

**HYDROLOGY & HYDRAULIC ANALYSIS FOR
WINROD VINEYARDS
3465 STATE HIGHWAY 128, NAPA COUNTY, CA
APN 017-110-038**

As required by Napa County Planning Building & Environmental Service (PBES), Bartelt Engineering has prepared a Hydrology & Hydraulic Analysis for the Winrod Vineyards project to compare pre-development and post-development peak storm water runoff.

PROJECT DESCRIPTION

The proposed project involves a Track I Vineyard Development and Erosion Control Plan that includes the planting of three (3) separate vineyard blocks (Vineyard Block 1, Block 2, and Block 3) located on the above referenced parcel that is located within the Agricultural Watershed (AW) zoning district. The 104.79± acre subject parcel is currently developed with a residence, garage, well, access roads, and 4.6± acres of vineyard. The project will be constructed under three (3) phases and includes a disturbed area of approximately 16.5± acres.

Permit records for the existing vineyard could not be found; it is our understanding that the existing vineyard was planted between 1997 and 2009. The Track I Vineyard Development and Erosion Control Plan proposes to develop 8.4± acres of new vineyard, continue to operate the existing 4.6± acres of existing vineyard that was installed without an approved erosion control plan and ultimately remove and replant the existing vineyards and restore the necessary stream setbacks. The total proposed vineyard area is 13± acres. Refer to the attached Track I Vineyard Development and Erosion Control Plan (Plans) prepared by Bartelt Engineering for the existing and proposed development.

HYDROLOGY EXHIBIT

The Hydrology Exhibit included with the Plans shows the approximate location of the subject parcel property lines, existing structures/features, the proposed vineyard development areas, and the project sub-watersheds. The exhibit was created using topographic information sourced from the "Topographic Map of a Portion of the Lands of Michael Winrod Trustees" prepared by Terra Firma Surveys, Inc. dated February 29, 2019 and the Napa County Geographical Information Systems (GIS) Topographic Tiles.

METHODOLOGY

This analysis was prepared based on the United States Department of Agriculture (USDA) Urban Hydrology for Small Watersheds Technical Release 55 (TR-55) procedures for calculating storm runoff volume, peak rate of discharge, hydrographs, and storage volumes using Autodesk Storm and Sanitary Analysis (SSA). These methods were used to simulate peak stormwater runoff rates for the 2, 10, 50, and 100-year, 24-hour storm events. The project watersheds shown on the hydrology exhibit were drawn in and then exported from Autodesk Civil 3D to Autodesk SSA. Rainfall data, land use, curve numbers, and other subbasin properties were assigned in Autodesk SSA and are discussed in the following sections.

This analysis evaluates overland flow and pipe flow and several outfall locations. The time of concentration is calculated using NRCS TR-55: Urban Hydrology for Small Watersheds; TR-55 and Hydrographs are modeled using TR-20. Both methods utilize the Soil

Conservation Service (SCS) runoff equation to predict the peak rate of runoff as well as the total volume.

HYDROLOGY OVERVIEW

The subject parcel is located approximately four (4) miles west of the City of Calistoga, CA and borders the Sonoma County line to the west. The westerly portion of the subject parcel consists predominately of wooded areas and ground slopes greater than 50%. The easterly portion consists of vineyards, a small orchard, and residential improvements. The subject parcel was heavily impacted by the 2017 Tubbs Lane fire and has been undergoing redevelopment of the residential structures. Several drainage courses are located throughout the subject parcel that drain to Blossom Creek which is located to the east of the subject parcel and is a tributary to the Napa River.

The subject parcel is entirely located within Zone X which is defined as “areas determined to be outside the 0.2% annual chance floodplain” by FEMA¹ and therefore not impacted by a 500-year flood.

Slopes on the parcel range between zero (0) and 75 percent. According to the NRCS Soil Report, the soil types found on the parcel and the corresponding Hydrologic Soil Group (HSG) consist of the following:

- Aiken loam, 15 to 30 percent slopes (map symbol 101, HSG C)
- Bale clay loam, 2 to 5 percent slopes (map symbol 105, HSG B)
- Forward silt loam, 5 to 39 percent slopes (map symbol 139, HSG C)
- Forward silt loam, 12 to 57 percent slopes (map symbol 140, HSG C)
- Kidd Loam, 30 to 75 percent slopes (map symbol 156, HSG D)
- Forward silt loam, 12 to 57 percent slopes (map symbol FoG, HSG C)

Sub-Watershed Summary

The hydrology analysis evaluates runoff from seven (7) catchment areas or sub-watersheds that include the project area. According to the NRCS Custom Soil Resource Report for the sub-watersheds, the soil types found within the sub-watershed areas and the corresponding HSG consist of the following:

- Aiken loam, 15 to 30 percent slopes (map symbol 101, HSG C)
- Aiken loam, 30 to 50 percent slopes (map symbol 102, HSG C)
- Bale clay loam, 2 to 5 percent slopes (map symbol 105, HSG B)
- Forward silt loam, 5 to 39 percent slopes (map symbol 139, HSG C)
- Forward silt loam, 12 to 57 percent slopes (map symbol 140, HSG C)
- Forward-Kidd Complex, 11 to 60 percent slopes (map symbol 141, HSG C)
- Kidd Loam, 30 to 75 percent slopes (map symbol 156, HSG D)
- Forward silt loam, 12 to 57 percent slopes (map symbol FoG, HSG C)

Portions of the project sub-watersheds consist of impervious areas (driveways, residential structures, and agricultural structures), pastures, woodland areas, and vineyards.

¹ United States Department of Homeland Security, Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), Panel Number 06055C0225E effective September 26, 2008.

RAINFALL

Rainfall data used in the TR-55 procedures includes four (4) regional rainfall time distributions (Types I, IA, II, and III) all over a 24-hr period. The rainfall distributions are based on geographic boundaries which are shown on the following figure:

The 24-hr rainfall data utilized in this analysis are based on point precipitation frequency estimations provided by National Oceanic Atmosphere Administration (NOAA)² for a Type 1A rainfall distribution. The table below summarizes the precipitation (rainfall) over various storm recurrence intervals (storm frequency) for the project site:

Storm Frequency:	2-Yr	10-Yr	50-Yr	100-Yr
Rainfall (in):	5.10	7.78	10.69	11.89

² Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS) from NOAA Atlas 14, Volume 6, Version 2; location name: Napa, CA, US, latitude: 38.5992^o, longitude: -122.6236^o and elevation: 439.73 ft.

TIME OF CONCENTRATION

The time of concentration (T_c) represents the time it takes for runoff to travel to a point of interest from the hydraulically most distant point of a watershed. For channelized flow, the wetted perimeter is assumed to represent seasonal high flow conditions and the flow area is calculated from the topographic map included with the Hydrology Exhibit. Tee spreaders are proposed downstream of the Point of Concentration (POC) for sub-watersheds D, E, and F. The path used to determine the T_c for each sub-watershed is described below.

Sub-watershed A1

Sub-watershed A1 is approximately 25.12 acres and includes the majority of Block 1 as well as the existing Residence and Garage. The existing and proposed conditions are the same for the longest path of travel. Initial overland sheet flow at the furthest extent of the sub-watershed travels 100 feet through woodland areas with an average slope of 30%. A watershed run-off factor of 0.47 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow and travels for 1,499 feet over unpaved areas with an average slope of 16.7% until it reaches POC A1. POC A1 outlets to the north of the subject property line within an existing vineyard area. The T_c for sub-watershed A1 is calculated to be 10 minutes and 20 seconds.

Sub-watershed A2

Sub-watershed A2 is approximately 3.57 acres and includes the southerly portion of Block 1.

For the existing conditions, initial overland sheet flow at the furthest extent of the sub-watershed travels 100 feet through woodland areas with an average slope of 43%. A watershed run-off factor of 0.47 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow and travels for 290 feet over woodland areas with an average slope of 25.3%. Shallow concentrated flow transitions to channelized flow where it travels for 380 feet at a slope of 1.8% until reaching POC A2. POC A2 outlets upstream of a watercourse that travels through the subject parcel and outlets on the neighboring parcel north of the subject property line. The T_c for sub-watershed A2 (existing conditions) is calculated to be nine (9) minutes and 3 seconds.

For the proposed conditions, initial overland sheet flow at the furthest extent of the sub-watershed travels 100 feet through woodland areas with an average slope of 43%. A watershed run-off factor of 0.47 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow and travels for 290 feet over woodland areas with an average slope of 25.3%. Shallow concentrated flow transitions to channel flow within the proposed vineyard cross slope diversion swale where it travels for 380 feet at a slope of 1.8% until reaching POC A2. POC A2 outlets upstream of a watercourse that travels through the subject parcel and outlets on the neighboring parcel north of the subject property line. The T_c for sub-watershed A2 (proposed conditions) is calculated to be nine (9) minutes and 3 seconds.

Sub-watershed B

Sub-watershed B is approximately 93.54 acres and includes the westerly side of the subject parcel and the westerly portion of Block 3. The existing and proposed conditions are the same for the longest path of travel. Initial overland sheet flow at the furthest extent of the

sub-watershed travels 100 feet through woodland areas with an average slope of 45%. A watershed run-off factor of 0.56 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow and travels for 2,154 feet over unpaved areas with an average slope of 25.3% prior to entering an existing water course where it becomes channelized flow. Channelized flow runs for 2,196 feet with an average slope of 7.2% prior to out letting at POC B. Channelized flow with this sub-watershed has a manning's roughness factor of $n = 0.5$ for a non-maintained channel with uncut weeds and brush³. POC B outlets to the north of the subject property line. The Tc for sub-watershed B is calculated to be 28 minutes and 59 seconds.

Sub-watershed C

Sub-watershed C is approximately 54.14 acres and includes the southerly portion of Block 1 and neighboring area to the south. The existing and proposed conditions are the same for the longest path of travel. Initial overland sheet flow at the furthest extent of the drainage travels 100 feet with an average slope of 50%. A watershed run-off factor of 0.56 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow and travels for 1,940 feet at a slope of 31.7% over woodland areas until it reaches a watercourse where it transitions to channelized flow. Channelized flow runs for 1,445 feet with an average slope of 8.7% until reaching the POC C that outlets on the neighboring parcel to the south. The same Manning's roughness factor of $n = 0.5$ from sub-watershed B was used in sub-watershed C. The Tc for sub-watershed C is calculated to be 24 minutes and 3 seconds.

Sub-watershed D

Sub-watershed D is approximately 1.93 acres and includes the westerly portion of Block 3.

For the existing conditions, initial overland sheet flow at the furthest extent of the sub-watershed travels 100 feet through woodland areas with an average slope of 25%. A watershed run-off factor of 0.47 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow and travels for 244 feet over cultivated straight row areas with an average slope of 7.4%. Shallow concentrated flow transitions to channelized flow where it travels for 52 feet at a slope of 2.2% until reaching POC D. The Tc for sub-watershed D (existing conditions) is calculated to be eight (8) minutes and 53 seconds.

For the proposed conditions, initial overland sheet flow at the furthest extent of the sub-watershed travels 100 feet through woodland areas with an average slope of 25%. A watershed run-off factor of 0.22 was applied for cultivated areas, conventional tillage with residue. Overland sheet flow transitions to shallow concentrated flow and travels for 244 feet over cultivated straight row areas with an average slope of 7.4% until it transitions to channelized flow. Channelized flow runs for 52 feet within the proposed grass-lined swale with a 2.2% slope prior to reaching point of concentration POC D. A Manning's roughness factor of $n = 0.027$ was used for the grass-lined swale which represents an "Excavated or Dredged Channel Earth, Straight, and Uniform – with short grass, few weeds"⁴. POC D

³ The Manning's Roughness factor (n) for open channel flow is selected from the "Manning's Roughness n for Open Channels" table included with the AutoCAD® Storm and Sanitary Analysis.

⁴ Roughness factor for open channel flow is selected from the "Manning's Roughness n for Open Channels" table included with the AutoCAD® Storm and Sanitary Analysis.

outlets to a 15 inch diameter storm drain tee spreader (tee spreader #1). The tee spreader outlets on the subject parcel south of a watercourse that flows off the subject parcel in an easterly direction. The Tc for sub-watershed D (proposed conditions) is calculated to be five (5) minutes and 41 seconds.

Sub-watershed E

Sub-watershed E is approximately 4.90 acres and includes the middle portion of Block 3.

For the existing conditions, initial overland sheet flow at the furthest extent of the sub-watershed travels 100 feet through woodland areas with an average slope of 22%. A watershed run-off factor of 0.47 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow and travels for 321 feet over forest areas with an average slope of 23% until it transitions to channelized flow. Channelized flow travels for 161 feet at a slope of 12% until reaching point of concentration POC E. The Tc for sub-watershed E (existing conditions) is calculated to be 12 minutes and 7 seconds.

For the proposed conditions, initial overland sheet flow at the furthest extent of the sub-watershed travels 100 feet through woodland areas with an average slope of 22%. A watershed run-off factor of 0.22 was applied for cultivated areas, conventional tillage with residue. Overland sheet flow transitions to shallow concentrated flow and travels for 321 feet over cultivated straight row areas with an average slope of 23% until it transitions to channelized flow. Channelized flow runs for 161 feet within the proposed rock lined swale at an 12% slope prior to reaching point of concentration POC E. A Manning's roughness factor of $n = 0.033$ was used for the rock-lined swale which represents "Lined or Constructed Channels, Gravel Bottom with sides of Dry Rubble or Riprap."⁵ POC E outlets to an 18 inch diameter storm drain tee spreader (tee spreader #2). The tee spreader outlets on the subject parcel south of a watercourse that flows off the subject parcel in an easterly direction. The Tc for sub-watershed E (proposed conditions) is calculated to be five (5) minutes and 40 seconds.

Sub-watershed F

Sub-watershed F is approximately 2.67 acres and includes the middle portion of Block 3.

For the existing conditions, initial overland sheet flow through the longest path of travel to POC F travels 100 feet through a grassy area with an average slope of 40%. A watershed run-off factor of 0.47 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow and travels for 318 feet over woodland areas with an average slope of 22% until it transitions to channelized flow. Channelized flow runs for 325 feet at a slope of 5.3% until reaching point of concentration POC F. The Tc for sub-watershed F (existing conditions) is calculated to be eight (8) minutes and 49 seconds.

For the proposed conditions, initial overland sheet flow at the furthest extent of the sub-watershed travels 100 feet through woodland areas with an average slope of 40%. A watershed run-off factor of 0.47 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow

⁵ Roughness factor for open channel flow is selected from the "Manning's Roughness n for Open Channels" table included with the AutoCAD® Storm and Sanitary Analysis.

and travels for 318 feet over cultivated straight row areas with an average slope of 22% until it transitions to channelized flow. Channelized flow runs for 325 feet within the proposed rock lined swale at a slope of 5.3%. Refer to the description of sub-watersheds D and E for a discussion on the Manning's roughness factor selected for rock lined swales. The rock lined swale flows into POC F which is a 15 inch diameter storm drain tee spreader (tee spreader #3). The tee spreader outlets on the subject parcel south of a watercourse that flows off the subject parcel in an easterly direction. The Tc for sub-watershed F (proposed conditions) is calculated to be eight (8) minutes and 3 seconds.

Sub-watershed G

Sub-watershed G is approximately 2.91 acres and includes the easterly portion of Block 3.

For the existing conditions, initial overland sheet flow at the furthest extent of the sub-watershed travels 100 feet through woodland areas with an average slope of 35%. A watershed run-off factor of 0.47 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow and travels for 742 feet over cultivated straight row areas with an average slope of 13.5% until it reaches point of concentration POC G. The Tc for sub-watershed G (existing conditions) is calculated to be nine (9) minutes and 53 seconds.

For the proposed conditions, initial overland sheet flow at the furthest extent of the sub-watershed travels 100 feet through woodland areas with an average slope of 35%. A watershed run-off factor of 0.47 was applied per the current Napa County Road & Street Standards (see attachment). Overland sheet flow transitions to shallow concentrated flow and travels for 718 feet over cultivated straight row areas with an average slope of 13.5% until it transitions to channelized flow. Channelized flow runs for 24 feet within the proposed rock lined swale at a slope of 8.3%. Refer to the description of sub-watershed E for a discussion of the Manning's roughness factor for the rock lined swale. The rock lined swale outlets to a rock slope protection outfall near the driveway entrance. The Tc for sub-watershed G (proposed conditions) is calculated to be nine (9) minutes and 49 seconds.

LAND USE AND CURVE NUMBER DETAILS

As part of the analysis, the project watershed was subdivided into areas based on the type of land use (i.e. pavement, gravel, grassland, etc.), soil type, and condition (i.e. good, fair or poor). A runoff curve number is assigned based on the land use information and hydrologic soil group. A curve number is an empirical value which aids in predicting storm water runoff or infiltration. A lower curve number means a lower potential for runoff and a higher curve number means a higher potential for runoff.

These subdivided areas are shown on the attached Hydrology Exhibit and summarized in the following tables for both the existing conditions (pre-development) conditions and proposed conditions (post-development).

Sub-Watershed	Weighted Curve Number (Existing)	Weighted Curve Number (Proposed)
A1	79.58	79.23
A2	76.12	75.65
B	77.02	77.01
C	76.00	76.00
D	78.53	76.87
E	76.63	75.70
F	77.33	76.55
G	77.89	75.91

HYDROLOGY RESULTS

The calculated 2-year, 10-year, 50-year, and 100-year peak stormwater runoff rate at the point of concentration for the existing conditions (pre-development) and proposed conditions (post-development) are as follows:

Condition	Sub-Watershed	Total Runoff (inches)	Peak Runoff (cfs)
PRE	A1	2.94	18.08
POST	A1	2.91	17.82
POST-PRE	AΔ	-0.03	-0.26
PRE	A2	2.63	2.22
POST	A2	2.59	2.18
POST-PRE	A2Δ	-0.04	-0.04
PRE	B	2.71	53.00
POST	B	2.71	52.96
POST-PRE	BΔ	0	-0.04
PRE	C	2.62	30.53
POST	C	2.62	30.53
POST-PRE	CΔ	0	0
PRE	D	2.85	1.34
POST	D	2.70	1.26
POST-PRE	DΔ	-0.15	-0.08
PRE	E	2.68	3.09
POST	E	2.59	3.03
POST-PRE	EΔ	-0.07	-0.06
PRE	F	2.74	1.75
POST	F	2.67	1.70
POST-PRE	FΔ	-0.07	-0.05
PRE	G	2.79	1.96
POST	G	2.61	1.79
POST-PRE	GΔ	-0.18	-0.17

Condition	Sub-Watershed	Total Runoff (inches)	Peak Runoff (cfs)
PRE	A1	5.37	34.49
POST	A1	5.33	34.19
POST-PRE	AΔ	-0.04	-0.30
PRE	A2	4.97	4.48
POST	A2	4.92	4.42
POST-PRE	A2Δ	-0.05	-0.06
PRE	B	5.07	106.33
POST	B	5.07	106.30
POST-PRE	BΔ	0	-0.03
PRE	C	4.96	62.21
POST	C	4.96	62.21
POST-PRE	CΔ	0	0
PRE	D	5.25	2.59
POST	D	5.06	2.50
POST-PRE	DΔ	-0.19	-0.09
PRE	E	5.03	6.18
POST	E	4.92	6.13
POST-PRE	EΔ	-0.11	-0.05
PRE	F	5.11	3.47
POST	F	5.02	3.40
POST-PRE	FΔ	-0.09	-0.07
PRE	G	5.17	3.83
POST	G	4.95	3.63
POST-PRE	GΔ	-0.22	-0.20

Condition	Sub-Watershed	Total Runoff (inches)	Peak Runoff (cfs)
PRE	A1	8.12	52.86
POST	A1	8.08	52.54
POST-PRE	AΔ	-0.04	-0.32
PRE	A2	7.67	7.07
POST	A2	7.60	7.00
POST-PRE	A2Δ	-0.07	-0.07
PRE	B	7.79	167.15
POST	B	7.78	167.10
POST-PRE	BΔ	-0.01	-0.05
PRE	C	7.65	98.62
POST	C	7.65	98.62
POST-PRE	CΔ	0	0
PRE	D	7.99	4.01
POST	D	7.77	3.90
POST-PRE	DΔ	-0.22	-0.11
PRE	E	7.73	9.71
POST	E	7.61	9.68
POST-PRE	EΔ	-0.12	-0.03
PRE	F	7.83	5.41
POST	F	7.72	5.34
POST-PRE	FΔ	-0.11	-0.07
PRE	G	7.90	5.95
POST	G	7.64	5.73
POST-PRE	GΔ	-0.26	-0.22

Condition	Sub-Watershed	Total Runoff (inches)	Peak Runoff (cfs)
PRE	A1	9.37	61.10
POST	A1	9.33	60.77
POST-PRE	AΔ	-0.04	-0.33
PRE	A2	8.90	8.24
POST	A2	8.83	8.18
POST-PRE	A2Δ	-0.07	-0.06
PRE	B	9.02	194.64
POST	B	9.02	194.62
POST-PRE	BΔ	0	-0.02
PRE	C	8.88	115.11
POST	C	8.88	115.11
POST-PRE	CΔ	0	0
PRE	D	9.23	4.64
POST	D	9.00	4.54
POST-PRE	DΔ	-0.23	-0.10
PRE	E	8.97	11.30
POST	E	8.84	11.28
POST-PRE	EΔ	-0.13	-0.02
PRE	F	9.07	6.29
POST	F	8.96	6.22
POST-PRE	FΔ	-0.11	-0.07
PRE	G	9.14	6.91
POST	G	8.87	6.68
POST-PRE	GΔ	-0.27	-0.23

The post-development peak stormwater runoff rates are calculated to be less than the pre-development peak stormwater runoff rates. Hydrographs for each storm event (pre-development and post-development) over a 24-hour period are attached.

PIPE SIZING

The proposed tee spreaders are sized to handle the peak stormwater runoff rate for the post conditions 100-yr storm event. The pipe capacity is calculated per the equation shown below at varying slopes and then compared to the calculated storm water runoff rate from the Sub-watershed Hydrology Results summarized in the above tables.

$$Q = 1.49 \times \frac{r^{2/3} \times s^{1/2} \times A}{n}$$

Where:

- Q = Pipe flowrate capacity, cubic feet per second (cfs)
- r = Hydraulic radius, feet (ft)
- s = Pipe slope (ft/ft)
- A = Pipe cross-sectional area, square feet (ft²)
- n = Manning's n factor

The attached Pipe Capacity Charts show the capacity of a 15 inch and an 18 inch ADS n-12 storm drain with a manning's roughness factor (n) of 0.12 at varying slopes and percentages full. The proposed pipes leading to the tee spreaders are proposed to be installed at a 2% minimum slope.

Tee Spreader #1

At 95% full with a 2% minimum pipe slope, the proposed 15 inch diameter pipe has a calculated pipe capacity of 10.12 cfs which is greater than the calculated 100-year peak runoff rate of 4.54 cfs from Sub-watershed D. Therefore, tee spreader #1 is sized appropriately.

Tee Spreader #2

At 95% full with a 2% minimum pipe slope, the proposed 18 inch diameter pipe has a calculated pipe capacity of 16.46 cfs which is greater than the calculated 100-year peak runoff rate of 11.28 cfs from Sub-watershed E. Therefore, tee spreader #2 is sized appropriately.

Tee Spreader #3

At 95% full with a 2% minimum pipe slope, the proposed 15 inch diameter pipe has a calculated pipe capacity of 10.12 cfs which is greater than the calculated 100-year peak runoff rate of 6.22 cfs from Sub-watershed F. Therefore, tee spreader #3 is sized appropriately.

CONCLUSIONS

As demonstrated in this analysis, the post-development weighted curve numbers were calculated to be less than the pre-development weighted curve numbers. Some of the times of concentration did change as part of the proposed stormwater infrastructure improvements. As demonstrated in the above analysis, the peak stormwater runoff rate at the point of concentration for each sub-watershed is projected to decrease as a result of the proposed project development. The proposed storm drain pipes and tee spreaders located downstream of sub-watersheds D, E, and F are all sized to handle peak stormwater runoff from a 100-yr storm event.

ATTACHMENTS

Flood Insurance Rate Map

Rainfall Data (NOAA Point Precipitation Frequency Estimates)

Watershed Runoff Factors (from the current Napa County Road & Street Standards)

Autodesk Storm and Sewer Analysis Custom Report

Pipe Capacity Charts

REFERENCES

Autodesk Storm and Sanitary Analysis. February 2020. Storm and Sanitary Analysis Software. 32-bit Window Based Application. Version 13.2.160.0.

U.S. Department of Agriculture. June 1986. Technical Release 55 Urban Hydrology for Small Watersheds.

U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map (FIRM), 06055C0420E effective September 26, 2008.

National Flood Hazard Layer FIRMette

122°38'11"W 38°35'47"N

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>
OTHER AREAS	NO SCREEN	Area of Minimal Flood Hazard <i>Zone X</i>
		Effective LOMRs
		Area of Undetermined Flood Hazard <i>Zone D</i>
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2 17.5 s	Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped
MAP PANELS		



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/13/2020 at 4:04 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

NOAA Atlas 14, Volume 6, Version 2
Location name: Calistoga, California, USA*
Latitude: 38.5992°, Longitude: -122.6236°
Elevation: 439.73 ft**
 * source: ESRI Maps
 ** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

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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	0.161 (0.143–0.182)	0.195 (0.173–0.221)	0.239 (0.211–0.273)	0.275 (0.241–0.317)	0.323 (0.273–0.387)	0.360 (0.296–0.442)	0.397 (0.318–0.501)	0.436 (0.338–0.568)	0.488 (0.361–0.666)	0.528 (0.375–0.749)
10-min	0.230 (0.205–0.261)	0.279 (0.248–0.317)	0.342 (0.303–0.391)	0.394 (0.345–0.454)	0.463 (0.391–0.554)	0.516 (0.425–0.633)	0.570 (0.456–0.719)	0.625 (0.484–0.814)	0.699 (0.517–0.954)	0.756 (0.538–1.07)
15-min	0.278 (0.247–0.316)	0.337 (0.300–0.384)	0.414 (0.367–0.473)	0.476 (0.418–0.549)	0.560 (0.472–0.671)	0.624 (0.514–0.765)	0.689 (0.551–0.869)	0.755 (0.586–0.984)	0.845 (0.625–1.15)	0.915 (0.650–1.30)
30-min	0.406 (0.361–0.461)	0.492 (0.437–0.560)	0.604 (0.535–0.690)	0.695 (0.609–0.801)	0.817 (0.689–0.979)	0.911 (0.750–1.12)	1.00 (0.805–1.27)	1.10 (0.855–1.44)	1.23 (0.912–1.68)	1.34 (0.949–1.90)
60-min	0.585 (0.520–0.664)	0.709 (0.630–0.807)	0.870 (0.770–0.993)	1.00 (0.878–1.15)	1.18 (0.993–1.41)	1.31 (1.08–1.61)	1.45 (1.16–1.83)	1.59 (1.23–2.07)	1.78 (1.31–2.43)	1.92 (1.37–2.73)
2-hr	0.899 (0.799–1.02)	1.08 (0.958–1.23)	1.31 (1.16–1.49)	1.49 (1.31–1.72)	1.73 (1.46–2.07)	1.91 (1.57–2.34)	2.09 (1.67–2.63)	2.27 (1.76–2.95)	2.50 (1.85–3.42)	2.68 (1.91–3.81)
3-hr	1.16 (1.03–1.31)	1.39 (1.23–1.58)	1.68 (1.48–1.91)	1.91 (1.67–2.19)	2.20 (1.86–2.64)	2.42 (2.00–2.97)	2.64 (2.11–3.33)	2.86 (2.21–3.72)	3.14 (2.32–4.28)	3.35 (2.38–4.75)
6-hr	1.75 (1.56–1.99)	2.12 (1.88–2.41)	2.57 (2.28–2.93)	2.92 (2.56–3.37)	3.37 (2.85–4.04)	3.70 (3.05–4.54)	4.02 (3.22–5.07)	4.33 (3.36–5.65)	4.74 (3.50–6.47)	5.03 (3.58–7.15)
12-hr	2.48 (2.20–2.81)	3.12 (2.77–3.55)	3.90 (3.45–4.45)	4.49 (3.94–5.18)	5.24 (4.42–6.28)	5.78 (4.76–7.09)	6.29 (5.04–7.94)	6.79 (5.26–8.84)	7.41 (5.48–10.1)	7.86 (5.59–11.2)
24-hr	3.41 (3.07–3.88)	4.49 (4.03–5.11)	5.80 (5.19–6.61)	6.79 (6.04–7.79)	8.04 (6.96–9.48)	8.93 (7.59–10.7)	9.78 (8.15–12.0)	10.6 (8.62–13.3)	11.6 (9.14–15.1)	12.4 (9.44–16.6)
2-day	4.52 (4.06–5.14)	5.90 (5.30–6.71)	7.64 (6.84–8.71)	9.01 (8.01–10.3)	10.8 (9.33–12.7)	12.1 (10.3–14.5)	13.4 (11.2–16.4)	14.7 (11.9–18.4)	16.3 (12.8–21.2)	17.6 (13.4–23.5)
3-day	5.31 (4.77–6.03)	6.86 (6.16–7.80)	8.87 (7.94–10.1)	10.5 (9.32–12.0)	12.6 (10.9–14.9)	14.3 (12.1–17.1)	15.9 (13.2–19.5)	17.6 (14.3–22.0)	19.8 (15.6–25.7)	21.5 (16.4–28.8)
4-day	5.94 (5.34–6.75)	7.65 (6.87–8.70)	9.88 (8.85–11.3)	11.7 (10.4–13.4)	14.1 (12.2–16.7)	16.0 (13.6–19.2)	17.9 (14.9–21.9)	19.8 (16.1–24.9)	22.5 (17.6–29.2)	24.5 (18.7–32.8)
7-day	7.34 (6.59–8.33)	9.41 (8.45–10.7)	12.1 (10.9–13.8)	14.4 (12.8–16.5)	17.4 (15.0–20.5)	19.7 (16.8–23.6)	22.1 (18.4–27.0)	24.5 (19.9–30.7)	27.8 (21.9–36.2)	30.4 (23.2–40.7)
10-day	8.34 (7.50–9.47)	10.7 (9.61–12.2)	13.8 (12.3–15.7)	16.3 (14.5–18.6)	19.6 (16.9–23.1)	22.1 (18.8–26.5)	24.7 (20.6–30.2)	27.3 (22.2–34.2)	30.8 (24.2–40.0)	33.5 (25.6–44.8)
20-day	11.0 (9.93–12.5)	14.2 (12.8–16.2)	18.2 (16.3–20.7)	21.2 (18.9–24.4)	25.2 (21.8–29.7)	28.1 (23.9–33.7)	30.9 (25.7–37.8)	33.6 (27.4–42.2)	37.2 (29.2–48.3)	39.8 (30.4–53.3)
30-day	13.4 (12.0–15.2)	17.2 (15.4–19.5)	21.8 (19.5–24.9)	25.3 (22.5–29.1)	29.8 (25.8–35.1)	32.9 (28.0–39.5)	35.9 (29.9–44.0)	38.8 (31.6–48.7)	42.4 (33.3–55.1)	45.1 (34.4–60.3)
45-day	16.4 (14.8–18.7)	21.0 (18.9–23.9)	26.5 (23.7–30.2)	30.5 (27.1–35.0)	35.5 (30.7–41.8)	38.9 (33.1–46.7)	42.1 (35.1–51.6)	45.1 (36.7–56.6)	48.8 (38.4–63.4)	51.5 (39.3–68.8)
60-day	19.5 (17.5–22.2)	24.8 (22.3–28.2)	31.0 (27.8–35.3)	35.5 (31.6–40.7)	40.9 (35.4–48.3)	44.6 (38.0–53.6)	48.0 (40.0–58.8)	51.2 (41.7–64.2)	55.0 (43.2–71.5)	57.7 (44.0–77.2)

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.

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PF graphical

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Maps & aerials

Small scale terrain

3km
2mi



Large scale terrain

100km
60mi



Large scale map

100km
60mi





100km

60mi

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WATERSHED TYPES AND FACTORS

RUN-OFF PRODUCING CHARACTERISTICS OF WATERSHEDS SHOWING FACTORS FOR EACH CHARACTERISTIC FOR VARIOUS WATERSHED TYPES

WATERSHED TYPES AND FACTORS 0.40-.54 (.47 MEDIAN)

Run-off Producing Features	Extreme	High	Normal	Low
Relief	0.28 – 0.38 Steep, rugged terrain, with average slopes above 30%	0.20 – 0.28 Rolling, with average slopes of 10 to 30%	0.14 – 0.20 Rolling, with average slopes of 5 to 10%	0.08 – 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 – 0.16 No effective soil cover either rock or thin soil mantle of negligible infiltration capacity.	0.08 – 0.12 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.	0.06 – 0.08 Normal; well drained light and medium textured soils sandy loams, silt, and silt loams.	0.04 – 0.06 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.
Vegetation Cover	0.12 – 0.16 No effective plant cover; bare or very sparse cover.	0.08 – 0.12 Poor to fair; clean cultivation crops or poor natural cover; less than 20% of drainage area under good cover.	0.06 – 0.08 Fair to good; about 50% of area in good grassland or woodland; not more than 50% of area in cultivated crops.	0.04 – 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent crop.
Surface	0.10 – 0.12 Negligible; surface depressions, few and shallow; drainage ways steep and small; no marshes.	0.08 – 0.10 Low well-defined system of small drainage ways; no ponds or marsh.	0.06 – 0.08 Normal; considerable surface depression storage; lakes, ponds, and marshes.	0.04 – 0.06 High; surface storage high; drainage system not sharply defined; large floodplain storage or large number of ponds or marshes.

THE RUNOFF FACTOR IS DETERMINED BY THE SUM OF THE FACTORS FOR RELIEF INFILTRATION, COVER, AND SURFACE. NOT APPLICABLE TO BUILT UP AREAS.

FIGURE 3

WATERSHEDS B, C

WATERSHED TYPES AND FACTORS

RUN-OFF PRODUCING CHARACTERISTICS OF WATERSHEDS SHOWING FACTORS
FOR EACH CHARACTERISTIC FOR VARIOUS WATERSHED TYPES

WATERSHED TYPES AND FACTORS 0.48-.64 (.56 MEDIAN)

Run-off Producing

Features	Extreme	High	Normal	Low
Relief	0.28 – 0.38 Steep, rugged terrain, with average slopes above 30%	0.20 – 0.28 Rolling, with average slopes of 10 to 30%	0.14 – 0.20 Rolling, with average slopes of 5 to 10%	0.08 – 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 – 0.16 No effective soil cover either rock or thin soil mantle of negligible infiltration capacity.	0.08 – 0.12 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.	0.06 – 0.08 Normal; well drained light and medium textured soils sandy loams, silt, and silt loams.	0.04 – 0.06 Slow to take up water; clay or shallow loam soils of low infiltration capacity imperfectly or poorly drained.
Vegetation Cover	0.12 – 0.16 No effective plant cover; bare or very sparse cover.	0.08 – 0.12 Poor to fair; clean cultivation crops or poor natural cover; less than 20% of drainage area under good cover.	0.06 – 0.08 Fair to good; about 50% of area in good grassland or woodland; not more than 50% of area in cultivated crops.	0.04 – 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland, or equivalent crop.
Surface	0.10 – 0.12 Negligible; surface depressions, few and shallow; drainage ways steep and small; no marshes.	0.08 – 0.10 Low well-defined system of small drainage ways; no ponds or marsh.	0.06 – 0.08 Normal; considerable surface depression storage; lakes, ponds, and marshes.	0.04 – 0.06 High; surface storage high; drainage system not sharply defined; large floodplain storage or large number of ponds or marshes.

THE RUNOFF FACTOR IS DETERMINED BY THE SUM OF THE FACTORS FOR RELIEF
INFILTRATION, COVER, AND SURFACE. NOT APPLICABLE TO BUILT UP AREAS.

FIGURE 3

Project Description

File Name 1826-DRHY_PRE.SPF
Description
WINROD VINEYARD ECP
STORM AND SEWER ANALYSIS

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-20
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
YES

Analysis Options

Start Analysis On Jul 13, 2020 00:00:00
End Analysis On Jul 14, 2020 00:00:00
Start Reporting On Jul 13, 2020 00:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 8
Nodes..... 8
 Junctions 0
 Outfalls 8
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage	Data	Data Source	Rainfall	Rain	State	County	Return	Rainfall	Rainfall
ID		Source	ID	Type	Units			Period	Depth	Distribution
								(years)	(inches)	

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)			(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	{WTSH}.A1	25.12	484.00	79.58	5.10	2.94	73.95	18.08	0 00:10:20
2	{WTSH}.A2	3.57	484.00	76.12	5.10	2.63	9.39	2.23	0 00:08:36
3	{WTSH}.B	93.54	484.00	77.02	5.10	2.71	253.59	53.00	0 00:28:59
4	{WTSH}.C	54.14	484.00	76.00	5.10	2.62	141.85	30.53	0 00:24:03
5	{WTSH}.D	1.93	484.00	78.53	5.10	2.85	5.49	1.34	0 00:08:43
6	{WTSH}.E	4.90	484.00	76.63	5.10	2.68	13.11	3.09	0 00:12:06
7	{WTSH}.F	2.67	484.00	77.33	5.10	2.74	7.31	1.75	0 00:08:49
8	{WTSH}.G	2.91	484.00	77.89	5.10	2.79	8.12	1.93	0 00:12:52

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	A1	Outfall	0.00					0.00	0.00					
2	A2	Outfall	0.00					0.00	0.00					
3	B	Outfall	0.00					0.00	0.00					
4	C	Outfall	0.00					0.00	0.00					
5	D	Outfall	0.00					0.00	0.00					
6	E	Outfall	0.00					0.00	0.00					
7	F	Outfall	0.00					0.00	0.00					
8	G	Outfall	0.00					0.00	0.00					

Subbasin Hydrology**Subbasin : {WTSH}.A1****Input Data**

Area (ac) 25.12
 Peak Rate Factor 484.00
 Weighted Curve Number 79.58
 Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.23	C	98.00
Woods & grass combination, Fair	8.03	C	76.00
Woods & grass combination, Fair	5.13	D	82.00
50 - 75% grass cover, Fair	10.73	C	79.00
Composite Area & Weighted CN	25.12		79.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
 V = 20.3282 * (S_f^{0.5}) (paved surface)
 V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
 V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
 V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
 V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
 V = 5.0 * (S_f^{0.5}) (woodland surface)
 V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
 T_c = (L_f / V) / (3600 sec/hr)

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n
 R = A_q / W_p
 T_c = (L_f / V) / (3600 sec/hr)

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

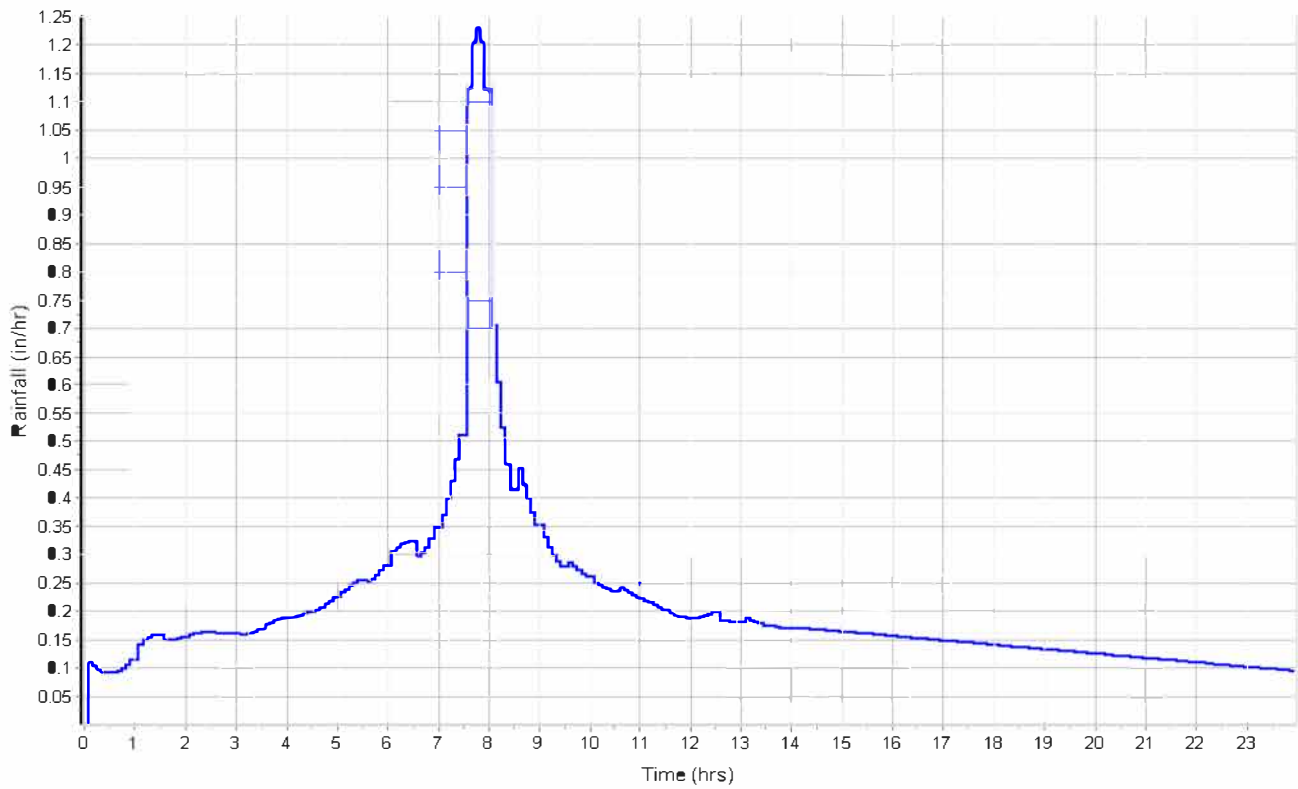
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.25	0.00	0.00
Computed Flow Time (min) :	6.54	0.00	0.00
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1499	0.00	0.00
Slope (%) :	16.7	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.59	0.00	0.00
Computed Flow Time (min) :	3.79	0.00	0.00
Total TOC (min)	10.34		

Subbasin Runoff Results

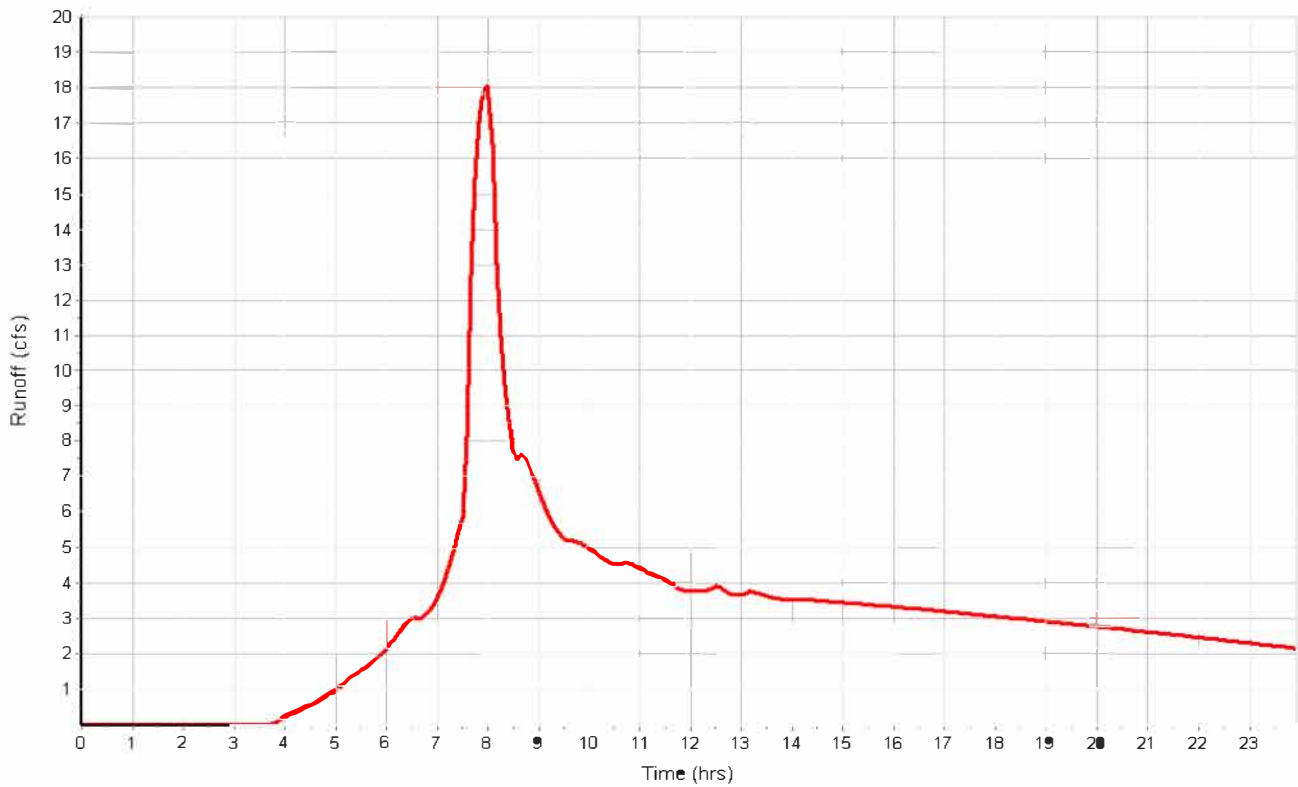
Total Rainfall (in)	5.10
Total Runoff (in)	2.94
Peak Runoff (cfs)	18.08
Weighted Curve Number	79.58
Time of Concentration (days hh:mm:ss)	0 00:10:20

Subbasin : {WTSH}.A1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.A2

Input Data

Area (ac) 3.57
Peak Rate Factor 484.00
Weighted Curve Number 76.12
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	3.43	C	76.00
50 - 75% grass cover, Fair	0.14	C	79.00
Composite Area & Weighted CN	3.57		76.12

Time of Concentration

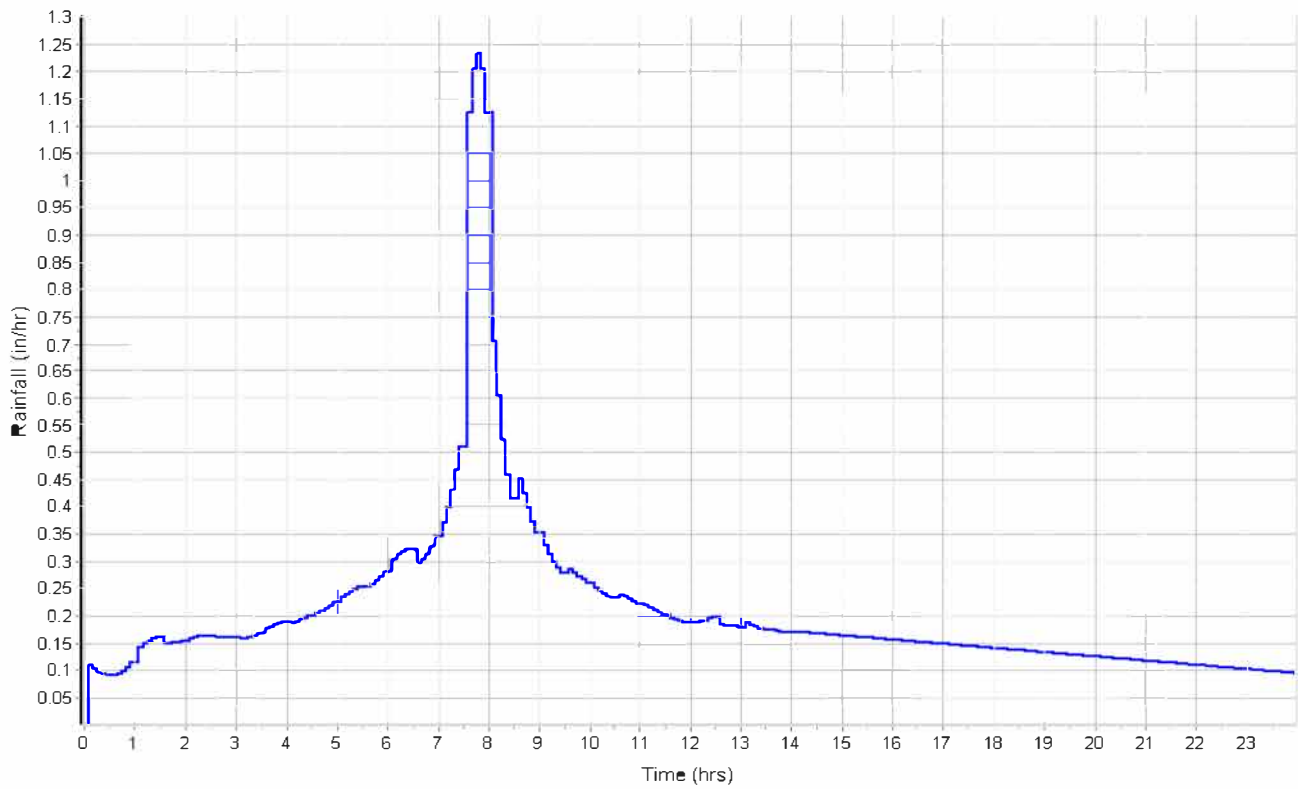
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	43	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.67	0.00	0.00
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	290	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.51	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	380	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	6.29	0.00	0.00
Computed Flow Time (min) :	1.01	0.00	0.00
Total TOC (min)	8.60		

Subbasin Runoff Results

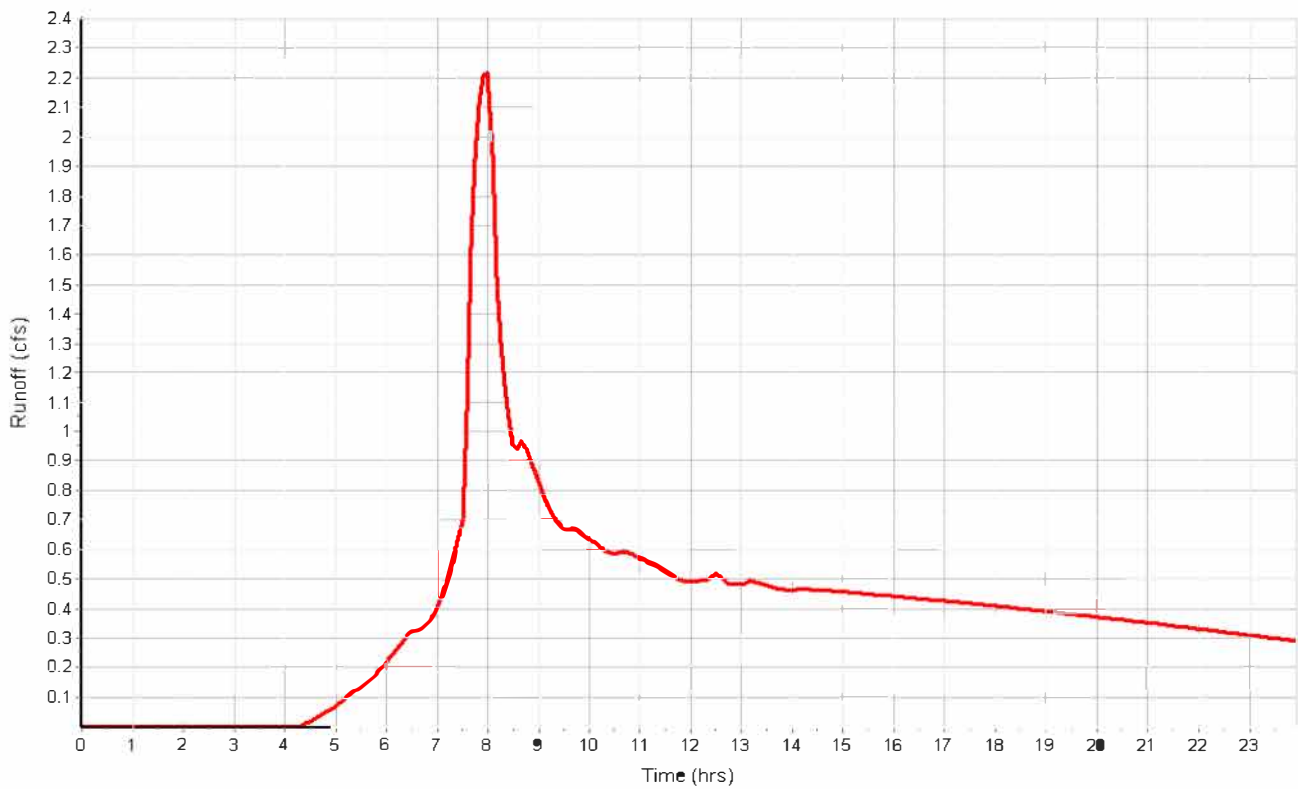
Total Rainfall (in) 5.10
Total Runoff (in) 2.63
Peak Runoff (cfs) 2.23
Weighted Curve Number 76.12
Time of Concentration (days hh:mm:ss) 0 00:08:36

Subbasin : {WTSH}.A2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.B

Input Data

Area (ac) 93.54
Peak Rate Factor 484.00
Weighted Curve Number 77.02
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.20	C	98.00
Woods & grass combination, Fair	78.03	C	76.00
Woods & grass combination, Fair	14.94	D	82.00
50 - 75% grass cover, Fair	0.37	C	79.00
Composite Area & Weighted CN	93.54		77.02

Time of Concentration

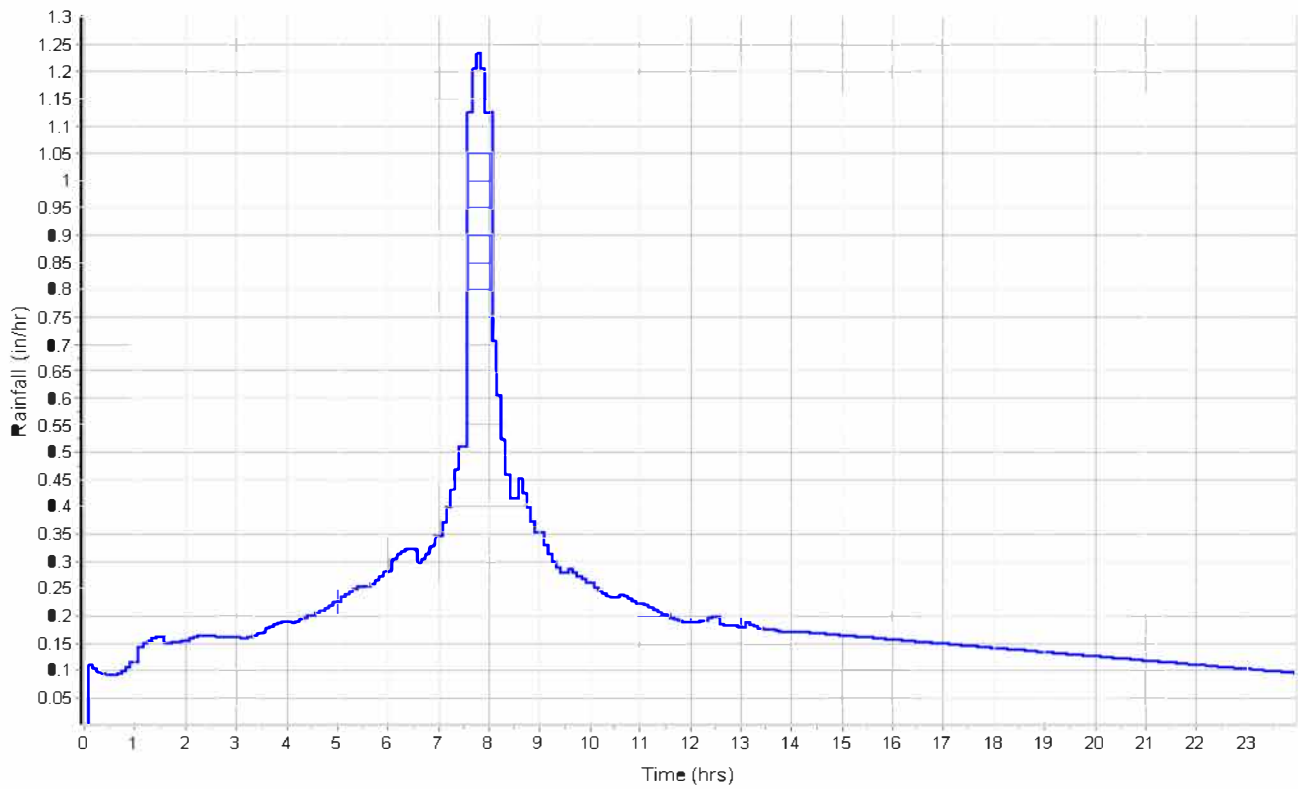
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	45	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	6.40	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	2154	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	8.12	0.00	0.00
Computed Flow Time (min) :	4.42	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.5	0.00	0.00
Flow Length (ft) :	2196	0.00	0.00
Channel Slope (%) :	7.2	0.00	0.00
Cross Section Area (ft²) :	60	0.00	0.00
Wetted Perimeter (ft) :	15	0.00	0.00
Velocity (ft/sec) :	2.01	0.00	0.00
Computed Flow Time (min) :	18.16	0.00	0.00
Total TOC (min)	28.99		

Subbasin Runoff Results

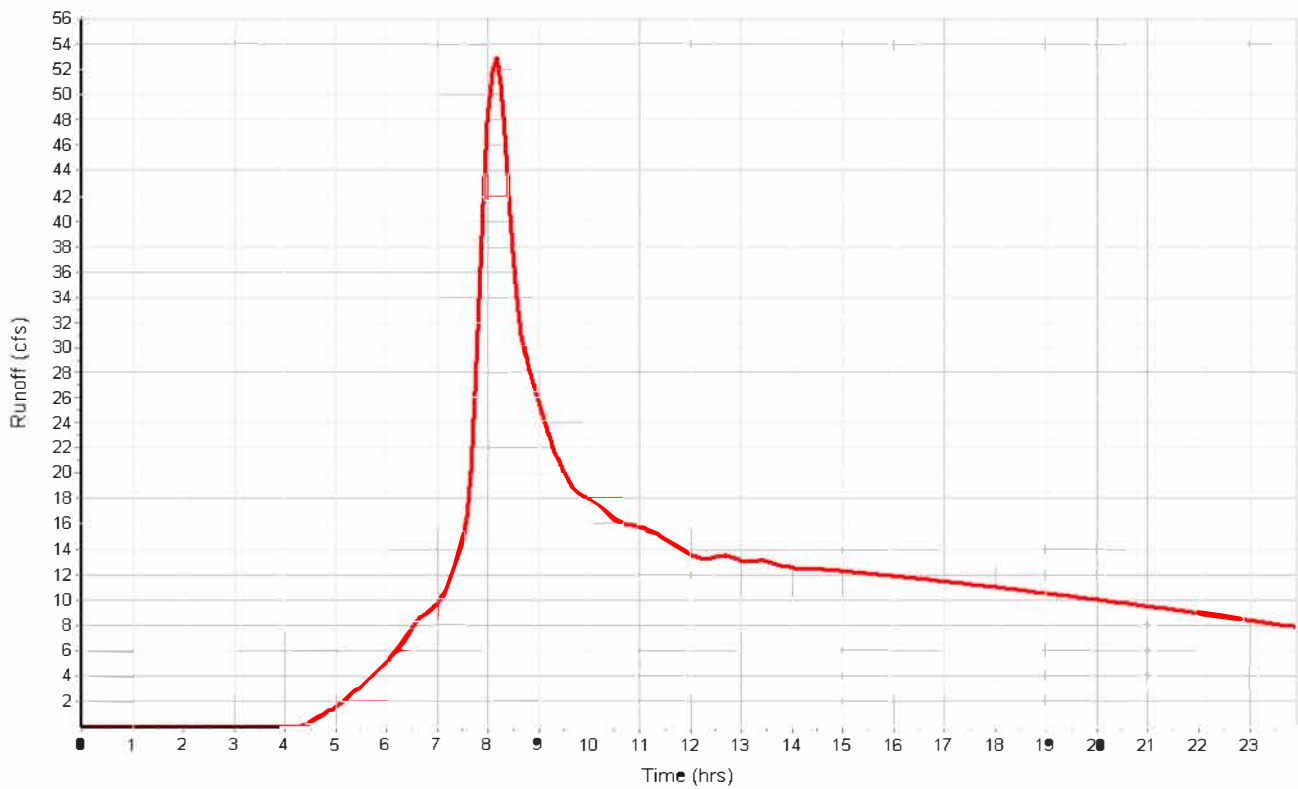
Total Rainfall (in) 5.10
Total Runoff (in) 2.71
Peak Runoff (cfs) 53.00
Weighted Curve Number 77.02
Time of Concentration (days hh:mm:ss) 0 00:28:59

Subbasin : {WTSH}.B

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.C

Input Data

Area (ac) 54.14
Peak Rate Factor 484.00
Weighted Curve Number 76.00
Rain Gage ID Rain Gage-01

Composite Curve Number

	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Woods & grass combination, Fair	54.14	C	76.00
Composite Area & Weighted CN	54.14		76.00

Time of Concentration

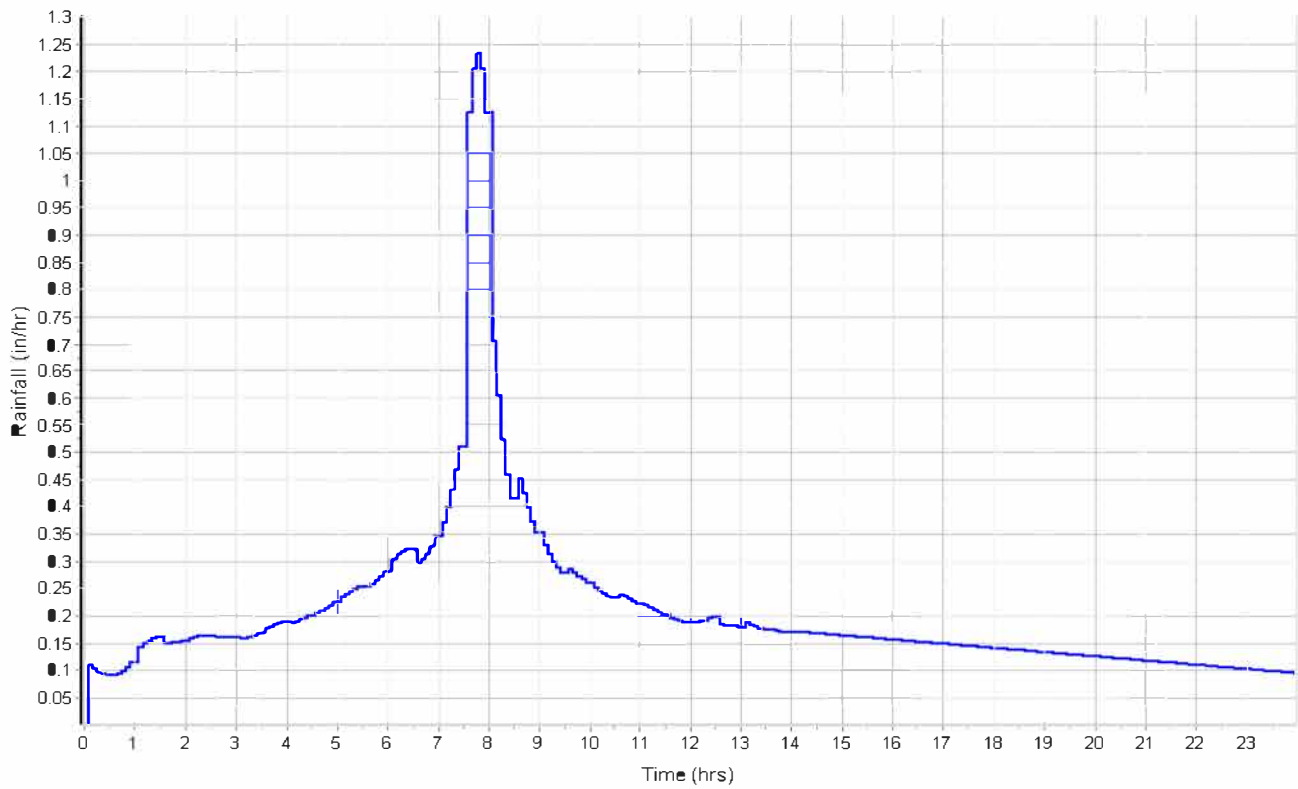
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.14	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1940	0.00	0.00
Slope (%) :	31.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.82	0.00	0.00
Computed Flow Time (min) :	11.47	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.50	0.00	0.00
Flow Length (ft) :	1445	0.00	0.00
Channel Slope (%) :	8.7	0.00	0.00
Cross Section Area (ft²) :	228	0.00	0.00
Wetted Perimeter (ft) :	26	0.00	0.00
Velocity (ft/sec) :	3.74	0.00	0.00
Computed Flow Time (min) :	6.44	0.00	0.00
Total TOC (min) 24.05			

Subbasin Runoff Results

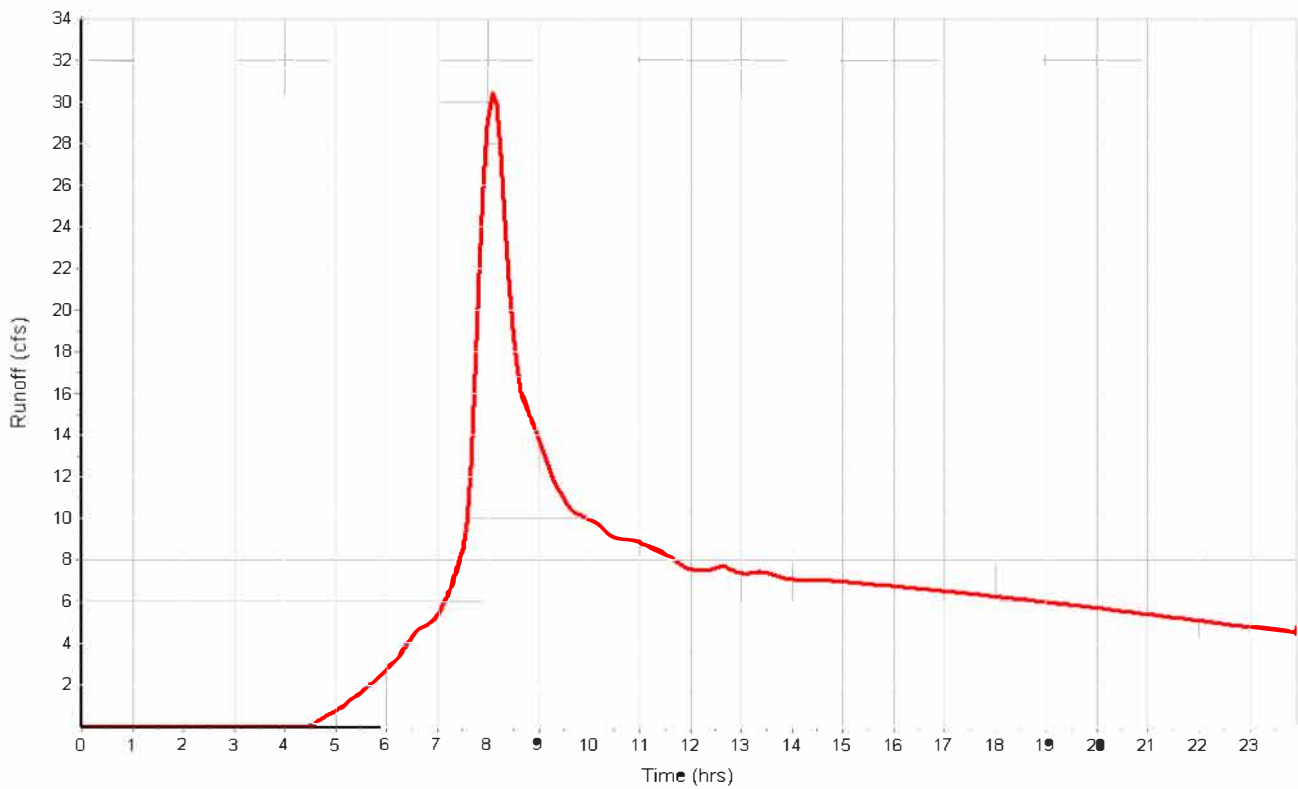
Total Rainfall (in) 5.10
Total Runoff (in) 2.62
Peak Runoff (cfs) 30.53
Weighted Curve Number 76.00
Time of Concentration (days hh:mm:ss) 0 00:24:03

Subbasin : {WTSH}.C

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.D

Input Data

Area (ac) 1.93
Peak Rate Factor 484.00
Weighted Curve Number 78.53
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.06	C	98.00
Woods & grass combination, Fair	0.68	C	76.00
50 - 75% grass cover, Fair	1.19	C	79.00
Composite Area & Weighted CN	1.93		78.53

Time of Concentration

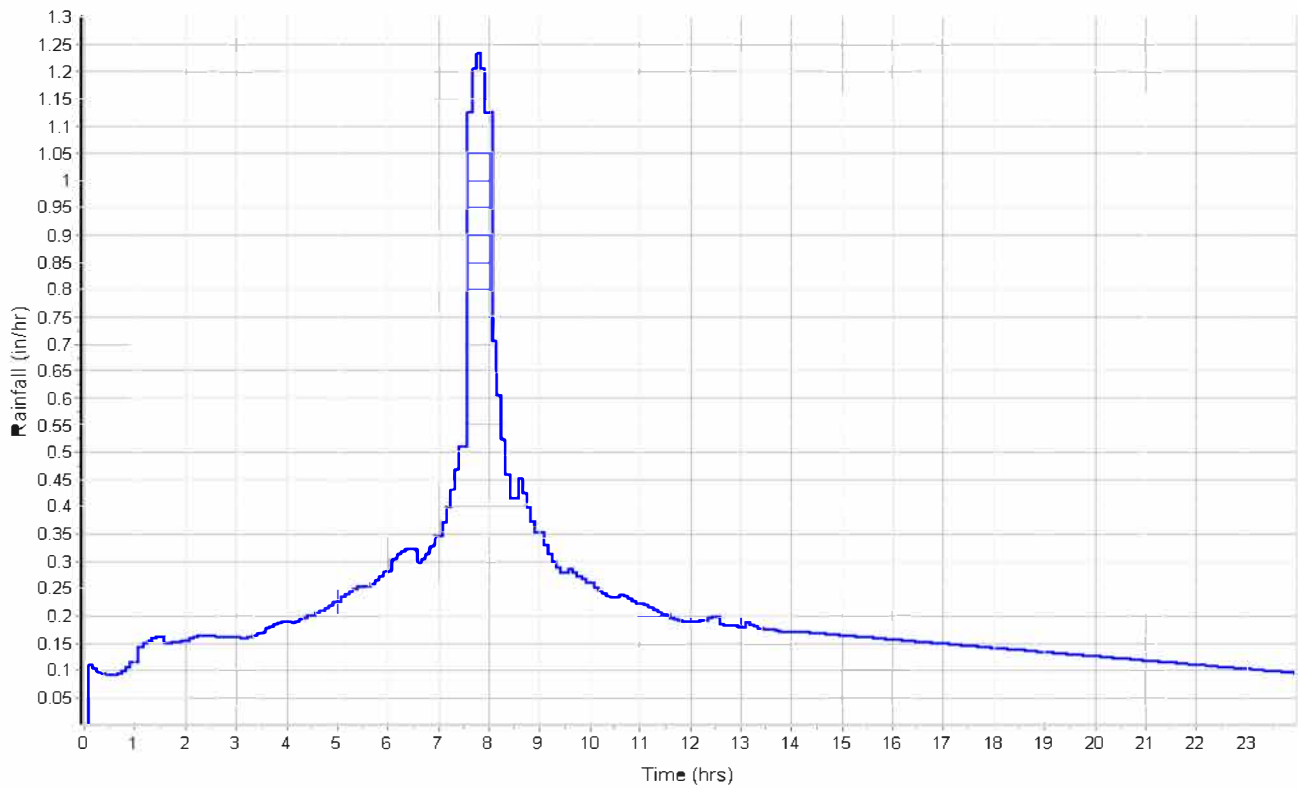
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	7.04	0.00	0.00
Shallow Concentrated Flow Computations			
	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	244	0.00	0.00
Slope (%) :	7.4	0.00	0.00
Surface Type :	Bare & untilled	Unpaved	Unpaved
Velocity (ft/sec) :	2.72	0.00	0.00
Computed Flow Time (min) :	1.50	0.00	0.00
Channel Flow Computations			
	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	52	0.00	0.00
Channel Slope (%) :	2.2	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	4.79	0.00	0.00
Computed Flow Time (min) :	0.18	0.00	0.00
Total TOC (min)	8.72		

Subbasin Runoff Results

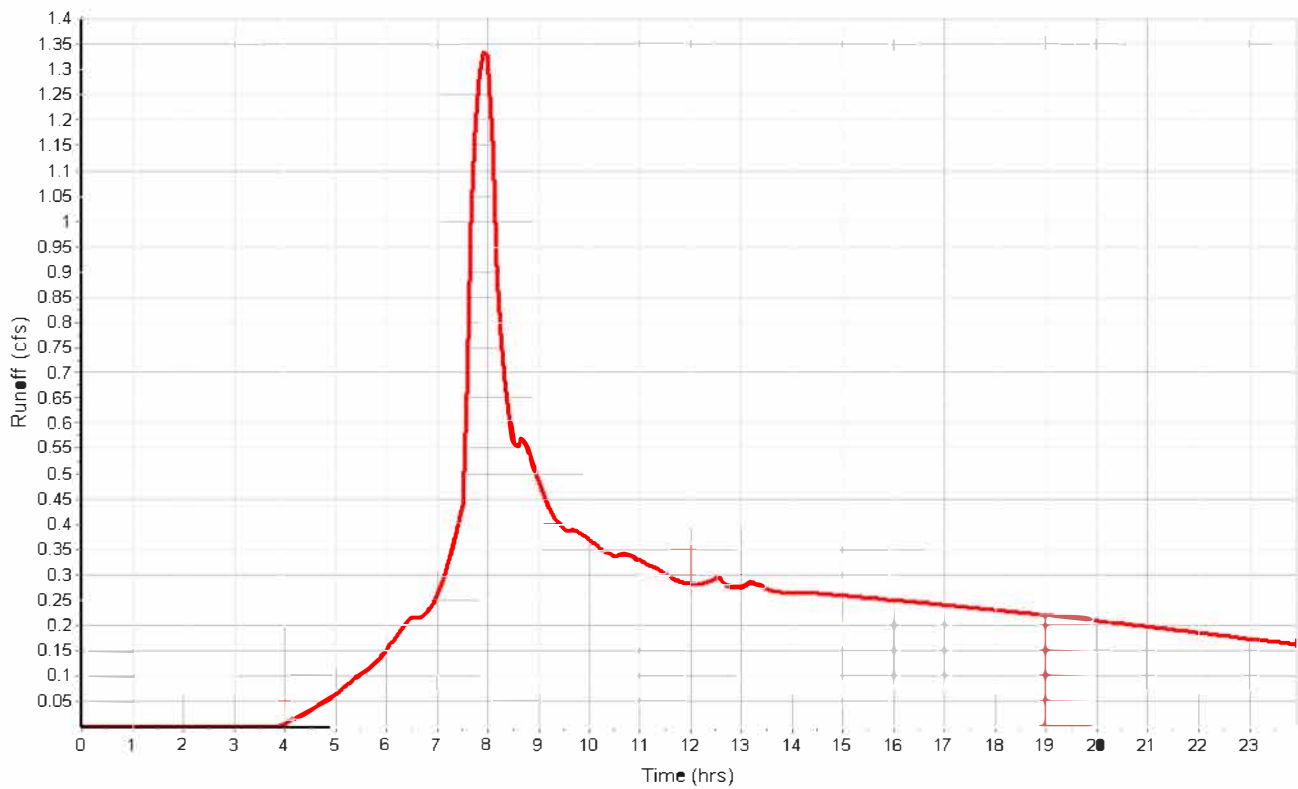
Total Rainfall (in) 5.10
Total Runoff (in) 2.85
Peak Runoff (cfs) 1.34
Weighted Curve Number 78.53
Time of Concentration (days hh:mm:ss) 0 00:08:43

Subbasin : {WTSH}.D

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.E

Input Data

Area (ac) 4.90
Peak Rate Factor 484.00
Weighted Curve Number 76.63
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.10	C	98.00
Woods & grass combination, Fair	4.50	C	76.00
50 - 75% grass cover, Fair	0.30	C	79.00
Composite Area & Weighted CN	4.90		76.63

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	7.41	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	321	0.00	0.00
Slope (%) :	23	0.00	0.00
Surface Type :	Forest	Unpaved	Unpaved
Velocity (ft/sec) :	1.20	0.00	0.00
Computed Flow Time (min) :	4.46	0.00	0.00

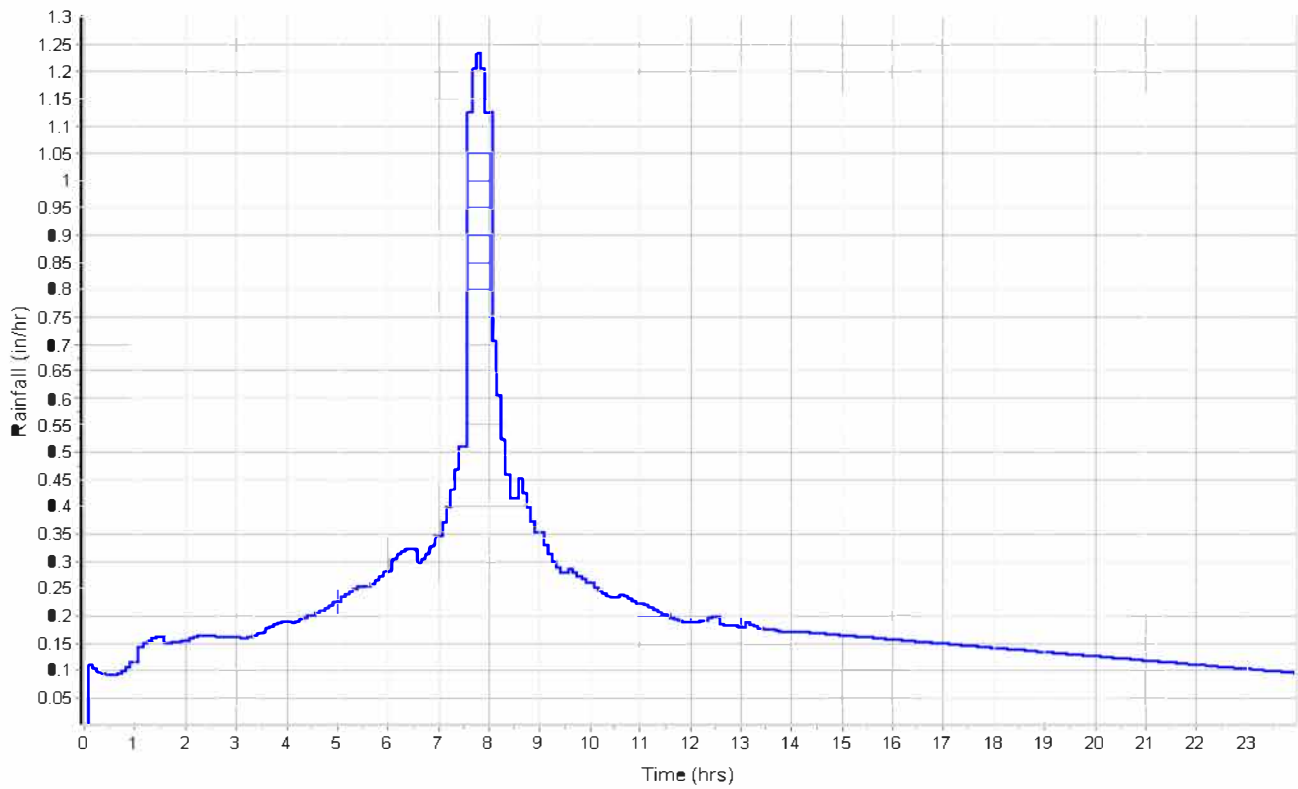
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	161	0.00	0.00
Channel Slope (%) :	12	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	11.18	0.00	0.00
Computed Flow Time (min) :	0.24	0.00	0.00
Total TOC (min)	12.11		

Subbasin Runoff Results

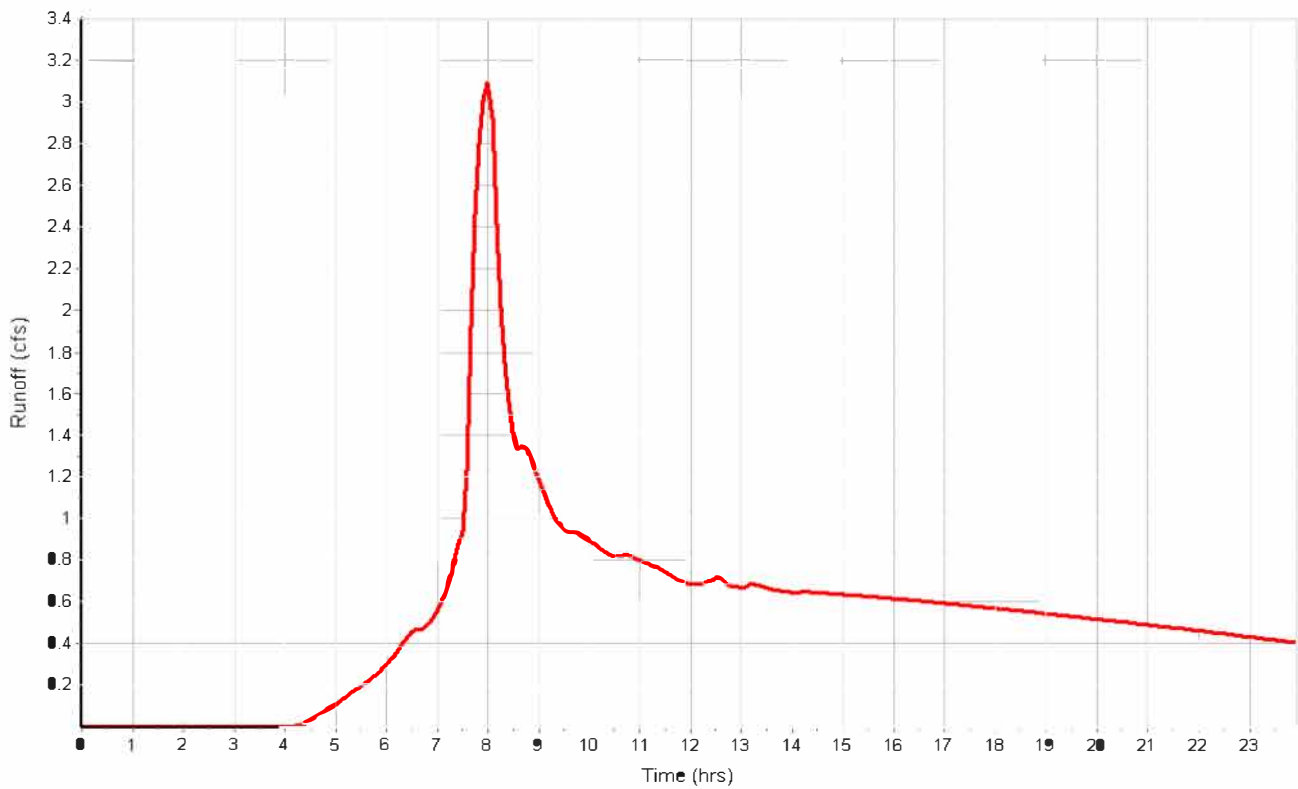
Total Rainfall (in) 5.10
Total Runoff (in) 2.68
Peak Runoff (cfs) 3.09
Weighted Curve Number 76.63
Time of Concentration (days hh:mm:ss) 0 00:12:07

Subbasin : {WTSH}.E

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.F

Input Data

Area (ac) 2.67
Peak Rate Factor 484.00
Weighted Curve Number 77.33
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.07	C	98.00
Woods & grass combination, Fair	1.93	C	76.00
50 - 75% grass cover, Fair	0.67	C	79.00
Composite Area & Weighted CN	2.67		77.33

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	40	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.83	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	318	0.00	0.00
Slope (%) :	22	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.35	0.00	0.00
Computed Flow Time (min) :	2.26	0.00	0.00

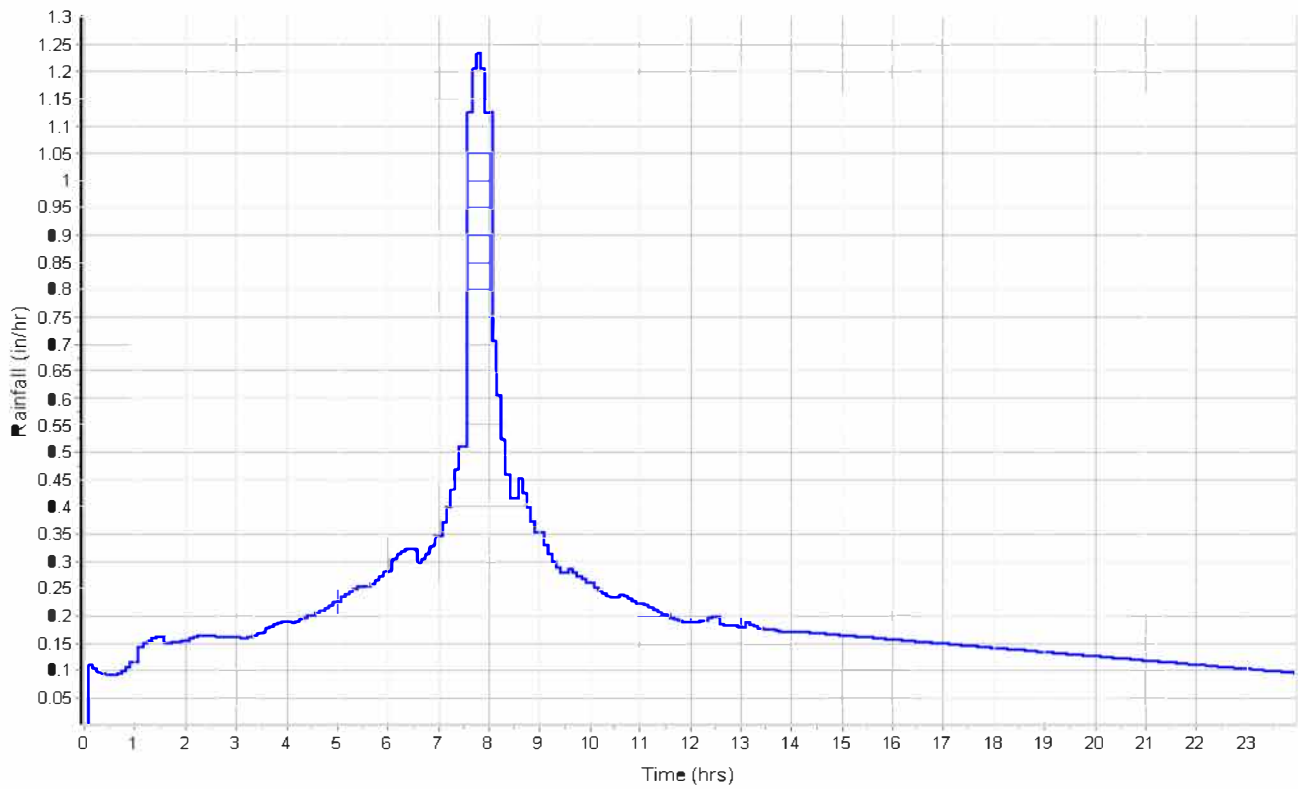
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	325	0.00	0.00
Channel Slope (%) :	5.3	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	7.43	0.00	0.00
Computed Flow Time (min) :	0.73	0.00	0.00
Total TOC (min)	8.82		

Subbasin Runoff Results

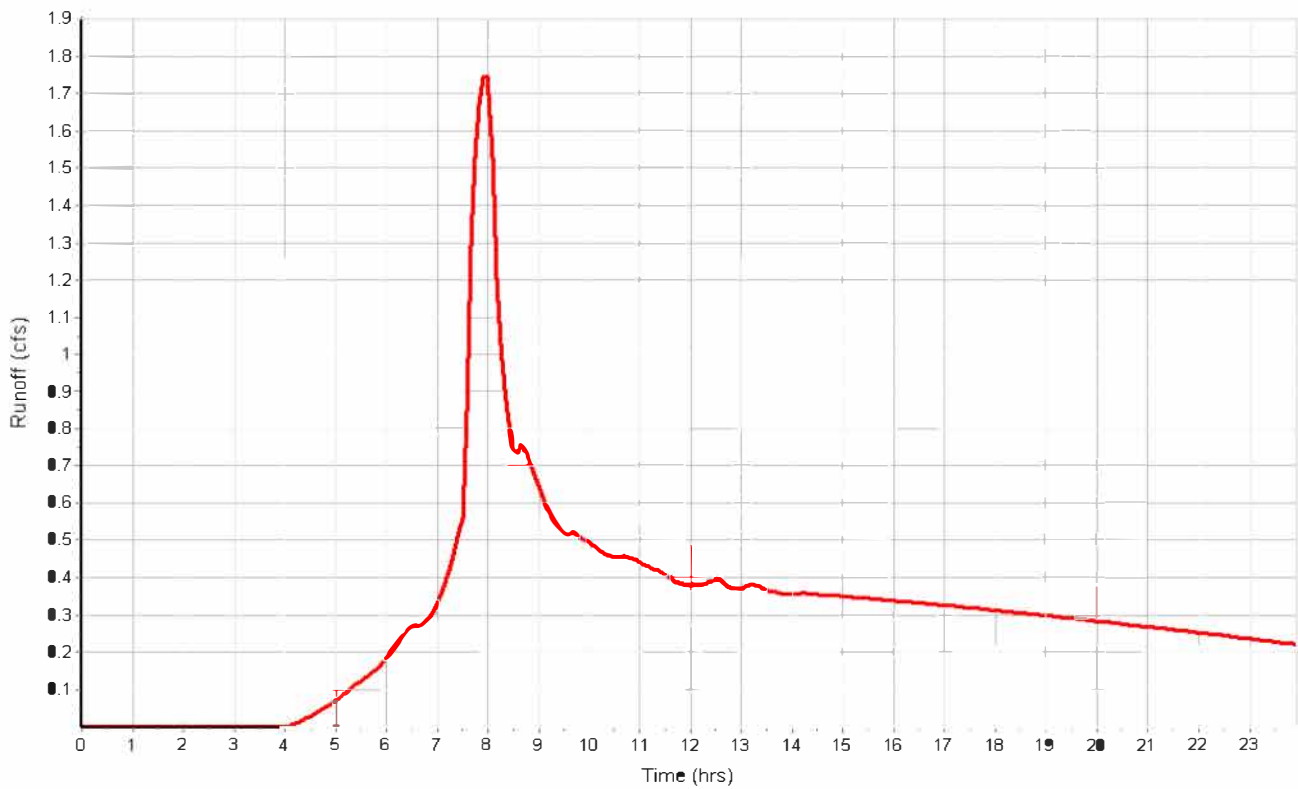
Total Rainfall (in) 5.10
Total Runoff (in) 2.74
Peak Runoff (cfs) 1.75
Weighted Curve Number 77.33
Time of Concentration (days hh:mm:ss) 0 00:08:49

Subbasin : {WTSH}.F

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.G

Input Data

Area (ac) 2.91
Peak Rate Factor 484.00
Weighted Curve Number 77.89
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	0.10	C	79.00
Paved parking & roofs	0.05	C	98.00
Woods & grass combination, Fair	1.39	C	76.00
50 - 75% grass cover, Fair	1.37	C	79.00
Composite Area & Weighted CN	2.91		77.89

Time of Concentration

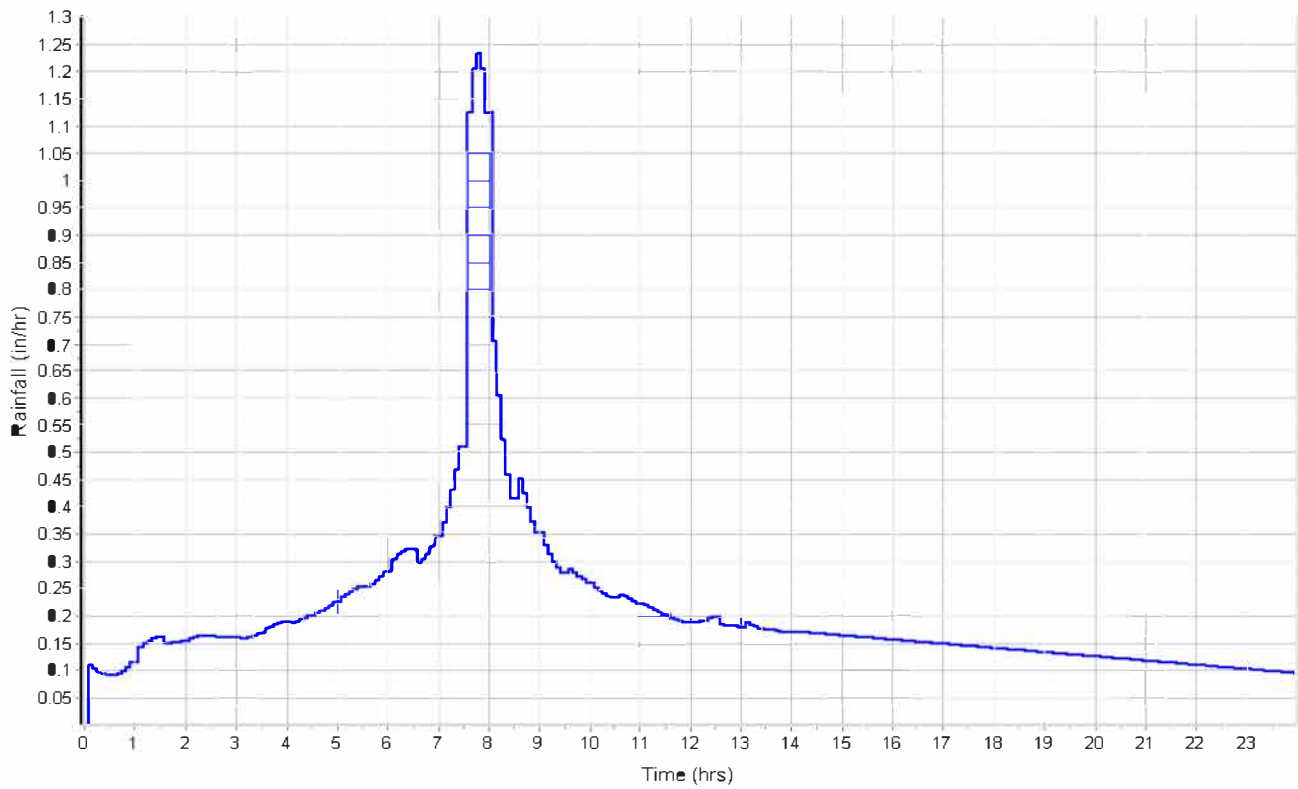
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.15	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	742	0.00	0.00
Slope (%) :	13.5	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.84	0.00	0.00
Computed Flow Time (min) :	6.72	0.00	0.00
Total TOC (min)	12.87		

Subbasin Runoff Results

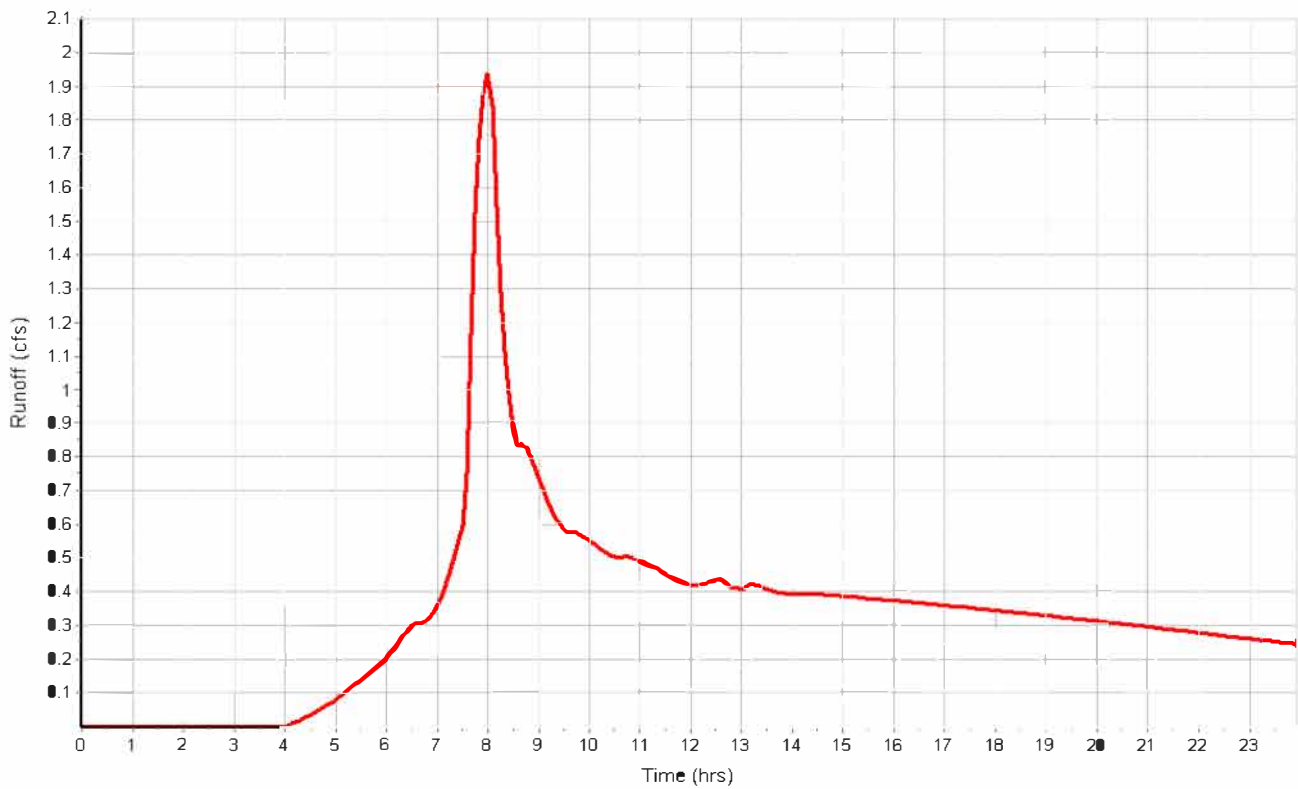
Total Rainfall (in) 5.10
Total Runoff (in) 2.79
Peak Runoff (cfs) 1.93
Weighted Curve Number 77.89
Time of Concentration (days hh:mm:ss) 0 00:12:52

Subbasin : {WTSH}.G

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name 1826-DRHY_PRE.SPF
Description
WINROD VINEYARD ECP
STORM AND SEWER ANALYSIS

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-20
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
YES

Analysis Options

Start Analysis On Jul 13, 2020 00:00:00
End Analysis On Jul 14, 2020 00:00:00
Start Reporting On Jul 13, 2020 00:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 8
Nodes..... 8
 Junctions 0
 Outfalls 8
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage	Data	Data Source	Rainfall	Rain	State	County	Return	Rainfall	Rainfall
ID		Source	ID	Type	Units			Period	Depth	Distribution
								(years)	(inches)	

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)			(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	{WTSH}.A1	25.12	484.00	79.58	7.78	5.37	134.87	34.49	0 00:10:20
2	{WTSH}.A2	3.57	484.00	76.12	7.78	4.97	17.75	4.49	0 00:08:36
3	{WTSH}.B	93.54	484.00	77.02	7.78	5.07	474.62	106.33	0 00:28:59
4	{WTSH}.C	54.14	484.00	76.00	7.78	4.96	268.37	62.21	0 00:24:03
5	{WTSH}.D	1.93	484.00	78.53	7.78	5.25	10.13	2.59	0 00:08:43
6	{WTSH}.E	4.90	484.00	76.63	7.78	5.03	24.64	6.18	0 00:12:06
7	{WTSH}.F	2.67	484.00	77.33	7.78	5.11	13.64	3.47	0 00:08:49
8	{WTSH}.G	2.91	484.00	77.89	7.78	5.17	15.06	3.79	0 00:12:52

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	A1	Outfall	0.00					0.00	0.00					
2	A2	Outfall	0.00					0.00	0.00					
3	B	Outfall	0.00					0.00	0.00					
4	C	Outfall	0.00					0.00	0.00					
5	D	Outfall	0.00					0.00	0.00					
6	E	Outfall	0.00					0.00	0.00					
7	F	Outfall	0.00					0.00	0.00					
8	G	Outfall	0.00					0.00	0.00					

Subbasin Hydrology**Subbasin : {WTSH}.A1****Input Data**

Area (ac) 25.12
 Peak Rate Factor 484.00
 Weighted Curve Number 79.58
 Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.23	C	98.00
Woods & grass combination, Fair	8.03	C	76.00
Woods & grass combination, Fair	5.13	D	82.00
50 - 75% grass cover, Fair	10.73	C	79.00
Composite Area & Weighted CN	25.12		79.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
 V = 20.3282 * (S_f^{0.5}) (paved surface)
 V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
 V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
 V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
 V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
 V = 5.0 * (S_f^{0.5}) (woodland surface)
 V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
 T_c = (L_f / V) / (3600 sec/hr)

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n
 R = A_q / W_p
 T_c = (L_f / V) / (3600 sec/hr)

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

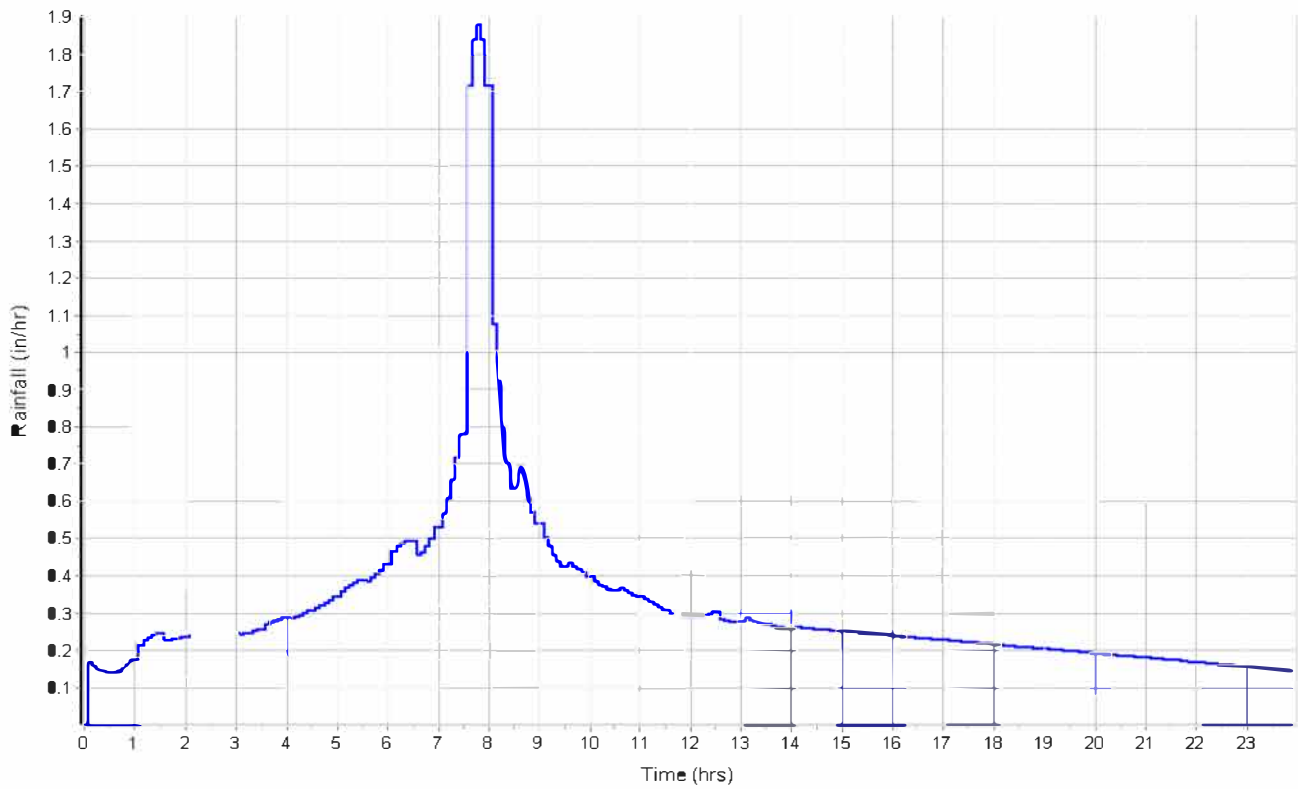
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.25	0.00	0.00
Computed Flow Time (min) :	6.54	0.00	0.00
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1499	0.00	0.00
Slope (%) :	16.7	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.59	0.00	0.00
Computed Flow Time (min) :	3.79	0.00	0.00
Total TOC (min)	10.34		

Subbasin Runoff Results

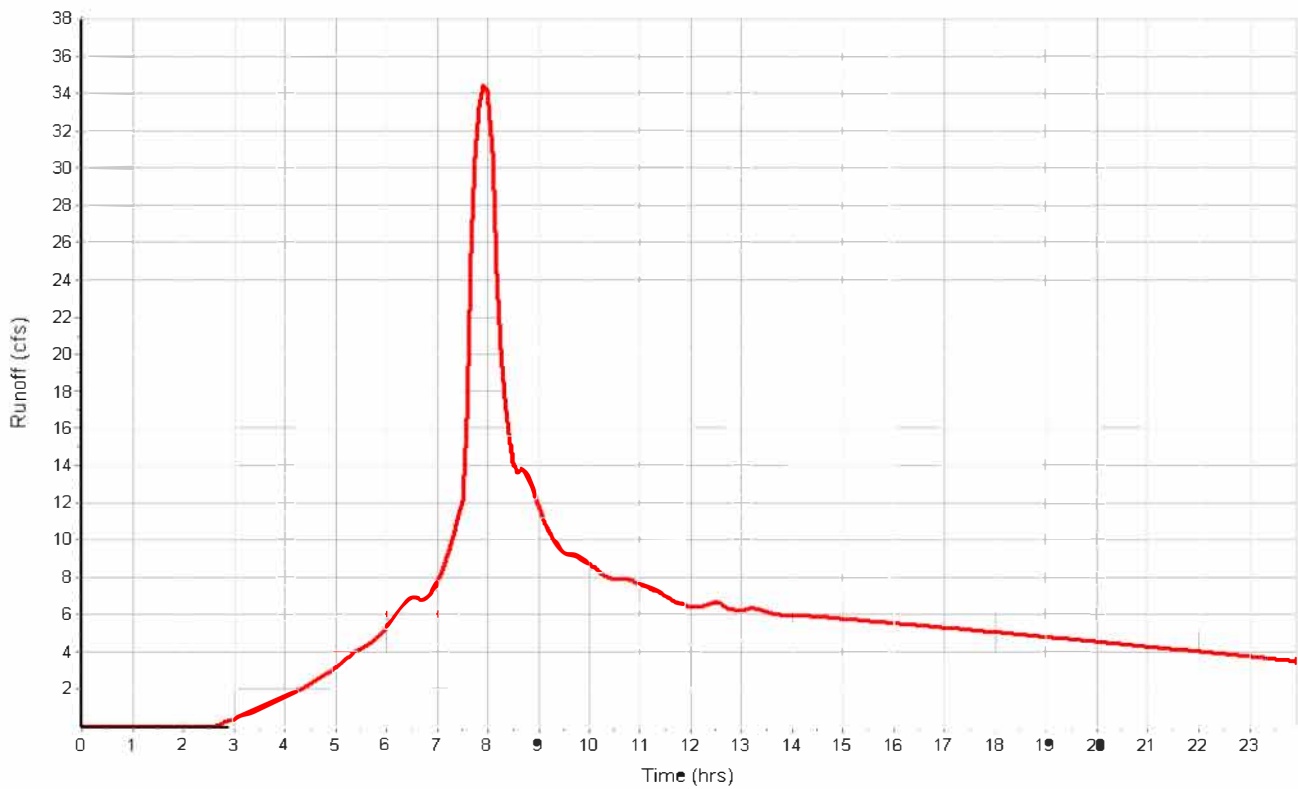
Total Rainfall (in)	7.78
Total Runoff (in)	5.37
Peak Runoff (cfs)	34.49
Weighted Curve Number	79.58
Time of Concentration (days hh:mm:ss)	0 00:10:20

Subbasin : {WTSH}.A1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.A2

Input Data

Area (ac) 3.57
Peak Rate Factor 484.00
Weighted Curve Number 76.12
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	3.43	C	76.00
50 - 75% grass cover, Fair	0.14	C	79.00
Composite Area & Weighted CN	3.57		76.12

Time of Concentration

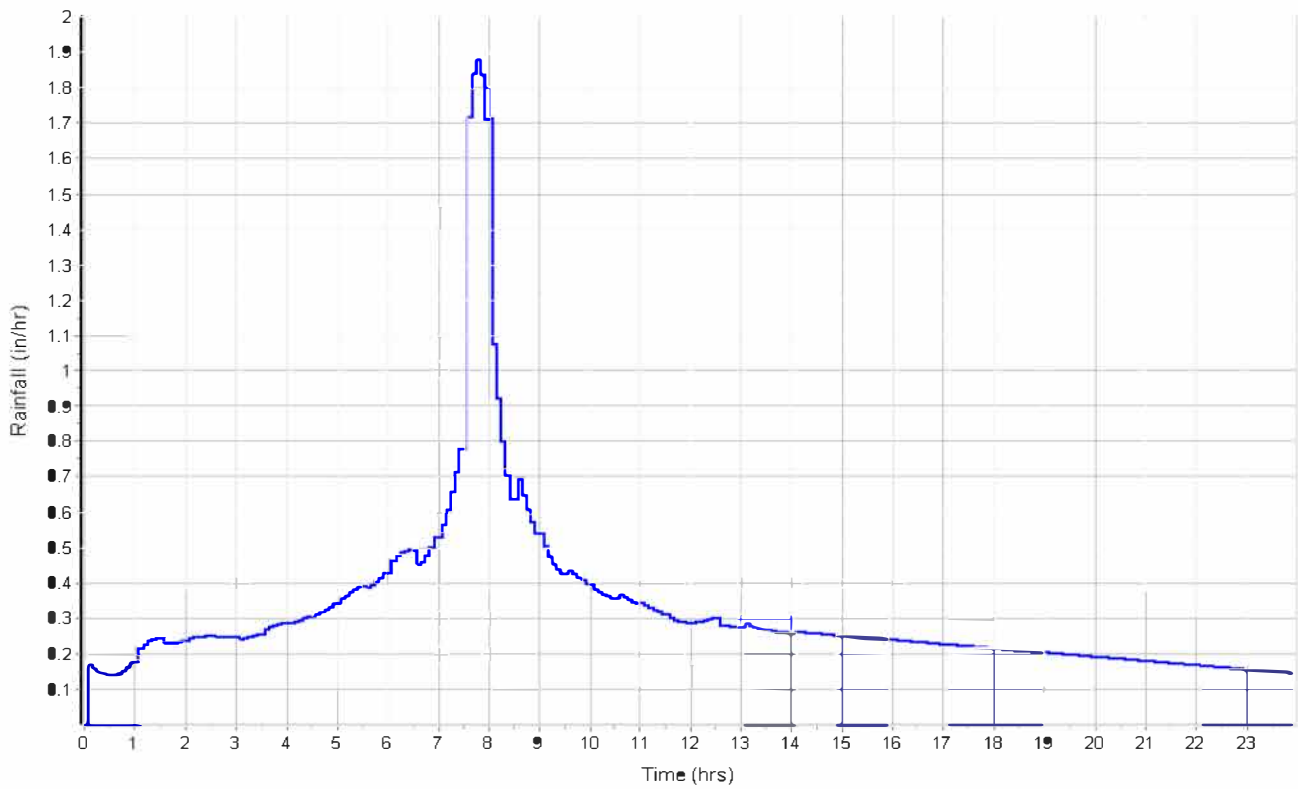
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	43	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.67	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	290	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.51	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	380	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	6.29	0.00	0.00
Computed Flow Time (min) :	1.01	0.00	0.00
Total TOC (min)	8.60		

Subbasin Runoff Results

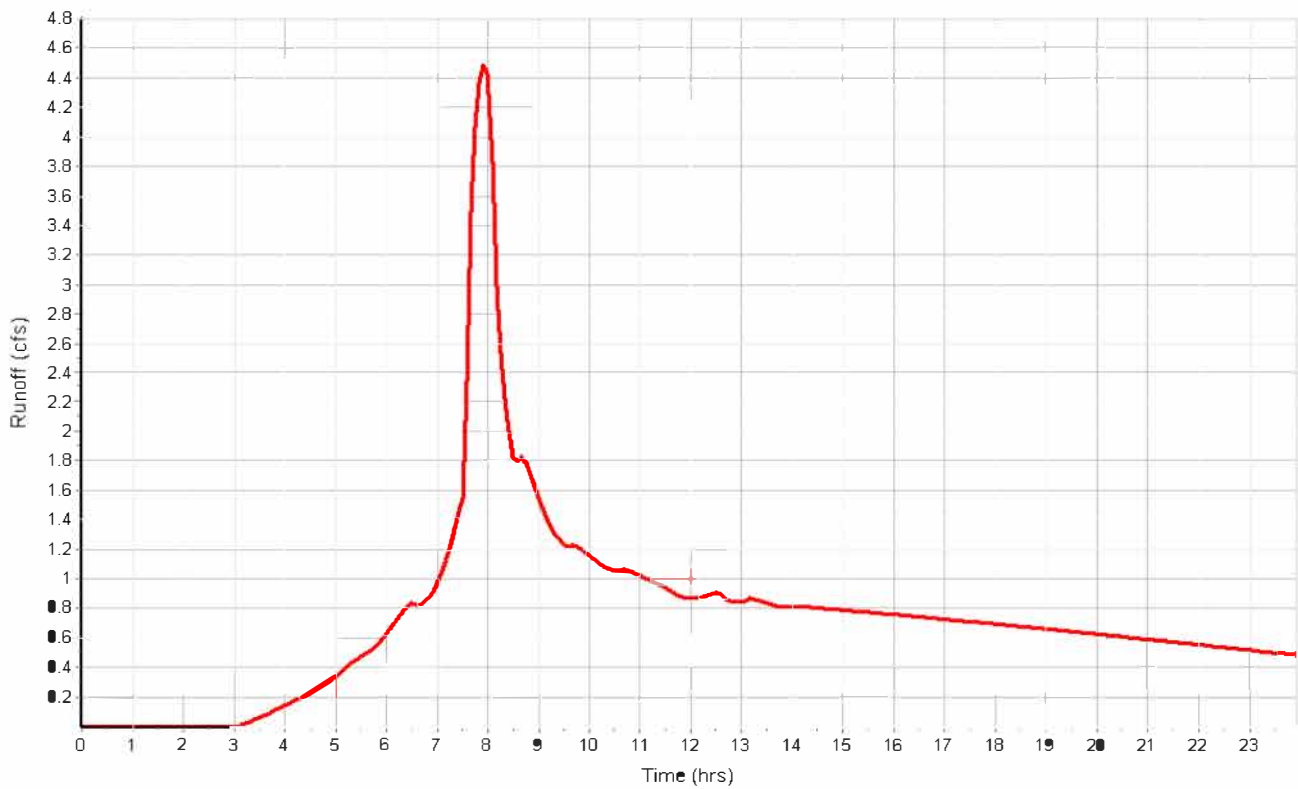
Total Rainfall (in) 7.78
Total Runoff (in) 4.97
Peak Runoff (cfs) 4.49
Weighted Curve Number 76.12
Time of Concentration (days hh:mm:ss) 0 00:08:36

Subbasin : {WTSH}.A2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.B

Input Data

Area (ac) 93.54
Peak Rate Factor 484.00
Weighted Curve Number 77.02
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.20	C	98.00
Woods & grass combination, Fair	78.03	C	76.00
Woods & grass combination, Fair	14.94	D	82.00
50 - 75% grass cover, Fair	0.37	C	79.00
Composite Area & Weighted CN	93.54		77.02

Time of Concentration

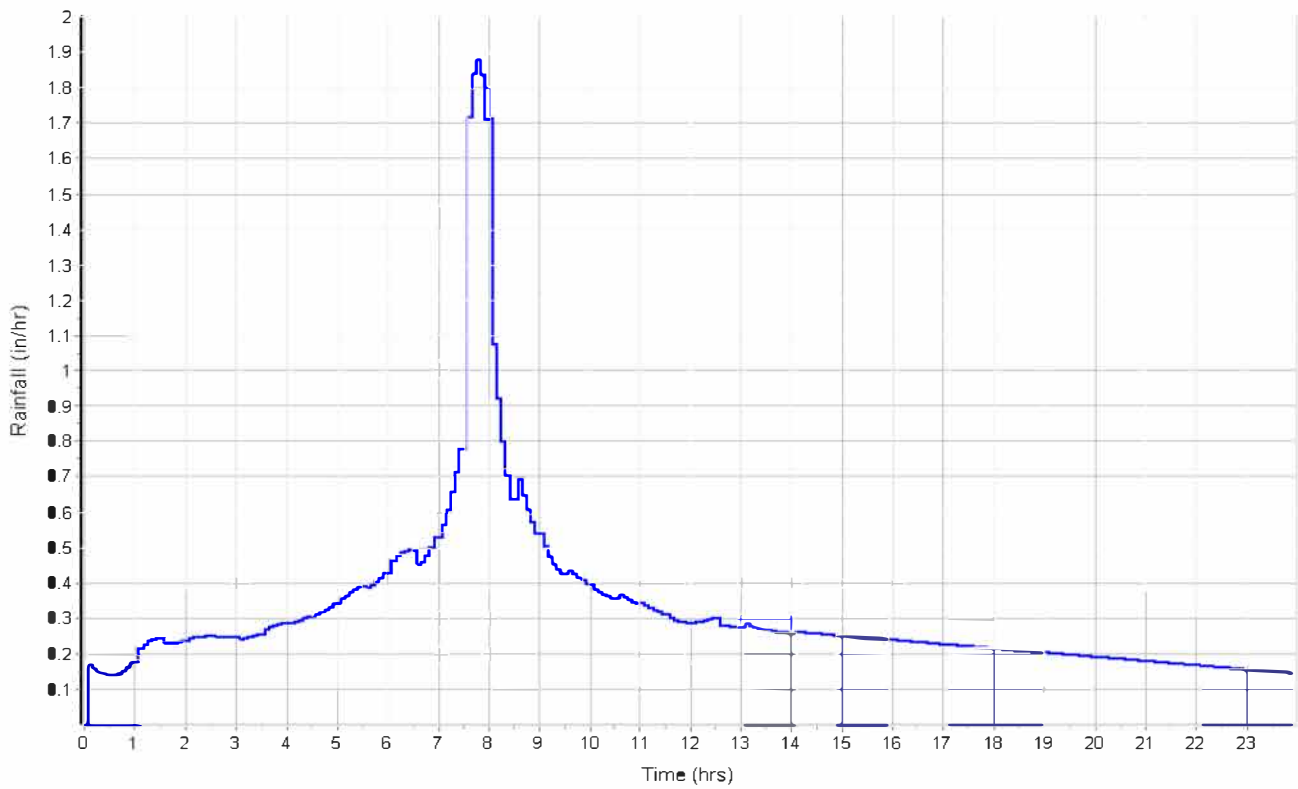
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	45	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	6.40	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	2154	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	8.12	0.00	0.00
Computed Flow Time (min) :	4.42	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.5	0.00	0.00
Flow Length (ft) :	2196	0.00	0.00
Channel Slope (%) :	7.2	0.00	0.00
Cross Section Area (ft²) :	60	0.00	0.00
Wetted Perimeter (ft) :	15	0.00	0.00
Velocity (ft/sec) :	2.01	0.00	0.00
Computed Flow Time (min) :	18.16	0.00	0.00
Total TOC (min)	28.99		

Subbasin Runoff Results

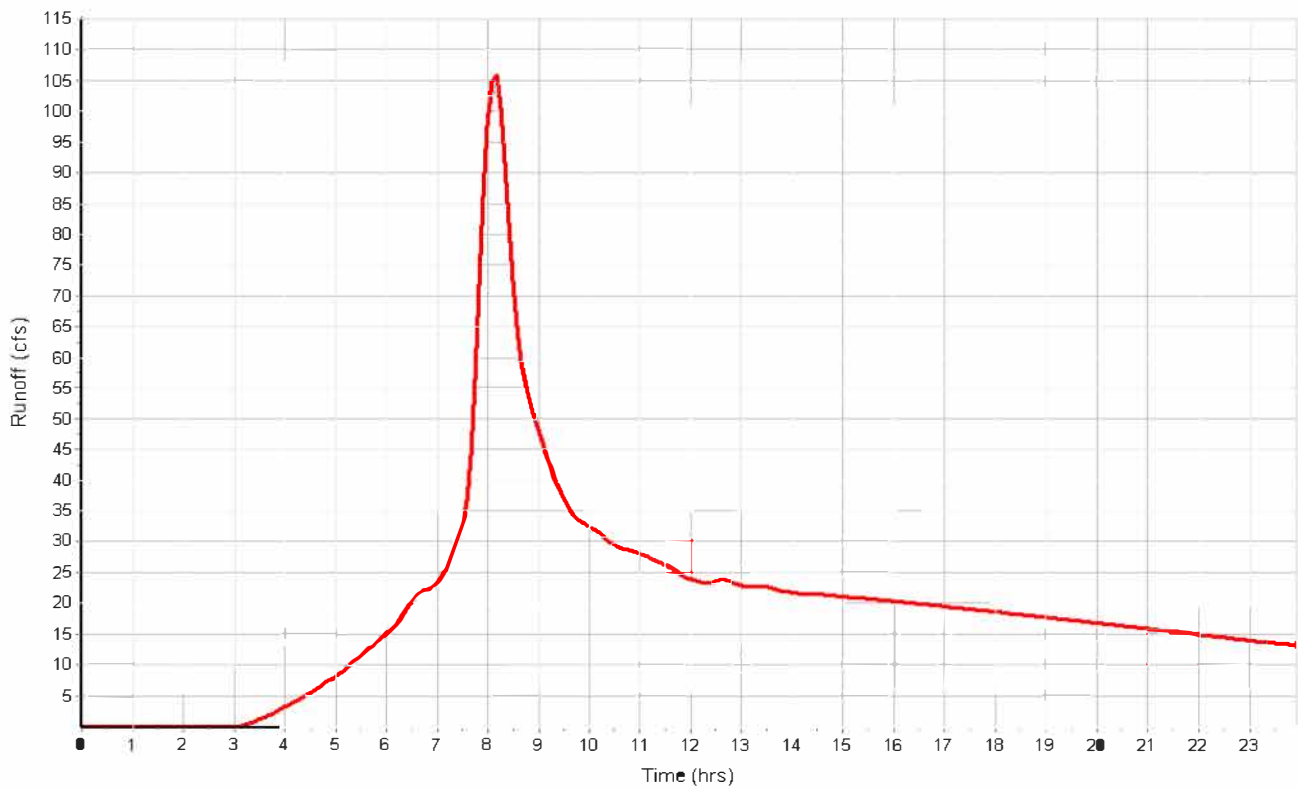
Total Rainfall (in) 7.78
Total Runoff (in) 5.07
Peak Runoff (cfs) 106.33
Weighted Curve Number 77.02
Time of Concentration (days hh:mm:ss) 0 00:28:59

Subbasin : {WTSH}.B

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.C

Input Data

Area (ac) 54.14
Peak Rate Factor 484.00
Weighted Curve Number 76.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	54.14	C	76.00
Composite Area & Weighted CN	54.14		76.00

Time of Concentration

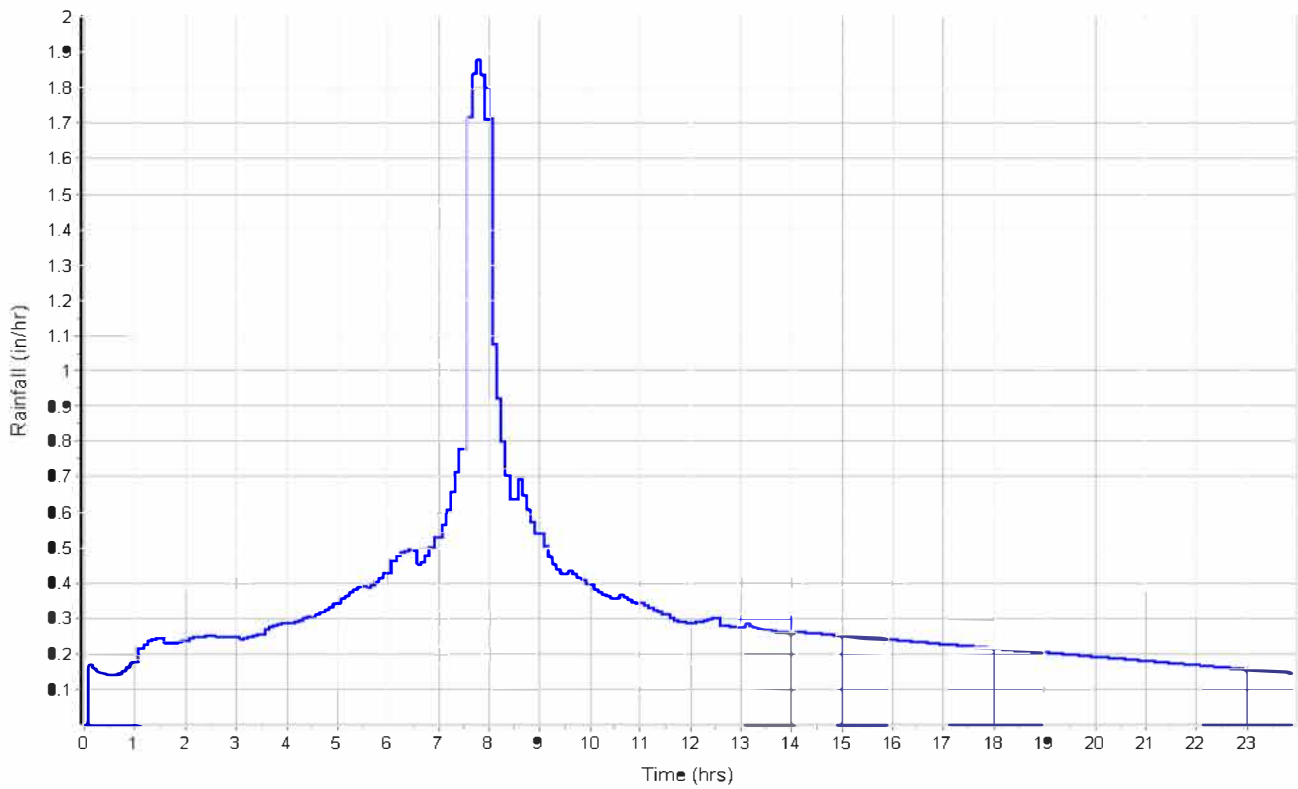
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.14	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1940	0.00	0.00
Slope (%) :	31.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.82	0.00	0.00
Computed Flow Time (min) :	11.47	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.50	0.00	0.00
Flow Length (ft) :	1445	0.00	0.00
Channel Slope (%) :	8.7	0.00	0.00
Cross Section Area (ft²) :	228	0.00	0.00
Wetted Perimeter (ft) :	26	0.00	0.00
Velocity (ft/sec) :	3.74	0.00	0.00
Computed Flow Time (min) :	6.44	0.00	0.00
Total TOC (min) 24.05			

Subbasin Runoff Results

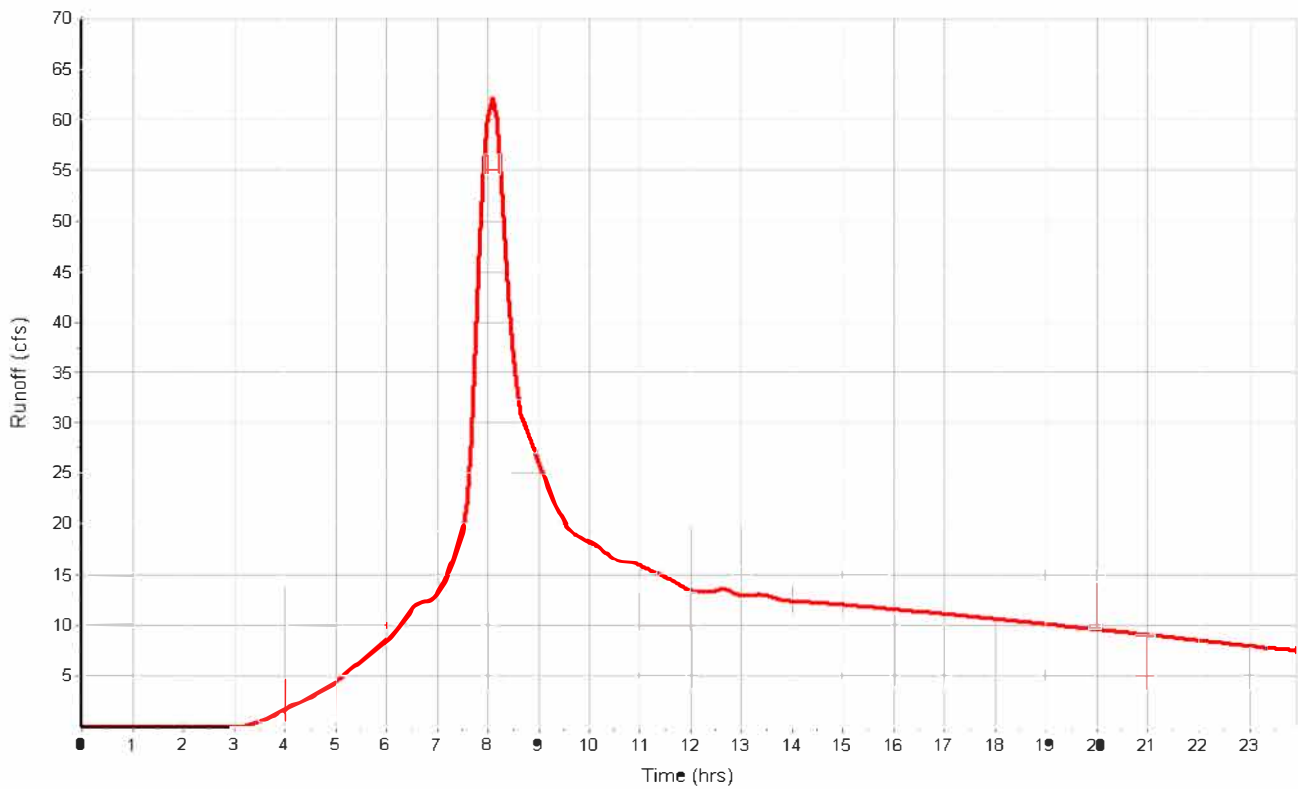
Total Rainfall (in) 7.78
Total Runoff (in) 4.96
Peak Runoff (cfs) 62.21
Weighted Curve Number 76.00
Time of Concentration (days hh:mm:ss) 0 00:24:03

Subbasin : {WTSH}.C

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.D

Input Data

Area (ac) 1.93
Peak Rate Factor 484.00
Weighted Curve Number 78.53
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.06	C	98.00
Woods & grass combination, Fair	0.68	C	76.00
50 - 75% grass cover, Fair	1.19	C	79.00
Composite Area & Weighted CN	1.93		78.53

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	7.04	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	244	0.00	0.00
Slope (%) :	7.4	0.00	0.00
Surface Type :	Bare & untilled	Unpaved	Unpaved
Velocity (ft/sec) :	2.72	0.00	0.00
Computed Flow Time (min) :	1.50	0.00	0.00

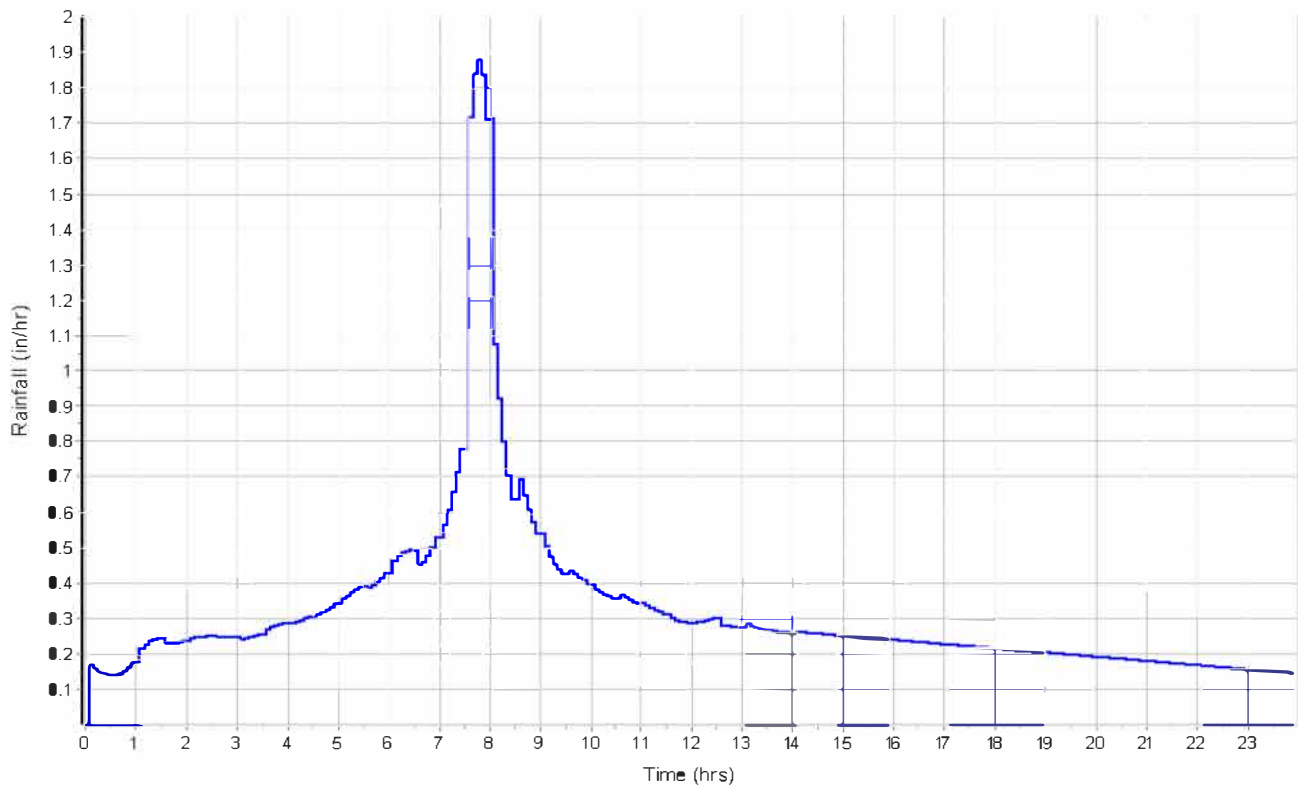
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	52	0.00	0.00
Channel Slope (%) :	2.2	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	4.79	0.00	0.00
Computed Flow Time (min) :	0.18	0.00	0.00
Total TOC (min)	8.72		

Subbasin Runoff Results

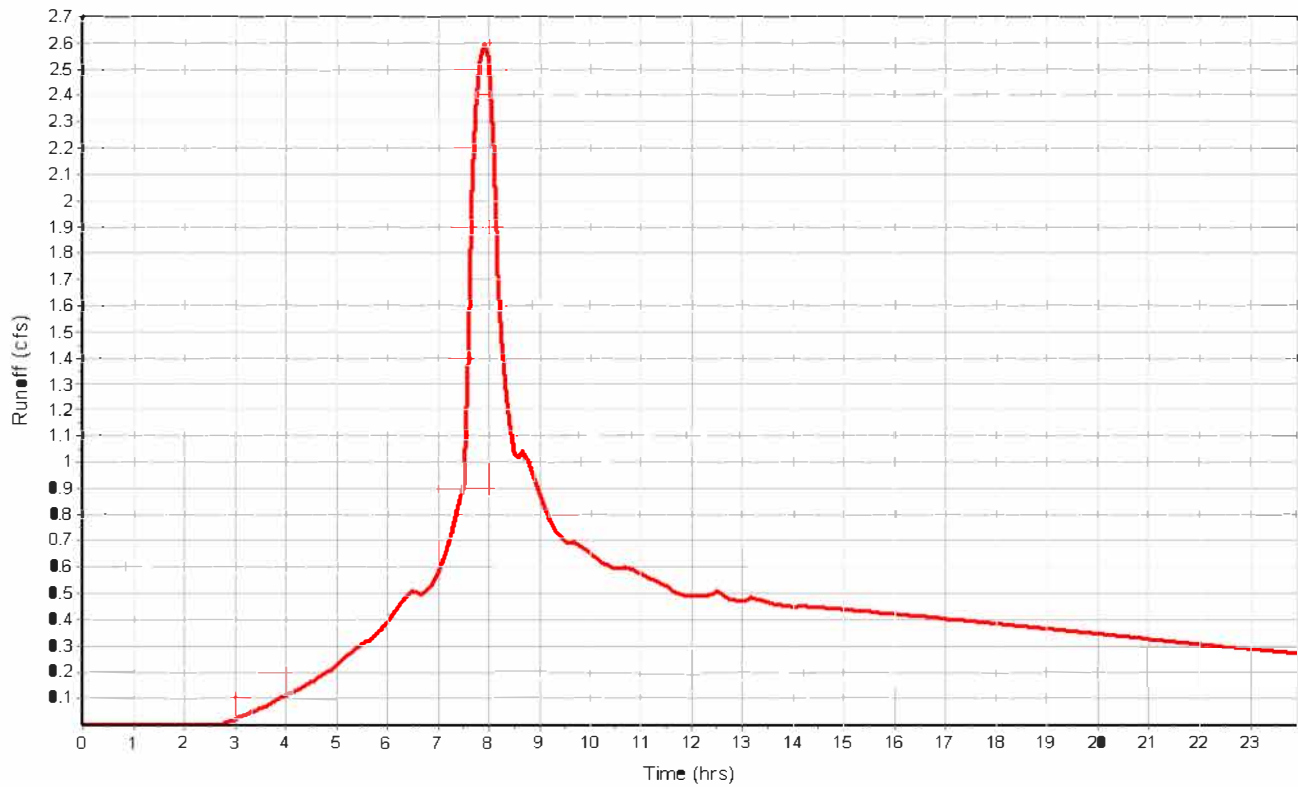
Total Rainfall (in) 7.78
Total Runoff (in) 5.25
Peak Runoff (cfs) 2.59
Weighted Curve Number 78.53
Time of Concentration (days hh:mm:ss) 0 00:08:43

Subbasin : {WTSH}.D

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.E

Input Data

Area (ac) 4.90
Peak Rate Factor 484.00
Weighted Curve Number 76.63
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.10	C	98.00
Woods & grass combination, Fair	4.50	C	76.00
50 - 75% grass cover, Fair	0.30	C	79.00
Composite Area & Weighted CN	4.90		76.63

Time of Concentration

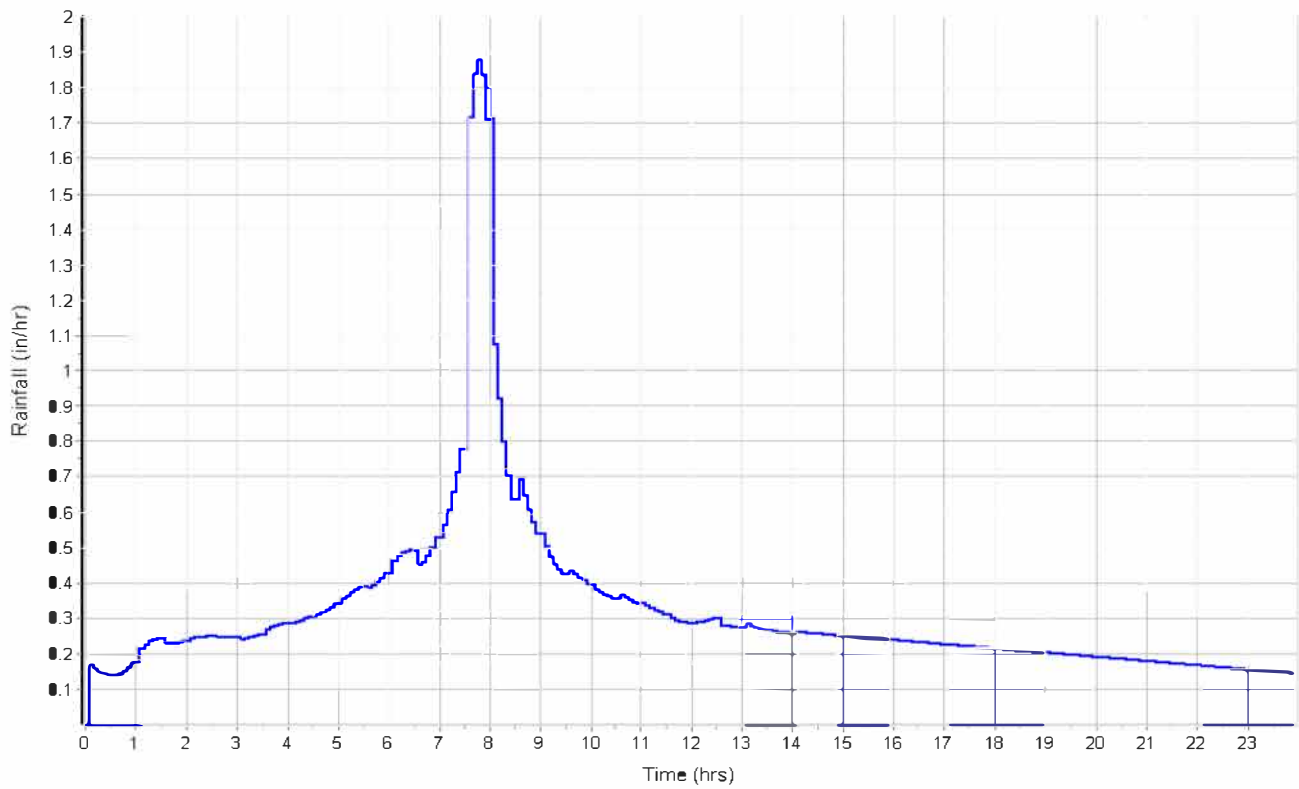
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	7.41	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	321	0.00	0.00
Slope (%) :	23	0.00	0.00
Surface Type :	Forest	Unpaved	Unpaved
Velocity (ft/sec) :	1.20	0.00	0.00
Computed Flow Time (min) :	4.46	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	161	0.00	0.00
Channel Slope (%) :	12	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	11.18	0.00	0.00
Computed Flow Time (min) :	0.24	0.00	0.00
Total TOC (min)	12.11		

Subbasin Runoff Results

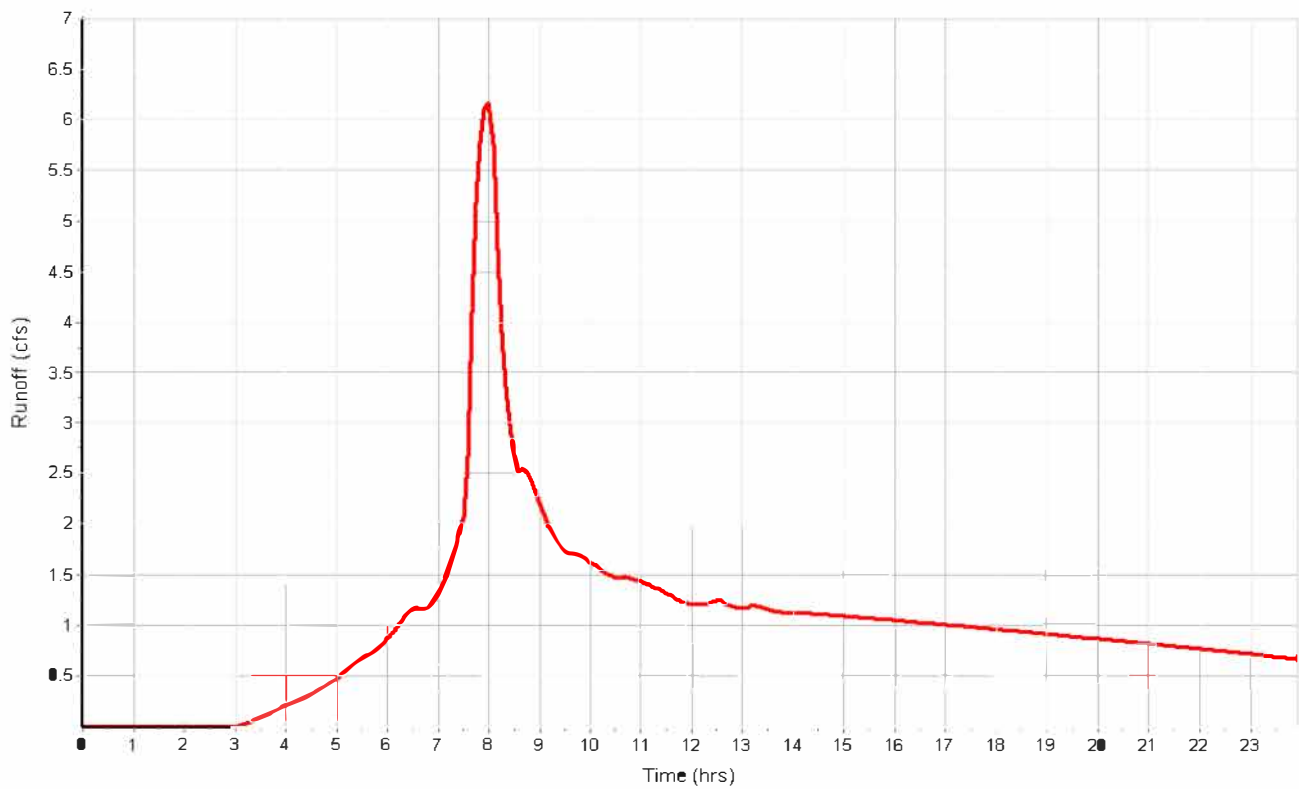
Total Rainfall (in) 7.78
Total Runoff (in) 5.03
Peak Runoff (cfs) 6.18
Weighted Curve Number 76.63
Time of Concentration (days hh:mm:ss) 0 00:12:07

Subbasin : {WTSH}.E

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.F

Input Data

Area (ac) 2.67
Peak Rate Factor 484.00
Weighted Curve Number 77.33
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.07	C	98.00
Woods & grass combination, Fair	1.93	C	76.00
50 - 75% grass cover, Fair	0.67	C	79.00
Composite Area & Weighted CN	2.67		77.33

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	40	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.83	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	318	0.00	0.00
Slope (%) :	22	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.35	0.00	0.00
Computed Flow Time (min) :	2.26	0.00	0.00

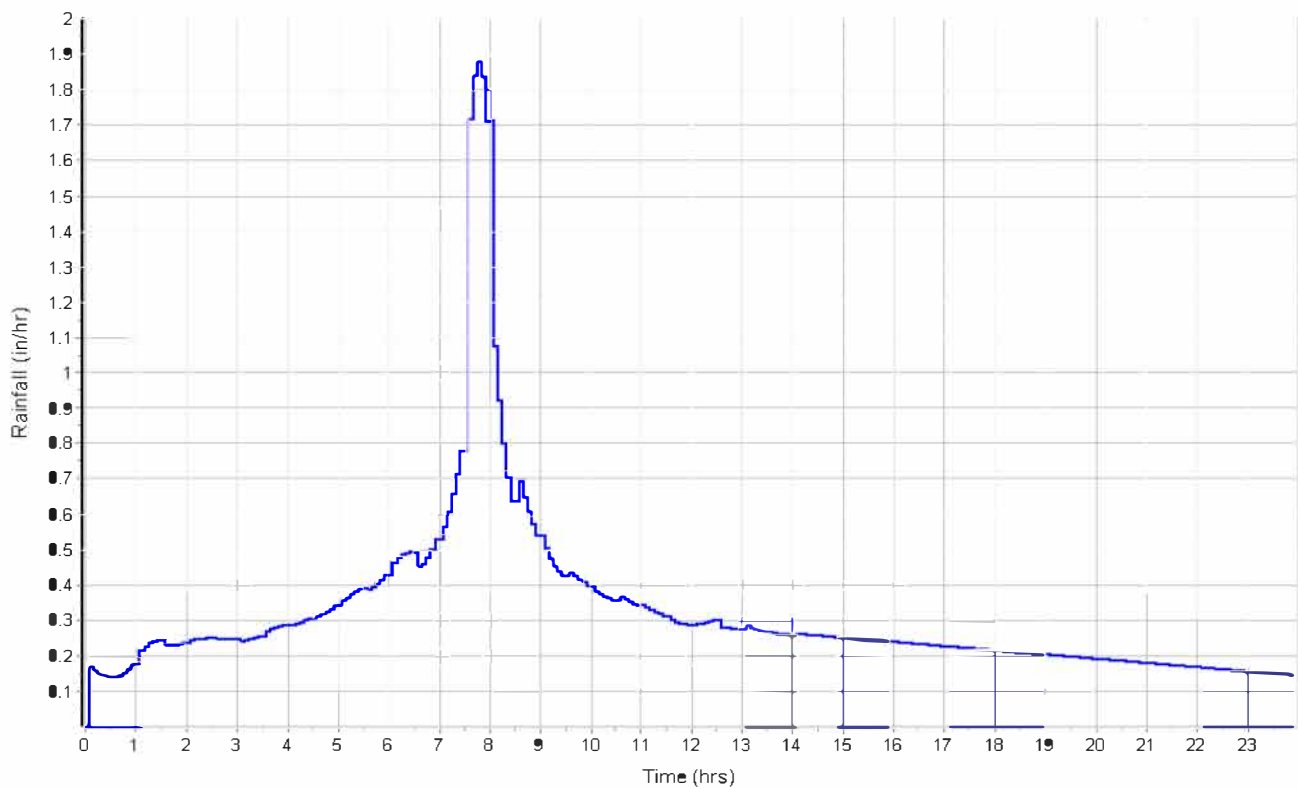
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	325	0.00	0.00
Channel Slope (%) :	5.3	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	7.43	0.00	0.00
Computed Flow Time (min) :	0.73	0.00	0.00
Total TOC (min)	8.82		

Subbasin Runoff Results

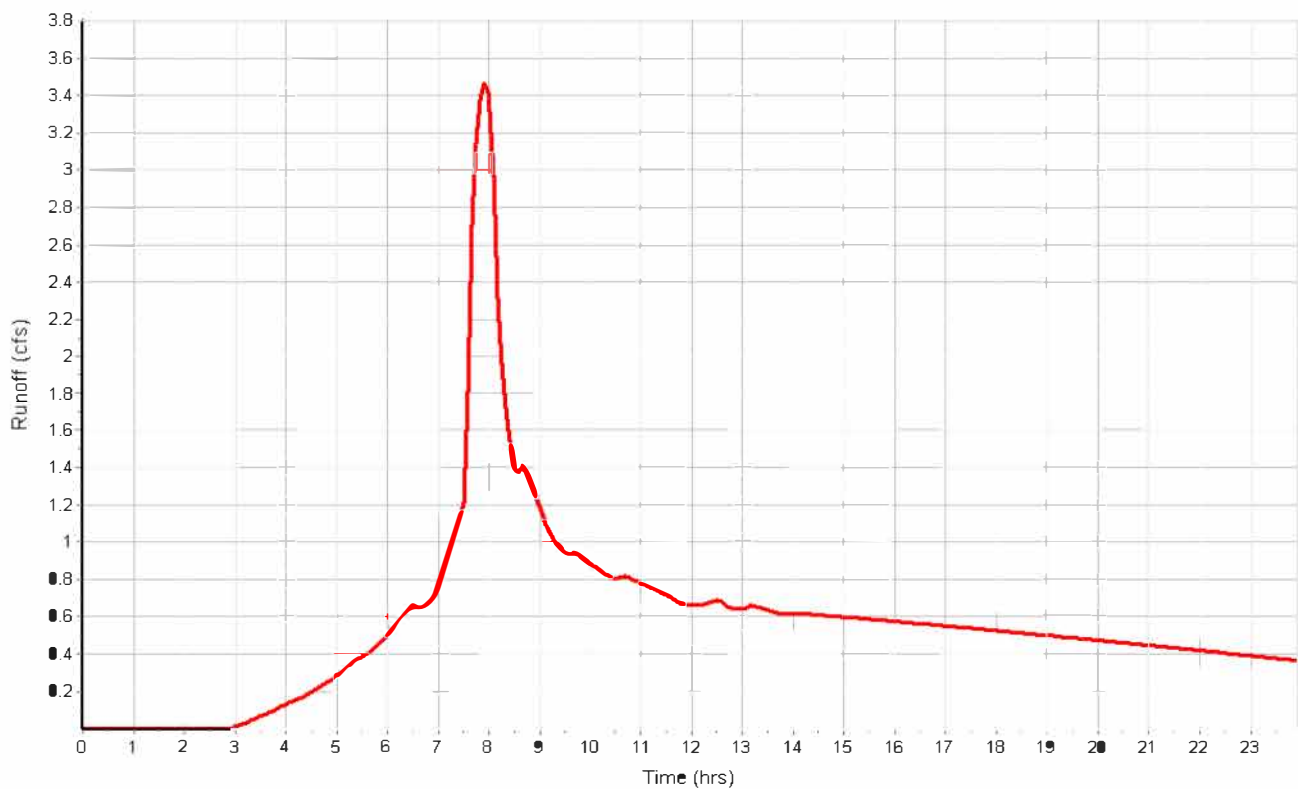
Total Rainfall (in) 7.78
Total Runoff (in) 5.11
Peak Runoff (cfs) 3.47
Weighted Curve Number 77.33
Time of Concentration (days hh:mm:ss) 0 00:08:49

Subbasin : {WTSH}.F

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.G

Input Data

Area (ac) 2.91
Peak Rate Factor 484.00
Weighted Curve Number 77.89
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	0.10	C	79.00
Paved parking & roofs	0.05	C	98.00
Woods & grass combination, Fair	1.39	C	76.00
50 - 75% grass cover, Fair	1.37	C	79.00
Composite Area & Weighted CN	2.91		77.89

Time of Concentration

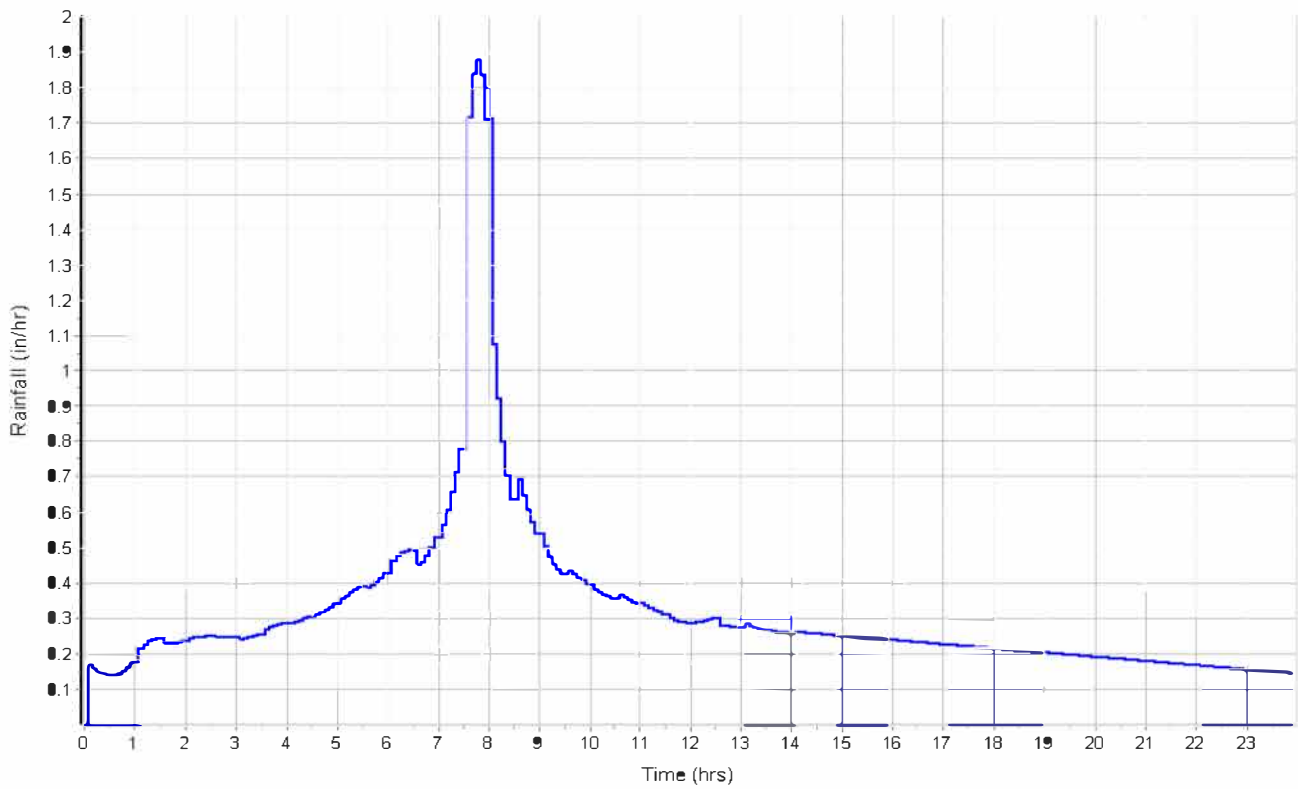
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.15	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	742	0.00	0.00
Slope (%) :	13.5	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.84	0.00	0.00
Computed Flow Time (min) :	6.72	0.00	0.00
Total TOC (min)	12.87		

Subbasin Runoff Results

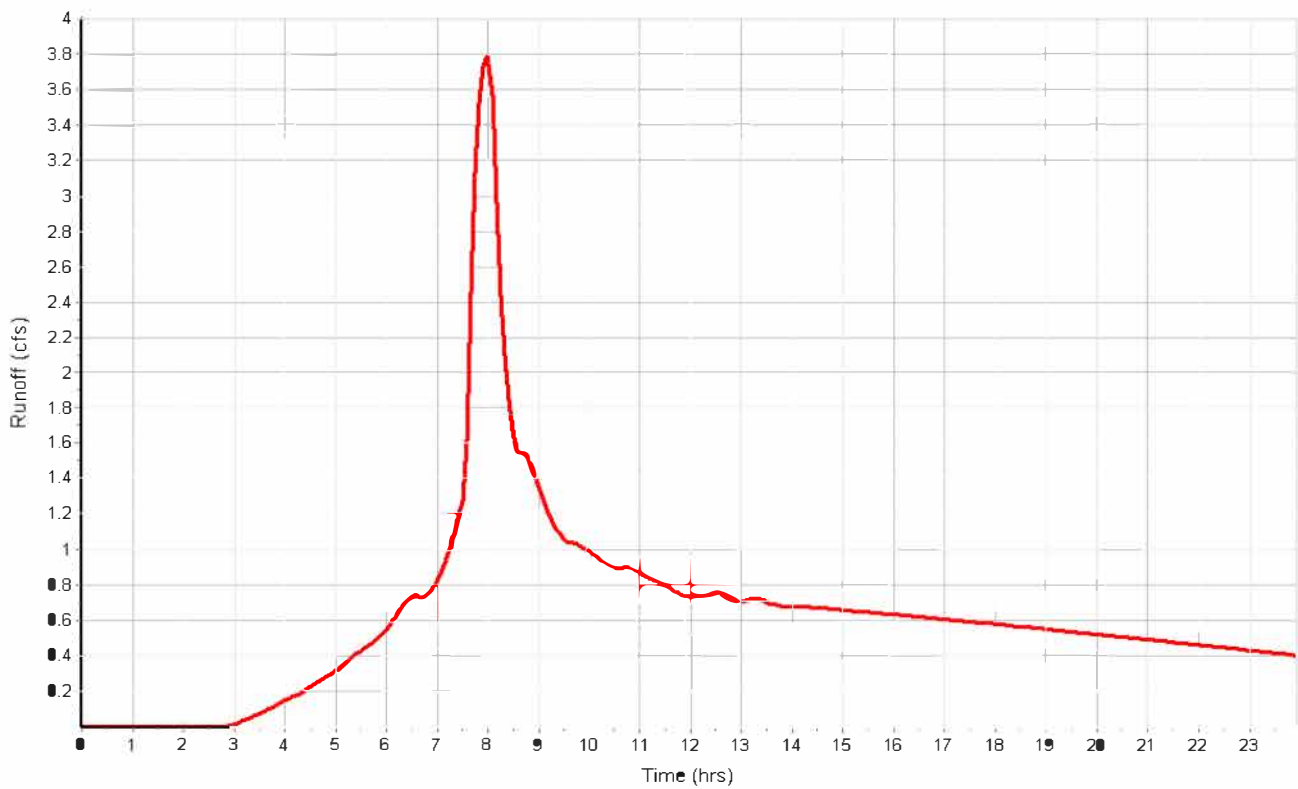
Total Rainfall (in) 7.78
Total Runoff (in) 5.17
Peak Runoff (cfs) 3.79
Weighted Curve Number 77.89
Time of Concentration (days hh:mm:ss) 0 00:12:52

Subbasin : {WTSH}.G

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name 1826-DRHY_PRE.SPF
Description
WINROD VINEYARD ECP
STORM AND SEWER ANALYSIS

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-20
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
YES

Analysis Options

Start Analysis On Jul 13, 2020 00:00:00
End Analysis On Jul 14, 2020 00:00:00
Start Reporting On Jul 13, 2020 00:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 8
Nodes..... 8
 Junctions 0
 Outfalls 8
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage	Data	Data Source	Rainfall	Rain	State	County	Return	Rainfall	Rainfall
ID		Source	ID	Type	Units			Period	Depth	Distribution
								(years)	(inches)	

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)			(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	{WTSH}.A1	25.12	484.00	79.58	10.69	8.12	204.05	52.86	0 00:10:20
2	{WTSH}.A2	3.57	484.00	76.12	10.69	7.67	27.37	7.08	0 00:08:36
3	{WTSH}.B	93.54	484.00	77.02	10.69	7.79	728.21	167.15	0 00:28:59
4	{WTSH}.C	54.14	484.00	76.00	10.69	7.65	414.17	98.62	0 00:24:03
5	{WTSH}.D	1.93	484.00	78.53	10.69	7.99	15.41	4.01	0 00:08:43
6	{WTSH}.E	4.90	484.00	76.63	10.69	7.73	37.90	9.71	0 00:12:06
7	{WTSH}.F	2.67	484.00	77.33	10.69	7.83	20.90	5.41	0 00:08:49
8	{WTSH}.G	2.91	484.00	77.89	10.69	7.90	22.99	5.89	0 00:12:52

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	A1	Outfall	0.00					0.00	0.00					
2	A2	Outfall	0.00					0.00	0.00					
3	B	Outfall	0.00					0.00	0.00					
4	C	Outfall	0.00					0.00	0.00					
5	D	Outfall	0.00					0.00	0.00					
6	E	Outfall	0.00					0.00	0.00					
7	F	Outfall	0.00					0.00	0.00					
8	G	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : {WTSH}.A1

Input Data

Area (ac) 25.12
Peak Rate Factor 484.00
Weighted Curve Number 79.58
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.23	C	98.00
Woods & grass combination, Fair	8.03	C	76.00
Woods & grass combination, Fair	5.13	D	82.00
50 - 75% grass cover, Fair	10.73	C	79.00
Composite Area & Weighted CN	25.12		79.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
n = Manning's roughness
L_f = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
V = 20.3282 * (S_f^{0.5}) (paved surface)
V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
V = 5.0 * (S_f^{0.5}) (woodland surface)
V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
T_c = (L_f / V) / (3600 sec/hr)

Where:

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n
R = A_q / W_p
T_c = (L_f / V) / (3600 sec/hr)

Where :

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
R = Hydraulic Radius (ft)
A_q = Flow Area (ft²)
W_p = Wetted Perimeter (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)
n = Manning's roughness

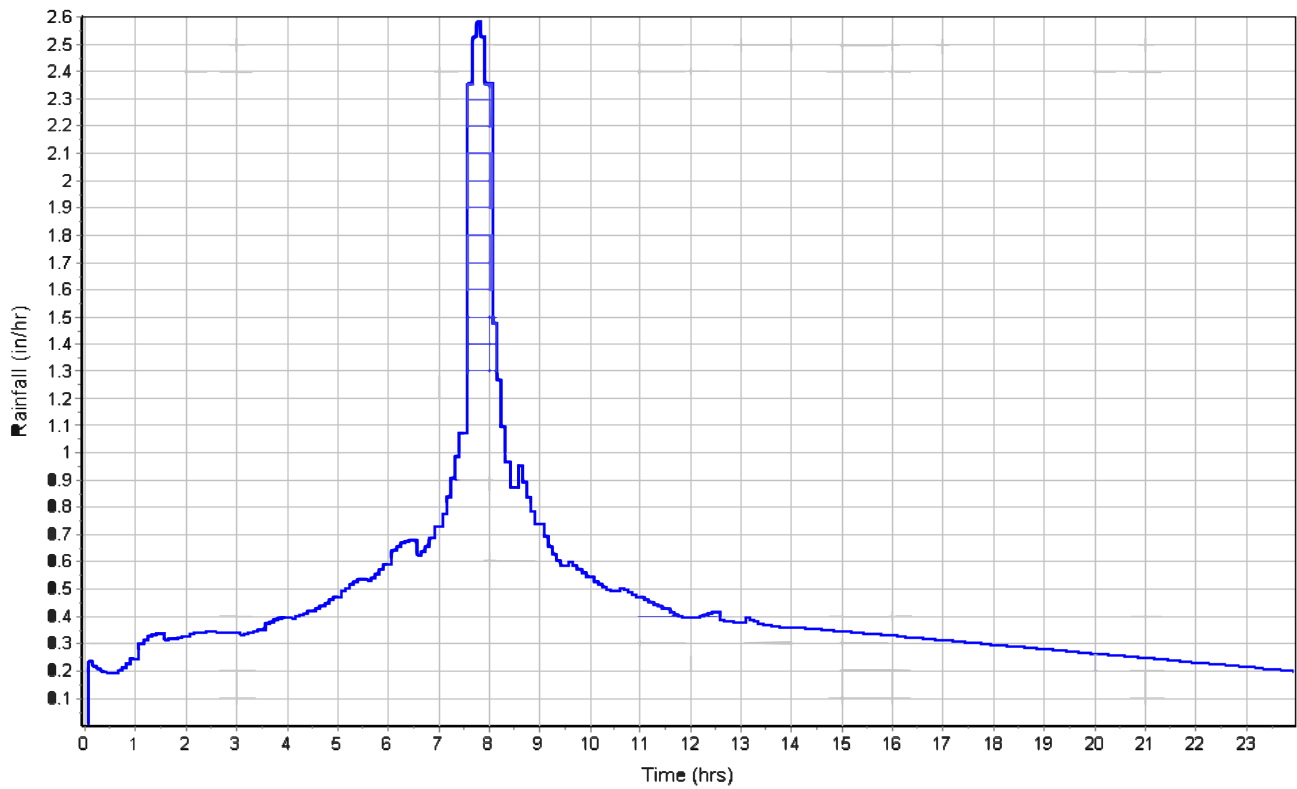
Sheet Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.25	0.00	0.00
Computed Flow Time (min) :	6.54	0.00	0.00
Shallow Concentrated Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Flow Length (ft) :	1499	0.00	0.00
Slope (%) :	16.7	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.59	0.00	0.00
Computed Flow Time (min) :	3.79	0.00	0.00
Total TOC (min)	10.34		

Subbasin Runoff Results

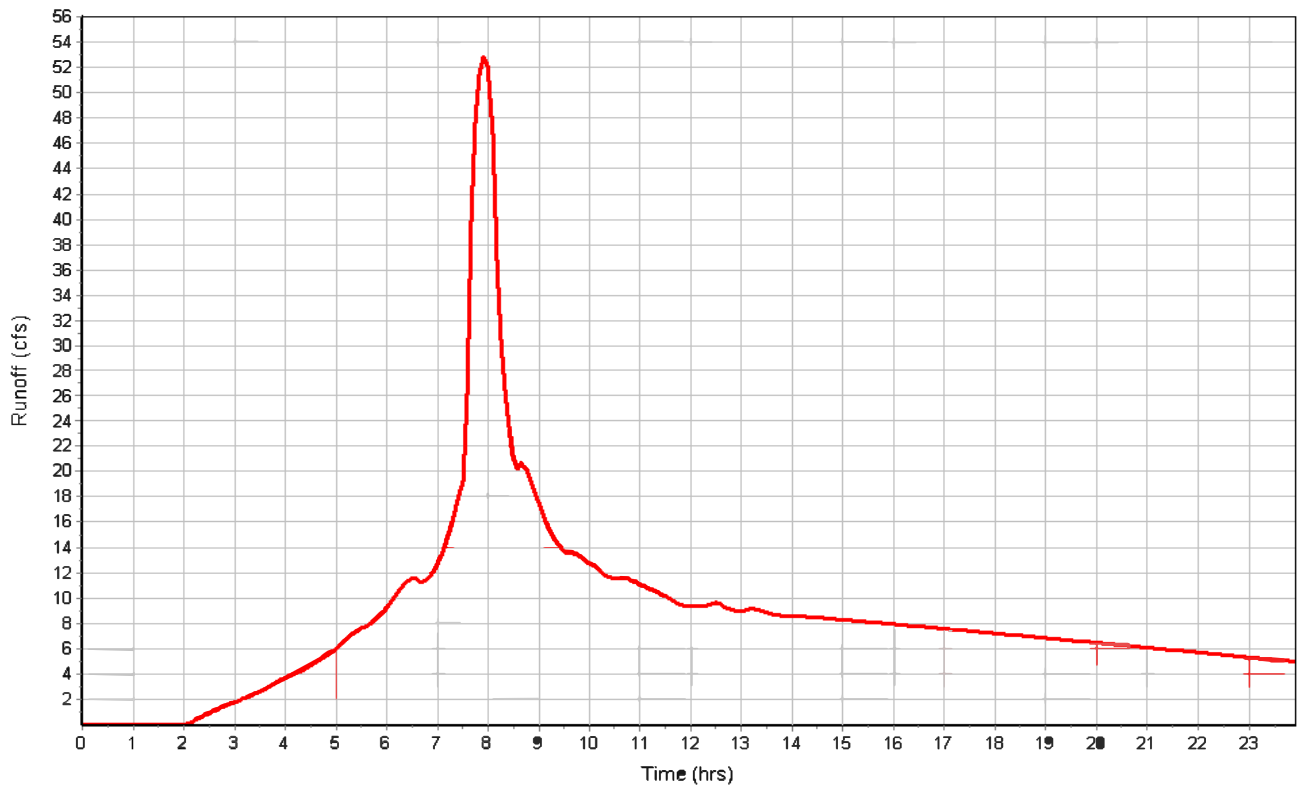
Total Rainfall (in)	10.69
Total Runoff (in)	8.12
Peak Runoff (cfs)	52.86
Weighted Curve Number	79.58
Time of Concentration (days hh:mm:ss)	0 00:10:20

Subbasin : {WTSH}.A1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.A2

Input Data

Area (ac) 3.57
Peak Rate Factor 484.00
Weighted Curve Number 76.12
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	3.43	C	76.00
50 - 75% grass cover, Fair	0.14	C	79.00
Composite Area & Weighted CN	3.57		76.12

Time of Concentration

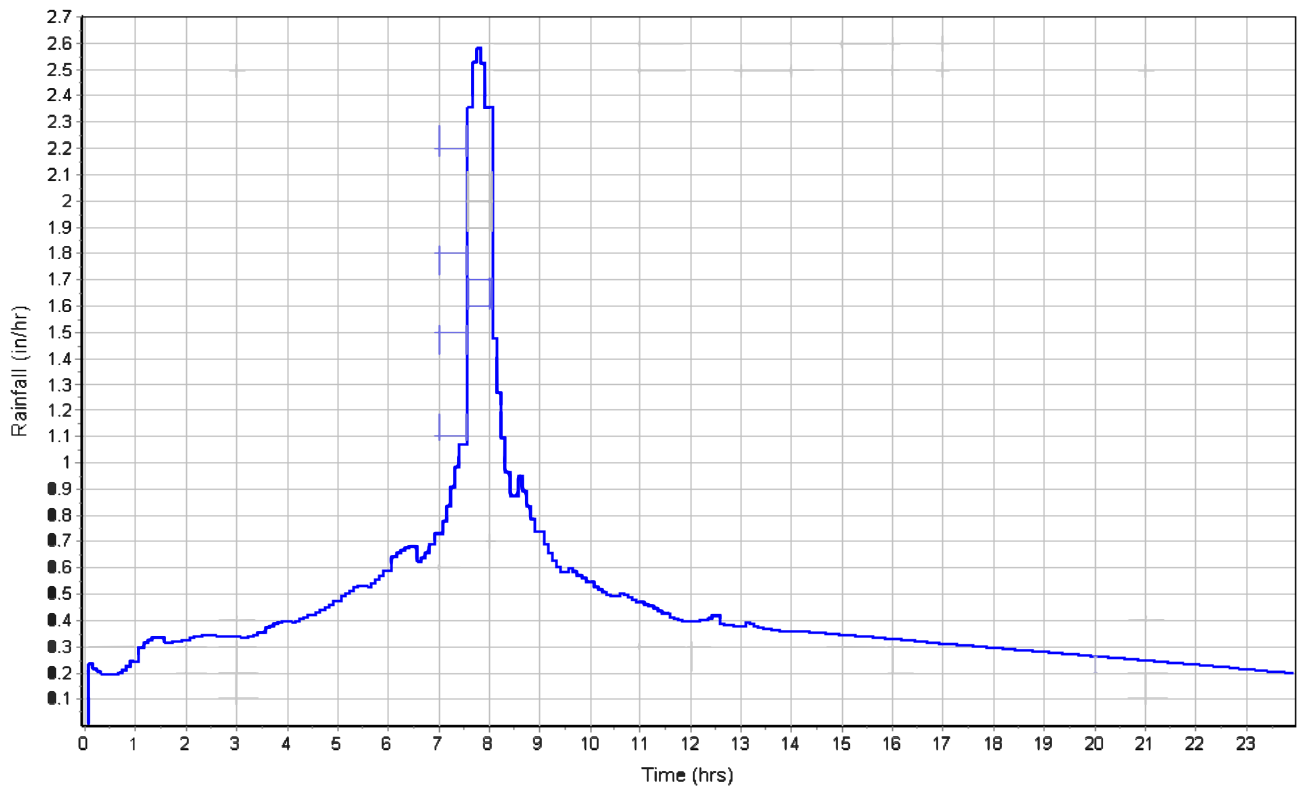
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	43	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.67	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	290	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.51	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	380	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	6.29	0.00	0.00
Computed Flow Time (min) :	1.01	0.00	0.00
Total TOC (min)	8.60		

Subbasin Runoff Results

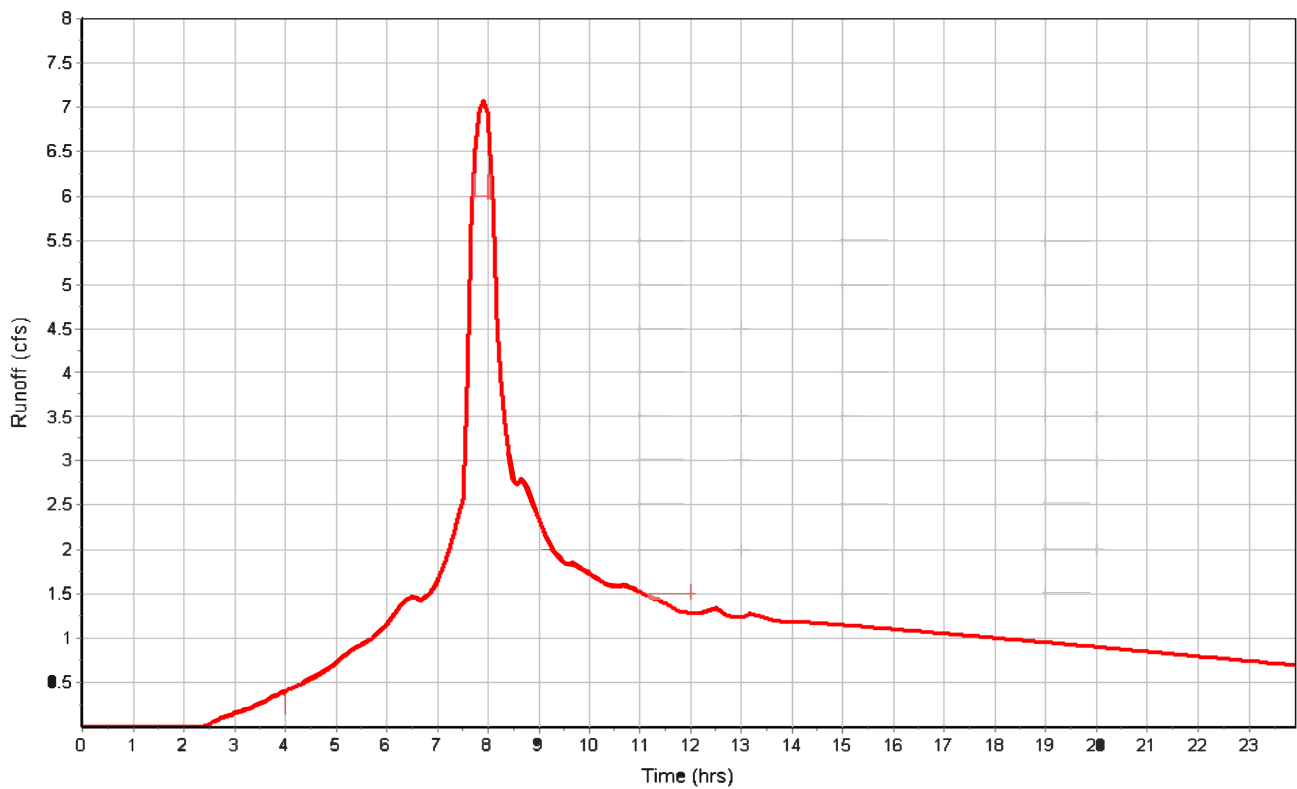
Total Rainfall (in) 10.69
Total Runoff (in) 7.67
Peak Runoff (cfs) 7.08
Weighted Curve Number 76.12
Time of Concentration (days hh:mm:ss) 0 00:08:36

Subbasin : {WTSH}.A2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.B

Input Data

Area (ac) 93.54
Peak Rate Factor 484.00
Weighted Curve Number 77.02
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.20	C	98.00
Woods & grass combination, Fair	78.03	C	76.00
Woods & grass combination, Fair	14.94	D	82.00
50 - 75% grass cover, Fair	0.37	C	79.00
Composite Area & Weighted CN	93.54		77.02

Time of Concentration

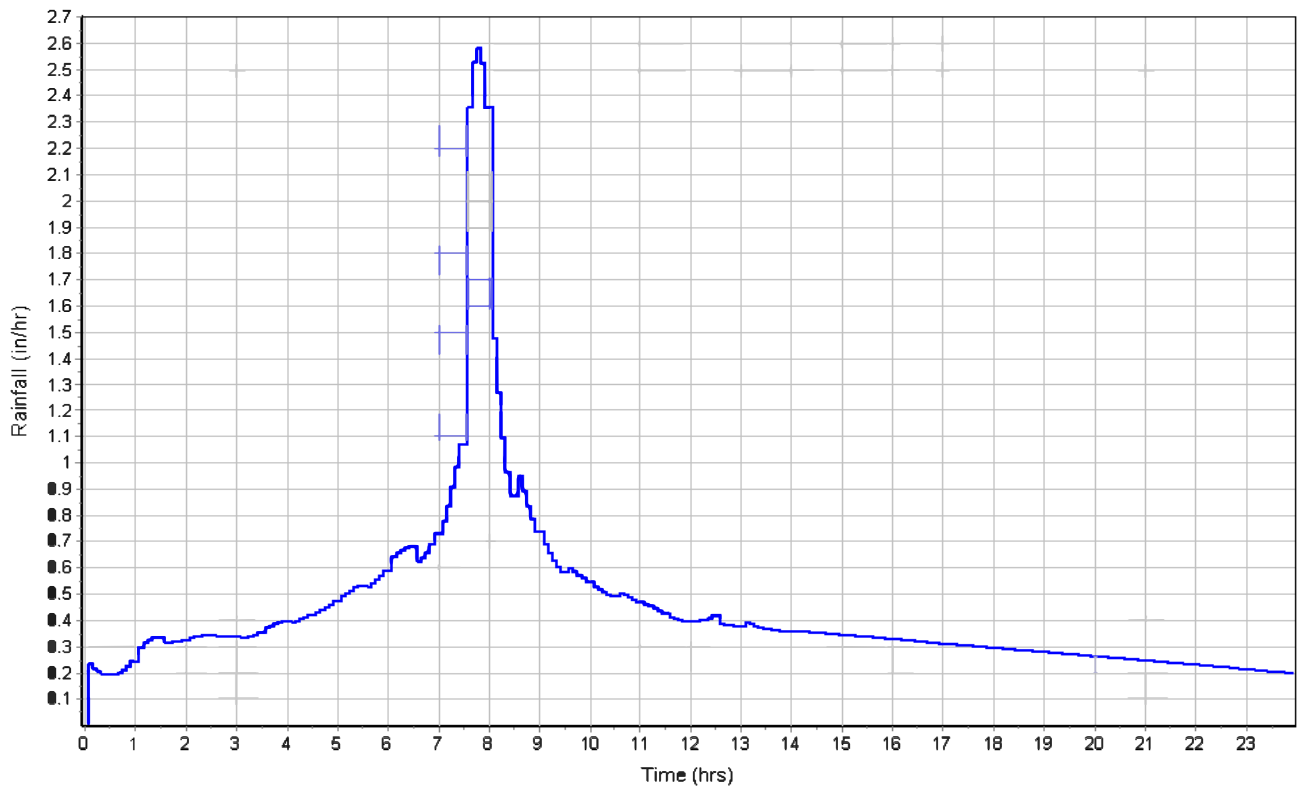
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	45	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	6.40	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	2154	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	8.12	0.00	0.00
Computed Flow Time (min) :	4.42	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.5	0.00	0.00
Flow Length (ft) :	2196	0.00	0.00
Channel Slope (%) :	7.2	0.00	0.00
Cross Section Area (ft ²) :	60	0.00	0.00
Wetted Perimeter (ft) :	15	0.00	0.00
Velocity (ft/sec) :	2.01	0.00	0.00
Computed Flow Time (min) :	18.16	0.00	0.00
Total TOC (min)	28.99		

Subbasin Runoff Results

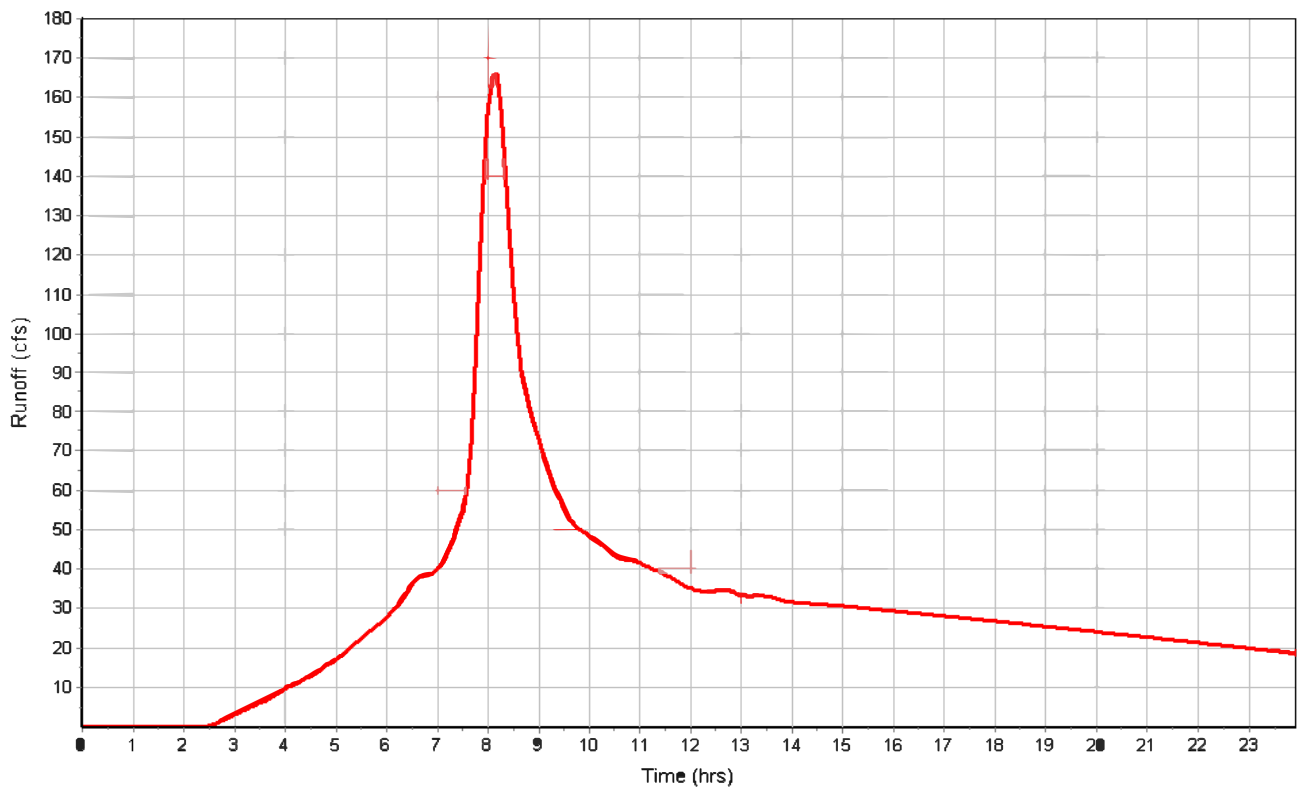
Total Rainfall (in) 10.69
Total Runoff (in) 7.79
Peak Runoff (cfs) 167.15
Weighted Curve Number 77.02
Time of Concentration (days hh:mm:ss) 0 00:28:59

Subbasin : {WTSH}.B

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.C

Input Data

Area (ac) 54.14
Peak Rate Factor 484.00
Weighted Curve Number 76.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	54.14	C	76.00
Composite Area & Weighted CN	54.14		76.00

Time of Concentration

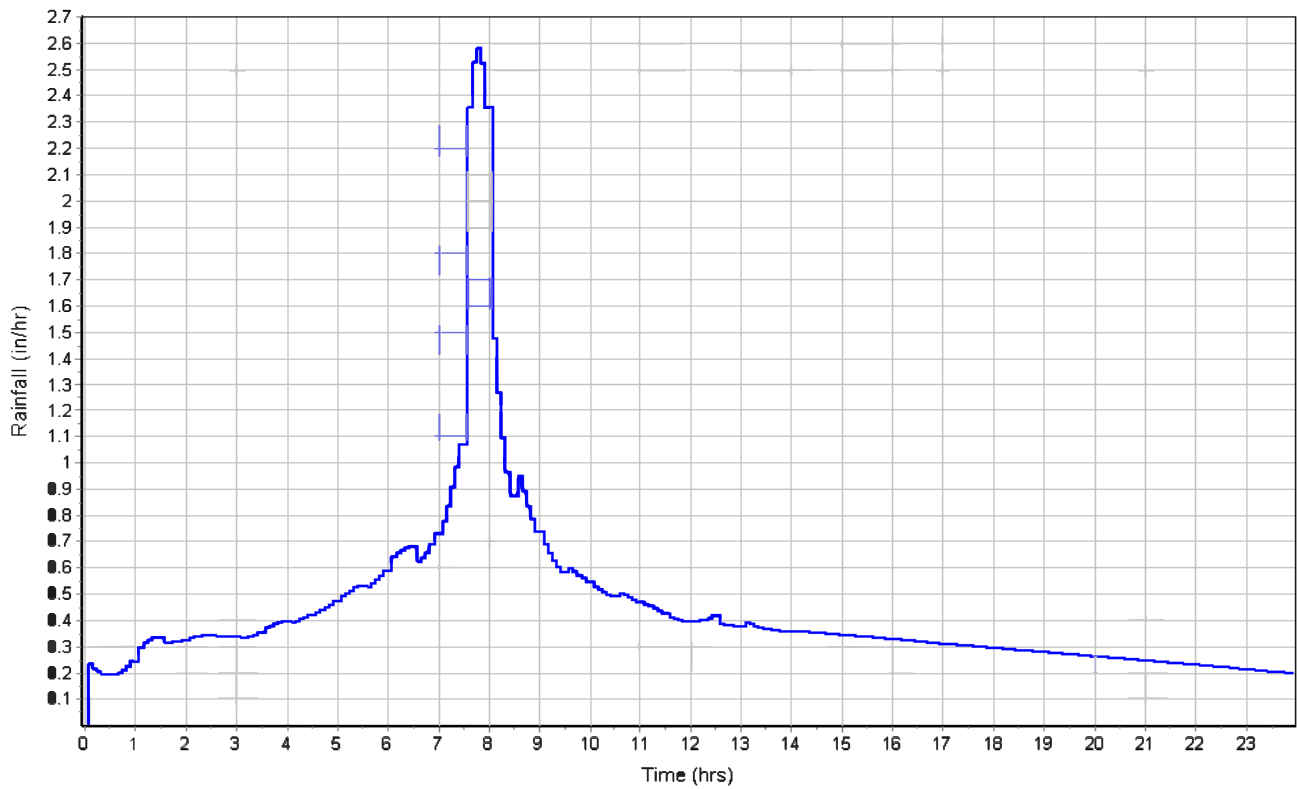
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.14	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1940	0.00	0.00
Slope (%) :	31.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.82	0.00	0.00
Computed Flow Time (min) :	11.47	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.50	0.00	0.00
Flow Length (ft) :	1445	0.00	0.00
Channel Slope (%) :	8.7	0.00	0.00
Cross Section Area (ft²) :	228	0.00	0.00
Wetted Perimeter (ft) :	26	0.00	0.00
Velocity (ft/sec) :	3.74	0.00	0.00
Computed Flow Time (min) :	6.44	0.00	0.00
Total TOC (min) 24.05			

Subbasin Runoff Results

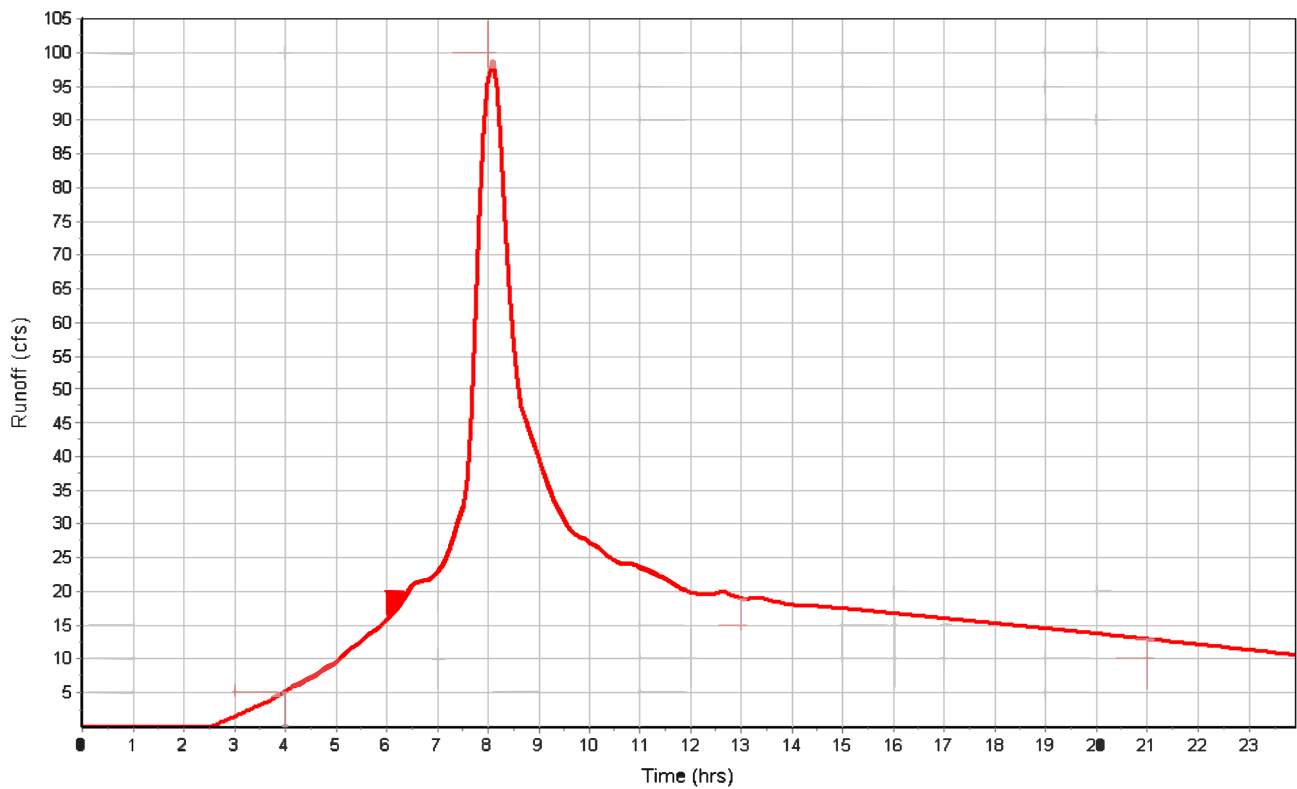
Total Rainfall (in) 10.69
Total Runoff (in) 7.65
Peak Runoff (cfs) 98.62
Weighted Curve Number 76.00
Time of Concentration (days hh:mm:ss) 0 00:24:03

Subbasin : {WTSH}.C

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.D

Input Data

Area (ac) 1.93
Peak Rate Factor 484.00
Weighted Curve Number 78.53
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.06	C	98.00
Woods & grass combination, Fair	0.68	C	76.00
50 - 75% grass cover, Fair	1.19	C	79.00
Composite Area & Weighted CN	1.93		78.53

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	7.04	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	244	0.00	0.00
Slope (%) :	7.4	0.00	0.00
Surface Type :	Bare & untilled	Unpaved	Unpaved
Velocity (ft/sec) :	2.72	0.00	0.00
Computed Flow Time (min) :	1.50	0.00	0.00

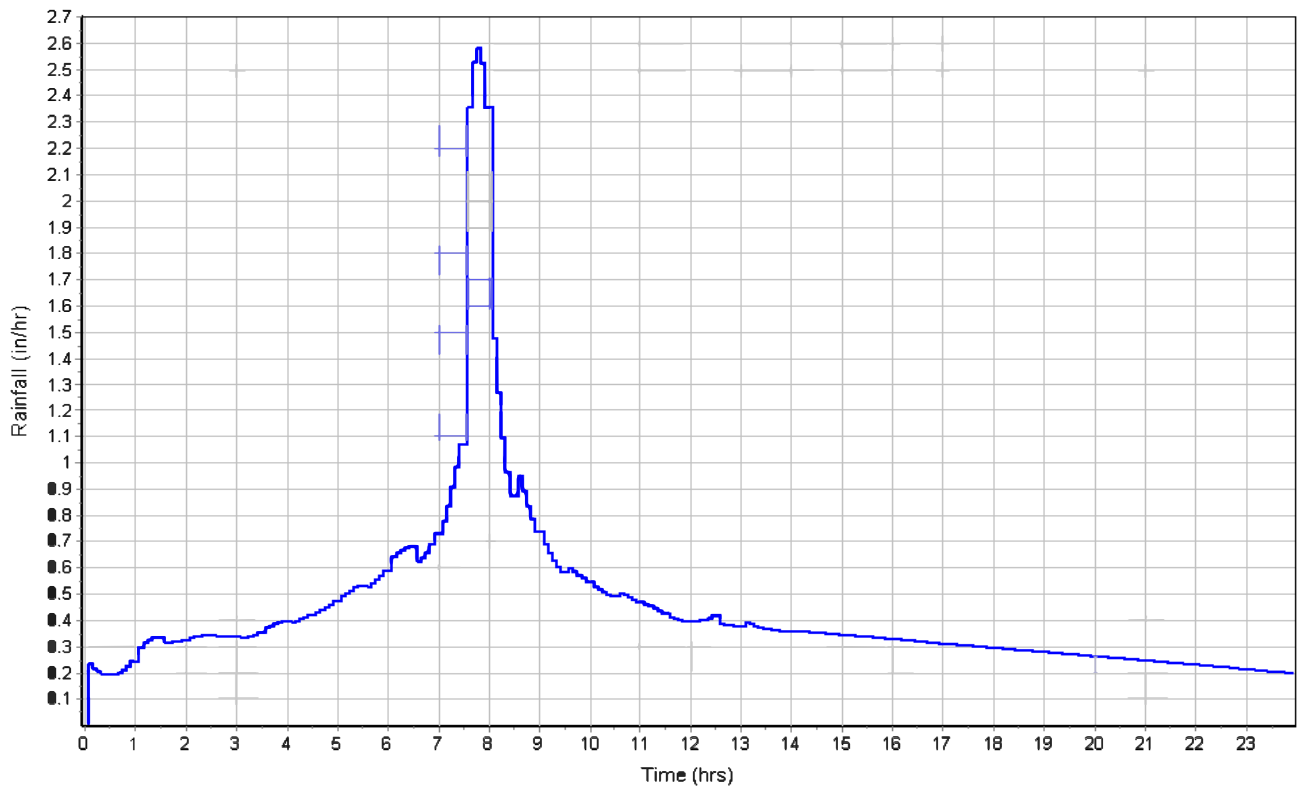
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	52	0.00	0.00
Channel Slope (%) :	2.2	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	4.79	0.00	0.00
Computed Flow Time (min) :	0.18	0.00	0.00
Total TOC (min)	8.72		

Subbasin Runoff Results

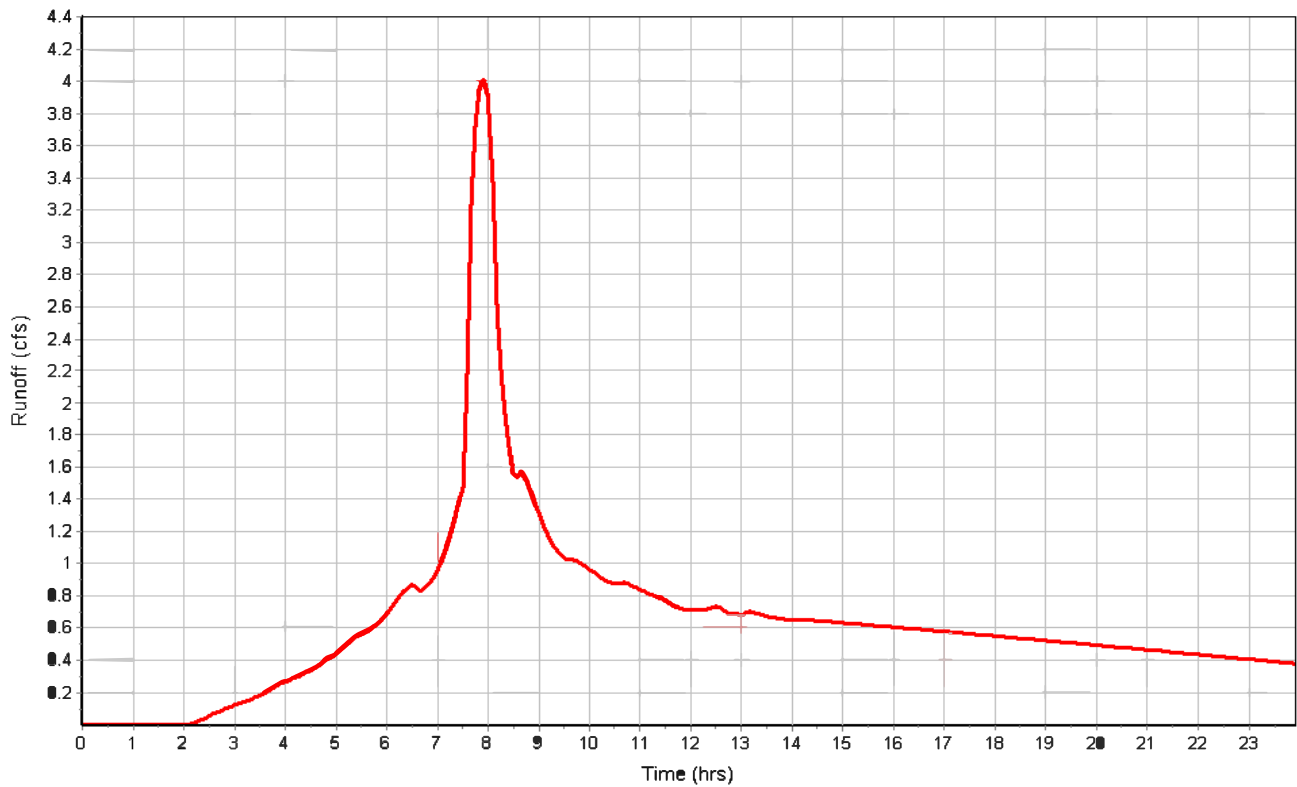
Total Rainfall (in) 10.69
Total Runoff (in) 7.99
Peak Runoff (cfs) 4.01
Weighted Curve Number 78.53
Time of Concentration (days hh:mm:ss) 0 00:08:43

Subbasin : {WTSH}.D

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.E

Input Data

Area (ac) 4.90
Peak Rate Factor 484.00
Weighted Curve Number 76.63
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.10	C	98.00
Woods & grass combination, Fair	4.50	C	76.00
50 - 75% grass cover, Fair	0.30	C	79.00
Composite Area & Weighted CN	4.90		76.63

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
	A	B	C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	7.41	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
	A	B	C
Flow Length (ft) :	321	0.00	0.00
Slope (%) :	23	0.00	0.00
Surface Type :	Forest	Unpaved	Unpaved
Velocity (ft/sec) :	1.20	0.00	0.00
Computed Flow Time (min) :	4.46	0.00	0.00

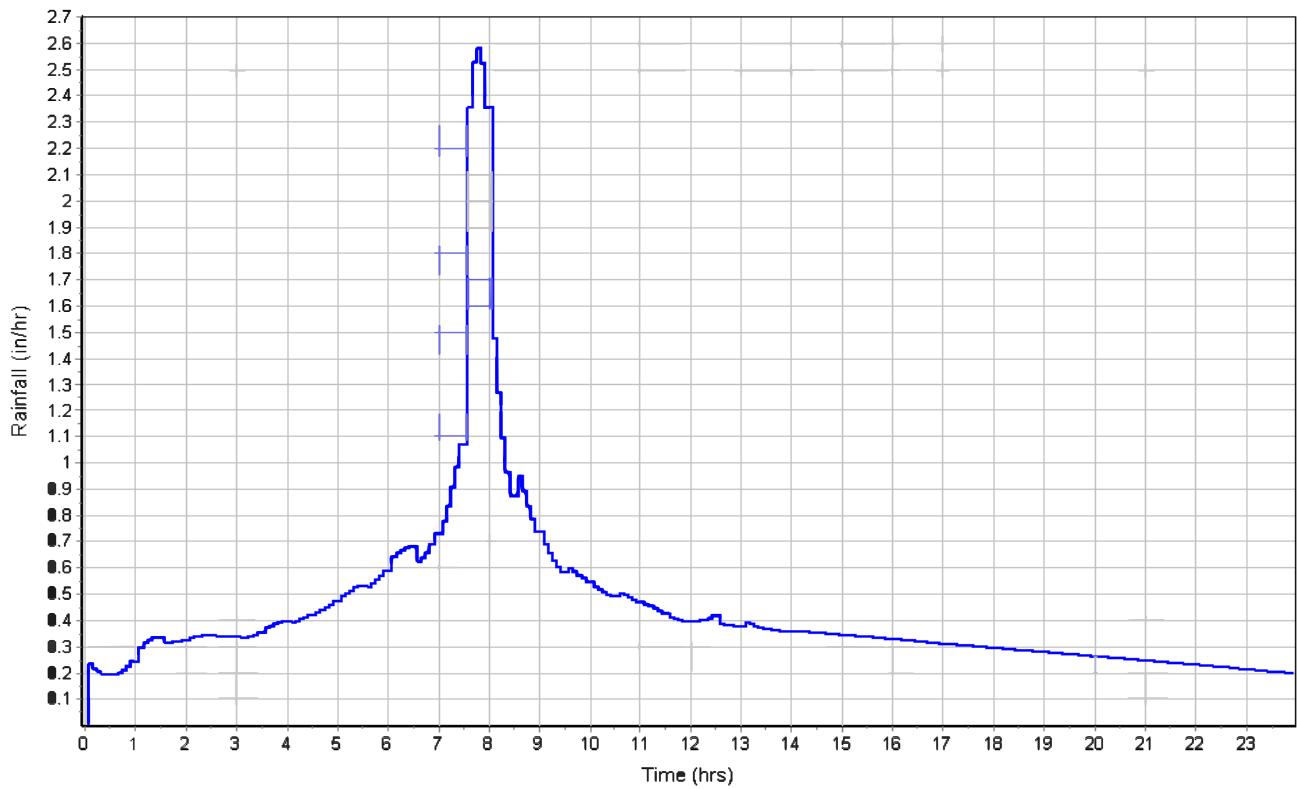
Channel Flow Computations	Subarea A	Subarea B	Subarea C
	A	B	C
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	161	0.00	0.00
Channel Slope (%) :	12	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	11.18	0.00	0.00
Computed Flow Time (min) :	0.24	0.00	0.00
Total TOC (min)	12.11		

Subbasin Runoff Results

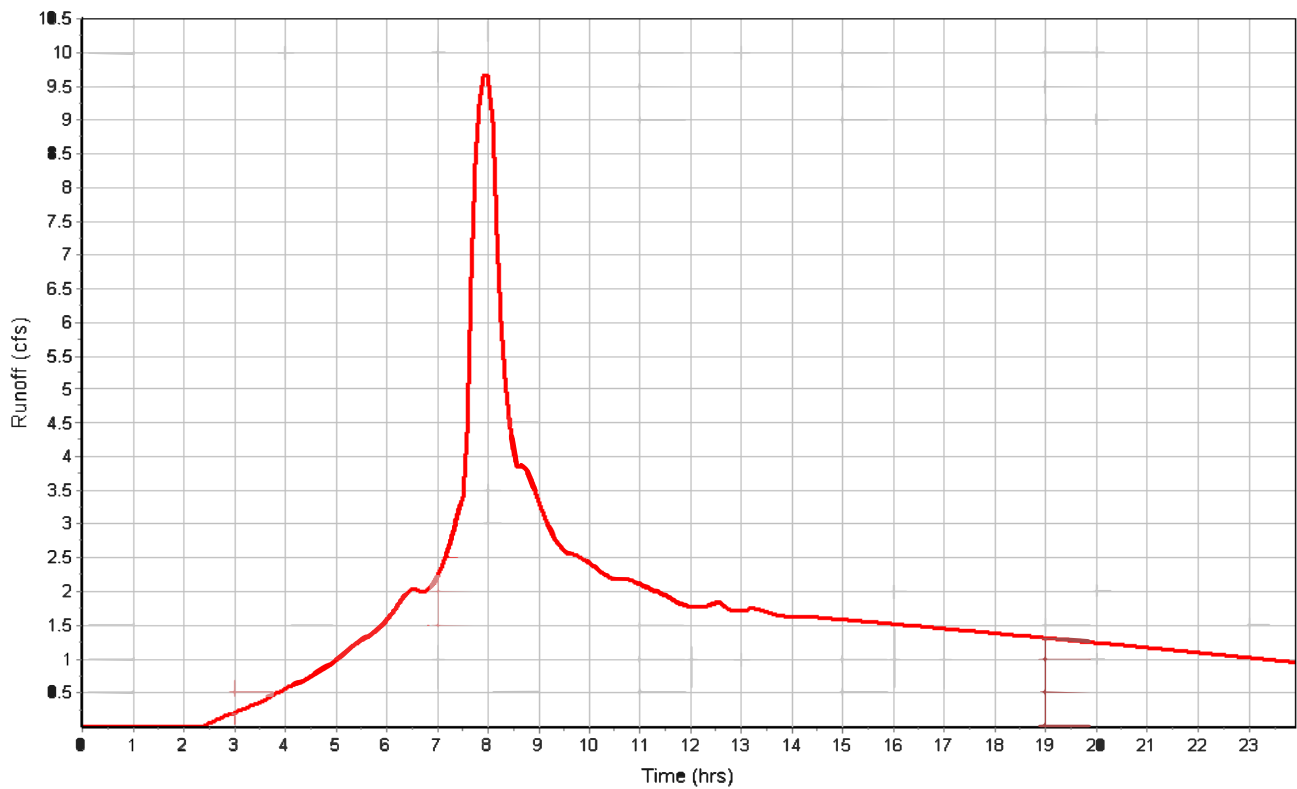
Total Rainfall (in) 10.69
Total Runoff (in) 7.73
Peak Runoff (cfs) 9.71
Weighted Curve Number 76.63
Time of Concentration (days hh:mm:ss) 0 00:12:07

Subbasin : {WTSH}.E

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.F

Input Data

Area (ac) 2.67
Peak Rate Factor 484.00
Weighted Curve Number 77.33
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.07	C	98.00
Woods & grass combination, Fair	1.93	C	76.00
50 - 75% grass cover, Fair	0.67	C	79.00
Composite Area & Weighted CN	2.67		77.33

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
	A	B	C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	40	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.83	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
	A	B	C
Flow Length (ft) :	318	0.00	0.00
Slope (%) :	22	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.35	0.00	0.00
Computed Flow Time (min) :	2.26	0.00	0.00

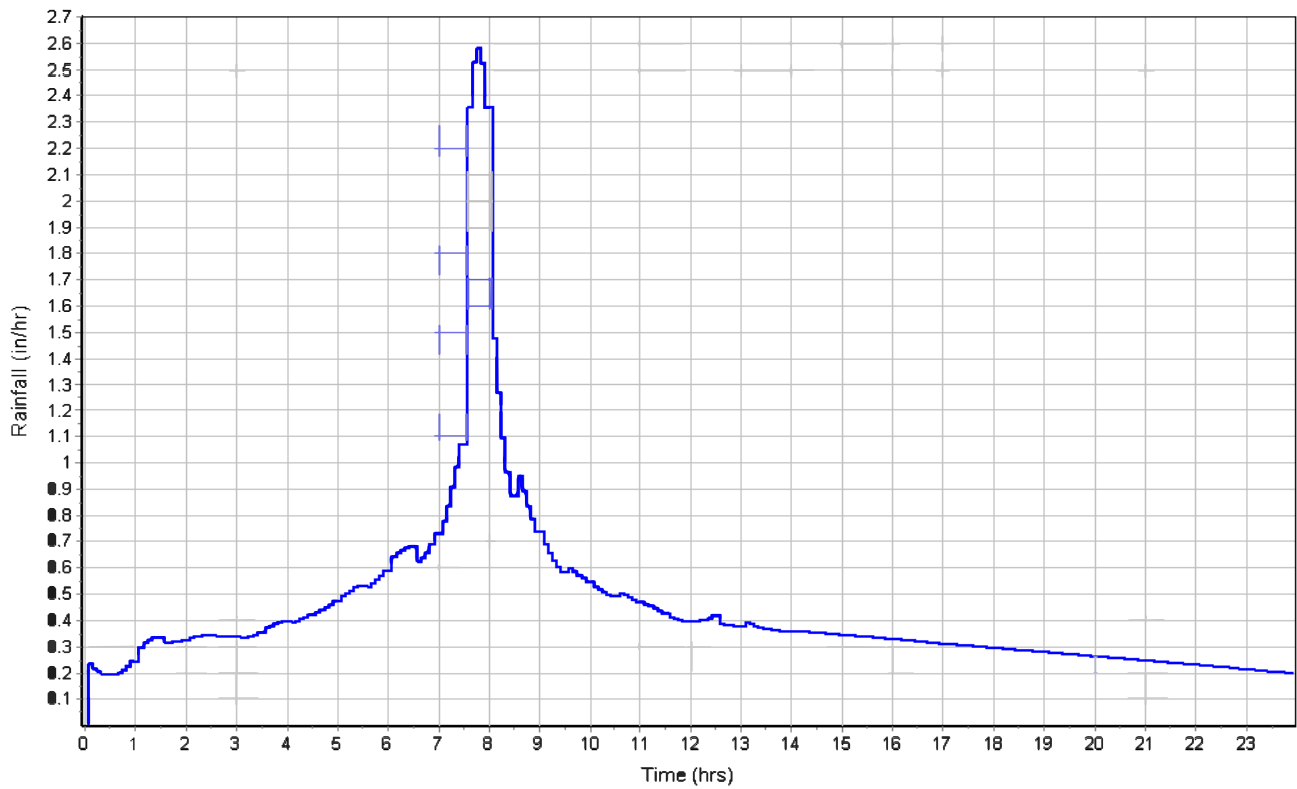
Channel Flow Computations	Subarea A	Subarea B	Subarea C
	A	B	C
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	325	0.00	0.00
Channel Slope (%) :	5.3	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	7.43	0.00	0.00
Computed Flow Time (min) :	0.73	0.00	0.00
Total TOC (min)	8.82		

Subbasin Runoff Results

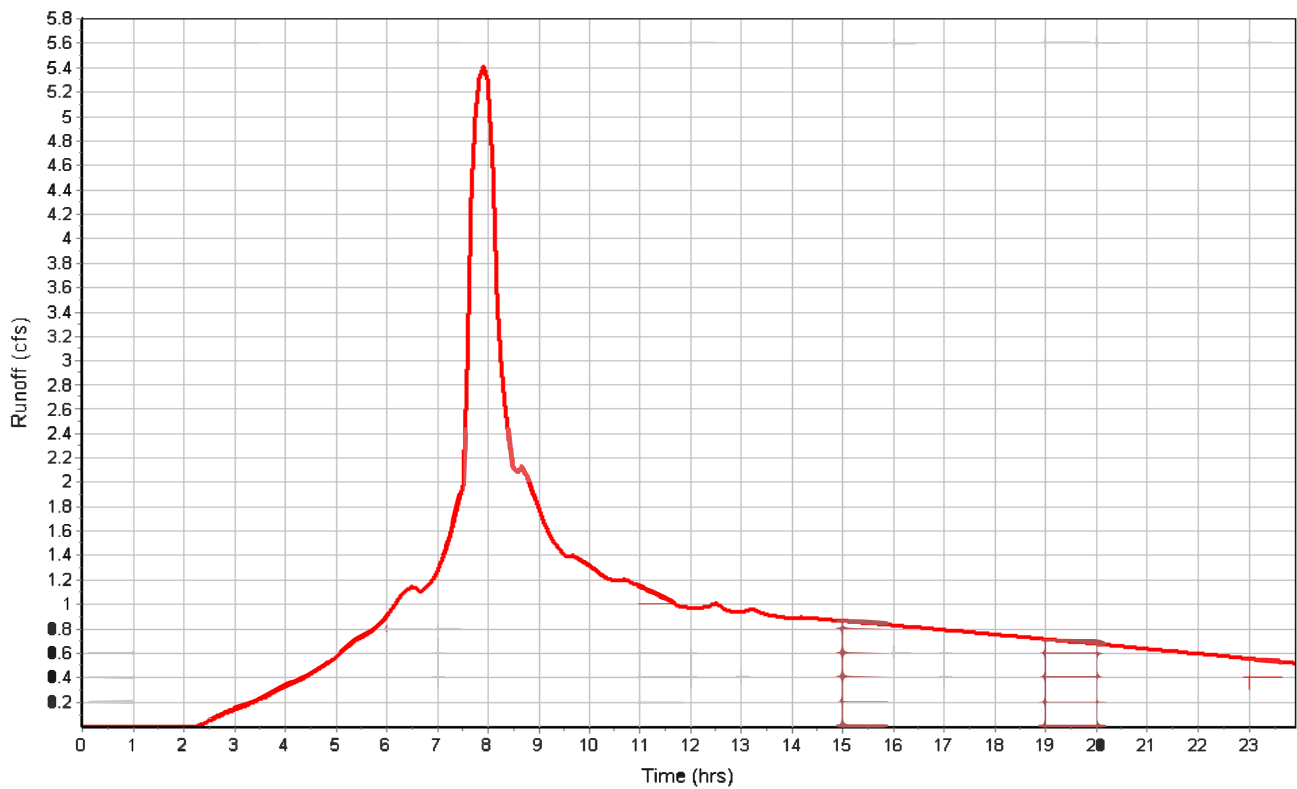
Total Rainfall (in) 10.69
Total Runoff (in) 7.83
Peak Runoff (cfs) 5.41
Weighted Curve Number 77.33
Time of Concentration (days hh:mm:ss) 0 00:08:49

Subbasin : {WTSH}.F

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.G

Input Data

Area (ac) 2.91
Peak Rate Factor 484.00
Weighted Curve Number 77.89
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	0.10	C	79.00
Paved parking & roofs	0.05	C	98.00
Woods & grass combination, Fair	1.39	C	76.00
50 - 75% grass cover, Fair	1.37	C	79.00
Composite Area & Weighted CN	2.91		77.89

Time of Concentration

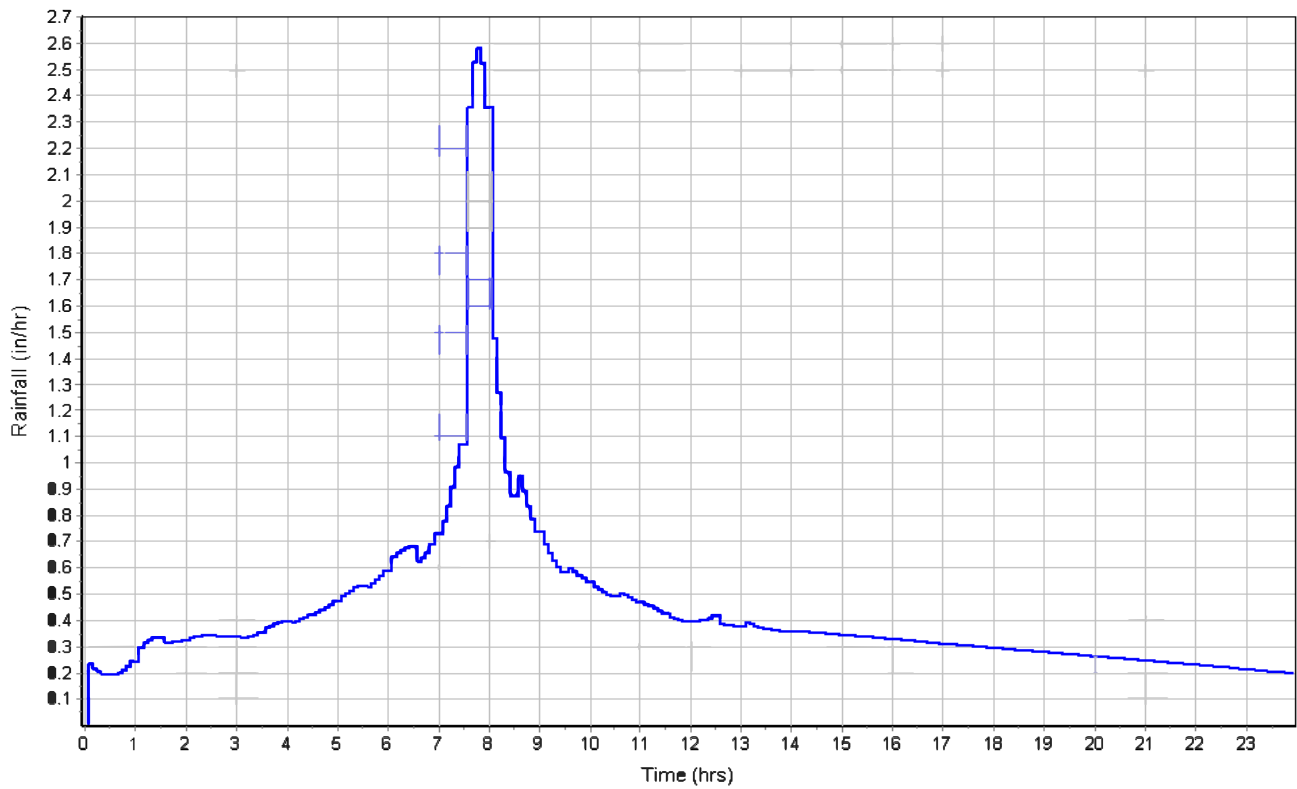
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.15	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	742	0.00	0.00
Slope (%) :	13.5	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.84	0.00	0.00
Computed Flow Time (min) :	6.72	0.00	0.00
Total TOC (min) 12.87			

Subbasin Runoff Results

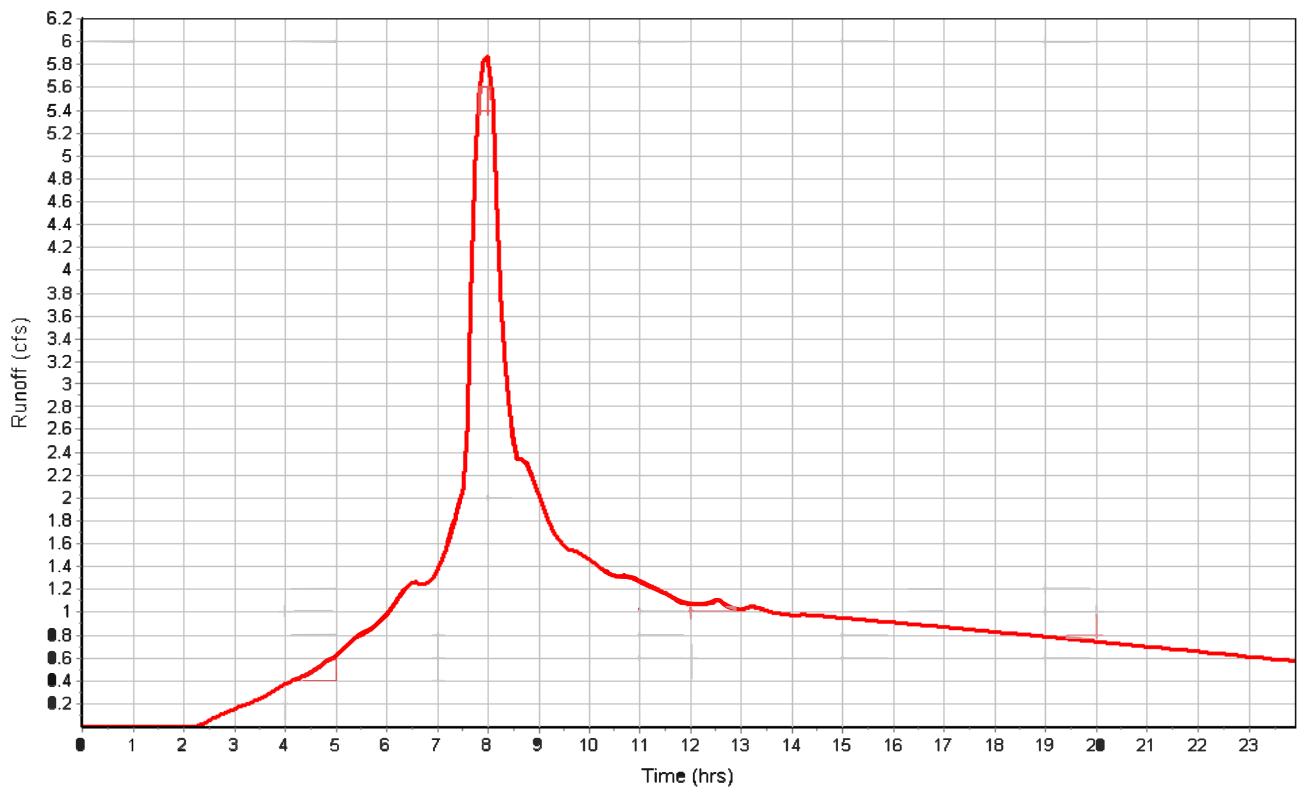
Total Rainfall (in) 10.69
Total Runoff (in) 7.90
Peak Runoff (cfs) 5.89
Weighted Curve Number 77.89
Time of Concentration (days hh:mm:ss) 0 00:12:52

Subbasin : {WTSH}.G

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name 1826-DRHY_PRE.SPF
Description
WINROD VINEYARD ECP
STORM AND SEWER ANALYSIS

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-20
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
YES

Analysis Options

Start Analysis On Jul 13, 2020 00:00:00
End Analysis On Jul 14, 2020 00:00:00
Start Reporting On Jul 13, 2020 00:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 8
Nodes..... 8
 Junctions 0
 Outfalls 8
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
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Subbasin Summary

SN Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
	(ac)			(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1 {WTSH}.A1	25.12	484.00	79.58	11.98	9.37	235.45	61.10	0 00:10:20
2 {WTSH}.A2	3.57	484.00	76.12	11.98	8.90	31.76	8.25	0 00:08:36
3 {WTSH}.B	93.54	484.00	77.02	11.98	9.02	843.92	194.64	0 00:28:59
4 {WTSH}.C	54.14	484.00	76.00	11.98	8.88	480.82	115.11	0 00:24:03
5 {WTSH}.D	1.93	484.00	78.53	11.98	9.23	17.81	4.64	0 00:08:43
6 {WTSH}.E	4.90	484.00	76.63	11.98	8.97	43.94	11.30	0 00:12:06
7 {WTSH}.F	2.67	484.00	77.33	11.98	9.07	24.20	6.29	0 00:08:49
8 {WTSH}.G	2.91	484.00	77.89	11.98	9.14	26.60	6.84	0 00:12:52

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft ²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	A1	Outfall	0.00					0.00	0.00					
2	A2	Outfall	0.00					0.00	0.00					
3	B	Outfall	0.00					0.00	0.00					
4	C	Outfall	0.00					0.00	0.00					
5	D	Outfall	0.00					0.00	0.00					
6	E	Outfall	0.00					0.00	0.00					
7	F	Outfall	0.00					0.00	0.00					
8	G	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : {WTSH}.A1

Input Data

Area (ac) 25.12
Peak Rate Factor 484.00
Weighted Curve Number 79.58
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.23	C	98.00
Woods & grass combination, Fair	8.03	C	76.00
Woods & grass combination, Fair	5.13	D	82.00
50 - 75% grass cover, Fair	10.73	C	79.00
Composite Area & Weighted CN	25.12		79.58

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
n = Manning's roughness
L_f = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
V = 20.3282 * (S_f^{0.5}) (paved surface)
V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
V = 5.0 * (S_f^{0.5}) (woodland surface)
V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
T_c = (L_f / V) / (3600 sec/hr)

Where:

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n
R = A_q / W_p
T_c = (L_f / V) / (3600 sec/hr)

Where :

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
R = Hydraulic Radius (ft)
A_q = Flow Area (ft²)
W_p = Wetted Perimeter (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)
n = Manning's roughness

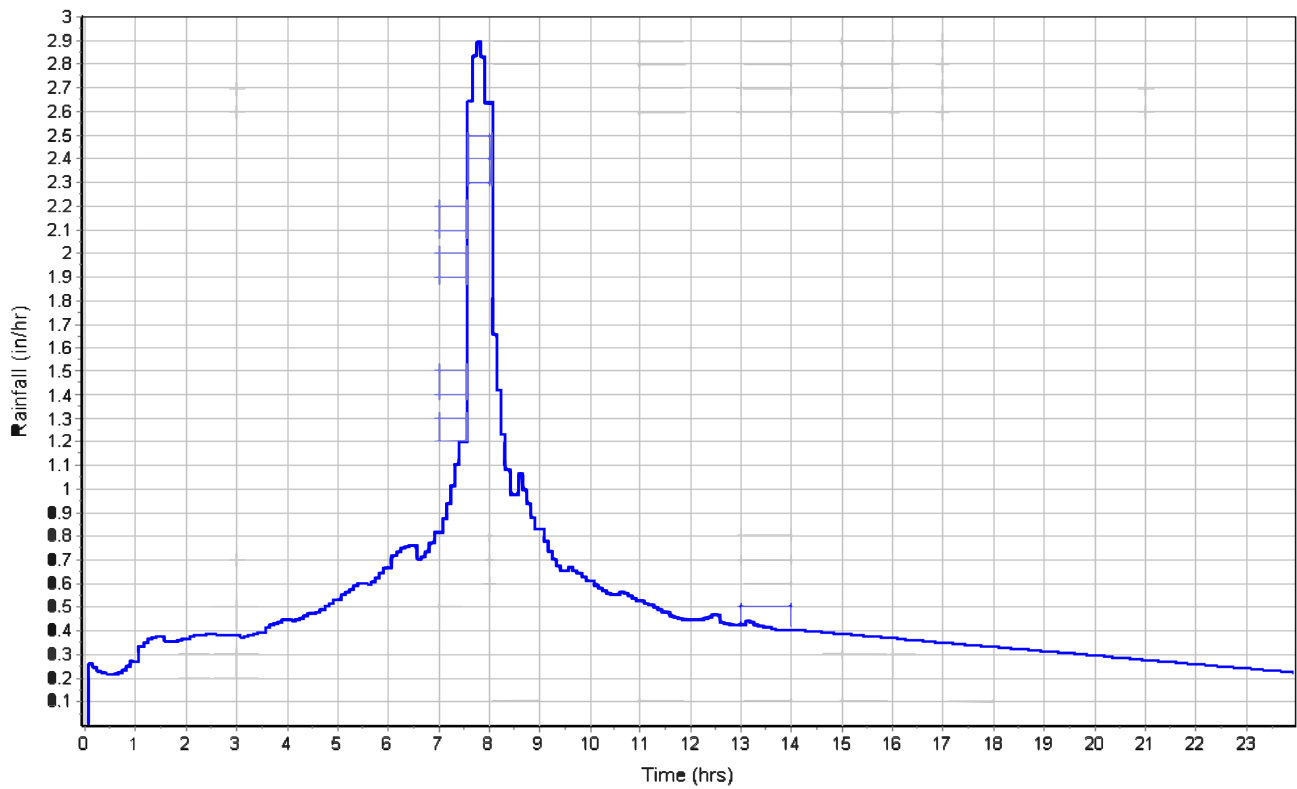
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.25	0.00	0.00
Computed Flow Time (min) :	6.54	0.00	0.00
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1499	0.00	0.00
Slope (%) :	16.7	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.59	0.00	0.00
Computed Flow Time (min) :	3.79	0.00	0.00
Total TOC (min)	10.34		

Subbasin Runoff Results

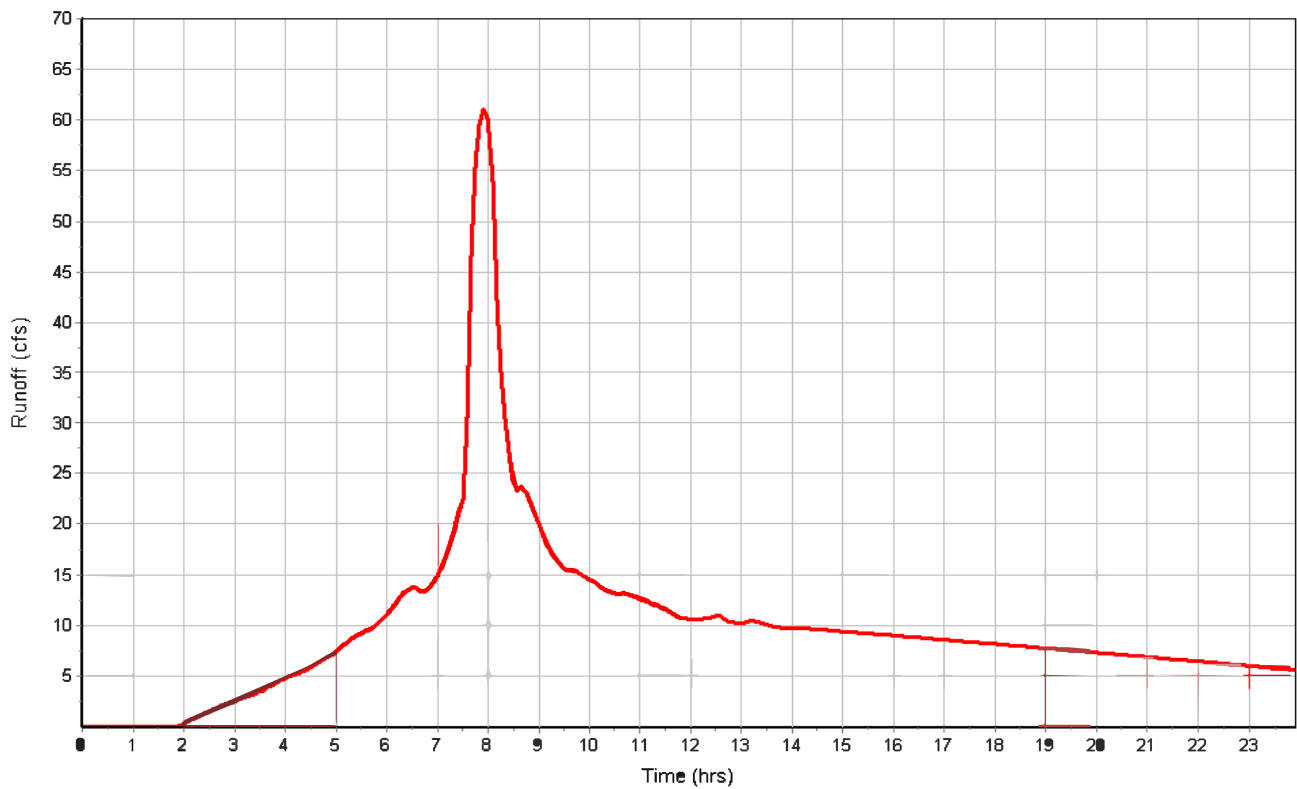
Total Rainfall (in)	11.98
Total Runoff (in)	9.37
Peak Runoff (cfs)	61.10
Weighted Curve Number	79.58
Time of Concentration (days hh:mm:ss)	0 00:10:20

Subbasin : {WTSH}.A1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.A2

Input Data

Area (ac) 3.57
Peak Rate Factor 484.00
Weighted Curve Number 76.12
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	3.43	C	76.00
50 - 75% grass cover, Fair	0.14	C	79.00
Composite Area & Weighted CN	3.57		76.12

Time of Concentration

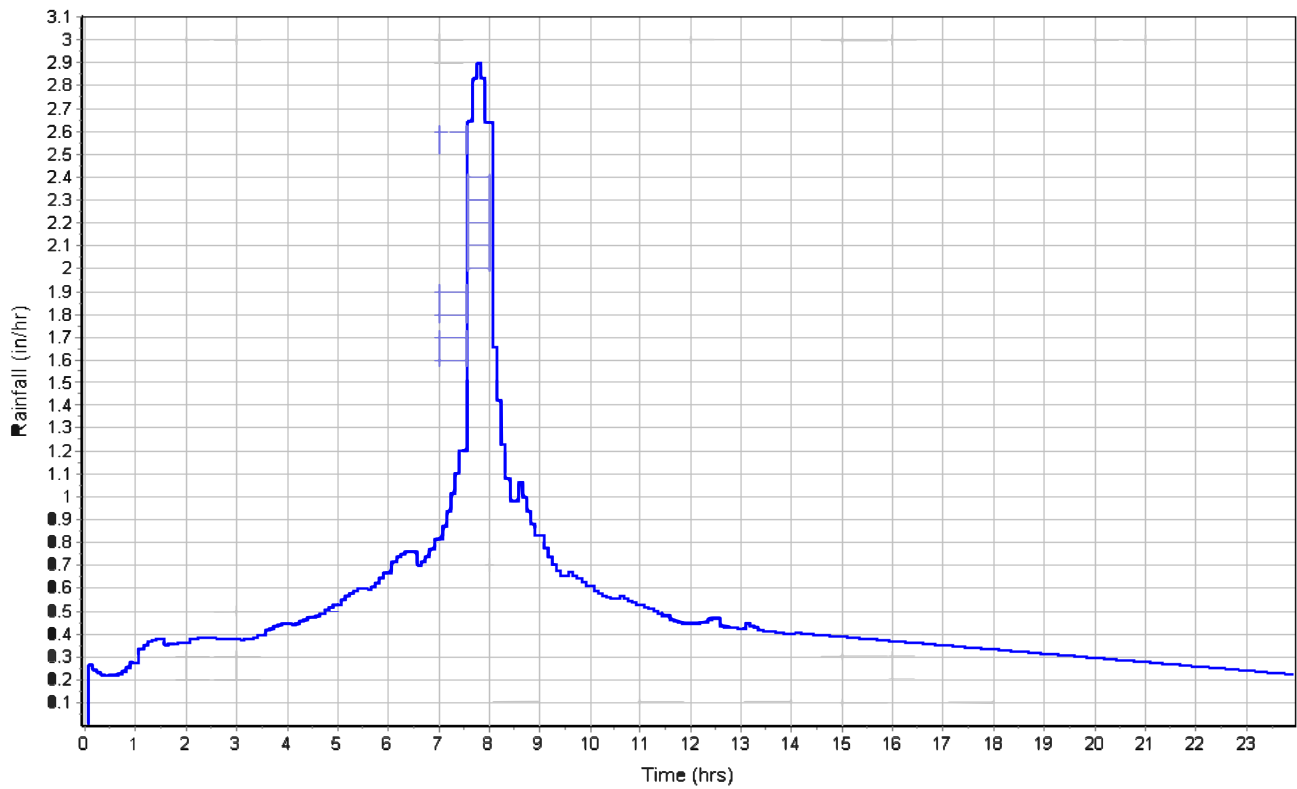
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	43	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.67	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	290	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.51	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	380	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	6.29	0.00	0.00
Computed Flow Time (min) :	1.01	0.00	0.00
Total TOC (min)	8.60		

Subbasin Runoff Results

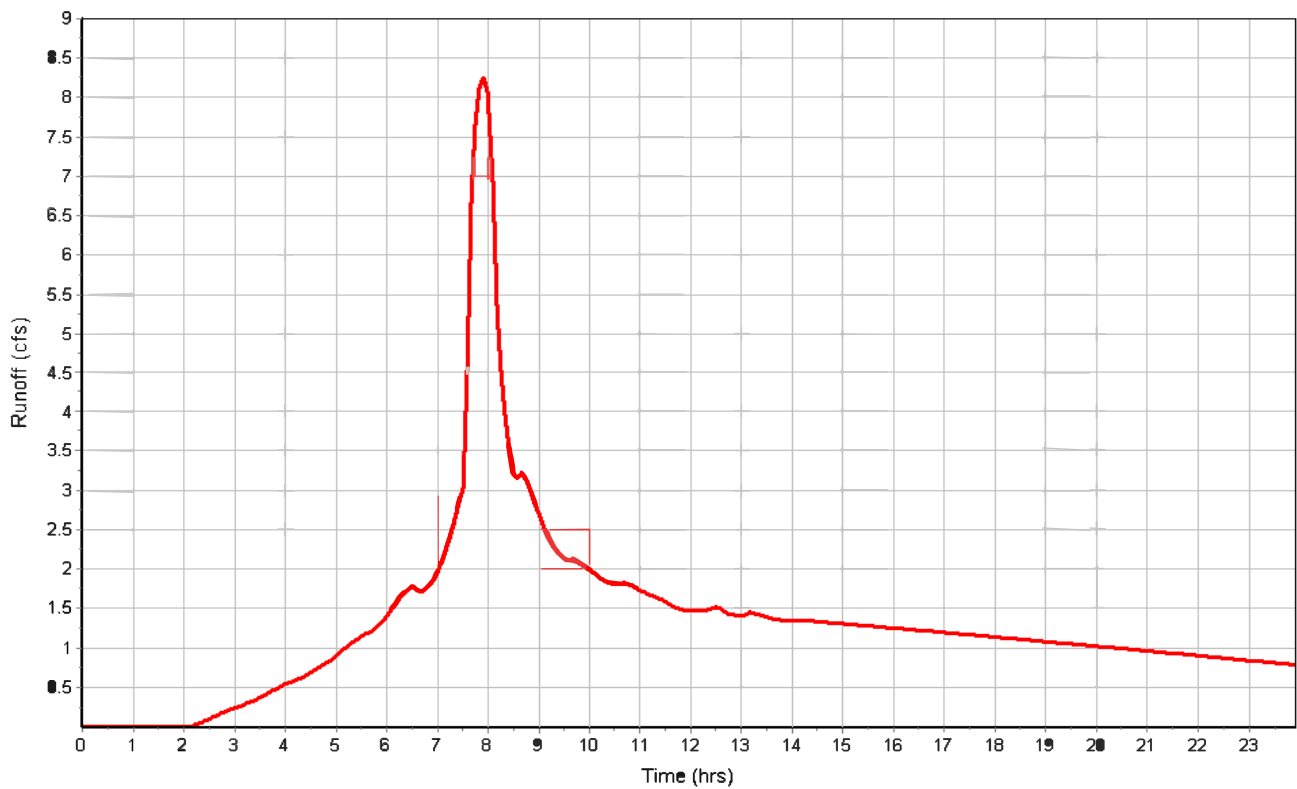
Total Rainfall (in) 11.98
Total Runoff (in) 8.90
Peak Runoff (cfs) 8.25
Weighted Curve Number 76.12
Time of Concentration (days hh:mm:ss) 0 00:08:36

Subbasin : {WTSH}.A2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.B

Input Data

Area (ac) 93.54
Peak Rate Factor 484.00
Weighted Curve Number 77.02
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.20	C	98.00
Woods & grass combination, Fair	78.03	C	76.00
Woods & grass combination, Fair	14.94	D	82.00
50 - 75% grass cover, Fair	0.37	C	79.00
Composite Area & Weighted CN	93.54		77.02

Time of Concentration

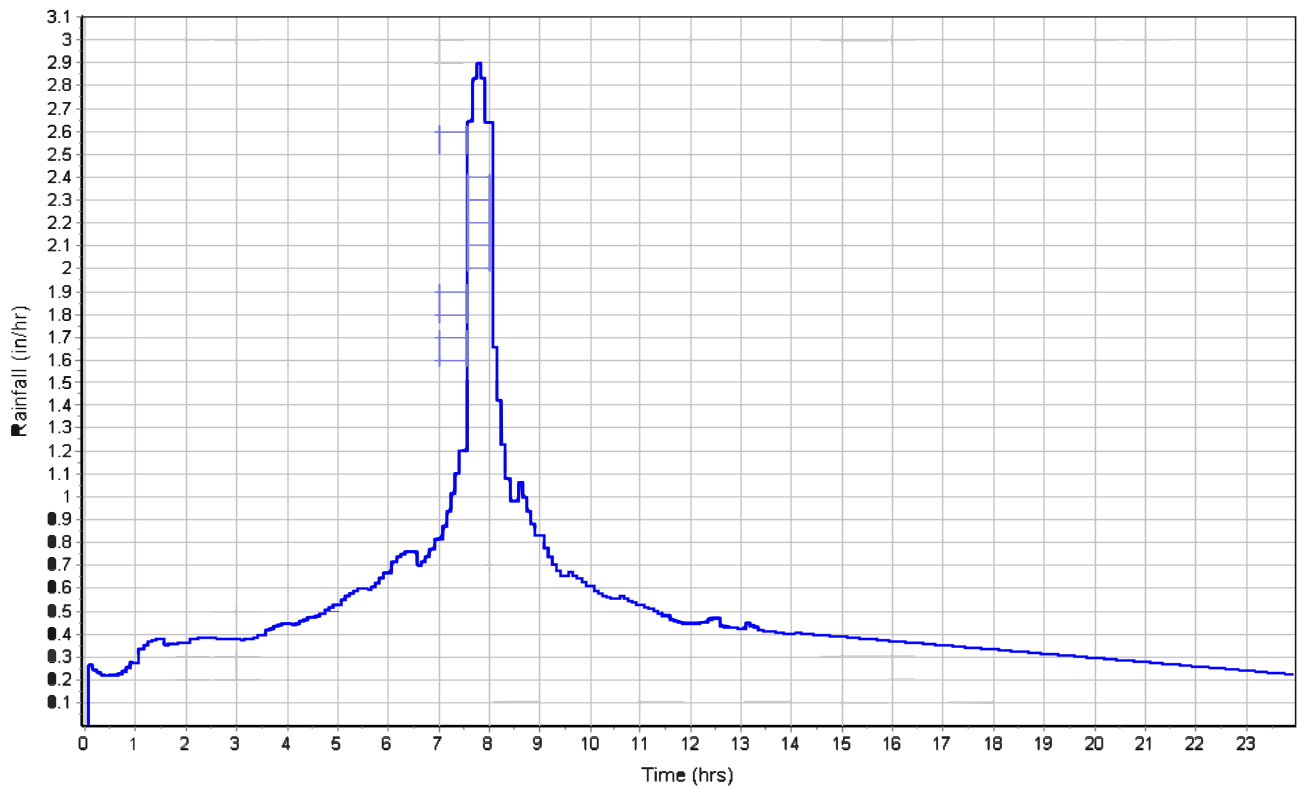
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	45	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	6.40	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	2154	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	8.12	0.00	0.00
Computed Flow Time (min) :	4.42	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.5	0.00	0.00
Flow Length (ft) :	2196	0.00	0.00
Channel Slope (%) :	7.2	0.00	0.00
Cross Section Area (ft ²) :	60	0.00	0.00
Wetted Perimeter (ft) :	15	0.00	0.00
Velocity (ft/sec) :	2.01	0.00	0.00
Computed Flow Time (min) :	18.16	0.00	0.00
Total TOC (min)	28.99		

Subbasin Runoff Results

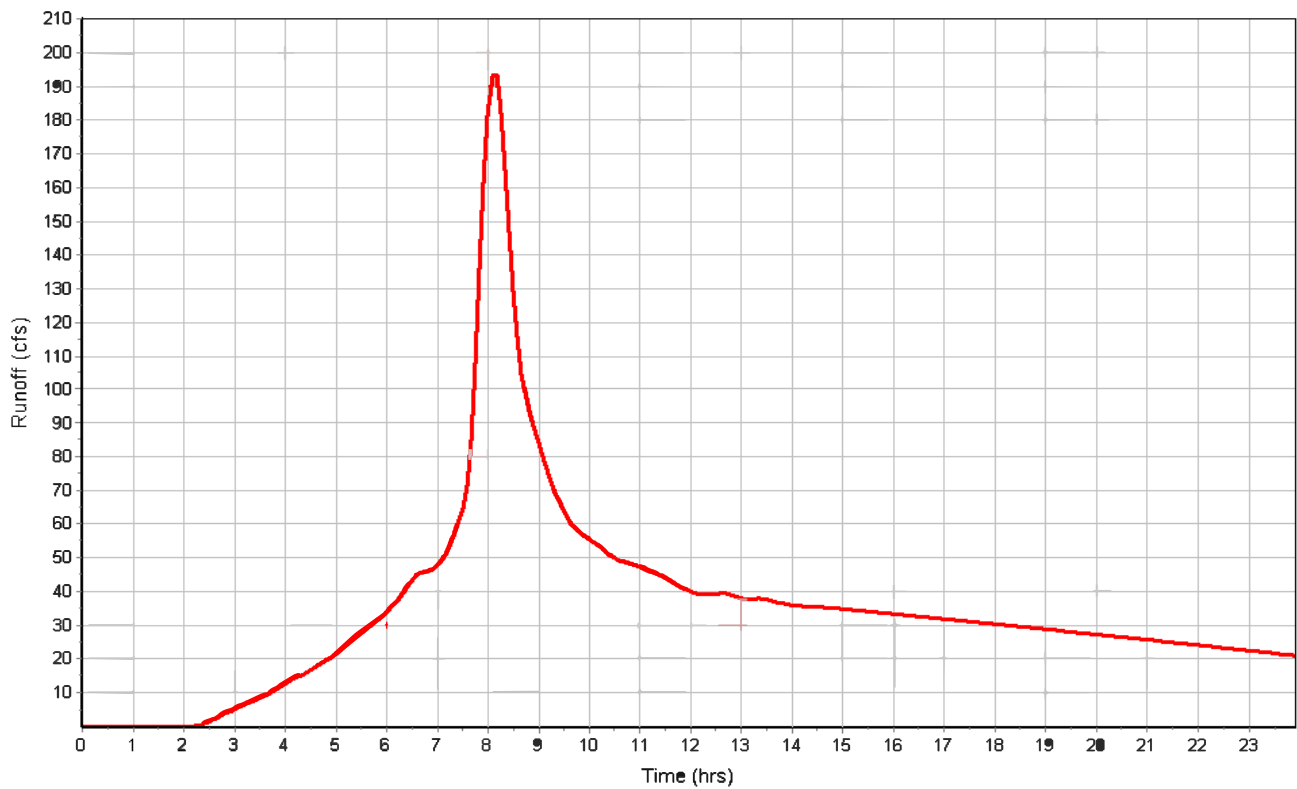
Total Rainfall (in) 11.98
Total Runoff (in) 9.02
Peak Runoff (cfs) 194.64
Weighted Curve Number 77.02
Time of Concentration (days hh:mm:ss) 0 00:28:59

Subbasin : {WTSH}.B

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.C

Input Data

Area (ac) 54.14
Peak Rate Factor 484.00
Weighted Curve Number 76.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	54.14	C	76.00
Composite Area & Weighted CN	54.14		76.00

Time of Concentration

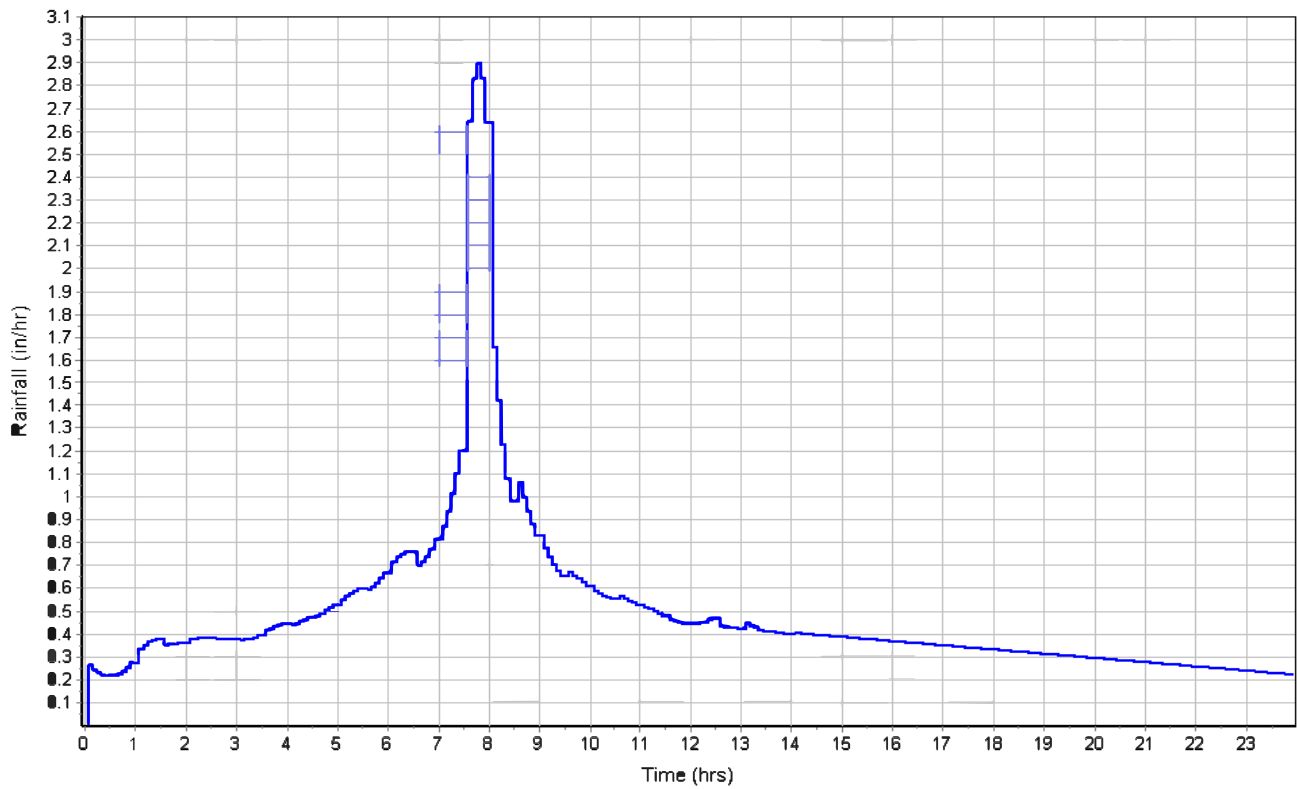
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.14	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1940	0.00	0.00
Slope (%) :	31.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.82	0.00	0.00
Computed Flow Time (min) :	11.47	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.50	0.00	0.00
Flow Length (ft) :	1445	0.00	0.00
Channel Slope (%) :	8.7	0.00	0.00
Cross Section Area (ft²) :	228	0.00	0.00
Wetted Perimeter (ft) :	26	0.00	0.00
Velocity (ft/sec) :	3.74	0.00	0.00
Computed Flow Time (min) :	6.44	0.00	0.00
Total TOC (min) 24.05			

Subbasin Runoff Results

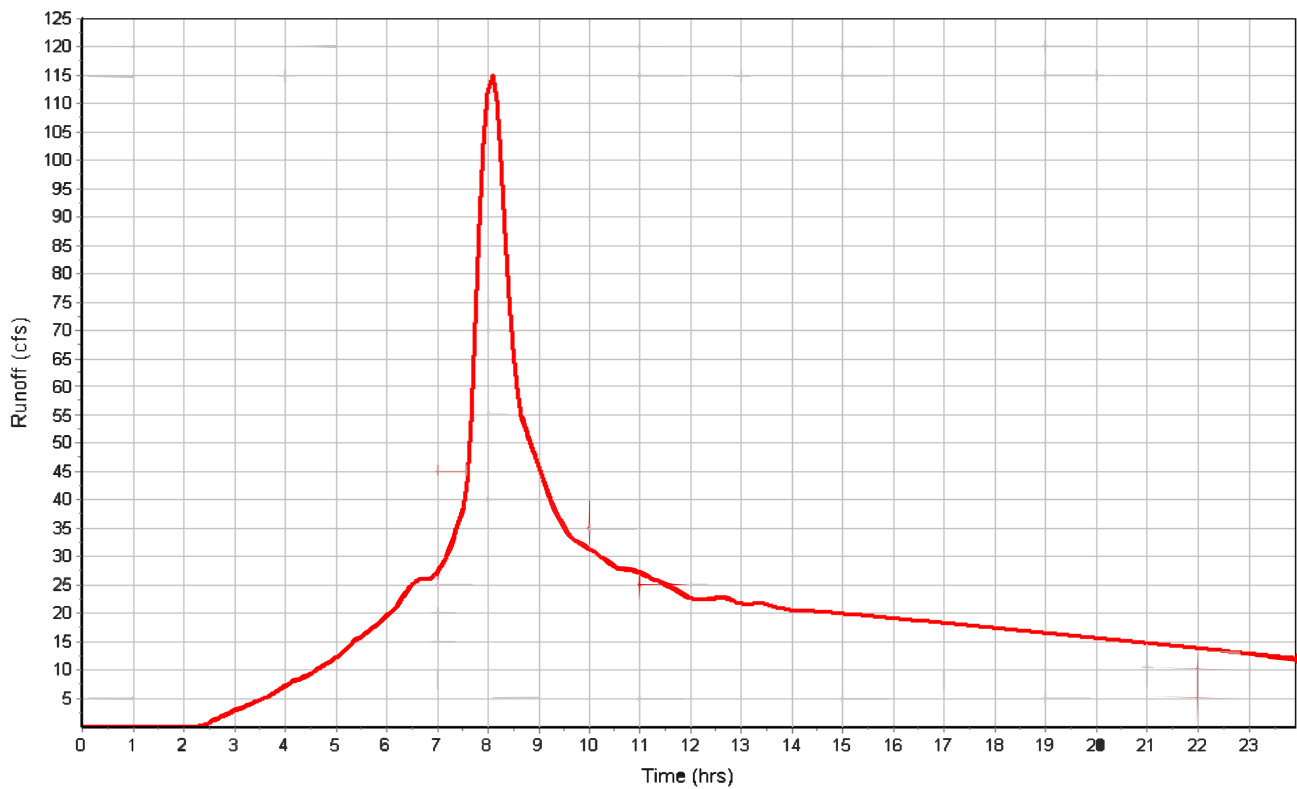
Total Rainfall (in) 11.98
Total Runoff (in) 8.88
Peak Runoff (cfs) 115.11
Weighted Curve Number 76.00
Time of Concentration (days hh:mm:ss) 0 00:24:03

Subbasin : {WTSH}.C

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.D

Input Data

Area (ac) 1.93
Peak Rate Factor 484.00
Weighted Curve Number 78.53
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.06	C	98.00
Woods & grass combination, Fair	0.68	C	76.00
50 - 75% grass cover, Fair	1.19	C	79.00
Composite Area & Weighted CN	1.93		78.53

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	7.04	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	244	0.00	0.00
Slope (%) :	7.4	0.00	0.00
Surface Type :	Bare & untilled	Unpaved	Unpaved
Velocity (ft/sec) :	2.72	0.00	0.00
Computed Flow Time (min) :	1.50	0.00	0.00

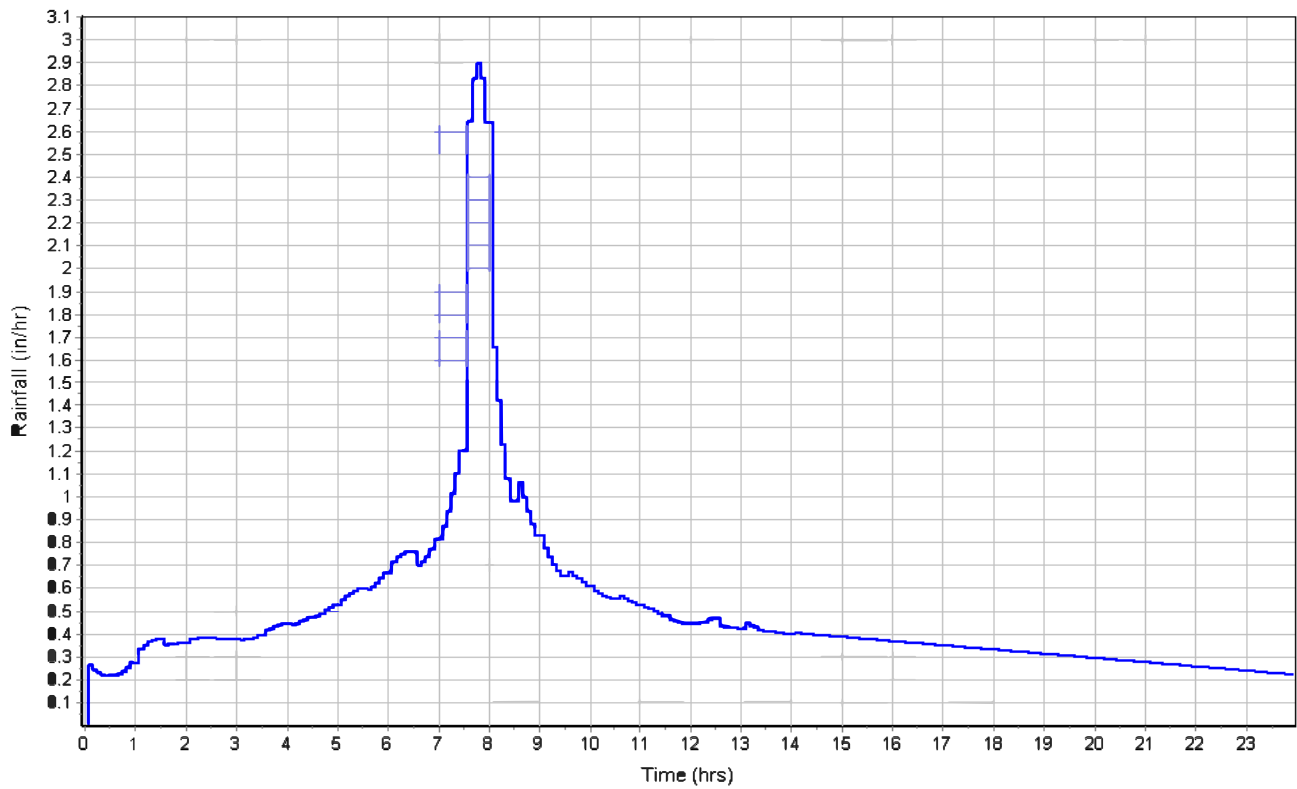
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	52	0.00	0.00
Channel Slope (%) :	2.2	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	4.79	0.00	0.00
Computed Flow Time (min) :	0.18	0.00	0.00
Total TOC (min)	8.72		

Subbasin Runoff Results

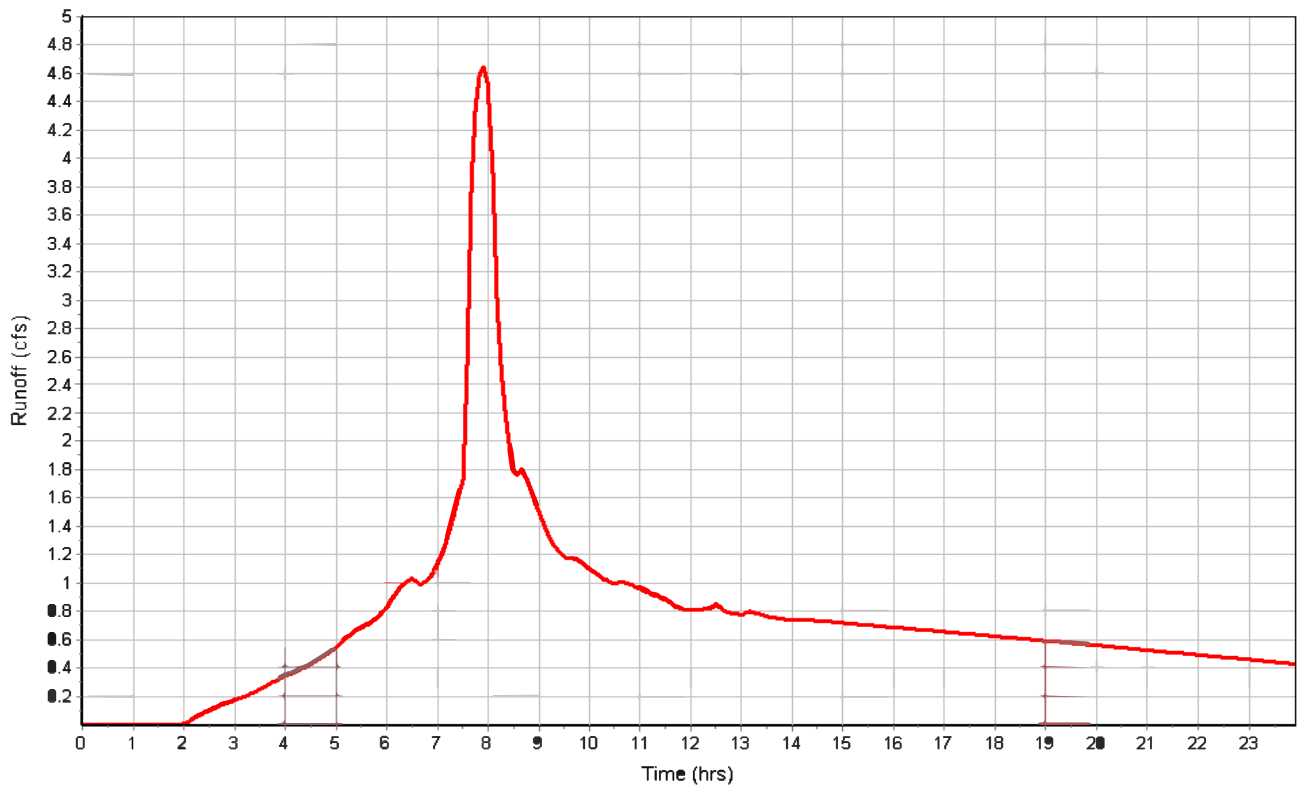
Total Rainfall (in) 11.98
Total Runoff (in) 9.23
Peak Runoff (cfs) 4.64
Weighted Curve Number 78.53
Time of Concentration (days hh:mm:ss) 0 00:08:43

Subbasin : {WTSH}.D

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.E

Input Data

Area (ac) 4.90
Peak Rate Factor 484.00
Weighted Curve Number 76.63
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.10	C	98.00
Woods & grass combination, Fair	4.50	C	76.00
50 - 75% grass cover, Fair	0.30	C	79.00
Composite Area & Weighted CN	4.90		76.63

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.22	0.00	0.00
Computed Flow Time (min) :	7.41	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	321	0.00	0.00
Slope (%) :	23	0.00	0.00
Surface Type :	Forest	Unpaved	Unpaved
Velocity (ft/sec) :	1.20	0.00	0.00
Computed Flow Time (min) :	4.46	0.00	0.00

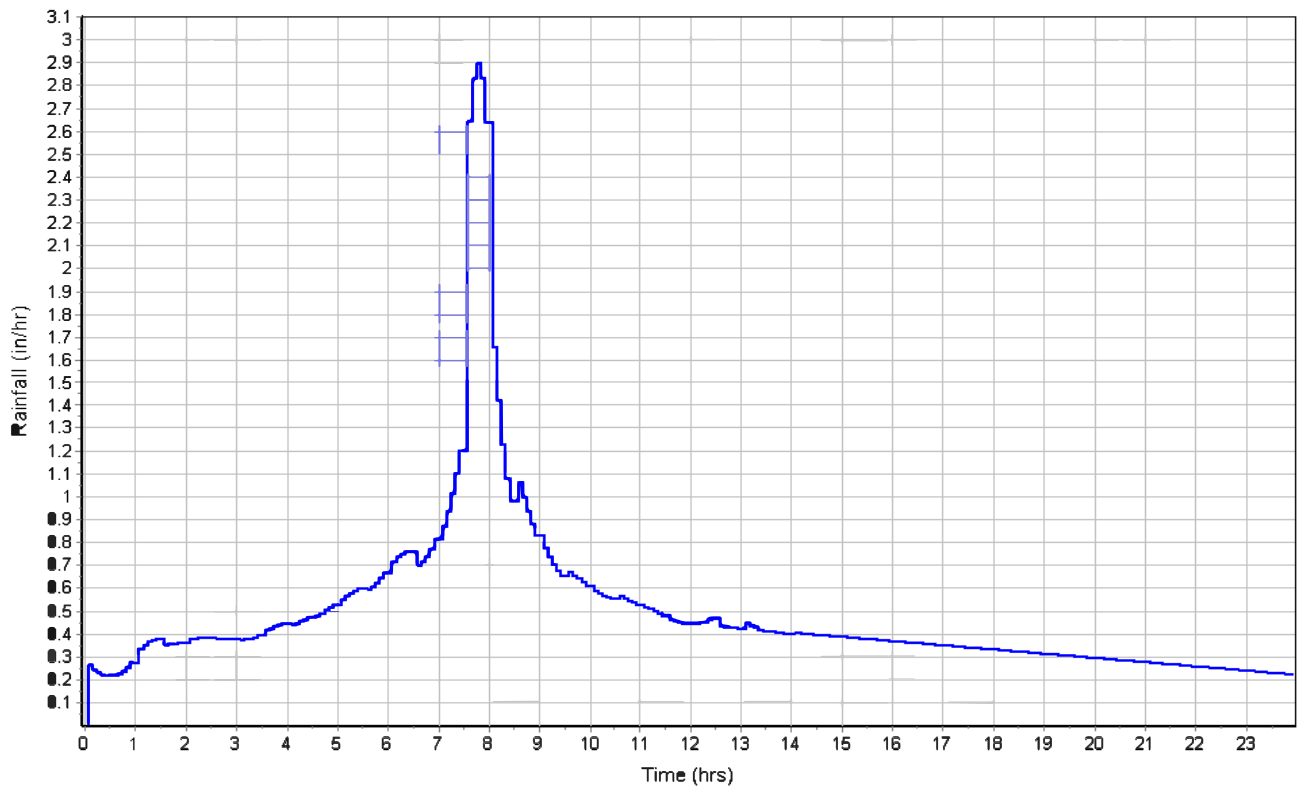
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	161	0.00	0.00
Channel Slope (%) :	12	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	11.18	0.00	0.00
Computed Flow Time (min) :	0.24	0.00	0.00
Total TOC (min)	12.11		

Subbasin Runoff Results

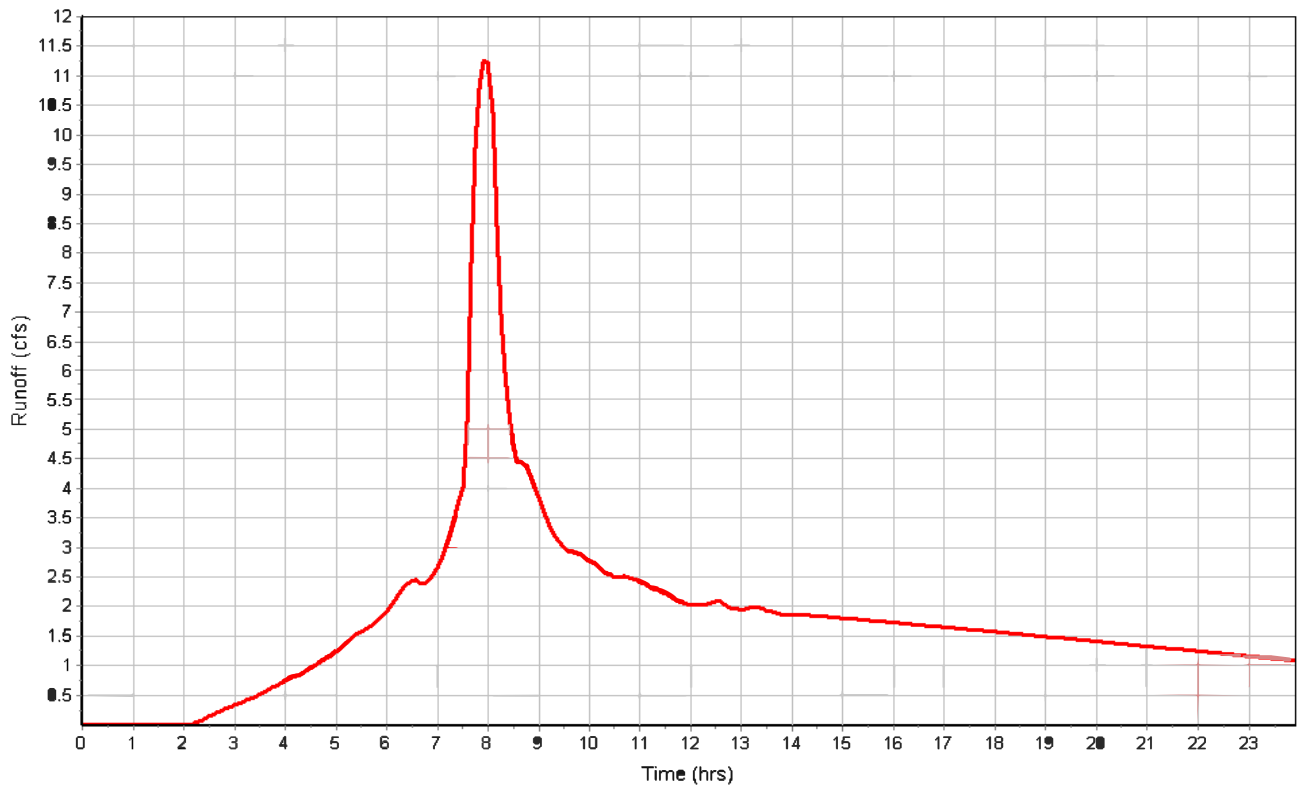
Total Rainfall (in) 11.98
Total Runoff (in) 8.97
Peak Runoff (cfs) 11.30
Weighted Curve Number 76.63
Time of Concentration (days hh:mm:ss) 0 00:12:07

Subbasin : {WTSH}.E

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.F

Input Data

Area (ac) 2.67
Peak Rate Factor 484.00
Weighted Curve Number 77.33
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.07	C	98.00
Woods & grass combination, Fair	1.93	C	76.00
50 - 75% grass cover, Fair	0.67	C	79.00
Composite Area & Weighted CN	2.67		77.33

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
	A	B	C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	40	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.83	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
	A	B	C
Flow Length (ft) :	318	0.00	0.00
Slope (%) :	22	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.35	0.00	0.00
Computed Flow Time (min) :	2.26	0.00	0.00

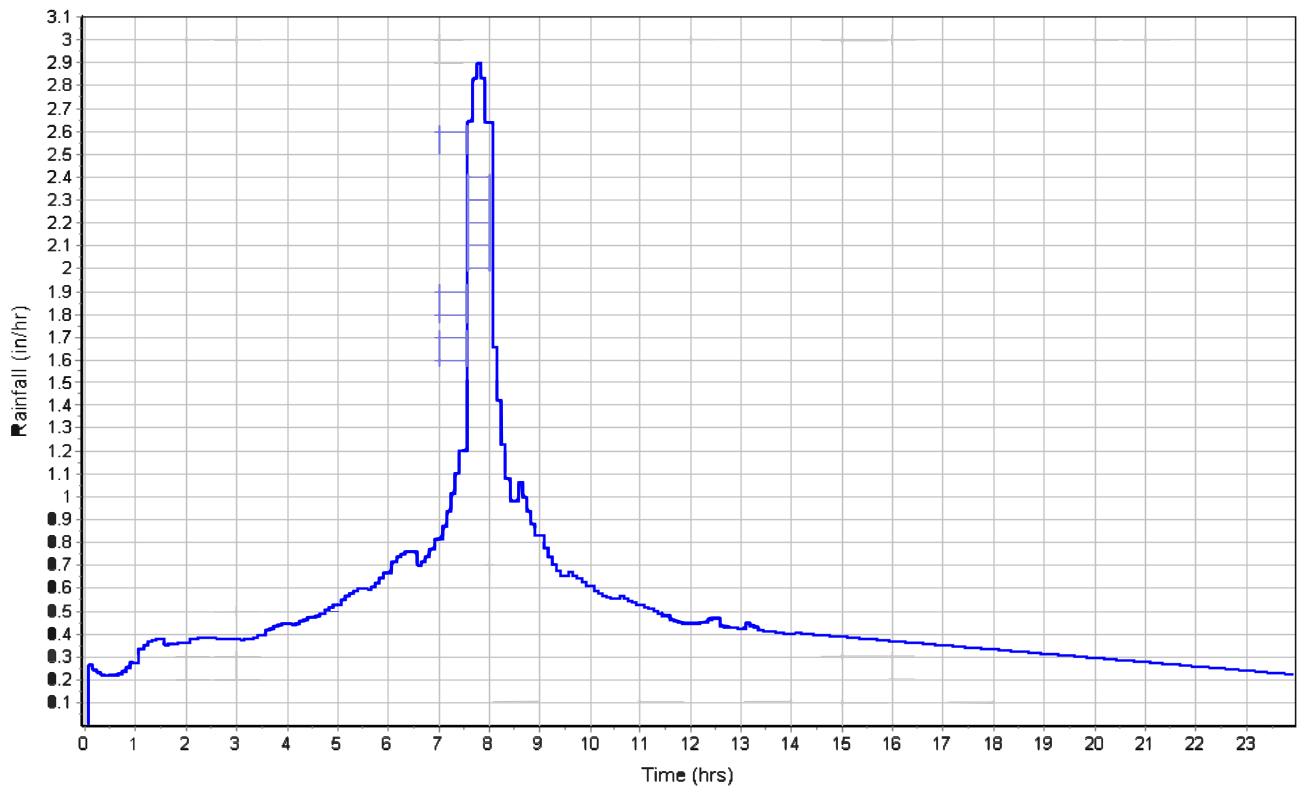
Channel Flow Computations	Subarea A	Subarea B	Subarea C
	A	B	C
Manning's Roughness :	0.027	0.00	0.00
Flow Length (ft) :	325	0.00	0.00
Channel Slope (%) :	5.3	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	7.43	0.00	0.00
Computed Flow Time (min) :	0.73	0.00	0.00
Total TOC (min)	8.82		

Subbasin Runoff Results

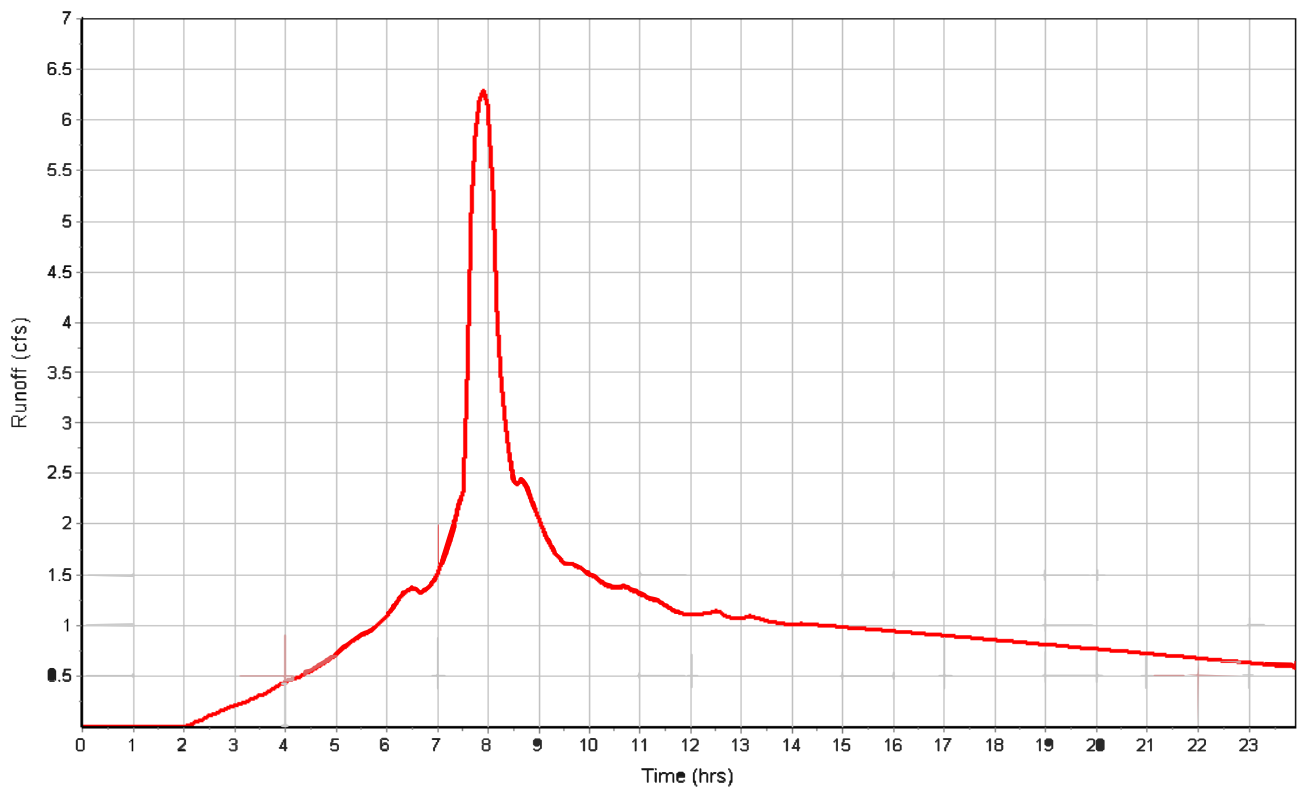
Total Rainfall (in) 11.98
Total Runoff (in) 9.07
Peak Runoff (cfs) 6.29
Weighted Curve Number 77.33
Time of Concentration (days hh:mm:ss) 0 00:08:49

Subbasin : {WTSH}.F

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.G

Input Data

Area (ac) 2.91
Peak Rate Factor 484.00
Weighted Curve Number 77.89
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	0.10	C	79.00
Paved parking & roofs	0.05	C	98.00
Woods & grass combination, Fair	1.39	C	76.00
50 - 75% grass cover, Fair	1.37	C	79.00
Composite Area & Weighted CN	2.91		77.89

Time of Concentration

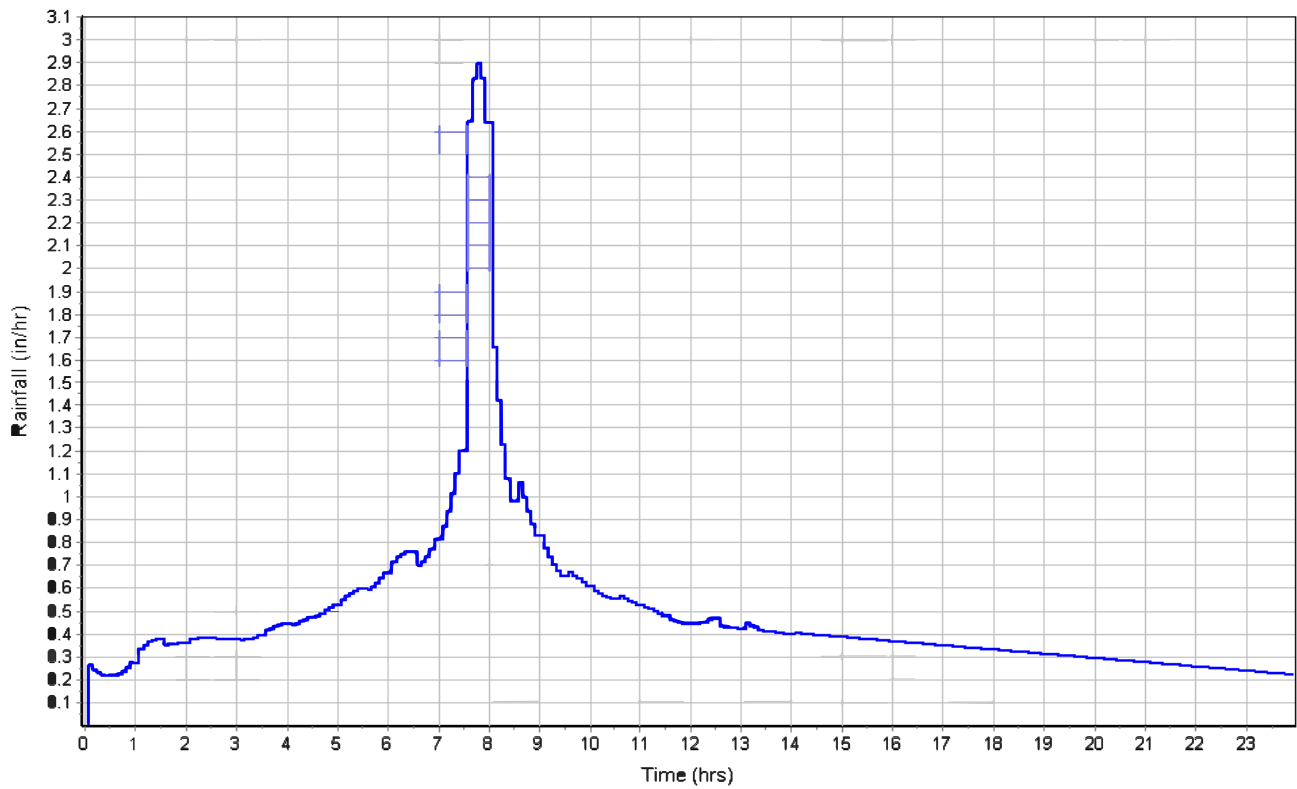
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.15	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	742	0.00	0.00
Slope (%) :	13.5	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.84	0.00	0.00
Computed Flow Time (min) :	6.72	0.00	0.00
Total TOC (min) 12.87			

Subbasin Runoff Results

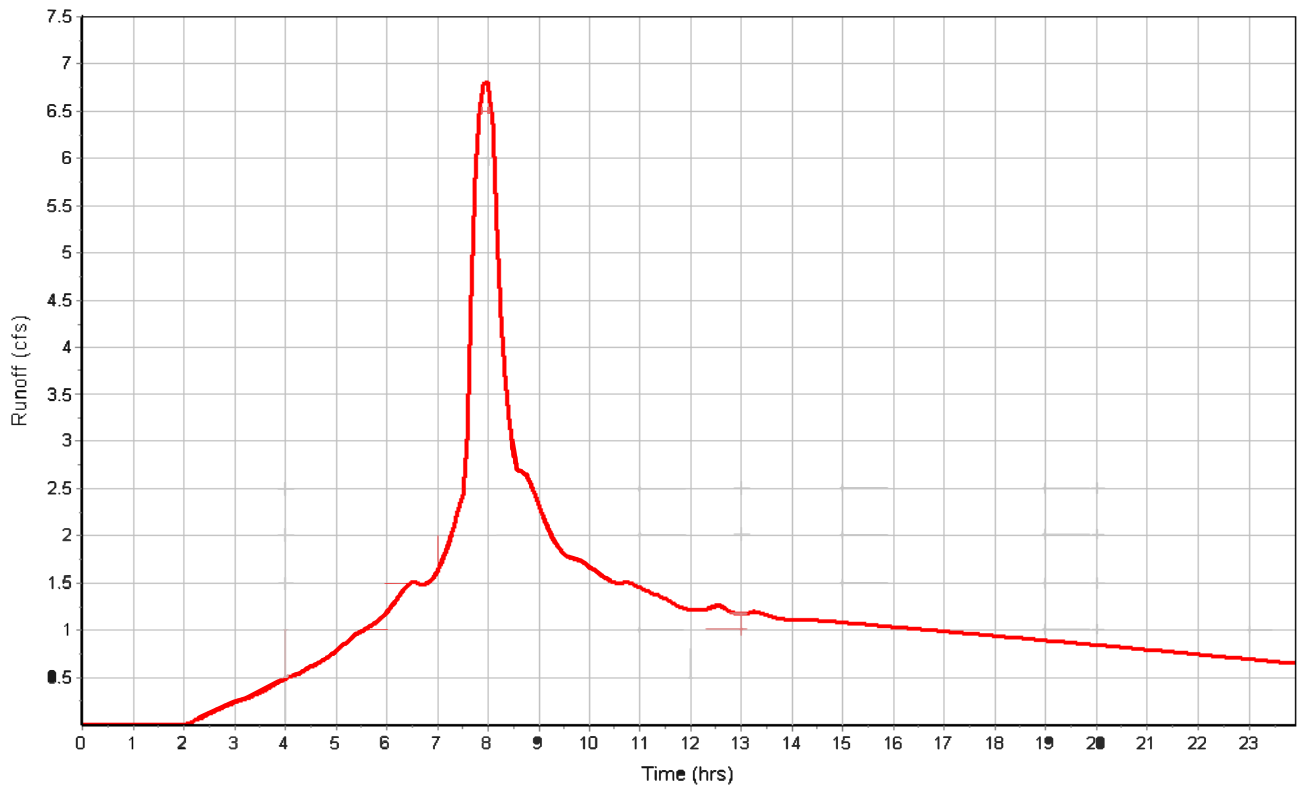
Total Rainfall (in) 11.98
Total Runoff (in) 9.14
Peak Runoff (cfs) 6.84
Weighted Curve Number 77.89
Time of Concentration (days hh:mm:ss) 0 00:12:52

Subbasin : {WTSH}.G

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name 1826-DRHY_POST.SPF
Description WINROD VINEYARD ECP
STORM AND SEWER ANALYSIS

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-20
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
YES

Analysis Options

Start Analysis On Jul 13, 2020 00:00:00
End Analysis On Jul 14, 2020 00:00:00
Start Reporting On Jul 13, 2020 00:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 8
Nodes..... 8
 Junctions 0
 Outfalls 8
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
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Subbasin Summary

SN Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1 {WTSH}.A1	25.12	484.00	79.23	5.10	2.91	73.12	17.82	0 00:10:20
2 {WTSH}.A2	3.57	484.00	75.65	5.10	2.59	9.25	2.21	0 00:04:27
3 {WTSH}.B	93.54	484.00	77.01	5.10	2.71	253.49	52.96	0 00:28:59
4 {WTSH}.C	54.14	484.00	76.00	5.10	2.62	141.85	30.53	0 00:24:03
5 {WTSH}.D	1.93	484.00	76.87	5.10	2.70	5.21	1.26	0 00:05:40
6 {WTSH}.E	4.90	484.00	75.70	5.10	2.59	12.71	3.02	0 00:06:06
7 {WTSH}.F	2.67	484.00	76.55	5.10	2.67	7.13	1.72	0 00:04:12
8 {WTSH}.G	2.91	484.00	75.91	5.10	2.61	7.60	1.79	0 00:09:48

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft ²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	A1	Outfall	0.00					0.00	0.00					
2	A2	Outfall	0.00					0.00	0.00					
3	B	Outfall	0.00					0.00	0.00					
4	C	Outfall	0.00					0.00	0.00					
5	D	Outfall	0.00					0.00	0.00					
6	E	Outfall	0.00					0.00	0.00					
7	F	Outfall	0.00					0.00	0.00					
8	G	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : {WTSH}.A1

Input Data

Area (ac) 25.12
Peak Rate Factor 484.00
Weighted Curve Number 79.23
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.09	C	98.00
Woods & grass combination, Fair	7.83	C	76.00
Woods & grass combination, Fair	5.13	D	82.00
50 - 75% grass cover, Fair	9.72	C	79.00
> 75% grass cover, Good	1.35	C	74.00
Composite Area & Weighted CN	25.12		79.23

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

Where :

T_c = Time of Concentration (hr)
n = Manning's roughness
L_f = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
V = 20.3282 * (S_f^{0.5}) (paved surface)
V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
V = 5.0 * (S_f^{0.5}) (woodland surface)
V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
T_c = (L_f / V) / (3600 sec/hr)

Where:

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n
R = A_q / W_p
T_c = (L_f / V) / (3600 sec/hr)

Where :

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
R = Hydraulic Radius (ft)
A_q = Flow Area (ft²)
W_p = Wetted Perimeter (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)
n = Manning's roughness

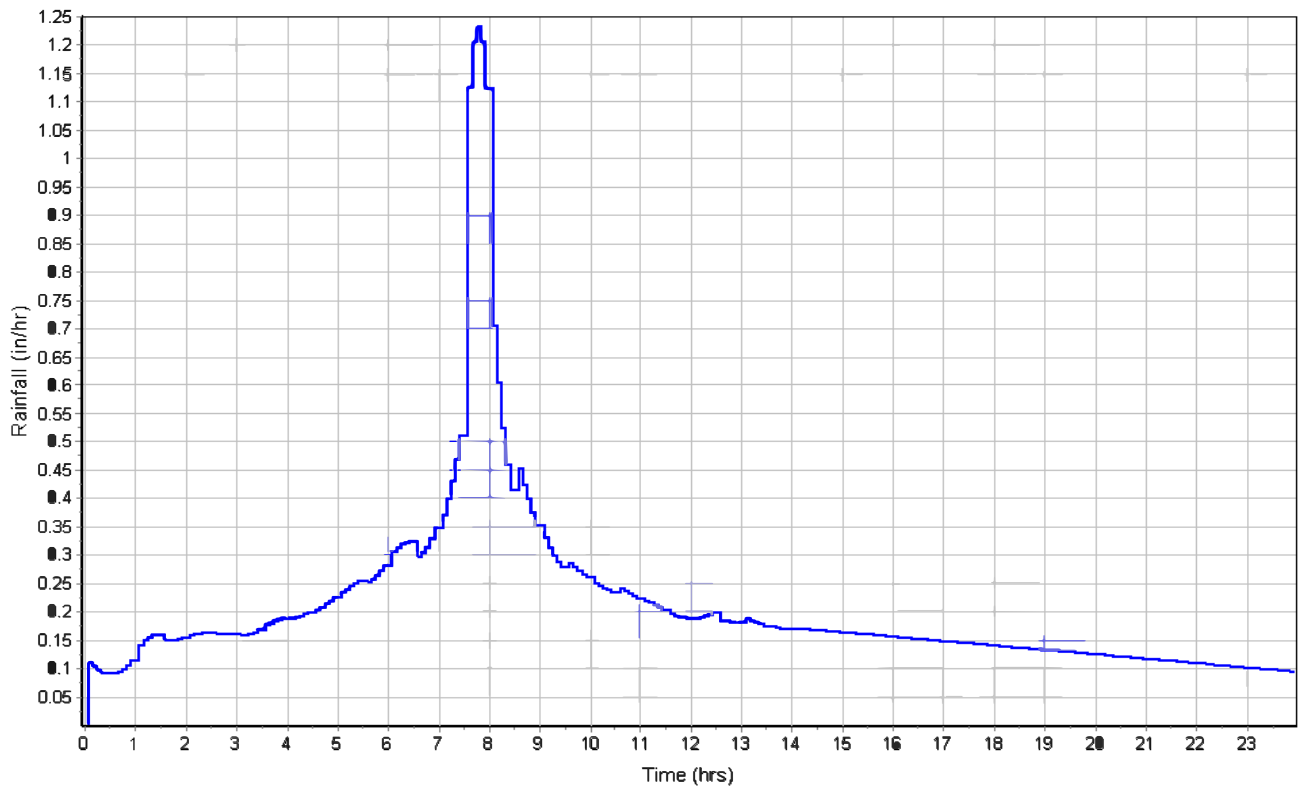
Sheet Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.25	0.00	0.00
Computed Flow Time (min) :	6.54	0.00	0.00
Shallow Concentrated Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Flow Length (ft) :	1499	0.00	0.00
Slope (%) :	16.7	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.59	0.00	0.00
Computed Flow Time (min) :	3.79	0.00	0.00
Total TOC (min)	10.34		

Subbasin Runoff Results

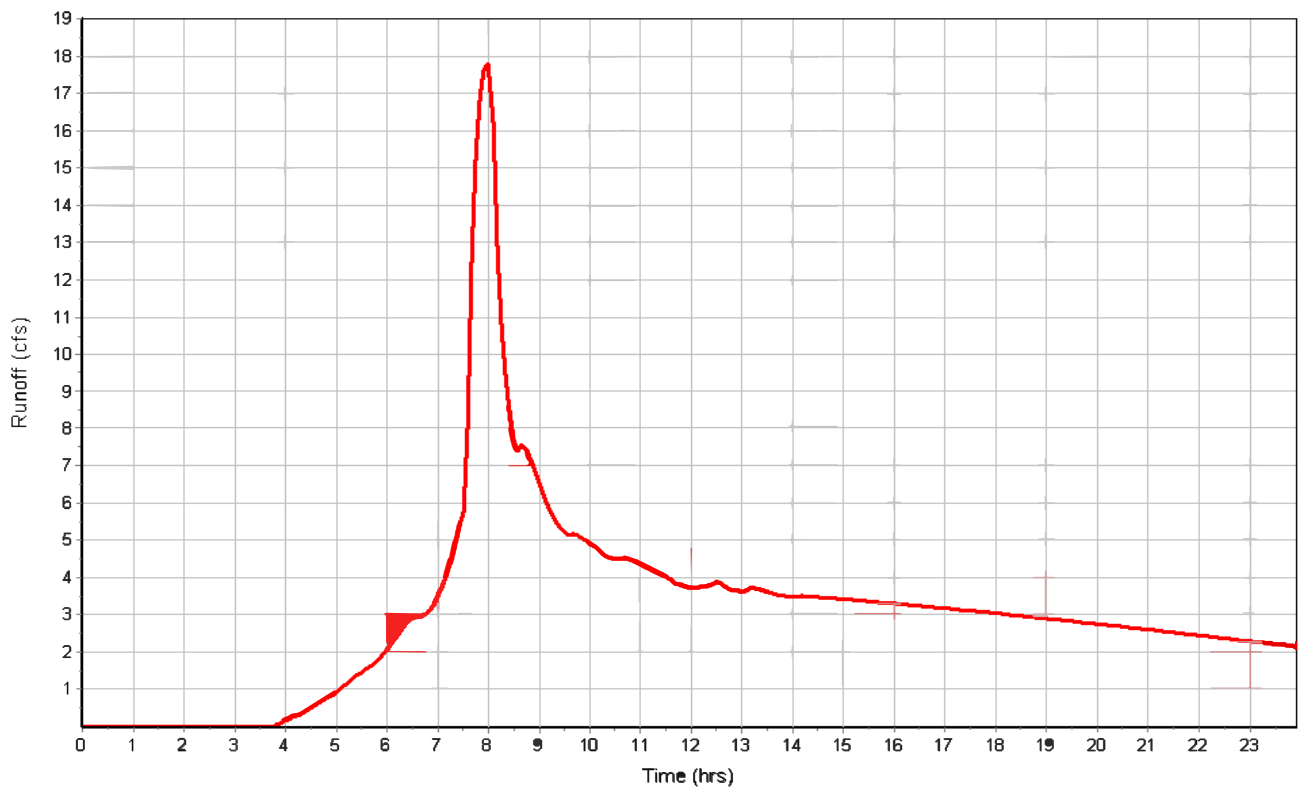
Total Rainfall (in)	5.10
Total Runoff (in)	2.91
Peak Runoff (cfs)	17.82
Weighted Curve Number	79.23
Time of Concentration (days hh:mm:ss)	0 00:10:20

Subbasin : {WTSH}.A1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.A2

Input Data

Area (ac) 3.57
Peak Rate Factor 484.00
Weighted Curve Number 75.65
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	2.94	C	76.00
> 75% grass cover, Good	0.63	C	74.00
Composite Area & Weighted CN	3.57		75.65

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	43	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.67	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	290	34	0.00
Slope (%) :	25.3	11.8	0.00
Surface Type :	Woodland	Woodland	Unpaved
Velocity (ft/sec) :	2.51	1.72	0.00
Computed Flow Time (min) :	1.93	0.33	0.00

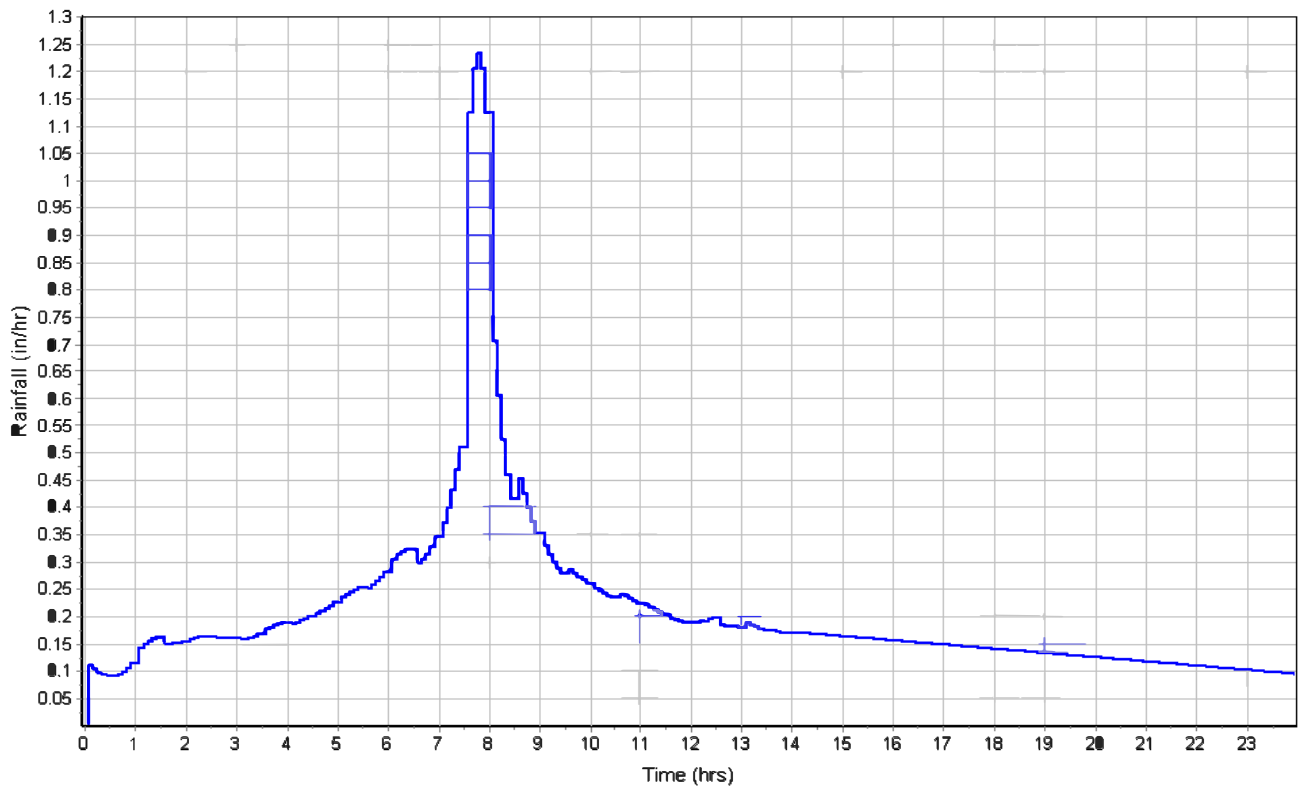
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	380	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	6.29	0.00	0.00
Computed Flow Time (min) :	1.01	0.00	0.00
Total TOC (min)	4.46		

Subbasin Runoff Results

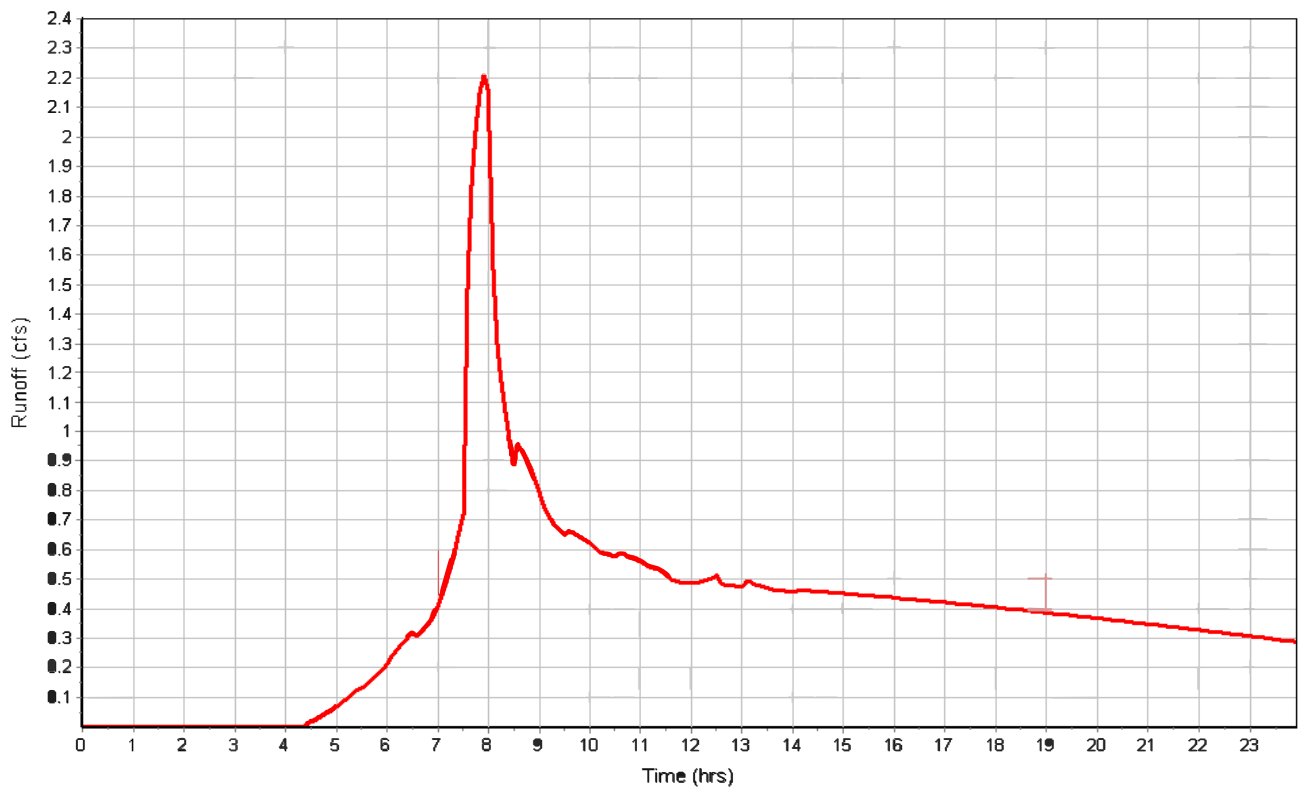
Total Rainfall (in) 5.10
Total Runoff (in) 2.59
Peak Runoff (cfs) 2.21
Weighted Curve Number 75.65
Time of Concentration (days hh:mm:ss) 0 00:04:28

Subbasin : {WTSH}.A2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.B

Input Data

Area (ac) 93.54
Peak Rate Factor 484.00
Weighted Curve Number 77.01
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.22	C	98.00
Woods & grass combination, Fair	74.50	C	76.00
Woods & grass combination, Fair	14.94	D	82.00
50 - 75% grass cover, Fair	0.16	C	79.00
> 75% grass cover, Good	3.24	C	74.00
Gravel roads	0.48	C	89.00
Composite Area & Weighted CN	93.54		77.01

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	45	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	6.40	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	2154	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	8.12	0.00	0.00
Computed Flow Time (min) :	4.42	0.00	0.00

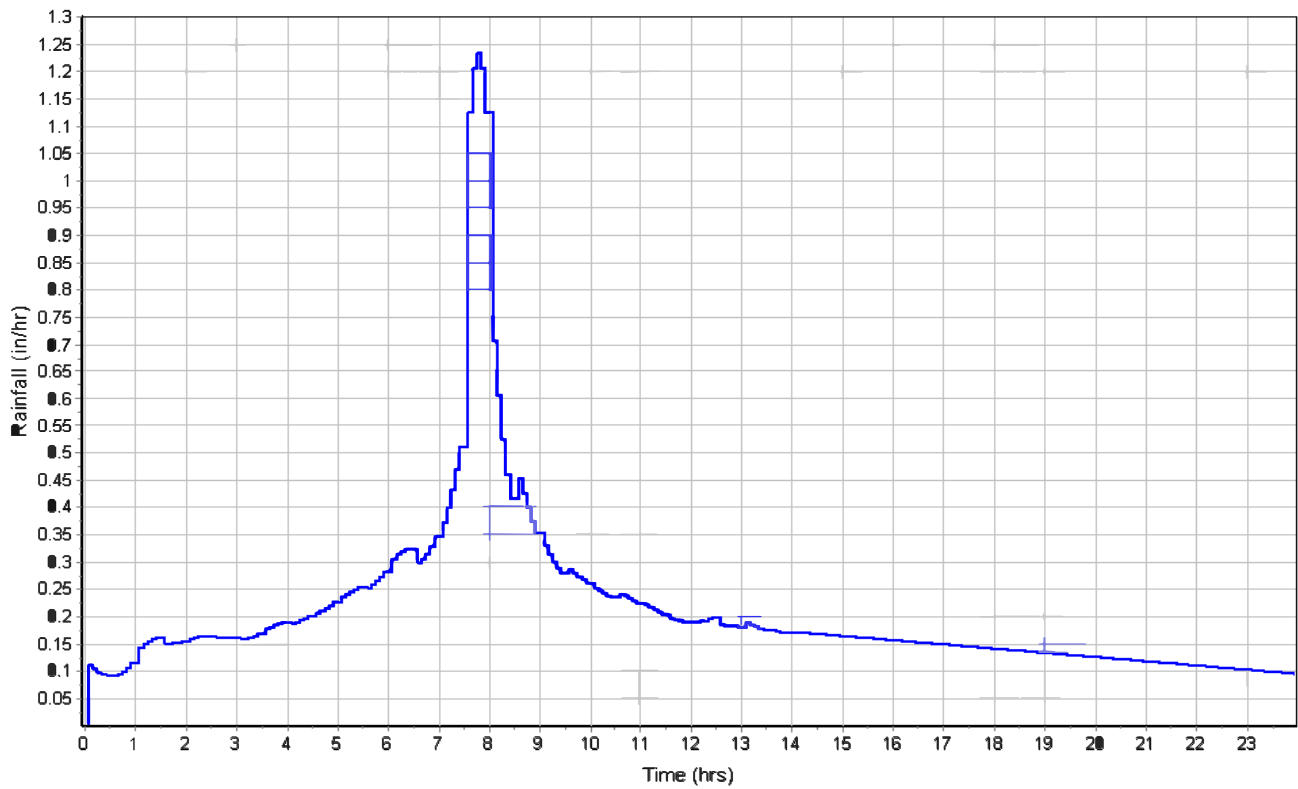
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	0.5	0.00	0.00
Flow Length (ft) :	2196	0.00	0.00
Channel Slope (%) :	7.2	0.00	0.00
Cross Section Area (ft²) :	60	0.00	0.00
Wetted Perimeter (ft) :	15	0.00	0.00
Velocity (ft/sec) :	2.01	0.00	0.00
Computed Flow Time (min) :	18.16	0.00	0.00
Total TOC (min)	28.99		

Subbasin Runoff Results

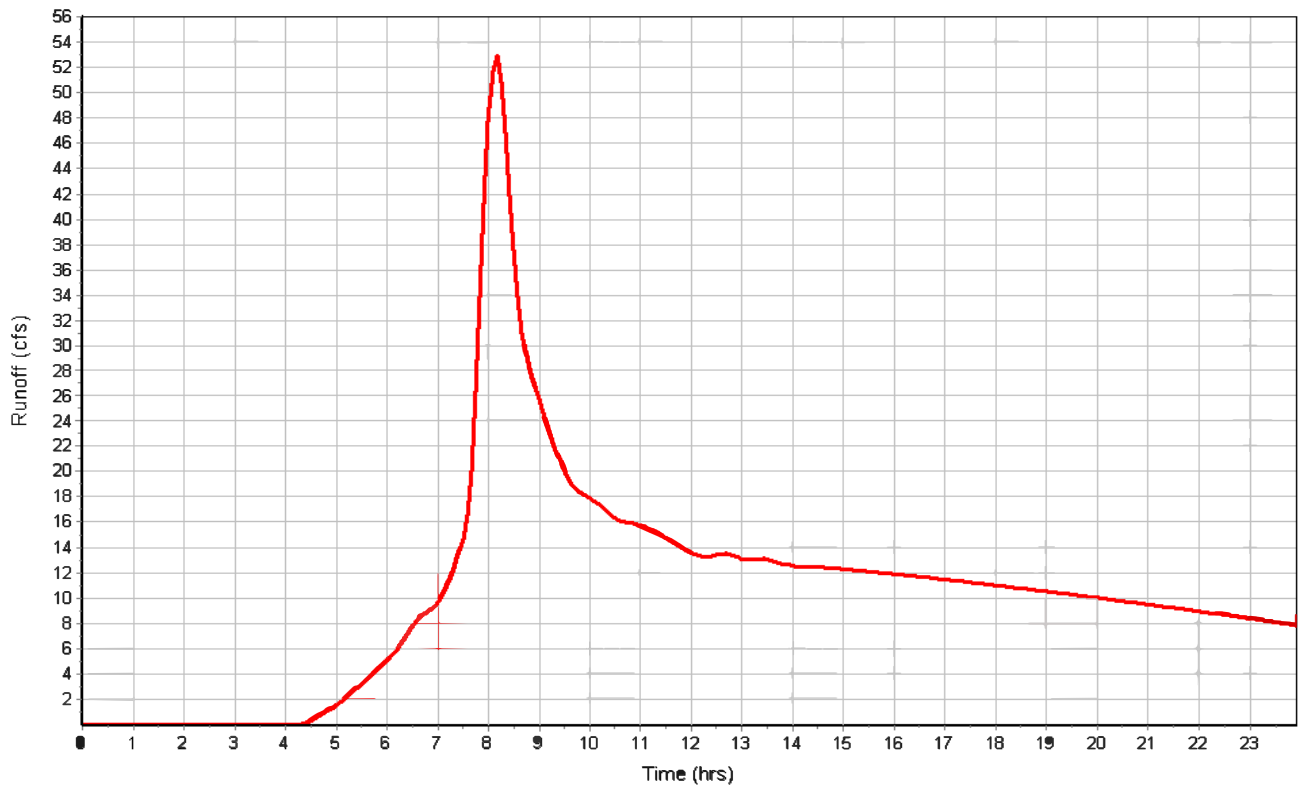
Total Rainfall (in) 5.10
Total Runoff (in) 2.71
Peak Runoff (cfs) 52.96
Weighted Curve Number 77.01
Time of Concentration (days hh:mm:ss) 0 00:28:59

Subbasin : {WTSH}.B

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.C

Input Data

Area (ac) 54.14
Peak Rate Factor 484.00
Weighted Curve Number 76.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	54.14	C	76.00
Composite Area & Weighted CN	54.14		76.00

Time of Concentration

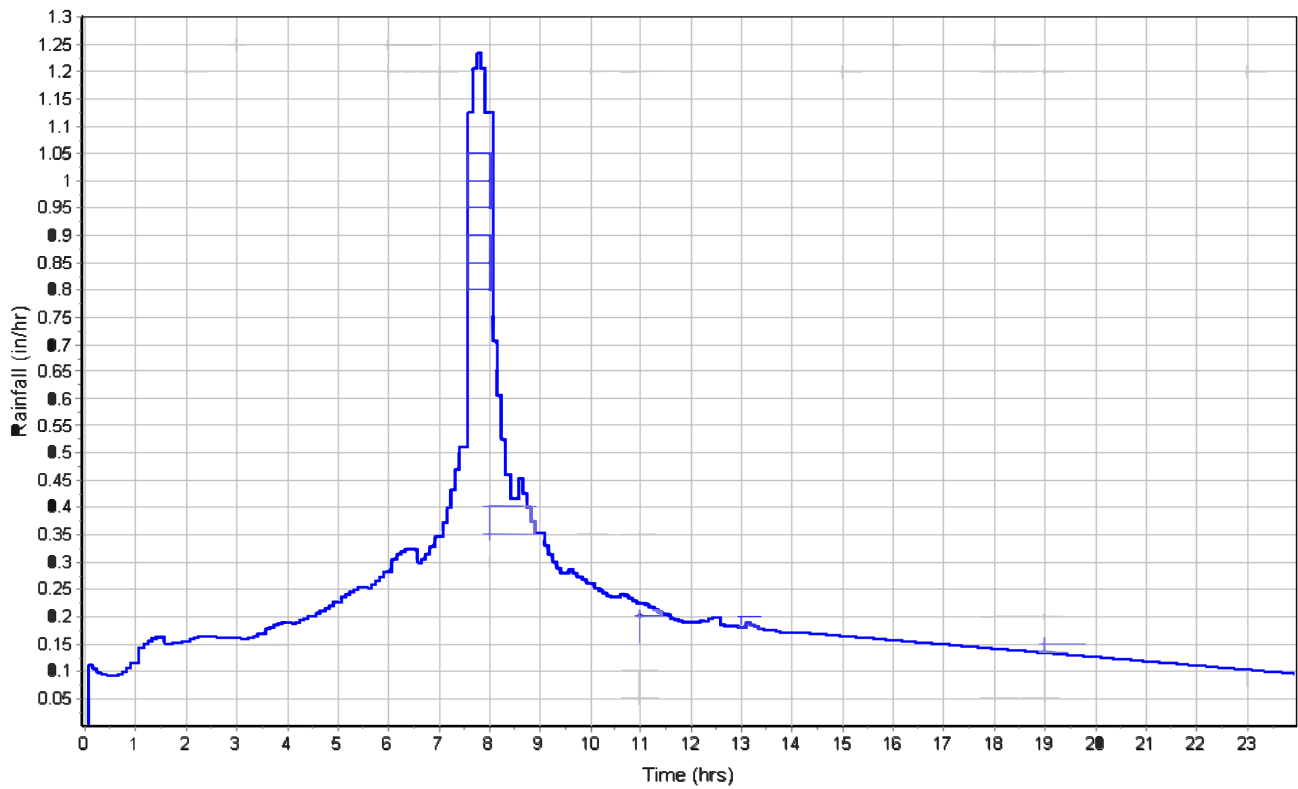
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.14	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1940	0.00	0.00
Slope (%) :	31.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.82	0.00	0.00
Computed Flow Time (min) :	11.47	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.50	0.00	0.00
Flow Length (ft) :	1445	0.00	0.00
Channel Slope (%) :	8.7	0.00	0.00
Cross Section Area (ft²) :	228	0.00	0.00
Wetted Perimeter (ft) :	26	0.00	0.00
Velocity (ft/sec) :	3.74	0.00	0.00
Computed Flow Time (min) :	6.44	0.00	0.00
Total TOC (min)	24.05		

Subbasin Runoff Results

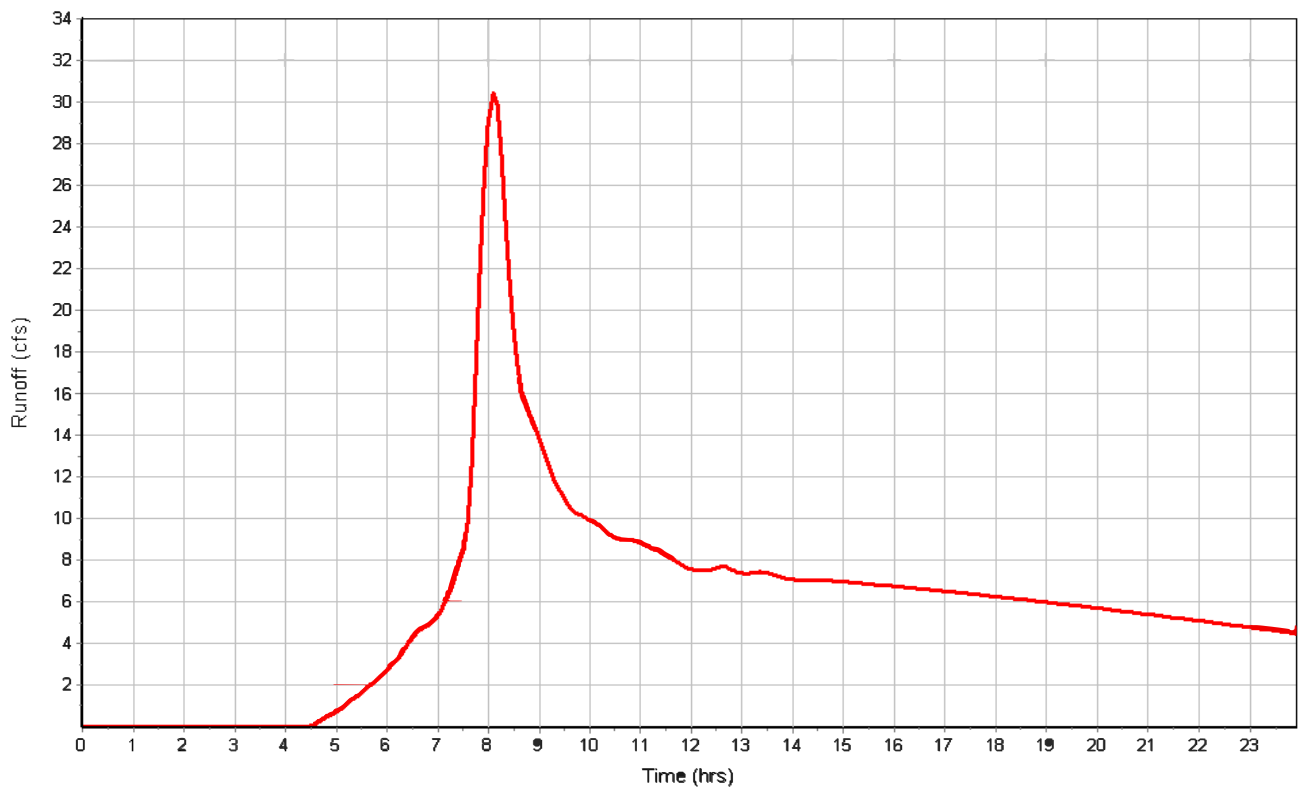
Total Rainfall (in) 5.10
Total Runoff (in) 2.62
Peak Runoff (cfs) 30.53
Weighted Curve Number 76.00
Time of Concentration (days hh:mm:ss) 0 00:24:03

Subbasin : {WTSH}.C

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.D

Input Data

Area (ac) 1.93
Peak Rate Factor 484.00
Weighted Curve Number 76.87
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.21	C	98.00
Woods & grass combination, Fair	0.25	C	76.00
> 75% grass cover, Good	1.47	C	74.00
Composite Area & Weighted CN	1.93		76.87

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.22	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.43	0.00	0.00
Computed Flow Time (min) :	3.84	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	244	0.00	0.00
Slope (%) :	7.4	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	2.45	0.00	0.00
Computed Flow Time (min) :	1.66	0.00	0.00

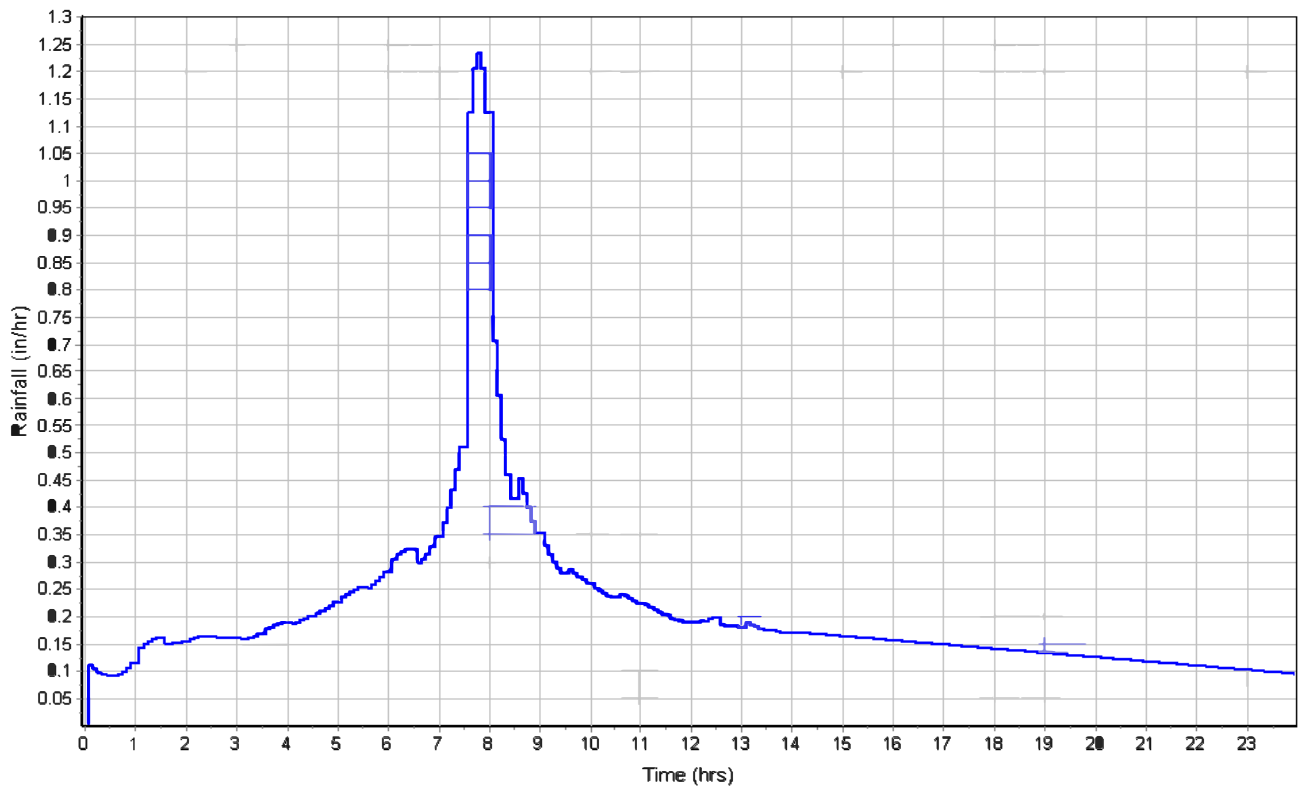
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	52	0.00	0.00
Channel Slope (%) :	2.2	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	4.79	0.00	0.00
Computed Flow Time (min) :	0.18	0.00	0.00
Total TOC (min)	5.68		

Subbasin Runoff Results

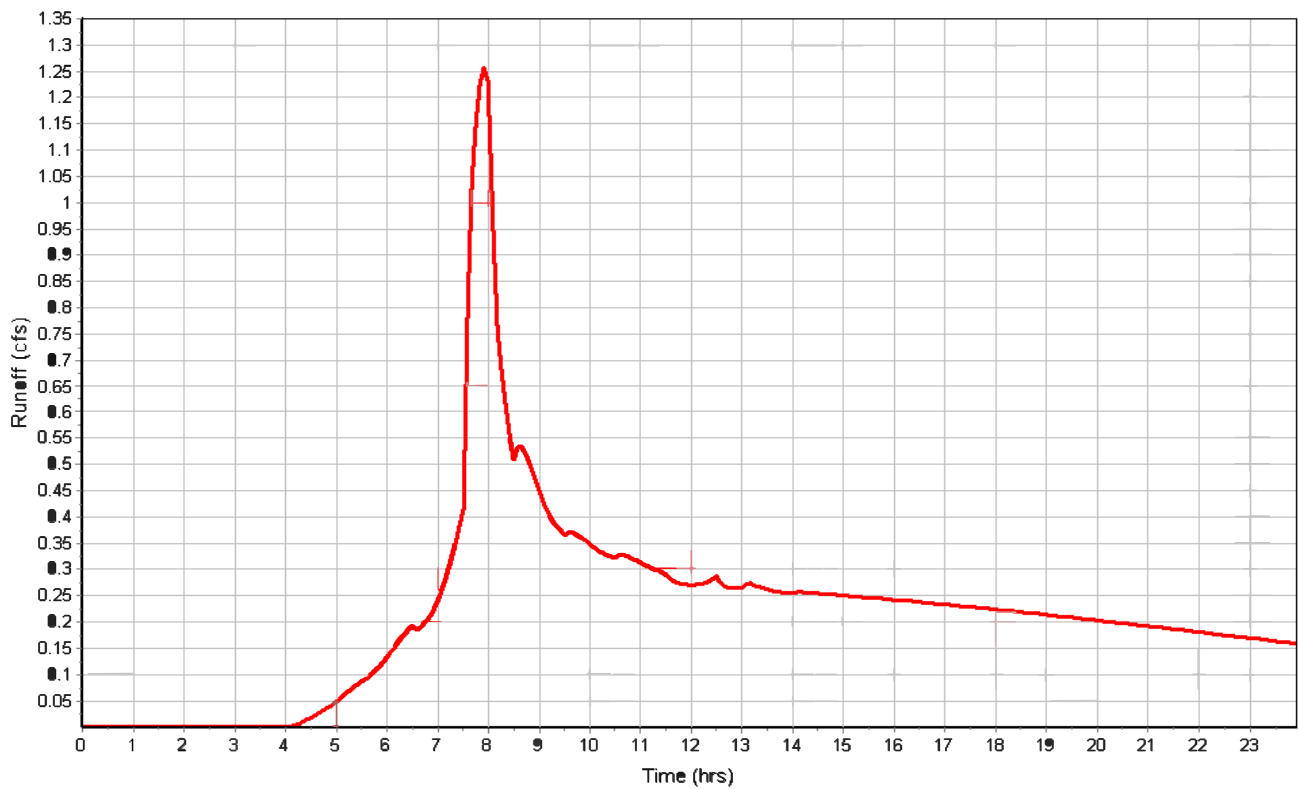
Total Rainfall (in) 5.10
Total Runoff (in) 2.70
Peak Runoff (cfs) 1.26
Weighted Curve Number 76.87
Time of Concentration (days hh:mm:ss) 0 00:05:41

Subbasin : {WTSH}.D

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.E

Input Data

Area (ac) 4.90
Peak Rate Factor 484.00
Weighted Curve Number 75.70
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.17	C	98.00
Woods & grass combination, Fair	2.13	C	76.00
> 75% grass cover, Good	2.60	C	74.00
Composite Area & Weighted CN	4.90		75.70

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.22	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.41	0.00	0.00
Computed Flow Time (min) :	4.04	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	321	0.00	0.00
Slope (%) :	23	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	3.36	0.00	0.00
Computed Flow Time (min) :	1.59	0.00	0.00

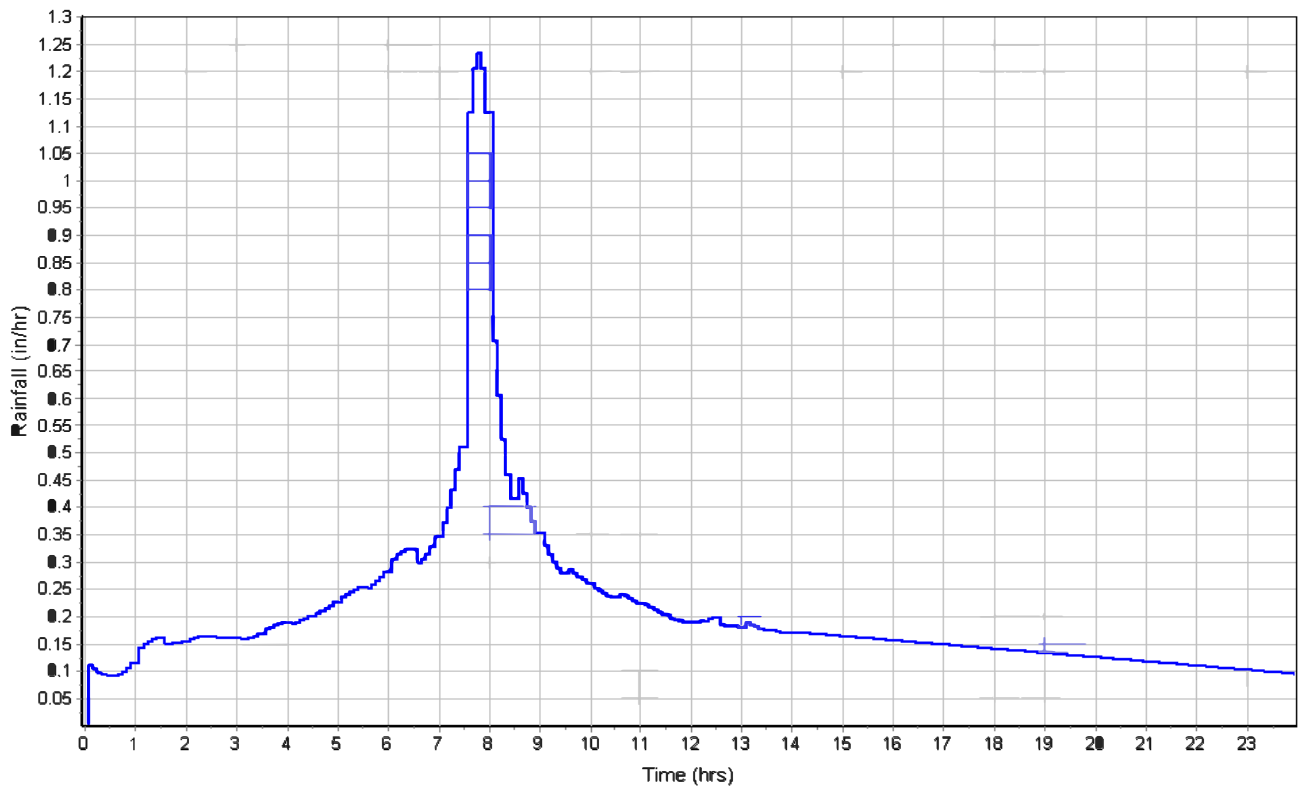
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	161	0.00	0.00
Channel Slope (%) :	12	0.00	0.00
Cross Section Area (ft ²) :	1.4	0.00	0.00
Wetted Perimeter (ft) :	4.7	0.00	0.00
Velocity (ft/sec) :	5.76	0.00	0.00
Computed Flow Time (min) :	0.47	0.00	0.00
Total TOC (min)	6.10		

Subbasin Runoff Results

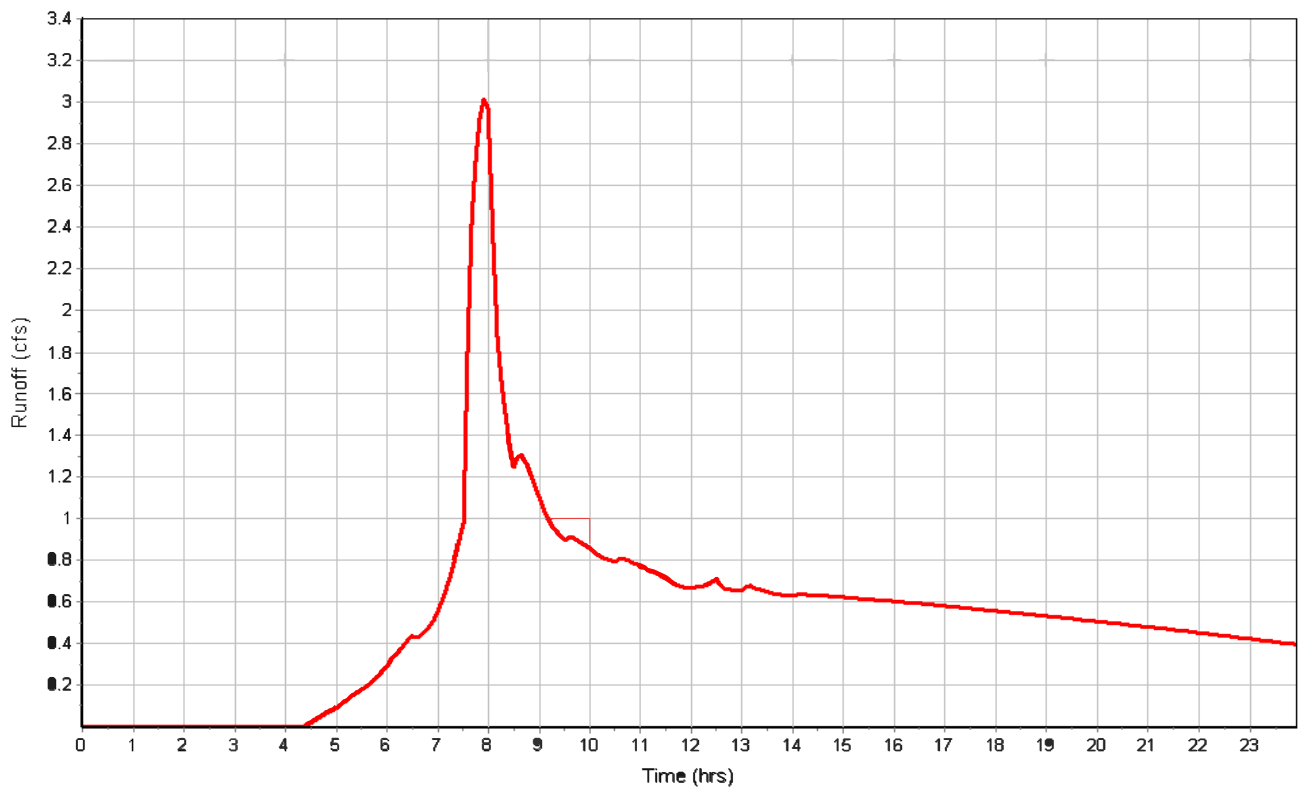
Total Rainfall (in) 5.10
Total Runoff (in) 2.59
Peak Runoff (cfs) 3.02
Weighted Curve Number 75.70
Time of Concentration (days hh:mm:ss) 0 00:06:06

Subbasin : {WTSH}.E

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.F

Input Data

Area (ac) 2.67
Peak Rate Factor 484.00
Weighted Curve Number 76.55
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.20	C	98.00
Woods & grass combination, Fair	1.00	C	76.00
> 75% grass cover, Good	1.47	C	74.00
Composite Area & Weighted CN	2.67		76.55

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	40	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.83	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	318	0.00	0.00
Slope (%) :	22	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	4.22	0.00	0.00
Computed Flow Time (min) :	1.26	0.00	0.00

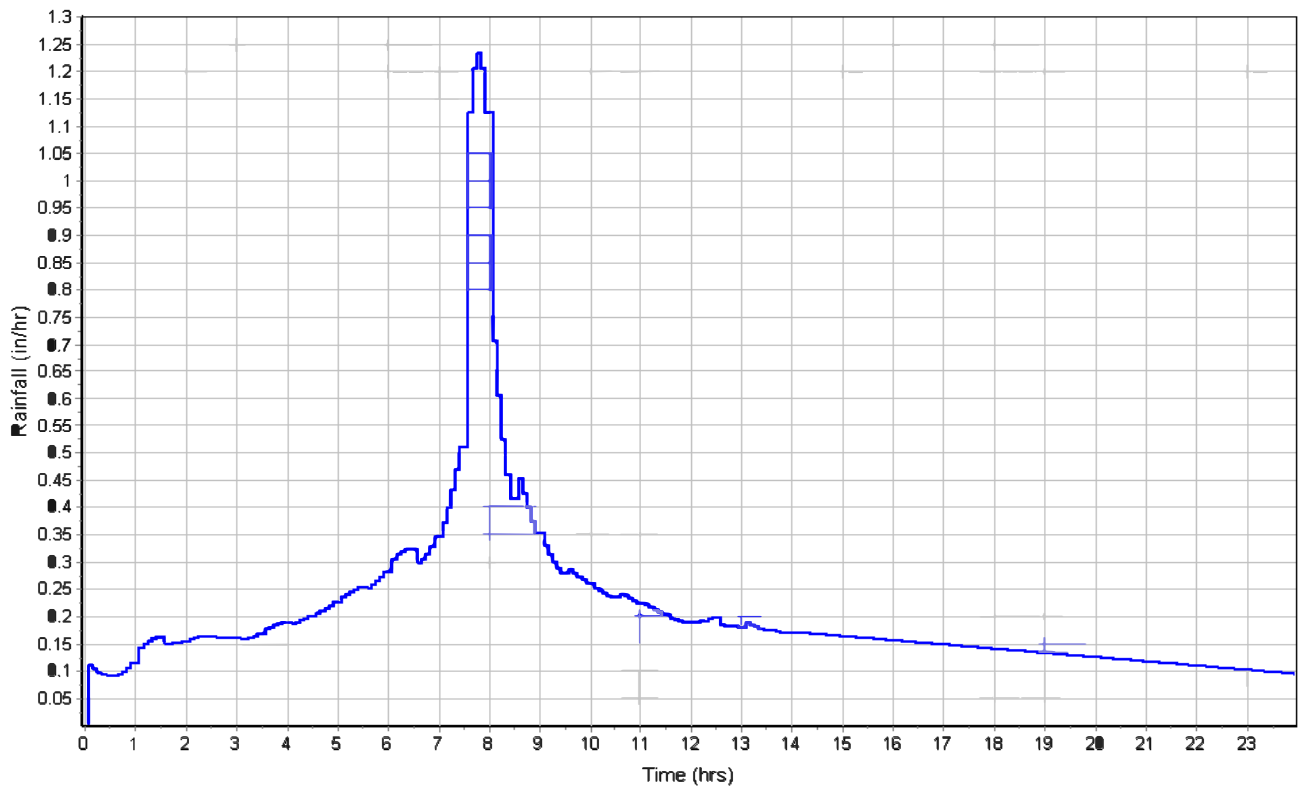
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.04	.022	0.00
Flow Length (ft) :	325	112	0.00
Channel Slope (%) :	5.3	11	0.00
Cross Section Area (ft ²) :	2	2	0.00
Wetted Perimeter (ft) :	5	5	0.00
Velocity (ft/sec) :	4.66	12.19	0.00
Computed Flow Time (min) :	1.16	0.15	0.00
Total TOC (min)	4.20		

Subbasin Runoff Results

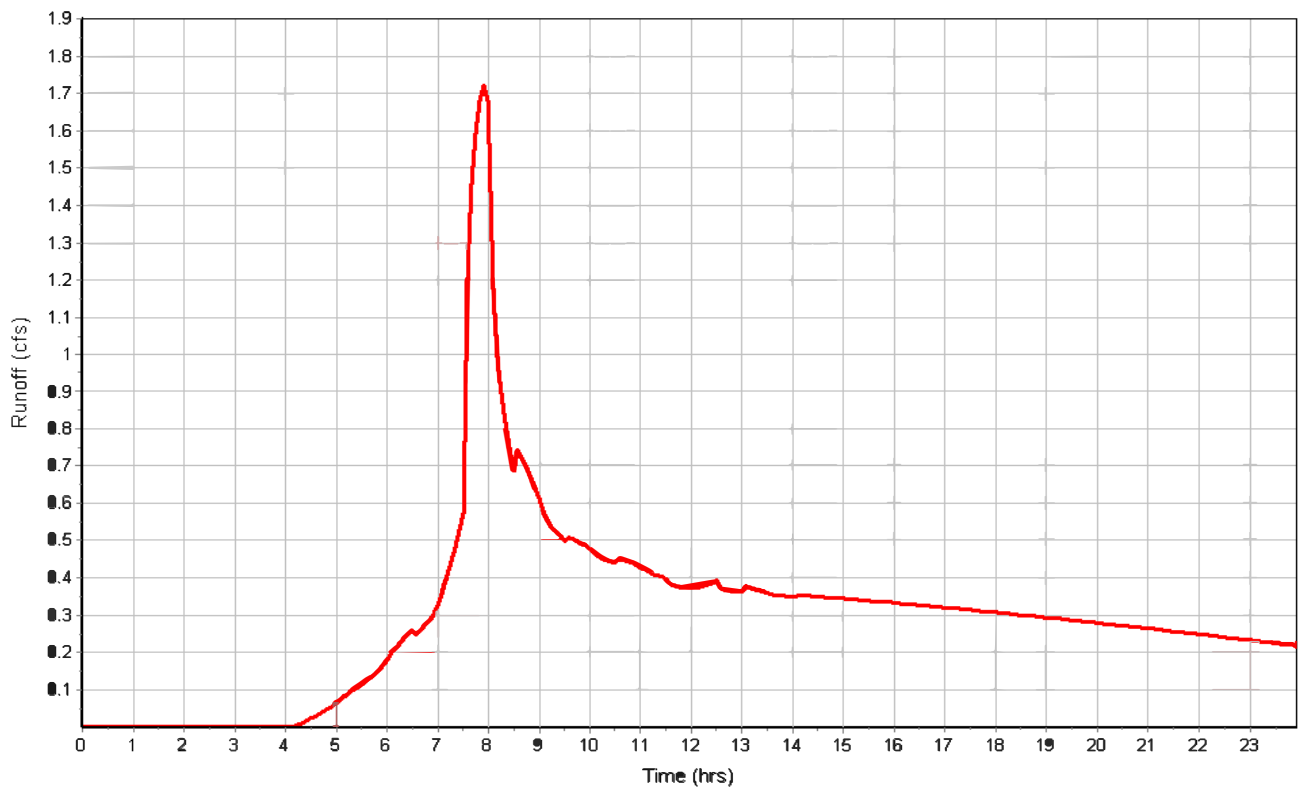
Total Rainfall (in) 5.10
Total Runoff (in) 2.67
Peak Runoff (cfs) 1.72
Weighted Curve Number 76.55
Time of Concentration (days hh:mm:ss) 0 00:04:12

Subbasin : {WTSH}.F

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.G

Input Data

Area (ac) 2.91
Peak Rate Factor 484.00
Weighted Curve Number 75.91
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.09	C	98.00
Woods & grass combination, Fair	0.97	C	76.00
50 - 75% grass cover, Fair	0.29	C	79.00
> 75% grass cover, Good	1.56	C	74.00
Composite Area & Weighted CN	2.91		75.91

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.15	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	718	0.00	0.00
Slope (%) :	13.5	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	3.31	0.00	0.00
Computed Flow Time (min) :	3.62	0.00	0.00

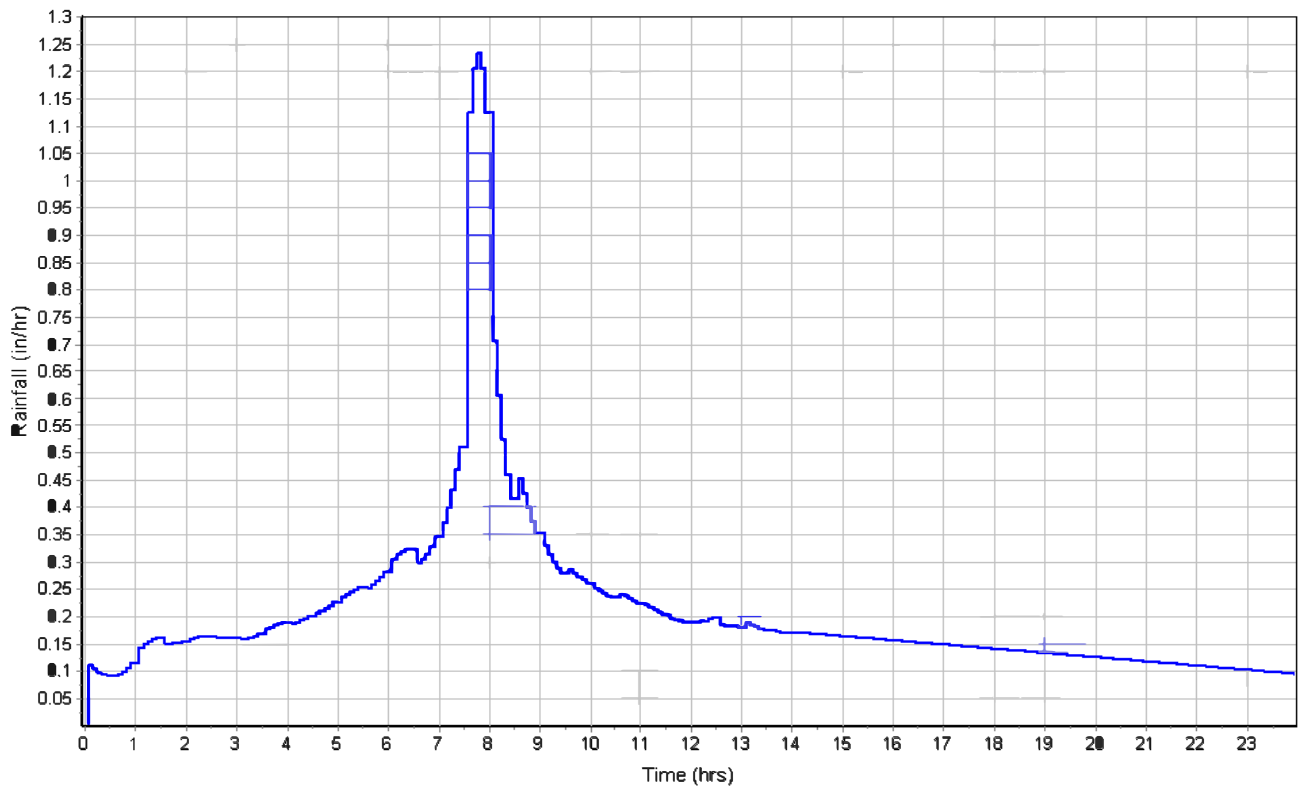
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	0.022	0.00	0.00
Flow Length (ft) :	24	0.00	0.00
Channel Slope (%) :	8.3	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	10.59	0.00	0.00
Computed Flow Time (min) :	0.04	0.00	0.00
Total TOC (min)	9.81		

Subbasin Runoff Results

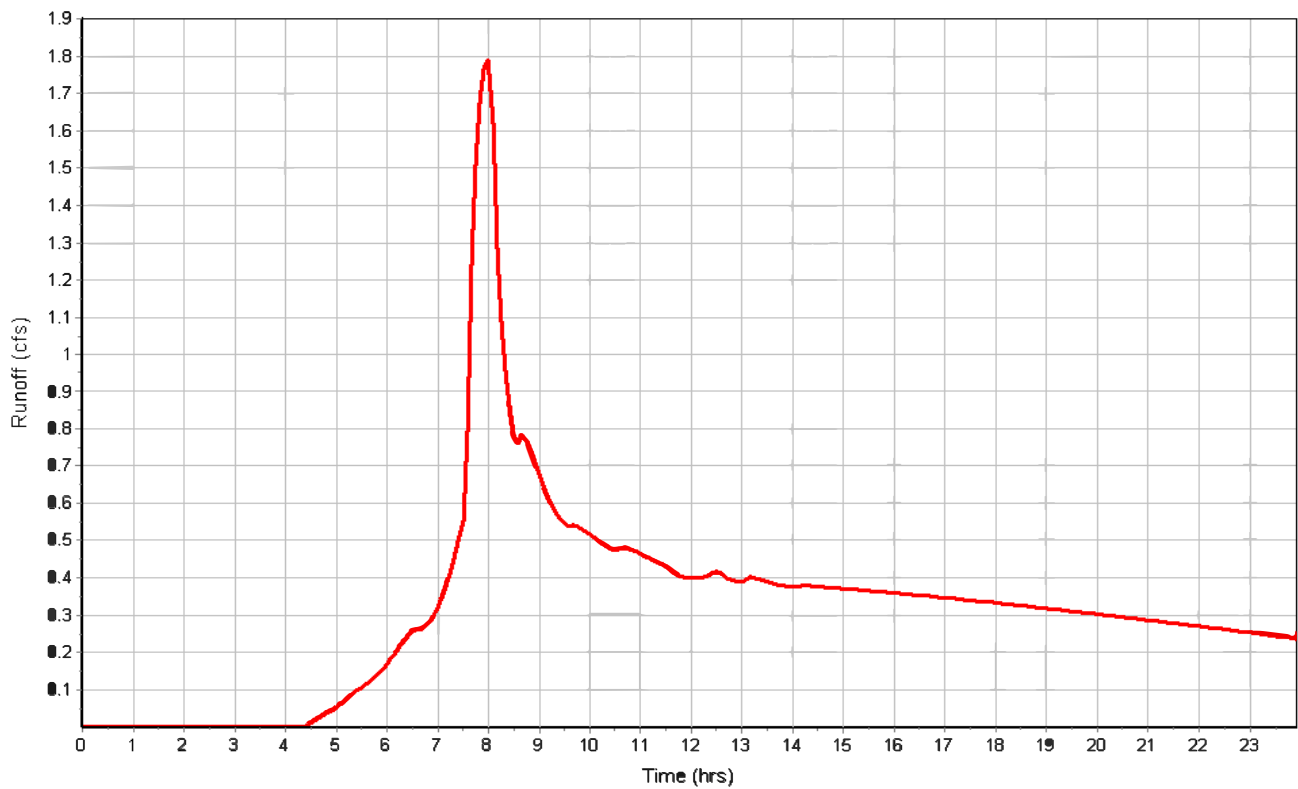
Total Rainfall (in) 5.10
Total Runoff (in) 2.61
Peak Runoff (cfs) 1.79
Weighted Curve Number 75.91
Time of Concentration (days hh:mm:ss) 0 00:09:49

Subbasin : {WTSH}.G

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name 1826-DRHY_POST.SPF
Description
WINROD VINEYARD ECP
STORM AND SEWER ANALYSIS

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-20
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
YES

Analysis Options

Start Analysis On Jul 13, 2020 00:00:00
End Analysis On Jul 14, 2020 00:00:00
Start Reporting On Jul 13, 2020 00:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins 8
Nodes 8
 Junctions 0
 Outfalls 8
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
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Subbasin Summary

SN Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
	(ac)			(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1 {WTSH}.A1	25.12	484.00	79.23	7.78	5.33	133.86	34.19	0 00:10:20
2 {WTSH}.A2	3.57	484.00	75.65	7.78	4.92	17.55	4.47	0 00:04:27
3 {WTSH}.B	93.54	484.00	77.01	7.78	5.07	474.53	106.30	0 00:28:59
4 {WTSH}.C	54.14	484.00	76.00	7.78	4.96	268.37	62.21	0 00:24:03
5 {WTSH}.D	1.93	484.00	76.87	7.78	5.06	9.76	2.50	0 00:05:40
6 {WTSH}.E	4.90	484.00	75.70	7.78	4.92	24.12	6.12	0 00:06:06
7 {WTSH}.F	2.67	484.00	76.55	7.78	5.02	13.40	3.43	0 00:04:12
8 {WTSH}.G	2.91	484.00	75.91	7.78	4.95	14.40	3.62	0 00:09:48

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft ²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	A1	Outfall	0.00					0.00	0.00					
2	A2	Outfall	0.00					0.00	0.00					
3	B	Outfall	0.00					0.00	0.00					
4	C	Outfall	0.00					0.00	0.00					
5	D	Outfall	0.00					0.00	0.00					
6	E	Outfall	0.00					0.00	0.00					
7	F	Outfall	0.00					0.00	0.00					
8	G	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : {WTSH}.A1

Input Data

Area (ac) 25.12
Peak Rate Factor 484.00
Weighted Curve Number 79.23
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.09	C	98.00
Woods & grass combination, Fair	7.83	C	76.00
Woods & grass combination, Fair	5.13	D	82.00
50 - 75% grass cover, Fair	9.72	C	79.00
> 75% grass cover, Good	1.35	C	74.00
Composite Area & Weighted CN	25.12		79.23

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

Where :

T_c = Time of Concentration (hr)
n = Manning's roughness
L_f = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
V = 20.3282 * (S_f^{0.5}) (paved surface)
V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
V = 5.0 * (S_f^{0.5}) (woodland surface)
V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
T_c = (L_f / V) / (3600 sec/hr)

Where:

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n
R = A_q / W_p
T_c = (L_f / V) / (3600 sec/hr)

Where :

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
R = Hydraulic Radius (ft)
A_q = Flow Area (ft²)
W_p = Wetted Perimeter (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)
n = Manning's roughness

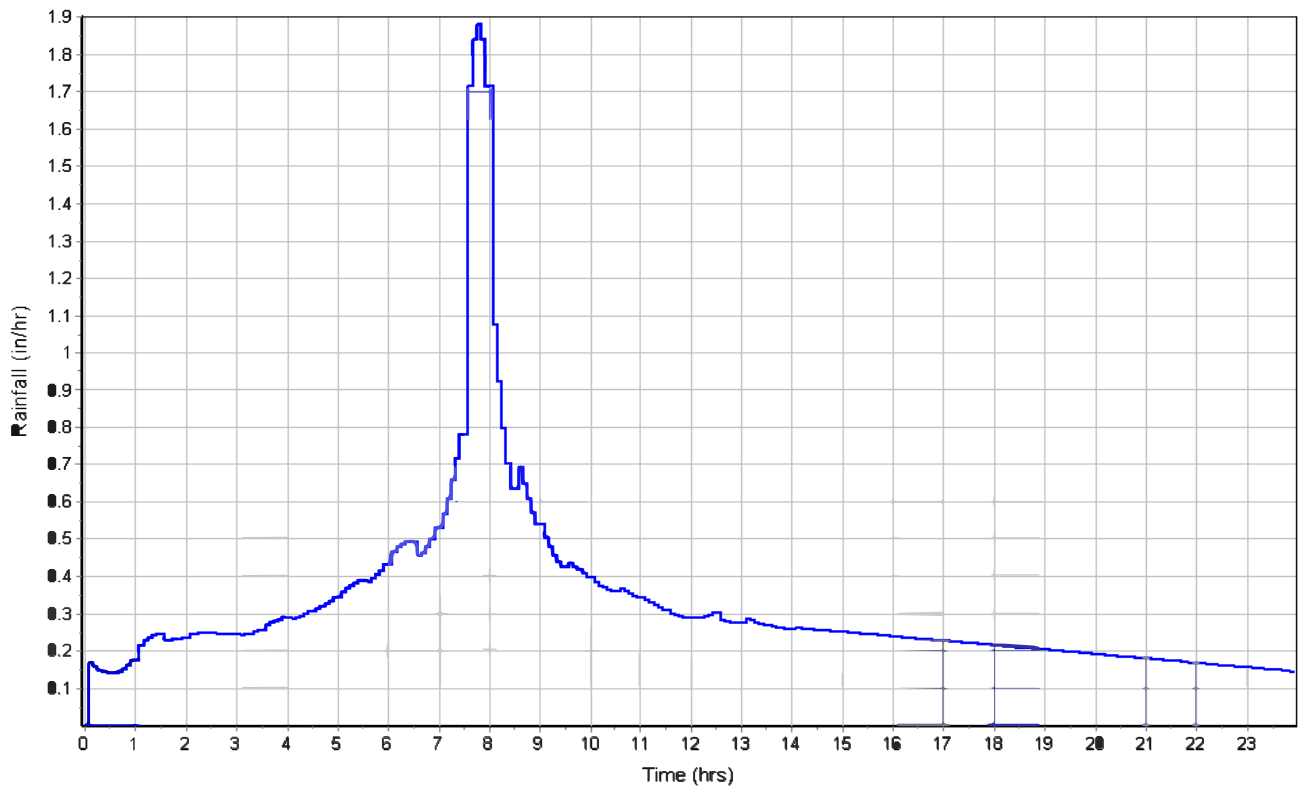
Sheet Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.25	0.00	0.00
Computed Flow Time (min) :	6.54	0.00	0.00
Shallow Concentrated Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Flow Length (ft) :	1499	0.00	0.00
Slope (%) :	16.7	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.59	0.00	0.00
Computed Flow Time (min) :	3.79	0.00	0.00
Total TOC (min)	10.34		

Subbasin Runoff Results

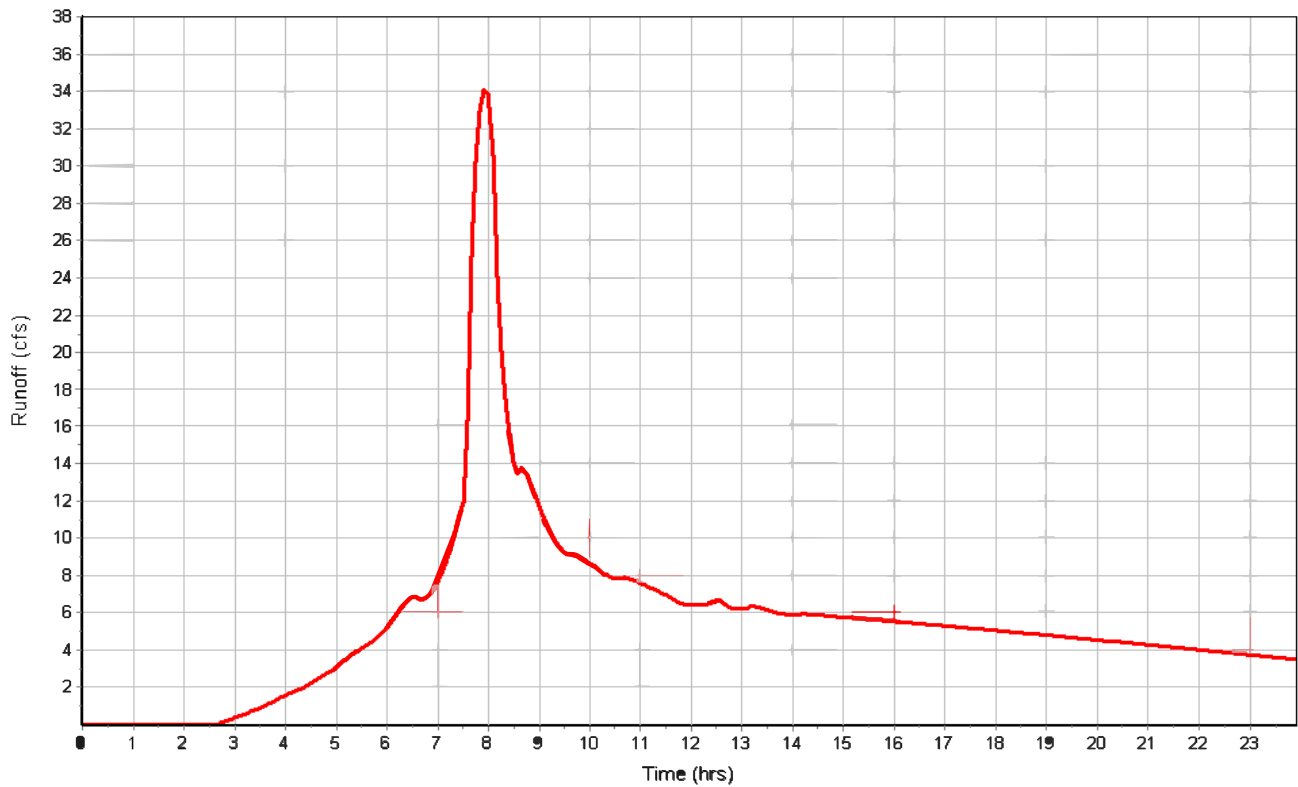
Total Rainfall (in)	7.78
Total Runoff (in)	5.33
Peak Runoff (cfs)	34.19
Weighted Curve Number	79.23
Time of Concentration (days hh:mm:ss)	0 00:10:20

Subbasin : {WTSH}.A1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.A2

Input Data

Area (ac) 3.57
Peak Rate Factor 484.00
Weighted Curve Number 75.65
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	2.94	C	76.00
> 75% grass cover, Good	0.63	C	74.00
Composite Area & Weighted CN	3.57		75.65

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	43	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.67	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	290	34	0.00
Slope (%) :	25.3	11.8	0.00
Surface Type :	Woodland	Woodland	Unpaved
Velocity (ft/sec) :	2.51	1.72	0.00
Computed Flow Time (min) :	1.93	0.33	0.00

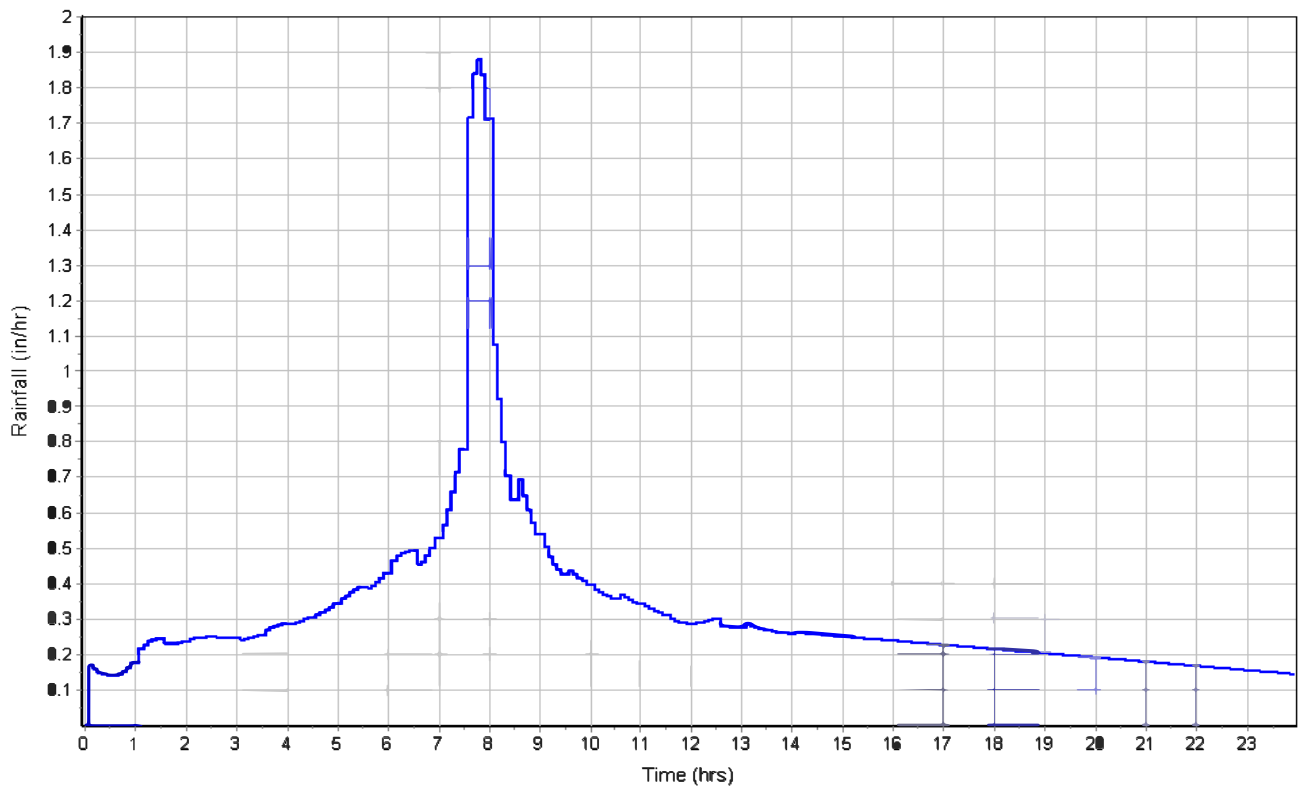
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	380	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	6.29	0.00	0.00
Computed Flow Time (min) :	1.01	0.00	0.00
Total TOC (min)	4.46		

Subbasin Runoff Results

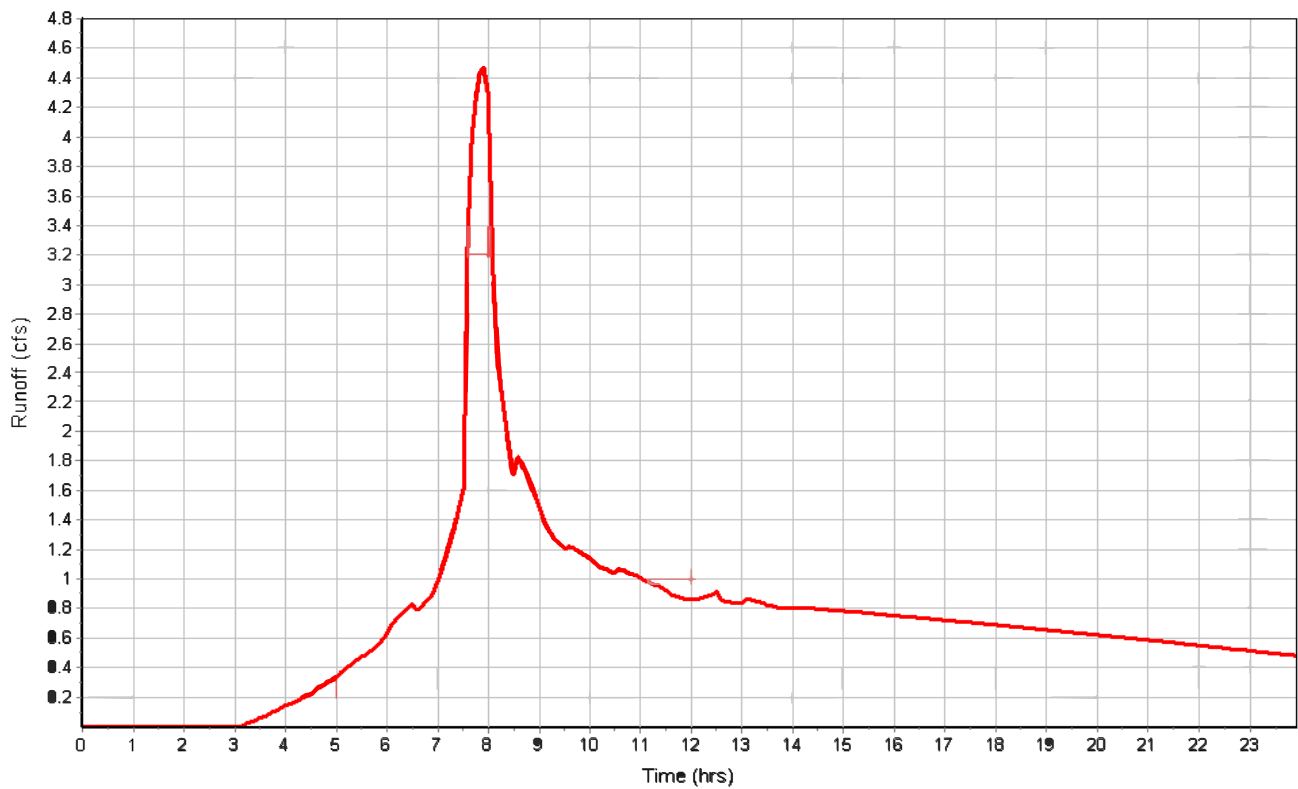
Total Rainfall (in) 7.78
Total Runoff (in) 4.92
Peak Runoff (cfs) 4.47
Weighted Curve Number 75.65
Time of Concentration (days hh:mm:ss) 0 00:04:28

Subbasin : {WTSH}.A2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.B

Input Data

Area (ac) 93.54
Peak Rate Factor 484.00
Weighted Curve Number 77.01
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.22	C	98.00
Woods & grass combination, Fair	74.50	C	76.00
Woods & grass combination, Fair	14.94	D	82.00
50 - 75% grass cover, Fair	0.16	C	79.00
> 75% grass cover, Good	3.24	C	74.00
Gravel roads	0.48	C	89.00
Composite Area & Weighted CN	93.54		77.01

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	45	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	6.40	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	2154	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	8.12	0.00	0.00
Computed Flow Time (min) :	4.42	0.00	0.00

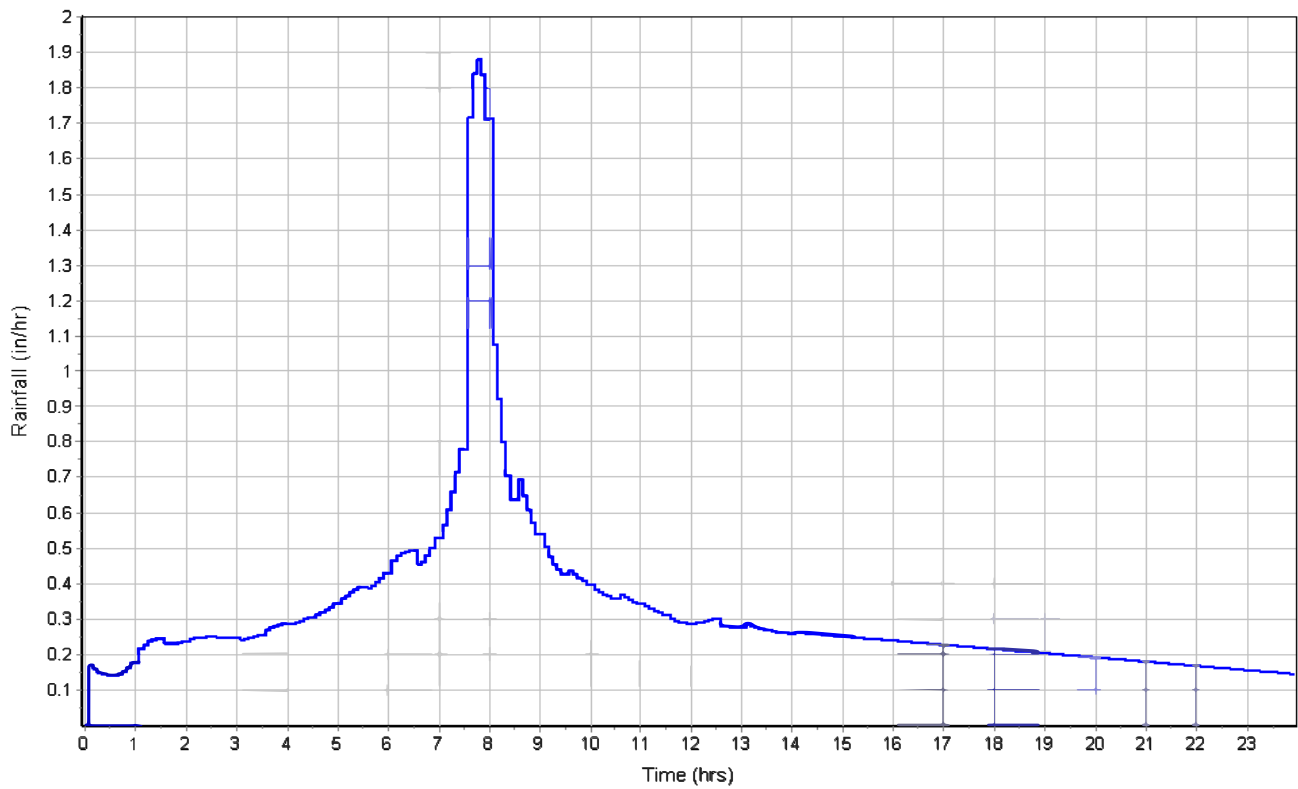
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	0.5	0.00	0.00
Flow Length (ft) :	2196	0.00	0.00
Channel Slope (%) :	7.2	0.00	0.00
Cross Section Area (ft²) :	60	0.00	0.00
Wetted Perimeter (ft) :	15	0.00	0.00
Velocity (ft/sec) :	2.01	0.00	0.00
Computed Flow Time (min) :	18.16	0.00	0.00
Total TOC (min)	28.99		

Subbasin Runoff Results

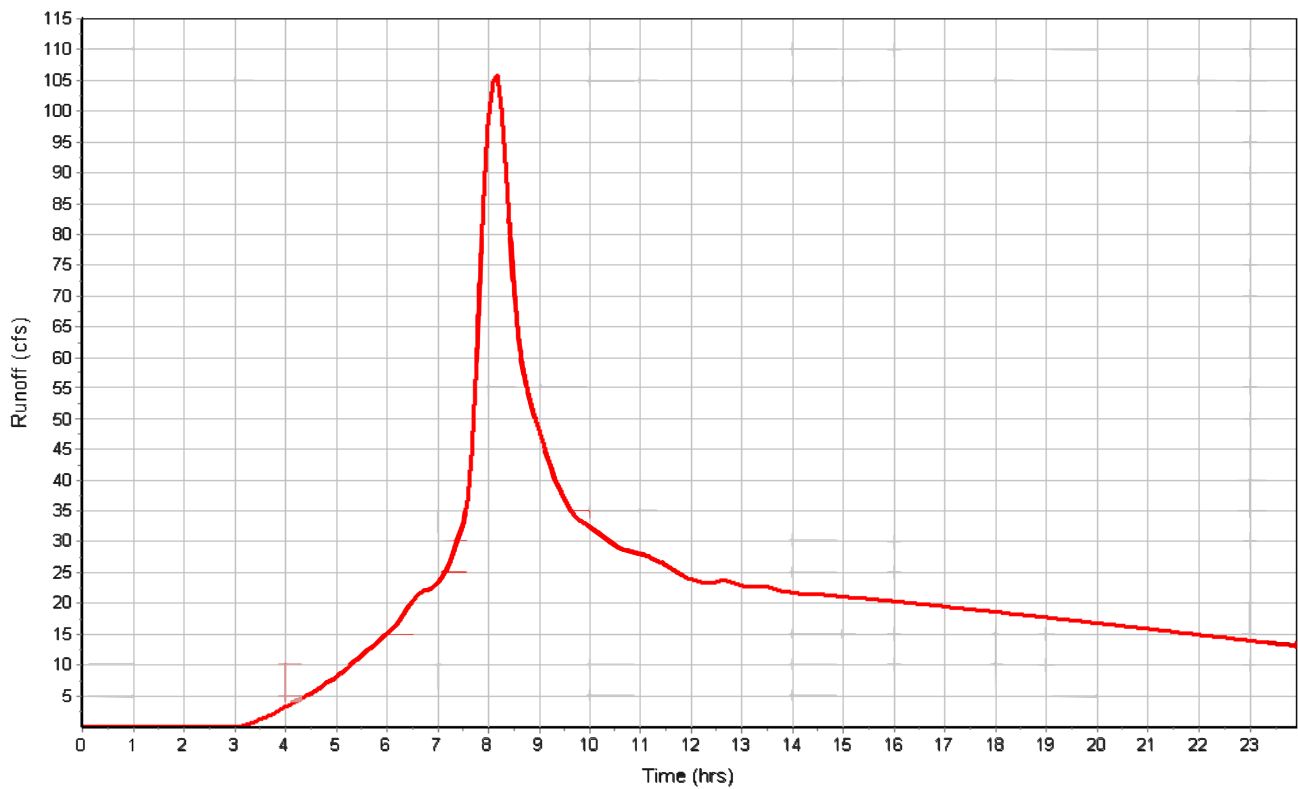
Total Rainfall (in) 7.78
Total Runoff (in) 5.07
Peak Runoff (cfs) 106.30
Weighted Curve Number 77.01
Time of Concentration (days hh:mm:ss) 0 00:28:59

Subbasin : {WTSH}.B

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.C

Input Data

Area (ac) 54.14
Peak Rate Factor 484.00
Weighted Curve Number 76.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	54.14	C	76.00
Composite Area & Weighted CN	54.14		76.00

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.14	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1940	0.00	0.00
Slope (%) :	31.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.82	0.00	0.00
Computed Flow Time (min) :	11.47	0.00	0.00

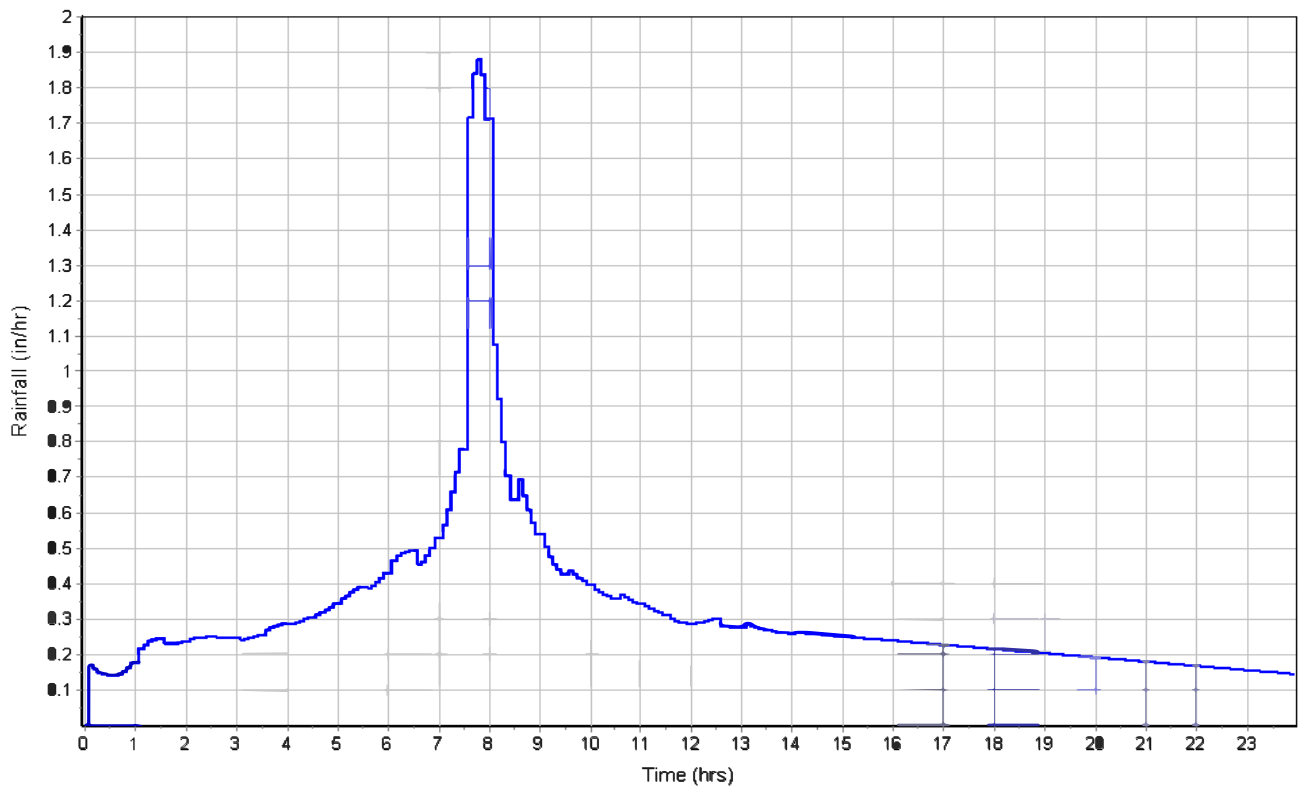
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	0.50	0.00	0.00
Flow Length (ft) :	1445	0.00	0.00
Channel Slope (%) :	8.7	0.00	0.00
Cross Section Area (ft²) :	228	0.00	0.00
Wetted Perimeter (ft) :	26	0.00	0.00
Velocity (ft/sec) :	3.74	0.00	0.00
Computed Flow Time (min) :	6.44	0.00	0.00
Total TOC (min) 24.05			

Subbasin Runoff Results

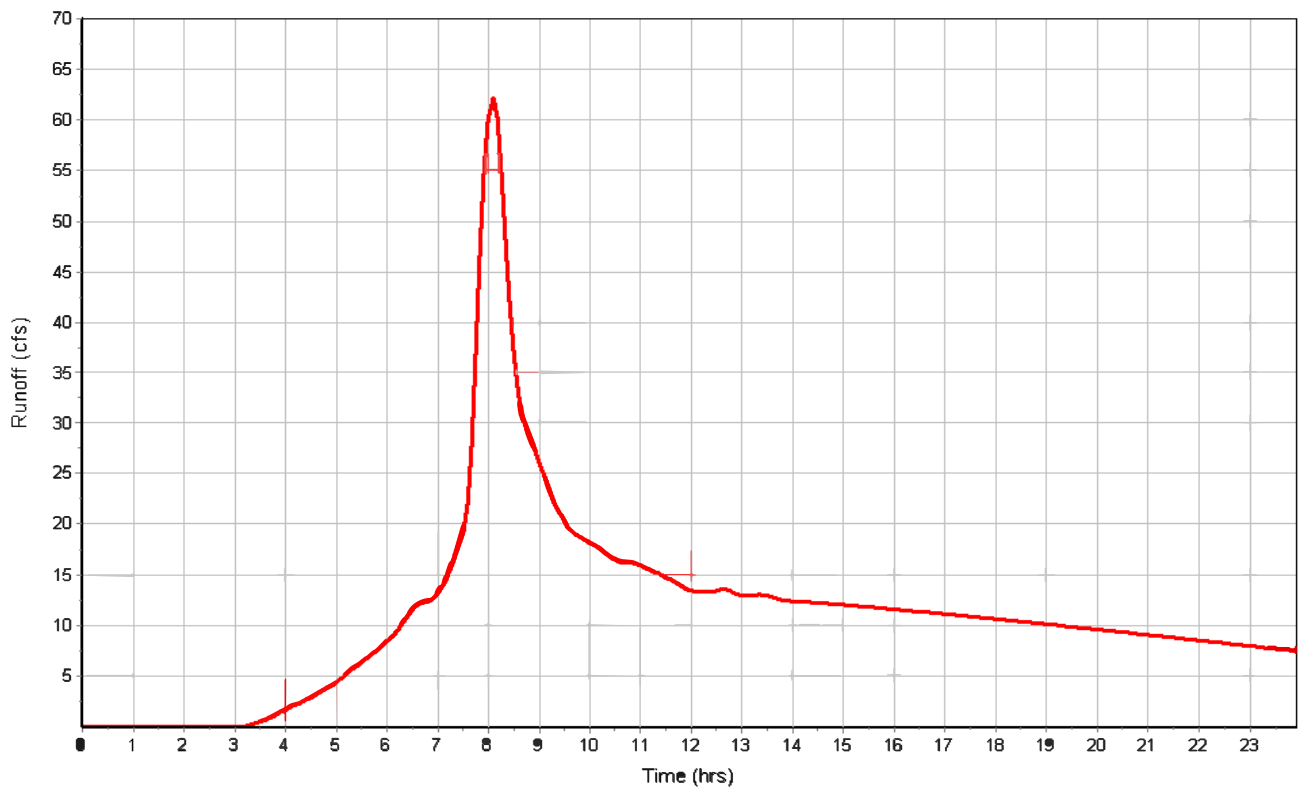
Total Rainfall (in) 7.78
Total Runoff (in) 4.96
Peak Runoff (cfs) 62.21
Weighted Curve Number 76.00
Time of Concentration (days hh:mm:ss) 0 00:24:03

Subbasin : {WTSH}.C

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.D

Input Data

Area (ac) 1.93
Peak Rate Factor 484.00
Weighted Curve Number 76.87
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.21	C	98.00
Woods & grass combination, Fair	0.25	C	76.00
> 75% grass cover, Good	1.47	C	74.00
Composite Area & Weighted CN	1.93		76.87

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.22	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.43	0.00	0.00
Computed Flow Time (min) :	3.84	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	244	0.00	0.00
Slope (%) :	7.4	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	2.45	0.00	0.00
Computed Flow Time (min) :	1.66	0.00	0.00

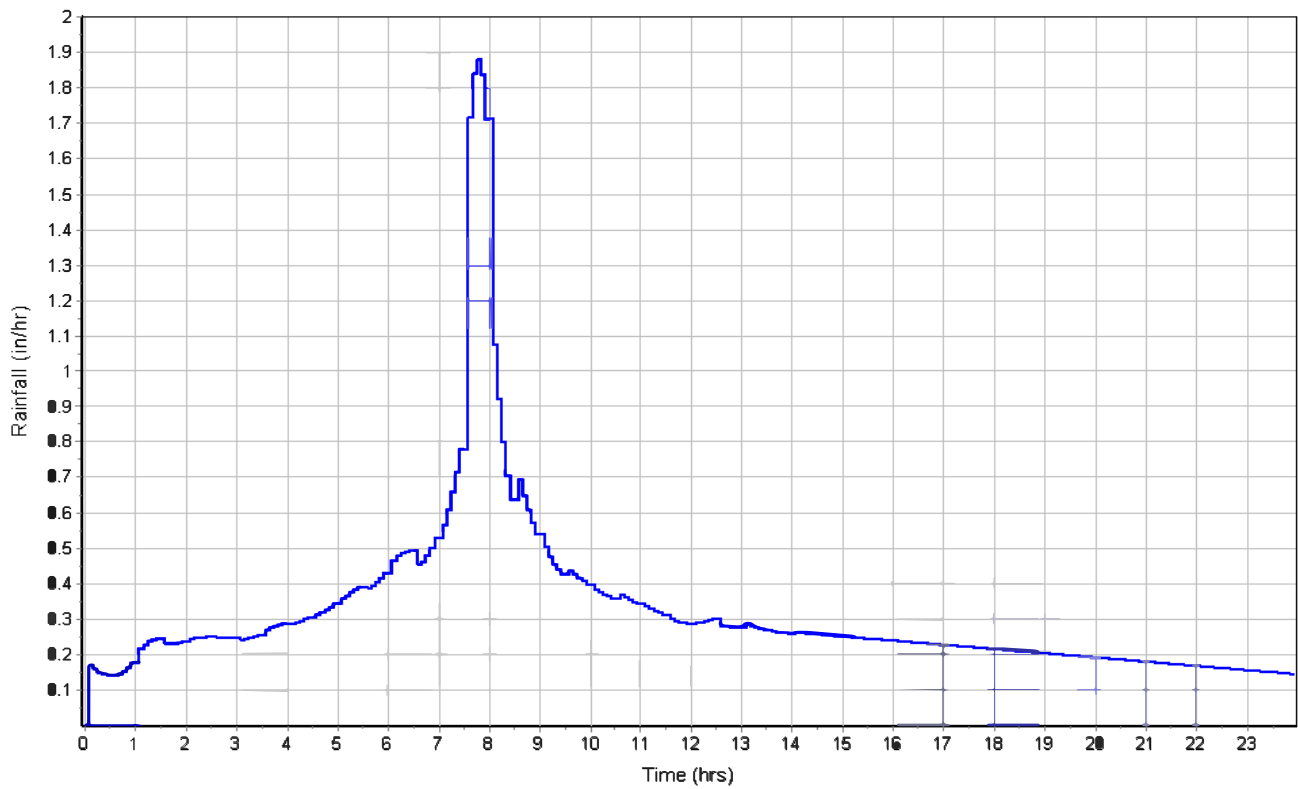
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	52	0.00	0.00
Channel Slope (%) :	2.2	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	4.79	0.00	0.00
Computed Flow Time (min) :	0.18	0.00	0.00
Total TOC (min)	5.68		

Subbasin Runoff Results

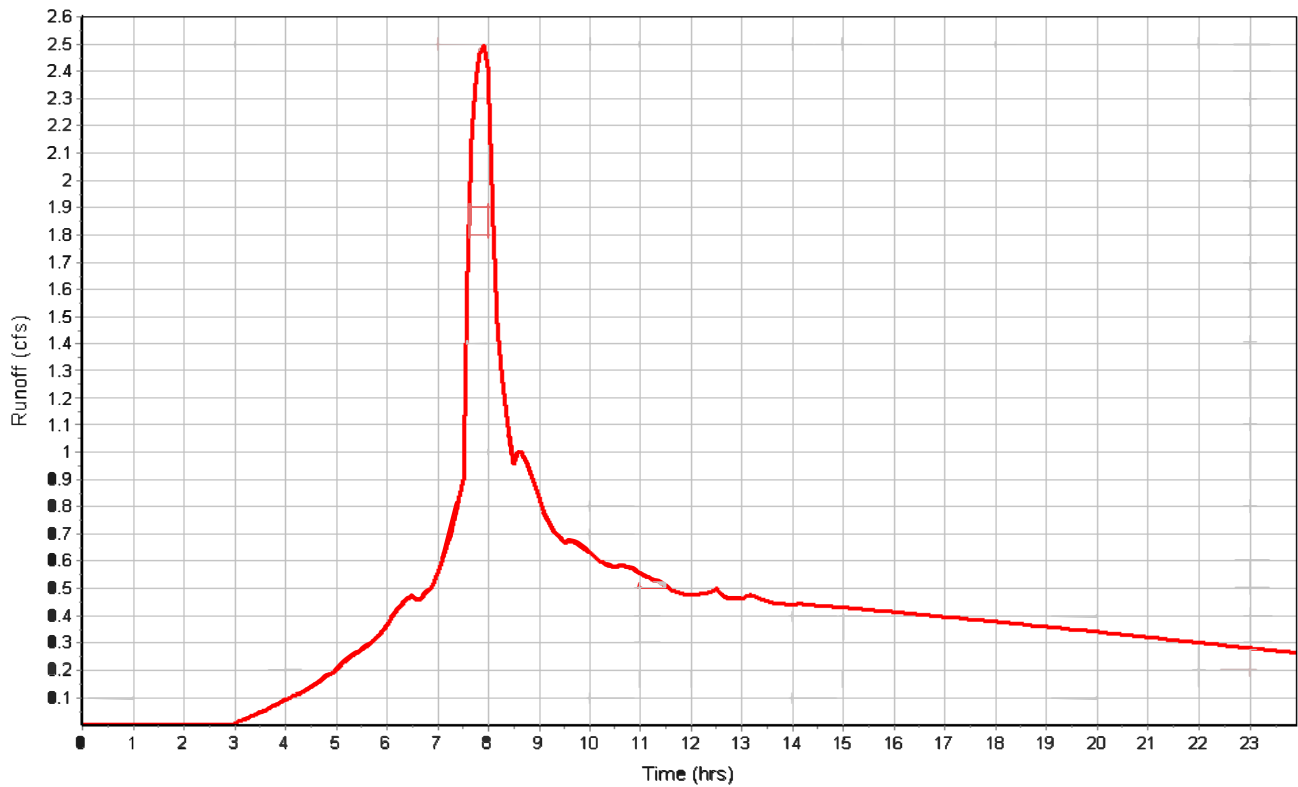
Total Rainfall (in) 7.78
Total Runoff (in) 5.06
Peak Runoff (cfs) 2.50
Weighted Curve Number 76.87
Time of Concentration (days hh:mm:ss) 0 00:05:41

Subbasin : {WTSH}.D

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.E

Input Data

Area (ac) 4.90
Peak Rate Factor 484.00
Weighted Curve Number 75.70
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.17	C	98.00
Woods & grass combination, Fair	2.13	C	76.00
> 75% grass cover, Good	2.60	C	74.00
Composite Area & Weighted CN	4.90		75.70

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.22	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.41	0.00	0.00
Computed Flow Time (min) :	4.04	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	321	0.00	0.00
Slope (%) :	23	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	3.36	0.00	0.00
Computed Flow Time (min) :	1.59	0.00	0.00

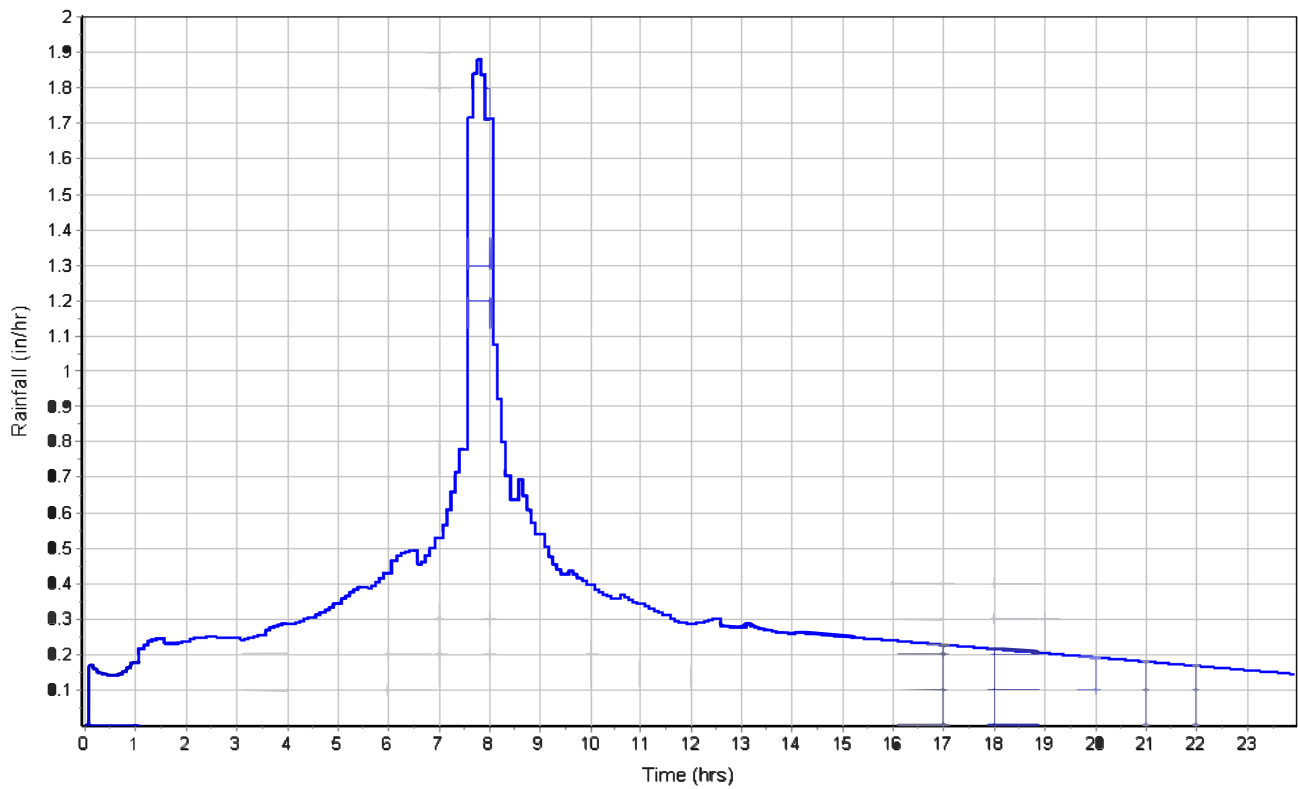
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	161	0.00	0.00
Channel Slope (%) :	12	0.00	0.00
Cross Section Area (ft ²) :	1.4	0.00	0.00
Wetted Perimeter (ft) :	4.7	0.00	0.00
Velocity (ft/sec) :	5.76	0.00	0.00
Computed Flow Time (min) :	0.47	0.00	0.00
Total TOC (min) 6.10			

Subbasin Runoff Results

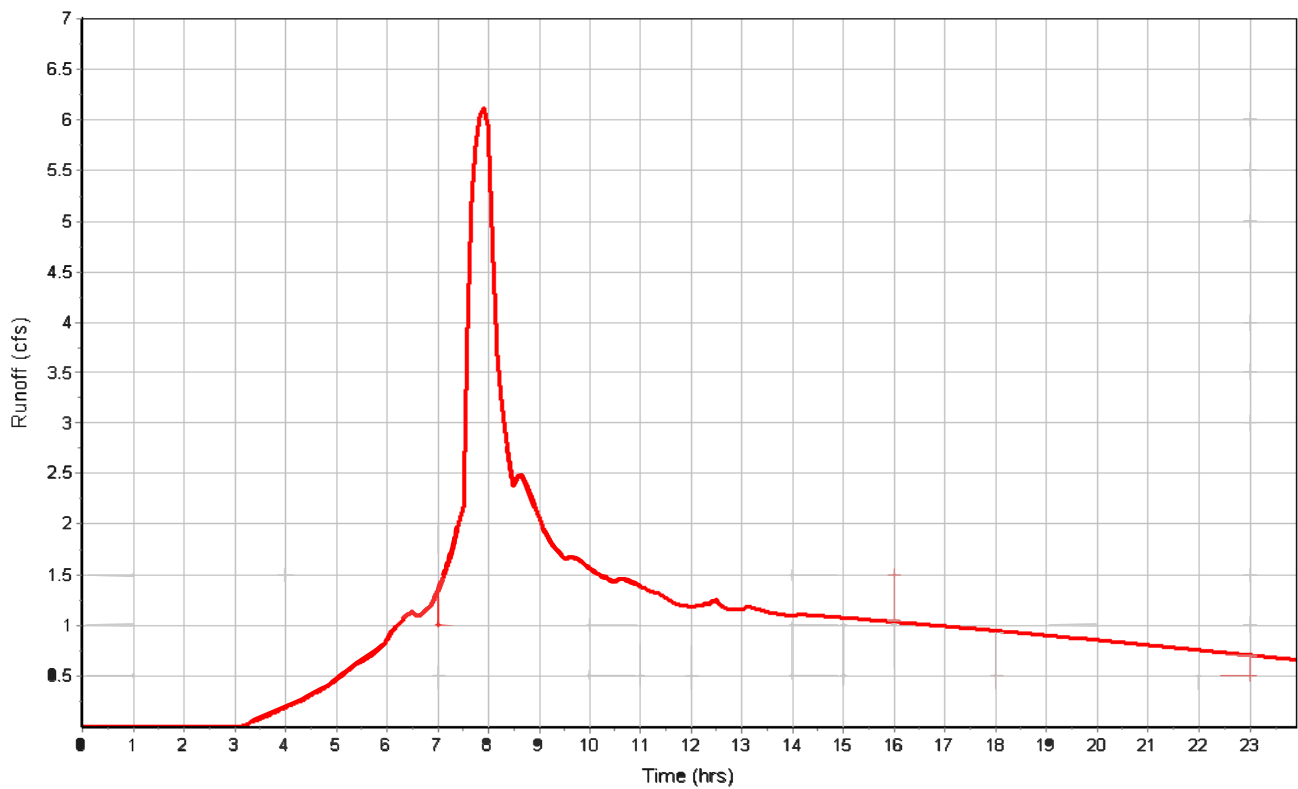
Total Rainfall (in) 7.78
Total Runoff (in) 4.92
Peak Runoff (cfs) 6.12
Weighted Curve Number 75.70
Time of Concentration (days hh:mm:ss) 0 00:06:06

Subbasin : {WTSH}.E

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.F

Input Data

Area (ac) 2.67
Peak Rate Factor 484.00
Weighted Curve Number 76.55
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.20	C	98.00
Woods & grass combination, Fair	1.00	C	76.00
> 75% grass cover, Good	1.47	C	74.00
Composite Area & Weighted CN	2.67		76.55

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	40	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.83	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	318	0.00	0.00
Slope (%) :	22	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	4.22	0.00	0.00
Computed Flow Time (min) :	1.26	0.00	0.00

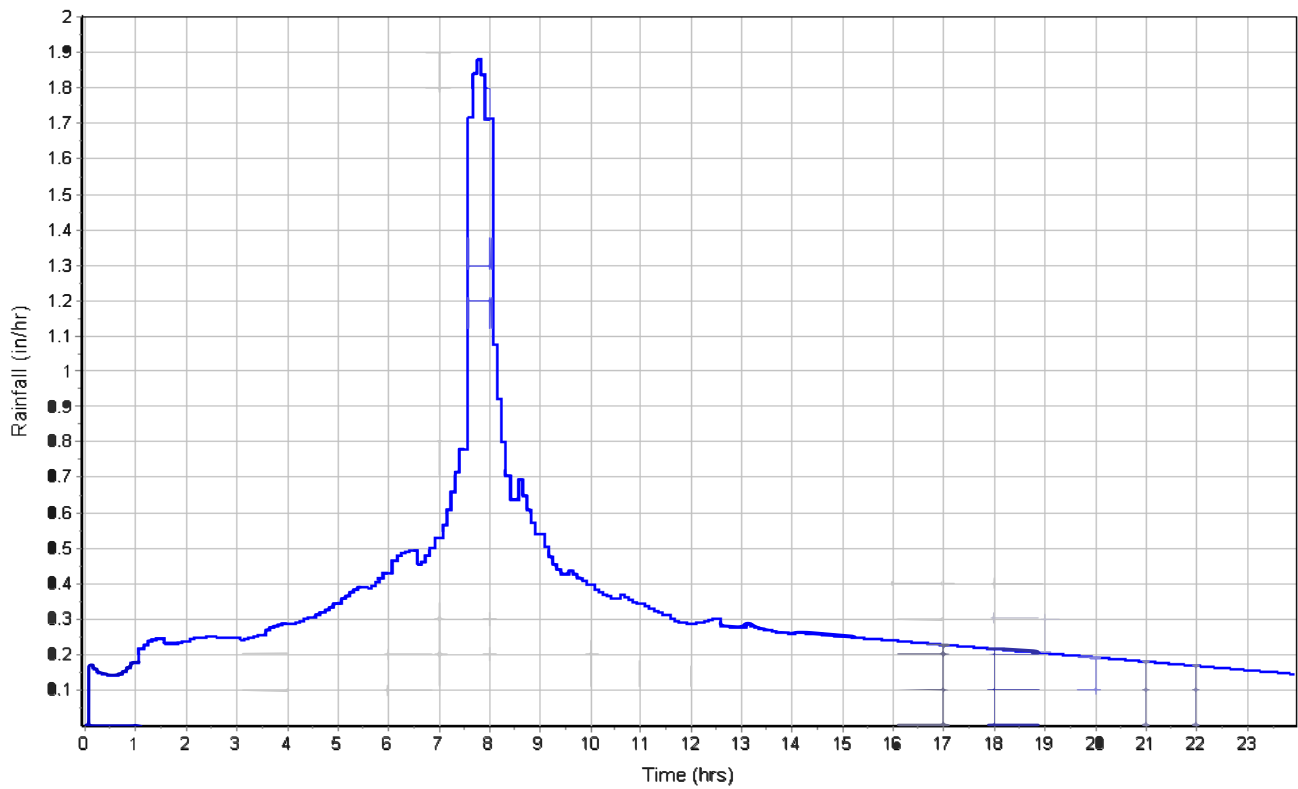
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.04	.022	0.00
Flow Length (ft) :	325	112	0.00
Channel Slope (%) :	5.3	11	0.00
Cross Section Area (ft ²) :	2	2	0.00
Wetted Perimeter (ft) :	5	5	0.00
Velocity (ft/sec) :	4.66	12.19	0.00
Computed Flow Time (min) :	1.16	0.15	0.00
Total TOC (min)	4.20		

Subbasin Runoff Results

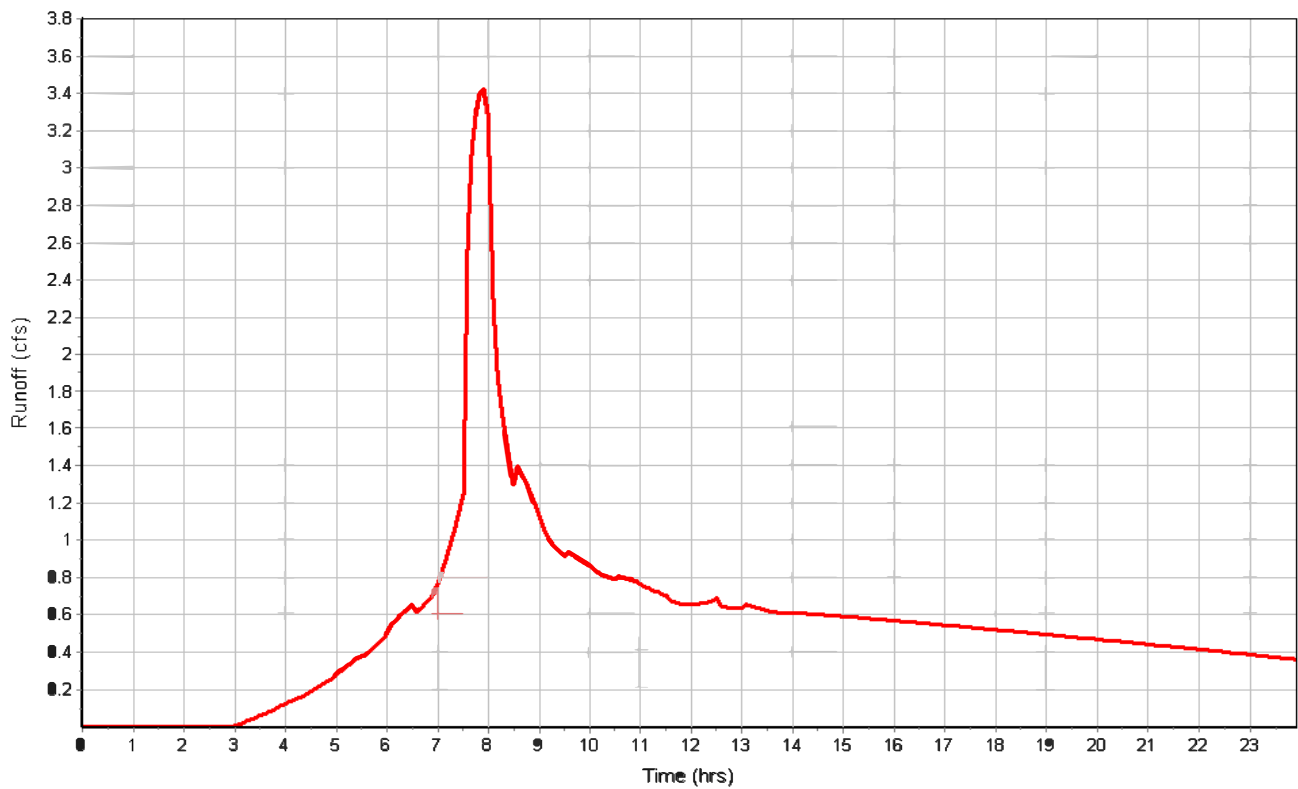
Total Rainfall (in) 7.78
Total Runoff (in) 5.02
Peak Runoff (cfs) 3.43
Weighted Curve Number 76.55
Time of Concentration (days hh:mm:ss) 0 00:04:12

Subbasin : {WTSH}.F

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.G

Input Data

Area (ac) 2.91
Peak Rate Factor 484.00
Weighted Curve Number 75.91
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.09	C	98.00
Woods & grass combination, Fair	0.97	C	76.00
50 - 75% grass cover, Fair	0.29	C	79.00
> 75% grass cover, Good	1.56	C	74.00
Composite Area & Weighted CN	2.91		75.91

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.15	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	718	0.00	0.00
Slope (%) :	13.5	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	3.31	0.00	0.00
Computed Flow Time (min) :	3.62	0.00	0.00

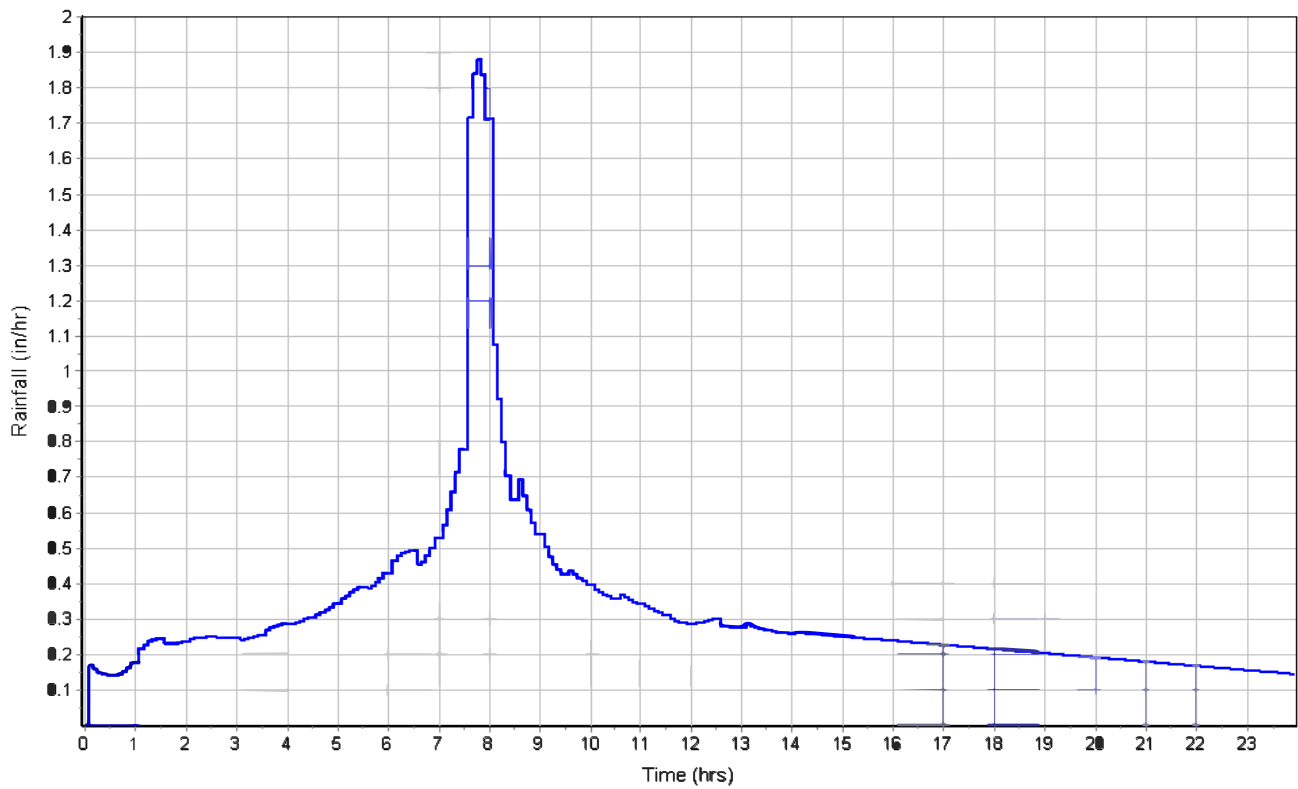
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	0.022	0.00	0.00
Flow Length (ft) :	24	0.00	0.00
Channel Slope (%) :	8.3	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	10.59	0.00	0.00
Computed Flow Time (min) :	0.04	0.00	0.00
Total TOC (min)	9.81		

Subbasin Runoff Results

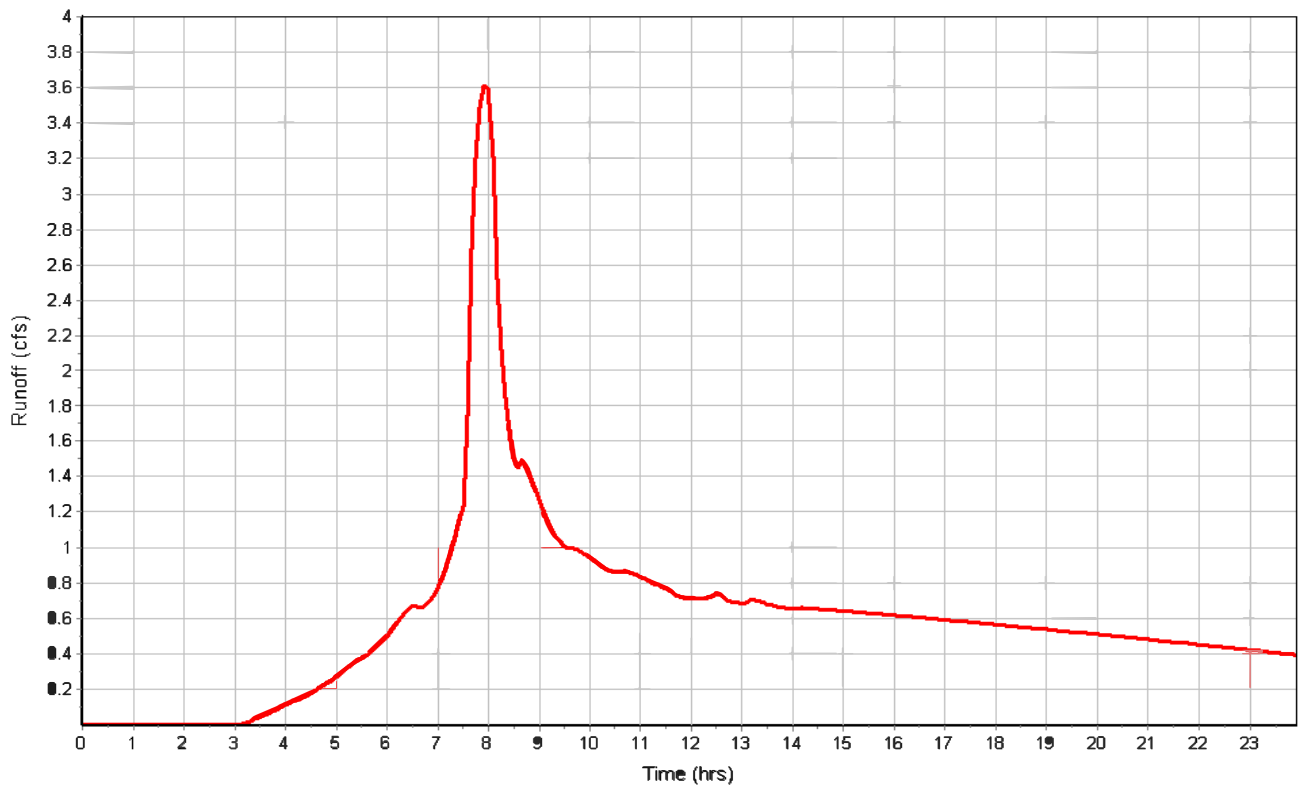
Total Rainfall (in) 7.78
Total Runoff (in) 4.95
Peak Runoff (cfs) 3.62
Weighted Curve Number 75.91
Time of Concentration (days hh:mm:ss) 0 00:09:49

Subbasin : {WTSH}.G

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name 1826-DRHY_POST.SPF
Description WINROD VINEYARD ECP
STORM AND SEWER ANALYSIS

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-20
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
YES

Analysis Options

Start Analysis On Jul 13, 2020 00:00:00
End Analysis On Jul 14, 2020 00:00:00
Start Reporting On Jul 13, 2020 00:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 8
Nodes..... 8
 Junctions 0
 Outfalls 8
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
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Subbasin Summary

SN Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
	(ac)			(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1 {WTSH}.A1	25.12	484.00	79.23	10.69	8.08	202.89	52.54	0 00:10:20
2 {WTSH}.A2	3.57	484.00	75.65	10.69	7.60	27.15	7.05	0 00:04:27
3 {WTSH}.B	93.54	484.00	77.01	10.69	7.78	728.12	167.10	0 00:28:59
4 {WTSH}.C	54.14	484.00	76.00	10.69	7.65	414.17	98.62	0 00:24:03
5 {WTSH}.D	1.93	484.00	76.87	10.69	7.77	14.99	3.90	0 00:05:40
6 {WTSH}.E	4.90	484.00	75.70	10.69	7.61	37.29	9.67	0 00:06:06
7 {WTSH}.F	2.67	484.00	76.55	10.69	7.72	20.62	5.37	0 00:04:12
8 {WTSH}.G	2.91	484.00	75.91	10.69	7.64	22.23	5.73	0 00:09:48

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	A1	Outfall	0.00					0.00	0.00					
2	A2	Outfall	0.00					0.00	0.00					
3	B	Outfall	0.00					0.00	0.00					
4	C	Outfall	0.00					0.00	0.00					
5	D	Outfall	0.00					0.00	0.00					
6	E	Outfall	0.00					0.00	0.00					
7	F	Outfall	0.00					0.00	0.00					
8	G	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : {WTSH}.A1

Input Data

Area (ac) 25.12
Peak Rate Factor 484.00
Weighted Curve Number 79.23
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.09	C	98.00
Woods & grass combination, Fair	7.83	C	76.00
Woods & grass combination, Fair	5.13	D	82.00
50 - 75% grass cover, Fair	9.72	C	79.00
> 75% grass cover, Good	1.35	C	74.00
Composite Area & Weighted CN	25.12		79.23

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
n = Manning's roughness
L_f = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
V = 20.3282 * (S_f^{0.5}) (paved surface)
V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
V = 5.0 * (S_f^{0.5}) (woodland surface)
V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
T_c = (L_f / V) / (3600 sec/hr)

Where:

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n
R = A_q / W_p
T_c = (L_f / V) / (3600 sec/hr)

Where :

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
R = Hydraulic Radius (ft)
A_q = Flow Area (ft²)
W_p = Wetted Perimeter (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)
n = Manning's roughness

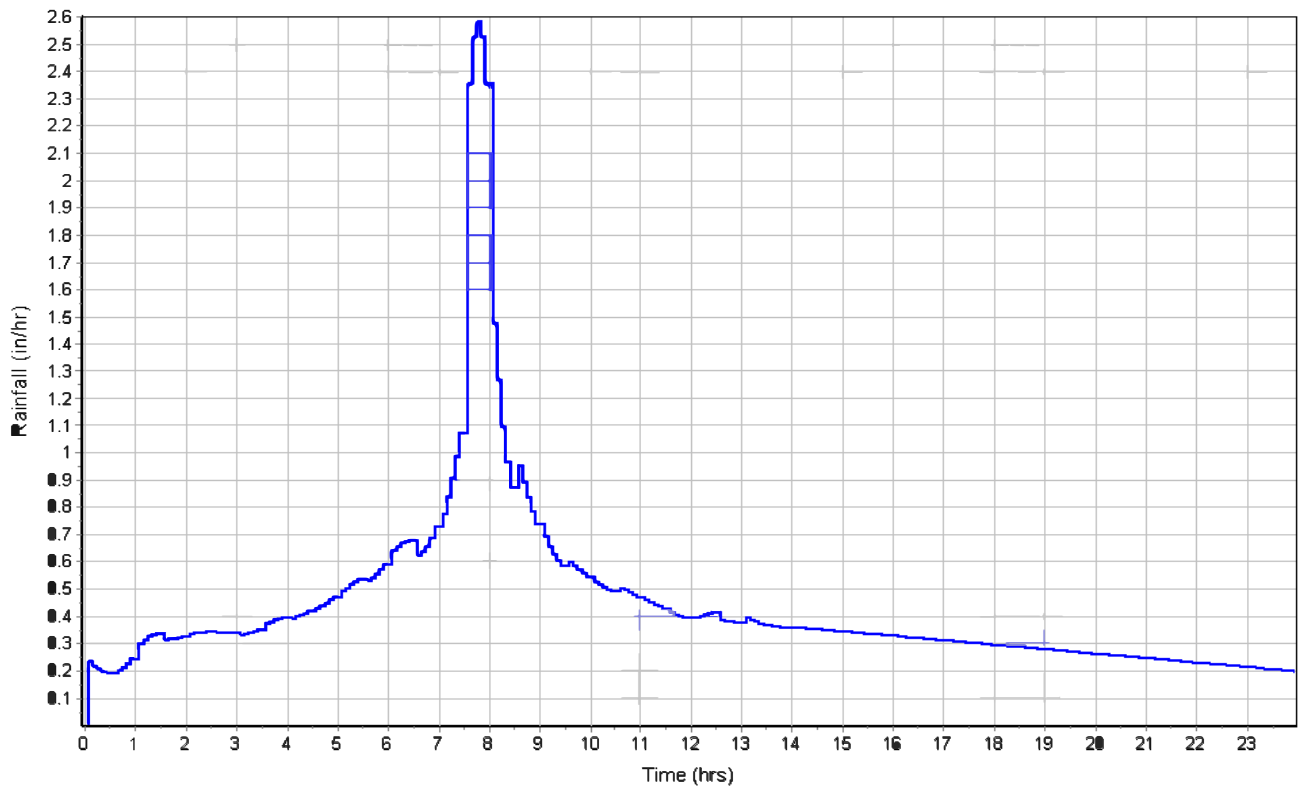
Sheet Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.25	0.00	0.00
Computed Flow Time (min) :	6.54	0.00	0.00
Shallow Concentrated Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Flow Length (ft) :	1499	0.00	0.00
Slope (%) :	16.7	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.59	0.00	0.00
Computed Flow Time (min) :	3.79	0.00	0.00
Total TOC (min)	10.34		

Subbasin Runoff Results

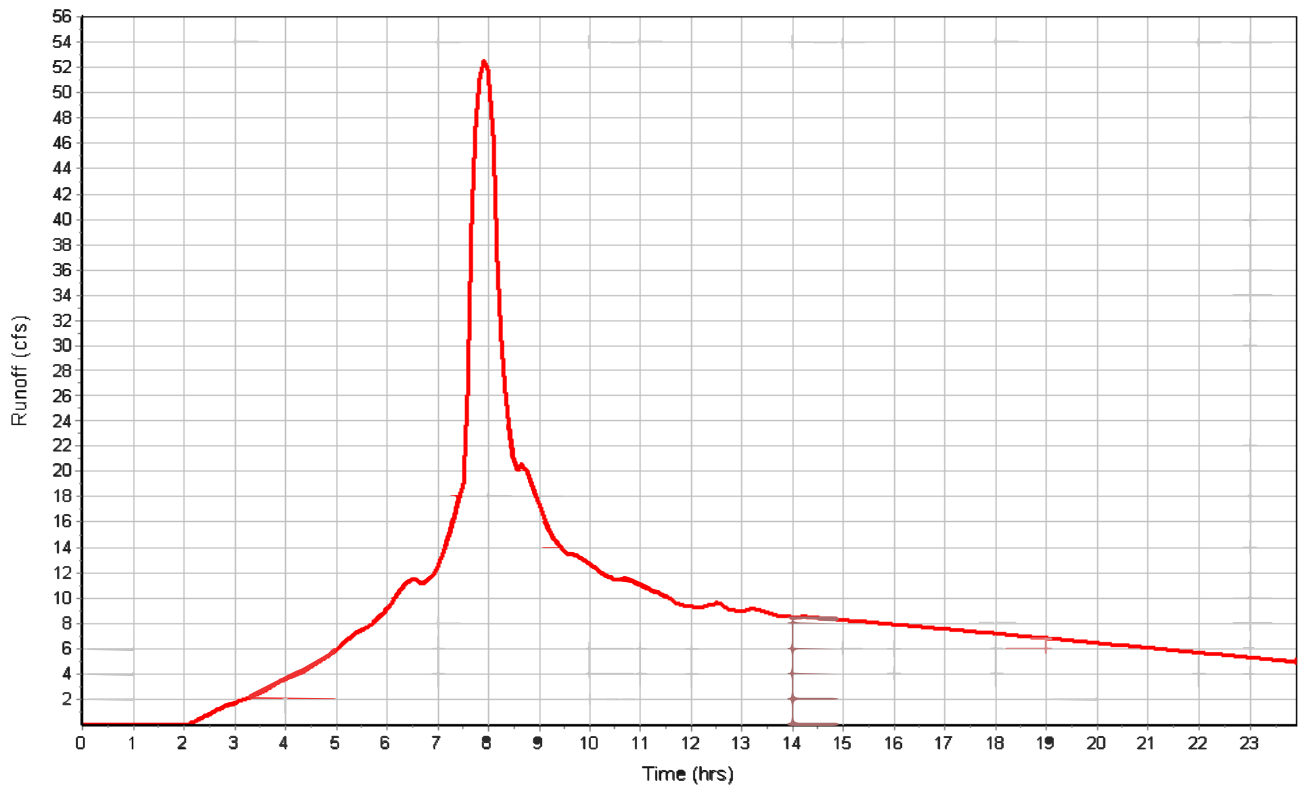
Total Rainfall (in)	10.69
Total Runoff (in)	8.08
Peak Runoff (cfs)	52.54
Weighted Curve Number	79.23
Time of Concentration (days hh:mm:ss)	0 00:10:20

Subbasin : {WTSH}.A1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.A2

Input Data

Area (ac) 3.57
Peak Rate Factor 484.00
Weighted Curve Number 75.65
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	2.94	C	76.00
> 75% grass cover, Good	0.63	C	74.00
Composite Area & Weighted CN	3.57		75.65

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	43	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.67	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	290	34	0.00
Slope (%) :	25.3	11.8	0.00
Surface Type :	Woodland	Woodland	Unpaved
Velocity (ft/sec) :	2.51	1.72	0.00
Computed Flow Time (min) :	1.93	0.33	0.00

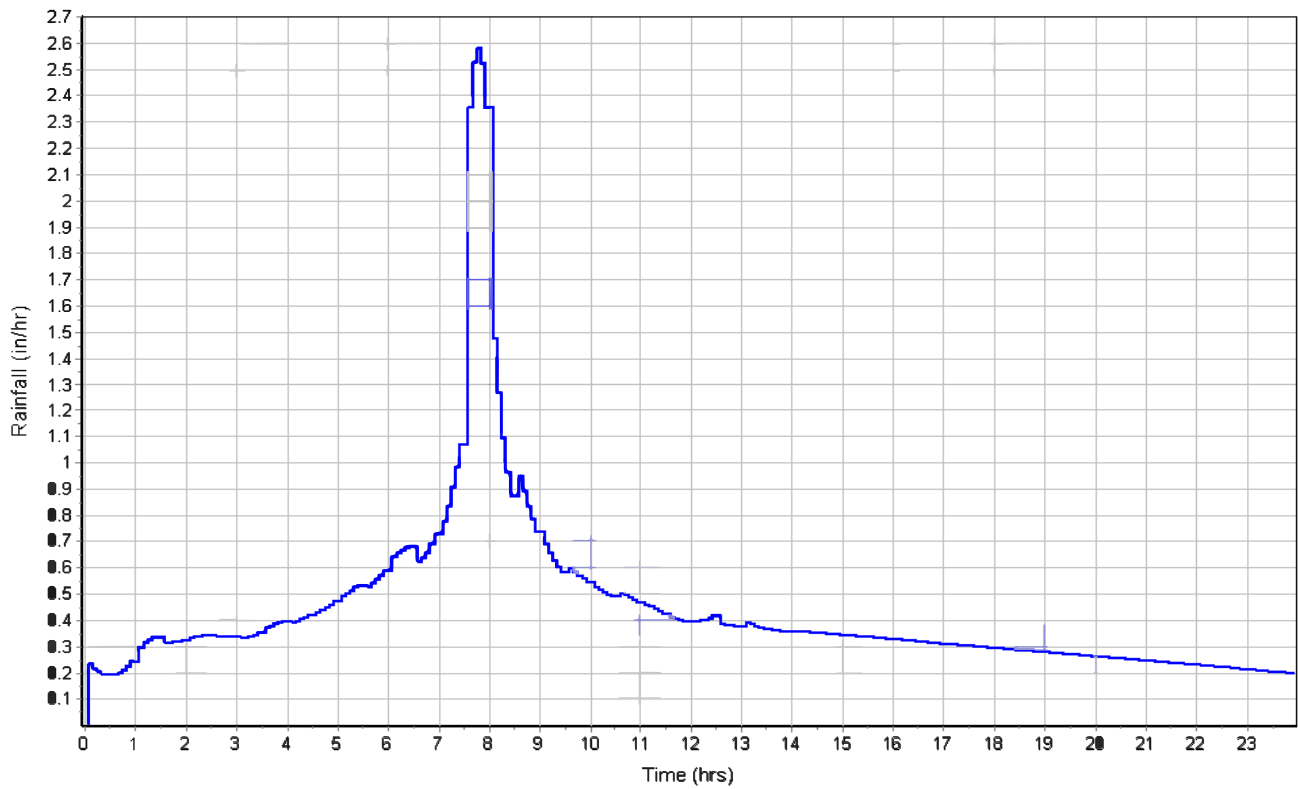
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	380	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	6.29	0.00	0.00
Computed Flow Time (min) :	1.01	0.00	0.00
Total TOC (min)	4.46		

Subbasin Runoff Results

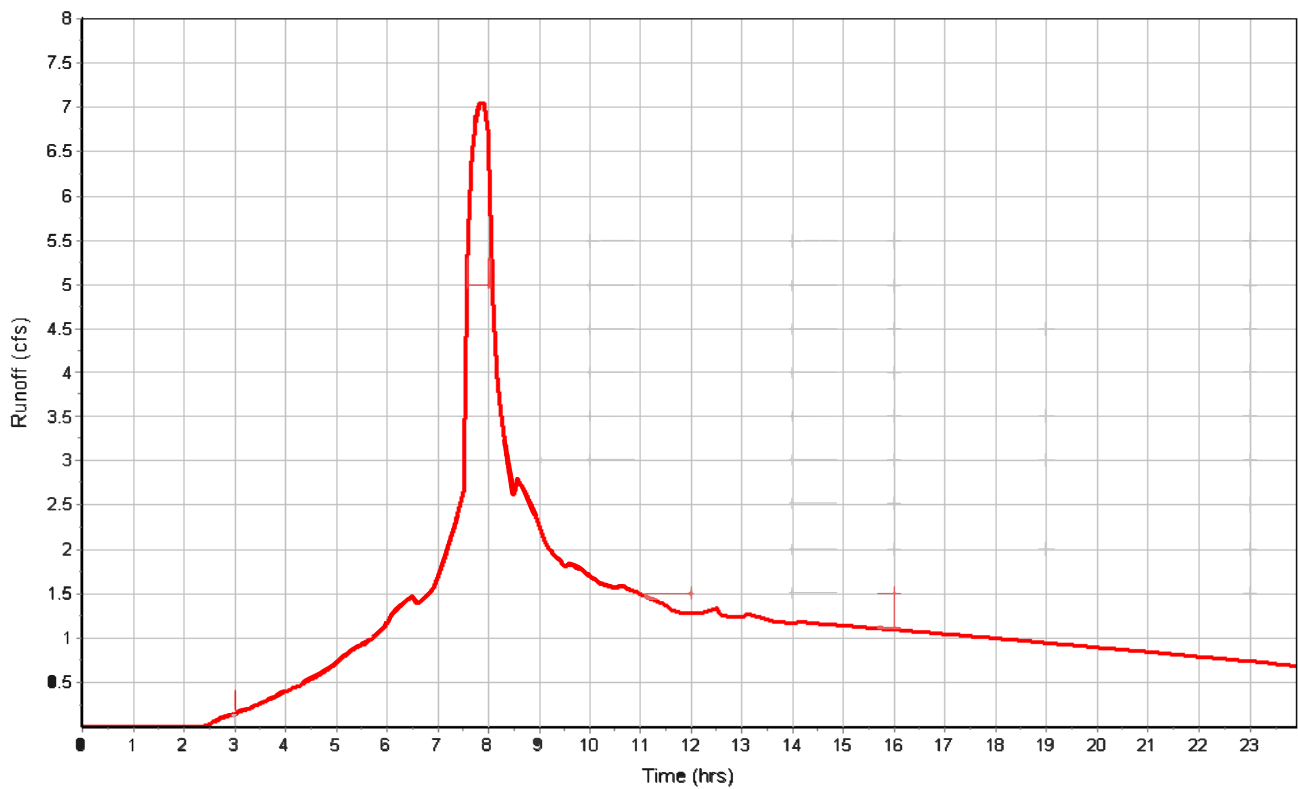
Total Rainfall (in) 10.69
Total Runoff (in) 7.60
Peak Runoff (cfs) 7.05
Weighted Curve Number 75.65
Time of Concentration (days hh:mm:ss) 0 00:04:28

Subbasin : {WTSH}.A2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.B

Input Data

Area (ac) 93.54
Peak Rate Factor 484.00
Weighted Curve Number 77.01
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.22	C	98.00
Woods & grass combination, Fair	74.50	C	76.00
Woods & grass combination, Fair	14.94	D	82.00
50 - 75% grass cover, Fair	0.16	C	79.00
> 75% grass cover, Good	3.24	C	74.00
Gravel roads	0.48	C	89.00
Composite Area & Weighted CN	93.54		77.01

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	45	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	6.40	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	2154	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	8.12	0.00	0.00
Computed Flow Time (min) :	4.42	0.00	0.00

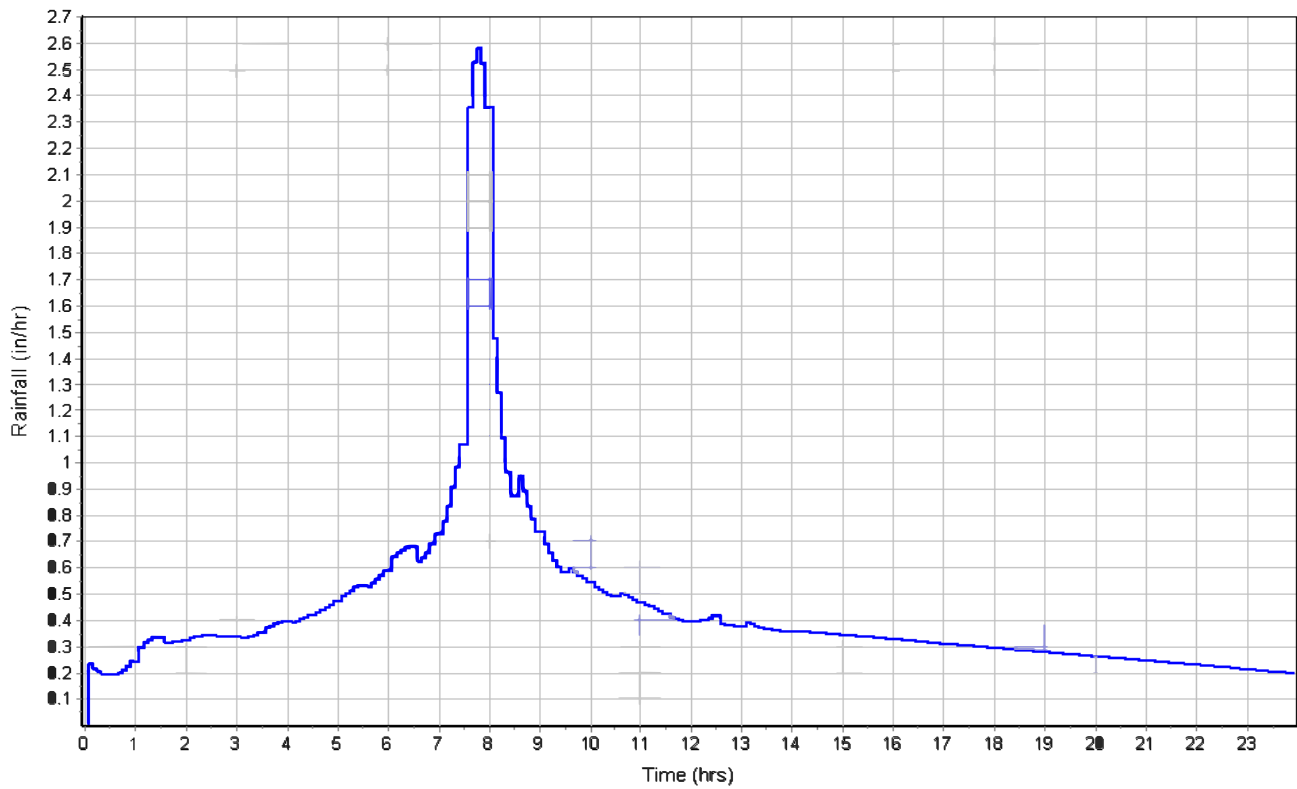
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	0.5	0.00	0.00
Flow Length (ft) :	2196	0.00	0.00
Channel Slope (%) :	7.2	0.00	0.00
Cross Section Area (ft²) :	60	0.00	0.00
Wetted Perimeter (ft) :	15	0.00	0.00
Velocity (ft/sec) :	2.01	0.00	0.00
Computed Flow Time (min) :	18.16	0.00	0.00
Total TOC (min)	28.99		

Subbasin Runoff Results

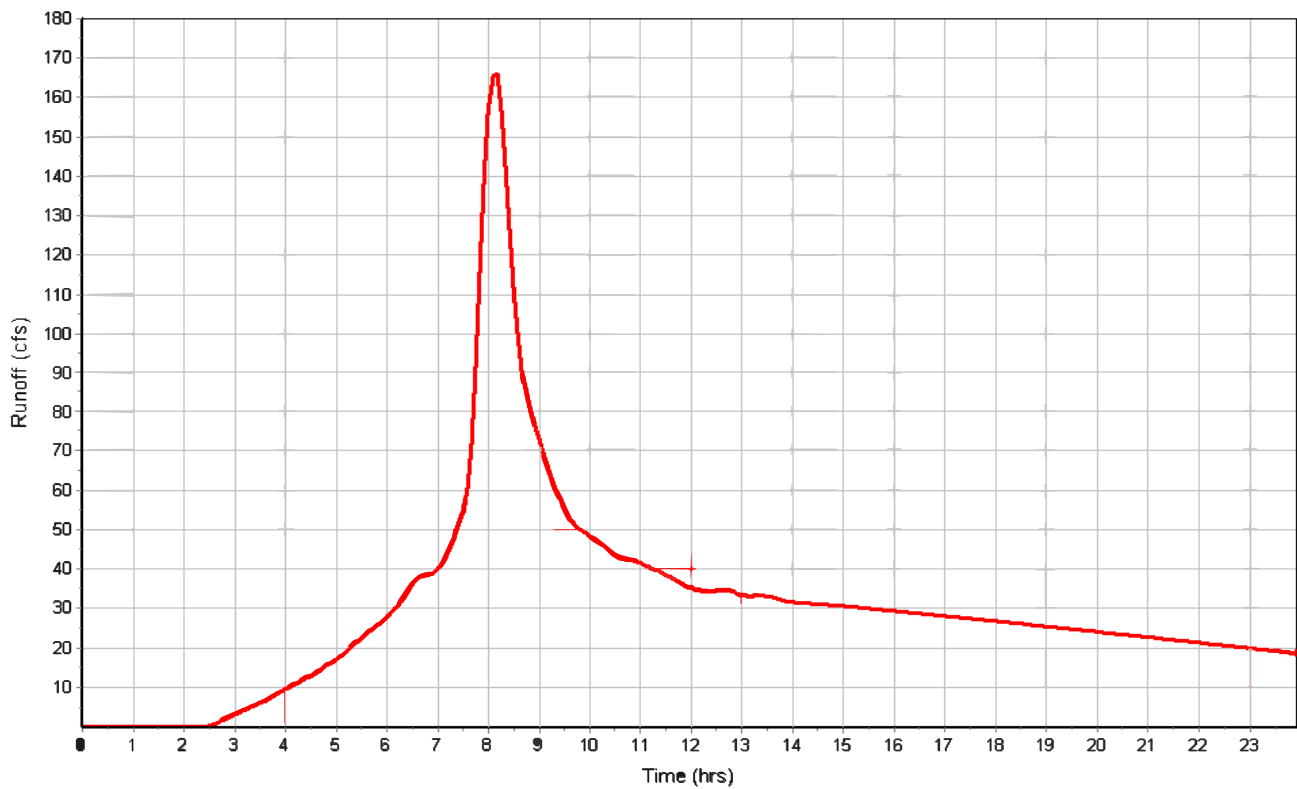
Total Rainfall (in) 10.69
Total Runoff (in) 7.78
Peak Runoff (cfs) 167.10
Weighted Curve Number 77.01
Time of Concentration (days hh:mm:ss) 0 00:28:59

Subbasin : {WTSH}.B

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.C

Input Data

Area (ac) 54.14
Peak Rate Factor 484.00
Weighted Curve Number 76.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	54.14	C	76.00
Composite Area & Weighted CN	54.14		76.00

Time of Concentration

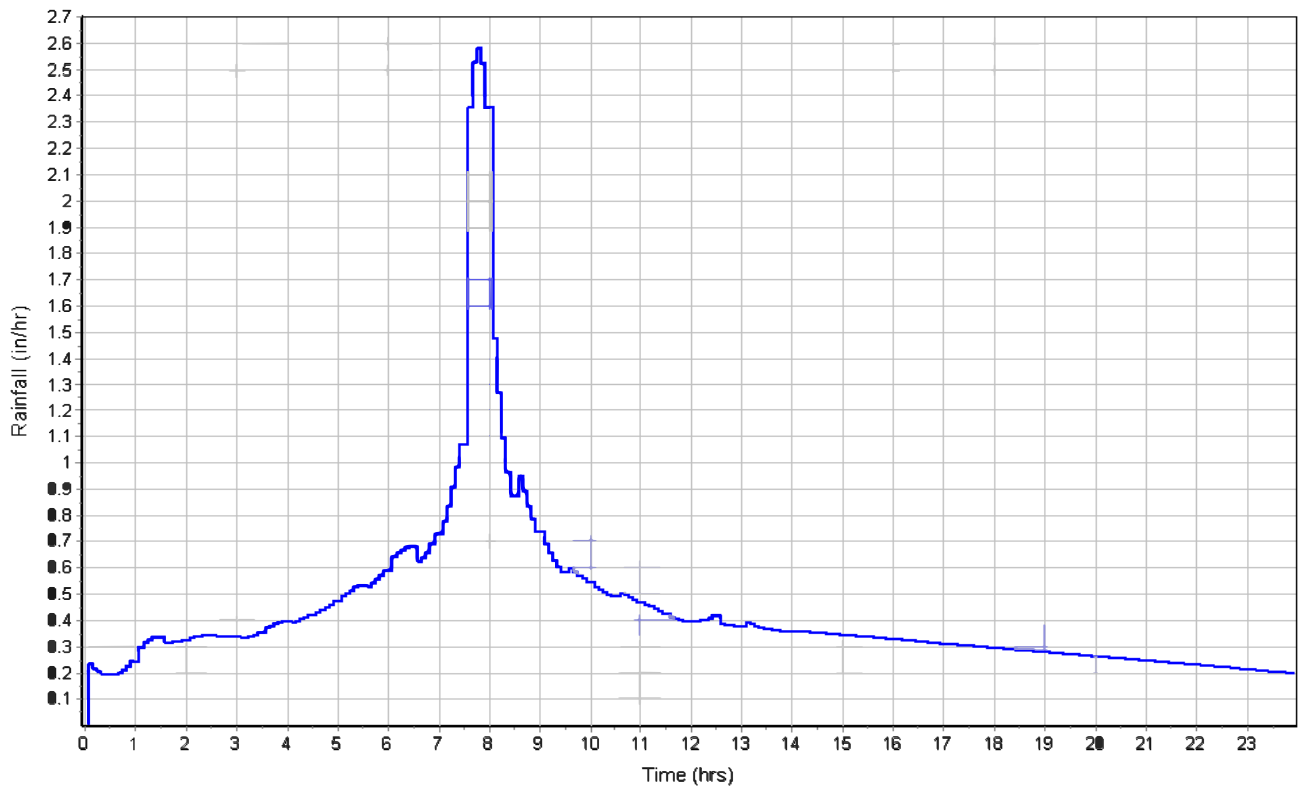
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.14	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1940	0.00	0.00
Slope (%) :	31.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.82	0.00	0.00
Computed Flow Time (min) :	11.47	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.50	0.00	0.00
Flow Length (ft) :	1445	0.00	0.00
Channel Slope (%) :	8.7	0.00	0.00
Cross Section Area (ft²) :	228	0.00	0.00
Wetted Perimeter (ft) :	26	0.00	0.00
Velocity (ft/sec) :	3.74	0.00	0.00
Computed Flow Time (min) :	6.44	0.00	0.00
Total TOC (min) 24.05			

Subbasin Runoff Results

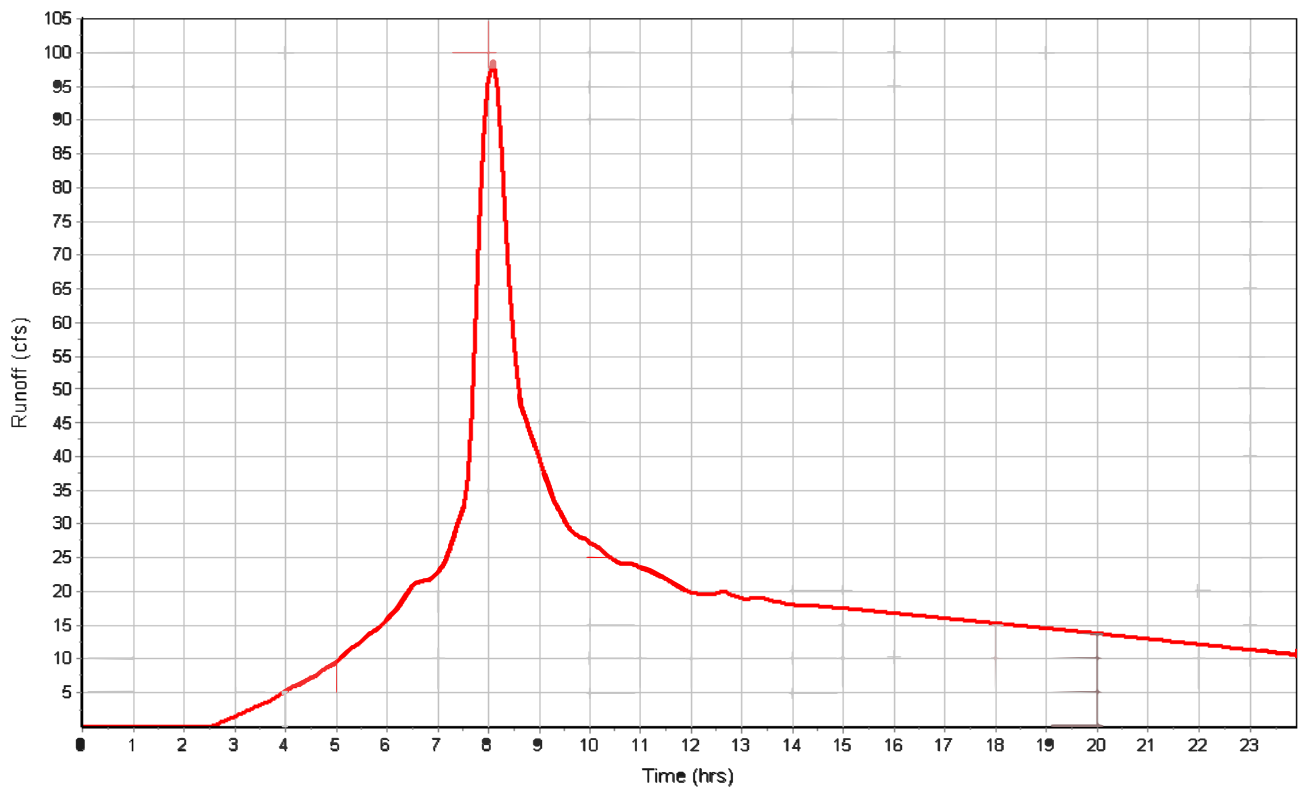
Total Rainfall (in) 10.69
Total Runoff (in) 7.65
Peak Runoff (cfs) 98.62
Weighted Curve Number 76.00
Time of Concentration (days hh:mm:ss) 0 00:24:03

Subbasin : {WTSH}.C

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.D

Input Data

Area (ac) 1.93
Peak Rate Factor 484.00
Weighted Curve Number 76.87
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.21	C	98.00
Woods & grass combination, Fair	0.25	C	76.00
> 75% grass cover, Good	1.47	C	74.00
Composite Area & Weighted CN	1.93		76.87

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.22	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.43	0.00	0.00
Computed Flow Time (min) :	3.84	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	244	0.00	0.00
Slope (%) :	7.4	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	2.45	0.00	0.00
Computed Flow Time (min) :	1.66	0.00	0.00

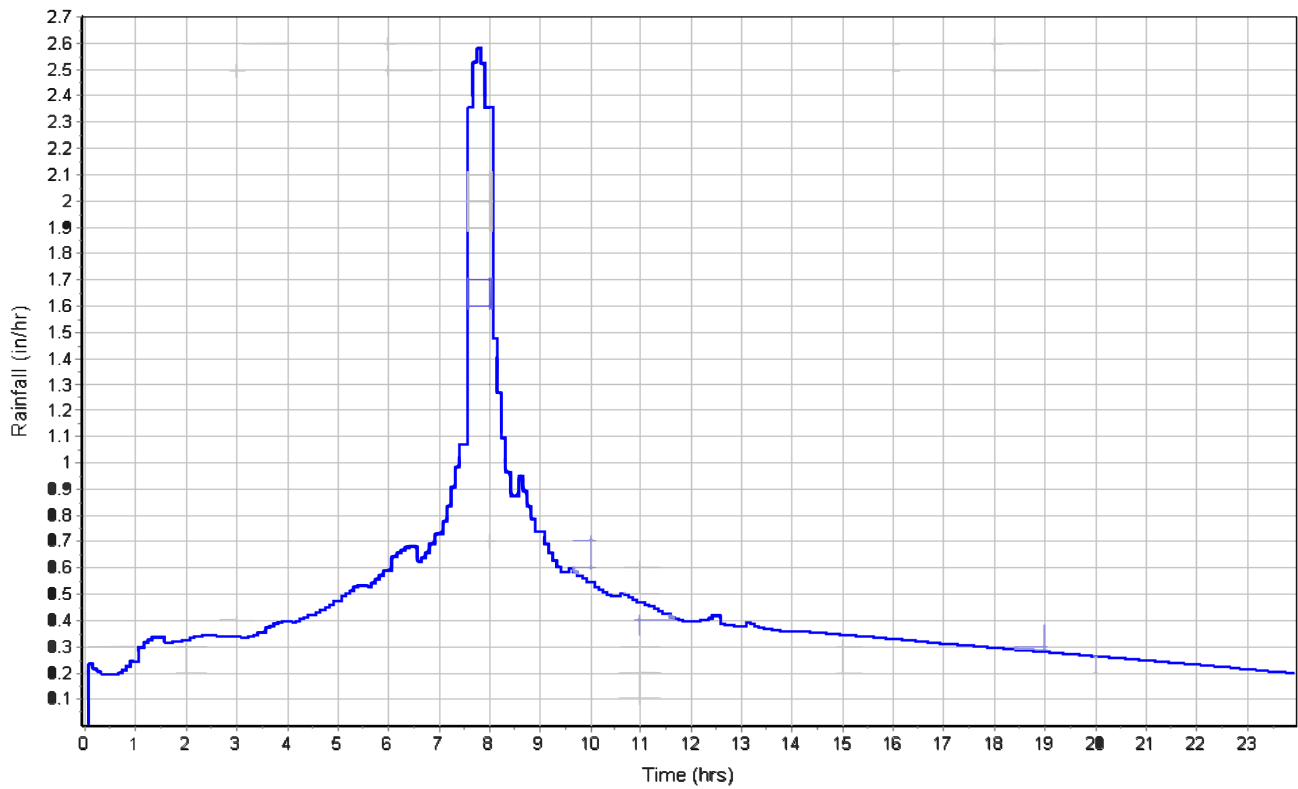
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	52	0.00	0.00
Channel Slope (%) :	2.2	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	4.79	0.00	0.00
Computed Flow Time (min) :	0.18	0.00	0.00
Total TOC (min)	5.68		

Subbasin Runoff Results

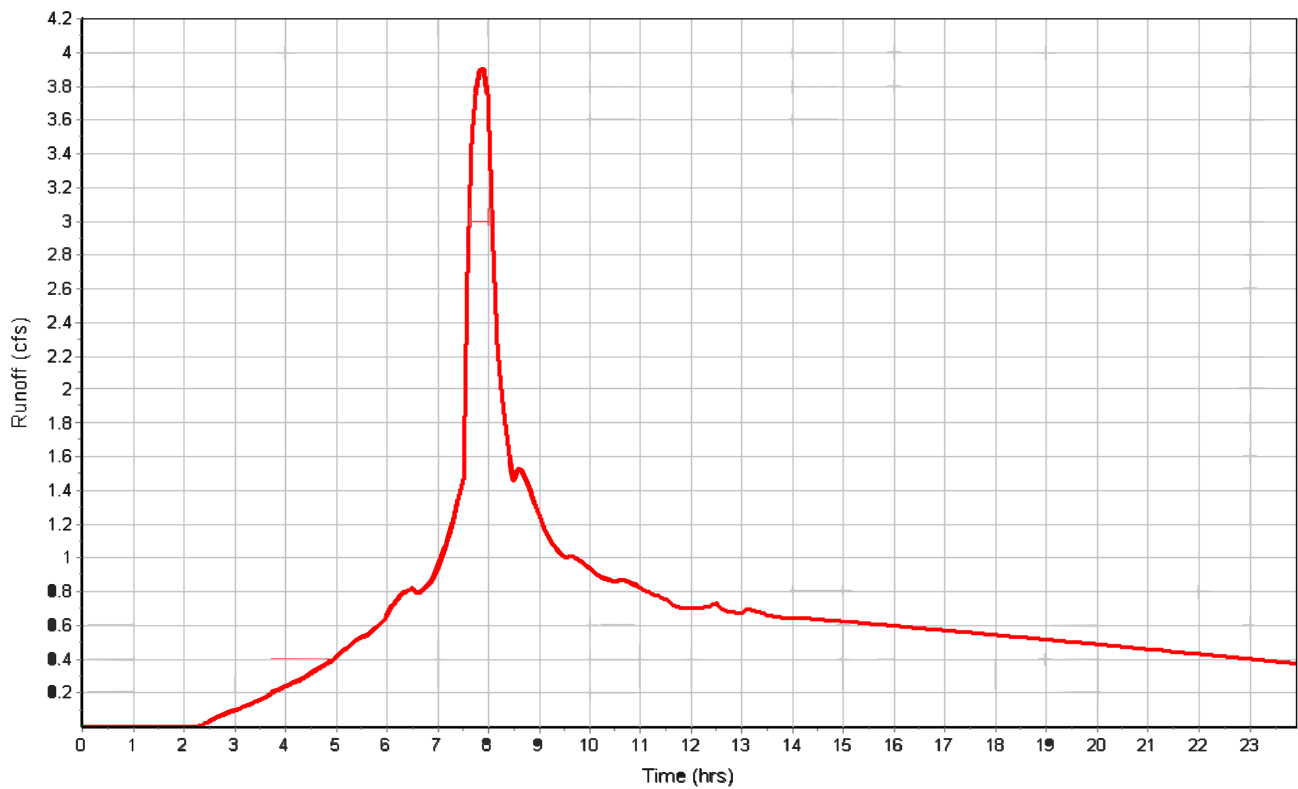
Total Rainfall (in) 10.69
Total Runoff (in) 7.77
Peak Runoff (cfs) 3.90
Weighted Curve Number 76.87
Time of Concentration (days hh:mm:ss) 0 00:05:41

Subbasin : {WTSH}.D

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.E

Input Data

Area (ac) 4.90
Peak Rate Factor 484.00
Weighted Curve Number 75.70
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.17	C	98.00
Woods & grass combination, Fair	2.13	C	76.00
> 75% grass cover, Good	2.60	C	74.00
Composite Area & Weighted CN	4.90		75.70

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.22	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.41	0.00	0.00
Computed Flow Time (min) :	4.04	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	321	0.00	0.00
Slope (%) :	23	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	3.36	0.00	0.00
Computed Flow Time (min) :	1.59	0.00	0.00

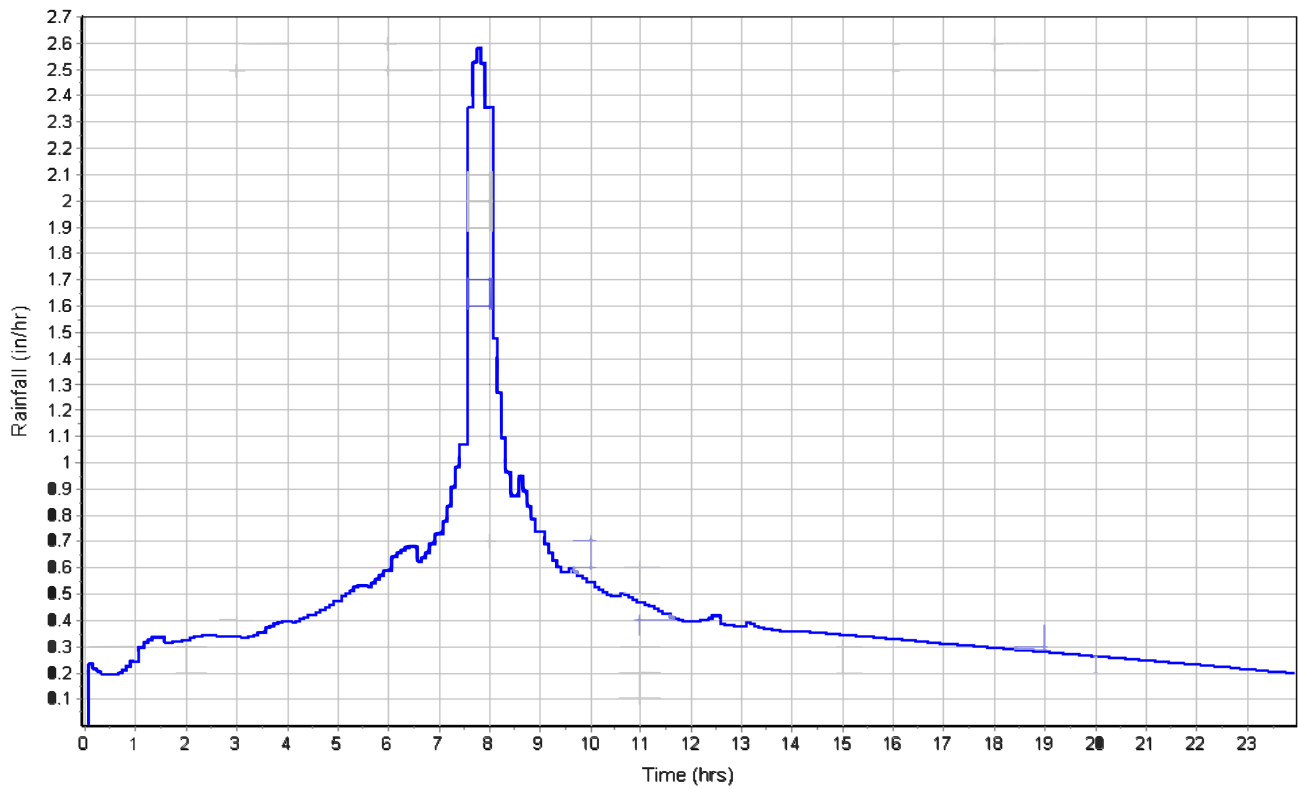
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	161	0.00	0.00
Channel Slope (%) :	12	0.00	0.00
Cross Section Area (ft ²) :	1.4	0.00	0.00
Wetted Perimeter (ft) :	4.7	0.00	0.00
Velocity (ft/sec) :	5.76	0.00	0.00
Computed Flow Time (min) :	0.47	0.00	0.00
Total TOC (min)	6.10		

Subbasin Runoff Results

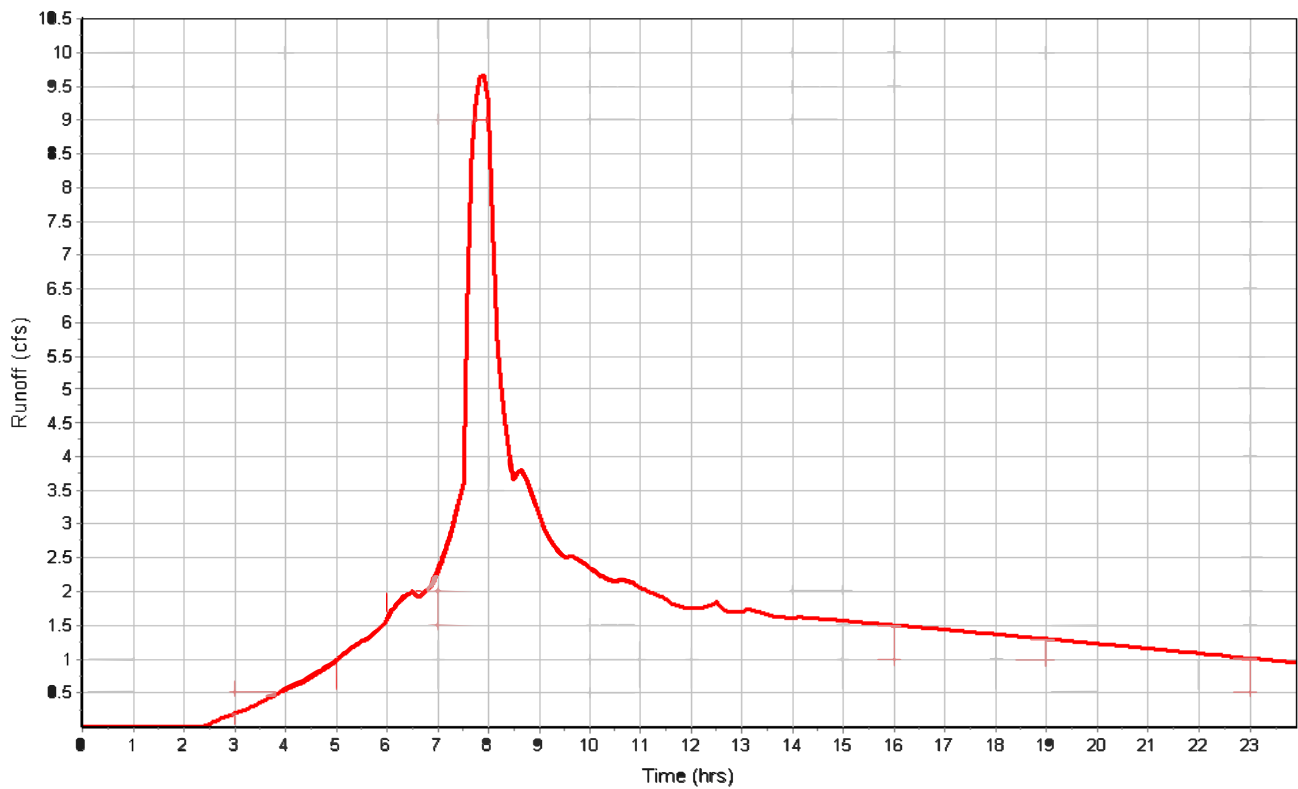
Total Rainfall (in) 10.69
Total Runoff (in) 7.61
Peak Runoff (cfs) 9.67
Weighted Curve Number 75.70
Time of Concentration (days hh:mm:ss) 0 00:06:06

Subbasin : {WTSH}.E

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.F

Input Data

Area (ac) 2.67
Peak Rate Factor 484.00
Weighted Curve Number 76.55
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.20	C	98.00
Woods & grass combination, Fair	1.00	C	76.00
> 75% grass cover, Good	1.47	C	74.00
Composite Area & Weighted CN	2.67		76.55

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	40	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.83	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	318	0.00	0.00
Slope (%) :	22	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	4.22	0.00	0.00
Computed Flow Time (min) :	1.26	0.00	0.00

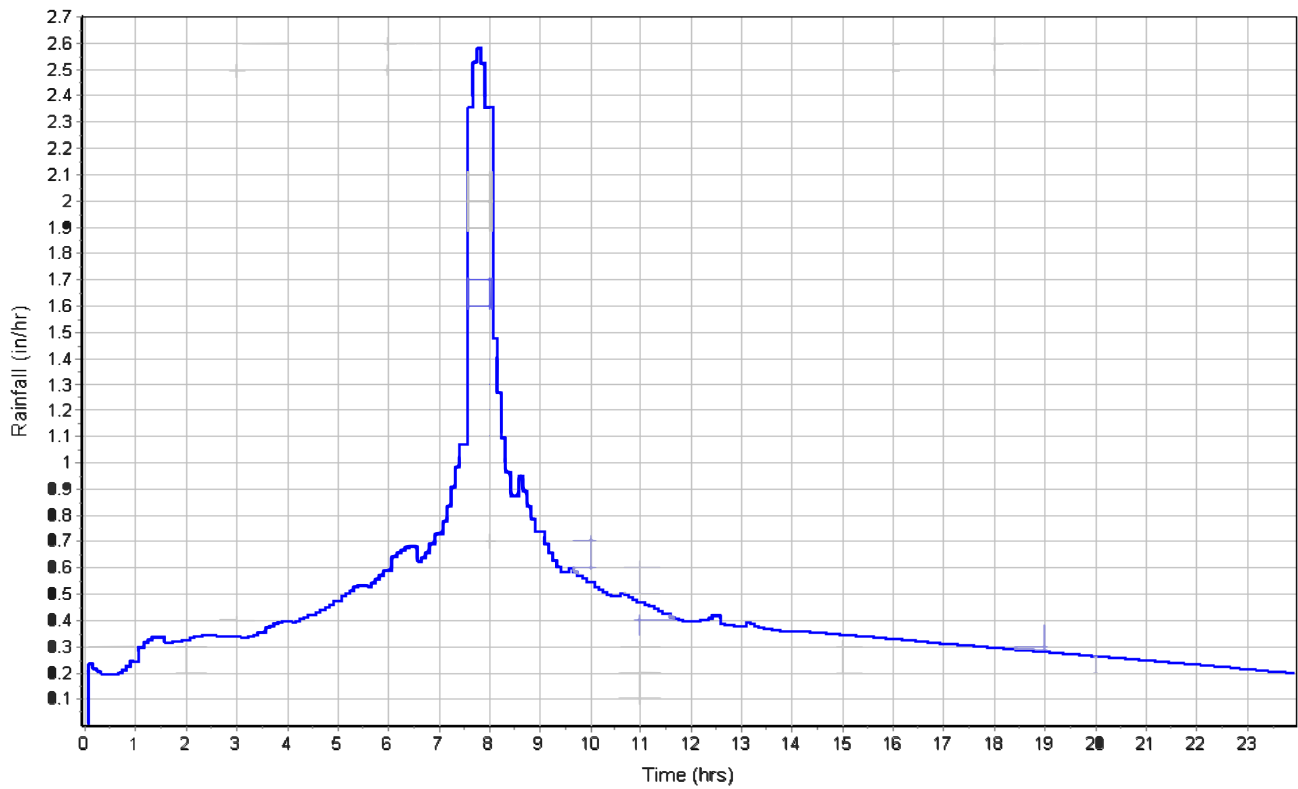
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.04	.022	0.00
Flow Length (ft) :	325	112	0.00
Channel Slope (%) :	5.3	11	0.00
Cross Section Area (ft ²) :	2	2	0.00
Wetted Perimeter (ft) :	5	5	0.00
Velocity (ft/sec) :	4.66	12.19	0.00
Computed Flow Time (min) :	1.16	0.15	0.00
Total TOC (min)	4.20		

Subbasin Runoff Results

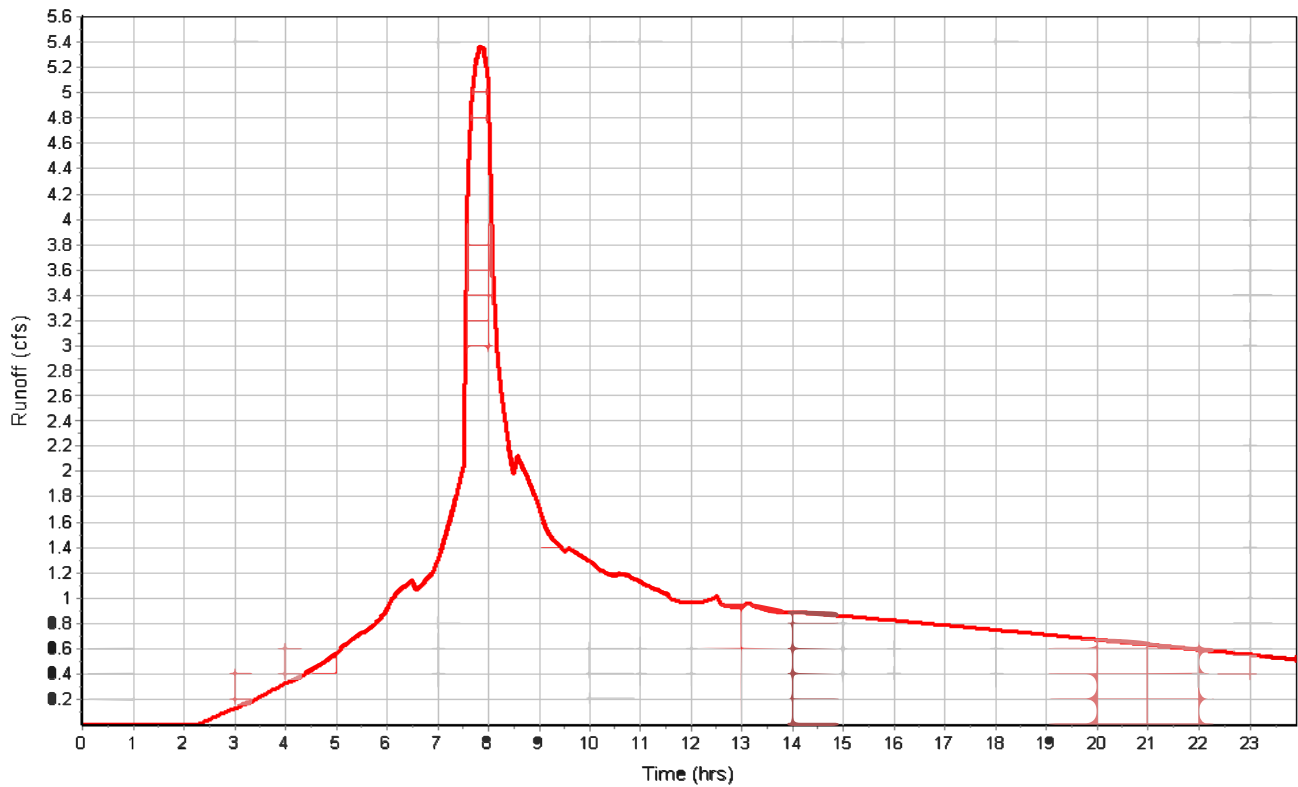
Total Rainfall (in) 10.69
Total Runoff (in) 7.72
Peak Runoff (cfs) 5.37
Weighted Curve Number 76.55
Time of Concentration (days hh:mm:ss) 0 00:04:12

Subbasin : {WTSH}.F

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.G

Input Data

Area (ac) 2.91
Peak Rate Factor 484.00
Weighted Curve Number 75.91
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.09	C	98.00
Woods & grass combination, Fair	0.97	C	76.00
50 - 75% grass cover, Fair	0.29	C	79.00
> 75% grass cover, Good	1.56	C	74.00
Composite Area & Weighted CN	2.91		75.91

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.15	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	718	0.00	0.00
Slope (%) :	13.5	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	3.31	0.00	0.00
Computed Flow Time (min) :	3.62	0.00	0.00

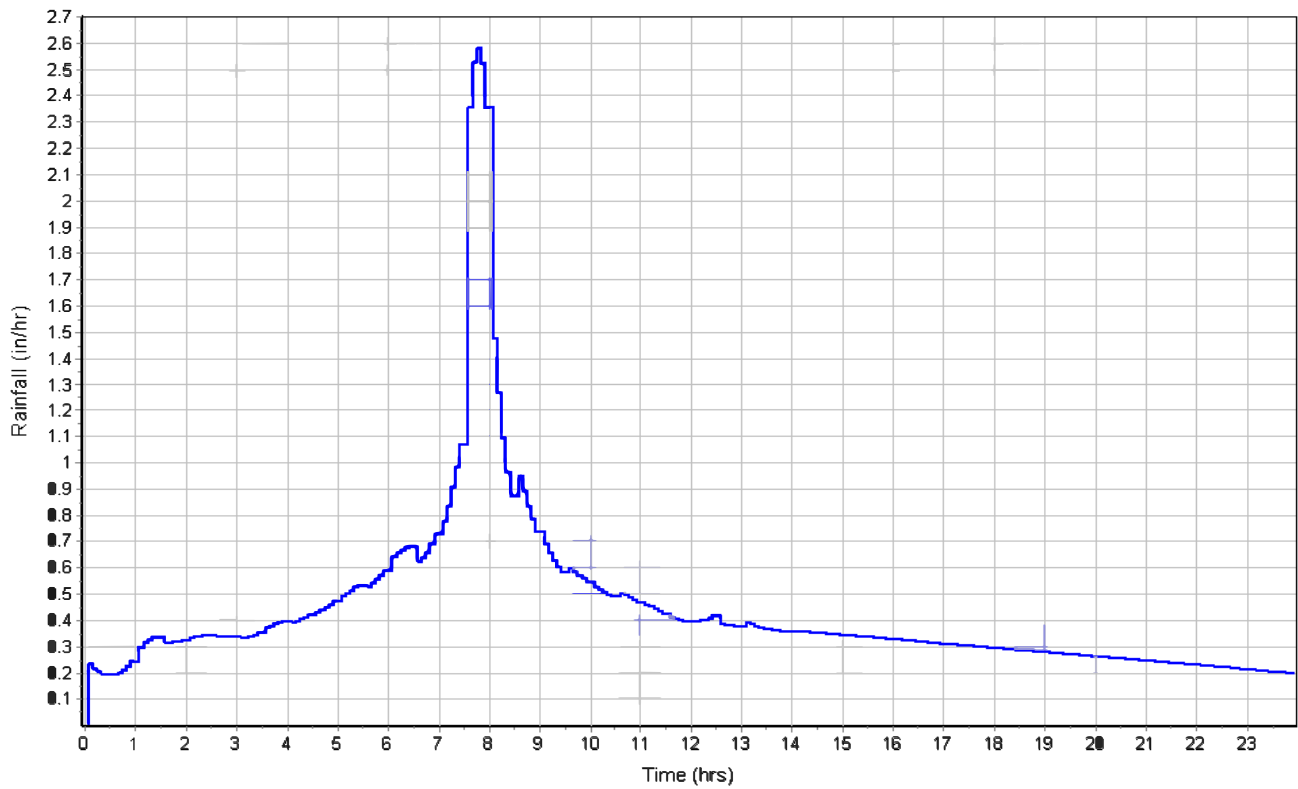
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	0.022	0.00	0.00
Flow Length (ft) :	24	0.00	0.00
Channel Slope (%) :	8.3	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	10.59	0.00	0.00
Computed Flow Time (min) :	0.04	0.00	0.00
Total TOC (min)	9.81		

Subbasin Runoff Results

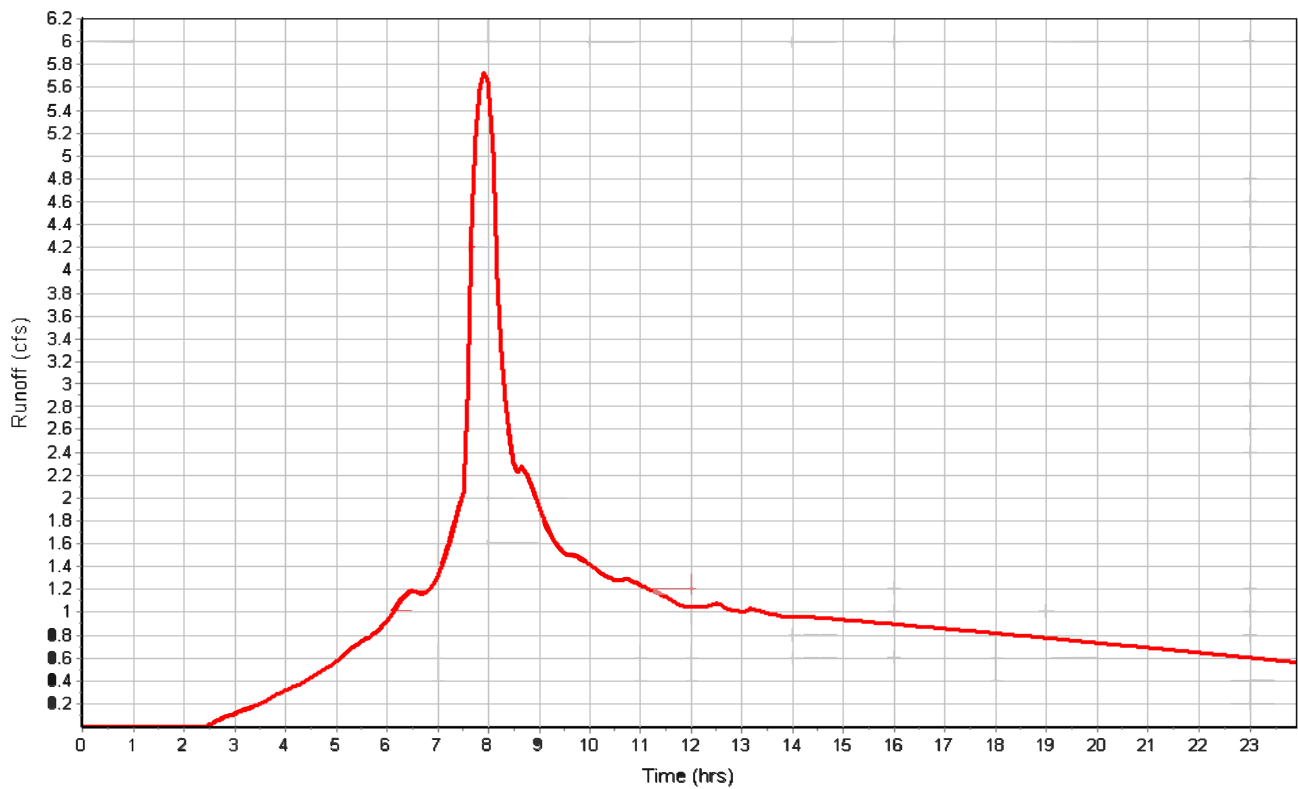
Total Rainfall (in) 10.69
Total Runoff (in) 7.64
Peak Runoff (cfs) 5.73
Weighted Curve Number 75.91
Time of Concentration (days hh:mm:ss) 0 00:09:49

Subbasin : {WTSH}.G

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name 1826-DRHY_POST.SPF
Description WINROD VINEYARD ECP
STORM AND SEWER ANALYSIS

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-20
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
YES

Analysis Options

Start Analysis On Jul 13, 2020 00:00:00
End Analysis On Jul 14, 2020 00:00:00
Start Reporting On Jul 13, 2020 00:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins 8
Nodes 8
 Junctions 0
 Outfalls 8
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
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Subbasin Summary

SN Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
	(ac)			(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1 {WTSH}.A1	25.12	484.00	79.23	11.98	9.33	234.24	60.77	0 00:10:20
2 {WTSH}.A2	3.57	484.00	75.65	11.98	8.83	31.53	8.23	0 00:04:27
3 {WTSH}.B	93.54	484.00	77.01	11.98	9.02	843.82	194.62	0 00:28:59
4 {WTSH}.C	54.14	484.00	76.00	11.98	8.88	480.82	115.11	0 00:24:03
5 {WTSH}.D	1.93	484.00	76.87	11.98	9.00	17.37	4.54	0 00:05:40
6 {WTSH}.E	4.90	484.00	75.70	11.98	8.84	43.31	11.28	0 00:06:06
7 {WTSH}.F	2.67	484.00	76.55	11.98	8.96	23.92	6.26	0 00:04:12
8 {WTSH}.G	2.91	484.00	75.91	11.98	8.87	25.81	6.68	0 00:09:48

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	A1	Outfall	0.00					0.00	0.00					
2	A2	Outfall	0.00					0.00	0.00					
3	B	Outfall	0.00					0.00	0.00					
4	C	Outfall	0.00					0.00	0.00					
5	D	Outfall	0.00					0.00	0.00					
6	E	Outfall	0.00					0.00	0.00					
7	F	Outfall	0.00					0.00	0.00					
8	G	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : {WTSH}.A1

Input Data

Area (ac) 25.12
Peak Rate Factor 484.00
Weighted Curve Number 79.23
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.09	C	98.00
Woods & grass combination, Fair	7.83	C	76.00
Woods & grass combination, Fair	5.13	D	82.00
50 - 75% grass cover, Fair	9.72	C	79.00
> 75% grass cover, Good	1.35	C	74.00
Composite Area & Weighted CN	25.12		79.23

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

Where :

T_c = Time of Concentration (hr)
n = Manning's roughness
L_f = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
V = 20.3282 * (S_f^{0.5}) (paved surface)
V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
V = 5.0 * (S_f^{0.5}) (woodland surface)
V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
T_c = (L_f / V) / (3600 sec/hr)

Where:

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n
R = A_q / W_p
T_c = (L_f / V) / (3600 sec/hr)

Where :

T_c = Time of Concentration (hr)
L_f = Flow Length (ft)
R = Hydraulic Radius (ft)
A_q = Flow Area (ft²)
W_p = Wetted Perimeter (ft)
V = Velocity (ft/sec)
S_f = Slope (ft/ft)
n = Manning's roughness

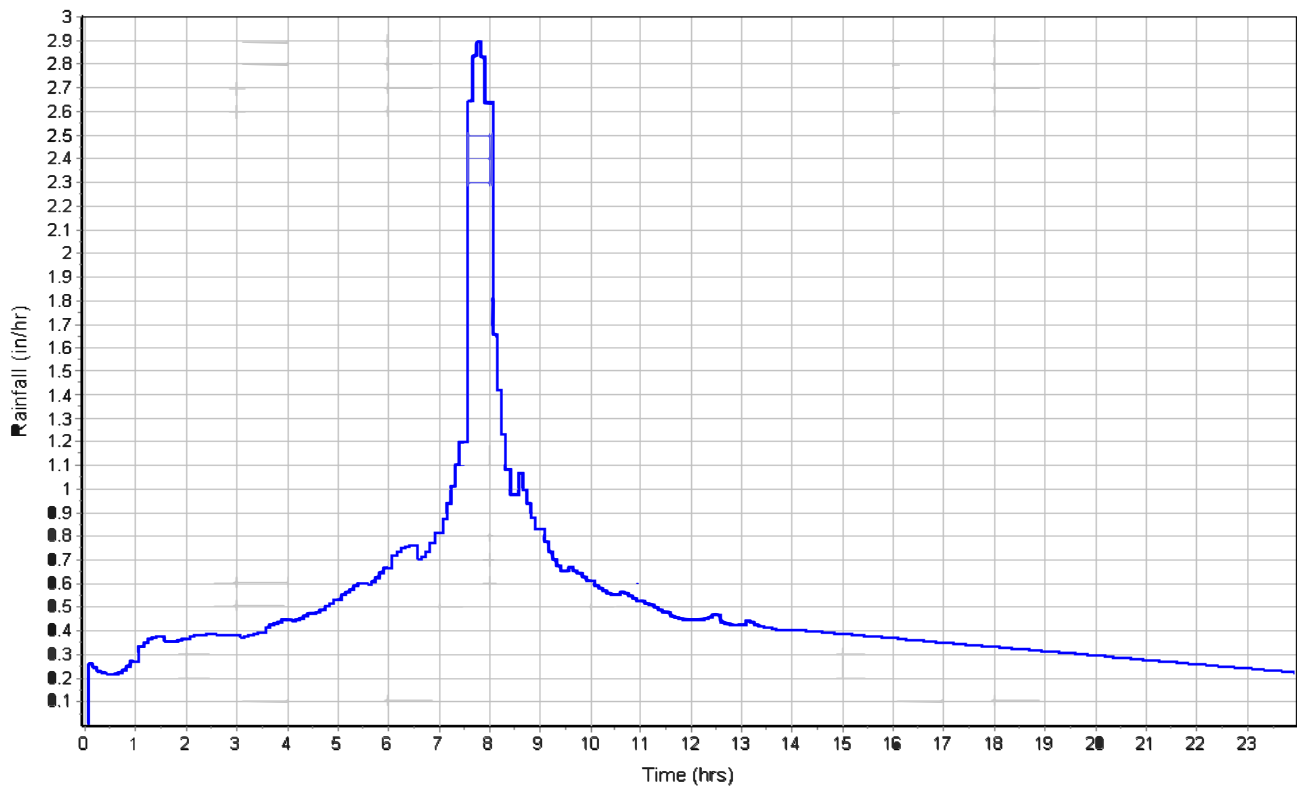
Sheet Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	30	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.25	0.00	0.00
Computed Flow Time (min) :	6.54	0.00	0.00
Shallow Concentrated Flow Computations	Subarea	Subarea	Subarea
	A	B	C
Flow Length (ft) :	1499	0.00	0.00
Slope (%) :	16.7	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	6.59	0.00	0.00
Computed Flow Time (min) :	3.79	0.00	0.00
Total TOC (min)	10.34		

Subbasin Runoff Results

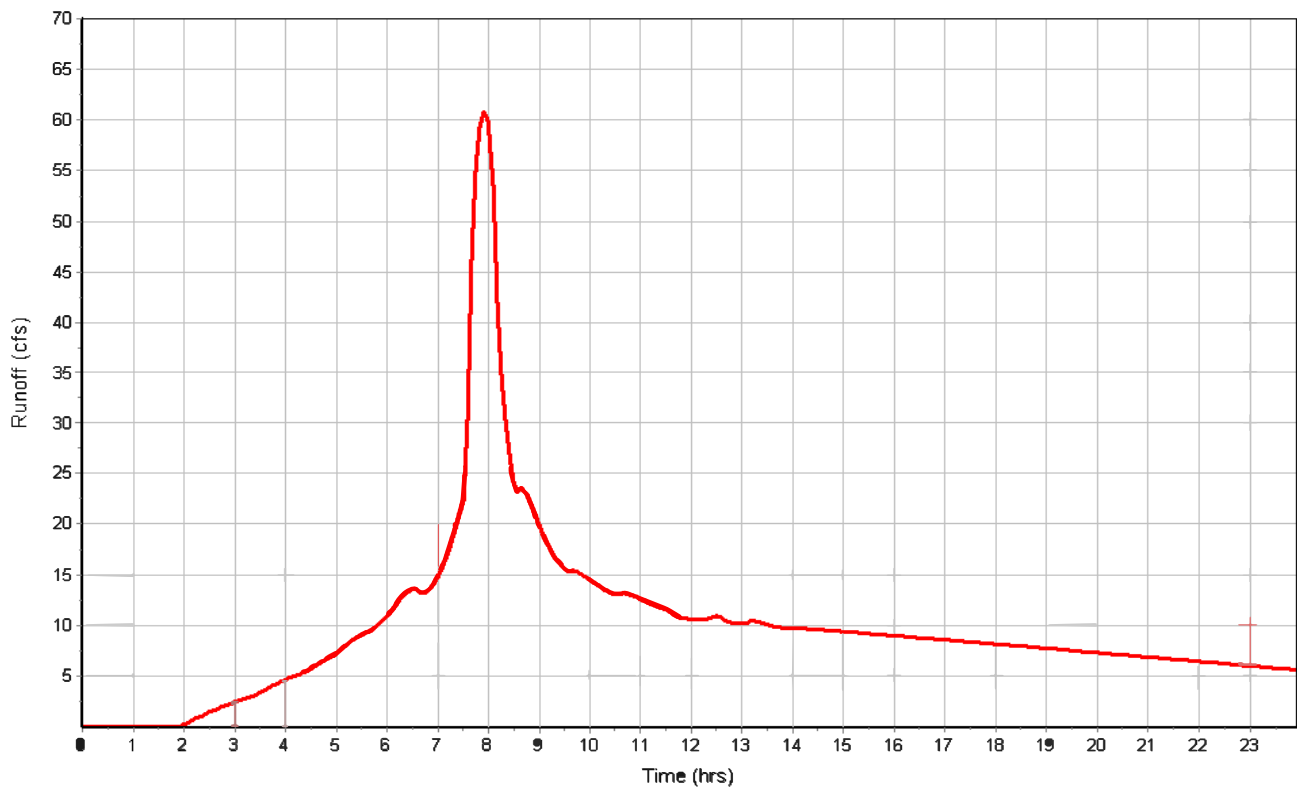
Total Rainfall (in)	11.98
Total Runoff (in)	9.33
Peak Runoff (cfs)	60.77
Weighted Curve Number	79.23
Time of Concentration (days hh:mm:ss)	0 00:10:20

Subbasin : {WTSH}.A1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.A2

Input Data

Area (ac) 3.57
Peak Rate Factor 484.00
Weighted Curve Number 75.65
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	2.94	C	76.00
> 75% grass cover, Good	0.63	C	74.00
Composite Area & Weighted CN	3.57		75.65

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	43	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.67	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	290	34	0.00
Slope (%) :	25.3	11.8	0.00
Surface Type :	Woodland	Woodland	Unpaved
Velocity (ft/sec) :	2.51	1.72	0.00
Computed Flow Time (min) :	1.93	0.33	0.00

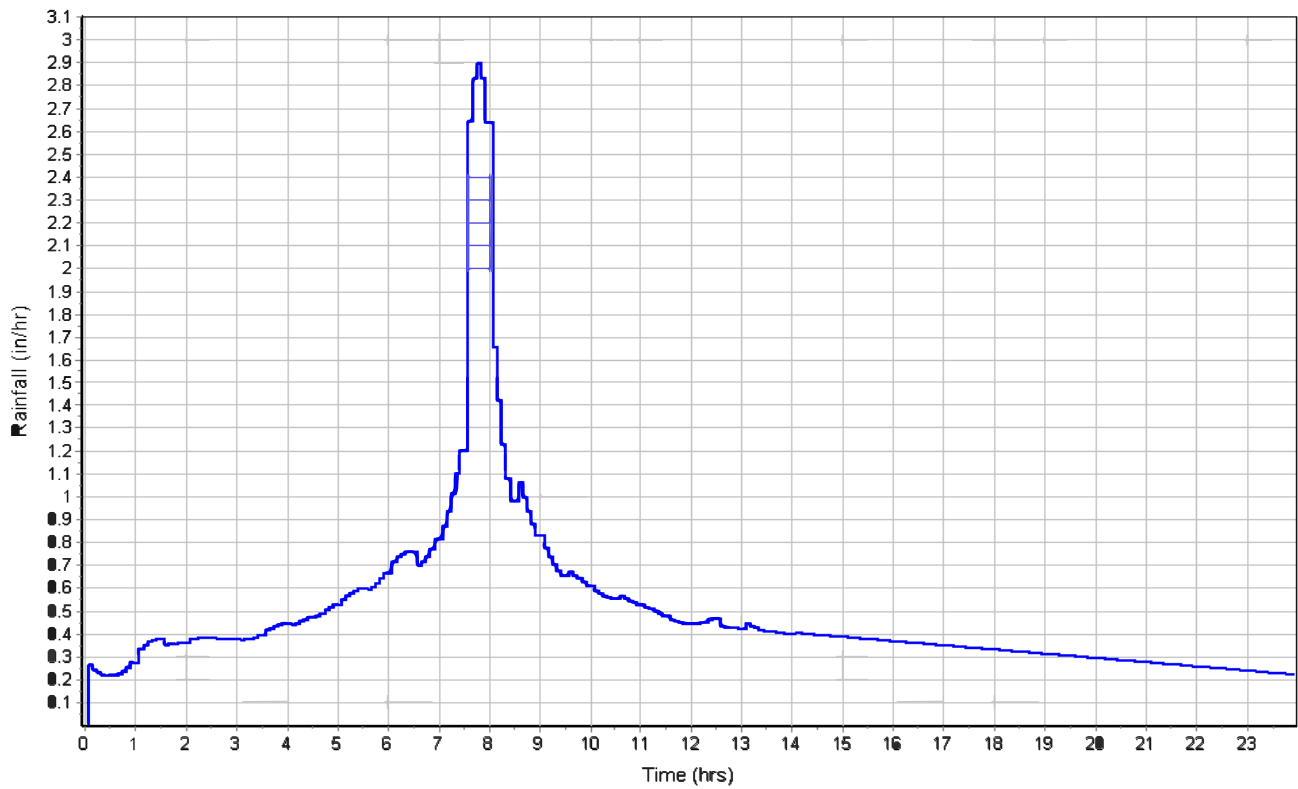
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	380	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	6.29	0.00	0.00
Computed Flow Time (min) :	1.01	0.00	0.00
Total TOC (min)	4.46		

Subbasin Runoff Results

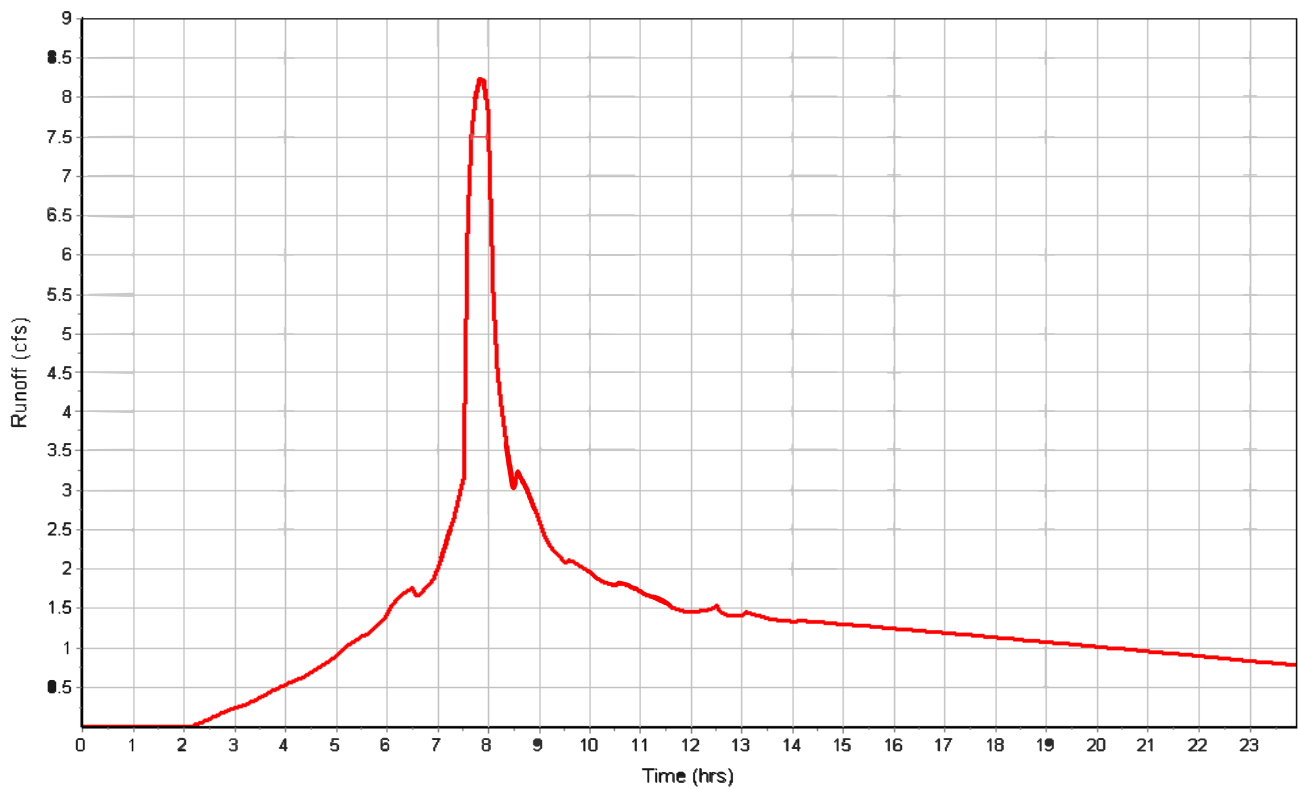
Total Rainfall (in) 11.98
Total Runoff (in) 8.83
Peak Runoff (cfs) 8.23
Weighted Curve Number 75.65
Time of Concentration (days hh:mm:ss) 0 00:04:28

Subbasin : {WTSH}.A2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.B

Input Data

Area (ac) 93.54
Peak Rate Factor 484.00
Weighted Curve Number 77.01
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.22	C	98.00
Woods & grass combination, Fair	74.50	C	76.00
Woods & grass combination, Fair	14.94	D	82.00
50 - 75% grass cover, Fair	0.16	C	79.00
> 75% grass cover, Good	3.24	C	74.00
Gravel roads	0.48	C	89.00
Composite Area & Weighted CN	93.54		77.01

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	45	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	6.40	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	2154	0.00	0.00
Slope (%) :	25.3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	8.12	0.00	0.00
Computed Flow Time (min) :	4.42	0.00	0.00

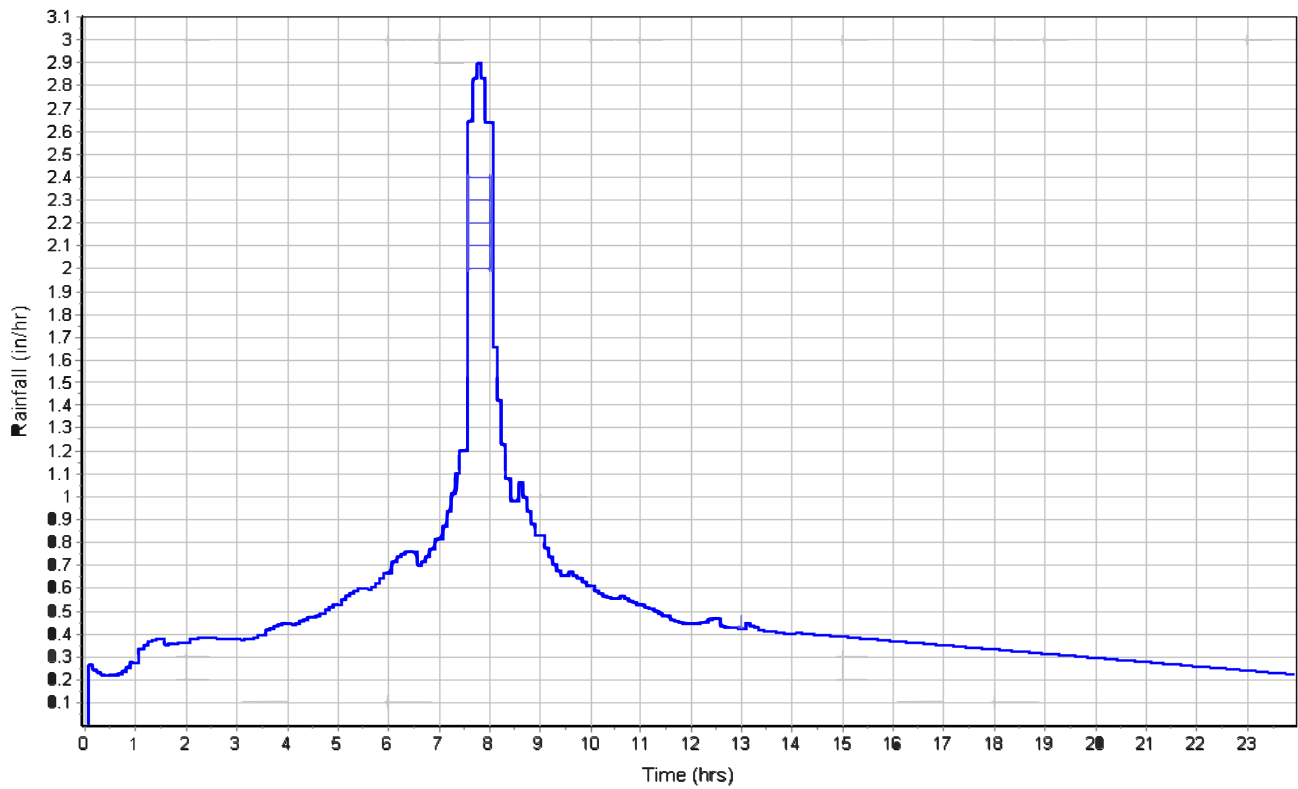
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	0.5	0.00	0.00
Flow Length (ft) :	2196	0.00	0.00
Channel Slope (%) :	7.2	0.00	0.00
Cross Section Area (ft²) :	60	0.00	0.00
Wetted Perimeter (ft) :	15	0.00	0.00
Velocity (ft/sec) :	2.01	0.00	0.00
Computed Flow Time (min) :	18.16	0.00	0.00
Total TOC (min)	28.99		

Subbasin Runoff Results

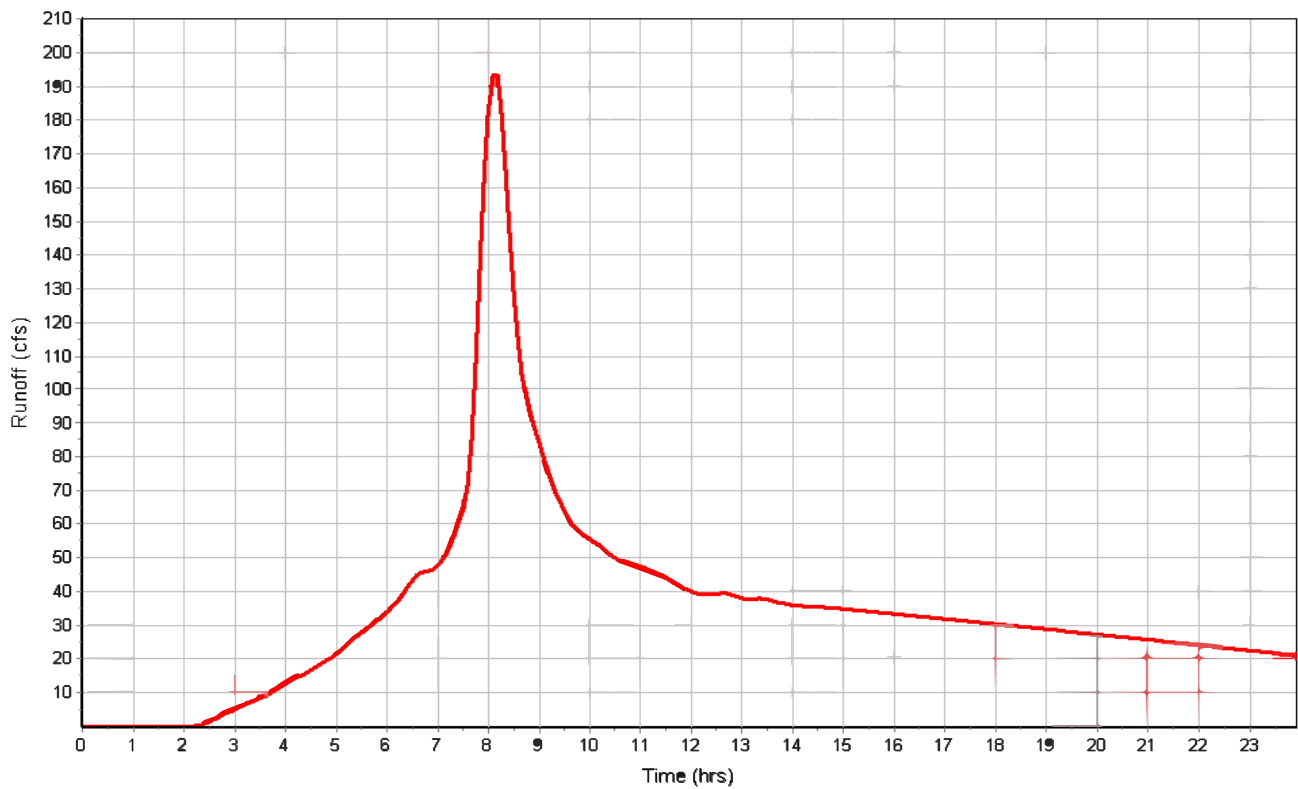
Total Rainfall (in) 11.98
Total Runoff (in) 9.02
Peak Runoff (cfs) 194.62
Weighted Curve Number 77.01
Time of Concentration (days hh:mm:ss) 0 00:28:59

Subbasin : {WTSH}.B

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.C

Input Data

Area (ac) 54.14
Peak Rate Factor 484.00
Weighted Curve Number 76.00
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	54.14	C	76.00
Composite Area & Weighted CN	54.14		76.00

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.56	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	50	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.14	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1940	0.00	0.00
Slope (%) :	31.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	2.82	0.00	0.00
Computed Flow Time (min) :	11.47	0.00	0.00

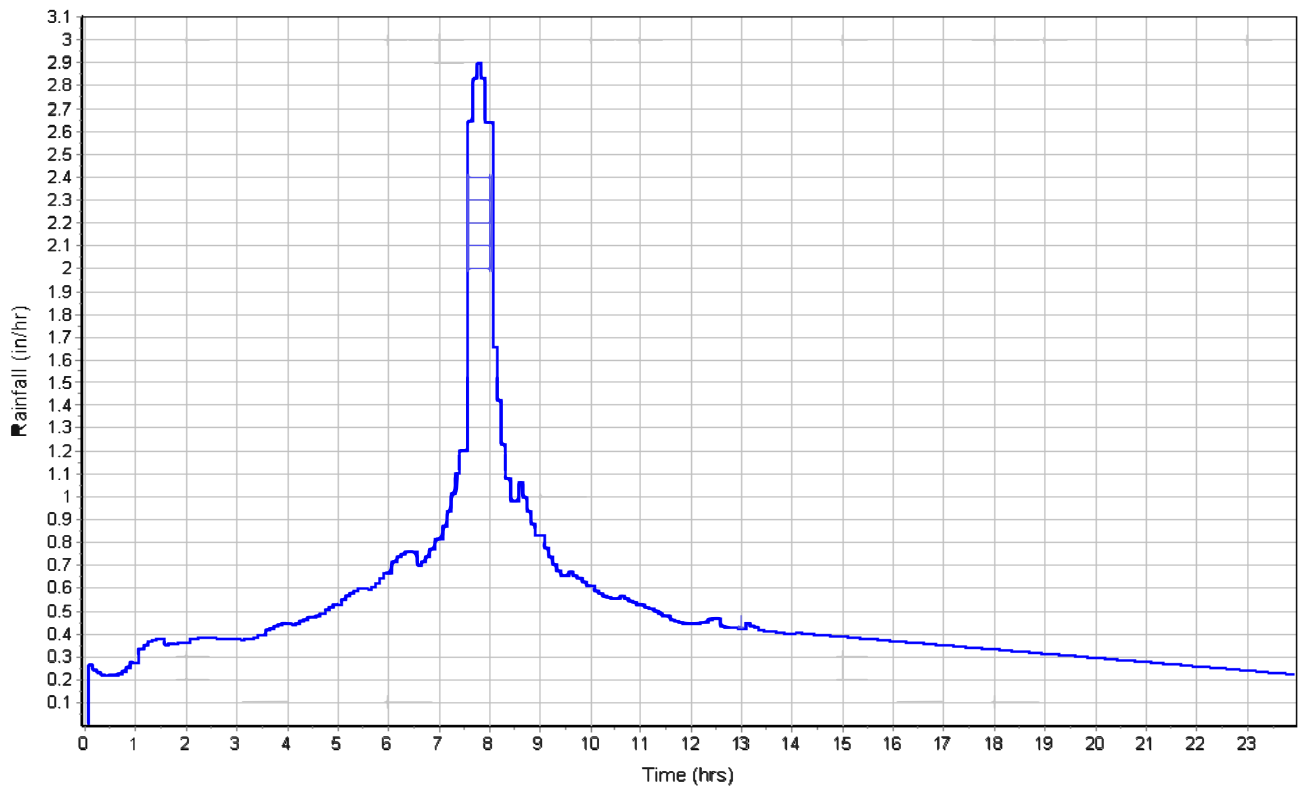
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	0.50	0.00	0.00
Flow Length (ft) :	1445	0.00	0.00
Channel Slope (%) :	8.7	0.00	0.00
Cross Section Area (ft²) :	228	0.00	0.00
Wetted Perimeter (ft) :	26	0.00	0.00
Velocity (ft/sec) :	3.74	0.00	0.00
Computed Flow Time (min) :	6.44	0.00	0.00
Total TOC (min) 24.05			

Subbasin Runoff Results

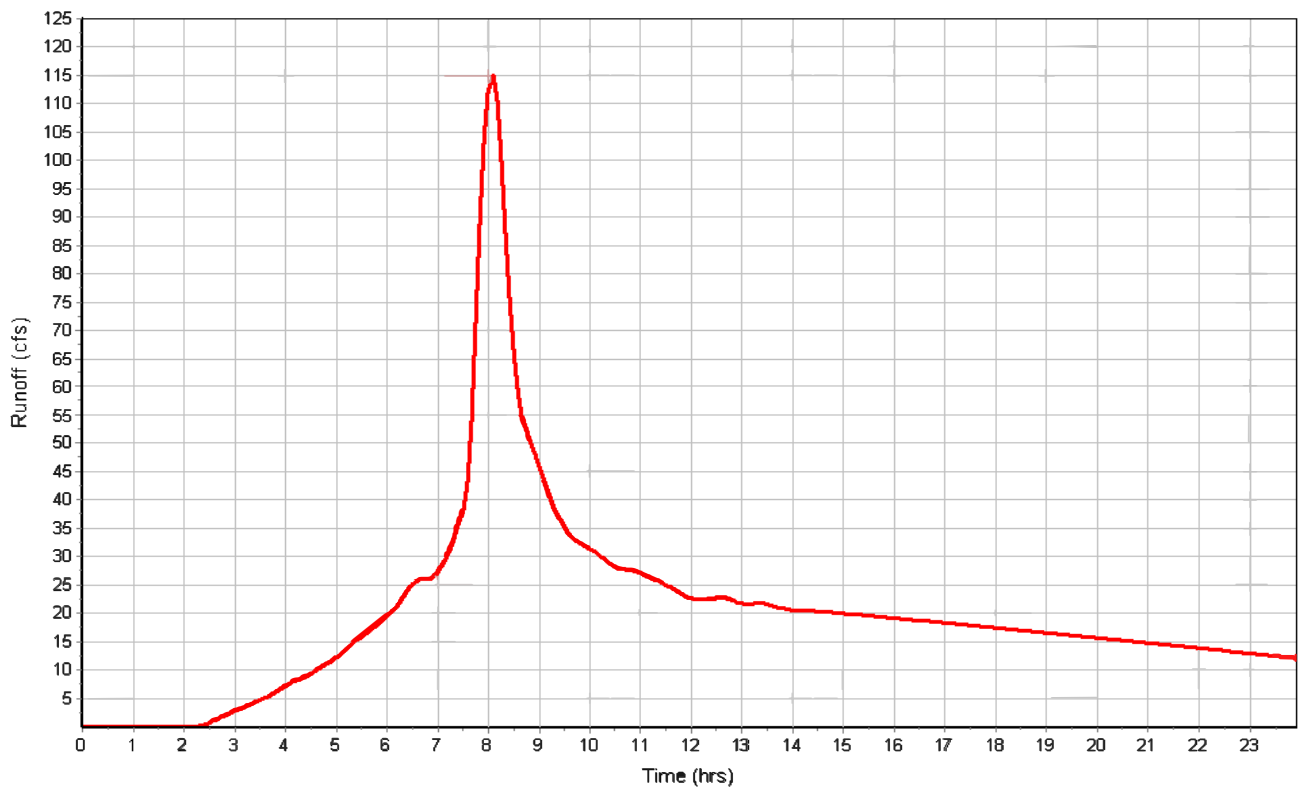
Total Rainfall (in) 11.98
Total Runoff (in) 8.88
Peak Runoff (cfs) 115.11
Weighted Curve Number 76.00
Time of Concentration (days hh:mm:ss) 0 00:24:03

Subbasin : {WTSH}.C

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.D

Input Data

Area (ac) 1.93
Peak Rate Factor 484.00
Weighted Curve Number 76.87
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.21	C	98.00
Woods & grass combination, Fair	0.25	C	76.00
> 75% grass cover, Good	1.47	C	74.00
Composite Area & Weighted CN	1.93		76.87

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	.22	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	25	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.43	0.00	0.00
Computed Flow Time (min) :	3.84	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	244	0.00	0.00
Slope (%) :	7.4	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	2.45	0.00	0.00
Computed Flow Time (min) :	1.66	0.00	0.00

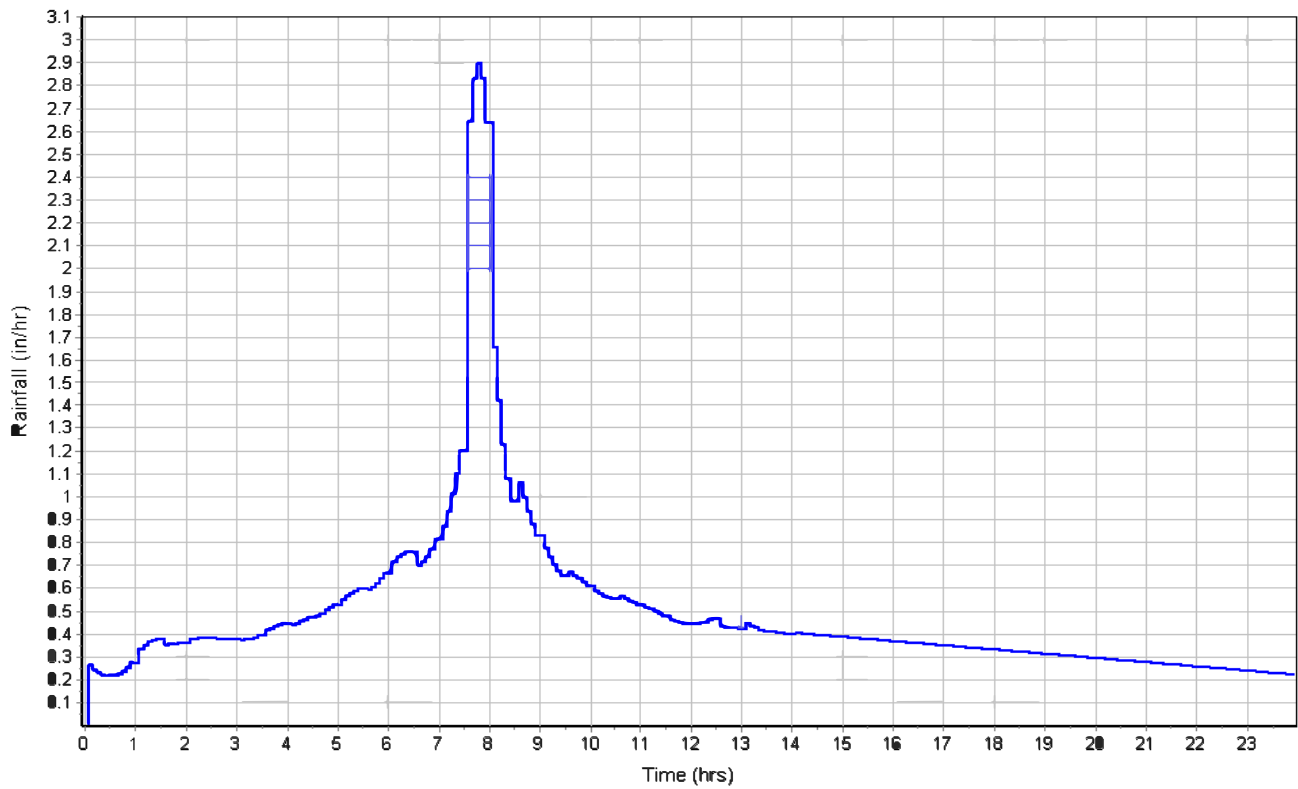
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.027	0.00	0.00
Flow Length (ft) :	52	0.00	0.00
Channel Slope (%) :	2.2	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	4.47	0.00	0.00
Velocity (ft/sec) :	4.79	0.00	0.00
Computed Flow Time (min) :	0.18	0.00	0.00
Total TOC (min)	5.68		

Subbasin Runoff Results

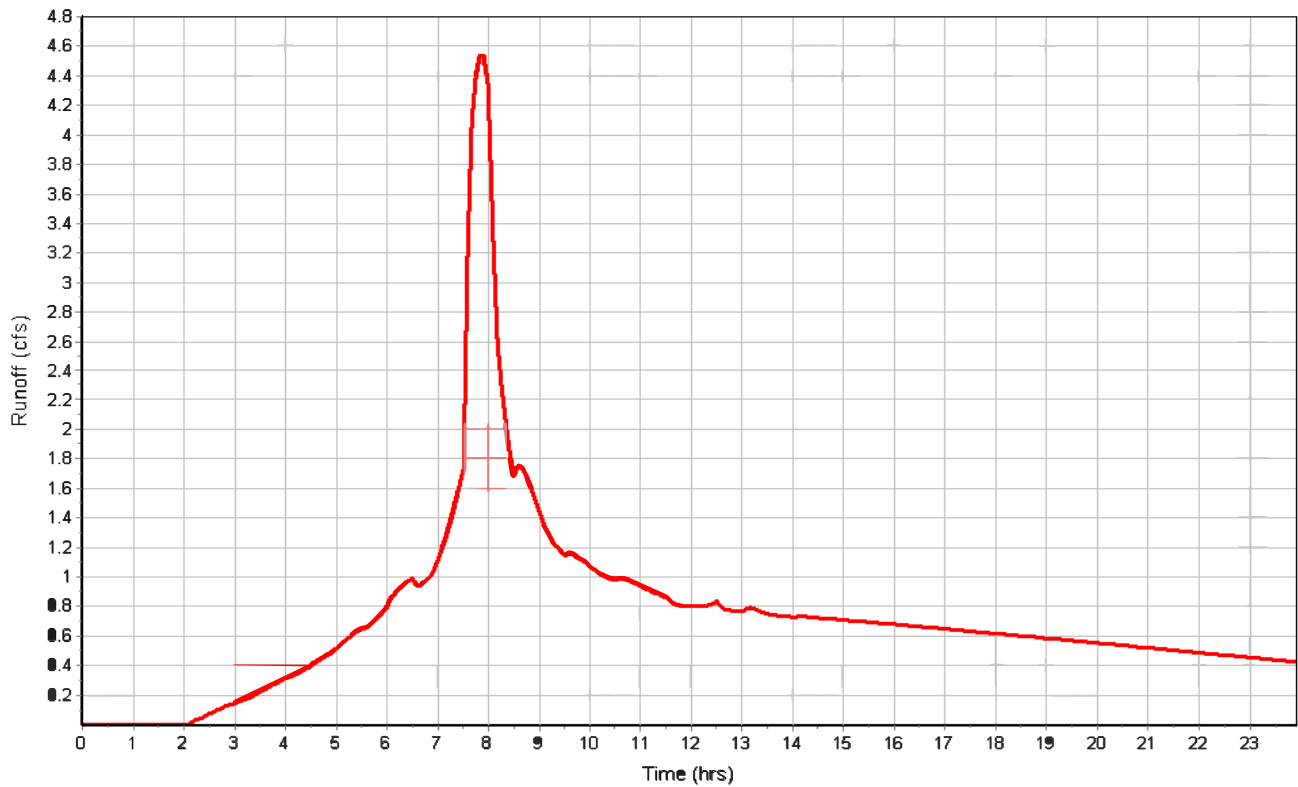
Total Rainfall (in) 11.98
Total Runoff (in) 9.00
Peak Runoff (cfs) 4.54
Weighted Curve Number 76.87
Time of Concentration (days hh:mm:ss) 0 00:05:41

Subbasin : {WTSH}.D

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.E

Input Data

Area (ac) 4.90
Peak Rate Factor 484.00
Weighted Curve Number 75.70
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.17	C	98.00
Woods & grass combination, Fair	2.13	C	76.00
> 75% grass cover, Good	2.60	C	74.00
Composite Area & Weighted CN	4.90		75.70

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.22	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	22	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.41	0.00	0.00
Computed Flow Time (min) :	4.04	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	321	0.00	0.00
Slope (%) :	23	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	3.36	0.00	0.00
Computed Flow Time (min) :	1.59	0.00	0.00

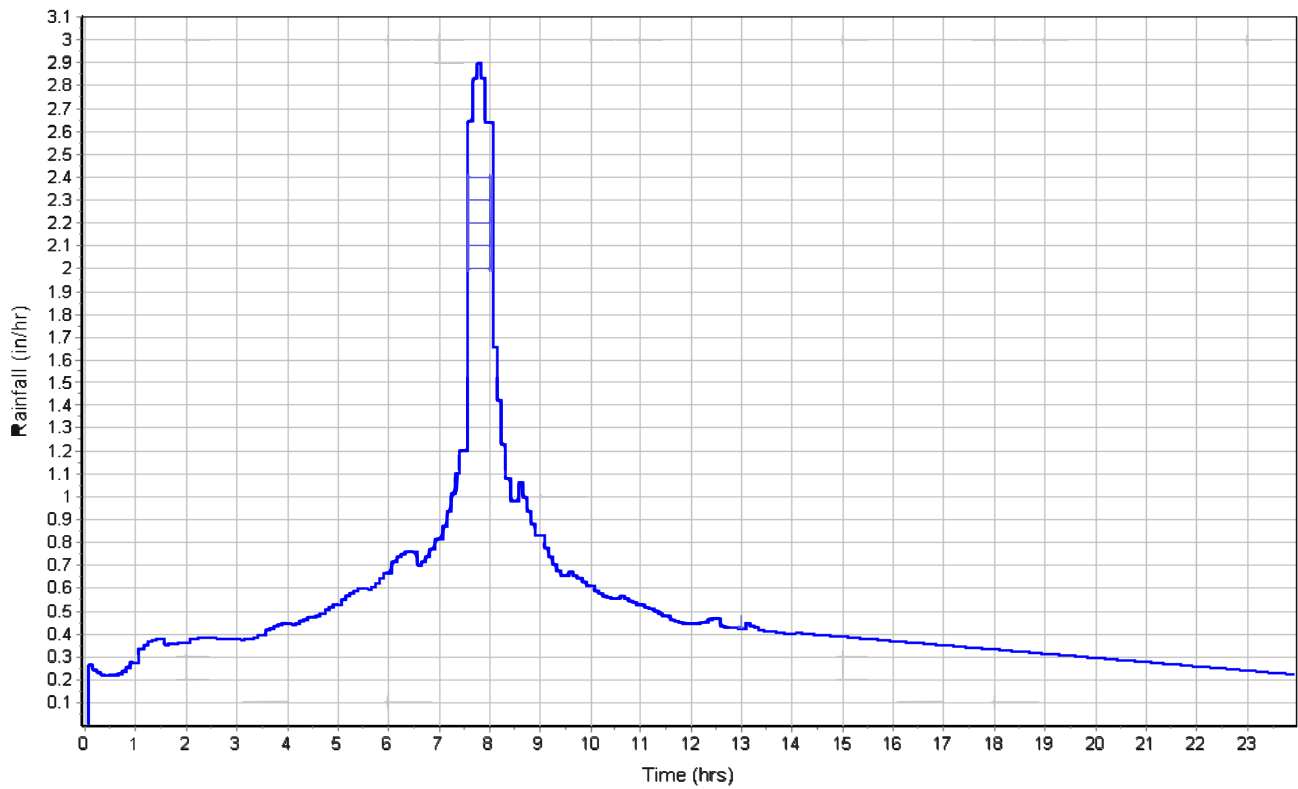
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	161	0.00	0.00
Channel Slope (%) :	12	0.00	0.00
Cross Section Area (ft ²) :	1.4	0.00	0.00
Wetted Perimeter (ft) :	4.7	0.00	0.00
Velocity (ft/sec) :	5.76	0.00	0.00
Computed Flow Time (min) :	0.47	0.00	0.00
Total TOC (min)	6.10		

Subbasin Runoff Results

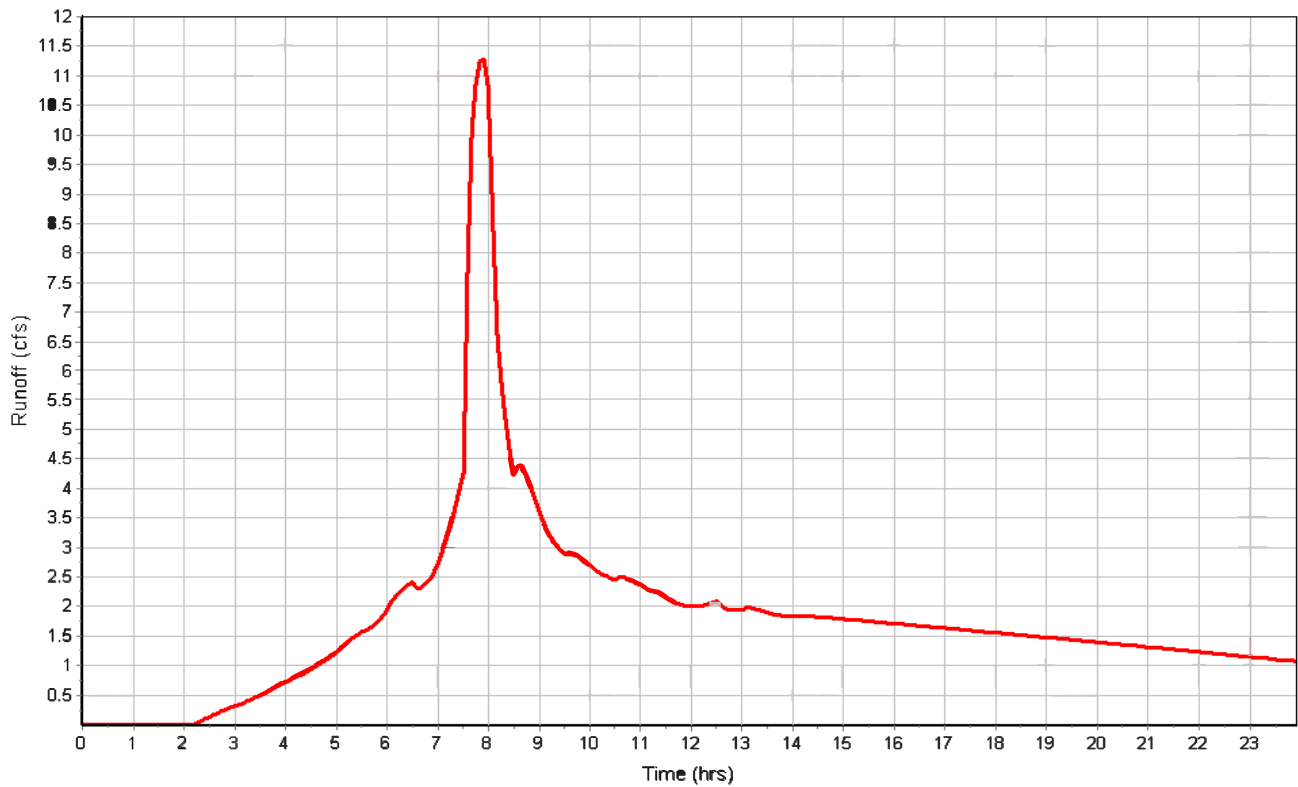
Total Rainfall (in) 11.98
Total Runoff (in) 8.84
Peak Runoff (cfs) 11.28
Weighted Curve Number 75.70
Time of Concentration (days hh:mm:ss) 0 00:06:06

Subbasin : {WTSH}.E

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.F

Input Data

Area (ac) 2.67
Peak Rate Factor 484.00
Weighted Curve Number 76.55
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.20	C	98.00
Woods & grass combination, Fair	1.00	C	76.00
> 75% grass cover, Good	1.47	C	74.00
Composite Area & Weighted CN	2.67		76.55

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	40	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.29	0.00	0.00
Computed Flow Time (min) :	5.83	0.00	0.00

	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	318	0.00	0.00
Slope (%) :	22	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	4.22	0.00	0.00
Computed Flow Time (min) :	1.26	0.00	0.00

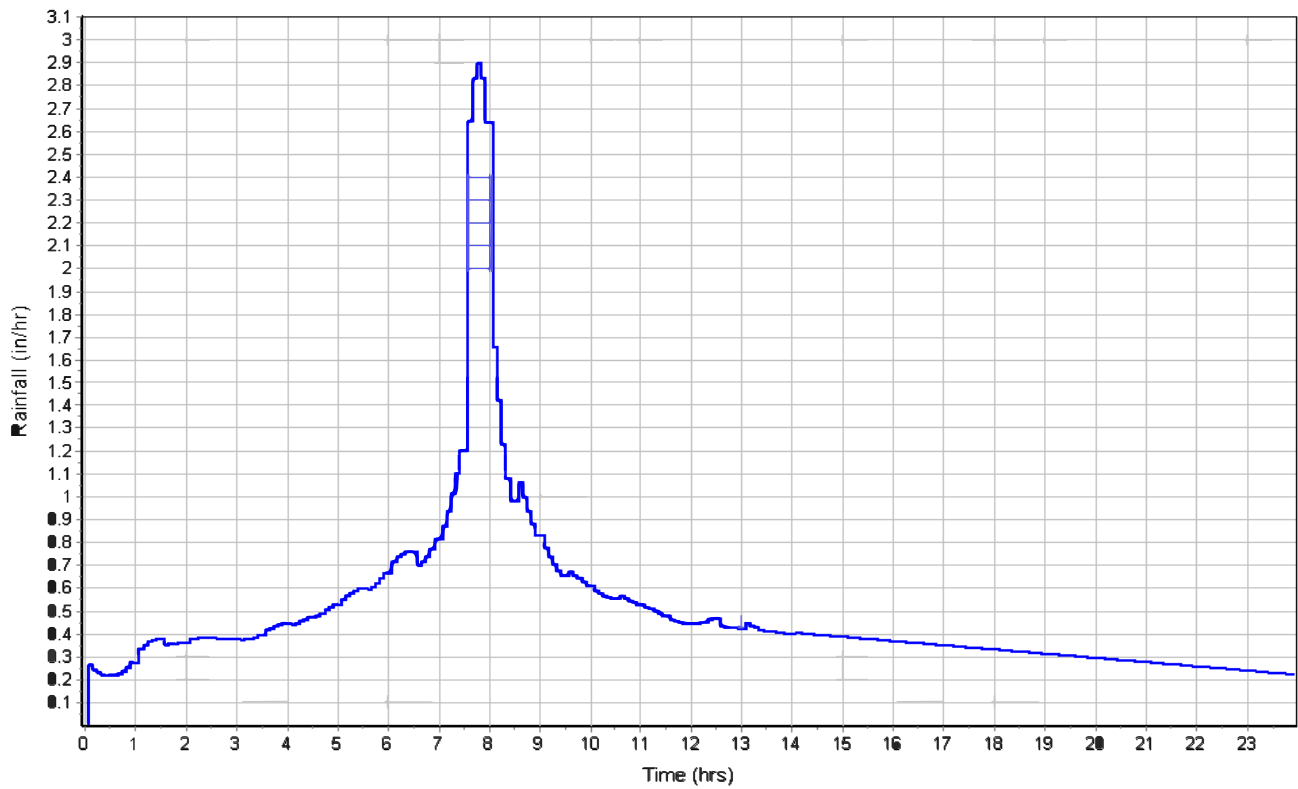
	Subarea A	Subarea B	Subarea C
Channel Flow Computations			
Manning's Roughness :	.04	.022	0.00
Flow Length (ft) :	325	112	0.00
Channel Slope (%) :	5.3	11	0.00
Cross Section Area (ft ²) :	2	2	0.00
Wetted Perimeter (ft) :	5	5	0.00
Velocity (ft/sec) :	4.66	12.19	0.00
Computed Flow Time (min) :	1.16	0.15	0.00
Total TOC (min)	4.20		

Subbasin Runoff Results

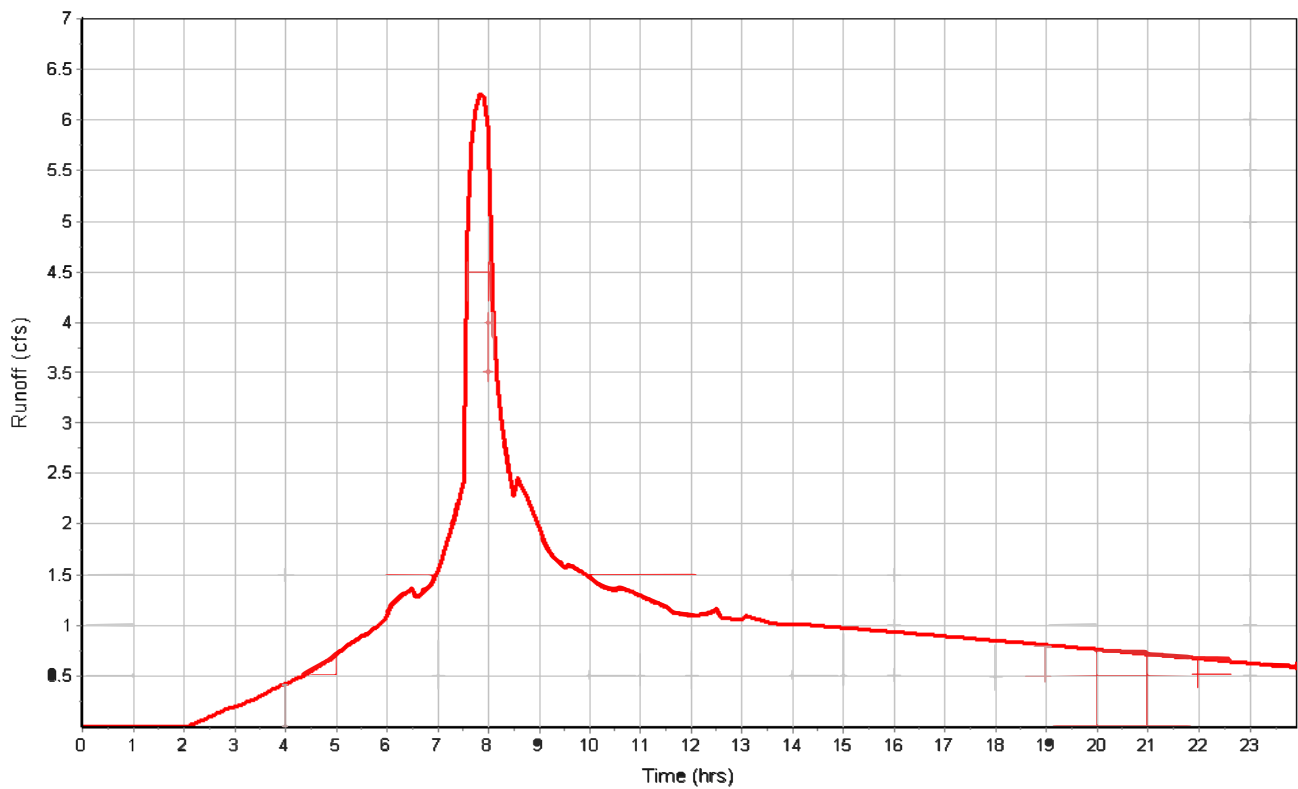
Total Rainfall (in) 11.98
Total Runoff (in) 8.96
Peak Runoff (cfs) 6.26
Weighted Curve Number 76.55
Time of Concentration (days hh:mm:ss) 0 00:04:12

Subbasin : {WTSH}.F

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : {WTSH}.G

Input Data

Area (ac) 2.91
Peak Rate Factor 484.00
Weighted Curve Number 75.91
Rain Gage ID Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.09	C	98.00
Woods & grass combination, Fair	0.97	C	76.00
50 - 75% grass cover, Fair	0.29	C	79.00
> 75% grass cover, Good	1.56	C	74.00
Composite Area & Weighted CN	2.91		75.91

Time of Concentration

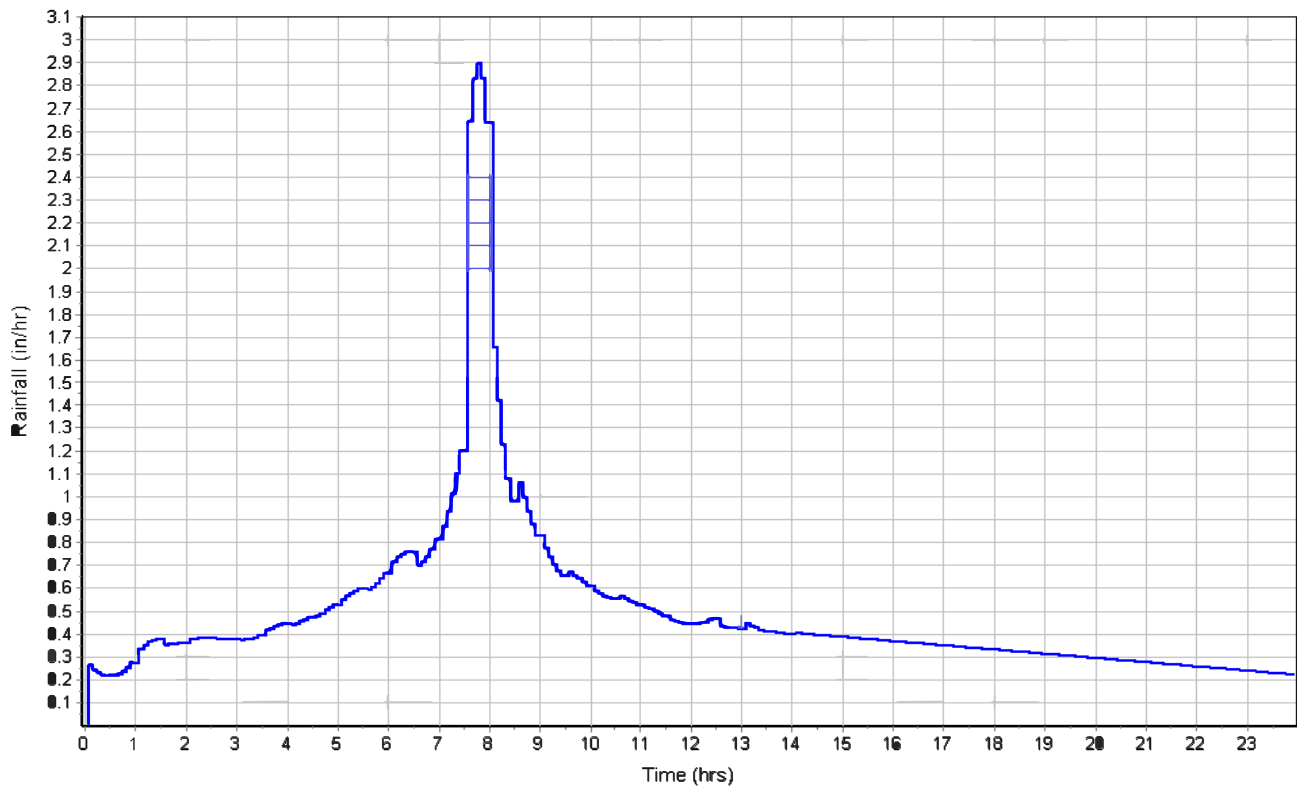
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.47	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	35	0.00	0.00
2 yr, 24 hr Rainfall (in) :	5.11	0.00	0.00
Velocity (ft/sec) :	0.27	0.00	0.00
Computed Flow Time (min) :	6.15	0.00	0.00
Shallow Concentrated Flow Computations			
Flow Length (ft) :	718	0.00	0.00
Slope (%) :	13.5	0.00	0.00
Surface Type :	Straight rows	Unpaved	Unpaved
Velocity (ft/sec) :	3.31	0.00	0.00
Computed Flow Time (min) :	3.62	0.00	0.00
Channel Flow Computations			
Manning's Roughness :	0.022	0.00	0.00
Flow Length (ft) :	24	0.00	0.00
Channel Slope (%) :	8.3	0.00	0.00
Cross Section Area (ft ²) :	2	0.00	0.00
Wetted Perimeter (ft) :	5	0.00	0.00
Velocity (ft/sec) :	10.59	0.00	0.00
Computed Flow Time (min) :	0.04	0.00	0.00
Total TOC (min)	9.81		

Subbasin Runoff Results

Total Rainfall (in) 11.98
Total Runoff (in) 8.87
Peak Runoff (cfs) 6.68
Weighted Curve Number 75.91
Time of Concentration (days hh:mm:ss) 0 00:09:49

Subbasin : {WTSH}.G

Rainfall Intensity Graph



Runoff Hydrograph

