

Summit Engineering & Survey, Inc.

HYDRAULIC / HYDROLOGIC CALCULATIONS

**Padding Site Plan
Stafford Street
Leicester Massachusetts**

Prepared For:
Schold Development, LLC

Prepared By:
**SUMMIT ENGINEERING & SURVEY, INC.
710 MAIN STREET
OXFORD, MASSACHUSETTS**

March 7, 2022

TABLE OF CONTENTS

Cover Page

Table of Contents

Drainage Summary

Stormwater Management Calculations

Standard #2 Peak Discharge Rates

Standard #3 Loss of Annual Recharge

Standard #4 80% TSS Removal

Standard #9 Operation & Maintenance Plan

Appendices

Pre-Development Diagram

Post- Development Diagram

Pre-Development Watershed Subcatchments

Post-Development Watershed Subcatchments

Soil Maps

Flood Map

Summit Engineering & Survey, Inc.

710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

DRAINAGE SUMMARY

Summit Engineering & Survey, Inc. is pleased to provide the following Hydraulic / Hydrologic analysis for the proposed site plan for Schold Development. The proposed project is located on Stafford Street in Leicester, Massachusetts. The existing site consists of an undeveloped parcel, much of it wooded with mature woodland. The hydrologic conditions were analyzed using TR-55 and HydroCAD® for the 2, 10 and 100 year storm events utilizing Technical Paper 40, 24 hour Rainfall events.

Project site consists of the grading a padding site for a future site plan for a commercial site. The project as designed conforms to the Massachusetts DEP Stormwater Management Policy.

EXISTING CONDITIONS: The project is located on Stafford Street near the intersection of Auburn Street. The parcel is 37.1 acres in size. The site wooded and has not been disturbed. There is an existing wetland that running parallel with Auburn Street.

The topography of the site is steep, which slopes from east (888) to west (752), which is toward west property line.

For the purpose of the analysis of the effect on the padding site grading, the site was analyzed as one watershed. In the Pre-Development Condition, Subcatchment 1 represents the tributary area of the property that flows to the east property line and the existing wetlands.

According to the online USGS soil survey, the analyzed area consists of soils with "C" hydrologic ratings. Per the soil map the soil on site are Paxton. The cover consists of predominantly woodland area.

PROPOSED CONDITIONS:

The proposed condition of the site will consists of a woodland area and gravel area set at specific elevation for building padding areas for future commercial site. The proposed drainage system will consist of diverter berms and swales to collect and direct runoff during the grading of the pad site. There will be two temporary basins constructed to mitigate runoff as well as treatment of runoff prior to discharge into the existing basin located on the site.

The site will be re-graded in the future to support a future commercial project and control stormwater in accordance with the Massachusetts.

In order to analyze the surface water flows, the site was divided into multiple Subcatchments, Ponds and a Reaches

In summary, the peak rates of runoff were compared under pre-development and post-development conditions for analysis of the 2 year, 10 year, 25 year and 100 year storm events. The following is a **Peak Discharge Summary Table**:

Design Point Analysis:

Watershed		Design Event			
		2 Year	10 Year	25 Year	100 Year
Pre-Development	IP#1E	20.50	45.69	54.92	84.12
Post Development	IP#1P	8.41	22.60	30.15	51.20

DEP Stormwater Management Standards:

Standard #1: The proposed changes will not cause erosion in adjacent water of the Commonwealth, as BMP measures are proposed in accordance with the design requirements of the Stormwater Management handbook. The Erosion & Sedimentation Control Plan provides for the installation of siltation barriers, temporary basins, temporary construction entrances and outlines intermediary measures to control runoff during construction and after construction.

Standard #2: The proposed development peak discharge rates for the total off-site flow are less than or equal to pre-development discharge rates for the 2 year, 10 year, and 100 year storm events for the design points analyzed. Attached calculations show how the site mitigates the increased flow rates due to surface changes from the site development.

Standard #3: The proposed project does not propose any impervious area at this time. The proposed future site will address this Standard as required by Stormwater Management. The proposed basins will address this Standard as it was designed to infiltrate runoff from the Padding areas after pre-treatment. The proposed basins will be monitored throughout the construction to ensure that the Infiltration depths are designed to drain in under 72 hours as required by the Policy.

Standard #4: Over 80% TSS shall occur based on the BMP measurements provided. The treatment train varies for each section. TSS worksheets are provided in the report for each treatment train in the site.

Standard #5: The proposed development will not generate higher potential pollutant loads and therefore will not require additional BMP practices.

Standard #6: The proposed project is not near a critical area.

Standard #7: The proposed project is not a redevelopment project.

Standard #8: Erosion and sediment control measures are proposed as part of the proposed project.

Standard #9: An Operation & Maintenance plan is provided within this document

Standard #10: This project does not propose any illicit discharges.

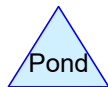
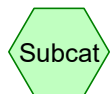
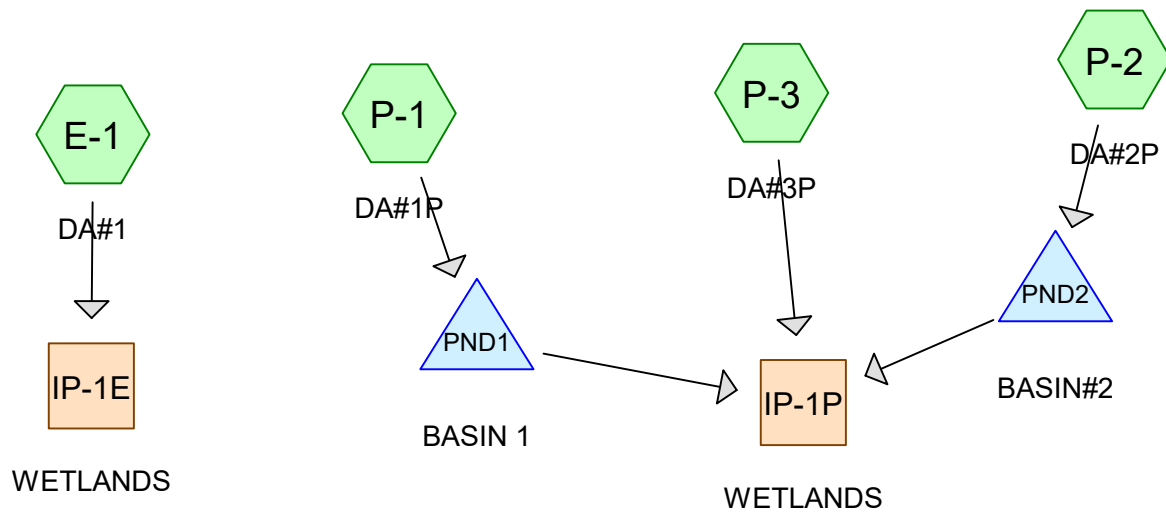
Summit Engineering & Survey, Inc.

710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

STANDARD #2- PEAK DISCHARGE RATES

Summit Engineering & Survey, Inc.

710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Printed 3/7/2022

Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
11.859	74	>75% Grass cover, Good, HSG C (P-1, P-2, P-3)
45.064	70	Woods, Good, HSG C (E-1, P-1, P-2, P-3)
56.923	71	TOTAL AREA

pre-port development

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 3

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
56.923	HSG C	E-1, P-1, P-2, P-3
0.000	HSG D	
0.000	Other	
56.923		TOTAL AREA

pre-port development

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	11.859	0.000	0.000	11.859	>75% Grass cover, Good	P-1, P-2, P-3
0.000	0.000	45.064	0.000	0.000	45.064	Woods, Good	E-1, P-1, P-2, P-3
0.000	0.000	56.923	0.000	0.000	56.923	TOTAL AREA	

pre-port development*Type III 24-hr 2YR Rainfall=3.40"*

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 5

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 E-1: DA#1

Runoff Area=1,239,786 sf 0.00% Impervious Runoff Depth>0.85"
Flow Length=1,200' Tc=17.1 min CN=70 Runoff=20.50 cfs 2.024 af

Subcatchment P-1: DA#1P

Runoff Area=299,741 sf 0.00% Impervious Runoff Depth>0.96"
Flow Length=956' Tc=15.3 min CN=72 Runoff=5.90 cfs 0.549 af

Subcatchment P-2: DA#2P

Runoff Area=467,864 sf 0.00% Impervious Runoff Depth>0.96"
Flow Length=1,086' Tc=15.9 min CN=72 Runoff=9.10 cfs 0.857 af

Subcatchment P-3: DA#3P

Runoff Area=472,160 sf 0.00% Impervious Runoff Depth>0.90"
Flow Length=765' Tc=16.9 min CN=71 Runoff=8.41 cfs 0.817 af

Reach IP-1E: WETLANDS

Inflow=20.50 cfs 2.024 af
Outflow=20.50 cfs 2.024 af

Reach IP-1P: WETLANDS

Inflow=8.41 cfs 1.482 af
Outflow=8.41 cfs 1.482 af

Pond PND1: BASIN 1

Peak Elev=807.84' Storage=15,092 cf Inflow=5.90 cfs 0.549 af
Outflow=0.59 cfs 0.230 af

Pond PND2: BASIN#2

Peak Elev=812.49' Storage=20,582 cf Inflow=9.10 cfs 0.857 af
Outflow=1.20 cfs 0.435 af

Total Runoff Area = 56.923 ac Runoff Volume = 4.246 af Average Runoff Depth = 0.90"
100.00% Pervious = 56.923 ac 0.00% Impervious = 0.000 ac

pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2YR Rainfall=3.40"

Printed 3/7/2022

Page 6

Summary for Subcatchment E-1: DA#1

Runoff = 20.50 cfs @ 12.26 hrs, Volume= 2.024 af, Depth> 0.85"

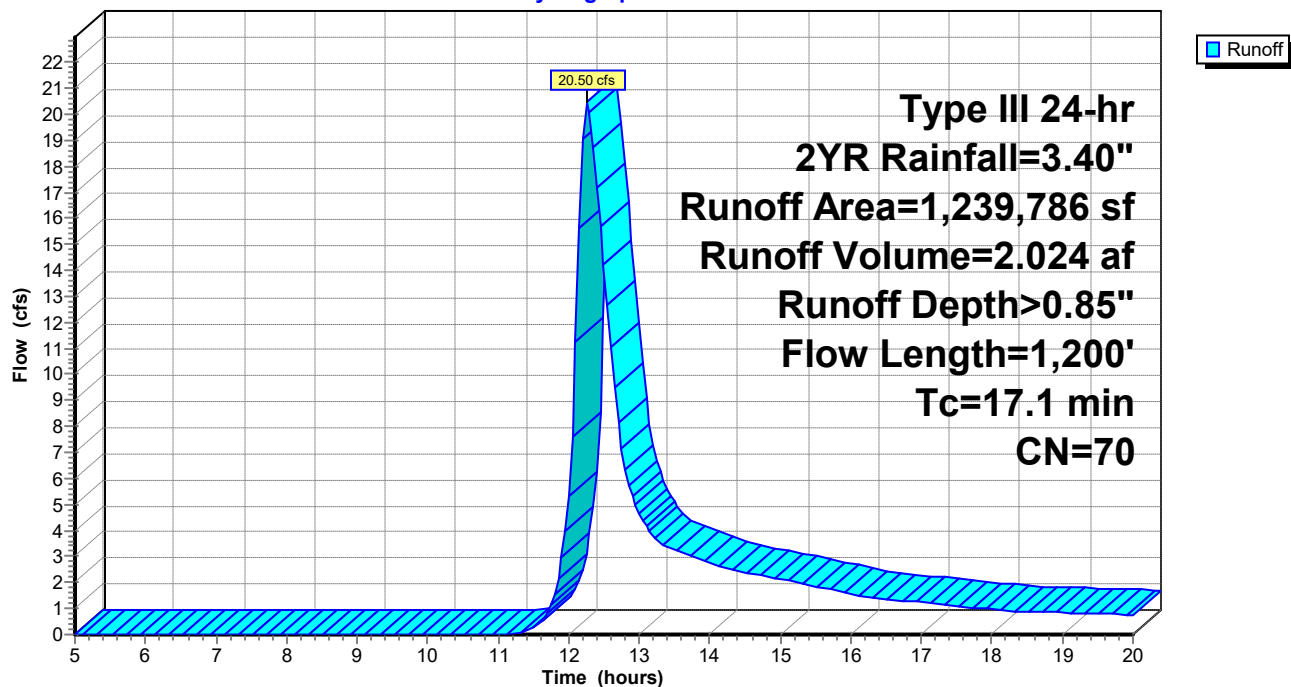
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
1,239,786	70	Woods, Good, HSG C
1,239,786		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0500	0.24		Sheet Flow, TRAVEL PATH A TO B
13.6	1,150	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C
					Woodland Kv= 5.0 fps
17.1	1,200	Total			

Subcatchment E-1: DA#1

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2YR Rainfall=3.40"

Printed 3/7/2022

Page 7

Summary for Subcatchment P-1: DA#1P

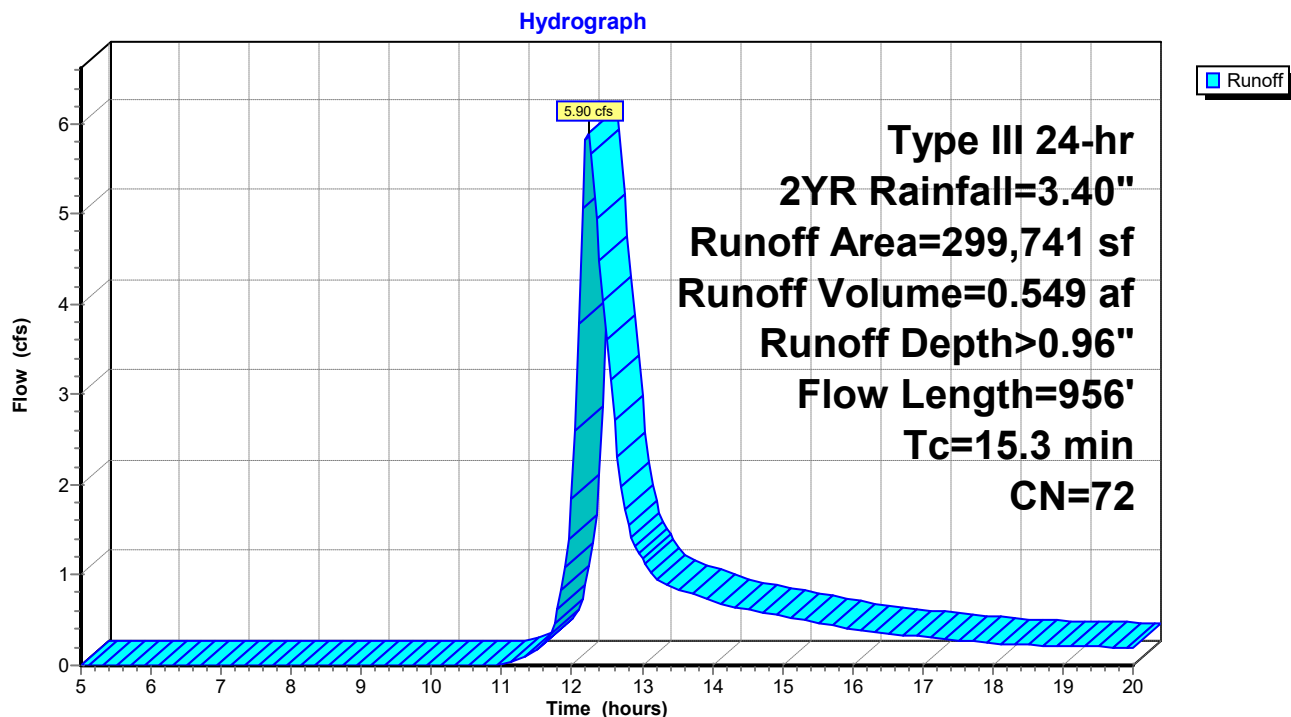
Runoff = 5.90 cfs @ 12.23 hrs, Volume= 0.549 af, Depth> 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
133,103	74	>75% Grass cover, Good, HSG C
166,638	70	Woods, Good, HSG C
299,741	72	Weighted Average
299,741		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL PATH A TO B Woods: Light underbrush n= 0.400 P2= 3.20"
4.3	364	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
2.5	542	0.0500	3.60		Shallow Concentrated Flow, TRAVEL PATH C TO D Unpaved Kv= 16.1 fps
15.3	956	Total			

Subcatchment P-1: DA#1P



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2YR Rainfall=3.40"

Printed 3/7/2022

Page 8

Summary for Subcatchment P-2: DA#2P

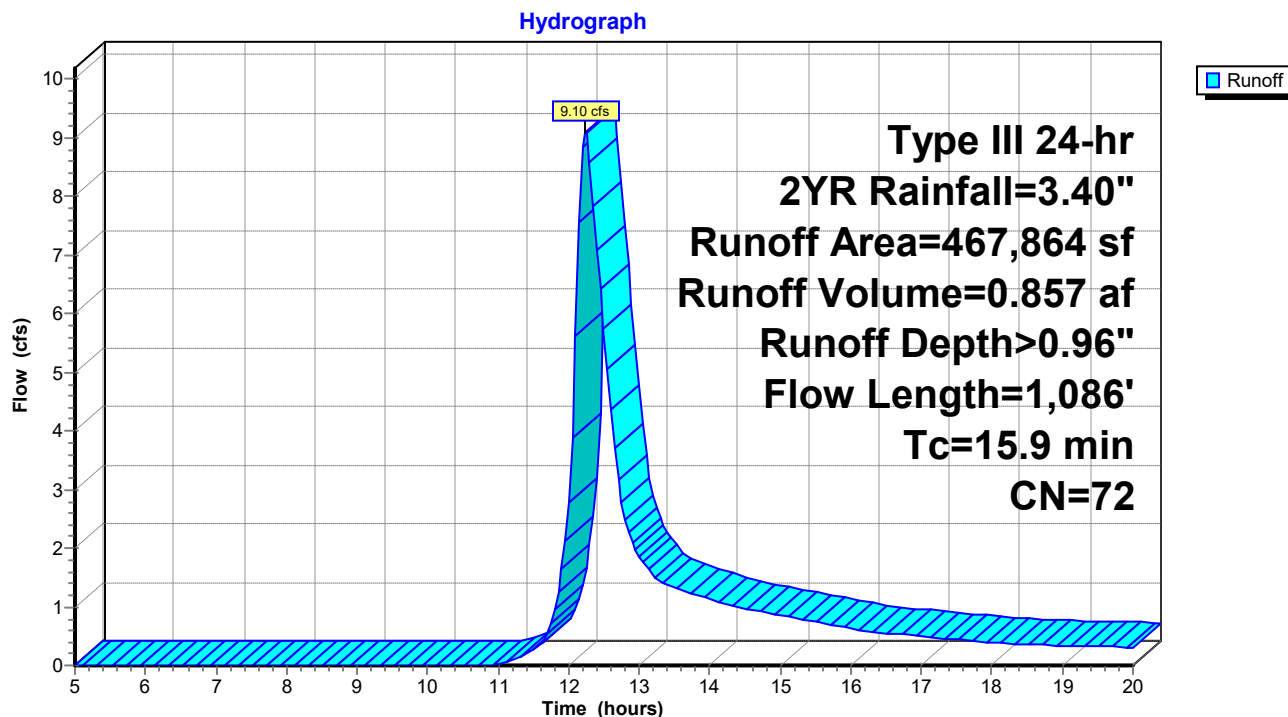
Runoff = 9.10 cfs @ 12.24 hrs, Volume= 0.857 af, Depth> 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
215,212	74	>75% Grass cover, Good, HSG C
252,652	70	Woods, Good, HSG C
467,864	72	Weighted Average
467,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL PATH A TO B Woods: Light underbrush n= 0.400 P2= 3.20"
4.3	364	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
3.1	672	0.0500	3.60		Shallow Concentrated Flow, TRAVEL PATH C TO D Unpaved Kv= 16.1 fps
15.9	1,086	Total			

Subcatchment P-2: DA#2P



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2YR Rainfall=3.40"

Printed 3/7/2022

Page 9

Summary for Subcatchment P-3: DA#3P

Runoff = 8.41 cfs @ 12.26 hrs, Volume= 0.817 af, Depth> 0.90"

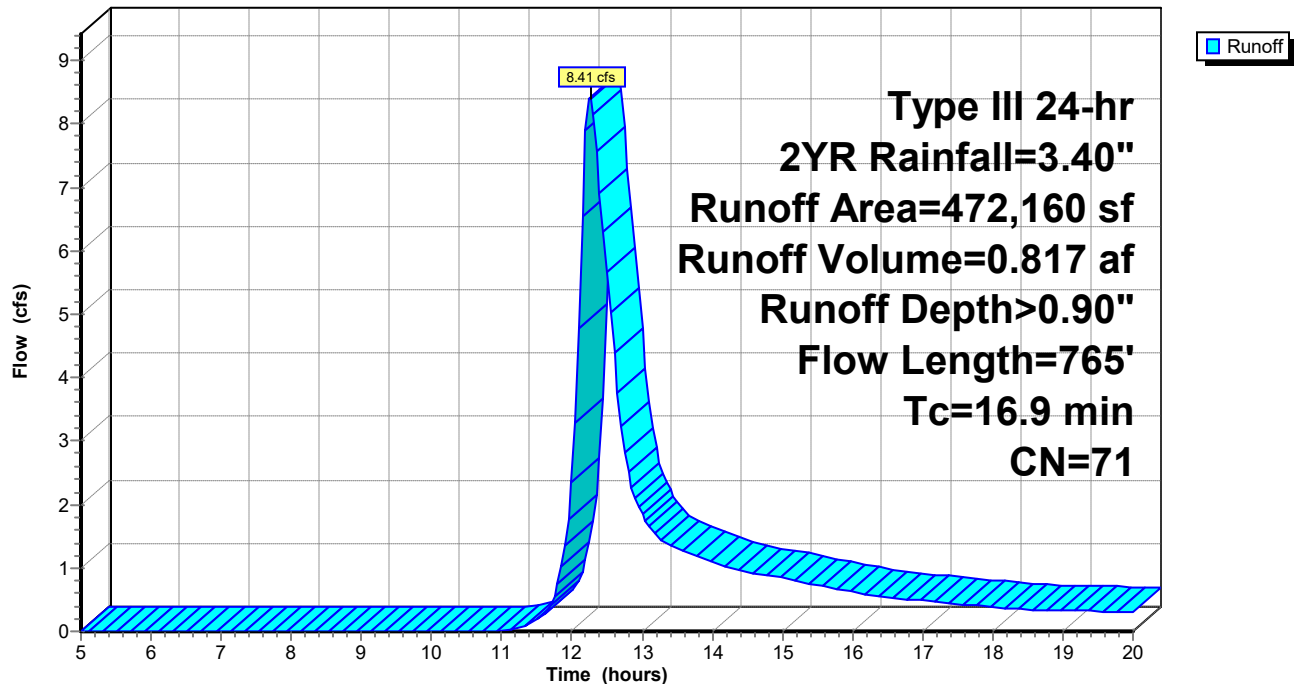
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.40"

Area (sf)	CN	Description
168,262	74	>75% Grass cover, Good, HSG C
303,898	70	Woods, Good, HSG C
472,160	71	Weighted Average
472,160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL A TO B
					Woods: Light underbrush n= 0.400 P2= 3.20"
8.4	715	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C
					Woodland Kv= 5.0 fps
16.9	765	Total			

Subcatchment P-3: DA#3P

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2YR Rainfall=3.40"

Printed 3/7/2022

Page 10

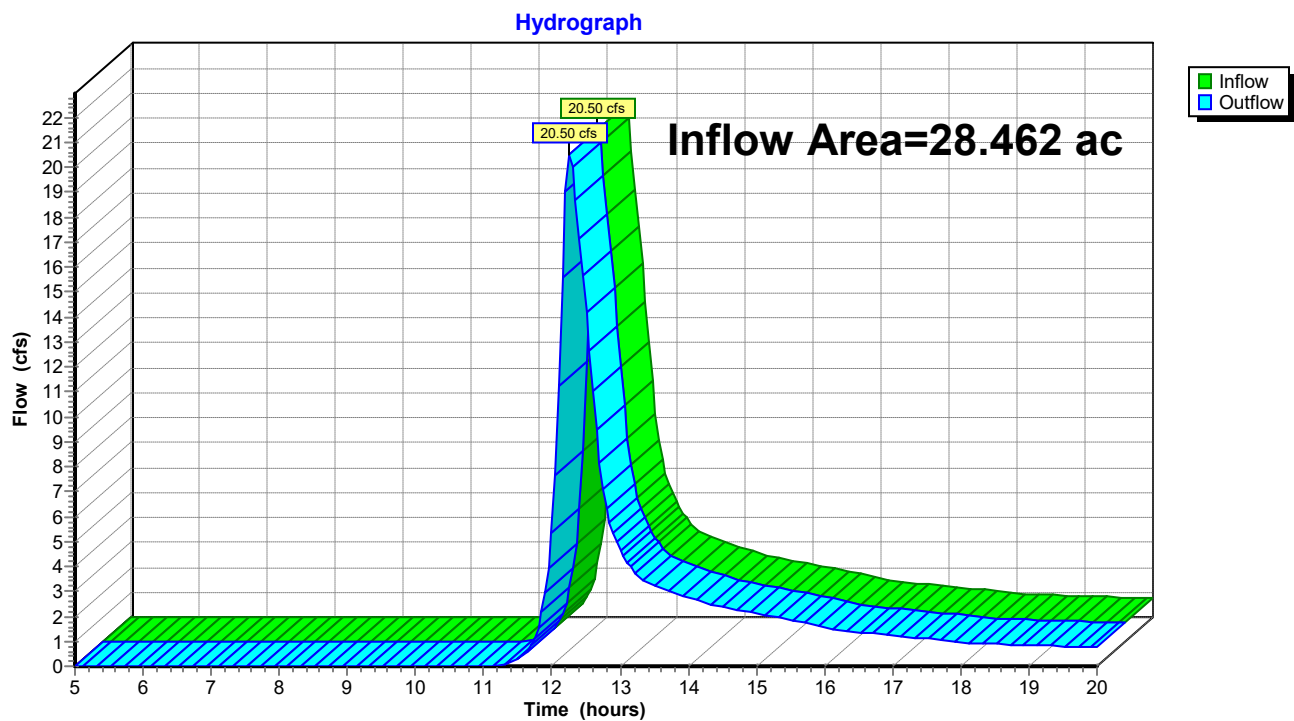
Summary for Reach IP-1E: WETLANDS

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 28.462 ac, 0.00% Impervious, Inflow Depth > 0.85" for 2YR event
Inflow = 20.50 cfs @ 12.26 hrs, Volume= 2.024 af
Outflow = 20.50 cfs @ 12.26 hrs, Volume= 2.024 af, Atten= 0%, Lag= 0.0 min

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

Reach IP-1E: WETLANDS



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2YR Rainfall=3.40"

Printed 3/7/2022

Page 11

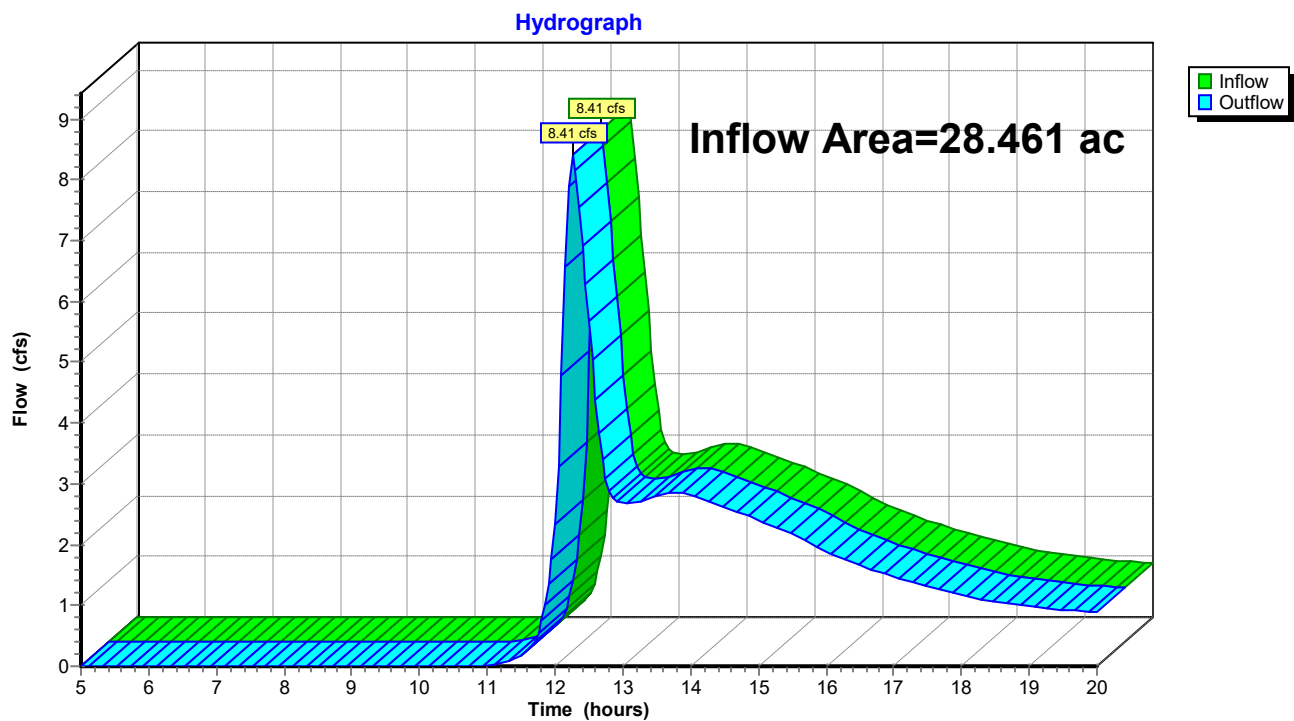
Summary for Reach IP-1P: WETLANDS

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 28.461 ac, 0.00% Impervious, Inflow Depth > 0.62" for 2YR event
Inflow = 8.41 cfs @ 12.26 hrs, Volume= 1.482 af
Outflow = 8.41 cfs @ 12.26 hrs, Volume= 1.482 af, Atten= 0%, Lag= 0.0 min

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

Reach IP-1P: WETLANDS



pre-port development

Type III 24-hr 2YR Rainfall=3.40"

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 12

Summary for Pond PND1: BASIN 1

Inflow Area = 6.881 ac, 0.00% Impervious, Inflow Depth > 0.96" for 2YR event
 Inflow = 5.90 cfs @ 12.23 hrs, Volume= 0.549 af
 Outflow = 0.59 cfs @ 14.68 hrs, Volume= 0.230 af, Atten= 90%, Lag= 146.8 min
 Primary = 0.59 cfs @ 14.68 hrs, Volume= 0.230 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 807.84' @ 14.68 hrs Surf.Area= 9,035 sf Storage= 15,092 cf

Plug-Flow detention time= 235.5 min calculated for 0.230 af (42% of inflow)
 Center-of-Mass det. time= 141.4 min (968.7 - 827.3)

Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	36,818 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

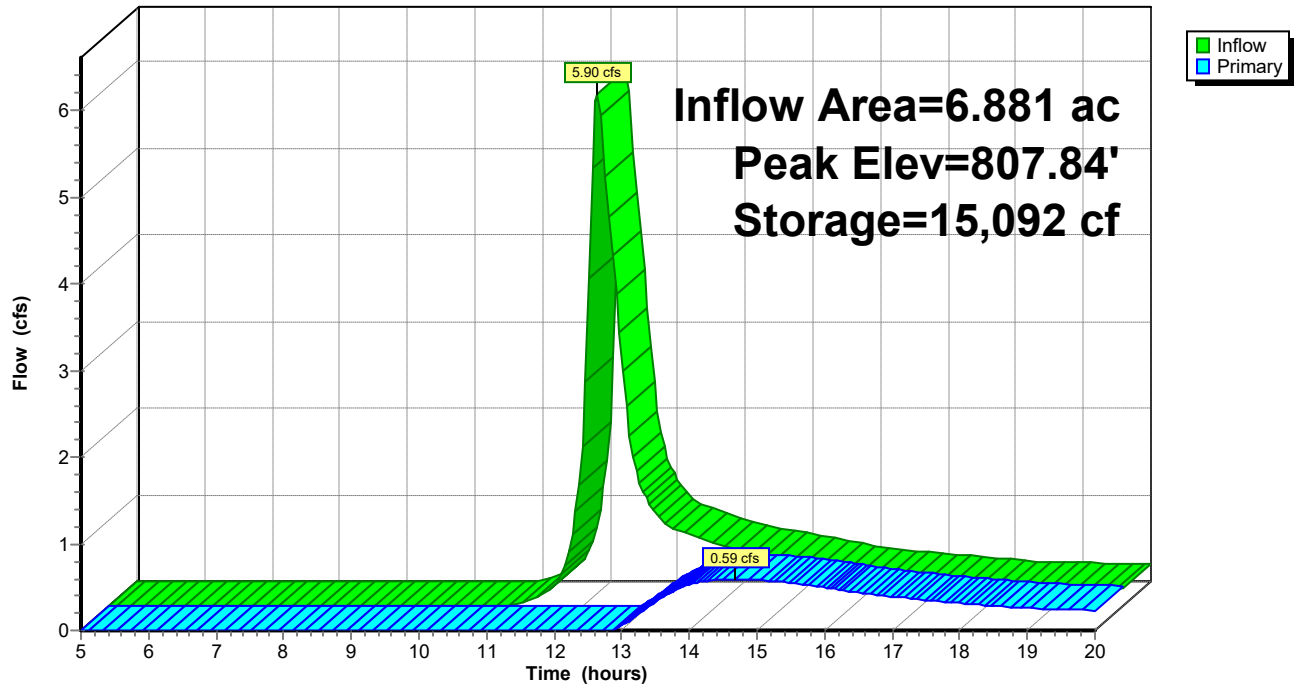
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	7,384	0	0
808.00	9,180	16,564	16,564
810.00	11,074	20,254	36,818

Device	Routing	Invert	Outlet Devices
#1	Primary	807.50'	18.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.59 cfs @ 14.68 hrs HW=807.84' (Free Discharge)
 ↑ **1=Orifice/Grate** (Orifice Controls 0.59 cfs @ 1.98 fps)

Pond PND1: BASIN 1

Hydrograph



pre-port development

Type III 24-hr 2YR Rainfall=3.40"

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 14

Summary for Pond PND2: BASIN#2

Inflow Area = 10.741 ac, 0.00% Impervious, Inflow Depth > 0.96" for 2YR event
 Inflow = 9.10 cfs @ 12.24 hrs, Volume= 0.857 af
 Outflow = 1.20 cfs @ 13.81 hrs, Volume= 0.435 af, Atten= 87%, Lag= 93.9 min
 Primary = 1.20 cfs @ 13.81 hrs, Volume= 0.435 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 812.49' @ 13.81 hrs Surf.Area= 9,588 sf Storage= 20,582 cf

Plug-Flow detention time= 201.1 min calculated for 0.435 af (51% of inflow)
 Center-of-Mass det. time= 111.8 min (939.6 - 827.8)

Volume	Invert	Avail.Storage	Storage Description
#1	810.00'	61,451 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

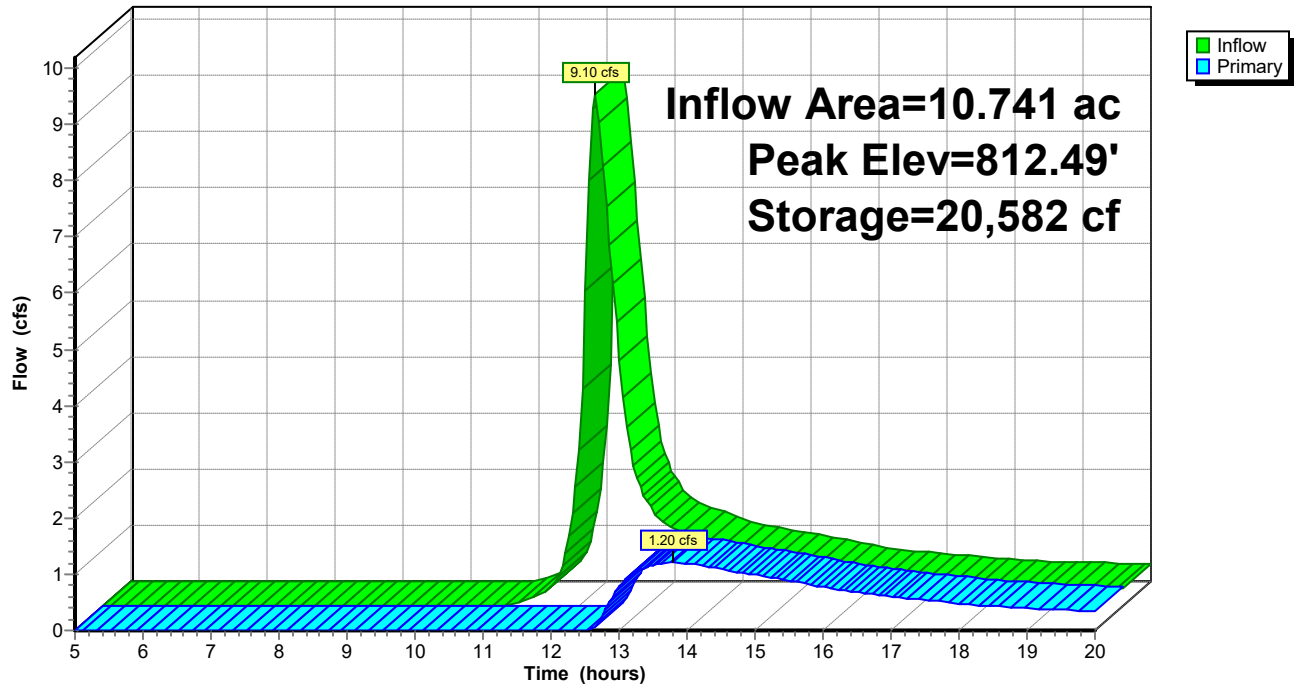
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
810.00	6,983	0	0
812.00	9,030	16,013	16,013
814.00	11,303	20,333	36,346
816.00	13,802	25,105	61,451

Device	Routing	Invert	Outlet Devices
#1	Primary	812.00'	18.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=1.20 cfs @ 13.81 hrs HW=812.49' (Free Discharge)
 ↑ **1=Orifice/Grate** (Orifice Controls 1.20 cfs @ 2.39 fps)

Pond PND2: BASIN#2

Hydrograph



pre-port development*Type III 24-hr 10YR Rainfall=4.90"*

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 16

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 E-1: DA#1

Runoff Area=1,239,786 sf 0.00% Impervious Runoff Depth>1.80"
Flow Length=1,200' Tc=17.1 min CN=70 Runoff=45.69 cfs 4.264 af

Subcatchment P-1: DA#1P

Runoff Area=299,741 sf 0.00% Impervious Runoff Depth>1.95"
Flow Length=956' Tc=15.3 min CN=72 Runoff=12.61 cfs 1.119 af

Subcatchment P-2: DA#2P

Runoff Area=467,864 sf 0.00% Impervious Runoff Depth>1.95"
Flow Length=1,086' Tc=15.9 min CN=72 Runoff=19.30 cfs 1.746 af

Subcatchment P-3: DA#3P

Runoff Area=472,160 sf 0.00% Impervious Runoff Depth>1.87"
Flow Length=765' Tc=16.9 min CN=71 Runoff=18.27 cfs 1.692 af

Reach IP-1E: WETLANDS

Inflow=45.69 cfs 4.264 af
Outflow=45.69 cfs 4.264 af

Reach IP-1P: WETLANDS

Inflow=22.60 cfs 3.786 af
Outflow=22.60 cfs 3.786 af

Pond PND1: BASIN 1

Peak Elev=808.51' Storage=21,379 cf Inflow=12.61 cfs 1.119 af
Outflow=4.34 cfs 0.787 af

Pond PND2: BASIN#2

Peak Elev=813.52' Storage=31,056 cf Inflow=19.30 cfs 1.746 af
Outflow=7.48 cfs 1.307 af

Total Runoff Area = 56.923 ac Runoff Volume = 8.821 af Average Runoff Depth = 1.86"
100.00% Pervious = 56.923 ac 0.00% Impervious = 0.000 ac

pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10YR Rainfall=4.90"

Printed 3/7/2022

Page 17

Summary for Subcatchment E-1: DA#1

Runoff = 45.69 cfs @ 12.25 hrs, Volume= 4.264 af, Depth> 1.80"

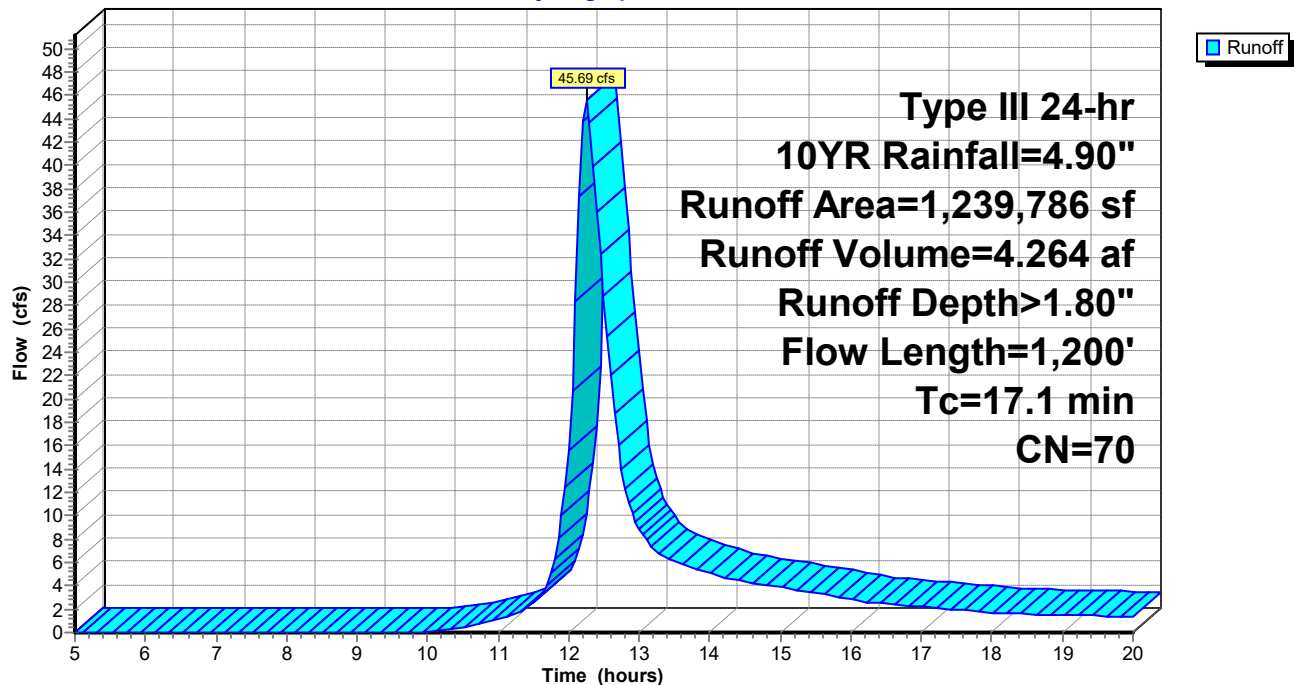
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
1,239,786	70	Woods, Good, HSG C
1,239,786		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0500	0.24		Sheet Flow, TRAVEL PATH A TO B Range n= 0.130 P2= 3.20"
13.6	1,150	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
17.1	1,200	Total			

Subcatchment E-1: DA#1

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10YR Rainfall=4.90"

Printed 3/7/2022

Page 18

Summary for Subcatchment P-1: DA#1P

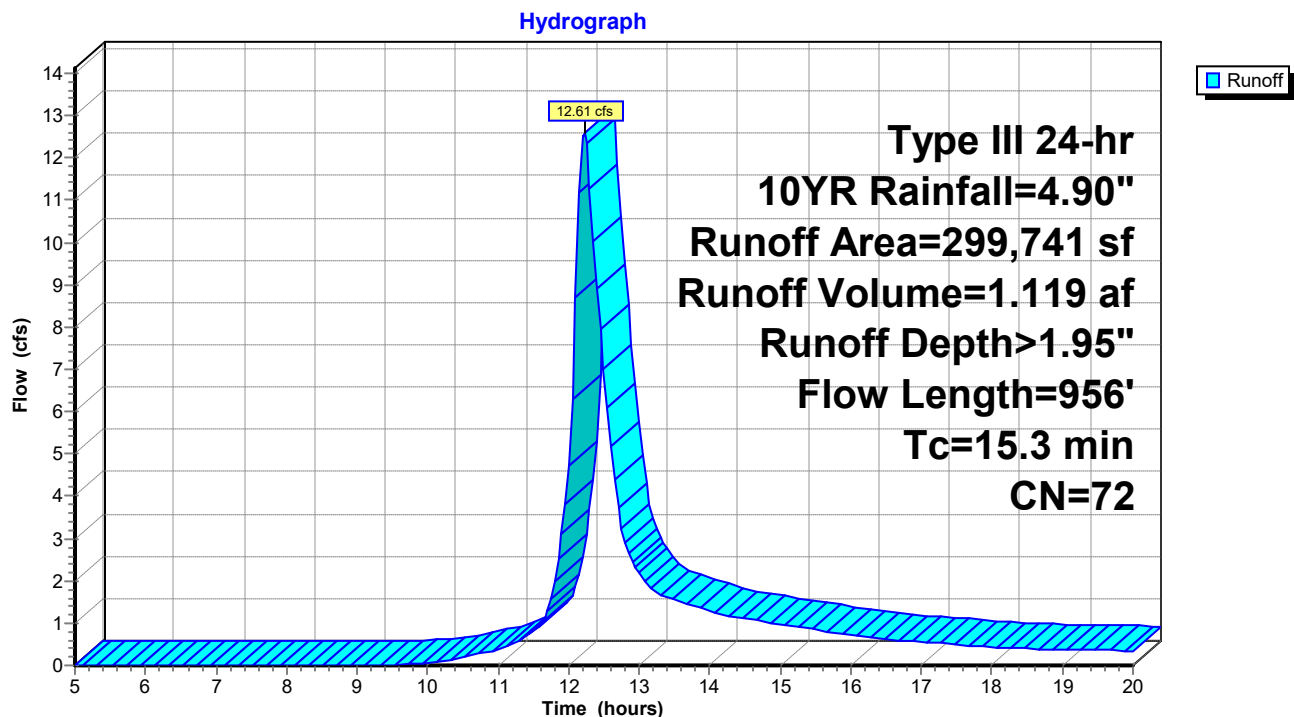
Runoff = 12.61 cfs @ 12.22 hrs, Volume= 1.119 af, Depth> 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
133,103	74	>75% Grass cover, Good, HSG C
166,638	70	Woods, Good, HSG C
299,741	72	Weighted Average
299,741		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL PATH A TO B Woods: Light underbrush n= 0.400 P2= 3.20"
4.3	364	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
2.5	542	0.0500	3.60		Shallow Concentrated Flow, TRAVEL PATH C TO D Unpaved Kv= 16.1 fps
15.3	956	Total			

Subcatchment P-1: DA#1P



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10YR Rainfall=4.90"

Printed 3/7/2022

Page 19

Summary for Subcatchment P-2: DA#2P

Runoff = 19.30 cfs @ 12.23 hrs, Volume= 1.746 af, Depth> 1.95"

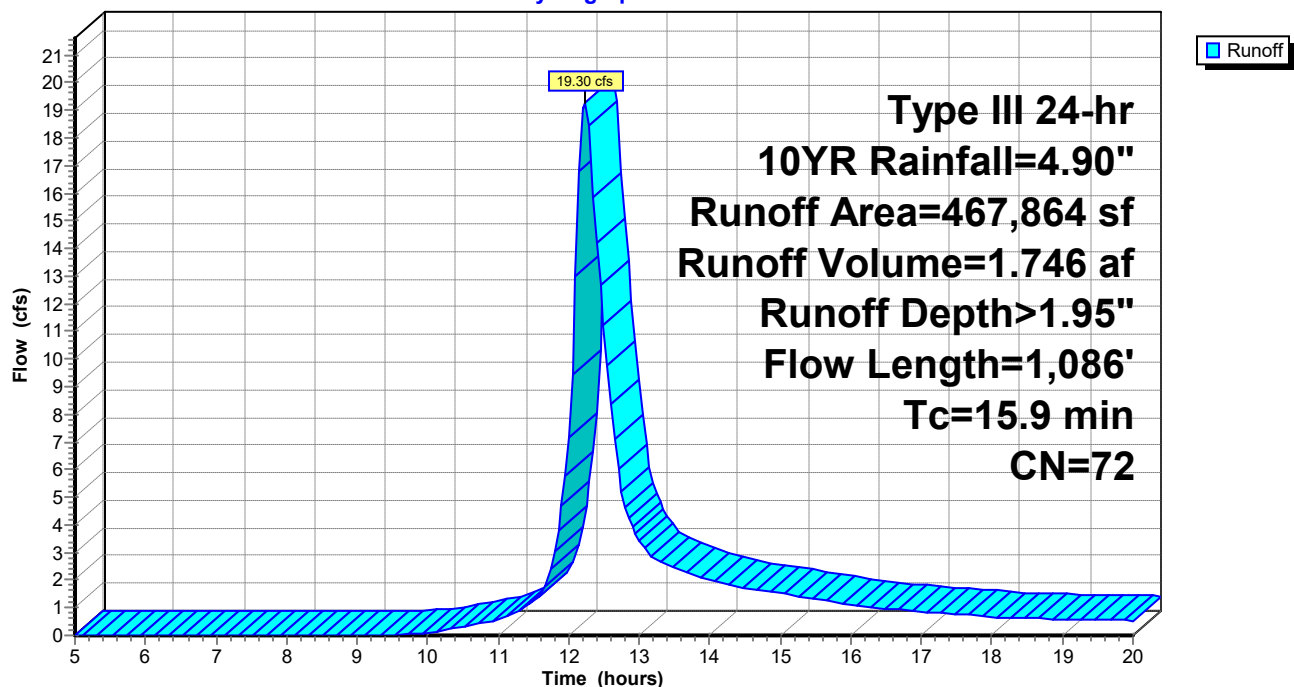
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
215,212	74	>75% Grass cover, Good, HSG C
252,652	70	Woods, Good, HSG C
467,864	72	Weighted Average
467,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL PATH A TO B Woods: Light underbrush n= 0.400 P2= 3.20"
4.3	364	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
3.1	672	0.0500	3.60		Shallow Concentrated Flow, TRAVEL PATH C TO D Unpaved Kv= 16.1 fps
15.9	1,086	Total			

Subcatchment P-2: DA#2P

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10YR Rainfall=4.90"

Printed 3/7/2022

Page 20

Summary for Subcatchment P-3: DA#3P

Runoff = 18.27 cfs @ 12.25 hrs, Volume= 1.692 af, Depth> 1.87"

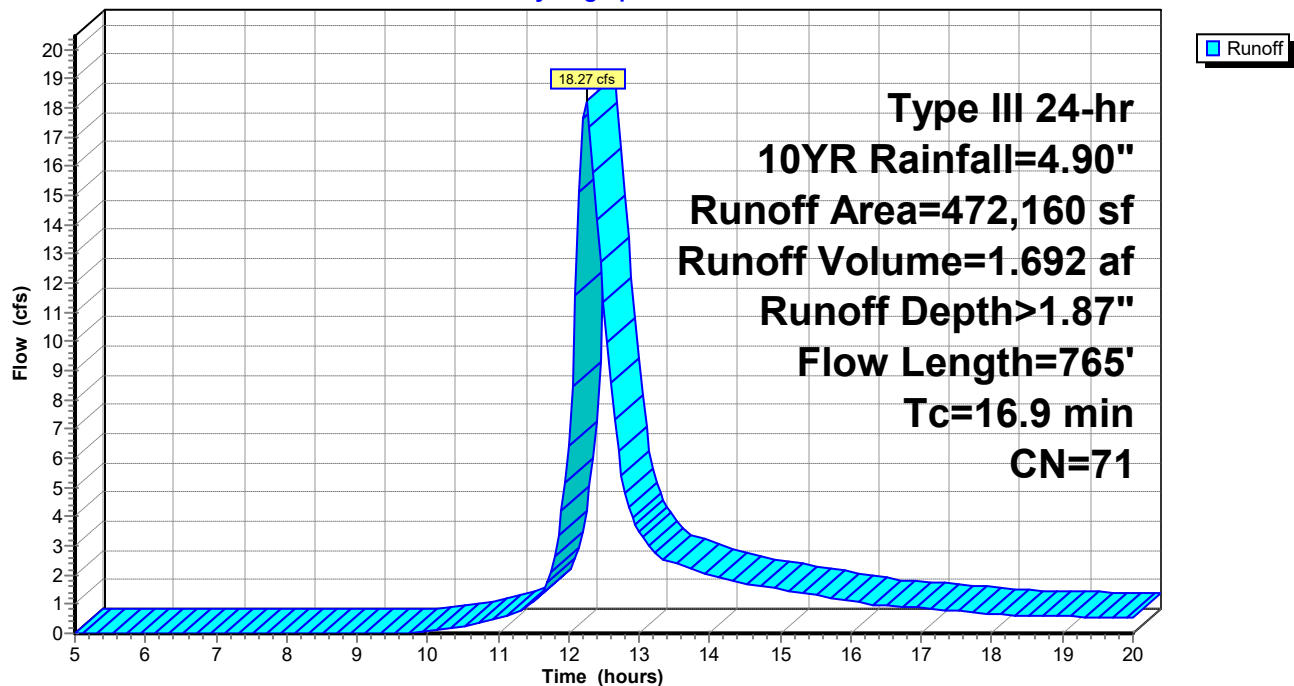
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR Rainfall=4.90"

Area (sf)	CN	Description
168,262	74	>75% Grass cover, Good, HSG C
303,898	70	Woods, Good, HSG C
472,160	71	Weighted Average
472,160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL A TO B
					Woods: Light underbrush n= 0.400 P2= 3.20"
8.4	715	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C
					Woodland Kv= 5.0 fps
16.9	765	Total			

Subcatchment P-3: DA#3P

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10YR Rainfall=4.90"

Printed 3/7/2022

Page 21

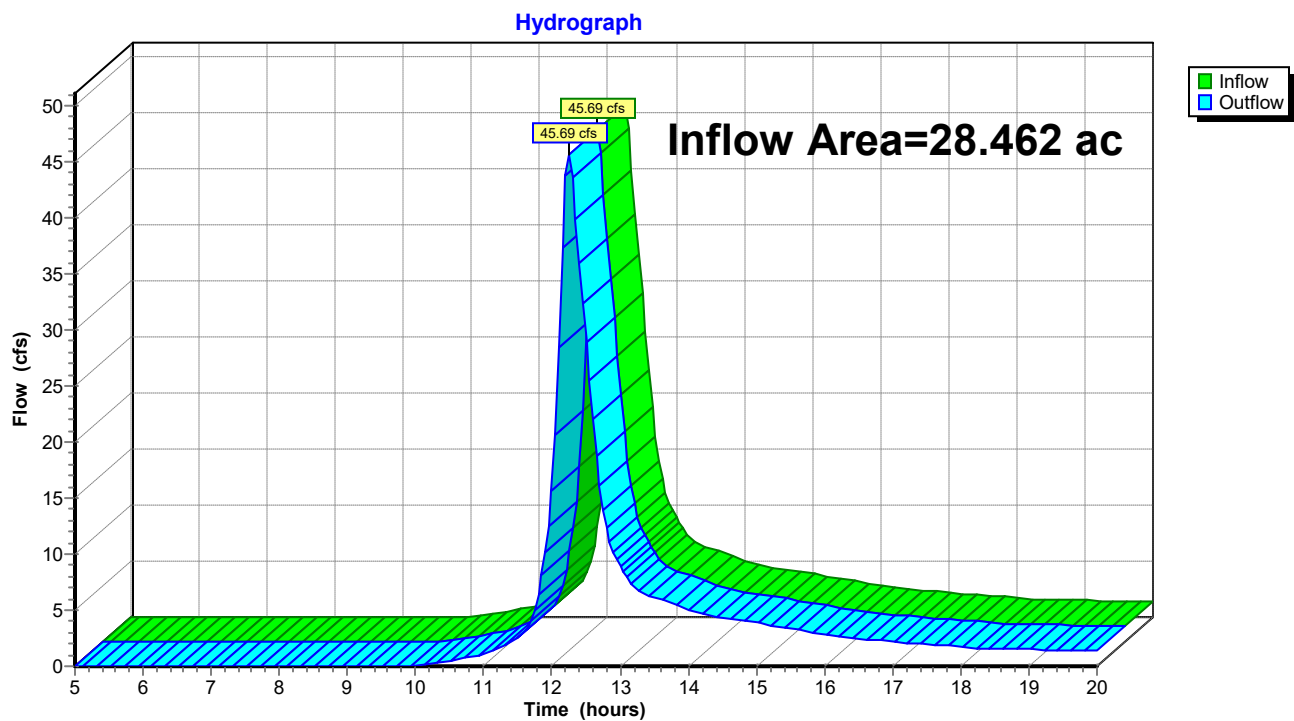
Summary for Reach IP-1E: WETLANDS

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 28.462 ac, 0.00% Impervious, Inflow Depth > 1.80" for 10YR event
Inflow = 45.69 cfs @ 12.25 hrs, Volume= 4.264 af
Outflow = 45.69 cfs @ 12.25 hrs, Volume= 4.264 af, Atten= 0%, Lag= 0.0 min

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

Reach IP-1E: WETLANDS



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10YR Rainfall=4.90"

Printed 3/7/2022

Page 22

Summary for Reach IP-1P: WETLANDS

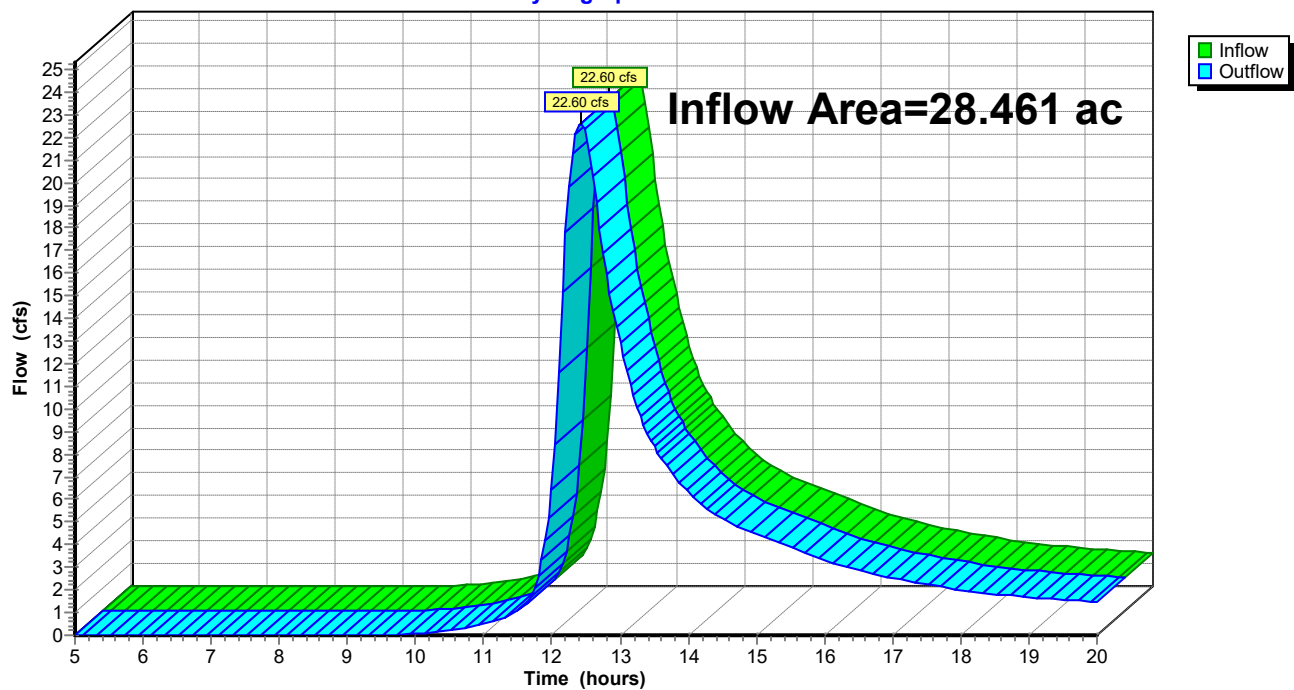
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 28.461 ac, 0.00% Impervious, Inflow Depth > 1.60" for 10YR event
Inflow = 22.60 cfs @ 12.43 hrs, Volume= 3.786 af
Outflow = 22.60 cfs @ 12.43 hrs, Volume= 3.786 af, Atten= 0%, Lag= 0.0 min

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

Reach IP-1P: WETLANDS

Hydrograph



pre-port development

Type III 24-hr 10YR Rainfall=4.90"

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 23

Summary for Pond PND1: BASIN 1

Inflow Area = 6.881 ac, 0.00% Impervious, Inflow Depth > 1.95" for 10YR event
 Inflow = 12.61 cfs @ 12.22 hrs, Volume= 1.119 af
 Outflow = 4.34 cfs @ 12.66 hrs, Volume= 0.787 af, Atten= 66%, Lag= 26.3 min
 Primary = 4.34 cfs @ 12.66 hrs, Volume= 0.787 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 808.51' @ 12.66 hrs Surf.Area= 9,664 sf Storage= 21,379 cf

Plug-Flow detention time= 132.6 min calculated for 0.787 af (70% of inflow)
 Center-of-Mass det. time= 65.3 min (876.8 - 811.5)

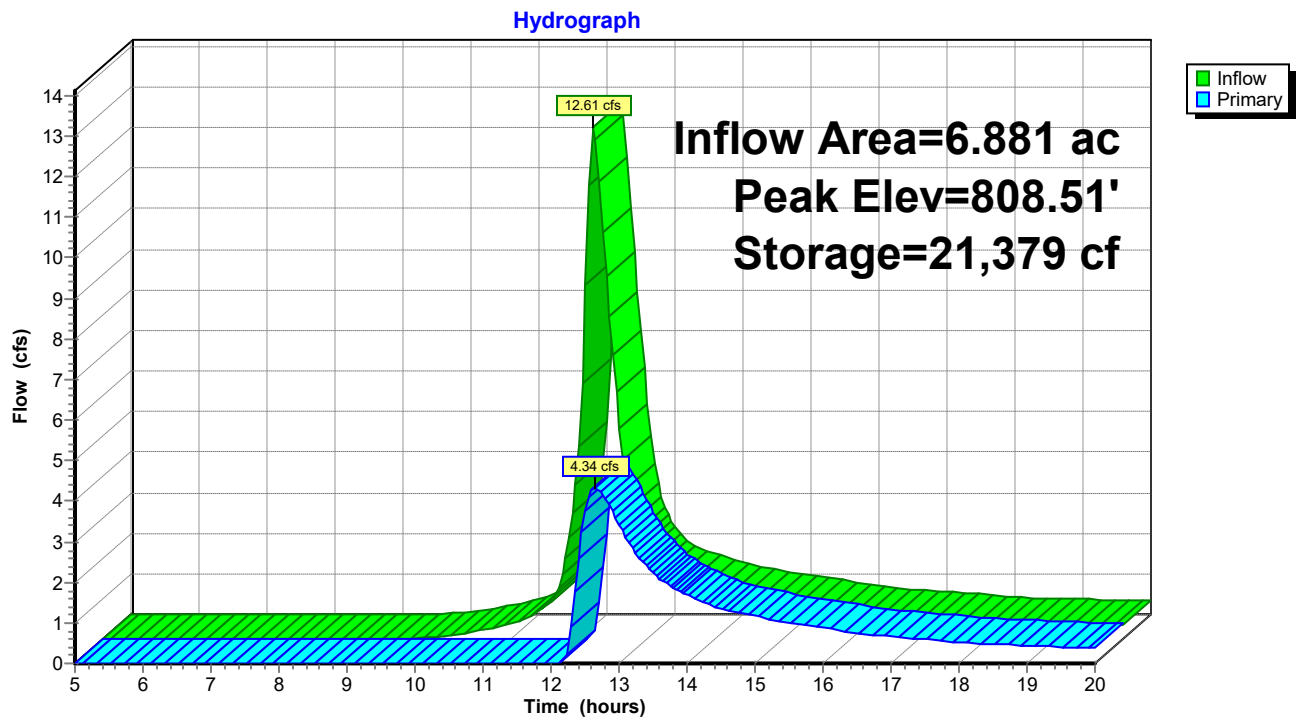
Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	36,818 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	7,384	0	0
808.00	9,180	16,564	16,564
810.00	11,074	20,254	36,818

Device	Routing	Invert	Outlet Devices
#1	Primary	807.50'	18.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=4.33 cfs @ 12.66 hrs HW=808.51' (Free Discharge)
 ↑ **1=Orifice/Grate** (Orifice Controls 4.33 cfs @ 3.42 fps)

Pond PND1: BASIN 1



pre-port development

Type III 24-hr 10YR Rainfall=4.90"

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 25

Summary for Pond PND2: BASIN#2

Inflow Area = 10.741 ac, 0.00% Impervious, Inflow Depth > 1.95" for 10YR event
 Inflow = 19.30 cfs @ 12.23 hrs, Volume= 1.746 af
 Outflow = 7.48 cfs @ 12.64 hrs, Volume= 1.307 af, Atten= 61%, Lag= 24.5 min
 Primary = 7.48 cfs @ 12.64 hrs, Volume= 1.307 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 813.52' @ 12.64 hrs Surf.Area= 10,758 sf Storage= 31,056 cf

Plug-Flow detention time= 117.0 min calculated for 1.307 af (75% of inflow)
 Center-of-Mass det. time= 56.0 min (868.0 - 812.0)

Volume	Invert	Avail.Storage	Storage Description
#1	810.00'	61,451 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

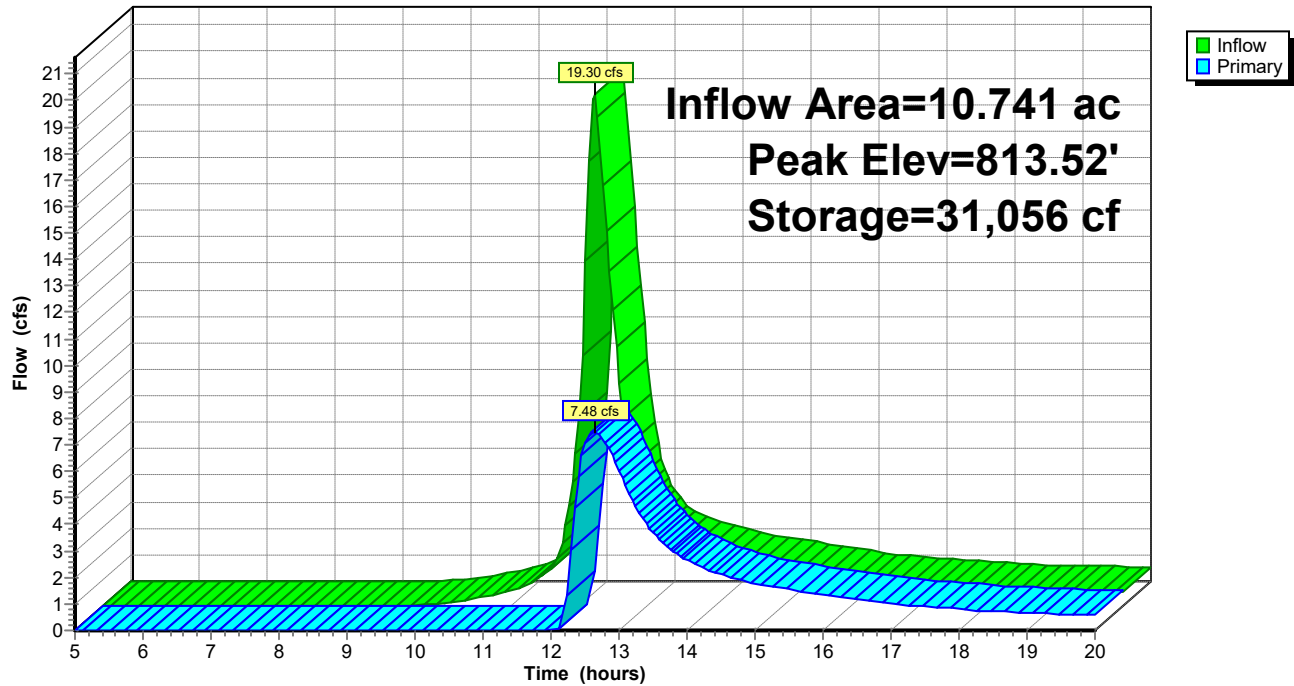
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
810.00	6,983	0	0
812.00	9,030	16,013	16,013
814.00	11,303	20,333	36,346
816.00	13,802	25,105	61,451

Device	Routing	Invert	Outlet Devices
#1	Primary	812.00'	18.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=7.46 cfs @ 12.64 hrs HW=813.52' (Free Discharge)
 ↑ **1=Orifice/Grate** (Orifice Controls 7.46 cfs @ 4.22 fps)

Pond PND2: BASIN#2

Hydrograph



pre-port development*Type III 24-hr 25YR Rainfall=5.40"*

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 27

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 E-1: DA#1

Runoff Area=1,239,786 sf 0.00% Impervious Runoff Depth>2.15"
Flow Length=1,200' Tc=17.1 min CN=70 Runoff=54.92 cfs 5.096 af

Subcatchment P-1: DA#1P

Runoff Area=299,741 sf 0.00% Impervious Runoff Depth>2.32"
Flow Length=956' Tc=15.3 min CN=72 Runoff=15.02 cfs 1.328 af

Subcatchment P-2: DA#2P

Runoff Area=467,864 sf 0.00% Impervious Runoff Depth>2.32"
Flow Length=1,086' Tc=15.9 min CN=72 Runoff=23.10 cfs 2.073 af

Subcatchment P-3: DA#3P

Runoff Area=472,160 sf 0.00% Impervious Runoff Depth>2.23"
Flow Length=765' Tc=16.9 min CN=71 Runoff=21.86 cfs 2.015 af

Reach IP-1E: WETLANDS

Inflow=54.92 cfs 5.096 af
Outflow=54.92 cfs 5.096 af

Reach IP-1P: WETLANDS

Inflow=30.15 cfs 4.637 af
Outflow=30.15 cfs 4.637 af

Pond PND1: BASIN 1

Peak Elev=808.77' Storage=23,928 cf Inflow=15.02 cfs 1.328 af
Outflow=6.13 cfs 0.992 af

Pond PND2: BASIN#2

Peak Elev=813.95' Storage=35,786 cf Inflow=23.10 cfs 2.073 af
Outflow=9.32 cfs 1.629 af

Total Runoff Area = 56.923 ac Runoff Volume = 10.513 af Average Runoff Depth = 2.22"
100.00% Pervious = 56.923 ac 0.00% Impervious = 0.000 ac

pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25YR Rainfall=5.40"

Printed 3/7/2022

Page 28

Summary for Subcatchment E-1: DA#1

Runoff = 54.92 cfs @ 12.25 hrs, Volume= 5.096 af, Depth> 2.15"

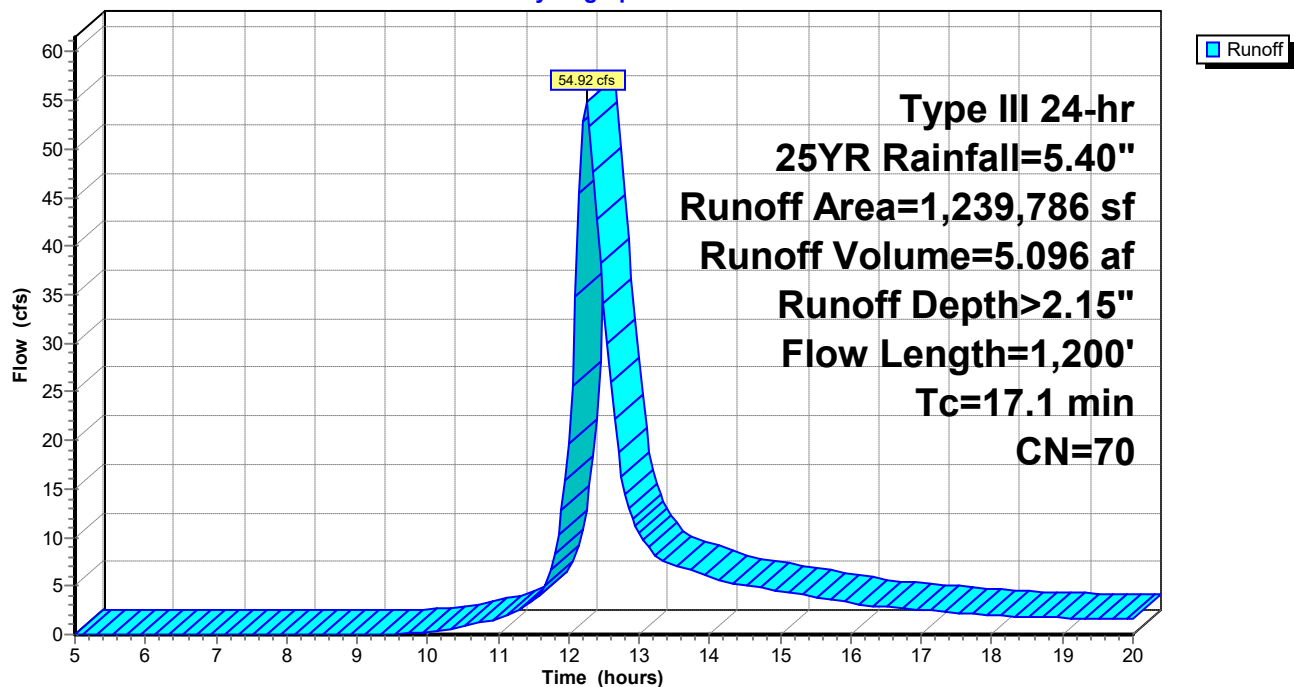
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=5.40"

Area (sf)	CN	Description
1,239,786	70	Woods, Good, HSG C
1,239,786		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0500	0.24		Sheet Flow, TRAVEL PATH A TO B Range n= 0.130 P2= 3.20"
13.6	1,150	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
17.1	1,200	Total			

Subcatchment E-1: DA#1

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25YR Rainfall=5.40"

Printed 3/7/2022

Page 29

Summary for Subcatchment P-1: DA#1P

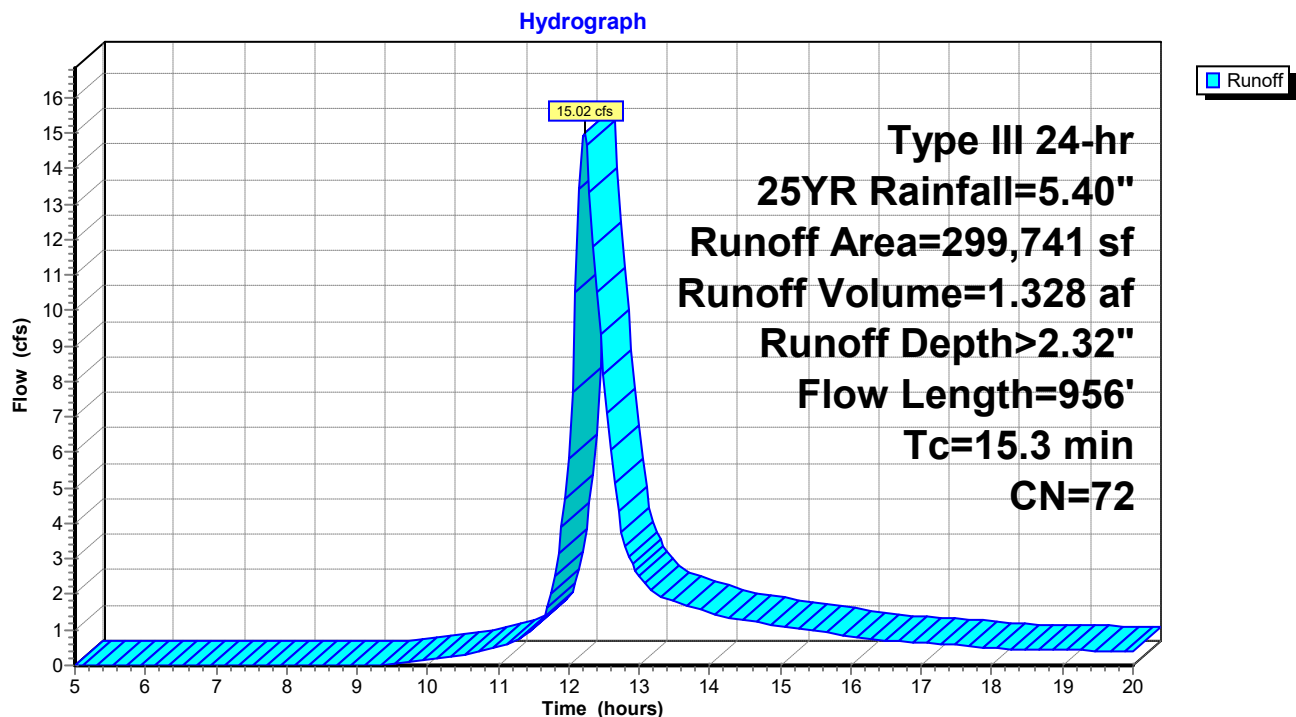
Runoff = 15.02 cfs @ 12.22 hrs, Volume= 1.328 af, Depth> 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=5.40"

Area (sf)	CN	Description
133,103	74	>75% Grass cover, Good, HSG C
166,638	70	Woods, Good, HSG C
299,741	72	Weighted Average
299,741		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL PATH A TO B Woods: Light underbrush n= 0.400 P2= 3.20"
4.3	364	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
2.5	542	0.0500	3.60		Shallow Concentrated Flow, TRAVEL PATH C TO D Unpaved Kv= 16.1 fps
15.3	956	Total			

Subcatchment P-1: DA#1P



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25YR Rainfall=5.40"

Printed 3/7/2022

Page 30

Summary for Subcatchment P-2: DA#2P

Runoff = 23.10 cfs @ 12.22 hrs, Volume= 2.073 af, Depth> 2.32"

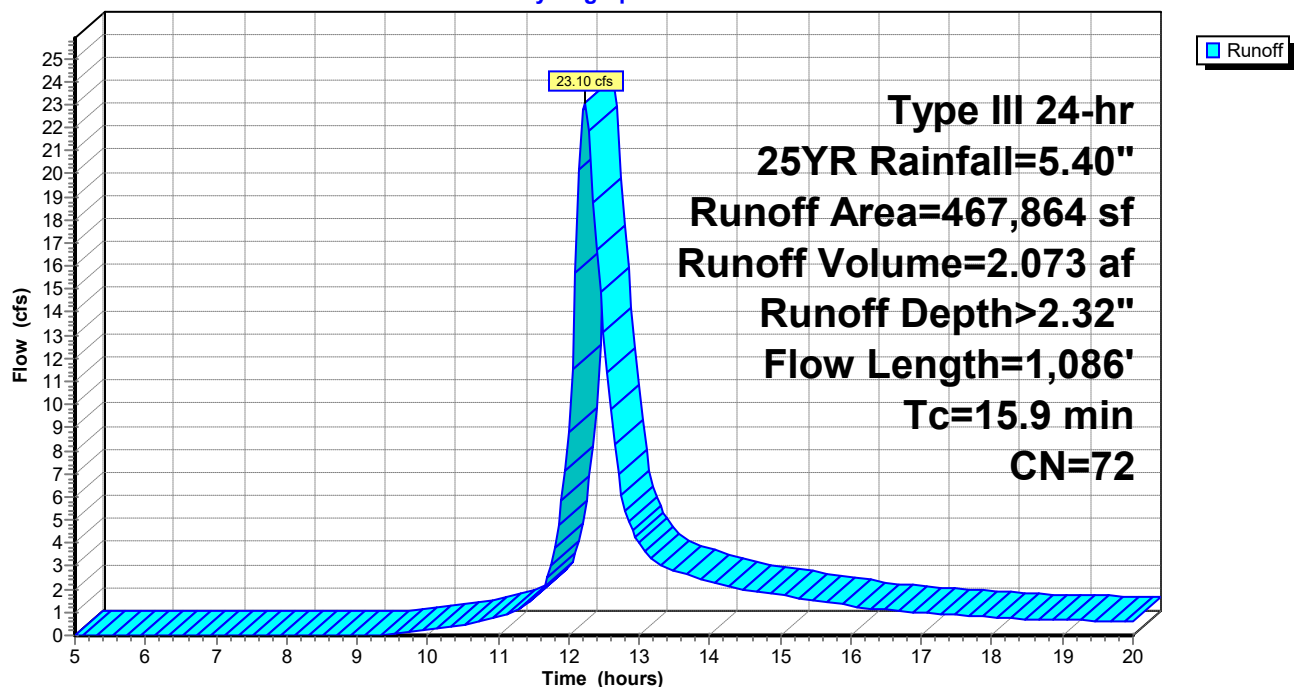
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=5.40"

Area (sf)	CN	Description
215,212	74	>75% Grass cover, Good, HSG C
252,652	70	Woods, Good, HSG C
467,864	72	Weighted Average
467,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL PATH A TO B Woods: Light underbrush n= 0.400 P2= 3.20"
4.3	364	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
3.1	672	0.0500	3.60		Shallow Concentrated Flow, TRAVEL PATH C TO D Unpaved Kv= 16.1 fps
15.9	1,086	Total			

Subcatchment P-2: DA#2P

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25YR Rainfall=5.40"

Printed 3/7/2022

Page 31

Summary for Subcatchment P-3: DA#3P

Runoff = 21.86 cfs @ 12.24 hrs, Volume= 2.015 af, Depth> 2.23"

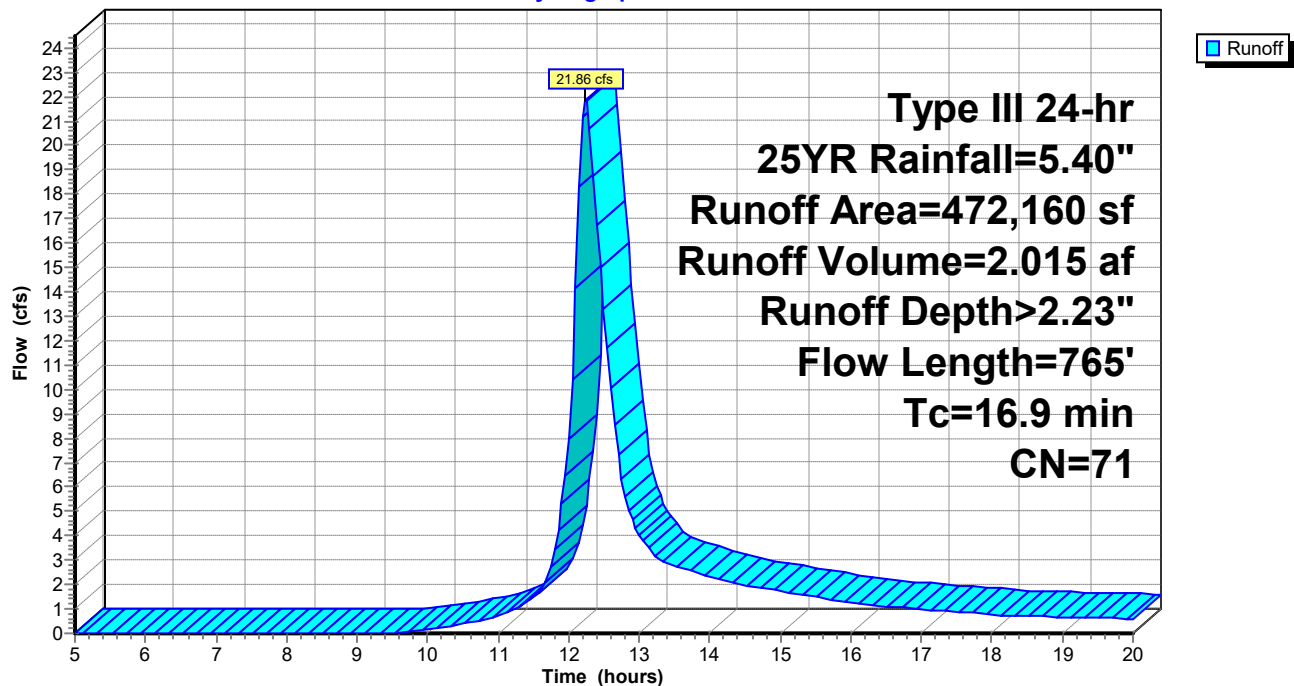
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25YR Rainfall=5.40"

Area (sf)	CN	Description
168,262	74	>75% Grass cover, Good, HSG C
303,898	70	Woods, Good, HSG C
472,160	71	Weighted Average
472,160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL A TO B
					Woods: Light underbrush n= 0.400 P2= 3.20"
8.4	715	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C
					Woodland Kv= 5.0 fps
16.9	765	Total			

Subcatchment P-3: DA#3P

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25YR Rainfall=5.40"

Printed 3/7/2022

Page 32

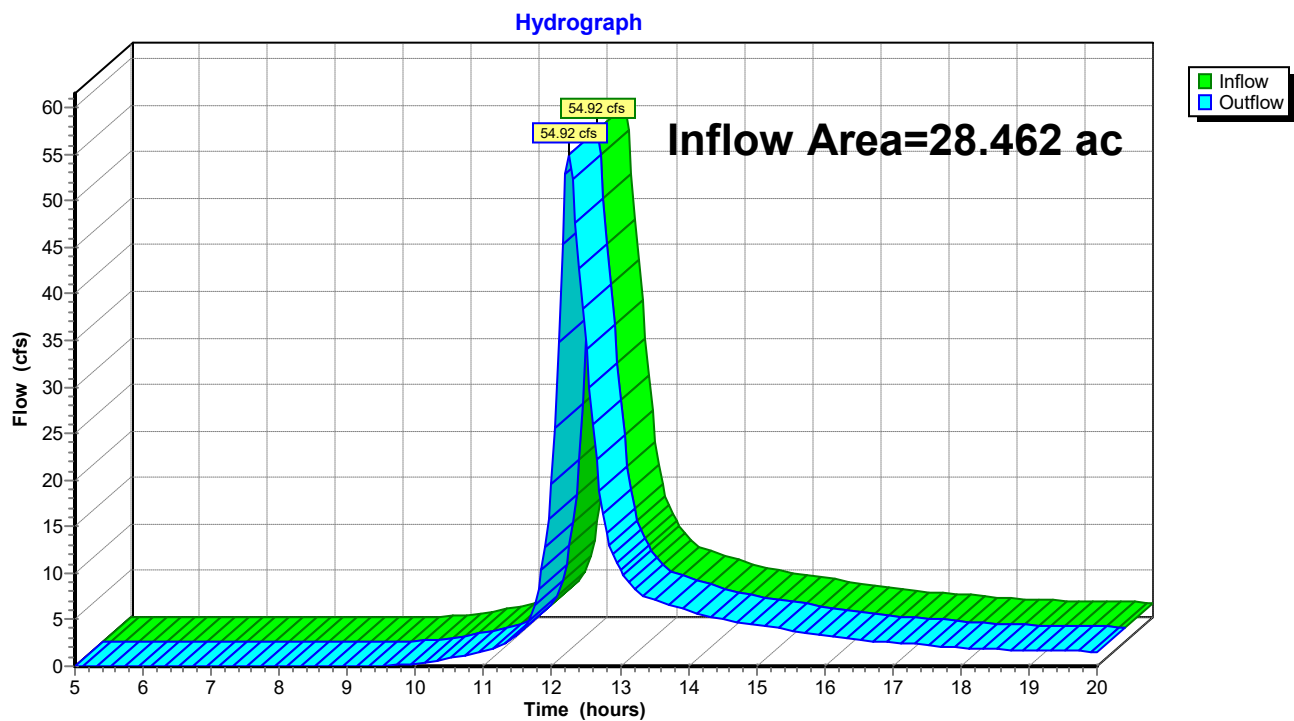
Summary for Reach IP-1E: WETLANDS

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 28.462 ac, 0.00% Impervious, Inflow Depth > 2.15" for 25YR event
Inflow = 54.92 cfs @ 12.25 hrs, Volume= 5.096 af
Outflow = 54.92 cfs @ 12.25 hrs, Volume= 5.096 af, Atten= 0%, Lag= 0.0 min

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

Reach IP-1E: WETLANDS



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25YR Rainfall=5.40"

Printed 3/7/2022

Page 33

Summary for Reach IP-1P: WETLANDS

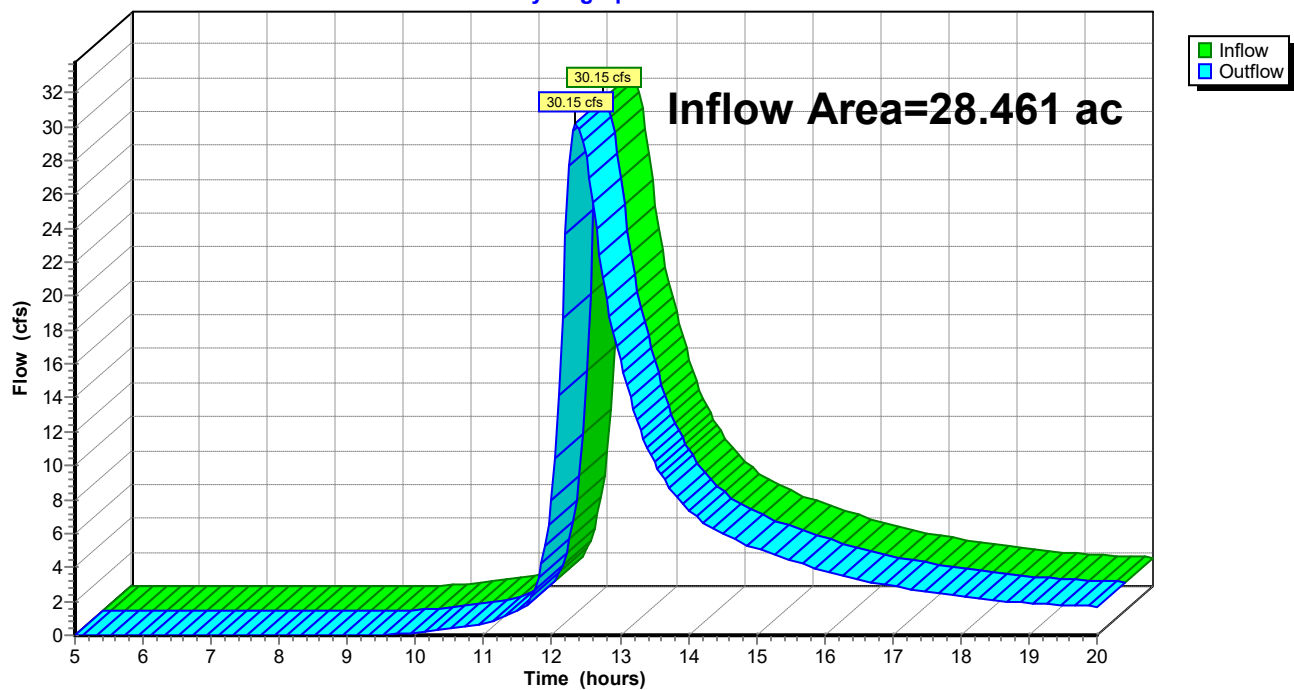
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 28.461 ac, 0.00% Impervious, Inflow Depth > 1.96" for 25YR event
Inflow = 30.15 cfs @ 12.35 hrs, Volume= 4.637 af
Outflow = 30.15 cfs @ 12.35 hrs, Volume= 4.637 af, Atten= 0%, Lag= 0.0 min

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

Reach IP-1P: WETLANDS

Hydrograph



pre-port development

Type III 24-hr 25YR Rainfall=5.40"

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 34

Summary for Pond PND1: BASIN 1

Inflow Area = 6.881 ac, 0.00% Impervious, Inflow Depth > 2.32" for 25YR event
 Inflow = 15.02 cfs @ 12.22 hrs, Volume= 1.328 af
 Outflow = 6.13 cfs @ 12.60 hrs, Volume= 0.992 af, Atten= 59%, Lag= 22.9 min
 Primary = 6.13 cfs @ 12.60 hrs, Volume= 0.992 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 808.77' @ 12.60 hrs Surf.Area= 9,911 sf Storage= 23,928 cf

Plug-Flow detention time= 117.7 min calculated for 0.989 af (74% of inflow)
 Center-of-Mass det. time= 57.4 min (865.2 - 807.7)

Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	36,818 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

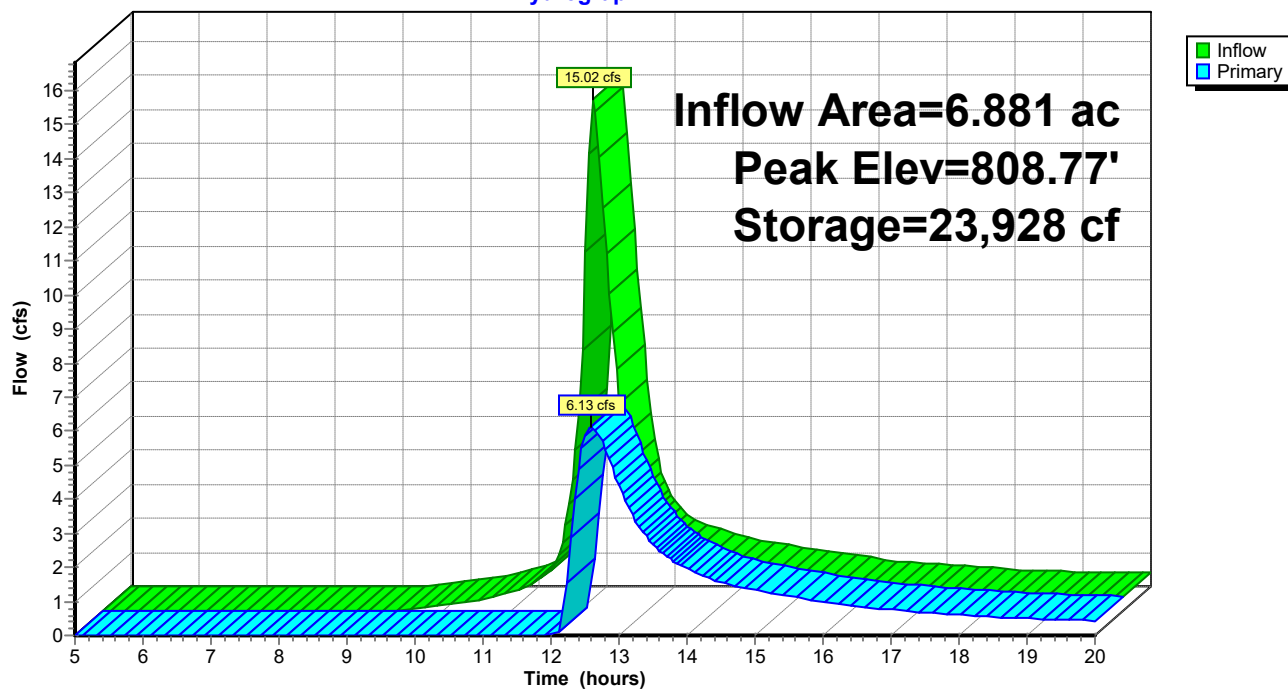
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	7,384	0	0
808.00	9,180	16,564	16,564
810.00	11,074	20,254	36,818

Device	Routing	Invert	Outlet Devices
#1	Primary	807.50'	18.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=6.13 cfs @ 12.60 hrs HW=808.77' (Free Discharge)
 ↑ **1=Orifice/Grate** (Orifice Controls 6.13 cfs @ 3.84 fps)

Pond PND1: BASIN 1

Hydrograph



pre-port development

Type III 24-hr 25YR Rainfall=5.40"

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 36

Summary for Pond PND2: BASIN#2

Inflow Area = 10.741 ac, 0.00% Impervious, Inflow Depth > 2.32" for 25YR event
 Inflow = 23.10 cfs @ 12.22 hrs, Volume= 2.073 af
 Outflow = 9.32 cfs @ 12.62 hrs, Volume= 1.629 af, Atten= 60%, Lag= 23.5 min
 Primary = 9.32 cfs @ 12.62 hrs, Volume= 1.629 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 813.95' @ 12.62 hrs Surf.Area= 11,247 sf Storage= 35,786 cf

Plug-Flow detention time= 105.6 min calculated for 1.624 af (78% of inflow)
 Center-of-Mass det. time= 51.4 min (859.6 - 808.2)

Volume	Invert	Avail.Storage	Storage Description
#1	810.00'	61,451 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

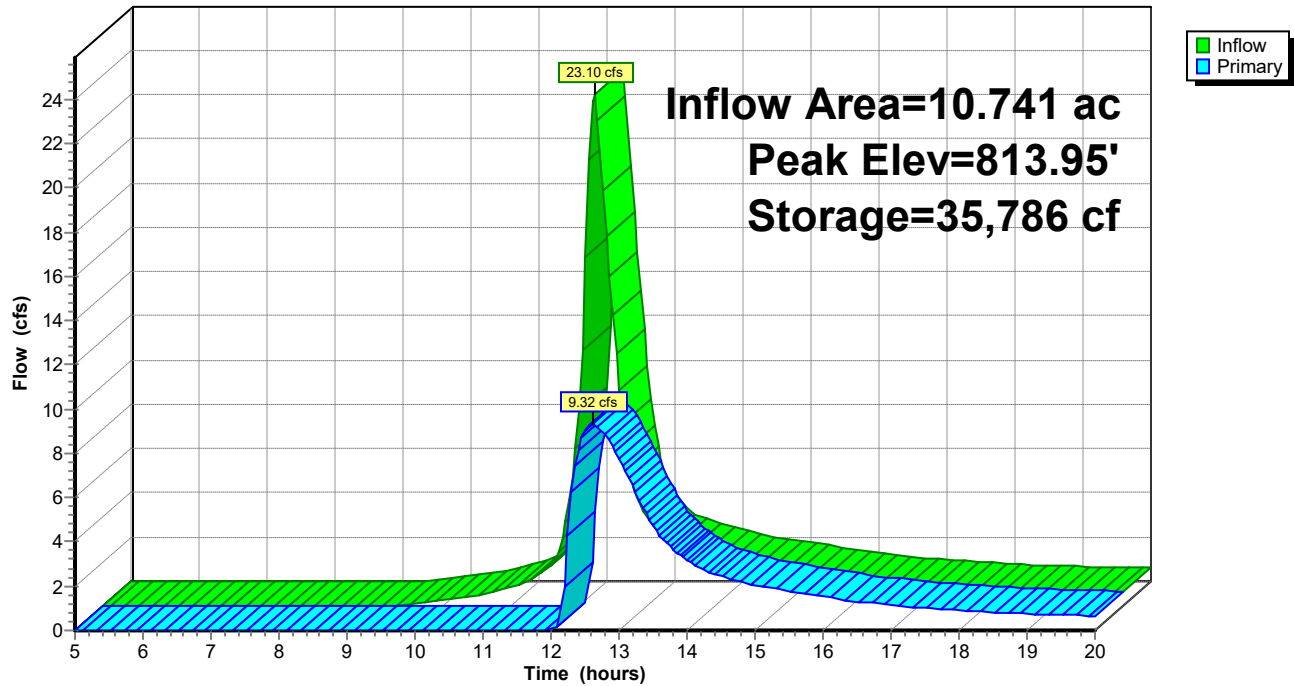
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
810.00	6,983	0	0
812.00	9,030	16,013	16,013
814.00	11,303	20,333	36,346
816.00	13,802	25,105	61,451

Device	Routing	Invert	Outlet Devices
#1	Primary	812.00'	18.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=9.31 cfs @ 12.62 hrs HW=813.95' (Free Discharge)
 ↑ **1=Orifice/Grate** (Orifice Controls 9.31 cfs @ 5.27 fps)

Pond PND2: BASIN#2

Hydrograph



pre-port development*Type III 24-hr 100YR Rainfall=6.90"*

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 38

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 E-1: DA#1

Runoff Area=1,239,786 sf 0.00% Impervious Runoff Depth>3.27"
Flow Length=1,200' Tc=17.1 min CN=70 Runoff=84.12 cfs 7.764 af

Subcatchment P-1: DA#1P

Runoff Area=299,741 sf 0.00% Impervious Runoff Depth>3.48"
Flow Length=956' Tc=15.3 min CN=72 Runoff=22.59 cfs 1.994 af

Subcatchment P-2: DA#2P

Runoff Area=467,864 sf 0.00% Impervious Runoff Depth>3.48"
Flow Length=1,086' Tc=15.9 min CN=72 Runoff=34.75 cfs 3.112 af

Subcatchment P-3: DA#3P

Runoff Area=472,160 sf 0.00% Impervious Runoff Depth>3.37"
Flow Length=765' Tc=16.9 min CN=71 Runoff=33.17 cfs 3.048 af

Reach IP-1E: WETLANDS

Inflow=84.12 cfs 7.764 af
Outflow=84.12 cfs 7.764 af

Reach IP-1P: WETLANDS

Inflow=51.20 cfs 7.350 af
Outflow=51.20 cfs 7.350 af

Pond PND1: BASIN 1

Peak Elev=809.67' Storage=33,222 cf Inflow=22.59 cfs 1.994 af
Outflow=10.14 cfs 1.648 af

Pond PND2: BASIN#2

Peak Elev=815.35' Storage=52,746 cf Inflow=34.75 cfs 3.112 af
Outflow=13.72 cfs 2.655 af

Total Runoff Area = 56.923 ac Runoff Volume = 15.918 af Average Runoff Depth = 3.36"
100.00% Pervious = 56.923 ac 0.00% Impervious = 0.000 ac

pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100YR Rainfall=6.90"

Printed 3/7/2022

Page 39

Summary for Subcatchment E-1: DA#1

Runoff = 84.12 cfs @ 12.24 hrs, Volume= 7.764 af, Depth> 3.27"

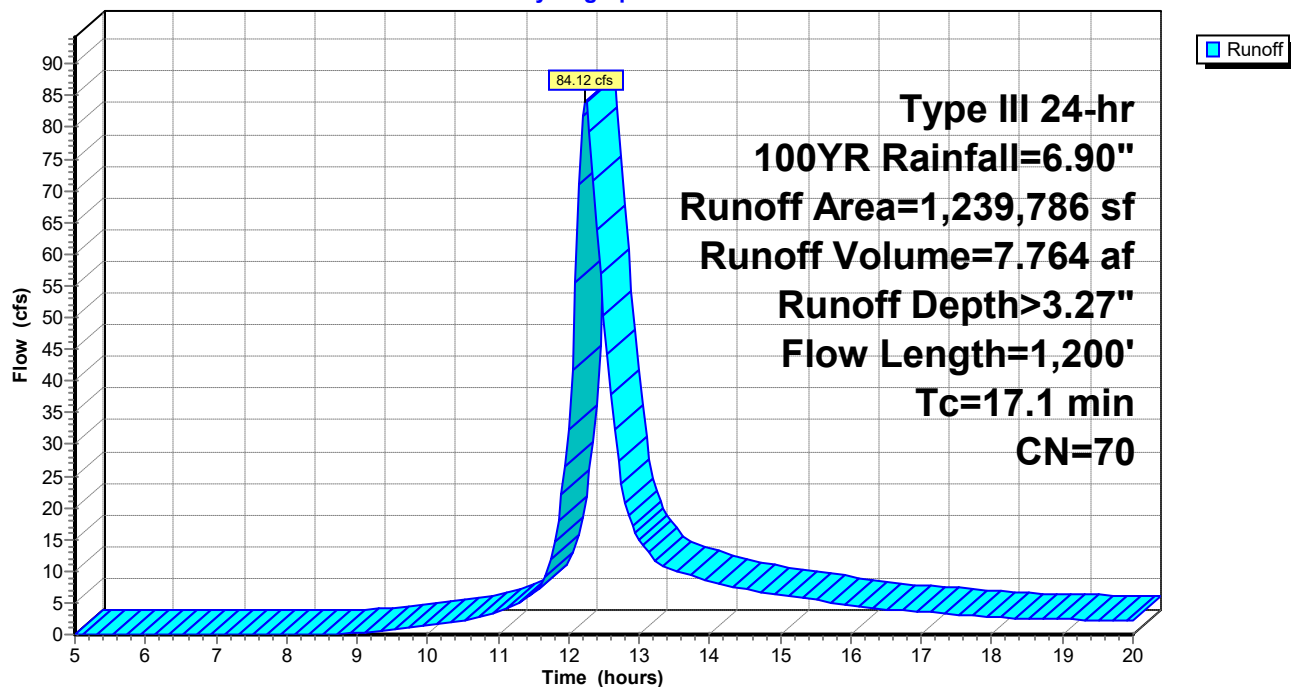
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
1,239,786	70	Woods, Good, HSG C
1,239,786		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0500	0.24		Sheet Flow, TRAVEL PATH A TO B Range n= 0.130 P2= 3.20"
13.6	1,150	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
17.1	1,200	Total			

Subcatchment E-1: DA#1

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100YR Rainfall=6.90"

Printed 3/7/2022

Page 40

Summary for Subcatchment P-1: DA#1P

Runoff = 22.59 cfs @ 12.21 hrs, Volume= 1.994 af, Depth> 3.48"

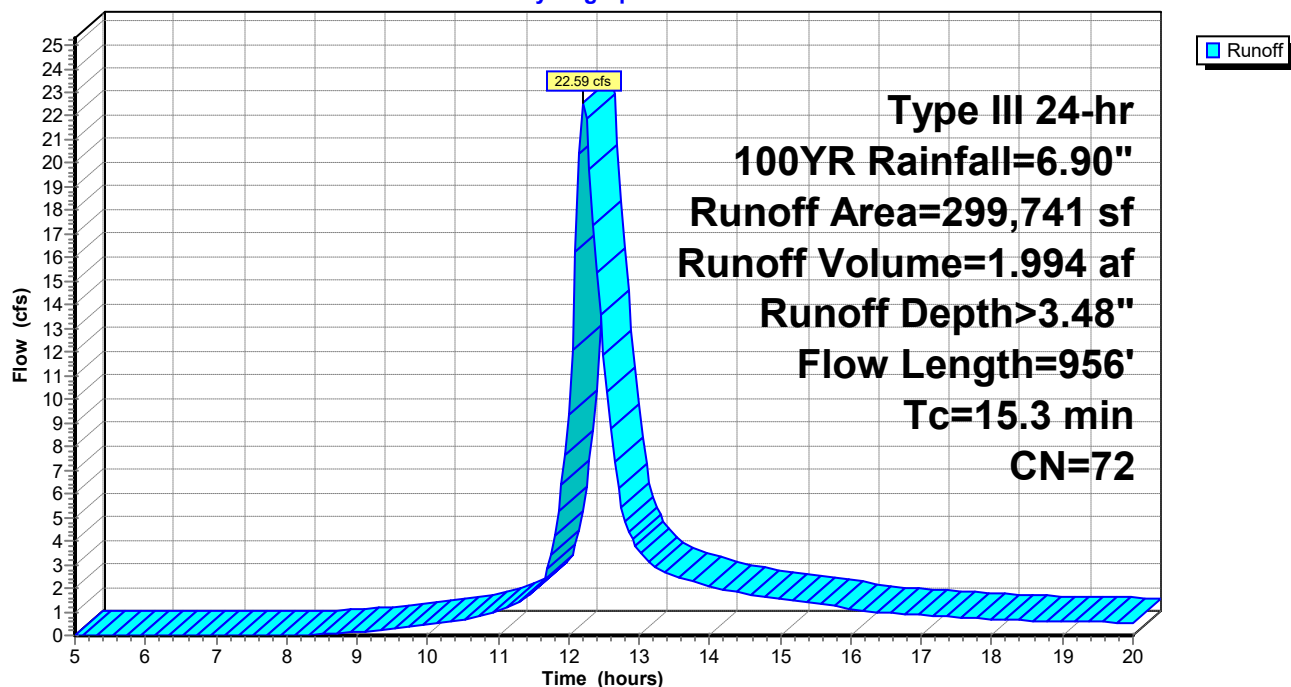
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
133,103	74	>75% Grass cover, Good, HSG C
166,638	70	Woods, Good, HSG C
299,741	72	Weighted Average
299,741		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL PATH A TO B Woods: Light underbrush n= 0.400 P2= 3.20"
4.3	364	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
2.5	542	0.0500	3.60		Shallow Concentrated Flow, TRAVEL PATH C TO D Unpaved Kv= 16.1 fps
15.3	956	Total			

Subcatchment P-1: DA#1P

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100YR Rainfall=6.90"

Printed 3/7/2022

Page 41

Summary for Subcatchment P-2: DA#2P

Runoff = 34.75 cfs @ 12.22 hrs, Volume= 3.112 af, Depth> 3.48"

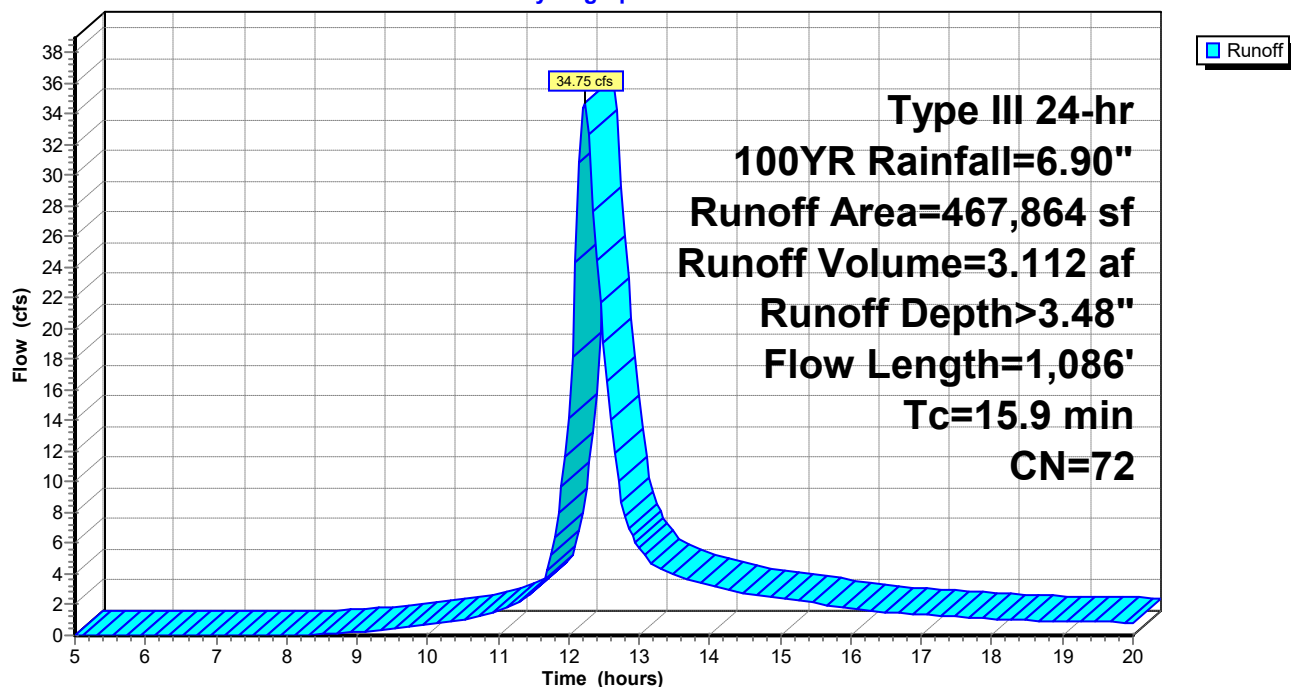
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
215,212	74	>75% Grass cover, Good, HSG C
252,652	70	Woods, Good, HSG C
467,864	72	Weighted Average
467,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL PATH A TO B Woods: Light underbrush n= 0.400 P2= 3.20"
4.3	364	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps
3.1	672	0.0500	3.60		Shallow Concentrated Flow, TRAVEL PATH C TO D Unpaved Kv= 16.1 fps
15.9	1,086	Total			

Subcatchment P-2: DA#2P

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100YR Rainfall=6.90"

Printed 3/7/2022

Page 42

Summary for Subcatchment P-3: DA#3P

Runoff = 33.17 cfs @ 12.24 hrs, Volume= 3.048 af, Depth> 3.37"

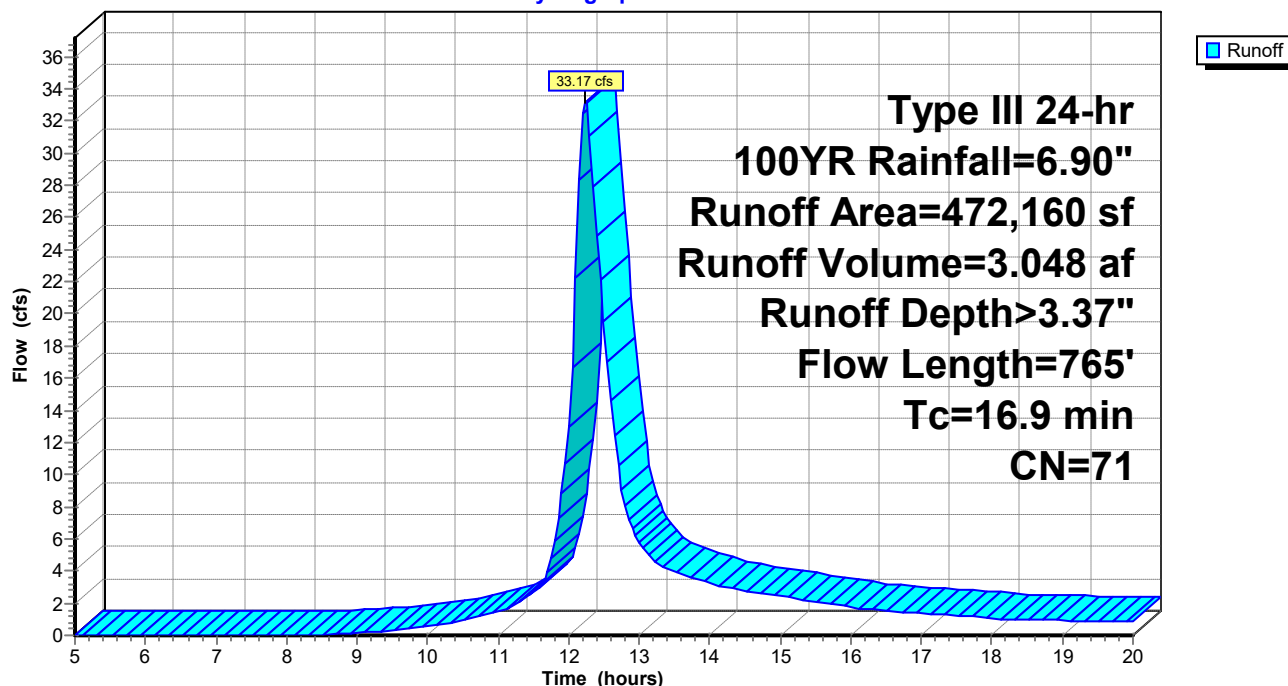
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=6.90"

Area (sf)	CN	Description
168,262	74	>75% Grass cover, Good, HSG C
303,898	70	Woods, Good, HSG C
472,160	71	Weighted Average
472,160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	50	0.0500	0.10		Sheet Flow, TRAVEL A TO B
					Woods: Light underbrush n= 0.400 P2= 3.20"
8.4	715	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C
					Woodland Kv= 5.0 fps
16.9	765	Total			

Subcatchment P-3: DA#3P

Hydrograph



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100YR Rainfall=6.90"

Printed 3/7/2022

Page 43

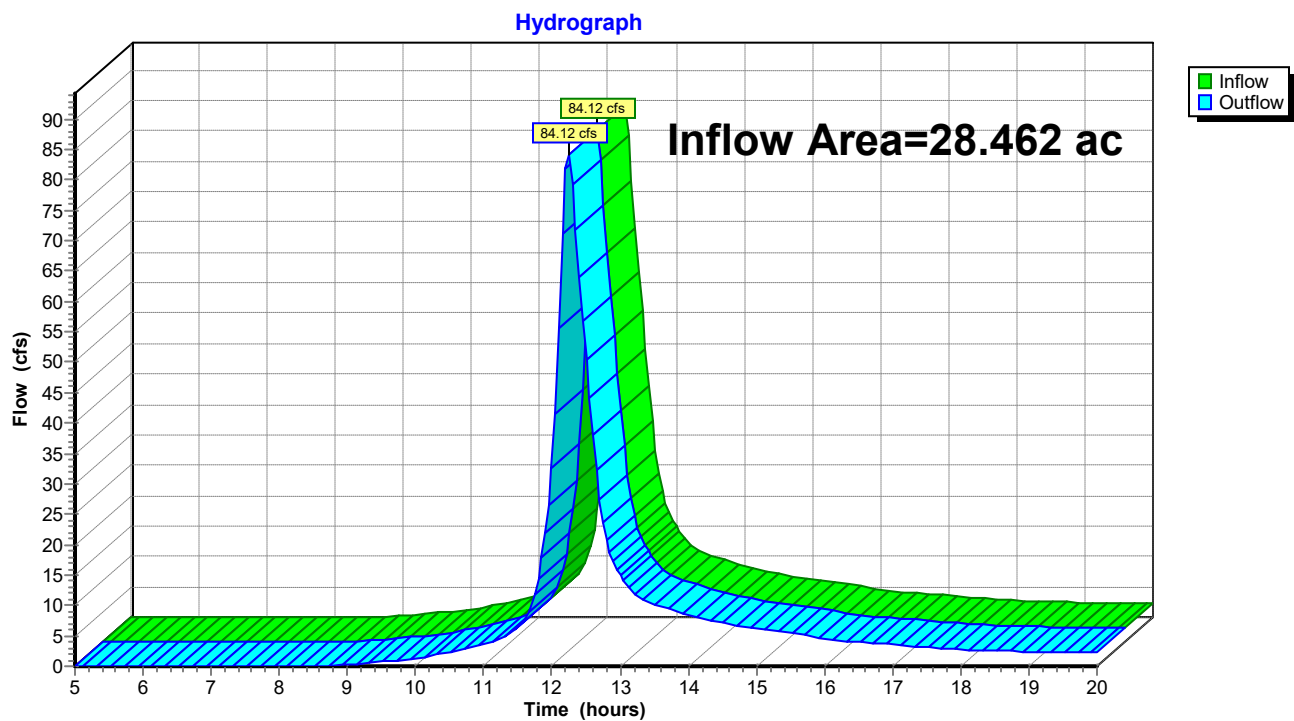
Summary for Reach IP-1E: WETLANDS

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 28.462 ac, 0.00% Impervious, Inflow Depth > 3.27" for 100YR event
Inflow = 84.12 cfs @ 12.24 hrs, Volume= 7.764 af
Outflow = 84.12 cfs @ 12.24 hrs, Volume= 7.764 af, Atten= 0%, Lag= 0.0 min

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

Reach IP-1E: WETLANDS



pre-port development

Prepared by {enter your company name here}

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100YR Rainfall=6.90"

Printed 3/7/2022

Page 44

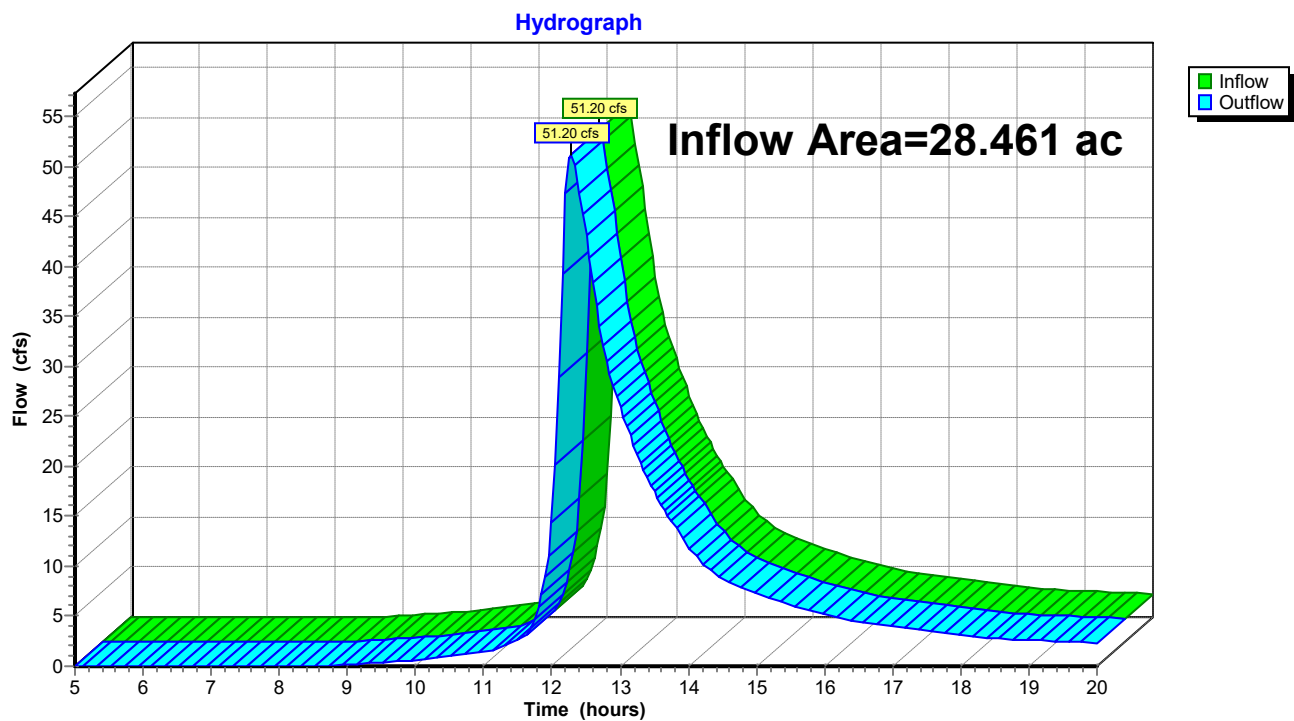
Summary for Reach IP-1P: WETLANDS

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 28.461 ac, 0.00% Impervious, Inflow Depth > 3.10" for 100YR event
Inflow = 51.20 cfs @ 12.28 hrs, Volume= 7.350 af
Outflow = 51.20 cfs @ 12.28 hrs, Volume= 7.350 af, Atten= 0%, Lag= 0.0 min

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

Reach IP-1P: WETLANDS



pre-port development

Type III 24-hr 100YR Rainfall=6.90"

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 45

Summary for Pond PND1: BASIN 1

Inflow Area = 6.881 ac, 0.00% Impervious, Inflow Depth > 3.48" for 100YR event
 Inflow = 22.59 cfs @ 12.21 hrs, Volume= 1.994 af
 Outflow = 10.14 cfs @ 12.56 hrs, Volume= 1.648 af, Atten= 55%, Lag= 20.5 min
 Primary = 10.14 cfs @ 12.56 hrs, Volume= 1.648 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 809.67' @ 12.56 hrs Surf.Area= 10,762 sf Storage= 33,222 cf

Plug-Flow detention time= 95.0 min calculated for 1.643 af (82% of inflow)
 Center-of-Mass det. time= 48.1 min (846.8 - 798.6)

Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	36,818 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

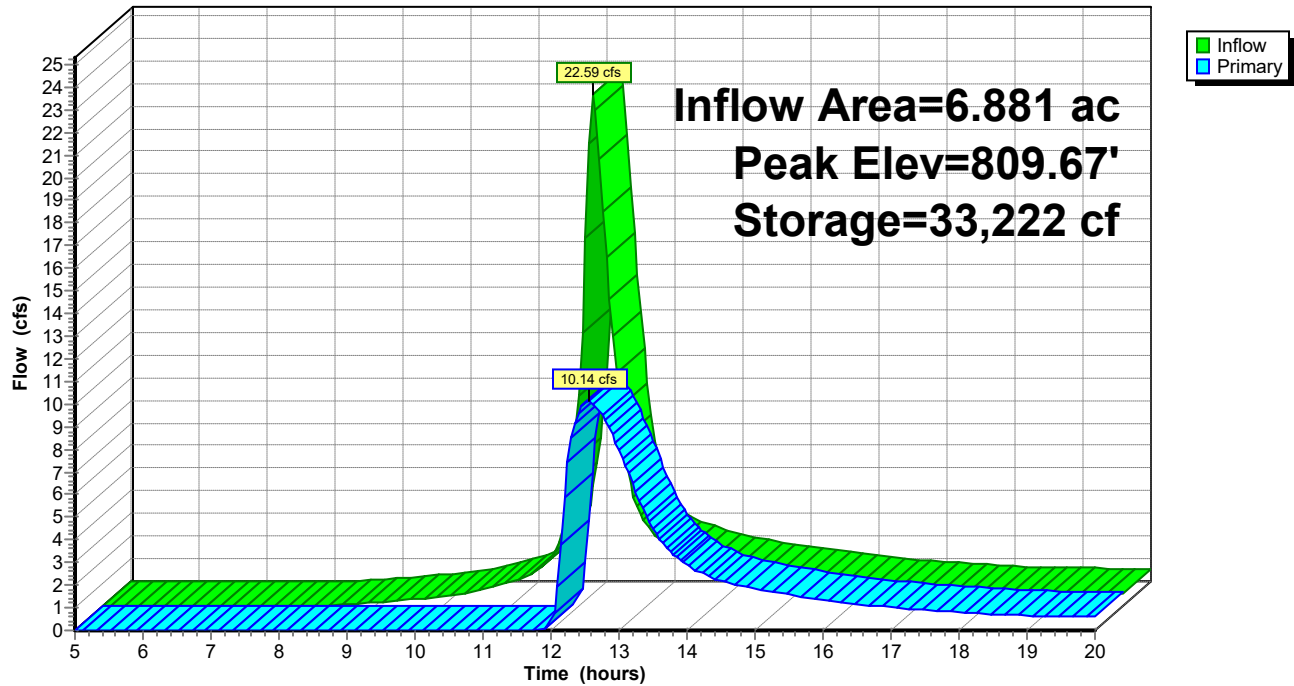
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	7,384	0	0
808.00	9,180	16,564	16,564
810.00	11,074	20,254	36,818

Device	Routing	Invert	Outlet Devices
#1	Primary	807.50'	18.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=10.14 cfs @ 12.56 hrs HW=809.67' (Free Discharge)
 ↑ **1=Orifice/Grate** (Orifice Controls 10.14 cfs @ 5.74 fps)

Pond PND1: BASIN 1

Hydrograph



pre-port development

Type III 24-hr 100YR Rainfall=6.90"

Prepared by {enter your company name here}

Printed 3/7/2022

HydroCAD® 10.00-26 s/n 09589 © 2020 HydroCAD Software Solutions LLC

Page 47

Summary for Pond PND2: BASIN#2

Inflow Area = 10.741 ac, 0.00% Impervious, Inflow Depth > 3.48" for 100YR event
 Inflow = 34.75 cfs @ 12.22 hrs, Volume= 3.112 af
 Outflow = 13.72 cfs @ 12.61 hrs, Volume= 2.655 af, Atten= 61%, Lag= 23.3 min
 Primary = 13.72 cfs @ 12.61 hrs, Volume= 2.655 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 815.35' @ 12.61 hrs Surf.Area= 12,990 sf Storage= 52,746 cf

Plug-Flow detention time= 90.0 min calculated for 2.646 af (85% of inflow)
 Center-of-Mass det. time= 48.3 min (847.4 - 799.1)

Volume	Invert	Avail.Storage	Storage Description
#1	810.00'	61,451 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

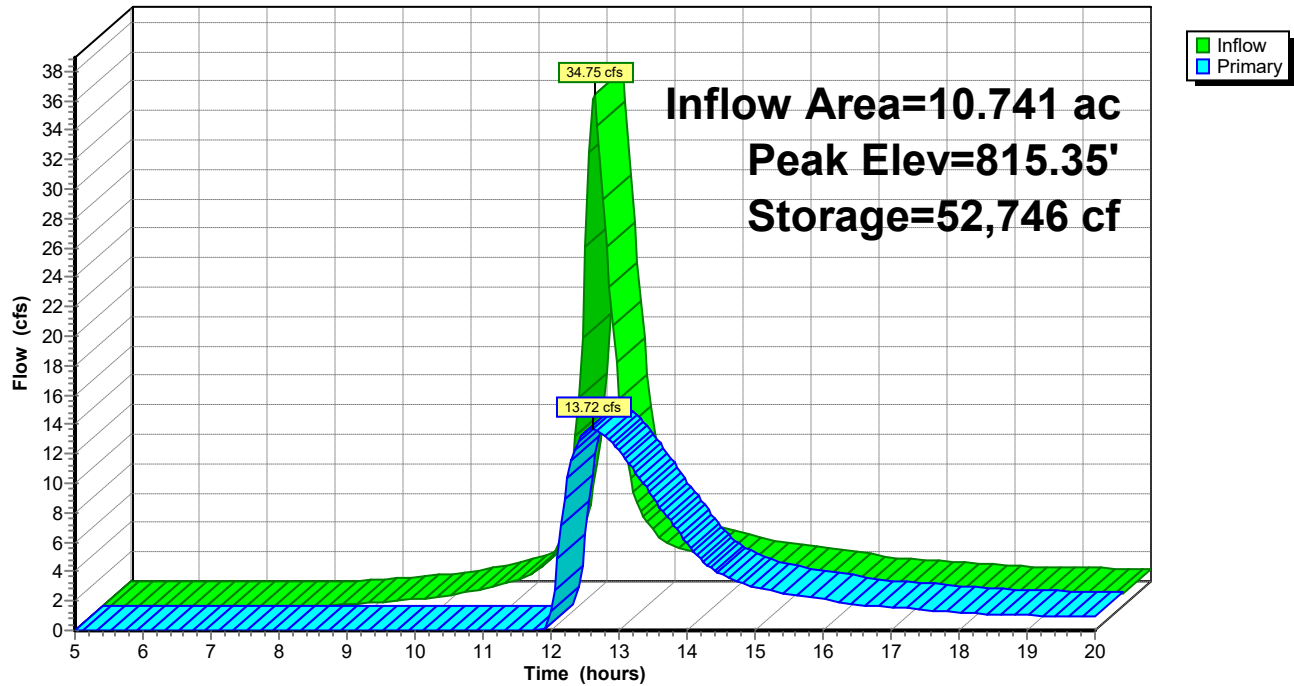
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
810.00	6,983	0	0
812.00	9,030	16,013	16,013
814.00	11,303	20,333	36,346
816.00	13,802	25,105	61,451

Device	Routing	Invert	Outlet Devices
#1	Primary	812.00'	18.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=13.71 cfs @ 12.61 hrs HW=815.35' (Free Discharge)
 ↑ **1=Orifice/Grate** (Orifice Controls 13.71 cfs @ 7.76 fps)

Pond PND2: BASIN#2

Hydrograph



STANDARD #3 –LOSS OF ANNUAL RECHARGE

The site is predominately un-developed. Temporary Basin 1& 2 are constructed for pretreatment prior to the existing wetland located in the west corner of the parcel. Soils were found to be Class C permeability.

The table below shows the required and provided recharge volumes for the project. As shown, the proposed condition exceeds the minimum requirement for the additional impervious areas.

Recharge Volume Summary

Soil Type	Recharge Factor (in. runoff)	Existing Impervious Area (sf)	Additional Impervious Area (sf)	Min. Req. Recharge Volume (cf)
A	0.60	0	0	0
B	0.35	0	0	0
C	0.25	0	0	0
D	0.10	0	0	0
Total Required				0

Standard #3 Only Applies to Additional Impervious

Provided Recharge Volume (cf)		
Roof Recharge (Pond#4)		0
		0
		0
Total Provided		0

Summit Engineering & Survey, Inc.

710 Main Street North Oxford MA 01537 (P) 508-987-8713 (F) 508-987-8714

STANDARD #4- 80% TSS REMOVAL

ESTIMATED PROPOSED NEW PAVED COVER= 0 S.F.

REQUIRED WATER QUALITY VOLUME:

Water Quality Volume		
Required Treatment Volume	1.0	Inches Over Impervious Areas
Watershed Series	Paved Area	Water Quality Volume

The design of the drainage system is such that the site is routed through a series of treatment BMP's meeting the Standard. The attached TSS worksheets show the water treatment prior to the existing basin located on. No bypass is designed of the BMP's reducing the WQV.

INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Basin#1&2

TSS Removal Calculation Worksheet	B BMP ¹	C TSS Removal Rate ¹	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
	Grass Channel	0.50	1.00	0.50	0.50
	Extended Dry Detention Basin	0.50	0.50	0.25	0.25
		0.00	0.25	0.00	0.25
		0.00	0.25	0.00	0.25
		0.00	0.25	0.00	0.25

Total TSS Removal =

75%

Separate Form Needs to
be Completed for Each
Outlet or BMP Train

Project: 21-301
Prepared By: pml
Date: 3/7/2022

*Equals remaining load from previous BMP (E)
which enters the BMP

STANDARD #9- OPERATION & MAINTENANCE

OPERATION & MAINTENANCE PLAN:

CURRENT OWNER & RESPONSIBLE PARTY:

Matt Schold (Contractor shall be responsible during construction)

FUTURE OWNER & RESPONSIBLE PARTY:

Matt Schold

DURING CONSTRUCTION:

SILT FENCE BARRIER:

The silt fence barrier shall be installed prior to construction.

During construction the contractor shall inspect the silt fence barrier on a weekly basis and after any significant rainstorm resulting in greater than 0.5" of rainfall. The barrier shall be inspected for any breaches or disturbed silt fence and repaired immediately.

After construction the barrier shall be maintained as stated above until all new areas are vegetated.

After construction these duties shall transfer to the property owner.

CONSTRUCTION ENTRANCE APRONS:

Construction aprons shall be installed to protect Tractor Supply Parking Lot and Route 9. The construction entrance apron shall be installed prior to commencement of construction and shall be inspected weekly. The construction entrance apron shall be replaced when debris becomes noticeable on the existing pavement surfaces leading to and from the construction site.

SLOPE STABILIZATION:

The slope stabilization controls shall be installed immediately upon obtaining final grades as shown on the project plans. Slopes in the swale area shall be stabilized according to the details provided. All 3:1 slopes established on-site shall be loamed and seeded as soon as weather permits. Any 2:1 slopes established shall be covered with slope stabilization fabric, then loamed and seeded as soon as weather permits. Areas in failure shall be re-graded to final grade and stabilized as necessary.

TEMPORARY BASINS:

The temporary basins shall be inspected immediately after storm events and cleaned to remove sediment build-up. Outfalls shall be inspected for erosion or scouring. Additional rip rap shall be added as required to minimize erosion.

Proposed outlet control structures:

Outlet control structures at basins have temporary stone or other filtration device installed around inlet to prevent sediment deposits. Sediment shall be removed when accumulation exceeds 1" depth on paved surfaces.

CHECK DAMS:

Check Dams shall be inspected weekly and after rainfall in excess of 0.5". Accumulated sediment shall be removed when depth exceeds 3" on the upstream sided of the dam. Stone or fabric shall be replaced when evidence of clogging is present.

CONSTRUCTION COMPLETION:

The entire stormwater management system shall be inspected upon completion of construction. Portions of the system containing sediment shall be cleaned and all sediment properly removed.

AFTER CONSTRUCTION:

Existing CATCH BASINS:

At a minimum, the catch basins shall be inspected and cleaned on a quarterly basis. It is preferred that collection of accumulated sediment shall be accomplished by means of vacuum pumping and not by means of a clamshell bucket. Disposal of accumulated sediment shall be performed in accordance with applicable local, state, and federal guidelines and regulations.

SEDIMENT BASINS

Sediment Basins shall be visually inspected monthly for accumulation of debris, slope failure, or stone displacement. Slopes shall be mowed quarterly. Bottom shall be swept, vacuumed of accumulated debris semi-annually.

INFILTRATION BASIN

Inspect infiltration basin after major storm events (>3.0 inches) to verify stabilization and infiltration. Mow slopes, berms quarterly. Removed accumulated clippings from infiltration stone. Inspect basin semi-annually for the following:

- Signs of differential settlement

- Cracking
- Erosion
- Leakage in embankments
- Tree growth on embankments
- Condition of rip rap
- Sediment accumulation
- Turf health.

LONG TERM POLLUTION PREVENTION PLAN

The following are the material management practices that shall be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff.

Good Housekeeping: The following good housekeeping practices will be followed on site during the construction project and continued upon completion of the construction activities.

1. A concerted effort shall be made to store only enough product required to complete a particular task.
2. All materials stored on site shall be stored in a neat and orderly fashion in their appropriate containers and, if possible, under a roof or other secure enclosure.
3. Products shall be kept in their original containers with the original manufacture's label.
4. Substances shall not be mixed with one another unless recommended by the manufacturer.
5. Whenever possible, all of a product shall be used up before disposing of the container.
6. Manufacture's recommendations for proper use and disposal shall be followed.
7. The site superintendent shall inspect daily to ensure proper use and disposal of materials on site.

Hazardous Products: The following practices are intended to reduce the risks associated with hazardous materials.

1. Products shall be kept in original containers unless they are not re-sealable.
2. Where feasible, the original label and material safety data shall be retained, whereas they contain important product information.
3. If surplus product must be disposed of, follow manufacturers or local and State recommended methods for proper disposal.

Product Specific Practices: The following product-specific practices shall be followed on site:
Petroleum Products:

1. All on site vehicles shall be monitored for leaks and receive regular preventative maintenance to reduce the risk of leakage.
2. Petroleum products shall be stored in tightly sealed containers which are clearly labeled.
3. Petroleum Products shall be stored in compliance with Fire Marshall regulations.

Bituminous Concrete:

Any bituminous concrete or asphalt substances used on site shall be applied according to the manufacturer's recommendations.

Fertilizers:

Fertilizers shall be applied in the minimum amounts recommended by the manufacturer. Once applied, fertilizers shall be worked into the soil to limit exposure to stormwater. Storage shall be in a covered shed or trailer. The contents of any partially-used bags of fertilizer shall be transferred to a sealable plastic bag or bin to avoid spills

Paints:

1. All containers shall be tightly sealed and stored when not required for use.
2. Excess paint shall not be discharged into any catch basin, drain manhole or any portion of the stormwater management system.
3. Excess paint shall be properly disposed of according to manufacturer's recommendations or State and local regulations.

Concrete Trucks:

Concrete trucks shall not be allowed to wash out or discharge surplus concrete or drum wash water on site.

SPILL CONTROL PRACTICES

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices shall be followed for spill prevention and cleanup:

1. Manufacturer's recommended methods for cleanup shall be readily available at the onsite trailer, and site personnel shall be made aware of the procedures and the location of the information.
2. Materials and equipment necessary for spill clean up shall be kept in the material storage area on site. Equipment and materials shall include, but not be limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust and plastic and metal trash containers specifically for this purpose.
3. All spills shall be cleaned up immediately after discovery.
4. The spill area shall be kept well ventilated, and personnel shall wear appropriate protective clothing to prevent injury from contact with hazardous substance.
5. Spills of toxic or hazardous material shall be reported to the appropriate State and/or local authority in accordance with local and/or State regulations.
6. The spill prevention plan shall be adjusted to include measures to prevent a particular type of spill from reoccurring and instructions on how to clean up the spill if there is another occurrence. A description of the spill, what caused it, and the clean up measures shall also be included.
7. The "Manager" shall be the spill prevention and cleanup coordinator. The "Manager" shall designate at least three other site personnel who will be trained in the spill control practices identified above.

APPENDICES:

PRE-DEVELOPMENT DIAGRAM

POST-DEVELOPMENT DIAGRAM

PRE-DEVELOPMENT WATERSHED MAP

POST-DEVELOPMENT WATERSHED MAP

SOIL MAPS