APPENDIX O
PENFIELD AND SMITH DRAINAGE REPORT (JULY 2008)

Preliminary Hydrology Report

For

Residence Inn

6300 Hollister Ave

City of Goleta, California

JULY 23, 2008

CLIENT: R. D. Olson Development

PREPARED BY: Penfield & Smith
111 East Victoria Street
Santa Barbara, California 93101
(805) 963-9532

WORK ORDER NO.: 17636.03

PROJECT MANAGER: Donald E. Donaldson, P.E.
DESIGN ENGINEER: Robert Schmidt, P.E.

PURPOSE OF REPORT

The purpose of this report is 1.) To document the methods and assumptions used in preparing the hydrology study, and 2.) Outline the approach to dealing with storm water quality issues for the Residence Inn proposed hotel.

LOCATION

The Residence Inn project, address 6300 Hollister Ave is located at the corner of Hollister Ave and Robin Hill Road in the City of Goleta, California. It is referenced as APN 073-050-020. See Figure A.

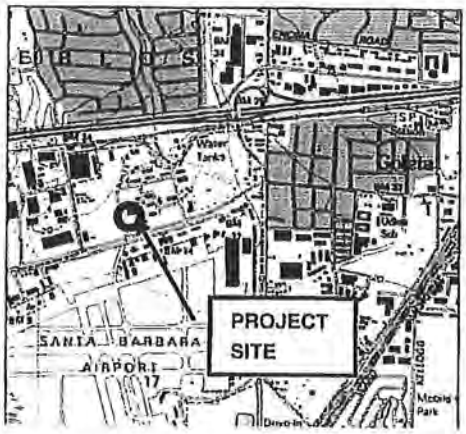


FIGURE A

BACKGROUND

The site is currently partially developed with parking lot surfaces. The other portion is undeveloped. The undeveloped terrain is flat and covered with grass and shrubs. The site does receive runoff water from offsite. Currently the drainage water drains to two existing channels. One is a concrete channel on the westside of Robin Hill Road and the other is a natural channel on the southside of Hollister Ave.

The proposed development on the new westerly parcel (Parcel 2) consists of a hotel building and parking areas for commercial use. The existing development on the new easterly parcel (Parcel 1) consists of a commercial building and parking areas that will remain.

HYDROLOGY STUDY METHOD OF ANALYSIS

The site was reviewed and checked (by sight only) against the available topographic mapping. The watersheds were found using survey topography. The watershed boundary map is attached.

A hydrologic analysis was performed for both the existing condition development and the proposed condition development. The hydrologic analysis was prepared using HydroCAD and the Santa Barbara County Flood Control guidelines. Pre-project and post-project site watershed maps are attached.

HYDROLOGY STUDY FINDINGS

Existing Conditons: (12.24 Acres) There are 3 existing storm drains outlets with 6 existing drainage areas. The drainage runoff mainly sheet flows over paved areas with 3 of the areas containing grassy undeveloped areas. All runoff ultimately drains into the storm drain systems. Two of the outlets (See outlet A and B on Sheet 1, Existing Condition Hydrology Map) are located on the west side of the site, and drain to a concrete channel on the west side of Robin Hill Road. The concrete channel ultimately drains to a natural channel on the south side of Hollister Avenue. The other outlet (See outlet C on Sheet 1, Existing Condition Hydrology Map) is located on the south side of the site, and drains to the south to a natural channel on the south side of Hollister Avenue.

Proposed Conditions: (12.24 Acres) The proposed site is broken up into 18 proposed drainage areas. The drainage runoff mainly sheet flows over paved areas with a few of the areas containing landscaping. All runoff ultimately drains into the storm drain systems. The existing southern portion of Parcel 1 keeps the original drainage path and drains to Outlet C which in turn drains across Hollister Avenue to the natural channel on the south side. The existing northern portion drains by storm drain through the proposed site and outlets through Outlet B to the channel on the west side of Robin Hill Road. The southern portion of the proposed site drains to a detention basin to reduce flows of a 5, 10 and 25 year storm to be less than existing conditions. This basin is located on the southwest corner of the site, just before outlet A. The remaining proposed drainage areas on the north side of the proposed project drain to Outlet B which drains to the channel on the west site of Robin Hill Road.

EXISTING CONDITIONS				
DRAINAGE AREA #	AREA (ACRES)	Q_5 FLOW (cfs)	Q10 FLOW (cfs)	Q_{25} FLOW (cfs)
1	5.52	11.95	14.59	17.82
2	0.24	0.44	0.58	0.77
3	1.82	3.64	4.80	6.25
4	4.18	10.50	12.93	15.92
5	0.30	0.48	0.65	0.85
6	0.18	0.60	0.72	0.87
TOTAL	**12.24**	**27.61**	**34.27**	**42.48**

PROPOSED CONDITIONS WITHOUT DETENTION				
DRAINAGE AREA #	AREA (ACRES)	Q_5 FLOW (cfs)	Q10 FLOW (cfs)	Q_{25} FLOW (cfs)
1	4.34	9.96	12.16	14.86
2	0.47	1.41	1.71	2.09
3	0.07	0.23	0.28	0.34
4	0.23	0.68	0.83	1.01
5	0.24	0.37	0.46	0.57
6	0.11	0.33	0.4	0.49
7	0.66	2.04	2.49	3.04
8	0.34	0.93	1.16	1.45
9	0.17	0.44	0.55	0.69
10	0.32	0.75	0.98	1.26
11	3.33	7.96	9.86	12.19
12	0.32	1.03	1.25	1.53
13	0.53	1.41	1.77	2.22
14	0.14	0.42	0.51	0.62
15	0.04	0.08	0.11	0.14
16	0.45	1.16	1.4	1.69
17	0.21	0.55	0.69	0.87
18	0.27	0.81	1.02	1.27
TOTAL	**12.24**	**30.56**	**37.63**	**46.33**

PROPOSD CONDITIONS WITH DETENTION				
DRAINAGE AREA #	AREA (ACRES)	Q_5 FLOW (cfs)	Q10 FLOW (cfs)	Q_{25} FLOW (cfs)
7,8,9,10,12,13,16,17,18(Outlet A)	3.27	5.61	6.41	7.29
1,2,3,4,5,6,14,15 (Outlet B)	5.64	13.48	16.46	20.12
11 (Outlet C)	3.33	7.96	9.86	12.19
TOTAL	**12.24**	**27.05**	**32.73**	**39.60**

TABLE 1

HYDROLOGY STUDY CONCLUSION

Based on the findings presented in this report, 5-year, 10-year, and 25-year event existing condition development peak flows leaving the site are 27.61 cfs, 34.27 cfs, and 42.48 cfs respectfully. Proposed condition development peak flows, with detention onsite, leaving the site are 27.05 cfs, 32.73 cfs, and 39.98 cfs respectfully.

Therefore the overall proposed condition will be discharging less drainage flow than existing into the natural drainage channel on the south side of Hollister Avenue.

STORM WATER QUALITY METHOD OF ANALYSIS

The storm water quality design applies the formulas and approaches provided in the City of Goleta Storm Water Management Plan – Appendix G.

Areas of analysis: 1. Volume Retention for a 1.2" rainstorm event.

2. Percentage Effective Imperviousness at Pre- and Post-development conditions.

STORM WATER QUALITY FINDINGS

A review of the proposed development improvements was accomplished with respect to storm water quality. It was found that the proposed improvements did include "open air" parking facilities. As a result, a portion of the proposed parking areas and drive aisles are to be drained to bio-swales and detention basins before entering the storm drain system. Additionally, the proposed detention basin will be planted and also serve as a bio-swale for the majority of the proposed property. The following is a brief summary of the results.

Post Volume Retention:

Per the City of Goleta Storm Water Management Plan storm water quality treatment facilities is equal to the runoff volume that would occur from the contributing area from a 1.2 inch rainstorm event.

WQDV = (.05 + 0.9 XIMP) x 1.2" x A x 3630

WQDV = water quality design volume (cubic feet)
IMP= total impervious area, expressed as a percentage
A = tributary area (acres)
3630 = factor to convert units from acre-inch to cubic feet

WQDV for this project equals 14,400 cf.

Total retention volume (detention basins, bioswales, and storm drain pipes) equals 12,650 c.f.
The project site retains 87.8% of a 1.2" rainstorm event.

Impervious Areas:

In looking at impervious areas for the site first the site is being looked at in 2 parts, Parcel 1 and Parcel 2 (see attachment for location). Parcel 1 is the eastern side of the site that has an existing building and parking on it with nothing new to be developed on this portion. Parcel 2 is the proposed development. The existing conditions of this parcel are open space and parking areas.

The analysis of imperviousness is on percentage of effective impervious areas. (Definition of effective impervious area is the impervious area that collects and drains the water directly to a stream or wetland system via pipes or sheet flow.) The results are as follows:

Existing Conditions	
Area	% Effective Impervious
Parcel 1	92%
Parcel 2	59%

Proposed Conditions	
Area	% Effective Impervious
Parcel 1	92% *
Parcel 2	30%

*no new development

STORM WATER QUALITY CONCLUSION

Based on the findings presented in this report, the site will be retaining 87% of a 1.2" rainstorm event onsite in the use of detention basins, mirco-detention basins, bioswales, and storm drain lines. With impervious areas draining to bioswales and landscaped areas the effective imperviousness of the proposed site will be reduced by 29% from pre-development conditions to post-development conditions.

Overall water will be treated for contaminants using vegetated swales for a portion of the site. Where site constraints exist and water cannot be drained to vegetated swales then filters will be added to the appropriate storm drain catch basins.

CALCULATIONS AND ATTACHMENTS

SOIL SURVEY OF

Santa Barbara County, California South Coastal Part

United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
University of California Agricultural Experiment Station

(Joins sheet 6)
25'

GUIDE TO MAPPING UNITS-CONTINUED

Symbol	Mapping unit	Page	Capability unit Irrigated	Capability unit Dryland	Vegetative soil group	Range site	Avocado root rot hazard
			Symbol	Symbol	Letter	Name	Rating
MdD	Milpitas stony fine sandy loam, 9 to 15 percent slopes	38	IVs-3(19)	IVs-3(15)	D	Claypan	Severe
MdE	Milpitas stony fine sandy loam, 15 to 30 percent slopes	38	VIe-1(19)	VIe-1(15)	D	Claypan	Severe
MdF	Milpitas stony fine sandy loam, 30 to 50 percent slopes	38	VIIe-1(19)	VIIe-1(15)	D	Claypan	Severe
MeC	Milpitas-Positas fine sandy loams, 2 to 9 percent slopes2/	38	IIIe-3(19)	IIIe-3(15)	D	Claypan	Severe
MeD2	Milpitas-Positas fine sandy loams, 9 to 15 percent slopes, eroded2/	38	IVe-3(19)	IVe-3(15)	D	Claypan	Severe
MeE2	Milpitas-Positas fine sandy loams, 15 to 30 percent slopes, eroded2/	39	VIe-1(19)	VIe-1(15)	D	Claypan	Severe
MeF2	Milpitas-Positas fine sandy loams, 30 to 50 percent slopes, eroded2/	39	VIIe-1(19)	VIIe-1(15)	D	Claypan	Severe
MgF2	Montara stony clay, 15 to 50 percent slopes, eroded	40	----------	VIIs-1(15)	J	Shallow Loamy	Severe
NaE2	Nacimiento silty clay loam, 30 to 50 percent slopes, eroded	41	VIe-1(19)	VIe-1(15)	A	Clayey	Severe
NbG	Nacimiento complex, landslide, 30 to 75 percent slopes	41	----------	VIIe-1(15)	-	Clayey	Severe
	Nacimiento part	--	----------	----------	A	------	------
	Landslide part	--	----------	----------	J	------	------
OAG	Orthents, 50 to 75 percent slopes	41	VIIe-1(19)	VIIe-1(15)	J	-------	Variable
P	Pits and dumps	41	Onsite investigation is needed				
R	Riverwash	43	VIIw-1(19)	VIIw-1(20)	J	-------	Slight
RbG	Rock outcrop-Maymen complex, 75 to 100 percent slopes	43	----------	VIIIs-1(15, 20)	-	-------	Severe
SaE2	San Andreas-Tierra complex, 9 to 15 percent slopes, eroded	44	IVe-1(19)	IVe-1(15)	-	-------	Severe
	San Andreas part	--	----------	----------	G	Loamy	------
	Tierra part	--	----------	----------	D	Claypan	------
SeE2	San Andreas-Tierra complex, 15 to 30 percent slopes, eroded	44	VIe-1(19)	VIe-1(15)	-	-------	Severe
	San Andreas part	--	----------	----------	G	Loamy	------
	Tierra part	--	----------	----------	D	Claypan	------
SaF2	San Andreas-Tierra complex, 30 to 50 percent slopes, eroded	44	VIIe-1(19)	VIIe-1(15)	-	-------	Severe
	San Andreas part	--	----------	----------	G	Loamy	------
	Tierra part	--	----------	----------	D	Claypan	------
SB	Sanitary landfill areas	45	Onsite investigation is needed				
ShD2	Santa Lucia shaly clay loam, 9 to 15 percent slopes, eroded	45	IIIe-1(19)	IIIe-1(15)	G	Loamy	Severe
ShE2	Santa Lucia shaly clay loam, 15 to 30 percent slopes, eroded	45	IVe-1(19)	IVe-1(15)	G	Loamy	Severe
ShF2	Santa Lucia shaly clay loam, 30 to 50 percent slopes, eroded	45	VIe-1(19)	VIe-1(15)	G	Loamy	Severe
ShG	Santa Lucia shaly loam, 50 to 75 percent slopes	46	VIIe-1(19)	VIIe-1(15)	G	Loamy	Severe
TaE2	Tierra-San Andreas complex, 15 to 30 percent slopes, severely eroded	48	----------	VIIe-1(15)	-	-------	Severe
	Tierra part	--	----------	----------	D	Claypan	------
	San Andreas part	--	----------	----------	G	Loamy	------

WATER QUALITY DESIGN VOLUME

(SEE APPENDIX G - CITY OF GOLETA STORM WATER MANAGEMENT PLAN)

$$WQDV = (0.05 + 0.9 \times IMP) \times 1.2'' \times A \times 3630$$

WQDV = WATER QUALITY DESIGN VOLUME (CUBIC FT)
IMP = TOTAL IMPERVIOUS AREA, EXPRESSED AS A PERCENTAGE
A = TRIBUTARY AREAS (ACRES)
3630 = FACTOR TO CONVERT UNITS FROM ACRE-INCH TO CUBIC-FEET

IMP = 0.75 (PARCEL 2 ONLY) (AREA 1+11 NOT INCLUDED (PARCEL 1))
A = 4.56 ACRES (DEVELOPED AREAS)

$$WQDV = (0.05 + 0.9 \times 0.75) \times 1.2'' \times 4.56\,AC \times 3630$$

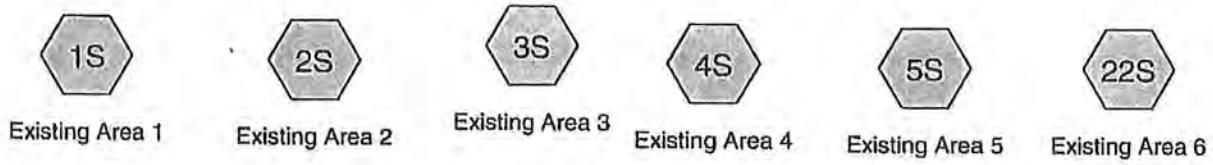
$$= 14400\,ft^3$$

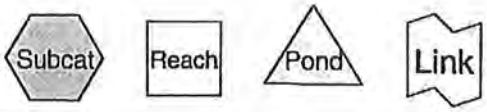
TOTAL PROPOSED SITE RETENTION VOLUME (INCLUDING BIOSWALES, DETENTION BASIN, MICRO-DETENTION BASIN AND STORM DRAIN ~~WORKS~~ PIPES)

$$V = 12{,}600\,ft^3$$

% SITE VOLUME CAN HOLD OF 1.2" STORM

$$\frac{12600}{14400} = 87.5\%$$





Drainage Diagram for Residence1
Prepared by Penfield & Smith 7/24/2008

Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
2.810	80	>75% Grass cover, Good, HSG D (2S,3S,4S,5S)
9.030	95	Urban commercial, 85% imp, HSG D (1S,4S)
0.400	98	Paved roads w/curbs & sewers (3S,22S)
12.240		

Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SBUH method
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Area 1 Runoff Area=5.520 ac Runoff Depth=4.03"
Flow Length=780' Tc=11.3 min CN=95 Runoff=11.95 cfs 1.855 af

Subcatchment 2S: Existing Area 2 Runoff Area=0.240 ac Runoff Depth=2.56"
Flow Length=140' Slope=0.0037 '/' Tc=3.8 min CN=80 Runoff=0.44 cfs 0.051 af

Subcatchment 3S: Existing Area 3 Runoff Area=1.820 ac Runoff Depth=2.73"
Flow Length=300' Slope=0.0086 '/' Tc=3.3 min CN=82 Runoff=3.64 cfs 0.414 af

Subcatchment 4S: Existing Area 4 Runoff Area=4.180 ac Runoff Depth=3.82"
Flow Length=565' Slope=0.0061 '/' Tc=5.9 min CN=93 Runoff=10.50 cfs 1.329 af

Subcatchment 5S: Existing Area 5 Runoff Area=0.300 ac Runoff Depth=2.56"
Flow Length=100' Slope=0.0006 '/' Tc=6.8 min CN=80 Runoff=0.48 cfs 0.064 af

Subcatchment 22S: Existing Area 6 Runoff Area=0.180 ac Runoff Depth=4.37"
Flow Length=78' Slope=0.0100 '/' Tc=0.6 min CN=98 Runoff=0.60 cfs 0.066 af

Total Runoff Area = 12.240 ac Runoff Volume = 3.780 af Average Runoff Depth = 3.71"
34.02% Pervious Area = 4.164 ac 65.98% Impervious Area = 8.076 ac

Subcatchment 1S: Existing Area 1

[49] Hint: Tc<2dt may require smaller dt

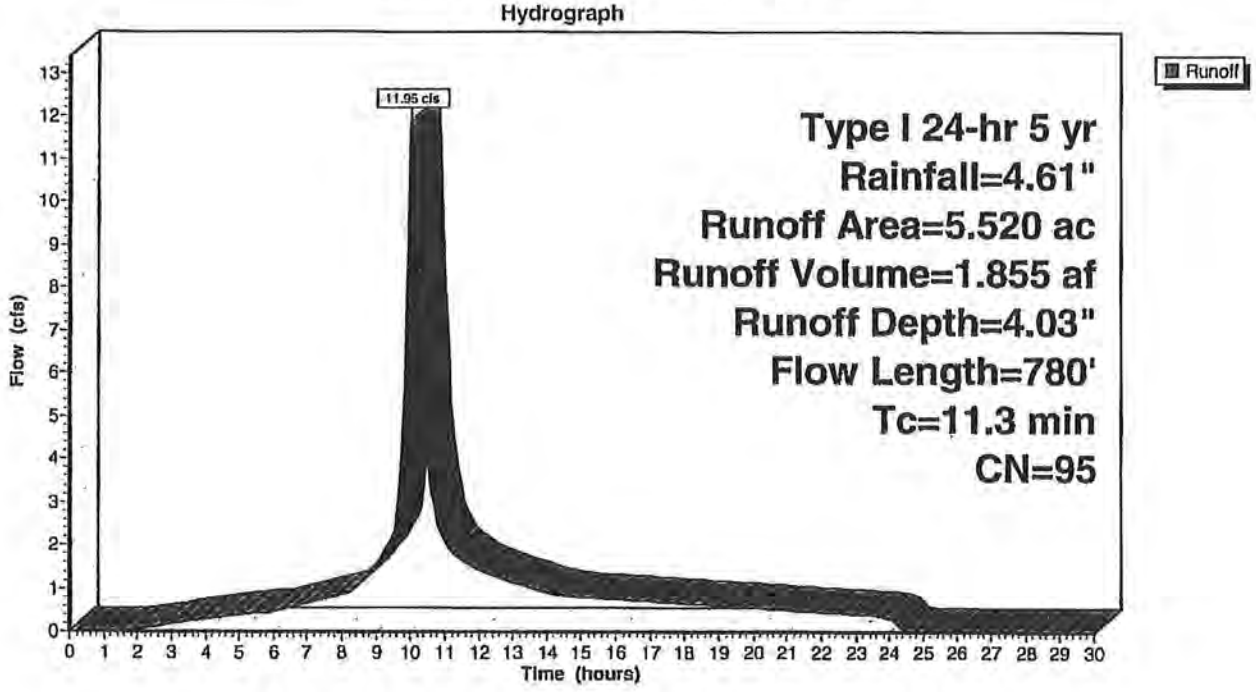
Runoff = 11.95 cfs @ 10.02 hrs, Volume= 1.855 af, Depth= 4.03"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
5.520	95	Urban commercial, 85% imp, HSG D
0.828		Pervious Area
4.692		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	290	0.0128	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
5.2	490	0.0060	1.57		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.3	780	Total			

Subcatchment 1S: Existing Area 1



Subcatchment 2S: Existing Area 2

[49] Hint: Tc<2dt may require smaller dt

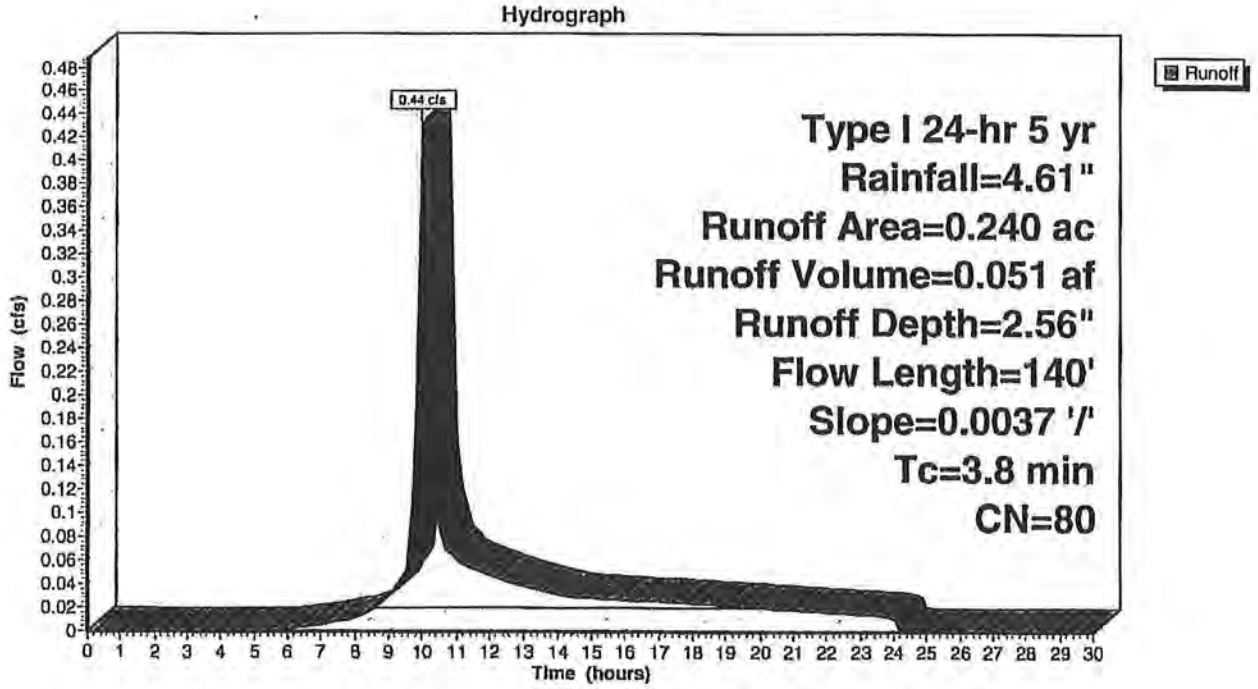
Runoff = 0.44 cfs @ 9.98 hrs, Volume= 0.051 af, Depth= 2.56"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.240	80	>75% Grass cover, Good, HSG D
0.240		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	140	0.0037	0.61		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps

Subcatchment 2S: Existing Area 2



Subcatchment 3S: Existing Area 3

[49] Hint: Tc<2dt may require smaller dt

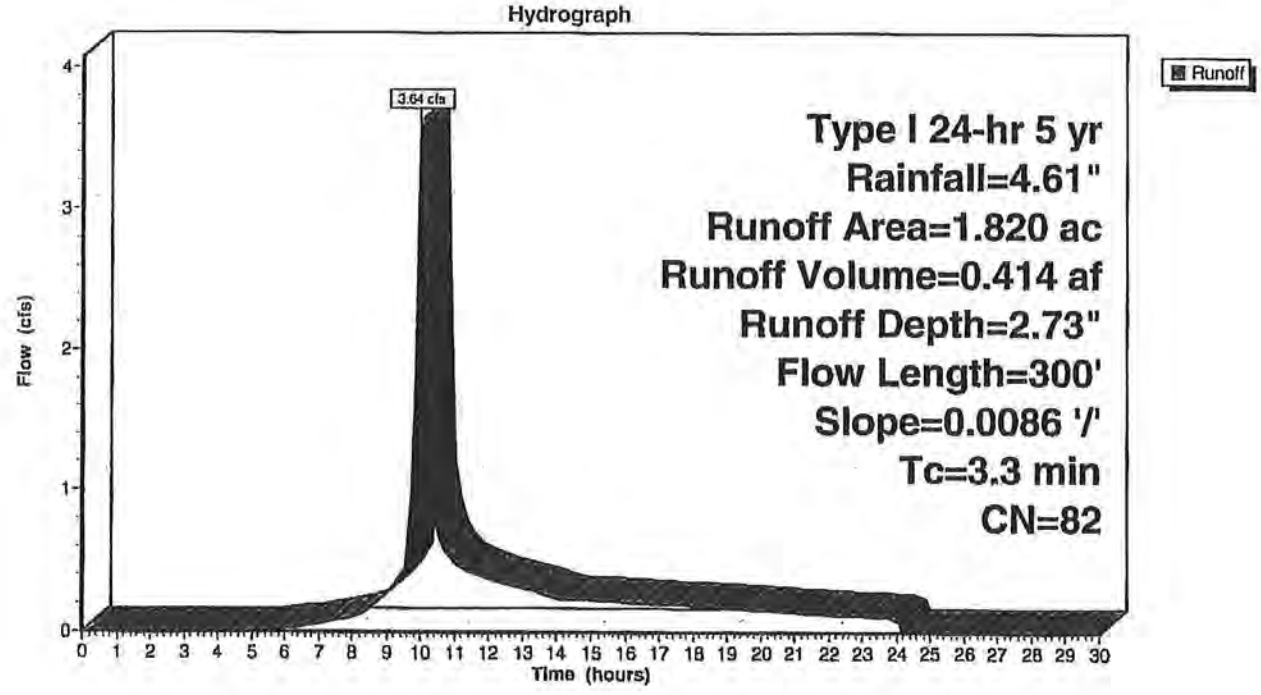
Runoff = 3.64 cfs @ 9.98 hrs, Volume= 0.414 af, Depth= 2.73"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
1.600	80	>75% Grass cover, Good, HSG D
0.220	98	Paved roads w/curbs & sewers
1.820	82	Weighted Average
1.600		Pervious Area
0.220		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	300	0.0086	1.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps

Subcatchment 3S: Existing Area 3



Subcatchment 4S: Existing Area 4

[49] Hint: Tc<2dt may require smaller dt

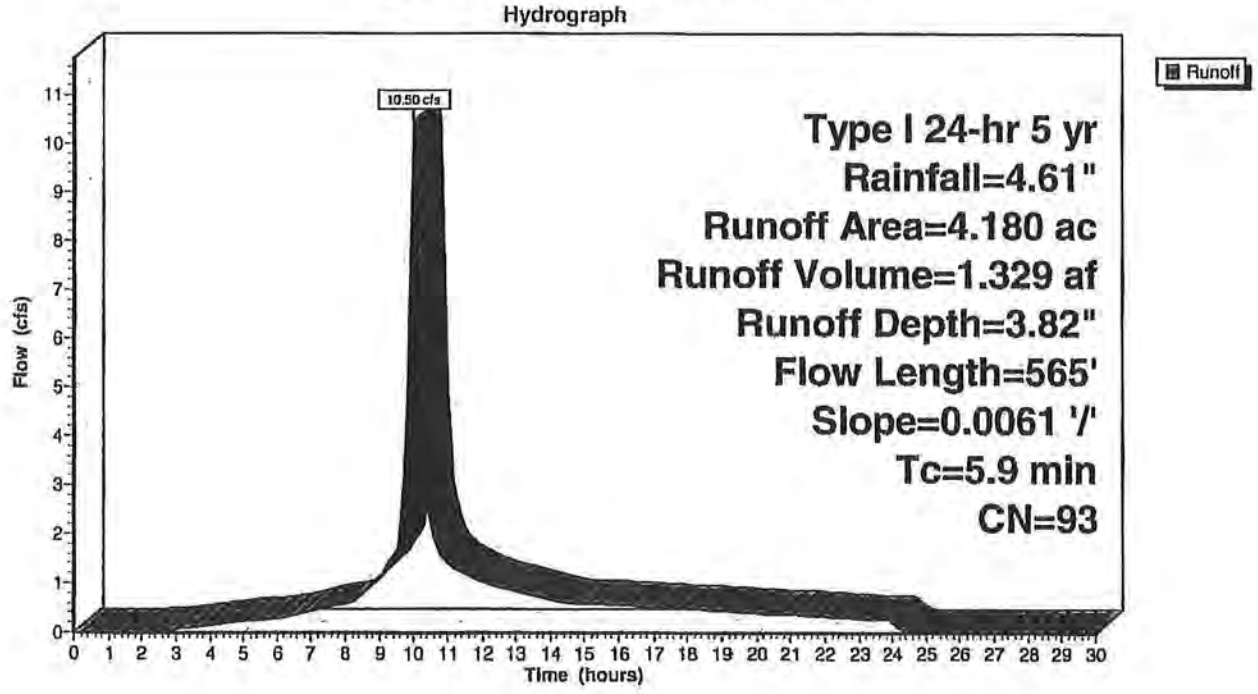
Runoff = 10.50 cfs @ 9.99 hrs, Volume= 1.329 af, Depth= 3.82"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
3.510	95	Urban commercial, 85% imp, HSG D
0.670	80	>75% Grass cover, Good, HSG D
4.180	93	Weighted Average
1.197		Pervious Area
2.984		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	565	0.0061	1.59		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 4S: Existing Area 4



Subcatchment 5S: Existing Area 5

[49] Hint: Tc<2dt may require smaller dt

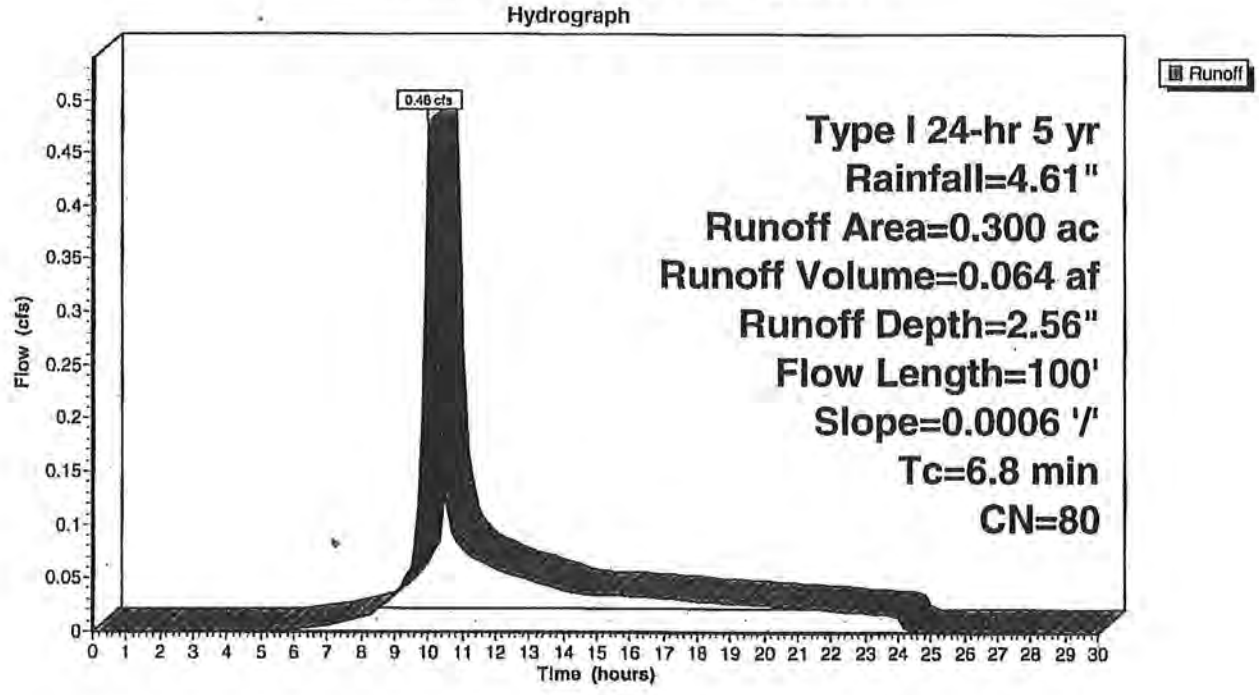
Runoff = 0.48 cfs @ 10.00 hrs, Volume= 0.064 af, Depth= 2.56"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.300	80	>75% Grass cover, Good, HSG D
0.300		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0006	0.24		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps

Subcatchment 5S: Existing Area 5



Subcatchment 22S: Existing Area 6

[49] Hint: Tc<2dt may require smaller dt

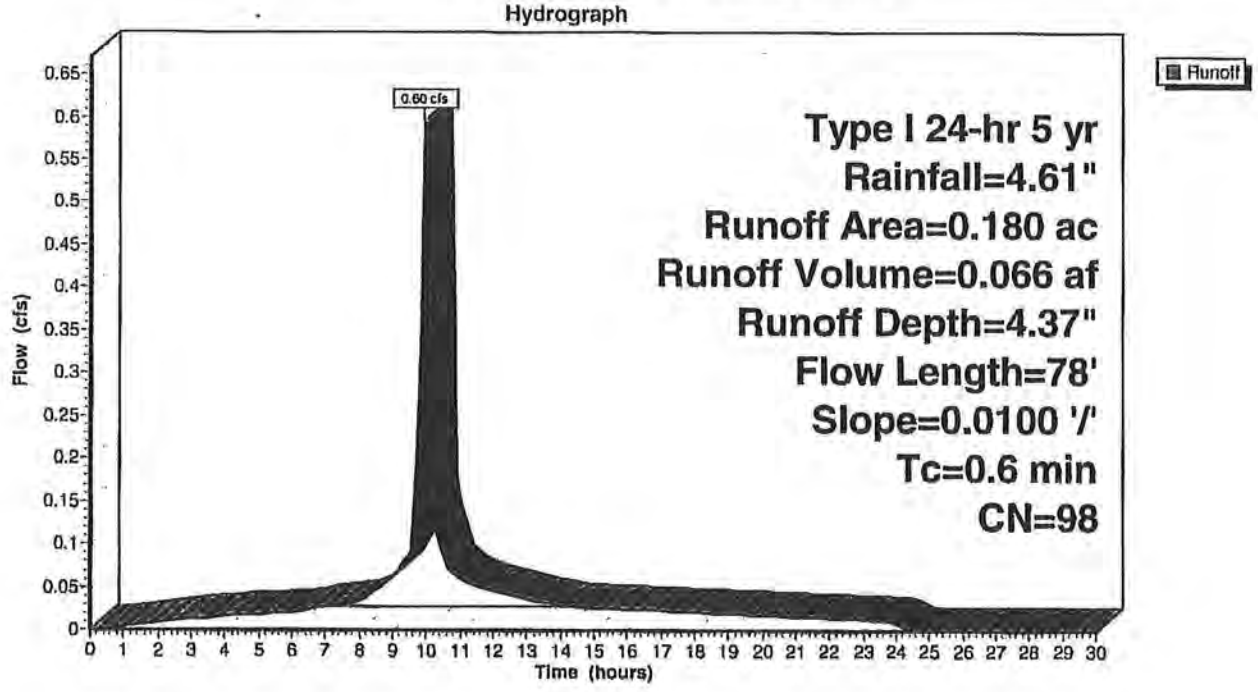
Runoff = 0.60 cfs @ 9.92 hrs, Volume= 0.066 af, Depth= 4.37"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.180	98	Paved roads w/curbs & sewers
0.180		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	78	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 22S: Existing Area 6



Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SBUH method
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Area 1 Runoff Area=5.520 ac Runoff Depth=4.96"
Flow Length=780' Tc=11.3 min CN=95 Runoff=14.59 cfs 2.284 af

Subcatchment 2S: Existing Area 2 Runoff Area=0.240 ac Runoff Depth=3.38"
Flow Length=140' Slope=0.0037 '/' Tc=3.8 min CN=80 Runoff=0.58 cfs 0.068 af

Subcatchment 3S: Existing Area 3 Runoff Area=1.820 ac Runoff Depth=3.58"
Flow Length=300' Slope=0.0086 '/' Tc=3.3 min CN=82 Runoff=4.80 cfs 0.542 af

Subcatchment 4S: Existing Area 4 Runoff Area=4.180 ac Runoff Depth=4.74"
Flow Length=565' Slope=0.0061 '/' Tc=5.9 min CN=93 Runoff=12.93 cfs 1.651 af

Subcatchment 5S: Existing Area 5 Runoff Area=0.300 ac Runoff Depth=3.38"
Flow Length=100' Slope=0.0006 '/' Tc=6.8 min CN=80 Runoff=0.65 cfs 0.084 af

Subcatchment 22S: Existing Area 6 Runoff Area=0.180 ac Runoff Depth=5.31"
Flow Length=78' Slope=0.0100 '/' Tc=0.6 min CN=98 Runoff=0.72 cfs 0.080 af

Total Runoff Area = 12.240 ac Runoff Volume = 4.708 af Average Runoff Depth = 4.62"
34.02% Pervious Area = 4.164 ac 65.98% Impervious Area = 8.076 ac

Subcatchment 1S: Existing Area 1

[49] Hint: Tc<2dt may require smaller dt

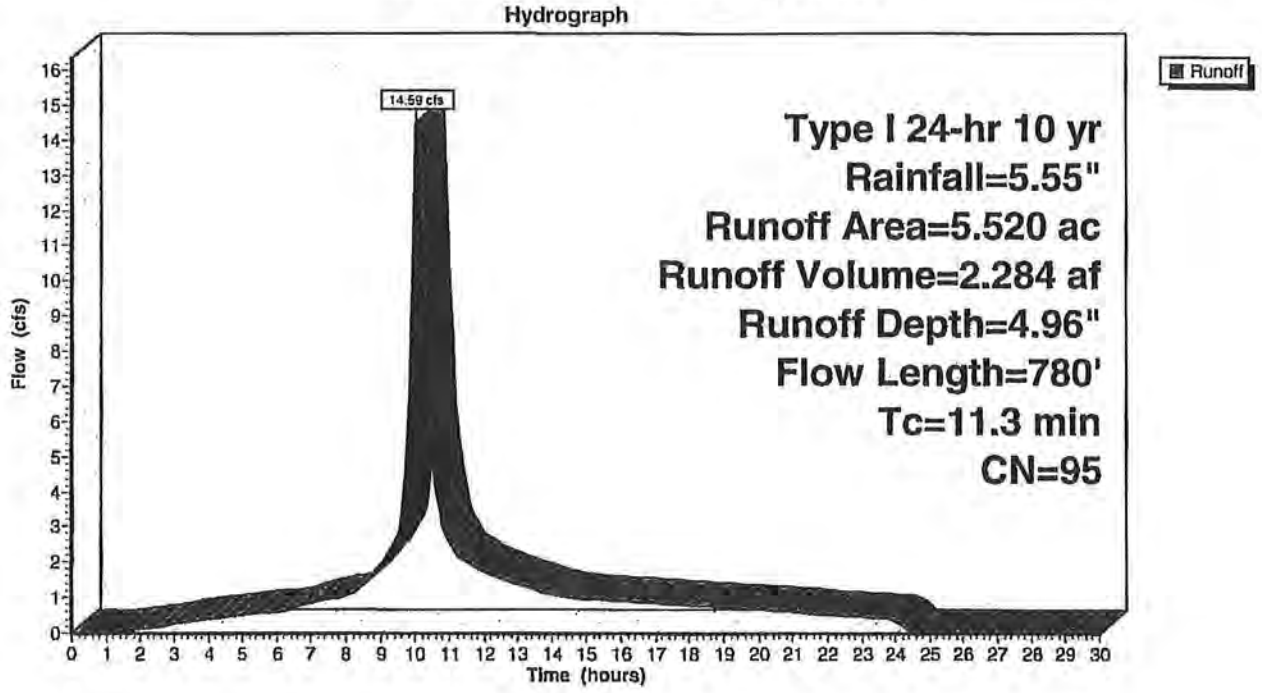
Runoff = 14.59 cfs @ 10.01 hrs, Volume= 2.284 af, Depth= 4.96"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
5.520	95	Urban commercial, 85% imp, HSG D
0.828		Pervious Area
4.692		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	290	0.0128	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
5.2	490	0.0060	1.57		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.3	780	Total			

Subcatchment 1S: Existing Area 1



Subcatchment 2S: Existing Area 2

[49] Hint: Tc<2dt may require smaller dt

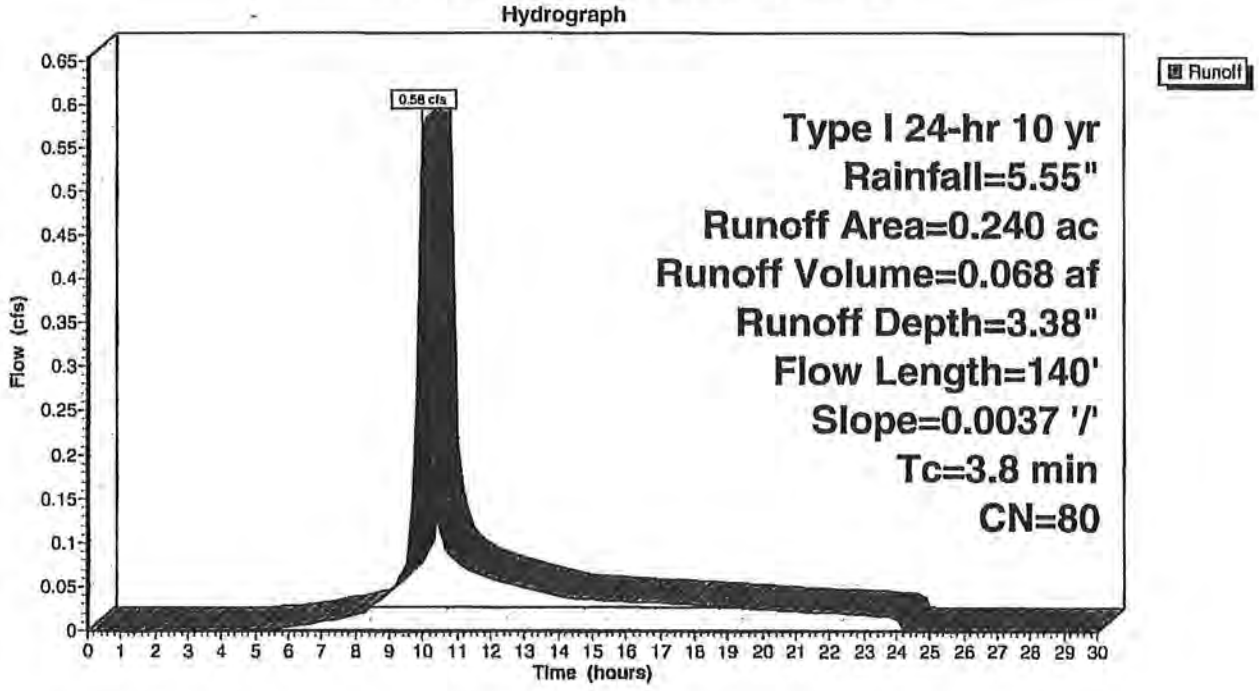
Runoff = 0.58 cfs @ 9.98 hrs, Volume= 0.068 af, Depth= 3.38"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.240	80	>75% Grass cover, Good, HSG D
0.240		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	140	0.0037	0.61		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps

Subcatchment 2S: Existing Area 2



Subcatchment 3S: Existing Area 3

[49] Hint: Tc<2dt may require smaller dt

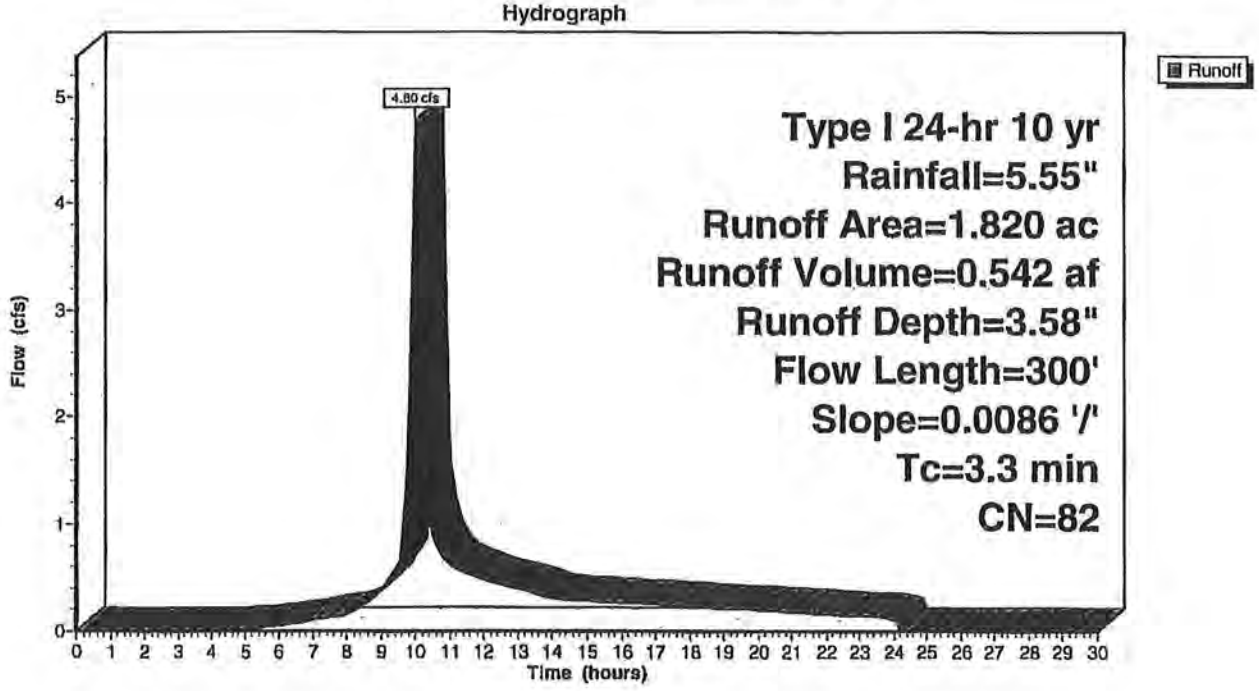
Runoff = 4.80 cfs @ 9.97 hrs, Volume= 0.542 af, Depth= 3.58"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
1.600	80	>75% Grass cover, Good, HSG D
0.220	98	Paved roads w/curbs & sewers
1.820	82	Weighted Average
1.600		Pervious Area
0.220		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	300	0.0086	1.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps

Subcatchment 3S: Existing Area 3



Subcatchment 4S: Existing Area 4

[49] Hint: Tc<2dt may require smaller dt

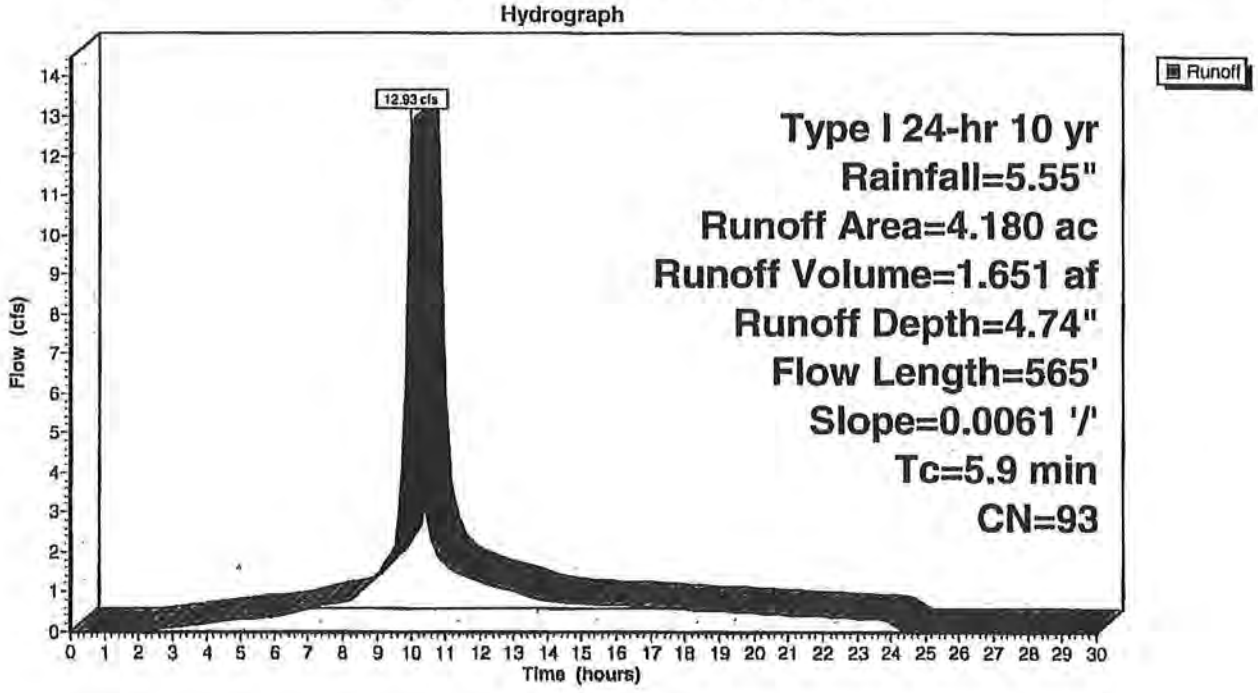
Runoff = 12.93 cfs @ 9.99 hrs, Volume= 1.651 af, Depth= 4.74"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
3.510	95	Urban commercial, 85% imp, HSG D
0.670	80	>75% Grass cover, Good, HSG D
4.180	93	Weighted Average
1.197		Pervious Area
2.984		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	565	0.0061	1.59		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 4S: Existing Area 4



Subcatchment 5S: Existing Area 5

[49] Hint: Tc<2dt may require smaller dt

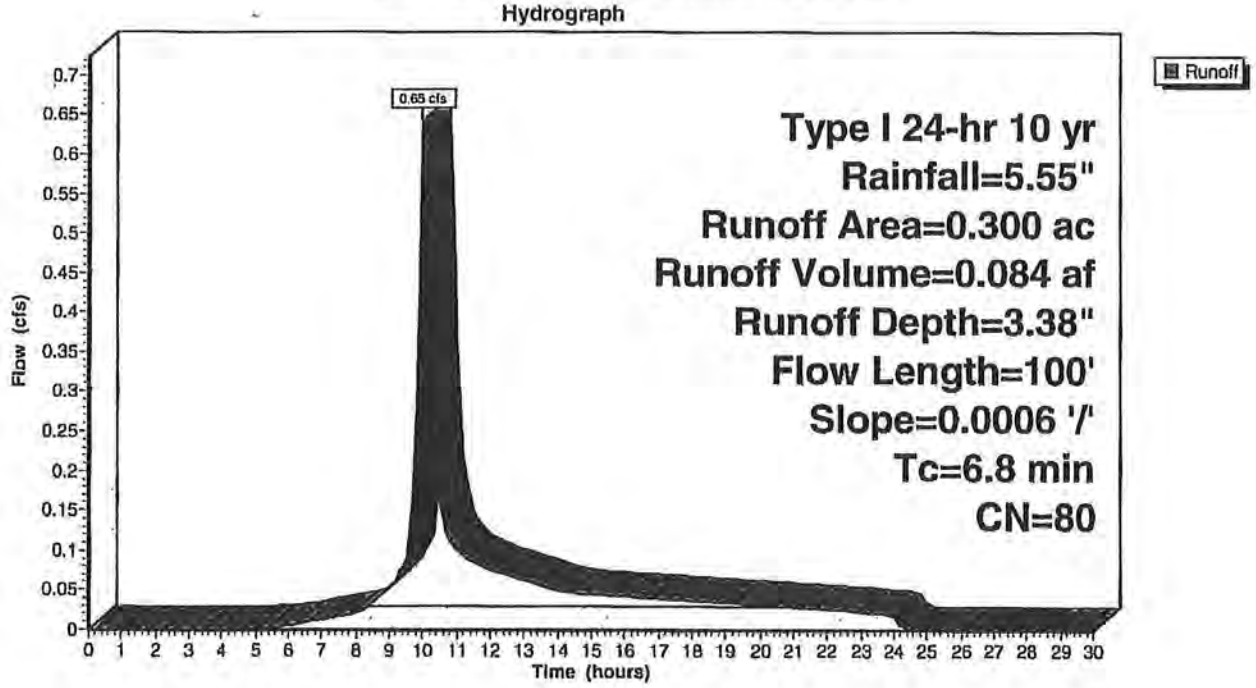
Runoff = 0.65 cfs @ 10.00 hrs, Volume= 0.084 af, Depth= 3.38"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.300	80	>75% Grass cover, Good, HSG D
0.300		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0006	0.24		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps

Subcatchment 5S: Existing Area 5



Subcatchment 22S: Existing Area 6

[49] Hint: Tc<2dt may require smaller dt

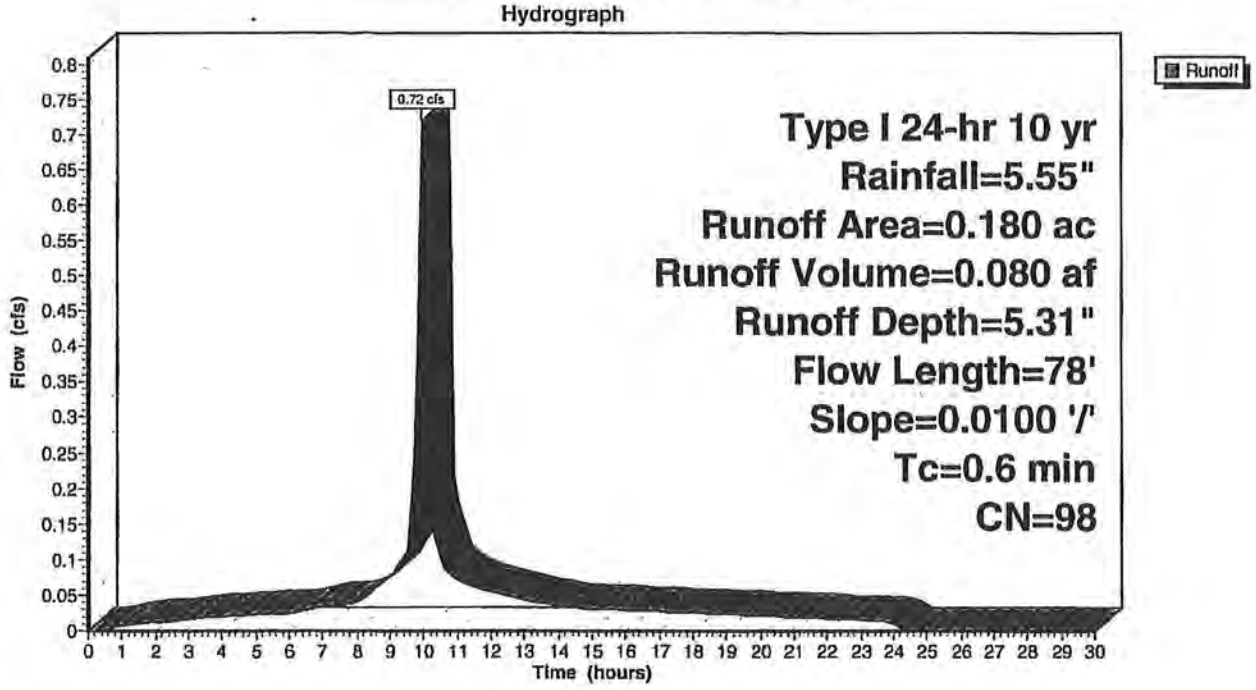
Runoff = 0.72 cfs @ 9.92 hrs, Volume= 0.080 af, Depth= 5.31"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.180	98	Paved roads w/curbs & sewers
0.180		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	78	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 22S: Existing Area 6



Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SBUH method
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Area 1 Runoff Area=5.520 ac Runoff Depth=6.12"
Flow Length=780' Tc=11.3 min CN=95 Runoff=17.82 cfs 2.814 af

Subcatchment 2S: Existing Area 2 Runoff Area=0.240 ac Runoff Depth=4.43"
Flow Length=140' Slope=0.0037 '/' Tc=3.8 min CN=80 Runoff=0.77 cfs 0.089 af

Subcatchment 3S: Existing Area 3 Runoff Area=1.820 ac Runoff Depth=4.65"
Flow Length=300' Slope=0.0086 '/' Tc=3.3 min CN=82 Runoff=6.25 cfs 0.704 af

Subcatchment 4S: Existing Area 4 Runoff Area=4.180 ac Runoff Depth=5.88"
Flow Length=565' Slope=0.0061 '/' Tc=5.9 min CN=93 Runoff=15.92 cfs 2.050 af

Subcatchment 5S: Existing Area 5 Runoff Area=0.300 ac Runoff Depth=4.43"
Flow Length=100' Slope=0.0006 '/' Tc=6.8 min CN=80 Runoff=0.85 cfs 0.111 af

Subcatchment 22S: Existing Area 6 Runoff Area=0.180 ac Runoff Depth=6.47"
Flow Length=78' Slope=0.0100 '/' Tc=0.6 min CN=98 Runoff=0.87 cfs 0.097 af

Total Runoff Area = 12.240 ac Runoff Volume = 5.864 af Average Runoff Depth = 5.75"
34.02% Pervious Area = 4.164 ac 65.98% Impervious Area = 8.076 ac

Subcatchment 1S: Existing Area 1

[49] Hint: Tc<2dt may require smaller dt

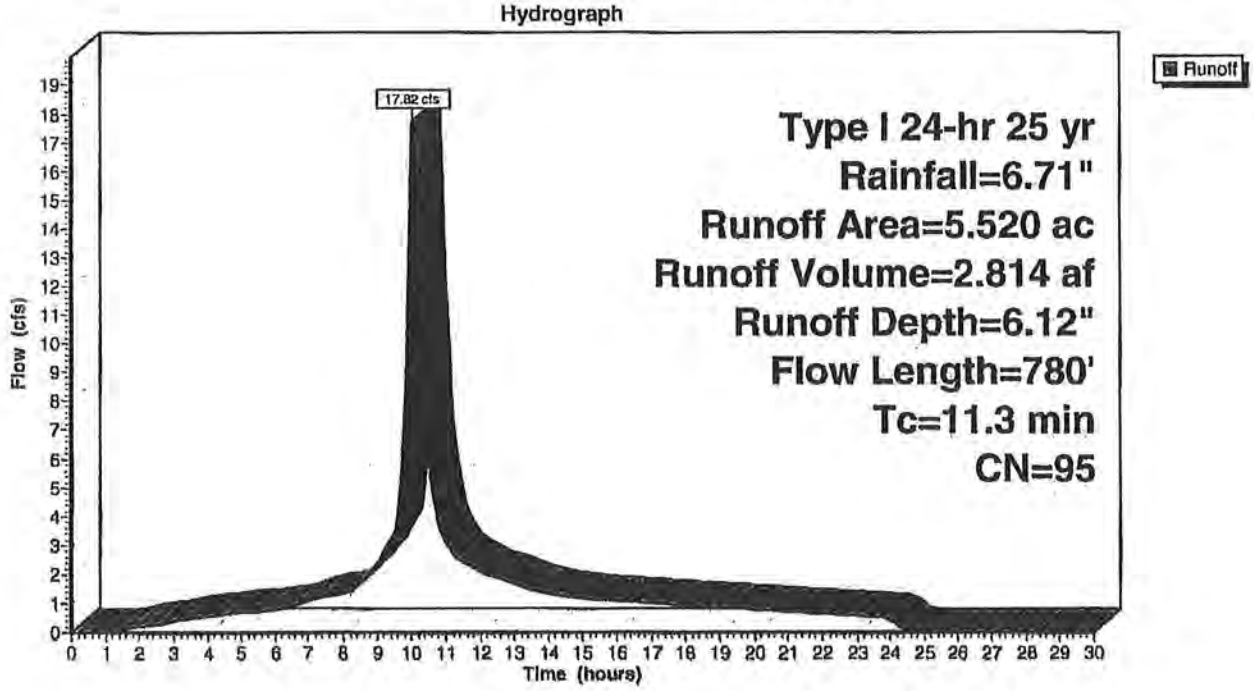
Runoff = 17.82 cfs @ 10.01 hrs, Volume= 2.814 af, Depth= 6.12"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
5.520	95	Urban commercial, 85% imp, HSG D
0.828		Pervious Area
4.692		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	290	0.0128	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
5.2	490	0.0060	1.57		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.3	780	Total			

Subcatchment 1S: Existing Area 1



Subcatchment 2S: Existing Area 2

[49] Hint: Tc<2dt may require smaller dt

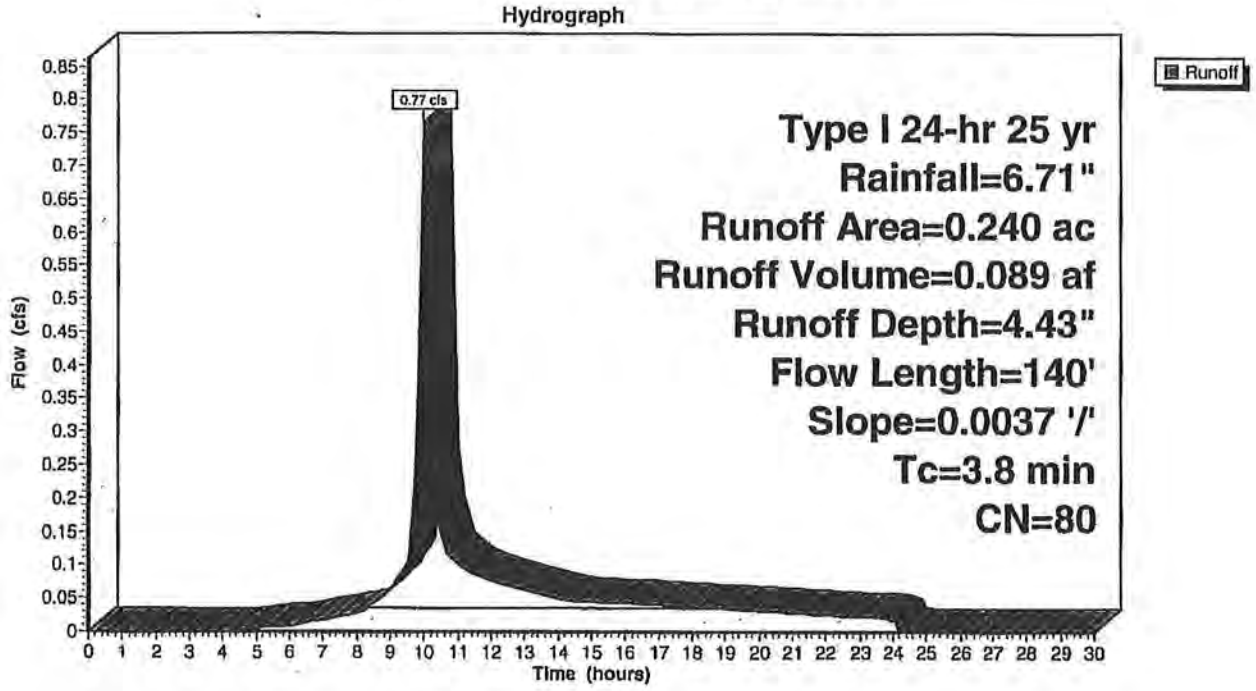
Runoff = 0.77 cfs @ 9.98 hrs, Volume= 0.089 af, Depth= 4.43"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.240	80	>75% Grass cover, Good, HSG D
0.240		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	140	0.0037	0.61		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps

Subcatchment 2S: Existing Area 2



Subcatchment 3S: Existing Area 3

[49] Hint: Tc<2dt may require smaller dt

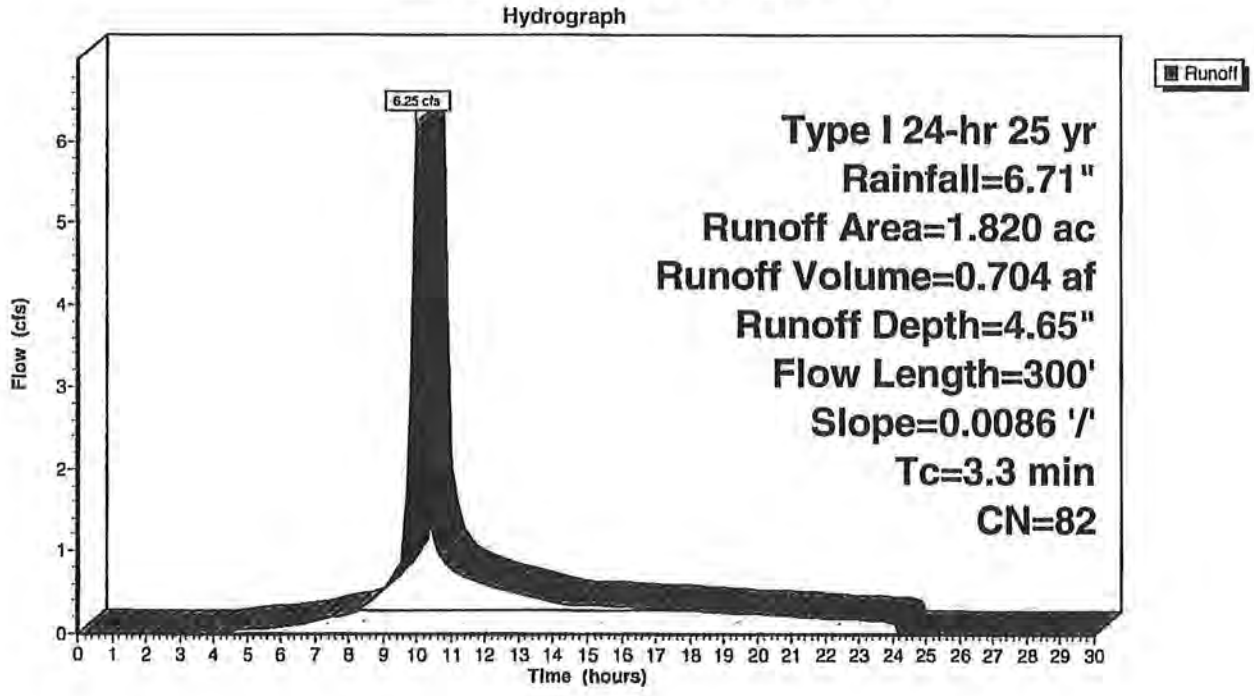
Runoff = 6.25 cfs @ 9.97 hrs, Volume= 0.704 af, Depth= 4.65"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
1.600	80	>75% Grass cover, Good, HSG D
0.220	98	Paved roads w/curbs & sewers
1.820	82	Weighted Average
1.600		Pervious Area
0.220		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	300	0.0086	1.49		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps

Subcatchment 3S: Existing Area 3



Subcatchment 4S: Existing Area 4

[49] Hint: Tc<2dt may require smaller dt

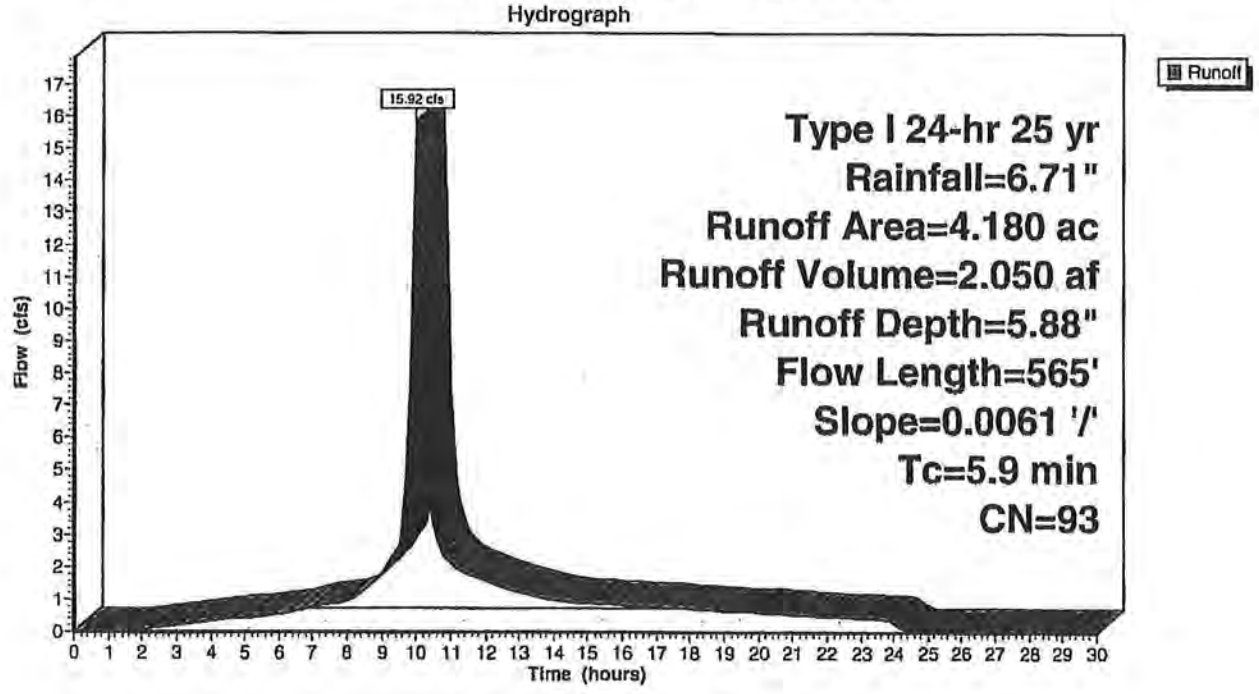
Runoff = 15.92 cfs @ 9.99 hrs, Volume= 2.050 af, Depth= 5.88"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
3.510	95	Urban commercial, 85% imp, HSG D
0.670	80	>75% Grass cover, Good, HSG D
4.180	93	Weighted Average
1.197		Pervious Area
2.984		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	565	0.0061	1.59		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 4S: Existing Area 4



Subcatchment 5S: Existing Area 5

[49] Hint: Tc<2dt may require smaller dt

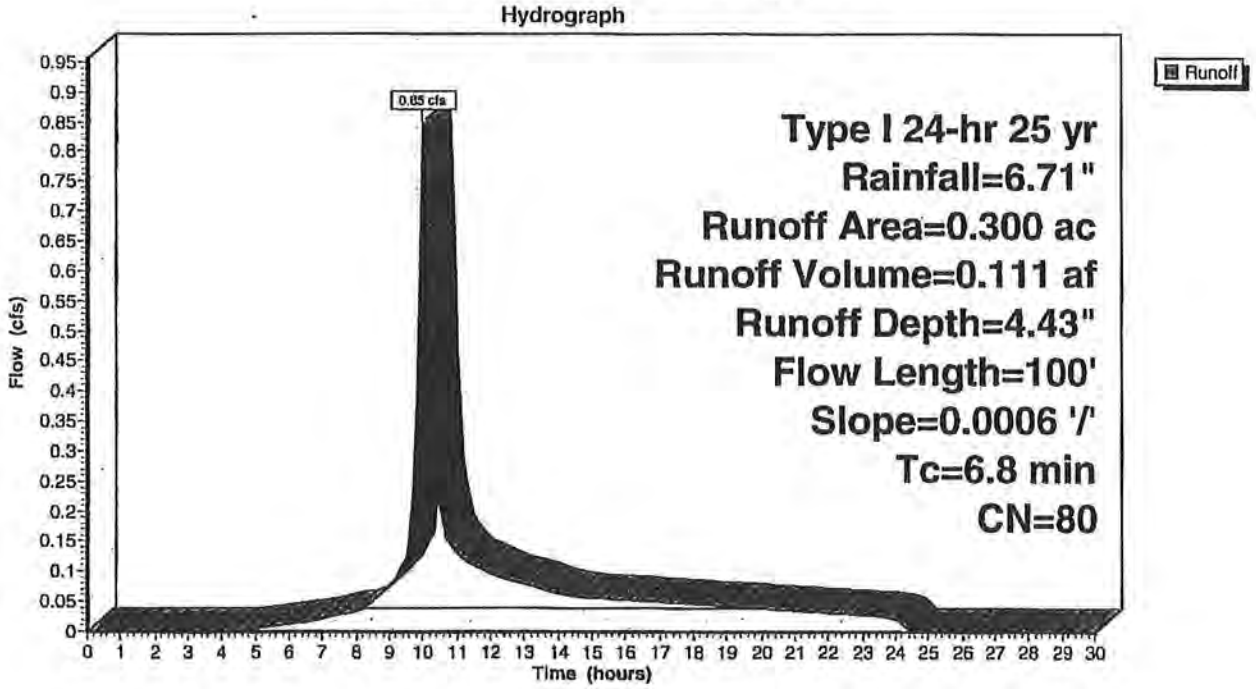
Runoff = 0.85 cfs @ 10.00 hrs, Volume= 0.111 af, Depth= 4.43"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.300	80	>75% Grass cover, Good, HSG D
0.300		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0006	0.24		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps

Subcatchment 5S: Existing Area 5



Subcatchment 22S: Existing Area 6

[49] Hint: Tc<2dt may require smaller dt

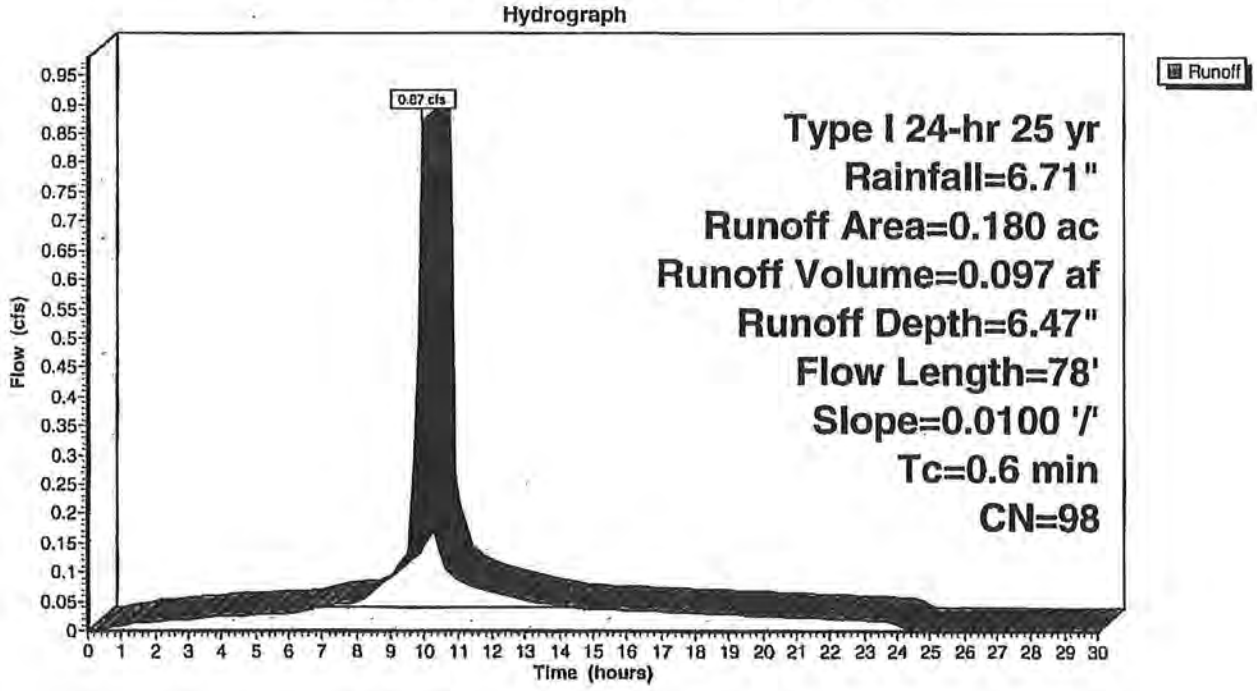
Runoff = 0.87 cfs @ 9.92 hrs, Volume= 0.097 af, Depth= 6.47"

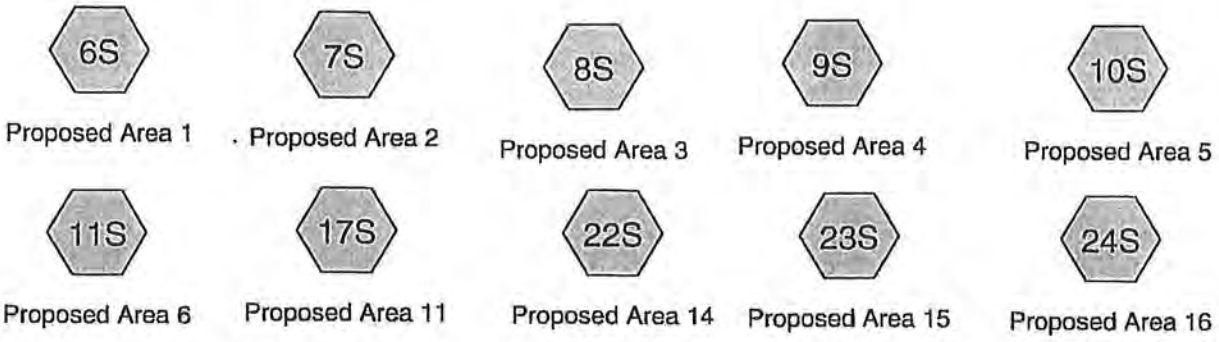
Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.180	98	Paved roads w/curbs & sewers
0.180		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	78	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 22S: Existing Area 6





Subcat Reach Pond Link

Drainage Diagram for Residence-Pro-1
Prepared by Penfield & Smith 7/24/2008

Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
0.640	80	>75% Grass cover, Good, HSG D (17S,23S)
0.100	84	50-75% Grass cover, Fair, HSG D (10S)
8.090	95	Urban commercial, 85% imp, HSG D (6S,7S,8S,9S,11S,17S,22S)
0.140	98	Paved parking & roofs (10S)
0.450	98	Paved roads w/curbs & sewers (24S)
9.420		

Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SBUH method
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 6S: Proposed Area 1 Runoff Area=4.340 ac Runoff Depth=4.03"
Flow Length=550' Tc=9.5 min CN=95 Runoff=9.96 cfs 1.459 af

Subcatchment 7S: Proposed Area 2 Runoff Area=0.470 ac Runoff Depth=4.03"
Flow Length=180' Tc=2.2 min CN=95 Runoff=1.41 cfs 0.158 af

Subcatchment 8S: Proposed Area 3 Runoff Area=0.070 ac Runoff Depth=4.03"
Flow Length=70' Slope=0.0180 '/' Tc=0.4 min CN=95 Runoff=0.23 cfs 0.024 af

Subcatchment 9S: Proposed Area 4 Runoff Area=0.230 ac Runoff Depth=4.03"
Flow Length=235' Tc=2.5 min CN=95 Runoff=0.68 cfs 0.077 af

Subcatchment 10S: Proposed Area 5 Runoff Area=0.240 ac Runoff Depth=3.71"
Flow Length=161' Tc=21.7 min CN=92 Runoff=0.37 cfs 0.074 af

Subcatchment 11S: Proposed Area 6 Runoff Area=0.110 ac Runoff Depth=4.03"
Flow Length=110' Slope=0.0210 '/' Tc=2.3 min CN=95 Runoff=0.33 cfs 0.037 af

Subcatchment 17S: Proposed Area 11 Runoff Area=3.330 ac Runoff Depth=3.71"
Flow Length=632' Tc=6.6 min CN=92 Runoff=7.96 cfs 1.029 af

Subcatchment 22S: Proposed Area 14 Runoff Area=0.140 ac Runoff Depth=4.03"
Flow Length=82' Slope=0.0200 '/' Tc=1.8 min CN=95 Runoff=0.42 cfs 0.047 af

Subcatchment 23S: Proposed Area 15 Runoff Area=0.040 ac Runoff Depth=2.56"
Flow Length=60' Slope=0.0150 '/' Tc=0.5 min CN=80 Runoff=0.08 cfs 0.009 af

Subcatchment 24S: Proposed Area 16 Runoff Area=0.450 ac Runoff Depth=4.37"
Flow Length=635' Slope=0.0050 '/' Tc=7.4 min CN=98 Runoff=1.16 cfs 0.164 af

Total Runoff Area = 9.420 ac Runoff Volume = 3.078 af Average Runoff Depth = 3.92"
20.74% Pervious Area = 1.953 ac 79.26% Impervious Area = 7.467 ac

Subcatchment 6S: Proposed Area 1

[49] Hint: Tc<2dt may require smaller dt

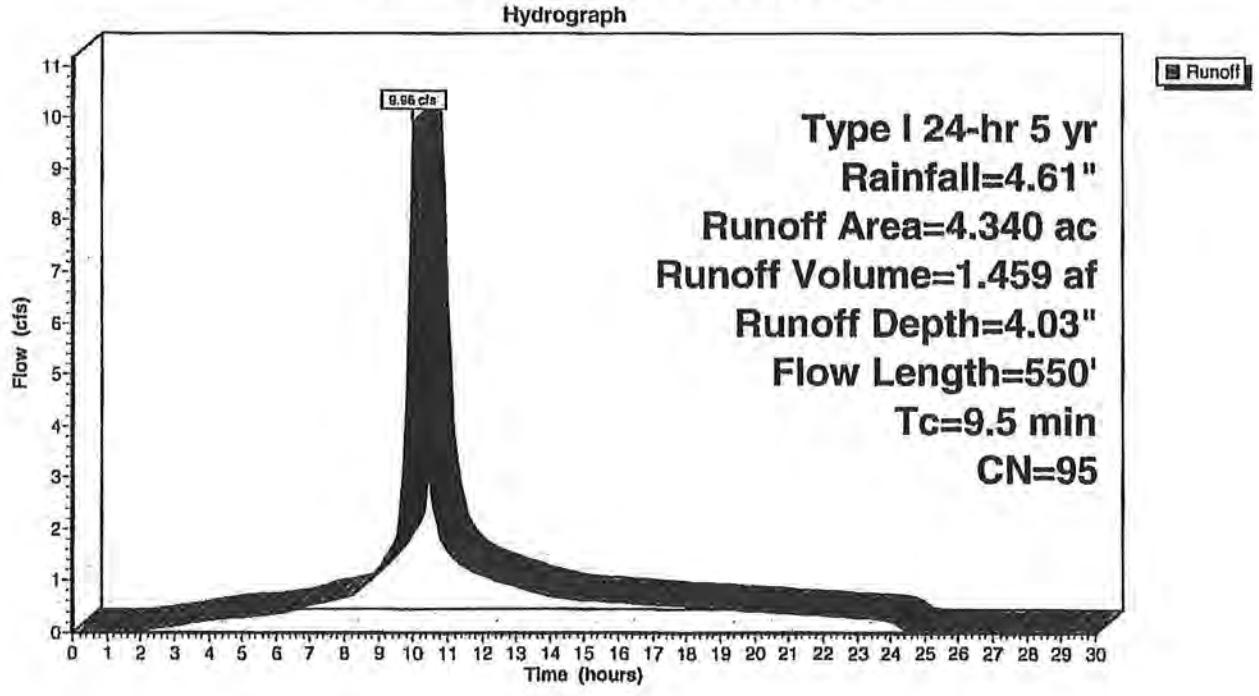
Runoff = 9.96 cfs @ 10.01 hrs, Volume= 1.459 af, Depth= 4.03"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
4.340	95	Urban commercial, 85% imp, HSG D
0.651		Pervious Area
3.689		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	290	0.0128	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
3.4	260	0.0040	1.28		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	550	Total			

Subcatchment 6S: Proposed Area 1



Subcatchment 7S: Proposed Area 2

[49] Hint: Tc<2dt may require smaller dt

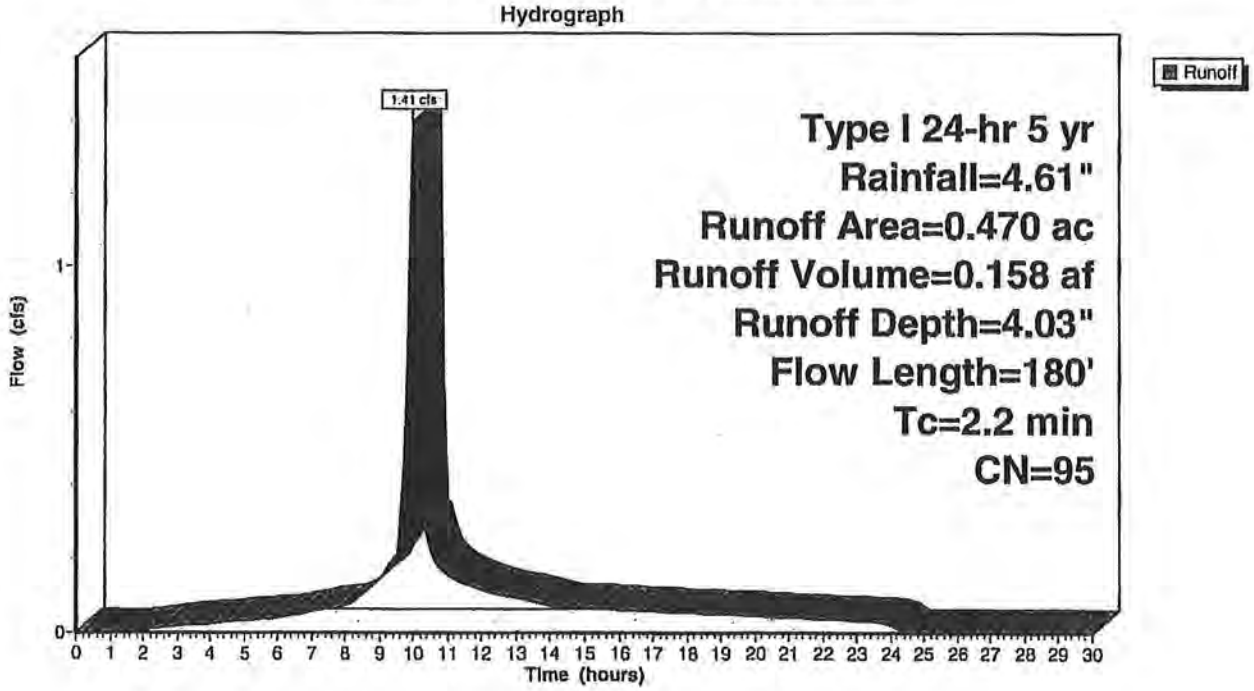
Runoff = 1.41 cfs @ 9.96 hrs, Volume= 0.158 af, Depth= 4.03"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.470	95	Urban commercial, 85% imp, HSG D
0.070		Pervious Area
0.400		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	40	0.0300	0.75		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
1.3	140	0.0080	1.82		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.2	180	Total			

Subcatchment 7S: Proposed Area 2



Subcatchment 8S: Proposed Area 3

[49] Hint: Tc<2dt may require smaller dt

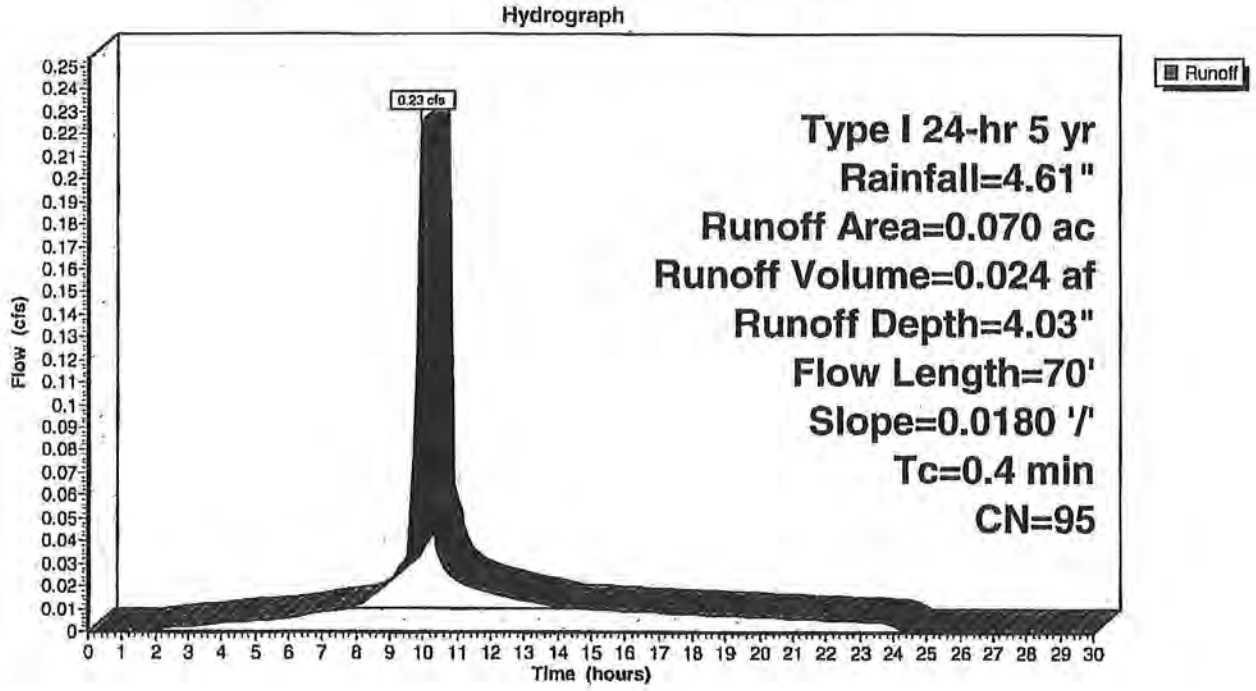
Runoff = 0.23 cfs @ 9.92 hrs, Volume= 0.024 af, Depth= 4.03"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.070	95	Urban commercial, 85% imp, HSG D
0.011		Pervious Area
0.059		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	70	0.0180	2.72		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 8S: Proposed Area 3



Subcatchment 9S: Proposed Area 4

[49] Hint: Tc<2dt may require smaller dt

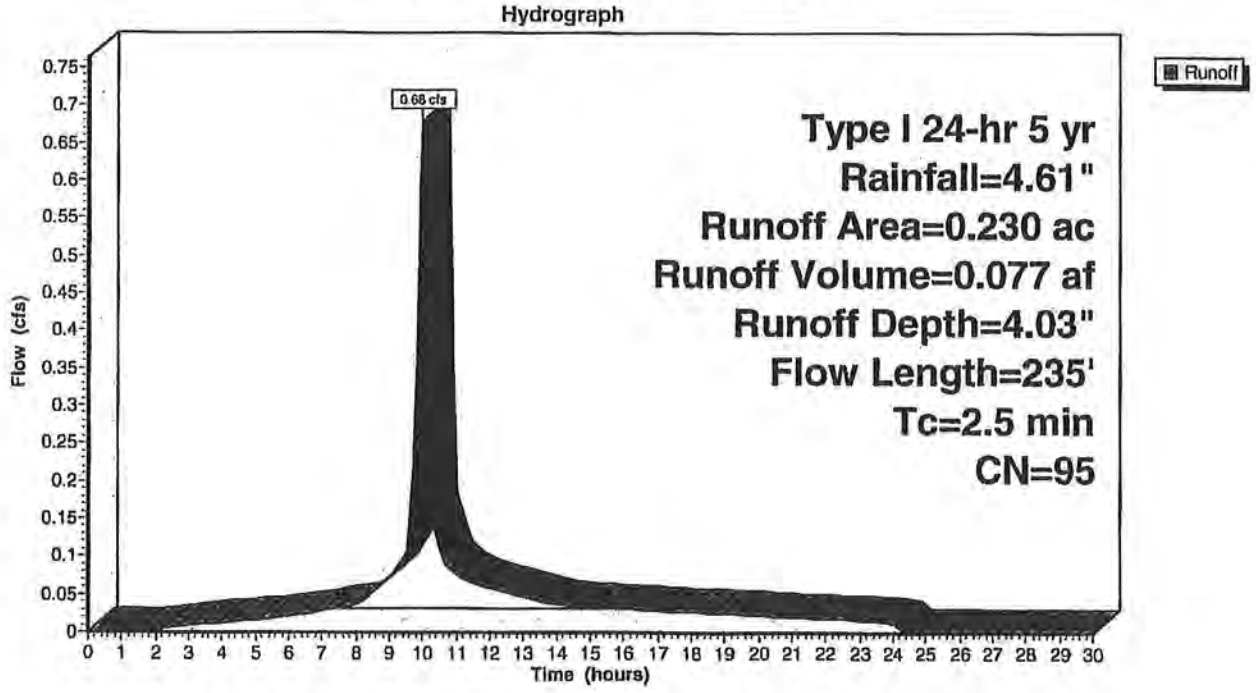
Runoff = 0.68 cfs @ 9.96 hrs, Volume= 0.077 af, Depth= 4.03"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.230	95	Urban commercial, 85% imp, HSG D
0.034		Pervious Area
0.195		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	70	0.0240	0.77		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
1.0	165	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.5	235	Total			

Subcatchment 9S: Proposed Area 4



Subcatchment 10S: Proposed Area 5

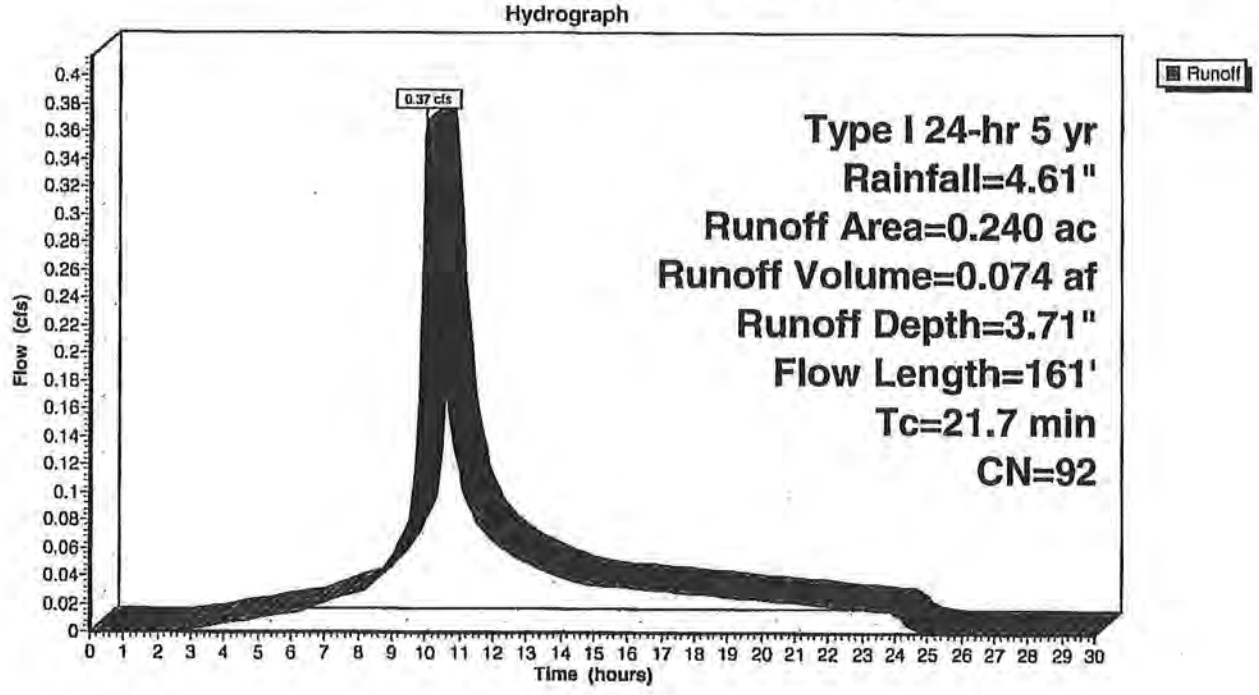
Runoff = 0.37 cfs @ 10.05 hrs, Volume= 0.074 af, Depth= 3.71"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.100	84	50-75% Grass cover, Fair, HSG D
0.140	98	Paved parking & roofs
0.240	92	Weighted Average
0.100		Pervious Area
0.140		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	125	0.0200	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 1.00"
0.7	36	0.0500	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
21.7	161	Total			

Subcatchment 10S: Proposed Area 5



Subcatchment 11S: Proposed Area 6

[49] Hint: Tc<2dt may require smaller dt

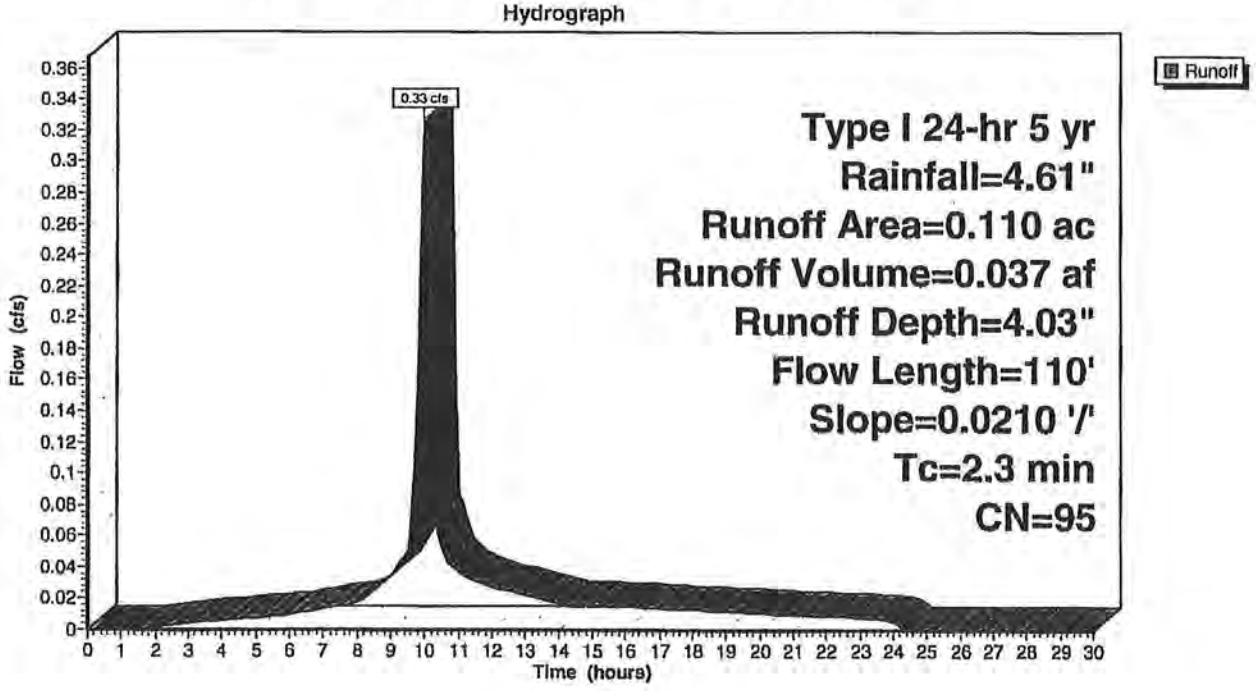
Runoff = 0.33 cfs @ 9.96 hrs, Volume= 0.037 af, Depth= 4.03"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.110	95	Urban commercial, 85% imp, HSG D
0.017		Pervious Area
0.094		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	110	0.0210	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 11S: Proposed Area 6



Subcatchment 17S: Proposed Area 11

[49] Hint: Tc<2dt may require smaller dt

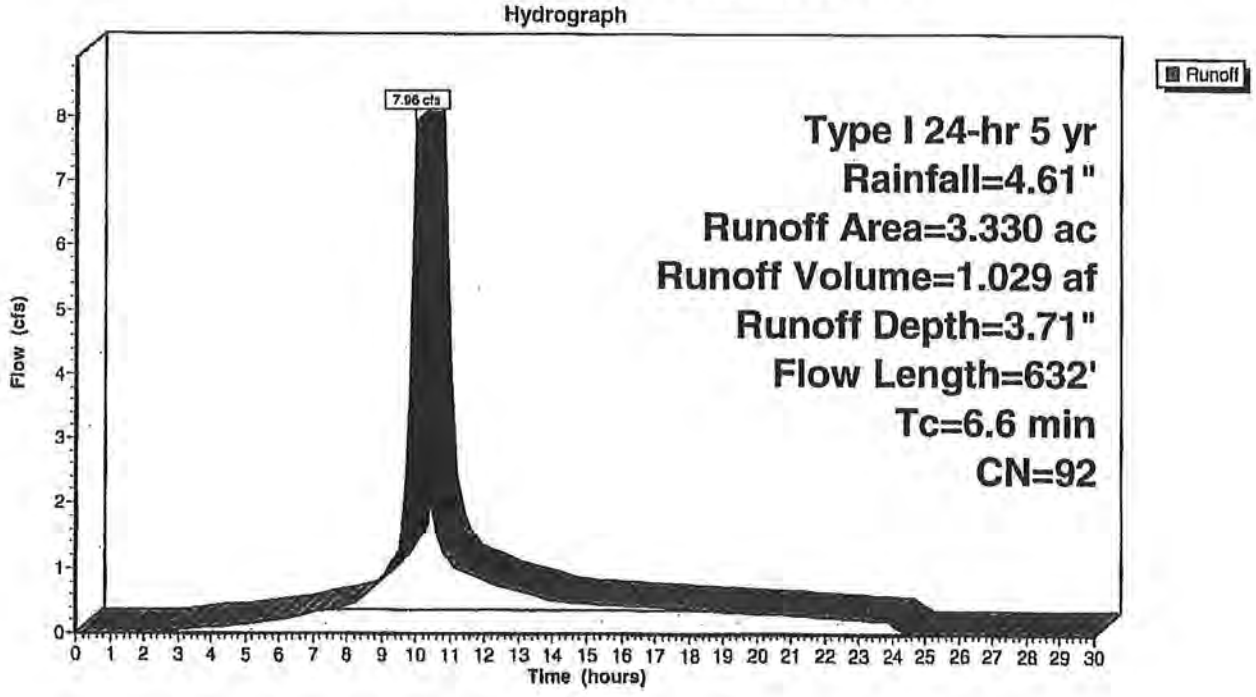
Runoff = 7.96 cfs @ 9.99 hrs, Volume= 1.029 af, Depth= 3.71"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.600	80	>75% Grass cover, Good, HSG D
2.730	95	Urban commercial, 85% imp, HSG D
3.330	92	Weighted Average
1.010		Pervious Area
2.321		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	586	0.0061	1.59		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	46	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
6.6	632	Total			

Subcatchment 17S: Proposed Area 11



Subcatchment 22S: Proposed Area 14

[49] Hint: Tc<2dt may require smaller dt

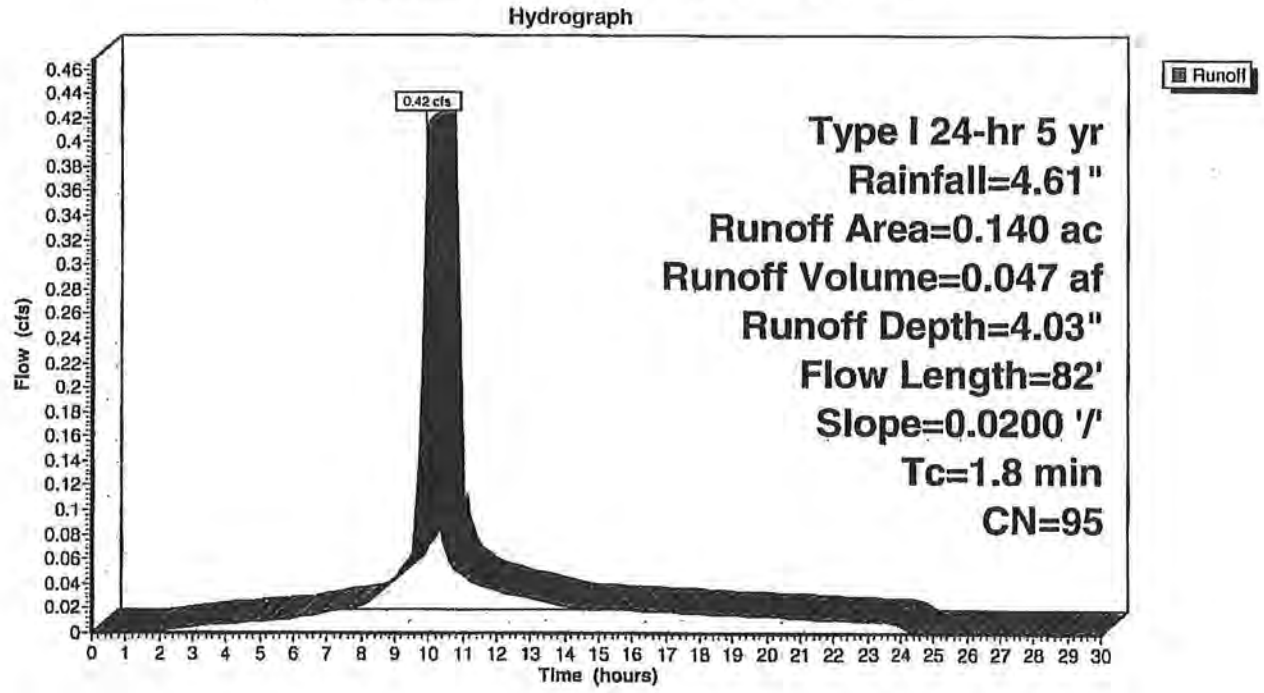
Runoff = 0.42 cfs @ 9.95 hrs, Volume= 0.047 af, Depth= 4.03"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.140	95	Urban commercial, 85% imp, HSG D
0.021		Pervious Area
0.119		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	82	0.0200	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 22S: Proposed Area 14



Subcatchment 23S: Proposed Area 15

[49] Hint: Tc<2dt may require smaller dt

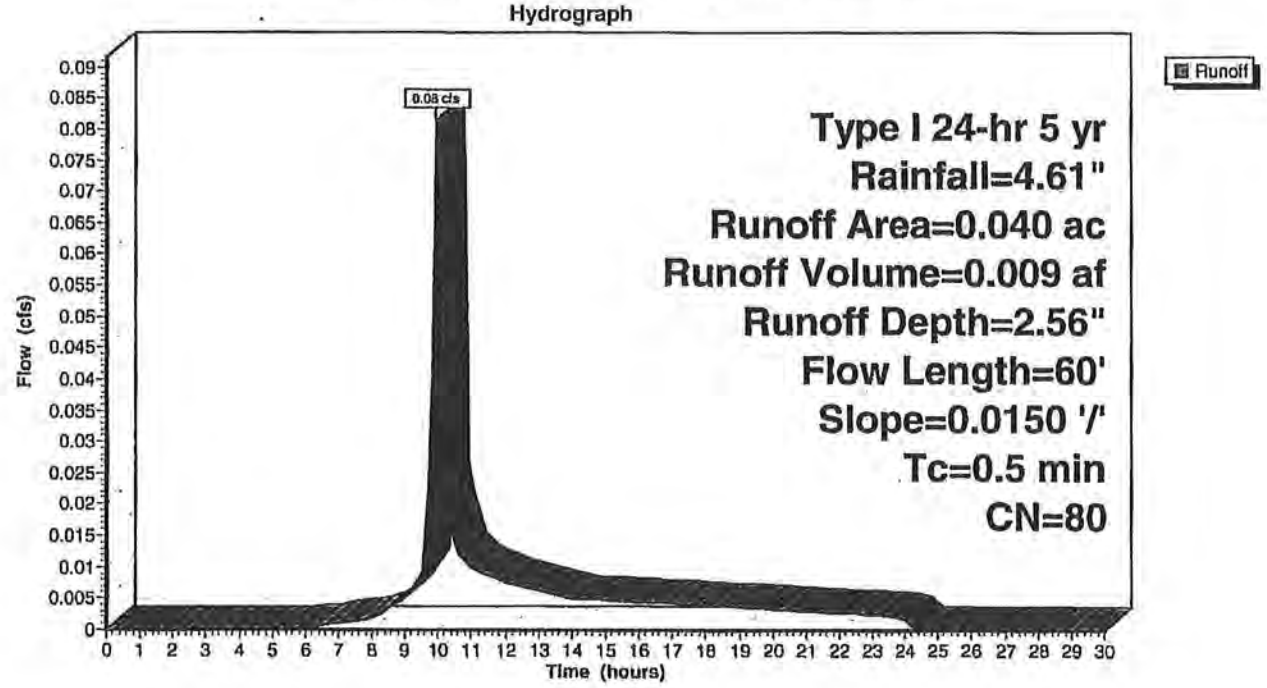
Runoff = 0.08 cfs @ 9.93 hrs, Volume= 0.009 af, Depth= 2.56"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.040	80	>75% Grass cover, Good, HSG D
0.040		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	60	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Subcatchment 23S: Proposed Area 15



Subcatchment 24S: Proposed Area 16

[49] Hint: Tc<2dt may require smaller dt

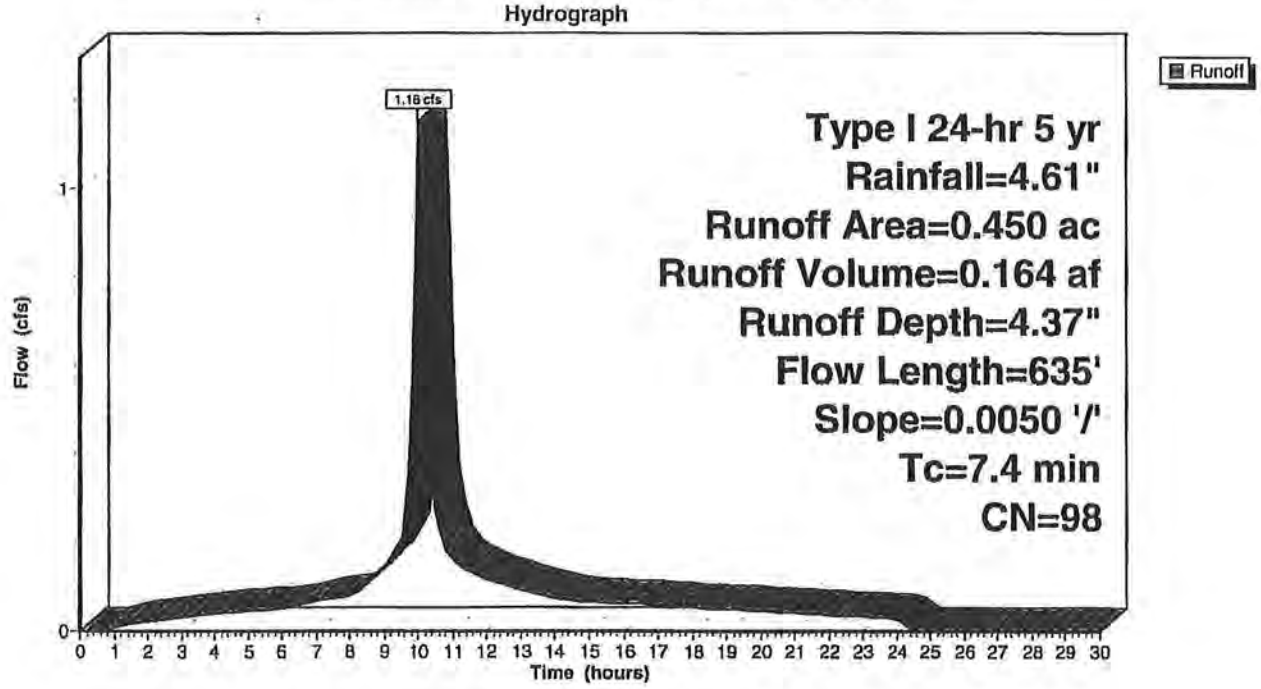
Runoff = 1.16 cfs @ 10.00 hrs, Volume= 0.164 af, Depth= 4.37"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.450	98	Paved roads w/curbs & sewers
0.450		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	635	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 24S: Proposed Area 16



Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SBUH method
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 6S: Proposed Area 1 Runoff Area=4.340 ac Runoff Depth=4.96"
Flow Length=550' Tc=9.5 min CN=95 Runoff=12.16 cfs 1.796 af

Subcatchment 7S: Proposed Area 2 Runoff Area=0.470 ac Runoff Depth=4.97"
Flow Length=180' Tc=2.2 min CN=95 Runoff=1.71 cfs 0.194 af

Subcatchment 8S: Proposed Area 3 Runoff Area=0.070 ac Runoff Depth=4.97"
Flow Length=70' Slope=0.0180 '/' Tc=0.4 min CN=95 Runoff=0.28 cfs 0.029 af

Subcatchment 9S: Proposed Area 4 Runoff Area=0.230 ac Runoff Depth=4.97"
Flow Length=235' Tc=2.5 min CN=95 Runoff=0.83 cfs 0.095 af

Subcatchment 10S: Proposed Area 5 Runoff Area=0.240 ac Runoff Depth=4.63"
Flow Length=161' Tc=21.7 min CN=92 Runoff=0.46 cfs 0.093 af

Subcatchment 11S: Proposed Area 6 Runoff Area=0.110 ac Runoff Depth=4.97"
Flow Length=110' Slope=0.0210 '/' Tc=2.3 min CN=95 Runoff=0.40 cfs 0.046 af

Subcatchment 17S: Proposed Area 11 Runoff Area=3.330 ac Runoff Depth=4.63"
Flow Length=632' Tc=6.6 min CN=92 Runoff=9.86 cfs 1.284 af

Subcatchment 22S: Proposed Area 14 Runoff Area=0.140 ac Runoff Depth=4.97"
Flow Length=82' Slope=0.0200 '/' Tc=1.8 min CN=95 Runoff=0.51 cfs 0.058 af

Subcatchment 23S: Proposed Area 15 Runoff Area=0.040 ac Runoff Depth=3.38"
Flow Length=60' Slope=0.0150 '/' Tc=0.5 min CN=80 Runoff=0.11 cfs 0.011 af

Subcatchment 24S: Proposed Area 16 Runoff Area=0.450 ac Runoff Depth=5.31"
Flow Length=635' Slope=0.0050 '/' Tc=7.4 min CN=98 Runoff=1.40 cfs 0.199 af

Total Runoff Area = 9.420 ac Runoff Volume = 3.805 af Average Runoff Depth = 4.85"
20.74% Pervious Area = 1.953 ac 79.26% Impervious Area = 7.467 ac

Subcatchment 6S: Proposed Area 1

[49] Hint: Tc<2dt may require smaller dt

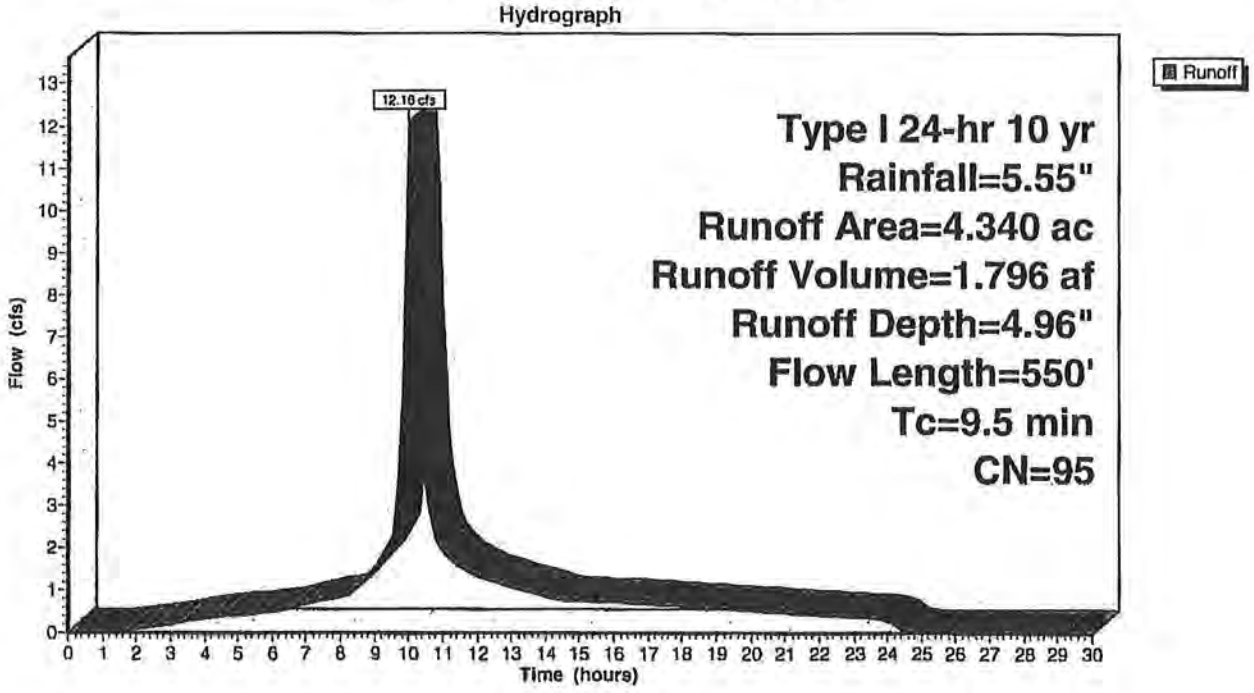
Runoff = 12.16 cfs @ 10.01 hrs, Volume= 1.796 af, Depth= 4.96"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
4.340	95	Urban commercial, 85% imp, HSG D
0.651		Pervious Area
3.689		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	290	0.0128	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
3.4	260	0.0040	1.28		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	550	Total			

Subcatchment 6S: Proposed Area 1



Subcatchment 7S: Proposed Area 2

[49] Hint: Tc<2dt may require smaller dt

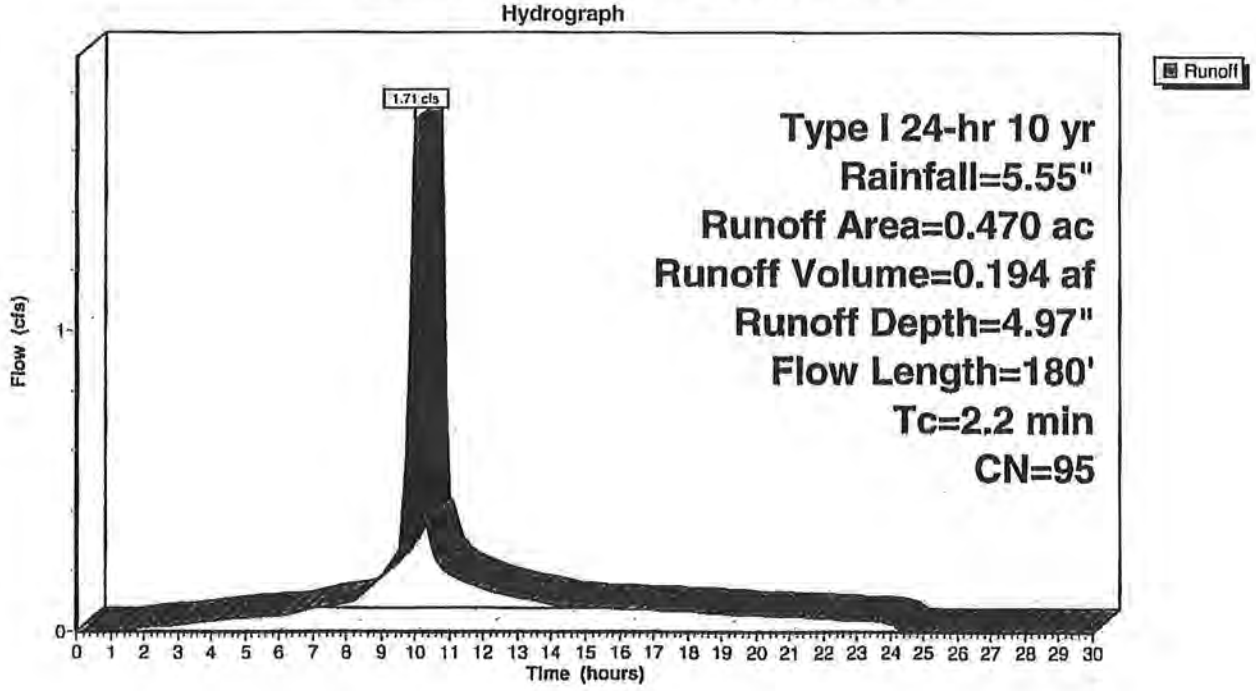
Runoff = 1.71 cfs @ 9.96 hrs, Volume= 0.194 af, Depth= 4.97"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.470	95	Urban commercial, 85% imp, HSG D
0.070		Pervious Area
0.400		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	40	0.0300	0.75		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
1.3	140	0.0080	1.82		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.2	180	Total			

Subcatchment 7S: Proposed Area 2



Subcatchment 8S: Proposed Area 3

[49] Hint: Tc<2dt may require smaller dt

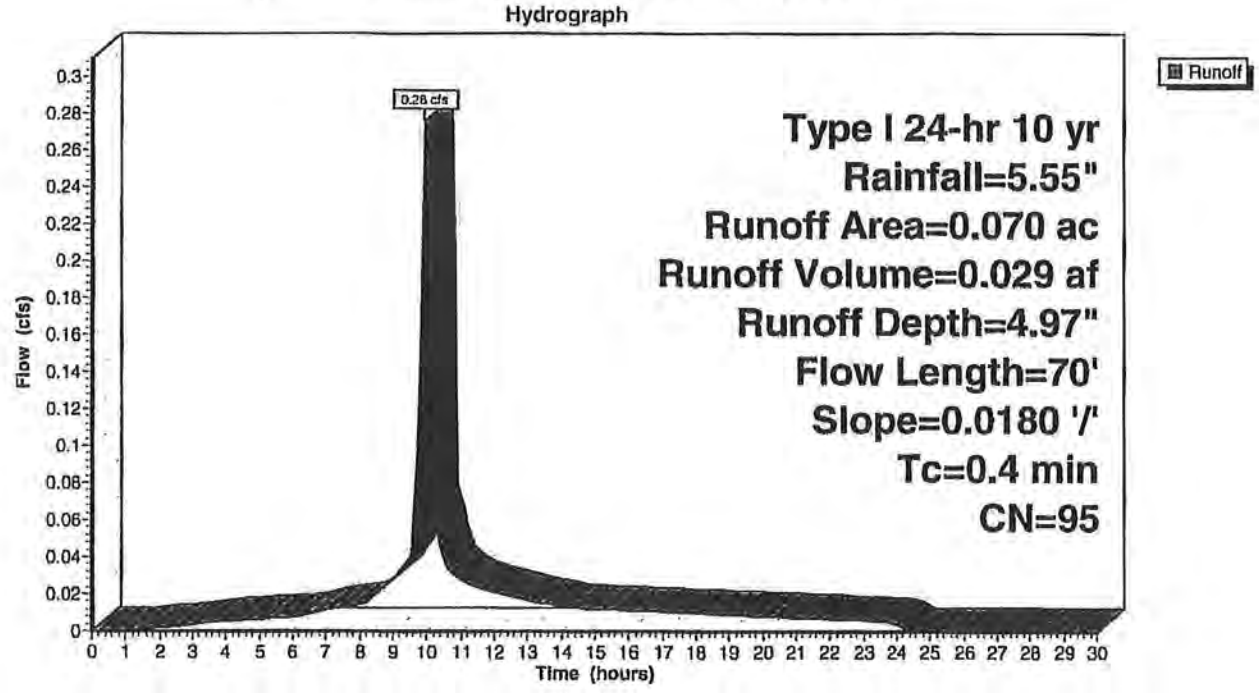
Runoff = 0.28 cfs @ 9.92 hrs, Volume= 0.029 af, Depth= 4.97"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.070	95	Urban commercial, 85% imp, HSG D
0.011		Pervious Area
0.059		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	70	0.0180	2.72		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 8S: Proposed Area 3



Subcatchment 9S: Proposed Area 4

[49] Hint: Tc<2dt may require smaller dt

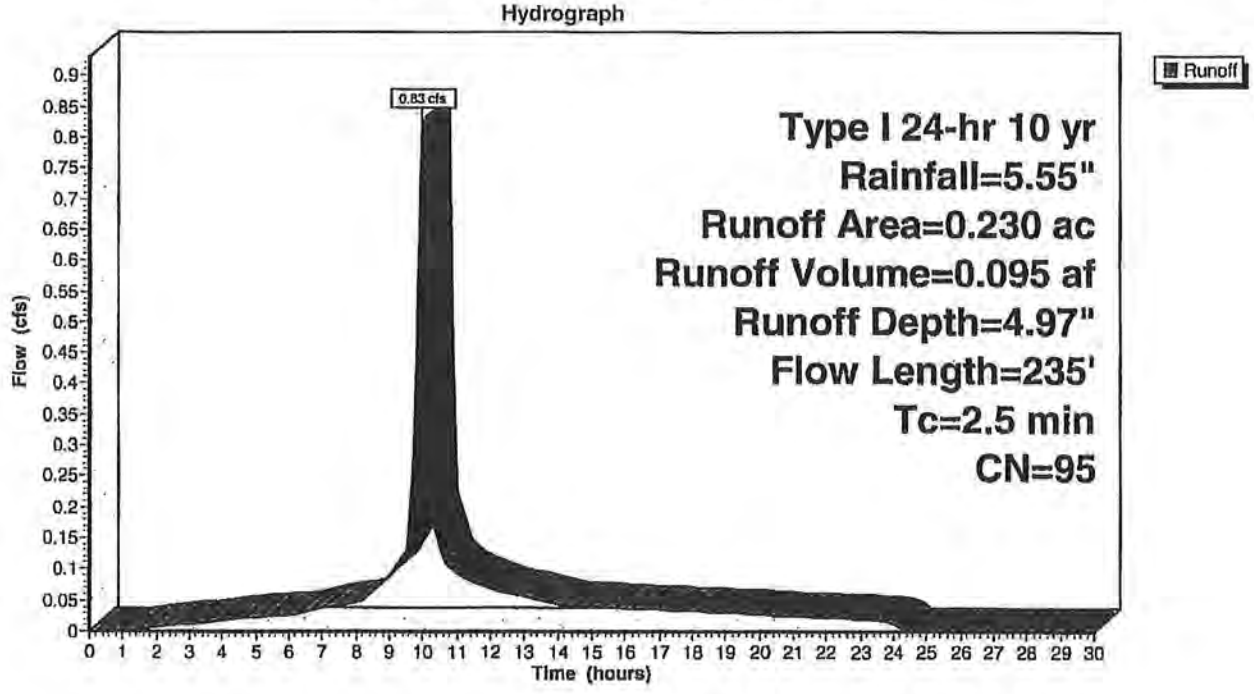
Runoff = 0.83 cfs @ 9.96 hrs, Volume= 0.095 af, Depth= 4.97"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.230	95	Urban commercial, 85% imp, HSG D
0.034		Pervious Area
0.195		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	70	0.0240	0.77		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
1.0	165	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.5	235	Total			

Subcatchment 9S: Proposed Area 4



Subcatchment 10S: Proposed Area 5

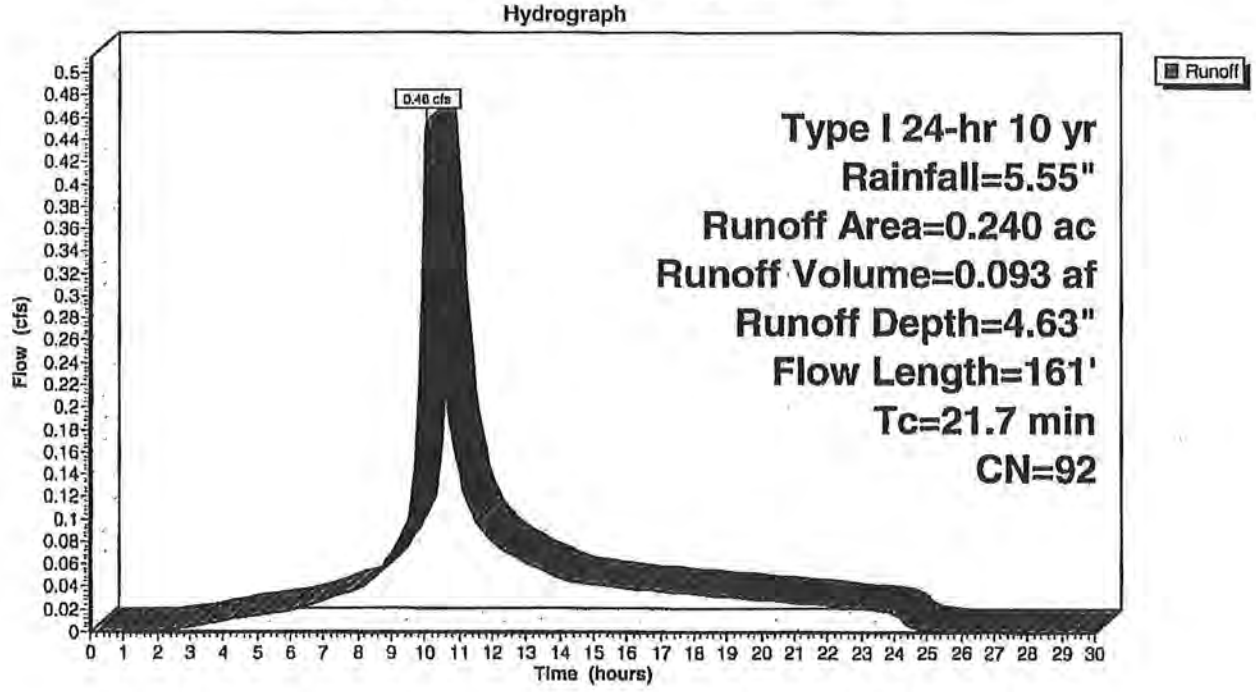
Runoff = 0.46 cfs @ 10.05 hrs, Volume= 0.093 af, Depth= 4.63"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.100	84	50-75% Grass cover, Fair, HSG D
0.140	98	Paved parking & roofs
0.240	92	Weighted Average
0.100		Pervious Area
0.140		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	125	0.0200	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 1.00"
0.7	36	0.0500	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
21.7	161	Total			

Subcatchment 10S: Proposed Area 5



Subcatchment 11S: Proposed Area 6

[49] Hint: Tc<2dt may require smaller dt

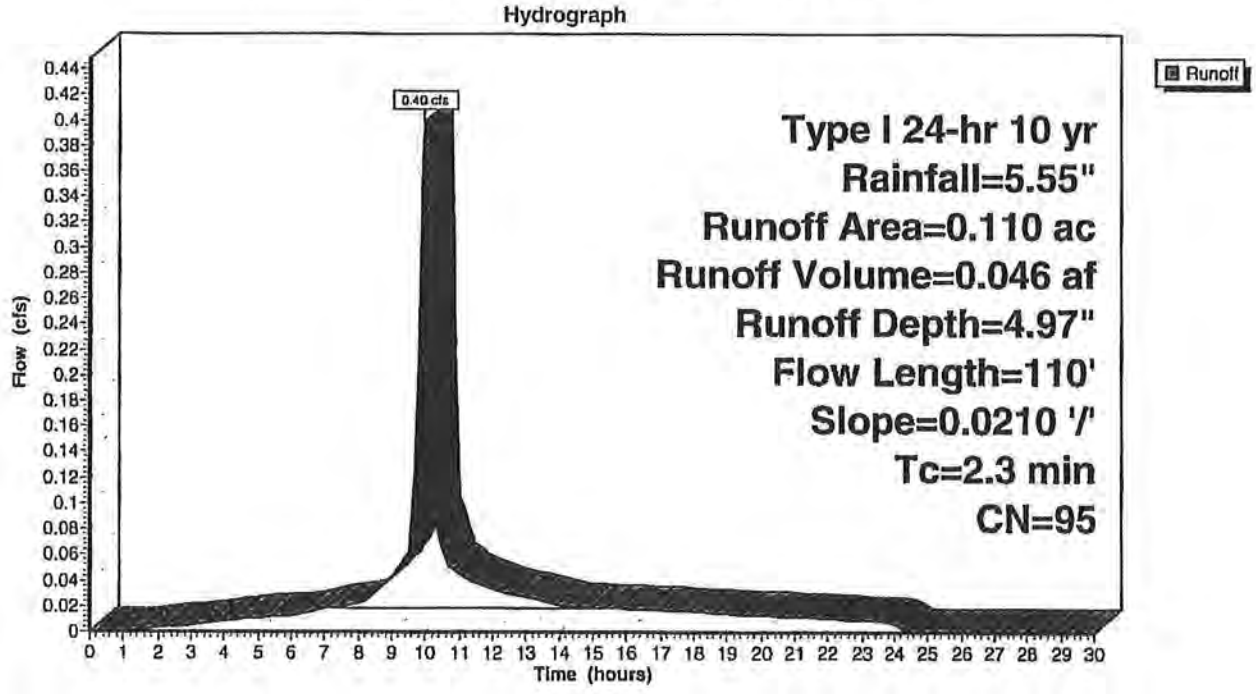
Runoff = 0.40 cfs @ 9.96 hrs, Volume= 0.046 af, Depth= 4.97"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.110	95	Urban commercial, 85% imp, HSG D
0.017		Pervious Area
0.094		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	110	0.0210	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 11S: Proposed Area 6



Subcatchment 17S: Proposed Area 11

[49] Hint: Tc<2dt may require smaller dt

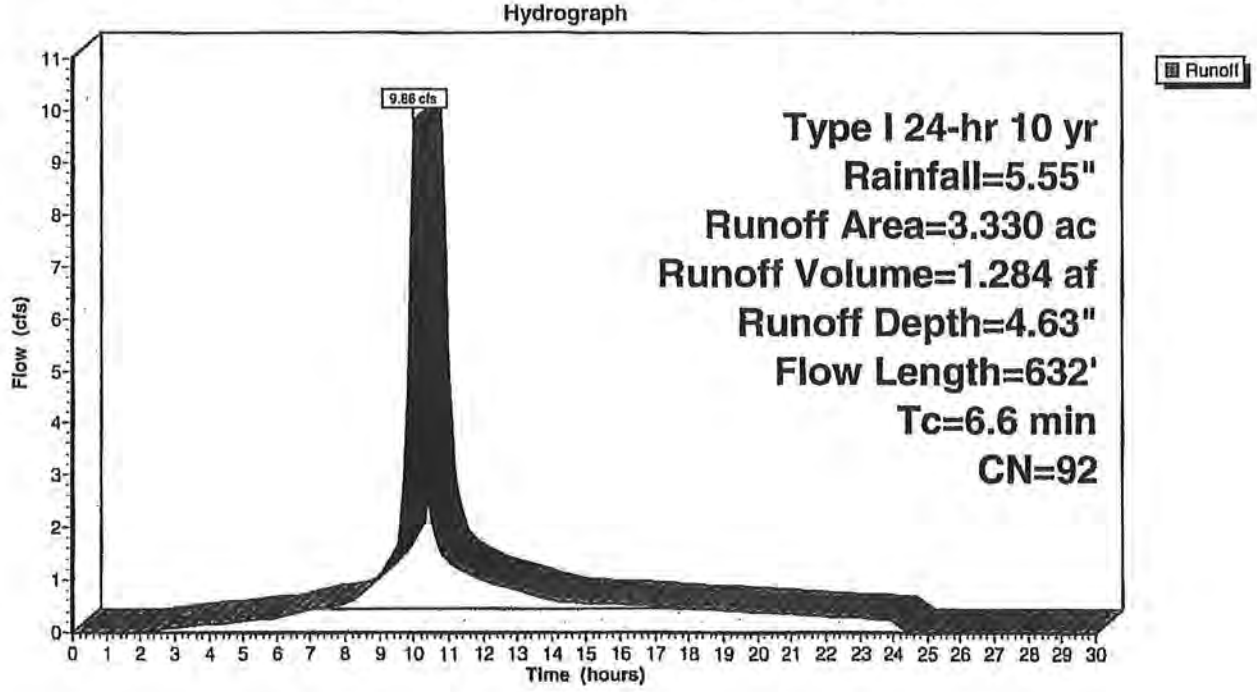
Runoff = 9.86 cfs @ 9.99 hrs, Volume= 1.284 af, Depth= 4.63"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.600	80	>75% Grass cover, Good, HSG D
2.730	95	Urban commercial, 85% imp, HSG D
3.330	92	Weighted Average
1.010		Pervious Area
2.321		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	586	0.0061	1.59		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	46	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
6.6	632	Total			

Subcatchment 17S: Proposed Area 11



Subcatchment 22S: Proposed Area 14

[49] Hint: Tc<2dt may require smaller dt

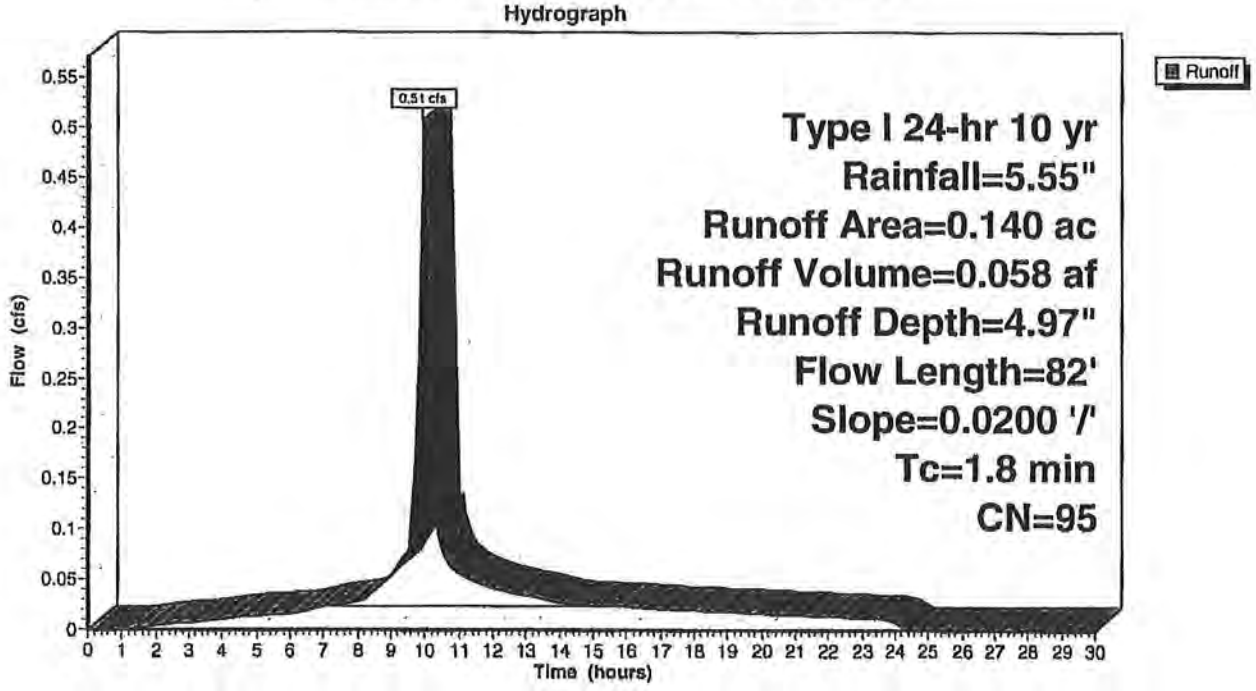
Runoff = 0.51 cfs @ 9.95 hrs, Volume= 0.058 af, Depth= 4.97"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.140	95	Urban commercial, 85% imp, HSG D
0.021		Pervious Area
0.119		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	82	0.0200	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 22S: Proposed Area 14



Subcatchment 23S: Proposed Area 15

[49] Hint: Tc<2dt may require smaller dt

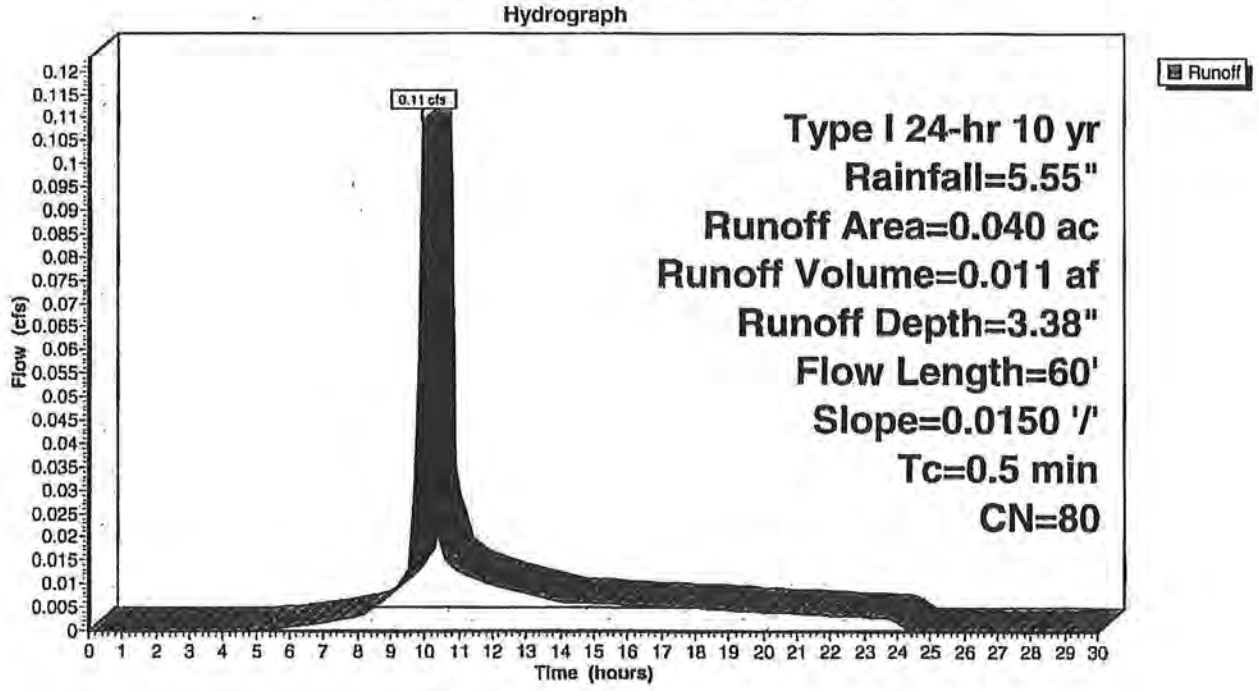
Runoff = 0.11 cfs @ 9.93 hrs, Volume= 0.011 af, Depth= 3.38"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.040	80	>75% Grass cover, Good, HSG D
0.040		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	60	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Subcatchment 23S: Proposed Area 15



Subcatchment 24S: Proposed Area 16

[49] Hint: Tc<2dt may require smaller dt

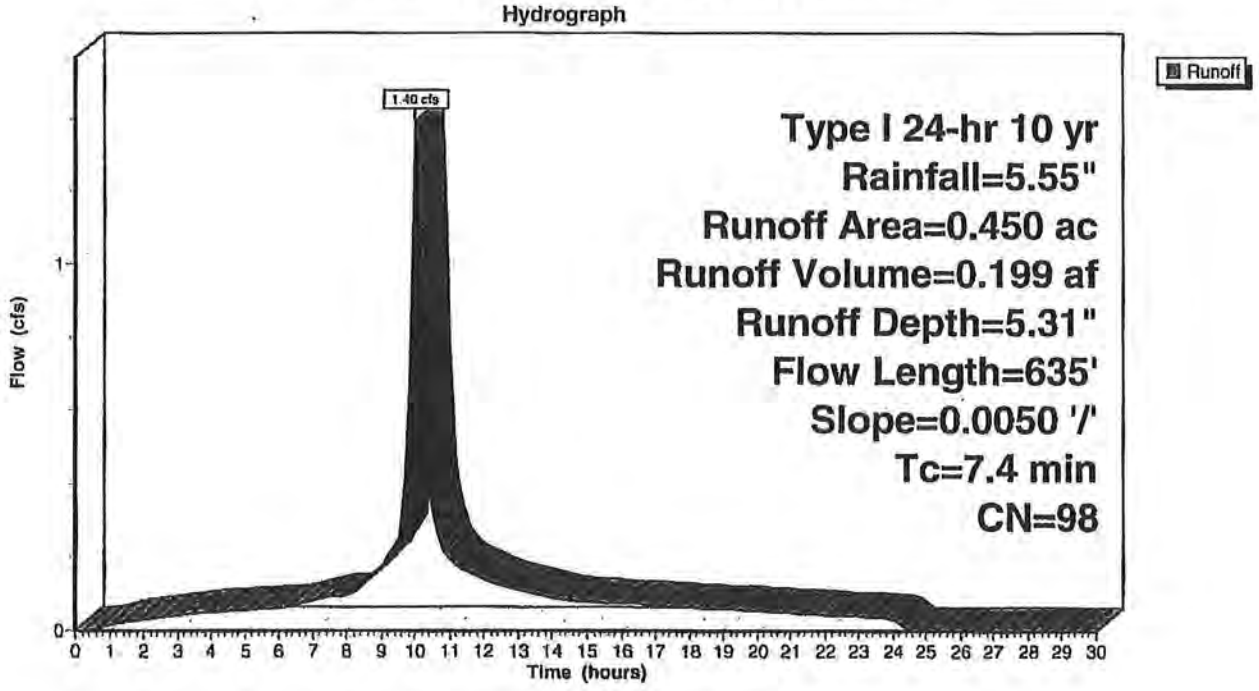
Runoff = 1.40 cfs @ 10.00 hrs, Volume= 0.199 af, Depth= 5.31"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.450	98	Paved roads w/curbs & sewers
0.450		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	635	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 24S: Proposed Area 16



Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SBUH method
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 6S: Proposed Area 1 Runoff Area=4.340 ac Runoff Depth=6.12"
Flow Length=550' Tc=9.5 min CN=95 Runoff=14.86 cfs 2.212 af

Subcatchment 7S: Proposed Area 2 Runoff Area=0.470 ac Runoff Depth=6.12"
Flow Length=180' Tc=2.2 min CN=95 Runoff=2.09 cfs 0.240 af

Subcatchment 8S: Proposed Area 3 Runoff Area=0.070 ac Runoff Depth=6.12"
Flow Length=70' Slope=0.0180 '/' Tc=0.4 min CN=95 Runoff=0.34 cfs 0.036 af

Subcatchment 9S: Proposed Area 4 Runoff Area=0.230 ac Runoff Depth=6.12"
Flow Length=235' Tc=2.5 min CN=95 Runoff=1.01 cfs 0.117 af

Subcatchment 10S: Proposed Area 5 Runoff Area=0.240 ac Runoff Depth=5.77"
Flow Length=161' Tc=21.7 min CN=92 Runoff=0.57 cfs 0.115 af

Subcatchment 11S: Proposed Area 6 Runoff Area=0.110 ac Runoff Depth=6.12"
Flow Length=110' Slope=0.0210 '/' Tc=2.3 min CN=95 Runoff=0.49 cfs 0.056 af

Subcatchment 17S: Proposed Area 11 Runoff Area=3.330 ac Runoff Depth=5.77"
Flow Length=632' Tc=6.6 min CN=92 Runoff=12.19 cfs 1.601 af

Subcatchment 22S: Proposed Area 14 Runoff Area=0.140 ac Runoff Depth=6.12"
Flow Length=82' Slope=0.0200 '/' Tc=1.8 min CN=95 Runoff=0.62 cfs 0.071 af

Subcatchment 23S: Proposed Area 15 Runoff Area=0.040 ac Runoff Depth=4.43"
Flow Length=60' Slope=0.0150 '/' Tc=0.5 min CN=80 Runoff=0.14 cfs 0.015 af

Subcatchment 24S: Proposed Area 16 Runoff Area=0.450 ac Runoff Depth=6.47"
Flow Length=635' Slope=0.0050 '/' Tc=7.4 min CN=98 Runoff=1.69 cfs 0.243 af

Total Runoff Area = 9.420 ac Runoff Volume = 4.706 af Average Runoff Depth = 5.99"
20.74% Pervious Area = 1.953 ac 79.26% Impervious Area = 7.467 ac

Subcatchment 6S: Proposed Area 1

[49] Hint: Tc<2dt may require smaller dt

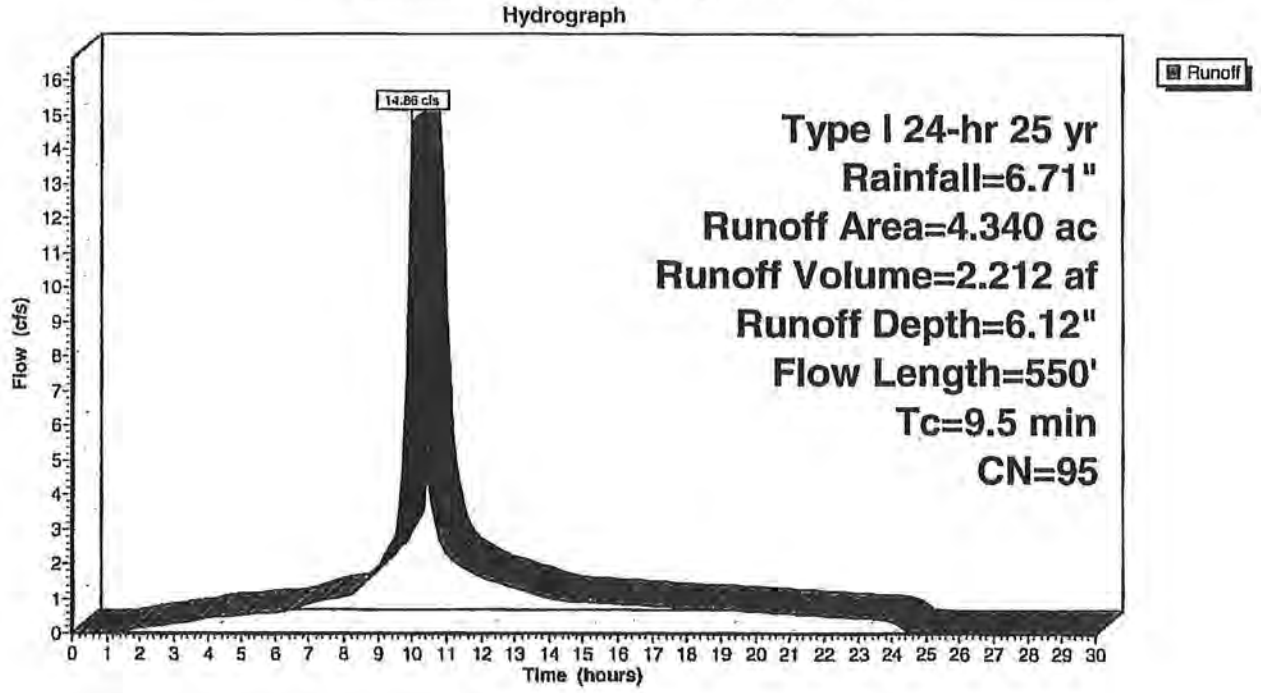
Runoff = 14.86 cfs @ 10.01 hrs, Volume= 2.212 af, Depth= 6.12"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
4.340	95	Urban commercial, 85% imp, HSG D
0.651		Pervious Area
3.689		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	290	0.0128	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
3.4	260	0.0040	1.28		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.5	550	Total			

Subcatchment 6S: Proposed Area 1



Subcatchment 7S: Proposed Area 2

[49] Hint: Tc<2dt may require smaller dt

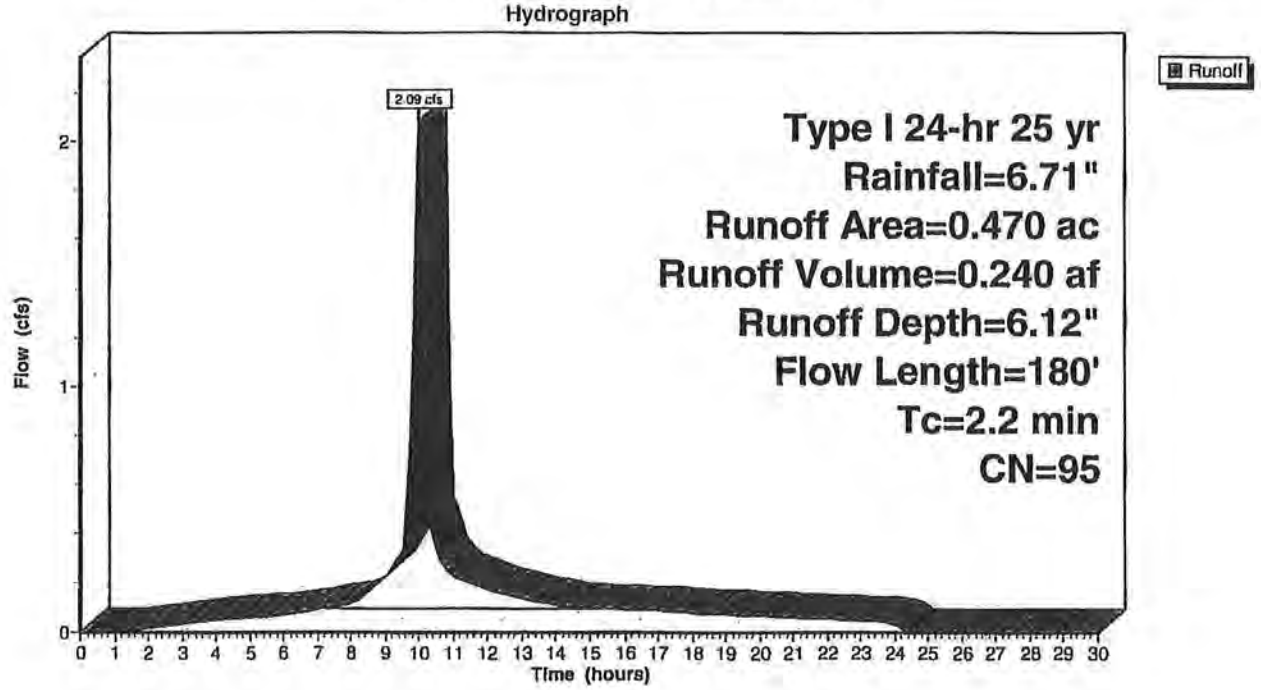
Runoff = 2.09 cfs @ 9.95 hrs, Volume= 0.240 af, Depth= 6.12"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.470	95	Urban commercial, 85% imp, HSG D
0.070		Pervious Area
0.400		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	40	0.0300	0.75		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
1.3	140	0.0080	1.82		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.2	180	Total			

Subcatchment 7S: Proposed Area 2



Subcatchment 8S: Proposed Area 3

[49] Hint: Tc<2dt may require smaller dt

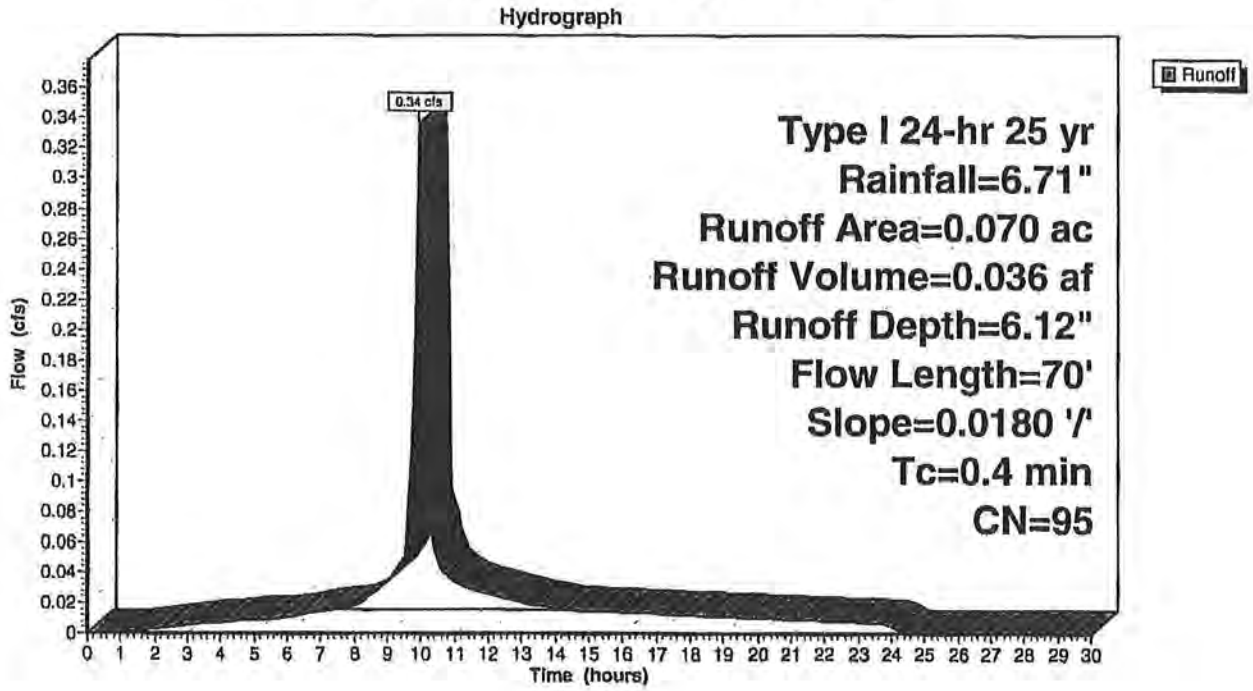
Runoff = 0.34 cfs @ 9.92 hrs, Volume= 0.036 af, Depth= 6.12"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.070	95	Urban commercial, 85% imp, HSG D
0.011		Pervious Area
0.059		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	70	0.0180	2.72		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 8S: Proposed Area 3



Subcatchment 9S: Proposed Area 4

[49] Hint: Tc<2dt may require smaller dt

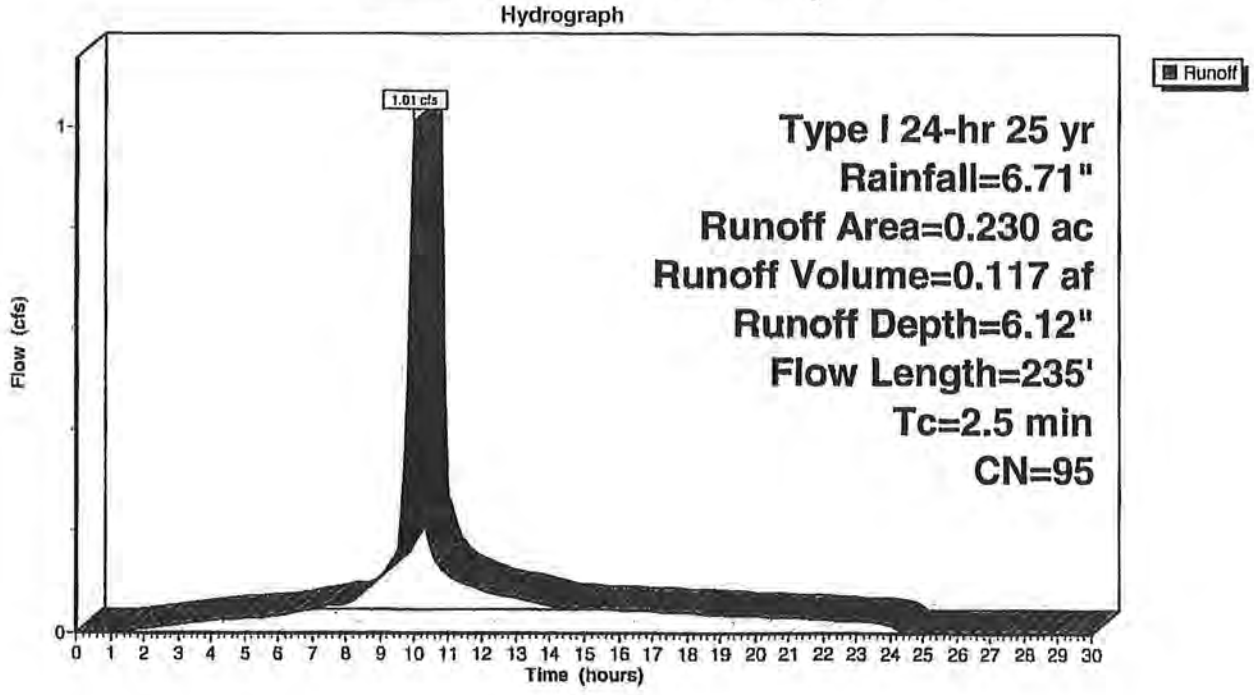
Runoff = 1.01 cfs @ 9.96 hrs, Volume= 0.117 af, Depth= 6.12"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.230	95	Urban commercial, 85% imp, HSG D
0.034		Pervious Area
0.195		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	70	0.0240	0.77		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
1.0	165	0.0170	2.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.5	235	Total			

Subcatchment 9S: Proposed Area 4



Subcatchment 10S: Proposed Area 5

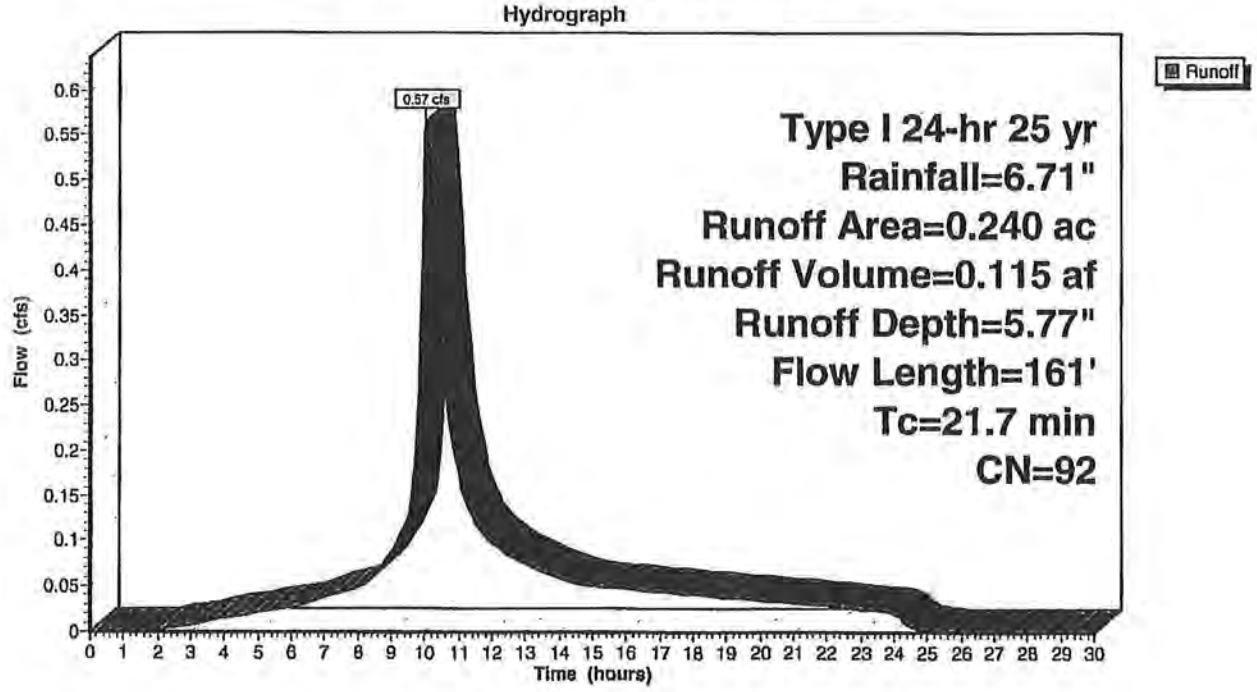
Runoff = 0.57 cfs @ 10.05 hrs, Volume= 0.115 af, Depth= 5.77"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.100	84	50-75% Grass cover, Fair, HSG D
0.140	98	Paved parking & roofs
0.240	92	Weighted Average
0.100		Pervious Area
0.140		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	125	0.0200	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 1.00"
0.7	36	0.0500	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
21.7	161	Total			

Subcatchment 10S: Proposed Area 5



Subcatchment 11S: Proposed Area 6

[49] Hint: Tc<2dt may require smaller dt

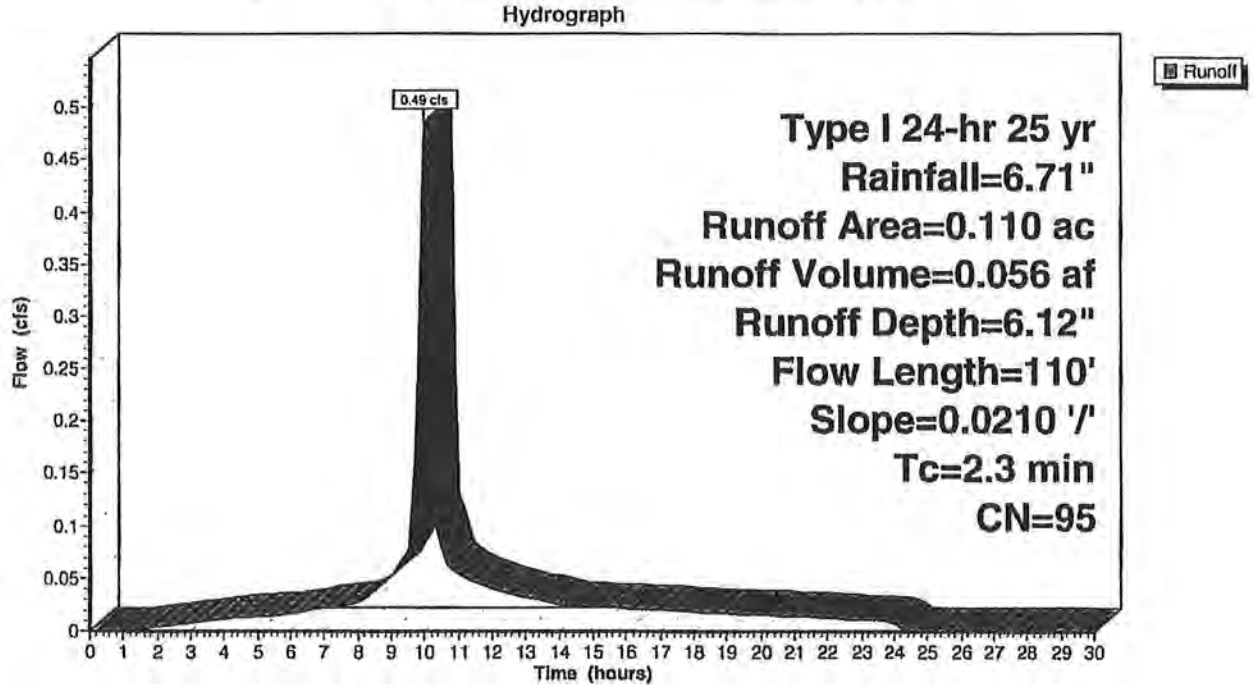
Runoff = 0.49 cfs @ 9.96 hrs, Volume= 0.056 af, Depth= 6.12"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.110	95	Urban commercial, 85% imp, HSG D
0.017		Pervious Area
0.094		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	110	0.0210	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 11S: Proposed Area 6



Subcatchment 17S: Proposed Area 11

[49] Hint: Tc<2dt may require smaller dt

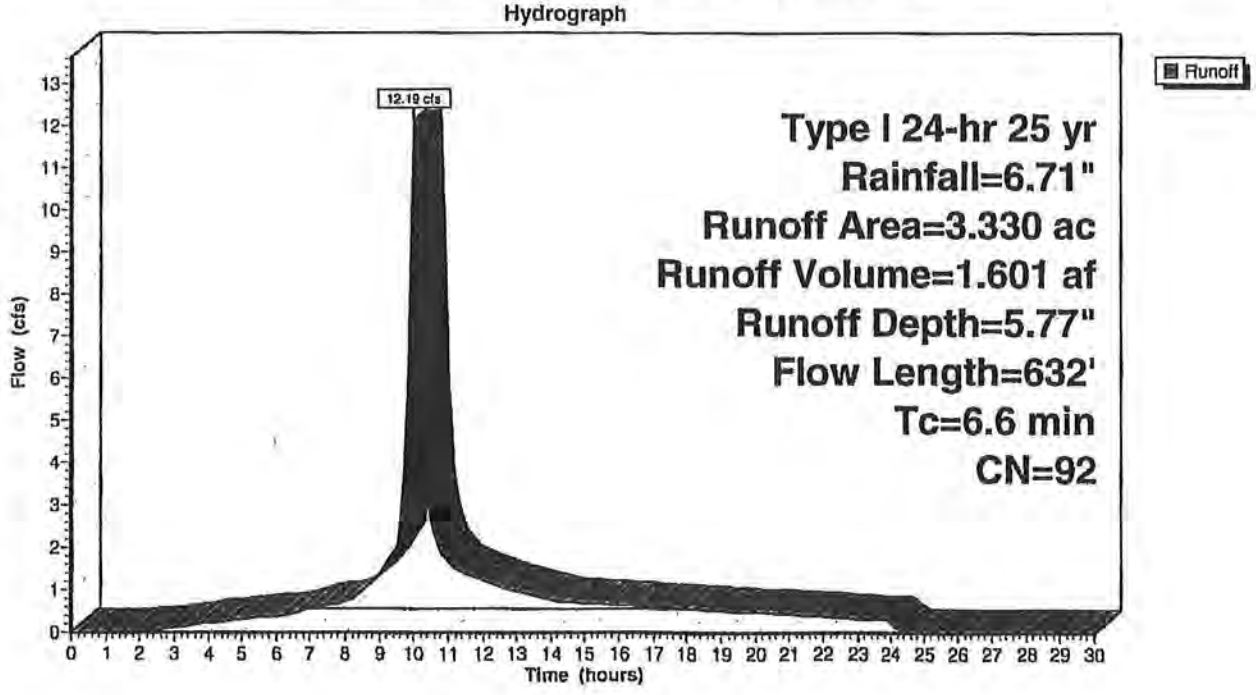
Runoff = 12.19 cfs @ 9.99 hrs, Volume= 1.601 af, Depth= 5.77"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.600	80	>75% Grass cover, Good, HSG D
2.730	95	Urban commercial, 85% imp, HSG D
3.330	92	Weighted Average
1.010		Pervious Area
2.321		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	586	0.0061	1.59		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	46	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
6.6	632	Total			

Subcatchment 17S: Proposed Area 11



Subcatchment 22S: Proposed Area 14

[49] Hint: Tc<2dt may require smaller dt

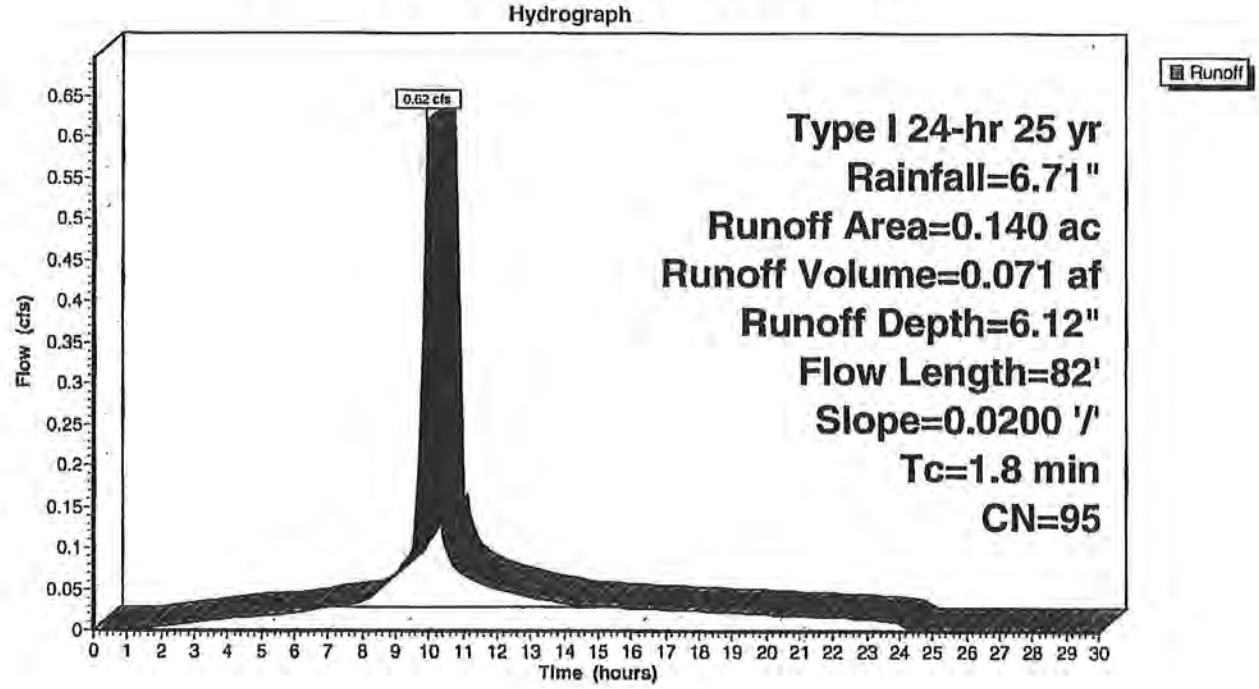
Runoff = 0.62 cfs @ 9.95 hrs, Volume= 0.071 af, Depth= 6.12"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.140	95	Urban commercial, 85% imp, HSG D
0.021		Pervious Area
0.119		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	82	0.0200	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 22S: Proposed Area 14



Subcatchment 23S: Proposed Area 15

[49] Hint: Tc<2dt may require smaller dt

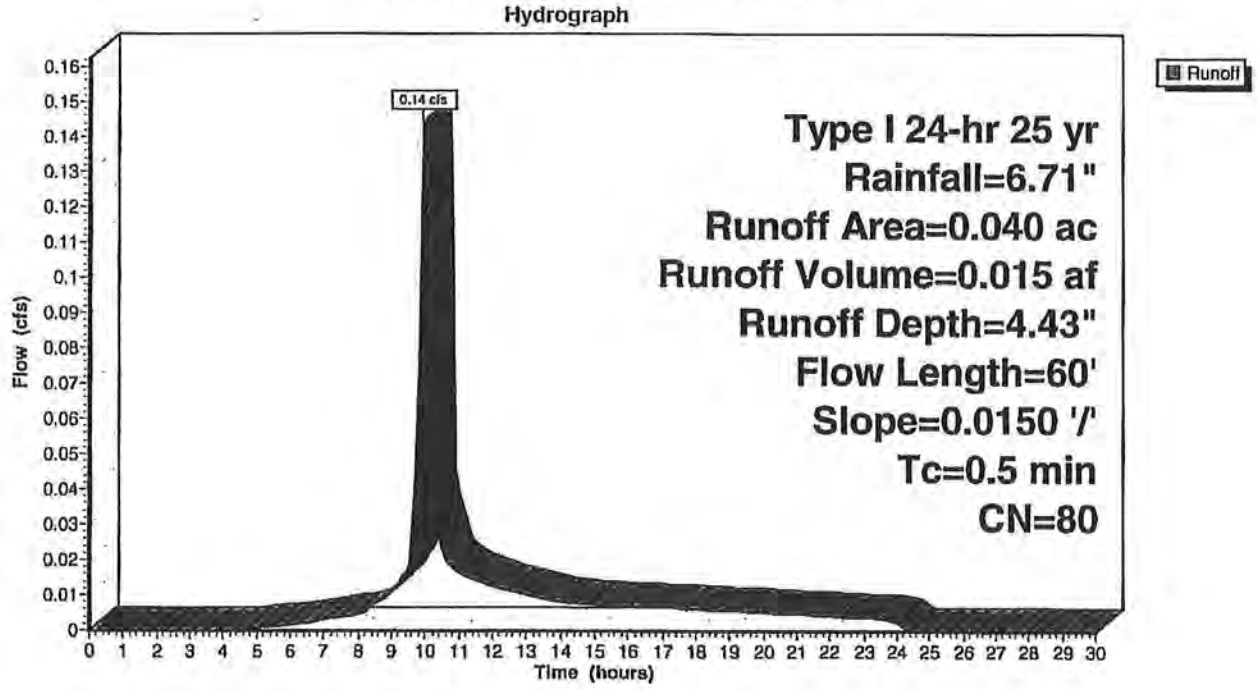
Runoff = 0.14 cfs @ 9.93 hrs, Volume= 0.015 af, Depth= 4.43"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.040	80	>75% Grass cover, Good, HSG D
0.040		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	60	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps

Subcatchment 23S: Proposed Area 15



Subcatchment 24S: Proposed Area 16

[49] Hint: Tc<2dt may require smaller dt

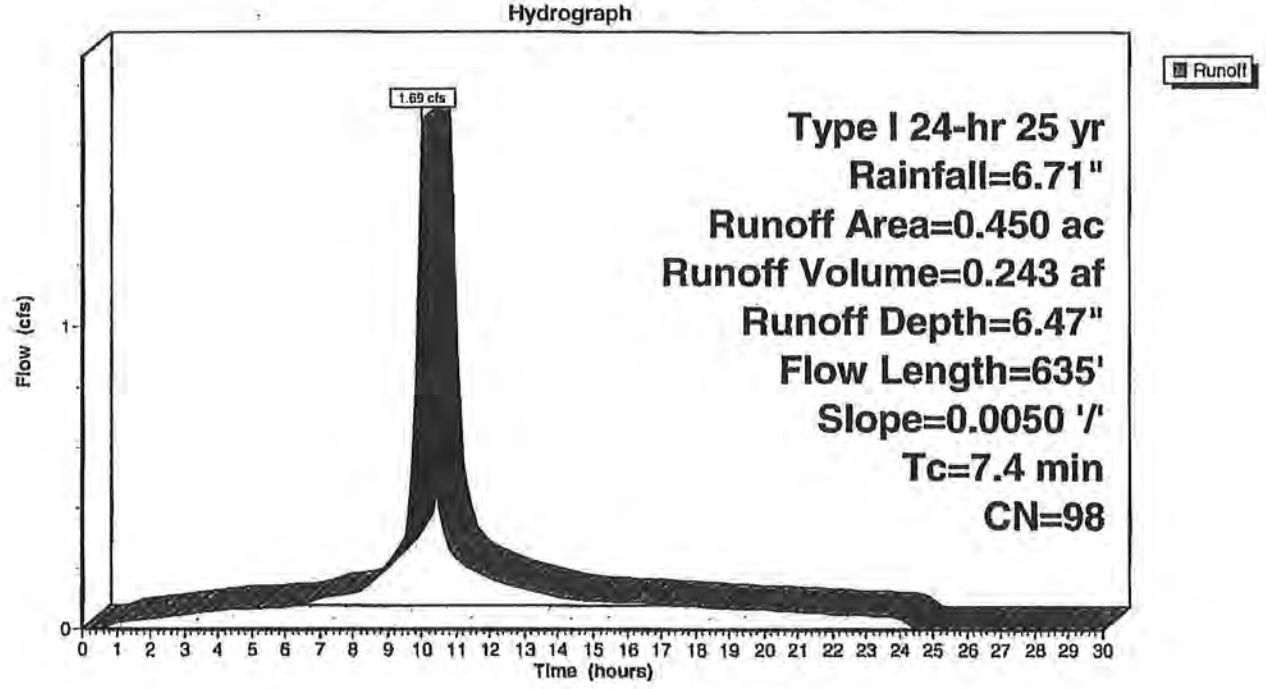
Runoff = 1.69 cfs @ 10.00 hrs, Volume= 0.243 af, Depth= 6.47"

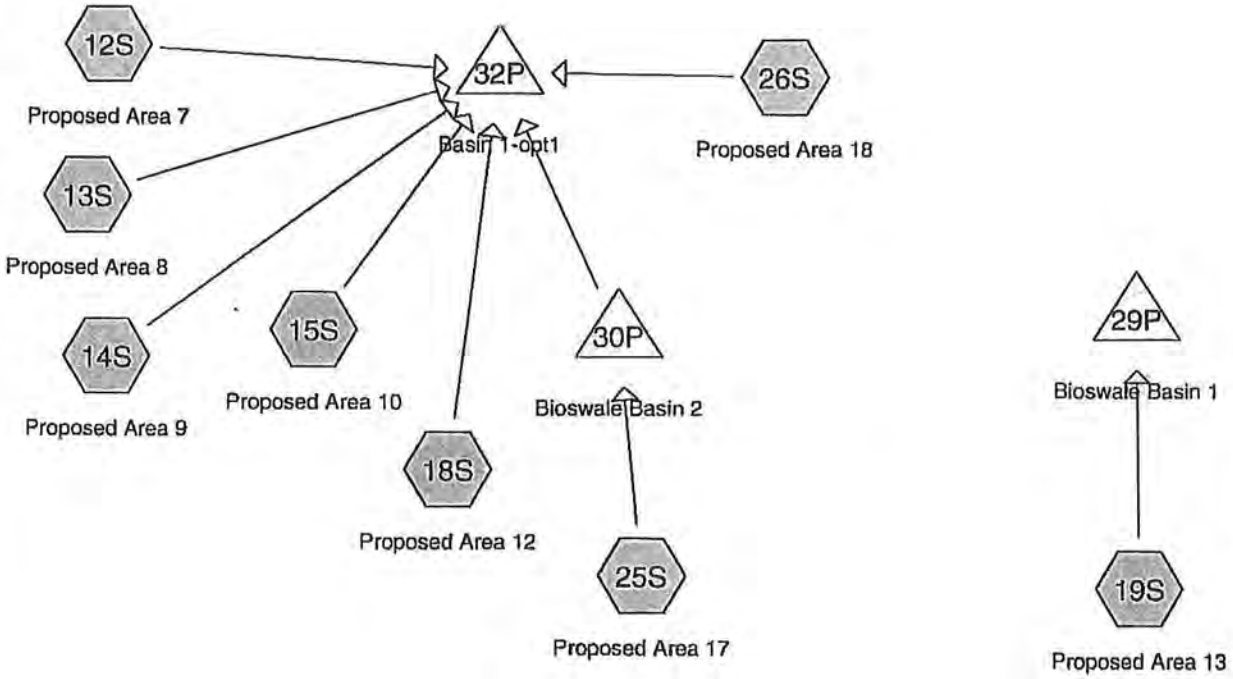
Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.450	98	Paved roads w/curbs & sewers
0.450		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	635	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 24S: Proposed Area 16





Subcat Reach Pond Link

Drainage Diagram for Residence-Pro-2
Prepared by Penfield & Smith 7/24/2008

Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
0.865	80	>75% Grass cover, Good, HSG D (13S,14S,15S,19S,25S,26S)
1.730	95	Urban commercial, 85% imp, HSG D (12S,13S,15S,18S,19S,25S)
0.265	98	Paved parking & roofs (14S,26S)
2.860		

Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SBUH method
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 12S: Proposed Area 7 Runoff Area=0.660 ac Runoff Depth=4.03"
Flow Length=275' Slope=0.0100 '/' Tc=1.1 min CN=95 Runoff=2.04 cfs 0.222 af

Subcatchment 13S: Proposed Area 8 Runoff Area=0.340 ac Runoff Depth=3.50"
Flow Length=149' Tc=1.3 min CN=90 Runoff=0.93 cfs 0.099 af

Subcatchment 14S: Proposed Area 9 Runoff Area=0.170 ac Runoff Depth=3.40"
Flow Length=113' Slope=0.0200 '/' Tc=2.4 min CN=89 Runoff=0.44 cfs 0.048 af

Subcatchment 15S: Proposed Area 10 Runoff Area=0.320 ac Runoff Depth=2.92"
Flow Length=164' Tc=0.7 min CN=84 Runoff=0.75 cfs 0.078 af

Subcatchment 18S: Proposed Area 12 Runoff Area=0.320 ac Runoff Depth=4.03"
Flow Length=136' Slope=0.0500 '/' Tc=0.5 min CN=95 Runoff=1.03 cfs 0.108 af

Subcatchment 19S: Proposed Area 13 Runoff Area=0.530 ac Runoff Depth=3.40"
Flow Length=203' Tc=1.3 min CN=89 Runoff=1.41 cfs 0.150 af

Subcatchment 25S: Proposed Area 17 Runoff Area=0.210 ac Runoff Depth=3.40"
Flow Length=146' Tc=2.0 min CN=89 Runoff=0.55 cfs 0.060 af

Subcatchment 26S: Proposed Area 18 Runoff Area=0.310 ac Runoff Depth=3.50"
Flow Length=135' Slope=0.0200 '/' Tc=2.8 min CN=90 Runoff=0.81 cfs 0.090 af

Pond 29P: Bioswale Basin 1 Peak Elev=14.54' Storage=919 cf Inflow=1.41 cfs 0.150 af
Outflow=0.71 cfs 0.148 af

Pond 30P: Bioswale Basin 2 Peak Elev=13.77' Storage=26 cf Inflow=0.55 cfs 0.060 af
Outflow=0.56 cfs 0.059 af

Pond 32P: Basin 1-opt1 Peak Elev=11.77' Storage=4,289 cf Inflow=6.44 cfs 0.705 af
Outflow=3.74 cfs 0.679 af

Total Runoff Area = 2.860 ac Runoff Volume = 0.855 af Average Runoff Depth = 3.59"
39.32% Pervious Area = 1.125 ac 60.68% Impervious Area = 1.736 ac

Subcatchment 12S: Proposed Area 7

[49] Hint: Tc<2dt may require smaller dt

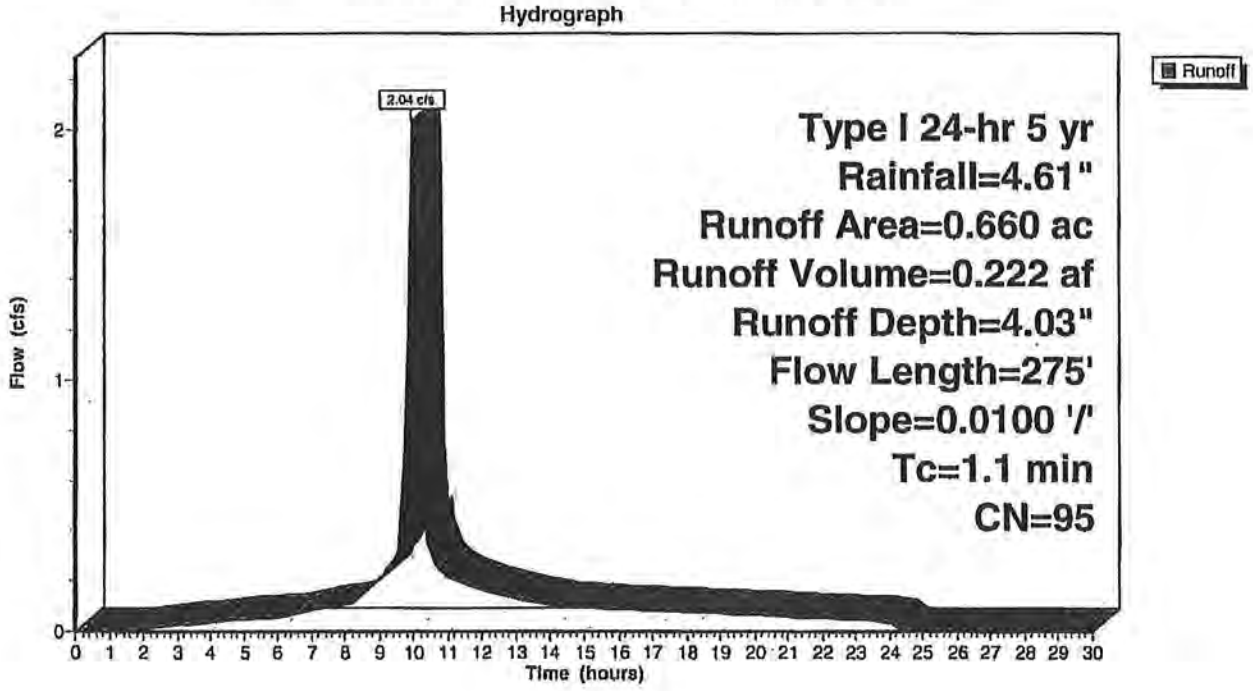
Runoff = 2.04 cfs @ 9.93 hrs, Volume= 0.222 af, Depth= 4.03"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.660	95	Urban commercial, 85% imp, HSG D
0.099		Pervious Area
0.561		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	275	0.0100	4.09	1.43	**Circular Channel (pipe),** Diam= 8.0" Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.011 PVC, smooth interior

Subcatchment 12S: Proposed Area 7



Subcatchment 13S: Proposed Area 8

[49] Hint: Tc<2dt may require smaller dt

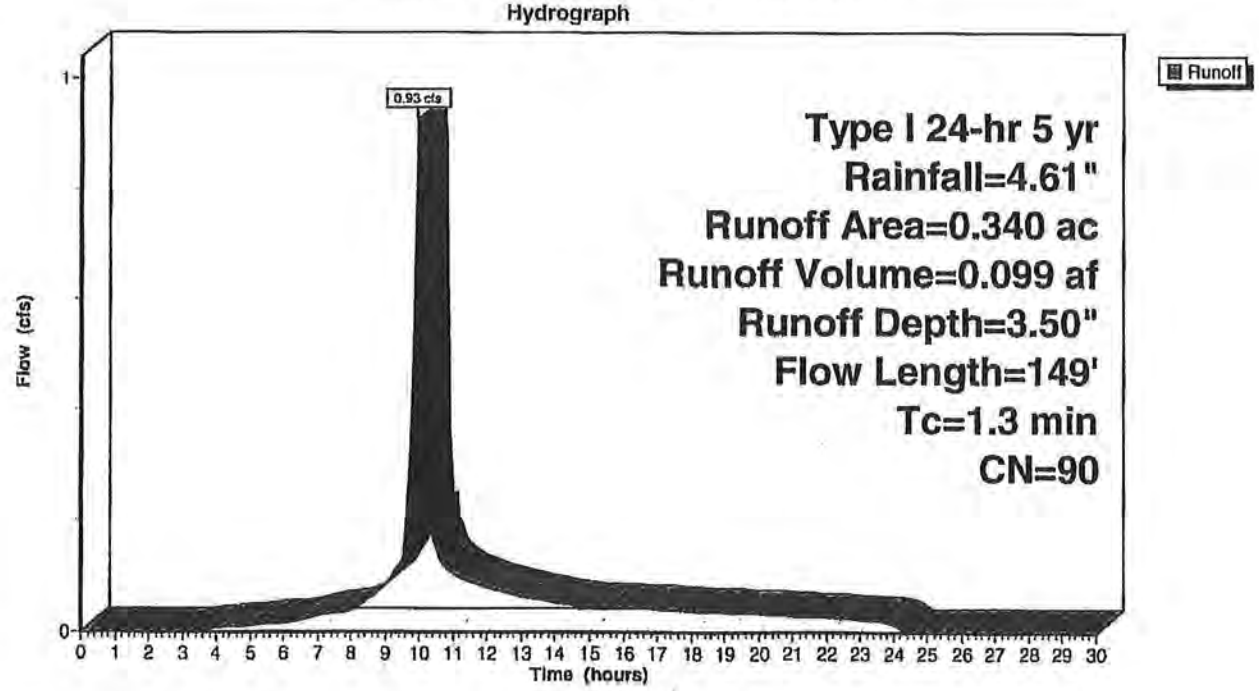
Runoff = 0.93 cfs @ 9.94 hrs, Volume= 0.099 af, Depth= 3.50"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.120	80	>75% Grass cover, Good, HSG D
0.220	95	Urban commercial, 85% imp, HSG D
0.340	90	Weighted Average
0.153		Pervious Area
0.187		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	79	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	70	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.3	149	Total			

Subcatchment 13S: Proposed Area 8



Subcatchment 14S: Proposed Area 9

[49] Hint: Tc<2dt may require smaller dt

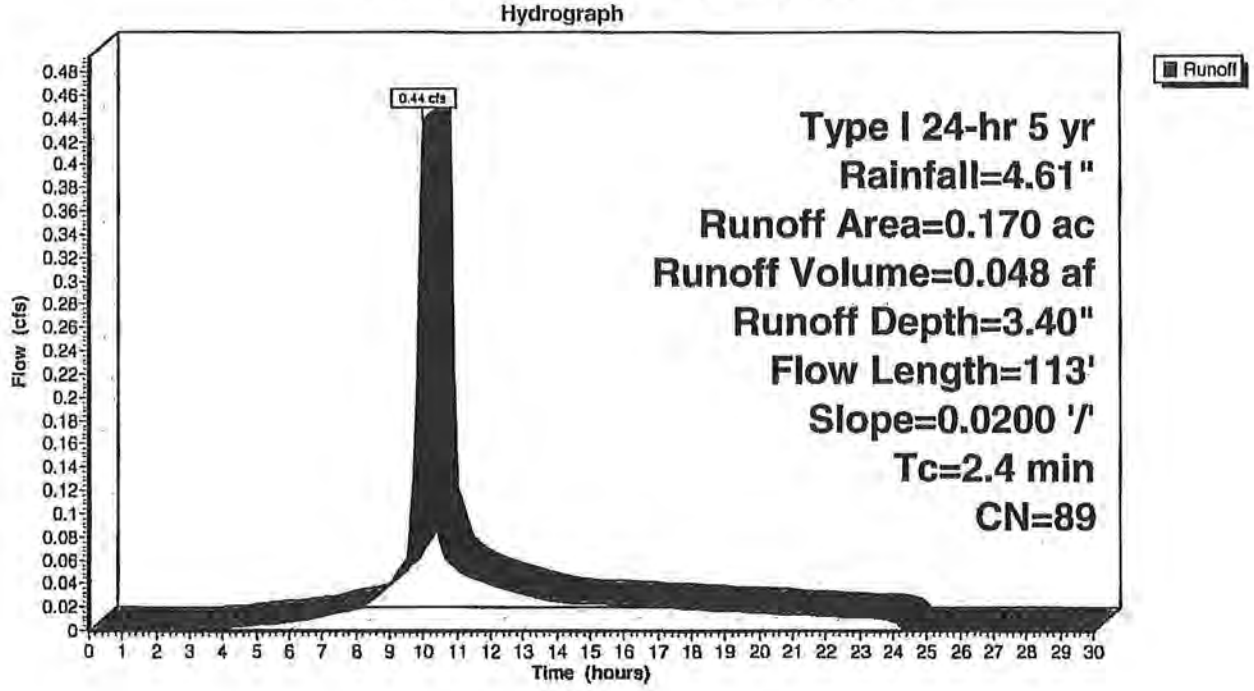
Runoff = 0.44 cfs @ 9.96 hrs, Volume= 0.048 af, Depth= 3.40"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.085	80	>75% Grass cover, Good, HSG D
0.085	98	Paved parking & roofs
0.170	89	Weighted Average
0.085		Pervious Area
0.085		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	113	0.0200	0.79		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 14S: Proposed Area 9



Subcatchment 15S: Proposed Area 10

[49] Hint: Tc<2dt may require smaller dt

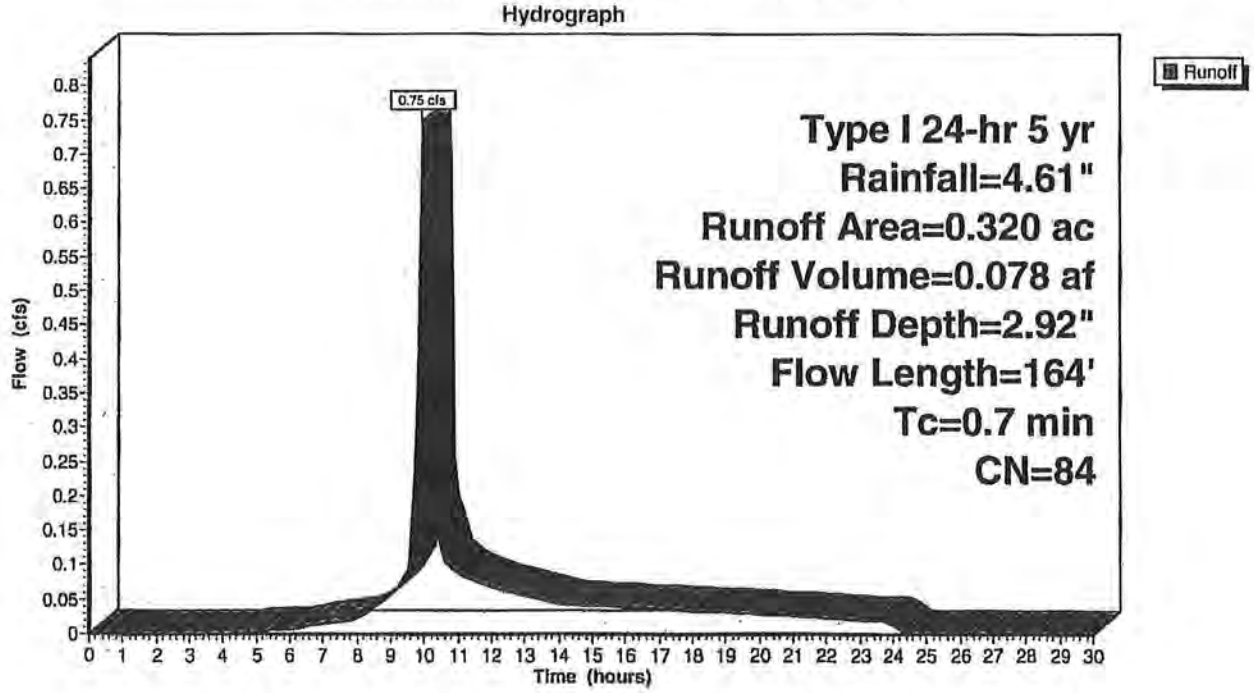
Runoff = 0.75 cfs @ 9.93 hrs, Volume= 0.078 af, Depth= 2.92"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.230	80	>75% Grass cover, Good, HSG D
0.090	95	Urban commercial, 85% imp, HSG D
0.320	84	Weighted Average
0.243		Pervious Area
0.077		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	130	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	34	0.1090	4.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.7	164	Total			

Subcatchment 15S: Proposed Area 10



Subcatchment 18S: Proposed Area 12

[49] Hint: Tc<2dt may require smaller dt

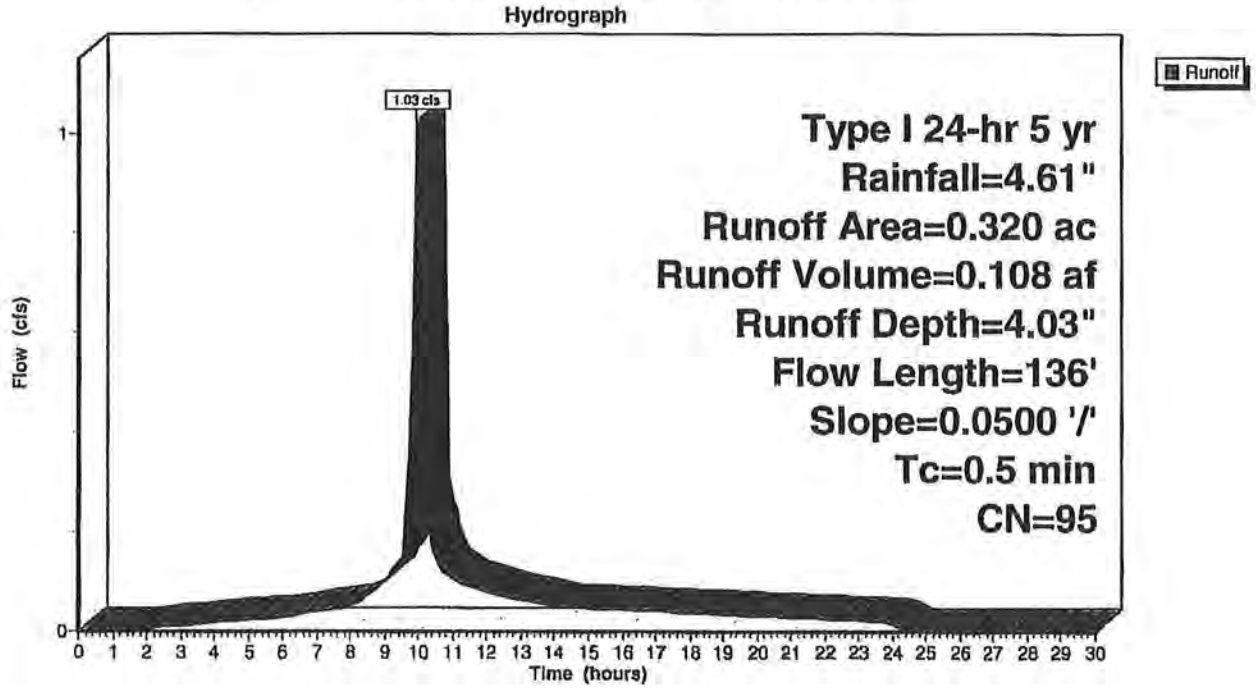
Runoff = 1.03 cfs @ 9.92 hrs, Volume= 0.108 af, Depth= 4.03"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.320	95	Urban commercial, 85% imp, HSG D
0.048		Pervious Area
0.272		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	136	0.0500	4.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 18S: Proposed Area 12



Subcatchment 19S: Proposed Area 13

[49] Hint: Tc<2dt may require smaller dt

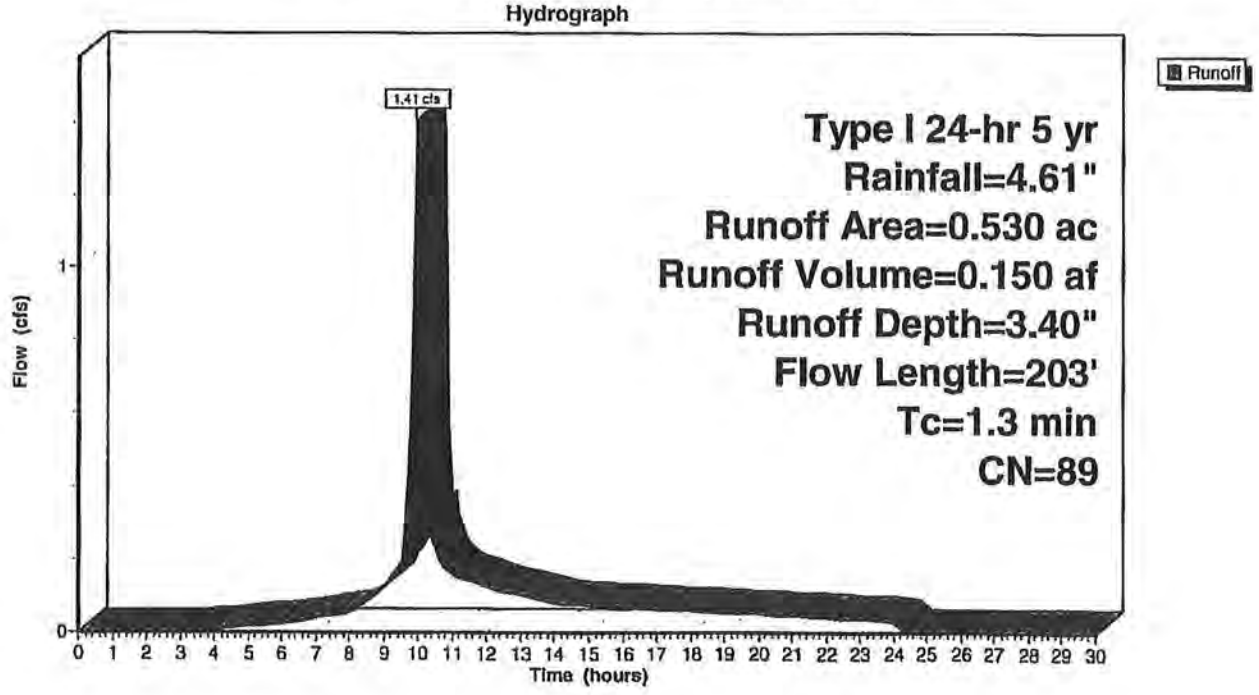
Runoff = 1.41 cfs @ 9.94 hrs, Volume= 0.150 af, Depth= 3.40"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.220	80	>75% Grass cover, Good, HSG D
0.310	95	Urban commercial, 85% imp, HSG D
0.530	89	Weighted Average
0.267		Pervious Area
0.263		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	107	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	96	0.0210	2.17		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.3	203	Total			

Subcatchment 19S: Proposed Area 13



Subcatchment 25S: Proposed Area 17

[49] Hint: Tc<2dt may require smaller dt

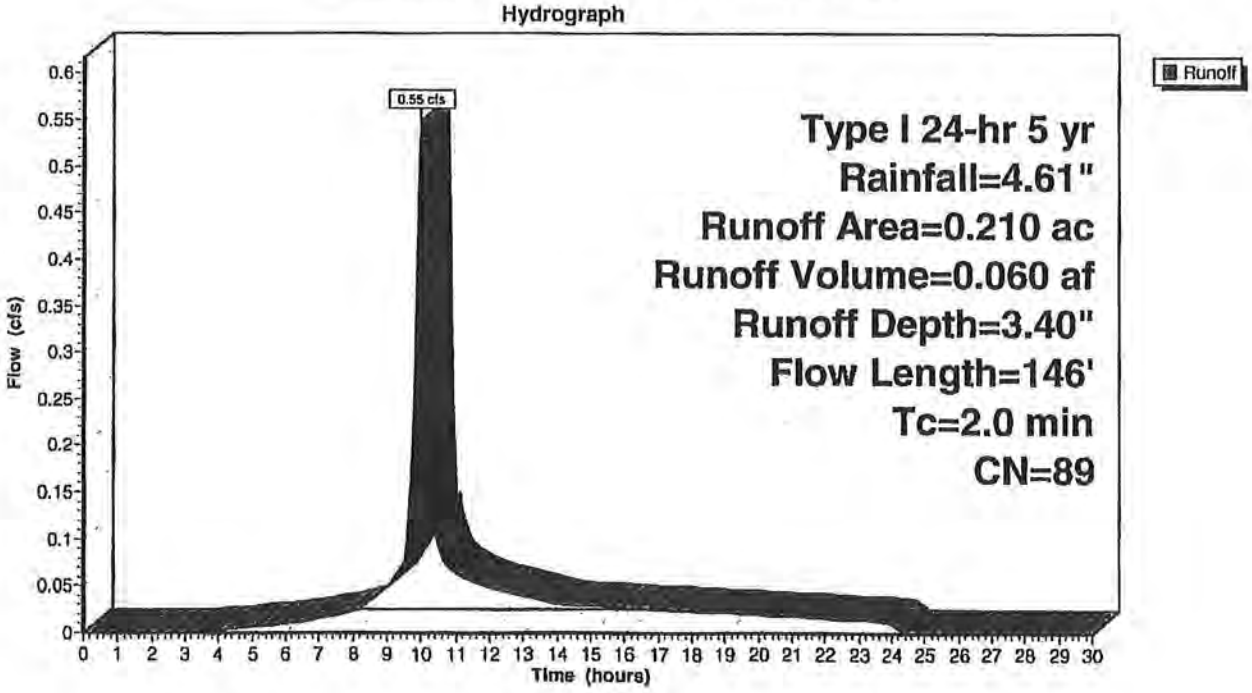
Runoff = 0.55 cfs @ 9.96 hrs, Volume= 0.060 af, Depth= 3.40"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.130	95	Urban commercial, 85% imp, HSG D
0.080	80	>75% Grass cover, Good, HSG D
0.210	89	Weighted Average
0.100		Pervious Area
0.111		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	56	0.0200	0.68		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
0.6	90	0.0250	2.37		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
2.0	146	Total			

Subcatchment 25S: Proposed Area 17



Subcatchment 26S: Proposed Area 18

[49] Hint: Tc<2dt may require smaller dt

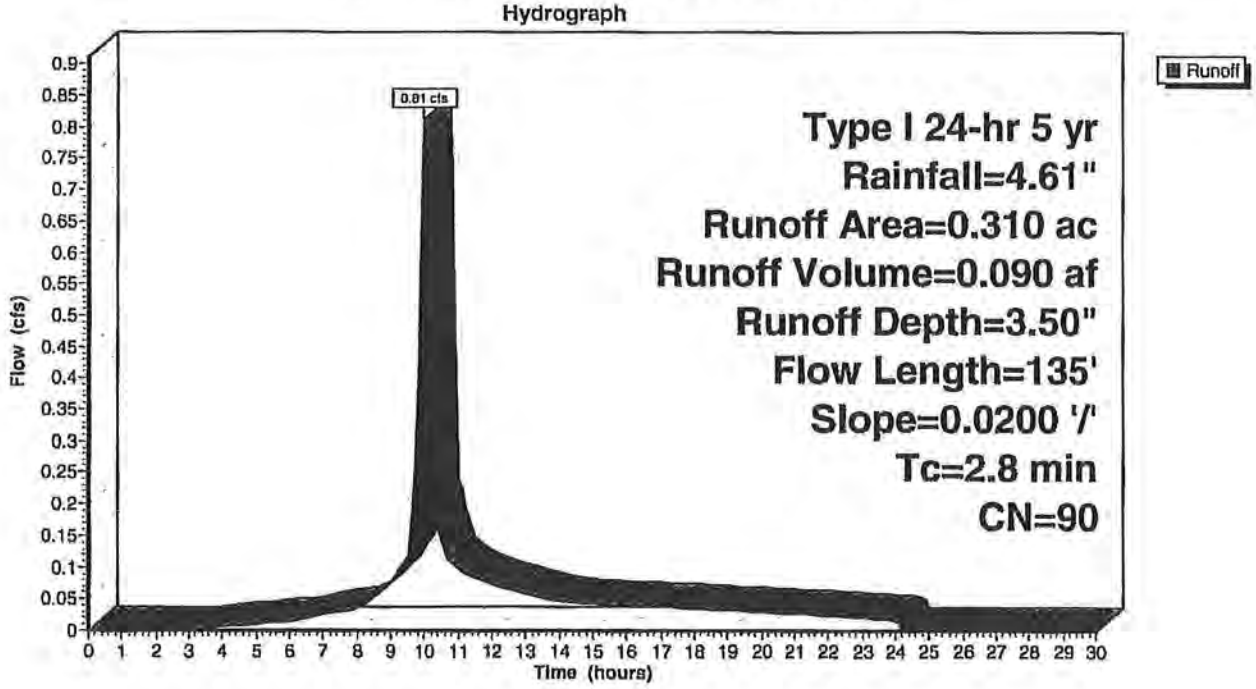
Runoff = 0.81 cfs @ 9.97 hrs, Volume= 0.090 af, Depth= 3.50"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 5 yr Rainfall=4.61"

Area (ac)	CN	Description
0.130	80	>75% Grass cover, Good, HSG D
0.180	98	Paved parking & roofs
0.310	90	Weighted Average
0.130		Pervious Area
0.180		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	135	0.0200	0.82		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 26S: Proposed Area 18



Pond 29P: Bioswale Basin 1

Inflow Area = 0.530 ac, Inflow Depth = 3.40" for 5 yr event
Inflow = 1.41 cfs @ 9.94 hrs, Volume= 0.150 af
Outflow = 0.71 cfs @ 10.09 hrs, Volume= 0.148 af, Atten= 50%, Lag= 8.9 min
Primary = 0.71 cfs @ 10.09 hrs, Volume= 0.148 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Peak Elev= 14.54' @ 10.09 hrs Surf.Area= 2,045 sf Storage= 919 cf

Plug-Flow detention time= 47.6 min calculated for 0.148 af (99% of inflow)
Center-of-Mass det. time= 37.9 min (794.0 - 756.1)

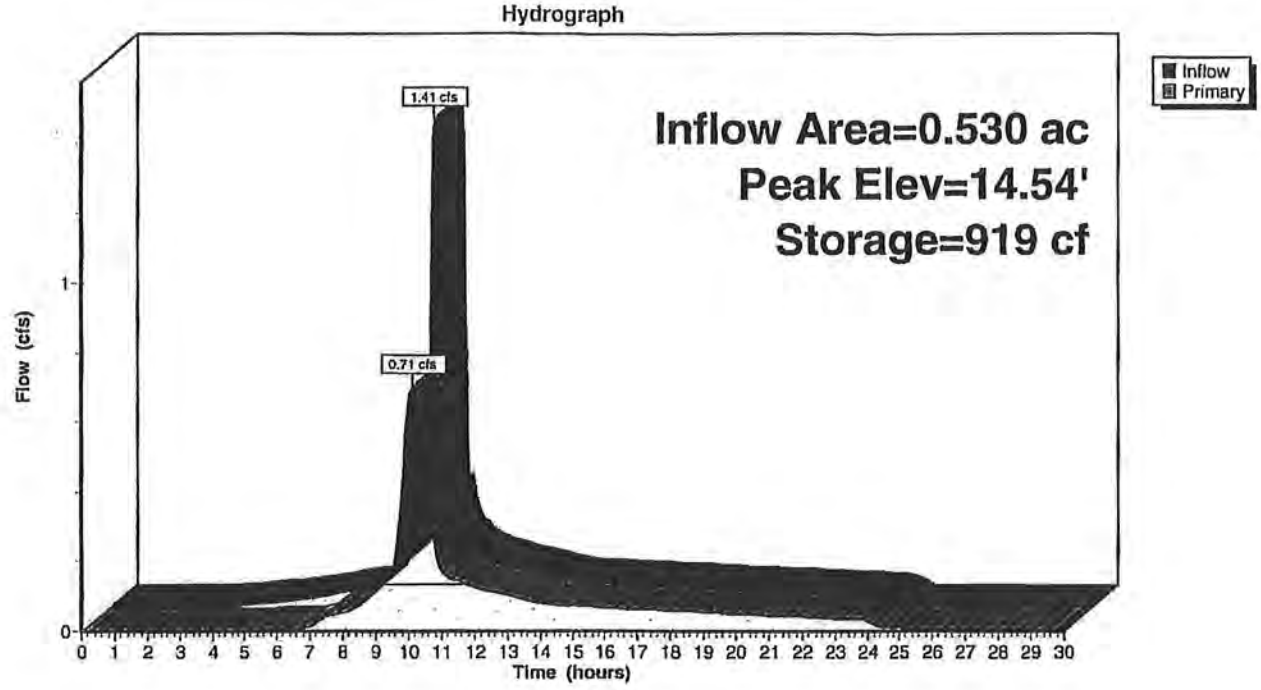
Volume	Invert	Avail.Storage	Storage Description
#1	13.27'	2,148 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.27	9	0	0
14.00	572	212	212
15.00	3,300	1,936	2,148

Device	Routing	Invert	Outlet Devices
#1	Primary	13.50'	**0.5" Vert. Orifice/Grate** C= 0.600
#2	Primary	13.75'	**0.5" Vert. Orifice/Grate** C= 0.600
#3	Primary	14.00'	**6.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=0.70 cfs @ 10.09 hrs HW=14.54' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.01 cfs @ 4.85 fps)
- **2=Orifice/Grate** (Orifice Controls 0.01 cfs @ 4.21 fps)
- **3=Orifice/Grate** (Orifice Controls 0.69 cfs @ 3.53 fps)

Pond 29P: Bioswale Basin 1



Pond 30P: Bioswale Basin 2

[88] Warning: Qout>Qin may require Finer Routing>1

Inflow Area = 0.210 ac, Inflow Depth = 3.40" for 5 yr event
Inflow = 0.55 cfs @ 9.96 hrs, Volume= 0.060 af
Outflow = 0.56 cfs @ 9.98 hrs, Volume= 0.059 af, Atten= 0%, Lag= 1.2 min
Primary = 0.56 cfs @ 9.98 hrs, Volume= 0.059 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Peak Elev= 13.77' @ 9.97 hrs Surf.Area= 115 sf Storage= 26 cf

Plug-Flow detention time= 1.8 min calculated for 0.059 af (100% of inflow)
Center-of-Mass det. time= 1.0 min (757.8 - 756.8)

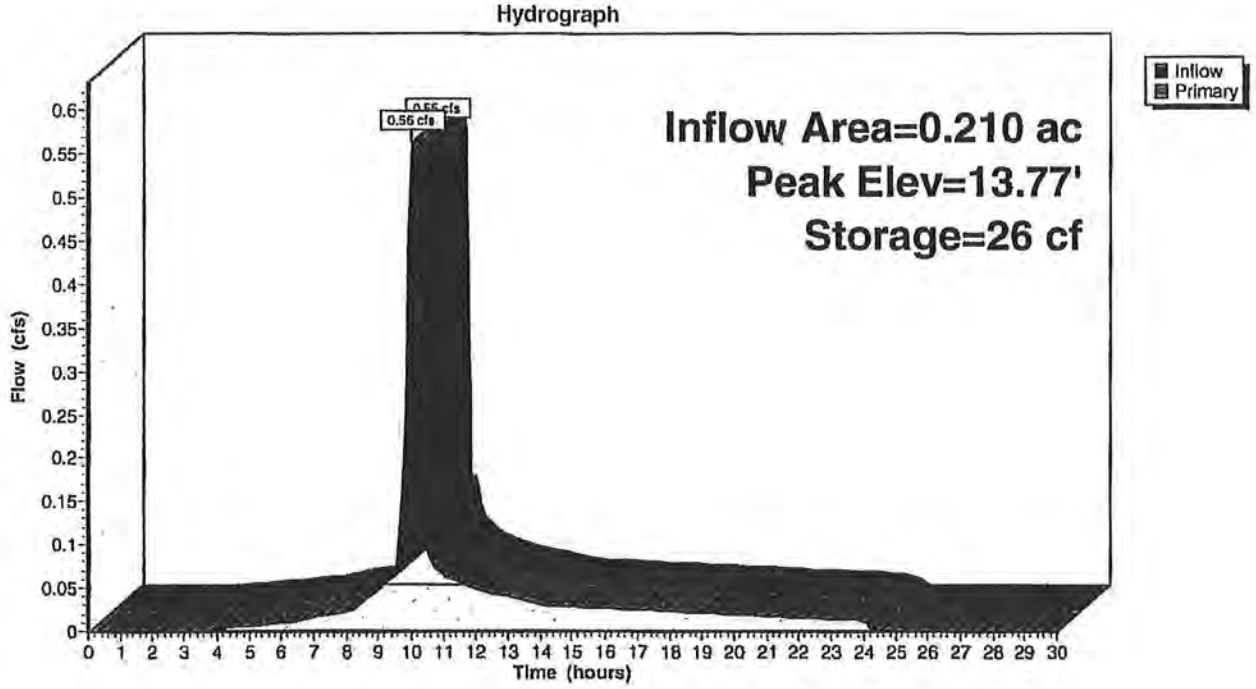
Volume	Invert	Avail.Storage	Storage Description
#1	13.35'	57 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.35	9	0	0
13.85	136	36	36
14.00	136	20	57

Device	Routing	Invert	Outlet Devices
#1	Primary	13.40'	**1.5" Vert. Orifice/Grate X 7.00** C= 0.600
#2	Primary	13.50'	**1.5" Vert. Orifice/Grate X 7.00** C= 0.600
#3	Primary	13.70'	**12.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=0.53 cfs @ 9.98 hrs HW=13.75' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.22 cfs @ 2.59 fps)
- **2=Orifice/Grate** (Orifice Controls 0.18 cfs @ 2.10 fps)
- **3=Orifice/Grate** (Weir Controls 0.13 cfs @ 0.75 fps)

Pond 30P: Bioswale Basin 2



Pond 32P: Basin 1-opt1

Inflow Area = 2.330 ac, Inflow Depth = 3.63" for 5 yr event
Inflow = 6.44 cfs @ 9.94 hrs, Volume= 0.705 af
Outflow = 3.74 cfs @ 10.07 hrs, Volume= 0.679 af, Atten= 42%, Lag= 7.8 min
Primary = 3.74 cfs @ 10.07 hrs, Volume= 0.679 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Peak Elev= 11.77' @ 10.07 hrs Surf.Area= 3,896 sf Storage= 4,289 cf

Plug-Flow detention time= 62.2 min calculated for 0.676 af (96% of inflow)
Center-of-Mass det. time= 39.0 min (779.5 - 740.4)

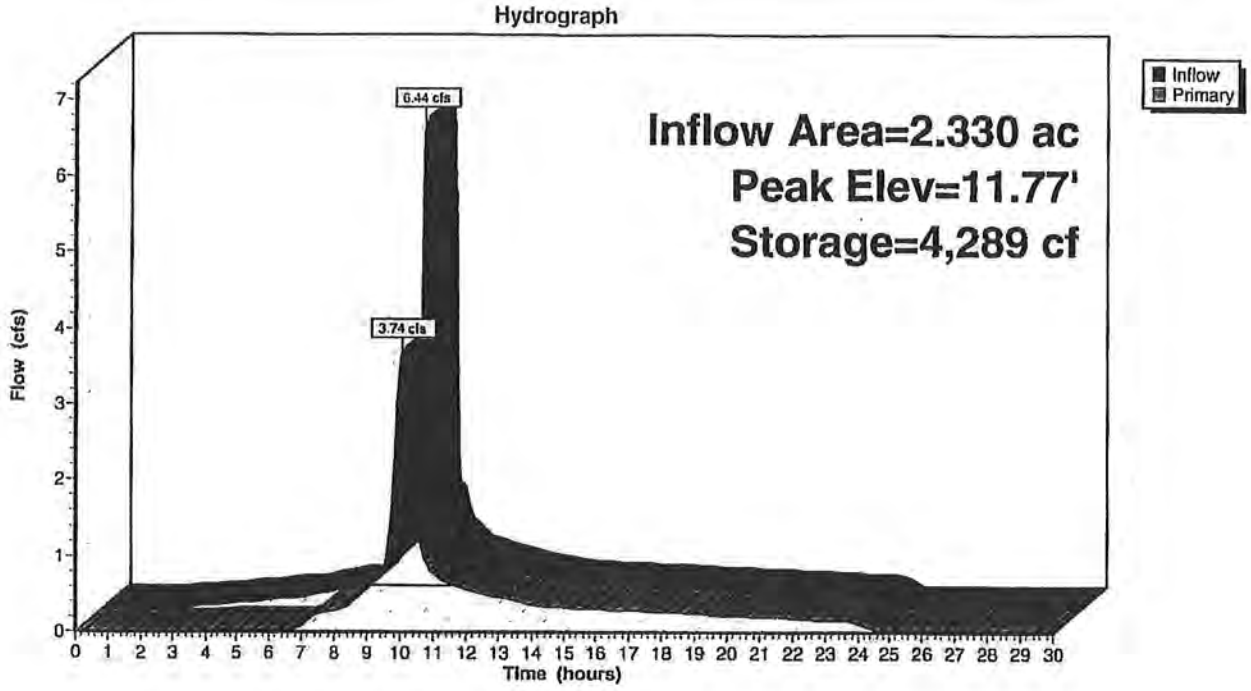
Volume	Invert	Avail.Storage	Storage Description
#1	9.30'	7,686 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.30	9	0	0
10.00	758	268	268
11.00	2,436	1,597	1,865
12.00	4,343	3,390	5,255
12.50	5,381	2,431	7,686

Device	Routing	Invert	Outlet Devices
#1	Primary	9.30'	**1.0" x 19.0' long Culvert** RCP, rounded edge headwall, Ke= 0.100 Outlet Invert= 9.11' S= 0.0100 '/' Cc= 0.900 n= 0.011 PVC, smooth interior
#2	Primary	10.80'	**12.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=3.69 cfs @ 10.07 hrs HW=11.74' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.02 cfs @ 3.58 fps)
└—**2=Orifice/Grate** (Orifice Controls 3.67 cfs @ 4.68 fps)

Pond 32P: Basin 1-opt1



Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SBUH method
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 12S: Proposed Area 7 Runoff Area=0.660 ac Runoff Depth=4.97"
Flow Length=275' Slope=0.0100 '/' Tc=1.1 min CN=95 Runoff=2.49 cfs 0.273 af

Subcatchment 13S: Proposed Area 8 Runoff Area=0.340 ac Runoff Depth=4.41"
Flow Length=149' Tc=1.3 min CN=90 Runoff=1.16 cfs 0.125 af

Subcatchment 14S: Proposed Area 9 Runoff Area=0.170 ac Runoff Depth=4.30"
Flow Length=113' Slope=0.0200 '/' Tc=2.4 min CN=89 Runoff=0.55 cfs 0.061 af

Subcatchment 15S: Proposed Area 10 Runoff Area=0.320 ac Runoff Depth=3.78"
Flow Length=164' Tc=0.7 min CN=84 Runoff=0.98 cfs 0.101 af

Subcatchment 18S: Proposed Area 12 Runoff Area=0.320 ac Runoff Depth=4.97"
Flow Length=136' Slope=0.0500 '/' Tc=0.5 min CN=95 Runoff=1.25 cfs 0.132 af

Subcatchment 19S: Proposed Area 13 Runoff Area=0.530 ac Runoff Depth=4.30"
Flow Length=203' Tc=1.3 min CN=89 Runoff=1.77 cfs 0.190 af

Subcatchment 25S: Proposed Area 17 Runoff Area=0.210 ac Runoff Depth=4.30"
Flow Length=146' Tc=2.0 min CN=89 Runoff=0.69 cfs 0.075 af

Subcatchment 26S: Proposed Area 18 Runoff Area=0.310 ac Runoff Depth=4.41"
Flow Length=135' Slope=0.0200 '/' Tc=2.8 min CN=90 Runoff=1.02 cfs 0.114 af

Pond 29P: Bioswale Basin 1 Peak Elev=14.67' Storage=1,215 cf Inflow=1.77 cfs 0.190 af
Outflow=0.79 cfs 0.188 af

Pond 30P: Bioswale Basin 2 Peak Elev=13.79' Storage=29 cf Inflow=0.69 cfs 0.075 af
Outflow=0.70 cfs 0.075 af

Pond 32P: Basin 1-opt1 Peak Elev=12.04' Storage=5,412 cf Inflow=8.03 cfs 0.881 af
Outflow=4.22 cfs 0.855 af

Total Runoff Area = 2.860 ac Runoff Volume = 1.071 af Average Runoff Depth = 4.49"
39.32% Pervious Area = 1.125 ac 60.68% Impervious Area = 1.736 ac

Subcatchment 12S: Proposed Area 7

[49] Hint: Tc<2dt may require smaller dt

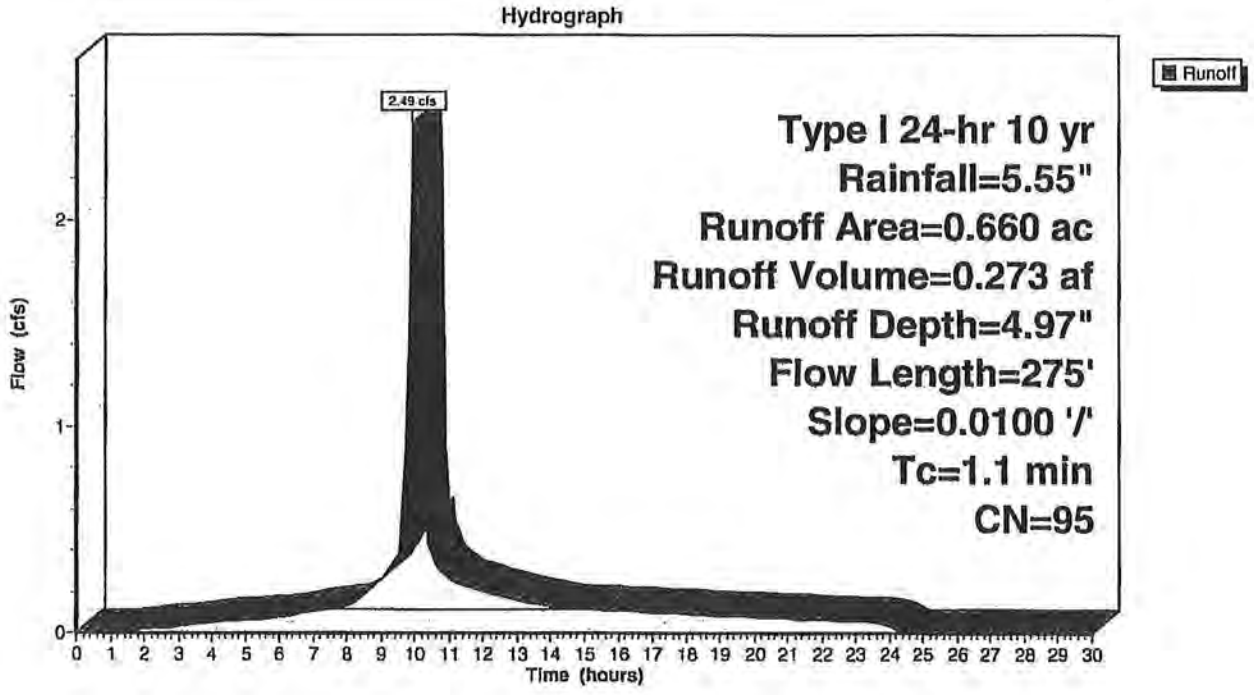
Runoff = 2.49 cfs @ 9.93 hrs, Volume= 0.273 af, Depth= 4.97"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.660	95	Urban commercial, 85% imp, HSG D
0.099		Pervious Area
0.561		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	275	0.0100	4.09	1.43	**Circular Channel (pipe),** Diam= 8.0" Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.011 PVC, smooth interior

Subcatchment 12S: Proposed Area 7



Subcatchment 13S: Proposed Area 8

[49] Hint: Tc<2dt may require smaller dt

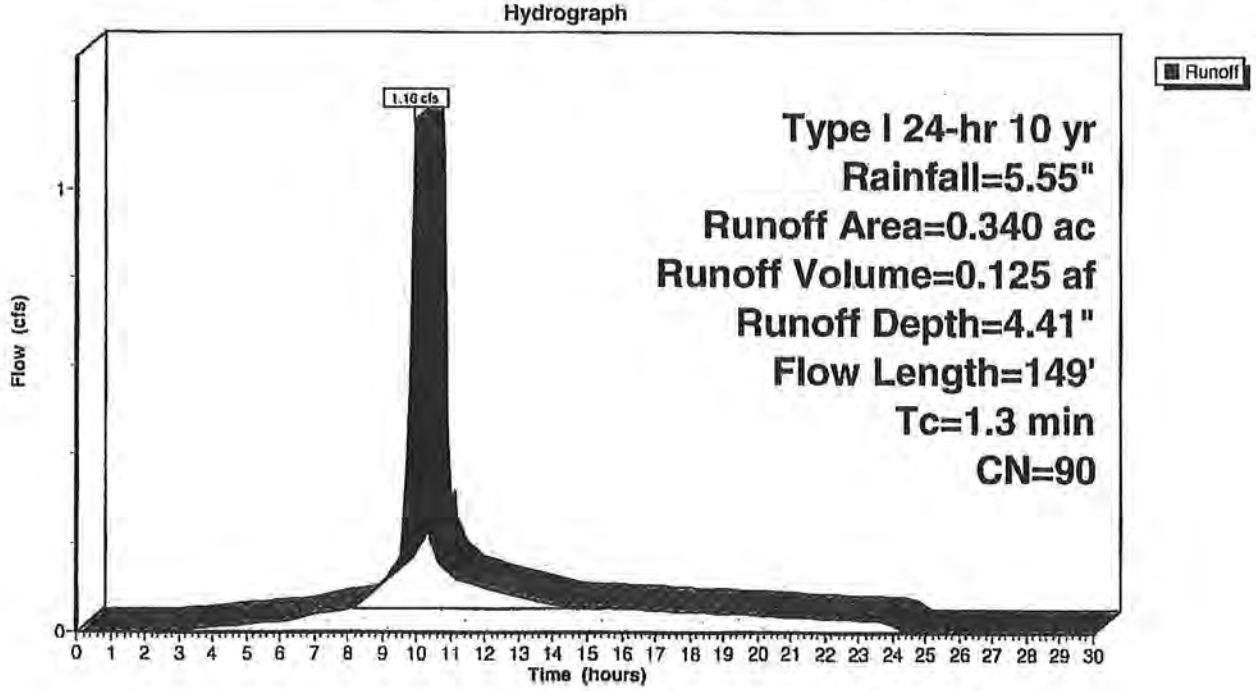
Runoff = 1.16 cfs @ 9.94 hrs, Volume= 0.125 af, Depth= 4.41"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.120	80	>75% Grass cover, Good, HSG D
0.220	95	Urban commercial, 85% imp, HSG D
0.340	90	Weighted Average
0.153		Pervious Area
0.187		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	79	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	70	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.3	149	Total			

Subcatchment 13S: Proposed Area 8



Subcatchment 14S: Proposed Area 9

[49] Hint: Tc<2dt may require smaller dt

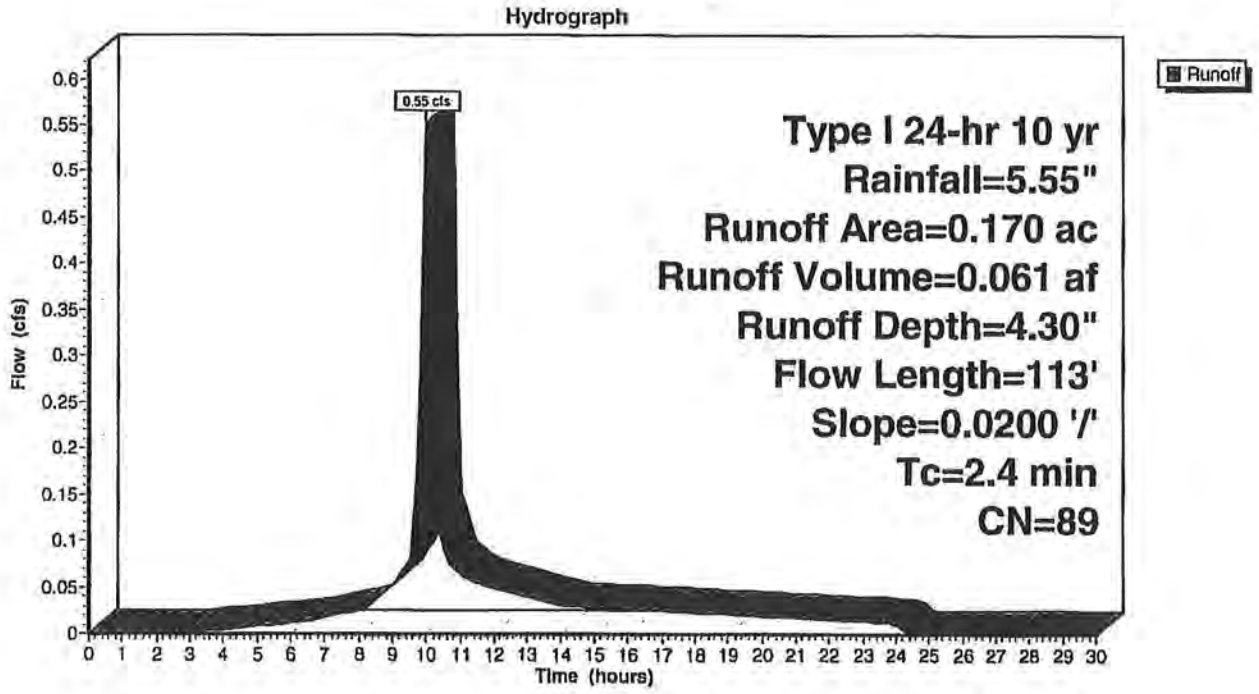
Runoff = 0.55 cfs @ 9.96 hrs, Volume= 0.061 af, Depth= 4.30"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.085	80	>75% Grass cover, Good, HSG D
0.085	98	Paved parking & roofs
0.170	89	Weighted Average
0.085		Pervious Area
0.085		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	113	0.0200	0.79		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 14S: Proposed Area 9



Subcatchment 15S: Proposed Area 10

[49] Hint: Tc<2dt may require smaller dt

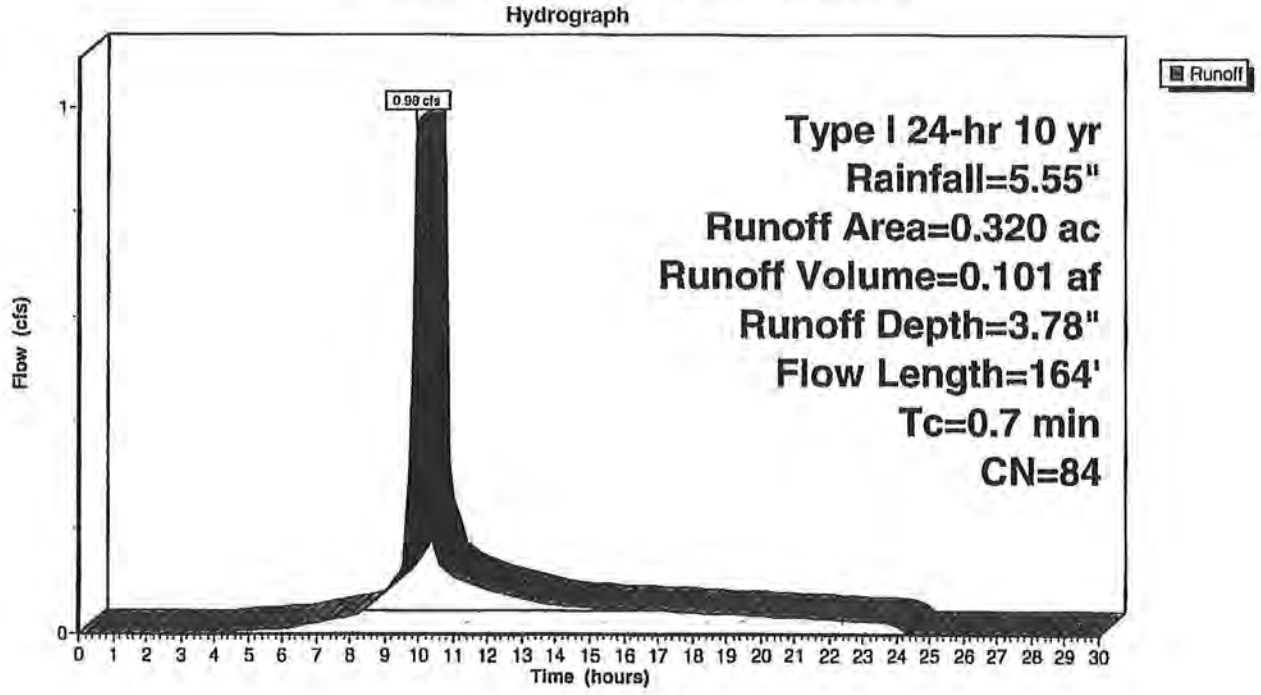
Runoff = 0.98 cfs @ 9.93 hrs, Volume= 0.101 af, Depth= 3.78"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.230	80	>75% Grass cover, Good, HSG D
0.090	95	Urban commercial, 85% imp, HSG D
0.320	84	Weighted Average
0.243		Pervious Area
0.077		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	130	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	34	0.1090	4.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.7	164	Total			

Subcatchment 15S: Proposed Area 10



Subcatchment 18S: Proposed Area 12

[49] Hint: Tc<2dt may require smaller dt

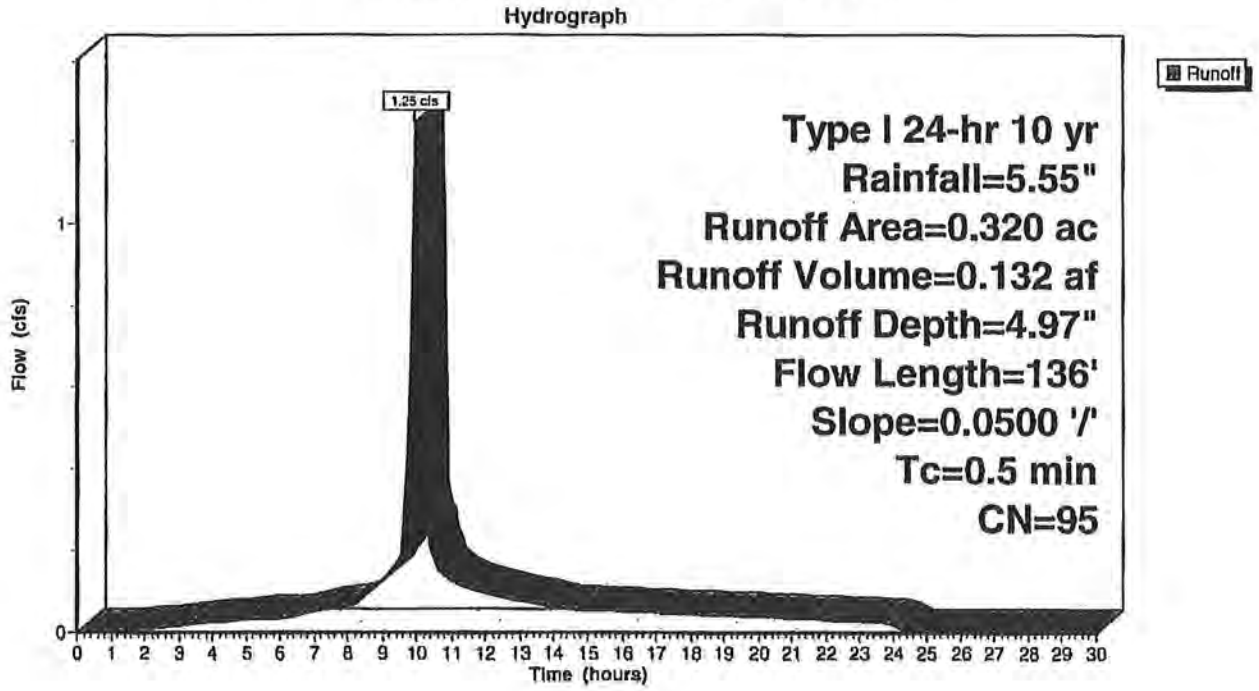
Runoff = 1.25 cfs @ 9.92 hrs, Volume= 0.132 af, Depth= 4.97"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.320	95	Urban commercial, 85% imp, HSG D
0.048		Pervious Area
0.272		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	136	0.0500	4.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 18S: Proposed Area 12



Subcatchment 19S: Proposed Area 13

[49] Hint: Tc<2dt may require smaller dt

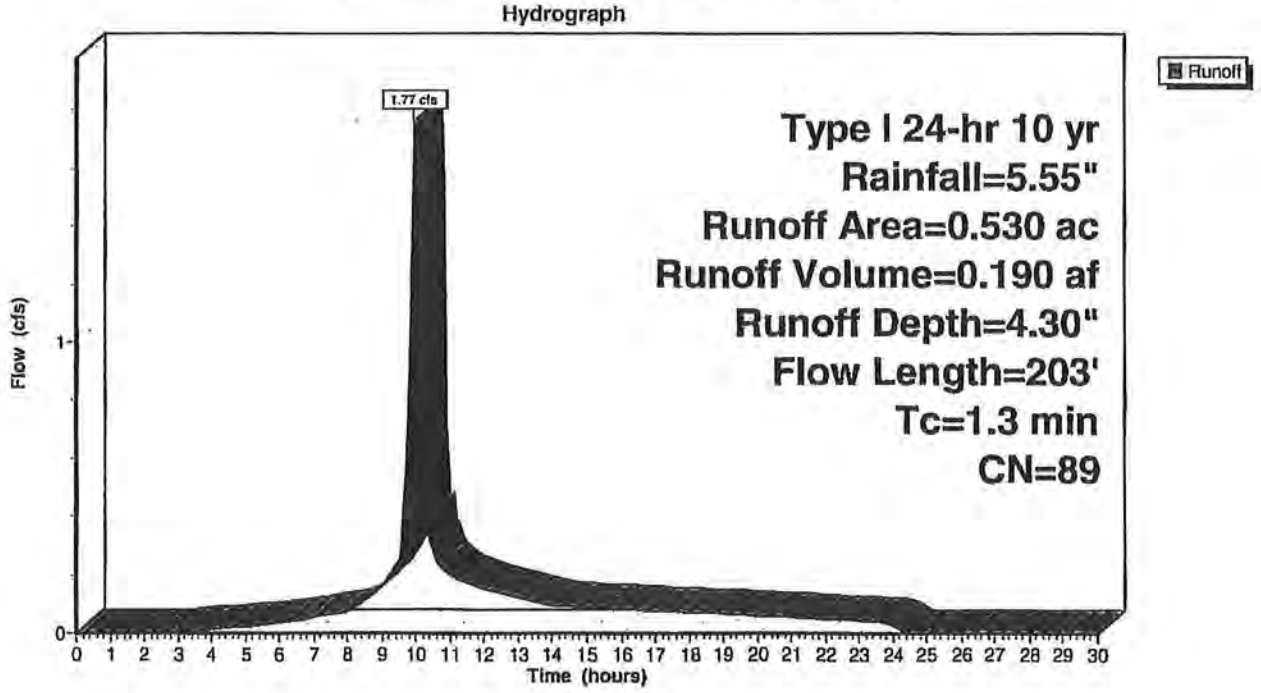
Runoff = 1.77 cfs @ 9.94 hrs, Volume= 0.190 af, Depth= 4.30"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.220	80	>75% Grass cover, Good, HSG D
0.310	95	Urban commercial, 85% imp, HSG D
0.530	89	Weighted Average
0.267		Pervious Area
0.263		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	107	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	96	0.0210	2.17		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.3	203	Total			

Subcatchment 19S: Proposed Area 13



Subcatchment 25S: Proposed Area 17

[49] Hint: Tc<2dt may require smaller dt

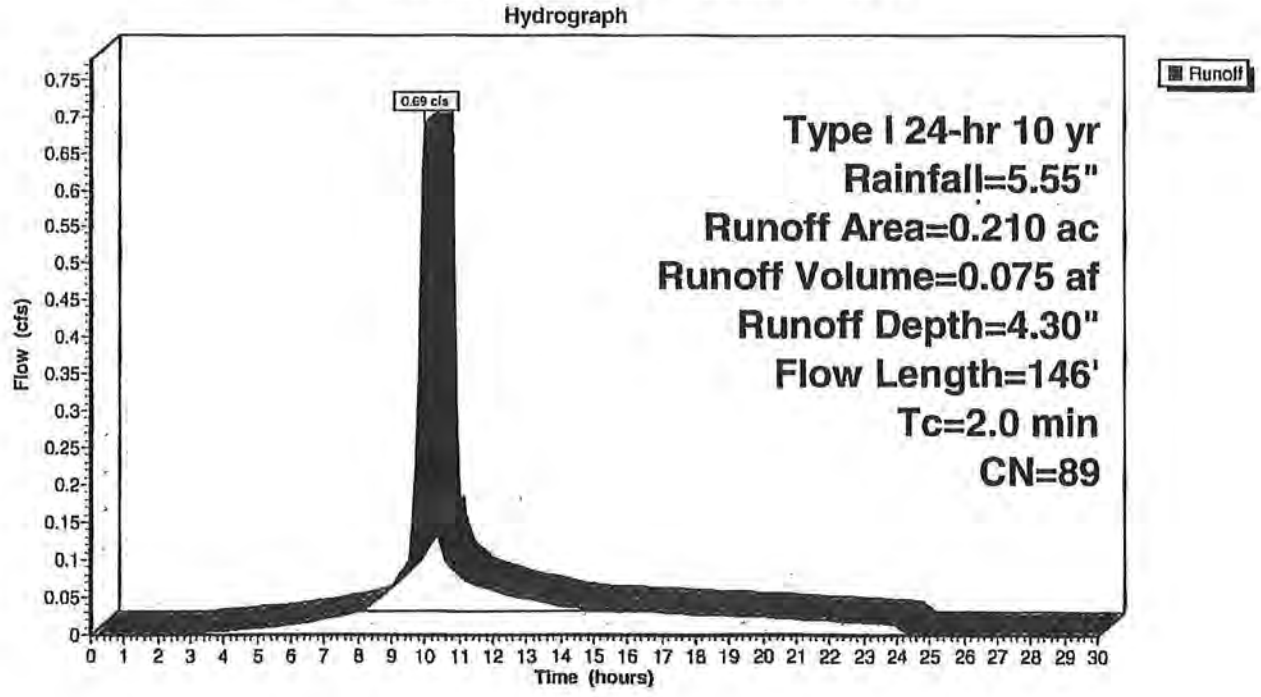
Runoff = 0.69 cfs @ 9.96 hrs, Volume= 0.075 af, Depth= 4.30"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.130	95	Urban commercial, 85% imp, HSG D
0.080	80	>75% Grass cover, Good, HSG D
0.210	89	Weighted Average
0.100		Pervious Area
0.111		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	56	0.0200	0.68		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
0.6	90	0.0250	2.37		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
2.0	146	Total			

Subcatchment 25S: Proposed Area 17



Subcatchment 26S: Proposed Area 18

[49] Hint: Tc<2dt may require smaller dt

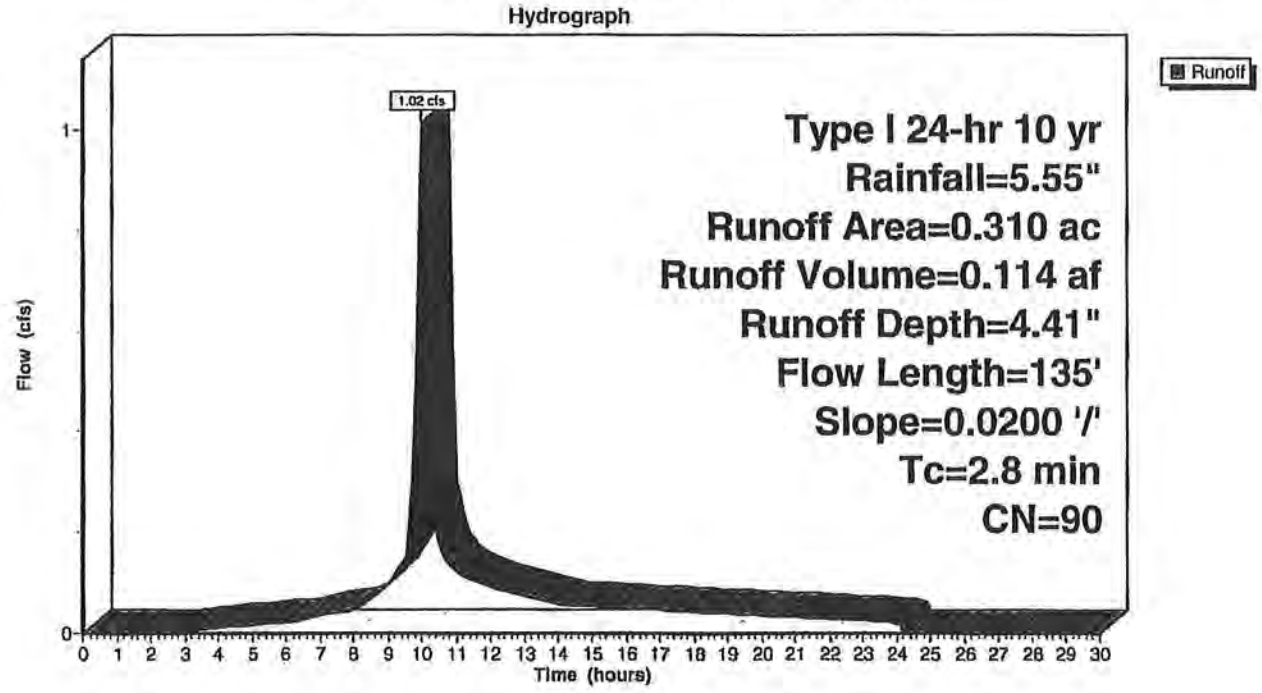
Runoff = 1.02 cfs @ 9.97 hrs, Volume= 0.114 af, Depth= 4.41"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 10 yr Rainfall=5.55"

Area (ac)	CN	Description
0.130	80	>75% Grass cover, Good, HSG D
0.180	98	Paved parking & roofs
0.310	90	Weighted Average
0.130		Pervious Area
0.180		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	135	0.0200	0.82		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 26S: Proposed Area 18



Pond 29P: Bioswale Basin 1

Inflow Area = 0.530 ac, Inflow Depth = 4.30" for 10 yr event
Inflow = 1.77 cfs @ 9.94 hrs, Volume= 0.190 af
Outflow = 0.79 cfs @ 10.11 hrs, Volume= 0.188 af, Atten= 56%, Lag= 9.9 min
Primary = 0.79 cfs @ 10.11 hrs, Volume= 0.188 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Peak Elev= 14.67' @ 10.11 hrs Surf.Area= 2,408 sf Storage= 1,215 cf

Plug-Flow detention time= 41.5 min calculated for 0.188 af (99% of inflow)
Center-of-Mass det. time= 33.7 min (780.6 - 746.9)

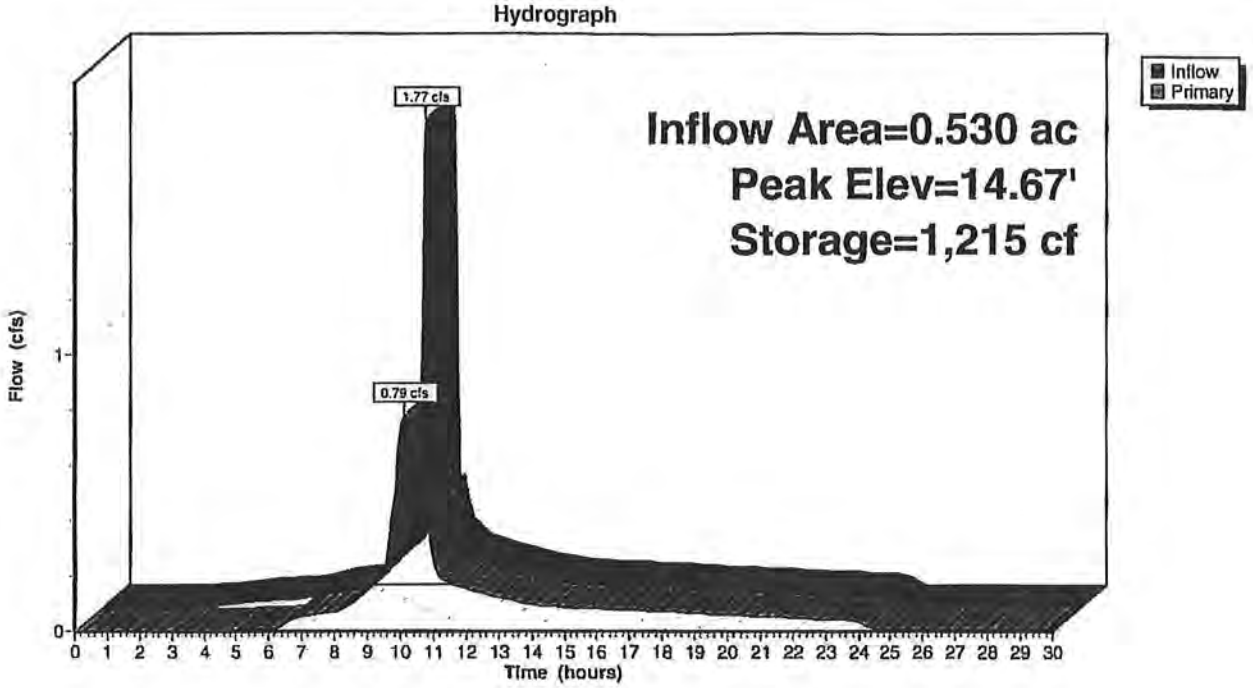
Volume	Invert	Avail.Storage	Storage Description
#1	13.27'	2,148 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.27	9	0	0
14.00	572	212	212
15.00	3,300	1,936	2,148

Device	Routing	Invert	Outlet Devices
#1	Primary	13.50'	**0.5" Vert. Orifice/Grate** C= 0.600
#2	Primary	13.75'	**0.5" Vert. Orifice/Grate** C= 0.600
#3	Primary	14.00'	**6.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=0.79 cfs @ 10.11 hrs HW=14.67' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.01 cfs @ 5.16 fps)
—**2=Orifice/Grate** (Orifice Controls 0.01 cfs @ 4.57 fps)
—**3=Orifice/Grate** (Orifice Controls 0.77 cfs @ 3.94 fps)

Pond 29P: Bioswale Basin 1



Pond 30P: Bioswale Basin 2

[88] Warning: Qout>Qin may require Finer Routing>1

Inflow Area = 0.210 ac, Inflow Depth = 4.30" for 10 yr event
Inflow = 0.69 cfs @ 9.96 hrs, Volume= 0.075 af
Outflow = 0.70 cfs @ 9.97 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.7 min
Primary = 0.70 cfs @ 9.97 hrs, Volume= 0.075 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Peak Elev= 13.79' @ 9.96 hrs Surf.Area= 121 sf Storage= 29 cf

Plug-Flow detention time= 1.1 min calculated for 0.075 af (100% of inflow)
Center-of-Mass det. time= 1.0 min (748.6 - 747.6)

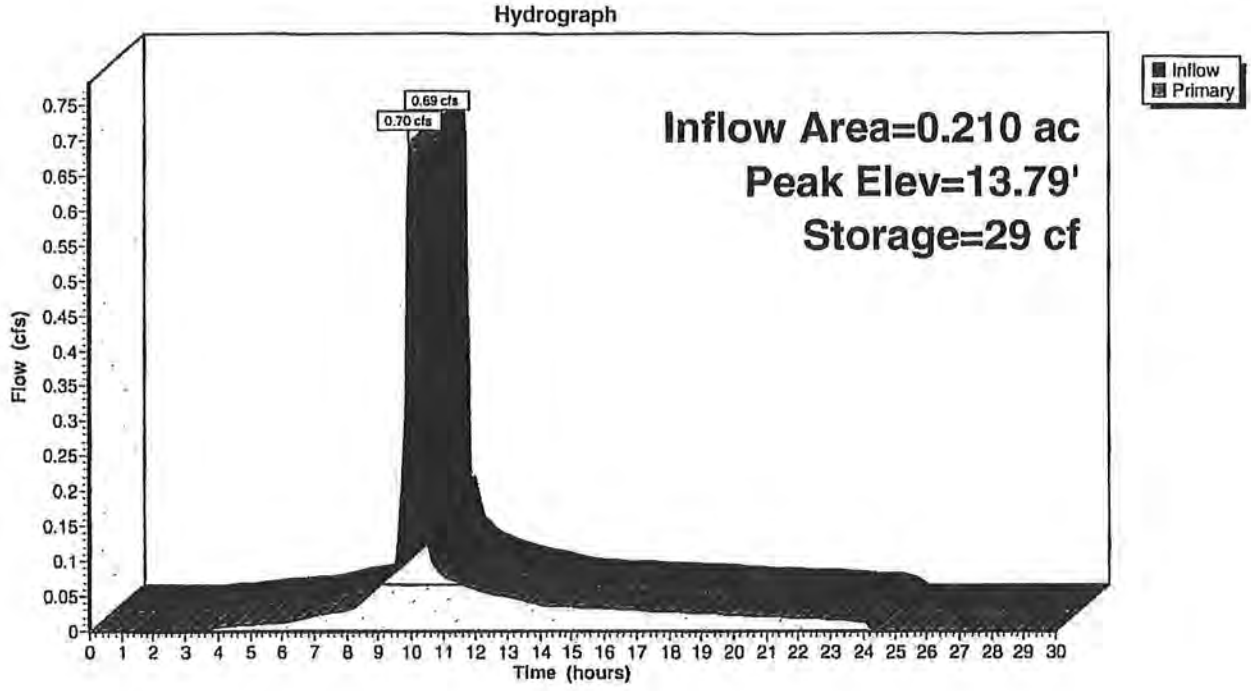
Volume	Invert	Avail.Storage	Storage Description
#1	13.35'	57 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.35	9	0	0
13.85	136	36	36
14.00	136	20	57

Device	Routing	Invert	Outlet Devices
#1	Primary	13.40'	**1.5" Vert. Orifice/Grate X 7.00** C= 0.600
#2	Primary	13.50'	**1.5" Vert. Orifice/Grate X 7.00** C= 0.600
#3	Primary	13.70'	**12.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=0.65 cfs @ 9.97 hrs HW=13.78' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.23 cfs @ 2.71 fps)
- **2=Orifice/Grate** (Orifice Controls 0.19 cfs @ 2.24 fps)
- **3=Orifice/Grate** (Weir Controls 0.23 cfs @ 0.92 fps)

Pond 30P: Bioswale Basin 2



Pond 32P: Basin 1-opt1

Inflow Area = 2.330 ac, Inflow Depth = 4.54" for 10 yr event
Inflow = 8.03 cfs @ 9.94 hrs, Volume= 0.881 af
Outflow = 4.22 cfs @ 10.08 hrs, Volume= 0.855 af, Atten= 47%, Lag= 8.8 min
Primary = 4.22 cfs @ 10.08 hrs, Volume= 0.855 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Peak Elev= 12.04' @ 10.09 hrs Surf.Area= 4,417 sf Storage= 5,412 cf

Plug-Flow detention time= 53.5 min calculated for 0.853 af (97% of inflow)
Center-of-Mass det. time= 34.8 min (767.7 - 732.9)

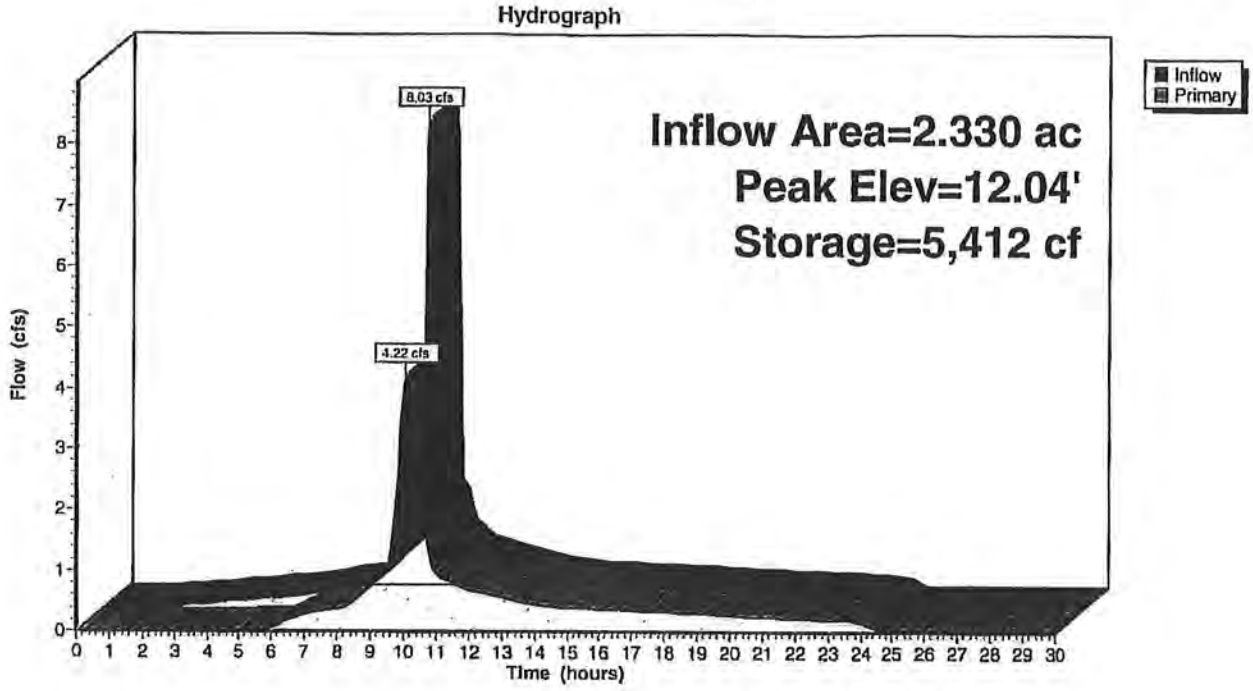
Volume	Invert	Avail.Storage	Storage Description
#1	9.30'	7,686 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.30	9	0	0
10.00	758	268	268
11.00	2,436	1,597	1,865
12.00	4,343	3,390	5,255
12.50	5,381	2,431	7,686

Device	Routing	Invert	Outlet Devices
#1	Primary	9.30'	**1.0" x 19.0' long Culvert** RCP, rounded edge headwall, Ke= 0.100 Outlet Invert= 9.11' S= 0.0100 '/' Cc= 0.900 n= 0.011 PVC, smooth interior
#2	Primary	10.80'	**12.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=4.20 cfs @ 10.08 hrs HW=12.02' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.02 cfs @ 3.77 fps)
└—**2=Orifice/Grate** (Orifice Controls 4.18 cfs @ 5.32 fps)

Pond 32P: Basin 1-opt1



Time span=0.00-30.00 hrs, dt=0.10 hrs, 301 points
Runoff by SBUH method
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 12S: Proposed Area 7 Runoff Area=0.660 ac Runoff Depth=6.12"
Flow Length=275' Slope=0.0100 '/' Tc=1.1 min CN=95 Runoff=3.04 cfs 0.336 af

Subcatchment 13S: Proposed Area 8 Runoff Area=0.340 ac Runoff Depth=5.54"
Flow Length=149' Tc=1.3 min CN=90 Runoff=1.45 cfs 0.157 af

Subcatchment 14S: Proposed Area 9 Runoff Area=0.170 ac Runoff Depth=5.43"
Flow Length=113' Slope=0.0200 '/' Tc=2.4 min CN=89 Runoff=0.69 cfs 0.077 af

Subcatchment 15S: Proposed Area 10 Runoff Area=0.320 ac Runoff Depth=4.87"
Flow Length=164' Tc=0.7 min CN=84 Runoff=1.26 cfs 0.130 af

Subcatchment 18S: Proposed Area 12 Runoff Area=0.320 ac Runoff Depth=6.12"
Flow Length=136' Slope=0.0500 '/' Tc=0.5 min CN=95 Runoff=1.53 cfs 0.163 af

Subcatchment 19S: Proposed Area 13 Runoff Area=0.530 ac Runoff Depth=5.43"
Flow Length=203' Tc=1.3 min CN=89 Runoff=2.22 cfs 0.240 af

Subcatchment 25S: Proposed Area 17 Runoff Area=0.210 ac Runoff Depth=5.43"
Flow Length=146' Tc=2.0 min CN=89 Runoff=0.87 cfs 0.095 af

Subcatchment 26S: Proposed Area 18 Runoff Area=0.310 ac Runoff Depth=5.54"
Flow Length=135' Slope=0.0200 '/' Tc=2.8 min CN=90 Runoff=1.27 cfs 0.143 af

Pond 29P: Bioswale Basin 1 Peak Elev=14.83' Storage=1,618 cf Inflow=2.22 cfs 0.240 af
Outflow=0.87 cfs 0.237 af

Pond 30P: Bioswale Basin 2 Peak Elev=13.82' Storage=32 cf Inflow=0.87 cfs 0.095 af
Outflow=0.87 cfs 0.095 af

Pond 32P: Basin 1-opt1 Peak Elev=12.35' Storage=6,917 cf Inflow=9.99 cfs 1.101 af
Outflow=4.73 cfs 1.075 af

Total Runoff Area = 2.860 ac Runoff Volume = 1.341 af Average Runoff Depth = 5.63"
39.32% Pervious Area = 1.125 ac 60.68% Impervious Area = 1.736 ac

Subcatchment 12S: Proposed Area 7

[49] Hint: Tc<2dt may require smaller dt

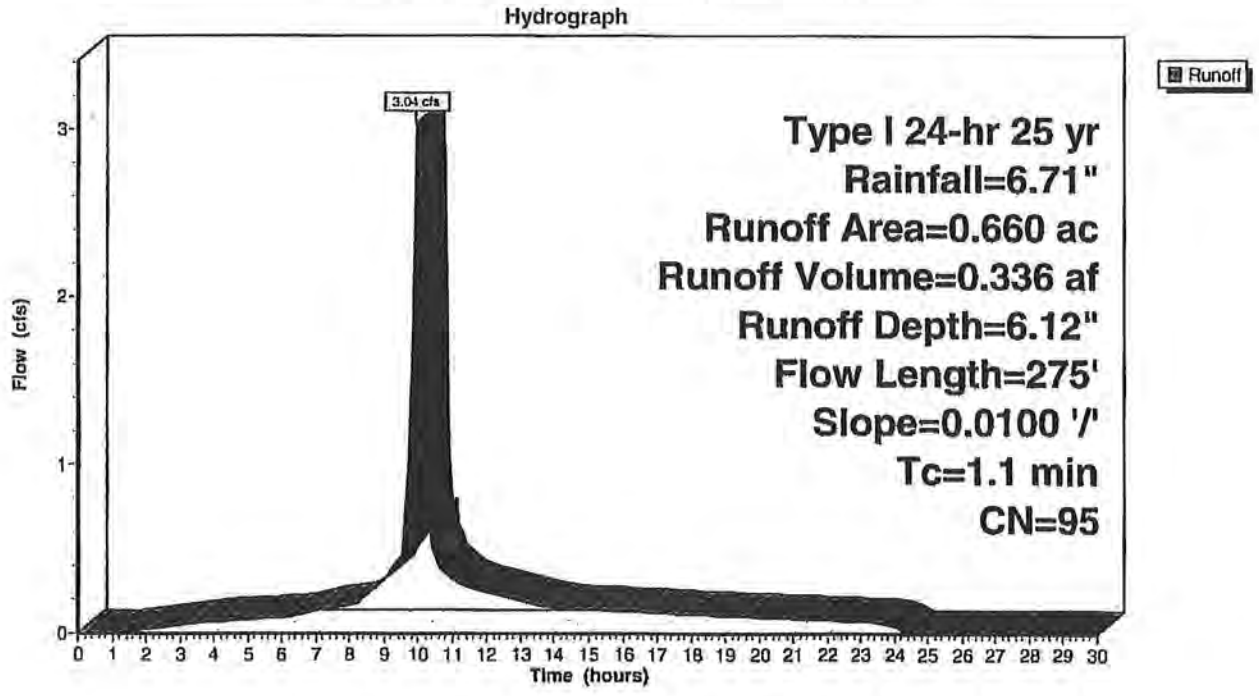
Runoff = 3.04 cfs @ 9.93 hrs, Volume= 0.336 af, Depth= 6.12"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.660	95	Urban commercial, 85% imp, HSG D
0.099		Pervious Area
0.561		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	275	0.0100	4.09	1.43	**Circular Channel (pipe),** Diam= 8.0" Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.011 PVC, smooth interior

Subcatchment 12S: Proposed Area 7



Subcatchment 13S: Proposed Area 8

[49] Hint: Tc<2dt may require smaller dt

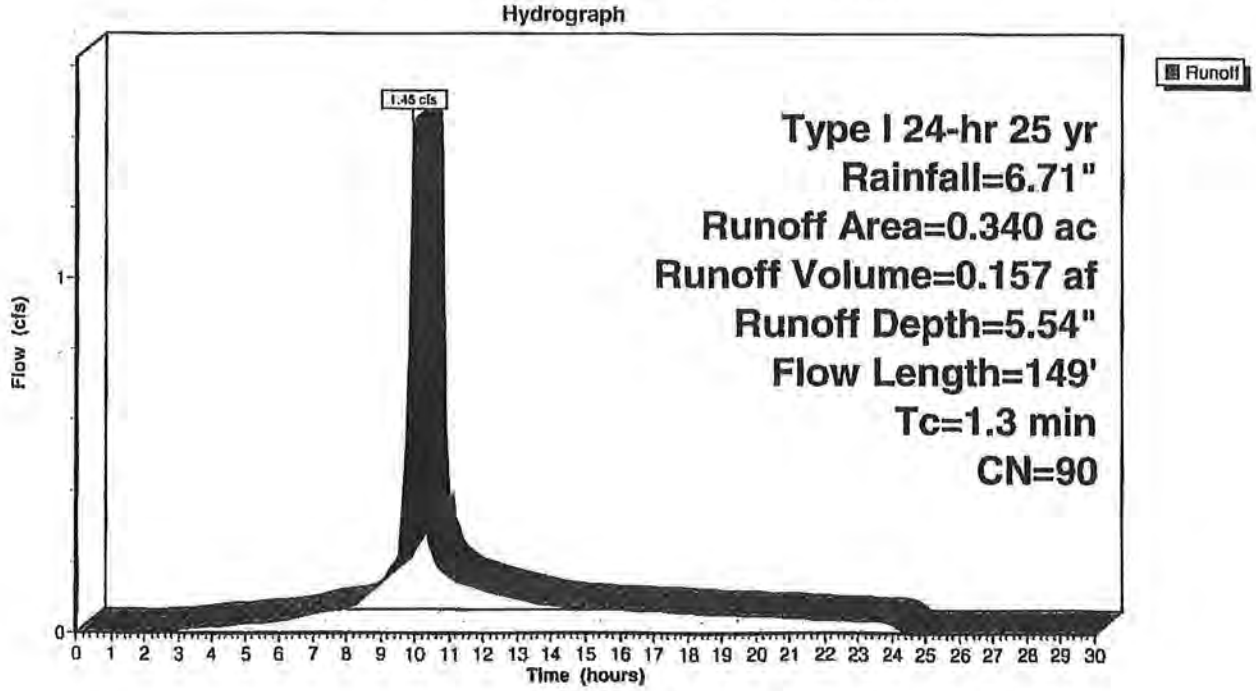
Runoff = 1.45 cfs @ 9.94 hrs, Volume= 0.157 af, Depth= 5.54"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.120	80	>75% Grass cover, Good, HSG D
0.220	95	Urban commercial, 85% imp, HSG D
0.340	90	Weighted Average
0.153		Pervious Area
0.187		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	79	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	70	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.3	149	Total			

Subcatchment 13S: Proposed Area 8



Subcatchment 14S: Proposed Area 9

[49] Hint: Tc<2dt may require smaller dt

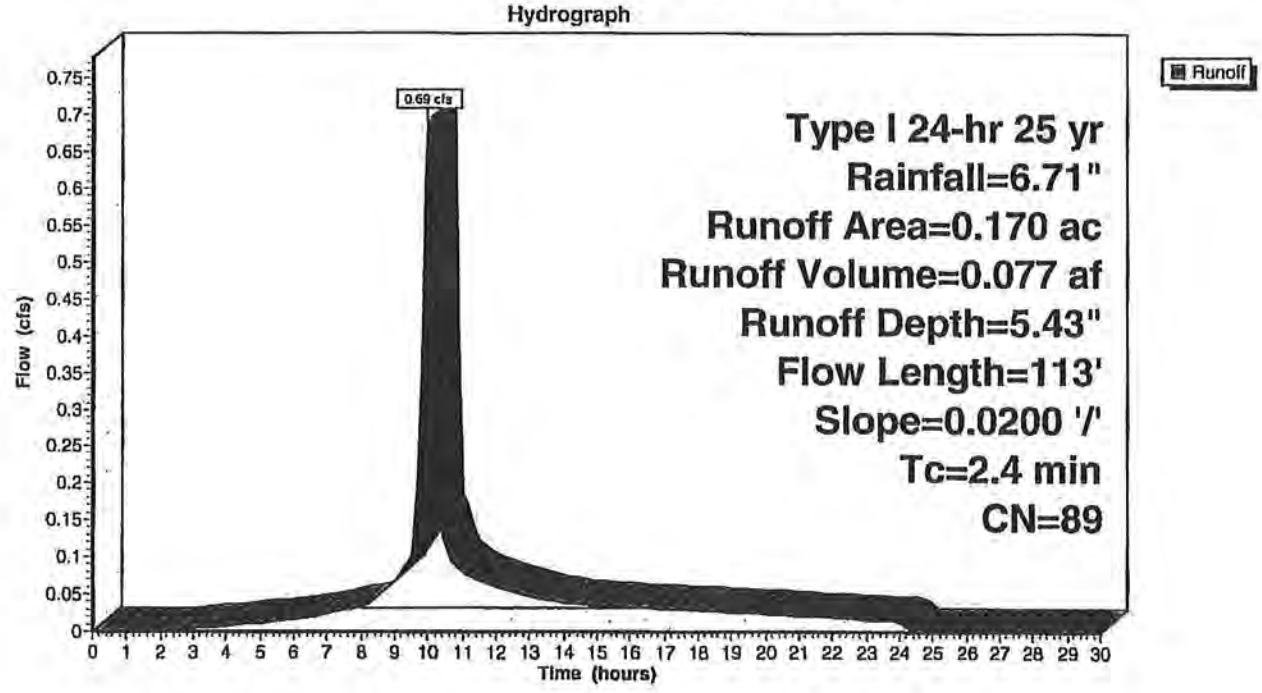
Runoff = 0.69 cfs @ 9.96 hrs, Volume= 0.077 af, Depth= 5.43"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.085	80	>75% Grass cover, Good, HSG D
0.085	98	Paved parking & roofs
0.170	89	Weighted Average
0.085		Pervious Area
0.085		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	113	0.0200	0.79		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 14S: Proposed Area 9



Subcatchment 15S: Proposed Area 10

[49] Hint: Tc<2dt may require smaller dt

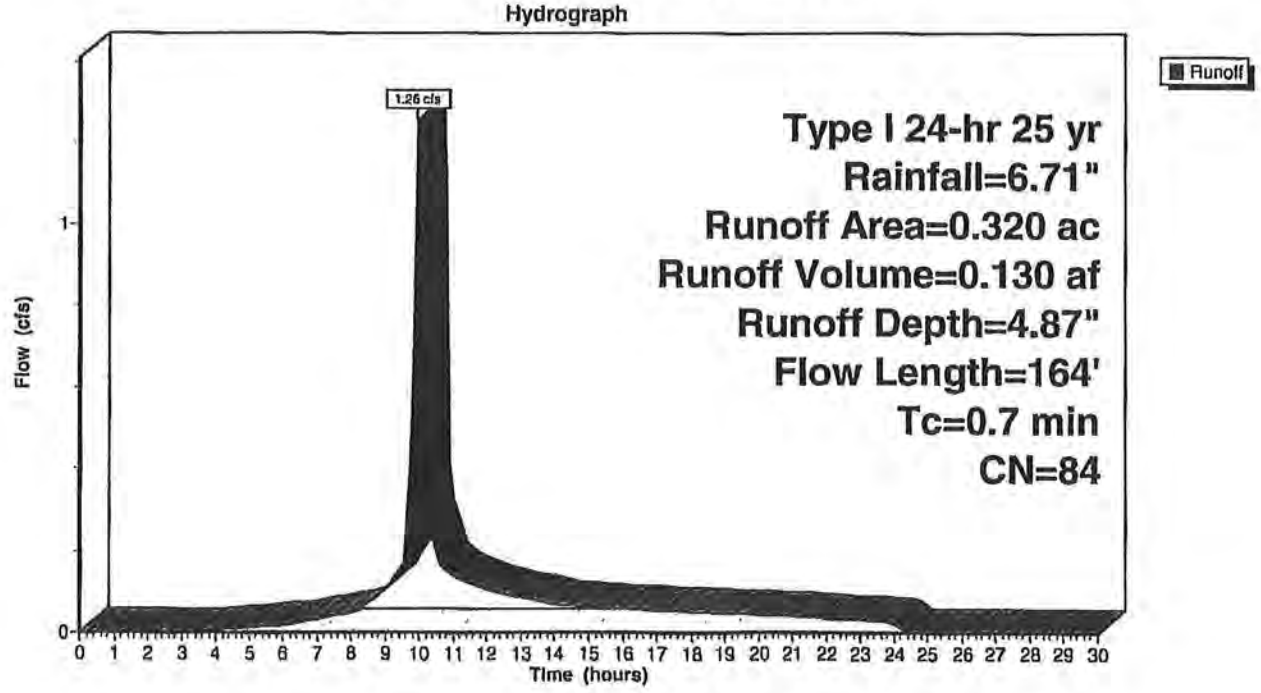
Runoff = 1.26 cfs @ 9.93 hrs, Volume= 0.130 af, Depth= 4.87"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.230	80	>75% Grass cover, Good, HSG D
0.090	95	Urban commercial, 85% imp, HSG D
0.320	84	Weighted Average
0.243		Pervious Area
0.077		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	130	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	34	0.1090	4.95		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.7	164	Total			

Subcatchment 15S: Proposed Area 10



Subcatchment 18S: Proposed Area 12

[49] Hint: Tc<2dt may require smaller dt

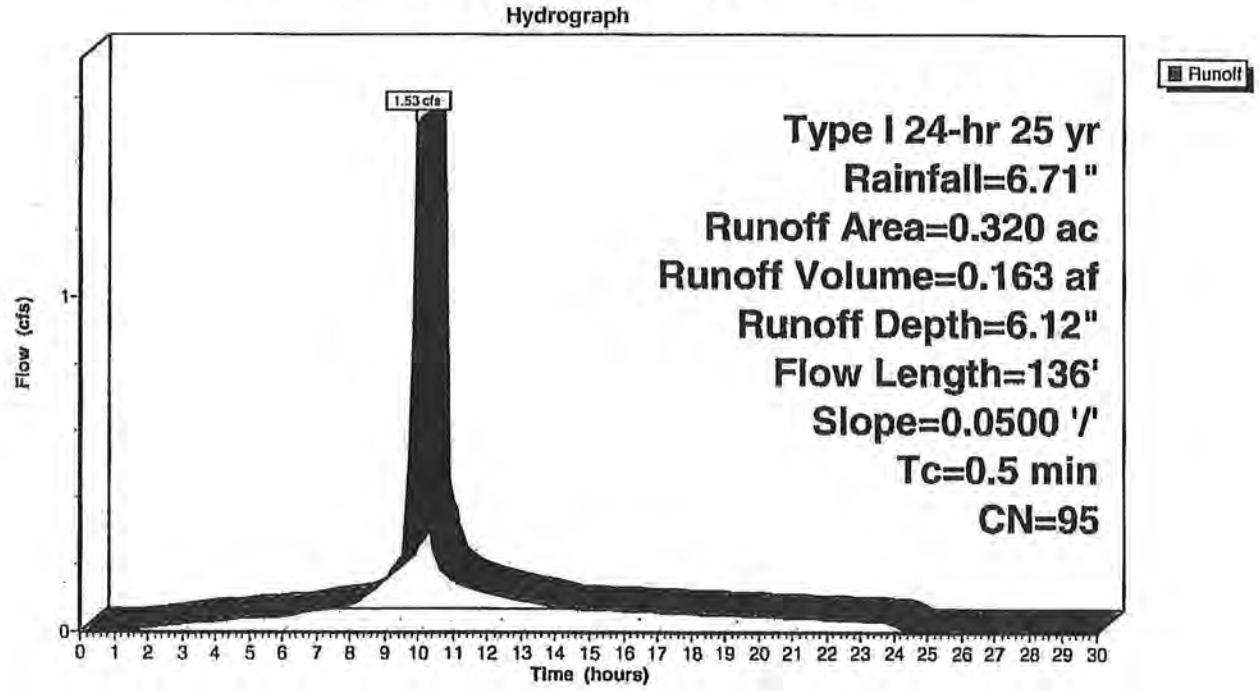
Runoff = 1.53 cfs @ 9.92 hrs, Volume= 0.163 af, Depth= 6.12"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.320	95	Urban commercial, 85% imp, HSG D
0.048		Pervious Area
0.272		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	136	0.0500	4.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 18S: Proposed Area 12



Subcatchment 19S: Proposed Area 13

[49] Hint: Tc<2dt may require smaller dt

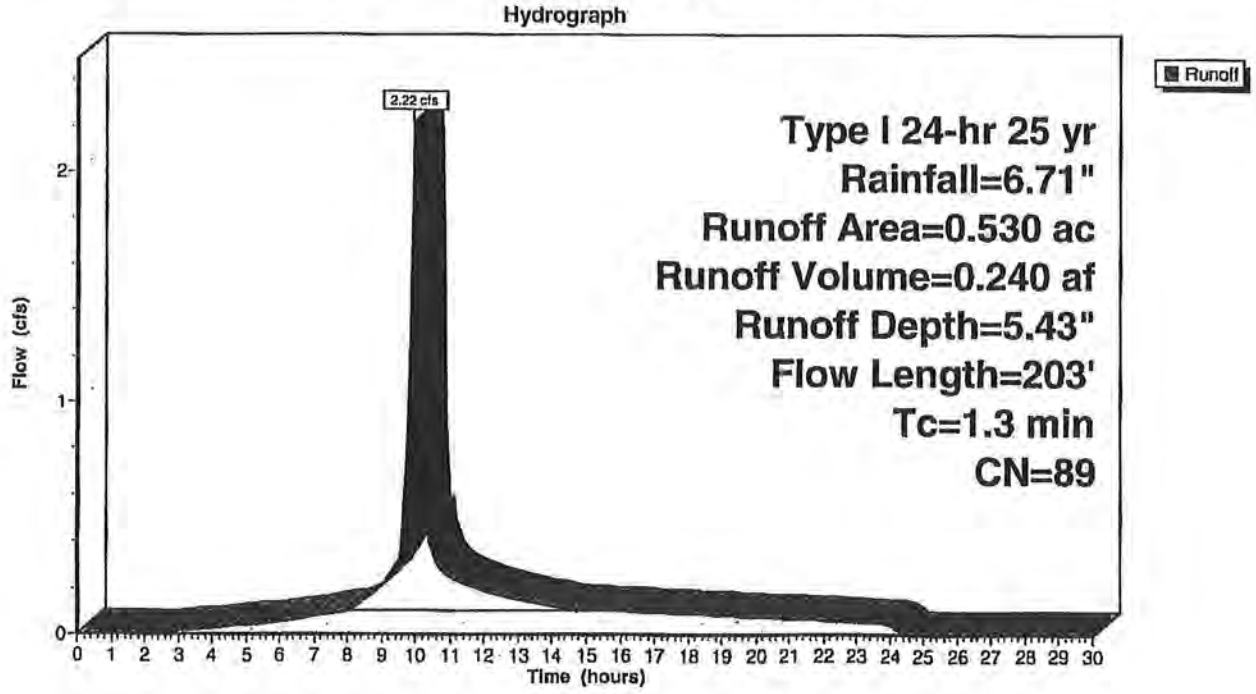
Runoff = 2.22 cfs @ 9.94 hrs, Volume= 0.240 af, Depth= 5.43"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.220	80	>75% Grass cover, Good, HSG D
0.310	95	Urban commercial, 85% imp, HSG D
0.530	89	Weighted Average
0.267		Pervious Area
0.263		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	107	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	96	0.0210	2.17		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.3	203	Total			

Subcatchment 19S: Proposed Area 13



Subcatchment 25S: Proposed Area 17

[49] Hint: Tc<2dt may require smaller dt

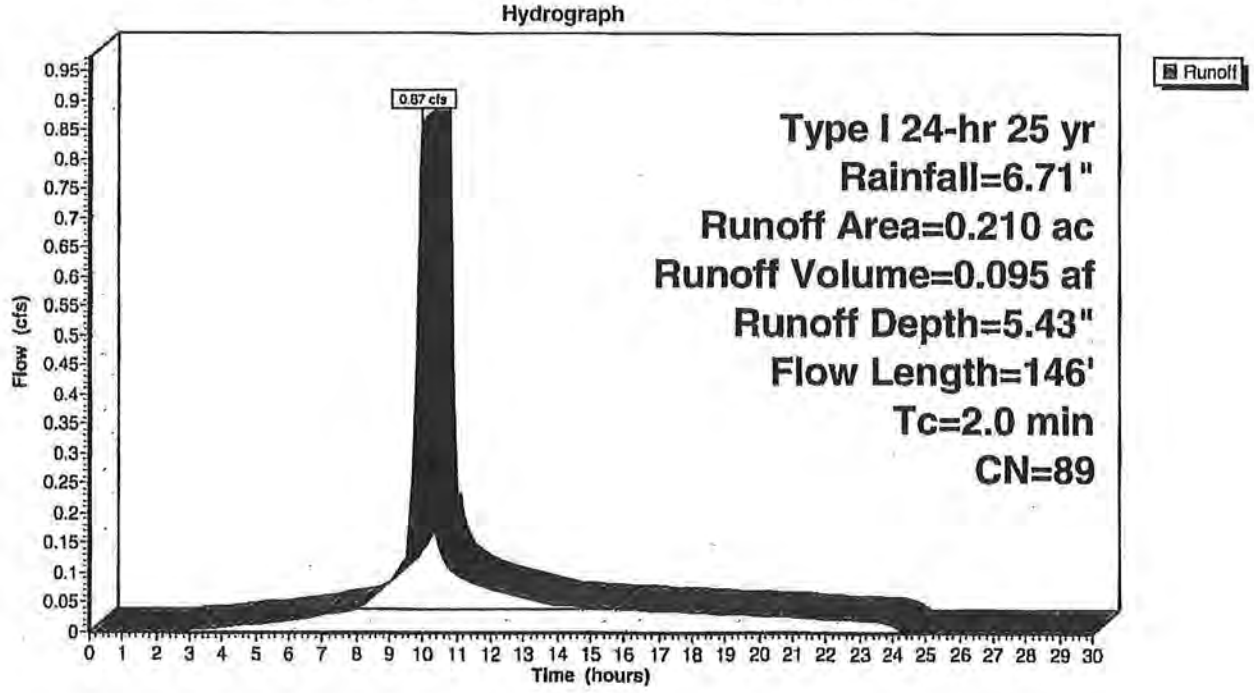
Runoff = 0.87 cfs @ 9.95 hrs, Volume= 0.095 af, Depth= 5.43"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.130	95	Urban commercial, 85% imp, HSG D
0.080	80	>75% Grass cover, Good, HSG D
0.210	89	Weighted Average
0.100		Pervious Area
0.111		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	56	0.0200	0.68		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"
0.6	90	0.0250	2.37		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
2.0	146	Total			

Subcatchment 25S: Proposed Area 17



Subcatchment 26S: Proposed Area 18

[49] Hint: Tc<2dt may require smaller dt

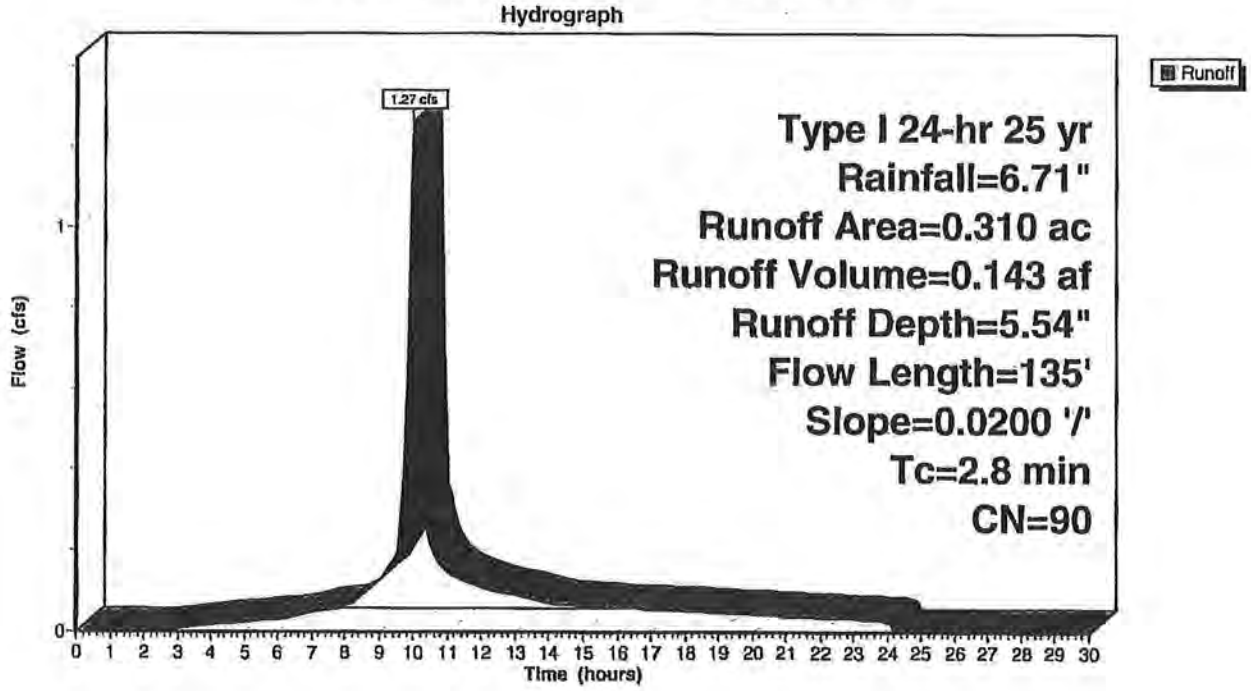
Runoff = 1.27 cfs @ 9.96 hrs, Volume= 0.143 af, Depth= 5.54"

Runoff by SBUH method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25 yr Rainfall=6.71"

Area (ac)	CN	Description
0.130	80	>75% Grass cover, Good, HSG D
0.180	98	Paved parking & roofs
0.310	90	Weighted Average
0.130		Pervious Area
0.180		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	135	0.0200	0.82		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 1.00"

Subcatchment 26S: Proposed Area 18



Pond 29P: Bioswale Basin 1

Inflow Area = 0.530 ac, Inflow Depth = 5.43" for 25 yr event
Inflow = 2.22 cfs @ 9.94 hrs, Volume= 0.240 af
Outflow = 0.87 cfs @ 10.12 hrs, Volume= 0.237 af, Atten= 61%, Lag= 10.8 min
Primary = 0.87 cfs @ 10.12 hrs, Volume= 0.237 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Peak Elev= 14.83' @ 10.12 hrs Surf.Area= 2,828 sf Storage= 1,618 cf

Plug-Flow detention time= 37.1 min calculated for 0.237 af (99% of inflow)
Center-of-Mass det. time= 30.8 min (769.0 - 738.3)

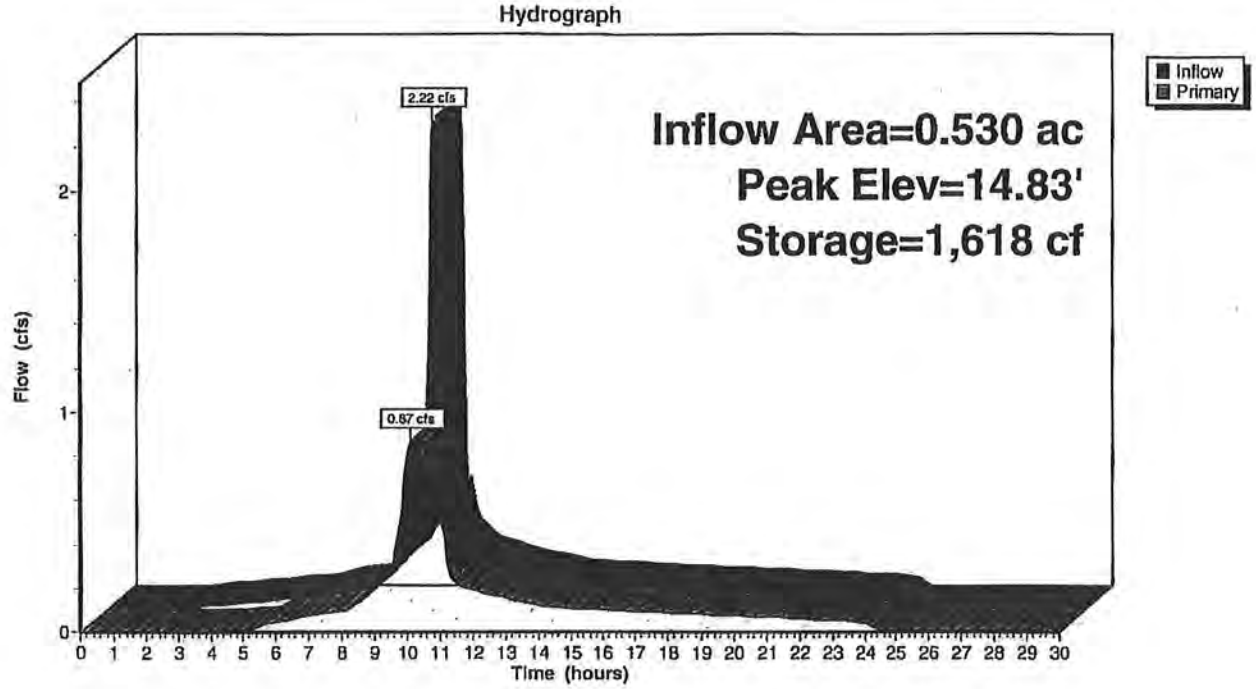
Volume	Invert	Avail.Storage	Storage Description
#1	13.27'	2,148 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.27	9	0	0
14.00	572	212	212
15.00	3,300	1,936	2,148

Device	Routing	Invert	Outlet Devices
#1	Primary	13.50'	**0.5" Vert. Orifice/Grate** C= 0.600
#2	Primary	13.75'	**0.5" Vert. Orifice/Grate** C= 0.600
#3	Primary	14.00'	**6.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=0.87 cfs @ 10.12 hrs HW=14.82' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.01 cfs @ 5.49 fps)
- **2=Orifice/Grate** (Orifice Controls 0.01 cfs @ 4.93 fps)
- **3=Orifice/Grate** (Orifice Controls 0.86 cfs @ 4.36 fps)

Pond 29P: Bioswale Basin 1



Pond 30P: Bioswale Basin 2

Inflow Area = 0.210 ac, Inflow Depth = 5.43" for 25 yr event
Inflow = 0.87 cfs @ 9.95 hrs, Volume= 0.095 af
Outflow = 0.87 cfs @ 9.96 hrs, Volume= 0.095 af, Atten= 0%, Lag= 0.3 min
Primary = 0.87 cfs @ 9.96 hrs, Volume= 0.095 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Peak Elev= 13.82' @ 9.96 hrs Surf.Area= 128 sf Storage= 32 cf

Plug-Flow detention time= 1.0 min calculated for 0.095 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (739.9 - 739.0)

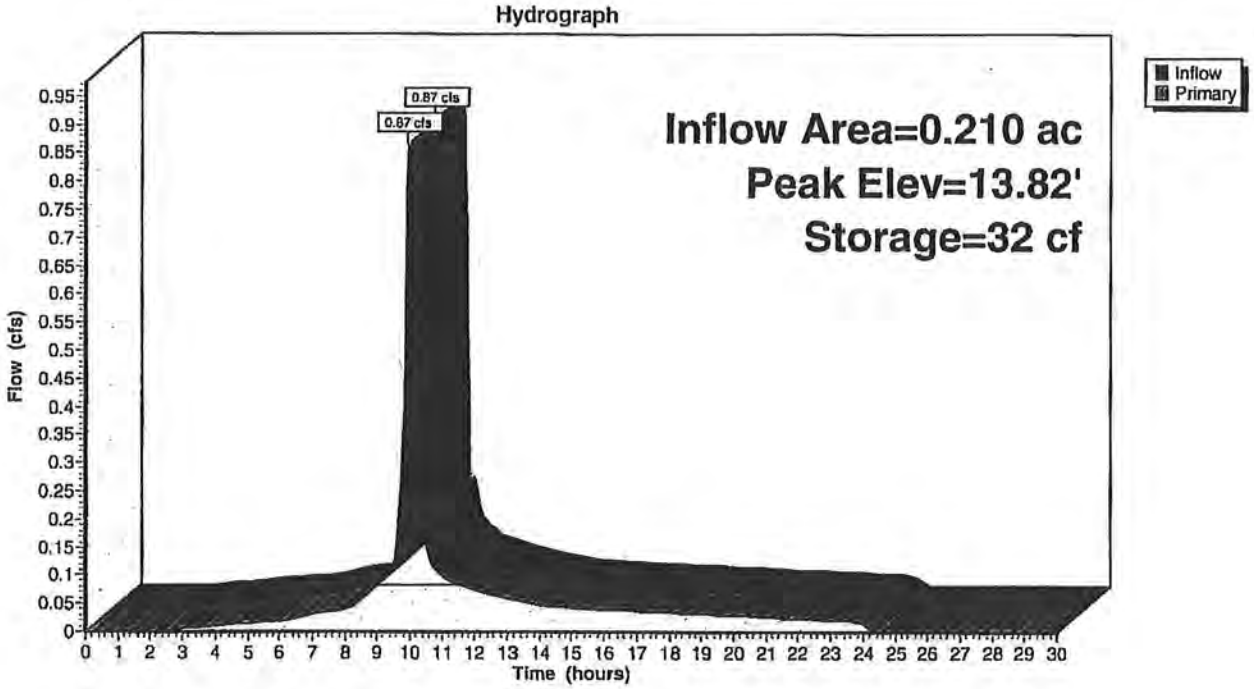
Volume	Invert	Avail.Storage	Storage Description
#1	13.35'	57 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.35	9	0	0
13.85	136	36	36
14.00	136	20	57

Device	Routing	Invert	Outlet Devices
#1	Primary	13.40'	**1.5" Vert. Orifice/Grate X 7.00** C= 0.600
#2	Primary	13.50'	**1.5" Vert. Orifice/Grate X 7.00** C= 0.600
#3	Primary	13.70'	**12.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=0.81 cfs @ 9.96 hrs HW=13.81' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.24 cfs @ 2.83 fps)
- **2=Orifice/Grate** (Orifice Controls 0.20 cfs @ 2.38 fps)
- **3=Orifice/Grate** (Weir Controls 0.36 cfs @ 1.07 fps)

Pond 30P: Bioswale Basin 2



Pond 32P: Basin 1-opt1

Inflow Area = 2.330 ac, Inflow Depth = 5.67" for 25 yr event
Inflow = 9.99 cfs @ 9.94 hrs, Volume= 1.101 af
Outflow = 4.73 cfs @ 10.10 hrs, Volume= 1.075 af, Atten= 53%, Lag= 9.7 min
Primary = 4.73 cfs @ 10.10 hrs, Volume= 1.075 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Peak Elev= 12.35' @ 10.10 hrs Surf.Area= 5,076 sf Storage= 6,917 cf

Plug-Flow detention time= 47.5 min calculated for 1.075 af (98% of inflow)
Center-of-Mass det. time= 31.2 min (757.1 - 725.8)

Volume	Invert	Avail.Storage	Storage Description
#1	9.30'	7,686 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.30	9	0	0
10.00	758	268	268
11.00	2,436	1,597	1,865
12.00	4,343	3,390	5,255
12.50	5,381	2,431	7,686

Device	Routing	Invert	Outlet Devices
#1	Primary	9.30'	**1.0" x 19.0' long Culvert** RCP, rounded edge headwall, Ke= 0.100 Outlet Invert= 9.11' S= 0.0100 '/' Cc= 0.900 n= 0.011 PVC, smooth interior
#2	Primary	10.80'	**12.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=4.73 cfs @ 10.10 hrs HW=12.35' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.02 cfs @ 3.98 fps)
└—**2=Orifice/Grate** (Orifice Controls 4.71 cfs @ 6.00 fps)

Pond 32P: Basin 1-opt1