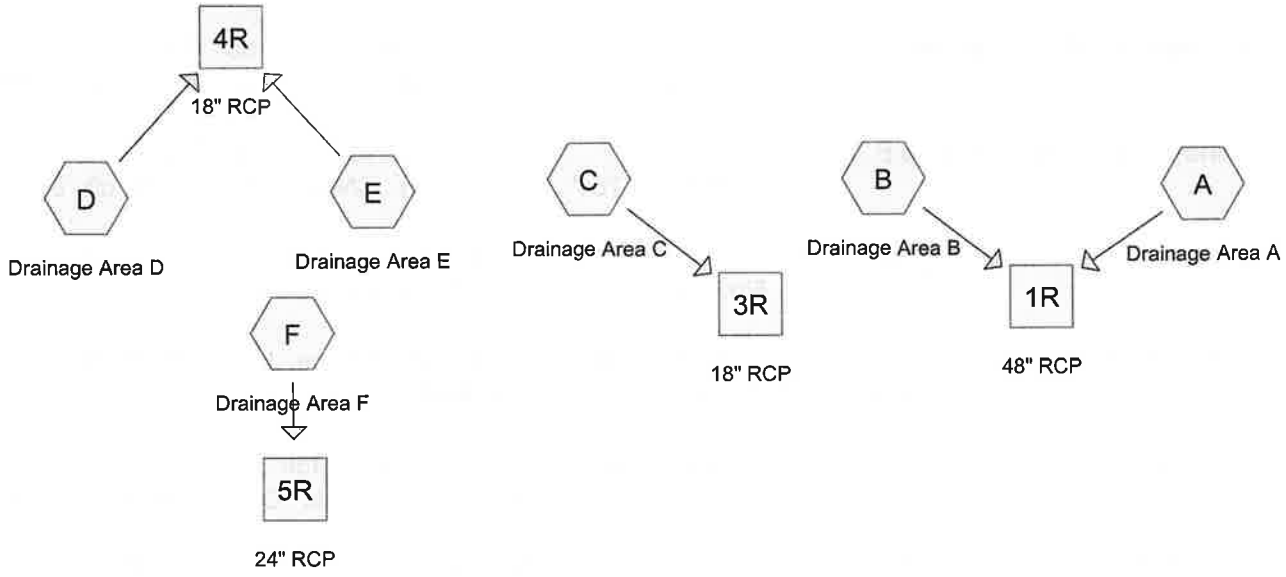
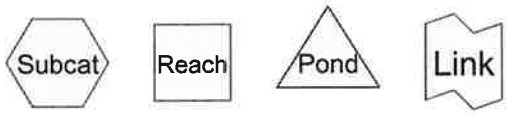
Appendix 2-5

HydroCAD Analysis Calculations





Drainage Diagram for Nantasket Existing Drainage
Prepared by {enter your company name here} 6/20/2007
HydroCAD® 7.00 s/n 002745 © 1986-2003 Applied Microcomputer Systems

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Drainage Area A Runoff Area=12.200 ac Runoff Depth=2.03"
Flow Length=2,676' Tc=16.0 min CN=91 Runoff=22.53 cfs 2.066 af

Subcatchment B: Drainage Area B Runoff Area=4.400 ac Runoff Depth=1.63"
Flow Length=921' Tc=11.1 min CN=86 Runoff=7.56 cfs 0.597 af

Subcatchment C: Drainage Area C Runoff Area=3.700 ac Runoff Depth=2.31"
Flow Length=1,323' Tc=8.8 min CN=94 Runoff=9.15 cfs 0.713 af

Subcatchment D: Drainage Area D Runoff Area=4.900 ac Runoff Depth=1.10"
Flow Length=1,135' Tc=20.3 min CN=78 Runoff=4.47 cfs 0.448 af

Subcatchment E: Drainage Area E Runoff Area=3.000 ac Runoff Depth=1.35"
Flow Length=1,758' Tc=12.3 min CN=82 Runoff=4.09 cfs 0.337 af

Subcatchment F: Drainage Area F Runoff Area=2.000 ac Runoff Depth=1.79"
Flow Length=590' Tc=5.2 min CN=88 Runoff=4.44 cfs 0.298 af

Reach 1R: 48" RCP Peak Depth=1.89' Max Vel=5.0 fps Inflow=29.45 cfs 2.663 af
D=48.0" n=0.013 L=78.0' S=0.0021 '/' Capacity=65.06 cfs Outflow=29.34 cfs 2.662 af

Reach 3R: 18" RCP Peak Depth=1.50' Max Vel=3.9 fps Inflow=9.15 cfs 0.713 af
D=18.0" n=0.013 L=72.0' S=0.0035 '/' Capacity=6.19 cfs Outflow=6.19 cfs 0.712 af

Reach 4R: 18" RCP Peak Depth=1.50' Max Vel=2.7 fps Inflow=7.98 cfs 0.785 af
D=18.0" n=0.013 L=100.0' S=0.0016 '/' Capacity=4.20 cfs Outflow=4.20 cfs 0.784 af

Reach 5R: 24" RCP Peak Depth=0.83' Max Vel=3.6 fps Inflow=4.44 cfs 0.298 af
D=24.0" n=0.013 L=100.0' S=0.0030 '/' Capacity=12.39 cfs Outflow=4.38 cfs 0.298 af

Total Runoff Area = 30.200 ac Runoff Volume = 4.458 af Average Runoff Depth = 1.77"

Subcatchment A: Drainage Area A

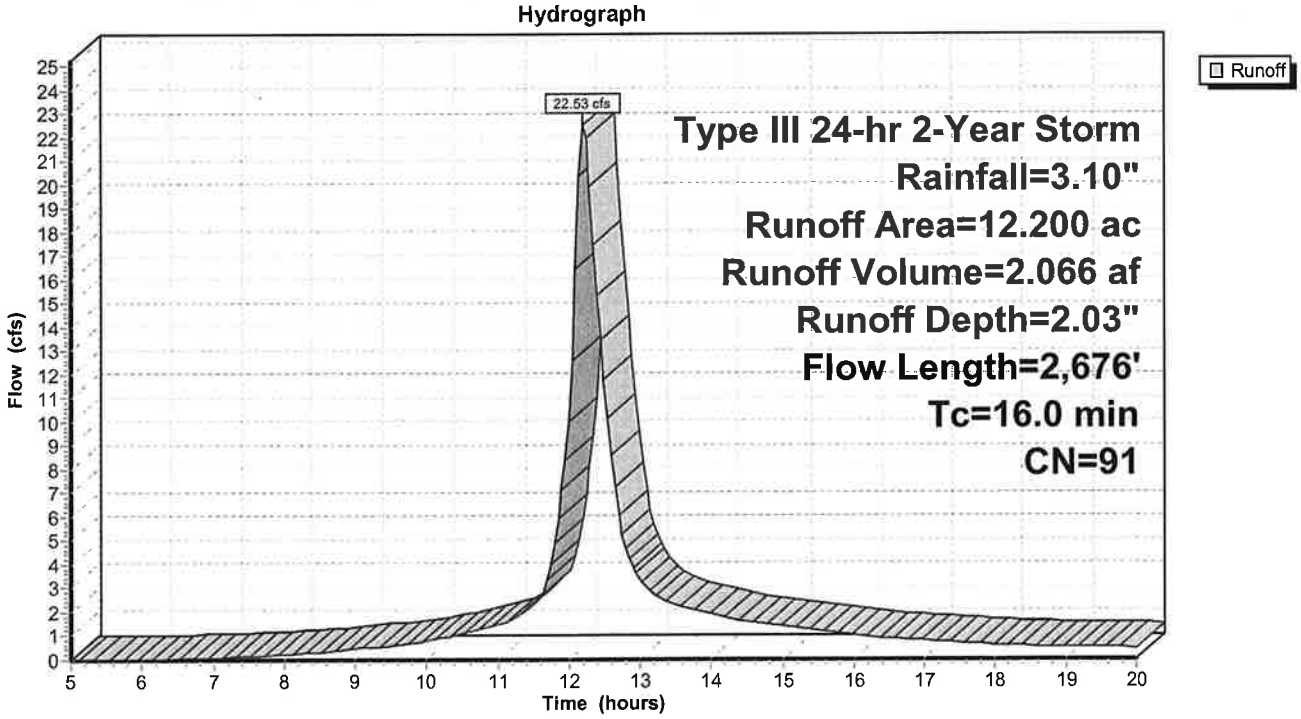
Runoff = 22.53 cfs @ 12.22 hrs, Volume= 2.066 af, Depth= 2.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

Area (ac)	CN	Description
8.540	98	Pavement
1.220	49	50-75% Grass cover, Fair, HSG A
2.440	89	Urban commercial, 85% imp, HSG A
12.200	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	275	0.0100	1.1		**Sheet Flow, Flow across roadway** n= 0.013 P2= 3.10"
4.3	669	0.0023	2.6	2.02	**Circular Channel (pipe), 12" VCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.6	305	0.0026	3.2	3.89	**Circular Channel (pipe), 15" VCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
3.2	609	0.0020	3.1	5.55	**Circular Channel (pipe), 18" VCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011
2.7	818	0.0045	5.1	11.03	**Circular Channel (pipe), 20" VCP** Diam= 20.0" Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.011
16.0	2,676	Total			

Subcatchment A: Drainage Area A



Subcatchment B: Drainage Area B

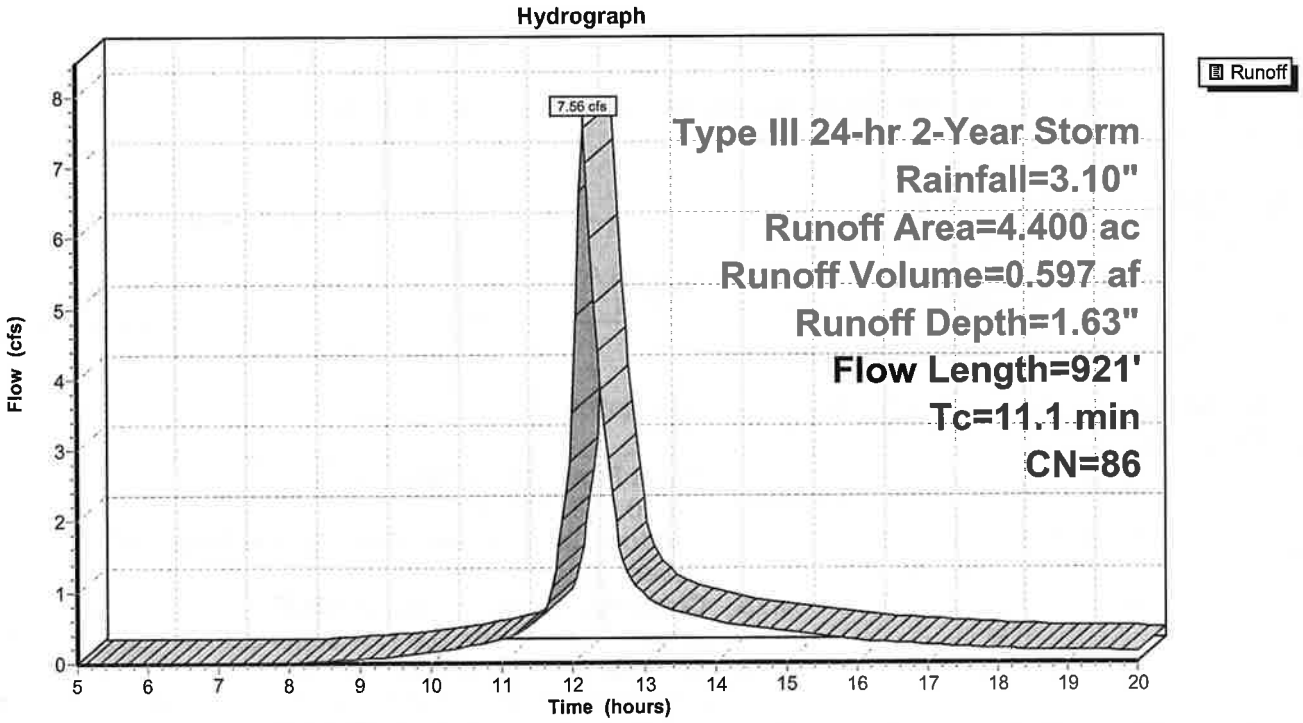
Runoff = 7.56 cfs @ 12.16 hrs, Volume= 0.597 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

Area (ac)	CN	Description
2.640	98	Paved parking & roofs
0.880	49	50-75% Grass cover, Fair, HSG A
0.880	89	Urban commercial, 85% imp, HSG A
4.400	86	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	95	0.0400	0.2		**Sheet Flow, Grass at Bathhouse to Gutter** Grass: Short n= 0.150 P2= 3.10"
0.5	50	0.0080	1.8		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
1.1	186	0.0037	2.9	1.58	**Circular Channel (pipe), 10" VCP** Diam= 10.0" Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.011
1.0	196	0.0041	3.4	2.70	**Circular Channel (pipe), 12" VCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.0	194	0.0026	3.2	3.89	**Circular Channel (pipe), 15" VCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
0.0	40	0.0998	20.1	43.95	**Circular Channel (pipe), 20" VCP** Diam= 20.0" Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.013
0.3	160	0.0047	7.8	98.48	**Circular Channel (pipe), 48" RCP** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
11.1	921	Total			

Subcatchment B: Drainage Area B



Subcatchment C: Drainage Area C

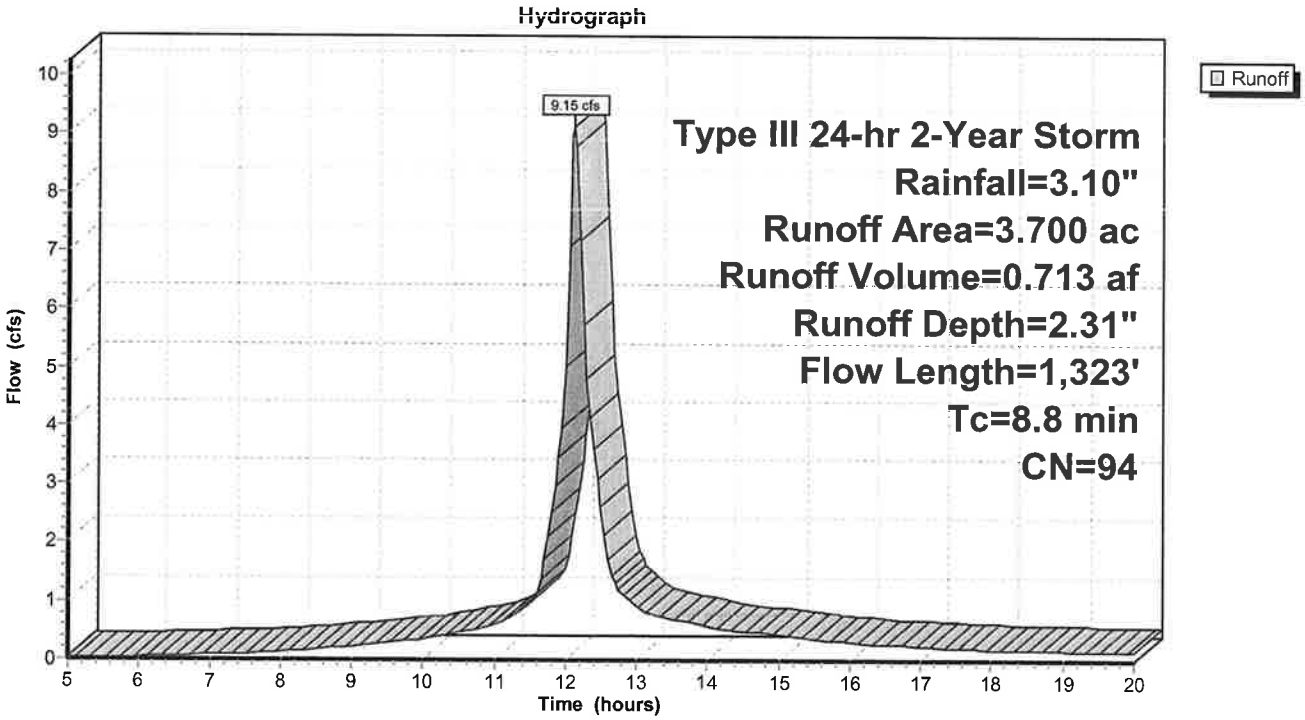
Runoff = 9.15 cfs @ 12.12 hrs, Volume= 0.713 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

Area (ac)	CN	Description
2.960	98	Paved parking & roofs
0.550	89	Urban commercial, 85% imp, HSG A
0.190	49	50-75% Grass cover, Fair, HSG A
3.700	94	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	20	0.0200	0.9		**Sheet Flow, Sheet Flow to Gutter** n= 0.013 P2= 3.10"
1.5	100	0.0030	1.1		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
3.1	425	0.0025	2.3	1.78	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
2.3	534	0.0055	3.9	4.79	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.5	244	0.0022	2.8	4.93	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
8.8	1,323	Total			

Subcatchment C: Drainage Area C



Subcatchment D: Drainage Area D

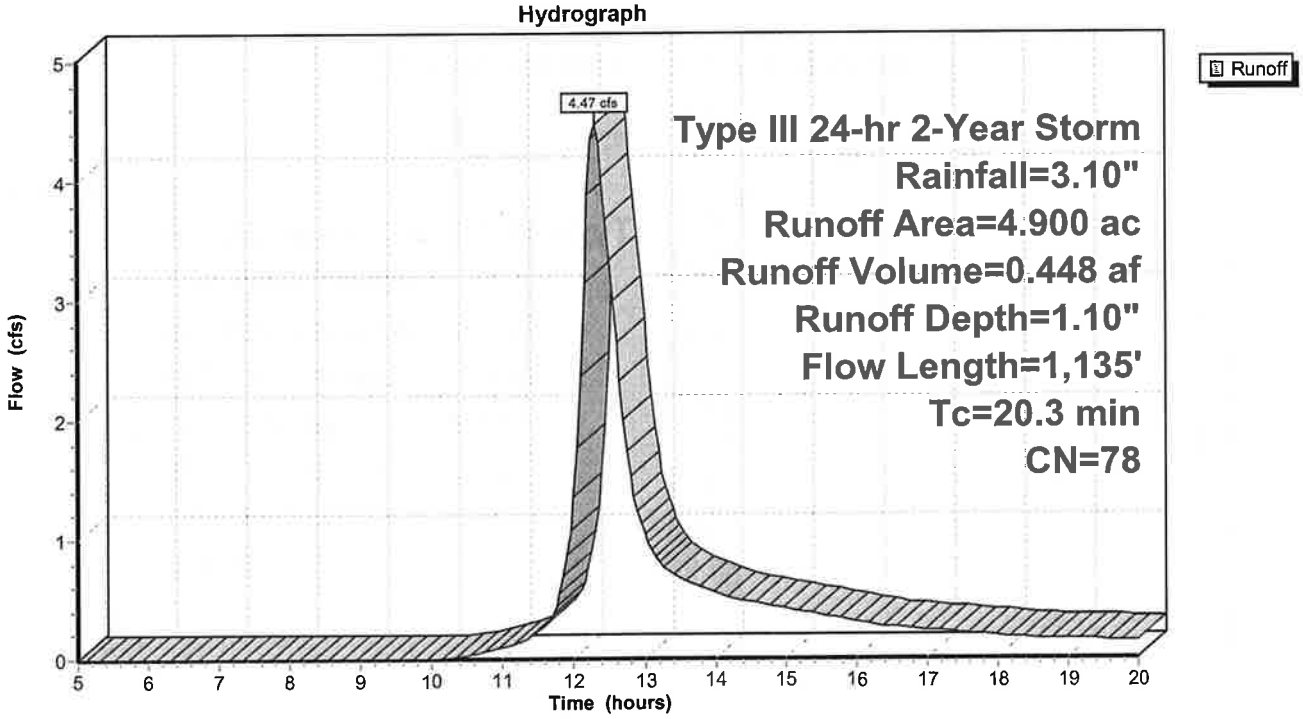
Runoff = 4.47 cfs @ 12.30 hrs, Volume= 0.448 af, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

Area (ac)	CN	Description
2.940	98	Paved parking & roofs
1.960	49	50-75% Grass cover, Fair, HSG A
4.900	78	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	100	0.0100	0.1		**Sheet Flow, Grass to gutter** Grass: Short n= 0.150 P2= 3.10"
2.1	180	0.0050	1.4		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
3.5	622	0.0032	3.0	3.65	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.6	233	0.0016	2.4	4.20	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
20.3	1,135	Total			

Subcatchment D: Drainage Area D



Subcatchment E: Drainage Area E

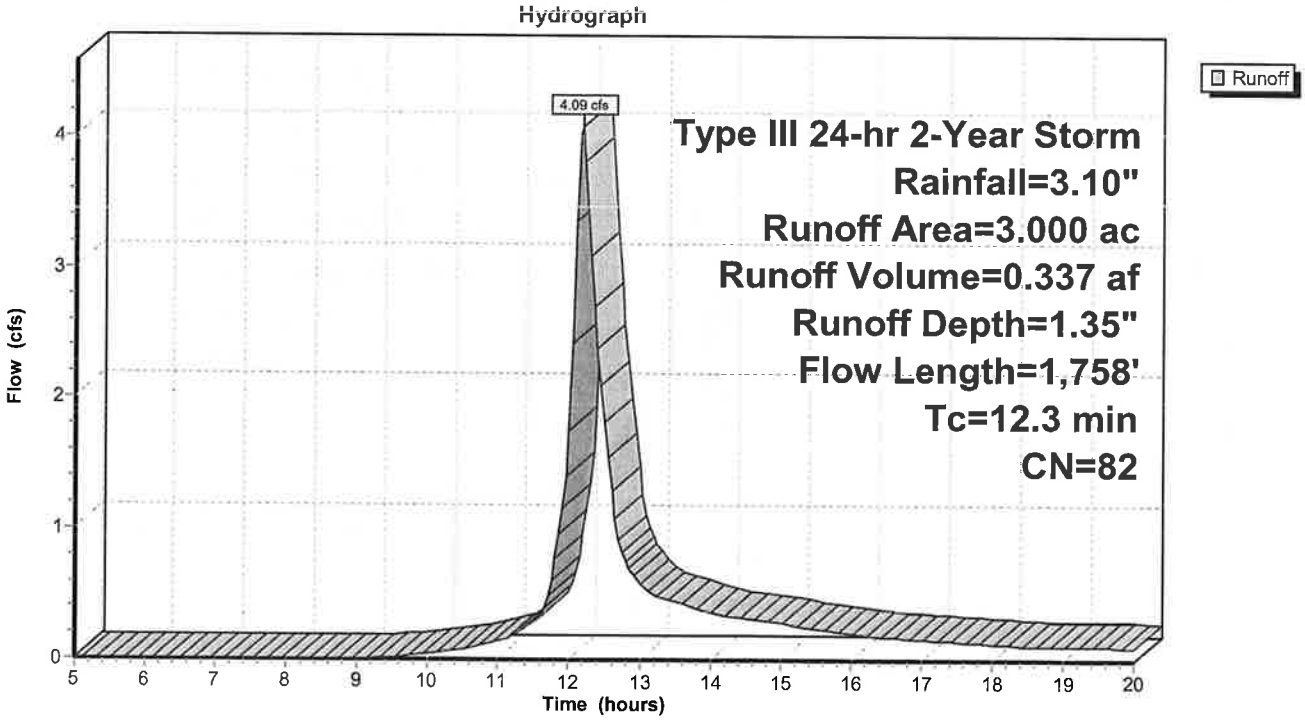
Runoff = 4.09 cfs @ 12.18 hrs, Volume= 0.337 af, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

Area (ac)	CN	Description
1.650	98	Paved parking & roofs
0.900	49	50-75% Grass cover, Fair, HSG A
0.450	89	Urban commercial, 85% imp, HSG A
3.000	82	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	100	0.0200	1.2		**Sheet Flow, Parking lot to gutter** n= 0.013 P2= 3.10"
1.8	100	0.0020	0.9		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
2.7	425	0.0034	2.6	2.08	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
2.6	400	0.0024	2.6	3.16	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.8	733	0.0029	3.2	5.66	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
12.3	1,758	Total			

Subcatchment E: Drainage Area E



Subcatchment F: Drainage Area F

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

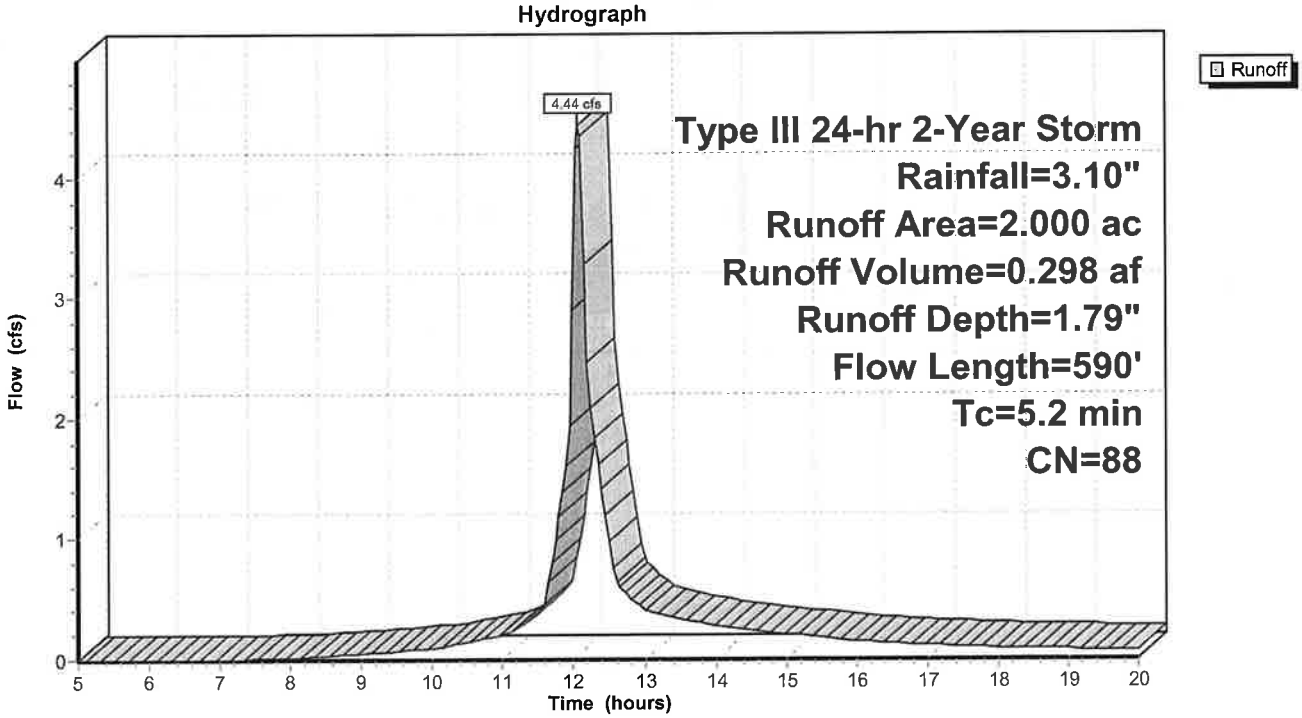
Runoff = 4.44 cfs @ 12.08 hrs, Volume= 0.298 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

Area (ac)	CN	Description
1.600	98	Paved parking & roofs
0.400	49	50-75% Grass cover, Fair, HSG A
2.000	88	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	85	0.0100	0.9		**Sheet Flow, Parking Lot to Gutter** n= 0.013 P2= 3.10"
2.0	155	0.0040	1.3		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
0.7	180	0.0080	4.1	3.19	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.9	170	0.0030	3.3	5.75	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
5.2	590	Total			

Subcatchment F: Drainage Area F



Reach 1R: 48" RCP

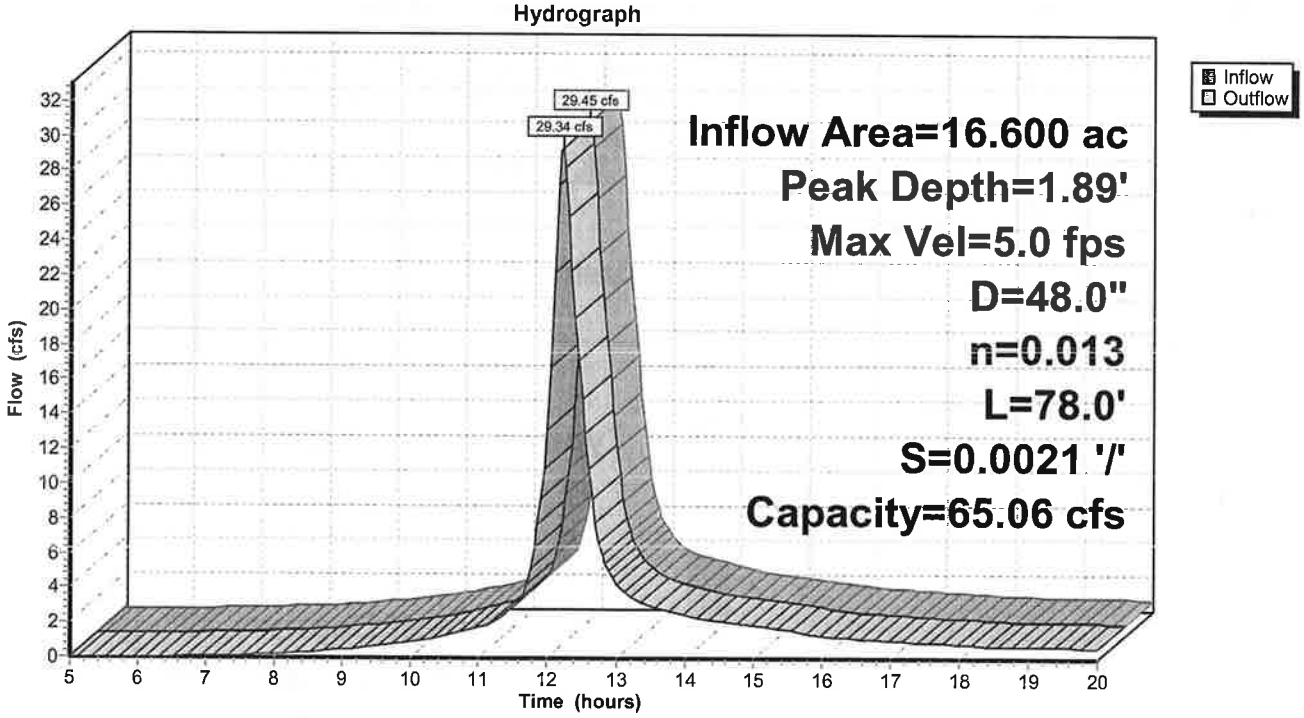
[52] Hint: Inlet conditions not evaluated

Inflow Area = 16.600 ac, Inflow Depth = 1.92" for 2-Year Storm event
Inflow = 29.45 cfs @ 12.20 hrs, Volume= 2.663 af
Outflow = 29.34 cfs @ 12.21 hrs, Volume= 2.662 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.0 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 0.7 min

Peak Depth= 1.89' @ 12.20 hrs
Capacity at bank full= 65.06 cfs
Inlet Invert= -0.81', Outlet Invert= -0.97'
48.0" Diameter Pipe n= 0.013 Length= 78.0' Slope= 0.0021 '/'

Reach 1R: 48" RCP



Reach 3R: 18" RCP

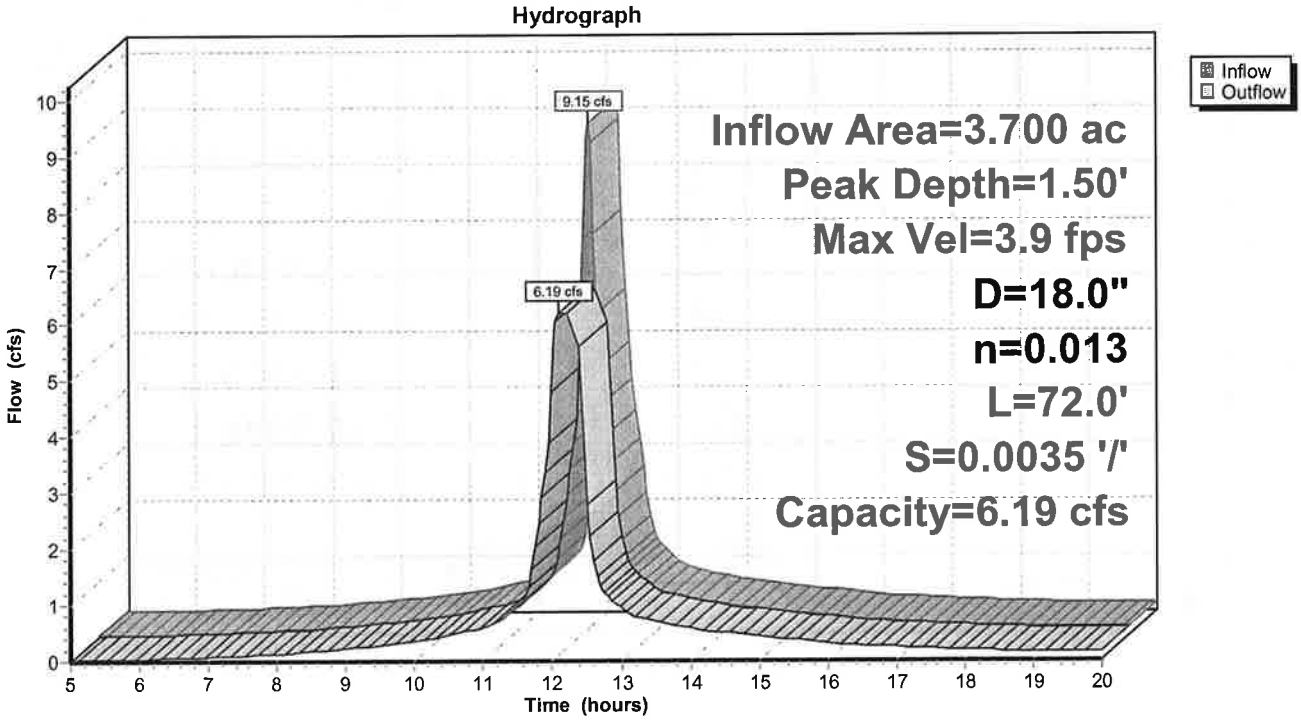
[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[55] Hint: Peak inflow is 148% of Manning's capacity
[76] Warning: Detained 0.030 af (Pond w/culvert advised)

Inflow Area =	3.700 ac,	Inflow Depth =	2.31"	for	2-Year Storm event
Inflow =	9.15 cfs @	12.12 hrs,	Volume=	0.713 af	
Outflow =	6.19 cfs @	12.10 hrs,	Volume=	0.712 af,	Atten= 32%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.9 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 0.7 min

Peak Depth= 1.50' @ 12.05 hrs
Capacity at bank full= 6.19 cfs
Inlet Invert= 5.62', Outlet Invert= 5.37'
18.0" Diameter Pipe n= 0.013 Length= 72.0' Slope= 0.0035 '/'

Reach 3R: 18" RCP



Reach 4R: 18" RCP

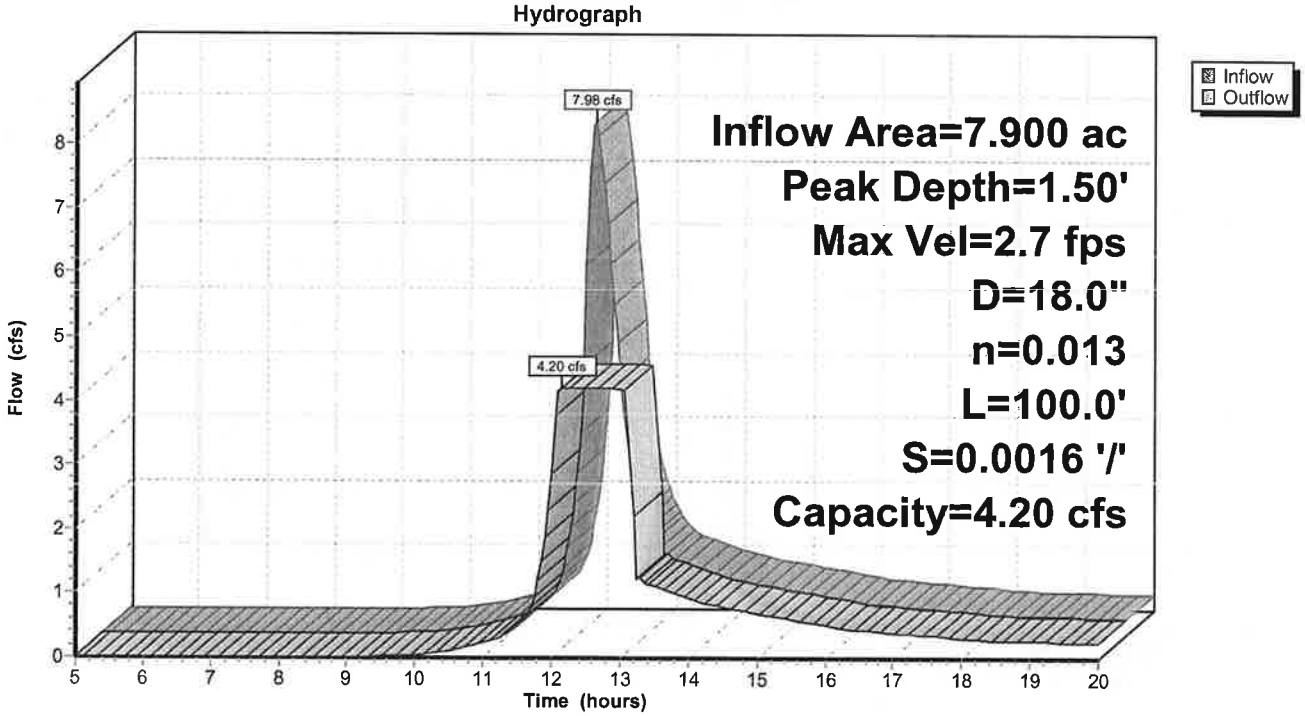
[52] Hint: Inlet conditions not evaluated
[55] Hint: Peak inflow is 190% of Manning's capacity
[76] Warning: Detained 0.096 af (Pond w/culvert advised)

Inflow Area =	7.900 ac,	Inflow Depth =	1.19"	for	2-Year Storm event
Inflow =	7.98 cfs @	12.23 hrs,	Volume=	0.785 af	
Outflow =	4.20 cfs @	12.15 hrs,	Volume=	0.784 af,	Atten= 47%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.7 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 1.1 min

Peak Depth= 1.50' @ 12.10 hrs
Capacity at bank full= 4.20 cfs
Inlet Invert= 5.46', Outlet Invert= 5.30'
18.0" Diameter Pipe n= 0.013 Length= 100.0' Slope= 0.0016 '/'

Reach 4R: 18" RCP



Reach 5R: 24" RCP

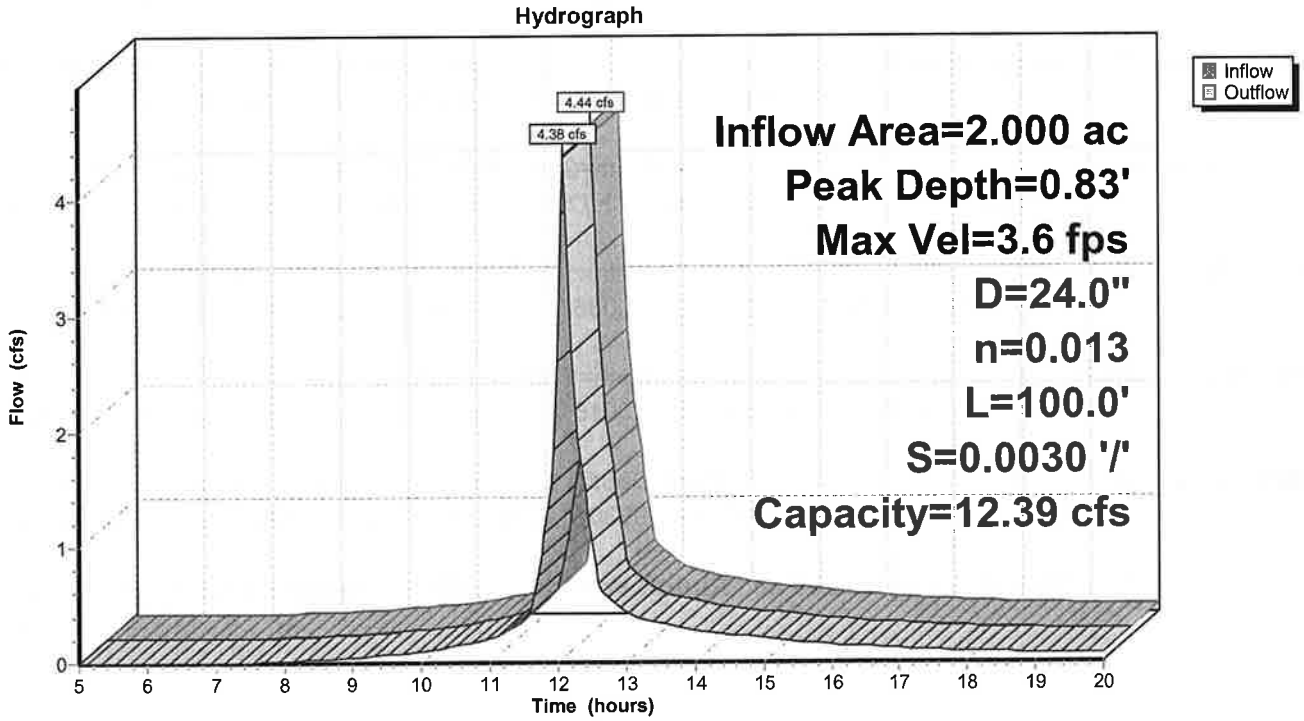
[52] Hint: Inlet conditions not evaluated

Inflow Area =	2.000 ac,	Inflow Depth =	1.79"	for	2-Year Storm event
Inflow =	4.44 cfs @	12.08 hrs,	Volume=		0.298 af
Outflow =	4.38 cfs @	12.09 hrs,	Volume=		0.298 af, Atten= 1%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.6 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.4 fps, Avg. Travel Time= 1.2 min

Peak Depth= 0.83' @ 12.09 hrs
Capacity at bank full= 12.39 cfs
Inlet Invert= 7.92', Outlet Invert= 7.62'
24.0" Diameter Pipe n= 0.013 Length= 100.0' Slope= 0.0030 '/'

Reach 5R: 24" RCP



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Drainage Area A Runoff Area=12.200 ac Runoff Depth=3.30"
Flow Length=2,676' Tc=16.0 min CN=91 Runoff=35.70 cfs 3.352 af

Subcatchment B: Drainage Area B Runoff Area=4.400 ac Runoff Depth=2.82"
Flow Length=921' Tc=11.1 min CN=86 Runoff=12.89 cfs 1.033 af

Subcatchment C: Drainage Area C Runoff Area=3.700 ac Runoff Depth=3.60"
Flow Length=1,323' Tc=8.8 min CN=94 Runoff=13.92 cfs 1.110 af

Subcatchment D: Drainage Area D Runoff Area=4.900 ac Runoff Depth=2.12"
Flow Length=1,135' Tc=20.3 min CN=78 Runoff=8.77 cfs 0.866 af

Subcatchment E: Drainage Area E Runoff Area=3.000 ac Runoff Depth=2.46"
Flow Length=1,758' Tc=12.3 min CN=82 Runoff=7.50 cfs 0.615 af

Subcatchment F: Drainage Area F Runoff Area=2.000 ac Runoff Depth=3.01"
Flow Length=590' Tc=5.2 min CN=88 Runoff=7.32 cfs 0.502 af

Reach 1R: 48" RCP Peak Depth=2.54' Max Vel=5.7 fps Inflow=47.48 cfs 4.385 af
D=48.0" n=0.013 L=78.0' S=0.0021 '/' Capacity=65.06 cfs Outflow=47.33 cfs 4.384 af

Reach 3R: 18" RCP Peak Depth=1.50' Max Vel=4.0 fps Inflow=13.92 cfs 1.110 af
D=18.0" n=0.013 L=72.0' S=0.0035 '/' Capacity=6.19 cfs Outflow=6.19 cfs 1.110 af

Reach 4R: 18" RCP Peak Depth=1.50' Max Vel=2.7 fps Inflow=15.27 cfs 1.480 af
D=18.0" n=0.013 L=100.0' S=0.0016 '/' Capacity=4.20 cfs Outflow=4.28 cfs 1.479 af

Reach 5R: 24" RCP Peak Depth=1.11' Max Vel=4.1 fps Inflow=7.32 cfs 0.502 af
D=24.0" n=0.013 L=100.0' S=0.0030 '/' Capacity=12.39 cfs Outflow=7.23 cfs 0.502 af

Total Runoff Area = 30.200 ac Runoff Volume = 7.478 af Average Runoff Depth = 2.97"

Subcatchment A: Drainage Area A

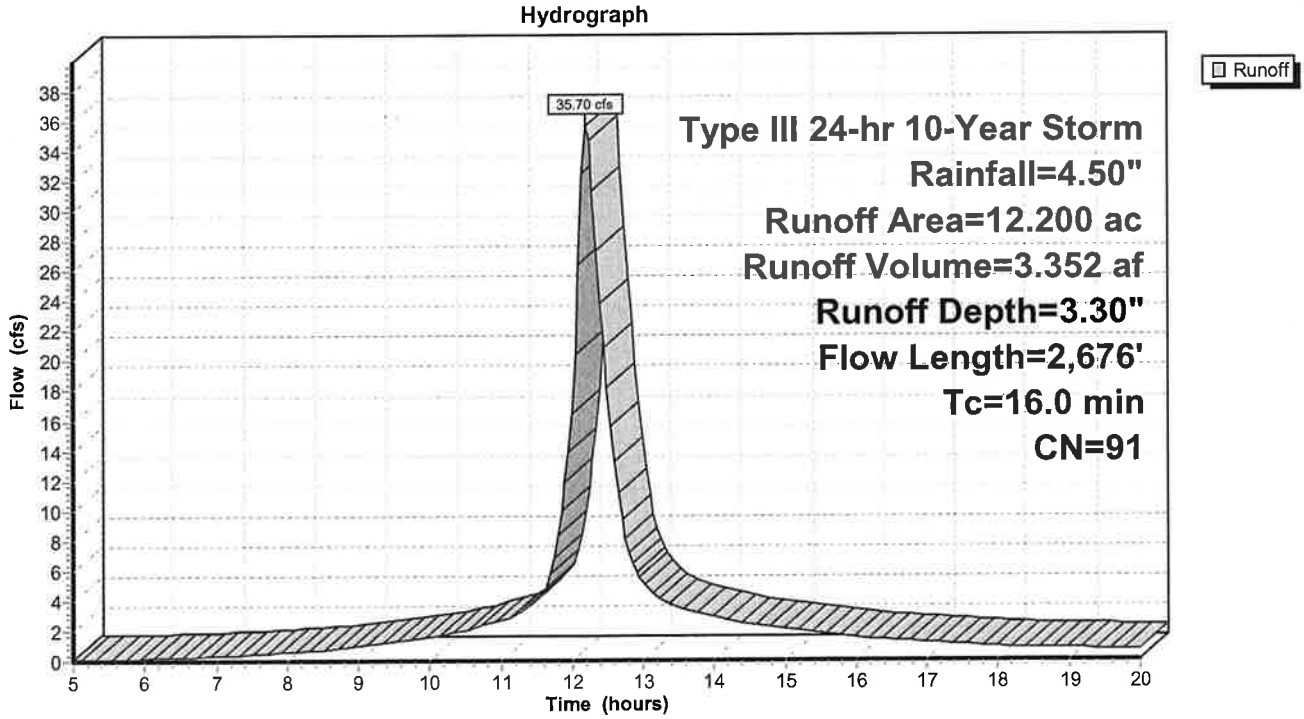
Runoff = 35.70 cfs @ 12.21 hrs, Volume= 3.352 af, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

Area (ac)	CN	Description
8.540	98	Pavement
1.220	49	50-75% Grass cover, Fair, HSG A
2.440	89	Urban commercial, 85% imp, HSG A
12.200	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	275	0.0100	1.1		**Sheet Flow, Flow across roadway** n= 0.013 P2= 3.10"
4.3	669	0.0023	2.6	2.02	**Circular Channel (pipe), 12" VCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.6	305	0.0026	3.2	3.89	**Circular Channel (pipe), 15" VCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
3.2	609	0.0020	3.1	5.55	**Circular Channel (pipe), 18" VCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011
2.7	818	0.0045	5.1	11.03	**Circular Channel (pipe), 20" VCP** Diam= 20.0" Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.011
16.0	2,676	Total			

Subcatchment A: Drainage Area A



Subcatchment B: Drainage Area B

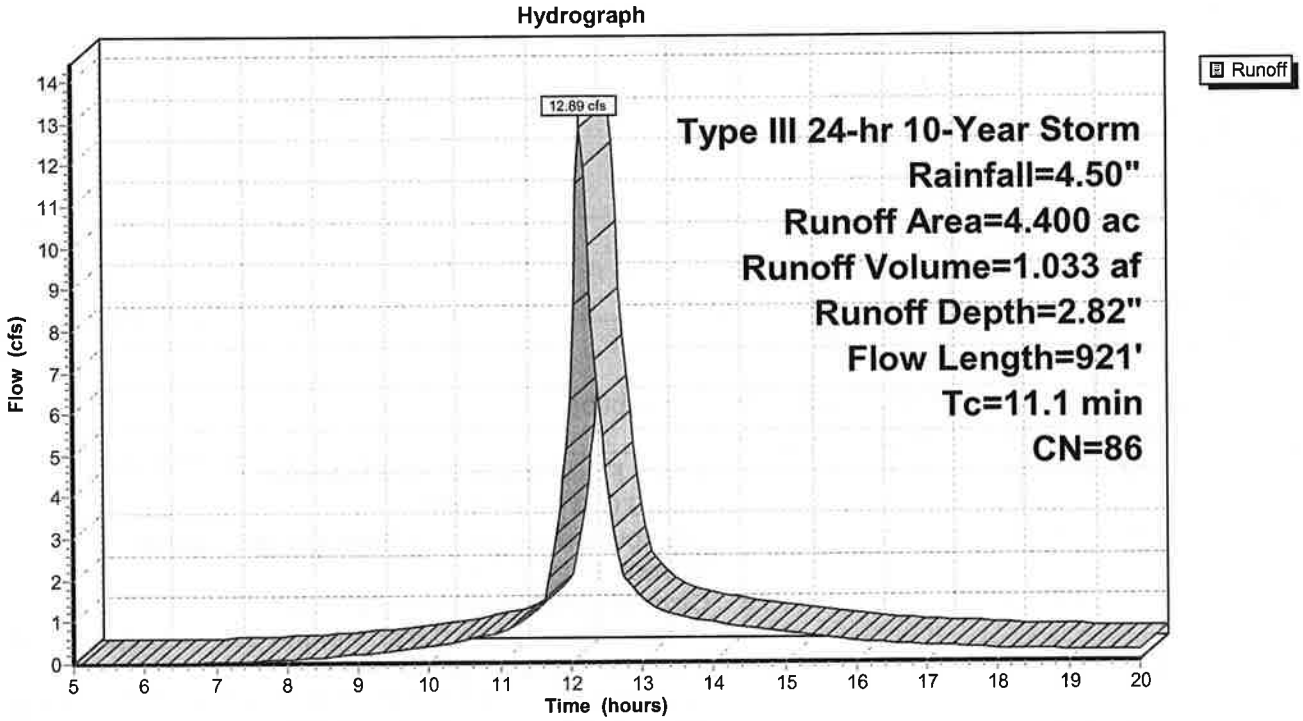
Runoff = 12.89 cfs @ 12.15 hrs, Volume= 1.033 af, Depth= 2.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

Area (ac)	CN	Description
2.640	98	Paved parking & roofs
0.880	49	50-75% Grass cover, Fair, HSG A
0.880	89	Urban commercial, 85% imp, HSG A
4.400	86	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	95	0.0400	0.2		**Sheet Flow, Grass at Bathhouse to Gutter** Grass: Short n= 0.150 P2= 3.10"
0.5	50	0.0080	1.8		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
1.1	186	0.0037	2.9	1.58	**Circular Channel (pipe), 10" VCP** Diam= 10.0" Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.011
1.0	196	0.0041	3.4	2.70	**Circular Channel (pipe), 12" VCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.0	194	0.0026	3.2	3.89	**Circular Channel (pipe), 15" VCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
0.0	40	0.0998	20.1	43.95	**Circular Channel (pipe), 20" VCP** Diam= 20.0" Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.013
0.3	160	0.0047	7.8	98.48	**Circular Channel (pipe), 48" RCP** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
11.1	921	Total			

Subcatchment B: Drainage Area B



Subcatchment C: Drainage Area C

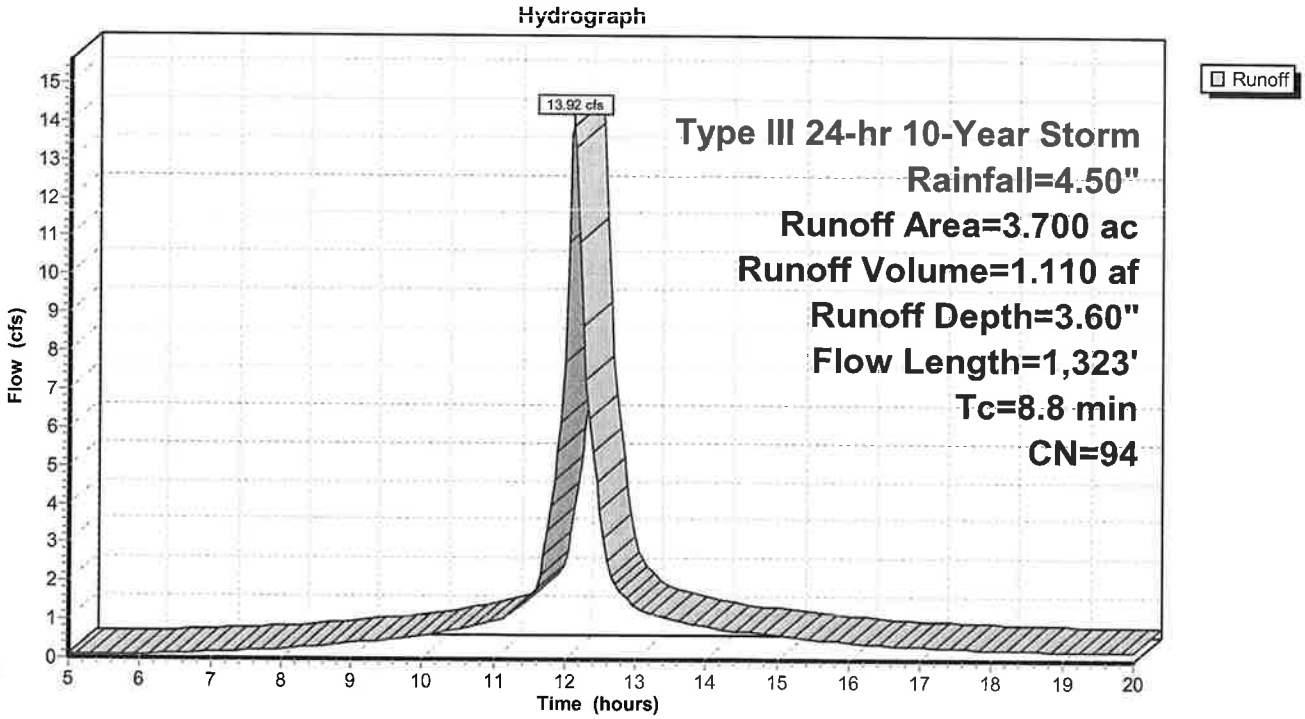
Runoff = 13.92 cfs @ 12.12 hrs, Volume= 1.110 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

Area (ac)	CN	Description
2.960	98	Paved parking & roofs
0.550	89	Urban commercial, 85% imp, HSG A
0.190	49	50-75% Grass cover, Fair, HSG A
3.700	94	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	20	0.0200	0.9		**Sheet Flow, Sheet Flow to Gutter** n= 0.013 P2= 3.10"
1.5	100	0.0030	1.1		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
3.1	425	0.0025	2.3	1.78	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
2.3	534	0.0055	3.9	4.79	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.5	244	0.0022	2.8	4.93	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
8.8	1,323	Total			

Subcatchment C: Drainage Area C



Subcatchment D: Drainage Area D

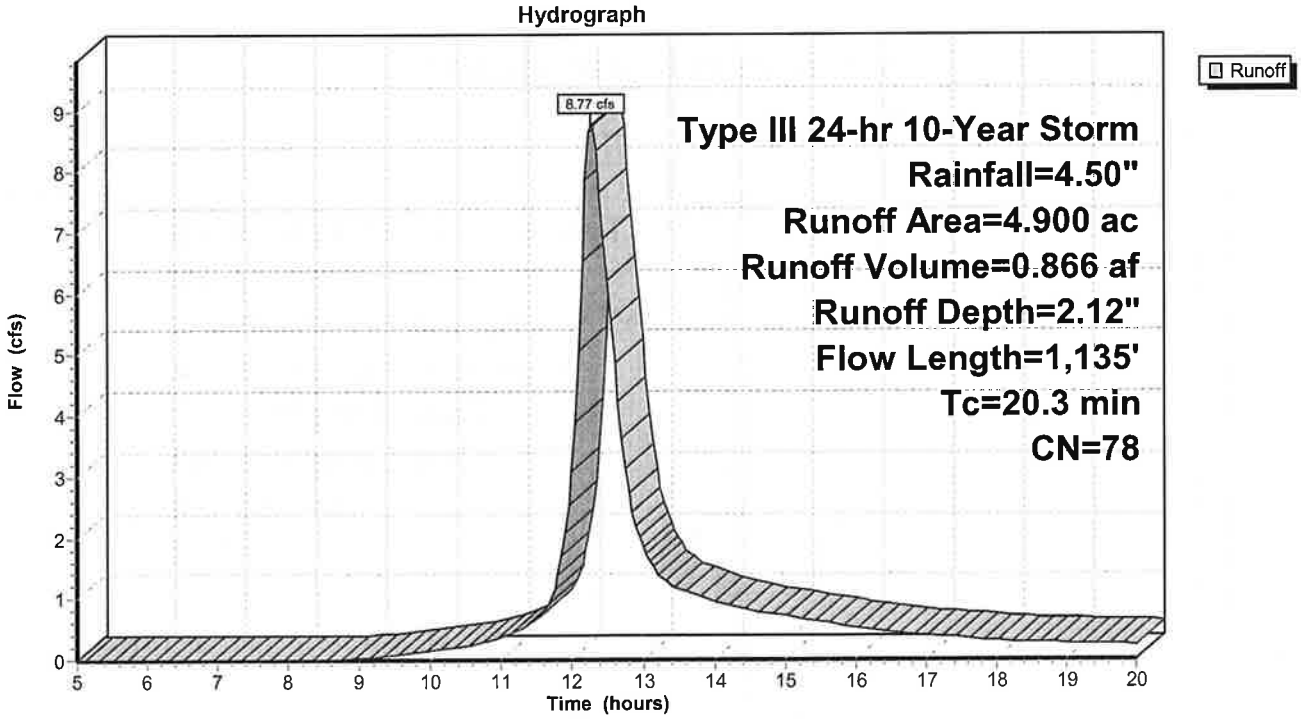
Runoff = 8.77 cfs @ 12.29 hrs, Volume= 0.866 af, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

Area (ac)	CN	Description
2.940	98	Paved parking & roofs
1.960	49	50-75% Grass cover, Fair, HSG A
4.900	78	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	100	0.0100	0.1		**Sheet Flow, Grass to gutter** Grass: Short n= 0.150 P2= 3.10"
2.1	180	0.0050	1.4		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
3.5	622	0.0032	3.0	3.65	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.6	233	0.0016	2.4	4.20	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
20.3	1,135	Total			

Subcatchment D: Drainage Area D



Subcatchment E: Drainage Area E

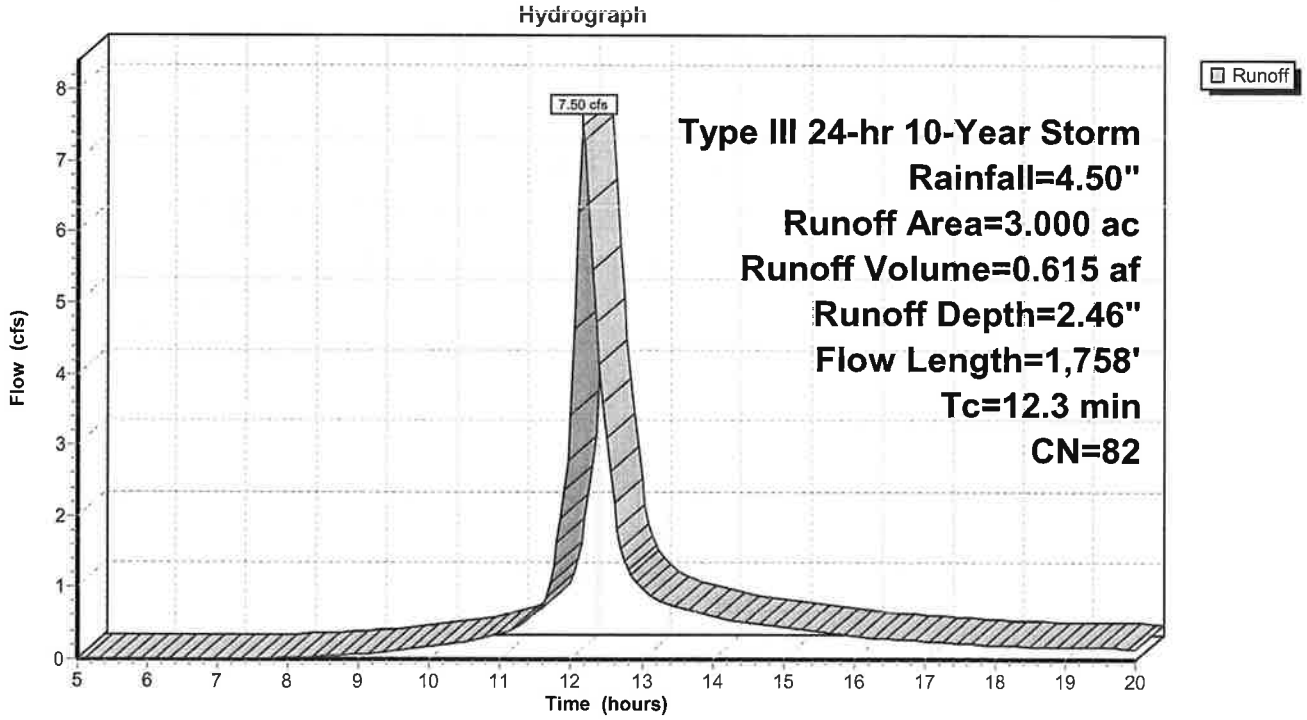
Runoff = 7.50 cfs @ 12.17 hrs, Volume= 0.615 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

Area (ac)	CN	Description
1.650	98	Paved parking & roofs
0.900	49	50-75% Grass cover, Fair, HSG A
0.450	89	Urban commercial, 85% imp, HSG A
3.000	82	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	100	0.0200	1.2		**Sheet Flow, Parking lot to gutter** n= 0.013 P2= 3.10"
1.8	100	0.0020	0.9		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
2.7	425	0.0034	2.6	2.08	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
2.6	400	0.0024	2.6	3.16	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.8	733	0.0029	3.2	5.66	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
12.3	1,758	Total			

Subcatchment E: Drainage Area E



Subcatchment F: Drainage Area F

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

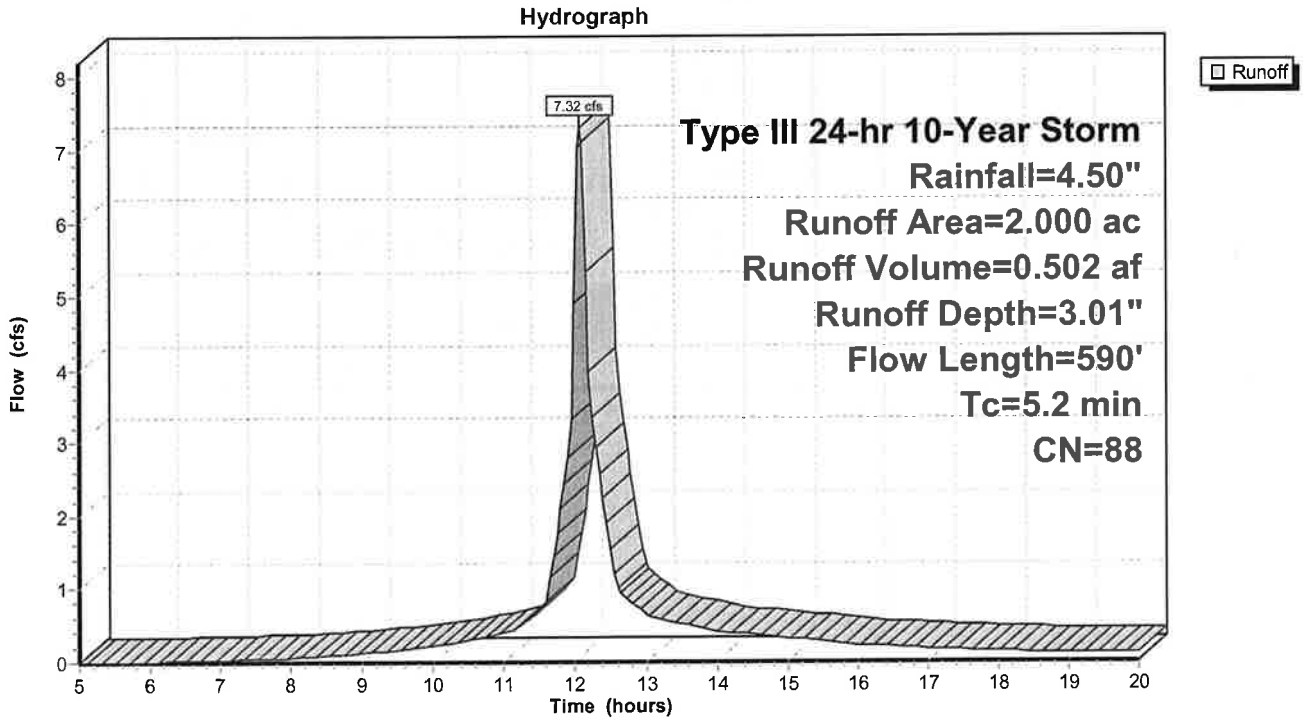
Runoff = 7.32 cfs @ 12.08 hrs, Volume= 0.502 af, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

Area (ac)	CN	Description
1.600	98	Paved parking & roofs
0.400	49	50-75% Grass cover, Fair, HSG A
2.000	88	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	85	0.0100	0.9		**Sheet Flow, Parking Lot to Gutter** n= 0.013 P2= 3.10"
2.0	155	0.0040	1.3		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
0.7	180	0.0080	4.1	3.19	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.9	170	0.0030	3.3	5.75	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
5.2	590	Total			

Subcatchment F: Drainage Area F



Reach 1R: 48" RCP

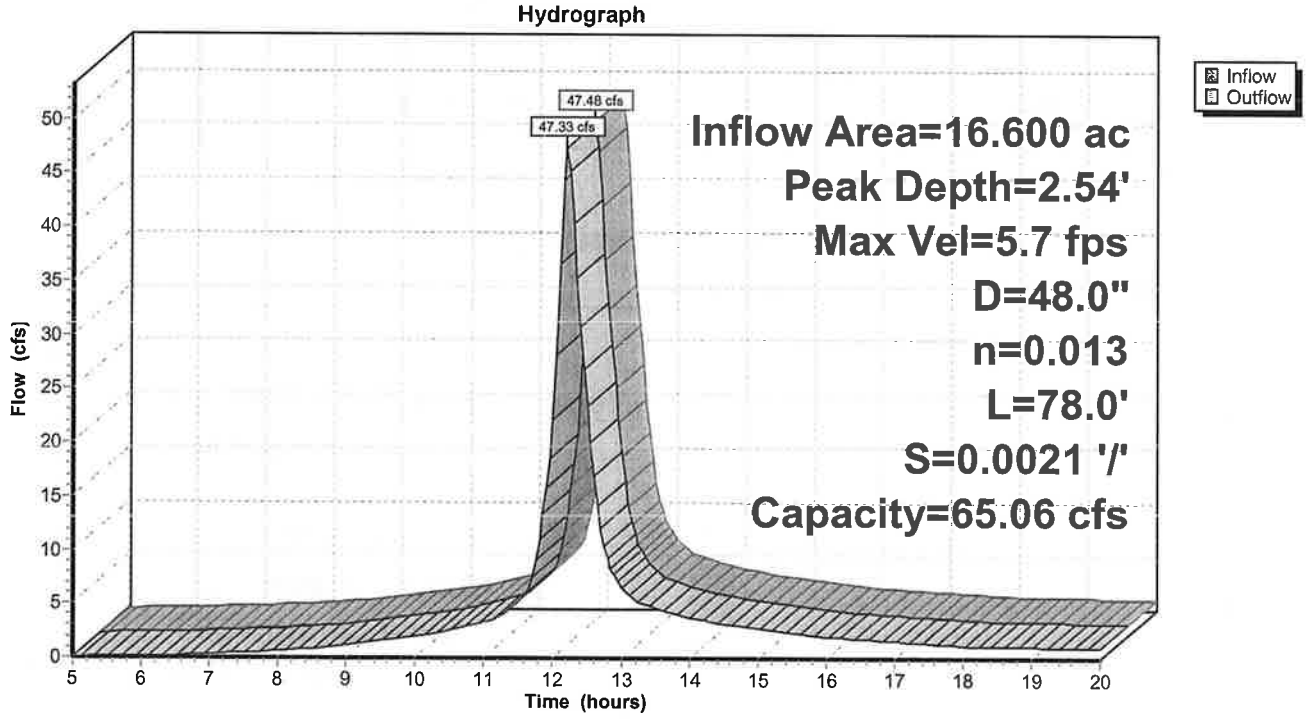
[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

Inflow Area =	16.600 ac,	Inflow Depth =	3.17"	for	10-Year Storm event
Inflow =	47.48 cfs @	12.20 hrs,	Volume=	4.385 af	
Outflow =	47.33 cfs @	12.20 hrs,	Volume=	4.384 af,	Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.7 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 0.6 min

Peak Depth= 2.54' @ 12.20 hrs
Capacity at bank full= 65.06 cfs
Inlet Invert= -0.81', Outlet Invert= -0.97'
48.0" Diameter Pipe n= 0.013 Length= 78.0' Slope= 0.0021 '/'

Reach 1R: 48" RCP



Reach 3R: 18" RCP

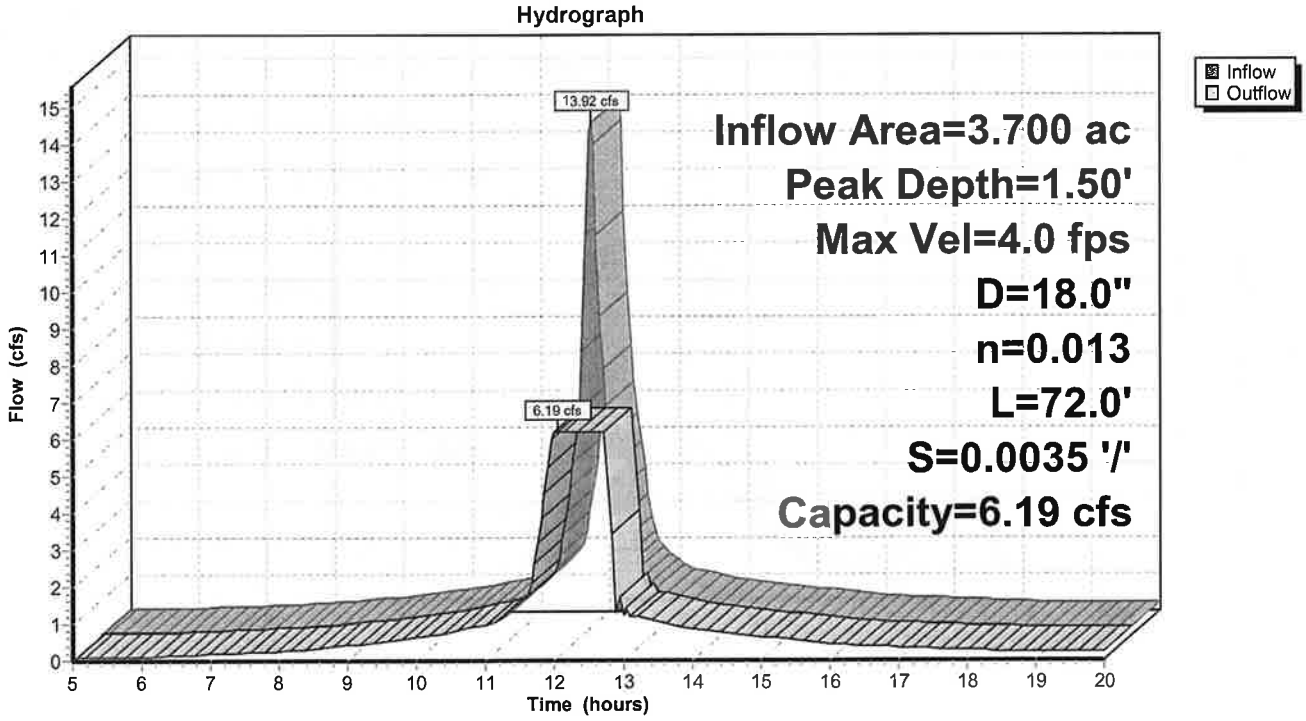
[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[55] Hint: Peak inflow is 225% of Manning's capacity
[76] Warning: Detained 0.121 af (Pond w/culvert advised)
[85] Warning: Oscillations may require Finer Routing>1

Inflow Area =	3.700 ac,	Inflow Depth =	3.60"	for	10-Year Storm event
Inflow =	13.92 cfs @	12.12 hrs,	Volume=	1.110 af	
Outflow =	6.19 cfs @	12.05 hrs,	Volume=	1.110 af,	Atten= 56%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.0 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.1 fps, Avg. Travel Time= 0.6 min

Peak Depth= 1.50' @ 12.00 hrs
Capacity at bank full= 6.19 cfs
Inlet Invert= 5.62', Outlet Invert= 5.37'
18.0" Diameter Pipe n= 0.013 Length= 72.0' Slope= 0.0035 '/'

Reach 3R: 18" RCP



Reach 4R: 18" RCP

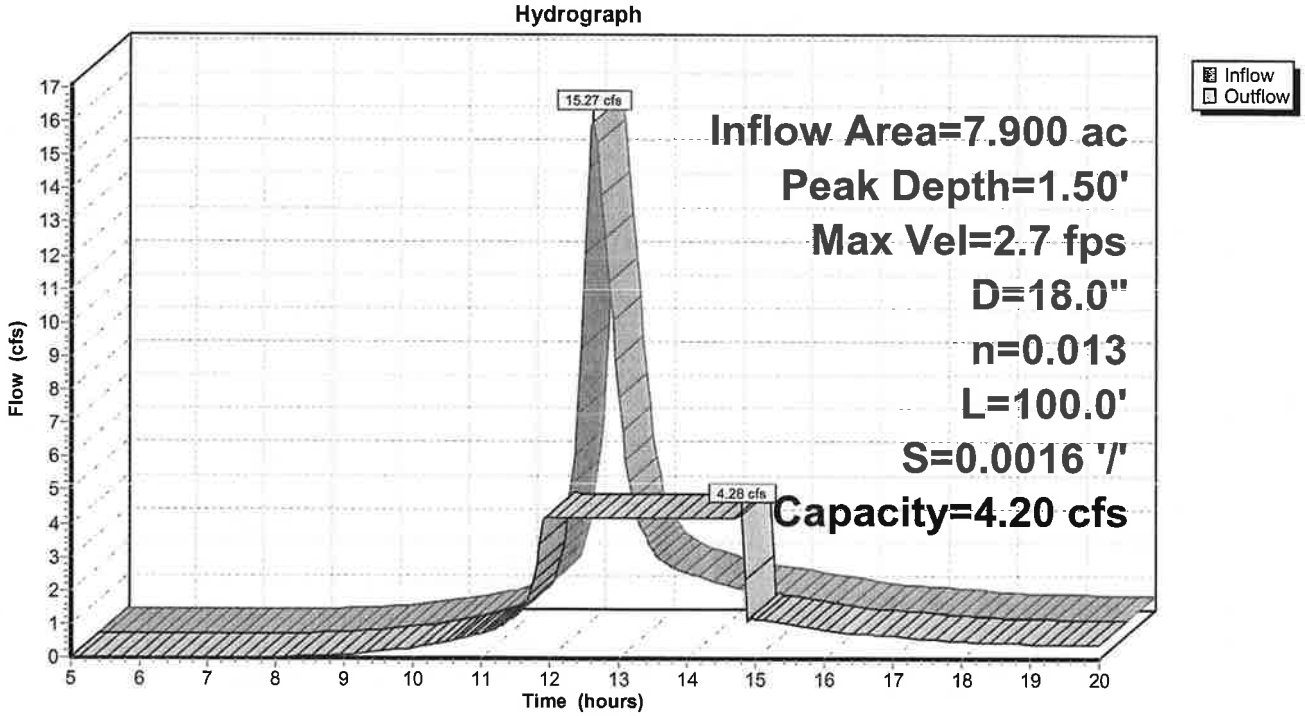
[52] Hint: Inlet conditions not evaluated
[55] Hint: Peak inflow is 363% of Manning's capacity
[76] Warning: Detained 0.390 af (Pond w/culvert advised)

Inflow Area =	7.900 ac,	Inflow Depth =	2.25"	for	10-Year Storm event
Inflow =	15.27 cfs @	12.22 hrs,	Volume=	1.480 af	
Outflow =	4.28 cfs @	14.80 hrs,	Volume=	1.479 af,	Atten= 72%, Lag= 154.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.7 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 1.0 min

Peak Depth= 1.50' @ 11.95 hrs
Capacity at bank full= 4.20 cfs
Inlet Invert= 5.46', Outlet Invert= 5.30'
18.0" Diameter Pipe n= 0.013 Length= 100.0' Slope= 0.0016 '/'

Reach 4R: 18" RCP



Reach 5R: 24" RCP

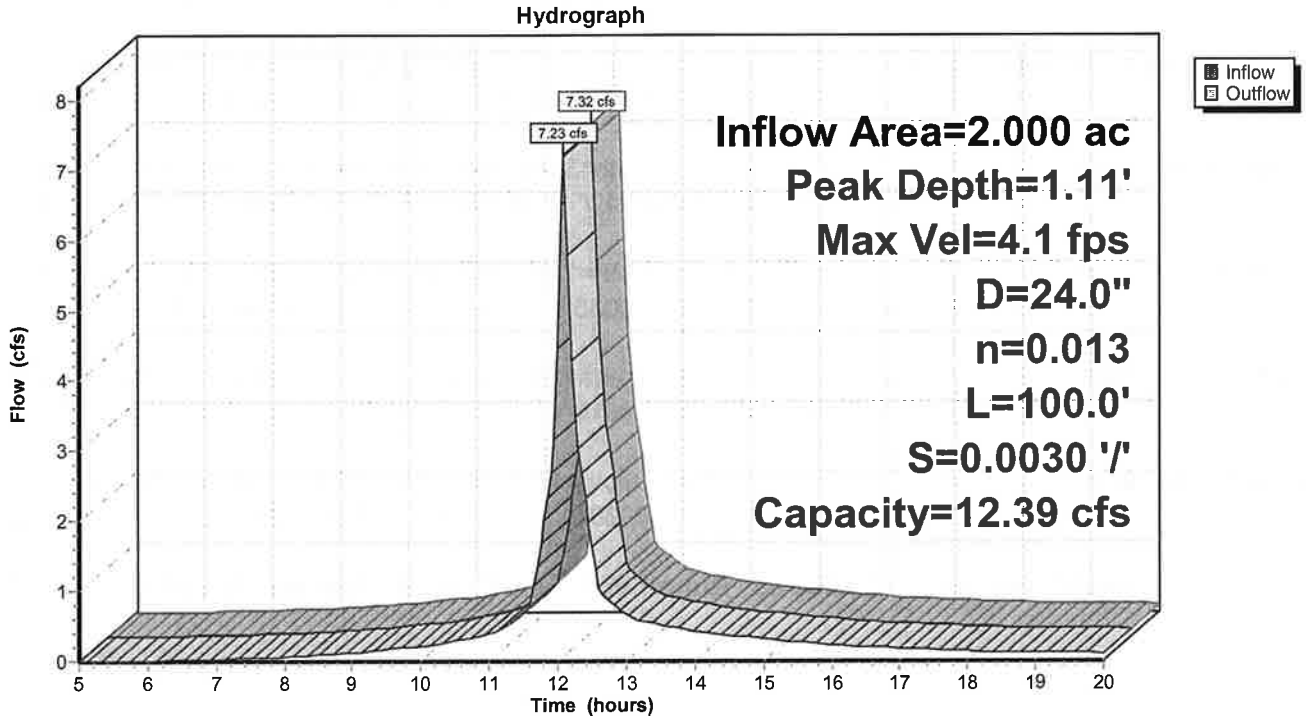
[52] Hint: Inlet conditions not evaluated

Inflow Area = 2.000 ac, Inflow Depth = 3.01" for 10-Year Storm event
Inflow = 7.32 cfs @ 12.08 hrs, Volume= 0.502 af
Outflow = 7.23 cfs @ 12.09 hrs, Volume= 0.502 af, Atten= 1%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.1 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 1.1 min

Peak Depth= 1.11' @ 12.09 hrs
Capacity at bank full= 12.39 cfs
Inlet Invert= 7.92', Outlet Invert= 7.62'
24.0" Diameter Pipe n= 0.013 Length= 100.0' Slope= 0.0030 '/'

Reach 5R: 24" RCP



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Drainage Area A Runoff Area=12.200 ac Runoff Depth=4.21"
Flow Length=2,676' Tc=16.0 min CN=91 Runoff=45.05 cfs 4.285 af

Subcatchment B: Drainage Area B Runoff Area=4.400 ac Runoff Depth=3.70"
Flow Length=921' Tc=11.1 min CN=86 Runoff=16.74 cfs 1.358 af

Subcatchment C: Drainage Area C Runoff Area=3.700 ac Runoff Depth=4.52"
Flow Length=1,323' Tc=8.8 min CN=94 Runoff=17.30 cfs 1.395 af

Subcatchment D: Drainage Area D Runoff Area=4.900 ac Runoff Depth=2.92"
Flow Length=1,135' Tc=20.3 min CN=78 Runoff=12.05 cfs 1.192 af

Subcatchment E: Drainage Area E Runoff Area=3.000 ac Runoff Depth=3.31"
Flow Length=1,758' Tc=12.3 min CN=82 Runoff=10.01 cfs 0.826 af

Subcatchment F: Drainage Area F Runoff Area=2.000 ac Runoff Depth=3.92"
Flow Length=590' Tc=5.2 min CN=88 Runoff=9.38 cfs 0.653 af

Reach 1R: 48" RCP Peak Depth=3.05' Max Vel=5.9 fps Inflow=60.34 cfs 5.643 af
D=48.0" n=0.013 L=78.0' S=0.0021 '/' Capacity=65.06 cfs Outflow=60.16 cfs 5.641 af

Reach 3R: 18" RCP Peak Depth=1.50' Max Vel=4.0 fps Inflow=17.30 cfs 1.395 af
D=18.0" n=0.013 L=72.0' S=0.0035 '/' Capacity=6.19 cfs Outflow=6.58 cfs 1.394 af

Reach 4R: 18" RCP Peak Depth=1.50' Max Vel=2.7 fps Inflow=20.74 cfs 2.018 af
D=18.0" n=0.013 L=100.0' S=0.0016 '/' Capacity=4.20 cfs Outflow=4.20 cfs 2.017 af

Reach 5R: 24" RCP Peak Depth=1.30' Max Vel=4.3 fps Inflow=9.38 cfs 0.653 af
D=24.0" n=0.013 L=100.0' S=0.0030 '/' Capacity=12.39 cfs Outflow=9.27 cfs 0.652 af

Total Runoff Area = 30.200 ac Runoff Volume = 9.708 af Average Runoff Depth = 3.86"

Subcatchment A: Drainage Area A

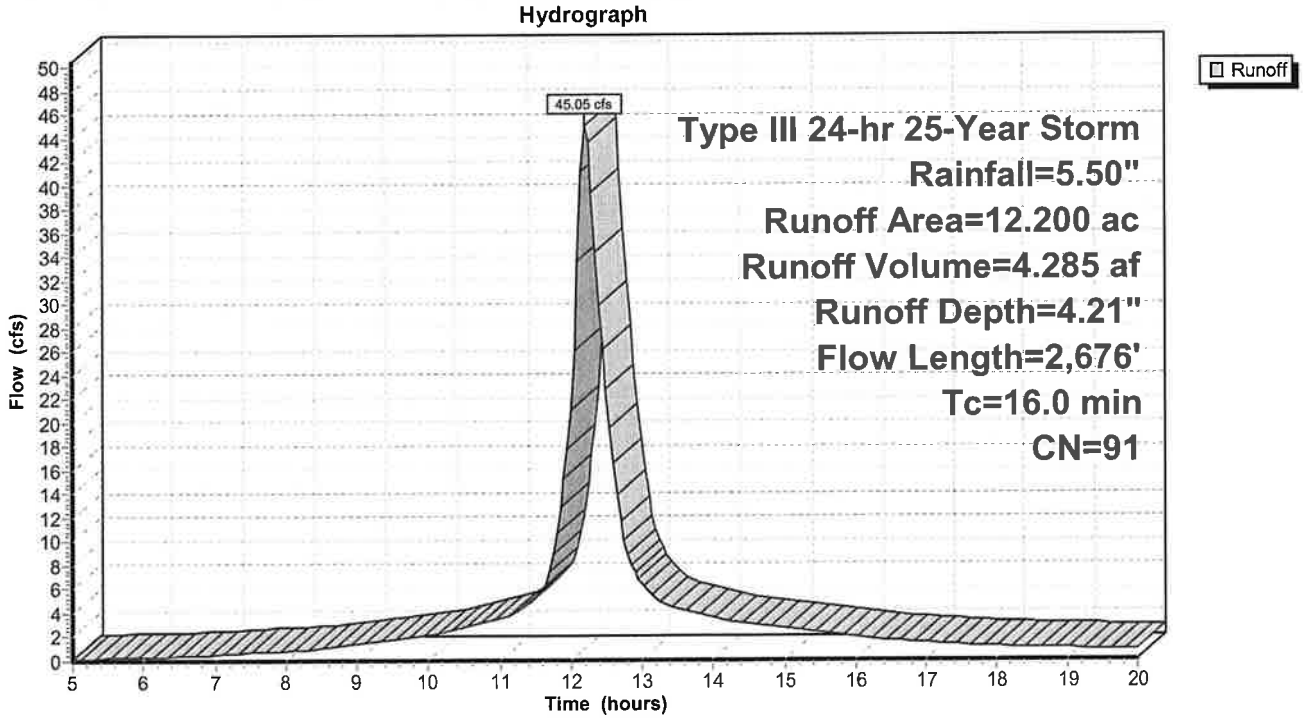
Runoff = 45.05 cfs @ 12.21 hrs, Volume= 4.285 af, Depth= 4.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Storm Rainfall=5.50"

Area (ac)	CN	Description
8.540	98	Pavement
1.220	49	50-75% Grass cover, Fair, HSG A
2.440	89	Urban commercial, 85% imp, HSG A
12.200	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	275	0.0100	1.1		**Sheet Flow, Flow across roadway** n= 0.013 P2= 3.10"
4.3	669	0.0023	2.6	2.02	**Circular Channel (pipe), 12" VCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.6	305	0.0026	3.2	3.89	**Circular Channel (pipe), 15" VCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
3.2	609	0.0020	3.1	5.55	**Circular Channel (pipe), 18" VCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011
2.7	818	0.0045	5.1	11.03	**Circular Channel (pipe), 20" VCP** Diam= 20.0" Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.011
16.0	2,676	Total			

Subcatchment A: Drainage Area A



Subcatchment B: Drainage Area B

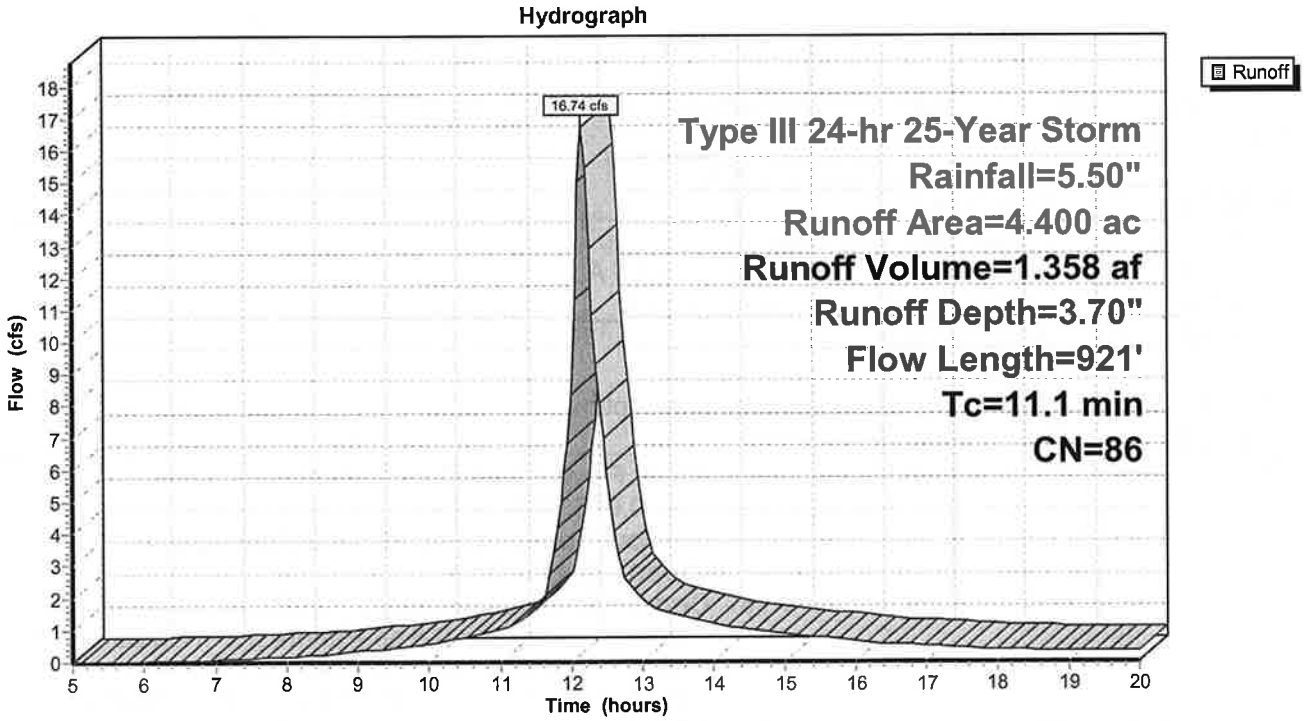
Runoff = 16.74 cfs @ 12.15 hrs, Volume= 1.358 af, Depth= 3.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Storm Rainfall=5.50"

Area (ac)	CN	Description
2.640	98	Paved parking & roofs
0.880	49	50-75% Grass cover, Fair, HSG A
0.880	89	Urban commercial, 85% imp, HSG A
4.400	86	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	95	0.0400	0.2		**Sheet Flow, Grass at Bathhouse to Gutter** Grass: Short n= 0.150 P2= 3.10"
0.5	50	0.0080	1.8		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
1.1	186	0.0037	2.9	1.58	**Circular Channel (pipe), 10" VCP** Diam= 10.0" Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.011
1.0	196	0.0041	3.4	2.70	**Circular Channel (pipe), 12" VCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.0	194	0.0026	3.2	3.89	**Circular Channel (pipe), 15" VCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
0.0	40	0.0998	20.1	43.95	**Circular Channel (pipe), 20" VCP** Diam= 20.0" Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.013
0.3	160	0.0047	7.8	98.48	**Circular Channel (pipe), 48" RCP** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
11.1	921	Total			

Subcatchment B: Drainage Area B



Subcatchment C: Drainage Area C

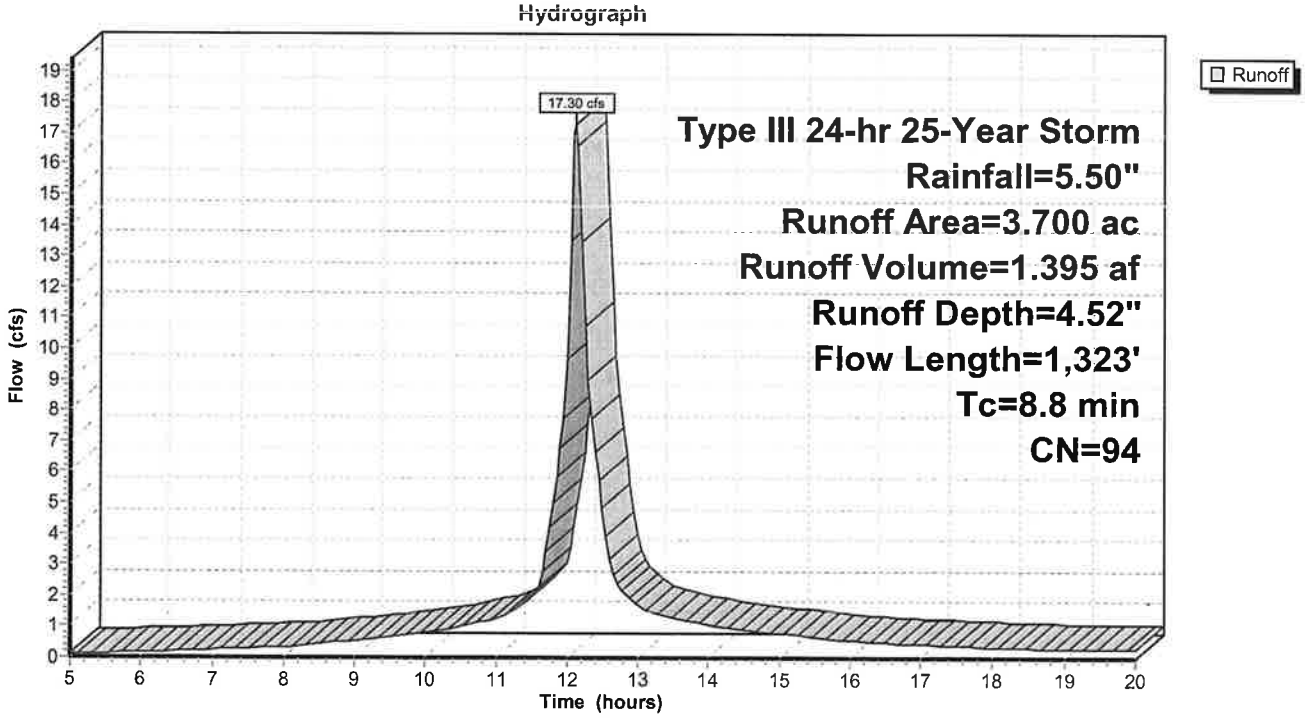
Runoff = 17.30 cfs @ 12.12 hrs, Volume= 1.395 af, Depth= 4.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Storm Rainfall=5.50"

Area (ac)	CN	Description
2.960	98	Paved parking & roofs
0.550	89	Urban commercial, 85% imp, HSG A
0.190	49	50-75% Grass cover, Fair, HSG A
3.700	94	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	20	0.0200	0.9		**Sheet Flow, Sheet Flow to Gutter** n= 0.013 P2= 3.10"
1.5	100	0.0030	1.1		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
3.1	425	0.0025	2.3	1.78	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
2.3	534	0.0055	3.9	4.79	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.5	244	0.0022	2.8	4.93	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
8.8	1,323	Total			

Subcatchment C: Drainage Area C



Subcatchment D: Drainage Area D

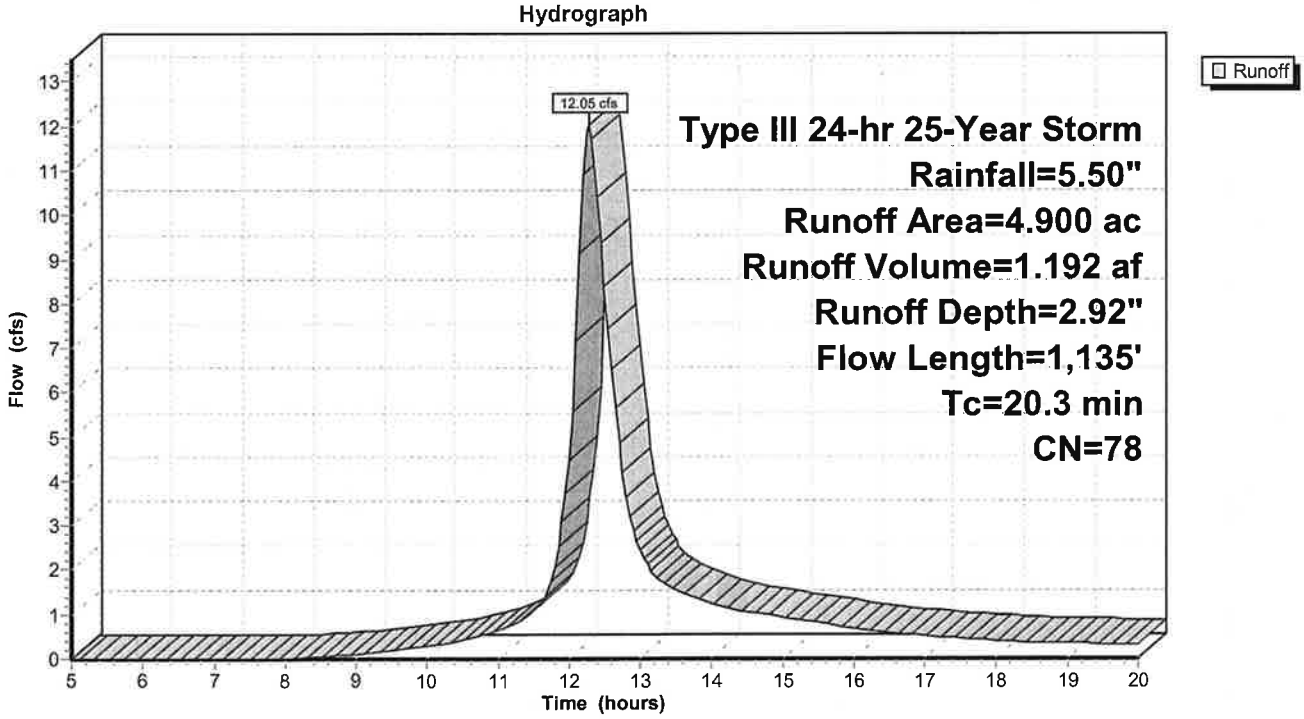
Runoff = 12.05 cfs @ 12.28 hrs, Volume= 1.192 af, Depth= 2.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Storm Rainfall=5.50"

Area (ac)	CN	Description
2.940	98	Paved parking & roofs
1.960	49	50-75% Grass cover, Fair, HSG A
4.900	78	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	100	0.0100	0.1		**Sheet Flow, Grass to gutter** Grass: Short n= 0.150 P2= 3.10"
2.1	180	0.0050	1.4		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
3.5	622	0.0032	3.0	3.65	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.6	233	0.0016	2.4	4.20	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
20.3	1,135	Total			

Subcatchment D: Drainage Area D



Subcatchment E: Drainage Area E

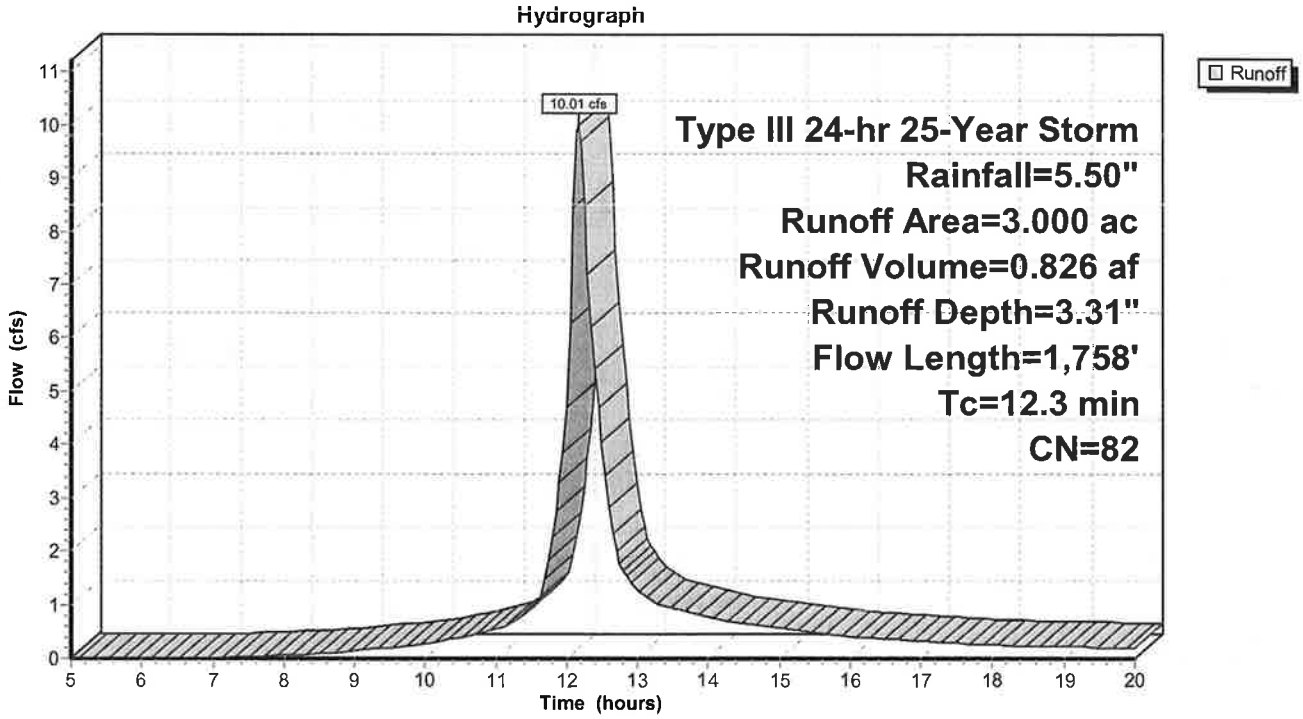
Runoff = 10.01 cfs @ 12.17 hrs, Volume= 0.826 af, Depth= 3.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Storm Rainfall=5.50"

Area (ac)	CN	Description
1.650	98	Paved parking & roofs
0.900	49	50-75% Grass cover, Fair, HSG A
0.450	89	Urban commercial, 85% imp, HSG A
3.000	82	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	100	0.0200	1.2		**Sheet Flow, Parking lot to gutter** n= 0.013 P2= 3.10"
1.8	100	0.0020	0.9		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
2.7	425	0.0034	2.6	2.08	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
2.6	400	0.0024	2.6	3.16	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.8	733	0.0029	3.2	5.66	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
12.3	1,758	Total			

Subcatchment E: Drainage Area E



Subcatchment F: Drainage Area F

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

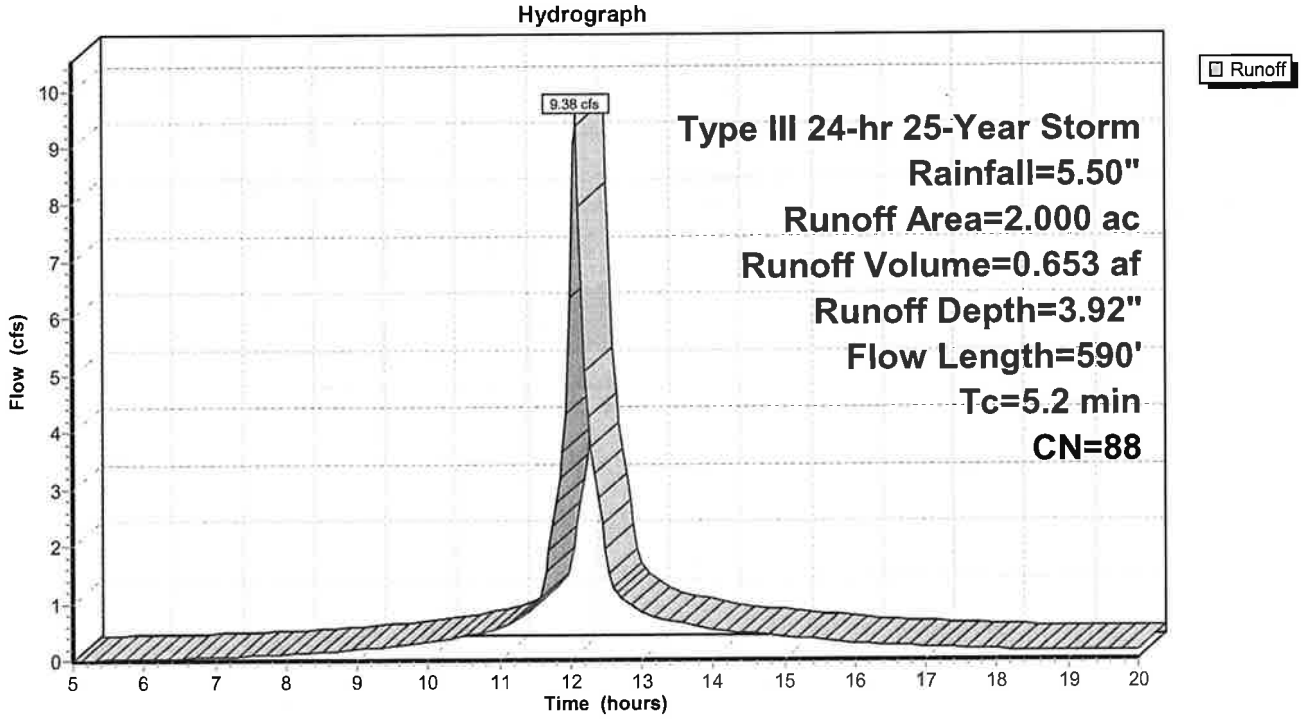
Runoff = 9.38 cfs @ 12.08 hrs, Volume= 0.653 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Storm Rainfall=5.50"

Area (ac)	CN	Description
1.600	98	Paved parking & roofs
0.400	49	50-75% Grass cover, Fair, HSG A
2.000	88	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	85	0.0100	0.9		**Sheet Flow, Parking Lot to Gutter** n= 0.013 P2= 3.10"
2.0	155	0.0040	1.3		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
0.7	180	0.0080	4.1	3.19	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.9	170	0.0030	3.3	5.75	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
5.2	590	Total			

Subcatchment F: Drainage Area F



Reach 1R: 48" RCP

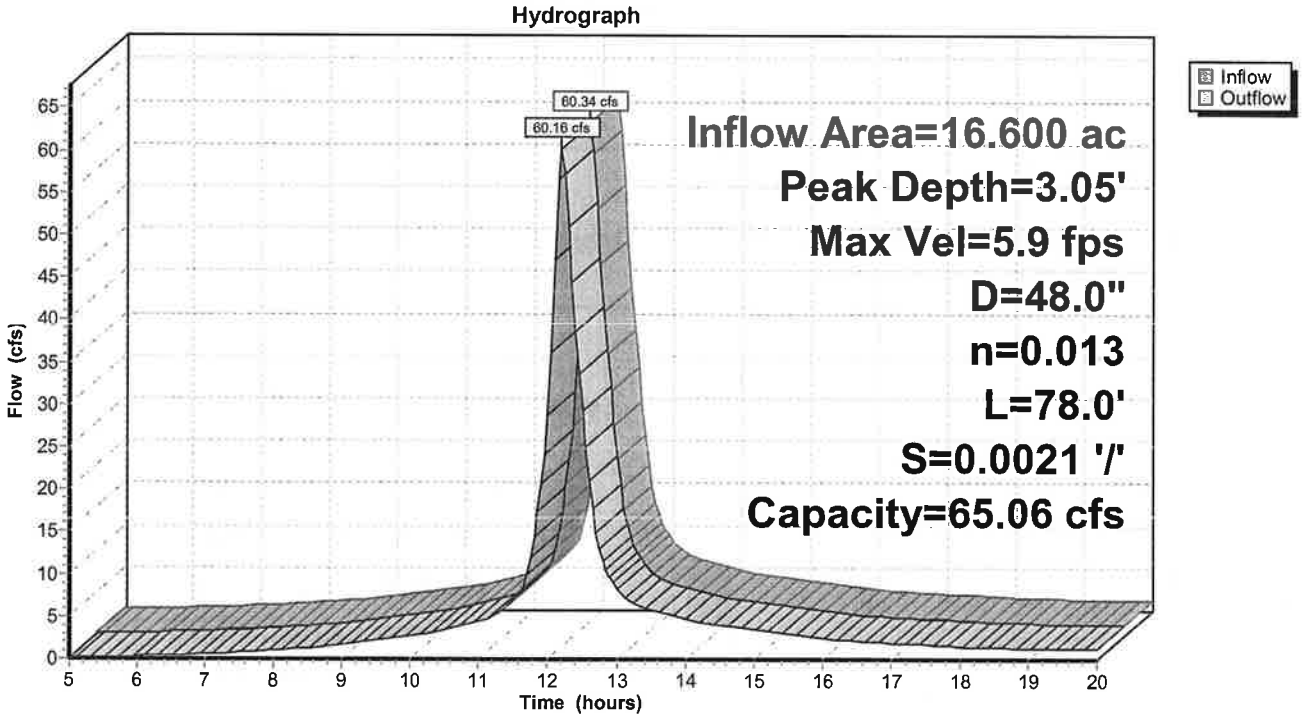
[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

Inflow Area =	16.600 ac,	Inflow Depth =	4.08"	for	25-Year Storm event
Inflow =	60.34 cfs @	12.19 hrs,	Volume=		5.643 af
Outflow =	60.16 cfs @	12.20 hrs,	Volume=		5.641 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.9 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.5 min

Peak Depth= 3.05' @ 12.20 hrs
Capacity at bank full= 65.06 cfs
Inlet Invert= -0.81', Outlet Invert= -0.97'
48.0" Diameter Pipe n= 0.013 Length= 78.0' Slope= 0.0021 '/'

Reach 1R: 48" RCP



Reach 3R: 18" RCP

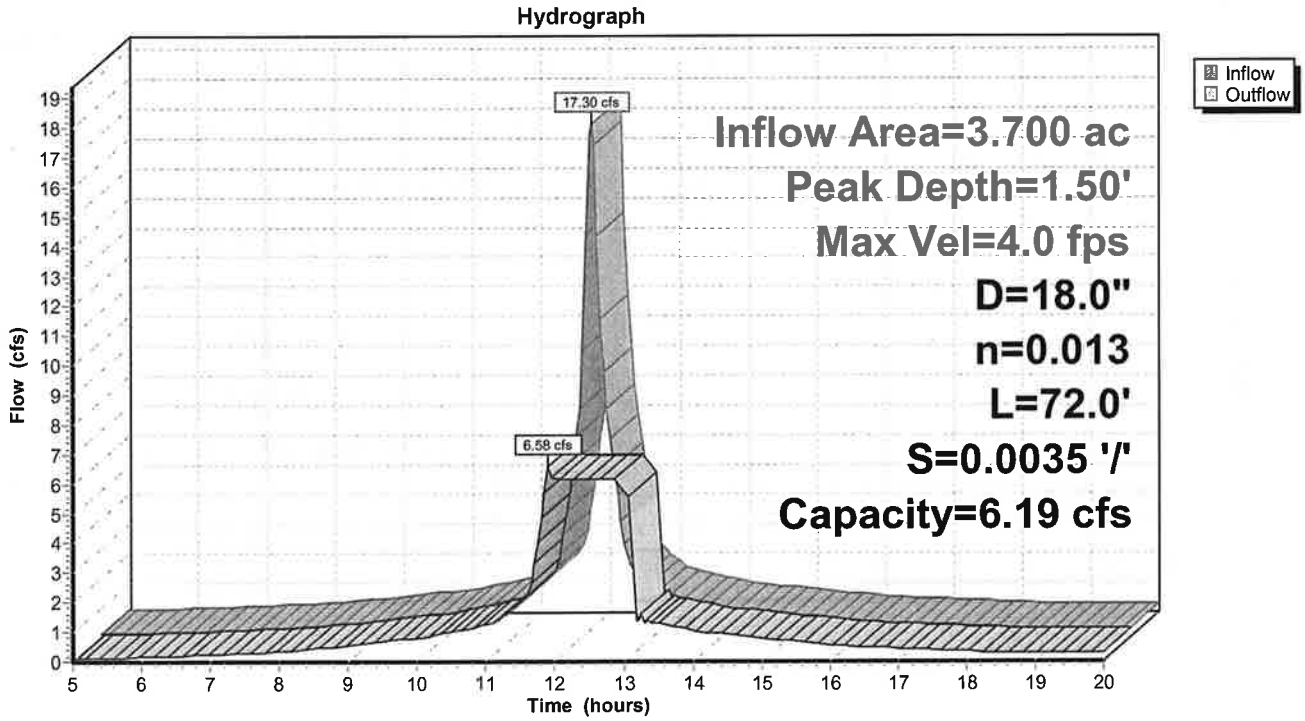
[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[55] Hint: Peak inflow is 279% of Manning's capacity
[76] Warning: Detained 0.207 af (Pond w/culvert advised)
[85] Warning: Oscillations may require Finer Routing>1

Inflow Area =	3.700 ac,	Inflow Depth =	4.52"	for	25-Year Storm event
Inflow =	17.30 cfs @	12.12 hrs,	Volume=	1.395 af	
Outflow =	6.58 cfs @	11.91 hrs,	Volume=	1.394 af,	Atten= 62%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.0 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 0.5 min

Peak Depth= 1.50' @ 11.95 hrs
Capacity at bank full= 6.19 cfs
Inlet Invert= 5.62', Outlet Invert= 5.37'
18.0" Diameter Pipe n= 0.013 Length= 72.0' Slope= 0.0035 '/'

Reach 3R: 18" RCP



Reach 4R: 18" RCP

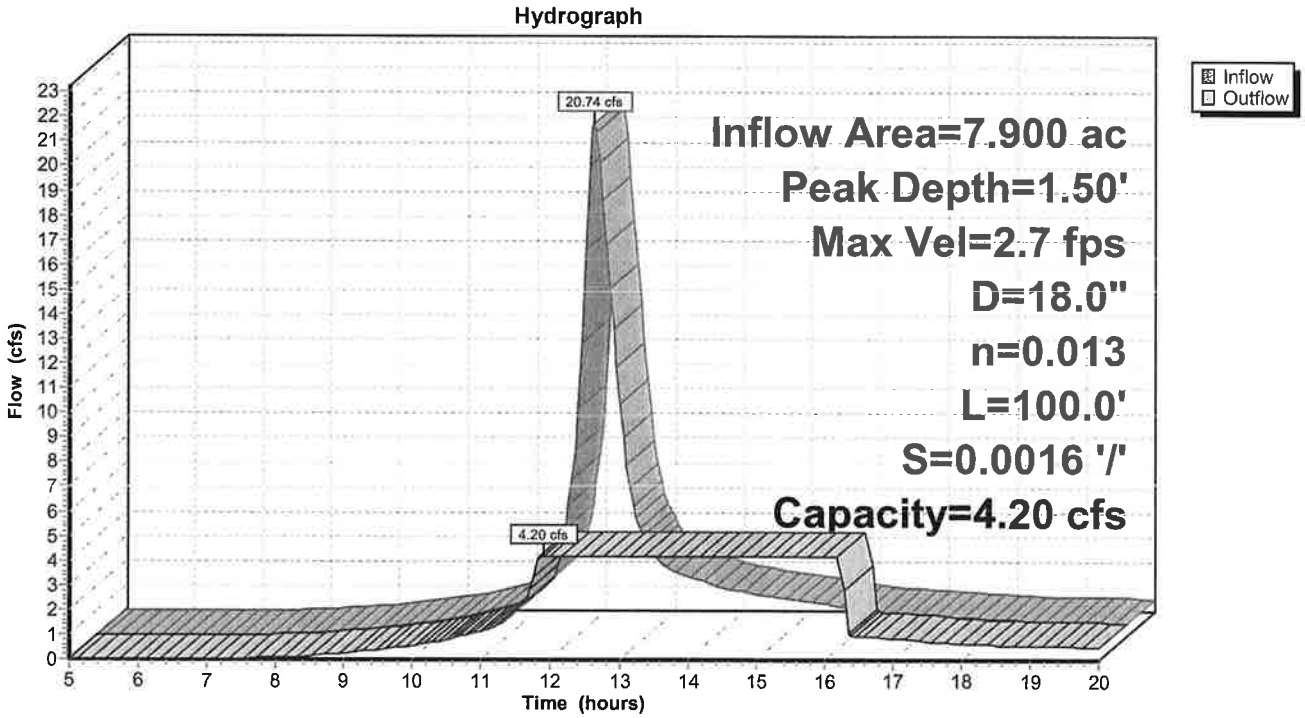
[52] Hint: Inlet conditions not evaluated
[55] Hint: Peak inflow is 494% of Manning's capacity
[76] Warning: Detained 0.653 af (Pond w/culvert advised)

Inflow Area =	7.900 ac,	Inflow Depth =	3.07"	for	25-Year Storm event
Inflow =	20.74 cfs @	12.22 hrs,	Volume=	2.018 af	
Outflow =	4.20 cfs @	11.90 hrs,	Volume=	2.017 af,	Atten= 80%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.7 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 0.9 min

Peak Depth= 1.50' @ 11.85 hrs
Capacity at bank full= 4.20 cfs
Inlet Invert= 5.46', Outlet Invert= 5.30'
18.0" Diameter Pipe n= 0.013 Length= 100.0' Slope= 0.0016 '/'

Reach 4R: 18" RCP



Reach 5R: 24" RCP

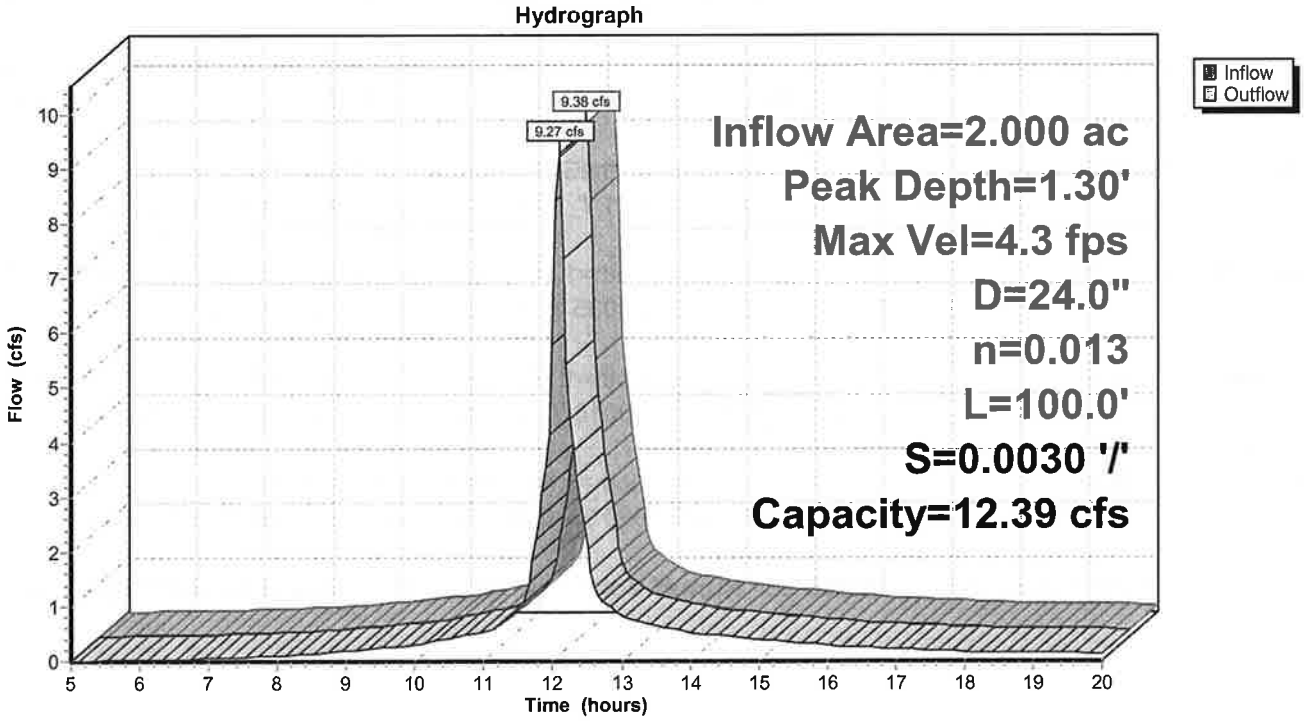
[52] Hint: Inlet conditions not evaluated

Inflow Area =	2.000 ac,	Inflow Depth =	3.92"	for	25-Year Storm event
Inflow =	9.38 cfs @	12.08 hrs,	Volume=		0.653 af
Outflow =	9.27 cfs @	12.09 hrs,	Volume=		0.652 af, Atten= 1%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.3 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 1.0 min

Peak Depth= 1.30' @ 12.08 hrs
Capacity at bank full= 12.39 cfs
Inlet Invert= 7.92', Outlet Invert= 7.62'
24.0" Diameter Pipe n= 0.013 Length= 100.0' Slope= 0.0030 '/'

Reach 5R: 24" RCP



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Drainage Area A Runoff Area=12.200 ac Runoff Depth=4.67"
Flow Length=2,676' Tc=16.0 min CN=91 Runoff=49.70 cfs 4.753 af

Subcatchment B: Drainage Area B Runoff Area=4.400 ac Runoff Depth=4.15"
Flow Length=921' Tc=11.1 min CN=86 Runoff=18.66 cfs 1.523 af

Subcatchment C: Drainage Area C Runoff Area=3.700 ac Runoff Depth=4.99"
Flow Length=1,323' Tc=8.8 min CN=94 Runoff=18.97 cfs 1.537 af

Subcatchment D: Drainage Area D Runoff Area=4.900 ac Runoff Depth=3.33"
Flow Length=1,135' Tc=20.3 min CN=78 Runoff=13.72 cfs 1.361 af

Subcatchment E: Drainage Area E Runoff Area=3.000 ac Runoff Depth=3.74"
Flow Length=1,758' Tc=12.3 min CN=82 Runoff=11.27 cfs 0.935 af

Subcatchment F: Drainage Area F Runoff Area=2.000 ac Runoff Depth=4.37"
Flow Length=590' Tc=5.2 min CN=88 Runoff=10.41 cfs 0.729 af

Reach 1R: 48" RCP Peak Depth=3.38' Max Vel=5.9 fps Inflow=66.75 cfs 6.276 af
D=48.0" n=0.013 L=78.0' S=0.0021 '/' Capacity=65.06 cfs Outflow=66.52 cfs 6.274 af

Reach 3R: 18" RCP Peak Depth=1.50' Max Vel=4.0 fps Inflow=18.97 cfs 1.537 af
D=18.0" n=0.013 L=72.0' S=0.0035 '/' Capacity=6.19 cfs Outflow=6.37 cfs 1.536 af

Reach 4R: 18" RCP Peak Depth=1.50' Max Vel=2.7 fps Inflow=23.52 cfs 2.295 af
D=18.0" n=0.013 L=100.0' S=0.0016 '/' Capacity=4.20 cfs Outflow=4.20 cfs 2.294 af

Reach 5R: 24" RCP Peak Depth=1.41' Max Vel=4.4 fps Inflow=10.41 cfs 0.729 af
D=24.0" n=0.013 L=100.0' S=0.0030 '/' Capacity=12.39 cfs Outflow=10.29 cfs 0.728 af

Total Runoff Area = 30.200 ac Runoff Volume = 10.837 af Average Runoff Depth = 4.31"

Subcatchment A: Drainage Area A

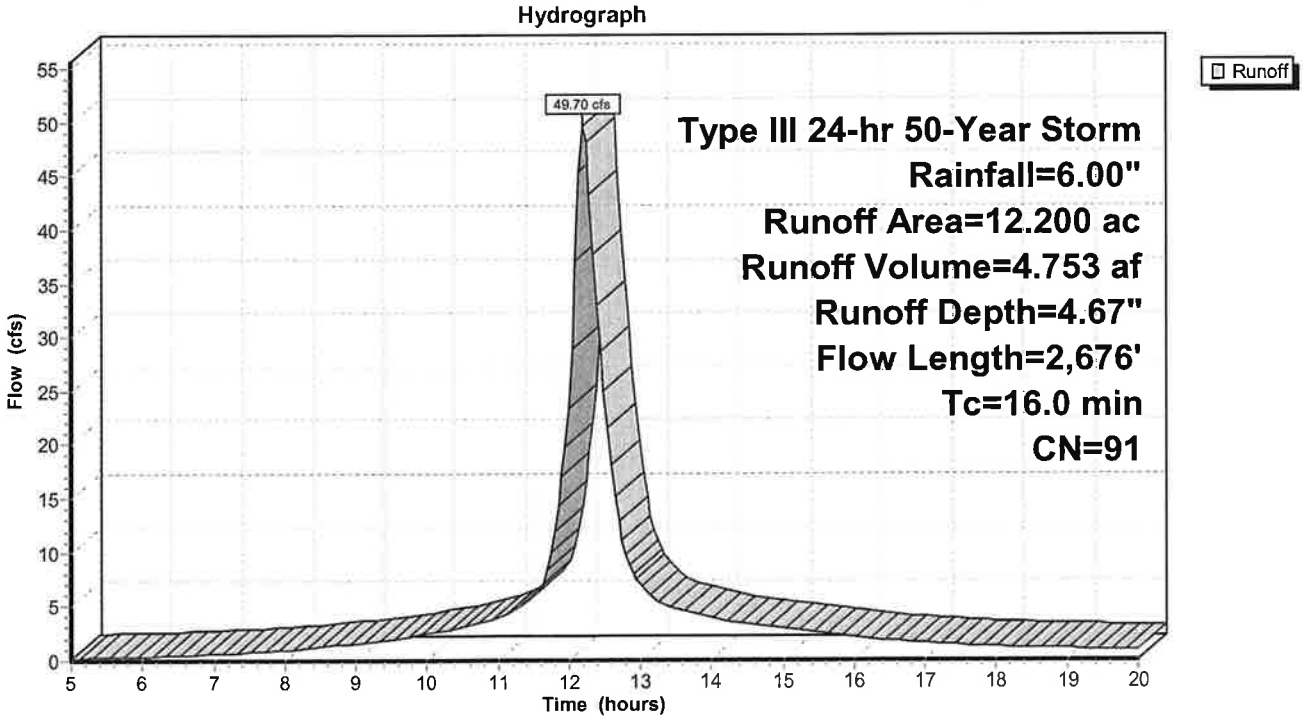
Runoff = 49.70 cfs @ 12.21 hrs, Volume= 4.753 af, Depth= 4.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Storm Rainfall=6.00"

Area (ac)	CN	Description
8.540	98	Pavement
1.220	49	50-75% Grass cover, Fair, HSG A
2.440	89	Urban commercial, 85% imp, HSG A
12.200	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	275	0.0100	1.1		**Sheet Flow, Flow across roadway** n= 0.013 P2= 3.10"
4.3	669	0.0023	2.6	2.02	**Circular Channel (pipe), 12" VCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.6	305	0.0026	3.2	3.89	**Circular Channel (pipe), 15" VCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
3.2	609	0.0020	3.1	5.55	**Circular Channel (pipe), 18" VCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011
2.7	818	0.0045	5.1	11.03	**Circular Channel (pipe), 20" VCP** Diam= 20.0" Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.011
16.0	2,676	Total			

Subcatchment A: Drainage Area A



Subcatchment B: Drainage Area B

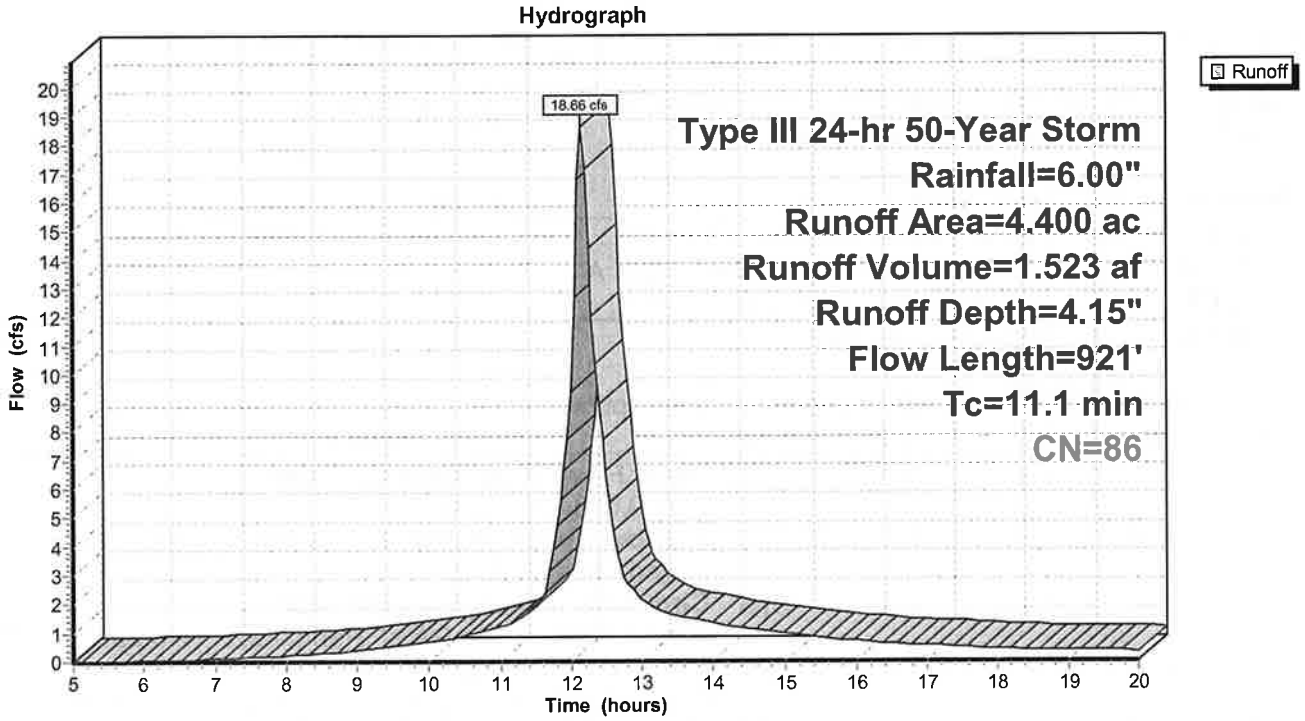
Runoff = 18.66 cfs @ 12.15 hrs, Volume= 1.523 af, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Storm Rainfall=6.00"

Area (ac)	CN	Description
2.640	98	Paved parking & roofs
0.880	49	50-75% Grass cover, Fair, HSG A
0.880	89	Urban commercial, 85% imp, HSG A
4.400	86	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	95	0.0400	0.2		**Sheet Flow, Grass at Bathhouse to Gutter** Grass: Short n= 0.150 P2= 3.10"
0.5	50	0.0080	1.8		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
1.1	186	0.0037	2.9	1.58	**Circular Channel (pipe), 10" VCP** Diam= 10.0" Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.011
1.0	196	0.0041	3.4	2.70	**Circular Channel (pipe), 12" VCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.0	194	0.0026	3.2	3.89	**Circular Channel (pipe), 15" VCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
0.0	40	0.0998	20.1	43.95	**Circular Channel (pipe), 20" VCP** Diam= 20.0" Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.013
0.3	160	0.0047	7.8	98.48	**Circular Channel (pipe), 48" RCP** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
11.1	921	Total			

Subcatchment B: Drainage Area B



Subcatchment C: Drainage Area C

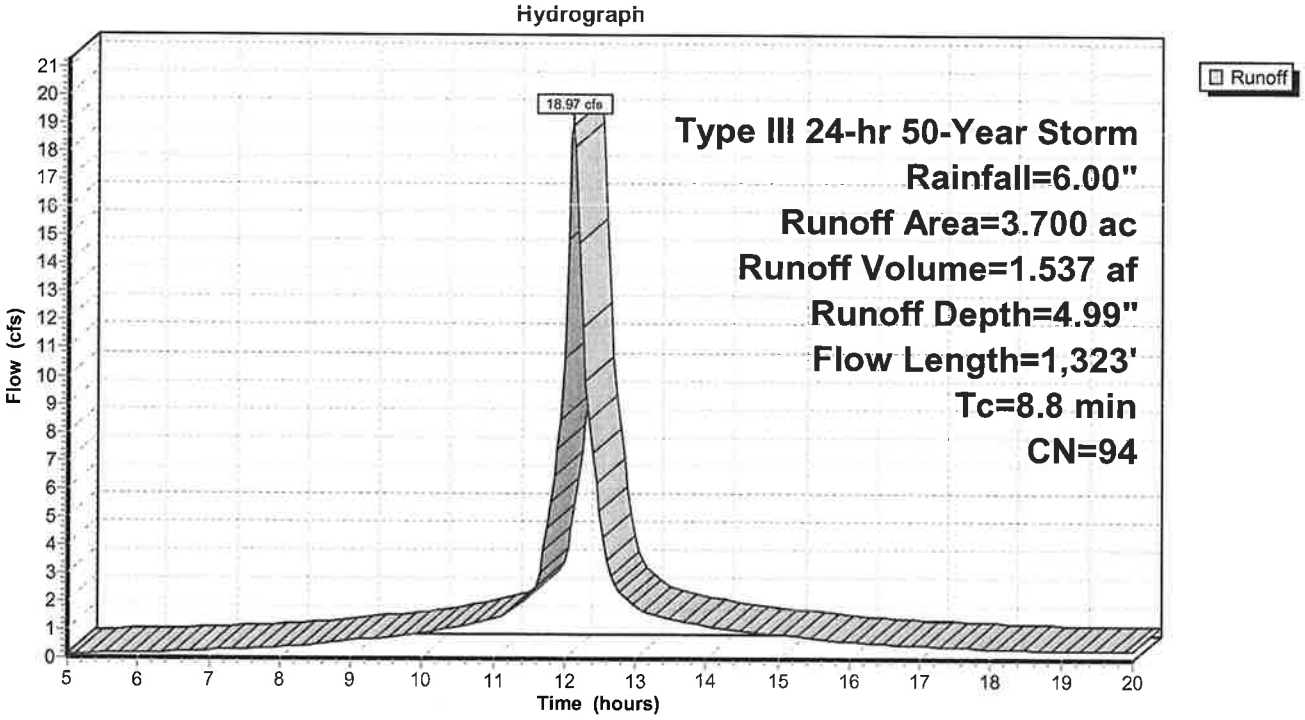
Runoff = 18.97 cfs @ 12.12 hrs, Volume= 1.537 af, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Storm Rainfall=6.00"

Area (ac)	CN	Description
2.960	98	Paved parking & roofs
0.550	89	Urban commercial, 85% imp, HSG A
0.190	49	50-75% Grass cover, Fair, HSG A
3.700	94	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	20	0.0200	0.9		**Sheet Flow, Sheet Flow to Gutter** n= 0.013 P2= 3.10"
1.5	100	0.0030	1.1		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
3.1	425	0.0025	2.3	1.78	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
2.3	534	0.0055	3.9	4.79	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.5	244	0.0022	2.8	4.93	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
8.8	1,323	Total			

Subcatchment C: Drainage Area C



Subcatchment D: Drainage Area D

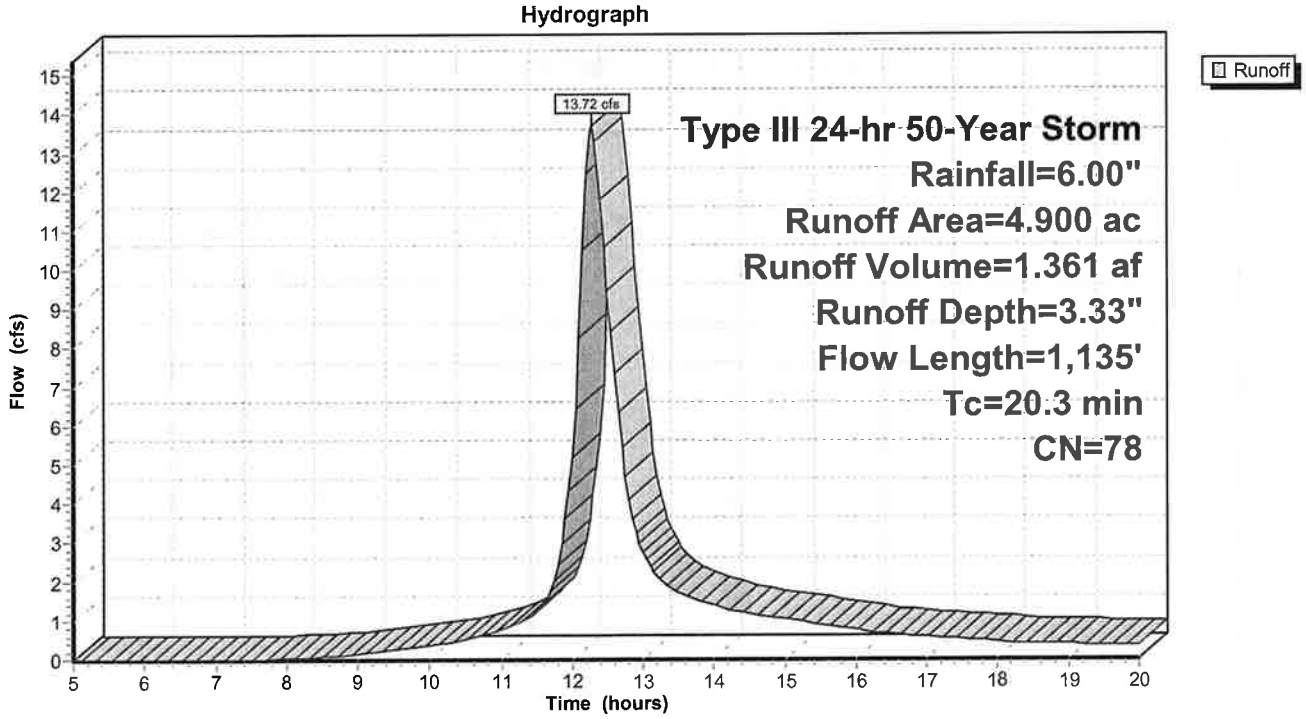
Runoff = 13.72 cfs @ 12.28 hrs, Volume= 1.361 af, Depth= 3.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Storm Rainfall=6.00"

Area (ac)	CN	Description
2.940	98	Paved parking & roofs
1.960	49	50-75% Grass cover, Fair, HSG A
4.900	78	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	100	0.0100	0.1		**Sheet Flow, Grass to gutter** Grass: Short n= 0.150 P2= 3.10"
2.1	180	0.0050	1.4		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
3.5	622	0.0032	3.0	3.65	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.6	233	0.0016	2.4	4.20	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
20.3	1,135	Total			

Subcatchment D: Drainage Area D



Subcatchment E: Drainage Area E

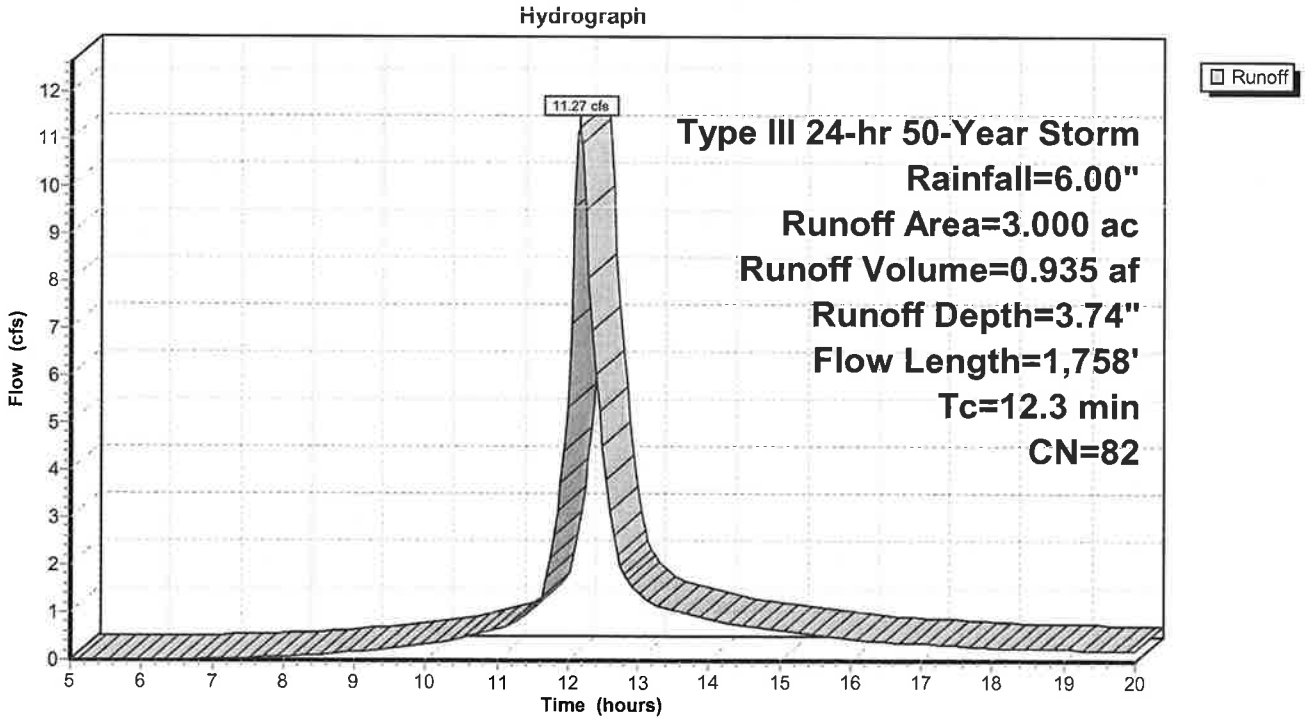
Runoff = 11.27 cfs @ 12.17 hrs, Volume= 0.935 af, Depth= 3.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Storm Rainfall=6.00"

Area (ac)	CN	Description
1.650	98	Paved parking & roofs
0.900	49	50-75% Grass cover, Fair, HSG A
0.450	89	Urban commercial, 85% imp, HSG A
3.000	82	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	100	0.0200	1.2		**Sheet Flow, Parking lot to gutter** n= 0.013 P2= 3.10"
1.8	100	0.0020	0.9		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
2.7	425	0.0034	2.6	2.08	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
2.6	400	0.0024	2.6	3.16	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.8	733	0.0029	3.2	5.66	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
12.3	1,758	Total			

Subcatchment E: Drainage Area E



Subcatchment F: Drainage Area F

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

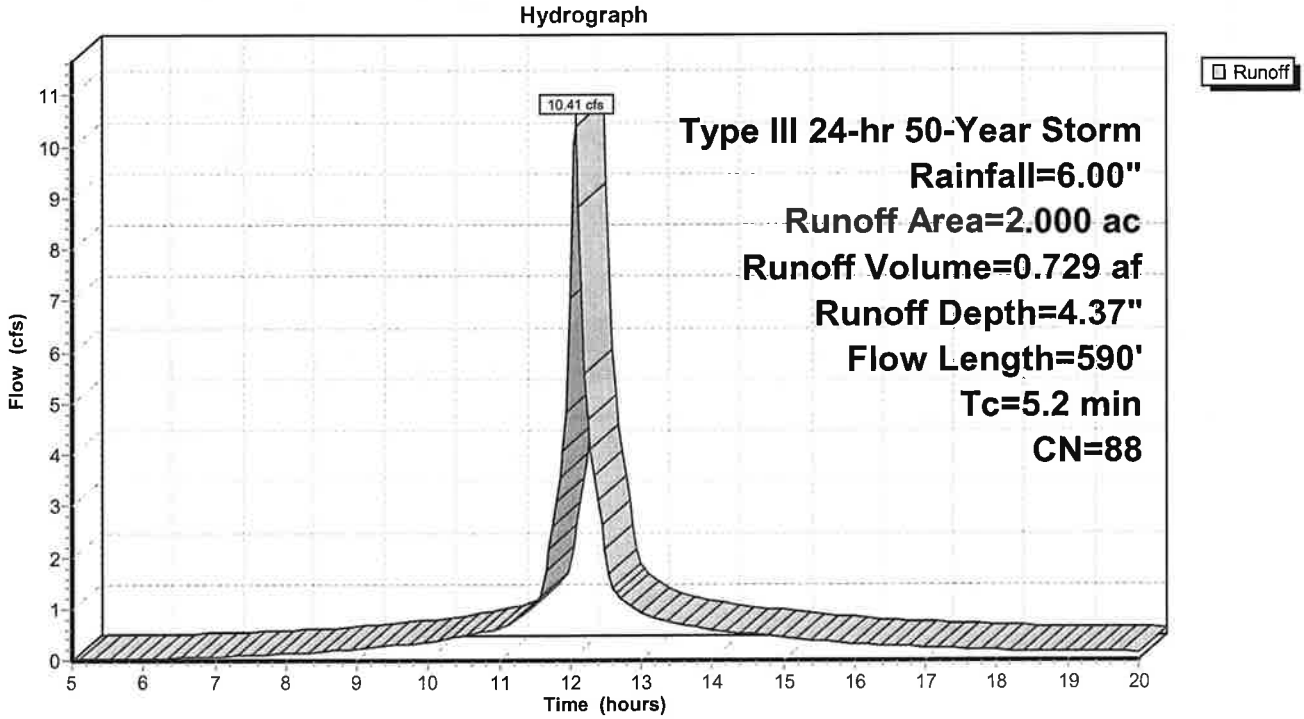
Runoff = 10.41 cfs @ 12.08 hrs, Volume= 0.729 af, Depth= 4.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Storm Rainfall=6.00"

Area (ac)	CN	Description
1.600	98	Paved parking & roofs
0.400	49	50-75% Grass cover, Fair, HSG A
2.000	88	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	85	0.0100	0.9		**Sheet Flow, Parking Lot to Gutter** n= 0.013 P2= 3.10"
2.0	155	0.0040	1.3		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
0.7	180	0.0080	4.1	3.19	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.9	170	0.0030	3.3	5.75	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
5.2	590	Total			

Subcatchment F: Drainage Area F



Reach 1R: 48" RCP

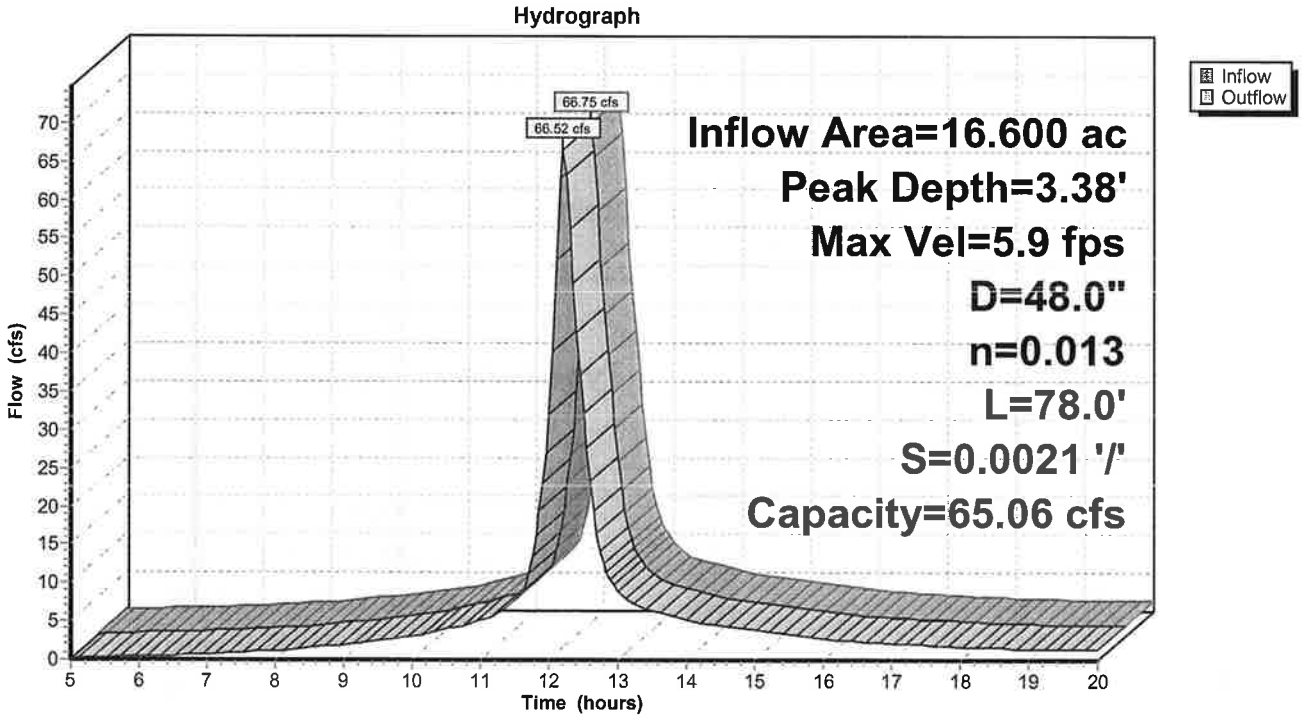
[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[55] Hint: Peak inflow is 103% of Manning's capacity

Inflow Area =	16.600 ac,	Inflow Depth =	4.54"	for	50-Year Storm event
Inflow =	66.75 cfs @	12.19 hrs,	Volume=	6.276 af	
Outflow =	66.52 cfs @	12.20 hrs,	Volume=	6.274 af,	Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.9 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.6 fps, Avg. Travel Time= 0.5 min

Peak Depth= 3.38' @ 12.20 hrs
Capacity at bank full= 65.06 cfs
Inlet Invert= -0.81', Outlet Invert= -0.97'
48.0" Diameter Pipe n= 0.013 Length= 78.0' Slope= 0.0021 '/'

Reach 1R: 48" RCP



Reach 3R: 18" RCP

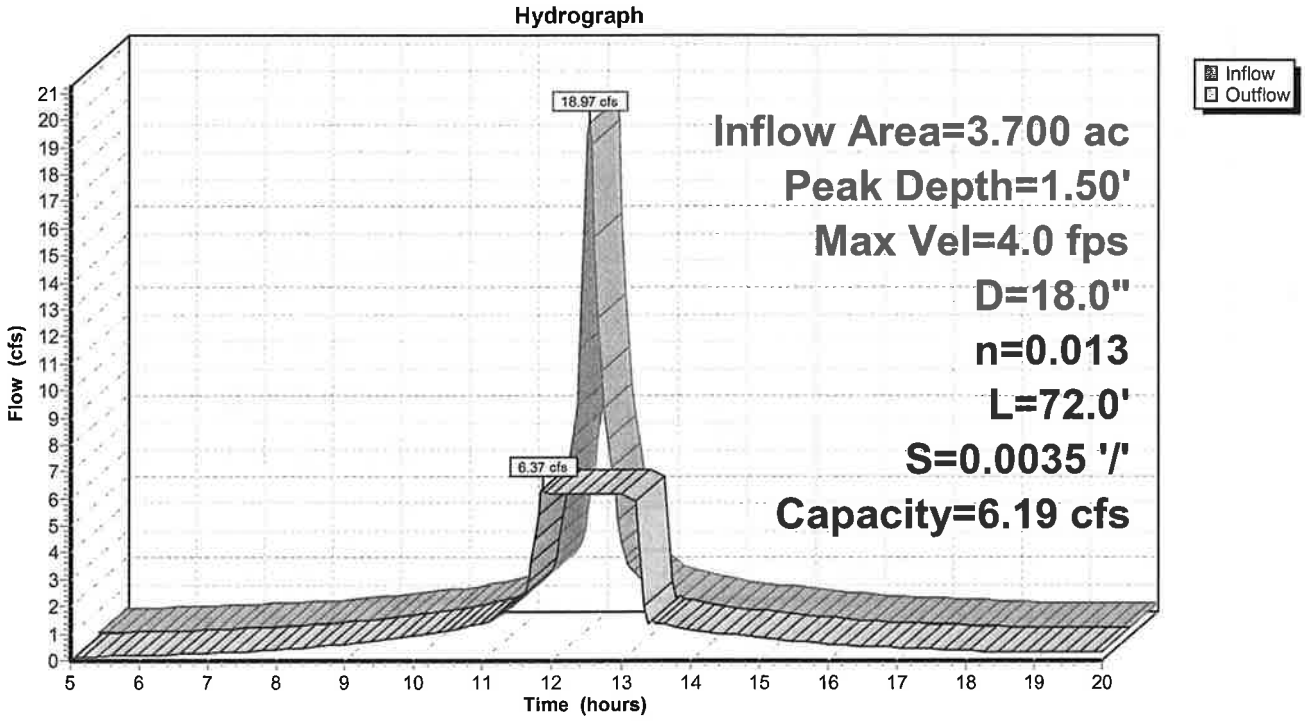
[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[55] Hint: Peak inflow is 307% of Manning's capacity
[76] Warning: Detained 0.258 af (Pond w/culvert advised)
[85] Warning: Oscillations may require Finer Routing>1

Inflow Area =	3.700 ac,	Inflow Depth =	4.99"	for	50-Year Storm event
Inflow =	18.97 cfs @	12.12 hrs,	Volume=		1.537 af
Outflow =	6.37 cfs @	11.87 hrs,	Volume=		1.536 af, Atten= 66%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.0 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 0.5 min

Peak Depth= 1.50' @ 11.90 hrs
Capacity at bank full= 6.19 cfs
Inlet Invert= 5.62', Outlet Invert= 5.37'
18.0" Diameter Pipe n= 0.013 Length= 72.0' Slope= 0.0035 '/'

Reach 3R: 18" RCP



Reach 4R: 18" RCP

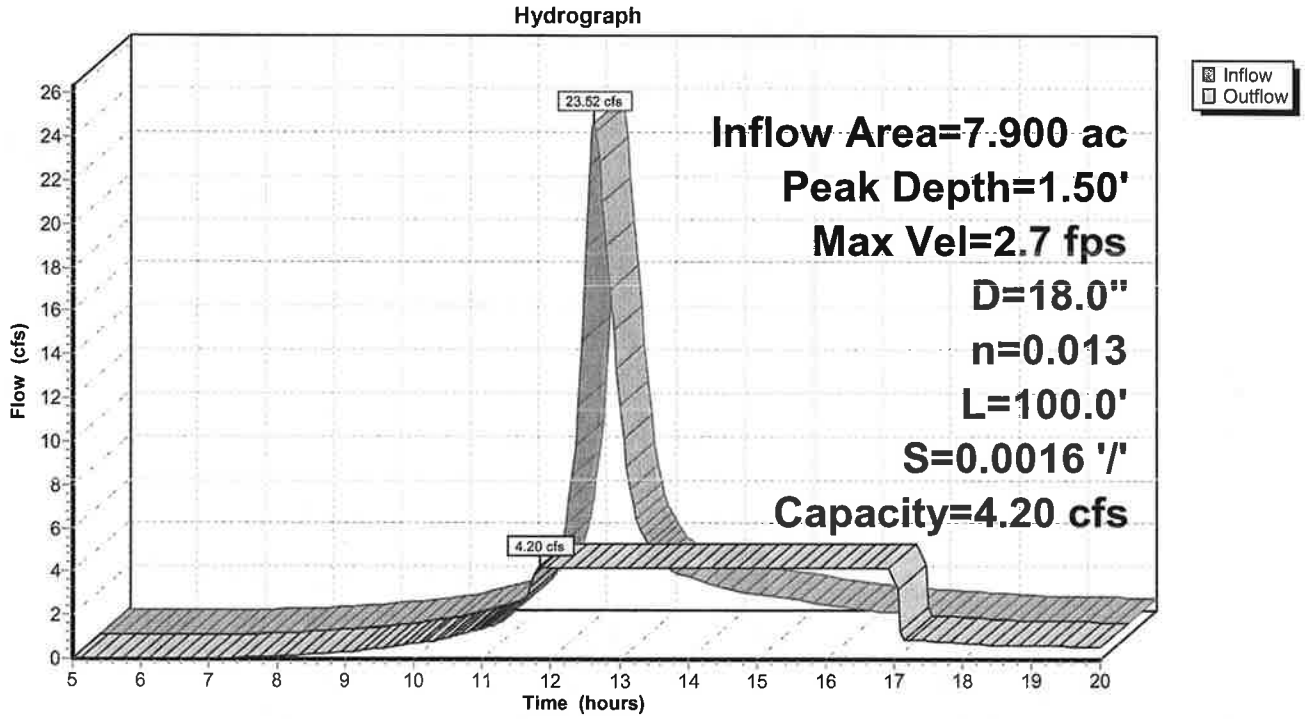
[52] Hint: Inlet conditions not evaluated
[55] Hint: Peak inflow is 560% of Manning's capacity
[76] Warning: Detained 0.796 af (Pond w/culvert advised)

Inflow Area =	7.900 ac,	Inflow Depth =	3.49"	for	50-Year Storm event
Inflow =	23.52 cfs @	12.22 hrs,	Volume=	2.295 af	
Outflow =	4.20 cfs @	11.85 hrs,	Volume=	2.294 af,	Atten= 82%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.7 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 0.9 min

Peak Depth= 1.50' @ 11.80 hrs
Capacity at bank full= 4.20 cfs
Inlet Invert= 5.46', Outlet Invert= 5.30'
18.0" Diameter Pipe n= 0.013 Length= 100.0' Slope= 0.0016 '/'

Reach 4R: 18" RCP



Reach 5R: 24" RCP

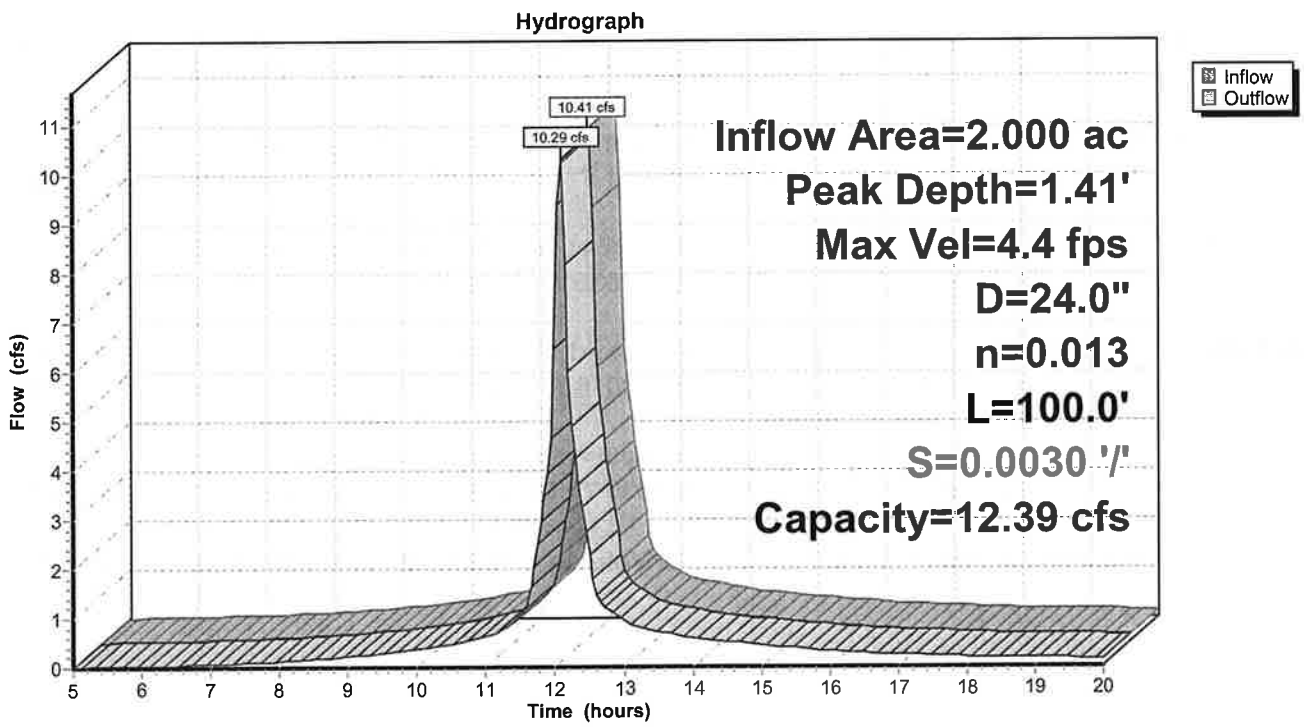
[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

Inflow Area =	2.000 ac,	Inflow Depth =	4.37"	for	50-Year Storm event
Inflow =	10.41 cfs @	12.08 hrs,	Volume=	0.729 af	
Outflow =	10.29 cfs @	12.09 hrs,	Volume=	0.728 af,	Atten= 1%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.4 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 1.0 min

Peak Depth= 1.41' @ 12.08 hrs
Capacity at bank full= 12.39 cfs
Inlet Invert= 7.92', Outlet Invert= 7.62'
24.0" Diameter Pipe n= 0.013 Length= 100.0' Slope= 0.0030 '/'

Reach 5R: 24" RCP



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Drainage Area A Runoff Area=12.200 ac Runoff Depth=5.41"
Flow Length=2,676' Tc=16.0 min CN=91 Runoff=57.11 cfs 5.503 af

Subcatchment B: Drainage Area B Runoff Area=4.400 ac Runoff Depth=4.88"
Flow Length=921' Tc=11.1 min CN=86 Runoff=21.74 cfs 1.789 af

Subcatchment C: Drainage Area C Runoff Area=3.700 ac Runoff Depth=5.72"
Flow Length=1,323' Tc=8.8 min CN=94 Runoff=21.65 cfs 1.765 af

Subcatchment D: Drainage Area D Runoff Area=4.900 ac Runoff Depth=4.01"
Flow Length=1,135' Tc=20.3 min CN=78 Runoff=16.43 cfs 1.636 af

Subcatchment E: Drainage Area E Runoff Area=3.000 ac Runoff Depth=4.44"
Flow Length=1,758' Tc=12.3 min CN=82 Runoff=13.30 cfs 1.111 af

Subcatchment F: Drainage Area F Runoff Area=2.000 ac Runoff Depth=5.10"
Flow Length=590' Tc=5.2 min CN=88 Runoff=12.05 cfs 0.851 af

Reach 1R: 48" RCP Peak Depth=4.00' Max Vel=5.9 fps Inflow=76.97 cfs 7.292 af
D=48.0" n=0.013 L=78.0' S=0.0021 '/' Capacity=65.06 cfs Outflow=65.71 cfs 7.289 af

Reach 3R: 18" RCP Peak Depth=1.50' Max Vel=4.0 fps Inflow=21.65 cfs 1.765 af
D=18.0" n=0.013 L=72.0' S=0.0035 '/' Capacity=6.19 cfs Outflow=6.20 cfs 1.764 af

Reach 4R: 18" RCP Peak Depth=1.50' Max Vel=2.7 fps Inflow=28.01 cfs 2.747 af
D=18.0" n=0.013 L=100.0' S=0.0016 '/' Capacity=4.20 cfs Outflow=4.20 cfs 2.746 af

Reach 5R: 24" RCP Peak Depth=1.59' Max Vel=4.5 fps Inflow=12.05 cfs 0.851 af
D=24.0" n=0.013 L=100.0' S=0.0030 '/' Capacity=12.39 cfs Outflow=11.91 cfs 0.850 af

Total Runoff Area = 30.200 ac Runoff Volume = 12.654 af Average Runoff Depth = 5.03"

Subcatchment A: Drainage Area A

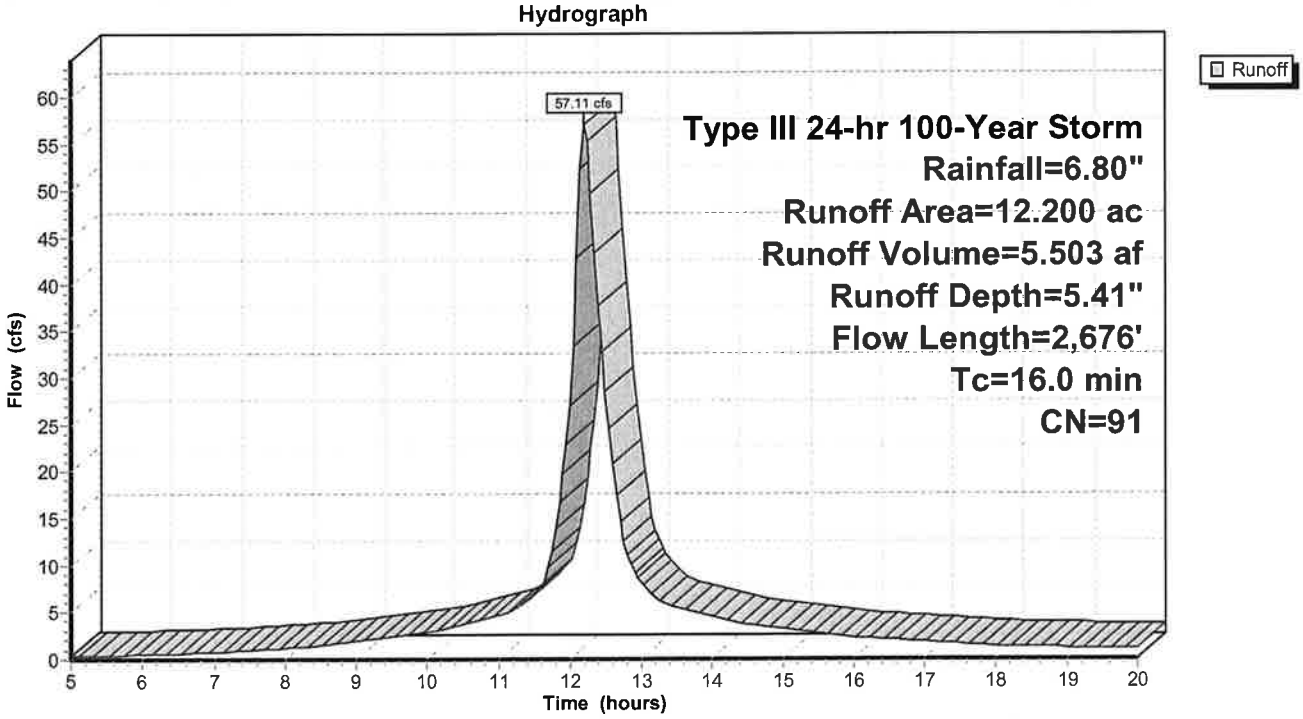
Runoff = 57.11 cfs @ 12.21 hrs, Volume= 5.503 af, Depth= 5.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Storm Rainfall=6.80"

Area (ac)	CN	Description
8.540	98	Pavement
1.220	49	50-75% Grass cover, Fair, HSG A
2.440	89	Urban commercial, 85% imp, HSG A
12.200	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	275	0.0100	1.1		**Sheet Flow, Flow across roadway** n= 0.013 P2= 3.10"
4.3	669	0.0023	2.6	2.02	**Circular Channel (pipe), 12" VCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.6	305	0.0026	3.2	3.89	**Circular Channel (pipe), 15" VCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
3.2	609	0.0020	3.1	5.55	**Circular Channel (pipe), 18" VCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011
2.7	818	0.0045	5.1	11.03	**Circular Channel (pipe), 20" VCP** Diam= 20.0" Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.011
16.0	2,676	Total			

Subcatchment A: Drainage Area A



Subcatchment B: Drainage Area B

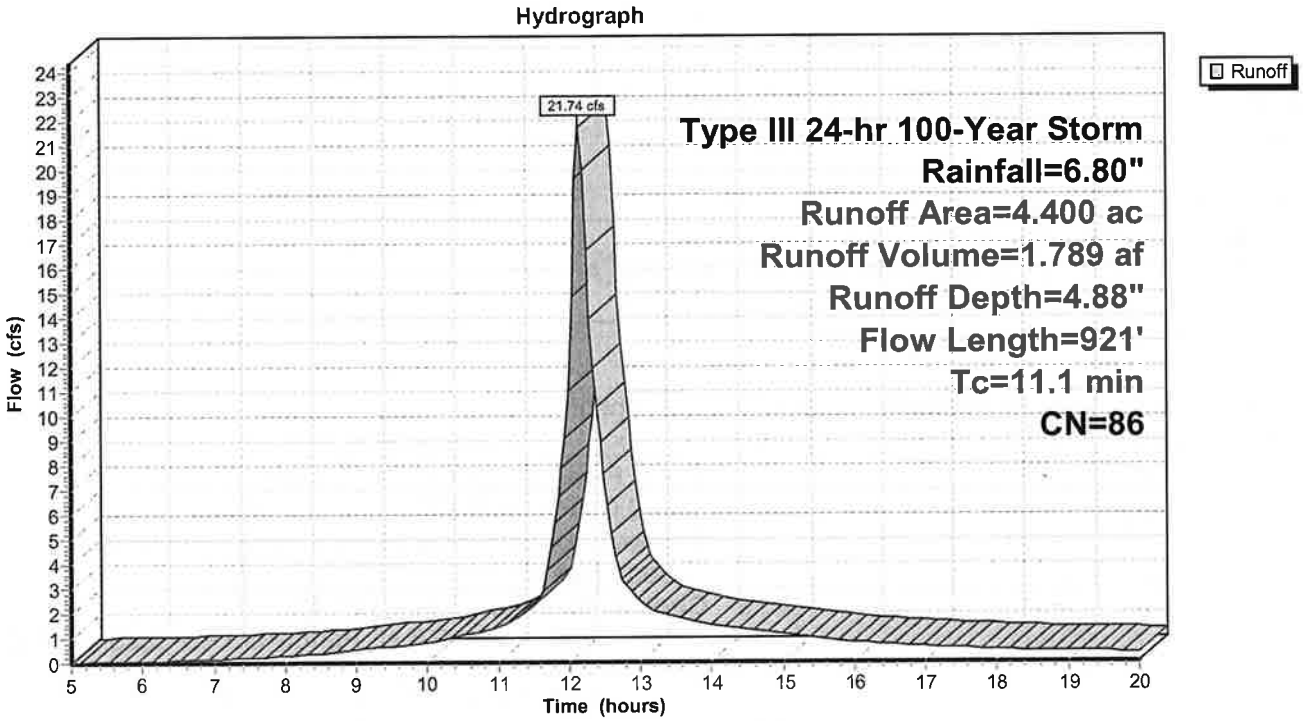
Runoff = 21.74 cfs @ 12.15 hrs, Volume= 1.789 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Storm Rainfall=6.80"

Area (ac)	CN	Description
2.640	98	Paved parking & roofs
0.880	49	50-75% Grass cover, Fair, HSG A
0.880	89	Urban commercial, 85% imp, HSG A
4.400	86	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	95	0.0400	0.2		**Sheet Flow, Grass at Bathhouse to Gutter** Grass: Short n= 0.150 P2= 3.10"
0.5	50	0.0080	1.8		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
1.1	186	0.0037	2.9	1.58	**Circular Channel (pipe), 10" VCP** Diam= 10.0" Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.011
1.0	196	0.0041	3.4	2.70	**Circular Channel (pipe), 12" VCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011
1.0	194	0.0026	3.2	3.89	**Circular Channel (pipe), 15" VCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011
0.0	40	0.0998	20.1	43.95	**Circular Channel (pipe), 20" VCP** Diam= 20.0" Area= 2.2 sf Perim= 5.2' r= 0.42' n= 0.013
0.3	160	0.0047	7.8	98.48	**Circular Channel (pipe), 48" RCP** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
11.1	921	Total			

Subcatchment B: Drainage Area B



Subcatchment C: Drainage Area C

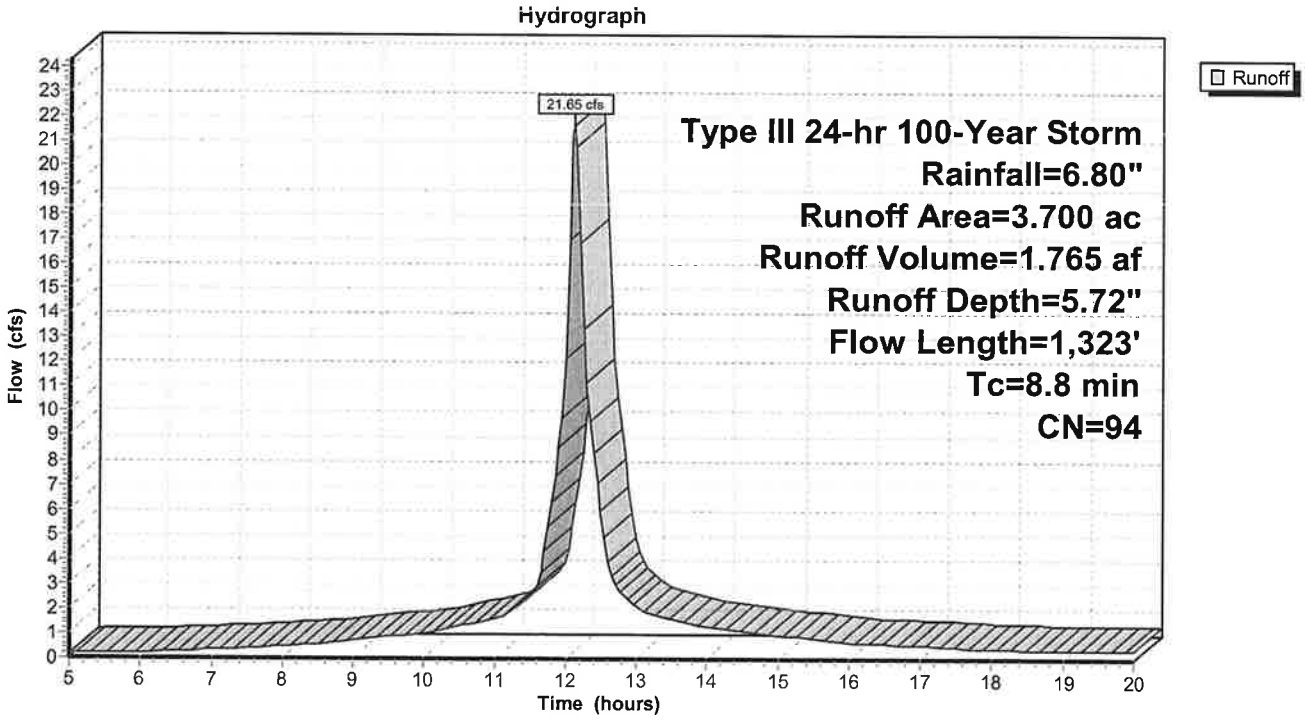
Runoff = 21.65 cfs @ 12.12 hrs, Volume= 1.765 af, Depth= 5.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Storm Rainfall=6.80"

Area (ac)	CN	Description
2.960	98	Paved parking & roofs
0.550	89	Urban commercial, 85% imp, HSG A
0.190	49	50-75% Grass cover, Fair, HSG A
3.700	94	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	20	0.0200	0.9		**Sheet Flow, Sheet Flow to Gutter** n= 0.013 P2= 3.10"
1.5	100	0.0030	1.1		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
3.1	425	0.0025	2.3	1.78	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
2.3	534	0.0055	3.9	4.79	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.5	244	0.0022	2.8	4.93	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
8.8	1,323	Total			

Subcatchment C: Drainage Area C



Subcatchment D: Drainage Area D

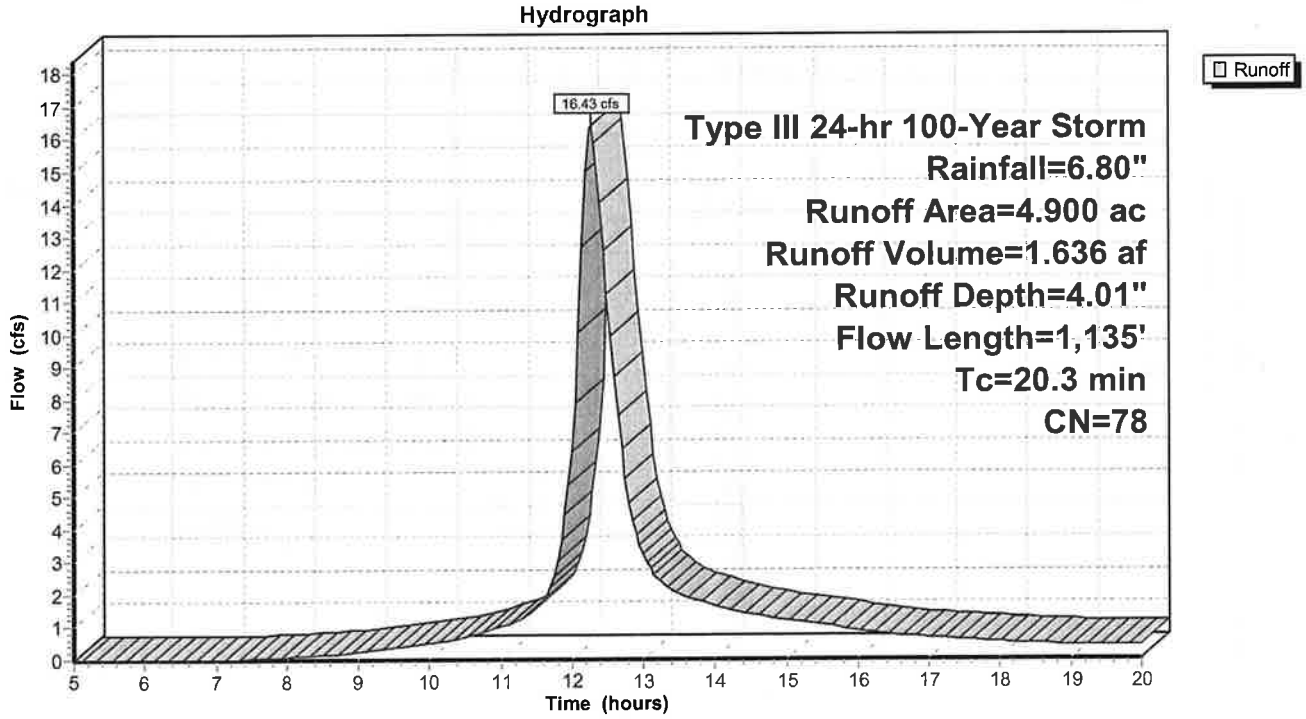
Runoff = 16.43 cfs @ 12.28 hrs, Volume= 1.636 af, Depth= 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Storm Rainfall=6.80"

Area (ac)	CN	Description
2.940	98	Paved parking & roofs
1.960	49	50-75% Grass cover, Fair, HSG A
4.900	78	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	100	0.0100	0.1		**Sheet Flow, Grass to gutter** Grass: Short n= 0.150 P2= 3.10"
2.1	180	0.0050	1.4		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
3.5	622	0.0032	3.0	3.65	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.6	233	0.0016	2.4	4.20	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
20.3	1,135	Total			

Subcatchment D: Drainage Area D



Subcatchment E: Drainage Area E

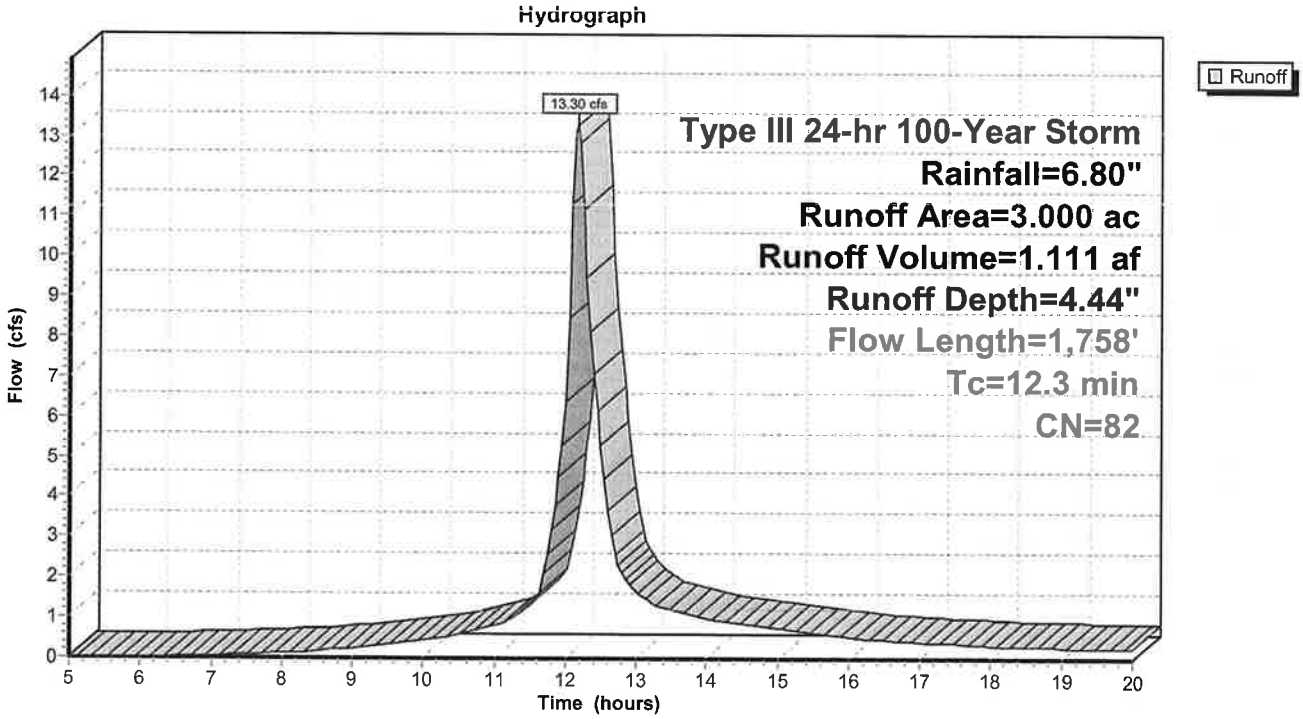
Runoff = 13.30 cfs @ 12.17 hrs, Volume= 1.111 af, Depth= 4.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Storm Rainfall=6.80"

Area (ac)	CN	Description
1.650	98	Paved parking & roofs
0.900	49	50-75% Grass cover, Fair, HSG A
0.450	89	Urban commercial, 85% imp, HSG A
3.000	82	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	100	0.0200	1.2		**Sheet Flow, Parking lot to gutter** n= 0.013 P2= 3.10"
1.8	100	0.0020	0.9		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
2.7	425	0.0034	2.6	2.08	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
2.6	400	0.0024	2.6	3.16	**Circular Channel (pipe), 15" RCP** Diam= 15.0" Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.8	733	0.0029	3.2	5.66	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
12.3	1,758	Total			

Subcatchment E: Drainage Area E



Subcatchment F: Drainage Area F

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

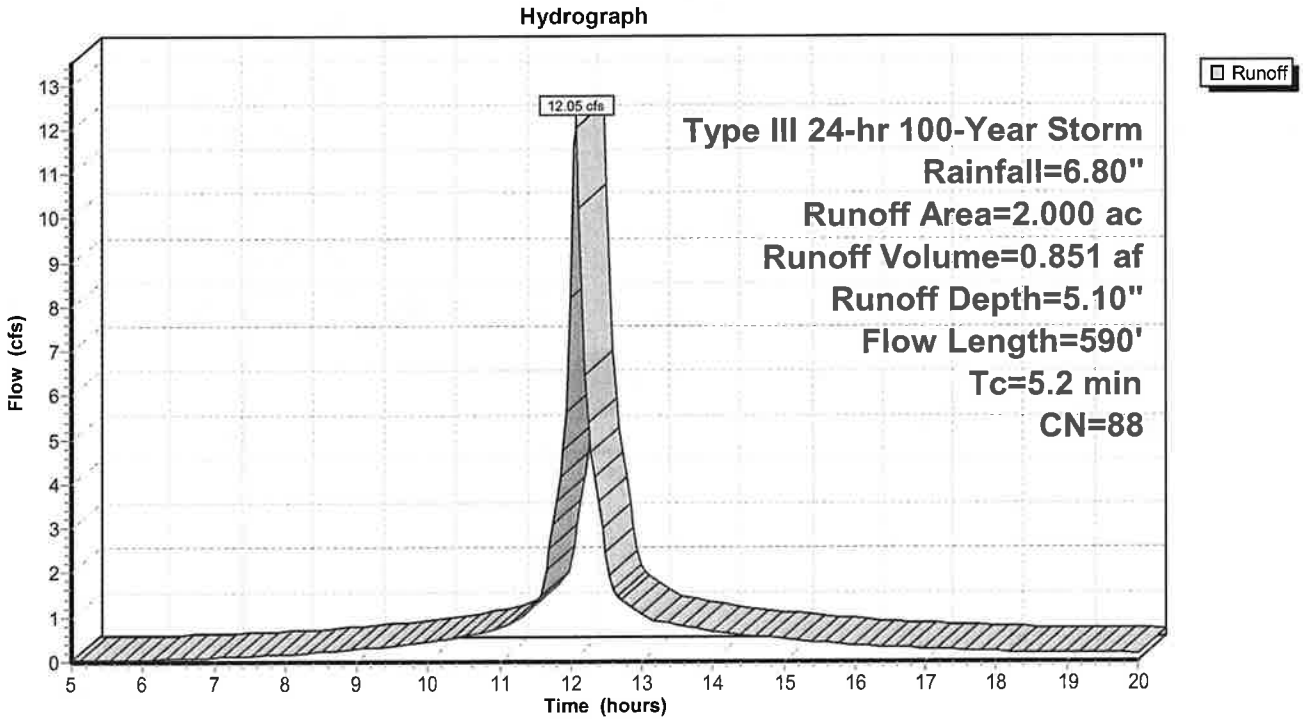
Runoff = 12.05 cfs @ 12.08 hrs, Volume= 0.851 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Storm Rainfall=6.80"

Area (ac)	CN	Description
1.600	98	Paved parking & roofs
0.400	49	50-75% Grass cover, Fair, HSG A
2.000	88	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	85	0.0100	0.9		**Sheet Flow, Parking Lot to Gutter** n= 0.013 P2= 3.10"
2.0	155	0.0040	1.3		**Shallow Concentrated Flow, Gutter Flow to CB** Paved Kv= 20.3 fps
0.7	180	0.0080	4.1	3.19	**Circular Channel (pipe), 12" RCP** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.9	170	0.0030	3.3	5.75	**Circular Channel (pipe), 18" RCP** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
5.2	590	Total			

Subcatchment F: Drainage Area F



Reach 1R: 48" RCP

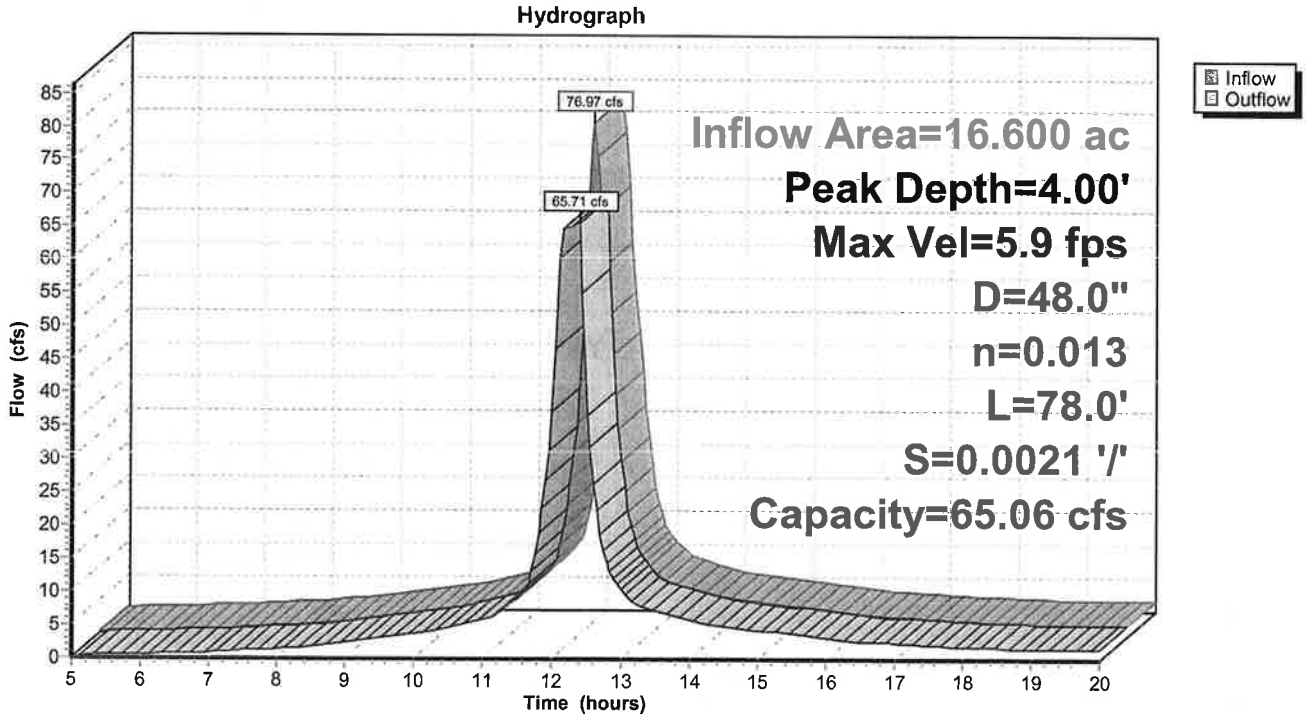
[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[55] Hint: Peak inflow is 118% of Manning's capacity
[76] Warning: Detained 0.111 af (Pond w/culvert advised)

Inflow Area =	16.600 ac,	Inflow Depth =	5.27"	for	100-Year Storm event
Inflow =	76.97 cfs @	12.19 hrs,	Volume=		7.292 af
Outflow =	65.71 cfs @	12.40 hrs,	Volume=		7.289 af, Atten= 15%, Lag= 12.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.9 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.7 fps, Avg. Travel Time= 0.5 min

Peak Depth= 4.00' @ 12.15 hrs
Capacity at bank full= 65.06 cfs
Inlet Invert= -0.81', Outlet Invert= -0.97'
48.0" Diameter Pipe n= 0.013 Length= 78.0' Slope= 0.0021 '/'

Reach 1R: 48" RCP



Reach 3R: 18" RCP

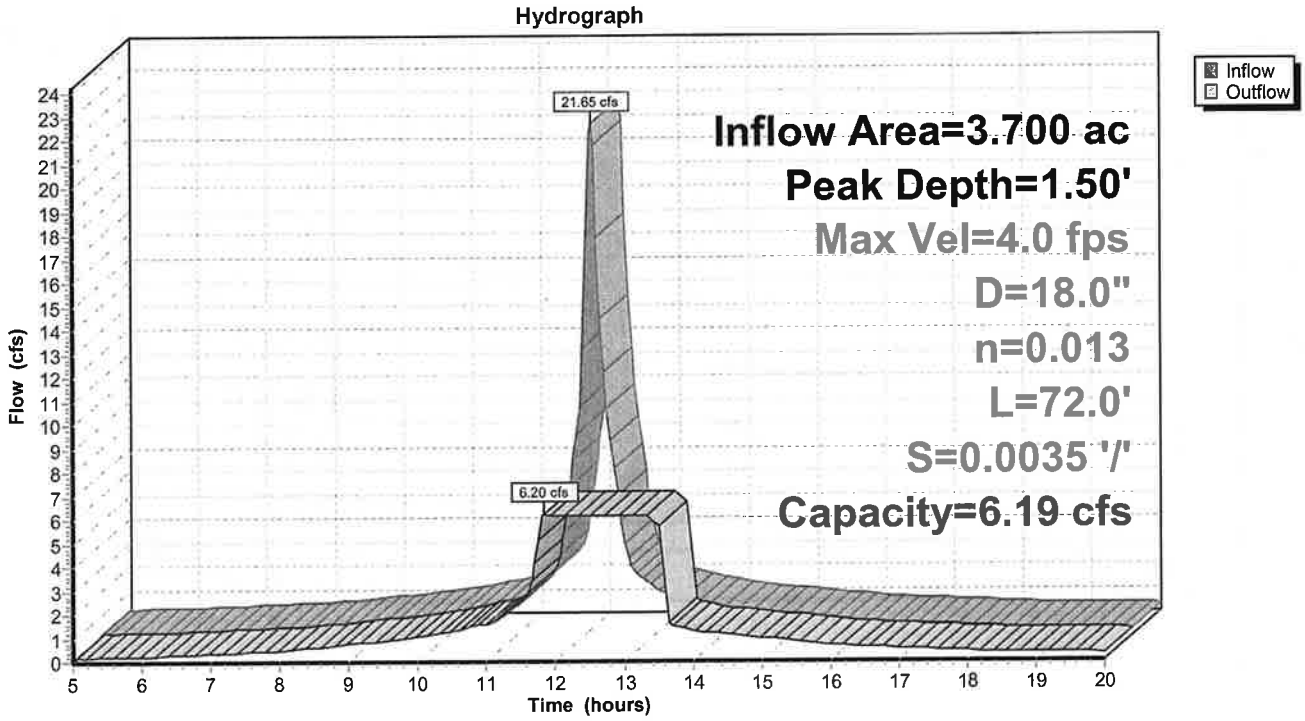
[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[55] Hint: Peak inflow is 350% of Manning's capacity
[76] Warning: Detained 0.342 af (Pond w/culvert advised)
[85] Warning: Oscillations may require Finer Routing>1

Inflow Area =	3.700 ac,	Inflow Depth =	5.72"	for	100-Year Storm event
Inflow =	21.65 cfs @	12.12 hrs,	Volume=		1.765 af
Outflow =	6.20 cfs @	11.85 hrs,	Volume=		1.764 af, Atten= 71%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.0 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.4 fps, Avg. Travel Time= 0.5 min

Peak Depth= 1.50' @ 11.85 hrs
Capacity at bank full= 6.19 cfs
Inlet Invert= 5.62', Outlet Invert= 5.37'
18.0" Diameter Pipe n= 0.013 Length= 72.0' Slope= 0.0035 '/'

Reach 3R: 18" RCP



Reach 4R: 18" RCP

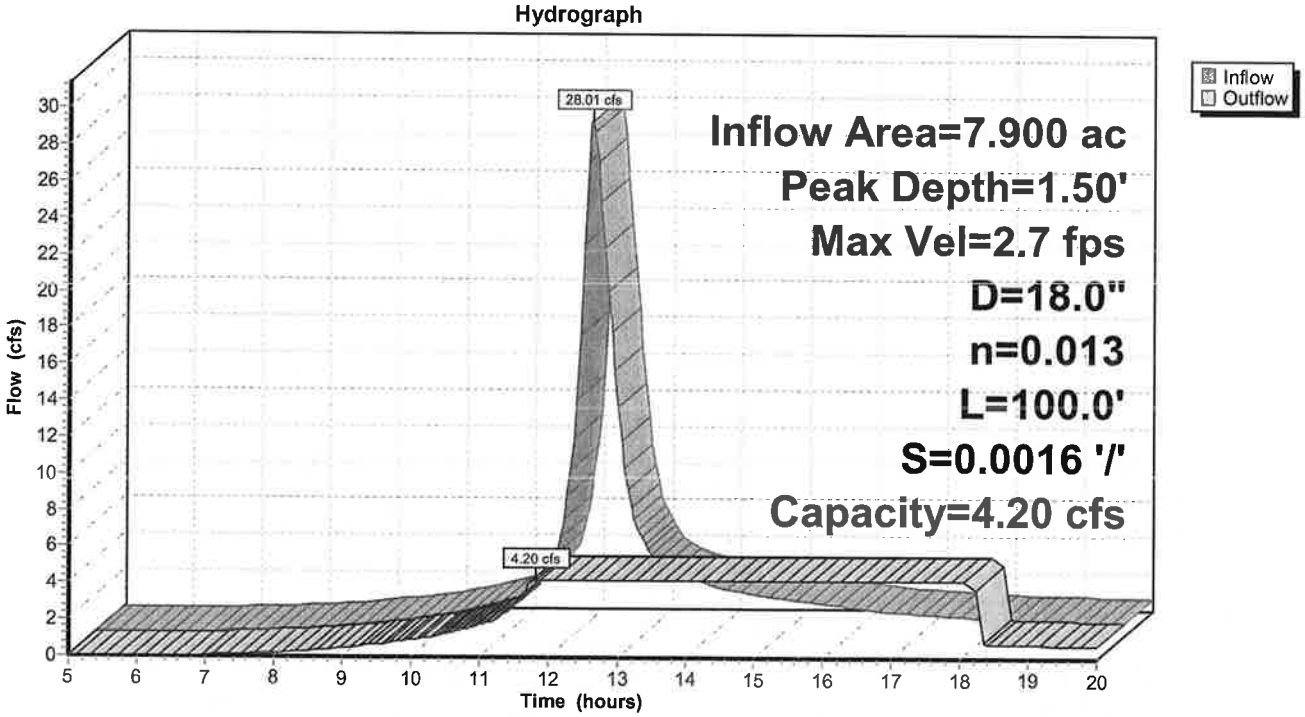
[52] Hint: Inlet conditions not evaluated
[55] Hint: Peak inflow is 667% of Manning's capacity
[76] Warning: Detained 1.034 af (Pond w/culvert advised)

Inflow Area =	7.900 ac,	Inflow Depth =	4.17"	for	100-Year Storm event
Inflow =	28.01 cfs @	12.22 hrs,	Volume=		2.747 af
Outflow =	4.20 cfs @	11.80 hrs,	Volume=		2.746 af, Atten= 85%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.7 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 0.9 min

Peak Depth= 1.50' @ 11.75 hrs
Capacity at bank full= 4.20 cfs
Inlet Invert= 5.46', Outlet Invert= 5.30'
18.0" Diameter Pipe n= 0.013 Length= 100.0' Slope= 0.0016 '/'

Reach 4R: 18" RCP

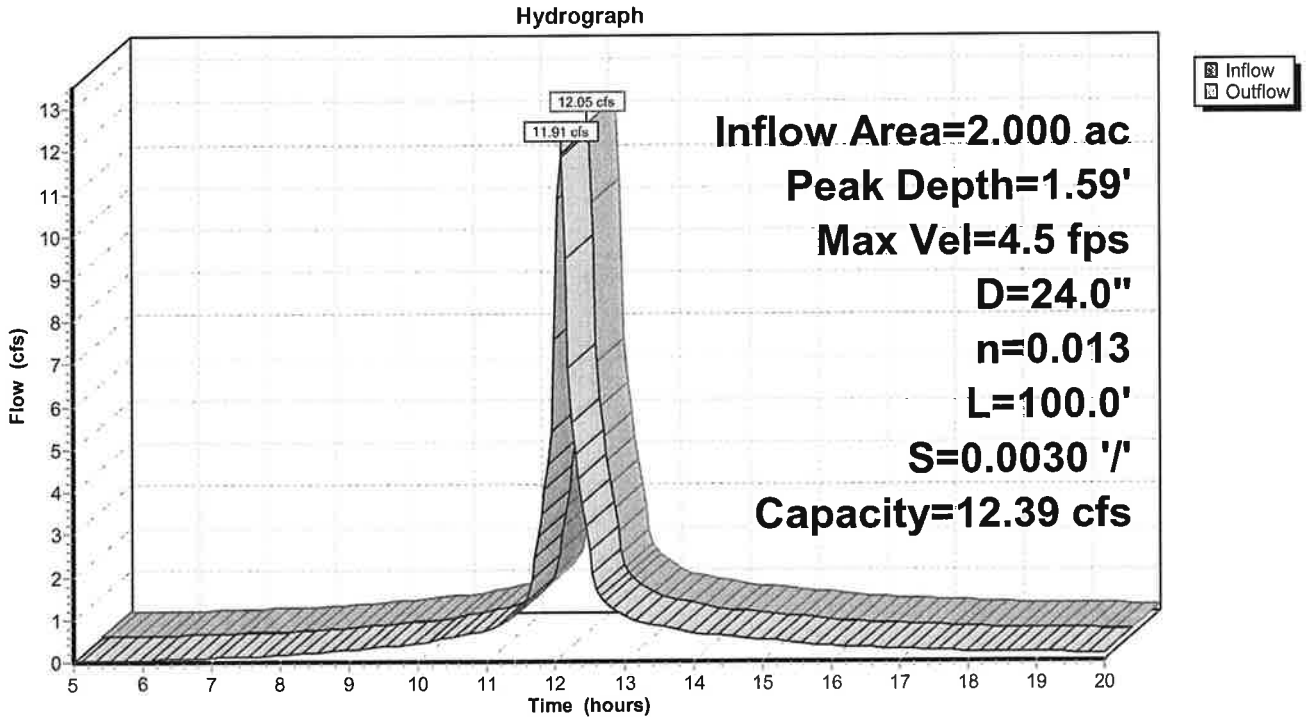


Reach 5R: 24" RCP

[52] Hint: Inlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

Inflow Area =	2.000 ac,	Inflow Depth =	5.10"	for	100-Year Storm event	
Inflow =	12.05 cfs @	12.08 hrs,	Volume=		0.851 af	
Outflow =	11.91 cfs @	12.09 hrs,	Volume=		0.850 af,	Atten= 1%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.5 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 0.9 min

Peak Depth= 1.59' @ 12.08 hrs
Capacity at bank full= 12.39 cfs
Inlet Invert= 7.92', Outlet Invert= 7.62'
24.0" Diameter Pipe n= 0.013 Length= 100.0' Slope= 0.0030 '/'

Reach 5R: 24" RCP