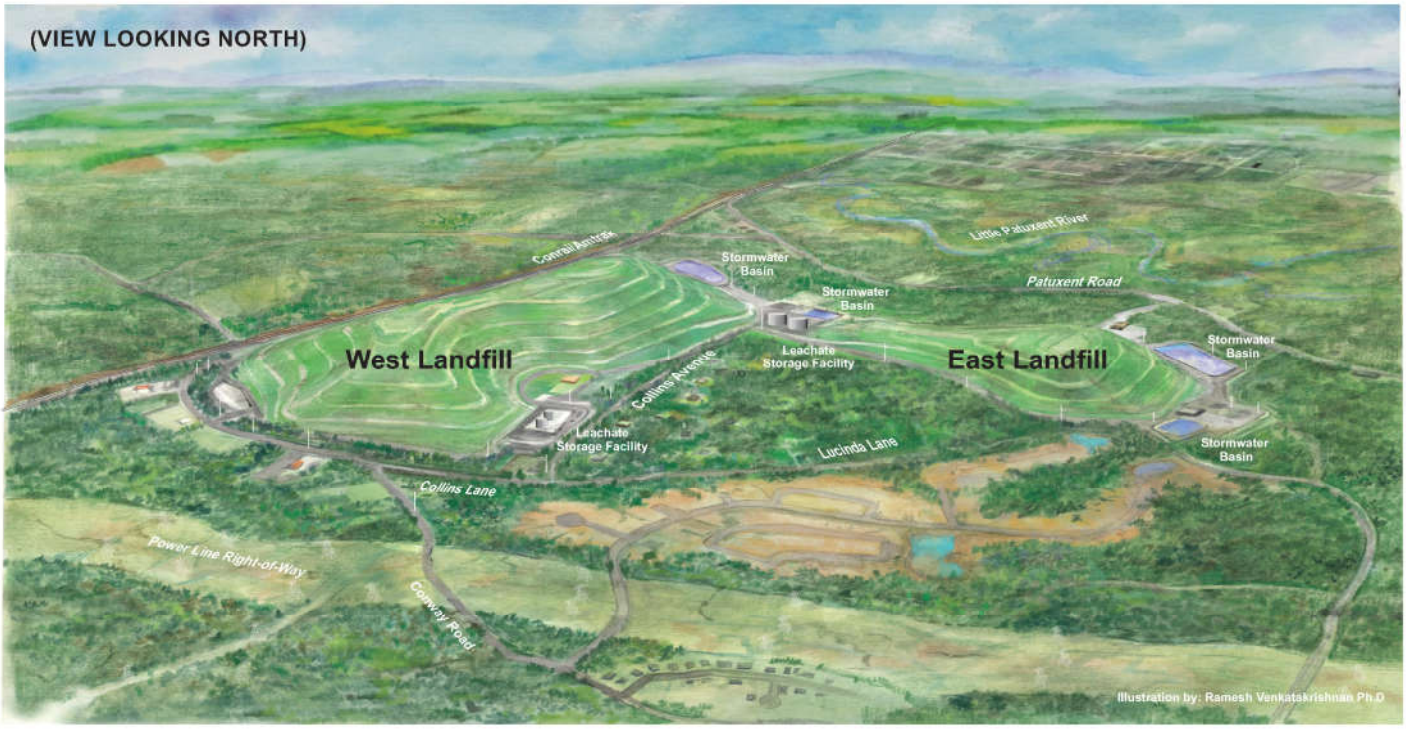
R E V I S E D
PHASE III PERMIT APPLICATION
FOR
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

VOLUME 3 OF 3



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JULY, 2020

PROJECT NO. 2018-3854 **REVISED JANUARY 14, 2022**

PROFESSIONAL ENGINEER'S CERTIFICATION

I hereby certify that these documents entitled *"Revised Phase III Permit Application for Chesapeake Terrace Rubble Landfill, Anne Arundel County, Maryland"* Revised January 14, 2022, were prepared by me, or under my direct supervision, and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 21681, Expiration Date: August 11, 2023.

1/14/22

Paul G. Stratman, P.E.
January 14, 2022

PHASE III PERMIT APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

TABLE OF CONTENTS

SECTION 17

STORMWATER MANAGEMENT

TABLE OF CONTENTS

LIST OF ATTACHMENTS

17.0 SURFACE WATER MANAGEMENT SYSTEM

As part of the design of the landfill and associated improvements, stormwater management features were designed. These features included perimeter channels, terraces and downchutes, roadside channels, roadway crossing culverts, and four (4) stormwater management detention basins and a water quality basin along the East Entrance Road. This design confirmed that the peak stormwater runoff rates from the proposed improvements during the 25-year and 100-year, 24-hour storm events will be less than the existing conditions of the site for the same storm events.

This narrative presents the supporting technical rationale behind the design of the new features.

17.1 Design Criteria for Surface Water Management System

The primary objective of the surface water management system is to convey rainwater off the landfill cap surface quickly and effectively. Since the surface water management features are to perform in support of a landfill, the modeled design storms selected as the 25-year, 24-hour storm event, which has a corresponding rainfall depth of 5.9 inches for this County, while giving consideration to the 100-year, 24-hour storm event, based on the NOAA (National Oceanic and Atmospheric Administration) Atlas 14 rainfall value of 8.5 inches.

Water quality impacts from the proposed improvements were provided in accordance with the 2000 Maryland Stormwater Design Manual Unified Stormwater Sizing Criteria (revised May 2009).

17.2 Existing Conditions

17.2.1 Climate

The mean annual precipitation for this area is approximately 45 inches, while the mean annual evaporation from lakes and shallow reservoirs is approximately 37 inches (Viessman et al., 1989). Gabler, et al. (1987), describe this climate as “humid subtropical” in the Köppen classification, with a growing season of approximately 170 days.

17.2.2 Soils

The Site’s historical use for mining classifies the Site soil profile as “manmade.” The Soil Conservation Service categorizes soils hydrologically into four types (A through D, from permeable to impermeable) based upon the soil’s ability to drain. Based on site-specific information, a hydrologic soil type of “C” was assumed for the existing capped conditions.

17.2.3 Land Use

The existing land use of the project area is undeveloped with a significant portion of the area wooded. (The site has been subject to surface mining operations in the past that have created irregular grading of the site.) The site generally slopes from west to east towards wetland areas along Patuxent Road, and drains to the Little Patuxent River.

17.3 Stormwater Management

In order to design new features at the site for the landfill use, the surface water runoff flow rates were determined for each surface water feature using methods described in Urban Hydrology for Small Watersheds, identified as Technical Release 55 (or TR-55), developed by the Soil Conservation Service (June 1986). This runoff rate was used to back-calculate the required geometric configuration for the new features.

The Program HydroCAD Version 8.50 was utilized to perform the stormwater analysis of the site to document compliance with the peak runoff rate requirements for each feature.

The following sections define the methods and input parameters used to evaluate the performance of the surface water management system and resulting design of the proposed repairs.

Runoff rates calculated from TR-55 were utilized to design the proposed stormwater management basins for the project. Basin routing calculations for the basins were performed to show compliance with the peak rate requirements during the 25-year and 100-year storm events.

17.3.1 Stormwater Management – Input Parameters

The input parameters for the TR-55 calculations consist of the following:

- Watershed delineation
- Watershed areas
- Curve numbers
- Times of concentration
- Storm type
- Design storm event

These input parameters are described in the following paragraphs.

Watershed Delineation
Watersheds for each drainage feature were delineated using the Site topographic maps at a contour interval of 2 feet. Off-site portions of the watersheds were delineated from 2011 topographic survey data downloaded from the County's website. The outlet points for each watershed were typically selected as the points of discharge from the five basins (Point of Study).

Watershed Areas
After performing the watershed delineation, the drainage area to each basin was determined within AutoCAD.

Curve Numbers
The curve number (CN), which assists in the estimation of the runoff, was evaluated using the projected future land uses in combination with the soil descriptions and hydrologic classifications. The CN values were obtained from the CN tables presented in the manual for TR-55. The curve numbers were calculated by overlaying the watershed areas over the soils data and aerial photography of the area. Existing conditions cover type for the site consisted of

Woods in good condition. Offsite existing conditions consisted of Woods in good condition, and a composite curve number value based upon the zoning. The two zoning areas were RA and R-2. For the proposed conditions, the onsite areas consisted of impervious areas, woods, good condition for undisturbed areas, Open Space, Good for disturbed areas to be maintained as grass, and the Closure Cap areas. Offsite areas curve numbers matched the existing conditions. The Cap was assumed to be a D soil type. All disturbed areas were reduced one hydrologic soil group in the proposed condition.

Time of Concentration

The time of concentration for each watershed was determined by evaluating the time that is required for water to travel from the hydrologically most distant point in the watershed to the discharge point. After selecting this point, the time of concentration was estimated by summing the travel times for sheet flow, shallow concentrated flow, channel flow, and pipe flow, where applicable. The calculations for these travel times were performed using methods outlined in the manual for TR-55. All of these computations involve the surface roughness, the length and the slope of the path selected. Sheet flow length was calculated for a maximum length of 100 feet. Shallow concentrated flow and trapezoidal channel flow were the other types of flow modeled in the time of concentration calculations.

Storm Type

The intensity and pattern of a storm varies, depending upon the Site's location relative to geographic features, such as mountains, large waterbodies, etc. TR-55 defines four storm types (I, II, IIA, and III) and maps the geographic regions where each type occurs. The storm type for this county is Type II, which represents the most intense short duration rainfall storm type of the four available.

Design Storm Event

Design storm events can last from 1 minute to 24 hours with a recurrence interval of 1 year to 500 years. EPA CFR Title 40 § 264.301 and §258.26 requires that surface water is managed based upon a 25-year, 24-hour storm event. Although not required for the Site, the 100-year, 24-hour storm event based upon NOAA Atlas 14 rainfall data was also modeled for conservatism. The NOAA Atlas 14 100-year 24-hour storm of 8.5 inches of rain for Anne Arundel County was selected over MDE's Unified Stormwater Sizing Criteria value of 7.4 inches for a 100 year 24-hour storm event, providing a larger volume for modeling.

A formal discussion as well as copies of the references are included in Attachment 17A.

17.4 Stormwater Management – Analysis Results

After developing the input parameters described above, the storm water analyses were performed for existing and proposed conditions. First, the watershed area, curve number, time of concentration, and storm type for existing conditions were input into the program HydroCAD 8.50. The output from this program is a runoff hydrograph based upon the TR-55 methodology for each watershed that provides the peak stormwater runoff rates for each watershed and corresponding drainage feature

17.4.1 Existing Conditions

The existing peak runoff rate to each point of study was utilized to provide the maximum runoff rate allowed to discharge from the proposed condition discharge points for ready comparison.

The formal calculation and supporting HydroCAD model for the existing conditions are provided in Attachment 17B.

Discharge Point	25 year, 24 hour Peak Flow (cfs)	100 year, 24 hour Peak Flow (cfs)
1	178.07	358.75
2	58.42	109.65
3	105.36	244.80
4	124.88	259.87
Subtotal	466.73	973.07
Conrail	22.09	48.87
East Entrance (incl WQv area)	389.64	739.58
TOTAL	**810.82**	**1,629.55**

17.4.2 Basin Routing

The watershed area, curve number, time of concentration, and storm type for the proposed conditions to each point of study were input into the program HydroCAD 8.50. Stage-Storage-Discharge calculations for the five (5) proposed basins (one (1) water quality basin and four (4) detention basins) were entered into the program, and a dynamic routing of each basin performed. The discharge from each basin along with the unmanaged area within each point of study were added together within the program and compared to the existing conditions peak rate to ensure the proposed conditions peak rate is less than the existing conditions peak rate for both design storms so as to not negatively impact the downstream hydrologic system.

Feature	Basin No. 1	Basin No. 2	Basin No. 3	Basin No. 4	WQv
Bottom of Basin (ft MSL)	79.0	72.0	72.0	76.5	88.0
Top of Wet Storage (ft MSL)	81.0	74.0	74.0	78.5	N/A
Invert of low flow Orifice (ft MSL)	81.0	74.0	74.0	78.5	88.0
Size of low flow Orifice (inches)	9	8	6	6	3
Elevation of Riser (ft MSL)	84.5	77.0	77.0	83.6	89.5
Dimensions of Riser (ft x ft)	3 x 6.5	3 x 6.5	3 x 6.5	7 x 10	4 x 4
Shape of Riser	rectangle	rectangle	rectangle	rectangle	rectangle
Invert of Emergency Spillway (ft MSL)	90.0	78.0	78.5	88.15	90.8
Width of Emergency Spillway (ft)	250	45	100	90	20
25-year, 24-hour storm event routing					
Peak Qin (cfs)	386.46	49.6	195.44	186.05	19.12
Peak Qout (cfs)	140.81	3.75	54.16	95.11	15.6
Max Water Surface Elev (ft MSL)	86.60	77.06	77.89	84.49	90.11
Riser Engaged?	Yes	Yes	Yes	Yes	Yes
Emergency Spillway Engaged?	No	No	No	No	No
% Reduction	64	92	72	49	18
Total Qout = 309.43 cfs					

Feature	Basin No. 1	Basin No. 2	Basin No. 3	Basin No. 4	WQv
100-year, 24-hour storm event routing					
Peak Qin (cfs)	672.36	110.04	314.99	399.01	32.48
Peak Qout (cfs)	255.13	58.51	193.46	184.84	26.48
Max Water Surface Elev (ft MSL)	90.22	77.93	79.10	88.13	91.10
Riser Engaged?	Yes	Yes	Yes	Yes	Yes
Emergency Spillway Engaged?	Yes	No	Yes	No	Yes
% Reduction	62	47	59	54	18
Total Qout = 718.42 cfs					

The analysis is presented in Attachment 17C.

17.4.3 Channel Design

The peak runoff rate to each channel was calculated with the TR-55 methodology described above. The runoff rates were then used to determine the drainage channel configuration, using Manning's Equation for open channel flow, where:

$$Q = \frac{1.49}{n} S^{1/2} R_h^{2/3} A$$

such that:

Q	=	runoff rate (cfs)
n	=	Manning's roughness coefficient
S	=	channel longitudinal slope (ft/ft)
R_h	=	hydraulic radius (ft) = A/P
A	=	area of flow
P	=	wetted perimeter

17.4.3.1 Channel and Culvert - Input Parameters

The input parameters for the TR-55 calculations and Manning's equation consist of the following:

- Manning's roughness coefficient
- Channel slope
- Channel geometry

These input parameters are described in the following sections.

Manning's Roughness Coefficient

In order to design the channels, which convey runoff from the Landfill, the Manning's roughness coefficient was required. This coefficient is related to the resistance provided by the type and condition of the channel lining. For example, a concrete lined channel has a lower roughness coefficient than a grass lined channel. This coefficient inversely impacts the flow capacity of the channel.

Channel Slope
The channel slope directly impacts the channel capacity and velocity. As a result, it is required input information. The channel slope is determined by dividing the elevation difference by the channel length. A channel slope must be selected to ensure positive drainage, and to assess the channel cross-section and channel velocity.

Channel Geometry
The channel geometry directly impacts the channel capacity. Therefore, the channel shape and dimensions are input. Several channel configurations were evaluated to select the most efficient channel geometry.

17.4.3.2 Channel –Analyses Results

After developing all of the input parameters described above, the storm water analyses were performed. First, the peak rates of discharge were calculated as described above for the 25-year and 100-year storm events. The runoff rates were developed using HydroCAD, V 8.5 and are presented in Attachment 17D.

The minimum channel design flow depth required to convey the peak runoff rate was back-calculated using Manning's equation for open channel flow incorporating the channel slope, the channel lining (i.e., Manning's roughness coefficient), and various geometric configurations. The channel depth was calculated by adding the design flow depth to an appropriate freeboard (0.5 feet), and then rounding this sum to the nearest tenth-foot. Freeboard is the unused capacity in the channel under the defined flow rate. This avoids channels flowing bank full during storms. Bank full channels can be overtopped, are blown by wind, and can over-saturate underlying soils. The proposed configuration of the channels is a trapezoidal channel lined with articulated concrete block.

Four types of channels will be used: terraces, downchutes, access road channels, and perimeter channels. The terraces will convey stormwater runoff horizontally from the landfill slope faces to downchutes. The downchutes will convey the water down the exterior slopes of the landfill cells to the perimeter channel, which will convey the water to the basins. The access road channels is located along the inside edge of the final cover access road and typically discharges into a downchute, at locations where the access road crosses the downchute.

A summary of the resulting channel sizes are below:

Channel ID	Channel Dimensions			25-year, 24-hour storm event		100-year, 24-hour storm event	
	Base Width	Depth	Side Slope	Qout (cfs)	V (fps)*	Qout (cfs)	V (fps)*
DOWNCHUTES							
DC- 1	15.3	1.0	2H:1V	60.95	12.1	94.79	14.4
DC- 2	13.8	1.0	2H:1V	54.36	12.0	85.88	14.3
DC- 3	17.9	1.0	2H:1V	70.96	12.1	113.02	14.4
DC- 4	13.8	1.0	2H:1V	49.88	11.6	80.10	13.9
DC- 5	13.8	1.0	2H:1V	51.59	11.8	82.86	14.1
DC- 6	17.9	1.0	2H:1V	68.55	11.9	107.42	14.2
DC- 7	17.9	1.0	2H:1V	65.04	11.9	103.58	14.0
DC- 8	17.9	1.0	2H:1V	59.62	11.4	100.17	13.8
DC- 9	12.4	1.0	2H:1V	47.30	11.8	74.71	14.0
DC- 10	16.5	1.0	2H:1V	58.89	11.6	93.03	14.0
DC- 20	11.0	1.0	2H:1V	35.77	11.0	57.44	13.3
DC- 21	15.1	1.0	2H:1V	53.31	11.6	85.62	13.9
DC- 22	9.6	1.0	2H:1V	29.30	10.7	47.05	12.8
DC- 23	11	1.0	2H:1V	42.90	11.9	68.89	13.9
PERIMETER CHANNELS							
PC- 1	9.6	2.5	2H:1V	64.62	5.7	158.72	6.6
PC-2	4.1	2.0	2H:1V	31.83	5.7	57.96	6.6
PC-3A	4.1	2.0	2H:1V	15.97	6.4	24.83	7.6
PC- 3B	9.6	2.0	2H:1V	80.84	7.7	128.22	4.7
PC- 3C	13.8	2.6	2H:1V	140.25	8.2	228.15	9.0
PC- 3D	15.1	2.6	2H:1V	197.64	7.0	319.29	9.7
PC- 3E	15.1	3.2	2H:1V	282.93	9.1	455.14	10.6
PC- 4A	4.1	2.0	2H:1V	40.72	6.1	63.32	6.9
PC- 4B	13.8	2.0	2H:1V	109.16	7.2	170.64	8.4
PC- 4C	13.8	2.5	2H:1V	160.59	7.7	253.31	8.9
PC- 4D	15.1	2.8	2H:1V	210.30	8.8	333.21	10.2
PC- 4E	15.1	3.3	2H:1V	281.05	9.1	445.99	10.5
PC- 4F	15.1	3.5	2H:1V	347.91	9.7	552.08	11.2
PC- 5	9.6	2.2	2H:1V	81.01	8.9	126.24	10.3
PC- 6	8.3	2.0	2H:1V	24.00	7.4	65.73	10.5
PC- 7	2.8	2.0	2H:1V	17.34	8.9	26.77	10.1
PC- 8A	2.8	2.0	2H:1V	36.51	7.2	57.29	8.1
PC- 8B	8.3	2.0	2H:1V	113.80	8.4	180.49	9.3
PC- 8C	17.9	2.2	2H:1V	279.88	8.1	444.63	9.4
PC- 9A	8.3	2.6	2H:1V	48.18	5.4	76.42	6.2
PC- 9B	9.6	2.6	2H:1V	91.08	6.4	145.31	7.4
PC- 9C	13.8	2.6	2H:1V	122.84	4.6	195.09	5.3
PC- 10	9.6	2.0	2H:1V	68.46	8.4	164.87	11.2

This analysis is presented in Attachment 17F.

The final terrace design is: Triangular channel,
4H:1V on one side; 10H:1V on the other
1 foot deep.
Grassed lined.

The final cover access road channel will be the following configuration:

Trapezoidal channel,
4H:1V on one side; 2H:1V on the other
3 foot base width
1 foot deep.
Grassed lined.

17.4.4 Culvert - Analyses Results

The runoff rates developed from TR-55, ran through HydroCAD, were used to size the culverts within the channels using the nomographs provided by smooth-walled HDPE drainage pipe manufacturers. The culverts are to be used at the road crossings of downchutes and perimeter channels. In the perimeter channels culverts will be covered and used as a driveway to access the leachate pump buildings.

Culvert ID	Inflow Channel	25-year, 24-hour Q (cfs)	100-year, 24-hour Q (cfs)	Culvert Dimensions		
				Culvert Dia	# Culverts	Material
1	PC-5	418.56	673.39	60 inches	2	HDPE
2	PC-4F	347.91	552.08	30-inches	4	HDPE
3	PC-10	68.46	164.87	48-inches	1	HDPE
4	PC-8C	279.9	444.63	54-inches	2	HDPE
5	PC-2	31.8	57.96	24-inches	2	HDPE
6	PC-1	44.0	101.3	30-inch	2	HDPE
7	PC-6	24.0	65.73	30-inch	1	HDPE
8	Off-site flow to Basin 4	186.05	399.01	48-inches	1	HDPE
AR-1	DC-2	67	106	24-inches	3	HDPE
AR-2	1/2 DC-1	30	47	18-inches	2	HDPE
AR-4 3	PC-8A	36.5	57.3	24-inches	2	HDPE

Note: Modification of the landfill slopes from 33% to 25% reduced the number of top of cap access culverts. Therefore, there are now only 3 AR Culverts (2 on the West Area and 1 on the East Area).

This analysis is presented in Attachment 17F.

17.4.5 Water Quality

The methodology described within Chapter 2 – Unified Stormwater Sizing Criteria from the 2000 Maryland Stormwater Design Manual (Manual, revised May 2009) was utilized to calculate the required and provided water quality for the project. The purpose of the unified sizing criteria are to “meet pollutant removal goals, maintain groundwater recharge, reduce channel erosion,

prevent overbank flooding, and pass extreme floods." These requirements are met by designing stormwater management features that meet the Water Quality Volume, Recharge Volume, and Channel Protection Storage Volume.

17.4.5.1 Water Quality Volume

The Water Quality Volume (WQv) is based upon the following equation:

WQV = [(P)(Rv)(A)] /12, where

P= rainfall depth in inches and is equal to 1.0 inches
Rv=volumetric runoff coefficient = 0.05 + 0.009(I)
A=area in acres
I=percent impervious cover

In addition, a minimum WQv of 0.2 inches per acre shall be met at sites or in drainage areas that have less than 15% impervious cover. The WQv is required to be controlled only for the specific project and not for off-site areas.

17.4.5.2 Recharge Volume

The recharge volume is a fraction of the WQv and is dependent on the pre-evelopment soil hydrologic group. It is based upon the following equation:

Rev=[(S)(Rv)(A)]/12, where

S=soil specific recharge factor in inches (0.38, 0.26, 0.13, or 0.07 for A, B, C, or D soils, respectively)
Rv=volumetric runoff coefficient = 0.05 + 0.009(I)
A=area in acres
I=percent impervious cover

Per the Manual "(t)he recharge volume is considered part of the total WQv that must be provided at a site and can be achieved either by a structural practice (e.g., infiltration, bioretention), a nonstructural practice (e.g., buffers, disconnection of rooftops), or a combination of both."

We have designed structural practices (detention basins) with dead storage to meet both the recharge volume and water quality volume requirements

This analysis is presented in Attachment 17G

17.5 Soil Loss

As part of this design effort, the existing conditions were evaluated for potential soil loss. The method of evaluation is the Universal Soil Loss Equation (USLE):

A = RK(LS)CP (tons/acre/year), where

A = Annual soil loss (tons/acre/year)
R = rainfall and runoff erosivity factor
K = soil erodibility
LS = slope length and steepness factor
C = cover-management factor
P = practice factor

per the USEPA guidance document titled "Evaluating Cover Systems for Solid and Hazardous Waste," 1982.

Based upon the soil erosion potential of the modeled conditions, the USLE calculations indicate that, with the existing Site topography and soil types, the potential for soil erosion can be reduced by maintaining a good stand of vegetation (i.e. >75% cover) on the existing clayey cover soils. The potential soil losses for the modeled, well vegetated existing conditions was approximately 1.86 tons/acre/year for the maximum inclination location (see Attachment 17G). This is consistent with the USEPA recommended guidance value of less than 2 tons/acre/year (USEPA, 1982).

17.6 Conclusion

The post-construction peak discharge rates for the 25-year and 100-year storm events is less than peak discharge rates under existing conditions.

Condition	**25-year, 24-hour storm event Qout (cfs)**	**100-year, 24-hour storm event Qout (cfs)**
Existing (prior to landfill construction)	466.73	973.07
Proposed (after closure)	309.43	718.42
Proposed < Existing??	Yes	Yes
% Reduction	34	26

ATTACHMENT 17A

Design Storm Selection

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Design Storm Rainfall Depth		
	Job No. 2018-3854	**Made by:** RP	**Date** 07-04-20
	Ref.	**Checked by:** VEF	**Sheet** 1 of 2

Reviewed by PGS 08/27/2021

Objective: To determine the rainfall depth associated with the design storms.

Design Approach and Assumptions:

One of the requirements of COMAR 26.04.07 and 40 CFR 257 is the management of surface water run-on from upgradient sources and the management of stormwater runoff from landfills. 40 CFR 257 and 258 list requirements for coal-combustion residual and municipal solid waste facilities. 40 CFR 258.26 (a) specifically requires

> "(1) A run-on control system to prevent flow onto the active portion of the landfill during the peak discharge from a 25-year storm;
> (2) A run-off control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm."

As this is a Rubble Waste facility, these federal requirements are not applicable. However, they are relevant and appropriate. Thus, surface water/stormwater runoff controls at the Chesapeake Terrace Rubble Landfill were designed for the 25-year, 24 hour storm event.

In light of the increased intensity of rainfall events and record rainfall in 2018, for due diligence, the stormwater management features will also be evaluated for the 100, year 24-hour storm event

Review of the available literature to determine the rainfall associated with each storm event:

Source	25-year, 24 hour storm event Rainfall (inches)	100 Year, 24-hour storm event Rainfall (inches)
Anne Arundel County Design Manual (inches)	5.9	7.4
MD Stormwater Manual 2009	N/A	6.2
NOAA Atlas 14	6.2	8.5

Conclusions:

Use the rainfall depths shaded in blue for the design storms.

e. Time of Concentration

The methods described in the latest version of TR-55 shall be used to compute time of concentration in each sub-area. The maximum length of overland flow shall be 200 feet.

f. Reach Routing

Reach routing shall be computed in accordance with procedures found in the latest TR-20 manual. Rating curves for representative cross-sections shall be derived using Manning's Equation for normal depth, or backwater computations from HEC-2.

g. Structure Routing

The TR-20 storage-indication routing shall be used for structure routing. Provide a schematic diagram for the TR-20 run. A sketch of the device's controls shall be included in the design computations with performance curves plotted.

h. Rainfall

The following rainfall depths shall be used in hydrologic computations:

Frequency	24 Hour - Type II Storm Rainfall
1 year	2.7"
2 year	3.3"
5 year	4.3"
10 year	5.2"
25 year	5.9"
50 year	6.5"
100 year	7.4"

Free Board Hydrograph Storm (NRCS National Engineering Handbook)

Antecedent Moisture Condition (AMC) II and the NRCS Type II Rainfall Distribution shall be used for all design analysis.

D. Construction Drawings

1. Stormwater Management Plans

a. Review Submittals

The owner shall make the following submittals to PACE for review:

Unified Stormwater Sizing Criteria

Chapter 2.0

Table 2.2 Rainfall Depths Associated with the 1,2,10 and 100-year, 24-hour Storm Events

County	Rainfall Depth			
	1 yr - 24 hr	2 yr-24 hr	10 yr-24 hr	100 yr-24 hr
Allegany	2.4 inches	2.9 inches	4.5 inches	6.2 inches
Anne Arundel	2.7	3.3	5.2	7.4
Baltimore	2.6	3.2	5.1	7.1
Calvert	2.8	3.4	5.3	7.6
Caroline	2.8	3.4	5.3	7.6
Carroll	2.5	3.1	5.0	7.1
Cecil	2.7	3.3	5.1	7.3
Charles	2.7	3.3	5.3	7.5
Dorchester	2.8	3.4	5.4	7.8
Frederick	2.5	3.1	5.0	7.0
Garrett	2.4	2.8	4.3	5.9
Harford	2.6	3.2	5.1	7.2
Howard	2.6	3.2	5.1	7.2
Kent	2.7	3.3	5.2	7.4
Montgomery	2.6	3.2	5.1	7.2
Prince George's	2.7	3.3	5.3	7.4
Queen Anne's	2.7	3.3	5.3	7.5
St. Mary's	2.8	3.4	5.4	7.7
Somerset	2.9	3.5	5.6	8.1
Talbot	2.8	3.4	5.3	7.6
Washington	2.5	3.0	4.8	6.7
Wicomico	2.9	3.5	5.6	7.9
Worcester	3.0	3.6	5.6	8.1

NOAA Atlas 14, Volume 2, Version 3
Location name: Odenton, Maryland, USA*
Latitude: 39.0389°, Longitude: -76.7264°
Elevation: 65.6 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.347 (0.315-0.382)	0.415 (0.377-0.457)	0.494 (0.447-0.545)	0.552 (0.499-0.608)	0.624 (0.560-0.688)	0.677 (0.605-0.748)	0.730 (0.649-0.808)	0.780 (0.689-0.867)	0.843 (0.737-0.944)	0.892 (0.773-1.00)
10-min	0.555 (0.503-0.611)	0.664 (0.602-0.731)	0.791 (0.717-0.872)	0.882 (0.797-0.972)	0.994 (0.892-1.10)	1.08 (0.964-1.19)	1.16 (1.03-1.28)	1.24 (1.09-1.38)	1.33 (1.17-1.49)	1.40 (1.22-1.58)
15-min	0.693 (0.629-0.763)	0.835 (0.757-0.919)	1.00 (0.906-1.10)	1.12 (1.01-1.23)	1.26 (1.13-1.39)	1.37 (1.22-1.51)	1.47 (1.30-1.62)	1.56 (1.38-1.74)	1.68 (1.47-1.88)	1.76 (1.53-1.99)
30-min	0.950 (0.862-1.05)	1.15 (1.05-1.27)	1.42 (1.29-1.57)	1.62 (1.46-1.78)	1.87 (1.68-2.06)	2.06 (1.84-2.27)	2.25 (2.00-2.49)	2.43 (2.15-2.70)	2.67 (2.33-2.99)	2.85 (2.48-3.21)
60-min	1.19 (1.08-1.31)	1.45 (1.31-1.59)	1.82 (1.65-2.01)	2.11 (1.90-2.32)	2.49 (2.23-2.74)	2.79 (2.49-3.08)	3.09 (2.75-3.42)	3.41 (3.01-3.79)	3.83 (3.35-4.29)	4.17 (3.61-4.69)
2-hr	1.40 (1.27-1.55)	1.71 (1.55-1.88)	2.16 (1.96-2.38)	2.51 (2.27-2.77)	3.01 (2.71-3.31)	3.41 (3.05-3.75)	3.83 (3.40-4.22)	4.26 (3.76-4.72)	4.89 (4.25-5.45)	5.38 (4.64-6.05)
3-hr	1.52 (1.38-1.67)	1.84 (1.67-2.04)	2.34 (2.12-2.58)	2.73 (2.46-3.01)	3.28 (2.94-3.62)	3.74 (3.33-4.13)	4.22 (3.73-4.67)	4.74 (4.14-5.26)	5.47 (4.72-6.11)	6.07 (5.17-6.83)
6-hr	1.87 (1.71-2.07)	2.27 (2.06-2.51)	2.87 (2.60-3.17)	3.36 (3.03-3.71)	4.08 (3.65-4.51)	4.70 (4.17-5.19)	5.37 (4.71-5.95)	6.09 (5.29-6.78)	7.16 (6.11-8.04)	8.06 (6.78-9.11)
12-hr	2.28 (2.05-2.56)	2.75 (2.48-3.09)	3.50 (3.14-3.93)	4.14 (3.70-4.64)	5.12 (4.52-5.74)	5.98 (5.23-6.71)	6.94 (5.98-7.80)	8.01 (6.81-9.04)	9.64 (8.01-11.0)	11.1 (9.02-12.6)
24-hr	2.65 (2.41-2.93)	3.20 (2.92-3.55)	4.12 (3.75-4.56)	4.92 (4.46-5.44)	6.16 (5.53-6.77)	7.26 (6.47-7.95)	8.50 (7.50-9.28)	9.92 (8.65-10.8)	12.1 (10.4-13.1)	14.0 (11.8-15.1)
2-day	3.07 (2.79-3.39)	3.71 (3.38-4.10)	4.76 (4.33-5.26)	5.67 (5.13-6.25)	7.03 (6.32-7.72)	8.22 (7.34-9.01)	9.54 (8.45-10.4)	11.0 (9.66-12.1)	13.3 (11.4-14.5)	15.2 (12.9-16.6)
3-day	3.23 (2.94-3.56)	3.91 (3.57-4.31)	5.01 (4.56-5.52)	5.95 (5.40-6.55)	7.37 (6.65-8.08)	8.61 (7.71-9.42)	9.98 (8.87-10.9)	11.5 (10.1-12.6)	13.8 (12.0-15.1)	15.8 (13.6-17.3)
4-day	3.39 (3.10-3.74)	4.10 (3.76-4.53)	5.25 (4.80-5.78)	6.24 (5.68-6.85)	7.71 (6.97-8.45)	8.99 (8.08-9.83)	10.4 (9.29-11.4)	12.0 (10.6-13.1)	14.4 (12.5-15.7)	16.5 (14.2-18.0)
7-day	3.94 (3.61-4.32)	4.74 (4.35-5.21)	5.99 (5.49-6.57)	7.07 (6.46-7.73)	8.67 (7.87-9.46)	10.0 (9.07-11.0)	11.6 (10.4-12.6)	13.3 (11.8-14.4)	15.8 (13.8-17.2)	17.9 (15.6-19.6)
10-day	4.49 (4.13-4.89)	5.39 (4.97-5.87)	6.73 (6.19-7.33)	7.85 (7.20-8.54)	9.48 (8.66-10.3)	10.8 (9.86-11.8)	12.3 (11.1-13.3)	13.9 (12.5-15.1)	16.2 (14.4-17.6)	18.2 (16.0-19.8)
20-day	6.05 (5.62-6.52)	7.20 (6.69-7.76)	8.70 (8.08-9.37)	9.92 (9.19-10.7)	11.6 (10.7-12.5)	13.0 (11.9-14.0)	14.4 (13.2-15.5)	15.9 (14.5-17.1)	18.0 (16.2-19.3)	19.6 (17.6-21.1)
30-day	7.48 (6.97-8.02)	8.84 (8.26-9.49)	10.5 (9.81-11.3)	11.9 (11.1-12.7)	13.7 (12.7-14.7)	15.2 (14.1-16.3)	16.7 (15.4-17.9)	18.3 (16.8-19.6)	20.4 (18.6-21.9)	22.0 (19.9-23.7)
45-day	9.40 (8.83-10.0)	11.1 (10.4-11.8)	13.0 (12.2-13.8)	14.4 (13.5-15.3)	16.3 (15.3-17.3)	17.8 (16.6-18.9)	19.2 (17.9-20.4)	20.6 (19.1-21.9)	22.4 (20.7-23.9)	23.7 (21.8-25.4)
60-day	11.2 (10.6-11.9)	13.2 (12.4-14.0)	15.2 (14.3-16.1)	16.8 (15.8-17.8)	18.8 (17.6-19.9)	20.3 (19.0-21.4)	21.7 (20.3-23.0)	23.0 (21.5-24.4)	24.8 (23.0-26.3)	26.0 (24.1-27.6)

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

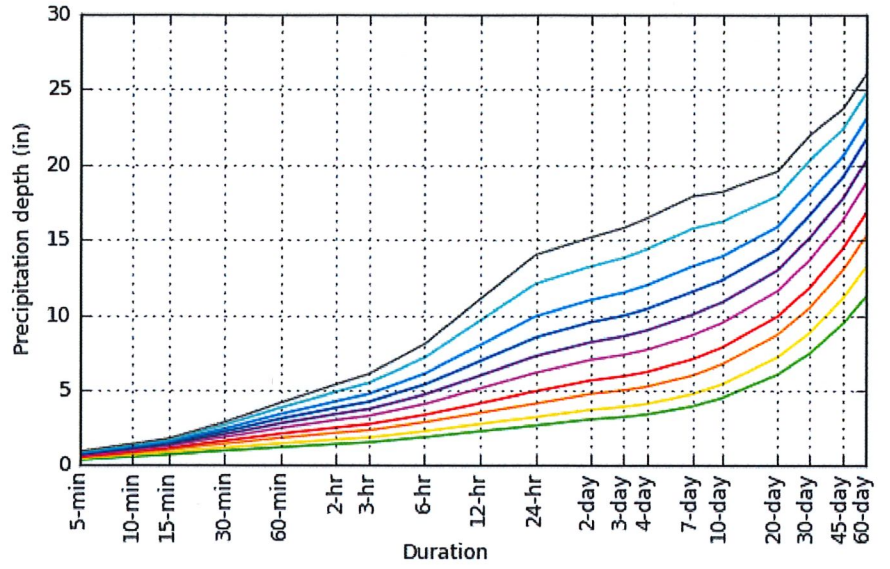
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

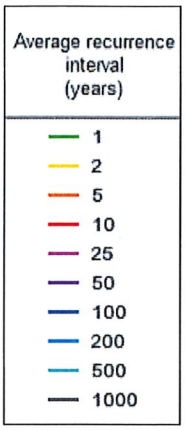
Please refer to NOAA Atlas 14 document for more information.

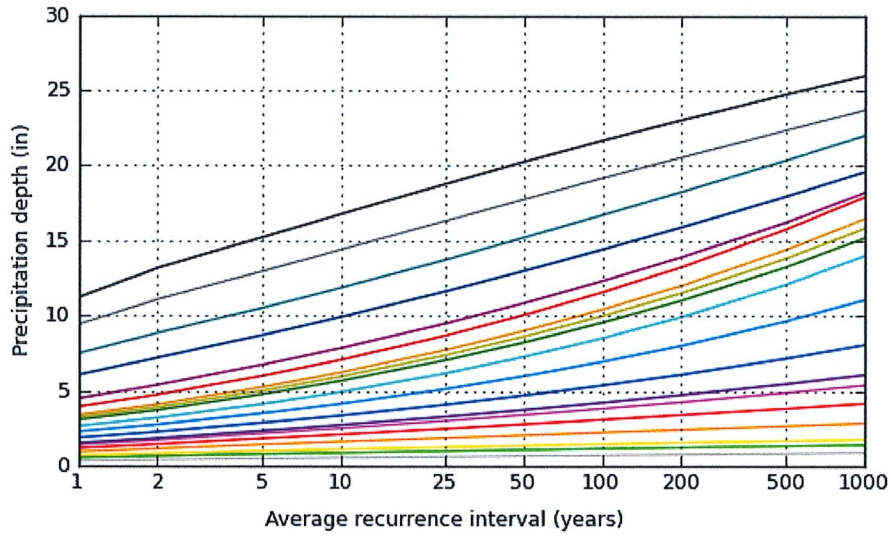
Back to Top

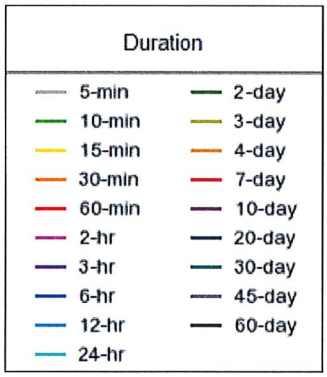
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.0389°, Longitude: -76.7264°







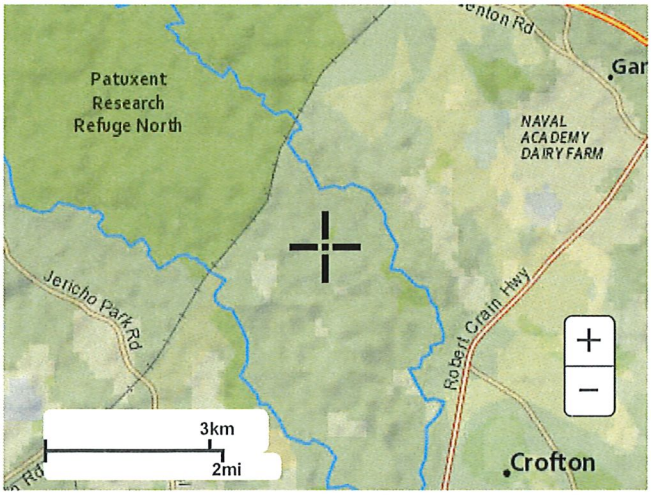


NOAA Atlas 14, Volume 2, Version 3 Created (GMT): Tue Mar 12 16:20:25 2019

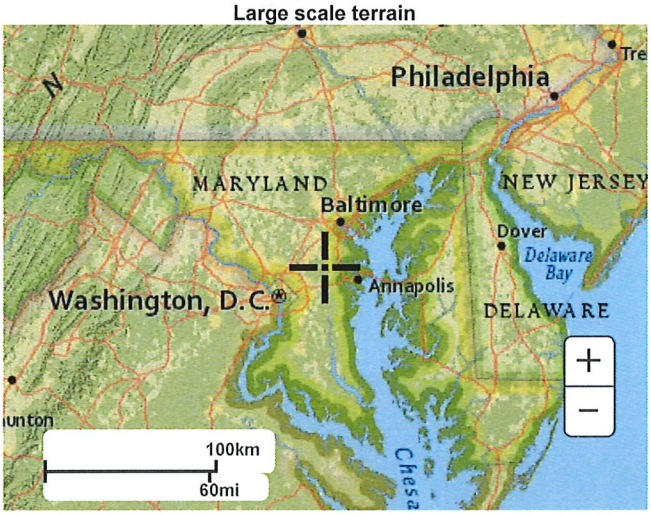
Back to Top

Maps & aerials

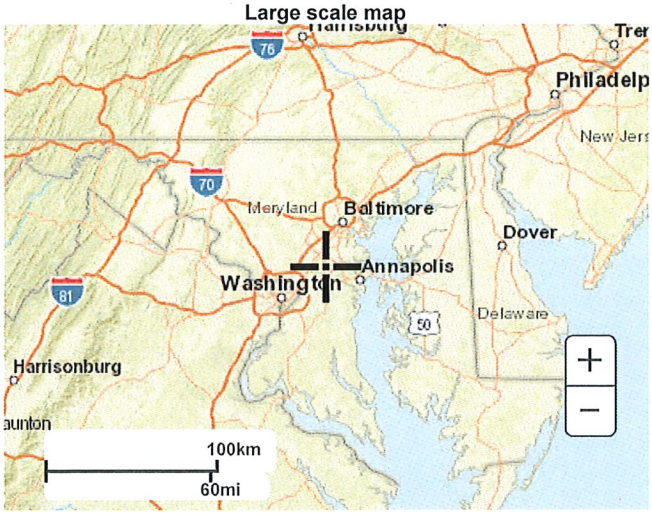
Small scale terrain



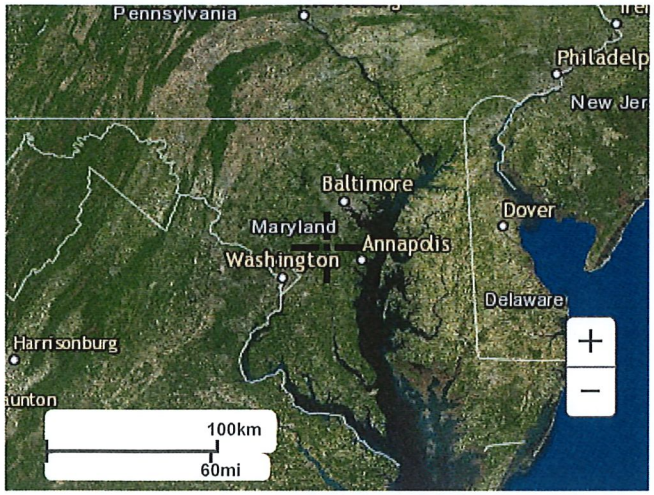
Large scale terrain



Large scale map



Large scale aerial



Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

ATTACHMENT 17B

Existing Conditions

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Stormwater Management – Existing Conditions		
	Job No. 2018-3854	**Made by:** RP	**Date** 07-15-20
	Ref.	**Checked by:** VEP	**Sheet** 1 of 1

Reviewed by PGS 08/27/2021

Objective: The objective of this analysis is to estimate the existing conditions stormwater runoff at the discharge points which align with the future stormwater management basin locations.

Design Approach and Assumptions:

Use HydroCad, a computer software which implements the principles of TR-55 and TR-20 for larger drainage areas. The input data for each is as follows:

1) Drainage areas – determine the contributing drainage area to the discharge location based upon the topographic data of the area. Use the "area" function in AutoCAD to find the area of the drainage area boundary.
2) Based on the soils types and the vegetative cover, determine the areas of multiple soil types and cover conditions in each drainage area. Aerial photographs visible through GoogleEarth along with pictures of the site taken by team members were used to review the vegetative cover. Calculate a "weighed" curve number. HYDroCAD actual does this calculation for you.
3) Determine the time of concentration for water to flow from the longest distance (in time) from the outlet. Measure the length and slope of the tc flow path and the surface condition.
4) Although the site is location along the eastern seaboard, this is a Type II storm event because the DelMarVa peninsula shields it from the affects of the ocean.
5) Determine the peak flows for the 25-year, 24 hour (5.9 inches of rain) and 100 year, 24 hour (8.5 inches of rain) storm events.

Calculations:

Attached is a summary table of the input data to the HydroCAD program and the computer printout for evaluation for the design storm events.

Conclusions:

A summary of the discharge from the site under existing conditions is provided in the table below.

Discharge Point	25 year, 24 hour Peak Flow (cfs)	100 year, 24 hour Peak Flow (cfs)
1	178.07	358.75
2	58.42	109.65
3	105.36	244.80
4	124.88	259.87
Subtotal	466.73	973.07
Conrail	22.09	48.87
East Entrance (incl WQv area)	389.64	739.58
TOTAL	**810.82**	**1,629.55**

References:

1. HydroCAD, V8.5.

EXISTING CONDITIONS

CONRAIL

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS	492,929	165,243	0	327,686	0	492,929
OFFSITE						
WOODS						
RA						
R-2						
TOTAL	492,929					492,929

Discharge Pt 1 (BASIN 1)

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS	4,652,379	743,289	0	3,361,697	547,393	4,652,379
OFFSITE	768,602					
WOODS		37,872	0	44,000	11,366	93,238
RA		381,005	59,413	234,946	0	675,364
R-2		0	0	0	0	0
TOTAL	5,420,981					5,420,981

Discharge Pt 2 (BASIN 2)

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS		80,990		739,718	99,116	919,825
OFFSITE						
LOD						0
RA						0
R-2						0
TOTAL	0					919,825

Discharge Pt 3 (BASIN 3)

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS		994,213	0	1,781,386	294,248	3,069,847
OFFSITE						
WOODS						0
RA		682,280	54,406	81,022	92,696	910,404
R-2						0
TOTAL						3,980,251

Discharge Pt 4 (BASIN 4)

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS	636,520	78,295	22,838	416,198	119,189	636,520
OFFSITE	3,093,191					
WOODS						0
RA		911,186	281,741	75,531	0	1,268,458
R-2		545,259	676,106	321,526	281,842	1,824,732
TOTAL	3,729,710					3,729,710

Discharge Pt 5 (WQv FACILITY)

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS	131,621	29,870	71,699	30,052	0	131,621
OFFSITE	10,252,576					
LOD		95,827	91,822	223,317	39,093	450,060
RA						0
R-2		3,240,207	2,914,445	2,748,808	899,056	9,802,517
TOTAL	10,384,197					10,384,198

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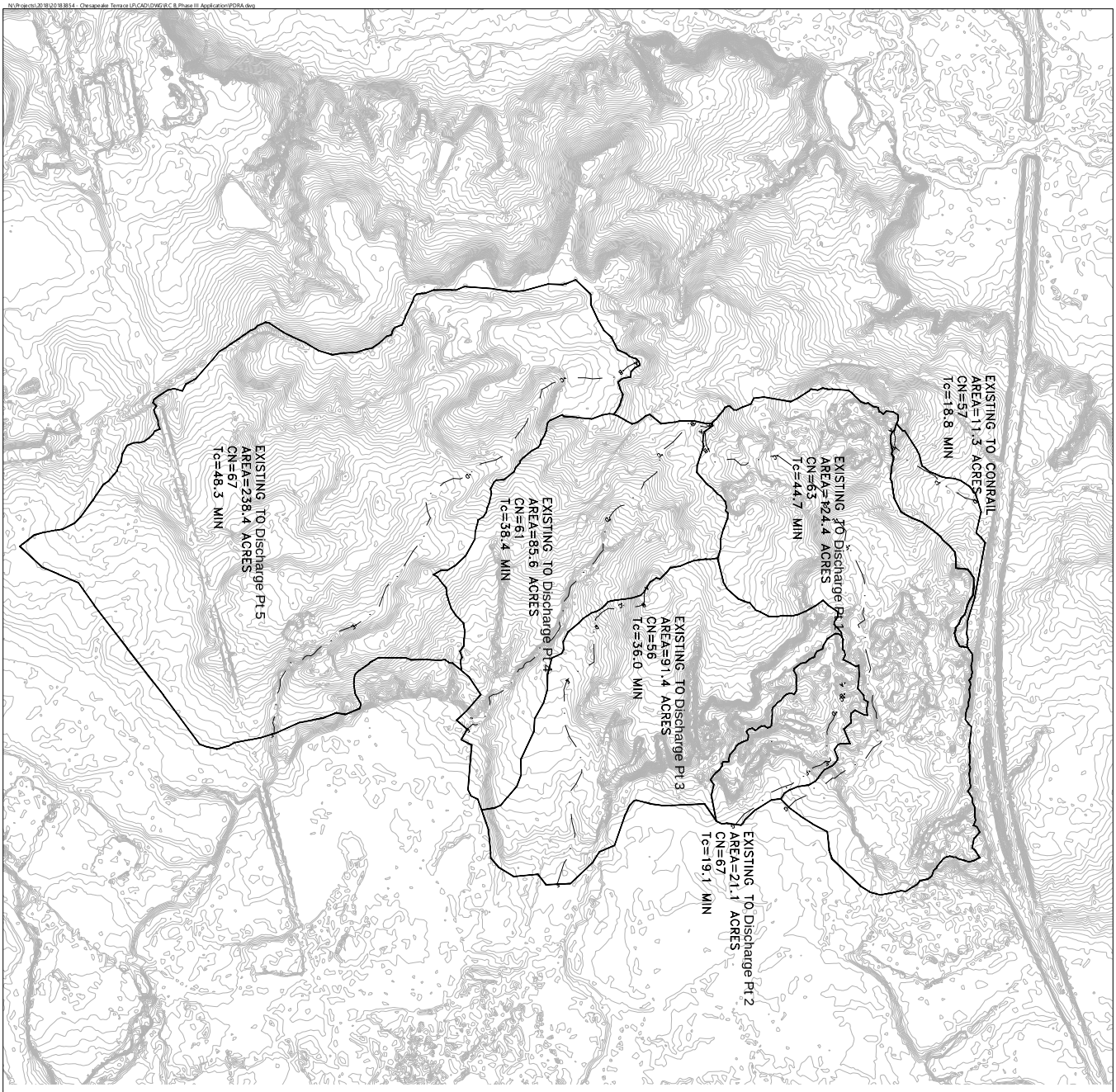
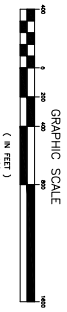




DA-1

EXISTING DRAINAGE AREA PLAN

PROJECT MANAGER:	VEF	SCALE:	AS SHOWN
CHECKED BY:	VEF	PROJECT NUMBER:	2018-3854
DRAWN BY:	EEE	DATE:	

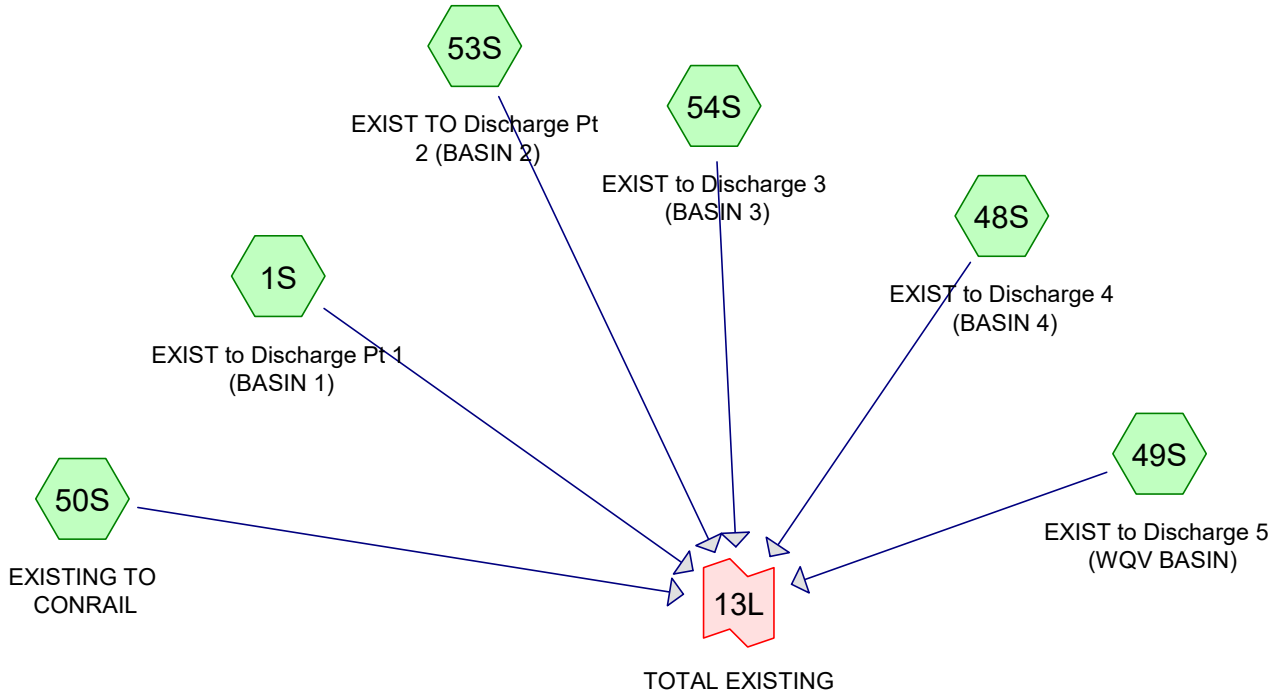
ADVANCED GeoServices
A Montrose Environmental Group company

1008 ANDREW DRIVE, SUITE A, WEST CHESTER PA, 19380
tel 610.840.9100 fax 610.840.9199 www.advancedgeoservices.com

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

DATE:	REVISION:

VERONICA E. FOSTER
LICENSED PROFESSIONAL ENGINEER
MD # 35645



Subcat Reach Pond Link

Drainage Diagram for CT_Existing condtions_07152020
Prepared by {enter your company name here}, Printed 7/18/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
48.023	30	Woods, Good, HSG A (1S,48S,49S,50S,53S,54S)
2.200	30	Woods, Good, HSG A (OFFSITE LOD) (49S)
0.869	30	Woods, Good, HSG A (OFFSITE) (1S)
45.328	42	RA ZONING A SOILS (1S,48S,54S)
86.902	50	R2 ZONING, A SOILS (48S,49S)
2.170	55	Woods, Good, HSG B (48S,49S)
2.108	55	Woods, Good, HSG B (OFFSITE LOD) (49S)
9.081	64	RA ZONING B SOILS (1S,48S,54S)
82.427	70	R2 ZONING, B SOILS (48S,49S)
152.819	70	Woods, Good, HSG C (1S,48S,49S,50S,53S,54S)
5.127	70	Woods, Good, HSG C (OFFSITE LOD) (49S)
1.010	70	Woods, Good, HSG C (OFFSITE) (1S)
8.988	76	RA ZONING C SOILS (1S,48S,54S)
24.332	77	Woods, Good, HSG D (1S,48S,53S,54S)
0.897	77	Woods, Good, HSG D (OFFSITE LOD) (49S)
0.261	77	Woods, Good, HSG D (OFFSITE) (1S)
70.485	80	R2 ZONING, C SOILS (48S,49S)
2.128	82	RA ZONING D SOILS (54S)
27.109	85	R2 ZONING, D SOILS (48S,49S)
572.264		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
51.092	HSG A	1S, 48S, 49S, 50S, 53S, 54S
4.278	HSG B	48S, 49S
158.956	HSG C	1S, 48S, 49S, 50S, 53S, 54S
25.490	HSG D	1S, 48S, 49S, 53S, 54S
332.448	Other	1S, 48S, 49S, 54S
572.264		**TOTAL AREA**

Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EXIST to Discharge Pt Runoff Area=124.449 ac 0.00% Impervious Runoff Depth=2.11"
Flow Length=4,561' Tc=39.7 min CN=63 Runoff=178.07 cfs 21.850 af

Subcatchment 48S: EXIST to Discharge 4 Runoff Area=85.621 ac 0.00% Impervious Runoff Depth=1.94"
Flow Length=3,617' Tc=33.5 min CN=61 Runoff=124.88 cfs 13.834 af

Subcatchment 49S: EXIST to Discharge Runoff Area=10,384,180 sf 0.00% Impervious Runoff Depth=2.45"
Flow Length=4,899' Tc=42.5 min CN=67 Runoff=389.64 cfs 48.767 af

Subcatchment 50S: EXISTING TO Runoff Area=492,925 sf 0.00% Impervious Runoff Depth=1.62"
Flow Length=983' Tc=14.9 min CN=57 Runoff=22.09 cfs 1.524 af

Subcatchment 53S: EXIST TO Discharge Pt Runoff Area=21.116 ac 0.00% Impervious Runoff Depth=2.45"
Flow Length=1,689' Tc=19.1 min CN=67 Runoff=58.42 cfs 4.320 af

Subcatchment 54S: EXIST to Discharge Runoff Area=3,980,251 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=3,050' Tc=30.5 min CN=56 Runoff=105.36 cfs 11.708 af

Link 13L: TOTAL EXISTING Inflow=810.82 cfs 102.002 af
Primary=810.82 cfs 102.002 af

Total Runoff Area = 572.264 ac Runoff Volume = 102.002 af Average Runoff Depth = 2.14"
100.00% Pervious = 572.264 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: EXIST to Discharge Pt 1 (BASIN 1)

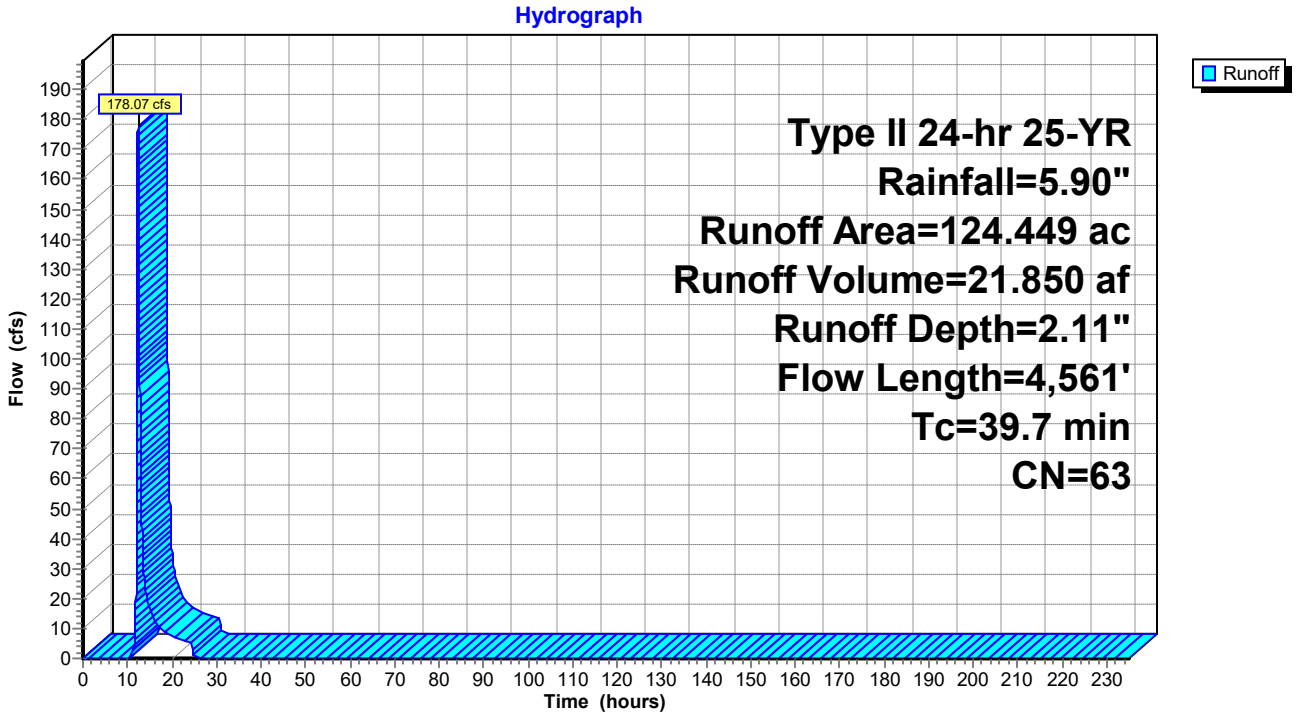
Runoff = 178.07 cfs @ 12.39 hrs, Volume= 21.850 af, Depth= 2.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
	17.064	30	Woods, Good, HSG A
	77.174	70	Woods, Good, HSG C
	12.566	77	Woods, Good, HSG D
*	0.869	30	Woods, Good, HSG A (OFFSITE)
*	1.010	70	Woods, Good, HSG C (OFFSITE)
*	0.261	77	Woods, Good, HSG D (OFFSITE)
*	8.747	42	RA ZONING A SOILS
*	1.364	64	RA ZONING B SOILS
*	5.394	76	RA ZONING C SOILS
	124.449	63	Weighted Average
	124.449		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0600	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.8	735	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.4	597	0.0200	2.28		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
0.4	149	0.1300	5.80		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.6	262	0.0300	2.79		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
15.7	2,718	0.0200	2.88	14.40	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=5.00' D=0.50' Z= 10.0 '/' Top.W=15.00' n= 0.035 Earth, dense weeds
39.7	4,561	Total			

Subcatchment 1S: EXIST to Discharge Pt 1 (BASIN 1)



Summary for Subcatchment 48S: EXIST to Discharge 4 (BASIN 4)

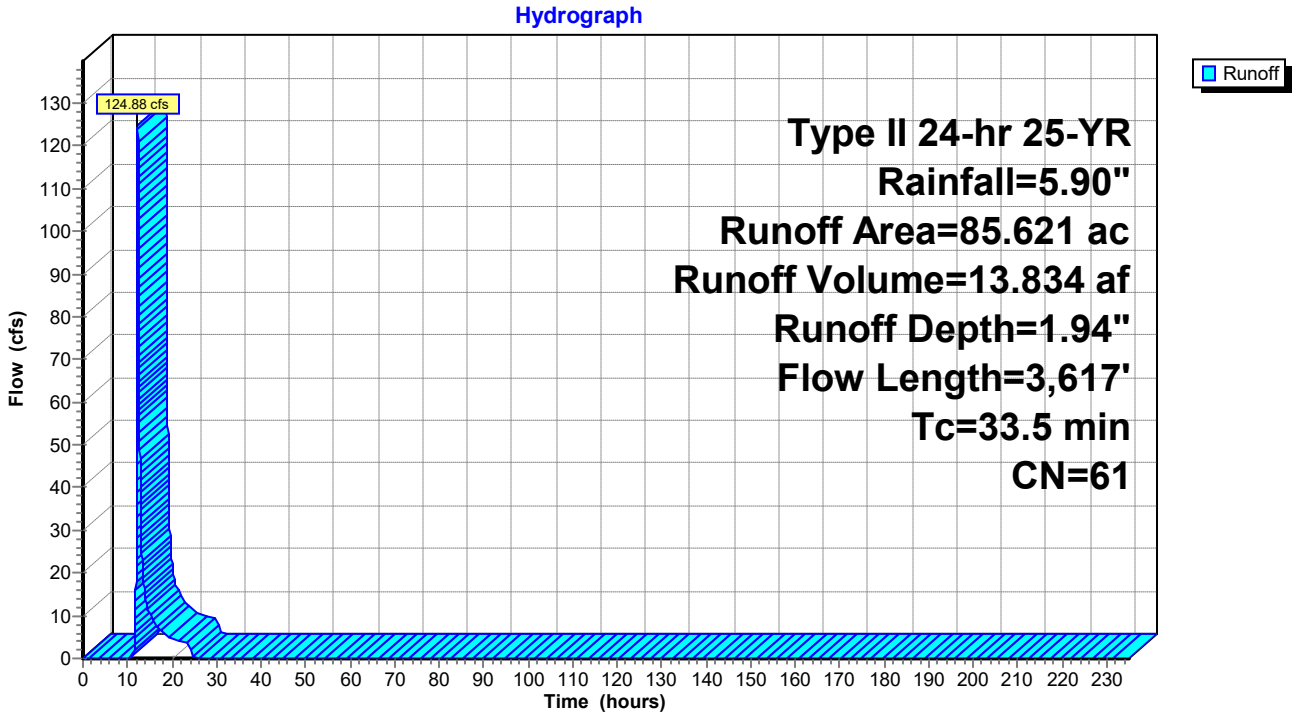
Runoff = 124.88 cfs @ 12.32 hrs, Volume= 13.834 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
	1.797	30	Woods, Good, HSG A
	0.524	55	Woods, Good, HSG B
	9.555	70	Woods, Good, HSG C
	2.736	77	Woods, Good, HSG D
*	20.918	42	RA ZONING A SOILS
*	6.468	64	RA ZONING B SOILS
*	1.734	76	RA ZONING C SOILS
*	12.517	50	R2 ZONING, A SOILS
*	15.521	70	R2 ZONING, B SOILS
*	7.381	80	R2 ZONING, C SOILS
*	6.470	85	R2 ZONING, D SOILS
	85.621	61	Weighted Average
	85.621		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0600	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	466	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
3.1	728	0.0600	3.94		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
13.2	2,323	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
33.5	3,617	Total			

Subcatchment 48S: EXIST to Discharge 4 (BASIN 4)



Summary for Subcatchment 49S: EXIST to Discharge 5 (WQV BASIN)

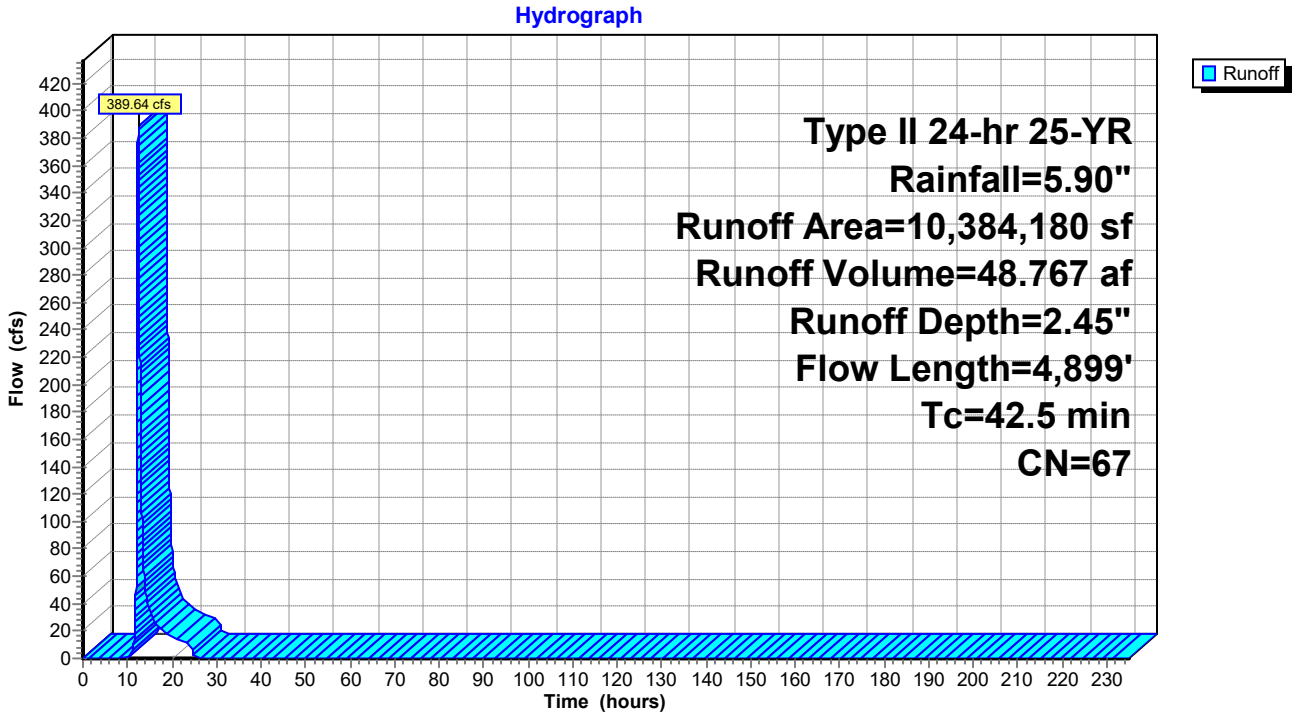
Runoff = 389.64 cfs @ 12.42 hrs, Volume= 48.767 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	29,882	30	Woods, Good, HSG A
	71,700	55	Woods, Good, HSG B
	30,056	70	Woods, Good, HSG C
*	95,832	30	Woods, Good, HSG A (OFFSITE LOD)
*	91,824	55	Woods, Good, HSG B (OFFSITE LOD)
*	223,332	70	Woods, Good, HSG C (OFFSITE LOD)
*	39,073	77	Woods, Good, HSG D (OFFSITE LOD)
*	3,240,211	50	R2 ZONING, A SOILS
*	2,914,425	70	R2 ZONING, B SOILS
*	2,748,810	80	R2 ZONING, C SOILS
*	899,035	85	R2 ZONING, D SOILS
	10,384,180	67	Weighted Average
	10,384,180		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	100	0.0400	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	558	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
5.1	1,221	0.0400	3.98	17.89	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=4.00' D=0.50' Z= 10.0 '/' Top.W=14.00' n= 0.035 Earth, dense weeds
9.8	1,723	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
7.2	1,297	0.0200	2.99	17.96	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=7.00' D=0.50' Z= 10.0 '/' Top.W=17.00' n= 0.035 Earth, dense weeds
42.5	4,899	Total			

Subcatchment 49S: EXIST to Discharge 5 (WQV BASIN)



Summary for Subcatchment 50S: EXISTING TO CONRAIL

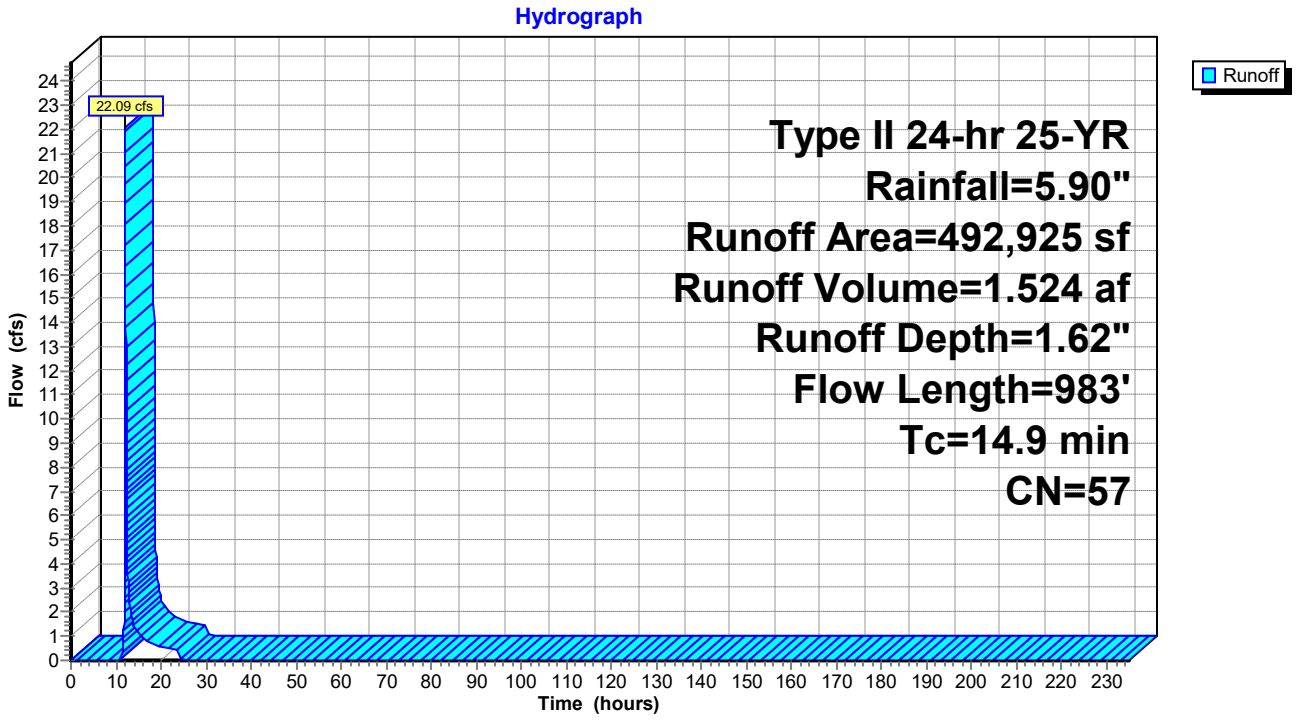
Runoff = 22.09 cfs @ 12.08 hrs, Volume= 1.524 af, Depth= 1.62"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
165,223	30	Woods, Good, HSG A
327,702	70	Woods, Good, HSG C
492,925	57	Weighted Average
492,925		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.1100	0.15		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.9	527	0.0800	4.55		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.1	356	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
14.9	983	Total			

Subcatchment 50S: EXISTING TO CONRAIL



Summary for Subcatchment 53S: EXIST TO Discharge Pt 2 (BASIN 2)

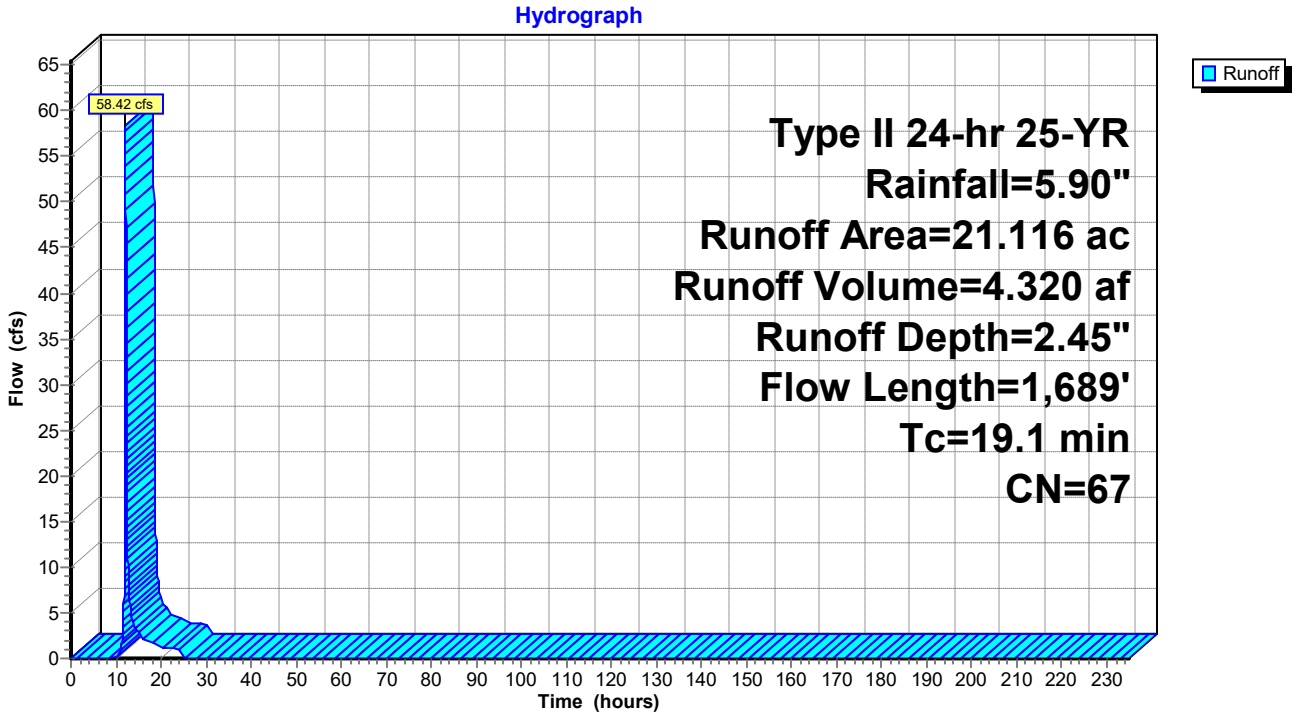
Runoff = 58.42 cfs @ 12.12 hrs, Volume= 4.320 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
1.859	30	Woods, Good, HSG A
16.982	70	Woods, Good, HSG C
2.275	77	Woods, Good, HSG D
21.116	67	Weighted Average
21.116		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	100	0.1300	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	26	0.1900	7.02		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.8	152	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.4	451	0.0100	2.24	9.52	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 5.0 '/' Top.W=11.00' n= 0.035 Earth, dense weeds
0.5	192	0.0800	6.33	26.91	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=6.00' D=0.50' Z= 5.0 '/' Top.W=11.00' n= 0.035 Earth, dense weeds
4.1	768	0.0200	3.12	35.10	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=15.00' D=0.50' Z= 15.0 '/' Top.W=30.00' n= 0.035 Earth, dense weeds
19.1	1,689	Total			

Subcatchment 53S: EXIST TO Discharge Pt 2 (BASIN 2)



Summary for Subcatchment 54S: EXIST to Discharge 3 (BASIN 3)

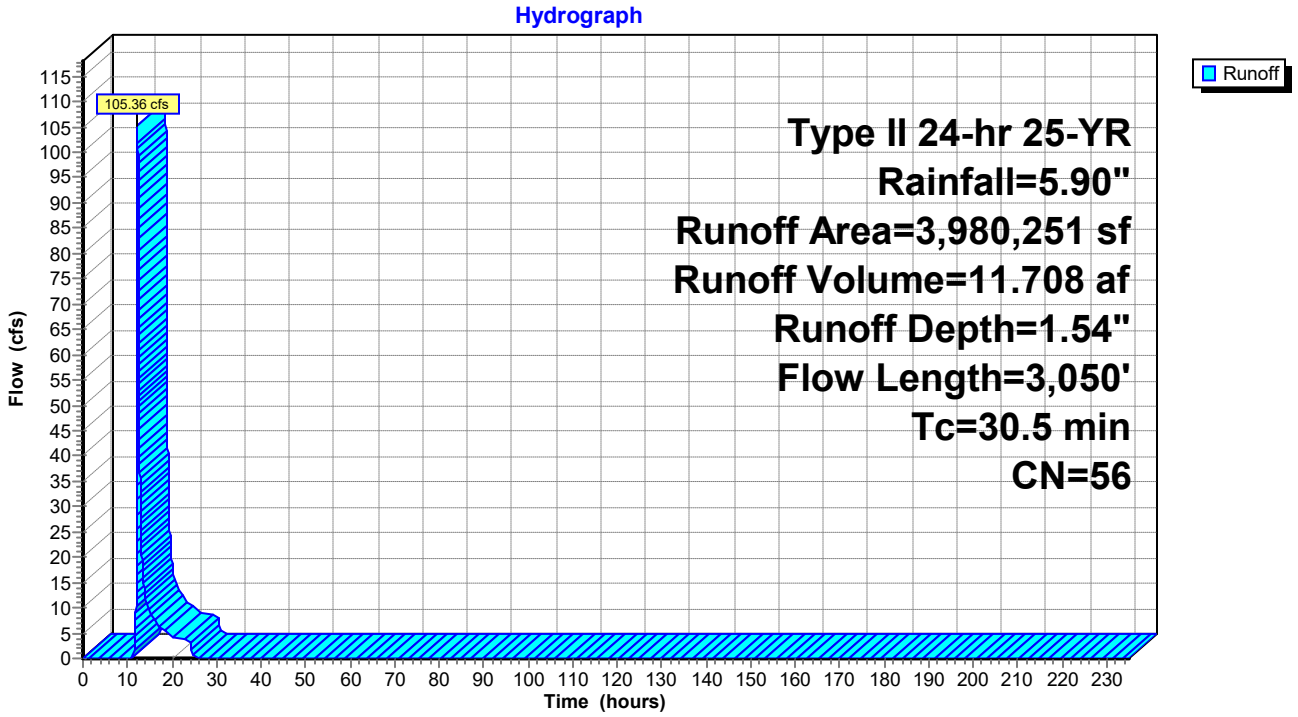
Runoff = 105.36 cfs @ 12.30 hrs, Volume= 11.708 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	994,213	30	Woods, Good, HSG A
	1,781,386	70	Woods, Good, HSG C
	294,248	77	Woods, Good, HSG D
*	682,280	42	RA ZONING A SOILS
*	54,406	64	RA ZONING B SOILS
*	81,022	76	RA ZONING C SOILS
*	92,696	82	RA ZONING D SOILS
	3,980,251	56	Weighted Average
	3,980,251		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.7	247	0.1400	6.02		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.3	328	0.0700	4.26		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.4	576	0.0300	2.79		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
10.2	1,799	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
30.5	3,050	Total			

Subcatchment 54S: EXIST to Discharge 3 (BASIN 3)

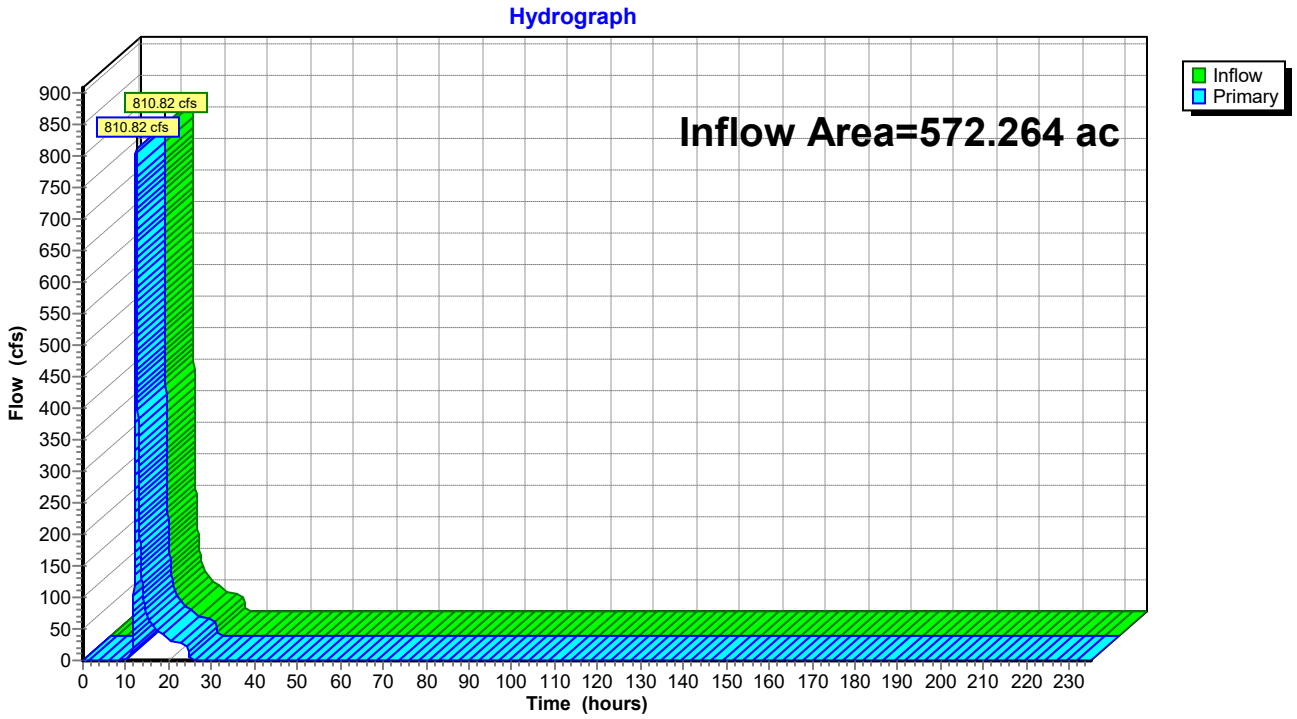


Summary for Link 13L: TOTAL EXISTING

Inflow Area = 572.264 ac, 0.00% Impervious, Inflow Depth = 2.14" for 25-YR event
Inflow = 810.82 cfs @ 12.36 hrs, Volume= 102.002 af
Primary = 810.82 cfs @ 12.36 hrs, Volume= 102.002 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 13L: TOTAL EXISTING



Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EXIST to Discharge Pt Runoff Area=124.449 ac 0.00% Impervious Runoff Depth=4.07"
Flow Length=4,561' Tc=39.7 min CN=63 Runoff=358.75 cfs 42.165 af

Subcatchment 48S: EXIST to Discharge 4 Runoff Area=85.621 ac 0.00% Impervious Runoff Depth=3.83"
Flow Length=3,617' Tc=33.5 min CN=61 Runoff=259.87 cfs 27.329 af

Subcatchment 49S: EXIST to Discharge Runoff Area=10,384,180 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=4,899' Tc=42.5 min CN=67 Runoff=739.58 cfs 90.182 af

Subcatchment 50S: EXISTING TO Runoff Area=492,925 sf 0.00% Impervious Runoff Depth=3.36"
Flow Length=983' Tc=14.9 min CN=57 Runoff=48.87 cfs 3.171 af

Subcatchment 53S: EXIST TO Discharge Pt Runoff Area=21.116 ac 0.00% Impervious Runoff Depth=4.54"
Flow Length=1,689' Tc=19.1 min CN=67 Runoff=109.65 cfs 7.988 af

Subcatchment 54S: EXIST to Discharge Runoff Area=3,980,251 sf 0.00% Impervious Runoff Depth=3.25"
Flow Length=3,050' Tc=30.5 min CN=56 Runoff=244.80 cfs 24.722 af

Link 13L: TOTAL EXISTING Inflow=1,629.55 cfs 195.557 af
Primary=1,629.55 cfs 195.557 af

Total Runoff Area = 572.264 ac Runoff Volume = 195.557 af Average Runoff Depth = 4.10"
100.00% Pervious = 572.264 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: EXIST to Discharge Pt 1 (BASIN 1)

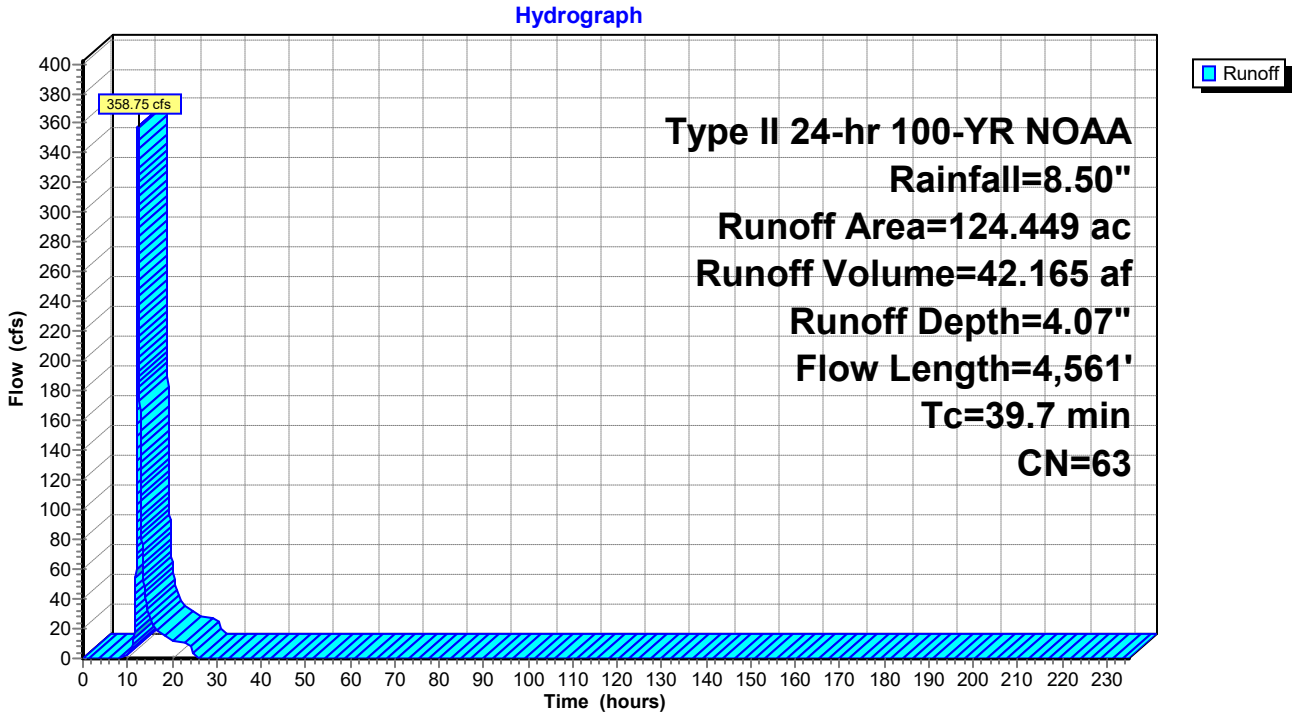
Runoff = 358.75 cfs @ 12.39 hrs, Volume= 42.165 af, Depth= 4.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
	17.064	30	Woods, Good, HSG A
	77.174	70	Woods, Good, HSG C
	12.566	77	Woods, Good, HSG D
*	0.869	30	Woods, Good, HSG A (OFFSITE)
*	1.010	70	Woods, Good, HSG C (OFFSITE)
*	0.261	77	Woods, Good, HSG D (OFFSITE)
*	8.747	42	RA ZONING A SOILS
*	1.364	64	RA ZONING B SOILS
*	5.394	76	RA ZONING C SOILS
	124.449	63	Weighted Average
	124.449		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0600	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.8	735	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.4	597	0.0200	2.28		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
0.4	149	0.1300	5.80		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.6	262	0.0300	2.79		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
15.7	2,718	0.0200	2.88	14.40	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=5.00' D=0.50' Z= 10.0 '/' Top.W=15.00' n= 0.035 Earth, dense weeds
39.7	4,561	Total			

Subcatchment 1S: EXIST to Discharge Pt 1 (BASIN 1)



Summary for Subcatchment 48S: EXIST to Discharge 4 (BASIN 4)

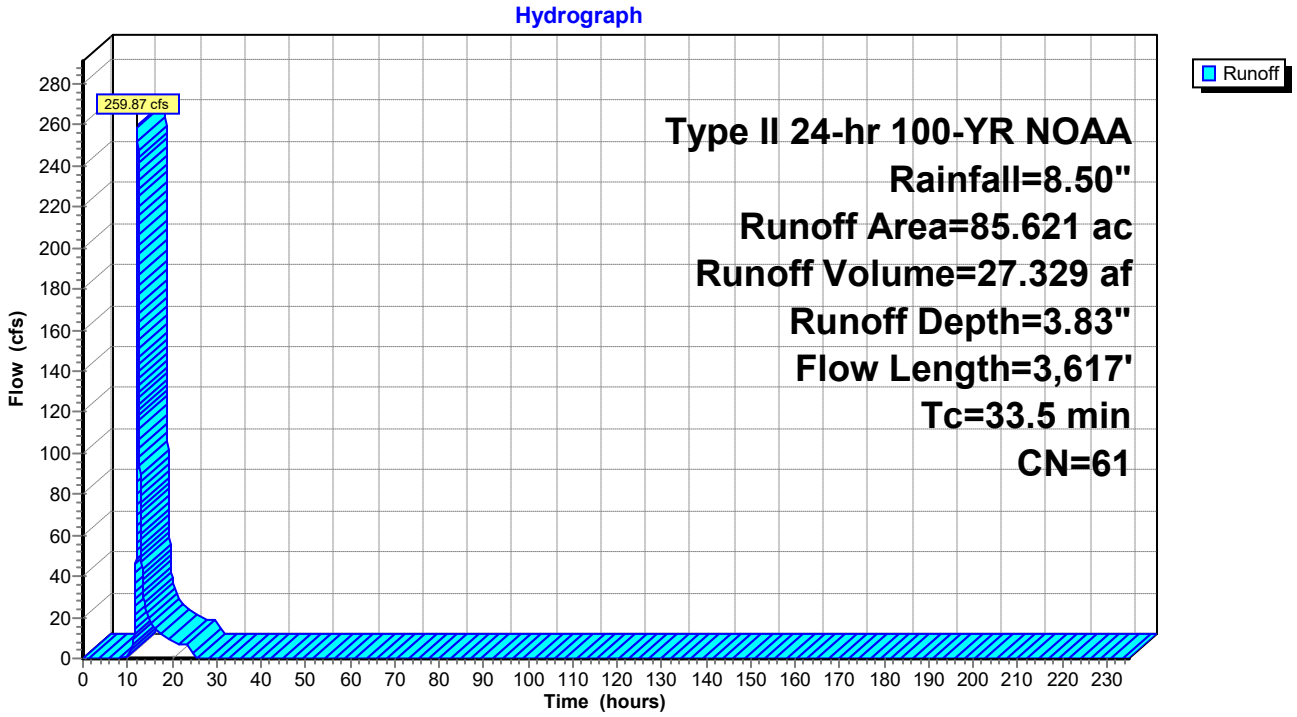
Runoff = 259.87 cfs @ 12.29 hrs, Volume= 27.329 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
	1.797	30	Woods, Good, HSG A
	0.524	55	Woods, Good, HSG B
	9.555	70	Woods, Good, HSG C
	2.736	77	Woods, Good, HSG D
*	20.918	42	RA ZONING A SOILS
*	6.468	64	RA ZONING B SOILS
*	1.734	76	RA ZONING C SOILS
*	12.517	50	R2 ZONING, A SOILS
*	15.521	70	R2 ZONING, B SOILS
*	7.381	80	R2 ZONING, C SOILS
*	6.470	85	R2 ZONING, D SOILS
	85.621	61	Weighted Average
	85.621		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0600	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	466	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
3.1	728	0.0600	3.94		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
13.2	2,323	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
33.5	3,617	Total			

Subcatchment 48S: EXIST to Discharge 4 (BASIN 4)



Summary for Subcatchment 49S: EXIST to Discharge 5 (WQV BASIN)

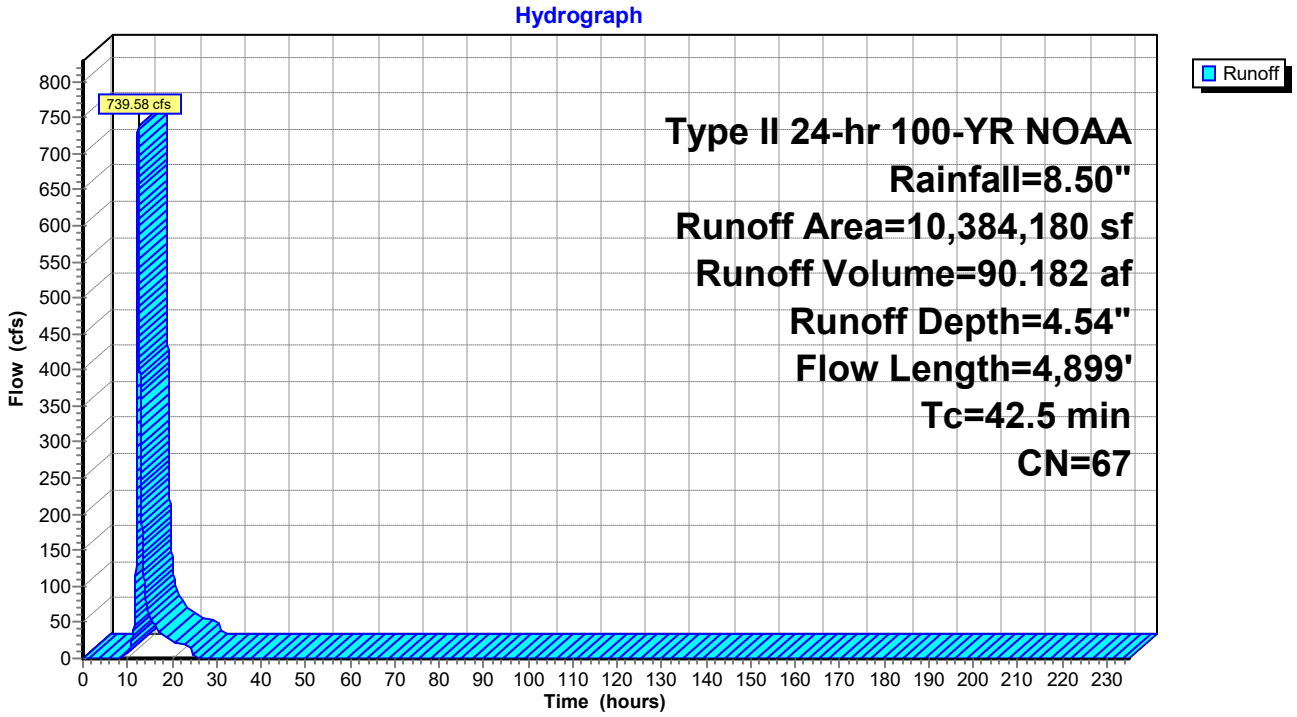
Runoff = 739.58 cfs @ 12.42 hrs, Volume= 90.182 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	29,882	30	Woods, Good, HSG A
	71,700	55	Woods, Good, HSG B
	30,056	70	Woods, Good, HSG C
*	95,832	30	Woods, Good, HSG A (OFFSITE LOD)
*	91,824	55	Woods, Good, HSG B (OFFSITE LOD)
*	223,332	70	Woods, Good, HSG C (OFFSITE LOD)
*	39,073	77	Woods, Good, HSG D (OFFSITE LOD)
*	3,240,211	50	R2 ZONING, A SOILS
*	2,914,425	70	R2 ZONING, B SOILS
*	2,748,810	80	R2 ZONING, C SOILS
*	899,035	85	R2 ZONING, D SOILS
	10,384,180	67	Weighted Average
	10,384,180		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	100	0.0400	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	558	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
5.1	1,221	0.0400	3.98	17.89	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=4.00' D=0.50' Z= 10.0 '/' Top.W=14.00' n= 0.035 Earth, dense weeds
9.8	1,723	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
7.2	1,297	0.0200	2.99	17.96	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=7.00' D=0.50' Z= 10.0 '/' Top.W=17.00' n= 0.035 Earth, dense weeds
42.5	4,899	Total			

Subcatchment 49S: EXIST to Discharge 5 (WQV BASIN)



Summary for Subcatchment 50S: EXISTING TO CONRAIL

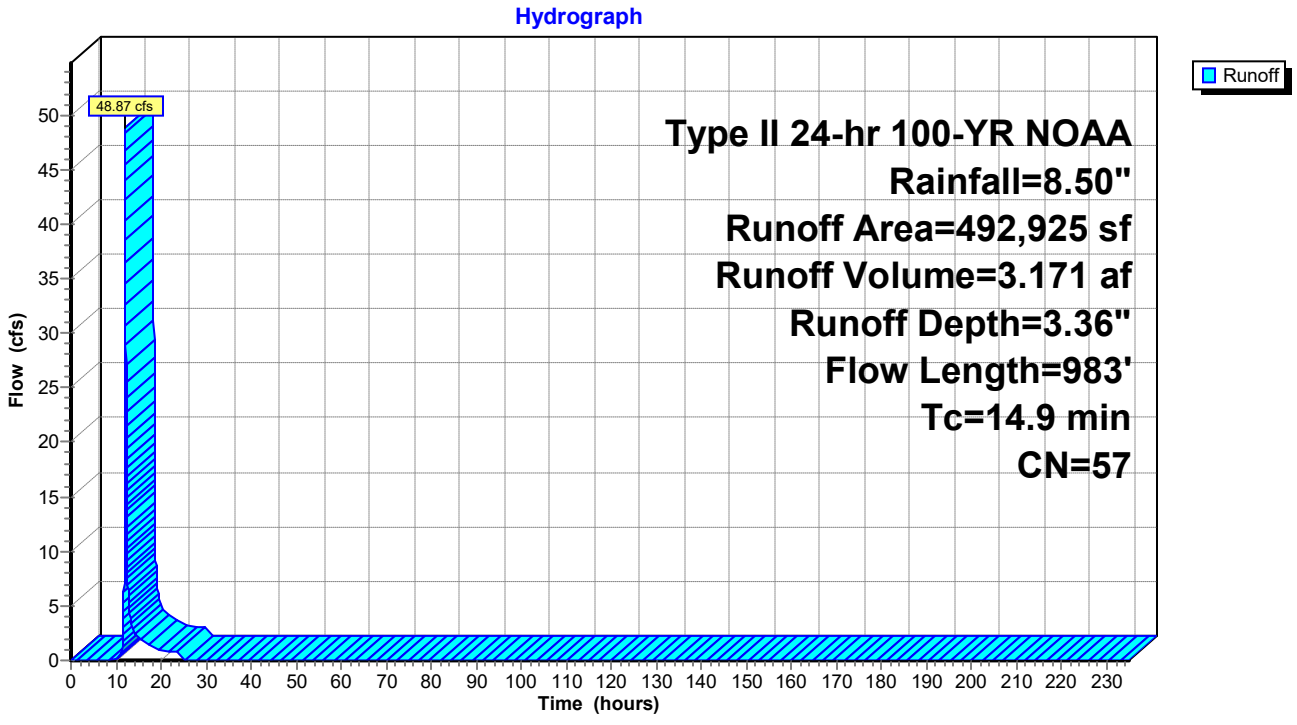
Runoff = 48.87 cfs @ 12.07 hrs, Volume= 3.171 af, Depth= 3.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
165,223	30	Woods, Good, HSG A
327,702	70	Woods, Good, HSG C
492,925	57	Weighted Average
492,925		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.1100	0.15		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.9	527	0.0800	4.55		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.1	356	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
14.9	983	Total			

Subcatchment 50S: EXISTING TO CONRAIL



Summary for Subcatchment 53S: EXIST TO Discharge Pt 2 (BASIN 2)

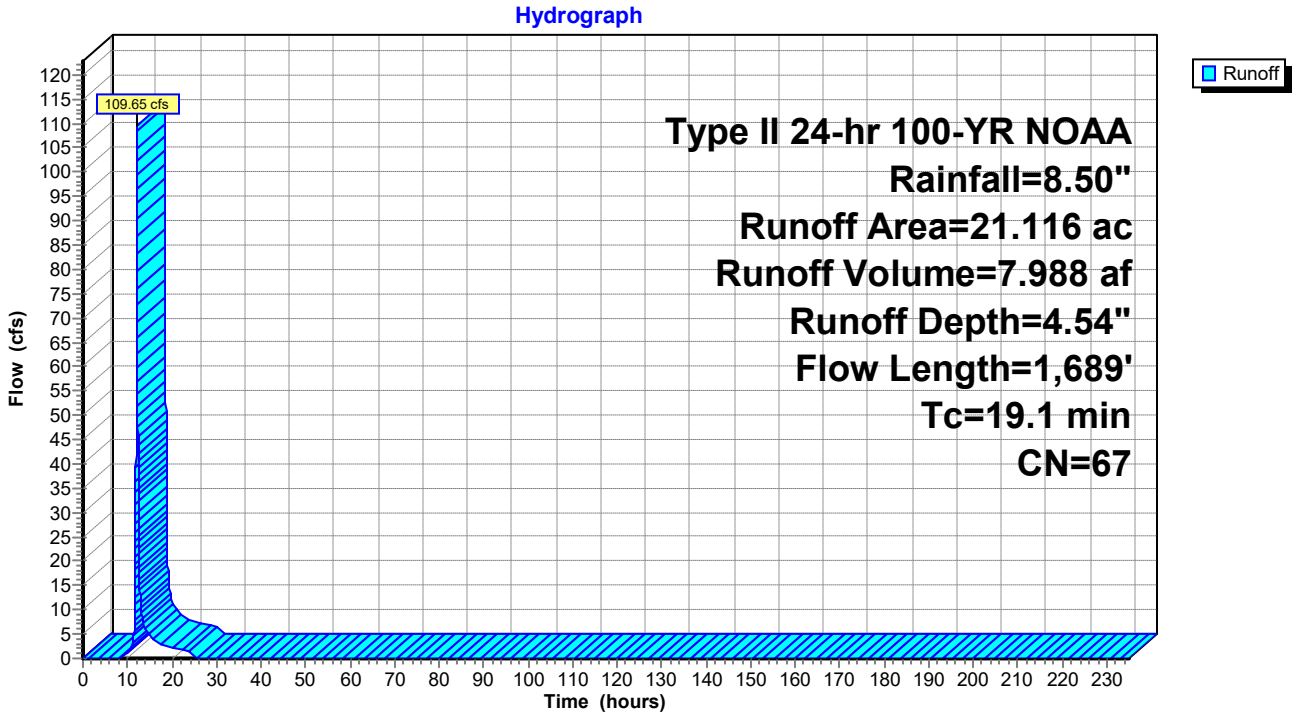
Runoff = 109.65 cfs @ 12.12 hrs, Volume= 7.988 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
1.859	30	Woods, Good, HSG A
16.982	70	Woods, Good, HSG C
2.275	77	Woods, Good, HSG D
21.116	67	Weighted Average
21.116		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	100	0.1300	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	26	0.1900	7.02		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.8	152	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.4	451	0.0100	2.24	9.52	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 5.0 '/' Top.W=11.00' n= 0.035 Earth, dense weeds
0.5	192	0.0800	6.33	26.91	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=6.00' D=0.50' Z= 5.0 '/' Top.W=11.00' n= 0.035 Earth, dense weeds
4.1	768	0.0200	3.12	35.10	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=15.00' D=0.50' Z= 15.0 '/' Top.W=30.00' n= 0.035 Earth, dense weeds
19.1	1,689	Total			

Subcatchment 53S: EXIST TO Discharge Pt 2 (BASIN 2)



Summary for Subcatchment 54S: EXIST to Discharge 3 (BASIN 3)

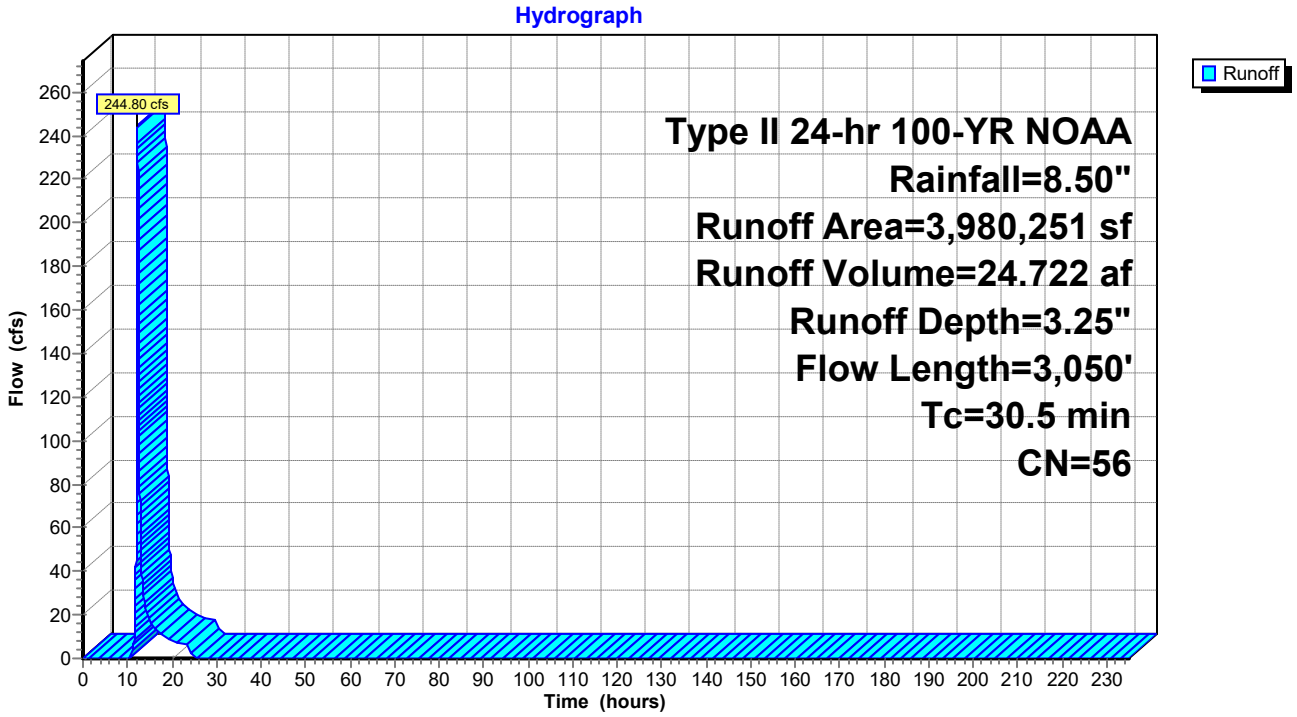
Runoff = 244.80 cfs @ 12.27 hrs, Volume= 24.722 af, Depth= 3.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	994,213	30	Woods, Good, HSG A
	1,781,386	70	Woods, Good, HSG C
	294,248	77	Woods, Good, HSG D
*	682,280	42	RA ZONING A SOILS
*	54,406	64	RA ZONING B SOILS
*	81,022	76	RA ZONING C SOILS
*	92,696	82	RA ZONING D SOILS
	3,980,251	56	Weighted Average
	3,980,251		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.7	247	0.1400	6.02		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.3	328	0.0700	4.26		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.4	576	0.0300	2.79		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
10.2	1,799	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
30.5	3,050	Total			

Subcatchment 54S: EXIST to Discharge 3 (BASIN 3)

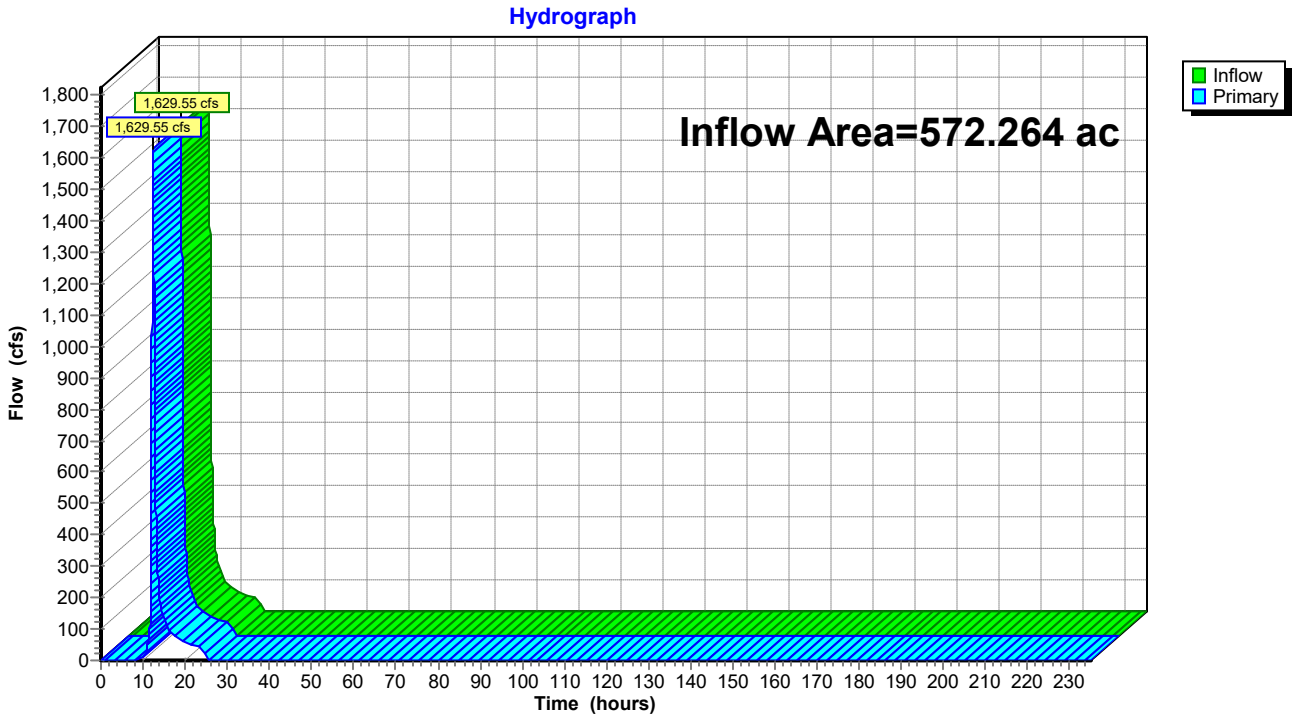


Summary for Link 13L: TOTAL EXISTING

Inflow Area = 572.264 ac, 0.00% Impervious, Inflow Depth = 4.10" for 100-YR NOAA event
Inflow = 1,629.55 cfs @ 12.33 hrs, Volume= 195.557 af
Primary = 1,629.55 cfs @ 12.33 hrs, Volume= 195.557 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 13L: TOTAL EXISTING



ATTACHMENT 17C

Proposed Basin Routing

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Stormwater Management – Proposed Basin Routing		
	Job No. 2018-3854	**Made by:** RP	**Date** 07-15-20
	Ref.	**Checked by:** VEF	**Sheet** 1 of 2

Reviewed by PGS 08/27/2021

Objective: The objective of this analysis is to estimate the proposed conditions – determining the stormwater runoff from the proposed Landfill and routing the runoff through stormwater management basin locations.

Design Approach and Assumptions:

Use HydroCad, a computer software which implements the principles of TR-55 and TR-20 for larger drainage areas. The input data for each is as follows:

1) Drainage areas – determine the contributing drainage area to the discharge location based upon the topographic data of the area. Use the "area" function in AutoCAD to find the area of the drainage area boundary.
2) Based on the proposed soils types and the vegetative cover, determine the areas of soil types and cover conditions in each drainage area. Calculate a "weighed" curve number. HydroCAD actually does this calculation based upon data entry.
3) Determine the time of concentration for water to flow from the longest distance (in time) from the outlet. Measure the length and slope of the tc flow path and the surface condition.
4) Although the site is location along the eastern seaboard, this is a Type II storm event because the DelMarVa peninsula shields it from the affects of the ocean.
5) Determine the peak flows for the 25-year, 24 hour (5.9 inches of rain) and 100 year, 24 hour (8.5 inches of rain) storm events.
6) Based on the proposed Basin configuration, routing the contributing inflow from the contributing drainage areas through the basins to determine whether they are adequately sized.

Calculations:

Attached is a summary table of the input data to the HydroCAD program and the computer printout for evaluation for the design storm events.

References:

1. HydroCAD, V8.5.
2. Advanced GeoServices Corp, Calculations entitled "Stormwater management – Existing Conditions," dated July 15, 2020.

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Stormwater Management – Proposed Basin Routing		
	Job No. 2018-3854	Made by: RP	Date 07-15-20
	Ref.	Checked by: VEF	Sheet 2 of 2

Reviewed by PGS 08/27/2021

Conclusions:

A summary of the inflow and the proposed Basin area provided in the table below.

Feature	Basin No. 1	Basin No. 2	Basin No. 3	Basin No. 4	WQv
Bottom of Basin (ft MSL)	79.0	72.0	72.0	76.5	88.0
Top of Wet Storage (ft MSL)	81.0	74.0	74.0	78.5	N/A
Invert of low flow Orifice (ft MSL)	81.0	74.0	74.0	78.5	88.0
Size of low flow Orifice (inches)	9	8	6	6	3
Elevation of Riser (ft MSL)	84.5	77.0	77.0	83.6	89.5
Dimensions of Riser (ft x ft)	3 x 6.5	3 x 6.5	3 x 6.5	7 x 10	4 x 4
Shape of Riser	rectangle	rectangle	rectangle	rectangle	rectangle
Invert of Emergency Spillway (ft MSL)	90.0	78.0	78.5	88.15	90.8
Width of Emergency Spillway (ft)	250	45	100	90	20
25 year ,24 hour storm event routing					
Peak Qin (cfs)	386.46	49.6	195.44	186.05	19.12
Peak Qout (cfs)	140.81	3.75	54.16	95.11	15.6
Max Water Surface Elev (ft MSL)	86.60	77.06	77.89	84.49	90.11
Riser Engaged?	Yes	Yes	Yes	Yes	Yes
Emergency Spillway Engaged?	No	No	No	No	No
% Reduction	64	92	72	49	18
Total Qout = 309.43 cfs					
100 year ,24 hour storm event routing					
Peak Qin (cfs)	672.36	110.04	314.99	399.01	32.48
Peak Qout (cfs)	255.13	58.51	193.46	184.84	26.48
Max Water Surface Elev (ft MSL)	90.22	77.93	79.10	88.13	91.10
Riser Engaged?	Yes	Yes	Yes	Yes	Yes
Emergency Spillway Engaged?	Yes	No	Yes	No	Yes
% Reduction	62	47	59	54	18
Total Qout = 718.42 cfs					

Comparing the proposed condition with existing conditions peak flow rates:

Condition	25 year, 24 hour storm event Qout (cfs)	100 year, 24 hour storm event Qout (cfs)
Existing (prior to landfill construction)	466.73	973.07
Proposed (after closure)	309.43	718.42
Proposed < Existing??	Yes	Yes
% Reduction	34	26

While the total volume of stormwater runoff is higher under the proposed conditions, the stormwater management basins hold the water and release it from site at a slower pace, mitigating flows such that they are even lower than under existing conditions.

Reviewed by PGS 08/27/2021

CHESAPEAKE TERRACE
BASIN 1
DEWATERING TIME

Rating Table			
	Elevation (ft.)	H (height from dewater hole) (ft.)	Q (cfs)
Crest of Riser	84.5	5.5	5.100
	84	5	3.957
	83	4	2.700
	82	3	1.670
Bottom Orifice	79	0	0

Dewatering Time				
Elevation (ft)	Volume (ft^3)	ΔStorage (ft^3)	Discharge (cfs)	time (hours)
84.5	427,754		5.100	
		67,005		4.11
84	360,749		3.957	
		131,071		10.94
83	229,678		2.700	
		117,882		14.99
82	111,796		1.670	
		111,796		37.19
79	0		0.000	
			Total=	**67.23 hours**
			=	**2.8 days**

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CHESAPEAKE TERRACE
BASIN 2
DEWATERING TIME

Rating Table			
	Elevation (ft.)	H (height from dewater hole) (ft.)	Q (cfs)
Crest of Riser	77	3	2.740
	76.4	2.4	2.420
	76	2	2.170
	75	1	1.370
Bottom Orifice	74	0	0

Dewatering Time				
Elevation (ft)	Volume (ft^3)	ΔStorage (ft^3)	Discharge (cfs)	time (hours)
77	77,190		2.740	
		18,841		2.03
76.4	58,349		2.420	
		12,074		1.46
76	46,275		2.170	
		24,499		3.84
75	21,776		1.370	
		21,776		8.83
74	0		0.000	
			Total=	**16.16 hours**
			=	**0.7 days**

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CHESAPEAKE TERRACE
BASIN 3
DEWATERING TIME

Rating Table			
	Elevation (ft.)	H (height from dewater hole) (ft.)	Q (cfs)
Crest of Riser	77	3	1.570
	76.4	2.4	1.390
	76	2	1.250
	75	1	0.820
Bottom Orifice	74	0	0

Dewatering Time				
Elevation (ft)	Volume (ft^3)	ΔStorage (ft^3)	Discharge (cfs)	time (hours)
77	204,126		1.570	
		47,232		8.86
76.4	156,894		1.390	
		30,661		6.45
76	126,233		1.250	
		65,733		17.64
75	60,500		0.820	
		60,500		40.99
74	0		0.000	
			Total=	**73.94 hours**
			=	**3.1 days**

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CHESAPEAKE TERRACE
BASIN 4
DEWATERING TIME

Rating Table			
	Elevation (ft.)	H (height from dewater hole) (ft.)	Q (cfs)
Crest of Riser	83.6	5.1	2.080
	82.1	3.6	1.730
	80	1.5	1.060
	79.1	0.6	0.560
Bottom Orifice	78.5	0	0

Dewatering Time				
Elevation (ft)	Volume (ft^3)	ΔStorage (ft^3)	Discharge (cfs)	time (hours)
83.6	163,820		2.080	
		56,574		8.25
82.1	107,246		1.730	
		69,211		13.78
80	38,035		1.060	
		23,687		8.12
79.1	14,348		0.560	
		14,348		14.23
78.5	0		0.000	
			Total=	**44.38 hours**
			=	**1.8 days**

Reviewed by PGS 08/27/2021

CHESAPEAKE TERRACE
WQV
DEWATERING TIME

Rating Table			
	Elevation (ft.)	H (height from dewater hole) (ft.)	Q (cfs)
Crest of Riser	89.5	1.5	0.280
	89.2	1.2	0.250
	88.7	0.7	0.180
	88.4	0.4	0.120
Bottom Orifice	88	0	0

Dewatering Time				
Elevation (ft)	Volume (ft^3)	ΔStorage (ft^3)	Discharge (cfs)	time (hours)
89.5	5,400		0.280	
		1,166		1.22
89.2	4,234		0.250	
		1,848		2.39
88.7	2,386		0.180	
		1,051		1.95
88.4	1,335		0.120	
		1,335		6.18
88	0		0.000	
			Total=	**11.74 hours**
			=	**0.5 days**

Reviewed by PGS 08/27/2021

PROPOSED CONDITIONS

BASIN 1

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE								16.52%
WOODS	332,365		131,028	25,995	489,387			0.00%
OPEN SPACE	411,144		669,712	274,313	1,355,168			73.99%
IMPERVIOUS	74,126	0	172,868	32,057	279,051	5.19%		9.49%
CAP	402,941		3,134,813	203,513	3,741,267		123.40	1.00
					0			
OFFSITE					0			
WOODS	33,629		51,548		85,177			
RA	403,214	103,642	214,775	55,609	777,240			
R-2					0			
TOTAL					6,727,291		6,727,291	

BASIN 2

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE								28.36%
WOODS	122,667		43,308	3,323	169,299			0.00%
OPEN SPACE	75,069		193,145		268,214			71.64%
IMPERVIOUS	12,756		39,104		51,859	14.30%		0.00%
CAP	15,027		27,590		42,617		8.33	1.00
					0			
OFFSITE					0			
WOODS					0			
RA	547,893	9,866	81,020	37,070	675,849			
R-2					0			
TOTAL					1,207,839		1,208,511	

BASIN 3

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE								9.74%
WOODS					0			0.00%
OPEN SPACE	68,751		252,304	29,508	350,562			85.38%
IMPERVIOUS	9,226		110,479	19,790	139,495	7.74%		4.88%
CAP	97,612		1,176,328	38,616	1,312,556		41.38	1.00
					0			
OFFSITE					0			
WOODS					0			
RA					0			
R-2					0			
TOTAL					1,802,613		1,802,614	

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PROPOSED CONDITIONS

BASIN 4

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE								12.12%
WOODS	395,927	5,767	404,259		805,954			9.96%
OPEN SPACE	35,334	18,850	198,718	50,619	303,522			61.68%
IMPERVIOUS	7,436	16,314	18,955	6,703	49,407	14.00%		16.24%
CAP					0		8.10	1.00
					0			
OFFSITE					0			
WOODS					0			
RA	1,043,104	281,741	75,531		1,400,376			
R-2	692,547	599,476	322,638	281,842	1,896,503			
TOTAL					4,455,761		4,455,761	

WQV

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE					0			0.00%
WOODS		**9,223**	**6,232**		15,455			57.83%
OPEN SPACE		**20,644**	**16,961**		37,605			42.17%
IMPERVIOUS		**8,752**	**4,475**		13,227	26.02%		0.00%
CAP					0		1.17	1.00
					0			
OFFSITE					0			
LOD					0			
RA					0			
R-2		**65,742**	**18,740**		84,482			
TOTAL					150,769		150,783	

UNMANAGED

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE					0			29.30%
WOODS					0			7.34%
OPEN SPACE	40,015	**9,812**	**68,391**	16,061	134,279			52.49%
IMPERVIOUS	12,080	**3,237**	**24,939**	3,262	43,518	24.48%		10.87%
CAP					0		4.08	1.00
					0			
OFFSITE					0			
LOD					0			
RA					0			
R-2					0			
TOTAL					177,796			

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PROPOSED CONDITIONS

WQV + UNM

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE					0			22.79%
WOODS	0	9,223	6,232	0	15,455			18.57%
OPEN SPACE	40,015	30,456	85,352	16,061	171,884			50.20%
IMPERVIOUS	12,080	11,989	29,414	3,262	56,745	24.82%		8.45%
CAP	0	0	0	0	0		5.25	1.00
	0	0	0	0	0			
OFFSITE	0	0	0	0	0			
LOD	0	0	0	0	0			
RA	0	0	0	0	0			
R-2	0	65,742	18,740	0	84,482			
TOTAL	0	0	0	0	328,565			

UNMANAGED Discharge Pt 2

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE					0			0.00%
WOODS	4,417		86,043	184,932	275,391			0.00%
OPEN SPACE			2,038	21,669	23,707			8.60%
IMPERVIOUS					0	0.00%		91.40%
CAP					0		0.54	1.00
OFFSITE								
LOD					0			
RA					0			
R-2					0			
TOTAL					299,098			

UNMANAGED Discharge Pt 2

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE					0			38.60%
WOODS			7,354	7,236	14,590			0.00%
OPEN SPACE	24,838		25,224	14,292	64,354			39.20%
IMPERVIOUS					0	0.00%		22.21%
CAP					0		1.48	1.00
OFFSITE								
LOD					0			
RA					0			
R-2					0			
TOTAL					78,944			

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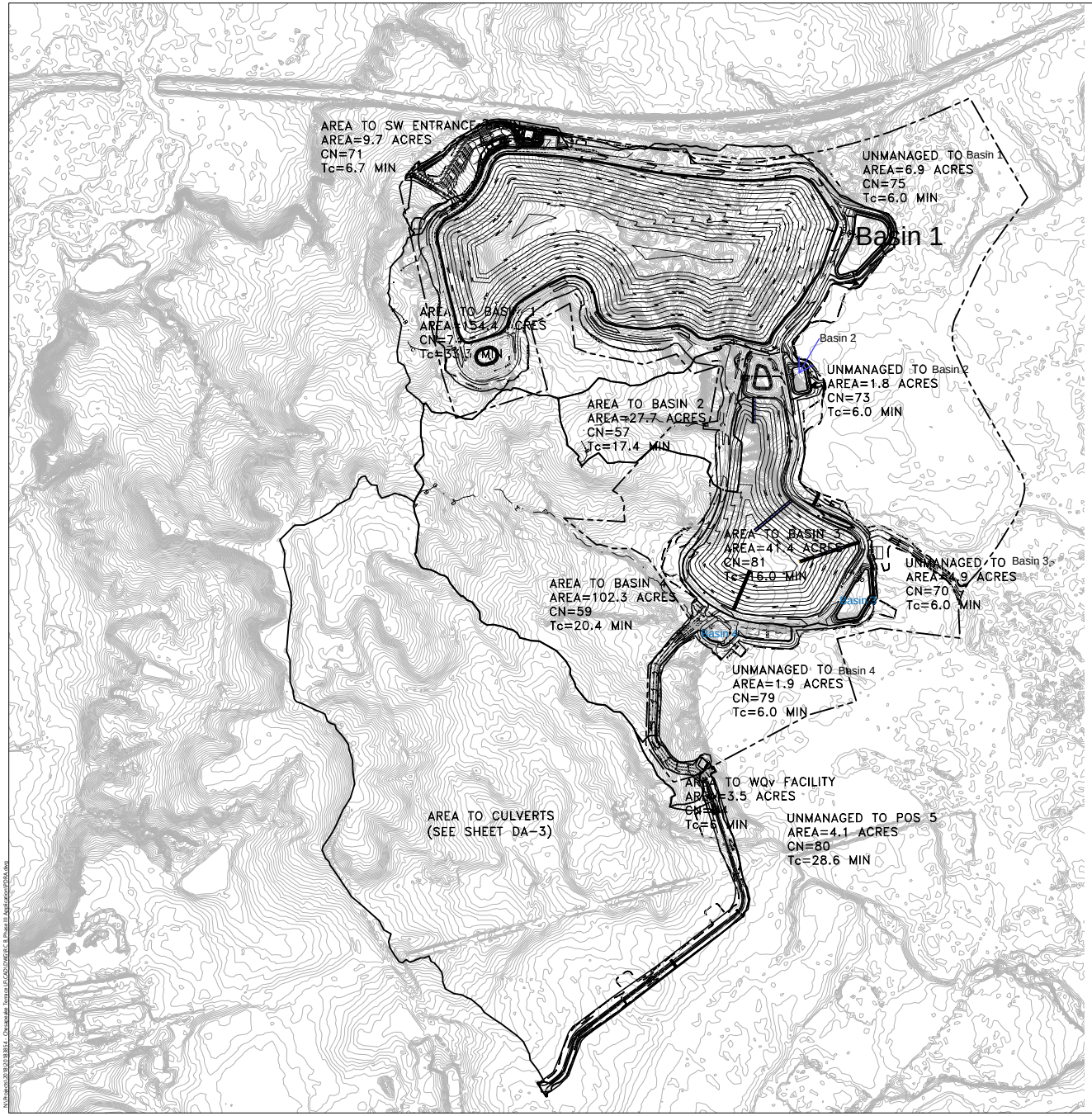
PROPOSED CONDITIONS

UNMANAGED Discharge Pt 3

	SOILS							
	A	**B**	**C**	**D**	**TOTAL CHECK**	**% IMPERVIOUS**	**DISTURBED AREA**	**% SOIL TYPE IN DIST AREA**
ONSITE					0			24.12%
WOODS	25,681		11,227	20,676	57,584			0.00%
OPEN SPACE	37,410		32,984	84,713	155,107			21.27%
IMPERVIOUS					0	0.00%		54.62%
CAP					0		3.56	1.00
OFFSITE								
LOD					0			
RA					0			
R-2					0			
TOTAL					212,691			

UNMANAGED Discharge Pt 4

	SOILS							
	A	**B**	**C**	**D**	**TOTAL CHECK**	**% IMPERVIOUS**	**DISTURBED AREA**	**% SOIL TYPE IN DIST AREA**
ONSITE					0			4.36%
WOODS					0			6.18%
OPEN SPACE	3,590	5,089	14,725	58,907	82,311			17.89%
IMPERVIOUS					0	0.00%		71.57%
CAP					0		1.89	1.00
OFFSITE								
LOD					0			
RA					0			
R-2					0			
TOTAL					82,311			



Reviewed by PGS 08/27/2021

GRAPHIC SCALE

400 0 200 400 800 1600

(IN FEET)
1 inch =400 ft.

VERONICA E. FOSTER
LICENSED PROFESSIONAL ENGINEER
MD # 35645

REVISION:

DATE:

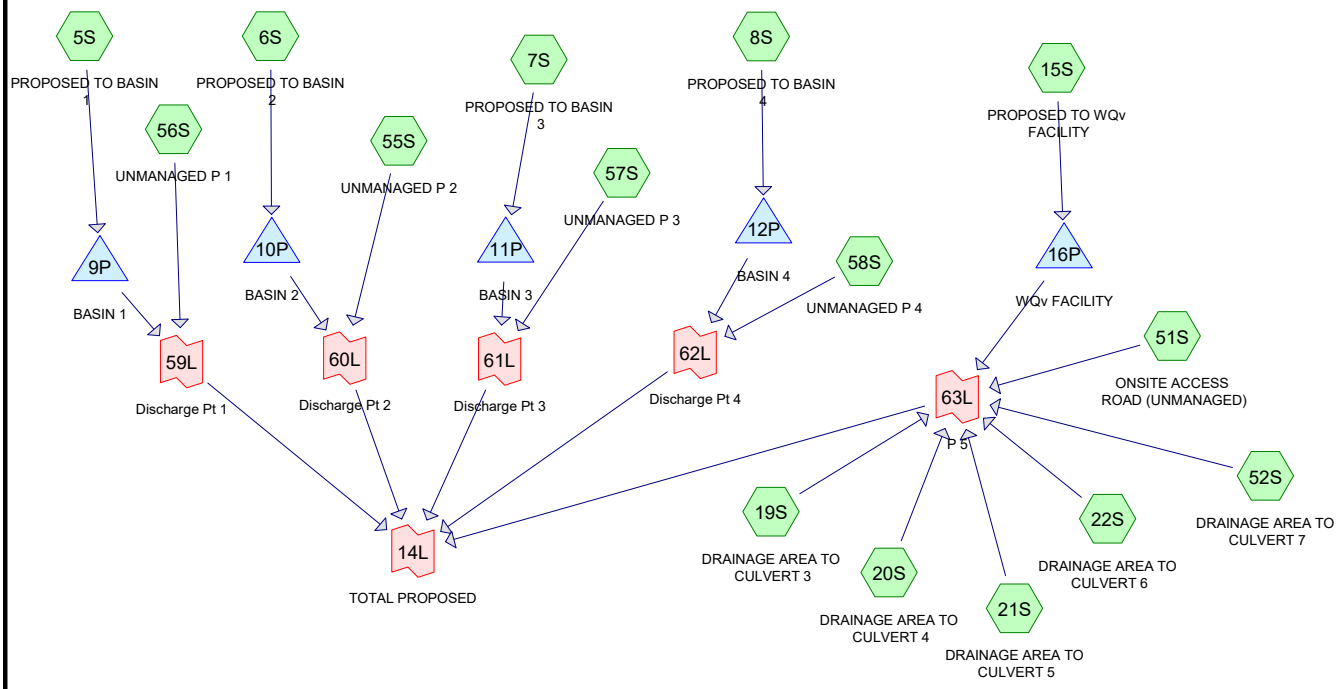
NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
Mentrose Environmental Group Company

PROPOSED DRAINAGE AREA PLAN

PROJECT MANAGER: VEF
CHECKED BY: VEF
DRAWN BY: CEC
SCALE: AS SHOWN
PROJECT NUMBER: 2018-3854
DATE:

DA-2



Reviewed by PGS 08/27/2021

Subcat Reach Pond Link

Drainage Diagram for CT_Prop Basins_07152020
Prepared by {enter your company name here}, Printed 7/18/2020
HydroCAD® 8.50 s/n 005690 © 2007 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.691	30	Woods, Good, HSG A (56S,57S)
19.535	30	Woods, Good, HSG A (ONSITE) (5S,6S,8S)
0.772	30	Woods, Good, HSG A OFFSITE (5S)
21.835	42	RA ZONING A SOIL (5S,6S)
23.946	42	RA ZONING A SOILS (8S)
86.984	50	R-2 ZONING A SOILS (8S,20S,21S,22S,52S)
0.212	55	Woods, Good, HSG B (15S)
0.132	55	Woods, Good, HSG B (ONSITE) (8S)
0.660	61	>75% Grass cover, Good, HSG B (DISTURBED A) (20S,21S)
1.723	61	>75% Grass cover, Good, HSG B (ONSITE A SOIL) (6S)
9.439	61	>75% Grass cover, Good, HSG B (ONSITE A SOILS) (5S)
4.820	61	>75% Grass cover, Good, HSG B (ONSITE A) (7S,8S,51S,55S,57S,58S)
2.605	64	RA ZONING B SOIL (5S,6S)
6.468	64	RA ZONING B SOILS (8S)
78.284	70	R-2 ZONING B SOILS (8S,15S,19S,20S,21S,22S,52S)
2.545	70	Woods, Good, HSG C (15S,55S,56S,57S)
13.283	70	Woods, Good, HSG C (ONSITE) (5S,6S,8S)
1.183	70	Woods, Good, HSG C OFFSITE (5S)
1.472	74	>75% Grass cover, Good, HSG C (DISTURBED B) (19S,20S,21S)
1.249	74	>75% Grass cover, Good, HSG C (ONSITE B) (8S,15S,51S,58S)
6.791	76	RA ZONING C SOIL (5S,6S)
1.734	76	RA ZONING C SOILS (8S)
4.886	77	Woods, Good, HSG D (55S,56S,57S)
0.673	77	Woods, Good, HSG D (ONSITE) (5S,6S)
6.558	80	>75% Grass cover, Good, HSG D (7S,8S,20S,51S,55S,56S,57S,58S)
1.768	80	>75% Grass cover, Good, HSG D (DISTURBED C) (19S,20S,22S,52S)
0.201	80	>75% Grass cover, Good, HSG D (DISTURBED D) (52S)
4.434	80	>75% Grass cover, Good, HSG D (ONSITE C SOIL) (6S)
15.374	80	>75% Grass cover, Good, HSG D (ONSITE C SOILS) (5S)
14.034	80	>75% Grass cover, Good, HSG D (ONSITE C) (7S,8S,15S,51S,55S,56S,57S,58S)
6.297	80	>75% Grass cover, Good, HSG D (ONSITE D SOILS) (5S)
31.110	80	CAP (6S,7S)
85.888	80	CAP AREA (5S)
70.697	80	R-2 ZONING C SOILS (8S,15S,20S,21S,22S,52S)
2.128	82	RA ZONING D SOIL (5S,6S)
27.167	85	R-2 ZONING D SOILS (8S,20S,52S)
0.332	98	Paved parking & roofs (21S,22S)
0.953	98	Paved parking & roofs (ONSITE A) (6S,7S,8S,51S)
0.650	98	Paved parking & roofs (ONSITE B) (8S,15S,51S)
4.545	98	Paved parking & roofs (ONSITE C) (6S,7S,8S,15S,51S)
0.683	98	Paved parking & roofs (ONSITE D) (7S,8S,51S)

Area Listing (all nodes) (continued)

Area (acres)	CN	Description (subcatchment-numbers)
1.702	98	Paved parking & roofs A ONSITE (5S)
0.050	98	Paved parking & roofs A SOILS (20S)
0.081	98	Paved parking & roofs B SOILS (19S,20S)
3.969	98	Paved parking & roofs C ONSITE (5S)
0.353	98	Paved parking & roofs C SOILS (19S,20S,52S)
0.736	98	Paved parking & roofs D ONSITE (5S)
0.080	98	Paved parking & roofs D SOILS (20S,52S)
571.713		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
20.998	HSG A	5S, 6S, 8S, 56S, 57S
16.986	HSG B	5S, 6S, 7S, 8S, 15S, 20S, 21S, 51S, 55S, 57S, 58S
19.731	HSG C	5S, 6S, 8S, 15S, 19S, 20S, 21S, 51S, 55S, 56S, 57S, 58S
54.225	HSG D	5S, 6S, 7S, 8S, 15S, 19S, 20S, 22S, 51S, 52S, 55S, 56S, 57S, 58S
459.772	Other	5S, 6S, 7S, 8S, 15S, 19S, 20S, 21S, 22S, 51S, 52S
571.713		**TOTAL AREA**

Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 5S: PROPOSED TO BASIN Runoff Area=154.439 ac 4.15% Impervious Runoff Depth=3.10"
Flow Length=5,552' Tc=33.3 min CN=74 Runoff=386.46 cfs 39.909 af

Subcatchment 6S: PROPOSED TO Runoff Area=1,207,838 sf 4.29% Impervious Runoff Depth=1.62"
Flow Length=2,643' Tc=17.4 min CN=57 Runoff=49.60 cfs 3.733 af

Subcatchment 7S: PROPOSED TO Runoff Area=1,802,614 sf 7.74% Impervious Runoff Depth=3.79"
Flow Length=2,398' Tc=16.0 min CN=81 Runoff=195.44 cfs 13.079 af

Subcatchment 8S: PROPOSED TO Runoff Area=4,455,761 sf 1.11% Impervious Runoff Depth=1.78"
Flow Length=3,075' Tc=20.4 min CN=59 Runoff=186.05 cfs 15.131 af

Subcatchment 15S: PROPOSED TO WQv Runoff Area=150,762 sf 8.78% Impervious Runoff Depth=3.10"
Tc=6.0 min CN=74 Runoff=19.12 cfs 0.894 af

Subcatchment 19S: DRAINAGE AREA TO Runoff Area=0.556 ac 8.99% Impervious Runoff Depth=3.10"
Tc=6.0 min CN=74 Runoff=3.07 cfs 0.144 af

Subcatchment 20S: DRAINAGE AREA TO Runoff Area=96.992 ac 0.16% Impervious Runoff Depth=2.54"
Flow Length=4,594' Tc=30.4 min CN=68 Runoff=208.26 cfs 20.565 af

Subcatchment 21S: DRAINAGE AREA TO Runoff Area=12.910 ac 1.93% Impervious Runoff Depth=2.28"
Flow Length=1,337' Tc=13.2 min CN=65 Runoff=39.97 cfs 2.452 af

Subcatchment 22S: DRAINAGE AREA TO Runoff Area=3,681,542 sf 0.10% Impervious Runoff Depth=2.37"
Flow Length=3,556' Tc=26.2 min CN=66 Runoff=184.60 cfs 16.666 af

Subcatchment 51S: ONSITE ACCESS Runoff Area=177,797 sf 24.48% Impervious Runoff Depth=3.69"
Tc=28.6 min CN=80 Runoff=13.49 cfs 1.255 af

Subcatchment 52S: DRAINAGE AREA TO Runoff Area=27.906 ac 1.27% Impervious Runoff Depth=3.29"
Flow Length=1,920' Tc=28.5 min CN=76 Runoff=82.38 cfs 7.660 af

Subcatchment 55S: UNMANAGED P 2 Runoff Area=78,944 sf 0.00% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=73 Runoff=9.72 cfs 0.454 af

Subcatchment 56S: UNMANAGED P 1 Runoff Area=299,039 sf 0.00% Impervious Runoff Depth=3.20"
Tc=6.0 min CN=75 Runoff=39.01 cfs 1.829 af

Subcatchment 57S: UNMANAGED P 3 Runoff Area=212,691 sf 0.00% Impervious Runoff Depth=2.73"
Tc=6.0 min CN=70 Runoff=23.85 cfs 1.109 af

Subcatchment 58S: UNMANAGED P 4 Runoff Area=82,311 sf 0.00% Impervious Runoff Depth=3.59"
Tc=6.0 min CN=79 Runoff=11.91 cfs 0.565 af

Pond 9P: BASIN 1 Peak Elev=86.60' Storage=718,710 cf Inflow=386.46 cfs 39.909 af
Outflow=140.81 cfs 39.794 af

Pond 10P: BASIN 2 Peak Elev=77.06' Storage=79,209 cf Inflow=49.60 cfs 3.733 af
Outflow=3.75 cfs 3.729 af

Pond 11P: BASIN 3 Peak Elev=77.89' Storage=277,110 cf Inflow=195.44 cfs 13.079 af
Outflow=54.16 cfs 13.036 af

Pond 12P: BASIN 4 Peak Elev=84.49' Storage=200,499 cf Inflow=186.05 cfs 15.131 af
Outflow=95.11 cfs 15.125 af

Pond 16P: WQv FACILITY Peak Elev=90.11' Storage=7,923 cf Inflow=19.12 cfs 0.894 af
Outflow=15.60 cfs 0.894 af

Link 14L: TOTAL PROPOSED Inflow=638.18 cfs 125.279 af
Primary=638.18 cfs 125.279 af

Link 59L: Discharge Pt 1 Inflow=143.29 cfs 41.622 af
Primary=143.29 cfs 41.622 af

Link 60L: Discharge Pt 2 Inflow=10.19 cfs 4.183 af
Primary=10.19 cfs 4.183 af

Link 61L: Discharge Pt 3 Inflow=56.90 cfs 14.146 af
Primary=56.90 cfs 14.146 af

Link 62L: Discharge Pt 4 Inflow=96.41 cfs 15.691 af
Primary=96.41 cfs 15.691 af

Link 63L: P 5 Inflow=505.10 cfs 49.637 af
Primary=505.10 cfs 49.637 af

Total Runoff Area = 571.713 ac Runoff Volume = 125.447 af Average Runoff Depth = 2.63"
97.53% Pervious = 557.579 ac 2.47% Impervious = 14.133 ac

Summary for Subcatchment 5S: PROPOSED TO BASIN 1

Runoff = 386.46 cfs @ 12.28 hrs, Volume= 39.909 af, Depth= 3.10"

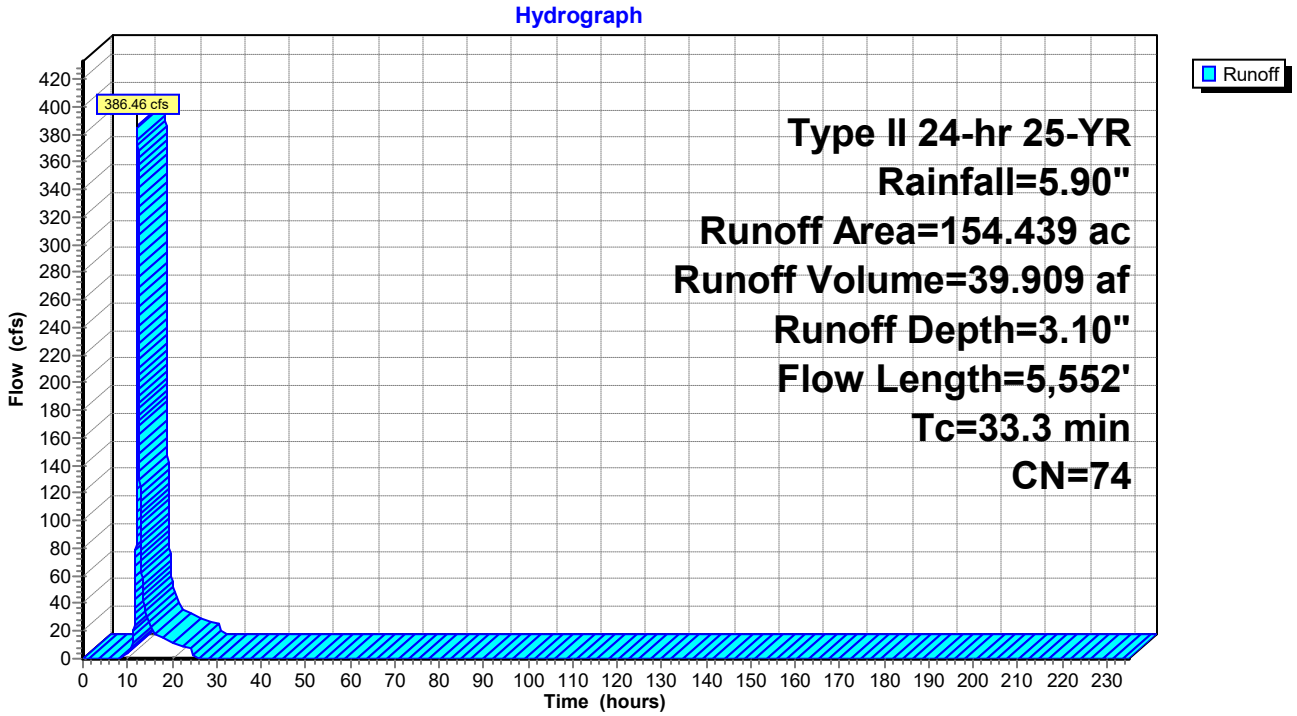
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	7.630	30	Woods, Good, HSG A (ONSITE)
*	3.008	70	Woods, Good, HSG C (ONSITE)
*	0.597	77	Woods, Good, HSG D (ONSITE)
*	9.439	61	>75% Grass cover, Good, HSG B (ONSITE A SOILS)
*	15.374	80	>75% Grass cover, Good, HSG D (ONSITE C SOILS)
*	6.297	80	>75% Grass cover, Good, HSG D (ONSITE D SOILS)
*	1.702	98	Paved parking & roofs A ONSITE
*	3.969	98	Paved parking & roofs C ONSITE
*	0.736	98	Paved parking & roofs D ONSITE
*	85.888	80	CAP AREA
*	0.772	30	Woods, Good, HSG A OFFSITE
*	1.183	70	Woods, Good, HSG C OFFSITE
*	9.257	42	RA ZONING A SOIL
*	2.379	64	RA ZONING B SOIL
*	4.931	76	RA ZONING C SOIL
*	1.277	82	RA ZONING D SOIL
	154.439	74	Weighted Average
	148.032		Pervious Area
	6.407		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0600	0.26		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
1.2	295	0.0700	4.26		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.3	272	0.0200	3.44	32.28	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=16.00' D=0.50' Z= 6.0 & 5.0 '/' Top.W=21.50' n= 0.035 Earth, dense weeds
6.5	1,025	0.0100	2.64	73.81	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=55.00' D=0.50' Z= 2.0 '/' Top.W=57.00' n= 0.035 Earth, dense weeds
9.4	2,107	0.0200	3.73	104.38	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=55.00' D=0.50' Z= 2.0 '/' Top.W=57.00' n= 0.035 Earth, dense weeds
0.3	165	0.0050	7.89	55.74	**Circular Channel (pipe), F-G** Diam= 36.0" Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.011 Concrete pipe, straight & clean
1.1	380	0.0600	5.78	17.35	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
5.1	724	0.0100	2.36	7.08	**Trap/Vee/Rect Channel Flow, H-I** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00'

n= 0.035 Earth, dense weeds					
1.9	376	0.0200	3.34	10.02	**Trap/Vee/Rect Channel Flow, I-J** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
0.2	108	0.0050	10.33	164.33	**Circular Channel (pipe), J-K** Diam= 54.0" Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.011 Concrete pipe, straight & clean
33.3	5,552	Total			

Subcatchment 5S: PROPOSED TO BASIN 1



Summary for Subcatchment 6S: PROPOSED TO BASIN 2

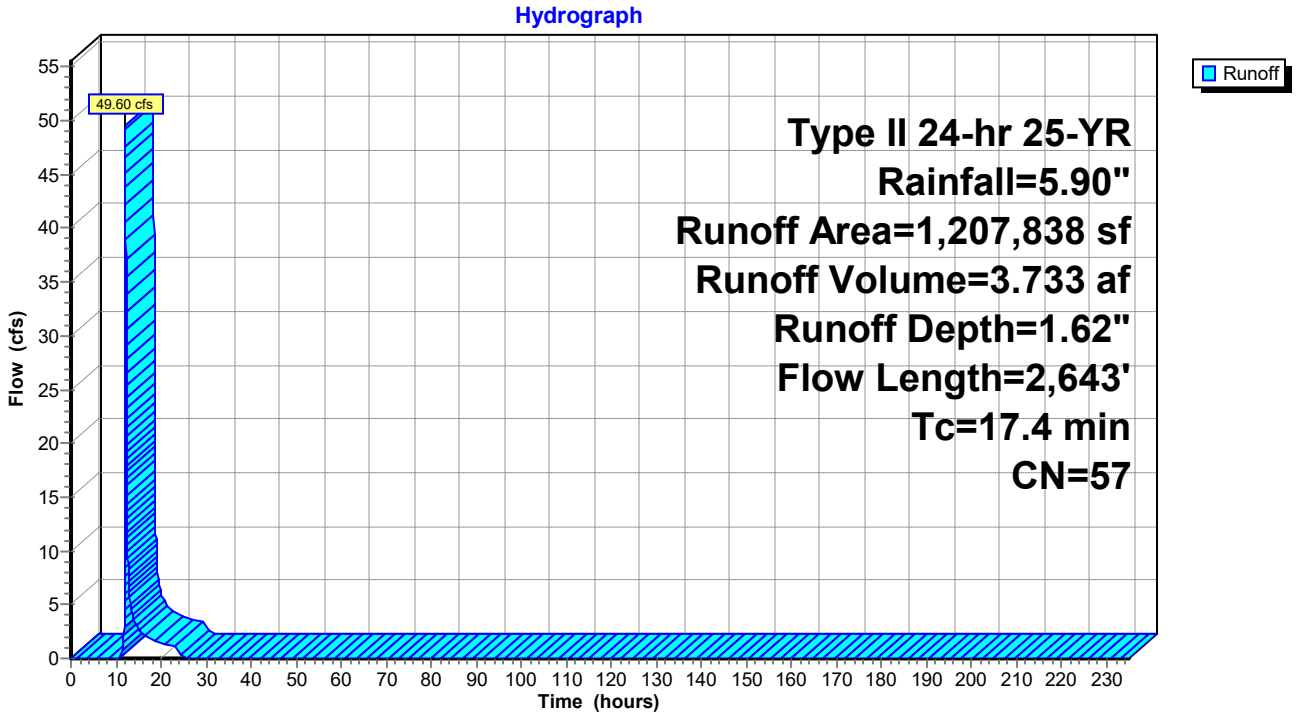
Runoff = 49.60 cfs @ 12.12 hrs, Volume= 3.733 af, Depth= 1.62"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	122,667	30	Woods, Good, HSG A (ONSITE)
*	43,308	70	Woods, Good, HSG C (ONSITE)
*	3,323	77	Woods, Good, HSG D (ONSITE)
*	75,069	61	>75% Grass cover, Good, HSG B (ONSITE A SOIL)
*	193,145	80	>75% Grass cover, Good, HSG D (ONSITE C SOIL)
*	12,756	98	Paved parking & roofs (ONSITE A)
*	39,104	98	Paved parking & roofs (ONSITE C)
*	42,617	80	CAP
*	547,893	42	RA ZONING A SOIL
*	9,866	64	RA ZONING B SOIL
*	81,020	76	RA ZONING C SOIL
*	37,070	82	RA ZONING D SOIL
	1,207,838	57	Weighted Average
	1,155,978		Pervious Area
	51,860		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	598	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.6	697	0.0400	4.43	12.72	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=4.00' D=0.50' Z= 3.5 '/' Top.W=7.50' n= 0.035 Earth, dense weeds
1.1	161	0.0100	2.45	11.05	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=8.00' D=0.50' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
2.1	545	0.0300	4.25	19.13	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=8.00' D=0.50' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
0.1	74	0.0700	23.95	117.56	**Circular Channel (pipe), F-G** Diam= 30.0" Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.012
0.9	305	0.0500	5.57	30.64	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=10.00' D=0.50' Z= 2.0 '/' Top.W=12.00' n= 0.035 Earth, dense weeds
0.1	163	0.0900	37.15	466.84	**Circular Channel (pipe), H-I** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.012
17.4	2,643	Total			

Subcatchment 6S: PROPOSED TO BASIN 2



Summary for Subcatchment 7S: PROPOSED TO BASIN 3

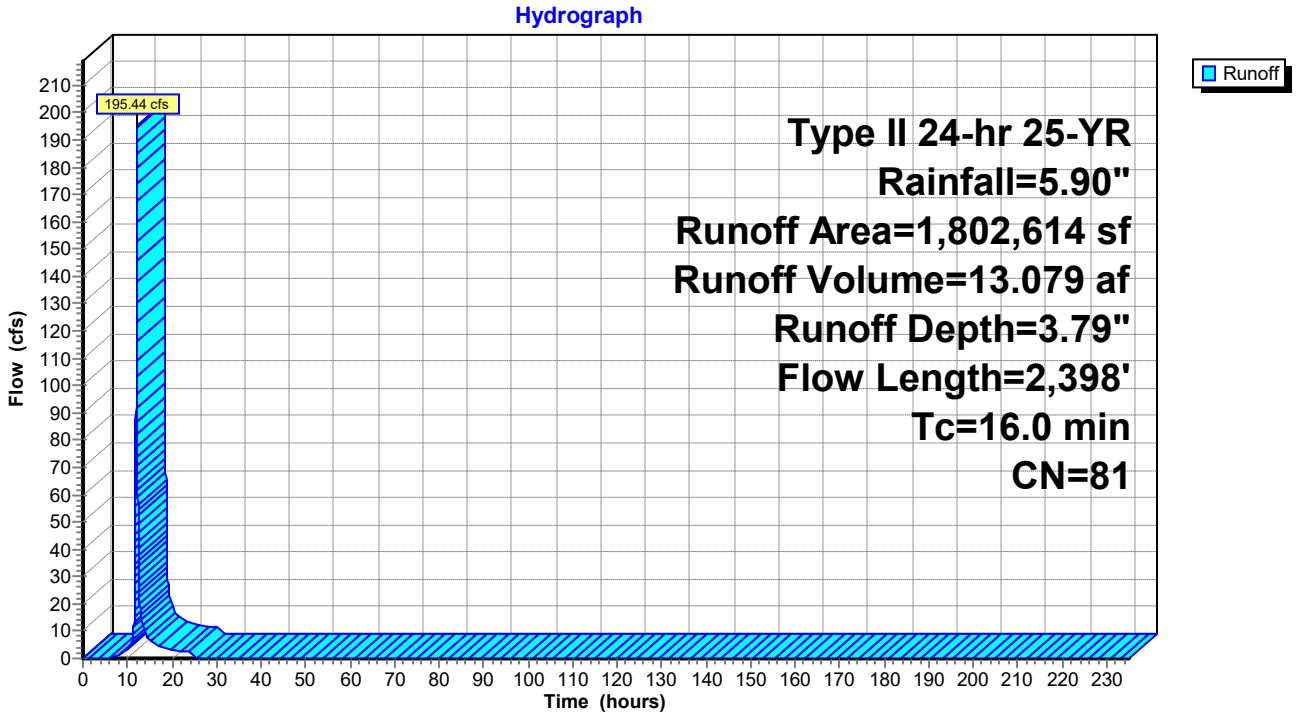
Runoff = 195.44 cfs @ 12.08 hrs, Volume= 13.079 af, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	68,751	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	252,304	80	>75% Grass cover, Good, HSG D (ONSITE C)
	29,508	80	>75% Grass cover, Good, HSG D
*	9,226	98	Paved parking & roofs (ONSITE A)
*	110,479	98	Paved parking & roofs (ONSITE C)
*	19,790	98	Paved parking & roofs (ONSITE D)
*	1,312,556	80	CAP
	1,802,614	81	Weighted Average
	1,663,119		Pervious Area
	139,495		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	33	0.5000	0.49		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
14.9	2,274	0.0100	2.54	19.03	**Trap/Vee/Rect Channel Flow, B-C** Bot.W=14.00' D=0.50' Z= 2.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
0.0	91	0.0600	35.20	691.11	**Circular Channel (pipe), C-D** Diam= 60.0" Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012
16.0	2,398	Total			

Subcatchment 7S: PROPOSED TO BASIN 3



Summary for Subcatchment 8S: PROPOSED TO BASIN 4

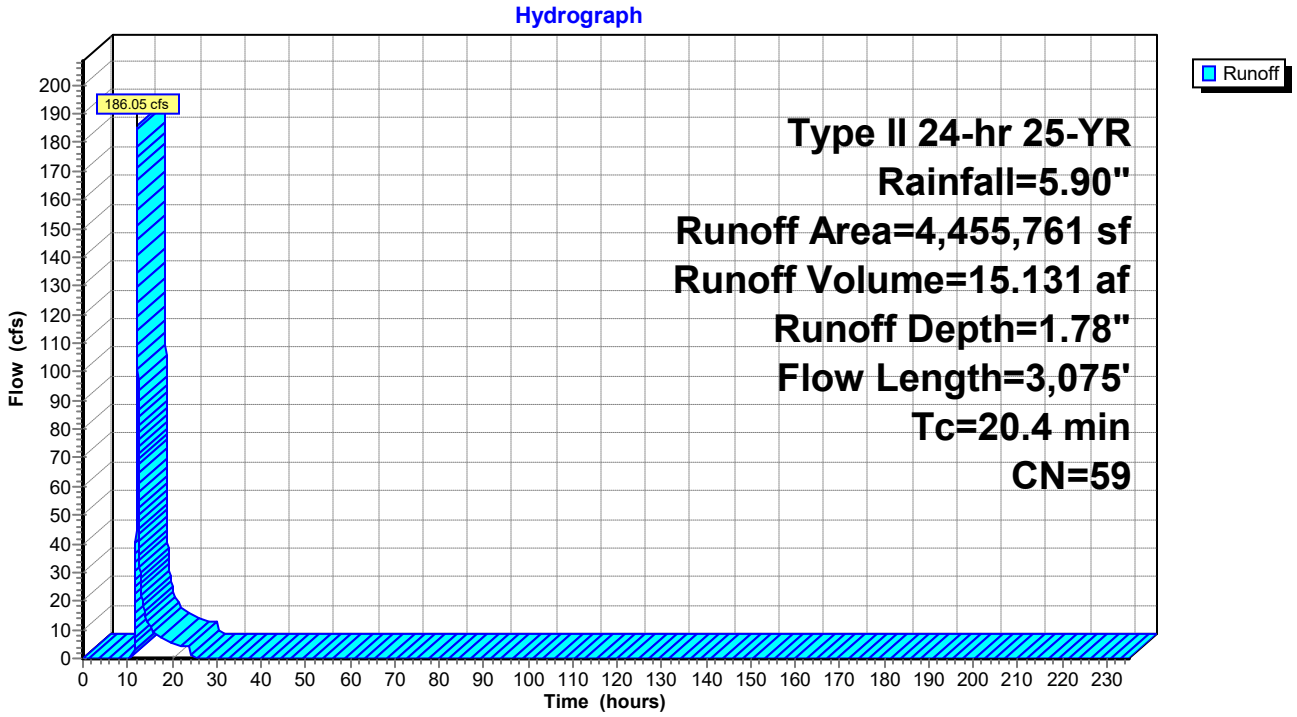
Runoff = 186.05 cfs @ 12.15 hrs, Volume= 15.131 af, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	395,927	30	Woods, Good, HSG A (ONSITE)
*	5,767	55	Woods, Good, HSG B (ONSITE)
*	404,259	70	Woods, Good, HSG C (ONSITE)
*	35,334	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	18,850	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	198,718	80	>75% Grass cover, Good, HSG D (ONSITE C)
	50,619	80	>75% Grass cover, Good, HSG D
*	7,436	98	Paved parking & roofs (ONSITE A)
*	16,314	98	Paved parking & roofs (ONSITE B)
*	18,955	98	Paved parking & roofs (ONSITE C)
*	6,703	98	Paved parking & roofs (ONSITE D)
*	1,043,104	42	RA ZONING A SOILS
*	281,741	64	RA ZONING B SOILS
*	75,531	76	RA ZONING C SOILS
*	692,547	50	R-2 ZONING A SOILS
*	599,476	70	R-2 ZONING B SOILS
*	322,638	80	R-2 ZONING C SOILS
*	281,842	85	R-2 ZONING D SOILS
	4,455,761	59	Weighted Average
	4,406,353		Pervious Area
	49,408		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.5	141	0.1000	5.09		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.5	190	0.0700	6.14	23.43	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=6.00' D=0.50' Z= 2.0 & 4.5 '/' Top.W=9.25' n= 0.035 Earth, dense weeds
2.8	653	0.0600	3.94		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.9	274	0.0500	5.01	15.67	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=4.50' D=0.50' Z= 3.5 '/' Top.W=8.00' n= 0.035 Earth, dense weeds
8.8	1,671	0.0200	3.17	9.91	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=4.50' D=0.50' Z= 3.5 '/' Top.W=8.00' n= 0.035 Earth, dense weeds
0.1	46	0.1800	9.91	27.26	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=4.50' D=0.50' Z= 2.0 '/' Top.W=6.50' n= 0.035 Earth, dense weeds
20.4	3,075	Total			

Subcatchment 8S: PROPOSED TO BASIN 4



Summary for Subcatchment 15S: PROPOSED TO WQv FACILITY

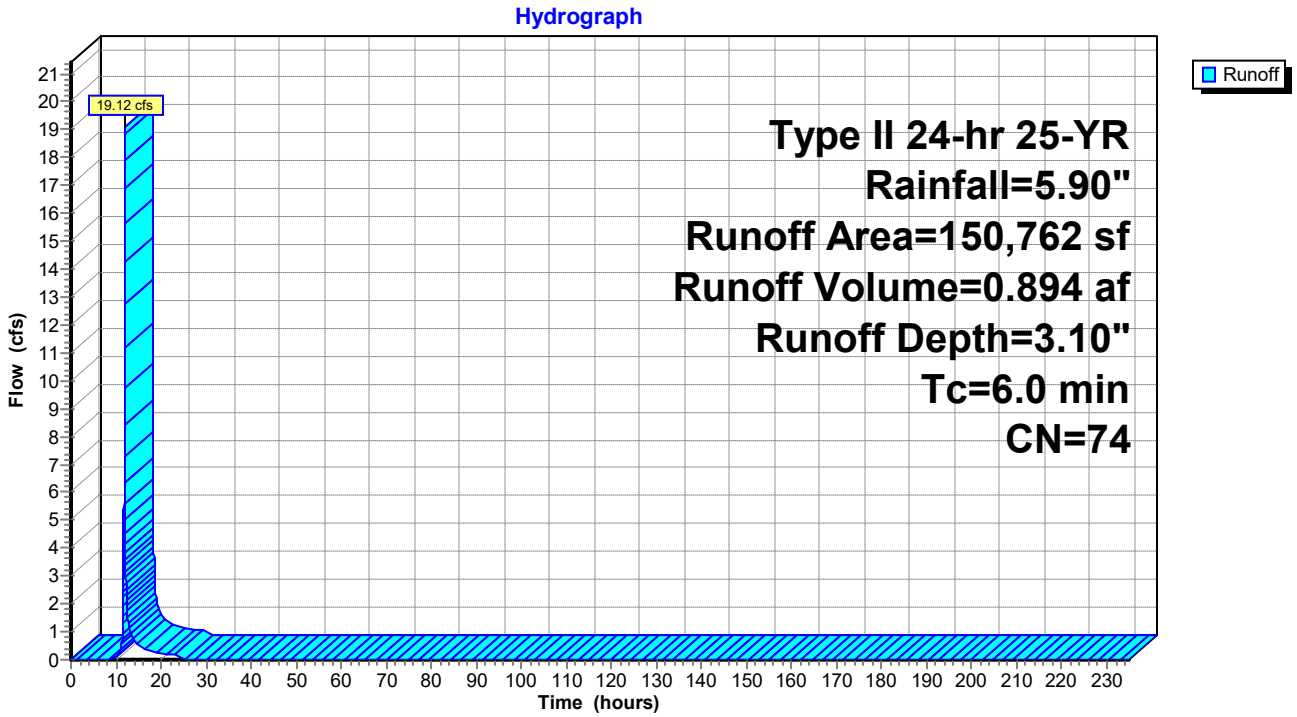
Runoff = 19.12 cfs @ 11.97 hrs, Volume= 0.894 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	9,235	55	Woods, Good, HSG B
	6,229	70	Woods, Good, HSG C
*	20,647	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	16,945	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	8,756	98	Paved parking & roofs (ONSITE B)
*	4,487	98	Paved parking & roofs (ONSITE C)
*	65,732	70	R-2 ZONING B SOILS
*	18,731	80	R-2 ZONING C SOILS
	150,762	74	Weighted Average
	137,519		Pervious Area
	13,243		Impervious Area

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

Subcatchment 15S: PROPOSED TO WQv FACILITY



Summary for Subcatchment 19S: DRAINAGE AREA TO CULVERT 3

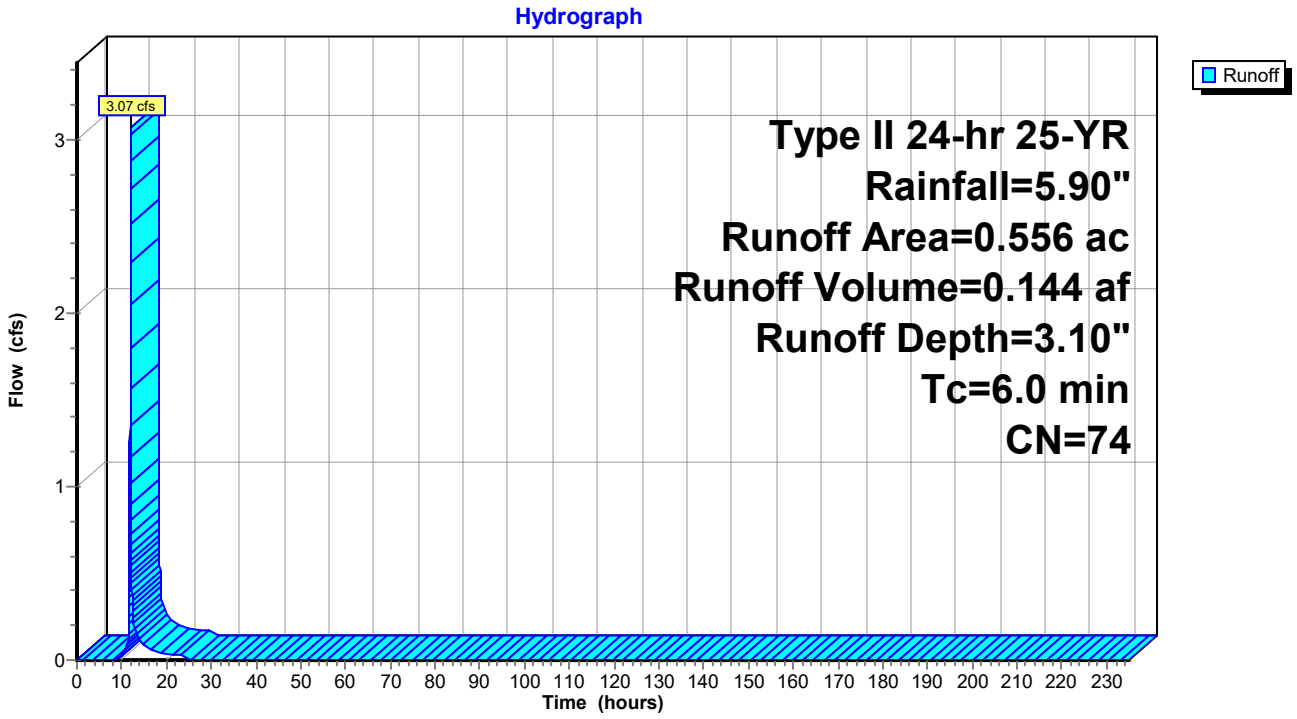
Runoff = 3.07 cfs @ 11.97 hrs, Volume= 0.144 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	0.150	74	>75% Grass cover, Good, HSG C (DISTURBED B)
*	0.013	80	>75% Grass cover, Good, HSG D (DISTURBED C)
*	0.008	98	Paved parking & roofs B SOILS
*	0.042	98	Paved parking & roofs C SOILS
*	0.343	70	R-2 ZONING B SOILS
	0.556	74	Weighted Average
	0.506		Pervious Area
	0.050		Impervious Area

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

Subcatchment 19S: DRAINAGE AREA TO CULVERT 3



Summary for Subcatchment 20S: DRAINAGE AREA TO CULVERT 4

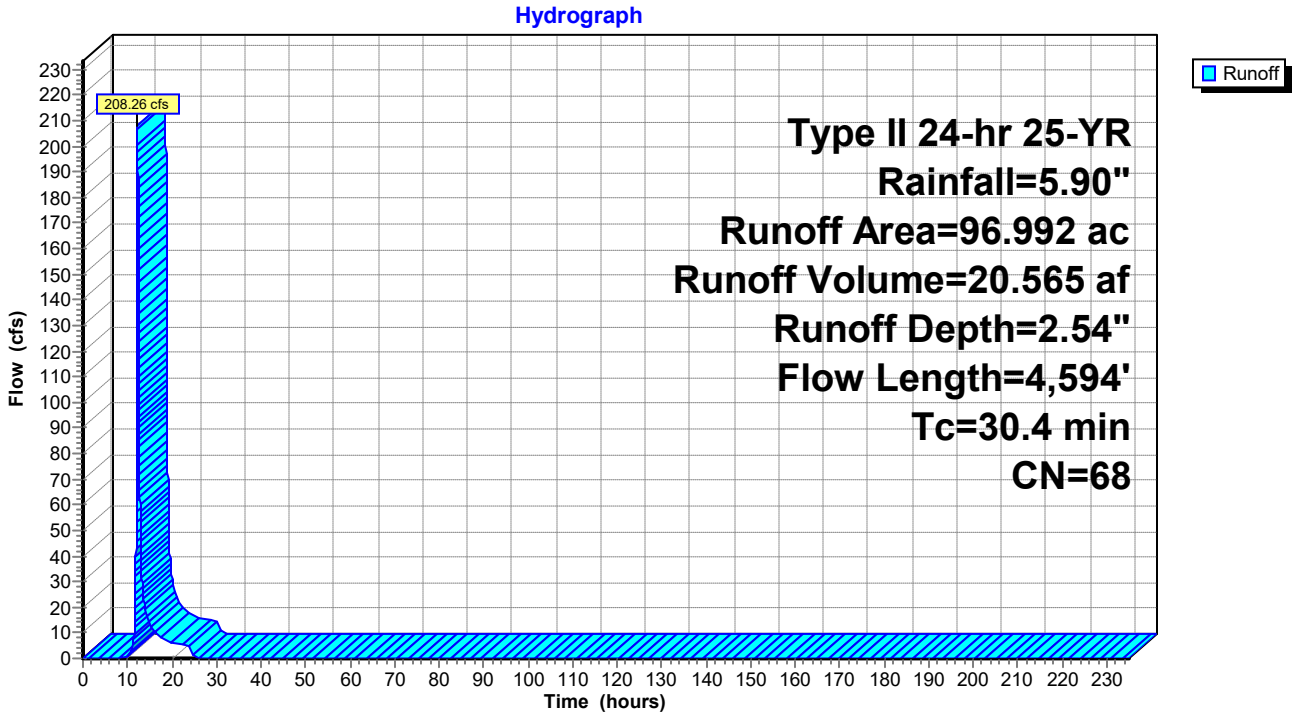
Runoff = 208.26 cfs @ 12.26 hrs, Volume= 20.565 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	0.193	61	>75% Grass cover, Good, HSG B (DISTURBED A)
*	0.776	74	>75% Grass cover, Good, HSG C (DISTURBED B)
*	0.003	80	>75% Grass cover, Good, HSG D (DISTURBED C)
	0.228	80	>75% Grass cover, Good, HSG D
*	0.050	98	Paved parking & roofs A SOILS
*	0.073	98	Paved parking & roofs B SOILS
*	0.008	98	Paved parking & roofs C SOILS
*	0.028	98	Paved parking & roofs D SOILS
*	33.640	50	R-2 ZONING A SOILS
*	27.405	70	R-2 ZONING B SOILS
*	19.119	80	R-2 ZONING C SOILS
*	15.469	85	R-2 ZONING D SOILS
	96.992	68	Weighted Average
	96.833		Pervious Area
	0.159		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
4.8	468	0.0100	1.61		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	83	0.1500	6.24		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
14.7	3,415	0.0300	3.88	13.59	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=5.00' D=0.50' Z= 4.0 '/' Top.W=9.00' n= 0.035 Earth, dense weeds
3.9	528	0.0100	2.24	7.85	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=5.00' D=0.50' Z= 4.0 '/' Top.W=9.00' n= 0.035 Earth, dense weeds
30.4	4,594	Total			

Subcatchment 20S: DRAINAGE AREA TO CULVERT 4



Summary for Subcatchment 21S: DRAINAGE AREA TO CULVERT 5

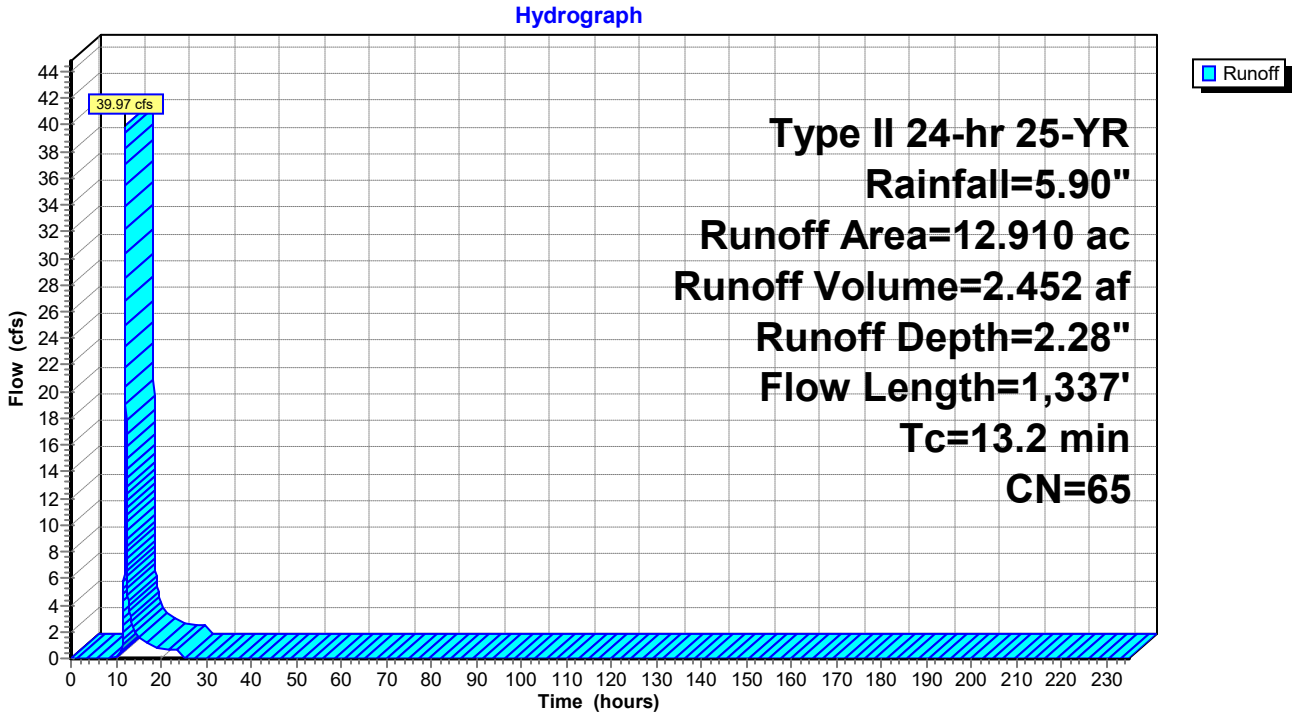
Runoff = 39.97 cfs @ 12.06 hrs, Volume= 2.452 af, Depth= 2.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	0.467	61	>75% Grass cover, Good, HSG B (DISTURBED A)
*	0.546	74	>75% Grass cover, Good, HSG C (DISTURBED B)
	0.197	98	Paved parking & roofs
	0.052	98	Paved parking & roofs
*	3.819	50	R-2 ZONING A SOILS
*	6.875	70	R-2 ZONING B SOILS
*	0.954	80	R-2 ZONING C SOILS
	12.910	65	Weighted Average
	12.661		Pervious Area
	0.249		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	428	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.0	10	0.6000	12.47		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
2.7	799	0.0200	4.96	13.30	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=10.00' D=0.25' Z= 1.7 & 4.0 '/' Top.W=11.43' n= 0.016 Asphalt, rough
13.2	1,337	Total			

Subcatchment 21S: DRAINAGE AREA TO CULVERT 5



Summary for Subcatchment 22S: DRAINAGE AREA TO CULVERT 6

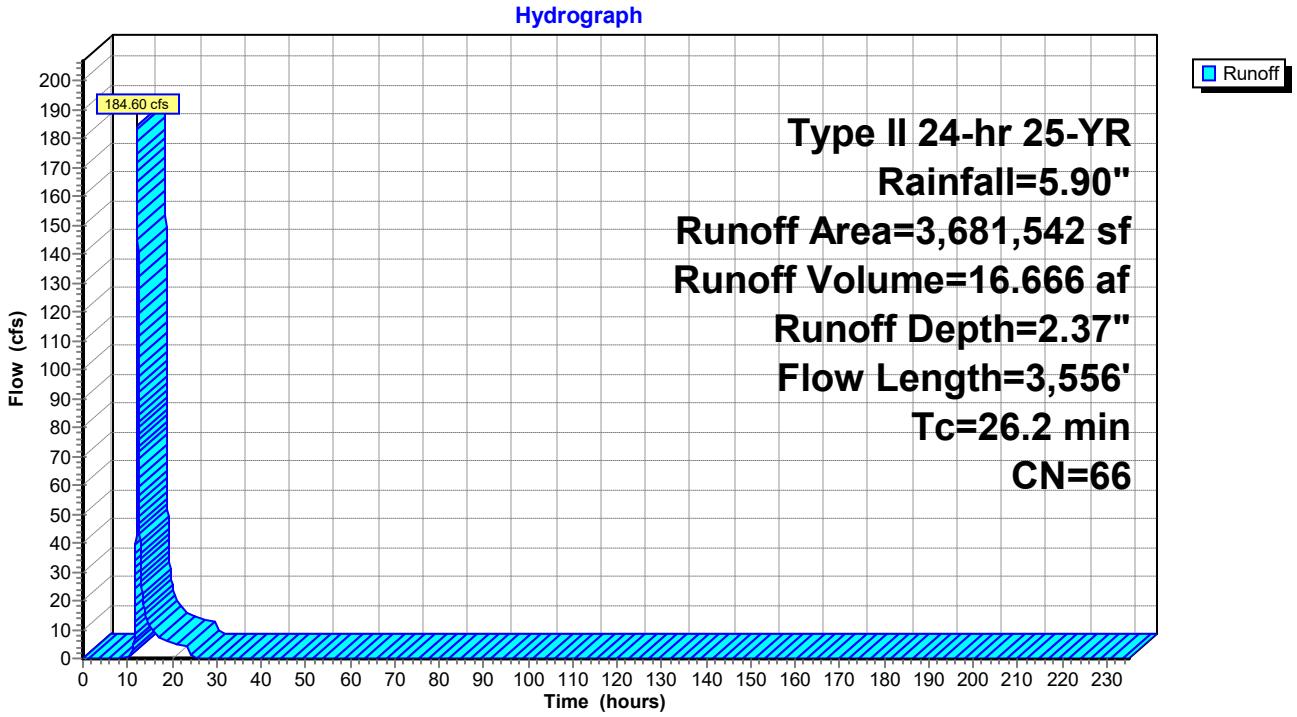
Runoff = 184.60 cfs @ 12.20 hrs, Volume= 16.666 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	9,867	80	>75% Grass cover, Good, HSG D (DISTURBED C)
	3,623	98	Paved parking & roofs
*	1,329,281	50	R-2 ZONING A SOILS
*	1,059,738	70	R-2 ZONING B SOILS
*	1,279,033	80	R-2 ZONING C SOILS
	3,681,542	66	Weighted Average
	3,677,919		Pervious Area
	3,623		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
2.6	700	0.0800	4.55		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
3.8	728	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
5.9	574	0.0100	1.61		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.1	53	0.2600	8.21		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
3.9	850	0.0300	3.60	19.81	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
3.1	551	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
26.2	3,556	Total			

Subcatchment 22S: DRAINAGE AREA TO CULVERT 6



Summary for Subcatchment 51S: ONSITE ACCESS ROAD (UNMANAGED)

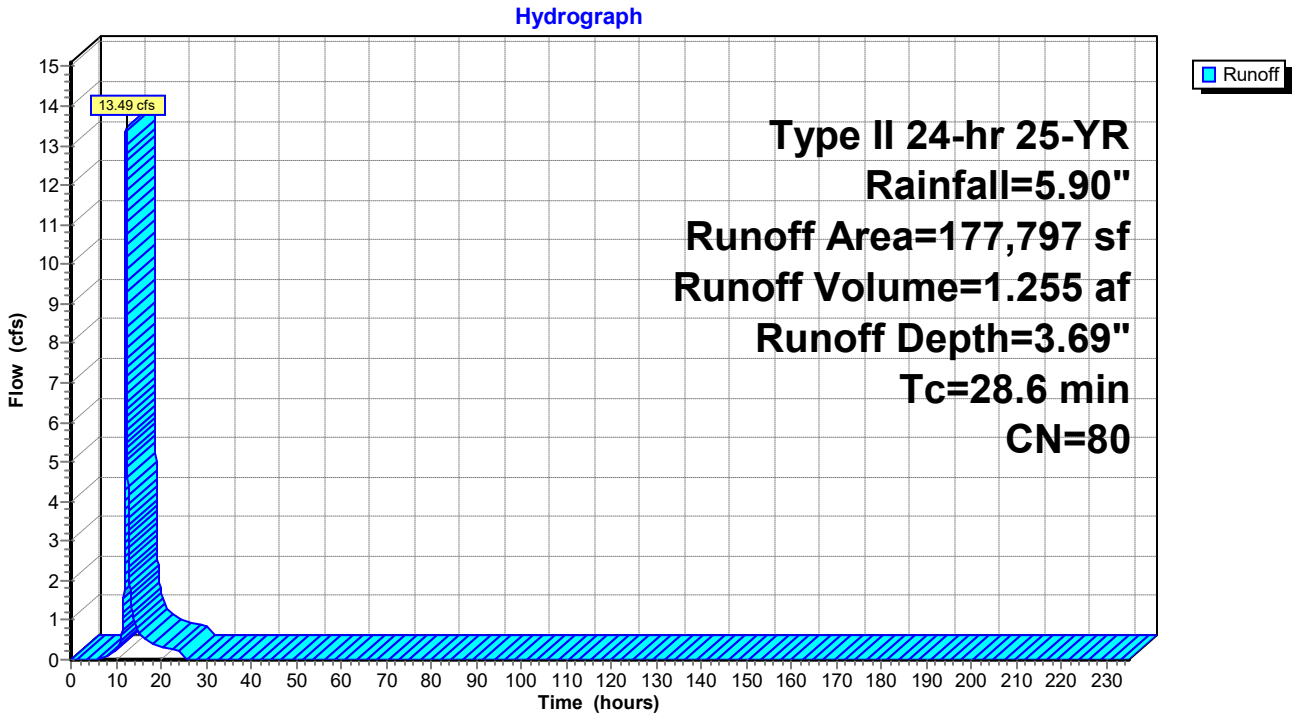
Runoff = 13.49 cfs @ 12.23 hrs, Volume= 1.255 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	40,015	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	9,812	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	68,391	80	>75% Grass cover, Good, HSG D (ONSITE C)
	16,061	80	>75% Grass cover, Good, HSG D
*	12,080	98	Paved parking & roofs (ONSITE A)
*	3,237	98	Paved parking & roofs (ONSITE B)
*	24,939	98	Paved parking & roofs (ONSITE C)
*	3,262	98	Paved parking & roofs (ONSITE D)
	177,797	80	Weighted Average
	134,279		Pervious Area
	43,518		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.6					**Direct Entry, SEE Tc CALC FOR AREA TO CULVERT 6**

Subcatchment 51S: ONSITE ACCESS ROAD (UNMANAGED)



Summary for Subcatchment 52S: DRAINAGE AREA TO CULVERT 7

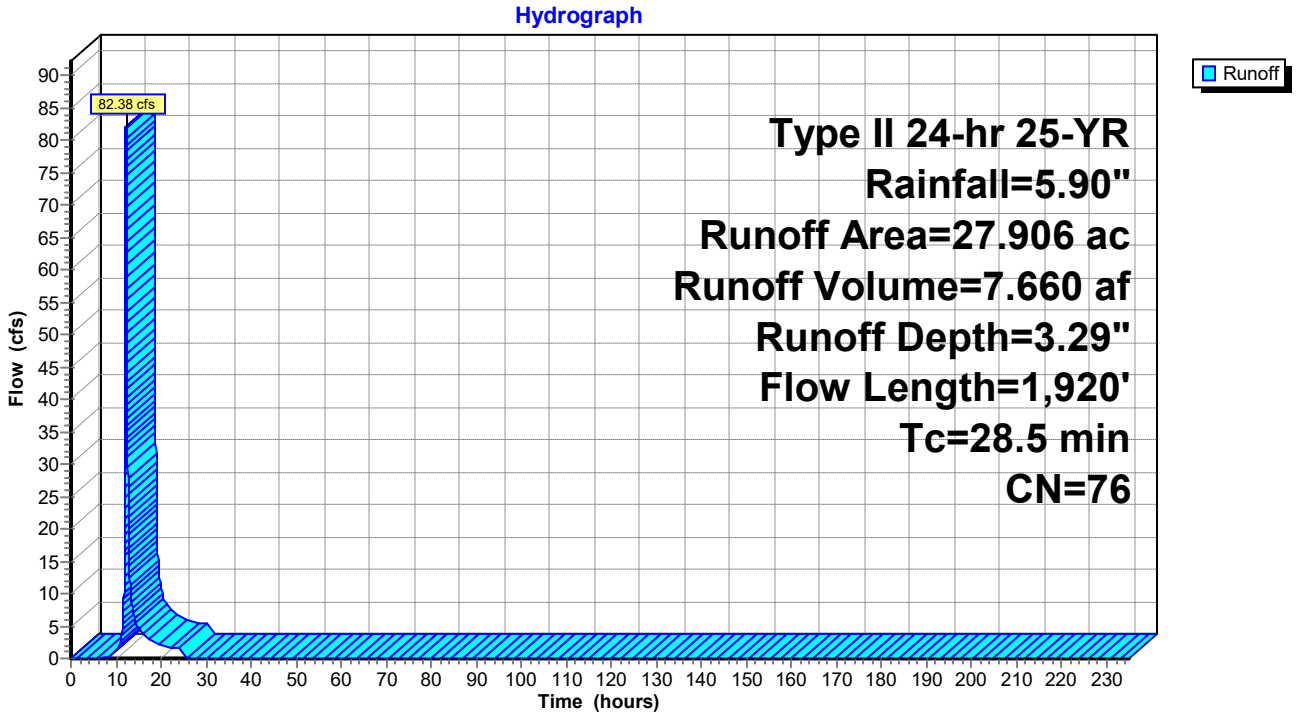
Runoff = 82.38 cfs @ 12.22 hrs, Volume= 7.660 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	1.525	80	>75% Grass cover, Good, HSG D (DISTURBED C)
*	0.201	80	>75% Grass cover, Good, HSG D (DISTURBED D)
*	0.303	98	Paved parking & roofs C SOILS
*	0.052	98	Paved parking & roofs D SOILS
*	3.110	50	R-2 ZONING A SOILS
*	4.062	70	R-2 ZONING B SOILS
*	13.425	80	R-2 ZONING C SOILS
*	5.228	85	R-2 ZONING D SOILS
	27.906	76	Weighted Average
	27.551		Pervious Area
	0.355		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	145	0.0700	4.26		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
5.9	986	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
7.1	689	0.0100	1.61		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
28.5	1,920	Total			

Subcatchment 52S: DRAINAGE AREA TO CULVERT 7



Summary for Subcatchment 55S: UNMANAGED P 2

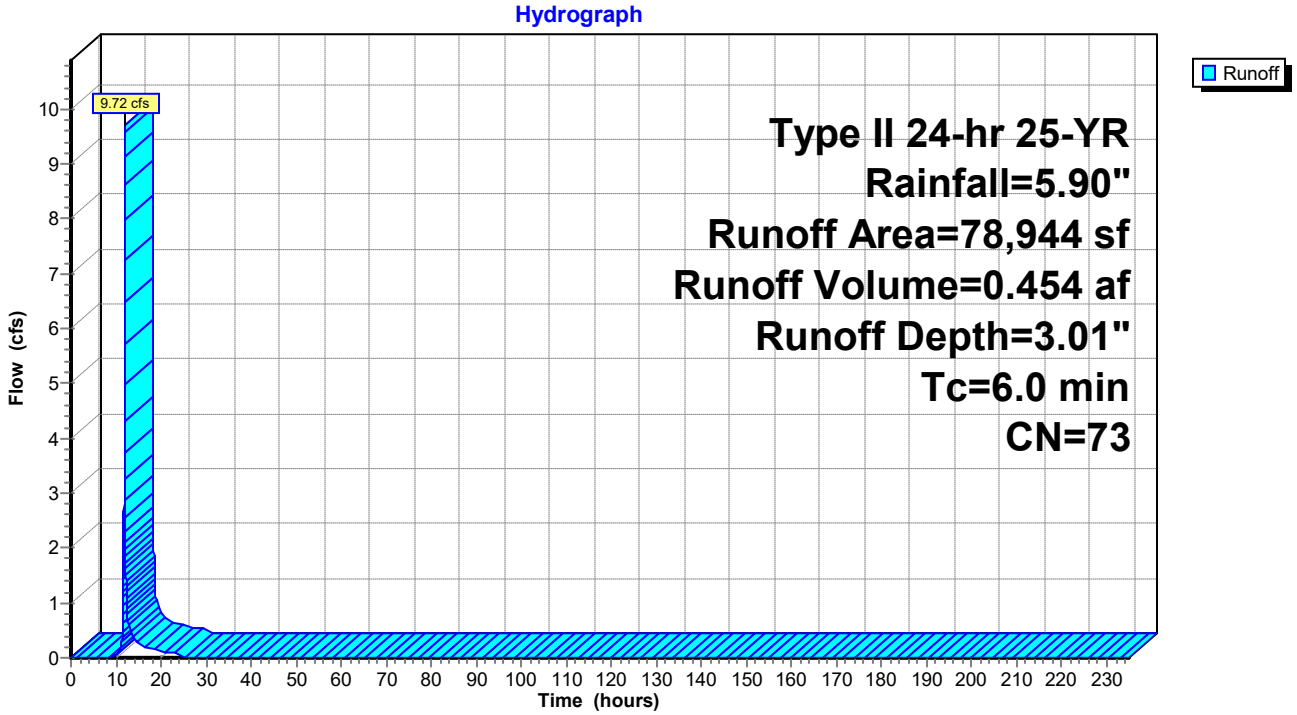
Runoff = 9.72 cfs @ 11.97 hrs, Volume= 0.454 af, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	7,354	70	Woods, Good, HSG C
	7,236	77	Woods, Good, HSG D
*	24,838	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	25,224	80	>75% Grass cover, Good, HSG D (ONSITE C)
	14,292	80	>75% Grass cover, Good, HSG D
	78,944	73	Weighted Average
	78,944		Pervious Area

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

Subcatchment 55S: UNMANAGED P 2



Summary for Subcatchment 56S: UNMANAGED P 1

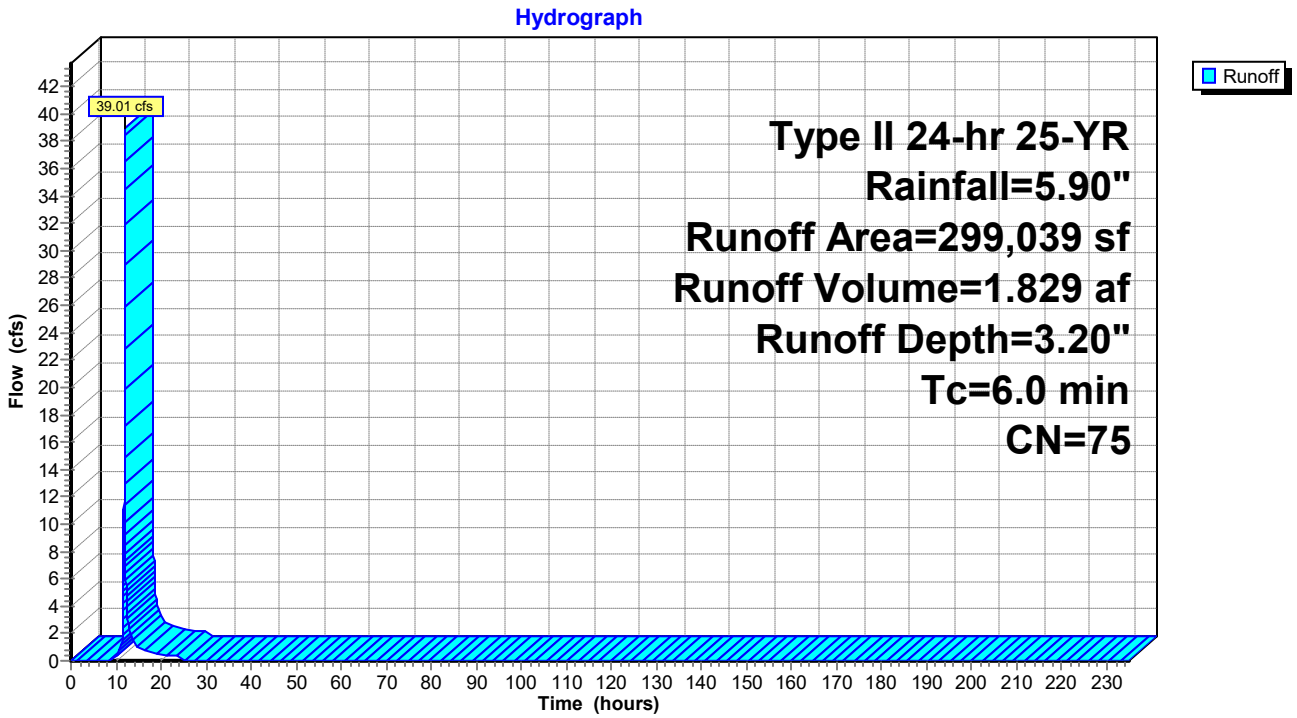
Runoff = 39.01 cfs @ 11.97 hrs, Volume= 1.829 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	4,400	30	Woods, Good, HSG A
	86,031	70	Woods, Good, HSG C
	184,912	77	Woods, Good, HSG D
*	2,047	80	>75% Grass cover, Good, HSG D (ONSITE C)
	21,649	80	>75% Grass cover, Good, HSG D
	299,039	75	Weighted Average
	299,039		Pervious Area

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

Subcatchment 56S: UNMANAGED P 1



Summary for Subcatchment 57S: UNMANAGED P 3

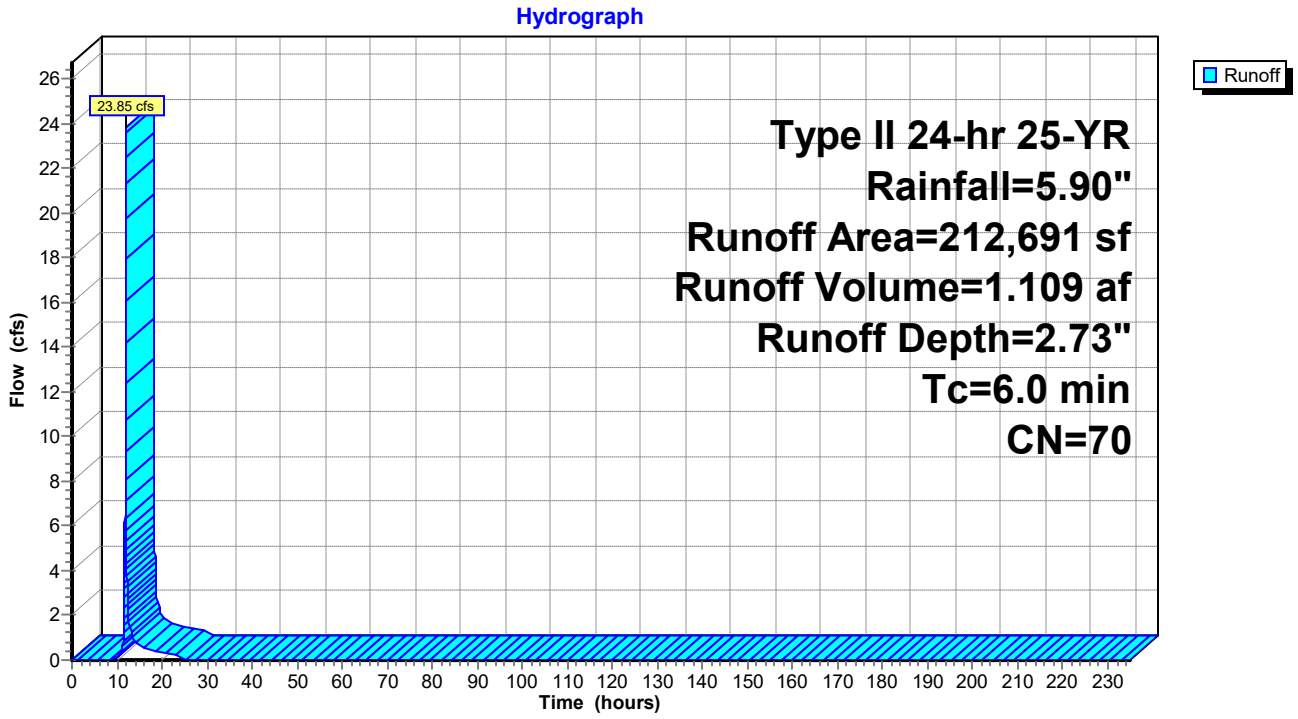
Runoff = 23.85 cfs @ 11.98 hrs, Volume= 1.109 af, Depth= 2.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	25,681	30	Woods, Good, HSG A
	11,227	70	Woods, Good, HSG C
	20,676	77	Woods, Good, HSG D
*	37,410	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	32,984	80	>75% Grass cover, Good, HSG D (ONSITE C)
	84,713	80	>75% Grass cover, Good, HSG D
	212,691	70	Weighted Average
	212,691		Pervious Area

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

Subcatchment 57S: UNMANAGED P 3



Summary for Subcatchment 58S: UNMANAGED P 4

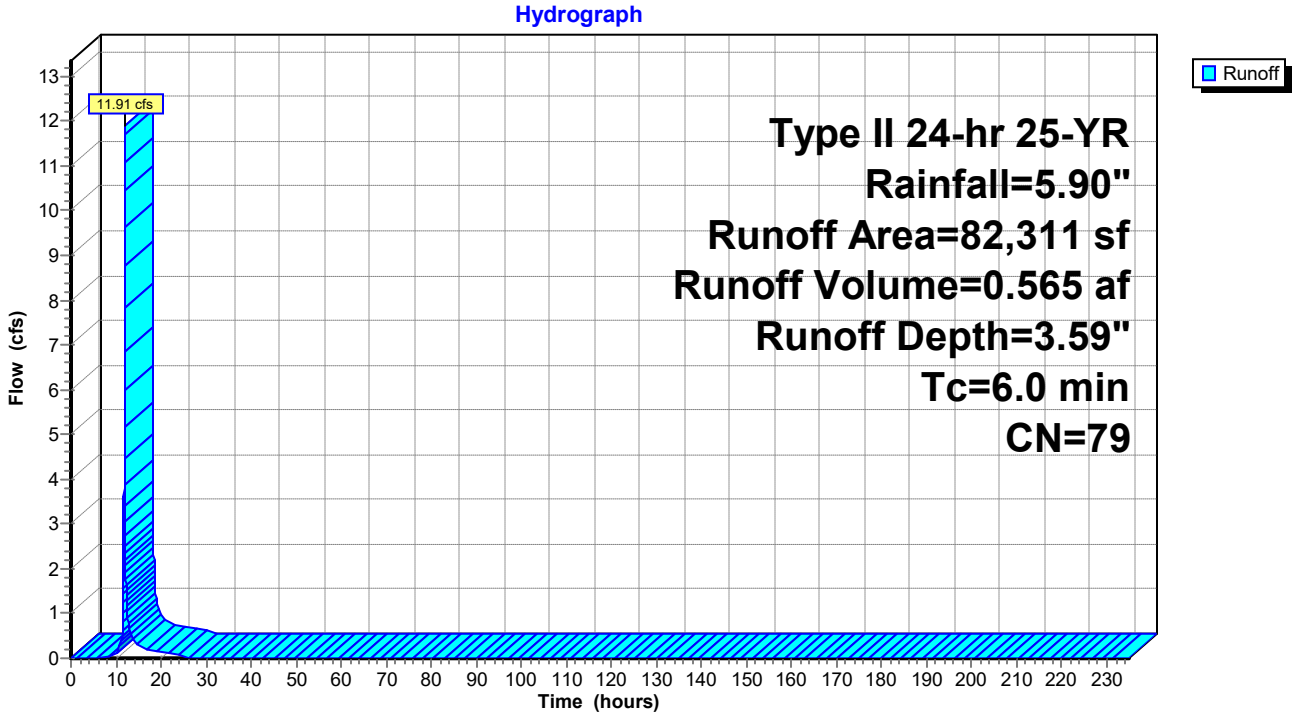
Runoff = 11.91 cfs @ 11.97 hrs, Volume= 0.565 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	3,590	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	5,089	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	14,725	80	>75% Grass cover, Good, HSG D (ONSITE C)
	58,907	80	>75% Grass cover, Good, HSG D
	82,311	79	Weighted Average
	82,311		Pervious Area

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

Subcatchment 58S: UNMANAGED P 4



Summary for Pond 9P: BASIN 1

Inflow Area = 154.439 ac, 4.15% Impervious, Inflow Depth = 3.10" for 25-YR event
Inflow = 386.46 cfs @ 12.28 hrs, Volume= 39.909 af
Outflow = 140.81 cfs @ 12.77 hrs, Volume= 39.794 af, Atten= 64%, Lag= 29.1 min
Primary = 140.81 cfs @ 12.77 hrs, Volume= 39.794 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 86.60' @ 12.77 hrs Surf.Area= 143,047 sf Storage= 718,710 cf

Plug-Flow detention time= 588.1 min calculated for 39.794 af (100% of inflow)
Center-of-Mass det. time= 586.2 min (1,438.0 - 851.7)

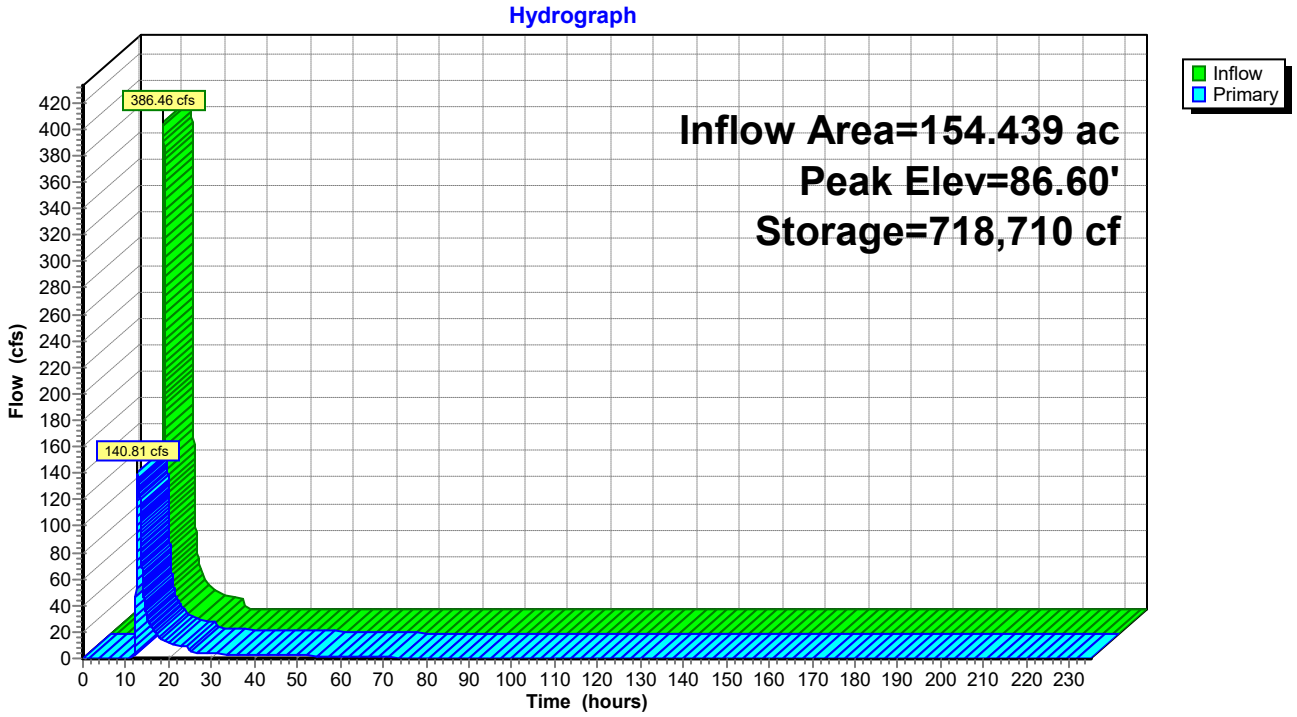
Volume	Invert	Avail.Storage	Storage Description
#1	81.00'	1,573,213 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.00	110,353	0	0
82.00	113,238	111,796	111,796
82.50	114,690	56,982	168,778
83.00	128,912	60,901	229,678
87.00	144,633	547,090	776,768
89.00	157,733	302,366	1,079,134
91.00	167,296	325,029	1,404,163
92.00	170,803	169,050	1,573,213

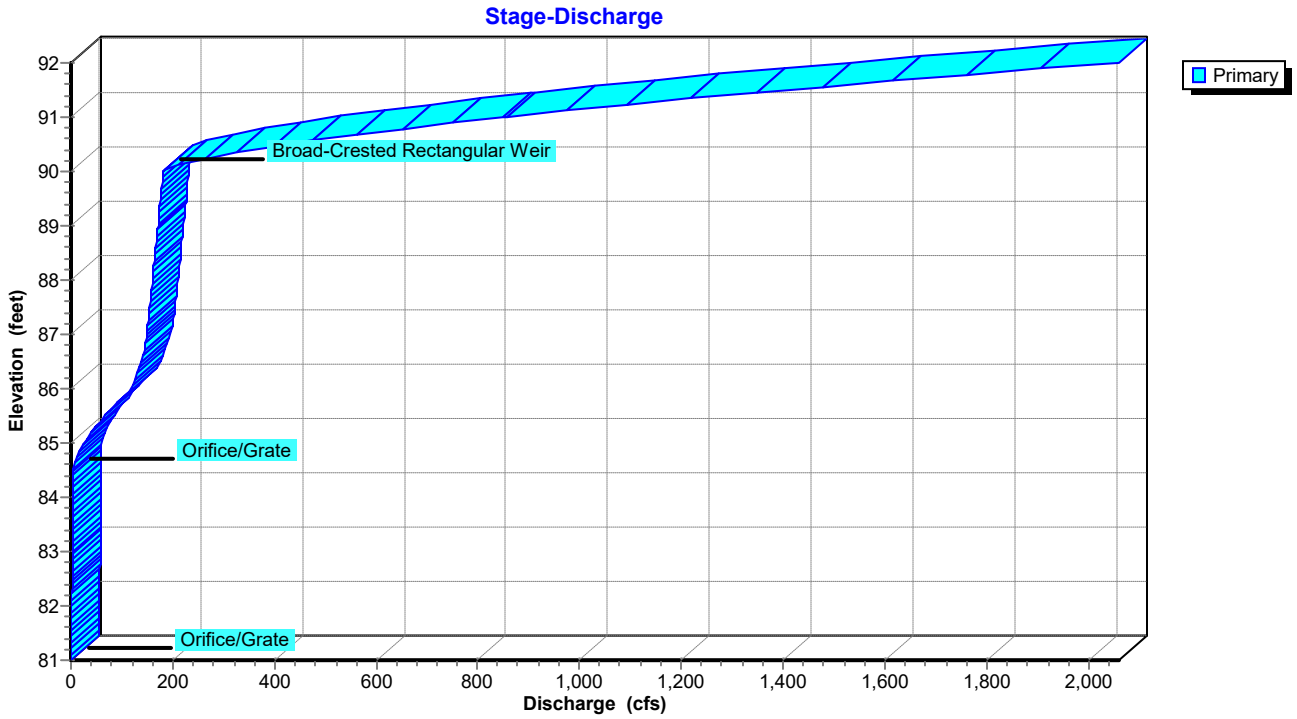
Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**48.0" x 70.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 78.66' S= 0.0049 '/' Cc= 0.900 n= 0.012
#2	Device 1	81.00'	**9.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	84.50'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	90.00'	**250.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=140.80 cfs @ 12.77 hrs HW=86.60' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 140.80 cfs of 143.14 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.86 cfs @ 11.00 fps)
  - **3=Orifice/Grate** (Orifice Controls 135.94 cfs @ 6.97 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

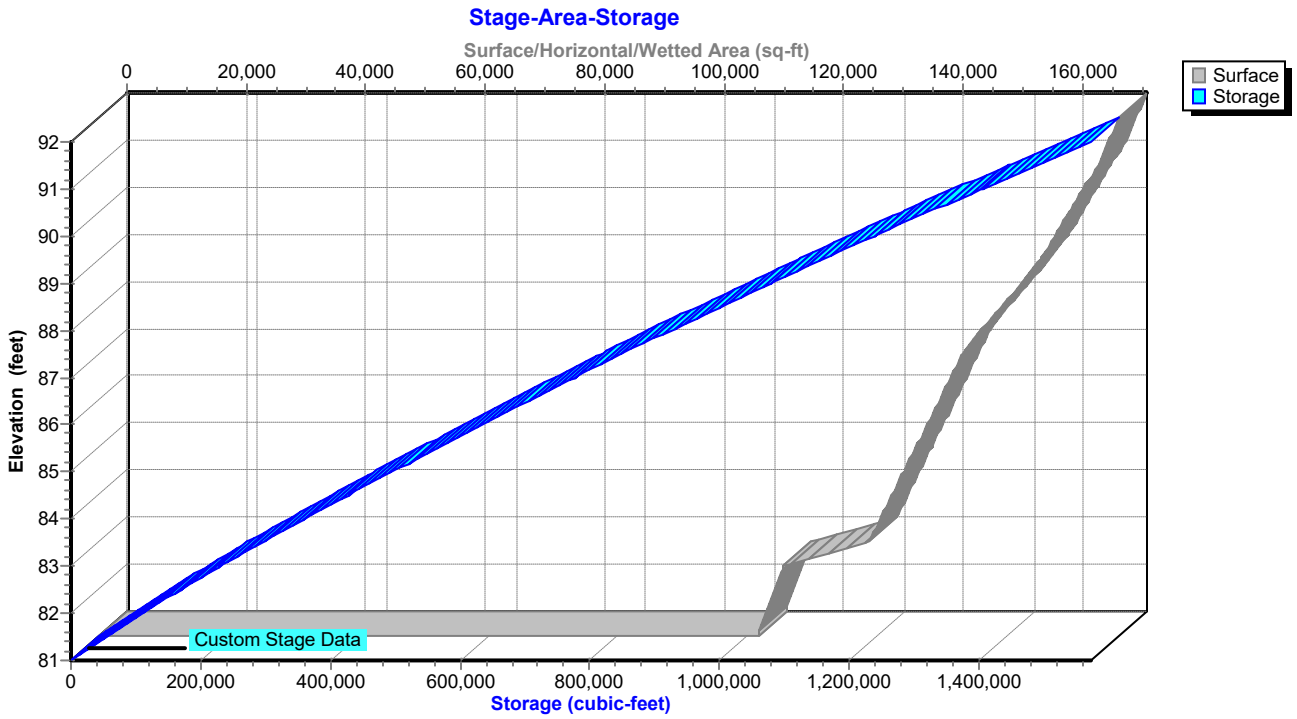
Pond 9P: BASIN 1



Pond 9P: BASIN 1



Pond 9P: BASIN 1



Stage-Discharge for Pond 9P: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
81.00	0.00	84.12	3.52	87.24	151.15	90.36	330.70
81.06	0.01	84.18	3.56	87.30	151.87	90.42	369.44
81.12	0.05	84.24	3.60	87.36	152.59	90.48	410.77
81.18	0.12	84.30	3.64	87.42	153.31	90.54	454.74
81.24	0.20	84.36	3.68	87.48	154.03	90.60	501.19
81.30	0.31	84.42	3.71	87.54	154.74	90.66	547.57
81.36	0.43	84.48	3.75	87.60	155.44	90.72	595.53
81.42	0.56	84.54	4.28	87.66	156.15	90.78	644.92
81.48	0.70	84.60	5.78	87.72	156.85	90.84	697.53
81.54	0.85	84.66	7.83	87.78	157.55	90.90	752.83
81.60	1.00	84.72	10.30	87.84	158.25	90.96	809.87
81.66	1.14	84.78	13.13	87.90	158.94	91.02	869.11
81.72	1.26	84.84	16.28	87.96	159.63	91.08	931.18
81.78	1.35	84.90	19.71	88.02	160.31	91.14	995.10
81.84	1.45	84.96	23.41	88.08	161.00	91.20	1,060.84
81.90	1.54	85.02	27.36	88.14	161.68	91.26	1,127.28
81.96	1.63	85.08	31.54	88.20	162.36	91.32	1,195.31
82.02	1.71	85.14	35.94	88.26	163.03	91.38	1,264.89
82.08	1.79	85.20	40.55	88.32	163.70	91.44	1,335.12
82.14	1.86	85.26	45.36	88.38	164.37	91.50	1,406.27
82.20	1.93	85.32	50.36	88.44	165.04	91.56	1,478.70
82.26	2.00	85.38	55.55	88.50	165.70	91.62	1,552.90
82.32	2.07	85.44	60.91	88.56	166.37	91.68	1,629.46
82.38	2.13	85.50	66.45	88.62	167.03	91.74	1,707.40
82.44	2.20	85.56	72.16	88.68	167.68	91.80	1,786.68
82.50	2.26	85.62	78.03	88.74	168.34	91.86	1,867.28
82.56	2.32	85.68	84.05	88.80	168.99	91.92	1,949.18
82.62	2.37	85.74	90.23	88.86	169.63	91.98	**2,032.36**
82.68	2.43	85.80	96.57	88.92	170.28		
82.74	2.49	85.86	103.04	88.98	170.92		
82.80	2.54	85.92	109.67	89.04	171.57		
82.86	2.59	85.98	116.43	89.10	172.21		
82.92	2.64	86.04	121.11	89.16	172.84		
82.98	2.69	86.10	123.39	89.22	173.48		
83.04	2.74	86.16	125.62	89.28	174.11		
83.10	2.79	86.22	127.82	89.34	174.74		
83.16	2.84	86.28	129.98	89.40	175.37		
83.22	2.89	86.34	132.10	89.46	175.99		
83.28	2.94	86.40	134.19	89.52	176.61		
83.34	2.98	86.46	136.25	89.58	177.23		
83.40	3.03	86.52	138.27	89.64	177.85		
83.46	3.07	86.58	140.27	89.70	178.47		
83.52	3.12	86.64	142.23	89.76	179.08		
83.58	3.16	86.70	144.17	89.82	179.70		
83.64	3.20	86.76	145.22	89.88	180.31		
83.70	3.24	86.82	145.97	89.94	180.91		
83.76	3.29	86.88	146.72	90.00	181.52		
83.82	3.33	86.94	147.47	90.06	191.97		
83.88	3.37	87.00	148.21	90.12	210.58		
83.94	3.41	87.06	148.95	90.18	234.49		
84.00	3.45	87.12	149.69	90.24	262.82		
84.06	3.49	87.18	150.42	90.30	295.02		

Stage-Area-Storage for Pond 9P: BASIN 1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
81.00	110,353	0
81.15	110,786	16,585
81.30	111,218	33,236
81.45	111,651	49,951
81.60	112,084	66,731
81.75	112,517	83,576
81.90	112,950	100,486
82.05	113,383	117,461
82.20	113,819	134,501
82.35	114,254	151,607
82.50	114,690	168,778
82.65	118,957	186,301
82.80	123,223	204,464
82.95	127,490	223,268
83.10	129,305	242,589
83.25	129,895	262,029
83.40	130,484	281,557
83.55	131,074	301,174
83.70	131,663	320,879
83.85	132,253	340,673
84.00	132,842	360,555
84.15	133,432	380,526
84.30	134,021	400,585
84.45	134,611	420,732
84.60	135,200	440,968
84.75	135,790	461,292
84.90	136,379	481,705
85.05	136,969	502,206
85.20	137,559	522,796
85.35	138,148	543,474
85.50	138,738	564,240
85.65	139,327	585,095
85.80	139,917	606,038
85.95	140,506	627,070
86.10	141,096	648,190
86.25	141,685	669,399
86.40	142,275	690,696
86.55	142,864	712,081
86.70	143,454	733,555
86.85	144,043	755,117
87.00	144,633	776,768
87.15	145,616	798,537
87.30	146,598	820,453
87.45	147,581	842,516
87.60	148,563	864,727
87.75	149,546	887,085
87.90	150,528	909,590
88.05	151,510	932,243
88.20	152,493	955,044
88.35	153,475	977,991
88.50	154,458	1,001,086
88.65	155,441	1,024,329
88.80	156,423	1,047,718
88.95	157,406	1,071,256
89.10	158,211	1,094,931
89.25	158,928	1,118,717
89.40	159,646	1,142,610
89.55	160,363	1,166,610
89.70	161,080	1,190,719
89.85	161,797	1,214,934
90.00	162,515	1,239,258
90.15	163,232	1,263,689
90.30	163,949	1,288,227
90.45	164,666	1,312,873
90.60	165,383	1,337,627
90.75	166,101	1,362,488
90.90	166,818	1,387,457
91.05	167,471	1,412,532
91.20	167,997	1,437,692
91.35	168,523	1,462,931
91.50	169,050	1,488,249
91.65	169,576	1,513,646
91.80	170,102	1,539,122
91.95	**170,628**	**1,564,677**

Summary for Pond 10P: BASIN 2

Inflow Area = 27.728 ac, 4.29% Impervious, Inflow Depth = 1.62" for 25-YR event
Inflow = 49.60 cfs @ 12.12 hrs, Volume= 3.733 af
Outflow = 3.75 cfs @ 13.90 hrs, Volume= 3.729 af, Atten= 92%, Lag= 106.8 min
Primary = 3.75 cfs @ 13.90 hrs, Volume= 3.729 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 77.06' @ 13.90 hrs Surf.Area= 32,285 sf Storage= 79,209 cf

Plug-Flow detention time= 404.9 min calculated for 3.729 af (100% of inflow)
Center-of-Mass det. time= 404.3 min (1,284.0 - 879.7)

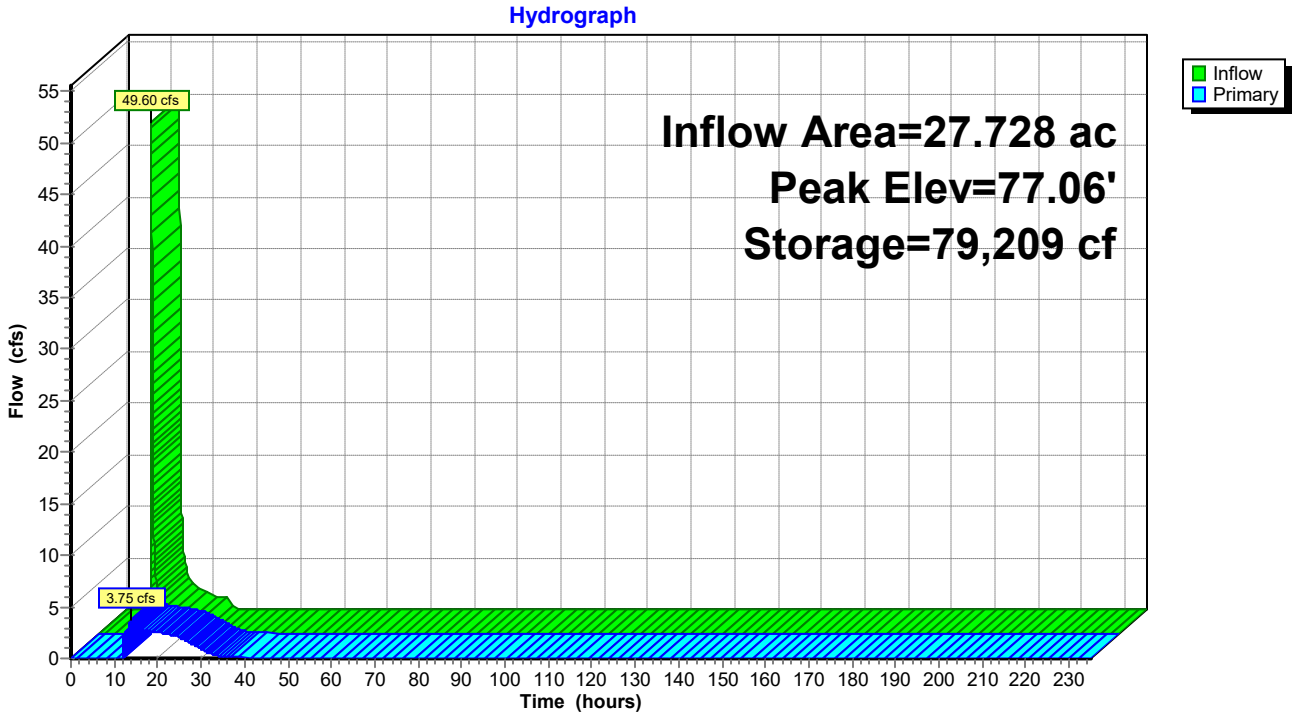
Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	183,706 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.00	21,185	0	0
75.00	22,367	21,776	21,776
75.50	22,967	11,334	33,110
76.00	29,696	13,166	46,275
78.00	34,569	64,265	110,540
80.00	38,597	73,166	183,706

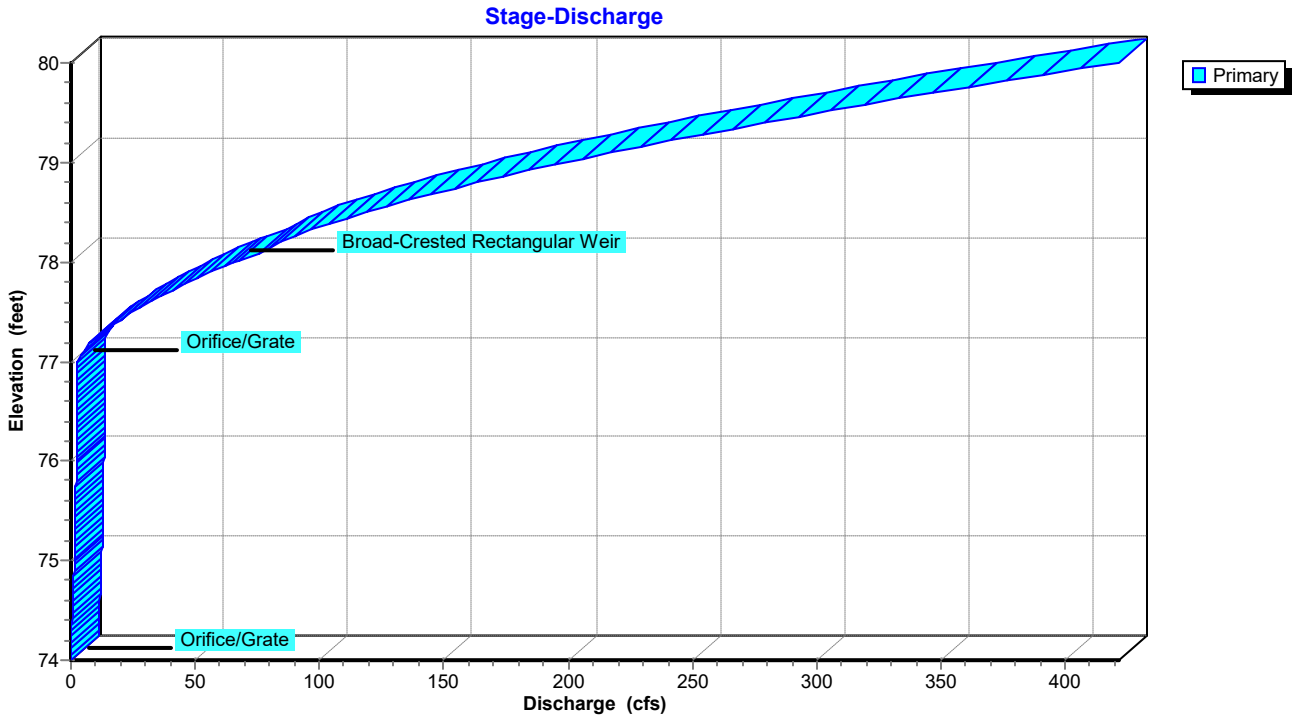
Device	Routing	Invert	Outlet Devices
#1	Primary	72.00'	**36.0" x 51.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 71.75' S= 0.0049 '/' Cc= 0.900 n= 0.012
#2	Device 1	74.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	77.00'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	78.00'	**45.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=3.75 cfs @ 13.90 hrs HW=77.06' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 3.75 cfs of 64.02 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.78 cfs @ 7.95 fps)
  - **3=Orifice/Grate** (Weir Controls 0.98 cfs @ 0.82 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

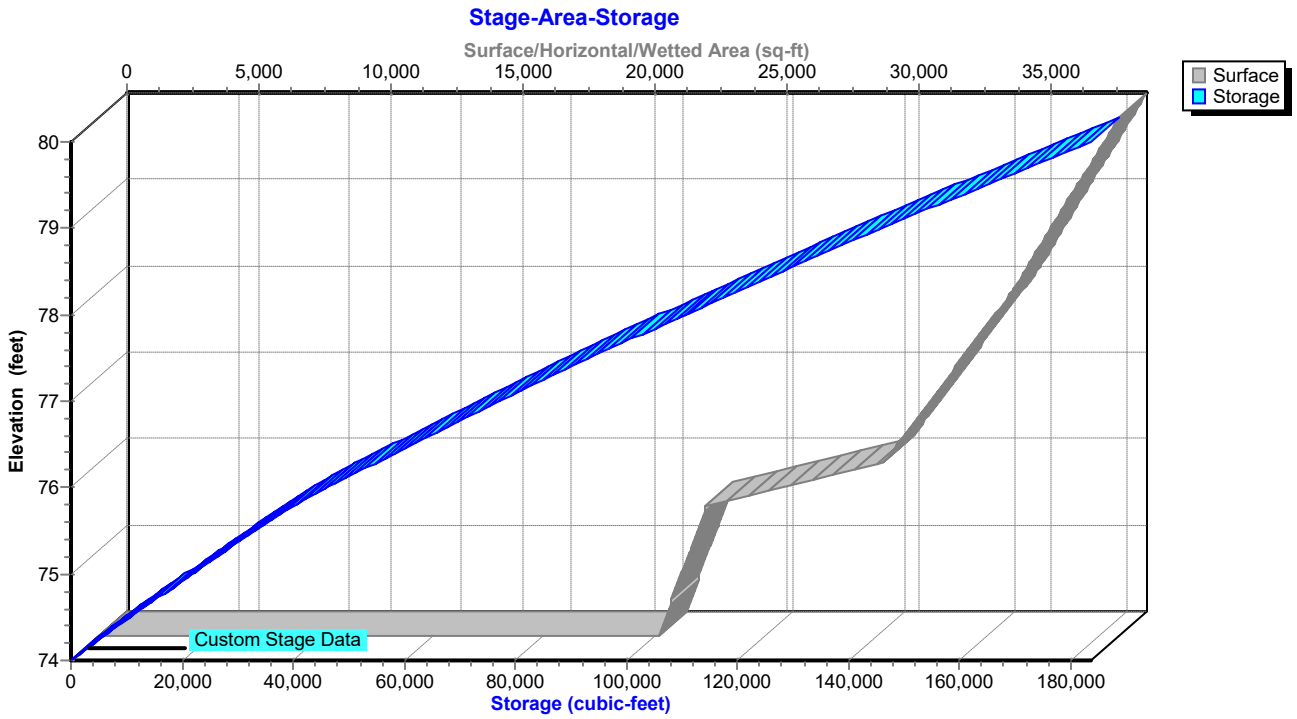
Pond 10P: BASIN 2



Pond 10P: BASIN 2



Pond 10P: BASIN 2



Stage-Discharge for Pond 10P: BASIN 2

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
74.00	0.00	76.08	2.22	78.16	81.19
74.04	0.01	76.12	2.25	78.20	84.57
74.08	0.02	76.16	2.27	78.24	88.30
74.12	0.05	76.20	2.30	78.28	92.33
74.16	0.09	76.24	2.32	78.32	96.65
74.20	0.13	76.28	2.35	78.36	101.24
74.24	0.19	76.32	2.37	78.40	106.08
74.28	0.25	76.36	2.39	78.44	111.11
74.32	0.32	76.40	2.42	78.48	116.36
74.36	0.39	76.44	2.44	78.52	121.82
74.40	0.47	76.48	2.46	78.56	127.48
74.44	0.55	76.52	2.49	78.60	133.33
74.48	0.63	76.56	2.51	78.64	139.09
74.52	0.72	76.60	2.53	78.68	144.99
74.56	0.80	76.64	2.55	78.72	151.00
74.60	0.87	76.68	2.57	78.76	157.13
74.64	0.94	76.72	2.60	78.80	163.36
74.68	0.99	76.76	2.62	78.84	170.04
74.72	1.05	76.80	2.64	78.88	176.87
74.76	1.10	76.84	2.66	78.92	183.83
74.80	1.15	76.88	2.68	78.96	190.93
74.84	1.20	76.92	2.70	79.00	198.17
74.88	1.24	76.96	2.72	79.04	205.73
74.92	1.29	77.00	2.74	79.08	213.43
74.96	1.33	77.04	3.26	79.12	221.29
75.00	1.37	77.08	4.19	79.16	229.28
75.04	1.41	77.12	5.39	79.20	237.42
75.08	1.45	77.16	6.80	79.24	245.58
75.12	1.49	77.20	8.40	79.28	253.87
75.16	1.53	77.24	10.17	79.32	262.28
75.20	1.56	77.28	12.09	79.36	270.81
75.24	1.60	77.32	14.15	79.40	279.46
75.28	1.64	77.36	16.34	79.44	288.08
75.32	1.67	77.40	18.66	79.48	296.80
75.36	1.70	77.44	21.10	79.52	305.63
75.40	1.74	77.48	23.64	79.56	314.56
75.44	1.77	77.52	26.30	79.60	323.58
75.48	1.80	77.56	29.06	79.64	332.90
75.52	1.83	77.60	31.91	79.68	342.32
75.56	1.86	77.64	34.87	79.72	351.85
75.60	1.89	77.68	37.91	79.76	361.49
75.64	1.92	77.72	41.05	79.80	371.24
75.68	1.95	77.76	44.28	79.84	381.09
75.72	1.98	77.80	47.59	79.88	391.04
75.76	2.01	77.84	50.98	79.92	401.10
75.80	2.04	77.88	54.45	79.96	411.26
75.84	2.06	77.92	58.01	80.00	**421.52**
75.88	2.09	77.96	61.64		
75.92	2.12	78.00	65.35		
75.96	2.14	78.04	70.10		
76.00	2.17	78.08	75.57		
76.04	2.20	78.12	78.17		

Stage-Area-Storage for Pond 10P: BASIN 2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
74.00	21,185	0
74.10	21,303	2,124
74.20	21,421	4,261
74.30	21,540	6,409
74.40	21,658	8,569
74.50	21,776	10,740
74.60	21,894	12,924
74.70	22,012	15,119
74.80	22,131	17,326
74.90	22,249	19,545
75.00	22,367	21,776
75.10	22,487	24,019
75.20	22,607	26,273
75.30	22,727	28,540
75.40	22,847	30,819
75.50	22,967	33,110
75.60	24,313	35,473
75.70	25,659	37,972
75.80	27,004	40,605
75.90	28,350	43,373
76.00	29,696	46,275
76.10	29,940	49,257
76.20	30,183	52,263
76.30	30,427	55,294
76.40	30,671	58,349
76.50	30,914	61,428
76.60	31,158	64,531
76.70	31,402	67,659
76.80	31,645	70,812
76.90	31,889	73,988
77.00	32,133	77,190
77.10	32,376	80,415
77.20	32,620	83,665
77.30	32,863	86,939
77.40	33,107	90,237
77.50	33,351	93,560
77.60	33,594	96,908
77.70	33,838	100,279
77.80	34,082	103,675
77.90	34,325	107,096
78.00	34,569	110,540
78.10	34,770	114,007
78.20	34,972	117,494
78.30	35,173	121,002
78.40	35,375	124,529
78.50	35,576	128,077
78.60	35,777	131,644
78.70	35,979	135,232
78.80	36,180	138,840
78.90	36,382	142,468
79.00	36,583	146,116
79.10	36,784	149,785
79.20	36,986	153,473
79.30	37,187	157,182
79.40	37,389	160,911
79.50	37,590	164,660
79.60	37,791	168,429
79.70	37,993	172,218
79.80	38,194	176,027
79.90	38,396	179,857
80.00	**38,597**	**183,706**

Summary for Pond 11P: BASIN 3

Inflow Area = 41.382 ac, 7.74% Impervious, Inflow Depth = 3.79" for 25-YR event
Inflow = 195.44 cfs @ 12.08 hrs, Volume= 13.079 af
Outflow = 54.16 cfs @ 12.37 hrs, Volume= 13.036 af, Atten= 72%, Lag= 17.7 min
Primary = 54.16 cfs @ 12.37 hrs, Volume= 13.036 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 77.89' @ 12.37 hrs Surf.Area= 83,655 sf Storage= 277,110 cf

Plug-Flow detention time= 865.5 min calculated for 13.036 af (100% of inflow)
Center-of-Mass det. time= 863.5 min (1,681.9 - 818.4)

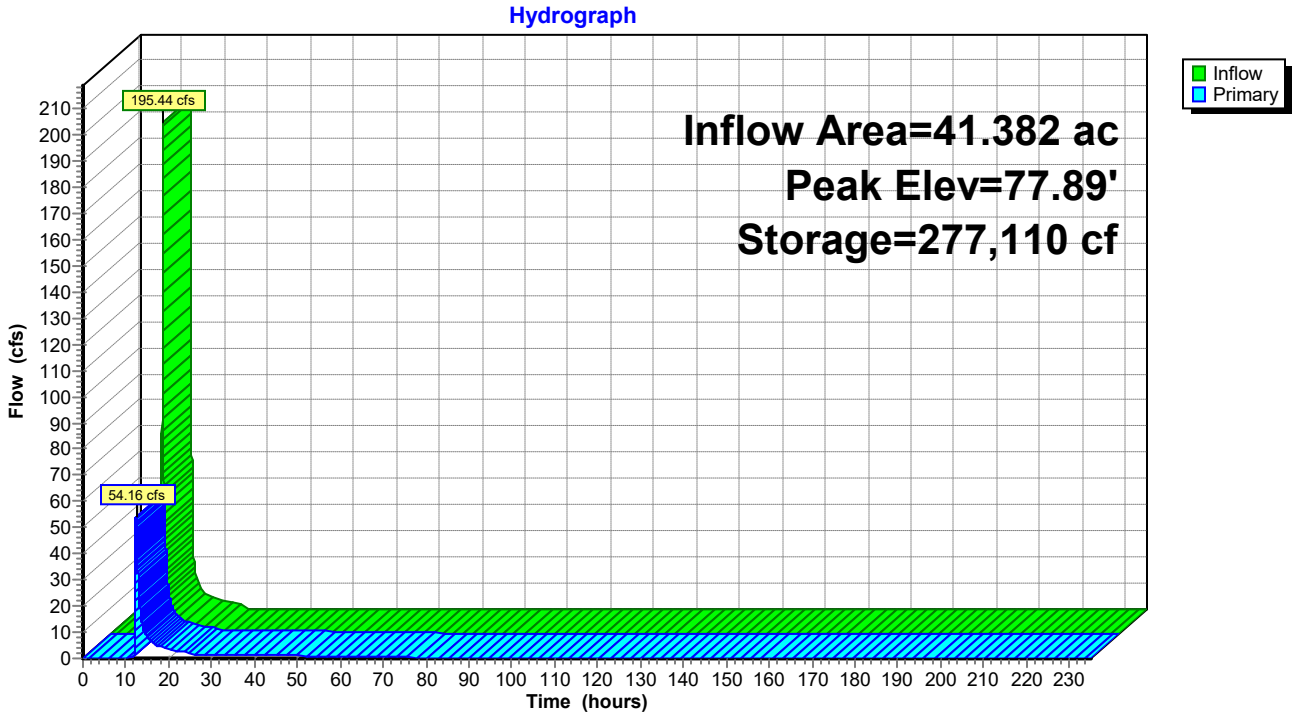
Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	461,645 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.00	59,381	0	0
75.00	61,618	60,500	60,500
75.50	62,746	31,091	91,591
76.00	75,824	34,643	126,233
78.00	84,101	159,925	286,158
80.00	91,386	175,487	461,645

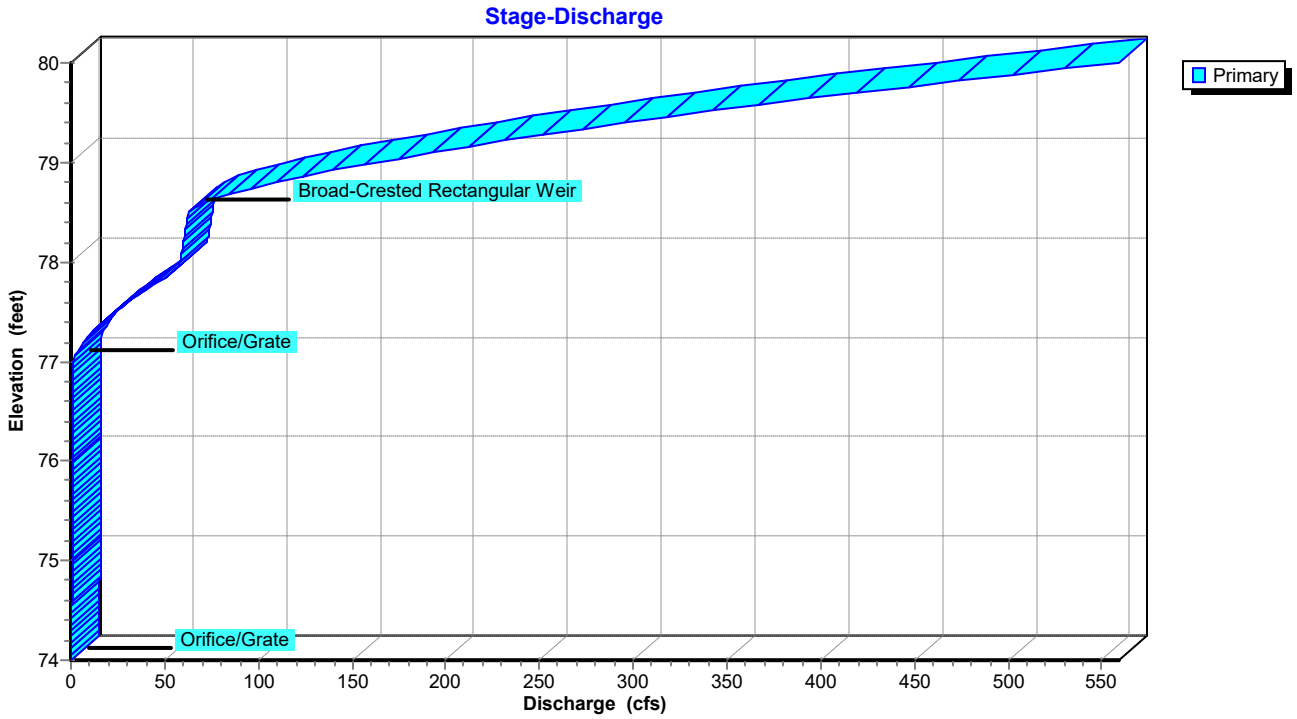
Device	Routing	Invert	Outlet Devices
#1	Primary	73.10'	**36.0" x 220.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 72.00' S= 0.0050 '/' Cc= 0.900 n= 0.012
#2	Device 1	74.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	77.00'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	78.50'	**100.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=54.15 cfs @ 12.37 hrs HW=77.89' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 54.15 cfs of 57.03 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 1.80 cfs @ 9.19 fps)
  - **3=Orifice/Grate** (Weir Controls 52.35 cfs @ 3.09 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

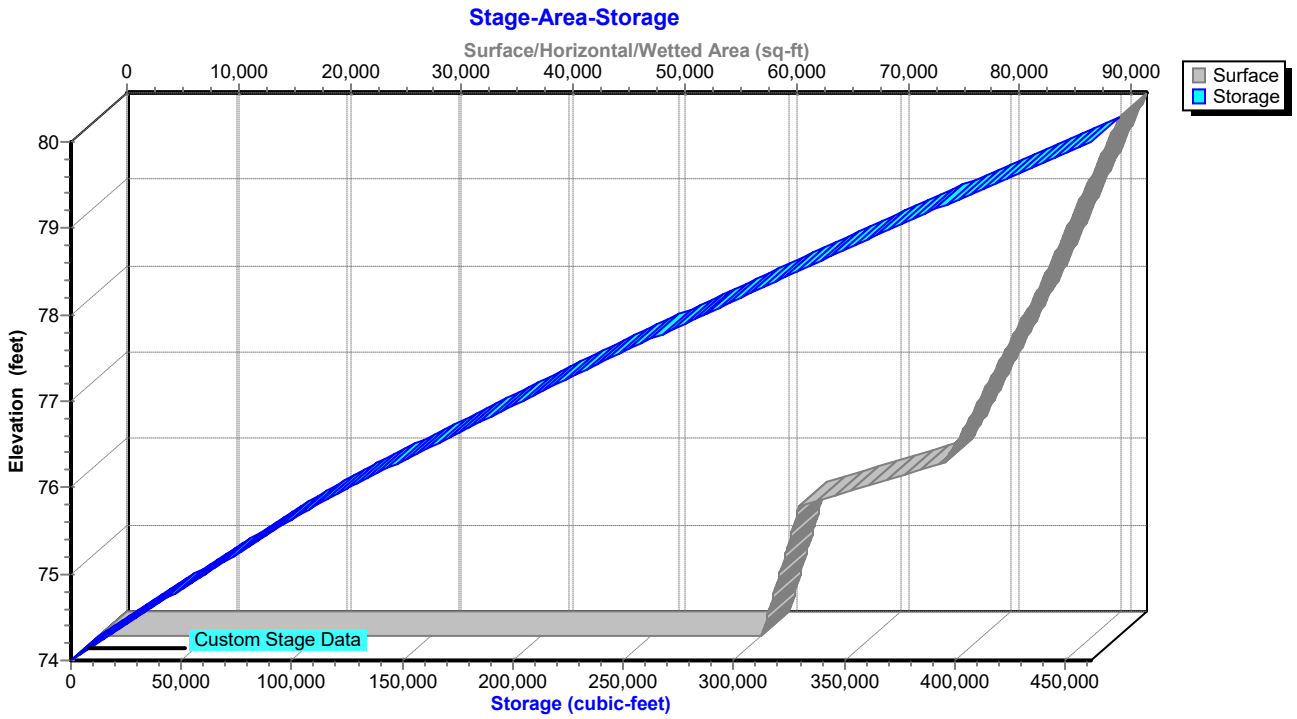
Pond 11P: BASIN 3



Pond 11P: BASIN 3



Pond 11P: BASIN 3



Stage-Discharge for Pond 11P: BASIN 3

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
74.00	0.00	76.08	1.28	78.16	59.62
74.04	0.01	76.12	1.29	78.20	59.99
74.08	0.02	76.16	1.31	78.24	60.37
74.12	0.04	76.20	1.32	78.28	60.74
74.16	0.07	76.24	1.33	78.32	61.11
74.20	0.11	76.28	1.35	78.36	61.48
74.24	0.16	76.32	1.36	78.40	61.84
74.28	0.20	76.36	1.37	78.44	62.20
74.32	0.26	76.40	1.39	78.48	62.56
74.36	0.31	76.44	1.40	78.52	63.68
74.40	0.36	76.48	1.41	78.56	67.22
74.44	0.41	76.52	1.42	78.60	72.11
74.48	0.46	76.56	1.44	78.64	78.02
74.52	0.49	76.60	1.45	78.68	84.80
74.56	0.53	76.64	1.46	78.72	92.36
74.60	0.56	76.68	1.47	78.76	100.64
74.64	0.59	76.72	1.49	78.80	109.58
74.68	0.62	76.76	1.50	78.84	119.13
74.72	0.65	76.80	1.51	78.88	129.26
74.76	0.68	76.84	1.52	78.92	139.89
74.80	0.70	76.88	1.53	78.96	150.98
74.84	0.73	76.92	1.54	79.00	162.53
74.88	0.75	76.96	1.56	79.04	174.55
74.92	0.77	77.00	1.57	79.08	187.01
74.96	0.80	77.04	2.08	79.12	199.59
75.00	0.82	77.08	3.00	79.16	212.21
75.04	0.84	77.12	4.18	79.20	225.10
75.08	0.86	77.16	5.59	79.24	238.26
75.12	0.88	77.20	7.18	79.28	251.66
75.16	0.90	77.24	8.94	79.32	265.66
75.20	0.92	77.28	10.85	79.36	280.34
75.24	0.94	77.32	12.90	79.40	295.33
75.28	0.96	77.36	15.09	79.44	310.63
75.32	0.98	77.40	17.40	79.48	326.23
75.36	1.00	77.44	19.82	79.52	342.33
75.40	1.01	77.48	22.36	79.56	358.97
75.44	1.03	77.52	25.01	79.60	375.93
75.48	1.05	77.56	27.76	79.64	393.21
75.52	1.07	77.60	30.61	79.68	410.82
75.56	1.08	77.64	33.55	79.72	428.61
75.60	1.10	77.68	36.59	79.76	446.56
75.64	1.11	77.72	39.72	79.80	464.79
75.68	1.13	77.76	42.94	79.84	483.29
75.72	1.15	77.80	46.24	79.88	502.07
75.76	1.16	77.84	49.62	79.92	520.94
75.80	1.18	77.88	53.09	79.96	539.89
75.84	1.19	77.92	56.64	80.00	**559.07**
75.88	1.21	77.96	57.70		
75.92	1.22	78.00	58.09		
75.96	1.24	78.04	58.47		
76.00	1.25	78.08	58.86		
76.04	1.26	78.12	59.24		

Stage-Area-Storage for Pond 11P: BASIN 3

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
74.00	59,381	0
74.10	59,605	5,949
74.20	59,828	11,921
74.30	60,052	17,915
74.40	60,276	23,931
74.50	60,500	29,970
74.60	60,723	36,031
74.70	60,947	42,115
74.80	61,171	48,221
74.90	61,394	54,349
75.00	61,618	60,500
75.10	61,844	66,673
75.20	62,069	72,868
75.30	62,295	79,086
75.40	62,520	85,327
75.50	62,746	91,591
75.60	65,362	97,996
75.70	67,977	104,663
75.80	70,593	111,591
75.90	73,208	118,781
76.00	75,824	126,233
76.10	76,238	133,836
76.20	76,652	141,481
76.30	77,066	149,166
76.40	77,479	156,894
76.50	77,893	164,662
76.60	78,307	172,472
76.70	78,721	180,324
76.80	79,135	188,217
76.90	79,549	196,151
77.00	79,963	204,126
77.10	80,376	212,143
77.20	80,790	220,202
77.30	81,204	228,301
77.40	81,618	236,442
77.50	82,032	244,625
77.60	82,446	252,849
77.70	82,859	261,114
77.80	83,273	269,421
77.90	83,687	277,769
78.00	84,101	286,158
78.10	84,465	294,586
78.20	84,830	303,051
78.30	85,194	311,552
78.40	85,558	320,090
78.50	85,922	328,664
78.60	86,286	337,274
78.70	86,651	345,921
78.80	87,015	354,604
78.90	87,379	363,324
79.00	87,744	372,080
79.10	88,108	380,873
79.20	88,472	389,702
79.30	88,836	398,567
79.40	89,201	407,469
79.50	89,565	416,407
79.60	89,929	425,382
79.70	90,293	434,393
79.80	90,657	443,441
79.90	91,022	452,525
80.00	**91,386**	**461,645**

Summary for Pond 12P: BASIN 4

Inflow Area = 102.290 ac, 1.11% Impervious, Inflow Depth = 1.78" for 25-YR event
Inflow = 186.05 cfs @ 12.15 hrs, Volume= 15.131 af
Outflow = 95.11 cfs @ 12.37 hrs, Volume= 15.125 af, Atten= 49%, Lag= 13.1 min
Primary = 95.11 cfs @ 12.37 hrs, Volume= 15.125 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 84.49' @ 12.37 hrs Surf.Area= 42,508 sf Storage= 200,499 cf

Plug-Flow detention time= 416.5 min calculated for 15.125 af (100% of inflow)
Center-of-Mass det. time= 416.2 min (1,292.9 - 876.7)

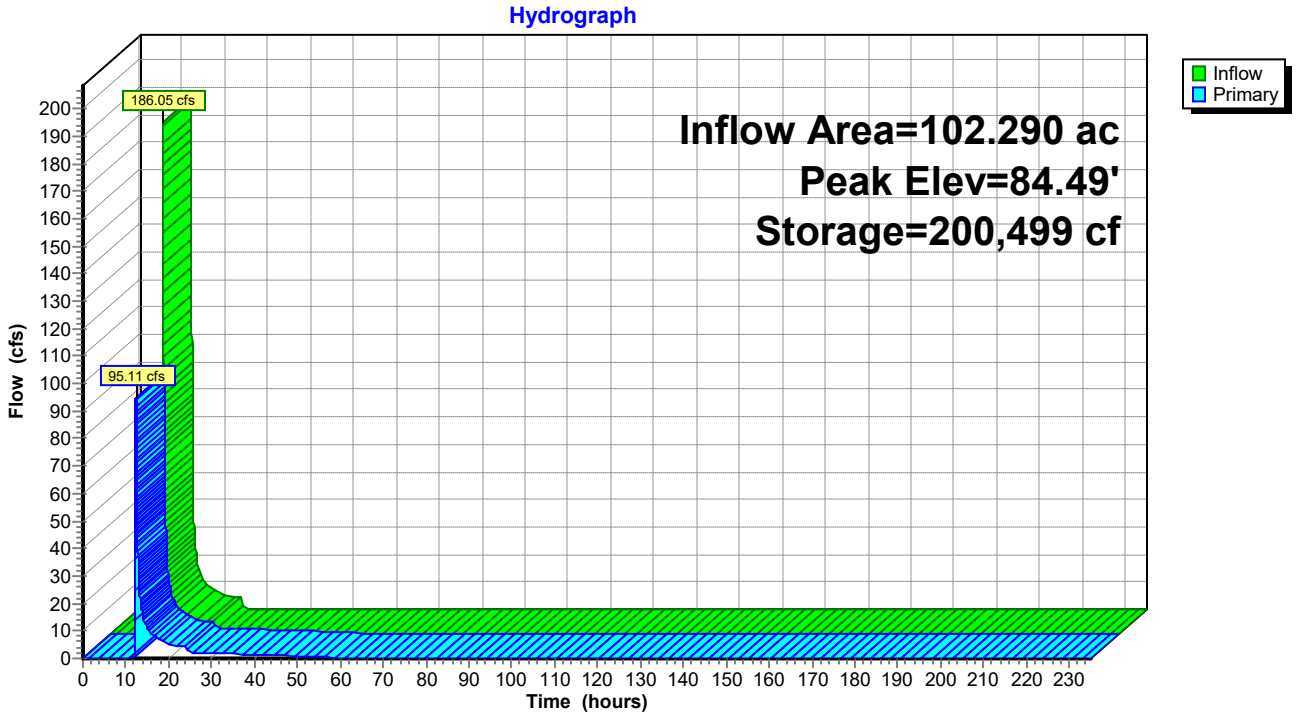
Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	420,819 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.50	23,525	0	0
79.50	24,819	24,172	24,172
80.00	30,634	13,863	38,035
82.00	35,056	65,690	103,725
84.00	41,314	76,370	180,095
86.00	46,221	87,535	267,630
88.00	50,842	97,063	364,693
89.00	61,410	56,126	420,819

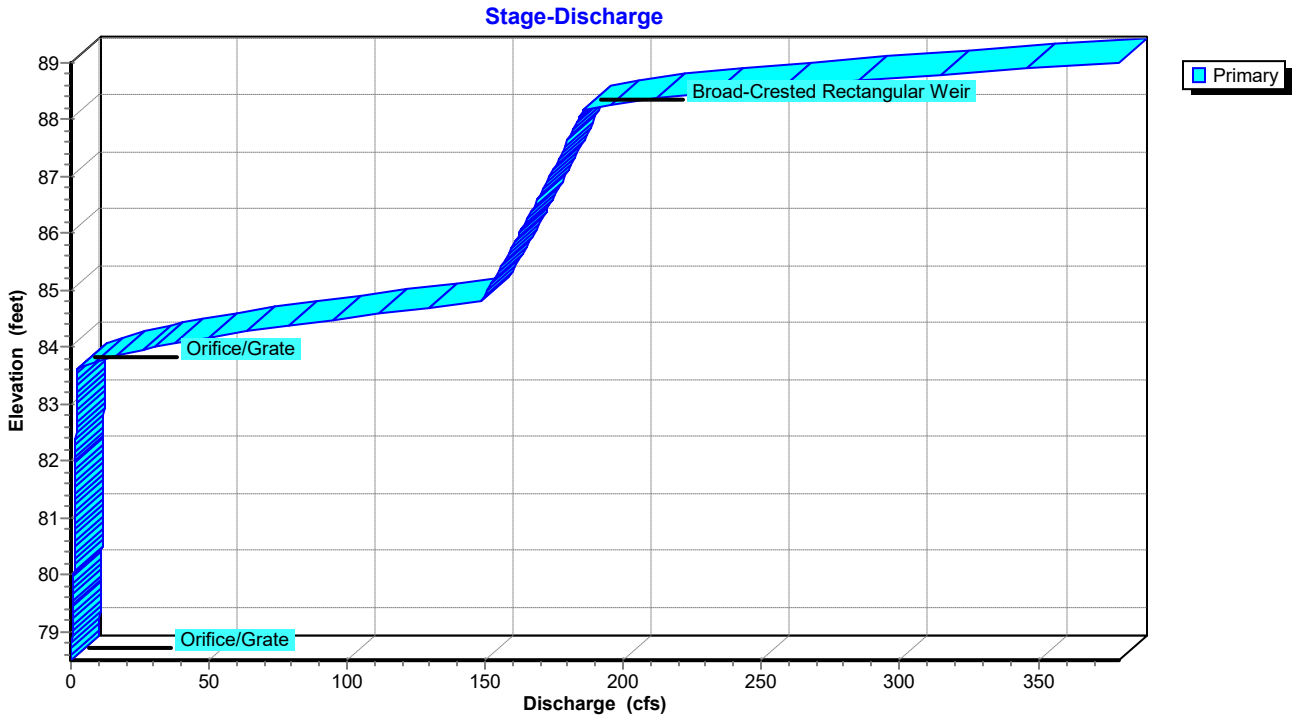
Device	Routing	Invert	Outlet Devices
#1	Primary	76.80'	**48.0" x 161.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 76.00' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	78.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	83.60'	**7.00' x 10.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	88.15'	**90.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=95.06 cfs @ 12.37 hrs HW=84.49' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 95.06 cfs of 144.29 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.26 cfs @ 11.53 fps)
  - **3=Orifice/Grate** (Weir Controls 92.80 cfs @ 3.08 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

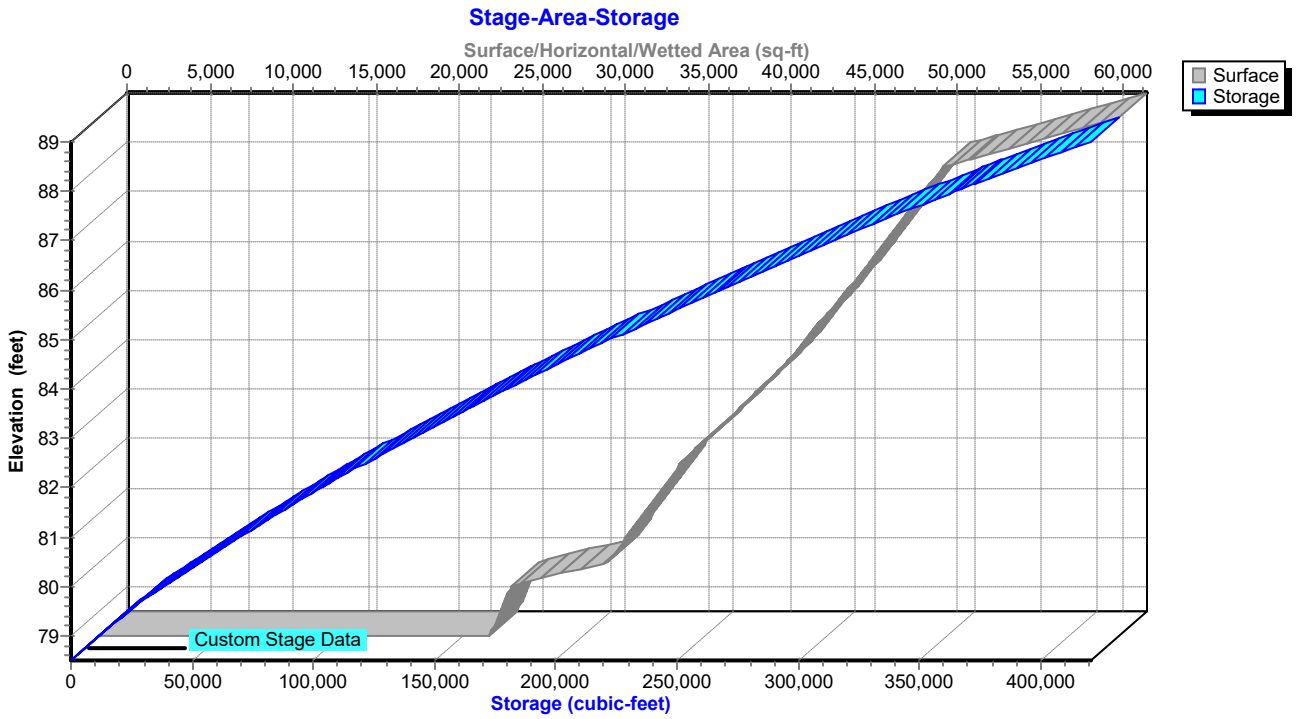
Pond 12P: BASIN 4



Pond 12P: BASIN 4



Pond 12P: BASIN 4



Stage-Discharge for Pond 12P: BASIN 4

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
78.50	0.00	81.62	1.60	84.74	137.64	87.86	182.12
78.56	0.01	81.68	1.62	84.80	148.21	87.92	182.73
78.62	0.04	81.74	1.63	84.86	148.95	87.98	183.33
78.68	0.09	81.80	1.65	84.92	149.69	88.04	183.92
78.74	0.16	81.86	1.67	84.98	150.42	88.10	184.52
78.80	0.23	81.92	1.68	85.04	151.15	88.16	185.36
78.86	0.31	81.98	1.70	85.10	151.87	88.22	190.17
78.92	0.39	82.04	1.71	85.16	152.59	88.28	197.60
78.98	0.46	82.10	1.73	85.22	153.31	88.34	206.86
79.04	0.51	82.16	1.75	85.28	154.03	88.40	217.68
79.10	0.56	82.22	1.76	85.34	154.74	88.46	229.86
79.16	0.61	82.28	1.78	85.40	155.44	88.52	243.27
79.22	0.65	82.34	1.79	85.46	156.15	88.58	257.74
79.28	0.69	82.40	1.81	85.52	156.85	88.64	273.15
79.34	0.73	82.46	1.82	85.58	157.55	88.70	289.50
79.40	0.76	82.52	1.84	85.64	158.25	88.76	306.60
79.46	0.80	82.58	1.85	85.70	158.94	88.82	323.76
79.52	0.83	82.64	1.86	85.76	159.63	88.88	341.48
79.58	0.86	82.70	1.88	85.82	160.31	88.94	359.70
79.64	0.89	82.76	1.89	85.88	161.00	89.00	**379.26**
79.70	0.92	82.82	1.91	85.94	161.68		
79.76	0.95	82.88	1.92	86.00	162.36		
79.82	0.98	82.94	1.94	86.06	163.03		
79.88	1.00	83.00	1.95	86.12	163.70		
79.94	1.03	83.06	1.96	86.18	164.37		
80.00	1.06	83.12	1.98	86.24	165.04		
80.06	1.08	83.18	1.99	86.30	165.70		
80.12	1.11	83.24	2.00	86.36	166.37		
80.18	1.13	83.30	2.02	86.42	167.03		
80.24	1.15	83.36	2.03	86.48	167.68		
80.30	1.18	83.42	2.04	86.54	168.34		
80.36	1.20	83.48	2.06	86.60	168.99		
80.42	1.22	83.54	2.07	86.66	169.63		
80.48	1.24	83.60	2.08	86.72	170.28		
80.54	1.26	83.66	3.73	86.78	170.92		
80.60	1.29	83.72	6.73	86.84	171.57		
80.66	1.31	83.78	10.61	86.90	172.21		
80.72	1.33	83.84	15.21	86.96	172.84		
80.78	1.35	83.90	20.41	87.02	173.48		
80.84	1.37	83.96	26.17	87.08	174.11		
80.90	1.39	84.02	32.43	87.14	174.74		
80.96	1.41	84.08	39.16	87.20	175.37		
81.02	1.42	84.14	46.31	87.26	175.99		
81.08	1.44	84.20	53.88	87.32	176.61		
81.14	1.46	84.26	61.83	87.38	177.23		
81.20	1.48	84.32	70.16	87.44	177.85		
81.26	1.50	84.38	78.83	87.50	178.47		
81.32	1.52	84.44	87.85	87.56	179.08		
81.38	1.53	84.50	97.19	87.62	179.70		
81.44	1.55	84.56	106.86	87.68	180.31		
81.50	1.57	84.62	116.82	87.74	180.91		
81.56	1.58	84.68	127.09	87.80	181.52		

Stage-Area-Storage for Pond 12P: BASIN 4

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
78.50	23,525	0
78.65	23,719	3,543
78.80	23,913	7,116
78.95	24,107	10,717
79.10	24,301	14,348
79.25	24,496	18,008
79.40	24,690	21,697
79.55	25,400	25,427
79.70	27,145	29,368
79.85	28,889	33,571
80.00	30,634	38,035
80.15	30,966	42,655
80.30	31,297	47,325
80.45	31,629	52,044
80.60	31,961	56,814
80.75	32,292	61,633
80.90	32,624	66,501
81.05	32,956	71,420
81.20	33,287	76,388
81.35	33,619	81,406
81.50	33,951	86,474
81.65	34,282	91,591
81.80	34,614	96,758
81.95	34,945	101,975
82.10	35,369	107,246
82.25	35,838	112,587
82.40	36,308	117,998
82.55	36,777	123,479
82.70	37,246	129,031
82.85	37,716	134,653
83.00	38,185	140,346
83.15	38,654	146,109
83.30	39,124	151,942
83.45	39,593	157,846
83.60	40,062	163,820
83.75	40,532	169,865
83.90	41,001	175,979
84.05	41,437	182,164
84.20	41,805	188,407
84.35	42,173	194,705
84.50	42,541	201,059
84.65	42,909	207,468
84.80	43,277	213,932
84.95	43,645	220,451
85.10	44,013	227,025
85.25	44,381	233,655
85.40	44,749	240,339
85.55	45,117	247,079
85.70	45,485	253,874
85.85	45,853	260,725
86.00	46,221	267,630
86.15	46,568	274,589
86.30	46,914	281,601
86.45	47,261	288,664
86.60	47,607	295,779
86.75	47,954	302,946
86.90	48,300	310,165
87.05	48,647	317,436
87.20	48,994	324,759
87.35	49,340	332,134
87.50	49,687	339,561
87.65	50,033	347,040
87.80	50,380	354,571
87.95	50,726	362,154
88.10	51,899	369,830
88.25	53,484	377,734
88.40	55,069	385,875
88.55	56,654	394,255
88.70	58,240	402,872
88.85	59,825	411,727
89.00	**61,410**	**420,819**

Summary for Pond 16P: WQv FACILITY

Inflow Area = 3.461 ac, 8.78% Impervious, Inflow Depth = 3.10" for 25-YR event
Inflow = 19.12 cfs @ 11.97 hrs, Volume= 0.894 af
Outflow = 15.60 cfs @ 12.02 hrs, Volume= 0.894 af, Atten= 18%, Lag= 2.8 min
Primary = 15.60 cfs @ 12.02 hrs, Volume= 0.894 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 90.11' @ 12.02 hrs Surf.Area= 4,271 sf Storage= 7,923 cf

Plug-Flow detention time= 134.0 min calculated for 0.894 af (100% of inflow)
Center-of-Mass det. time= 134.4 min (960.8 - 826.4)

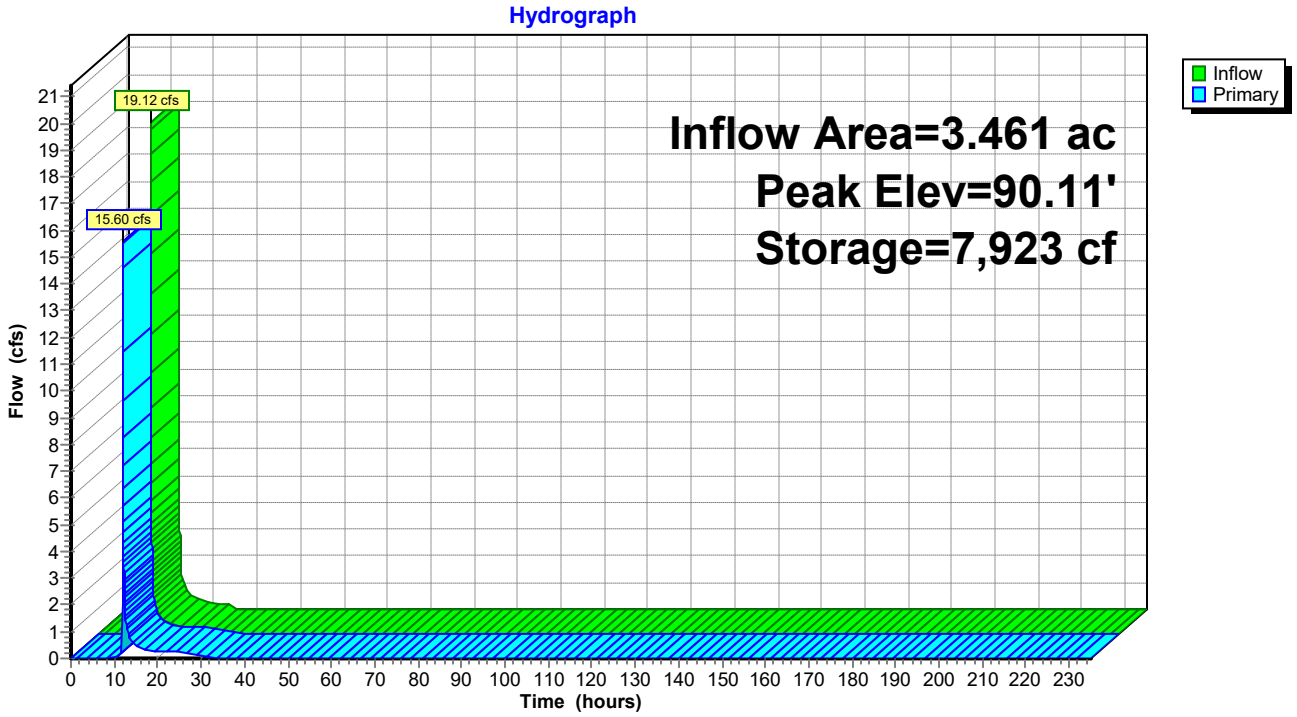
Volume	Invert	Avail.Storage	Storage Description
#1	88.00'	16,930 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
88.00	3,242	0	0
89.50	3,958	5,400	5,400
90.00	4,210	2,042	7,442
92.00	5,278	9,488	16,930

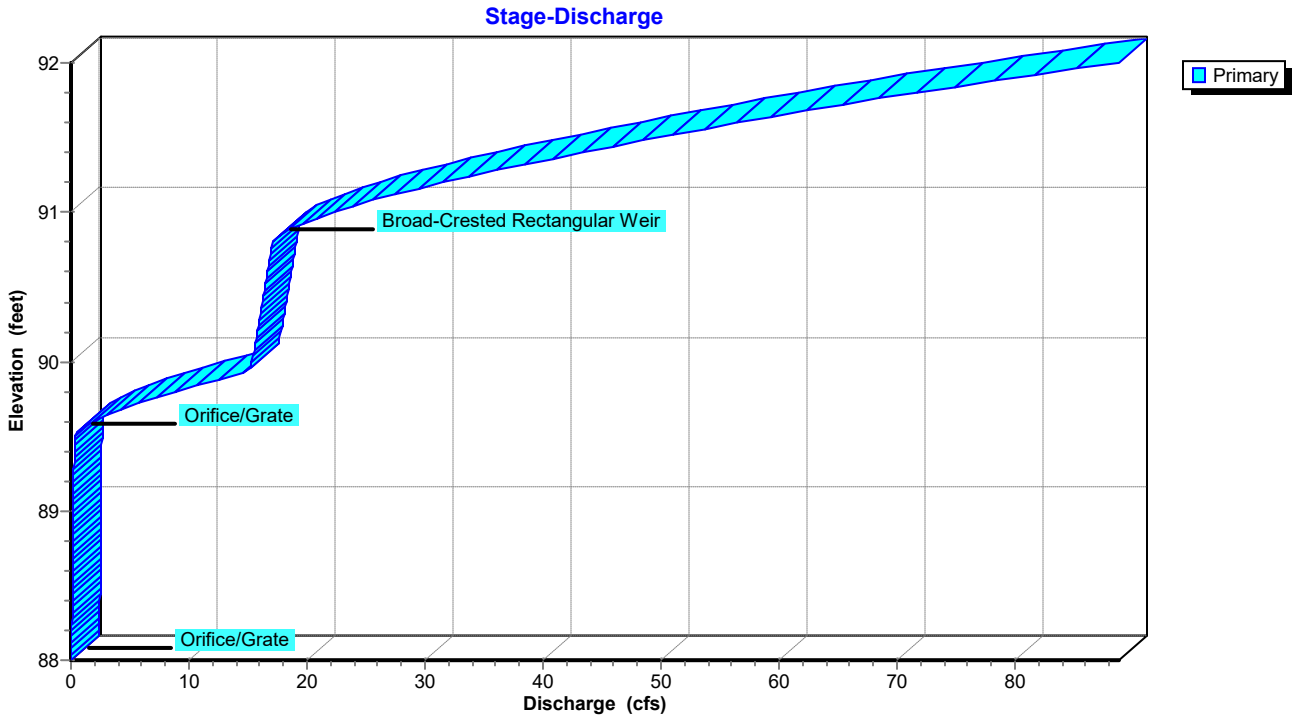
Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**18.0" x 44.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 82.00' S= 0.0909 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	88.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	89.50'	**4.00' x 4.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	90.80'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=15.60 cfs @ 12.02 hrs HW=90.11' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 15.60 cfs @ 8.83 fps)
  - **2=Orifice/Grate** (Passes < 0.33 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 25.13 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

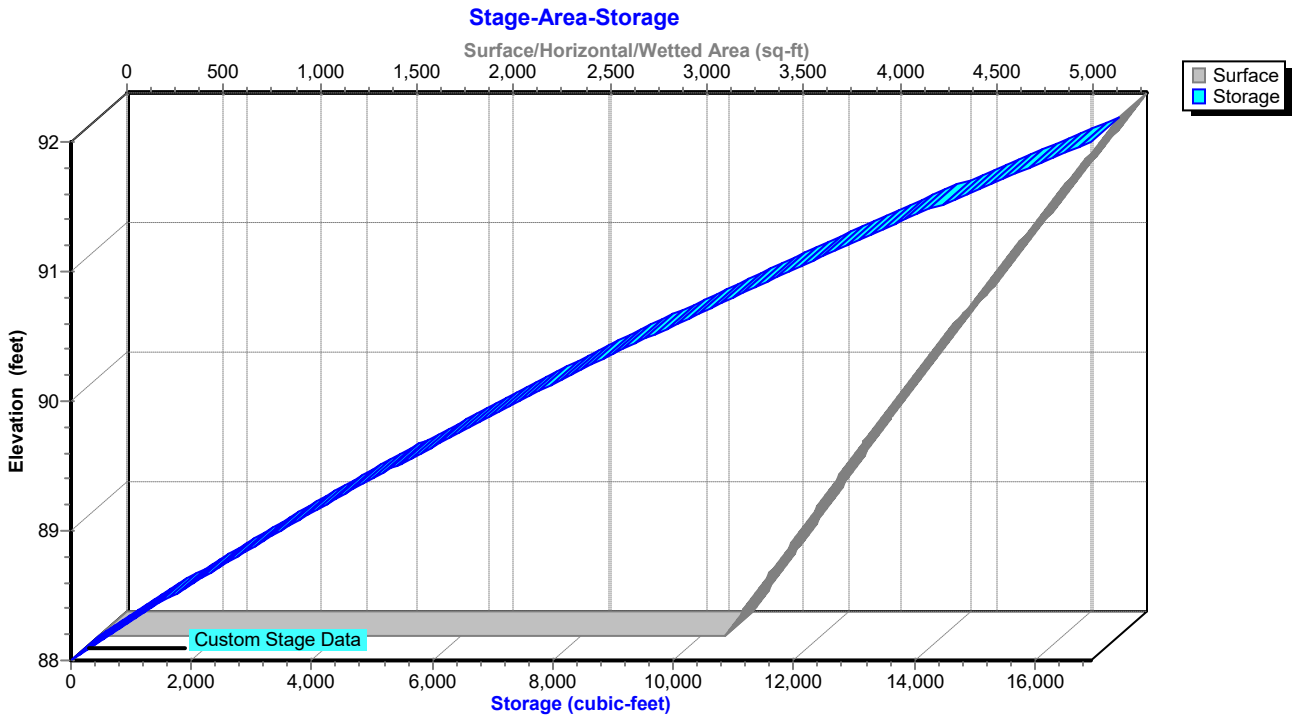
Pond 16P: WQv FACILITY



Pond 16P: WQv FACILITY



Pond 16P: WQv FACILITY



Stage-Discharge for Pond 16P: WQv FACILITY

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
88.00	0.00	89.04	0.23	90.08	15.53	91.12	27.53
88.02	0.00	89.06	0.23	90.10	15.57	91.14	28.51
88.04	0.00	89.08	0.23	90.12	15.62	91.16	29.52
88.06	0.01	89.10	0.23	90.14	15.67	91.18	30.55
88.08	0.01	89.12	0.24	90.16	15.71	91.20	31.61
88.10	0.02	89.14	0.24	90.18	15.76	91.22	32.69
88.12	0.03	89.16	0.24	90.20	15.80	91.24	33.79
88.14	0.04	89.18	0.24	90.22	15.85	91.26	34.92
88.16	0.05	89.20	0.25	90.24	15.90	91.28	36.07
88.18	0.05	89.22	0.25	90.26	15.94	91.30	37.24
88.20	0.06	89.24	0.25	90.28	15.99	91.32	38.44
88.22	0.07	89.26	0.25	90.30	16.03	91.34	39.66
88.24	0.08	89.28	0.25	90.32	16.08	91.36	40.90
88.26	0.09	89.30	0.26	90.34	16.12	91.38	42.16
88.28	0.09	89.32	0.26	90.36	16.17	91.40	43.45
88.30	0.10	89.34	0.26	90.38	16.21	91.42	44.69
88.32	0.10	89.36	0.26	90.40	16.26	91.44	45.95
88.34	0.11	89.38	0.26	90.42	16.30	91.46	47.23
88.36	0.11	89.40	0.27	90.44	16.34	91.48	48.52
88.38	0.12	89.42	0.27	90.46	16.39	91.50	49.82
88.40	0.12	89.44	0.27	90.48	16.43	91.52	51.13
88.42	0.13	89.46	0.27	90.50	16.48	91.54	52.46
88.44	0.13	89.48	0.28	90.52	16.52	91.56	53.80
88.46	0.14	89.50	0.28	90.54	16.56	91.58	55.16
88.48	0.14	89.52	0.43	90.56	16.61	91.60	56.52
88.50	0.14	89.54	0.70	90.58	16.65	91.62	57.97
88.52	0.15	89.56	1.05	90.60	16.70	91.64	59.43
88.54	0.15	89.58	1.47	90.62	16.74	91.66	60.92
88.56	0.16	89.60	1.94	90.64	16.78	91.68	62.41
88.58	0.16	89.62	2.46	90.66	16.82	91.70	63.93
88.60	0.16	89.64	3.03	90.68	16.87	91.72	65.46
88.62	0.17	89.66	3.64	90.70	16.91	91.74	67.00
88.64	0.17	89.68	4.29	90.72	16.95	91.76	68.56
88.66	0.17	89.70	4.98	90.74	17.00	91.78	70.13
88.68	0.18	89.72	5.70	90.76	17.04	91.80	71.72
88.70	0.18	89.74	6.45	90.78	17.08	91.82	73.37
88.72	0.18	89.76	7.24	90.80	17.12	91.84	75.03
88.74	0.19	89.78	8.06	90.82	17.32	91.86	76.70
88.76	0.19	89.80	8.90	90.84	17.64	91.88	78.40
88.78	0.19	89.82	9.78	90.86	18.04	91.90	80.11
88.80	0.19	89.84	10.68	90.88	18.50	91.92	81.84
88.82	0.20	89.86	11.61	90.90	19.03	91.94	83.58
88.84	0.20	89.88	12.57	90.92	19.60	91.96	85.34
88.86	0.20	89.90	13.55	90.94	20.22	91.98	87.11
88.88	0.21	89.92	14.56	90.96	20.89	92.00	**88.90**
88.90	0.21	89.94	15.20	90.98	21.59		
88.92	0.21	89.96	15.24	91.00	22.34		
88.94	0.21	89.98	15.29	91.02	23.12		
88.96	0.22	90.00	15.34	91.04	23.94		
88.98	0.22	90.02	15.39	91.06	24.79		
89.00	0.22	90.04	15.43	91.08	25.67		
89.02	0.22	90.06	15.48	91.10	26.59		

Stage-Area-Storage for Pond 16P: WQv FACILITY

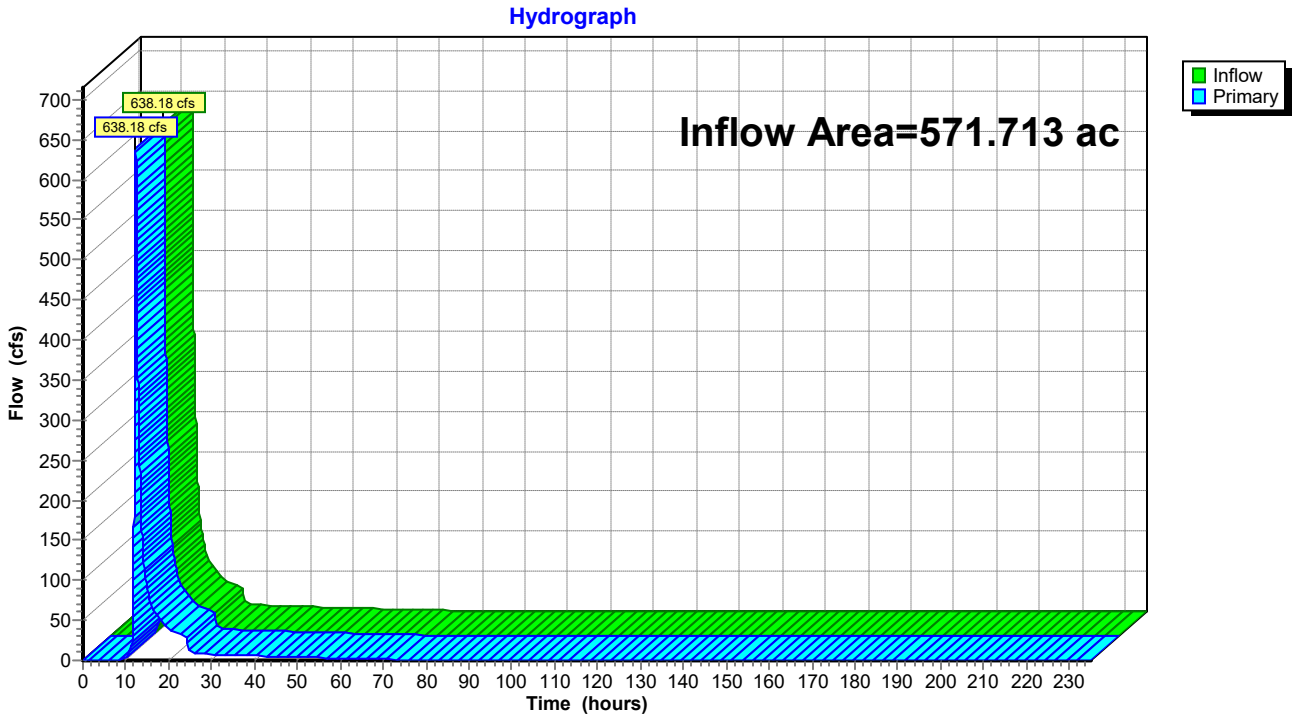
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
88.00	3,242	0
88.05	3,266	163
88.10	3,290	327
88.15	3,314	492
88.20	3,337	658
88.25	3,361	825
88.30	3,385	994
88.35	3,409	1,164
88.40	3,433	1,335
88.45	3,457	1,507
88.50	3,481	1,681
88.55	3,505	1,855
88.60	3,528	2,031
88.65	3,552	2,208
88.70	3,576	2,386
88.75	3,600	2,566
88.80	3,624	2,746
88.85	3,648	2,928
88.90	3,672	3,111
88.95	3,695	3,295
89.00	3,719	3,481
89.05	3,743	3,667
89.10	3,767	3,855
89.15	3,791	4,044
89.20	3,815	4,234
89.25	3,839	4,425
89.30	3,863	4,618
89.35	3,886	4,812
89.40	3,910	5,007
89.45	3,934	5,203
89.50	3,958	5,400
89.55	3,983	5,599
89.60	4,008	5,798
89.65	4,034	5,999
89.70	4,059	6,202
89.75	4,084	6,405
89.80	4,109	6,610
89.85	4,134	6,816
89.90	4,160	7,024
89.95	4,185	7,232
90.00	4,210	7,442
90.05	4,237	7,653
90.10	4,263	7,866
90.15	4,290	8,080
90.20	4,317	8,295
90.25	4,344	8,511
90.30	4,370	8,729
90.35	4,397	8,948
90.40	4,424	9,169
90.45	4,450	9,391
90.50	4,477	9,614
90.55	4,504	9,838
90.60	4,530	10,064
90.65	4,557	10,291
90.70	4,584	10,520
90.75	4,611	10,750
90.80	4,637	10,981
90.85	4,664	11,213
90.90	4,691	11,447
90.95	4,717	11,682
91.00	4,744	11,919
91.05	4,771	12,157
91.10	4,797	12,396
91.15	4,824	12,637
91.20	4,851	12,878
91.25	4,878	13,122
91.30	4,904	13,366
91.35	4,931	13,612
91.40	4,958	13,859
91.45	4,984	14,108
91.50	5,011	14,358
91.55	5,038	14,609
91.60	5,064	14,862
91.65	5,091	15,115
91.70	5,118	15,371
91.75	5,145	15,627
91.80	5,171	15,885
91.85	5,198	16,144
91.90	5,225	16,405
91.95	5,251	16,667
92.00	**5,278**	**16,930**

Summary for Link 14L: TOTAL PROPOSED

Inflow Area = 571.713 ac, 2.47% Impervious, Inflow Depth = 2.63" for 25-YR event
Inflow = 638.18 cfs @ 12.33 hrs, Volume= 125.279 af
Primary = 638.18 cfs @ 12.33 hrs, Volume= 125.279 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 14L: TOTAL PROPOSED

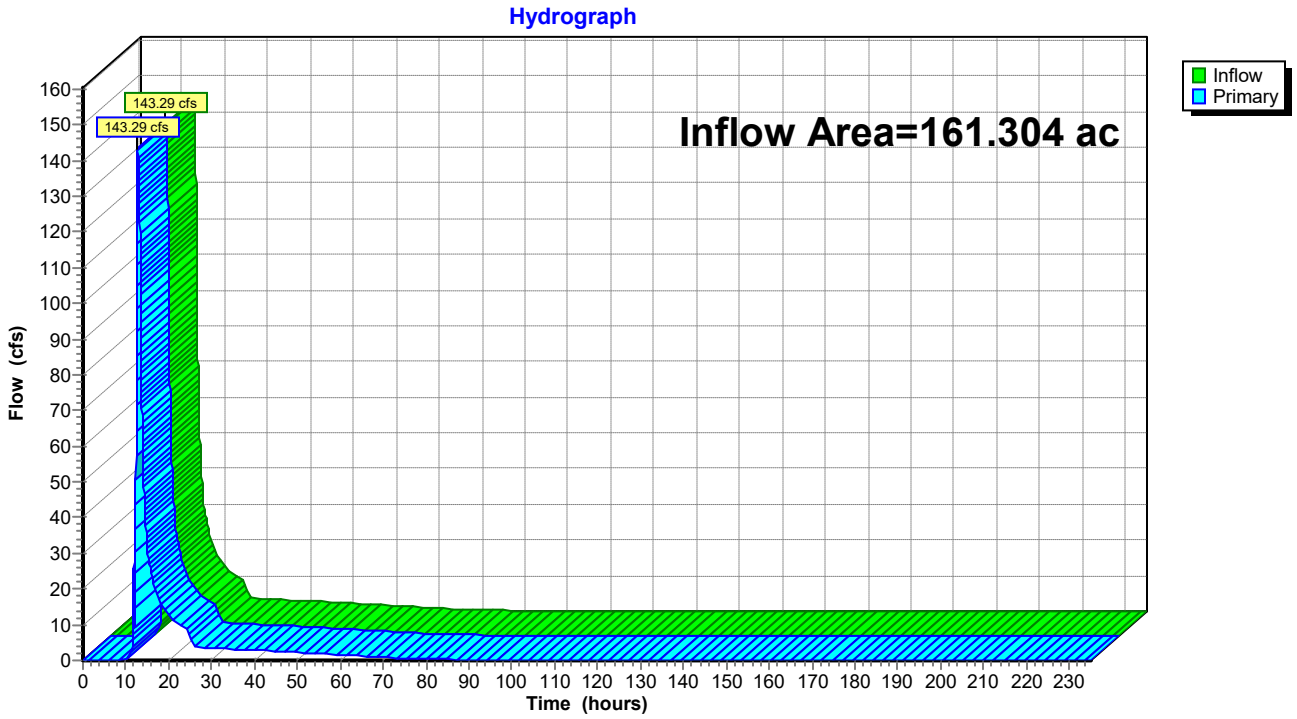


Summary for Link 59L: Discharge Pt 1

Inflow Area = 161.304 ac, 3.97% Impervious, Inflow Depth = 3.10" for 25-YR event
Inflow = 143.29 cfs @ 12.76 hrs, Volume= 41.622 af
Primary = 143.29 cfs @ 12.76 hrs, Volume= 41.622 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 59L: Discharge Pt 1

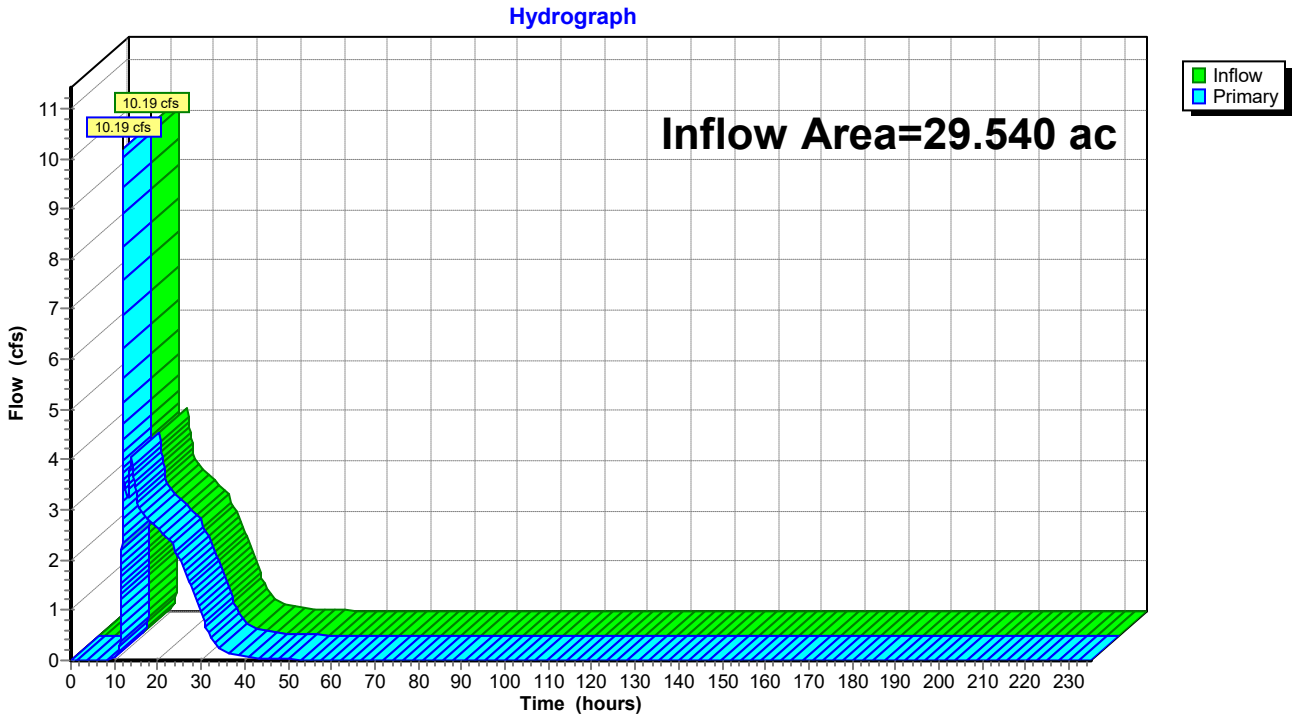


Summary for Link 60L: Discharge Pt 2

Inflow Area = 29.540 ac, 4.03% Impervious, Inflow Depth = 1.70" for 25-YR event
Inflow = 10.19 cfs @ 11.98 hrs, Volume= 4.183 af
Primary = 10.19 cfs @ 11.98 hrs, Volume= 4.183 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 60L: Discharge Pt 2

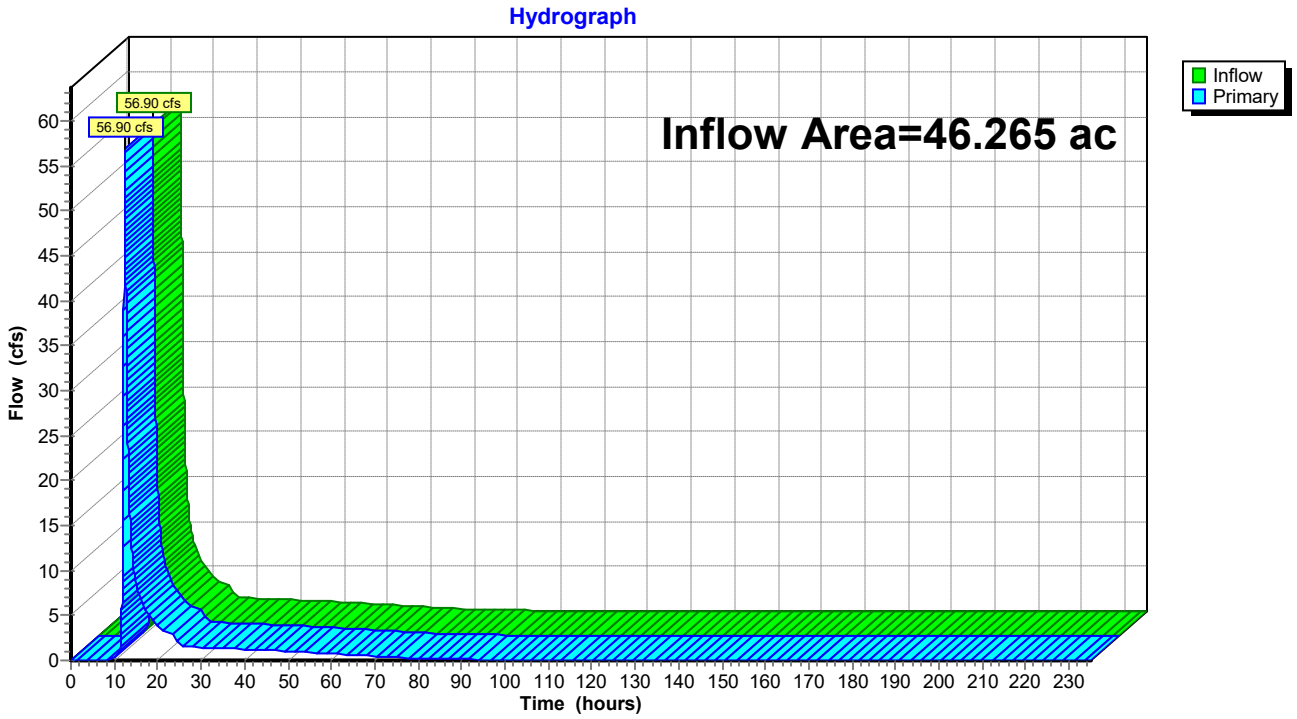


Summary for Link 61L: Discharge Pt 3

Inflow Area = 46.265 ac, 6.92% Impervious, Inflow Depth = 3.67" for 25-YR event
Inflow = 56.90 cfs @ 12.37 hrs, Volume= 14.146 af
Primary = 56.90 cfs @ 12.37 hrs, Volume= 14.146 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 61L: Discharge Pt 3

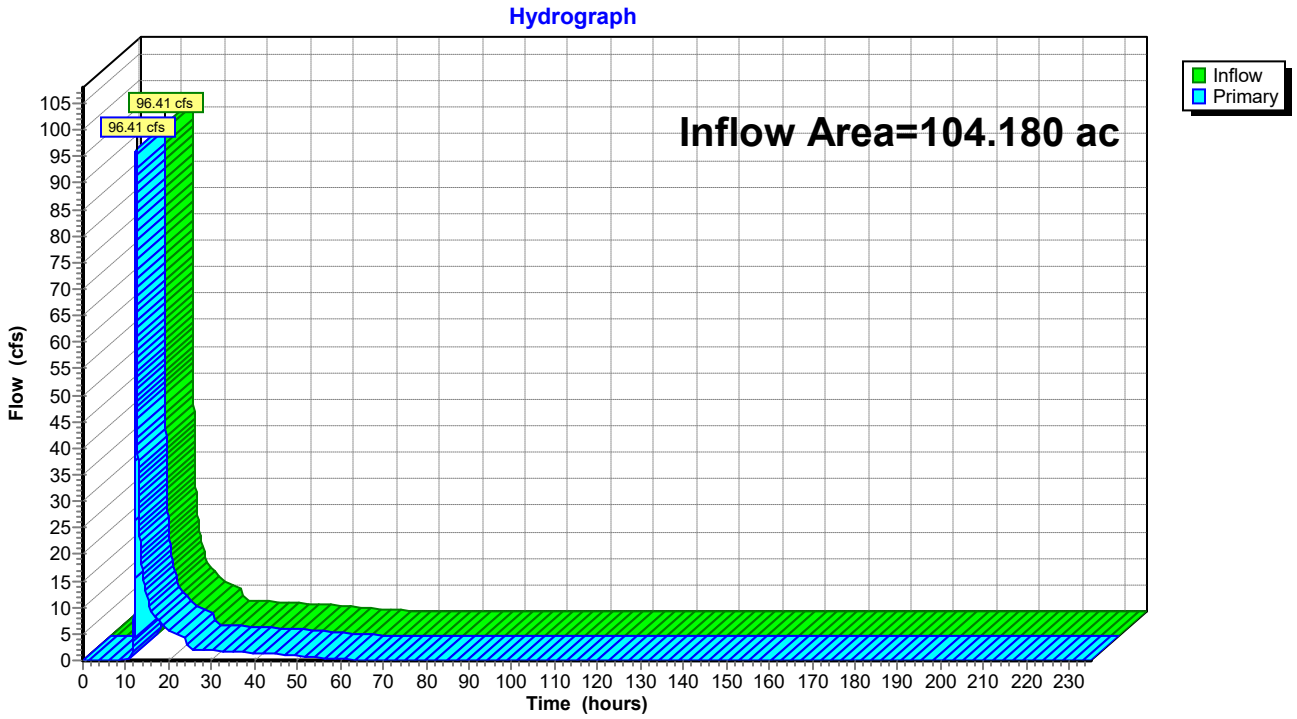


Summary for Link 62L: Discharge Pt 4

Inflow Area = 104.180 ac, 1.09% Impervious, Inflow Depth = 1.81" for 25-YR event
Inflow = 96.41 cfs @ 12.36 hrs, Volume= 15.691 af
Primary = 96.41 cfs @ 12.36 hrs, Volume= 15.691 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 62L: Discharge Pt 4

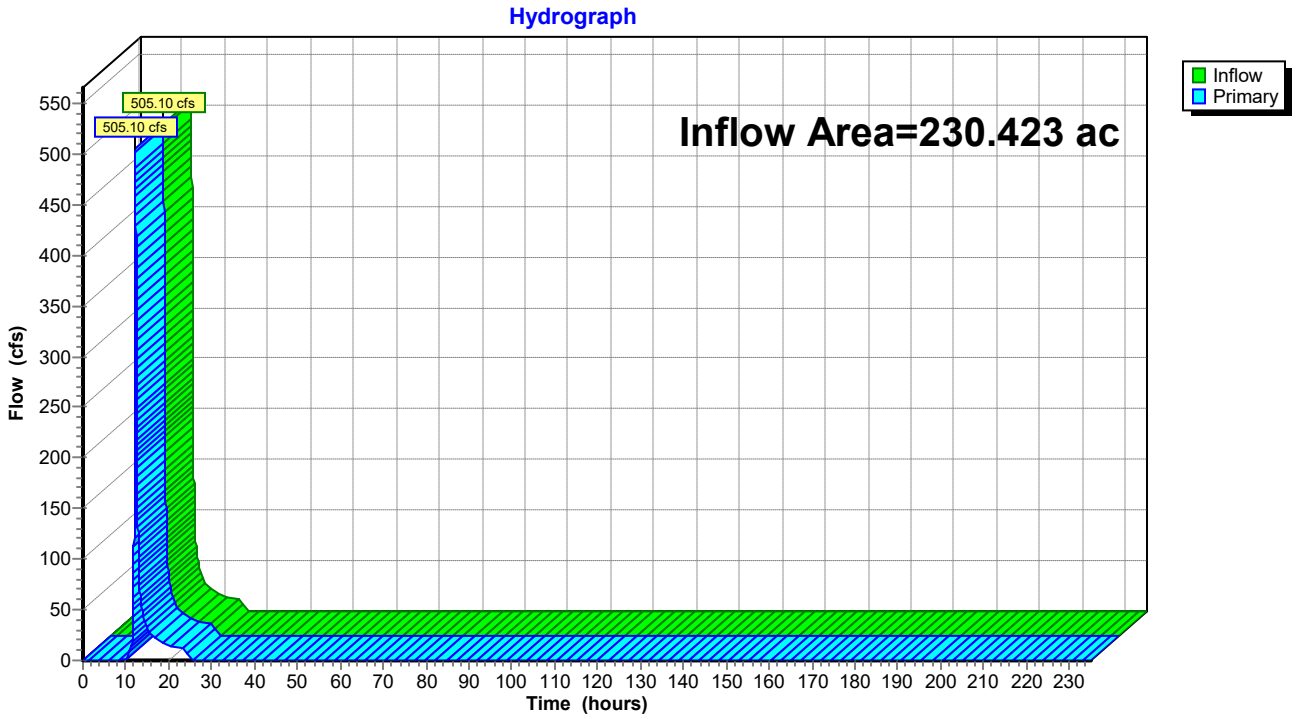


Summary for Link 63L: P 5

Inflow Area = 230.423 ac, 0.95% Impervious, Inflow Depth = 2.58" for 25-YR event
Inflow = 505.10 cfs @ 12.22 hrs, Volume= 49.637 af
Primary = 505.10 cfs @ 12.22 hrs, Volume= 49.637 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 63L: P 5



Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 5S: PROPOSED TO BASIN Runoff Area=154.439 ac 4.15% Impervious Runoff Depth=5.38"
Flow Length=5,552' Tc=33.3 min CN=74 Runoff=672.36 cfs 69.178 af

Subcatchment 6S: PROPOSED TO Runoff Area=1,207,838 sf 4.29% Impervious Runoff Depth=3.36"
Flow Length=2,643' Tc=17.4 min CN=57 Runoff=110.04 cfs 7.770 af

Subcatchment 7S: PROPOSED TO Runoff Area=1,802,614 sf 7.74% Impervious Runoff Depth=6.22"
Flow Length=2,398' Tc=16.0 min CN=81 Runoff=314.99 cfs 21.434 af

Subcatchment 8S: PROPOSED TO Runoff Area=4,455,761 sf 1.11% Impervious Runoff Depth=3.60"
Flow Length=3,075' Tc=20.4 min CN=59 Runoff=399.01 cfs 30.651 af

Subcatchment 15S: PROPOSED TO WQv Runoff Area=150,762 sf 8.78% Impervious Runoff Depth=5.38"
Tc=6.0 min CN=74 Runoff=32.48 cfs 1.550 af

Subcatchment 19S: DRAINAGE AREA TO Runoff Area=0.556 ac 8.99% Impervious Runoff Depth=5.38"
Tc=6.0 min CN=74 Runoff=5.22 cfs 0.249 af

Subcatchment 20S: DRAINAGE AREA TO Runoff Area=96.992 ac 0.16% Impervious Runoff Depth=4.66"
Flow Length=4,594' Tc=30.4 min CN=68 Runoff=388.58 cfs 37.654 af

Subcatchment 21S: DRAINAGE AREA TO Runoff Area=12.910 ac 1.93% Impervious Runoff Depth=4.30"
Flow Length=1,337' Tc=13.2 min CN=65 Runoff=76.44 cfs 4.629 af

Subcatchment 22S: DRAINAGE AREA TO Runoff Area=3,681,542 sf 0.10% Impervious Runoff Depth=4.42"
Flow Length=3,556' Tc=26.2 min CN=66 Runoff=353.81 cfs 31.136 af

Subcatchment 51S: ONSITE ACCESS Runoff Area=177,797 sf 24.48% Impervious Runoff Depth=6.10"
Tc=28.6 min CN=80 Runoff=22.03 cfs 2.073 af

Subcatchment 52S: DRAINAGE AREA TO Runoff Area=27.906 ac 1.27% Impervious Runoff Depth=5.61"
Flow Length=1,920' Tc=28.5 min CN=76 Runoff=140.08 cfs 13.058 af

Subcatchment 55S: UNMANAGED P 2 Runoff Area=78,944 sf 0.00% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=73 Runoff=16.69 cfs 0.794 af

Subcatchment 56S: UNMANAGED P 1 Runoff Area=299,039 sf 0.00% Impervious Runoff Depth=5.50"
Tc=6.0 min CN=75 Runoff=65.63 cfs 3.144 af

Subcatchment 57S: UNMANAGED P 3 Runoff Area=212,691 sf 0.00% Impervious Runoff Depth=4.90"
Tc=6.0 min CN=70 Runoff=42.26 cfs 1.993 af

Subcatchment 58S: UNMANAGED P 4 Runoff Area=82,311 sf 0.00% Impervious Runoff Depth=5.98"
Tc=6.0 min CN=79 Runoff=19.32 cfs 0.941 af

Pond 9P: BASIN 1 Peak Elev=90.22' Storage=1,275,872 cf Inflow=672.36 cfs 69.178 af
Outflow=255.13 cfs 69.062 af

Pond 10P: BASIN 2 Peak Elev=77.93' Storage=107,974 cf Inflow=110.04 cfs 7.770 af
Outflow=58.51 cfs 7.766 af

Pond 11P: BASIN 3 Peak Elev=79.10' Storage=380,892 cf Inflow=314.99 cfs 21.434 af
Outflow=193.46 cfs 21.391 af

Pond 12P: BASIN 4 Peak Elev=88.13' Storage=371,527 cf Inflow=399.01 cfs 30.651 af
Outflow=184.84 cfs 30.645 af

Pond 16P: WQv FACILITY Peak Elev=91.10' Storage=12,385 cf Inflow=32.48 cfs 1.550 af
Outflow=26.48 cfs 1.550 af

Link 14L: TOTAL PROPOSED Inflow=1,520.29 cfs 226.084 af
Primary=1,520.29 cfs 226.084 af

Link 59L: Discharge Pt 1 Inflow=259.19 cfs 72.206 af
Primary=259.19 cfs 72.206 af

Link 60L: Discharge Pt 2 Inflow=60.56 cfs 8.560 af
Primary=60.56 cfs 8.560 af

Link 61L: Discharge Pt 3 Inflow=199.52 cfs 23.384 af
Primary=199.52 cfs 23.384 af

Link 62L: Discharge Pt 4 Inflow=186.83 cfs 31.586 af
Primary=186.83 cfs 31.586 af

Link 63L: P 5 Inflow=946.15 cfs 90.348 af
Primary=946.15 cfs 90.348 af

Total Runoff Area = 571.713 ac Runoff Volume = 226.253 af Average Runoff Depth = 4.75"
97.53% Pervious = 557.579 ac 2.47% Impervious = 14.133 ac

Summary for Subcatchment 5S: PROPOSED TO BASIN 1

Runoff = 672.36 cfs @ 12.28 hrs, Volume= 69.178 af, Depth= 5.38"

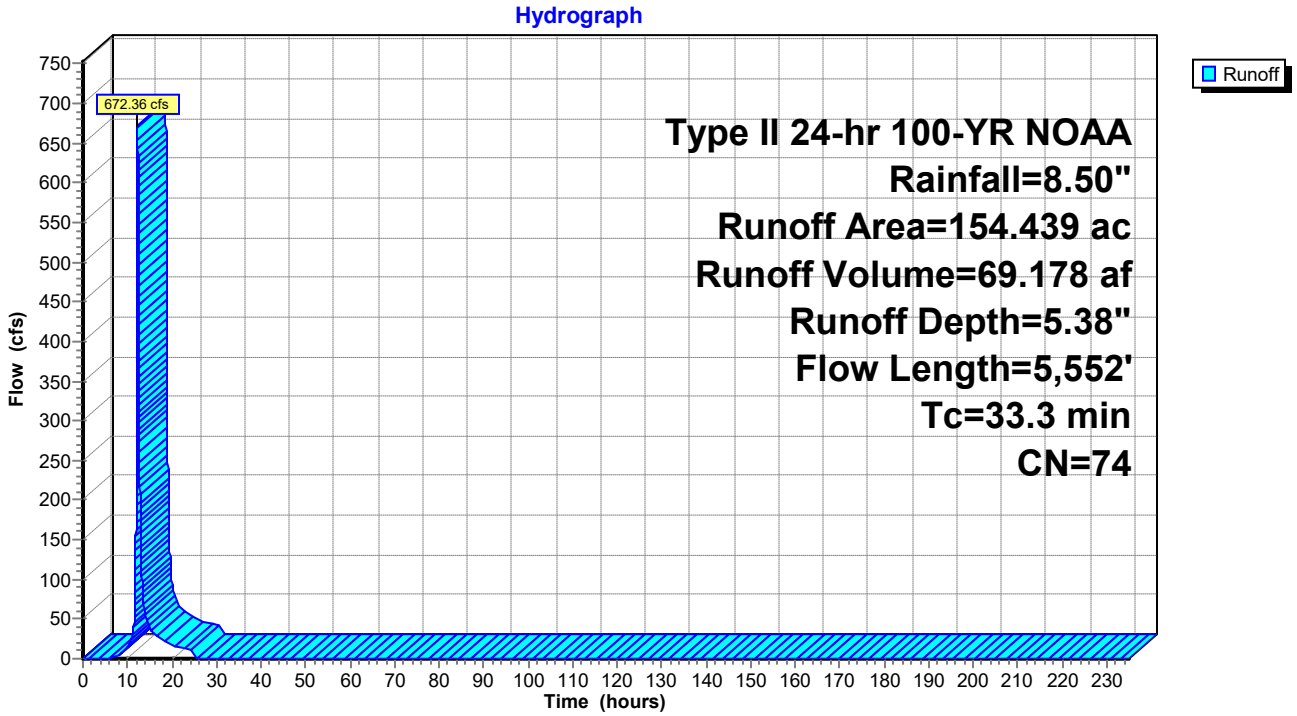
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	7.630	30	Woods, Good, HSG A (ONSITE)
*	3.008	70	Woods, Good, HSG C (ONSITE)
*	0.597	77	Woods, Good, HSG D (ONSITE)
*	9.439	61	>75% Grass cover, Good, HSG B (ONSITE A SOILS)
*	15.374	80	>75% Grass cover, Good, HSG D (ONSITE C SOILS)
*	6.297	80	>75% Grass cover, Good, HSG D (ONSITE D SOILS)
*	1.702	98	Paved parking & roofs A ONSITE
*	3.969	98	Paved parking & roofs C ONSITE
*	0.736	98	Paved parking & roofs D ONSITE
*	85.888	80	CAP AREA
*	0.772	30	Woods, Good, HSG A OFFSITE
*	1.183	70	Woods, Good, HSG C OFFSITE
*	9.257	42	RA ZONING A SOIL
*	2.379	64	RA ZONING B SOIL
*	4.931	76	RA ZONING C SOIL
*	1.277	82	RA ZONING D SOIL
	154.439	74	Weighted Average
	148.032		Pervious Area
	6.407		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0600	0.26		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
1.2	295	0.0700	4.26		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.3	272	0.0200	3.44	32.28	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=16.00' D=0.50' Z= 6.0 & 5.0 '/' Top.W=21.50' n= 0.035 Earth, dense weeds
6.5	1,025	0.0100	2.64	73.81	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=55.00' D=0.50' Z= 2.0 '/' Top.W=57.00' n= 0.035 Earth, dense weeds
9.4	2,107	0.0200	3.73	104.38	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=55.00' D=0.50' Z= 2.0 '/' Top.W=57.00' n= 0.035 Earth, dense weeds
0.3	165	0.0050	7.89	55.74	**Circular Channel (pipe), F-G** Diam= 36.0" Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.011 Concrete pipe, straight & clean
1.1	380	0.0600	5.78	17.35	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
5.1	724	0.0100	2.36	7.08	**Trap/Vee/Rect Channel Flow, H-I** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00'

n= 0.035 Earth, dense weeds					
1.9	376	0.0200	3.34	10.02	**Trap/Vee/Rect Channel Flow, I-J** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
0.2	108	0.0050	10.33	164.33	**Circular Channel (pipe), J-K** Diam= 54.0" Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.011 Concrete pipe, straight & clean
33.3	5,552	Total			

Subcatchment 5S: PROPOSED TO BASIN 1



Summary for Subcatchment 6S: PROPOSED TO BASIN 2

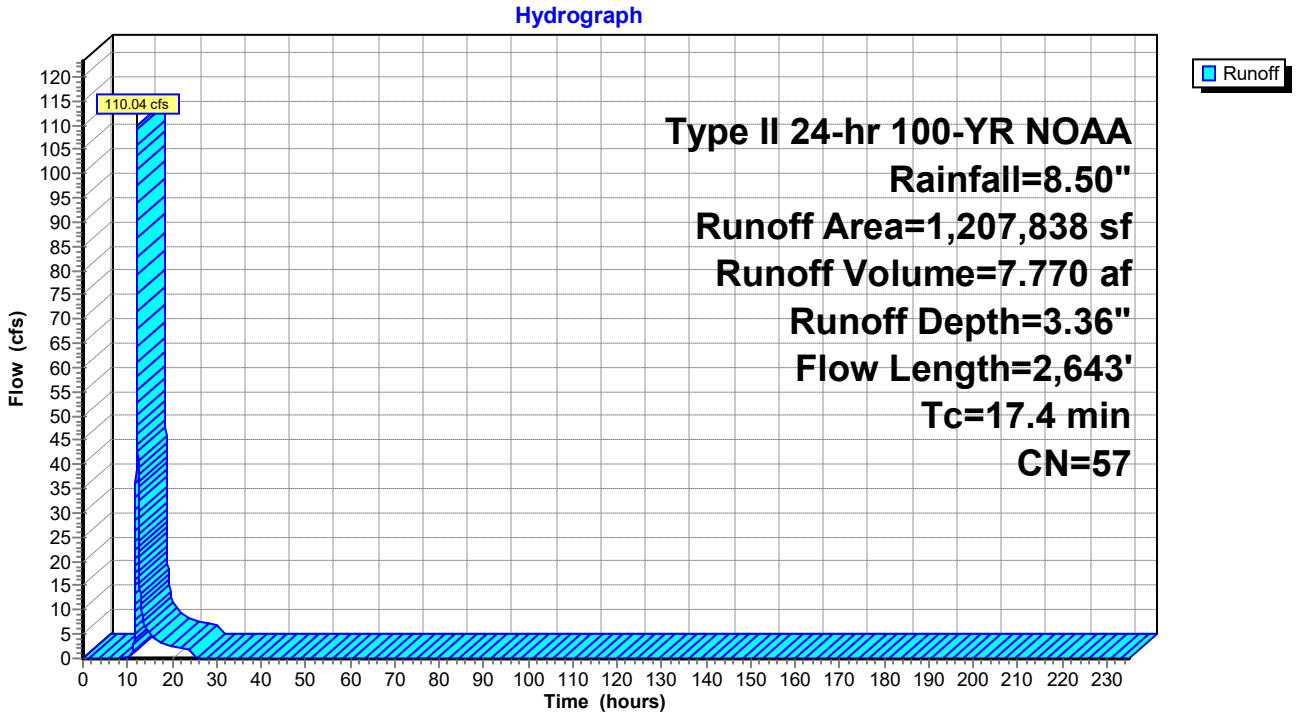
Runoff = 110.04 cfs @ 12.10 hrs, Volume= 7.770 af, Depth= 3.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	122,667	30	Woods, Good, HSG A (ONSITE)
*	43,308	70	Woods, Good, HSG C (ONSITE)
*	3,323	77	Woods, Good, HSG D (ONSITE)
*	75,069	61	>75% Grass cover, Good, HSG B (ONSITE A SOIL)
*	193,145	80	>75% Grass cover, Good, HSG D (ONSITE C SOIL)
*	12,756	98	Paved parking & roofs (ONSITE A)
*	39,104	98	Paved parking & roofs (ONSITE C)
*	42,617	80	CAP
*	547,893	42	RA ZONING A SOIL
*	9,866	64	RA ZONING B SOIL
*	81,020	76	RA ZONING C SOIL
*	37,070	82	RA ZONING D SOIL
	1,207,838	57	Weighted Average
	1,155,978		Pervious Area
	51,860		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	598	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.6	697	0.0400	4.43	12.72	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=4.00' D=0.50' Z= 3.5 '/' Top.W=7.50' n= 0.035 Earth, dense weeds
1.1	161	0.0100	2.45	11.05	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=8.00' D=0.50' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
2.1	545	0.0300	4.25	19.13	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=8.00' D=0.50' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
0.1	74	0.0700	23.95	117.56	**Circular Channel (pipe), F-G** Diam= 30.0" Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.012
0.9	305	0.0500	5.57	30.64	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=10.00' D=0.50' Z= 2.0 '/' Top.W=12.00' n= 0.035 Earth, dense weeds
0.1	163	0.0900	37.15	466.84	**Circular Channel (pipe), H-I** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.012
17.4	2,643	Total			

Subcatchment 6S: PROPOSED TO BASIN 2



Summary for Subcatchment 7S: PROPOSED TO BASIN 3

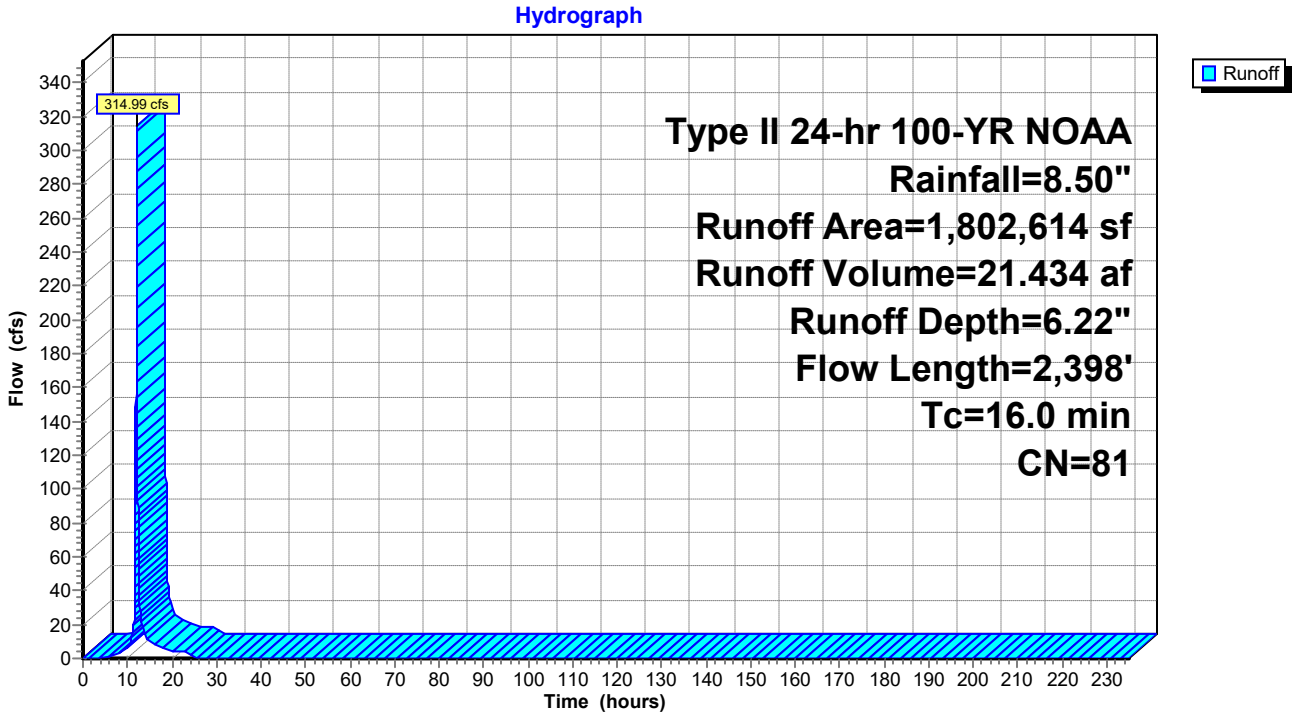
Runoff = 314.99 cfs @ 12.07 hrs, Volume= 21.434 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	68,751	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	252,304	80	>75% Grass cover, Good, HSG D (ONSITE C)
	29,508	80	>75% Grass cover, Good, HSG D
*	9,226	98	Paved parking & roofs (ONSITE A)
*	110,479	98	Paved parking & roofs (ONSITE C)
*	19,790	98	Paved parking & roofs (ONSITE D)
*	1,312,556	80	CAP
	1,802,614	81	Weighted Average
	1,663,119		Pervious Area
	139,495		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	33	0.5000	0.49		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
14.9	2,274	0.0100	2.54	19.03	**Trap/Vee/Rect Channel Flow, B-C** Bot.W=14.00' D=0.50' Z= 2.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
0.0	91	0.0600	35.20	691.11	**Circular Channel (pipe), C-D** Diam= 60.0" Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012
16.0	2,398	Total			

Subcatchment 7S: PROPOSED TO BASIN 3



Summary for Subcatchment 8S: PROPOSED TO BASIN 4

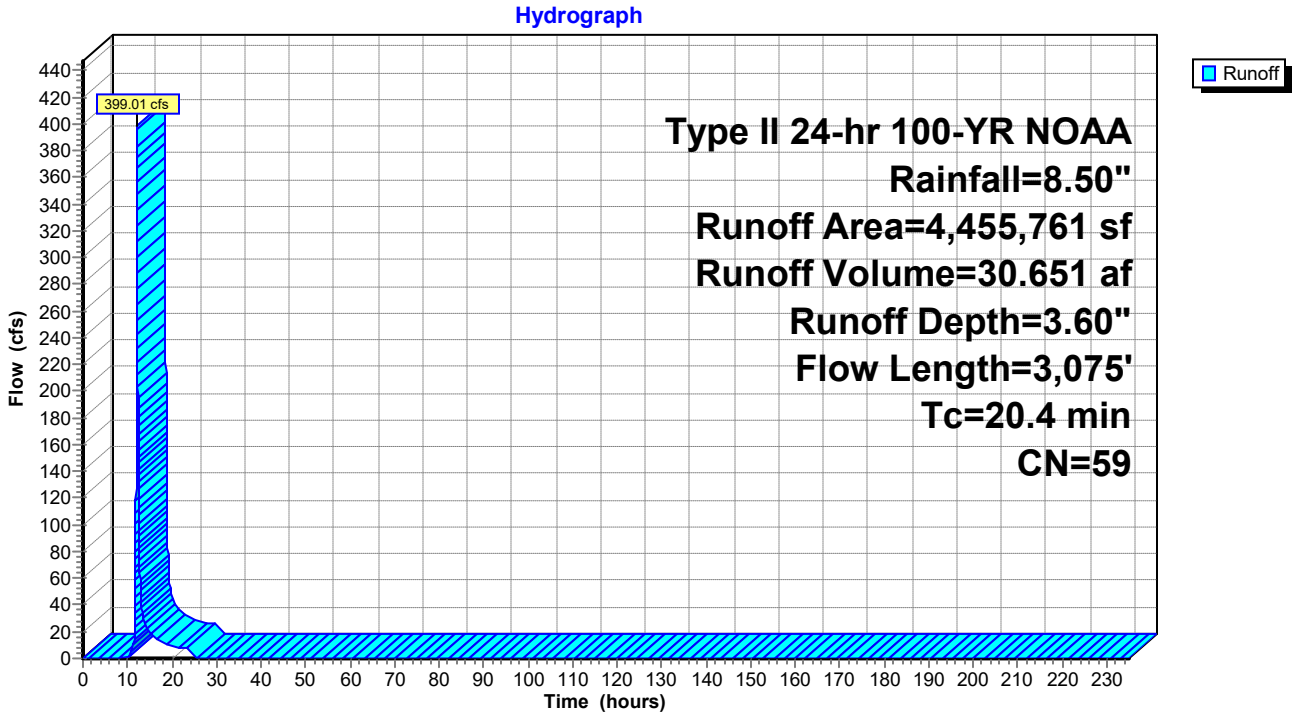
Runoff = 399.01 cfs @ 12.13 hrs, Volume= 30.651 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	395,927	30	Woods, Good, HSG A (ONSITE)
*	5,767	55	Woods, Good, HSG B (ONSITE)
*	404,259	70	Woods, Good, HSG C (ONSITE)
*	35,334	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	18,850	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	198,718	80	>75% Grass cover, Good, HSG D (ONSITE C)
	50,619	80	>75% Grass cover, Good, HSG D
*	7,436	98	Paved parking & roofs (ONSITE A)
*	16,314	98	Paved parking & roofs (ONSITE B)
*	18,955	98	Paved parking & roofs (ONSITE C)
*	6,703	98	Paved parking & roofs (ONSITE D)
*	1,043,104	42	RA ZONING A SOILS
*	281,741	64	RA ZONING B SOILS
*	75,531	76	RA ZONING C SOILS
*	692,547	50	R-2 ZONING A SOILS
*	599,476	70	R-2 ZONING B SOILS
*	322,638	80	R-2 ZONING C SOILS
*	281,842	85	R-2 ZONING D SOILS
	4,455,761	59	Weighted Average
	4,406,353		Pervious Area
	49,408		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.5	141	0.1000	5.09		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.5	190	0.0700	6.14	23.43	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=6.00' D=0.50' Z= 2.0 & 4.5 '/' Top.W=9.25' n= 0.035 Earth, dense weeds
2.8	653	0.0600	3.94		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.9	274	0.0500	5.01	15.67	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=4.50' D=0.50' Z= 3.5 '/' Top.W=8.00' n= 0.035 Earth, dense weeds
8.8	1,671	0.0200	3.17	9.91	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=4.50' D=0.50' Z= 3.5 '/' Top.W=8.00' n= 0.035 Earth, dense weeds
0.1	46	0.1800	9.91	27.26	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=4.50' D=0.50' Z= 2.0 '/' Top.W=6.50' n= 0.035 Earth, dense weeds
20.4	3,075	Total			

Subcatchment 8S: PROPOSED TO BASIN 4



Summary for Subcatchment 15S: PROPOSED TO WQv FACILITY

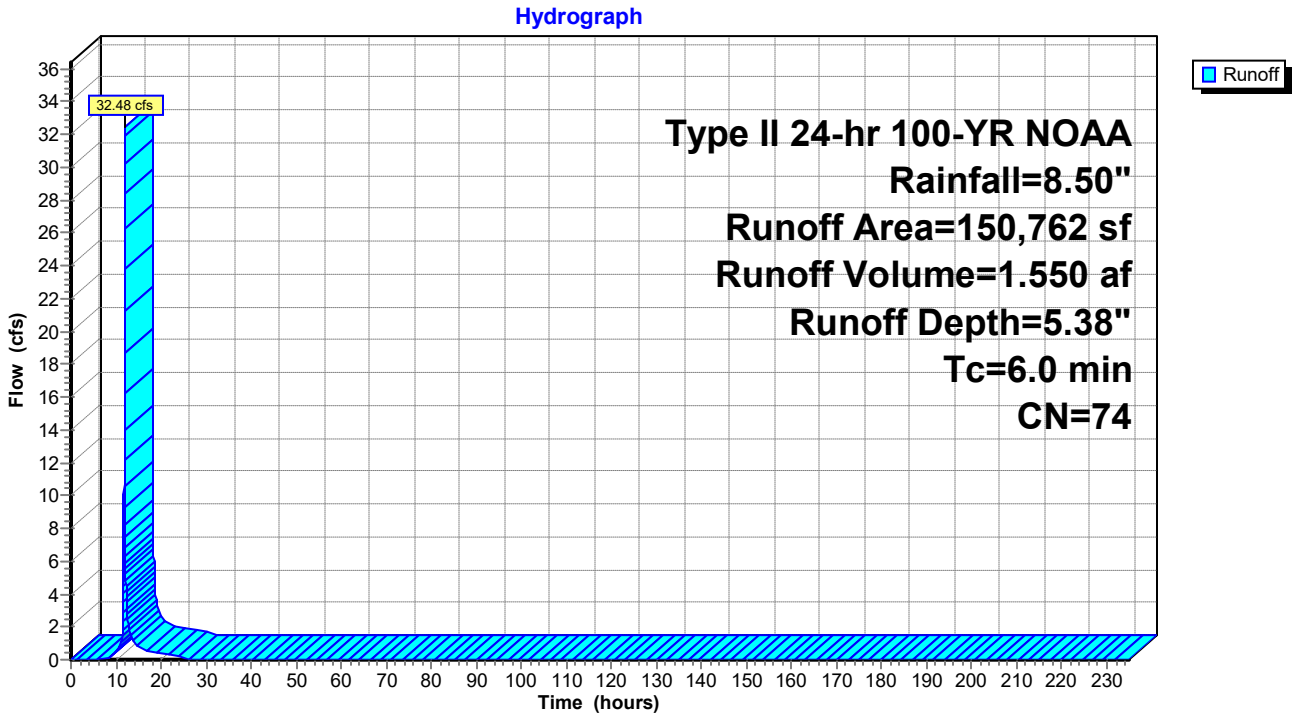
Runoff = 32.48 cfs @ 11.97 hrs, Volume= 1.550 af, Depth= 5.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	9,235	55	Woods, Good, HSG B
	6,229	70	Woods, Good, HSG C
*	20,647	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	16,945	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	8,756	98	Paved parking & roofs (ONSITE B)
*	4,487	98	Paved parking & roofs (ONSITE C)
*	65,732	70	R-2 ZONING B SOILS
*	18,731	80	R-2 ZONING C SOILS
	150,762	74	Weighted Average
	137,519		Pervious Area
	13,243		Impervious Area

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

Subcatchment 15S: PROPOSED TO WQv FACILITY



Summary for Subcatchment 19S: DRAINAGE AREA TO CULVERT 3

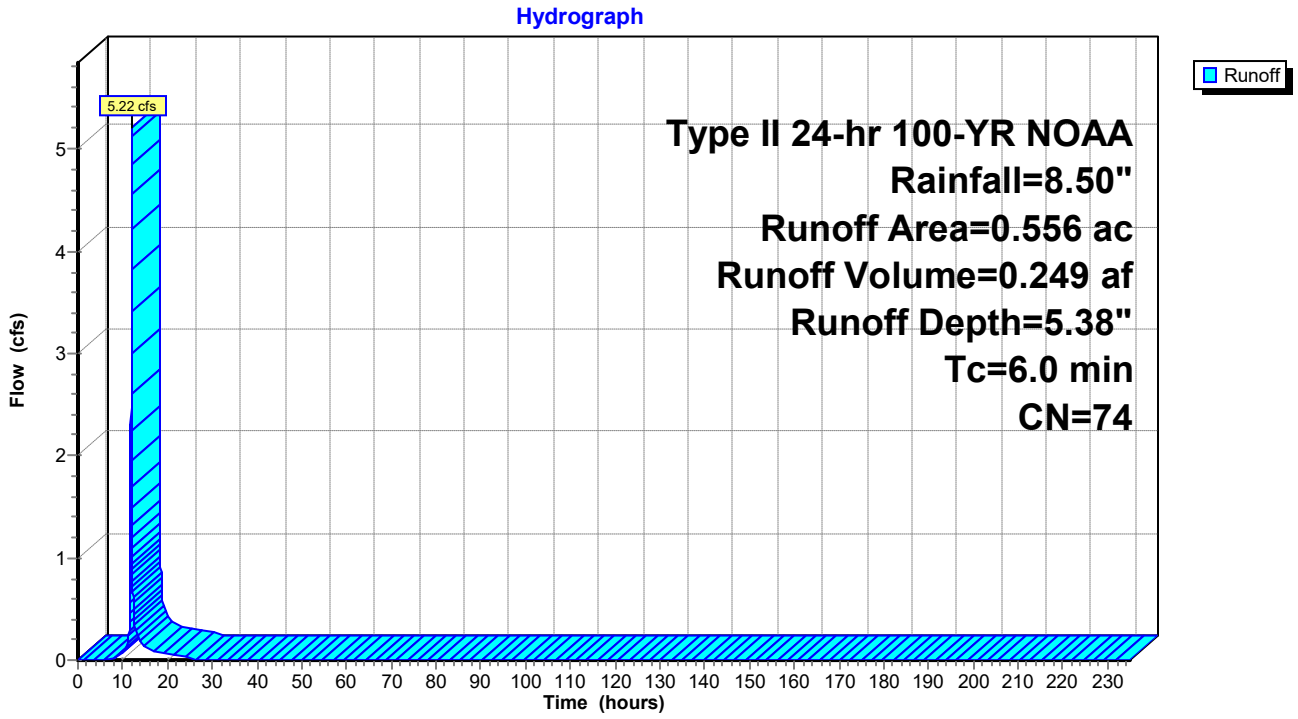
Runoff = 5.22 cfs @ 11.97 hrs, Volume= 0.249 af, Depth= 5.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	0.150	74	>75% Grass cover, Good, HSG C (DISTURBED B)
*	0.013	80	>75% Grass cover, Good, HSG D (DISTURBED C)
*	0.008	98	Paved parking & roofs B SOILS
*	0.042	98	Paved parking & roofs C SOILS
*	0.343	70	R-2 ZONING B SOILS
	0.556	74	Weighted Average
	0.506		Pervious Area
	0.050		Impervious Area

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

Subcatchment 19S: DRAINAGE AREA TO CULVERT 3



Summary for Subcatchment 20S: DRAINAGE AREA TO CULVERT 4

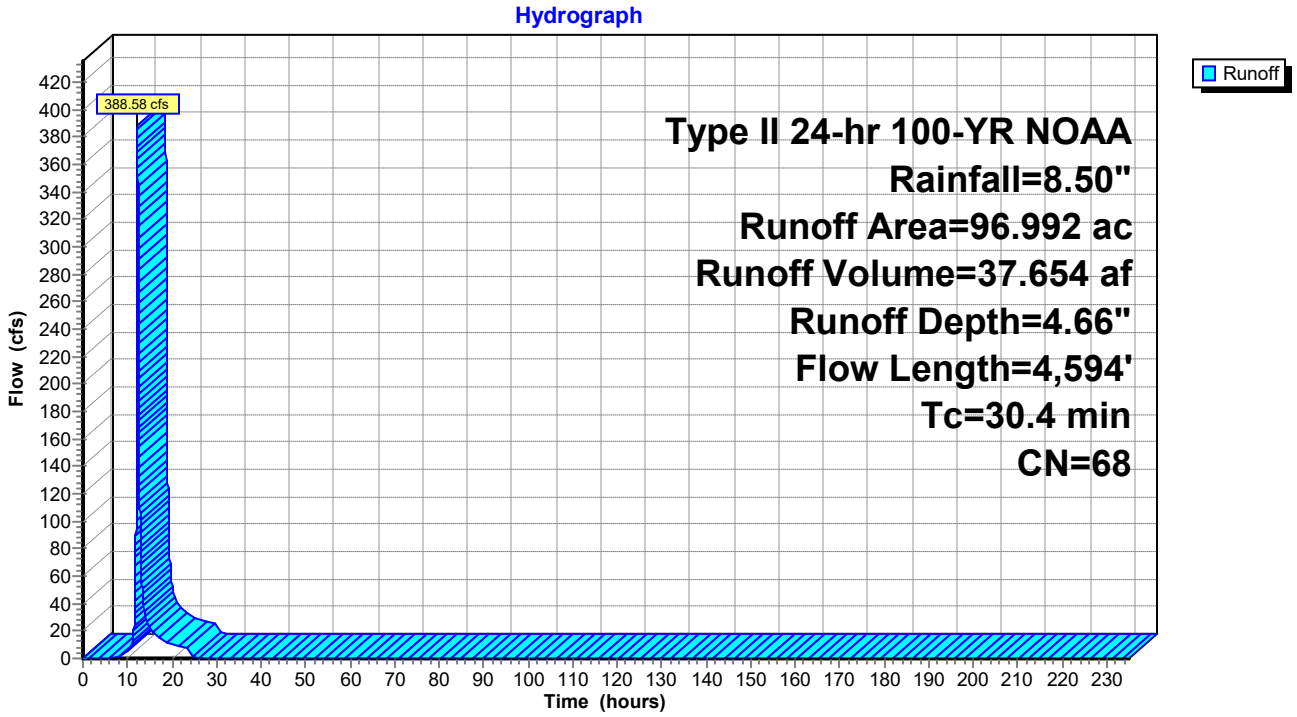
Runoff = 388.58 cfs @ 12.26 hrs, Volume= 37.654 af, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	0.193	61	>75% Grass cover, Good, HSG B (DISTURBED A)
*	0.776	74	>75% Grass cover, Good, HSG C (DISTURBED B)
*	0.003	80	>75% Grass cover, Good, HSG D (DISTURBED C)
	0.228	80	>75% Grass cover, Good, HSG D
*	0.050	98	Paved parking & roofs A SOILS
*	0.073	98	Paved parking & roofs B SOILS
*	0.008	98	Paved parking & roofs C SOILS
*	0.028	98	Paved parking & roofs D SOILS
*	33.640	50	R-2 ZONING A SOILS
*	27.405	70	R-2 ZONING B SOILS
*	19.119	80	R-2 ZONING C SOILS
*	15.469	85	R-2 ZONING D SOILS
	96.992	68	Weighted Average
	96.833		Pervious Area
	0.159		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
4.8	468	0.0100	1.61		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	83	0.1500	6.24		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
14.7	3,415	0.0300	3.88	13.59	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=5.00' D=0.50' Z= 4.0 '/' Top.W=9.00' n= 0.035 Earth, dense weeds
3.9	528	0.0100	2.24	7.85	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=5.00' D=0.50' Z= 4.0 '/' Top.W=9.00' n= 0.035 Earth, dense weeds
30.4	4,594	Total			

Subcatchment 20S: DRAINAGE AREA TO CULVERT 4



Summary for Subcatchment 21S: DRAINAGE AREA TO CULVERT 5

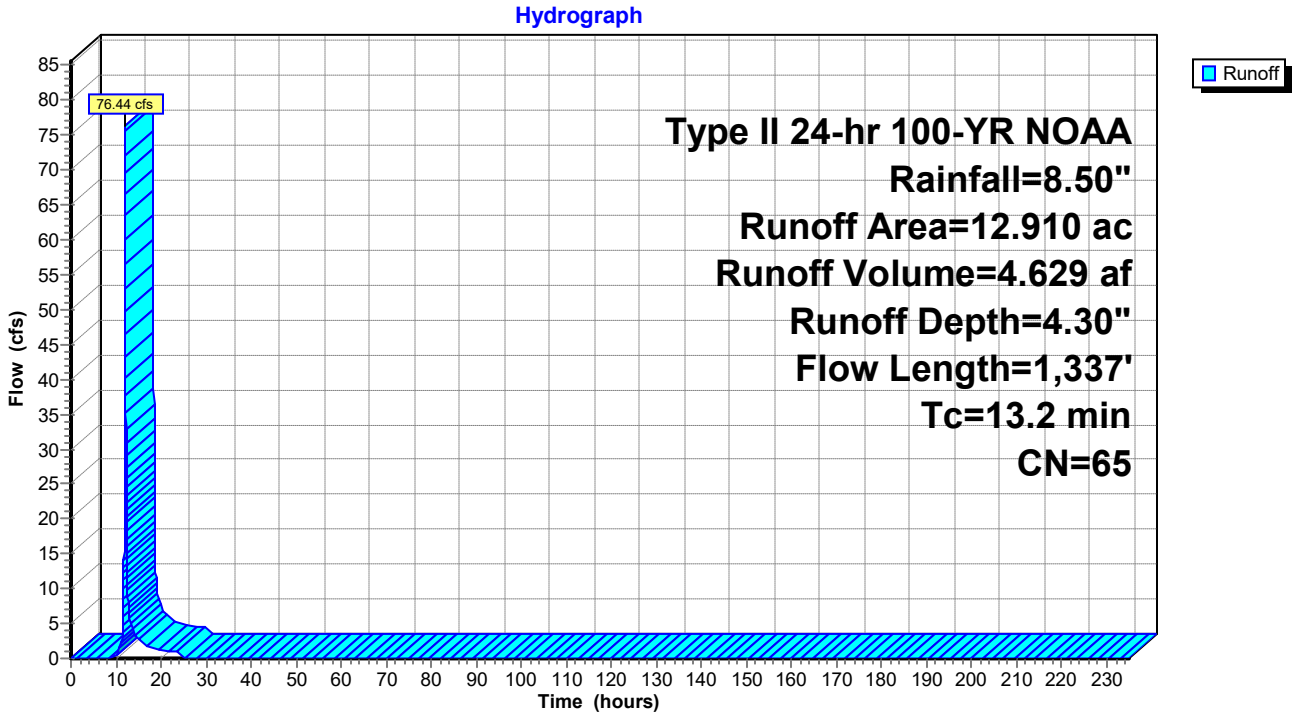
Runoff = 76.44 cfs @ 12.05 hrs, Volume= 4.629 af, Depth= 4.30"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	0.467	61	>75% Grass cover, Good, HSG B (DISTURBED A)
*	0.546	74	>75% Grass cover, Good, HSG C (DISTURBED B)
	0.197	98	Paved parking & roofs
	0.052	98	Paved parking & roofs
*	3.819	50	R-2 ZONING A SOILS
*	6.875	70	R-2 ZONING B SOILS
*	0.954	80	R-2 ZONING C SOILS
	12.910	65	Weighted Average
	12.661		Pervious Area
	0.249		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	428	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.0	10	0.6000	12.47		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
2.7	799	0.0200	4.96	13.30	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=10.00' D=0.25' Z= 1.7 & 4.0 '/' Top.W=11.43' n= 0.016 Asphalt, rough
13.2	1,337	Total			

Subcatchment 21S: DRAINAGE AREA TO CULVERT 5



Summary for Subcatchment 22S: DRAINAGE AREA TO CULVERT 6

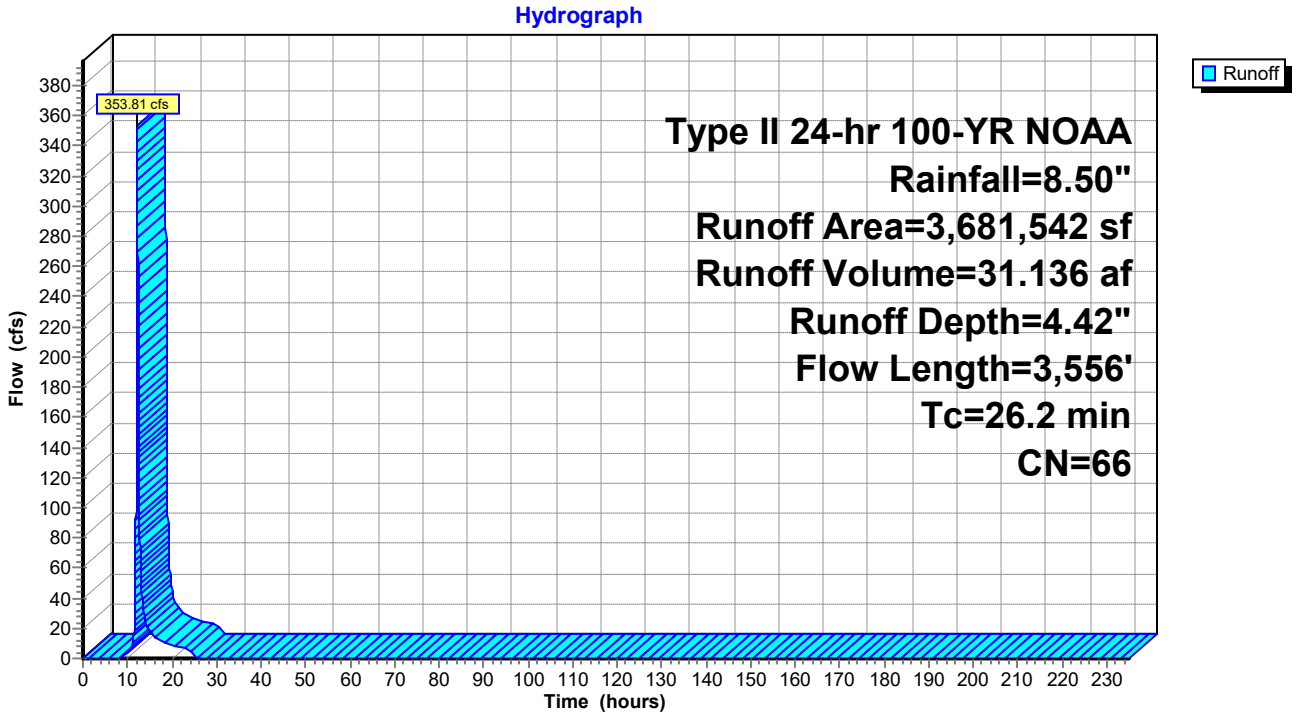
Runoff = 353.81 cfs @ 12.20 hrs, Volume= 31.136 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	9,867	80	>75% Grass cover, Good, HSG D (DISTURBED C)
	3,623	98	Paved parking & roofs
*	1,329,281	50	R-2 ZONING A SOILS
*	1,059,738	70	R-2 ZONING B SOILS
*	1,279,033	80	R-2 ZONING C SOILS
	3,681,542	66	Weighted Average
	3,677,919		Pervious Area
	3,623		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
2.6	700	0.0800	4.55		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
3.8	728	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
5.9	574	0.0100	1.61		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.1	53	0.2600	8.21		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
3.9	850	0.0300	3.60	19.81	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
3.1	551	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
26.2	3,556	Total			

Subcatchment 22S: DRAINAGE AREA TO CULVERT 6



Summary for Subcatchment 51S: ONSITE ACCESS ROAD (UNMANAGED)

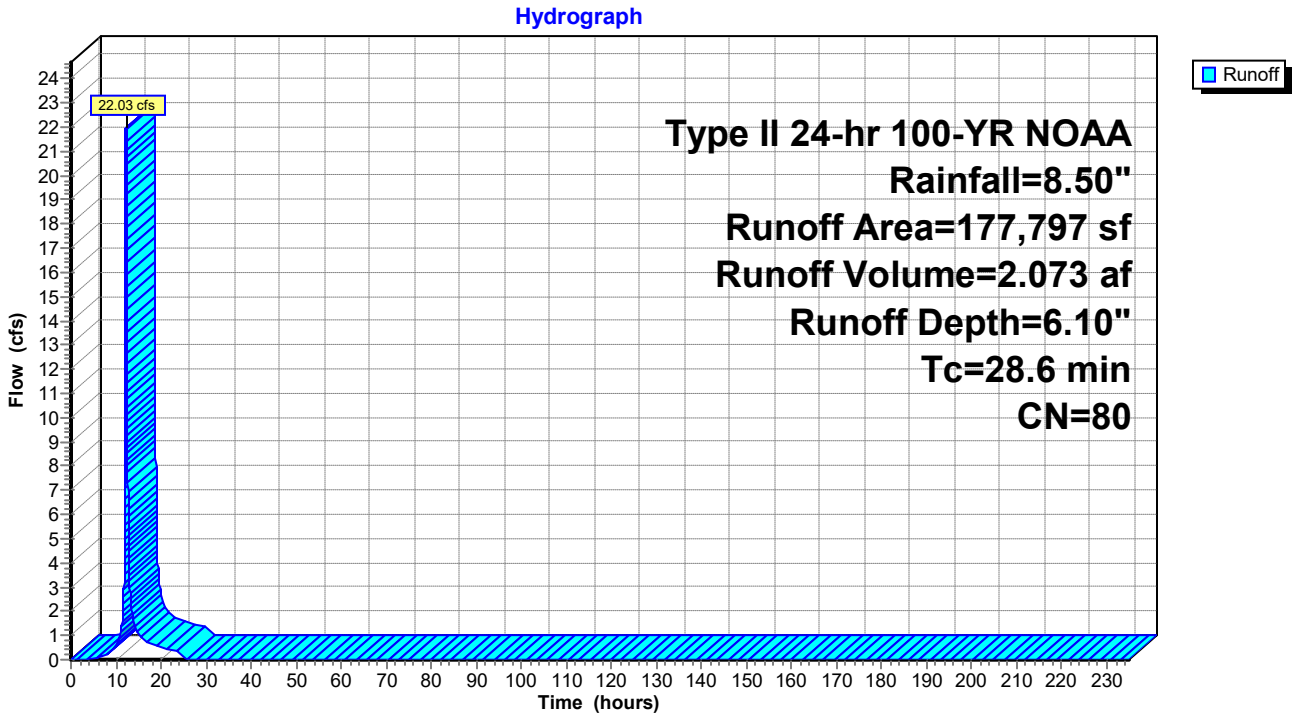
Runoff = 22.03 cfs @ 12.23 hrs, Volume= 2.073 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	40,015	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	9,812	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	68,391	80	>75% Grass cover, Good, HSG D (ONSITE C)
	16,061	80	>75% Grass cover, Good, HSG D
*	12,080	98	Paved parking & roofs (ONSITE A)
*	3,237	98	Paved parking & roofs (ONSITE B)
*	24,939	98	Paved parking & roofs (ONSITE C)
*	3,262	98	Paved parking & roofs (ONSITE D)
	177,797	80	Weighted Average
	134,279		Pervious Area
	43,518		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.6					**Direct Entry, SEE Tc CALC FOR AREA TO CULVERT 6**

Subcatchment 51S: ONSITE ACCESS ROAD (UNMANAGED)



Summary for Subcatchment 52S: DRAINAGE AREA TO CULVERT 7

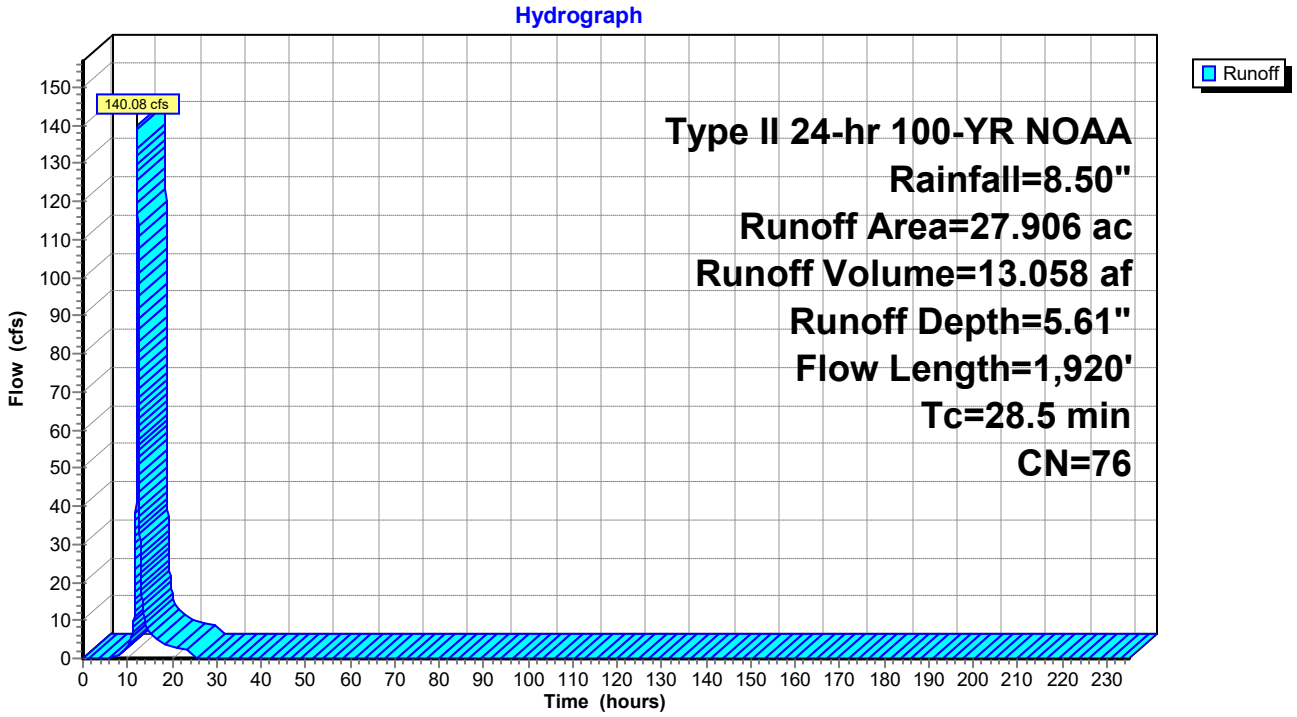
Runoff = 140.08 cfs @ 12.22 hrs, Volume= 13.058 af, Depth= 5.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	1.525	80	>75% Grass cover, Good, HSG D (DISTURBED C)
*	0.201	80	>75% Grass cover, Good, HSG D (DISTURBED D)
*	0.303	98	Paved parking & roofs C SOILS
*	0.052	98	Paved parking & roofs D SOILS
*	3.110	50	R-2 ZONING A SOILS
*	4.062	70	R-2 ZONING B SOILS
*	13.425	80	R-2 ZONING C SOILS
*	5.228	85	R-2 ZONING D SOILS
	27.906	76	Weighted Average
	27.551		Pervious Area
	0.355		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	145	0.0700	4.26		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
5.9	986	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
7.1	689	0.0100	1.61		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
28.5	1,920	Total			

Subcatchment 52S: DRAINAGE AREA TO CULVERT 7



Summary for Subcatchment 55S: UNMANAGED P 2

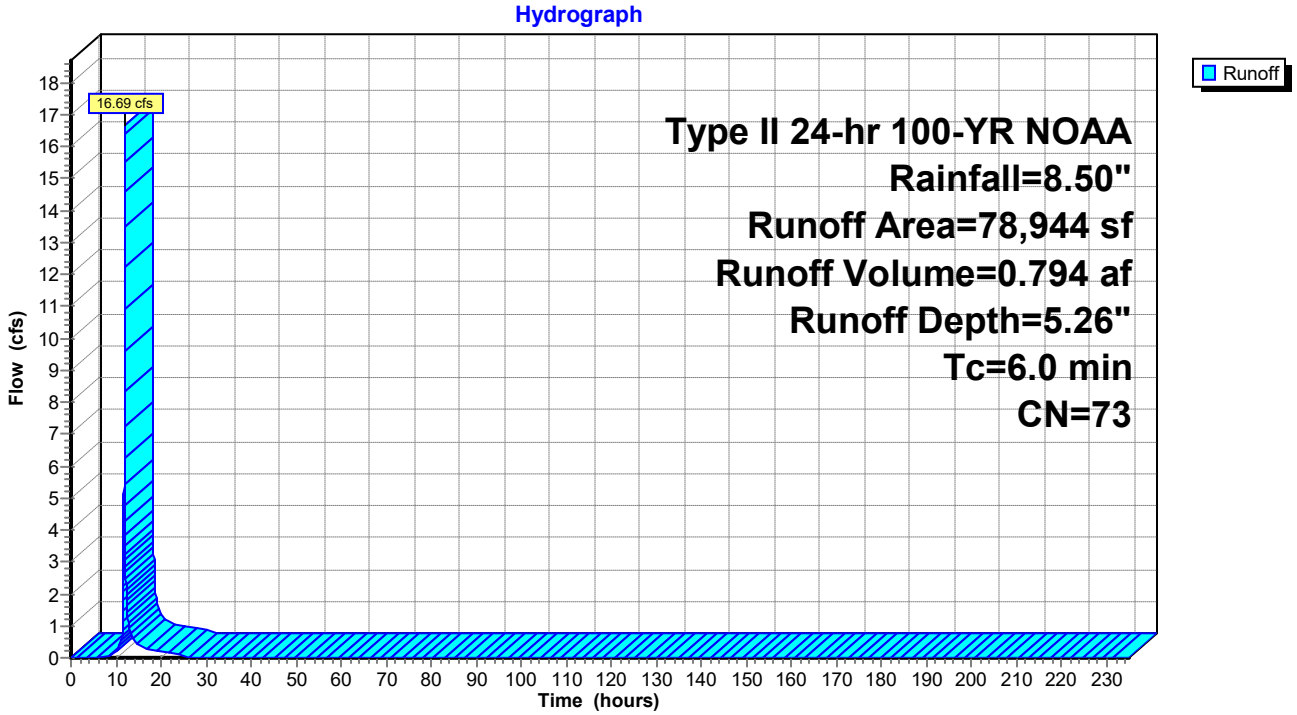
Runoff = 16.69 cfs @ 11.97 hrs, Volume= 0.794 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	7,354	70	Woods, Good, HSG C
	7,236	77	Woods, Good, HSG D
*	24,838	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	25,224	80	>75% Grass cover, Good, HSG D (ONSITE C)
	14,292	80	>75% Grass cover, Good, HSG D
	78,944	73	Weighted Average
	78,944		Pervious Area

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

Subcatchment 55S: UNMANAGED P 2



Summary for Subcatchment 56S: UNMANAGED P 1

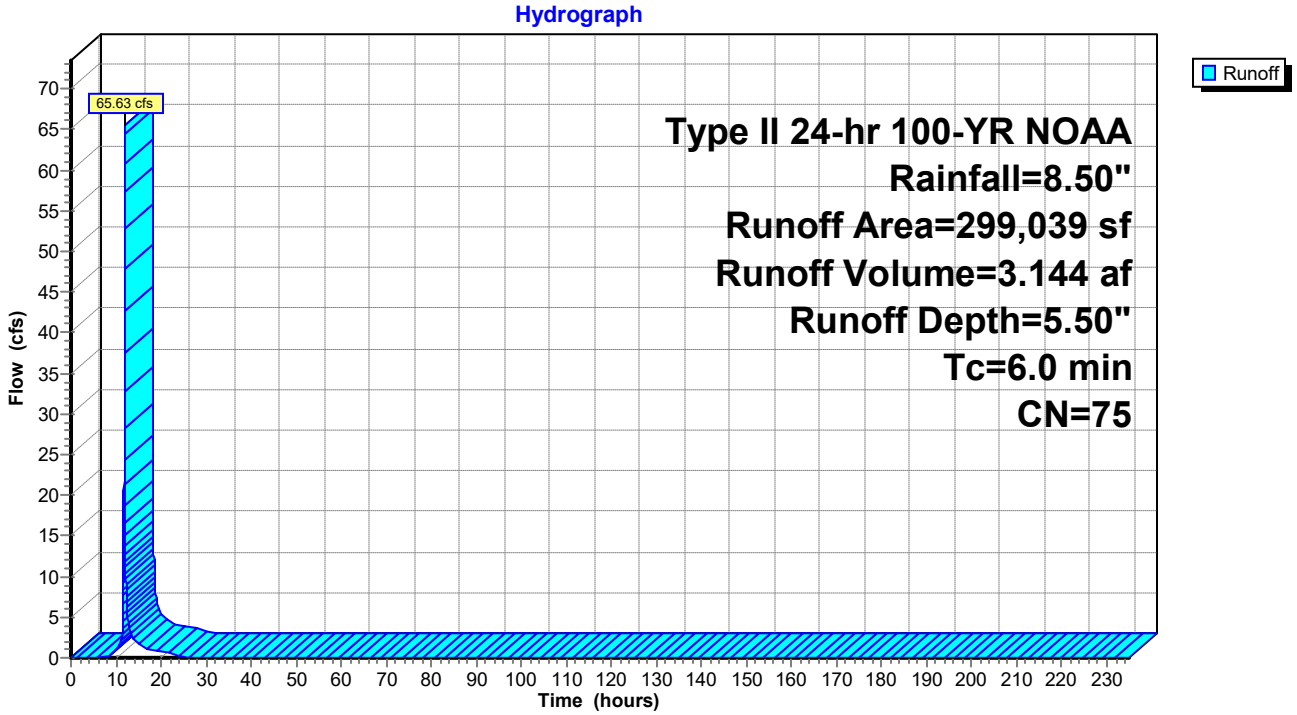
Runoff = 65.63 cfs @ 11.97 hrs, Volume= 3.144 af, Depth= 5.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	4,400	30	Woods, Good, HSG A
	86,031	70	Woods, Good, HSG C
	184,912	77	Woods, Good, HSG D
*	2,047	80	>75% Grass cover, Good, HSG D (ONSITE C)
	21,649	80	>75% Grass cover, Good, HSG D
	299,039	75	Weighted Average
	299,039		Pervious Area

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

Subcatchment 56S: UNMANAGED P 1



Summary for Subcatchment 57S: UNMANAGED P 3

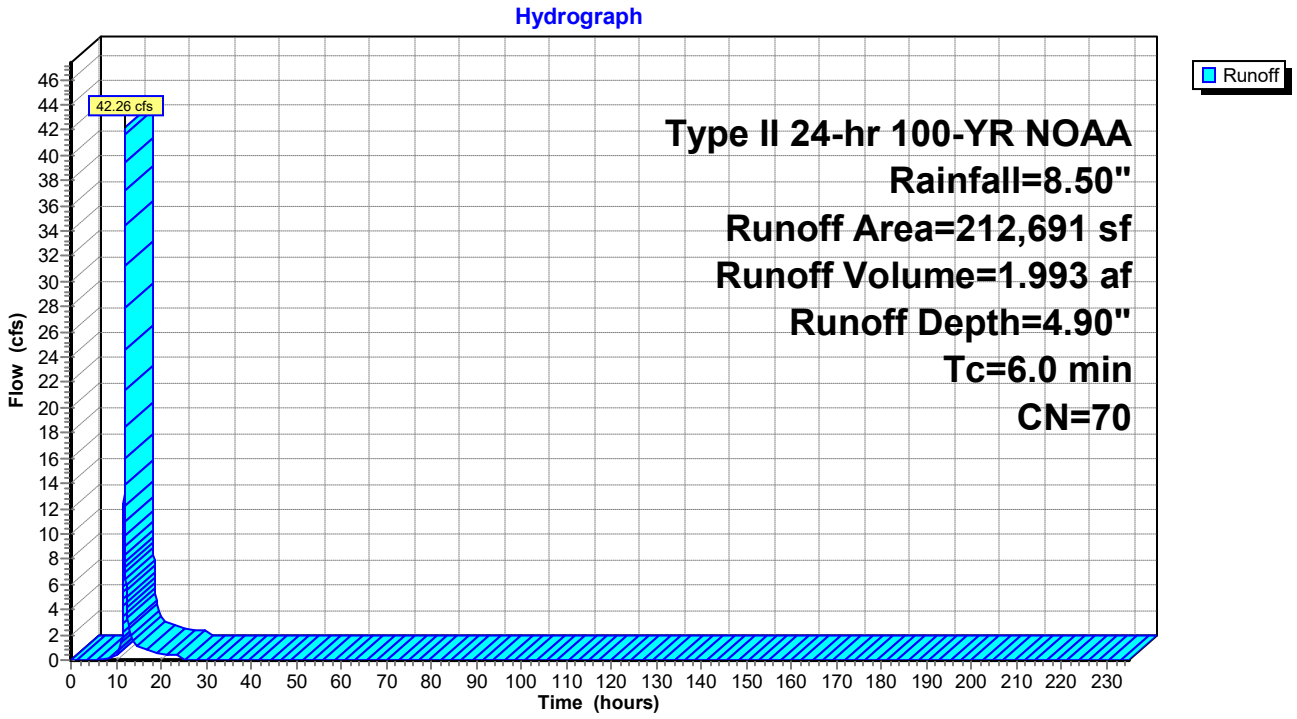
Runoff = 42.26 cfs @ 11.97 hrs, Volume= 1.993 af, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	25,681	30	Woods, Good, HSG A
	11,227	70	Woods, Good, HSG C
	20,676	77	Woods, Good, HSG D
*	37,410	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	32,984	80	>75% Grass cover, Good, HSG D (ONSITE C)
	84,713	80	>75% Grass cover, Good, HSG D
	212,691	70	Weighted Average
	212,691		Pervious Area

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

Subcatchment 57S: UNMANAGED P 3



Summary for Subcatchment 58S: UNMANAGED P 4

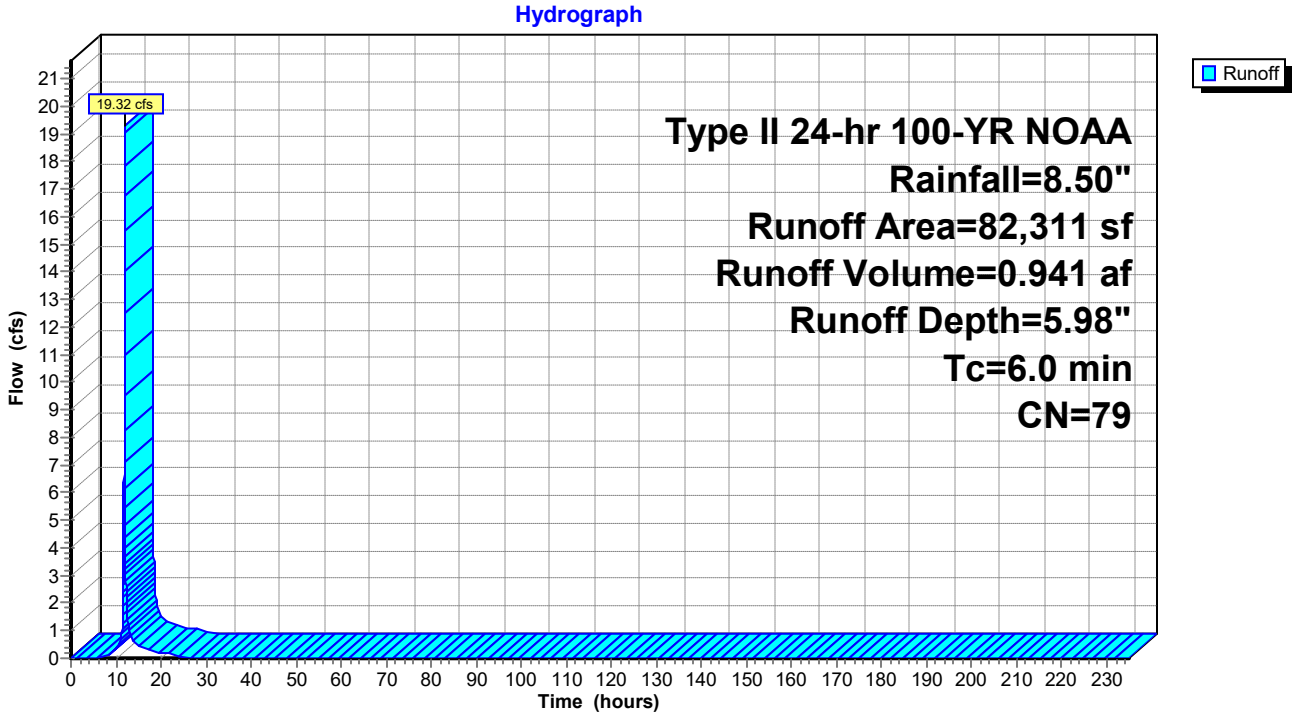
Runoff = 19.32 cfs @ 11.97 hrs, Volume= 0.941 af, Depth= 5.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	3,590	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	5,089	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	14,725	80	>75% Grass cover, Good, HSG D (ONSITE C)
	58,907	80	>75% Grass cover, Good, HSG D
	82,311	79	Weighted Average
	82,311		Pervious Area

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

Subcatchment 58S: UNMANAGED P 4



Summary for Pond 9P: BASIN 1

Inflow Area = 154.439 ac, 4.15% Impervious, Inflow Depth = 5.38" for 100-YR NOAA event
Inflow = 672.36 cfs @ 12.28 hrs, Volume= 69.178 af
Outflow = 255.13 cfs @ 12.73 hrs, Volume= 69.062 af, Atten= 62%, Lag= 27.2 min
Primary = 255.13 cfs @ 12.73 hrs, Volume= 69.062 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 90.22' @ 12.73 hrs Surf.Area= 163,588 sf Storage= 1,275,872 cf

Plug-Flow detention time= 374.2 min calculated for 69.060 af (100% of inflow)
Center-of-Mass det. time= 373.6 min (1,209.7 - 836.0)

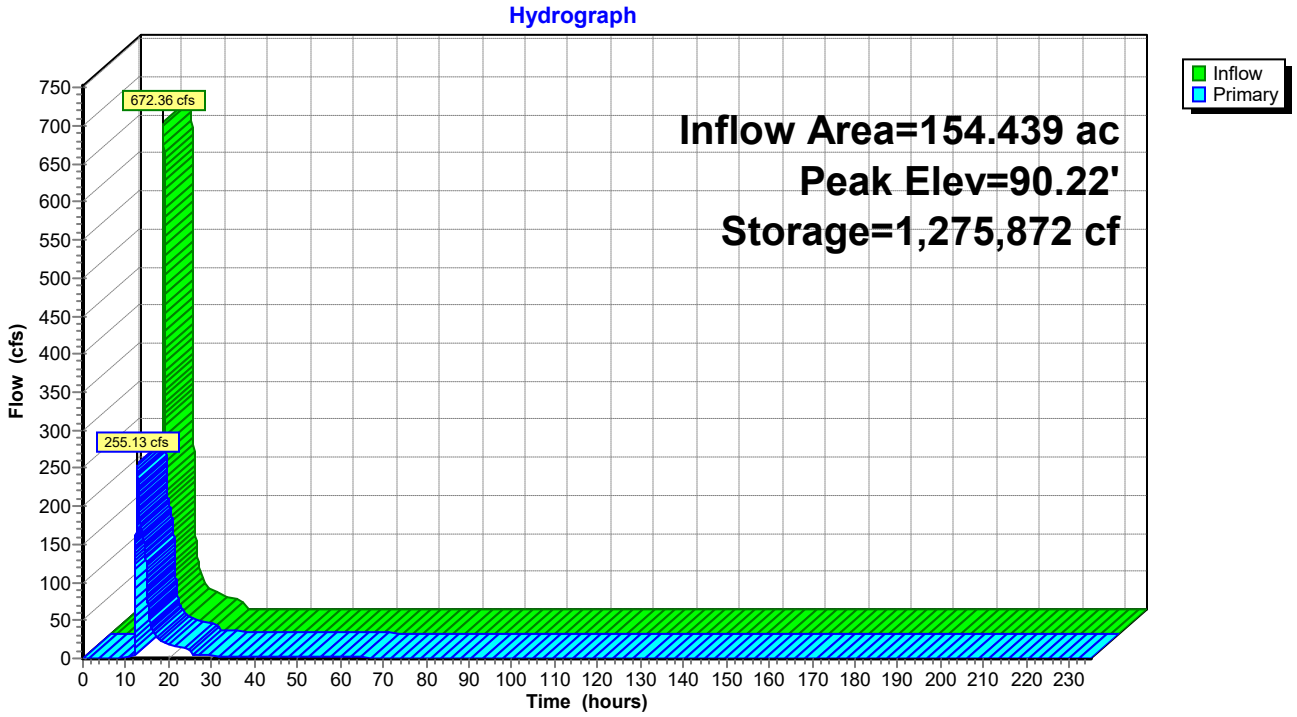
Volume	Invert	Avail.Storage	Storage Description
#1	81.00'	1,573,213 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.00	110,353	0	0
82.00	113,238	111,796	111,796
82.50	114,690	56,982	168,778
83.00	128,912	60,901	229,678
87.00	144,633	547,090	776,768
89.00	157,733	302,366	1,079,134
91.00	167,296	325,029	1,404,163
92.00	170,803	169,050	1,573,213

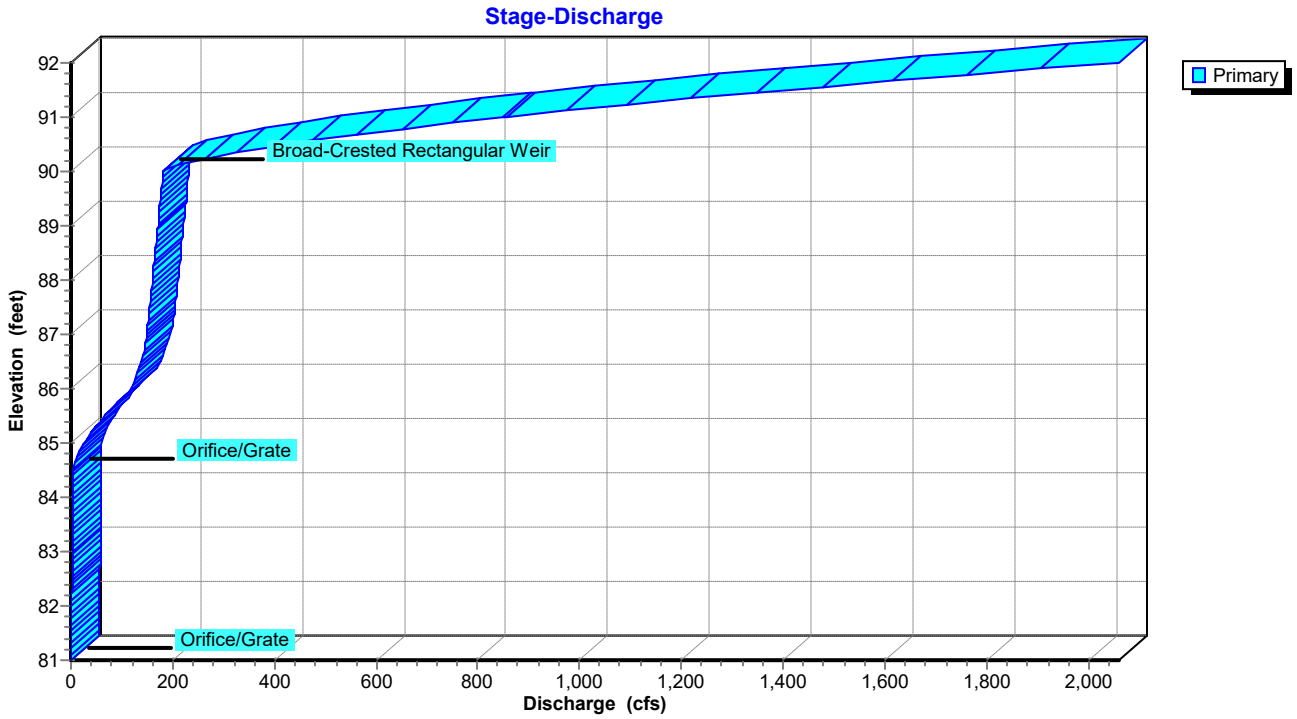
Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**48.0" x 70.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 78.66' S= 0.0049 '/' Cc= 0.900 n= 0.012
#2	Device 1	81.00'	**9.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	84.50'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	90.00'	**250.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=255.06 cfs @ 12.73 hrs HW=90.22' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 183.77 cfs @ 14.62 fps)
  - **2=Orifice/Grate** (Passes < 6.33 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 224.64 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 71.29 cfs @ 1.27 fps)

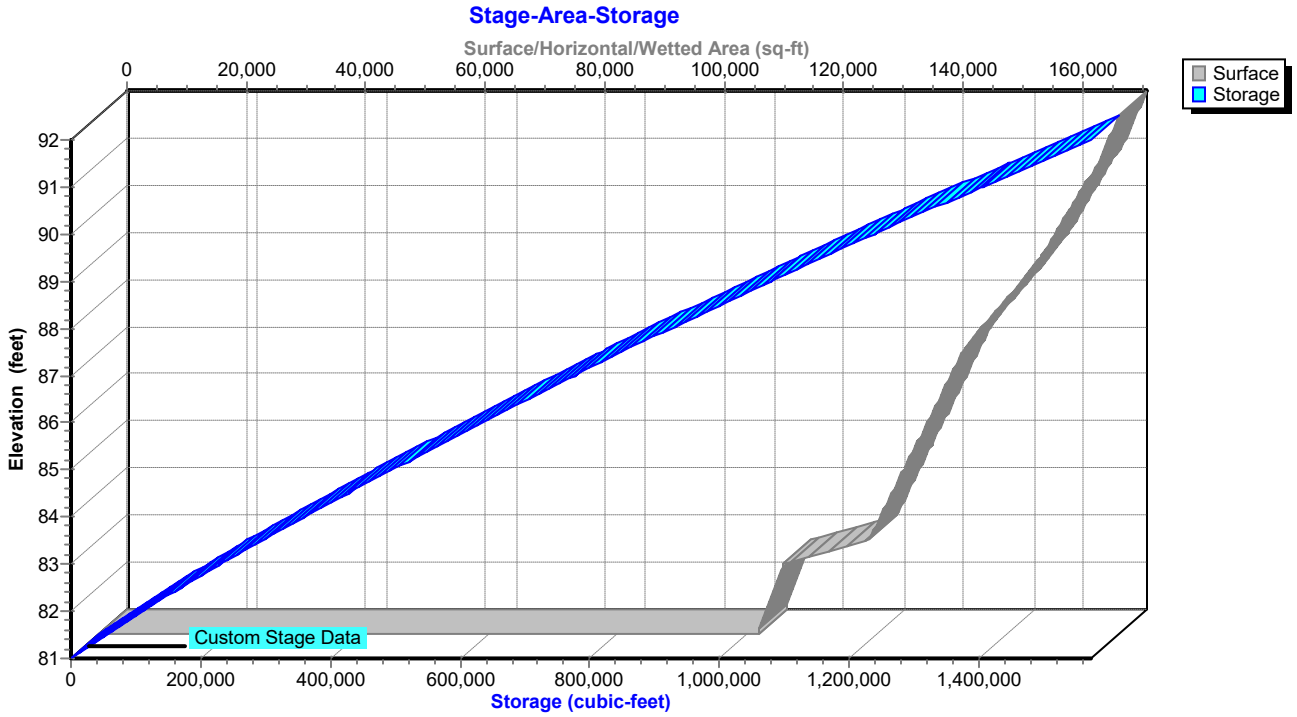
Pond 9P: BASIN 1



Pond 9P: BASIN 1



Pond 9P: BASIN 1



Stage-Discharge for Pond 9P: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
81.00	0.00	84.12	3.52	87.24	151.15	90.36	330.70
81.06	0.01	84.18	3.56	87.30	151.87	90.42	369.44
81.12	0.05	84.24	3.60	87.36	152.59	90.48	410.77
81.18	0.12	84.30	3.64	87.42	153.31	90.54	454.74
81.24	0.20	84.36	3.68	87.48	154.03	90.60	501.19
81.30	0.31	84.42	3.71	87.54	154.74	90.66	547.57
81.36	0.43	84.48	3.75	87.60	155.44	90.72	595.53
81.42	0.56	84.54	4.28	87.66	156.15	90.78	644.92
81.48	0.70	84.60	5.78	87.72	156.85	90.84	697.53
81.54	0.85	84.66	7.83	87.78	157.55	90.90	752.83
81.60	1.00	84.72	10.30	87.84	158.25	90.96	809.87
81.66	1.14	84.78	13.13	87.90	158.94	91.02	869.11
81.72	1.26	84.84	16.28	87.96	159.63	91.08	931.18
81.78	1.35	84.90	19.71	88.02	160.31	91.14	995.10
81.84	1.45	84.96	23.41	88.08	161.00	91.20	1,060.84
81.90	1.54	85.02	27.36	88.14	161.68	91.26	1,127.28
81.96	1.63	85.08	31.54	88.20	162.36	91.32	1,195.31
82.02	1.71	85.14	35.94	88.26	163.03	91.38	1,264.89
82.08	1.79	85.20	40.55	88.32	163.70	91.44	1,335.12
82.14	1.86	85.26	45.36	88.38	164.37	91.50	1,406.27
82.20	1.93	85.32	50.36	88.44	165.04	91.56	1,478.70
82.26	2.00	85.38	55.55	88.50	165.70	91.62	1,552.90
82.32	2.07	85.44	60.91	88.56	166.37	91.68	1,629.46
82.38	2.13	85.50	66.45	88.62	167.03	91.74	1,707.40
82.44	2.20	85.56	72.16	88.68	167.68	91.80	1,786.68
82.50	2.26	85.62	78.03	88.74	168.34	91.86	1,867.28
82.56	2.32	85.68	84.05	88.80	168.99	91.92	1,949.18
82.62	2.37	85.74	90.23	88.86	169.63	91.98	**2,032.36**
82.68	2.43	85.80	96.57	88.92	170.28		
82.74	2.49	85.86	103.04	88.98	170.92		
82.80	2.54	85.92	109.67	89.04	171.57		
82.86	2.59	85.98	116.43	89.10	172.21		
82.92	2.64	86.04	121.11	89.16	172.84		
82.98	2.69	86.10	123.39	89.22	173.48		
83.04	2.74	86.16	125.62	89.28	174.11		
83.10	2.79	86.22	127.82	89.34	174.74		
83.16	2.84	86.28	129.98	89.40	175.37		
83.22	2.89	86.34	132.10	89.46	175.99		
83.28	2.94	86.40	134.19	89.52	176.61		
83.34	2.98	86.46	136.25	89.58	177.23		
83.40	3.03	86.52	138.27	89.64	177.85		
83.46	3.07	86.58	140.27	89.70	178.47		
83.52	3.12	86.64	142.23	89.76	179.08		
83.58	3.16	86.70	144.17	89.82	179.70		
83.64	3.20	86.76	145.22	89.88	180.31		
83.70	3.24	86.82	145.97	89.94	180.91		
83.76	3.29	86.88	146.72	90.00	181.52		
83.82	3.33	86.94	147.47	90.06	191.97		
83.88	3.37	87.00	148.21	90.12	210.58		
83.94	3.41	87.06	148.95	90.18	234.49		
84.00	3.45	87.12	149.69	90.24	262.82		
84.06	3.49	87.18	150.42	90.30	295.02		

Stage-Area-Storage for Pond 9P: BASIN 1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
81.00	110,353	0
81.15	110,786	16,585
81.30	111,218	33,236
81.45	111,651	49,951
81.60	112,084	66,731
81.75	112,517	83,576
81.90	112,950	100,486
82.05	113,383	117,461
82.20	113,819	134,501
82.35	114,254	151,607
82.50	114,690	168,778
82.65	118,957	186,301
82.80	123,223	204,464
82.95	127,490	223,268
83.10	129,305	242,589
83.25	129,895	262,029
83.40	130,484	281,557
83.55	131,074	301,174
83.70	131,663	320,879
83.85	132,253	340,673
84.00	132,842	360,555
84.15	133,432	380,526
84.30	134,021	400,585
84.45	134,611	420,732
84.60	135,200	440,968
84.75	135,790	461,292
84.90	136,379	481,705
85.05	136,969	502,206
85.20	137,559	522,796
85.35	138,148	543,474
85.50	138,738	564,240
85.65	139,327	585,095
85.80	139,917	606,038
85.95	140,506	627,070
86.10	141,096	648,190
86.25	141,685	669,399
86.40	142,275	690,696
86.55	142,864	712,081
86.70	143,454	733,555
86.85	144,043	755,117
87.00	144,633	776,768
87.15	145,616	798,537
87.30	146,598	820,453
87.45	147,581	842,516
87.60	148,563	864,727
87.75	149,546	887,085
87.90	150,528	909,590
88.05	151,510	932,243
88.20	152,493	955,044
88.35	153,475	977,991
88.50	154,458	1,001,086
88.65	155,441	1,024,329
88.80	156,423	1,047,718
88.95	157,406	1,071,256
89.10	158,211	1,094,931
89.25	158,928	1,118,717
89.40	159,646	1,142,610
89.55	160,363	1,166,610
89.70	161,080	1,190,719
89.85	161,797	1,214,934
90.00	162,515	1,239,258
90.15	163,232	1,263,689
90.30	163,949	1,288,227
90.45	164,666	1,312,873
90.60	165,383	1,337,627
90.75	166,101	1,362,488
90.90	166,818	1,387,457
91.05	167,471	1,412,532
91.20	167,997	1,437,692
91.35	168,523	1,462,931
91.50	169,050	1,488,249
91.65	169,576	1,513,646
91.80	170,102	1,539,122
91.95	**170,628**	**1,564,677**

Summary for Pond 10P: BASIN 2

Inflow Area = 27.728 ac, 4.29% Impervious, Inflow Depth = 3.36" for 100-YR NOAA event
Inflow = 110.04 cfs @ 12.10 hrs, Volume= 7.770 af
Outflow = 58.51 cfs @ 12.28 hrs, Volume= 7.766 af, Atten= 47%, Lag= 10.5 min
Primary = 58.51 cfs @ 12.28 hrs, Volume= 7.766 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 77.93' @ 12.28 hrs Surf.Area= 34,388 sf Storage= 107,974 cf

Plug-Flow detention time= 248.0 min calculated for 7.766 af (100% of inflow)
Center-of-Mass det. time= 248.2 min (1,105.0 - 856.8)

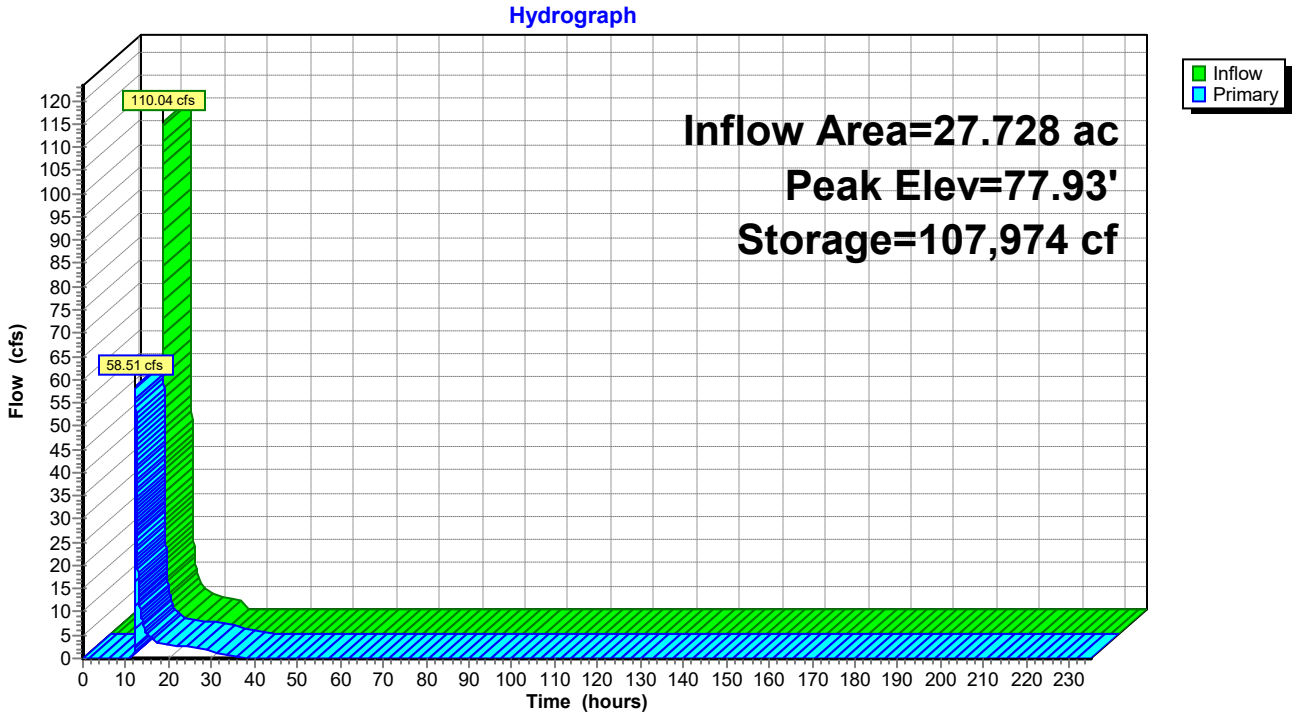
Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	183,706 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.00	21,185	0	0
75.00	22,367	21,776	21,776
75.50	22,967	11,334	33,110
76.00	29,696	13,166	46,275
78.00	34,569	64,265	110,540
80.00	38,597	73,166	183,706

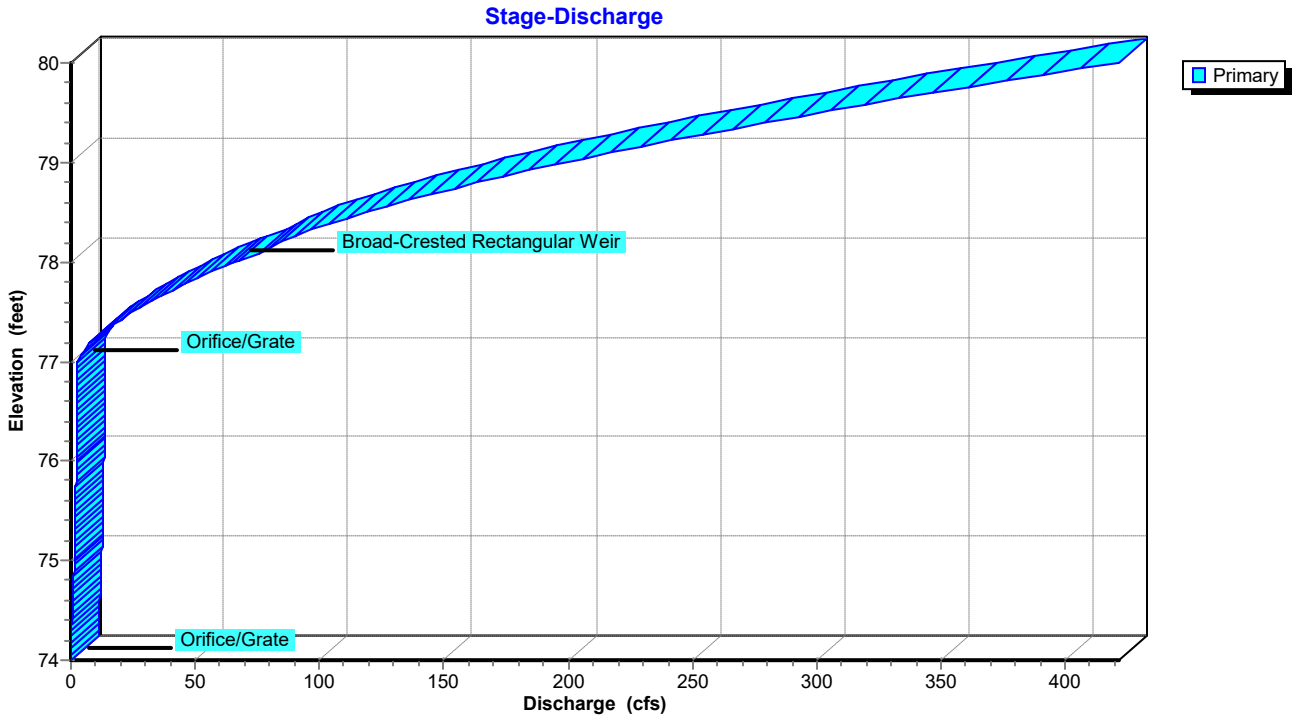
Device	Routing	Invert	Outlet Devices
#1	Primary	72.00'	**36.0" x 51.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 71.75' S= 0.0049 '/' Cc= 0.900 n= 0.012
#2	Device 1	74.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	77.00'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	78.00'	**45.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=58.50 cfs @ 12.28 hrs HW=77.93' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 58.50 cfs of 71.60 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 3.19 cfs @ 9.13 fps)
  - **3=Orifice/Grate** (Weir Controls 55.32 cfs @ 3.15 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

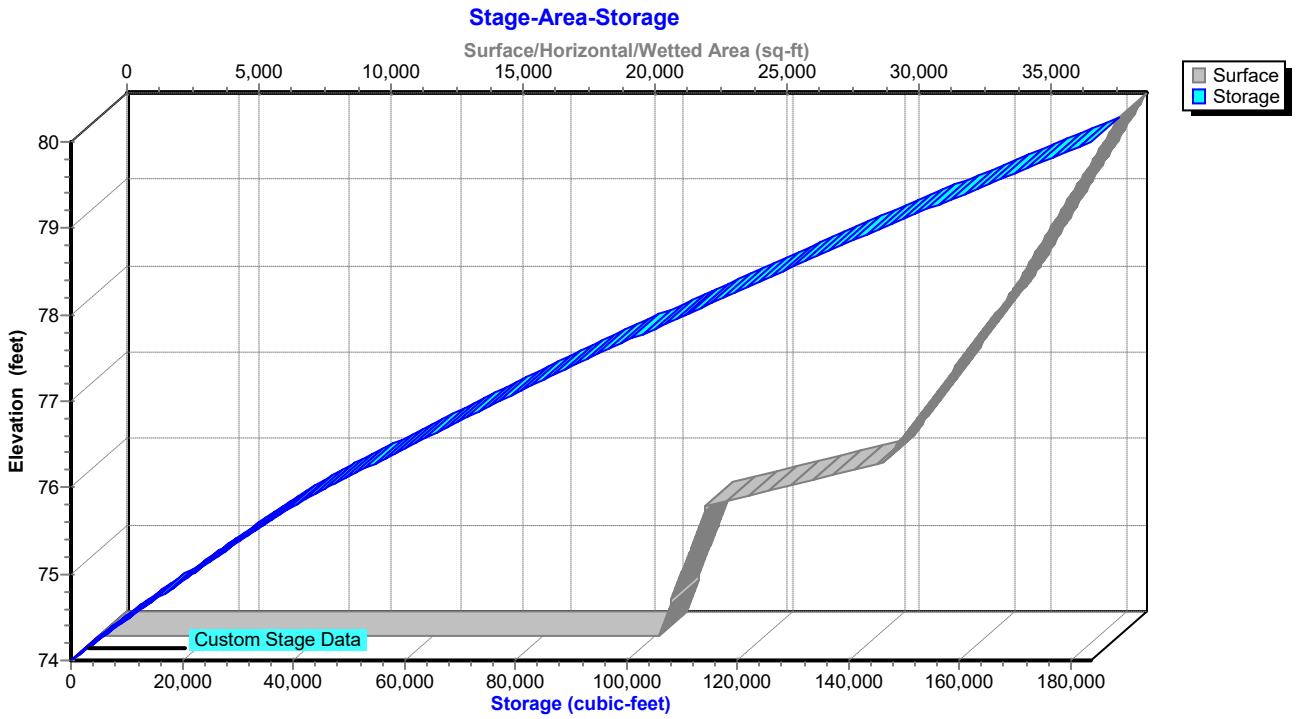
Pond 10P: BASIN 2



Pond 10P: BASIN 2



Pond 10P: BASIN 2



Stage-Discharge for Pond 10P: BASIN 2

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
74.00	0.00	76.08	2.22	78.16	81.19
74.04	0.01	76.12	2.25	78.20	84.57
74.08	0.02	76.16	2.27	78.24	88.30
74.12	0.05	76.20	2.30	78.28	92.33
74.16	0.09	76.24	2.32	78.32	96.65
74.20	0.13	76.28	2.35	78.36	101.24
74.24	0.19	76.32	2.37	78.40	106.08
74.28	0.25	76.36	2.39	78.44	111.11
74.32	0.32	76.40	2.42	78.48	116.36
74.36	0.39	76.44	2.44	78.52	121.82
74.40	0.47	76.48	2.46	78.56	127.48
74.44	0.55	76.52	2.49	78.60	133.33
74.48	0.63	76.56	2.51	78.64	139.09
74.52	0.72	76.60	2.53	78.68	144.99
74.56	0.80	76.64	2.55	78.72	151.00
74.60	0.87	76.68	2.57	78.76	157.13
74.64	0.94	76.72	2.60	78.80	163.36
74.68	0.99	76.76	2.62	78.84	170.04
74.72	1.05	76.80	2.64	78.88	176.87
74.76	1.10	76.84	2.66	78.92	183.83
74.80	1.15	76.88	2.68	78.96	190.93
74.84	1.20	76.92	2.70	79.00	198.17
74.88	1.24	76.96	2.72	79.04	205.73
74.92	1.29	77.00	2.74	79.08	213.43
74.96	1.33	77.04	3.26	79.12	221.29
75.00	1.37	77.08	4.19	79.16	229.28
75.04	1.41	77.12	5.39	79.20	237.42
75.08	1.45	77.16	6.80	79.24	245.58
75.12	1.49	77.20	8.40	79.28	253.87
75.16	1.53	77.24	10.17	79.32	262.28
75.20	1.56	77.28	12.09	79.36	270.81
75.24	1.60	77.32	14.15	79.40	279.46
75.28	1.64	77.36	16.34	79.44	288.08
75.32	1.67	77.40	18.66	79.48	296.80
75.36	1.70	77.44	21.10	79.52	305.63
75.40	1.74	77.48	23.64	79.56	314.56
75.44	1.77	77.52	26.30	79.60	323.58
75.48	1.80	77.56	29.06	79.64	332.90
75.52	1.83	77.60	31.91	79.68	342.32
75.56	1.86	77.64	34.87	79.72	351.85
75.60	1.89	77.68	37.91	79.76	361.49
75.64	1.92	77.72	41.05	79.80	371.24
75.68	1.95	77.76	44.28	79.84	381.09
75.72	1.98	77.80	47.59	79.88	391.04
75.76	2.01	77.84	50.98	79.92	401.10
75.80	2.04	77.88	54.45	79.96	411.26
75.84	2.06	77.92	58.01	80.00	**421.52**
75.88	2.09	77.96	61.64		
75.92	2.12	78.00	65.35		
75.96	2.14	78.04	70.10		
76.00	2.17	78.08	75.57		
76.04	2.20	78.12	78.17		

Stage-Area-Storage for Pond 10P: BASIN 2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
74.00	21,185	0
74.10	21,303	2,124
74.20	21,421	4,261
74.30	21,540	6,409
74.40	21,658	8,569
74.50	21,776	10,740
74.60	21,894	12,924
74.70	22,012	15,119
74.80	22,131	17,326
74.90	22,249	19,545
75.00	22,367	21,776
75.10	22,487	24,019
75.20	22,607	26,273
75.30	22,727	28,540
75.40	22,847	30,819
75.50	22,967	33,110
75.60	24,313	35,473
75.70	25,659	37,972
75.80	27,004	40,605
75.90	28,350	43,373
76.00	29,696	46,275
76.10	29,940	49,257
76.20	30,183	52,263
76.30	30,427	55,294
76.40	30,671	58,349
76.50	30,914	61,428
76.60	31,158	64,531
76.70	31,402	67,659
76.80	31,645	70,812
76.90	31,889	73,988
77.00	32,133	77,190
77.10	32,376	80,415
77.20	32,620	83,665
77.30	32,863	86,939
77.40	33,107	90,237
77.50	33,351	93,560
77.60	33,594	96,908
77.70	33,838	100,279
77.80	34,082	103,675
77.90	34,325	107,096
78.00	34,569	110,540
78.10	34,770	114,007
78.20	34,972	117,494
78.30	35,173	121,002
78.40	35,375	124,529
78.50	35,576	128,077
78.60	35,777	131,644
78.70	35,979	135,232
78.80	36,180	138,840
78.90	36,382	142,468
79.00	36,583	146,116
79.10	36,784	149,785
79.20	36,986	153,473
79.30	37,187	157,182
79.40	37,389	160,911
79.50	37,590	164,660
79.60	37,791	168,429
79.70	37,993	172,218
79.80	38,194	176,027
79.90	38,396	179,857
80.00	**38,597**	**183,706**

Summary for Pond 11P: BASIN 3

Inflow Area = 41.382 ac, 7.74% Impervious, Inflow Depth = 6.22" for 100-YR NOAA event
Inflow = 314.99 cfs @ 12.07 hrs, Volume= 21.434 af
Outflow = 193.46 cfs @ 12.21 hrs, Volume= 21.391 af, Atten= 39%, Lag= 8.3 min
Primary = 193.46 cfs @ 12.21 hrs, Volume= 21.391 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 79.10' @ 12.21 hrs Surf.Area= 88,109 sf Storage= 380,892 cf

Plug-Flow detention time= 550.2 min calculated for 21.390 af (100% of inflow)
Center-of-Mass det. time= 549.4 min (1,353.9 - 804.4)

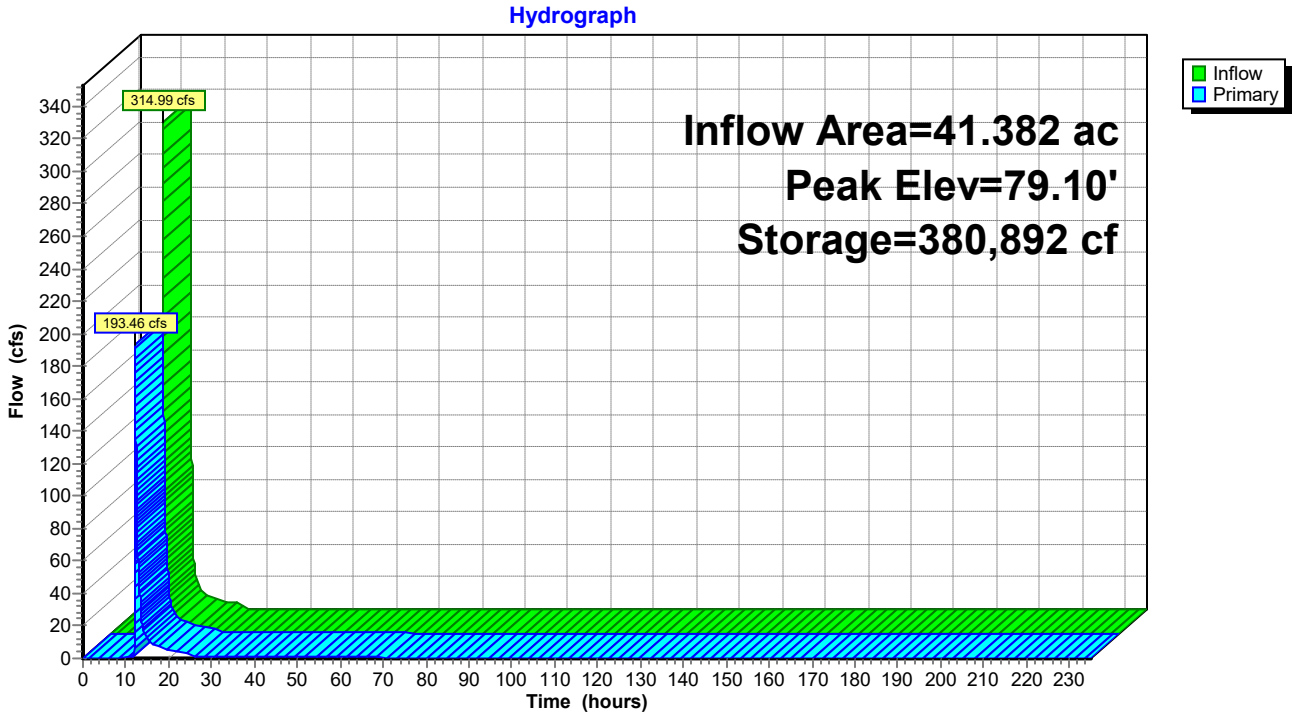
Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	461,645 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.00	59,381	0	0
75.00	61,618	60,500	60,500
75.50	62,746	31,091	91,591
76.00	75,824	34,643	126,233
78.00	84,101	159,925	286,158
80.00	91,386	175,487	461,645

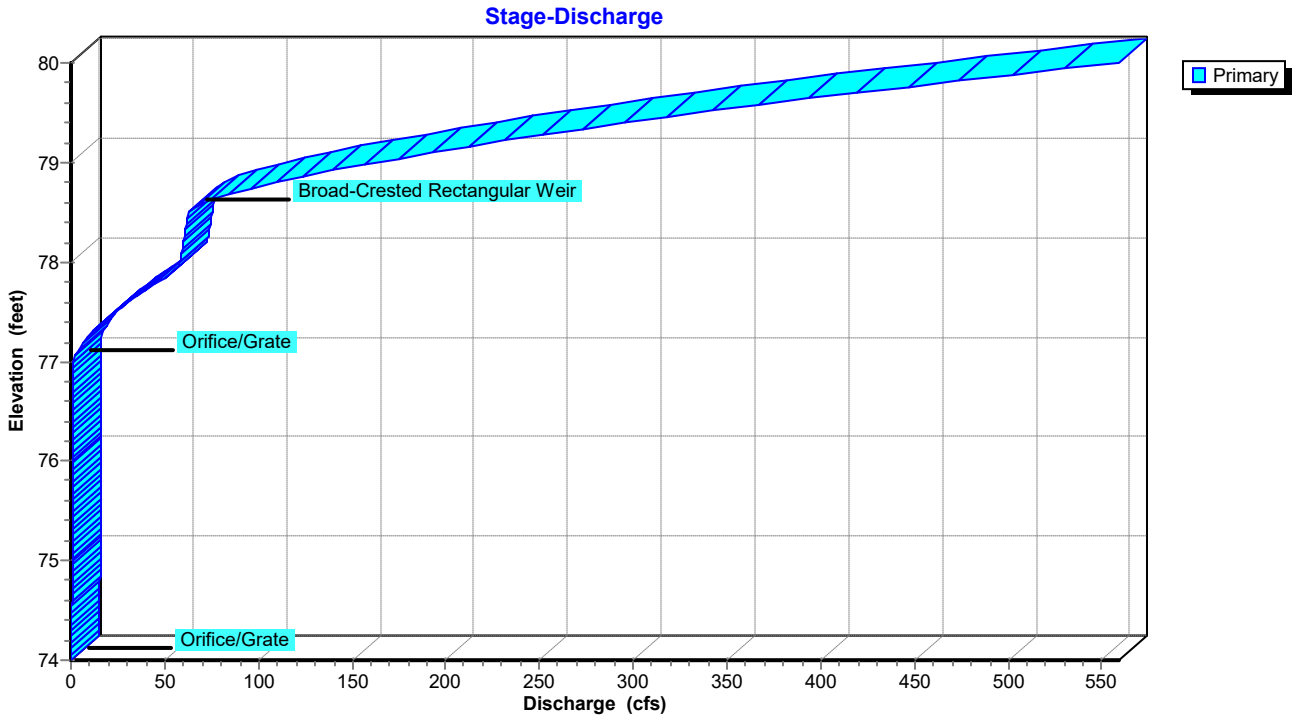
Device	Routing	Invert	Outlet Devices
#1	Primary	73.10'	**36.0" x 220.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 72.00' S= 0.0050 '/' Cc= 0.900 n= 0.012
#2	Device 1	74.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	77.00'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	78.50'	**100.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=193.35 cfs @ 12.21 hrs HW=79.10' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Barrel Controls 67.91 cfs @ 9.61 fps)
  - **2=Orifice/Grate** (Passes < 2.08 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 136.06 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 125.44 cfs @ 2.09 fps)

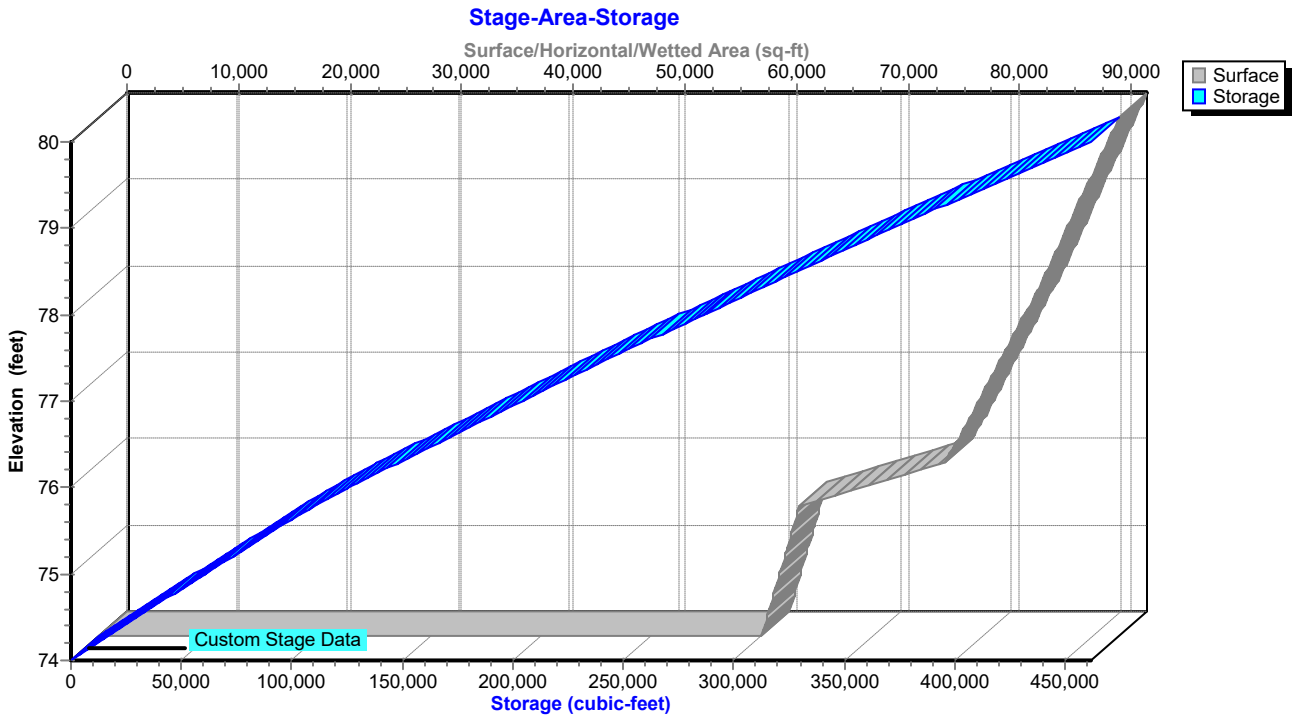
Pond 11P: BASIN 3



Pond 11P: BASIN 3



Pond 11P: BASIN 3



Stage-Discharge for Pond 11P: BASIN 3

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
74.00	0.00	76.08	1.28	78.16	59.62
74.04	0.01	76.12	1.29	78.20	59.99
74.08	0.02	76.16	1.31	78.24	60.37
74.12	0.04	76.20	1.32	78.28	60.74
74.16	0.07	76.24	1.33	78.32	61.11
74.20	0.11	76.28	1.35	78.36	61.48
74.24	0.16	76.32	1.36	78.40	61.84
74.28	0.20	76.36	1.37	78.44	62.20
74.32	0.26	76.40	1.39	78.48	62.56
74.36	0.31	76.44	1.40	78.52	63.68
74.40	0.36	76.48	1.41	78.56	67.22
74.44	0.41	76.52	1.42	78.60	72.11
74.48	0.46	76.56	1.44	78.64	78.02
74.52	0.49	76.60	1.45	78.68	84.80
74.56	0.53	76.64	1.46	78.72	92.36
74.60	0.56	76.68	1.47	78.76	100.64
74.64	0.59	76.72	1.49	78.80	109.58
74.68	0.62	76.76	1.50	78.84	119.13
74.72	0.65	76.80	1.51	78.88	129.26
74.76	0.68	76.84	1.52	78.92	139.89
74.80	0.70	76.88	1.53	78.96	150.98
74.84	0.73	76.92	1.54	79.00	162.53
74.88	0.75	76.96	1.56	79.04	174.55
74.92	0.77	77.00	1.57	79.08	187.01
74.96	0.80	77.04	2.08	79.12	199.59
75.00	0.82	77.08	3.00	79.16	212.21
75.04	0.84	77.12	4.18	79.20	225.10
75.08	0.86	77.16	5.59	79.24	238.26
75.12	0.88	77.20	7.18	79.28	251.66
75.16	0.90	77.24	8.94	79.32	265.66
75.20	0.92	77.28	10.85	79.36	280.34
75.24	0.94	77.32	12.90	79.40	295.33
75.28	0.96	77.36	15.09	79.44	310.63
75.32	0.98	77.40	17.40	79.48	326.23
75.36	1.00	77.44	19.82	79.52	342.33
75.40	1.01	77.48	22.36	79.56	358.97
75.44	1.03	77.52	25.01	79.60	375.93
75.48	1.05	77.56	27.76	79.64	393.21
75.52	1.07	77.60	30.61	79.68	410.82
75.56	1.08	77.64	33.55	79.72	428.61
75.60	1.10	77.68	36.59	79.76	446.56
75.64	1.11	77.72	39.72	79.80	464.79
75.68	1.13	77.76	42.94	79.84	483.29
75.72	1.15	77.80	46.24	79.88	502.07
75.76	1.16	77.84	49.62	79.92	520.94
75.80	1.18	77.88	53.09	79.96	539.89
75.84	1.19	77.92	56.64	80.00	**559.07**
75.88	1.21	77.96	57.70		
75.92	1.22	78.00	58.09		
75.96	1.24	78.04	58.47		
76.00	1.25	78.08	58.86		
76.04	1.26	78.12	59.24		

Stage-Area-Storage for Pond 11P: BASIN 3

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
74.00	59,381	0
74.10	59,605	5,949
74.20	59,828	11,921
74.30	60,052	17,915
74.40	60,276	23,931
74.50	60,500	29,970
74.60	60,723	36,031
74.70	60,947	42,115
74.80	61,171	48,221
74.90	61,394	54,349
75.00	61,618	60,500
75.10	61,844	66,673
75.20	62,069	72,868
75.30	62,295	79,086
75.40	62,520	85,327
75.50	62,746	91,591
75.60	65,362	97,996
75.70	67,977	104,663
75.80	70,593	111,591
75.90	73,208	118,781
76.00	75,824	126,233
76.10	76,238	133,836
76.20	76,652	141,481
76.30	77,066	149,166
76.40	77,479	156,894
76.50	77,893	164,662
76.60	78,307	172,472
76.70	78,721	180,324
76.80	79,135	188,217
76.90	79,549	196,151
77.00	79,963	204,126
77.10	80,376	212,143
77.20	80,790	220,202
77.30	81,204	228,301
77.40	81,618	236,442
77.50	82,032	244,625
77.60	82,446	252,849
77.70	82,859	261,114
77.80	83,273	269,421
77.90	83,687	277,769
78.00	84,101	286,158
78.10	84,465	294,586
78.20	84,830	303,051
78.30	85,194	311,552
78.40	85,558	320,090
78.50	85,922	328,664
78.60	86,286	337,274
78.70	86,651	345,921
78.80	87,015	354,604
78.90	87,379	363,324
79.00	87,744	372,080
79.10	88,108	380,873
79.20	88,472	389,702
79.30	88,836	398,567
79.40	89,201	407,469
79.50	89,565	416,407
79.60	89,929	425,382
79.70	90,293	434,393
79.80	90,657	443,441
79.90	91,022	452,525
80.00	**91,386**	**461,645**

Summary for Pond 12P: BASIN 4

Inflow Area = 102.290 ac, 1.11% Impervious, Inflow Depth = 3.60" for 100-YR NOAA event
Inflow = 399.01 cfs @ 12.13 hrs, Volume= 30.651 af
Outflow = 184.84 cfs @ 12.37 hrs, Volume= 30.645 af, Atten= 54%, Lag= 14.5 min
Primary = 184.84 cfs @ 12.37 hrs, Volume= 30.645 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 88.13' @ 12.37 hrs Surf.Area= 52,243 sf Storage= 371,527 cf

Plug-Flow detention time= 215.0 min calculated for 30.644 af (100% of inflow)
Center-of-Mass det. time= 215.4 min (1,070.6 - 855.2)

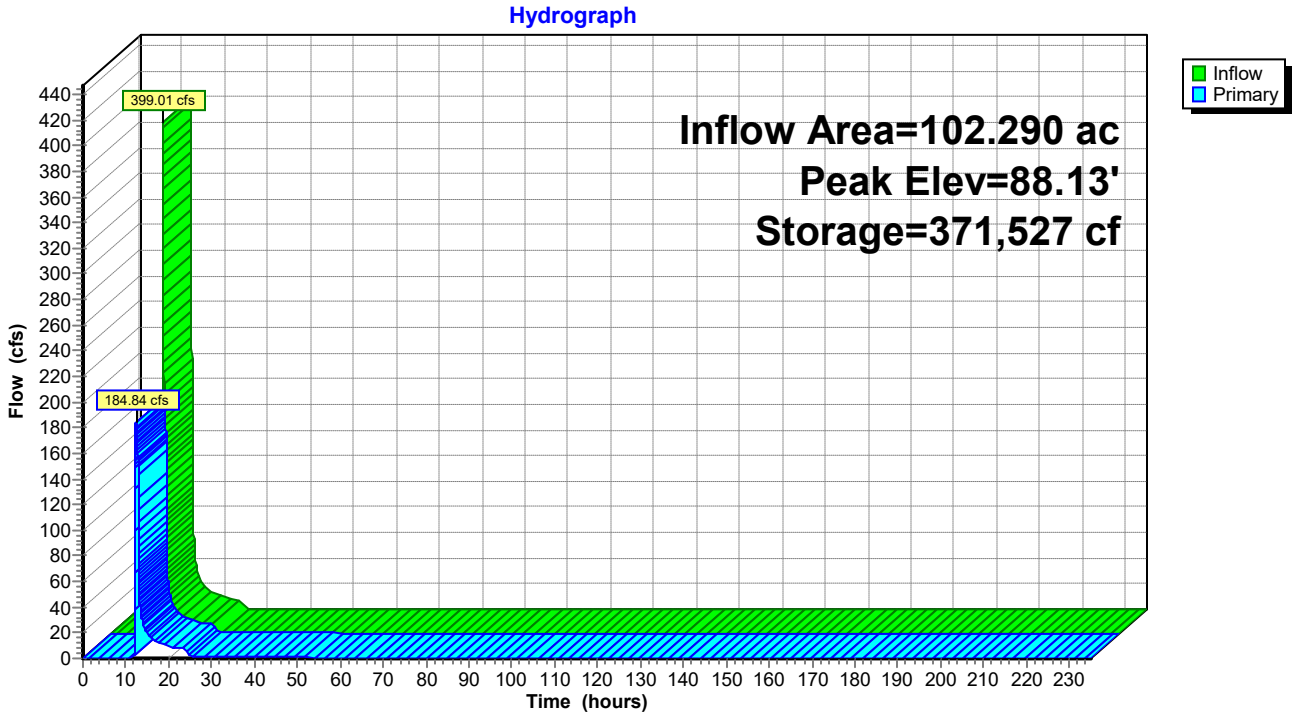
Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	420,819 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.50	23,525	0	0
79.50	24,819	24,172	24,172
80.00	30,634	13,863	38,035
82.00	35,056	65,690	103,725
84.00	41,314	76,370	180,095
86.00	46,221	87,535	267,630
88.00	50,842	97,063	364,693
89.00	61,410	56,126	420,819

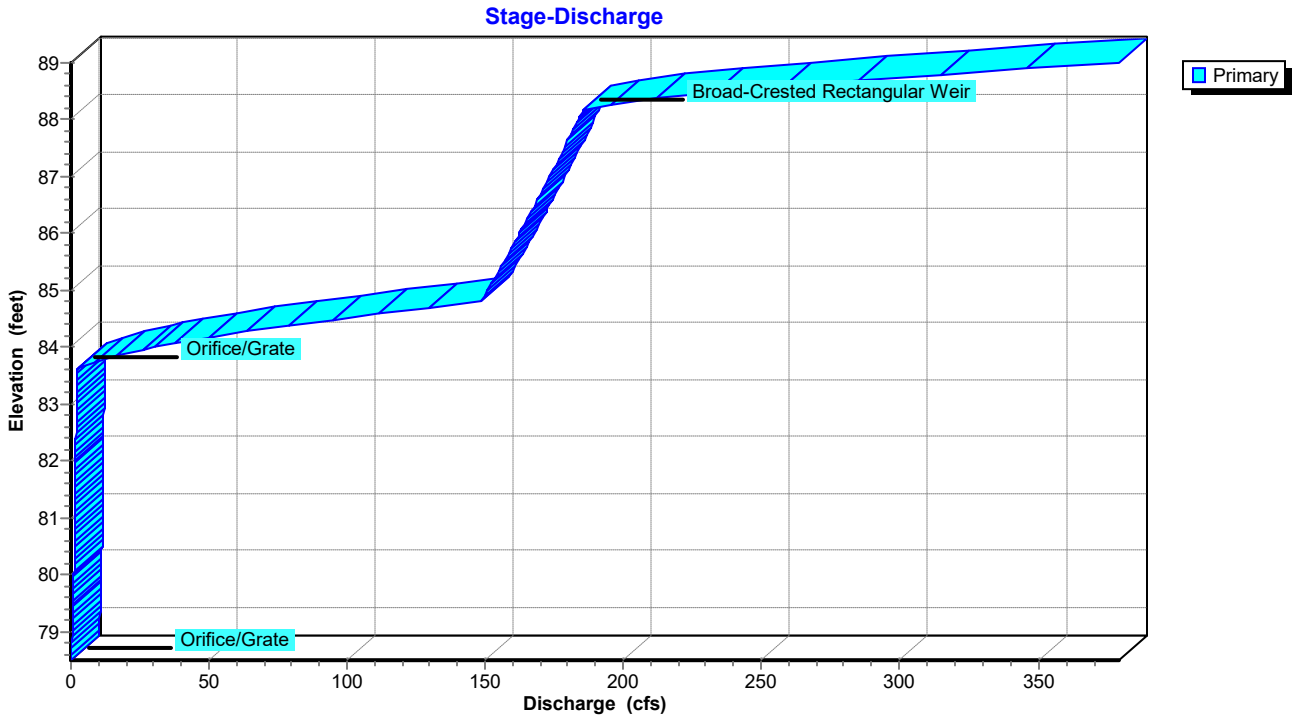
Device	Routing	Invert	Outlet Devices
#1	Primary	76.80'	**48.0" x 161.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 76.00' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	78.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	83.60'	**7.00' x 10.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	88.15'	**90.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=184.84 cfs @ 12.37 hrs HW=88.13' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 184.84 cfs @ 14.71 fps)
  - **2=Orifice/Grate** (Passes < 2.90 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 717.52 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

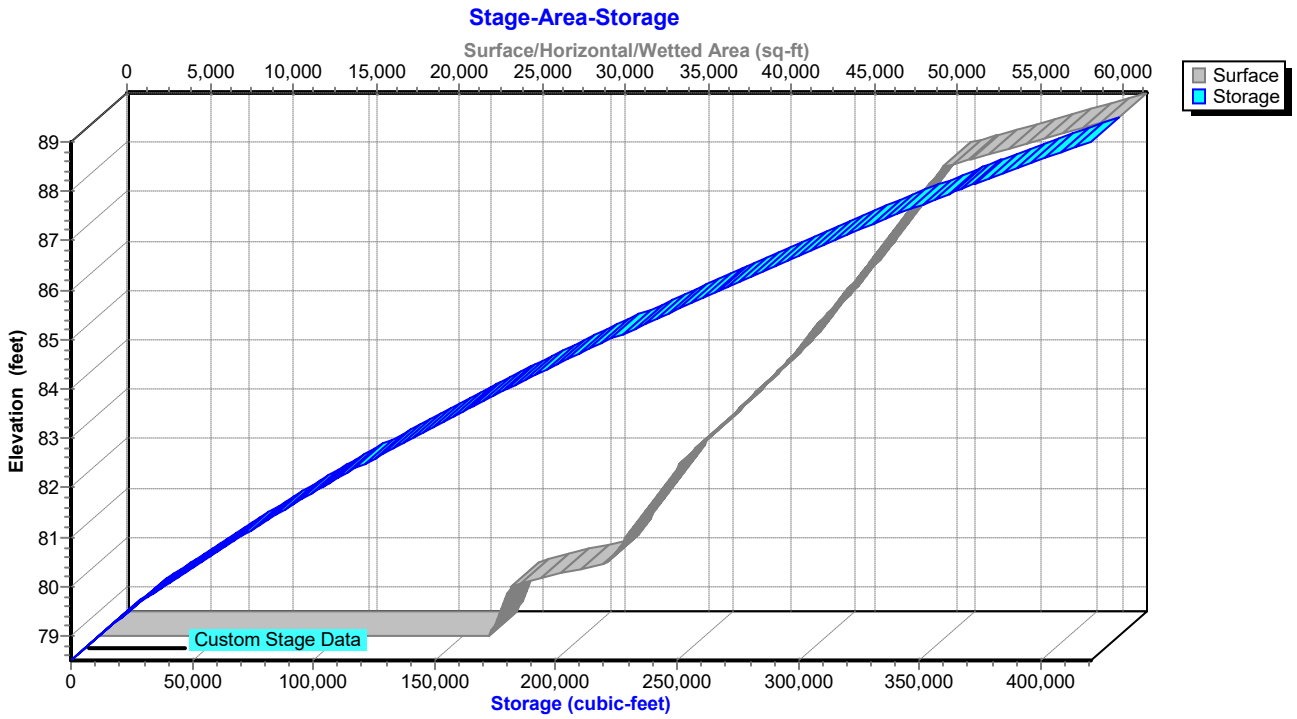
Pond 12P: BASIN 4



Pond 12P: BASIN 4



Pond 12P: BASIN 4



Stage-Discharge for Pond 12P: BASIN 4

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
78.50	0.00	81.62	1.60	84.74	137.64	87.86	182.12
78.56	0.01	81.68	1.62	84.80	148.21	87.92	182.73
78.62	0.04	81.74	1.63	84.86	148.95	87.98	183.33
78.68	0.09	81.80	1.65	84.92	149.69	88.04	183.92
78.74	0.16	81.86	1.67	84.98	150.42	88.10	184.52
78.80	0.23	81.92	1.68	85.04	151.15	88.16	185.36
78.86	0.31	81.98	1.70	85.10	151.87	88.22	190.17
78.92	0.39	82.04	1.71	85.16	152.59	88.28	197.60
78.98	0.46	82.10	1.73	85.22	153.31	88.34	206.86
79.04	0.51	82.16	1.75	85.28	154.03	88.40	217.68
79.10	0.56	82.22	1.76	85.34	154.74	88.46	229.86
79.16	0.61	82.28	1.78	85.40	155.44	88.52	243.27
79.22	0.65	82.34	1.79	85.46	156.15	88.58	257.74
79.28	0.69	82.40	1.81	85.52	156.85	88.64	273.15
79.34	0.73	82.46	1.82	85.58	157.55	88.70	289.50
79.40	0.76	82.52	1.84	85.64	158.25	88.76	306.60
79.46	0.80	82.58	1.85	85.70	158.94	88.82	323.76
79.52	0.83	82.64	1.86	85.76	159.63	88.88	341.48
79.58	0.86	82.70	1.88	85.82	160.31	88.94	359.70
79.64	0.89	82.76	1.89	85.88	161.00	89.00	**379.26**
79.70	0.92	82.82	1.91	85.94	161.68		
79.76	0.95	82.88	1.92	86.00	162.36		
79.82	0.98	82.94	1.94	86.06	163.03		
79.88	1.00	83.00	1.95	86.12	163.70		
79.94	1.03	83.06	1.96	86.18	164.37		
80.00	1.06	83.12	1.98	86.24	165.04		
80.06	1.08	83.18	1.99	86.30	165.70		
80.12	1.11	83.24	2.00	86.36	166.37		
80.18	1.13	83.30	2.02	86.42	167.03		
80.24	1.15	83.36	2.03	86.48	167.68		
80.30	1.18	83.42	2.04	86.54	168.34		
80.36	1.20	83.48	2.06	86.60	168.99		
80.42	1.22	83.54	2.07	86.66	169.63		
80.48	1.24	83.60	2.08	86.72	170.28		
80.54	1.26	83.66	3.73	86.78	170.92		
80.60	1.29	83.72	6.73	86.84	171.57		
80.66	1.31	83.78	10.61	86.90	172.21		
80.72	1.33	83.84	15.21	86.96	172.84		
80.78	1.35	83.90	20.41	87.02	173.48		
80.84	1.37	83.96	26.17	87.08	174.11		
80.90	1.39	84.02	32.43	87.14	174.74		
80.96	1.41	84.08	39.16	87.20	175.37		
81.02	1.42	84.14	46.31	87.26	175.99		
81.08	1.44	84.20	53.88	87.32	176.61		
81.14	1.46	84.26	61.83	87.38	177.23		
81.20	1.48	84.32	70.16	87.44	177.85		
81.26	1.50	84.38	78.83	87.50	178.47		
81.32	1.52	84.44	87.85	87.56	179.08		
81.38	1.53	84.50	97.19	87.62	179.70		
81.44	1.55	84.56	106.86	87.68	180.31		
81.50	1.57	84.62	116.82	87.74	180.91		
81.56	1.58	84.68	127.09	87.80	181.52		

Stage-Area-Storage for Pond 12P: BASIN 4

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
78.50	23,525	0
78.65	23,719	3,543
78.80	23,913	7,116
78.95	24,107	10,717
79.10	24,301	14,348
79.25	24,496	18,008
79.40	24,690	21,697
79.55	25,400	25,427
79.70	27,145	29,368
79.85	28,889	33,571
80.00	30,634	38,035
80.15	30,966	42,655
80.30	31,297	47,325
80.45	31,629	52,044
80.60	31,961	56,814
80.75	32,292	61,633
80.90	32,624	66,501
81.05	32,956	71,420
81.20	33,287	76,388
81.35	33,619	81,406
81.50	33,951	86,474
81.65	34,282	91,591
81.80	34,614	96,758
81.95	34,945	101,975
82.10	35,369	107,246
82.25	35,838	112,587
82.40	36,308	117,998
82.55	36,777	123,479
82.70	37,246	129,031
82.85	37,716	134,653
83.00	38,185	140,346
83.15	38,654	146,109
83.30	39,124	151,942
83.45	39,593	157,846
83.60	40,062	163,820
83.75	40,532	169,865
83.90	41,001	175,979
84.05	41,437	182,164
84.20	41,805	188,407
84.35	42,173	194,705
84.50	42,541	201,059
84.65	42,909	207,468
84.80	43,277	213,932
84.95	43,645	220,451
85.10	44,013	227,025
85.25	44,381	233,655
85.40	44,749	240,339
85.55	45,117	247,079
85.70	45,485	253,874
85.85	45,853	260,725
86.00	46,221	267,630
86.15	46,568	274,589
86.30	46,914	281,601
86.45	47,261	288,664
86.60	47,607	295,779
86.75	47,954	302,946
86.90	48,300	310,165
87.05	48,647	317,436
87.20	48,994	324,759
87.35	49,340	332,134
87.50	49,687	339,561
87.65	50,033	347,040
87.80	50,380	354,571
87.95	50,726	362,154
88.10	51,899	369,830
88.25	53,484	377,734
88.40	55,069	385,875
88.55	56,654	394,255
88.70	58,240	402,872
88.85	59,825	411,727
89.00	**61,410**	**420,819**

Summary for Pond 16P: WQv FACILITY

Inflow Area = 3.461 ac, 8.78% Impervious, Inflow Depth = 5.38" for 100-YR NOAA event
Inflow = 32.48 cfs @ 11.97 hrs, Volume= 1.550 af
Outflow = 26.48 cfs @ 12.02 hrs, Volume= 1.550 af, Atten= 18%, Lag= 2.9 min
Primary = 26.48 cfs @ 12.02 hrs, Volume= 1.550 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 91.10' @ 12.02 hrs Surf.Area= 4,796 sf Storage= 12,385 cf

Plug-Flow detention time= 89.7 min calculated for 1.550 af (100% of inflow)
Center-of-Mass det. time= 90.1 min (900.9 - 810.7)

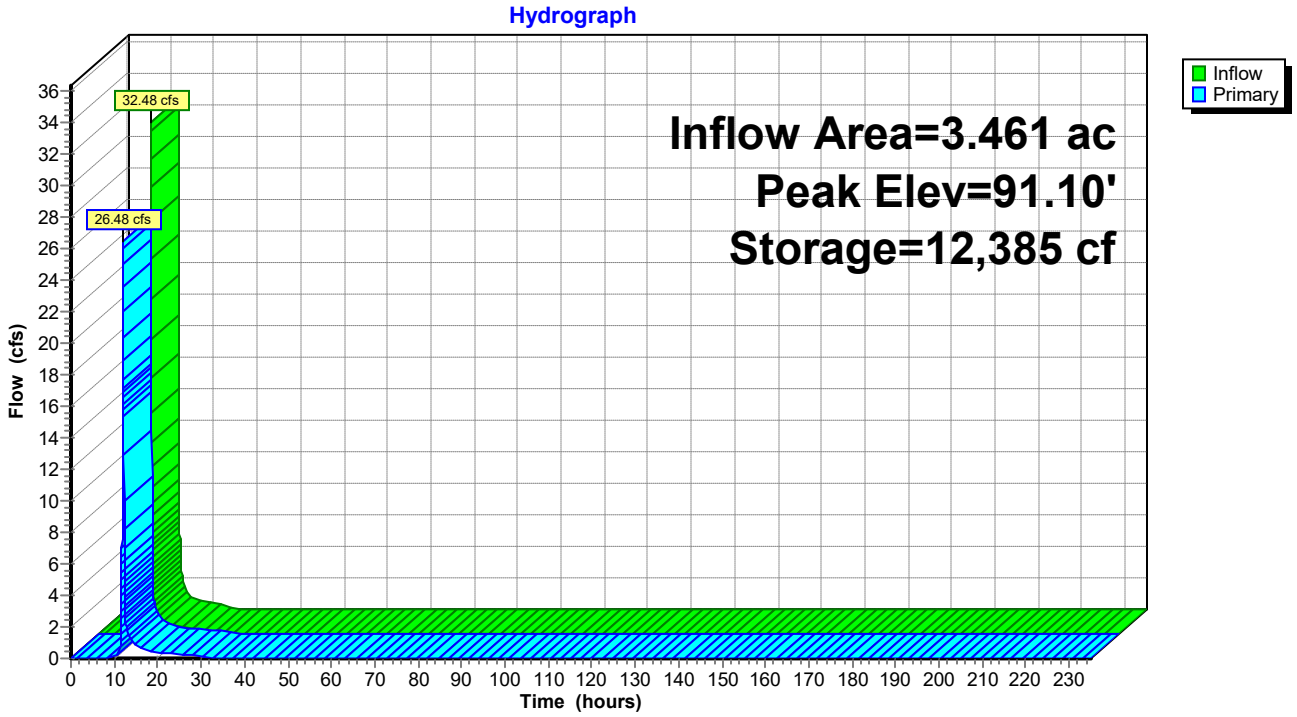
Volume	Invert	Avail.Storage	Storage Description
#1	88.00'	16,930 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
88.00	3,242	0	0
89.50	3,958	5,400	5,400
90.00	4,210	2,042	7,442
92.00	5,278	9,488	16,930

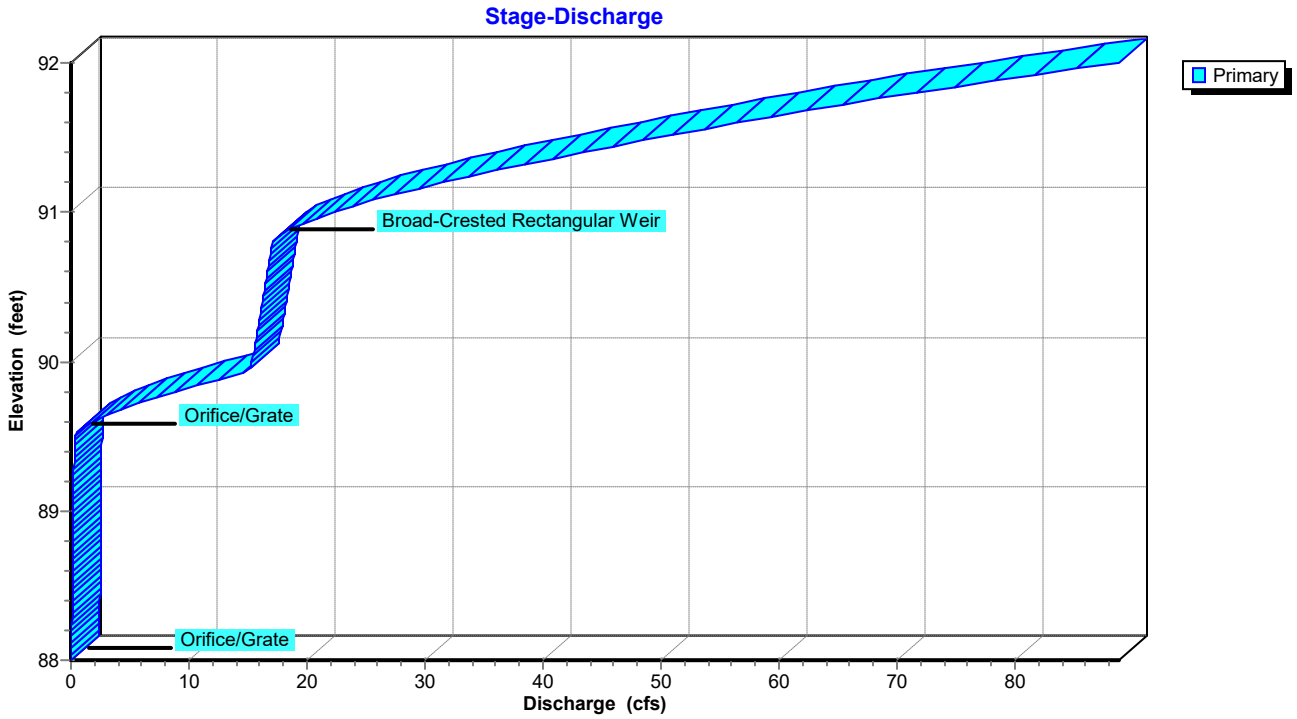
Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**18.0" x 44.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 82.00' S= 0.0909 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	88.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	89.50'	**4.00' x 4.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	90.80'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=26.46 cfs @ 12.02 hrs HW=91.10' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 17.74 cfs @ 10.04 fps)
  - **2=Orifice/Grate** (Passes < 0.41 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 97.36 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 8.72 cfs @ 1.47 fps)

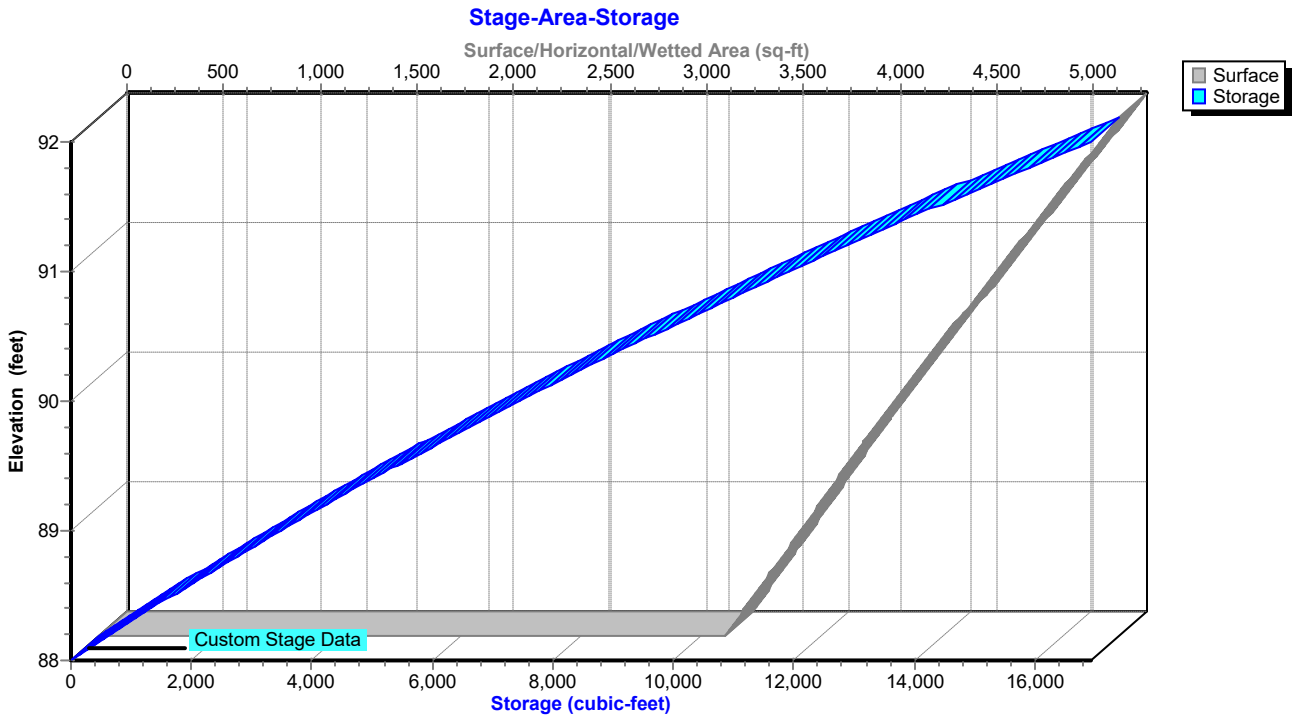
Pond 16P: WQv FACILITY



Pond 16P: WQv FACILITY



Pond 16P: WQv FACILITY



Stage-Discharge for Pond 16P: WQv FACILITY

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
88.00	0.00	89.04	0.23	90.08	15.53	91.12	27.53
88.02	0.00	89.06	0.23	90.10	15.57	91.14	28.51
88.04	0.00	89.08	0.23	90.12	15.62	91.16	29.52
88.06	0.01	89.10	0.23	90.14	15.67	91.18	30.55
88.08	0.01	89.12	0.24	90.16	15.71	91.20	31.61
88.10	0.02	89.14	0.24	90.18	15.76	91.22	32.69
88.12	0.03	89.16	0.24	90.20	15.80	91.24	33.79
88.14	0.04	89.18	0.24	90.22	15.85	91.26	34.92
88.16	0.05	89.20	0.25	90.24	15.90	91.28	36.07
88.18	0.05	89.22	0.25	90.26	15.94	91.30	37.24
88.20	0.06	89.24	0.25	90.28	15.99	91.32	38.44
88.22	0.07	89.26	0.25	90.30	16.03	91.34	39.66
88.24	0.08	89.28	0.25	90.32	16.08	91.36	40.90
88.26	0.09	89.30	0.26	90.34	16.12	91.38	42.16
88.28	0.09	89.32	0.26	90.36	16.17	91.40	43.45
88.30	0.10	89.34	0.26	90.38	16.21	91.42	44.69
88.32	0.10	89.36	0.26	90.40	16.26	91.44	45.95
88.34	0.11	89.38	0.26	90.42	16.30	91.46	47.23
88.36	0.11	89.40	0.27	90.44	16.34	91.48	48.52
88.38	0.12	89.42	0.27	90.46	16.39	91.50	49.82
88.40	0.12	89.44	0.27	90.48	16.43	91.52	51.13
88.42	0.13	89.46	0.27	90.50	16.48	91.54	52.46
88.44	0.13	89.48	0.28	90.52	16.52	91.56	53.80
88.46	0.14	89.50	0.28	90.54	16.56	91.58	55.16
88.48	0.14	89.52	0.43	90.56	16.61	91.60	56.52
88.50	0.14	89.54	0.70	90.58	16.65	91.62	57.97
88.52	0.15	89.56	1.05	90.60	16.70	91.64	59.43
88.54	0.15	89.58	1.47	90.62	16.74	91.66	60.92
88.56	0.16	89.60	1.94	90.64	16.78	91.68	62.41
88.58	0.16	89.62	2.46	90.66	16.82	91.70	63.93
88.60	0.16	89.64	3.03	90.68	16.87	91.72	65.46
88.62	0.17	89.66	3.64	90.70	16.91	91.74	67.00
88.64	0.17	89.68	4.29	90.72	16.95	91.76	68.56
88.66	0.17	89.70	4.98	90.74	17.00	91.78	70.13
88.68	0.18	89.72	5.70	90.76	17.04	91.80	71.72
88.70	0.18	89.74	6.45	90.78	17.08	91.82	73.37
88.72	0.18	89.76	7.24	90.80	17.12	91.84	75.03
88.74	0.19	89.78	8.06	90.82	17.32	91.86	76.70
88.76	0.19	89.80	8.90	90.84	17.64	91.88	78.40
88.78	0.19	89.82	9.78	90.86	18.04	91.90	80.11
88.80	0.19	89.84	10.68	90.88	18.50	91.92	81.84
88.82	0.20	89.86	11.61	90.90	19.03	91.94	83.58
88.84	0.20	89.88	12.57	90.92	19.60	91.96	85.34
88.86	0.20	89.90	13.55	90.94	20.22	91.98	87.11
88.88	0.21	89.92	14.56	90.96	20.89	92.00	**88.90**
88.90	0.21	89.94	15.20	90.98	21.59		
88.92	0.21	89.96	15.24	91.00	22.34		
88.94	0.21	89.98	15.29	91.02	23.12		
88.96	0.22	90.00	15.34	91.04	23.94		
88.98	0.22	90.02	15.39	91.06	24.79		
89.00	0.22	90.04	15.43	91.08	25.67		
89.02	0.22	90.06	15.48	91.10	26.59		

Stage-Area-Storage for Pond 16P: WQv FACILITY

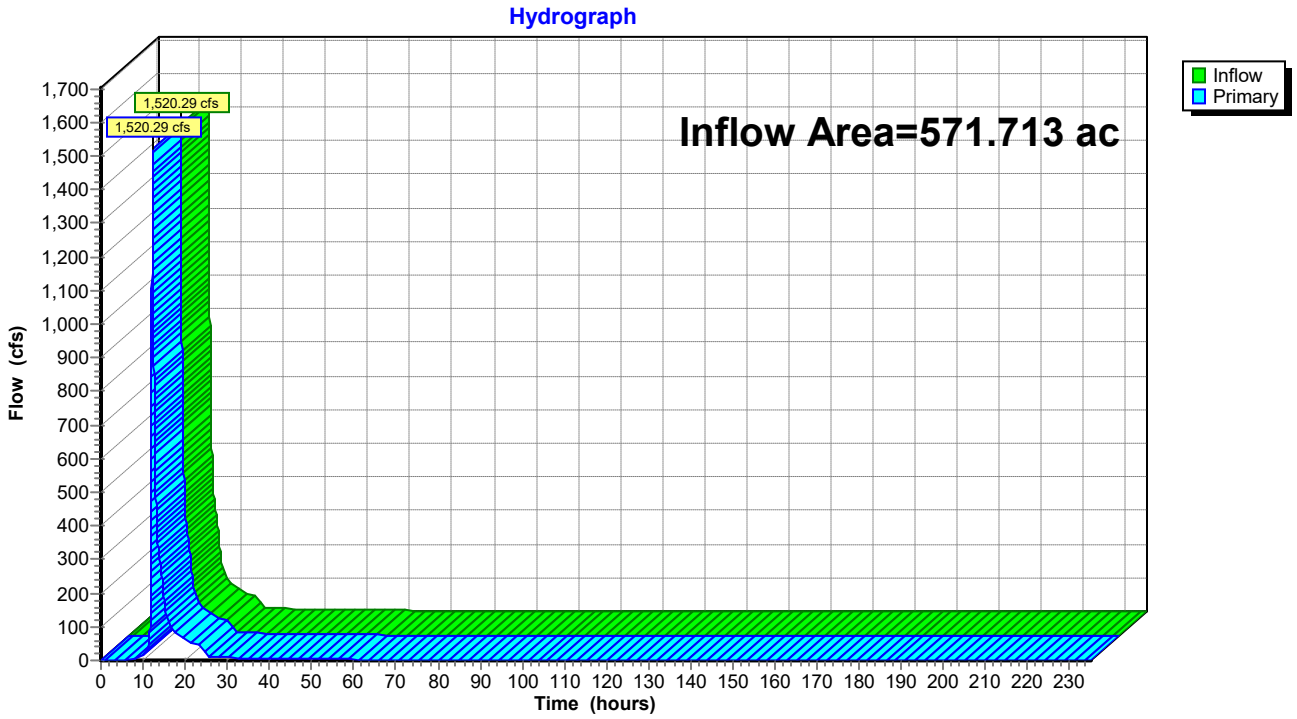
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
88.00	3,242	0
88.05	3,266	163
88.10	3,290	327
88.15	3,314	492
88.20	3,337	658
88.25	3,361	825
88.30	3,385	994
88.35	3,409	1,164
88.40	3,433	1,335
88.45	3,457	1,507
88.50	3,481	1,681
88.55	3,505	1,855
88.60	3,528	2,031
88.65	3,552	2,208
88.70	3,576	2,386
88.75	3,600	2,566
88.80	3,624	2,746
88.85	3,648	2,928
88.90	3,672	3,111
88.95	3,695	3,295
89.00	3,719	3,481
89.05	3,743	3,667
89.10	3,767	3,855
89.15	3,791	4,044
89.20	3,815	4,234
89.25	3,839	4,425
89.30	3,863	4,618
89.35	3,886	4,812
89.40	3,910	5,007
89.45	3,934	5,203
89.50	3,958	5,400
89.55	3,983	5,599
89.60	4,008	5,798
89.65	4,034	5,999
89.70	4,059	6,202
89.75	4,084	6,405
89.80	4,109	6,610
89.85	4,134	6,816
89.90	4,160	7,024
89.95	4,185	7,232
90.00	4,210	7,442
90.05	4,237	7,653
90.10	4,263	7,866
90.15	4,290	8,080
90.20	4,317	8,295
90.25	4,344	8,511
90.30	4,370	8,729
90.35	4,397	8,948
90.40	4,424	9,169
90.45	4,450	9,391
90.50	4,477	9,614
90.55	4,504	9,838
90.60	4,530	10,064
90.65	4,557	10,291
90.70	4,584	10,520
90.75	4,611	10,750
90.80	4,637	10,981
90.85	4,664	11,213
90.90	4,691	11,447
90.95	4,717	11,682
91.00	4,744	11,919
91.05	4,771	12,157
91.10	4,797	12,396
91.15	4,824	12,637
91.20	4,851	12,878
91.25	4,878	13,122
91.30	4,904	13,366
91.35	4,931	13,612
91.40	4,958	13,859
91.45	4,984	14,108
91.50	5,011	14,358
91.55	5,038	14,609
91.60	5,064	14,862
91.65	5,091	15,115
91.70	5,118	15,371
91.75	5,145	15,627
91.80	5,171	15,885
91.85	5,198	16,144
91.90	5,225	16,405
91.95	5,251	16,667
92.00	**5,278**	**16,930**

Summary for Link 14L: TOTAL PROPOSED

Inflow Area = 571.713 ac, 2.47% Impervious, Inflow Depth = 4.75" for 100-YR NOAA event
Inflow = 1,520.29 cfs @ 12.23 hrs, Volume= 226.084 af
Primary = 1,520.29 cfs @ 12.23 hrs, Volume= 226.084 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 14L: TOTAL PROPOSED

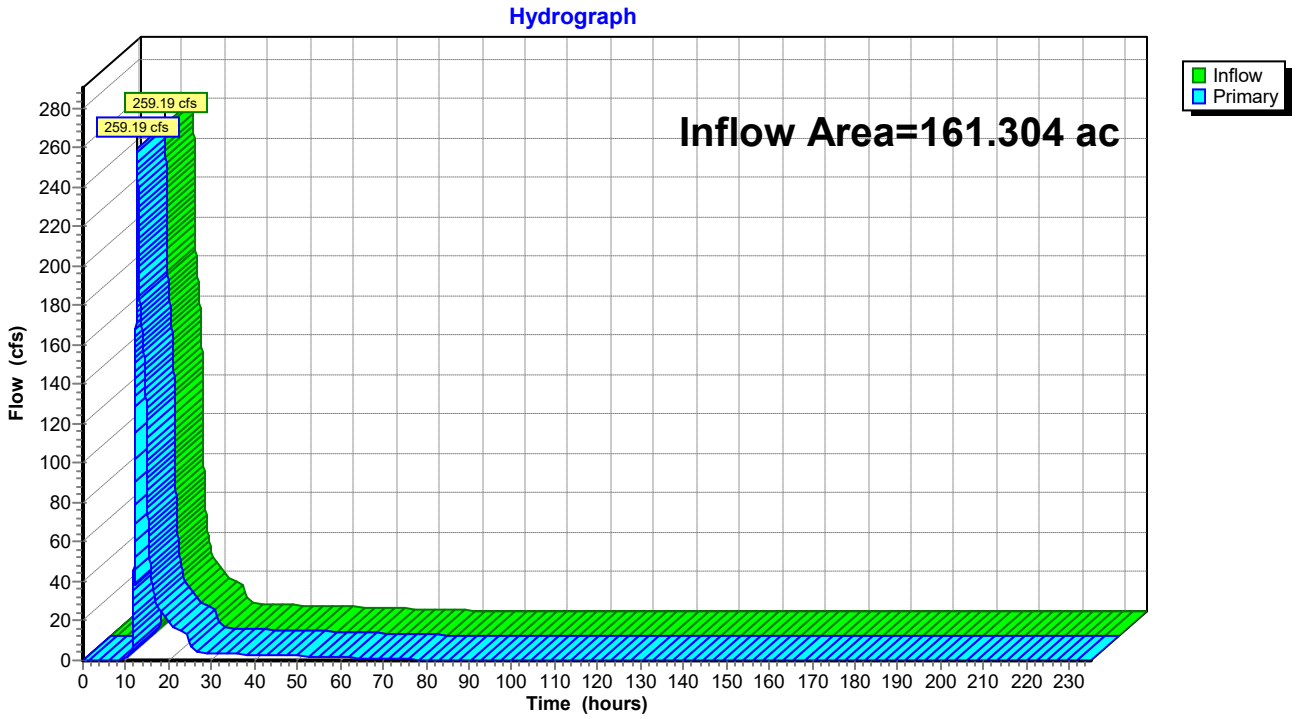


Summary for Link 59L: Discharge Pt 1

Inflow Area = 161.304 ac, 3.97% Impervious, Inflow Depth = 5.37" for 100-YR NOAA event
Inflow = 259.19 cfs @ 12.73 hrs, Volume= 72.206 af
Primary = 259.19 cfs @ 12.73 hrs, Volume= 72.206 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 59L: Discharge Pt 1

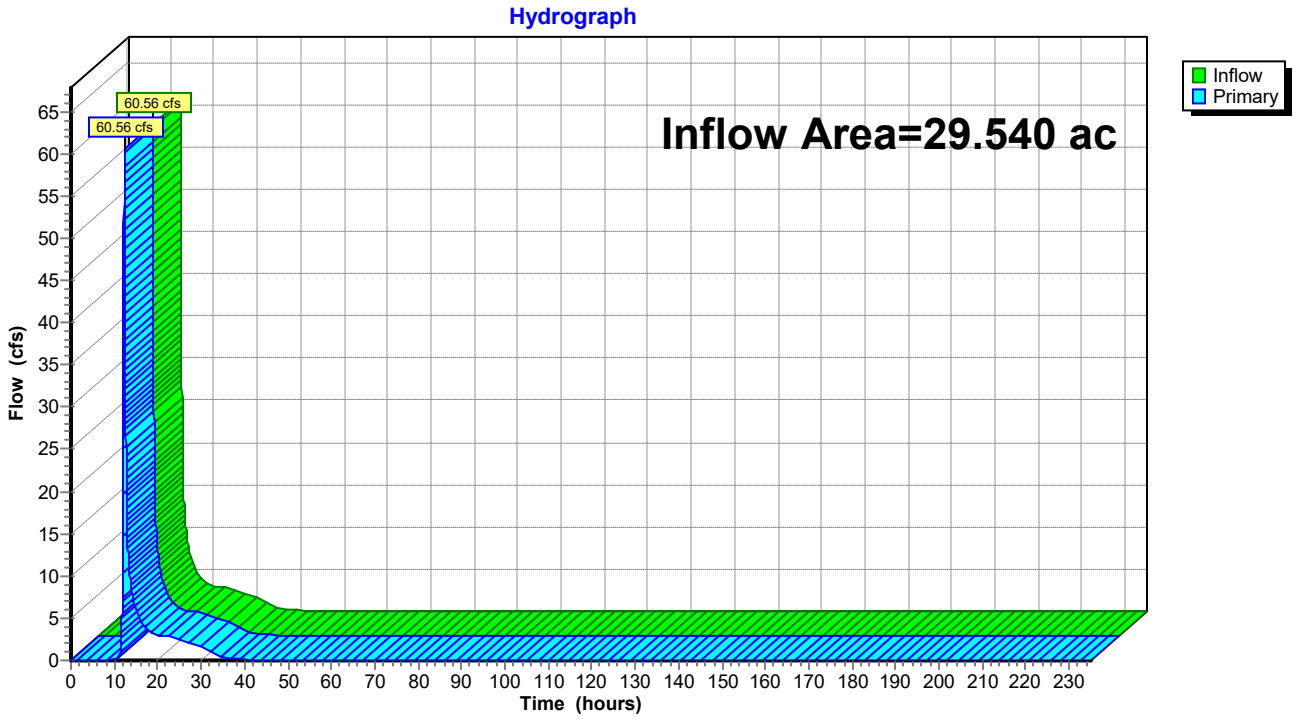


Summary for Link 60L: Discharge Pt 2

Inflow Area = 29.540 ac, 4.03% Impervious, Inflow Depth = 3.48" for 100-YR NOAA event
Inflow = 60.56 cfs @ 12.28 hrs, Volume= 8.560 af
Primary = 60.56 cfs @ 12.28 hrs, Volume= 8.560 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 60L: Discharge Pt 2

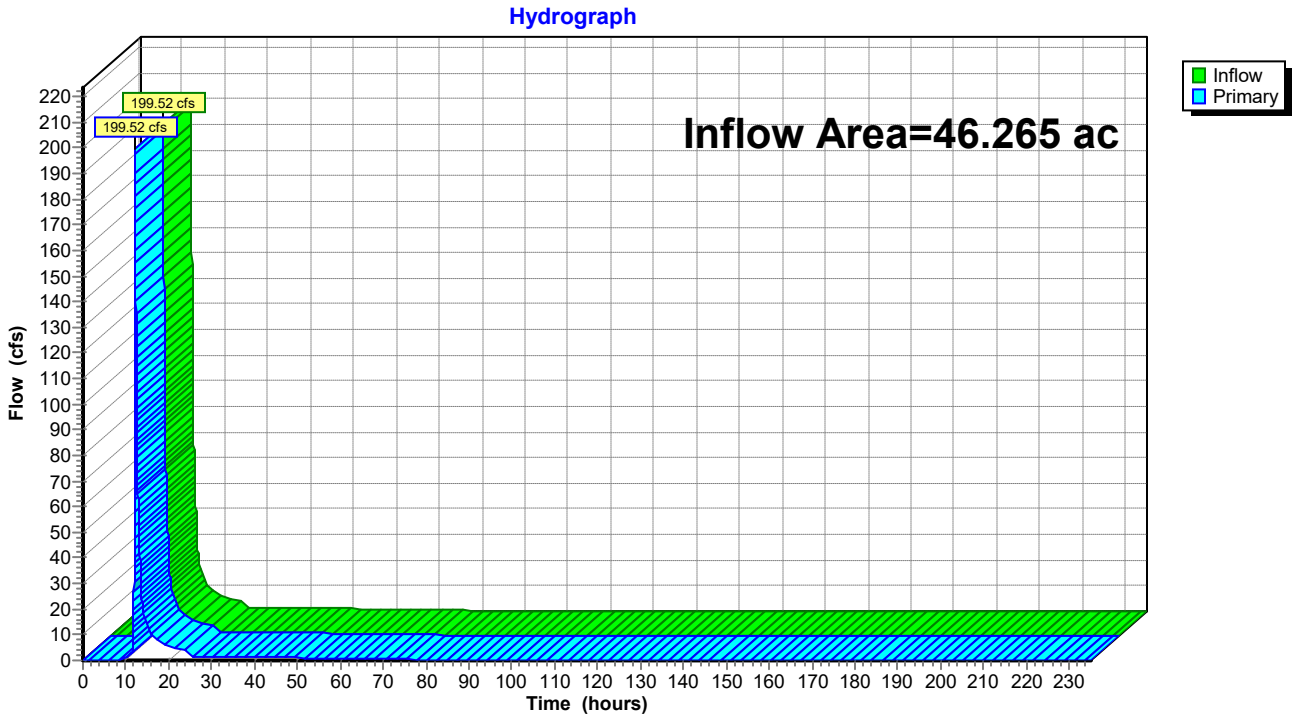


Summary for Link 61L: Discharge Pt 3

Inflow Area = 46.265 ac, 6.92% Impervious, Inflow Depth = 6.07" for 100-YR NOAA event
Inflow = 199.52 cfs @ 12.21 hrs, Volume= 23.384 af
Primary = 199.52 cfs @ 12.21 hrs, Volume= 23.384 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 61L: Discharge Pt 3

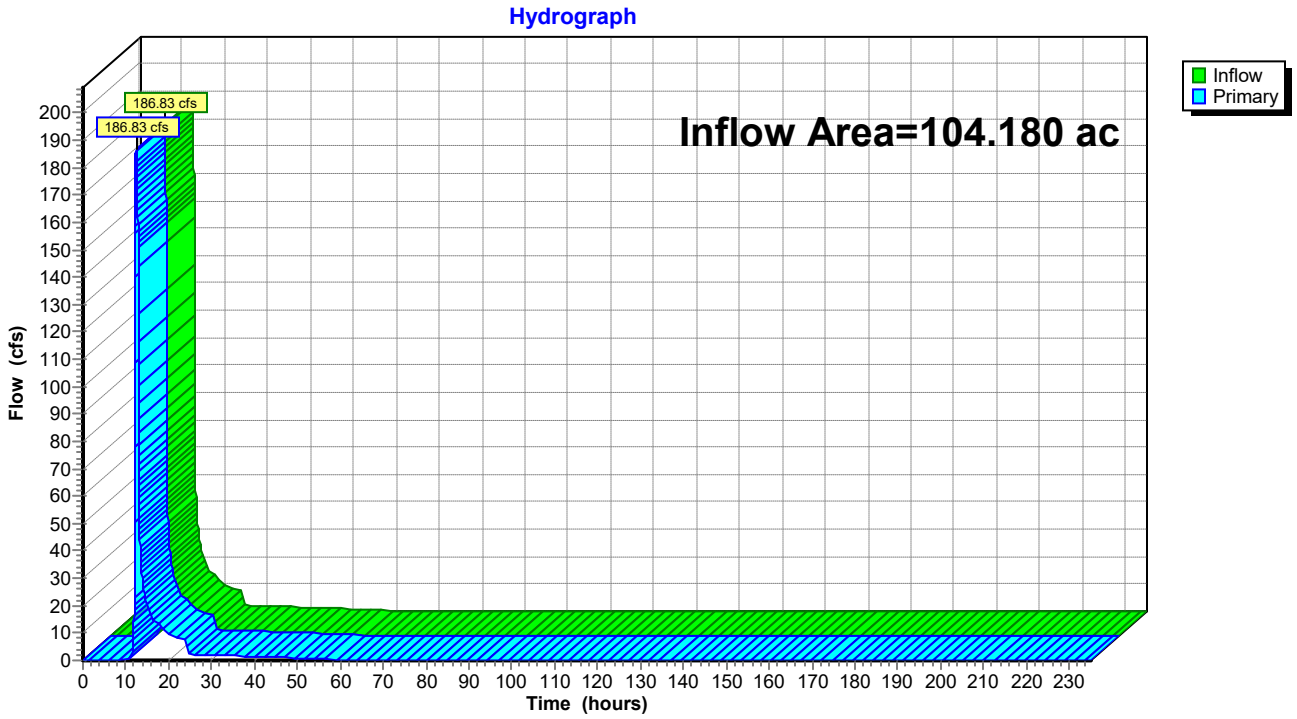


Summary for Link 62L: Discharge Pt 4

Inflow Area = 104.180 ac, 1.09% Impervious, Inflow Depth = 3.64" for 100-YR NOAA event
Inflow = 186.83 cfs @ 12.37 hrs, Volume= 31.586 af
Primary = 186.83 cfs @ 12.37 hrs, Volume= 31.586 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 62L: Discharge Pt 4

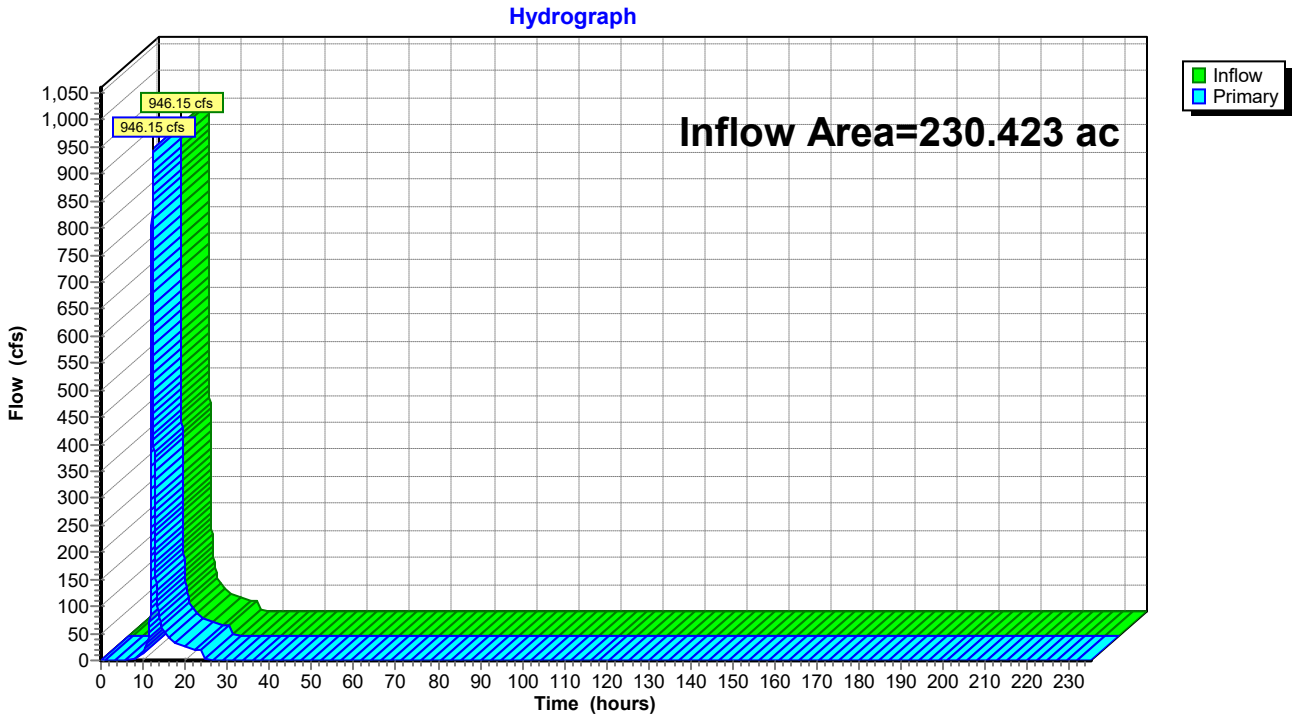


Summary for Link 63L: P 5

Inflow Area = 230.423 ac, 0.95% Impervious, Inflow Depth = 4.71" for 100-YR NOAA event
Inflow = 946.15 cfs @ 12.20 hrs, Volume= 90.348 af
Primary = 946.15 cfs @ 12.20 hrs, Volume= 90.348 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 63L: P 5



ATTACHMENT 17D

Proposed Channel Flows

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Stormwater Management – Proposed Channel Flows		
	Job No. 2018-3854	**Made by:** RP	**Date** 07-15-20
	Ref.	**Checked by:** VEF	**Sheet** 1 of 3

Revised by PGS 08/21/2021

Objective: The objective of this analysis is to estimate the flow in the proposed stormwater management channels under the design storms being considered.

Design Approach and Assumptions:

Use HydroCad, a computer software which implements the principles of TR-55 and TR-20 for larger drainage areas. The input data for each is as follows:

1) Drainage areas – determine the contributing drainage area to the discharge location based upon the topographic data of the area. Use the "area" function in AutoCAD to find the area of the drainage area boundary.
2) Based on the soils types and the vegetative cover, determine the areas of multiple soil types and cover conditions in each drainage area. Calculate a "weighed" curve number. HydroCAD actually does this calculation based upon data entry.
3) Determine the time of concentration for water to flow from the longest distance (in time) from the outlet. Measure the length and slope of the tc flow path and the surface condition.
4) Although the site is ~~location~~ located along the eastern seaboard, this is a Type II storm event because the DelMarVa peninsula shields it from the affects of the ocean.
5) Determine the peak flows for the 25-year, 24 hour (5.9 inches of rain) and 100 year, 24 hour (8.5 inches of rain) storm events.
6) The HydroCad models allows calculating the peak flows without conducting a full-~~sledged~~ fledged hydraulic routing.

Calculations:

Attached is a summary table of the input data to the HydroCAD program and the computer printout for evaluation for the design storm events.

References:

1. HydroCAD, V8.5.
2. Advanced GeoServices Corp, Calculations entitled "Stormwater management – Existing Conditions," dated July 15, 2020.

Revised by PGS 08/21/2021

Conclusions:

A summary of the inflow and the proposed channel flows are provided in the table below.

Channel ID	25 year, 24 hour storm event Qout (cfs)	100 year, 24 hour storm event Qout (cfs)
West Section (Cells 1-10)		
Downchute 1 (DC-1)	60.95	94.79
Downchute 2 (DC-2)	54.36	85.88
Downchute 3 (DC-3)	70.96	113.02
Downchute 4 (DC-4)	49.88	80.10
Downchute 5 (DC-5)	51.59	82.86
Downchute 6 (DC-6)	68.55	107.42
Downchute 7 (DC-7)	65.04	103.58
Downchute 8 (DC-8)	59.62	100.17
Downchute 9 (DC-9)	47.30	74.71
Downchute 10 (DC-10)	58.89	93.03
Perimeter Channel 2	31.83	57.96
Perimeter Channel 3A	15.97	24.83
Perimeter Channel 3B	80.84	128.22
Perimeter Channel 3C	140.25	228.15
Perimeter Channel 3D	197.64	319.29
Perimeter Channel 3E	282.93	455.14
Perimeter Channel 4A	40.72	63.32
Perimeter Channel 4B	109.16	170.64
Perimeter Channel 4C	160.59	253.31
Perimeter Channel 4D	210.30	333.21
Perimeter Channel 4E	281.05	445.99
Perimeter Channel 4F	~~347.91~~ 391.91*	~~552.08~~ 653.38*
Perimeter Channel 5	81.01	126.24
Leachate Storage Facility No. 1		
Perimeter Channel 1	64.62	158.72
Perimeter Channel 6	24.00	65.73
Perimeter Channel 7	17.34	26.77
Perimeter Channel 10	68.46	164.87

*Proposed channel flows were increased by 44.0 cfs and 101.3 cfs for the 25 year and 100 year storm events to include inflow from Culvert #6. Added peak to peak without routing to be conservative.

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Stormwater Management – Proposed Channel Flows		
	Job No. 2018-3854	**Made by:** RP	**Date** 07-15-20
	Ref.	**Checked by:** VEF	**Sheet** 3 of 3

Revised by PGS 08/21/2021

Channel ID	25 year, 24 hour storm event Qout (cfs)	100 year, 24 hour storm event Qout (cfs)
East Section (Cells 11-16)		
Downchute 20 (DC-20)	35.77	57.44
Downchute 21 (DC-21)	53.31	85.62
Downchute 22 (DC-22)	29.30	47.05
Downchute 23 (DC-23)	42.90	68.89
Perimeter Channel 8A	36.51	57.29
Perimeter Channel 8B	113.80	180.49
Perimeter Channel 8C	279.88	444.63
Perimeter Channel 9A	48.18	76.42
Perimeter Channel 9B	91.08	145.31
Perimeter Channel 9C	122.84	195.09

The 25 year, 24 hour storm event flow rates will be used to determine the size of the channels and select channel lining. These flow rates will also be used to size culverts.

The selected channels will be checked for overtopping under 100 year, 24 hour flow conditions.

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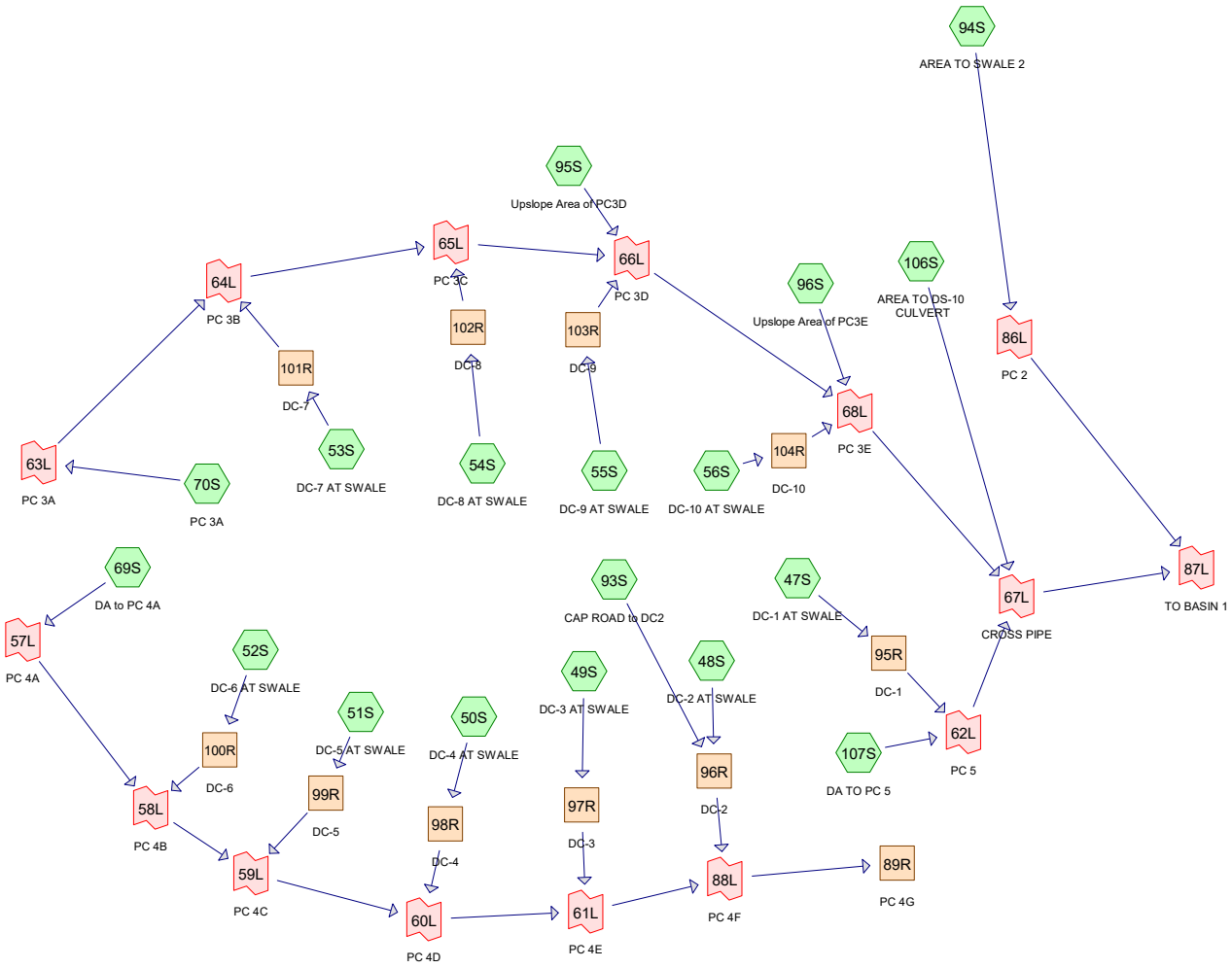
West Section (Cells 1-10)



Subcat 92S
Drainage from PC 1
to PC 4F(88L)
(enters 88L through Culvert #6. Included in SWM
add flows peak to peak for channel design flow)

Revised by PGS 08/21/2021

Subcat Reach Pond Link

Drainage Diagram for PC AND DOWNCHUTES_07152020
Prepared by {enter your company name here}, Printed 7/18/2020

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.317	30	Woods, Good, HSG A (94S)
2.613	61	>75% Grass cover, Good, HSG B (ONSITE A) (94S)
0.669	70	Woods, Good, HSG C (94S)
14.090	74	>75% Grass cover, Good, HSG C (54S,95S,96S)
1.448	74	FROM APPROVED CALCS (93S)
1.462	76	RA ZONING C SOILS (94S)
0.732	77	Woods, Good, HSG D (94S)
84.159	80	>75% Grass cover, Good, HSG D (47S,48S,49S,50S,51S,52S,53S,55S,56S,69S,70S,106S,107
6.261	80	>75% Grass cover, Good, HSG D (ONSITE C) (94S)
0.279	80	>75% Grass cover, Good, HSG D (ONSITE D) (94S)
0.539	98	CAP ACCESS (47S)
0.225	98	CAP ROAD (48S)
2.511	98	PERIMETER ROAD (47S,48S,107S)
7.462	98	Paved parking & roofs (49S,50S,51S,52S,53S,54S,55S,56S,69S,70S,95S,96S)
0.472	98	Paved roads w/curbs & sewers (93S)
124.239		**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
1.317	HSG A	94S
2.613	HSG B	94S
14.759	HSG C	54S, 94S, 95S, 96S
91.431	HSG D	47S, 48S, 49S, 50S, 51S, 52S, 53S, 55S, 56S, 69S, 70S, 94S, 106S, 107S
14.119	Other	47S, 48S, 49S, 50S, 51S, 52S, 53S, 54S, 55S, 56S, 69S, 70S, 93S, 94S, 95S, 96S, 107S
124.239		**TOTAL AREA**

Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 47S: DC-1 AT SWALE Runoff Area=8.371 ac 21.28% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=60.95 cfs 2.862 af

Subcatchment 48S: DC-2 AT SWALE Runoff Area=7.779 ac 11.04% Impervious Runoff Depth=3.90"
Tc=5.0 min CN=82 Runoff=54.36 cfs 2.525 af

Subcatchment 49S: DC-3 AT SWALE Runoff Area=10.378 ac 4.90% Impervious Runoff Depth=3.79"
Tc=5.0 min CN=81 Runoff=70.96 cfs 3.280 af

Subcatchment 50S: DC-4 AT SWALE Runoff Area=325,003 sf 2.45% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=49.88 cfs 2.295 af

Subcatchment 51S: DC-5 AT SWALE Runoff Area=336,190 sf 2.47% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=51.59 cfs 2.374 af

Subcatchment 52S: DC-6 AT SWALE Runoff Area=9.605 ac 13.94% Impervious Runoff Depth=4.00"
Tc=5.0 min CN=83 Runoff=68.55 cfs 3.201 af

Subcatchment 53S: DC-7 AT SWALE Runoff Area=414,298 sf 5.16% Impervious Runoff Depth=3.79"
Tc=5.0 min CN=81 Runoff=65.04 cfs 3.006 af

Subcatchment 54S: DC-8 AT SWALE Runoff Area=440,848 sf 5.29% Impervious Runoff Depth=3.20"
Tc=5.0 min CN=75 Runoff=59.62 cfs 2.696 af

Subcatchment 55S: DC-9 AT SWALE Runoff Area=294,805 sf 9.96% Impervious Runoff Depth=3.90"
Tc=5.0 min CN=82 Runoff=47.30 cfs 2.197 af

Subcatchment 56S: DC-10 AT SWALE Runoff Area=8.427 ac 8.39% Impervious Runoff Depth=3.90"
Tc=5.0 min CN=82 Runoff=58.89 cfs 2.735 af

Subcatchment 69S: DA to PC 4A Runoff Area=243,601 sf 21.90% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=40.72 cfs 1.912 af

Subcatchment 70S: PC 3A Runoff Area=95,531 sf 21.86% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=15.97 cfs 0.750 af

Subcatchment 93S: CAP ROAD to DC2 Runoff Area=83,627 sf 24.59% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=12.83 cfs 0.591 af

Subcatchment 94S: AREA TO SWALE 2 Runoff Area=580,809 sf 0.00% Impervious Runoff Depth=2.73"
Flow Length=4,507' Tc=29.0 min CN=70 Runoff=31.83 cfs 3.029 af

Subcatchment 95S: Upslope Area of PC3D Runoff Area=1.573 ac 21.17% Impervious Runoff Depth=3.59"
Flow Length=80' Slope=0.3300 '/' Tc=5.0 min CN=79 Runoff=10.27 cfs 0.471 af

Subcatchment 96S: Upslope Area of PC3E Runoff Area=4.062 ac 19.62% Impervious Runoff Depth=3.59"
Flow Length=80' Slope=0.3300 '/' Tc=5.0 min CN=79 Runoff=26.52 cfs 1.215 af

Subcatchment 106S: AREA TO DS-10 Runoff Area=286,585 sf 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=43.98 cfs 2.024 af

Subcatchment 107S: DA TO PC 5 Runoff Area=124,070 sf 22.29% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=20.74 cfs 0.974 af

391.91
Reach 89R: PC 4G Avg. Depth=1.59' Max Vel=11.82 fps Inflow=~~347.91~~ cfs ~~16.177~~ af
n=0.015 L=1,000.0' S=0.0100 '/' Capacity=1,809.44 cfs Outflow=~~340.56~~ cfs ~~16.177~~ af
Inflow/Outflow still <<capacity 391.91

Reach 95R: DC-1 Avg. Depth=0.40' Max Vel=14.60 fps Inflow=60.95 cfs 2.862 af
n=0.025 L=800.0' S=0.2325 '/' Capacity=292.29 cfs Outflow=60.41 cfs 2.862 af
Q=120.4 cfs across bench at full depth

Reach 96R: DC-2 Avg. Depth=0.40' Max Vel=16.19 fps Inflow=67.20 cfs 3.116 af
n=0.025 L=600.0' S=0.2867 '/' Capacity=324.56 cfs Outflow=66.91 cfs 3.116 af
Q=120.4 cfs across bench at full depth

Reach 97R: DC-3 Avg. Depth=0.41' Max Vel=16.55 fps Inflow=70.96 cfs 3.280 af
n=0.025 L=465.0' S=0.2882 '/' Capacity=325.41 cfs Outflow=70.77 cfs 3.280 af
Q=120.4 cfs across bench at full depth

Reach 98R: DC-4 Avg. Depth=0.33' Max Vel=14.56 fps Inflow=49.88 cfs 2.295 af
n=0.025 L=415.0' S=0.2892 '/' Capacity=325.96 cfs Outflow=49.75 cfs 2.295 af
Q=120.4 cfs across bench at full depth

Reach 99R: DC-5 Avg. Depth=0.34' Max Vel=14.84 fps Inflow=51.59 cfs 2.374 af
n=0.025 L=390.0' S=0.2949 '/' Capacity=329.17 cfs Outflow=51.47 cfs 2.374 af
Q=120.4 cfs across bench at full depth

Reach 100R: DC-6 Avg. Depth=0.41' Max Vel=16.05 fps Inflow=68.55 cfs 3.201 af
n=0.025 L=280.0' S=0.2714 '/' Capacity=315.81 cfs Outflow=68.47 cfs 3.201 af
Q=120.4 cfs across bench at full depth

Reach 101R: DC-7 Avg. Depth=0.39' Max Vel=15.84 fps Inflow=65.04 cfs 3.006 af
n=0.025 L=390.0' S=0.2769 '/' Capacity=318.99 cfs Outflow=64.90 cfs 3.006 af
Q=120.4 cfs across bench at full depth

Reach 102R: DC-8 Avg. Depth=0.37' Max Vel=15.34 fps Inflow=59.62 cfs 2.696 af
n=0.025 L=430.0' S=0.2767 '/' Capacity=318.89 cfs Outflow=59.47 cfs 2.696 af
Q=120.4 cfs across bench at full depth

Reach 103R: DC-9 Avg. Depth=0.33' Max Vel=13.99 fps Inflow=47.30 cfs 2.197 af
n=0.025 L=450.0' S=0.2711 '/' Capacity=315.63 cfs Outflow=47.14 cfs 2.197 af
Q=120.4 cfs across bench at full depth

Reach 104R: DC-10 Avg. Depth=0.37' Max Vel=15.46 fps Inflow=58.89 cfs 2.735 af
n=0.025 L=320.0' S=0.2875 '/' Capacity=325.03 cfs Outflow=58.81 cfs 2.735 af
Q=120.4 cfs across bench at full depth

Link 57L: PC 4A Inflow=40.72 cfs 1.912 af
Primary=40.72 cfs 1.912 af

Link 58L: PC 4B Inflow=109.16 cfs 5.113 af
Primary=109.16 cfs 5.113 af

Link 59L: PC 4C Inflow=160.59 cfs 7.487 af
Primary=160.59 cfs 7.487 af

Link 60L: PC 4D Inflow=210.30 cfs 9.782 af
Primary=210.30 cfs 9.782 af

Back calculated capacity for downchute at 7% slope across bench, with 1 ft flow depth Q= 120.4 cfs, V=13.4 fps

Link 61L: PC 4E
Inflow=281.05 cfs 13.062 af
Primary=281.05 cfs 13.062 af

Link 62L: PC 5
Inflow=81.01 cfs 3.836 af
Primary=81.01 cfs 3.836 af

Link 63L: PC 3A
Inflow=15.97 cfs 0.750 af
Primary=15.97 cfs 0.750 af

Link 64L: PC 3B
Inflow=80.84 cfs 3.756 af
Primary=80.84 cfs 3.756 af

Link 65L: PC 3C
Inflow=140.25 cfs 6.452 af
Primary=140.25 cfs 6.452 af

Link 66L: PC 3D
Inflow=197.64 cfs 9.120 af
Primary=197.64 cfs 9.120 af

Link 67L: CROSS PIPE
Inflow=407.82 cfs 18.930 af
Primary=407.82 cfs 18.930 af

Link 68L: PC 3E
Inflow=282.93 cfs 13.070 af
Primary=282.93 cfs 13.070 af

Link 86L: PC 2
Inflow=31.83 cfs 3.029 af
Primary=31.83 cfs 3.029 af

Link 87L: TO BASIN 1
Inflow=418.56 cfs 21.959 af
Primary=418.56 cfs 21.959 af

Link 88L: PC 4F Add flows from 92S to include Culvert #6 flow
391.91 cfs
Inflow=~~347.91~~ cfs ~~16.177~~ af
Primary=~~347.91~~ cfs ~~16.177~~ af
391.91 cfs

Total Runoff Area = ~~124.239~~ ac Runoff Volume = ~~38.137~~ af Average Runoff Depth = 3.68"
90.98% Pervious = 113.030 ac 9.02% Impervious = 11.209 ac

Summary for Subcatchment 47S: DC-1 AT SWALE

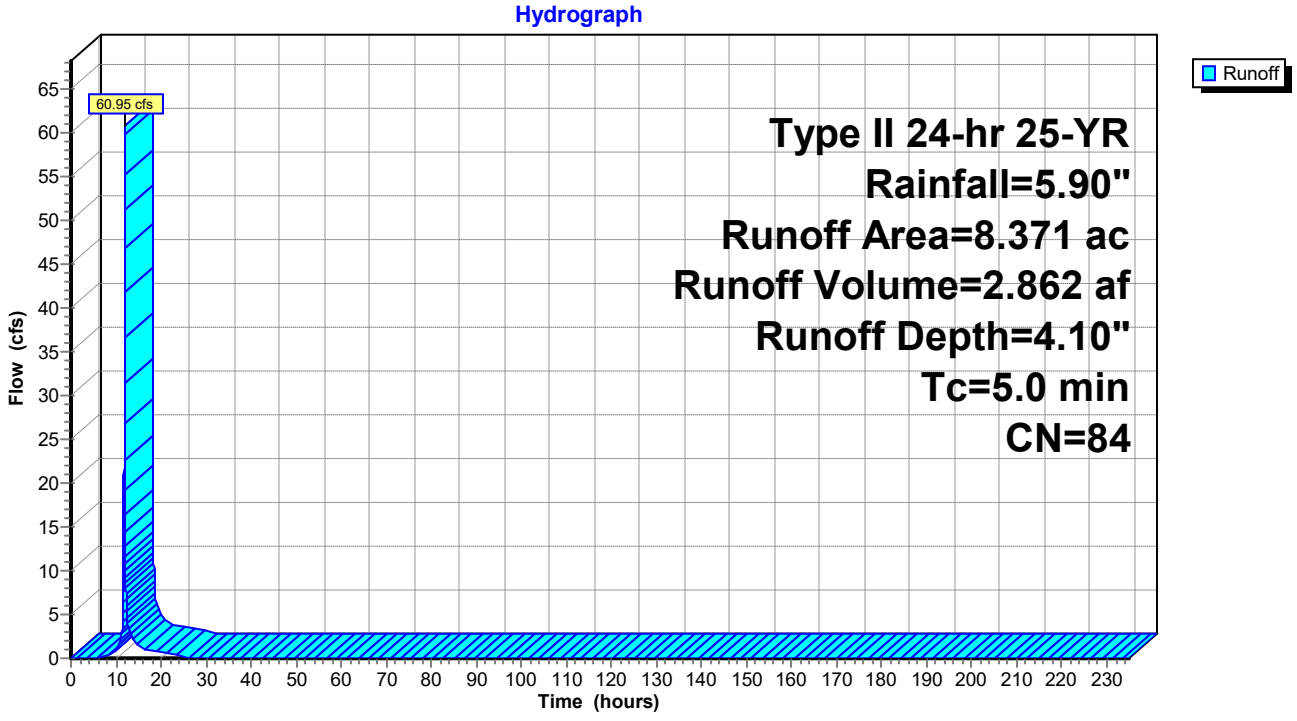
Runoff = 60.95 cfs @ 11.96 hrs, Volume= 2.862 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	1.242	98	PERIMETER ROAD
	6.590	80	>75% Grass cover, Good, HSG D
*	0.539	98	CAP ACCESS
	8.371	84	Weighted Average
	6.590		Pervious Area
	1.781		Impervious Area

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

Subcatchment 47S: DC-1 AT SWALE



Summary for Subcatchment 48S: DC-2 AT SWALE

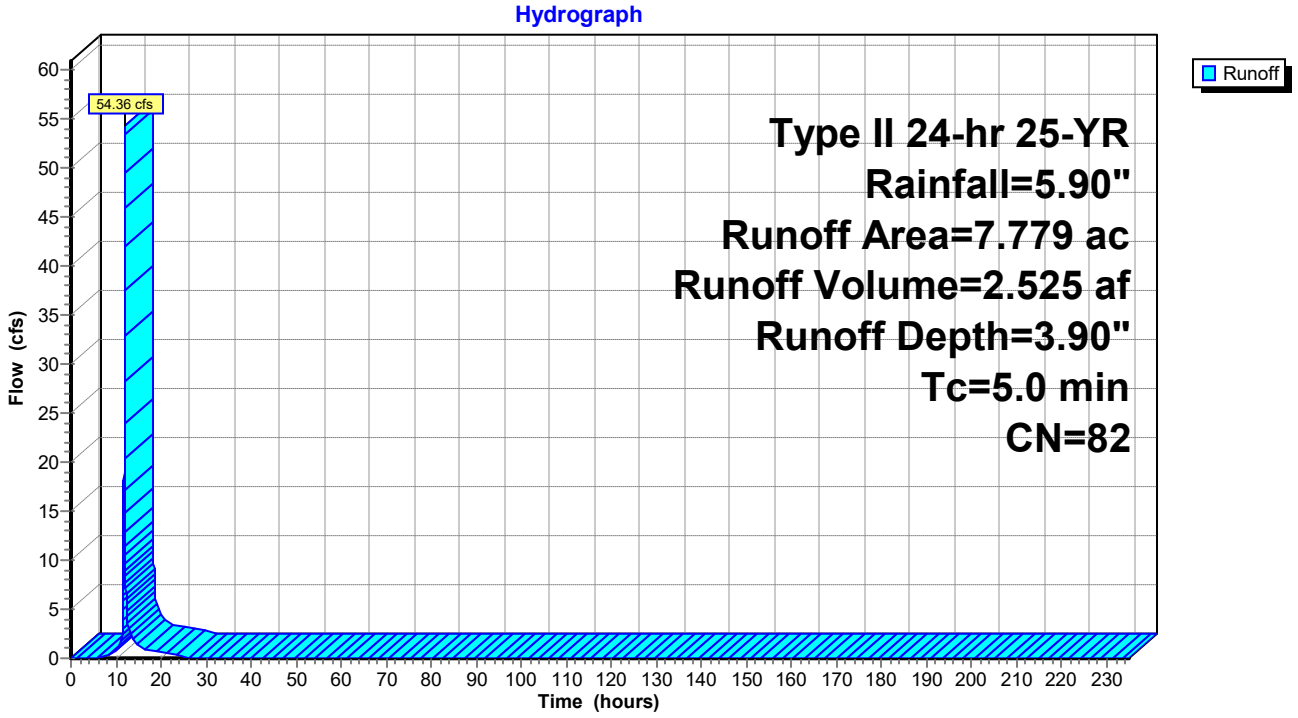
Runoff = 54.36 cfs @ 11.96 hrs, Volume= 2.525 af, Depth= 3.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	0.634	98	PERIMETER ROAD
	6.920	80	>75% Grass cover, Good, HSG D
*	0.225	98	CAP ROAD
	7.779	82	Weighted Average
	6.920		Pervious Area
	0.859		Impervious Area

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

Subcatchment 48S: DC-2 AT SWALE



Summary for Subcatchment 49S: DC-3 AT SWALE

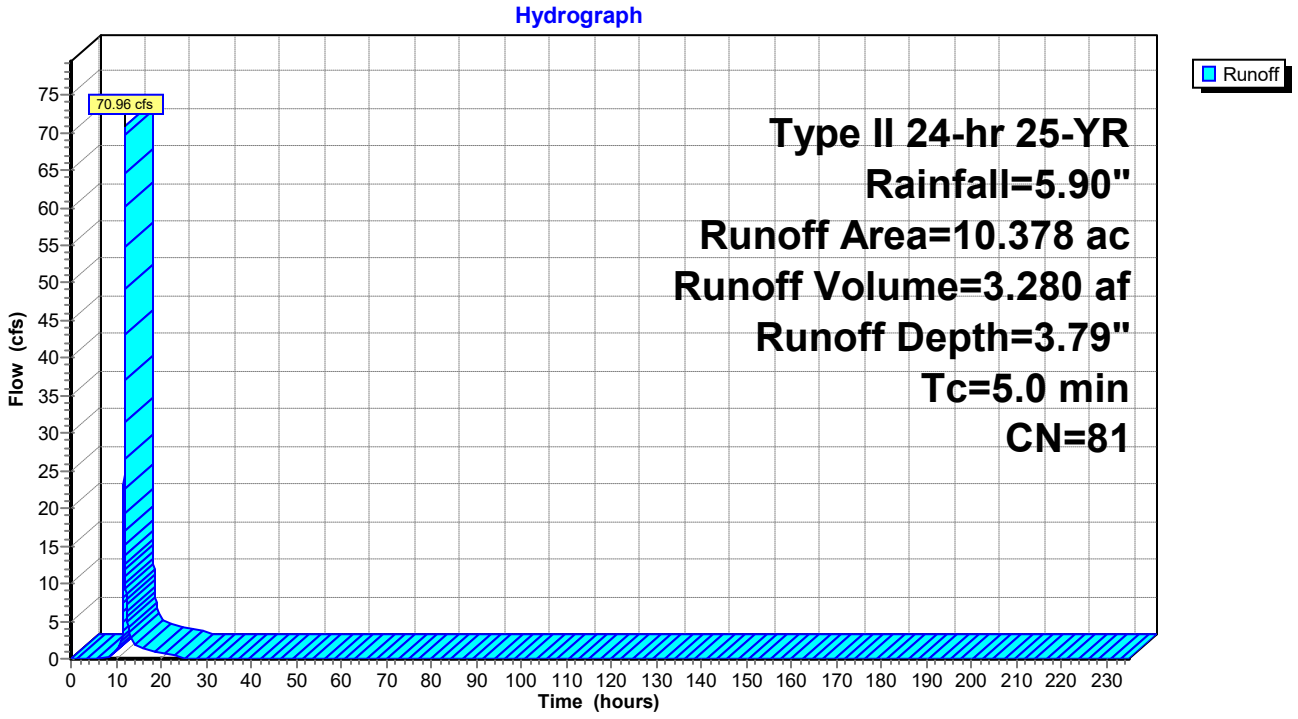
Runoff = 70.96 cfs @ 11.96 hrs, Volume= 3.280 af, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
0.509	98	Paved parking & roofs
9.869	80	>75% Grass cover, Good, HSG D
10.378	81	Weighted Average
9.869		Pervious Area
0.509		Impervious Area

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

Subcatchment 49S: DC-3 AT SWALE



Summary for Subcatchment 50S: DC-4 AT SWALE

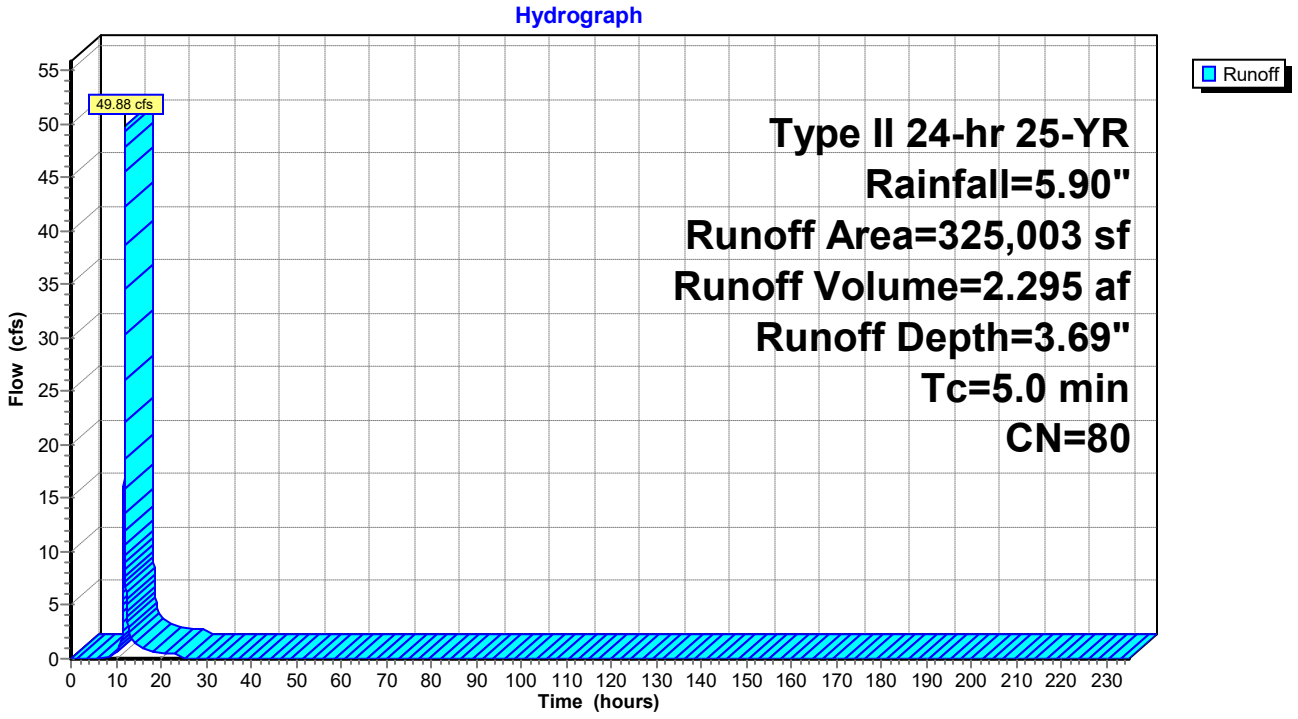
Runoff = 49.88 cfs @ 11.96 hrs, Volume= 2.295 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
7,956	98	Paved parking & roofs
317,047	80	>75% Grass cover, Good, HSG D
325,003	80	Weighted Average
317,047		Pervious Area
7,956		Impervious Area

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

Subcatchment 50S: DC-4 AT SWALE



Summary for Subcatchment 51S: DC-5 AT SWALE

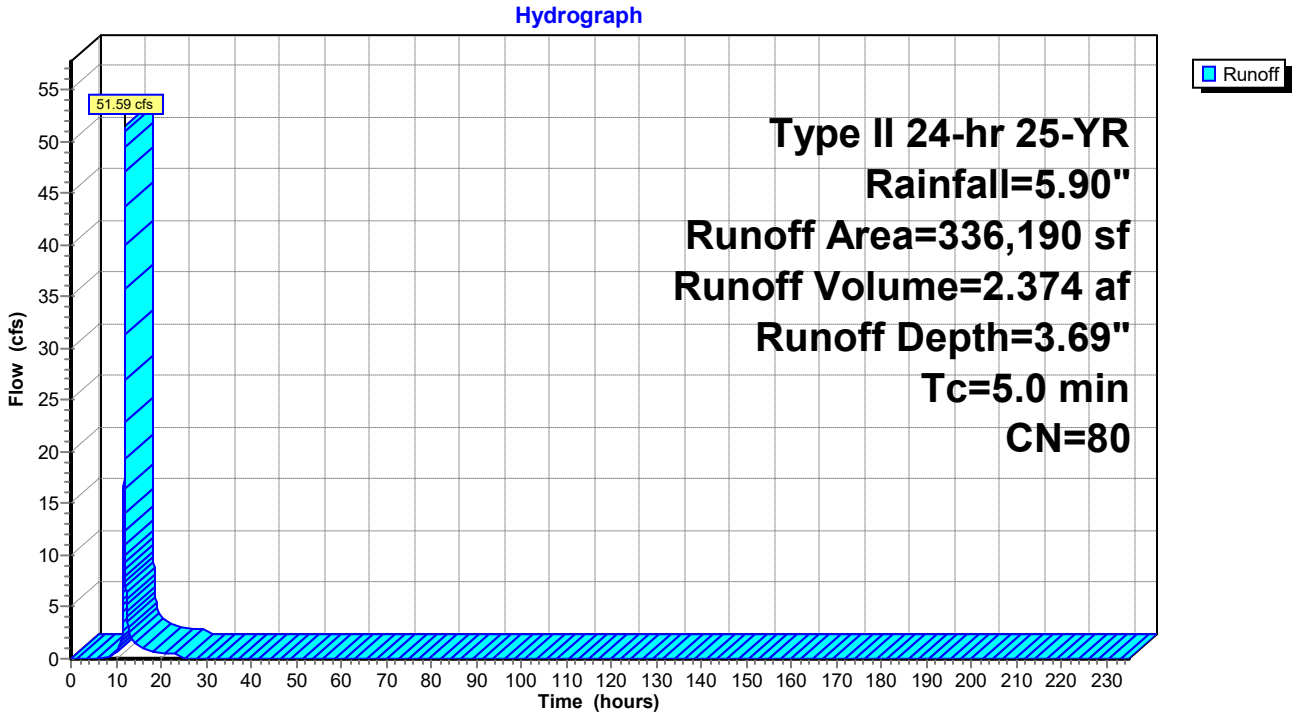
Runoff = 51.59 cfs @ 11.96 hrs, Volume= 2.374 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
8,293	98	Paved parking & roofs
327,897	80	>75% Grass cover, Good, HSG D
336,190	80	Weighted Average
327,897		Pervious Area
8,293		Impervious Area

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

Subcatchment 51S: DC-5 AT SWALE



Summary for Subcatchment 52S: DC-6 AT SWALE

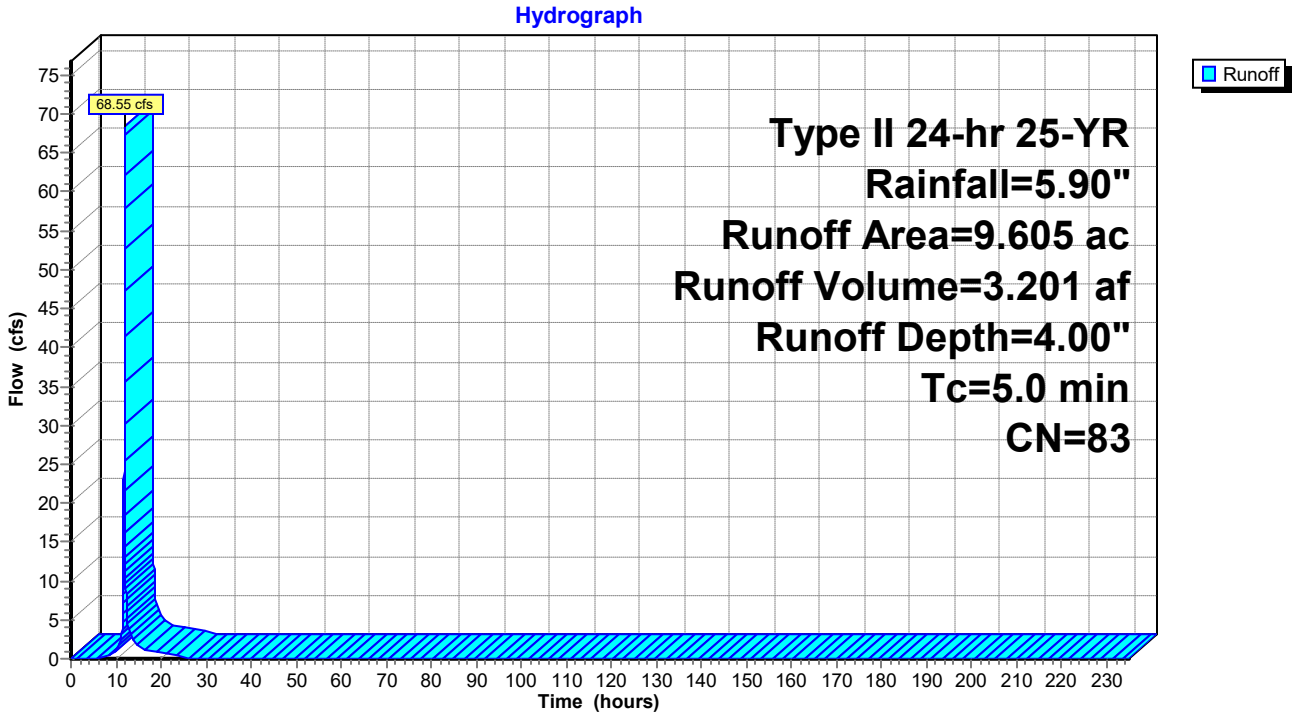
Runoff = 68.55 cfs @ 11.96 hrs, Volume= 3.201 af, Depth= 4.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
1.339	98	Paved parking & roofs
8.266	80	>75% Grass cover, Good, HSG D
9.605	83	Weighted Average
8.266		Pervious Area
1.339		Impervious Area

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

Subcatchment 52S: DC-6 AT SWALE



Summary for Subcatchment 53S: DC-7 AT SWALE

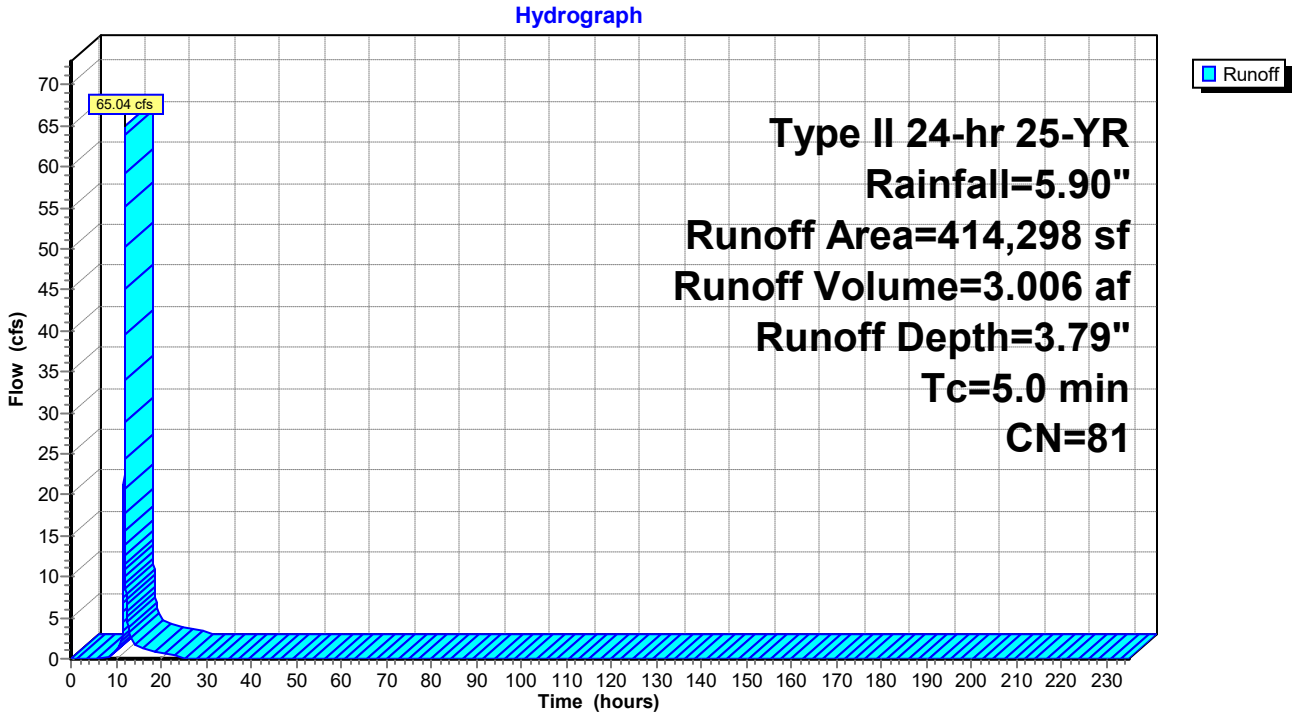
Runoff = 65.04 cfs @ 11.96 hrs, Volume= 3.006 af, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
21,376	98	Paved parking & roofs
392,922	80	>75% Grass cover, Good, HSG D
414,298	81	Weighted Average
392,922		Pervious Area
21,376		Impervious Area

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

Subcatchment 53S: DC-7 AT SWALE



Summary for Subcatchment 54S: DC-8 AT SWALE

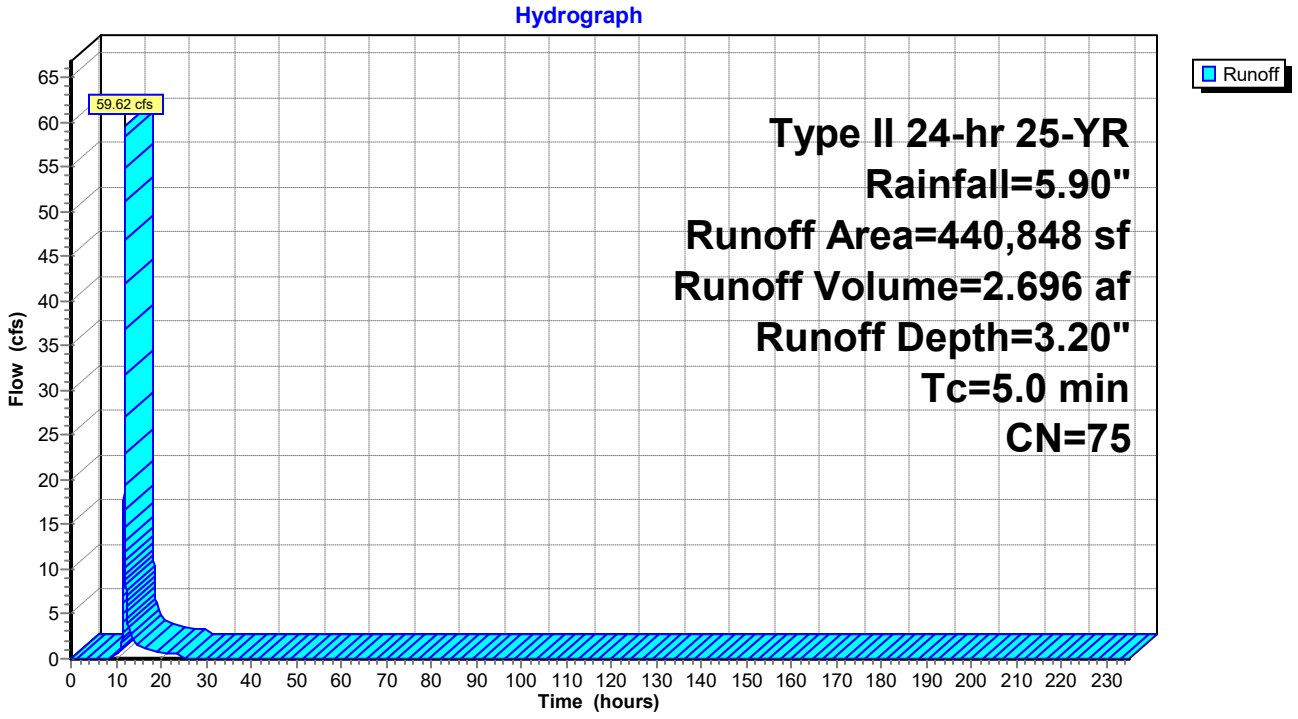
Runoff = 59.62 cfs @ 11.96 hrs, Volume= 2.696 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
23,312	98	Paved parking & roofs
417,536	74	>75% Grass cover, Good, HSG C
440,848	75	Weighted Average
417,536		Pervious Area
23,312		Impervious Area

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

Subcatchment 54S: DC-8 AT SWALE



Summary for Subcatchment 55S: DC-9 AT SWALE

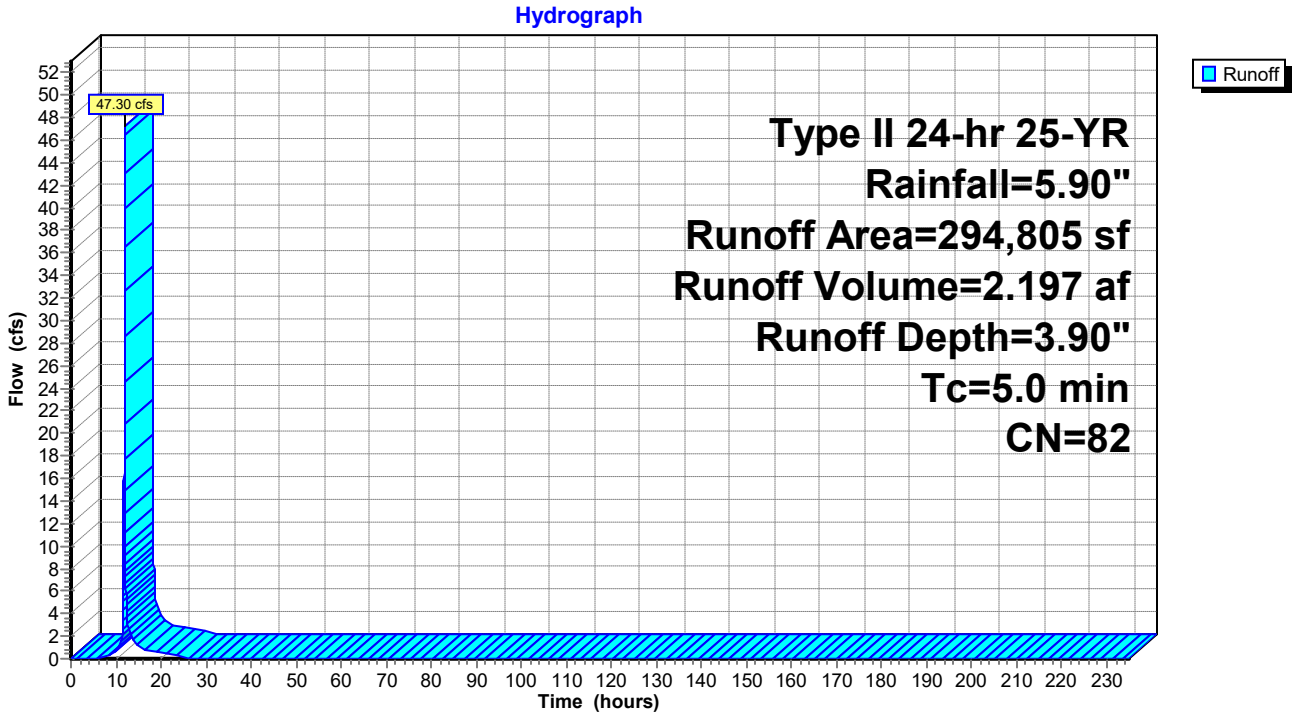
Runoff = 47.30 cfs @ 11.96 hrs, Volume= 2.197 af, Depth= 3.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
29,366	98	Paved parking & roofs
265,439	80	>75% Grass cover, Good, HSG D
294,805	82	Weighted Average
265,439		Pervious Area
29,366		Impervious Area

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

Subcatchment 55S: DC-9 AT SWALE



Summary for Subcatchment 56S: DC-10 AT SWALE

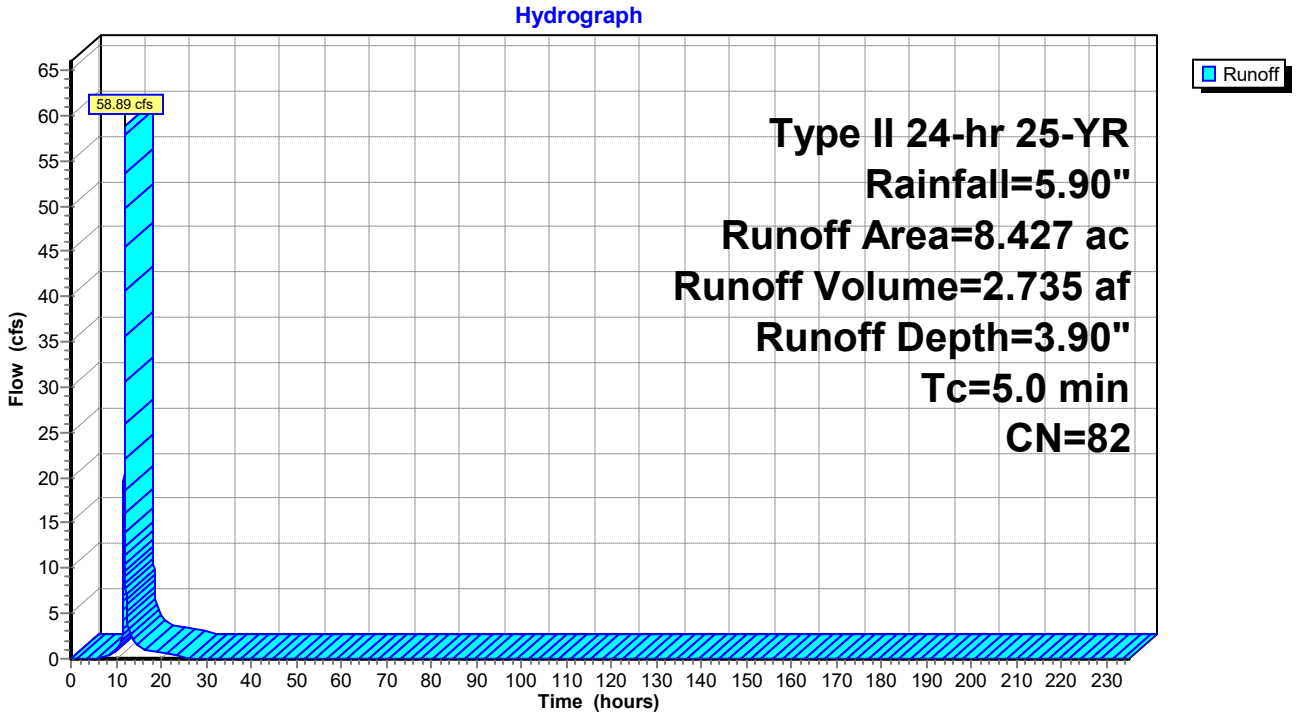
Runoff = 58.89 cfs @ 11.96 hrs, Volume= 2.735 af, Depth= 3.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
0.707	98	Paved parking & roofs
7.720	80	>75% Grass cover, Good, HSG D
8.427	82	Weighted Average
7.720		Pervious Area
0.707		Impervious Area

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

Subcatchment 56S: DC-10 AT SWALE



Summary for Subcatchment 69S: DA to PC 4A

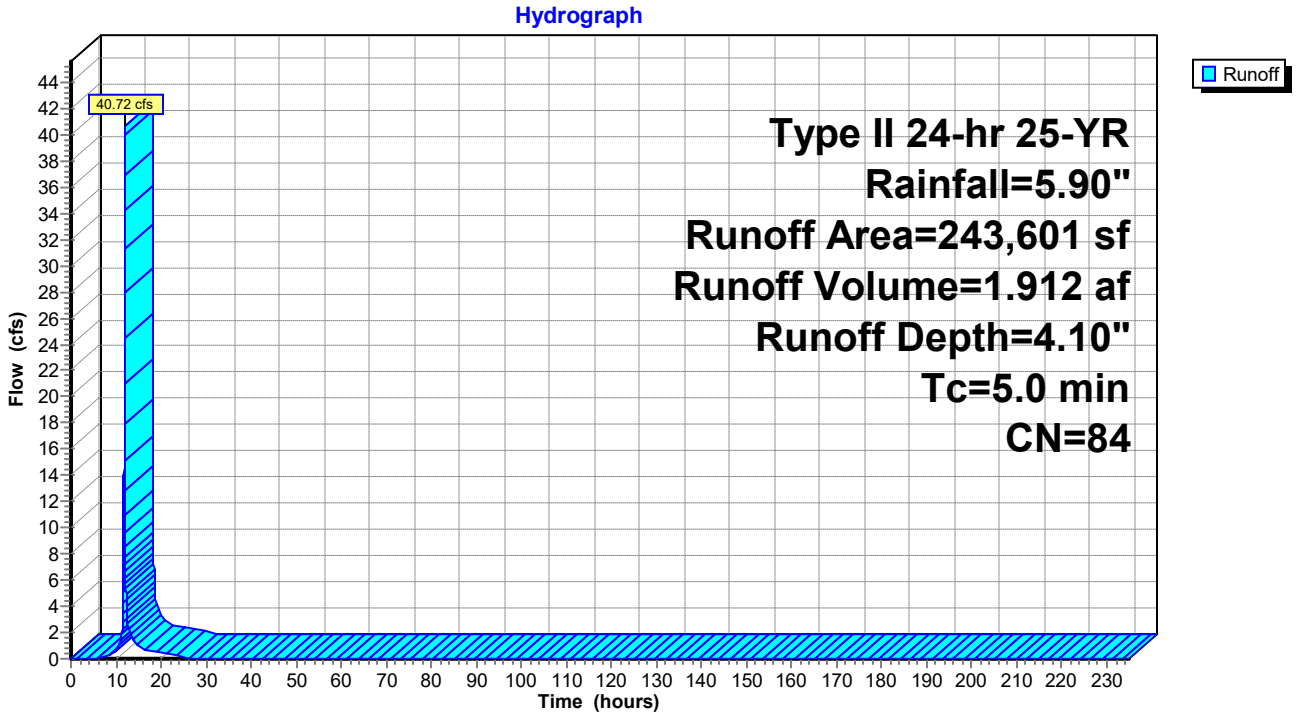
Runoff = 40.72 cfs @ 11.96 hrs, Volume= 1.912 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
53,337	98	Paved parking & roofs
190,264	80	>75% Grass cover, Good, HSG D
243,601	84	Weighted Average
190,264		Pervious Area
53,337		Impervious Area

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

Subcatchment 69S: DA to PC 4A



Summary for Subcatchment 70S: PC 3A

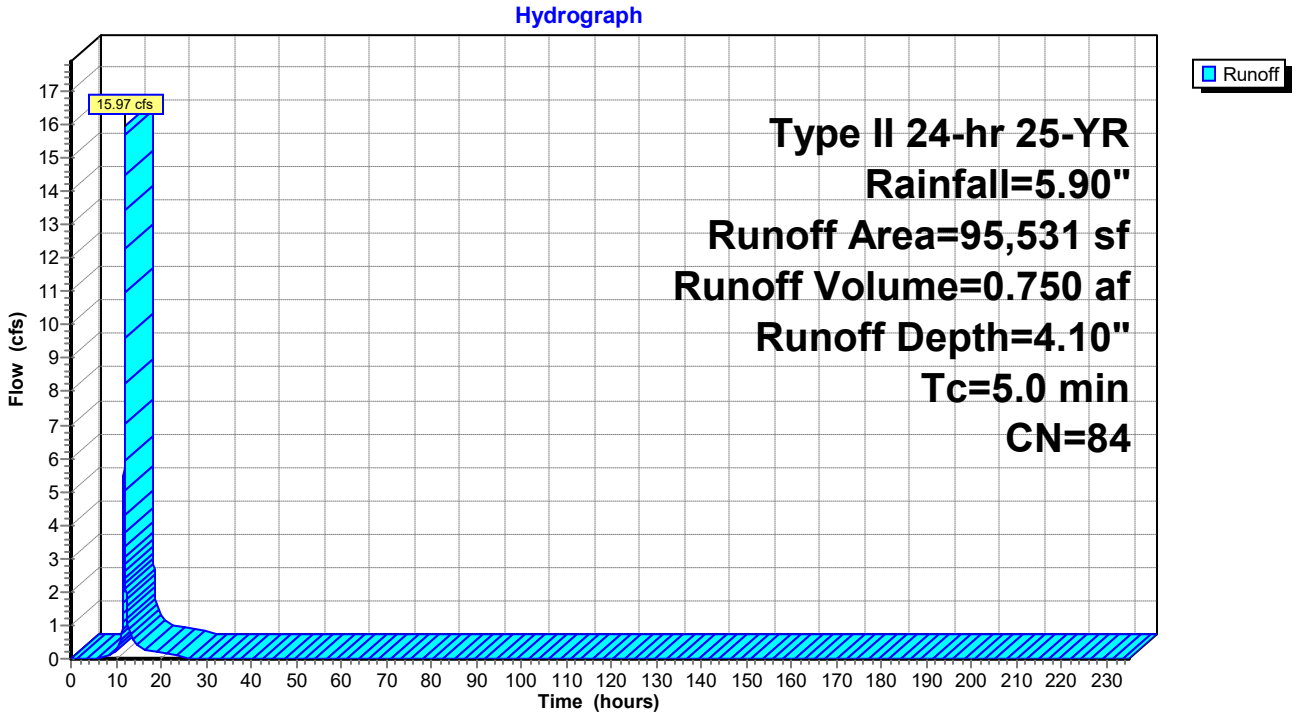
Runoff = 15.97 cfs @ 11.96 hrs, Volume= 0.750 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
20,880	98	Paved parking & roofs
74,651	80	>75% Grass cover, Good, HSG D
95,531	84	Weighted Average
74,651		Pervious Area
20,880		Impervious Area

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

Subcatchment 70S: PC 3A



Summary for Subcatchment 93S: CAP ROAD to DC2

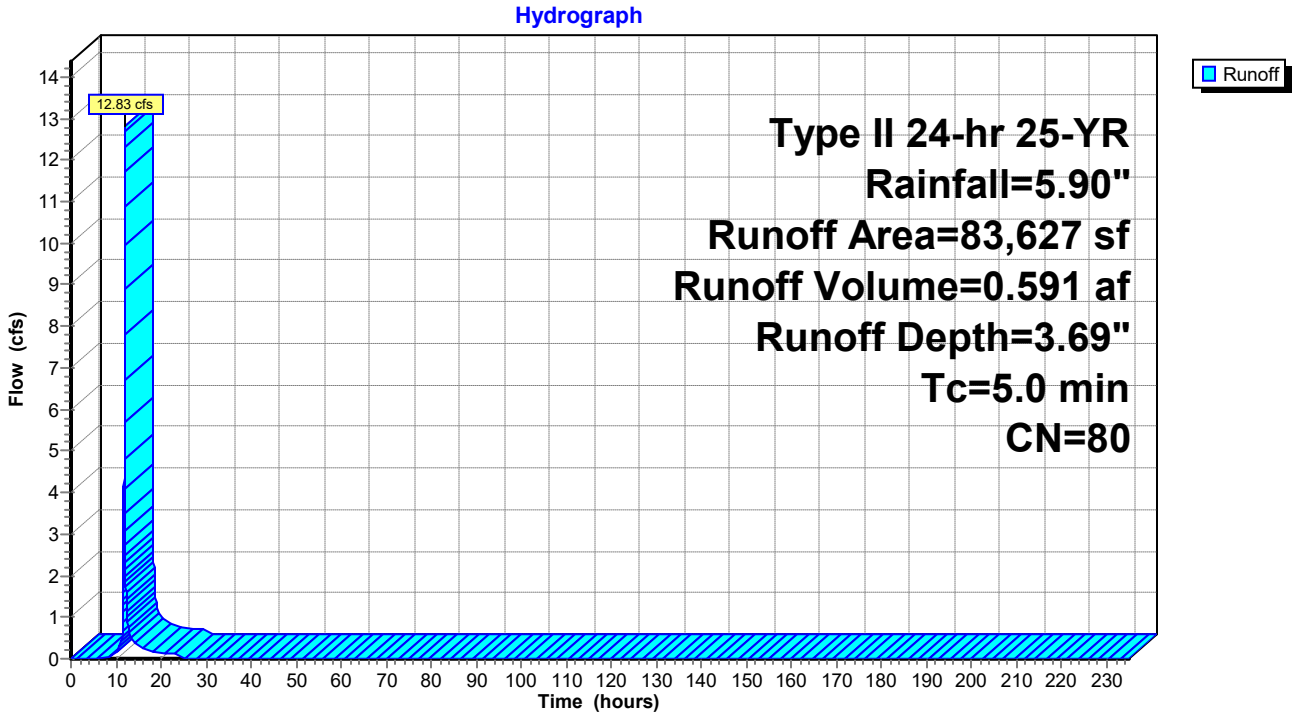
Runoff = 12.83 cfs @ 11.96 hrs, Volume= 0.591 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	63,066	74	FROM APPROVED CALCS
	20,561	98	Paved roads w/curbs & sewers
	83,627	80	Weighted Average
	63,066		Pervious Area
	20,561		Impervious Area

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

Subcatchment 93S: CAP ROAD to DC2



Summary for Subcatchment 94S: AREA TO SWALE 2

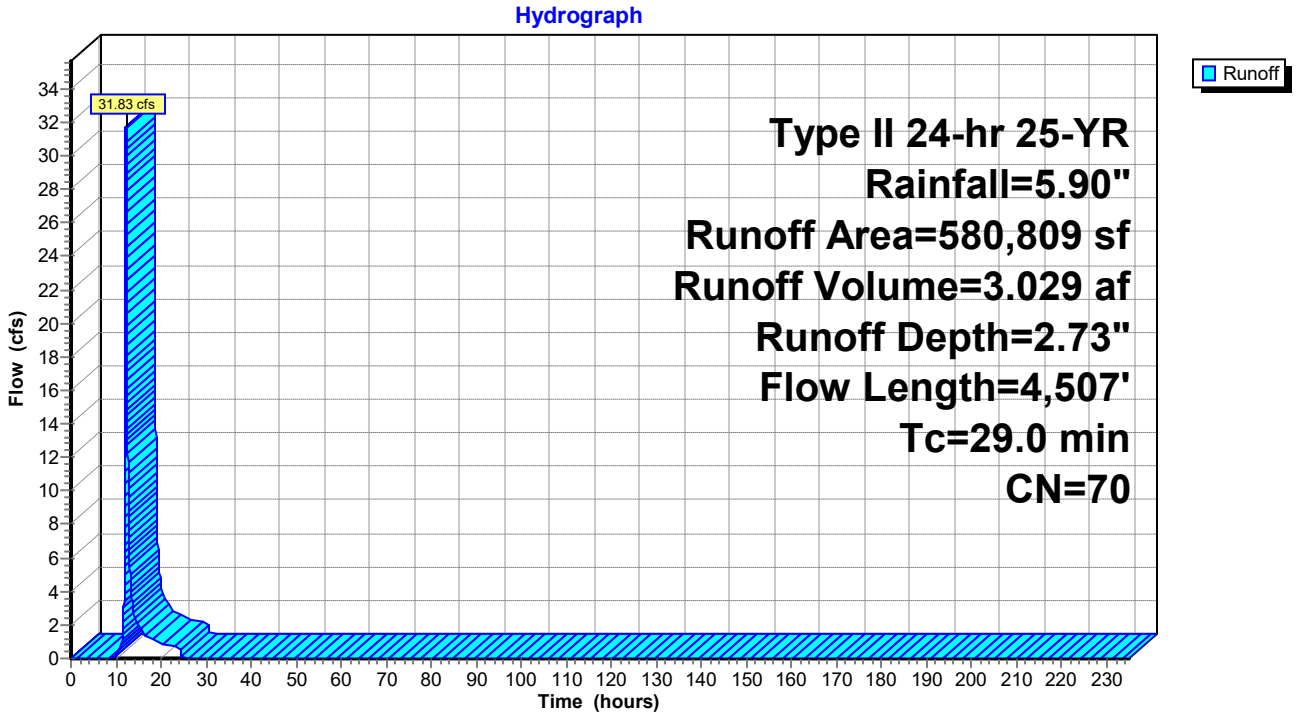
Runoff = 31.83 cfs @ 12.24 hrs, Volume= 3.029 af, Depth= 2.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	23,760	30	Woods, Good, HSG A
	29,120	70	Woods, Good, HSG C
*	113,835	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	272,732	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	12,155	80	>75% Grass cover, Good, HSG D (ONSITE D)
	33,629	30	Woods, Good, HSG A
	31,887	77	Woods, Good, HSG D
*	63,691	76	RA ZONING C SOILS
	580,809	70	Weighted Average
	580,809		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.6	120	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.1	27	0.3000	8.82		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.5	250	0.0300	2.79		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
20.0	4,010	0.0200	3.34	10.02	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
29.0	4,507	Total			

Subcatchment 94S: AREA TO SWALE 2



Summary for Subcatchment 95S: Upslope Area of PC3D

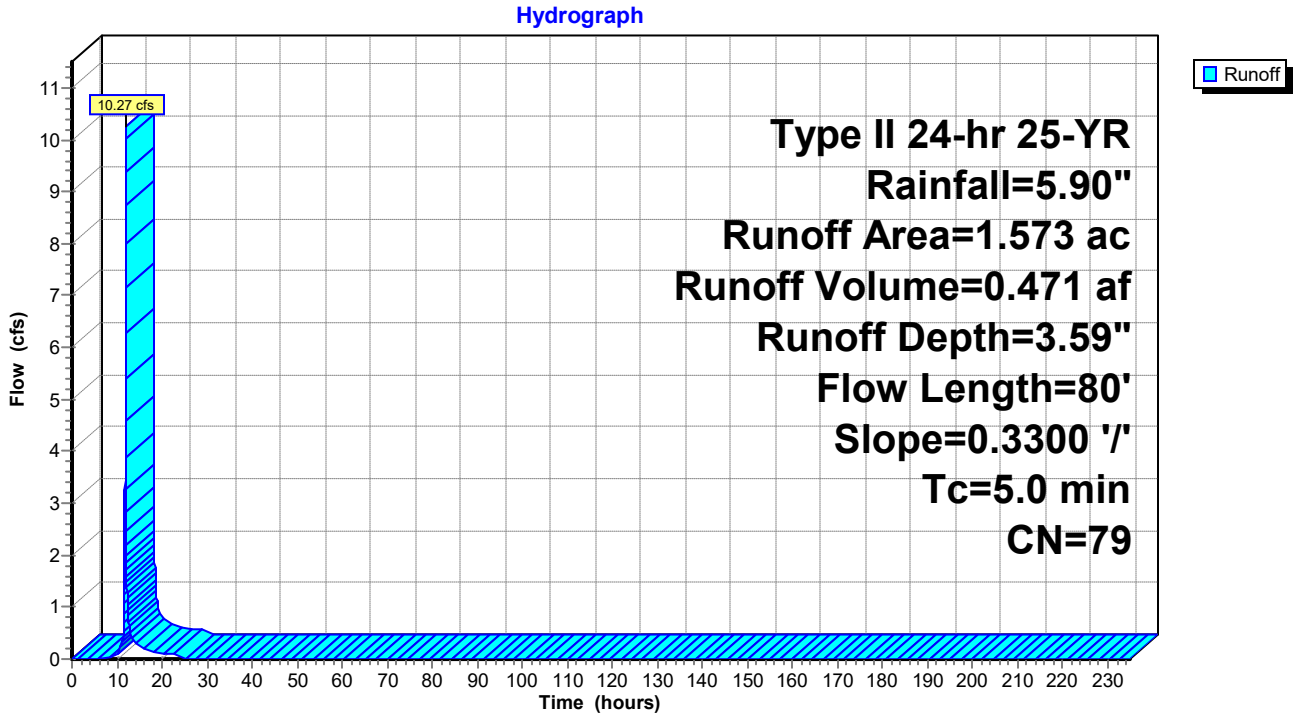
Runoff = 10.27 cfs @ 11.96 hrs, Volume= 0.471 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
1.240	74	>75% Grass cover, Good, HSG C
0.333	98	Paved parking & roofs
1.573	79	Weighted Average
1.240		Pervious Area
0.333		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	80	0.3300	0.50		**Sheet Flow, PErimeter Berm** Grass: Short n= 0.150 P2= 3.20"
2.7	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 95S: Upslope Area of PC3D



Summary for Subcatchment 96S: Upslope Area of PC3E

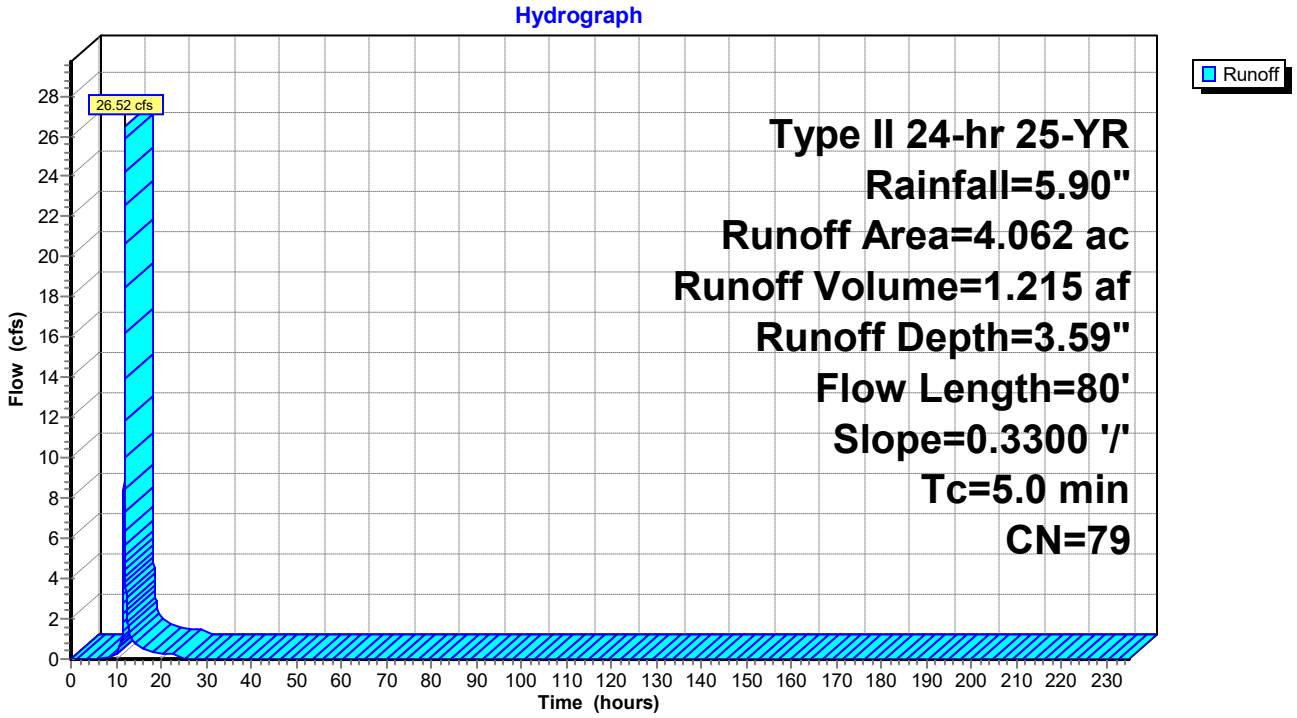
Runoff = 26.52 cfs @ 11.96 hrs, Volume= 1.215 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
3.265	74	>75% Grass cover, Good, HSG C
0.797	98	Paved parking & roofs
4.062	79	Weighted Average
3.265		Pervious Area
0.797		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	80	0.3300	0.50		**Sheet Flow, Perimeter Berm** Grass: Short n= 0.150 P2= 3.20"
2.7	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 96S: Upslope Area of PC3E



Summary for Subcatchment 106S: AREA TO DS-10 CULVERT

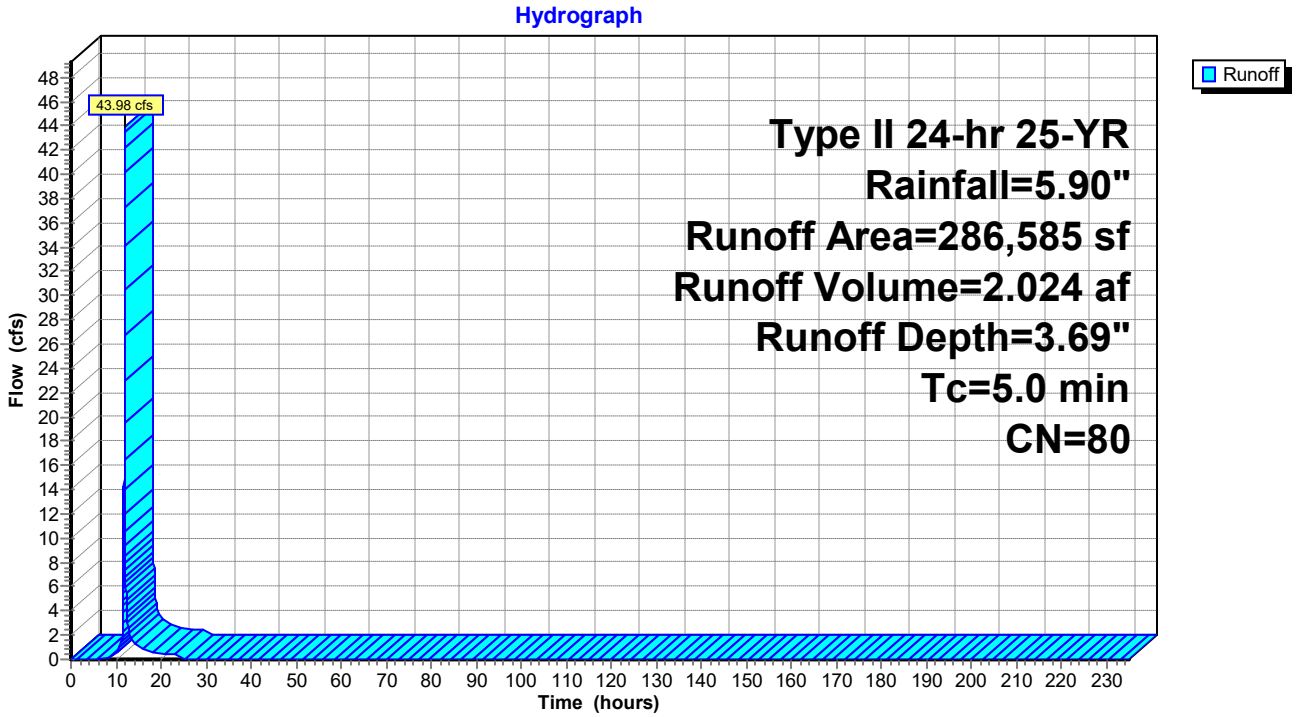
Runoff = 43.98 cfs @ 11.96 hrs, Volume= 2.024 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
286,585	80	>75% Grass cover, Good, HSG D
286,585		Pervious Area

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

Subcatchment 106S: AREA TO DS-10 CULVERT



Summary for Subcatchment 107S: DA TO PC 5

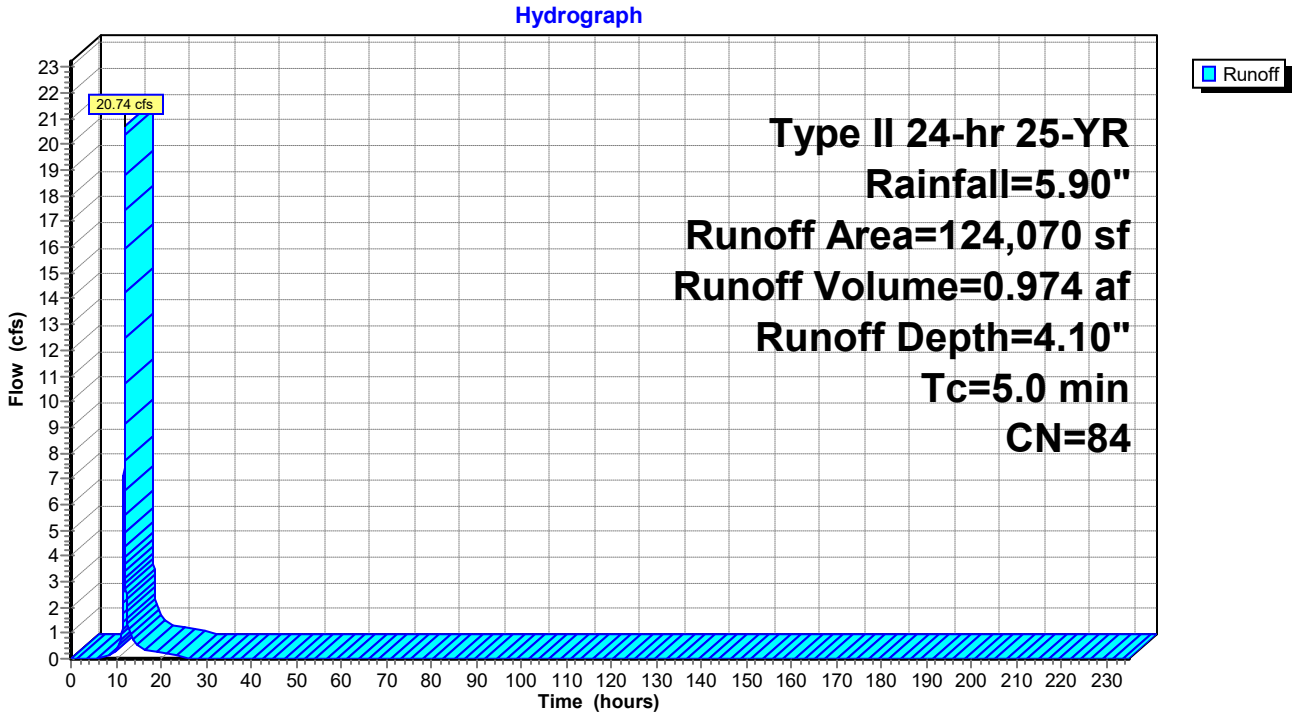
Runoff = 20.74 cfs @ 11.96 hrs, Volume= 0.974 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	27,657	98	PERIMETER ROAD
	96,413	80	>75% Grass cover, Good, HSG D
	124,070	84	Weighted Average
	96,413		Pervious Area
	27,657		Impervious Area

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

Subcatchment 107S: DA TO PC 5

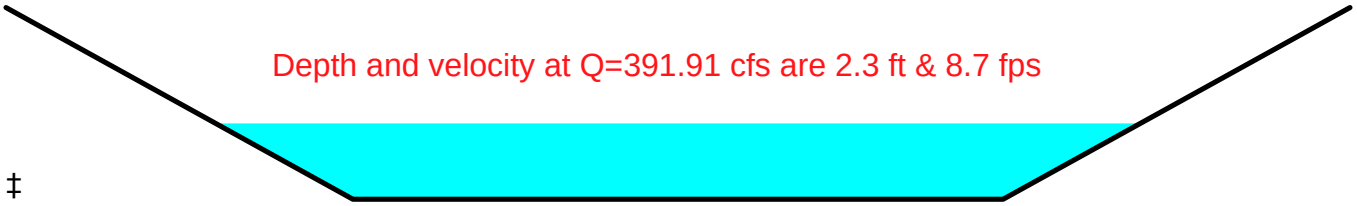


Summary for Reach 89R: PC 4G

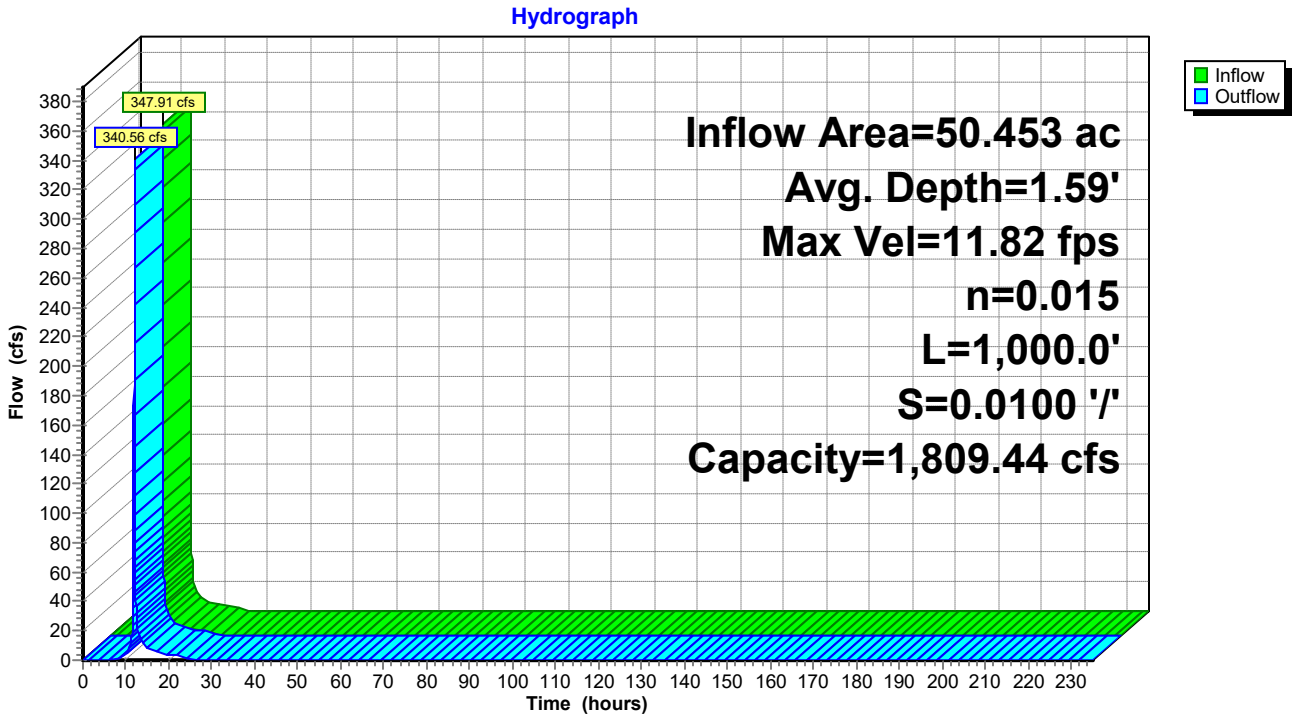
Inflow Area = 50.453 ac, 9.47% Impervious, Inflow Depth = 3.85" for 25-YR event
Inflow = ~~347.91~~ cfs @ 11.96 hrs, Volume= 16.177 af
Outflow = ~~340.56~~ cfs @ 11.98 hrs, Volume= 16.177 af, Atten= 2%, Lag= 0.9 min
391.1 (assume no attenuation)
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.82 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 2.47 fps, Avg. Travel Time= 6.7 min

Peak Storage= 28,801 cf @ 11.98 hrs, Average Depth at Peak Storage= 1.59'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,809.44 cfs

15.00' x 4.00' deep channel, n= 0.015
Side Slope Z-value= 2.0 '/' Top Width= 31.00'
Length= 1,000.0' Slope= 0.0100 '/'
Inlet Invert= 90.00', Outlet Invert= 80.00'



‡



Summary for Reach 95R: DC-1

Inflow Area = 8.371 ac, 21.28% Impervious, Inflow Depth = 4.10" for 25-YR event
Inflow = 60.95 cfs @ 11.96 hrs, Volume= 2.862 af
Outflow = 60.41 cfs @ 11.97 hrs, Volume= 2.862 af, Atten= 1%, Lag= 0.6 min

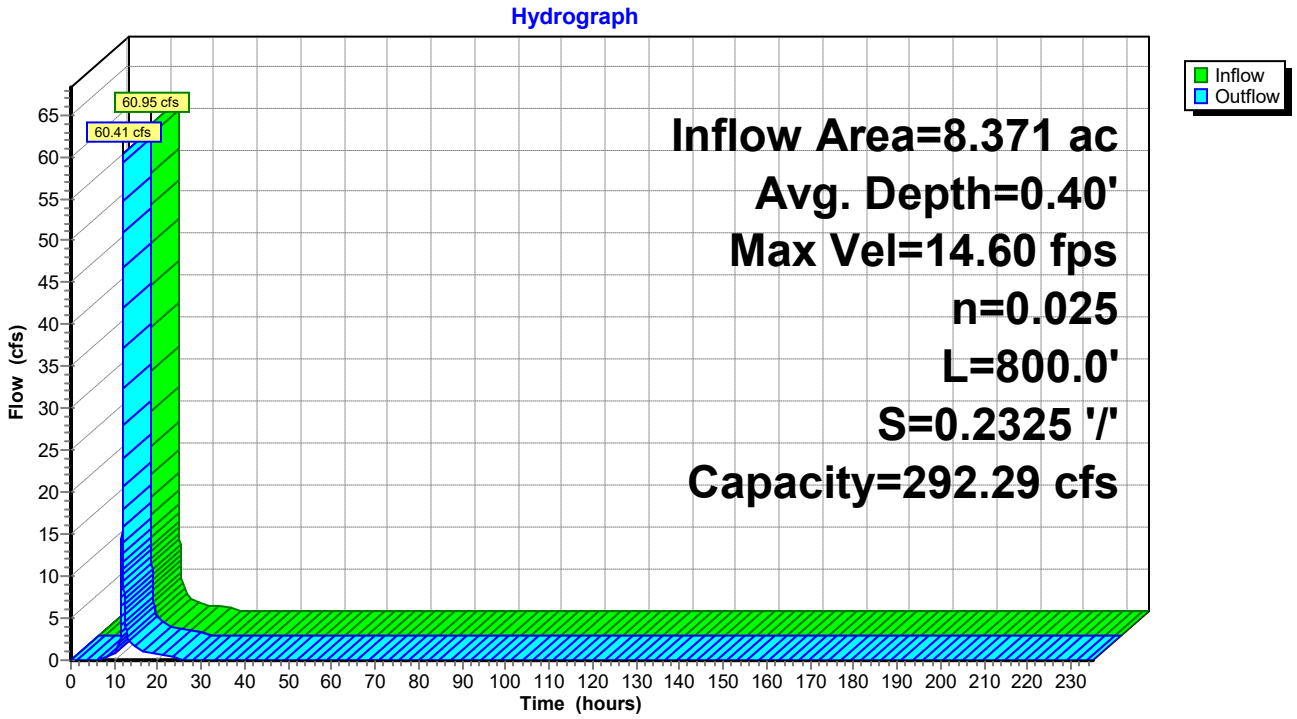
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.60 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.94 fps, Avg. Travel Time= 4.5 min

Peak Storage= 3,310 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 292.29 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 800.0' Slope= 0.2325 '/'
Inlet Invert= 264.00', Outlet Invert= 78.00'

‡

Reach 95R: DC-1



Summary for Reach 96R: DC-2

Inflow Area = 9.699 ac, 13.72% Impervious, Inflow Depth = 3.85" for 25-YR event
Inflow = 67.20 cfs @ 11.96 hrs, Volume= 3.116 af
Outflow = 66.91 cfs @ 11.97 hrs, Volume= 3.116 af, Atten= 0%, Lag= 0.4 min

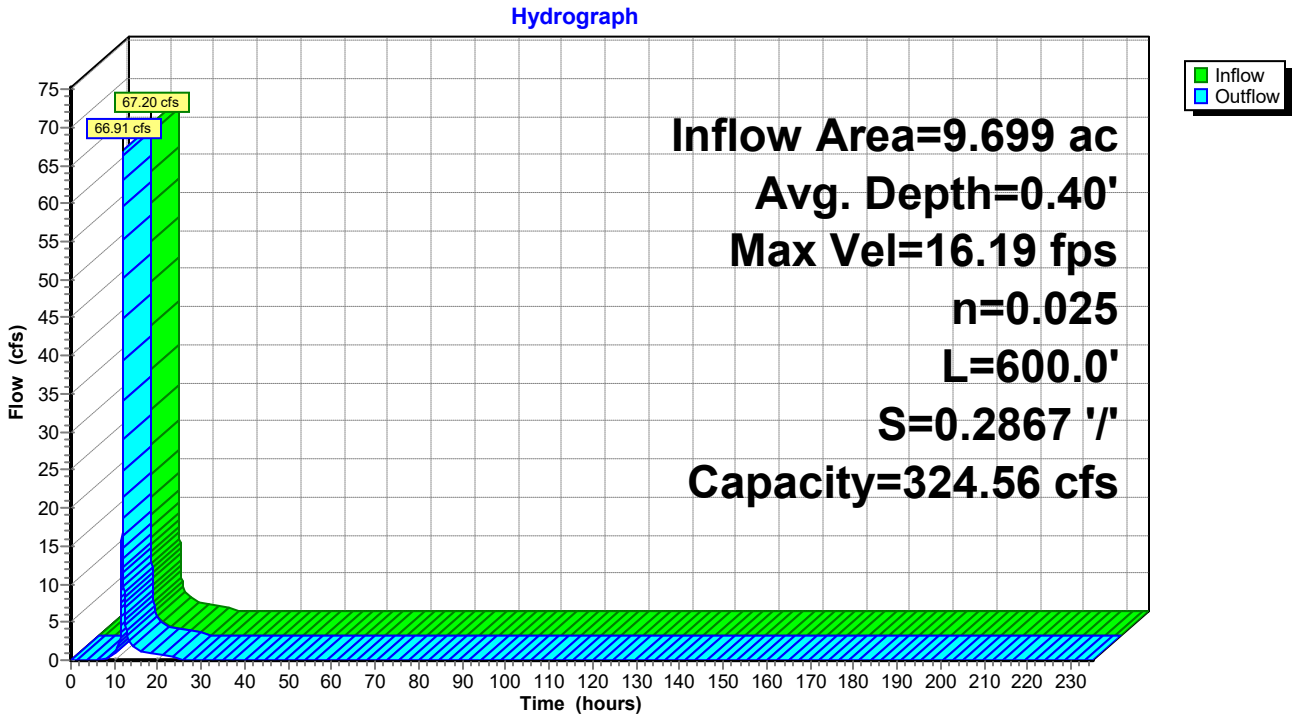
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.19 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 3.31 fps, Avg. Travel Time= 3.0 min

Peak Storage= 2,478 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 324.56 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 600.0' Slope= 0.2867 '/'
Inlet Invert= 264.00', Outlet Invert= 92.00'

‡

Reach 96R: DC-2



Summary for Reach 97R: DC-3

Inflow Area = 10.378 ac, 4.90% Impervious, Inflow Depth = 3.79" for 25-YR event
Inflow = 70.96 cfs @ 11.96 hrs, Volume= 3.280 af
Outflow = 70.77 cfs @ 11.96 hrs, Volume= 3.280 af, Atten= 0%, Lag= 0.3 min

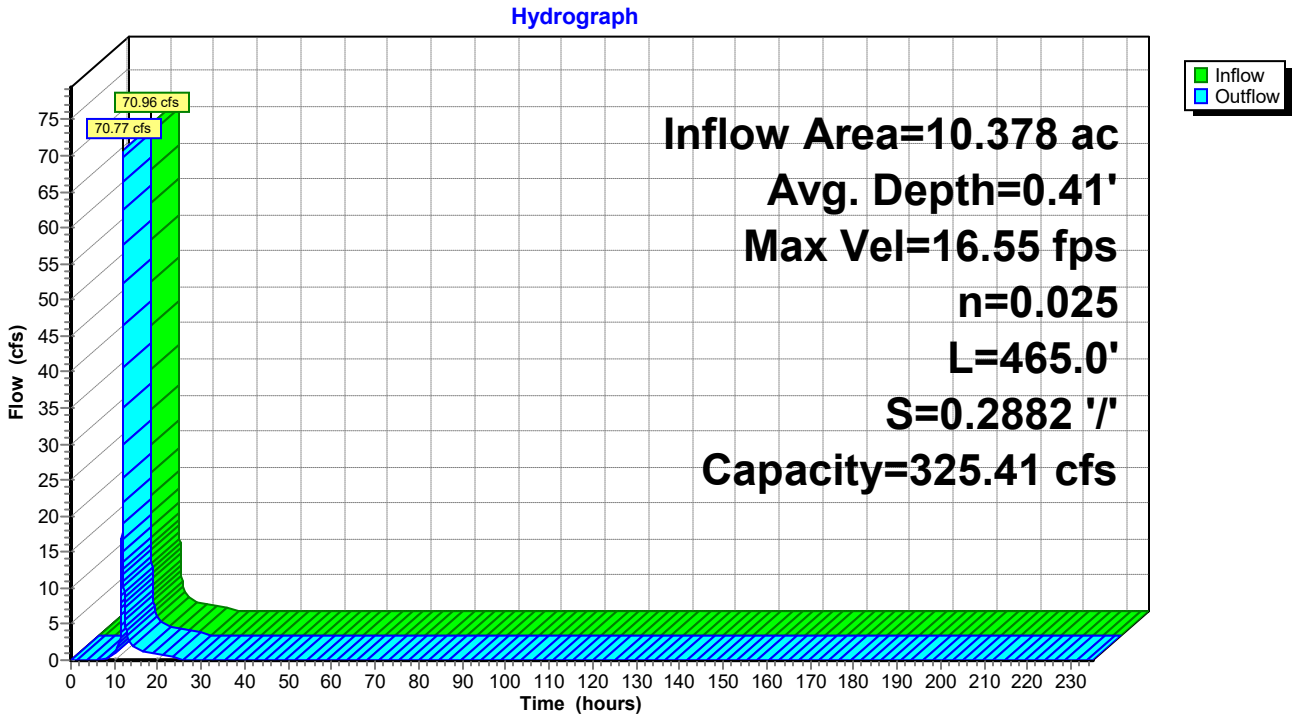
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.55 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.43 fps, Avg. Travel Time= 2.3 min

Peak Storage= 1,988 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.41 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 465.0' Slope= 0.2882 '/'
Inlet Invert= 264.00', Outlet Invert= 130.00'

‡

Reach 97R: DC-3



Summary for Reach 98R: DC-4

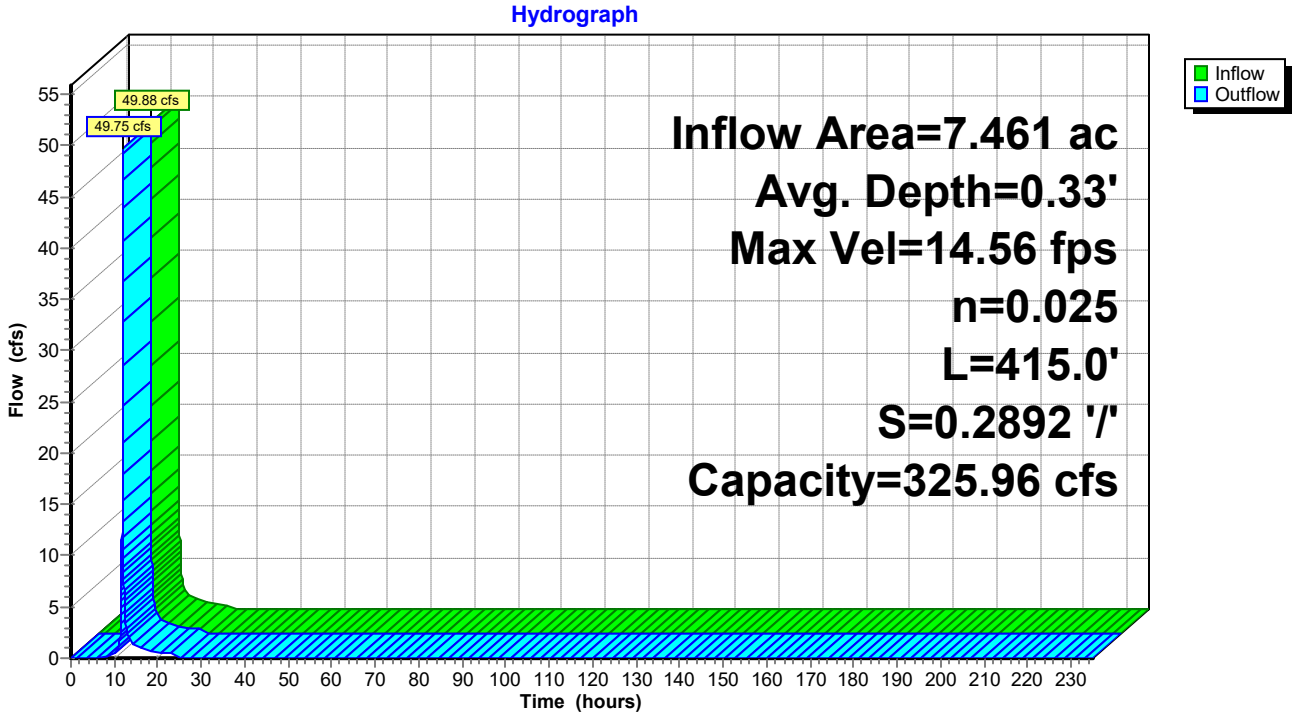
Inflow Area = 7.461 ac, 2.45% Impervious, Inflow Depth = 3.69" for 25-YR event
Inflow = 49.88 cfs @ 11.96 hrs, Volume= 2.295 af
Outflow = 49.75 cfs @ 11.97 hrs, Volume= 2.295 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.56 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.03 fps, Avg. Travel Time= 2.3 min

Peak Storage= 1,417 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.96 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 415.0' Slope= 0.2892 '/'
Inlet Invert= 264.00', Outlet Invert= 144.00'

‡



Summary for Reach 99R: DC-5

Inflow Area = 7.718 ac, 2.47% Impervious, Inflow Depth = 3.69" for 25-YR event
Inflow = 51.59 cfs @ 11.96 hrs, Volume= 2.374 af
Outflow = 51.47 cfs @ 11.96 hrs, Volume= 2.374 af, Atten= 0%, Lag= 0.3 min

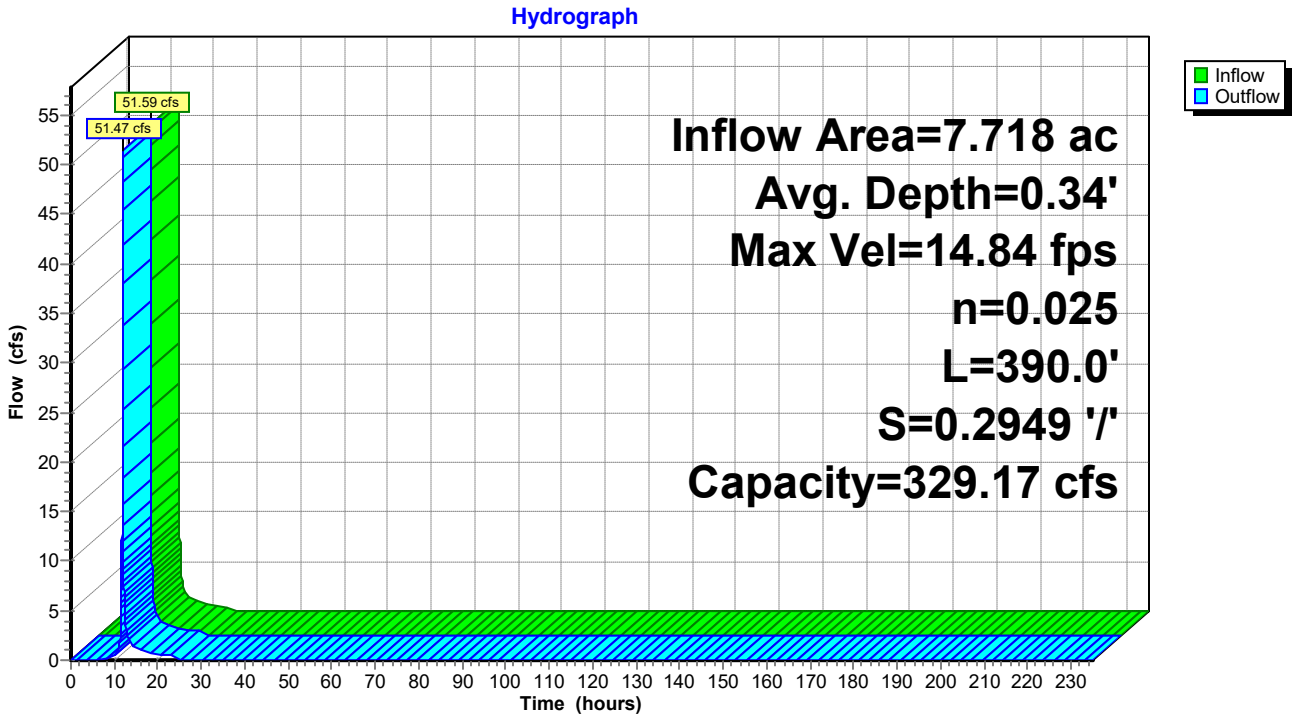
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.84 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.09 fps, Avg. Travel Time= 2.1 min

Peak Storage= 1,352 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 329.17 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 390.0' Slope= 0.2949 '/'
Inlet Invert= 264.00', Outlet Invert= 149.00'

‡

Reach 99R: DC-5



Summary for Reach 100R: DC-6

Inflow Area = 9.605 ac, 13.94% Impervious, Inflow Depth = 4.00" for 25-YR event
Inflow = 68.55 cfs @ 11.96 hrs, Volume= 3.201 af
Outflow = 68.47 cfs @ 11.96 hrs, Volume= 3.201 af, Atten= 0%, Lag= 0.2 min

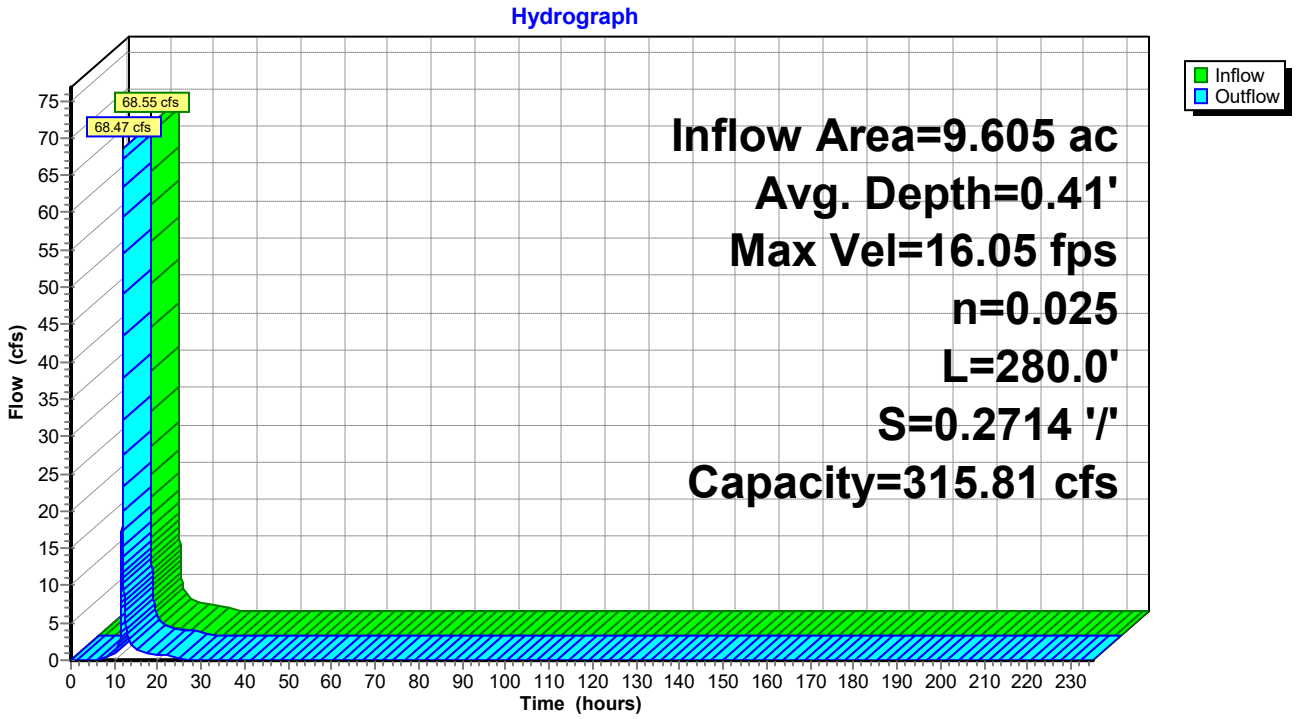
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.05 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.31 fps, Avg. Travel Time= 1.4 min

Peak Storage= 1,194 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 315.81 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 280.0' Slope= 0.2714 '/'
Inlet Invert= 230.00', Outlet Invert= 154.00'

‡

Reach 100R: DC-6



Summary for Reach 101R: DC-7

Inflow Area = 9.511 ac, 5.16% Impervious, Inflow Depth = 3.79" for 25-YR event
Inflow = 65.04 cfs @ 11.96 hrs, Volume= 3.006 af
Outflow = 64.90 cfs @ 11.96 hrs, Volume= 3.006 af, Atten= 0%, Lag= 0.3 min

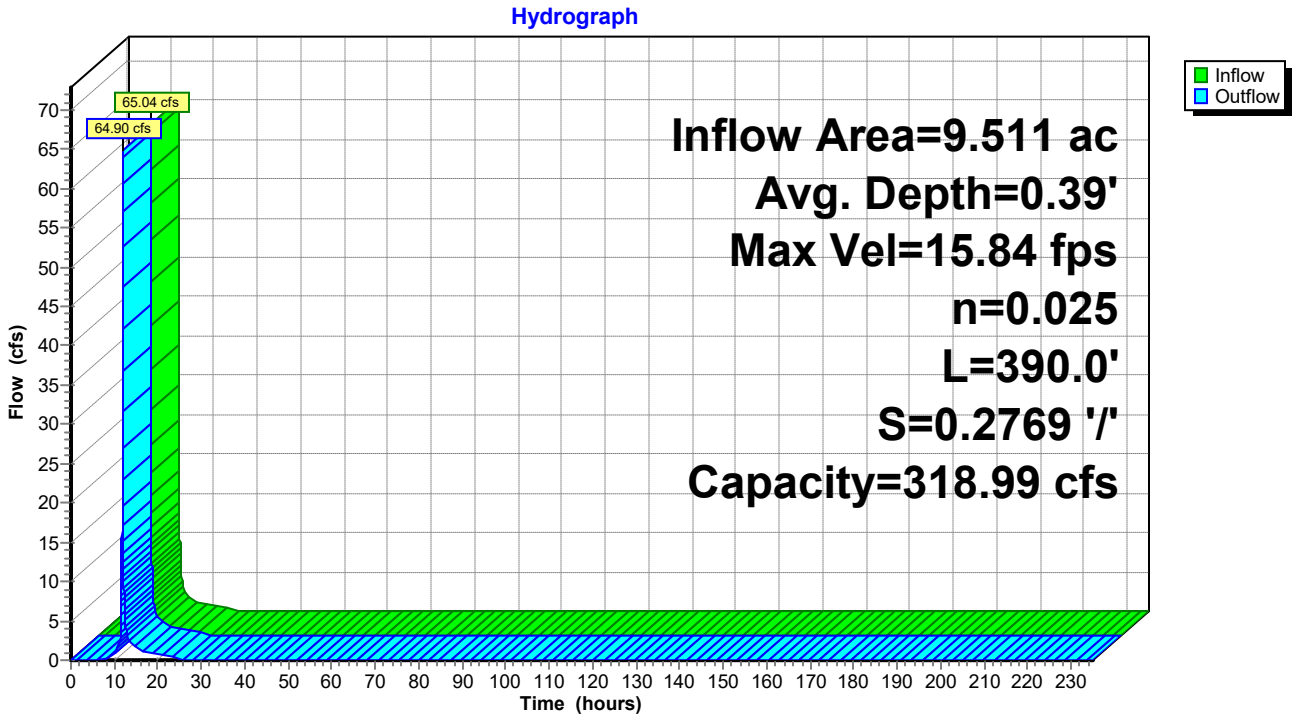
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.84 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.29 fps, Avg. Travel Time= 2.0 min

Peak Storage= 1,598 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 318.99 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 390.0' Slope= 0.2769 '/'
Inlet Invert= 266.00', Outlet Invert= 158.00'

‡

Reach 101R: DC-7



Summary for Reach 102R: DC-8

Inflow Area = 10.120 ac, 5.29% Impervious, Inflow Depth = 3.20" for 25-YR event
Inflow = 59.62 cfs @ 11.96 hrs, Volume= 2.696 af
Outflow = 59.47 cfs @ 11.97 hrs, Volume= 2.696 af, Atten= 0%, Lag= 0.3 min

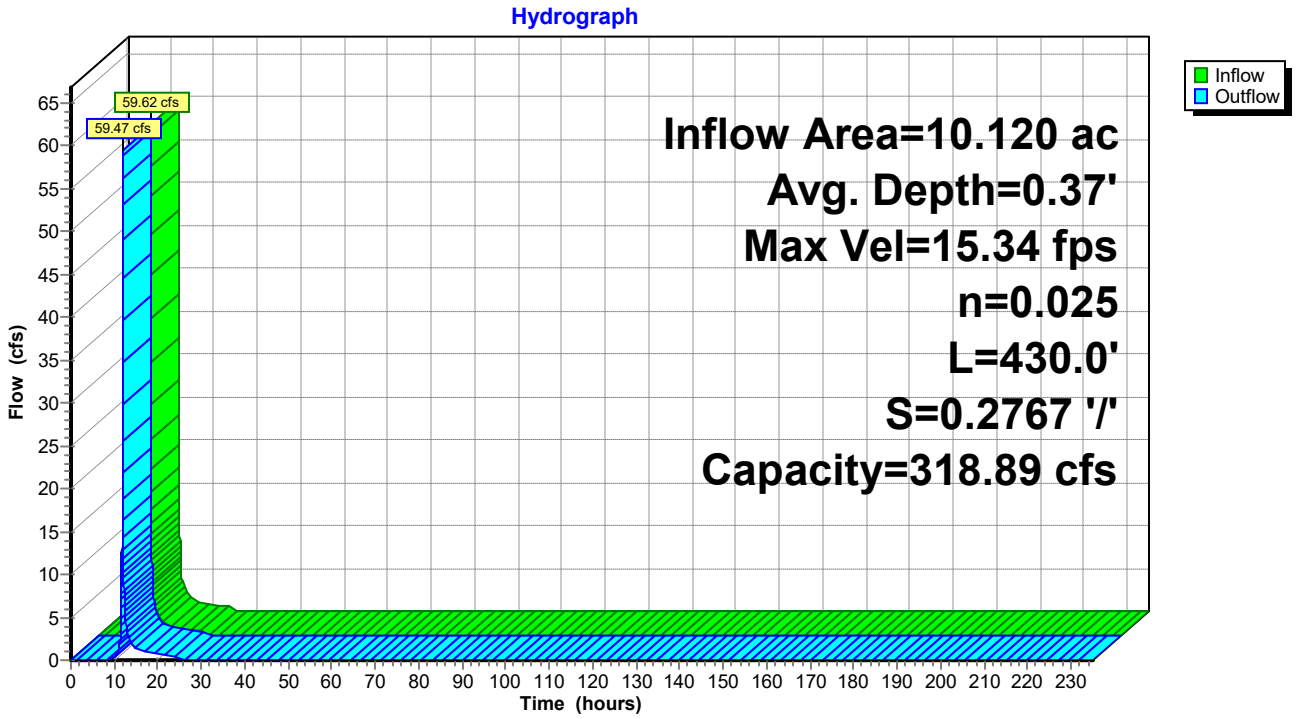
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.34 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.30 fps, Avg. Travel Time= 2.2 min

Peak Storage= 1,666 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 318.89 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 430.0' Slope= 0.2767 '/'
Inlet Invert= 262.00', Outlet Invert= 143.00'

‡

Reach 102R: DC-8



Summary for Reach 103R: DC-9

Inflow Area = 6.768 ac, 9.96% Impervious, Inflow Depth = 3.90" for 25-YR event
Inflow = 47.30 cfs @ 11.96 hrs, Volume= 2.197 af
Outflow = 47.14 cfs @ 11.97 hrs, Volume= 2.197 af, Atten= 0%, Lag= 0.3 min

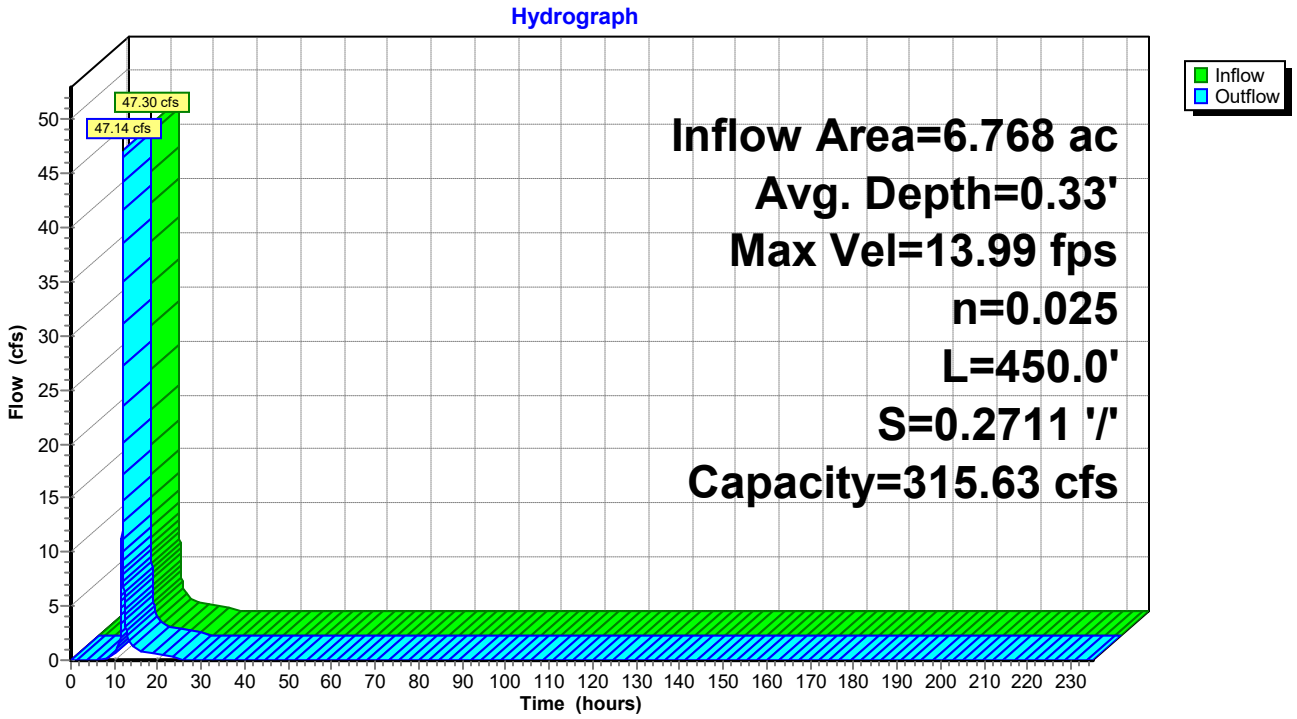
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 13.99 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.88 fps, Avg. Travel Time= 2.6 min

Peak Storage= 1,515 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 315.63 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 450.0' Slope= 0.2711 '/'
Inlet Invert= 252.00', Outlet Invert= 130.00'

‡

Reach 103R: DC-9



Summary for Reach 104R: DC-10

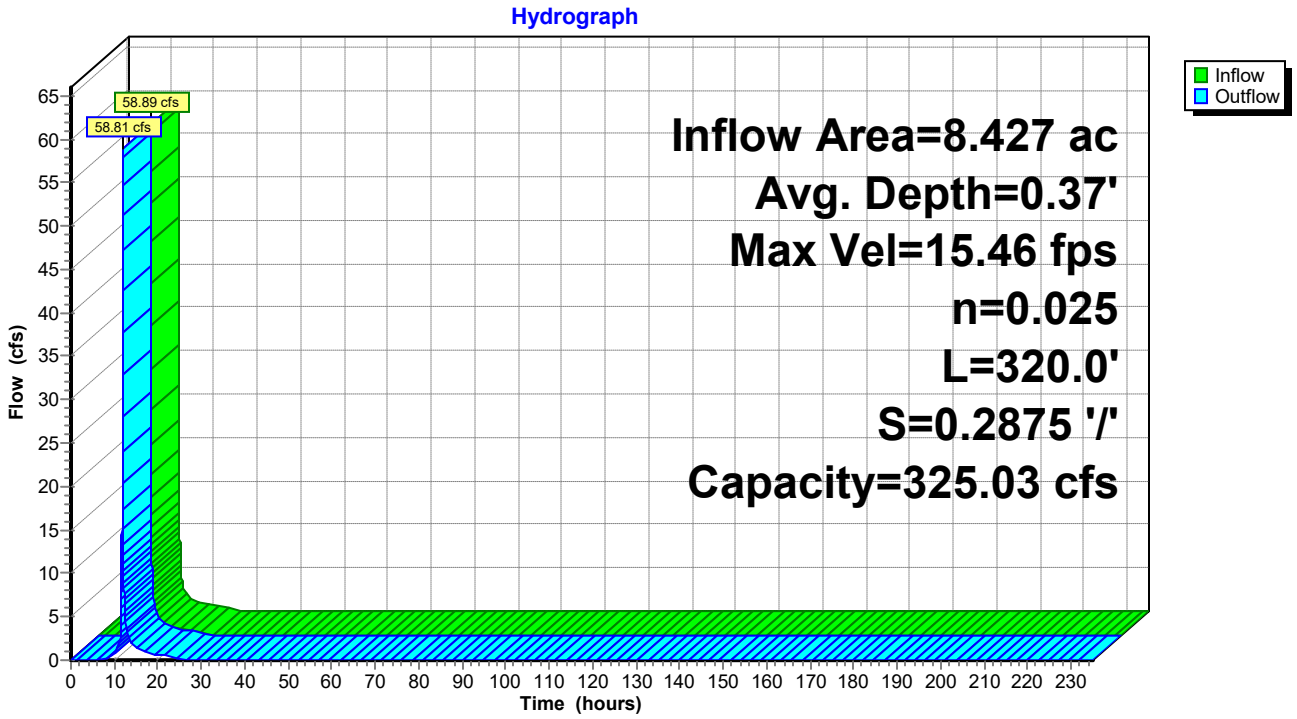
Inflow Area = 8.427 ac, 8.39% Impervious, Inflow Depth = 3.90" for 25-YR event
Inflow = 58.89 cfs @ 11.96 hrs, Volume= 2.735 af
Outflow = 58.81 cfs @ 11.96 hrs, Volume= 2.735 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.46 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.20 fps, Avg. Travel Time= 1.7 min

Peak Storage= 1,217 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.03 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 320.0' Slope= 0.2875 '/'
Inlet Invert= 210.00', Outlet Invert= 118.00'

‡

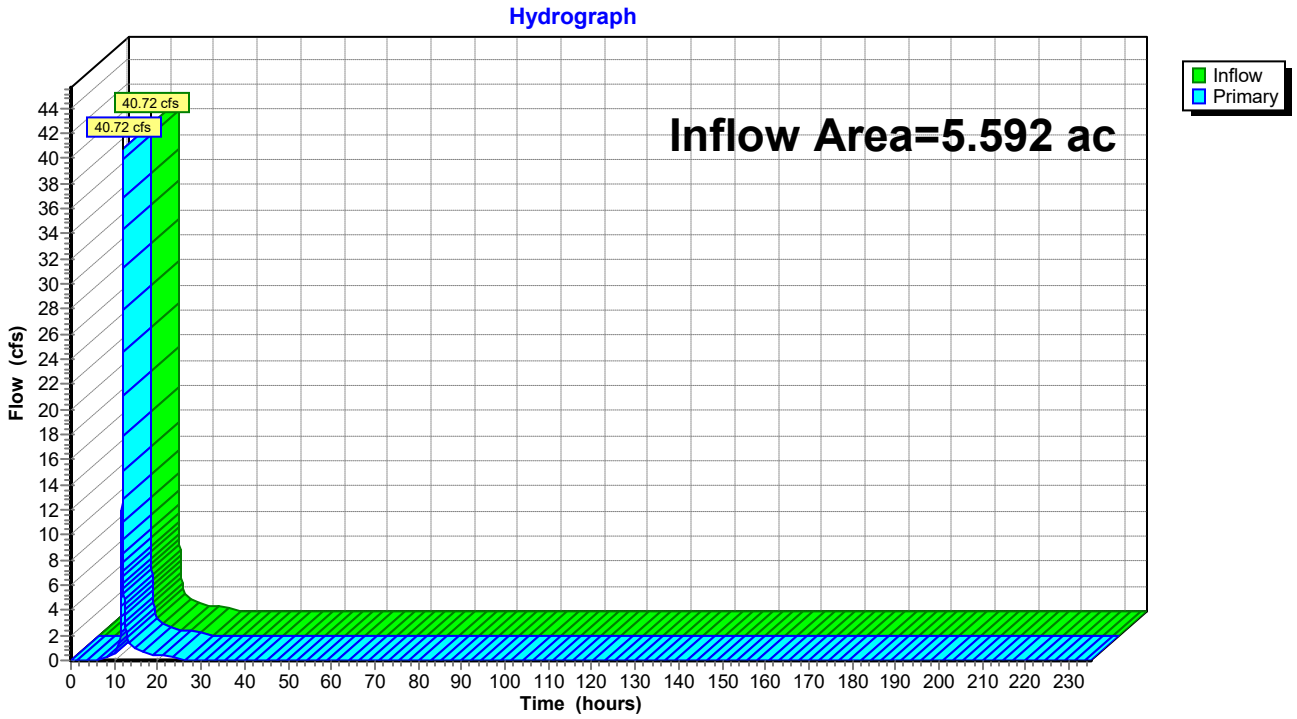


Summary for Link 57L: PC 4A

Inflow Area = 5.592 ac, 21.90% Impervious, Inflow Depth = 4.10" for 25-YR event
Inflow = 40.72 cfs @ 11.96 hrs, Volume= 1.912 af
Primary = 40.72 cfs @ 11.96 hrs, Volume= 1.912 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 57L: PC 4A

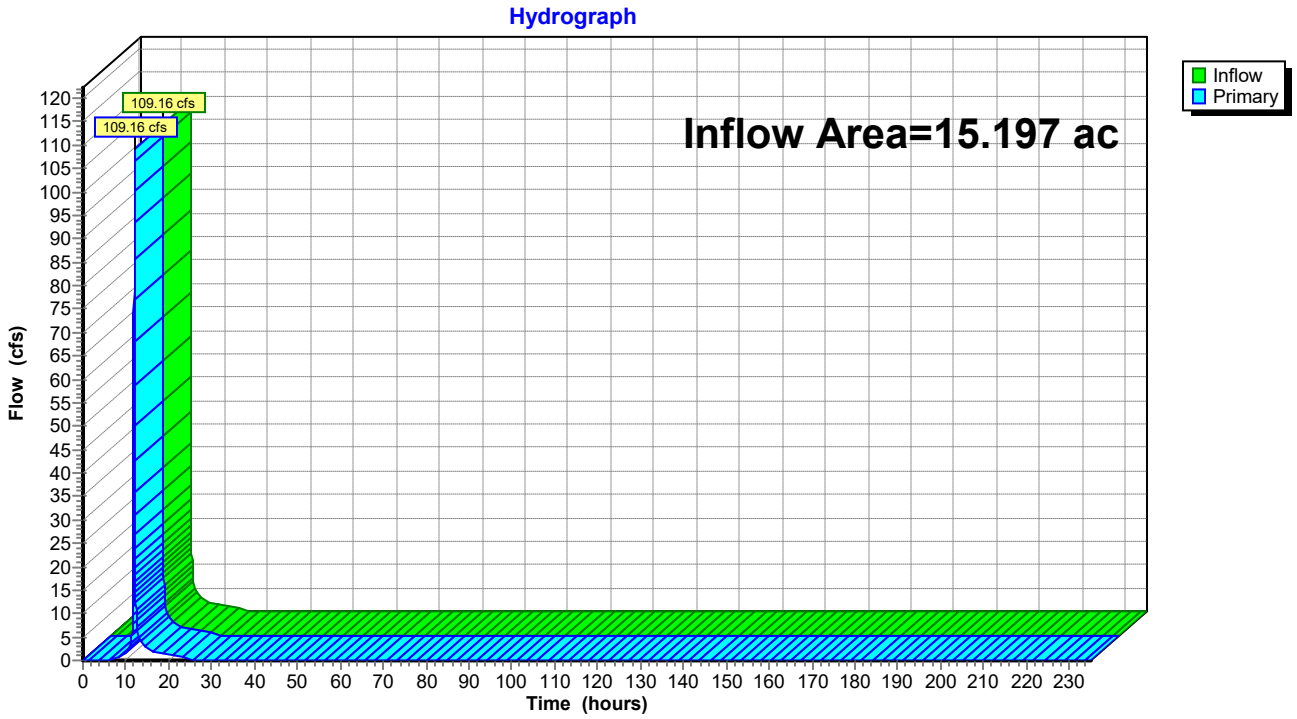


Summary for Link 58L: PC 4B

Inflow Area = 15.197 ac, 16.87% Impervious, Inflow Depth = 4.04" for 25-YR event
Inflow = 109.16 cfs @ 11.96 hrs, Volume= 5.113 af
Primary = 109.16 cfs @ 11.96 hrs, Volume= 5.113 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 58L: PC 4B

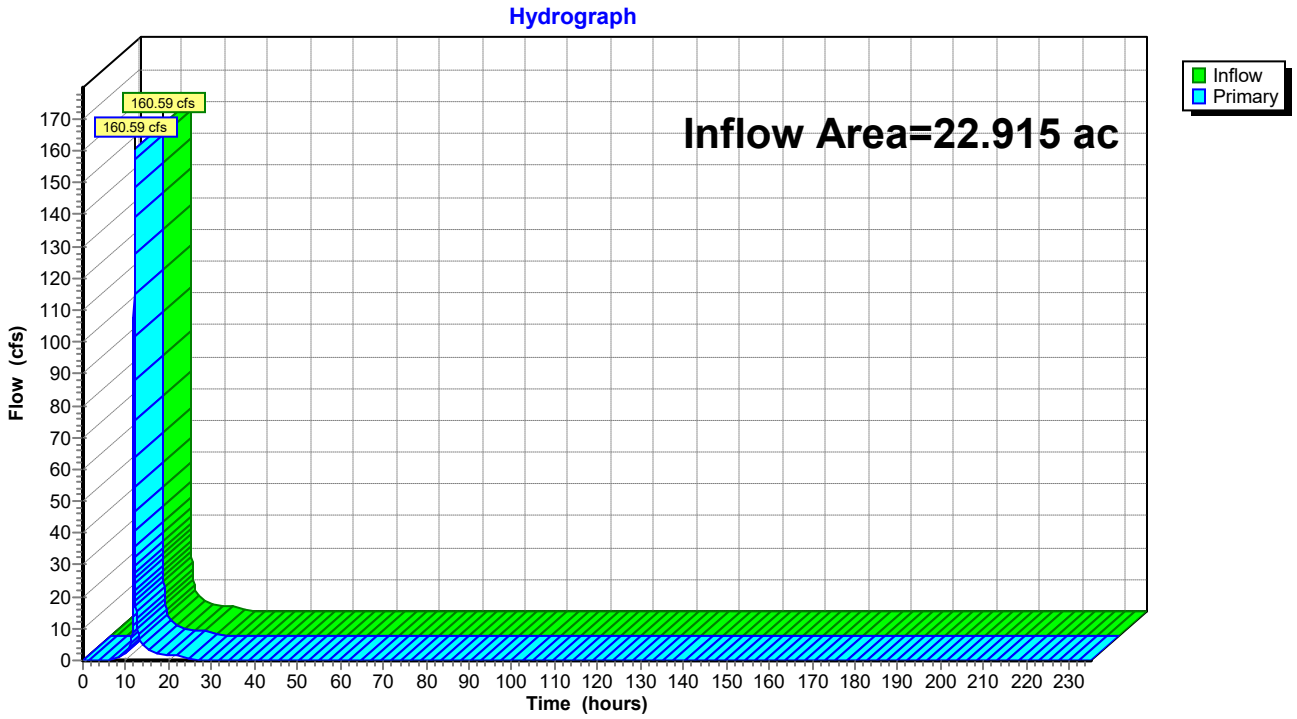


Summary for Link 59L: PC 4C

Inflow Area = 22.915 ac, 12.02% Impervious, Inflow Depth = 3.92" for 25-YR event
Inflow = 160.59 cfs @ 11.96 hrs, Volume= 7.487 af
Primary = 160.59 cfs @ 11.96 hrs, Volume= 7.487 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 59L: PC 4C

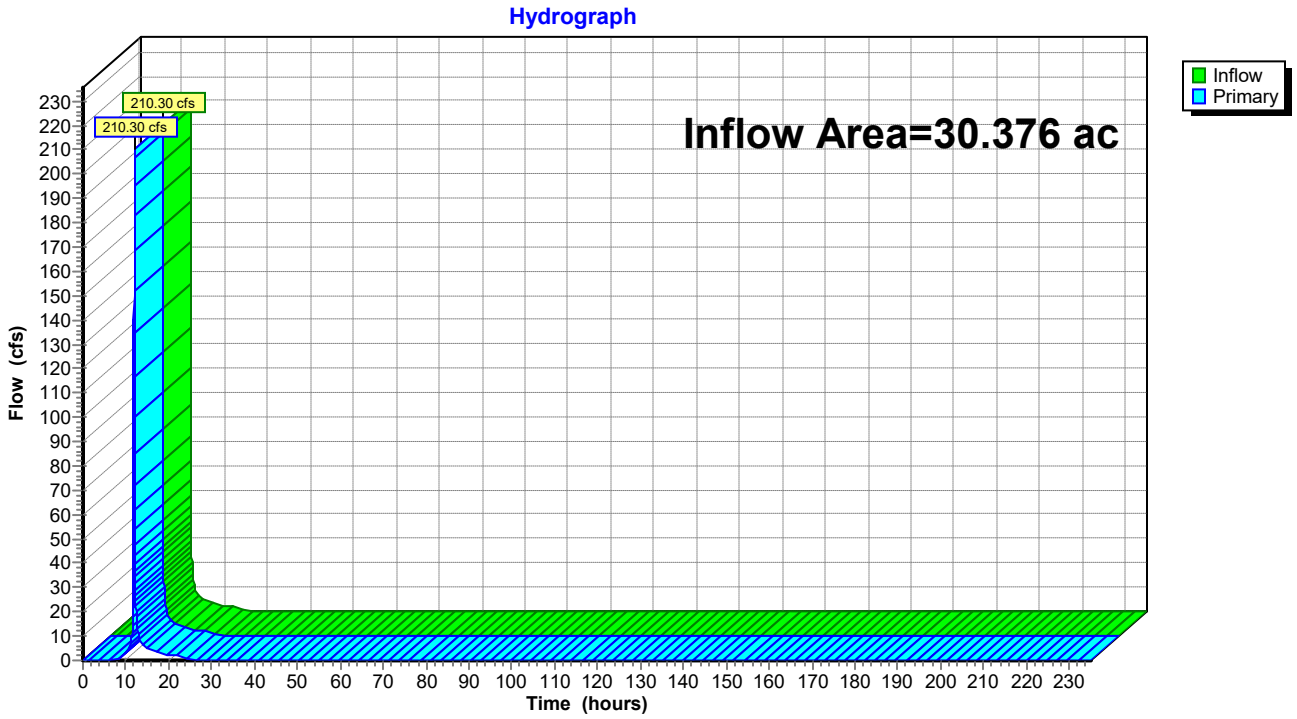


Summary for Link 60L: PC 4D

Inflow Area = 30.376 ac, 9.67% Impervious, Inflow Depth = 3.86" for 25-YR event
Inflow = 210.30 cfs @ 11.96 hrs, Volume= 9.782 af
Primary = 210.30 cfs @ 11.96 hrs, Volume= 9.782 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 60L: PC 4D

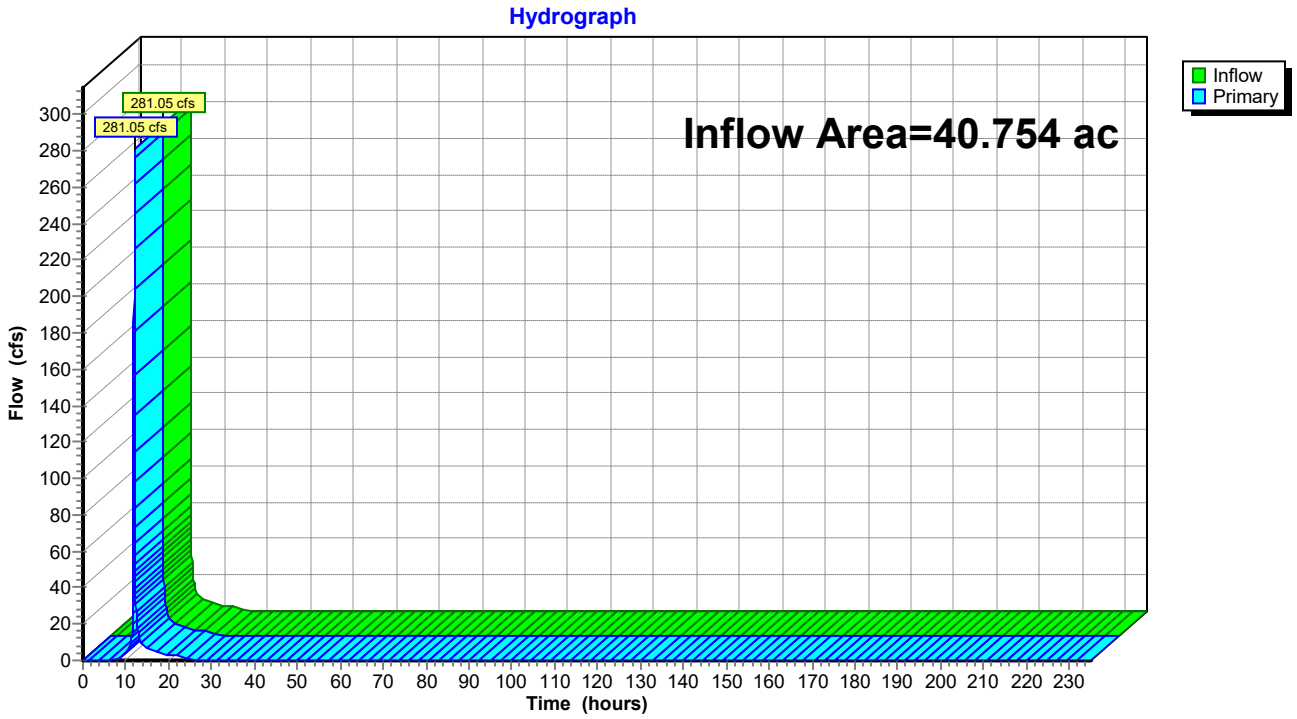


Summary for Link 61L: PC 4E

Inflow Area = 40.754 ac, 8.45% Impervious, Inflow Depth = 3.85" for 25-YR event
Inflow = 281.05 cfs @ 11.96 hrs, Volume= 13.062 af
Primary = 281.05 cfs @ 11.96 hrs, Volume= 13.062 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 61L: PC 4E

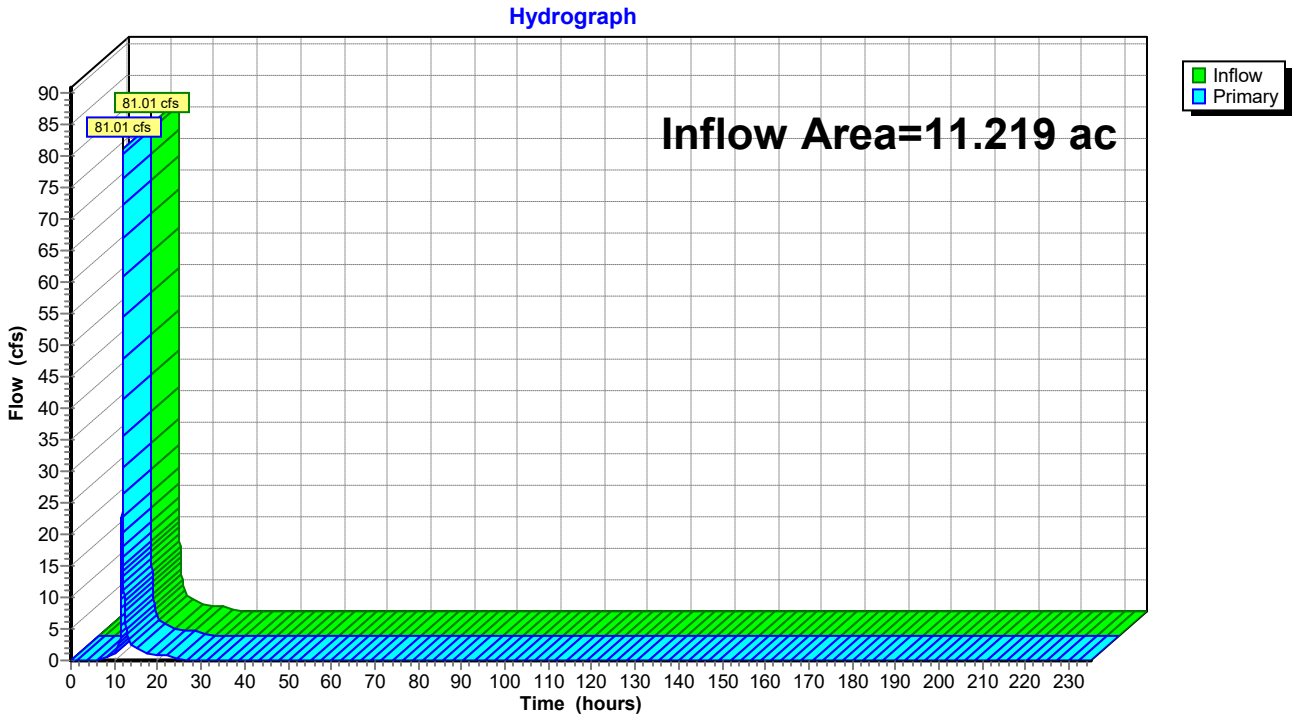


Summary for Link 62L: PC 5

Inflow Area = 11.219 ac, 21.53% Impervious, Inflow Depth = 4.10" for 25-YR event
Inflow = 81.01 cfs @ 11.97 hrs, Volume= 3.836 af
Primary = 81.01 cfs @ 11.97 hrs, Volume= 3.836 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 62L: PC 5

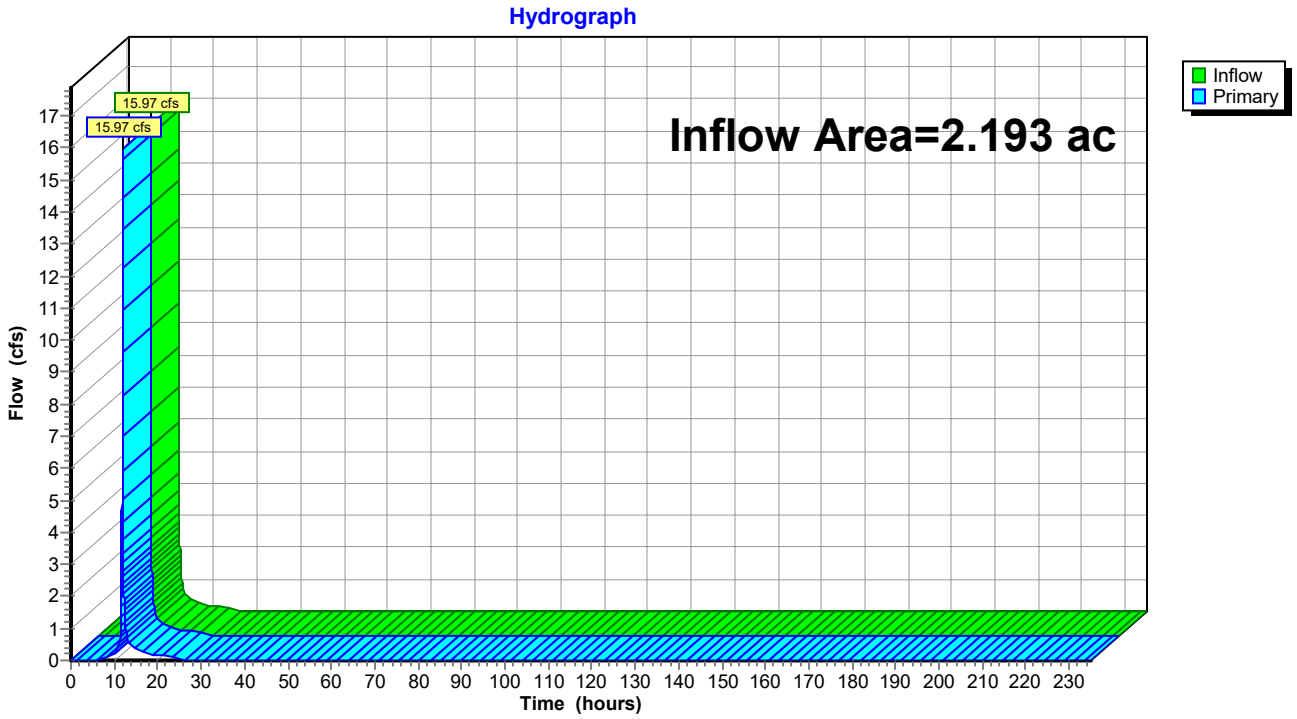


Summary for Link 63L: PC 3A

Inflow Area = 2.193 ac, 21.86% Impervious, Inflow Depth = 4.10" for 25-YR event
Inflow = 15.97 cfs @ 11.96 hrs, Volume= 0.750 af
Primary = 15.97 cfs @ 11.96 hrs, Volume= 0.750 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 63L: PC 3A

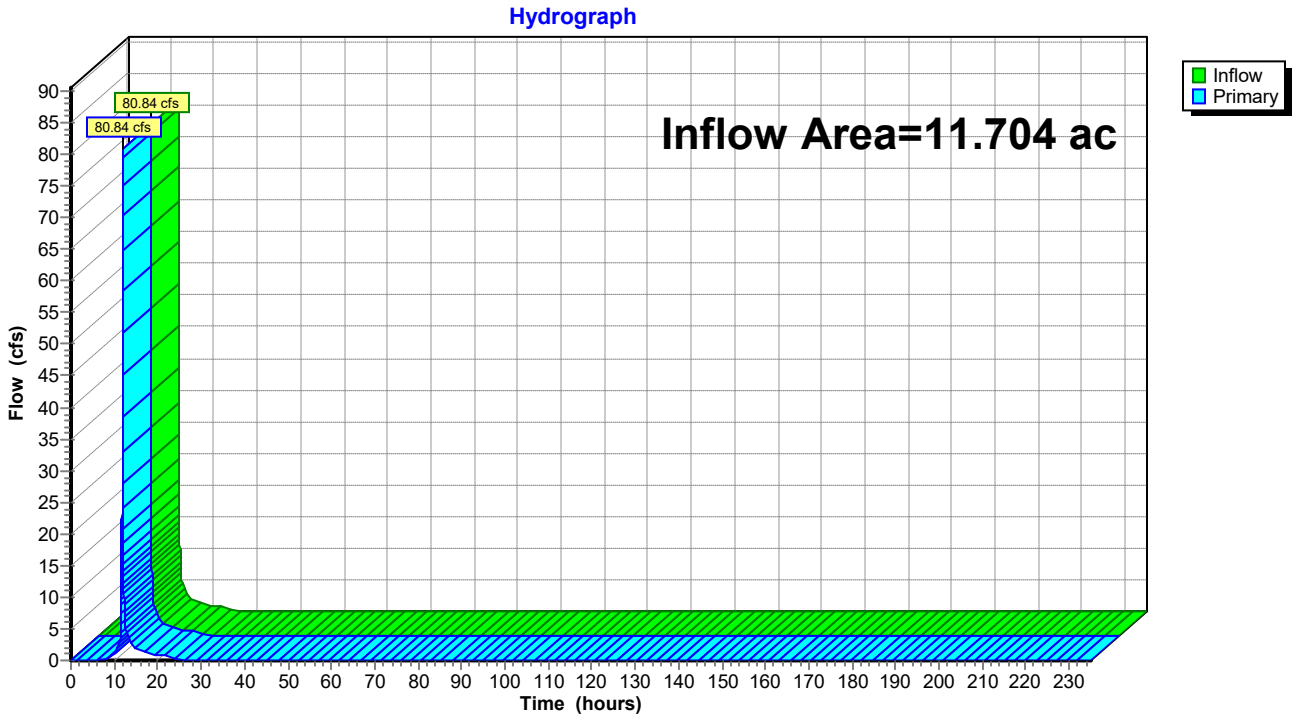


Summary for Link 64L: PC 3B

Inflow Area = 11.704 ac, 8.29% Impervious, Inflow Depth = 3.85" for 25-YR event
Inflow = 80.84 cfs @ 11.96 hrs, Volume= 3.756 af
Primary = 80.84 cfs @ 11.96 hrs, Volume= 3.756 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 64L: PC 3B

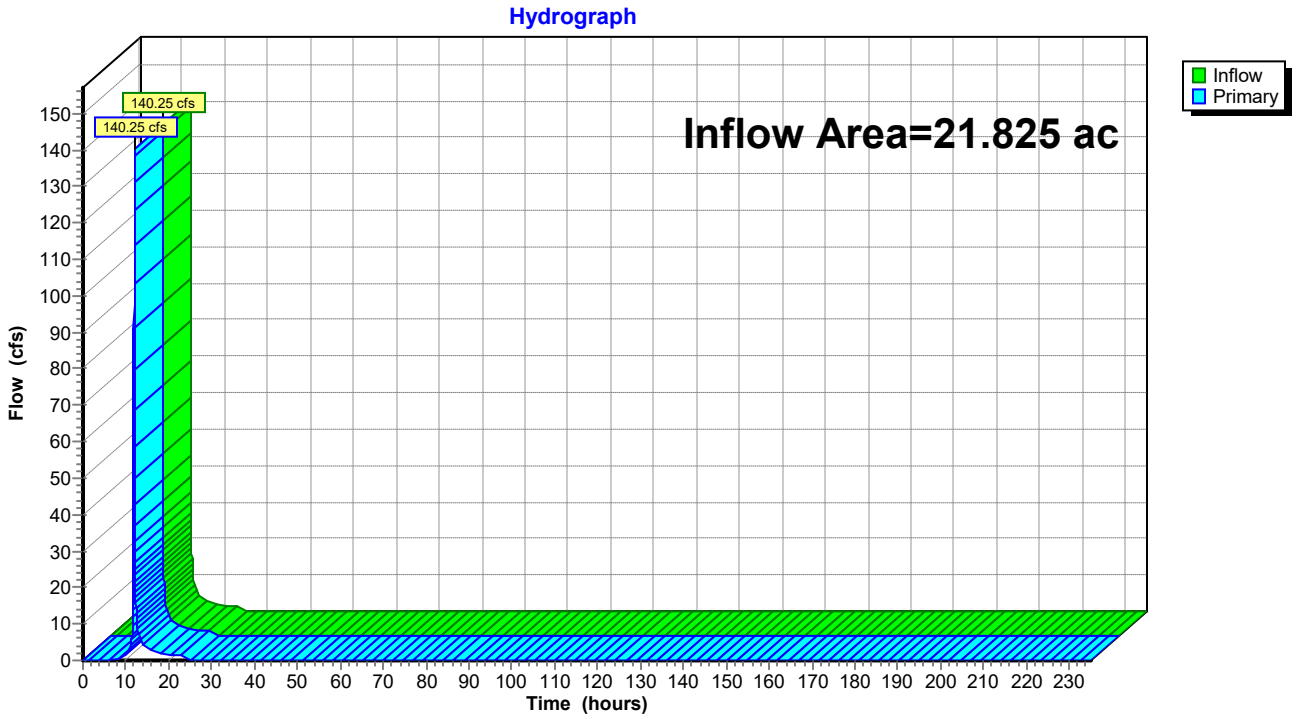


Summary for Link 65L: PC 3C

Inflow Area = 21.825 ac, 6.90% Impervious, Inflow Depth = 3.55" for 25-YR event
Inflow = 140.25 cfs @ 11.96 hrs, Volume= 6.452 af
Primary = 140.25 cfs @ 11.96 hrs, Volume= 6.452 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 65L: PC 3C

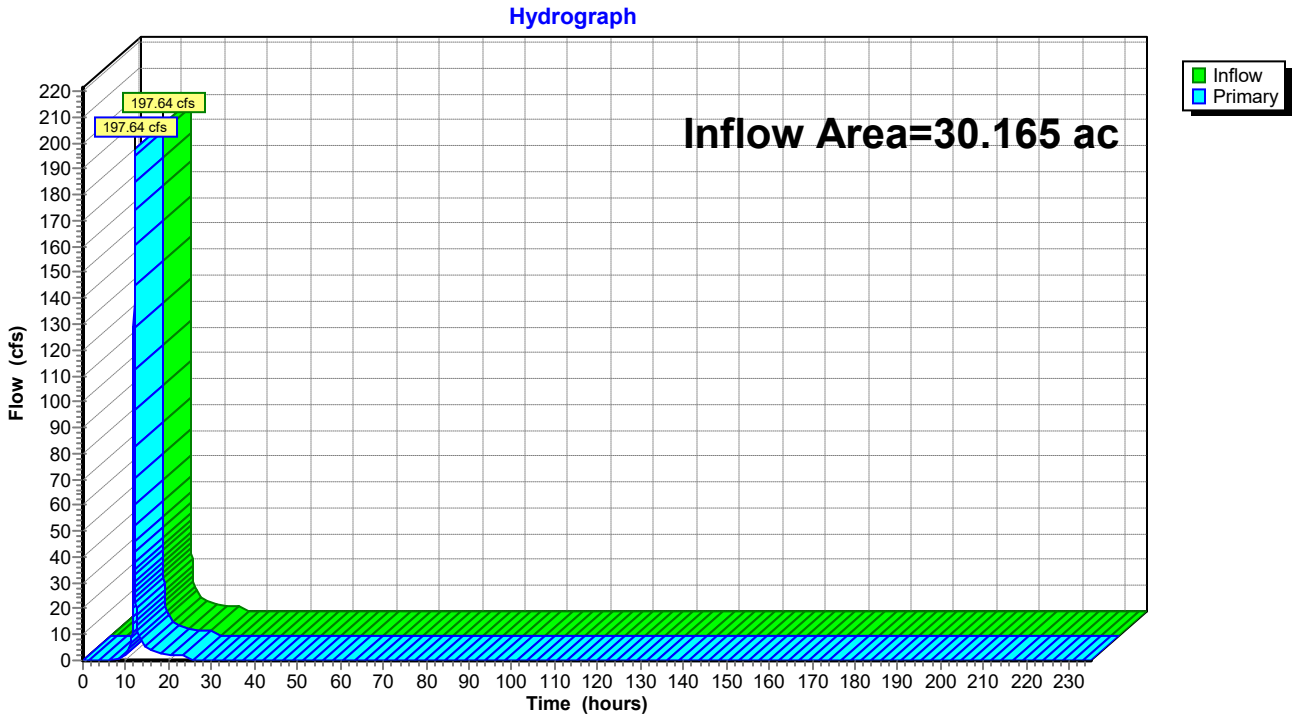


Summary for Link 66L: PC 3D

Inflow Area = 30.165 ac, 8.33% Impervious, Inflow Depth = 3.63" for 25-YR event
Inflow = 197.64 cfs @ 11.96 hrs, Volume= 9.120 af
Primary = 197.64 cfs @ 11.96 hrs, Volume= 9.120 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 66L: PC 3D

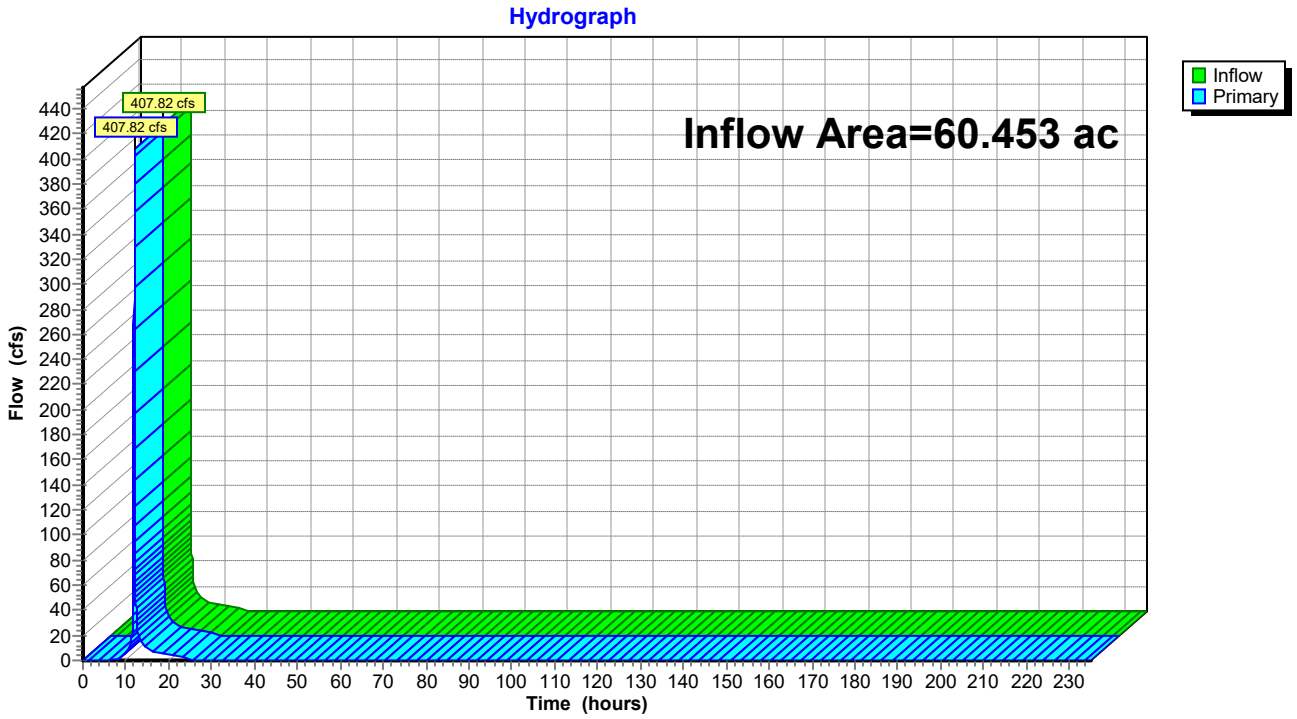


Summary for Link 67L: CROSS PIPE

Inflow Area = 60.453 ac, 10.64% Impervious, Inflow Depth = 3.76" for 25-YR event
Inflow = 407.82 cfs @ 11.96 hrs, Volume= 18.930 af
Primary = 407.82 cfs @ 11.96 hrs, Volume= 18.930 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 67L: CROSS PIPE

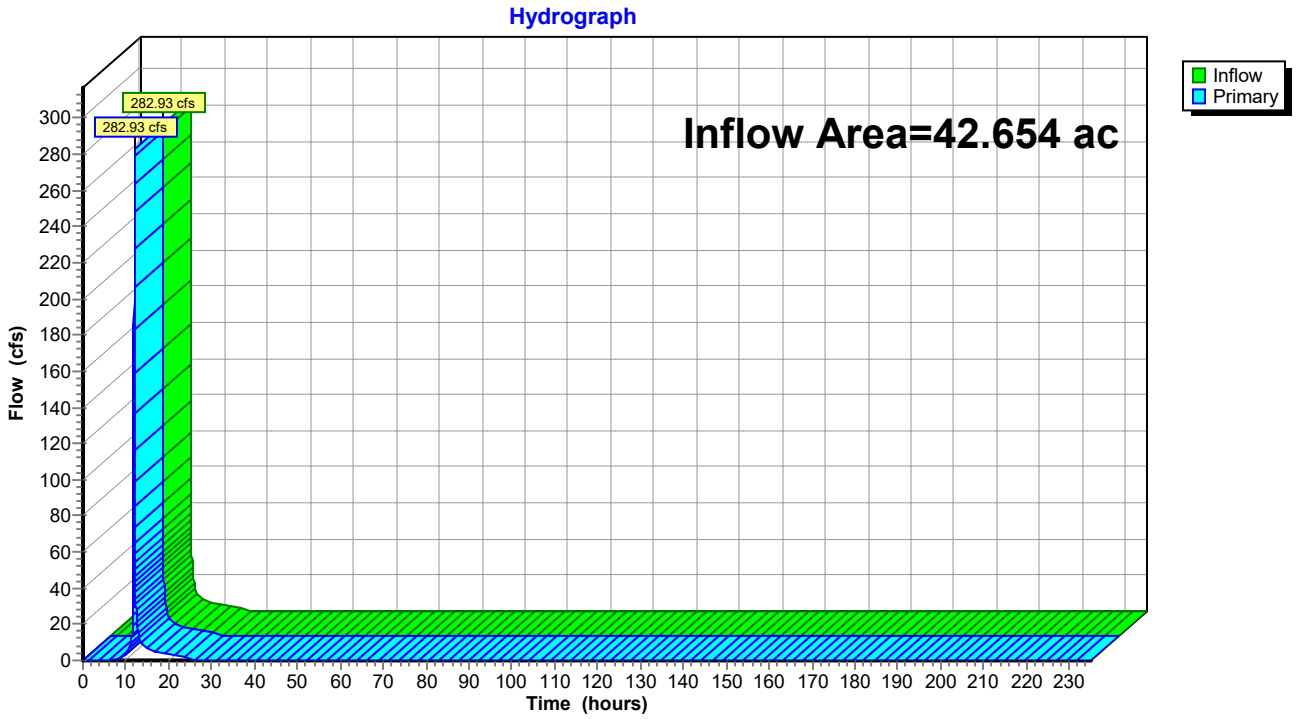


Summary for Link 68L: PC 3E

Inflow Area = 42.654 ac, 9.42% Impervious, Inflow Depth = 3.68" for 25-YR event
Inflow = 282.93 cfs @ 11.96 hrs, Volume= 13.070 af
Primary = 282.93 cfs @ 11.96 hrs, Volume= 13.070 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 68L: PC 3E

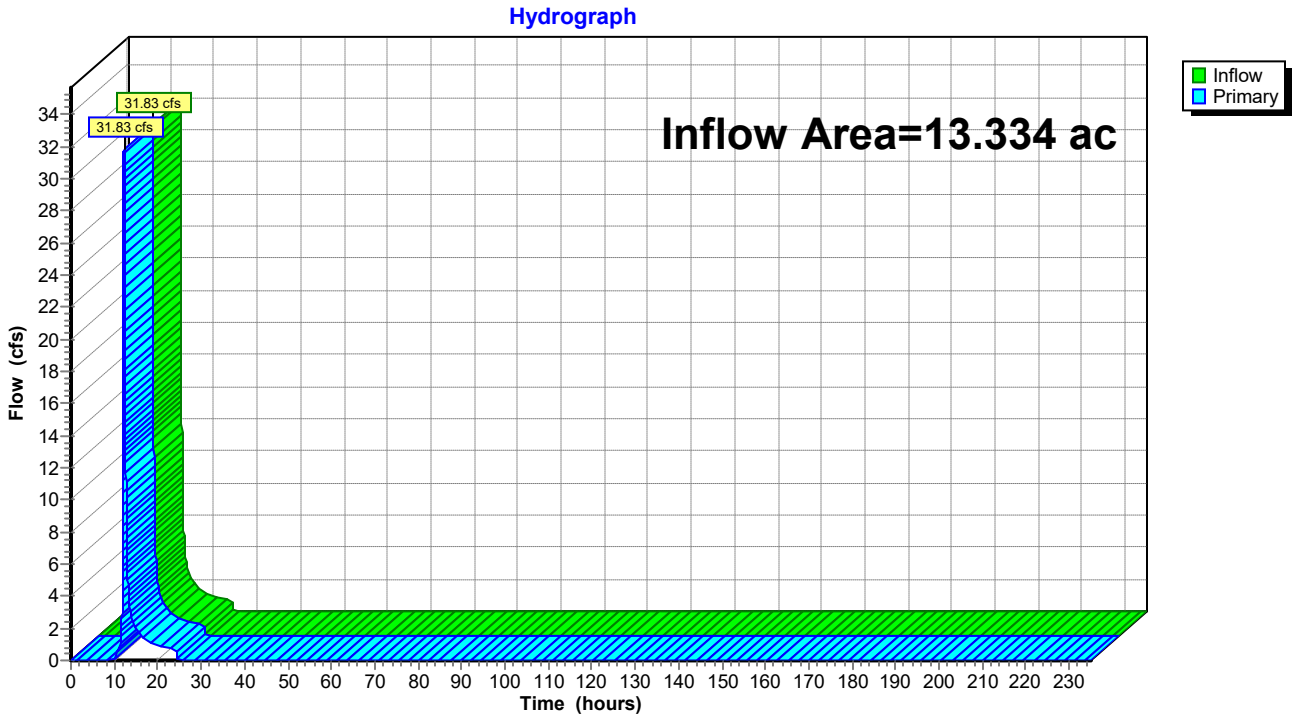


Summary for Link 86L: PC 2

Inflow Area = 13.334 ac, 0.00% Impervious, Inflow Depth = 2.73" for 25-YR event
Inflow = 31.83 cfs @ 12.24 hrs, Volume= 3.029 af
Primary = 31.83 cfs @ 12.24 hrs, Volume= 3.029 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 86L: PC 2

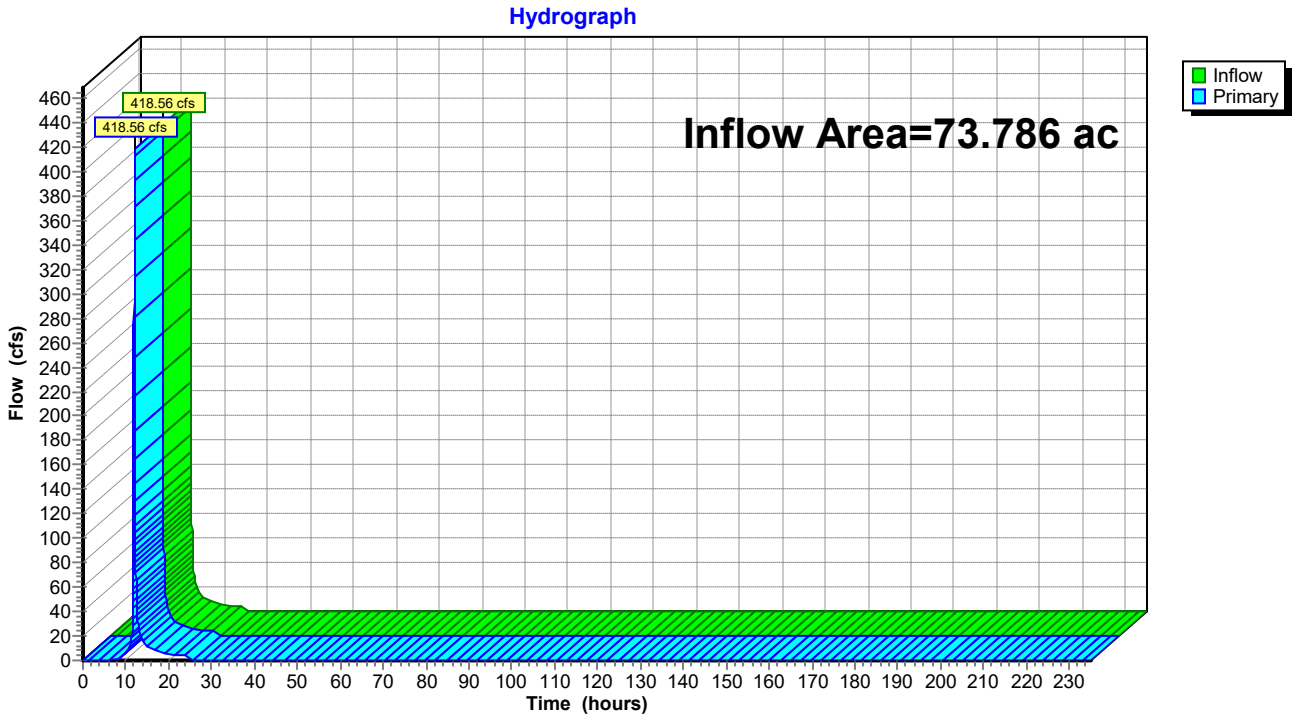


Summary for Link 87L: TO BASIN 1

Inflow Area = 73.786 ac, 8.72% Impervious, Inflow Depth = 3.57" for 25-YR event
Inflow = 418.56 cfs @ 11.96 hrs, Volume= 21.959 af
Primary = 418.56 cfs @ 11.96 hrs, Volume= 21.959 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

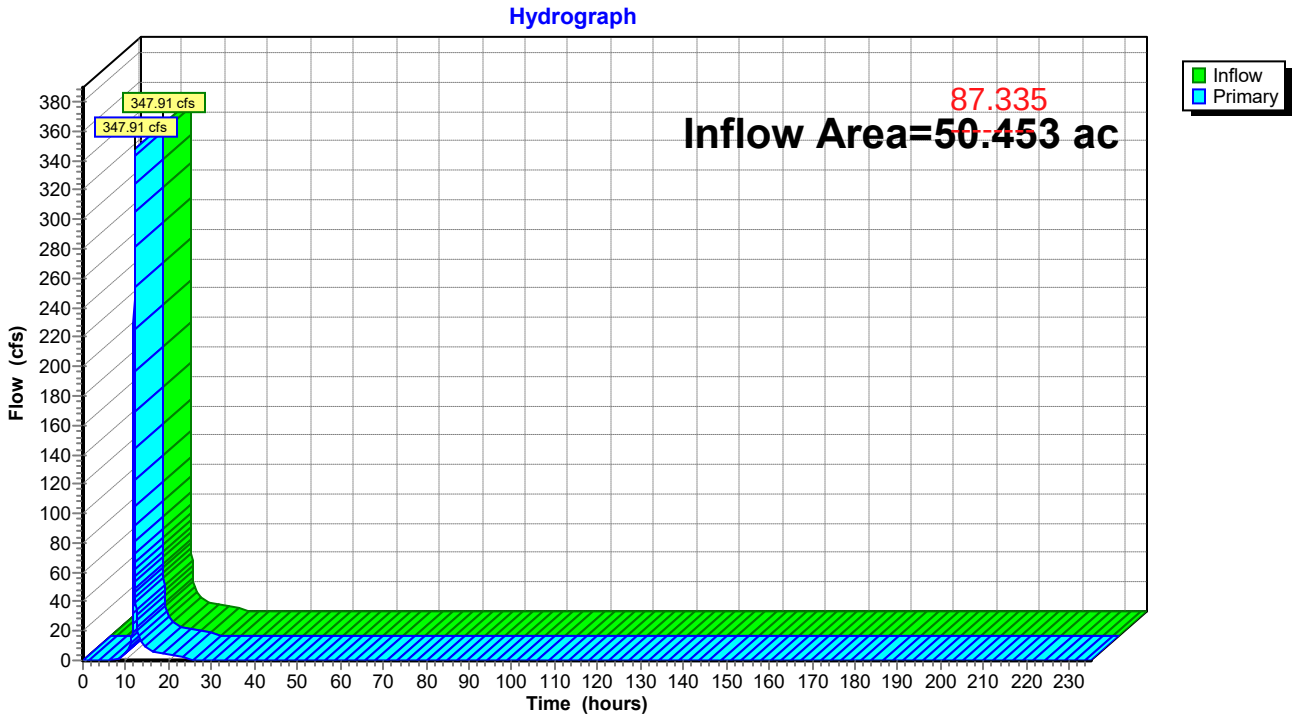
Link 87L: TO BASIN 1



Summary for Link 88L: PC 4F

Inflow Area = ~~50.453~~ 87.335 ac, 9.47% Impervious, Inflow Depth = 3.85" for 25-YR event
Inflow = ~~347.91~~ 391.91 cfs @ 11.96 hrs, Volume= ~~16.177~~ 20.390 af
Primary = ~~347.91~~ 391.91 cfs @ 11.96 hrs, Volume= ~~16.177~~ 20.390 af, Atten= 0%, Lag= 0.0 min
Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 88L: PC 4F



Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 47S: DC-1 AT SWALE Runoff Area=8.371 ac 21.28% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=94.79 cfs 4.587 af

Subcatchment 48S: DC-2 AT SWALE Runoff Area=7.779 ac 11.04% Impervious Runoff Depth=6.34"
Tc=5.0 min CN=82 Runoff=85.88 cfs 4.107 af

Subcatchment 49S: DC-3 AT SWALE Runoff Area=10.378 ac 4.90% Impervious Runoff Depth=6.22"
Tc=5.0 min CN=81 Runoff=113.02 cfs 5.375 af

Subcatchment 50S: DC-4 AT SWALE Runoff Area=325,003 sf 2.45% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=80.10 cfs 3.790 af

Subcatchment 51S: DC-5 AT SWALE Runoff Area=336,190 sf 2.47% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=82.86 cfs 3.920 af

Subcatchment 52S: DC-6 AT SWALE Runoff Area=9.605 ac 13.94% Impervious Runoff Depth=6.46"
Tc=5.0 min CN=83 Runoff=107.42 cfs 5.167 af

Subcatchment 53S: DC-7 AT SWALE Runoff Area=414,298 sf 5.16% Impervious Runoff Depth=6.22"
Tc=5.0 min CN=81 Runoff=103.58 cfs 4.926 af

Subcatchment 54S: DC-8 AT SWALE Runoff Area=440,848 sf 5.29% Impervious Runoff Depth=5.50"
Tc=5.0 min CN=75 Runoff=100.17 cfs 4.634 af

Subcatchment 55S: DC-9 AT SWALE Runoff Area=294,805 sf 9.96% Impervious Runoff Depth=6.34"
Tc=5.0 min CN=82 Runoff=74.71 cfs 3.573 af

Subcatchment 56S: DC-10 AT SWALE Runoff Area=8.427 ac 8.39% Impervious Runoff Depth=6.34"
Tc=5.0 min CN=82 Runoff=93.03 cfs 4.449 af

Subcatchment 69S: DA to PC 4A Runoff Area=243,601 sf 21.90% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=63.32 cfs 3.065 af

Subcatchment 70S: PC 3A Runoff Area=95,531 sf 21.86% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=24.83 cfs 1.202 af

Subcatchment 93S: CAP ROAD to DC2 Runoff Area=83,627 sf 24.59% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=20.61 cfs 0.975 af

Subcatchment 94S: AREA TO SWALE 2 Runoff Area=580,809 sf 0.00% Impervious Runoff Depth=4.90"
Flow Length=4,507' Tc=29.0 min CN=70 Runoff=57.96 cfs 5.441 af

Subcatchment 95S: Upslope Area of PC3D Runoff Area=1.573 ac 21.17% Impervious Runoff Depth=5.98"
Flow Length=80' Slope=0.3300 '/' Tc=5.0 min CN=79 Runoff=16.64 cfs 0.783 af

Subcatchment 96S: Upslope Area of PC3E Runoff Area=4.062 ac 19.62% Impervious Runoff Depth=5.98"
Flow Length=80' Slope=0.3300 '/' Tc=5.0 min CN=79 Runoff=42.96 cfs 2.023 af

Subcatchment 106S: AREA TO DS-10 Runoff Area=286,585 sf 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=70.63 cfs 3.342 af

Subcatchment 107S: DA TO PC 5 Runoff Area=124,070 sf 22.29% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=32.25 cfs 1.561 af

Reach 89R: PC 4G Avg. Depth=2.07' Max Vel=13.72 fps Inflow=552.08 cfs 26.400 af
n=0.015 L=1,000.0' S=0.0100 '/' Capacity=1,809.44 cfs Outflow=542.99 cfs 26.400 af

Reach 95R: DC-1 Avg. Depth=0.52' Max Vel=17.11 fps Inflow=94.79 cfs 4.587 af
n=0.025 L=800.0' S=0.2325 '/' Capacity=292.29 cfs Outflow=94.16 cfs 4.587 af

Reach 96R: DC-2 Avg. Depth=0.52' Max Vel=19.10 fps Inflow=106.49 cfs 5.082 af
n=0.025 L=600.0' S=0.2867 '/' Capacity=324.56 cfs Outflow=106.14 cfs 5.082 af

Reach 97R: DC-3 Avg. Depth=0.54' Max Vel=19.56 fps Inflow=113.02 cfs 5.375 af
n=0.025 L=465.0' S=0.2882 '/' Capacity=325.41 cfs Outflow=112.80 cfs 5.375 af

Reach 98R: DC-4 Avg. Depth=0.44' Max Vel=17.32 fps Inflow=80.10 cfs 3.790 af
n=0.025 L=415.0' S=0.2892 '/' Capacity=325.96 cfs Outflow=79.94 cfs 3.790 af

Reach 99R: DC-5 Avg. Depth=0.45' Max Vel=17.64 fps Inflow=82.86 cfs 3.920 af
n=0.025 L=390.0' S=0.2949 '/' Capacity=329.17 cfs Outflow=82.72 cfs 3.920 af

Reach 100R: DC-6 Avg. Depth=0.53' Max Vel=18.85 fps Inflow=107.42 cfs 5.167 af
n=0.025 L=280.0' S=0.2714 '/' Capacity=315.81 cfs Outflow=107.34 cfs 5.167 af

Reach 101R: DC-7 Avg. Depth=0.52' Max Vel=18.72 fps Inflow=103.58 cfs 4.926 af
n=0.025 L=390.0' S=0.2769 '/' Capacity=318.99 cfs Outflow=103.42 cfs 4.926 af

Reach 102R: DC-8 Avg. Depth=0.51' Max Vel=18.49 fps Inflow=100.17 cfs 4.634 af
n=0.025 L=430.0' S=0.2767 '/' Capacity=318.89 cfs Outflow=99.97 cfs 4.634 af

Reach 103R: DC-9 Avg. Depth=0.43' Max Vel=16.54 fps Inflow=74.71 cfs 3.573 af
n=0.025 L=450.0' S=0.2711 '/' Capacity=315.63 cfs Outflow=74.53 cfs 3.573 af

Reach 104R: DC-10 Avg. Depth=0.48' Max Vel=18.25 fps Inflow=93.03 cfs 4.449 af
n=0.025 L=320.0' S=0.2875 '/' Capacity=325.03 cfs Outflow=92.93 cfs 4.449 af

Link 57L: PC 4A Inflow=63.32 cfs 3.065 af
Primary=63.32 cfs 3.065 af

Link 58L: PC 4B Inflow=170.64 cfs 8.232 af
Primary=170.64 cfs 8.232 af

Link 59L: PC 4C Inflow=253.31 cfs 12.152 af
Primary=253.31 cfs 12.152 af

Link 60L: PC 4D Inflow=333.21 cfs 15.942 af
Primary=333.21 cfs 15.942 af

Link 61L: PC 4E
Inflow=445.99 cfs 21.317 af
Primary=445.99 cfs 21.317 af

Link 62L: PC 5
Inflow=126.24 cfs 6.148 af
Primary=126.24 cfs 6.148 af

Link 63L: PC 3A
Inflow=24.83 cfs 1.202 af
Primary=24.83 cfs 1.202 af

Link 64L: PC 3B
Inflow=128.22 cfs 6.128 af
Primary=128.22 cfs 6.128 af

Link 65L: PC 3C
Inflow=228.15 cfs 10.762 af
Primary=228.15 cfs 10.762 af

Link 66L: PC 3D
Inflow=319.29 cfs 15.119 af
Primary=319.29 cfs 15.119 af

Link 67L: CROSS PIPE
Inflow=651.89 cfs 31.081 af
Primary=651.89 cfs 31.081 af

Link 68L: PC 3E
Inflow=455.14 cfs 21.591 af
Primary=455.14 cfs 21.591 af

Link 86L: PC 2
Inflow=57.96 cfs 5.441 af
Primary=57.96 cfs 5.441 af

Link 87L: TO BASIN 1
Inflow=673.39 cfs 36.522 af
Primary=673.39 cfs 36.522 af

Link 88L: PC 4F
653.39 35.297
Inflow=~~552.08~~ cfs 26.400 af
Primary=~~552.08~~ cfs 26.400 af
653.39 35.297

Total Runoff Area = 124.239 ac Runoff Volume = 62.922 af Average Runoff Depth = 6.08"
90.98% Pervious = 113.030 ac 9.02% Impervious = 11.209 ac

Summary for Subcatchment 47S: DC-1 AT SWALE

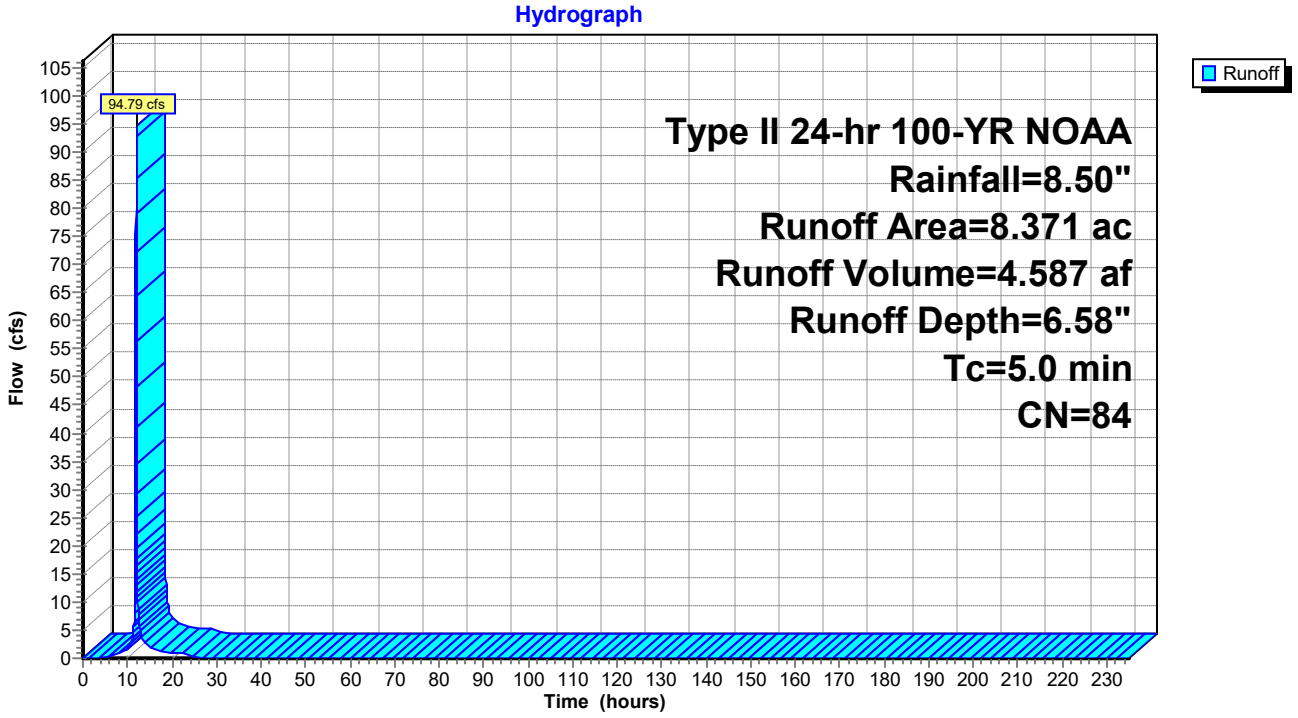
Runoff = 94.79 cfs @ 11.96 hrs, Volume= 4.587 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	1.242	98	PERIMETER ROAD
	6.590	80	>75% Grass cover, Good, HSG D
*	0.539	98	CAP ACCESS
	8.371	84	Weighted Average
	6.590		Pervious Area
	1.781		Impervious Area

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

Subcatchment 47S: DC-1 AT SWALE



Summary for Subcatchment 48S: DC-2 AT SWALE

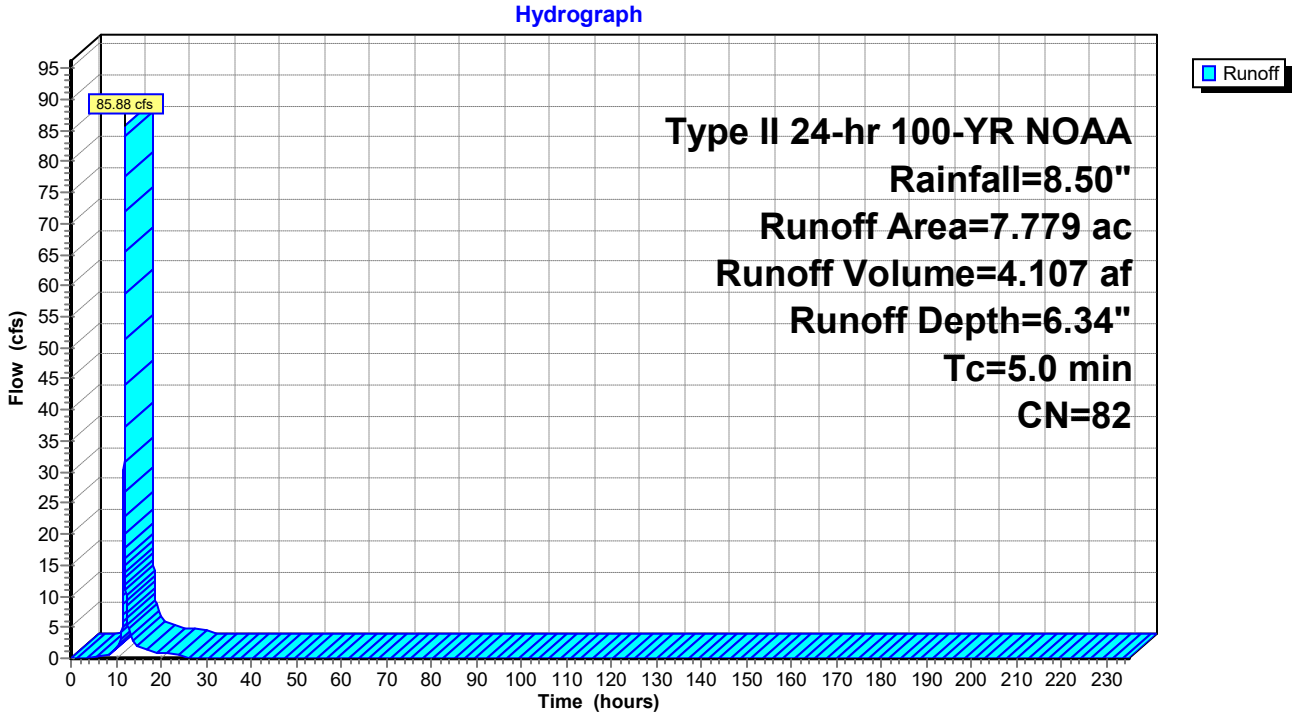
Runoff = 85.88 cfs @ 11.96 hrs, Volume= 4.107 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	0.634	98	PERIMETER ROAD
	6.920	80	>75% Grass cover, Good, HSG D
*	0.225	98	CAP ROAD
	7.779	82	Weighted Average
	6.920		Pervious Area
	0.859		Impervious Area

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

Subcatchment 48S: DC-2 AT SWALE



Summary for Subcatchment 49S: DC-3 AT SWALE

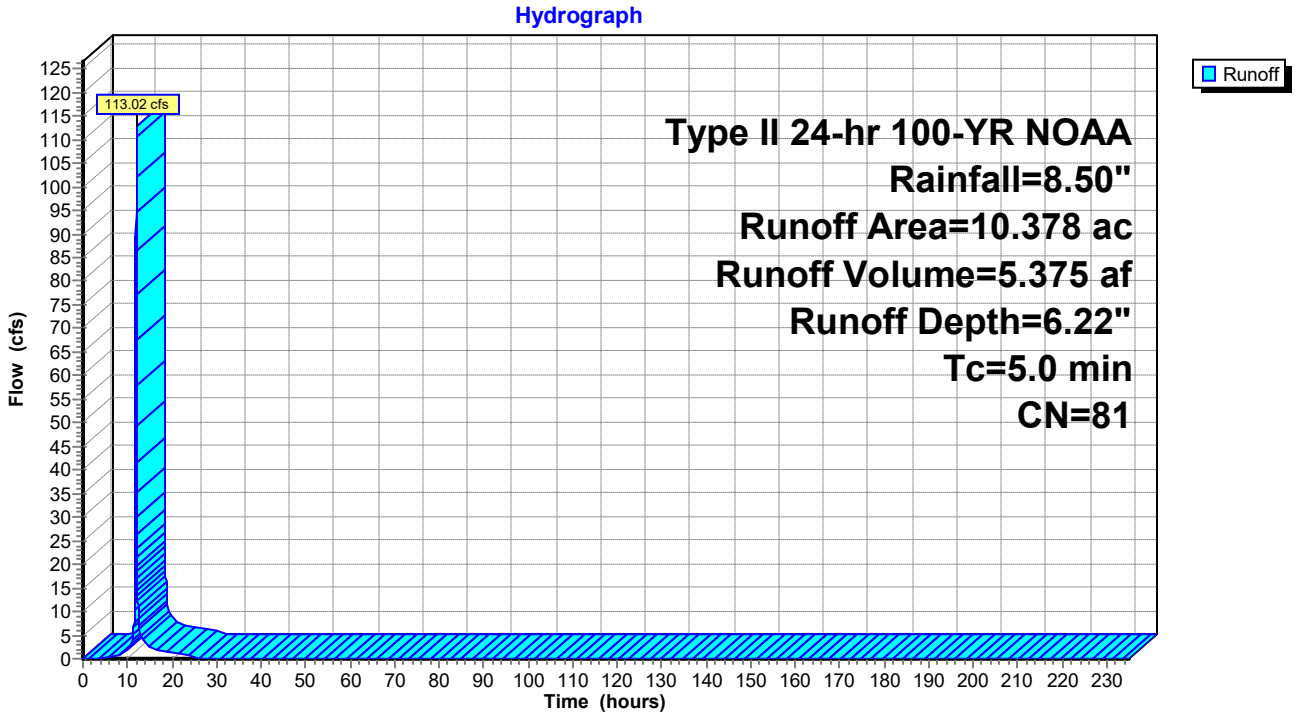
Runoff = 113.02 cfs @ 11.96 hrs, Volume= 5.375 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
0.509	98	Paved parking & roofs
9.869	80	>75% Grass cover, Good, HSG D
10.378	81	Weighted Average
9.869		Pervious Area
0.509		Impervious Area

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

Subcatchment 49S: DC-3 AT SWALE



Summary for Subcatchment 50S: DC-4 AT SWALE

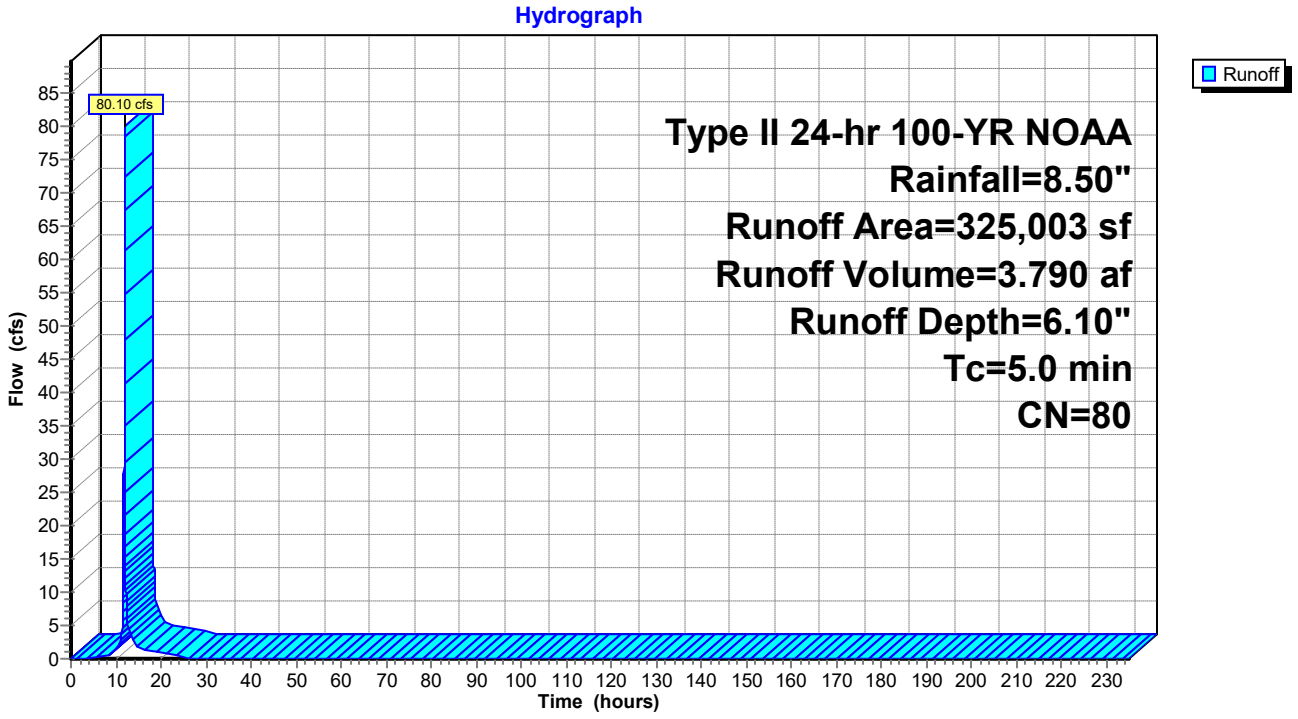
Runoff = 80.10 cfs @ 11.96 hrs, Volume= 3.790 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
7,956	98	Paved parking & roofs
317,047	80	>75% Grass cover, Good, HSG D
325,003	80	Weighted Average
317,047		Pervious Area
7,956		Impervious Area

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

Subcatchment 50S: DC-4 AT SWALE



Summary for Subcatchment 51S: DC-5 AT SWALE

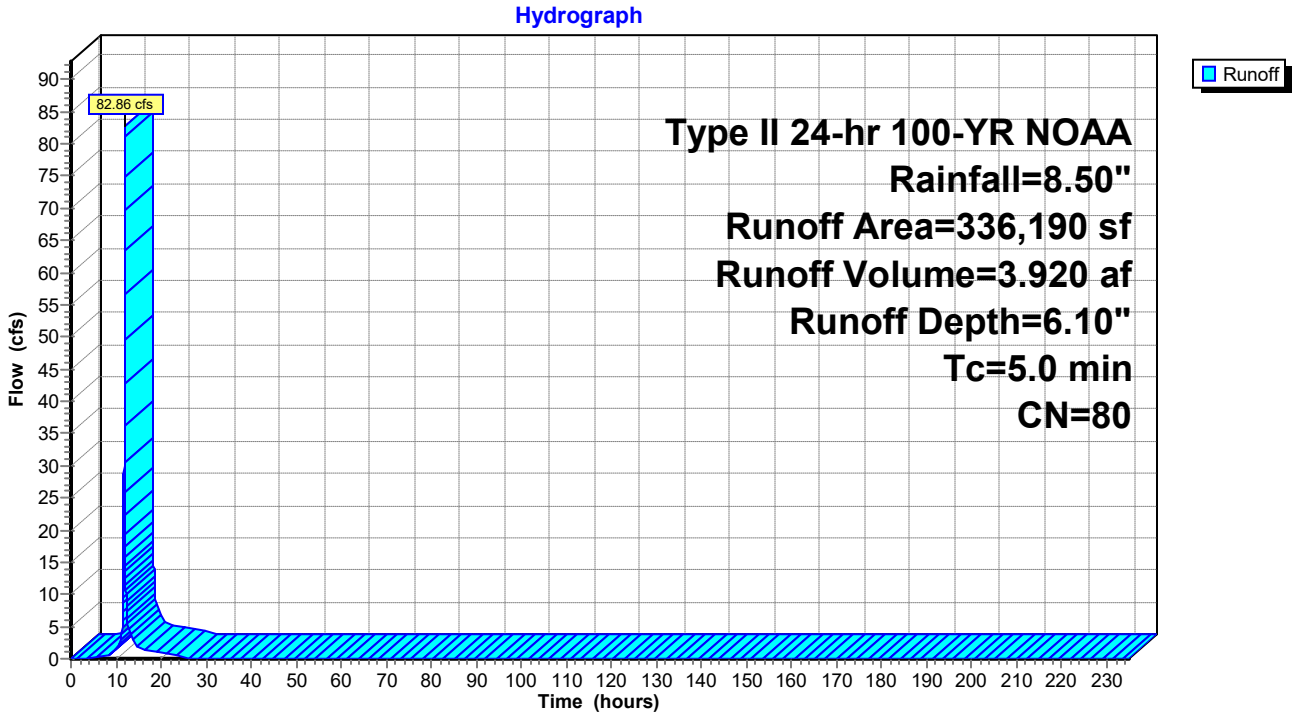
Runoff = 82.86 cfs @ 11.96 hrs, Volume= 3.920 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
8,293	98	Paved parking & roofs
327,897	80	>75% Grass cover, Good, HSG D
336,190	80	Weighted Average
327,897		Pervious Area
8,293		Impervious Area

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

Subcatchment 51S: DC-5 AT SWALE



Summary for Subcatchment 52S: DC-6 AT SWALE

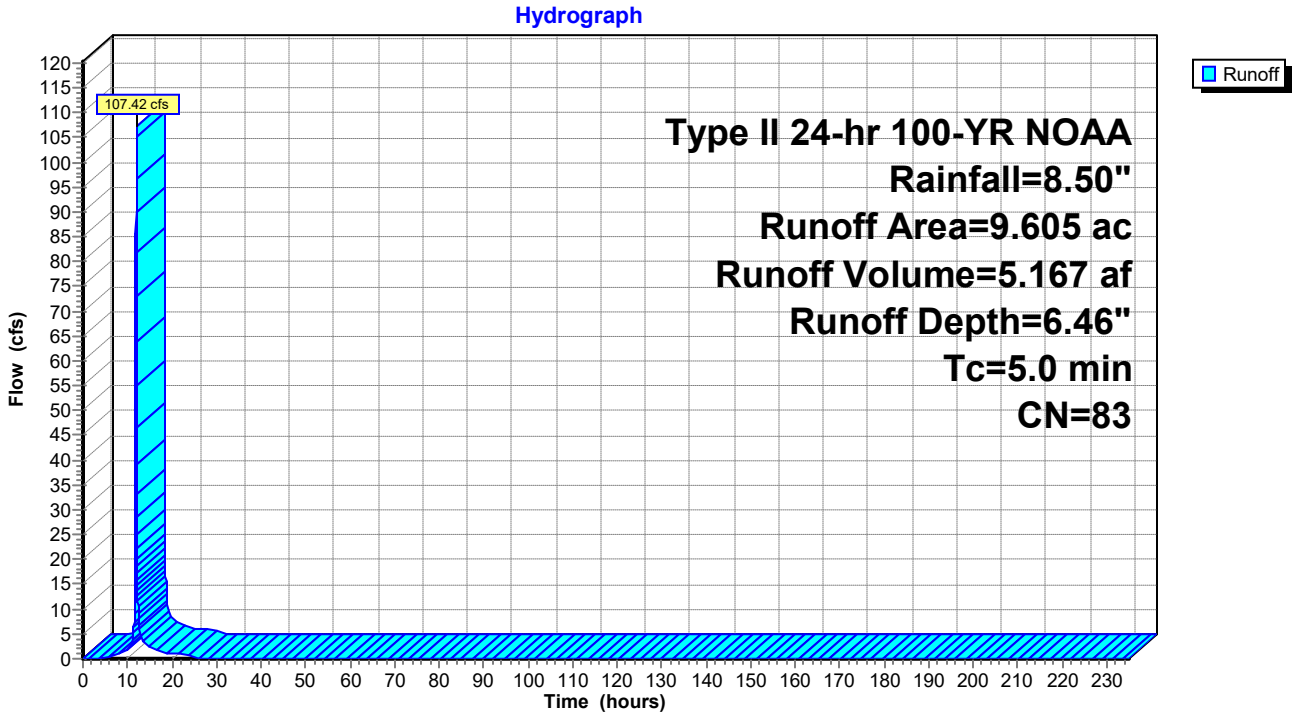
Runoff = 107.42 cfs @ 11.96 hrs, Volume= 5.167 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
1.339	98	Paved parking & roofs
8.266	80	>75% Grass cover, Good, HSG D
9.605	83	Weighted Average
8.266		Pervious Area
1.339		Impervious Area

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

Subcatchment 52S: DC-6 AT SWALE



Summary for Subcatchment 53S: DC-7 AT SWALE

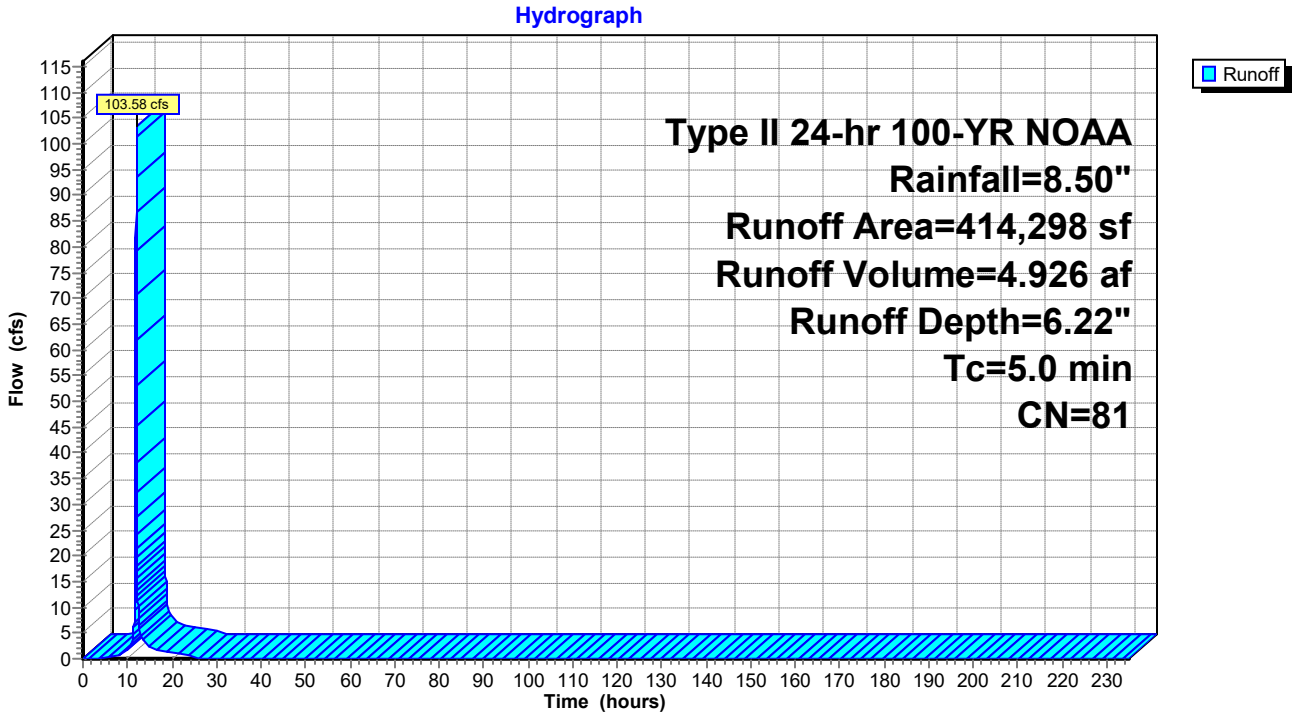
Runoff = 103.58 cfs @ 11.96 hrs, Volume= 4.926 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
21,376	98	Paved parking & roofs
392,922	80	>75% Grass cover, Good, HSG D
414,298	81	Weighted Average
392,922		Pervious Area
21,376		Impervious Area

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

Subcatchment 53S: DC-7 AT SWALE



Summary for Subcatchment 54S: DC-8 AT SWALE

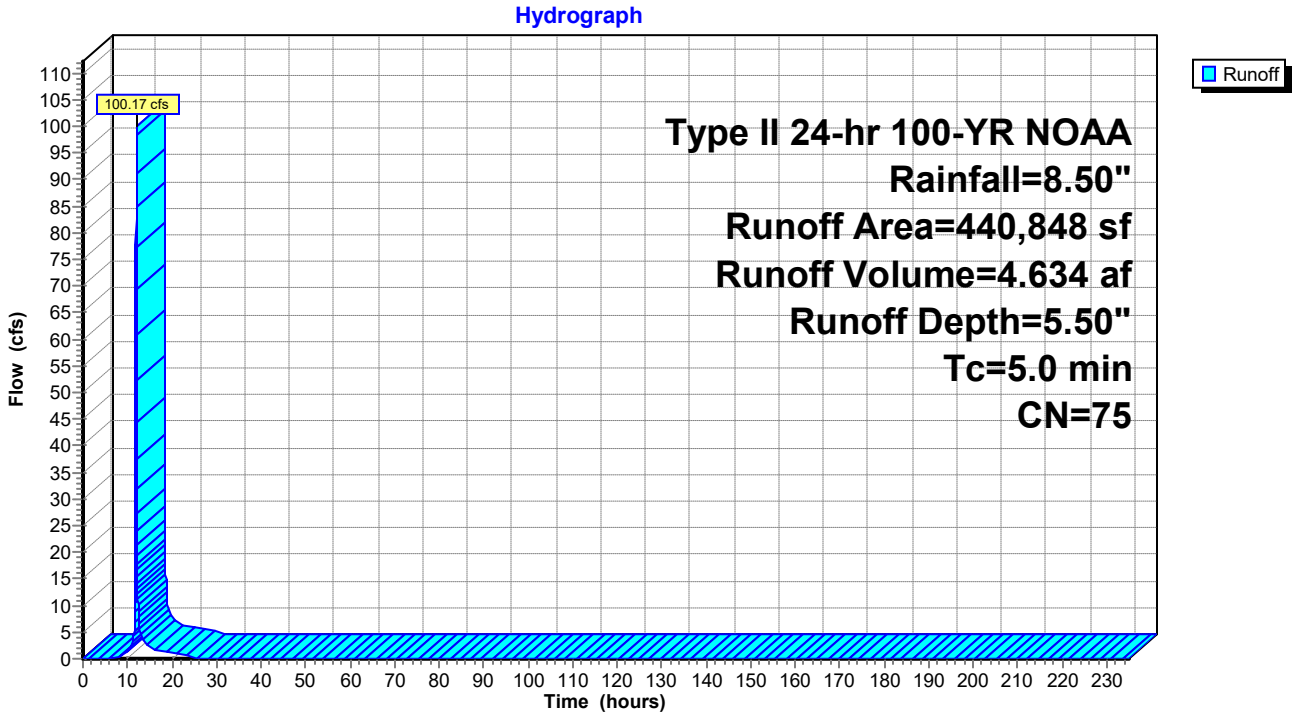
Runoff = 100.17 cfs @ 11.96 hrs, Volume= 4.634 af, Depth= 5.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
23,312	98	Paved parking & roofs
417,536	74	>75% Grass cover, Good, HSG C
440,848	75	Weighted Average
417,536		Pervious Area
23,312		Impervious Area

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

Subcatchment 54S: DC-8 AT SWALE



Summary for Subcatchment 55S: DC-9 AT SWALE

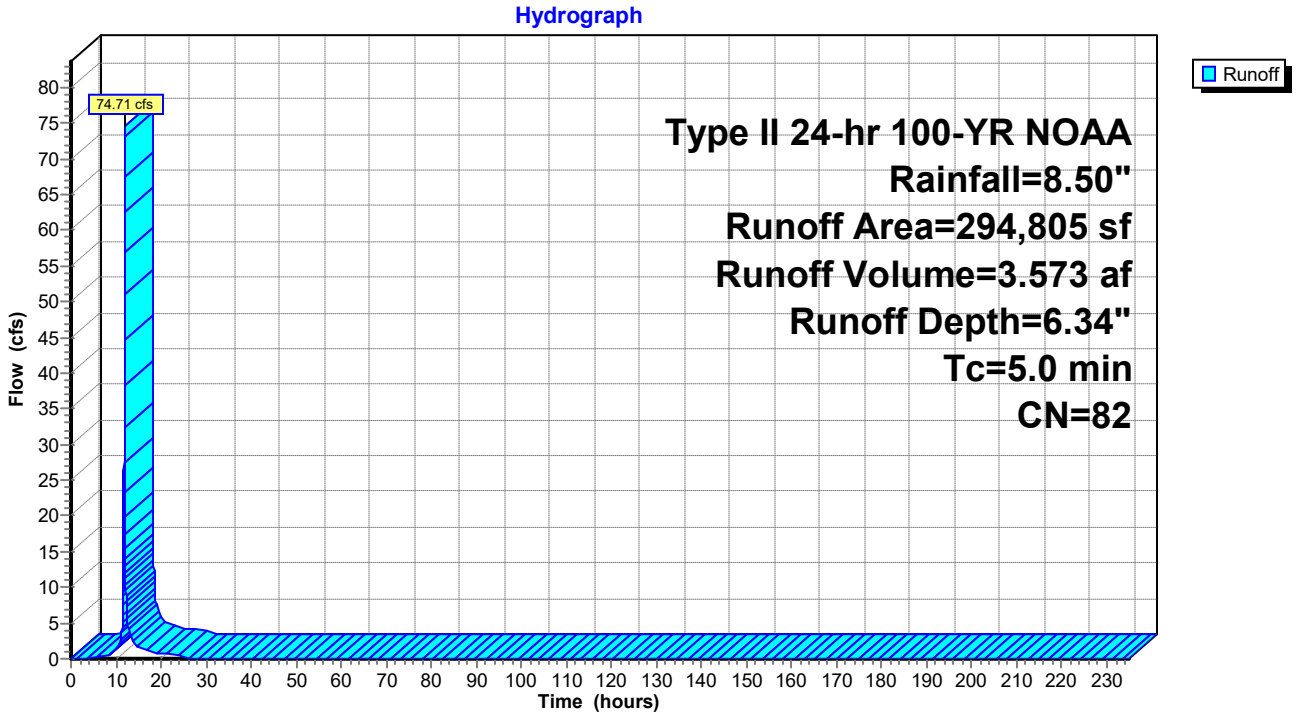
Runoff = 74.71 cfs @ 11.96 hrs, Volume= 3.573 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
29,366	98	Paved parking & roofs
265,439	80	>75% Grass cover, Good, HSG D
294,805	82	Weighted Average
265,439		Pervious Area
29,366		Impervious Area

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

Subcatchment 55S: DC-9 AT SWALE



Summary for Subcatchment 56S: DC-10 AT SWALE

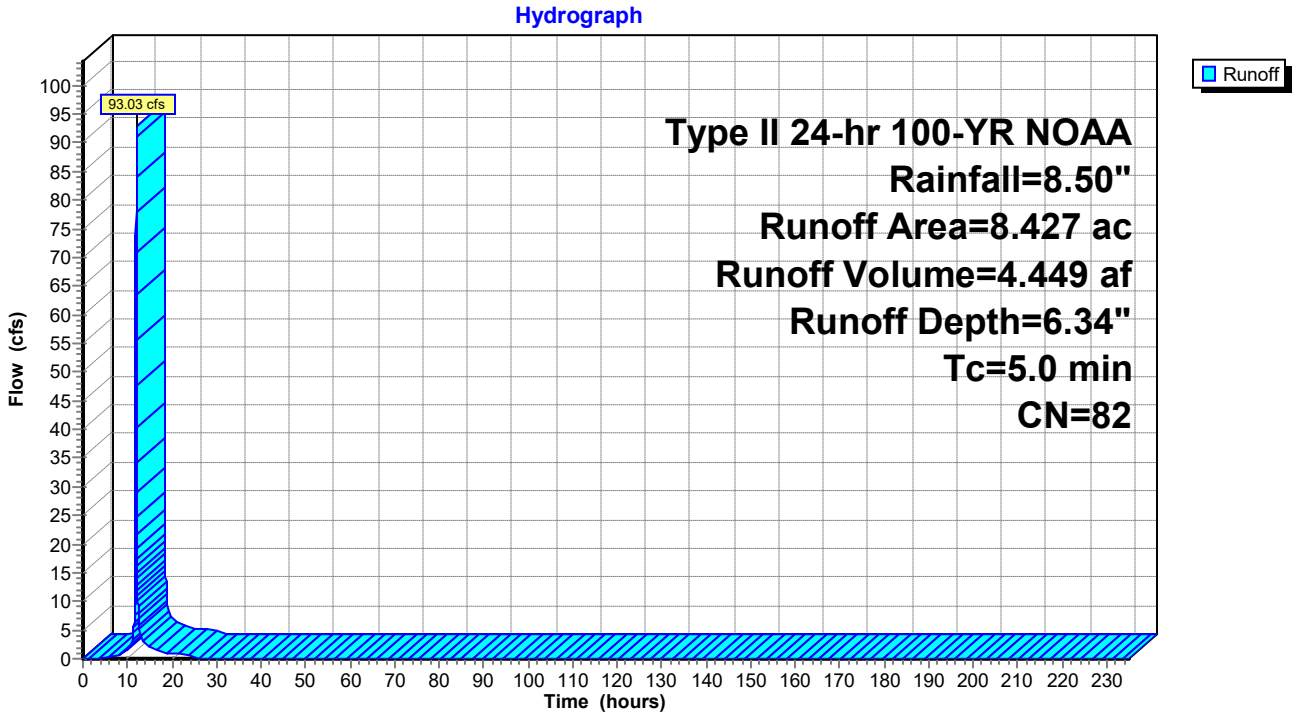
Runoff = 93.03 cfs @ 11.96 hrs, Volume= 4.449 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
0.707	98	Paved parking & roofs
7.720	80	>75% Grass cover, Good, HSG D
8.427	82	Weighted Average
7.720		Pervious Area
0.707		Impervious Area

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

Subcatchment 56S: DC-10 AT SWALE



Summary for Subcatchment 69S: DA to PC 4A

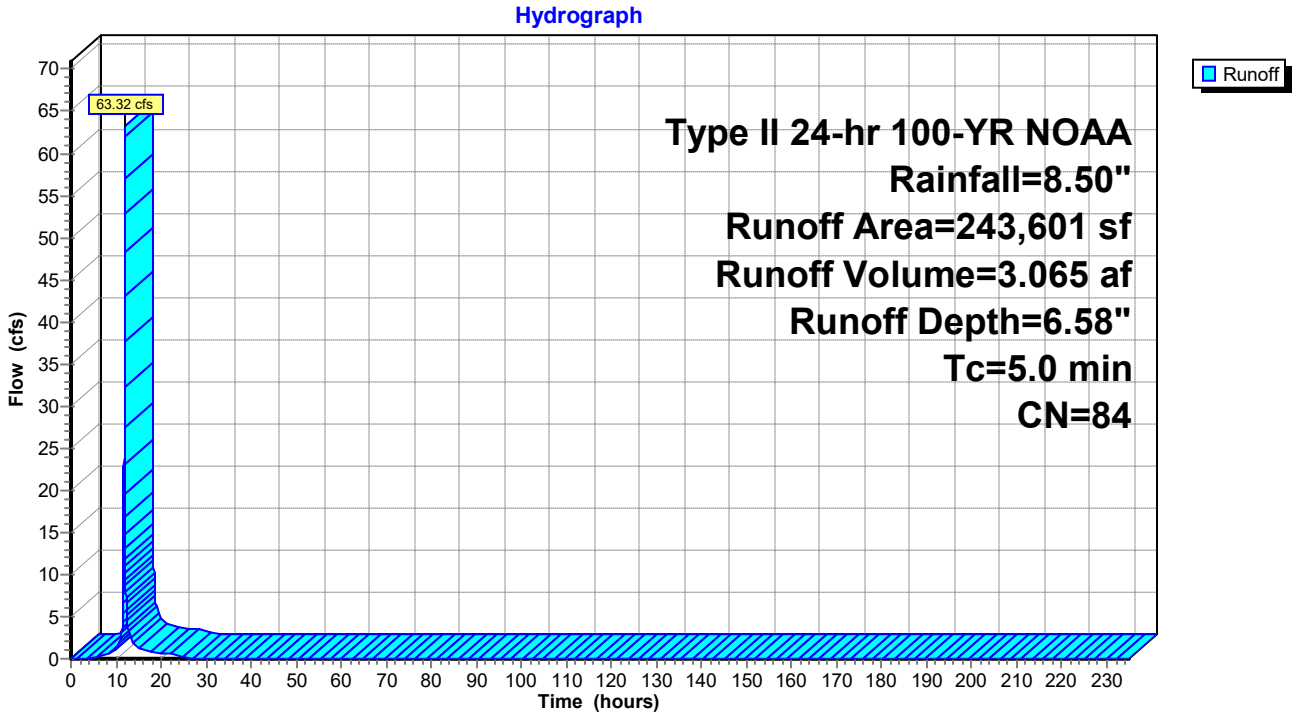
Runoff = 63.32 cfs @ 11.96 hrs, Volume= 3.065 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
53,337	98	Paved parking & roofs
190,264	80	>75% Grass cover, Good, HSG D
243,601	84	Weighted Average
190,264		Pervious Area
53,337		Impervious Area

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

Subcatchment 69S: DA to PC 4A



Summary for Subcatchment 70S: PC 3A

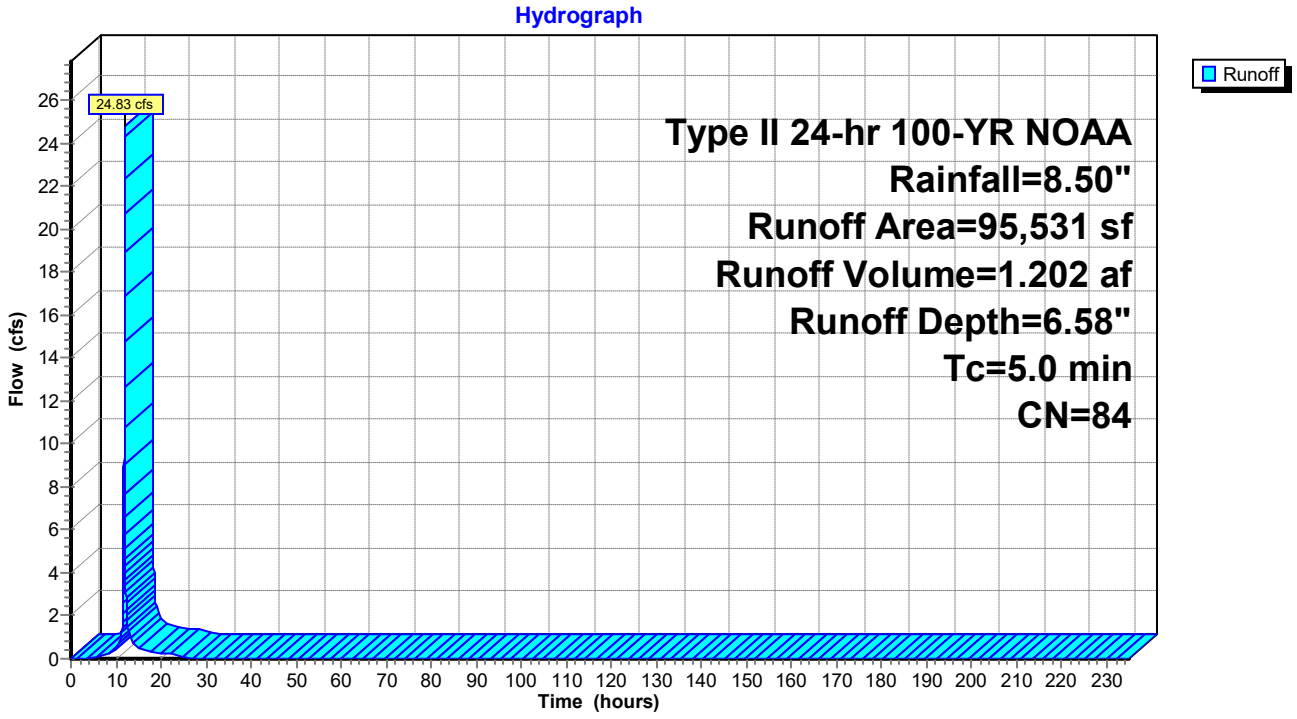
Runoff = 24.83 cfs @ 11.96 hrs, Volume= 1.202 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
20,880	98	Paved parking & roofs
74,651	80	>75% Grass cover, Good, HSG D
95,531	84	Weighted Average
74,651		Pervious Area
20,880		Impervious Area

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

Subcatchment 70S: PC 3A



Summary for Subcatchment 93S: CAP ROAD to DC2

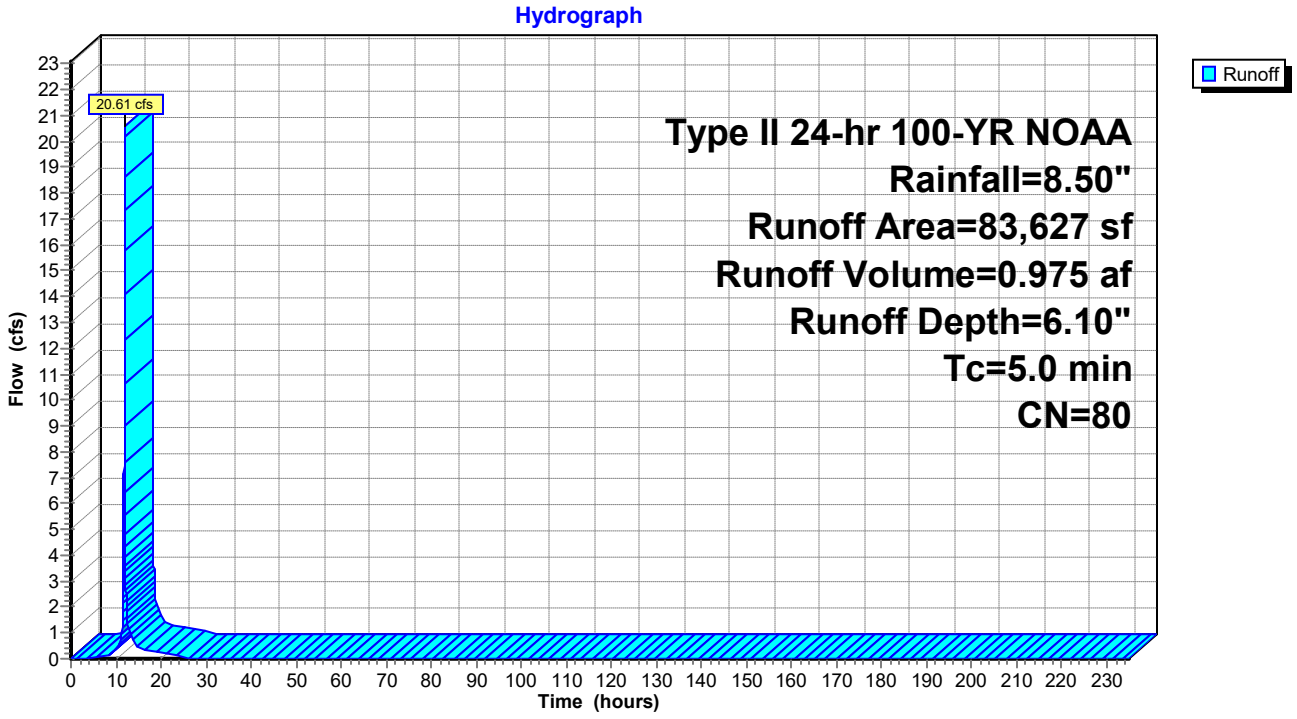
Runoff = 20.61 cfs @ 11.96 hrs, Volume= 0.975 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	63,066	74	FROM APPROVED CALCS
	20,561	98	Paved roads w/curbs & sewers
	83,627	80	Weighted Average
	63,066		Pervious Area
	20,561		Impervious Area

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

Subcatchment 93S: CAP ROAD to DC2



Summary for Subcatchment 94S: AREA TO SWALE 2

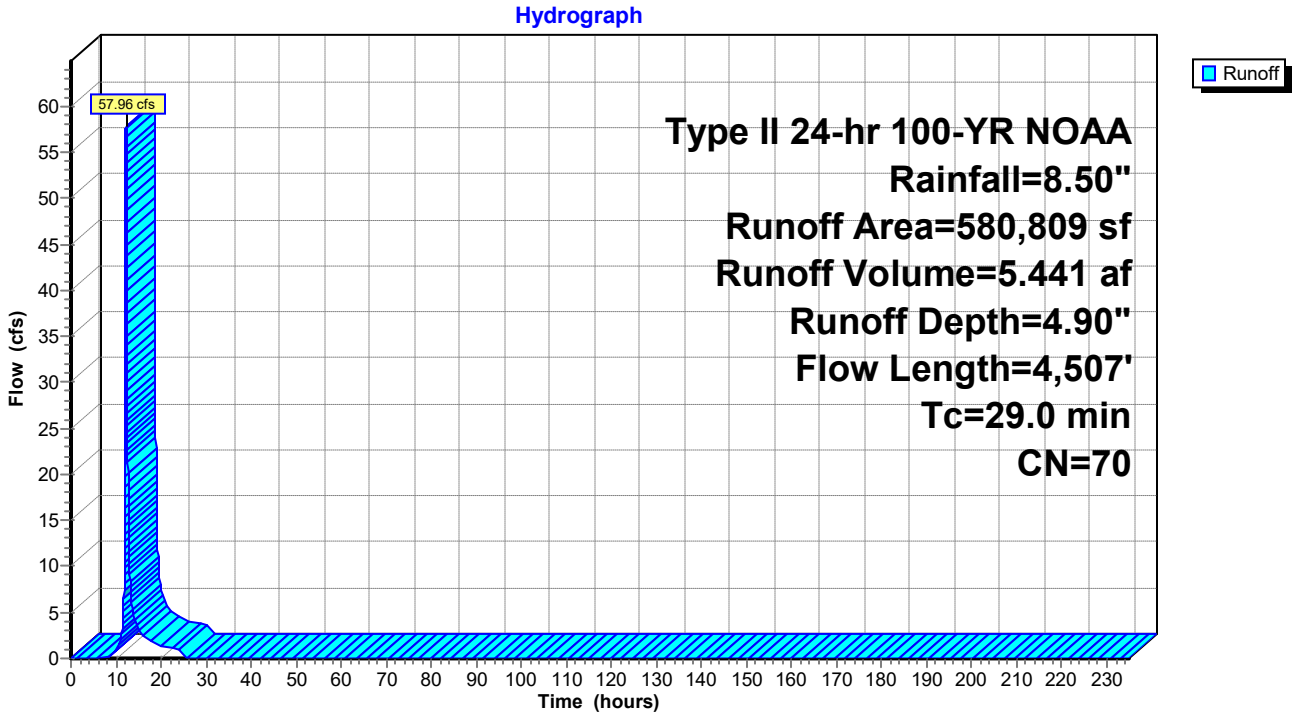
Runoff = 57.96 cfs @ 12.22 hrs, Volume= 5.441 af, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	23,760	30	Woods, Good, HSG A
	29,120	70	Woods, Good, HSG C
*	113,835	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	272,732	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	12,155	80	>75% Grass cover, Good, HSG D (ONSITE D)
	33,629	30	Woods, Good, HSG A
	31,887	77	Woods, Good, HSG D
*	63,691	76	RA ZONING C SOILS
	580,809	70	Weighted Average
	580,809		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.6	120	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.1	27	0.3000	8.82		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.5	250	0.0300	2.79		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
20.0	4,010	0.0200	3.34	10.02	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
29.0	4,507	Total			

Subcatchment 94S: AREA TO SWALE 2



Summary for Subcatchment 95S: Upslope Area of PC3D

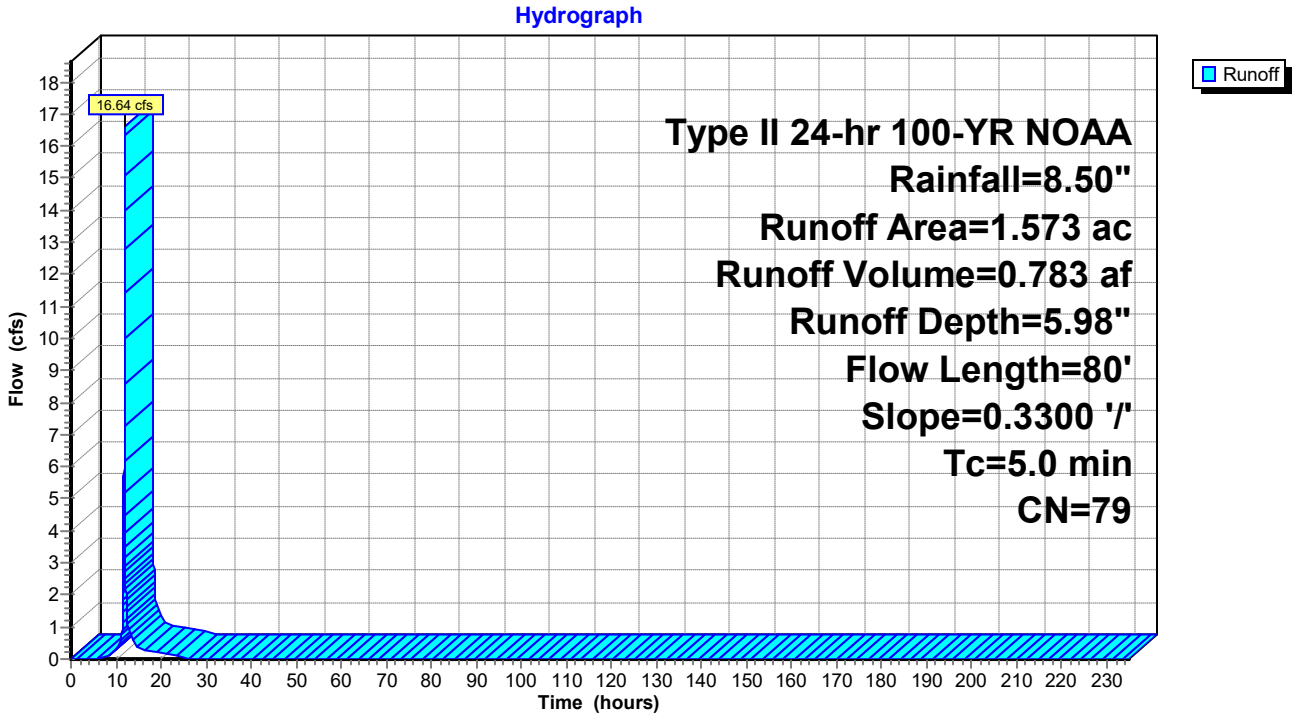
Runoff = 16.64 cfs @ 11.96 hrs, Volume= 0.783 af, Depth= 5.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
1.240	74	>75% Grass cover, Good, HSG C
0.333	98	Paved parking & roofs
1.573	79	Weighted Average
1.240		Pervious Area
0.333		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	80	0.3300	0.50		**Sheet Flow, PErimeter Berm** Grass: Short n= 0.150 P2= 3.20"
2.7	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 95S: Upslope Area of PC3D



Summary for Subcatchment 96S: Upslope Area of PC3E

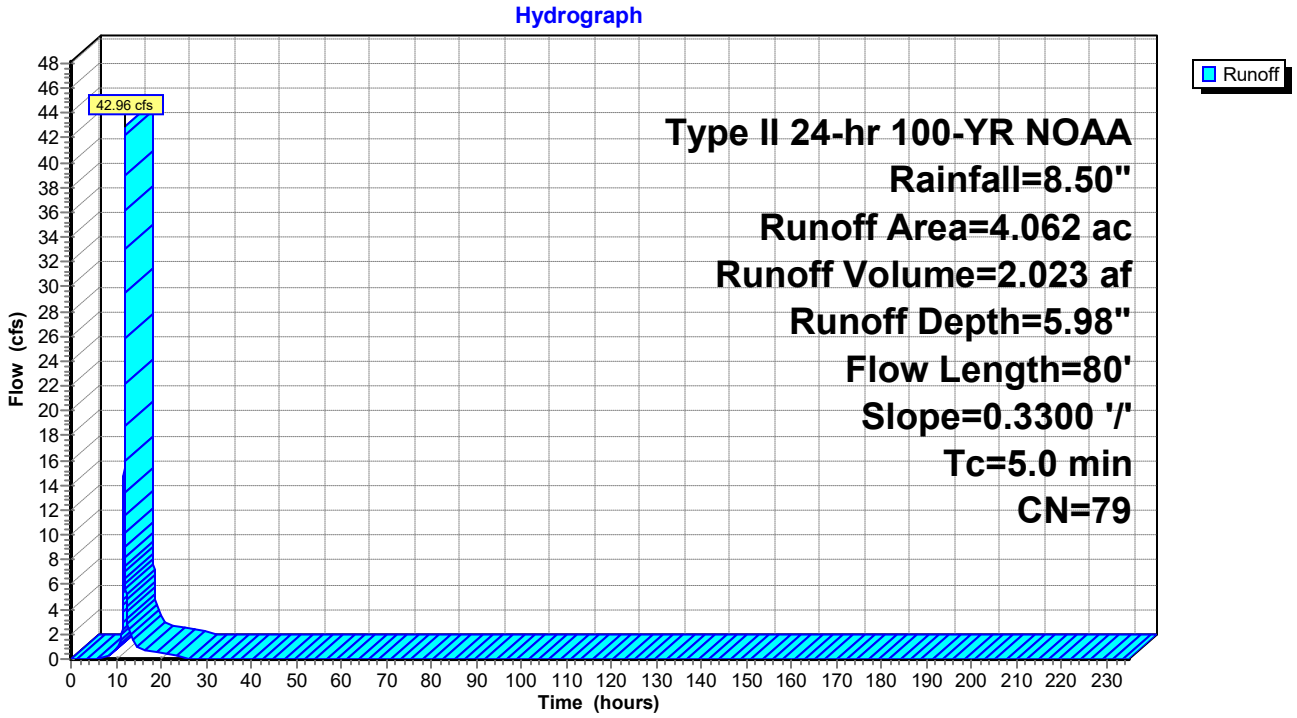
Runoff = 42.96 cfs @ 11.96 hrs, Volume= 2.023 af, Depth= 5.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
3.265	74	>75% Grass cover, Good, HSG C
0.797	98	Paved parking & roofs
4.062	79	Weighted Average
3.265		Pervious Area
0.797		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	80	0.3300	0.50		**Sheet Flow, Perimeter Berm** Grass: Short n= 0.150 P2= 3.20"
2.7	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 96S: Upslope Area of PC3E



Summary for Subcatchment 106S: AREA TO DS-10 CULVERT

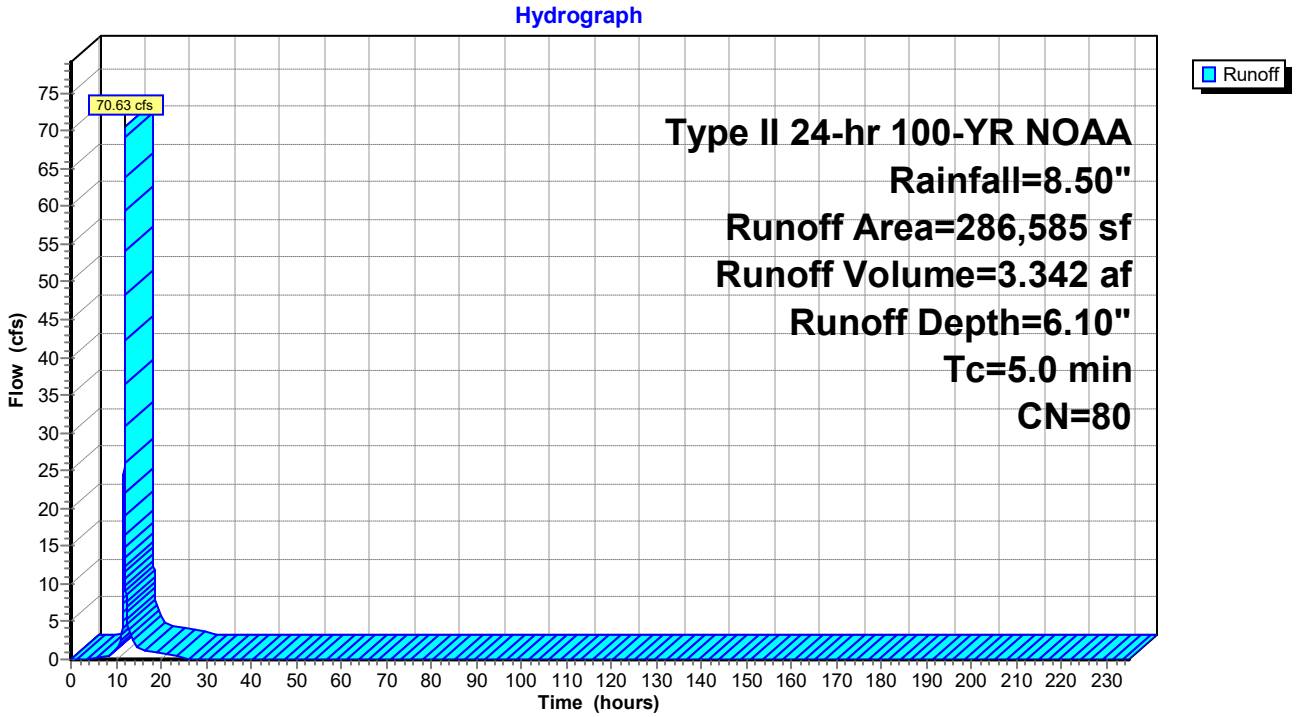
Runoff = 70.63 cfs @ 11.96 hrs, Volume= 3.342 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
286,585	80	>75% Grass cover, Good, HSG D
286,585		Pervious Area

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

Subcatchment 106S: AREA TO DS-10 CULVERT



Summary for Subcatchment 107S: DA TO PC 5

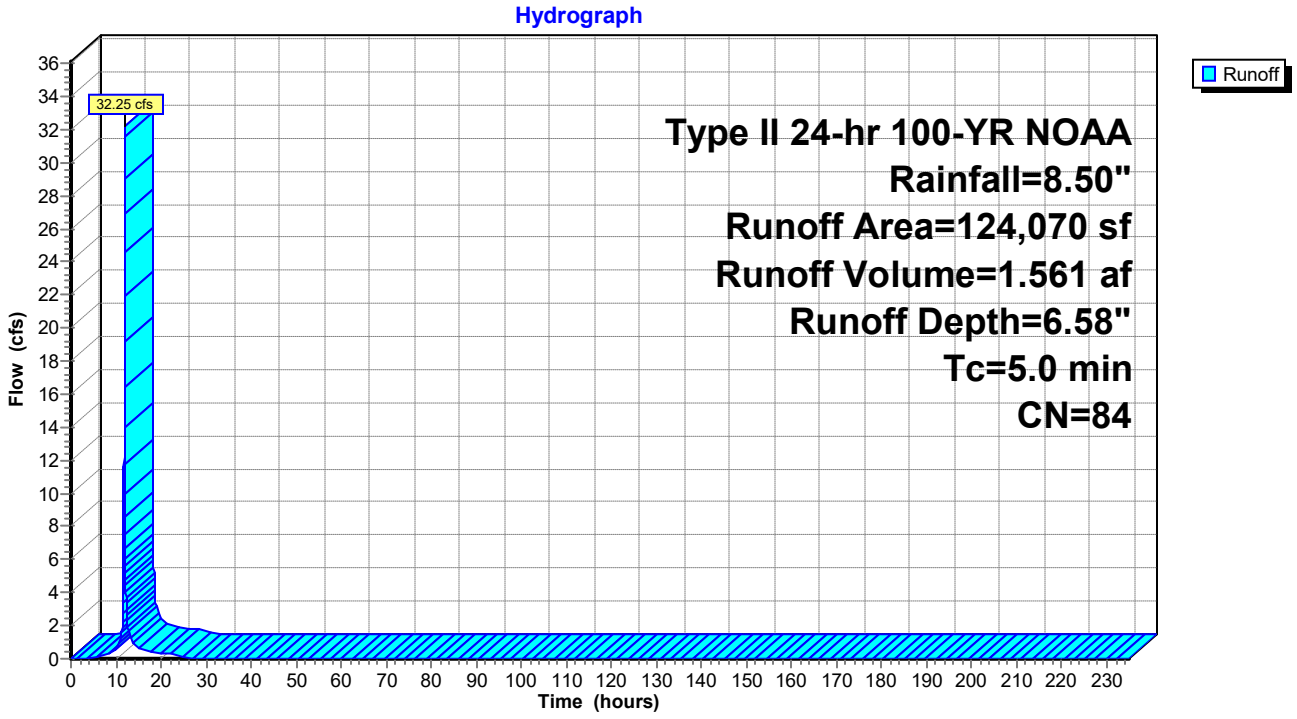
Runoff = 32.25 cfs @ 11.96 hrs, Volume= 1.561 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	27,657	98	PERIMETER ROAD
	96,413	80	>75% Grass cover, Good, HSG D
	124,070	84	Weighted Average
	96,413		Pervious Area
	27,657		Impervious Area

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

Subcatchment 107S: DA TO PC 5



Summary for Reach 89R: PC 4G

Inflow Area = 50.453 ac, 9.47% Impervious, Inflow Depth = 6.28" for 100-YR NOAA event
Inflow = 552.08 cfs @ 11.96 hrs, Volume= 26.400 af
Outflow = 542.99 cfs @ 11.97 hrs, Volume= 26.400 af, Atten= 2%, Lag= 0.8 min

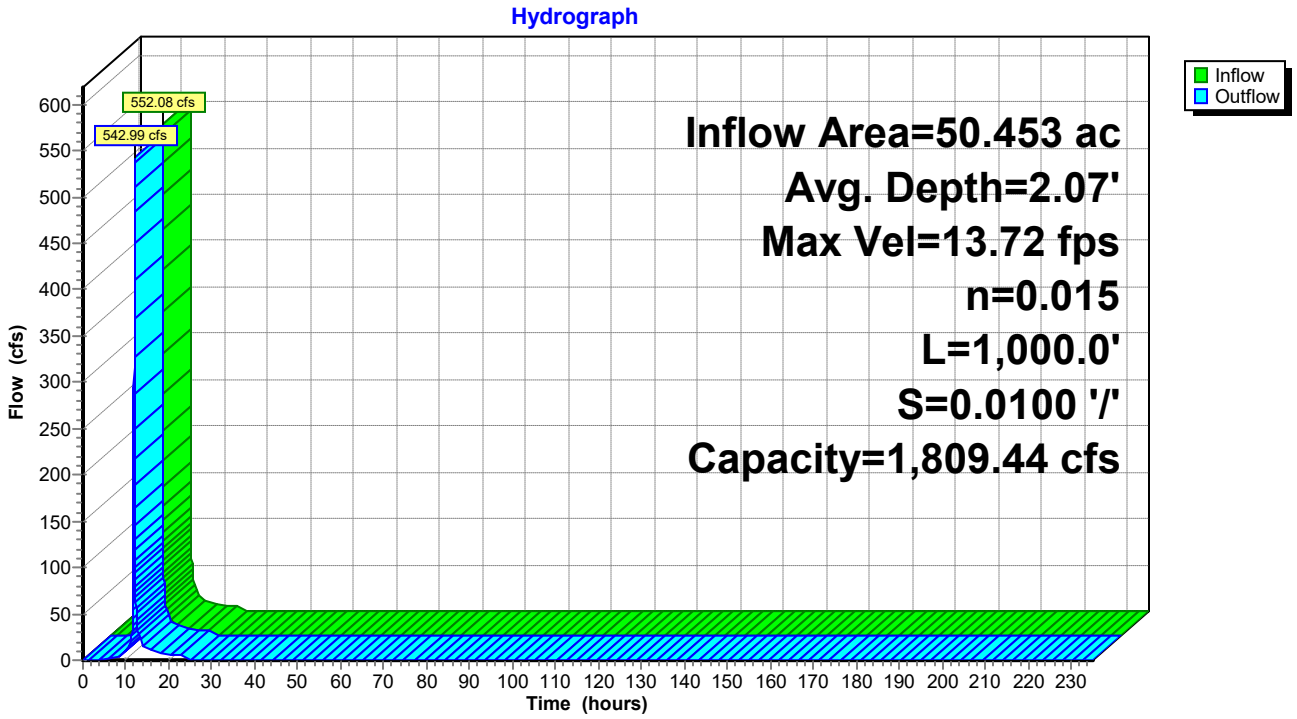
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 13.72 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 2.87 fps, Avg. Travel Time= 5.8 min

Peak Storage= 39,550 cf @ 11.97 hrs, Average Depth at Peak Storage= 2.07'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,809.44 cfs

15.00' x 4.00' deep channel, n= 0.015
Side Slope Z-value= 2.0 '/' Top Width= 31.00'
Length= 1,000.0' Slope= 0.0100 '/'
Inlet Invert= 90.00', Outlet Invert= 80.00'

‡

Reach 89R: PC 4G



Summary for Reach 95R: DC-1

Inflow Area = 8.371 ac, 21.28% Impervious, Inflow Depth = 6.58" for 100-YR NOAA event
Inflow = 94.79 cfs @ 11.96 hrs, Volume= 4.587 af
Outflow = 94.16 cfs @ 11.97 hrs, Volume= 4.587 af, Atten= 1%, Lag= 0.5 min

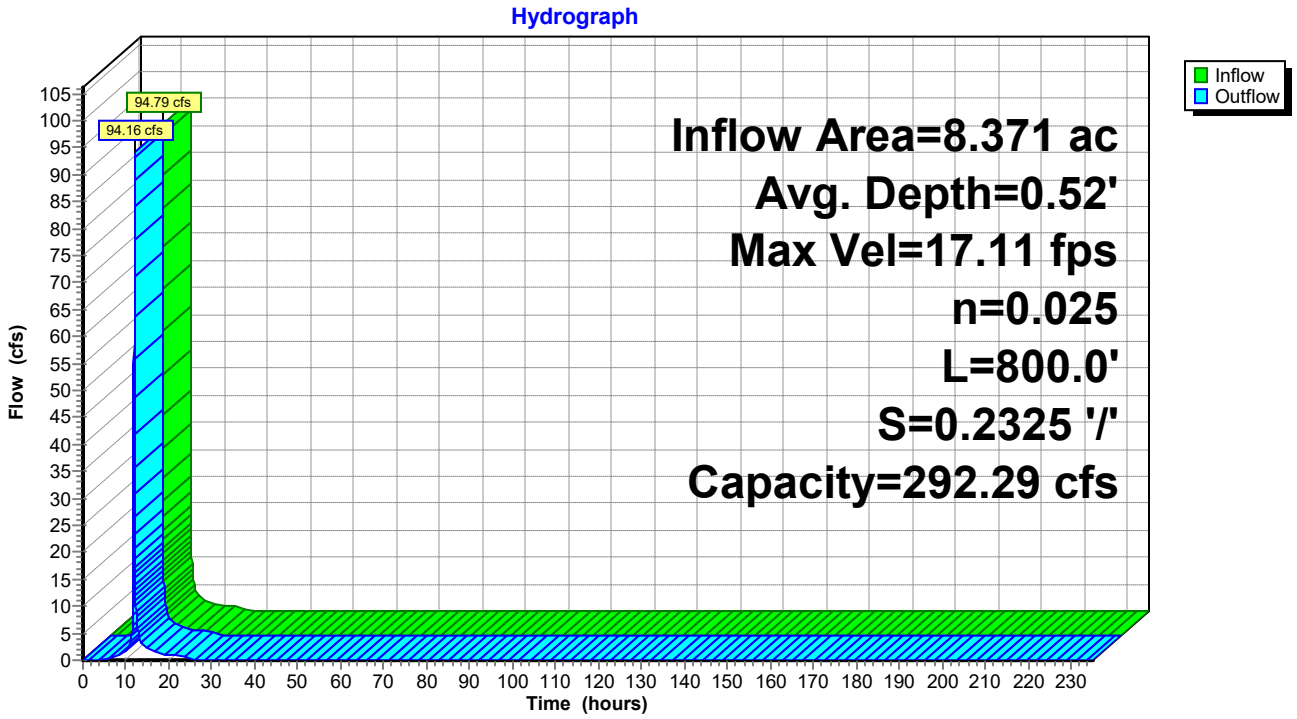
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 17.11 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.41 fps, Avg. Travel Time= 3.9 min

Peak Storage= 4,400 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 292.29 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 800.0' Slope= 0.2325 '/'
Inlet Invert= 264.00', Outlet Invert= 78.00'

‡

Reach 95R: DC-1



Summary for Reach 96R: DC-2

Inflow Area = 9.699 ac, 13.72% Impervious, Inflow Depth = 6.29" for 100-YR NOAA event
Inflow = 106.49 cfs @ 11.96 hrs, Volume= 5.082 af
Outflow = 106.14 cfs @ 11.96 hrs, Volume= 5.082 af, Atten= 0%, Lag= 0.3 min

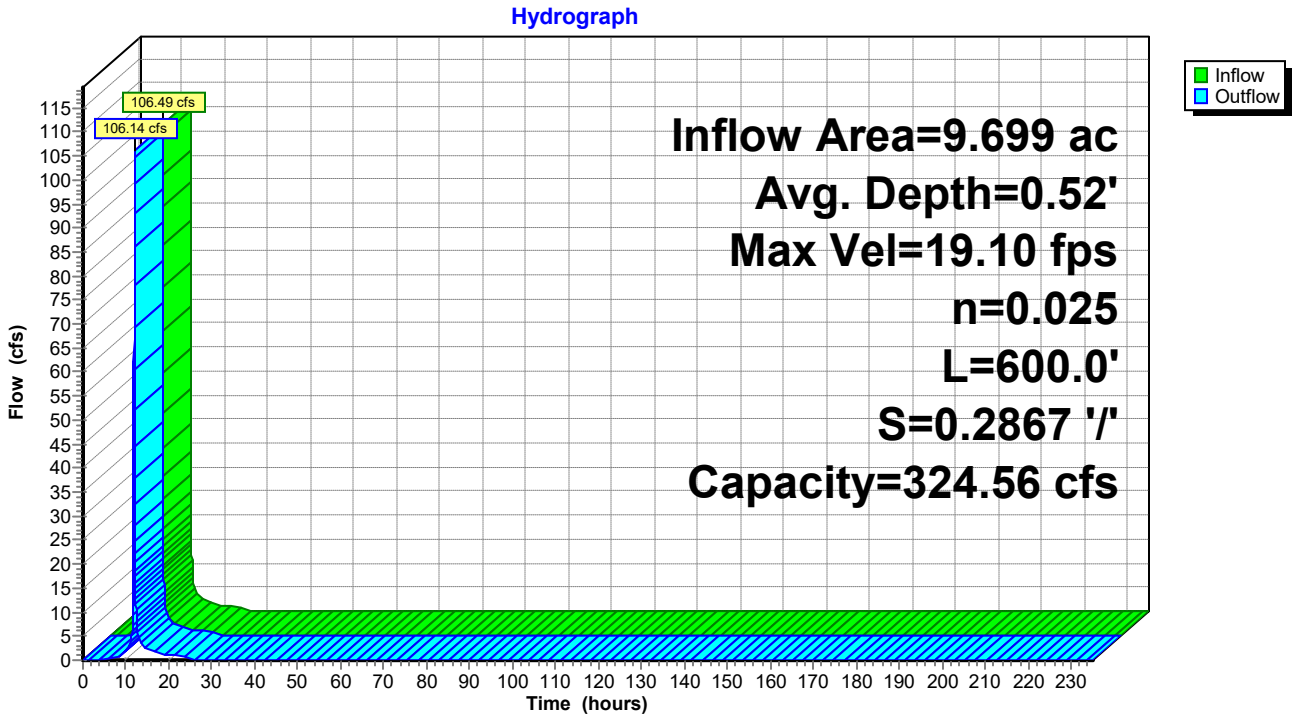
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 19.10 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.85 fps, Avg. Travel Time= 2.6 min

Peak Storage= 3,332 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 324.56 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 600.0' Slope= 0.2867 '/'
Inlet Invert= 264.00', Outlet Invert= 92.00'

‡

Reach 96R: DC-2



Summary for Reach 97R: DC-3

Inflow Area = 10.378 ac, 4.90% Impervious, Inflow Depth = 6.22" for 100-YR NOAA event
Inflow = 113.02 cfs @ 11.96 hrs, Volume= 5.375 af
Outflow = 112.80 cfs @ 11.96 hrs, Volume= 5.375 af, Atten= 0%, Lag= 0.3 min

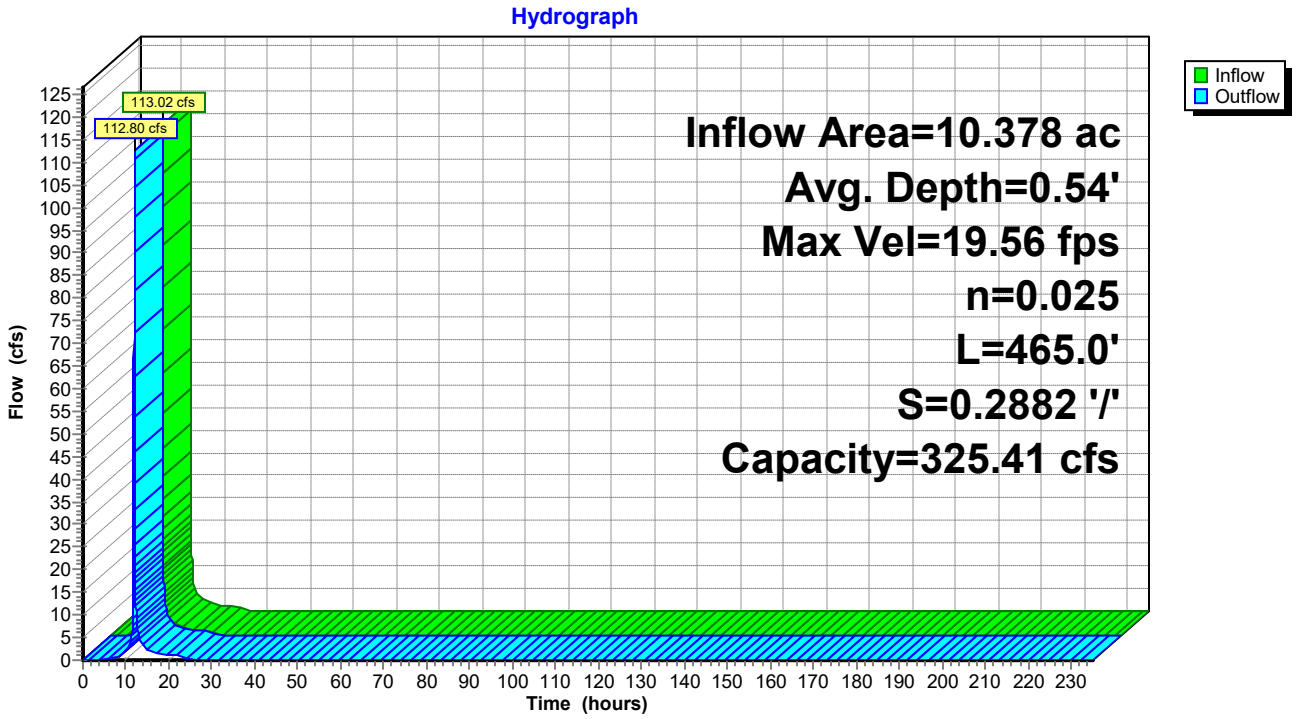
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 19.56 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.99 fps, Avg. Travel Time= 1.9 min

Peak Storage= 2,681 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.41 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 465.0' Slope= 0.2882 '/'
Inlet Invert= 264.00', Outlet Invert= 130.00'

‡

Reach 97R: DC-3



Summary for Reach 98R: DC-4

Inflow Area = 7.461 ac, 2.45% Impervious, Inflow Depth = 6.10" for 100-YR NOAA event
Inflow = 80.10 cfs @ 11.96 hrs, Volume= 3.790 af
Outflow = 79.94 cfs @ 11.96 hrs, Volume= 3.790 af, Atten= 0%, Lag= 0.3 min

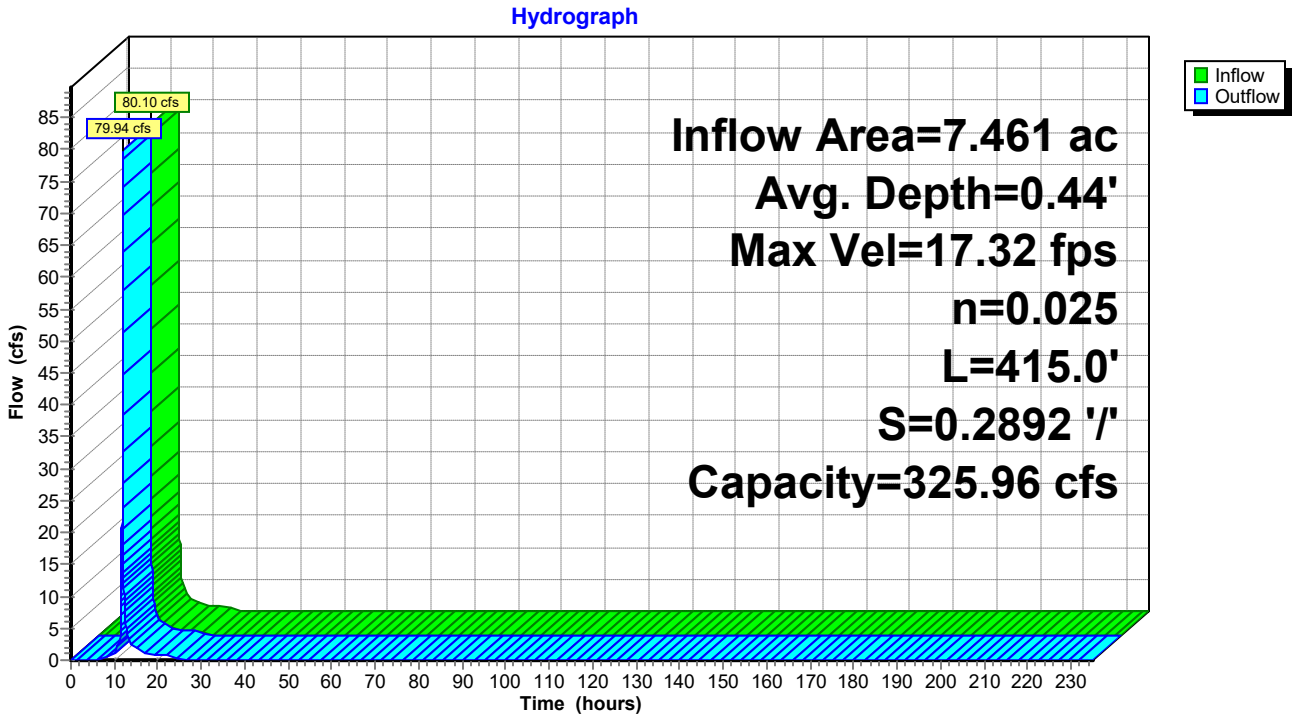
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 17.32 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.53 fps, Avg. Travel Time= 2.0 min

Peak Storage= 1,915 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.44'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.96 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 415.0' Slope= 0.2892 '/'
Inlet Invert= 264.00', Outlet Invert= 144.00'

‡

Reach 98R: DC-4



Summary for Reach 99R: DC-5

Inflow Area = 7.718 ac, 2.47% Impervious, Inflow Depth = 6.10" for 100-YR NOAA event
Inflow = 82.86 cfs @ 11.96 hrs, Volume= 3.920 af
Outflow = 82.72 cfs @ 11.96 hrs, Volume= 3.920 af, Atten= 0%, Lag= 0.2 min

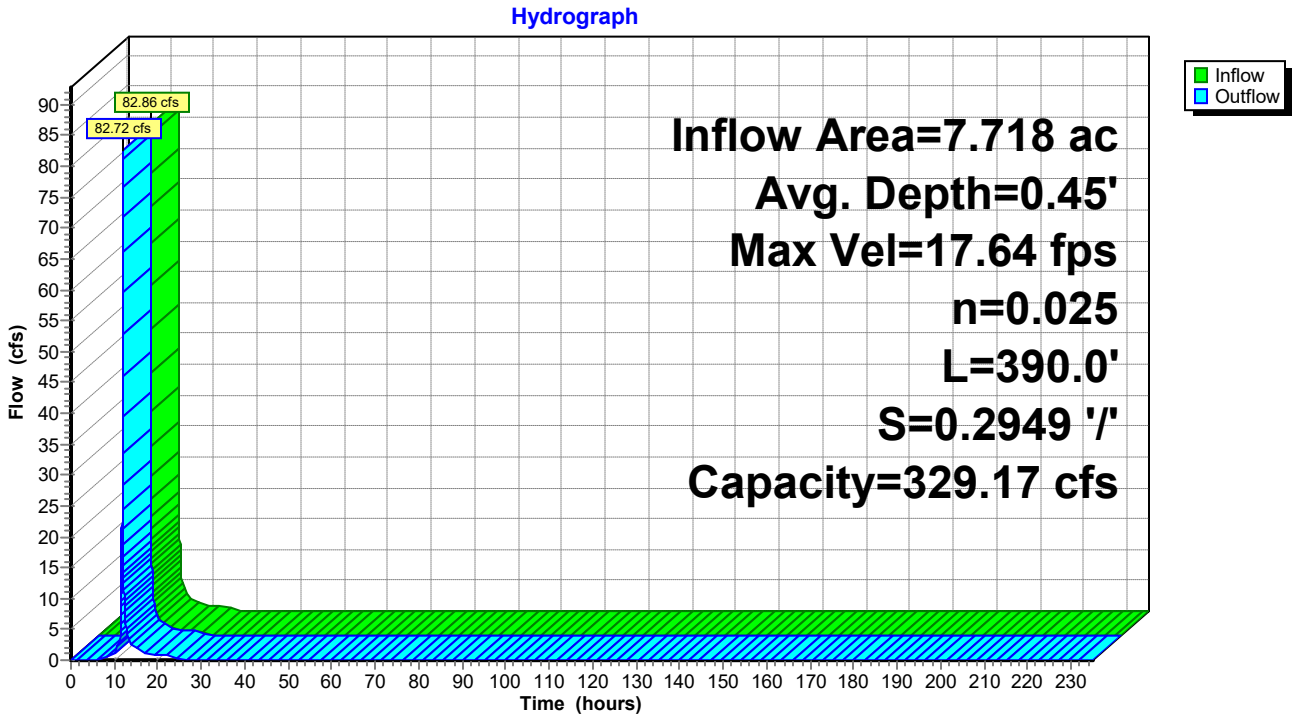
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 17.64 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.60 fps, Avg. Travel Time= 1.8 min

Peak Storage= 1,828 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 329.17 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 390.0' Slope= 0.2949 '/'
Inlet Invert= 264.00', Outlet Invert= 149.00'

‡

Reach 99R: DC-5



Summary for Reach 100R: DC-6

Inflow Area = 9.605 ac, 13.94% Impervious, Inflow Depth = 6.46" for 100-YR NOAA event
Inflow = 107.42 cfs @ 11.96 hrs, Volume= 5.167 af
Outflow = 107.34 cfs @ 11.96 hrs, Volume= 5.167 af, Atten= 0%, Lag= 0.2 min

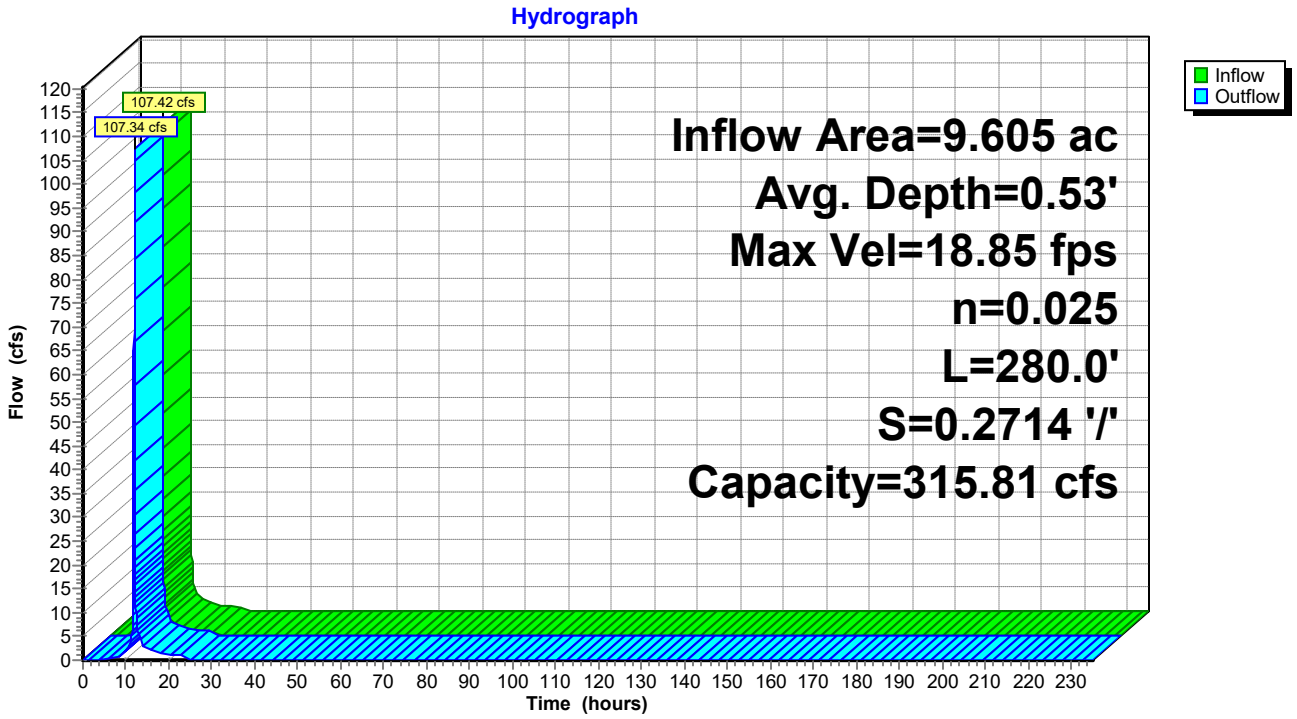
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 18.85 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.85 fps, Avg. Travel Time= 1.2 min

Peak Storage= 1,594 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 315.81 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 280.0' Slope= 0.2714 '/'
Inlet Invert= 230.00', Outlet Invert= 154.00'

‡

Reach 100R: DC-6



Summary for Reach 101R: DC-7

Inflow Area = 9.511 ac, 5.16% Impervious, Inflow Depth = 6.22" for 100-YR NOAA event
Inflow = 103.58 cfs @ 11.96 hrs, Volume= 4.926 af
Outflow = 103.42 cfs @ 11.96 hrs, Volume= 4.926 af, Atten= 0%, Lag= 0.2 min

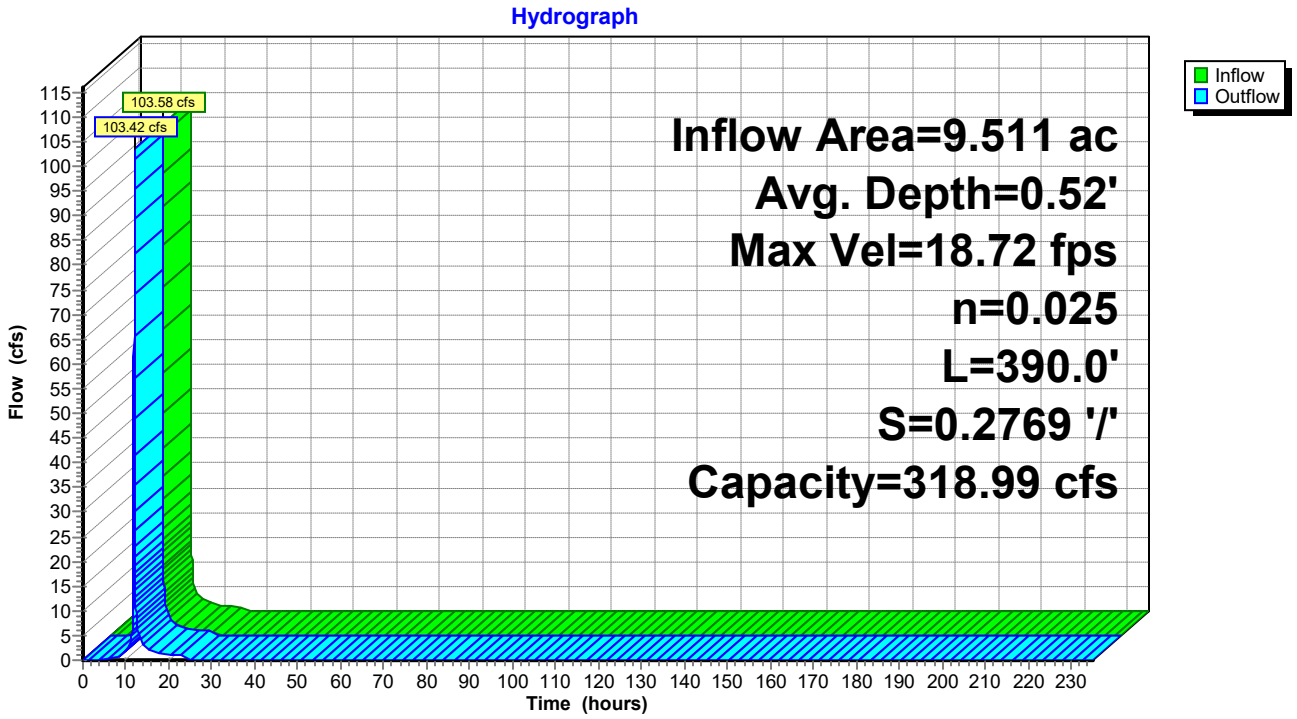
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 18.72 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.82 fps, Avg. Travel Time= 1.7 min

Peak Storage= 2,154 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 318.99 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 390.0' Slope= 0.2769 '/'
Inlet Invert= 266.00', Outlet Invert= 158.00'

‡

Reach 101R: DC-7



Summary for Reach 102R: DC-8

Inflow Area = 10.120 ac, 5.29% Impervious, Inflow Depth = 5.50" for 100-YR NOAA event
Inflow = 100.17 cfs @ 11.96 hrs, Volume= 4.634 af
Outflow = 99.97 cfs @ 11.96 hrs, Volume= 4.634 af, Atten= 0%, Lag= 0.3 min

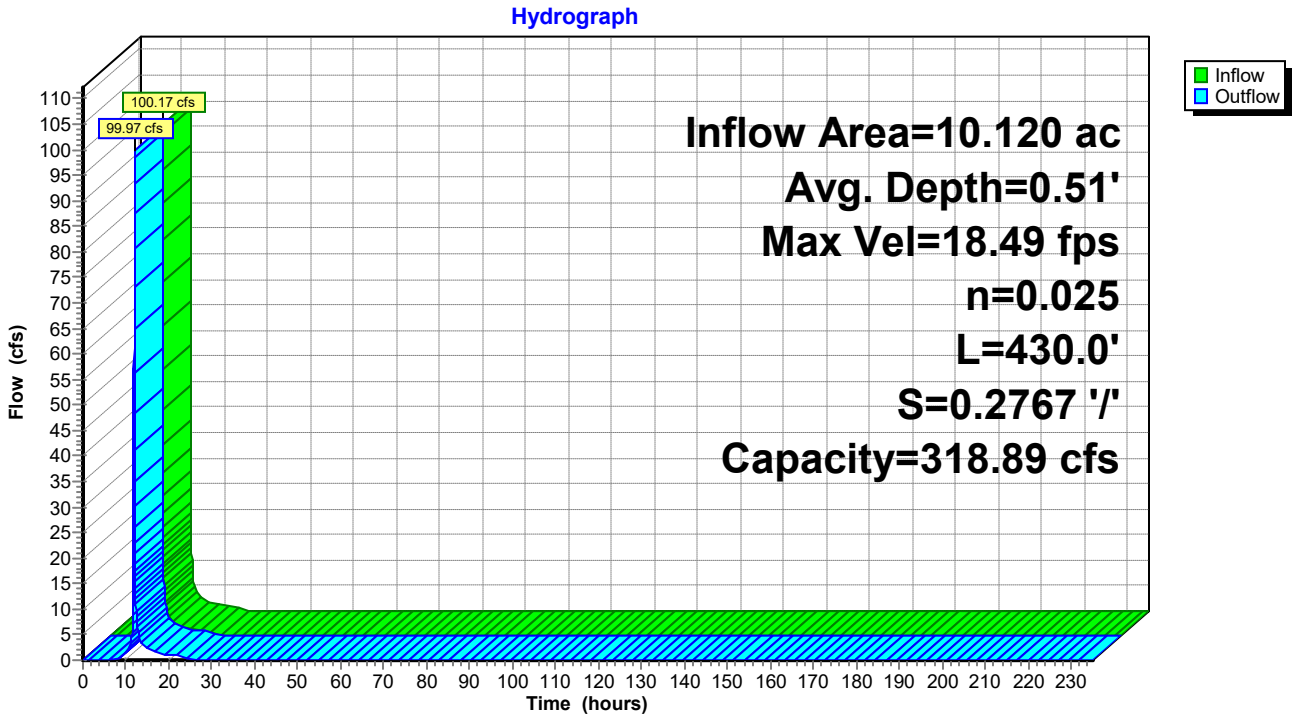
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 18.49 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.84 fps, Avg. Travel Time= 1.9 min

Peak Storage= 2,324 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 318.89 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 430.0' Slope= 0.2767 '/'
Inlet Invert= 262.00', Outlet Invert= 143.00'

‡

Reach 102R: DC-8



Summary for Reach 103R: DC-9

Inflow Area = 6.768 ac, 9.96% Impervious, Inflow Depth = 6.34" for 100-YR NOAA event
Inflow = 74.71 cfs @ 11.96 hrs, Volume= 3.573 af
Outflow = 74.53 cfs @ 11.96 hrs, Volume= 3.573 af, Atten= 0%, Lag= 0.3 min

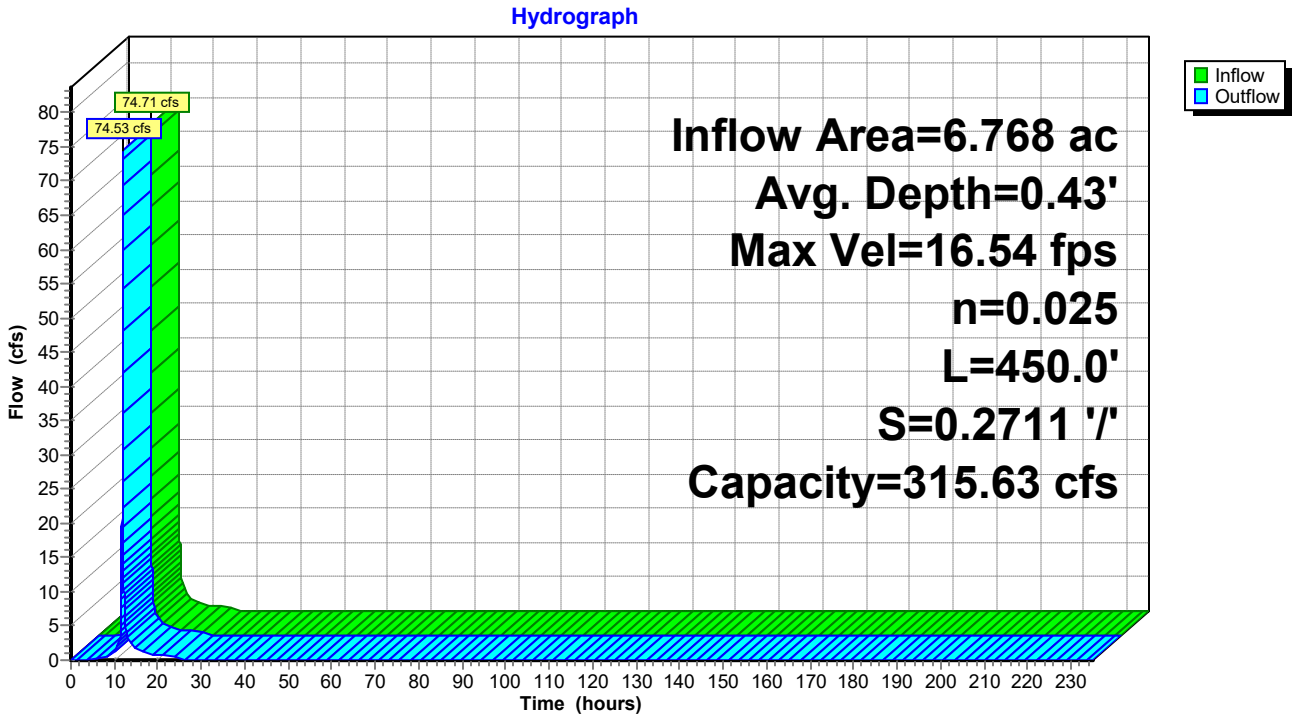
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.54 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.35 fps, Avg. Travel Time= 2.2 min

Peak Storage= 2,027 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 315.63 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 450.0' Slope= 0.2711 '/'
Inlet Invert= 252.00', Outlet Invert= 130.00'

‡

Reach 103R: DC-9



Summary for Reach 104R: DC-10

Inflow Area = 8.427 ac, 8.39% Impervious, Inflow Depth = 6.34" for 100-YR NOAA event
Inflow = 93.03 cfs @ 11.96 hrs, Volume= 4.449 af
Outflow = 92.93 cfs @ 11.96 hrs, Volume= 4.449 af, Atten= 0%, Lag= 0.2 min

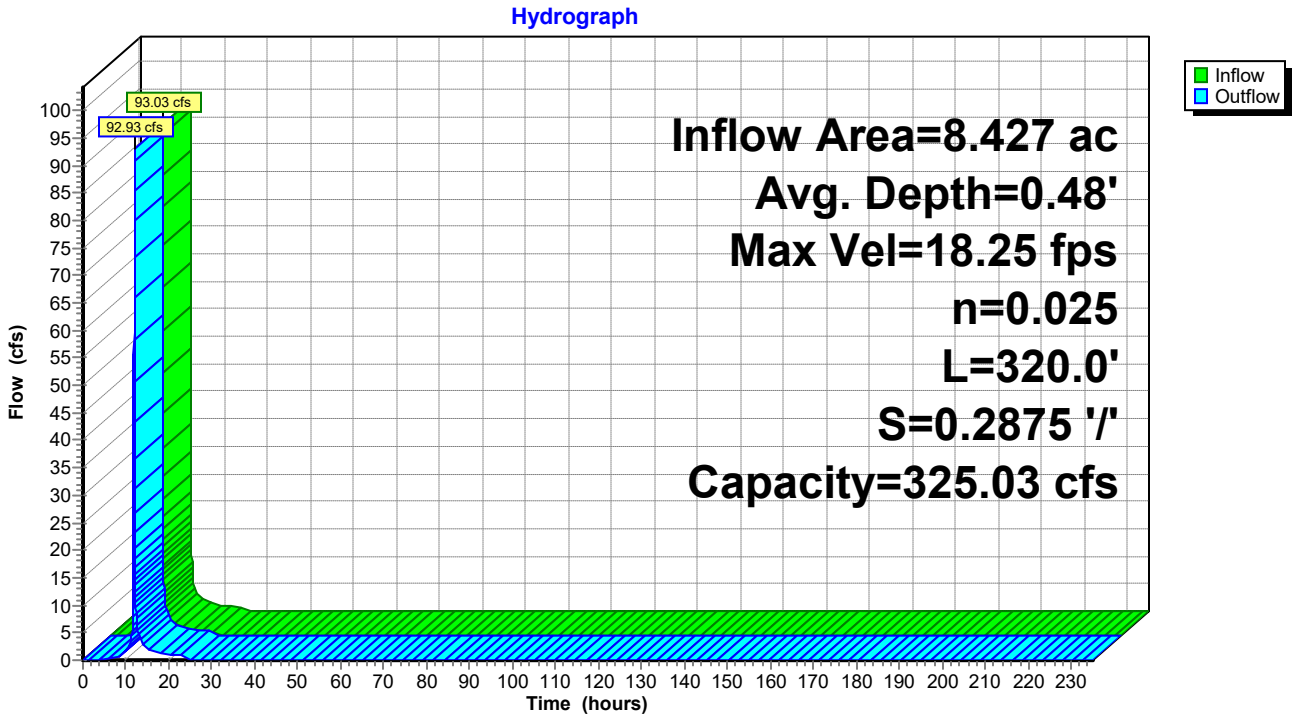
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 18.25 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.72 fps, Avg. Travel Time= 1.4 min

Peak Storage= 1,630 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.03 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 320.0' Slope= 0.2875 '/'
Inlet Invert= 210.00', Outlet Invert= 118.00'

‡

Reach 104R: DC-10

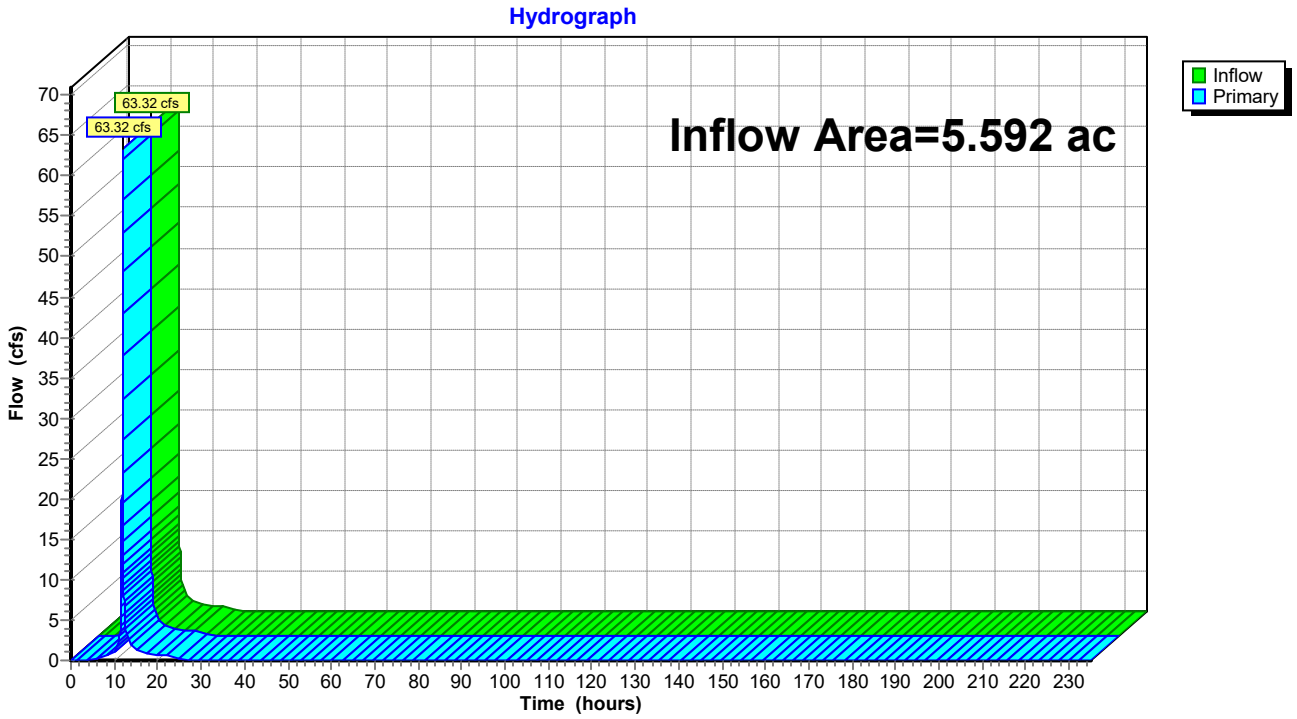


Summary for Link 57L: PC 4A

Inflow Area = 5.592 ac, 21.90% Impervious, Inflow Depth = 6.58" for 100-YR NOAA event
Inflow = 63.32 cfs @ 11.96 hrs, Volume= 3.065 af
Primary = 63.32 cfs @ 11.96 hrs, Volume= 3.065 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 57L: PC 4A

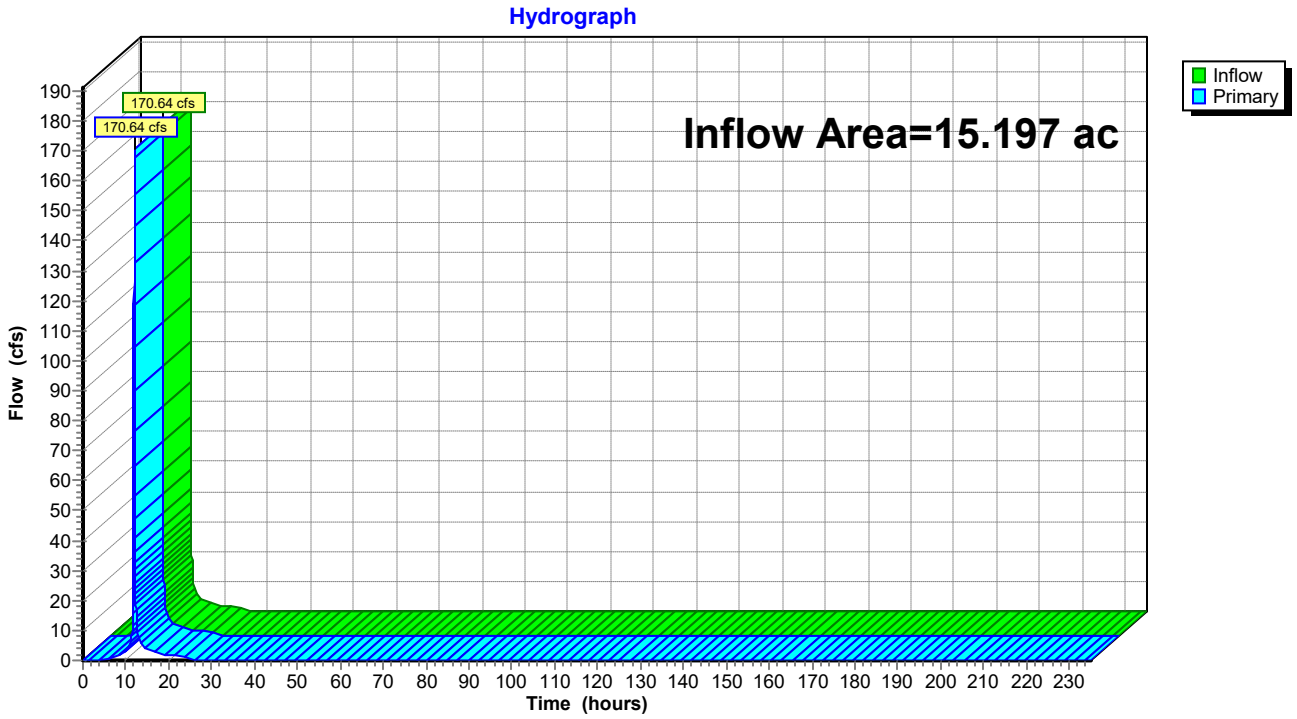


Summary for Link 58L: PC 4B

Inflow Area = 15.197 ac, 16.87% Impervious, Inflow Depth = 6.50" for 100-YR NOAA event
Inflow = 170.64 cfs @ 11.96 hrs, Volume= 8.232 af
Primary = 170.64 cfs @ 11.96 hrs, Volume= 8.232 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 58L: PC 4B

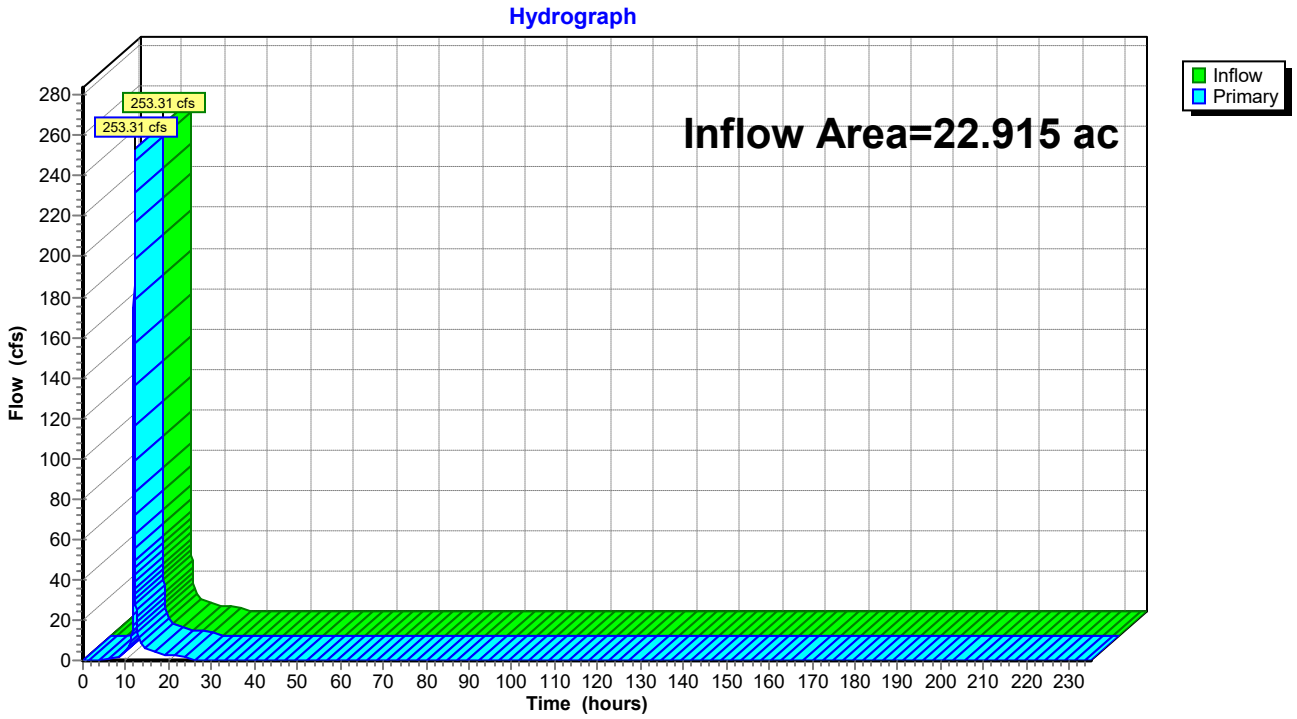


Summary for Link 59L: PC 4C

Inflow Area = 22.915 ac, 12.02% Impervious, Inflow Depth = 6.36" for 100-YR NOAA event
Inflow = 253.31 cfs @ 11.96 hrs, Volume= 12.152 af
Primary = 253.31 cfs @ 11.96 hrs, Volume= 12.152 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 59L: PC 4C

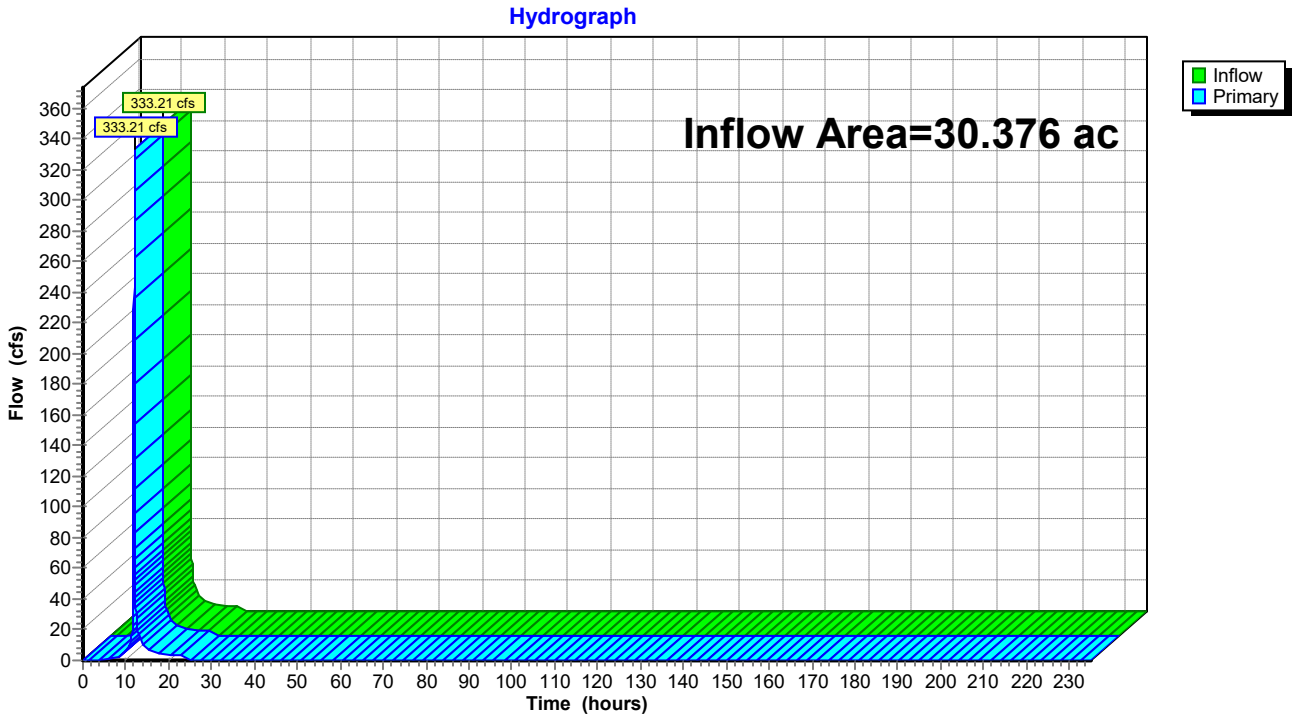


Summary for Link 60L: PC 4D

Inflow Area = 30.376 ac, 9.67% Impervious, Inflow Depth = 6.30" for 100-YR NOAA event
Inflow = 333.21 cfs @ 11.96 hrs, Volume= 15.942 af
Primary = 333.21 cfs @ 11.96 hrs, Volume= 15.942 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 60L: PC 4D

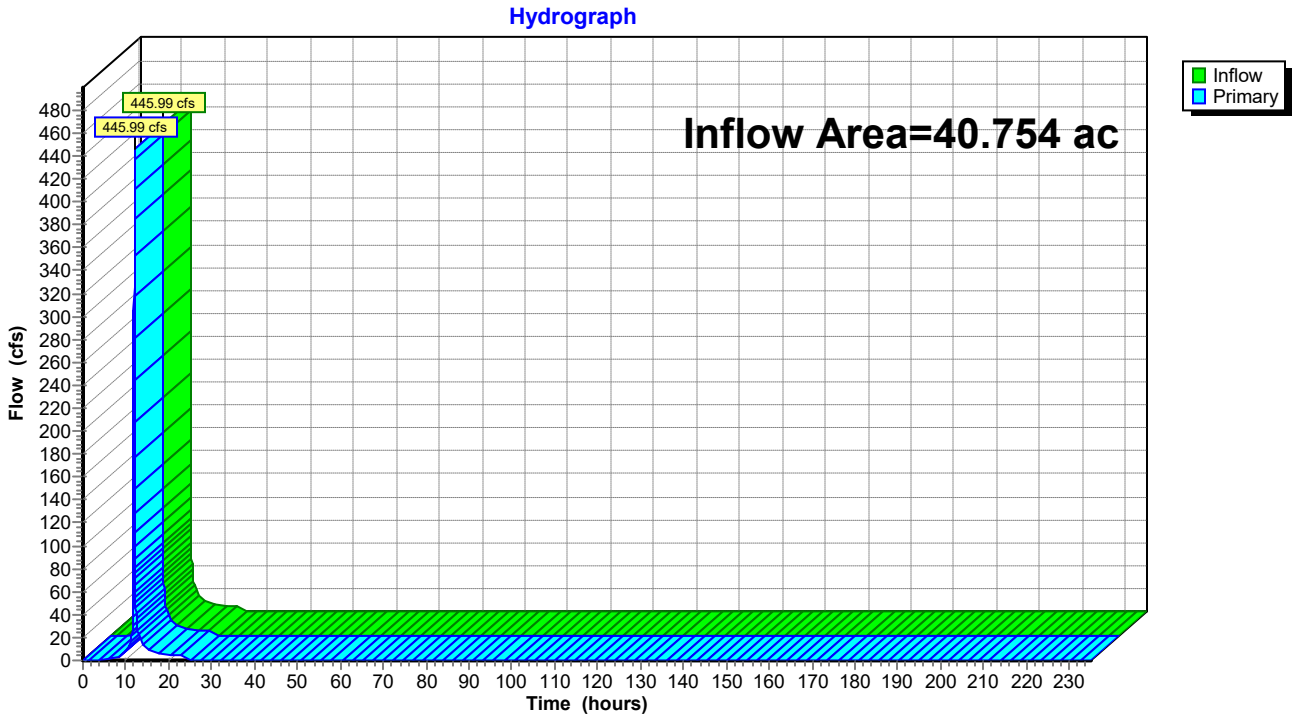


Summary for Link 61L: PC 4E

Inflow Area = 40.754 ac, 8.45% Impervious, Inflow Depth = 6.28" for 100-YR NOAA event
Inflow = 445.99 cfs @ 11.96 hrs, Volume= 21.317 af
Primary = 445.99 cfs @ 11.96 hrs, Volume= 21.317 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 61L: PC 4E

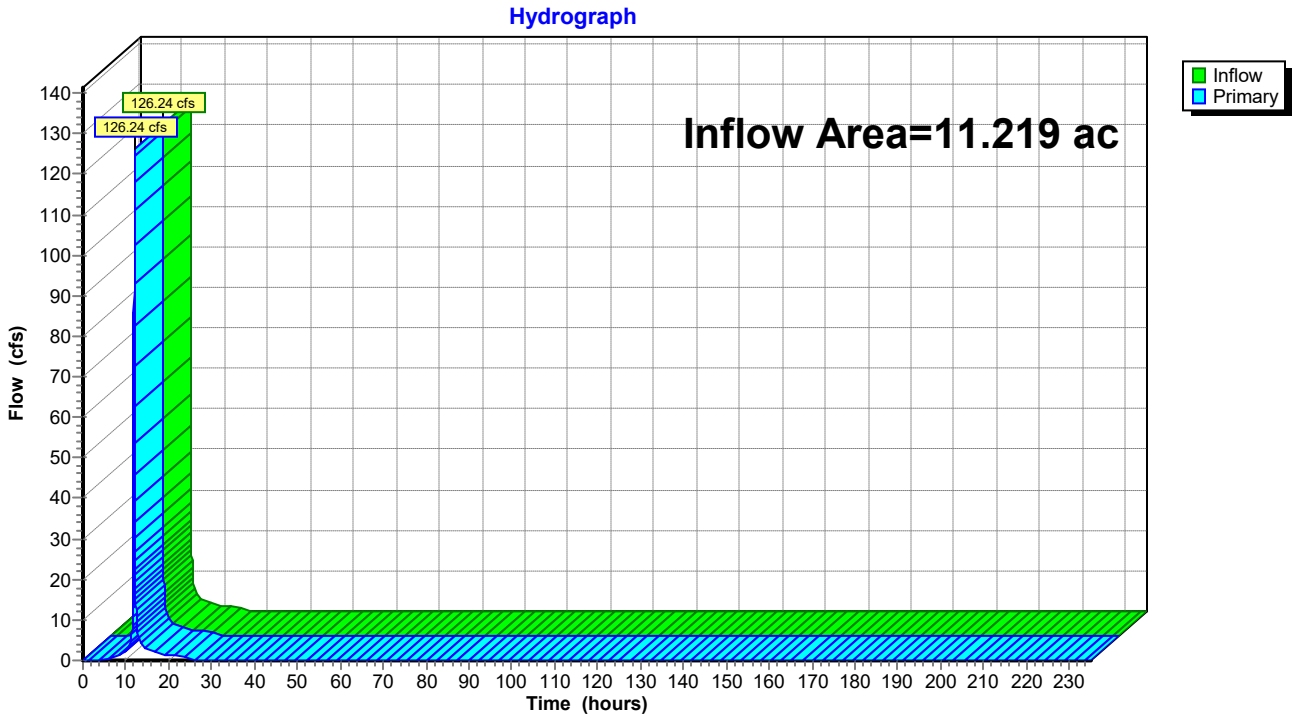


Summary for Link 62L: PC 5

Inflow Area = 11.219 ac, 21.53% Impervious, Inflow Depth = 6.58" for 100-YR NOAA event
Inflow = 126.24 cfs @ 11.96 hrs, Volume= 6.148 af
Primary = 126.24 cfs @ 11.96 hrs, Volume= 6.148 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 62L: PC 5

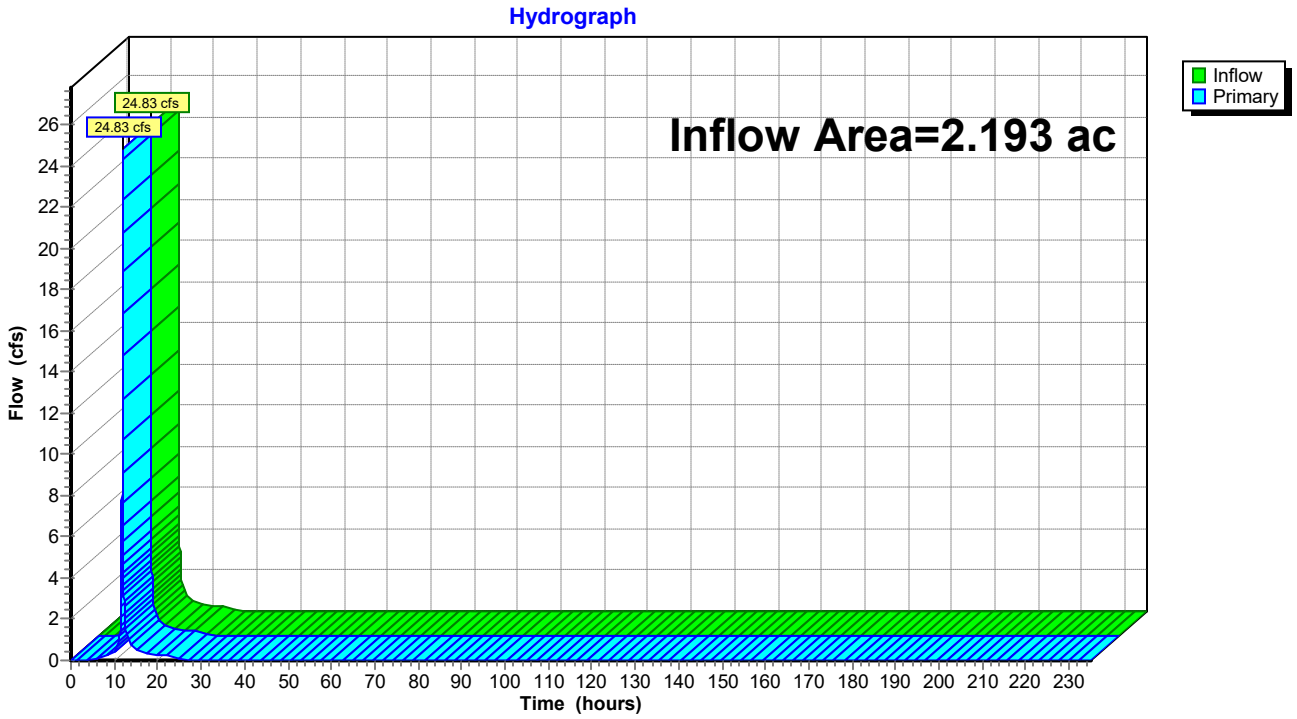


Summary for Link 63L: PC 3A

Inflow Area = 2.193 ac, 21.86% Impervious, Inflow Depth = 6.58" for 100-YR NOAA event
Inflow = 24.83 cfs @ 11.96 hrs, Volume= 1.202 af
Primary = 24.83 cfs @ 11.96 hrs, Volume= 1.202 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 63L: PC 3A

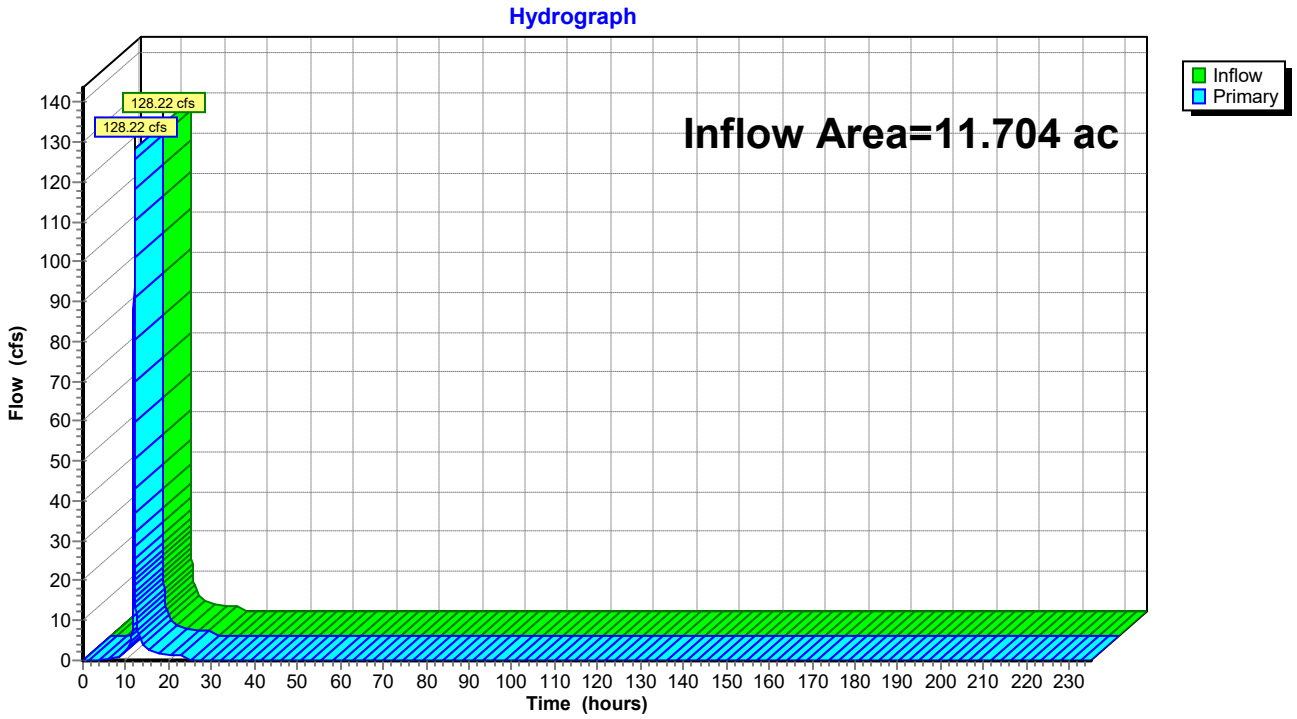


Summary for Link 64L: PC 3B

Inflow Area = 11.704 ac, 8.29% Impervious, Inflow Depth = 6.28" for 100-YR NOAA event
Inflow = 128.22 cfs @ 11.96 hrs, Volume= 6.128 af
Primary = 128.22 cfs @ 11.96 hrs, Volume= 6.128 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 64L: PC 3B

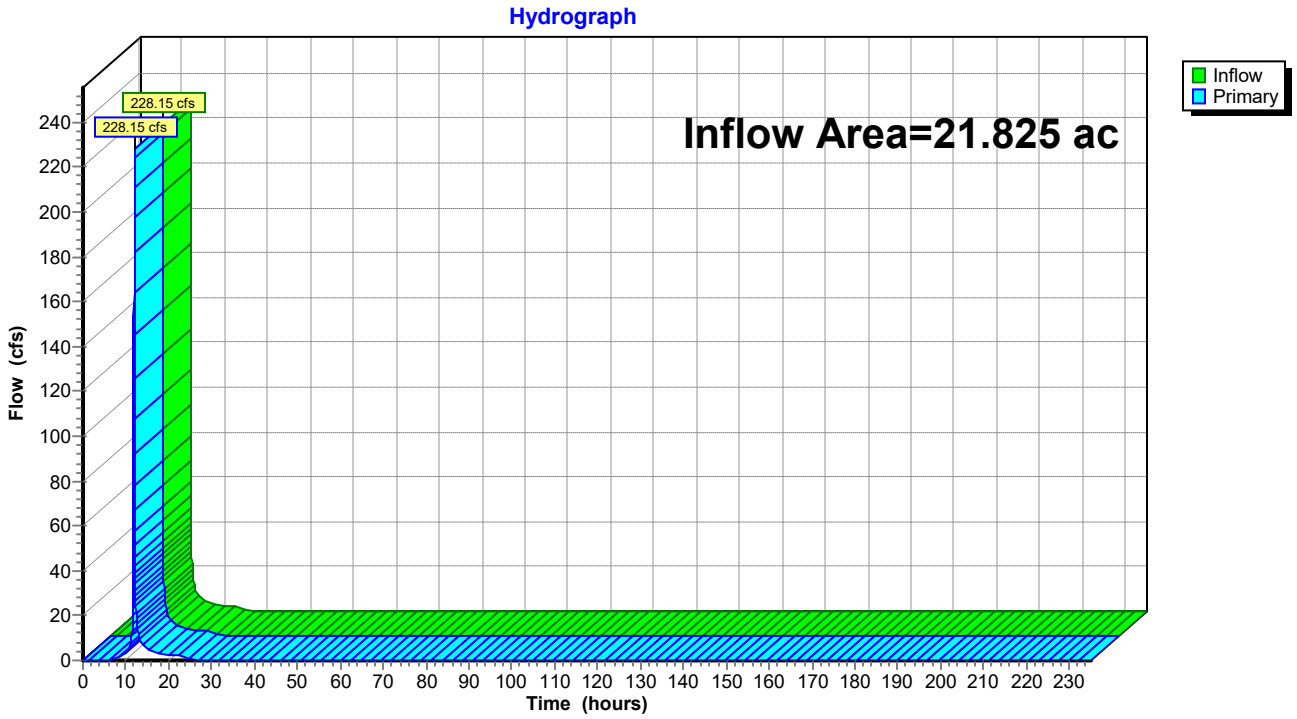


Summary for Link 65L: PC 3C

Inflow Area = 21.825 ac, 6.90% Impervious, Inflow Depth = 5.92" for 100-YR NOAA event
Inflow = 228.15 cfs @ 11.96 hrs, Volume= 10.762 af
Primary = 228.15 cfs @ 11.96 hrs, Volume= 10.762 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 65L: PC 3C

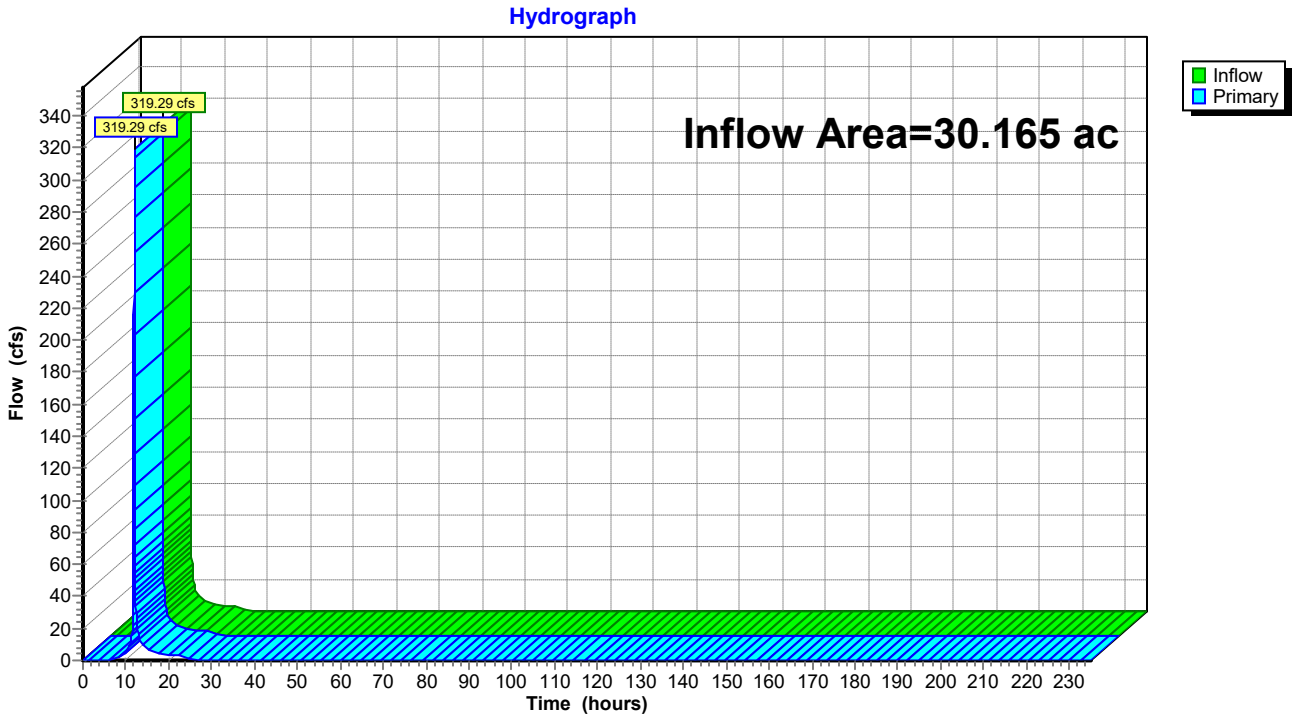


Summary for Link 66L: PC 3D

Inflow Area = 30.165 ac, 8.33% Impervious, Inflow Depth = 6.01" for 100-YR NOAA event
Inflow = 319.29 cfs @ 11.96 hrs, Volume= 15.119 af
Primary = 319.29 cfs @ 11.96 hrs, Volume= 15.119 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 66L: PC 3D

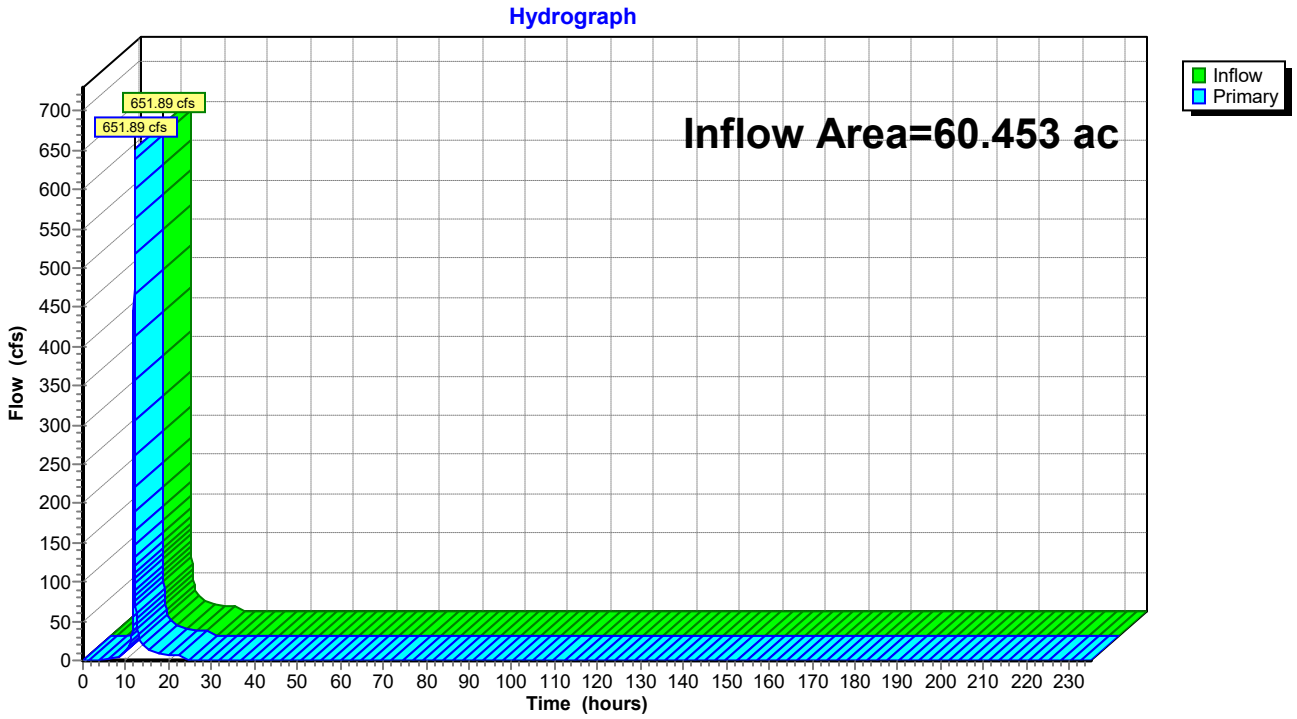


Summary for Link 67L: CROSS PIPE

Inflow Area = 60.453 ac, 10.64% Impervious, Inflow Depth = 6.17" for 100-YR NOAA event
Inflow = 651.89 cfs @ 11.96 hrs, Volume= 31.081 af
Primary = 651.89 cfs @ 11.96 hrs, Volume= 31.081 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 67L: CROSS PIPE

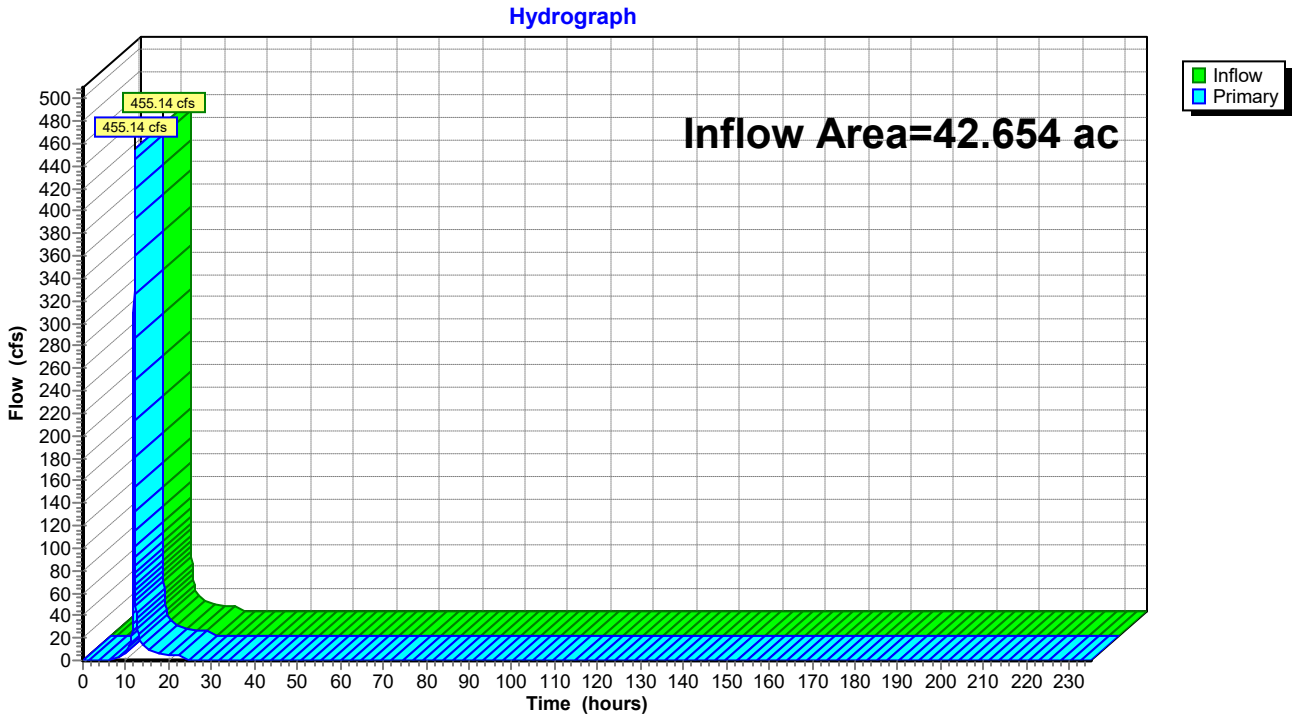


Summary for Link 68L: PC 3E

Inflow Area = 42.654 ac, 9.42% Impervious, Inflow Depth = 6.07" for 100-YR NOAA event
Inflow = 455.14 cfs @ 11.96 hrs, Volume= 21.591 af
Primary = 455.14 cfs @ 11.96 hrs, Volume= 21.591 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 68L: PC 3E

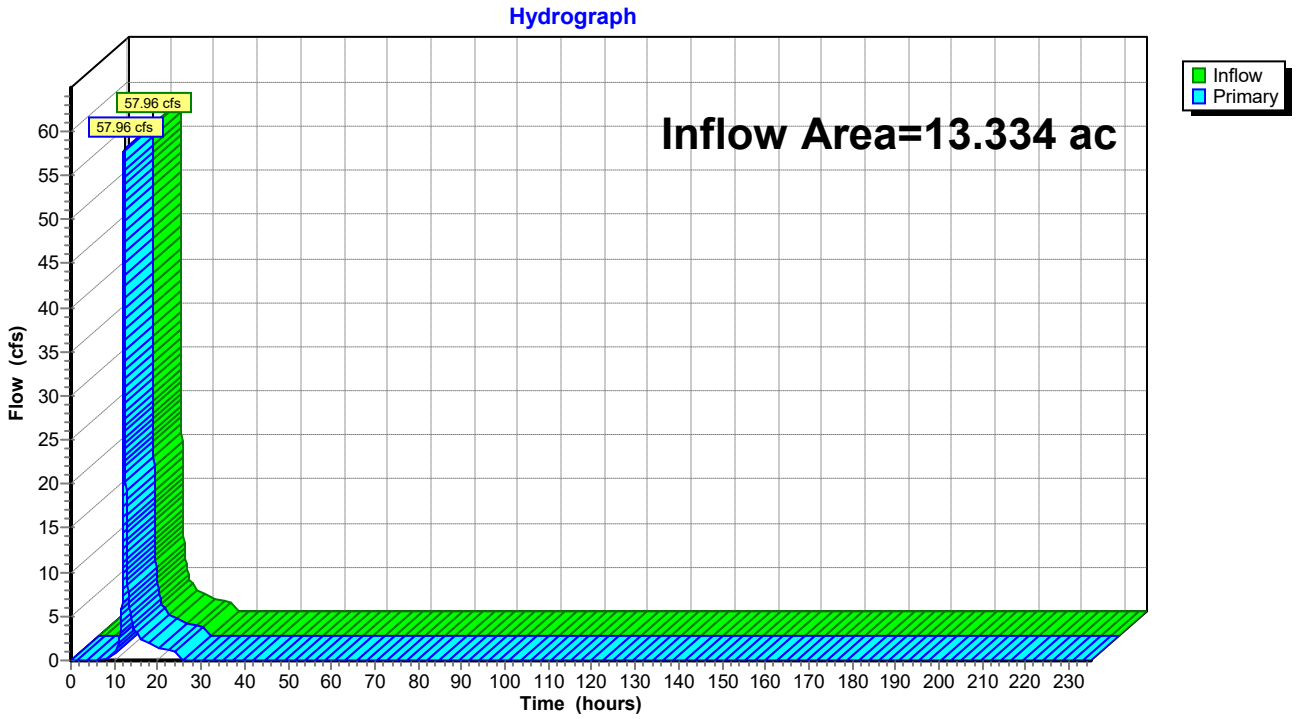


Summary for Link 86L: PC 2

Inflow Area = 13.334 ac, 0.00% Impervious, Inflow Depth = 4.90" for 100-YR NOAA event
Inflow = 57.96 cfs @ 12.22 hrs, Volume= 5.441 af
Primary = 57.96 cfs @ 12.22 hrs, Volume= 5.441 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 86L: PC 2

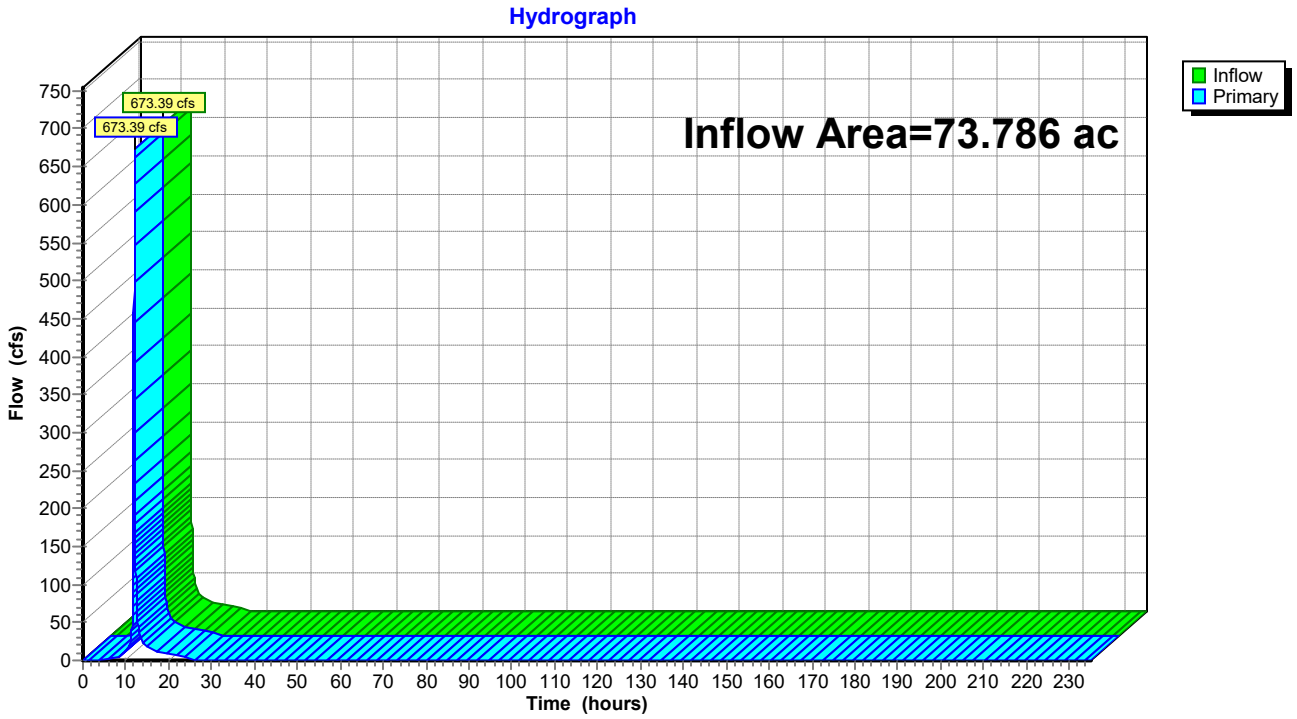


Summary for Link 87L: TO BASIN 1

Inflow Area = 73.786 ac, 8.72% Impervious, Inflow Depth = 5.94" for 100-YR NOAA event
Inflow = 673.39 cfs @ 11.96 hrs, Volume= 36.522 af
Primary = 673.39 cfs @ 11.96 hrs, Volume= 36.522 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 87L: TO BASIN 1

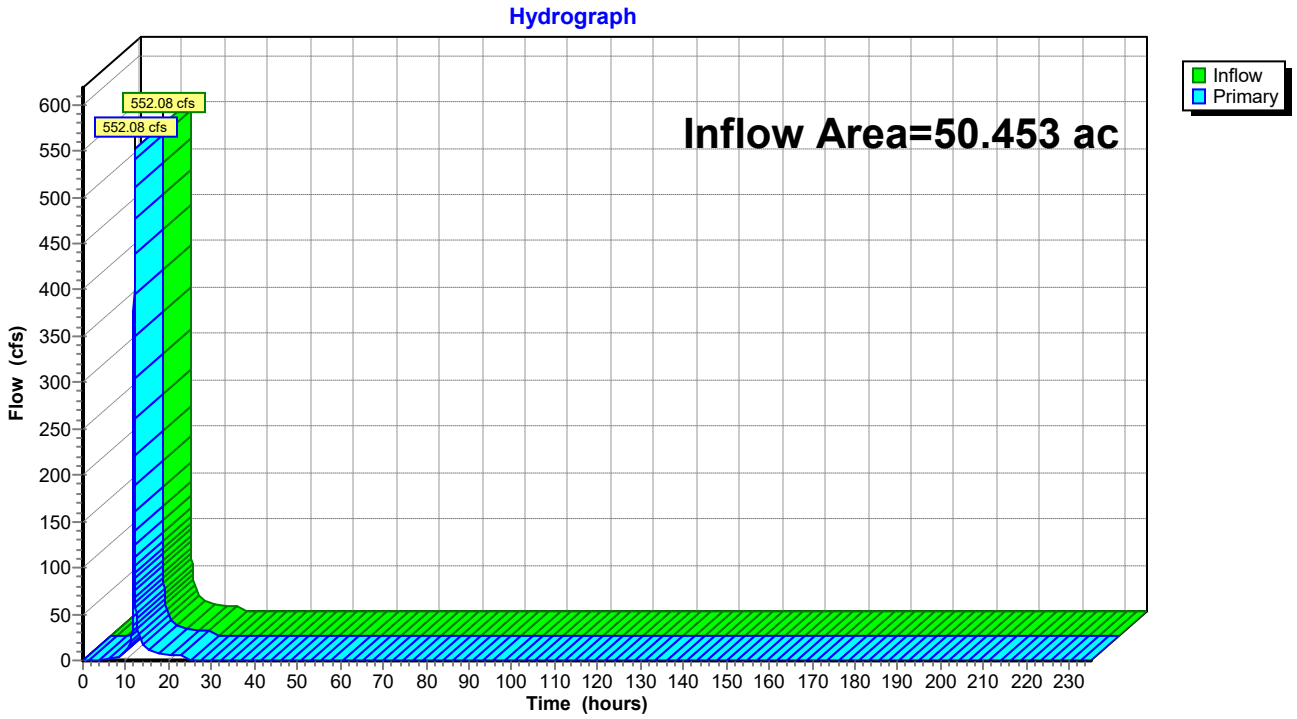


Summary for Link 88L: PC 4F

Inflow Area = 50.453 ac, 9.47% Impervious, Inflow Depth = 6.28" for 100-YR NOAA event
Inflow = 552.08 cfs @ 11.96 hrs, Volume= 26.400 af
Primary = 552.08 cfs @ 11.96 hrs, Volume= 26.400 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 88L: PC 4F



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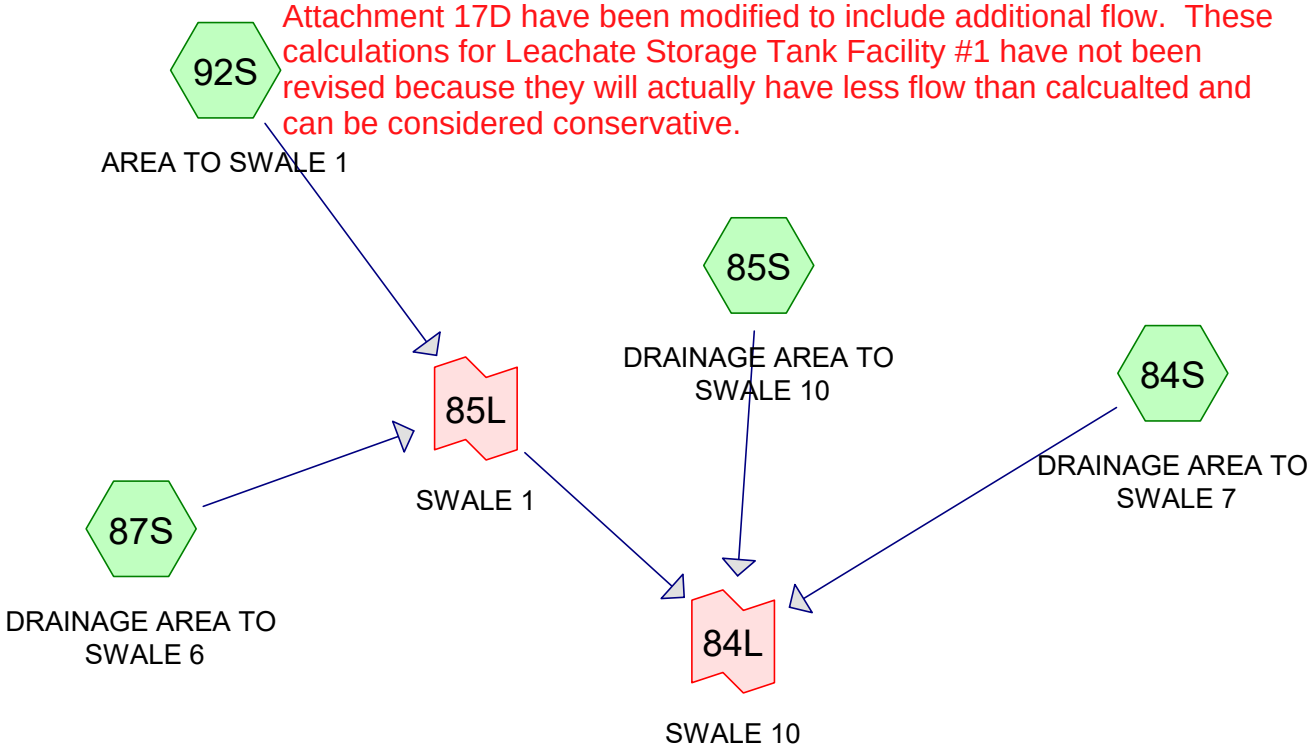
Leachate Storage Facility No. 1

Based on routing calculations 92S and 87S do not combine. 92S flows into PC-4F through Culvert #6. Proposed channel flow calculations Attachment 17D have been modified to include additional flow. These calculations for Leachate Storage Tank Facility #1 have not been revised because they will actually have less flow than calcualted and can be considered conservative.



Revised by PGS 08/21/2021

Subcat Reach Pond Link

Drainage Diagram for PC AND DOWNCHUTES_07152020
Prepared by {enter your company name here}, Printed 7/18/2020

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.485	30	Woods, Good, HSG A (92S)
4.665	30	Woods, Good, HSG A (ONSITE) (87S)
19.521	42	RA ZONING A SOILS (87S,92S)
5.191	61	>75% Grass cover, Good, HSG B (ONSITE A) (87S,92S)
2.514	64	RA ZONING B SOILS (87S,92S)
1.808	70	Woods, Good, HSG C (92S)
1.272	70	Woods, Good, HSG C (ONSITE) (87S)
5.791	76	RA ZONING C SOILS (87S,92S)
0.611	77	Woods, Good, HSG D (92S)
0.018	77	Woods, Good, HSG D (ONSITE) (87S)
2.595	80	>75% Grass cover, Good, HSG D (84S,85S)
4.270	80	>75% Grass cover, Good, HSG D (ONSITE C) (87S,92S)
1.650	80	>75% Grass cover, Good, HSG D (ONSITE D) (92S)
1.846	82	RA ZONING D SOILS (87S,92S)
0.108	98	Paved parking & roofs (87S)
1.037	98	Paved roads w/curbs & sewers (84S,85S)
58.383		**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
10.150	HSG A	87S, 92S
5.191	HSG B	87S, 92S
3.080	HSG C	87S, 92S
9.145	HSG D	84S, 85S, 87S, 92S
30.817	Other	84S, 85S, 87S, 92S
58.383		**TOTAL AREA**

Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 84S: DRAINAGE AREA TO Runoff Area=101,792 sf 25.93% Impervious Runoff Depth=4.21"
Tc=5.0 min CN=85 Runoff=17.34 cfs 0.819 af

Subcatchment 85S: DRAINAGE AREA TO Runoff Area=56,453 sf 33.28% Impervious Runoff Depth=4.31"
Tc=5.0 min CN=86 Runoff=9.80 cfs 0.466 af

Subcatchment 87S: DRAINAGE AREA TO Runoff Area=952,570 sf 0.49% Impervious Runoff Depth=1.09"
Tc=16.3 min CN=50 Runoff=24.00 cfs 1.994 af

Subcatchment 92S: AREA TO SWALE 1 Runoff Area=1,432,342 sf 0.00% Impervious Runoff Depth=1.54"
Tc=24.7 min CN=56 Runoff=44.00 cfs 4.213 af

Link 84L: SWALE 10 Inflow=68.46 cfs 7.493 af
Primary=68.46 cfs 7.493 af

Link 85L: SWALE 1 Inflow=64.62 cfs 6.207 af
Primary=64.62 cfs 6.207 af

Total Runoff Area = 58.383 ac Runoff Volume = 7.493 af Average Runoff Depth = 1.54"
98.04% Pervious = 57.238 ac 1.96% Impervious = 1.145 ac

Summary for Subcatchment 84S: DRAINAGE AREA TO SWALE 7

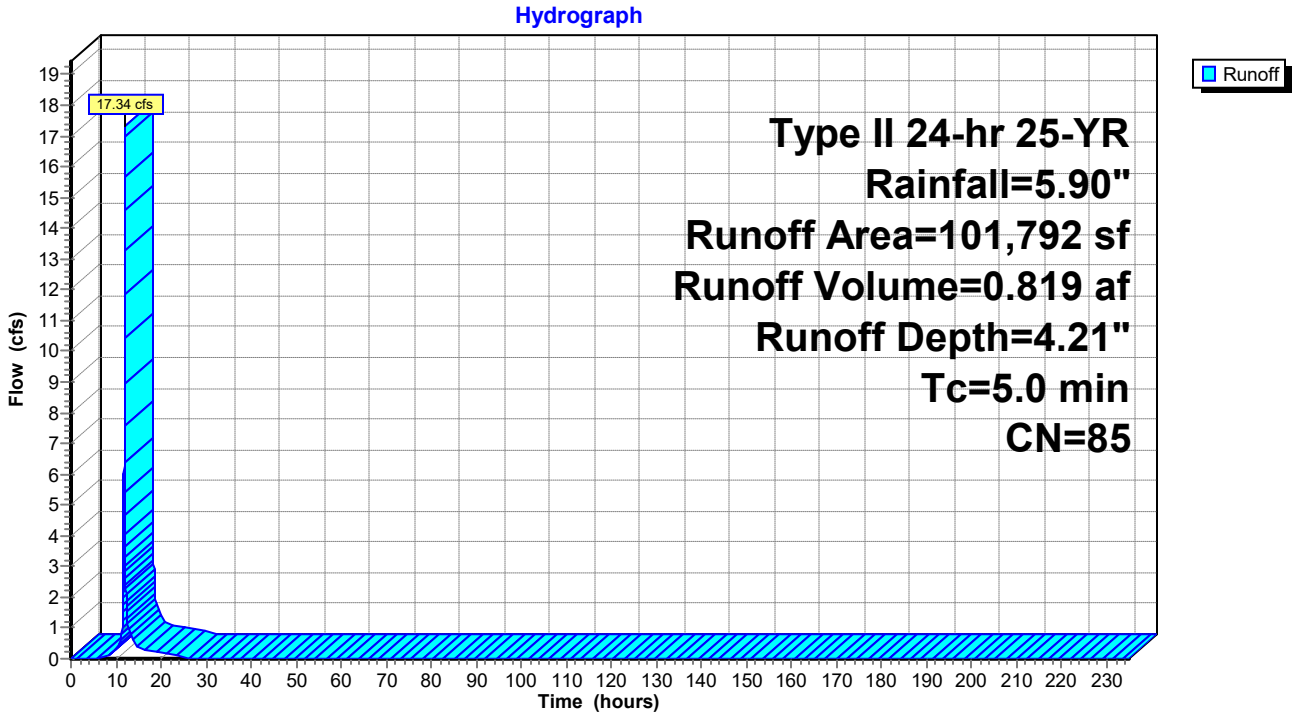
Runoff = 17.34 cfs @ 11.96 hrs, Volume= 0.819 af, Depth= 4.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
75,393	80	>75% Grass cover, Good, HSG D
26,399	98	Paved roads w/curbs & sewers
101,792	85	Weighted Average
75,393		Pervious Area
26,399		Impervious Area

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

Subcatchment 84S: DRAINAGE AREA TO SWALE 7



Summary for Subcatchment 85S: DRAINAGE AREA TO SWALE 10

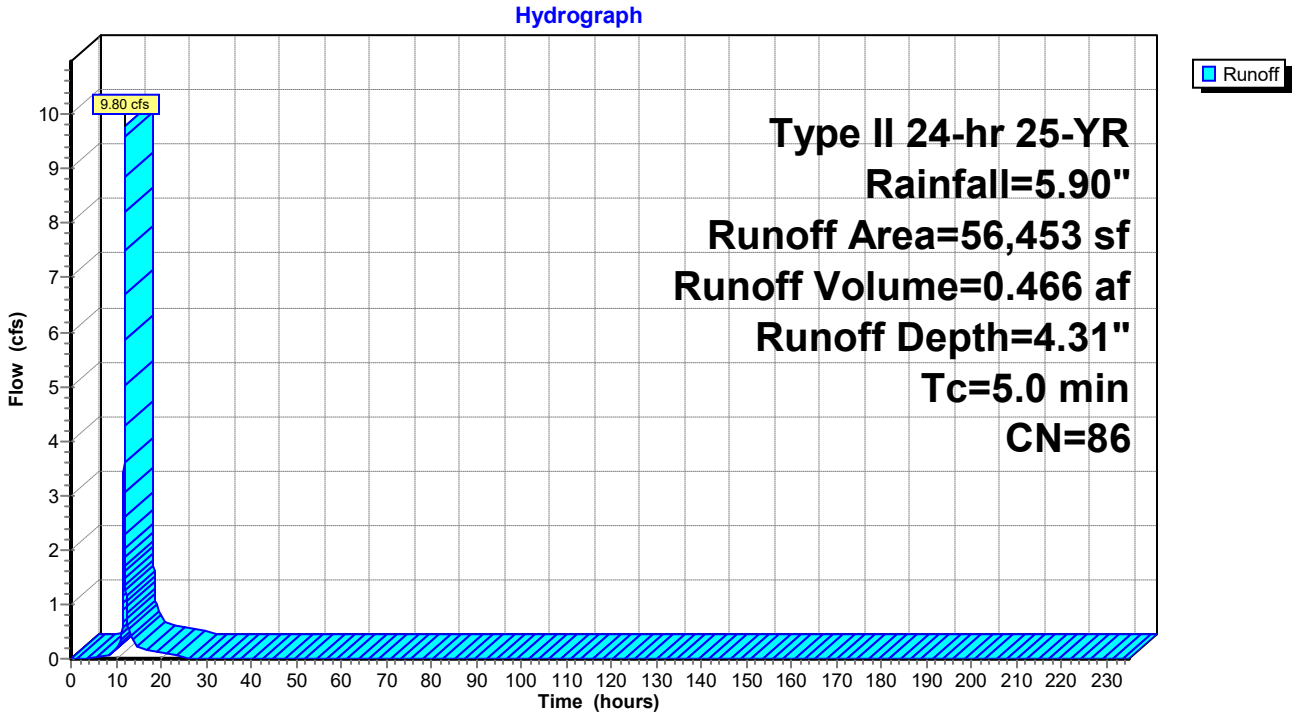
Runoff = 9.80 cfs @ 11.96 hrs, Volume= 0.466 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
37,666	80	>75% Grass cover, Good, HSG D
18,787	98	Paved roads w/curbs & sewers
56,453	86	Weighted Average
37,666		Pervious Area
18,787		Impervious Area

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

Subcatchment 85S: DRAINAGE AREA TO SWALE 10



Summary for Subcatchment 87S: DRAINAGE AREA TO SWALE 6

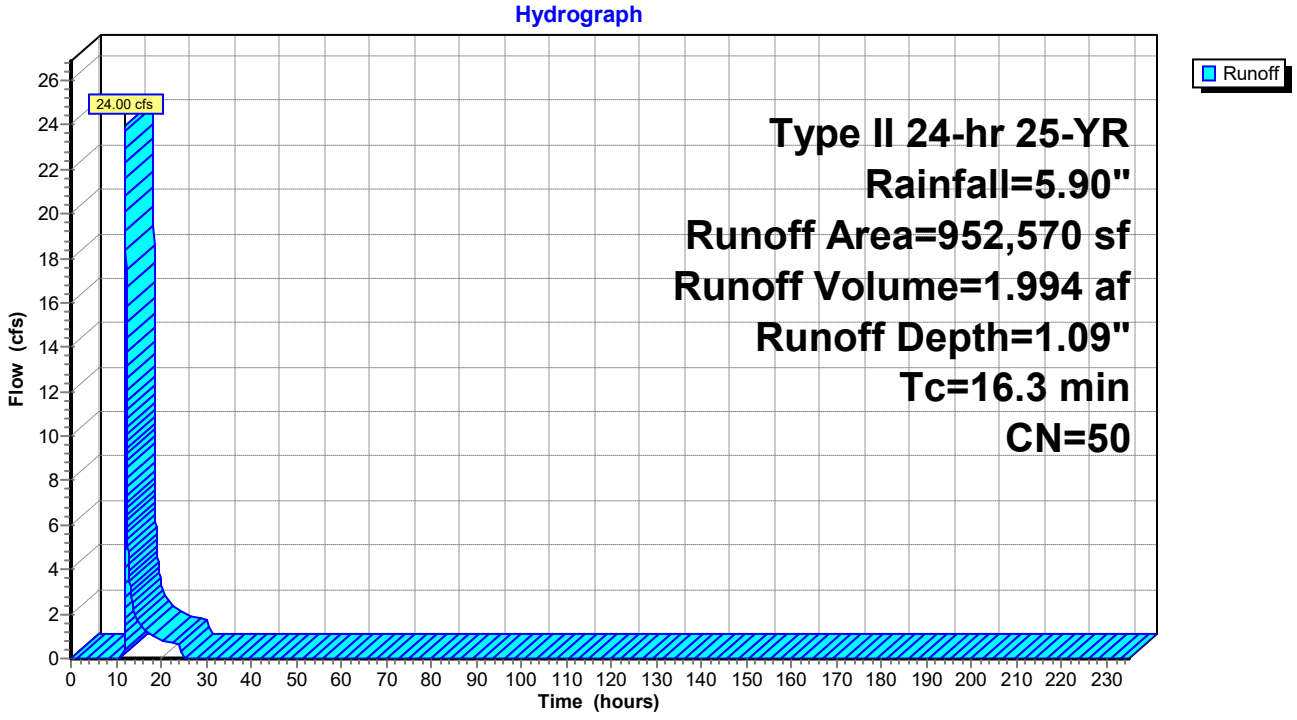
Runoff = 24.00 cfs @ 12.12 hrs, Volume= 1.994 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	203,207	30	Woods, Good, HSG A (ONSITE)
*	55,408	70	Woods, Good, HSG C (ONSITE)
*	784	77	Woods, Good, HSG D (ONSITE)
*	47,045	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	82,633	80	>75% Grass cover, Good, HSG D (ONSITE C)
	4,704	98	Paved parking & roofs
*	447,100	42	RA ZONING A SOILS
*	5,881	64	RA ZONING B SOILS
*	81,022	76	RA ZONING C SOILS
*	24,786	82	RA ZONING D SOILS
	952,570	50	Weighted Average
	947,866		Pervious Area
	4,704		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3					**Direct Entry, FROM BASIN A HYDROGRAPH**

Subcatchment 87S: DRAINAGE AREA TO SWALE 6



Summary for Subcatchment 92S: AREA TO SWALE 1

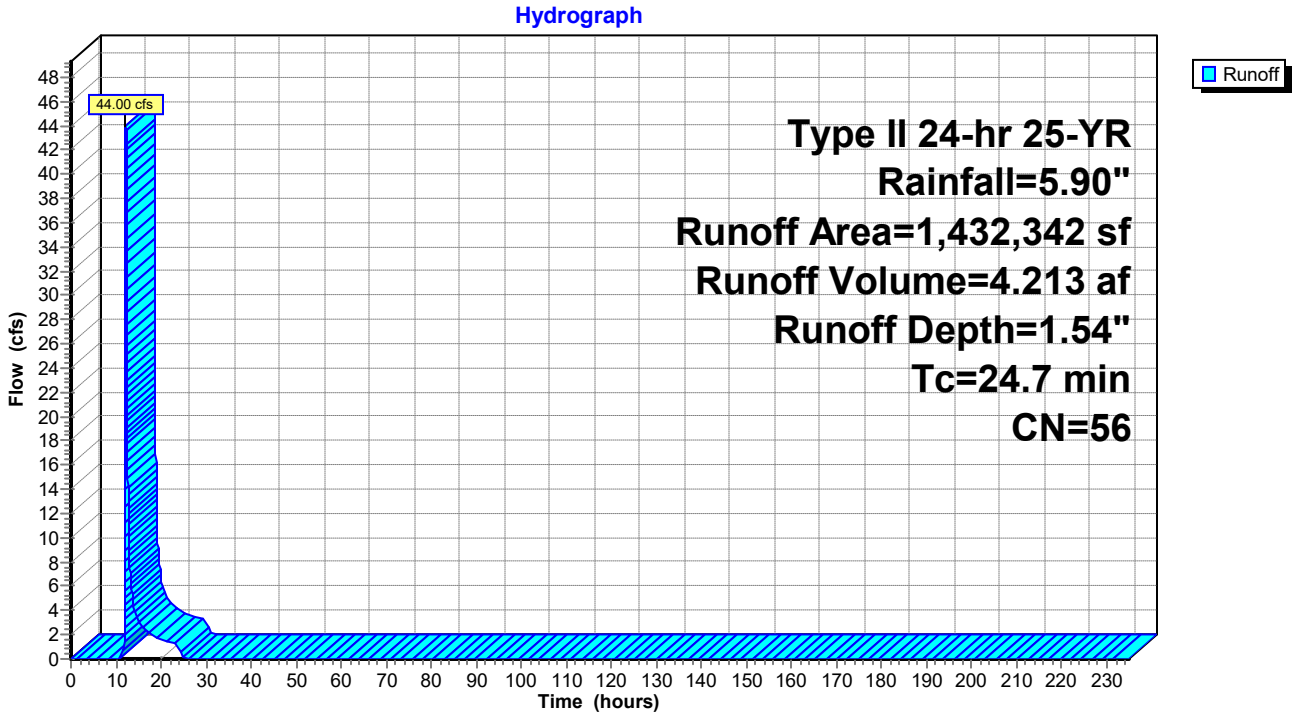
Runoff = 44.00 cfs @ 12.21 hrs, Volume= 4.213 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	238,936	30	Woods, Good, HSG A
	78,739	70	Woods, Good, HSG C
	26,634	77	Woods, Good, HSG D
*	179,075	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	103,360	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	71,885	80	>75% Grass cover, Good, HSG D (ONSITE D)
*	403,214	42	RA ZONING A SOILS
*	103,642	64	RA ZONING B SOILS
*	171,248	76	RA ZONING C SOILS
*	55,609	82	RA ZONING D SOILS
	1,432,342	56	Weighted Average
	1,432,342		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.7					**Direct Entry, A-F OF BASIN 1 Tc**

Subcatchment 92S: AREA TO SWALE 1

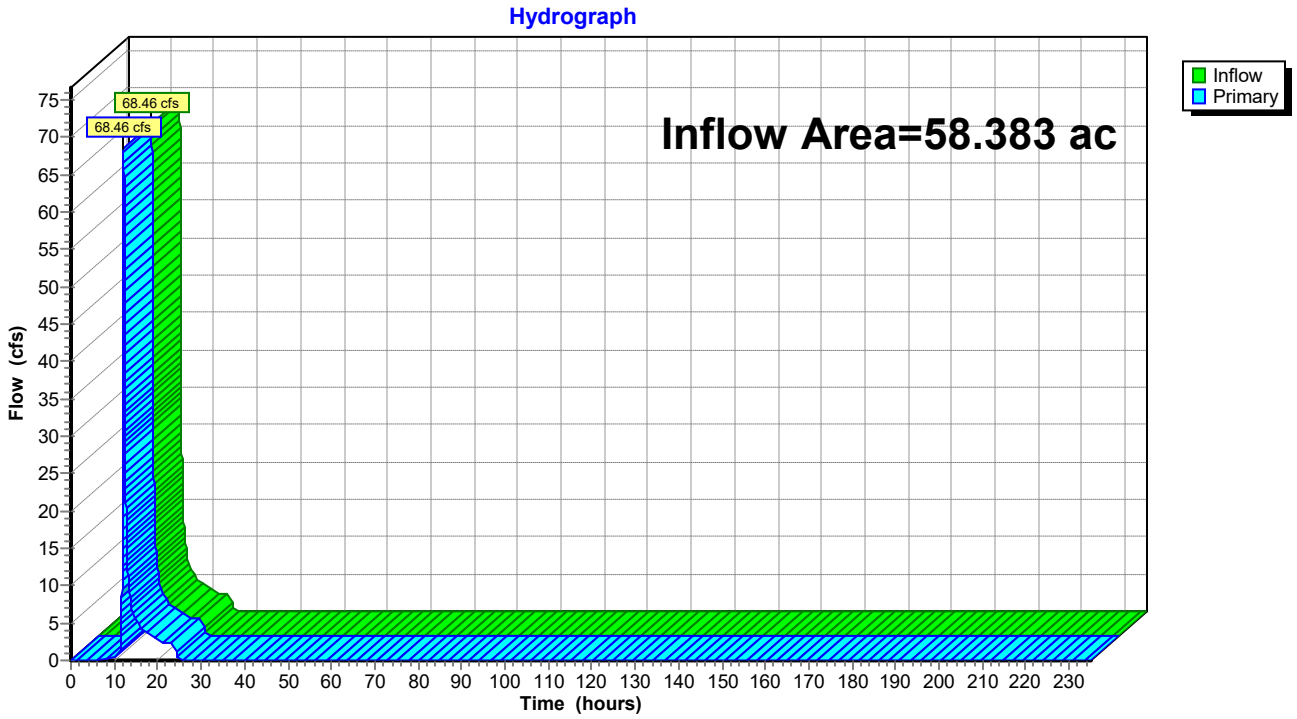


Summary for Link 84L: SWALE 10

Inflow Area = 58.383 ac, 1.96% Impervious, Inflow Depth = 1.54" for 25-YR event
Inflow = 68.46 cfs @ 12.16 hrs, Volume= 7.493 af
Primary = 68.46 cfs @ 12.16 hrs, Volume= 7.493 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 84L: SWALE 10

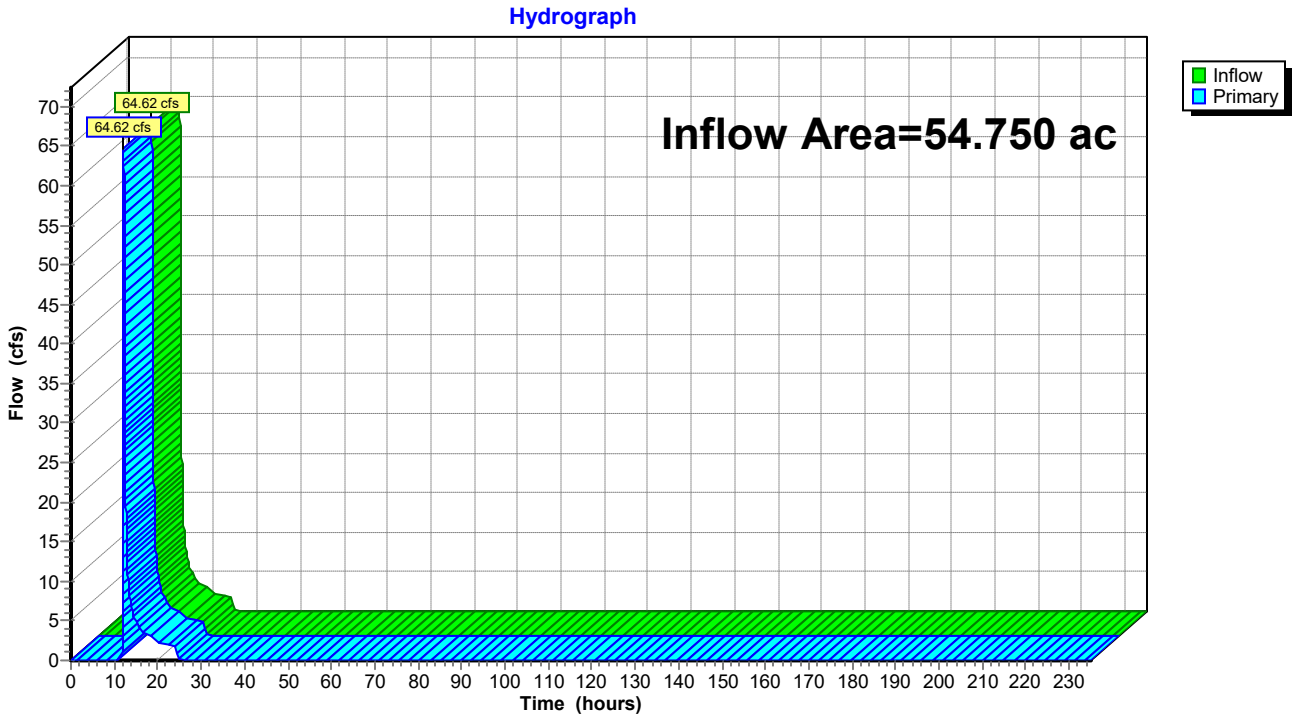


Summary for Link 85L: SWALE 1

Inflow Area = 54.750 ac, 0.20% Impervious, Inflow Depth = 1.36" for 25-YR event
Inflow = 64.62 cfs @ 12.16 hrs, Volume= 6.207 af
Primary = 64.62 cfs @ 12.16 hrs, Volume= 6.207 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 85L: SWALE 1



Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 84S: DRAINAGE AREA TO Runoff Area=101,792 sf 25.93% Impervious Runoff Depth=6.70"
Tc=5.0 min CN=85 Runoff=26.77 cfs 1.304 af

Subcatchment 85S: DRAINAGE AREA TO Runoff Area=56,453 sf 33.28% Impervious Runoff Depth=6.82"
Tc=5.0 min CN=86 Runoff=15.01 cfs 0.736 af

Subcatchment 87S: DRAINAGE AREA TO Runoff Area=952,570 sf 0.49% Impervious Runoff Depth=2.56"
Tc=16.3 min CN=50 Runoff=65.73 cfs 4.666 af

Subcatchment 92S: AREA TO SWALE 1 Runoff Area=1,432,342 sf 0.00% Impervious Runoff Depth=3.25"
Tc=24.7 min CN=56 Runoff=101.31 cfs 8.897 af

Link 84L: SWALE 10 Inflow=164.87 cfs 15.603 af
Primary=164.87 cfs 15.603 af

Link 85L: SWALE 1 Inflow=158.72 cfs 13.563 af
Primary=158.72 cfs 13.563 af

Total Runoff Area = 58.383 ac Runoff Volume = 15.603 af Average Runoff Depth = 3.21"
98.04% Pervious = 57.238 ac 1.96% Impervious = 1.145 ac

Summary for Subcatchment 84S: DRAINAGE AREA TO SWALE 7

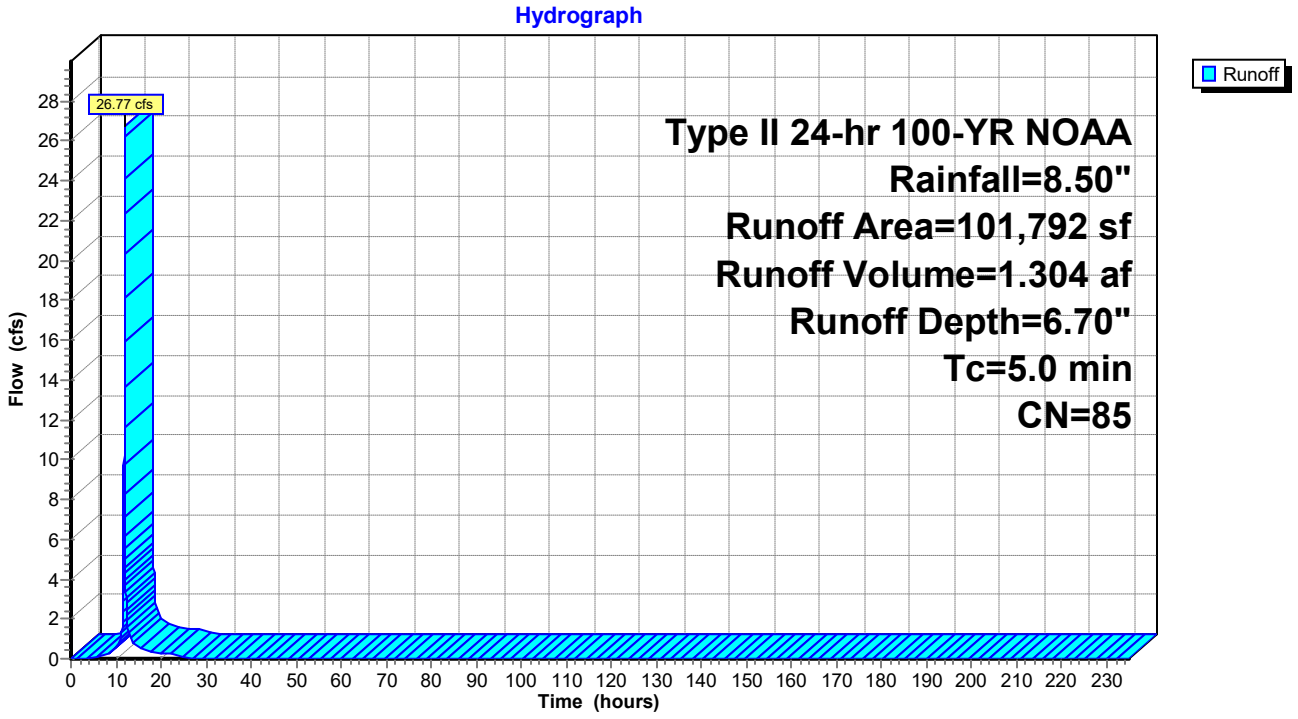
Runoff = 26.77 cfs @ 11.96 hrs, Volume= 1.304 af, Depth= 6.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
75,393	80	>75% Grass cover, Good, HSG D
26,399	98	Paved roads w/curbs & sewers
101,792	85	Weighted Average
75,393		Pervious Area
26,399		Impervious Area

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

Subcatchment 84S: DRAINAGE AREA TO SWALE 7



Summary for Subcatchment 85S: DRAINAGE AREA TO SWALE 10

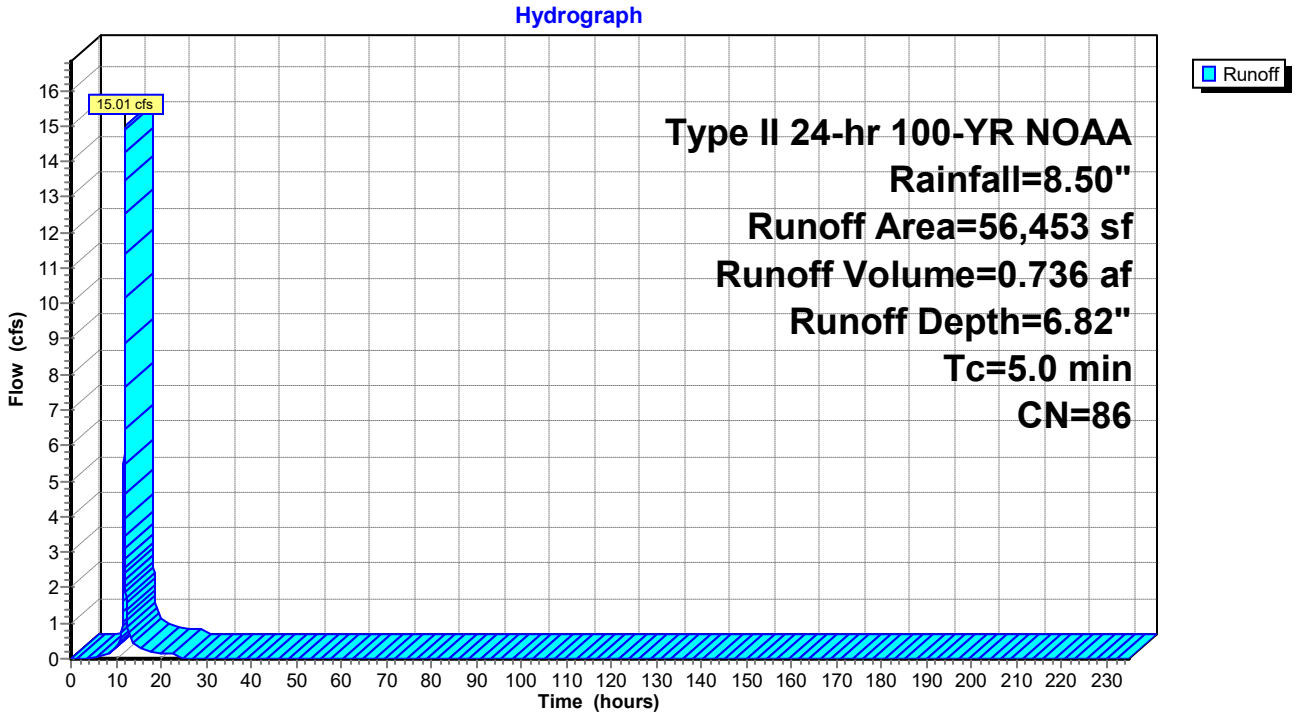
Runoff = 15.01 cfs @ 11.96 hrs, Volume= 0.736 af, Depth= 6.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
37,666	80	>75% Grass cover, Good, HSG D
18,787	98	Paved roads w/curbs & sewers
56,453	86	Weighted Average
37,666		Pervious Area
18,787		Impervious Area

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

Subcatchment 85S: DRAINAGE AREA TO SWALE 10



Summary for Subcatchment 87S: DRAINAGE AREA TO SWALE 6

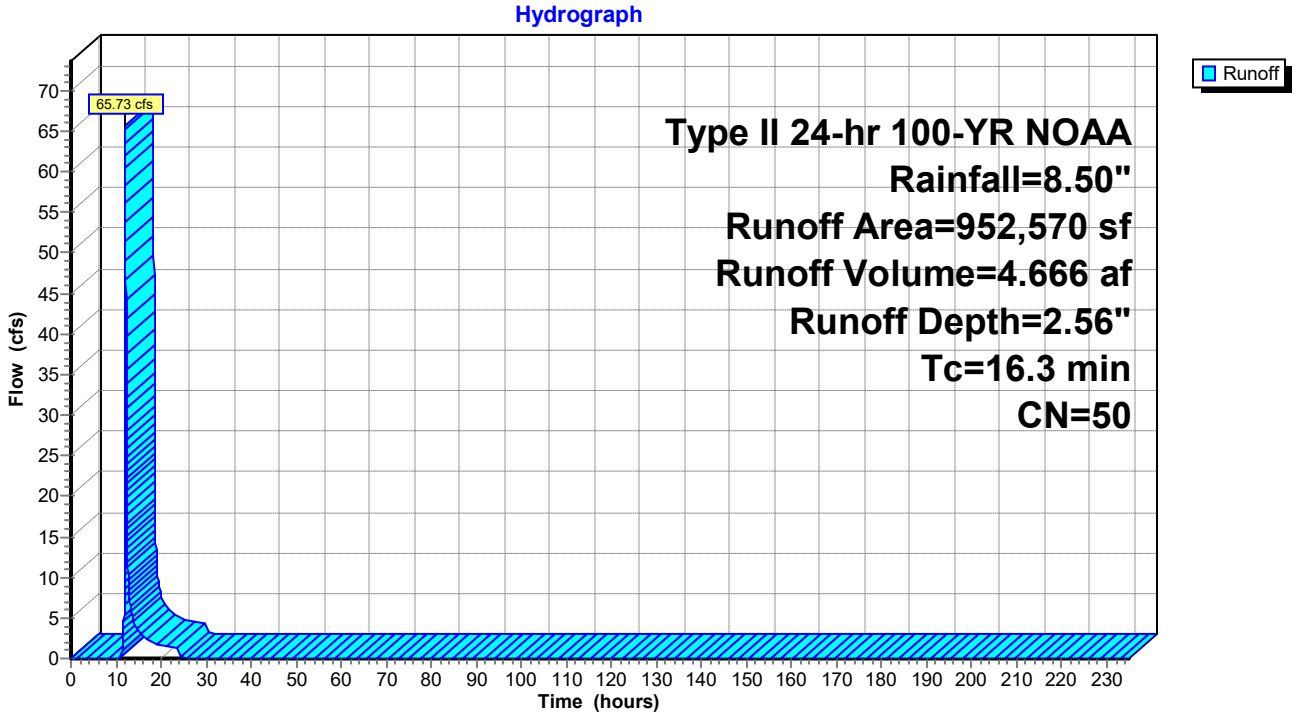
Runoff = 65.73 cfs @ 12.10 hrs, Volume= 4.666 af, Depth= 2.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	203,207	30	Woods, Good, HSG A (ONSITE)
*	55,408	70	Woods, Good, HSG C (ONSITE)
*	784	77	Woods, Good, HSG D (ONSITE)
*	47,045	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	82,633	80	>75% Grass cover, Good, HSG D (ONSITE C)
	4,704	98	Paved parking & roofs
*	447,100	42	RA ZONING A SOILS
*	5,881	64	RA ZONING B SOILS
*	81,022	76	RA ZONING C SOILS
*	24,786	82	RA ZONING D SOILS
	952,570	50	Weighted Average
	947,866		Pervious Area
	4,704		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3					**Direct Entry, FROM BASIN A HYDROGRAPH**

Subcatchment 87S: DRAINAGE AREA TO SWALE 6



Summary for Subcatchment 92S: AREA TO SWALE 1

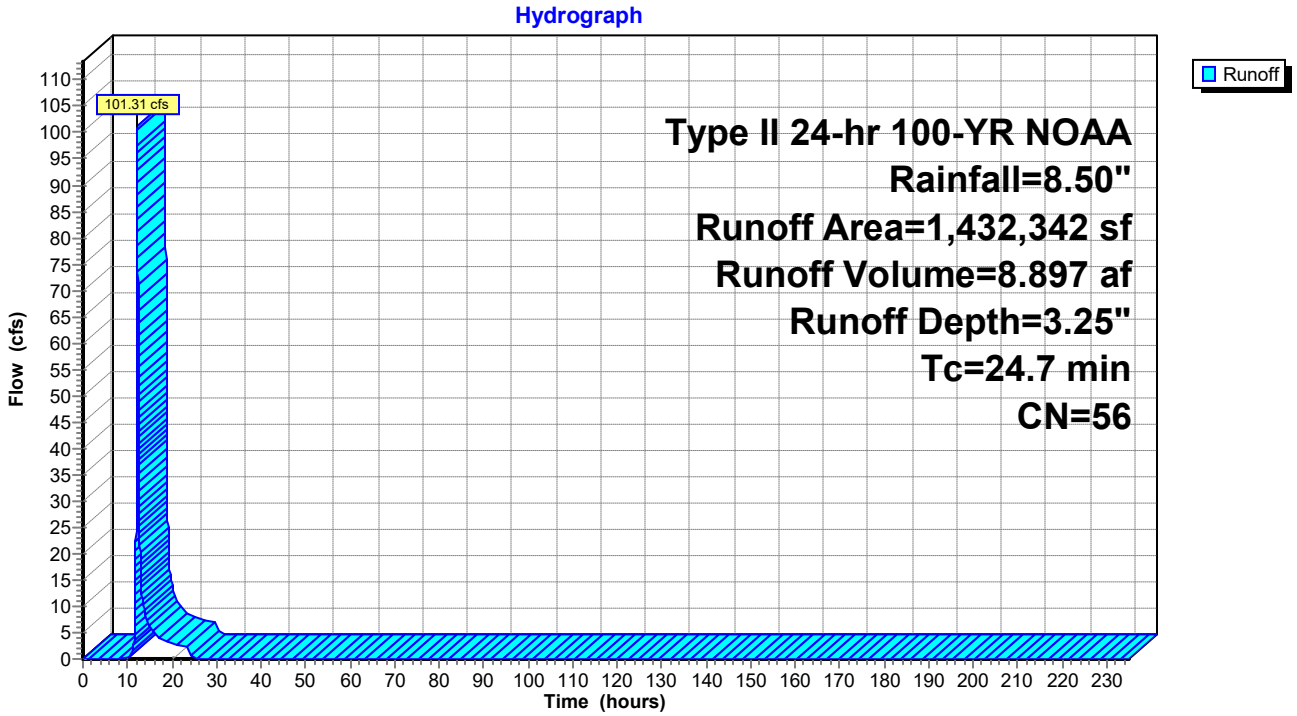
Runoff = 101.31 cfs @ 12.19 hrs, Volume= 8.897 af, Depth= 3.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	238,936	30	Woods, Good, HSG A
	78,739	70	Woods, Good, HSG C
	26,634	77	Woods, Good, HSG D
*	179,075	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	103,360	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	71,885	80	>75% Grass cover, Good, HSG D (ONSITE D)
*	403,214	42	RA ZONING A SOILS
*	103,642	64	RA ZONING B SOILS
*	171,248	76	RA ZONING C SOILS
*	55,609	82	RA ZONING D SOILS
	1,432,342	56	Weighted Average
	1,432,342		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.7					**Direct Entry, A-F OF BASIN 1 Tc**

Subcatchment 92S: AREA TO SWALE 1

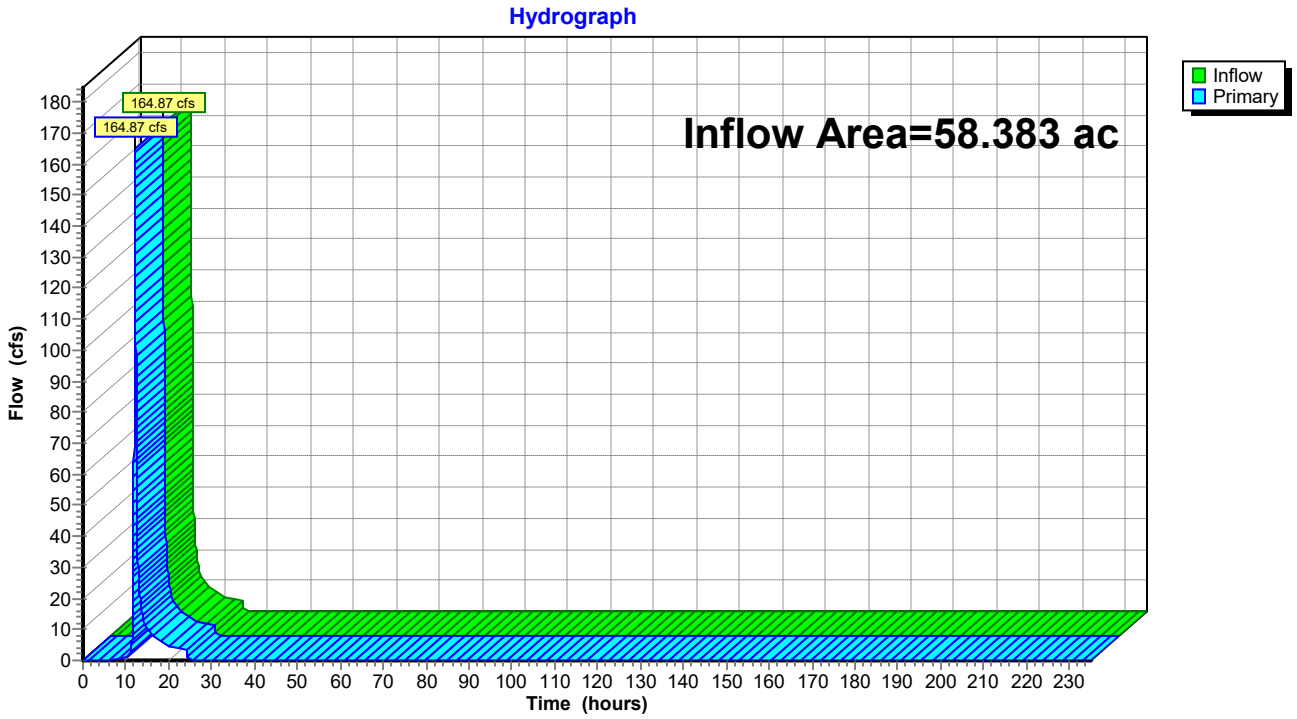


Summary for Link 84L: SWALE 10

Inflow Area = 58.383 ac, 1.96% Impervious, Inflow Depth = 3.21" for 100-YR NOAA event
Inflow = 164.87 cfs @ 12.14 hrs, Volume= 15.603 af
Primary = 164.87 cfs @ 12.14 hrs, Volume= 15.603 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 84L: SWALE 10

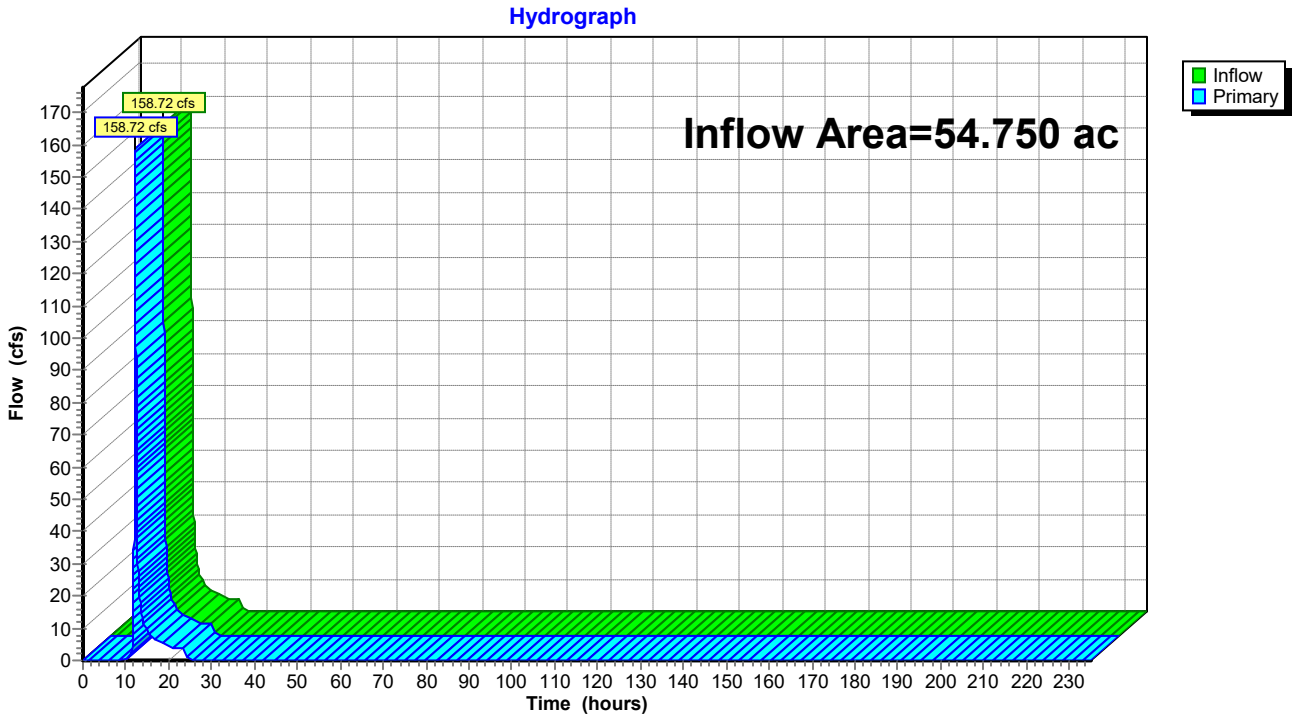


Summary for Link 85L: SWALE 1

Inflow Area = 54.750 ac, 0.20% Impervious, Inflow Depth = 2.97" for 100-YR NOAA event
Inflow = 158.72 cfs @ 12.15 hrs, Volume= 13.563 af
Primary = 158.72 cfs @ 12.15 hrs, Volume= 13.563 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 85L: SWALE 1



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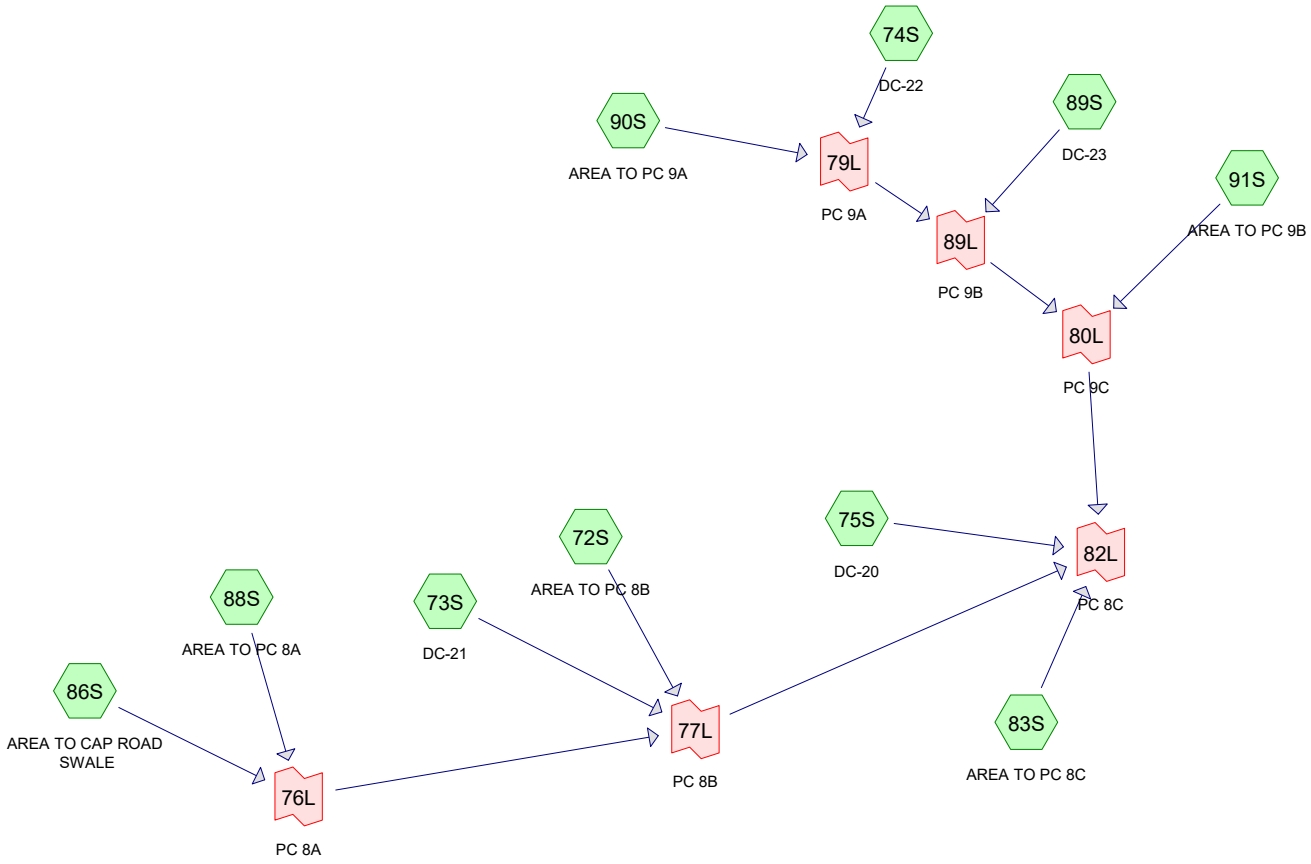
East Side (Cells 11-16)



Revised by PGS 08/21/2021

Subcat Reach Pond Link

Drainage Diagram for PC AND DOWNCHUTES_07152020
Prepared by {enter your company name here}, Printed 7/18/2020

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
37.672	80	>75% Grass cover, Good, HSG D (72S,73S,74S,75S,83S,86S,88S,89S,90S,91S)
3.021	98	Paved parking & roofs (72S,83S,88S,90S,91S)
40.694		**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
37.672	HSG D	72S, 73S, 74S, 75S, 83S, 86S, 88S, 89S, 90S, 91S
3.021	Other	72S, 83S, 88S, 90S, 91S
40.694		**TOTAL AREA**

Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 72S: AREA TO PC 8B Runoff Area=146,396 sf 15.66% Impervious Runoff Depth=4.00"
Tc=5.0 min CN=83 Runoff=23.98 cfs 1.120 af

Subcatchment 73S: DC-21 Runoff Area=347,408 sf 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=53.31 cfs 2.453 af

Subcatchment 74S: DC-22 Runoff Area=190,896 sf 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=29.30 cfs 1.348 af

Subcatchment 75S: DC-20 Runoff Area=233,065 sf 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=35.77 cfs 1.646 af

Subcatchment 83S: AREA TO PC 8C Runoff Area=44,677 sf 22.27% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=7.47 cfs 0.351 af

Subcatchment 86S: AREA TO CAP ROAD Runoff Area=65,391 sf 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=10.04 cfs 0.462 af

Subcatchment 88S: AREA TO PC 8A Runoff Area=158,379 sf 24.90% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=26.47 cfs 1.243 af

Subcatchment 89S: DC-23 Runoff Area=6.417 ac 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=42.90 cfs 1.974 af

Subcatchment 90S: AREA TO PC 9A Runoff Area=113,003 sf 20.90% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=18.89 cfs 0.887 af

Subcatchment 91S: AREA TO PC 9B Runoff Area=193,876 sf 18.41% Impervious Runoff Depth=4.00"
Tc=5.0 min CN=83 Runoff=31.76 cfs 1.483 af

Link 76L: PC 8A Inflow=36.51 cfs 1.705 af
Primary=36.51 cfs 1.705 af

Link 77L: PC 8B Inflow=113.80 cfs 5.278 af
Primary=113.80 cfs 5.278 af

Link 79L: PC 9A Inflow=48.18 cfs 2.235 af
Primary=48.18 cfs 2.235 af

Link 80L: PC 9C Inflow=122.84 cfs 5.692 af
Primary=122.84 cfs 5.692 af

Link 82L: PC 8C Inflow=279.88 cfs 12.966 af
Primary=279.88 cfs 12.966 af

Link 89L: PC 9B Inflow=91.08 cfs 4.209 af
Primary=91.08 cfs 4.209 af

Total Runoff Area = 40.694 ac Runoff Volume = 12.966 af Average Runoff Depth = 3.82"
92.58% Pervious = 37.672 ac 7.42% Impervious = 3.021 ac

Summary for Subcatchment 72S: AREA TO PC 8B

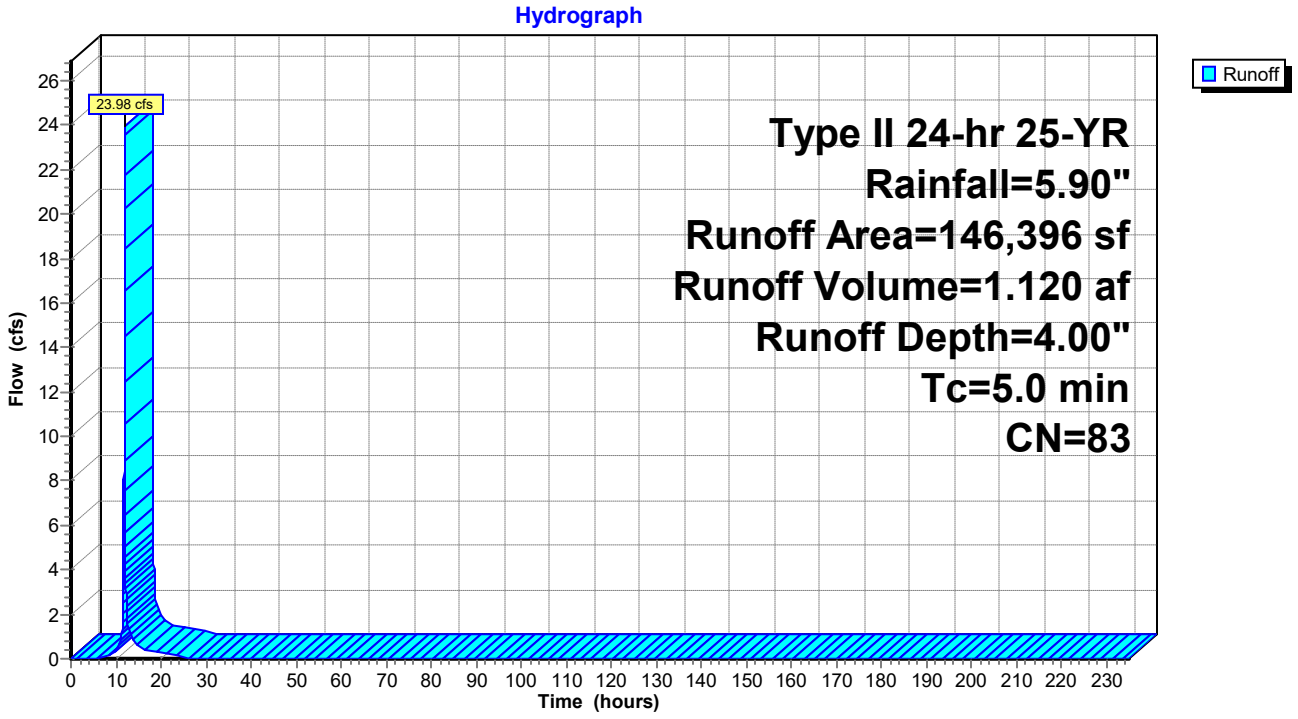
Runoff = 23.98 cfs @ 11.96 hrs, Volume= 1.120 af, Depth= 4.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
123,465	80	>75% Grass cover, Good, HSG D
22,931	98	Paved parking & roofs
146,396	83	Weighted Average
123,465		Pervious Area
22,931		Impervious Area

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

Subcatchment 72S: AREA TO PC 8B



Summary for Subcatchment 73S: DC-21

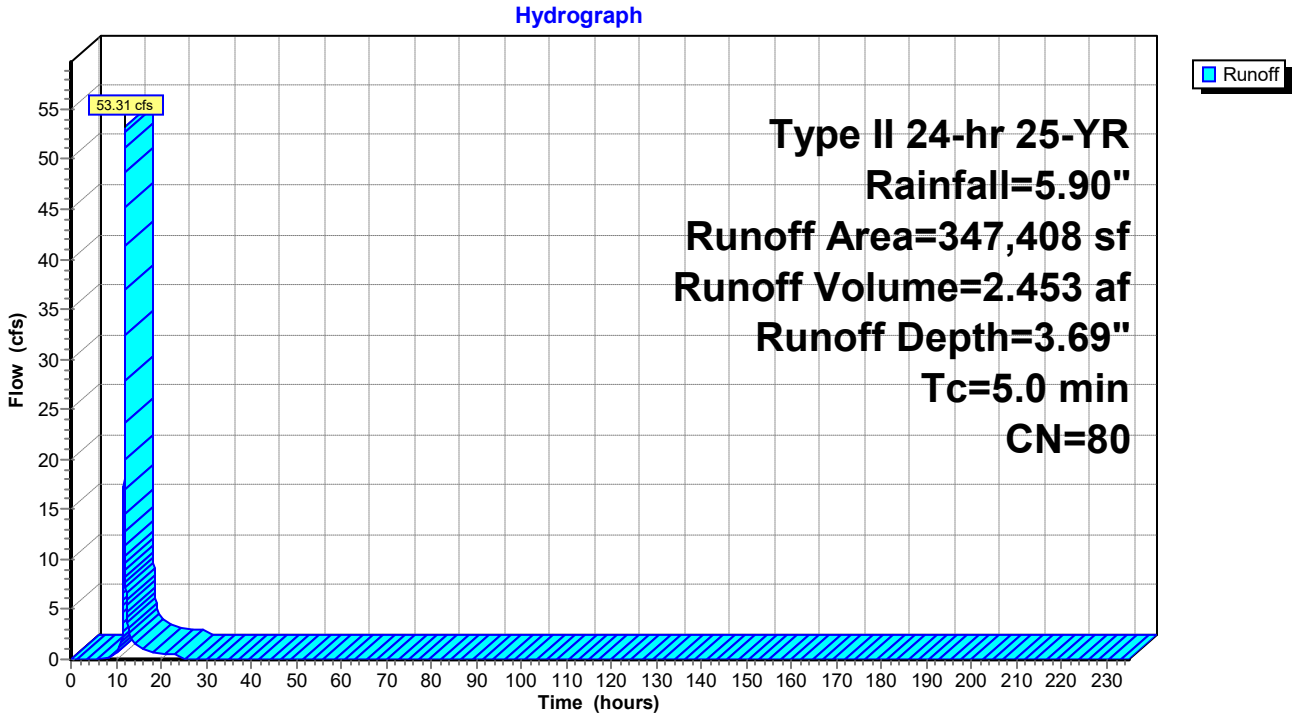
Runoff = 53.31 cfs @ 11.96 hrs, Volume= 2.453 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
347,408	80	>75% Grass cover, Good, HSG D
347,408		Pervious Area

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

Subcatchment 73S: DC-21



Summary for Subcatchment 74S: DC-22

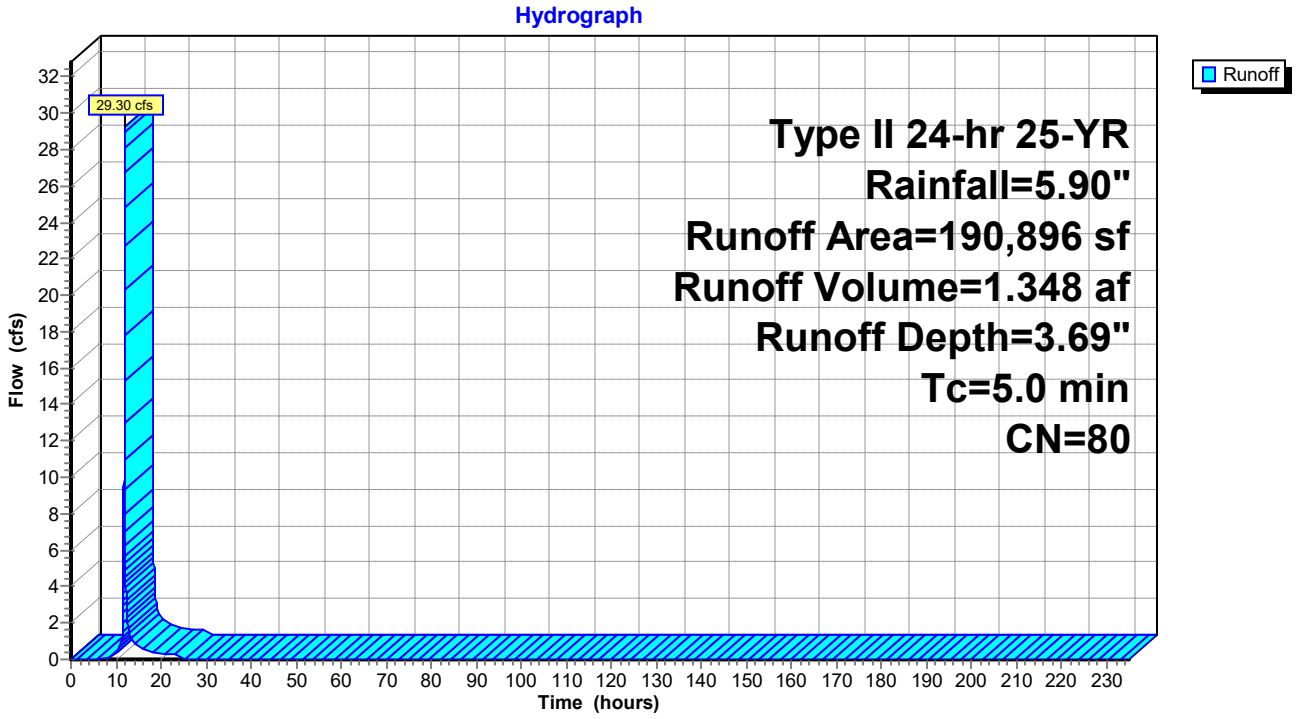
Runoff = 29.30 cfs @ 11.96 hrs, Volume= 1.348 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
190,896	80	>75% Grass cover, Good, HSG D
190,896		Pervious Area

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

Subcatchment 74S: DC-22



Summary for Subcatchment 75S: DC-20

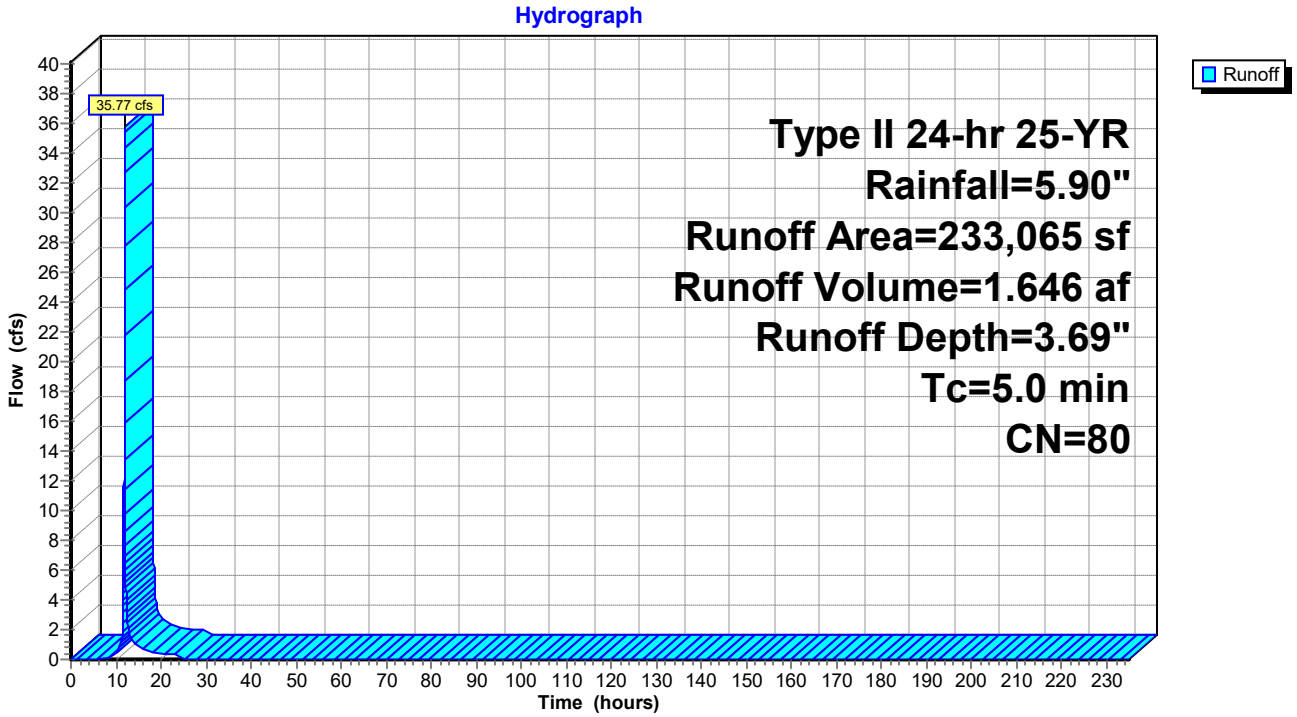
Runoff = 35.77 cfs @ 11.96 hrs, Volume= 1.646 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
233,065	80	>75% Grass cover, Good, HSG D
233,065		Pervious Area

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

Subcatchment 75S: DC-20



Summary for Subcatchment 83S: AREA TO PC 8C

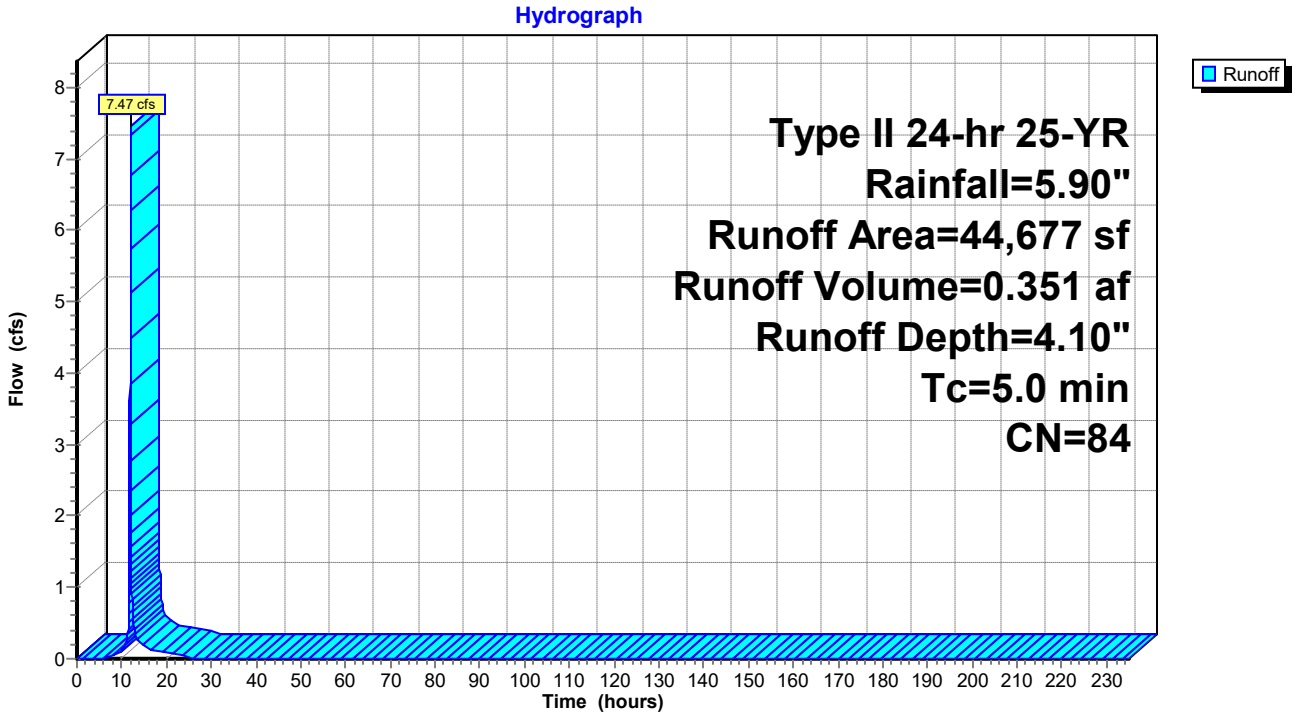
Runoff = 7.47 cfs @ 11.96 hrs, Volume= 0.351 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
34,727	80	>75% Grass cover, Good, HSG D
9,950	98	Paved parking & roofs
44,677	84	Weighted Average
34,727		Pervious Area
9,950		Impervious Area

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

Subcatchment 83S: AREA TO PC 8C



Summary for Subcatchment 86S: AREA TO CAP ROAD SWALE

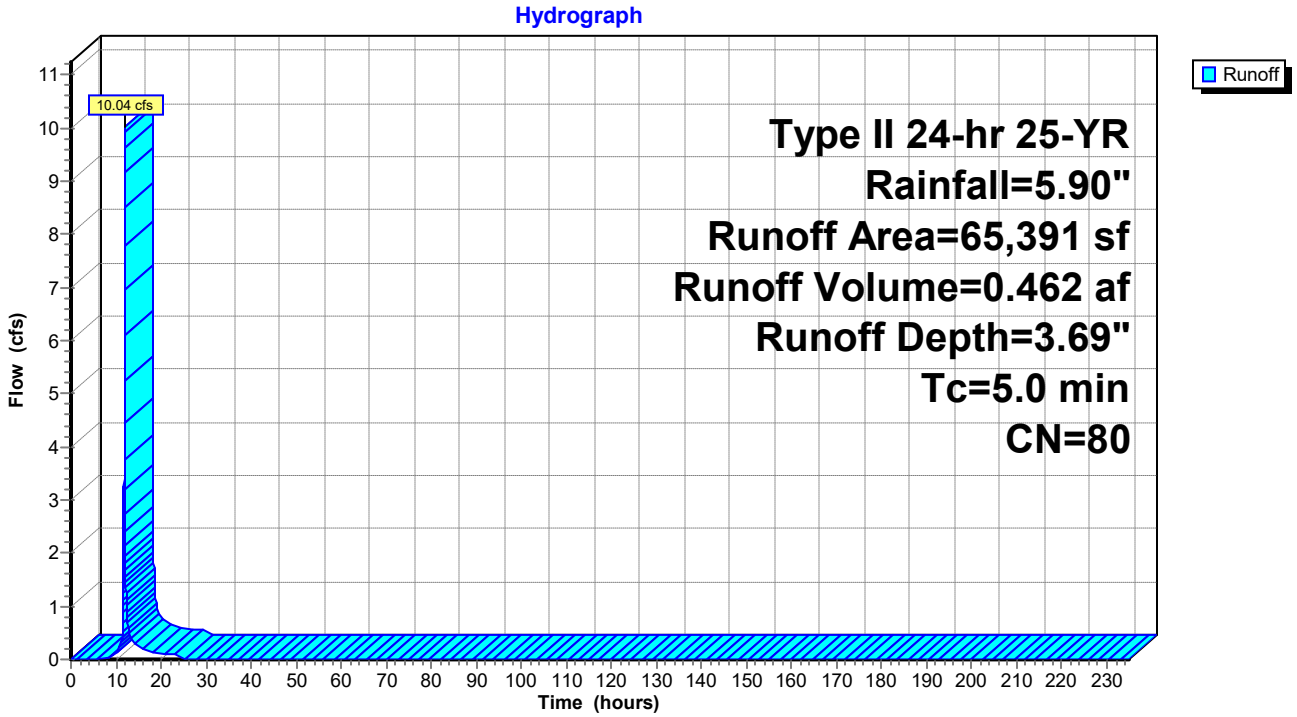
Runoff = 10.04 cfs @ 11.96 hrs, Volume= 0.462 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
65,391	80	>75% Grass cover, Good, HSG D
65,391		Pervious Area

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

Subcatchment 86S: AREA TO CAP ROAD SWALE



Summary for Subcatchment 88S: AREA TO PC 8A

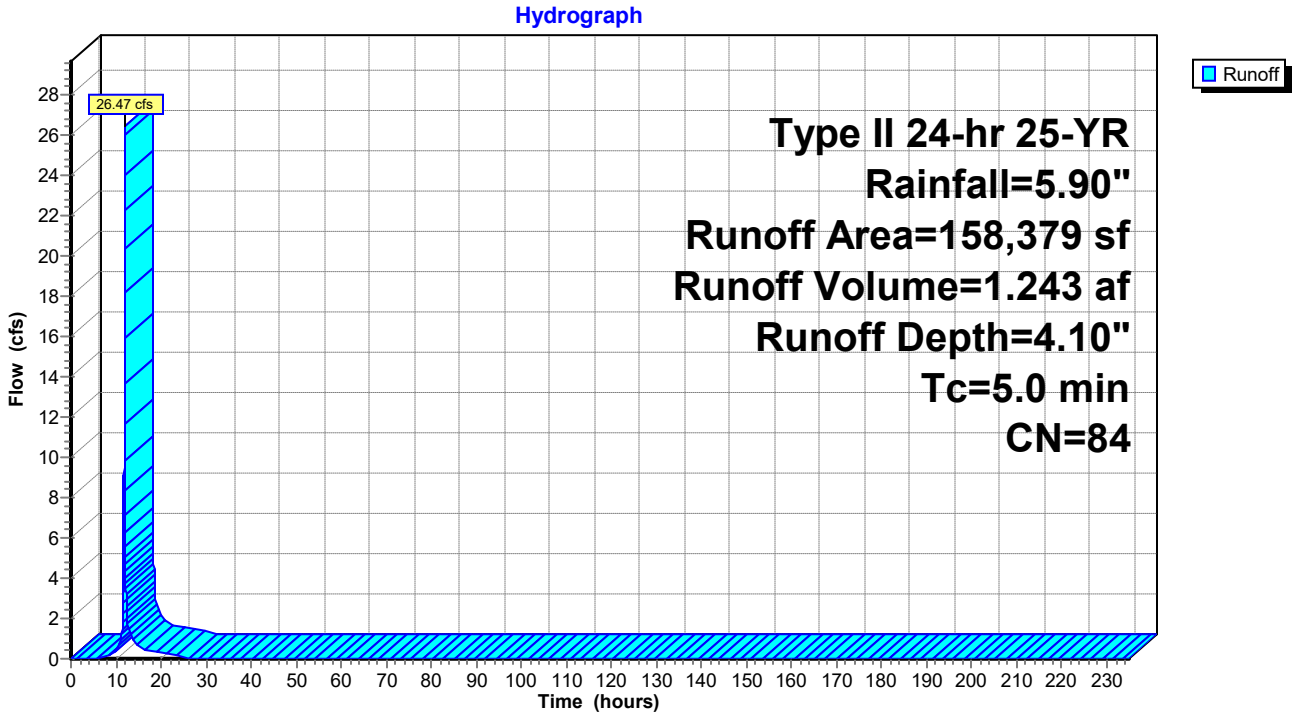
Runoff = 26.47 cfs @ 11.96 hrs, Volume= 1.243 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
118,947	80	>75% Grass cover, Good, HSG D
39,432	98	Paved parking & roofs
158,379	84	Weighted Average
118,947		Pervious Area
39,432		Impervious Area

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

Subcatchment 88S: AREA TO PC 8A



Summary for Subcatchment 89S: DC-23

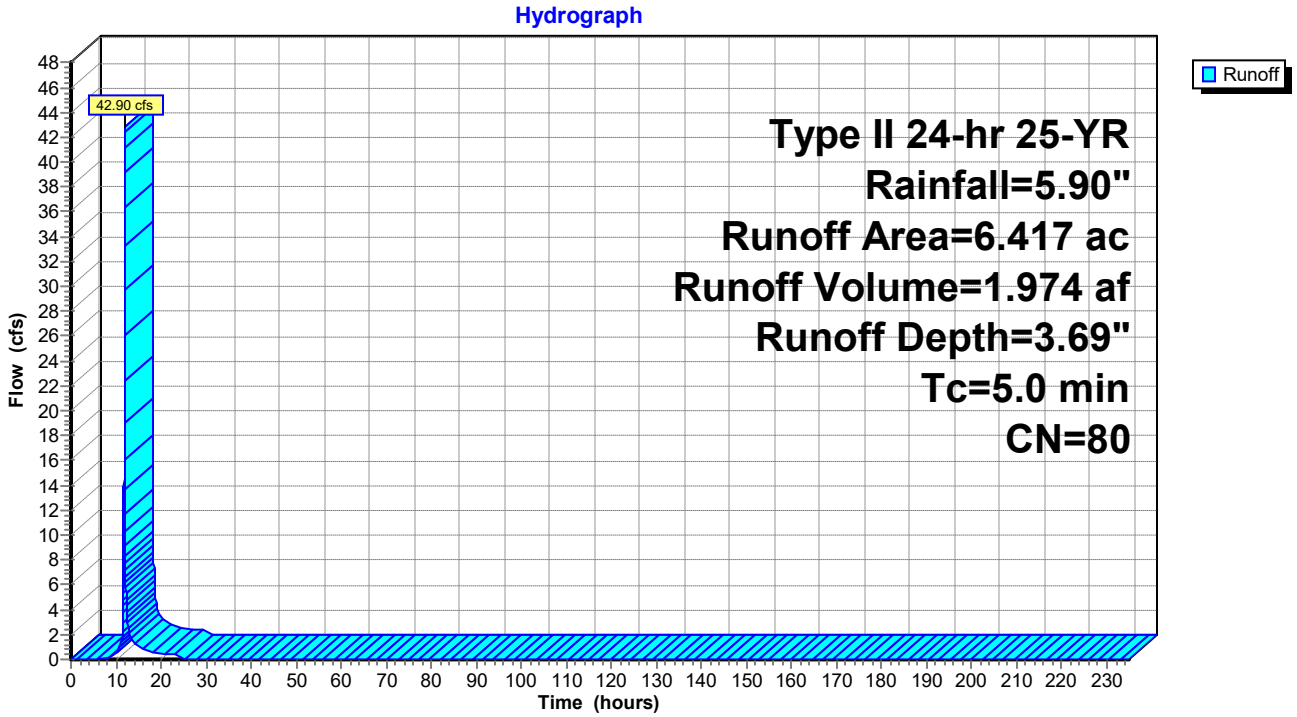
Runoff = 42.90 cfs @ 11.96 hrs, Volume= 1.974 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
6.417	80	>75% Grass cover, Good, HSG D
6.417		Pervious Area

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

Subcatchment 89S: DC-23



Summary for Subcatchment 90S: AREA TO PC 9A

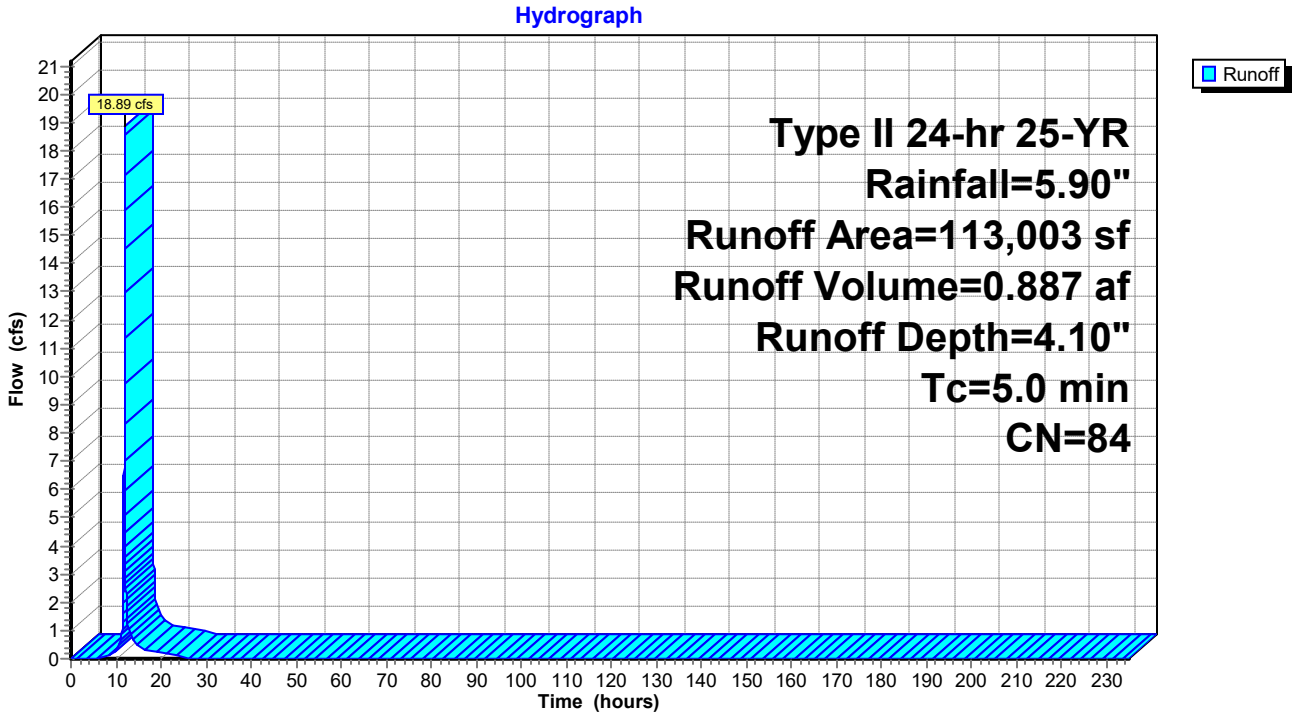
Runoff = 18.89 cfs @ 11.96 hrs, Volume= 0.887 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
89,389	80	>75% Grass cover, Good, HSG D
23,614	98	Paved parking & roofs
113,003	84	Weighted Average
89,389		Pervious Area
23,614		Impervious Area

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

Subcatchment 90S: AREA TO PC 9A



Summary for Subcatchment 91S: AREA TO PC 9B

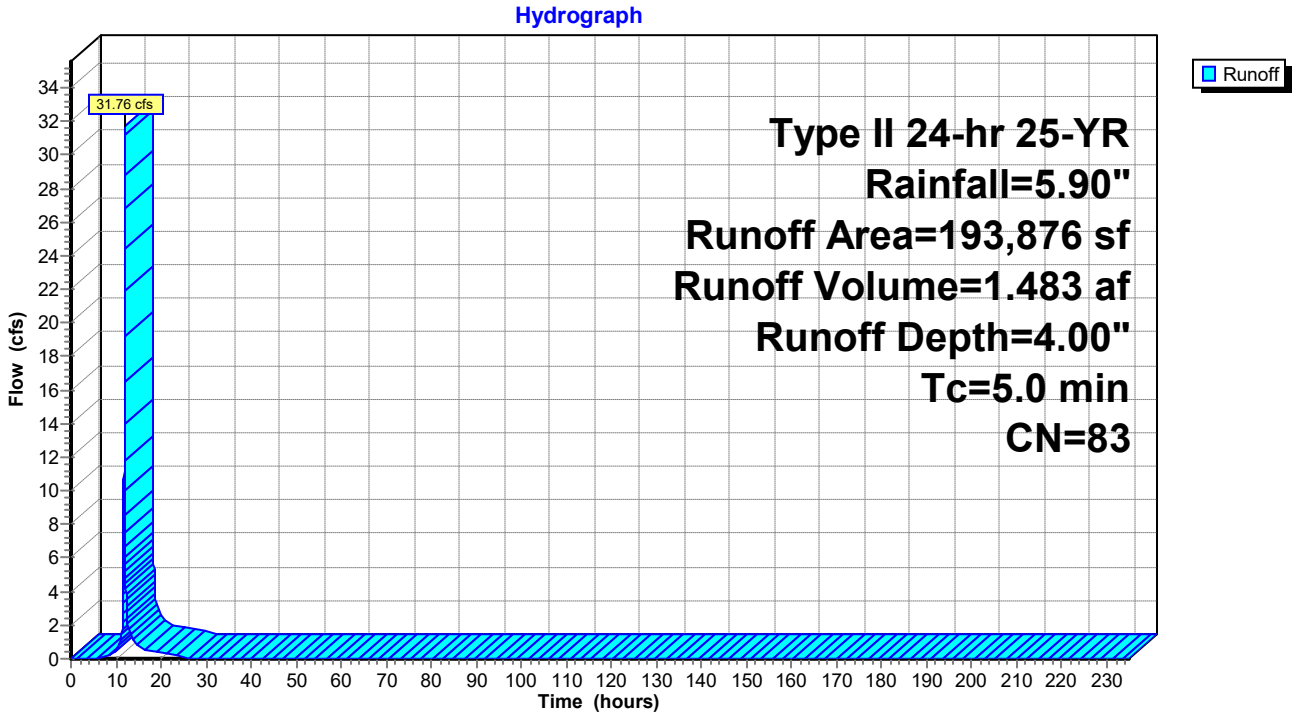
Runoff = 31.76 cfs @ 11.96 hrs, Volume= 1.483 af, Depth= 4.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
158,192	80	>75% Grass cover, Good, HSG D
35,684	98	Paved parking & roofs
193,876	83	Weighted Average
158,192		Pervious Area
35,684		Impervious Area

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

Subcatchment 91S: AREA TO PC 9B

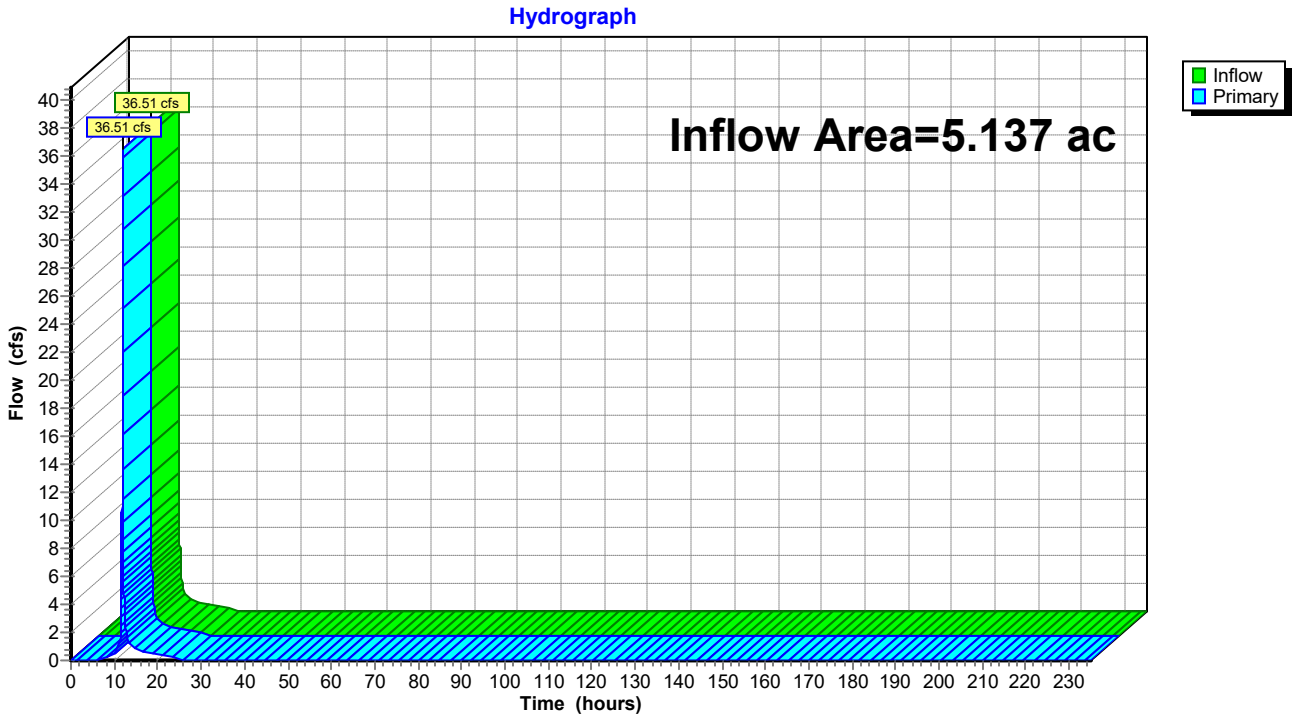


Summary for Link 76L: PC 8A

Inflow Area = 5.137 ac, 17.62% Impervious, Inflow Depth = 3.98" for 25-YR event
Inflow = 36.51 cfs @ 11.96 hrs, Volume= 1.705 af
Primary = 36.51 cfs @ 11.96 hrs, Volume= 1.705 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 76L: PC 8A

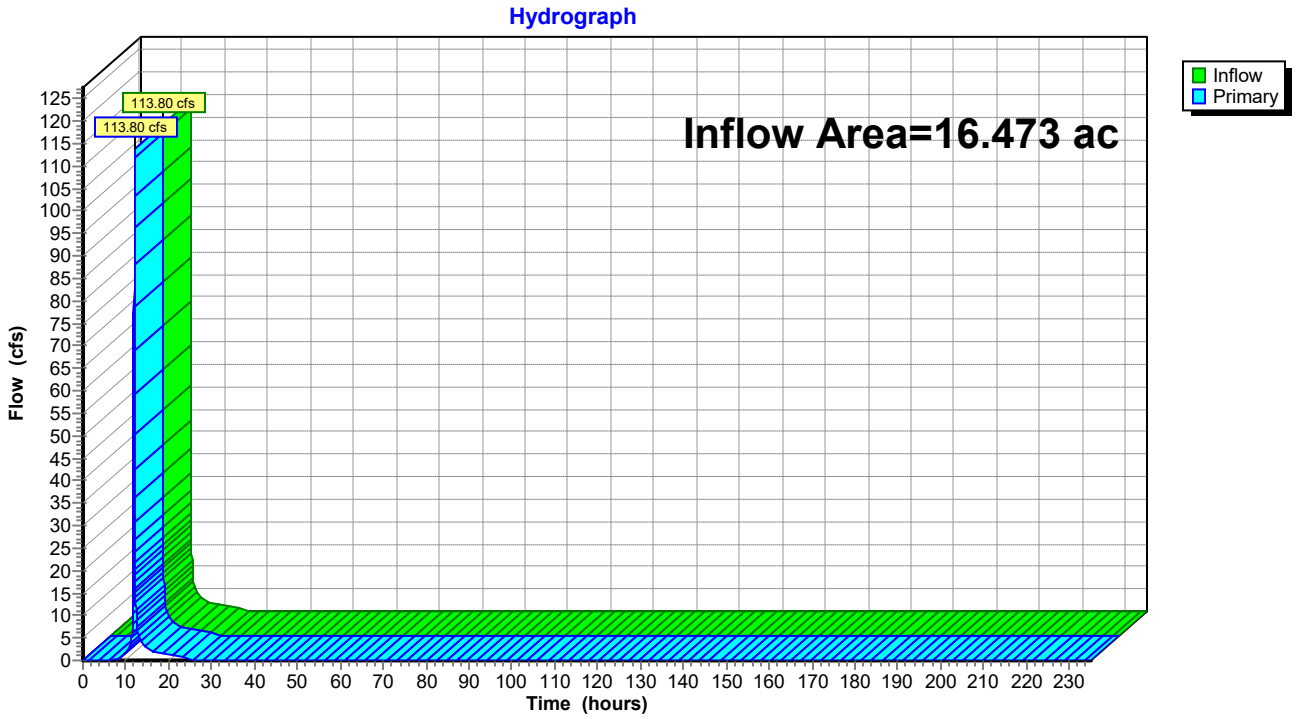


Summary for Link 77L: PC 8B

Inflow Area = 16.473 ac, 8.69% Impervious, Inflow Depth = 3.84" for 25-YR event
Inflow = 113.80 cfs @ 11.96 hrs, Volume= 5.278 af
Primary = 113.80 cfs @ 11.96 hrs, Volume= 5.278 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 77L: PC 8B

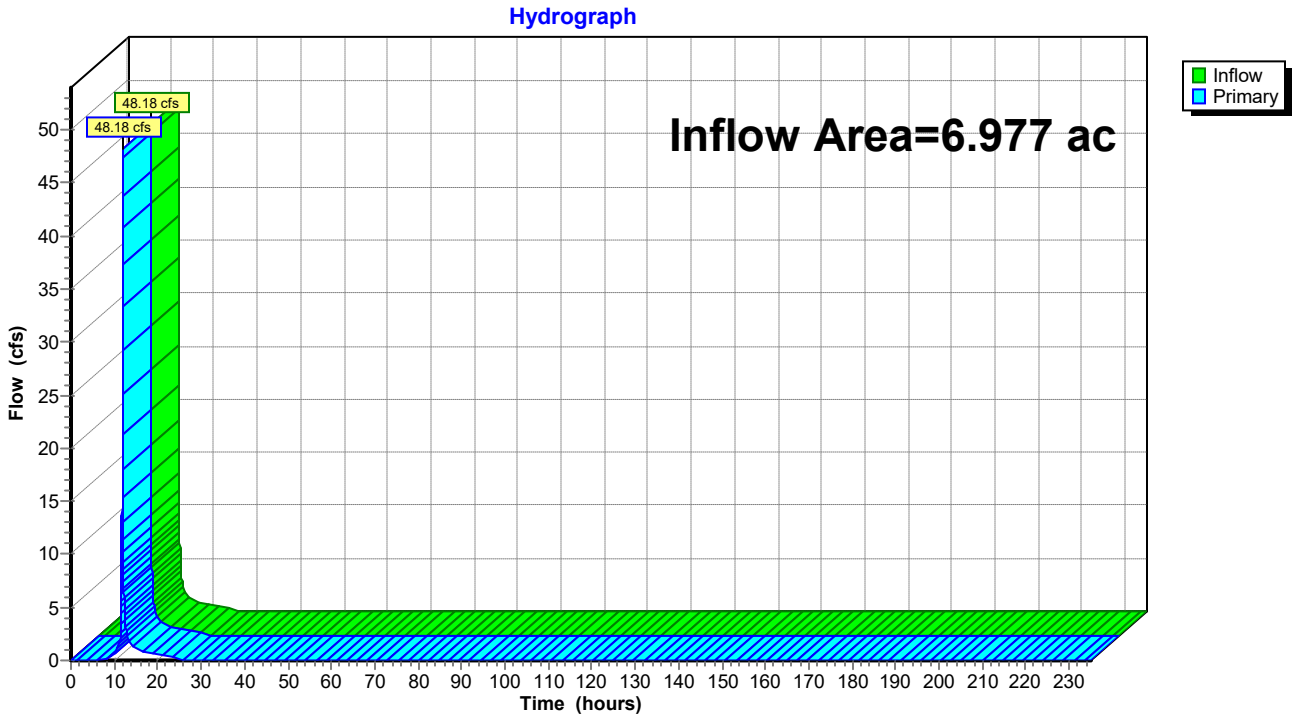


Summary for Link 79L: PC 9A

Inflow Area = 6.977 ac, 7.77% Impervious, Inflow Depth = 3.84" for 25-YR event
Inflow = 48.18 cfs @ 11.96 hrs, Volume= 2.235 af
Primary = 48.18 cfs @ 11.96 hrs, Volume= 2.235 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 79L: PC 9A

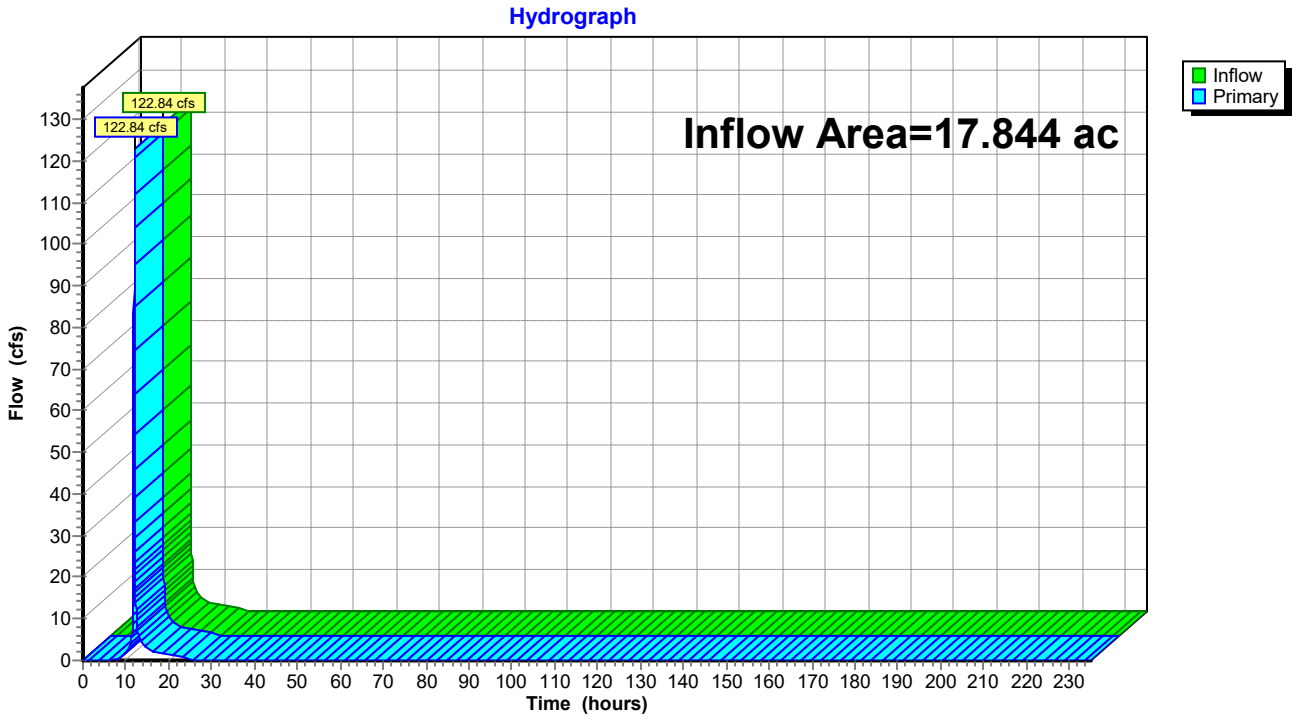


Summary for Link 80L: PC 9C

Inflow Area = 17.844 ac, 7.63% Impervious, Inflow Depth = 3.83" for 25-YR event
Inflow = 122.84 cfs @ 11.96 hrs, Volume= 5.692 af
Primary = 122.84 cfs @ 11.96 hrs, Volume= 5.692 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 80L: PC 9C

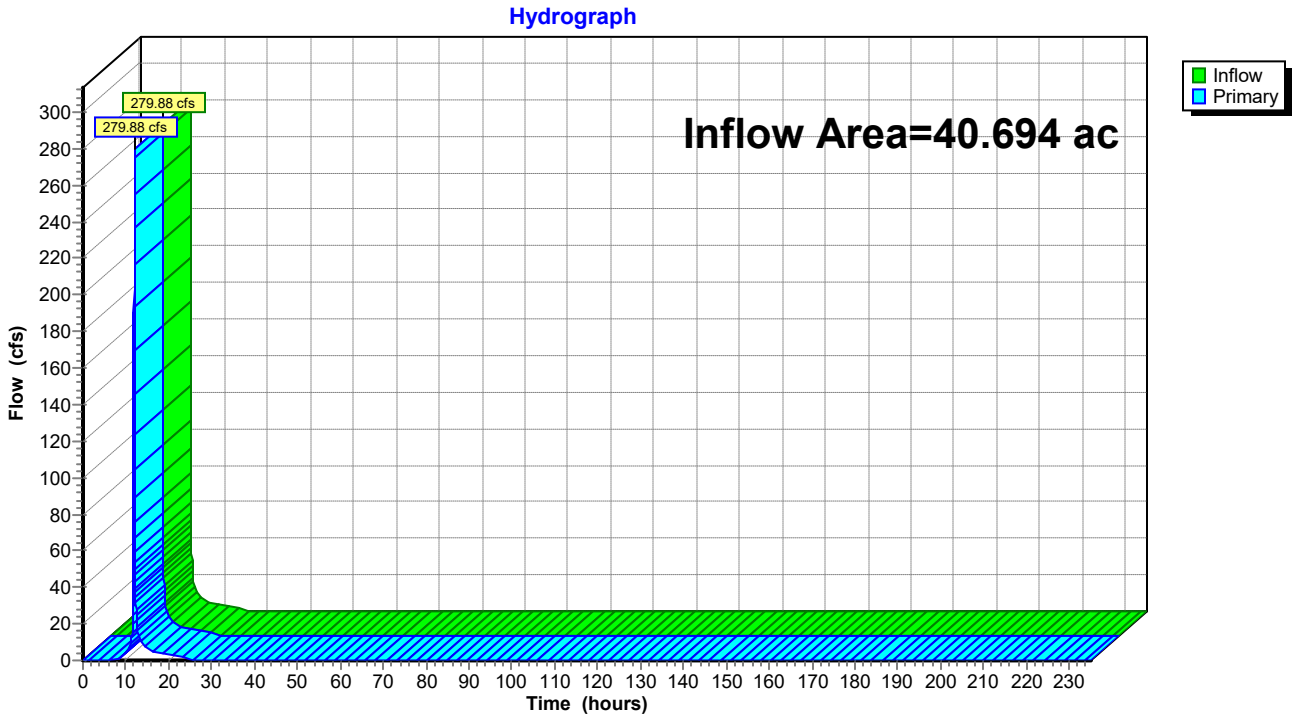


Summary for Link 82L: PC 8C

Inflow Area = 40.694 ac, 7.42% Impervious, Inflow Depth = 3.82" for 25-YR event
Inflow = 279.88 cfs @ 11.96 hrs, Volume= 12.966 af
Primary = 279.88 cfs @ 11.96 hrs, Volume= 12.966 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 82L: PC 8C

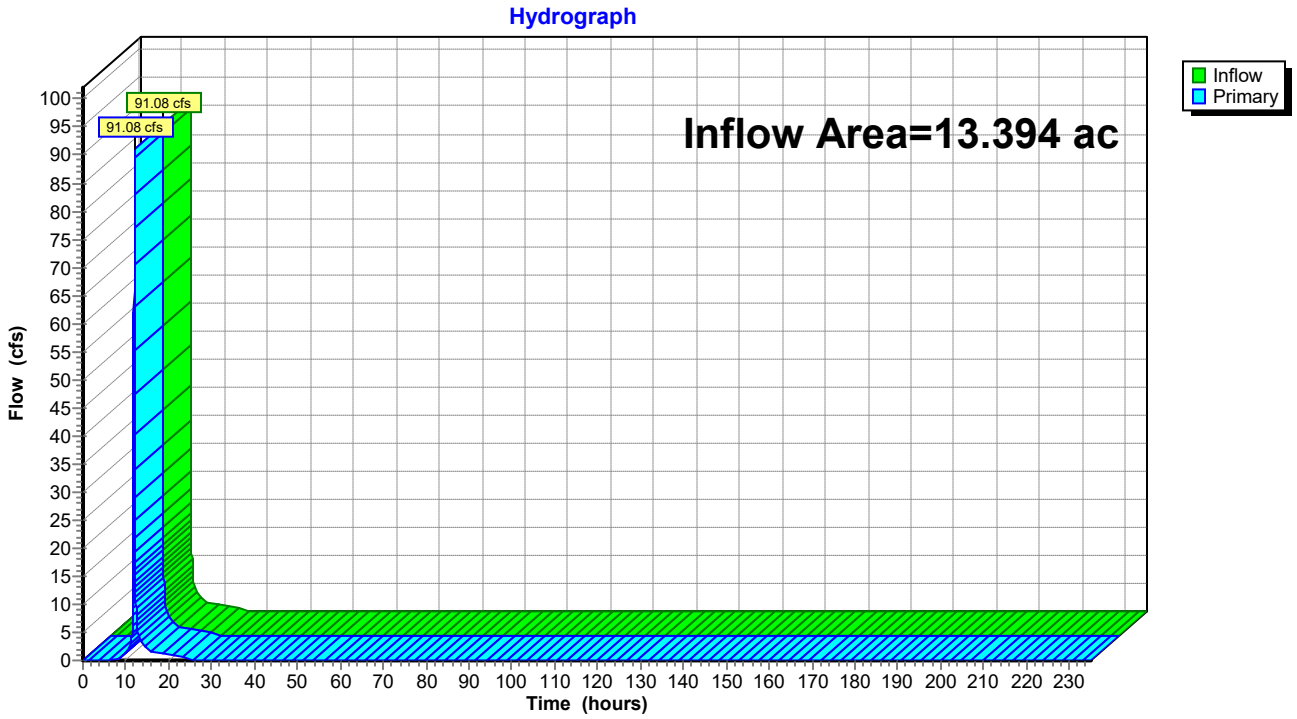


Summary for Link 89L: PC 9B

Inflow Area = 13.394 ac, 4.05% Impervious, Inflow Depth = 3.77" for 25-YR event
Inflow = 91.08 cfs @ 11.96 hrs, Volume= 4.209 af
Primary = 91.08 cfs @ 11.96 hrs, Volume= 4.209 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 89L: PC 9B



Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 72S: AREA TO PC 8B Runoff Area=146,396 sf 15.66% Impervious Runoff Depth=6.46"
Tc=5.0 min CN=83 Runoff=37.59 cfs 1.808 af

Subcatchment 73S: DC-21 Runoff Area=347,408 sf 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=85.62 cfs 4.051 af

Subcatchment 74S: DC-22 Runoff Area=190,896 sf 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=47.05 cfs 2.226 af

Subcatchment 75S: DC-20 Runoff Area=233,065 sf 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=57.44 cfs 2.718 af

Subcatchment 83S: AREA TO PC 8C Runoff Area=44,677 sf 22.27% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=11.61 cfs 0.562 af

Subcatchment 86S: AREA TO CAP ROAD Runoff Area=65,391 sf 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=16.12 cfs 0.762 af

Subcatchment 88S: AREA TO PC 8A Runoff Area=158,379 sf 24.90% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=41.17 cfs 1.993 af

Subcatchment 89S: DC-23 Runoff Area=6.417 ac 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=68.89 cfs 3.259 af

Subcatchment 90S: AREA TO PC 9A Runoff Area=113,003 sf 20.90% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=29.38 cfs 1.422 af

Subcatchment 91S: AREA TO PC 9B Runoff Area=193,876 sf 18.41% Impervious Runoff Depth=6.46"
Tc=5.0 min CN=83 Runoff=49.78 cfs 2.394 af

Link 76L: PC 8A Inflow=57.29 cfs 2.755 af
Primary=57.29 cfs 2.755 af

Link 77L: PC 8B Inflow=180.49 cfs 8.614 af
Primary=180.49 cfs 8.614 af

Link 79L: PC 9A Inflow=76.42 cfs 3.648 af
Primary=76.42 cfs 3.648 af

Link 80L: PC 9C Inflow=195.09 cfs 9.302 af
Primary=195.09 cfs 9.302 af

Link 82L: PC 8C Inflow=444.63 cfs 21.195 af
Primary=444.63 cfs 21.195 af

Link 89L: PC 9B Inflow=145.31 cfs 6.907 af
Primary=145.31 cfs 6.907 af

Total Runoff Area = 40.694 ac Runoff Volume = 21.195 af Average Runoff Depth = 6.25"
92.58% Pervious = 37.672 ac 7.42% Impervious = 3.021 ac

Summary for Subcatchment 72S: AREA TO PC 8B

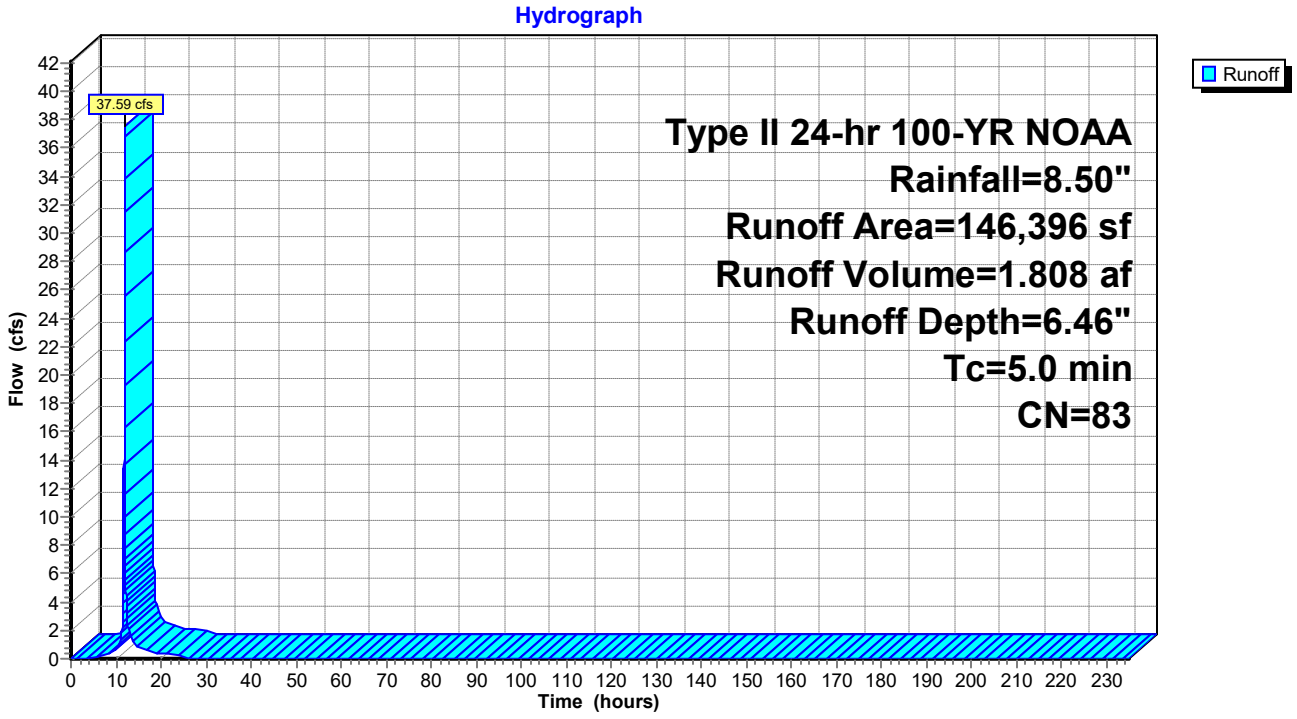
Runoff = 37.59 cfs @ 11.96 hrs, Volume= 1.808 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
123,465	80	>75% Grass cover, Good, HSG D
22,931	98	Paved parking & roofs
146,396	83	Weighted Average
123,465		Pervious Area
22,931		Impervious Area

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

Subcatchment 72S: AREA TO PC 8B



Summary for Subcatchment 73S: DC-21

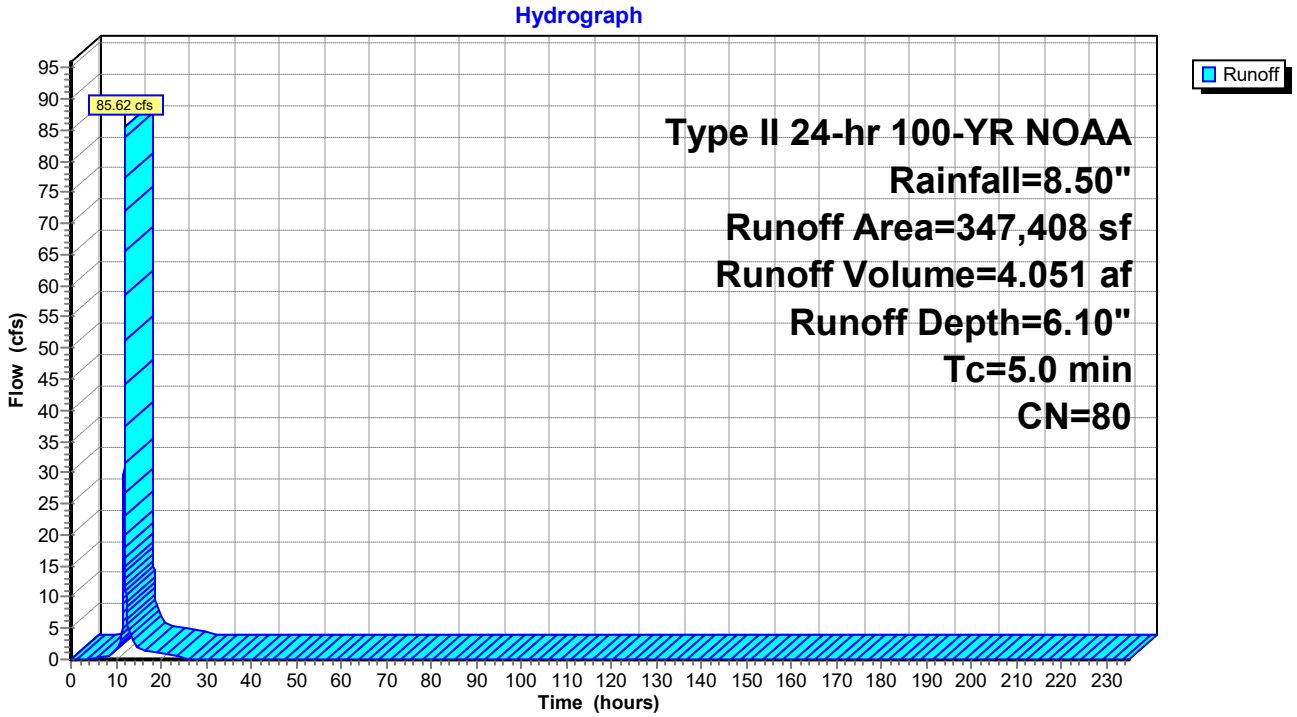
Runoff = 85.62 cfs @ 11.96 hrs, Volume= 4.051 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
347,408	80	>75% Grass cover, Good, HSG D
347,408		Pervious Area

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

Subcatchment 73S: DC-21



Summary for Subcatchment 74S: DC-22

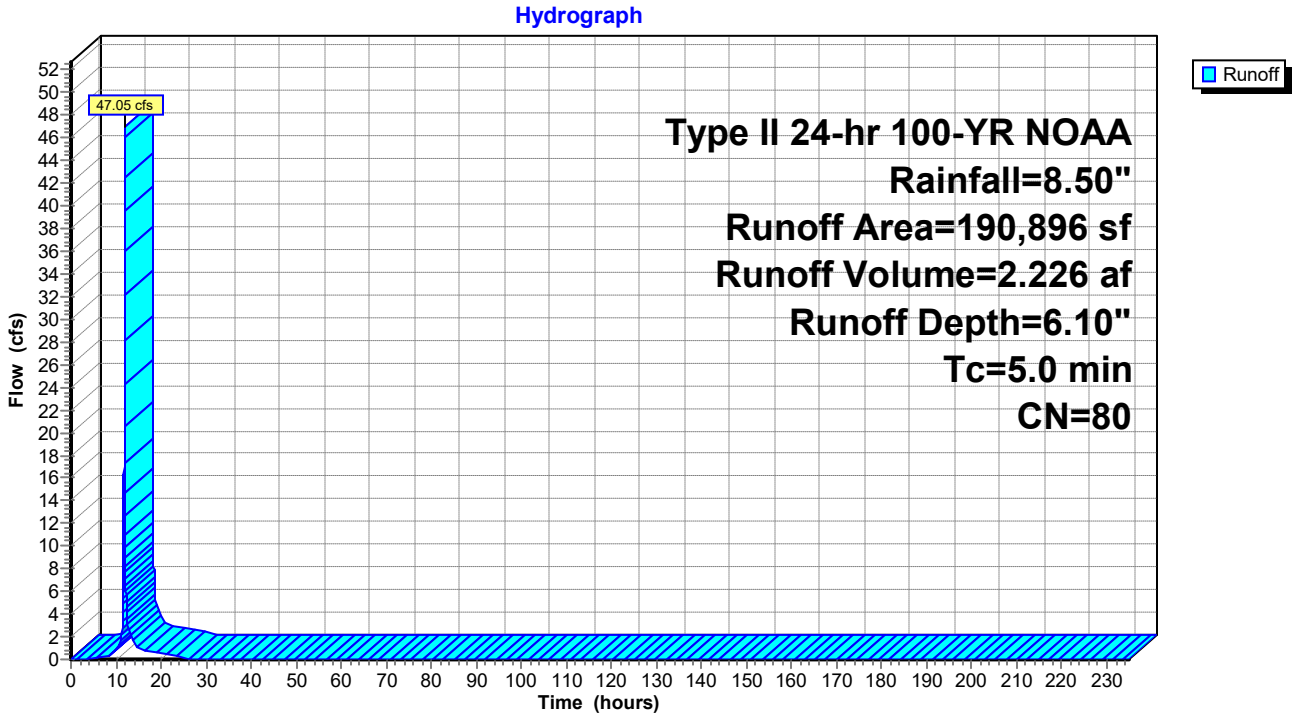
Runoff = 47.05 cfs @ 11.96 hrs, Volume= 2.226 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
190,896	80	>75% Grass cover, Good, HSG D
190,896		Pervious Area

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

Subcatchment 74S: DC-22



Summary for Subcatchment 75S: DC-20

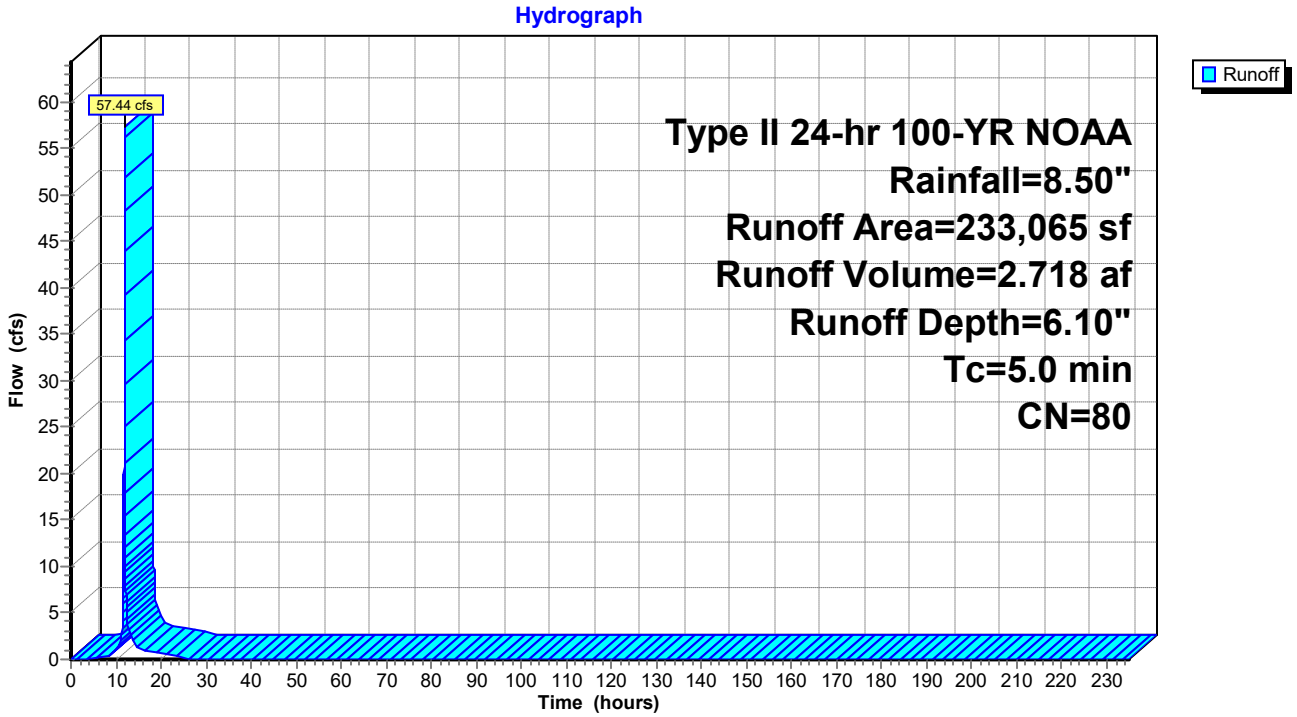
Runoff = 57.44 cfs @ 11.96 hrs, Volume= 2.718 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
233,065	80	>75% Grass cover, Good, HSG D
233,065		Pervious Area

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

Subcatchment 75S: DC-20



Summary for Subcatchment 83S: AREA TO PC 8C

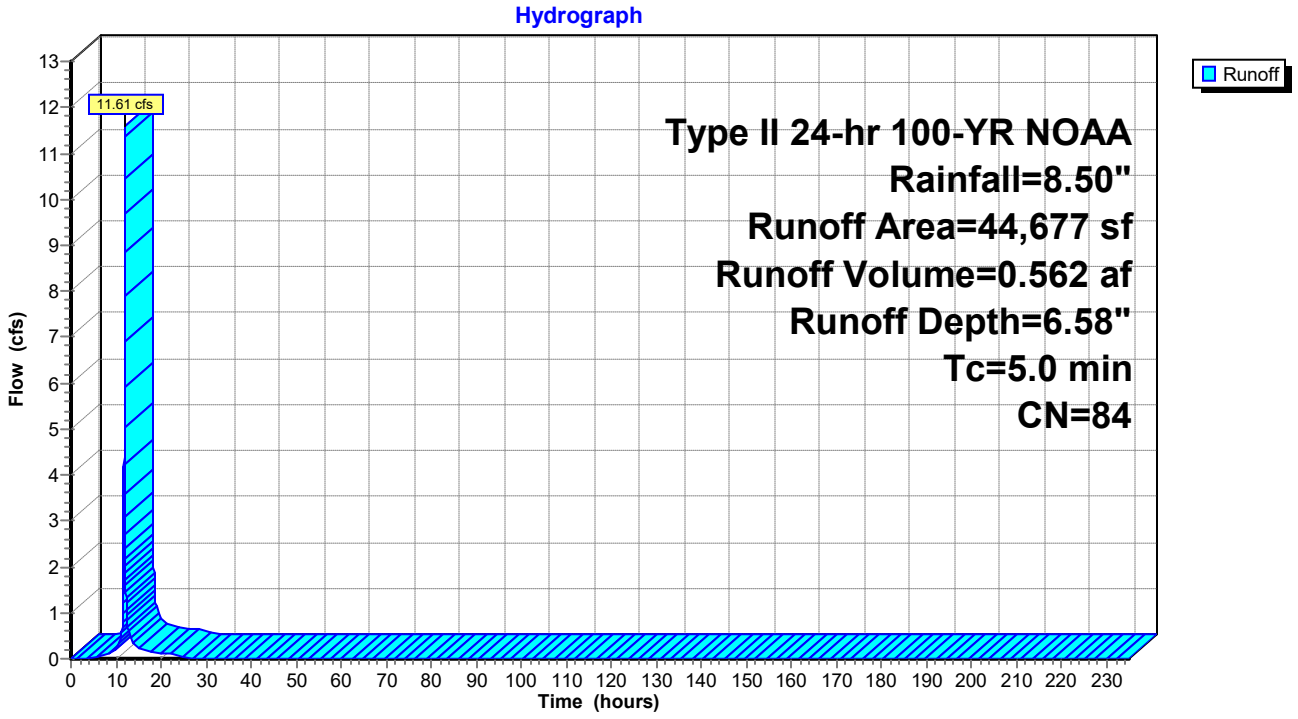
Runoff = 11.61 cfs @ 11.96 hrs, Volume= 0.562 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
34,727	80	>75% Grass cover, Good, HSG D
9,950	98	Paved parking & roofs
44,677	84	Weighted Average
34,727		Pervious Area
9,950		Impervious Area

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

Subcatchment 83S: AREA TO PC 8C



Summary for Subcatchment 86S: AREA TO CAP ROAD SWALE

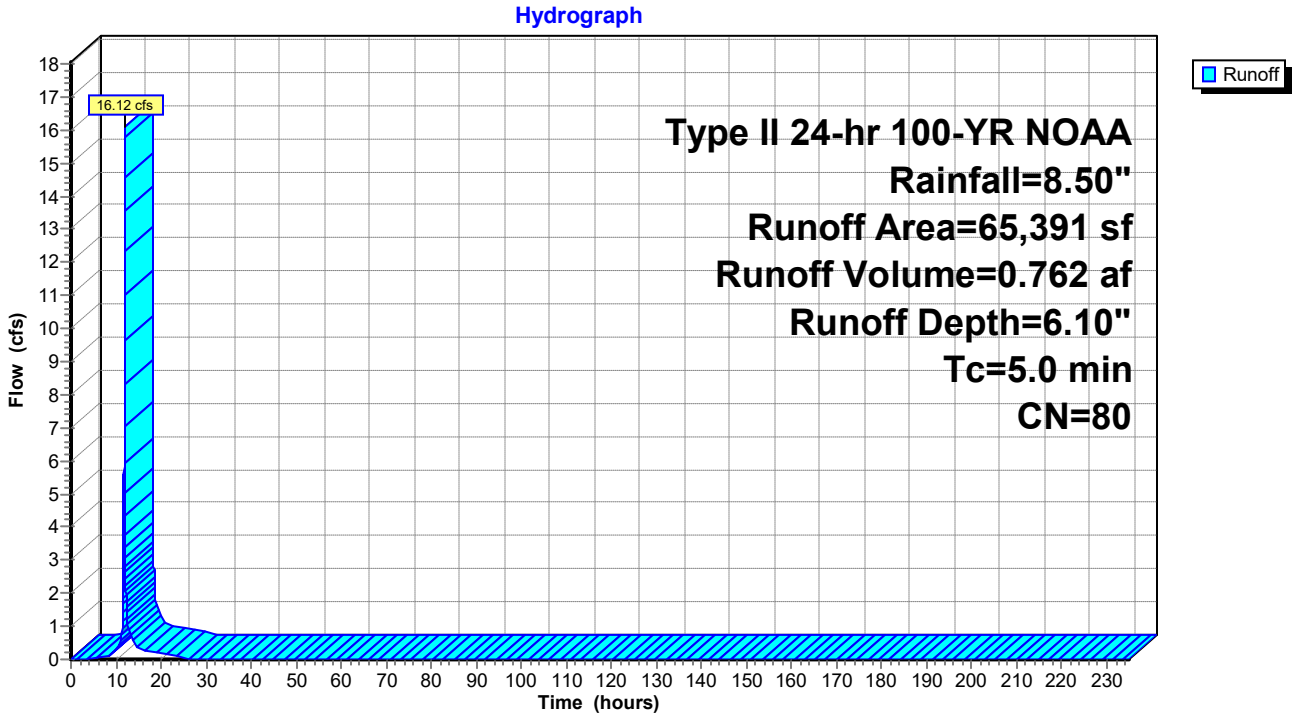
Runoff = 16.12 cfs @ 11.96 hrs, Volume= 0.762 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
65,391	80	>75% Grass cover, Good, HSG D
65,391		Pervious Area

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

Subcatchment 86S: AREA TO CAP ROAD SWALE



Summary for Subcatchment 88S: AREA TO PC 8A

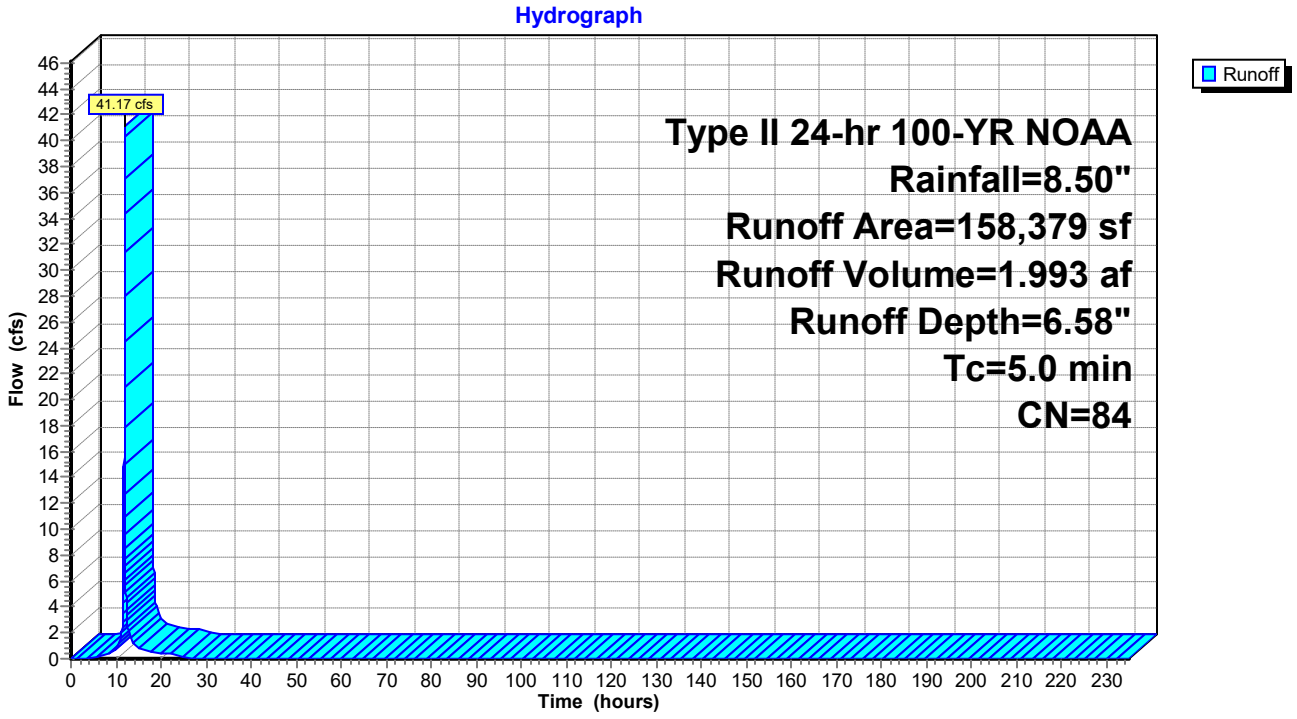
Runoff = 41.17 cfs @ 11.96 hrs, Volume= 1.993 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
118,947	80	>75% Grass cover, Good, HSG D
39,432	98	Paved parking & roofs
158,379	84	Weighted Average
118,947		Pervious Area
39,432		Impervious Area

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

Subcatchment 88S: AREA TO PC 8A



Summary for Subcatchment 89S: DC-23

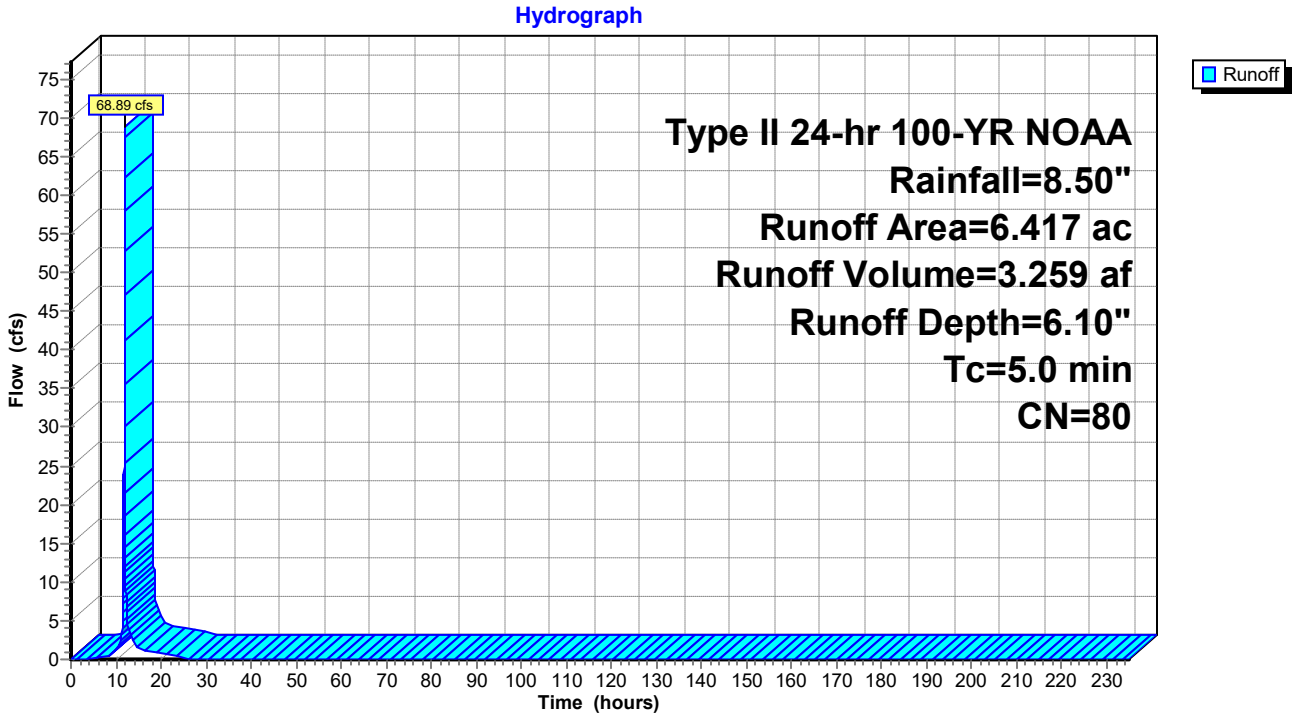
Runoff = 68.89 cfs @ 11.96 hrs, Volume= 3.259 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
6.417	80	>75% Grass cover, Good, HSG D
6.417		Pervious Area

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

Subcatchment 89S: DC-23



Summary for Subcatchment 90S: AREA TO PC 9A

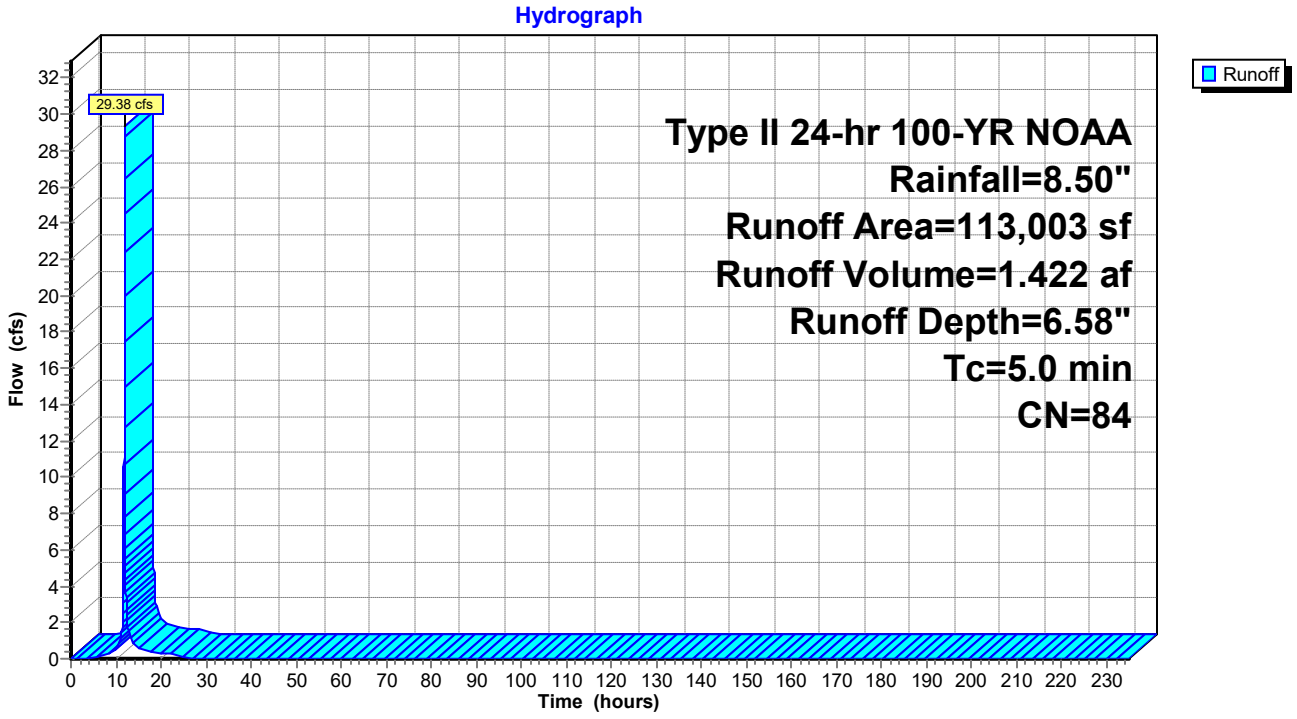
Runoff = 29.38 cfs @ 11.96 hrs, Volume= 1.422 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
89,389	80	>75% Grass cover, Good, HSG D
23,614	98	Paved parking & roofs
113,003	84	Weighted Average
89,389		Pervious Area
23,614		Impervious Area

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

Subcatchment 90S: AREA TO PC 9A



Summary for Subcatchment 91S: AREA TO PC 9B

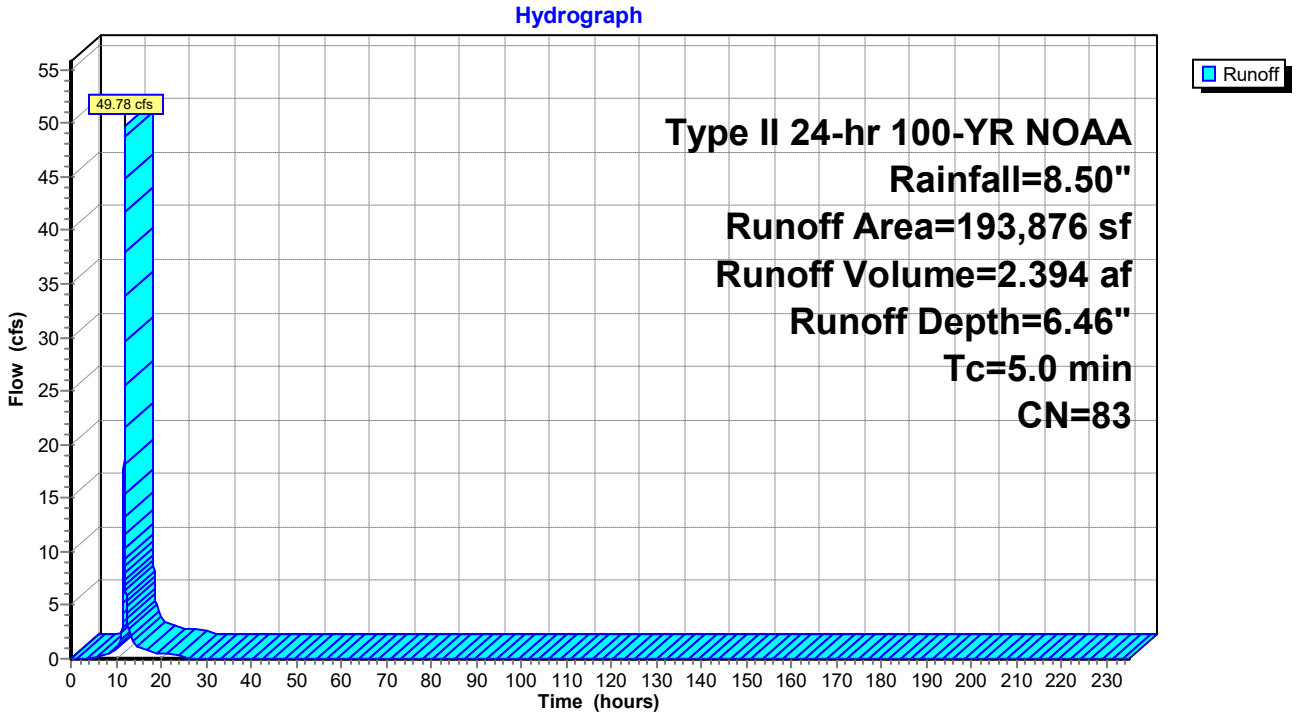
Runoff = 49.78 cfs @ 11.96 hrs, Volume= 2.394 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
158,192	80	>75% Grass cover, Good, HSG D
35,684	98	Paved parking & roofs
193,876	83	Weighted Average
158,192		Pervious Area
35,684		Impervious Area

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

Subcatchment 91S: AREA TO PC 9B

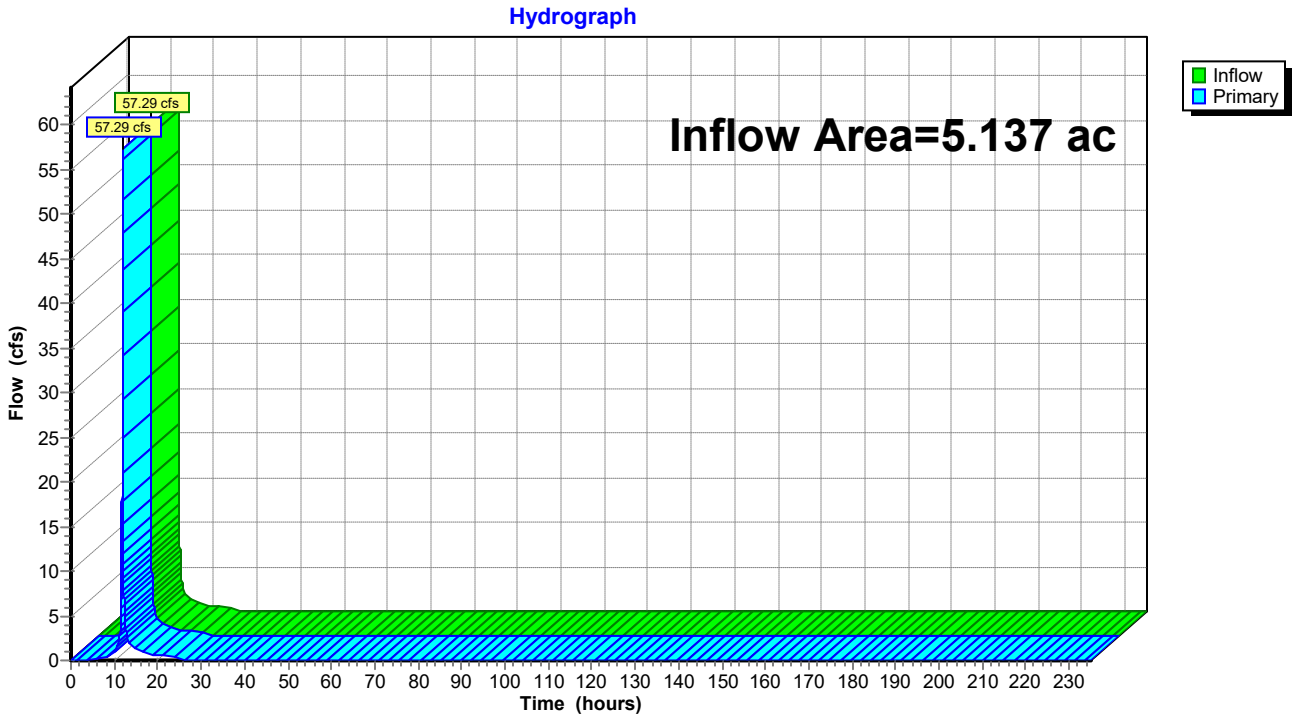


Summary for Link 76L: PC 8A

Inflow Area = 5.137 ac, 17.62% Impervious, Inflow Depth = 6.44" for 100-YR NOAA event
Inflow = 57.29 cfs @ 11.96 hrs, Volume= 2.755 af
Primary = 57.29 cfs @ 11.96 hrs, Volume= 2.755 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 76L: PC 8A

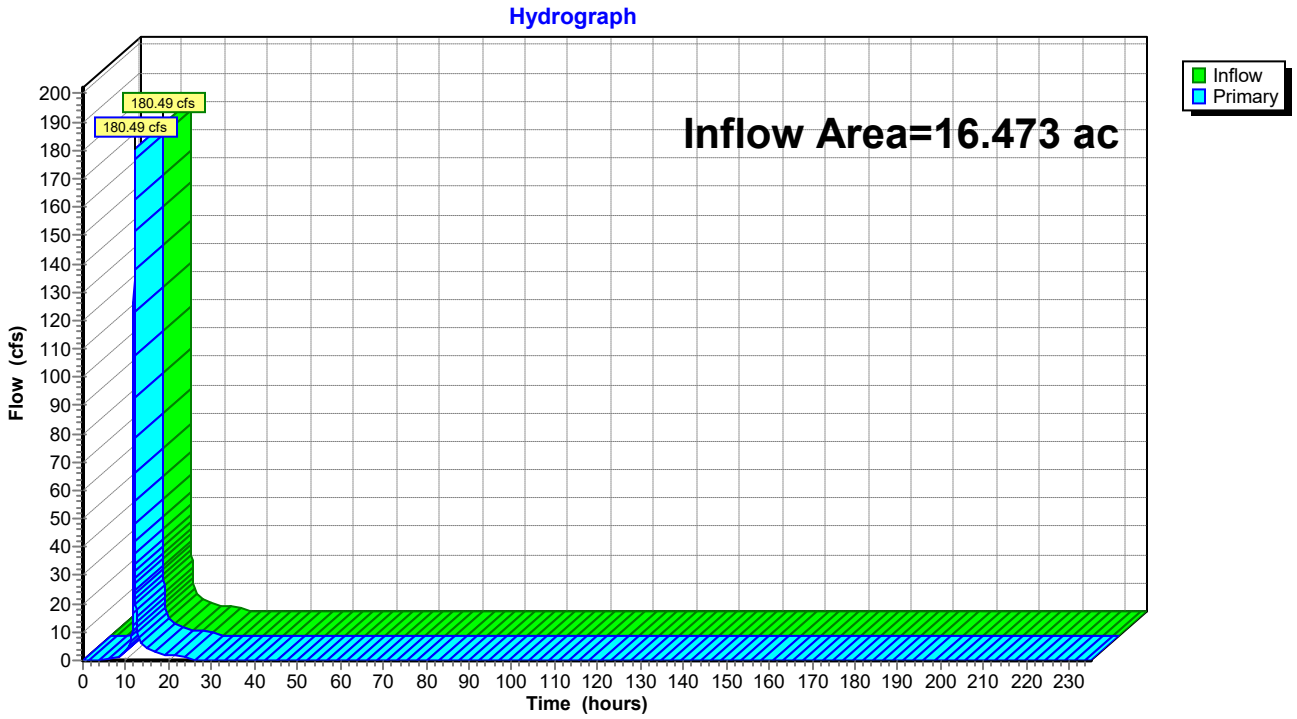


Summary for Link 77L: PC 8B

Inflow Area = 16.473 ac, 8.69% Impervious, Inflow Depth = 6.27" for 100-YR NOAA event
Inflow = 180.49 cfs @ 11.96 hrs, Volume= 8.614 af
Primary = 180.49 cfs @ 11.96 hrs, Volume= 8.614 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 77L: PC 8B

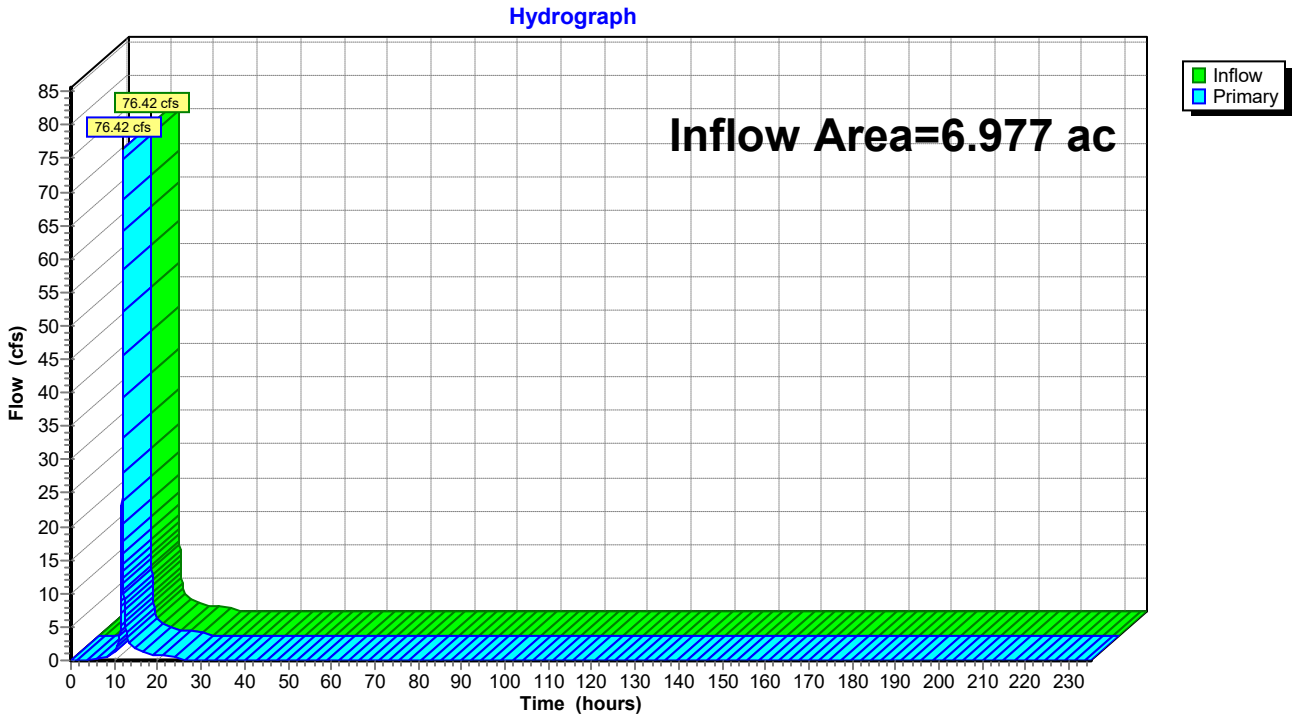


Summary for Link 79L: PC 9A

Inflow Area = 6.977 ac, 7.77% Impervious, Inflow Depth = 6.27" for 100-YR NOAA event
Inflow = 76.42 cfs @ 11.96 hrs, Volume= 3.648 af
Primary = 76.42 cfs @ 11.96 hrs, Volume= 3.648 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 79L: PC 9A

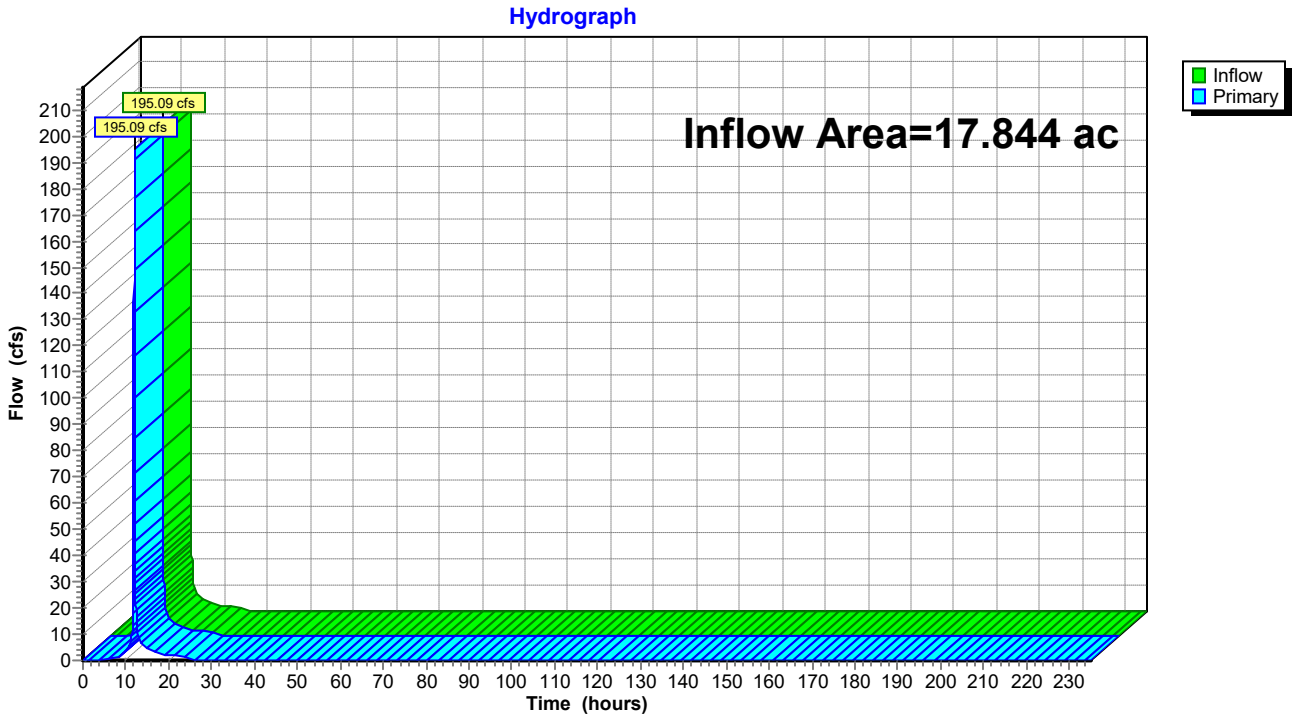


Summary for Link 80L: PC 9C

Inflow Area = 17.844 ac, 7.63% Impervious, Inflow Depth = 6.26" for 100-YR NOAA event
Inflow = 195.09 cfs @ 11.96 hrs, Volume= 9.302 af
Primary = 195.09 cfs @ 11.96 hrs, Volume= 9.302 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 80L: PC 9C

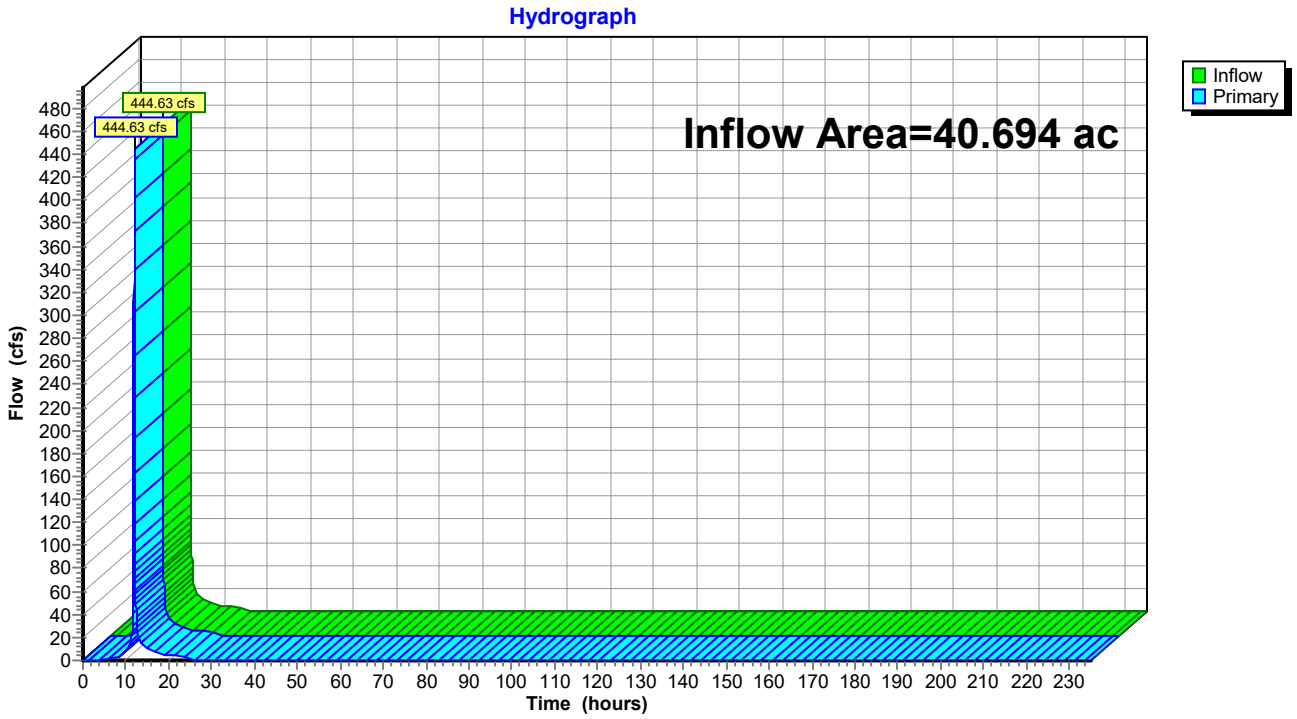


Summary for Link 82L: PC 8C

Inflow Area = 40.694 ac, 7.42% Impervious, Inflow Depth = 6.25" for 100-YR NOAA event
Inflow = 444.63 cfs @ 11.96 hrs, Volume= 21.195 af
Primary = 444.63 cfs @ 11.96 hrs, Volume= 21.195 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 82L: PC 8C

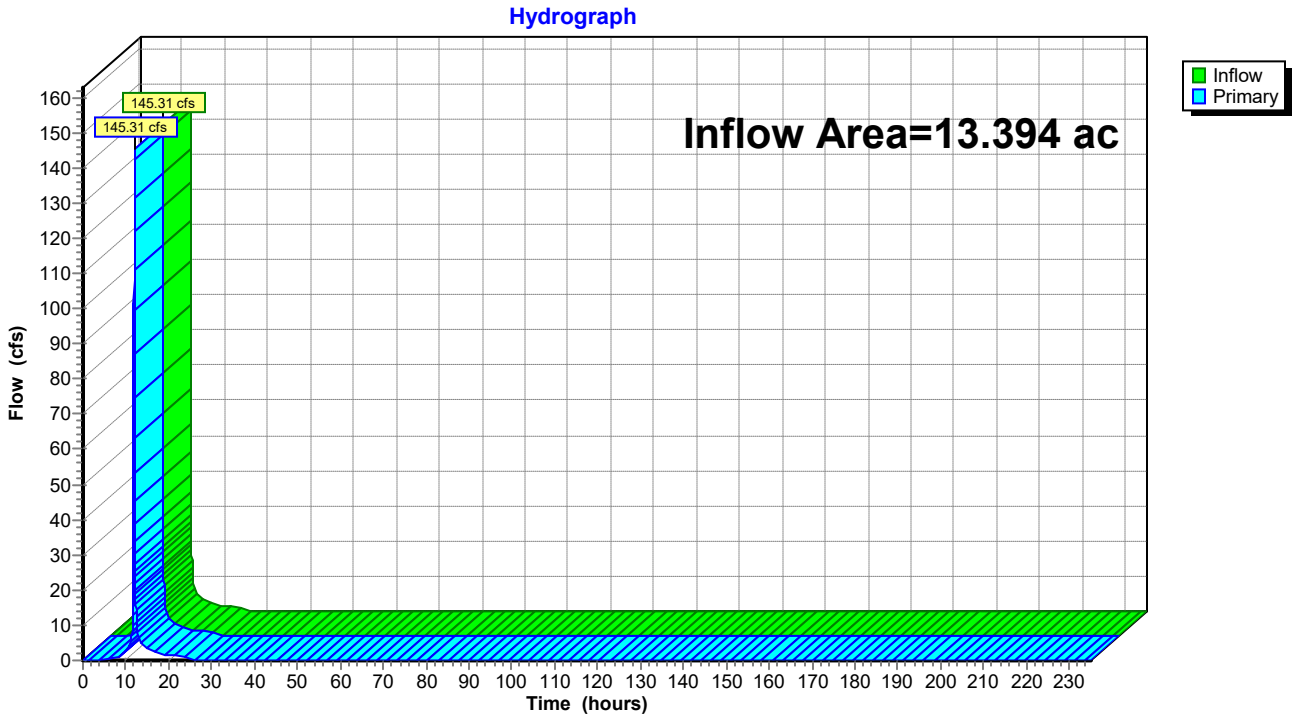


Summary for Link 89L: PC 9B

Inflow Area = 13.394 ac, 4.05% Impervious, Inflow Depth = 6.19" for 100-YR NOAA event
Inflow = 145.31 cfs @ 11.96 hrs, Volume= 6.907 af
Primary = 145.31 cfs @ 11.96 hrs, Volume= 6.907 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 89L: PC 9B



ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 17E

Proposed Channels Design

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Stormwater Management – Proposed Channel Flows		
	Job No. 2018-3854	**Made by:** RP	**Date** 07-15-20
	Ref.	**Checked by:** VEF	**Sheet** 1 of 4

Revised by PGS 08/27/2021

Objective: The objective of this analysis is to estimate the flow in the proposed stormwater management channels under the design storms being considered.

Design Approach and Assumptions:

Use HydroCad, a computer software which implements the principles of TR-55 and TR-20 for larger drainage areas. The input data for each is as follows:

1) With proposed channel flows for the 25 year, 24 hour and 100 year, 24 hour storm events, size the perimeter and downchute channels using open channel flow methods.
2) Design the channels to meet 25-year, 24-hour peak flow rates with adequate freeboard.

   Use an Excel Spreadsheet that implements Manning's equation, where

$$Q = (1.49 \times R_h^{2/3} \times A \times S^{1/2})/n, \text{ where}$$

Q = channel flow rate (cfs)
R_h = hydrualic radius of channel = A/P
A = cross-sectional area of flow
P = wetted perimeter of flow
S = channel slope
n = Manning's coefficient

   In the spreadsheet you back-calculate the actual flow depth to meet the design flow, then add freeboard and check shear stress, where

$$\tau = 62.4\ d \times S, \text{ when}$$

d = flow depth (ft)
s = channel slope (ft/ft)

3) Check the selected channel size also contains the flow from the 100-year 24 hour peak flows.

Calculations:

Attached is a summary table of the input data to the HydroCAD program and the computer printout for evaluation for the design storm events.

References:

1. HydroCAD, V8.5.
2. Advanced GeoServices Corp, Calculations entitled "Stormwater Management – Proposed Channel Flow," dated July 15, 2020.
3. McCuen, Richard H., et al, "Hydrologic Analysis and Design," 1989.
4. PADEP, "Erosion and Sediment Pollution Control Program Manual," March 2000.

Revised by PGS 08/27/2021

Conclusions:

A summary of the inflow and the proposed channel configurations for perimeter channels and downchutes are provided in the table below.

Channel ID	Channel Dimensions			25 year, 24 hour storm event		100 year, 24 hour storm event	
	Base Width	Depth	Side Slope	Qout (cfs)	V (fps)*	Qout (cfs)	V (fps)*
DOWNCHUTES							
DC- 1	15.3	1.0	2H:1V	60.95	12.1	94.79	14.4
DC- 2	13.8	1.0	2H:1V	54.36	12.0	85.88	14.3
DC- 3	17.9	1.0	2H:1V	70.96	12.1	113.02	14.4
DC- 4	13.8	1.0	2H:1V	49.88	11.6	80.10	13.9
DC- 5	13.8	1.0	2H:1V	51.59	11.8	82.86	14.1
DC- 6	17.9	1.0	2H:1V	68.55	11.9	107.42	14.2
DC- 7	17.9	1.0	2H:1V	65.04	11.9	103.58	14.0
DC- 8	17.9	1.0	2H:1V	59.62	11.4	100.17	13.8
DC- 9	12.4	1.0	2H:1V	47.30	11.8	74.71	14.0
DC- 10	16.5	1.0	2H:1V	58.89	11.6	93.03	14.0
DC- 20	11.0	1.0	2H:1V	35.77	11.0	57.44	13.3
DC- 21	15.1	1.0	2H:1V	53.31	11.6	85.62	13.9
DC- 22	9.6	1.0	2H:1V	29.30	10.7	47.05	12.8
DC- 23	11	1.0	2H:1V	42.90	11.9	68.89	13.9
PERIMETER CHANNELS							
PC- 1	9.6	2.5	2H:1V	64.62	5.7	158.72	6.6
PC-2	4.1	2.0	2H:1V	31.83	5.7	57.96	6.6
PC-3A	4.1	2.0	2H:1V	15.97	6.4	24.83	7.6
PC- 3B	9.6	2.0	2H:1V	80.84	7.7	128.22	4.7
PC- 3C	13.8	2.6	2H:1V	140.25	8.2	228.15	9.0
PC- 3D	15.1	2.6	2H:1V	197.64	7.0	319.29	9.7
PC- 3E	15.1	3.2	2H:1V	282.93	9.1	455.14	10.6
PC- 4A	4.1	2.0	2H:1V	40.72	6.1	63.32	6.9
PC- 4B	13.8	2.0	2H:1V	109.16	7.2	170.64	8.4
PC- 4C	13.8	2.5	2H:1V	160.59	7.7	253.31	8.9
PC- 4D	15.1	2.8	2H:1V	210.30	8.8	333.21	10.2
PC- 4E	15.1	3.3	2H:1V	281.05	9.1	445.99	10.5
PC- 4F	15.1	3.5	2H:1V	347.91	9.7	552.08	11.2
PC- 5	9.6	2.2	2H:1V	81.01	8.9	126.24	10.3
PC- 6	8.3	2.0	2H:1V	24.00	7.4	65.73	10.5
PC- 7	2.8	2.0	2H:1V	17.34	8.9	26.77	10.1
PC- 8A	2.8	2.0	2H:1V	36.51	7.2	57.29	8.1
PC- 8B	8.3	2.0	2H:1V	113.80	8.4	180.49	9.3
PC- 8C	17.9	2.2	2H:1V	279.88	8.1	444.63	9.4
PC- 9A	8.3	2.6	2H:1V	48.18	5.4	76.42	6.2
PC- 9B	9.6	2.6	2H:1V	91.08	6.4	145.31	7.4
PC- 9C	13.8	2.6	2H:1V	122.84	4.6	195.09	5.3
PC- 10	9.6	2.0	2H:1V	68.46	8.4	164.87	11.2

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The required channel depth and velocities were checked for minimum and maximum slope conditions for each channel. The velocity values provided in the table are the maximum values associated with the maximum slope. Perimeter channels and downchutes will both be armored with cable-concrete channel lining (CC-45 from Bethlehem Precast, or equivalent).

The 25 year, 24 hour storm event flow rates will be used to determine the size of the channels and select channel lining. These flow rates will also be used to size culverts.

Terraces

The Terraces and (Final Cover) Access Road channels were checked for typical expected flows.

The longest terrace is on the West Side with a drainage area of ~~1200~~ 900 liner feet in length by ~~80~~ 120 feet slope upgradient. Drainage area = ~~96,000~~ 108,000 s.f. = ~~2.2~~ 2.5 acres

The 2nd longest Terrace is on the East side at 520 ~~feet~~ 725 ft in length with an upgradient slope of ~~80~~ 120 feet provide an area of ~~520~~ 725 ft x 80 = ~~41,600~~ 87,000 s.f. = ~~0.96~~ 2.0 acres

Using a c = 0.35 and an i = 8.0 in.hr (assuming a Tc of 5 minutes for 25 year storm)

Using the Rational Method, where Q (cfs) = c i A, with i in inches/hr and A in acres

Q west = (0.35) (8.0) ~~(2.2)~~ 2.5 = ~~6.2~~ 7.0 cfs
Q east = (0.35) (8.0) ~~(0.96)~~ 2.0 = ~~2.7~~ 5.6 cfs

Using the open channel flow method for evaluation, with

Manning's n = 0.08 for Retardance D (Rh = 0.38, S=2%)
Manning's n = 0.065 for Retardance D (Rh = 0.34, S=3%)

Min channel depth for the longest and 2nd longest terraces are 0.81 and 0.59 feet, respectively. The Remaining terraces have drainage areas comparable to or smaller than the 2nd longest terrace. With a specified depth of 1.0 for the terraces, there is adequate freeboard. Velocities under both conditions remained below 2 fps, which is less than the recommended 4 fps for grassed, easily eroded soil and 5 fps for erosion resistant soils (on slopes less than 5%) when stabilized with permanent vegetation.

The final Terrace design is: Triangular channel,
4 3H:1V on one side; 10H:1V on the other
1 foot deep.
Grassed lined.

AR Channel

The Access Road Channel is along the inside edge of the final cover access road, and collect runoff mostly from the access road and small areas of upgradient slope between terraces. Where the

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access road (AR) channel intersects with Downchutes channels, the flow discharges into the Downchute.

The longest AR channel is on the East Section where it does not cross a Downchute. The length of the AR Channel is 750 feet, with an upslope measures 0 ft and the upgradient slope measuring 90 ftat the downgradient end. The access road is 24-feet wide.

Drainage Area = 750 x ({ (90+24) + (0 + 24)} /2) = 750 x (69) = 51,750 s.f. = 1.19 acres

Using a c = 0.35 and an i = 8.0 in.hr (assuming a Tc of 5 minutes for 25 year storm)

Using the Rational Method, where Q (cfs) = c i A, with i in inches/hr and A in acres

$$Q_{\text{AR Channel}} = (0.35)\ (8.0)\ (1.19) = 3.3 \text{ cfs}$$

Using an Excel spreadsheet the employs Manning's Equation for open channel flow, the AR Channel will be the following configuration:

Trapezoidal channel,
4/ 3H:1V on one side; 2H:1V on the other
3 foot base width
1 foot deep.
Grassed lined.

Velocity was check for the 4% and 8% slopes. The calculated peak velocity of 2.31 fps was on the 8% sloped segments of the channel, which is less than the recommended 3 fps for grassed, easily eroded soil and 4 fps for erosion resistant soils (on slopes between 5% and 10%) when stabilized with permanent vegetation.

JULY 2020

PERIMETER CHANNEL DESIGN
25-year, 24 hour storm event flows

20183854

CHANNEL OR CHANNEL SECTION	1A	1A	1B	1B	2	2	3A	3B	3C	3C	3D	3E	3E	4A	4A
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	16.68	15.52	16.68	15.52	10.38	9.54	9.70	15.24	21.96	20.12	23.34	23.86	24.90	10.38	11.02
CHANNEL TOP WIDTH @ d (FT)	14.68	13.52	14.68	13.52	8.38	7.54	7.70	13.24	19.96	18.12	21.34	21.86	22.90	8.38	9.02
CHANNEL SIDE SLOPES (H:1V)	2.00	2.00	2.00	2.00	2.00	2.00	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	9.60	9.60	9.60	9.60	4.10	4.10	4.1	9.6	13.8	13.8	15.1	15.1	15.1	4.1	4.1
d (FLOW DEPTH IN FEET)	1.27	0.98	1.27	0.98	1.07	0.86	0.9	0.91	1.54	1.08	1.56	1.69	1.95	1.07	1.23
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	7.56	9.80	7.56	9.80	3.83	4.77	4.6	10.5	9.0	12.8	9.7	8.9	7.7	3.8	3.3
A (AREA IN SF)	15.42	11.33	15.42	11.33	6.68	5.01	5.31	10.3922	25.9952	17.2368	28.4232	31.2312	37.05	6.6768	8.0688
R (HYDRAULIC RADIUS)	1.01	0.81	1.01	0.81	0.75	0.63	0.65	0.76	1.26	0.93	1.29	1.38	1.56	0.75	0.84
S (BED SLOPE, FT/FT) *	0.008	0.02	0.008	0.02	0.015	0.035	0.018	0.040	0.010	0.035	0.016	0.025	0.015	0.025	0.015
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	4.18	5.71	4.18	5.71	4.70	6.38	4.7	7.7	5.4	8.2	7.0	9.1	7.6	6.1	5.1
Q (AT FLOW DEPTH d, CFS)	64.42	64.66	64.42	64.66	31.39	31.95	24.9	80.4	140.6	142.2	197.6	284.0	282.9	40.5	40.9
Qr (REQUIRED CAPACITY, CFS)	64.62	64.62	64.62	64.62	31.83	31.83	16.0	80.8	140.3	140.3	197.6	282.9	282.9	40.7	40.7
Sc (CRITICAL SLOPE)	0.02	0.02	0.02	0.02	0.02	0.02	0.018	0.017	0.014	0.016	0.014	0.014	0.013	0.017	0.017
.7Sc	0.01	0.01	0.01	0.01	0.01	0.01	0.013	0.012	0.010	0.011	0.010	0.010	0.009	0.012	0.012
1.3Sc	0.02	0.02	0.02	0.02	0.02	0.02	0.024	0.022	0.019	0.020	0.018	0.018	0.017	0.023	0.022
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.32	0.25	0.32	0.25	0.27	0.22	0.225	0.2275	0.385	0.27	0.39	0.4225	0.4875	0.2675	0.3075
MINIMUM REQUIRED FREEBOARD, FT	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	1.77	1.48	1.77	1.48	1.57	1.36	1.4	1.41	2.04	1.58	2.06	2.19	2.45	1.57	1.73
PROVIDED DEPTH (FT)	2.50	2.50	2.50	2.50	2.00	2.00	2	2	2.6	2.6	2.6	3.2	3.2	2	2
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	0.63	1.22	0.63	1.22	1.00	1.88	1.01	2.27	0.96	2.36	1.56	2.64	1.83	1.67	1.15
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

PERIMETER CHANNEL DESIGN
25-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	4B	4B	4C	4C	4D	4D	4E	4E	4F	4F	5	5	6	6	7
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	20.56	19.68	20.92	21.72	25.80	22.50	23.82	24.90	24.70	26.05	16.56	14.88	11.78	12.46	7.84
CHANNEL TOP WIDTH @ d (FT)	18.56	17.68	18.92	19.72	23.66	20.50	21.82	22.90	22.70	23.86	14.56	12.88	9.78	10.46	5.84
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	13.8	13.8	13.8	13.8	15.1	15.1	15.1	15.1	15.1	15.1	9.6	9.6	8.3	8.3	2.8
d (FLOW DEPTH IN FEET)	1.19	0.97	1.28	1.48	2.14	1.35	1.68	1.95	1.9	2.19	1.24	0.82	0.37	0.54	0.76
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	11.6	14.2	10.8	9.3	7.1	11.2	9.0	7.7	7.9	6.9	7.7	11.7	22.4	15.4	3.7
A (AREA IN SF)	19.2542	15.2678	20.9408	24.8048	41.4732	24.03	31.0128	37.05	35.91	42.6612	14.9792	9.2168	3.3448	5.0652	3.2832
R (HYDRAULIC RADIUS)	1.01	0.84	1.07	1.21	1.68	1.14	1.37	1.56	1.52	1.71	0.99	0.69	0.34	0.47	0.53
S (BED SLOPE, FT/FT) *	0.015	0.030	0.025	0.015	0.015	0.030	0.025	0.015	0.025	0.015	0.014	0.060	0.110	0.030	0.030
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	5.7	7.2	7.7	6.5	8.0	8.8	9.1	7.6	9.7	8.1	5.5	8.9	7.4	4.9	5.3
Q (AT FLOW DEPTH d, CFS)	110.0	109.5	161.1	160.6	333.5	210.5	281.1	282.9	348.8	347.5	81.7	82.2	24.9	24.7	17.3
Qr (REQUIRED CAPACITY, CFS)	109.2	109.2	160.6	160.6	210.3	210.3	281.1	281.1	347.9	347.9	81.0	81.0	24.0	24.0	17.3
Sc (CRITICAL SLOPE)	0.015	0.016	0.015	0.014	0.013	0.015	0.014	0.013	0.013	0.013	0.016	0.017	0.022	0.020	0.020
.7Sc	0.011	0.011	0.011	0.010	0.009	0.010	0.010	0.009	0.009	0.009	0.011	0.012	0.015	0.014	0.014
1.3Sc	0.020	0.021	0.020	0.019	0.017	0.019	0.018	0.017	0.018	0.017	0.020	0.023	0.028	0.025	0.025
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.2975	0.2425	0.32	0.37	0.535	0.3375	0.42	0.4875	0.475	0.5475	0.31	0.205	0.0925	0.135	0.19
MINIMUM REQUIRED FREEBOARD, FT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	1.69	1.47	1.78	1.98	2.675	1.85	2.18	2.45	2.4	2.7375	1.74	1.32	0.87	1.04	1.26
PROVIDED DEPTH (FT)	2	2	2.5	2.5	2.8	2.8	3.3	3.3	3.5	3.5	2.2	2.2	2	2	2
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	1.11	1.82	2.00	1.39	2.00	2.53	2.62	1.83	2.96	2.05	1.08	3.07	2.54	1.01	1.42
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
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PERIMETER CHANNEL DESIGN
25-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	7	8A	8A	8B	8B	8C	9A	9B	9B	9C	10	10	FC AR Channel	FC AR Channel
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	Grass	Grass
CHANNEL TOP WIDTH @ D (FT)	6.88	8.96	9.76	15.90	16.58	26.42	13.90	16.40	18.00	22.12	15.20	14.56	8.05	9.35
CHANNEL TOP WIDTH @ d (FT)	4.88	6.96	7.76	13.90	14.58	24.42	11.90	14.40	16.00	20.12	13.20	12.56	5.55	6.85
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2.5
CHANNEL BOTTOM WIDTH (FT)	2.8	2.8	2.8	8.3	8.3	17.9	8.3	9.6	9.6	13.8	9.6	9.6	4	4
d (FLOW DEPTH IN FEET)	0.52	1.04	1.24	1.40	1.57	1.63	0.9	1.20	1.60	1.58	0.9	0.74	0.31	0.57
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	5.4	2.7	2.3	5.9	5.3	11.0	9.2	8.0	6.0	8.7	10.7	13.0	12.9	7.0
A (AREA IN SF)	1.9968	5.0752	6.5472	15.54	17.9608	34.4908	9.09	14.4	20.48	26.7968	10.26	8.1992	1.48025	3.09225
R (HYDRAULIC RADIUS)	0.39	0.68	0.78	1.07	1.17	1.37	0.74	0.96	1.22	1.28	0.75	0.64	0.26	0.44
S (BED SLOPE, FT/FT) *	0.130	0.040	0.020	0.030	0.015	0.020	0.020	0.020	0.007	0.007	0.030	0.060	0.080	0.080
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.050	0.050
V (AT FLOW DEPTH d, FPS)	8.9	7.2	5.6	8.4	6.3	8.1	5.4	6.4	4.4	4.6	6.7	8.4	3.4	4.8
Q (AT FLOW DEPTH d, CFS)	17.8	36.5	36.6	130.5	113.6	279.3	48.7	92.2	91.0	123.0	68.3	68.9	5.1	15.0
Qr (REQUIRED CAPACITY, CFS)	17.3	36.5	36.5	113.8	113.8	279.9	48.2	91.1	91.1	122.8	68.5	68.5	5.0	15.0
Sc (CRITICAL SLOPE)	0.021	0.018	0.017	0.015	0.015	0.014	0.017	0.016	0.015	0.014	0.017	0.018	0.058	0.049
.7Sc	0.015	0.013	0.012	0.011	0.010	0.010	0.012	0.011	0.010	0.010	0.012	0.012	0.041	0.035
1.3Sc	0.028	0.024	0.023	0.020	0.019	0.018	0.022	0.020	0.019	0.018	0.022	0.023	0.076	0.064
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.13	0.26	0.31	0.35	0.3925	0.4075	0.225	0.3	0.4	0.395	0.225	0.185	0.0775	0.1425
MINIMUM REQUIRED FREEBOARD, FT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	1.02	1.54	1.74	1.9	2.07	2.13	1.4	1.7	2.1	2.08	1.4	1.24	0.81	1.07
PROVIDED DEPTH (FT)	2	2	2	2	2	2.2	2.6	2.6	2.6	2.6	2	2	1.5	1.5
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	4.22	2.60	1.55	2.62	1.47	2.03	1.12	1.50	0.70	0.69	1.68	2.77	1.55	2.85
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

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**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
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PERIMETER CHANNEL DESIGN
100-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	1A	1A	1B	1B	2	2	3A	3B	3C	3C	3D	3E	3E	4A	4A
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	18.15	16.66	18.15	16.66	11.98	10.82	9.70	16.36	23.95	21.48	25.35	26.15	27.85	11.50	12.26
CHANNEL TOP WIDTH @ d (FT)	16.15	14.66	16.15	14.66	9.98	8.82	7.70	14.36	21.92	19.48	23.30	23.94	25.30	9.50	10.26
CHANNEL SIDE SLOPES (H:1V)	2.00	2.00	2.00	2.00	2.00	2.00	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	9.60	9.60	9.60	9.60	4.10	4.10	4.1	9.6	13.8	13.8	15.1	15.1	15.1	4.1	4.1
d (FLOW DEPTH IN FEET)	1.64	1.27	1.64	1.27	1.47	1.18	0.9	1.19	2.03	1.42	2.05	2.21	2.55	1.35	1.54
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	5.86	7.58	5.86	7.58	2.79	3.47	4.6	8.1	6.8	9.7	7.4	6.8	5.9	3.0	2.7
A (AREA IN SF)	21.07	15.36	21.07	15.36	10.35	7.62	5.31	14.26	36.26	23.63	39.36	43.14	51.51	9.18	11.06
R (HYDRAULIC RADIUS)	1.25	1.01	1.25	1.01	0.97	0.81	0.65	0.96	1.58	1.17	1.62	1.73	1.94	0.91	1.01
S (BED SLOPE, FT/FT) *	0.008	0.02	0.008	0.02	0.015	0.035	0.018	0.040	0.010	0.035	0.016	0.025	0.015	0.025	0.015
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	4.81	6.60	4.81	6.60	5.57	7.57	4.7	9.0	6.3	9.7	8.1	10.6	8.9	6.9	5.7
Q (AT FLOW DEPTH d, CFS)	101.33	101.30	101.33	101.30	57.66	57.68	24.9	128.4	228.8	228.3	319.2	455.9	456.2	63.1	63.2
Qr (REQUIRED CAPACITY, CFS)	101.31	101.31	101.31	101.31	57.96	57.96	24.8	128.2	228.2	228.2	319.3	455.1	455.1	63.3	63.3
Sc (CRITICAL SLOPE)	0.01	0.02	0.01	0.02	0.02	0.02	0.018	0.016	0.013	0.015	0.013	0.013	0.013	0.016	0.016
.7Sc	0.01	0.01	0.01	0.01	0.01	0.01	0.013	0.011	0.009	0.010	0.009	0.009	0.009	0.012	0.011
1.3Sc	0.02	0.02	0.02	0.02	0.02	0.02	0.024	0.020	0.017	0.019	0.017	0.017	0.016	0.021	0.021
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.41	0.32	0.41	0.32	0.37	0.30	0.23	0.30	0.51	0.36	0.51	0.55	0.64	0.34	0.39
MINIMUM REQUIRED FREEBOARD, FT	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	2.14	1.77	2.14	1.77	1.97	1.68	1.40	1.69	2.54	1.92	2.56	2.76	3.19	1.85	2.04
PROVIDED DEPTH (FT)	2.50	2.50	2.50	2.50	2.00	2.00	2	2	2.6	2.6	2.6	3.2	3.2	2	2
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	0.82	1.58	0.82	1.58	1.38	2.58	1.01	2.97	1.27	3.10	2.05	3.45	2.39	2.11	1.44
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

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**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
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PERIMETER CHANNEL DESIGN
100-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	4B	4B	4C	4C	4D	4D	4E	4E	4F	4F	5	5	6	6	7
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	21.92	20.84	22.44	23.48	25.80	24.14	26.03	27.70	27.40	29.25	17.96	15.80	12.92	14.10	8.62
CHANNEL TOP WIDTH @ d (FT)	19.92	18.84	20.44	21.48	23.66	22.14	23.84	25.18	24.94	26.42	15.96	13.80	10.92	12.10	6.62
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	13.8	13.8	13.8	13.8	15.1	15.1	15.1	15.1	15.1	15.1	9.6	9.6	8.3	8.3	2.8
d (FLOW DEPTH IN FEET)	1.53	1.26	1.66	1.92	2.14	1.76	2.185	2.52	2.46	2.83	1.59	1.05	0.65	0.95	0.96
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	9.0	11.0	8.3	7.2	7.1	8.6	6.9	6.0	6.1	5.3	6.0	9.1	12.7	8.7	2.9
A (AREA IN SF)	25.80	20.56	28.42	33.87	41.47	32.77	42.54	50.75	49.25	58.75	20.32	12.29	6.28	9.70	4.50
R (HYDRAULIC RADIUS)	1.25	1.06	1.34	1.51	1.68	1.43	1.71	1.92	1.89	2.12	1.22	0.86	0.56	0.77	0.64
S (BED SLOPE, FT/FT) *	0.015	0.030	0.025	0.015	0.015	0.030	0.025	0.015	0.025	0.015	0.014	0.060	0.110	0.030	0.030
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	6.6	8.4	8.9	7.5	8.0	10.2	10.5	8.8	11.2	9.4	6.3	10.3	10.5	6.8	6.0
Q (AT FLOW DEPTH d, CFS)	170.2	171.7	253.5	253.9	333.5	334.0	446.8	446.6	552.2	550.8	127.2	126.3	65.7	65.7	26.8
Qr (REQUIRED CAPACITY, CFS)	170.6	170.6	253.3	253.3	333.2	333.2	446.0	446.0	552.1	552.1	126.2	126.2	65.7	65.7	26.8
Sc (CRITICAL SLOPE)	0.014	0.015	0.014	0.014	0.013	0.014	0.013	0.013	0.013	0.012	0.015	0.016	0.019	0.017	0.019
.7Sc	0.010	0.011	0.010	0.009	0.009	0.010	0.009	0.009	0.009	0.009	0.010	0.011	0.013	0.012	0.013
1.3Sc	0.019	0.020	0.018	0.018	0.017	0.018	0.017	0.016	0.016	0.016	0.019	0.021	0.024	0.022	0.024
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.38	0.32	0.42	0.48	0.54	0.44	0.55	0.63	0.62	0.71	0.40	0.26	0.16	0.24	0.24
MINIMUM REQUIRED FREEBOARD, FT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	2.03	1.76	2.16	2.42	2.68	2.26	2.73	3.15	3.08	3.54	2.09	1.55	1.15	1.45	1.46
PROVIDED DEPTH (FT)	2	2	2.5	2.5	2.8	2.8	3.3	3.3	3.5	3.5	2.2	2.2	2	2	2
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	1.43	2.36	2.59	1.80	2.00	3.29	3.41	2.36	3.84	2.65	1.39	3.93	4.49	1.78	1.79
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

PERIMETER CHANNEL DESIGN
100-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	7	8A	8A	8B	8B	8C	9A	9B	9B	9C	10	10	FC AR Channel	FC AR Channel
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	Grass	Grass
CHANNEL TOP WIDTH @ D (FT)	7.40	10.02	10.98	17.00	18.40	28.51	14.94	17.80	19.95	24.06	17.56	16.52	8.05	9.35
CHANNEL TOP WIDTH @ d (FT)	5.40	8.02	8.98	15.00	16.38	26.39	12.94	15.80	17.88	22.01	15.56	14.52	5.55	6.85
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2.5
CHANNEL BOTTOM WIDTH (FT)	2.8	2.8	2.8	8.3	8.3	17.9	8.3	9.6	9.6	13.8	9.6	9.6	4	4
d (FLOW DEPTH IN FEET)	0.65	1.30	1.55	1.67	2.02	2.12	1.16	1.55	2.07	2.05	1.49	1.23	0.31	0.57
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	4.3	2.1	1.8	5.0	4.1	8.4	7.2	6.2	4.6	6.7	6.4	7.8	12.9	7.0
A (AREA IN SF)	2.66	7.06	9.11	19.50	24.92	47.02	12.32	19.69	28.44	36.73	18.74	14.83	1.48	3.09
R (HYDRAULIC RADIUS)	0.47	0.82	0.94	1.24	1.44	1.72	0.91	1.19	1.51	1.60	1.15	0.98	0.26	0.44
S (BED SLOPE, FT/FT) *	0.130	0.040	0.020	0.030	0.015	0.020	0.020	0.020	0.007	0.007	0.030	0.060	0.080	0.080
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.050	0.050
V (AT FLOW DEPTH d, FPS)	10.1	8.1	6.3	9.3	7.2	9.4	6.2	7.4	5.1	5.3	8.8	11.2	3.4	4.8
Q (AT FLOW DEPTH d, CFS)	26.8	57.3	57.3	180.5	180.5	442.6	76.2	145.3	145.3	195.1	165.7	166.7	5.1	15.0
Qr (REQUIRED CAPACITY, CFS)	26.8	57.3	57.3	180.5	180.5	444.6	76.4	145.3	145.3	195.1	164.9	164.9	5.0	15.0
Sc (CRITICAL SLOPE)	0.020	0.017	0.016	0.015	0.014	0.013	0.016	0.015	0.014	0.013	0.015	0.016	0.058	0.049
.7Sc	0.014	0.012	0.012	0.010	0.010	0.009	0.011	0.010	0.010	0.009	0.010	0.011	0.041	0.035
1.3Sc	0.026	0.022	0.021	0.019	0.018	0.017	0.021	0.019	0.018	0.017	0.019	0.020	0.076	0.064
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.16	0.33	0.39	0.42	0.50	0.53	0.29	0.39	0.52	0.51	0.37	0.31	0.08	0.14
MINIMUM REQUIRED FREEBOARD, FT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	1.15	1.80	2.05	2.17	2.52	2.65	1.66	2.05	2.59	2.56	1.99	1.73	0.81	1.07
PROVIDED DEPTH (FT)	2	2	2	2	2	2.2	2.6	2.6	2.6	2.6	2	2	1.5	1.5
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	5.27	3.26	1.93	3.13	1.89	2.65	1.45	1.93	0.90	0.90	2.79	4.61	1.55	2.85
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

DOWNCHUTE CHANNEL DESIGN
25-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	DC-1	DC-1	DC-2	DC-2	DC-3	DC-3	DC-4	DC-4	DC-5	DC-5	DC-6	DC-6	DC-7	DC-7	DC-8
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	18.62	17.78	17.12	16.28	21.22	20.38	17.00	16.20	17.04	16.24	21.18	20.34	21.10	20.34	21.02
CHANNEL TOP WIDTH @ d (FT)	17.42	16.58	15.92	15.08	20.02	19.18	15.80	15.00	15.84	15.04	19.98	19.14	19.90	19.14	19.82
CHANNEL SIDE SLOPES (H:1V)	2.00	2.00	2.00	2.00	2.00	2.00	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	15.30	15.30	13.80	13.80	17.90	17.90	13.8	13.8	13.8	13.8	17.9	17.9	17.9	17.9	17.9
d (FLOW DEPTH IN FEET) to meet Qr	0.53	0.32	0.53	0.32	0.53	0.32	0.5	0.3	0.51	0.31	0.52	0.31	0.501	0.31	0.48
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	28.87	47.81	26.04	43.13	33.77	55.94	27.6	46.0	27.1	44.5	34.4	57.7	35.7	57.7	37.3
A (AREA IN SF)	8.67	5.10	7.88	4.62	10.05	5.93	7.40	4.32	7.56	4.47	9.85	5.74	9.47	5.74	9.05
R (HYDRAULIC RADIUS)	0.49	0.30	0.49	0.30	0.50	0.31	0.46	0.29	0.47	0.29	0.49	0.30	0.47	0.30	0.45
S (BED SLOPE, FT/FT) *	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	7.08	12.08	7.04	12.04	7.12	12.14	6.8	11.6	6.9	11.8	7.0	11.9	6.9	11.9	6.7
Q (AT FLOW DEPTH d, CFS)	61.36	61.64	55.46	55.65	71.60	72.01	50.3	49.9	52.0	52.8	69.3	68.3	65.1	68.3	60.6
Qr (REQUIRED CAPACITY, CFS)	60.95	60.95	54.36	54.36	70.96	70.96	49.9	49.9	51.6	51.6	68.6	68.6	65.0	65.0	59.6
Sc (CRITICAL SLOPE)	0.02	0.02	0.02	0.02	0.02	0.02	0.020	0.023	0.019	0.023	0.019	0.023	0.019	0.023	0.020
.7Sc	0.01	0.02	0.01	0.02	0.01	0.02	0.014	0.016	0.014	0.016	0.013	0.016	0.014	0.016	0.014
1.3Sc	0.02	0.03	0.03	0.03	0.02	0.03	0.025	0.030	0.025	0.029	0.025	0.029	0.025	0.029	0.026
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.13	0.08	0.13	0.08	0.13	0.08	0.13	0.08	0.13	0.08	0.13	0.08	0.13	0.08	0.12
MINIMUM REQUIRED FREEBOARD, FT	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
D (TOTAL DEPTH, FT)	0.83	0.62	0.83	0.62	0.83	0.62	0.80	0.60	0.81	0.61	0.82	0.61	0.80	0.61	0.78
PROVIDED DEPTH (FT)	1.00	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2
τd (SHEAR STRESS AT d, PSF)	1.98	6.59	1.98	6.59	1.98	6.59	1.87	6.18	1.91	6.38	1.95	6.38	1.88	6.38	1.80
τa (MAX ALLOWABLE, PSF)+	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
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DOWNCHUTE CHANNEL DESIGN
25-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	DC-8	DC-9	DC=9	DC-10	DC-10	DC-20	DC-20	DC-21	DC-21	DC-22	DC-22	DC-23	DC-23
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	20.26	15.68	14.84	19.70	18.90	14.08	13.32	18.30	17.50	12.60	11.88	14.28	13.48
CHANNEL TOP WIDTH @ d (FT)	19.06	14.48	13.64	18.50	17.70	12.88	12.12	17.10	16.30	11.40	10.68	13.08	12.28
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	17.9	12.4	12.4	16.5	16.5	11	11	15.1	15.1	9.6	9.6	11	11
d (FLOW DEPTH IN FEET) to meet Qr	0.29	0.52	0.31	0.5	0.3	0.47	0.28	0.5	0.3	0.45	0.27	0.52	0.32
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	61.7	23.8	40.0	33.0	55.0	23.4	39.3	30.2	50.3	21.3	35.6	21.2	34.4
A (AREA IN SF)	5.36	6.99	4.04	8.75	5.13	5.61	3.24	8.05	4.71	4.73	2.74	6.26	3.72
R (HYDRAULIC RADIUS)	0.28	0.47	0.29	0.47	0.29	0.43	0.26	0.46	0.29	0.41	0.25	0.47	0.30
S (BED SLOPE, FT/FT) *	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	11.4	6.9	11.8	6.8	11.6	6.5	11.0	6.8	11.6	6.2	10.7	6.9	11.9
Q (AT FLOW DEPTH d, CFS)	61.1	48.4	47.5	59.9	59.6	36.3	35.6	54.9	54.6	29.5	29.2	43.0	44.5
Qr (REQUIRED CAPACITY, CFS)	59.6	47.3	47.3	58.9	58.9	35.8	35.8	53.3	53.3	29.3	29.3	42.9	42.9
Sc (CRITICAL SLOPE)	0.023	0.019	0.023	0.019	0.023	0.020	0.023	0.020	0.023	0.020	0.024	0.020	0.023
.7Sc	0.016	0.014	0.016	0.014	0.016	0.014	0.016	0.014	0.016	0.014	0.017	0.014	0.016
1.3Sc	0.030	0.025	0.030	0.025	0.030	0.026	0.031	0.025	0.030	0.027	0.031	0.025	0.029
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.07	0.13	0.08	0.13	0.08	0.12	0.07	0.13	0.08	0.11	0.07	0.13	0.08
MINIMUM REQUIRED FREEBOARD, FT	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
D (TOTAL DEPTH, FT)	0.59	0.82	0.61	0.80	0.60	0.77	0.58	0.80	0.60	0.75	0.57	0.82	0.62
PROVIDED DEPTH (FT)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1
τd (SHEAR STRESS AT d, PSF)	5.97	1.95	6.38	1.87	6.18	1.76	5.77	1.87	6.18	1.68	5.56	1.95	6.59
τa (MAX ALLOWABLE, PSF)+	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

DOWNCHUTE CHANNEL DESIGN
100-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	DC-1	DC-1	DC-2	DC-2	DC-3	DC-3	DC-4	DC-4	DC-5	DC-5	DC-6	DC-6	DC-7	DC-7	DC-8
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	19.26	18.18	17.76	16.68	21.90	20.78	17.64	16.60	17.68	16.64	21.82	20.74	21.74	20.70	21.70
CHANNEL TOP WIDTH @ d (FT)	18.06	16.98	16.56	15.48	20.70	19.58	16.44	15.40	16.48	15.44	20.62	19.54	20.54	19.50	20.50
CHANNEL SIDE SLOPES (H:1V)	2.00	2.00	2.00	2.00	2.00	2.00	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	15.30	15.30	13.80	13.80	17.90	17.90	13.8	13.8	13.8	13.8	17.9	17.9	17.9	17.9	17.9
d (FLOW DEPTH IN FEET)	0.69	0.42	0.69	0.42	0.70	0.42	0.66	0.4	0.67	0.41	0.68	0.41	0.66	0.4	0.65
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	22.17	36.43	20.00	32.86	25.57	42.62	20.9	34.5	20.6	33.7	26.3	43.7	27.1	44.8	27.5
A (AREA IN SF)	11.51	6.78	10.47	6.15	13.51	7.87	9.98	5.84	10.14	5.99	13.10	7.68	12.69	7.48	12.48
R (HYDRAULIC RADIUS)	0.63	0.39	0.62	0.39	0.64	0.40	0.60	0.37	0.60	0.38	0.63	0.39	0.61	0.38	0.60
S (BED SLOPE, FT/FT) *	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	8.32	14.35	8.27	14.29	8.47	14.43	8.1	13.9	8.1	14.1	8.3	14.2	8.2	14.0	8.1
Q (AT FLOW DEPTH d, CFS)	95.80	97.29	86.66	87.88	114.41	113.60	80.4	81.0	82.4	84.4	108.9	109.1	103.6	104.7	101.0
Qr (REQUIRED CAPACITY, CFS)	94.79	94.79	85.88	85.88	113.02	113.02	80.1	80.1	82.9	82.9	107.4	107.4	103.6	103.6	100.2
Sc (CRITICAL SLOPE)	0.02	0.02	0.02	0.02	0.02	0.02	0.018	0.021	0.018	0.021	0.018	0.021	0.018	0.021	0.018
.7Sc	0.01	0.01	0.01	0.01	0.01	0.01	0.013	0.015	0.013	0.015	0.012	0.014	0.013	0.015	0.013
1.3Sc	0.02	0.03	0.02	0.03	0.02	0.03	0.023	0.027	0.023	0.027	0.023	0.027	0.023	0.027	0.023
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.17	0.11	0.17	0.11	0.18	0.11	0.17	0.10	0.17	0.10	0.17	0.10	0.17	0.10	0.16
MINIMUM REQUIRED FREEBOARD, FT	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
D (TOTAL DEPTH, FT)	0.99	0.72	0.99	0.72	1.00	0.72	0.96	0.70	0.97	0.71	0.98	0.71	0.96	0.70	0.95
PROVIDED DEPTH (FT)	1.00	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2
τd (SHEAR STRESS AT d, PSF)	2.58	8.65	2.58	8.65	2.62	8.65	2.47	8.24	2.51	8.44	2.55	8.44	2.47	8.24	2.43
τa (MAX ALLOWABLE, PSF)+	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

DOWNCHUTE CHANNEL DESIGN
100-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	DC-8	DC-9	DC=9	DC-10	DC-10	DC-20	DC-20	DC-21	DC-21	DC-22	DC-22	DC-23	DC-23
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	20.66	16.28	15.24	20.30	19.30	14.68	13.72	18.90	17.90	13.16	12.24	14.88	13.84
CHANNEL TOP WIDTH @ d (FT)	19.46	15.08	14.04	19.10	18.10	13.48	12.52	17.70	16.70	11.96	11.04	13.68	12.64
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	17.9	12.4	12.4	16.5	16.5	11	11	15.1	15.1	9.6	9.6	11	11
d (FLOW DEPTH IN FEET)	0.39	0.67	0.41	0.65	0.4	0.62	0.38	0.65	0.4	0.59	0.36	0.67	0.41
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	45.9	18.5	30.2	25.4	41.3	17.7	28.9	23.2	37.8	16.3	26.7	16.4	26.8
A (AREA IN SF)	7.29	9.21	5.42	11.57	6.92	7.59	4.47	10.66	6.36	6.36	3.72	8.27	4.85
R (HYDRAULIC RADIUS)	0.37	0.60	0.38	0.60	0.38	0.55	0.35	0.59	0.38	0.52	0.33	0.59	0.38
S (BED SLOPE, FT/FT) *	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	13.8	8.1	14.0	8.1	14.0	7.6	13.3	8.0	13.9	7.4	12.8	8.0	13.9
Q (AT FLOW DEPTH d, CFS)	100.3	74.3	76.0	93.2	96.6	58.0	59.4	85.5	88.5	46.8	47.5	66.2	67.5
Qr (REQUIRED CAPACITY, CFS)	100.2	74.7	74.7	93.0	93.0	57.4	57.4	85.6	85.6	47.1	47.1	65.7	65.7
Sc (CRITICAL SLOPE)	0.021	0.018	0.021	0.018	0.021	0.019	0.021	0.018	0.021	0.019	0.022	0.018	0.021
.7Sc	0.015	0.013	0.015	0.013	0.015	0.013	0.015	0.013	0.015	0.013	0.015	0.013	0.015
1.3Sc	0.027	0.023	0.027	0.023	0.027	0.024	0.028	0.023	0.027	0.025	0.028	0.024	0.027
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.10	0.17	0.10	0.16	0.10	0.16	0.10	0.16	0.10	0.15	0.09	0.17	0.10
MINIMUM REQUIRED FREEBOARD, FT	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
D (TOTAL DEPTH, FT)	0.69	0.97	0.71	0.95	0.70	0.92	0.68	0.95	0.70	0.89	0.66	0.97	0.71
PROVIDED DEPTH (FT)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1
τd (SHEAR STRESS AT d, PSF)	8.03	2.51	8.44	2.43	8.24	2.32	7.82	2.43	8.24	2.21	7.41	2.51	8.44
τa (MAX ALLOWABLE, PSF)+	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

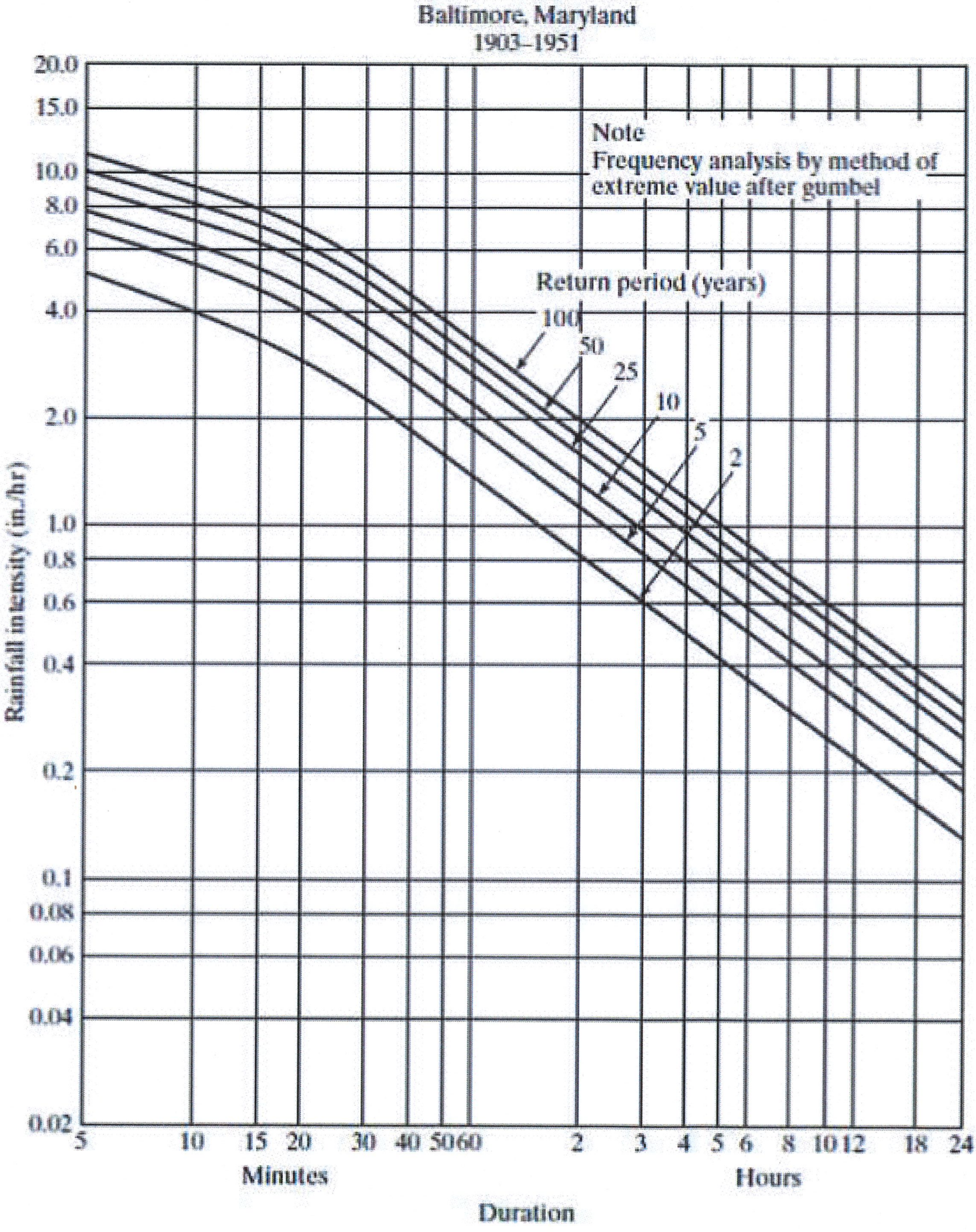


Figure 2.4 Rainfall intensity-duration-frequency (National Weather Service, 1961).

Title:	CHANNEL DESIGN	Site: CHESAPEAKE TERRACE	DATE: July 17, 2020
Prepared by:	VEF	Telephone Number:	Sheet 1 of 1

Design Calculations: PROPOSED CHANNEL DESIGN

Chan-nel Name	Design Storm (years)	Peak Discharge (cfs)	Channel Bed Slope (ft/ft)	Free-board (ft)	Channel Lining	Manning Coeff.	Channel Bottom Width (ft)	Left Side Slopes Inclintion	Right Side Slopes Inclintion	Flow Area (sq.ft.)	Rh = A/P	Flow Depth (ft)	Top Flow Width (ft.)	Flow Velocity (ft/s)	Actual Q (cfs)	With Freeboard		
																Channel Depth (ft)	Top Channel Width (ft)	Q Available (cfs)
Terrace	25	6.2	0.020	0.19	Grass	0.078	0.00	10.00	3.00	4.26	0.40	0.81	10.53	1.46	6.2	1.00	13.0	10.9
Terrace	25	6.2	0.030	0.30	Grass	0.065	0.00	10.00	3.00	3.19	0.34	0.70	9.10	1.95	6.2	1.00	13.0	16.0
Terrace	25	2.7	0.020	0.41	Grass	0.078	0.00	10.00	3.00	2.26	0.29	0.59	7.67	1.18	2.7	1.00	13.0	10.9
Terrace	25	2.7	0.030	0.49	Grass	0.065	0.00	10.00	3.00	1.69	0.25	0.51	6.63	1.58	2.7	1.00	13.0	16.0
AR Channel	25	3.3	0.040	1.06	Grass	0.080	3.00	3.00	2.00	1.83	0.31	0.45	5.23	1.81	3.3	1.50	10.5	35.4
AR Channel	25	3.3	0.080	1.13	Grass	0.080	3.00	3.00	2.00	1.45	0.30	0.37	4.85	2.31	3.3	1.50	10.5	50.0

 FROM Ref 3

TABLE 7-3 Runoff coefficients for the Rational method

Description of Area	Runoff Coefficients
Business	
Downtown	0.70–0.95
Neighborhood	0.50–0.70
Residential	
Single-family	0.30–0.50
Multiunits, detached	0.40–0.60
Multiunits, attached	0.60–0.75
Residental (suburban)	0.25–0.40
Apartment	0.50–0.70
Industrial	
Light	0.50–0.80
Heavy	0.60–0.90
Parks, cemeteries	0.10–0.25
Playgrounds	0.20–0.35
Railroad yard	0.20–0.35
Unimproved	0.10–0.30

It often is desirable to develop a composite runoff coefficient based on the percentage of different types of surface in the drainage area. This procedure often is applied to typical "sample" blocks as a guide to selection of reasonable values of the coefficient for an entire area. Coefficients with respect to surface type currently in use are:

Character of Surface	Runoff Coefficients
Pavement	
Asphaltic and Concrete	0.70–0.95
Brick	0.70–0.85
Roofs	0.75–0.95
Lawns, sandy soil	
Flat, 2%	0.05–0.10
Average, 2 to 7%	0.10–0.15
Steep, 7%	0.15–0.20
Lawns, heavy soil	
Flat, 2%	0.13–0.17
Average, 2 to 7%	0.18–0.22
Steep, 7%	0.25–0.35

The coefficients in these two tabulations are applicable for storms of 5- to 10-year frequencies. Less frequent, higher intensity storms will require the use of higher coefficients because infiltration and other losses have a proportionally smaller effect on runoff. The coefficients are based on the assumption that the design storm does not occur when the ground surface is frozen.

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers, New York, p. 332, 1969.

7.3.1 *Runoff Coefficients for Nonhomogeneous Areas*

The runoff coefficients of Table 7-2 reflect the effect of land use, soil, and slope on runoff potential. The use of Eq. 7-4 assumes that the watershed is homogeneous in these characteristics so that the runoff coefficient used provides unbiased estimates.

Reference 4

TABLE 7a
Maximum Permissible Velocities for Channels Lined with Vegetation

Cover	Slope Range Percent	Erosion resistant Soil[1]	Easily Eroded Soil [2]
Kentucky Bluegrass Tall Fescue	<5 5-10 >10	7 [3] 6 [3] 5	5 4 3
Grass Mixture Reed Canarygrass	<5 5-10	5 4	4 3
Serecea Lespedeza Weeping Lovegrass Redtop Red Fescue	<5	3.5	2.5
Annuals Temporary cover only Sudangrass	<5	3.5	2.5

[1]Cohesive (clayey) fine grain soils and coarse grain soils with a plasticity index OF 10 TO 40 (CL,CH,SC and GC). Soils with K values less than 0.37.

[2]Soils with K values greater than 0.37.

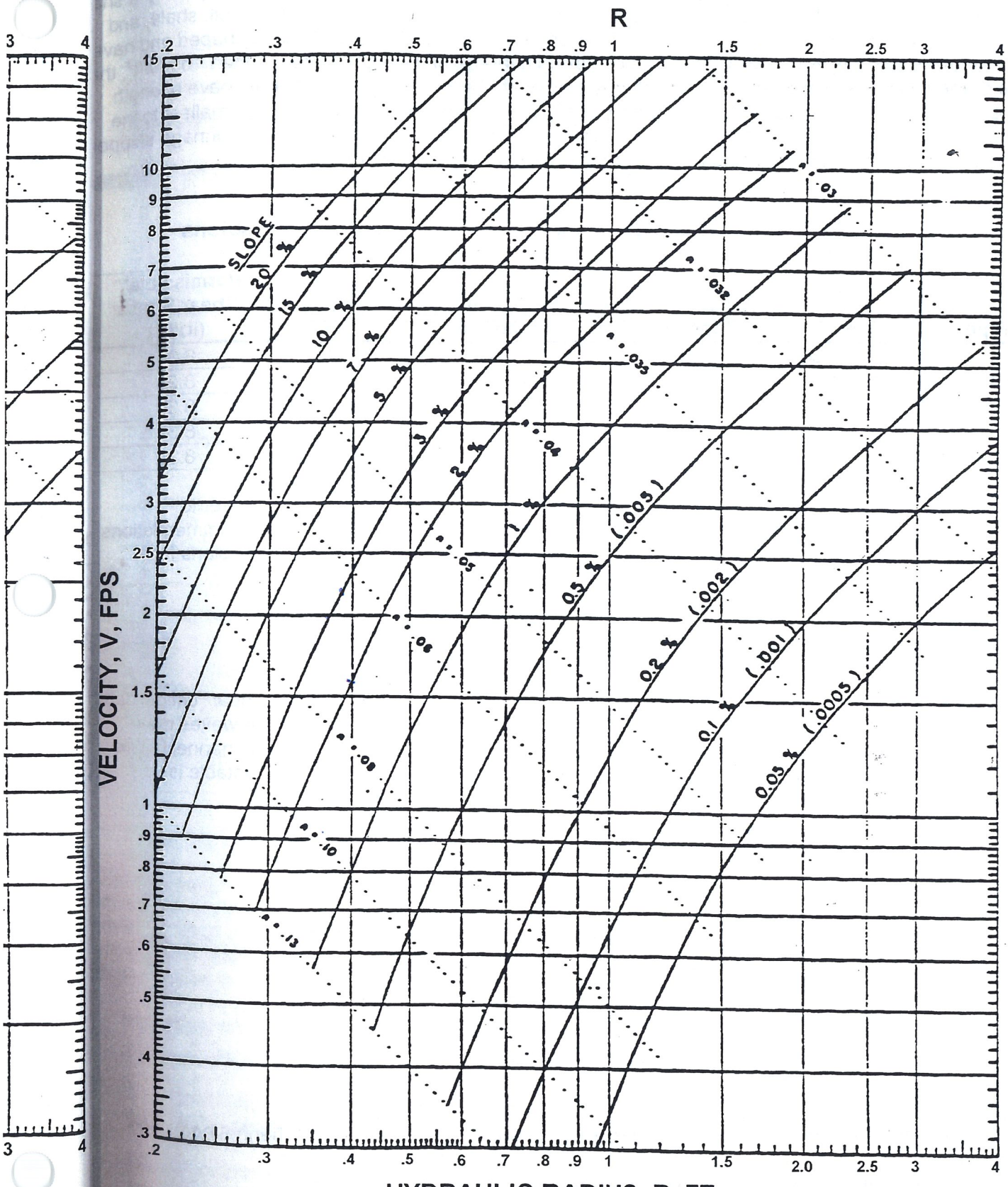
[3]Use velocities exceeding 5 ft/sec only where good cover and proper maintenance can be obtained.

ADDITIONAL NOTES REGARDING THE USE OF TABLE 7a

1. A velocity of 3.0 ft/sec should be the maximum if because of shade, soils or climate, only a sparse cover can be established or maintained.
2. A velocity of 3.0 to 4.0 ft/sec should be used under normal conditions if the vegetation is to be established by seeding.
3. A velocity of 4.0 to 5.0 ft/sec should be used only in areas if a dense, vigorous sod is obtained quickly or if water can be diverted out of the waterway while vegetation is being established.
4. A velocity of 5.0 to 6.0 ft/sec may be used on well established, good quality sod. Special maintenance may be required.
5. A velocity of 6.0 to 7.0 ft/sec may be used only on established, excellent quality sod, and only under special circumstances in which flow cannot be handled at a lower velocity. Under these conditions, special maintenance and appurtenant structures will be required.
6. If stone centers, or other erosion resistant materials supplement the vegetative lining, the velocities in the above table may be increased by 2.0 ft/sec.
7. When base flow exists, a rock lined low flow channel should be designed and incorporated into the vegetative lined channel section.

from Ref 4

Figure 3c
"n" Values for Vegetated Channels, D Retardance



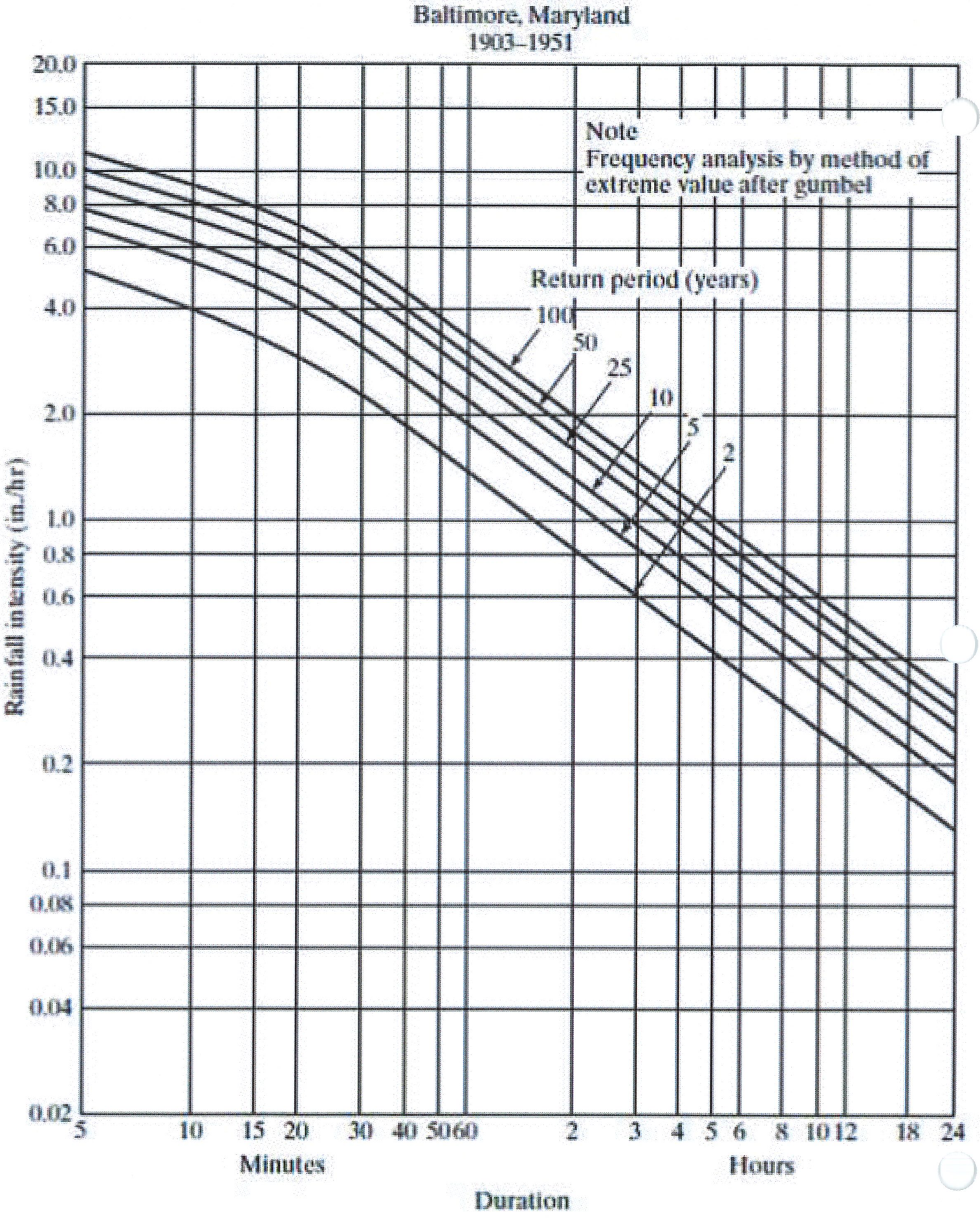


Figure 2.4 Rainfall intensity-duration-frequency (National Weather Service, 1961).

from Bethlehem Pre Cast for Cable Concrete lined Channel

Inte[illegible]nal Erosion Control Systems — Block [illegible]on Guide

IMPERIAL UNITS

	Block Type / Cell Type	CC20 Closed	CC35 Closed	CC45 Closed	CC70 Closed	CC45 OS Closed	CC90 OS Closed	CC35 Open	CC55 Open	CC35 OS Open	CC65 OS Open	CC95 OS Open
L1 (inches)		1.13	2.03	2.48	3.83	2.15	4.06	2.32	3.58	2.07	3.92	4.84
L2 and L4 (inches)		7.75	7.75	7.75	7.75	15.79	15.79	7.75	7.75	15.79	15.79	15.79
L3 (inches)		2.5	4.5	5.5	8.5	4.5	8.5	5.5	8.5	4.5	8.5	10.5
Submerged Weight (pounds)		21.01	37.82	46.22	71.43	180.55	341.03	35.03	54.14	145.93	271.67	335.84
ALLOWABLE SHEAR STRESSES (lb/sq. ft.) (Factor of Safety = 1.0)												
	Bed Slope											
Level Bed Critical Shear Stress - Failure by Over-Turning - No Cable Interaction	0.000	24.7	24.6	25.3	27.1	45.5	51.4	27.6	26.7	6[illegible].4	66	66.3
Level Bed Critical Shear Stress - Failure by Sliding - With Cable Interaction	0.000	10.1	18.1	22.1	34.2	21.6	40.8	16.8	26.0	17.3	32.6	40.3
Level Bed Critical Shear Stress - Failure by Sliding - No Cable Interaction	0.000	6.0	10.7	13.2	20.7	12.8	24.1	9.9	15.4	10.2	19.3	23.8
Bed Slope 1.5H:1V (34 degrees) - Failure by Over-Turning - No Cable Interaction	0.667	17.2	15.4	17.0	15.5	34.7	35.7	16.6	13.3	4[illegible].2	41.6	39.6
Bed Slope 1.5H:1V (34 degrees) - Failure by Sliding - With Cable Interaction	0.667	1.8	3.3	4.0	6.2	3.9	7.4	14.0	21.6	14.4	27.2	33.6
Bed Slope 1.5H:1V (34 degrees) - Failure by Sliding - No Cable Interaction	0.667	1.1	2.0	2.4	3.7	2.3	4.4	8.3	12.8	8.5	16.1	19.9
Bed Slope 2H:1V (26.5 degrees) - Failure by Over-Turning - No Cable Interaction	0.500	20.0	18.5	19.5	18.8	38.2	40.3	20.3	17.5	5[illegible].8	50.1	48.5
Bed Slope 2H:1V (26.5 degrees) - Failure by Sliding - With Cable Interaction	0.500	3.7	6.7	8.2	12.7	8.0	15.1	15.0	23.2	15.4	29.1	36.0
Bed Slope 2H:1V (26.5 degrees) - Failure by Sliding - No Cable Interaction	0.500	2.2	4.0	4.8	7.5	4.7	8.9	8.9	13.7	9.1	17.2	21.3
Bed Slope 3H:1V (18.5 degrees) - Failure by Over-Turning - No Cable Interaction	0.333	22.2	21.2	22.0	22.1	41.5	44.9	23.4	21.2	6[illegible].7	57.1	56.0
Bed Slope 3H:1V (18.5 degrees) - Failure by Sliding - With Cable Interaction	0.333	5.6	10.4	12.7	19.6	12.4	23.4	15.7	24.3	16.1	30.5	37.6
Bed Slope 3H:1V (18.5 degrees) - Failure by Sliding - No Cable Interaction	0.333	3.4	6.2	7.5	11.6	7.3	13.9	9.3	14.4	9.5	18.0	22.3
Bed Slope 4H:1V (14 degrees) - Failure by Over-Turning - No Cable Interaction	0.250	23.1	22.3	23.2	23.7	42.9	47.0	24.7	22.8	6[illegible].1	59.9	59.2
Bed Slope 4H:1V (14 degrees) - Failure by Sliding - With Cable Interaction	0.250	6.9	12.4	15.2	23.4	14.8	28.0	16.0	24.7	16.4	31.0	38.3
Bed Slope 4H:1V (14 degrees) - Failure by Sliding - No Cable Interaction	0.250	4.1	7.3	9.0	13.9	8.8	16.5	9.5	14.6	9.7	18.4	22.7
Bed Slope 5H:1V (11.3 degrees) - Failure by Over-Turning - No Cable Interaction	0.200	23.5	22.9	23.8	24.6	43.7	48.1	25.4	23.7	6[illegible].3	61.5	61.0
Bed Slope 5H:1V (11.3 degrees) - Failure by Sliding - With Cable Interaction	0.200	7.5	13.5	16.5	25.5	16.1	30.4	16.5	25.5	16.9	32.0	39.5
Bed Slope 5H:1V (11.3 degrees) - Failure by Sliding - No Cable Interaction	0.200	4.4	8.0	9.8	15.1	9.5	18.0	9.8	15.1	10.0	18.9	23.4
MAXIMUM ALLOWABLE VELOCITIES (ft./sec.)												
Note: Velocities above 25.0 feet per second are not recommended.												
Level Bed Maximum Velocity - Failure by Over-Turning - No Cable Interaction	0.000	26.0	25.9	26.3	27.2	38.0	39.0	22.7	22.3	3[illegible].8	35.2	35.2
Level Bed Maximum Velocity - Failure by Sliding - With Cable Interaction	0.000	17.4	23.4	25.9	32.2	25.6	35.1	19.7	24.5	20.0	27.4	30.5
Level Bed Maximum Velocity - Failure by Sliding - No Cable Interaction	0.000	13.5	18.0	20.0	25.0	19.7	27.0	15.2	18.8	15.4	21.1	23.5
Bed Slope 1.5H:1V (34 degrees) - Failure by Over-Turning - No Cable Interaction	0.667	21.7	20.5	21.6	20.6	30.8	31.2	17.6	15.8	3[illegible].0	28.0	27.2
Bed Slope 1.5H:1V (34 degrees) - Failure by Sliding - With Cable Interaction	0.667	7.5	10.0	11.1	13.7	10.9	15.0	17.0	21.1	17.2	23.7	26.3
Bed Slope 1.5H:1V (34 degrees) - Failure by Sliding - No Cable Interaction	0.667	5.7	7.7	8.5	10.6	8.4	11.5	13.1	16.3	13.3	18.2	20.2
Bed Slope 2H:1V (26.5 degrees) - Failure by Over-Turning - No Cable Interaction	0.500	23.4	22.5	23.1	22.6	32.3	33.2	22.0	18.1	32.3	30.6	30.1
Bed Slope 2H:1V (26.5 degrees) - Failure by Sliding - With Cable Interaction	0.500	10.6	14.2	15.7	19.5	15.5	21.3	20.3	25.2	21.6	28.3	31.4
Bed Slope 2H:1V (26.5 degrees) - Failure by Sliding - No Cable Interaction	0.500	8.1	10.9	12.1	15.0	11.9	16.4	15.6	19.4	15.8	21.8	24.2
Bed Slope 3H:1V (18.5 degrees) - Failure by Over-Turning - No Cable Interaction	0.333	24.6	24.1	24.5	24.6	33.7	35.0	20.9	19.9	3[illegible].0	32.7	32.4
Bed Slope 3H:1V (18.5 degrees) - Failure by Sliding - With Cable Interaction	0.333	13.3	17.8	19.7	24.5	19.4	26.7	19.0	23.6	19.3	26.5	29.4
Bed Slope 3H:1V (18.5 degrees) - Failure by Sliding - No Cable Interaction	0.333	10.2	13.7	15.1	18.8	15.0	20.6	14.6	18.2	14.8	20.4	22.6
Bed Slope 4H:1V (14 degrees) - Failure by Over-Turning - No Cable Interaction	0.250	25.1	24.7	25.2	25.5	34.3	35.8	21.5	20.7	3[illegible].6	33.5	33.3
Bed Slope 4H:1V (14 degrees) - Failure by Sliding - With Cable Interaction	0.250	14.4	19.3	21.3	26.5	21.1	29.0	19.2	23.9	19.5	26.7	29.7
Bed Slope 4H:1V (14 degrees) - Failure by Sliding - No Cable Interaction	0.250	11.1	14.8	16.4	20.4	16.2	22.3	14.8	18.4	15.0	20.6	22.9
Bed Slope 5H:1V (11.3 degrees) - Failure by Over-Turning - No Cable Interaction	0.200	25.4	25.0	25.5	25.9	34.6	36.3	21.8	21.1	3[illegible].9	33.9	33.8
Bed Slope 5H:1V (11.3 degrees) - Failure by Sliding - With Cable Interaction	0.200	15.1	20.2	22.[illegible]	27.8	22.1	30.3	19.5	24.2	19.8	27.2	30.2
Bed Slope 5H:1V (11.3 degrees) - Failure by Sliding - No Cable Interaction	0.200	11.6	15.5	17.2	21.4	17.0	23.3	15.0	18.6	15.2	20.9	23.2

Testing Authority -- Colorado State University, University of Minnesota, University of Windsor

Failure Mode -- Loss of intimate contact

max allowable Shear Stress

max allowable velocity

[illegible] Load

ATTACHMENT 17F

Proposed Culverts

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Stormwater Management – Proposed Channel Flows		
	Job No. 2018-3854	**Made by:** VEF	**Date** 07-15-20
	Ref.	**Checked by:** VEF	**Sheet** 1 of 1

Revised by PGS 08/27/2021

Objective: The objective of this analysis is to estimate the flow in the proposed stormwater management channels under the design storms being considered.

Design Approach and Assumptions:

Use HydroCad, a computer software which implements the principles of TR-55 and TR-20 for larger drainage areas. The input data for each is as follows:

1) With proposed channel flows for the 25 year, 24 hour storm event, size the Culverts for road crossings.
2) Assume orifice flow, so use a nomograph developed by the HDPE pipe manufacturer.

Calculations:

See the attached nomographs.

References:

1. HydroCAD, V8.5.
2. Advanced GeoServices Corp, Calculations entitled "Stormwater Management – Proposed Channel Flow," dated July 15, 2020.

Conclusions:

A summary of the inflow and the culvert sizes provided in the table below.

Culvert ID	Inflow Channel	25 year, 24 hour Q (cfs)	100 year, 24 hour Q (cfs)	Culvert Dimensions		
				Culvert Dia	# Culverts	Material
1	PC-5	418.56	673.39	60 inches	2	HDPE
2	PC-4F	347.91	552.08	30-inches	4	HDPE
3	PC-10	68.46	164.87	48-inches	1	HDPE
4	PC-8C	279.9	444.63	54-inches	2	HDPE
5	PC-2	31.8	57.96	24-inches	2	HDPE
AR-1	DC-2	67	106	24-inches	3	HDPE
AR-2	1/2 DC-1	30	47	18-inches	2	HDPE
~~AR-3~~	~~1/3 DC-10~~	~~20~~	~~30~~	~~18-inches~~	~~2~~	~~HDPE~~
~~AR-4~~ 3	PC-8A	36.5	57.3	24-inches	2	HDPE

6 PC-1 44.0 101.3 30-inch 2 HDPE
7 PC-6 24.0 65.73 30-inch 1 HDPE
8 Off-site flow to Basin 4 186.05 399.01 48-inches 1 HDPE

HW/D =

$Inv_{up.} = 85$

$Inv_{down} = 81$

H = 6'

Rd. Elev = 92

Culvert #1 - Into Basin 1

$Q_{25} = 418.56$ cfs

$Q_{100} = 673.39$ cfs

Figure 3-1

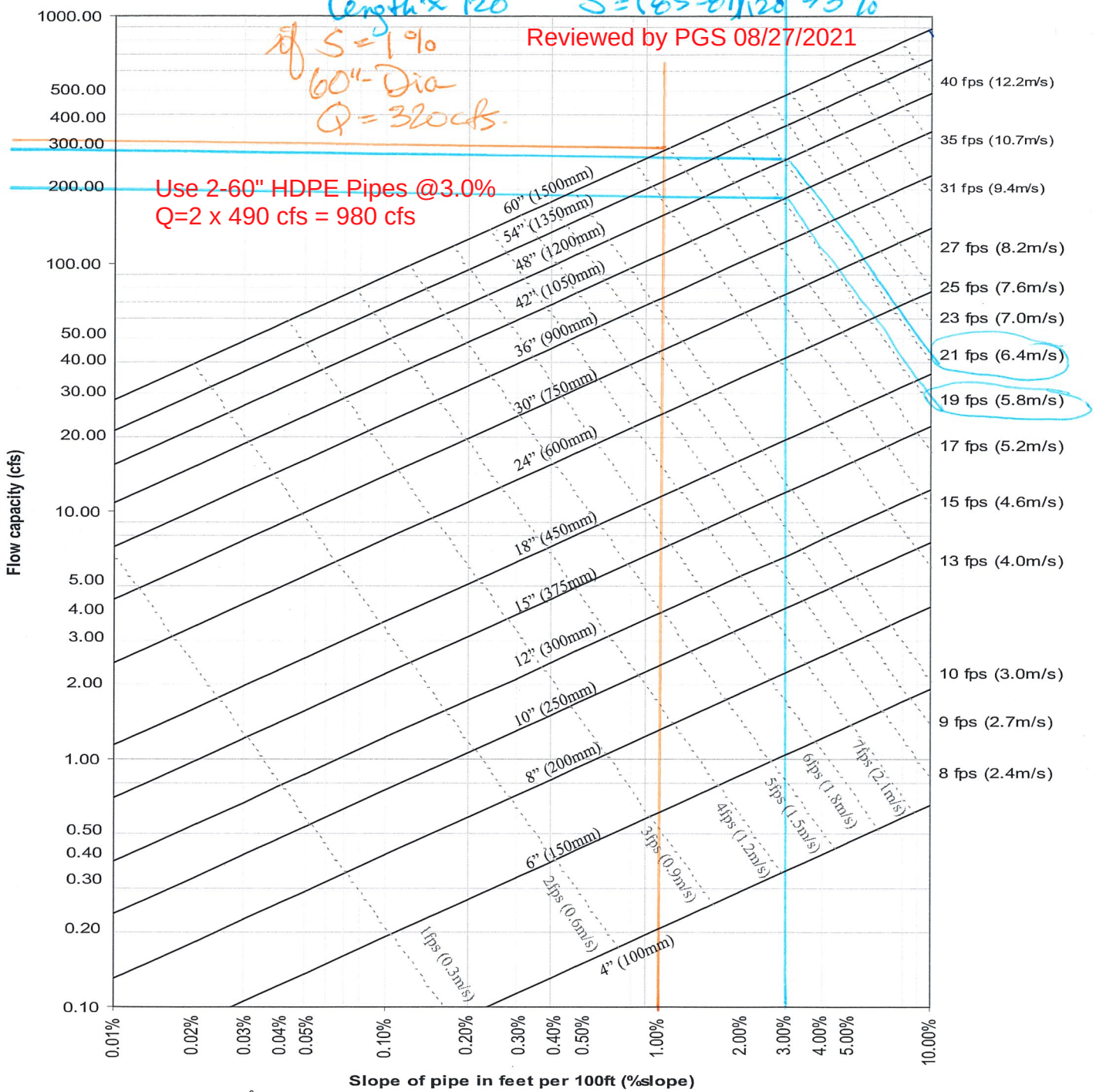
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]

Length x 120 S = (85-81)/120 ⇒ 3%

Reviewed by PGS 08/27/2021

If S = 1%
60"-Dia
Q = 320 cfs.

Use 2-60" HDPE Pipes @3.0%
Q=2 x 490 cfs = 980 cfs



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

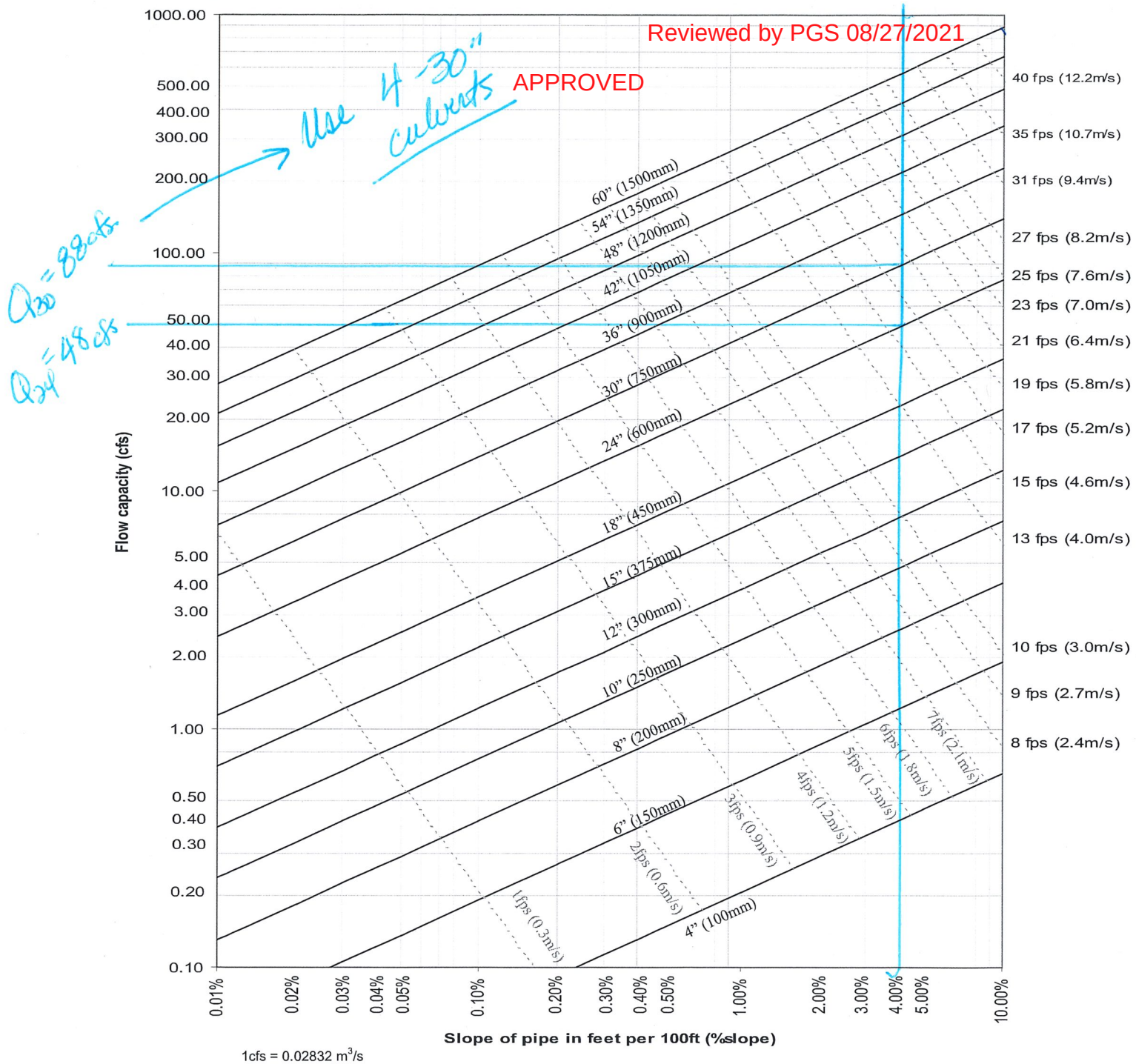
1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

Culvert #2 → Channel 4F
$Q_{25} = 347.91$
$Q_{100} = 552.08$
Channel Width 15.1 ft.

Inlet = 94
Outlet = 90
Culvert Length = 100 ft
S = 4%
Road Cost = 100 ft/LR

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



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1% = 0.01 ft/ft

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Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

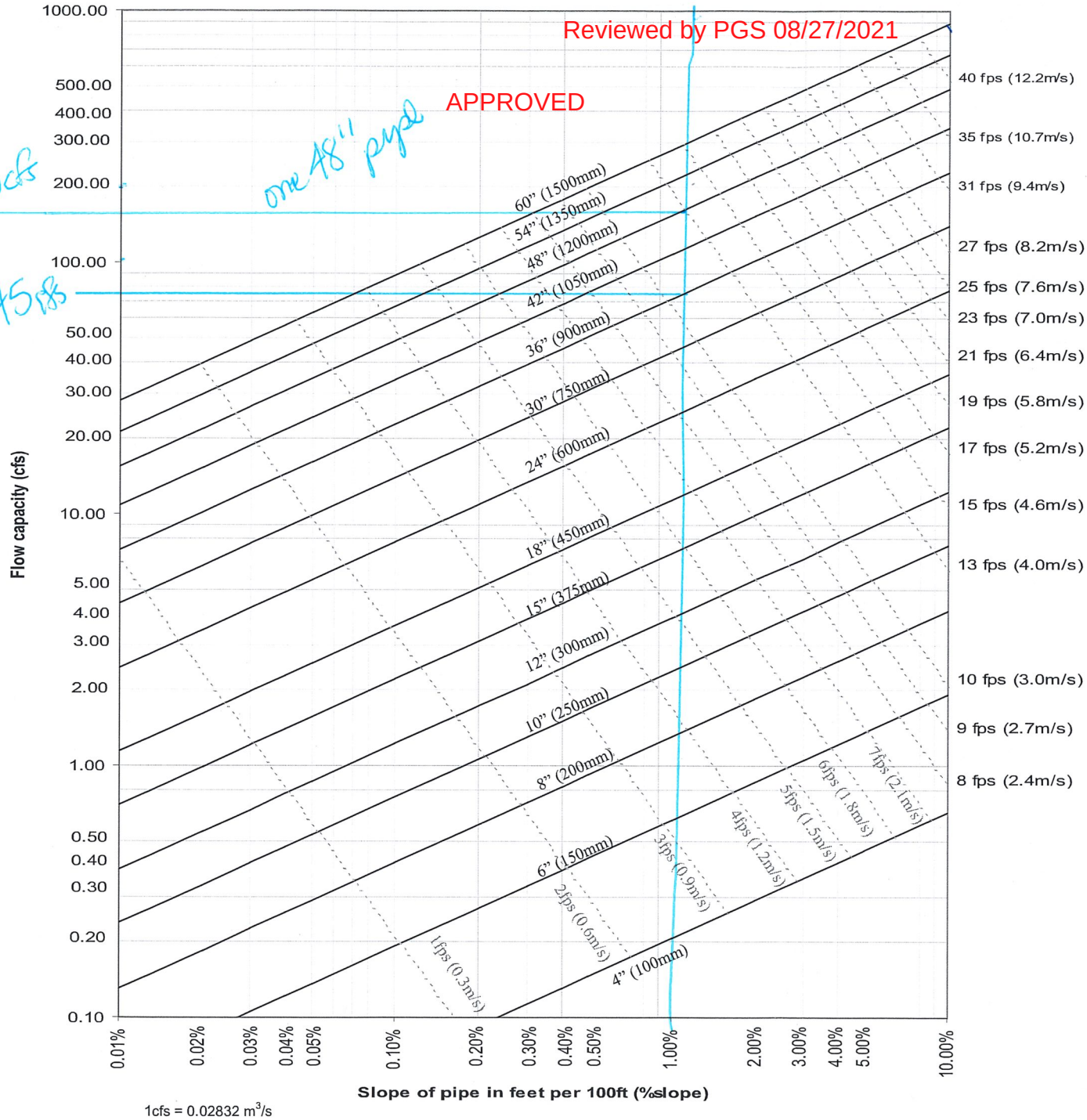
from PC10 → Basin #2 Culvert #3

$Q_{25} = 68.46$ cfs

$Q_{100} = 164.87$ cfs

$S = 1\%$

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

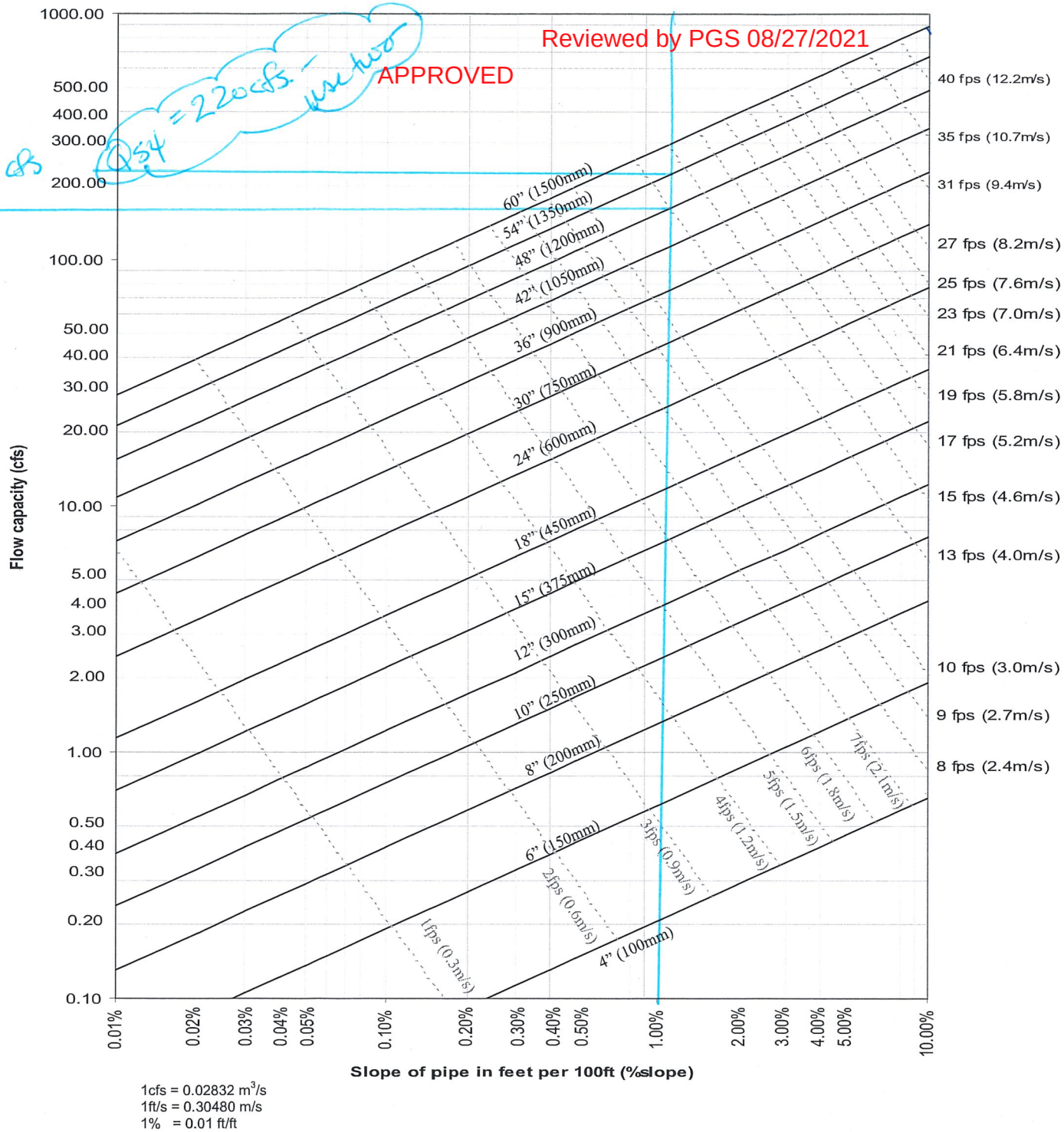
Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

Culvert #4 → PC 8C → Basin #3

Road
Inlet = 76.8
Outlet = 72.0
S = 1%

Q_{25} = 279.9
Q_{100} = 444.63

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

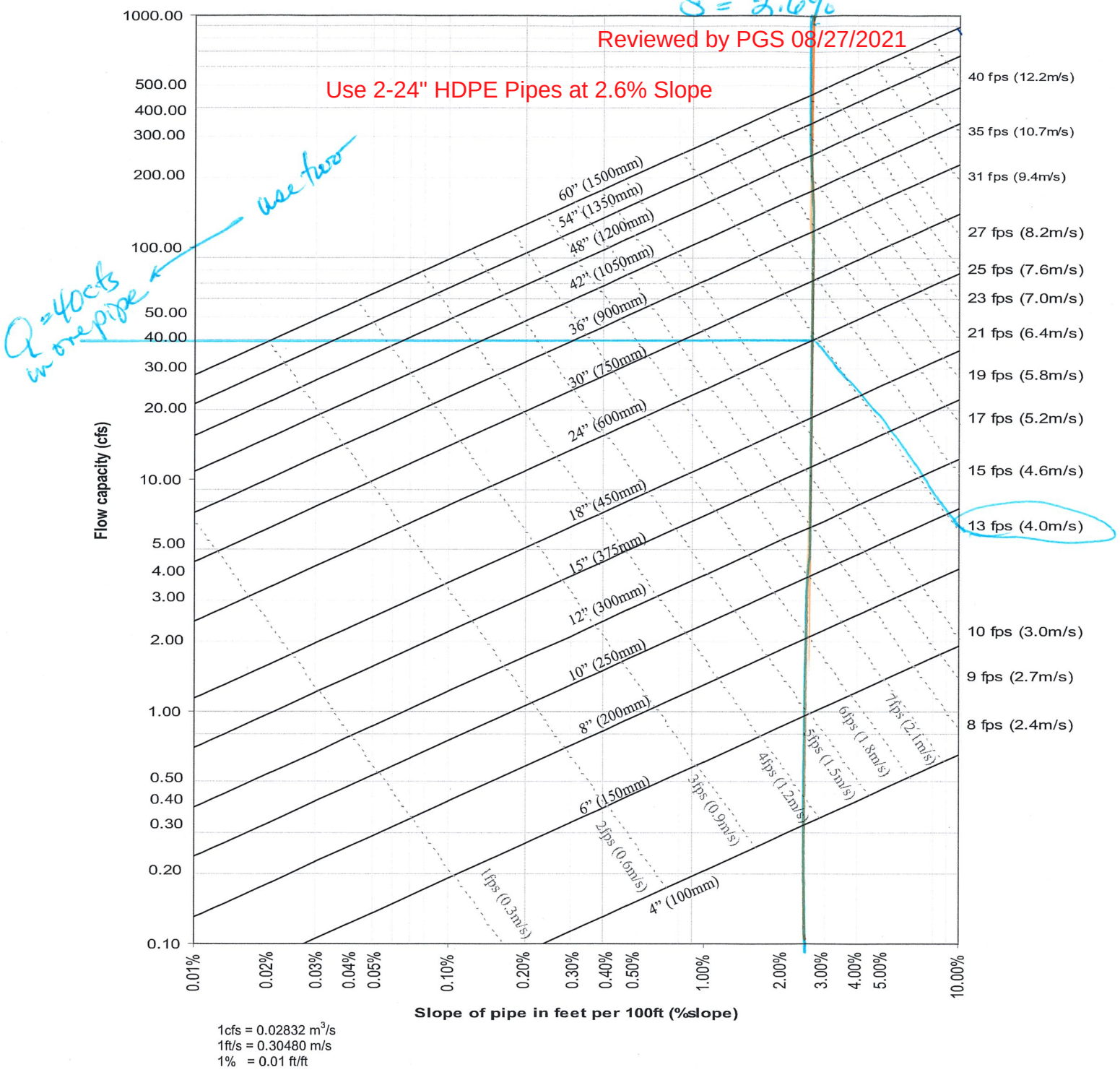
1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

Swale 2 info Basin #1 Culvert #5

$Q_{25} = 31.8$ Invert ⇒ 87
$Q_{100} = 57.96$ Outlet ⇒ 81
Length = 195
S = 2.6%

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

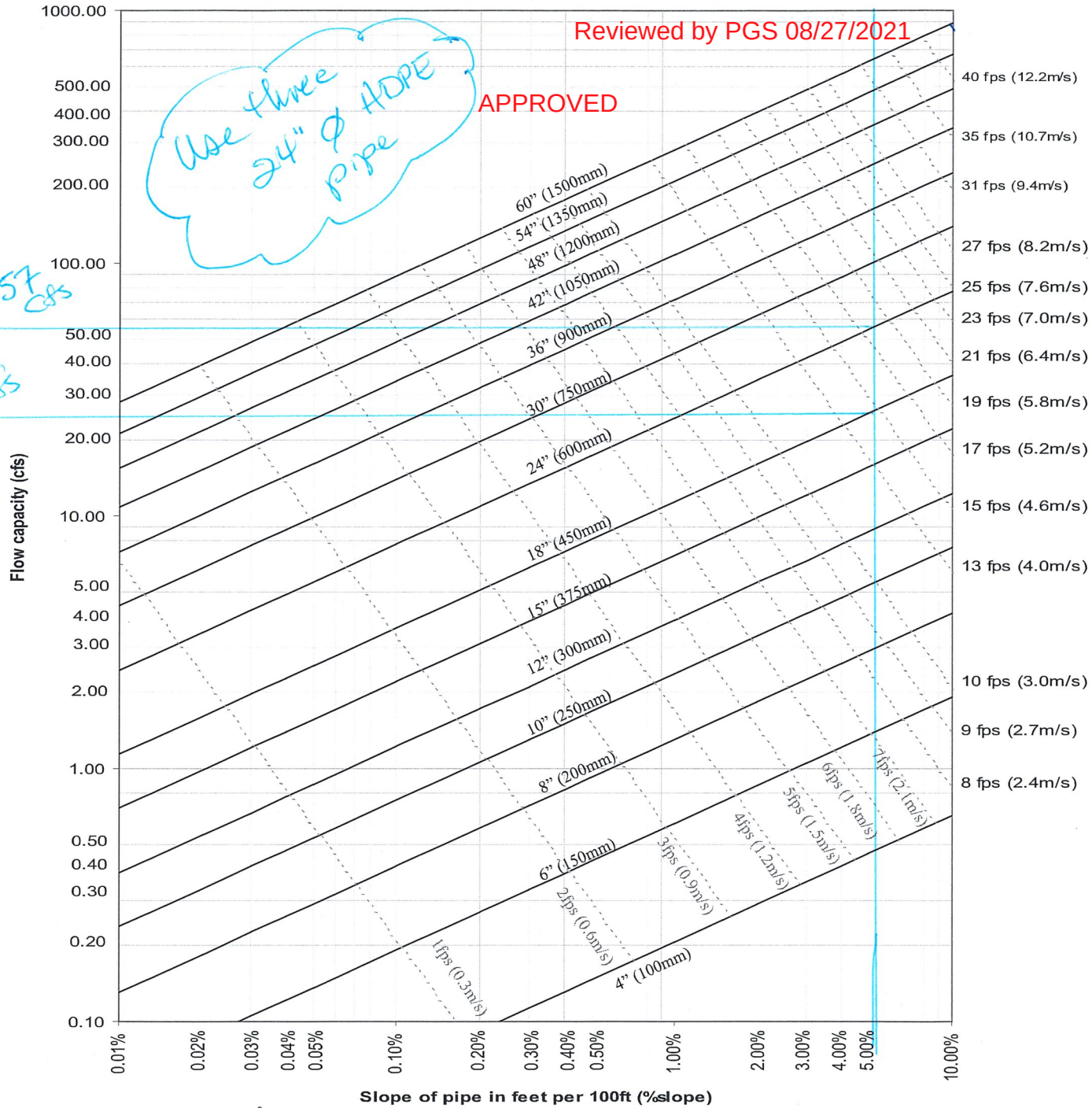
Final Crop Access Road culvert AR-1 (DC-2)

$Q_{25} = 67$ cfs

$Q_{100} = 106$ cfs

$S = 6\%$

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



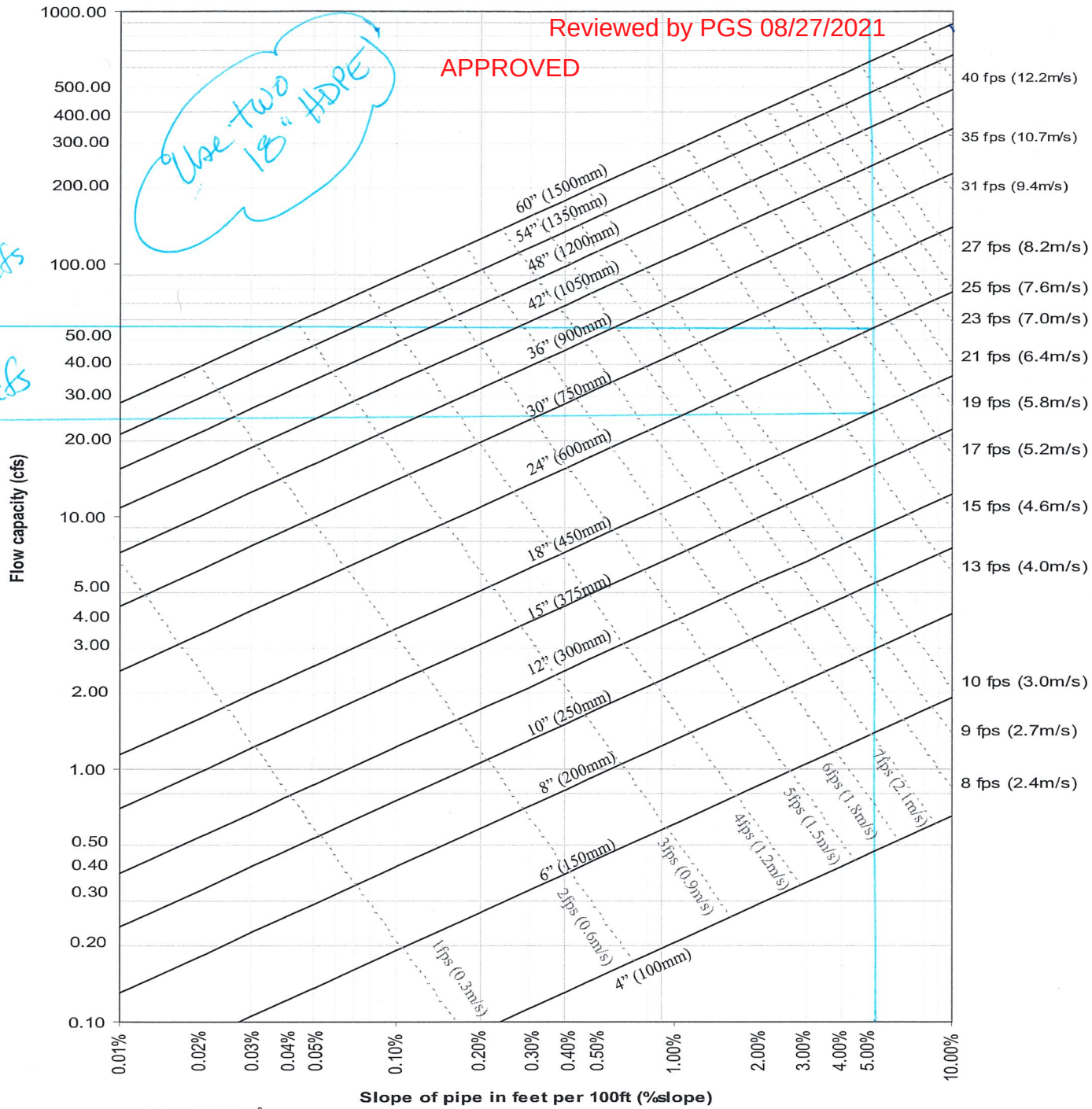
1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

Find Cap Access Road Culvert AR-2 (½ DC-1)
$Q_{25} = 30$ cfs
$Q_{100} = 47$ cfs
S = 6%

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

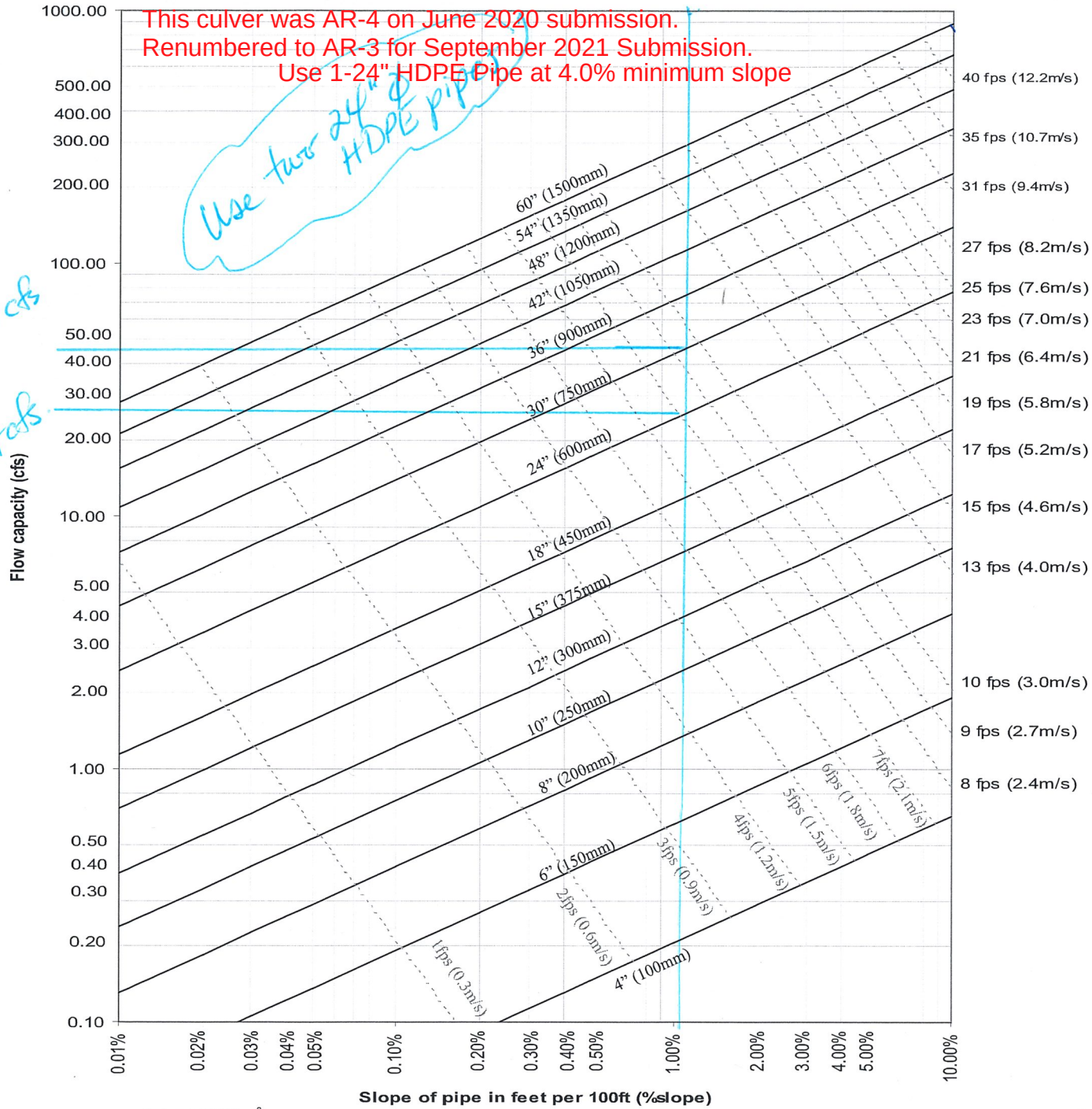
Final Cap Access Road Culvert AR-4 (PC 8A)

$Q_{25} = 36.5$

$Q_{100} = 57.3$

$S = 1\%$

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

CULVERT #6 Q_{25} = 44.0 cfs

IE (up) = 117.0

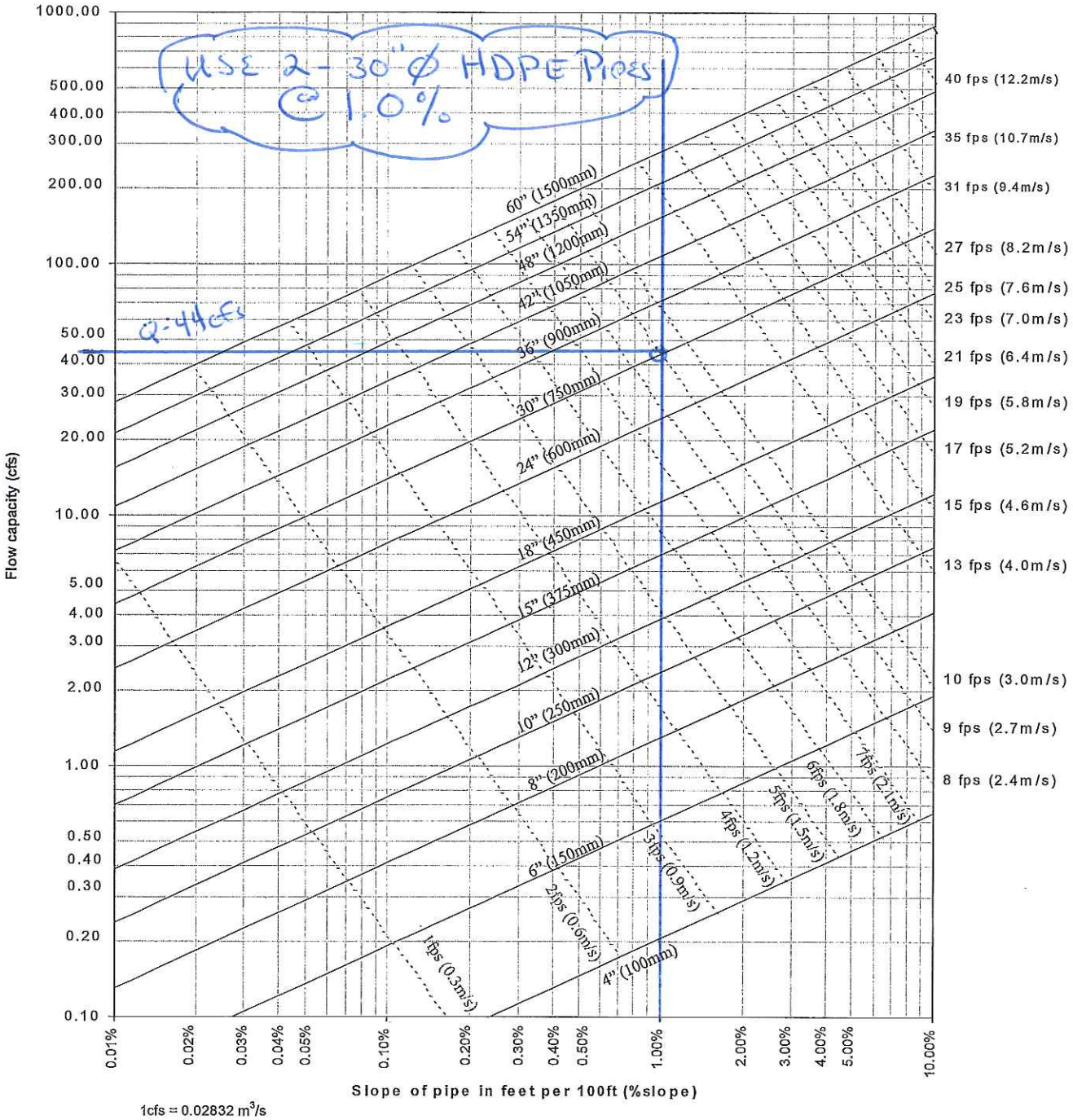
IE (down) = 115.8

L = 120 LF

S = 0.01 Ft/Ft

Figure 3-1

Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



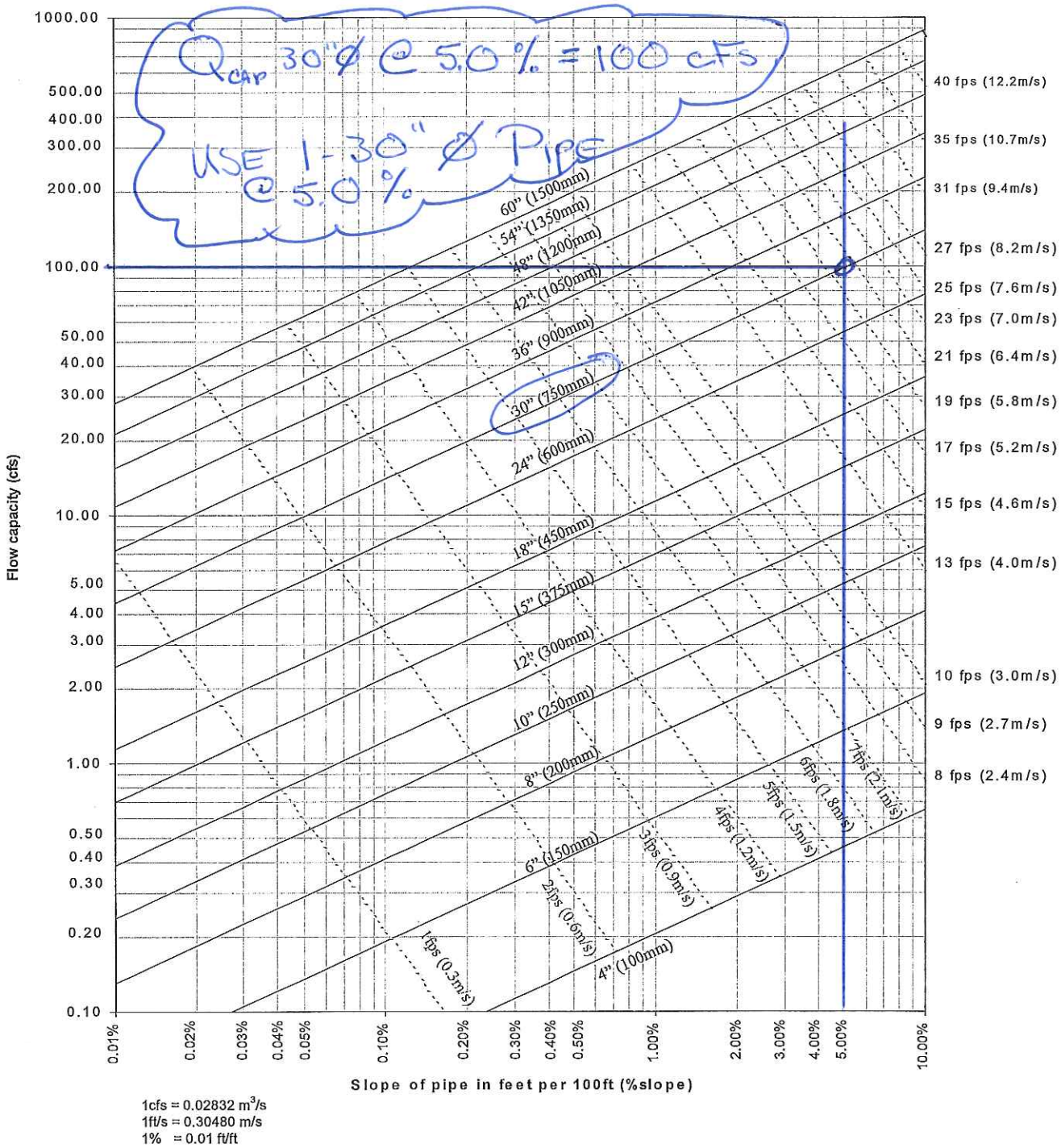
1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, N-12 HP, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

CULVERT #7 Q_{25} = 24.0 cfs
IE(up) = 105.00 L = 100'
IE(down) = 100.00 S = 0.05 ft/ft

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



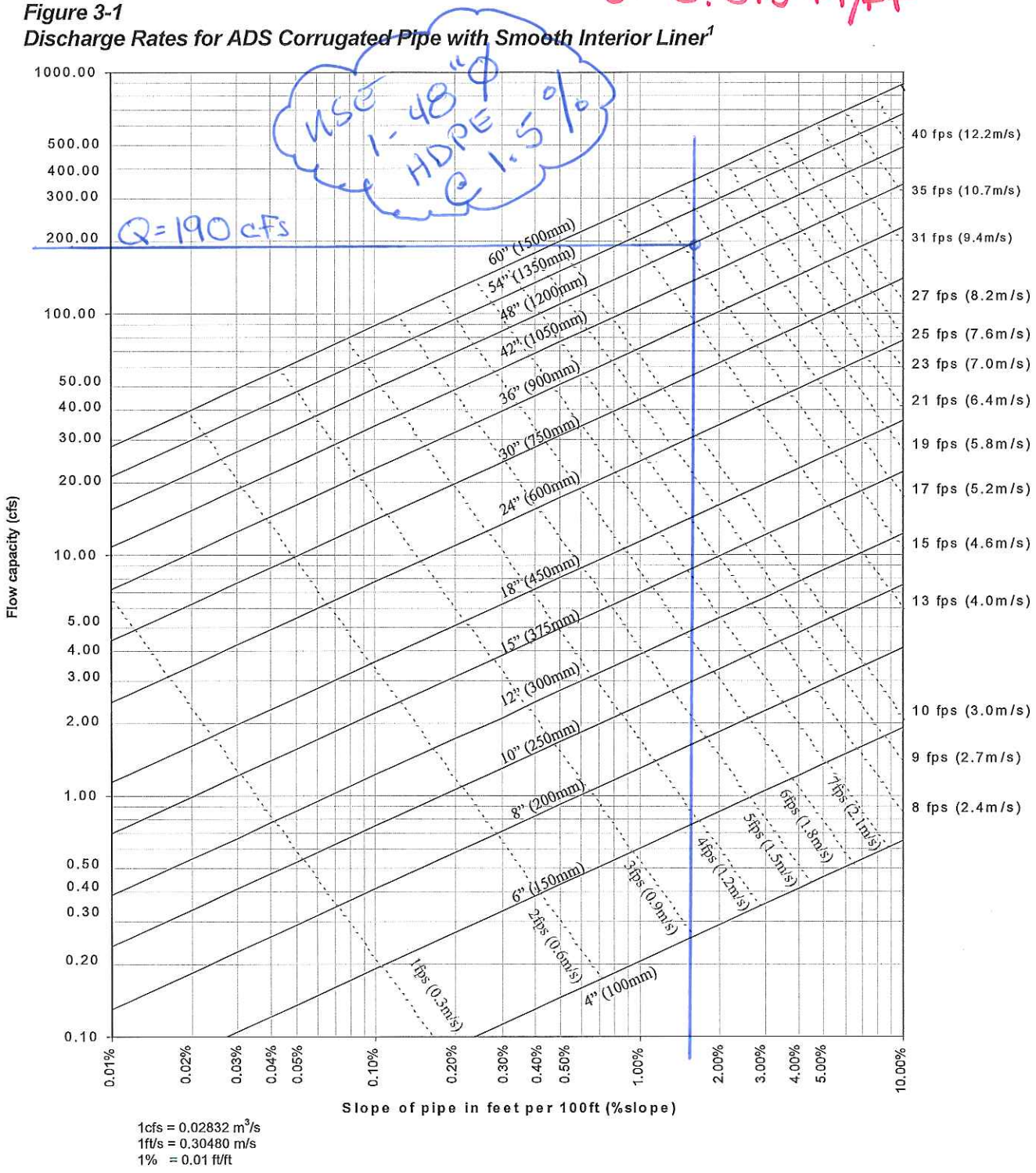
1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, N-12 HP, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

CULVERT #8 $Q_{25} = 186$ cfs IE (up) = 82.72'
IE (Down) = 80.50'
L = 148 LF
S = 0.015 Ft/Ft

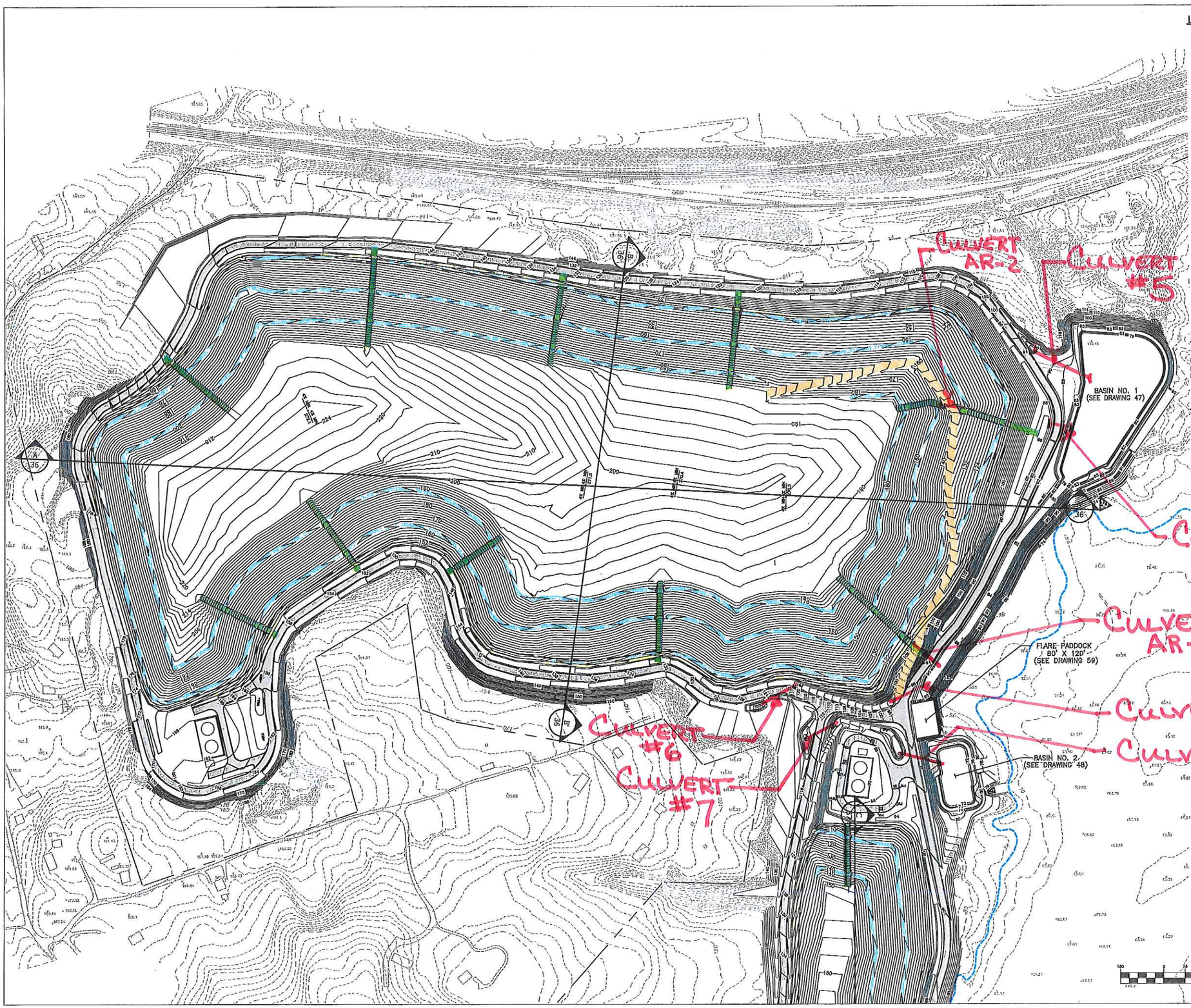
Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, N-12 HP, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- 1 SIGNS, SEE DRAWING 9
- ACCESS ROAD TO THE TOP, SEE DETAIL 4/35
- TERRACE, SEE DETAIL 4/35
- PERIMETER BERM, SEE DETAIL 4/35
- DOWNCHUTE, SEE DETAIL 4/20

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

NOTES

1.) WHILE FEMA HAS RE-ASSESSED AND MODIFIED THE 100 YEAR FLOOD PLAIN IN THE VICINITY OF THE SITE, THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE NEW FEMA BASE FLOOD ELEVATIONS.

2.) FOR STORMWATER MANAGEMENT FEATURES, SEE DRAWINGS 38 & 39.

3.) THE GRADES SHOWN ON THIS REPRESENT THE TOP OF THE FINAL COVER LAYER.

4.) FINAL COVER/CLOSURE CAP DETAILS ARE ON DRAWINGS 34 & 35.

REVISION:

DATE:	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3
5/03/2021	

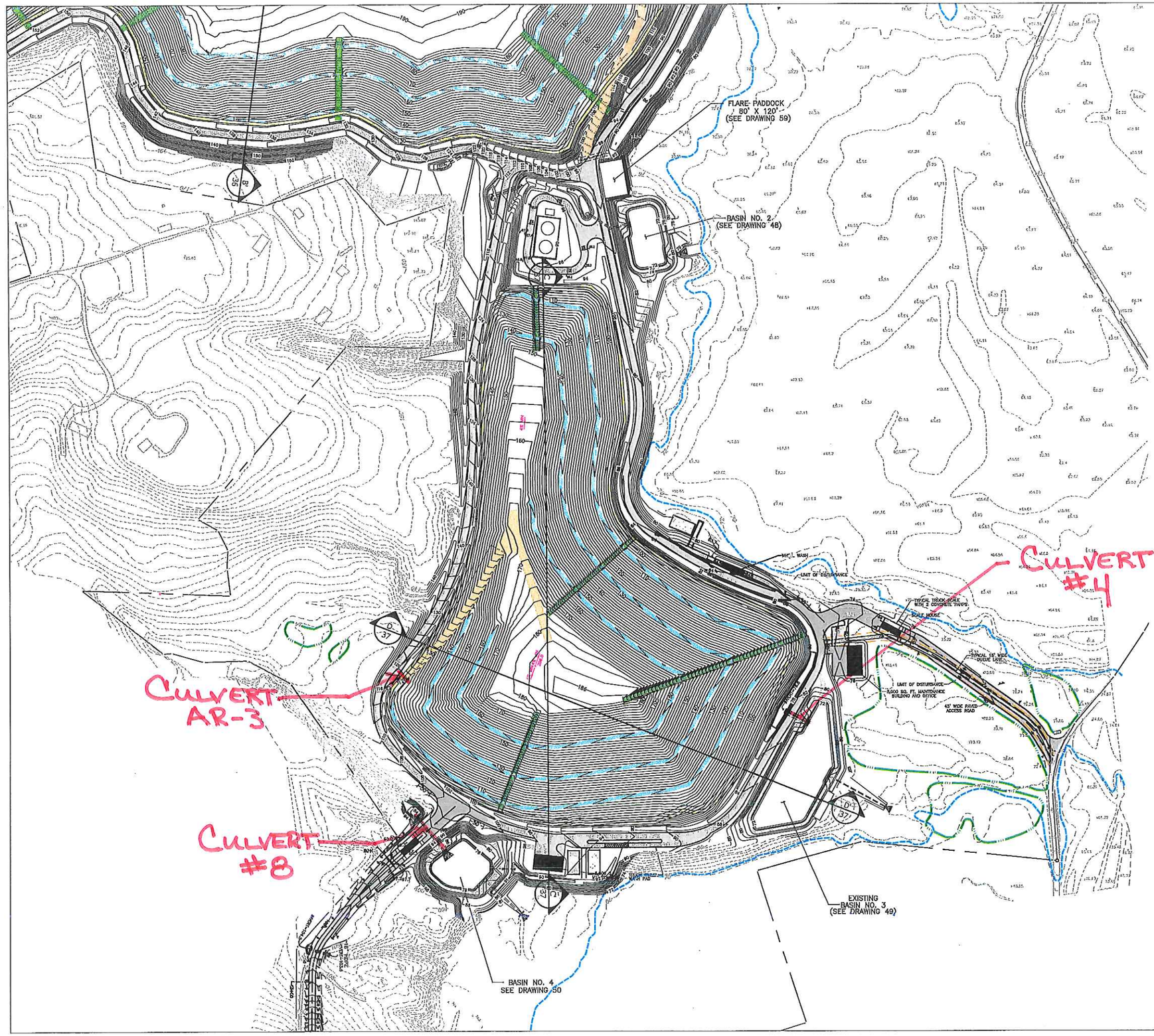
NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Mantrose Environmental Group company
1879 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
Ph: 856.354.2270 Fx: 856.354.1036 www.advancedgeoservices.com

TOP OF FINAL COVER GRADING PLAN - WEST (CELL 1-10)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 - 2854
DATE:	09/03/2021

DRAWING 32



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- ACCESS ROAD TO THE TOP, SEE DETAIL 4/35
- TERRACE, SEE DETAIL 2/34
- PERIMETER BERM, SEE DETAIL 3/35
- DOWNCHUTE, SEE DETAIL 1/20

REFERENCES

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NOTES

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3.) THE GRADES SHOWN ON THIS REPRESENT THE TOP OF THE FINAL COVER LAYER.

4.) FINAL COVER/CLOSURE CAP DETAILS ARE ON DRAWINGS 34 & 35.

GRAPHIC SCALE

150 0 75 150 300 600

1 Inch = 150 ft.

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION

CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
A Maccaferri Environmental Group company
1878 MARLTON PIKE EAST, SUITE 1D, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.2258 www.advancedgeoservices.com

TOP OF FINAL COVER GRADING PLAN - EAST (CELL 11-16)

PROJECT MANAGER:	PCS
CHECKED BY:	PCS
DRAWN BY:	BJP
SCALE:	AS NOTED
PROJECT NUMBER:	2015 - 3054
DATE:	09/03/2021

DRAWING 33

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 17G

WQv Facility Design

UNIFIED STORMWATER SIZING CRITERIA

WQV BASIN + UNMANAGED

RAINFALL DEPTH (INCHES) P=	1	IN	
VOLUMETRIC RUNOFF COEFFICIENT Rv=	0.2732	(0.05 + 0.009(I))	
PERCENT IMPERVIOUS COVER I=	24.80	%	
AREA (ACRES) A=	5.25	ACRES	
SOIL SPECIFIC RECHARGE FACTOR (INCHES) S=	0.21	INCHES (SEE BELOW)	
WATER QUALITY VOLUME (ACRE-FEET) WQv*=	**0.12**	ACRE-FEET	0.09 ACRE-FEET
RECHARGE VOLUME (ACRE-FEET) Rev=	0.02	ACRE-FEET	

*MINIMUM 0.2 INCHES/ACRE WQv FOR <15% IMPERVIOUS COVERAGE

COMPOSITE SOIL SPECIFIC RECHARGE FACTOR CALCULATION

SOIL TYPE	%	S	%*S
A	22.8%	0.38	0.087
B	18.6%	0.26	0.048
C	50.2%	0.13	0.065
D	8.5%	0.07	0.006
TOTAL	100.1%		**0.21 COMPOSITE S**

WQv PROVIDED=	0.12	ACRE-FEET	89.5 FEET

(<15% IMP*)

ATTACHMENT 17H

Soil Loss

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Final Cover Soil Loss Analysis		
	Job No. 2018-3854	Made by: VG	Date 07/11/19
	Ref. Phase III Report	Checked by:	Sheet 1 of 2

Objective:

Using the Universal Soil Loss Equation, estimate the amount of soil loss that can be expected to occur on the steepest section of the finished cap area and verify that it is below the Resource Conservation and Recovery Act (RCRA) standard of 2 tons/acre/year.

Design Criteria and Assumptions:

1.) The erosivity index, R, was obtained from Figure 20 of "Evaluating Cover Systems for Solid and Hazardous Waste," (Lutton). The erosivity index was determined to be 200.

2.) The soil erodibility factor, K, was obtained from Table 5 of "Evaluating Cover Systems for Solid and Hazardous Waste," (Lutton). The cap cover soil will consist of a sandy loam with an organic matter content of at least 2%. Therefore the soil erodibility factor was determined to be 0.24 tons/acre.

3.) From figures "Final Grading Plan West Section," Advanced GeoServices, Corp., July 2020, and "Final Grading Plan East Section," Advanced GeoServices, Corp., July 2020, the steepest slope of the final cover is 3:1 H:V, or approximately 33%, and the longest slope length is 100. Using this information, and Table 15-3 of "Hydrologic Analysis and Design," (McCuen), the topographic factor, T, was determined to be 9.5.

4.) The crop management factor, C, was obtained from Table 15-4 of "Hydrologic Analysis and Design," (McCuen). The landfill cover cap vegetation will be a high productivity grass and legume mix. Therefore the crop management factor was determined to be 0.004.

5.) The conservation practice factor, P, was obtained from Table 15-5 of "Hydrologic Analysis and Design," (McCuen). A conservation practice factor of 1.0 (no support practice) was selected in order to produce a more conservative estimate of soil loss.

Calculation:

The Universal Soil Loss Equation was used to determine the average annual soil loss:

$$E = RKTCP$$

Where:
- E = soil loss (tons/acre/year)
- R = erosivity index
- K = soil erodibility factor (tons/acre)
- T = topographic factor
- C = crop management factor
- P = conservation practice factor

Using the design criteria and assumptions stated above, the average annual soil loss is estimated to be:

$$E = 200 \times 0.24 \text{ tons/acre} \times 9.5 \times 0.004 \times 1.0 = 1.824 \text{ tons/acre/year}$$

Conclusion:

Using the Universal Soil Loss Equation and the design criteria and assumptions stated above, the average annual soil loss was estimated to be 1.824 tons/acre/year. This value is below the maximum allowable annual soil loss of 2.0 tons/acre/year per RCRA standards.

References:

1.) Lutton, R. J. *Evaluating Cover Systems for Solid and Hazardous Waste*. Municipal Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, 1982.

2.) McCuen, Richard H. *Hydrologic Analysis and Design*. Prentice-Hall, 1989.

3.) "Final Grading Plan West Section." Prepared by Advanced GeoServices, Corp., August 2019.

4.) "Final Grading Plan East Section." Prepared by Advanced GeoServices, Corp., August 2019.

Not only is erosion objectionable in itself but erosion can degrade the cover and seriously reduce its effectiveness.

Evaluate Erosion Potential — Step 19

The USDA universal soil loss equation (USLE) is a convenient tool for use in evaluating erosion potential. The USLE predicts average annual soil loss as the product of six quantifiable factors. The equation is:

$$A = R\ K\ L\ S\ C\ P$$

where A = average annual soil loss, in tons/acre
R = rainfall and runoff erosivity index
K = soil erodibility factor, tons/acre
L = slope-length factor
S = slope-steepness factor
C = cover-management factor
P = practice factor

The data necessary as input to this equation are available to the evaluator in a figure and tables included below. Note that the evaluations in Step 8 on soil composition and Steps 25-32 on vegetation all impact on the evaluation of erosion also.

Factor R in the USLE can be calculated empirically from climatological data. For average annual soil loss determinations, however, R can be obtained directly from Figure 20. Factor K, the average soil loss for a given

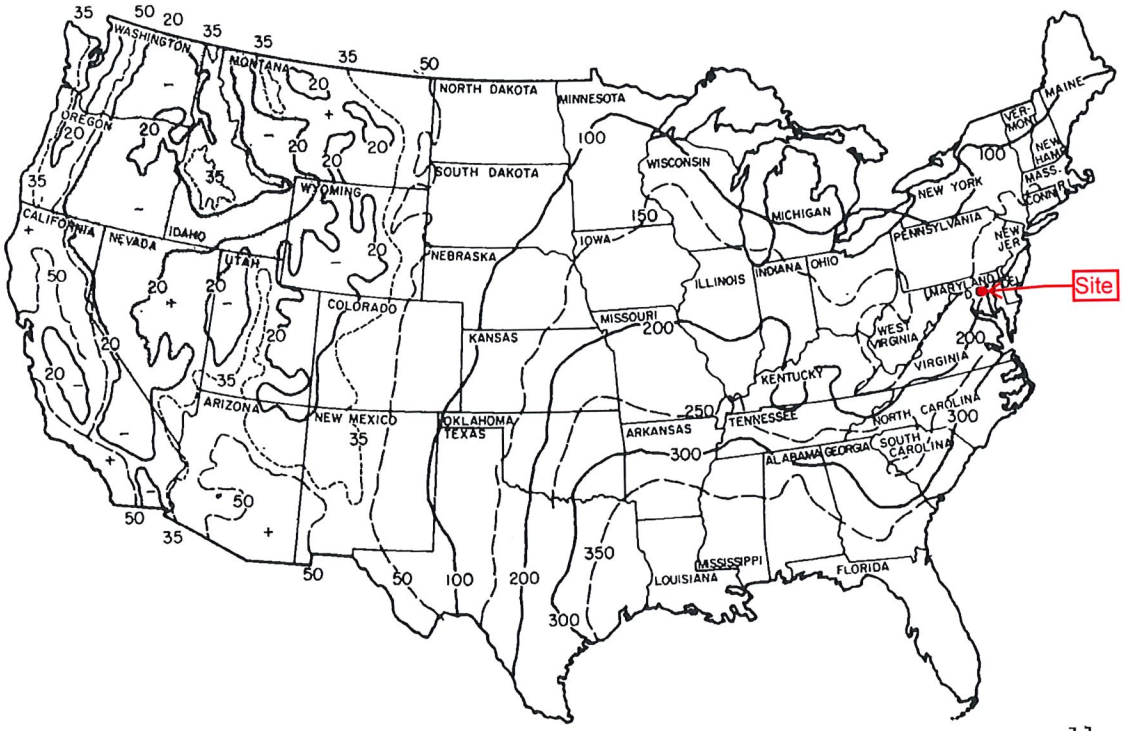

Figure 20. Average annual values of rainfall-erosivity factor R.[11]

soil in a unit plot, pinpoints differences in erosion according to differences in soil type. Long-term plot studies under natural rainfall have produced K values generalized in Table 5 for the USDA soil types.

TABLE 5. APPROXIMATE VALUES OF FACTOR K FOR USDA TEXTURAL CLASSES[11]

Texture class	Organic matter content		
	<0.5%	2%	4%
	K	K	K
Sand	0.05	0.03	0.02
Fine sand	.16	.14	.10
Very fine sand	.42	.36	.28
Loamy sand	.12	.10	.08
Loamy fine sand	.24	.20	.16
Loamy very fine sand	.44	.38	.30
Sandy loam	.27	.24	.19
Fine sandy loam	.35	.30	.24
Very fine sandy loam	.47	.41	.33
Loam	.38	.34	.29
Silt loam	.48	.42	.33
Silt	.60	.52	.42
Sandy clay loam	.27	.25	.21
Clay loam	.28	.25	.21
Silty clay loam	.37	.32	.26
Sandy clay	.14	.13	.12
Silty clay	.25	.23	.19
Clay		0.13-0.29	

The values shown are estimated averages of broad ranges of specific-soil values. When a texture is near the borderline of two texture classes, use the average of the two K values.

The evaluator must next consider the shape of the slope in terms of length and inclination. The appropriate LS factor is obtained from Table 6. A nonlinear slope may have to be evaluated as a series of segments, each with uniform gradient. Two or three segments should be sufficient for most engineered landfills, provided the segments are selected so that they are also of equal length (Table 6 can be used, with certain adjustments). Enter Table 6 with the total slope length and read LS values corresponding to the percent slope of each segment. For three segments, multiply the chart LS values for the upper, middle, and lower segments by 0.58, 1.06, and 1.37, respectively. The average of the three products is a good estimate of the

TABLE 15-3 Values of the erosion equation's topographic factor, LS, for specified combinations of slope length and steepness[a]

Percent Slope	Slope Length (ft)										
	25	50	75	100	150	200	300	400	500	600	800	1000
0.5	0.07	0.08	0.09	0.10	0.11	0.12	0.14	0.15	0.16	0.17	0.19	0.20
1	0.09	0.10	0.12	0.13	0.15	0.16	0.18	0.20	0.21	0.22	0.24	0.26
2	0.13	0.16	0.19	0.20	0.23	0.25	0.28	0.31	0.33	0.34	0.38	0.40
3	0.19	0.23	0.26	0.29	0.33	0.35	0.40	0.44	0.47	0.49	0.54	0.57
4	0.23	0.30	0.36	0.40	0.47	0.53	0.62	0.70	0.76	0.82	0.92	1.0
5	0.27	0.38	0.46	0.54	0.66	0.76	0.93	1.1	1.2	1.3	1.5	1.7
6	0.34	0.48	0.58	0.67	0.82	0.95	1.2	1.4	1.5	1.7	1.9	2.1
8	0.50	0.70	0.86	0.99	1.2	1.4	1.7	2.0	2.2	2.4	2.8	3.1
10	0.69	0.97	1.2	1.4	1.7	1.9	2.4	2.7	3.1	3.4	3.9	4.3
12	0.90	1.3	1.6	1.8	2.2	2.6	3.1	3.6	4.0	4.4	5.1	5.7
14	1.2	1.6	2.0	2.3	2.8	3.3	4.0	4.6	5.1	5.6	6.5	7.3
16	1.4	2.0	2.5	2.8	3.5	4.0	4.9	5.7	6.4	7.0	8.0	9.0
18	1.7	2.4	3.0	3.4	4.2	4.9	6.0	6.9	7.7	8.4	9.7	11.0
20	2.0	2.9	3.5	4.1	5.0	5.8	7.1	8.2	9.1	10.0	12.0	13.0
25	3.0	4.2	5.1	5.9	7.2	8.3	10.0	12.0	13.0	14.0	17.0	19.0
30	4.0	5.6	6.9	8.0	9.7	11.0	14.0	16.0	18.0	20.0	23.0	25.0
40	6.3	9.0	11.0	13.0	16.0	18.0	22.0	25.0	28.0	31.0	—	—
50	8.9	13.0	15.0	18.0	22.0	25.0	31.0	—	—	—	—	—
60	12.0	16.0	20.0	23.0	28.0	—	—	—	—	—	—	—

[a] Values given for slopes longer than 300 ft or steeper than 18% are extrapolations beyond the range of the research data, and therefore less certain than the others. Adjustments for irregularity of slope are available.

TABLE 15-4 Generalized values of the cover and management factor, C, in the 37 states east of the Rocky Mountains[a]

Line no.	Crop, Rotation, and Management[c,d]	Productivity Level[b]	
		High	Mod.
		C Value	
	Base value: continuous fallow, tilled up and down slope	1.00	1.00
CORN			
1	C, RdR, fall TP, conv (1)	0.54	0.62
2	C, RdR, spring TP, conv (1)	0.50	0.59
3	C, RdL, fall TP, conv (1)	0.42	0.52
4	C, RdR, wc seeding, spring TP, conv (1)	0.40	0.49
5	C, RdL, standing, spring TP, conv (1)	0.38	0.48
6	C, fall shred stalks, spring TP, conv (1)	0.35	0.44
7	C(silage)-W(RdL, fall TP) (2)	0.31	0.35
8	C, RdL, fall chisel, spring disk, 40-30% rc (1)	0.24	0.30
9	C(silage), W wc seeding, no-till pl in c-k W (1)	0.20	0.24
10	C(RdL)-W(RdL, spring TP) (2)	0.20	0.28
11	C, fall shred stalks, chisel p1, 40-30% rc (1)	0.19	0.26
12	C-C-C-W-M, RdL, TP for C, disk for W (5)	0.17	0.23
13	C, RdL, strip till row zones, 55-40% rc (1)	0.16	0.24
14	C-C-C-W-M-M, RdL, TP for C, disk for W (6)	0.14	0.20
15	C-C-W-M, RdL, TP for C, disk for W (4)	0.12	0.17
16	C, fall shred, no-till pl, 70-50% rc (1)	0.11	0.18
17	C-C-W-M-M, RdL, TP for C, disk for W (5)	0.087	0.14
18	C-C-C-W-M, RdL, no-till pl 2d & 3rd C (5)	0.076	0.13
19	C-C-W-M, RdL, no-till pl 2d C (4)	0.068	0.11
20	C, no-till pl in c-k wheat, 90-70% rc (1)	0.062	0.14
21	C-C-C-W-M-M, no-till pl 2d & 3rd C (6)	0.061	0.11
22	C-W-M, RdL, TP for C, disk for W (3)	0.055	0.095
23	C-C-W-M-M, RdL, no-till pl 2d C (5)	0.051	0.094
24	C-W-M-M, RdL, TP for C, disk for W (4)	0.039	0.074
25	C-W-M-M-M, RdL, TP for C, disk for W (5)	0.032	0.061
26	C, no-till pl in c-k sod, 95-80% rc (1)	0.017	0.053
COTTON[e]			
27	Cot, conv (Western Plains) (1)	0.42	0.49
28	Cot, conv (South) (1)	0.34	0.40
MEADOW			
29	Grass and legume mix	0.004	0.01
30	Alfalfa, lespedeza, or Sericia	0.020	
31	Sweet clover	0.025	
SORGHUM, GRAIN (Western Plains)[e]			
32	RdL, spring TP, conv (1)	0.43	0.53
33	No-till pl in shredded 70-50% rc	0.11	0.18

(Continued)

TABLE 15-4 Generalized values of the cover and management factor, C, in the 37 states east of the Rocky Mountains[a] (*Continued*)

Line no.	Crop, Rotation, and Management[c,d]	Productivity Level[b] High	Productivity Level[b] Mod.
		C Value	
Base value: continuous fallow, tilled up and down slope		1.00	1.00
SOYBEANS[e]			
34	B, RdL, spring TP, conv (1)	0.48	0.54
35	C-B, TP annually, conv (2)	0.43	0.51
36	B, no-till pl	0.22	0.28
37	C-B, no-till pl, fall shred C stalks (2)	0.18	0.22
WHEAT			
38	W-F, fall TP after W (2)	0.38	
39	W-F, stubble mulch, 500 lbs rc (2)	0.32	
40	W-F, stubble mulch, 1000 lbs rc (2)	0.21	
41	Spring W, RdL, Sept TP, conv (N. Dak. and S. Dak.) (1)	0.23	
42	Winter W, RdL, Aug TP, conv (Kans.) (1)	0.19	
43	Spring W, stubble mulch, 750 lb rc (1)	0.15	
44	Spring W, stubble mulch, 1250 lb rc (1)	0.12	
45	Winter W, stubble mulch, 750 lb rc (1)	0.11	
46	Winter W, stubble mulch, 1250 lb rc (1)	0.10	
47	W-M, conv (2)	0.054	
48	W-M-M, conv (3)	0.026	
49	W-M-M-M, conv (4)	0.021	

[a] This table is for illustrative purposes only and is not a complete list of cropping systems or potential practices. Values of *C* differ with rainfall pattern and planting dates. These generalized values show approximately the relative erosion-reducing effectiveness of various crop systems, but locationally derived *C* values should be used for conservation planning at the field level. Tables of local values are available from the Soil Conservation Service.

[b] High level is exemplified by long-term yield averages greater than 75 bu of corn or 3 tons of grass-and-legume hay; or cotton management that regularly provides good stands and growth.

[c] Numbers in parentheses indicate number of years in the rotation cycle. (1) designates a continuous one-crop system.

[d] Abbreviations

B	soybeans	F	fallow
C	corn	M	grass and legume hay
c-k	chemically killed	pl	plant
conv	conventional	W	wheat
cot	cotton	wc	winter cover

lb rc — pounds of crop residue per acre remaining on surface after new crop seeding
% rc — percentage of soil surface covered by residue mulch after new crop seeding
70-50% rc — 70% cover for C values in first column; 50% for second column
RdR — residues (corn stover, straw, etc.) removed or burned
RdL — all residues left on field (on surface or incorporated)
TP — turn plowed (upper 5 or more inches of soil inverted, covering residues)

[e] Grain sorghum, soybeans, or cotton may be substituted for corn in lines 12, 14, 15, 17–19, 21–15 to estimate *C* values for sod-based rotations.

TABLE 15-5 Values of support-practice factor, *P*

Practice	Land Slope (%) 1.1–2	2.1–7	7.1–12	12.1–18	18.1–24
	Factor *P*				
Contouring, P_c	0.60	0.50	0.60	0.80	0.90
Contour strip cropping,[a] P_{sc}					
R-R-M-M	0.30	0.25	0.30	0.40	0.45
R-W-M-M	0.30	0.25	0.30	0.40	0.45
R-R-W-M	0.45	0.38	0.45	0.60	0.68
R-W	0.52	0.44	0.52	0.70	0.90
R-O	0.60	0.50	0.60	0.80	0.90
Contour listing or ridge planting, P_{c1}	0.30	0.25	0.30	0.40	0.45
Contour terracing,[b,c] P_t	$0.6/\sqrt{n}$	$0.5/\sqrt{n}$	$0.6/\sqrt{n}$	$0.8/\sqrt{n}$	$0.9/\sqrt{n}$
No support practice	1.0	1.0	1.0	1.0	1.0

[a] R, rowcrop; W, fall-seeded grain; O, spring-seeded grain; M, meadow. The crops are grown in rotation and so arranged on the field that rowcrop strips are always separated by a meadow or winter-grain strip.

[b] These P_t values estimate the amount of soil eroded to the terrace channels and are used for conservation planning. For prediction of off-field sediment, the P_t values are multiplied by 0.2.

[c] n, number of approximately equal-length intervals into which the field slope is divided by the terraces. Tillage operations must be parallel to the terraces.

Predicted values of E represent average, time-invariant estimates. Given that R is based on an average number and distribution of storms per year, actual values of E would vary from year to year depending on the number, size, and timing of erosive rainstorms and other weather conditions. Although any one predicted value of E may not be highly accurate, the USLE should be more reliable when it is used to measure either relative effects or long-term sheet and rill erosion rates.

Example 15-1: Soil Loss Estimation with USLE. The general data requirements for making soil loss estimates with the USLE equation are (1) site location (to get R); (2) soil properties (to get K); (3) flow length and slope (to get T); (4) crop, rotation, and management practices (to get C); and (5) slope and support practice (to get P). The estimation process will be illustrated using a hypothetical example. The site, which has a drainage area of 2 acres, is located in central Illinois. The site of interest has an average slope of 2.5% and a flow length of 300 ft. A soil analysis indicates 25% sand, 2% organic matter, 35% silt and very fine sand, a medium granular structure, and moderate permeability. The plot is used for corn, with a crop management value of 0.31, which was determined from information published locally. No support practice is provided.

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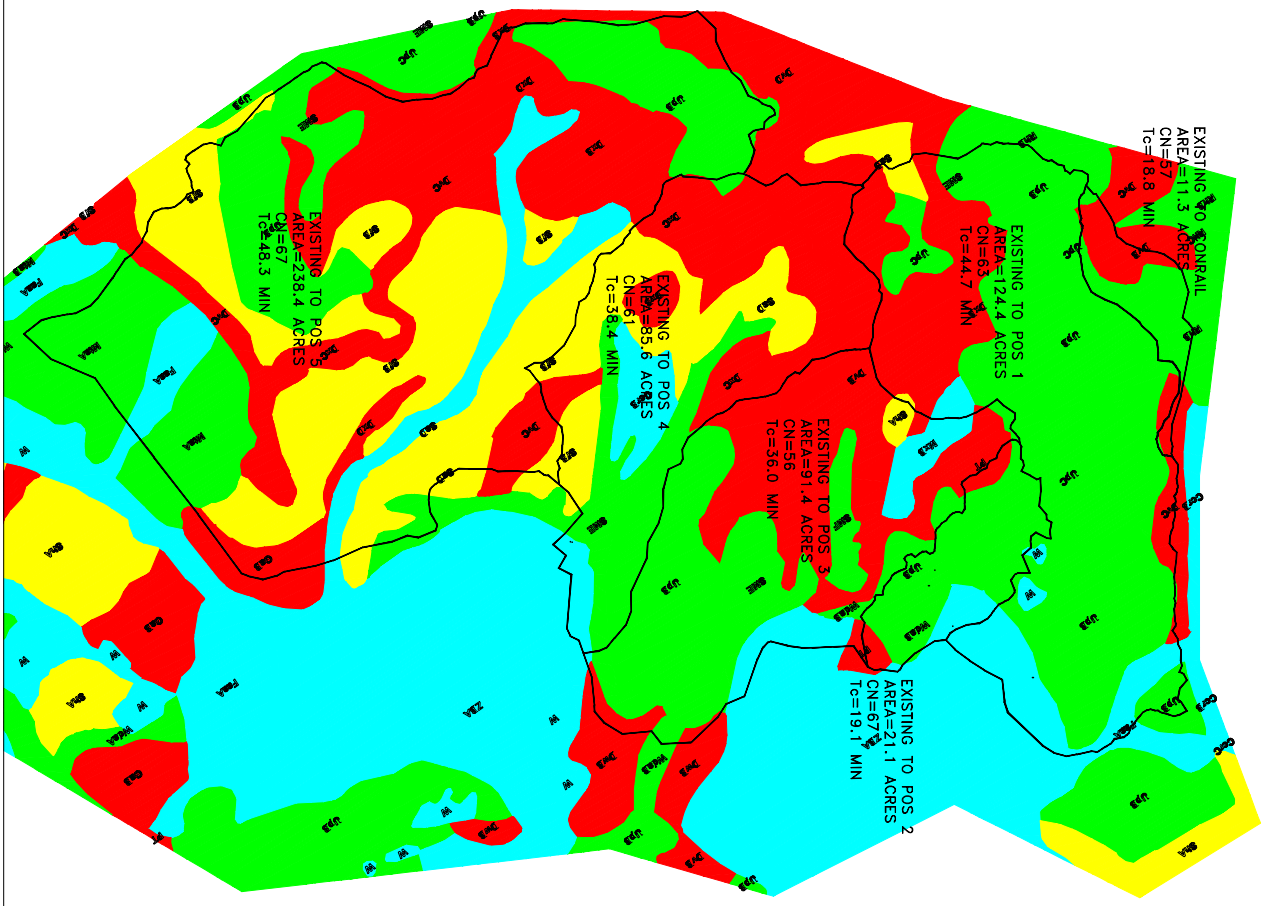
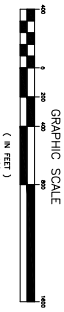
ATTACHMENT 17I

Soil Survey Map

N:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\DWG\RC 8_Phase III Application\PDRA.dwg





DA-7

EXISTING SOILS
AREA PLAN

PROJECT MANAGER:	VEF	SCALE:	AS SHOWN
CHECKED BY:	VEF	PROJECT NUMBER:	2018-3854
DRAWN BY:	EEE	DATE:	

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NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

DATE:	REVISION:

VERONICA E. FOSTER
LICENSED PROFESSIONAL ENGINEER
MD # 35645

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SECTION 18

DRAWINGS