

DRAINAGE ANALYSIS

***648-654 MAIN STREET
WINCHESTER, MA***



SEPTEMBER 24, 2018

648-654 Main Street
Drainage Summary

The Applicant is proposing to demolish the existing structures and construct a mixed use building at 648-654 Main Street. Rainfall data for this analysis was based on the Cornell University Northeast Regional Climate Center Atlas for Northeast United States.

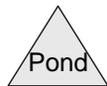
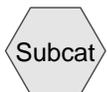
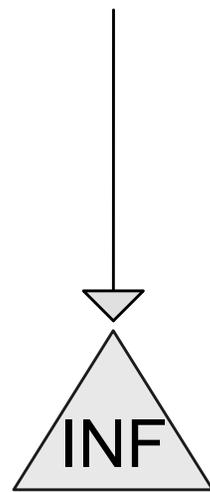
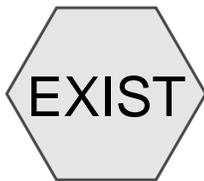
The proposed project will yield an increase in impervious cover (15,850+/-sf) compared to existing conditions (15,050+/-sf). In order to offset the increase in impervious cover, runoff generated by the proposed outdoor parking area (approximately 2,540 +/-sf) will connect to a subsurface infiltration system designed for the 100-year storm event. In addition, stormwater from the project site currently sheet flows onto Main Street. In order to minimize sheet flow onto Main Street for post-development conditions, direct connections from roof drains to the existing municipal drain system in Main Street are proposed. Finally, the rear portion of the proposed building will be equipped with a “green roof”, further reducing flows from the site for post-development conditions.

Soils investigations were conducted on-site, including two deep-hole observations to determine the estimated seasonal high water table and soil texture. The Natural Resources Conservation Service Web Soil Survey was also referenced. As a result Hydrologic Group “A” soils with a Rawls infiltration rate of 8.27 inches per hour was used to design the proposed infiltration systems. (*Note: bottom area only of proposed infiltration system used to determine exfiltration rate*).

In summary by utilizing the proposed subsurface infiltration system to mitigate stormwater runoff generated by the proposed outdoor parking area, peak rates and volume of runoff will be reduced for post development conditions.

Pre-Development vs. Post-Development Drainage Summary Table

Storm Event	Pre-Development		Post-Development	
	Rate (cfs)	Volume (af)	Rate (cfs)	Volume (af)
2	0.88	0.071	0.76	0.062
10	1.54	0.128	1.33	0.111
25	2.05	0.172	1.77	0.149
100	3.09	0.267	2.67	0.230



648-654 Main Street

Type III 24-hr 2 year storm Rainfall=3.20"

Prepared by Frederick W. Russell, PE

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Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EXIST: Runoff Area=18,708 sf 80.45% Impervious Runoff Depth=2.00"
Tc=10.0 min CN=88 Runoff=0.88 cfs 0.071 af

Subcatchment PARKING: Runoff Area=2,540 sf 100.00% Impervious Runoff Depth=2.97"
Tc=5.0 min CN=98 Runoff=0.19 cfs 0.014 af

Subcatchment PROP: Runoff Area=16,168 sf 82.32% Impervious Runoff Depth=2.00"
Tc=10.0 min CN=88 Runoff=0.76 cfs 0.062 af

Pond INF: Peak Elev=19.55' Storage=76 cf Inflow=0.19 cfs 0.014 af
Outflow=0.07 cfs 0.014 af

Total Runoff Area = 0.859 ac Runoff Volume = 0.148 af Average Runoff Depth = 2.06"
17.42% Pervious = 0.150 ac 82.58% Impervious = 0.709 ac

Summary for Subcatchment EXIST:

Runoff = 0.88 cfs @ 12.14 hrs, Volume= 0.071 af, Depth= 2.00"

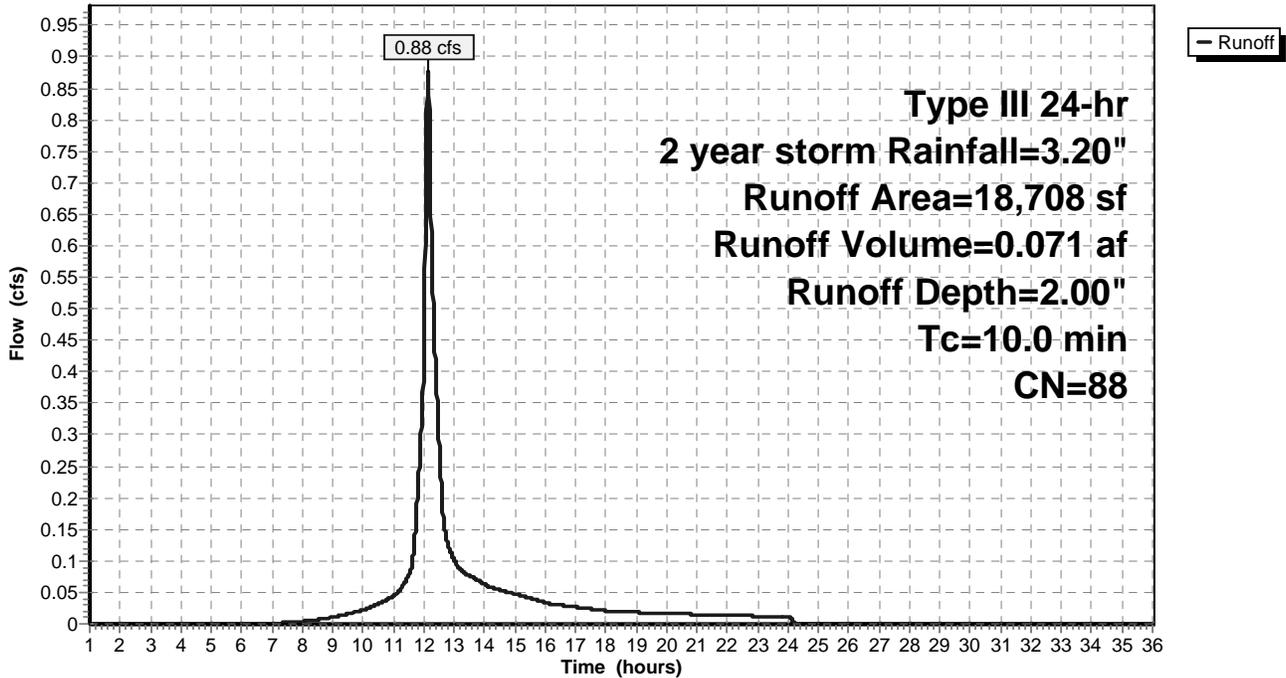
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 year storm Rainfall=3.20"

Area (sf)	CN	Description
3,110	98	Roofs, HSG A
11,940	98	Paved parking, HSG A
3,658	49	50-75% Grass cover, Fair, HSG A
18,708	88	Weighted Average
3,658		19.55% Pervious Area
15,050		80.45% Impervious Area

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

Subcatchment EXIST:

Hydrograph



Summary for Subcatchment PARKING:

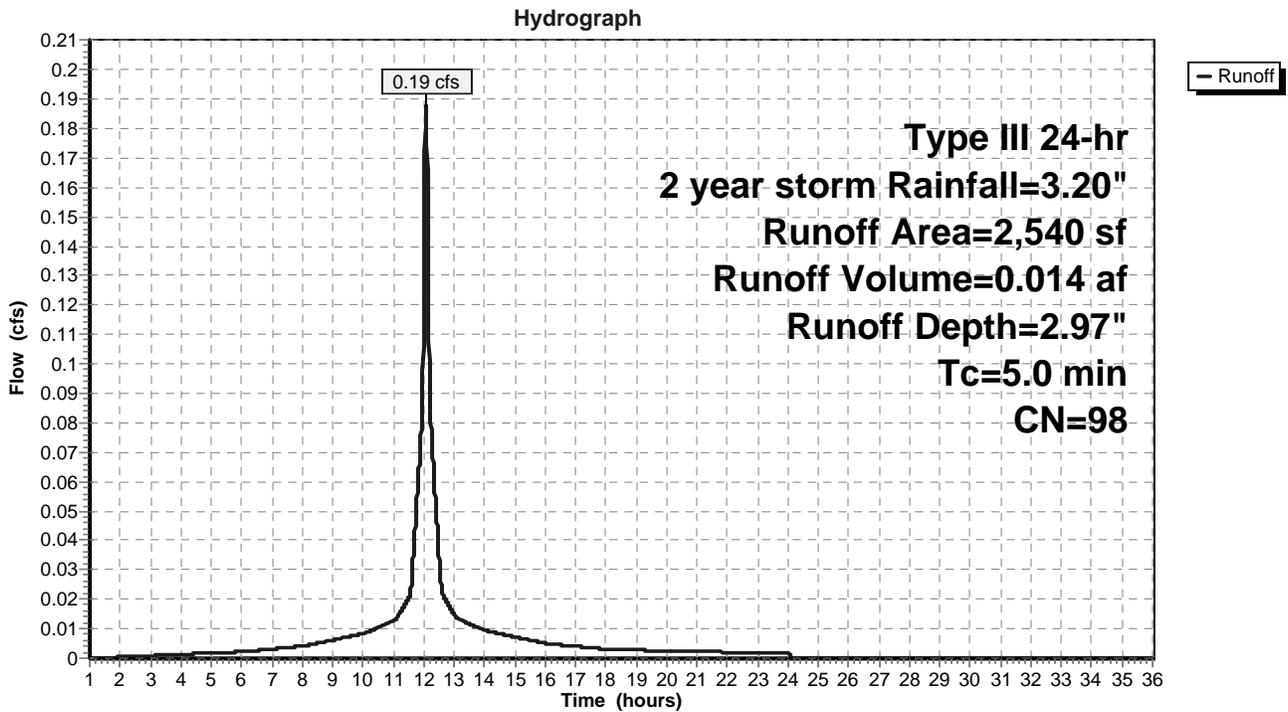
Runoff = 0.19 cfs @ 12.07 hrs, Volume= 0.014 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 year storm Rainfall=3.20"

Area (sf)	CN	Description
2,290	98	Paved parking, HSG A
* 250	98	Walks, HSG A
2,540	98	Weighted Average
2,540		100.00% Impervious Area

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

Subcatchment PARKING:



Summary for Subcatchment PROP:

Runoff = 0.76 cfs @ 12.14 hrs, Volume= 0.062 af, Depth= 2.00"

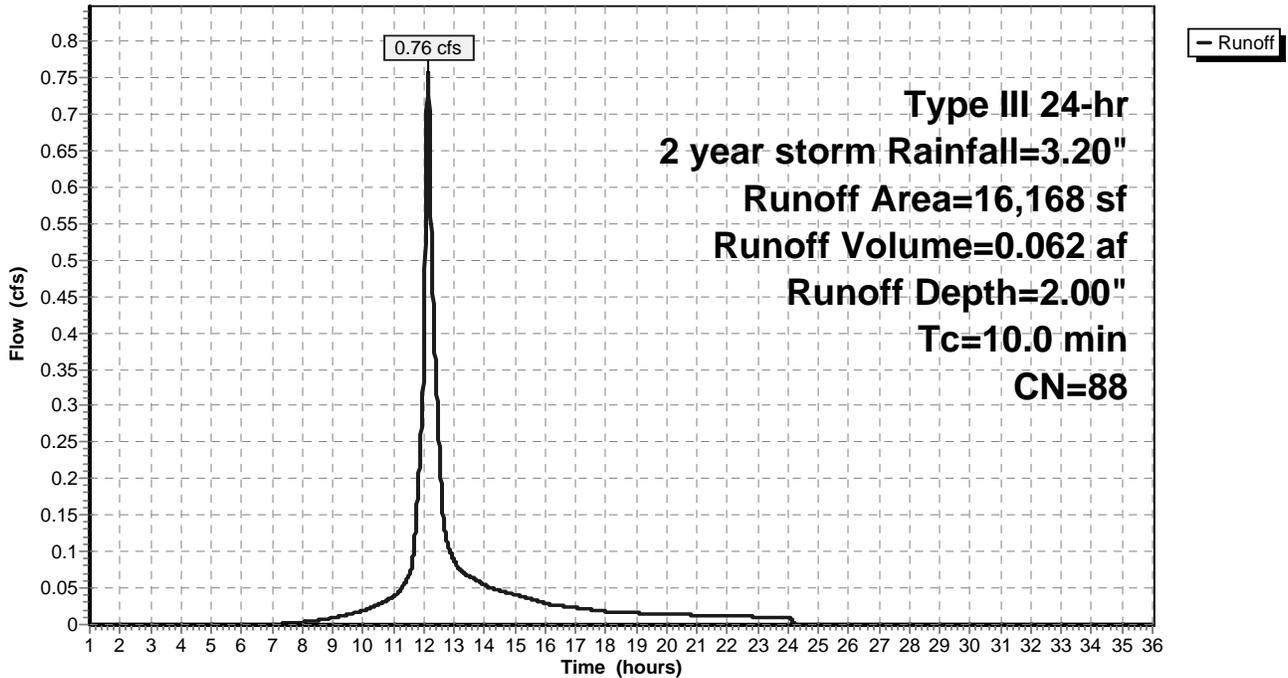
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 year storm Rainfall=3.20"

Area (sf)	CN	Description
13,310	98	Roofs, HSG A
2,858	39	>75% Grass cover, Good, HSG A
16,168	88	Weighted Average
2,858		17.68% Pervious Area
13,310		82.32% Impervious Area

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

Subcatchment PROP:

Hydrograph



Summary for Pond INF:

Inflow Area = 0.058 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2 year storm event
 Inflow = 0.19 cfs @ 12.07 hrs, Volume= 0.014 af
 Outflow = 0.07 cfs @ 11.88 hrs, Volume= 0.014 af, Atten= 64%, Lag= 0.0 min
 Discarded = 0.07 cfs @ 11.88 hrs, Volume= 0.014 af

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 19.55' @ 12.30 hrs Surf.Area= 353 sf Storage= 76 cf

Plug-Flow detention time= 4.9 min calculated for 0.014 af (100% of inflow)
 Center-of-Mass det. time= 4.9 min (760.4 - 755.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	304 cf	11.00'W x 32.10'L x 3.50'H Field A
			1,236 cf Overall - 368 cf Embedded = 868 cf x 35.0% Voids
#2A	19.50'	368 cf	ADS_StormTech SC-740 +Cap x 8 Inside #1
			Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
			Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
			2 Rows of 4 Chambers
		671 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.07 cfs @ 11.88 hrs HW=19.04' (Free Discharge)
 ↳ **1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Pond INF: - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

4 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 30.10' Row Length +12.0" End Stone x 2 = 32.10' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

8 Chambers x 45.9 cf = 367.5 cf Chamber Storage

1,235.7 cf Field - 367.5 cf Chambers = 868.2 cf Stone x 35.0% Voids = 303.9 cf Stone Storage

Chamber Storage + Stone Storage = 671.4 cf = 0.015 af

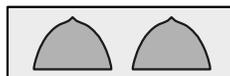
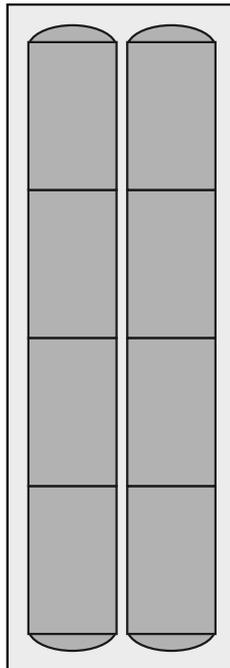
Overall Storage Efficiency = 54.3%

Overall System Size = 32.10' x 11.00' x 3.50'

8 Chambers

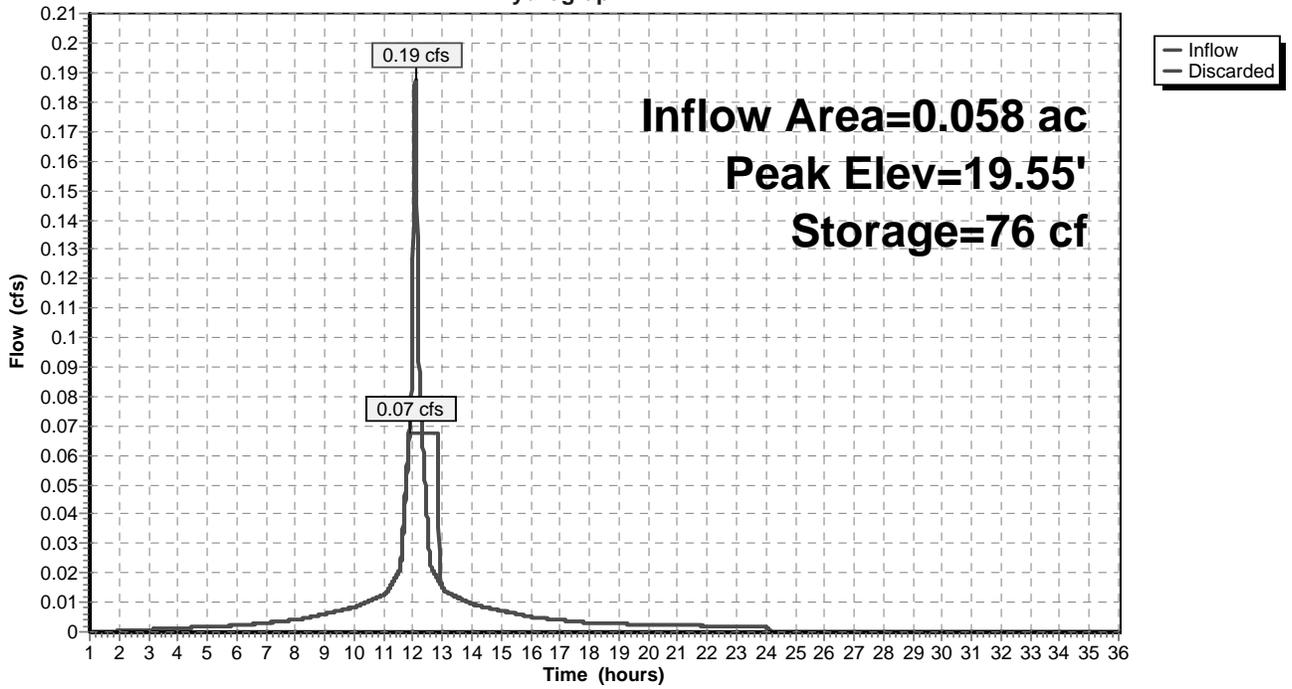
45.8 cy Field

32.2 cy Stone



Pond INF:

Hydrograph



648-654 Main Street

Type III 24-hr 10 year storm Rainfall=4.90"

Prepared by Frederick W. Russell, PE

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Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EXIST: Runoff Area=18,708 sf 80.45% Impervious Runoff Depth=3.57"
Tc=10.0 min CN=88 Runoff=1.54 cfs 0.128 af

Subcatchment PARKING: Runoff Area=2,540 sf 100.00% Impervious Runoff Depth>4.66"
Tc=5.0 min CN=98 Runoff=0.29 cfs 0.023 af

Subcatchment PROP: Runoff Area=16,168 sf 82.32% Impervious Runoff Depth=3.57"
Tc=10.0 min CN=88 Runoff=1.33 cfs 0.111 af

Pond INF: Peak Elev=20.00' Storage=192 cf Inflow=0.29 cfs 0.023 af
Outflow=0.07 cfs 0.023 af

Total Runoff Area = 0.859 ac Runoff Volume = 0.261 af Average Runoff Depth = 3.65"
17.42% Pervious = 0.150 ac 82.58% Impervious = 0.709 ac

Summary for Subcatchment EXIST:

Runoff = 1.54 cfs @ 12.14 hrs, Volume= 0.128 af, Depth= 3.57"

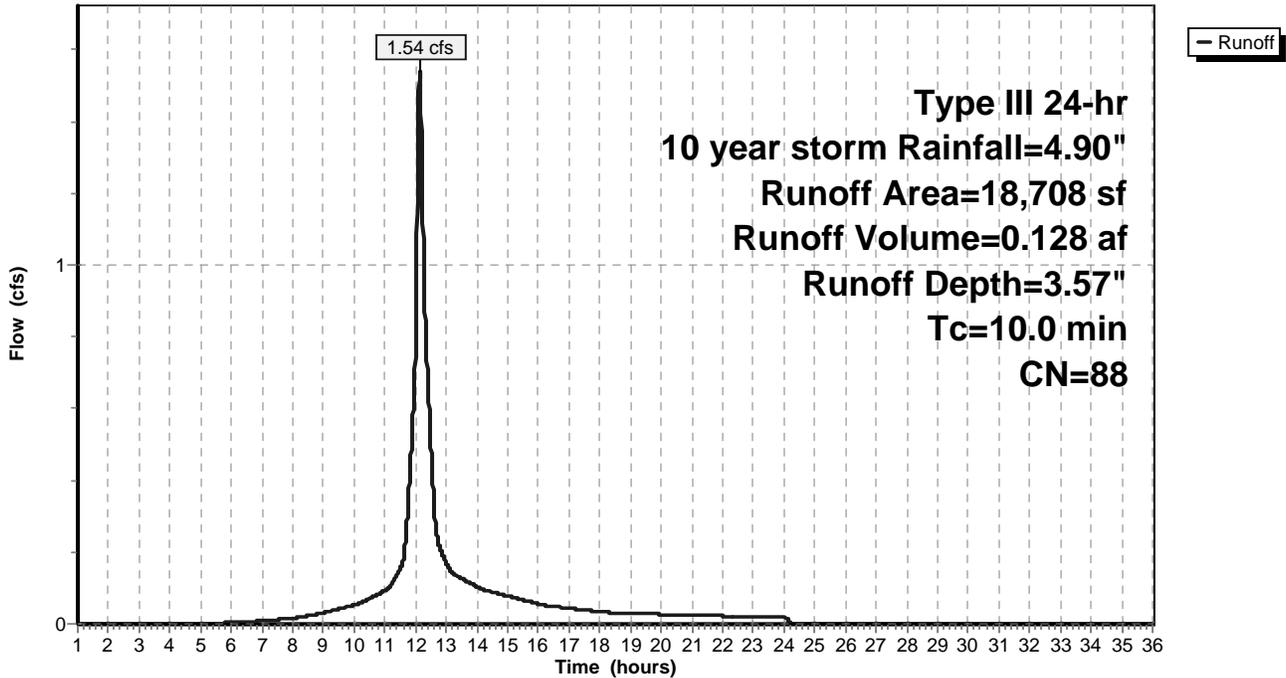
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 year storm Rainfall=4.90"

Area (sf)	CN	Description
3,110	98	Roofs, HSG A
11,940	98	Paved parking, HSG A
3,658	49	50-75% Grass cover, Fair, HSG A
18,708	88	Weighted Average
3,658		19.55% Pervious Area
15,050		80.45% Impervious Area

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

Subcatchment EXIST:

Hydrograph



Summary for Subcatchment PARKING:

Runoff = 0.29 cfs @ 12.07 hrs, Volume= 0.023 af, Depth> 4.66"

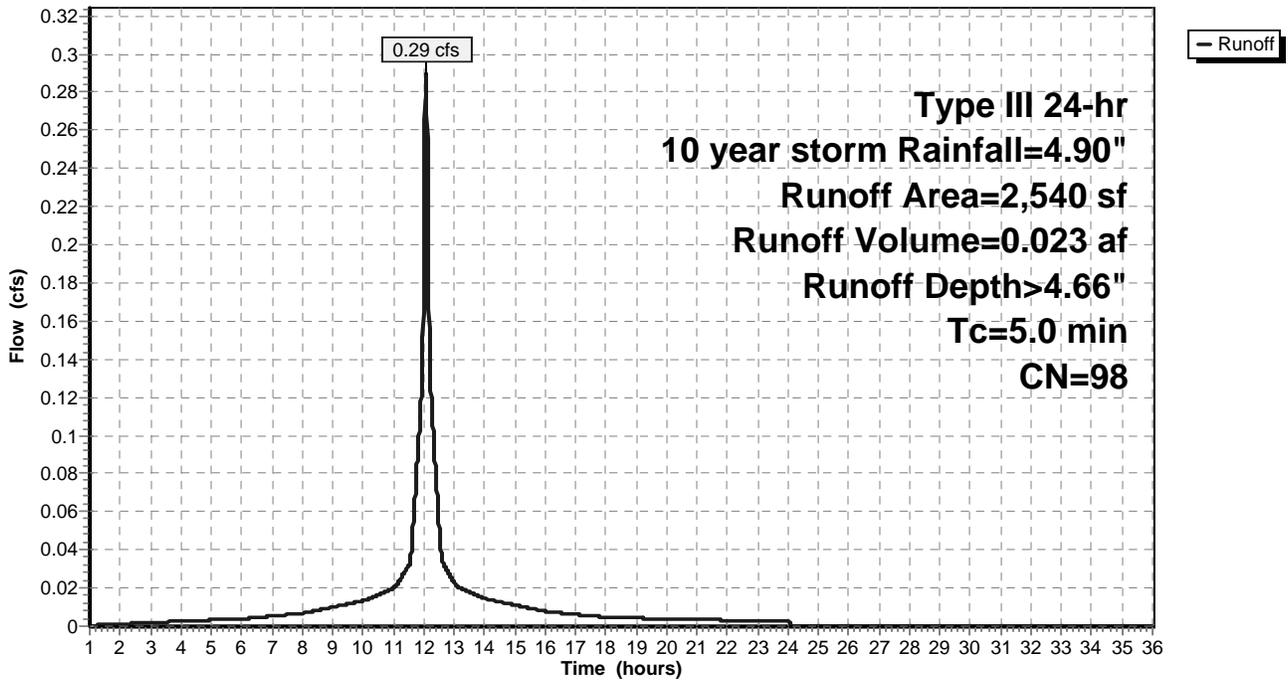
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 year storm Rainfall=4.90"

Area (sf)	CN	Description
2,290	98	Paved parking, HSG A
* 250	98	Walks, HSG A
2,540	98	Weighted Average
2,540		100.00% Impervious Area

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

Subcatchment PARKING:

Hydrograph



Summary for Subcatchment PROP:

Runoff = 1.33 cfs @ 12.14 hrs, Volume= 0.111 af, Depth= 3.57"

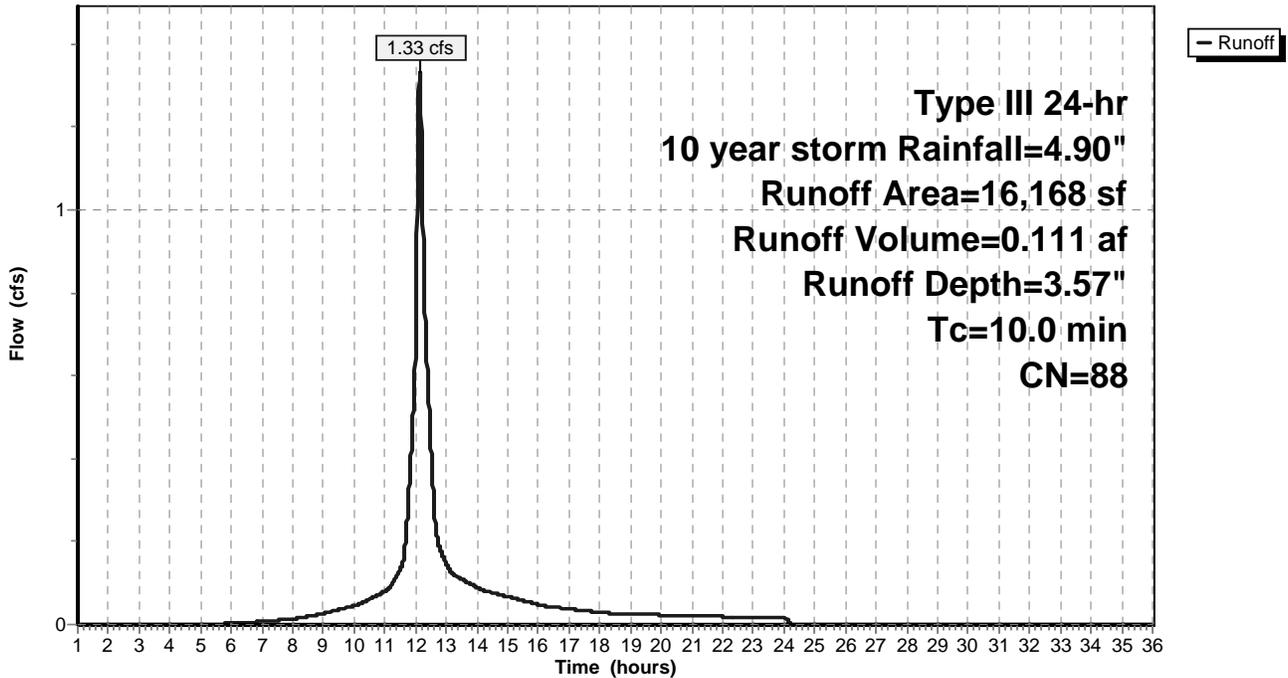
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 year storm Rainfall=4.90"

Area (sf)	CN	Description
13,310	98	Roofs, HSG A
2,858	39	>75% Grass cover, Good, HSG A
16,168	88	Weighted Average
2,858		17.68% Pervious Area
13,310		82.32% Impervious Area

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

Subcatchment PROP:

Hydrograph



Summary for Pond INF:

Inflow Area = 0.058 ac, 100.00% Impervious, Inflow Depth > 4.66" for 10 year storm event
 Inflow = 0.29 cfs @ 12.07 hrs, Volume= 0.023 af
 Outflow = 0.07 cfs @ 11.73 hrs, Volume= 0.023 af, Atten= 77%, Lag= 0.0 min
 Discarded = 0.07 cfs @ 11.73 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 20.00' @ 12.45 hrs Surf.Area= 353 sf Storage= 192 cf

Plug-Flow detention time= 13.2 min calculated for 0.023 af (100% of inflow)
 Center-of-Mass det. time= 13.2 min (760.7 - 747.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	304 cf	11.00'W x 32.10'L x 3.50'H Field A
			1,236 cf Overall - 368 cf Embedded = 868 cf x 35.0% Voids
#2A	19.50'	368 cf	ADS_StormTech SC-740 +Cap x 8 Inside #1
			Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
			Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
			2 Rows of 4 Chambers
		671 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.07 cfs @ 11.73 hrs HW=19.04' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.07 cfs)

Pond INF: - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

4 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 30.10' Row Length +12.0" End Stone x 2 = 32.10' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

8 Chambers x 45.9 cf = 367.5 cf Chamber Storage

1,235.7 cf Field - 367.5 cf Chambers = 868.2 cf Stone x 35.0% Voids = 303.9 cf Stone Storage

Chamber Storage + Stone Storage = 671.4 cf = 0.015 af

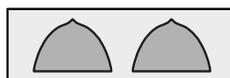
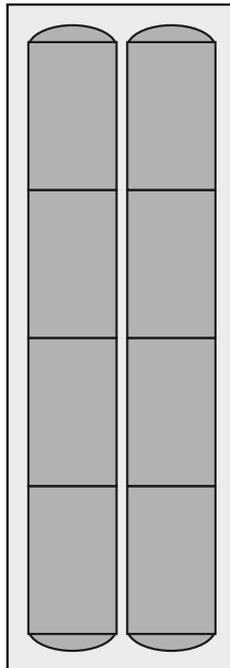
Overall Storage Efficiency = 54.3%

Overall System Size = 32.10' x 11.00' x 3.50'

8 Chambers

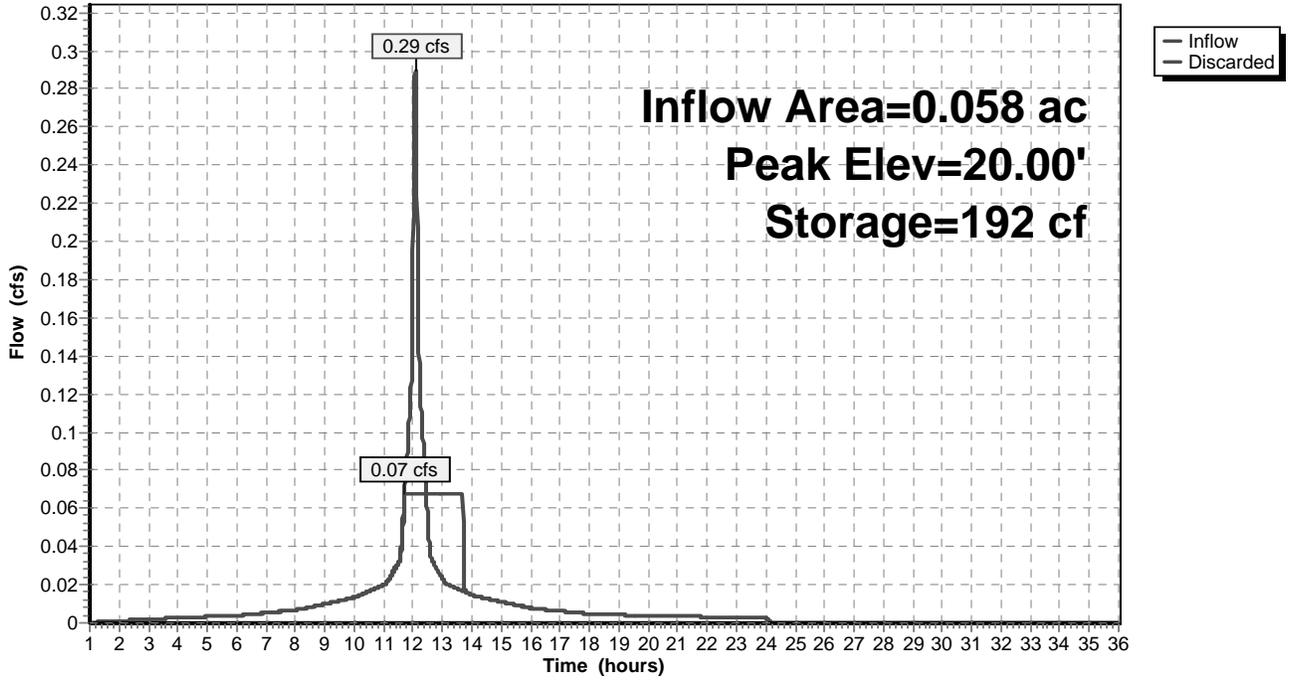
45.8 cy Field

32.2 cy Stone



Pond INF:

Hydrograph



648-654 Main Street

Type III 24-hr 25 year storm Rainfall=6.20"

Prepared by Frederick W. Russell, PE

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Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EXIST: Runoff Area=18,708 sf 80.45% Impervious Runoff Depth=4.82"
Tc=10.0 min CN=88 Runoff=2.05 cfs 0.172 af

Subcatchment PARKING: Runoff Area=2,540 sf 100.00% Impervious Runoff Depth>5.96"
Tc=5.0 min CN=98 Runoff=0.37 cfs 0.029 af

Subcatchment PROP: Runoff Area=16,168 sf 82.32% Impervious Runoff Depth=4.82"
Tc=10.0 min CN=88 Runoff=1.77 cfs 0.149 af

Pond INF: Peak Elev=20.41' Storage=294 cf Inflow=0.37 cfs 0.029 af
Outflow=0.07 cfs 0.029 af

Total Runoff Area = 0.859 ac Runoff Volume = 0.350 af Average Runoff Depth = 4.90"
17.42% Pervious = 0.150 ac 82.58% Impervious = 0.709 ac

Summary for Subcatchment EXIST:

Runoff = 2.05 cfs @ 12.14 hrs, Volume= 0.172 af, Depth= 4.82"

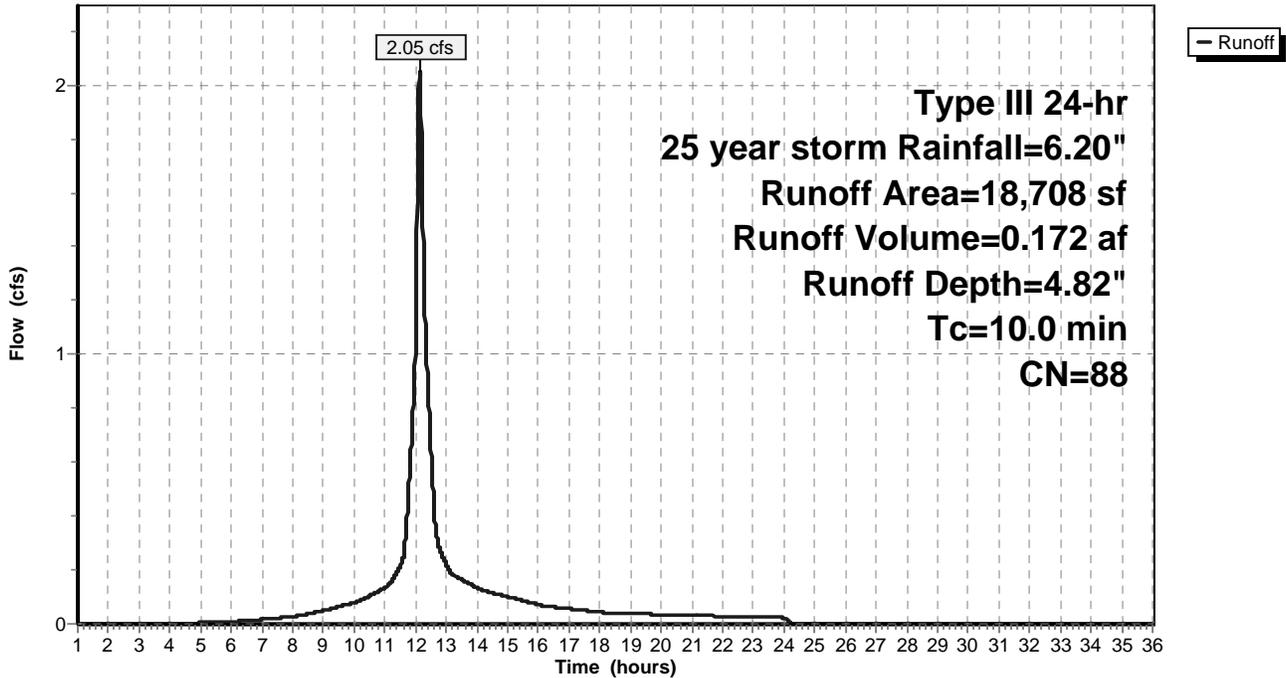
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 Type III 24-hr 25 year storm Rainfall=6.20"

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3,658		19.55% Pervious Area
15,050		80.45% Impervious Area

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

Subcatchment EXIST:

Hydrograph



Summary for Subcatchment PARKING:

Runoff = 0.37 cfs @ 12.07 hrs, Volume= 0.029 af, Depth> 5.96"

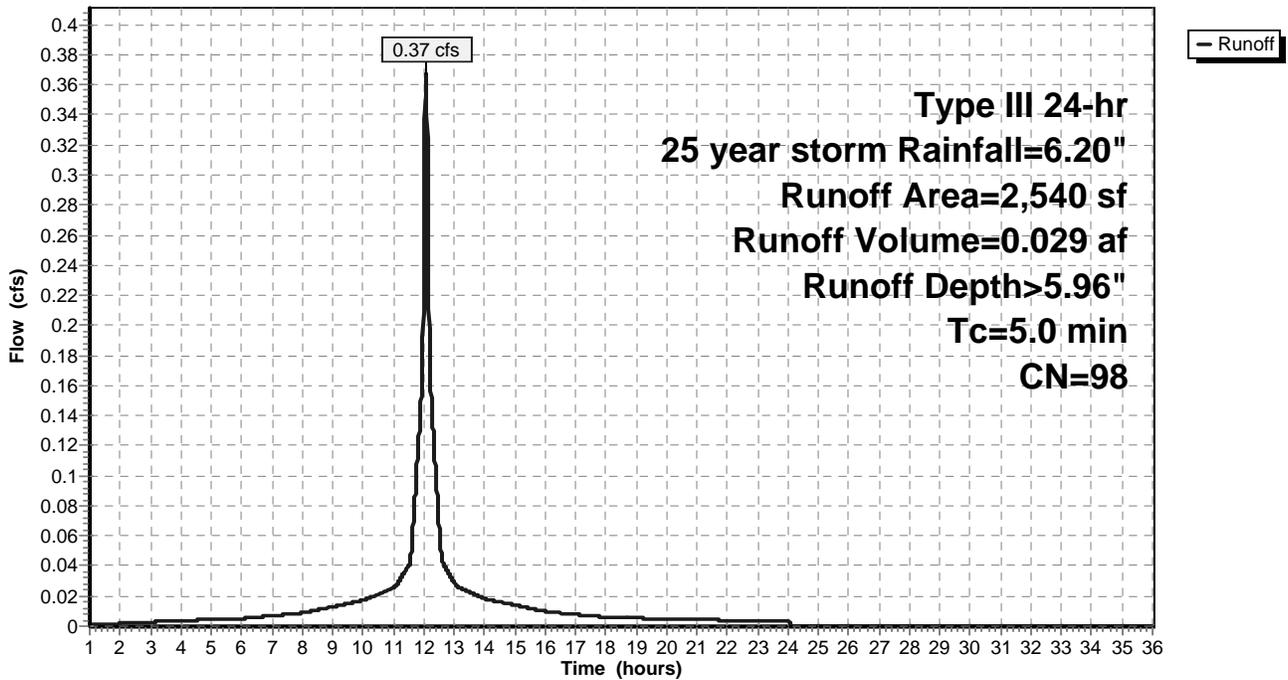
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Area (sf)	CN	Description
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2,540	98	Weighted Average
2,540		100.00% Impervious Area

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

Subcatchment PARKING:

Hydrograph



Summary for Subcatchment PROP:

Runoff = 1.77 cfs @ 12.14 hrs, Volume= 0.149 af, Depth= 4.82"

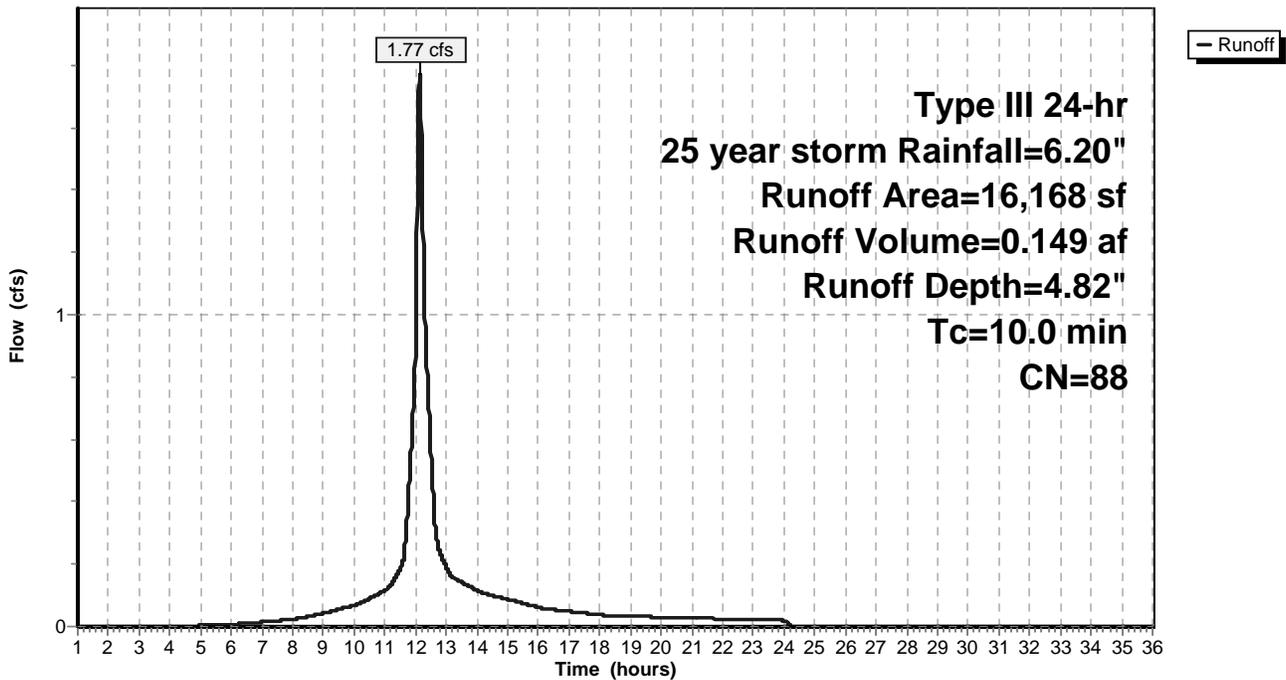
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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,

Subcatchment PROP:

Hydrograph



Summary for Pond INF:

Inflow Area = 0.058 ac, 100.00% Impervious, Inflow Depth > 5.96" for 25 year storm event
 Inflow = 0.37 cfs @ 12.07 hrs, Volume= 0.029 af
 Outflow = 0.07 cfs @ 11.68 hrs, Volume= 0.029 af, Atten= 82%, Lag= 0.0 min
 Discarded = 0.07 cfs @ 11.68 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 20.41' @ 12.50 hrs Surf.Area= 353 sf Storage= 294 cf

Plug-Flow detention time= 21.8 min calculated for 0.029 af (100% of inflow)
 Center-of-Mass det. time= 21.8 min (765.6 - 743.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	304 cf	11.00'W x 32.10'L x 3.50'H Field A 1,236 cf Overall - 368 cf Embedded = 868 cf x 35.0% Voids
#2A	19.50'	368 cf	ADS_StormTech SC-740 +Cap x 8 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 2 Rows of 4 Chambers
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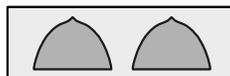
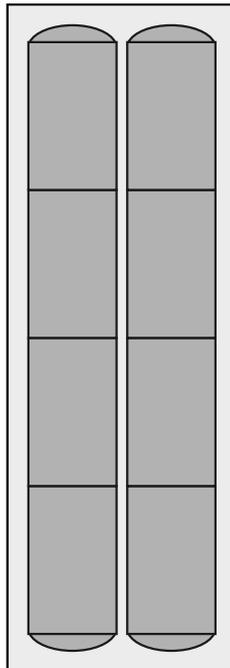
Overall Storage Efficiency = 54.3%

Overall System Size = 32.10' x 11.00' x 3.50'

8 Chambers

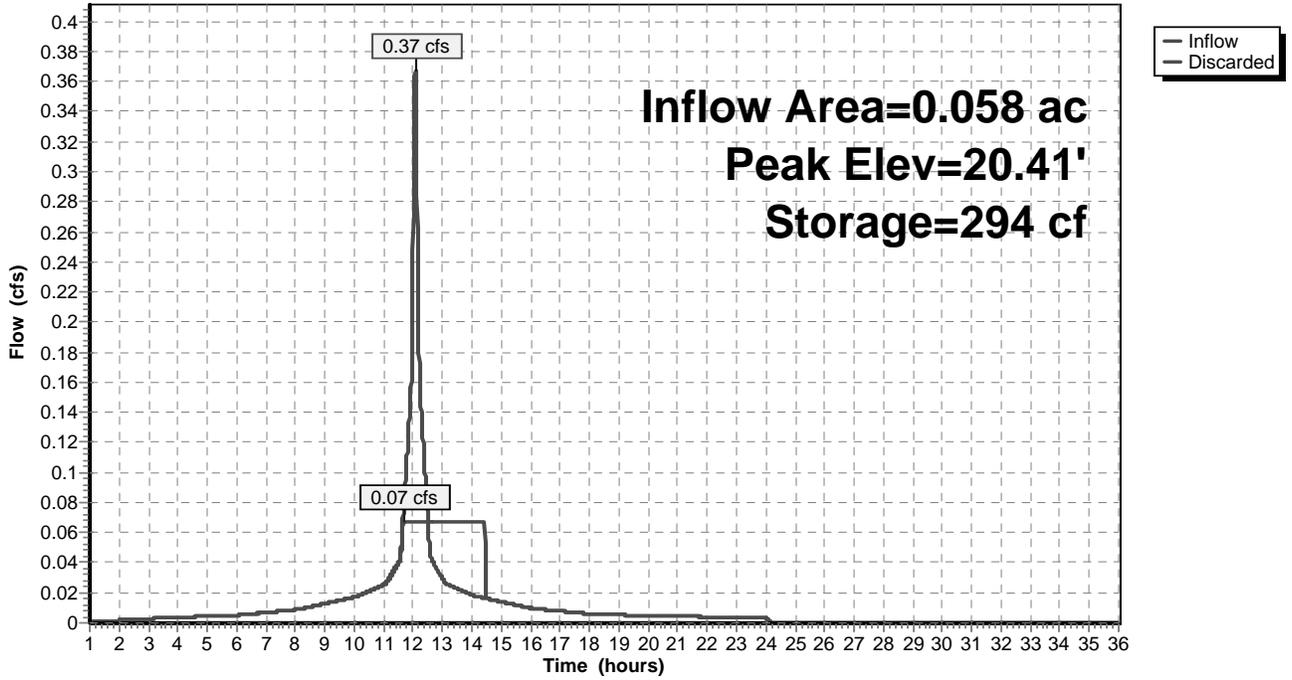
45.8 cy Field

32.2 cy Stone



Pond INF:

Hydrograph



648-654 Main Street

Type III 24-hr 100 year storm Rainfall=8.90"

Prepared by Frederick W. Russell, PE

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Time span=1.00-36.00 hrs, dt=0.01 hrs, 3501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EXIST: Runoff Area=18,708 sf 80.45% Impervious Runoff Depth=7.45"
Tc=10.0 min CN=88 Runoff=3.09 cfs 0.267 af

Subcatchment PARKING: Runoff Area=2,540 sf 100.00% Impervious Runoff Depth>8.65"
Tc=5.0 min CN=98 Runoff=0.53 cfs 0.042 af

Subcatchment PROP: Runoff Area=16,168 sf 82.32% Impervious Runoff Depth=7.45"
Tc=10.0 min CN=88 Runoff=2.67 cfs 0.230 af

Pond INF: Peak Elev=21.43' Storage=519 cf Inflow=0.53 cfs 0.042 af
Outflow=0.07 cfs 0.042 af

Total Runoff Area = 0.859 ac Runoff Volume = 0.539 af Average Runoff Depth = 7.53"
17.42% Pervious = 0.150 ac 82.58% Impervious = 0.709 ac

Summary for Subcatchment EXIST:

Runoff = 3.09 cfs @ 12.13 hrs, Volume= 0.267 af, Depth= 7.45"

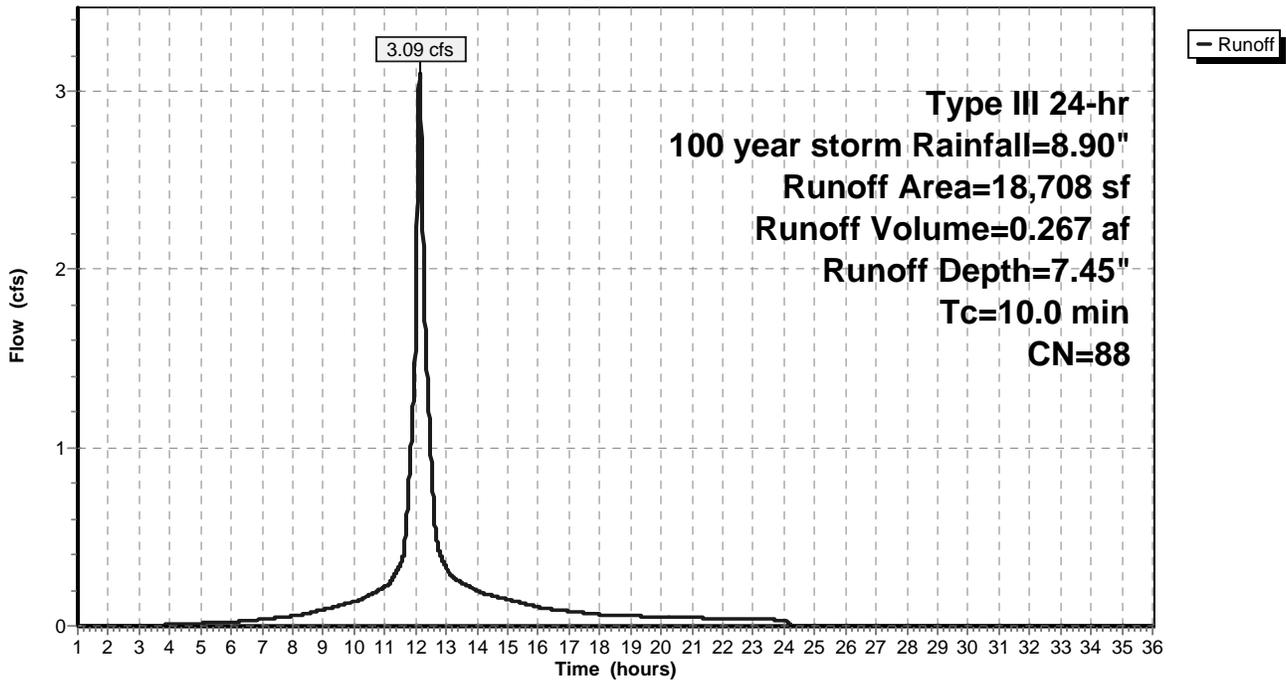
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 year storm Rainfall=8.90"

Area (sf)	CN	Description
3,110	98	Roofs, HSG A
11,940	98	Paved parking, HSG A
3,658	49	50-75% Grass cover, Fair, HSG A
18,708	88	Weighted Average
3,658		19.55% Pervious Area
15,050		80.45% Impervious Area

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

Subcatchment EXIST:

Hydrograph



Summary for Subcatchment PARKING:

Runoff = 0.53 cfs @ 12.07 hrs, Volume= 0.042 af, Depth> 8.65"

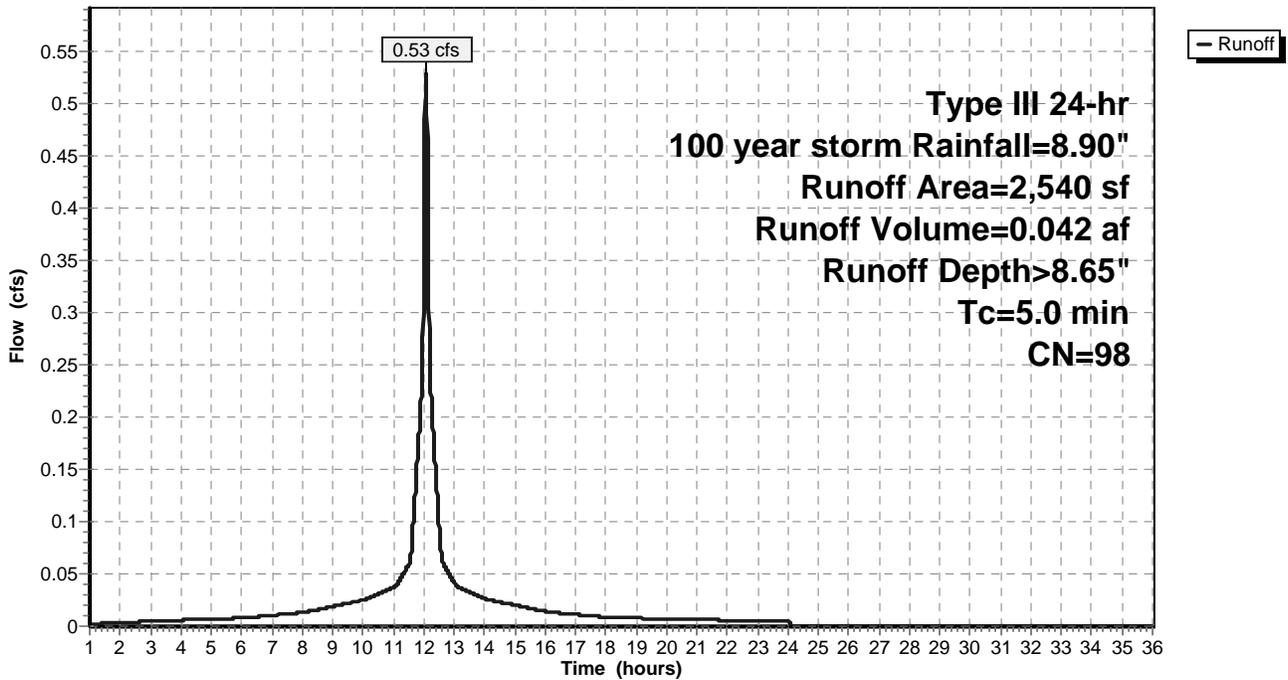
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 year storm Rainfall=8.90"

Area (sf)	CN	Description
2,290	98	Paved parking, HSG A
* 250	98	Walks, HSG A
2,540	98	Weighted Average
2,540		100.00% Impervious Area

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

Subcatchment PARKING:

Hydrograph



Summary for Subcatchment PROP:

Runoff = 2.67 cfs @ 12.13 hrs, Volume= 0.230 af, Depth= 7.45"

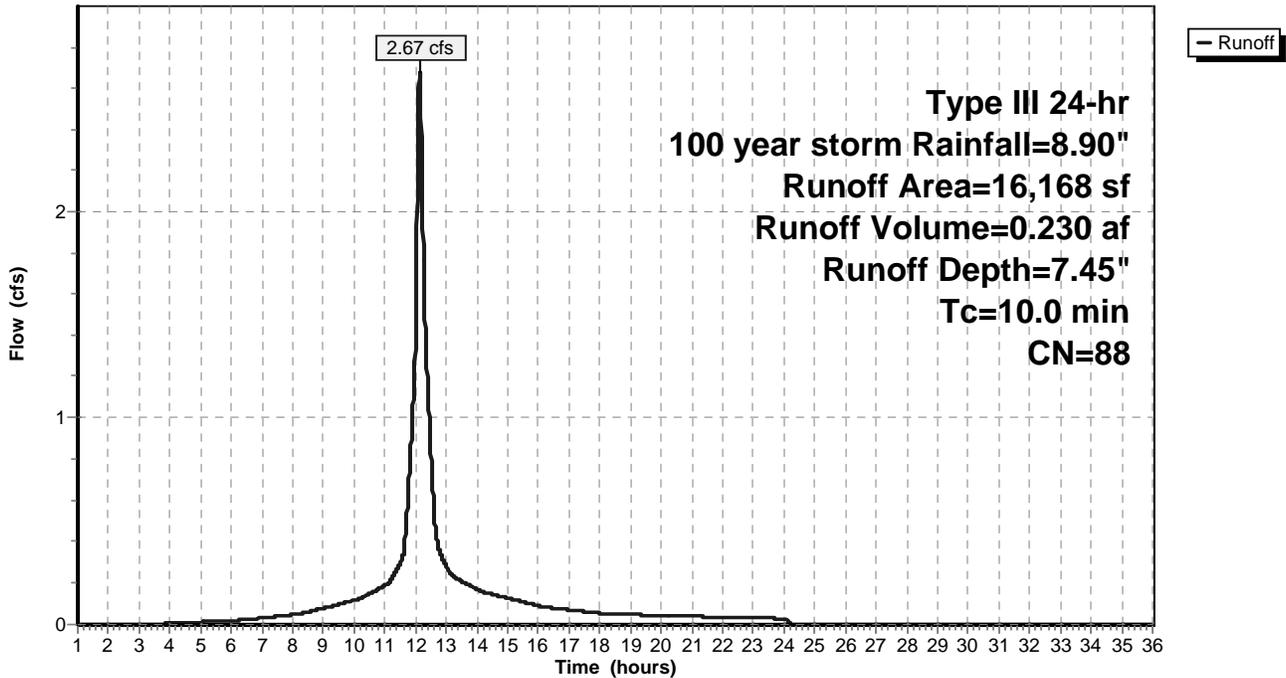
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100 year storm Rainfall=8.90"

Area (sf)	CN	Description
13,310	98	Roofs, HSG A
2,858	39	>75% Grass cover, Good, HSG A
16,168	88	Weighted Average
2,858		17.68% Pervious Area
13,310		82.32% Impervious Area

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

Subcatchment PROP:

Hydrograph



Summary for Pond INF:

Inflow Area = 0.058 ac, 100.00% Impervious, Inflow Depth > 8.65" for 100 year storm event
 Inflow = 0.53 cfs @ 12.07 hrs, Volume= 0.042 af
 Outflow = 0.07 cfs @ 11.60 hrs, Volume= 0.042 af, Atten= 87%, Lag= 0.0 min
 Discarded = 0.07 cfs @ 11.60 hrs, Volume= 0.042 af

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 21.43' @ 12.58 hrs Surf.Area= 353 sf Storage= 519 cf

Plug-Flow detention time= 44.1 min calculated for 0.042 af (100% of inflow)
 Center-of-Mass det. time= 44.1 min (783.6 - 739.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	19.00'	304 cf	11.00'W x 32.10'L x 3.50'H Field A 1,236 cf Overall - 368 cf Embedded = 868 cf x 35.0% Voids
#2A	19.50'	368 cf	ADS_StormTech SC-740 +Cap x 8 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 2 Rows of 4 Chambers
		671 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	19.00'	8.270 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.07 cfs @ 11.60 hrs HW=19.04' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.07 cfs)

Pond INF: - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

4 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 30.10' Row Length +12.0" End Stone x 2 = 32.10' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

8 Chambers x 45.9 cf = 367.5 cf Chamber Storage

1,235.7 cf Field - 367.5 cf Chambers = 868.2 cf Stone x 35.0% Voids = 303.9 cf Stone Storage

Chamber Storage + Stone Storage = 671.4 cf = 0.015 af

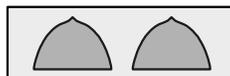
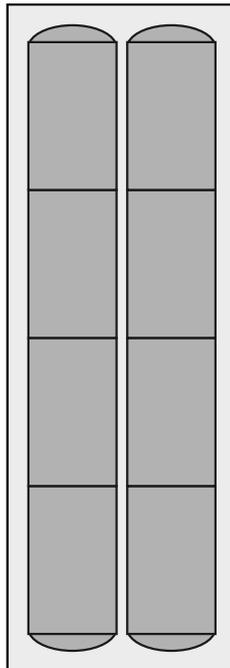
Overall Storage Efficiency = 54.3%

Overall System Size = 32.10' x 11.00' x 3.50'

8 Chambers

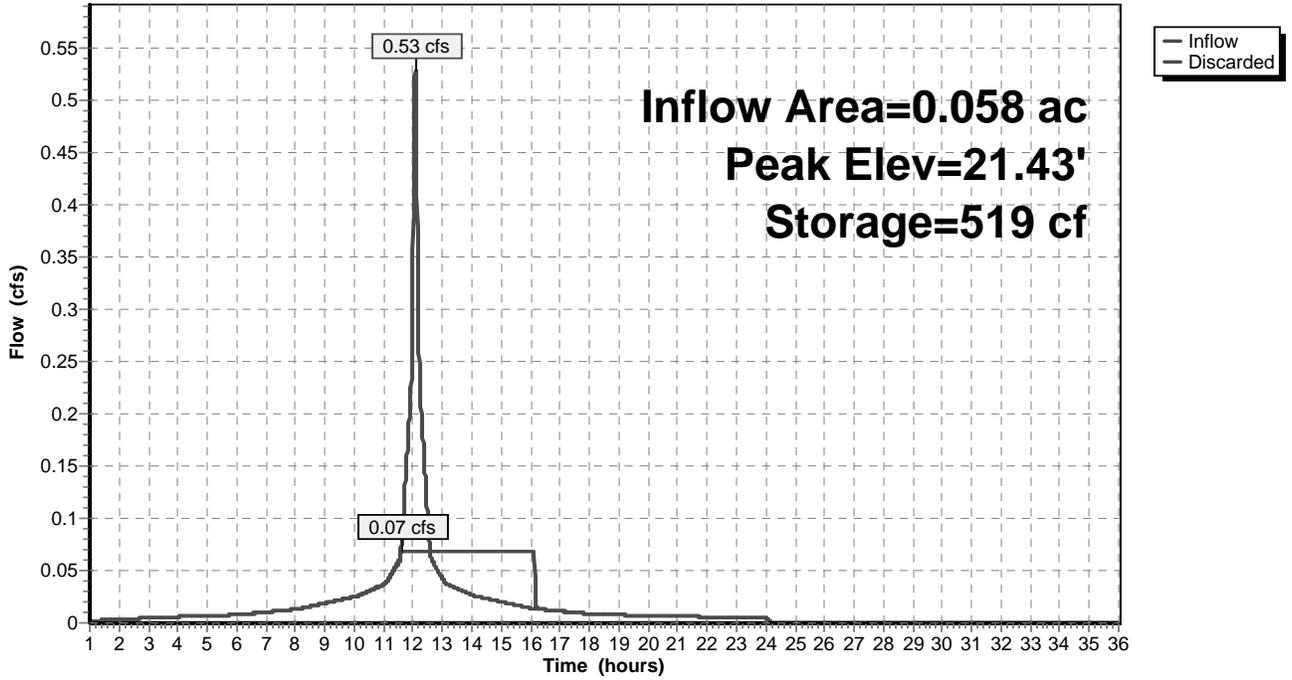
45.8 cy Field

32.2 cy Stone



Pond INF:

Hydrograph



***STORMWATER OPERATION &
MAINTENANCE PLAN***

Owner's & Applicant's Name(s) & Responsible for Maintenance (until transfer):

Applicant/Owner:

*Seaver Construction
215 Lexington Street
Woburn, MA 01801*

Stormwater System Description:

The proposed drainage system consists of one subsurface infiltration system containing eight (8) Stormtech SC-740© chambers.

Planned Erosion and Sedimentation Control Measures During construction Activities

Drain Inlet Protection

A temporary storm inlet protection, filter fabric, shall be placed in the proposed trench drain during construction. In addition, filter fabric, or silt sack, will be placed in the proposed trench drain and existing catch basins in Main Street within 50 feet downstream of the project. The purpose of the filter fabric is to prevent the inflow of sediments into the closed drainage system. The filter fabric shall remain in place until the proposed driveway is paved and a permanent vegetative cover is established so that the transport of sediment is no longer visibly apparent. The filter fabric shall be inspected and maintained on a weekly basis.

Surface Stabilization

The surface of all disturbed areas shall be stabilized during and after construction. Temporary measures shall be taken during construction to prevent erosion and siltation. No construction sediment shall be allowed to enter the infiltration system. All disturbed slopes will be stabilized with a permanent vegetative cover. Some or all of the following measures will be utilized on this project as conditions may warrant.

- a. Temporary Seeding
- b. Temporary Mulching
- c. Permanent Seeding
- d. Placement of Sod
- e. Hydroseeding
- f. Placement of Hay
- g. Placement of Jute Netting

Subsurface Infiltration System:

Erosion controls (such as haybales or silt fencing) and temporary swales should be installed around the perimeter of the excavation to collect and/or divert runoff containing fines and sediments from entering the infiltration systems during construction. The existing subgrade under the system bed area shall not be compacted or subject to excessive construction equipment traffic. Once the site is stabilized and final grade over the systems is established, ensure that proper signs and/or barricades around the systems are installed to avoid compaction

or vehicular traffic over the systems. During construction, the infiltration system should be inspected weekly and after every major storm event (>3 inches). Pondered water inside the system (as visible from the observation wells) after several days often indicates that the bottom of the system is clogged. If the system is found to be clogged, flushing and vacuuming of the system using a sewer vacuum truck will be required (search “sewer vacuum truck services”).

Long-Term Inspection and Maintenance Measures After Construction

Erosion Control

Eroded sediments can adversely affect the performance of the stormwater management system. Eroding or barren areas should be immediately re-vegetated.

Subsurface Infiltration System:

The subsurface infiltration system should be inspected after the first several rainfall events or a few months after construction, after all major storms (>3 inches), and on regular bi-annual (April and October) scheduled dates. Pondered water inside the system (as visible from the observation wells) after several days often indicates that the bottom of the system is clogged. If the system is found to be clogged, flushing and vacuuming of the system using a sewer vacuum truck will be required (search “sewer vacuum truck services”).

Inspection and Maintenance of Trench Drain:

The trench drain shall be inspected two (2) times per year, and if necessary, any maintenance shall be performed so that it functions as designed. The trench drain shall be cleaned twice per year, or as necessary. Outlet pipe should also be checked for clogging. At a minimum, inspection of the trench drain shall be performed during April and October each year.

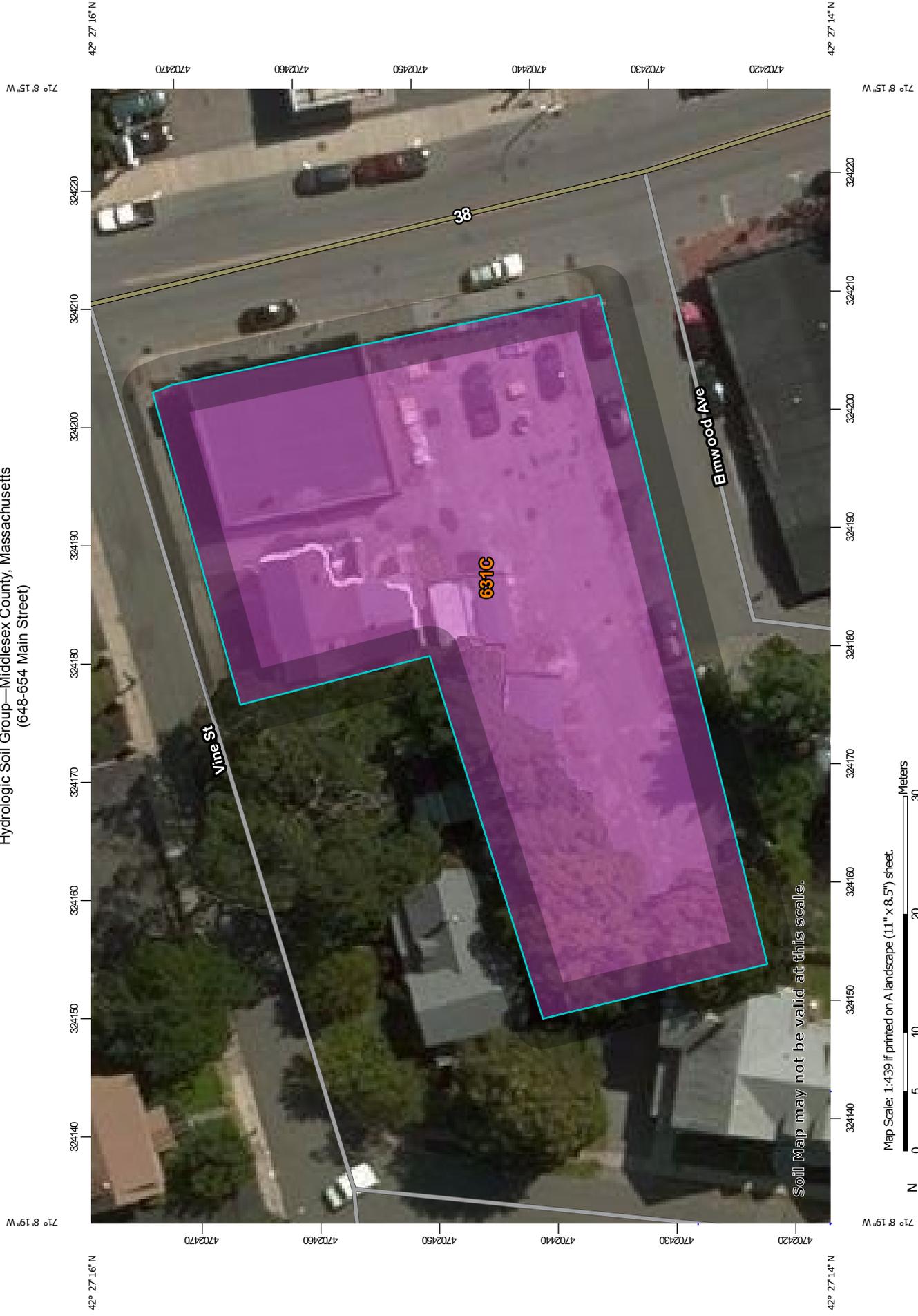
Inspection and Maintenance of Drain Manhole w/4-ft sump:

The drain manhole shall be inspected two (2) times per year, and if necessary, any maintenance shall be performed so that it functions as designed. The Drain Manhole sump shall be cleaned twice per year, and when sediment in the bottom of the sump reaches within 2 inches below the bottom of the outlet. Inlet and outlet pipes should be checked for clogging. At a minimum, inspection of the drain manhole shall be performed during the last week of April and the first week of October each year.

Debris and Leaf Removal:

Roof gutters should be inspected every April and October and cleaned of any debris and leaves.

Hydrologic Soil Group—Middlesex County, Massachusetts
(648-654 Main Street)



Soil Map may not be valid at this scale.

Map Scale: 1:439 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

MAP LEGEND

Area of Interest (AOI)
 Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
 Survey Area Data: Version 17, Oct 6, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	A	0.4	100.0%
Totals for Area of Interest			0.4	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher