

8 & 10 CHARGE POND ROAD

WAREHAM, MA

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1. Project Overview

The project is located at 8 & 10 Charge Pond Road in Wareham and consists of Lots 1035 & 1076 as shown on Assessor's Map 110. These properties lie partially within the General Commercial Zoning District and Residence 60 Zoning District. The total land area of the two lots is 140,003 square feet. Currently, this is a vacant wooded lot. The topography is relatively flat and pitches southerly and westerly off the property.

Under proposed conditions, the applicant would like to construct a 7,350 s.f. structure to be used for a landscaping company services. The structure will be made up of office space as well as garage storage and will require a total of 28 parking spaces. The parking area is proposed to be paved and will have a total of 33 parking spaces, including two handicap spaces as well as 18 company vehicle parking spaces. Landscaping is proposed between the roadway and building. To aid in buffering along Charge Pond Road, a proposed privacy fence will be installed at the front face of the structure.

2. Impact Statement

Water and Sewer System

The proposed building will be serviced by Town Water and a Private Septic System. An existing fire hydrant has been located only 30' from the northern property line.

Fire and Police Protection

The proposed parking lot entrances will provide adequate accessibility for fire and police. The aisle widths are proposed at minimum of 24' wide and the two entrances off Charge Pond Road allow for vehicular circulation throughout the entire site.

Schools and Parks

This is a proposed commercial development; therefore, no additional residences are proposed that may impact the student population or existing park uses.

Traffic and Pedestrian

There will not be an adverse impact to the traffic and pedestrian movement from the proposed development. The project is located directly off Charge Pond Road. Another landscaping service company exists directly across the street.

Ecology

A majority of the site is wooded and does not contain any wetland resource areas. The proposed drainage system is designed so that stormwater runoff leaving the site post-development will be less than what currently exists. The proposed development also includes the installation of numerous trees, shrubs, and landscaped areas.

2. Stormwater Management

Methodology

Stormwater runoff was evaluated for the 2-year, 10-year, 25-year, and 100-year, Type III, 24-hour storm for post-development conditions. The runoff generated from the area of the lot to be developed currently drains towards the south and west. Once this project is completed, a majority of the runoff will be captured and infiltrated onsite, therefore, considerably reducing the amount of runoff that exits the property. Four proposed catch basins will capture the runoff generated from the parking area and direct the runoff to two detention basins. A proposed leaching chamber will be situated as the bottom of both detention basins to provide additional storage and infiltration. The proposed grading is very similar to the current topography, therefore, not major changes in drainage patterns are proposed.

The Pre- and Post-development conditions were modeled using HydroCAD software, which combines USDA Soil Conservation Service hydrology and hydraulic techniques (commonly known as SCS TR-55 and TR-20) to generate hydrographs (calculations are provided in the supplemental section of this report). The rainfall amounts used for calculating runoff for the 2-year, 10-year, and 100-year storm events were obtained from the HydroCAD Manual.

General Soils Information

Existing soil classifications and hydrologic soil groups for the site were obtained from the USDA Soil Conservation Service, Soil Survey of Plymouth County, Massachusetts, Southern Part (1969). The soil type found within the project site is classified as Carver Coarse Sand (CaB). Carver Soils are very deep, excessively drained soils formed in thick deposits of coarse and very coarse sands. Carver soils are in broad areas on outwash plains, terraces and deltas. Carver soil is classified as Hydrologic Group A and is the dominant soil type found within the site. An on-site examination of the soils in the vicinity of the proposed detention basin and leaching chambers were performed and found to be consistent with the properties of Carver soils (see attached Test Pits Logs).

Proposed Stormwater Management System and Mitigation

The purpose of the proposed stormwater management system is to remove a minimum of 80% total of the suspended solids, while preventing off-site flooding and adverse environmental impacts from the 2-year, 10-year, 25-year, and 100-year storm events. Additionally, a goal of a site's stormwater management plan also includes the improvement of water quality through the design and implementation of best management practices (BMPs) for the site. BMPs can include physical features, such as infiltration structures, detention basins and swales, as well as maintenance procedures and other management techniques. Several regulatory standards or policies are applicable for the proposed site, including the Town of Wareham Subdivision Rules and Regulations and Zoning Bylaws.

Criteria for the management of stormwater runoff were designed in accordance with the applicable criteria for drainage design of the Department of Environmental Protection (DEP) Stormwater Management Policy.

The stormwater will be captured by a four deep sump catch basins and will be infiltrated through two detention basins, which are designed to capture and infiltrate the 100-year storm event. A proposed leaching pit will be situated at the bottom of each detention basin to provide additional storage and infiltration. The catch basin, sediment forebay, and detention basin, combined, will remove a minimum of 80% total suspended solids.

PIPE SIZING CALCULATIONS

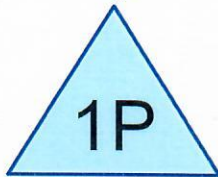
Design for 25 Year Storm

Pipe Coeff. "n" = 0.013

Drainage Structure		Type of Area	RUNOFF						PIPE				STRUCTURE ELEVATION				
			Tributary Area		Runoff Coeff. "C"	Time of Flow Tc (min)	Rainfall Intensity I (in/hr)	Discharge Q=CIA		Length (ft.)	Dia. (in.)	Design Slope (ft/ft)	Min. Slope (ft/ft)	From Struct	Invert In (feet)	Invert Out (feet)	Rim (feet)
			A Incr. (acres)	A Total (acres)				Q Incr. (cfs)	Total (cfs)								
No.	Sta.																
CB-1		Imp.	0.340		0.98												
to DMH1		Woods	0.350		0.36												
		Grass	0.210		0.49												
		Total	0.900		0.625	12	6.05	3.401	3.401	110	11.8	0.010					
										Use	12						
CB-2		Imp.	0.390		0.98												
to DMH 1		Woods	0.260		0.36												
		Grass	0.120		0.49												
		Total	0.770		0.694	17.9	6.05	3.234	3.234	20	11.6	0.010					
										Use	12						
DMH 1		Imp.	0.730		0.98												
to FES #4		Woods	0.610		0.36												
		Grass	0.330		0.49												
		Total	1.670		0.657	17.9	6.05	6.635	6.635	20	15.1	0.010					
										Use	16						
CB-3		Imp.	0.390		0.98												
to FES #2																	
		Total	0.390		0.98	1.5	6.05	2.312	2.312	12	10.2	0.010					
										Use	12						
CB-4		Imp.	0.110		0.98												
to FES #1																	
		Grass	0.010		0.49												
		Total	0.120		0.939	2	6.05	0.682	0.682	102	6.45	0.010					
										Use	12						



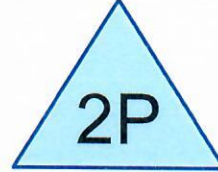
Site Runoff



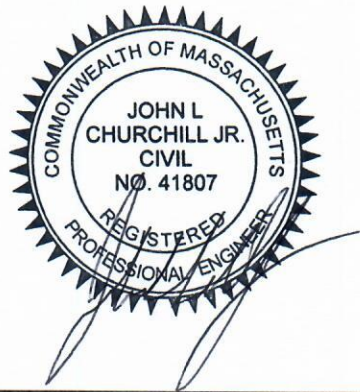
Detention Basin



Site Runoff



Detention Basin



Routing Diagram for Proposed Conditions
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.931	49	Pasture/grassland/range, Fair, HSG A (DA-1, DA-2)
1.234	98	Paved parking, HSG A (DA-1, DA-2)
1.012	36	Woods, Fair, HSG A (DA-1, DA-2)
3.178	64	TOTAL AREA

Proposed Conditions

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
3.178	HSG A	DA-1, DA-2
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
3.178		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.931	0.000	0.000	0.000	0.000	0.931	Pasture/grassland/range, Fair	DA-1, DA-2
1.234	0.000	0.000	0.000	0.000	1.234	Paved parking	DA-1, DA-2
1.012	0.000	0.000	0.000	0.000	1.012	Woods, Fair	DA-1, DA-2
3.178	0.000	0.000	0.000	0.000	3.178	TOTAL AREA	

Proposed Conditions

Type III 24-hr 2-year Rainfall=3.44"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment DA-1: Site Runoff Runoff Area=32,772 sf 66.38% Impervious Runoff Depth>1.66"
Flow Length=168' Slope=0.0100 '/' Tc=1.9 min CN=81 Runoff=1.69 cfs 0.104 af

Subcatchment DA-2: Site Runoff Runoff Area=105,667 sf 30.30% Impervious Runoff Depth>0.46"
Flow Length=355' Tc=17.9 min CN=59 Runoff=0.60 cfs 0.094 af

Pond 1P: Detention Basin Peak Elev=26.91' Storage=1,873 cf Inflow=1.69 cfs 0.104 af
Outflow=0.13 cfs 0.104 af

Pond 2P: Detention Basin Peak Elev=26.18' Storage=734 cf Inflow=0.60 cfs 0.094 af
Outflow=0.21 cfs 0.093 af

Total Runoff Area = 3.178 ac Runoff Volume = 0.198 af Average Runoff Depth = 0.75"
61.16% Pervious = 1.944 ac 38.84% Impervious = 1.234 ac

Proposed Conditions

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Type III 24-hr 2-year Rainfall=3.44"

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Summary for Subcatchment DA-1: Site Runoff

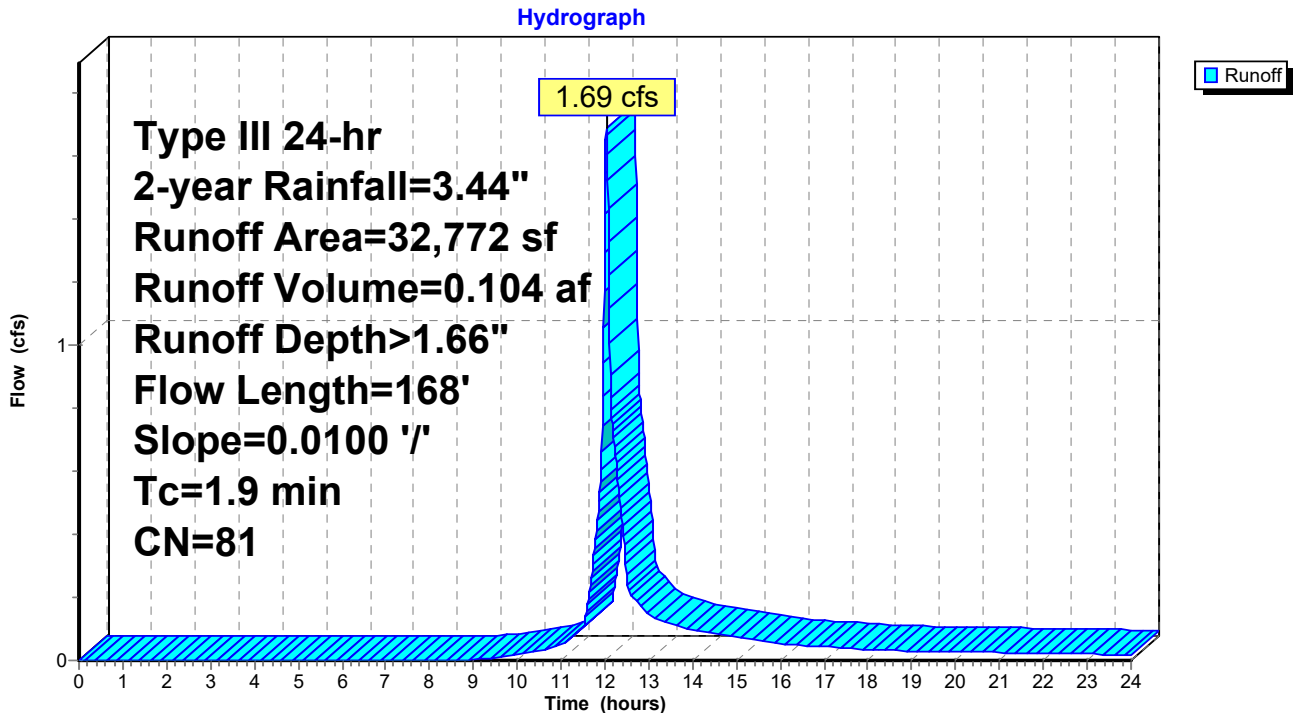
Runoff = 1.69 cfs @ 12.03 hrs, Volume= 0.104 af, Depth> 1.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.44"

Area (sf)	CN	Description
21,755	98	Paved parking, HSG A
1,140	36	Woods, Fair, HSG A
9,877	49	Pasture/grassland/range, Fair, HSG A
32,772	81	Weighted Average
11,017		33.62% Pervious Area
21,755		66.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.94		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 3.40"
1.0	118	0.0100	2.03		Shallow Concentrated Flow, B-C Paved Kv= 20.3 fps
1.9	168	Total			

Subcatchment DA-1: Site Runoff



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Type III 24-hr 2-year Rainfall=3.44"

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Summary for Subcatchment DA-2: Site Runoff

Runoff = 0.60 cfs @ 12.36 hrs, Volume= 0.094 af, Depth> 0.46"

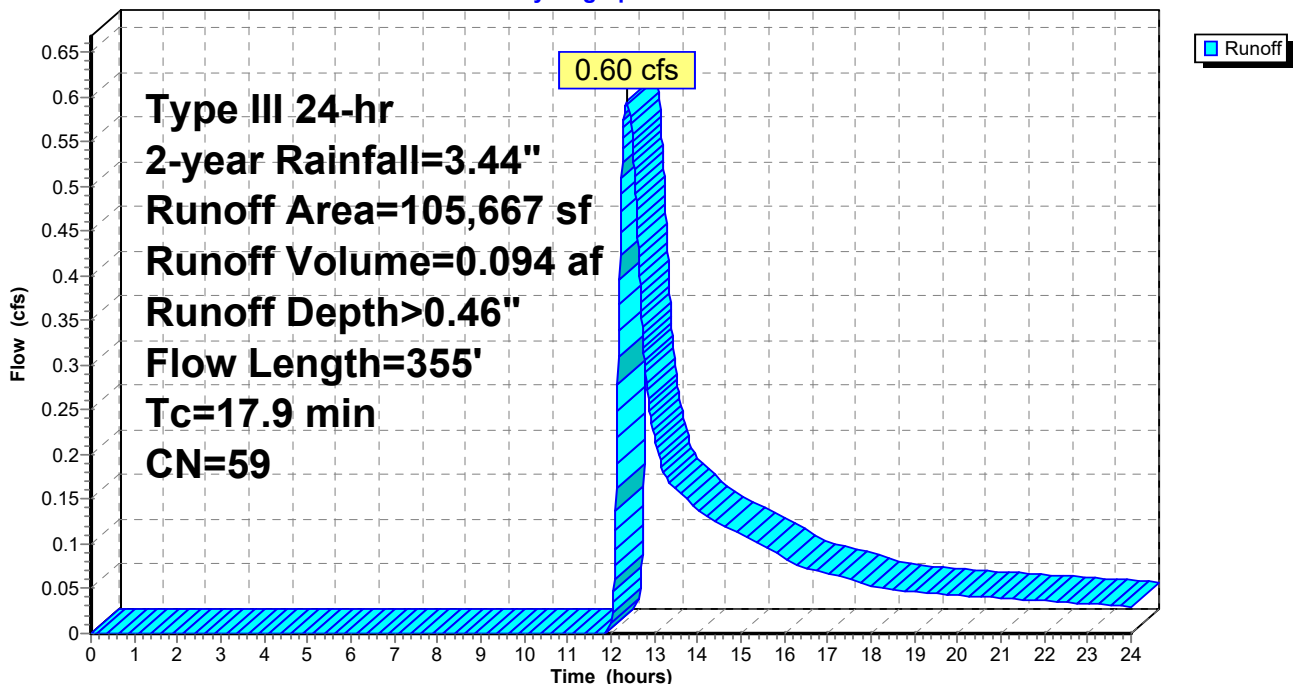
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.44"

Area (sf)	CN	Description
32,015	98	Paved parking, HSG A
42,960	36	Woods, Fair, HSG A
30,692	49	Pasture/grassland/range, Fair, HSG A
105,667	59	Weighted Average
73,652		69.70% Pervious Area
32,015		30.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.40"
5.1	215	0.0200	0.71		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
0.4	30	0.0300	1.21		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
0.4	60	0.0150	2.49		Shallow Concentrated Flow, D-E Paved Kv= 20.3 fps
17.9	355	Total			

Subcatchment DA-2: Site Runoff

Hydrograph



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Type III 24-hr 2-year Rainfall=3.44"

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Summary for Pond 1P: Detention Basin

Inflow Area = 0.752 ac, 66.38% Impervious, Inflow Depth > 1.66" for 2-year event
 Inflow = 1.69 cfs @ 12.03 hrs, Volume= 0.104 af
 Outflow = 0.13 cfs @ 13.19 hrs, Volume= 0.104 af, Atten= 92%, Lag= 69.7 min
 Discarded = 0.13 cfs @ 13.19 hrs, Volume= 0.104 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 26.91' @ 13.19 hrs Surf.Area= 2,352 sf Storage= 1,873 cf

Plug-Flow detention time= 144.1 min calculated for 0.104 af (100% of inflow)
 Center-of-Mass det. time= 142.0 min (974.0 - 832.0)

Volume	Invert	Avail.Storage	Storage Description		
#1	26.00'	12,998 cf	Custom Stage Data (Conic) Listed below		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
26.00	1,725	0	0	1,725	
27.00	2,415	2,060	2,060	2,433	
28.00	3,214	2,805	4,865	3,254	
29.00	4,010	3,605	8,470	4,078	
30.00	5,067	4,528	12,998	5,162	

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.13 cfs @ 13.19 hrs HW=26.91' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

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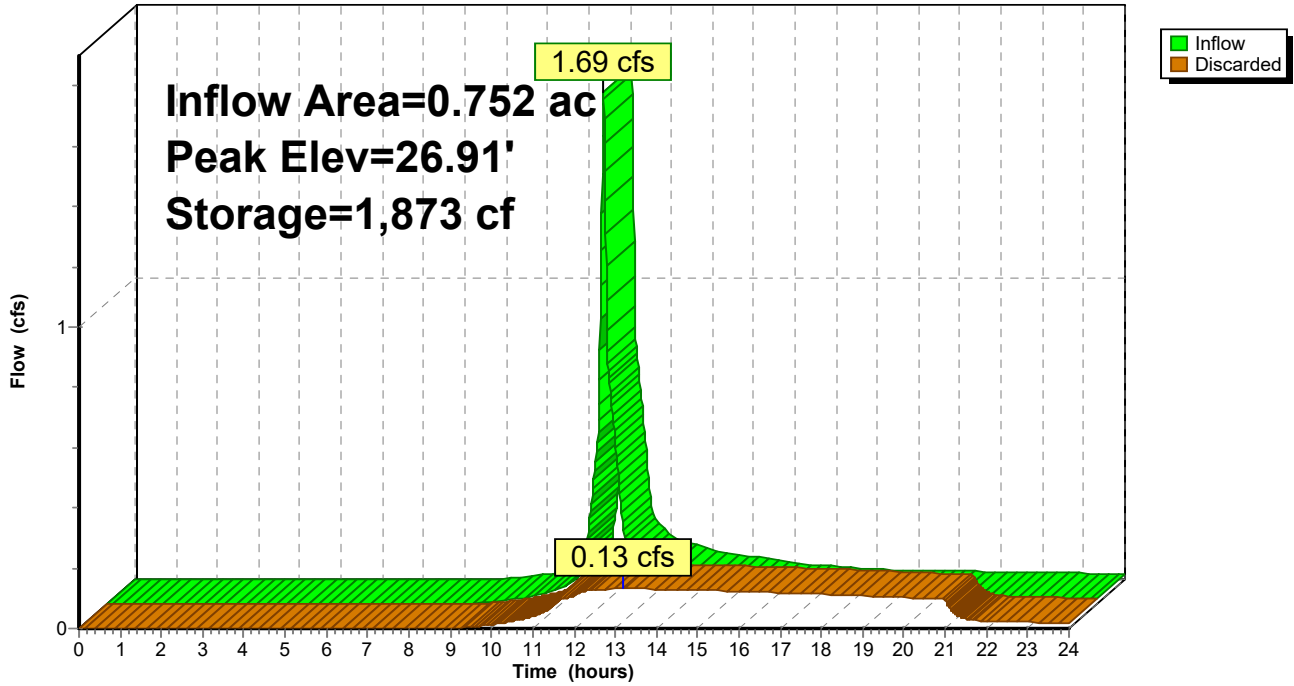
Type III 24-hr 2-year Rainfall=3.44"

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Pond 1P: Detention Basin

Hydrograph



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Type III 24-hr 2-year Rainfall=3.44"

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Summary for Pond 2P: Detention Basin

Inflow Area = 2.426 ac, 30.30% Impervious, Inflow Depth > 0.46" for 2-year event
 Inflow = 0.60 cfs @ 12.36 hrs, Volume= 0.094 af
 Outflow = 0.21 cfs @ 13.05 hrs, Volume= 0.093 af, Atten= 65%, Lag= 41.7 min
 Discarded = 0.21 cfs @ 13.05 hrs, Volume= 0.093 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 26.18' @ 13.05 hrs Surf.Area= 3,746 sf Storage= 734 cf

Plug-Flow detention time= 29.6 min calculated for 0.093 af (99% of inflow)
 Center-of-Mass det. time= 26.4 min (950.0 - 923.6)

Volume	Invert	Avail.Storage	Storage Description
#1	26.00'	23,817 cf	Custom Stage Data (Conic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
26.00	3,553	0	0	3,553
27.00	4,626	4,078	4,078	4,650
28.00	6,075	5,334	9,412	6,121
29.00	7,198	6,629	16,040	7,281
30.00	8,369	7,776	23,817	8,493

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.21 cfs @ 13.05 hrs HW=26.18' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.21 cfs)

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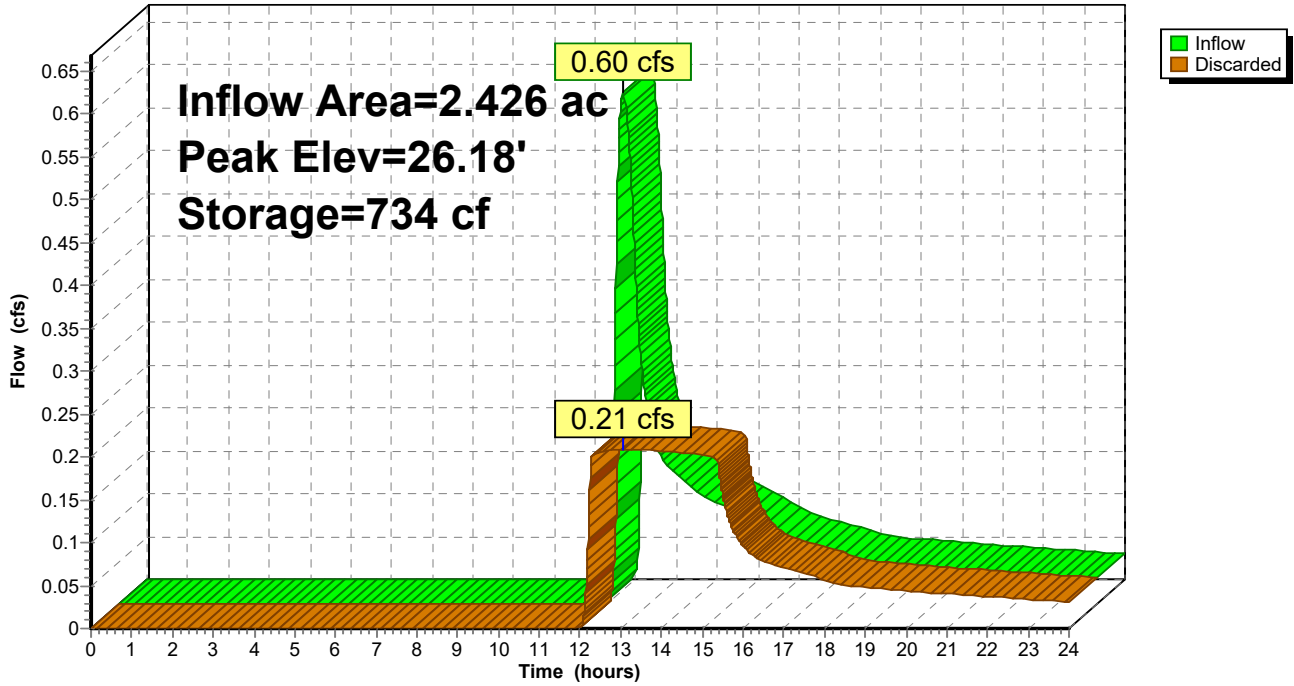
Type III 24-hr 2-year Rainfall=3.44"

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Pond 2P: Detention Basin

Hydrograph



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Type III 24-hr 10-year Rainfall=5.05"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment DA-1: Site Runoff Runoff Area=32,772 sf 66.38% Impervious Runoff Depth>3.03"
Flow Length=168' Slope=0.0100 '/' Tc=1.9 min CN=81 Runoff=3.10 cfs 0.190 af

Subcatchment DA-2: Site Runoff Runoff Area=105,667 sf 30.30% Impervious Runoff Depth>1.26"
Flow Length=355' Tc=17.9 min CN=59 Runoff=2.22 cfs 0.254 af

Pond 1P: Detention Basin Peak Elev=27.70' Storage=4,026 cf Inflow=3.10 cfs 0.190 af
Outflow=0.17 cfs 0.165 af

Pond 2P: Detention Basin Peak Elev=27.09' Storage=4,575 cf Inflow=2.22 cfs 0.254 af
Outflow=0.27 cfs 0.242 af

Total Runoff Area = 3.178 ac Runoff Volume = 0.444 af Average Runoff Depth = 1.68"
61.16% Pervious = 1.944 ac 38.84% Impervious = 1.234 ac

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Type III 24-hr 10-year Rainfall=5.05"

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Summary for Subcatchment DA-1: Site Runoff

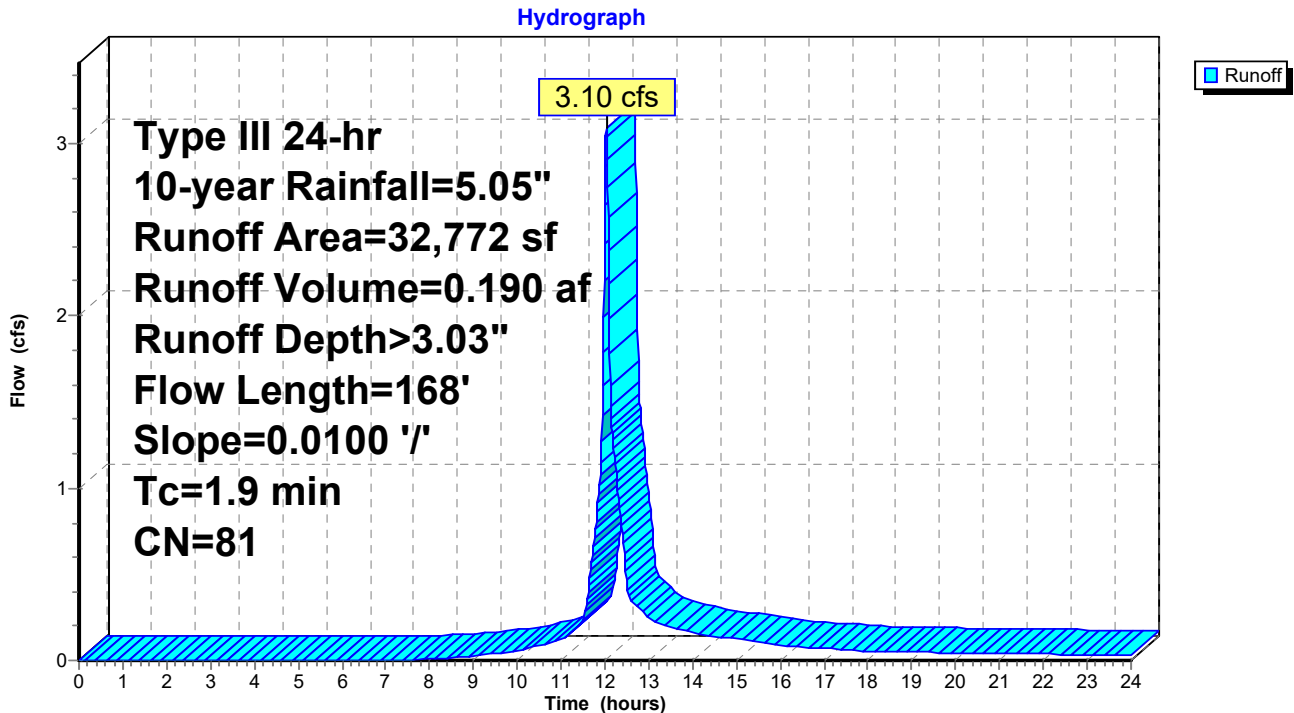
Runoff = 3.10 cfs @ 12.03 hrs, Volume= 0.190 af, Depth> 3.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-year Rainfall=5.05"

Area (sf)	CN	Description
21,755	98	Paved parking, HSG A
1,140	36	Woods, Fair, HSG A
9,877	49	Pasture/grassland/range, Fair, HSG A
32,772	81	Weighted Average
11,017		33.62% Pervious Area
21,755		66.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.94		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 3.40"
1.0	118	0.0100	2.03		Shallow Concentrated Flow, B-C Paved Kv= 20.3 fps
1.9	168	Total			

Subcatchment DA-1: Site Runoff



Proposed Conditions

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Type III 24-hr 10-year Rainfall=5.05"

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Summary for Subcatchment DA-2: Site Runoff

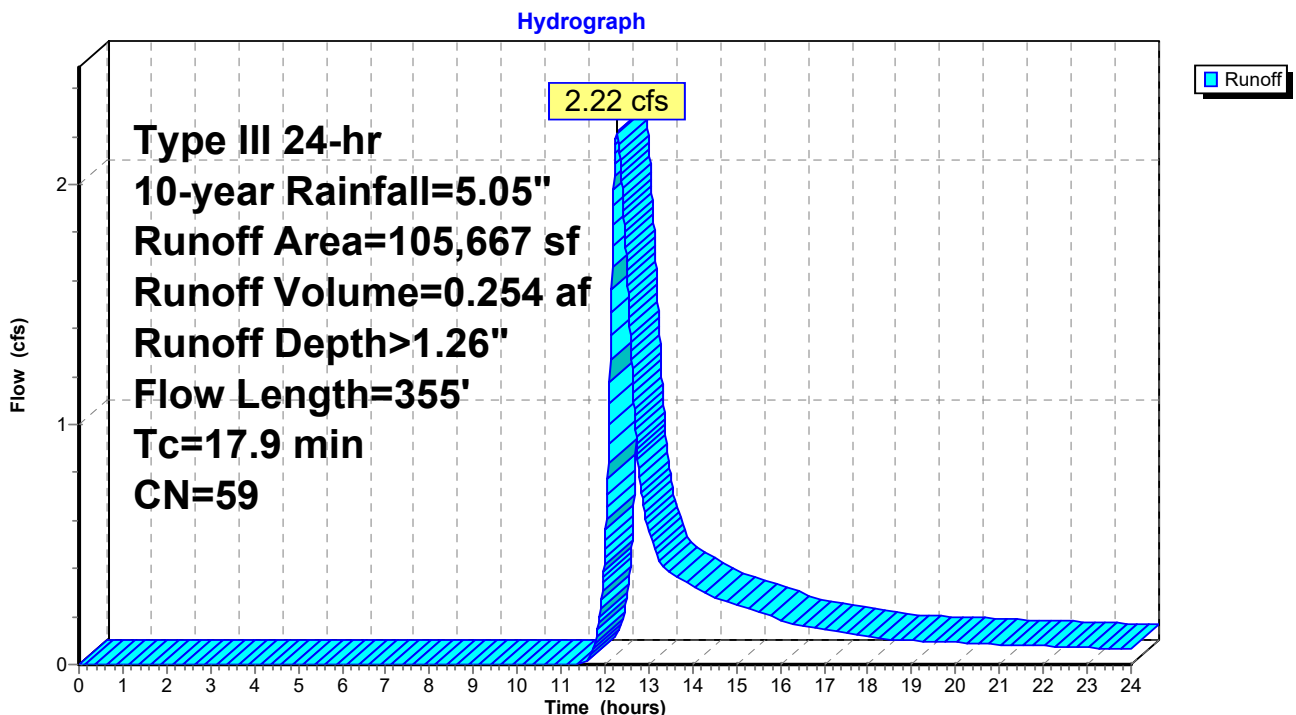
Runoff = 2.22 cfs @ 12.28 hrs, Volume= 0.254 af, Depth> 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.05"

Area (sf)	CN	Description
32,015	98	Paved parking, HSG A
42,960	36	Woods, Fair, HSG A
30,692	49	Pasture/grassland/range, Fair, HSG A
105,667	59	Weighted Average
73,652		69.70% Pervious Area
32,015		30.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.40"
5.1	215	0.0200	0.71		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
0.4	30	0.0300	1.21		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
0.4	60	0.0150	2.49		Shallow Concentrated Flow, D-E Paved Kv= 20.3 fps
17.9	355	Total			

Subcatchment DA-2: Site Runoff



Proposed Conditions

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Type III 24-hr 10-year Rainfall=5.05"

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Summary for Pond 1P: Detention Basin

Inflow Area = 0.752 ac, 66.38% Impervious, Inflow Depth > 3.03" for 10-year event
 Inflow = 3.10 cfs @ 12.03 hrs, Volume= 0.190 af
 Outflow = 0.17 cfs @ 13.93 hrs, Volume= 0.165 af, Atten= 95%, Lag= 114.2 min
 Discarded = 0.17 cfs @ 13.93 hrs, Volume= 0.165 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 27.70' @ 13.93 hrs Surf.Area= 2,975 sf Storage= 4,026 cf

Plug-Flow detention time= 257.0 min calculated for 0.165 af (87% of inflow)
 Center-of-Mass det. time= 198.1 min (1,012.7 - 814.6)

Volume	Invert	Avail.Storage	Storage Description		
#1	26.00'	12,998 cf	Custom Stage Data (Conic) Listed below		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
26.00	1,725	0	0	1,725	
27.00	2,415	2,060	2,060	2,433	
28.00	3,214	2,805	4,865	3,254	
29.00	4,010	3,605	8,470	4,078	
30.00	5,067	4,528	12,998	5,162	

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.17 cfs @ 13.93 hrs HW=27.70' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.17 cfs)

Proposed Conditions

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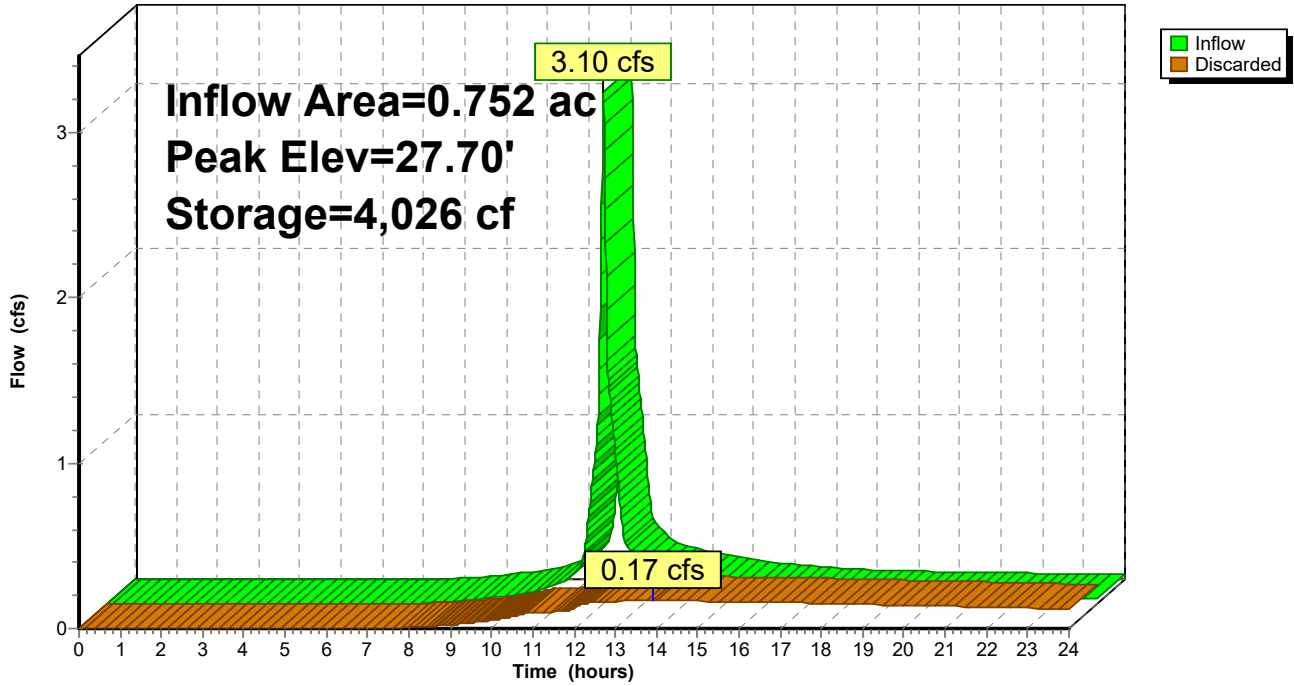
Type III 24-hr 10-year Rainfall=5.05"

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Pond 1P: Detention Basin

Hydrograph



Proposed Conditions

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Type III 24-hr 10-year Rainfall=5.05"

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Summary for Pond 2P: Detention Basin

Inflow Area = 2.426 ac, 30.30% Impervious, Inflow Depth > 1.26" for 10-year event
 Inflow = 2.22 cfs @ 12.28 hrs, Volume= 0.254 af
 Outflow = 0.27 cfs @ 14.75 hrs, Volume= 0.242 af, Atten= 88%, Lag= 148.4 min
 Discarded = 0.27 cfs @ 14.75 hrs, Volume= 0.242 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 27.09' @ 14.75 hrs Surf.Area= 4,761 sf Storage= 4,575 cf

Plug-Flow detention time= 203.0 min calculated for 0.242 af (95% of inflow)
 Center-of-Mass det. time= 179.6 min (1,065.4 - 885.8)

Volume	Invert	Avail.Storage	Storage Description
#1	26.00'	23,817 cf	Custom Stage Data (Conic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
26.00	3,553	0	0	3,553
27.00	4,626	4,078	4,078	4,650
28.00	6,075	5,334	9,412	6,121
29.00	7,198	6,629	16,040	7,281
30.00	8,369	7,776	23,817	8,493

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.27 cfs @ 14.75 hrs HW=27.09' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.27 cfs)

Proposed Conditions

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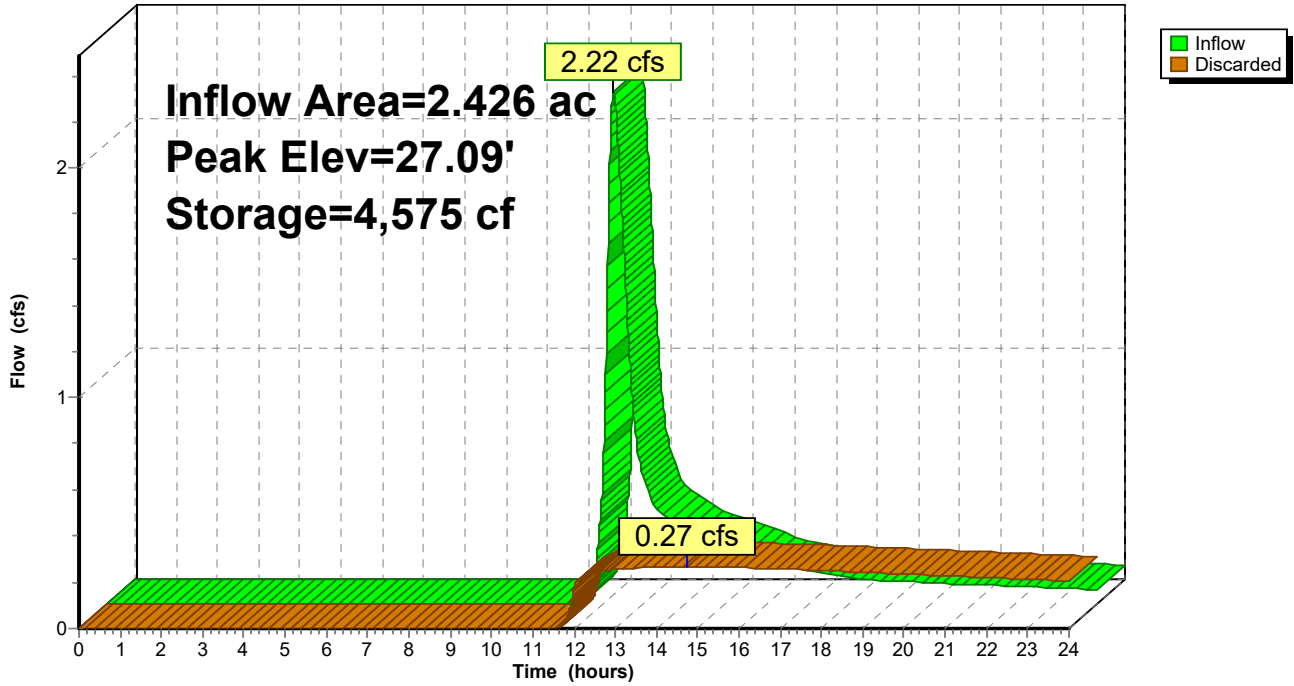
Type III 24-hr 10-year Rainfall=5.05"

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Pond 2P: Detention Basin

Hydrograph



Proposed Conditions

Type III 24-hr 25-year Rainfall=6.05"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment DA-1: Site Runoff Runoff Area=32,772 sf 66.38% Impervious Runoff Depth>3.93"
Flow Length=168' Slope=0.0100 '/' Tc=1.9 min CN=81 Runoff=3.99 cfs 0.246 af

Subcatchment DA-2: Site Runoff Runoff Area=105,667 sf 30.30% Impervious Runoff Depth>1.86"
Flow Length=355' Tc=17.9 min CN=59 Runoff=3.49 cfs 0.376 af

Pond 1P: Detention Basin Peak Elev=28.19' Storage=5,547 cf Inflow=3.99 cfs 0.246 af
Outflow=0.19 cfs 0.193 af

Pond 2P: Detention Basin Peak Elev=27.73' Storage=7,952 cf Inflow=3.49 cfs 0.376 af
Outflow=0.32 cfs 0.294 af

Total Runoff Area = 3.178 ac Runoff Volume = 0.623 af Average Runoff Depth = 2.35"
61.16% Pervious = 1.944 ac 38.84% Impervious = 1.234 ac

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Type III 24-hr 25-year Rainfall=6.05"

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Summary for Subcatchment DA-1: Site Runoff

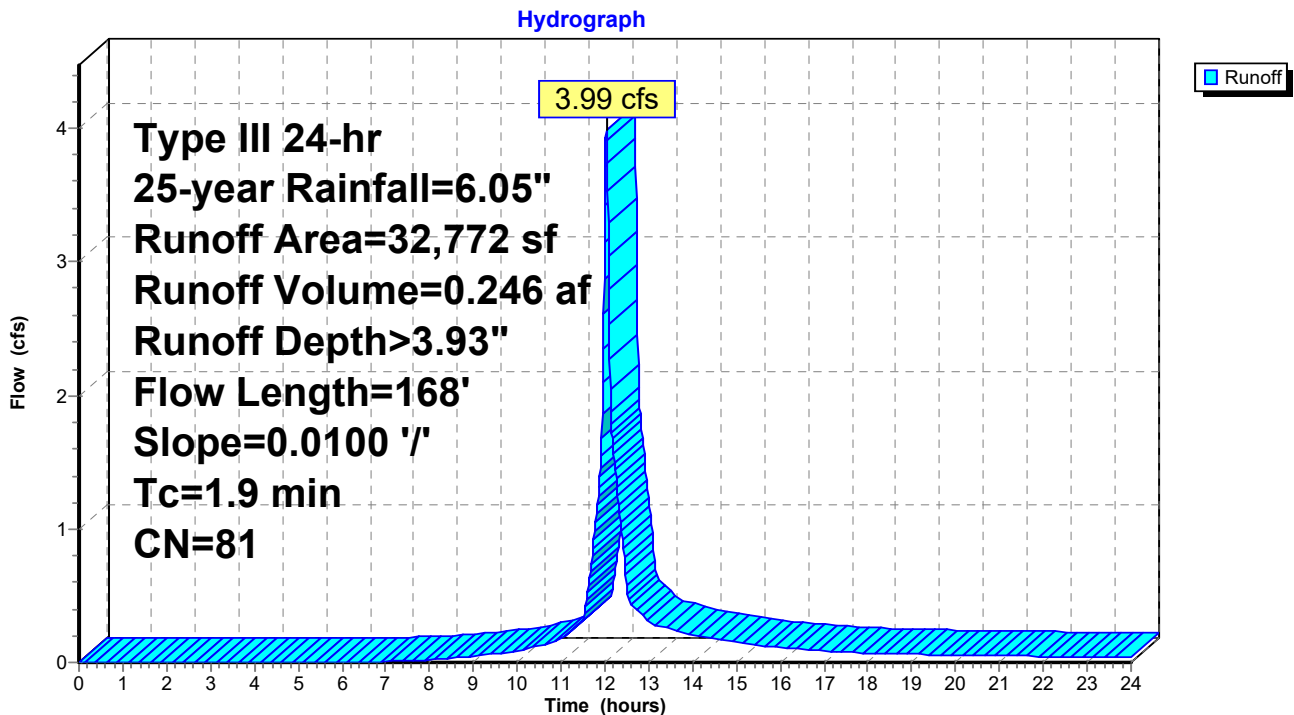
Runoff = 3.99 cfs @ 12.03 hrs, Volume= 0.246 af, Depth> 3.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.05"

Area (sf)	CN	Description
21,755	98	Paved parking, HSG A
1,140	36	Woods, Fair, HSG A
9,877	49	Pasture/grassland/range, Fair, HSG A
32,772	81	Weighted Average
11,017		33.62% Pervious Area
21,755		66.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.94		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 3.40"
1.0	118	0.0100	2.03		Shallow Concentrated Flow, B-C Paved Kv= 20.3 fps
1.9	168	Total			

Subcatchment DA-1: Site Runoff



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Type III 24-hr 25-year Rainfall=6.05"

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Summary for Subcatchment DA-2: Site Runoff

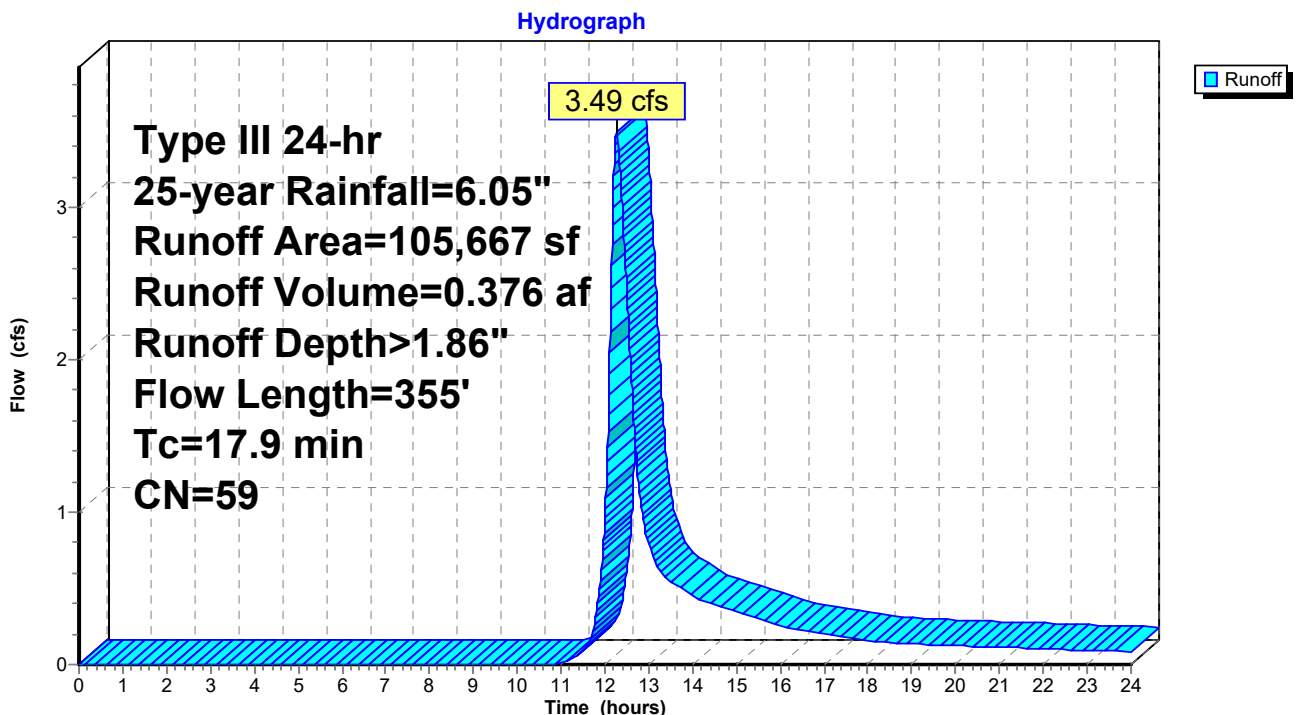
Runoff = 3.49 cfs @ 12.27 hrs, Volume= 0.376 af, Depth> 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.05"

Area (sf)	CN	Description
32,015	98	Paved parking, HSG A
42,960	36	Woods, Fair, HSG A
30,692	49	Pasture/grassland/range, Fair, HSG A
105,667	59	Weighted Average
73,652		69.70% Pervious Area
32,015		30.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.40"
5.1	215	0.0200	0.71		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
0.4	30	0.0300	1.21		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
0.4	60	0.0150	2.49		Shallow Concentrated Flow, D-E Paved Kv= 20.3 fps
17.9	355	Total			

Subcatchment DA-2: Site Runoff



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Type III 24-hr 25-year Rainfall=6.05"

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Summary for Pond 1P: Detention Basin

Inflow Area = 0.752 ac, 66.38% Impervious, Inflow Depth > 3.93" for 25-year event
 Inflow = 3.99 cfs @ 12.03 hrs, Volume= 0.246 af
 Outflow = 0.19 cfs @ 14.26 hrs, Volume= 0.193 af, Atten= 95%, Lag= 133.9 min
 Discarded = 0.19 cfs @ 14.26 hrs, Volume= 0.193 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 28.19' @ 14.26 hrs Surf.Area= 3,364 sf Storage= 5,547 cf

Plug-Flow detention time= 280.4 min calculated for 0.193 af (78% of inflow)
 Center-of-Mass det. time= 200.7 min (1,008.0 - 807.2)

Volume	Invert	Avail.Storage	Storage Description		
#1	26.00'	12,998 cf	Custom Stage Data (Conic) Listed below		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
26.00	1,725	0	0	1,725	
27.00	2,415	2,060	2,060	2,433	
28.00	3,214	2,805	4,865	3,254	
29.00	4,010	3,605	8,470	4,078	
30.00	5,067	4,528	12,998	5,162	

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.19 cfs @ 14.26 hrs HW=28.19' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.19 cfs)

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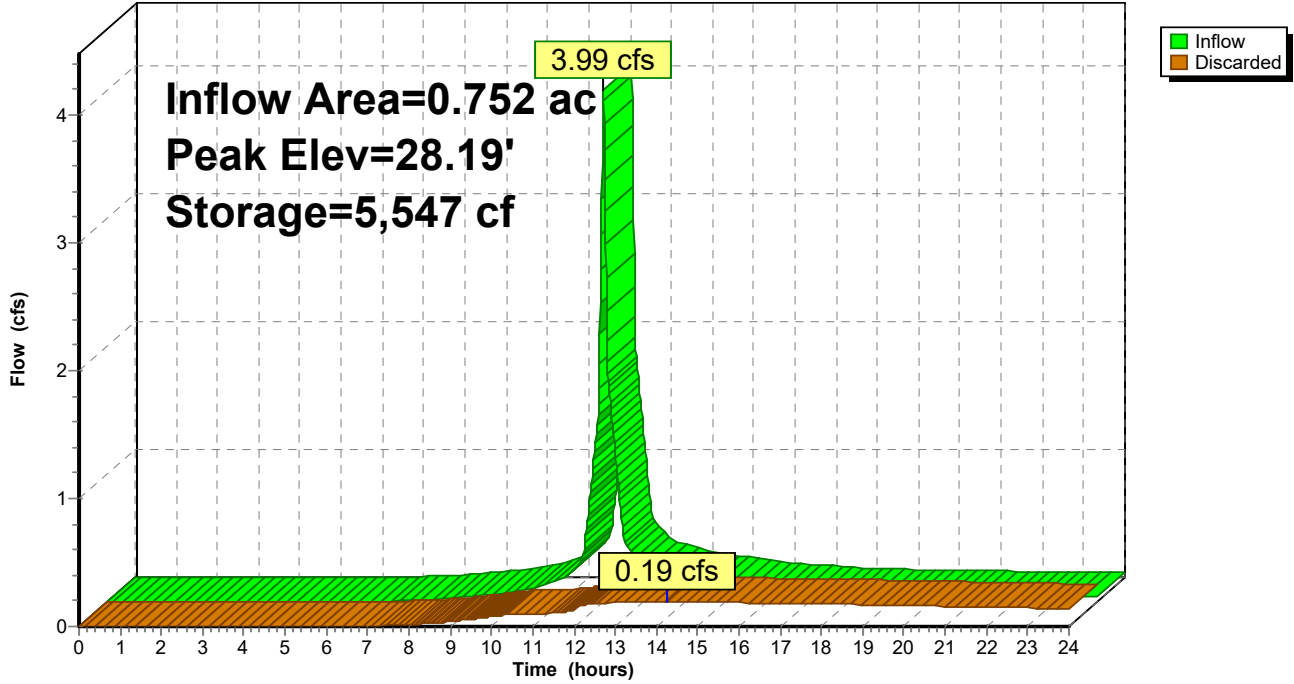
Type III 24-hr 25-year Rainfall=6.05"

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Pond 1P: Detention Basin

Hydrograph



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Type III 24-hr 25-year Rainfall=6.05"

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Summary for Pond 2P: Detention Basin

Inflow Area = 2.426 ac, 30.30% Impervious, Inflow Depth > 1.86" for 25-year event
 Inflow = 3.49 cfs @ 12.27 hrs, Volume= 0.376 af
 Outflow = 0.32 cfs @ 15.34 hrs, Volume= 0.294 af, Atten= 91%, Lag= 184.0 min
 Discarded = 0.32 cfs @ 15.34 hrs, Volume= 0.294 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 27.73' @ 15.34 hrs Surf.Area= 5,678 sf Storage= 7,952 cf

Plug-Flow detention time= 275.5 min calculated for 0.294 af (78% of inflow)
 Center-of-Mass det. time= 190.7 min (1,063.9 - 873.2)

Volume	Invert	Avail.Storage	Storage Description		
#1	26.00'	23,817 cf	Custom Stage Data (Conic) Listed below		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
26.00	3,553	0	0	3,553	
27.00	4,626	4,078	4,078	4,650	
28.00	6,075	5,334	9,412	6,121	
29.00	7,198	6,629	16,040	7,281	
30.00	8,369	7,776	23,817	8,493	

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.32 cfs @ 15.34 hrs HW=27.73' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.32 cfs)

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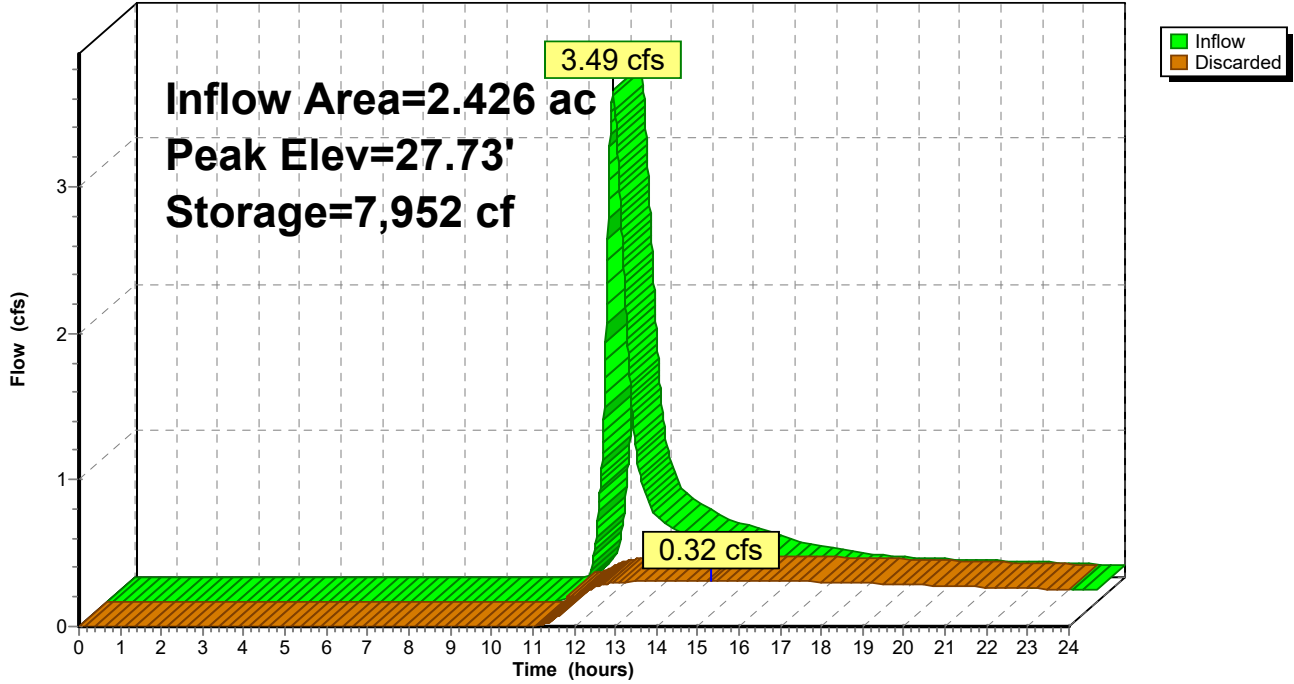
Type III 24-hr 25-year Rainfall=6.05"

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Pond 2P: Detention Basin

Hydrograph



Proposed Conditions

Type III 24-hr 100-year Rainfall=7.59"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment DA-1: Site Runoff Runoff Area=32,772 sf 66.38% Impervious Runoff Depth>5.35"
Flow Length=168' Slope=0.0100 '/' Tc=1.9 min CN=81 Runoff=5.39 cfs 0.336 af

Subcatchment DA-2: Site Runoff Runoff Area=105,667 sf 30.30% Impervious Runoff Depth>2.91"
Flow Length=355' Tc=17.9 min CN=59 Runoff=5.68 cfs 0.588 af

Pond 1P: Detention Basin Peak Elev=28.90' Storage=8,098 cf Inflow=5.39 cfs 0.336 af
Outflow=0.22 cfs 0.233 af

Pond 2P: Detention Basin Peak Elev=28.72' Storage=14,169 cf Inflow=5.68 cfs 0.588 af
Outflow=0.38 cfs 0.376 af

Total Runoff Area = 3.178 ac Runoff Volume = 0.924 af Average Runoff Depth = 3.49"
61.16% Pervious = 1.944 ac 38.84% Impervious = 1.234 ac

Proposed Conditions

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Type III 24-hr 100-year Rainfall=7.59"

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Summary for Subcatchment DA-1: Site Runoff

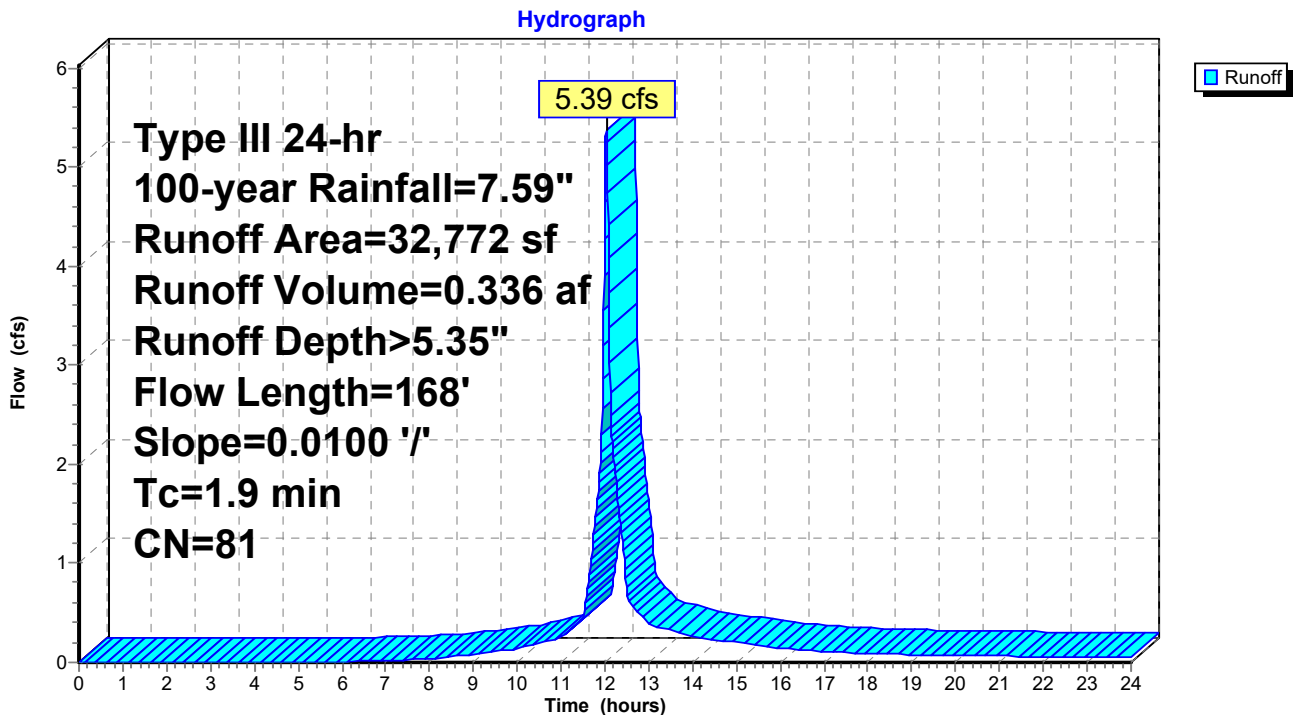
Runoff = 5.39 cfs @ 12.03 hrs, Volume= 0.336 af, Depth> 5.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.59"

Area (sf)	CN	Description
21,755	98	Paved parking, HSG A
1,140	36	Woods, Fair, HSG A
9,877	49	Pasture/grassland/range, Fair, HSG A
32,772	81	Weighted Average
11,017		33.62% Pervious Area
21,755		66.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.94		Sheet Flow, A-B Smooth surfaces n= 0.011 P2= 3.40"
1.0	118	0.0100	2.03		Shallow Concentrated Flow, B-C Paved Kv= 20.3 fps
1.9	168	Total			

Subcatchment DA-1: Site Runoff



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Type III 24-hr 100-year Rainfall=7.59"

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Summary for Subcatchment DA-2: Site Runoff

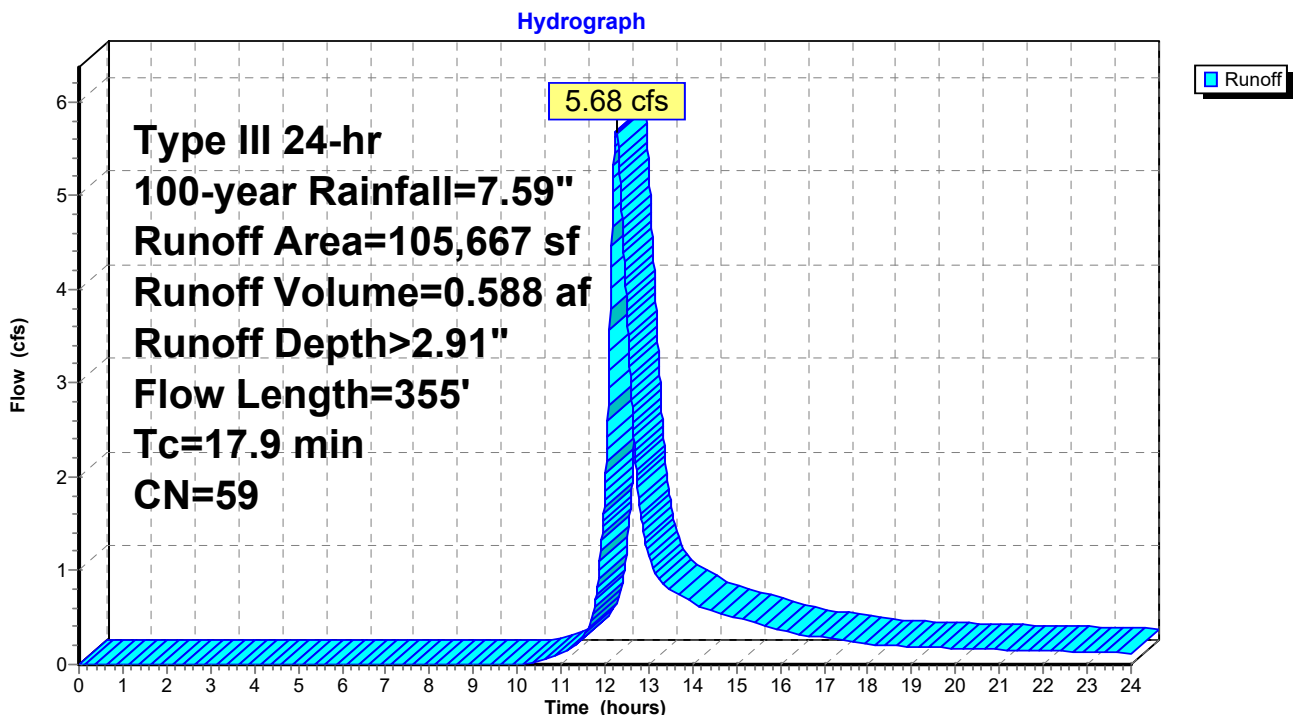
Runoff = 5.68 cfs @ 12.26 hrs, Volume= 0.588 af, Depth> 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.59"

Area (sf)	CN	Description
32,015	98	Paved parking, HSG A
42,960	36	Woods, Fair, HSG A
30,692	49	Pasture/grassland/range, Fair, HSG A
105,667	59	Weighted Average
73,652		69.70% Pervious Area
32,015		30.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0200	0.07		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.40"
5.1	215	0.0200	0.71		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
0.4	30	0.0300	1.21		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
0.4	60	0.0150	2.49		Shallow Concentrated Flow, D-E Paved Kv= 20.3 fps
17.9	355	Total			

Subcatchment DA-2: Site Runoff



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Type III 24-hr 100-year Rainfall=7.59"

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Summary for Pond 1P: Detention Basin

Inflow Area = 0.752 ac, 66.38% Impervious, Inflow Depth > 5.35" for 100-year event
 Inflow = 5.39 cfs @ 12.03 hrs, Volume= 0.336 af
 Outflow = 0.22 cfs @ 14.69 hrs, Volume= 0.233 af, Atten= 96%, Lag= 159.7 min
 Discarded = 0.22 cfs @ 14.69 hrs, Volume= 0.233 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 28.90' @ 14.69 hrs Surf.Area= 3,928 sf Storage= 8,098 cf

Plug-Flow detention time= 298.4 min calculated for 0.233 af (69% of inflow)
 Center-of-Mass det. time= 205.0 min (1,003.5 - 798.5)

Volume	Invert	Avail.Storage	Storage Description		
#1	26.00'	12,998 cf	Custom Stage Data (Conic) Listed below		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
26.00	1,725	0	0	1,725	
27.00	2,415	2,060	2,060	2,433	
28.00	3,214	2,805	4,865	3,254	
29.00	4,010	3,605	8,470	4,078	
30.00	5,067	4,528	12,998	5,162	

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.22 cfs @ 14.69 hrs HW=28.90' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.22 cfs)

Proposed Conditions

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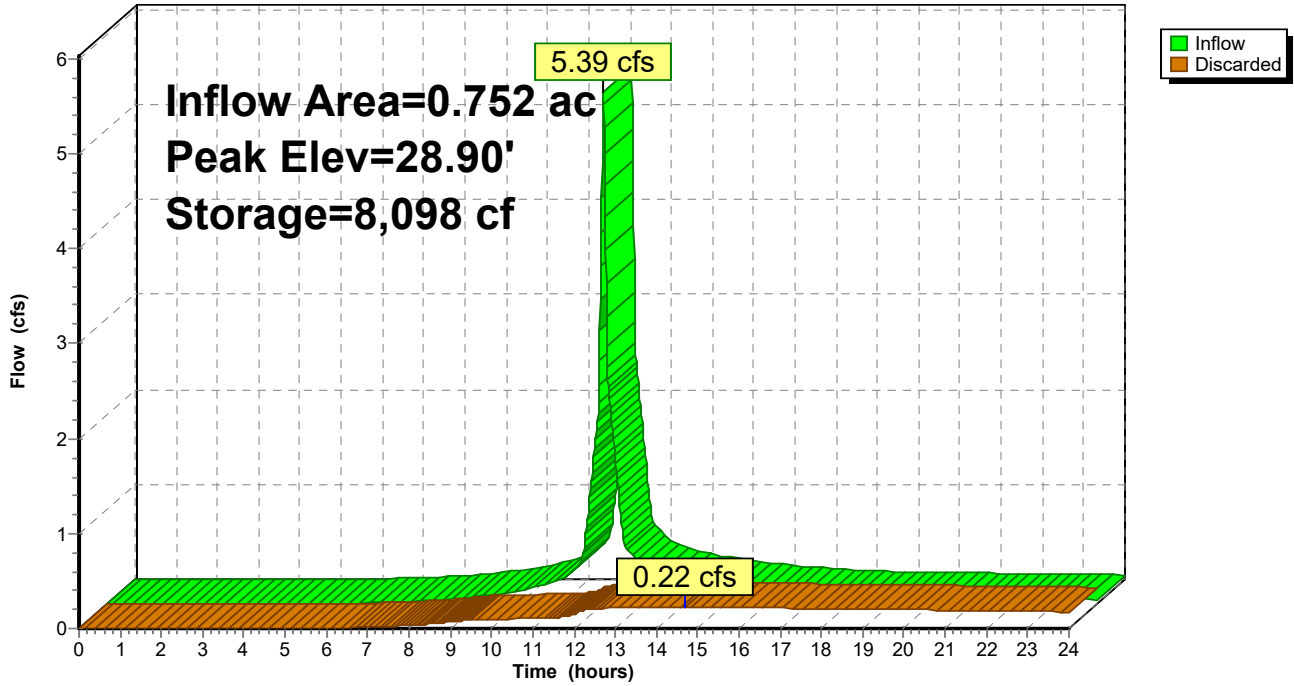
Type III 24-hr 100-year Rainfall=7.59"

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Pond 1P: Detention Basin

Hydrograph



Proposed Conditions

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Type III 24-hr 100-year Rainfall=7.59"

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Summary for Pond 2P: Detention Basin

Inflow Area = 2.426 ac, 30.30% Impervious, Inflow Depth > 2.91" for 100-year event
 Inflow = 5.68 cfs @ 12.26 hrs, Volume= 0.588 af
 Outflow = 0.38 cfs @ 15.87 hrs, Volume= 0.376 af, Atten= 93%, Lag= 216.7 min
 Discarded = 0.38 cfs @ 15.87 hrs, Volume= 0.376 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 28.72' @ 15.87 hrs Surf.Area= 6,881 sf Storage= 14,169 cf

Plug-Flow detention time= 312.0 min calculated for 0.376 af (64% of inflow)
 Center-of-Mass det. time= 202.8 min (1,062.5 - 859.7)

Volume	Invert	Avail.Storage	Storage Description		
#1	26.00'	23,817 cf	Custom Stage Data (Conic) Listed below		
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
26.00	3,553	0	0	3,553	
27.00	4,626	4,078	4,078	4,650	
28.00	6,075	5,334	9,412	6,121	
29.00	7,198	6,629	16,040	7,281	
30.00	8,369	7,776	23,817	8,493	

Device	Routing	Invert	Outlet Devices
#1	Discarded	26.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.38 cfs @ 15.87 hrs HW=28.72' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.38 cfs)

Proposed Conditions

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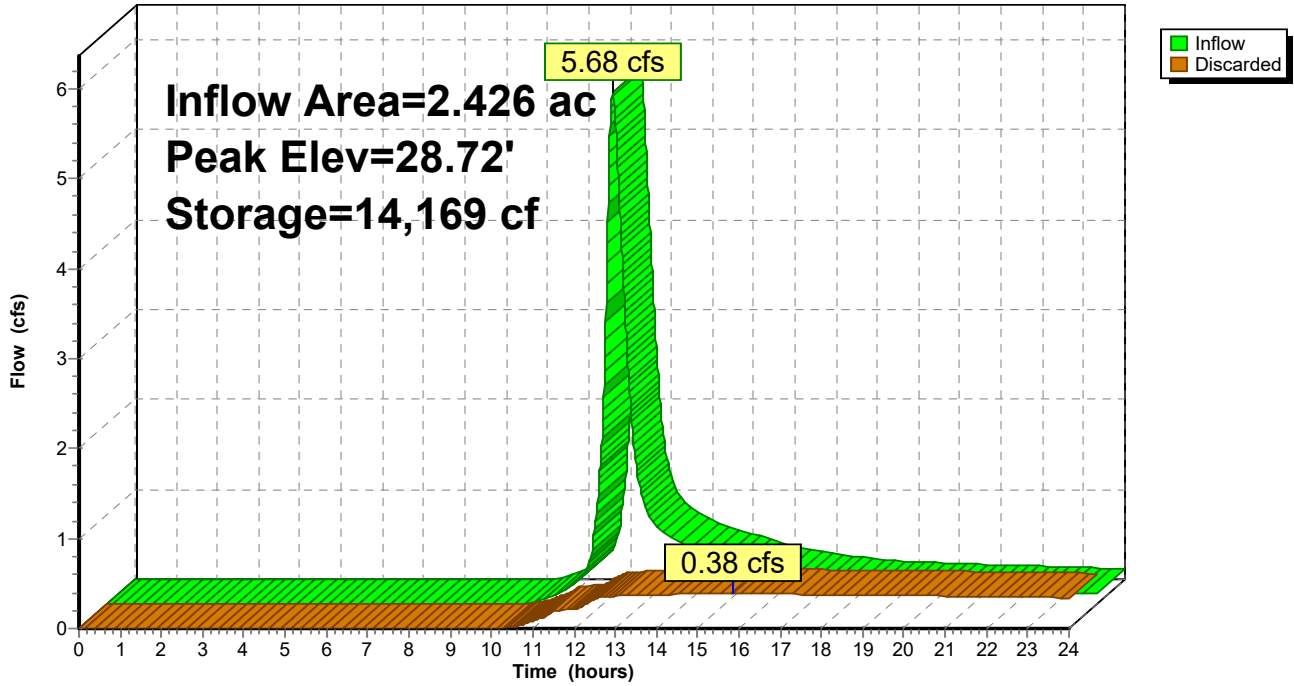
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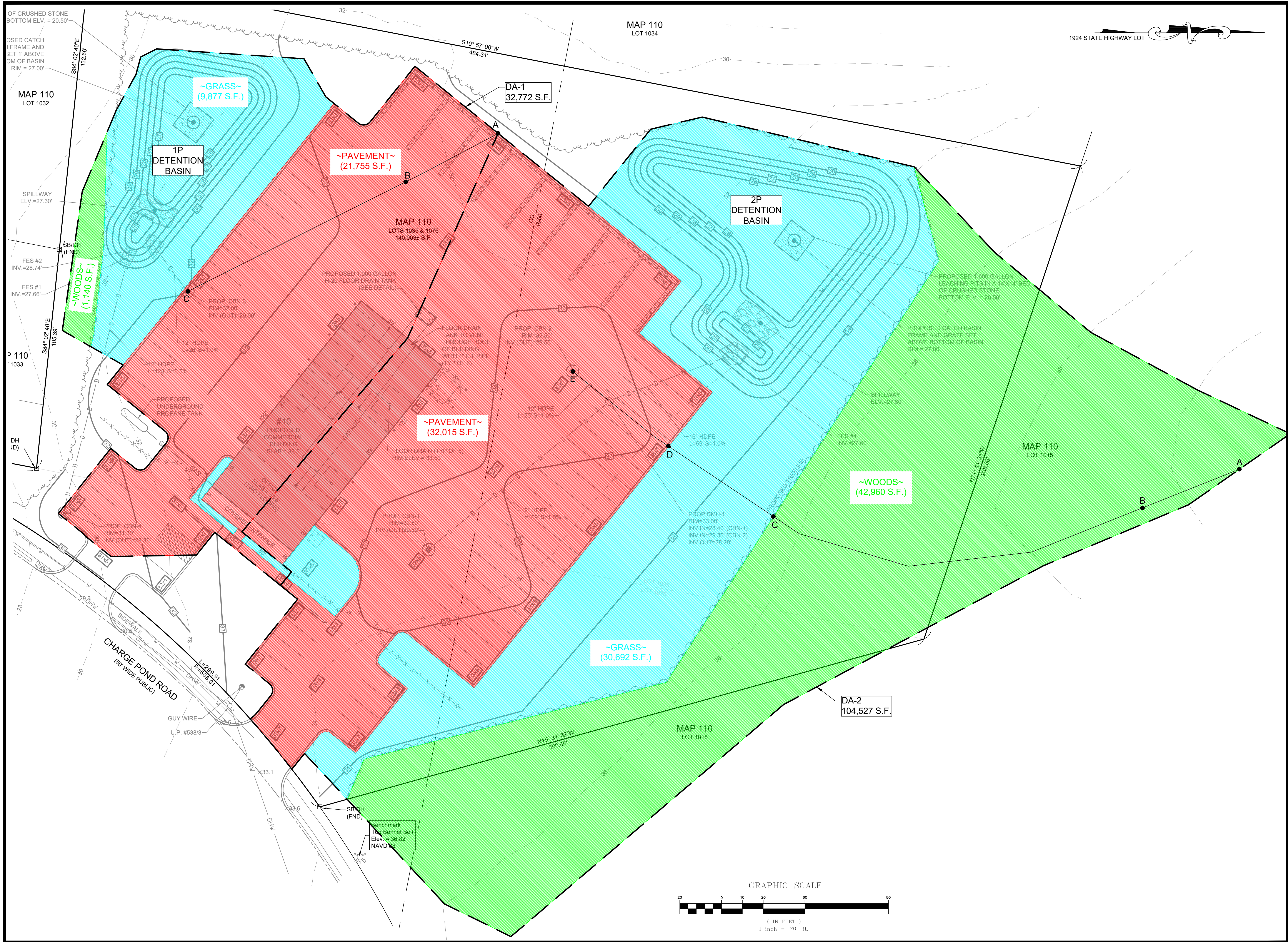
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Pond 2P: Detention Basin

Hydrograph





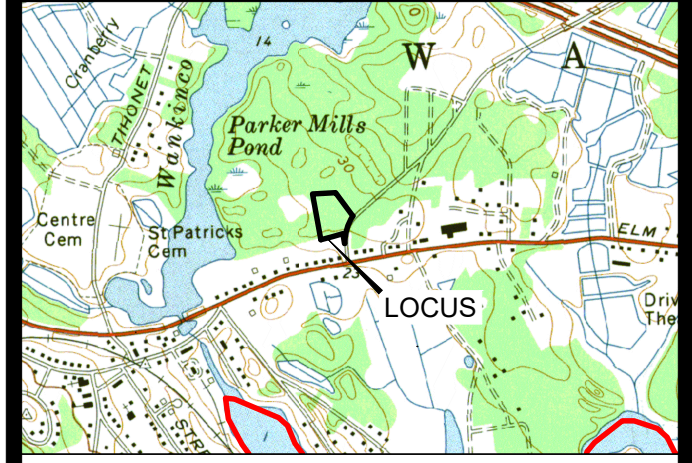
MAP 110
LOT 1034

1924 STATE HIGHWAY LOT

MAP 110
LOT 1032

MAP 110
LOTS 1035 & 1076
140,003± S.F.

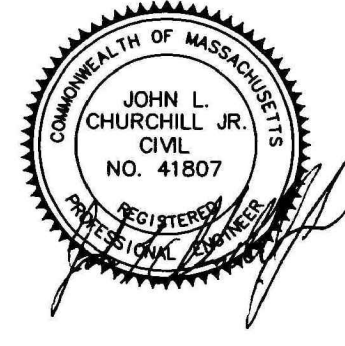
MAP 110
LOT 1015



LOCUS MAP
SCALE 1" = 2000'



JOHN L. CHURCHILL JR., P.L.S. DATE



JOHN L. CHURCHILL JR., P.E. DATE

PROPOSED SITE PLAN
AT
8 & 10 CHARGE POND ROAD
IN
WAREHAM
MASSACHUSETTS
(PLYMOUTH COUNTY)
DRAINAGE AREAS

REVISIONS:

No.	DATE	DESC.
1	2-9-22	BUILDING LAYOUT

PREPARED FOR:
DAVID SERGI
21 PATTERSON BROOK ROAD
SUITE G
W. WAREHAM, MA 02576

PREPARED BY:
JC ENGINEERING, INC
2854 CRANBERRY HIGHWAY
EAST WAREHAM, MA 02538
508-273-0377

DATE:	DECEMBER 27, 2021
FIELD:	CB/RB
CALC./DESIGN:	SJI
DRAWN:	SJI
CHECK:	JLC
JOB NO.:	5942

