

Stormwater Management Report

Owner:

Chu Vision Institute
9117 Lyndale Ave S
Bloomington, MN 55420

Project:

Chu Vision Institute – Parking Lot Expansion
9117 Lyndale Ave S
Bloomington, MN 55420

Engineer's Certification:

All plans and supporting Documentation contained in this report have been reviewed by me and it is hereby certified that to the best of my knowledge the plans comply with the requirements of the ordinance.

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.



Robert A. Latta P.E.

Registration Number: 59612

Date:

08/12/2024

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- HydroCAD
 - Existing Conditions HydroCAD Modeling
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2.0 Summary Analysis / Narrative:

2.1 Introduction:

This stormwater management report accompanies the Civil Engineering Plans prepared by Civil Site Group for the subject project dated 08/12/2024. This report includes a summary of the existing and proposed site conditions, the stormwater requirements of relevant regulatory agencies, and proposed design calculations and data to meet the requirements.

2.2 Existing Site Conditions:

Site Description:

The existing site is a medical office facility with associated parking and landscape infrastructure.

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
EX1 (TO ADJ. PROPERTIES)	0	98	6942	61	6942	61
EX2 (TO STREET)	48761	98	23862	61	72623	86

Existing Soils:

A geotechnical evaluation has not been completed at this site as of 08/09/2024. Site soils are assumed, for the purposes of this report and the design of the on-site infiltration basin, to have an HSG 'B' designation, with an infiltration rate of 0.45 in/hr.

Groundwater:

Groundwater observations have not been taken at this site as of 08/09/2024.

2.3 Proposed Site Conditions:

Site Description:

The proposed improvements consist of the construction of new parking capacity on-site. The proposed conditions site areas are below.

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
PR1 (TO BASIN)	11158	98	10581	61	21739	80
PR2 (TO STREET)	48140	98	5148	61	53288	94
PR3 (TO ADJ. PROPERTIES)	0	98	4538	61	4538	61

2.4 Stormwater Requirements City (Bloomington):

See Nine Mile Creek Watershed District requirements below.

2.5 Stormwater Requirements Watershed (Nine Mile Creek Watershed District):

Requirement threshold - Projects that disturbs 5,000 sf or more area.

Rate Control – Runoff rate may not exceed existing conditions for the 2, 10, and 100-yr storm events. Utilize Atlas-14 rainfall data.

Water Quality – Stormwater BMPs shall remove 90% of the post-development TSS and 60% of the post TP loading for the new/reconstructed impervious and disturbed areas.

Volume Control – Stormwater runoff volume must be reduced by 1.1" over all new and reconstructed impervious surfaces (includes all newly constructed impervious surfaces, i.e. all impervious disturbed and reconstructed as well as new impervious).

Building Low Floor Elevation - Low-floor elevation. All new and reconstructed buildings must be constructed such that the low floor is:

- a. At least two feet above the 100-year high water elevation or one foot above the natural overflow of a waterbody;
- b. At least two feet above the 100-year high water elevation of any open stormwater conveyance; and Nine Mile Creek Watershed District Rules Revisions adopted on December 20, 2023 23;
- c. At least two feet above the 100-year high water elevation or one foot above the emergency overflow of a constructed facility.

In addition, a stormwater management facility must be constructed at an elevation that ensures that no adjacent habitable building will be brought into noncompliance with a standard in this subsection 4.3.3.

2.6 Stormwater Requirements - Minnesota Pollution Control Agency – NPDES permit (MPCA):

Requirement threshold - A permit is required for projects with a disturbed area over 1 acre in size, Stormwater management is required for a project adding 1-acre of more of NEW impervious surface (reconstructed impervious is not included).

Rate Control – No specific regulation, may not degrade downstream facilities.

Water Quality – Stormwater water quality treatment volume must be provided equal to 1.0" over all new impervious surfaces (includes all newly constructed impervious surfaces only, re-constructed impervious surfaces are not included).

Volume Control – Must consider volume reduction if feasible and not prohibited on site. The required infiltration volume is equal to the water quality volume described above.

3.0 Stormwater Calculations:

3.1 Proposed Stormwater Management Strategy & Facilities Description

This project proposes an aboveground infiltration basin to treat and infiltrate runoff from the new and reconstructed impervious surfaces on the site.

3.2 Rate Control

Rate control is provided by the proposed filtration basin. This information was derived using HydroCAD stormwater modeling software. The existing and proposed runoff rates are shown in the summary table below.

Overall Stormwater Rate Summary

	Existing Conditions Rate (cfs)	Proposed Conditions Rate (cfs)
2-Year Event	4.95	4.73
10-Year Event	8.22	7.35
100-Year Event	16.09	13.29

3.3 Water Quality

The proposed stormwater BMP is be designed to capture the prescribed water quality volume meeting the watershed requirements, confirmed by the MIDS printout attached to this report as an appendix. Results are also shown below.

Pollutant	TSS Generated (lb/yr)	TSS Removed (lb/yr)	Removal Efficiency
TSS	103.4	99.5	96%
TP	0.5692	0.547	96%

3.4 Volume Control

Water quality and volume control requirements are met by providing infiltration onsite in the amount equal to 1.1 inches of runoff from the new or reconstructed impervious surfaces.

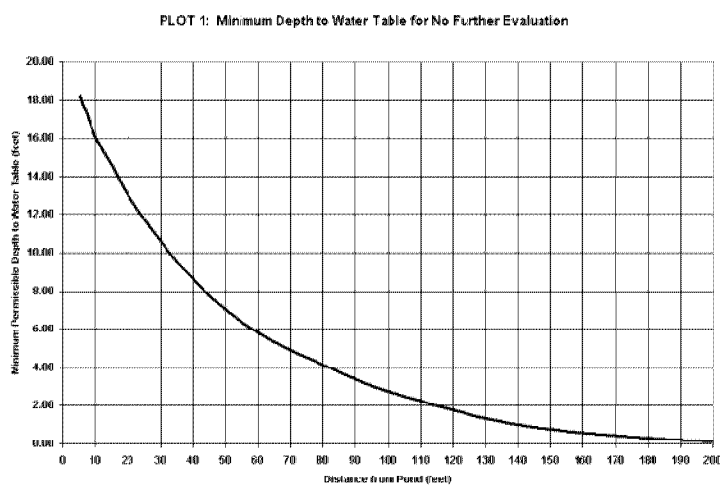
The calculations are shown below:

Drainage Area	Required Infiltration Vol. Summary		Infiltration Volume = 1.1" * Dist. Impv. Area
	New Impv. Area (sf)	Required Volume (cf)	
NEW/RECONSTRUCTED IMPERVIOUS	11665	1069	
TOTAL	11665	1069	

Proposed BMP Area	Provided Vol (cf)
Infiltration Basin 1	13530
TOTAL	13530

3.5 Low Building Floor Elevation

Nine Mile Creek Watershed District rule 4.3.4 requires a stormwater management facility must be constructed such that no adjacent habitable building will be brought into noncompliance with the low floor standards as stated. The proposed infiltration basin onsite will be constructed with a 100-yr flood elevation at or above the existing low floor elevation of the building on the subject site and other adjacent properties. However, the proposed basin has a relatively small contributing drainage area and is, at minimum, 60 feet away from every adjacent building. The proposed HydroCAD simulation of the basins show that in the 100-year and back-to-back events, surface flows would be unable to penetrate any low-opening of any adjacent building. Neither events simulate the basin utilizing the 833.36 EOF in the parking lot, or, let-alone, overflowing the berm to the north, east and south. Further, pending the forthcoming soil boring logs and groundwater observations, a likely low groundwater elevation coupled with the basin's distance from every adjacent building will prevent seepage by groundwater mounding. NMCWD's appendix 4a, plot 1 is shown below. No further evaluation is required (given the nearest building is 60 feet away) provided the water table observed in the forthcoming borings is greater than 6' below the finished floor elevation of that building, roughly 830.0. If groundwater observations show a higher water table at that time, the design will be reassessed.



Nine Mile Creek Watershed District Rules
Revisions adopted on December 24, 2013

4.0 Conclusions:

To the best of our knowledge, this project meets all State, City, and Watershed stormwater management requirements.

Lapham Hickey Steel
Civil Site Group - Stormwater Calculations

Existing Conditions

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
EX1 (TO ADJ. PROPERTIES)	0	98	6942	61	6942	61
EX2 (TO STREET)	48761	98	23862	61	72623	86

Proposed Conditions

Drainage Area	Impervious Area		Pervious Area		Total Area	
	Area [SF]	CN Value	Area [SF]	CN Value	Area [SF]	CN Value
PR1 (TO BASIN)	11158	98	10581	61	21739	80
PR2 (TO STREET)	48140	98	5148	61	53288	94
PR3 (TO ADJ. PROPERTIES)	0	98	4538	61	4538	61

Site Area Summary

	Impervious [SF]	Impervious [AC]	Pervious [SF]	Pervious [AC]	Total [SF]	Total [AC]
Existing Site	48761	1.12	30804	0.71	79565	1.83
Proposed Site	59298	1.36	20267	0.47	79565	1.83

Stormwater Rate Summary

Drainage Area	Existing Rate (cfs)		
	2-YR [2.94"]	10-YR [4.47"]	100-YR [7.81"]
EX1 (TO ADJ. PROPERTIES)	0.06	0.26	0.87
EX2 (TO STREET)	4.90	7.97	15.22
TOTAL (REACH)	4.95	8.22	16.09

Drainage Area	Proposed Conditions Rate (cfs)		
	2-YR [2.94"]	10-YR [4.47"]	100-YR [7.81"]
PR1 (1P)	0.00	0.00	0.00
PR2 (TO STREET)	4.70	7.19	12.72
PR3 (TO ADJ. PROPERTIES)	0.04	0.17	0.57
TOTAL (REACH)	4.73	7.35	13.29

Overall Stormwater Rate Summary

	Existing Conditions Rate (cfs)	Proposed Conditions Rate (cfs)
2-Year Event	4.95	4.73
10-Year Event	8.22	7.35
100-Year Event	16.09	13.29

Stormwater Rate Summary - To Adjacent Property

	Existing Conditions Rate (cfs)	Proposed Conditions Rate (cfs)
2-Year Event	0.06	0.04
10-Year Event	0.26	0.17
100-Year Event	0.87	0.57

Stormwater Water Quality and Volume Summary

Drainage Area	Required Infiltration Vol. Summary		Infiltration Volume = 1.1"Dist. Impv. Area
	New Impv. Area (sf)	Required Volume (cf)	
NEW/RECONSTRUCTED IMPERVIOUS	11665	1069	
TOTAL	11665	1069	

Proposed BMP Area	Provided Vol (cf)
Infiltration Basin 1	13530
TOTAL	13530

Stormwater Water Quality Summary

Pollutant	TSS Generated (lb/yr)	TSS Removed (lb/yr)	Removal Efficiency
TSS	103.4	99.5	96%
TP	0.5692	0.547	96%

Project Information

Calculator Version:	Version 4: July 2020
Project Name:	CHU VISION INSTITUTE - PARKING LOT EXPANSION
User Name / Company Name:	CIVIL SITE GROUP
Date:	08/09/2024
Project Description:	PARKING LOT EXPANSION
Construction Permit?:	No

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	55420
Annual Rainfall (inches):	31.5
Phosphorus EMC (mg/l):	0.3
TSS EMC (mg/l):	54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed		0.204			0.204
			Impervious Area (acres)		0.268
			Total Area (acres)		0.472

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed		0.204			0.204
			Impervious Area (acres)		0.256
			Total Area (acres)		0.46

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	1070	ft ³
Volume removed by BMPs towards performance goal:	1022	ft ³
Percent volume removed towards performance goal	96	%

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	0.6979	acre-ft
Annual runoff volume removed by BMPs:	0.671	acre-ft
Percent annual runoff volume removed:	96	%

Post development annual particulate P load:	0.3132	lbs
Annual particulate P removed by BMPs:	0.301	lbs
Post development annual dissolved P load:	0.256	lbs
Annual dissolved P removed by BMPs:	0.246	lbs
Total P removed by BMPs	0.547	lbs
Percent annual total phosphorus removed:	96	%

Post development annual TSS load:	103.4	lbs
Annual TSS removed by BMPs:	99.5	lbs
Percent annual TSS removed:	96	%

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft ³)	Volume Recieved (ft ³)	Volume Retained (ft ³)	Volume Outflow (ft ³)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	11365	1022	1022	0	100

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	0.671	0	0.671	0	100

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	0.3011	0	0.3011	0	100

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	0.2464	0	0.2464	0	100

Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	0.5475	0	0.5475	0	100

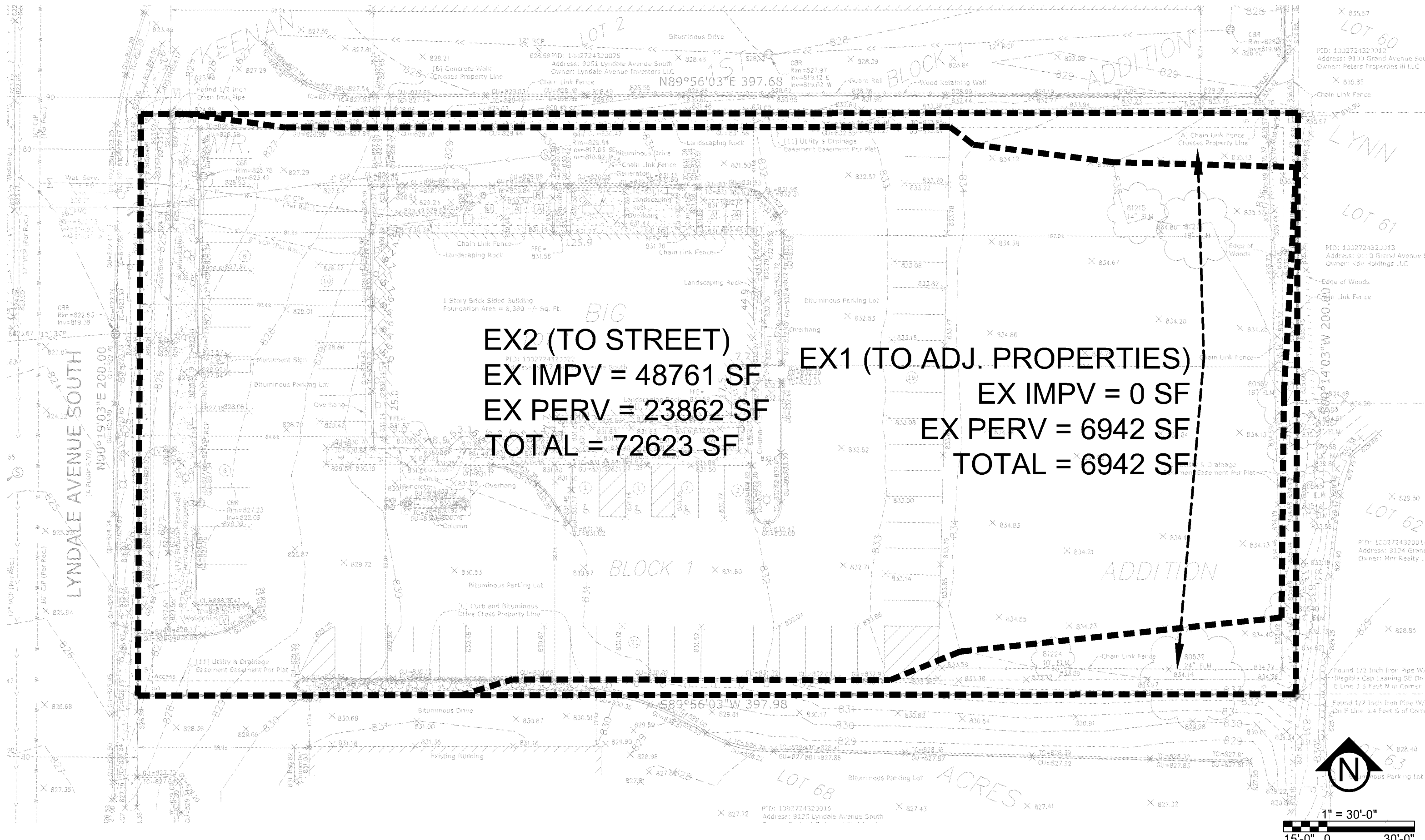
TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
1 - Bioretention basin (w/o underdrain)	99.46	0	99.46	0	100

BMP Schematic



1 - Bioretention basin (w/o
underdrain)



EX2 (TO STREET)
EX IMPV = 48761 SF
EX PERV = 23862 SF
TOTAL = 72623 SF

EX1 (TO ADJ. PROPERTIES)
EX IMPV = 0 SF
EX PERV = 6942 SF
TOTAL = 6942 SF



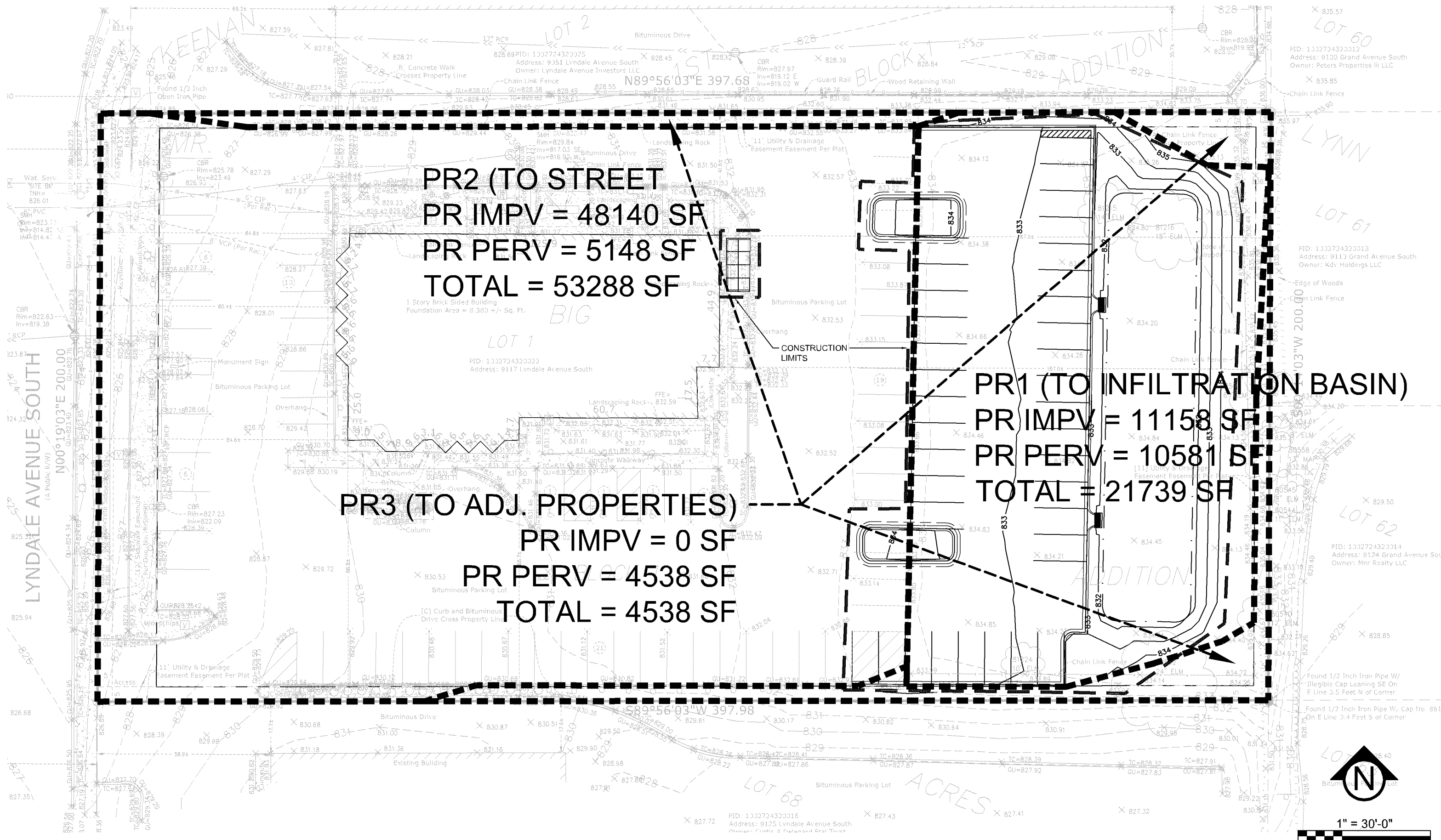
5000 Glenwood Avenue
Golden Valley, MN 55422
612-615-0060
www.CivilSiteGroup.com

EXISTING DRAINAGE MAP

Project Number: 24322
Issue Date: 8/9/2024

Revision Number:
Revision Date:

DA 1



PR2 (TO STREET)
PR IMPV = 48140 SF
PR PERV = 5148 SF
TOTAL = 53288 SF

PR1 (TO INFILTRATION BASIN)
PR IMPV = 11158 SF
PR PERV = 10581 SF
TOTAL = 21739 SF

PR3 (TO ADJ. PROPERTIES)
PR IMPV = 0 SF
PR PERV = 4538 SF
TOTAL = 4538 SF

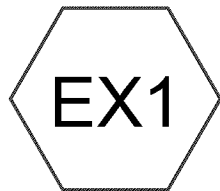


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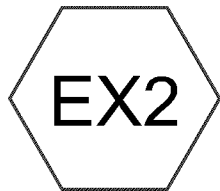
PROPOSED DRAINAGE MAP

Project Number: 24322
Issue Date: 8/9/2024
Revision Number:
Revision Date:

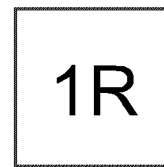
DA 2



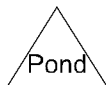
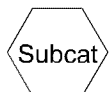
EX1 (TO ADJ.
PROPERTIES)



EX2 (TO STREET)



TOTAL



Routing Diagram for 24322 EXISTING

Prepared by Civil Site Group, Printed 8/9/2024

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24322 EXISTING

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Project Notes

Rainfall events imported from "24322 PROPOSED.hcp"

Rainfall events imported from "24322 PROPOSED.hcp"

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Page 3

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	MSE 24-hr	3	Default	24.00	1	2.86	2
2	10-Year	MSE 24-hr	3	Default	24.00	1	4.26	2
3	100-Year	MSE 24-hr	3	Default	24.00	1	7.32	2

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.707	61	>75% Grass cover, Good, HSG B (EX1, EX2)
1.119	98	Paved parking, HSG B (EX2)
1.827	84	TOTAL AREA

24322 EXISTING

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	EX1, EX2
1.827	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.827		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
0.000	0.707	0.000	0.000	0.000	0.707	>75% Grass cover, Good	EX1, EX2
0.000	1.119	0.000	0.000	0.000	1.119	Paved parking	EX2
0.000	1.827	0.000	0.000	0.000	1.827	TOTAL AREA	

24322 EXISTING*MSE 24-hr 3 2-Year Rainfall=2.86"*

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

SubcatchmentEX1: EX1 (TO ADJ.

Runoff Area=6,942 sf 0.00% Impervious Runoff Depth=0.31"
Tc=6.0 min CN=61 Runoff=0.06 cfs 0.004 af

SubcatchmentEX2: EX2 (TO STREET)

Runoff Area=72,623 sf 67.14% Impervious Runoff Depth=1.87"
Tc=6.0 min CN=WQ Runoff=4.90 cfs 0.260 af

Reach 1R: TOTAL

Inflow=4.95 cfs 0.264 af
Outflow=4.95 cfs 0.264 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.264 af Average Runoff Depth = 1.73"
38.72% Pervious = 0.707 ac 61.28% Impervious = 1.119 ac

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MSE 24-hr 3 2-Year Rainfall=2.86"

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Summary for Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)

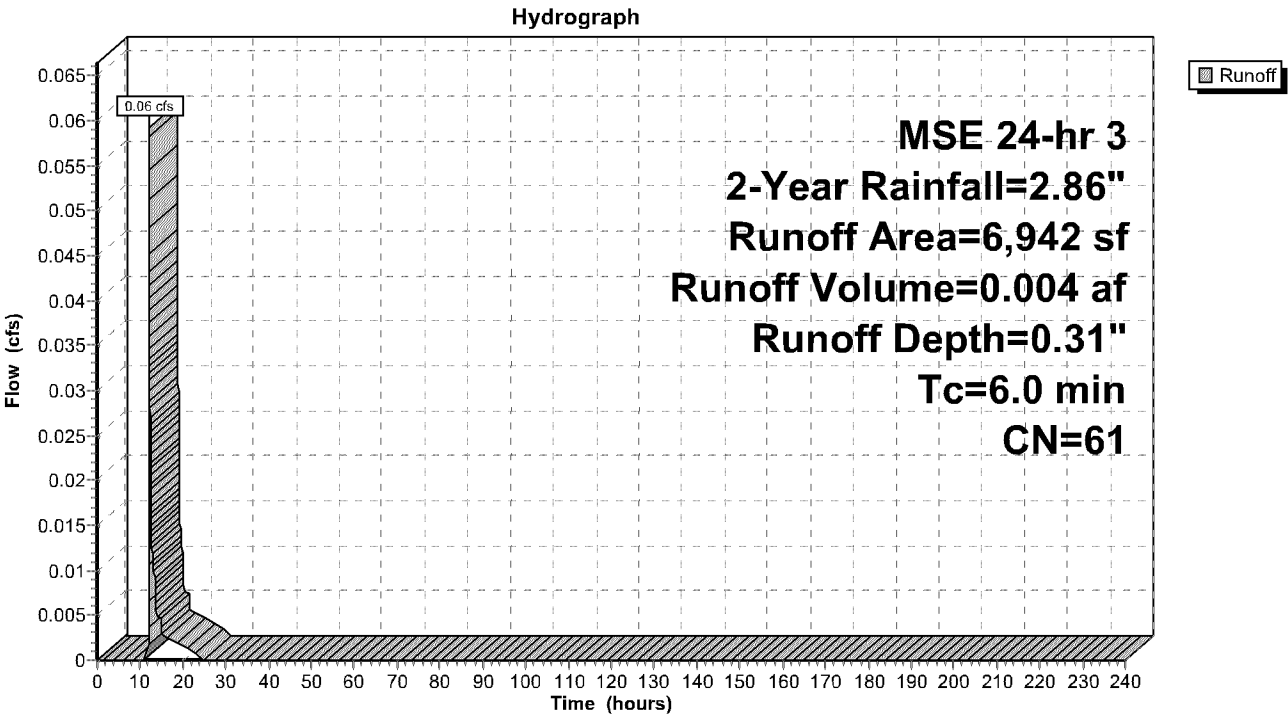
Runoff = 0.06 cfs @ 12.16 hrs, Volume= 0.004 af, Depth= 0.31"
Routed to Reach 1R : TOTAL

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (sf)	CN	Description
6,942	61	>75% Grass cover, Good, HSG B
6,942		100.00% Pervious Area

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

Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)



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MSE 24-hr 3 2-Year Rainfall=2.86"

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Summary for Subcatchment EX2: EX2 (TO STREET)

Runoff = 4.90 cfs @ 12.13 hrs, Volume= 0.260 af, Depth= 1.87"
Routed to Reach 1R : TOTAL

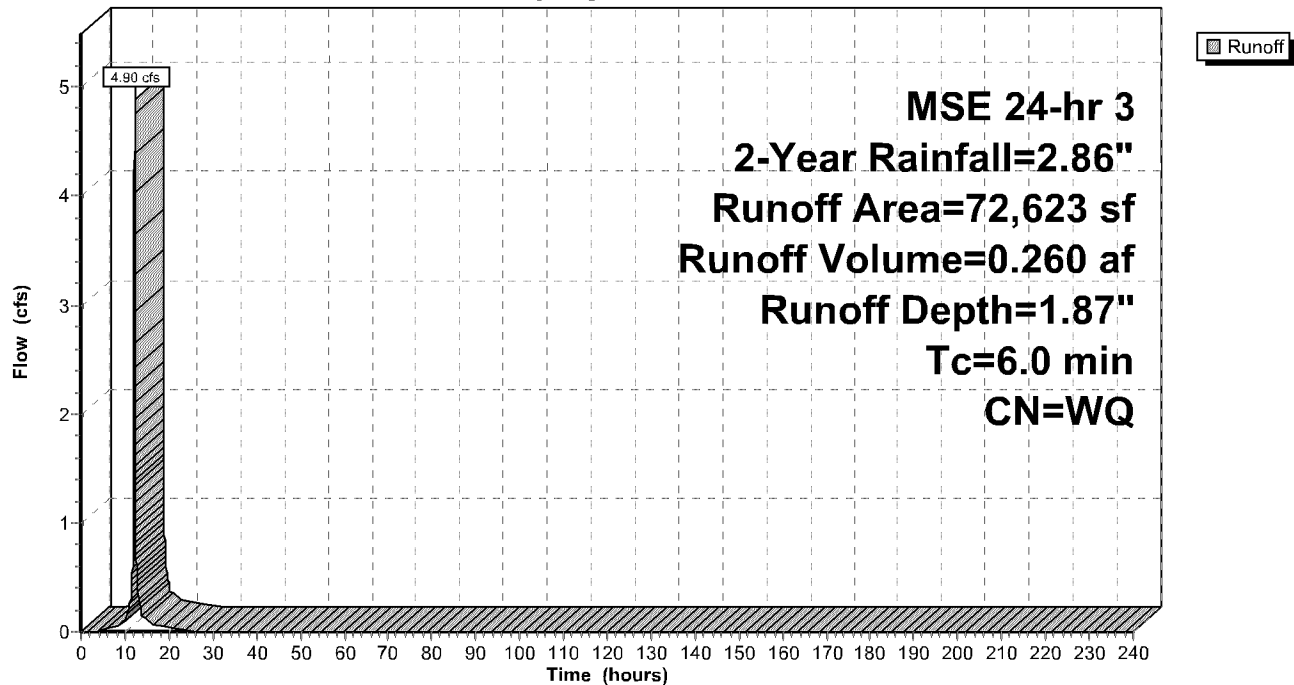
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (sf)	CN	Description
48,761	98	Paved parking, HSG B
23,862	61	>75% Grass cover, Good, HSG B
72,623		Weighted Average
23,862		32.86% Pervious Area
48,761		67.14% Impervious Area

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

Subcatchment EX2: EX2 (TO STREET)

Hydrograph



24322 EXISTING

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MSE 24-hr 3 2-Year Rainfall=2.86"

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Summary for Reach 1R: TOTAL

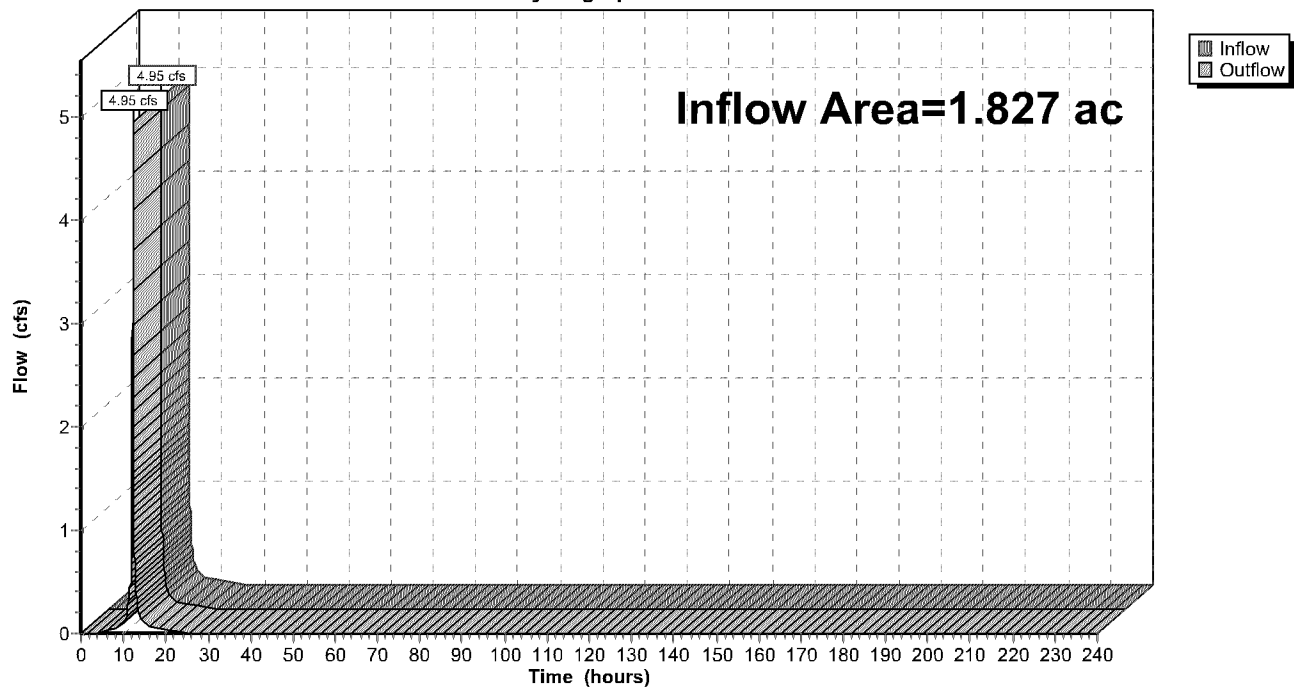
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.827 ac, 61.28% Impervious, Inflow Depth = 1.73" for 2-Year event
Inflow = 4.95 cfs @ 12.13 hrs, Volume= 0.264 af
Outflow = 4.95 cfs @ 12.13 hrs, Volume= 0.264 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL

Hydrograph



24322 EXISTING*MSE 24-hr 3 10-Year Rainfall=4.26"*

Prepared by Civil Site Group

Printed 8/9/2024

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

SubcatchmentEX1: EX1 (TO ADJ.

Runoff Area=6,942 sf 0.00% Impervious Runoff Depth=0.95"
Tc=6.0 min CN=61 Runoff=0.26 cfs 0.013 af

SubcatchmentEX2: EX2 (TO STREET)

Runoff Area=72,623 sf 67.14% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=WQ Runoff=7.97 cfs 0.419 af

Reach 1R: TOTAL

Inflow=8.22 cfs 0.431 af
Outflow=8.22 cfs 0.431 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.431 af Average Runoff Depth = 2.83"
38.72% Pervious = 0.707 ac 61.28% Impervious = 1.119 ac

24322 EXISTING

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MSE 24-hr 3 10-Year Rainfall=4.26"

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Summary for Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)

Runoff = 0.26 cfs @ 12.14 hrs, Volume= 0.013 af, Depth= 0.95"
Routed to Reach 1R : TOTAL

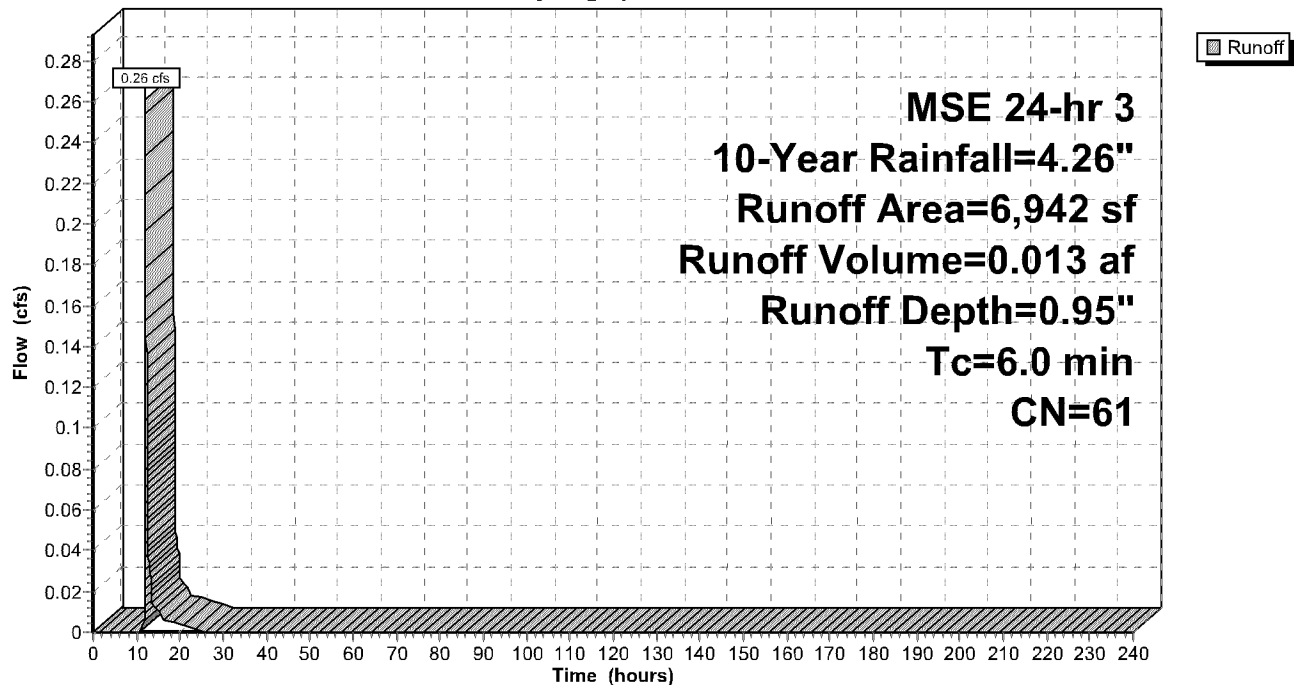
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (sf)	CN	Description
6,942	61	>75% Grass cover, Good, HSG B
6,942		100.00% Pervious Area

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

Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)

Hydrograph



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MSE 24-hr 3 10-Year Rainfall=4.26"

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Summary for Subcatchment EX2: EX2 (TO STREET)

Runoff = 7.97 cfs @ 12.13 hrs, Volume= 0.419 af, Depth= 3.01"
Routed to Reach 1R : TOTAL

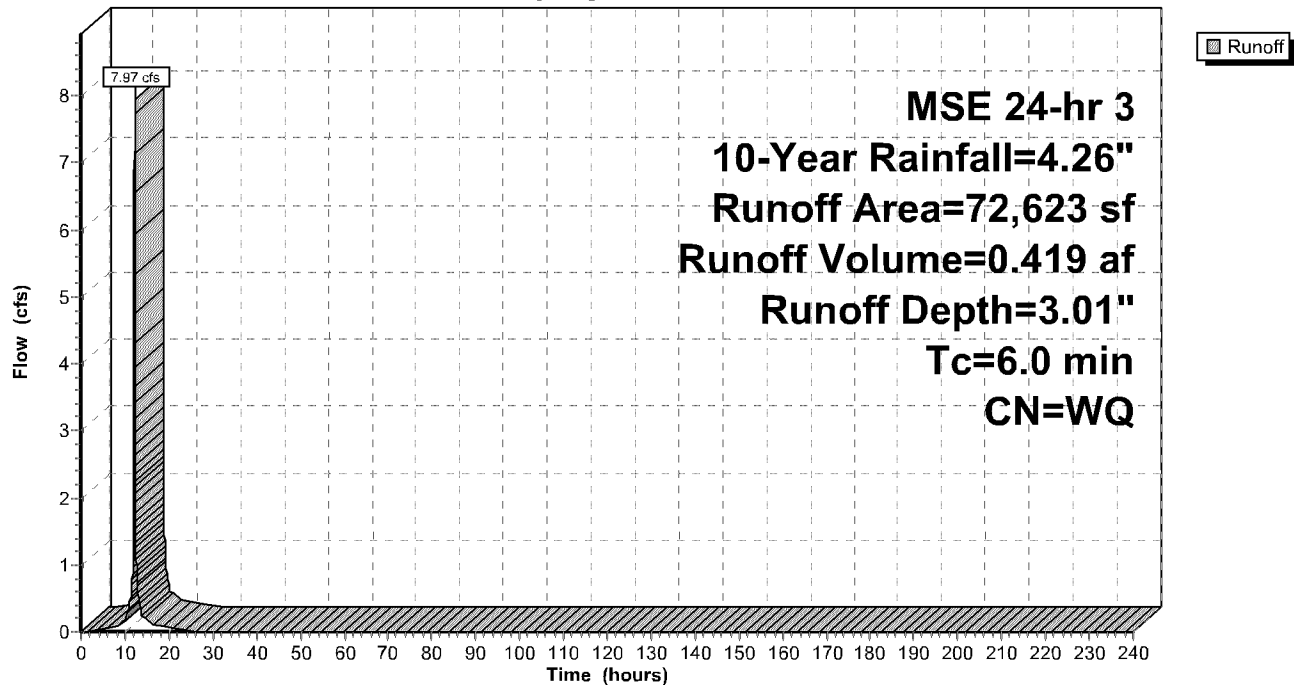
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (sf)	CN	Description
48,761	98	Paved parking, HSG B
23,862	61	>75% Grass cover, Good, HSG B
72,623		Weighted Average
23,862		32.86% Pervious Area
48,761		67.14% Impervious Area

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

Subcatchment EX2: EX2 (TO STREET)

Hydrograph



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MSE 24-hr 3 10-Year Rainfall=4.26"

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Summary for Reach 1R: TOTAL

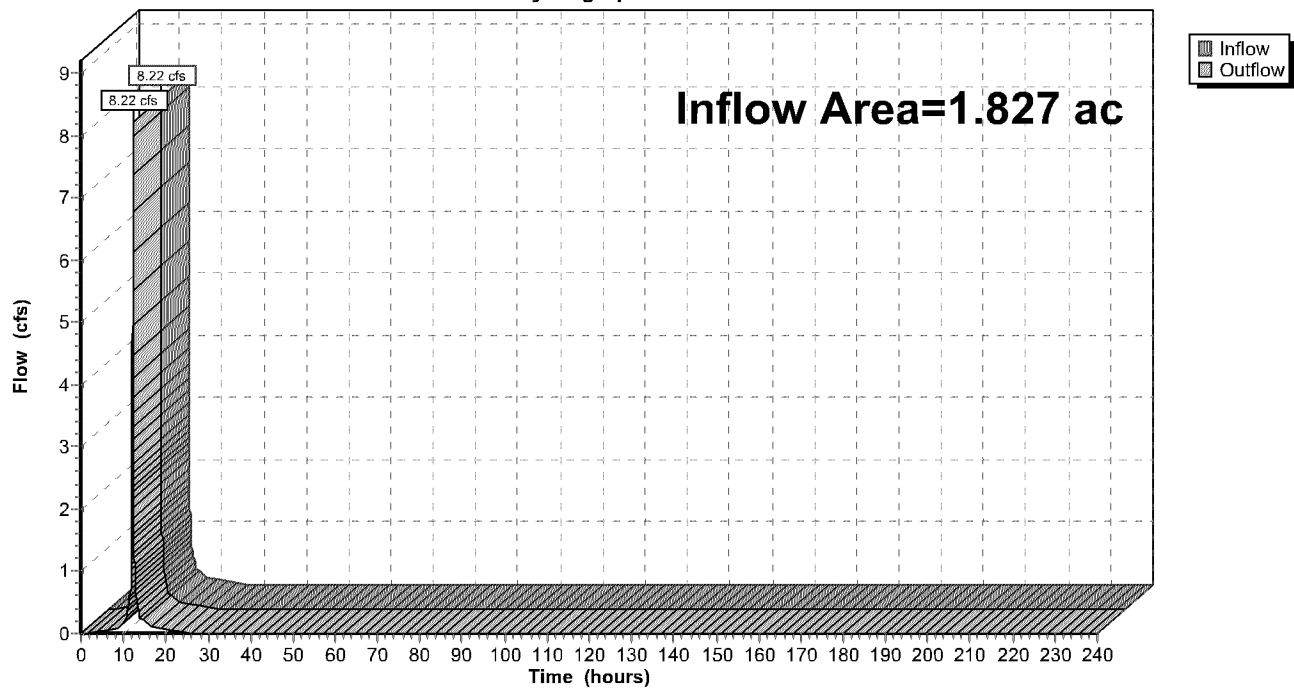
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.827 ac, 61.28% Impervious, Inflow Depth = 2.83" for 10-Year event
Inflow = 8.22 cfs @ 12.13 hrs, Volume= 0.431 af
Outflow = 8.22 cfs @ 12.13 hrs, Volume= 0.431 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL

Hydrograph



24322 EXISTING*MSE 24-hr 3 100-Year Rainfall=7.32"*

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

SubcatchmentEX1: EX1 (TO ADJ.

Runoff Area=6,942 sf 0.00% Impervious Runoff Depth=2.94"
Tc=6.0 min CN=61 Runoff=0.87 cfs 0.039 af

SubcatchmentEX2: EX2 (TO STREET)

Runoff Area=72,623 sf 67.14% Impervious Runoff Depth=5.72"
Tc=6.0 min CN=WQ Runoff=15.22 cfs 0.794 af

Reach 1R: TOTAL

Inflow=16.09 cfs 0.833 af
Outflow=16.09 cfs 0.833 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.833 af Average Runoff Depth = 5.48"
38.72% Pervious = 0.707 ac 61.28% Impervious = 1.119 ac

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MSE 24-hr 3 100-Year Rainfall=7.32"

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Summary for Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)

Runoff = 0.87 cfs @ 12.14 hrs, Volume= 0.039 af, Depth= 2.94"
Routed to Reach 1R : TOTAL

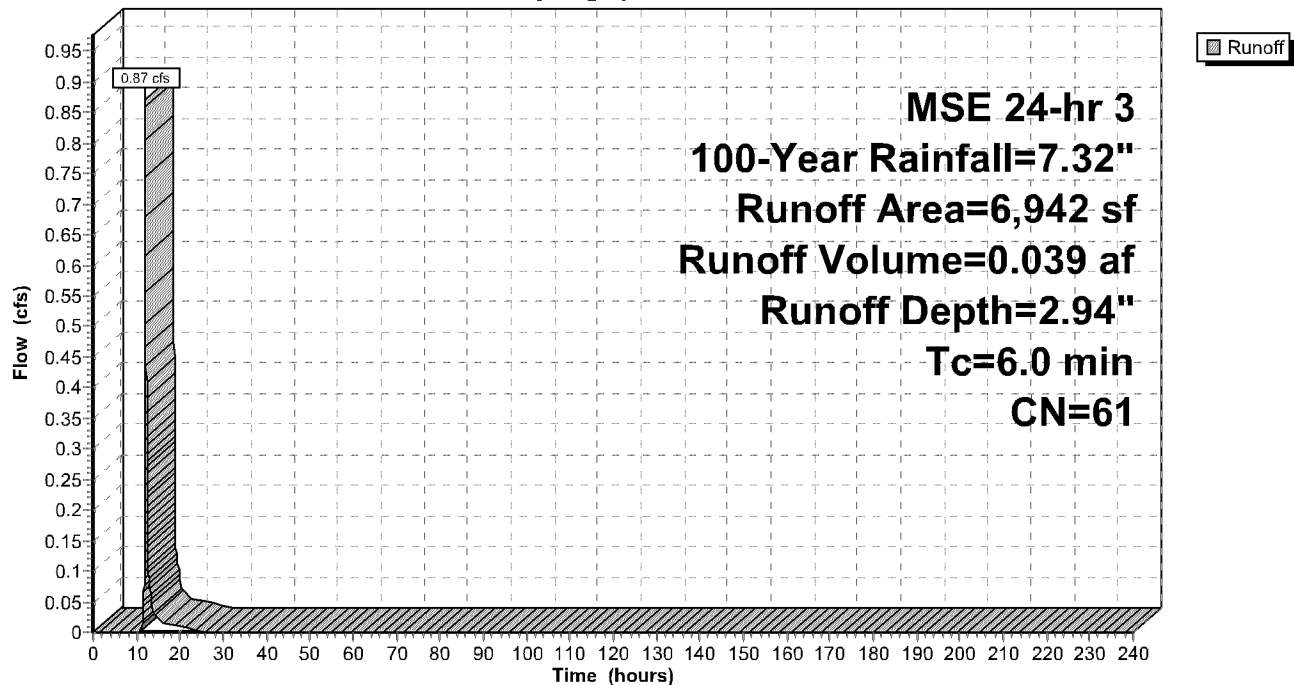
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

Area (sf)	CN	Description
6,942	61	>75% Grass cover, Good, HSG B
6,942		100.00% Pervious Area

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

Subcatchment EX1: EX1 (TO ADJ. PROPERTIES)

Hydrograph



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MSE 24-hr 3 100-Year Rainfall=7.32"

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Summary for Subcatchment EX2: EX2 (TO STREET)

Runoff = 15.22 cfs @ 12.13 hrs, Volume= 0.794 af, Depth= 5.72"
Routed to Reach 1R : TOTAL

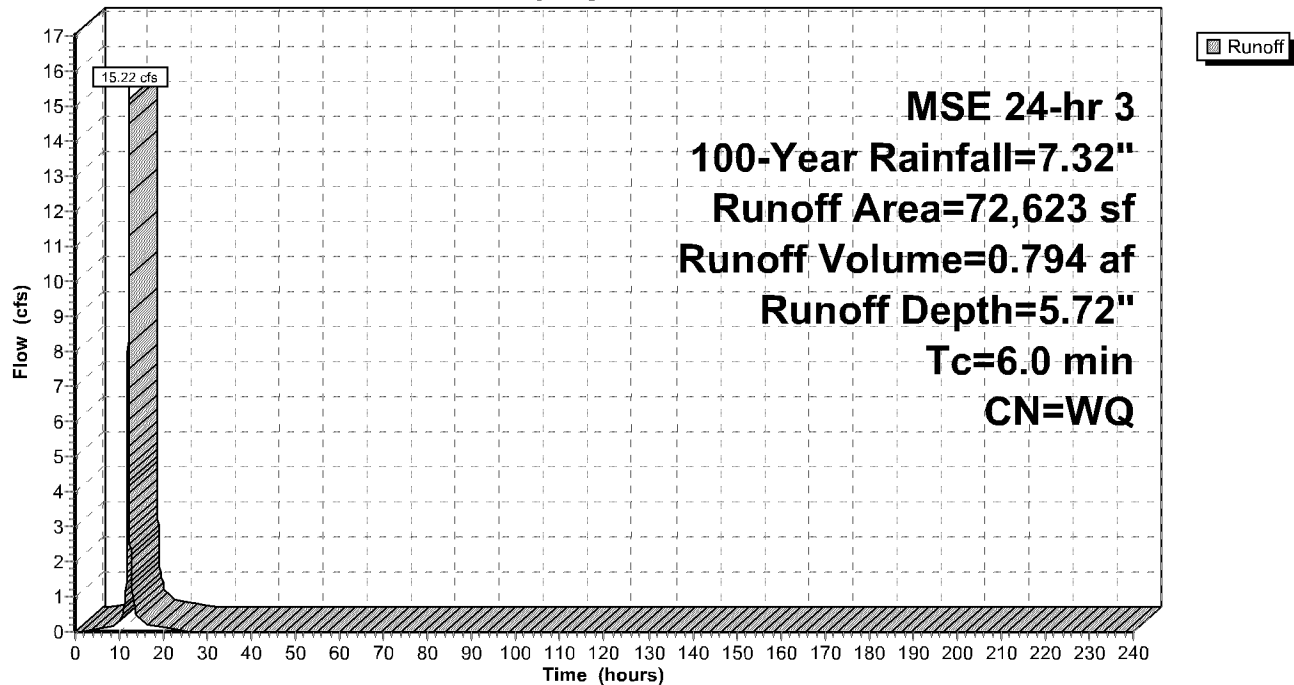
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

Area (sf)	CN	Description
48,761	98	Paved parking, HSG B
23,862	61	>75% Grass cover, Good, HSG B
72,623		Weighted Average
23,862		32.86% Pervious Area
48,761		67.14% Impervious Area

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

Subcatchment EX2: EX2 (TO STREET)

Hydrograph



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MSE 24-hr 3 100-Year Rainfall=7.32"

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Summary for Reach 1R: TOTAL

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

Inflow Area = 1.827 ac, 61.28% Impervious, Inflow Depth = 5.48" for 100-Year event

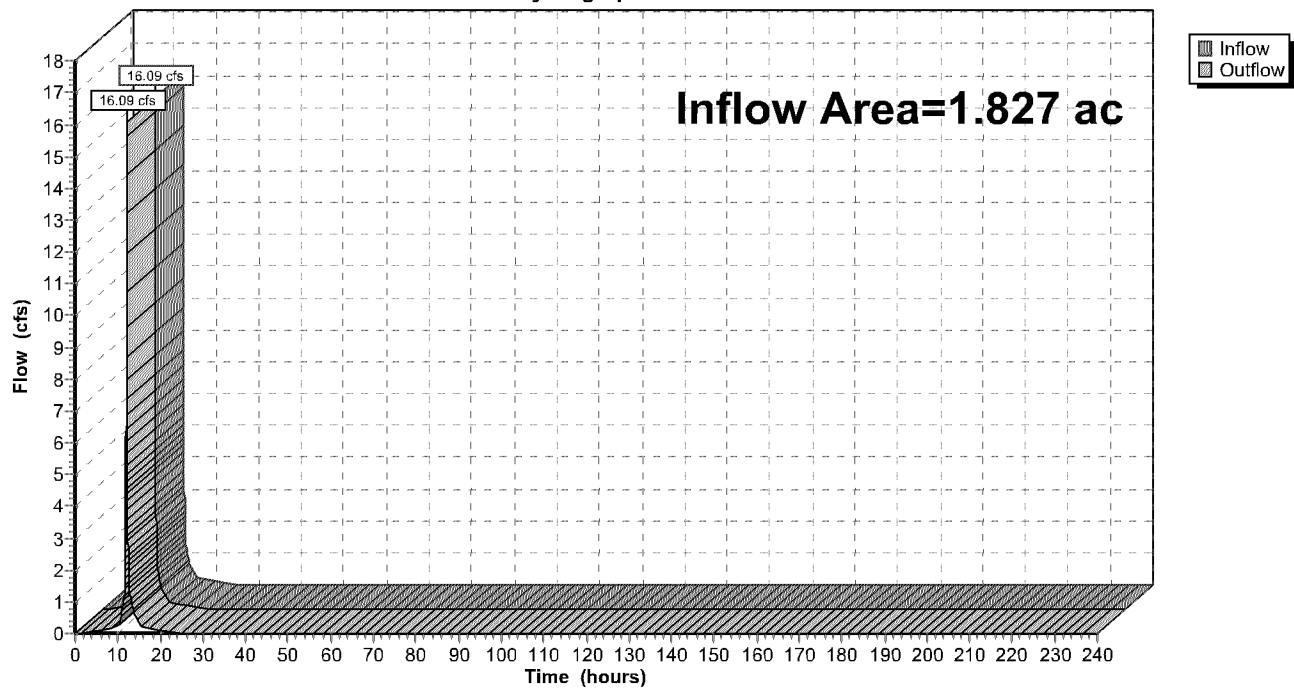
Inflow = 16.09 cfs @ 12.13 hrs, Volume= 0.833 af

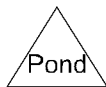
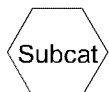
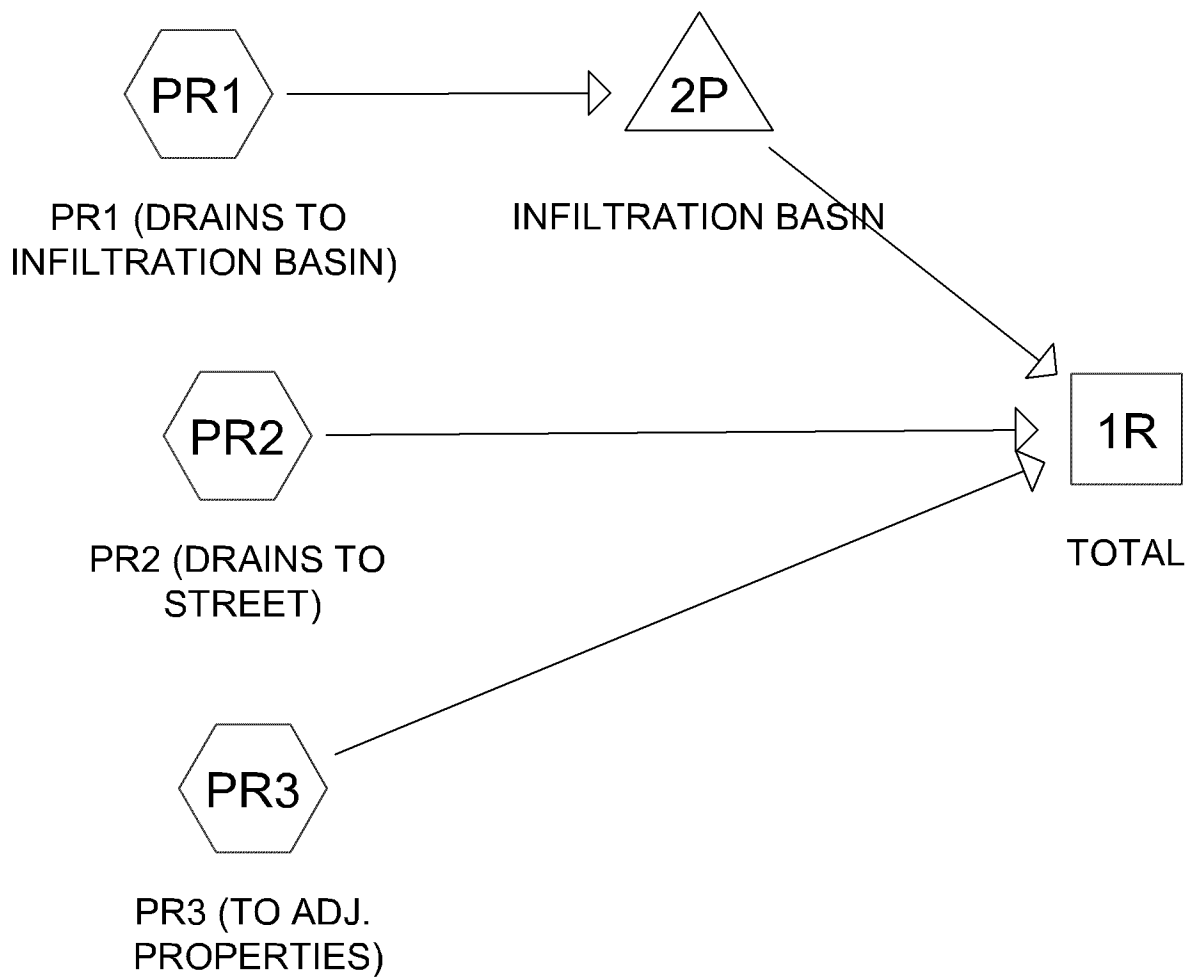
Outflow = 16.09 cfs @ 12.13 hrs, Volume= 0.833 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL

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Project Notes

Rainfall events imported from "Atlas-14-Rain.txt" for 543 MN Hennepin

Rainfall events imported from "Atlas-14-Rain.txt" for 543 MN Hennepin

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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	MSE 24-hr	3	Default	24.00	1	2.86	2
2	10-Year	MSE 24-hr	3	Default	24.00	1	4.26	2
3	100-Year	MSE 24-hr	3	Default	24.00	1	7.32	2
4	100-Year B-B	MSE 24-hr	3	Default	24.00	2	7.32	2

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.465	61	>75% Grass cover, Good, HSG B (PR1, PR2, PR3)
1.361	98	Paved parking, HSG B (PR1, PR2)
1.827	89	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	PR1, PR2, PR3
1.827	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.827		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
0.000	0.465	0.000	0.000	0.000	0.465	>75% Grass cover, Good	PR1, PR2, PR3
0.000	1.361	0.000	0.000	0.000	1.361	Paved parking	PR1, PR2
0.000	1.827	0.000	0.000	0.000	1.827	TOTAL AREA	

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment PR1: PR1 (DRAINS TO Runoff Area=21,739 sf 51.33% Impervious Runoff Depth=1.50"
Tc=6.0 min CN=WQ Runoff=1.16 cfs 0.062 af

Subcatchment PR2: PR2 (DRAINS TO Runoff Area=53,288 sf 90.34% Impervious Runoff Depth=2.41"
Tc=6.0 min CN=WQ Runoff=4.70 cfs 0.245 af

Subcatchment PR3: PR3 (TO ADJ. Runoff Area=4,538 sf 0.00% Impervious Runoff Depth=0.31"
Tc=6.0 min CN=61 Runoff=0.04 cfs 0.003 af

Reach 1R: TOTAL Inflow=4.73 cfs 0.248 af
Outflow=4.73 cfs 0.248 af

Pond 2P: INFILTRATION BASIN Peak Elev=831.92' Storage=1,483 cf Inflow=1.16 cfs 0.062 af
Discarded=0.05 cfs 0.062 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.062 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.310 af Average Runoff Depth = 2.04"
25.47% Pervious = 0.465 ac 74.53% Impervious = 1.361 ac

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MSE 24-hr 3 2-Year Rainfall=2.86"

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Summary for Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

Runoff = 1.16 cfs @ 12.13 hrs, Volume= 0.062 af, Depth= 1.50"
Routed to Pond 2P : INFILTRATION BASIN

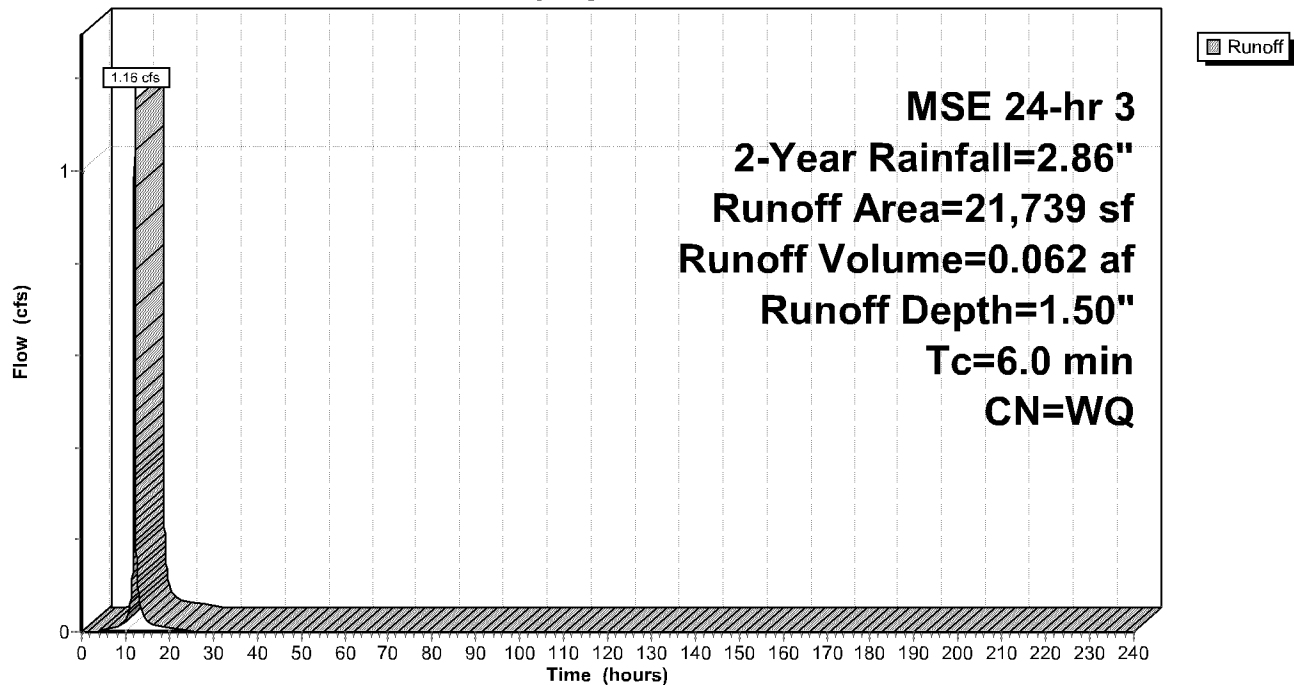
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (sf)	CN	Description
11,158	98	Paved parking, HSG B
10,581	61	>75% Grass cover, Good, HSG B
21,739		Weighted Average
10,581		48.67% Pervious Area
11,158		51.33% Impervious Area

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

Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

Hydrograph



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MSE 24-hr 3 2-Year Rainfall=2.86"

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Summary for Subcatchment PR2: PR2 (DRAINS TO STREET)

Runoff = 4.70 cfs @ 12.13 hrs, Volume= 0.245 af, Depth= 2.41"
Routed to Reach 1R : TOTAL

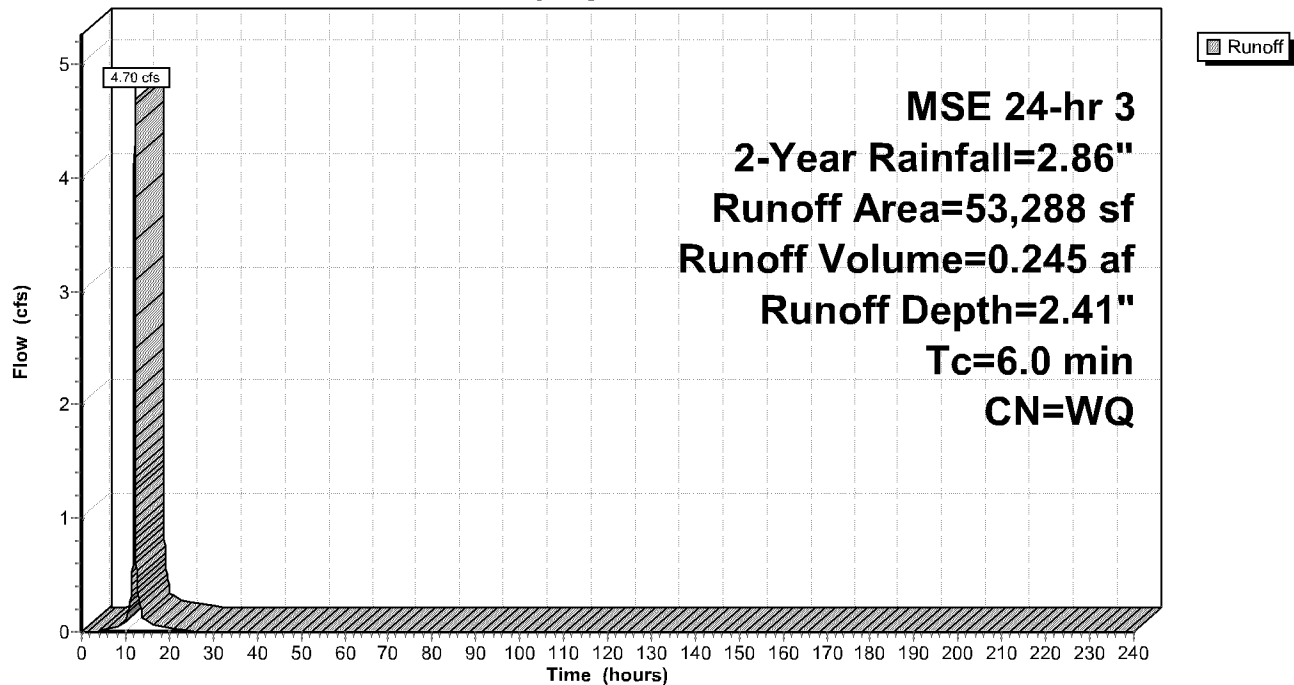
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (sf)	CN	Description
48,140	98	Paved parking, HSG B
5,148	61	>75% Grass cover, Good, HSG B
53,288		Weighted Average
5,148		9.66% Pervious Area
48,140		90.34% Impervious Area

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

Subcatchment PR2: PR2 (DRAINS TO STREET)

Hydrograph



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MSE 24-hr 3 2-Year Rainfall=2.86"

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Summary for Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

Runoff = 0.04 cfs @ 12.16 hrs, Volume= 0.003 af, Depth= 0.31"
Routed to Reach 1R : TOTAL

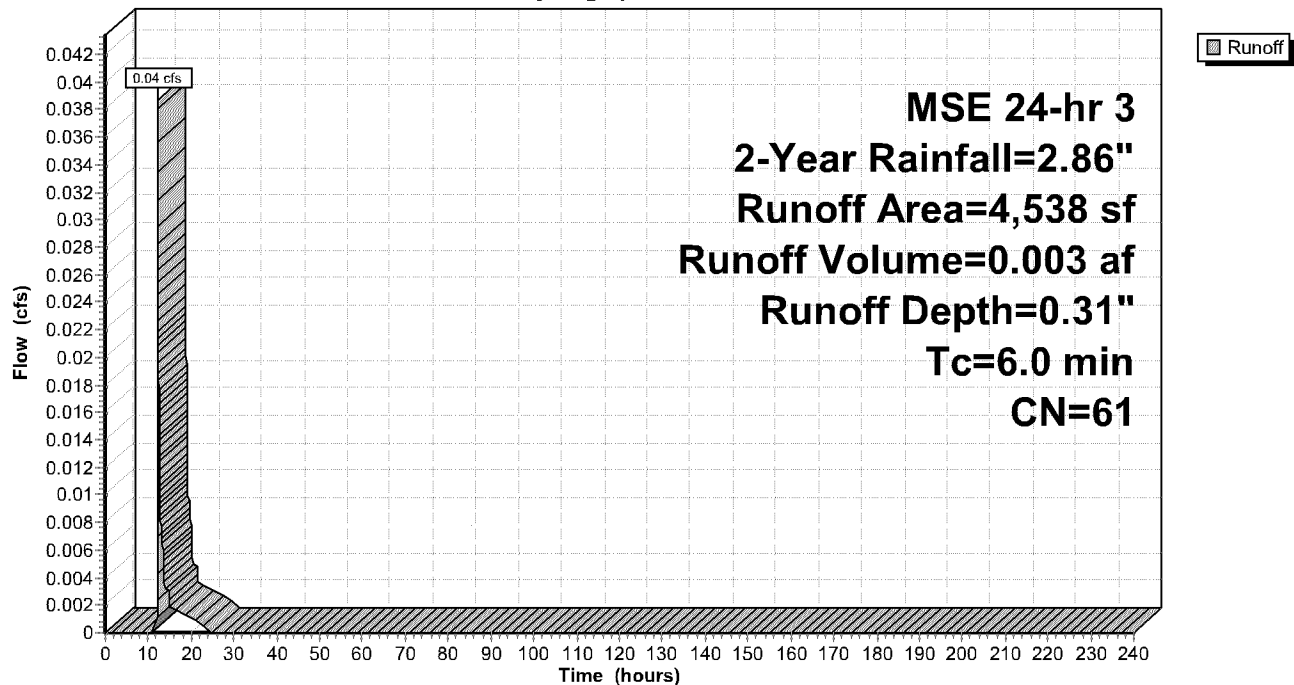
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (sf)	CN	Description
4,538	61	>75% Grass cover, Good, HSG B
4,538		100.00% Pervious Area

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

Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

Hydrograph



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Summary for Reach 1R: TOTAL

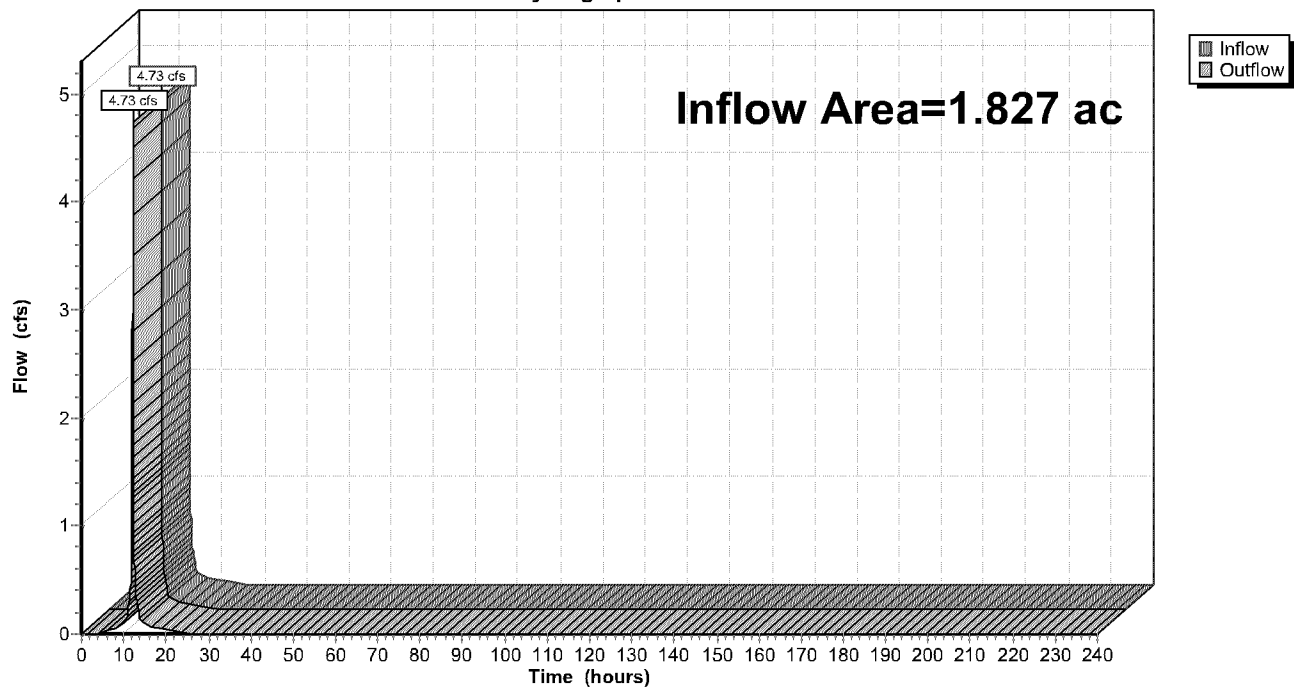
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.827 ac, 74.53% Impervious, Inflow Depth = 1.63" for 2-Year event
Inflow = 4.73 cfs @ 12.13 hrs, Volume= 0.248 af
Outflow = 4.73 cfs @ 12.13 hrs, Volume= 0.248 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL

Hydrograph



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MSE 24-hr 3 2-Year Rainfall=2.86"

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Summary for Pond 2P: INFILTRATION BASIN

Inflow Area = 0.499 ac, 51.33% Impervious, Inflow Depth = 1.50" for 2-Year event
 Inflow = 1.16 cfs @ 12.13 hrs, Volume= 0.062 af
 Outflow = 0.05 cfs @ 13.56 hrs, Volume= 0.062 af, Atten= 96%, Lag= 85.6 min
 Discarded = 0.05 cfs @ 13.56 hrs, Volume= 0.062 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 1R : TOTAL

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 Peak Elev= 831.92' @ 13.56 hrs Surf.Area= 4,807 sf Storage= 1,483 cf

Plug-Flow detention time= 267.4 min calculated for 0.062 af (100% of inflow)
 Center-of-Mass det. time= 267.4 min (1,034.1 - 766.7)

Volume	Invert	Avail.Storage	Storage Description
#1	831.60'	15,705 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.60	4,344	0	0
832.00	4,916	1,852	1,852
832.50	6,074	2,748	4,599
833.00	11,042	4,279	8,878
833.50	16,263	6,826	15,705

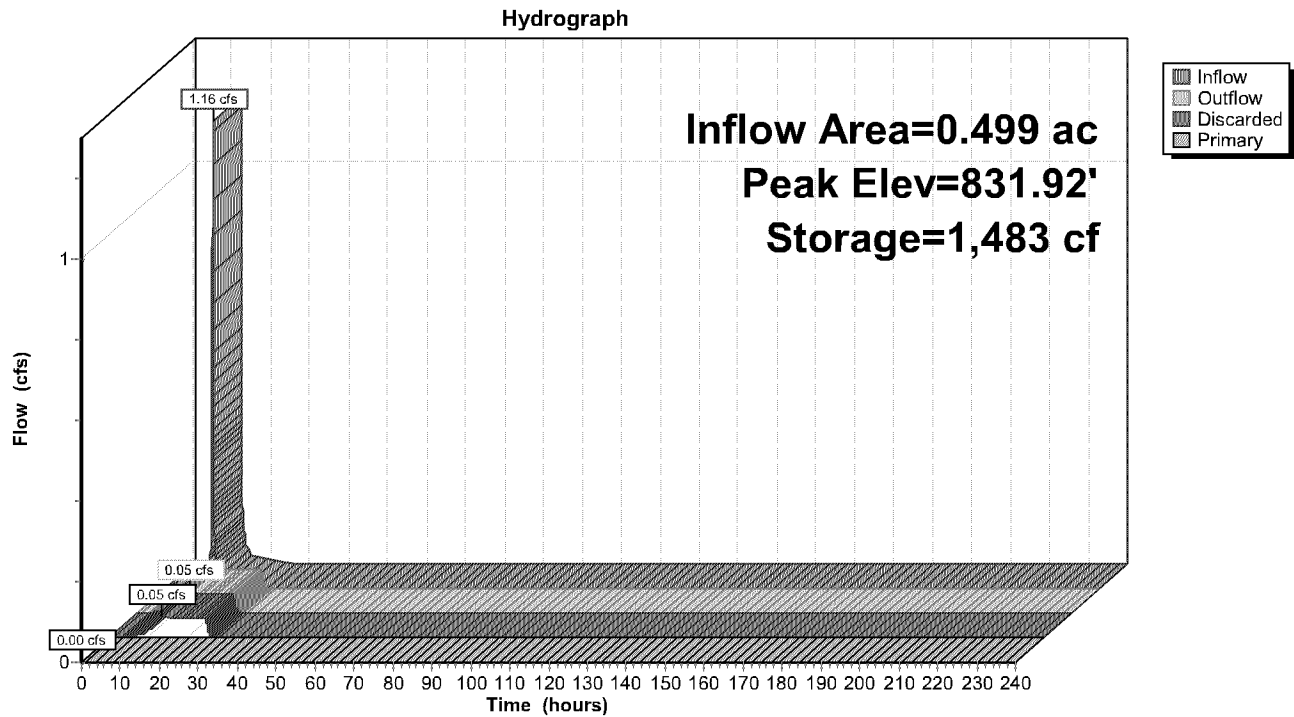
Device	Routing	Invert	Outlet Devices
#1	Discarded	831.60'	0.450 in/hr Exfiltration over Surface area
#2	Primary	833.36'	5.0' long x 5.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			
2.50 3.00 3.50 4.00 4.50 5.00 5.50			
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65			
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88			

Discarded OutFlow Max=0.05 cfs @ 13.56 hrs HW=831.92' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=831.60' (Free Discharge)

↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: INFILTRATION BASIN

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MSE 24-hr 3 2-Year Rainfall=2.86"

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Stage-Area-Storage for Pond 2P: INFILTRATION BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
831.60	4,344	0	832.64	7,465	5,547
831.62	4,373	87	832.66	7,664	5,699
831.64	4,401	175	832.68	7,862	5,854
831.66	4,430	263	832.70	8,061	6,013
831.68	4,458	352	832.72	8,260	6,176
831.70	4,487	442	832.74	8,459	6,343
831.72	4,516	532	832.76	8,657	6,515
831.74	4,544	622	832.78	8,856	6,690
831.76	4,573	713	832.80	9,055	6,869
831.78	4,601	805	832.82	9,254	7,052
831.80	4,630	897	832.84	9,452	7,239
831.82	4,659	990	832.86	9,651	7,430
831.84	4,687	1,084	832.88	9,850	7,625
831.86	4,716	1,178	832.90	10,048	7,824
831.88	4,744	1,272	832.92	10,247	8,027
831.90	4,773	1,368	832.94	10,446	8,234
831.92	4,802	1,463	832.96	10,645	8,445
831.94	4,830	1,560	832.98	10,843	8,660
831.96	4,859	1,657	833.00	11,042	8,878
831.98	4,887	1,754	833.02	11,251	9,101
832.00	4,916	1,852	833.04	11,460	9,329
832.02	4,962	1,951	833.06	11,669	9,560
832.04	5,009	2,050	833.08	11,877	9,795
832.06	5,055	2,151	833.10	12,086	10,035
832.08	5,101	2,253	833.12	12,295	10,279
832.10	5,148	2,355	833.14	12,504	10,527
832.12	5,194	2,459	833.16	12,713	10,779
832.14	5,240	2,563	833.18	12,922	11,035
832.16	5,287	2,668	833.20	13,130	11,296
832.18	5,333	2,774	833.22	13,339	11,560
832.20	5,379	2,882	833.24	13,548	11,829
832.22	5,426	2,990	833.26	13,757	12,102
832.24	5,472	3,099	833.28	13,966	12,380
832.26	5,518	3,208	833.30	14,175	12,661
832.28	5,564	3,319	833.32	14,383	12,947
832.30	5,611	3,431	833.34	14,592	13,236
832.32	5,657	3,544	833.36	14,801	13,530
832.34	5,703	3,657	833.38	15,010	13,828
832.36	5,750	3,772	833.40	15,219	14,131
832.38	5,796	3,887	833.42	15,428	14,437
832.40	5,842	4,004	833.44	15,636	14,748
832.42	5,889	4,121	833.46	15,845	15,063
832.44	5,935	4,239	833.48	16,054	15,382
832.46	5,981	4,358	833.50	16,263	15,705
832.48	6,028	4,478			
832.50	6,074	4,599			
832.52	6,273	4,723			
832.54	6,471	4,850			
832.56	6,670	4,982			
832.58	6,869	5,117			
832.60	7,068	5,257			
832.62	7,266	5,400			

24322 PROPOSED

MSE 24-hr 3 10-Year Rainfall=4.26"

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment PR1: PR1 (DRAINS TO Runoff Area=21,739 sf 51.33% Impervious Runoff Depth=2.53"
Tc=6.0 min CN=WQ Runoff=2.01 cfs 0.105 af

Subcatchment PR2: PR2 (DRAINS TO Runoff Area=53,288 sf 90.34% Impervious Runoff Depth=3.73"
Tc=6.0 min CN=WQ Runoff=7.19 cfs 0.380 af

Subcatchment PR3: PR3 (TO ADJ. Runoff Area=4,538 sf 0.00% Impervious Runoff Depth=0.95"
Tc=6.0 min CN=61 Runoff=0.17 cfs 0.008 af

Reach 1R: TOTAL Inflow=7.35 cfs 0.388 af
Outflow=7.35 cfs 0.388 af

Pond 2P: INFILTRATION BASIN Peak Elev=832.18' Storage=2,767 cf Inflow=2.01 cfs 0.105 af
Discarded=0.06 cfs 0.105 af Primary=0.00 cfs 0.000 af Outflow=0.06 cfs 0.105 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.493 af Average Runoff Depth = 3.24"
25.47% Pervious = 0.465 ac 74.53% Impervious = 1.361 ac

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MSE 24-hr 3 10-Year Rainfall=4.26"

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Summary for Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

Runoff = 2.01 cfs @ 12.13 hrs, Volume= 0.105 af, Depth= 2.53"
Routed to Pond 2P : INFILTRATION BASIN

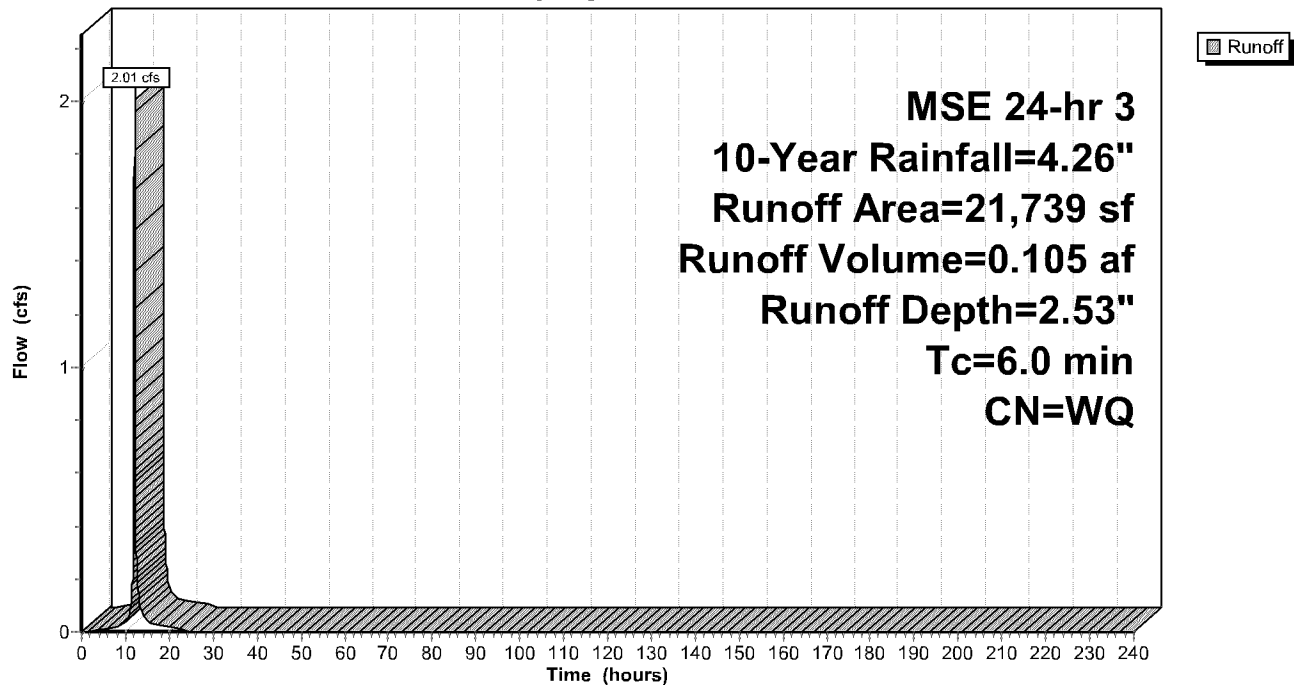
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (sf)	CN	Description
11,158	98	Paved parking, HSG B
10,581	61	>75% Grass cover, Good, HSG B
21,739		Weighted Average
10,581		48.67% Pervious Area
11,158		51.33% Impervious Area

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

Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

Hydrograph



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MSE 24-hr 3 10-Year Rainfall=4.26"

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Summary for Subcatchment PR2: PR2 (DRAINS TO STREET)

Runoff = 7.19 cfs @ 12.13 hrs, Volume= 0.380 af, Depth= 3.73"
Routed to Reach 1R : TOTAL

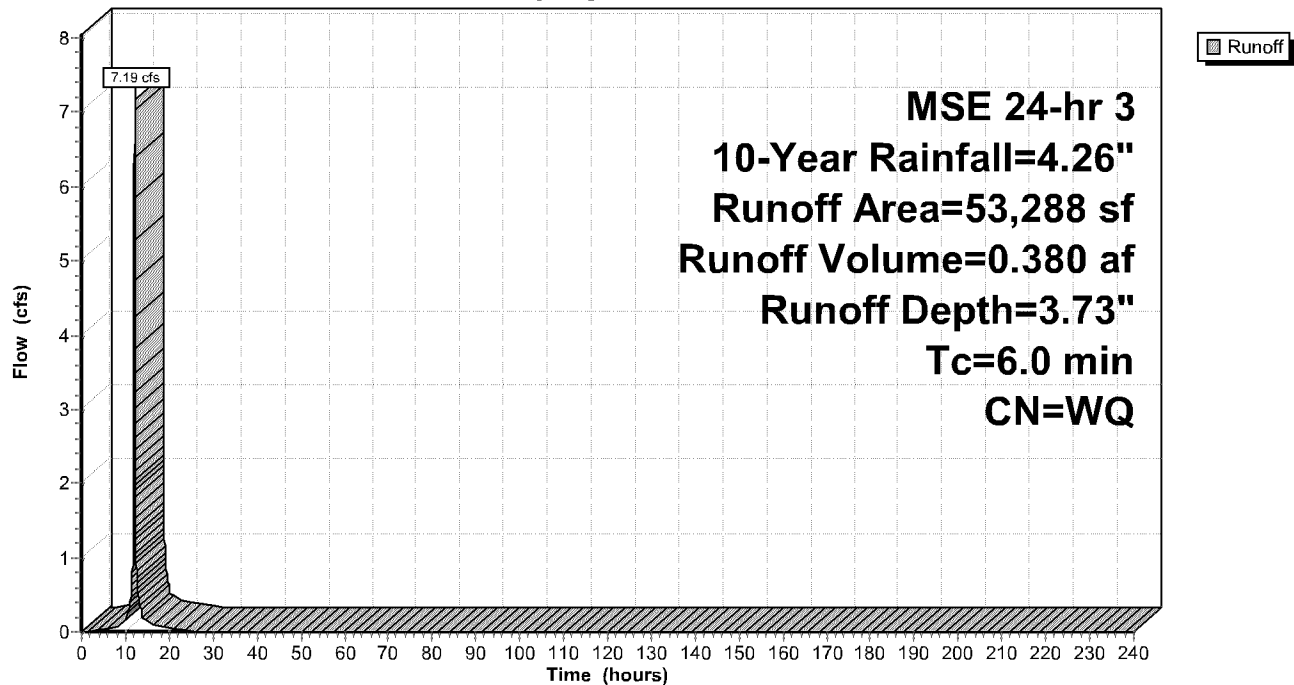
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (sf)	CN	Description
48,140	98	Paved parking, HSG B
5,148	61	>75% Grass cover, Good, HSG B
53,288		Weighted Average
5,148		9.66% Pervious Area
48,140		90.34% Impervious Area

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

Subcatchment PR2: PR2 (DRAINS TO STREET)

Hydrograph



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MSE 24-hr 3 10-Year Rainfall=4.26"

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Summary for Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

Runoff = 0.17 cfs @ 12.14 hrs, Volume= 0.008 af, Depth= 0.95"
Routed to Reach 1R : TOTAL

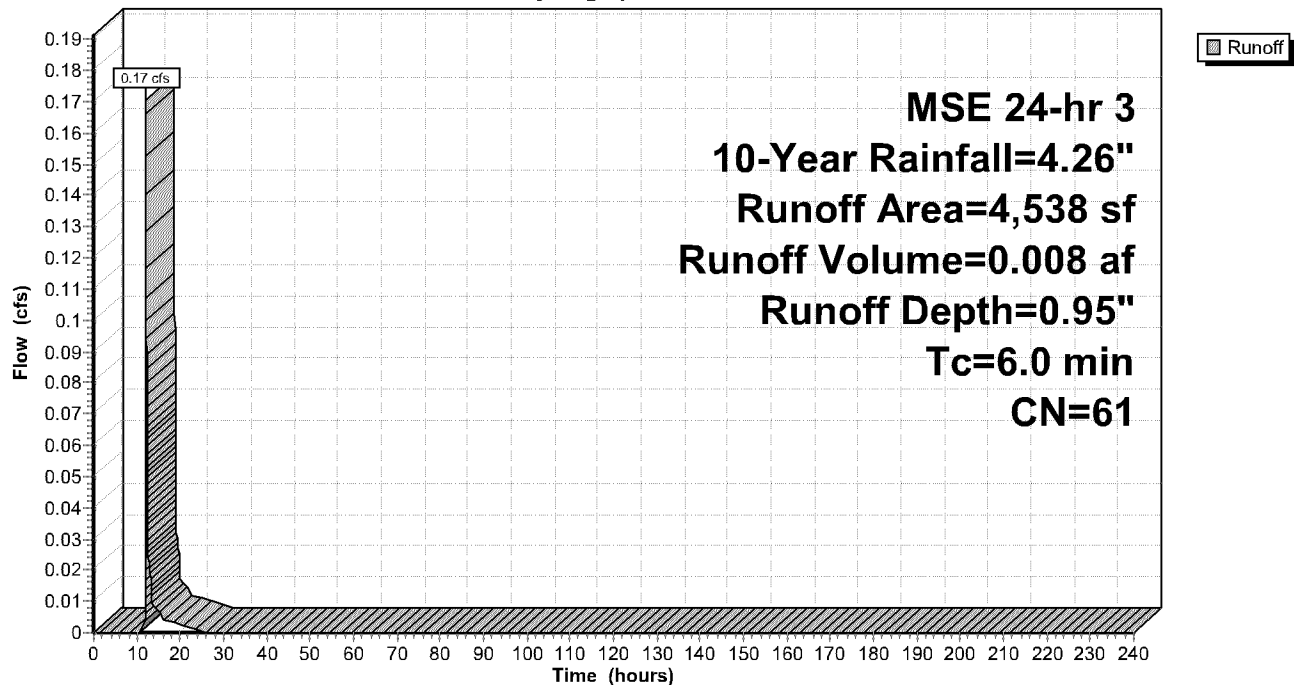
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (sf)	CN	Description
4,538	61	>75% Grass cover, Good, HSG B
4,538		100.00% Pervious Area

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

Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

Hydrograph



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MSE 24-hr 3 10-Year Rainfall=4.26"

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Summary for Reach 1R: TOTAL

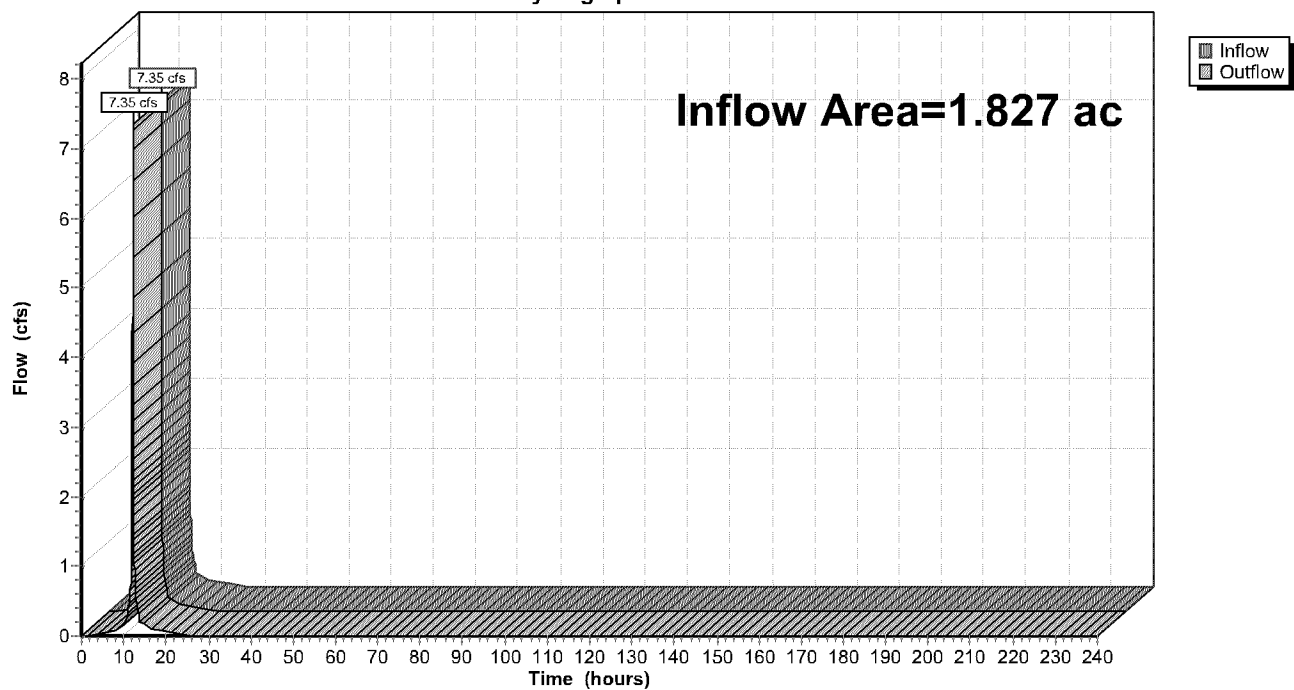
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.827 ac, 74.53% Impervious, Inflow Depth = 2.55" for 10-Year event
Inflow = 7.35 cfs @ 12.13 hrs, Volume= 0.388 af
Outflow = 7.35 cfs @ 12.13 hrs, Volume= 0.388 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL

Hydrograph



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MSE 24-hr 3 10-Year Rainfall=4.26"

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Summary for Pond 2P: INFILTRATION BASIN

Inflow Area = 0.499 ac, 51.33% Impervious, Inflow Depth = 2.53" for 10-Year event
 Inflow = 2.01 cfs @ 12.13 hrs, Volume= 0.105 af
 Outflow = 0.06 cfs @ 14.52 hrs, Volume= 0.105 af, Atten= 97%, Lag= 143.1 min
 Discarded = 0.06 cfs @ 14.52 hrs, Volume= 0.105 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 1R : TOTAL

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 Peak Elev= 832.18' @ 14.52 hrs Surf.Area= 5,330 sf Storage= 2,767 cf

Plug-Flow detention time= 478.5 min calculated for 0.105 af (100% of inflow)
 Center-of-Mass det. time= 478.5 min (1,243.9 - 765.3)

Volume	Invert	Avail.Storage	Storage Description
#1	831.60'	15,705 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.60	4,344	0	0
832.00	4,916	1,852	1,852
832.50	6,074	2,748	4,599
833.00	11,042	4,279	8,878
833.50	16,263	6,826	15,705

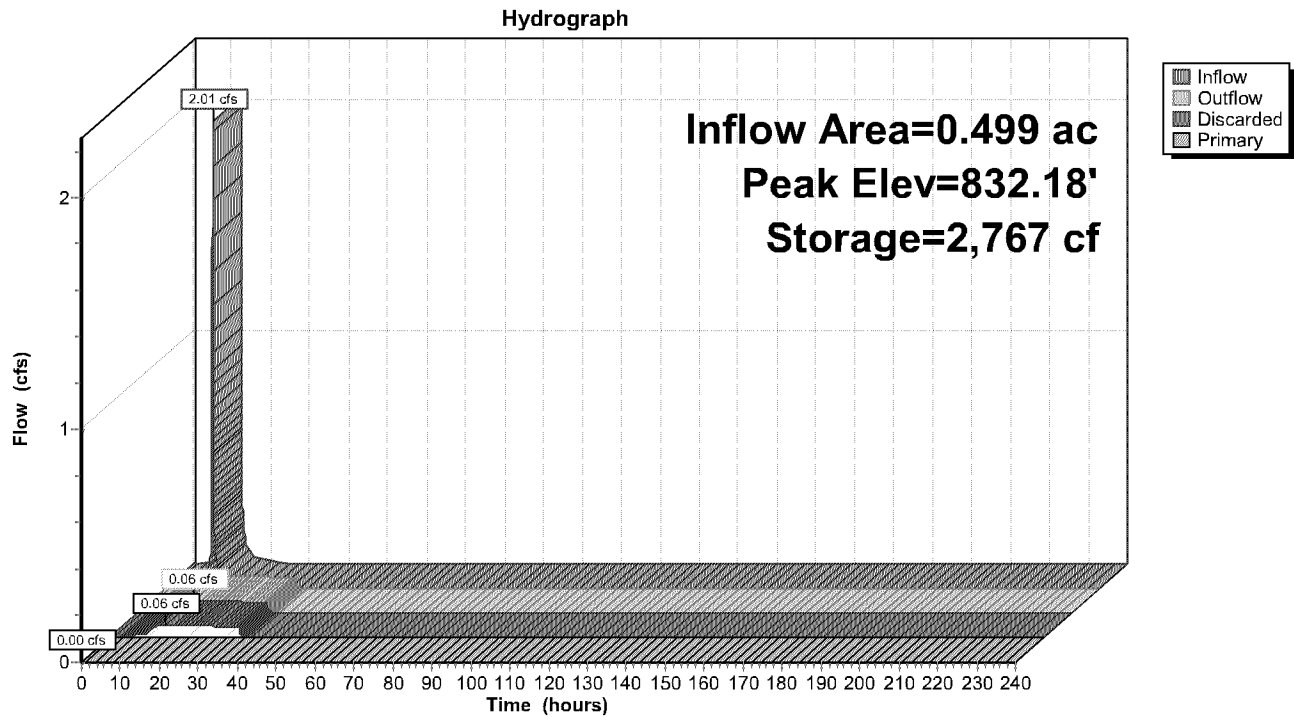
Device	Routing	Invert	Outlet Devices
#1	Discarded	831.60'	0.450 in/hr Exfiltration over Surface area
#2	Primary	833.36'	5.0' long x 5.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			
2.50 3.00 3.50 4.00 4.50 5.00 5.50			
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65			
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88			

Discarded OutFlow Max=0.06 cfs @ 14.52 hrs HW=832.18' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=831.60' (Free Discharge)

↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: INFILTRATION BASIN

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MSE 24-hr 3 10-Year Rainfall=4.26"

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Stage-Area-Storage for Pond 2P: INFILTRATION BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
831.60	4,344	0	832.64	7,465	5,547
831.62	4,373	87	832.66	7,664	5,699
831.64	4,401	175	832.68	7,862	5,854
831.66	4,430	263	832.70	8,061	6,013
831.68	4,458	352	832.72	8,260	6,176
831.70	4,487	442	832.74	8,459	6,343
831.72	4,516	532	832.76	8,657	6,515
831.74	4,544	622	832.78	8,856	6,690
831.76	4,573	713	832.80	9,055	6,869
831.78	4,601	805	832.82	9,254	7,052
831.80	4,630	897	832.84	9,452	7,239
831.82	4,659	990	832.86	9,651	7,430
831.84	4,687	1,084	832.88	9,850	7,625
831.86	4,716	1,178	832.90	10,048	7,824
831.88	4,744	1,272	832.92	10,247	8,027
831.90	4,773	1,368	832.94	10,446	8,234
831.92	4,802	1,463	832.96	10,645	8,445
831.94	4,830	1,560	832.98	10,843	8,660
831.96	4,859	1,657	833.00	11,042	8,878
831.98	4,887	1,754	833.02	11,251	9,101
832.00	4,916	1,852	833.04	11,460	9,329
832.02	4,962	1,951	833.06	11,669	9,560
832.04	5,009	2,050	833.08	11,877	9,795
832.06	5,055	2,151	833.10	12,086	10,035
832.08	5,101	2,253	833.12	12,295	10,279
832.10	5,148	2,355	833.14	12,504	10,527
832.12	5,194	2,459	833.16	12,713	10,779
832.14	5,240	2,563	833.18	12,922	11,035
832.16	5,287	2,668	833.20	13,130	11,296
832.18	5,333	2,774	833.22	13,339	11,560
832.20	5,379	2,882	833.24	13,548	11,829
832.22	5,426	2,990	833.26	13,757	12,102
832.24	5,472	3,099	833.28	13,966	12,380
832.26	5,518	3,208	833.30	14,175	12,661
832.28	5,564	3,319	833.32	14,383	12,947
832.30	5,611	3,431	833.34	14,592	13,236
832.32	5,657	3,544	833.36	14,801	13,530
832.34	5,703	3,657	833.38	15,010	13,828
832.36	5,750	3,772	833.40	15,219	14,131
832.38	5,796	3,887	833.42	15,428	14,437
832.40	5,842	4,004	833.44	15,636	14,748
832.42	5,889	4,121	833.46	15,845	15,063
832.44	5,935	4,239	833.48	16,054	15,382
832.46	5,981	4,358	833.50	16,263	15,705
832.48	6,028	4,478			
832.50	6,074	4,599			
832.52	6,273	4,723			
832.54	6,471	4,850			
832.56	6,670	4,982			
832.58	6,869	5,117			
832.60	7,068	5,257			
832.62	7,266	5,400			

24322 PROPOSED*MSE 24-hr 3 100-Year Rainfall=7.32"*

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment PR1: PR1 (DRAINS TO Runoff Area=21,739 sf 51.33% Impervious Runoff Depth=5.06"
Tc=6.0 min CN=WQ Runoff=4.12 cfs 0.211 af

Subcatchment PR2: PR2 (DRAINS TO Runoff Area=53,288 sf 90.34% Impervious Runoff Depth=6.68"
Tc=6.0 min CN=WQ Runoff=12.72 cfs 0.681 af

Subcatchment PR3: PR3 (TO ADJ. Runoff Area=4,538 sf 0.00% Impervious Runoff Depth=2.94"
Tc=6.0 min CN=61 Runoff=0.57 cfs 0.025 af

Reach 1R: TOTAL Inflow=13.29 cfs 0.706 af
Outflow=13.29 cfs 0.706 af

Pond 2P: INFILTRATION BASIN Peak Elev=832.72' Storage=6,173 cf Inflow=4.12 cfs 0.211 af
Discarded=0.09 cfs 0.211 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.211 af

Total Runoff Area = 1.827 ac Runoff Volume = 0.917 af Average Runoff Depth = 6.02"
25.47% Pervious = 0.465 ac 74.53% Impervious = 1.361 ac

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MSE 24-hr 3 100-Year Rainfall=7.32"

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Summary for Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

Runoff = 4.12 cfs @ 12.13 hrs, Volume= 0.211 af, Depth= 5.06"
 Routed to Pond 2P : INFILTRATION BASIN

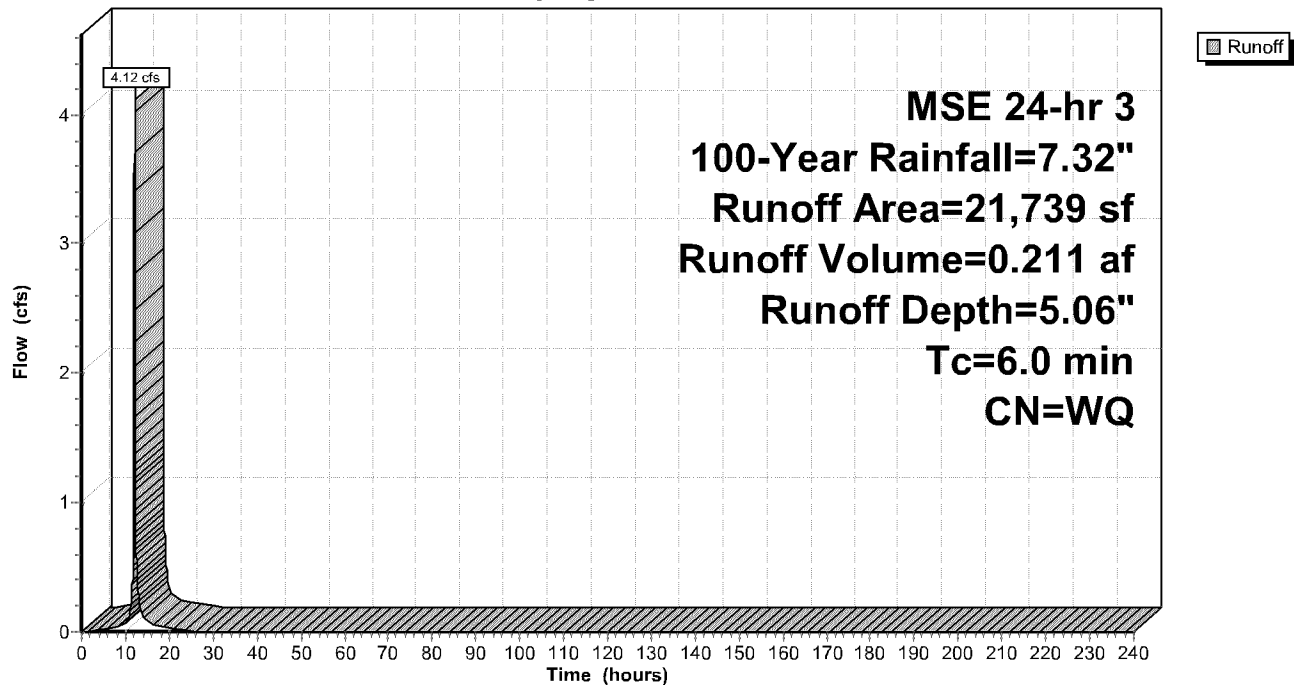
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-Year Rainfall=7.32"

Area (sf)	CN	Description
11,158	98	Paved parking, HSG B
10,581	61	>75% Grass cover, Good, HSG B
21,739		Weighted Average
10,581		48.67% Pervious Area
11,158		51.33% Impervious Area

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

Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

Hydrograph



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MSE 24-hr 3 100-Year Rainfall=7.32"

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Summary for Subcatchment PR2: PR2 (DRAINS TO STREET)

Runoff = 12.72 cfs @ 12.13 hrs, Volume= 0.681 af, Depth= 6.68"
Routed to Reach 1R : TOTAL

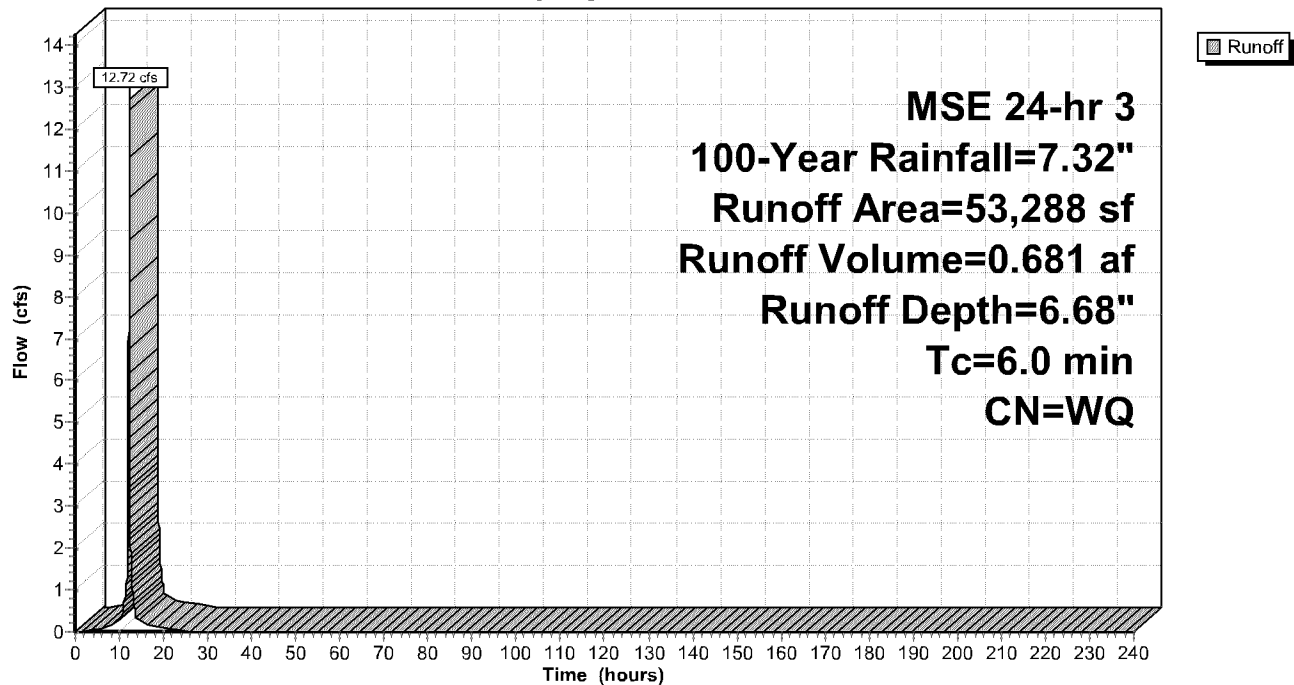
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

Area (sf)	CN	Description
48,140	98	Paved parking, HSG B
5,148	61	>75% Grass cover, Good, HSG B
53,288		Weighted Average
5,148		9.66% Pervious Area
48,140		90.34% Impervious Area

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

Subcatchment PR2: PR2 (DRAINS TO STREET)

Hydrograph



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MSE 24-hr 3 100-Year Rainfall=7.32"

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Summary for Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

Runoff = 0.57 cfs @ 12.14 hrs, Volume= 0.025 af, Depth= 2.94"
Routed to Reach 1R : TOTAL

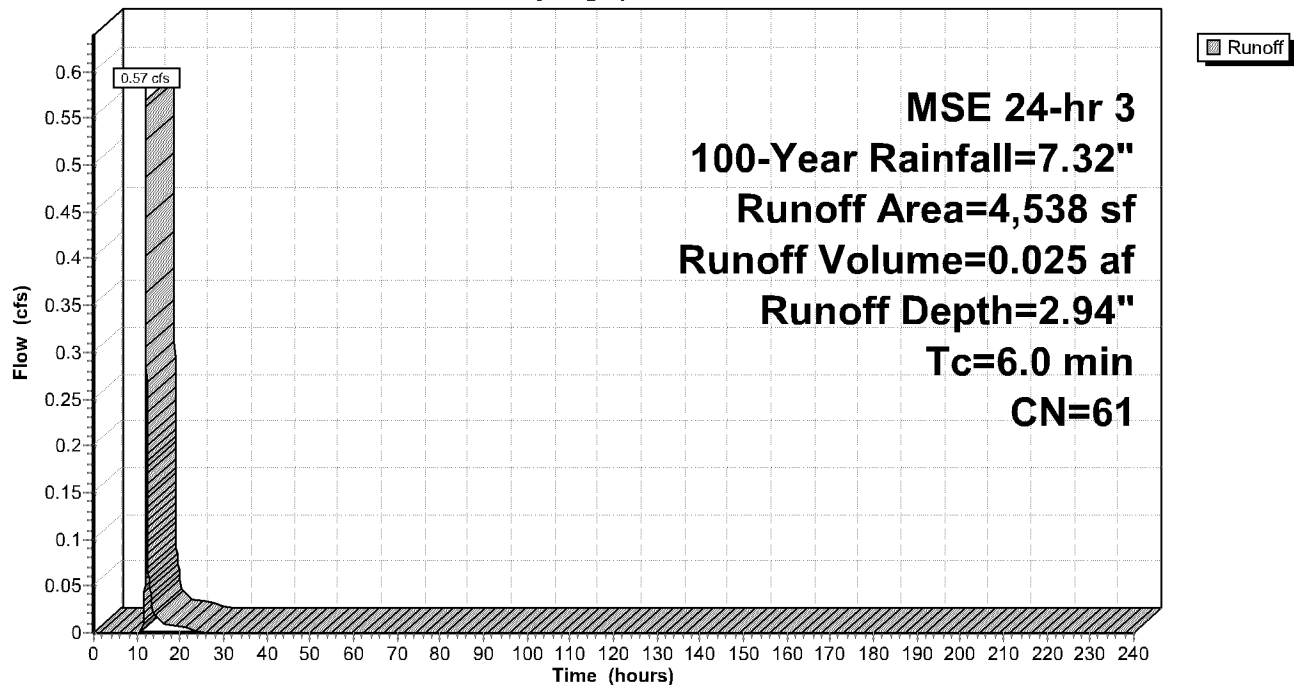
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

Area (sf)	CN	Description
4,538	61	>75% Grass cover, Good, HSG B
4,538		100.00% Pervious Area

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

Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

Hydrograph



Summary for Reach 1R: TOTAL

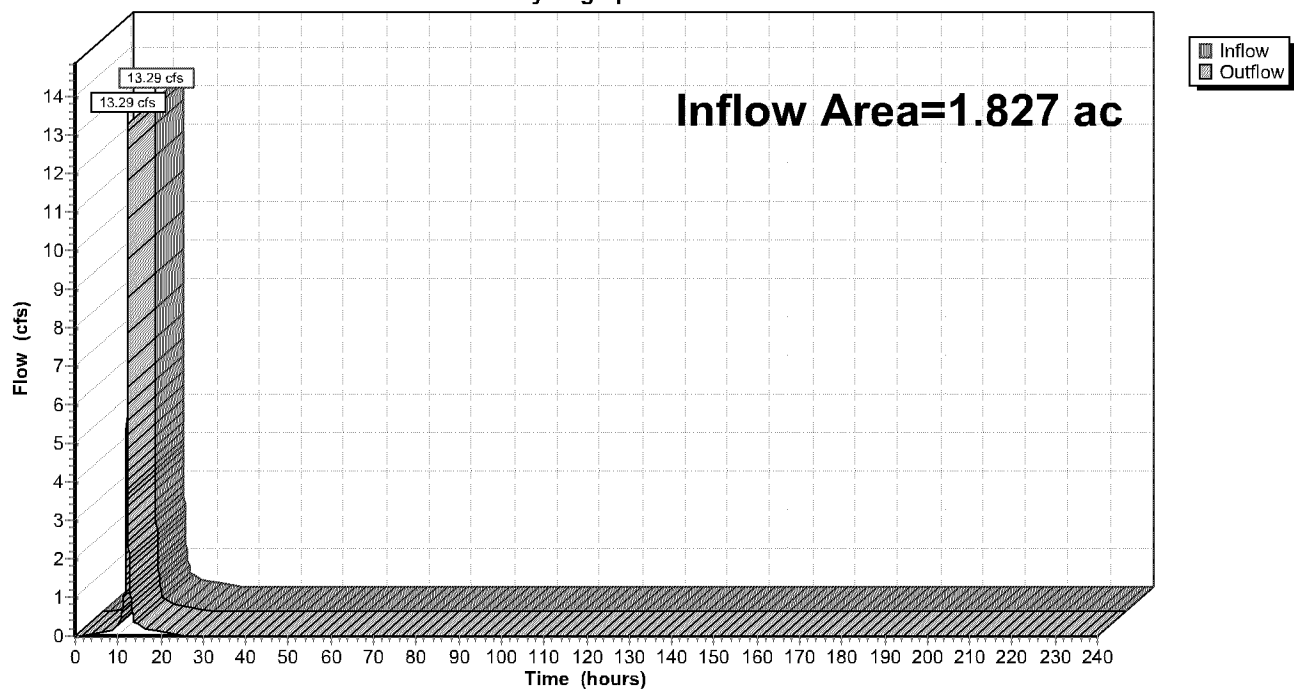
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.827 ac, 74.53% Impervious, Inflow Depth = 4.64" for 100-Year event
Inflow = 13.29 cfs @ 12.13 hrs, Volume= 0.706 af
Outflow = 13.29 cfs @ 12.13 hrs, Volume= 0.706 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL

Hydrograph



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MSE 24-hr 3 100-Year Rainfall=7.32"

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Summary for Pond 2P: INFILTRATION BASIN

Inflow Area = 0.499 ac, 51.33% Impervious, Inflow Depth = 5.06" for 100-Year event
 Inflow = 4.12 cfs @ 12.13 hrs, Volume= 0.211 af
 Outflow = 0.09 cfs @ 15.08 hrs, Volume= 0.211 af, Atten= 98%, Lag= 176.7 min
 Discarded = 0.09 cfs @ 15.08 hrs, Volume= 0.211 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 1R : TOTAL

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
 Peak Elev= 832.72' @ 15.08 hrs Surf.Area= 8,256 sf Storage= 6,173 cf

Plug-Flow detention time= 820.1 min calculated for 0.211 af (100% of inflow)
 Center-of-Mass det. time= 820.2 min (1,582.7 - 762.6)

Volume	Invert	Avail.Storage	Storage Description
#1	831.60'	15,705 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.60	4,344	0	0
832.00	4,916	1,852	1,852
832.50	6,074	2,748	4,599
833.00	11,042	4,279	8,878
833.50	16,263	6,826	15,705

Device	Routing	Invert	Outlet Devices
#1	Discarded	831.60'	0.450 in/hr Exfiltration over Surface area
#2	Primary	833.36'	5.0' long x 5.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			
2.50 3.00 3.50 4.00 4.50 5.00 5.50			
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65			
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88			

Discarded OutFlow Max=0.09 cfs @ 15.08 hrs HW=832.72' (Free Discharge)

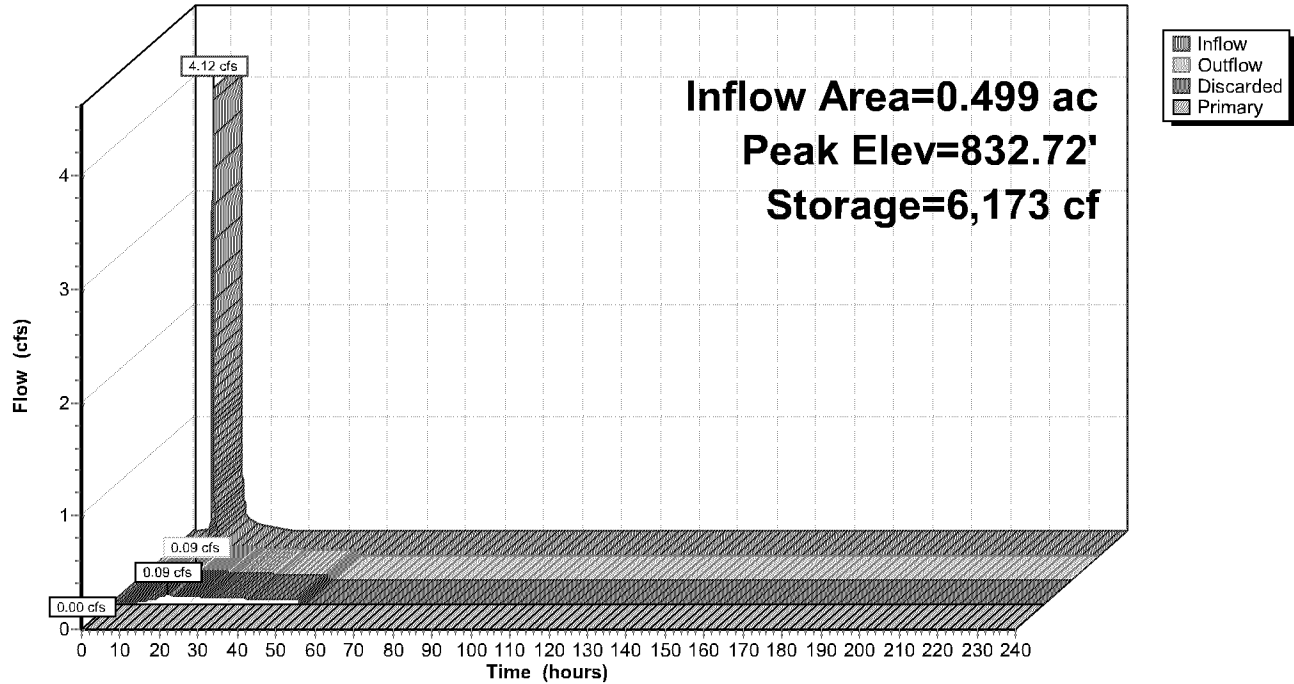
↑ **1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=831.60' (Free Discharge)

↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: INFILTRATION BASIN

Hydrograph



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MSE 24-hr 3 100-Year Rainfall=7.32"

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Stage-Area-Storage for Pond 2P: INFILTRATION BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
831.60	4,344	0	832.64	7,465	5,547
831.62	4,373	87	832.66	7,664	5,699
831.64	4,401	175	832.68	7,862	5,854
831.66	4,430	263	832.70	8,061	6,013
831.68	4,458	352	832.72	8,260	6,176
831.70	4,487	442	832.74	8,459	6,343
831.72	4,516	532	832.76	8,657	6,515
831.74	4,544	622	832.78	8,856	6,690
831.76	4,573	713	832.80	9,055	6,869
831.78	4,601	805	832.82	9,254	7,052
831.80	4,630	897	832.84	9,452	7,239
831.82	4,659	990	832.86	9,651	7,430
831.84	4,687	1,084	832.88	9,850	7,625
831.86	4,716	1,178	832.90	10,048	7,824
831.88	4,744	1,272	832.92	10,247	8,027
831.90	4,773	1,368	832.94	10,446	8,234
831.92	4,802	1,463	832.96	10,645	8,445
831.94	4,830	1,560	832.98	10,843	8,660
831.96	4,859	1,657	833.00	11,042	8,878
831.98	4,887	1,754	833.02	11,251	9,101
832.00	4,916	1,852	833.04	11,460	9,329
832.02	4,962	1,951	833.06	11,669	9,560
832.04	5,009	2,050	833.08	11,877	9,795
832.06	5,055	2,151	833.10	12,086	10,035
832.08	5,101	2,253	833.12	12,295	10,279
832.10	5,148	2,355	833.14	12,504	10,527
832.12	5,194	2,459	833.16	12,713	10,779
832.14	5,240	2,563	833.18	12,922	11,035
832.16	5,287	2,668	833.20	13,130	11,296
832.18	5,333	2,774	833.22	13,339	11,560
832.20	5,379	2,882	833.24	13,548	11,829
832.22	5,426	2,990	833.26	13,757	12,102
832.24	5,472	3,099	833.28	13,966	12,380
832.26	5,518	3,208	833.30	14,175	12,661
832.28	5,564	3,319	833.32	14,383	12,947
832.30	5,611	3,431	833.34	14,592	13,236
832.32	5,657	3,544	833.36	14,801	13,530
832.34	5,703	3,657	833.38	15,010	13,828
832.36	5,750	3,772	833.40	15,219	14,131
832.38	5,796	3,887	833.42	15,428	14,437
832.40	5,842	4,004	833.44	15,636	14,748
832.42	5,889	4,121	833.46	15,845	15,063
832.44	5,935	4,239	833.48	16,054	15,382
832.46	5,981	4,358	833.50	16,263	15,705
832.48	6,028	4,478			
832.50	6,074	4,599			
832.52	6,273	4,723			
832.54	6,471	4,850			
832.56	6,670	4,982			
832.58	6,869	5,117			
832.60	7,068	5,257			
832.62	7,266	5,400			

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MSE 24-hr 3 100-Year B-B Rainfall=7.32" x 2

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Time span=0.00-240.00 hrs, dt=0.01 hrs, 24001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment PR1: PR1 (DRAINS TO Runoff Area=21,739 sf 51.33% Impervious Runoff Depth=11.79"
Tc=6.0 min CN=WQ Runoff=5.06 cfs 0.490 af

Subcatchment PR2: PR2 (DRAINS TO Runoff Area=53,288 sf 90.34% Impervious Runoff Depth=13.88"
Tc=6.0 min CN=WQ Runoff=13.21 cfs 1.415 af

Subcatchment PR3: PR3 (TO ADJ. Runoff Area=4,538 sf 0.00% Impervious Runoff Depth=9.04"
Tc=6.0 min CN=61 Runoff=0.97 cfs 0.078 af

Reach 1R: TOTAL Inflow=14.17 cfs 1.493 af
Outflow=14.17 cfs 1.493 af

Pond 2P: INFILTRATION BASIN Peak Elev=833.22' Storage=11,593 cf Inflow=5.06 cfs 0.490 af
Discarded=0.14 cfs 0.490 af Primary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.490 af

Total Runoff Area = 1.827 ac Runoff Volume = 1.984 af Average Runoff Depth = 13.03"
25.47% Pervious = 0.465 ac 74.53% Impervious = 1.361 ac

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MSE 24-hr 3 100-Year B-B Rainfall=7.32" x 2

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Summary for Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

Runoff = 5.06 cfs @ 36.13 hrs, Volume= 0.490 af, Depth=11.79"
Routed to Pond 2P : INFILTRATION BASIN

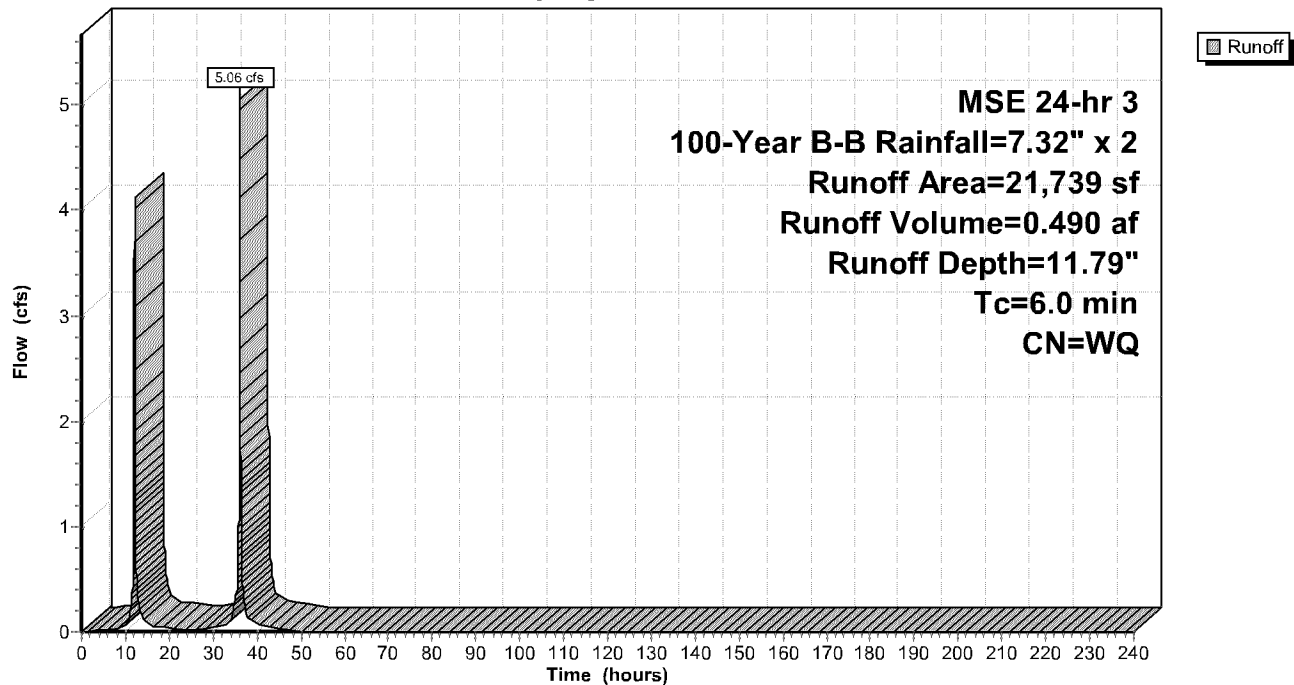
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year B-B Rainfall=7.32" x 2

Area (sf)	CN	Description
11,158	98	Paved parking, HSG B
10,581	61	>75% Grass cover, Good, HSG B
21,739		Weighted Average
10,581		48.67% Pervious Area
11,158		51.33% Impervious Area

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

Subcatchment PR1: PR1 (DRAINS TO INFILTRATION BASIN)

Hydrograph



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MSE 24-hr 3 100-Year B-B Rainfall=7.32" x 2

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Summary for Subcatchment PR2: PR2 (DRAINS TO STREET)

Runoff = 13.21 cfs @ 36.13 hrs, Volume= 1.415 af, Depth=13.88"
Routed to Reach 1R : TOTAL

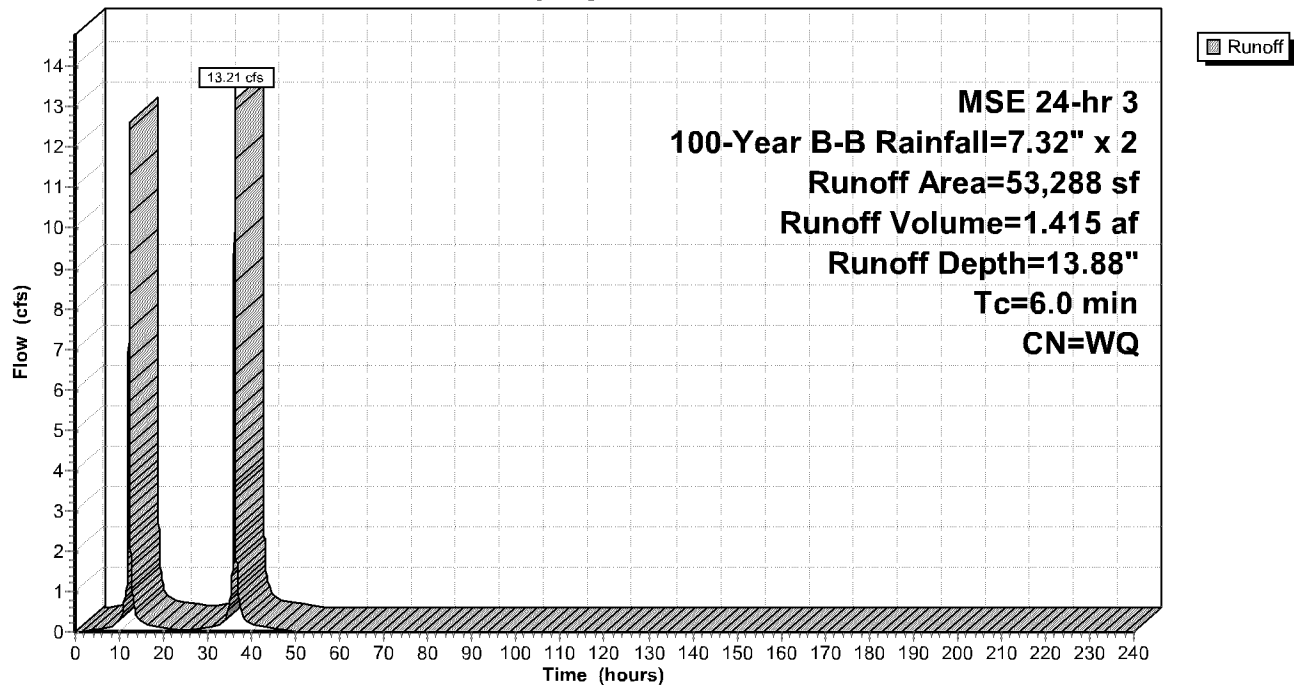
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year B-B Rainfall=7.32" x 2

Area (sf)	CN	Description
48,140	98	Paved parking, HSG B
5,148	61	>75% Grass cover, Good, HSG B
53,288		Weighted Average
5,148		9.66% Pervious Area
48,140		90.34% Impervious Area

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

Subcatchment PR2: PR2 (DRAINS TO STREET)

Hydrograph



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MSE 24-hr 3 100-Year B-B Rainfall=7.32" x 2

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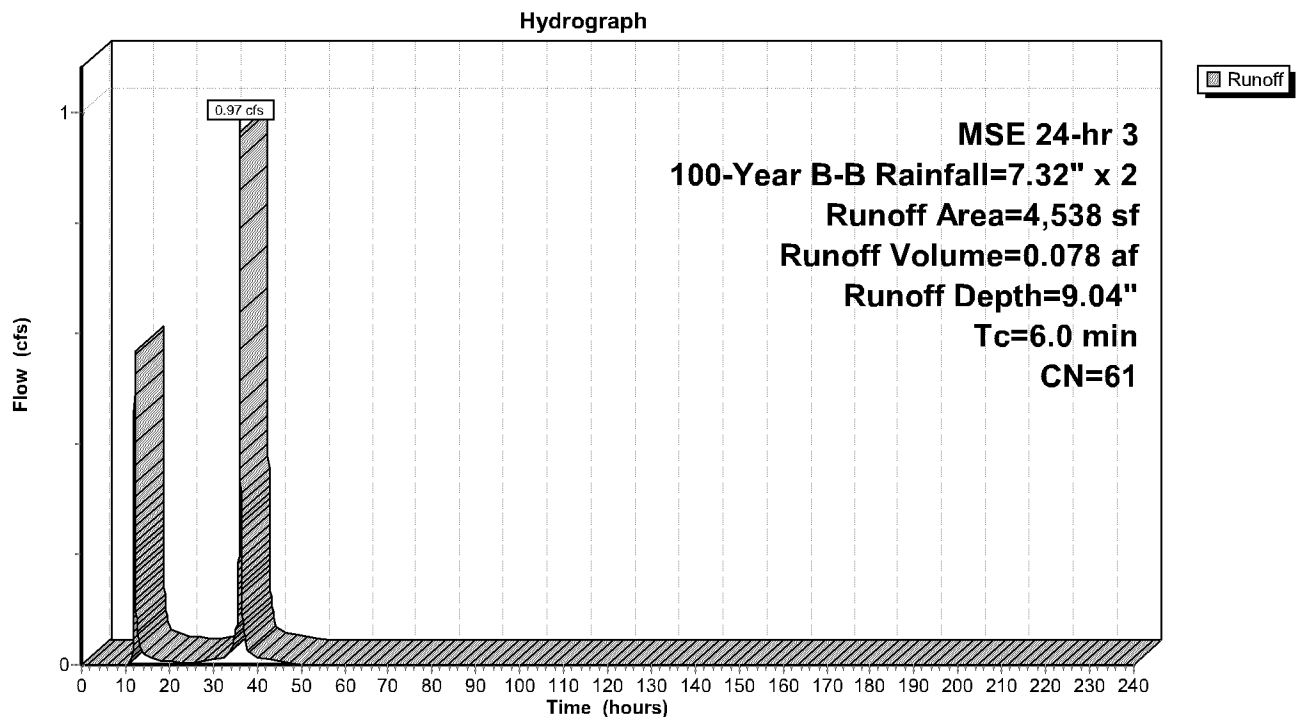
Summary for Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

Runoff = 0.97 cfs @ 36.13 hrs, Volume= 0.078 af, Depth= 9.04"
Routed to Reach 1R : TOTAL

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year B-B Rainfall=7.32" x 2

Area (sf)	CN	Description
4,538	61	>75% Grass cover, Good, HSG B
4,538		100.00% Pervious Area

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

Subcatchment PR3: PR3 (TO ADJ. PROPERTIES)

Summary for Reach 1R: TOTAL

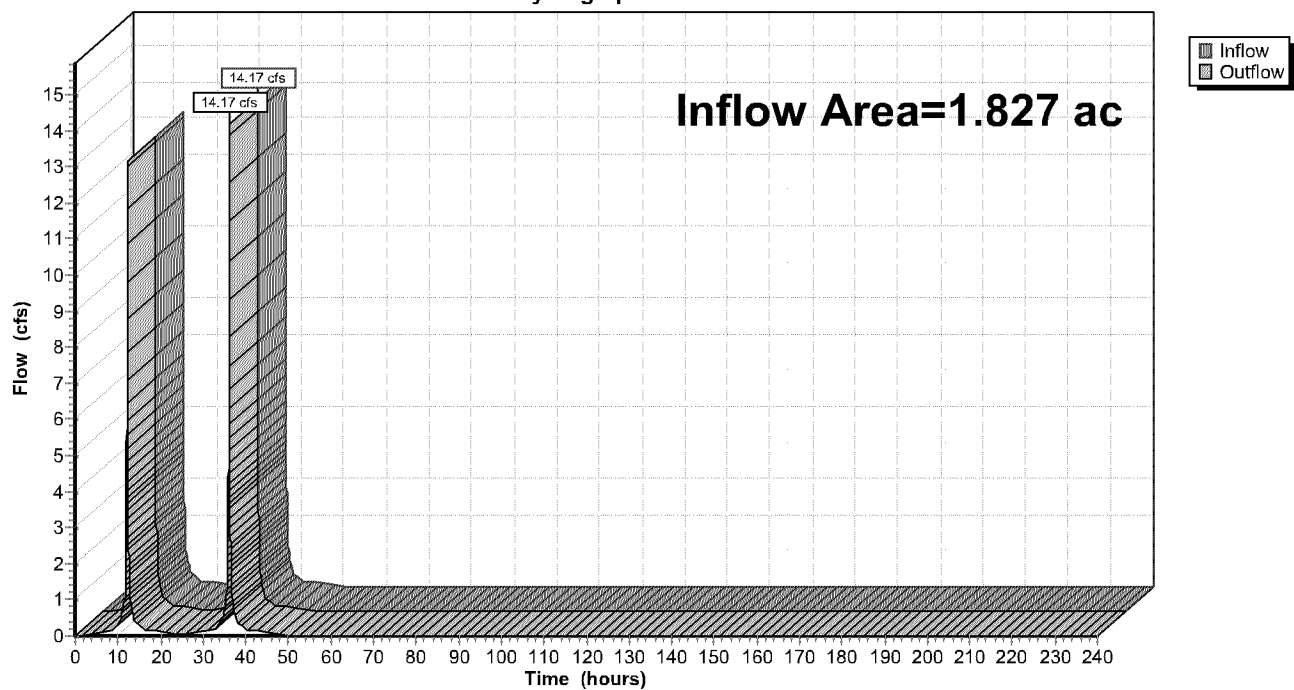
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.827 ac, 74.53% Impervious, Inflow Depth = 9.81" for 100-Year B-B event
Inflow = 14.17 cfs @ 36.13 hrs, Volume= 1.493 af
Outflow = 14.17 cfs @ 36.13 hrs, Volume= 1.493 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Reach 1R: TOTAL

Hydrograph



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MSE 24-hr 3 100-Year B-B Rainfall=7.32" x 2

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Summary for Pond 2P: INFILTRATION BASIN

Inflow Area = 0.499 ac, 51.33% Impervious, Inflow Depth = 11.79" for 100-Year B-B event
 Inflow = 5.06 cfs @ 36.13 hrs, Volume= 0.490 af
 Outflow = 0.14 cfs @ 37.66 hrs, Volume= 0.490 af, Atten= 97%, Lag= 92.0 min
 Discarded = 0.14 cfs @ 37.66 hrs, Volume= 0.490 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 1R : TOTAL

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs

Peak Elev= 833.22' @ 37.66 hrs Surf.Area= 13,365 sf Storage= 11,593 cf

Plug-Flow detention time= 1,072.0 min calculated for 0.490 af (100% of inflow)

Center-of-Mass det. time= 1,072.0 min (2,637.3 - 1,565.3)

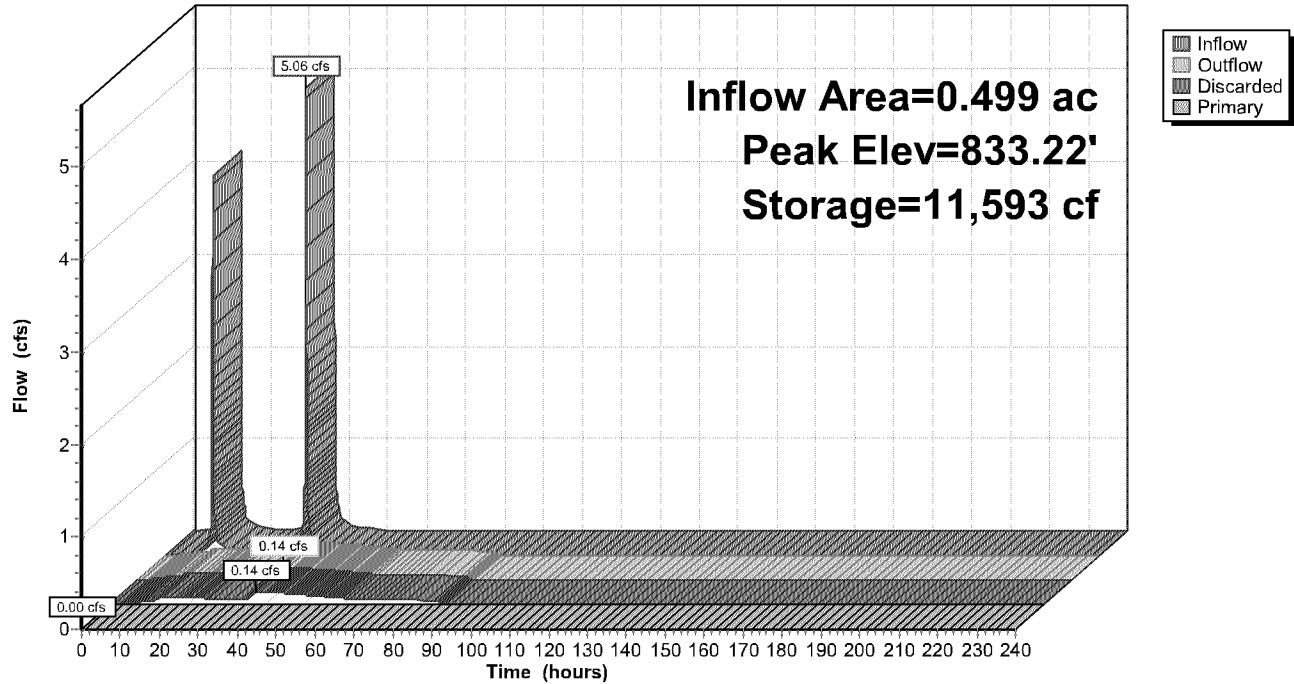
Volume	Invert	Avail.Storage	Storage Description
#1	831.60'	15,705 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.60	4,344	0	0
832.00	4,916	1,852	1,852
832.50	6,074	2,748	4,599
833.00	11,042	4,279	8,878
833.50	16,263	6,826	15,705

Device	Routing	Invert	Outlet Devices
#1	Discarded	831.60'	0.450 in/hr Exfiltration over Surface area
#2	Primary	833.36'	5.0' long x 5.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			
2.50 3.00 3.50 4.00 4.50 5.00 5.50			
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65			
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88			

Discarded OutFlow Max=0.14 cfs @ 37.66 hrs HW=833.22' (Free Discharge)↑ **1=Exfiltration** (Exfiltration Controls 0.14 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=831.60' (Free Discharge)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: INFILTRATION BASIN

Hydrograph



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MSE 24-hr 3 100-Year B-B Rainfall=7.32" x 2

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Stage-Area-Storage for Pond 2P: INFILTRATION BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
831.60	4,344	0	832.64	7,465	5,547
831.62	4,373	87	832.66	7,664	5,699
831.64	4,401	175	832.68	7,862	5,854
831.66	4,430	263	832.70	8,061	6,013
831.68	4,458	352	832.72	8,260	6,176
831.70	4,487	442	832.74	8,459	6,343
831.72	4,516	532	832.76	8,657	6,515
831.74	4,544	622	832.78	8,856	6,690
831.76	4,573	713	832.80	9,055	6,869
831.78	4,601	805	832.82	9,254	7,052
831.80	4,630	897	832.84	9,452	7,239
831.82	4,659	990	832.86	9,651	7,430
831.84	4,687	1,084	832.88	9,850	7,625
831.86	4,716	1,178	832.90	10,048	7,824
831.88	4,744	1,272	832.92	10,247	8,027
831.90	4,773	1,368	832.94	10,446	8,234
831.92	4,802	1,463	832.96	10,645	8,445
831.94	4,830	1,560	832.98	10,843	8,660
831.96	4,859	1,657	833.00	11,042	8,878
831.98	4,887	1,754	833.02	11,251	9,101
832.00	4,916	1,852	833.04	11,460	9,329
832.02	4,962	1,951	833.06	11,669	9,560
832.04	5,009	2,050	833.08	11,877	9,795
832.06	5,055	2,151	833.10	12,086	10,035
832.08	5,101	2,253	833.12	12,295	10,279
832.10	5,148	2,355	833.14	12,504	10,527
832.12	5,194	2,459	833.16	12,713	10,779
832.14	5,240	2,563	833.18	12,922	11,035
832.16	5,287	2,668	833.20	13,130	11,296
832.18	5,333	2,774	833.22	13,339	11,560
832.20	5,379	2,882	833.24	13,548	11,829
832.22	5,426	2,990	833.26	13,757	12,102
832.24	5,472	3,099	833.28	13,966	12,380
832.26	5,518	3,208	833.30	14,175	12,661
832.28	5,564	3,319	833.32	14,383	12,947
832.30	5,611	3,431	833.34	14,592	13,236
832.32	5,657	3,544	833.36	14,801	13,530
832.34	5,703	3,657	833.38	15,010	13,828
832.36	5,750	3,772	833.40	15,219	14,131
832.38	5,796	3,887	833.42	15,428	14,437
832.40	5,842	4,004	833.44	15,636	14,748
832.42	5,889	4,121	833.46	15,845	15,063
832.44	5,935	4,239	833.48	16,054	15,382
832.46	5,981	4,358	833.50	16,263	15,705
832.48	6,028	4,478			
832.50	6,074	4,599			
832.52	6,273	4,723			
832.54	6,471	4,850			
832.56	6,670	4,982			
832.58	6,869	5,117			
832.60	7,068	5,257			
832.62	7,266	5,400			