

432 Cony Road
P.O. Box 4687
Augusta, ME 04330



(207) 623-9475
Fax (207) 623-0016
1-800-244-9475

March 4th, 2022

City of Gardiner
Mr. Kris McNeil, CEO
6 Church Street
Gardiner, Maine 04345

Subject: Stormwater Report
BHS Inc.

Dear Kris,

E.S. Coffin Engineering & Surveying has completed the hydrologic calculations for BHS, Inc. and their project located on Brunswick Avenue in Gardiner. The one-acre parcel of land is identified as Lot 49 on Tax Map 19 in the City of Gardiner tax maps. The applicant is proposing to develop the parcel into self-storage units.

The project results in 31,460 sf of new impervious area and therefore does not meet the threshold for a Department of Environmental Protection (DEP) Stormwater Permit Application. However, the project must comply with the City of Gardiner's Land Use Ordinance stating that the amount of flow (stormwater) in the post-development condition must be equal to or less than the flow in the pre-development condition for the 2-, 10- and 25-year peak storm events.

Modeling assumptions: The "Hydro-Cad" computer program was used to determine the peak storm water runoff for the pre- and post-development conditions. Hydro-Cad is a storm water modeling system, which utilizes the TR-20 method developed by the Soil Conservation Service (SCS).

The design assumptions used for this project are:

Design storm: 24-hour, Type III rainfall distribution.

Rainfall: 24-hour precipitation values from U.S. Weather Bureau Technical Release No. 40:

2-year storm = 2.8 inches
10-year storm = 4.2 inches
25-year storm = 5.2 inches

Site specific parameters for the project are listed below:

Soils: Soils information to determine the hydrologic soil group for the site is derived from the Soil Survey of Kennebec County by the United States Department of Agriculture Soil Conservation Service. The soils and hydrologic group are listed below:

<u>Soil Classification</u>	<u>Hydrologic Group</u>
Scantic (ScA)	"D"
Lyman (HrC)	"D"

Ground Cover:

Pre-Development: The existing watershed ground cover is modeled as impervious and woods.

Post-Development: The proposed watershed ground cover is impervious and lawn.

<u>Cover Description</u>	<u>Curve Number:</u>
Impervious	98
Lawn "D"	80
Woods "D"	77

Results:

The project will result in an increase of 31,460 sf of impervious area. These results are shown on the Hydro Cad output sheets enclosed at the end of the report. All of the runoff from the site ends up in the ditching along the south side of Brunswick Avenue. A detention pond is utilized to reduce peak flows exiting the site.

Pre-development:

The hydrologic study evaluates a portion of the parcel that includes impervious (1,390 sf) and woods (48,745 sf) and is broken down into one drainage areas (see plan entitled "PRE"). The peak flows for the 2-, 10- and 25-year events (see node labeled "SP") in the pre-development condition are 1.02 cfs (cubic feet per second), 2.19 cfs and 3.09 cfs.

Post Development:

The proposed site (see plan entitled "C-1") will be comprised of impervious area (32,850 sf) and lawn (16,740 sf). The post-development is broken down into five drainage areas and is shown on the plan entitled "POST". Summary tables showing the input values and resulting peak flows for Sub Areas and reaches are also included at the end of the report. In the post development condition, the 2-, 10- and 25-year peak storm events for the study point "SP" yield 1.00 cfs, 1.86 cfs and 3.00 cfs. See the table on the next page for results.

PRE- & POST-DEVELOPMENT HYDROLOGIC RESULTS (SP)			
<u>Event</u>	<u>Pre-Develop.</u>	<u>Post-Develop.</u>	<u>Difference</u>
2 year	1.02 cfs	1.00 cfs	- 0.02 cfs
10 year	2.19 cfs	1.86 cfs	- 0.33 cfs
25 year	3.09 cfs	3.00 cfs	- 0.09 cfs

Conclusion:

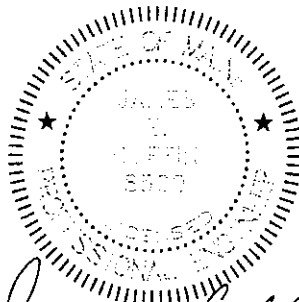
By comparing the node labeled "SP" in the post-development condition and in the pre-development condition, the results show that there will be a decrease in flow for all of the three peak storm events.

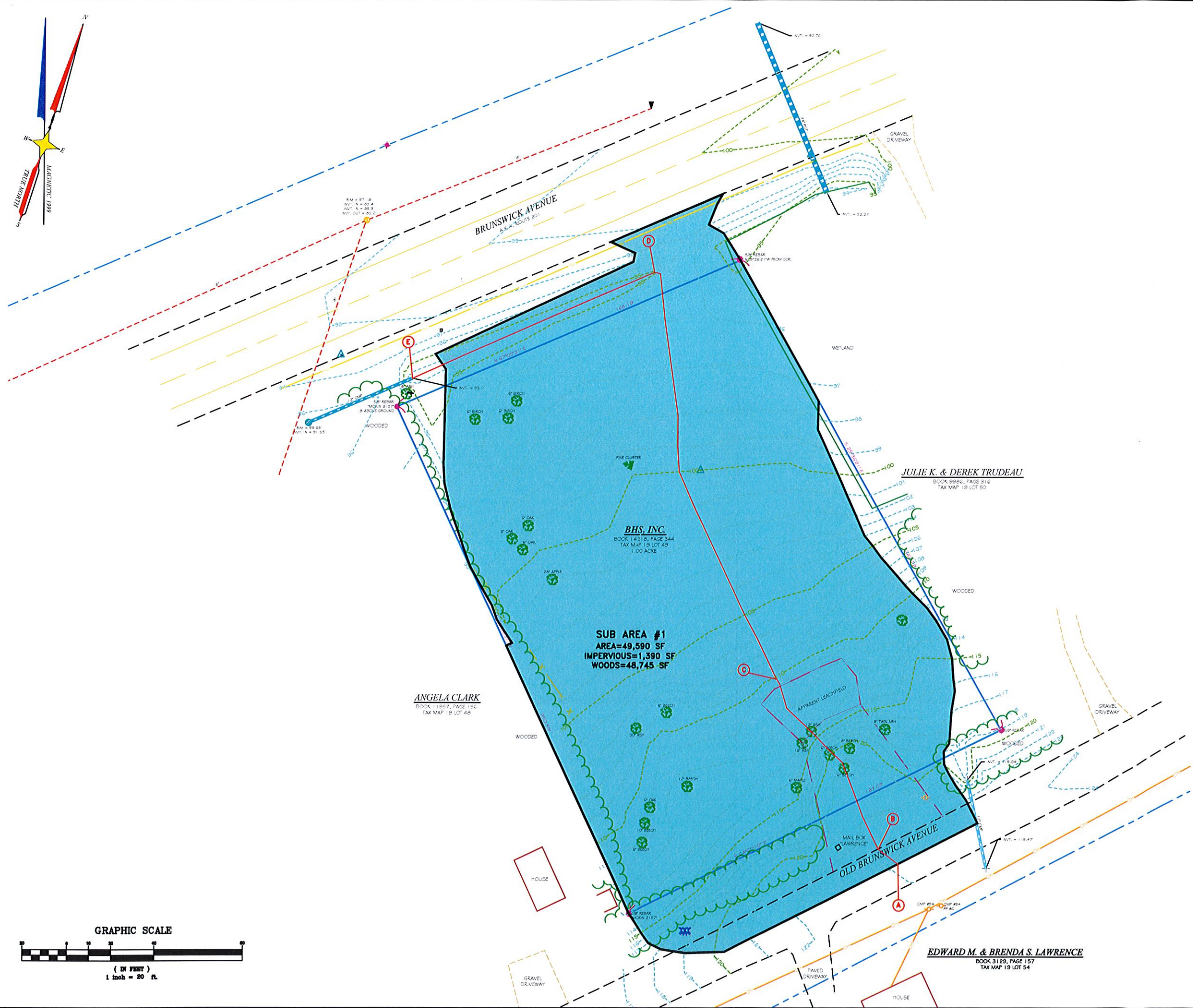
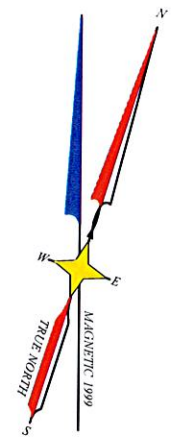
If you should have any questions or concerns, please do not hesitate to contact me at 623-9475.

Respectfully submitted,

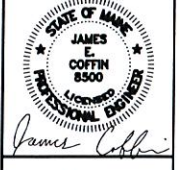
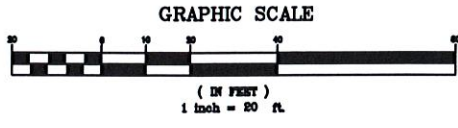


James E. Coffin, PE



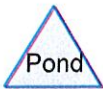
- LEGEND**
- IRON ROD FOUND
 - IRON PIPE FOUND
 - DRILL HOLE IN LEDGE
 - GRANITE MONUMENT FOUND
 - 5/8" REBAR PROPOSED
 - 4"x4" GRANITE MONUMENT PROPOSED
 - UTILITY POLE
 - GUY ANCHOR
 - OVERHEAD UTILITY LINE
 - BELOW GROUND ELECTRIC
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 - WELL
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 - STORM PIPE
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 - FLAG
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 - DECIDUOUS TREE
 - VEGETATION
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 - PRIOR OWNER



JAMES E. COFFIN
 ENGINEERING
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 E.S. COFFIN ENGINEERING & SURVEYING, INC.
 432 Camp Road P.O. Box 4687 Augusta, Maine 04330
 Ph. (207) 625-9473 Fax (207) 625-9016 Toll Free 1-800-246-9473

NO.	REVISIONS	DATE

CLIENT/PROJECT	PRE-DEVELOPMENT PLAN	
	BHS INC.	
LOCATION	BRUNSWICK AVE & OLD BRUNSWICK RD	
	GARDNER	KENNEBEC STATE, MAINE
TOWN	GARDNER	
	COUNTY	KENNEBEC
SCALE	1 INCH=20 FEET	
	DRAWN BY:	CSC
DATE	MARCH 15, 2022	
	CHECKED BY:	KPC
PROJ. NO.	2021-080	
PRE		



Summary for Subcatchment 1S: Sub Area #1

Runoff = 1.02 cfs @ 12.19 hrs, Volume= 0.087 af, Depth> 0.90"

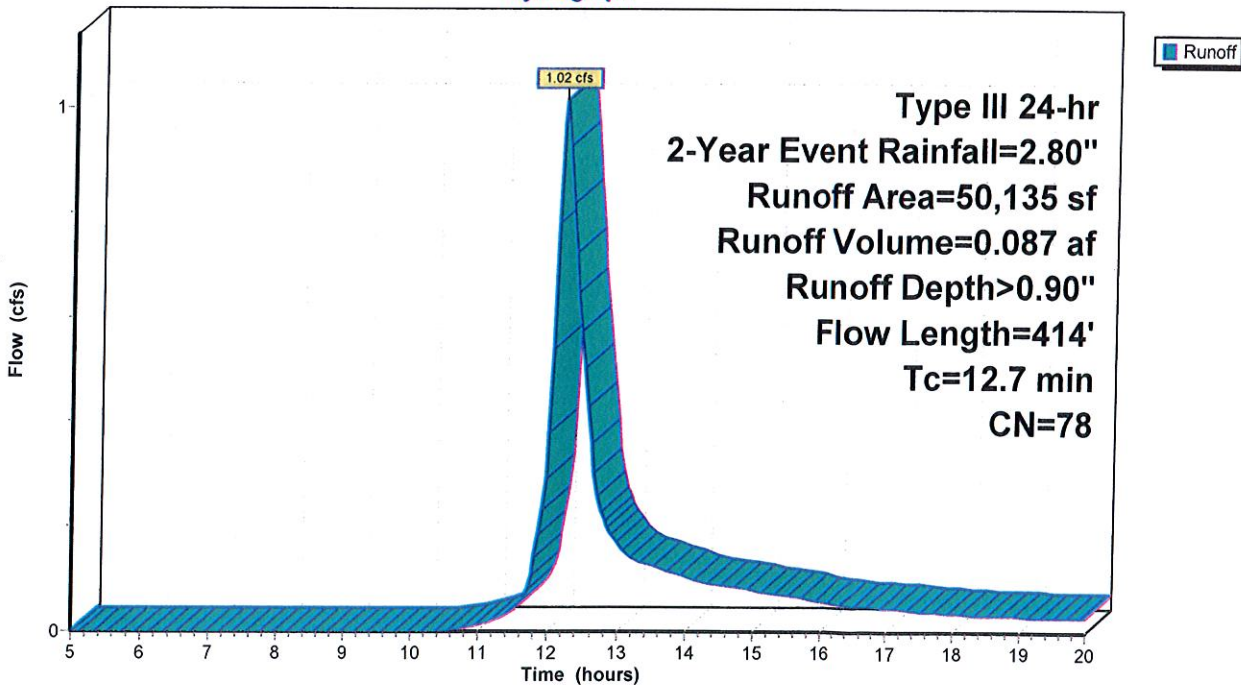
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Event Rainfall=2.80"

Area (sf)	CN	Description
1,390	98	Paved parking, HSG D
48,745	77	Woods, Good, HSG D
50,135	78	Weighted Average
48,745		97.23% Pervious Area
1,390		2.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	11	0.0200	0.8		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
9.7	89	0.1348	0.2		Sheet Flow, BC Woods: Light underbrush n= 0.400 P2= 2.80"
2.3	195	0.0769	1.4		Shallow Concentrated Flow, CD Woodland Kv= 5.0 fps
0.5	119	0.0160	4.3	17.26	Channel Flow, DE Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.030 Earth, grassed & winding
12.7	414	Total			

Subcatchment 1S: Sub Area #1

Hydrograph



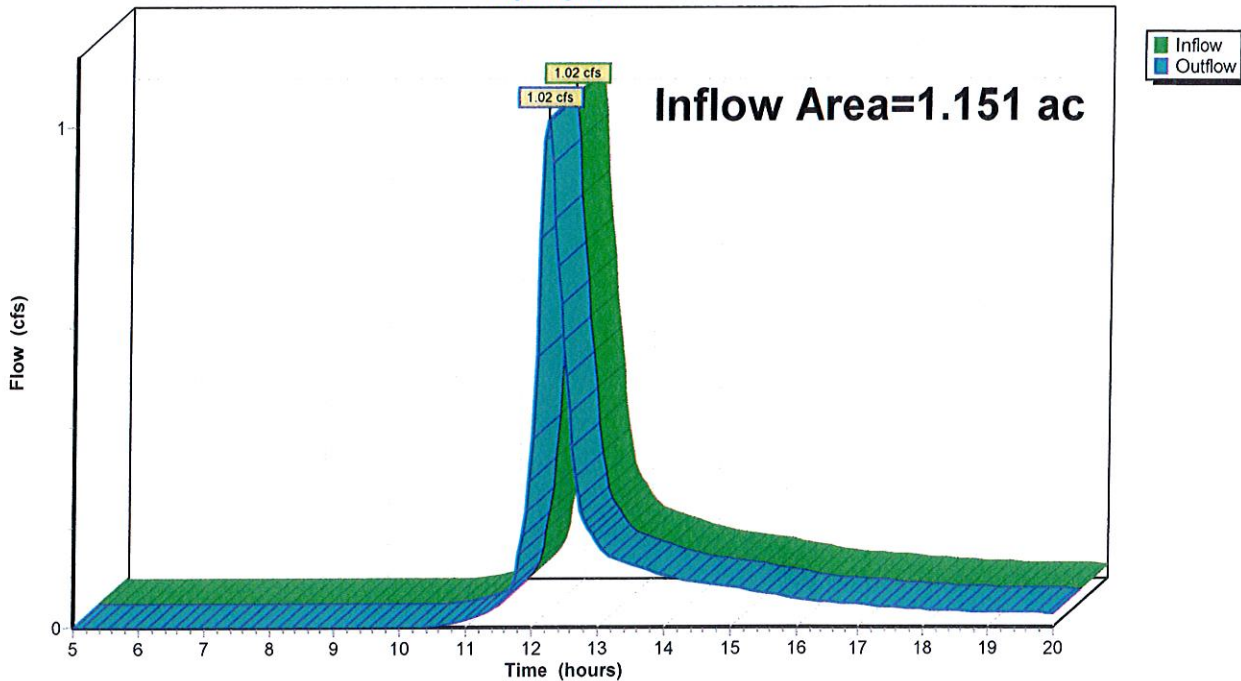
Summary for Reach SP: Study Point

Inflow Area = 1.151 ac, 2.77% Impervious, Inflow Depth > 0.90" for 2-Year Event event
Inflow = 1.02 cfs @ 12.19 hrs, Volume= 0.087 af
Outflow = 1.02 cfs @ 12.19 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min

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

Reach SP: Study Point

Hydrograph



Summary for Subcatchment 1S: Sub Area #1

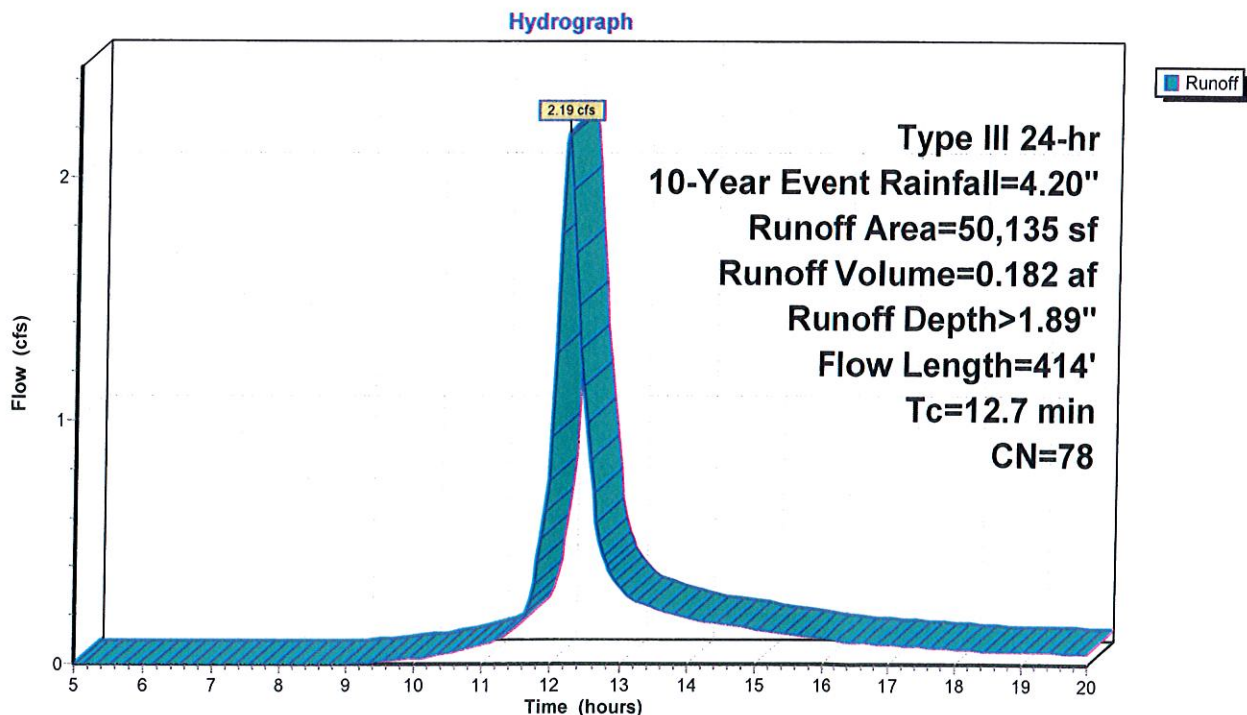
Runoff = 2.19 cfs @ 12.18 hrs, Volume= 0.182 af, Depth> 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Event Rainfall=4.20"

Area (sf)	CN	Description
1,390	98	Paved parking, HSG D
48,745	77	Woods, Good, HSG D
50,135	78	Weighted Average
48,745		97.23% Pervious Area
1,390		2.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	11	0.0200	0.8		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
9.7	89	0.1348	0.2		Sheet Flow, BC Woods: Light underbrush n= 0.400 P2= 2.80"
2.3	195	0.0769	1.4		Shallow Concentrated Flow, CD Woodland Kv= 5.0 fps
0.5	119	0.0160	4.3	17.26	Channel Flow, DE Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.030 Earth, grassed & winding
12.7	414	Total			

Subcatchment 1S: Sub Area #1

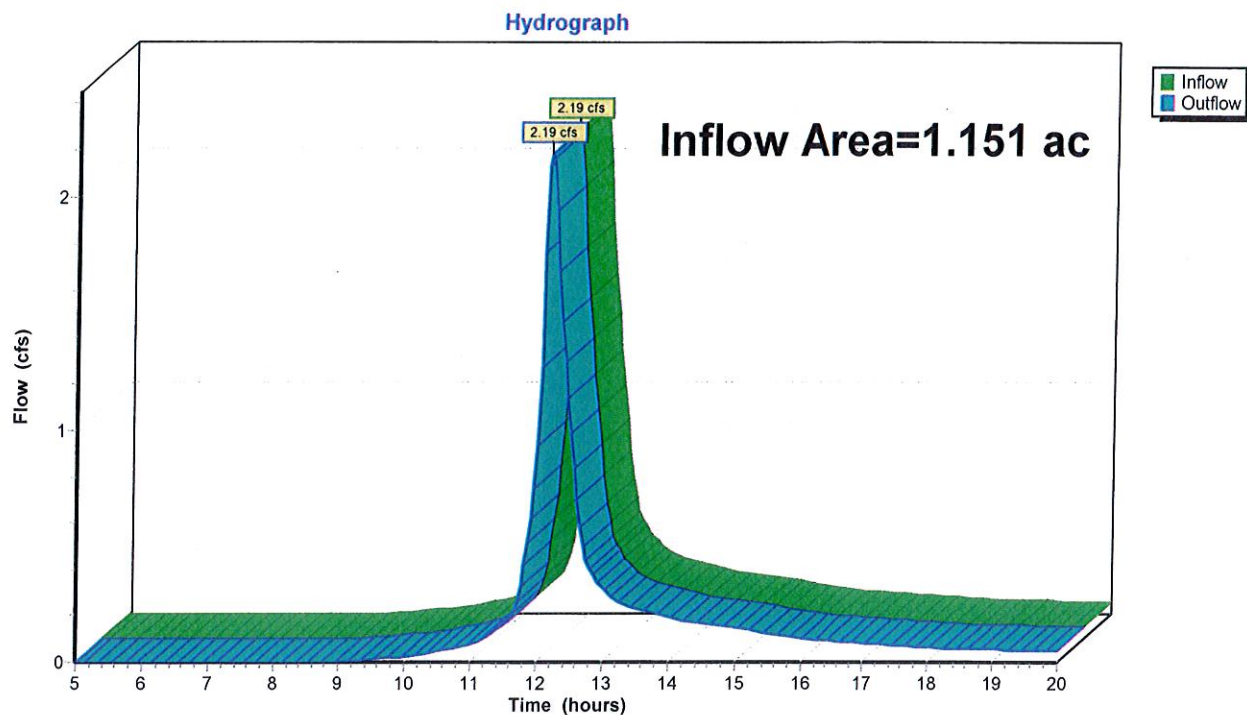


Summary for Reach SP: Study Point

Inflow Area = 1.151 ac, 2.77% Impervious, Inflow Depth > 1.89" for 10-Year Event event
Inflow = 2.19 cfs @ 12.18 hrs, Volume= 0.182 af
Outflow = 2.19 cfs @ 12.18 hrs, Volume= 0.182 af, Atten= 0%, Lag= 0.0 min

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

Reach SP: Study Point



Summary for Subcatchment 1S: Sub Area #1

Runoff = 3.09 cfs @ 12.18 hrs, Volume= 0.257 af, Depth> 2.68"

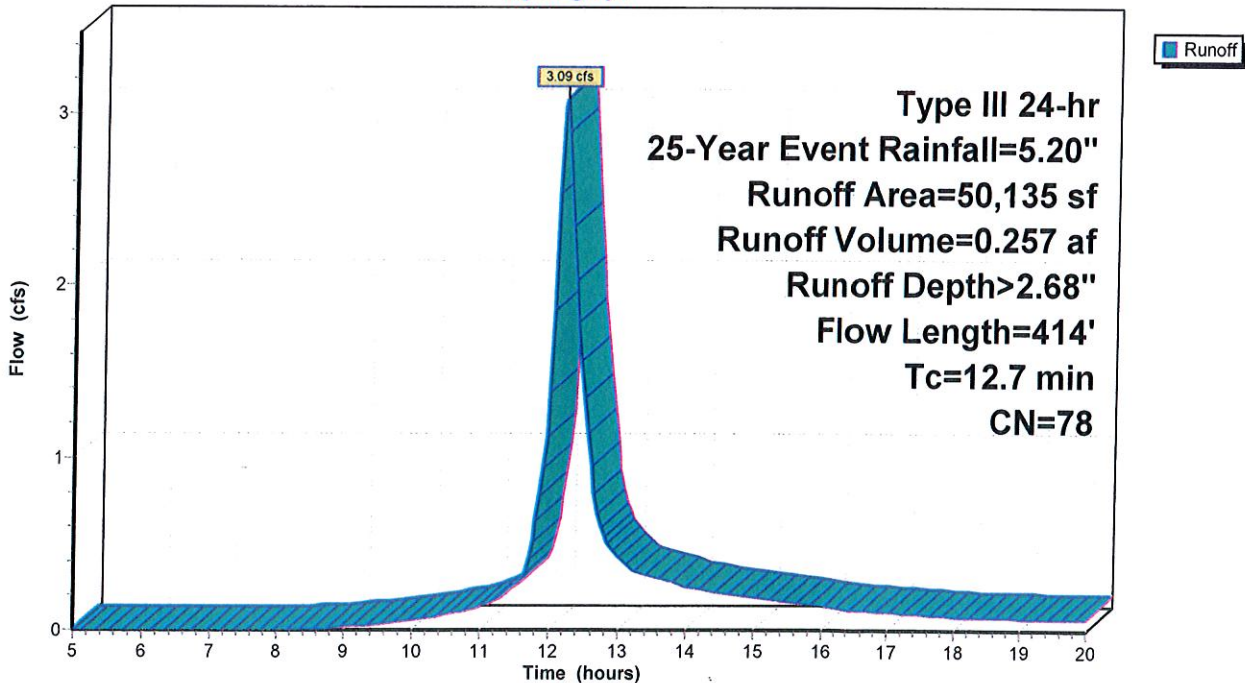
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Event Rainfall=5.20"

Area (sf)	CN	Description
1,390	98	Paved parking, HSG D
48,745	77	Woods, Good, HSG D
50,135	78	Weighted Average
48,745		97.23% Pervious Area
1,390		2.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	11	0.0200	0.8		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
9.7	89	0.1348	0.2		Sheet Flow, BC Woods: Light underbrush n= 0.400 P2= 2.80"
2.3	195	0.0769	1.4		Shallow Concentrated Flow, CD Woodland Kv= 5.0 fps
0.5	119	0.0160	4.3	17.26	Channel Flow, DE Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.030 Earth, grassed & winding
12.7	414	Total			

Subcatchment 1S: Sub Area #1

Hydrograph

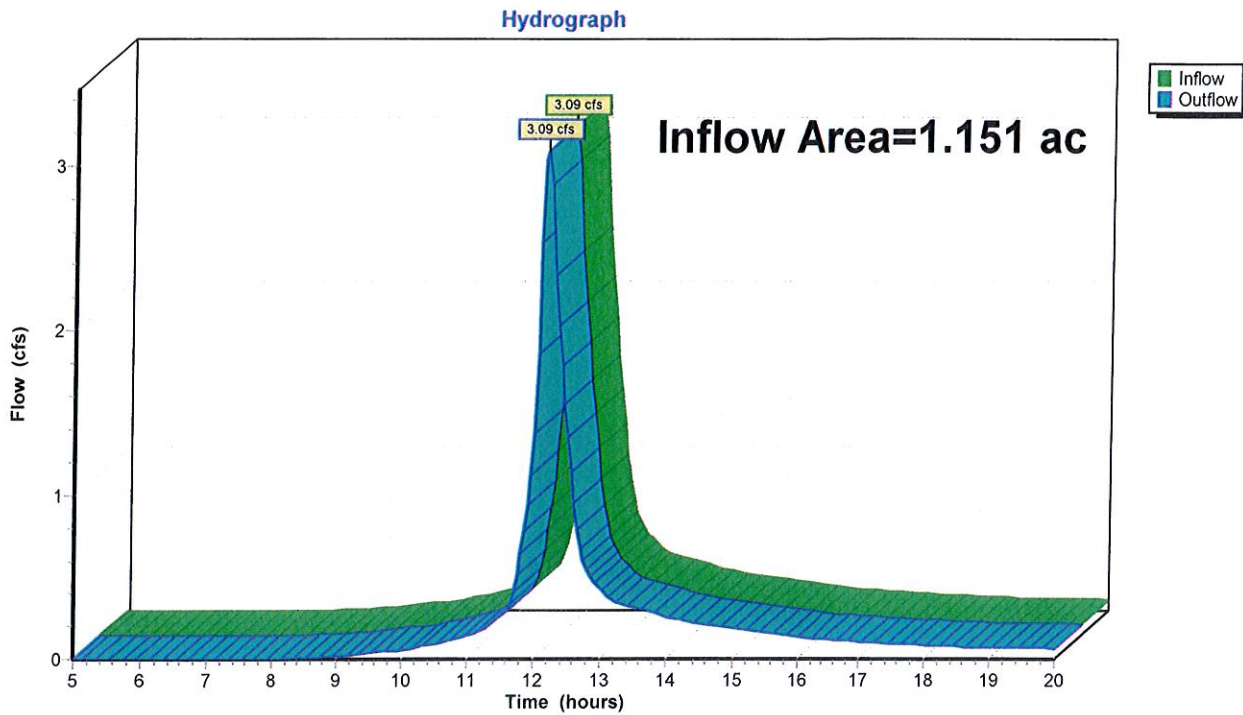


Summary for Reach SP: Study Point

Inflow Area = 1.151 ac, 2.77% Impervious, Inflow Depth > 2.68" for 25-Year Event event
Inflow = 3.09 cfs @ 12.18 hrs, Volume= 0.257 af
Outflow = 3.09 cfs @ 12.18 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.0 min

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

Reach SP: Study Point



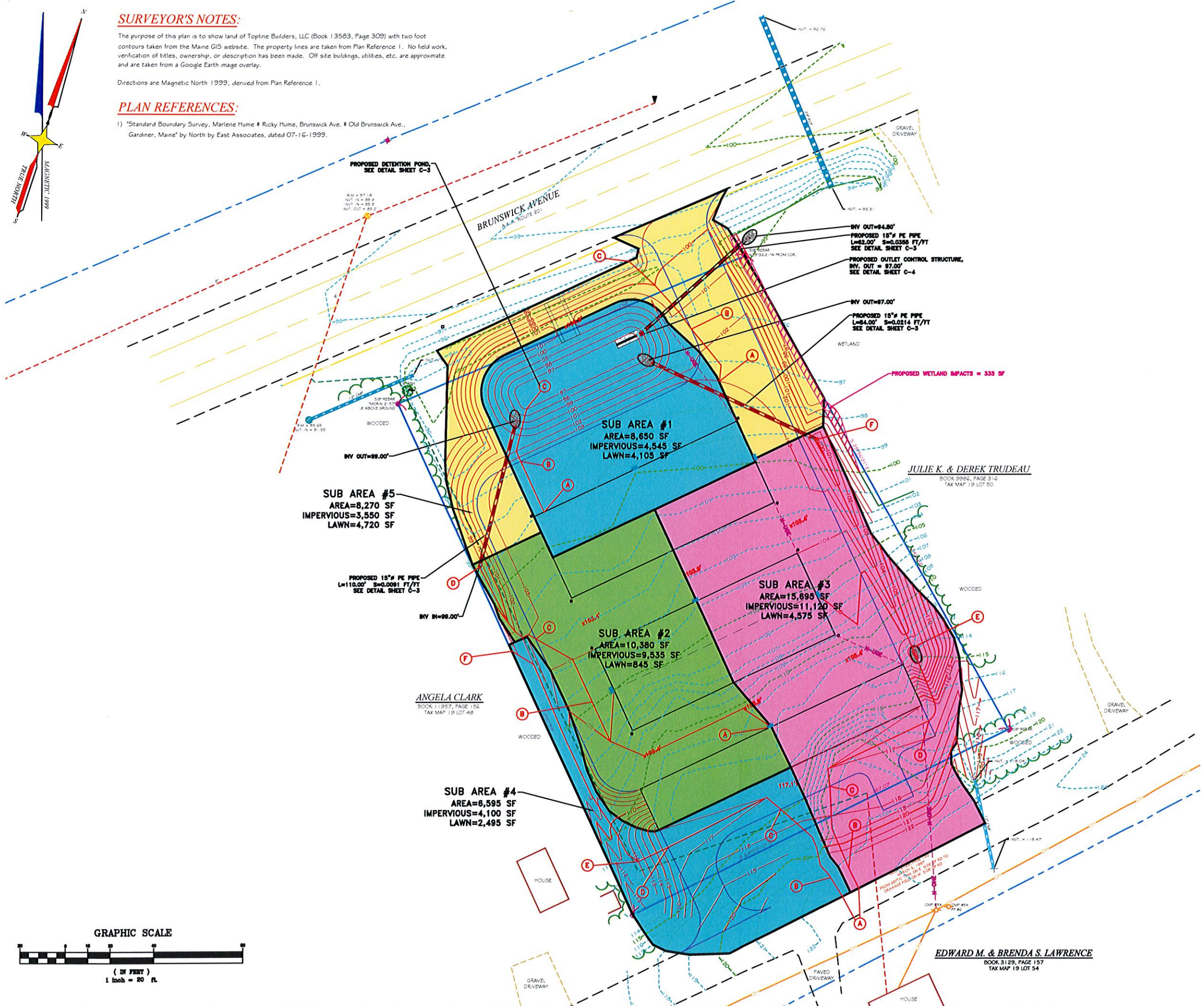
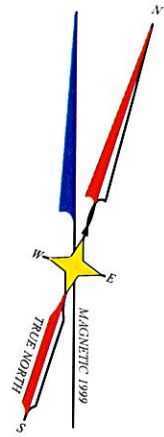
SURVEYOR'S NOTES:

The purpose of this plan is to show land of Topline Builders, LLC (Book 13583, Page 309) with two foot contours taken from the Maine GIS website. The property lines are taken from Plan Reference 1. No field work, verification of titles, ownership, or description has been made. Off site buildings, utilities, etc. are approximate and are taken from a Google Earth image overlay.

Directions are Magnetic North 1999, derived from Plan Reference 1.

PLAN REFERENCES:

- 1) "Standard Boundary Survey, Marlene Hume & Ricky Hume, Brunswick Ave. & Old Brunswick Ave., Gardiner, Maine" by North by East Associates, dated 07-16-1999.



LEGEND

- IRON ROD FOUND
- IRON PIPE FOUND
- DRILL HOLE IN LEDGE
- GRANITE MONUMENT FOUND
- 5/8" REBAR PROPOSED
- 4"x4" GRANITE MONUMENT PROPOSED
- UTILITY POLE
- GUY ANCHOR
- OVERHEAD UTILITY LINE
- BELOW GROUND ELECTRIC
- LIGHT
- HYDRANT
- WATER VALVE
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- DECIDUOUS TREE
- VEGETATION
- APPROXIMATE WETLANDS
- PRIOR OWNER



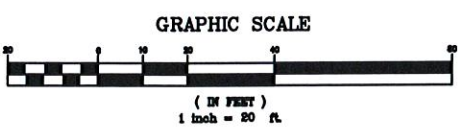
JAMES E. COFFIN
 ENGINEERING & SURVEYING, INC.
 432 Camp Road, P.O. Box 4887, Augusta, Maine 04308
 Ph. (207) 625-9475 Fax. (207) 625-0016 Toll Free 1-800-244-9475

NO.	REVISIONS	DATE

POST-DEVELOPMENT PLAN
SCALE: 1 INCH=20 FEET
DATE: MARCH 15, 2022
DRAWN BY: TGH
CHECKED BY: JFC

BRANDON ELLIS & BEN ROWE
LOCATION: BRUNSWICK AVE & OLD BRUNSWICK RD
TOWN: GARDINER COUNTY, KENNEBEC STATE, MAINE

PROJ. NO. 2021-080
POST



EDWARD M. & BRENDA S. LAWRENCE
 BOOK 3129, PAGE 157
 TAX MAP 19 LOT 54

ANGELA CLARK
 BOOK 11857, PAGE 156
 TAX MAP 19 LOT 48

JULIE K. & DEREK TRUDEAU
 BOOK 9946, PAGE 316
 TAX MAP 19 LOT 50

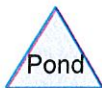
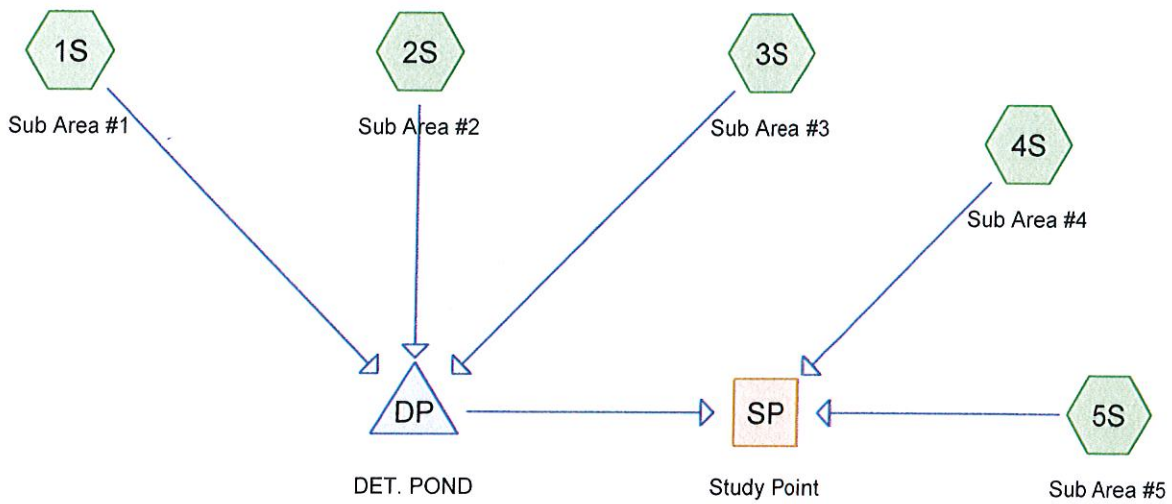
SUB AREA #5
 AREA=8,270 SF
 IMPERVIOUS=3,550 SF
 LAWN=4,720 SF

SUB AREA #1
 AREA=8,650 SF
 IMPERVIOUS=4,545 SF
 LAWN=4,105 SF

SUB AREA #3
 AREA=15,695 SF
 IMPERVIOUS=11,120 SF
 LAWN=4,575 SF

SUB AREA #2
 AREA=10,380 SF
 IMPERVIOUS=9,535 SF
 LAWN=845 SF

SUB AREA #4
 AREA=6,595 SF
 IMPERVIOUS=4,100 SF
 LAWN=2,495 SF



Routing Diagram for BHS Post-Development
 Prepared by {enter your company name here}, Printed 3/4/2022
 HydroCAD® 10.00-12 s/n 00434 © 2014 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: Sub Area #1

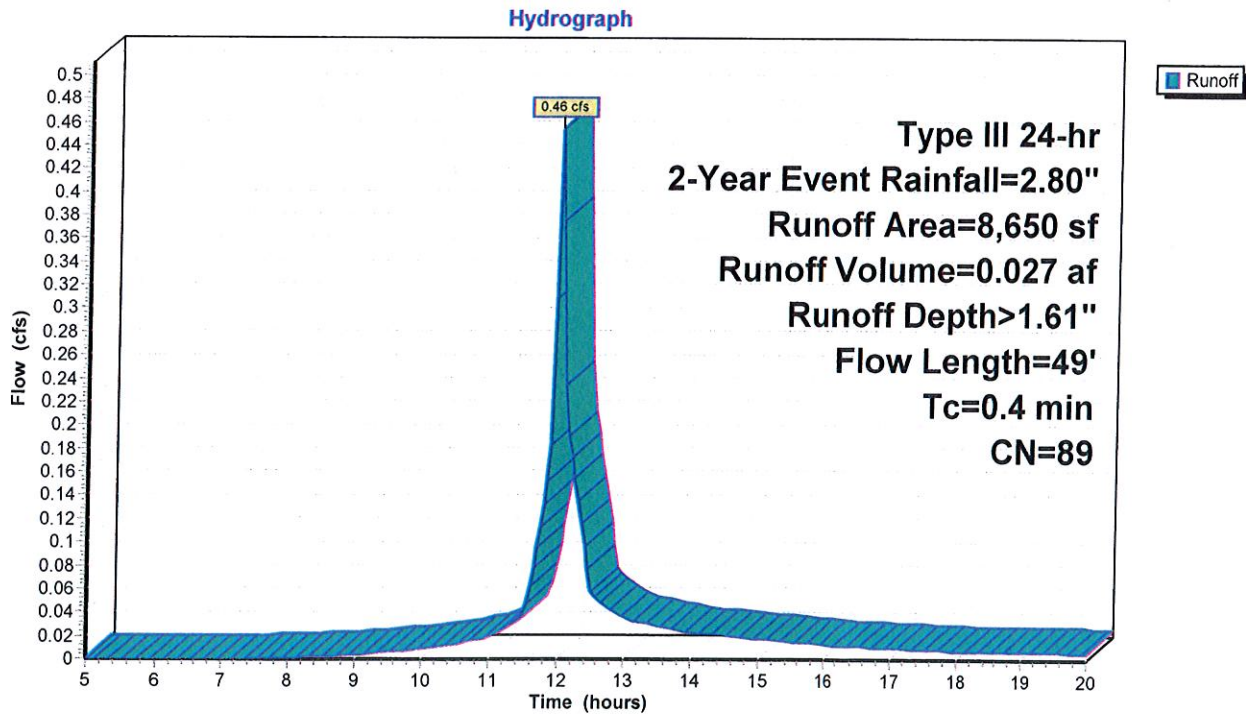
Runoff = 0.46 cfs @ 12.01 hrs, Volume= 0.027 af, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Event Rainfall=2.80"

Area (sf)	CN	Description
4,545	98	Paved parking, HSG D
4,105	80	>75% Grass cover, Good, HSG D
8,650	89	Weighted Average
4,105		47.46% Pervious Area
4,545		52.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	25	0.0400	1.3		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
0.1	24	0.2500	7.5		Shallow Concentrated Flow, BC Grassed Waterway Kv= 15.0 fps
0.4	49	Total			

Subcatchment 1S: Sub Area #1



BHS Post-Development

Type III 24-hr 2-Year Event Rainfall=2.80"

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Printed 3/4/2022

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Summary for Subcatchment 2S: Sub Area #2

Runoff = 0.69 cfs @ 12.03 hrs, Volume= 0.046 af, Depth> 2.32"

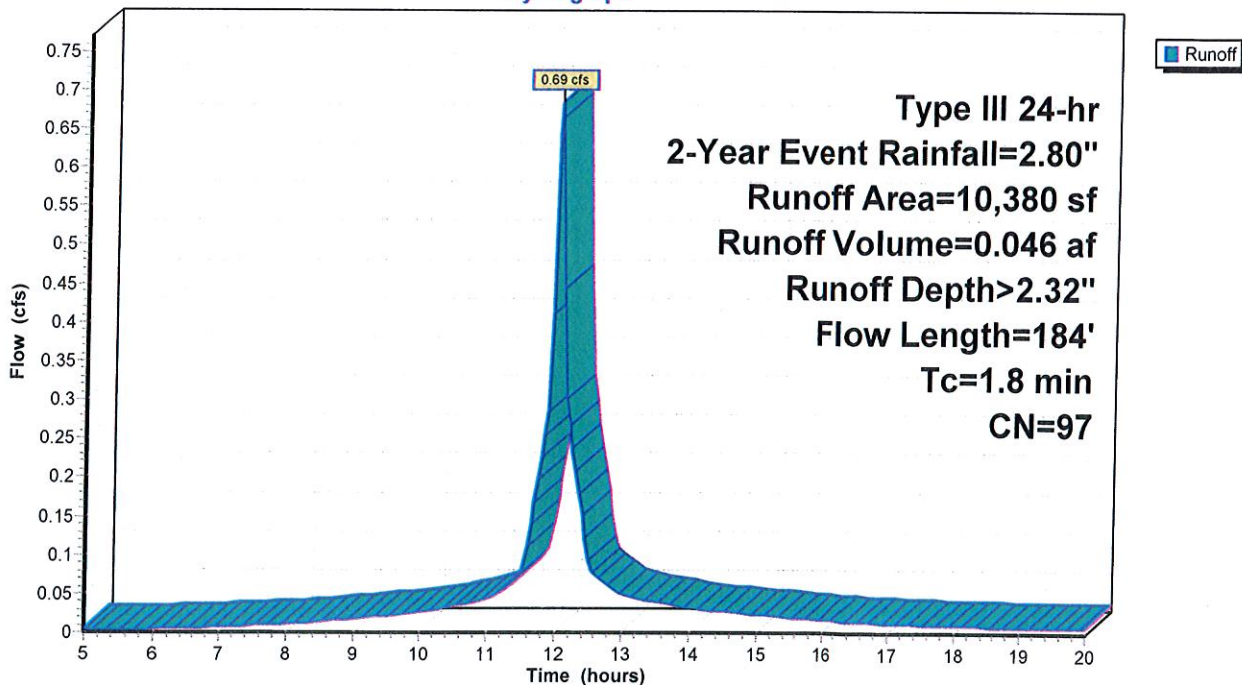
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Event Rainfall=2.80"

Area (sf)	CN	Description
9,535	98	Paved parking, HSG D
845	80	>75% Grass cover, Good, HSG D
10,380	97	Weighted Average
845		8.14% Pervious Area
9,535		91.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0150	1.1		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
0.2	40	0.0375	3.9		Shallow Concentrated Flow, BC Paved Kv= 20.3 fps
0.1	44	0.0909	10.3	41.14	Channel Flow, CD Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.030 Earth, grassed & winding
1.8	184	Total			

Subcatchment 2S: Sub Area #2

Hydrograph



BHS Post-Development

Type III 24-hr 2-Year Event Rainfall=2.80"

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Summary for Subcatchment 3S: Sub Area #3

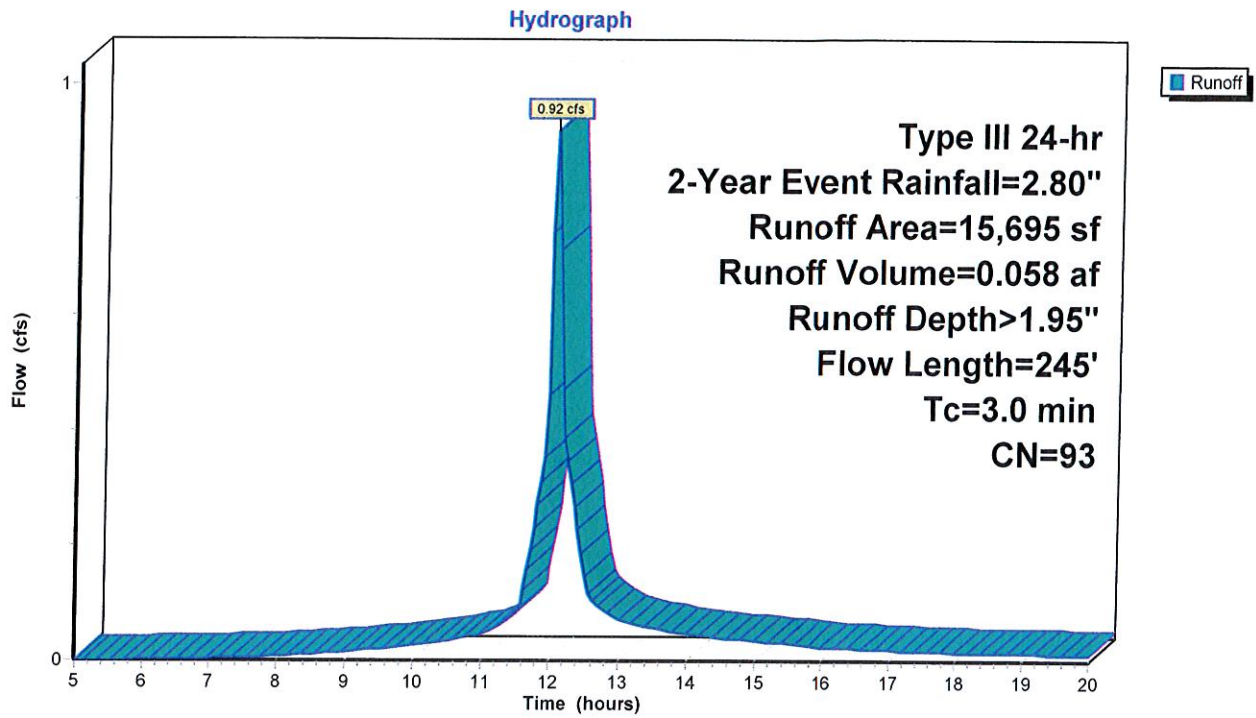
Runoff = 0.92 cfs @ 12.05 hrs, Volume= 0.058 af, Depth> 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Event Rainfall=2.80"

Area (sf)	CN	Description
11,120	98	Paved parking, HSG D
4,575	80	>75% Grass cover, Good, HSG D
15,695	93	Weighted Average
4,575		29.15% Pervious Area
11,120		70.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	10	0.0200	0.8		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
2.3	38	0.1316	0.3		Sheet Flow, BC Grass: Short n= 0.150 P2= 2.80"
0.3	58	0.0200	2.9		Shallow Concentrated Flow, CD Paved Kv= 20.3 fps
0.0	36	0.2778	13.5	53.93	Channel Flow, DE Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.040 Earth, cobble bottom, clean sides
0.2	103	0.0583	8.2	32.94	Channel Flow, EF Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.030 Earth, grassed & winding
3.0	245	Total			

Subcatchment 3S: Sub Area #3



BHS Post-Development

Type III 24-hr 2-Year Event Rainfall=2.80"

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Printed 3/4/2022

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Summary for Subcatchment 4S: Sub Area #4

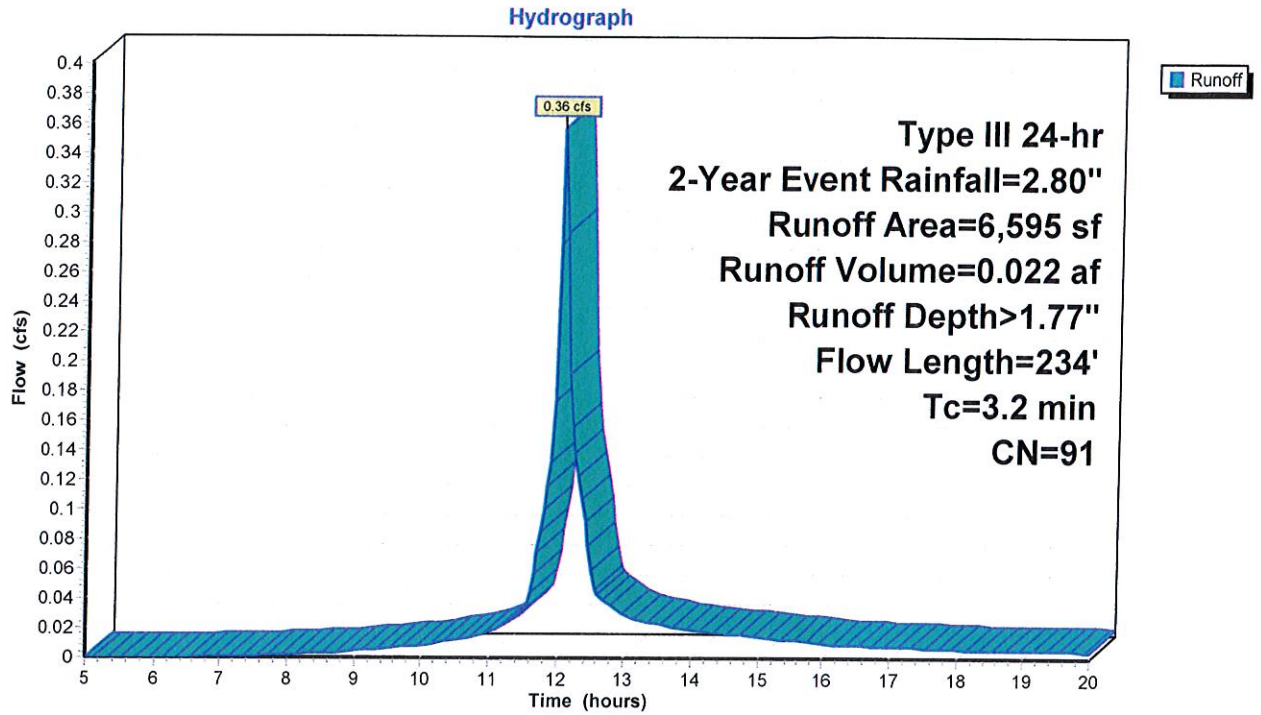
Runoff = 0.36 cfs @ 12.05 hrs, Volume= 0.022 af, Depth> 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Event Rainfall=2.80"

Area (sf)	CN	Description
4,100	98	Paved parking, HSG D
2,495	80	>75% Grass cover, Good, HSG D
6,595	91	Weighted Average
2,495		37.83% Pervious Area
4,100		62.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	10	0.0200	0.8		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
2.3	39	0.1282	0.3		Sheet Flow, BC Grass: Short n= 0.150 P2= 2.80"
0.3	58	0.0200	2.9		Shallow Concentrated Flow, CD Paved Kv= 20.3 fps
0.0	15	0.2667	7.7		Shallow Concentrated Flow, DE Grassed Waterway Kv= 15.0 fps
0.4	112	0.1071	4.9		Shallow Concentrated Flow, EF Grassed Waterway Kv= 15.0 fps
3.2	234	Total			

Subcatchment 4S: Sub Area #4



BHS Post-Development

Type III 24-hr 2-Year Event Rainfall=2.80"

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Summary for Subcatchment 5S: Sub Area #5

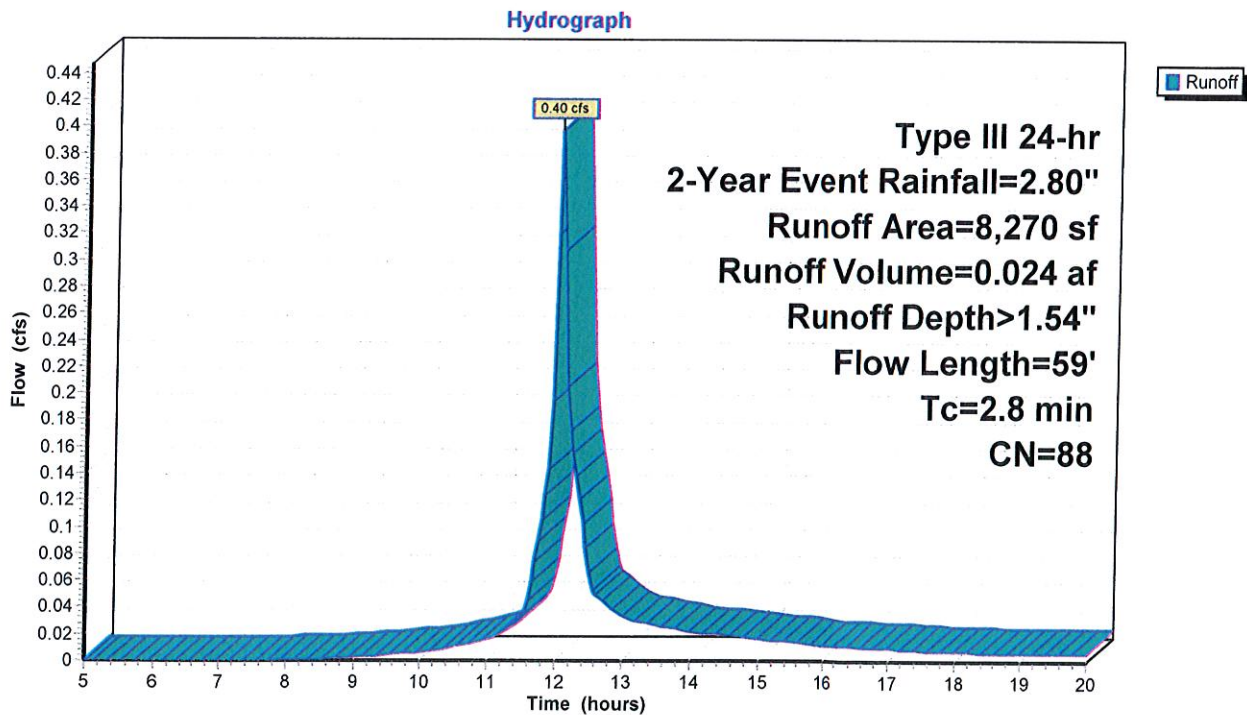
Runoff = 0.40 cfs @ 12.05 hrs, Volume= 0.024 af, Depth> 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Event Rainfall=2.80"

Area (sf)	CN	Description
3,550	98	Paved parking, HSG D
4,720	80	>75% Grass cover, Good, HSG D
8,270	88	Weighted Average
4,720		57.07% Pervious Area
3,550		42.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	18	0.0833	1.6		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
2.6	41	0.1098	0.3		Sheet Flow, BC Grass: Short n= 0.150 P2= 2.80"
2.8	59	Total			

Subcatchment 5S: Sub Area #5



BHS Post-Development

Type III 24-hr 2-Year Event Rainfall=2.80"

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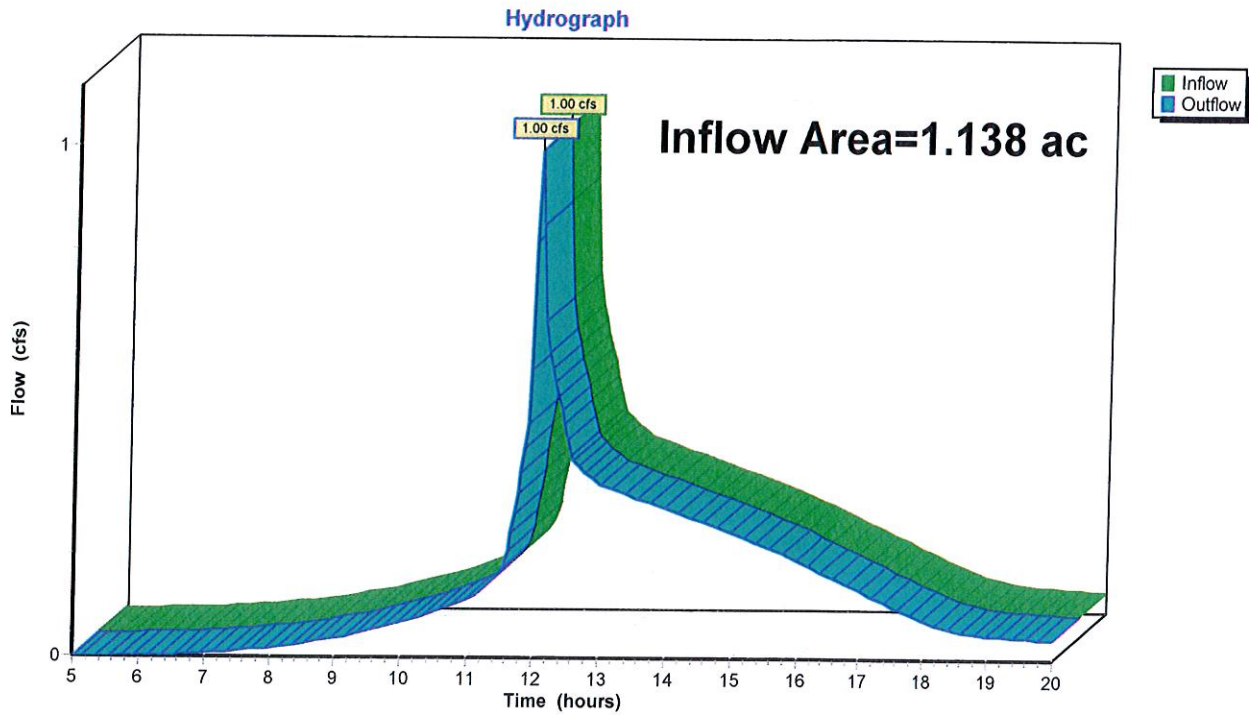
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Summary for Reach SP: Study Point

Inflow Area = 1.138 ac, 66.24% Impervious, Inflow Depth > 1.85" for 2-Year Event event
Inflow = 1.00 cfs @ 12.05 hrs, Volume= 0.176 af
Outflow = 1.00 cfs @ 12.05 hrs, Volume= 0.176 af, Atten= 0%, Lag= 0.0 min

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

Reach SP: Study Point



BHS Post-Development

Type III 24-hr 2-Year Event Rainfall=2.80"

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Summary for Pond DP: DET. POND

Inflow Area = 0.797 ac, 72.57% Impervious, Inflow Depth > 1.98" for 2-Year Event event
 Inflow = 2.00 cfs @ 12.03 hrs, Volume= 0.131 af
 Outflow = 0.30 cfs @ 12.51 hrs, Volume= 0.129 af, Atten= 85%, Lag= 28.4 min
 Primary = 0.30 cfs @ 12.51 hrs, Volume= 0.129 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 99.06' @ 12.51 hrs Surf.Area= 1,617 sf Storage= 2,291 cf

Plug-Flow detention time= 85.0 min calculated for 0.129 af (98% of inflow)
 Center-of-Mass det. time= 78.5 min (837.8 - 759.3)

Volume	Invert	Avail.Storage	Storage Description
#1	97.00'	7,998 cf	Custom Stage Data (Conic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
97.00	655	0	0	655
98.00	1,090	863	863	1,102
99.00	1,585	1,330	2,193	1,614
100.00	2,140	1,856	4,049	2,189
101.00	2,745	2,436	6,485	2,819
101.50	3,315	1,513	7,998	3,397

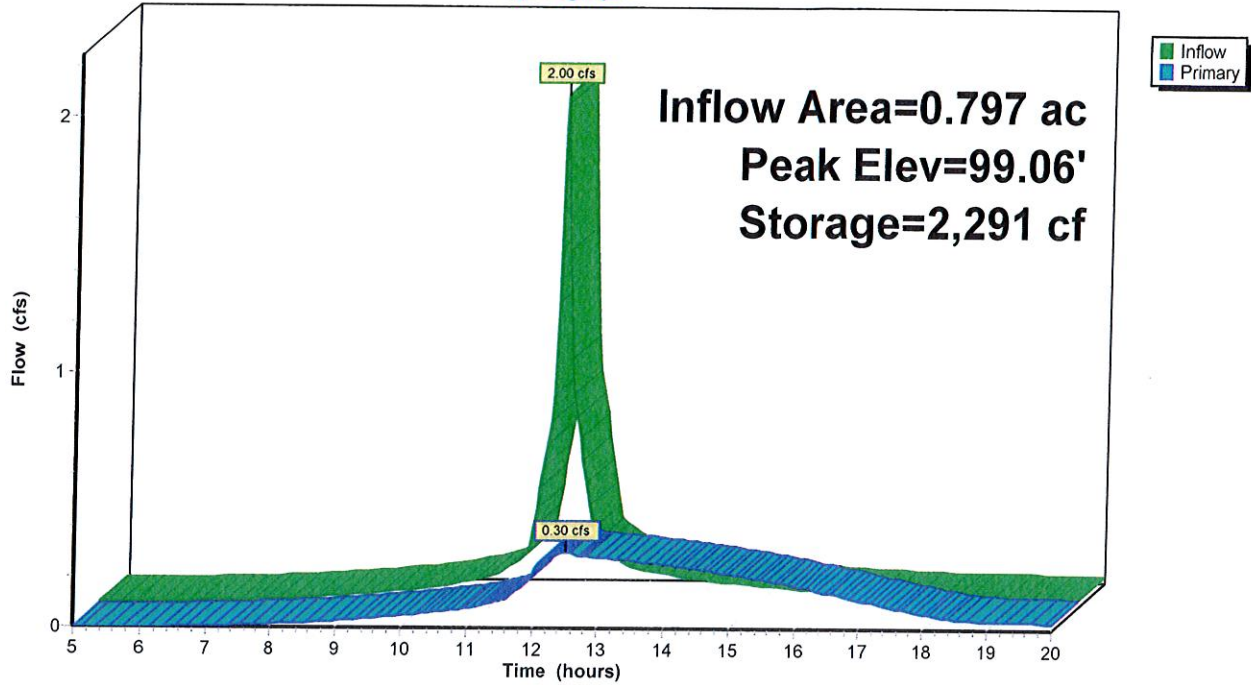
Device	Routing	Invert	Outlet Devices
#1	Primary	97.00'	15.0" Round Culvert L= 62.0' Ke= 0.9? Inlet / Outlet Invert= 97.00' / 94.80' S= 0.0355 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.22718463030851?
#2	Device 1	97.00'	2.8" Vert. Orifice/Grate C= 0.600
#3	Device 1	99.00'	8.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.30 cfs @ 12.51 hrs HW=99.06' (Free Discharge)

- 1=Culvert (Passes 0.30 cfs of 5.59 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.29 cfs @ 6.7 fps)
- 3=Orifice/Grate (Orifice Controls 0.01 cfs @ 0.8 fps)

Pond DP: DET. POND

Hydrograph



BHS Post-Development

Type III 24-hr 10-Year Event Rainfall=4.20"

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Summary for Subcatchment 1S: Sub Area #1

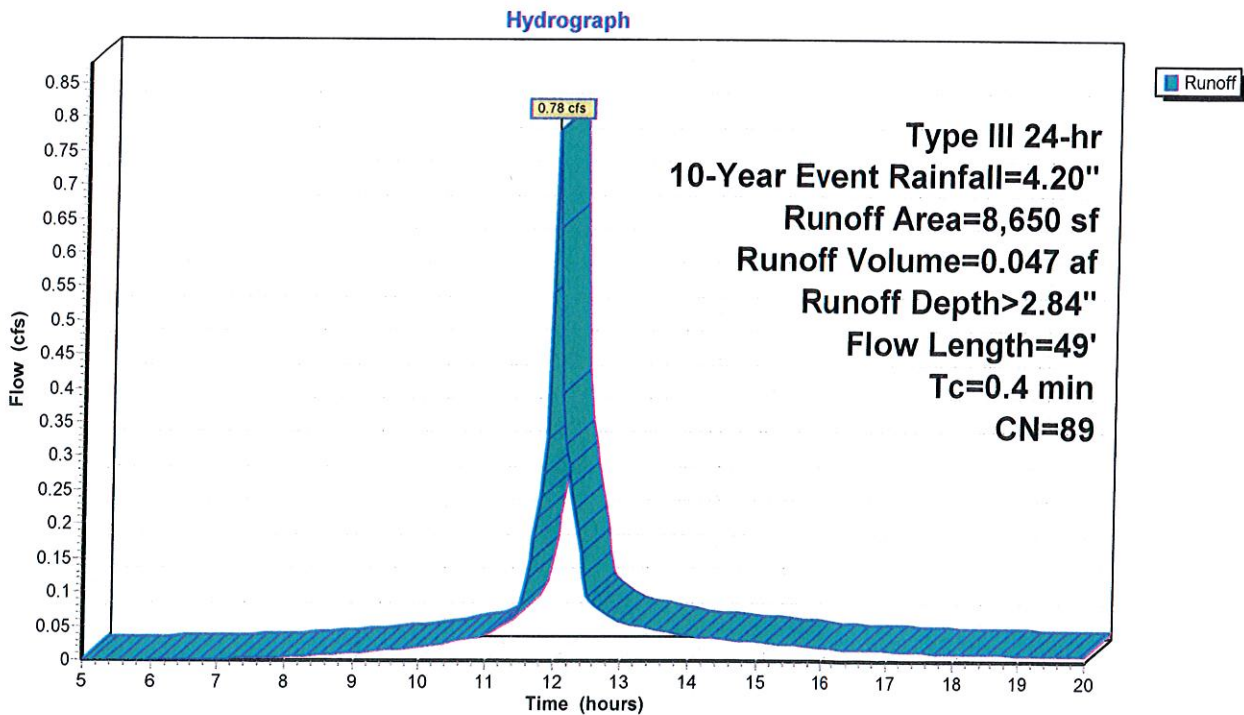
Runoff = 0.78 cfs @ 12.01 hrs, Volume= 0.047 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Event Rainfall=4.20"

Area (sf)	CN	Description
4,545	98	Paved parking, HSG D
4,105	80	>75% Grass cover, Good, HSG D
8,650	89	Weighted Average
4,105		47.46% Pervious Area
4,545		52.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	25	0.0400	1.3		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
0.1	24	0.2500	7.5		Shallow Concentrated Flow, BC Grassed Waterway Kv= 15.0 fps
0.4	49	Total			

Subcatchment 1S: Sub Area #1



BHS Post-Development

Type III 24-hr 10-Year Event Rainfall=4.20"

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Summary for Subcatchment 2S: Sub Area #2

Runoff = 1.05 cfs @ 12.03 hrs, Volume= 0.072 af, Depth> 3.61"

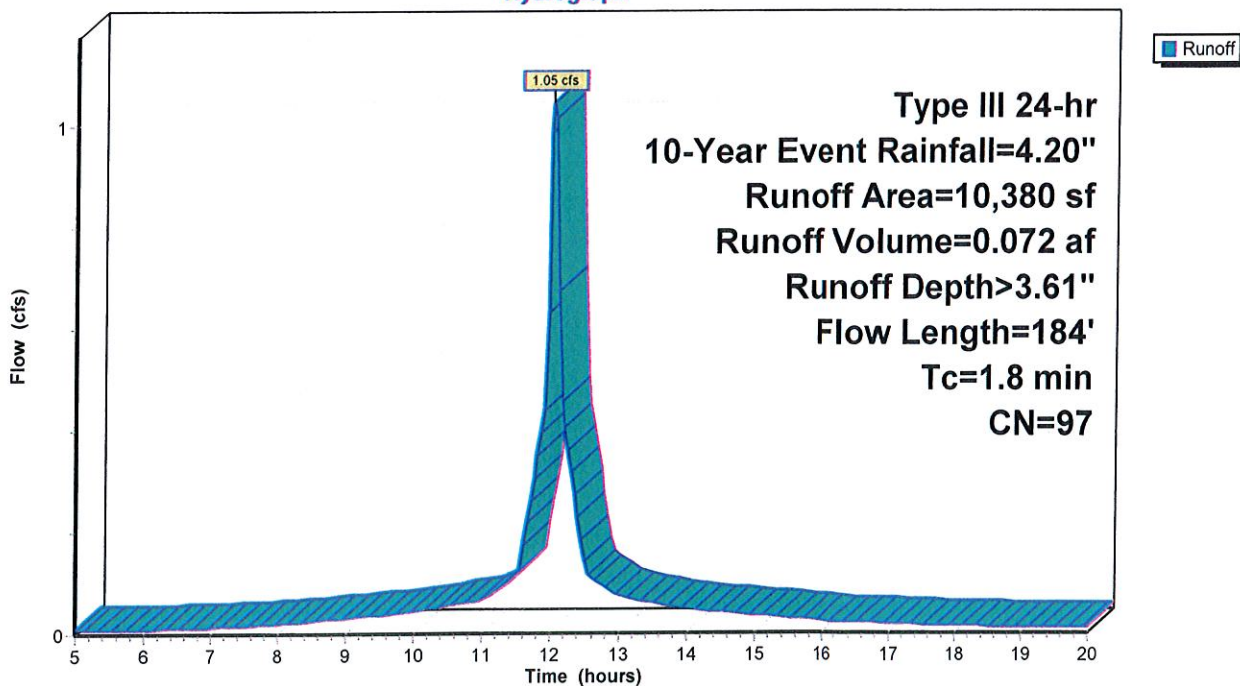
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Event Rainfall=4.20"

Area (sf)	CN	Description
9,535	98	Paved parking, HSG D
845	80	>75% Grass cover, Good, HSG D
10,380	97	Weighted Average
845		8.14% Pervious Area
9,535		91.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0150	1.1		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
0.2	40	0.0375	3.9		Shallow Concentrated Flow, BC Paved Kv= 20.3 fps
0.1	44	0.0909	10.3	41.14	Channel Flow, CD Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.030 Earth, grassed & winding
1.8	184	Total			

Subcatchment 2S: Sub Area #2

Hydrograph



BHS Post-Development

Type III 24-hr 10-Year Event Rainfall=4.20"

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Summary for Subcatchment 3S: Sub Area #3

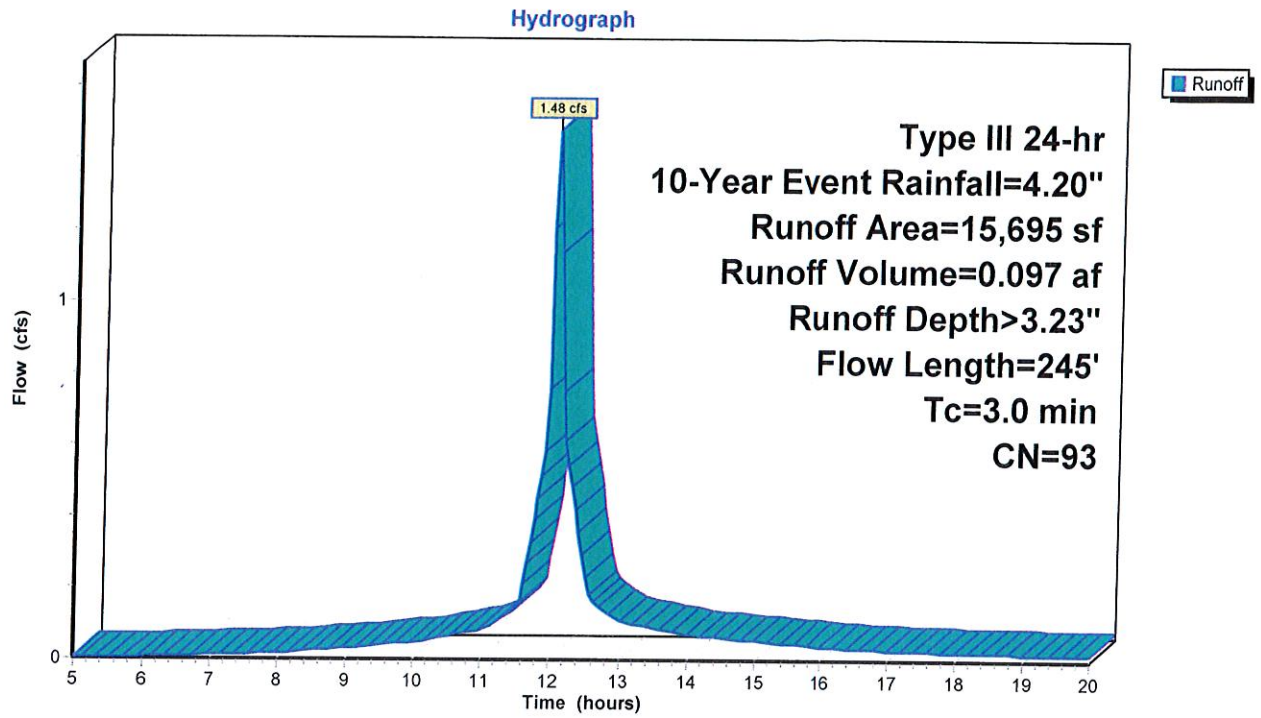
Runoff = 1.48 cfs @ 12.05 hrs, Volume= 0.097 af, Depth> 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Event Rainfall=4.20"

Area (sf)	CN	Description
11,120	98	Paved parking, HSG D
4,575	80	>75% Grass cover, Good, HSG D
15,695	93	Weighted Average
4,575		29.15% Pervious Area
11,120		70.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	10	0.0200	0.8		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
2.3	38	0.1316	0.3		Sheet Flow, BC Grass: Short n= 0.150 P2= 2.80"
0.3	58	0.0200	2.9		Shallow Concentrated Flow, CD Paved Kv= 20.3 fps
0.0	36	0.2778	13.5	53.93	Channel Flow, DE Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.040 Earth, cobble bottom, clean sides
0.2	103	0.0583	8.2	32.94	Channel Flow, EF Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.030 Earth, grassed & winding
3.0	245	Total			

Subcatchment 3S: Sub Area #3



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Type III 24-hr 10-Year Event Rainfall=4.20"

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Summary for Subcatchment 4S: Sub Area #4

Runoff = 0.59 cfs @ 12.05 hrs, Volume= 0.038 af, Depth> 3.03"

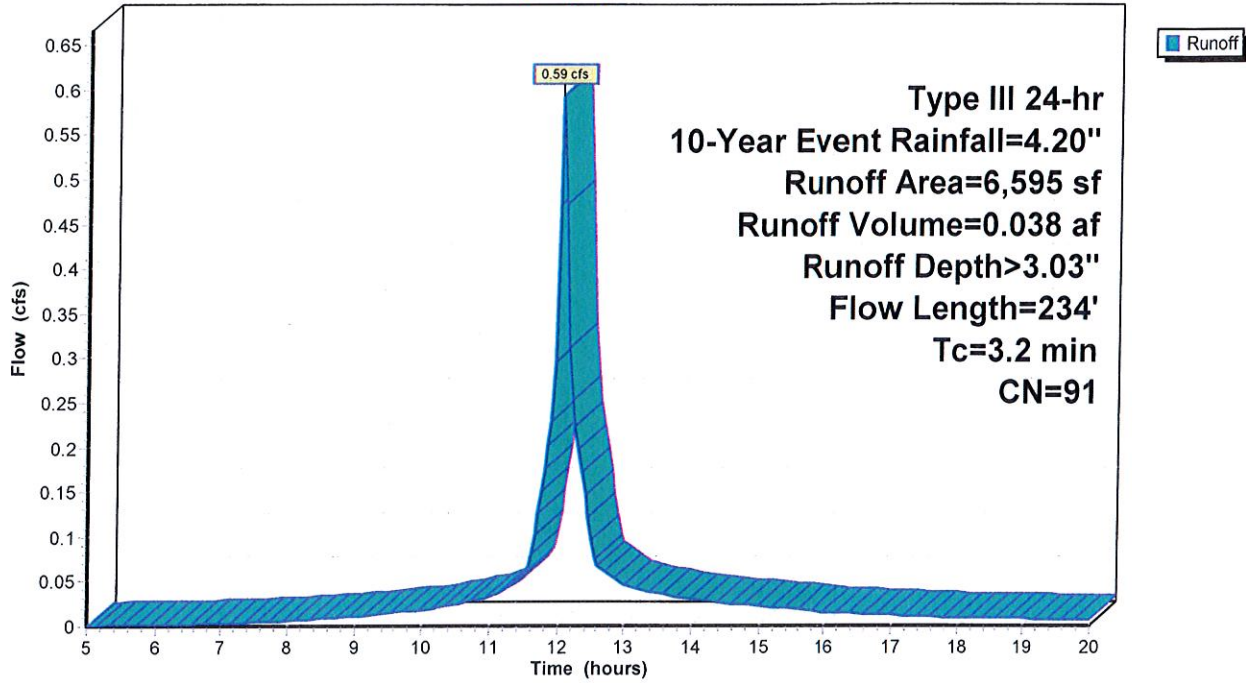
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Event Rainfall=4.20"

Area (sf)	CN	Description
4,100	98	Paved parking, HSG D
2,495	80	>75% Grass cover, Good, HSG D
6,595	91	Weighted Average
2,495		37.83% Pervious Area
4,100		62.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	10	0.0200	0.8		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
2.3	39	0.1282	0.3		Sheet Flow, BC Grass: Short n= 0.150 P2= 2.80"
0.3	58	0.0200	2.9		Shallow Concentrated Flow, CD Paved Kv= 20.3 fps
0.0	15	0.2667	7.7		Shallow Concentrated Flow, DE Grassed Waterway Kv= 15.0 fps
0.4	112	0.1071	4.9		Shallow Concentrated Flow, EF Grassed Waterway Kv= 15.0 fps
3.2	234	Total			

Subcatchment 4S: Sub Area #4

Hydrograph



BHS Post-Development

Type III 24-hr 10-Year Event Rainfall=4.20"

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Summary for Subcatchment 5S: Sub Area #5

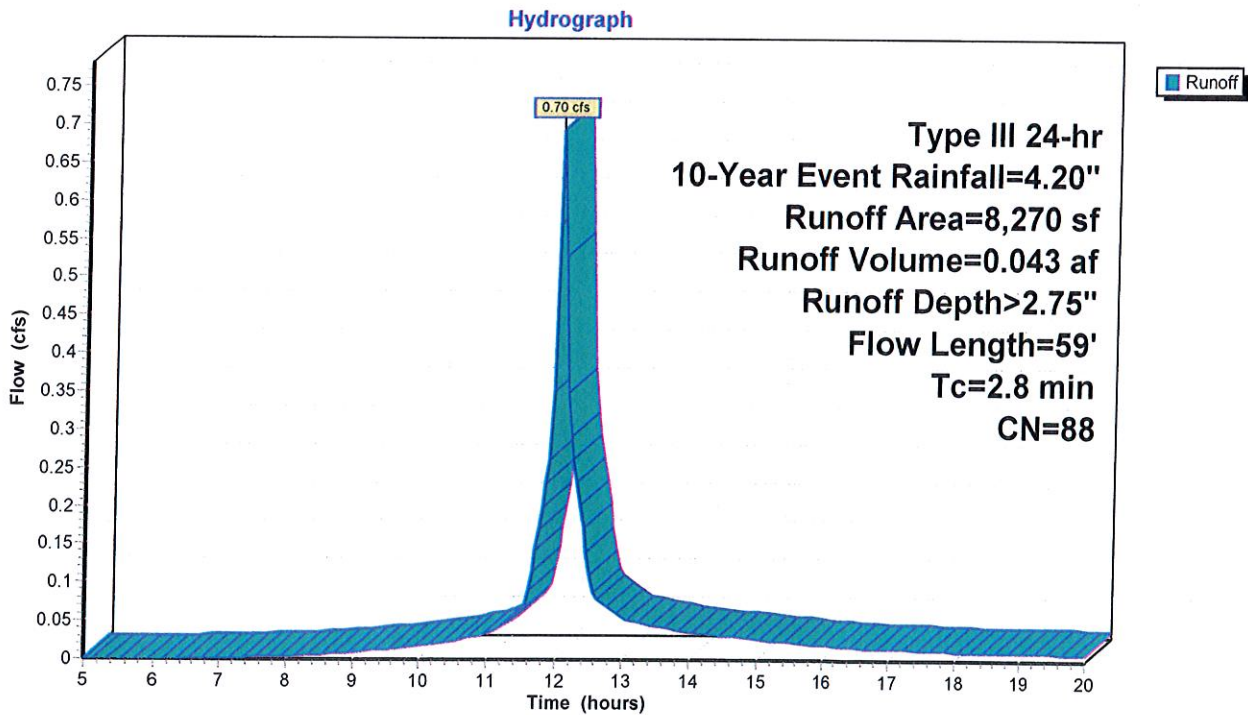
Runoff = 0.70 cfs @ 12.05 hrs, Volume= 0.043 af, Depth> 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Event Rainfall=4.20"

Area (sf)	CN	Description
3,550	98	Paved parking, HSG D
4,720	80	>75% Grass cover, Good, HSG D
8,270	88	Weighted Average
4,720		57.07% Pervious Area
3,550		42.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	18	0.0833	1.6		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
2.6	41	0.1098	0.3		Sheet Flow, BC Grass: Short n= 0.150 P2= 2.80"
2.8	59	Total			

Subcatchment 5S: Sub Area #5

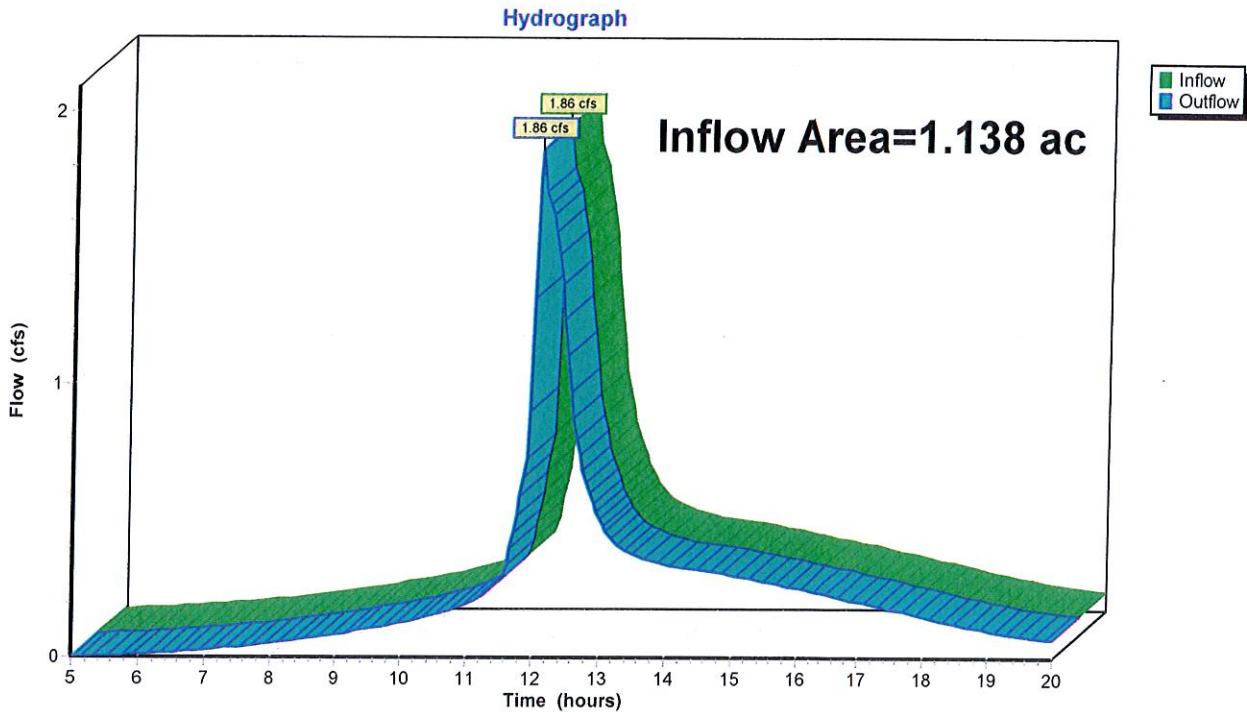


Summary for Reach SP: Study Point

Inflow Area = 1.138 ac, 66.24% Impervious, Inflow Depth > 3.10" for 10-Year Event event
Inflow = 1.86 cfs @ 12.09 hrs, Volume= 0.295 af
Outflow = 1.86 cfs @ 12.09 hrs, Volume= 0.295 af, Atten= 0%, Lag= 0.0 min

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

Reach SP: Study Point



BHS Post-Development

Type III 24-hr 10-Year Event Rainfall=4.20"

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Summary for Pond DP: DET. POND

Inflow Area = 0.797 ac, 72.57% Impervious, Inflow Depth > 3.25" for 10-Year Event event
 Inflow = 3.21 cfs @ 12.03 hrs, Volume= 0.216 af
 Outflow = 1.14 cfs @ 12.26 hrs, Volume= 0.213 af, Atten= 64%, Lag= 13.9 min
 Primary = 1.14 cfs @ 12.26 hrs, Volume= 0.213 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 99.57' @ 12.26 hrs Surf.Area= 1,891 sf Storage= 3,183 cf

Plug-Flow detention time= 76.5 min calculated for 0.213 af (99% of inflow)
 Center-of-Mass det. time= 70.7 min (820.9 - 750.2)

Volume	Invert	Avail.Storage	Storage Description		
#1	97.00'	7,998 cf	Custom Stage Data (Conic) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
97.00	655	0	0	655	
98.00	1,090	863	863	1,102	
99.00	1,585	1,330	2,193	1,614	
100.00	2,140	1,856	4,049	2,189	
101.00	2,745	2,436	6,485	2,819	
101.50	3,315	1,513	7,998	3,397	

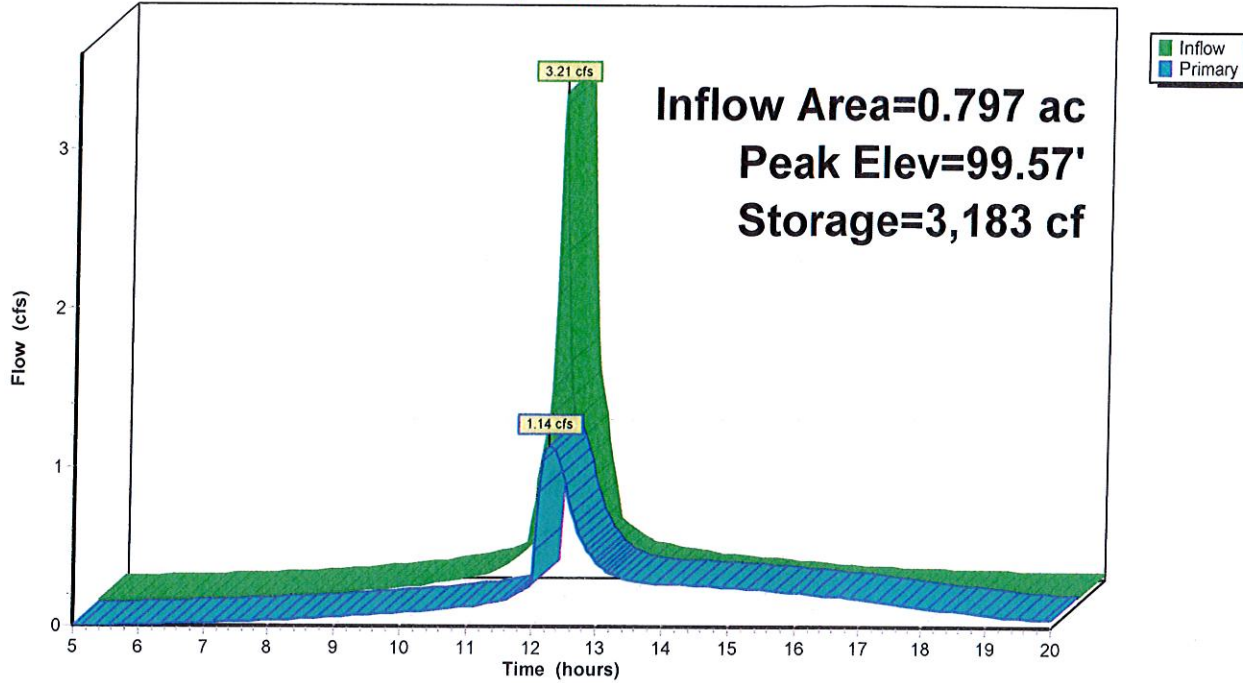
Device	Routing	Invert	Outlet Devices	
#1	Primary	97.00'	15.0" Round Culvert L= 62.0' Ke= 0.9? Inlet / Outlet Invert= 97.00' / 94.80' S= 0.0355 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.22718463030851?	
#2	Device 1	97.00'	2.8" Vert. Orifice/Grate C= 0.600	
#3	Device 1	99.00'	8.0" Vert. Orifice/Grate C= 0.600	

Primary OutFlow Max=1.14 cfs @ 12.26 hrs HW=99.57' (Free Discharge)

- ← 1=Culvert (Passes 1.14 cfs of 6.50 cfs potential flow)
- ← 2=Orifice/Grate (Orifice Controls 0.32 cfs @ 7.5 fps)
- ← 3=Orifice/Grate (Orifice Controls 0.81 cfs @ 2.6 fps)

Pond DP: DET. POND

Hydrograph



BHS Post-Development

Type III 24-hr 25-Year Event Rainfall=5.20"

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Summary for Subcatchment 1S: Sub Area #1

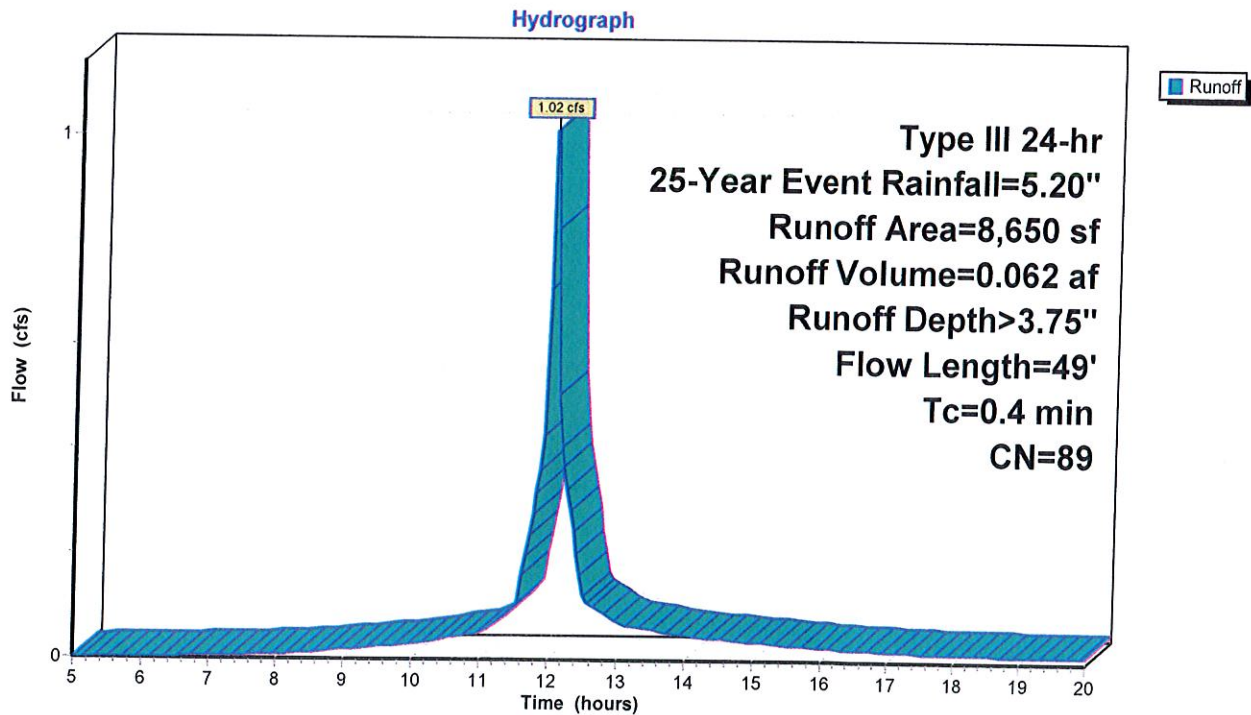
Runoff = 1.02 cfs @ 12.01 hrs, Volume= 0.062 af, Depth> 3.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Event Rainfall=5.20"

Area (sf)	CN	Description
4,545	98	Paved parking, HSG D
4,105	80	>75% Grass cover, Good, HSG D
8,650	89	Weighted Average
4,105		47.46% Pervious Area
4,545		52.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	25	0.0400	1.3		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
0.1	24	0.2500	7.5		Shallow Concentrated Flow, BC Grassed Waterway Kv= 15.0 fps
0.4	49	Total			

Subcatchment 1S: Sub Area #1



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Type III 24-hr 25-Year Event Rainfall=5.20"

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Summary for Subcatchment 2S: Sub Area #2

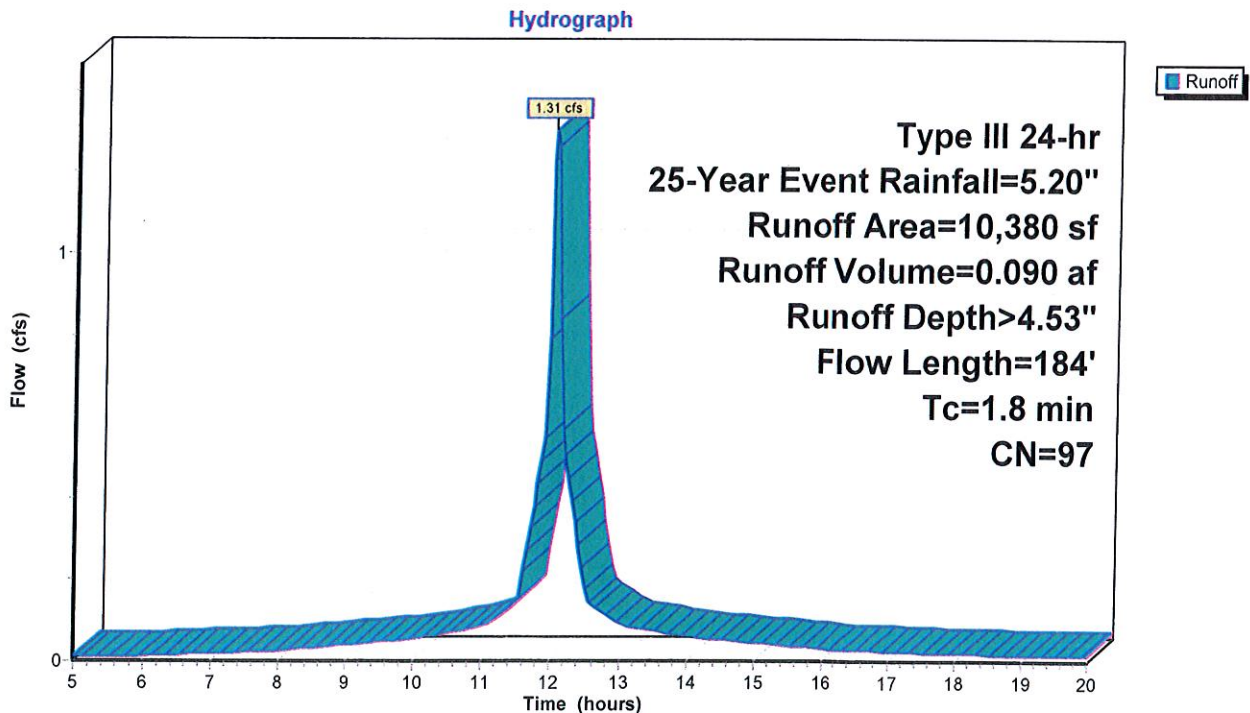
Runoff = 1.31 cfs @ 12.03 hrs, Volume= 0.090 af, Depth> 4.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Event Rainfall=5.20"

Area (sf)	CN	Description
9,535	98	Paved parking, HSG D
845	80	>75% Grass cover, Good, HSG D
10,380	97	Weighted Average
845		8.14% Pervious Area
9,535		91.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0150	1.1		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
0.2	40	0.0375	3.9		Shallow Concentrated Flow, BC Paved Kv= 20.3 fps
0.1	44	0.0909	10.3	41.14	Channel Flow, CD Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.030 Earth, grassed & winding
1.8	184	Total			

Subcatchment 2S: Sub Area #2



BHS Post-Development

Type III 24-hr 25-Year Event Rainfall=5.20"

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Summary for Subcatchment 3S: Sub Area #3

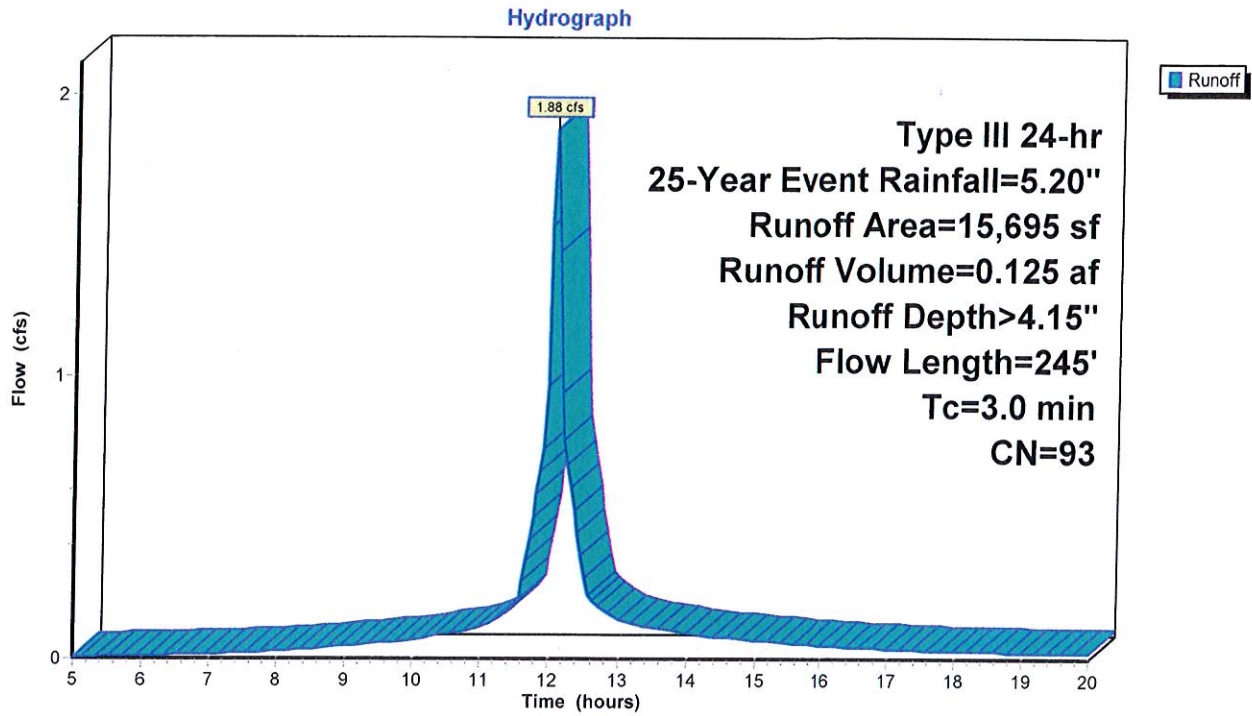
Runoff = 1.88 cfs @ 12.05 hrs, Volume= 0.125 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Event Rainfall=5.20"

Area (sf)	CN	Description
11,120	98	Paved parking, HSG D
4,575	80	>75% Grass cover, Good, HSG D
15,695	93	Weighted Average
4,575		29.15% Pervious Area
11,120		70.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	10	0.0200	0.8		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
2.3	38	0.1316	0.3		Sheet Flow, BC Grass: Short n= 0.150 P2= 2.80"
0.3	58	0.0200	2.9		Shallow Concentrated Flow, CD Paved Kv= 20.3 fps
0.0	36	0.2778	13.5	53.93	Channel Flow, DE Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.040 Earth, cobble bottom, clean sides
0.2	103	0.0583	8.2	32.94	Channel Flow, EF Area= 4.0 sf Perim= 7.0' r= 0.57' n= 0.030 Earth, grassed & winding
3.0	245	Total			

Subcatchment 3S: Sub Area #3



BHS Post-Development

Type III 24-hr 25-Year Event Rainfall=5.20"

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Summary for Subcatchment 4S: Sub Area #4

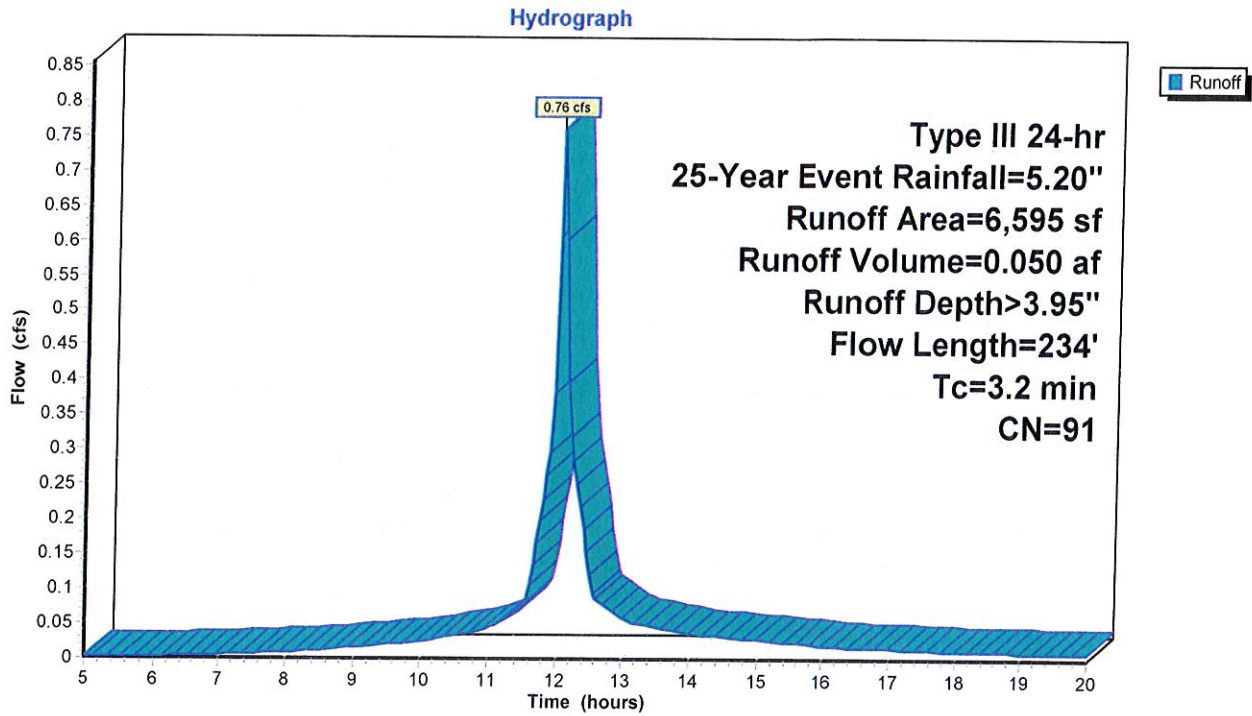
Runoff = 0.76 cfs @ 12.05 hrs, Volume= 0.050 af, Depth> 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Event Rainfall=5.20"

Area (sf)	CN	Description
4,100	98	Paved parking, HSG D
2,495	80	>75% Grass cover, Good, HSG D
6,595	91	Weighted Average
2,495		37.83% Pervious Area
4,100		62.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	10	0.0200	0.8		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
2.3	39	0.1282	0.3		Sheet Flow, BC Grass: Short n= 0.150 P2= 2.80"
0.3	58	0.0200	2.9		Shallow Concentrated Flow, CD Paved Kv= 20.3 fps
0.0	15	0.2667	7.7		Shallow Concentrated Flow, DE Grassed Waterway Kv= 15.0 fps
0.4	112	0.1071	4.9		Shallow Concentrated Flow, EF Grassed Waterway Kv= 15.0 fps
3.2	234	Total			

Subcatchment 4S: Sub Area #4



Summary for Subcatchment 5S: Sub Area #5

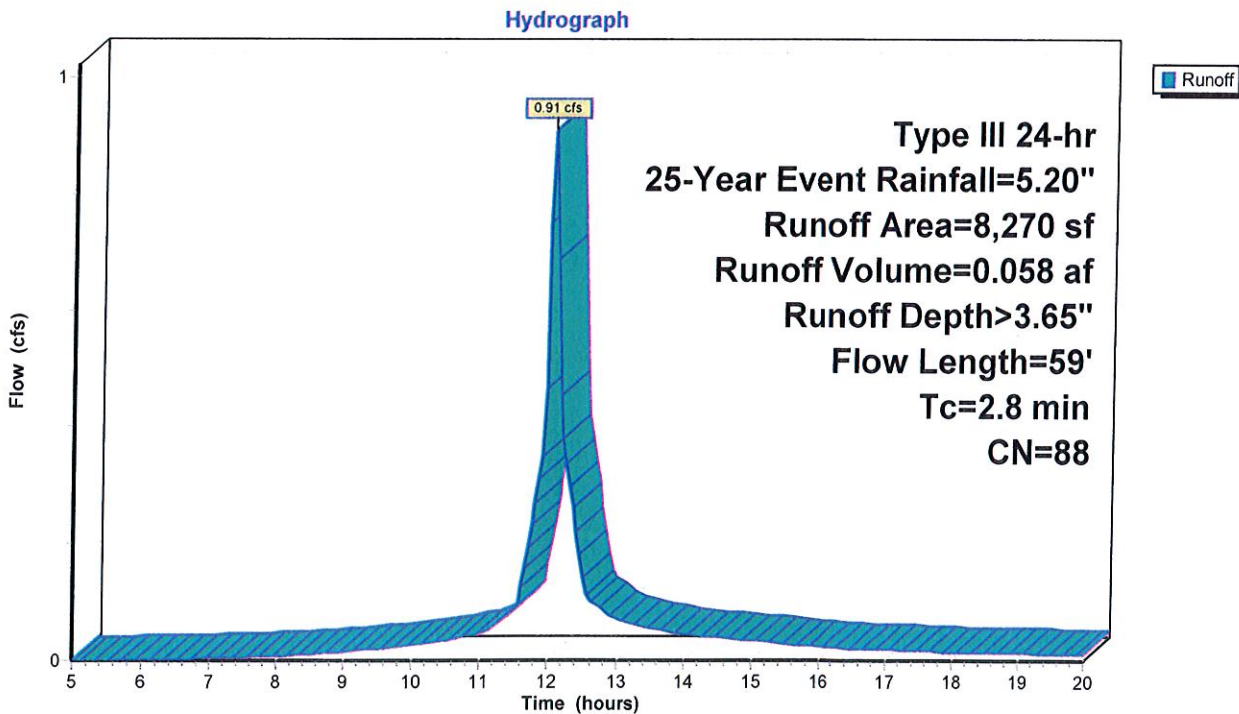
Runoff = 0.91 cfs @ 12.05 hrs, Volume= 0.058 af, Depth> 3.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Event Rainfall=5.20"

Area (sf)	CN	Description
3,550	98	Paved parking, HSG D
4,720	80	>75% Grass cover, Good, HSG D
8,270	88	Weighted Average
4,720		57.07% Pervious Area
3,550		42.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	18	0.0833	1.6		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 2.80"
2.6	41	0.1098	0.3		Sheet Flow, BC Grass: Short n= 0.150 P2= 2.80"
2.8	59	Total			

Subcatchment 5S: Sub Area #5

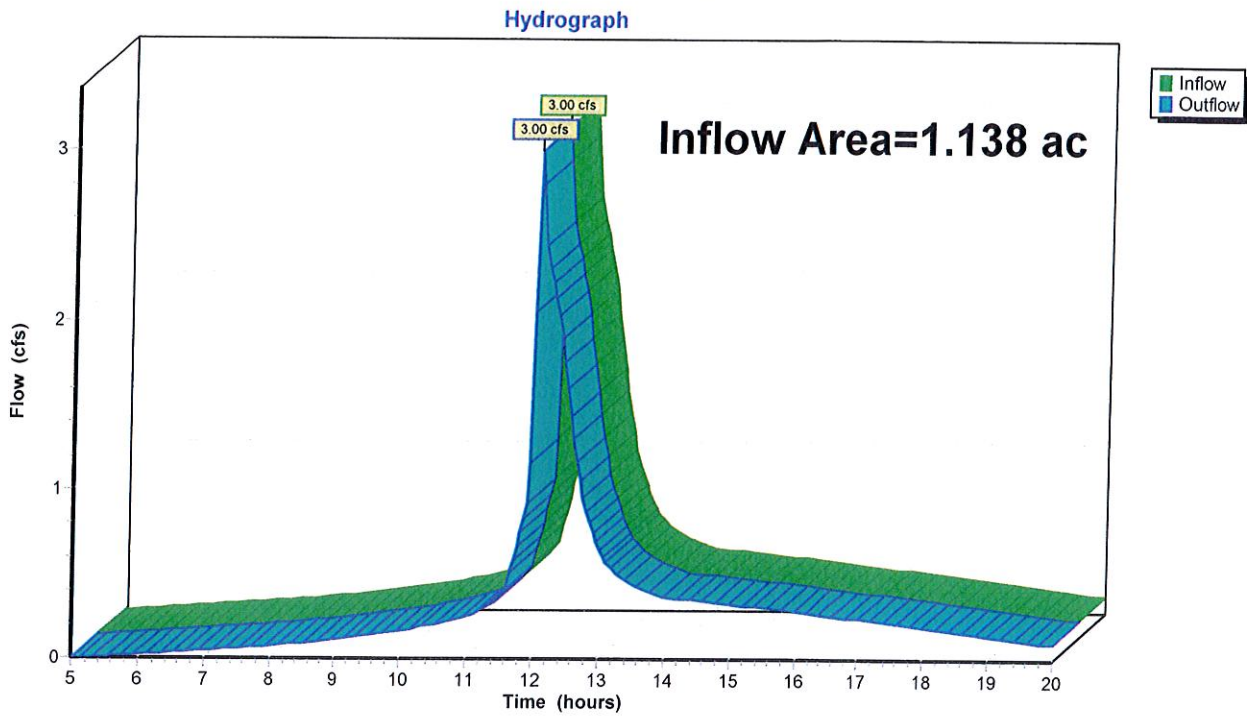


Summary for Reach SP: Study Point

Inflow Area = 1.138 ac, 66.24% Impervious, Inflow Depth > 4.01" for 25-Year Event event
Inflow = 3.00 cfs @ 12.07 hrs, Volume= 0.380 af
Outflow = 3.00 cfs @ 12.07 hrs, Volume= 0.380 af, Atten= 0%, Lag= 0.0 min

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

Reach SP: Study Point



Summary for Pond DP: DET. POND

Inflow Area = 0.797 ac, 72.57% Impervious, Inflow Depth > 4.16" for 25-Year Event event
 Inflow = 4.06 cfs @ 12.03 hrs, Volume= 0.277 af
 Outflow = 1.62 cfs @ 12.21 hrs, Volume= 0.272 af, Atten= 60%, Lag= 10.9 min
 Primary = 1.62 cfs @ 12.21 hrs, Volume= 0.272 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 99.91' @ 12.21 hrs Surf.Area= 2,085 sf Storage= 3,854 cf

Plug-Flow detention time= 71.8 min calculated for 0.272 af (99% of inflow)
 Center-of-Mass det. time= 65.2 min (811.4 - 746.1)

Volume	Invert	Avail.Storage	Storage Description		
#1	97.00'	7,998 cf	Custom Stage Data (Conic) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
97.00	655	0	0	655	
98.00	1,090	863	863	1,102	
99.00	1,585	1,330	2,193	1,614	
100.00	2,140	1,856	4,049	2,189	
101.00	2,745	2,436	6,485	2,819	
101.50	3,315	1,513	7,998	3,397	

Device	Routing	Invert	Outlet Devices	
#1	Primary	97.00'	15.0" Round Culvert L= 62.0' Ke= 0.9? Inlet / Outlet Invert= 97.00' / 94.80' S= 0.0355 ' /' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.22718463030851?	
#2	Device 1	97.00'	2.8" Vert. Orifice/Grate C= 0.600	
#3	Device 1	99.00'	8.0" Vert. Orifice/Grate C= 0.600	

Primary OutFlow Max=1.62 cfs @ 12.21 hrs HW=99.91' (Free Discharge)

- 1=Culvert (Passes 1.62 cfs of 7.05 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.34 cfs @ 8.0 fps)
- 3=Orifice/Grate (Orifice Controls 1.27 cfs @ 3.6 fps)

Pond DP: DET. POND

Hydrograph

