STORMWATER REPORT

North Apartments
572-596 North Ave
Wakefield, Massachusetts

December 2, 2020
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Applicant
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W&S Project Data
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Existing.hcp
Proposed_R3.hcp
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WILLIAMS & SPARAGES
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1 | Mitigative Drainage Analysis

1.1 Purpose

The purpose of this analysis is to compare the pre-development watershed condition to the post development watershed condition for the proposed project located at 0 North Ave, Wakefield, MA. This is accomplished by analyzing the surface stormwater runoff rates to the limit of watershed analysis as shown on the accompanying watershed map(s). The result(s) of this analysis are summarized in the Peak Rate of Runoff tables below, see Section 1.8.

1.2 Introduction

The subject property is located in the north west portion of Wakefield on the south side of North Ave near Route 128/95 and the Reading/Wakefield town line. The property is bounded by residential and commercial properties along North Ave and the B&M Railroad to the rear. Property access is via North Ave.

The property is currently undeveloped and largely wooded with deciduous tree cover and wetland resources.

The proposal is to construct a 36-unit apartment building with parking, landscaping, utilities and stormwater management devices for attenuation and treatment of stormwater runoff.

Construction activities will be within the 100-foot buffer zone of the on-site wetland resource and a Notice of Intent (NOI) filing is required with the Wakefield Conservation Commission.

The property is located within the Single Residence (SR) zoning district.

The property varies in elevation from approximately 86 at North Ave to an approximate elevation of 83 at the wetland system located to the rear of the property. The property primarily slopes from North Ave towards the wetland system.

1.3 Existing Condition Soils Analysis

In order to model the excess runoff for both the existing and proposed watershed condition, the parent soils on site were mapped using the Web Soil Survey (WSS) made available on the United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) website. The WSS provides vital soil data and information such as Hydrologic Soil Group (HSG), which is then input into a mathematical model to generate runoff curve numbers. The user inputs the soil cover type as well as the hydrologic soil group to generate a weighted curve number (CN) and also uses the topography of the land to generate a time of concentration (Tc) from which the stormwater runoff rate and volume can be calculated for a given watershed for comparison.

The soils present on site are comprised of Merrimac Urban Land Complex, Udorthents-Urban Land Complex and Freetown Muck. Udorthents-Urban Land Complex does not have an assigned HSG. On site soil testing reveals fill present at all soil testing locations of sandy loam therefore this analysis assumes a HSG rating of B for all soil groups.

1.4 Stormwater Modeling Methodology

The mathematical model used in this analysis for post development is computed using the stormwater modeling software HydroCAD, v10.20, developed by HydroCAD Software Solutions LLC. HydroCAD is a software program used to model the hydrology and hydraulics of stormwater runoff and is based largely on programs and techniques developed by the NRCS, specifically TR-20 and TR-55 and other hydraulic calculation methods.

HydroCAD allows the user, for a given rainfall event, to generate runoff hydrographs for single or multiple watersheds and is used to determine if a given drainage system is adequate under the desired conditions and to predict flooding or other hydraulic impacts such as erosion at specified locations.

Five design storm events are analyzed and the result is summarized below in the Peak Rate of Runoff tables, see Section 1.8.

1.5 Pre-Development Watershed

The total pre-development watershed area is one comparison edge with one subcatchment resulting from the existing topography and for comparison with the post-development condition.

The selected Comparison Edge 1L represents flow tributary towards the "B" series wetland located at the rear of the property and the southerly property line. The area tributary to this selected edge of comparison is 61,617 ft^2.

The total watershed area within the limit of watershed analysis is 61,617 ft^2.

Using the methods described in the stormwater modeling methodology above, runoff curve numbers and times of concentration are generated for each watershed for the pre-development condition to be used for comparison with the post-development condition described below. A schematic of the mathematical model and the result of the calculations for the 2-year, 10-year, 25-year, 50-year and 100-year Type III, 24-hour storm events are included in this analysis.

1.6 Post-Development Watershed

The post-development watershed is separated into five subcatchments tributary to the selected edge of comparisons.

The selected Comparison Edge 1L represents flow tributary towards the "B" series wetland. The area tributary to this selected edge of comparison is 50,248 ft^2.

The selected Comparison Edge 2L represents flow tributary towards North Ave. The area tributary to this selected edge of comparison is 11,369 ft^2.

The total watershed area within the limit of watershed analysis is 61,617 ft^2.

Post-development provides for the construction of a deep sump hooded catch basin, proprietary particle separator and subsurface corrugated metal perforated pipe system. These drainage devices will provide peak rate of runoff mitigation, water quality and groundwater recharge.

Building downspouts from roof areas will be piped directly to the subsurface corrugated metal perforated pipe system.

Using the methods described in the stormwater modeling methodology above, runoff curve numbers and times of concentration are generated for the post-development condition. A schematic of the mathematical model and the results of the calculations for the 2-year, 10-year, 25-year, 50-year and 100-year Type III, 24-hour storm events are included in this analysis.

1.7 Compliance with DEP Stormwater Management Standards

Standard 1
No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

New stormwater runoff requiring treatment will be treated prior to discharge towards the selected edge of comparison. However, some impervious (sidewalk) area will sheet flow untreated towards North Ave.

New stormwater outfalls will discharge to a level spreader providing protection from scour/erosion.

Standard 2
Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

Refer to Peak Rate of Runoff tables, see Section 1.8, which demonstrate the post-development peak discharge rates are less than or equal to the pre-development peak discharge rates at Comparison Edge 1L. However, at Comparison Edge 2L the relationship between the elevation of groundwater and the gutter line elevation of North Ave at the site entrance forces a grading program that slopes towards North Ave that does not allow for mitigating stormwater within the subject property.

Standard 3
Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from the pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The project site is analyzed using Hydrologic Soil Group B. Groundwater recharge is provided by subsurface corrugated metal perforated pipe system which lie within an area of loamy sands as determined by on site soil testing. An exfiltration rate of 2.41 inches per hour is used.

Any unsuitable material encountered during construction of the subsurface corrugated metal perforated pipe system will be removed and replaced with either on-site parent material or imported granular material. Should refusal/ledge be encountered during construction it shall be removed to a depth of four feet below infiltration system and backfilled with clean blasted rock fragments.

Standard 4
Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
b. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and
c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook

Post-development provides for the construction of a deep sump hooded catch basin, proprietary particle separators and a subsurface corrugated metal perforated pipe system. These drainage devices will provide peak rate of runoff mitigation, water quality and groundwater recharge.

Runoff from certain types of roof areas are considered "clean" by DEP and therefore, do not require treatment. We assume the roof types for this project will satisfy this criterion.

The project site is not considered a LUHPPL, within a Zone II or Interim Wellhead Protection Area or Critical Area. Given the stormwater management systems lie within an area of rapid infiltration water quality volume is based on a runoff of one inch.

Standard 5
For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow melt, and stormwater runoff, the proponent shall use specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated there under at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

This project is not being considered a LUHPPL.

Standard 6
Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2) (a) (1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of public water supply.

Stormwater discharge from this property is not within a Zone II, Interim Wellhead Protection Area of a public water supply or a critical area. A portion of the property lies within a Zone A with stormwater discharge outside of Zone A.

Standard 7
A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

This project is not considered a redevelopment.

Standard 8
A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

Refer to Section 6 Construction Period Pollution Prevention Plan and Erosion and Sediment Control.

Standard 9
A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

Refer to Section 4 Long Term Operation and Maintenance Plan (O&M).

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

Illicit Discharge Compliance Statement
No connection between the stormwater and wastewater management systems is proposed. Per requirements of Standard 10 it is herein stated that there are no proposed illicit discharges into the Stormwater Management System to be constructed as shown on the definitive plan.

Signed:_____Date:_____
Raymond Nickerson

Signed:_____Date:_____
Dana Lopez

1.8 Conclusion

Examining the following Peak Rate of Runoff and Basin Performance table, the proposed stormwater management system is effective for mitigating the peak flow rate towards Comparison Edge 1L for the 2-year, 10-year, 25-year, 50-year and 100-year storm events.

Table 1.0: Peak Rate of Runoff | Comparison Location 1L

Description	**2 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Existing Peak Rate of Runoff (cfs)	0.10	0.56	1.08	1.41	1.58
Proposed Peak Rate of Runoff (cfs)	0.10	0.36	0.61	0.93	1.16
Difference	**0.00**	**-0.20**	**-0.47**	**-0.48**	**-0.42**

Table 1.1: Peak Rate of Runoff | Comparison Location 2L

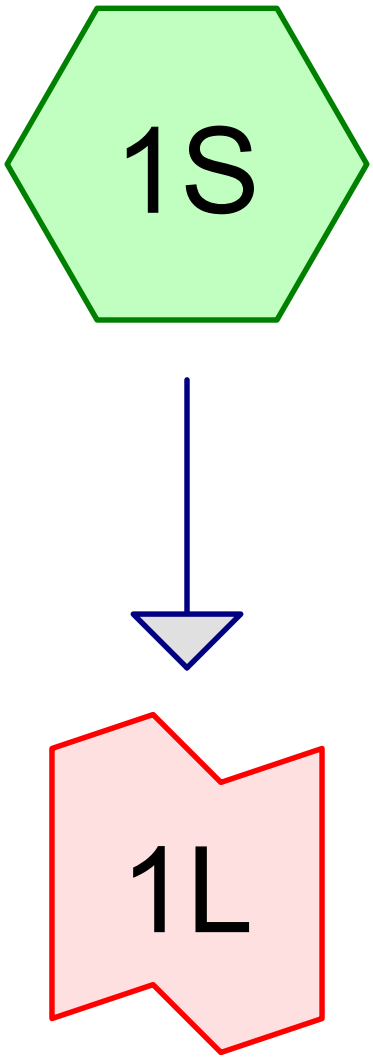
Description	**2 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
Existing Peak Rate of Runoff (cfs)	0.00	0.00	0.00	0.00	0.00
Proposed Peak Rate of Runoff (cfs)	0.10	0.22	0.33	0.40	0.43
Difference	**0.10**	**0.22**	**0.33**	**0.40**	**0.43**

Table 1.2: Stormwater Management Area 1P | Infiltration Pipe Network Performance Table

24 Hour Type III Storm event	Peak Rate of Inflow (cfs)	Peak Rates of Outflow (cfs)			Peak Water Level (ft)
		Total (cfs)	Exfiltration (cfs)	8″ Culvert (cfs)	
2 year	2.11	0.25	0.25	0.00	84.74
10 year	3.22	0.25	0.25	0.00	85.30
25 year	4.08	0.55	0.25	0.30	85.64
50 year	4.55	0.86	0.25	0.61	85.80
100 year	4.78	1.03	0.25	0.78	85.88

1.9 HydroCAD Data

1.9.1 Existing Condition



B Series Wetland

Subcat Reach Pond Link

Routing Diagram for EXISTING
Prepared by Williams & Sparages, Printed 10/24/2022

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 yr	Type III 24-hr		Default	24.00	1	3.10	2
2	10 yr	Type III 24-hr		Default	24.00	1	4.50	2
3	25 yr	Type III 24-hr		Default	24.00	1	5.60	2
4	50 yr	Type III 24-hr		Default	24.00	1	6.20	2
5	100 yr	Type III 24-hr		Default	24.00	1	6.50	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
7,508	61	>75% Grass cover, Good, HSG B (1S)
54,109	55	Woods, Good, HSG B (1S)
61,617	**56**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
61,617	HSG B	1S
0	HSG C	
0	HSG D	
0	Other	
61,617		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	7,508	0	0	0	7,508	>75% Grass cover, Good	
0	54,109	0	0	0	54,109	Woods, Good	
0	**61,617**	**0**	**0**	**0**	**61,617**	**TOTAL AREA**	

Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=61,617 sf 0.00% Impervious Runoff Depth=0.25"
Flow Length=240' Tc=32.6 min CN=56 Runoff=0.10 cfs 1,278 cf

Link 1L: B Series Wetland Inflow=0.10 cfs 1,278 cf
Primary=0.10 cfs 1,278 cf

Total Runoff Area = 61,617 sf Runoff Volume = 1,278 cf Average Runoff Depth = 0.25"
100.00% Pervious = 61,617 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S:

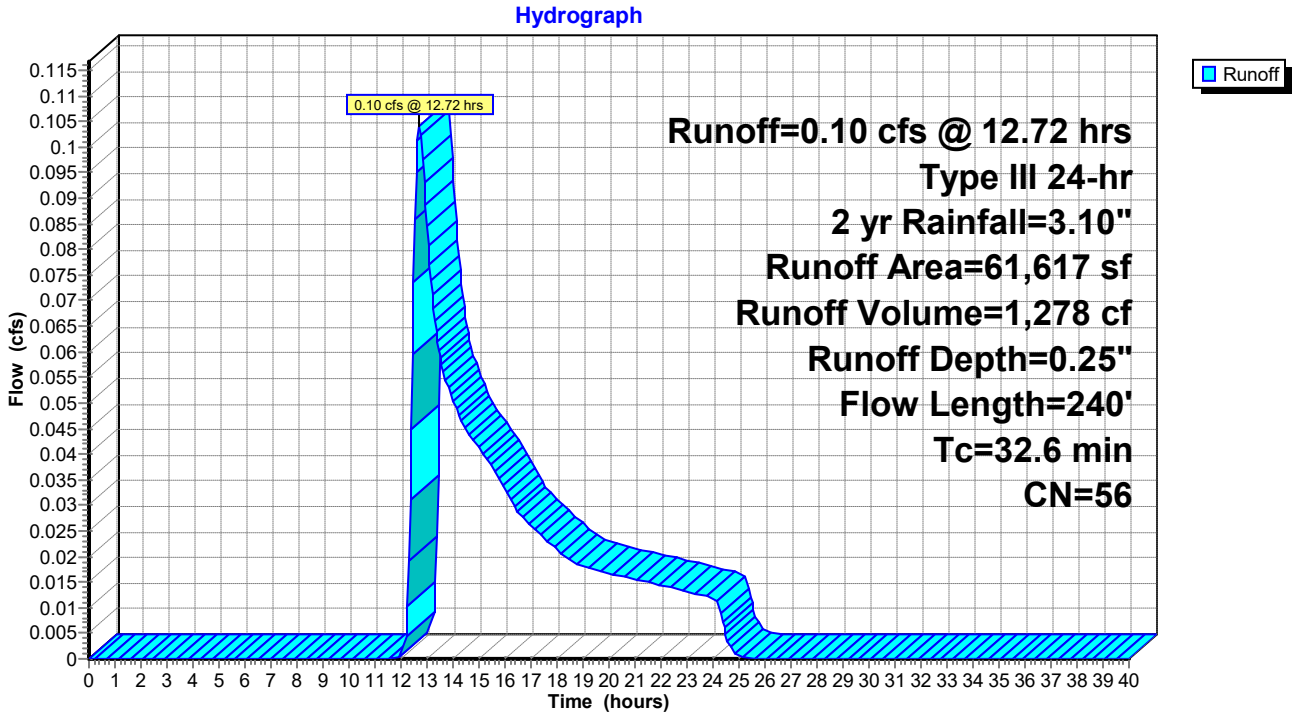
Runoff = 0.10 cfs @ 12.72 hrs, Volume= 1,278 cf, Depth= 0.25"
Routed to Link 1L : B Series Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
7,508	61	>75% Grass cover, Good, HSG B
54,109	55	Woods, Good, HSG B
61,617	56	Weighted Average
61,617		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0080	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.1	140	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
32.6	240	Total			

Subcatchment 1S:

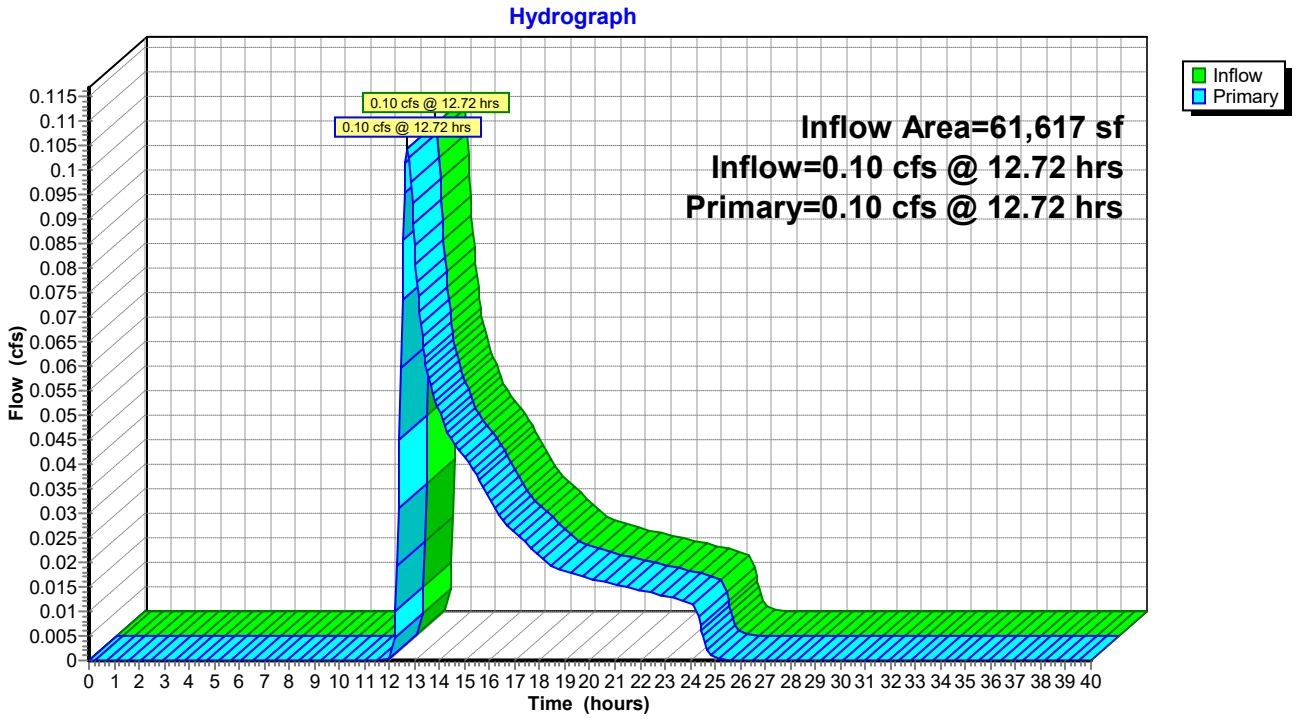


Summary for Link 1L: B Series Wetland

Inflow Area = 61,617 sf, 0.00% Impervious, Inflow Depth = 0.25" for 2 yr event
Inflow = 0.10 cfs @ 12.72 hrs, Volume= 1,278 cf
Primary = 0.10 cfs @ 12.72 hrs, Volume= 1,278 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: B Series Wetland



Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=61,617 sf 0.00% Impervious Runoff Depth=0.80"
Flow Length=240' Tc=32.6 min CN=56 Runoff=0.56 cfs 4,083 cf

Link 1L: B Series Wetland Inflow=0.56 cfs 4,083 cf
Primary=0.56 cfs 4,083 cf

Total Runoff Area = 61,617 sf Runoff Volume = 4,083 cf Average Runoff Depth = 0.80"
100.00% Pervious = 61,617 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S:

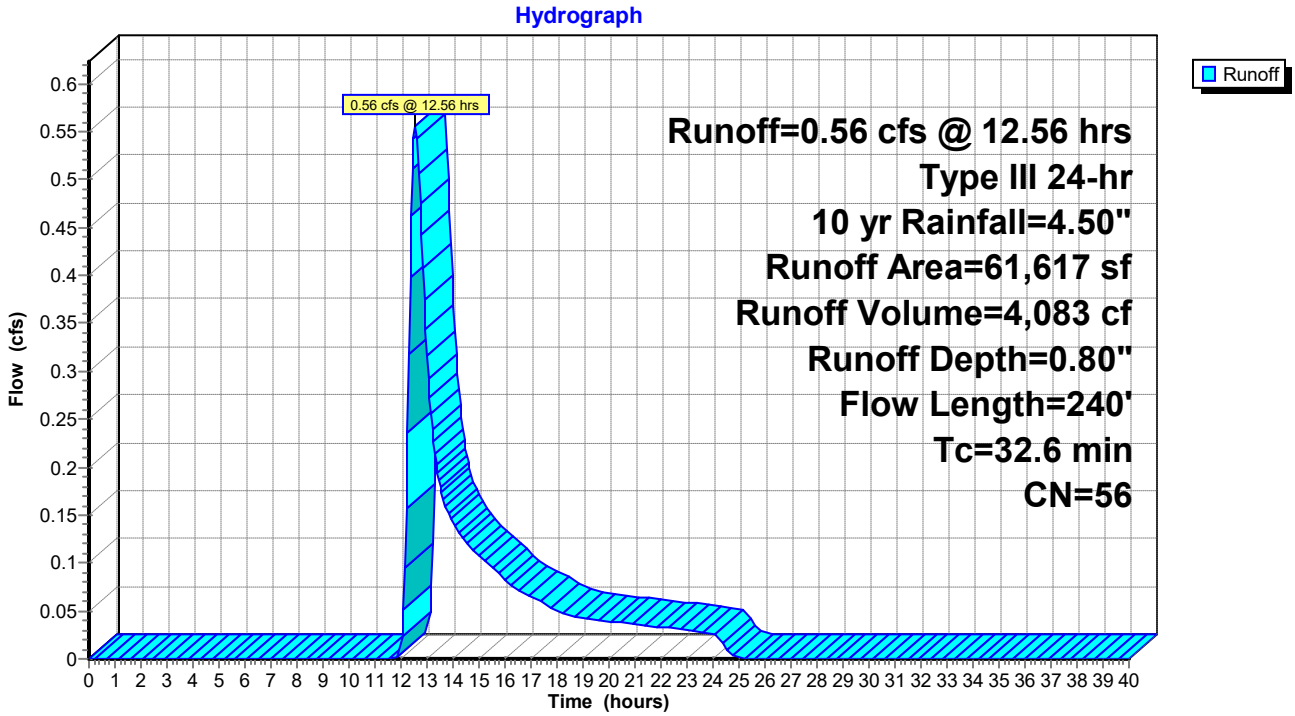
Runoff = 0.56 cfs @ 12.56 hrs, Volume= 4,083 cf, Depth= 0.80"
Routed to Link 1L : B Series Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
7,508	61	>75% Grass cover, Good, HSG B
54,109	55	Woods, Good, HSG B
61,617	56	Weighted Average
61,617		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0080	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.1	140	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
32.6	240	Total			

Subcatchment 1S:

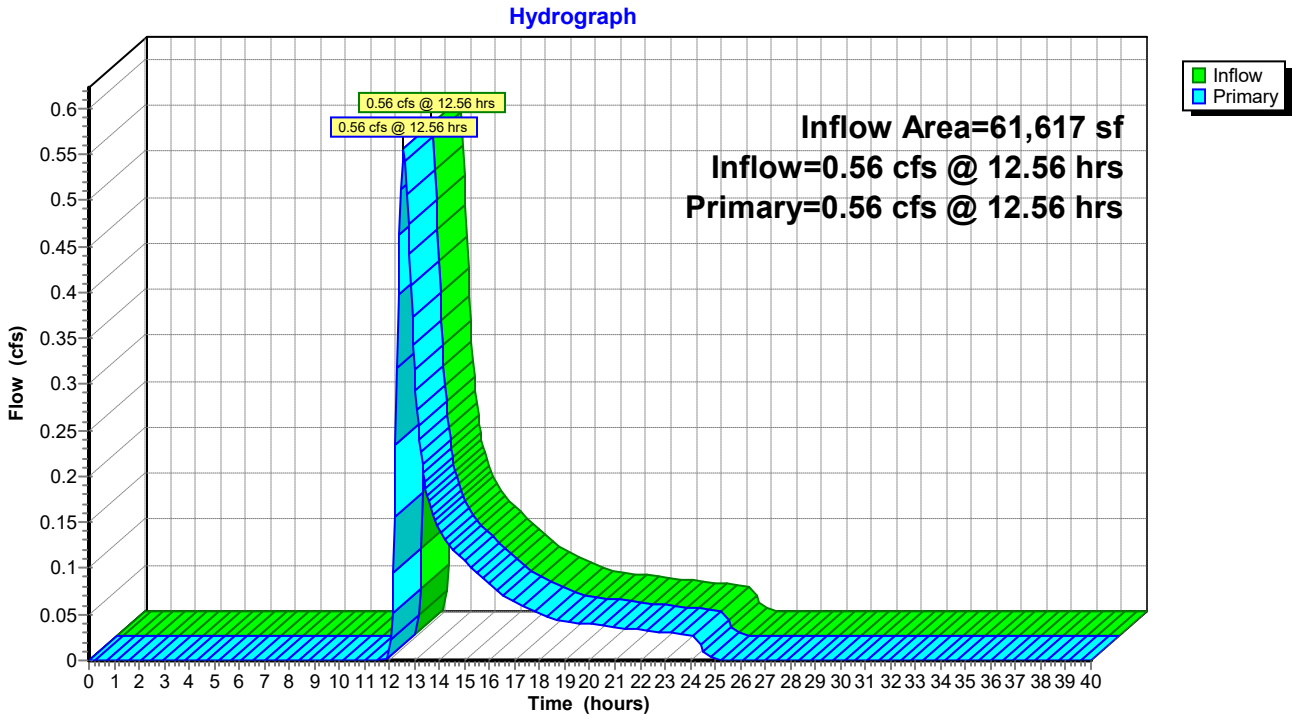


Summary for Link 1L: B Series Wetland

Inflow Area = 61,617 sf, 0.00% Impervious, Inflow Depth = 0.80" for 10 yr event
Inflow = 0.56 cfs @ 12.56 hrs, Volume= 4,083 cf
Primary = 0.56 cfs @ 12.56 hrs, Volume= 4,083 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: B Series Wetland



Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=61,617 sf 0.00% Impervious Runoff Depth=1.37"
Flow Length=240' Tc=32.6 min CN=56 Runoff=1.08 cfs 7,011 cf

Link 1L: B Series Wetland Inflow=1.08 cfs 7,011 cf
Primary=1.08 cfs 7,011 cf

Total Runoff Area = 61,617 sf Runoff Volume = 7,011 cf Average Runoff Depth = 1.37"
100.00% Pervious = 61,617 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S:

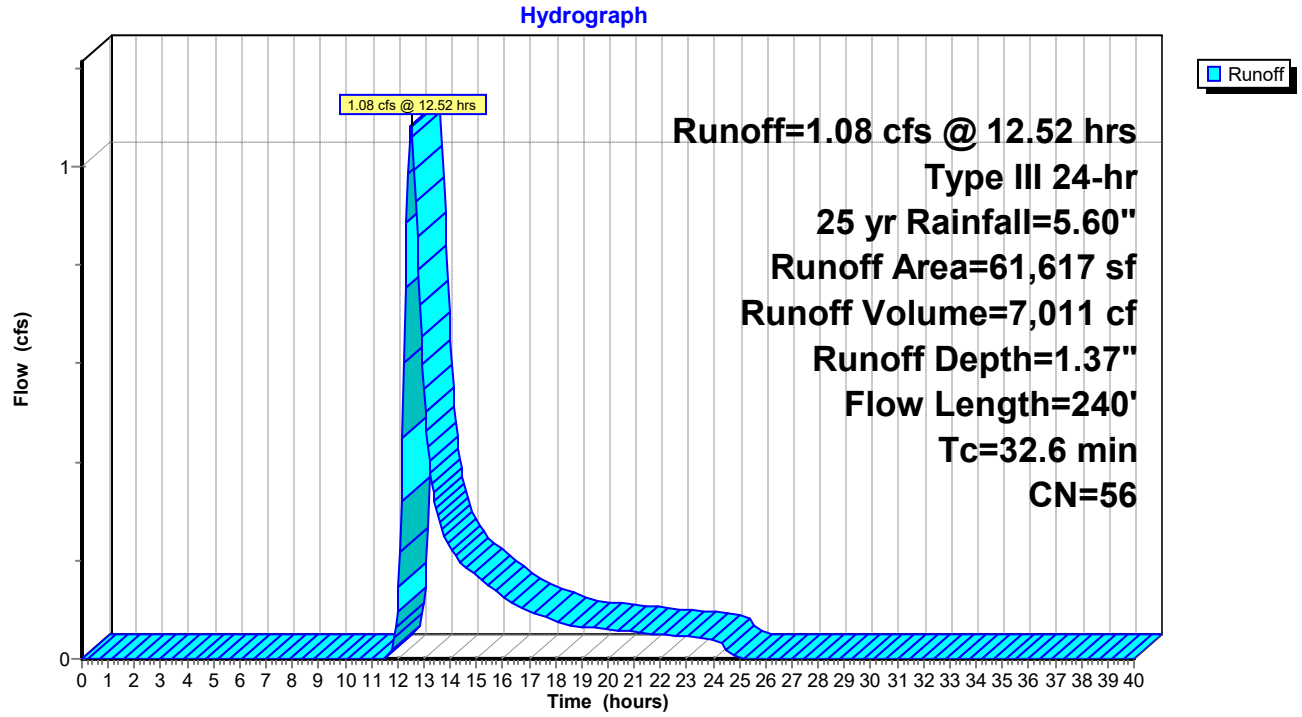
Runoff = 1.08 cfs @ 12.52 hrs, Volume= 7,011 cf, Depth= 1.37"
Routed to Link 1L : B Series Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
7,508	61	>75% Grass cover, Good, HSG B
54,109	55	Woods, Good, HSG B
61,617	56	Weighted Average
61,617		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0080	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.1	140	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
32.6	240	Total			

Subcatchment 1S:

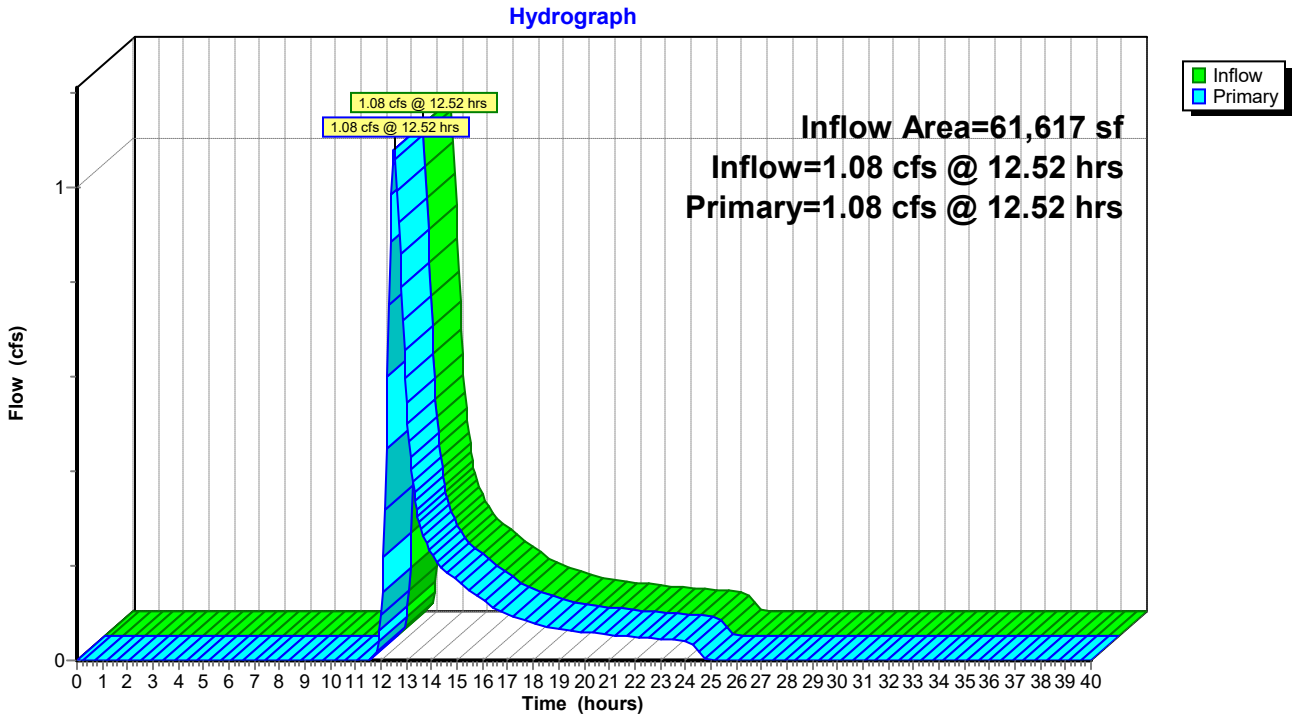


Summary for Link 1L: B Series Wetland

Inflow Area = 61,617 sf, 0.00% Impervious, Inflow Depth = 1.37" for 25 yr event
Inflow = 1.08 cfs @ 12.52 hrs, Volume= 7,011 cf
Primary = 1.08 cfs @ 12.52 hrs, Volume= 7,011 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: B Series Wetland



Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=61,617 sf 0.00% Impervious Runoff Depth=1.72"
Flow Length=240' Tc=32.6 min CN=56 Runoff=1.41 cfs 8,810 cf

Link 1L: B Series Wetland Inflow=1.41 cfs 8,810 cf
Primary=1.41 cfs 8,810 cf

Total Runoff Area = 61,617 sf Runoff Volume = 8,810 cf Average Runoff Depth = 1.72"
100.00% Pervious = 61,617 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S:

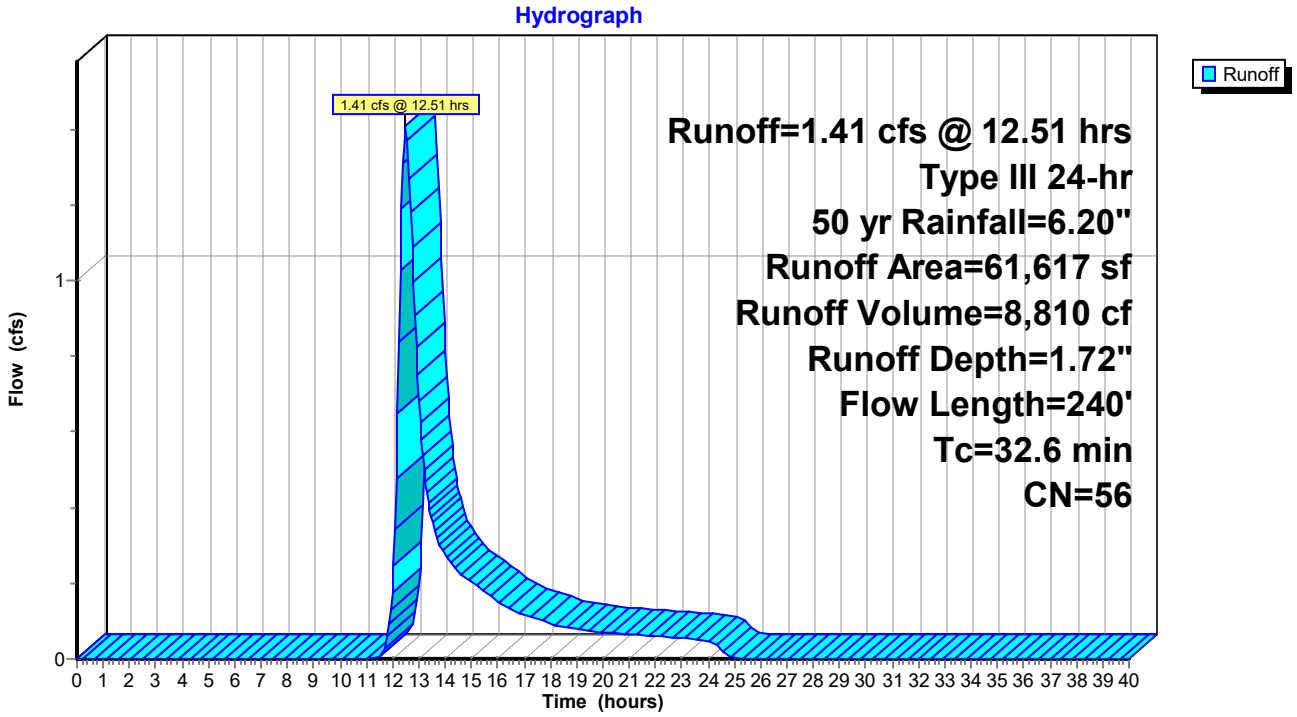
Runoff = 1.41 cfs @ 12.51 hrs, Volume= 8,810 cf, Depth= 1.72"
Routed to Link 1L : B Series Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
7,508	61	>75% Grass cover, Good, HSG B
54,109	55	Woods, Good, HSG B
61,617	56	Weighted Average
61,617		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0080	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.1	140	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
32.6	240	Total			

Subcatchment 1S:

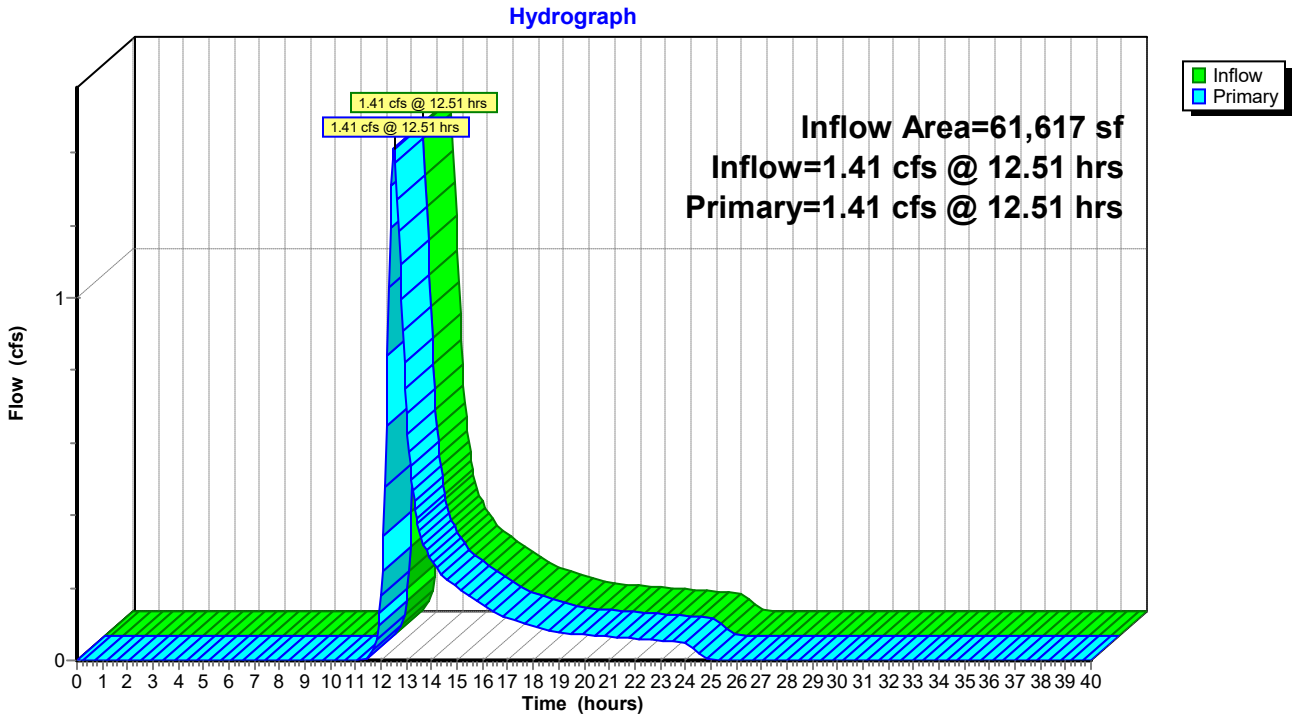


Summary for Link 1L: B Series Wetland

Inflow Area = 61,617 sf, 0.00% Impervious, Inflow Depth = 1.72" for 50 yr event
Inflow = 1.41 cfs @ 12.51 hrs, Volume= 8,810 cf
Primary = 1.41 cfs @ 12.51 hrs, Volume= 8,810 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: B Series Wetland



Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=61,617 sf 0.00% Impervious Runoff Depth=1.90"
Flow Length=240' Tc=32.6 min CN=56 Runoff=1.58 cfs 9,755 cf

Link 1L: B Series Wetland Inflow=1.58 cfs 9,755 cf
Primary=1.58 cfs 9,755 cf

Total Runoff Area = 61,617 sf Runoff Volume = 9,755 cf Average Runoff Depth = 1.90"
100.00% Pervious = 61,617 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S:

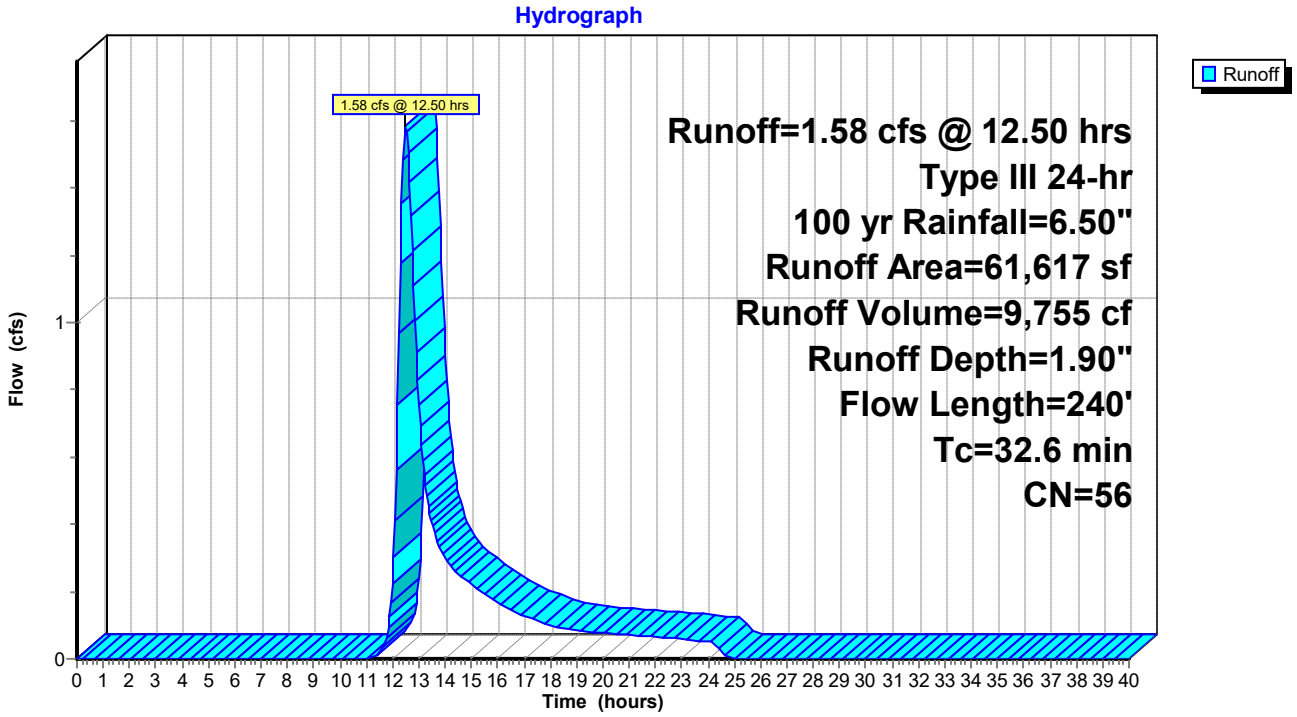
Runoff = 1.58 cfs @ 12.50 hrs, Volume= 9,755 cf, Depth= 1.90"
Routed to Link 1L : B Series Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
7,508	61	>75% Grass cover, Good, HSG B
54,109	55	Woods, Good, HSG B
61,617	56	Weighted Average
61,617		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0080	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.1	140	0.0160	2.04		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
32.6	240	Total			

Subcatchment 1S:

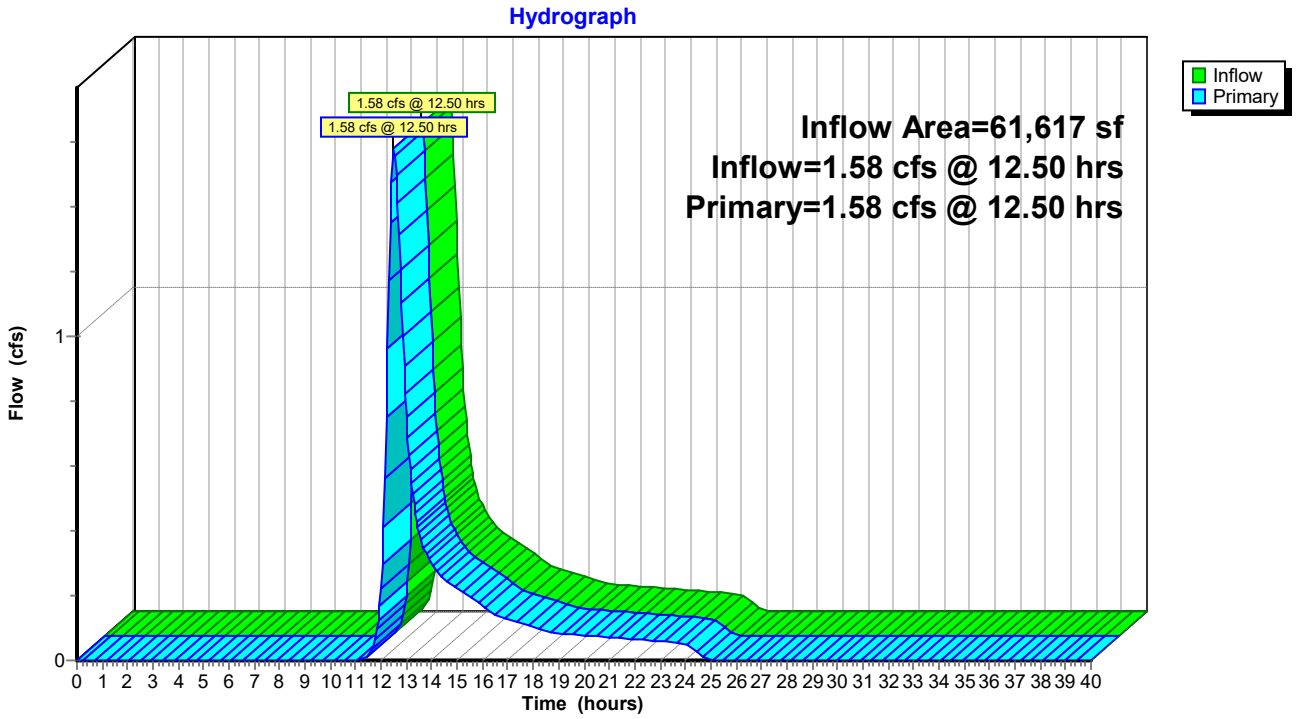


Summary for Link 1L: B Series Wetland

Inflow Area = 61,617 sf, 0.00% Impervious, Inflow Depth = 1.90" for 100 yr event
Inflow = 1.58 cfs @ 12.50 hrs, Volume= 9,755 cf
Primary = 1.58 cfs @ 12.50 hrs, Volume= 9,755 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: B Series Wetland



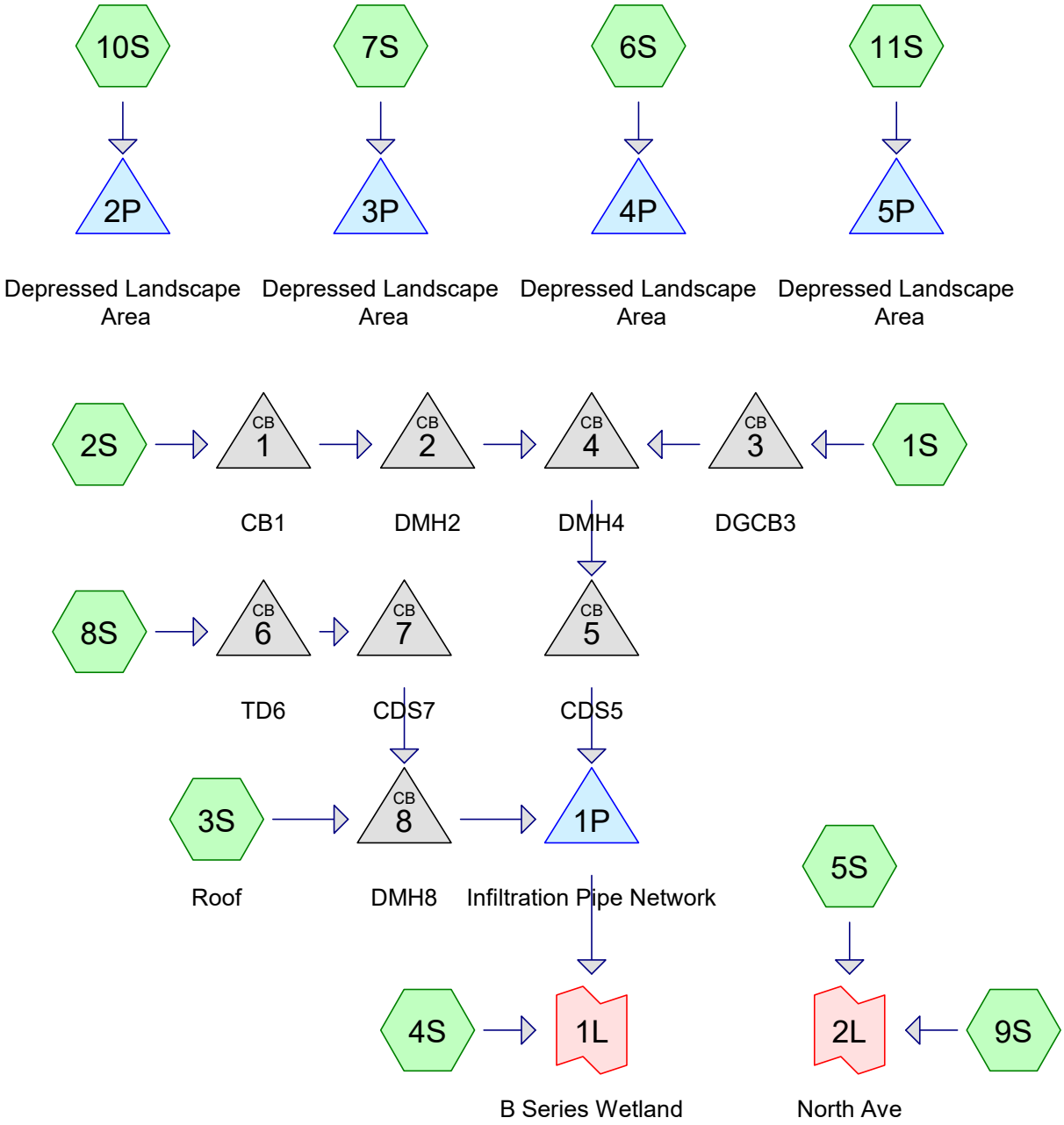
Events for Subcatchment 1S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.10	1,278	0.25
10 yr	4.50	0.56	4,083	0.80
25 yr	5.60	1.08	7,011	1.37
50 yr	6.20	1.41	8,810	1.72
100 yr	**6.50**	**1.58**	**9,755**	**1.90**

Events for Link 1L: B Series Wetland

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2 yr	0.10	0.10	**0.00**
10 yr	0.56	0.56	0.00
25 yr	1.08	1.08	0.00
50 yr	1.41	1.41	0.00
100 yr	**1.58**	**1.58**	0.00

1.9.2 Proposed Condition


10S
7S
6S
11S
2P
3P
4P
5P
Depressed Landscape Area
Depressed Landscape Area
Depressed Landscape Area
Depressed Landscape Area
2S
CB 1
CB 2
CB 4
CB 3
1S
CB1
DMH2
DMH4
DGCB3
8S
CB 6
CB 7
CB 5
TD6
CDS7
CDS5
3S
CB 8
1P
Roof
DMH8
Infiltration Pipe Network
5S
4S
1L
2L
9S
B Series Wetland
North Ave
Subcat
Reach
Pond
Link

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 yr	Type III 24-hr		Default	24.00	1	3.10	2
2	10 yr	Type III 24-hr		Default	24.00	1	4.50	2
3	25 yr	Type III 24-hr		Default	24.00	1	5.60	2
4	50 yr	Type III 24-hr		Default	24.00	1	6.20	2
5	100 yr	Type III 24-hr		Default	24.00	1	6.50	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
15,290	61	>75% Grass cover, Good, HSG B (1S, 2S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S)
24,333	98	Paved parking, HSG B (1S, 2S, 4S, 5S, 6S, 7S, 8S, 9S)
11,756	98	Roofs, HSG B (3S)
10,238	55	Woods, Good, HSG B (4S)
61,617	**82**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
61,617	HSG B	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S
0	HSG C	
0	HSG D	
0	Other	
61,617		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	15,290	0	0	0	15,290	>75% Grass cover, Good	
0	24,333	0	0	0	24,333	Paved parking	
0	11,756	0	0	0	11,756	Roofs	
0	10,238	0	0	0	10,238	Woods, Good	
0	**61,617**	**0**	**0**	**0**	**61,617**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	1	85.95	84.60	135.0	0.0100	0.012	0.0	12.0	0.0
2	1P	85.33	84.25	93.0	0.0116	0.010	0.0	8.0	0.0
3	2	84.60	84.29	31.0	0.0100	0.012	0.0	12.0	0.0
4	3	84.32	84.29	3.0	0.0100	0.012	0.0	12.0	0.0
5	4	84.29	84.25	4.0	0.0100	0.012	0.0	12.0	0.0
6	5	84.25	84.25	6.5	0.0000	0.012	0.0	12.0	0.0
7	6	85.00	84.60	39.0	0.0103	0.012	0.0	8.0	0.0
8	7	84.60	84.58	2.0	0.0100	0.012	0.0	8.0	0.0
9	8	84.25	84.25	12.0	0.0000	0.012	0.0	12.0	0.0

Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=15,827 sf 87.81% Impervious Runoff Depth=2.35"
Tc=6.0 min CN=93 Runoff=0.95 cfs 3,099 cf

Subcatchment 2S: Runoff Area=4,033 sf 74.14% Impervious Runoff Depth=1.91"
Tc=6.0 min CN=88 Runoff=0.20 cfs 641 cf

Subcatchment 3S: Roof Runoff Area=11,756 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=0.79 cfs 2,810 cf

Subcatchment 4S: Runoff Area=15,476 sf 14.53% Impervious Runoff Depth=0.44"
Flow Length=36' Slope=0.0170 '/' Tc=10.3 min CN=62 Runoff=0.10 cfs 566 cf

Subcatchment 5S: Runoff Area=4,281 sf 26.23% Impervious Runoff Depth=0.82"
Tc=6.0 min CN=71 Runoff=0.08 cfs 292 cf

Subcatchment 6S: Runoff Area=1,635 sf 41.77% Impervious Runoff Depth=1.08"
Tc=6.0 min CN=76 Runoff=0.05 cfs 148 cf

Subcatchment 7S: Runoff Area=1,660 sf 41.14% Impervious Runoff Depth=1.08"
Tc=6.0 min CN=76 Runoff=0.05 cfs 150 cf

Subcatchment 8S: Runoff Area=2,932 sf 84.21% Impervious Runoff Depth=2.26"
Tc=6.0 min CN=92 Runoff=0.17 cfs 551 cf

Subcatchment 9S: Runoff Area=543 sf 44.20% Impervious Runoff Depth=1.14"
Tc=6.0 min CN=77 Runoff=0.02 cfs 52 cf

Subcatchment 10S: Runoff Area=2,088 sf 0.00% Impervious Runoff Depth=0.40"
Tc=6.0 min CN=61 Runoff=0.01 cfs 70 cf

Subcatchment 11S: Runoff Area=1,386 sf 0.00% Impervious Runoff Depth=0.40"
Tc=6.0 min CN=61 Runoff=0.01 cfs 47 cf

Pond 1: CB1 Peak Elev=86.17' Inflow=0.20 cfs 641 cf
12.0" Round Culvert n=0.012 L=135.0' S=0.0100 '/' Outflow=0.20 cfs 641 cf

Pond 1P: Infiltration Pipe Network Peak Elev=84.74' Storage=2,310 cf Inflow=2.11 cfs 7,101 cf
Discarded=0.25 cfs 7,101 cf Primary=0.00 cfs 0 cf Outflow=0.25 cfs 7,101 cf

Pond 2: DMH2 Peak Elev=85.10' Inflow=0.20 cfs 641 cf
12.0" Round Culvert n=0.012 L=31.0' S=0.0100 '/' Outflow=0.20 cfs 641 cf

Pond 2P: Depressed Landscape Area Peak Elev=85.04' Storage=9 cf Inflow=0.01 cfs 70 cf
Outflow=0.01 cfs 70 cf

Pond 3: DGCB3 Peak Elev=85.13' Inflow=0.95 cfs 3,099 cf
12.0" Round Culvert n=0.012 L=3.0' S=0.0100 '/' Outflow=0.95 cfs 3,099 cf

Pond 3P: Depressed Landscape Area Peak Elev=86.17' Storage=33 cf Inflow=0.05 cfs 150 cf
Outflow=0.01 cfs 150 cf

Pond 4: DMH4 Peak Elev=85.09' Inflow=1.15 cfs 3,740 cf
12.0" Round Culvert n=0.012 L=4.0' S=0.0100 '/' Outflow=1.15 cfs 3,740 cf

Pond 4P: Depressed Landscape Area Peak Elev=86.18' Storage=34 cf Inflow=0.05 cfs 148 cf
Outflow=0.01 cfs 148 cf

Pond 5: CDS5 Peak Elev=84.97' Inflow=1.15 cfs 3,740 cf
12.0" Round Culvert n=0.012 L=6.5' S=0.0000 '/' Outflow=1.15 cfs 3,740 cf

Pond 5P: Depressed Landscape Area Peak Elev=85.00' Storage=1 cf Inflow=0.01 cfs 47 cf
Outflow=0.01 cfs 47 cf

Pond 6: TD6 Peak Elev=85.24' Inflow=0.17 cfs 551 cf
8.0" Round Culvert n=0.012 L=39.0' S=0.0103 '/' Outflow=0.17 cfs 551 cf

Pond 7: CDS7 Peak Elev=84.95' Inflow=0.17 cfs 551 cf
8.0" Round Culvert n=0.012 L=2.0' S=0.0100 '/' Outflow=0.17 cfs 551 cf

Pond 8: DMH8 Peak Elev=84.92' Inflow=0.96 cfs 3,361 cf
12.0" Round Culvert n=0.012 L=12.0' S=0.0000 '/' Outflow=0.96 cfs 3,361 cf

Link 1L: B Series Wetland Inflow=0.10 cfs 566 cf
Primary=0.10 cfs 566 cf

Link 2L: North Ave Inflow=0.10 cfs 344 cf
Primary=0.10 cfs 344 cf

Total Runoff Area = 61,617 sf Runoff Volume = 8,425 cf Average Runoff Depth = 1.64"
41.43% Pervious = 25,528 sf 58.57% Impervious = 36,089 sf

Summary for Subcatchment 1S:

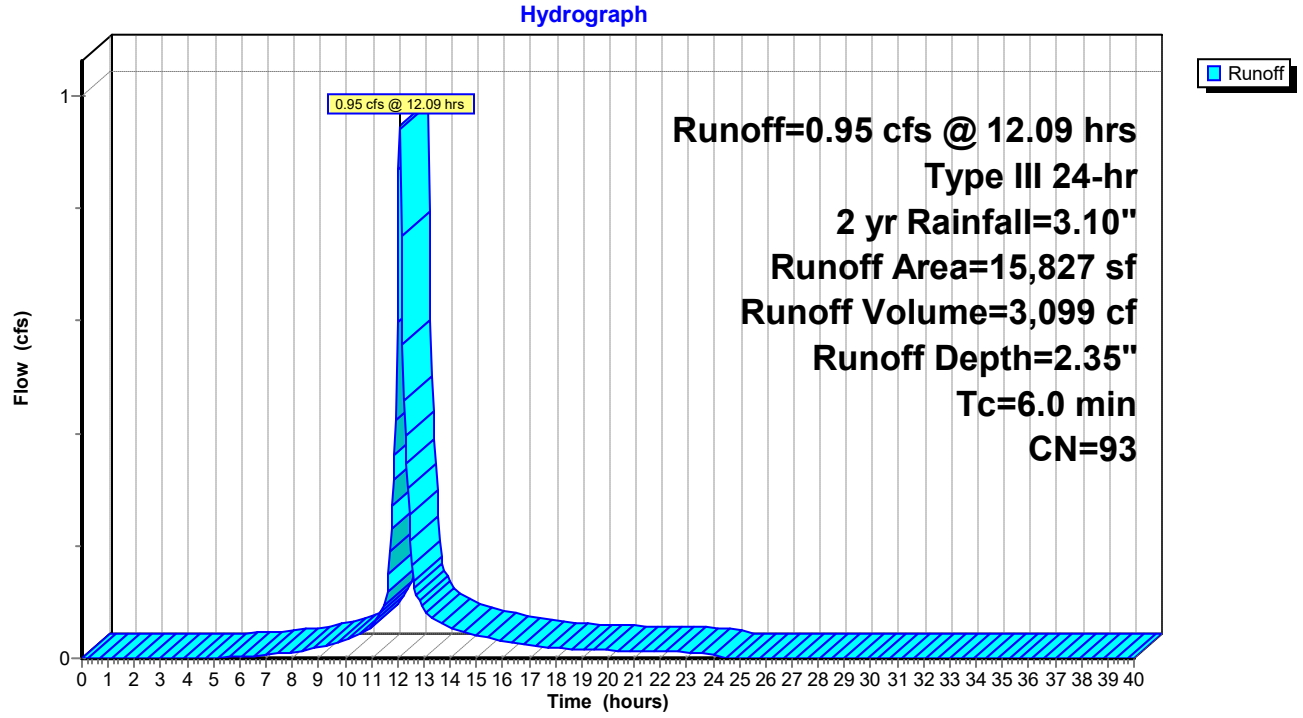
Runoff = 0.95 cfs @ 12.09 hrs, Volume= 3,099 cf, Depth= 2.35"
Routed to Pond 3 : DGCB3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
13,897	98	Paved parking, HSG B
1,930	61	>75% Grass cover, Good, HSG B
15,827	93	Weighted Average
1,930		12.19% Pervious Area
13,897		87.81% Impervious Area

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

Subcatchment 1S:



Summary for Subcatchment 2S:

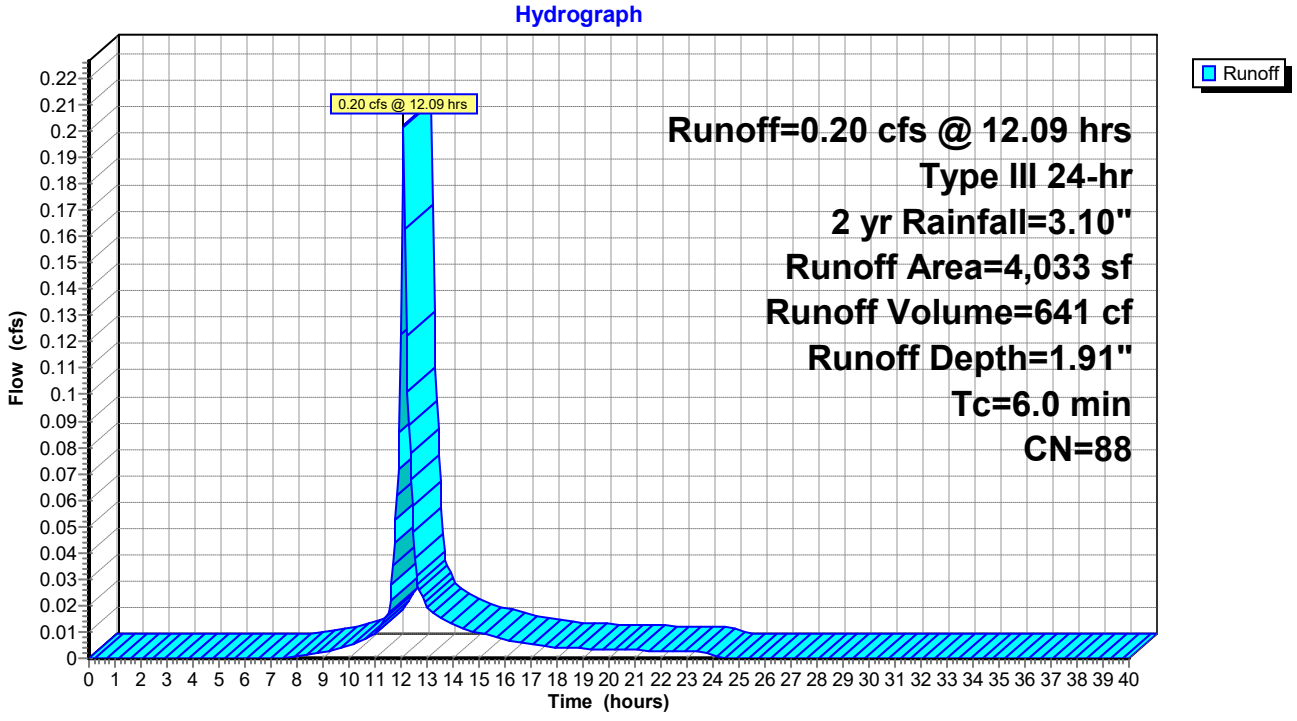
Runoff = 0.20 cfs @ 12.09 hrs, Volume= 641 cf, Depth= 1.91"
Routed to Pond 1 : CB1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
2,990	98	Paved parking, HSG B
1,043	61	>75% Grass cover, Good, HSG B
4,033	88	Weighted Average
1,043		25.86% Pervious Area
2,990		74.14% Impervious Area

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

Subcatchment 2S:



Summary for Subcatchment 3S: Roof

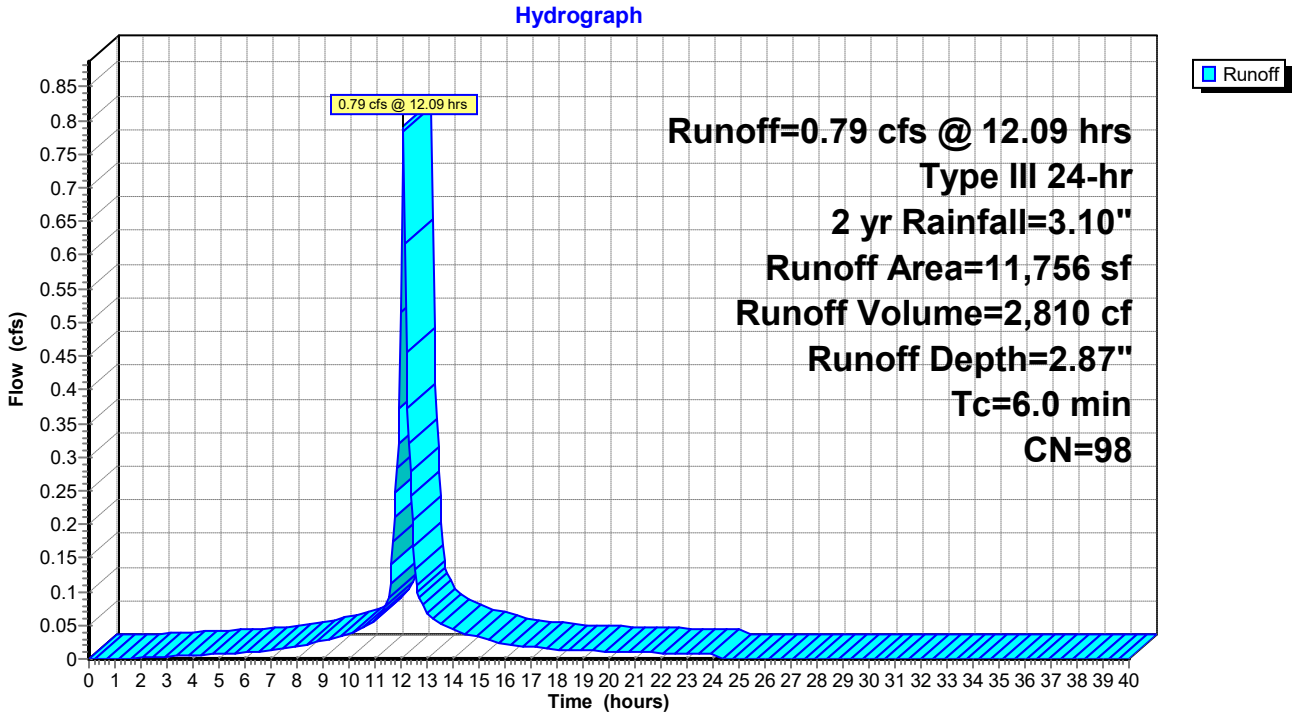
Runoff = 0.79 cfs @ 12.09 hrs, Volume= 2,810 cf, Depth= 2.87"
Routed to Pond 8 : DMH8

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
11,756	98	Roofs, HSG B
11,756		100.00% Impervious Area

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

Subcatchment 3S: Roof



Summary for Subcatchment 4S:

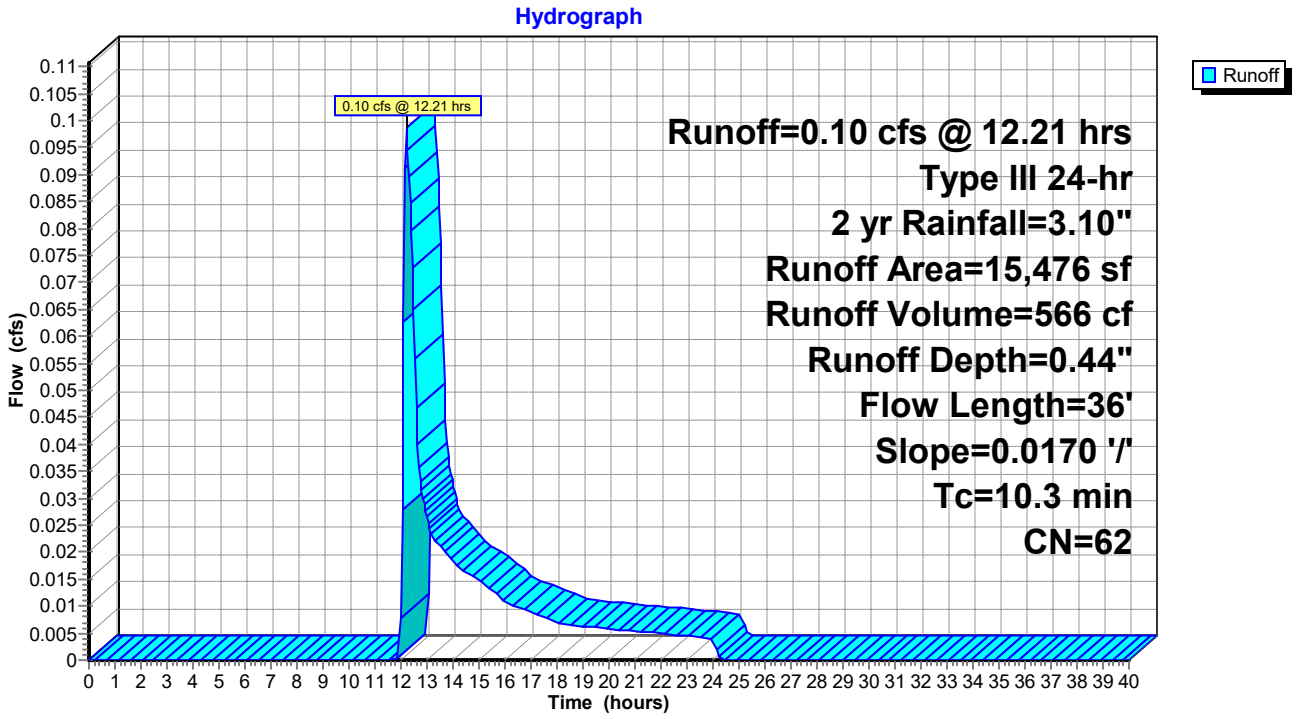
Runoff = 0.10 cfs @ 12.21 hrs, Volume= 566 cf, Depth= 0.44"
Routed to Link 1L : B Series Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
10,238	55	Woods, Good, HSG B
2,990	61	>75% Grass cover, Good, HSG B
2,248	98	Paved parking, HSG B
15,476	62	Weighted Average
13,228		85.47% Pervious Area
2,248		14.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	36	0.0170	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"

Subcatchment 4S:



Summary for Subcatchment 5S:

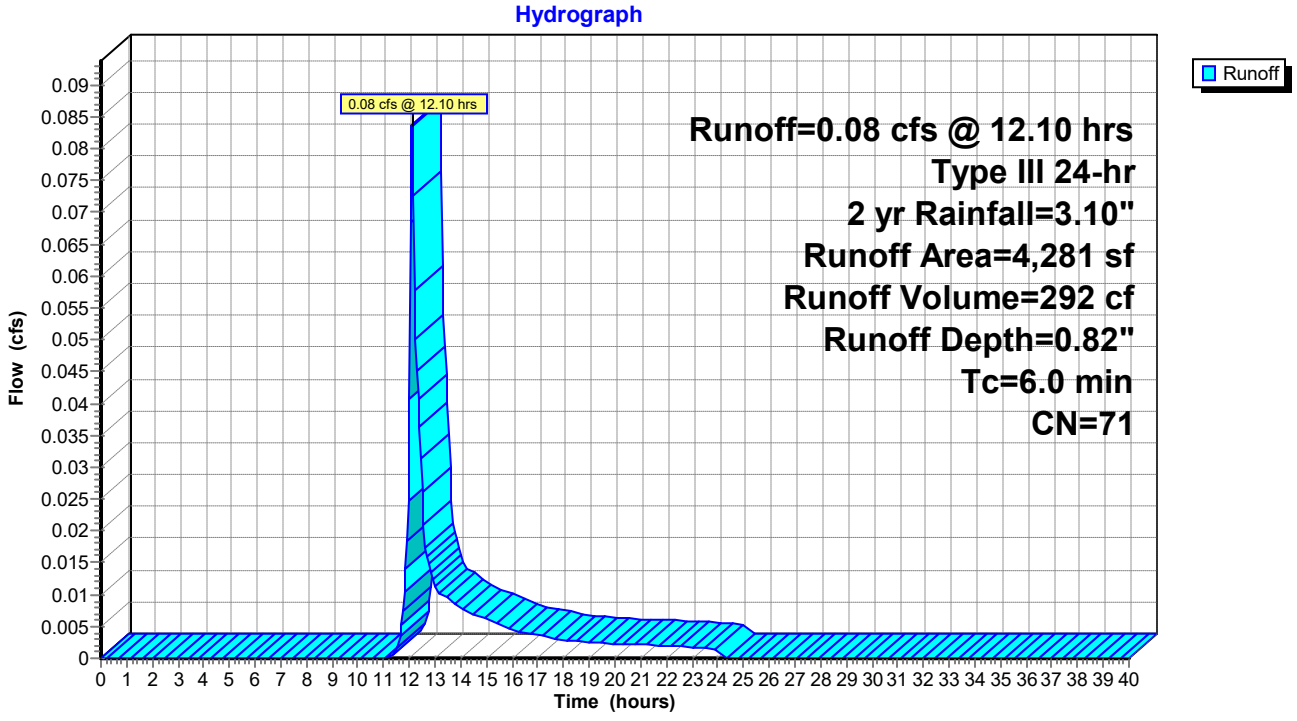
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 292 cf, Depth= 0.82"
Routed to Link 2L : North Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
1,123	98	Paved parking, HSG B
3,158	61	>75% Grass cover, Good, HSG B
4,281	71	Weighted Average
3,158		73.77% Pervious Area
1,123		26.23% Impervious Area

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

Subcatchment 5S:



Summary for Subcatchment 6S:

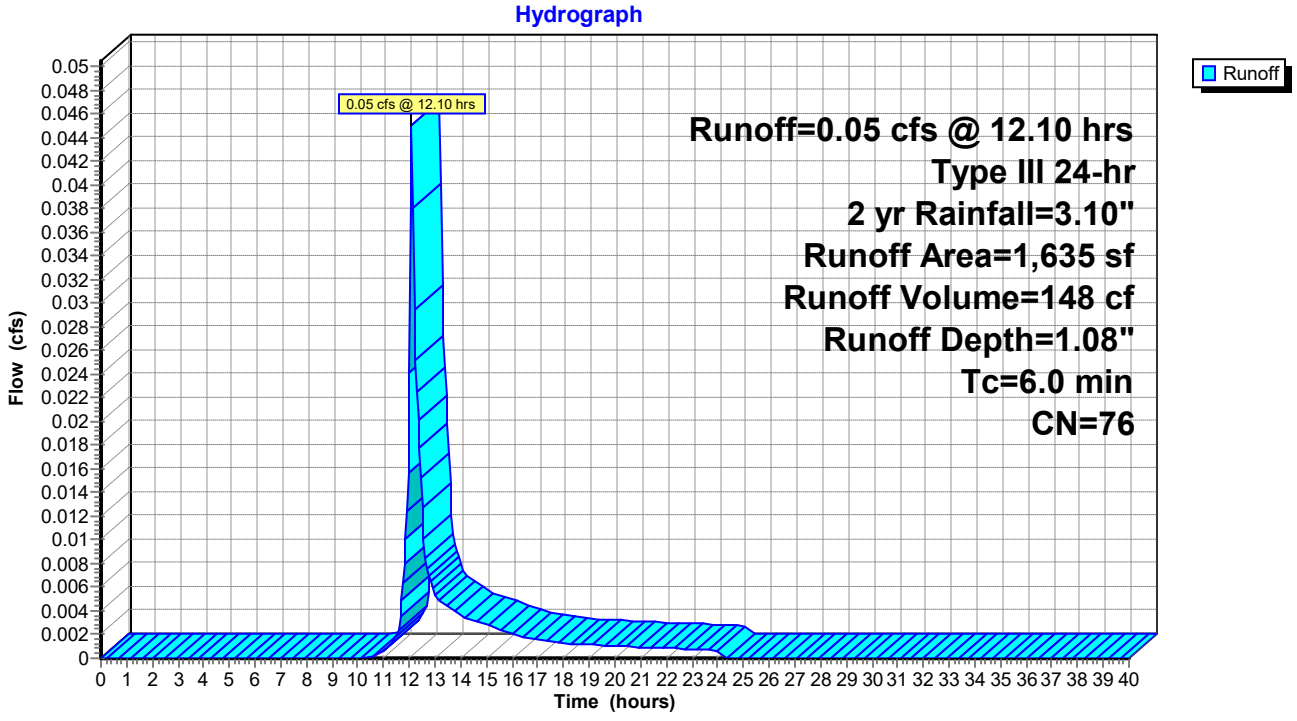
Runoff = 0.05 cfs @ 12.10 hrs, Volume= 148 cf, Depth= 1.08"
Routed to Pond 4P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
952	61	>75% Grass cover, Good, HSG B
683	98	Paved parking, HSG B
1,635	76	Weighted Average
952		58.23% Pervious Area
683		41.77% Impervious Area

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

Subcatchment 6S:



Summary for Subcatchment 7S:

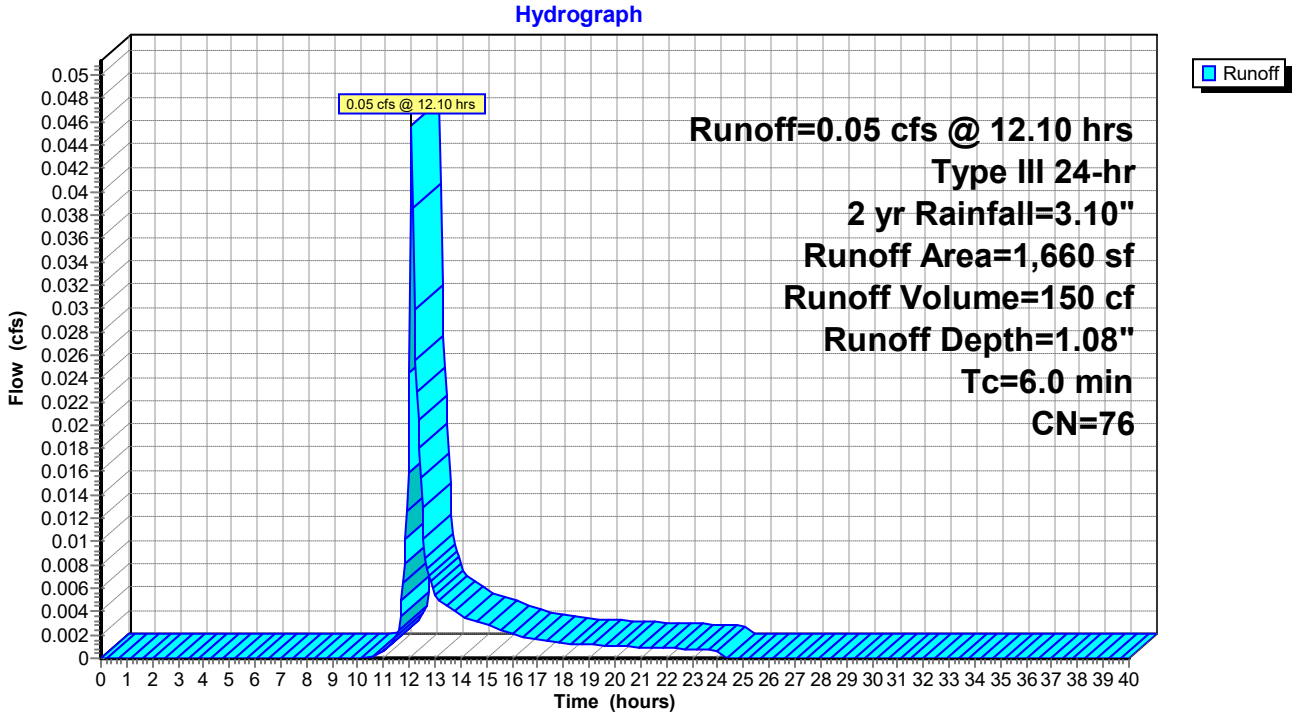
Runoff = 0.05 cfs @ 12.10 hrs, Volume= 150 cf, Depth= 1.08"
Routed to Pond 3P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
977	61	>75% Grass cover, Good, HSG B
683	98	Paved parking, HSG B
1,660	76	Weighted Average
977		58.86% Pervious Area
683		41.14% Impervious Area

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

Subcatchment 7S:



Summary for Subcatchment 8S:

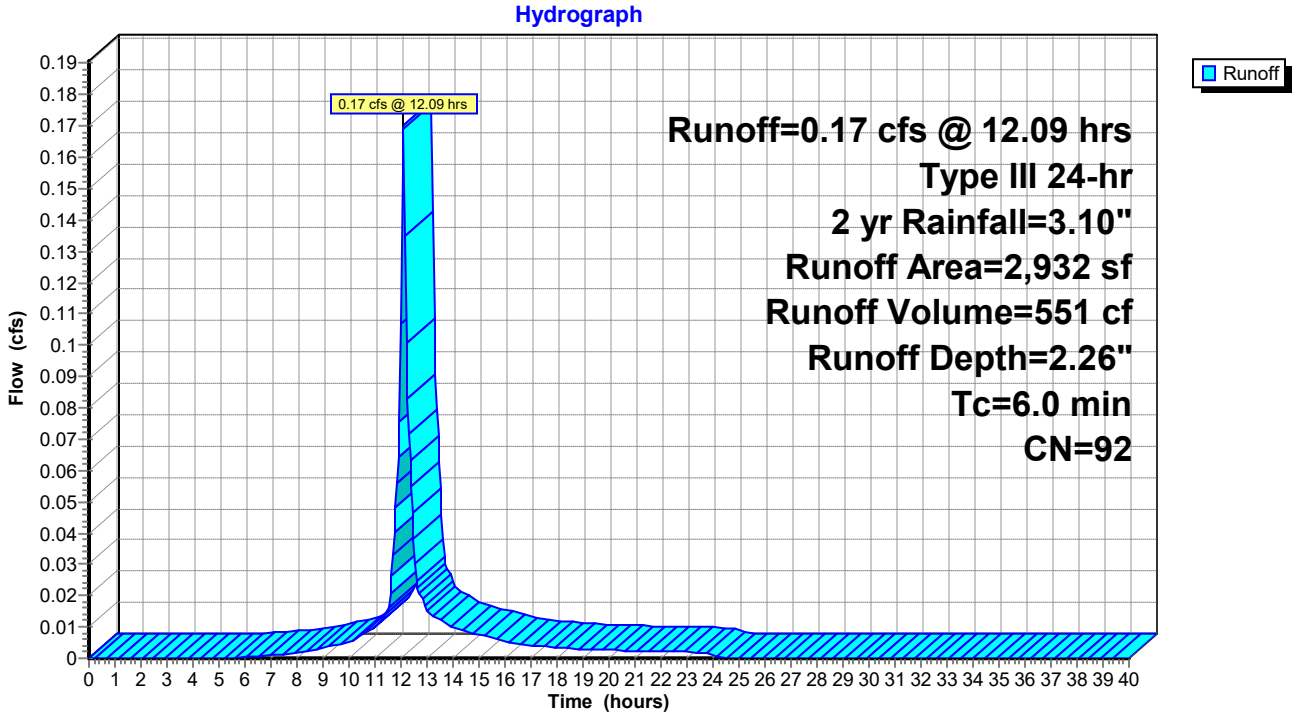
Runoff = 0.17 cfs @ 12.09 hrs, Volume= 551 cf, Depth= 2.26"
Routed to Pond 6 : TD6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
463	61	>75% Grass cover, Good, HSG B
2,469	98	Paved parking, HSG B
2,932	92	Weighted Average
463		15.79% Pervious Area
2,469		84.21% Impervious Area

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

Subcatchment 8S:



Summary for Subcatchment 9S:

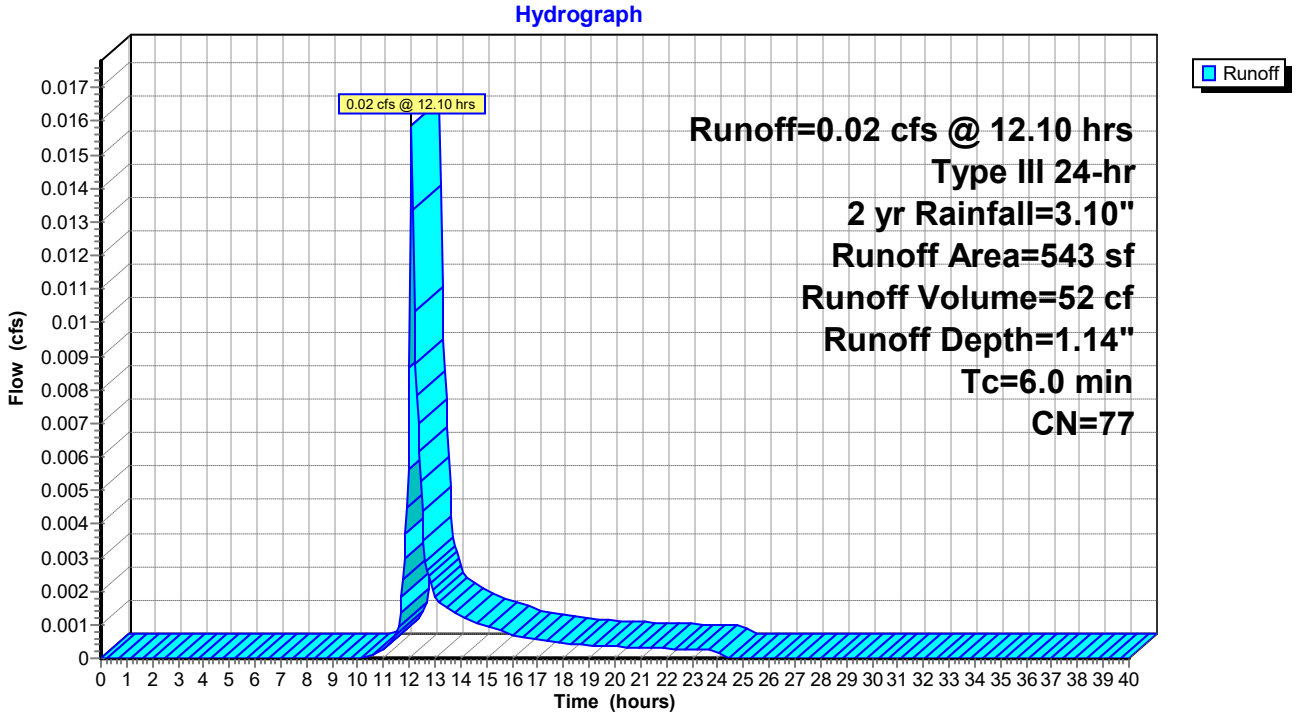
Runoff = 0.02 cfs @ 12.10 hrs, Volume= 52 cf, Depth= 1.14"
Routed to Link 2L : North Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
303	61	>75% Grass cover, Good, HSG B
240	98	Paved parking, HSG B
543	77	Weighted Average
303		55.80% Pervious Area
240		44.20% Impervious Area

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

Subcatchment 9S:



Summary for Subcatchment 10S:

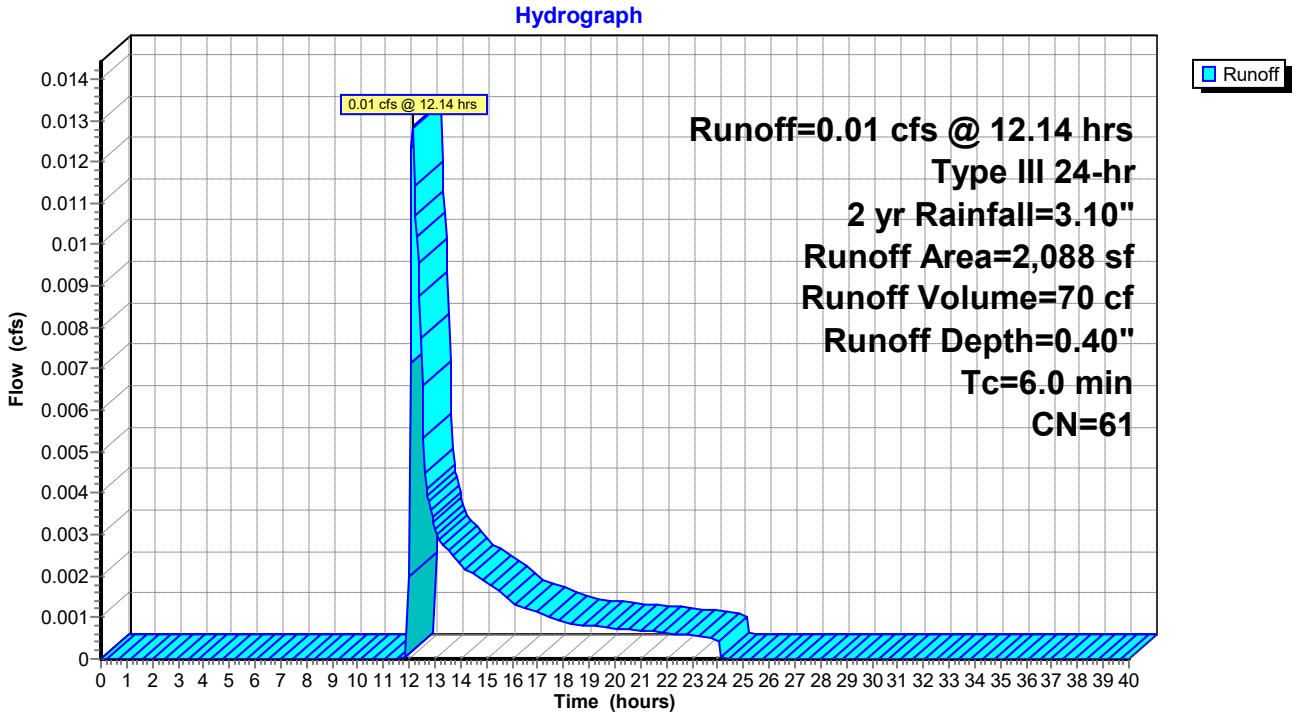
Runoff = 0.01 cfs @ 12.14 hrs, Volume= 70 cf, Depth= 0.40"
Routed to Pond 2P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
2,088	61	>75% Grass cover, Good, HSG B
2,088		100.00% Pervious Area

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

Subcatchment 10S:



Summary for Subcatchment 11S:

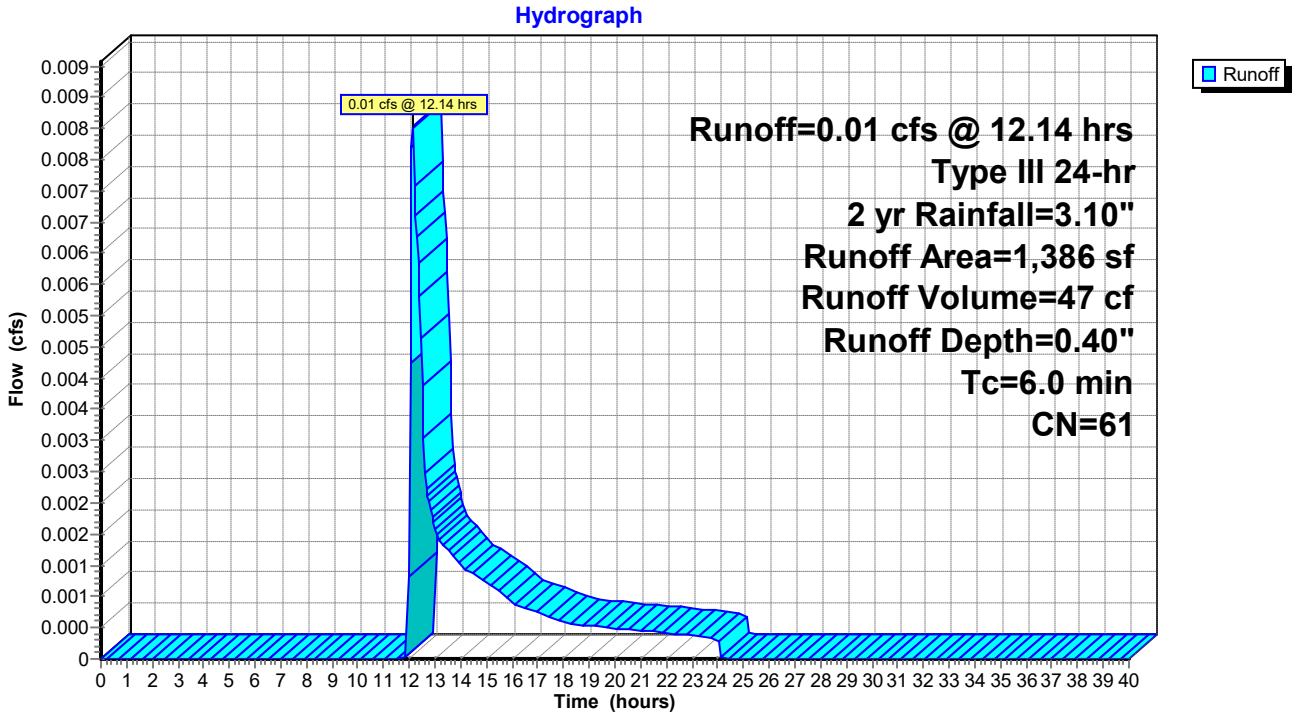
Runoff = 0.01 cfs @ 12.14 hrs, Volume= 47 cf, Depth= 0.40"
Routed to Pond 5P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
1,386	61	>75% Grass cover, Good, HSG B
1,386		100.00% Pervious Area

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

Subcatchment 11S:



Summary for Pond 1: CB1

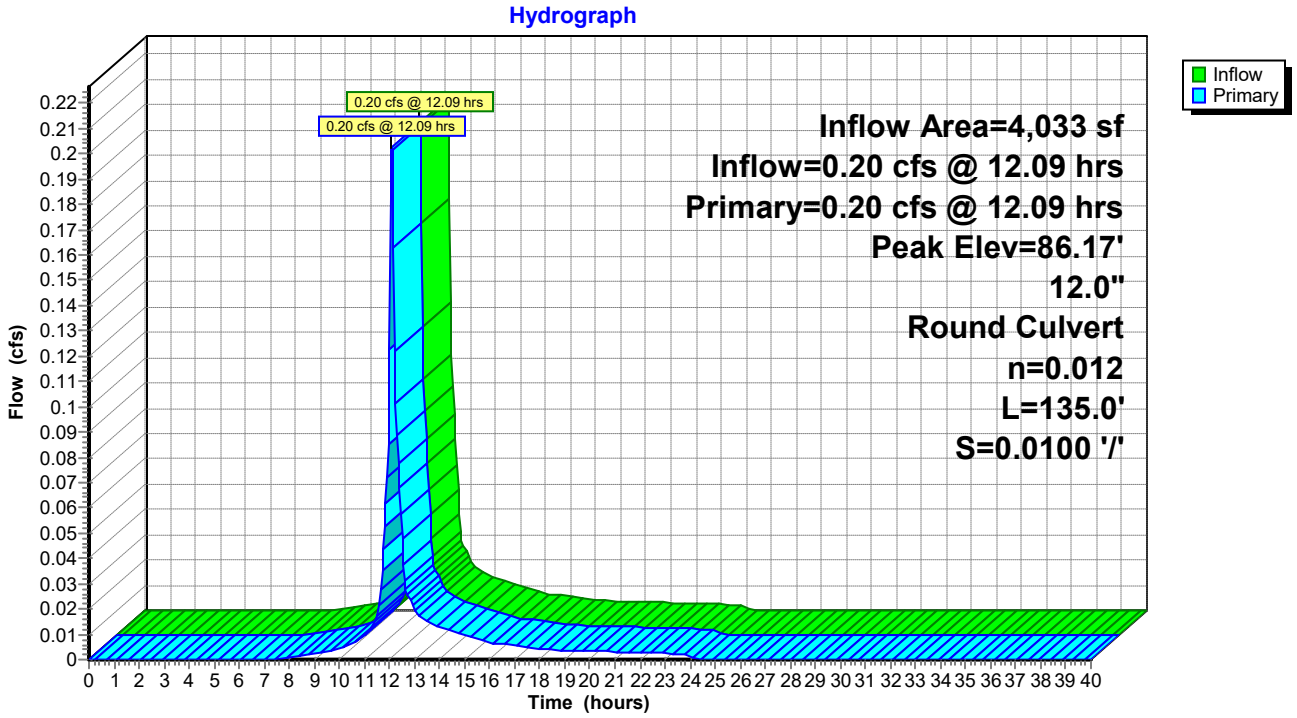
Inflow Area = 4,033 sf, 74.14% Impervious, Inflow Depth = 1.91" for 2 yr event
Inflow = 0.20 cfs @ 12.09 hrs, Volume= 641 cf
Outflow = 0.20 cfs @ 12.09 hrs, Volume= 641 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.20 cfs @ 12.09 hrs, Volume= 641 cf
Routed to Pond 2 : DMH2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.17' @ 12.09 hrs
Flood Elev= 88.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.95'	**12.0" Round Culvert** L= 135.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.95' / 84.60' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.19 cfs @ 12.09 hrs HW=86.17' TW=85.00' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.19 cfs @ 2.33 fps)

Pond 1: CB1



Summary for Pond 1P: Infiltration Pipe Network

Inflow Area = 34,548 sf, 90.05% Impervious, Inflow Depth = 2.47" for 2 yr event
Inflow = 2.11 cfs @ 12.09 hrs, Volume= 7,101 cf
Outflow = 0.25 cfs @ 11.70 hrs, Volume= 7,101 cf, Atten= 88%, Lag= 0.0 min
Discarded = 0.25 cfs @ 11.70 hrs, Volume= 7,101 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link 1L : B Series Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 84.74' @ 12.72 hrs Surf.Area= 4,503 sf Storage= 2,310 cf

Plug-Flow detention time= 62.4 min calculated for 7,092 cf (100% of inflow)
Center-of-Mass det. time= 62.3 min (844.0 - 781.7)

Volume	Invert	Avail.Storage	Storage Description
#1	83.75'	3,422 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 12,383 cf Overall - 3,828 cf Embedded = 8,555 cf x 40.0% Voids
#2	84.25'	3,828 cf	**Custom Stage Data** Listed below Inside #1
		7,250 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
83.75	4,503	0	0
86.50	4,503	12,383	12,383

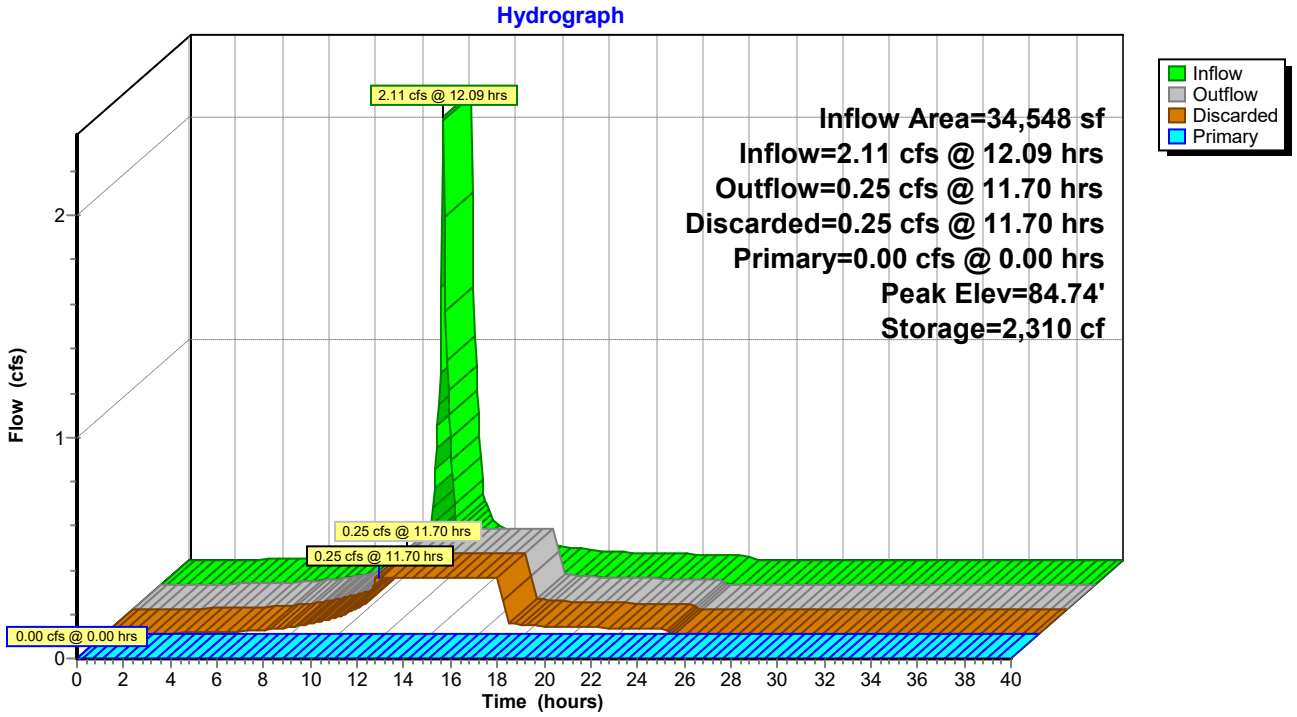
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
84.25	0	0
84.75	902	902
85.25	1,359	2,261
85.75	1,231	3,492
86.00	336	3,828

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.75'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	85.33'	**8.0" Round Culvert** L= 93.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.33' / 84.25' S= 0.0116 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.25 cfs @ 11.70 hrs HW=83.78' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=83.75' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Pond 1P: Infiltration Pipe Network



Summary for Pond 2: DMH2

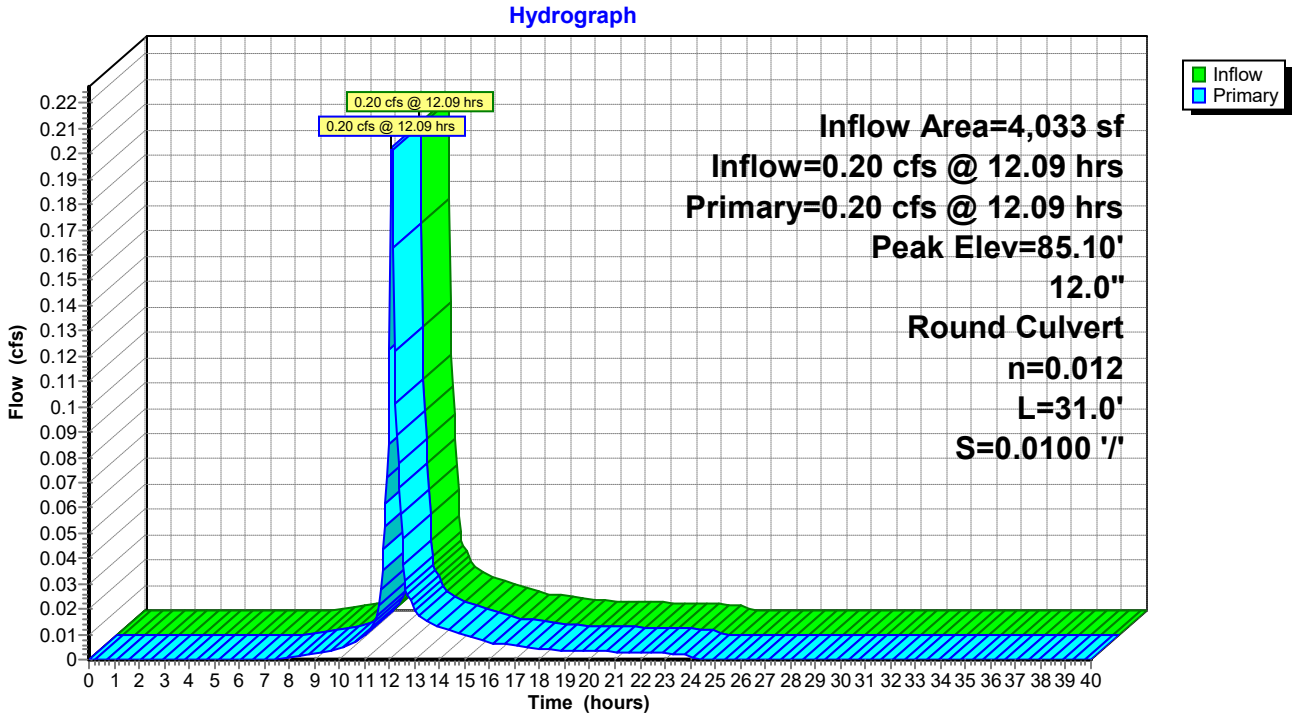
Inflow Area = 4,033 sf, 74.14% Impervious, Inflow Depth = 1.91" for 2 yr event
Inflow = 0.20 cfs @ 12.09 hrs, Volume= 641 cf
Outflow = 0.20 cfs @ 12.09 hrs, Volume= 641 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.20 cfs @ 12.09 hrs, Volume= 641 cf
Routed to Pond 4 : DMH4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.10' @ 12.16 hrs
Flood Elev= 88.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.60'	**12.0" Round Culvert** L= 31.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.60' / 84.29' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.00' TW=85.06' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 2: DMH2



Summary for Pond 2P: Depressed Landscape Area

Inflow Area = 2,088 sf, 0.00% Impervious, Inflow Depth = 0.40" for 2 yr event
Inflow = 0.01 cfs @ 12.14 hrs, Volume= 70 cf
Outflow = 0.01 cfs @ 12.56 hrs, Volume= 70 cf, Atten= 59%, Lag= 25.3 min
Discarded = 0.01 cfs @ 12.56 hrs, Volume= 70 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.04' @ 12.56 hrs Surf.Area= 222 sf Storage= 9 cf

Plug-Flow detention time= 12.4 min calculated for 70 cf (100% of inflow)
Center-of-Mass det. time= 12.3 min (931.3 - 919.0)

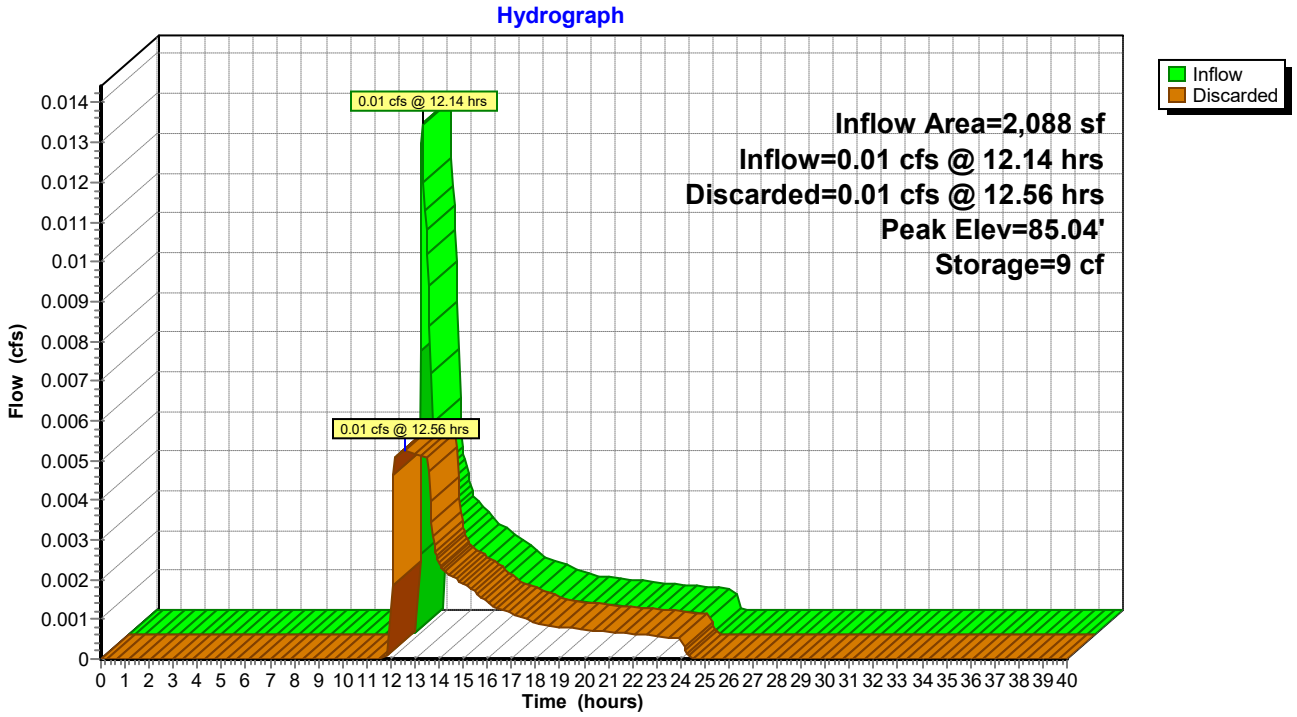
Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	210	0	0
86.00	488	349	349

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 12.56 hrs HW=85.04' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 2P: Depressed Landscape Area



Summary for Pond 3: DGCB3

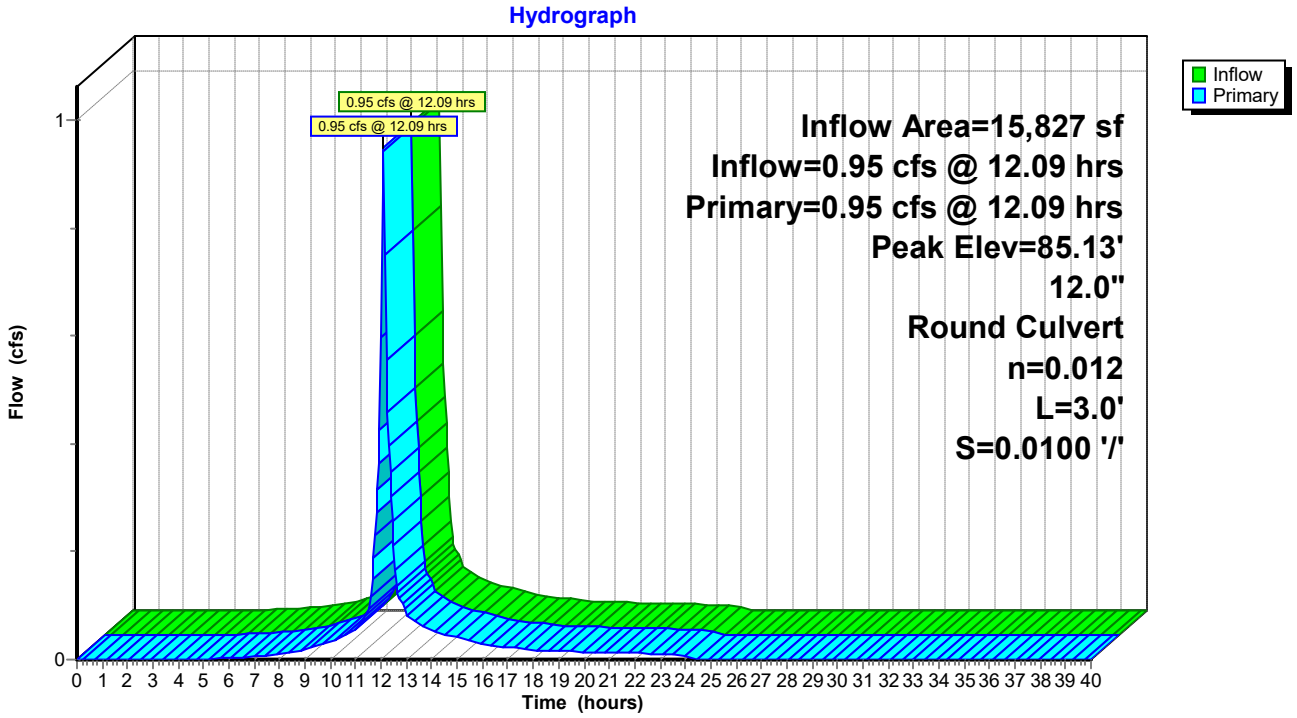
Inflow Area = 15,827 sf, 87.81% Impervious, Inflow Depth = 2.35" for 2 yr event
Inflow = 0.95 cfs @ 12.09 hrs, Volume= 3,099 cf
Outflow = 0.95 cfs @ 12.09 hrs, Volume= 3,099 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.95 cfs @ 12.09 hrs, Volume= 3,099 cf
Routed to Pond 4 : DMH4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.13' @ 12.16 hrs
Flood Elev= 87.33'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.32'	**12.0" Round Culvert** L= 3.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.32' / 84.29' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.10 cfs @ 12.09 hrs HW=85.06' TW=85.05' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.10 cfs @ 0.22 fps)

Pond 3: DGCB3



Summary for Pond 3P: Depressed Landscape Area

Inflow Area = 1,660 sf, 41.14% Impervious, Inflow Depth = 1.08" for 2 yr event
Inflow = 0.05 cfs @ 12.10 hrs, Volume= 150 cf
Outflow = 0.01 cfs @ 12.52 hrs, Volume= 150 cf, Atten= 74%, Lag= 25.4 min
Discarded = 0.01 cfs @ 12.52 hrs, Volume= 150 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.17' @ 12.52 hrs Surf.Area= 210 sf Storage= 33 cf

Plug-Flow detention time= 17.9 min calculated for 150 cf (100% of inflow)
Center-of-Mass det. time= 17.9 min (875.3 - 857.5)

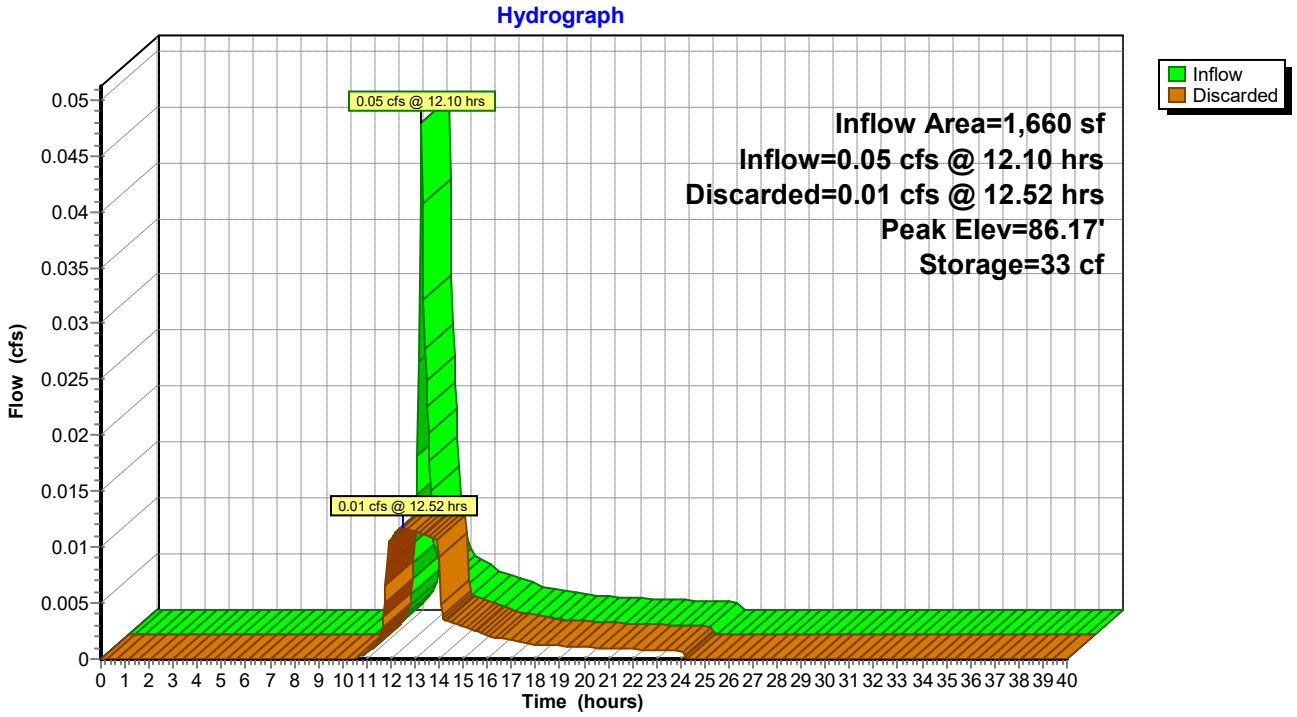
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	256 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
86.00	187	0	0
87.00	324	256	256

Device	Routing	Invert	Outlet Devices
#1	Discarded	86.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 12.52 hrs HW=86.17' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 3P: Depressed Landscape Area



Summary for Pond 4: DMH4

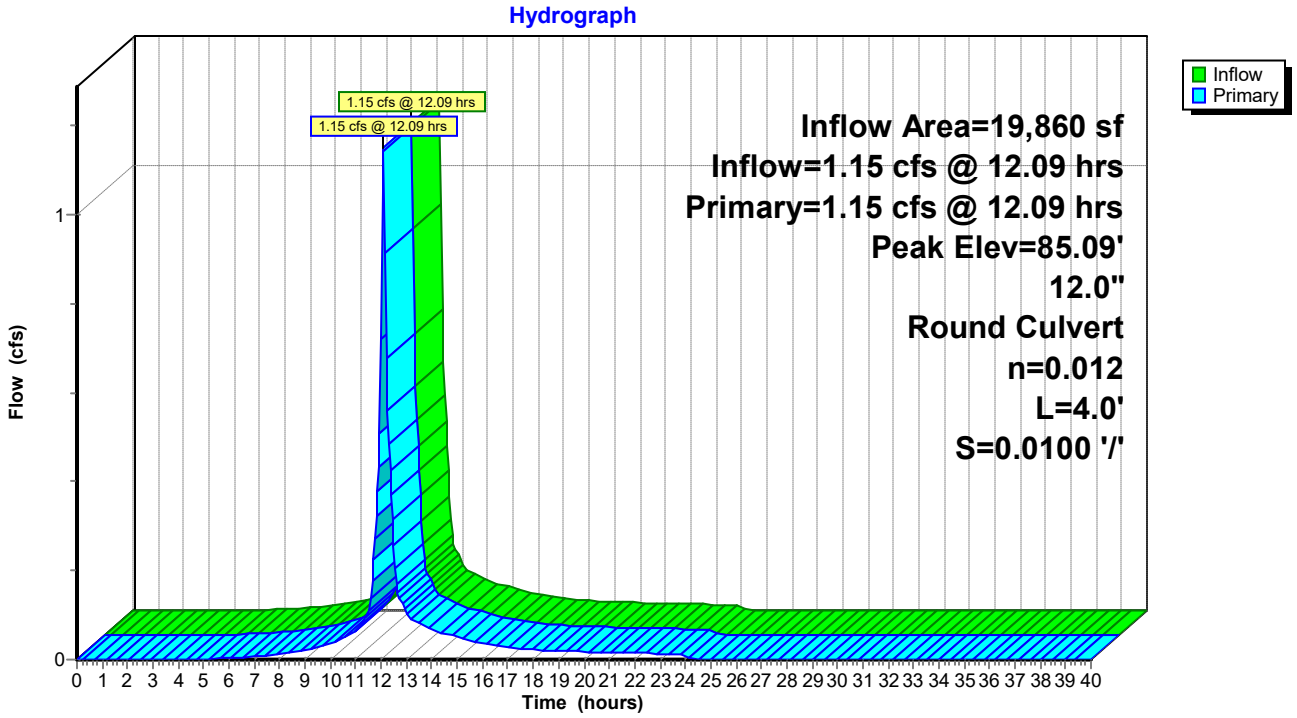
Inflow Area = 19,860 sf, 85.03% Impervious, Inflow Depth = 2.26" for 2 yr event
Inflow = 1.15 cfs @ 12.09 hrs, Volume= 3,740 cf
Outflow = 1.15 cfs @ 12.09 hrs, Volume= 3,740 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.15 cfs @ 12.09 hrs, Volume= 3,740 cf
Routed to Pond 5 : CDS5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.09' @ 12.12 hrs
Flood Elev= 87.36'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.29'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.29' / 84.25' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.90 cfs @ 12.09 hrs HW=85.06' TW=84.96' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.90 cfs @ 1.92 fps)

Pond 4: DMH4



Summary for Pond 4P: Depressed Landscape Area

Inflow Area = 1,635 sf, 41.77% Impervious, Inflow Depth = 1.08" for 2 yr event
Inflow = 0.05 cfs @ 12.10 hrs, Volume= 148 cf
Outflow = 0.01 cfs @ 12.53 hrs, Volume= 148 cf, Atten= 76%, Lag= 26.1 min
Discarded = 0.01 cfs @ 12.53 hrs, Volume= 148 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.18' @ 12.53 hrs Surf.Area= 197 sf Storage= 34 cf

Plug-Flow detention time= 19.9 min calculated for 148 cf (100% of inflow)
Center-of-Mass det. time= 19.8 min (877.3 - 857.5)

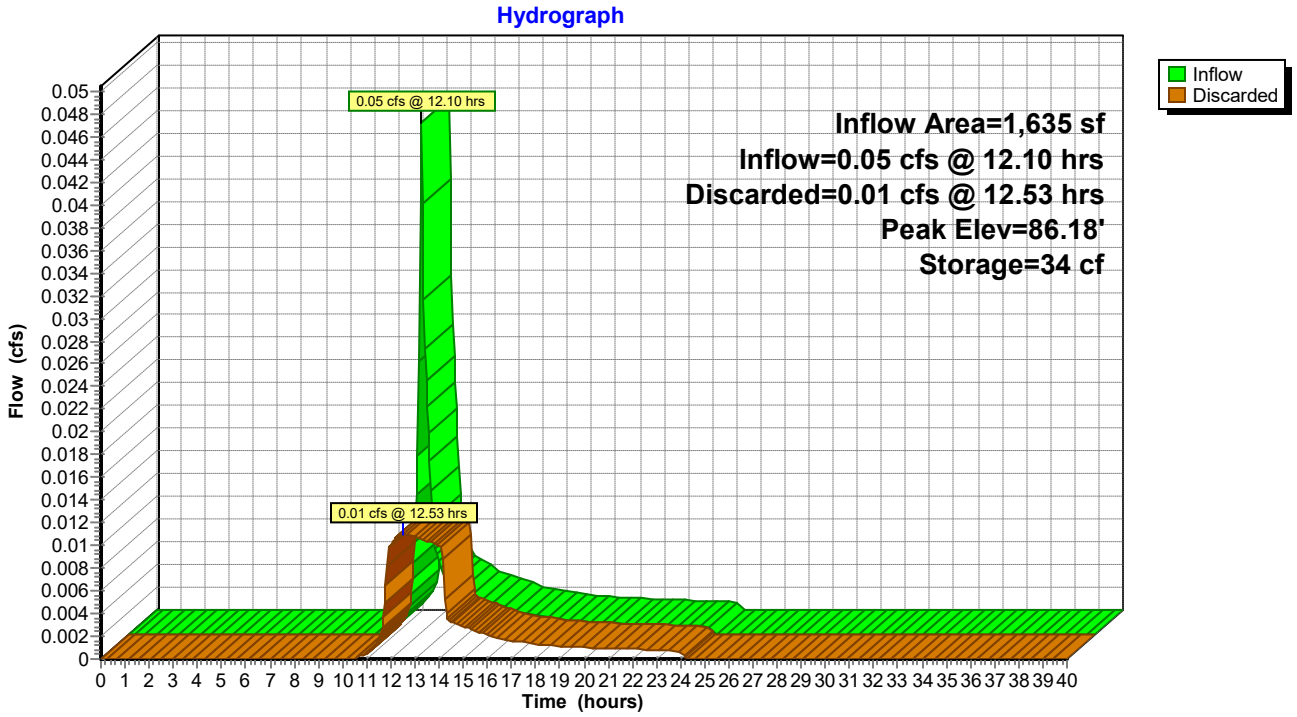
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	234 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
86.00	175	0	0
87.00	293	234	234

Device	Routing	Invert	Outlet Devices
#1	Discarded	86.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 12.53 hrs HW=86.18' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 4P: Depressed Landscape Area



Summary for Pond 5: CDS5

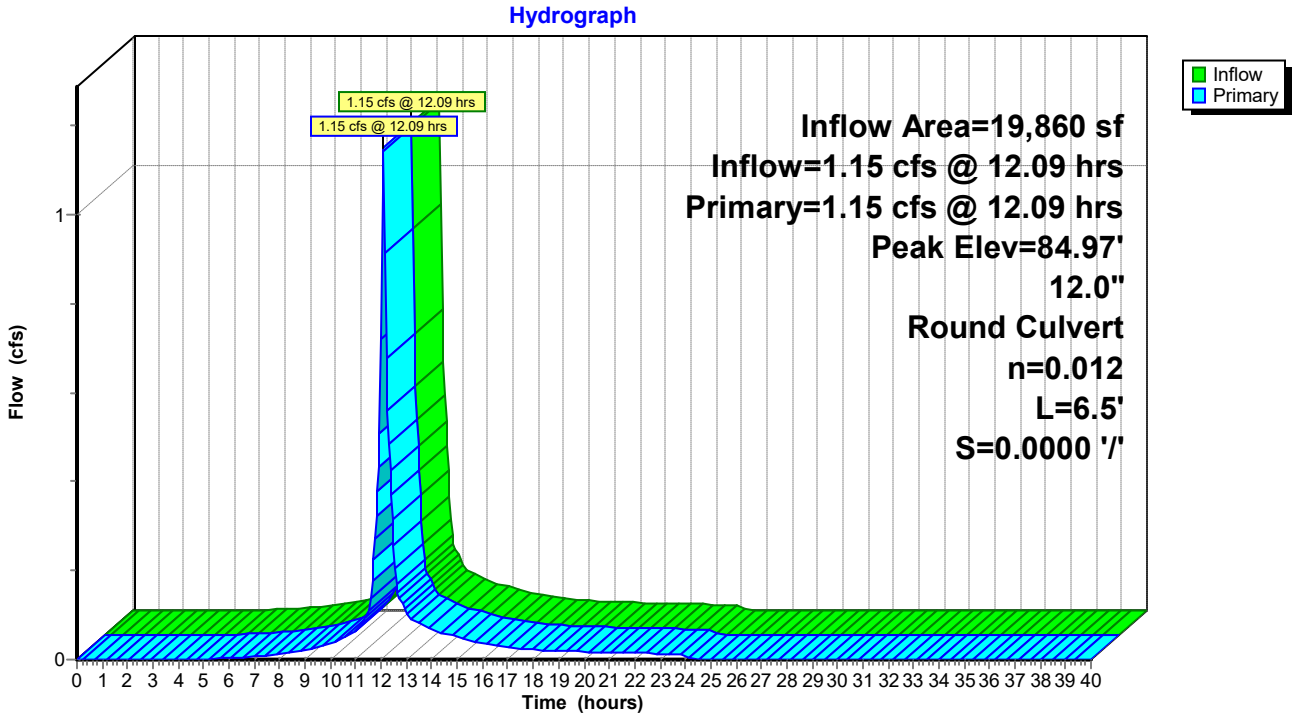
Inflow Area = 19,860 sf, 85.03% Impervious, Inflow Depth = 2.26" for 2 yr event
Inflow = 1.15 cfs @ 12.09 hrs, Volume= 3,740 cf
Outflow = 1.15 cfs @ 12.09 hrs, Volume= 3,740 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.15 cfs @ 12.09 hrs, Volume= 3,740 cf
Routed to Pond 1P : Infiltration Pipe Network

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 84.97' @ 12.09 hrs
Flood Elev= 87.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.25'	**12.0" Round Culvert** L= 6.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.25' / 84.25' S= 0.0000 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.12 cfs @ 12.09 hrs HW=84.96' TW=84.32' (Dynamic Tailwater)
1=Culvert (Barrel Controls 1.12 cfs @ 2.63 fps)

Pond 5: CDS5



Summary for Pond 5P: Depressed Landscape Area

Inflow Area = 1,386 sf, 0.00% Impervious, Inflow Depth = 0.40" for 2 yr event
Inflow = 0.01 cfs @ 12.14 hrs, Volume= 47 cf
Outflow = 0.01 cfs @ 12.21 hrs, Volume= 47 cf, Atten= 9%, Lag= 4.1 min
Discarded = 0.01 cfs @ 12.21 hrs, Volume= 47 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.00' @ 12.21 hrs Surf.Area= 317 sf Storage= 1 cf

Plug-Flow detention time= 3.0 min calculated for 47 cf (100% of inflow)
Center-of-Mass det. time= 3.0 min (922.0 - 919.0)

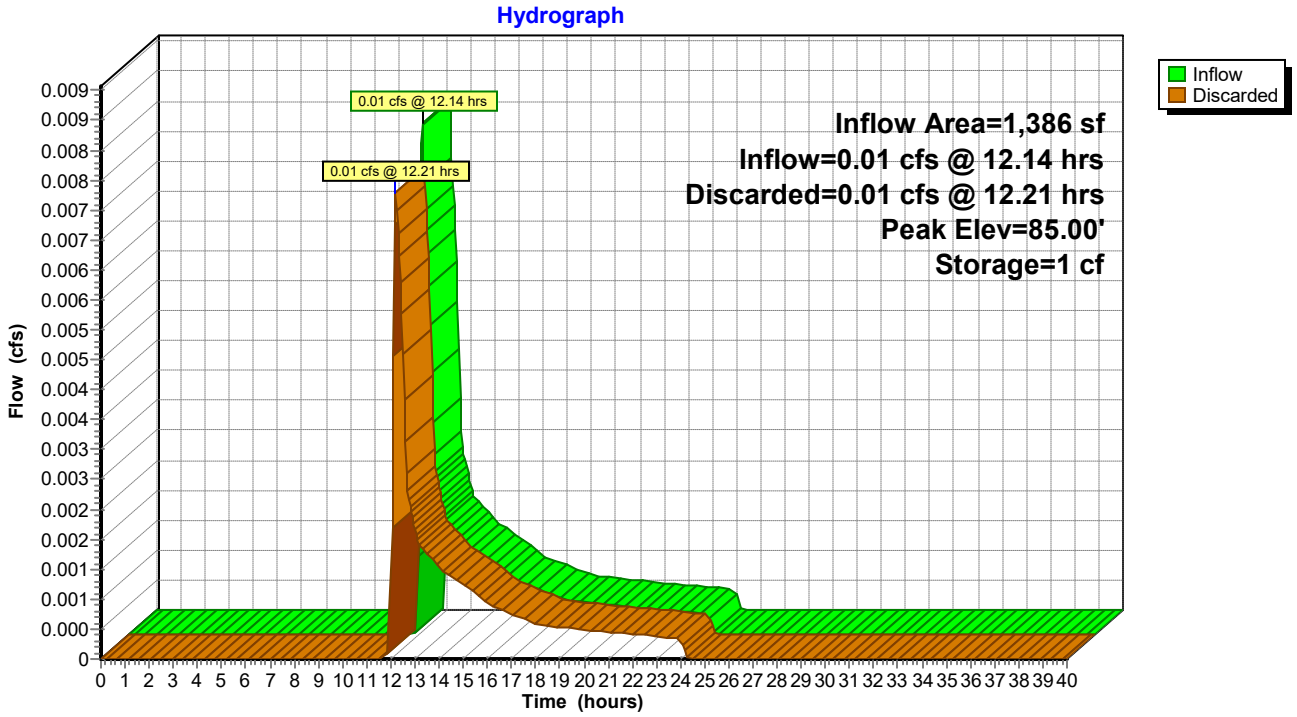
Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	462 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	316	0	0
86.00	608	462	462

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 12.21 hrs HW=85.00' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 5P: Depressed Landscape Area



Summary for Pond 6: TD6

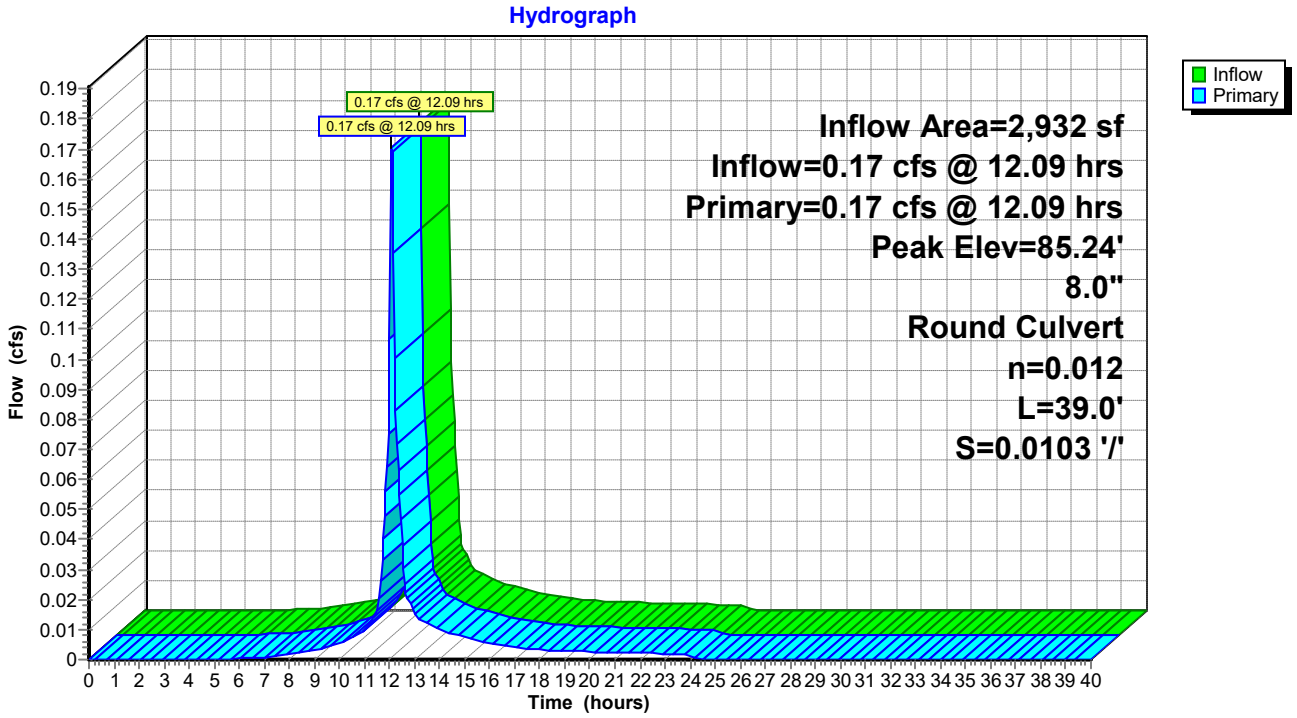
Inflow Area = 2,932 sf, 84.21% Impervious, Inflow Depth = 2.26" for 2 yr event
Inflow = 0.17 cfs @ 12.09 hrs, Volume= 551 cf
Outflow = 0.17 cfs @ 12.09 hrs, Volume= 551 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.17 cfs @ 12.09 hrs, Volume= 551 cf
Routed to Pond 7 : CDS7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.24' @ 12.10 hrs
Flood Elev= 86.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**8.0" Round Culvert** L= 39.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 84.60' S= 0.0103 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.15 cfs @ 12.09 hrs HW=85.24' TW=84.92' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.15 cfs @ 2.02 fps)

Pond 6: TD6



Summary for Pond 7: CDS7

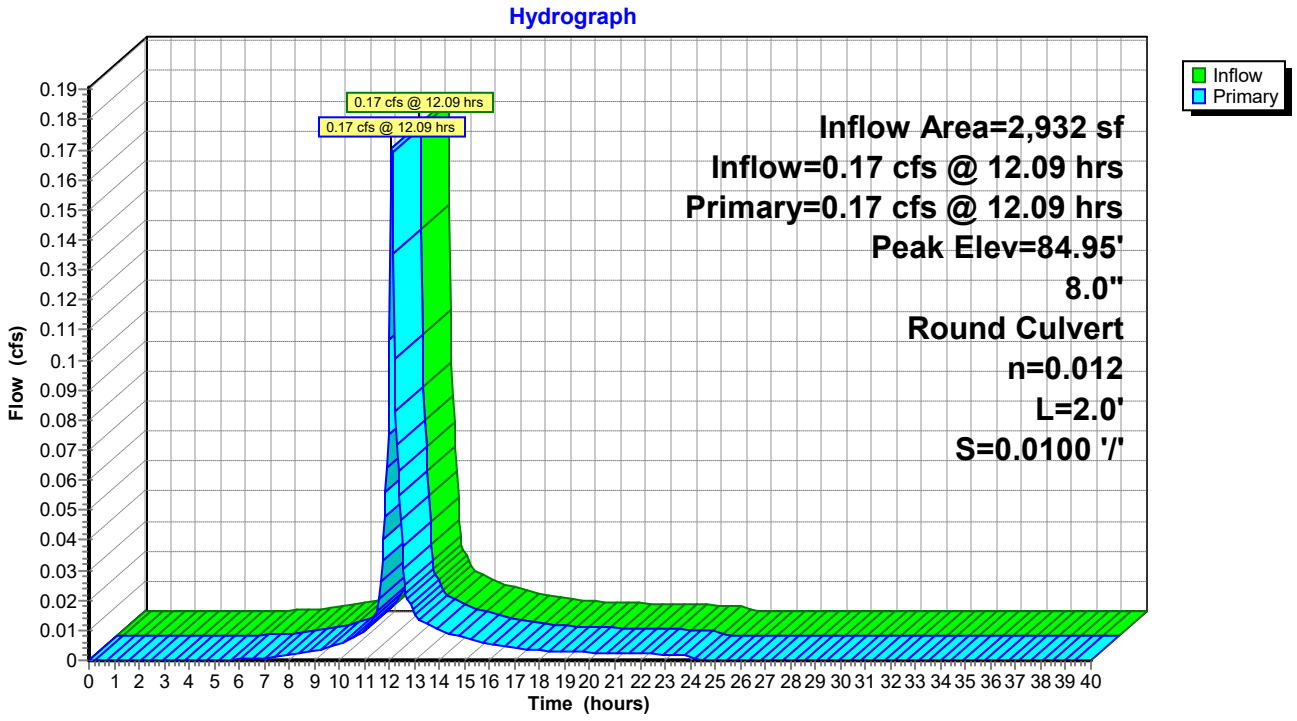
Inflow Area = 2,932 sf, 84.21% Impervious, Inflow Depth = 2.26" for 2 yr event
Inflow = 0.17 cfs @ 12.09 hrs, Volume= 551 cf
Outflow = 0.17 cfs @ 12.09 hrs, Volume= 551 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.17 cfs @ 12.09 hrs, Volume= 551 cf
Routed to Pond 8 : DMH8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 84.95' @ 12.13 hrs
Flood Elev= 90.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.60'	**8.0" Round Culvert** L= 2.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.60' / 84.58' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.08 cfs @ 12.09 hrs HW=84.92' TW=84.91' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.08 cfs @ 0.69 fps)

Pond 7: CDS7



Summary for Pond 8: DMH8

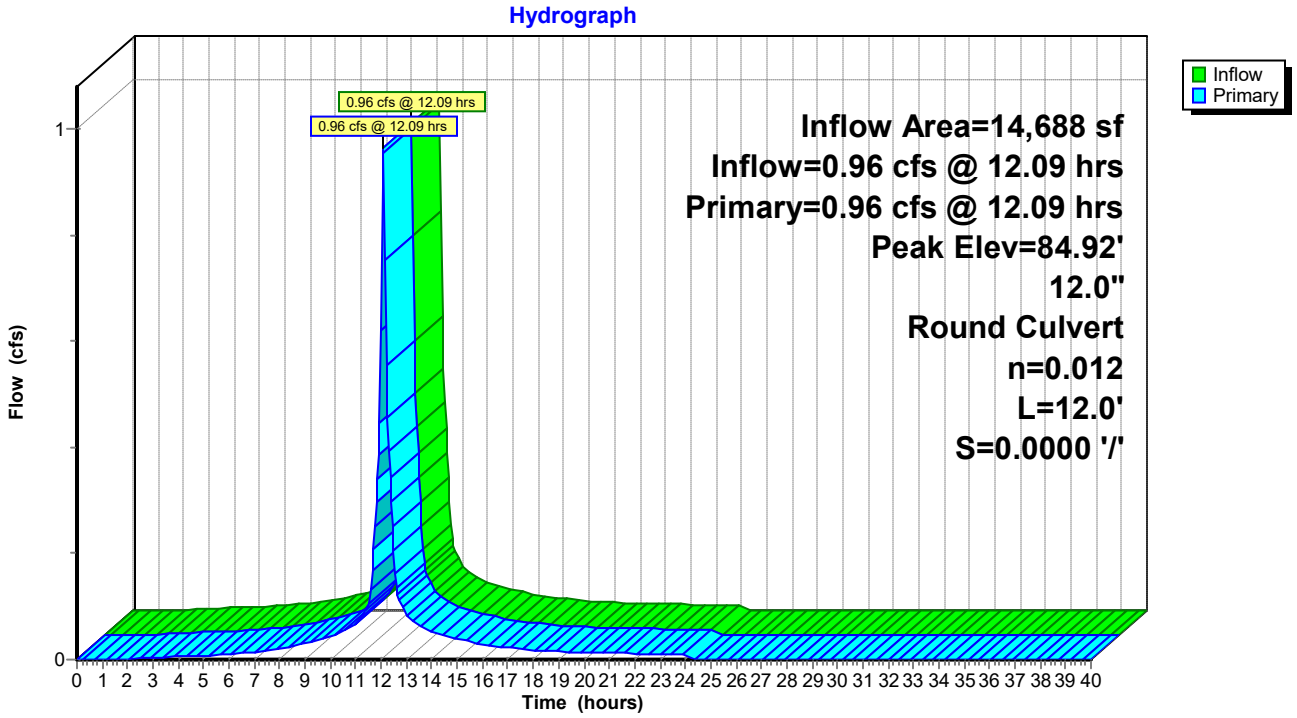
Inflow Area = 14,688 sf, 96.85% Impervious, Inflow Depth = 2.75" for 2 yr event
Inflow = 0.96 cfs @ 12.09 hrs, Volume= 3,361 cf
Outflow = 0.96 cfs @ 12.09 hrs, Volume= 3,361 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.96 cfs @ 12.09 hrs, Volume= 3,361 cf
Routed to Pond 1P : Infiltration Pipe Network

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 84.92' @ 12.09 hrs
Flood Elev= 90.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.25'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.25' / 84.25' S= 0.0000 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.94 cfs @ 12.09 hrs HW=84.91' TW=84.31' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.94 cfs @ 2.41 fps)

Pond 8: DMH8

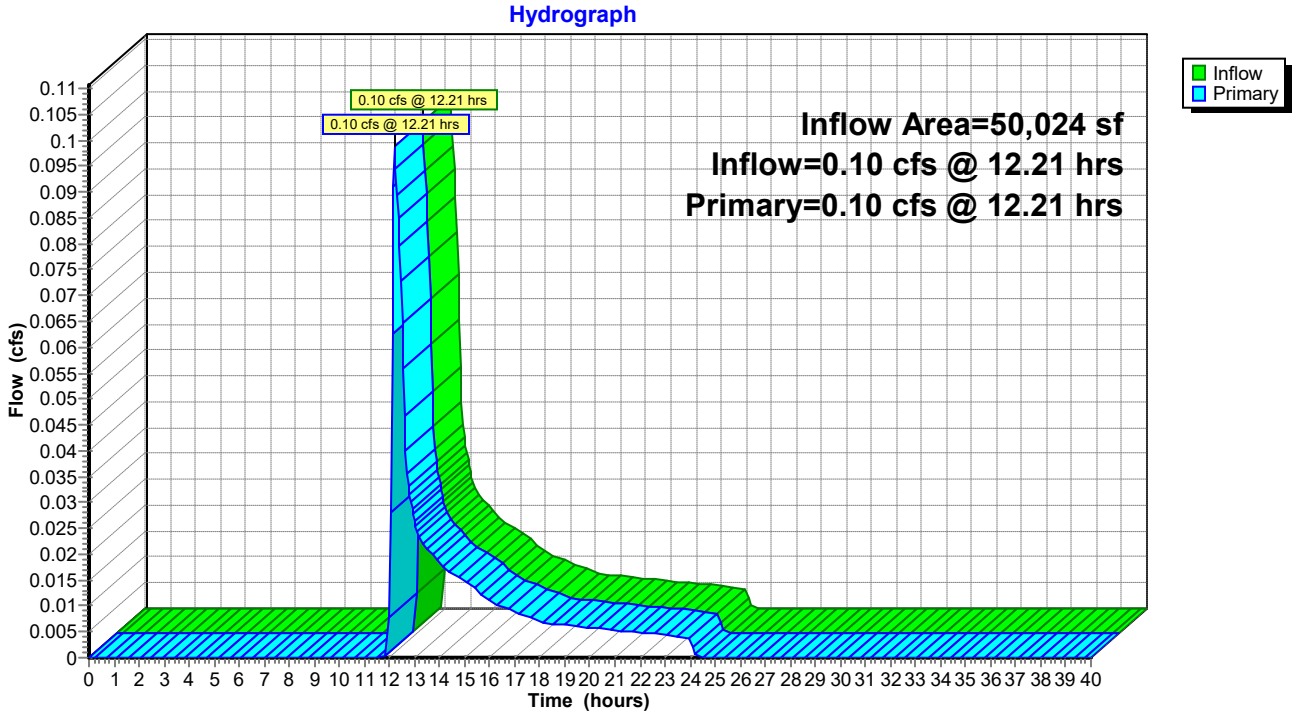


Summary for Link 1L: B Series Wetland

Inflow Area = 50,024 sf, 66.69% Impervious, Inflow Depth = 0.14" for 2 yr event
Inflow = 0.10 cfs @ 12.21 hrs, Volume= 566 cf
Primary = 0.10 cfs @ 12.21 hrs, Volume= 566 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 9L

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: B Series Wetland

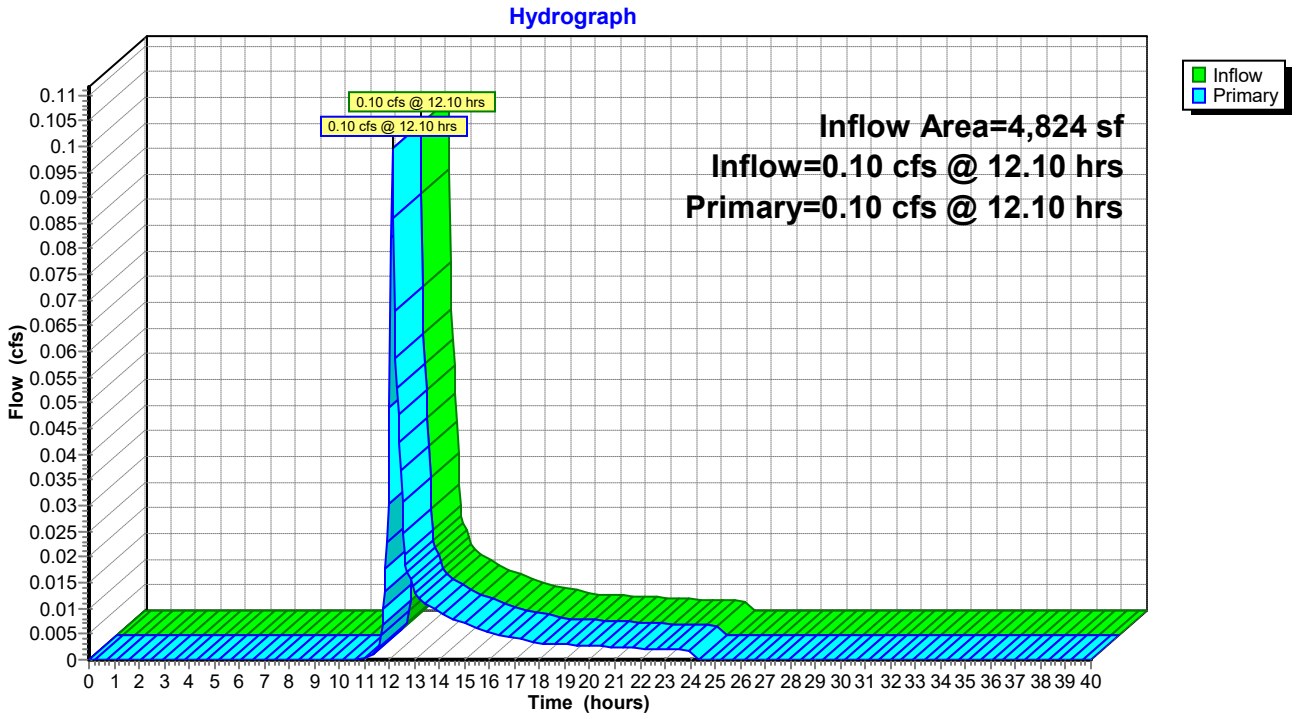


Summary for Link 2L: North Ave

Inflow Area = 4,824 sf, 28.25% Impervious, Inflow Depth = 0.85" for 2 yr event
Inflow = 0.10 cfs @ 12.10 hrs, Volume= 344 cf
Primary = 0.10 cfs @ 12.10 hrs, Volume= 344 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 9L

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: North Ave



Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=15,827 sf 87.81% Impervious Runoff Depth=3.71"
Tc=6.0 min CN=93 Runoff=1.46 cfs 4,890 cf

Subcatchment 2S: Runoff Area=4,033 sf 74.14% Impervious Runoff Depth=3.20"
Tc=6.0 min CN=88 Runoff=0.33 cfs 1,074 cf

Subcatchment 3S: Roof Runoff Area=11,756 sf 100.00% Impervious Runoff Depth=4.26"
Tc=6.0 min CN=98 Runoff=1.16 cfs 4,177 cf

Subcatchment 4S: Runoff Area=15,476 sf 14.53% Impervious Runoff Depth=1.14"
Flow Length=36' Slope=0.0170 '/' Tc=10.3 min CN=62 Runoff=0.36 cfs 1,470 cf

Subcatchment 5S: Runoff Area=4,281 sf 26.23% Impervious Runoff Depth=1.75"
Tc=6.0 min CN=71 Runoff=0.19 cfs 623 cf

Subcatchment 6S: Runoff Area=1,635 sf 41.77% Impervious Runoff Depth=2.13"
Tc=6.0 min CN=76 Runoff=0.09 cfs 290 cf

Subcatchment 7S: Runoff Area=1,660 sf 41.14% Impervious Runoff Depth=2.13"
Tc=6.0 min CN=76 Runoff=0.09 cfs 295 cf

Subcatchment 8S: Runoff Area=2,932 sf 84.21% Impervious Runoff Depth=3.60"
Tc=6.0 min CN=92 Runoff=0.27 cfs 880 cf

Subcatchment 9S: Runoff Area=543 sf 44.20% Impervious Runoff Depth=2.21"
Tc=6.0 min CN=77 Runoff=0.03 cfs 100 cf

Subcatchment 10S: Runoff Area=2,088 sf 0.00% Impervious Runoff Depth=1.08"
Tc=6.0 min CN=61 Runoff=0.05 cfs 188 cf

Subcatchment 11S: Runoff Area=1,386 sf 0.00% Impervious Runoff Depth=1.08"
Tc=6.0 min CN=61 Runoff=0.03 cfs 125 cf

Pond 1: CB1 Peak Elev=86.24' Inflow=0.33 cfs 1,074 cf
12.0" Round Culvert n=0.012 L=135.0' S=0.0100 '/' Outflow=0.33 cfs 1,074 cf

Pond 1P: Infiltration Pipe Network Peak Elev=85.30' Storage=4,228 cf Inflow=3.22 cfs 11,022 cf
Discarded=0.25 cfs 11,022 cf Primary=0.00 cfs 0 cf Outflow=0.25 cfs 11,022 cf

Pond 2: DMH2 Peak Elev=85.38' Inflow=0.33 cfs 1,074 cf
12.0" Round Culvert n=0.012 L=31.0' S=0.0100 '/' Outflow=0.33 cfs 1,074 cf

Pond 2P: Depressed Landscape Area Peak Elev=85.25' Storage=61 cf Inflow=0.05 cfs 188 cf
Outflow=0.01 cfs 188 cf

Pond 3: DGCB3 Peak Elev=85.46' Inflow=1.46 cfs 4,890 cf
12.0" Round Culvert n=0.012 L=3.0' S=0.0100 '/' Outflow=1.46 cfs 4,890 cf

Pond 3P: Depressed Landscape Area Peak Elev=86.44' Storage=96 cf Inflow=0.09 cfs 295 cf
Outflow=0.01 cfs 295 cf

Pond 4: DMH4 Peak Elev=85.37' Inflow=1.79 cfs 5,964 cf
12.0" Round Culvert n=0.012 L=4.0' S=0.0100 '/' Outflow=1.79 cfs 5,964 cf

Pond 4P: Depressed Landscape Area Peak Elev=86.48' Storage=97 cf Inflow=0.09 cfs 290 cf
Outflow=0.01 cfs 290 cf

Pond 5: CDS5 Peak Elev=85.30' Inflow=1.79 cfs 5,964 cf
12.0" Round Culvert n=0.012 L=6.5' S=0.0000 '/' Outflow=1.79 cfs 5,964 cf

Pond 5P: Depressed Landscape Area Peak Elev=85.04' Storage=11 cf Inflow=0.03 cfs 125 cf
Outflow=0.02 cfs 125 cf

Pond 6: TD6 Peak Elev=85.32' Inflow=0.27 cfs 880 cf
8.0" Round Culvert n=0.012 L=39.0' S=0.0103 '/' Outflow=0.27 cfs 880 cf

Pond 7: CDS7 Peak Elev=85.30' Inflow=0.27 cfs 880 cf
8.0" Round Culvert n=0.012 L=2.0' S=0.0100 '/' Outflow=0.27 cfs 880 cf

Pond 8: DMH8 Peak Elev=85.30' Inflow=1.42 cfs 5,057 cf
12.0" Round Culvert n=0.012 L=12.0' S=0.0000 '/' Outflow=1.42 cfs 5,057 cf

Link 1L: B Series Wetland Inflow=0.36 cfs 1,470 cf
Primary=0.36 cfs 1,470 cf

Link 2L: North Ave Inflow=0.22 cfs 723 cf
Primary=0.22 cfs 723 cf

Total Runoff Area = 61,617 sf Runoff Volume = 14,113 cf Average Runoff Depth = 2.75"
41.43% Pervious = 25,528 sf 58.57% Impervious = 36,089 sf

Summary for Subcatchment 1S:

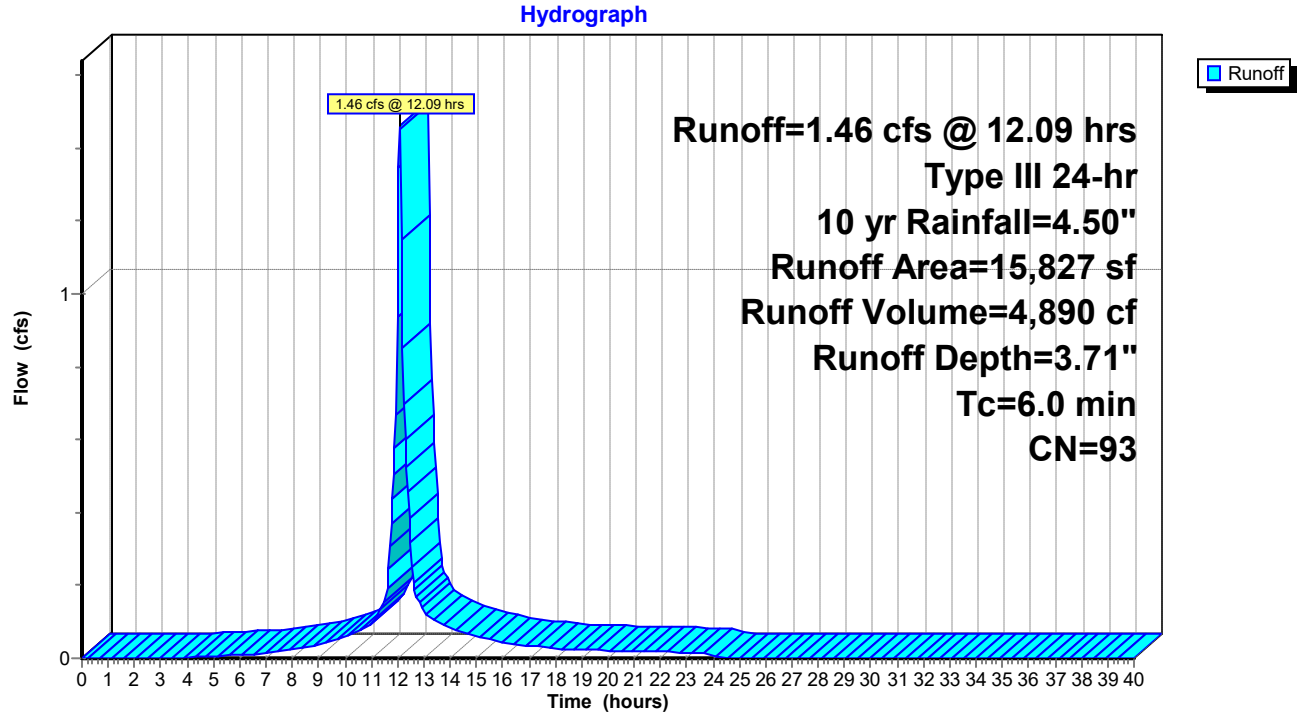
Runoff = 1.46 cfs @ 12.09 hrs, Volume= 4,890 cf, Depth= 3.71"
Routed to Pond 3 : DGCB3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
13,897	98	Paved parking, HSG B
1,930	61	>75% Grass cover, Good, HSG B
15,827	93	Weighted Average
1,930		12.19% Pervious Area
13,897		87.81% Impervious Area

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

Subcatchment 1S:



Summary for Subcatchment 2S:

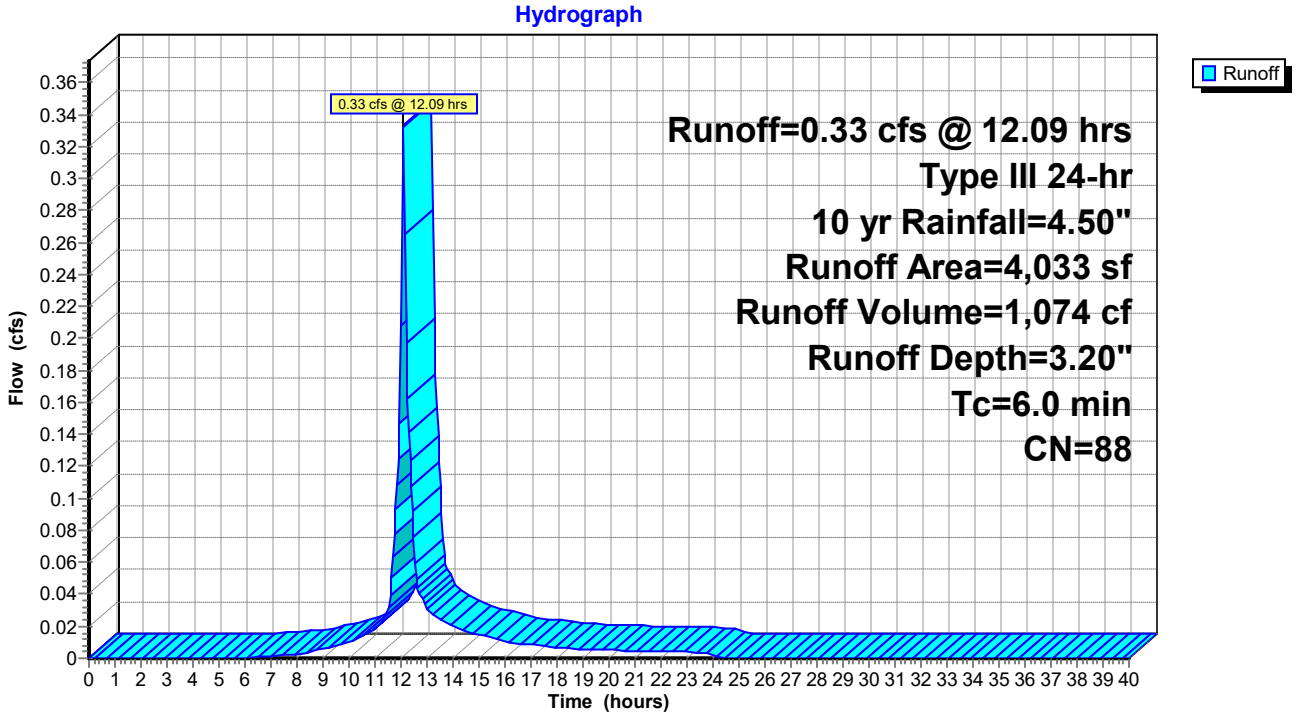
Runoff = 0.33 cfs @ 12.09 hrs, Volume= 1,074 cf, Depth= 3.20"
Routed to Pond 1 : CB1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
2,990	98	Paved parking, HSG B
1,043	61	>75% Grass cover, Good, HSG B
4,033	88	Weighted Average
1,043		25.86% Pervious Area
2,990		74.14% Impervious Area

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

Subcatchment 2S:



Summary for Subcatchment 3S: Roof

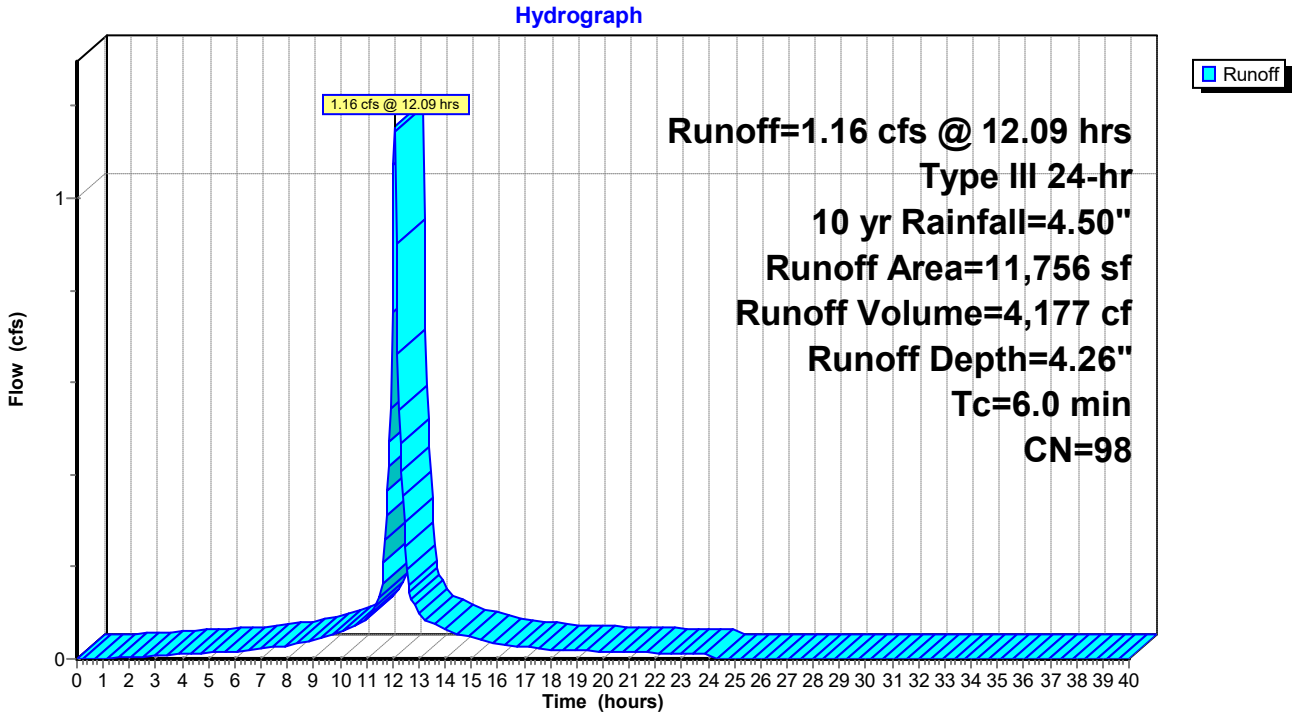
Runoff = 1.16 cfs @ 12.09 hrs, Volume= 4,177 cf, Depth= 4.26"
Routed to Pond 8 : DMH8

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
11,756	98	Roofs, HSG B
11,756		100.00% Impervious Area

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

Subcatchment 3S: Roof



Summary for Subcatchment 4S:

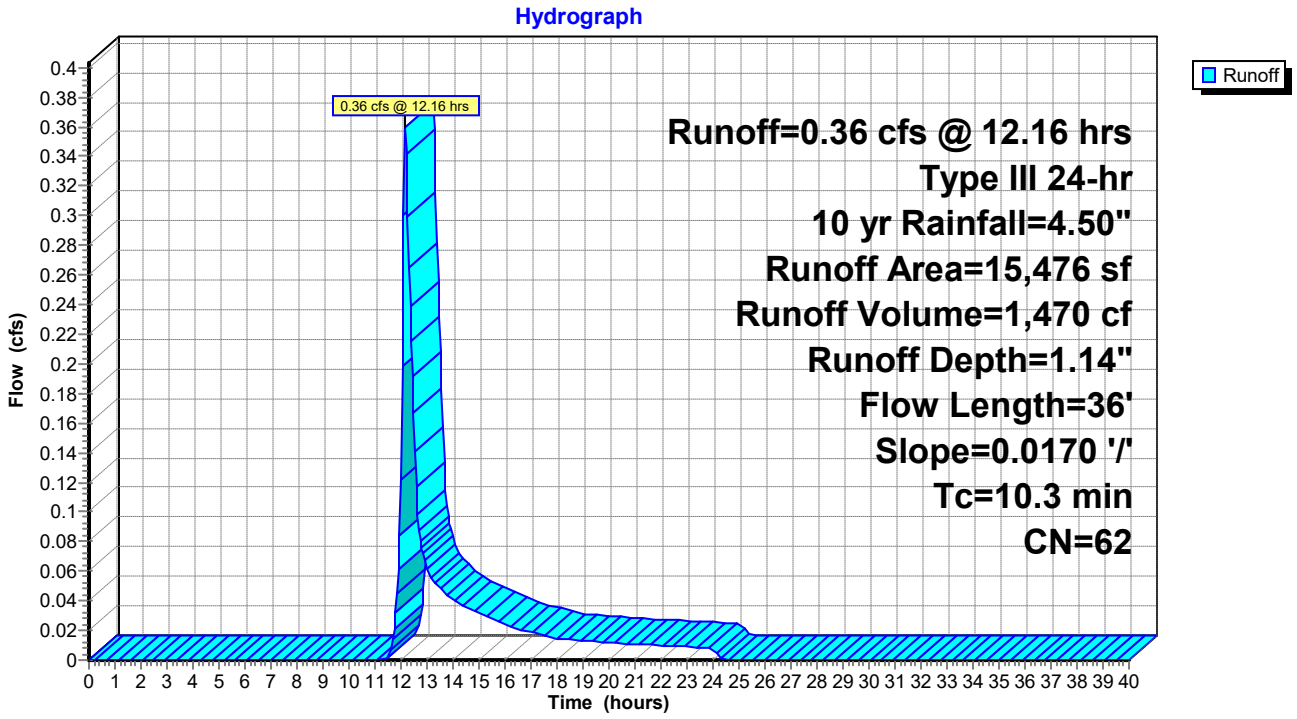
Runoff = 0.36 cfs @ 12.16 hrs, Volume= 1,470 cf, Depth= 1.14"
Routed to Link 1L : B Series Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
10,238	55	Woods, Good, HSG B
2,990	61	>75% Grass cover, Good, HSG B
2,248	98	Paved parking, HSG B
15,476	62	Weighted Average
13,228		85.47% Pervious Area
2,248		14.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	36	0.0170	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"

Subcatchment 4S:



Summary for Subcatchment 5S:

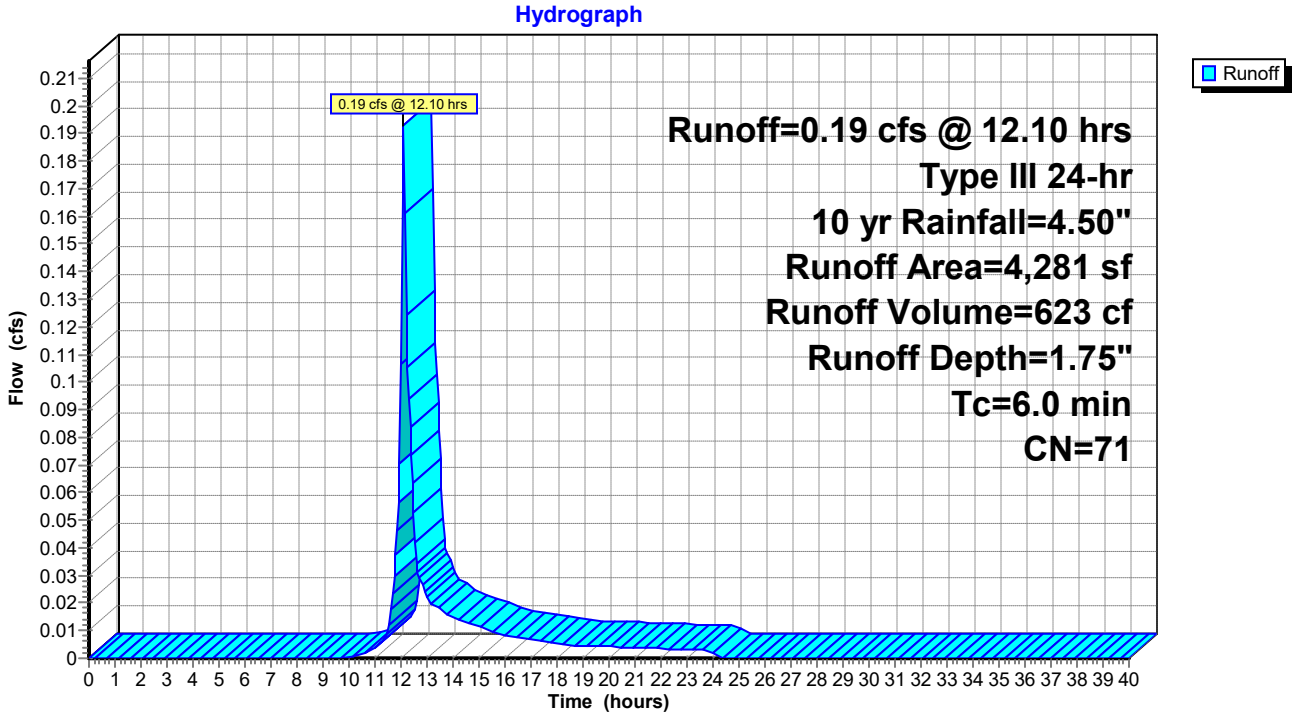
Runoff = 0.19 cfs @ 12.10 hrs, Volume= 623 cf, Depth= 1.75"
Routed to Link 2L : North Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
1,123	98	Paved parking, HSG B
3,158	61	>75% Grass cover, Good, HSG B
4,281	71	Weighted Average
3,158		73.77% Pervious Area
1,123		26.23% Impervious Area

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

Subcatchment 5S:



Summary for Subcatchment 6S:

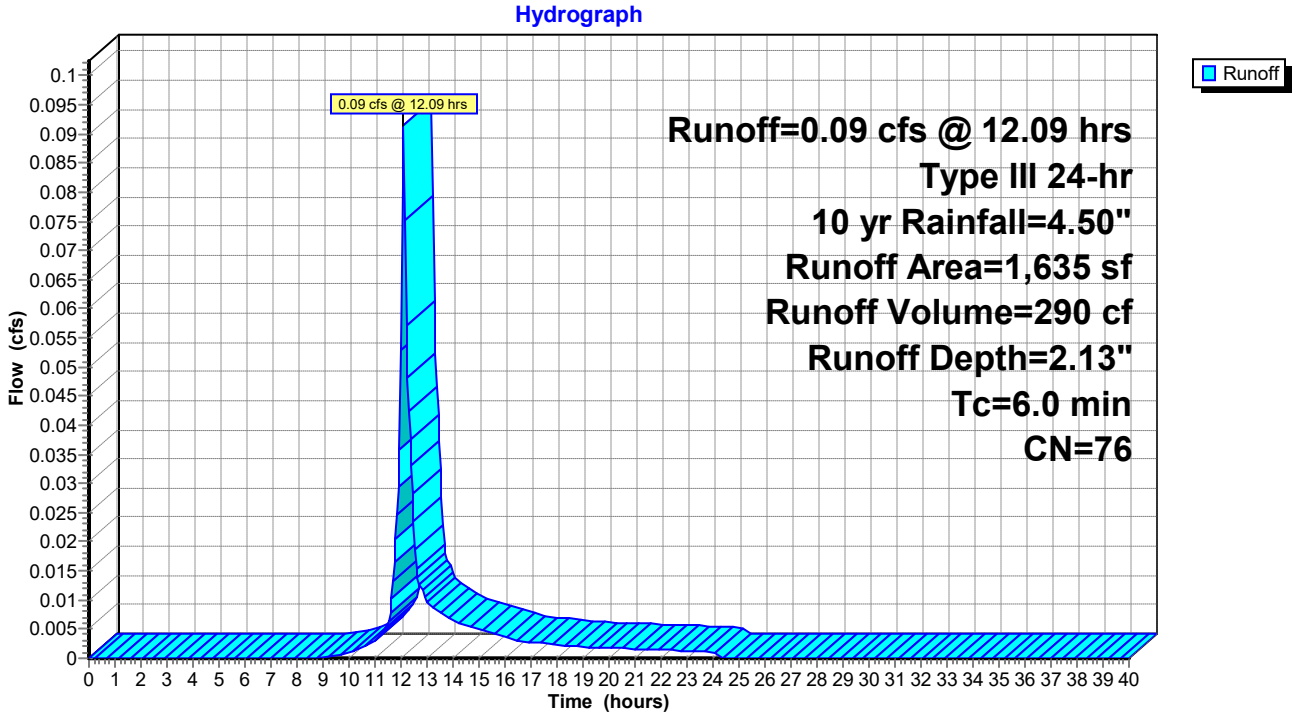
Runoff = 0.09 cfs @ 12.09 hrs, Volume= 290 cf, Depth= 2.13"
Routed to Pond 4P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
952	61	>75% Grass cover, Good, HSG B
683	98	Paved parking, HSG B
1,635	76	Weighted Average
952		58.23% Pervious Area
683		41.77% Impervious Area

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

Subcatchment 6S:



Summary for Subcatchment 7S:

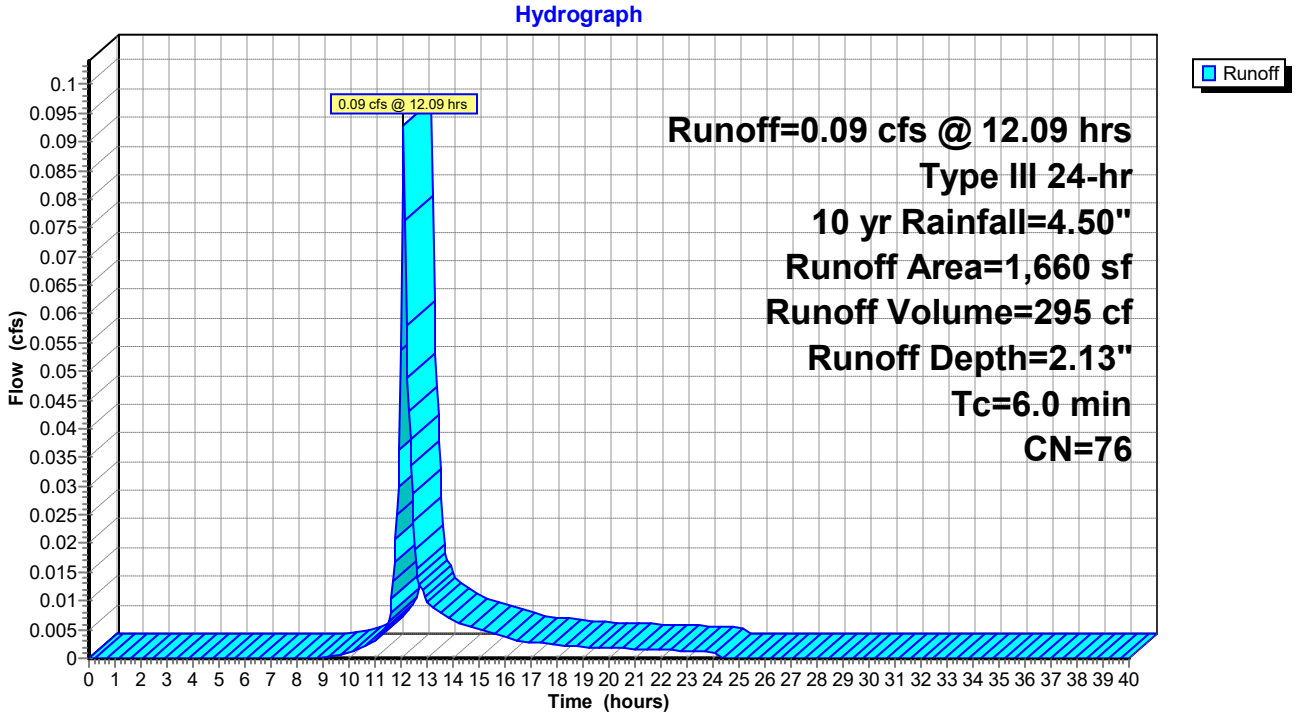
Runoff = 0.09 cfs @ 12.09 hrs, Volume= 295 cf, Depth= 2.13"
Routed to Pond 3P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
977	61	>75% Grass cover, Good, HSG B
683	98	Paved parking, HSG B
1,660	76	Weighted Average
977		58.86% Pervious Area
683		41.14% Impervious Area

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

Subcatchment 7S:



Summary for Subcatchment 8S:

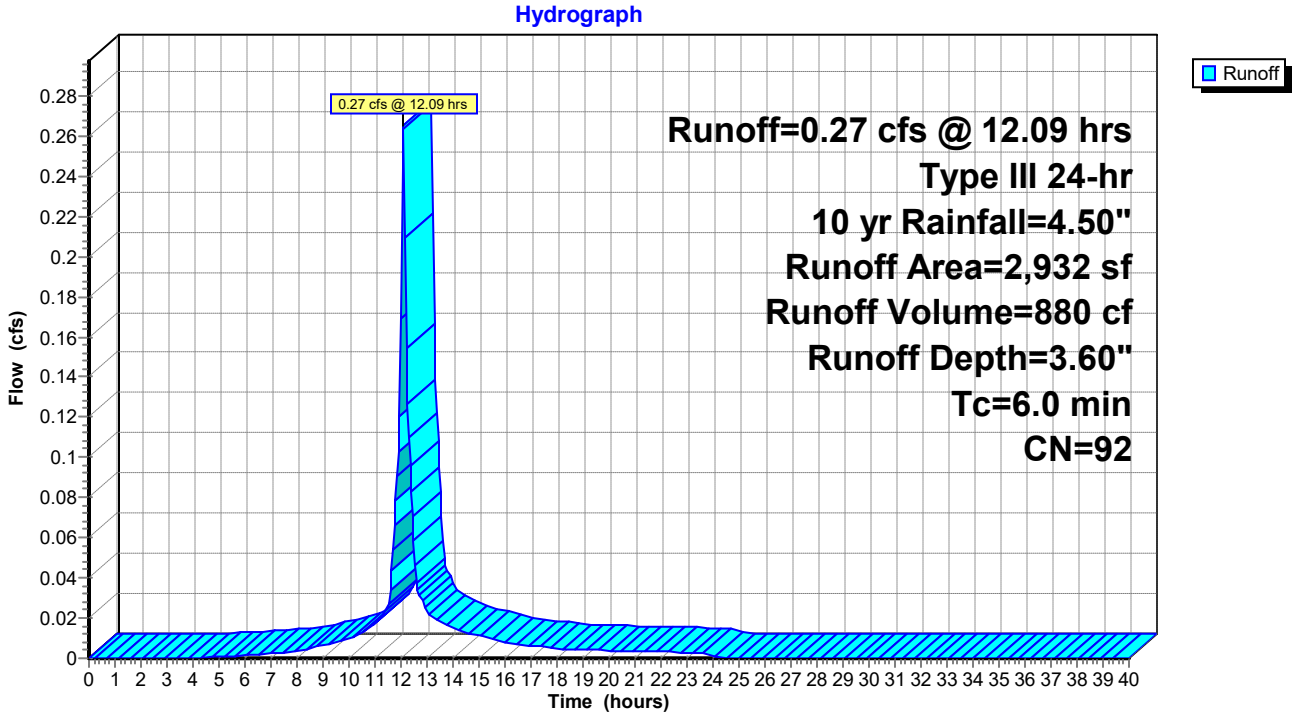
Runoff = 0.27 cfs @ 12.09 hrs, Volume= 880 cf, Depth= 3.60"
Routed to Pond 6 : TD6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
463	61	>75% Grass cover, Good, HSG B
2,469	98	Paved parking, HSG B
2,932	92	Weighted Average
463		15.79% Pervious Area
2,469		84.21% Impervious Area

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

Subcatchment 8S:



Summary for Subcatchment 9S:

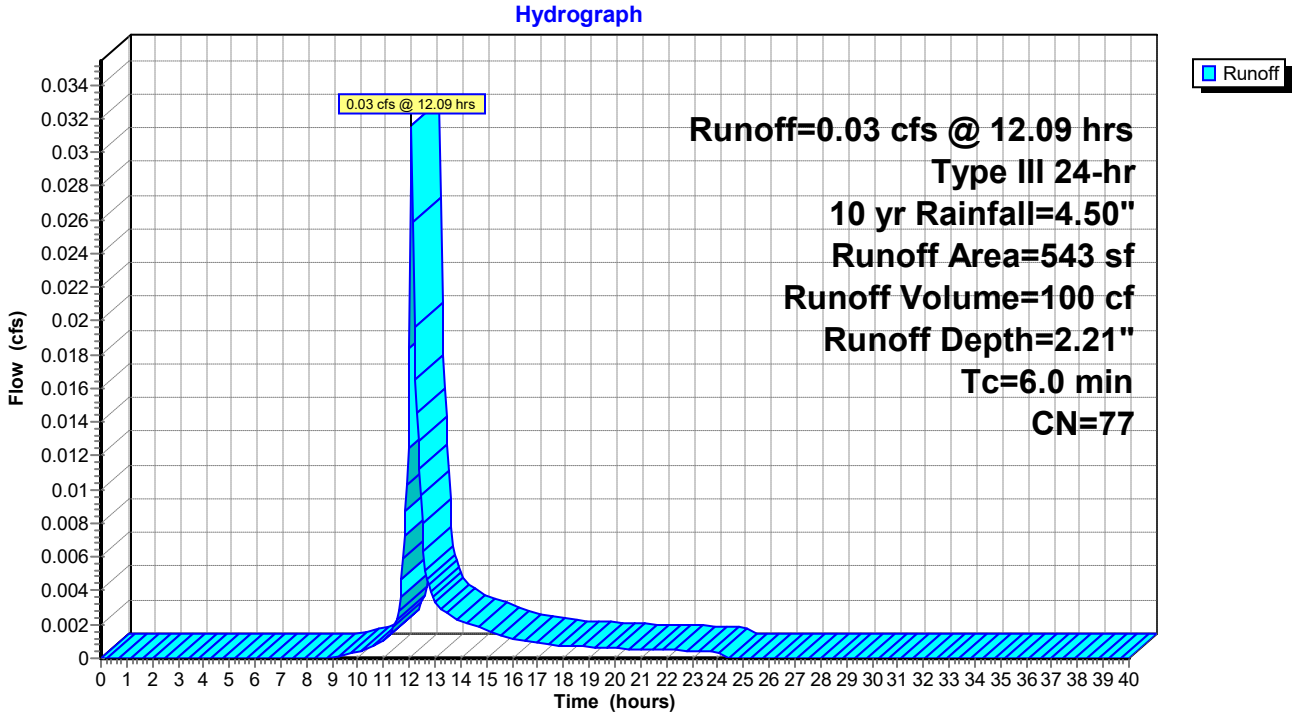
Runoff = 0.03 cfs @ 12.09 hrs, Volume= 100 cf, Depth= 2.21"
Routed to Link 2L : North Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
303	61	>75% Grass cover, Good, HSG B
240	98	Paved parking, HSG B
543	77	Weighted Average
303		55.80% Pervious Area
240		44.20% Impervious Area

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

Subcatchment 9S:



Summary for Subcatchment 10S:

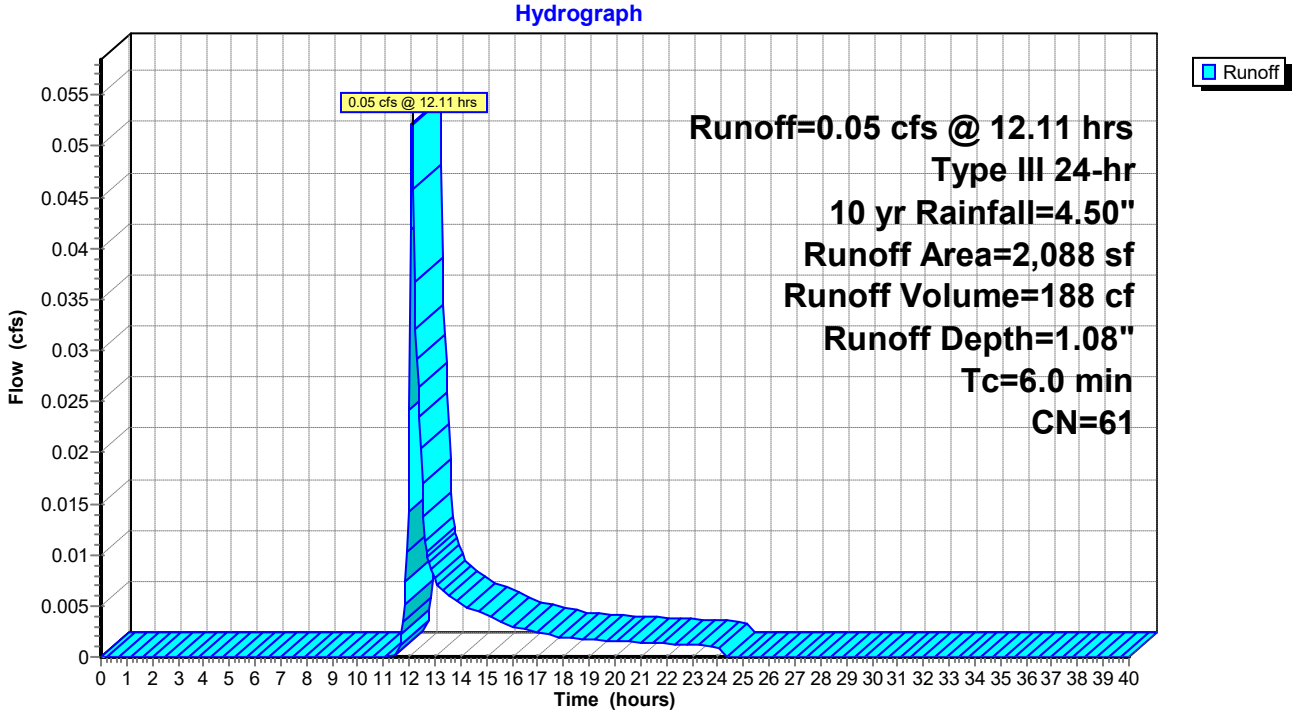
Runoff = 0.05 cfs @ 12.11 hrs, Volume= 188 cf, Depth= 1.08"
Routed to Pond 2P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
2,088	61	>75% Grass cover, Good, HSG B
2,088		100.00% Pervious Area

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

Subcatchment 10S:



Summary for Subcatchment 11S:

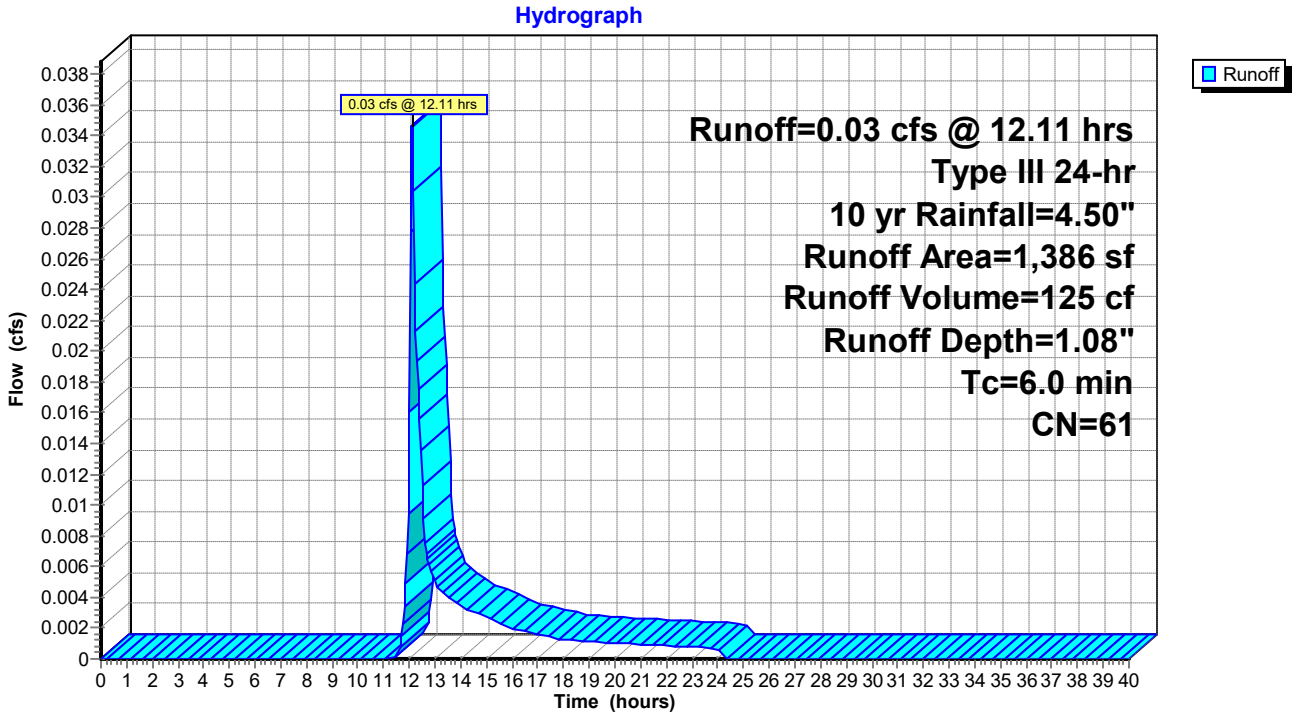
Runoff = 0.03 cfs @ 12.11 hrs, Volume= 125 cf, Depth= 1.08"
Routed to Pond 5P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
1,386	61	>75% Grass cover, Good, HSG B
1,386		100.00% Pervious Area

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

Subcatchment 11S:



Summary for Pond 1: CB1

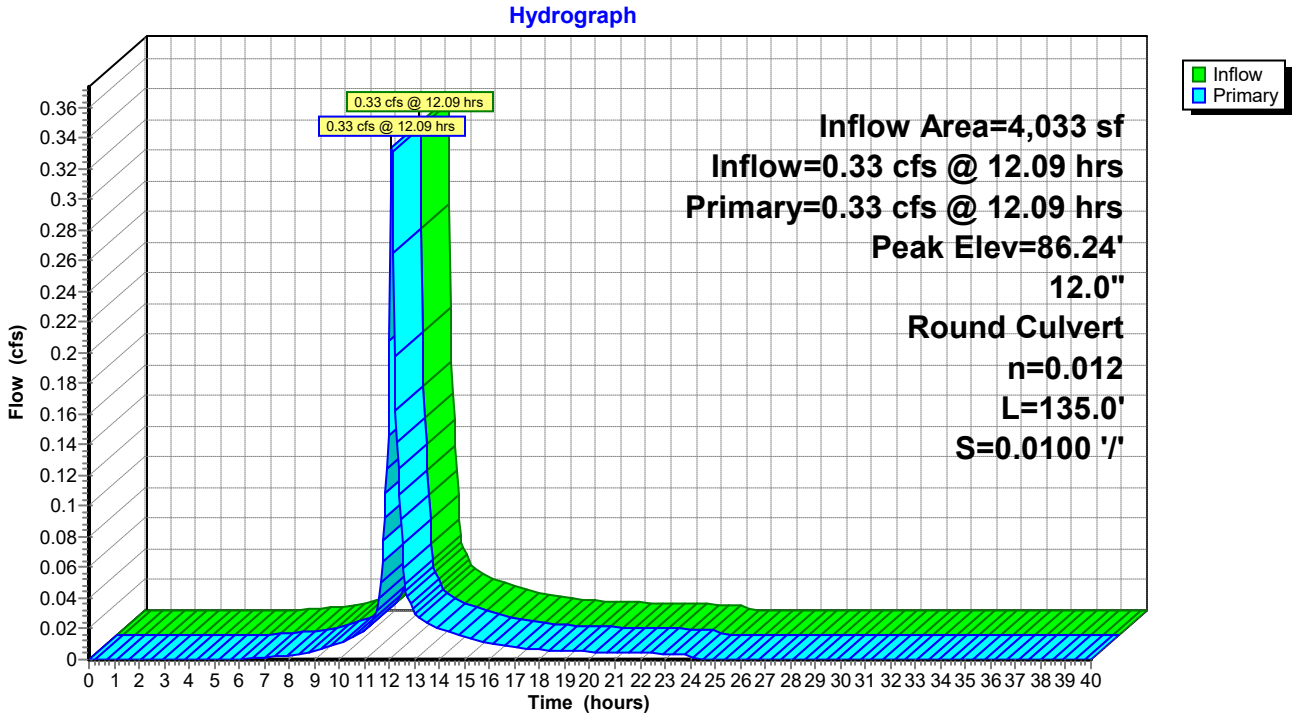
Inflow Area = 4,033 sf, 74.14% Impervious, Inflow Depth = 3.20" for 10 yr event
Inflow = 0.33 cfs @ 12.09 hrs, Volume= 1,074 cf
Outflow = 0.33 cfs @ 12.09 hrs, Volume= 1,074 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.33 cfs @ 12.09 hrs, Volume= 1,074 cf
Routed to Pond 2 : DMH2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.24' @ 12.10 hrs
Flood Elev= 88.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.95'	**12.0" Round Culvert** L= 135.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.95' / 84.60' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.31 cfs @ 12.09 hrs HW=86.23' TW=85.19' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.31 cfs @ 2.54 fps)

Pond 1: CB1



Summary for Pond 1P: Infiltration Pipe Network

Inflow Area = 34,548 sf, 90.05% Impervious, Inflow Depth = 3.83" for 10 yr event
Inflow = 3.22 cfs @ 12.09 hrs, Volume= 11,022 cf
Outflow = 0.25 cfs @ 11.45 hrs, Volume= 11,022 cf, Atten= 92%, Lag= 0.0 min
Discarded = 0.25 cfs @ 11.45 hrs, Volume= 11,022 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link 1L : B Series Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.30' @ 13.15 hrs Surf.Area= 4,503 sf Storage= 4,228 cf

Plug-Flow detention time= 129.1 min calculated for 11,008 cf (100% of inflow)
Center-of-Mass det. time= 128.9 min (900.7 - 771.8)

Volume	Invert	Avail.Storage	Storage Description
#1	83.75'	3,422 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 12,383 cf Overall - 3,828 cf Embedded = 8,555 cf x 40.0% Voids
#2	84.25'	3,828 cf	**Custom Stage Data** Listed below Inside #1
		7,250 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
83.75	4,503	0	0
86.50	4,503	12,383	12,383

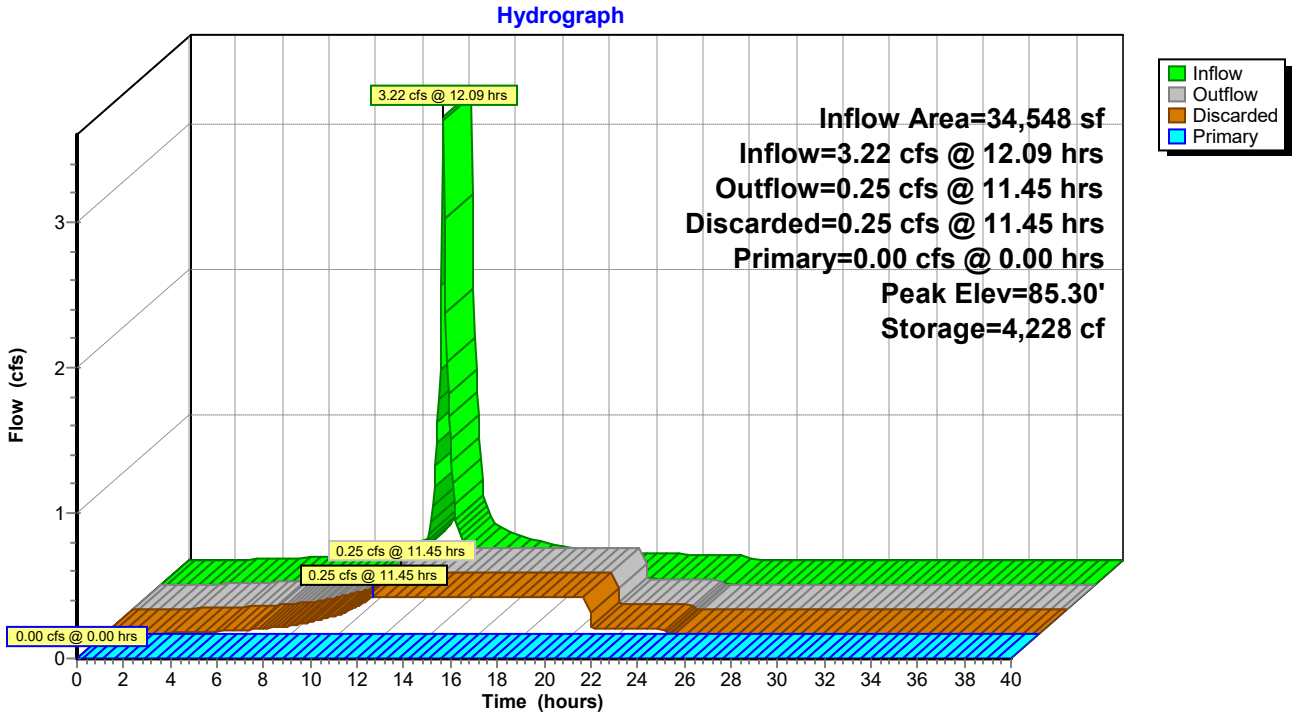
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
84.25	0	0
84.75	902	902
85.25	1,359	2,261
85.75	1,231	3,492
86.00	336	3,828

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.75'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	85.33'	**8.0" Round Culvert** L= 93.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.33' / 84.25' S= 0.0116 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.25 cfs @ 11.45 hrs HW=83.78' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=83.75' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Pond 1P: Infiltration Pipe Network



Summary for Pond 2: DMH2

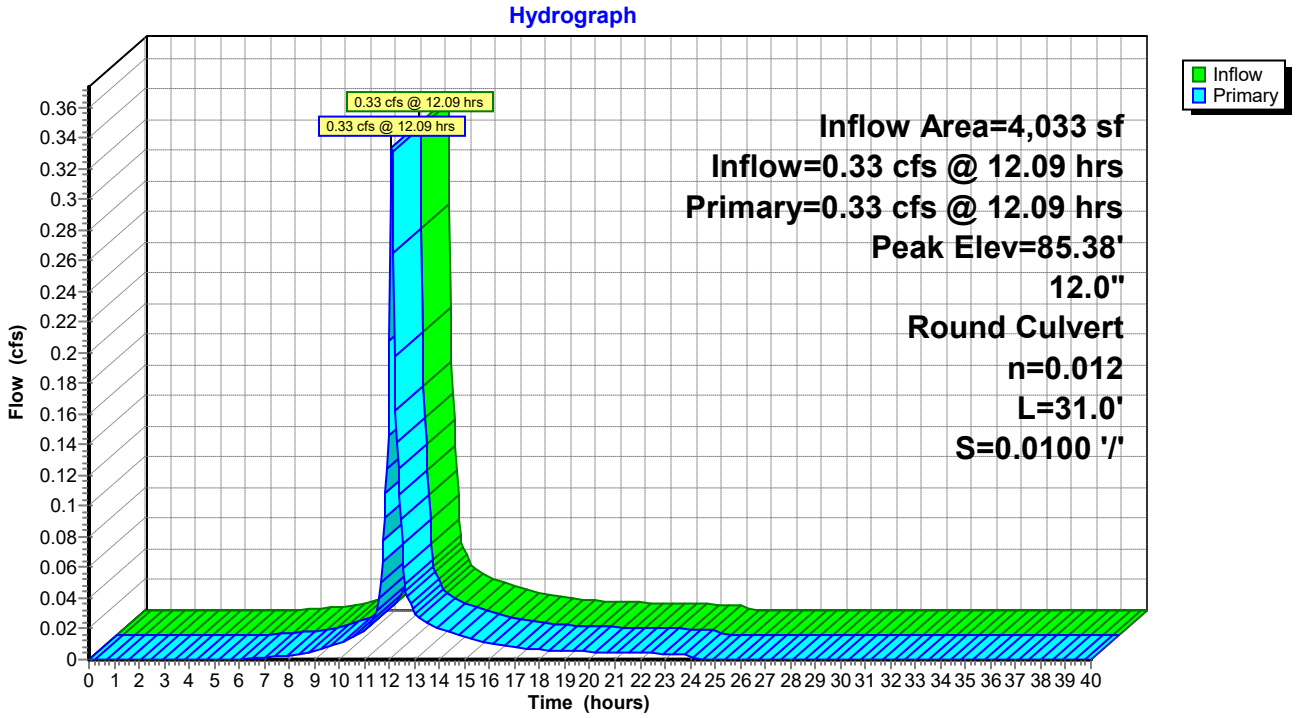
Inflow Area = 4,033 sf, 74.14% Impervious, Inflow Depth = 3.20" for 10 yr event
Inflow = 0.33 cfs @ 12.09 hrs, Volume= 1,074 cf
Outflow = 0.33 cfs @ 12.09 hrs, Volume= 1,074 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.33 cfs @ 12.09 hrs, Volume= 1,074 cf
Routed to Pond 4 : DMH4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.38' @ 12.16 hrs
Flood Elev= 88.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.60'	**12.0" Round Culvert** L= 31.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.60' / 84.29' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.19' TW=85.33' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 2: DMH2



Summary for Pond 2P: Depressed Landscape Area

Inflow Area = 2,088 sf, 0.00% Impervious, Inflow Depth = 1.08" for 10 yr event
Inflow = 0.05 cfs @ 12.11 hrs, Volume= 188 cf
Outflow = 0.01 cfs @ 13.26 hrs, Volume= 188 cf, Atten= 87%, Lag= 69.1 min
Discarded = 0.01 cfs @ 13.26 hrs, Volume= 188 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.25' @ 13.26 hrs Surf.Area= 280 sf Storage= 61 cf

Plug-Flow detention time= 93.0 min calculated for 188 cf (100% of inflow)
Center-of-Mass det. time= 92.9 min (973.2 - 880.3)

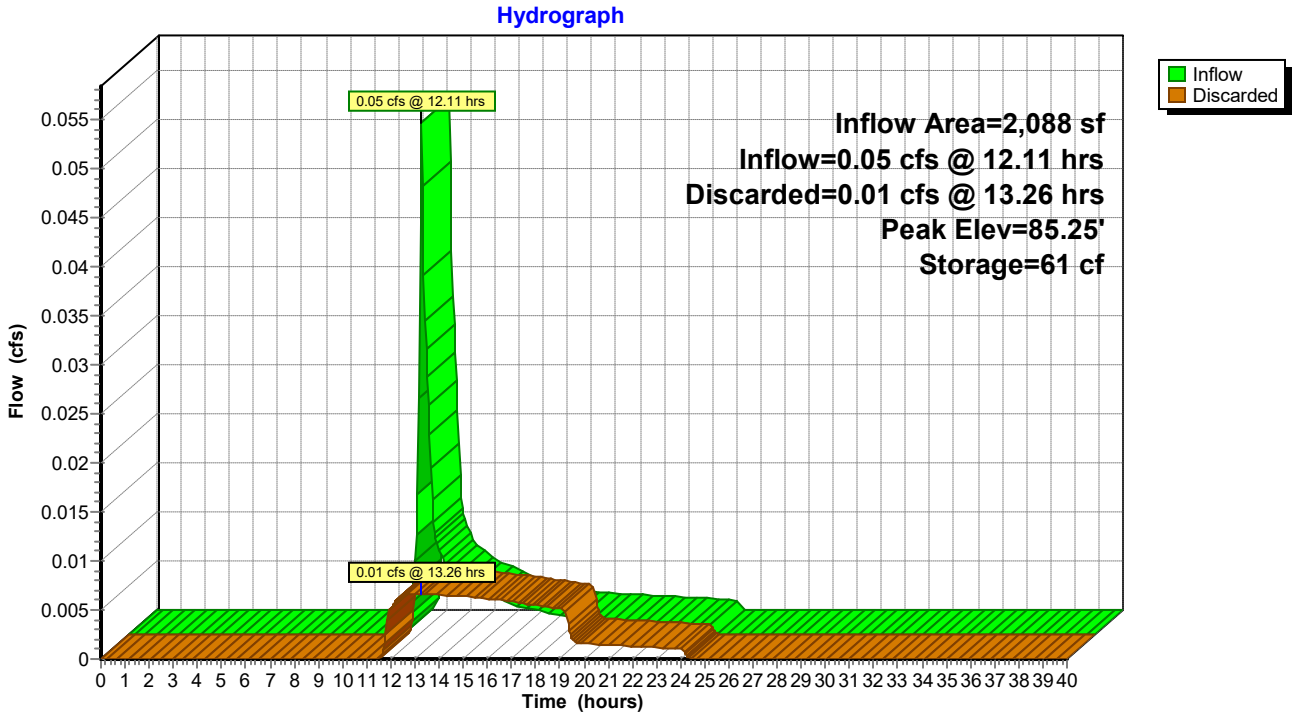
Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	210	0	0
86.00	488	349	349

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 13.26 hrs HW=85.25' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 2P: Depressed Landscape Area



Summary for Pond 3: DGCB3

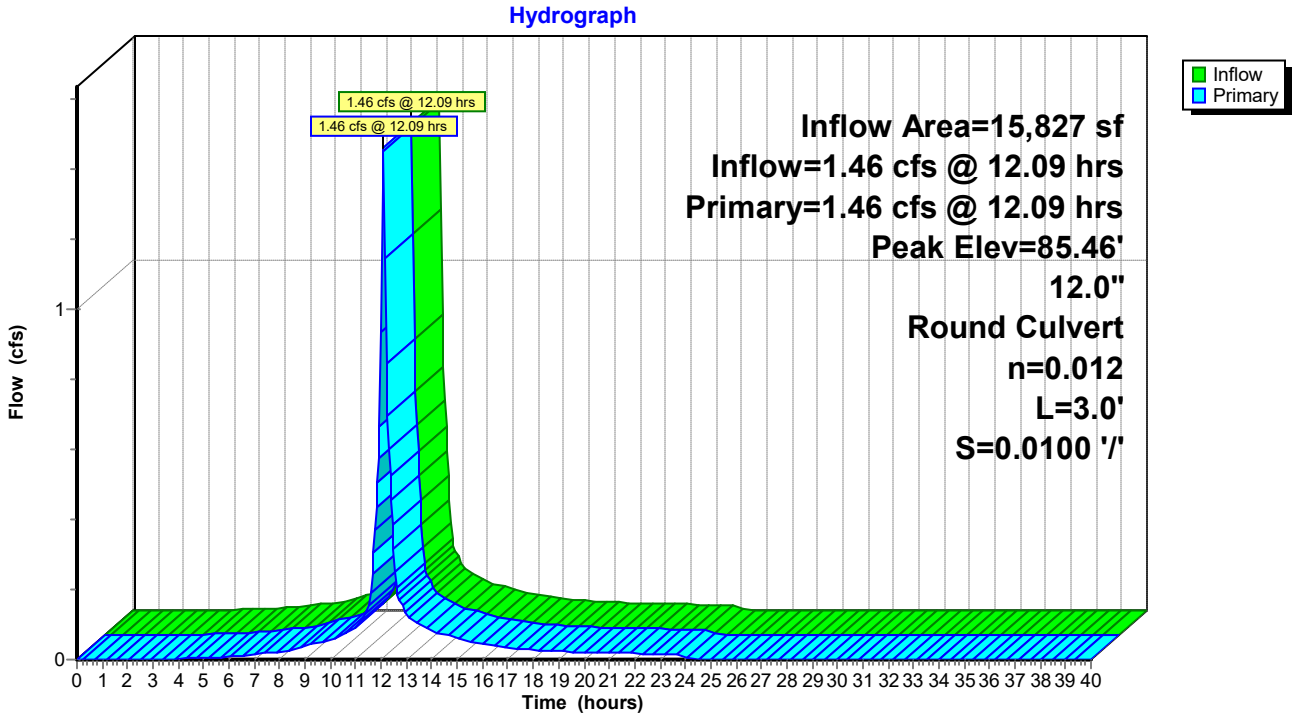
Inflow Area = 15,827 sf, 87.81% Impervious, Inflow Depth = 3.71" for 10 yr event
Inflow = 1.46 cfs @ 12.09 hrs, Volume= 4,890 cf
Outflow = 1.46 cfs @ 12.09 hrs, Volume= 4,890 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.46 cfs @ 12.09 hrs, Volume= 4,890 cf
Routed to Pond 4 : DMH4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.46' @ 12.16 hrs
Flood Elev= 87.33'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.32'	**12.0" Round Culvert** L= 3.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.32' / 84.29' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.29' TW=85.32' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 3: DGCB3



Summary for Pond 3P: Depressed Landscape Area

Inflow Area = 1,660 sf, 41.14% Impervious, Inflow Depth = 2.13" for 10 yr event
Inflow = 0.09 cfs @ 12.09 hrs, Volume= 295 cf
Outflow = 0.01 cfs @ 12.67 hrs, Volume= 295 cf, Atten= 85%, Lag= 34.4 min
Discarded = 0.01 cfs @ 12.67 hrs, Volume= 295 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.44' @ 12.67 hrs Surf.Area= 247 sf Storage= 96 cf

Plug-Flow detention time= 56.3 min calculated for 294 cf (100% of inflow)
Center-of-Mass det. time= 56.3 min (893.6 - 837.4)

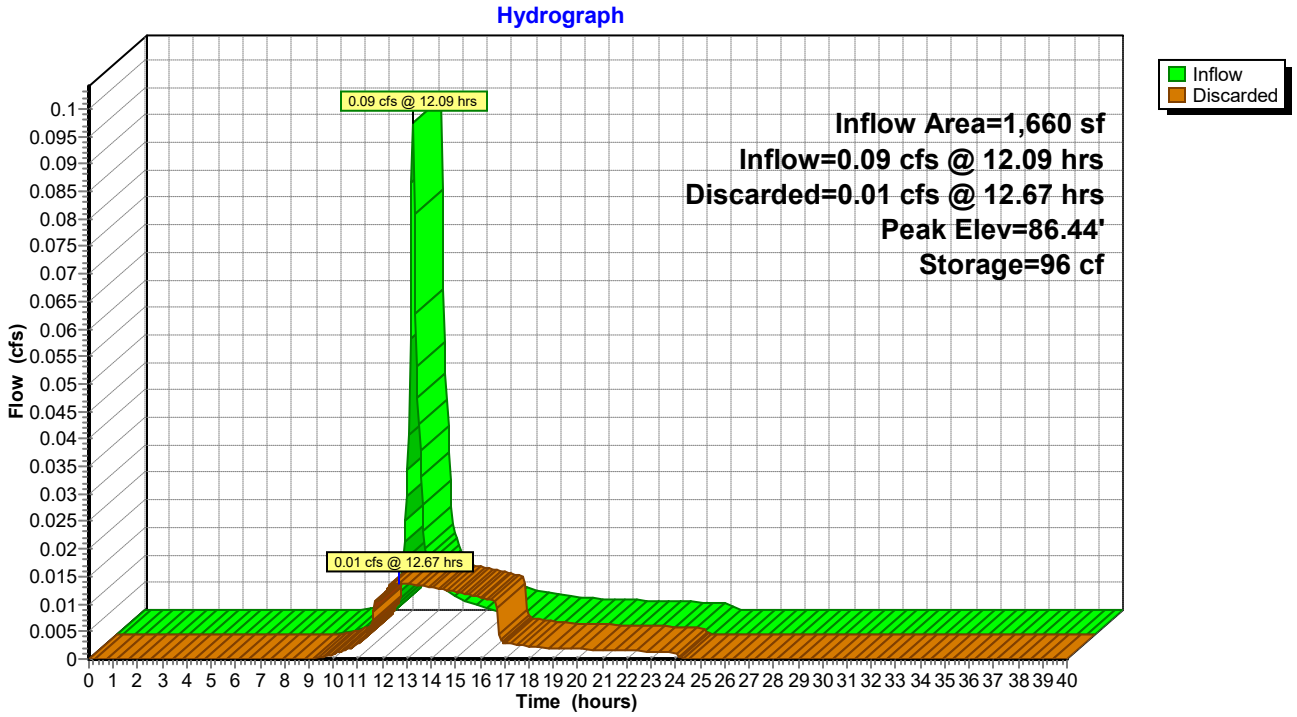
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	256 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
86.00	187	0	0
87.00	324	256	256

Device	Routing	Invert	Outlet Devices
#1	Discarded	86.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 12.67 hrs HW=86.44' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 3P: Depressed Landscape Area



Summary for Pond 4: DMH4

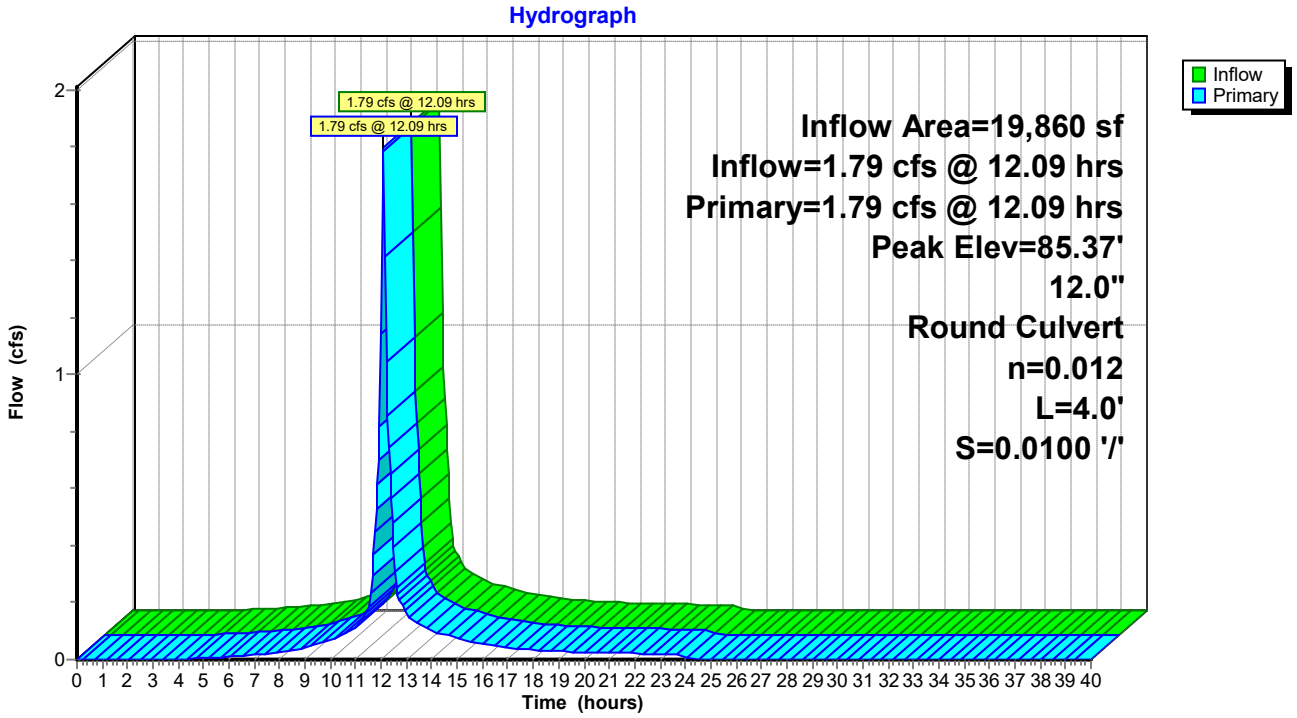
Inflow Area = 19,860 sf, 85.03% Impervious, Inflow Depth = 3.60" for 10 yr event
Inflow = 1.79 cfs @ 12.09 hrs, Volume= 5,964 cf
Outflow = 1.79 cfs @ 12.09 hrs, Volume= 5,964 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.79 cfs @ 12.09 hrs, Volume= 5,964 cf
Routed to Pond 5 : CDS5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.37' @ 12.12 hrs
Flood Elev= 87.36'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.29'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.29' / 84.25' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.45 cfs @ 12.09 hrs HW=85.32' TW=85.17' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.45 cfs @ 1.84 fps)

Pond 4: DMH4



Summary for Pond 4P: Depressed Landscape Area

Inflow Area = 1,635 sf, 41.77% Impervious, Inflow Depth = 2.13" for 10 yr event
Inflow = 0.09 cfs @ 12.09 hrs, Volume= 290 cf
Outflow = 0.01 cfs @ 12.72 hrs, Volume= 290 cf, Atten= 86%, Lag= 37.3 min
Discarded = 0.01 cfs @ 12.72 hrs, Volume= 290 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.48' @ 12.72 hrs Surf.Area= 231 sf Storage= 97 cf

Plug-Flow detention time= 62.2 min calculated for 290 cf (100% of inflow)
Center-of-Mass det. time= 62.1 min (899.5 - 837.4)

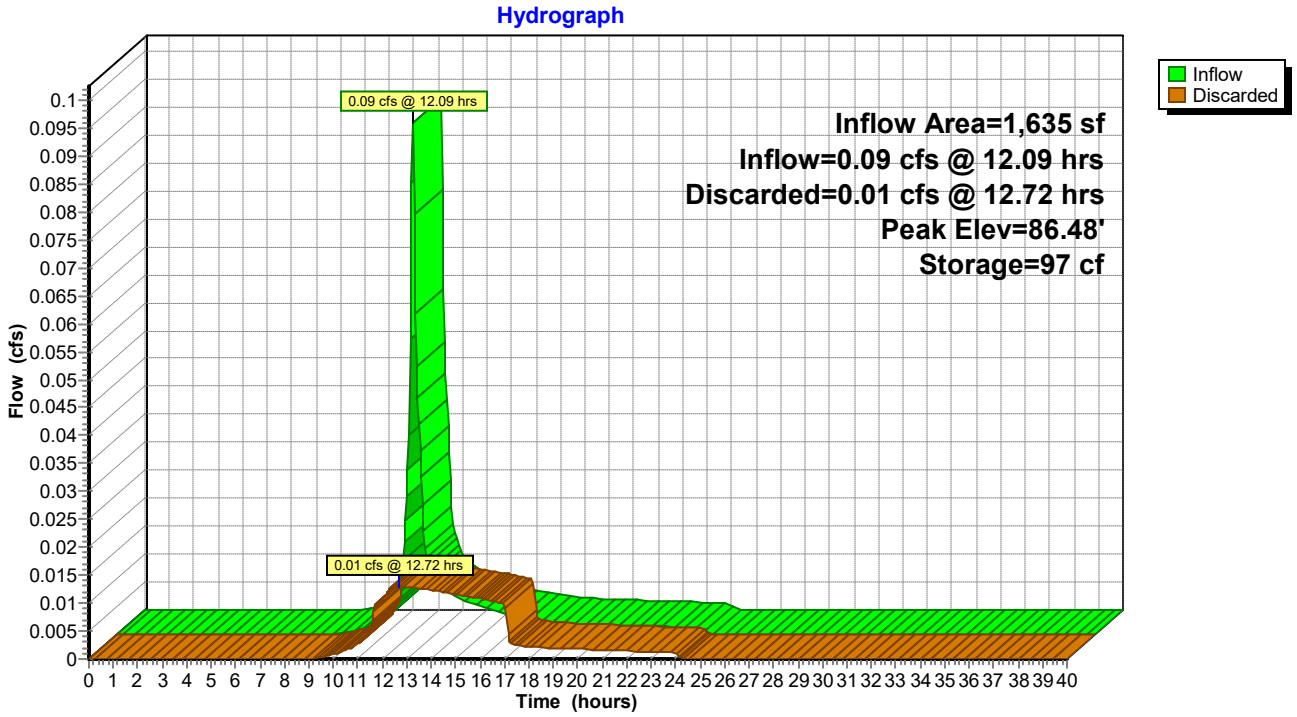
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	234 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
86.00	175	0	0
87.00	293	234	234

Device	Routing	Invert	Outlet Devices
#1	Discarded	86.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 12.72 hrs HW=86.48' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 4P: Depressed Landscape Area



Summary for Pond 5: CDS5

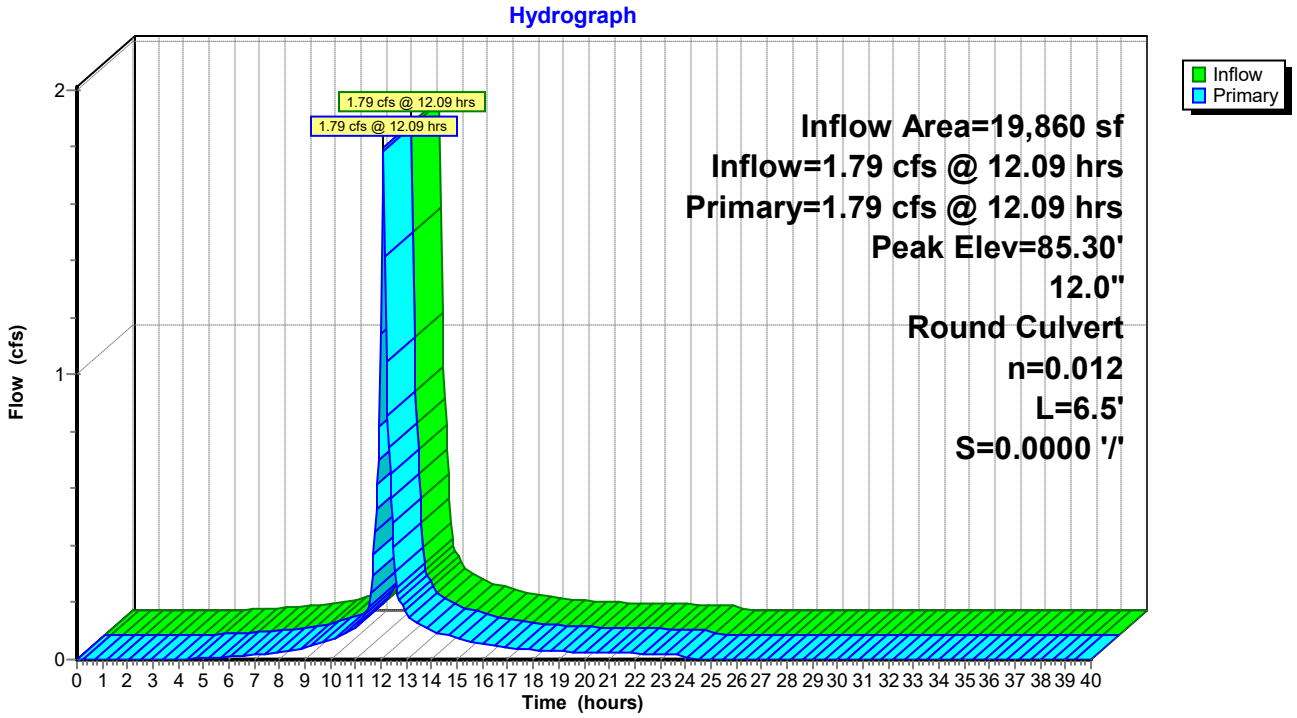
Inflow Area = 19,860 sf, 85.03% Impervious, Inflow Depth = 3.60" for 10 yr event
Inflow = 1.79 cfs @ 12.09 hrs, Volume= 5,964 cf
Outflow = 1.79 cfs @ 12.09 hrs, Volume= 5,964 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.79 cfs @ 12.09 hrs, Volume= 5,964 cf
Routed to Pond 1P : Infiltration Pipe Network

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.30' @ 13.19 hrs
Flood Elev= 87.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.25'	**12.0" Round Culvert** L= 6.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.25' / 84.25' S= 0.0000 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.75 cfs @ 12.09 hrs HW=85.17' TW=84.64' (Dynamic Tailwater)
1=Culvert (Barrel Controls 1.75 cfs @ 3.01 fps)

Pond 5: CDS5



Summary for Pond 5P: Depressed Landscape Area

Inflow Area = 1,386 sf, 0.00% Impervious, Inflow Depth = 1.08" for 10 yr event
Inflow = 0.03 cfs @ 12.11 hrs, Volume= 125 cf
Outflow = 0.02 cfs @ 12.33 hrs, Volume= 125 cf, Atten= 47%, Lag= 13.5 min
Discarded = 0.02 cfs @ 12.33 hrs, Volume= 125 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.04' @ 12.33 hrs Surf.Area= 326 sf Storage= 11 cf

Plug-Flow detention time= 4.6 min calculated for 125 cf (100% of inflow)
Center-of-Mass det. time= 4.6 min (884.9 - 880.3)

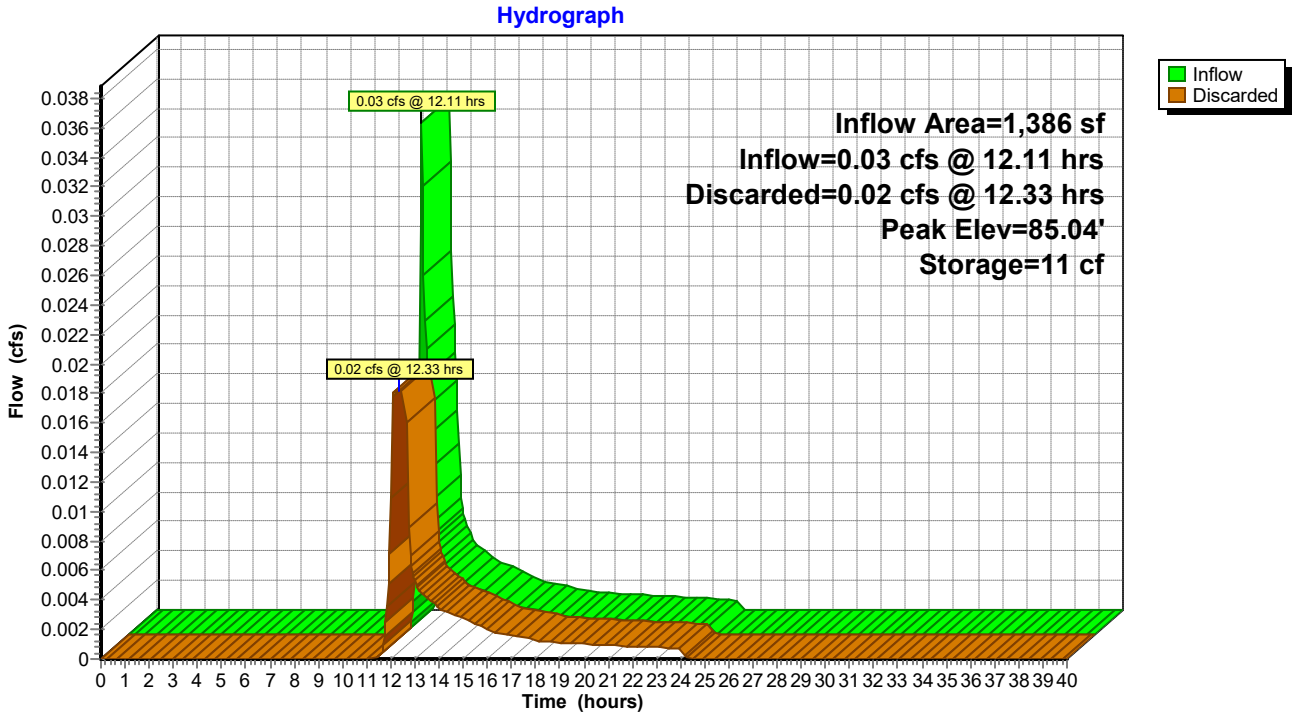
Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	462 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	316	0	0
86.00	608	462	462

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 12.33 hrs HW=85.03' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 5P: Depressed Landscape Area



Summary for Pond 6: TD6

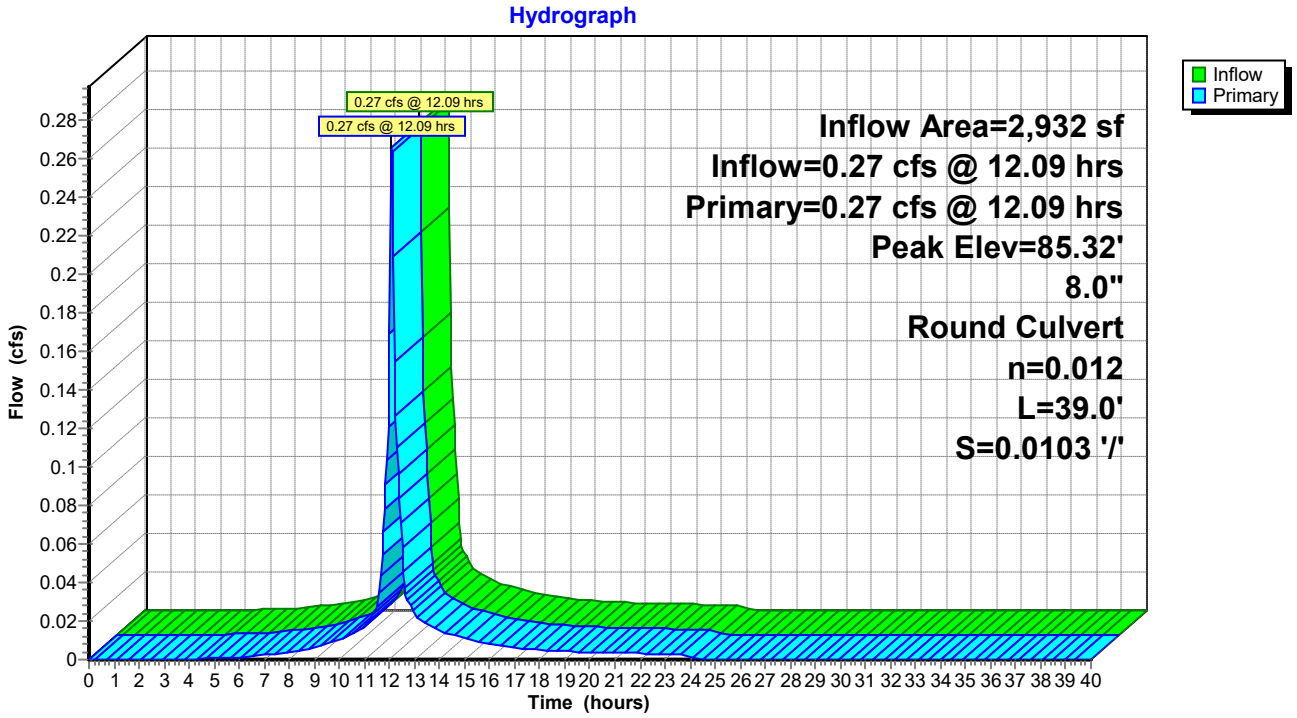
Inflow Area = 2,932 sf, 84.21% Impervious, Inflow Depth = 3.60" for 10 yr event
Inflow = 0.27 cfs @ 12.09 hrs, Volume= 880 cf
Outflow = 0.27 cfs @ 12.09 hrs, Volume= 880 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.27 cfs @ 12.09 hrs, Volume= 880 cf
Routed to Pond 7 : CDS7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.32' @ 12.12 hrs
Flood Elev= 86.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**8.0" Round Culvert** L= 39.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 84.60' S= 0.0103 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.22 cfs @ 12.09 hrs HW=85.31' TW=85.06' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.22 cfs @ 1.99 fps)

Pond 6: TD6



Summary for Pond 7: CDS7

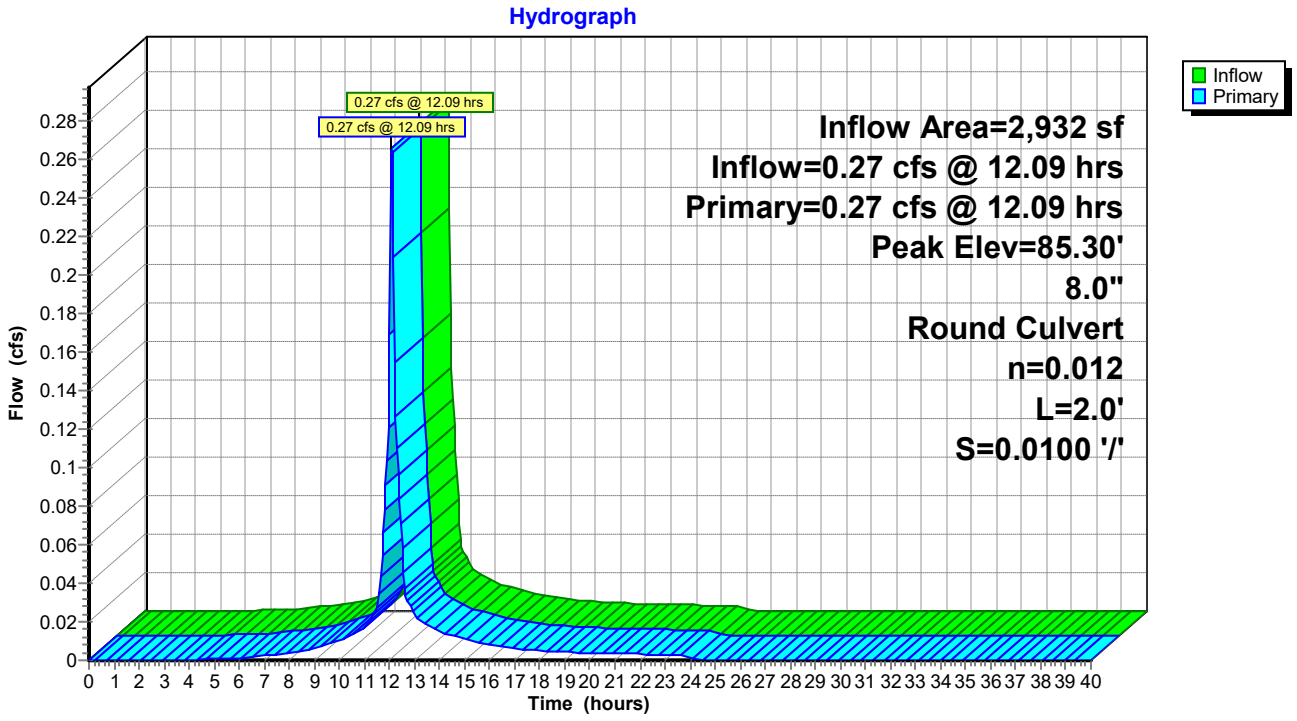
Inflow Area = 2,932 sf, 84.21% Impervious, Inflow Depth = 3.60" for 10 yr event
Inflow = 0.27 cfs @ 12.09 hrs, Volume= 880 cf
Outflow = 0.27 cfs @ 12.09 hrs, Volume= 880 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.27 cfs @ 12.09 hrs, Volume= 880 cf
Routed to Pond 8 : DMH8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.30' @ 13.24 hrs
Flood Elev= 90.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.60'	**8.0" Round Culvert** L= 2.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.60' / 84.58' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.06' TW=85.07' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 7: CDS7



Summary for Pond 8: DMH8

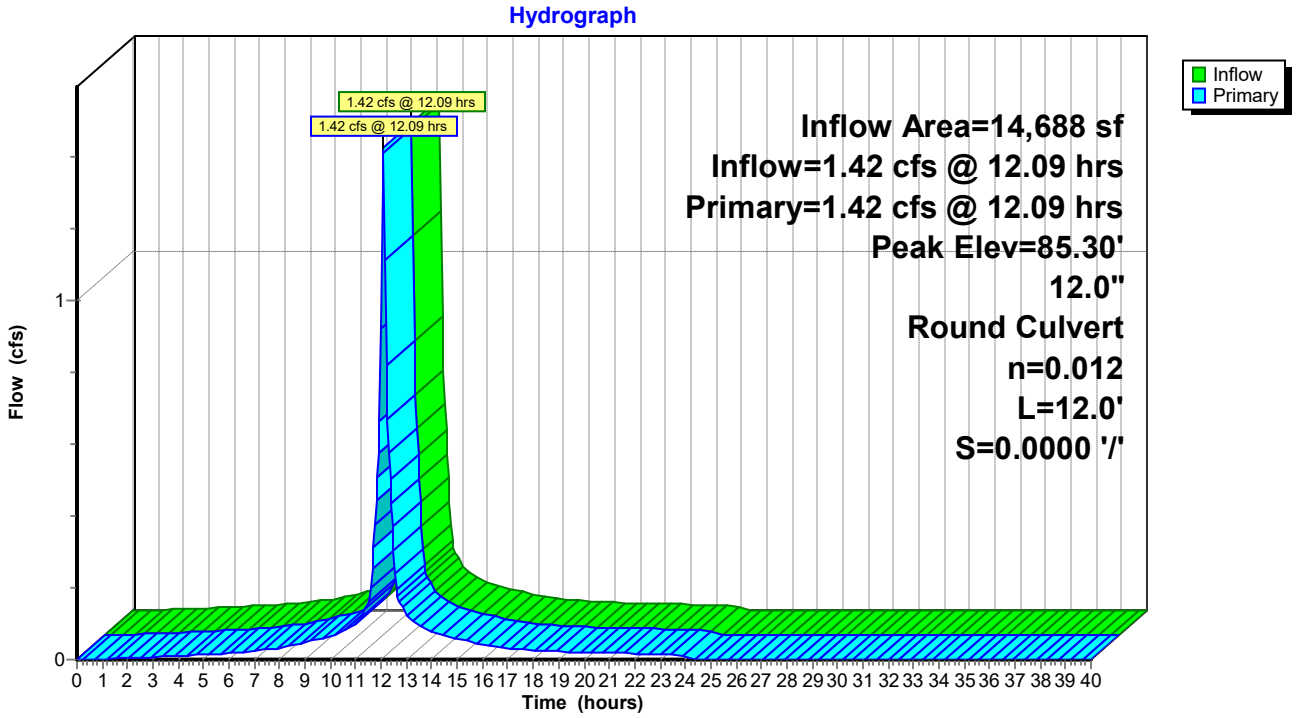
Inflow Area = 14,688 sf, 96.85% Impervious, Inflow Depth = 4.13" for 10 yr event
Inflow = 1.42 cfs @ 12.09 hrs, Volume= 5,057 cf
Outflow = 1.42 cfs @ 12.09 hrs, Volume= 5,057 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.42 cfs @ 12.09 hrs, Volume= 5,057 cf
Routed to Pond 1P : Infiltration Pipe Network

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.30' @ 13.19 hrs
Flood Elev= 90.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.25'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.25' / 84.25' S= 0.0000 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.39 cfs @ 12.09 hrs HW=85.07' TW=84.63' (Dynamic Tailwater)
1=Culvert (Barrel Controls 1.39 cfs @ 2.73 fps)

Pond 8: DMH8

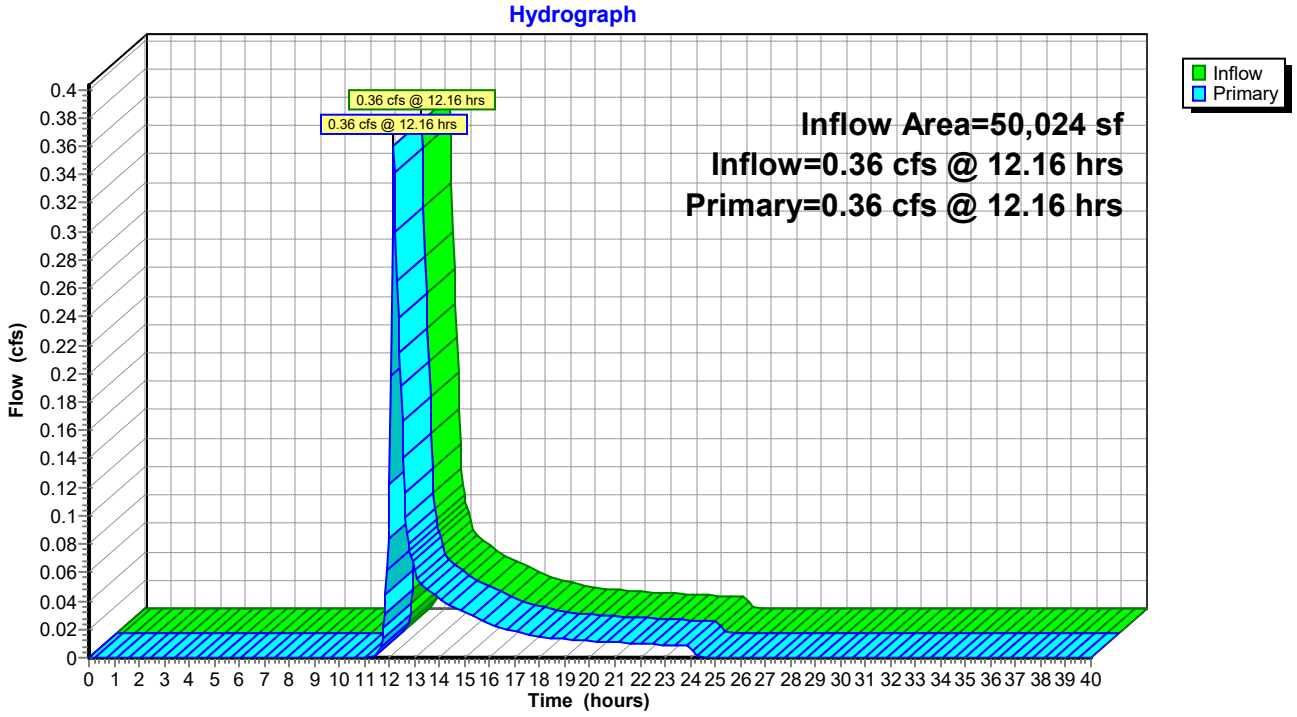


Summary for Link 1L: B Series Wetland

Inflow Area = 50,024 sf, 66.69% Impervious, Inflow Depth = 0.35" for 10 yr event
Inflow = 0.36 cfs @ 12.16 hrs, Volume= 1,470 cf
Primary = 0.36 cfs @ 12.16 hrs, Volume= 1,470 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 9L

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: B Series Wetland

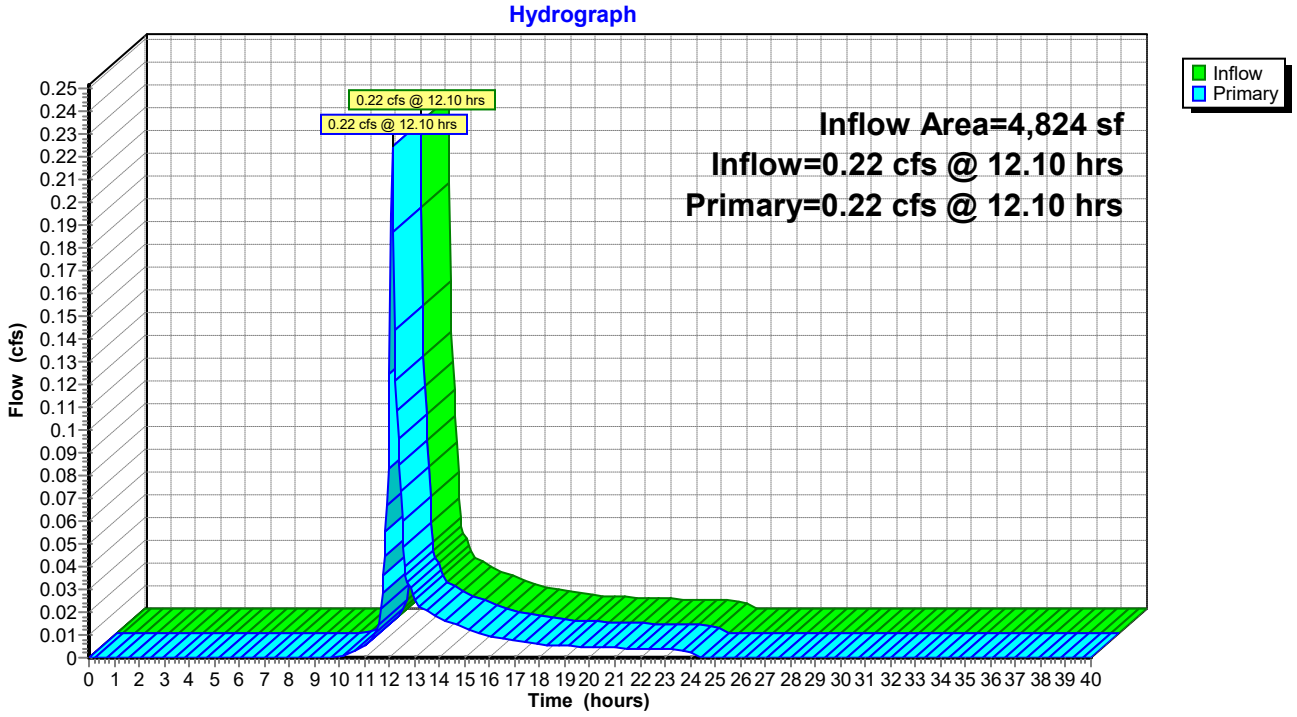


Summary for Link 2L: North Ave

Inflow Area = 4,824 sf, 28.25% Impervious, Inflow Depth = 1.80" for 10 yr event
Inflow = 0.22 cfs @ 12.10 hrs, Volume= 723 cf
Primary = 0.22 cfs @ 12.10 hrs, Volume= 723 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 9L

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: North Ave



Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=15,827 sf 87.81% Impervious Runoff Depth=4.79"
Tc=6.0 min CN=93 Runoff=1.86 cfs 6,315 cf

Subcatchment 2S: Runoff Area=4,033 sf 74.14% Impervious Runoff Depth=4.24"
Tc=6.0 min CN=88 Runoff=0.44 cfs 1,426 cf

Subcatchment 3S: Roof Runoff Area=11,756 sf 100.00% Impervious Runoff Depth=5.36"
Tc=6.0 min CN=98 Runoff=1.45 cfs 5,253 cf

Subcatchment 4S: Runoff Area=15,476 sf 14.53% Impervious Runoff Depth=1.82"
Flow Length=36' Slope=0.0170 '/' Tc=10.3 min CN=62 Runoff=0.61 cfs 2,349 cf

Subcatchment 5S: Runoff Area=4,281 sf 26.23% Impervious Runoff Depth=2.58"
Tc=6.0 min CN=71 Runoff=0.29 cfs 920 cf

Subcatchment 6S: Runoff Area=1,635 sf 41.77% Impervious Runoff Depth=3.04"
Tc=6.0 min CN=76 Runoff=0.13 cfs 414 cf

Subcatchment 7S: Runoff Area=1,660 sf 41.14% Impervious Runoff Depth=3.04"
Tc=6.0 min CN=76 Runoff=0.13 cfs 420 cf

Subcatchment 8S: Runoff Area=2,932 sf 84.21% Impervious Runoff Depth=4.68"
Tc=6.0 min CN=92 Runoff=0.34 cfs 1,143 cf

Subcatchment 9S: Runoff Area=543 sf 44.20% Impervious Runoff Depth=3.13"
Tc=6.0 min CN=77 Runoff=0.04 cfs 142 cf

Subcatchment 10S: Runoff Area=2,088 sf 0.00% Impervious Runoff Depth=1.74"
Tc=6.0 min CN=61 Runoff=0.09 cfs 303 cf

Subcatchment 11S: Runoff Area=1,386 sf 0.00% Impervious Runoff Depth=1.74"
Tc=6.0 min CN=61 Runoff=0.06 cfs 201 cf

Pond 1: CB1 Peak Elev=86.28' Inflow=0.44 cfs 1,426 cf
12.0" Round Culvert n=0.012 L=135.0' S=0.0100 '/' Outflow=0.44 cfs 1,426 cf

Pond 1P: Infiltration Pipe Network Peak Elev=85.64' Storage=5,341 cf Inflow=4.08 cfs 14,136 cf
Discarded=0.25 cfs 12,864 cf Primary=0.30 cfs 1,273 cf Outflow=0.55 cfs 14,136 cf

Pond 2: DMH2 Peak Elev=85.67' Inflow=0.44 cfs 1,426 cf
12.0" Round Culvert n=0.012 L=31.0' S=0.0100 '/' Outflow=0.44 cfs 1,426 cf

Pond 2P: Depressed Landscape Area Peak Elev=85.46' Storage=125 cf Inflow=0.09 cfs 303 cf
Outflow=0.01 cfs 303 cf

Pond 3: DGCB3 Peak Elev=85.80' Inflow=1.86 cfs 6,315 cf
12.0" Round Culvert n=0.012 L=3.0' S=0.0100 '/' Outflow=1.86 cfs 6,315 cf

Pond 3P: Depressed Landscape Area Peak Elev=86.67' Storage=155 cf Inflow=0.13 cfs 420 cf
Outflow=0.02 cfs 420 cf

Pond 4: DMH4 Peak Elev=85.67' Inflow=2.30 cfs 7,741 cf
12.0" Round Culvert n=0.012 L=4.0' S=0.0100 '/' Outflow=2.30 cfs 7,741 cf

Pond 4P: Depressed Landscape Area Peak Elev=86.72' Storage=156 cf Inflow=0.13 cfs 414 cf
Outflow=0.01 cfs 414 cf

Pond 5: CDS5 Peak Elev=85.65' Inflow=2.30 cfs 7,741 cf
12.0" Round Culvert n=0.012 L=6.5' S=0.0000 '/' Outflow=2.30 cfs 7,741 cf

Pond 5P: Depressed Landscape Area Peak Elev=85.11' Storage=36 cf Inflow=0.06 cfs 201 cf
Outflow=0.02 cfs 201 cf

Pond 6: TD6 Peak Elev=85.65' Inflow=0.34 cfs 1,143 cf
8.0" Round Culvert n=0.012 L=39.0' S=0.0103 '/' Outflow=0.34 cfs 1,143 cf

Pond 7: CDS7 Peak Elev=85.65' Inflow=0.34 cfs 1,143 cf
8.0" Round Culvert n=0.012 L=2.0' S=0.0100 '/' Outflow=0.34 cfs 1,143 cf

Pond 8: DMH8 Peak Elev=85.64' Inflow=1.79 cfs 6,396 cf
12.0" Round Culvert n=0.012 L=12.0' S=0.0000 '/' Outflow=1.79 cfs 6,396 cf

Link 1L: B Series Wetland Inflow=0.61 cfs 3,622 cf
Primary=0.61 cfs 3,622 cf

Link 2L: North Ave Inflow=0.33 cfs 1,062 cf
Primary=0.33 cfs 1,062 cf

Total Runoff Area = 61,617 sf Runoff Volume = 18,887 cf Average Runoff Depth = 3.68"
41.43% Pervious = 25,528 sf 58.57% Impervious = 36,089 sf

Summary for Subcatchment 1S:

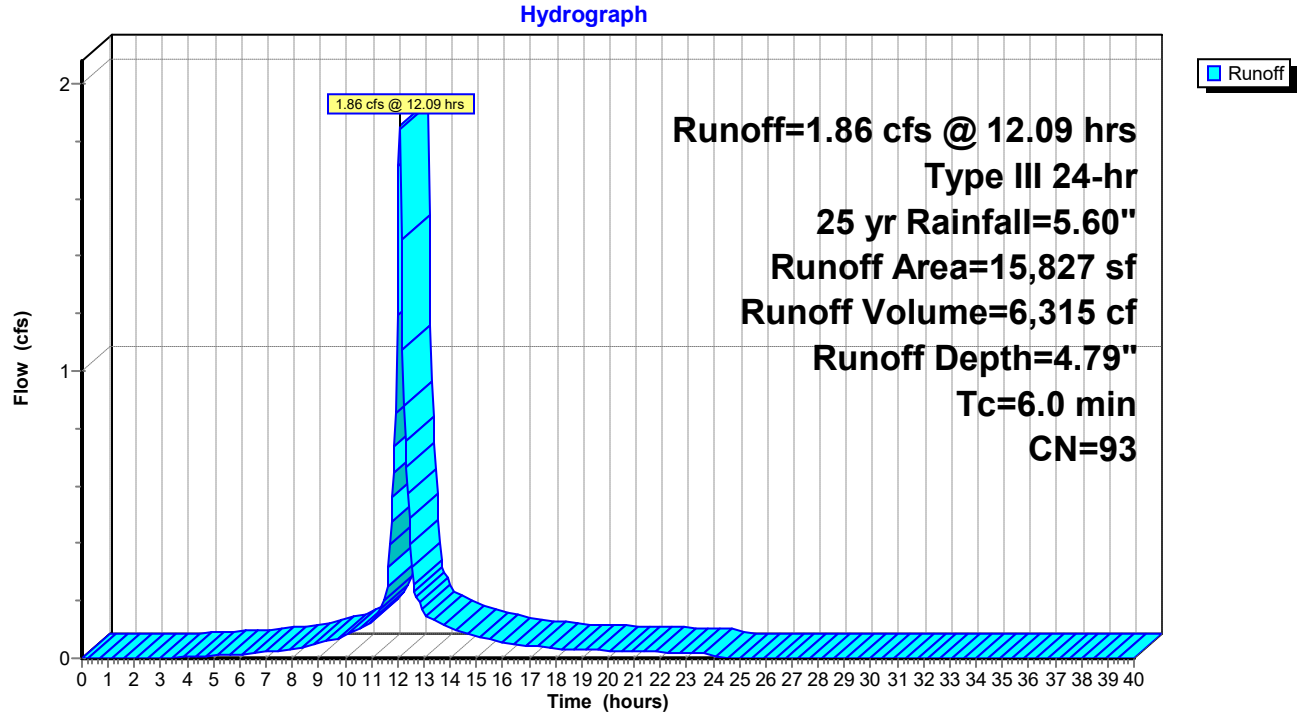
Runoff = 1.86 cfs @ 12.09 hrs, Volume= 6,315 cf, Depth= 4.79"
Routed to Pond 3 : DGCB3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
13,897	98	Paved parking, HSG B
1,930	61	>75% Grass cover, Good, HSG B
15,827	93	Weighted Average
1,930		12.19% Pervious Area
13,897		87.81% Impervious Area

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

Subcatchment 1S:



Summary for Subcatchment 2S:

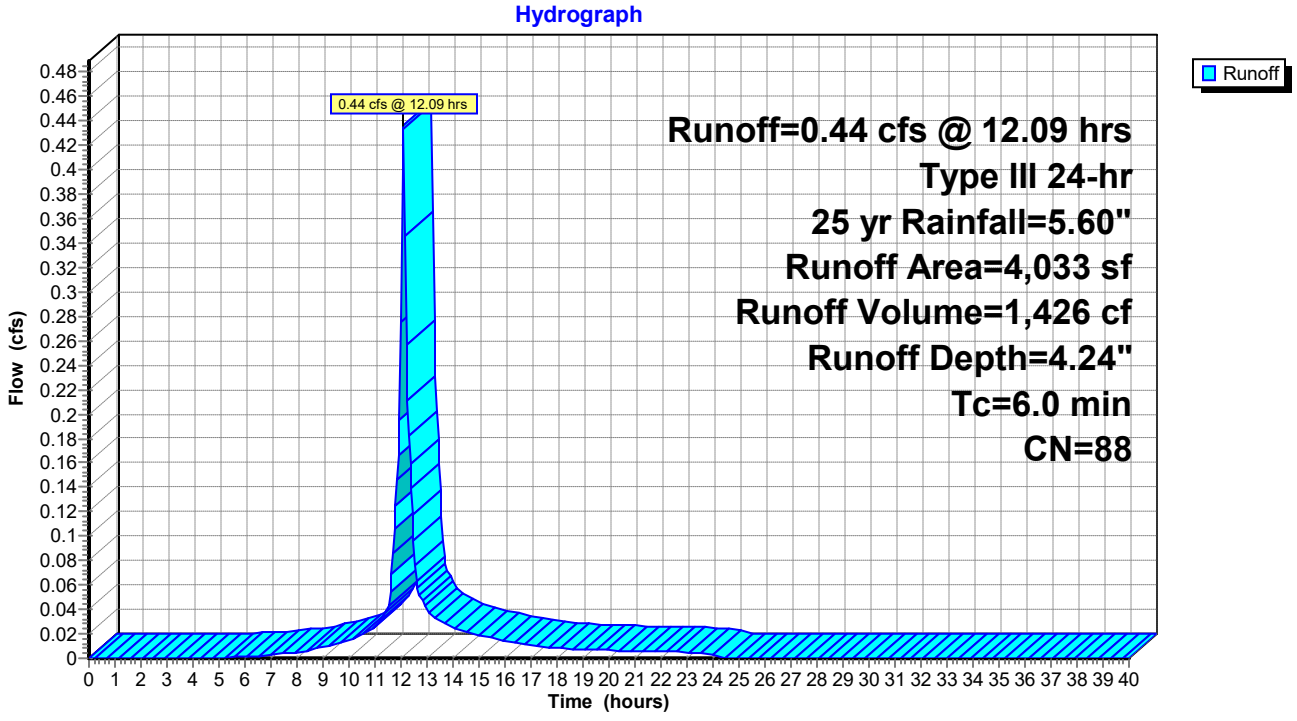
Runoff = 0.44 cfs @ 12.09 hrs, Volume= 1,426 cf, Depth= 4.24"
Routed to Pond 1 : CB1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
2,990	98	Paved parking, HSG B
1,043	61	>75% Grass cover, Good, HSG B
4,033	88	Weighted Average
1,043		25.86% Pervious Area
2,990		74.14% Impervious Area

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

Subcatchment 2S:



Summary for Subcatchment 3S: Roof

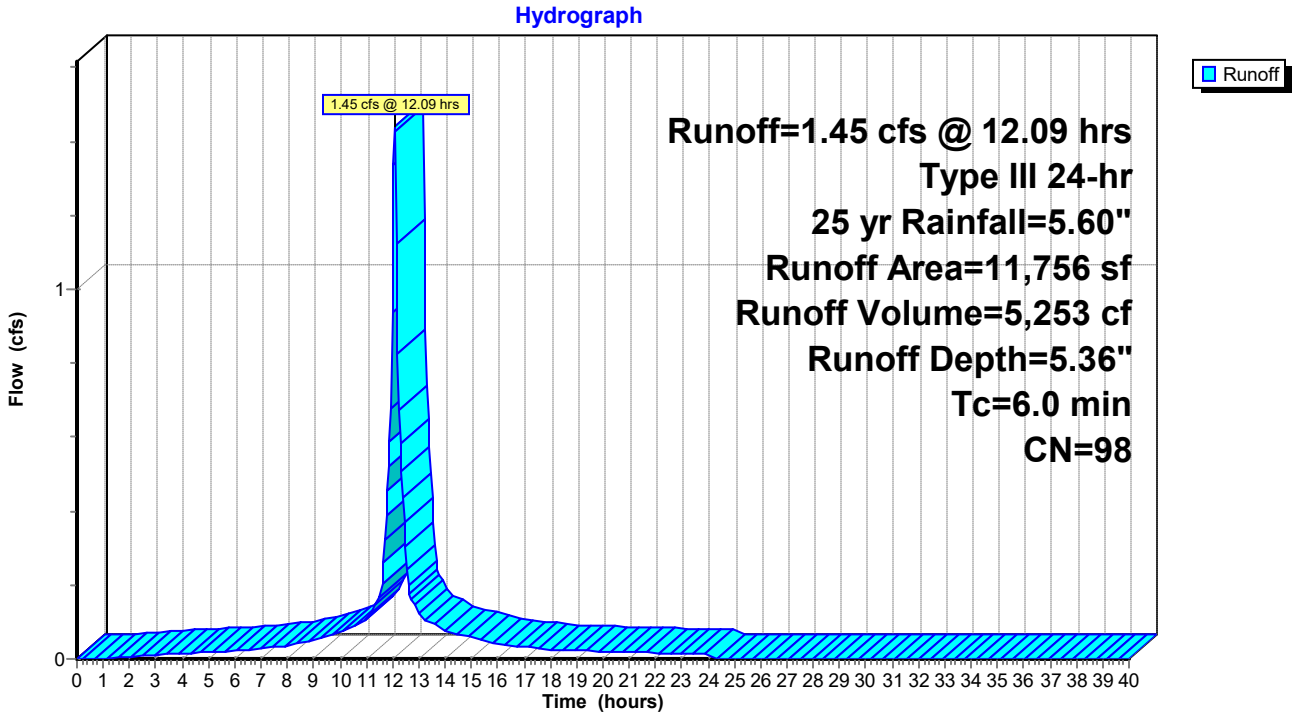
Runoff = 1.45 cfs @ 12.09 hrs, Volume= 5,253 cf, Depth= 5.36"
Routed to Pond 8 : DMH8

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
11,756	98	Roofs, HSG B
11,756		100.00% Impervious Area

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

Subcatchment 3S: Roof



Summary for Subcatchment 4S:

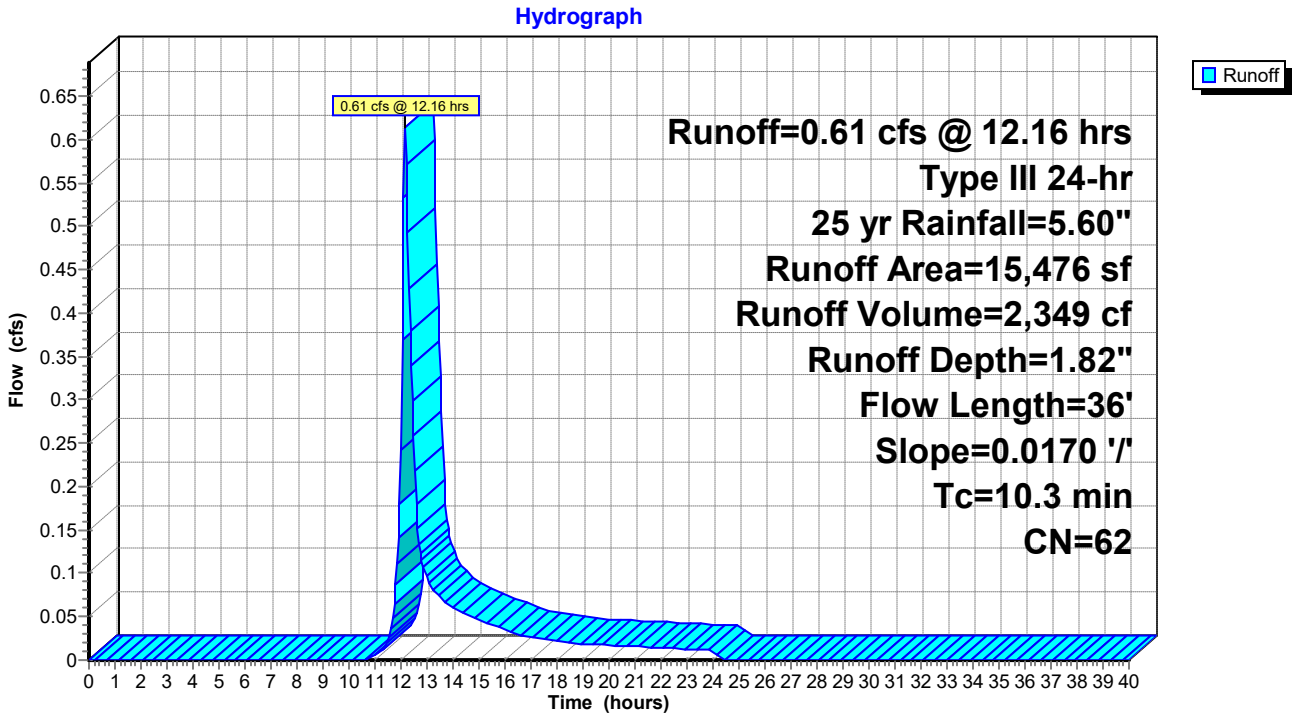
Runoff = 0.61 cfs @ 12.16 hrs, Volume= 2,349 cf, Depth= 1.82"
Routed to Link 1L : B Series Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
10,238	55	Woods, Good, HSG B
2,990	61	>75% Grass cover, Good, HSG B
2,248	98	Paved parking, HSG B
15,476	62	Weighted Average
13,228		85.47% Pervious Area
2,248		14.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	36	0.0170	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"

Subcatchment 4S:



Summary for Subcatchment 5S:

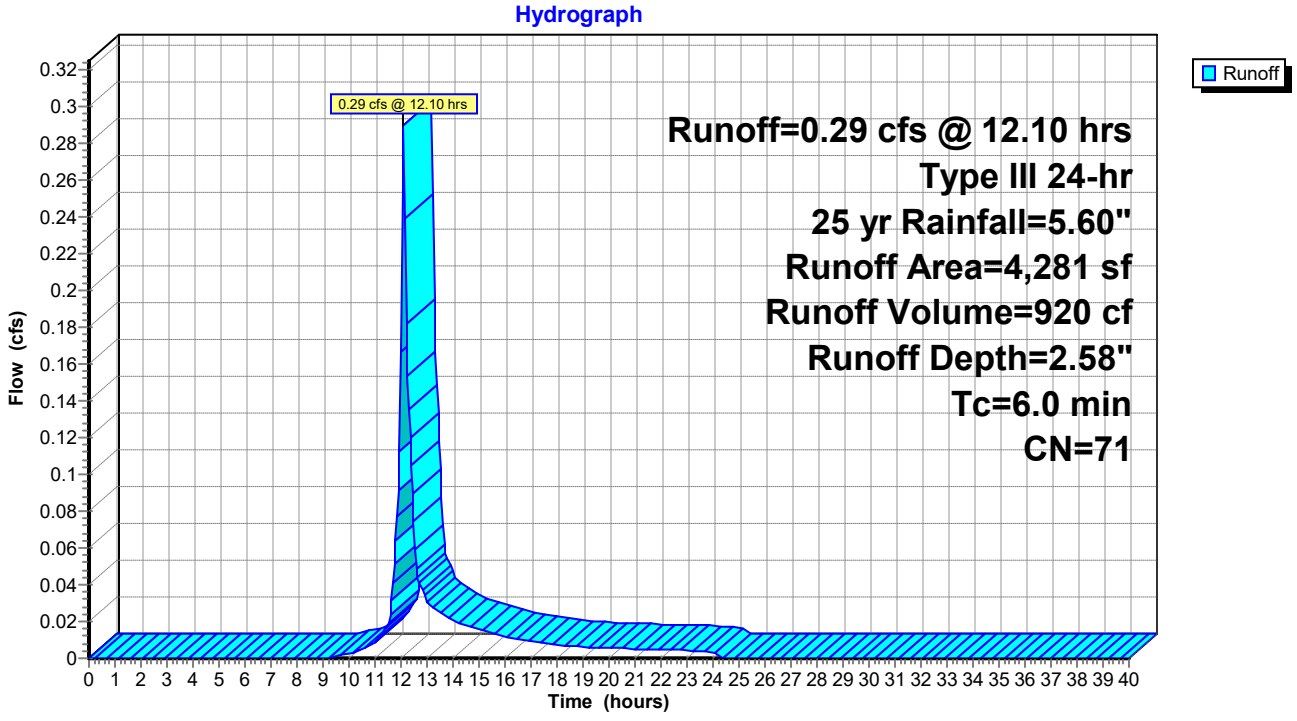
Runoff = 0.29 cfs @ 12.10 hrs, Volume= 920 cf, Depth= 2.58"
Routed to Link 2L : North Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
1,123	98	Paved parking, HSG B
3,158	61	>75% Grass cover, Good, HSG B
4,281	71	Weighted Average
3,158		73.77% Pervious Area
1,123		26.23% Impervious Area

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

Subcatchment 5S:



Summary for Subcatchment 6S:

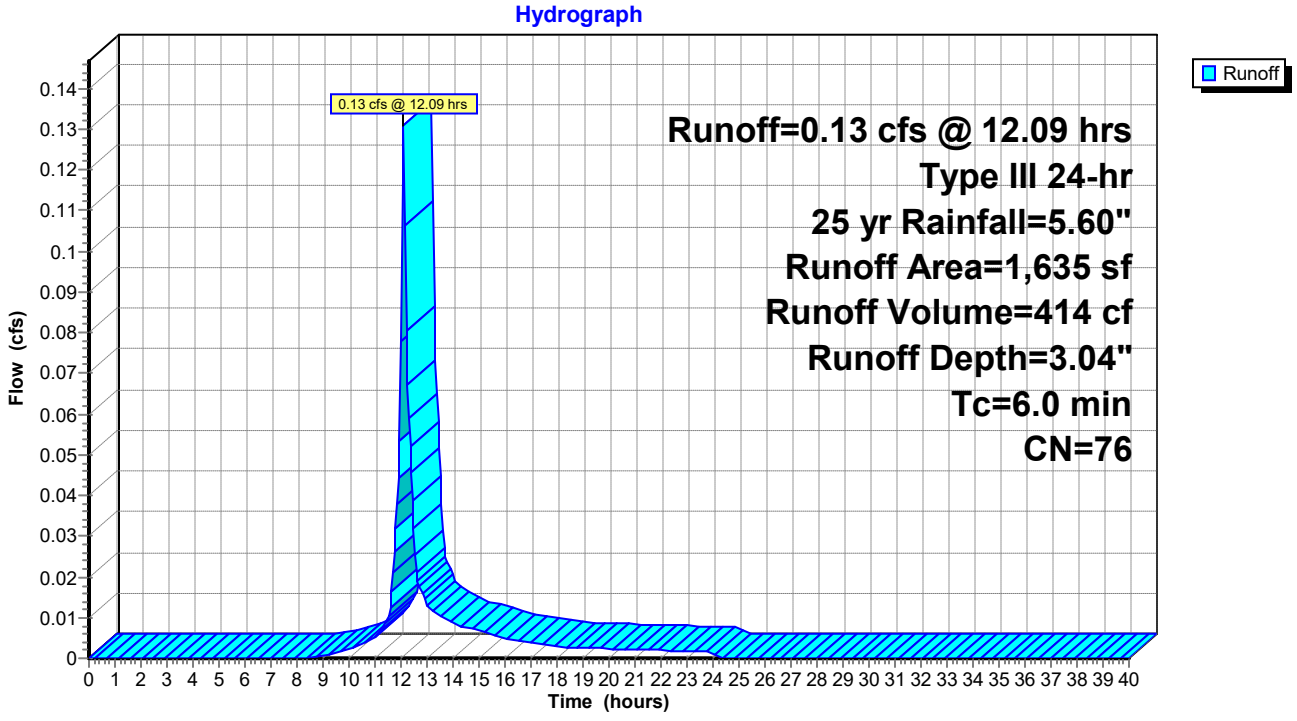
Runoff = 0.13 cfs @ 12.09 hrs, Volume= 414 cf, Depth= 3.04"
Routed to Pond 4P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
952	61	>75% Grass cover, Good, HSG B
683	98	Paved parking, HSG B
1,635	76	Weighted Average
952		58.23% Pervious Area
683		41.77% Impervious Area

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

Subcatchment 6S:



Summary for Subcatchment 7S:

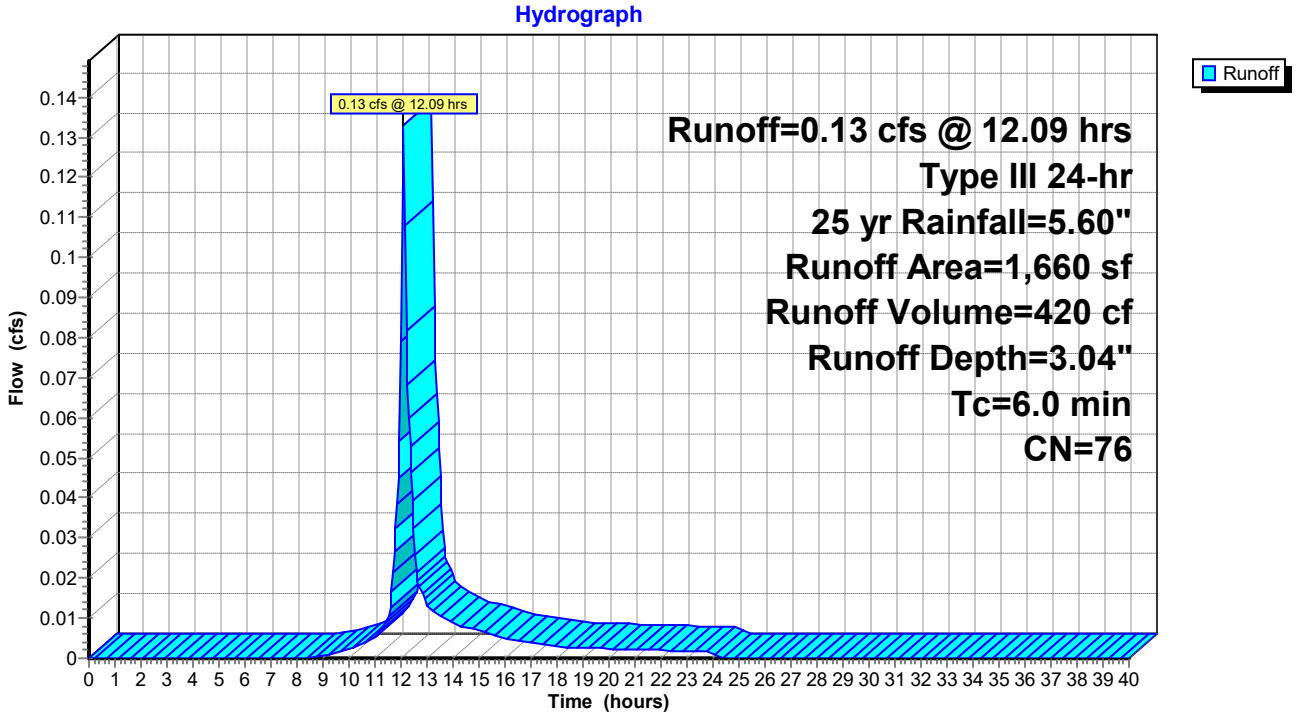
Runoff = 0.13 cfs @ 12.09 hrs, Volume= 420 cf, Depth= 3.04"
Routed to Pond 3P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
977	61	>75% Grass cover, Good, HSG B
683	98	Paved parking, HSG B
1,660	76	Weighted Average
977		58.86% Pervious Area
683		41.14% Impervious Area

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

Subcatchment 7S:



Summary for Subcatchment 8S:

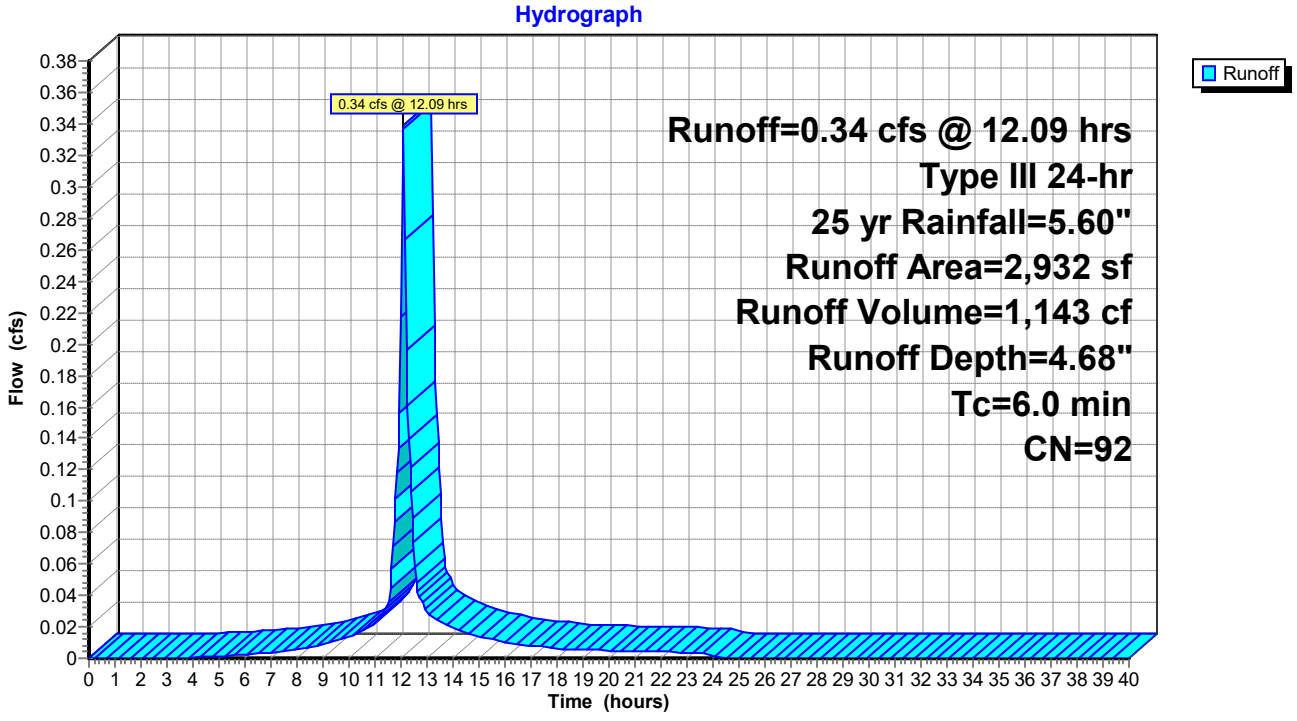
Runoff = 0.34 cfs @ 12.09 hrs, Volume= 1,143 cf, Depth= 4.68"
Routed to Pond 6 : TD6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
463	61	>75% Grass cover, Good, HSG B
2,469	98	Paved parking, HSG B
2,932	92	Weighted Average
463		15.79% Pervious Area
2,469		84.21% Impervious Area

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

Subcatchment 8S:



Summary for Subcatchment 9S:

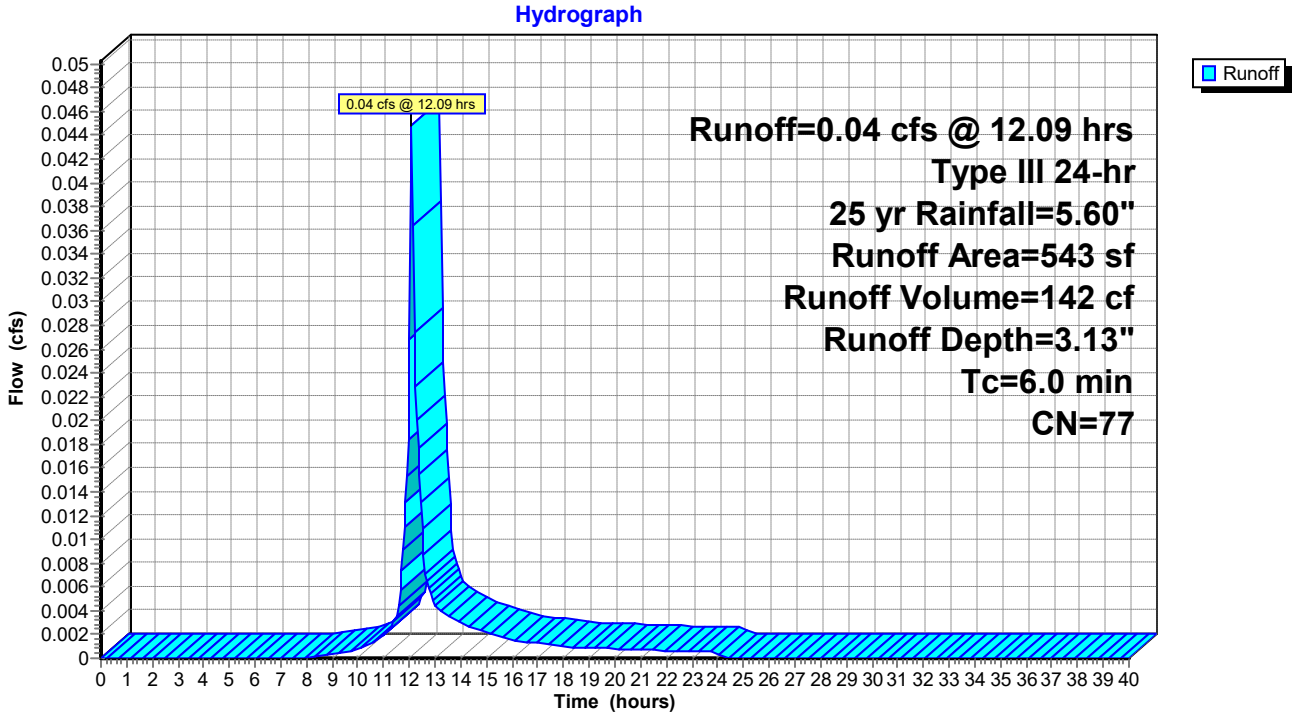
Runoff = 0.04 cfs @ 12.09 hrs, Volume= 142 cf, Depth= 3.13"
Routed to Link 2L : North Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
303	61	>75% Grass cover, Good, HSG B
240	98	Paved parking, HSG B
543	77	Weighted Average
303		55.80% Pervious Area
240		44.20% Impervious Area

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

Subcatchment 9S:



Summary for Subcatchment 10S:

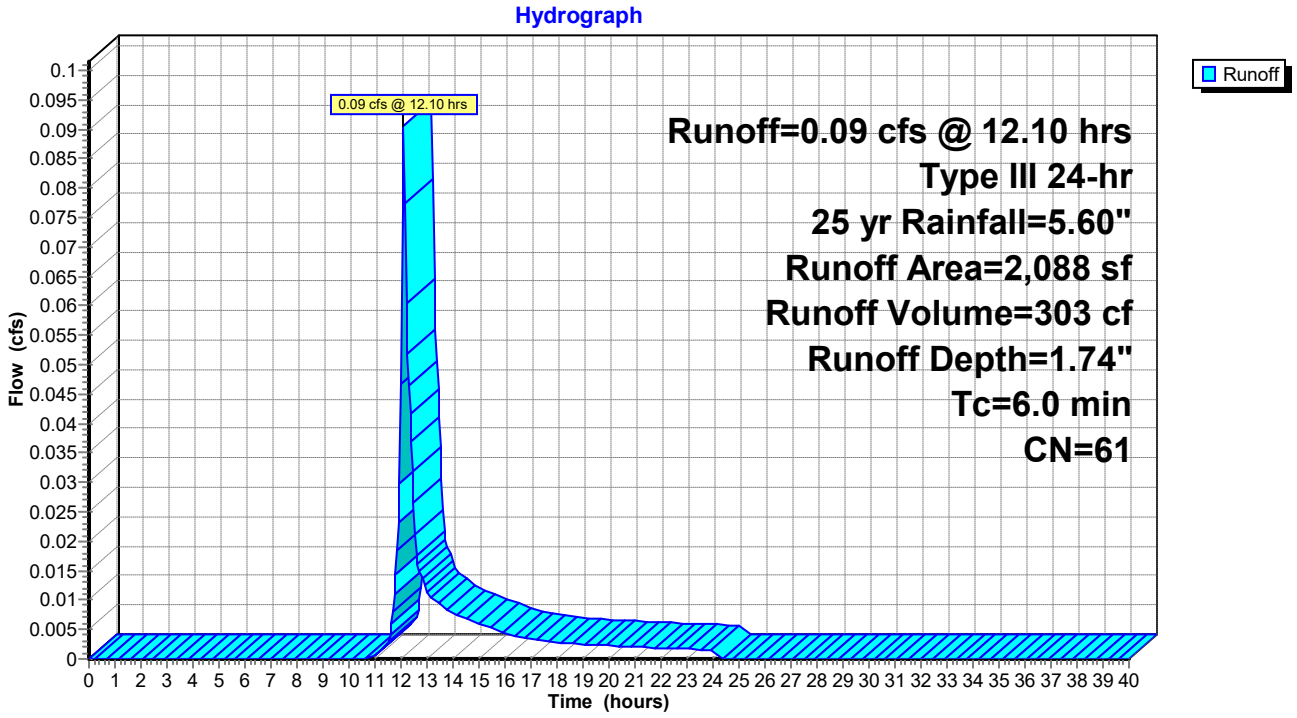
Runoff = 0.09 cfs @ 12.10 hrs, Volume= 303 cf, Depth= 1.74"
Routed to Pond 2P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
2,088	61	>75% Grass cover, Good, HSG B
2,088		100.00% Pervious Area

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

Subcatchment 10S:



Summary for Subcatchment 11S:

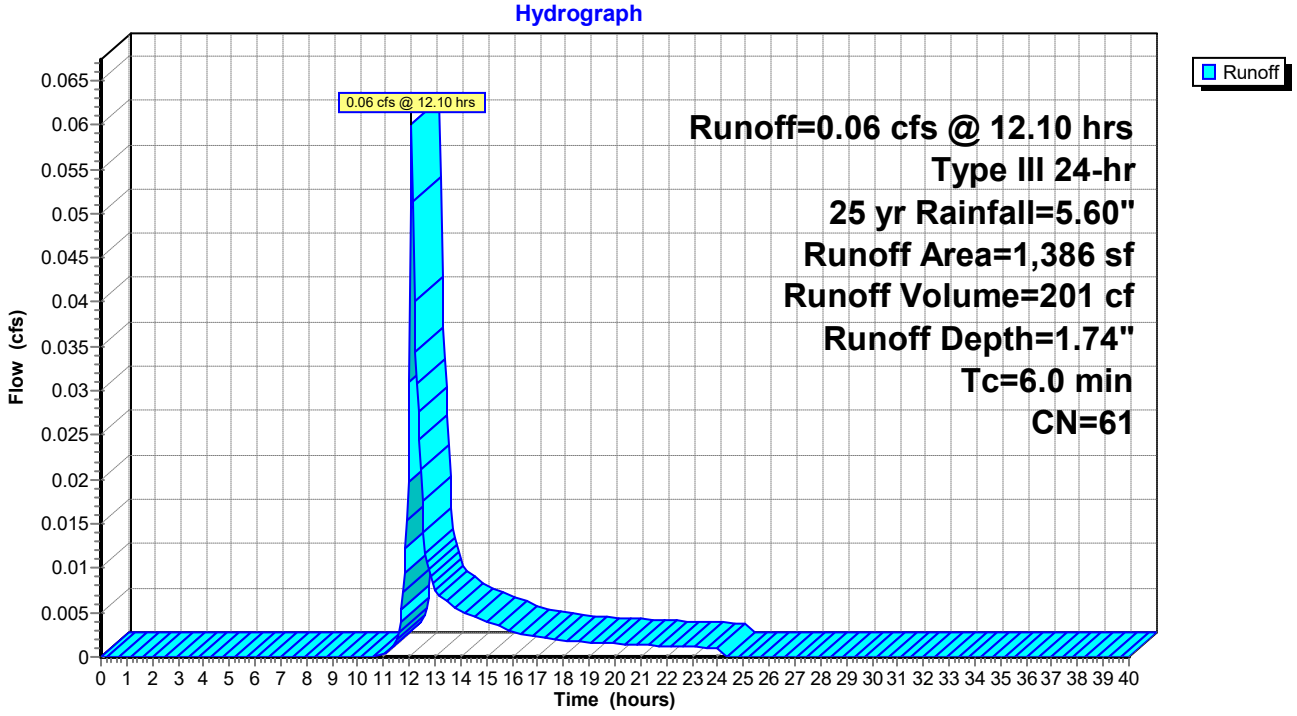
Runoff = 0.06 cfs @ 12.10 hrs, Volume= 201 cf, Depth= 1.74"
Routed to Pond 5P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=5.60"

Area (sf)	CN	Description
1,386	61	>75% Grass cover, Good, HSG B
1,386		100.00% Pervious Area

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

Subcatchment 11S:



Summary for Pond 1: CB1

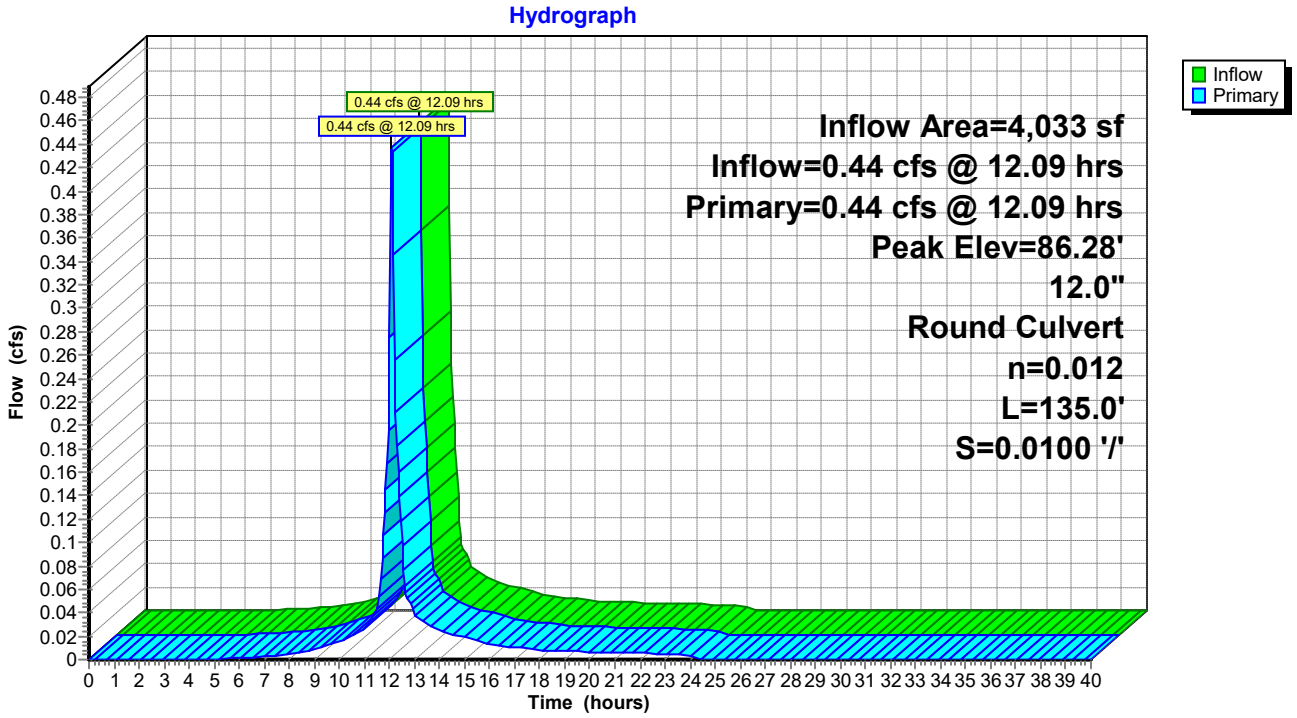
Inflow Area = 4,033 sf, 74.14% Impervious, Inflow Depth = 4.24" for 25 yr event
Inflow = 0.44 cfs @ 12.09 hrs, Volume= 1,426 cf
Outflow = 0.44 cfs @ 12.09 hrs, Volume= 1,426 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.44 cfs @ 12.09 hrs, Volume= 1,426 cf
Routed to Pond 2 : DMH2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.28' @ 12.10 hrs
Flood Elev= 88.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.95'	**12.0" Round Culvert** L= 135.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.95' / 84.60' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.39 cfs @ 12.09 hrs HW=86.28' TW=85.37' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.39 cfs @ 2.56 fps)

Pond 1: CB1



Summary for Pond 1P: Infiltration Pipe Network

Inflow Area = 34,548 sf, 90.05% Impervious, Inflow Depth = 4.91" for 25 yr event
Inflow = 4.08 cfs @ 12.09 hrs, Volume= 14,136 cf
Outflow = 0.55 cfs @ 12.62 hrs, Volume= 14,136 cf, Atten= 86%, Lag= 31.8 min
Discarded = 0.25 cfs @ 11.15 hrs, Volume= 12,864 cf
Primary = 0.30 cfs @ 12.62 hrs, Volume= 1,273 cf
Routed to Link 1L : B Series Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.64' @ 12.62 hrs Surf.Area= 4,503 sf Storage= 5,341 cf

Plug-Flow detention time= 138.4 min calculated for 14,119 cf (100% of inflow)
Center-of-Mass det. time= 138.2 min (904.8 - 766.5)

Volume	Invert	Avail.Storage	Storage Description
#1	83.75'	3,422 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 12,383 cf Overall - 3,828 cf Embedded = 8,555 cf x 40.0% Voids
#2	84.25'	3,828 cf	**Custom Stage Data** Listed below Inside #1
		7,250 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
83.75	4,503	0	0
86.50	4,503	12,383	12,383

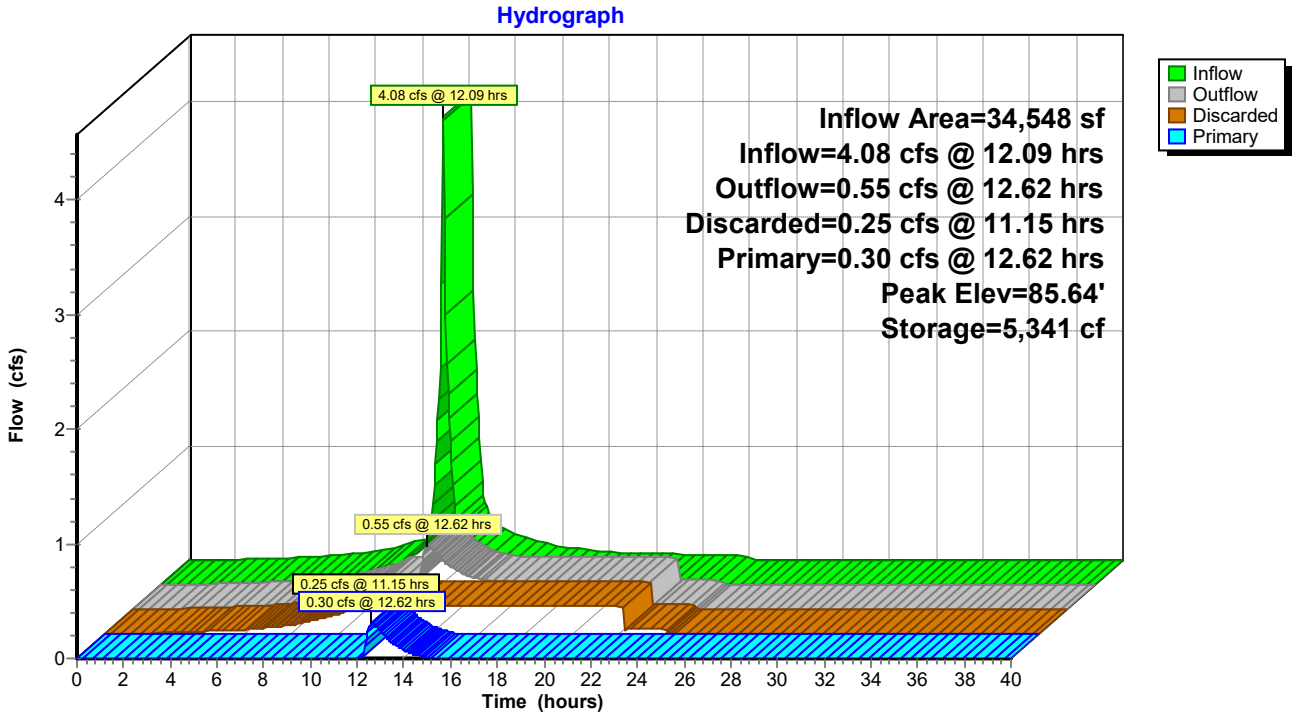
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
84.25	0	0
84.75	902	902
85.25	1,359	2,261
85.75	1,231	3,492
86.00	336	3,828

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.75'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	85.33'	**8.0" Round Culvert** L= 93.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.33' / 84.25' S= 0.0116 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.25 cfs @ 11.15 hrs HW=83.78' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=0.30 cfs @ 12.62 hrs HW=85.64' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.30 cfs @ 1.90 fps)

Pond 1P: Infiltration Pipe Network



Summary for Pond 2: DMH2

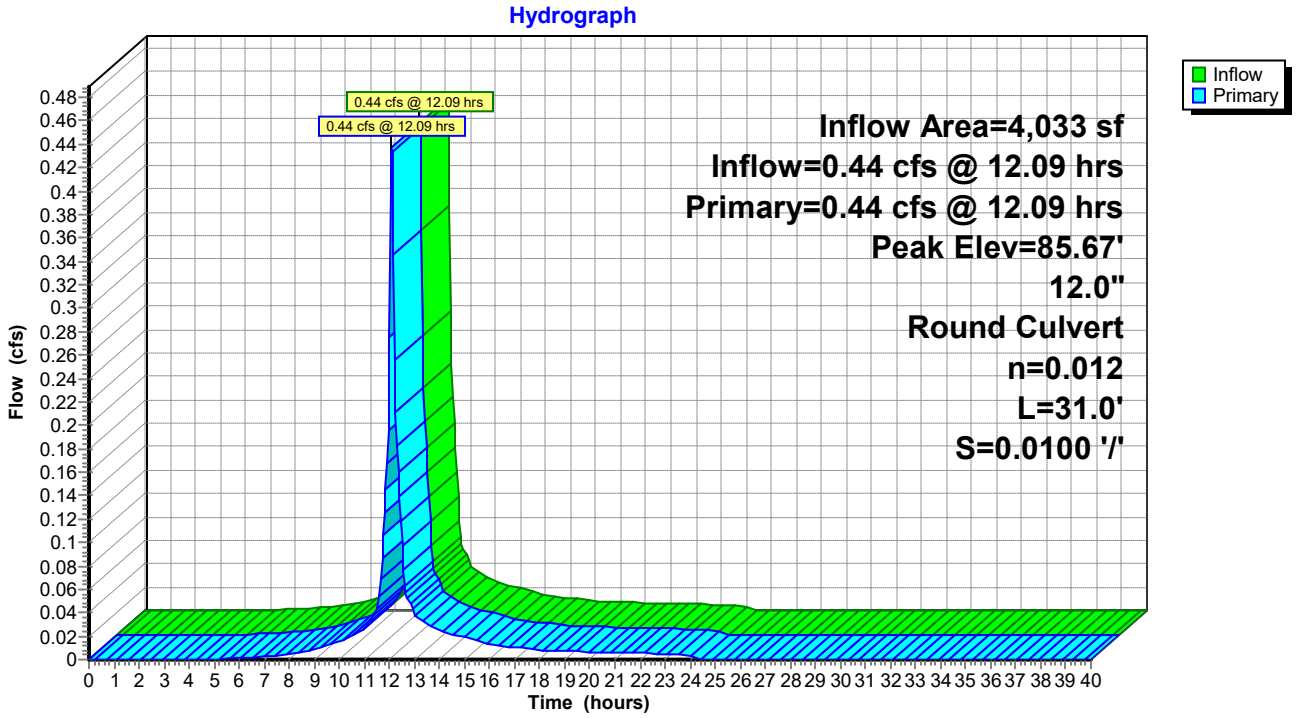
Inflow Area = 4,033 sf, 74.14% Impervious, Inflow Depth = 4.24" for 25 yr event
Inflow = 0.44 cfs @ 12.09 hrs, Volume= 1,426 cf
Outflow = 0.44 cfs @ 12.09 hrs, Volume= 1,426 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.44 cfs @ 12.09 hrs, Volume= 1,426 cf
Routed to Pond 4 : DMH4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.67' @ 12.16 hrs
Flood Elev= 88.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.60'	**12.0" Round Culvert** L= 31.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.60' / 84.29' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.37' TW=85.60' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 2: DMH2



Summary for Pond 2P: Depressed Landscape Area

Inflow Area = 2,088 sf, 0.00% Impervious, Inflow Depth = 1.74" for 25 yr event
Inflow = 0.09 cfs @ 12.10 hrs, Volume= 303 cf
Outflow = 0.01 cfs @ 13.94 hrs, Volume= 303 cf, Atten= 91%, Lag= 110.2 min
Discarded = 0.01 cfs @ 13.94 hrs, Volume= 303 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.46' @ 13.94 hrs Surf.Area= 337 sf Storage= 125 cf

Plug-Flow detention time= 176.1 min calculated for 303 cf (100% of inflow)
Center-of-Mass det. time= 176.0 min (1,040.6 - 864.6)

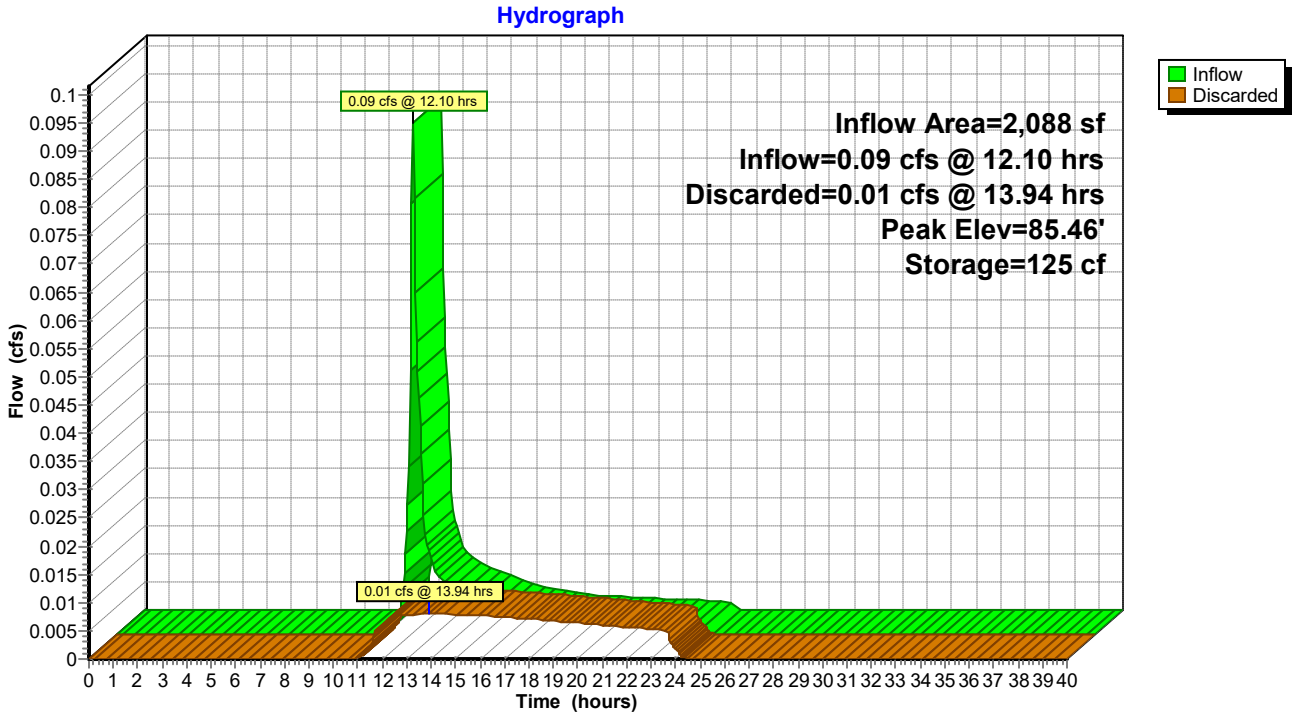
Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	210	0	0
86.00	488	349	349

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 13.94 hrs HW=85.46' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 2P: Depressed Landscape Area



Summary for Pond 3: DGCB3

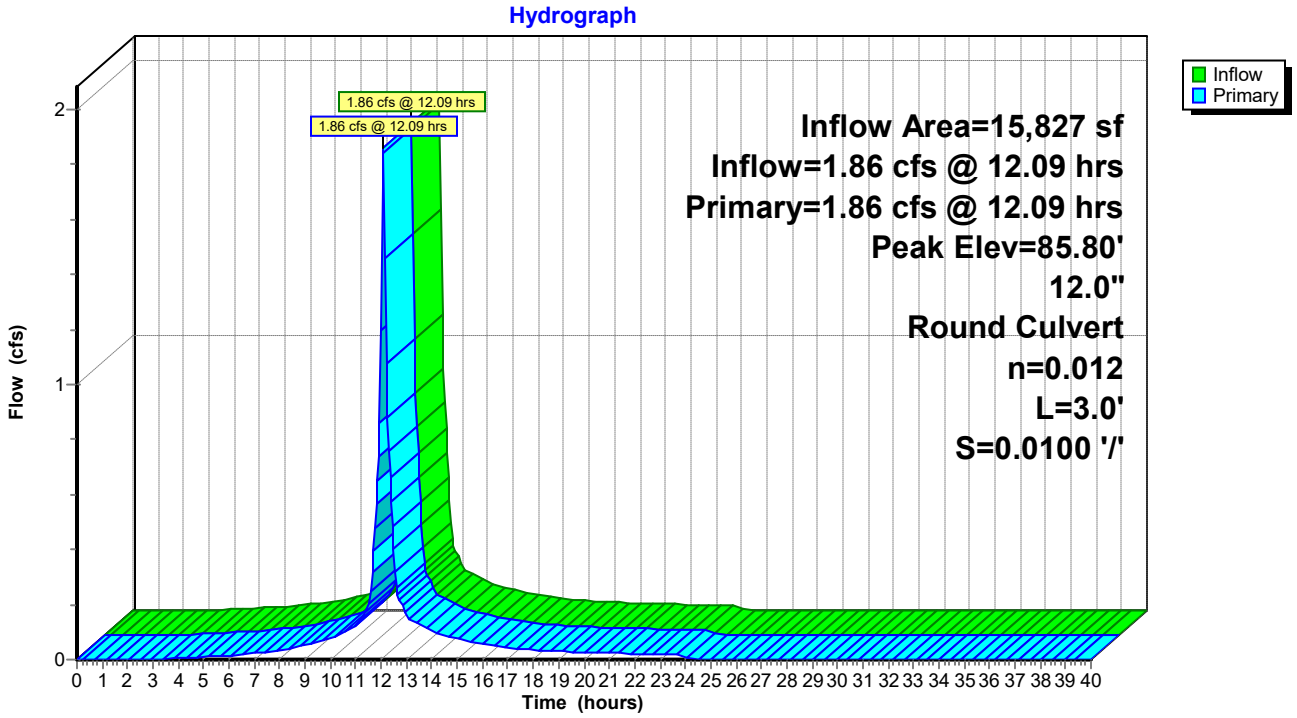
Inflow Area = 15,827 sf, 87.81% Impervious, Inflow Depth = 4.79" for 25 yr event
Inflow = 1.86 cfs @ 12.09 hrs, Volume= 6,315 cf
Outflow = 1.86 cfs @ 12.09 hrs, Volume= 6,315 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.86 cfs @ 12.09 hrs, Volume= 6,315 cf
Routed to Pond 4 : DMH4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.80' @ 12.15 hrs
Flood Elev= 87.33'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.32'	**12.0" Round Culvert** L= 3.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.32' / 84.29' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.56' TW=85.59' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 3: DGCB3



Summary for Pond 3P: Depressed Landscape Area

Inflow Area = 1,660 sf, 41.14% Impervious, Inflow Depth = 3.04" for 25 yr event
Inflow = 0.13 cfs @ 12.09 hrs, Volume= 420 cf
Outflow = 0.02 cfs @ 12.87 hrs, Volume= 420 cf, Atten= 88%, Lag= 46.7 min
Discarded = 0.02 cfs @ 12.87 hrs, Volume= 420 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.67' @ 12.87 hrs Surf.Area= 278 sf Storage= 155 cf

Plug-Flow detention time= 89.4 min calculated for 420 cf (100% of inflow)
Center-of-Mass det. time= 89.3 min (916.4 - 827.1)

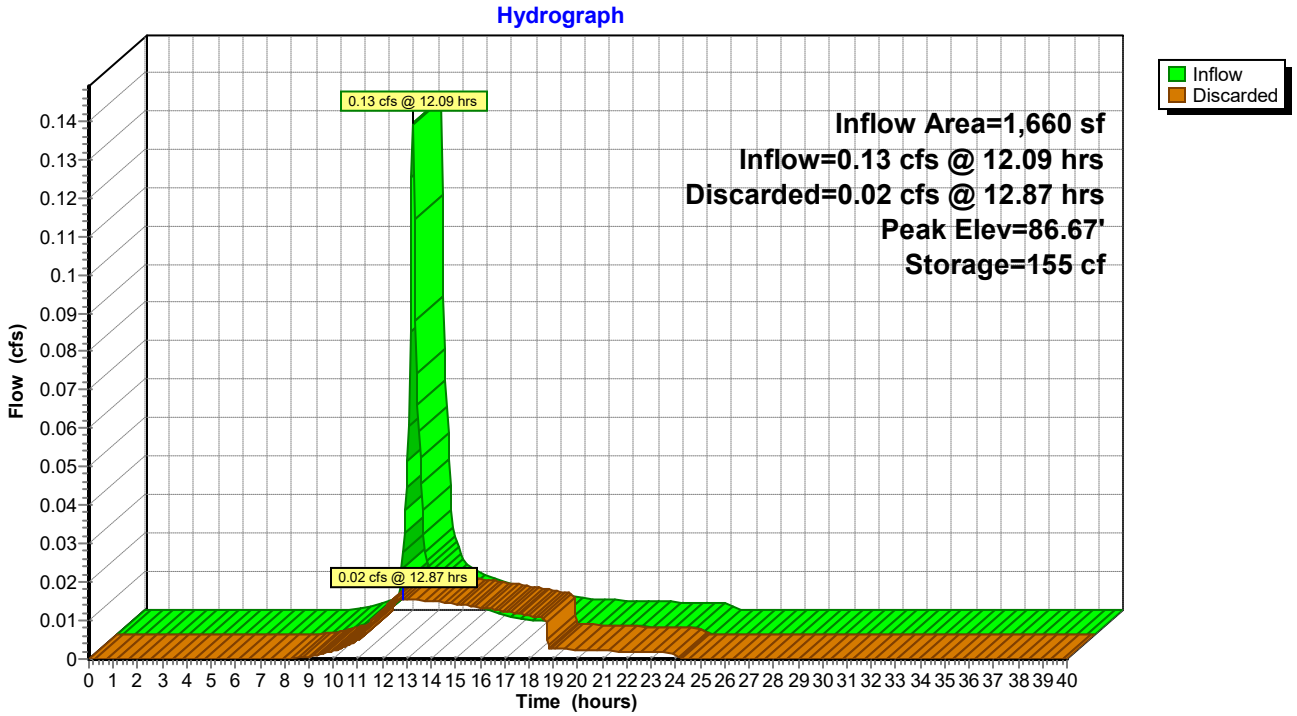
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	256 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
86.00	187	0	0
87.00	324	256	256

Device	Routing	Invert	Outlet Devices
#1	Discarded	86.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 12.87 hrs HW=86.67' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 3P: Depressed Landscape Area



Summary for Pond 4: DMH4

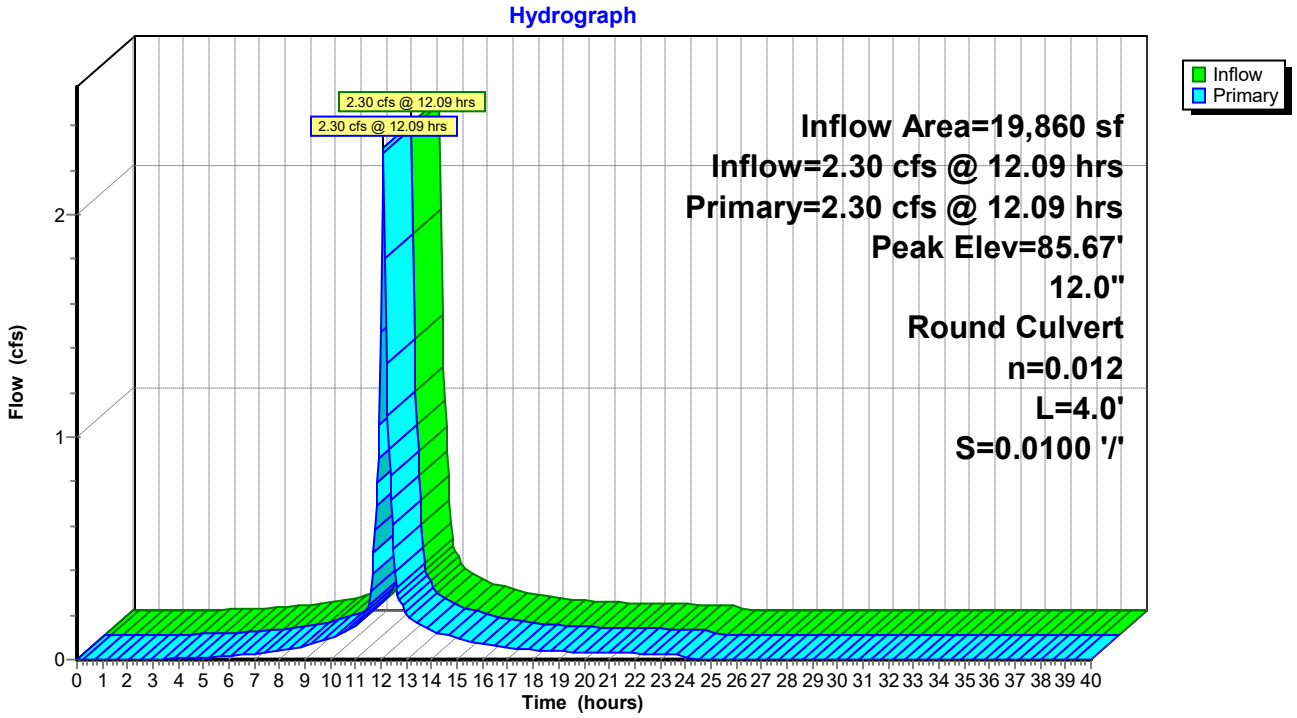
Inflow Area = 19,860 sf, 85.03% Impervious, Inflow Depth = 4.68" for 25 yr event
Inflow = 2.30 cfs @ 12.09 hrs, Volume= 7,741 cf
Outflow = 2.30 cfs @ 12.09 hrs, Volume= 7,741 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.30 cfs @ 12.09 hrs, Volume= 7,741 cf
Routed to Pond 5 : CDS5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.67' @ 12.11 hrs
Flood Elev= 87.36'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.29'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.29' / 84.25' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.92 cfs @ 12.09 hrs HW=85.59' TW=85.33' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.92 cfs @ 2.44 fps)

Pond 4: DMH4



Summary for Pond 4P: Depressed Landscape Area

Inflow Area = 1,635 sf, 41.77% Impervious, Inflow Depth = 3.04" for 25 yr event
Inflow = 0.13 cfs @ 12.09 hrs, Volume= 414 cf
Outflow = 0.01 cfs @ 12.93 hrs, Volume= 414 cf, Atten= 89%, Lag= 50.0 min
Discarded = 0.01 cfs @ 12.93 hrs, Volume= 414 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.72' @ 12.93 hrs Surf.Area= 260 sf Storage= 156 cf

Plug-Flow detention time= 98.1 min calculated for 413 cf (100% of inflow)
Center-of-Mass det. time= 98.0 min (925.1 - 827.1)

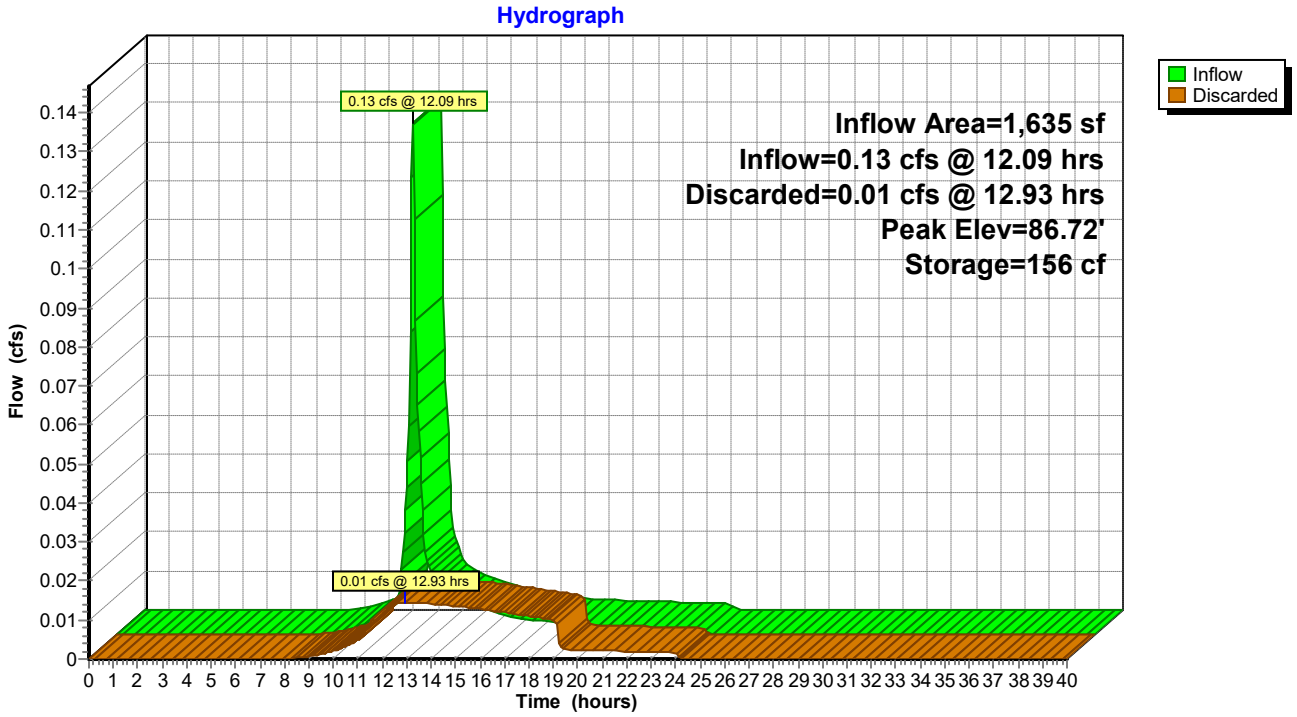
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	234 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
86.00	175	0	0
87.00	293	234	234

Device	Routing	Invert	Outlet Devices
#1	Discarded	86.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 12.93 hrs HW=86.72' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 4P: Depressed Landscape Area



Summary for Pond 5: CDS5

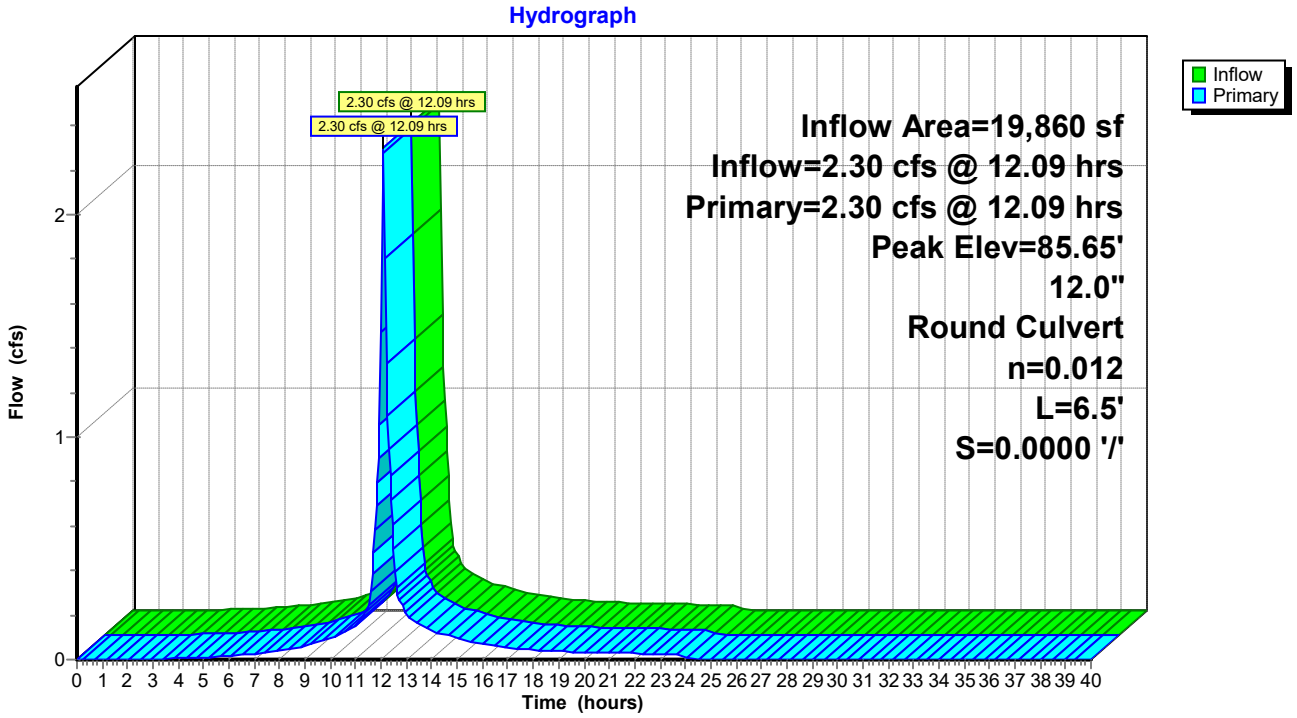
Inflow Area = 19,860 sf, 85.03% Impervious, Inflow Depth = 4.68" for 25 yr event
Inflow = 2.30 cfs @ 12.09 hrs, Volume= 7,741 cf
Outflow = 2.30 cfs @ 12.09 hrs, Volume= 7,741 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.30 cfs @ 12.09 hrs, Volume= 7,741 cf
Routed to Pond 1P : Infiltration Pipe Network

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.65' @ 12.66 hrs
Flood Elev= 87.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.25'	**12.0" Round Culvert** L= 6.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.25' / 84.25' S= 0.0000 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.24 cfs @ 12.09 hrs HW=85.33' TW=84.89' (Dynamic Tailwater)
1=Culvert (Barrel Controls 2.24 cfs @ 3.27 fps)

Pond 5: CDS5



Summary for Pond 5P: Depressed Landscape Area

Inflow Area = 1,386 sf, 0.00% Impervious, Inflow Depth = 1.74" for 25 yr event
Inflow = 0.06 cfs @ 12.10 hrs, Volume= 201 cf
Outflow = 0.02 cfs @ 12.48 hrs, Volume= 201 cf, Atten= 68%, Lag= 22.4 min
Discarded = 0.02 cfs @ 12.48 hrs, Volume= 201 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.11' @ 12.48 hrs Surf.Area= 348 sf Storage= 36 cf

Plug-Flow detention time= 11.3 min calculated for 201 cf (100% of inflow)
Center-of-Mass det. time= 11.3 min (875.9 - 864.6)

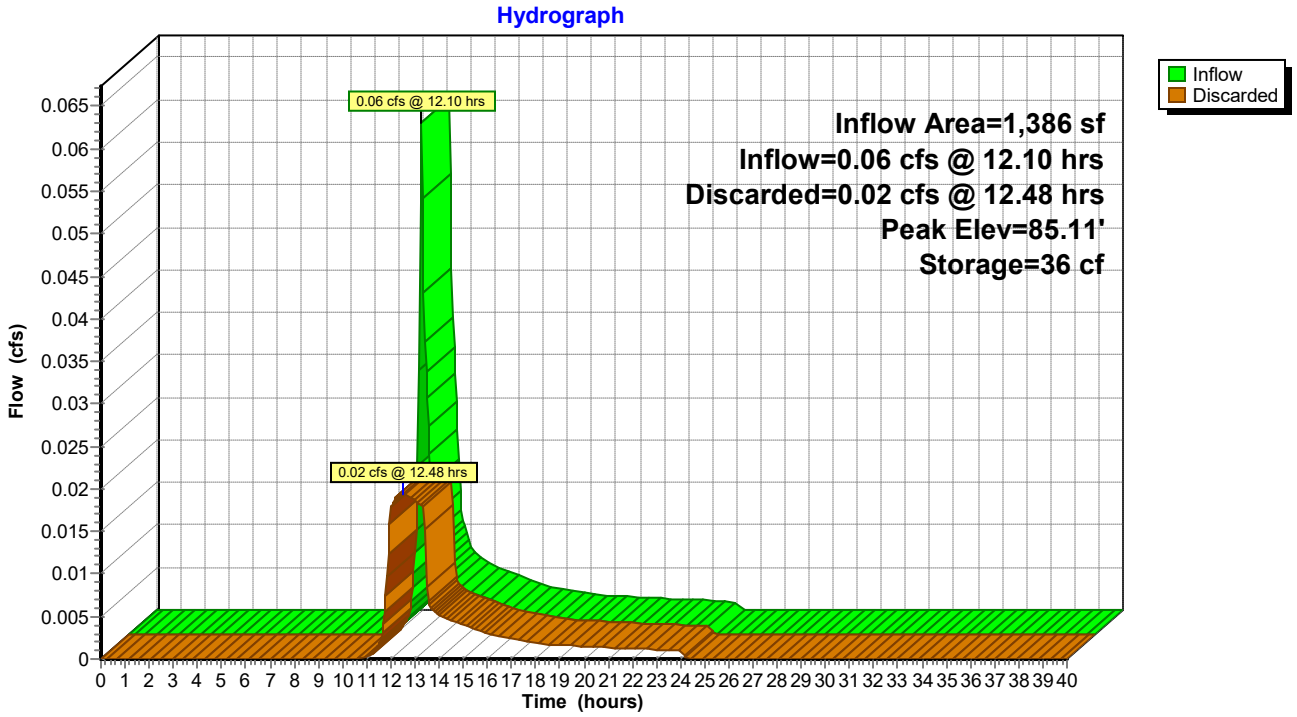
Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	462 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	316	0	0
86.00	608	462	462

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 12.48 hrs HW=85.11' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 5P: Depressed Landscape Area



Summary for Pond 6: TD6

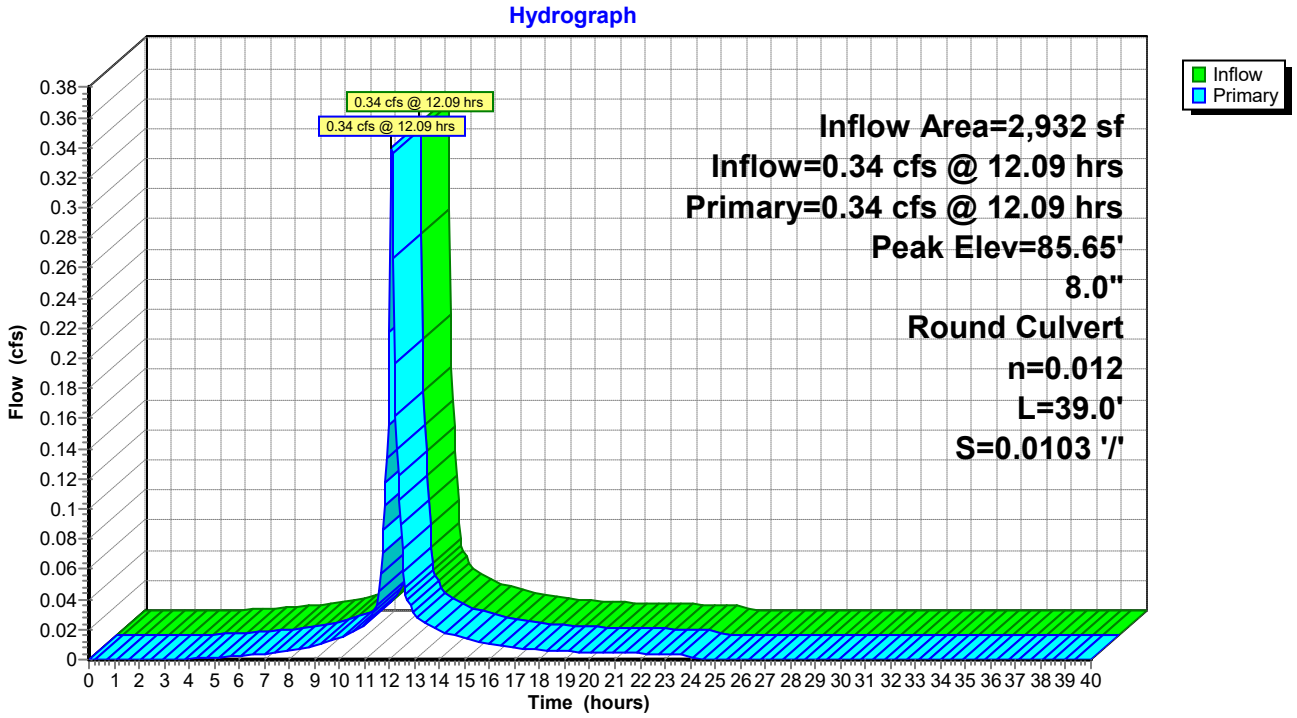
Inflow Area = 2,932 sf, 84.21% Impervious, Inflow Depth = 4.68" for 25 yr event
Inflow = 0.34 cfs @ 12.09 hrs, Volume= 1,143 cf
Outflow = 0.34 cfs @ 12.09 hrs, Volume= 1,143 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.34 cfs @ 12.09 hrs, Volume= 1,143 cf
Routed to Pond 7 : CDS7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.65' @ 12.76 hrs
Flood Elev= 86.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**8.0" Round Culvert** L= 39.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 84.60' S= 0.0103 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.26 cfs @ 12.09 hrs HW=85.37' TW=85.17' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.26 cfs @ 1.87 fps)

Pond 6: TD6



Summary for Pond 7: CDS7

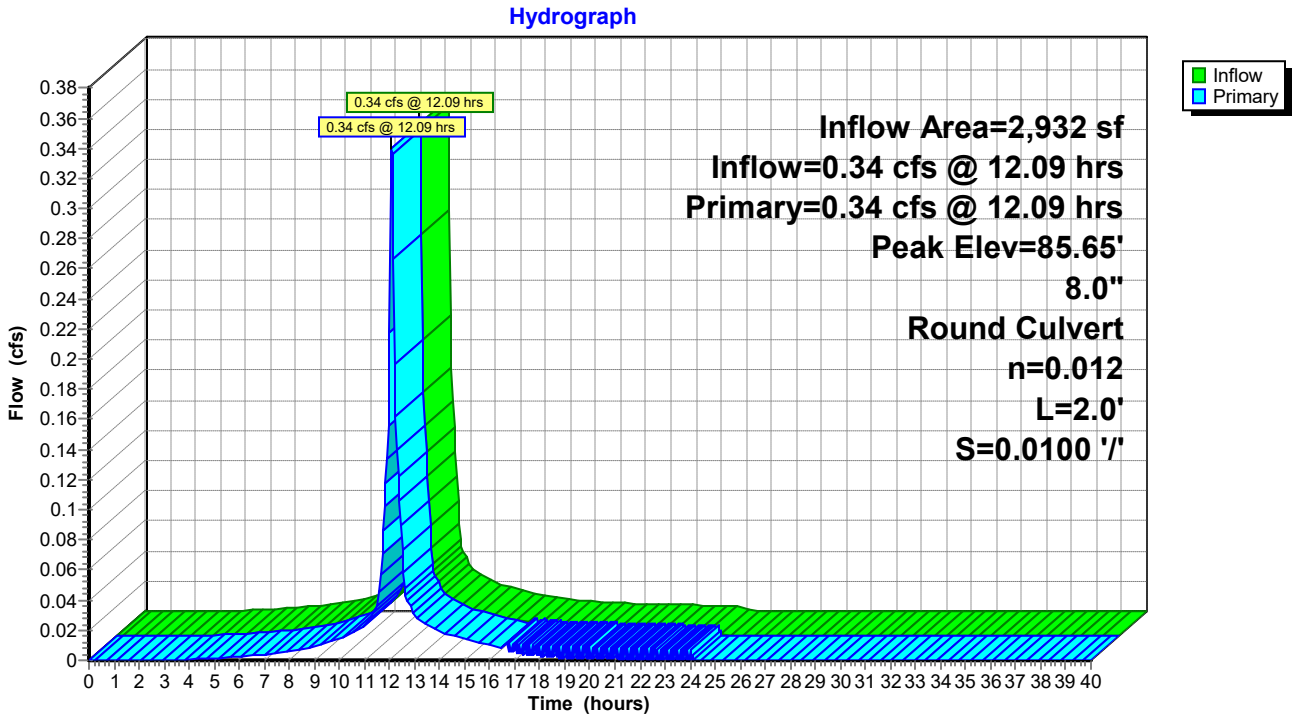
Inflow Area = 2,932 sf, 84.21% Impervious, Inflow Depth = 4.68" for 25 yr event
Inflow = 0.34 cfs @ 12.09 hrs, Volume= 1,143 cf
Outflow = 0.34 cfs @ 12.09 hrs, Volume= 1,143 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.34 cfs @ 12.09 hrs, Volume= 1,143 cf
Routed to Pond 8 : DMH8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.65' @ 12.71 hrs
Flood Elev= 90.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.60'	**8.0" Round Culvert** L= 2.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.60' / 84.58' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.17' TW=85.19' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 7: CDS7



Summary for Pond 8: DMH8

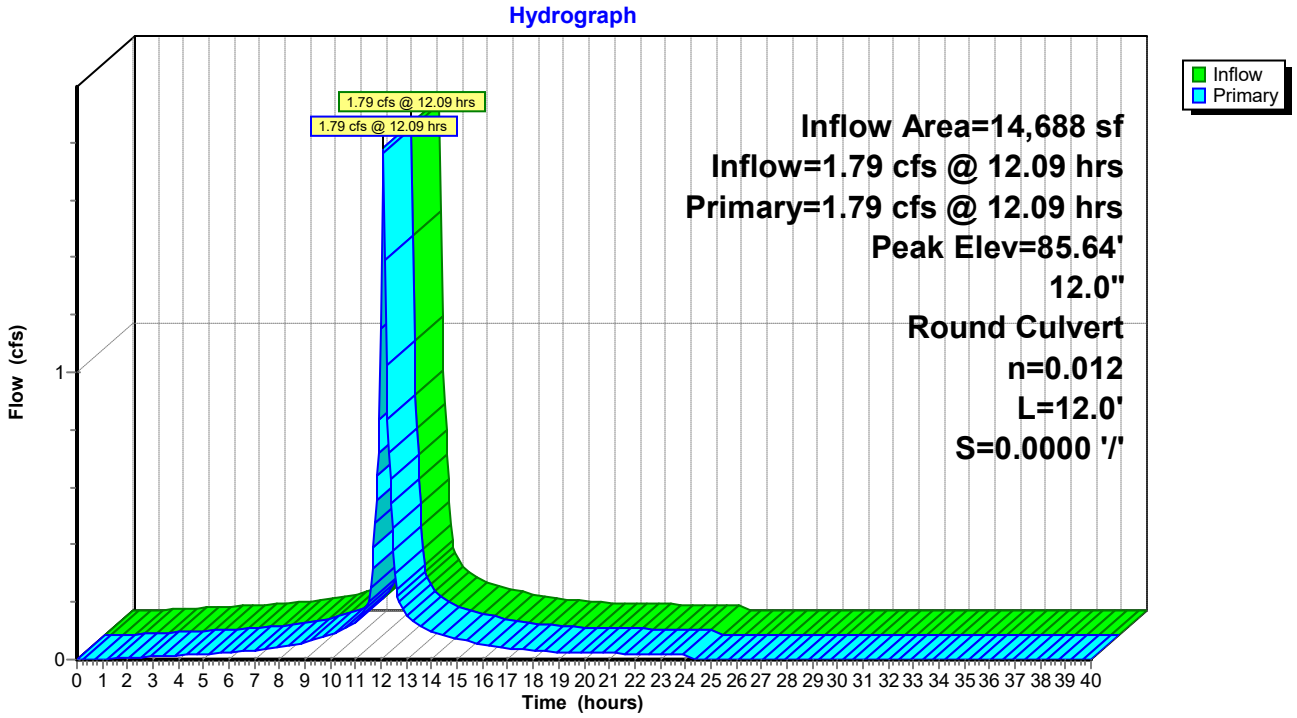
Inflow Area = 14,688 sf, 96.85% Impervious, Inflow Depth = 5.23" for 25 yr event
Inflow = 1.79 cfs @ 12.09 hrs, Volume= 6,396 cf
Outflow = 1.79 cfs @ 12.09 hrs, Volume= 6,396 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.79 cfs @ 12.09 hrs, Volume= 6,396 cf
Routed to Pond 1P : Infiltration Pipe Network

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.64' @ 12.66 hrs
Flood Elev= 90.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.25'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.25' / 84.25' S= 0.0000 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.74 cfs @ 12.09 hrs HW=85.19' TW=84.89' (Dynamic Tailwater)
1=Culvert (Barrel Controls 1.74 cfs @ 2.94 fps)

Pond 8: DMH8

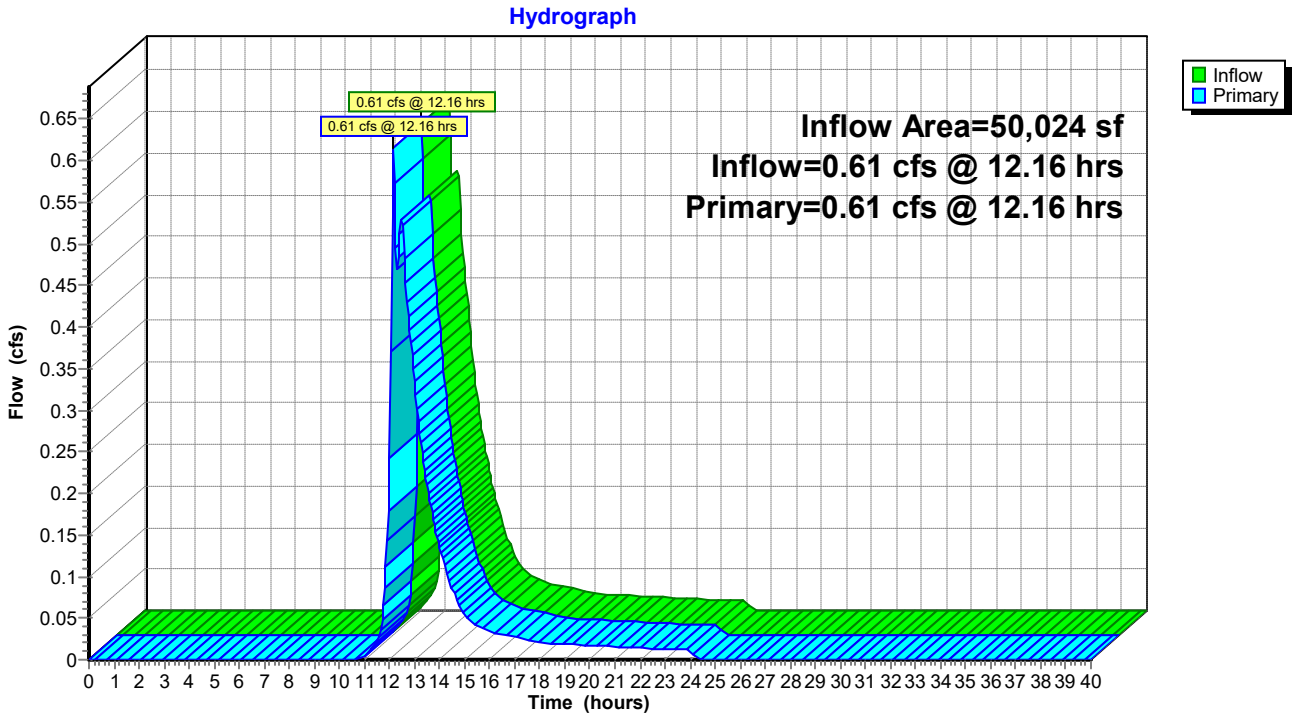


Summary for Link 1L: B Series Wetland

Inflow Area = 50,024 sf, 66.69% Impervious, Inflow Depth = 0.87" for 25 yr event
Inflow = 0.61 cfs @ 12.16 hrs, Volume= 3,622 cf
Primary = 0.61 cfs @ 12.16 hrs, Volume= 3,622 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 9L

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: B Series Wetland

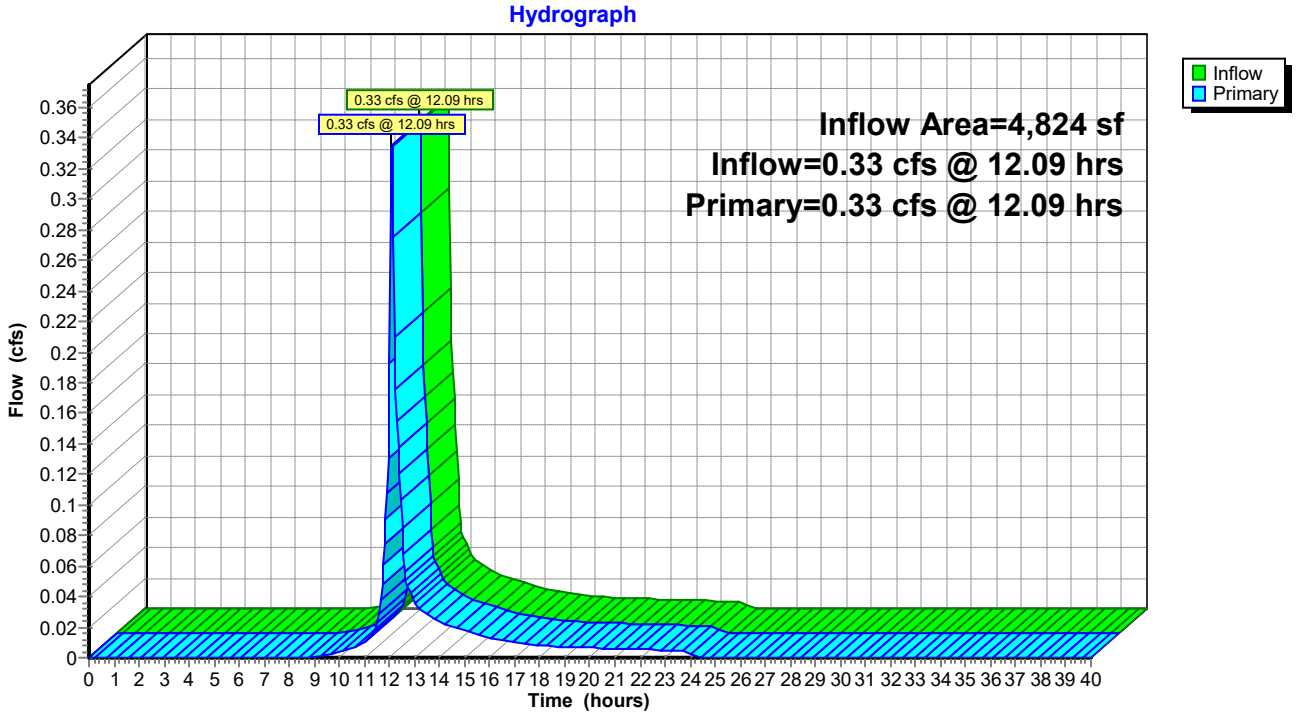


Summary for Link 2L: North Ave

Inflow Area = 4,824 sf, 28.25% Impervious, Inflow Depth = 2.64" for 25 yr event
Inflow = 0.33 cfs @ 12.09 hrs, Volume= 1,062 cf
Primary = 0.33 cfs @ 12.09 hrs, Volume= 1,062 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 9L

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: North Ave



Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=15,827 sf 87.81% Impervious Runoff Depth=5.38"
Tc=6.0 min CN=93 Runoff=2.07 cfs 7,096 cf

Subcatchment 2S: Runoff Area=4,033 sf 74.14% Impervious Runoff Depth=4.82"
Tc=6.0 min CN=88 Runoff=0.49 cfs 1,619 cf

Subcatchment 3S: Roof Runoff Area=11,756 sf 100.00% Impervious Runoff Depth=5.96"
Tc=6.0 min CN=98 Runoff=1.60 cfs 5,840 cf

Subcatchment 4S: Runoff Area=15,476 sf 14.53% Impervious Runoff Depth=2.23"
Flow Length=36' Slope=0.0170 '/' Tc=10.3 min CN=62 Runoff=0.77 cfs 2,874 cf

Subcatchment 5S: Runoff Area=4,281 sf 26.23% Impervious Runoff Depth=3.06"
Tc=6.0 min CN=71 Runoff=0.35 cfs 1,092 cf

Subcatchment 6S: Runoff Area=1,635 sf 41.77% Impervious Runoff Depth=3.55"
Tc=6.0 min CN=76 Runoff=0.15 cfs 484 cf

Subcatchment 7S: Runoff Area=1,660 sf 41.14% Impervious Runoff Depth=3.55"
Tc=6.0 min CN=76 Runoff=0.16 cfs 492 cf

Subcatchment 8S: Runoff Area=2,932 sf 84.21% Impervious Runoff Depth=5.27"
Tc=6.0 min CN=92 Runoff=0.38 cfs 1,287 cf

Subcatchment 9S: Runoff Area=543 sf 44.20% Impervious Runoff Depth=3.65"
Tc=6.0 min CN=77 Runoff=0.05 cfs 165 cf

Subcatchment 10S: Runoff Area=2,088 sf 0.00% Impervious Runoff Depth=2.14"
Tc=6.0 min CN=61 Runoff=0.11 cfs 372 cf

Subcatchment 11S: Runoff Area=1,386 sf 0.00% Impervious Runoff Depth=2.14"
Tc=6.0 min CN=61 Runoff=0.08 cfs 247 cf

Pond 1: CB1 Peak Elev=86.31' Inflow=0.49 cfs 1,619 cf
12.0" Round Culvert n=0.012 L=135.0' S=0.0100 '/' Outflow=0.49 cfs 1,619 cf

Pond 1P: Infiltration Pipe Network Peak Elev=85.80' Storage=5,823 cf Inflow=4.55 cfs 15,843 cf
Discarded=0.25 cfs 13,538 cf Primary=0.61 cfs 2,305 cf Outflow=0.86 cfs 15,843 cf

Pond 2: DMH2 Peak Elev=85.85' Inflow=0.49 cfs 1,619 cf
12.0" Round Culvert n=0.012 L=31.0' S=0.0100 '/' Outflow=0.49 cfs 1,619 cf

Pond 2P: Depressed Landscape Area Peak Elev=85.57' Storage=165 cf Inflow=0.11 cfs 372 cf
Outflow=0.01 cfs 372 cf

Pond 3: DGCB3 Peak Elev=86.02' Inflow=2.07 cfs 7,096 cf
12.0" Round Culvert n=0.012 L=3.0' S=0.0100 '/' Outflow=2.07 cfs 7,096 cf

Pond 3P: Depressed Landscape Area Peak Elev=86.79' Storage=190 cf Inflow=0.16 cfs 492 cf
Outflow=0.02 cfs 492 cf

Pond 4: DMH4 Peak Elev=85.85' Inflow=2.57 cfs 8,715 cf
12.0" Round Culvert n=0.012 L=4.0' S=0.0100 '/' Outflow=2.57 cfs 8,715 cf

Pond 4P: Depressed Landscape Area Peak Elev=86.85' Storage=191 cf Inflow=0.15 cfs 484 cf
Outflow=0.02 cfs 484 cf

Pond 5: CDS5 Peak Elev=85.81' Inflow=2.57 cfs 8,715 cf
12.0" Round Culvert n=0.012 L=6.5' S=0.0000 '/' Outflow=2.57 cfs 8,715 cf

Pond 5P: Depressed Landscape Area Peak Elev=85.16' Storage=53 cf Inflow=0.08 cfs 247 cf
Outflow=0.02 cfs 247 cf

Pond 6: TD6 Peak Elev=85.81' Inflow=0.38 cfs 1,287 cf
8.0" Round Culvert n=0.012 L=39.0' S=0.0103 '/' Outflow=0.38 cfs 1,287 cf

Pond 7: CDS7 Peak Elev=85.81' Inflow=0.38 cfs 1,287 cf
8.0" Round Culvert n=0.012 L=2.0' S=0.0100 '/' Outflow=0.38 cfs 1,287 cf

Pond 8: DMH8 Peak Elev=85.80' Inflow=1.98 cfs 7,127 cf
12.0" Round Culvert n=0.012 L=12.0' S=0.0000 '/' Outflow=1.98 cfs 7,127 cf

Link 1L: B Series Wetland Inflow=0.93 cfs 5,179 cf
Primary=0.93 cfs 5,179 cf

Link 2L: North Ave Inflow=0.40 cfs 1,257 cf
Primary=0.40 cfs 1,257 cf

Total Runoff Area = 61,617 sf Runoff Volume = 21,569 cf Average Runoff Depth = 4.20"
41.43% Pervious = 25,528 sf 58.57% Impervious = 36,089 sf

Summary for Subcatchment 1S:

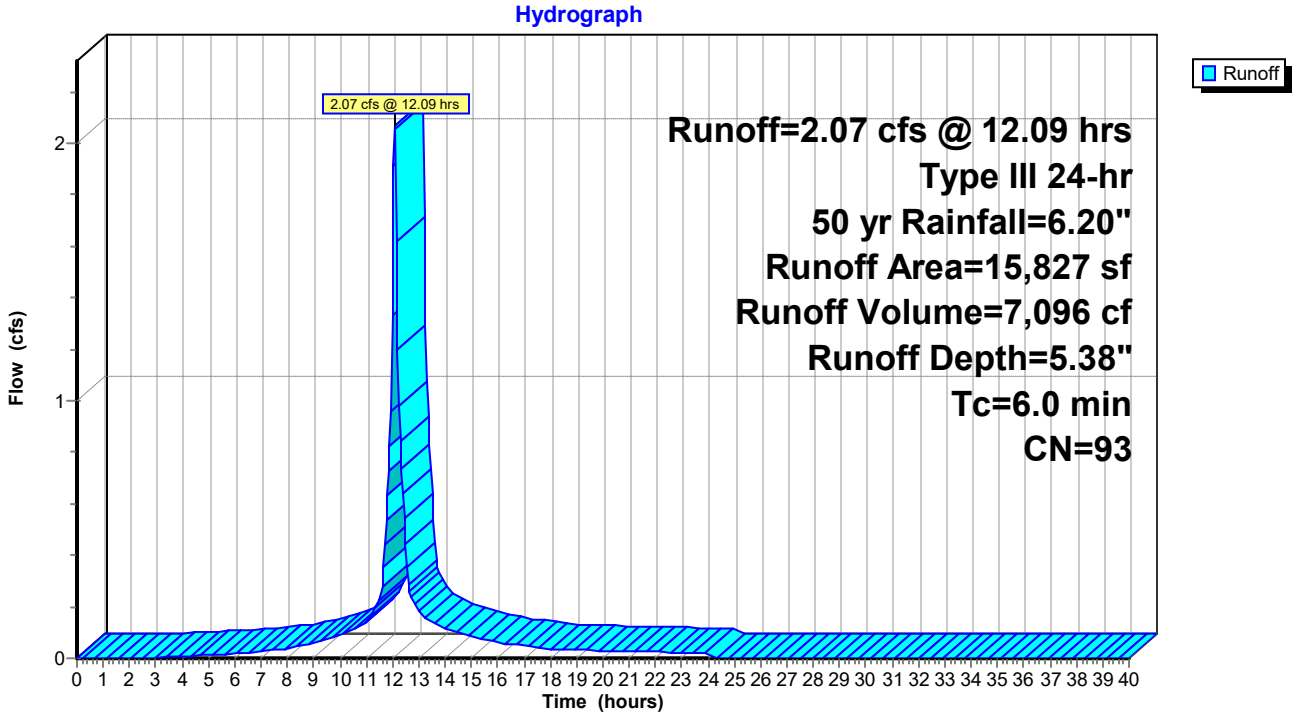
Runoff = 2.07 cfs @ 12.09 hrs, Volume= 7,096 cf, Depth= 5.38"
Routed to Pond 3 : DGCB3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
13,897	98	Paved parking, HSG B
1,930	61	>75% Grass cover, Good, HSG B
15,827	93	Weighted Average
1,930		12.19% Pervious Area
13,897		87.81% Impervious Area

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

Subcatchment 1S:



Summary for Subcatchment 2S:

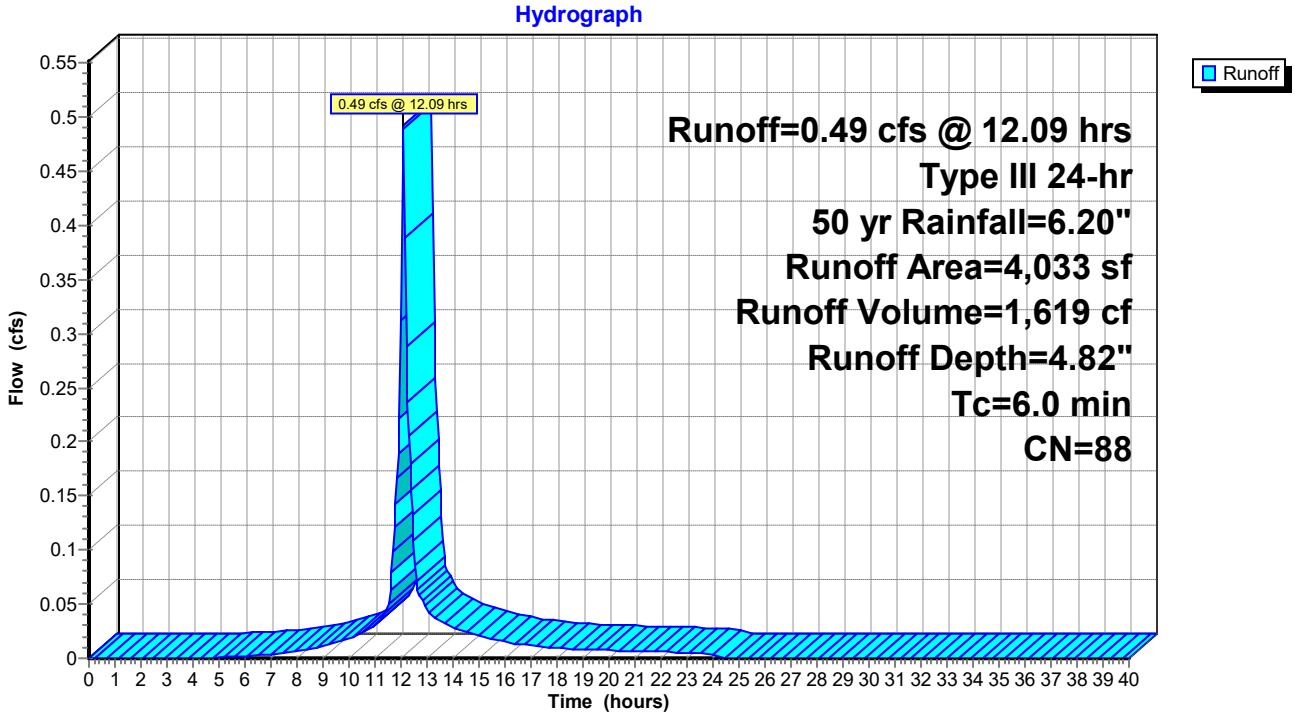
Runoff = 0.49 cfs @ 12.09 hrs, Volume= 1,619 cf, Depth= 4.82"
Routed to Pond 1 : CB1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
2,990	98	Paved parking, HSG B
1,043	61	>75% Grass cover, Good, HSG B
4,033	88	Weighted Average
1,043		25.86% Pervious Area
2,990		74.14% Impervious Area

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

Subcatchment 2S:



Summary for Subcatchment 3S: Roof

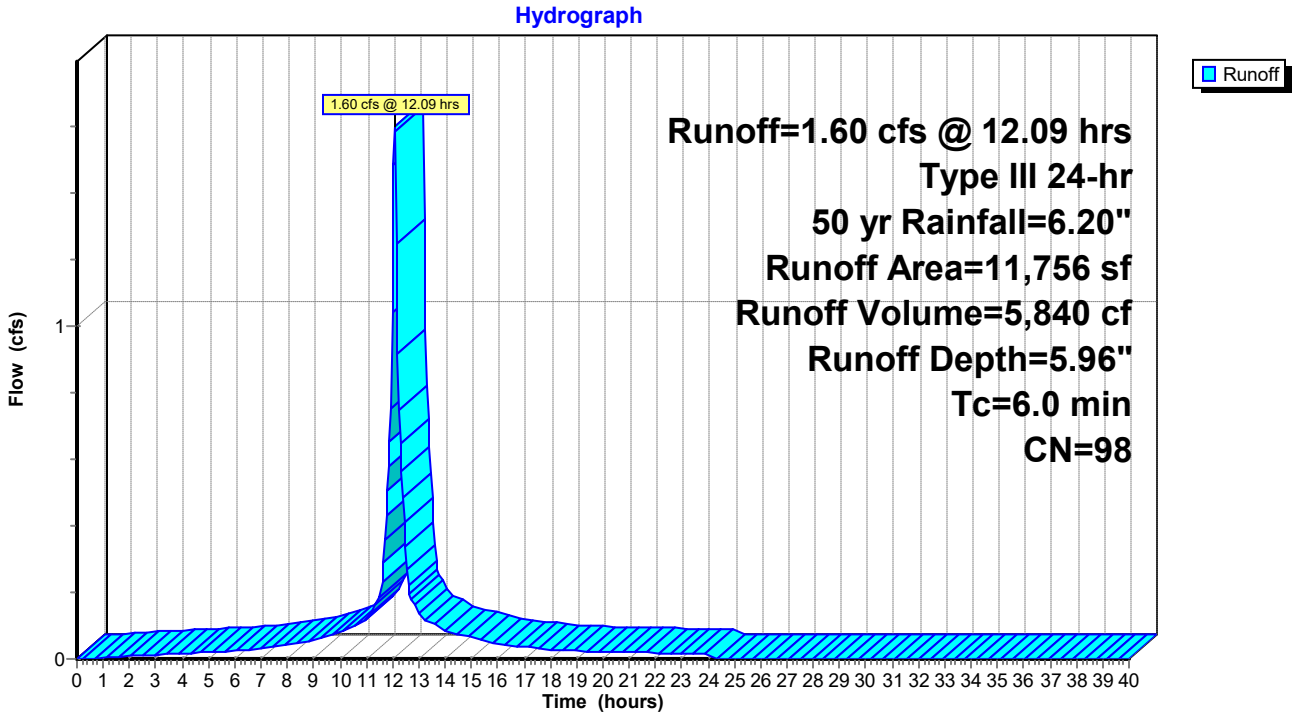
Runoff = 1.60 cfs @ 12.09 hrs, Volume= 5,840 cf, Depth= 5.96"
Routed to Pond 8 : DMH8

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
11,756	98	Roofs, HSG B
11,756		100.00% Impervious Area

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

Subcatchment 3S: Roof



Summary for Subcatchment 4S:

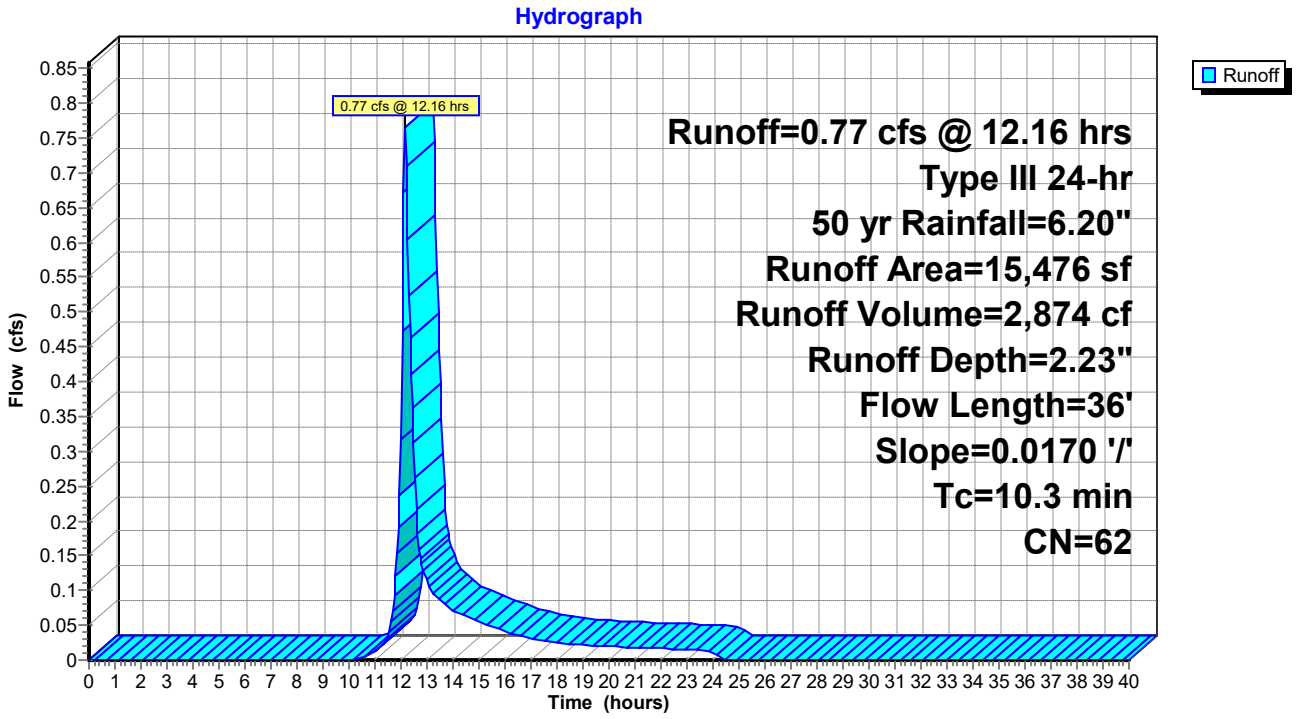
Runoff = 0.77 cfs @ 12.16 hrs, Volume= 2,874 cf, Depth= 2.23"
Routed to Link 1L : B Series Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
10,238	55	Woods, Good, HSG B
2,990	61	>75% Grass cover, Good, HSG B
2,248	98	Paved parking, HSG B
15,476	62	Weighted Average
13,228		85.47% Pervious Area
2,248		14.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	36	0.0170	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"

Subcatchment 4S:



Summary for Subcatchment 5S:

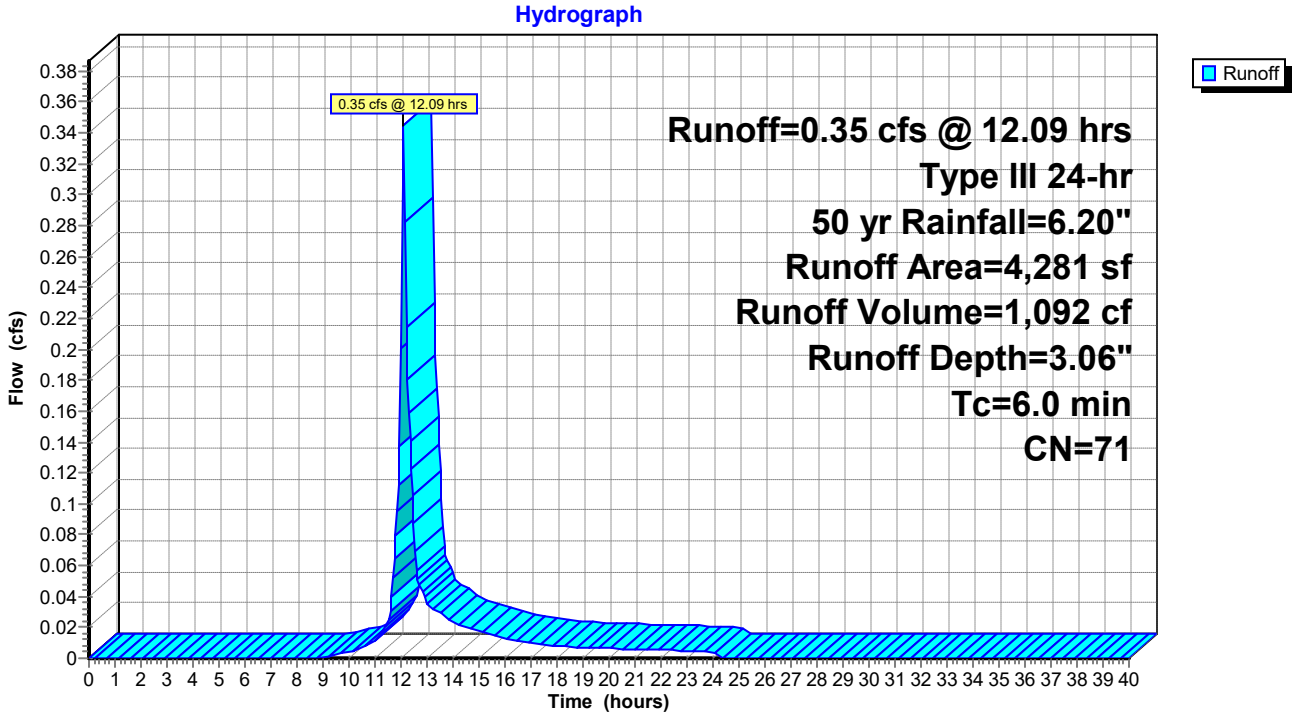
Runoff = 0.35 cfs @ 12.09 hrs, Volume= 1,092 cf, Depth= 3.06"
Routed to Link 2L : North Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
1,123	98	Paved parking, HSG B
3,158	61	>75% Grass cover, Good, HSG B
4,281	71	Weighted Average
3,158		73.77% Pervious Area
1,123		26.23% Impervious Area

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

Subcatchment 5S:



Summary for Subcatchment 6S:

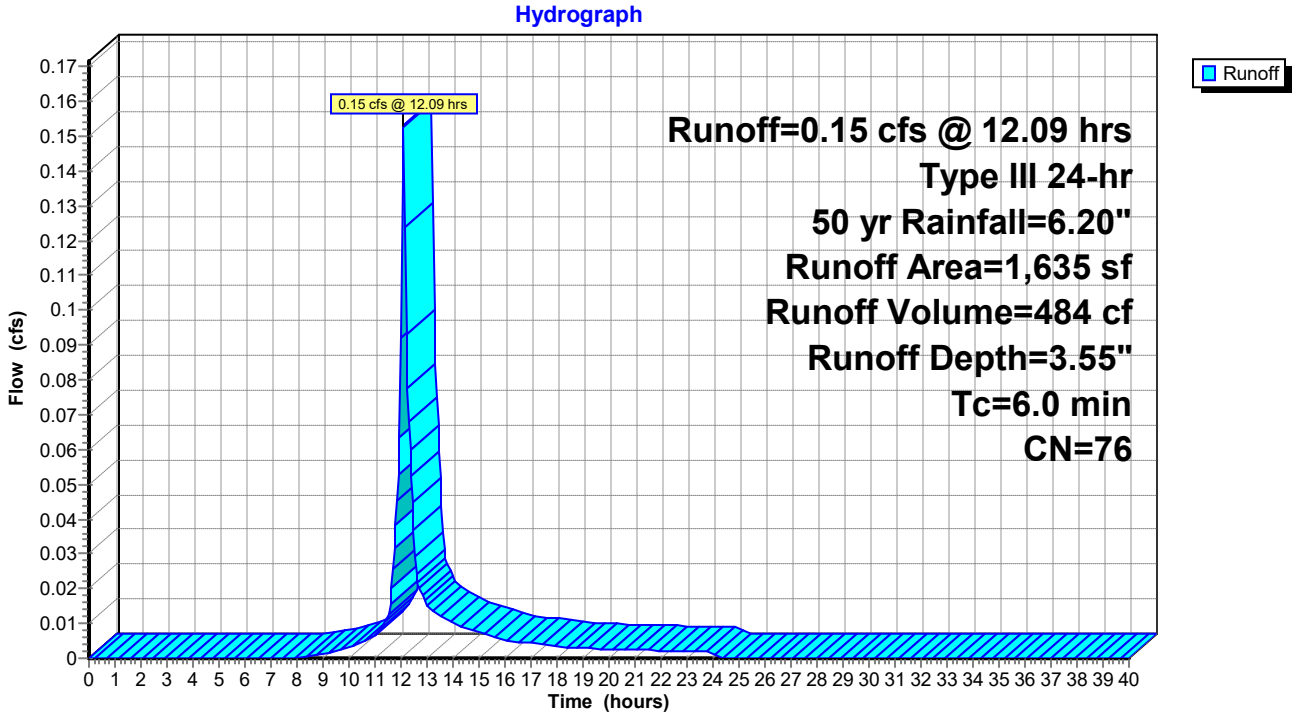
Runoff = 0.15 cfs @ 12.09 hrs, Volume= 484 cf, Depth= 3.55"
Routed to Pond 4P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
952	61	>75% Grass cover, Good, HSG B
683	98	Paved parking, HSG B
1,635	76	Weighted Average
952		58.23% Pervious Area
683		41.77% Impervious Area

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

Subcatchment 6S:



Summary for Subcatchment 7S:

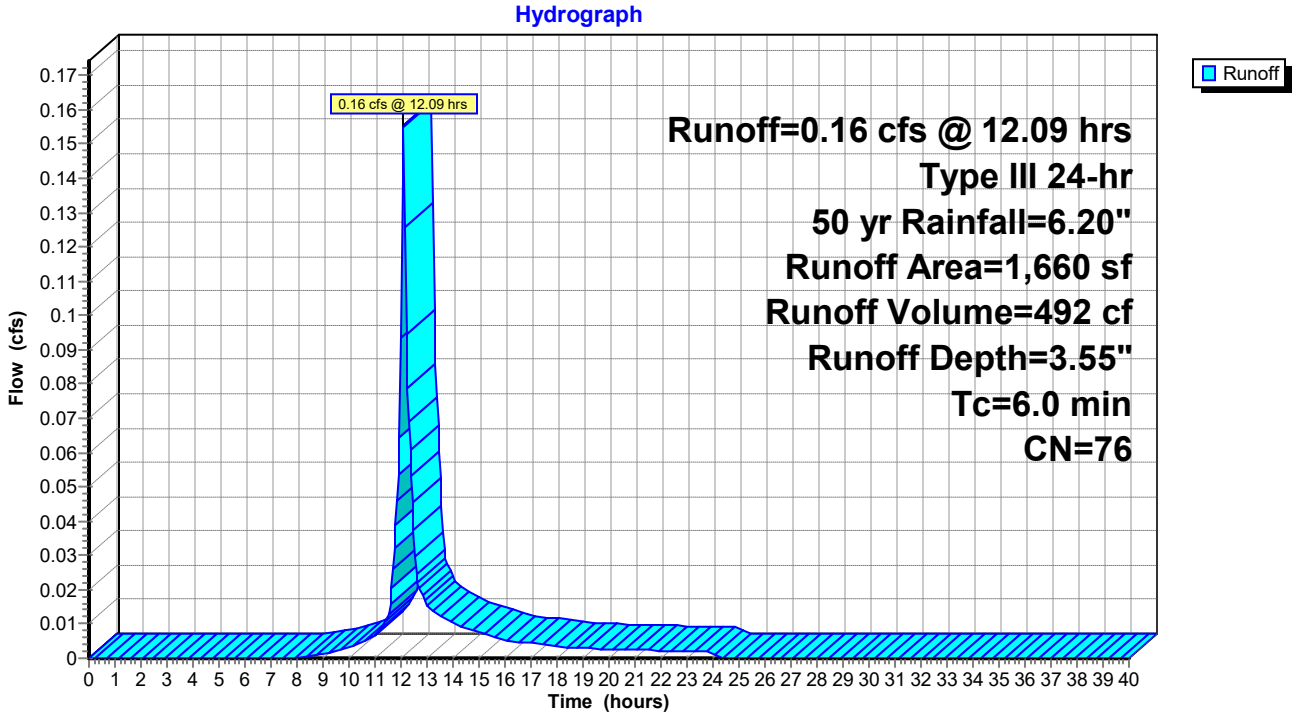
Runoff = 0.16 cfs @ 12.09 hrs, Volume= 492 cf, Depth= 3.55"
Routed to Pond 3P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
977	61	>75% Grass cover, Good, HSG B
683	98	Paved parking, HSG B
1,660	76	Weighted Average
977		58.86% Pervious Area
683		41.14% Impervious Area

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

Subcatchment 7S:



Summary for Subcatchment 8S:

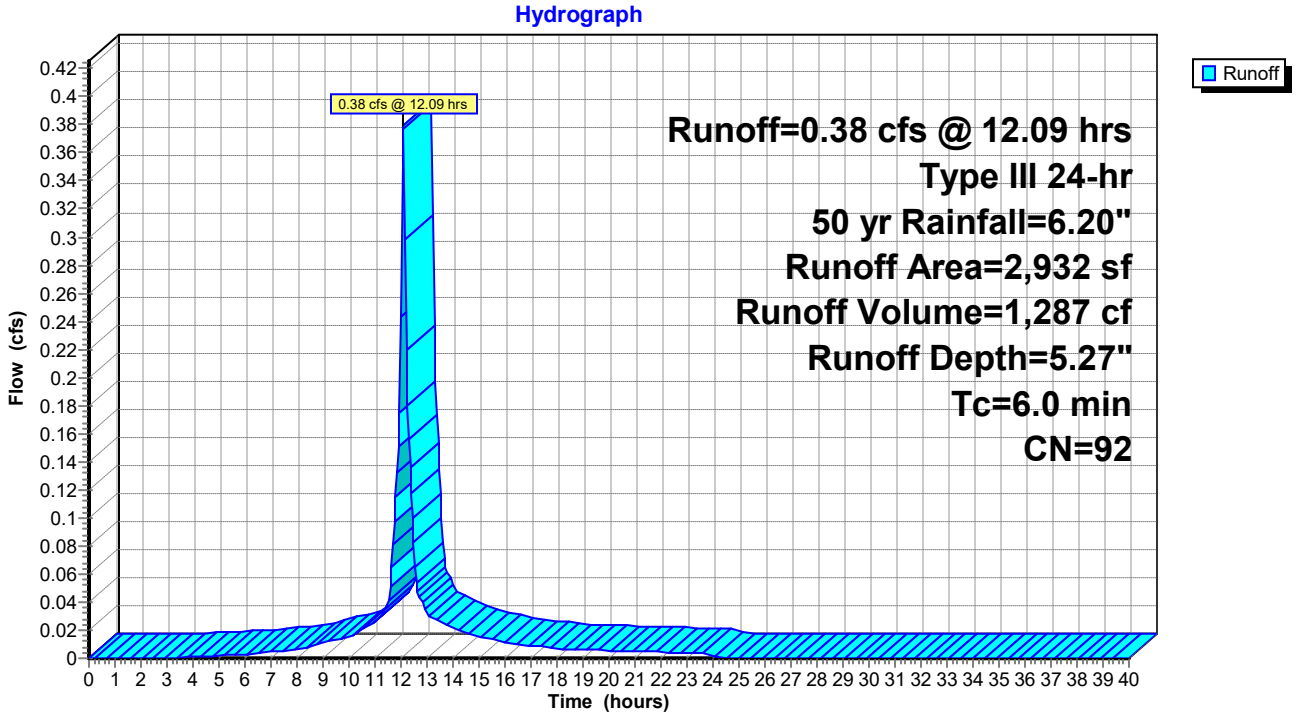
Runoff = 0.38 cfs @ 12.09 hrs, Volume= 1,287 cf, Depth= 5.27"
Routed to Pond 6 : TD6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
463	61	>75% Grass cover, Good, HSG B
2,469	98	Paved parking, HSG B
2,932	92	Weighted Average
463		15.79% Pervious Area
2,469		84.21% Impervious Area

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

Subcatchment 8S:



Summary for Subcatchment 9S:

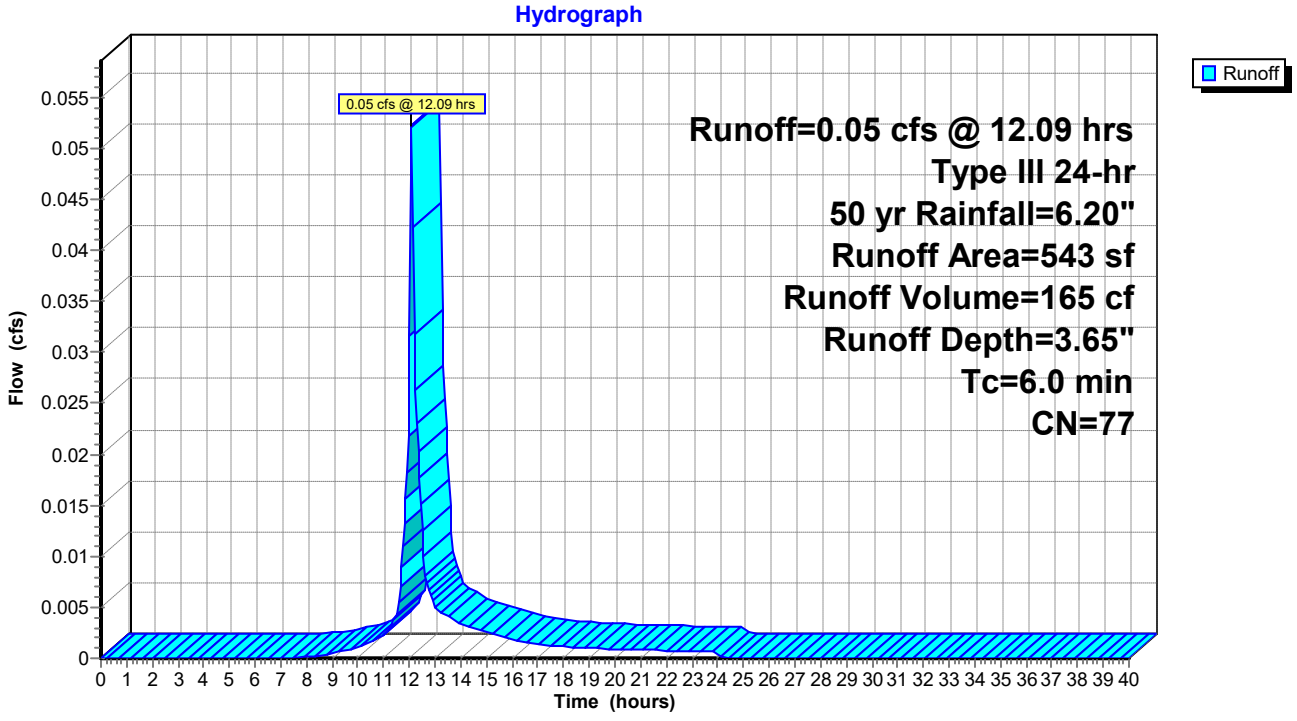
Runoff = 0.05 cfs @ 12.09 hrs, Volume= 165 cf, Depth= 3.65"
Routed to Link 2L : North Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
303	61	>75% Grass cover, Good, HSG B
240	98	Paved parking, HSG B
543	77	Weighted Average
303		55.80% Pervious Area
240		44.20% Impervious Area

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

Subcatchment 9S:



Summary for Subcatchment 10S:

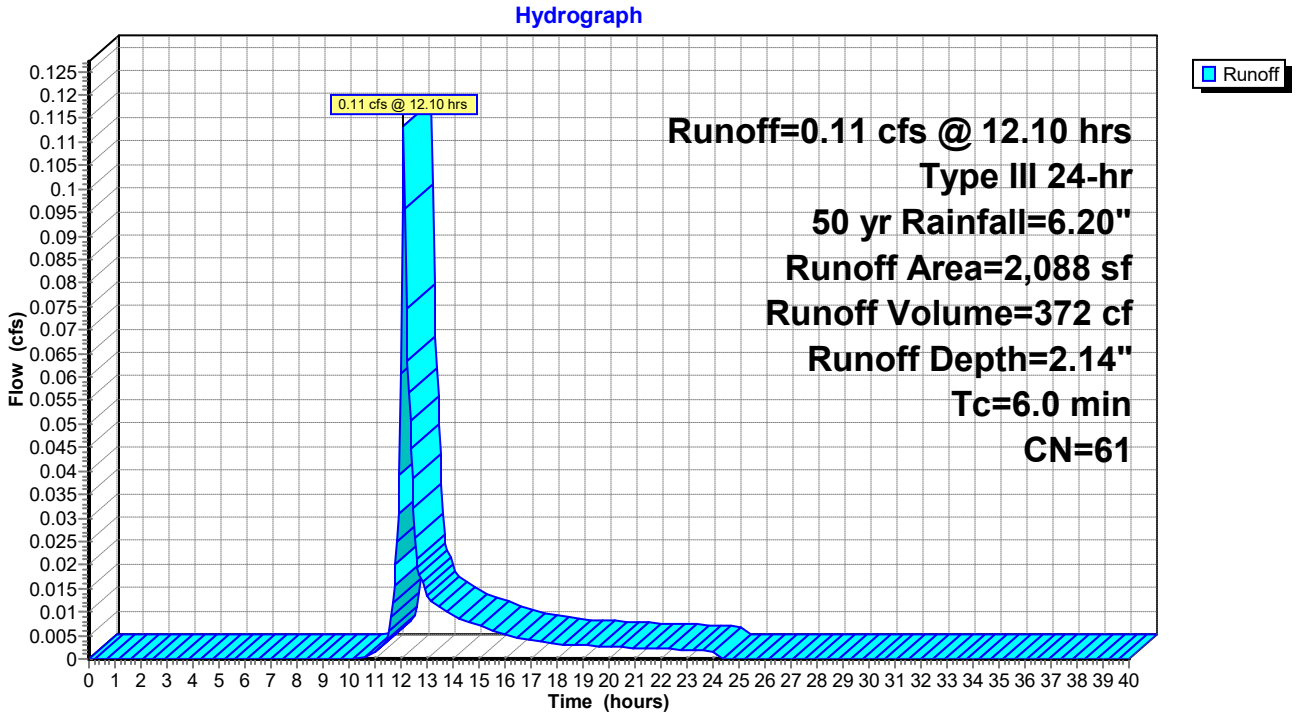
Runoff = 0.11 cfs @ 12.10 hrs, Volume= 372 cf, Depth= 2.14"
Routed to Pond 2P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
2,088	61	>75% Grass cover, Good, HSG B
2,088		100.00% Pervious Area

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

Subcatchment 10S:



Summary for Subcatchment 11S:

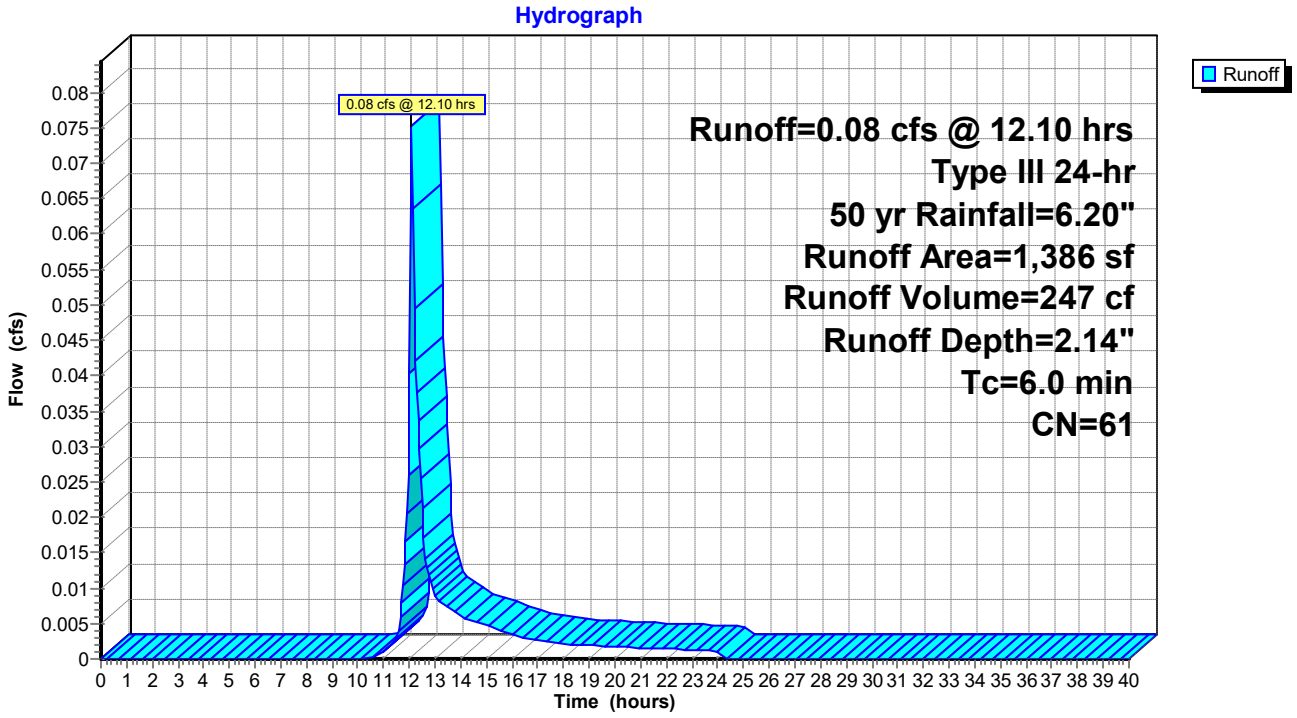
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 247 cf, Depth= 2.14"
Routed to Pond 5P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=6.20"

Area (sf)	CN	Description
1,386	61	>75% Grass cover, Good, HSG B
1,386		100.00% Pervious Area

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

Subcatchment 11S:



Summary for Pond 1: CB1

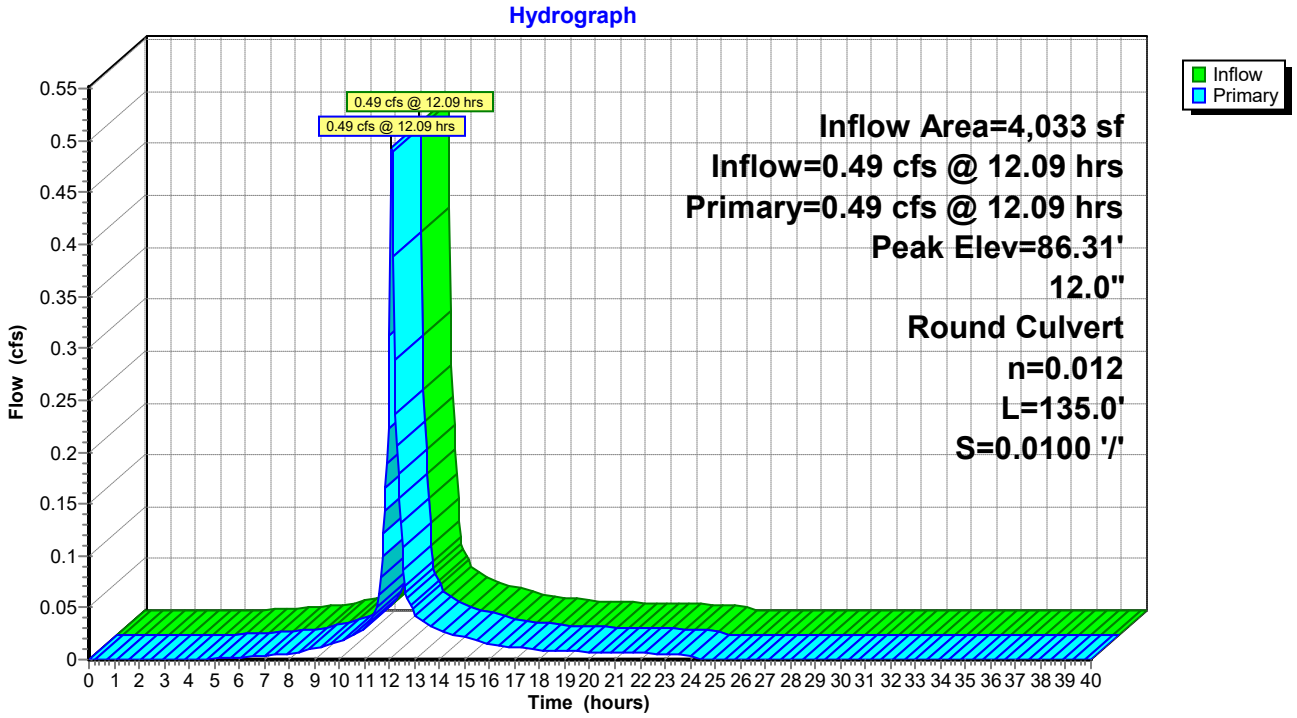
Inflow Area = 4,033 sf, 74.14% Impervious, Inflow Depth = 4.82" for 50 yr event
Inflow = 0.49 cfs @ 12.09 hrs, Volume= 1,619 cf
Outflow = 0.49 cfs @ 12.09 hrs, Volume= 1,619 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.49 cfs @ 12.09 hrs, Volume= 1,619 cf
Routed to Pond 2 : DMH2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.31' @ 12.11 hrs
Flood Elev= 88.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.95'	**12.0" Round Culvert** L= 135.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.95' / 84.60' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.42 cfs @ 12.09 hrs HW=86.30' TW=85.48' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.42 cfs @ 2.51 fps)

Pond 1: CB1



Summary for Pond 1P: Infiltration Pipe Network

Inflow Area = 34,548 sf, 90.05% Impervious, Inflow Depth = 5.50" for 50 yr event
Inflow = 4.55 cfs @ 12.09 hrs, Volume= 15,843 cf
Outflow = 0.86 cfs @ 12.53 hrs, Volume= 15,843 cf, Atten= 81%, Lag= 26.5 min
Discarded = 0.25 cfs @ 10.90 hrs, Volume= 13,538 cf
Primary = 0.61 cfs @ 12.53 hrs, Volume= 2,305 cf
Routed to Link 1L : B Series Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.80' @ 12.53 hrs Surf.Area= 4,503 sf Storage= 5,823 cf

Plug-Flow detention time= 133.4 min calculated for 15,823 cf (100% of inflow)
Center-of-Mass det. time= 133.2 min (897.4 - 764.2)

Volume	Invert	Avail.Storage	Storage Description
#1	83.75'	3,422 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 12,383 cf Overall - 3,828 cf Embedded = 8,555 cf x 40.0% Voids
#2	84.25'	3,828 cf	**Custom Stage Data** Listed below Inside #1
		7,250 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
83.75	4,503	0	0
86.50	4,503	12,383	12,383

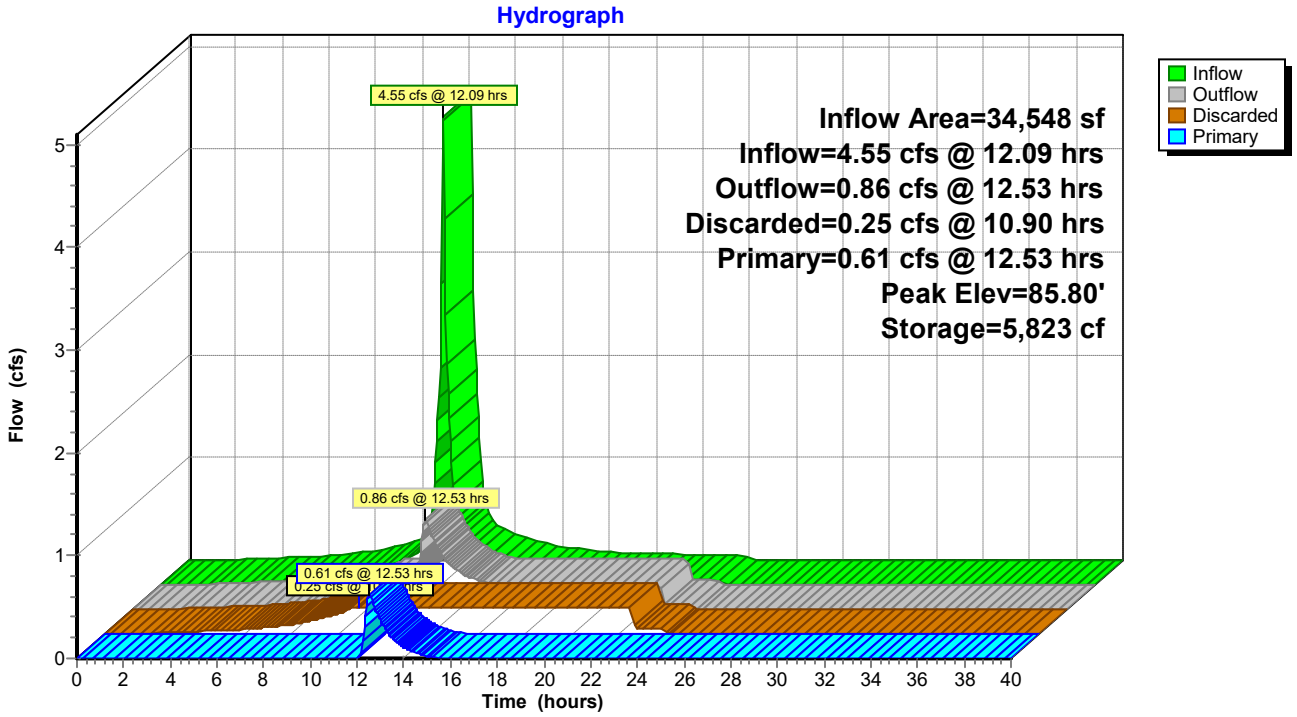
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
84.25	0	0
84.75	902	902
85.25	1,359	2,261
85.75	1,231	3,492
86.00	336	3,828

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.75'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	85.33'	**8.0" Round Culvert** L= 93.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.33' / 84.25' S= 0.0116 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.25 cfs @ 10.90 hrs HW=83.78' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=0.61 cfs @ 12.53 hrs HW=85.80' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.61 cfs @ 2.33 fps)

Pond 1P: Infiltration Pipe Network



Summary for Pond 2: DMH2

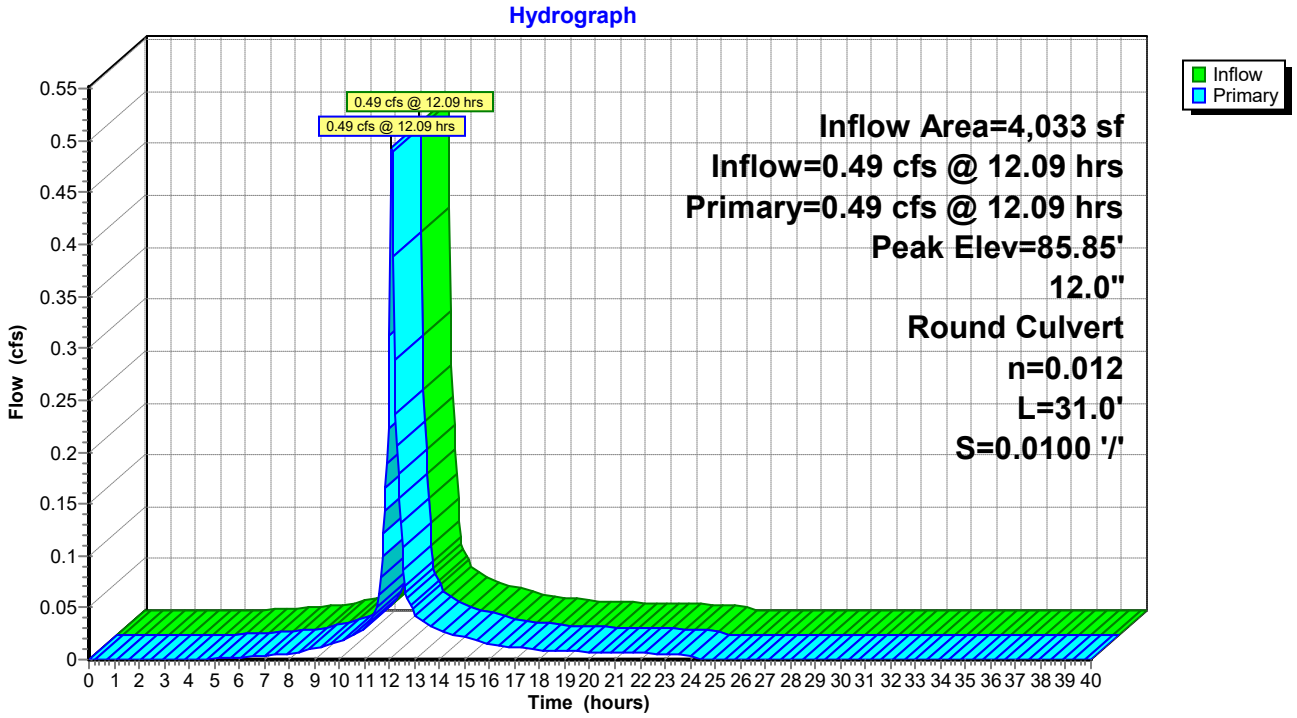
Inflow Area = 4,033 sf, 74.14% Impervious, Inflow Depth = 4.82" for 50 yr event
Inflow = 0.49 cfs @ 12.09 hrs, Volume= 1,619 cf
Outflow = 0.49 cfs @ 12.09 hrs, Volume= 1,619 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.49 cfs @ 12.09 hrs, Volume= 1,619 cf
Routed to Pond 4 : DMH4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.85' @ 12.16 hrs
Flood Elev= 88.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.60'	**12.0" Round Culvert** L= 31.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.60' / 84.29' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.48' TW=85.76' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 2: DMH2



Summary for Pond 2P: Depressed Landscape Area

Inflow Area = 2,088 sf, 0.00% Impervious, Inflow Depth = 2.14" for 50 yr event
Inflow = 0.11 cfs @ 12.10 hrs, Volume= 372 cf
Outflow = 0.01 cfs @ 14.18 hrs, Volume= 372 cf, Atten= 92%, Lag= 124.9 min
Discarded = 0.01 cfs @ 14.18 hrs, Volume= 372 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.57' @ 14.18 hrs Surf.Area= 369 sf Storage= 165 cf

Plug-Flow detention time= 219.6 min calculated for 372 cf (100% of inflow)
Center-of-Mass det. time= 219.5 min (1,077.7 - 858.2)

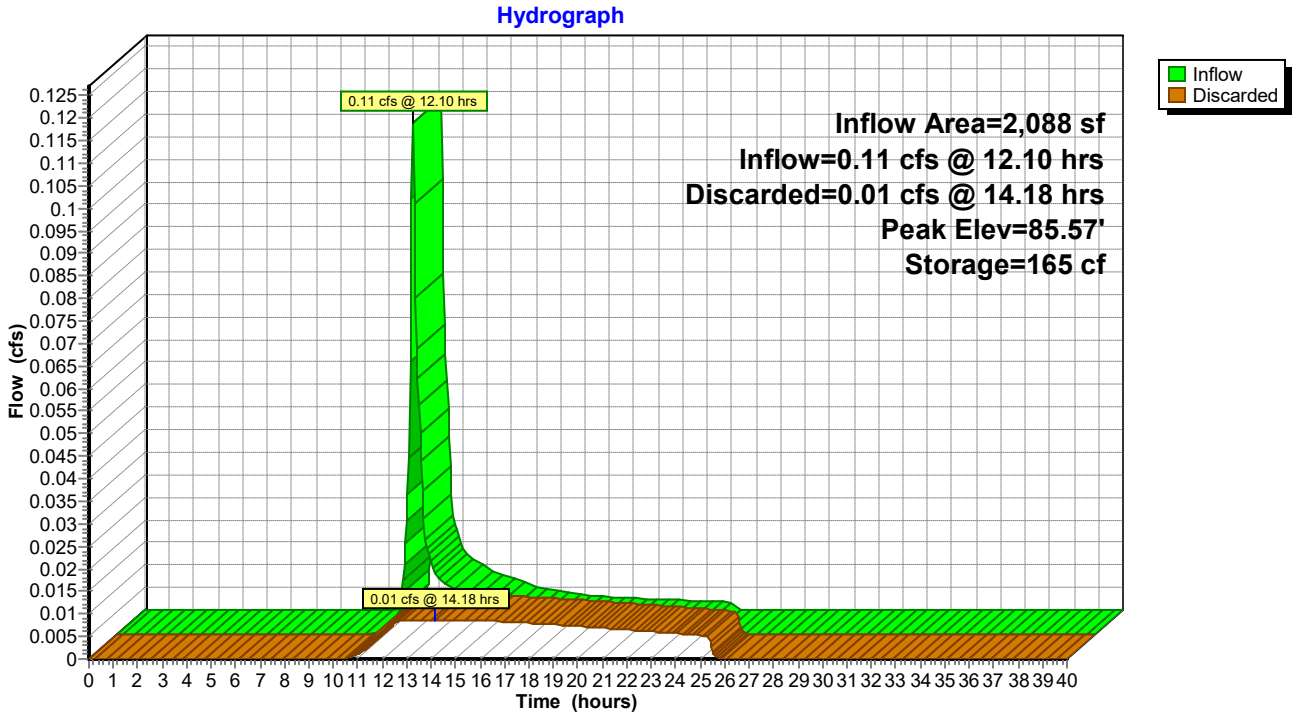
Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	210	0	0
86.00	488	349	349

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 14.18 hrs HW=85.57' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 2P: Depressed Landscape Area



Summary for Pond 3: DGCB3

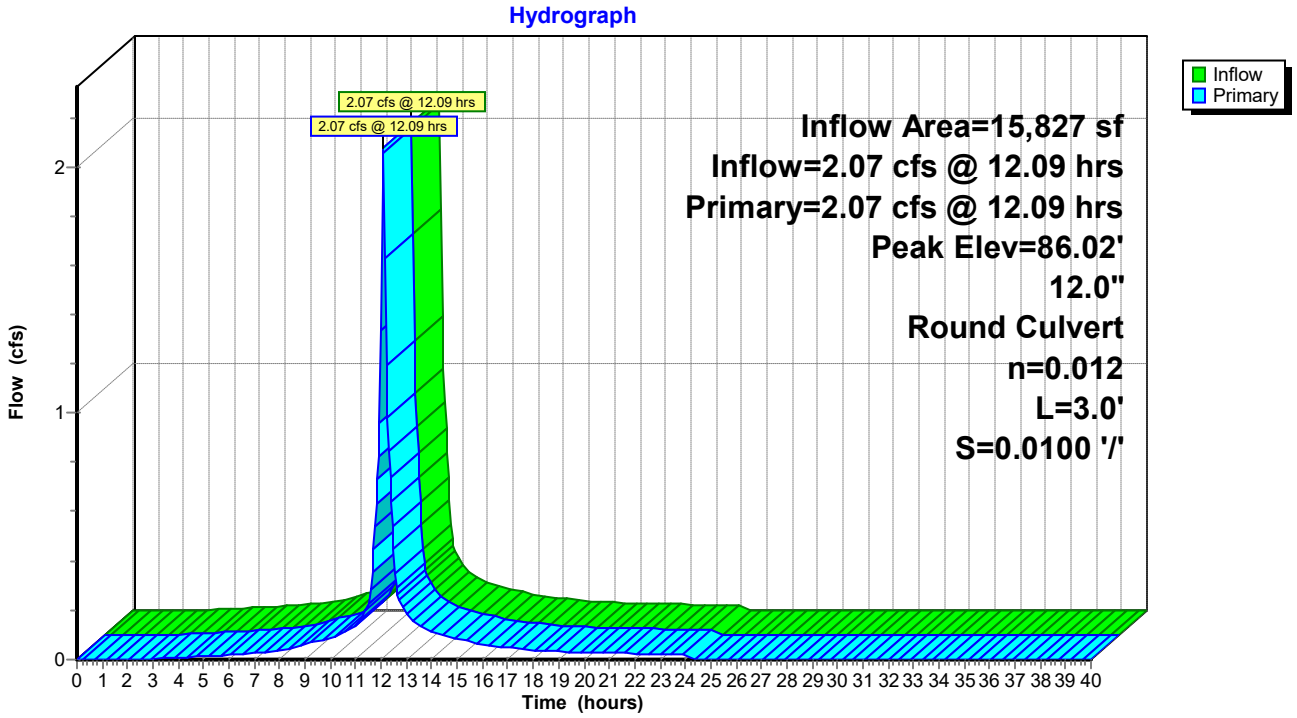
Inflow Area = 15,827 sf, 87.81% Impervious, Inflow Depth = 5.38" for 50 yr event
Inflow = 2.07 cfs @ 12.09 hrs, Volume= 7,096 cf
Outflow = 2.07 cfs @ 12.09 hrs, Volume= 7,096 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.07 cfs @ 12.09 hrs, Volume= 7,096 cf
Routed to Pond 4 : DMH4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.02' @ 12.15 hrs
Flood Elev= 87.33'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.32'	**12.0" Round Culvert** L= 3.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.32' / 84.29' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.73' TW=85.76' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 3: DGCB3



Summary for Pond 3P: Depressed Landscape Area

Inflow Area = 1,660 sf, 41.14% Impervious, Inflow Depth = 3.55" for 50 yr event
Inflow = 0.16 cfs @ 12.09 hrs, Volume= 492 cf
Outflow = 0.02 cfs @ 12.95 hrs, Volume= 492 cf, Atten= 89%, Lag= 51.5 min
Discarded = 0.02 cfs @ 12.95 hrs, Volume= 492 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.79' @ 12.95 hrs Surf.Area= 295 sf Storage= 190 cf

Plug-Flow detention time= 107.0 min calculated for 491 cf (100% of inflow)
Center-of-Mass det. time= 106.9 min (929.5 - 822.6)

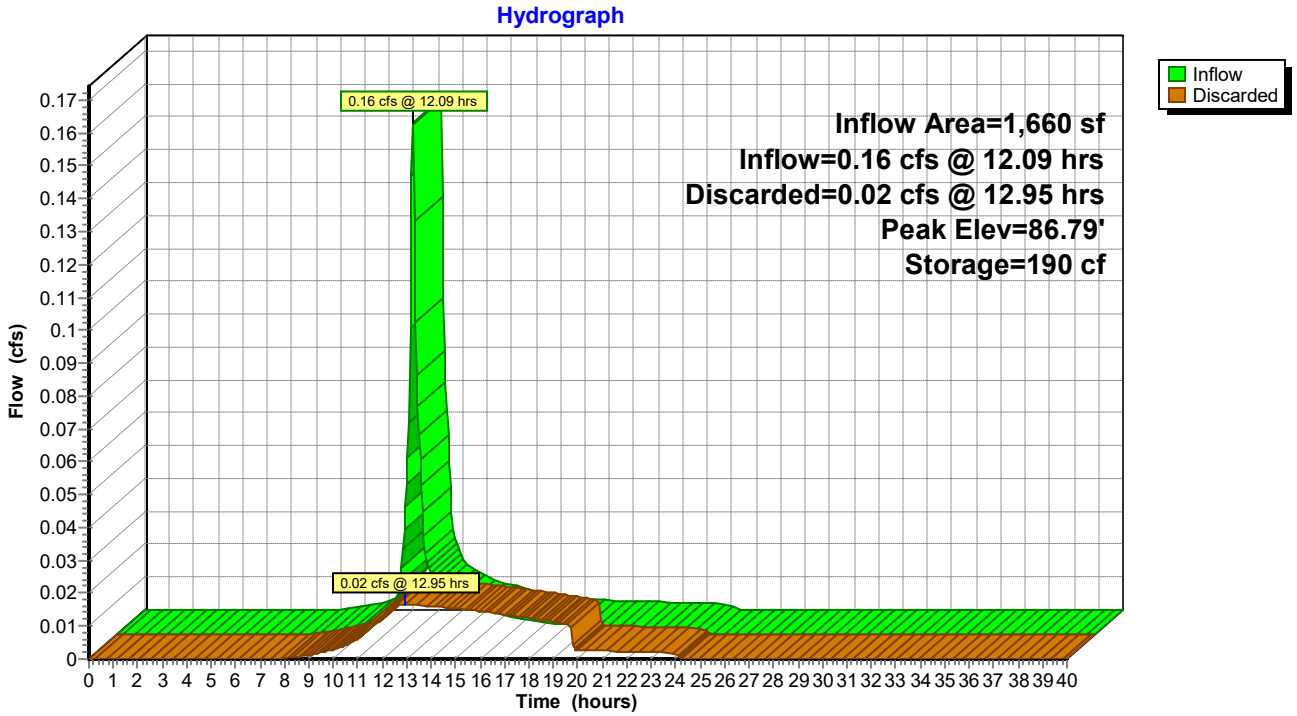
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	256 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
86.00	187	0	0
87.00	324	256	256

Device	Routing	Invert	Outlet Devices
#1	Discarded	86.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 12.95 hrs HW=86.79' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 3P: Depressed Landscape Area



Summary for Pond 4: DMH4

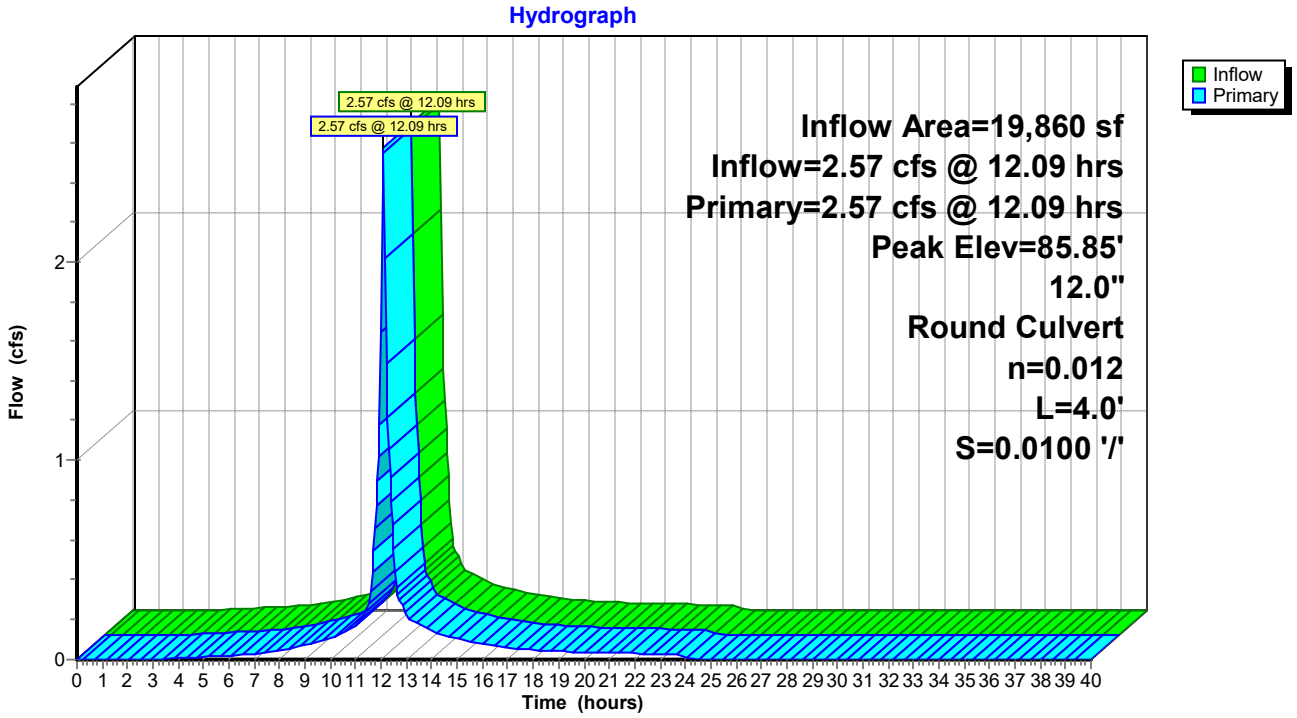
Inflow Area = 19,860 sf, 85.03% Impervious, Inflow Depth = 5.27" for 50 yr event
Inflow = 2.57 cfs @ 12.09 hrs, Volume= 8,715 cf
Outflow = 2.57 cfs @ 12.09 hrs, Volume= 8,715 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.57 cfs @ 12.09 hrs, Volume= 8,715 cf
Routed to Pond 5 : CDS5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.85' @ 12.11 hrs
Flood Elev= 87.36'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.29'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.29' / 84.25' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.17 cfs @ 12.09 hrs HW=85.76' TW=85.43' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.17 cfs @ 2.76 fps)

Pond 4: DMH4



Summary for Pond 4P: Depressed Landscape Area

Inflow Area = 1,635 sf, 41.77% Impervious, Inflow Depth = 3.55" for 50 yr event
Inflow = 0.15 cfs @ 12.09 hrs, Volume= 484 cf
Outflow = 0.02 cfs @ 13.00 hrs, Volume= 484 cf, Atten= 90%, Lag= 54.6 min
Discarded = 0.02 cfs @ 13.00 hrs, Volume= 484 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.85' @ 13.00 hrs Surf.Area= 275 sf Storage= 191 cf

Plug-Flow detention time= 117.4 min calculated for 484 cf (100% of inflow)
Center-of-Mass det. time= 117.2 min (939.8 - 822.6)

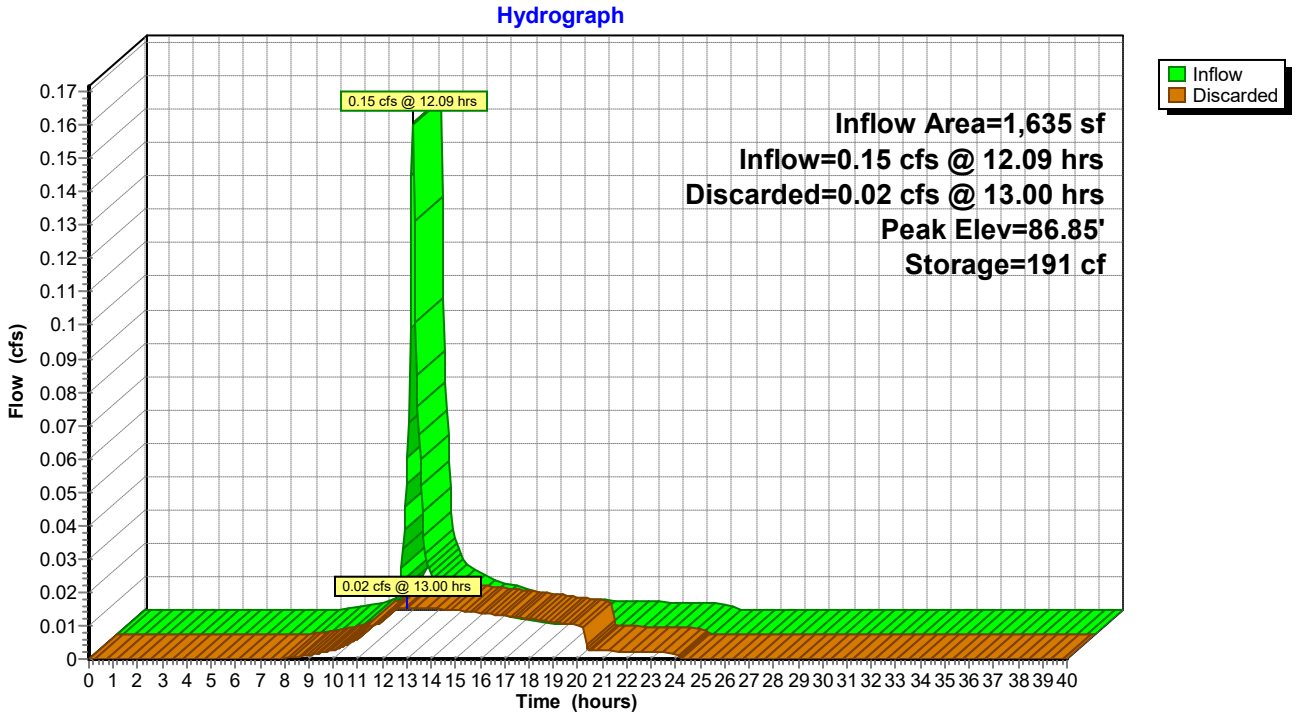
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	234 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
86.00	175	0	0
87.00	293	234	234

Device	Routing	Invert	Outlet Devices
#1	Discarded	86.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 13.00 hrs HW=86.85' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 4P: Depressed Landscape Area



Summary for Pond 5: CDS5

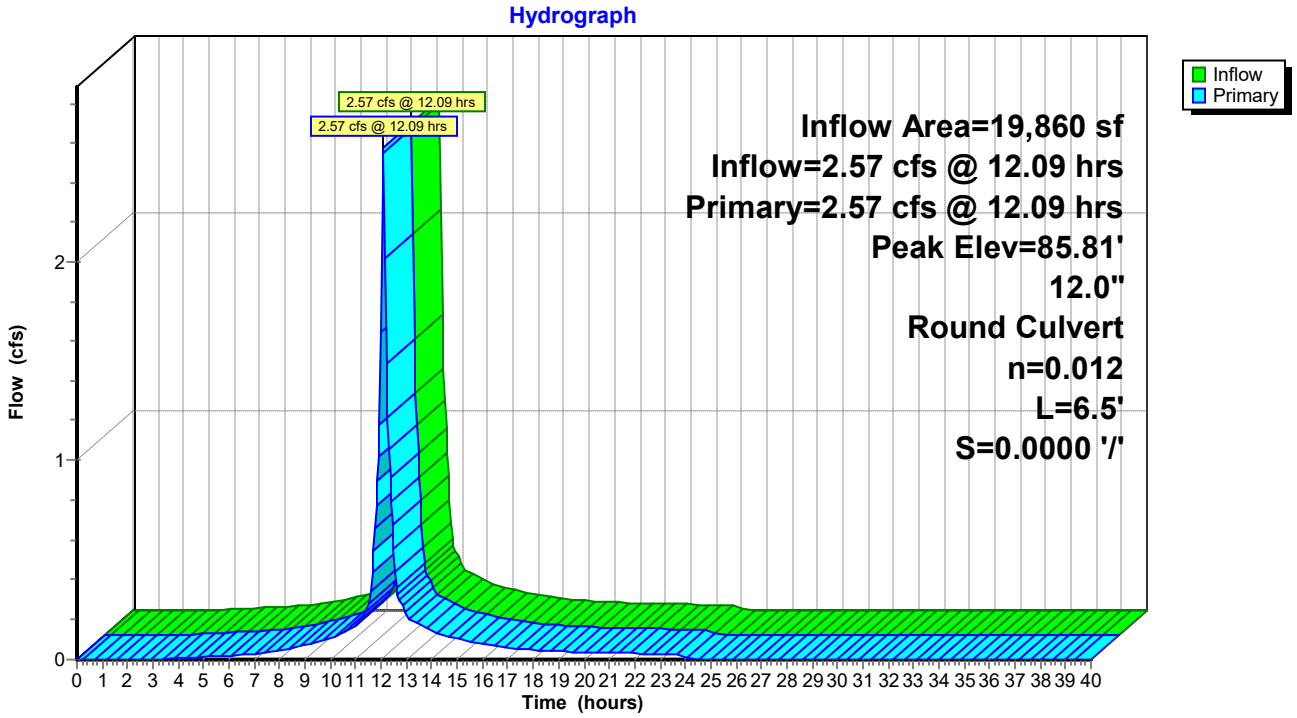
Inflow Area = 19,860 sf, 85.03% Impervious, Inflow Depth = 5.27" for 50 yr event
Inflow = 2.57 cfs @ 12.09 hrs, Volume= 8,715 cf
Outflow = 2.57 cfs @ 12.09 hrs, Volume= 8,715 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.57 cfs @ 12.09 hrs, Volume= 8,715 cf
Routed to Pond 1P : Infiltration Pipe Network

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.81' @ 12.56 hrs
Flood Elev= 87.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.25'	**12.0" Round Culvert** L= 6.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.25' / 84.25' S= 0.0000 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.36 cfs @ 12.09 hrs HW=85.43' TW=85.04' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.36 cfs @ 3.01 fps)

Pond 5: CDS5



Summary for Pond 5P: Depressed Landscape Area

Inflow Area = 1,386 sf, 0.00% Impervious, Inflow Depth = 2.14" for 50 yr event
Inflow = 0.08 cfs @ 12.10 hrs, Volume= 247 cf
Outflow = 0.02 cfs @ 12.51 hrs, Volume= 247 cf, Atten= 73%, Lag= 24.8 min
Discarded = 0.02 cfs @ 12.51 hrs, Volume= 247 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.16' @ 12.51 hrs Surf.Area= 362 sf Storage= 53 cf

Plug-Flow detention time= 16.5 min calculated for 247 cf (100% of inflow)
Center-of-Mass det. time= 16.5 min (874.7 - 858.2)

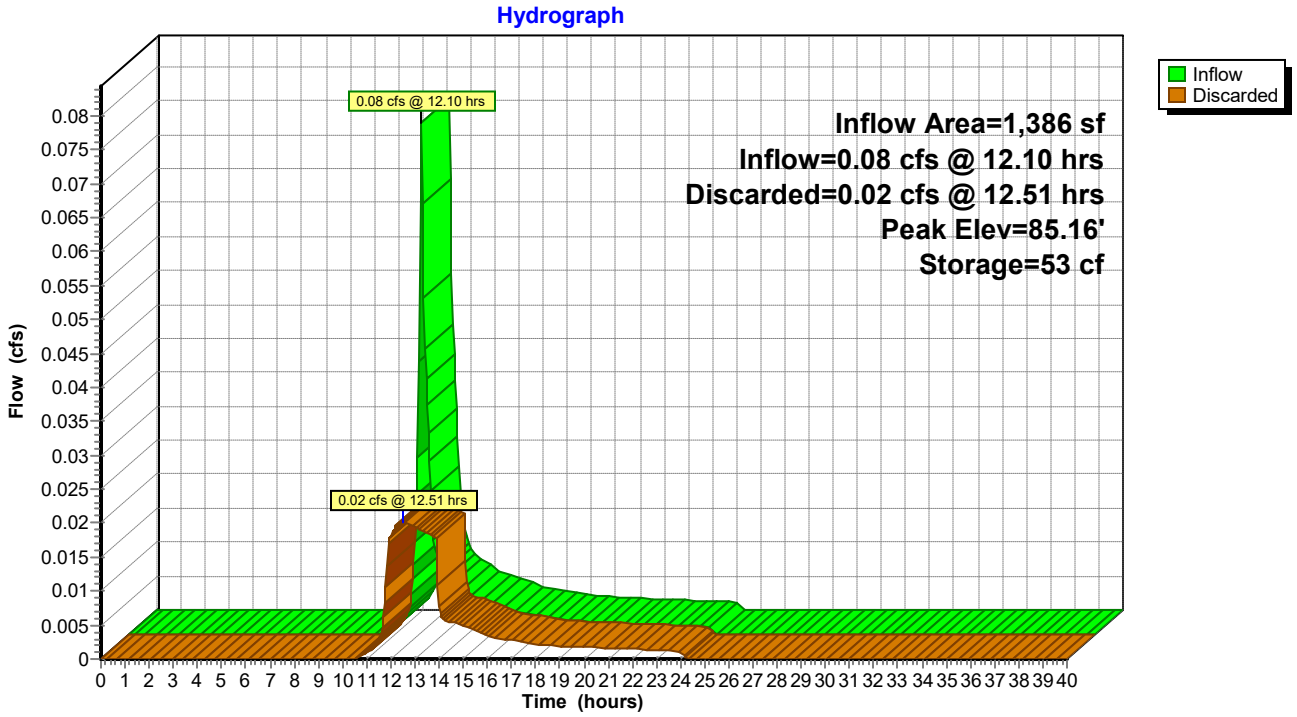
Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	462 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	316	0	0
86.00	608	462	462

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 12.51 hrs HW=85.16' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 5P: Depressed Landscape Area



Summary for Pond 6: TD6

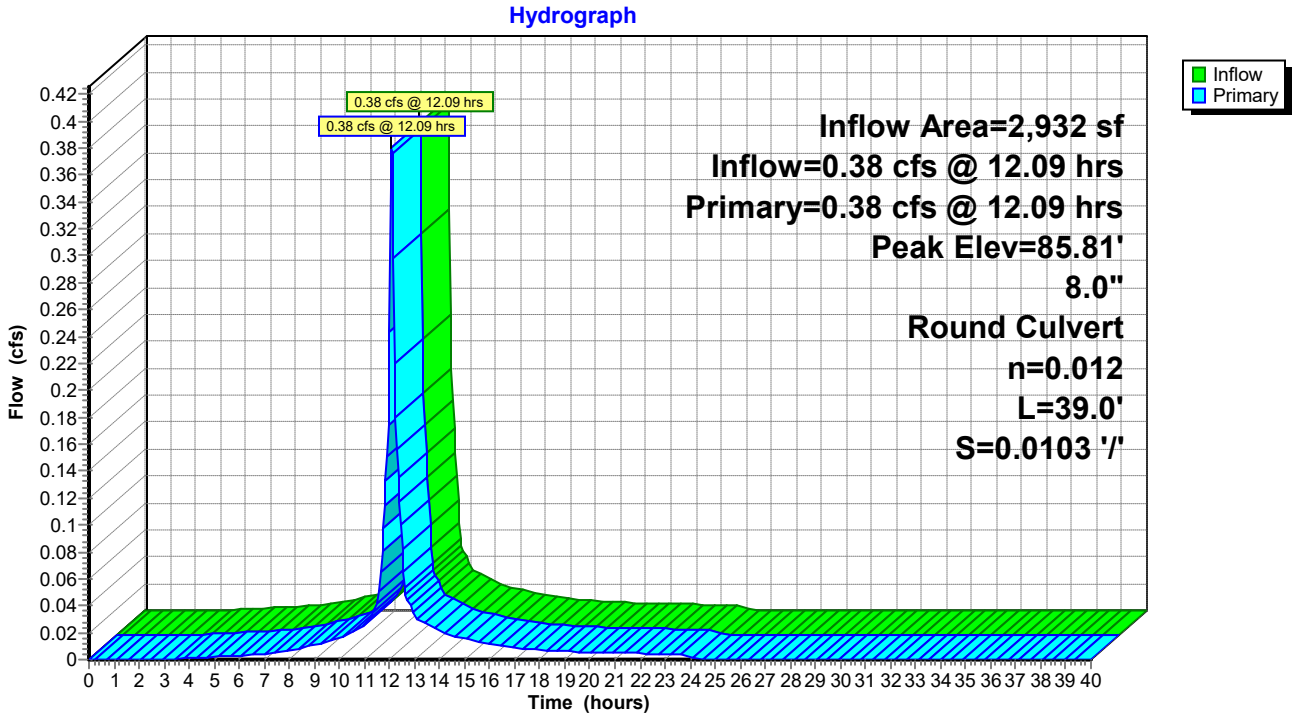
Inflow Area = 2,932 sf, 84.21% Impervious, Inflow Depth = 5.27" for 50 yr event
Inflow = 0.38 cfs @ 12.09 hrs, Volume= 1,287 cf
Outflow = 0.38 cfs @ 12.09 hrs, Volume= 1,287 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.38 cfs @ 12.09 hrs, Volume= 1,287 cf
Routed to Pond 7 : CDS7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.81' @ 12.67 hrs
Flood Elev= 86.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**8.0" Round Culvert** L= 39.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 84.60' S= 0.0103 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.27 cfs @ 12.09 hrs HW=85.40' TW=85.23' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.27 cfs @ 1.76 fps)

Pond 6: TD6



Summary for Pond 7: CDS7

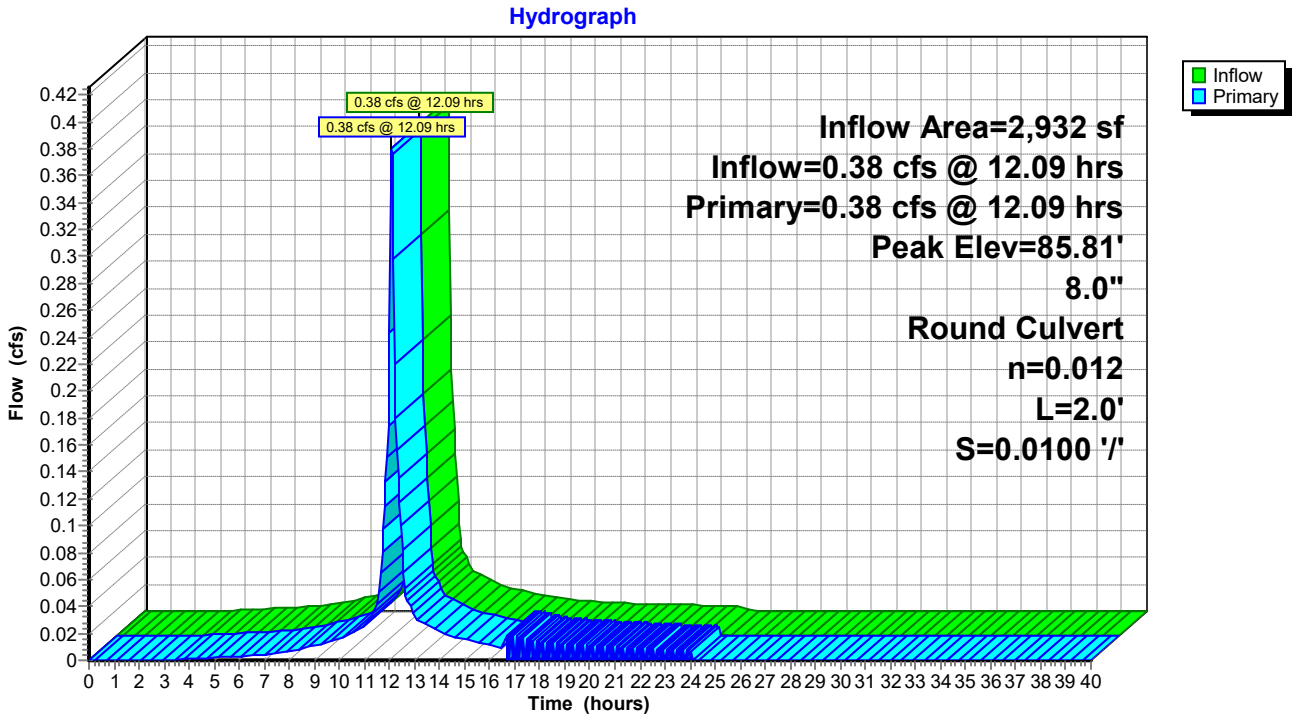
Inflow Area = 2,932 sf, 84.21% Impervious, Inflow Depth = 5.27" for 50 yr event
Inflow = 0.38 cfs @ 12.09 hrs, Volume= 1,287 cf
Outflow = 0.38 cfs @ 12.09 hrs, Volume= 1,287 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.38 cfs @ 12.09 hrs, Volume= 1,287 cf
Routed to Pond 8 : DMH8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.81' @ 12.62 hrs
Flood Elev= 90.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.60'	**8.0" Round Culvert** L= 2.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.60' / 84.58' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.23' TW=85.25' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 7: CDS7



Summary for Pond 8: DMH8

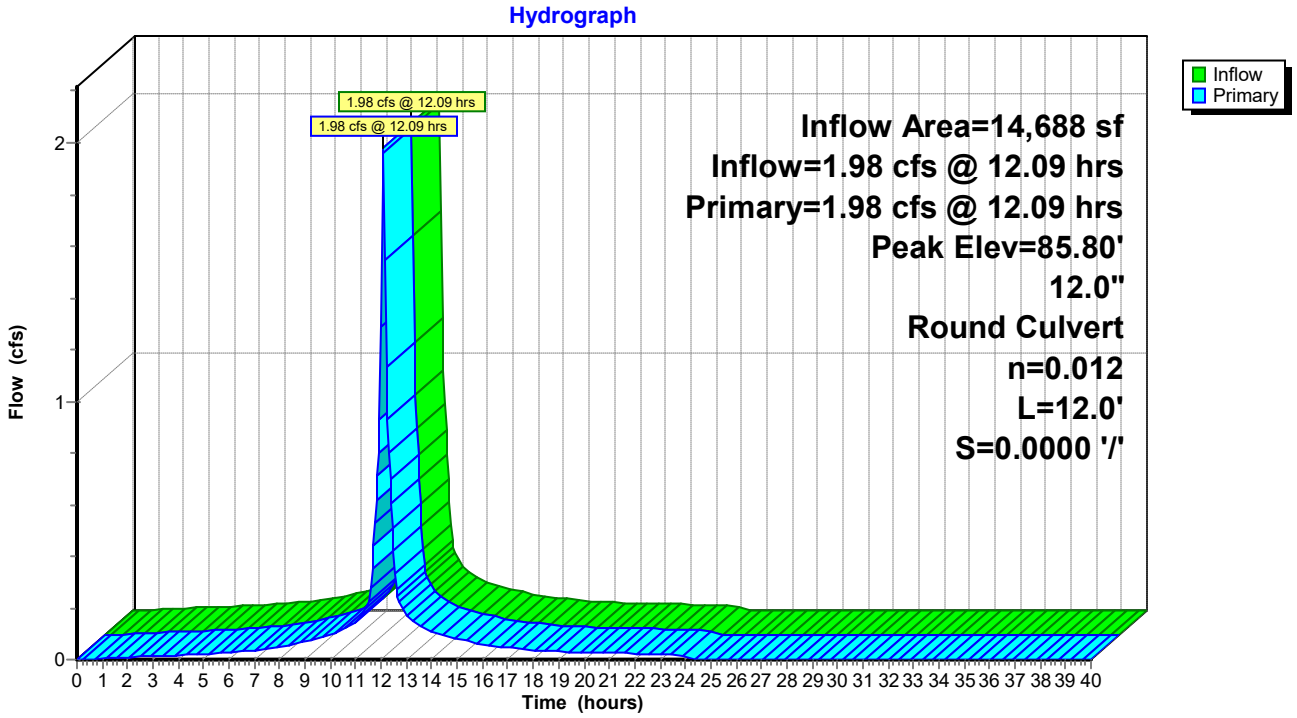
Inflow Area = 14,688 sf, 96.85% Impervious, Inflow Depth = 5.82" for 50 yr event
Inflow = 1.98 cfs @ 12.09 hrs, Volume= 7,127 cf
Outflow = 1.98 cfs @ 12.09 hrs, Volume= 7,127 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.98 cfs @ 12.09 hrs, Volume= 7,127 cf
Routed to Pond 1P : Infiltration Pipe Network

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.80' @ 12.57 hrs
Flood Elev= 90.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.25'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.25' / 84.25' S= 0.0000 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.77 cfs @ 12.09 hrs HW=85.25' TW=85.03' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.77 cfs @ 2.26 fps)

Pond 8: DMH8

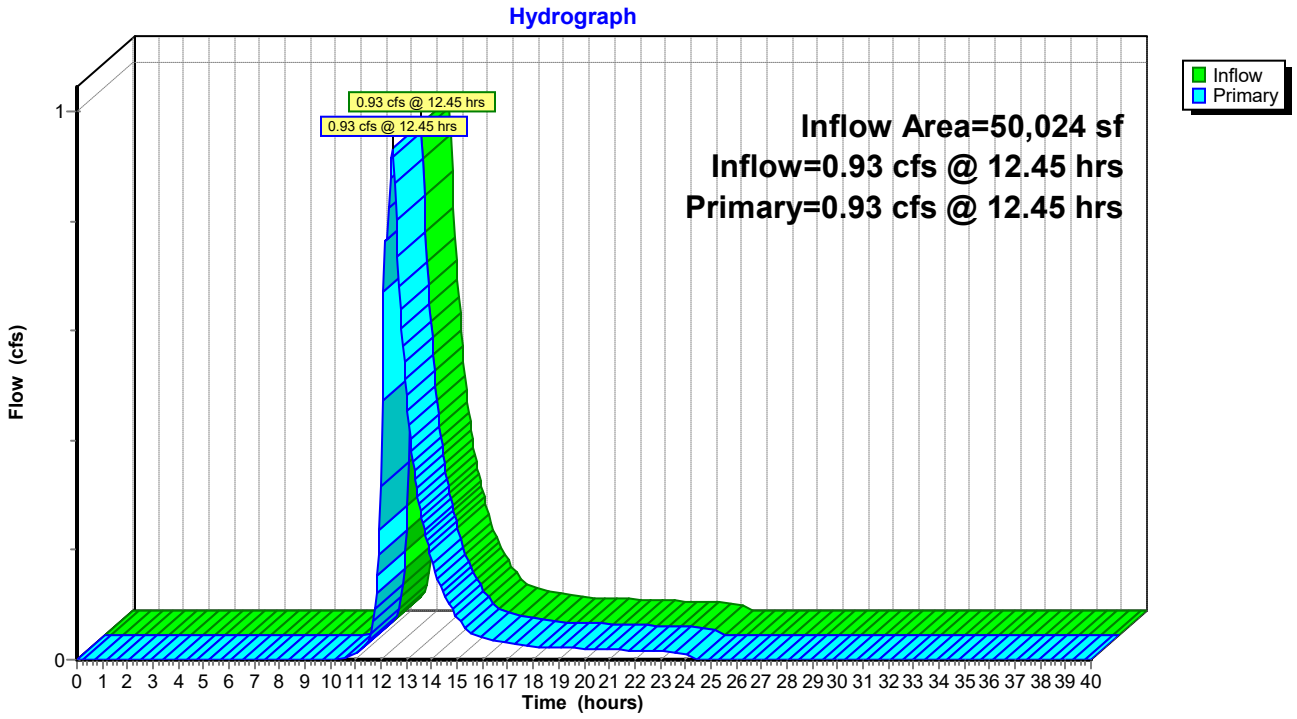


Summary for Link 1L: B Series Wetland

Inflow Area = 50,024 sf, 66.69% Impervious, Inflow Depth = 1.24" for 50 yr event
Inflow = 0.93 cfs @ 12.45 hrs, Volume= 5,179 cf
Primary = 0.93 cfs @ 12.45 hrs, Volume= 5,179 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 9L

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: B Series Wetland

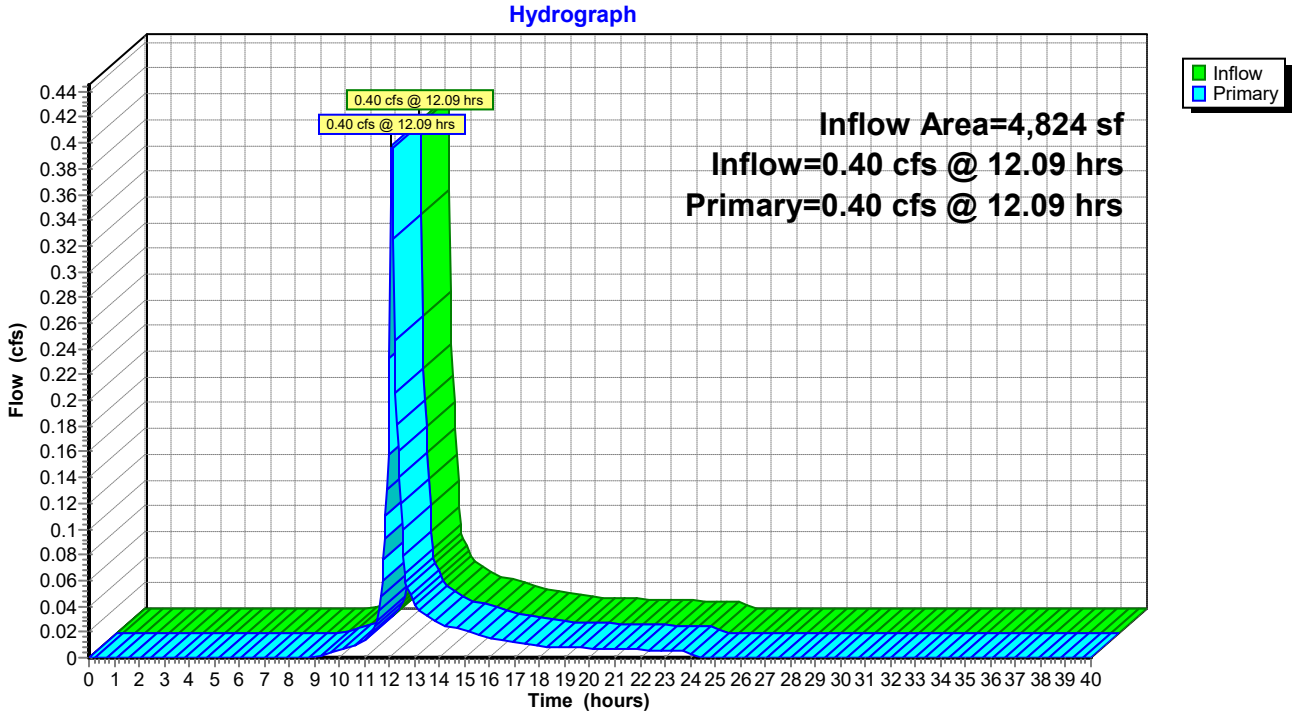


Summary for Link 2L: North Ave

Inflow Area = 4,824 sf, 28.25% Impervious, Inflow Depth = 3.13" for 50 yr event
Inflow = 0.40 cfs @ 12.09 hrs, Volume= 1,257 cf
Primary = 0.40 cfs @ 12.09 hrs, Volume= 1,257 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 9L

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: North Ave



Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=15,827 sf 87.81% Impervious Runoff Depth=5.68"
Tc=6.0 min CN=93 Runoff=2.18 cfs 7,487 cf

Subcatchment 2S: Runoff Area=4,033 sf 74.14% Impervious Runoff Depth=5.11"
Tc=6.0 min CN=88 Runoff=0.52 cfs 1,717 cf

Subcatchment 3S: Roof Runoff Area=11,756 sf 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=1.68 cfs 6,134 cf

Subcatchment 4S: Runoff Area=15,476 sf 14.53% Impervious Runoff Depth=2.44"
Flow Length=36' Slope=0.0170 '/' Tc=10.3 min CN=62 Runoff=0.84 cfs 3,146 cf

Subcatchment 5S: Runoff Area=4,281 sf 26.23% Impervious Runoff Depth=3.31"
Tc=6.0 min CN=71 Runoff=0.37 cfs 1,180 cf

Subcatchment 6S: Runoff Area=1,635 sf 41.77% Impervious Runoff Depth=3.82"
Tc=6.0 min CN=76 Runoff=0.16 cfs 520 cf

Subcatchment 7S: Runoff Area=1,660 sf 41.14% Impervious Runoff Depth=3.82"
Tc=6.0 min CN=76 Runoff=0.17 cfs 528 cf

Subcatchment 8S: Runoff Area=2,932 sf 84.21% Impervious Runoff Depth=5.56"
Tc=6.0 min CN=92 Runoff=0.40 cfs 1,359 cf

Subcatchment 9S: Runoff Area=543 sf 44.20% Impervious Runoff Depth=3.92"
Tc=6.0 min CN=77 Runoff=0.06 cfs 177 cf

Subcatchment 10S: Runoff Area=2,088 sf 0.00% Impervious Runoff Depth=2.35"
Tc=6.0 min CN=61 Runoff=0.13 cfs 408 cf

Subcatchment 11S: Runoff Area=1,386 sf 0.00% Impervious Runoff Depth=2.35"
Tc=6.0 min CN=61 Runoff=0.08 cfs 271 cf

Pond 1: CB1 Peak Elev=86.32' Inflow=0.52 cfs 1,717 cf
12.0" Round Culvert n=0.012 L=135.0' S=0.0100 '/' Outflow=0.52 cfs 1,717 cf

Pond 1P: Infiltration Pipe Network Peak Elev=85.88' Storage=6,038 cf Inflow=4.78 cfs 16,697 cf
Discarded=0.25 cfs 13,852 cf Primary=0.78 cfs 2,845 cf Outflow=1.03 cfs 16,697 cf

Pond 2: DMH2 Peak Elev=85.95' Inflow=0.52 cfs 1,717 cf
12.0" Round Culvert n=0.012 L=31.0' S=0.0100 '/' Outflow=0.52 cfs 1,717 cf

Pond 2P: Depressed Landscape Area Peak Elev=85.63' Storage=186 cf Inflow=0.13 cfs 408 cf
Outflow=0.01 cfs 408 cf

Pond 3: DGCB3 Peak Elev=86.13' Inflow=2.18 cfs 7,487 cf
12.0" Round Culvert n=0.012 L=3.0' S=0.0100 '/' Outflow=2.18 cfs 7,487 cf

Pond 3P: Depressed Landscape Area Peak Elev=86.85' Storage=208 cf Inflow=0.17 cfs 528 cf
Outflow=0.02 cfs 528 cf

Pond 4: DMH4 Peak Elev=85.94' Inflow=2.70 cfs 9,204 cf
12.0" Round Culvert n=0.012 L=4.0' S=0.0100 '/' Outflow=2.70 cfs 9,204 cf

Pond 4P: Depressed Landscape Area Peak Elev=86.91' Storage=209 cf Inflow=0.16 cfs 520 cf
Outflow=0.02 cfs 520 cf

Pond 5: CDS5 Peak Elev=85.90' Inflow=2.70 cfs 9,204 cf
12.0" Round Culvert n=0.012 L=6.5' S=0.0000 '/' Outflow=2.70 cfs 9,204 cf

Pond 5P: Depressed Landscape Area Peak Elev=85.18' Storage=63 cf Inflow=0.08 cfs 271 cf
Outflow=0.02 cfs 271 cf

Pond 6: TD6 Peak Elev=85.89' Inflow=0.40 cfs 1,359 cf
8.0" Round Culvert n=0.012 L=39.0' S=0.0103 '/' Outflow=0.40 cfs 1,359 cf

Pond 7: CDS7 Peak Elev=85.89' Inflow=0.40 cfs 1,359 cf
8.0" Round Culvert n=0.012 L=2.0' S=0.0100 '/' Outflow=0.40 cfs 1,360 cf

Pond 8: DMH8 Peak Elev=85.89' Inflow=2.08 cfs 7,494 cf
12.0" Round Culvert n=0.012 L=12.0' S=0.0000 '/' Outflow=2.08 cfs 7,494 cf

Link 1L: B Series Wetland Inflow=1.16 cfs 5,991 cf
Primary=1.16 cfs 5,991 cf

Link 2L: North Ave Inflow=0.43 cfs 1,357 cf
Primary=0.43 cfs 1,357 cf

Total Runoff Area = 61,617 sf Runoff Volume = 22,927 cf Average Runoff Depth = 4.47"
41.43% Pervious = 25,528 sf 58.57% Impervious = 36,089 sf

Summary for Subcatchment 1S:

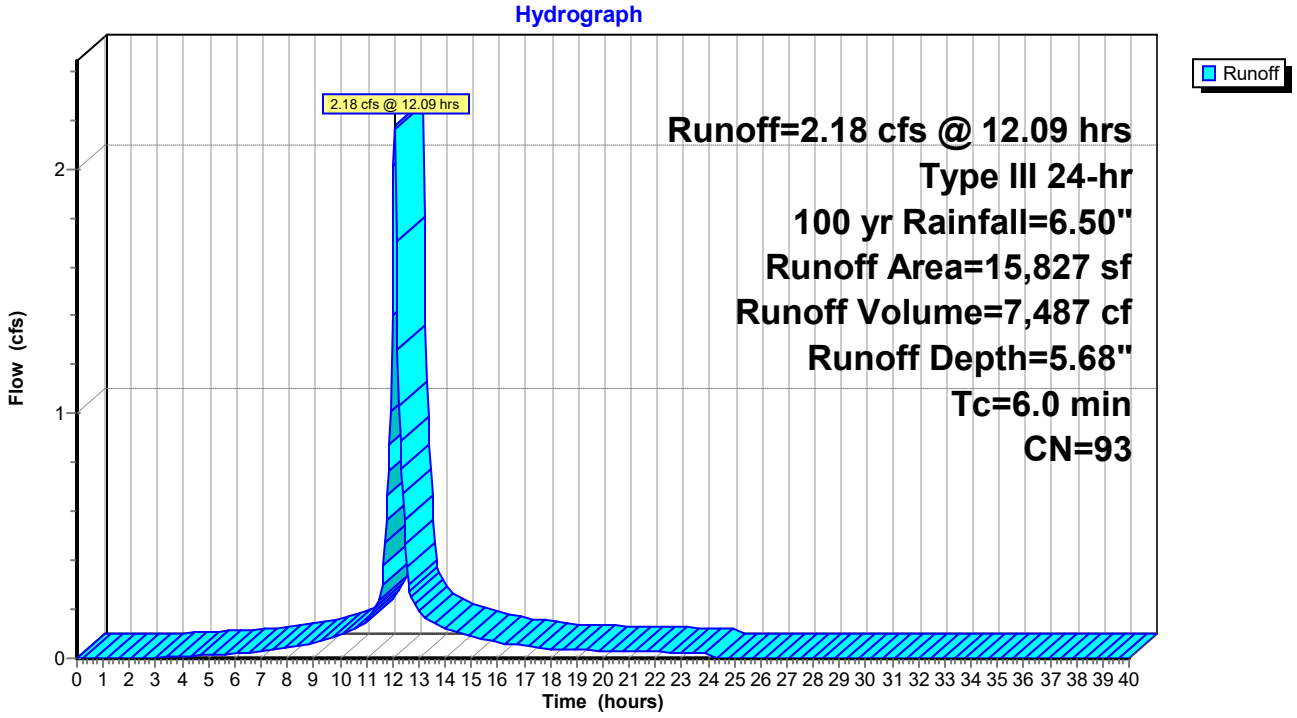
Runoff = 2.18 cfs @ 12.09 hrs, Volume= 7,487 cf, Depth= 5.68"
Routed to Pond 3 : DGCB3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
13,897	98	Paved parking, HSG B
1,930	61	>75% Grass cover, Good, HSG B
15,827	93	Weighted Average
1,930		12.19% Pervious Area
13,897		87.81% Impervious Area

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

Subcatchment 1S:



Summary for Subcatchment 2S:

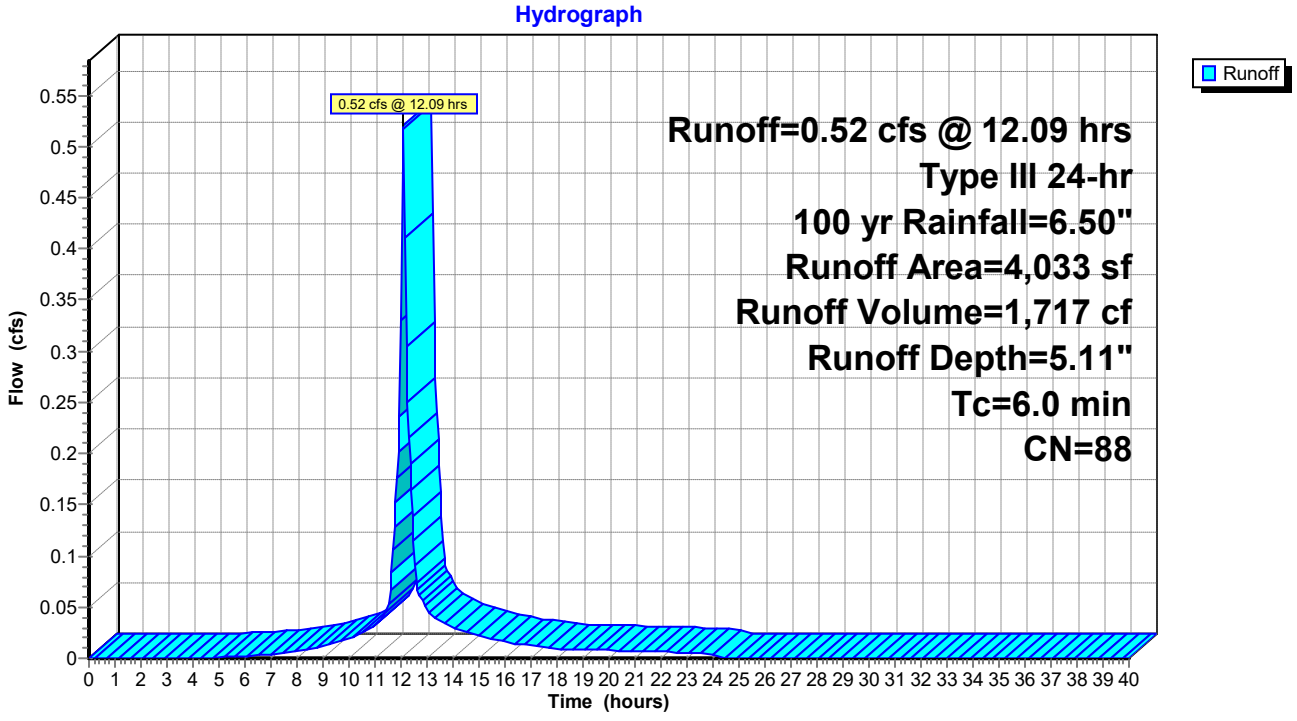
Runoff = 0.52 cfs @ 12.09 hrs, Volume= 1,717 cf, Depth= 5.11"
Routed to Pond 1 : CB1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
2,990	98	Paved parking, HSG B
1,043	61	>75% Grass cover, Good, HSG B
4,033	88	Weighted Average
1,043		25.86% Pervious Area
2,990		74.14% Impervious Area

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

Subcatchment 2S:



Summary for Subcatchment 3S: Roof

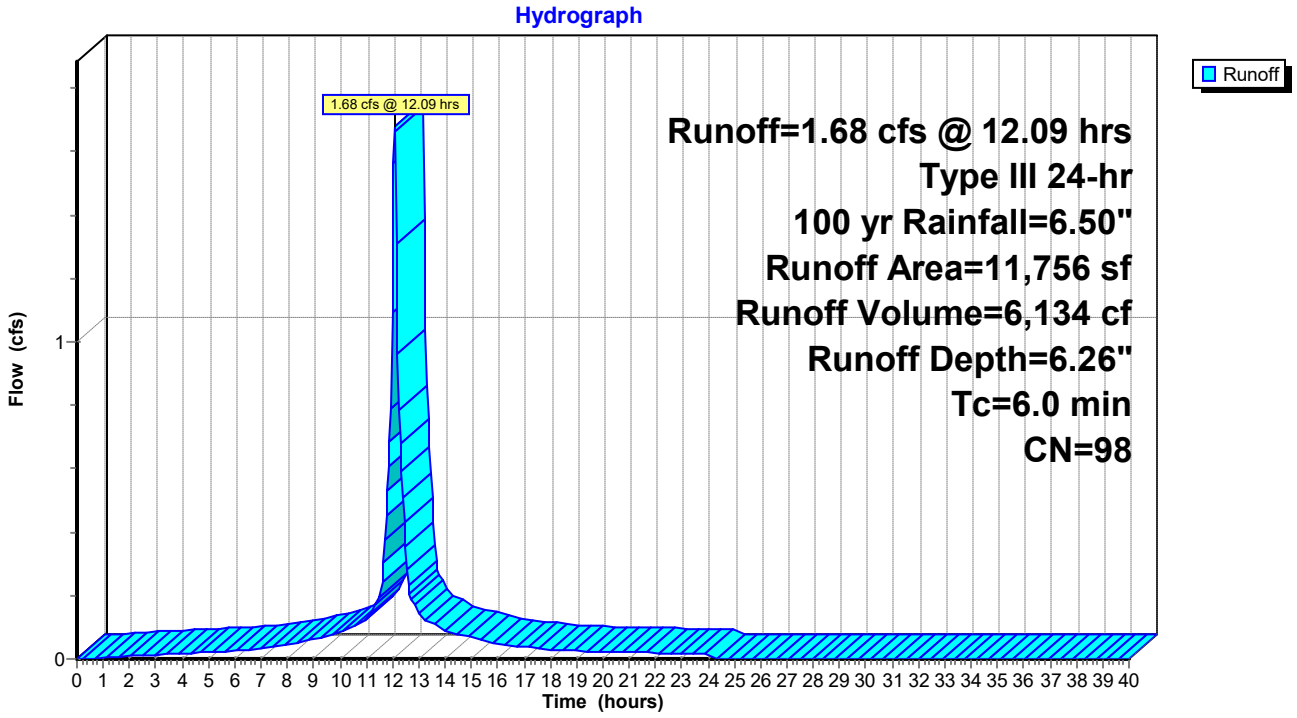
Runoff = 1.68 cfs @ 12.09 hrs, Volume= 6,134 cf, Depth= 6.26"
Routed to Pond 8 : DMH8

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
11,756	98	Roofs, HSG B
11,756		100.00% Impervious Area

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

Subcatchment 3S: Roof



Summary for Subcatchment 4S:

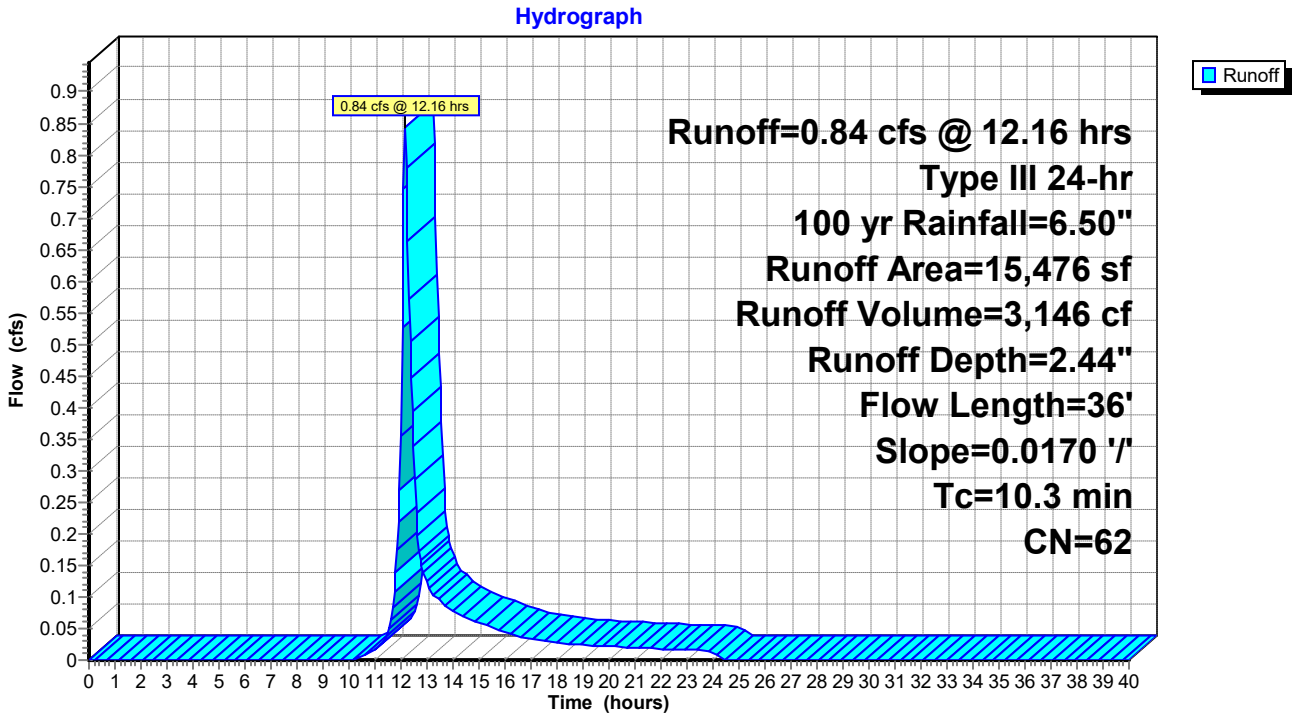
Runoff = 0.84 cfs @ 12.16 hrs, Volume= 3,146 cf, Depth= 2.44"
Routed to Link 1L : B Series Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
10,238	55	Woods, Good, HSG B
2,990	61	>75% Grass cover, Good, HSG B
2,248	98	Paved parking, HSG B
15,476	62	Weighted Average
13,228		85.47% Pervious Area
2,248		14.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	36	0.0170	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"

Subcatchment 4S:



Summary for Subcatchment 5S:

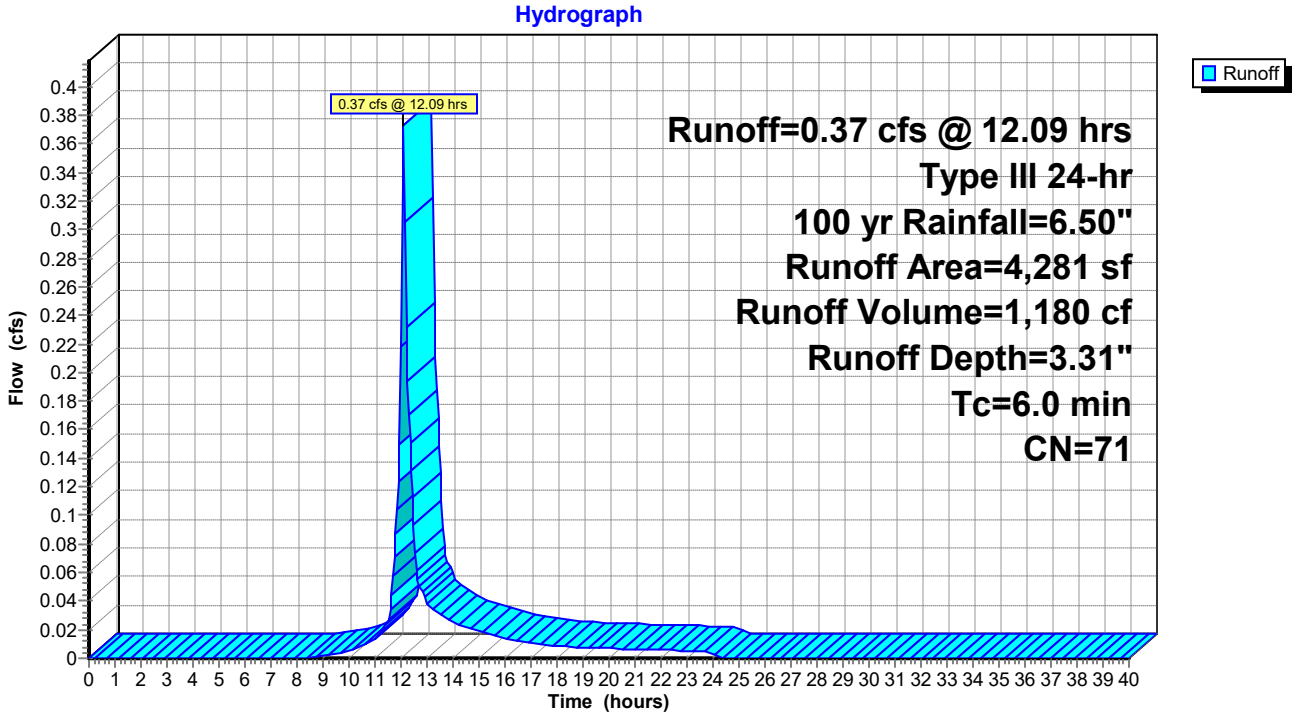
Runoff = 0.37 cfs @ 12.09 hrs, Volume= 1,180 cf, Depth= 3.31"
Routed to Link 2L : North Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
1,123	98	Paved parking, HSG B
3,158	61	>75% Grass cover, Good, HSG B
4,281	71	Weighted Average
3,158		73.77% Pervious Area
1,123		26.23% Impervious Area

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

Subcatchment 5S:



Summary for Subcatchment 6S:

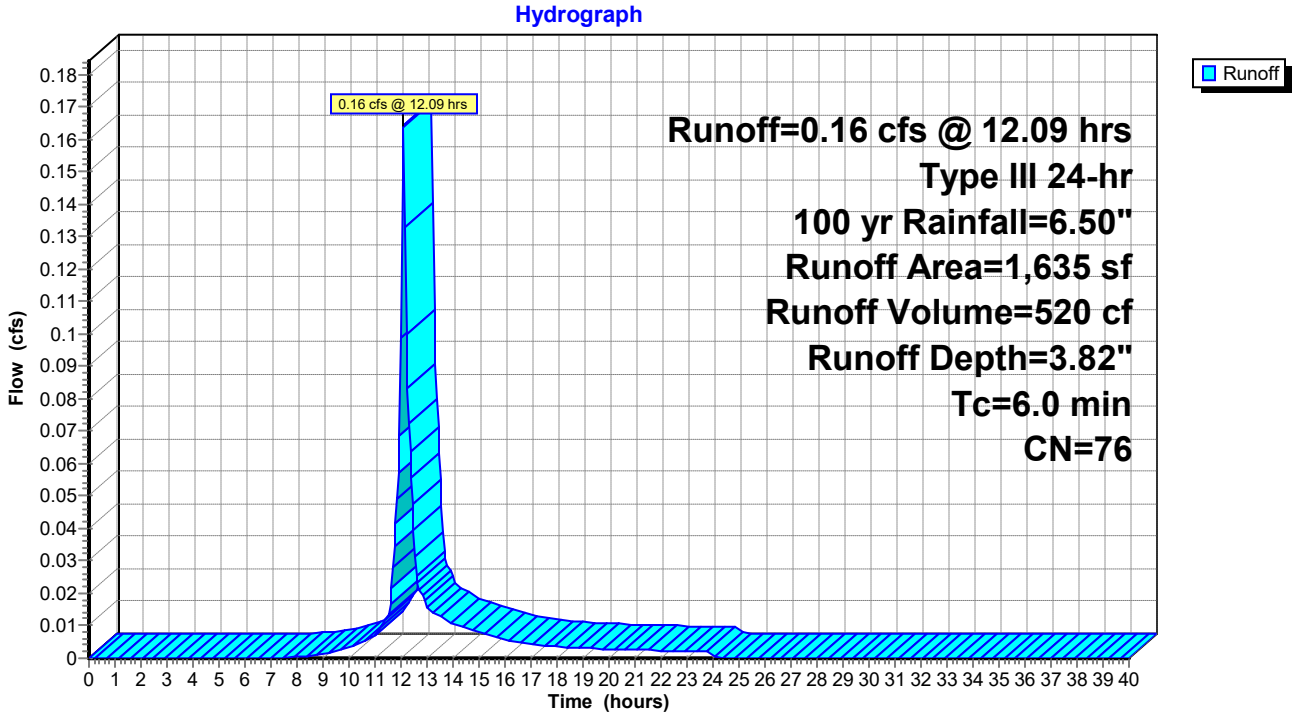
Runoff = 0.16 cfs @ 12.09 hrs, Volume= 520 cf, Depth= 3.82"
Routed to Pond 4P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
952	61	>75% Grass cover, Good, HSG B
683	98	Paved parking, HSG B
1,635	76	Weighted Average
952		58.23% Pervious Area
683		41.77% Impervious Area

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

Subcatchment 6S:



Summary for Subcatchment 7S:

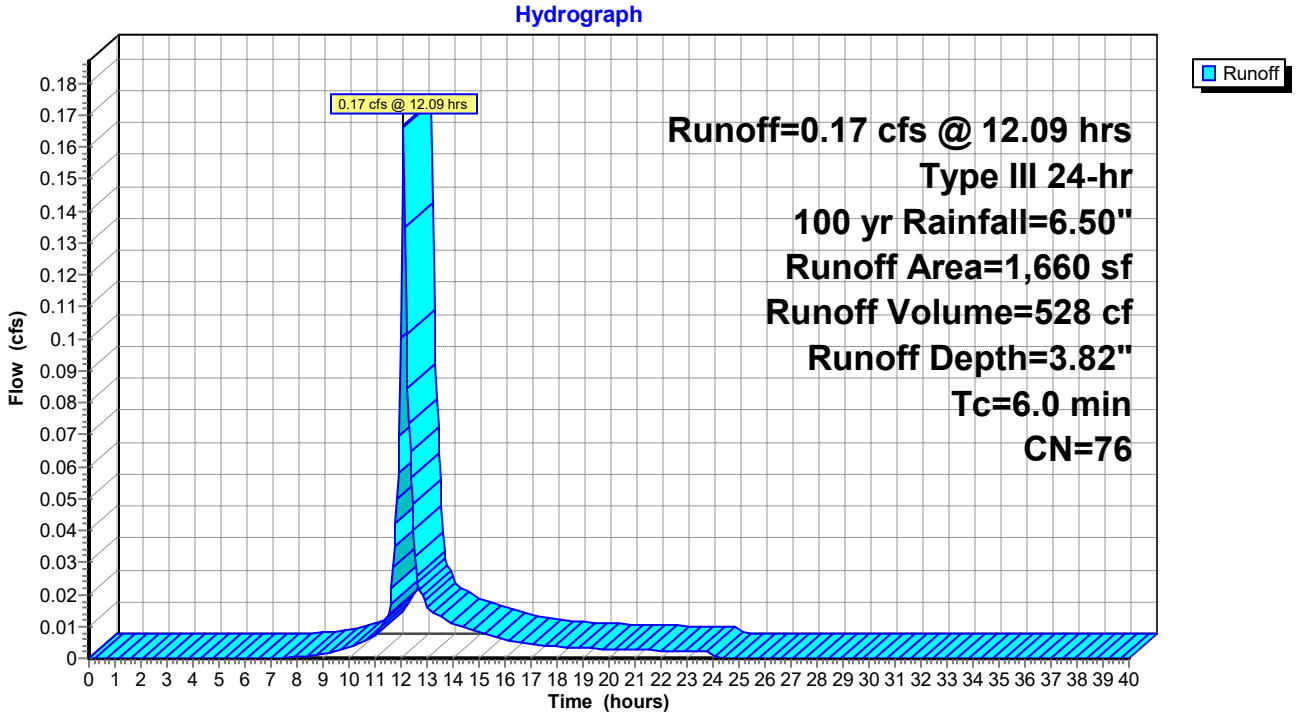
Runoff = 0.17 cfs @ 12.09 hrs, Volume= 528 cf, Depth= 3.82"
Routed to Pond 3P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
977	61	>75% Grass cover, Good, HSG B
683	98	Paved parking, HSG B
1,660	76	Weighted Average
977		58.86% Pervious Area
683		41.14% Impervious Area

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

Subcatchment 7S:



Summary for Subcatchment 8S:

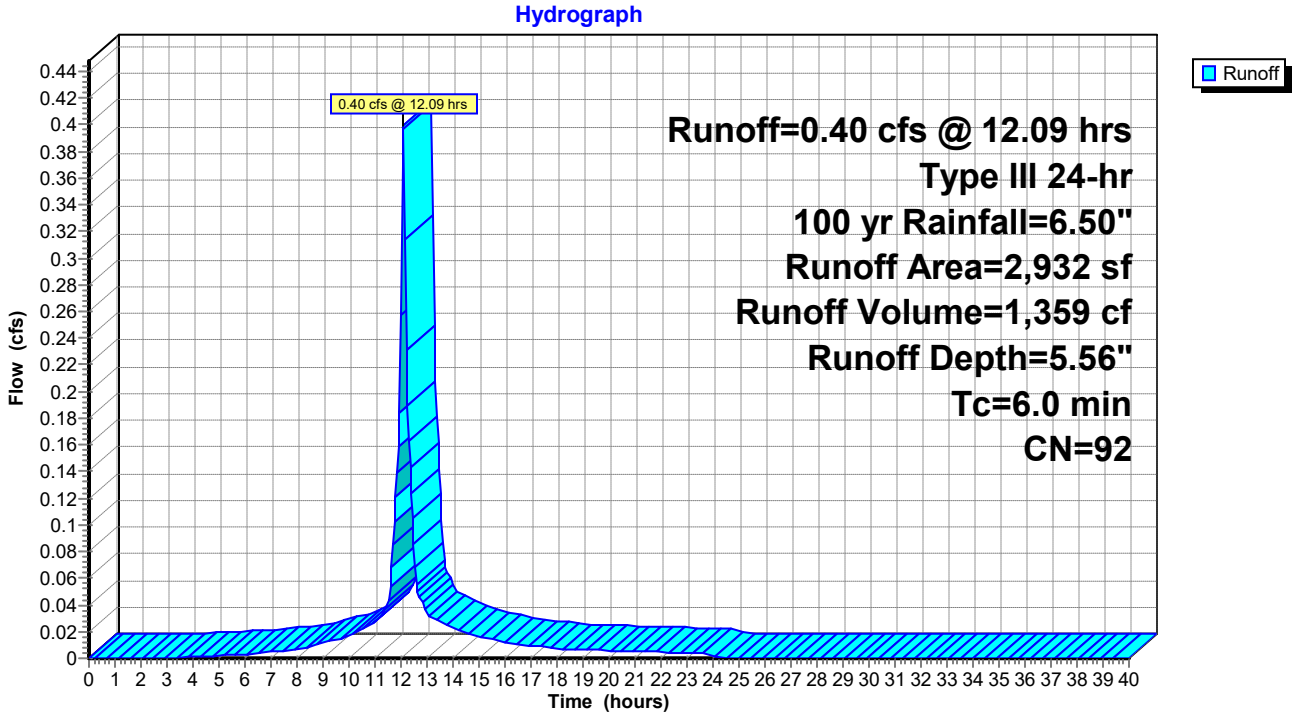
Runoff = 0.40 cfs @ 12.09 hrs, Volume= 1,359 cf, Depth= 5.56"
Routed to Pond 6 : TD6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
463	61	>75% Grass cover, Good, HSG B
2,469	98	Paved parking, HSG B
2,932	92	Weighted Average
463		15.79% Pervious Area
2,469		84.21% Impervious Area

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

Subcatchment 8S:



Summary for Subcatchment 9S:

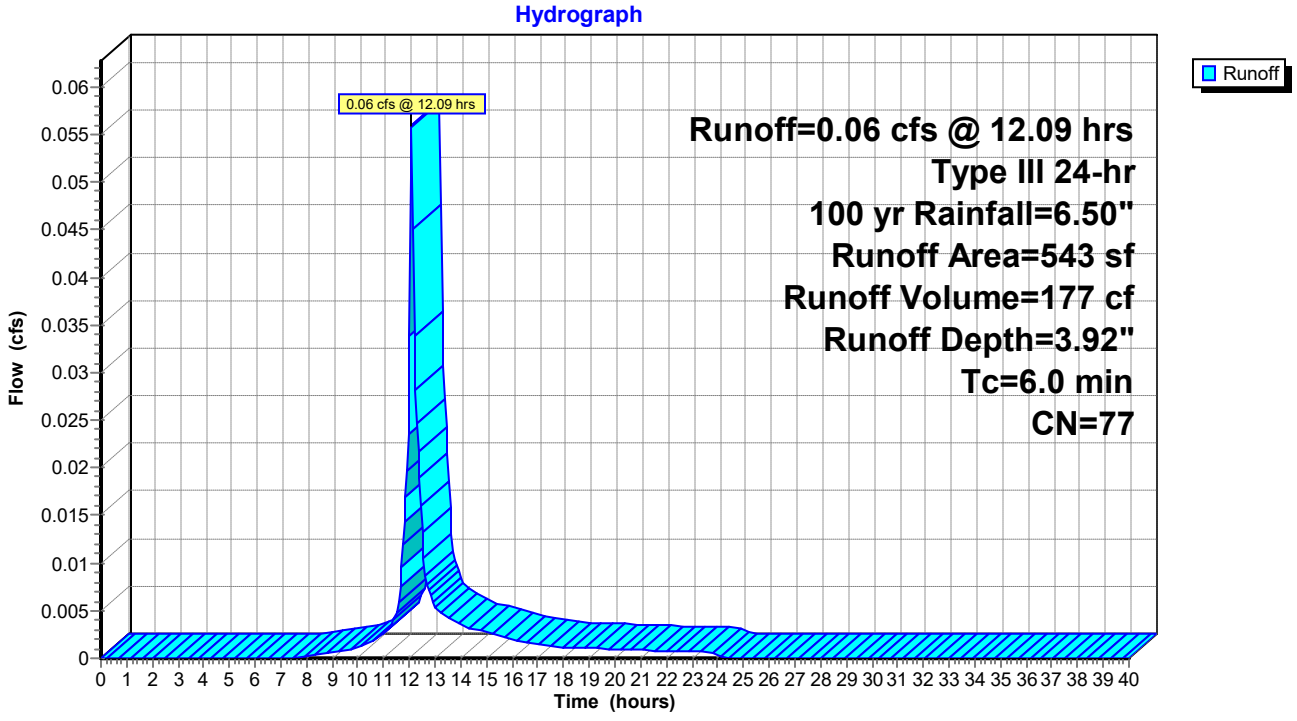
Runoff = 0.06 cfs @ 12.09 hrs, Volume= 177 cf, Depth= 3.92"
Routed to Link 2L : North Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
303	61	>75% Grass cover, Good, HSG B
240	98	Paved parking, HSG B
543	77	Weighted Average
303		55.80% Pervious Area
240		44.20% Impervious Area

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

Subcatchment 9S:



Summary for Subcatchment 10S:

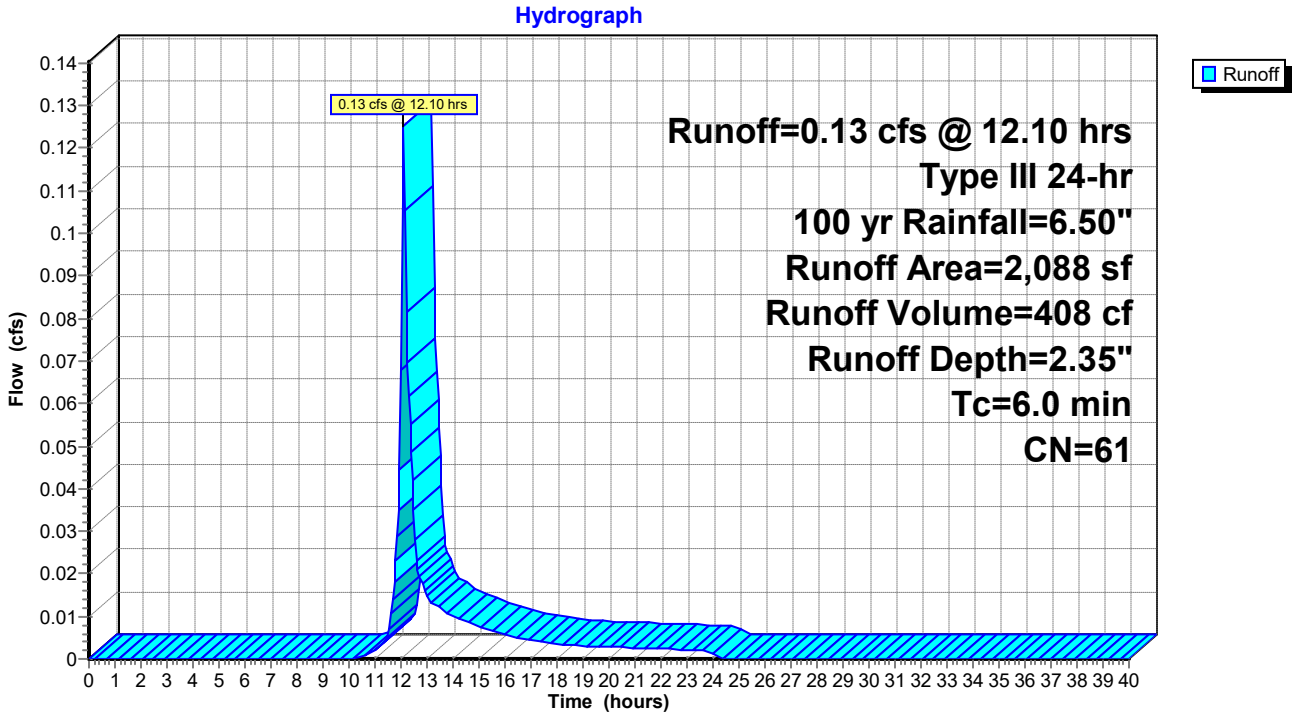
Runoff = 0.13 cfs @ 12.10 hrs, Volume= 408 cf, Depth= 2.35"
Routed to Pond 2P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
2,088	61	>75% Grass cover, Good, HSG B
2,088		100.00% Pervious Area

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

Subcatchment 10S:



Summary for Subcatchment 11S:

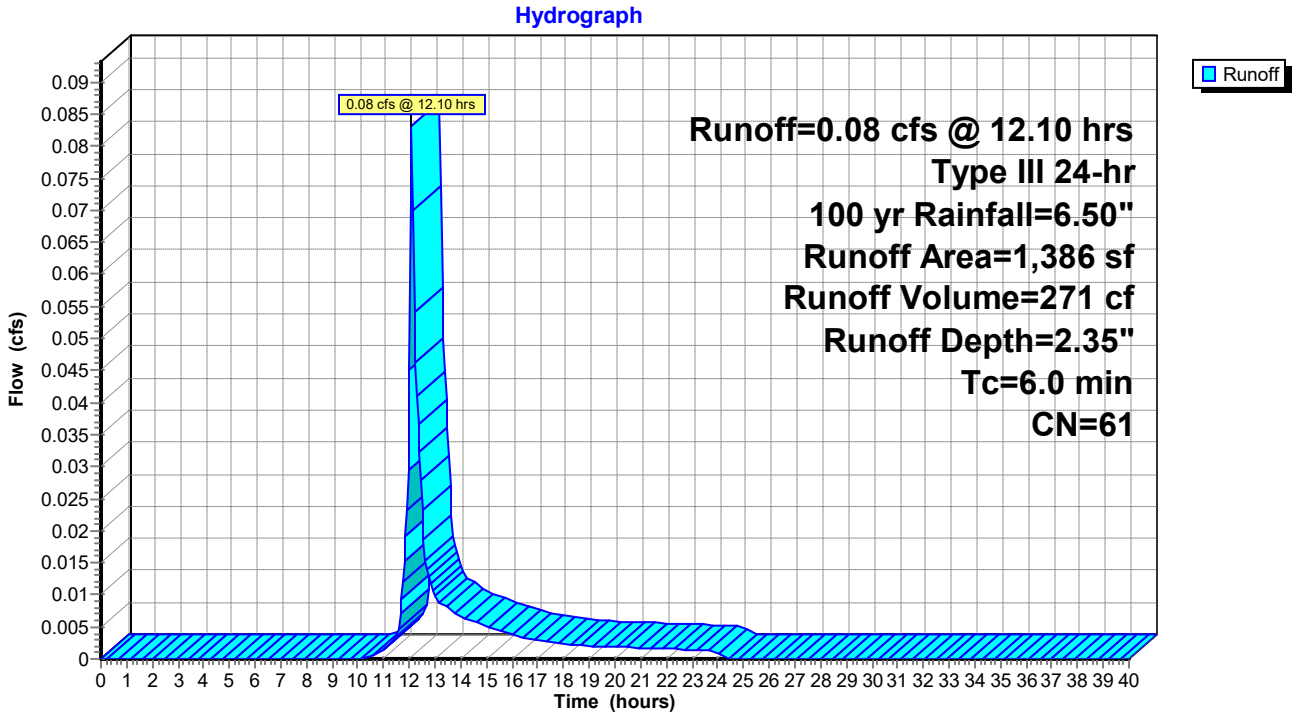
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 271 cf, Depth= 2.35"
Routed to Pond 5P : Depressed Landscape Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
1,386	61	>75% Grass cover, Good, HSG B
1,386		100.00% Pervious Area

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

Subcatchment 11S:



Summary for Pond 1: CB1

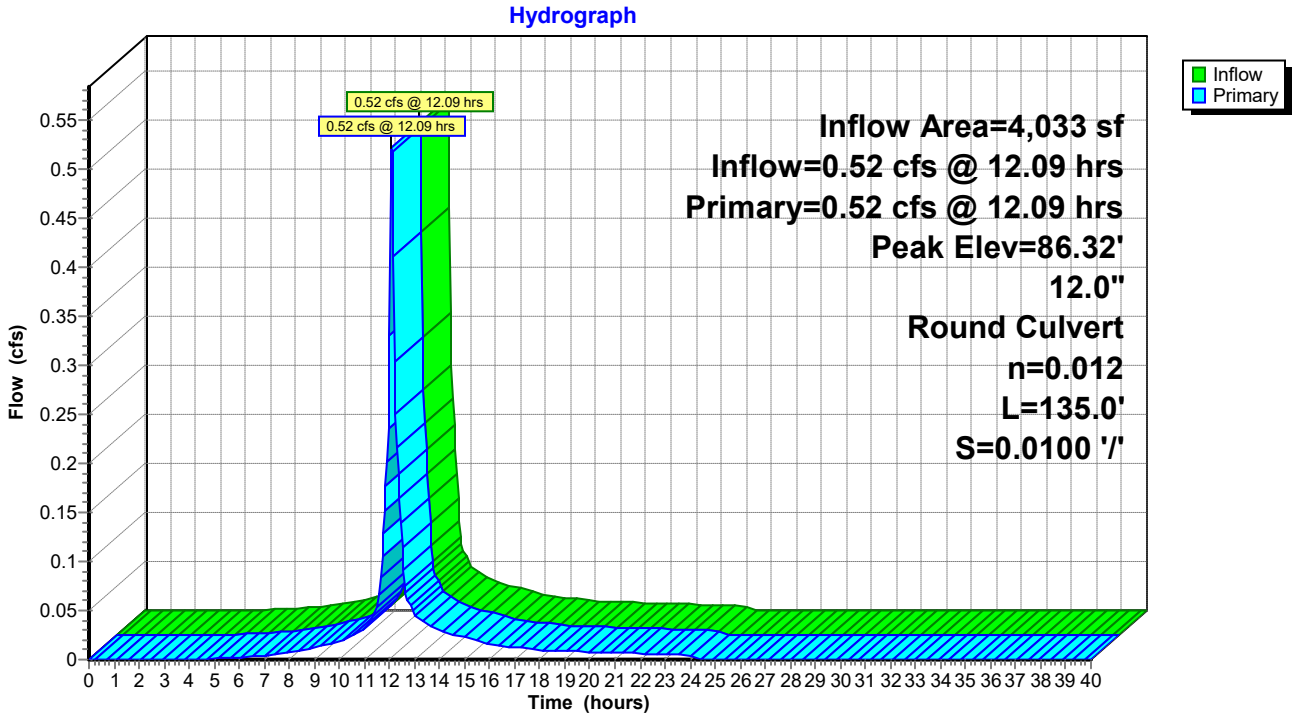
Inflow Area = 4,033 sf, 74.14% Impervious, Inflow Depth = 5.11" for 100 yr event
Inflow = 0.52 cfs @ 12.09 hrs, Volume= 1,717 cf
Outflow = 0.52 cfs @ 12.09 hrs, Volume= 1,717 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.52 cfs @ 12.09 hrs, Volume= 1,717 cf
Routed to Pond 2 : DMH2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.32' @ 12.12 hrs
Flood Elev= 88.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.95'	**12.0" Round Culvert** L= 135.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.95' / 84.60' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.43 cfs @ 12.09 hrs HW=86.32' TW=85.55' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.43 cfs @ 2.47 fps)

Pond 1: CB1



Summary for Pond 1P: Infiltration Pipe Network

Inflow Area = 34,548 sf, 90.05% Impervious, Inflow Depth = 5.80" for 100 yr event
Inflow = 4.78 cfs @ 12.09 hrs, Volume= 16,697 cf
Outflow = 1.03 cfs @ 12.50 hrs, Volume= 16,697 cf, Atten= 78%, Lag= 24.8 min
Discarded = 0.25 cfs @ 10.75 hrs, Volume= 13,852 cf
Primary = 0.78 cfs @ 12.50 hrs, Volume= 2,845 cf
Routed to Link 1L : B Series Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.88' @ 12.50 hrs Surf.Area= 4,503 sf Storage= 6,038 cf

Plug-Flow detention time= 130.9 min calculated for 16,677 cf (100% of inflow)
Center-of-Mass det. time= 130.8 min (893.9 - 763.1)

Volume	Invert	Avail.Storage	Storage Description
#1	83.75'	3,422 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 12,383 cf Overall - 3,828 cf Embedded = 8,555 cf x 40.0% Voids
#2	84.25'	3,828 cf	**Custom Stage Data** Listed below Inside #1
		7,250 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
83.75	4,503	0	0
86.50	4,503	12,383	12,383

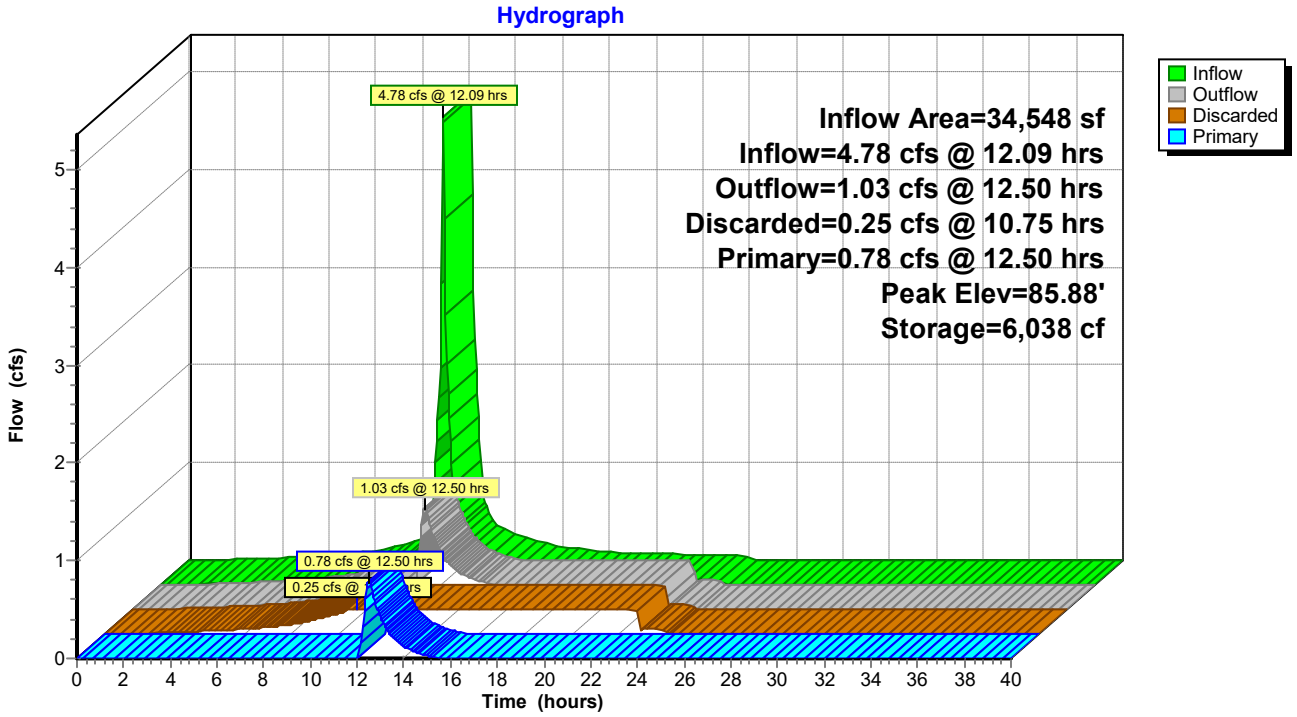
Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
84.25	0	0
84.75	902	902
85.25	1,359	2,261
85.75	1,231	3,492
86.00	336	3,828

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.75'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	85.33'	**8.0" Round Culvert** L= 93.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.33' / 84.25' S= 0.0116 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.25 cfs @ 10.75 hrs HW=83.78' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=0.78 cfs @ 12.50 hrs HW=85.88' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.78 cfs @ 2.53 fps)

Pond 1P: Infiltration Pipe Network



Summary for Pond 2: DMH2

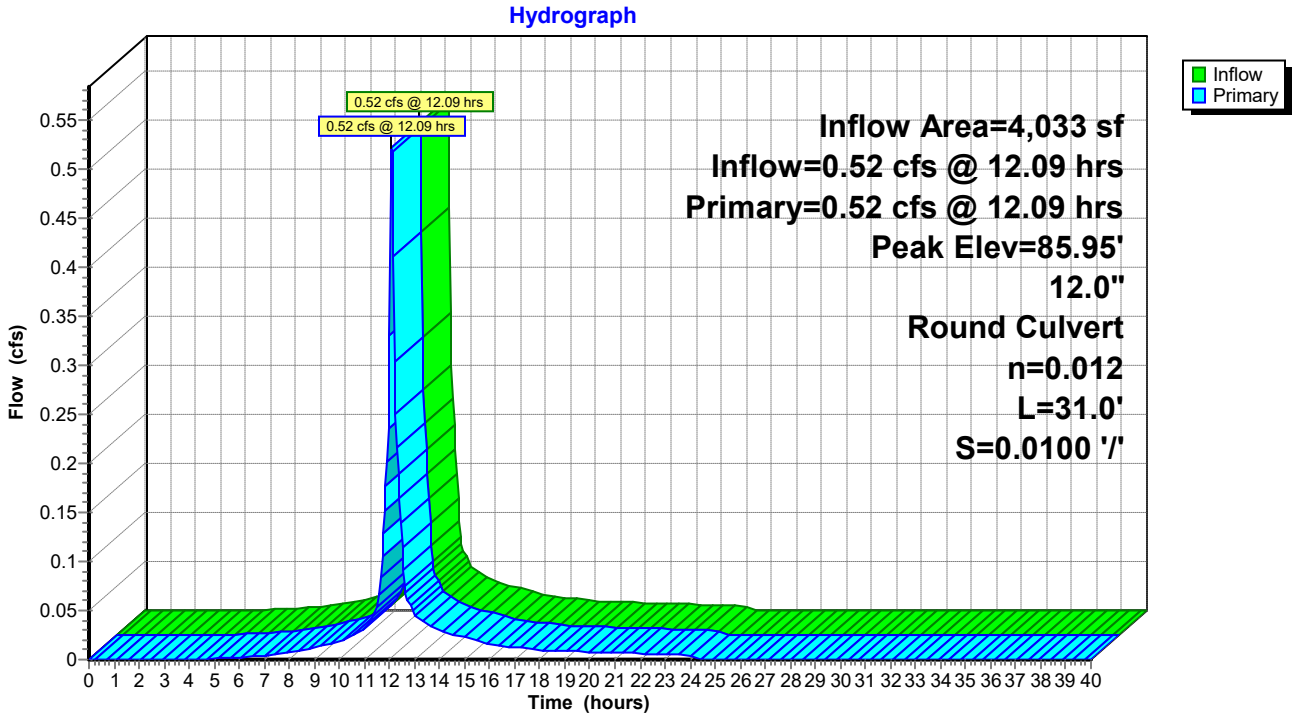
Inflow Area = 4,033 sf, 74.14% Impervious, Inflow Depth = 5.11" for 100 yr event
Inflow = 0.52 cfs @ 12.09 hrs, Volume= 1,717 cf
Outflow = 0.52 cfs @ 12.09 hrs, Volume= 1,717 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.52 cfs @ 12.09 hrs, Volume= 1,717 cf
Routed to Pond 4 : DMH4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.95' @ 12.16 hrs
Flood Elev= 88.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.60'	**12.0" Round Culvert** L= 31.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.60' / 84.29' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.55' TW=85.85' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 2: DMH2



Summary for Pond 2P: Depressed Landscape Area

Inflow Area = 2,088 sf, 0.00% Impervious, Inflow Depth = 2.35" for 100 yr event
Inflow = 0.13 cfs @ 12.10 hrs, Volume= 408 cf
Outflow = 0.01 cfs @ 14.35 hrs, Volume= 408 cf, Atten= 93%, Lag= 134.8 min
Discarded = 0.01 cfs @ 14.35 hrs, Volume= 408 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.63' @ 14.35 hrs Surf.Area= 384 sf Storage= 186 cf

Plug-Flow detention time= 239.8 min calculated for 408 cf (100% of inflow)
Center-of-Mass det. time= 239.6 min (1,095.0 - 855.4)

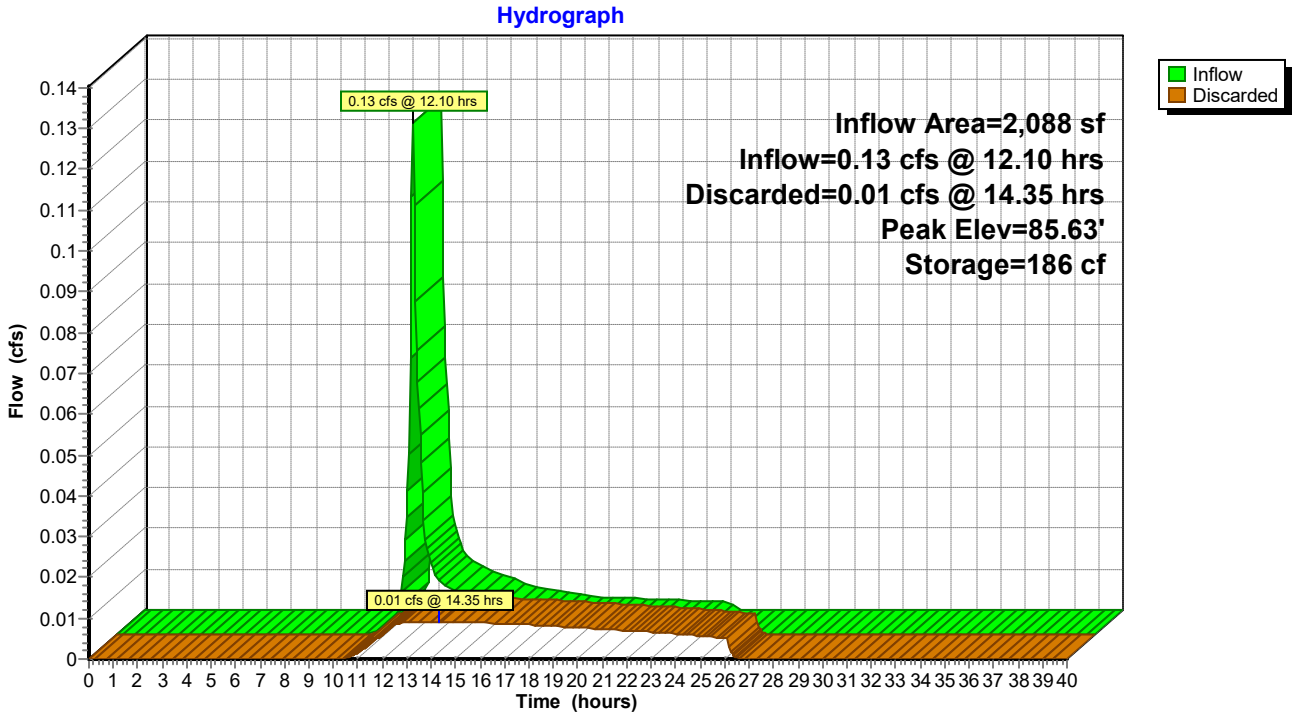
Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	210	0	0
86.00	488	349	349

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 14.35 hrs HW=85.63' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 2P: Depressed Landscape Area



Summary for Pond 3: DGCB3

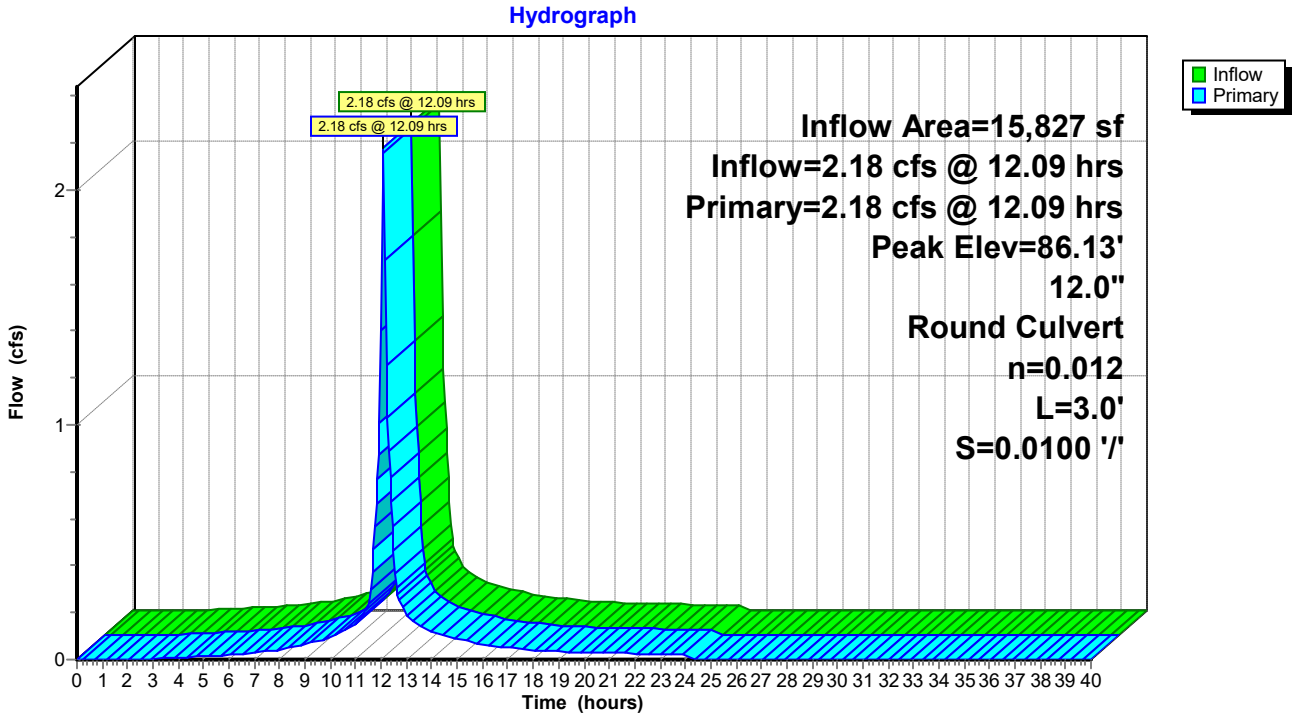
Inflow Area = 15,827 sf, 87.81% Impervious, Inflow Depth = 5.68" for 100 yr event
Inflow = 2.18 cfs @ 12.09 hrs, Volume= 7,487 cf
Outflow = 2.18 cfs @ 12.09 hrs, Volume= 7,487 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.18 cfs @ 12.09 hrs, Volume= 7,487 cf
Routed to Pond 4 : DMH4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.13' @ 12.15 hrs
Flood Elev= 87.33'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.32'	**12.0" Round Culvert** L= 3.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.32' / 84.29' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.82' TW=85.84' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 3: DGCB3



Summary for Pond 3P: Depressed Landscape Area

Inflow Area = 1,660 sf, 41.14% Impervious, Inflow Depth = 3.82" for 100 yr event
Inflow = 0.17 cfs @ 12.09 hrs, Volume= 528 cf
Outflow = 0.02 cfs @ 12.98 hrs, Volume= 528 cf, Atten= 90%, Lag= 53.5 min
Discarded = 0.02 cfs @ 12.98 hrs, Volume= 528 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.85' @ 12.98 hrs Surf.Area= 303 sf Storage= 208 cf

Plug-Flow detention time= 115.7 min calculated for 527 cf (100% of inflow)
Center-of-Mass det. time= 115.6 min (936.2 - 820.6)

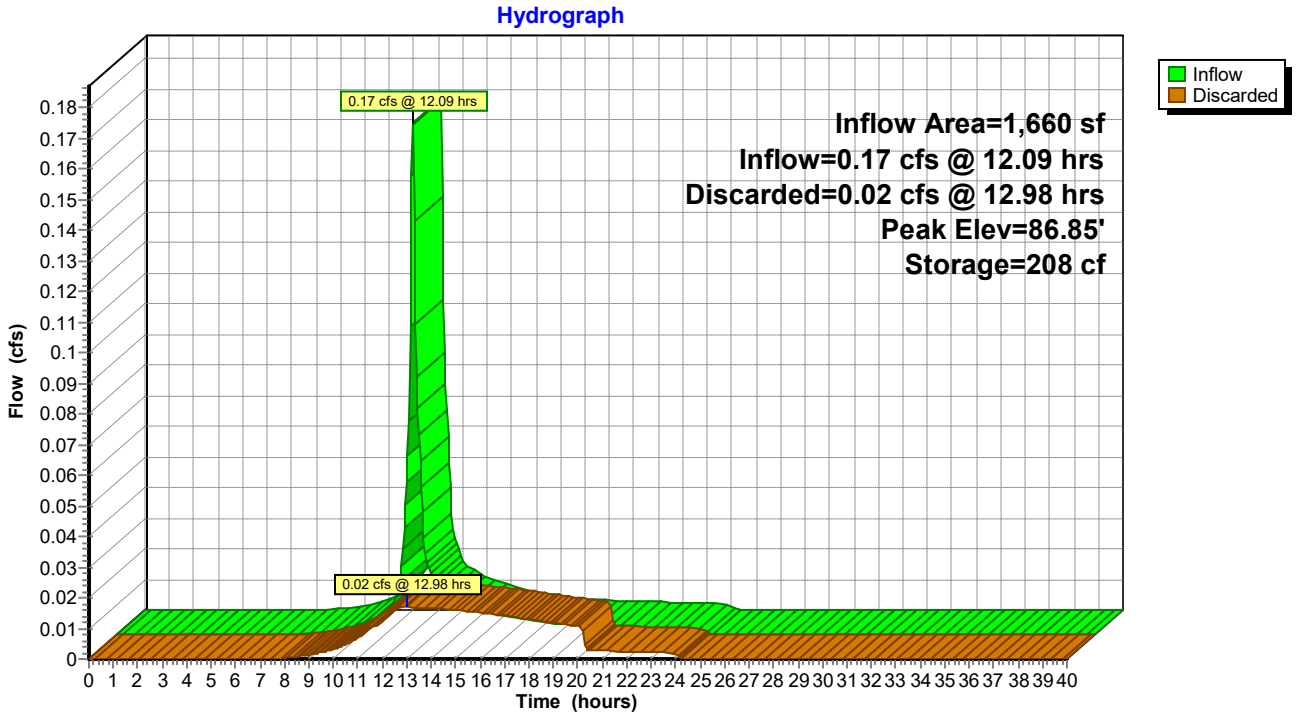
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	256 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
86.00	187	0	0
87.00	324	256	256

Device	Routing	Invert	Outlet Devices
#1	Discarded	86.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 12.98 hrs HW=86.85' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 3P: Depressed Landscape Area



Summary for Pond 4: DMH4

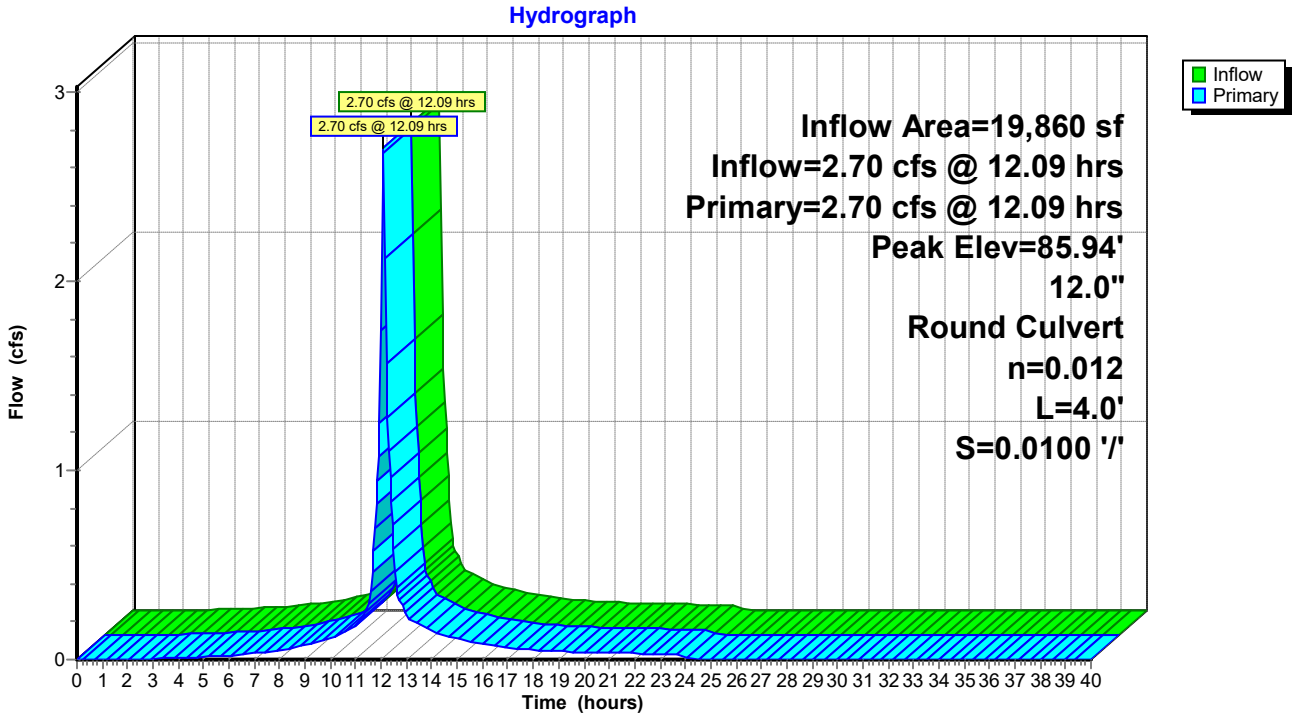
Inflow Area = 19,860 sf, 85.03% Impervious, Inflow Depth = 5.56" for 100 yr event
Inflow = 2.70 cfs @ 12.09 hrs, Volume= 9,204 cf
Outflow = 2.70 cfs @ 12.09 hrs, Volume= 9,204 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.70 cfs @ 12.09 hrs, Volume= 9,204 cf
Routed to Pond 5 : CDS5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.94' @ 12.11 hrs
Flood Elev= 87.36'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.29'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.29' / 84.25' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.28 cfs @ 12.09 hrs HW=85.85' TW=85.48' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.28 cfs @ 2.91 fps)

Pond 4: DMH4



Summary for Pond 4P: Depressed Landscape Area

Inflow Area = 1,635 sf, 41.77% Impervious, Inflow Depth = 3.82" for 100 yr event
Inflow = 0.16 cfs @ 12.09 hrs, Volume= 520 cf
Outflow = 0.02 cfs @ 13.03 hrs, Volume= 520 cf, Atten= 90%, Lag= 56.6 min
Discarded = 0.02 cfs @ 13.03 hrs, Volume= 520 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 86.91' @ 13.03 hrs Surf.Area= 283 sf Storage= 209 cf

Plug-Flow detention time= 126.8 min calculated for 520 cf (100% of inflow)
Center-of-Mass det. time= 126.8 min (947.3 - 820.6)

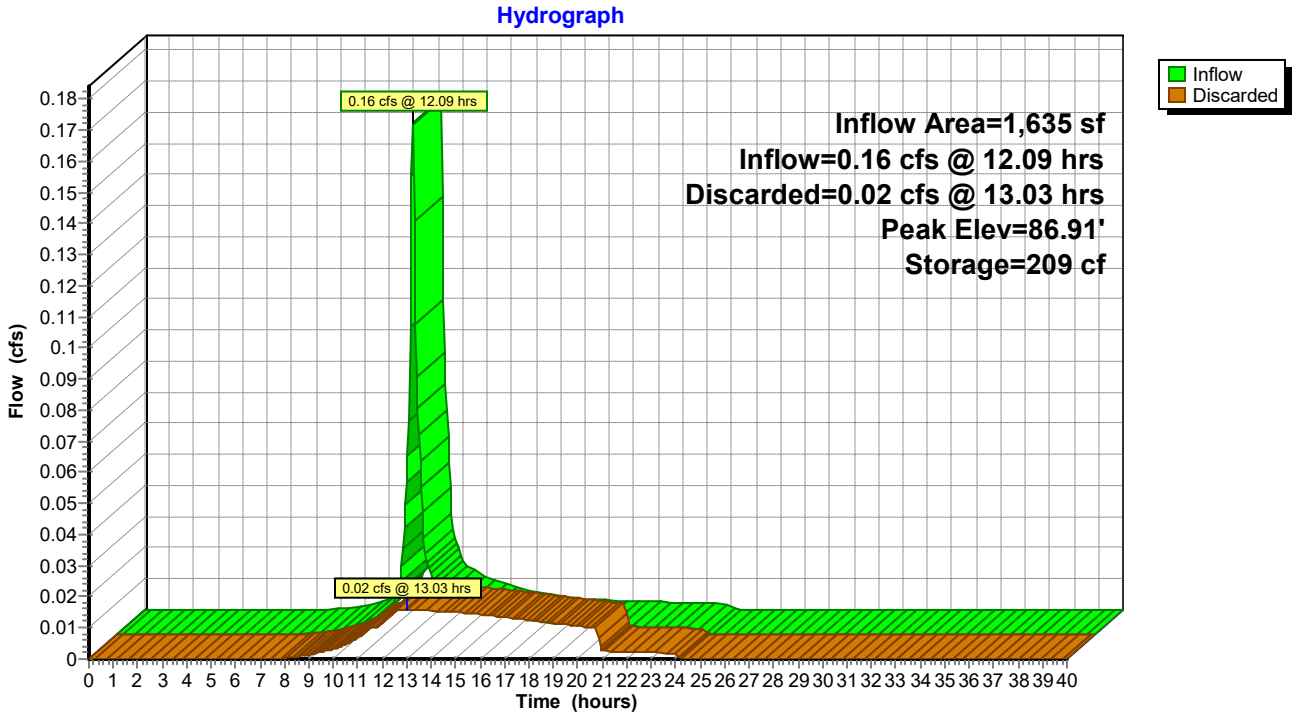
Volume	Invert	Avail.Storage	Storage Description
#1	86.00'	234 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
86.00	175	0	0
87.00	293	234	234

Device	Routing	Invert	Outlet Devices
#1	Discarded	86.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 13.03 hrs HW=86.91' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 4P: Depressed Landscape Area



Summary for Pond 5: CDS5

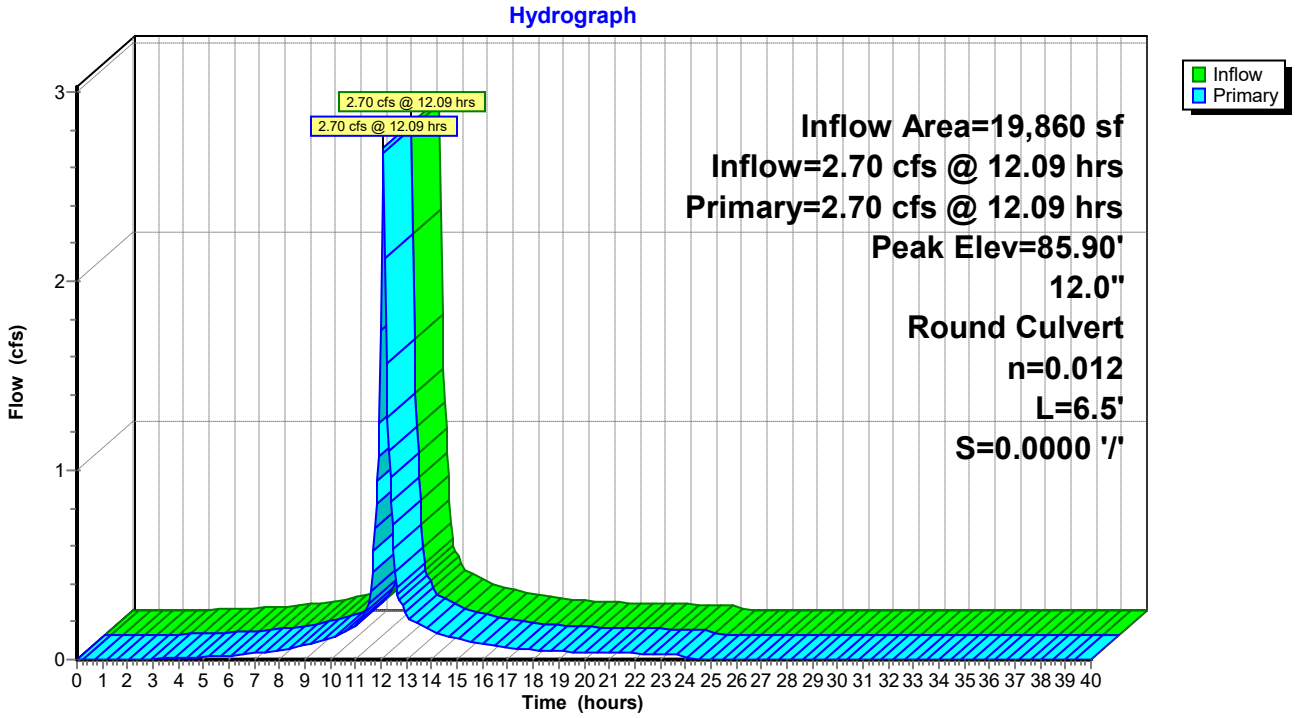
Inflow Area = 19,860 sf, 85.03% Impervious, Inflow Depth = 5.56" for 100 yr event
Inflow = 2.70 cfs @ 12.09 hrs, Volume= 9,204 cf
Outflow = 2.70 cfs @ 12.09 hrs, Volume= 9,204 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.70 cfs @ 12.09 hrs, Volume= 9,204 cf
Routed to Pond 1P : Infiltration Pipe Network

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.90' @ 12.52 hrs
Flood Elev= 87.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.25'	**12.0" Round Culvert** L= 6.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.25' / 84.25' S= 0.0000 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.30 cfs @ 12.09 hrs HW=85.48' TW=85.11' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.30 cfs @ 2.92 fps)

Pond 5: CDS5



Summary for Pond 5P: Depressed Landscape Area

Inflow Area = 1,386 sf, 0.00% Impervious, Inflow Depth = 2.35" for 100 yr event
Inflow = 0.08 cfs @ 12.10 hrs, Volume= 271 cf
Outflow = 0.02 cfs @ 12.53 hrs, Volume= 271 cf, Atten= 75%, Lag= 25.7 min
Discarded = 0.02 cfs @ 12.53 hrs, Volume= 271 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.18' @ 12.53 hrs Surf.Area= 369 sf Storage= 63 cf

Plug-Flow detention time= 19.6 min calculated for 271 cf (100% of inflow)
Center-of-Mass det. time= 19.6 min (875.0 - 855.4)

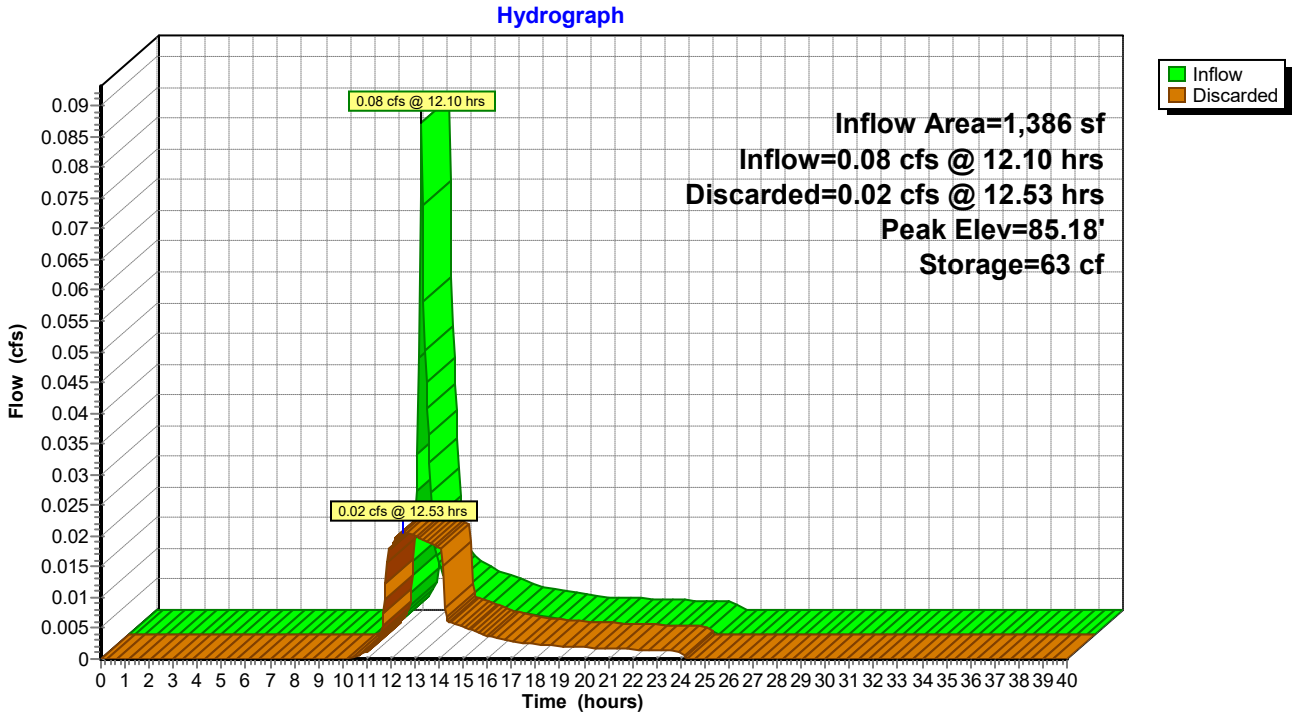
Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	462 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
85.00	316	0	0
86.00	608	462	462

Device	Routing	Invert	Outlet Devices
#1	Discarded	85.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.02 cfs @ 12.53 hrs HW=85.18' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond 5P: Depressed Landscape Area



Summary for Pond 6: TD6

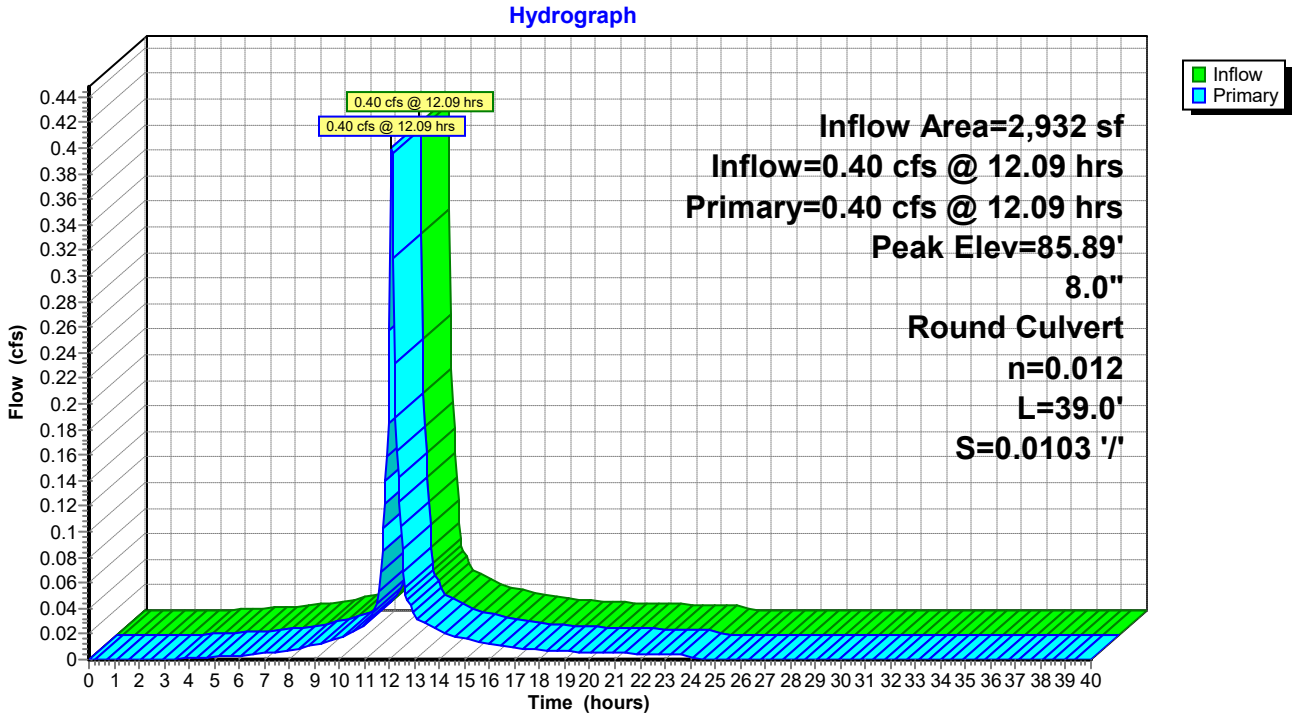
Inflow Area = 2,932 sf, 84.21% Impervious, Inflow Depth = 5.56" for 100 yr event
Inflow = 0.40 cfs @ 12.09 hrs, Volume= 1,359 cf
Outflow = 0.40 cfs @ 12.09 hrs, Volume= 1,359 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.40 cfs @ 12.09 hrs, Volume= 1,359 cf
Routed to Pond 7 : CDS7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.89' @ 12.63 hrs
Flood Elev= 86.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**8.0" Round Culvert** L= 39.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 84.60' S= 0.0103 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.27 cfs @ 12.09 hrs HW=85.41' TW=85.26' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.27 cfs @ 1.69 fps)

Pond 6: TD6



Summary for Pond 7: CDS7

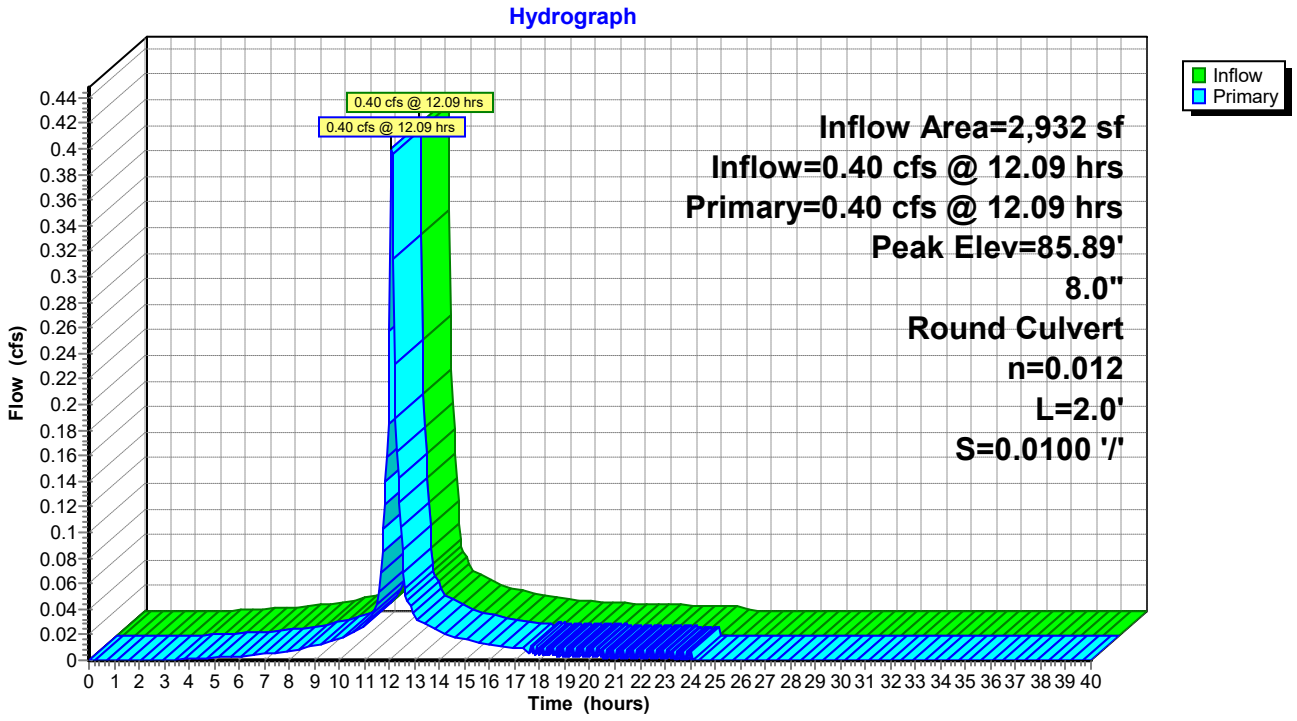
Inflow Area = 2,932 sf, 84.21% Impervious, Inflow Depth = 5.56" for 100 yr event
Inflow = 0.40 cfs @ 12.09 hrs, Volume= 1,359 cf
Outflow = 0.40 cfs @ 12.09 hrs, Volume= 1,360 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.40 cfs @ 12.09 hrs, Volume= 1,360 cf
Routed to Pond 8 : DMH8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.89' @ 12.58 hrs
Flood Elev= 90.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.60'	**8.0" Round Culvert** L= 2.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.60' / 84.58' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=85.26' TW=85.29' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Pond 7: CDS7



Summary for Pond 8: DMH8

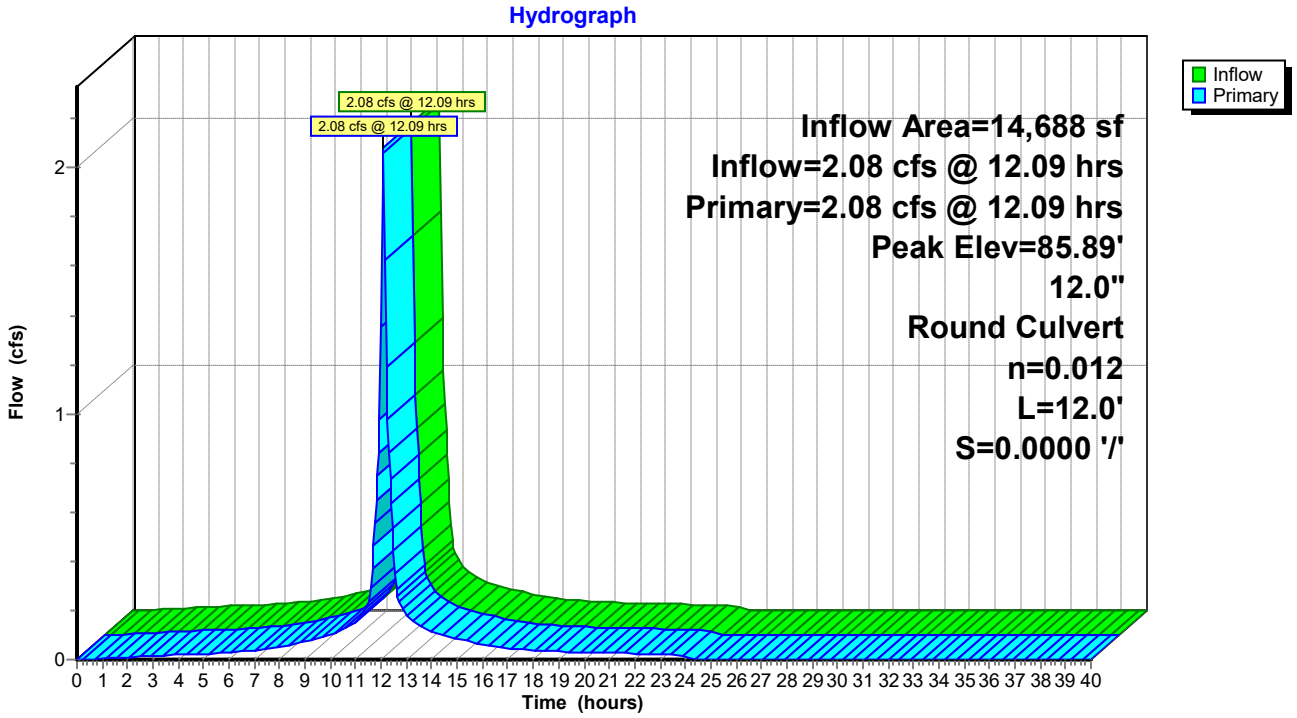
Inflow Area = 14,688 sf, 96.85% Impervious, Inflow Depth = 6.12" for 100 yr event
Inflow = 2.08 cfs @ 12.09 hrs, Volume= 7,494 cf
Outflow = 2.08 cfs @ 12.09 hrs, Volume= 7,494 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.08 cfs @ 12.09 hrs, Volume= 7,494 cf
Routed to Pond 1P : Infiltration Pipe Network

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 85.89' @ 12.54 hrs
Flood Elev= 90.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	84.25'	**12.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 84.25' / 84.25' S= 0.0000 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.59 cfs @ 12.09 hrs HW=85.29' TW=85.11' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.59 cfs @ 2.03 fps)

Pond 8: DMH8

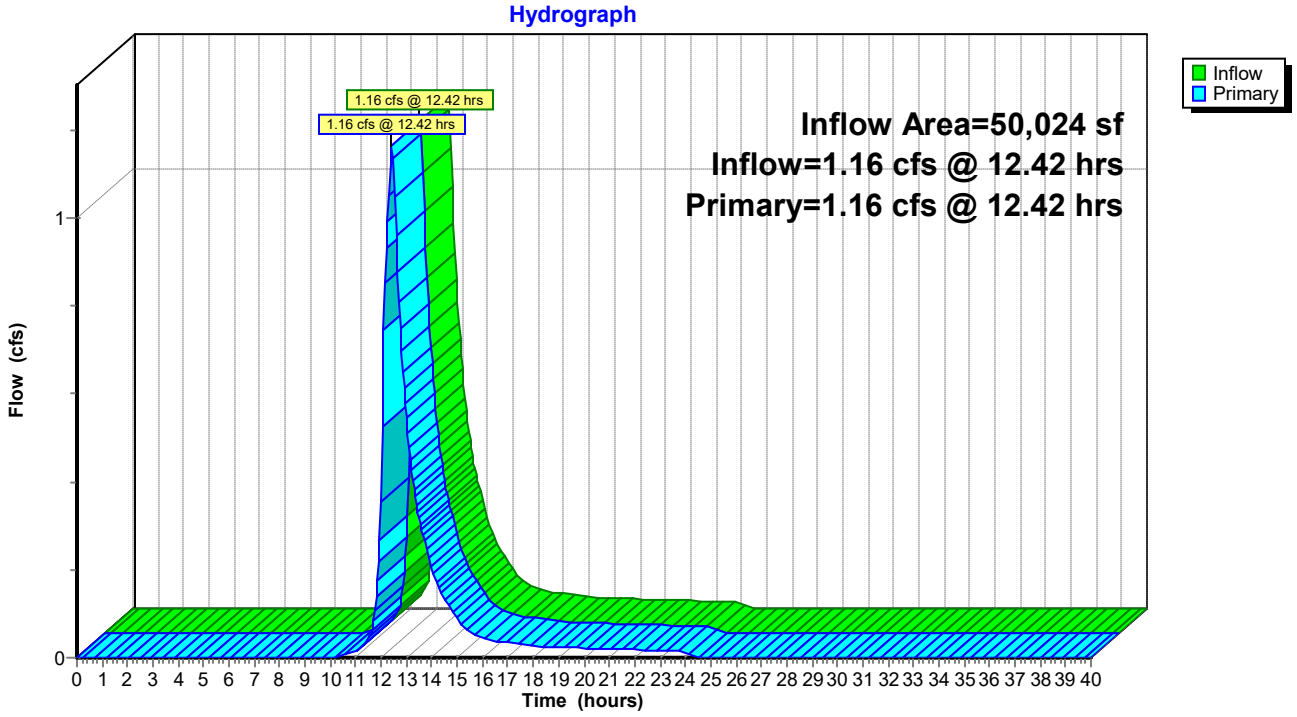


Summary for Link 1L: B Series Wetland

Inflow Area = 50,024 sf, 66.69% Impervious, Inflow Depth = 1.44" for 100 yr event
Inflow = 1.16 cfs @ 12.42 hrs, Volume= 5,991 cf
Primary = 1.16 cfs @ 12.42 hrs, Volume= 5,991 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 9L

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: B Series Wetland

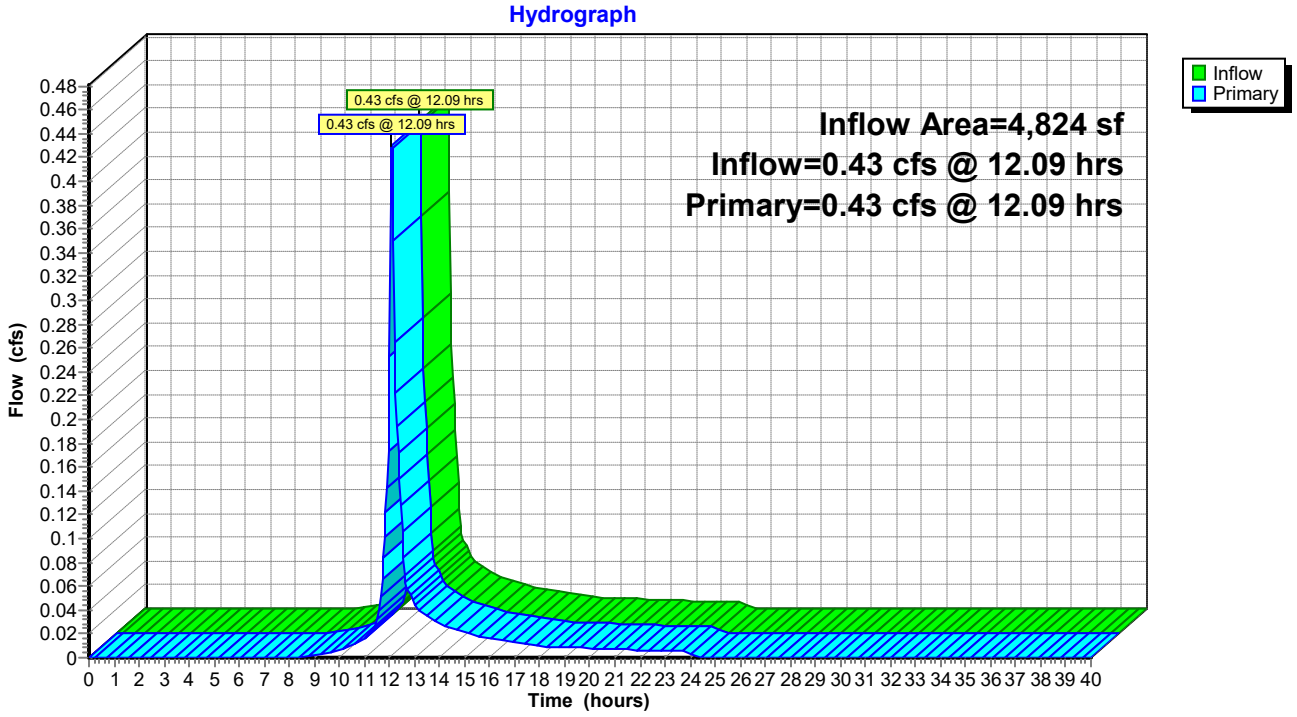


Summary for Link 2L: North Ave

Inflow Area = 4,824 sf, 28.25% Impervious, Inflow Depth = 3.38" for 100 yr event
Inflow = 0.43 cfs @ 12.09 hrs, Volume= 1,357 cf
Primary = 0.43 cfs @ 12.09 hrs, Volume= 1,357 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 9L

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: North Ave



Events for Subcatchment 1S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.95	3,099	2.35
10 yr	4.50	1.46	4,890	3.71
25 yr	5.60	1.86	6,315	4.79
50 yr	6.20	2.07	7,096	5.38
100 yr	**6.50**	**2.18**	**7,487**	**5.68**

Events for Subcatchment 2S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.20	641	1.91
10 yr	4.50	0.33	1,074	3.20
25 yr	5.60	0.44	1,426	4.24
50 yr	6.20	0.49	1,619	4.82
100 yr	**6.50**	**0.52**	**1,717**	**5.11**

Events for Subcatchment 3S: Roof

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.79	2,810	2.87
10 yr	4.50	1.16	4,177	4.26
25 yr	5.60	1.45	5,253	5.36
50 yr	6.20	1.60	5,840	5.96
100 yr	**6.50**	**1.68**	**6,134**	**6.26**

Events for Subcatchment 4S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.10	566	0.44
10 yr	4.50	0.36	1,470	1.14
25 yr	5.60	0.61	2,349	1.82
50 yr	6.20	0.77	2,874	2.23
100 yr	**6.50**	**0.84**	**3,146**	**2.44**

Events for Subcatchment 5S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.08	292	0.82
10 yr	4.50	0.19	623	1.75
25 yr	5.60	0.29	920	2.58
50 yr	6.20	0.35	1,092	3.06
100 yr	**6.50**	**0.37**	**1,180**	**3.31**

Events for Subcatchment 6S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.05	148	1.08
10 yr	4.50	0.09	290	2.13
25 yr	5.60	0.13	414	3.04
50 yr	6.20	0.15	484	3.55
100 yr	**6.50**	**0.16**	**520**	**3.82**

Events for Subcatchment 7S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.05	150	1.08
10 yr	4.50	0.09	295	2.13
25 yr	5.60	0.13	420	3.04
50 yr	6.20	0.16	492	3.55
100 yr	**6.50**	**0.17**	**528**	**3.82**

Events for Subcatchment 8S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.17	551	2.26
10 yr	4.50	0.27	880	3.60
25 yr	5.60	0.34	1,143	4.68
50 yr	6.20	0.38	1,287	5.27
100 yr	**6.50**	**0.40**	**1,359**	**5.56**

Events for Subcatchment 9S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.02	52	1.14
10 yr	4.50	0.03	100	2.21
25 yr	5.60	0.04	142	3.13
50 yr	6.20	0.05	165	3.65
100 yr	**6.50**	**0.06**	**177**	**3.92**

Events for Subcatchment 10S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.01	70	0.40
10 yr	4.50	0.05	188	1.08
25 yr	5.60	0.09	303	1.74
50 yr	6.20	0.11	372	2.14
100 yr	**6.50**	**0.13**	**408**	**2.35**

Events for Subcatchment 11S:

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2 yr	3.10	0.01	47	0.40
10 yr	4.50	0.03	125	1.08
25 yr	5.60	0.06	201	1.74
50 yr	6.20	0.08	247	2.14
100 yr	**6.50**	**0.08**	**271**	**2.35**

Events for Pond 1: CB1

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	0.20	0.20	86.17	**0**
10 yr	0.33	0.33	86.24	0
25 yr	0.44	0.44	86.28	0
50 yr	0.49	0.49	86.31	0
100 yr	**0.52**	**0.52**	**86.32**	0

Events for Pond 1P: Infiltration Pipe Network

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	2.11	0.25	**0.25**	0.00	84.74	2,310
10 yr	3.22	0.25	0.25	0.00	85.30	4,228
25 yr	4.08	0.55	0.25	0.30	85.64	5,341
50 yr	4.55	0.86	0.25	0.61	85.80	5,823
100 yr	**4.78**	**1.03**	0.25	**0.78**	**85.88**	**6,038**

Events for Pond 2: DMH2

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	0.20	0.20	85.10	**0**
10 yr	0.33	0.33	85.38	0
25 yr	0.44	0.44	85.67	0
50 yr	0.49	0.49	85.85	0
100 yr	**0.52**	**0.52**	**85.95**	0

Events for Pond 2P: Depressed Landscape Area

Event	Inflow (cfs)	Discarded (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	0.01	0.01	85.04	9
10 yr	0.05	0.01	85.25	61
25 yr	0.09	0.01	85.46	125
50 yr	0.11	0.01	85.57	165
100 yr	**0.13**	**0.01**	**85.63**	**186**

Events for Pond 3: DGCB3

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	0.95	0.95	85.13	**0**
10 yr	1.46	1.46	85.46	0
25 yr	1.86	1.86	85.80	0
50 yr	2.07	2.07	86.02	0
100 yr	**2.18**	**2.18**	**86.13**	0

Events for Pond 3P: Depressed Landscape Area

Event	Inflow (cfs)	Discarded (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	0.05	0.01	86.17	33
10 yr	0.09	0.01	86.44	96
25 yr	0.13	0.02	86.67	155
50 yr	0.16	0.02	86.79	190
100 yr	**0.17**	**0.02**	**86.85**	**208**

Events for Pond 4: DMH4

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	1.15	1.15	85.09	**0**
10 yr	1.79	1.79	85.37	0
25 yr	2.30	2.30	85.67	0
50 yr	2.57	2.57	85.85	0
100 yr	**2.70**	**2.70**	**85.94**	0

Events for Pond 4P: Depressed Landscape Area

Event	Inflow (cfs)	Discarded (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	0.05	0.01	86.18	34
10 yr	0.09	0.01	86.48	97
25 yr	0.13	0.01	86.72	156
50 yr	0.15	0.02	86.85	191
100 yr	**0.16**	**0.02**	**86.91**	**209**

Events for Pond 5: CDS5

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	1.15	1.15	84.97	**0**
10 yr	1.79	1.79	85.30	0
25 yr	2.30	2.30	85.65	0
50 yr	2.57	2.57	85.81	0
100 yr	**2.70**	**2.70**	**85.90**	0

Events for Pond 5P: Depressed Landscape Area

Event	Inflow (cfs)	Discarded (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	0.01	0.01	85.00	1
10 yr	0.03	0.02	85.04	11
25 yr	0.06	0.02	85.11	36
50 yr	0.08	0.02	85.16	53
100 yr	**0.08**	**0.02**	**85.18**	**63**

Events for Pond 6: TD6

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	0.17	0.17	85.24	**0**
10 yr	0.27	0.27	85.32	0
25 yr	0.34	0.34	85.65	0
50 yr	0.38	0.38	85.81	0
100 yr	**0.40**	**0.40**	**85.89**	0

Events for Pond 7: CDS7

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	0.17	0.17	84.95	**0**
10 yr	0.27	0.27	85.30	0
25 yr	0.34	0.34	85.65	0
50 yr	0.38	0.38	85.81	0
100 yr	**0.40**	**0.40**	**85.89**	0

Events for Pond 8: DMH8

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2 yr	0.96	0.96	84.92	**0**
10 yr	1.42	1.42	85.30	0
25 yr	1.79	1.79	85.64	0
50 yr	1.98	1.98	85.80	0
100 yr	**2.08**	**2.08**	**85.89**	0

Events for Link 1L: B Series Wetland

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2 yr	0.10	0.10	**0.00**
10 yr	0.36	0.36	0.00
25 yr	0.61	0.61	0.00
50 yr	0.93	0.93	0.00
100 yr	**1.16**	**1.16**	0.00

Events for Link 2L: North Ave

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2 yr	0.10	0.10	**0.00**
10 yr	0.22	0.22	0.00
25 yr	0.33	0.33	0.00
50 yr	0.40	0.40	0.00
100 yr	**0.43**	**0.43**	0.00

2 | Stormwater Report Compliance Calculations

2.1 Standard 1 | No Untreated Discharges Or Erosion To Wetlands

Untreated Discharges
To document compliance that new discharges are adequately treated refer to calculations for Standards 4 through 6.

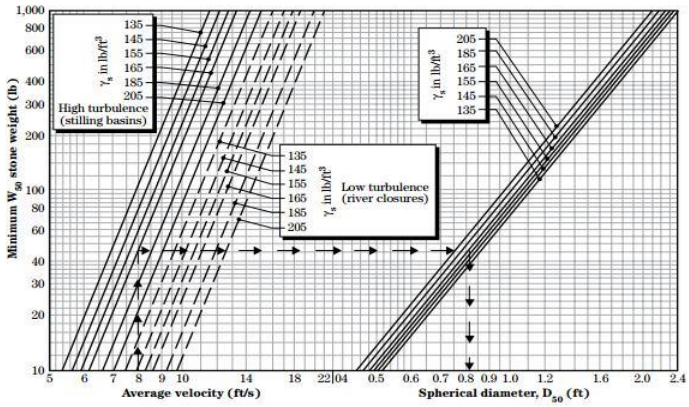
Erosion To Wetlands
Flow exiting the stormwater management area discharges to a level spreader/rip rap apron. For minimum stone size based on a maximum of Q_{100} = 0.78 cfs, V_{max}= 2.53 ft/s, see the following graphical solution to the Isbash Curve.

Given the velocity of 2.53 ft/s a D_{50} of 6 inches is recommended for a γ_s of 165 lb/ft^3.

Technical Supplement 14C | **Stone Sizing Criteria** | **Part 654 National Engineering Handbook**

Figure TS14C–6 Graphical solution for Isbash technique

(a)



Basic equations :

$$V_c = C\left[2g\left(\frac{\gamma_s - \gamma_w}{\gamma_w}\right)\right]^{\frac{1}{2}} (D_{50})^{\frac{1}{2}}$$

$$D_{50} = \left(\frac{8W_{50}}{\pi\gamma_s}\right)^{\frac{1}{3}}$$

where:
- V = Velocity, ft/s
- γ_s = Specific stone weight, lb/ft^3
- γ_w = Specific weight of water, 62.5 lb/ft^3
- W_{50} = Weight of stone, subscript denotes Percent of total weight of material containing stone of less weight
- D_{50} = Spherical diameter of stone having the same weight as W_{50}
- C = Isbash constant (0.86 for high turbulence level flow and 1.20 for low turbulence level flow)
- g = Acceleration of gravity, ft/s^2

Stone stability velocity vs. stone diameter
Hydraulic design chart 712–1 (Sheet 1 of 2)

TS14C–4 (210–VI–NEH, August 2007)

2.2 Standard 2 | Peak Rate Attenuation

Refer to Peak Rate of Runoff tables below (see Mitigative Drainage Analysis)

Table 2.0: Peak Rate of Runoff | Comparison Location 1L

Description	2 Year	10 Year	25 Year	50 Year	100 Year
Existing Peak Rate of Runoff (cfs)	0.10	0.56	1.08	1.41	1.58
Proposed Peak Rate of Runoff (cfs)	0.10	0.36	0.61	0.93	1.16
Difference	**0.00**	**-0.20**	**-0.47**	**-0.48**	**-0.42**

Table 2.1: Peak Rate of Runoff | Comparison Location 2L

Description	2 Year	10 Year	25 Year	50 Year	100 Year
Existing Peak Rate of Runoff (cfs)	0.00	0.00	0.00	0.00	0.00
Proposed Peak Rate of Runoff (cfs)	0.10	0.22	0.33	0.40	0.43
Difference	**0.10**	**0.22**	**0.33**	**0.40**	**0.43**

Table 2.2: Stormwater Management Area 1P | Infiltration Pipe Network Performance Table

24 Hour Type III Storm event	Peak Rate of Inflow (cfs)	Peak Rates of Outflow (cfs)				Peak Water Level (ft)
		Total (cfs)	Exfiltration (cfs)	8″ Culvert (cfs)		
2 year	2.11	0.25	0.25	0.00		84.74
10 year	3.22	0.25	0.25	0.00		85.30
25 year	4.08	0.55	0.25	0.30		85.64
50 year	4.55	0.86	0.25	0.61		85.80
100 year	4.78	1.03	0.25	0.78		85.88

2.3 Standard 3 | Stormwater Recharge

Recharge Volume:

$R_{v\ required}$ = (Impervious Area)(F)

Site is analyzed using Hydrologic Soil Group B: F_B = 0.35 in.

***Site Impervious Area Draining to Recharge Facilities*:**

Stormwater Management Area 1P

$A_{imp\ B\ soils}$ = 31112 ft²

$R_{v\ required}$ = [(31112)(0.35)/12] = 907 ft³

$R_{v\ provided}$ = 4321 ft³ (volume below 8″ outlet)

Capture Area Adjustment
Total impervious area: 36089 ft^2
Site impervious areas draining to recharge facilities: 31112 ft^2
Ratio of total impervious area to site impervious areas draining to recharge facilities:
(36089/31112) = 1.16

Total Recharge Volume Required
$A_{imp\ total}$ = 36089 ft^2
$R_{v\ required}$ = [(36086)(0.35)/12] = 1053 ft^3
Adjusted minimum required recharge volume = (1053)(1.16) = 1221 ft^3

Total Recharge Volume Provided
$R_{v\ provided}$ = 4321 ft^3

Capture Area Percentage:
Site impervious areas draining to recharge facilities: 31112 ft^2
Total impervious area: 36089 ft^2
Percent Captured: (31112/36089) = 86.2% > 65%

Drawdown Within 72 Hours:
$T_{drawdown}$ = [$R_{v\ total}$ / (K)(Bottom Area)]

Stormwater Management Area 1P
$R_{v\ 1P}$ = 6038 ft^3 (100 year storage volume)
K = 2.41 in/hr (Rawls Rate)
Bottom Area = 4503 ft^2 (see Mitigative Drainage Analysis)
$T_{drawdown}$ = 6038 / [(2.41)(4503)/12] = 7 hours < 72 hours

2.4 Standard 4 | Water Quality

Water Quality:
Water quality is provided through the following stormwater best management practices.

1) CDS 1515-3-C Proprietary Particle Separator
2) Subsurface Infiltration Pipe Network

Water Quality Volume:
$V_{wq\ required}$ = (A_{imp}) (D_{wq})

Stormwater Management Area 1P
$V_{wq\ required}$ = [(31112)(1.0)/12] = 2593 ft^3 (includes roof)
$V_{wq\ provided}$ = 4321 ft^3 (volume below 8" outlet)

Water quality is provided from a Contech CDS Model 1515-3 proprietary particle separator. Given the performance of this device is based on a flow rate metric and not volume, a conversion from volume to flow rate is necessary. The methodology given below is taken from the MassDEP "Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices".

CDS5 (CDS1515) at Stormwater Management Area 1P:

$Q_{required} = (q_u)(A)(WQV)$

$Q_{required} = (774\ csm/in.)(0.39\ ac.)(0.0015625\ mi^2/ac.)(1\ in.) = 0.47\ ft^3/s$ (excludes roof)

$Q_{provided} = 1.0\ ft^3/s$ (see page 15)

TSS Removal:

Pretreatment Chain 1 SWMA1P = 85%

- CDS1515-3 = 85%

Treatment Chain 1 SWMA1P = 80%

- Subsurface Infiltration Pipe Network = 80%

TSS Removal Calculation Worksheet

Location: Pretreatment Chain 1 SWMA1P

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Proprietary Treatment Practice	0.85	1.00	0.85	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: WAKE-0070
Prepared By: MEM
Date: 12/2/2020

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

TSS Removal Calculation Worksheet

Location: Treatment Chain 1 SWMA1P

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Subsurface Infiltration Structure	0.80	1.00	0.80	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

Total TSS Removal = 80%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: WAKE-0070
Prepared By: MEM
Date: 12/2/2020

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

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

NORTH AVE
WAKEFIELD, MA

Area	0.42 ac	Unit Site Designation	CDS4
Weighted C	0.9	Rainfall Station #	69
t_c	6 min		
CDS Model	1515-3	CDS Treatment Capacity	1.0 cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	10.2%	10.2%	0.01	0.01	9.8
0.04	9.6%	19.8%	0.02	0.02	9.3
0.06	9.4%	29.3%	0.02	0.02	9.0
0.08	7.7%	37.0%	0.03	0.03	7.4
0.10	8.6%	45.6%	0.04	0.04	8.1
0.12	6.3%	51.9%	0.05	0.05	5.9
0.14	4.7%	56.5%	0.05	0.05	4.4
0.16	4.6%	61.2%	0.06	0.06	4.3
0.18	3.5%	64.7%	0.07	0.07	3.3
0.20	4.3%	69.1%	0.08	0.08	4.0
0.25	8.0%	77.1%	0.09	0.09	7.3
0.30	5.6%	82.7%	0.11	0.11	5.0
0.35	4.4%	87.0%	0.13	0.13	3.9
0.40	2.5%	89.5%	0.15	0.15	2.2
0.45	2.5%	92.1%	0.17	0.17	2.2
0.50	1.4%	93.5%	0.19	0.19	1.2
0.75	5.0%	98.5%	0.28	0.28	3.9
1.00	1.0%	99.5%	0.38	0.38	0.7
1.50	0.0%	99.5%	0.57	0.57	0.0
2.00	0.0%	99.5%	0.76	0.76	0.0
3.00	0.5%	100.0%	1.13	1.00	0.1
					91.9
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**85.5%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS7 (CDS1515) at Stormwater Management Area 1P:

$Q_{required} = (q_u)(A)(WQV)$

$Q_{required}$ = (774 csm/in.)(0.067 ac.)(0.0015625 mi^2/ac.)(1 in.) = 0.08 ft^3/s (excludes roof)

$Q_{provided}$ = 1.0 ft^3/s (see page 18)

TSS Removal:

Pretreatment Chain 2 SWMA1P = 85%

- CDS1515-3 = 85%

Treatment Chain 2 SWMA1P = 80%

- Subsurface Infiltration Pipe Network = 80%

TSS Removal Calculation Worksheet

Location: Pretreatment Chain 2 SWMA1P

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Proprietary Treatment Practice	0.85	1.00	0.85	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: WAKE-0070
Prepared By: MEM
Date: 10/24/2022

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

TSS Removal Calculation Worksheet

Location: Treatment Chain 2 SWMA1P

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Subsurface Infiltration Structure	0.80	1.00	0.80	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

Total TSS Removal = 80%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: WAKE-0070
Prepared By: MEM
Date: 10/24/2022

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

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

NORTH AVE
WAKEFIELD, MA

Area	0.42 ac	Unit Site Designation	CDS4
Weighted C	0.9	Rainfall Station #	69
t_c	6 min		
CDS Model	1515-3	CDS Treatment Capacity	1.0 cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	10.2%	10.2%	0.01	0.01	9.8
0.04	9.6%	19.8%	0.02	0.02	9.3
0.06	9.4%	29.3%	0.02	0.02	9.0
0.08	7.7%	37.0%	0.03	0.03	7.4
0.10	8.6%	45.6%	0.04	0.04	8.1
0.12	6.3%	51.9%	0.05	0.05	5.9
0.14	4.7%	56.5%	0.05	0.05	4.4
0.16	4.6%	61.2%	0.06	0.06	4.3
0.18	3.5%	64.7%	0.07	0.07	3.3
0.20	4.3%	69.1%	0.08	0.08	4.0
0.25	8.0%	77.1%	0.09	0.09	7.3
0.30	5.6%	82.7%	0.11	0.11	5.0
0.35	4.4%	87.0%	0.13	0.13	3.9
0.40	2.5%	89.5%	0.15	0.15	2.2
0.45	2.5%	92.1%	0.17	0.17	2.2
0.50	1.4%	93.5%	0.19	0.19	1.2
0.75	5.0%	98.5%	0.28	0.28	3.9
1.00	1.0%	99.5%	0.38	0.38	0.7
1.50	0.0%	99.5%	0.57	0.57	0.0
2.00	0.0%	99.5%	0.76	0.76	0.0
3.00	0.5%	100.0%	1.13	1.00	0.1
					91.9
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**85.5%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Phosphorus Load Reduction:

The Phosphorous Load Reduction calculation is limited to watersheds tributary to stormwater management areas.

Stormwater Management Area 1P			
IA - Impervious Area Characteristics			
Subcatchment	Land Use	Area ft²	HSG
1S	HDR	13897	B
2S	HDR	2990	B
3S	HDR	11756	B
8S	HDR	2469	B
Total		31112	

Stormwater Management Area 1P			
PA - Pervious Area Characteristics			
Subcatchment	Land Use	Area ft²	HSG
1S	HDR	1930	B
2S	HDR	1043	B
3S	HDR	0	B
8S	HDR	463	B
Total		3436	

BMP Volume = 7250 ft^3 (total volume of chamber/stone system)
BMP $Volume_{(IA\text{-}in)1}$ = [(7250 ft^3)(12 in/ft)]/(31112 ft^2) = 2.80 in
Interpolated runoff depth for B Soils = 0.22 in
BMP $Volume_{(PA\text{-}ft^3)1}$ = [(3436 ft^2)(0.22 in)]/(12 in/ft) = 63 ft^3
BMP $Volume_{(IA\text{-}ft^3)1}$ = (7250 ft^3 - 63 ft^3) = 7187 ft^3
BMP $Volume_{(IA\text{-}in)2}$ = [(7187 ft^3)(12 in/ft)]/(31112 ft^2) = 2.77 in
% Difference = [(2.80 in – 2.77 in)/(2.80 in + 2.77 in)/2)] = 1.1% ∴ OK
BMP $Reduction_{(\%\text{-}P)}$ = 100% (from Table 3-10, Appendix F of the MA MS4 General Permit)
BMP Load = [(31112 ft^2)/(43560 ft^2/acre)](2.32 lbs/acre/year) +
[(3436 ft^2)/(43560 ft^2/acre)](0.12 lbs/acre/year) = 1.67 lbs/year
BMP $Reduction_{(lbs\text{-}P)}$ = (1.67 lbs/year)(1.0) = 1.67 lbs/year

2.5 Standard 5 | Land Uses With Higher Potential Pollutant Loading

This project is not considered a LUHPPL.

2.6 Standard 6 | Critical Areas

Stormwater discharge from this property is not within a Zone II, Interim Wellhead Protection Area of a public water supply or a critical area. A portion of the property lies within a Zone A with stormwater discharge outside of Zone A.

2.7 Standard 7 | Redevelopment

This project is not considered a redevelopment.

2.8 Standard 8 | Construction Period Controls

Refer to Section 6 Construction Period Pollution Prevention Plan and Erosion and Sediment Control.

2.9 Standard 9 | Long Term Operation And Maintenance Plan

Refer to Section 4 Long Term Operation and Maintenance Plan.

2.10 Standard 10 |Illicit Discharges To Drainage System

There are no proposed illicit discharges into the Stormwater Management Systems to be constructed as shown on the site/definitive plan.

3 | MassDEP Stormwater Checklist

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

Checklist for Stormwater Report

A. Introduction

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.

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.

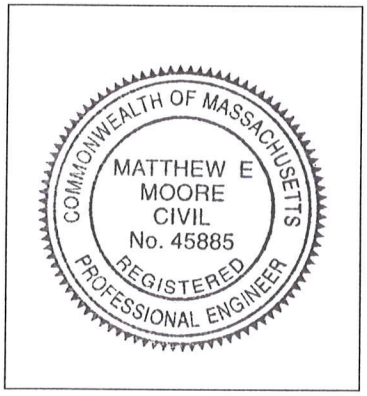
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



10.24.2022

Signature and Date

Checklist

3.1 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

3.2 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): _____

3.3 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.

3.4 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.

3.5 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.

☒ 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.

3.6 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.

☒ 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.

3.7 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.

3.8 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.

3.9 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.

3.10 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.

☐ 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.

3.11 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; (See site plan set)

☐ 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.

3.12 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; (See section 1.7 of the Mitigative Drainage Analysis)

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

4 | Long Term Operation & Maintenance Plan

This Operation & Maintenance Plan is prepared to comply with provisions set forth in the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards.

Structural Best Management Practices (BMPs) require periodic maintenance to ensure proper function and efficiency in pollutant removal from stormwater discharges that would otherwise reach wetland resource areas untreated. Maintenance schedules found below are as recommended in MassDEP's Massachusetts Stormwater Handbook and as recommended in the manufacturer's specifications.

The stormwater management system owner and the party responsible for maintenance of the stormwater management system shall be Raymond Nickerson and Dana Lopez and their designated employees.

4.1 The following BMPs provide pollutant removal and groundwater recharge

1. Deep Sump Catch Basin with Hood/Trap
2. CDS 1515-3 Proprietary Particle Separator
3. Subsurface Infiltration Pipe Network

Deep-Sump Catch Basin with Hood/Trap
Inspect and/or clean at least four times per year with special consideration given to the end of foliage and snow removal seasons.

Sediments must also be removed once per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the sump or one half the depth of the invert of the outlet pipe.

Clamshell buckets and/or vacuum trucks are typically used to remove sediment in Massachusetts.

Cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste without any prior approval by MassDEP. However, some landfills require catch basin cleanings to be tested before they are accepted. For information on all of the MassDEP requirements pertaining to the disposal of catch basin cleanings go to
http://www.mass.gov/eea/agencies/massdep/recycle/regulations/management-of-catch-basin-cleanings.html

Contech CDS 1515-3 Particle Separator
Inspect and/or clean at least four times per year with special consideration given to the end of foliage and snow removal seasons.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. When the distance from the water surface to the top of the sediment pile reached less than 3 feet the system should be cleaned. The CDS system shall be cleaned a minimum of twice per year. One cleaning shall occur prior to April 15th and one prior to September 15th of each year. Cleaning a CDS systems should be done during dry weather conditions when no flow is entering the system. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

Clamshell buckets and/or vacuum trucks are typically used to remove sediment in Massachusetts.

Subsurface Infiltration Pipe Network
CMP detention systems should be cleaned when an inspection reveals accumulated sediment or trash is clogging the discharge orifice.

Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

Systems are to be rinsed, including above the spring line, annually soon after the spring thaw, and after any additional use of salting agents, as part of the maintenance program for all systems where salting agents may accumulate inside the pipe.
Maintaining an underground detention or infiltration system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

Depressed Landscape Area
Inspections and preventative maintenance shall be performed at least twice a year. Inspect area after every major storm for the first few months to ensure that it is stabilized and functioning properly. Take corrective action if necessary.

Note the time that water remains standing in the basin after a storm event. Standing water within the basin 48 to 72 hours after a storm indicates that the infiltration capacity of the basin may have been overestimated or the bottom has been clogged.

If the reason is clogging, determine the cause, e.g. erosion, excessive compaction, or low spots and take the necessary corrective action. Thereafter, inspect the infiltration basin at least twice per year.

Important items to check during the inspections include:

1. Signs of differential settlement,
2. Cracking,
3. Erosion,
4. Leakage in the embankments,
5. Tree growth on the embankments,
6. Sediment accumulation and,
7. Health of the turf.

At least twice a year the buffer area, side slopes, and basin bottom shall be mowed. Remove the grass clippings and accumulated organic matter to prevent an impervious organic mat from forming. Remove trash and debris at this time as well as using deep tilling to break up any clogged surfaces, revegetate immediately.

Remove sediment from the basin as necessary only when the floor of the basin is completely dry. Use light equipment to remove the top layer to prevent compacting the underlying soil. Deep till the remaining soil and revegetate as soon as possible.

4.2 The following BMPs are utilized to minimize impacts to wetland resource areas

1. Driveway/Parking Lot Sweeping
2. Snow Removal
3. Rip Rap Level Spreader/Emergency Spillway

Driveway/Parking Lot Sweeping
Driveway and parking lot sweeping will be conducted four times annually. Special attention will be given to the spring (March or April) and late fall (November or December).

Snow Removal
Snow will be removed from parking areas and sidewalks during snow events. Snow will be stockpiled in the designated "Snow Storage" locations shown on the site/definitive plan. Snow disposal/removal shall be in compliance with MassDEP's Bureau of Water Resources guidelines, effective December 21, 2015. See Section 8 Snow Disposal Guidelines. Provisions will be made to remove snow from the site when the designated areas have reached their capacity.

Rip Rap Level Spreader/Emergency Spillway
The level spreader will be inspected during and after several storms (e.g. 0.5-inch or greater) and maintenance performed if necessary during the first year of operation. Thereafter, inspections and preventative maintenance shall be performed at least twice a year, and after every time drainage discharges through the high outlet orifice or a major storm event which is defined as a storm that is equal to or greater than the 2-year, 24-hour storm (3.1 inches in a 24 hour storm).

Any detrimental sediment accumulation shall be removed.

If rilling is present downgradient or adjacent to the emergency spillway or level spreader the cause shall be identified and corrected and damage shall be repaired.

Leaf litter shall be removed from the emergency spillway or level spreader area.
Vegetation in the vicinity of the emergency spillway and level spreader shall be inspected periodically and if needed, fertilized to maintain healthy, dense growth.

4.3 Permanent Seeding

Permanent Seeding & Plantings
Once final grades have been established and the weather permits, every effort shall be made to establish permanent vegetation on disturbed and exposed areas no later than September of that year, otherwise temporary seeding practices shall be used until permanent seeding practices can resume the following spring, April 1st through May 31st.

In addition to grass seed, tree and shrub plantings shall be an integral part of the permanent stabilization plan. Care shall be taken by the owner, builder, and/or site contractor to select trees, shrubs, and seed mixes that are best suited to the soil conditions on the site. Soil moisture, depth to seasonal groundwater, and exposure to sunlight shall be carefully considered when selecting species. In recent years, the emphasis on using plant species native to Massachusetts has grown. Information on the use of non-native and native species can be found on the web and in many local nursery catalogs.

Permanent seeding shall be performed in accordance with the guidelines set forth in the "Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, May 2003, prepared by Franklin, Hampden, and Hampshire Conservation Districts."

Inspection and Maintenance Form

Refer to Section 4.1 above for frequency of inspection (annual submittals to the Wakefield Engineering Division Office are required)

Inspector: Date:

Inspector Title:

Days since last rainfall: Amount of last rainfall:

Structural Controls: Catch Basins / Grates

Structure Identification	Location	Catch basin at grade	Hood/trap installed	Sediment buildup (in.)	Overall condition
CB1	Parking Field	Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
DGCB3	Parking Field	Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
TD6	Driveway Entrance	Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐

Maintenance required

To be performed by: On or before:

Inspection and Maintenance Form

Refer to Sections above for frequency of inspection (annual submittals to the Wakefield Engineering Division Office are required)

Inspector: Date:

Inspector Title:

Days since last rainfall: Amount of last rainfall:

Structural Controls: Subsurface Infiltration Pipe Network

Structure Identification	Location	Condition of stone bed	Filter fabric installed	Sediment buildup at inlet (in.)	Sediment buildup at outlet (in.)
SWMA1P	Parking field		Yes☐ No☐		
			Yes☐ No☐		
			Yes☐ No☐		
			Yes☐ No☐		
			Yes☐ No☐		
			Yes☐ No☐		

Maintenance required

To be performed by: On or before:

Inspection and Maintenance Form

Refer to Sections above for frequency of inspection (annual submittals to the Wakefield Engineering Division Office are required)

Inspector: Date:

Inspector Title:

Days since last rainfall: Amount of last rainfall:

Structural Controls: Contech CDS 1515-3

Structure Identification	Location	Water depth to sediment (ft.)	Floatable layer thickness (in.)	Overall condition
CDS5 CDS1515-3	Parking Field			Poor☐ Fair☐ Good☐
CDS7 CDS1515-3	Front Building			Poor☐ Fair☐ Good☐
				Poor☐ Fair☐ Good☐
				Poor☐ Fair☐ Good☐
				Poor☐ Fair☐ Good☐
				Poor☐ Fair☐ Good☐

Maintenance required/performed

To be performed by: On or before:

Inspection and Maintenance Form

Refer to Sections above for frequency of inspection (annual submittals to the Wakefield Engineering Division Office are required)

Inspector: Date:

Inspector Title:

Days since last rainfall: Amount of last rainfall:

Structural Controls: Level Spreader

Structure Identification	Location	Installed at grade	Granite curb installed	Sediment buildup (in.)	Overall condition
LSP1	Outlet from SWMA1P	Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐

Maintenance required

To be performed by: On or before:

Inspection and Maintenance Form

Refer to Sections above for frequency of inspection (annual submittals to the Wakefield Engineering Division Office are required)

Inspector: Date:

Inspector Title:

Days since last rainfall: Amount of last rainfall:

Structural Controls: Depressed Landscape Area

Structure Identification	**Location**	**Condition of side slope % vegetated**	**Sediment buildup in basin % accumulation**	**Rilling or gullying**
SWMA2P	Driveway Entrance			Minor☐ Moderate☐ Major☐
SWMA3P	Front Building			Minor☐ Moderate☐ Major☐
SWMA4P	Front Building			Minor☐ Moderate☐ Major☐
SWMA5P	Front Building			Minor☐ Moderate☐ Major☐
				Minor☐ Moderate☐ Major☐
				Minor☐ Moderate☐ Major☐

Maintenance required

To be performed by: On or before:

5 | Long Term Pollution Prevention Plan

This Long Term Pollution Prevention Plan is prepared to comply with the provisions set forth in the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards. Structural Best Management Practices (BMPs) require periodic maintenance to ensure proper function and efficiency in pollutant removal from stormwater discharges that would otherwise reach wetland resource areas untreated.

Maintenance schedules found below are as recommended in Department of Environmental Protection's Massachusetts Stormwater Handbook and as recommended in manufacturer's specifications.

5.1 Driveway/Parking Lot Sweeping

Driveway and parking lot shall be swept on a monthly average with special attention given to spring (March/April) and late fall (November/December).

5.2 Trash and Litter Cleanup

Property owner(s) shall perform trash and litter cleanup once per month in and around the site. Trash and litter shall be disposed of in the on-site dumpsters.

5.3 Ownership and Maintenance Responsibilities

After completion Raymond Nickerson and Dana Lopez will assume full responsibility of continuing the operation and maintenance of the stormwater management system. The exception would be if a legal agreement is made with another party to perform such duties for the owner(s).

5.4 DEP Standard 4 Water Quality

The Long Term Pollution Prevention Plan includes the following:

Good housekeeping practices
Prevent or reduce pollutant runoff from reaching the wetland resource areas through street sweeping, stabilizing all disturbed areas with vegetative cover and catch basin cleaning.

Provisions for storing materials and waste products inside or under cover
All materials on site are to be stored in a neat and orderly fashion in their appropriate containers and, if possible, under a roof or other secure enclosure. All waste products are to be placed in secure receptacles until they are emptied by a solid waste management company licensed in the Commonwealth of Massachusetts.

Vehicle washing controls
Vehicle owners shall wash their vehicles on lawn or gravel areas so the ground can filter the water naturally. This will prevent soap, dirt and oil from reaching the storm drains and ultimately wetlands, streams, rivers or marine waters. Encourage vehicle owners to wash their vehicles at commercial car washes which recycle water and use approximately 60% on average of the amount of water used in a home wash. All contaminants/hazardous waste shall be disposed of in a manner specified by local or State regulation or by the manufacturer. Site personnel shall be instructed in these practices.

Requirements for routine inspections and maintenance of Stormwater BMP's
Follow the procedures outlined in Section 4 Long Term Operation and Maintenance Plan and the provided Inspection and Maintenance Forms.

Spill prevention and response plans
Spill Prevention: As mentioned previously, all materials on site are to be stored in a neat and orderly fashion in their appropriate containers and, if possible, under a roof or other secure enclosure. Products shall be kept in their original containers with the original manufacturer's label. Products should not be mixed unless recommended by the manufacturer. The manufacturer's recommendations for proper use, storage and disposal shall be followed at all times and, if possible, all of the product should be used up before proper disposal.

Response: The manufacturer's recommended methods for cleanup must be followed and spills cleaned up immediately after discovery. Spills shall be kept well ventilated and personnel must wear appropriate protective gear to prevent injury from contact with hazardous substances. Spills of toxic or hazardous material must be reported to the appropriate local and/or State agencies in accordance with the local and/or Commonwealth of Massachusetts regulations.

Requirements for storage and use of fertilizers, herbicides and pesticides
Consult the Town of Wakefield, MA Conservation Commission for any questions regarding these materials.

Fertilizers: Fertilizers are to be applied at the minimum amounts recommended by the manufacturer and once applied shall be worked into the soil to limit the possibility of entering the storm drains. Storage procedures are to be followed as previously stated and the contents of any partially used bags should be transferred to a sealable container, either bag or bin to avoid spilling.

Herbicides and Pesticides: Storage of these materials are to be as outlined previously and especially out of the reach of pets and children, away from damp areas where their containers may succumb to moisture or rust and should not be stored near food. These materials must not be placed in the trash or washed down the drain. Handle using rubber gloves and use an appropriate mask when using these products for extensive periods of time.

Provisions for maintenance of lawns, gardens, and other landscaped areas
These activities are left to the owner(s) to schedule and perform.

Pet waste management provisions
These activities are left to the pet owner(s) to schedule and perform.

Provisions for solid waste management
All waste products are to be placed in secure receptacles until they are emptied by a solid waste management company licensed in the Commonwealth of Massachusetts.

Snow disposal and plowing plans relative to Wetland Resource Areas
Snow disposal/removal shall be in compliance with MassDEP's Bureau of Water Resources guidelines, effective December 11, 2020. See Section 8 Snow Disposal Guidelines.

Winter Road Salt and/or Sand Use and Storage restrictions
Road Salt use must be in compliance with the Guidelines on Deicing Chemical (Road Salt) Storage effective date December 19, 1997, Guideline No. DWSG97-1 found in the BRP's Drinking Water Program.

Sand Use: Encourage the use of environmentally friendly alternatives such as calcium chloride and/or sand instead of road salt for melting ice whenever possible.

Street Sweeping schedules
Street sweeping should be performed on a monthly average; however, at the very least sweeping must occur once a year in the spring and fall in order to minimize the amount of Total Suspended Solids load on the deep-sump catch basins and the other Best Management Practices tributary thereto.

Provisions for prevention of illicit discharges to the stormwater management systems
According to Standard 10 in the Massachusetts Stormwater Handbook, Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

Documentation that Stormwater BMP's are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from land uses with higher potential pollutant loads (LUHPPL)
Not applicable as this project does not meet the criteria for a LUHPPL.

Training for staff or personnel involved with implementing LTPPP
This responsibility lies with the owner(s) unless a legally-binding agreement is made with another party to perform such duties for the owner(s).

List of Emergency contacts for implementing Long-Term Pollution Prevention Plan
This responsibility lies with the owner(s) unless a legally-binding agreement is made with another party to perform such duties for the owner(s).

6 | Construction Period Pollution Prevention Plan & Erosion & Sediment Control Plan

This Construction Period Pollution Prevention Plan and Erosion and Sediment Control Plan is prepared to comply with the provisions set forth in the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards.

6.1 Site Description

Project name and location
576-596 North Ave
Wakefield, Massachusetts 01880

Applicant Name and Address
Raymond Nickerson And Dana Lopez
26 Venditto Road
Revere, MA 02151

Description (Purpose and Types of Soil Disturbing Activities)

The proposal is to construct a 36 unit apartment building with parking, landscaping, utilities and stormwater management devices for attenuation and treatment of stormwater runoff.

Soil disturbing activities include: Installation of erosion and sediment control devices, foundation, stormwater management devices, utilities, pavement, landscape and preparation for final loaming and seeding.

Site Runoff Coefficient
The final composite runoff coefficient for the area of construction is approximately 0.8.

Site Area
The site is 5.06 acres of which 0.98 acres will be disturbed by construction activities.

Sequence of Major Activities

1. Install construction entrances
2. Install erosion control devices
3. Clearing, cutting and grubbing
4. Rough grading
5. Utility Installation
6. Gravel and pavement base course installation
7. Building site preparation
8. Curbing and sidewalk construction
9. Finished grading and slope stabilization
10. Finished Paving
11. Loam and seed all disturbed areas
12. Final cleanup including inspection and cleanout of all stormwater structures

Name of Receiving Waters
Lake Quannapowitt

6.2 Erosion and Sediment Controls

In order to limit the amount of erosion and sedimentation that takes place during and after construction, it is important to implement a management plan, which will protect and limit the amount of land area that is devoid of vegetation at any given time.

Prior to Construction
Prior to start of construction activities, the owner, builder, and site contractor shall clearly identify areas that may be affected by the proposed clearing and earth moving activities by reviewing the approved grading plan as part of an initial site visit. During the site visit, the limit of work line shall be reviewed to confirm the type of erosion control measure to be used to protect downstream wetland resources and abutting property. Limits of tree clearing shall be verified during the initial site visit with emphasis on identifying "save areas" for existing trees and vegetation where practicable.

Erosion and Sediment Control Device
Siltfence is proposed as the primary erosion control device for this project (see detail provided on site/definitive plan). It is important for the owner, builder, and/or site contractor to have access to a supply of compost BMPs should the need arise for additional erosion and sediment control measures. A compost filter sock or approved equal may be used along a slope and/or together with siltfence to protect against concentrated stormwater runoff over exposed surfaces. Erosion and sediment control devices shall be inspected every 7 days or within 24-hours of a 1/4-inch (or greater) rainfall event to ensure that they are operating properly. Should sediment levels begin to build up on the erosion control devices, it may be necessary to remove the accumulated sediment to ensure that the erosion control devices continue to operate as designed. Sediment shall be removed when it reaches one third the height of the fence.

Earth-moving Activities
After trees and other vegetation are cleared, earth-moving (or grading) activities can begin. The approved grading plan shall be used to help guide the site contractor during regrading activities. Often times it is helpful to have a land surveyor establish benchmark elevations and/or lines of grade to aid the site contractor during regrading activities. This is the time during which the site is most vulnerable to erosion. Therefore, it is important for the site contractor to finalize grading activities as soon as practicable following land clearing. Areas than remain exposed longer than 30 working days in an interim condition shall be stabilized in a temporary fashion. Once final grades have been established, permanent vegetation can be established.

Temporary Seeding
During construction it may be necessary to temporarily stabilize areas that will not be brought to final grade for a period longer than 30 working days. Temporary seeding is accomplished using fast-growing grass seed species such as ryegrass. Seeding shall be performed in accordance with the guidelines set forth in the attached **Temporary Seeding Guidance**, which is an excerpt from the publication entitled, "Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, May 2003, prepared by Franklin, Hampden, and Hampshire Conservation Districts."

Permanent Seeding & Plantings
Once final grades have been established and the weather permits, every effort shall be made to establish permanent vegetation on disturbed and exposed areas. In addition to grass seed, tree and shrub plantings shall be an integral part of the permanent stabilization plan. Care shall be taken by the owner, builder, and/or site contractor to select trees, shrubs, and seed mixes that are best suited to the soil conditions on the site. Soil moisture, depth to seasonal groundwater, and exposure to sunlight shall be carefully considered when selecting species. In recent years, the emphasis on using plant species native to

Massachusetts has grown. Information on the use of non-native and native species can be found on the web and in many local nursery catalogs.

Permanent seeding shall be performed in accordance with the guidelines set forth in the attached **Permanent Seeding Guidance**, which is an excerpt from a publication entitled, "Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, May 2003, prepared by Franklin, Hampden, and Hampshire Conservation Districts."

Seeding, Permanent

The establishment of perennial vegetative cover on disturbed areas.

Purpose

Permanent seeding of grass and planting trees and shrubs provides stabilization to the soil by holding soil particles in place.

Vegetation reduces sediments and runoff to downstream areas by slowing the velocity of runoff and permitting greater infiltration of the runoff.

Vegetation also filters sediments, helps the soil absorb water, improves wildlife habitats, and enhances the aesthetics of a site.

Where Practice Applies

- Permanent seeding and planting is appropriate for any graded or cleared area where long-lived plant cover is needed to stabilize the soil.
- Areas which will not be brought to final grade for a year or more.
- Some areas where permanent seeding is especially important are filter strips, buffer areas, vegetated swales, steep slopes, and stream banks.
- This practice is effective on areas where soils are unstable because of their texture or structure, high water table, winds, or steep slope.

Advantages

Advantages of seeding over other means of establishing plants include the small initial establishment cost, the wide variety of grasses and legumes available, low labor requirement, and ease of establishment in difficult areas.

Seeding is usually the most economical way to stabilize large areas.

Well established grass and ground covers can give an aesthetically pleasing, finished look to a development.

Once established, the vegetation will serve to prevent erosion and retard the velocity of runoff.

Disadvantages/Problems

Disadvantages which must be dealt with are the potential for erosion during the establishment stage, a need to reseed areas that fail to establish, limited periods during the year suitable for seeding, and a need for water and appropriate climatic conditions during germination. Vegetation and mulch cannot prevent soil slippage and erosion if soil is not inherently stable.

Coarse, high grasses that are not mowed can create a fire hazard in some locales. Very short mowed grass, however, provides less stability and sediment filtering capacity.

Grass planted to the edge of a watercourse may encourage fertilizing and mowing near the water's edge and increase nutrient and pesticide contamination.

Depends initially on climate and weather for success.

May require regular irrigation to establish and maintain.

Planning considerations

Selection of the right plant materials for the site, good seedbed preparation, timing, and conscientious maintenance are important. Whenever possible, native species of plants should be used for landscaping. These plants are already adapted to the locale and survivability should be higher than with "introduced" species.

Native species are also less likely to require irrigation, which can be a large maintenance burden and is neither cost-effective nor ecologically sound.

If non-native plant species are used, they should be tolerant of a large range of growing conditions, as low-maintenance as possible, and not invasive.

Consider the microclimate within the development area. Low areas may be frost pockets and require hardier vegetation since cold air tends to sink and flow towards low spots. South-facing slopes may be more difficult to re-vegetate because they tend to be sunnier and drier.

Divert as much surface water as possible from the area to be planted.

Remove seepage water that would continue to have adverse effects on soil stability or the protecting vegetation. Subsurface drainage or other engineering practices may be needed. In this situation, a permit may be needed from the local Conservation Commission: check ahead of time to avoid construction delays.

Provide protection from equipment, trampling and other destructive agents.

Vegetation cannot be expected to supply an erosion control cover and prevent slippage on a soil that is not stable due to its texture, structure, water movement, or excessive slope.

Seeding Grasses and Legumes

Install needed surface runoff control measures such as gradient terraces, berms, dikes, level spreaders, waterways, and sediment basins prior to seeding or planting.

Seedbed Preparation

If infertile or coarse-textured subsoil will be exposed during land shaping, it is best to stockpile topsoil and respread it over the finished slope at a minimum 2- to 6-inch depth and roll it to provide a firm seedbed. If construction fill operations have left soil exposed with a loose, rough, or irregular surface, smooth with blade and roll.

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

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

Cool Season Grasses

Cool Season Grasses grow rapidly in the cool weather of spring and fall, and set seed in June and July. Cool season grasses become dormant when summer temperatures persist above 85 degrees and moisture is scarce.

Lime and Fertilizer

Apply lime and fertilizer according to soil test and current Extension Service recommendations. In absence of a soil test, apply lime (a pH of 5.5 - 6.0 is desired) at a rate of 2.5 tons per acre and 10-20-20 analysis fertilizer at a rate of 500 pounds per acre (40 % of N to be in an organic or slow release form). Incorporate lime and fertilizer into the top 2-3 inches of soil.

Seeding Dates

Seeding operations should be performed within one of the following periods:

- April 1 - May 31,
- August 1 - September 10,
- November 1 - December 15 as a dormant seeding (seeding rates shall be increased by 50% for dormant seedings).

Seeding Methods

Seeding should be performed by one of the following methods. Seed should be planted to a depth of ¼ to ½ inches.

- Drill seedings,
- Broadcast and rolled, cultipacked or tracked with a small track piece of construction equipment,
- Hydroseeding, with subsequent tracking.

Mulch

Mulch the seedings with straw applied at the rate of ½ tons per acre. Anchor the mulch with erosion control netting or fabric on sloping areas.

Warm Season Grasses

Warm Season Grasses begin growth slowly in the spring, grow rapidly in the hot summer months and set seed in the fall. Many warm season grasses are sensitive to frost in the fall, and the top growth may die back. Growth begins from the plant base the following spring.

Lime and Fertilizer

Lime to attain a pH of at least 5.5. Apply a 0-10-10 analysis fertilizer at the rate of 600 lbs./acre.

Incorporate both into the top 2-3 inches of soil. (30 lbs. of slow release nitrogen should be applied after emergence of grass in the late spring.)

Seeding Dates

Seeding operations should be performed as an early spring seeding (April 1-May 15) with the use of cold treated seed. A late fall early winter dormant seeding (November 1 - December 15) can also be made, however the seeding rate will need to be increased by 50%.

Seeding Methods

Seeding should be performed by one of the following methods:

- Drill seedings (de-awned or de-bearded seed should be used unless the drill is equipped with special features to accept awned seed).
- Broadcast seeding with subsequent rolling, cultipacking or tracking the seeding with small track construction equipment. Tracking should be oriented up and down the slope.
- Hydroseeding with subsequent tracking. If wood fiber mulch is used, it should be applied as a separate operation after seeding and tracking to assure good seed to soil contact.

Mulch

Mulch the seedings with straw applied at the rate of ½ tons per acre. Anchor the mulch with erosion control netting or fabric on sloping areas.

Seed Mixtures for Permanent Cover

Recommended mixtures for permanent seeding are provided on the following pages. Select plant species which are suited to the site conditions and planned use. Soil moisture conditions, often the major limiting site factor, are usually classified as follows:

Dry - Sands and gravels to sandy loams. No effective moisture supply from seepage or a high water table.

Moist - Well drained to moderately well drained sandy loams, loams, and finer; or coarser textured material with moderate influence on root zone from seepage or a high water table.

Wet - All textures with a water table at or very near the soil surface, or with enduring seepage.

When other factors strongly influence site conditions, the plants selected must also be tolerant of these conditions.

Permanent Seeding Mixtures

Mix	Site	Seed Mixture	Seed, Pounds per: Acre	1,000 sf	Remarks
1	Dry	Little Bluestem			* Use Warm Season planting procedure.
		or Broomsedge	10	0.25	* Roadsides
		Tumble Lovegrass*	1	0.10	* Sand and Gravel Stabilization
		Switchgrass	10	0.25	* Clover requires inoculation with nitrogen-fixing bacteria
		Bush Clover*	2	0.10	
		Red Top	1	0.10	* Rates for this mix are for PLS.
2	Dry	Deertongue	15	0.35	* Use Warm Season planting procedures.
		Broomsedge	10	0.25	* Acid sites/Mine spoil
		Bush Clover*	2	0.10	* Clover requires inoculation with nitrogen-fixing bacteria.
		Red Top	1	0.10	*Rates for this mix are for PLS.
3	Dry	Big Bluestem	10	0.25	* Use Warm Season planting procedures.
		Indian Grass	10	0.25	* Eastern Prairie appearance
		Switchgrass	10	0.25	* Sand and Gravel pits.
		Little Bluestem	10	0.25	* Golf Course Wild Areas
		Red Top or	1	0.10	* Sanitary Landfill Cover seeding
		Perennial Ryegrass	10	0.25	* Wildlife Areas *OK to substitute Poverty Dropseed in place of Red Top/Ryegrass. *Rates for this mix are for PLS.
4	Dry	Flat Pea	25	0.60	* Use Cool Season planting procedures
		Red Top or	2	0.10	* Utility Rights-of-Ways (tends to suppress woody growth)
		Perennial Ryegrass	15	0.35	
5	Dry	Little Bluestem	5	0.10	* Use Warm Season planting procedures.
		Switchgrass	10	0.25	* Coastal sites
		Beach Pea*	20	0.45	* Rates for Bluestein and Switchgrass are for PLS.
		Perennial Ryegrass	10	0.25	
6	Dry - Moist	Red Fescue	10	0.25	* Use Cool Season planting procedure.
		Canada Bluegrass	10	0.25	* Provides quick cover but is non-aggressive; will tend to allow indigenous plant colonization.
		Perennial Ryegrass	10	0.25	
		Red Top	1	0.10	* General erosion control on variety of sites, including forest roads, skid trails and landings.
7	Moist-Wet	Switchgrass	10	0.25	* Use Warm Season planting procedure.
		Virginia Wild Rye	5	0.10	* Coastal plain/flood plain
		Big Bluestem	15	0.35	* Rates for Bluestem and Switchgrass are for PLS.
		Red Top	1	0.10	

Permanent Seeding Mixtures

Mix	Site	Seed Mixture	Seed, Pounds per: Acre	1,000 sf	Remarks
8	Moist Wet	Creeping Bentgrass Fringed Bromegrass Fowl Meadowgrass Bluejoint Reedgrass or Rice Cutgrass Perennial Ryegrass	5 5 5 2 10	0.10 0.10 0.10 0.10 0.25	* Use Cool Season planting procedures. * Pond Banks * Waterways/ditch banks
9	Moist Wet	Red Fescue Creeping Bentgrass Switchgrass Perennial Ryegrass	5 2 8 10	0.10 0.10 0.20 0.25	*Salt Tolerant * Fescue and Bentgrass provide low growing appearance, while Switchgrass provides tall cover for wildlife.
10	Moist Wet	Red Fescue Creeping Bentgrass Virginia Wild Rye Wood Reed Grass* Showy Tick Trefoil*	5 5 8 1 1	0.10 0.10 0.20 0.10 0.10	* Use Cool Season planting procedure. * Trefoil requires inoculation with nitrogen fixing bacteria. * Suitable for forest access roads, skid trails and other partial shade situations.
11	Moist Wet	Creeping Bentgrass Bluejoint Reed Grass Virginia Wild Rye Fowl Meadow Grass Showy Tick Trefoil* Red Top	5 1 3 10 1 1	0.10 0.10 0.10 0.25 0.10 0.10	* Use Cool Season planting procedure. * Suitable for waterways, pond or ditch banks. * Trefoil requires inoculation with nitrogen fixing bacteria.
12	Wet	Blue Joint Reed Grass Canada Manna Grass Rice Cut Grass Creeping Bent Grass Fowl Meadow Grass	1 1 1 5 5	0.10 0.10 0.10 0.10 0.10	* Use Cool Season planting procedure. * OK to seed in saturated soil conditions, but not in standing water. * Suitable as stabilization seeding for created wetland. * All species in this mix are native to Massachusetts.
13	Dry - Moist	American Beachgrass	18" centers	18' centers	*Vegetative planting with dormant culms, 3-5 culms per planting
14	Inter-Tidal	Smooth Cordgrass Saltmeadow Cordgrass	12-18" centers	12-18" centers	* Vegetative planting with transplants.

Notes:
* Species such as Tumble Lovegrass, Fringed Bromegrass, Wood Reedgrass, Bush Clover and Beach Pea, while known to be commercially available from specific seed suppliers, may not always be available from your particular seed suppliers. The local Natural Resources Conservation Service office may be able to help with a source of supply. In the event a particular species listed in a mix can not be obtained, however, it may be possible to substitute another species.

Seed mixtures by courtesy of Natural Resources Conservation Service, Amherst, MA.

(PLS) Pure Live Seed

Warm Season grass seed is sold and planted on the basis of pure live seed. An adjustment is made to the bulk rate of the seed to compensate for inert material and non-viable seed. Percent of pure live seed is calculated by multiplying the percent purity by the percent germination; **(% purity) x (% germination) = percent PLS.**

For example, if the seeding rate calls for 10 lbs./acre PLS and the seed lot has a purity of 70% and germination of 75%, the PLS factor is:

(.70 x .75) =.53

10 lbs. divided by .53 = approx. 19 lbs.

Therefore, 19 lbs of seed from the particular lot will need to be applied to obtain 10 lbs. of pure live seed.

Special Note

Tall Fescue, Reed Canary Grass, Crownvetch and Birdsfoot Trefoil are no longer recommended for general erosion control use in Massachusetts due to the invasive characteristics of each. If these species are used, it is recommended that the ecosystem of the site be analyzed for the effects species invasiveness may impose. The mixes listed in the above mixtures include either species native to Massachusetts or non-native species that are not perceived to be invasive, as per the Massachusetts Native Plant Advisory Committee.

Wetlands Seed Mixtures

For newly created wetlands, a wetlands specialist should design plantings to provide the best chance of success. Do not use introduced, invasive plants like reed canarygrass (Phalaris arundinacea) or purple loosestrife (Lythrum salicaria). Using plants such as these will cause many more problems than they will solve.

The following grasses all thrive in wetland situations:

- Fresh Water Cordgrass (*Spartina pectinata*)
- Marsh/Creeping Bentgrass (*Agrostis stolonifera, var. Palustric*)
- Broomsedge (*Andropogon virginicus*)
- Fringed Bromegrass (*Bromus ciliatus*)
- Blue Joint Reed Grass (*Calamagrostis cavedensis*)
- Fowl Meadow Grass (*Glyceria striata*)
- Riverbank Wild Rye (*Elymus riparius*)
- Rice Cutgrass (*Leersia oryzoides*)
- Stout Wood Reed (*Cinna arundinacea*)
- Canada Manna Grass (*Glyceria canadensis*)

A sample wetlands seed mix developed by The New England Environmental Wetland Plant Nursery is shown on the following page.

Wetland Seed Mixture

The New England Environmental Wetland Plant Nursery has developed a seed mixture which is specifically designed to be used in wetland replication projects and stormwater detention basins. It is composed of seeds from a variety of indigenous wetland species. Establishing a native wetland plant understory in these areas provides quick erosion control, wildlife food and cover, and helps to reduce the establishment of undesirable invasive species such as Phragmites and purple loosestrife (Lythrum salicaria). The species have been selected to represent varying degrees of drought tolerance, and will establish themselves based upon microtopography and the resulting variation in soil moisture.

Common Name (*Scientific Name*)	% in Mix	Comments
Lurid Sedge (*Carex lurida*)	30	A low ground cover that tolerates mesic sites in addition to saturated areas; prolific seeder in second growing season.
Fowl Meadow Grass (*Glyceria Canadensis*)	25	Prolific seed producer that is a valuable wildlife food source.
Fringed Sedge (*Carex crinita*)	10	A medium to large sedge that tolerates saturated areas; good seed producer.
Joe-Pye Weed (*Eupatoriadelphus maculatus*)	10	Flowering plant that is valuable for wildlife cover. Grows to 4 feet.
Brook Sedge (*Carex spp., Ovales group*)	10	Tolerates a wide range of hydrologic conditions.
Woolgrass (*Scirpus cyperinus*)	5	Tolerates fluctuating hydrology.
Boneset (*Eupatorium perfoliatum*)	5	Flowering Plant that is valuable for wildlife cover. Grows to 3 feet.
Tussock Sedge (*Carex stricta*)	<5	Grows in elevated hummocks on wet sites, may grow rhizomonously on drier sites.
Blue Vervain (*Verbena hastata*)	<5	A native plant that bears attractive, blue flowers.

The recommended application rate is one pound per 5,000 square feet when used as an understory cover. This rate should be increased to one pound per 2,500 square feet for detention basins and other sites which require a very dense cover. For best results, a late fall application is recommended. This mix is not recommended for standing water.

Maintenance

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

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

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

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

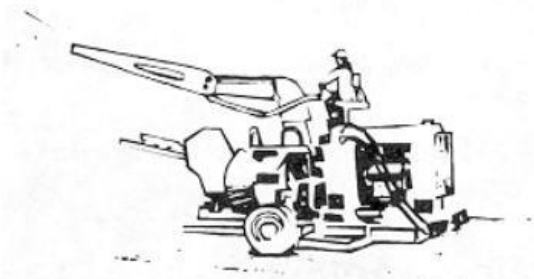
References

North Carolina Department of Environment, Health, and Natural Resources, ***Erosion and Sediment Control Field Manual***, Raleigh, NC, February 1991.

Personal communication, Richard J. DeVergilio, USDA, Natural Resources Conservation Service, Amherst, MA.

U.S. Environmental Protection Agency, ***Storm Water Management For Construction Activities***, EPA-832-R- 92-005, Washington, DC, September, 1992.

Washington State Department of Ecology, ***Stormwater Management Manual for the Puget Sound Basin***, Olympia, WA, February, 1992.



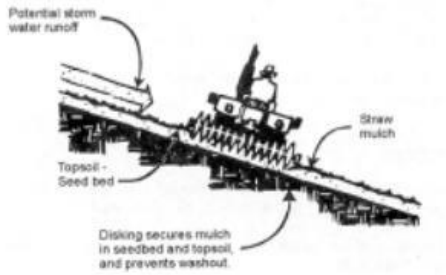
HYDRO-SEEDING

Seeding, Temporary

Planting rapid-growing annual grasses, small grains, or legumes to provide initial, temporary cover for erosion control on disturbed areas.

Purpose

To temporarily stabilize areas that will not be brought to final grade for a period of more than 30 working days.
To stabilize disturbed areas before final grading or in a season not suitable for permanent seeding.



Temporary seeding controls runoff and erosion until permanent vegetation or other erosion control measures can be established.
Root systems hold down the soils so that they are less apt to be carried offsite by storm water runoff or wind.
Temporary seeding also reduces the problems associated with mud and dust from bare soil surfaces during construction.

Where Practice Applies

On any cleared, unvegetated, or sparsely vegetated soil surface where vegetative cover is needed for less than one year. Applications of this practice include diversions, dams, temporary sediment basins, temporary road banks, and topsoil stockpiles.

Where permanent structures are to be installed or extensive re-grading of the area will occur prior to the establishment of permanent vegetation.

Areas which will not be subjected to heavy wear by construction traffic.

Areas sloping up to 10% for 100 feet or less, where temporary seeding is the only practice used.

Advantages

This is a relatively inexpensive form of erosion control but should only be used on sites awaiting permanent planting or grading. Those sites should have permanent measures used.

Vegetation will not only prevent erosion from occurring, but will also trap sediment in runoff from other parts of the site.

Temporary seeding offers fairly rapid protection to exposed areas.

Disadvantages/Problems

Temporary seeding is only viable when there is a sufficient window in time for plants to grow and establish cover. It depends heavily on the season and rainfall rate for success.

If sown on subsoil, growth will be poor unless heavily fertilized and limed. Because overfertilization can cause pollution of stormwater runoff, other practices such as mulching alone may be more appropriate. The potential for over-fertilization is an even worse problem in or near aquatic systems.

Once seeded, areas should not be travelled over.

Irrigation may be needed for successful growth. Regular irrigation is not encouraged because of the expense and the potential for erosion in areas that are not regularly inspected.

Planning Considerations

Temporary seedings provide protective cover for less than one year. Areas must be reseeded annual or planted with perennial vegetation.

Temporary seeding is used to protect earthen sediment control practices and to stabilize denuded areas that will not be brought into final grade for several weeks or months. Temporary seeding can provide a nurse crop for permanent vegetation, provide residue for soil protection and seedbed preparation, and help prevent dust production during construction.

Use low-maintenance native species wherever possible.

Planting should be timed to minimize the need for irrigation.

Sheet erosion, caused by the impact of rain on bare soil, is the source of most fine particles in sediment. To reduce this sediment load in runoff, the soil surface itself should be protected. The most efficient and economical means of controlling sheet and rill erosion is to establish vegetative cover. Annual plants which sprout rapidly and survive for only one growing season are suitable for establishing temporary vegetative cover. Temporary seeding is effective when combined with construction phasing so bare areas of the site are minimized at all times.

Temporary seeding may prevent costly maintenance operations on other erosion control systems. For example, sediment basin clean-outs will be reduced if the drainage area of the basin is seeded where grading and construction are not taking place. Perimeter dikes will be more effective if not choked with sediment.

Proper seedbed preparation and the use of quality seed are important in this practice just as in permanent seeding. Failure to carefully follow sound agronomic recommendations will often result in an inadequate stand of vegetation that provides little or no erosion control.

Soil that has been compacted by heavy traffic or machinery may need to be loosened. Successful growth usually requires that the soil be tilled before the seed is applied. Topsoiling is not necessary for temporary seeding; however, it may improve the chances of establishing temporary vegetation in an area.

Planting Procedures

Time of Planting

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

Site Preparation

Before seeding, install needed surface runoff control measures such as gradient terraces, interceptor dike/swales, level spreaders, and sediment basins.

Seedbed Preparation

The seedbed should be firm with a fairly fine surface.

Perform all cultural operations across or at right angles to the slope. See **Topsoiling** and **Surface Roughening** for more information on seedbed preparation. A minimum of 2 to 4 inches of tilled topsoil is required.

Liming and Fertilization

Apply uniformly 2 tons of ground limestone per acre (100 lbs. per 1,000 Sq. Ft.) or according to soil test.

Apply uniformly 10-10-10 analysis fertilizer at the rate of 400 lbs. per acre (14 lbs. per 1,000 Sq. Ft.) or as indicated by soil test. Forty percent of the nitrogen should be in organic form.

Work in lime and fertilizer to a depth of 4 inches using any suitable equipment.

Seedings for Temporary Cover

Species	Seeding Rates lbs/sq.ft. 1,000 Sq.Ft.	Seeding Rates lbs/sq.ft. Acre	Recommended Seeding Dates
Annual Ryegrass	1	40	April 1 to June 1 Aug. 15 to Sept. 15
Foxtail Millet	0.7	30	May 1 to June 30
Oats	2	80	April 1 to July 1 August 15 to Sept. 15
Winter Rye	3	120	Aug. 15 to Oct. 15

"Hydro-seeding" applications with appropriate seed-mulch-fertilizer mixtures may also be used.

Seeding

Select adapted species from the accompanying table.
Apply seed uniformly according to the rate indicated in the table by broadcasting, drilling or hydraulic application.
Cover seeds with suitable equipment as follows:

Rye grass	¼ inch
Millet	½ to ¾ inch
Oats	1 to 1-1/2 inches
Winter rye	1 to 1-1/2 inches.

Mulch

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

Common Trouble Points

Lime and fertilizer not incorporated to at least 4 inches
May be lost to runoff or remain concentrated near the surface where they may inhibit germination.

Mulch rate inadequate or straw mulch not tacked down
Results in poor germination or failure, and erosion damage. Repair damaged areas, reseed and mulch.

Annual ryegrass used for temporary seeding
Ryegrass reseeds itself and makes it difficult to establish a good cover of permanent vegetation.

Seed not broadcast evenly or rate too low
Results in patchy growth and erosion.

Maintenance

Inspect within 6 weeks of planting to see if stands are adequate. Check for damage after heavy rains. Stands should be uniform and dense. Fertilize, reseed, and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary.

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

Structural Practices
Silt fence with mulch sock or approved equal shall be installed as shown on the approved site/definitive plan to help prevent erosion and sedimentation of the downstream wetland resources identified on the project.

All proposed catch basins and existing catch basins identified on the site/definitive plan shall be fitted with a siltsack or approved equal during construction to prevent the accumulation of sediments in the catch basin sump. Catch basins shall be cleaned as specified in the Long Term Pollution Prevention Plan or the Long Term Operation and Maintenance Plan.

Stormwater Management
The stormwater runoff shall be managed through the use of best management practices:

1. CDS 1515-3 Proprietary Particle Separator
2. Subsurface Infiltration Pipe Network

6.3 Other Controls

Waste Materials
All waste materials shall be collected and stored in secure metal dumpsters rented from a licensed solid waste management company in Massachusetts. The dumpsters shall meet all local and state solid waste management regulations as outlined in 310 CMR 19.00. All trash and construction debris generated on site shall be disposed of in the dumpsters. The dumpsters shall be emptied as often as necessary during construction and transferred to an approved solid waste facility licensed to accept municipal solid waste and/or construction and demolition debris. No construction waste shall be buried on site. All personnel shall be instructed regarding the correct procedure for waste disposal.

Hazardous Waste
All hazardous waste materials shall be disposed of in a manner specified by local or State regulation or by the manufacturer. Site personnel shall be instructed in these practices.

Sanitary Waste
All sanitary shall be collected from portable units, as needed, by a licensed septage hauler in Massachusetts, in accordance with the requirements of the local Board of Health.

Offsite Vehicle Tracking
Construction entrance and exit shall be via North Ave.

6.4 Timing of Controls/Measures

As indicated in the Sequence of Major Activities, the installation of erosion and sediment control devices shall be in place prior to earth excavating activities.

6.5 Certification of Compliance with Federal, State, and Local Regulations

The Construction Period Pollution Prevention Plan reflects the requirements of the Massachusetts Wetlands Protection Act (310 CMR 10.00). There is no wetland filling associated with this project, it is strictly a buffer zone project. Note that there are no other applicable State or Federal requirements for sediment and erosion control plans (or permits), or stormwater management plans (or permits) required for this project to the best of our knowledge.

6.6 Maintenance and Inspection Procedures

Erosion and Sediment Control Inspection and Maintenance Practices
The following items represent the inspection and maintenance practices that will be used to maintain sediment and erosion control.

1. All control measures shall be inspected at least once every fourteen (14) days and following any storm event of 0.25 inches or greater.
2. All measures shall be maintained in good working order; if a repair is necessary, it shall be initiated within 24 hours of the report.
3. Built up sediment shall be removed from silt fencing when it has reached one-third the height of the fence.
4. Silt fence shall be inspected for depth of sediment, tears, to see if the fabric is securely attached to the fence posts, and to see that the fence posts are firmly set in the ground.
5. The catch basin grates shall be inspected for grate elevation relative to current surface condition; condition of silt sack, and degree to which sediment has accumulated on the grate and in the sump of the catch basin.
6. Temporary and permanent seeding and any plantings shall be inspected for bare spots, washouts, and healthy growth.
7. A maintenance inspection report shall be prepared following each inspection. A copy of the form to be completed by the inspector is attached to this document.
8. Raymond Nickerson and Dana Lopez shall select three individuals who will be responsible for inspections, maintenance and repair activities as well as who shall be responsible for filling out the inspection and maintenance report.
9. Personnel selected for inspection and maintenance responsibilities shall receive training from Raymond Nickerson and Dana Lopez or their designated representative. They will be trained in all the inspection and maintenance practices necessary for keeping the erosion and sediment control devices used on site in good working order.

6.7 Non Stormwater Discharges

It is expected that the following non-stormwater discharges will occur from the site during the construction period

1. Water from water line flushing.
2. Pavement wash waters.

All non-stormwater discharges shall be directed to the proposed site BMPs prior to discharge.

6.8 Inventory for Pollution Prevention Plan

The materials or substances listed below are expected to be present on site during construction

1. Concrete
2. Wood
3. Structural Steel
4. Masonry Block
5. Office Building Materials
6. Fiber Glass Insulation
7. Fertilizers
8. Petroleum Based Products
9. Cleaning Solvents
10. Paints (enamel and latex)

11. Tar
12. Waterproofing Materials

6.9 Spill Prevention

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

Good Housekeeping
The following good housekeeping practices will be followed on site during the construction project.
1. A concerted effort shall be made to store only enough product required to complete a particular task.
2. All materials stored on site shall be stored in a neat and orderly fashion in their appropriate containers and, if possible, under a roof or other secure enclosure.
3. Products shall be kept in their original containers with the original manufacturer's label.
4. Substances shall not be mixed with one another unless recommended by the manufacturer.
5. Whenever possible, all of a product shall be used up before disposing of the container.
6. Manufacturer's recommendations for proper use and disposal shall be followed.
7. The site superintendent shall perform a daily site inspection to ensure proper use and disposal of materials on site.

Hazardous Products
The following practices are intended to reduce the risks associated with hazardous materials.
1. Products shall be kept in original containers unless they are not resealable.
2. Where feasible, the original labels and material safety data shall be retained, whereas they contain important product information.
3. If surplus product must be disposed, follow manufacturer's or local and state recommended methods for proper disposal.

Product Specific Practices
The following product specific practices shall be followed on site:

Petroleum Products
All on site vehicles shall be monitored for leaks and receive regular preventative maintenance to reduce the risk of leakage. Petroleum products shall be stored in tightly sealed containers which are clearly labeled. Any bituminous concrete or asphalt substances used on site shall be applied according to the manufacturer's recommendations.

Fertilizers
Fertilizers shall be applied in the minimum amounts recommended by the manufacturer. Once applied, fertilizers shall be worked into the soil to limit exposure to stormwater. Storage shall be in a covered shed or trailer. The contents of any partially used bags of fertilizers shall be transferred to a sealable plastic bag or bin to avoid spills. Fertilizers shall be applied in the minimum amounts recommended by the manufacturer. Once applied, fertilizers shall be worked into the soil to limit exposure to stormwater. Storage shall be in a covered shed or trailer. The contents of any partially used bags of fertilizers shall be transferred to a sealable plastic bag or bin to avoid spills.

Paints
All containers shall be tightly sealed and stored when not required for use. Excess paint shall not be discharged into any catch basin, drain manhole, or any portion of the stormwater management system. Excess paint shall be properly disposed of according to manufacturer's recommendations or State and local regulations.

Concrete Trucks
Concrete trucks shall not be allowed to wash out or discharge surplus concrete or drum wash water on site.

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

1. Manufacturer's recommended methods for cleanup shall be readily available at the on site trailer and site personnel shall be made aware of the procedures and the location of the information.
2. Materials and equipment necessary for spill cleanup shall be kept in the material storage area on site. Equipment and materials shall include, but not be limited to
3. brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.
4. All spills shall be cleaned up immediately after discovery.
5. The spill area shall be kept well ventilated and personnel shall wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
6. Spills of toxic or hazardous material shall be reported to the appropriate State and/or local authority in accordance with local and/or State regulations.
7. The spill prevention plan shall be adjusted to include measures to prevent a particular type of spill from reoccurring and how to clean up the spill if there is another occurrence. A description of the spill, what caused it, and the clean up measures shall also be included.
8. Raymond Nickerson and Dana Lopez or their assigned designee shall be the spill prevention and cleanup coordinator. Raymond Nickerson and Dana Lopez shall designate at least three other site personnel who will be trained in the spill control practices identified above.

Pollution Prevention Plan Certificate

I certify under penalty of law that this document and all its attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed:_____Date:_____
Raymond Nickerson

Signed:_____Date:_____
Dana Lopez

Inspection and Maintenance Form

To be completed every 14 days and within 24 hours of a rainfall event of 0.25 inches or greater

Inspector: Date:

Inspector Title:

Days since last rainfall: Amount of last rainfall:

Structural Controls: Silt Fence/Compost Filter Sock

From	To	Avg. depth of sediment (in.)	Tear	Posts secure	Overall condition
			Yes☐ No☐	Yes☐ No☐	Poor☐ Fair☐ Good☐
			Yes☐ No☐	Yes☐ No☐	Poor☐ Fair☐ Good☐
			Yes☐ No☐	Yes☐ No☐	Poor☐ Fair☐ Good☐
			Yes☐ No☐	Yes☐ No☐	Poor☐ Fair☐ Good☐
			Yes☐ No☐	Yes☐ No☐	Poor☐ Fair☐ Good☐
			Yes☐ No☐	Yes☐ No☐	Poor☐ Fair☐ Good☐

Maintenance required

To be performed by: On or before:

Inspection and Maintenance Form

To be completed every 14 days and within 24 hours of a rainfall event of 0.25 inches or greater

Inspector: Date:

Inspector Title:

Days since last rainfall: Amount of last rainfall:

Structural Controls: Catch Basins / Grates

Structure Identification	Location	Catch basin at grade	Hood/trap installed	Sediment buildup (in.)	Overall condition
CB1	Parking Field	Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
DGCB3	Parking Field	Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
TD6	Driveway Entrance	Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐
		Yes☐ No☐	Yes☐ No☐		Poor☐ Fair☐ Good☐

Maintenance required

To be performed by: On or before:

Inspection and Maintenance Form

To be completed every 14 days and within 24 hours of a rainfall event of 0.25 inches or greater

Inspector: Date:

Inspector Title:

Days since last rainfall: Amount of last rainfall:

Structural Controls: Silt Sack / Filter Fabric

Structure Identification	Location	Catch basin at grade	Hood/trap installed	Sediment buildup (in.)	Silt Sack Full
CB1	Parking Field	Yes☐ No☐	Yes☐ No☐		Yes☐ No☐
DGCB3	Parking Field	Yes☐ No☐	Yes☐ No☐		Yes☐ No☐
TD6	Driveway Entrance	Yes☐ No☐	Yes☐ No☐		Yes☐ No☐
EXCB1	North Ave	Yes☐ No☐	Yes☐ No☐		Yes☐ No☐
EXCB2	North Ave	Yes☐ No☐	Yes☐ No☐		Yes☐ No☐
		Yes☐ No☐	Yes☐ No☐		Yes☐ No☐

Maintenance required

To be performed by: On or before:

Inspection and Maintenance Form

To be completed every 14 days and within 24 hours of a rainfall event of 0.25 inches or greater

Inspector: Date:

Inspector Title:

Days since last rainfall: Amount of last rainfall:

Structural Controls: Subsurface Infiltration Pipe Network

Structure Identification	Location	Condition of stone bed	Filter fabric installed	Sediment buildup at inlet (in.)	Sediment buildup at outlet (in.)
SWMA1P	Parking Field		Yes☐ No☐		
			Yes☐ No☐		
			Yes☐ No☐		
			Yes☐ No☐		
			Yes☐ No☐		
			Yes☐ No☐		

Maintenance required

To be performed by: On or before:

Inspection and Maintenance Form

To be completed every 14 days and within 24 hours of a rainfall event of 0.25 inches or greater

Changes required to the Construction Period Pollution Prevention Plan:

Reason for changes:

I certify under penalty of law that the above changes to the document and all its attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: Date:

7 | NRCS Web Soil Survey

8 | Snow Disposal Guidelines

The following Snow Disposal Guidance is reproduced from the Mass.gov website:
https://www.mass.gov/guides/snow-disposal-guidance

The Massachusetts Department of Environmental Protection's Snow Disposal Guidance offers information on the proper steps to take when locating sites for the disposal of snow. Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. Public safety is of the utmost importance. However, care must be taken to ensure that collected snow, which may be contaminated with road salt, sand, litter, and automotive pollutants such as oil, is disposed of in a manner that will minimize threats to nearby sensitive resource areas.

In order to avoid potential contamination to wetlands, water supplies, and waterbodies, MassDEP recommends that municipalities and businesses identify and map appropriate upland snow disposal locations. To assist municipalities and businesses in this planning effort, and to avoid use of snow disposal at sites which compromise wetlands resources or public water supplies, MassDEP has developed this snow disposal mapping tool:

https://maps.env.state.ma.us/dep/arcgis/js/templates/PSF/

If a community or business demonstrates that there is no remaining capacity at upland snow disposal locations, local conservation commissions are authorized to issue Emergency Certifications under the Massachusetts Wetlands Protection Act for snow disposal in certain wetland resource areas. In such cases, Emergency Certifications can only be issued at the request of a public agency or by order of a public agency for the protection of the health or safety of citizens, and are limited to those activities necessary to abate the emergency.

In the event of a regional or statewide severe weather event, MassDEP may also issue a broader Emergency Declaration under the Wetlands Protect Act which allows greater flexibility in snow disposal practices. Details of this approval process are found below.

Massachusetts Department of Environmental Protection
Bureau of Water Resources Snow Disposal Guidance

Effective Date: December 11, 2020

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: Bureau of Resource Protection (BRP) Snow Disposal Guideline No. BRPG97-1 issued December 12, 1997 and BRPG01-01 issued March 8, 2001; Bureau of Water Resources (BWR) snow disposal guidance issued December 21, 2015 and December 12, 2018.

Approved by: Kathleen Baskin, Assistant Commissioner, Bureau of Water Resources

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are protective of wetlands, drinking water, and water bodies, and are acceptable to the Massachusetts Department of Environmental Protection (MassDEP), Bureau of Water Resources.

APPLICABILITY: These Guidelines are issued by MassDEP's Bureau of Water Resources on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to all federal agencies, state agencies, state authorities, municipal agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While MassDEP is aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything that occurs on the land has the potential to impact the Commonwealth's water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help federal agencies, state agencies, state authorities, municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter. Following these guidelines and obtaining the necessary approvals may also help municipalities in cases when seeking reimbursement for snow disposal costs from the Federal Emergency Management Agency is possible.

RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas or upland locations on impervious surfaces away from water resources and drinking water wells. At these locations, the snow meltwater can filter into the soil, leaving behind sand and debris which can be removed in the spring. The following conditions should be followed:

- Within water supply Zone A and Zone II, avoid storage or disposal of snow and ice containing deicing chemicals that has been collected from streets located outside these zones. Municipalities may have a water supply protection land use control that prohibits the disposal of snow and ice containing deicing chemicals from outside the Zone A and Zone II, subject to the Massachusetts Drinking Water Regulations at 310 CMR 22.20C and 310 CMR 22.21(2).

• Avoid storage or disposal of snow or ice in Interim Wellhead Protection Areas (IWPA) of public water supply wells, and within 75 feet of a private well, where road salt may contaminate water supplies.

• Avoid dumping snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.

• Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater.

• Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.

• Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage systems including detention basins, swales or ditches. Snow combined with sand and debris may block a stormwater drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Recommended Site Selection Procedures

It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:

• Estimate how much snow disposal capacity may be needed for the season so that an adequate number of disposal sites can be selected and prepared.

• Identify sites that could potentially be used for snow disposal, such as municipal open space (e.g., parking lots or parks).

• Select sites located in upland locations that are not likely to impact sensitive environmental resources first.

• If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

Snow Disposal Mapping Assistance

MassDEP has an online mapping tool to assist in identifying possible locations to potentially dispose of snow. MassDEP encourages municipalities to use this tool to identify possible snow disposal options. The tool identifies wetland resource areas, public drinking water supplies and other sensitive locations where snow should not be disposed. The tool may be accessed through the Internet at the following web address: https://maps.env.state.ma.us/dep/arcgis/js/templates/PSF/.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.

- Wherever possible maintain a 50-foot vegetated buffer between the disposal site and adjacent waterbodies to filter pollutants from the meltwater.

- Clear debris from the site prior to using the site for snow disposal.

- Clear debris from the site and properly dispose of it at the end of the snow season, and no later than May 15.

3. SNOW DISPOSAL APPROVALS

Proper snow disposal may be undertaken through one of the following approval procedures:

- Routine snow disposal – Minimal, if any, administrative review is required in these cases when upland and pervious snow disposal locations or upland locations on impervious surfaces that have functioning and maintained stormwater management systems have been identified, mapped, and used for snow disposal following ordinary snowfalls. Use of upland and pervious snow disposal sites avoids wetland resource areas and allows snow meltwater to recharge groundwater and will help filter pollutants, sand, and other debris. This process will address the majority of snow removal efforts until an entity exhausts all available upland snow disposal sites. The location and mapping of snow disposal sites will help facilitate each entity's routine snow management efforts.

- Emergency Certifications – If an entity demonstrates that there is no remaining capacity at upland snow disposal locations, local conservation commissions may issue an Emergency Certification under the Massachusetts Wetlands Protection regulations to authorize snow disposal in buffer zones to wetlands, certain open water areas, and certain wetland resource areas (i.e. within flood plains). Emergency Certifications can only be issued at the request of a public agency or by order of a public agency for the protection of the health or safety of citizens, and are limited to those activities necessary to abate the emergency. See 310 CMR 10.06(1)-(4). Use the following guidelines in these emergency situations:

    - Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.

    - Do not dispose of snow in salt marshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.

    - Do not dispose of snow where trucks may cause shoreline damage or erosion.

• Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local ordinances and bylaws.

• Severe Weather Emergency Declarations – In the event of a large-scale severe weather event, MassDEP may issue a broader Emergency Declaration under the Wetlands Protection Act which allows federal agencies, state agencies, state authorities, municipalities, and businesses greater flexibility in snow disposal practices. Emergency Declarations typically authorize greater snow disposal options while protecting especially sensitive resources such as public drinking water supplies, vernal pools, land containing shellfish, FEMA designated floodways, coastal dunes, and salt marsh. In the event of severe winter storm emergencies, the snow disposal site maps created by municipalities will enable MassDEP and the Massachusetts Emergency Management Agency (MEMA) in helping communities identify appropriate snow disposal locations.

If upland disposal sites have been exhausted, the Emergency Declaration issued by MassDEP allows for snow disposal near water bodies. In these situations, a buffer of at least 50 feet, preferably vegetated, should still be maintained between the site and the waterbody. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, the Emergency Declaration issued by MassDEP may allow disposal of snow in certain waterbodies under certain conditions. ***A federal agency, state agency, state authority, municipality or business seeking to dispose of snow in a waterbody should take the following steps:***

• Call the emergency contact phone number [(888) 304-1133)] and notify the MEMA of the municipality's intent.

• MEMA will ask for some information about where the requested disposal will take place.

• MEMA will confirm that the disposal is consistent with MassDEP's Severe Weather Emergency Declaration and these guidelines and is therefore approved. During declared statewide snow emergency events, MassDEP's website will also highlight the emergency contact phone number [(888) 304-1133)] for authorizations and inquiries. For further non-emergency information about this Guidance you may contact your MassDEP Regional Office Service Center:

Northeast Regional Office, Wilmington, 978-694-3246
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7650
Western Regional Office, Springfield, 413-755-2114

9 | Deicing Chemical (Road Salt) Storage

The following Snow Disposal Guidance is reproduced from the Mass.gov website:
https://www.mass.gov/guides/guidelines-on-road-salt-storage

Effective Date: December 19, 1997
Guideline No. DWSG97-1

Applicability: Applies to all parties storing road salt or other chemical deicing agents.

Supersedes: Fact Sheet: DEICING CHEMICAL (ROAD SALT) STORAGE (January 1996)

Approved by: Arleen O'Donnell, Asst. Commissioner for Resource Protection

PURPOSE: To summarize salt storage prohibition standards around drinking water supplies and current salt storage practices.

APPLICABILITY: These guidelines are issued on behalf of the Bureau of Resource Protection's Drinking Water Program. They apply to all parties storing road salt or other chemical deicing agents.

The Road Salt Problem

Historically, there have been incidents in Massachusetts where improperly stored road salt has polluted public and private drinking water supplies. Recognizing the problem, state and local governments have taken steps in recent years to remediate impacted water supplies and to protect water supplies from future contamination. As a result of properly designing storage sheds, new incidents are uncommon. These guidelines summarize salt storage prohibition standards around drinking water supplies and current salt storage practices.

Salt Pile Restrictions in Water Supply Protection Areas

Uncovered storage of salt is forbidden by Massachusetts General Law Chapter 85, section 7A in areas that would threaten water supplies. The Drinking Water Regulations, 310 CMR 22.21(2)(b), also restrict deicing chemical storage within wellhead protection areas (Zone I and Zone II) for public water supply wells, as follows: "storage of sodium chloride, chemically treated abrasives or other chemicals used for the removal of ice and snow on roads [are prohibited], unless such storage is within a structure designed to prevent the generation and escape of contaminated runoff or leachate." For drinking water reservoirs, 310 CMR 22.20C prohibits, through local bylaw, uncovered or uncontained storage of road or parking lot de-icing and sanding materials within Zone A at new reservoirs and at those reservoirs increasing their withdrawals under MGL Chapter 21G, the Water Management Act.

For people on a low-sodium diet, 20 mg/L of sodium in drinking water is consistent with the bottled water regulations' meaning of "sodium free." At 20 mg/L, sodium contributes 10% or less to the sodium level in people on a sodium-restricted diet.

Salt Storage Best Management Practices

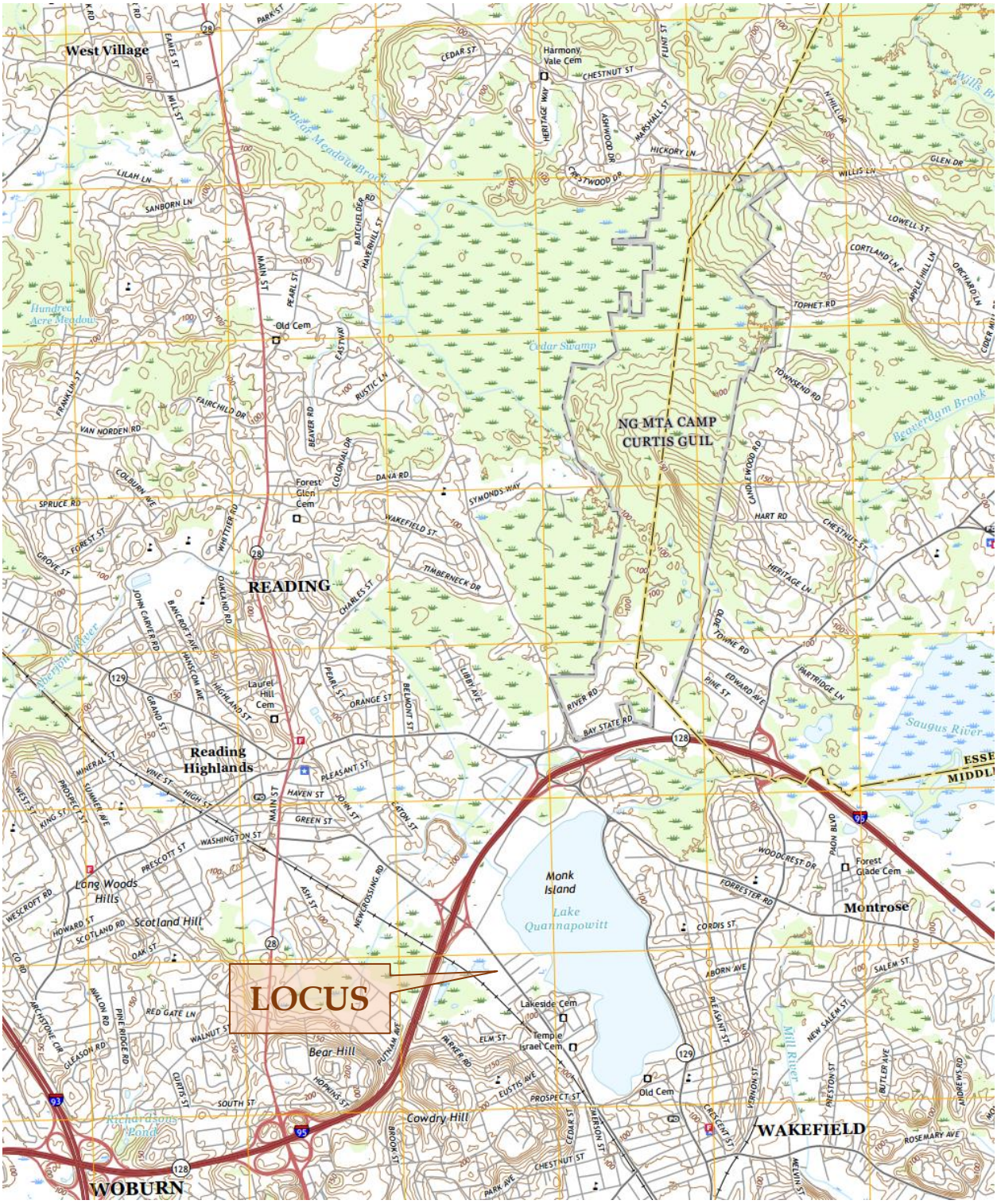
Components of an "environment-friendly" roadway deicing salt storage facility include:
the right site = a flat site;
adequate space for salt piles;

storage on a pad (impervious/paved area);
storage under a roof; and
runoff collection/containment.
For more information, see The Salt Storage Handbook, 6th ed. Virginia: Salt Institute, 2006.

Salt Storage Practices of the Massachusetts Highway Department

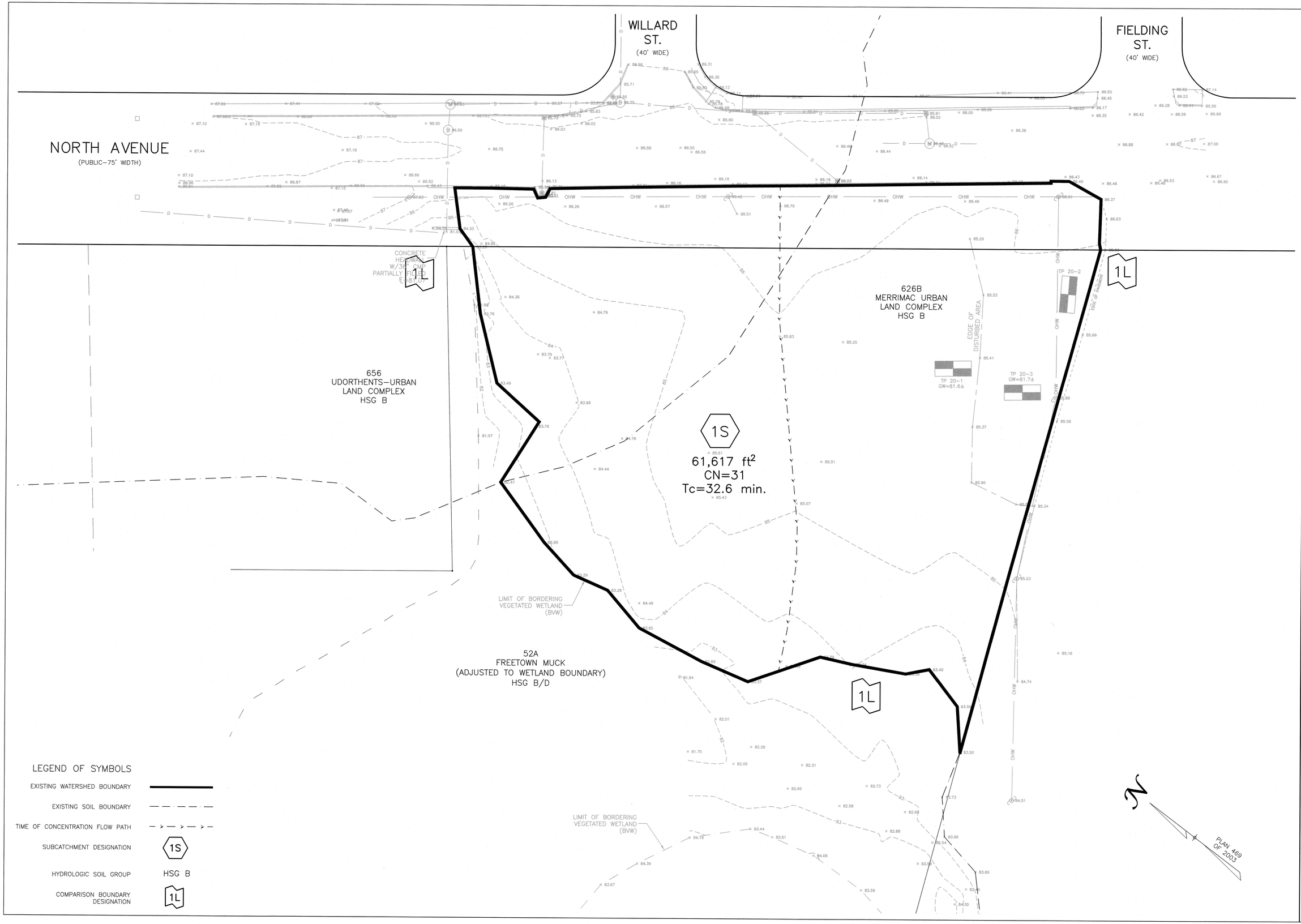
The Massachusetts Highway Department (MHD) has 216 permanent salt storage sheds at 109 locations in the state. On leased land and state land under arteries and ramps, where the MHD cannot build sheds, salt piles are stored under impermeable material. This accounts for an additional 15 sites. The MHD also administers a program to assist municipalities with the construction of salt storage sheds. Of 351 communities, 201 municipalities have used state funds for salt storage facilities.

Appendix A – General Location Map



USGS Locus Map
572-596 North Ave, Wakefield, MA
Reading Quadrangle
10′ contour interval NAVD88

Appendix B – Site Maps



LEGEND OF SYMBOLS

- EXISTING WATERSHED BOUNDARY
- EXISTING SOIL BOUNDARY
- TIME OF CONCENTRATION FLOW PATH
- SUBCATCHMENT DESIGNATION (1S)
- HYDROLOGIC SOIL GROUP (HSG B)
- COMPARISON BOUNDARY DESIGNATION (1L)

WILLIAMS & SPARAGES
ENVIRONMENTAL CONSULTANTS
189 NORTH MAIN STREET
SUITE 101
MIDDLETON, MA 01949
PHONE: (978) 539-8088
FAX: (978) 539-8200
WSENGINEERS.COM

Owner:
Raymond Nickerson
And Dana Lopez
26 Venditto Road
Revere, MA 02151

Applicant:
Raymond Nickerson
And Dana Lopez
26 Venditto Road
Revere, MA 02151

Designed By: MEM
Drawn By: MEM
Reviewed By: CPS
Project Manager: CPS
Job File Number: WAKE-0070
Drawing File Folder: WAKE70

Drawing Issued for Review
Drawing Issued for Permit
Drawing Issued for Construction

SEAL

COMMONWEALTH OF MASSACHUSETTS
MATTHEW E. MOORE
No. 45885
REGISTERED PROFESSIONAL ENGINEER
10.24.2022

EXISTING CONDITION WATERSHED MAP
NORTH APARTMENTS
572–596 NORTH AVE, WAKEFIELD, MA

12			
11			
10			
9			
8	10/20/2022	Town Comments	3
7	9/8/2022	Layout/Grading/Utilities	2
6			1
5			
4			
3			
2			
1			

0' 10' 20' 40'
SCALE: 1"=20'

DECEMBER 2, 2020

DRAWING: W1.1

SHEET 1 OF 1

WILLARD ST. (40' WIDE)

FIELDING ST. (40' WIDE)

NORTH AVENUE (PUBLIC–75' WIDTH)

11S
1,386 ft² CN= Tc=6.0 min.

5S
4,281 ft² CN=71 Tc=6.0 min.

6S
1,635 ft² CN=76 Tc=6.0 min.

7S
1,660 ft² CN=76 Tc=6.0 min.

8S
2,932 ft² CN=92 Tc=6.0 min.

9S
543 ft² CN=77 Tc=6.0 min.

10S
2,088 ft² CN=61 Tc=6.0 min.

4S
15,476 ft² CN=62 Tc=10.3 min.

3S
11,756 ft² CN=98 Tc=6.0 min.

2S
4,033 ft² CN=88 Tc=6.0 min.

1S
15,827 ft² CN=93 Tc=6.0 min.

2L

1L

5P

4P

3P

2P

1P

CONCRETE HEADWALL W/36" CMP PARTIALLY FILLED IE=81.07

656
UDORTHENTS–URBAN LAND COMPLEX
HSG B

626B
MERRIMAC–URBAN LAND COMPLEX
HSG B

LIMIT OF BORDERING VEGETATED WETLAND (BVW)

52A
FREETOWN MUCK
(ADJUSTED TO WETLAND BOUNDARY)
HSG B/D

LEGEND OF SYMBOLS

- PROPOSED WATERSHED BOUNDARY
- EXISTING SOIL BOUNDARY
- TIME OF CONCENTRATION FLOW PATH
- SUBCATCHMENT DESIGNATION (1S)
- HYDROLOGIC SOIL GROUP: HSG B
- COMPARISON BOUNDARY DESIGNATION (1L)

PLAN 469 OF 2003

WILLIAMS & SPARAGES
ENGINEERS PLANNERS SURVEYORS
189 NORTH MAIN STREET
SUITE 101
MIDDLETON, MA 01949
PHONE: (978) 539-8088
FAX: (978) 539-8200
WSENGINEERS.COM

Owner:
Raymond Nickerson
And Dana Lopez
26 Venditto Road
Revere, MA 02151

Applicant:
Raymond Nickerson
And Dana Lopez
26 Venditto Road
Revere, MA 02151

Designed By: MEM
Drawn By: MEM
Reviewed By: CPS
Project Manager: CPS
Job File Number: WAKE-0070
Drawing File Folder: WAKE70

Drawing Issued for Review
Drawing Issued for Permit
Drawing Issued for Construction

SEAL

COMMONWEALTH OF MASSACHUSETTS
MATTHEW E. MOORE
No. 43585
REGISTERED PROFESSIONAL ENGINEER

10.24.2022

12		
11		
10		
9		
8	10/20/2022	Town Comments
7	9/8/2022	Layout/Grading/Utilities
6		
5		
4		
3		
2		
1		

PROPOSED CONDITION WATERSHED MAP
NORTH APARTMENTS
572–596 NORTH AVE, WAKEFIELD, MA

0' 10' 20' 40'
SCALE: 1"=20'

DECEMBER 2, 2020

DRAWING: W1.2

SHEET 1 OF 1

Appendix C – Soil Logs

Commonwealth of Massachusetts
City/Town of Wakefield

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

A. Facility Information

Raymond Nickerson
Owner Name

0 North Avenue
Street Address

2A-016-47B
Map/Lot #

Wakefield
City

MA
State

01742
Zip Code

B. Site Information

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

2. Soil Survey Available? ☒ Yes ☐ No If yes: NRCS WEB SOIL SURVEY 626B Soil Map Unit

Merrimac-Urban land complex
Soil Name

Excessively drained
Soil Limitations

Sandy and gravelly glaciofluvial deposits
Soil Parent material

Outwash plain
Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: MassGIS Oliver
Year Published/Source

Sand and Gravel
Map Unit

Sand and Gravel
Description of Geologic Map Unit:

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

5. Within a velocity zone? ☐ Yes ☒ No

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

7. Current Water Resource Conditions (USGS): 11/3/20
Month/Day/ Year
Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Wakefield

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: 20-1 (Hole #) | 11/3/20 (Date) | 9:00AM (Time) | Sun, 50 (Weather) | 42.513282 (Latitude) | -71.085644 (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3% (Slope (%))

Description of Location: Woodland area behind Highland & Main Street along railroad

2. Soil Parent Material: Sandy outwash material | Outwash plain (Landform) | FS (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body 100+ feet | Drainage Way 100+ feet | Wetlands 100+ feet | Property Line 10+ feet | Drinking Water Well 100+ feet | Other _____ feet

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: __ Depth Weeping from Pit | 55" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-45	A/Fill	FSL	10YR 2/2 (mixed)								
45-55	Bwb	LS	10YR 6/8								
55-80	C	gLS	2.5Y 6/3	46"	2.5Y 6/1	15%					
					10YR 5/8	20%					

Additional Notes:
Buried concrete around 40"- 45"

Commonwealth of Massachusetts
City/Town of Wakefield

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: 20-2 (Hole #) | 11/3/20 (Date) | 10:00AM (Time) | Sun, 50 (Weather) | 42.513282 (Latitude) | -71.085644 (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) | Grass (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3% (Slope (%))

Description of Location: Woodland area behind Highland & Main Street along railroad

2. Soil Parent Material: Sandy outwash material | Outwash plain (Landform) | FS (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body 100+ feet | Drainage Way 100+ feet | Wetlands 100+ feet | Property Line 10+ feet | Drinking Water Well 100+ feet | Other _____ feet

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

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

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-50	A/Fill	FSL	10YR 2/2 (mixed)								
50-	Refusal	Concrete	N/A								

Additional Notes:
Buried concrete impenetrable by smaller machine – started to see sandier material beneath corners of concrete however. Unable to determine ESHGW.

Commonwealth of Massachusetts
City/Town of Wakefield

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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: 20-3 (Hole #) | 11/3/20 (Date) | 9:00AM (Time) | Sun, 50 (Weather) | 42.513282 (Latitude) | -71.085644 (Longitude:)

1. Land Use: Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) | Grass/edge of disturbed (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3% (Slope (%))

Description of Location: Woodland area behind Highland & Main Street along railroad

2. Soil Parent Material: Sandy outwash material | Outwash plain (Landform) | FS (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body 100+ feet | Drainage Way 100+ feet | Wetlands 100+ feet | Property Line 10+ feet | Drinking Water Well 100+ feet | Other _____ feet

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: __ Depth Weeping from Pit | 56" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-36	A/Fill	FSL	10YR 2/2 (mixed)								
36-41	Bwb	LS	10YR 6/8								
41-82	C	gLS	2.5Y 6/3	44"	2.5Y 6/1	15%					
					10YR 5/8	20%					

Additional Notes:
Buried concrete around 40"- 45"

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D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # 20-1	Obs. Hole # 20-3
☐ Depth observed standing water in observation hole	__ inches	__ inches
☐ Depth weeping from side of observation hole	_____ inches	_____ inches
☒ Depth to soil redoximorphic features (mottles)	46 inches	44 inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

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

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

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

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

☐ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)?	Upper boundary:	_____ inches	Lower boundary:	_____ inches
c. If no, at what depth was impervious material observed?	Upper boundary:	_____ inches	Lower boundary:	_____ inches

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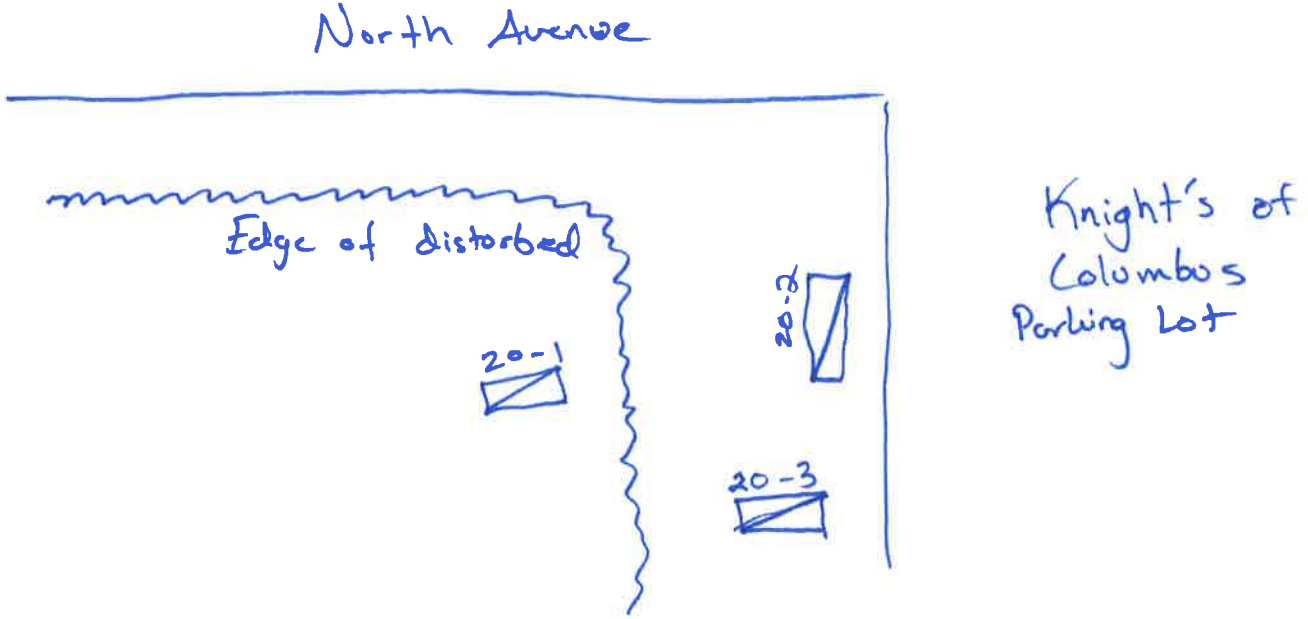
F. Certification

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

Signature of Soil Evaluator	11/11/2020 Date
Thorsen Akerley / #14016 Typed or Printed Name of Soil Evaluator / License #	6/30/2022 Expiration Date of License
William Renault Name of Approving Authority Witness	Wakefield Engineering Department Approving Authority

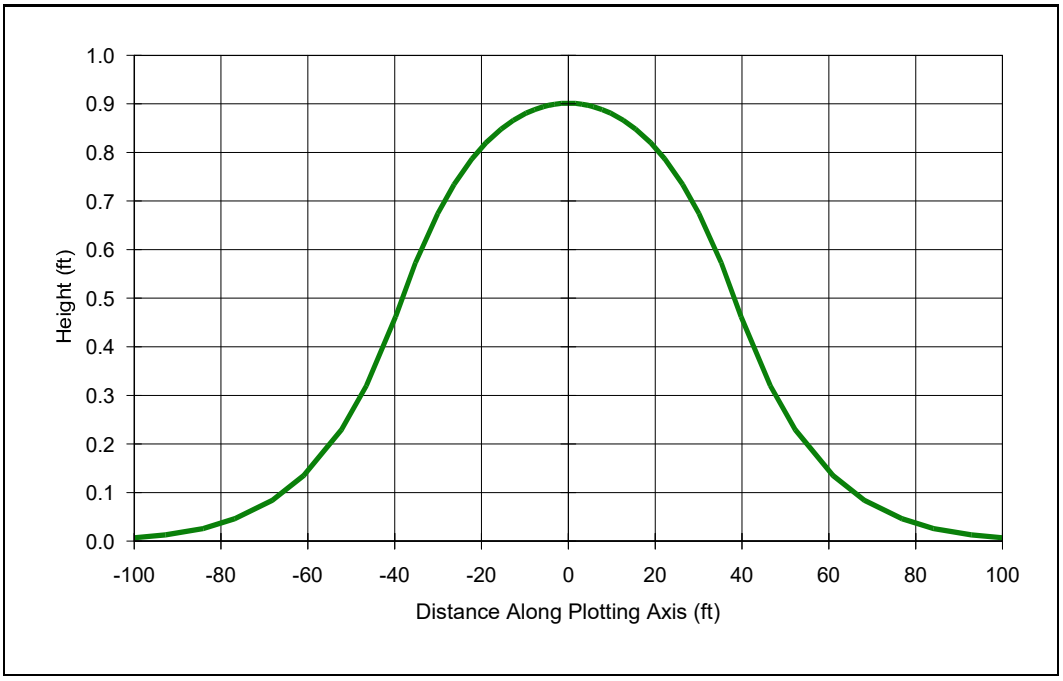
Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:



Appendix D – Groundwater Mounding Analysis

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Williams & Sparages

PROJECT: Contech 21" CMP

ANALYST: MEM

DATE: 10/24/2022 TIME: 7:04:15 AM

INPUT PARAMETERS

Application rate: 0.27 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.22
Hydraulic conductivity: 4.82 ft/day
Initial saturated thickness: 25 ft
Length of application area: 77 ft
Width of application area: 59 ft
No constant head boundary used
Plotting axis from Y-Axis: 0 degrees
Edge of recharge area:
positive X: 0 ft
positive Y: 38.5 ft
Total volume applied: 1226.61 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
0	-100	-100	0.01
0	-84.1	-84	0.03
0	-68.2	-68	0.08
0	-52.3	-52	0.23
0	-39.8	-40	0.46
0	-30.1	-30	0.67
0	-22.2	-22	0.79
0	-15.5	-15	0.85
0	-9.7	-10	0.88
0	-5.8	-6	0.89
0	-3.2	-3	0.9
0	0	0	0.9
0	3.2	3	0.9
0	5.8	6	0.89
0	9.7	10	0.88
0	15.5	15	0.85
0	22.2	22	0.79
0	30.1	30	0.67
0	39.8	40	0.46
0	52.3	52	0.23
0	68.2	68	0.08
0	84.1	84	0.03
0	100	100	0.01