐ Normal ☐ Below Normal
Month/Year

8. Other references reviewed:

Drainage Purposes Only

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

Deep Observation Hole Number: TP-1 4/9/19 (Date) 8:25 am (Time) Cloudy (Weather)

1. Location
   Ground Elevation at Surface of Hole: 321 feet Latitude/Longitude: /
   Description of Location: Grass Field
2. Land Use: Athletic Field (e.g., woodland, agricultural field, vacant lot, etc.) No (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 4->6% (Slope (%))
   Grass (Vegetation) Outwash Plain (Landform) S of S (Position on Landscape (SU, SH, BS, FS, TS))
3. Distances from: Open Water Body ____ feet; Drainage Way ____ feet; Wetlands ____ feet; Property Line ____ feet; Drinking Water Well ____ feet; Other ____ feet
4. Parent Material: Proglacial Outwash Unsuitable Materials Present: ☒ Yes ☐ No
   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock
5. Groundwater Observed: ☒ Yes ☐ No If yes: 44" (Depth Weeping from Pit) 84" (Depth Standing Water in Hole)
   Estimated Depth to High Groundwater: 44" inches 317.33 elevation
   ↳ Mottling

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-26	F	-	-	-	-	-	-	-	-	-	
26-34	A	10YR2/2	-	-	-	SL	<2	0	WG	F	
34-44	B	10YR4/4	-	-	-	SL	<2	0	WSBK	F	
44-68	C1	2.5Y6/2	44"	D: 2.5Y6/2 R: 7.5YR5/8	5	Fine LS	10	<2	M	L	
68-84	C2	2.5Y6/3	↓	↓	10	LS	10	<2	M	L	

Additional Notes:
C1 Material was tight in place but loose when excavated.

Commonwealth of Massachusetts
City/Town of

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

Deep Observation Hole Number: TP-2 4/9/19 (Date) 9am (Time) Cloudy (Weather)

1. Location

   Ground Elevation at Surface of Hole: 318.1 feet Latitude/Longitude: /

   Description of Location: Grass field

2. Land Use: Athletic Field (e.g., woodland, agricultural field, vacant lot, etc.) No (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 4→6% (Slope (%))

   Grass (Vegetation) Outwash Plain (Landform) Side of Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from:

Open Water Body	feet	Drainage Way	feet	Wetlands	feet
Property Line	feet	Drinking Water Well	feet	Other	feet

4. Parent Material: Proglacial Outwash Unsuitable Materials Present: ☒ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 42" (Depth Weeping from Pit) 57" (Depth Standing Water in Hole)

   Estimated Depth to High Groundwater: 42" inches 314.6 elevation

   6 Mottles

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-42	F	–	–	–	–	–	–	–	–	–	
42-60	C_1	2.5Y 6/2	42"	D: 2.5Y 6/2 R: 7.5YR 5/8	2	Fine L/S	10	0	M	L	
60-72	C_2	2.5Y 6/3	↓	↓	5	Coarse L/S	15	0	M	L	

Additional Notes:

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

Deep Observation Hole Number: TP-3 4/9/19 (Date) 9:20 am (Time) Cloudy (Weather)

1. Location
   Ground Elevation at Surface of Hole: 316.6 feet Latitude/Longitude: /
   Description of Location: Grass Field
2. Land Use: Athletic Field (e.g., woodland, agricultural field, vacant lot, etc.) No (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 4→6% (Slope (%))
   Grass (Vegetation) Outwash Plain (Landform) Bot. of Slope (Position on Landscape (SU, SH, BS, FS, TS))
3. Distances from: Open Water Body ____ feet; Drainage Way ____ feet; Wetlands ____ feet; Property Line ____ feet; Drinking Water Well ____ feet; Other ____ feet
4. Parent Material: Proglacial Outwash Unsuitable Materials Present: ☒ Yes ☐ No
   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock
5. Groundwater Observed: ☒ Yes ☐ No If yes: 62" (Depth Weeping from Pit) 70" (Depth Standing Water in Hole)
   Estimated Depth to High Groundwater: 60" inches 311.6 elevation
   ↳ Mottles

Commonwealth of Massachusetts
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C. On-Site Review (continued)

Deep Observation Hole Number: TP-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-48"	F	-	-	-	-	-	-	-	-	-	
48"-82"	C	2.5Y6/3	42"	D: 2.5Y6/2 R: 7.5YR5/8	10	Coarse L/S	25	<2	M	L	

Additional Notes:

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

Deep Observation Hole Number: TP-4 4/9/19 (Date) 9:55am (Time) Cloudy (Weather)

1. Location
   Ground Elevation at Surface of Hole: 315.5 feet Latitude/Longitude: /
   Description of Location: Grass Field
2. Land Use: Athletic Field (e.g., woodland, agricultural field, vacant lot, etc.) No (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 4-6% (Slope (%))
   Grass (Vegetation) Outwash Plain (Landform) Bot. of Slope (Position on Landscape (SU, SH, BS, FS, TS))
3. Distances from: Open Water Body ____ feet; Drainage Way ____ feet; Wetlands ____ feet; Property Line ____ feet; Drinking Water Well ____ feet; Other ____ feet
4. Parent Material: Proglacial Outwash Unsuitable Materials Present: ☒ Yes ☐ No
   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock
5. Groundwater Observed: ☒ Yes ☐ No If yes: 62" (Depth Weeping from Pit) 69" (Depth Standing Water in Hole)
   Estimated Depth to High Groundwater: 58" inches 310.7 elevation
   Mottles

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-53	F	—	—	—	—	—	—	—	—	—	
53-80	C	2.5Y6/3	58	D: 2.5Y6/3 R: 7.5YR5/8	10	Coarse LS	25	12	M	L	

Additional Notes:

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

Deep Observation Hole Number: TP-5 4/9/19 (Date) 10:30 am (Time) Cloudy (Weather)

1. Location

   Ground Elevation at Surface of Hole: 317.2 feet Latitude/Longitude: /

   Description of Location: Grass Field

2. Land Use: Athletic Field (e.g., woodland, agricultural field, vacant lot, etc.) No (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 4-6% (Slope (%))

   Grass (Vegetation) Outwash Plain (Landform) Bot. of Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ____ feet; Drainage Way ____ feet; Wetlands ____ feet; Property Line ____ feet; Drinking Water Well ____ feet; Other ____ feet

4. Parent Material: Proglacial Outwash Unsuitable Materials Present: ☒ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

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

   Estimated Depth to High Groundwater: 82" inches 310.4 elevation

   ↳ Weeping

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C. On-Site Review (continued)

Deep Observation Hole Number: TP-5

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-90	F	—	Not visible in fill			—	—	—	—	—	

Additional Notes:
Fill material mostly a loamy sand w/ high gravel content (25%) and pockets of buried loam.

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

Deep Observation Hole Number: TP-6 | 4/9/19 (Date) | 10:50am (Time) | Bar of Slope (Weather)

1. Location

   Ground Elevation at Surface of Hole: 319.7 feet | Latitude/Longitude: /

   Description of Location: Grass Field

2. Land Use: Athletic Field (e.g., woodland, agricultural field, vacant lot, etc.) | No (Surface Stones e.g., cobbles, stones, boulders, etc.) | 4-6% (Slope %)

   Grass (Vegetation) | Outwash Plain (Landform) | Bar. of Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from:

Open Water Body	feet	Drainage Way	feet	Wetlands	feet
Property Line	feet	Drinking Water Well	feet	Other	feet

4. Parent Material: Proglacial Outwash | Unsuitable Materials Present: ☒ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

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

   Estimated Depth to High Groundwater: 72" inches | 313.7 elevation

   & Mottles

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C. On-Site Review (continued)

Deep Observation Hole Number: TP-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-16	A	10YR2/2	—	—	—	LS	<2	0	WG	F	
16-30	B	10YR4/6	—	—	—	LS	5	0	WSAB	F	
30-64	C_1	2.5Y5/4	—	—	—	Grvly LS	2.5	0	M	L	
64-88	C_2	2.5Y5/3	72"	D:2.5Y5/3 R:7.5YR5/8	15%	Fine LS	<2	0	M	L	

Additional Notes:

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

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

Deep Observation Hole Number: TP-7 4/9/19 (Date) 12 pm (Time) Cloudy (Weather)

1. Location
   Ground Elevation at Surface of Hole: 323.5 feet Latitude/Longitude: /
   Description of Location: Edge of driveway
2. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) Yes (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 3:1 (Slope (%))
   None (Vegetation) Kame (Landform) Bot. of Slope (Position on Landscape (SU, SH, BS, FS, TS))
3. Distances from: Open Water Body ____ feet; Drainage Way ____ feet; Wetlands ____ feet; Property Line ____ feet; Drinking Water Well ____ feet; Other ____ feet
4. Parent Material: Ice-Contact Outwash Unsuitable Materials Present: ☒ Yes ☐ No
   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock
5. Groundwater Observed: ☐ Yes ☒ No If yes: ____ (Depth Weeping from Pit) ____ (Depth Standing Water in Hole)
   Estimated Depth to High Groundwater: 40" inches 320.2 elevation
   ↳ Bot. of hole

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C. On-Site Review (continued)

Deep Observation Hole Number: TP-7

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-20	F	-	-	-	-	-	-	-	-	-	
20-40	C	2.5Y6/1	-	-	-	Grvly L/S	5	15	M	L	

Additional Notes:
Large boulders in hole made excavation difficult.
No weeping, standing water or mottles

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

Deep Observation Hole Number: TP-8 4/9/19 (Date) 12:25 pm (Time) Cloudy (Weather)

1. Location

   Ground Elevation at Surface of Hole: 326.5 feet Latitude/Longitude: /

   Description of Location: Edge of driveway

2. Land Use: Parking Lot (e.g., woodland, agricultural field, vacant lot, etc.) Yes (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 3:1 (Slope (%))

   None (Vegetation) Kame (Landform) Bot. of Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ____ feet; Drainage Way ____ feet; Wetlands ____ feet; Property Line ____ feet; Drinking Water Well ____ feet; Other ____ feet

4. Parent Material: Ice-Contact Outwash Unsuitable Materials Present: ☒ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 44" (Depth Weeping from Pit) — (Depth Standing Water in Hole)

   Estimated Depth to High Groundwater: 44" inches 322.83 elevation

   Weeping

Commonwealth of Massachusetts
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C. On-Site Review (continued)

Deep Observation Hole Number: TP-8

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-13	F	-	-	-	-	-	-	-	-	-	
13-19	B	10YR5/4	-	-	-	LS	5	0	WSAB	F	
19-44	C	2.5Y6/1	-	-	-	Grvly LS	10	25	M	L	

Additional Notes:
No redox or weeping.
Lg boulders making excavation difficult.

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

Deep Observation Hole Number: TP-9 4/9/19 (Date) 12:50pm (Time) Cldy (Weather)

1. Location

   Ground Elevation at Surface of Hole: 330 feet Latitude/Longitude: /

   Description of Location: Edge of driveway

2. Land Use: Parking Lot (e.g., woodland, agricultural field, vacant lot, etc.) Yes (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 3:1 (Slope (%))

   None (Vegetation) Kame (Landform) Bot. of Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet

   Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Parent Material: Ice-Contact Outwash Unsuitable Materials Present: ☒ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

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

   Estimated Depth to High Groundwater: 60 inches 325 elevation

   ↳ Bot. of hole

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C. On-Site Review (continued)

Deep Observation Hole Number: TP-9

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-32	F	-	-	-	-	-	-	-	-	-	
32-45	C1	2.5Y4/3	-	-	-	Fine LS	15	42	M	L	
45-60	C2	2.5Y6/1	-	-	-	Gravelly LS	10	25	M	L	

Additional Notes:
No weeping, standing water or mottling.
Ring of "rust" @ 45" down but not consistent the remainder of the depth of the hole. Not mottling.

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

Deep Observation Hole Number: TP-10 4/9/19 (Date) 1:35 pm (Time) Cloudy (Weather)

1. Location
   Ground Elevation at Surface of Hole: 329 feet Latitude/Longitude: /
   Description of Location: Edge of parking
2. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) No (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 3:1 (Slope (%))
   Brush (Vegetation) Kame (Landform) Bot. of Slope (Position on Landscape (SU, SH, BS, FS, TS))
3. Distances from: Open Water Body ____ feet; Drainage Way ____ feet; Wetlands ____ feet; Property Line ____ feet; Drinking Water Well ____ feet; Other ____ feet
4. Parent Material: Ice-Contact Outwash Unsuitable Materials Present: ☒ Yes ☐ No
   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock
5. Groundwater Observed: ☒ Yes ☐ No If yes: 27" (Depth Weeping from Pit) 42" (Depth Standing Water in Hole)
   Estimated Depth to High Groundwater: 27" (inches) 326.75 (elevation)
   Gleyed Matrix

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C. On-Site Review (continued)

Deep Observation Hole Number: TP-10

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-16	F	—	—	—	—	—	—	—	—	—	
16-27	B	10YR4/4	—	—	—	Gravely LS	15	0	WSAB	F	
27-45	C	2.5Y6/2	27	D: 2.5Y6/2 R: 7.5YR5/5	2	Fine LS	<2	0	M	L	

Additional Notes:
Mottling was visible but faint in C layer

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

Deep Observation Hole Number: TP-11 (Date) 4/9/19 (Time) 2pm (Weather) Cloudy

1. Location

Ground Elevation at Surface of Hole: 330 feet Latitude/Longitude: /

Description of Location: Grass Field

2. Land Use: Athletic Field (e.g., woodland, agricultural field, vacant lot, etc.) No (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3% (Slope (%))

Grass (Vegetation) Outwash Plain (Landform) Bot. of Slope (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet

Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Parent Material: Proglacial Outwash Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: — (Depth Weeping from Pit) 25" (Depth Standing Water in Hole)

Estimated Depth to High Groundwater: 25" inches 327.9 elevation

Weeping

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C. On-Site Review (continued)

Deep Observation Hole Number: TP-11

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-36"	F	-	-	-	-	-	-	-	-		

Additional Notes:
No mottles visible in Fill.

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C. On-Site Review (continued)

Deep Observation Hole Number: TP-12 (Date) 2:15pm (Time) 4/9/19 (Weather) Cloudy

1. Location

Ground Elevation at Surface of Hole: 330 feet Latitude/Longitude: /

2. Land Use: Athletic Field (e.g., woodland, agricultural field, vacant lot, etc.) No (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3 (Slope (%))

Grass (Vegetation) Outwash Plain (Landform) (Position on Landscape (SU, SH, BS, FS,

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet

Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Parent Material: Proglacial Outwash Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 8" (Depth Weeping from Pit) — (Depth Standing Water in Hole)

Estimated Depth to High Groundwater: 20" inches 328.3 elevation

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

C. On-Site Review (continued)

Deep Observation Hole Number: TP-12

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-44	F	—	—	—	—	—	—	—	—		
44-48	C	2.5Y5/1	20"	D:2.5Y6/1 R:2.5YR5/8	5	Fine S	10	0	M	L	

Additional Notes:
Fill was gravely

STEVE VENTRESCA, PE SOIL EVALUATOR #2922
NITSCH ENGINEERING

Commonwealth of Massachusetts
City/Town of

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

April 10, 2019 (8:15 am)
Balmer School Whitinsville, MA
Cloudy / Drizzle 38°F
For Drainage Only

_____ inches _____ elevation

Deep Observation Hole Number: A

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10	O	10YR 2/1	-	-	-	ORGANIC	-	-	-	-	
10-48	FILL	-	20”	2.5Y 5/8	5%	SANDY LOAM	10%	-	SUB ANG BLKY	FRIABLE	

Additional Notes: GROUNDWATER AT 48 INCHES / WEEPING AT 20 INCHES

Commonwealth of Massachusetts
City/Town of

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

_____ inches _____ elevation

April 10, 2019 (8:15 am)
Beal School, Whitinsville, MA
Cloudy / Drizzle 38°F
For Drainage Only

Deep Observation Hole Number: B

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10	A(loam)	10YR 3/3	-	-	-	SANDY LOAM	-	-	GRANULAR	V. FRIABLE	
10-24	FILL	-	-	-	-	-	-	-	-	-	
24-53	C1	10YR 4/6	-	-	-	LOAMY SAND	20%	5%	LOOSE	V. FRIABLE	
53-63	C2	10YR 6/2	-	-	-	FINE SANDY LOAM	-	-	MASSIVE	V. FRIABLE	

Additional Notes: REFUSAL AT 63 INCHES

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

_____ inches _____ elevation

April 10, 2019 (8:15 am)
Beal School, Whitinsville, MA
Cloudy / Drizzle 38°F
For Drainage Only

Deep Observation Hole Number: C

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-18	A(loam)	10YR 3/3	-	-	-	SANDY LOAM	-	-	GRANULAR	V. FRIABLE	
18-80	FILL	-	-	-	-	-	-	-	-	-	

Additional Notes: WEEPING AT 56 INCHES

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

_____ inches _____ elevation

April 10, 2019 (8:15 am)
Beal School, Whitinsville, MA
Sunny 45°F
For Drainage Only

Deep Observation Hole Number: D

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-31	FILL	-	-	-	-	-	-	-	-	-	VARIED STRATIFIED FILL

Additional Notes: REFUSAL AT 31 INCHES NO GROUNDWATER OR REDOX VISIBLE

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

_____ inches _____ elevation

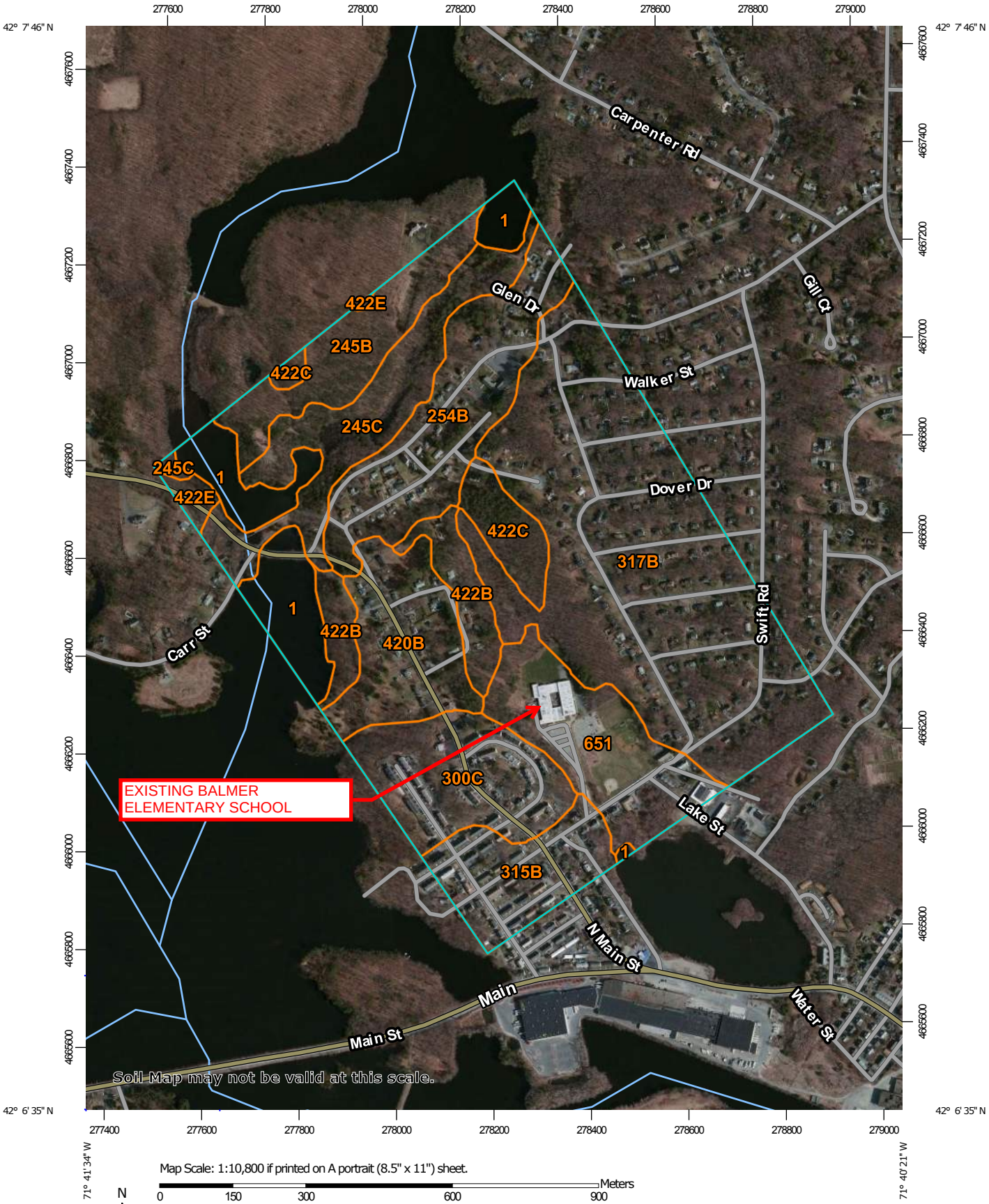
April 10, 2019 (8:15 am)
Beal School, Whitinsville, MA
Sunny 45°F
For Drainage Only

Deep Observation Hole Number: E

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-80	FILL	-	-	-	-	-	10%	10%	-	-	VARIED STRATIFIED FILL
80-88	C	10YR 6/4	81”	2.5YR 3/6	10%	SANDY LOAM	3%	-	LOOSE	V. FRIABLE	

Additional Notes: NO GROUNDWATER OR WEEPING VISIBLE

Soil Map—Worcester County, Massachusetts, Southern Part
(Existing Balmer Elementary School)



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 1:25,000.

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: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 9, Sep 15, 2016

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

Date(s) aerial images were photographed: Apr 8, 2011—Apr 9, 2011

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

Worcester County, Massachusetts, Southern Part (MA615)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1	Water	18.7	6.8%
245B	Hinckley loamy sand, 3 to 8 percent slopes	15.9	5.7%
245C	Hinckley loamy sand, 8 to 15 percent slopes	24.4	8.8%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	28.8	10.4%
300C	Montauk fine sandy loam, 8 to 15 percent slopes	22.1	8.0%
315B	Scituate fine sandy loam, 3 to 8 percent slopes	15.9	5.8%
317B	Scituate fine sandy loam, 3 to 8 percent slopes, extremely stony	86.7	31.3%
420B	Canton fine sandy loam, 3 to 8 percent slopes	20.1	7.3%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	10.9	4.0%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	7.8	2.8%
422E	Canton fine sandy loam, 15 to 35 percent slopes, extremely stony	1.9	0.7%
651	Udorthents, smoothed	23.4	8.5%
Totals for Area of Interest		**276.6**	**100.0%**

ATTACHMENT H

Methodology and HydroCAD Technical Information

Nitsch Engineering

ATTACHMENT H

METHODOLOGY AND HYDROCAD TECHNICAL INFORMATION

Project Name:	Balmer Elementary School
Nitsch Project #:	12260

HYDROLOGY CALCULATIONS

Nitsch Engineering completed a hydrologic analysis of the existing project site utilizing Soil Conservation Service (SCS) Runoff Curve Number (CN) methodology. The SCS method calculates the rate at which the runoff reaches the design point considering several factors: the slope and flow lengths of the subcatchment area, the soil type of the subcatchment area, and the type of surface cover in the subcatchment area. HydroCAD Version 10.00 computer modeling software was used in conjunction with the SCS method to determine the peak runoff rates and runoff volumes for the 2-, 10-, 25-, and 100-year, 24-hour storm events. The proposed project site is being analyzed with the same methodology.

The Site was divided into multiple drainage areas, or subcatchments, which drain to the design points along the property boundary and within the site. For each subcatchment area, SCS Runoff Curve Numbers (CNs) were selected by using the cover type and hydrologic soil group of each area. The peak runoff rates and runoff volumes for the 2-, 10-, 25- and 100-year 24-hour storm events were then determined by inputting the drainage areas, CNs, and time of concentration (T_c) paths into the HydroCAD model.

HydroCAD Version 10.00

The HydroCAD computer program uses SCS and TR-20 methods to model drainage systems. TR-20 (Technical Release 20) was developed by the Soil Conservation Service to estimate runoff and peak discharges in small watersheds. TR-20 is generally accepted by engineers and reviewing authorities as the standard method for estimating runoff and peak discharges.

HydroCAD Version 10.00 uses up to four types of components to analyze the hydrology of a given site: subcatchments, reaches, basins, and links. Subcatchments are areas of land that produce surface runoff. The area, weighted CN, and T_c characterize each individual subcatchment area. Reaches are generally uniform streams, channels, or pipes that convey water from one point to another. A basin is any impoundment that fills with water from one or more sources and empties via an outlet structure. Links are used to introduce hydrographs into a project from another source or to provide a junction for more than one hydrograph within a project. The time span for the model was set for 0-48 hours in order to prevent truncation of the hydrograph.

HYDRAULIC CALCULATIONS (Closed Drainage System)

The closed drainage system, catch basin to drain manhole system, was designed to convey the 25-year storm event using the Rational method. Refer to Appendix D for more information.

ATTACHMENT J

DR-EX Existing Watershed Areas

DR-PR Proposed Watershed Areas

Submitted Separate File