



City of Bloomington requires volume capture for all areas fully reconstructed, not just new impervious. Revise and resubmit calculations.

Stormwater Summary

Service Restoration
300 W 83rd Street
Bloomington, MN 55420

The project consists of a building addition of approximately 1700 SF and improvements on the site to add parking stalls to meet the zoning code requirements. The project size is relatively small, disturbing less than 0.5 acres, but triggers the requirement of a watershed permit since it exceeds 5,000 SF of land-disturbing activities. This disturbed area is less than 50% of the entire parcel, thus Section 4.3 will only apply to the new impervious. The total increased impervious area is 5,622 SF. This project requires 1.1" capture and infiltration for the additional 5,622 SF of impervious which computes to 515 CF.

To meet the stormwater requirements, a rainwater garden is provided to capture of 6200 SF impervious runoff. The design volume exceeds the required 515 CF of storage and infiltration. The outlet structure of the rainwater garden is dual stage, keeping the runoff rates of the smaller 2 and 10 year storms near existing and then allow for a secondary overflow during larger rain events.

The existing soil type is SP-SM with a classification of soil type B which will allow for full infiltration of the 9" depth of water in the rainwater garden within 24 hours based on 0.5" per hour which allows for a factor of safety of two base on the 48 hour requirement.

Please see the civil plans, enclosed drainage maps and HydroCad report for more information related to the project.

Thank you for your consideration,

Lance A. Elliott, PE

EXISTING DRAINAGE MAP

ALTA/ACSM LAND TITLE SURVEY FOR: CUSHMAN & WAKEFIELD

PROPERTY OWNER: TORO MANUFACTURING CORP.
PROPERTY ADDRESS: 8201 GRAND AVE. SOUTH
PARCEL NUMBER: 03-027-24-32-0031

LEGAL DESCRIPTION:

Parcel A (Certificate of Title No. 1198307):

Block 4, Raymond F. McDonald Addition.

That part of vacated West 83rd Street, as dedicated in Raymond F. McDonald Addition, lying between the Southerly extensions of the West line and the East line of Block 4, in said addition.

Parcel B:

Non-exclusive easements for driveway and storm sewer purposes as contained in the Grant of Mutual Easements, dated July 6, 2006, recorded December 7, 2006, in the office of the Hennepin County Registrar of Titles as Doc. No. 4335340.

NOTES:

1. The orientation of this bearing system is based on the Hennepin County coordinate grid (NAD 83-96 Adj).
2. The total area of the property described hereon is 54,092 square feet or 1.2418 acres.
3. The legal description and easement information used in the preparation of this survey were based on the Commitment for Title Insurance prepared by First American Title Insurance Company, Commitment No. NCS-685831-MPLS, having a commitment date of July 25, 2014 at 7:30 A.M.
4. Existing utilities, services and underground structures shown hereon were located based upon observed evidence. Verification and location of all utilities and services should be obtained from the owners of the respective utilities prior to any design, planning or excavation.
5. No zoning report or letter was received from the insurer pursuant to Optional Table A, Item 6(a), as set forth in the 2011 Minimum Standard Detail Requirements for ALTA/ACSM Land Title Surveys.
6. The property described hereon lies within Flood Zone X (areas determined to be outside of the 0.2% annual chance floodplain) per Federal Insurance Rate Map No. 27053 C 0456 E, dated September 2, 2004.
7. As of the date of this survey the property described hereon contains a total of 28 regular striped parking spaces.
8. As of the date of this survey there is no observable evidence of current earth moving work, building construction or building additions on the property described hereon.
9. As of the date of this survey there is no observable evidence that the property described hereon is being used as a solid waste dump, sump or sanitary landfill.
10. Adjacent property owners, addresses and parcel numbers were obtained from the Hennepin County Property Information Web site.

SURVEY ITEMS PER SCHEDULE B:

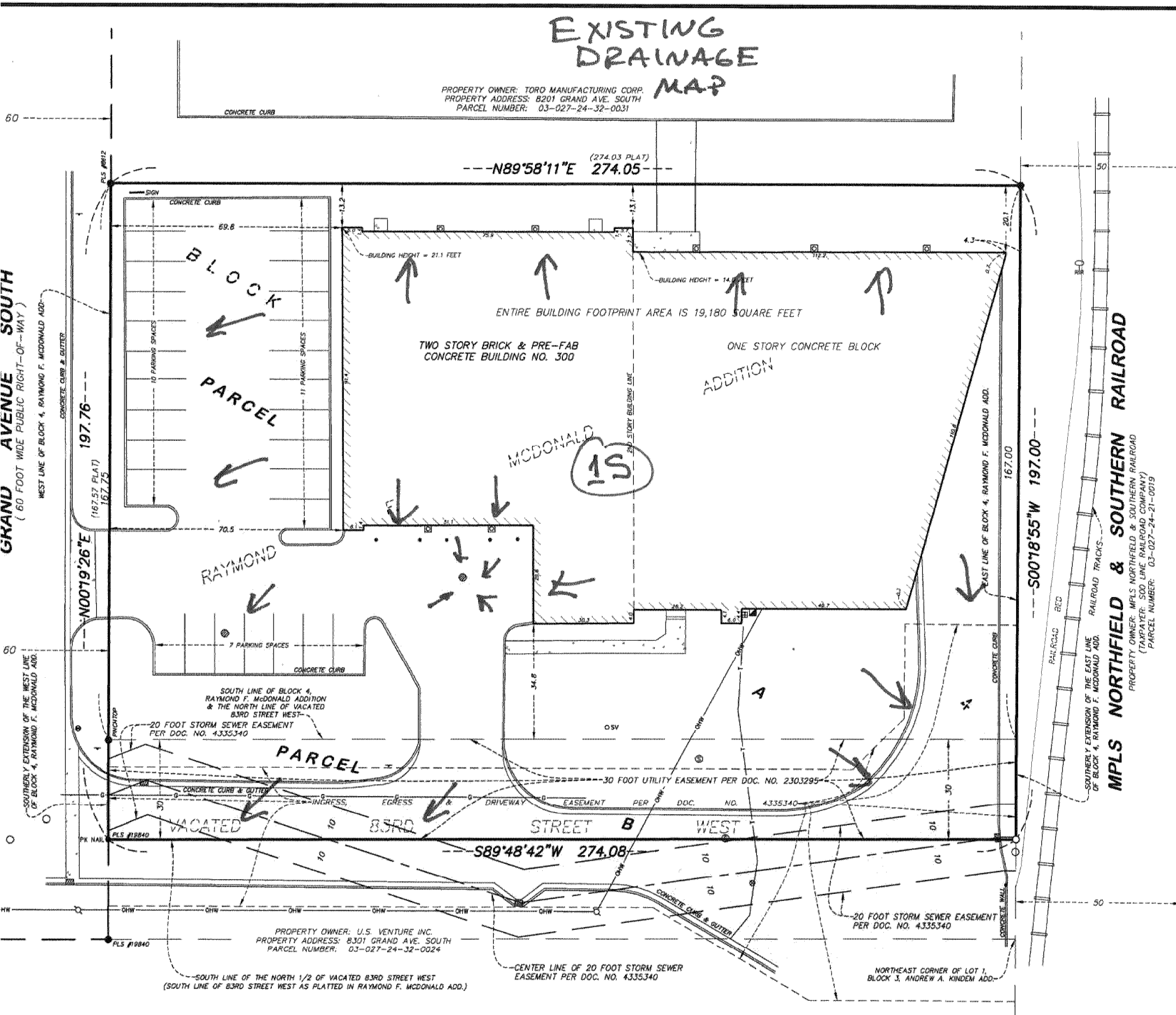
ITEM 10: Easement for utility purposes in favor of the City of Bloomington, as contained in the Easement, dated August 28, 1992, recorded October 6, 1992, as Doc. No. 2303495.

The easement referenced in said document affects the property and is depicted on the survey.

ITEM 11: Terms and conditions, including easements for driveway and storm sewer purposes, as contained in the Grant of Mutual Easements, dated July 6, 2006, recorded December 7, 2006, as Doc. No. 4335340.

The easements referenced in said document affect the property and are depicted on the survey.

CERTIFICATION:



MPLS NORTHFIELD & SOUTHERN RAILROAD
PROPERTY OWNER: MPLS NORTHFIELD & SOUTHERN RAILROAD
(TAXPAYER: 500 LINE RAILROAD COMPANY)
PARCEL NUMBER: 03-027-24-21-0019



PROPOSED DRAINAGE MAP

5616 DALRYMPLE RD
EDINA, MN 55424
BUS: (612)220-0150
email: info@elliottdesignbuild.com

SERVICE RESTORATION
300 W 83rd St,
Bloomington, MN
55420

UTILITY PLAN

PROJECT NO. E352

DATE 07/14/2020

REVISION NO. DATE

PRELIMINARY
NOT FOR
CONSTRUCTION

CIVIL SHEET INDEX

SHEET	TITLE
C1	CIVIL REMOVALS
C2	GRADING AND EROSION
C3	UTILITY PLAN
C4	SITE PLAN
C5	LANDSCAPE PLAN

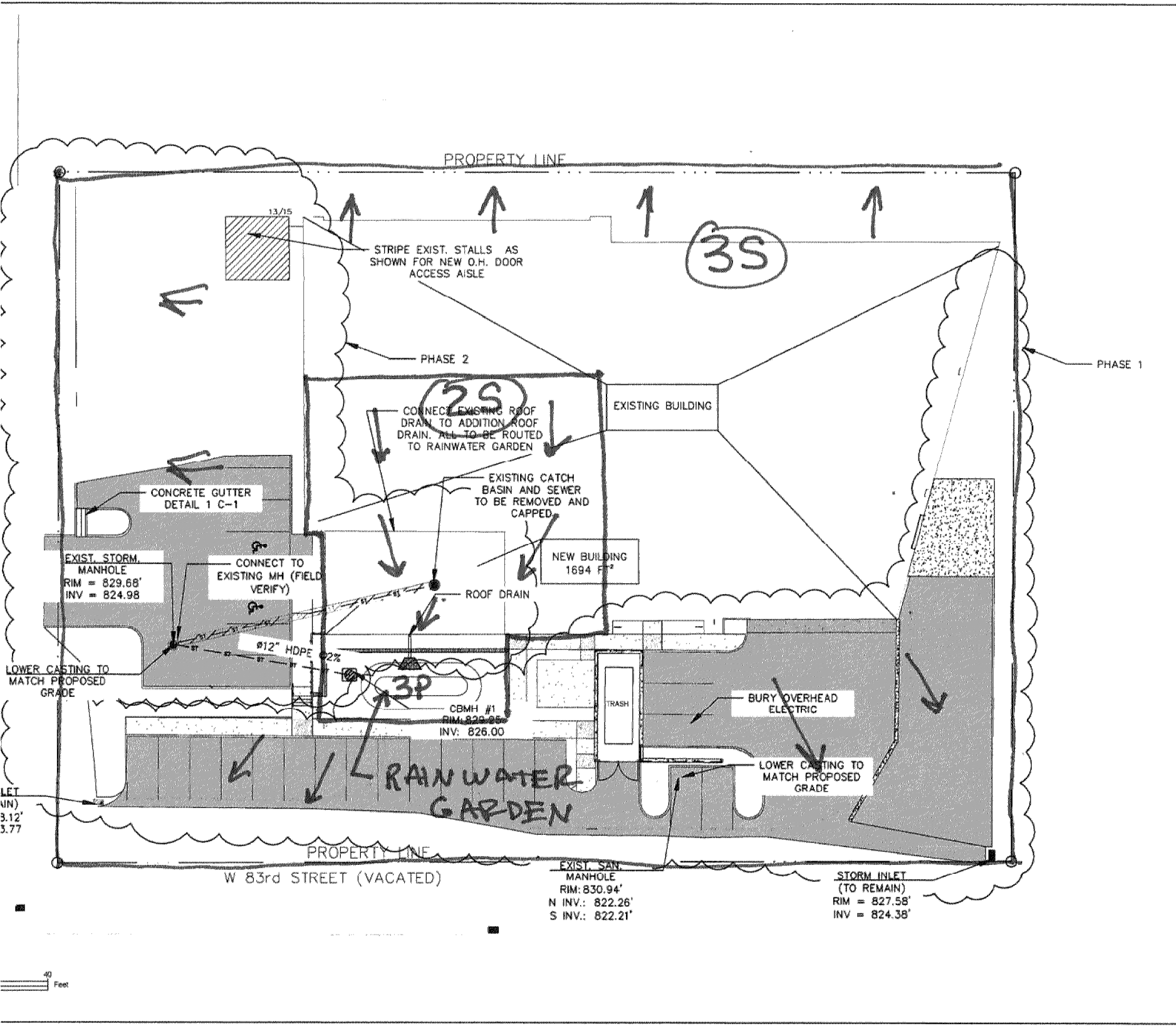
AREA CALCULATIONS	
TOTAL SITE AREA FT ²	54061
EXISTING IMPERVIOUS	
NAME	AREA FT ²
BUILDING	19175
WALK	590
PARKING	19091
TOTAL %	71.87
PROPOSED IMPERVIOUS	
NAME	AREA FT ²
BUILDING	21457
WALKS	1812
PARKING	21209
TOTAL %	82.27
ADDITIONAL IMPERVIOUS	5622 FT ²

LEGEND

— ST —	EXISTING STORM SEWER
— ST —	PROPOSED STORM SEWER

GENERAL NOTES:

- FOLLOW ALL CITY REQUIREMENTS.
- MINIMIZE DISTURBANCE TO LAWN DURING DEMOLITION RESTORE WHEN COMPLETE.
- PUBLIC STREETS ARE TO BE CLEAN OF DEBRIS AND DIRT ON A DAILY BASIS.
- STATE LAW REQUIRES NOTIFICATION OF GOPHER ONE CALL, BUT CAN BE LOCATED BY A CONTRACT LOCATOR OR OTHER



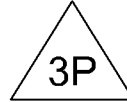
LAN



Existing



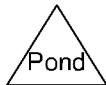
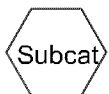
Proposed Draining to
Rainwater Garden



Rainwater Garden



Proposed NOT Draining to
Rainwater Garden



Routing Diagram for 10-28-20

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
24,788	61	>75% Grass cover, Good, HSG B (1S, 2S, 3S)
40,300	98	Parking (1S, 3S)
6,525	98	Roof Draining to Pond (2S)
34,107	98	Roofs (1S, 3S)
2,402	98	Walks (1S, 3S)
108,122	90	TOTAL AREA

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
24,788	HSG B	1S, 2S, 3S
0	HSG C	
0	HSG D	
83,334	Other	1S, 2S, 3S
108,122		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcat Numbers
0	24,788	0	0	0	24,788	>75% Grass cover, Good	
0	0	0	0	40,300	40,300	Parking	
0	0	0	0	6,525	6,525	Roof Draining to Pond	
0	0	0	0	34,107	34,107	Roofs	
0	0	0	0	2,402	2,402	Walks	
0	24,788	0	0	83,334	108,122	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	3P	826.00	825.25	50.0	0.0150	0.010	5.0	0.0	0.0

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MSE 24-hr 3 2-Year Rainfall=2.85"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 1S: Existing

Runoff Area=54,061 sf 71.87% Impervious Runoff Depth=1.69"
 Flow Length=200' Tc=3.1 min CN=88 Runoff=4.21 cfs 7,593 cf

Subcatchment 2S: Proposed Draining to

Runoff Area=7,869 sf 82.92% Impervious Runoff Depth=2.02"
 Flow Length=200' Tc=3.1 min CN=92 Runoff=0.71 cfs 1,324 cf

Subcatchment 3S: Proposed NOT Draining to

Runoff Area=46,192 sf 82.16% Impervious Runoff Depth=1.93"
 Flow Length=200' Tc=3.1 min CN=91 Runoff=4.03 cfs 7,436 cf

Pond 3P: Rainwater Garden

Peak Elev=829.66' Storage=562 cf Inflow=0.71 cfs 1,324 cf
 Discarded=0.02 cfs 740 cf Primary=0.21 cfs 584 cf Outflow=0.22 cfs 1,324 cf

Total Runoff Area = 108,122 sf Runoff Volume = 16,354 cf Average Runoff Depth = 1.82"
22.93% Pervious = 24,788 sf 77.07% Impervious = 83,334 sf

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MSE 24-hr 3 2-Year Rainfall=2.85"

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Summary for Subcatchment 1S: Existing

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

Runoff = 4.21 cfs @ 12.09 hrs, Volume= 7,593 cf, Depth= 1.69"

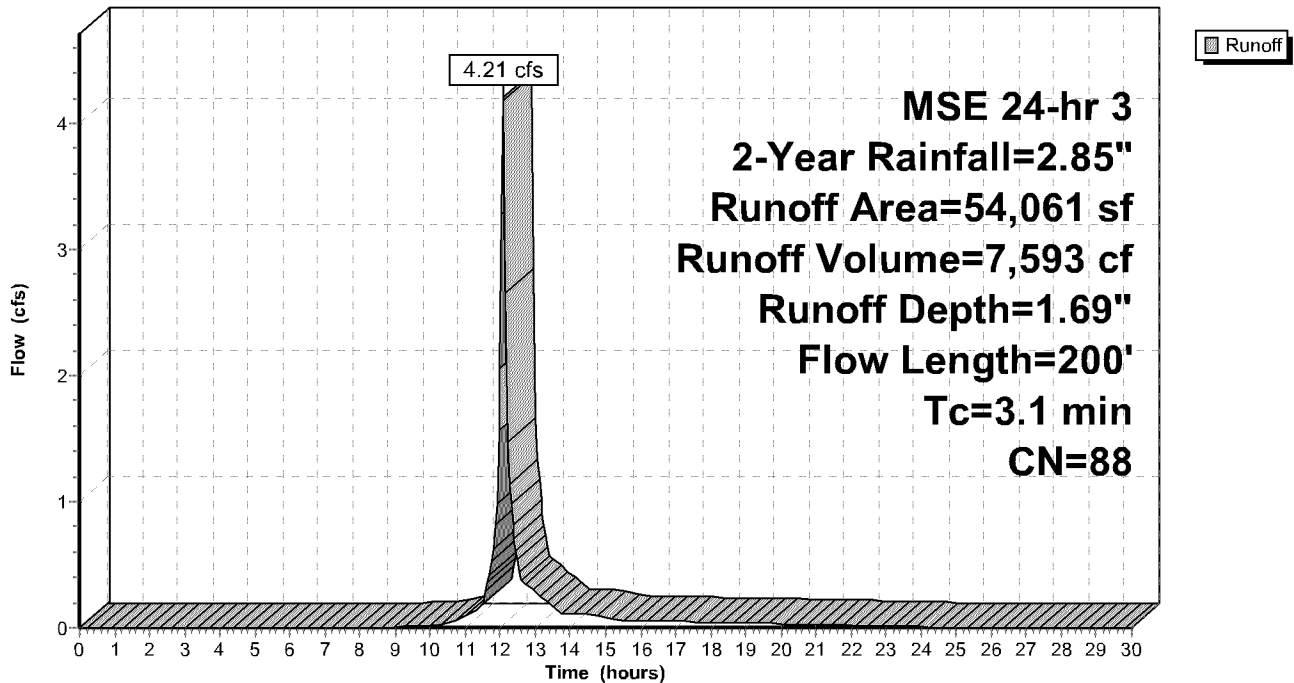
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-Year Rainfall=2.85"

	Area (sf)	CN	Description
*	19,175	98	Roofs
*	590	98	Walks
*	19,091	98	Parking
	15,205	61	>75% Grass cover, Good, HSG B
	54,061	88	Weighted Average
	15,205		28.13% Pervious Area
	38,856		71.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	150	0.0100	1.06		Sheet Flow, Roof
					Smooth surfaces n= 0.011 P2= 2.80"
0.7	50	0.0200	1.12		Sheet Flow, Parking
					Smooth surfaces n= 0.011 P2= 2.80"
3.1	200	Total			

Subcatchment 1S: Existing

Hydrograph



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MSE 24-hr 3 2-Year Rainfall=2.85"

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Summary for Subcatchment 2S: Proposed Draining to Rainwater Garden

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

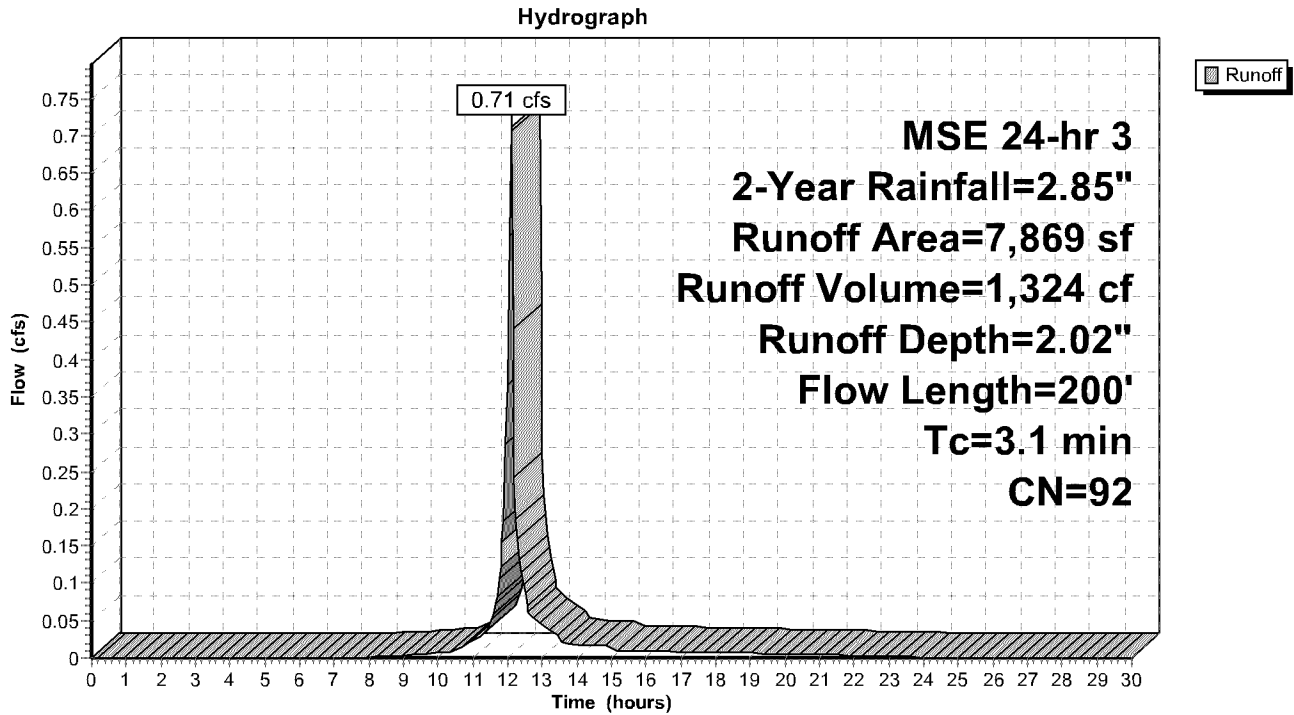
Runoff = 0.71 cfs @ 12.09 hrs, Volume= 1,324 cf, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-Year Rainfall=2.85"

	Area (sf)	CN	Description
*	6,525	98	Roof Draining to Pond
	1,344	61	>75% Grass cover, Good, HSG B
	7,869	92	Weighted Average
	1,344		17.08% Pervious Area
	6,525		82.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	150	0.0100	1.06		Sheet Flow, Roof
					Smooth surfaces n= 0.011 P2= 2.80"
0.7	50	0.0200	1.12		Sheet Flow, Parking
					Smooth surfaces n= 0.011 P2= 2.80"
3.1	200	Total			

Subcatchment 2S: Proposed Draining to Rainwater Garden



10-28-20

MSE 24-hr 3 2-Year Rainfall=2.85"

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Summary for Subcatchment 3S: Proposed NOT Draining to Rainwater Garden

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 4.03 cfs @ 12.09 hrs, Volume= 7,436 cf, Depth= 1.93"

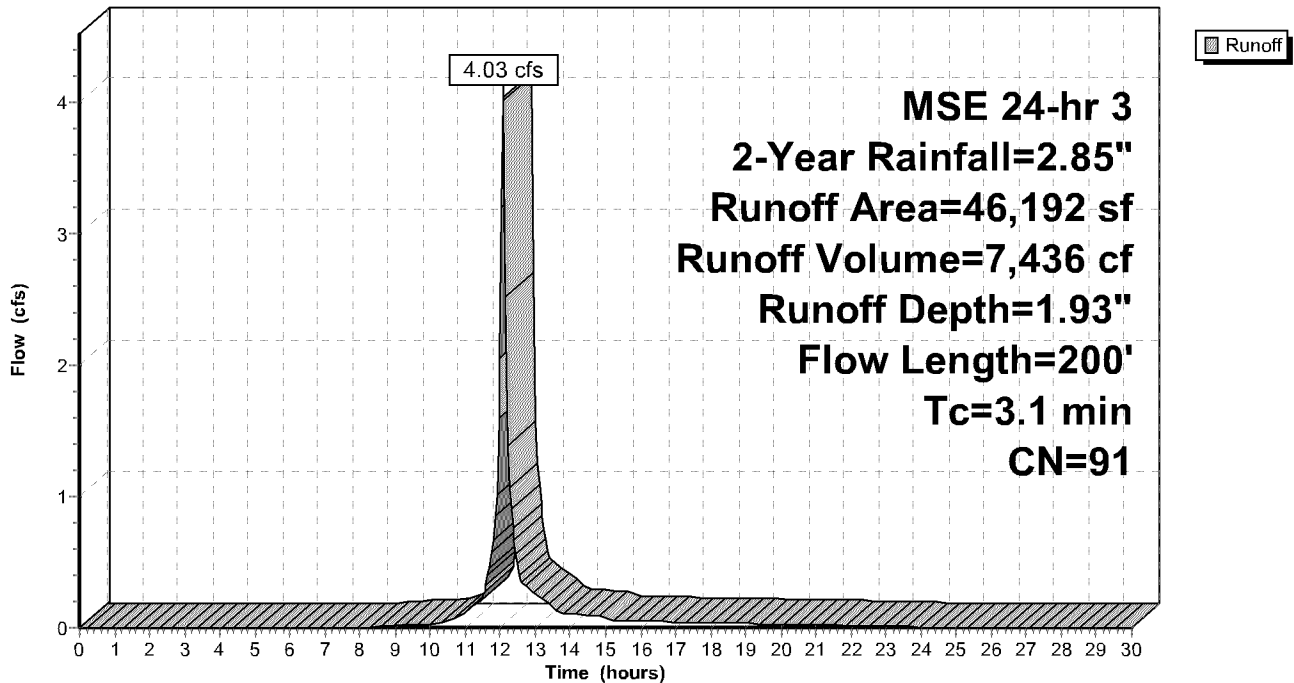
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-Year Rainfall=2.85"

	Area (sf)	CN	Description
*	14,932	98	Roofs
*	1,812	98	Walks
*	21,209	98	Parking
	8,239	61	>75% Grass cover, Good, HSG B
	46,192	91	Weighted Average
	8,239		17.84% Pervious Area
	37,953		82.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	150	0.0100	1.06		Sheet Flow, Roof
					Smooth surfaces n= 0.011 P2= 2.80"
0.7	50	0.0200	1.12		Sheet Flow, Parking
					Smooth surfaces n= 0.011 P2= 2.80"
3.1	200	Total			

Subcatchment 3S: Proposed NOT Draining to Rainwater Garden

Hydrograph



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MSE 24-hr 3 2-Year Rainfall=2.85"

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Summary for Pond 3P: Rainwater Garden

Inflow Area = 7,869 sf, 82.92% Impervious, Inflow Depth = 2.02" for 2-Year event
 Inflow = 0.71 cfs @ 12.09 hrs, Volume= 1,324 cf
 Outflow = 0.22 cfs @ 12.22 hrs, Volume= 1,324 cf, Atten= 69%, Lag= 7.9 min
 Discarded = 0.02 cfs @ 12.22 hrs, Volume= 740 cf
 Primary = 0.21 cfs @ 12.22 hrs, Volume= 584 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Peak Elev= 829.66' @ 12.22 hrs Surf.Area= 682 sf Storage= 562 cf

Plug-Flow detention time= 174.5 min calculated for 1,322 cf (100% of inflow)
 Center-of-Mass det. time= 174.8 min (957.7 - 782.9)

Volume	Invert	Avail.Storage	Storage Description
#1	828.50'	1,278 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
828.50	300	0	0
829.50	621	461	461
830.50	1,014	818	1,278

Device	Routing	Invert	Outlet Devices
#1	Device 3	829.25'	4.0" Vert. Orifice/Grate C= 0.600
#2	Device 3	829.75'	27.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	826.00'	5.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 826.00' / 825.25' S= 0.0150 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.14 sf
#4	Discarded	828.50'	1.000 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.02 cfs @ 12.22 hrs HW=829.65' (Free Discharge)
 ↑4=Exfiltration (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.20 cfs @ 12.22 hrs HW=829.65' (Free Discharge)
 ↑3=Culvert (Passes 0.20 cfs of 1.03 cfs potential flow)
 ↑1=Orifice/Grate (Orifice Controls 0.20 cfs @ 2.33 fps)
 ↑2=Orifice/Grate (Controls 0.00 cfs)

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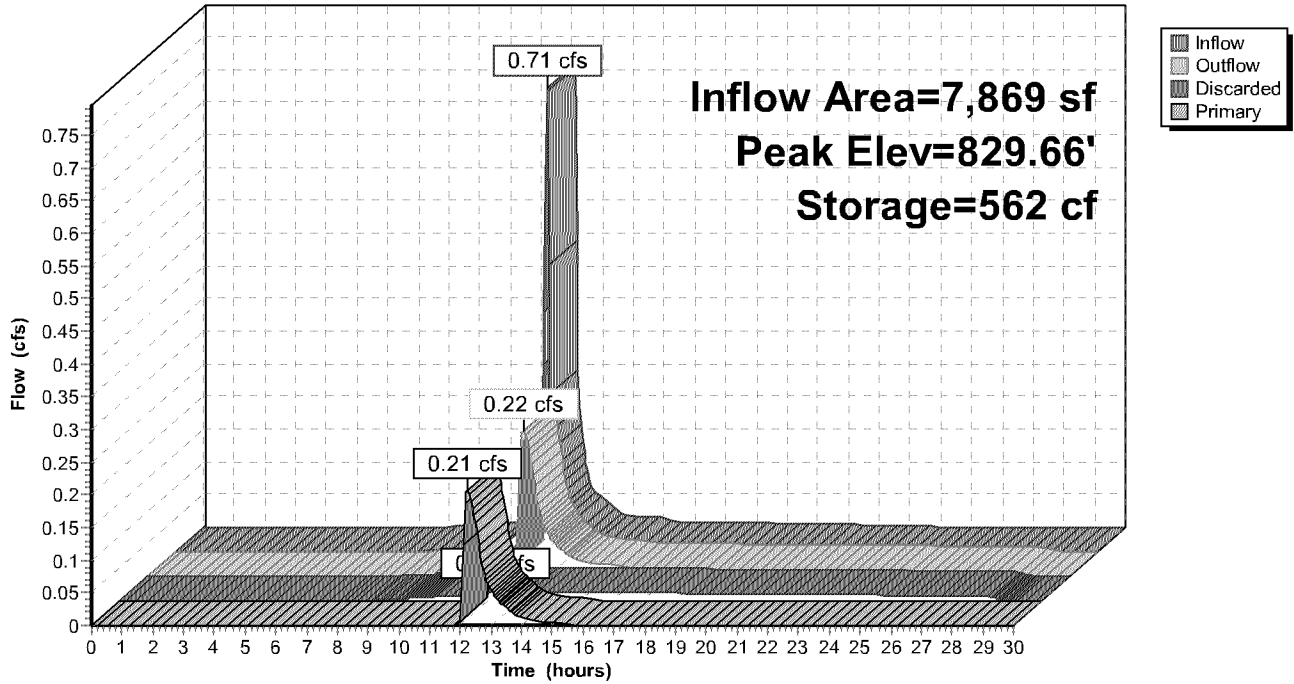
MSE 24-hr 3 2-Year Rainfall=2.85"

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Pond 3P: Rainwater Garden

Hydrograph



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MSE 24-hr 3 10-Year Rainfall=4.22"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 1S: Existing

Runoff Area=54,061 sf 71.87% Impervious Runoff Depth=2.93"
 Flow Length=200' Tc=3.1 min CN=88 Runoff=7.13 cfs 13,217 cf

Subcatchment 2S: Proposed Draining to

Runoff Area=7,869 sf 82.92% Impervious Runoff Depth=3.33"
 Flow Length=200' Tc=3.1 min CN=92 Runoff=1.13 cfs 2,184 cf

Subcatchment 3S: Proposed NOT Draining to

Runoff Area=46,192 sf 82.16% Impervious Runoff Depth=3.23"
 Flow Length=200' Tc=3.1 min CN=91 Runoff=6.52 cfs 12,427 cf

Pond 3P: Rainwater Garden

Peak Elev=829.84' Storage=697 cf Inflow=1.13 cfs 2,184 cf
 Discarded=0.02 cfs 869 cf Primary=0.94 cfs 1,308 cf Outflow=0.95 cfs 2,177 cf

Total Runoff Area = 108,122 sf Runoff Volume = 27,828 cf Average Runoff Depth = 3.09"
22.93% Pervious = 24,788 sf 77.07% Impervious = 83,334 sf

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MSE 24-hr 3 10-Year Rainfall=4.22"

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Summary for Subcatchment 1S: Existing

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

Runoff = 7.13 cfs @ 12.09 hrs, Volume= 13,217 cf, Depth= 2.93"

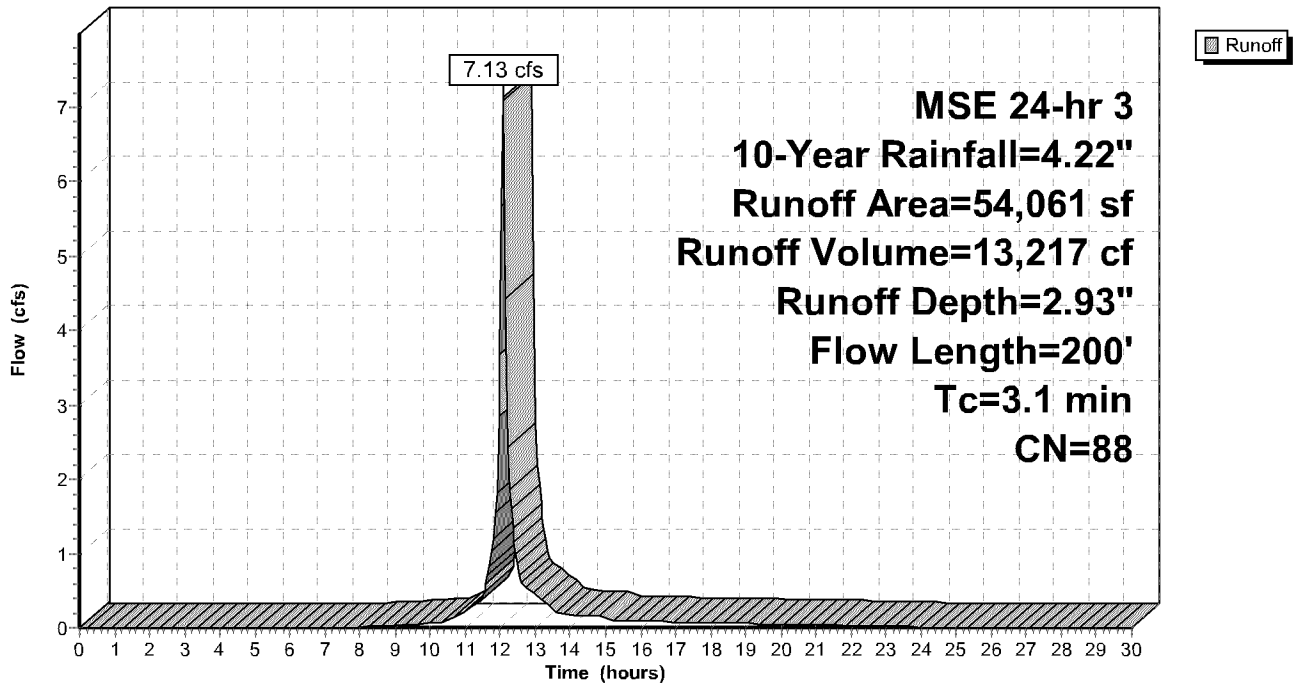
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.22"

	Area (sf)	CN	Description
*	19,175	98	Roofs
*	590	98	Walks
*	19,091	98	Parking
	15,205	61	>75% Grass cover, Good, HSG B
	54,061	88	Weighted Average
	15,205		28.13% Pervious Area
	38,856		71.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	150	0.0100	1.06		Sheet Flow, Roof
					Smooth surfaces n= 0.011 P2= 2.80"
0.7	50	0.0200	1.12		Sheet Flow, Parking
					Smooth surfaces n= 0.011 P2= 2.80"
3.1	200	Total			

Subcatchment 1S: Existing

Hydrograph



10-28-20

MSE 24-hr 3 10-Year Rainfall=4.22"

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Summary for Subcatchment 2S: Proposed Draining to Rainwater Garden

[49] Hint: $T_c < 2dt$ may require smaller dt

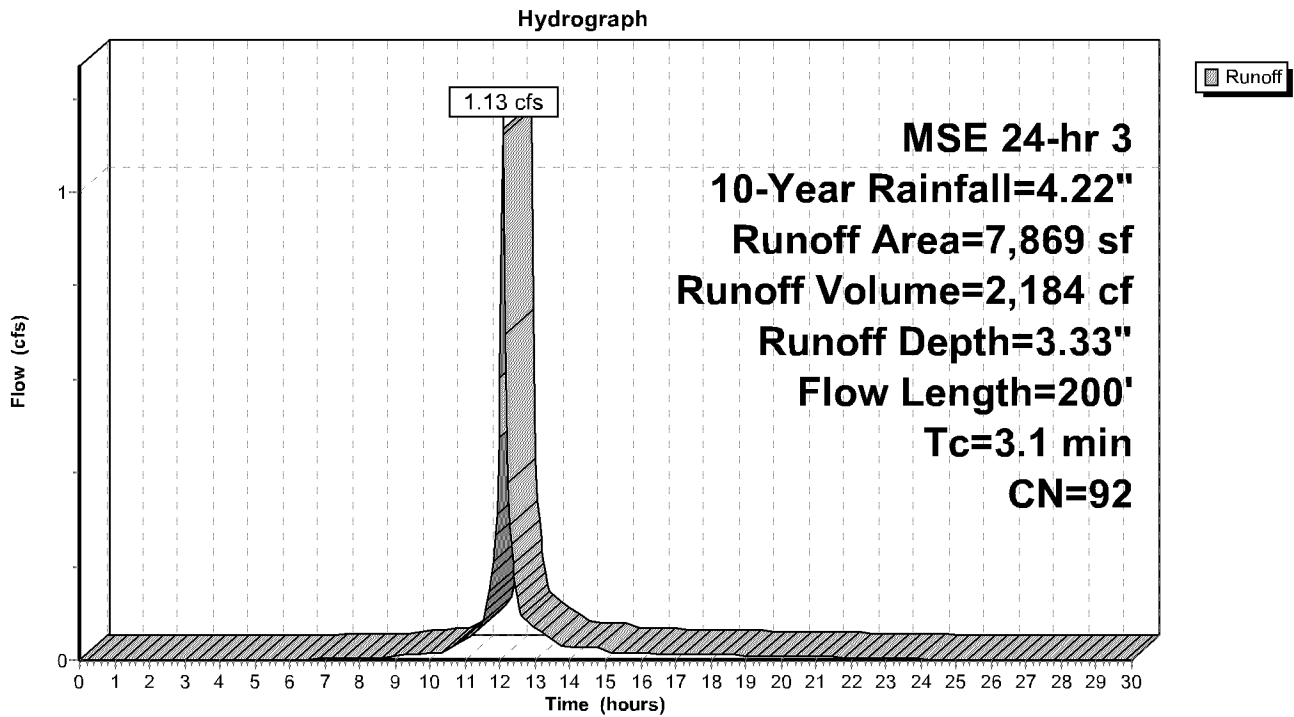
Runoff = 1.13 cfs @ 12.09 hrs, Volume= 2,184 cf, Depth= 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, $dt= 0.05$ hrs
MSE 24-hr 3 10-Year Rainfall=4.22"

	Area (sf)	CN	Description
*	6,525	98	Roof Draining to Pond
	1,344	61	>75% Grass cover, Good, HSG B
	7,869	92	Weighted Average
	1,344		17.08% Pervious Area
	6,525		82.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	150	0.0100	1.06		Sheet Flow, Roof
					Smooth surfaces n= 0.011 P2= 2.80"
0.7	50	0.0200	1.12		Sheet Flow, Parking
					Smooth surfaces n= 0.011 P2= 2.80"
3.1	200	Total			

Subcatchment 2S: Proposed Draining to Rainwater Garden



10-28-20

MSE 24-hr 3 10-Year Rainfall=4.22"

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Summary for Subcatchment 3S: Proposed NOT Draining to Rainwater Garden

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 6.52 cfs @ 12.09 hrs, Volume= 12,427 cf, Depth= 3.23"

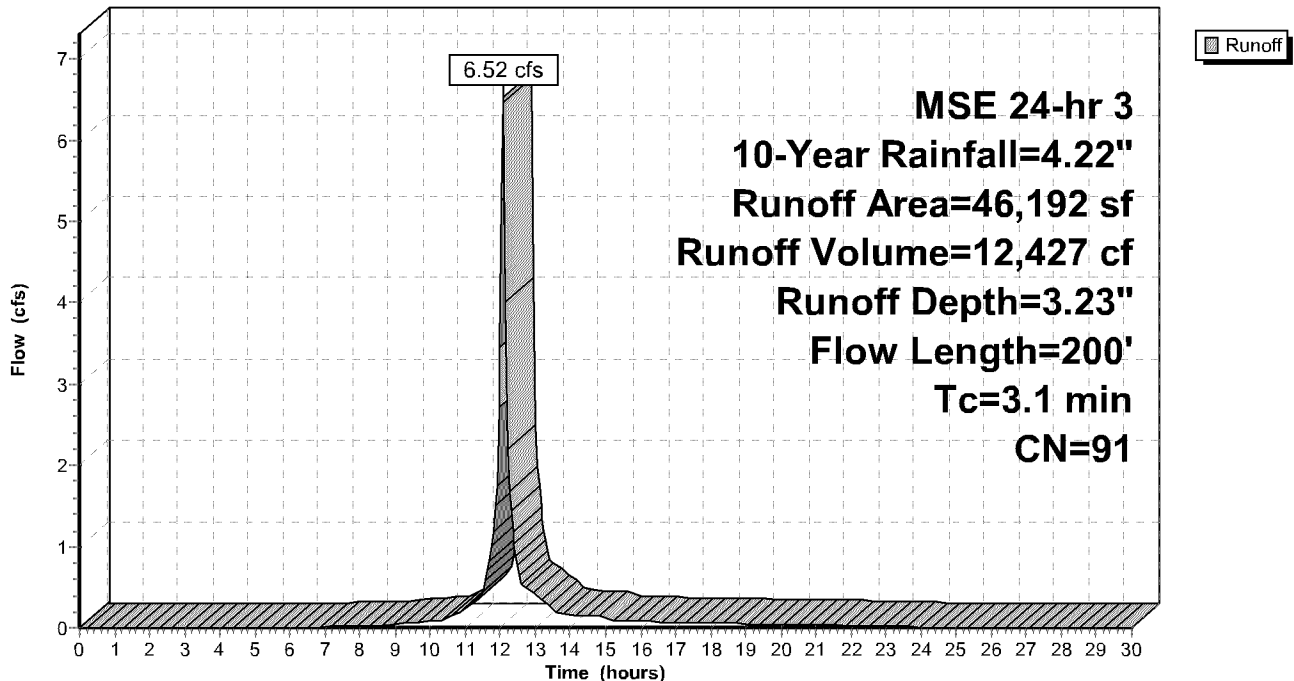
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.22"

	Area (sf)	CN	Description
*	14,932	98	Roofs
*	1,812	98	Walks
*	21,209	98	Parking
	8,239	61	>75% Grass cover, Good, HSG B
	46,192	91	Weighted Average
	8,239		17.84% Pervious Area
	37,953		82.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	150	0.0100	1.06		Sheet Flow, Roof
					Smooth surfaces n= 0.011 P2= 2.80"
0.7	50	0.0200	1.12		Sheet Flow, Parking
					Smooth surfaces n= 0.011 P2= 2.80"
3.1	200	Total			

Subcatchment 3S: Proposed NOT Draining to Rainwater Garden

Hydrograph



10-28-20

MSE 24-hr 3 10-Year Rainfall=4.22"

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Summary for Pond 3P: Rainwater Garden

Inflow Area = 7,869 sf, 82.92% Impervious, Inflow Depth = 3.33" for 10-Year event
 Inflow = 1.13 cfs @ 12.09 hrs, Volume= 2,184 cf
 Outflow = 0.95 cfs @ 12.13 hrs, Volume= 2,177 cf, Atten= 16%, Lag= 2.2 min
 Discarded = 0.02 cfs @ 12.13 hrs, Volume= 869 cf
 Primary = 0.94 cfs @ 12.13 hrs, Volume= 1,308 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Peak Elev= 829.84' @ 12.13 hrs Surf.Area= 756 sf Storage= 697 cf

Plug-Flow detention time= 131.1 min calculated for 2,174 cf (100% of inflow)
 Center-of-Mass det. time= 129.7 min (902.7 - 773.0)

Volume	Invert	Avail.Storage	Storage Description
#1	828.50'	1,278 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
828.50	300	0	0
829.50	621	461	461
830.50	1,014	818	1,278

Device	Routing	Invert	Outlet Devices
#1	Device 3	829.25'	4.0" Vert. Orifice/Grate C= 0.600
#2	Device 3	829.75'	27.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	826.00'	5.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 826.00' / 825.25' S= 0.0150 ' /' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.14 sf
#4	Discarded	828.50'	1.000 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.02 cfs @ 12.13 hrs HW=829.84' (Free Discharge)
 ↑4=Exfiltration (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.88 cfs @ 12.13 hrs HW=829.84' (Free Discharge)
 ↑3=Culvert (Passes 0.88 cfs of 1.06 cfs potential flow)
 ↑1=Orifice/Grate (Orifice Controls 0.27 cfs @ 3.13 fps)
 ↑2=Orifice/Grate (Weir Controls 0.61 cfs @ 0.97 fps)

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MSE 24-hr 3 10-Year Rainfall=4.22"

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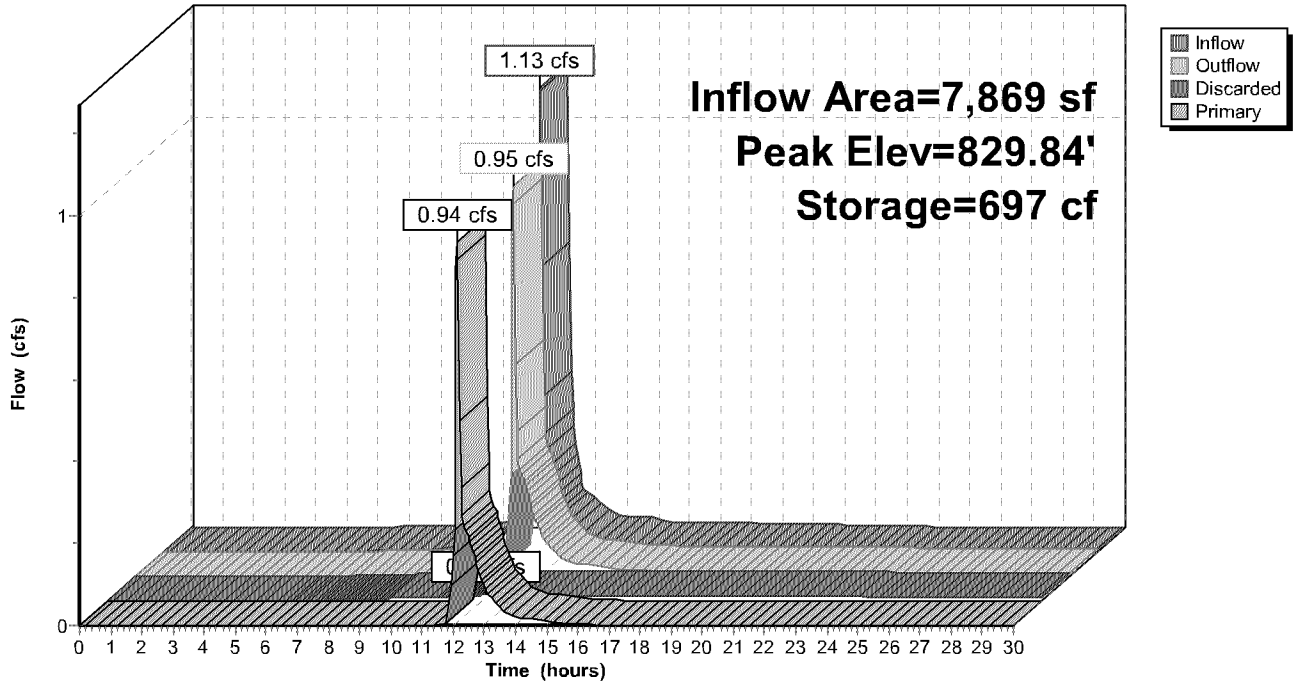
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Pond 3P: Rainwater Garden

Hydrograph



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MSE 24-hr 3 100-Year Rainfall=7.41"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 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 1S: Existing

Runoff Area=54,061 sf 71.87% Impervious Runoff Depth=5.99"
 Flow Length=200' Tc=3.1 min CN=88 Runoff=13.89 cfs 26,996 cf

Subcatchment 2S: Proposed Draining to

Runoff Area=7,869 sf 82.92% Impervious Runoff Depth=6.46"
 Flow Length=200' Tc=3.1 min CN=92 Runoff=2.10 cfs 4,236 cf

Subcatchment 3S: Proposed NOT Draining to

Runoff Area=46,192 sf 82.16% Impervious Runoff Depth=6.34"
 Flow Length=200' Tc=3.1 min CN=91 Runoff=12.24 cfs 24,414 cf

Pond 3P: Rainwater Garden

Peak Elev=830.24' Storage=1,025 cf Inflow=2.10 cfs 4,236 cf
 Discarded=0.02 cfs 1,014 cf Primary=1.10 cfs 3,167 cf Outflow=1.13 cfs 4,181 cf

Total Runoff Area = 108,122 sf Runoff Volume = 55,646 cf Average Runoff Depth = 6.18"
22.93% Pervious = 24,788 sf 77.07% Impervious = 83,334 sf

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MSE 24-hr 3 100-Year Rainfall=7.41"

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Summary for Subcatchment 1S: Existing

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

Runoff = 13.89 cfs @ 12.09 hrs, Volume= 26,996 cf, Depth= 5.99"

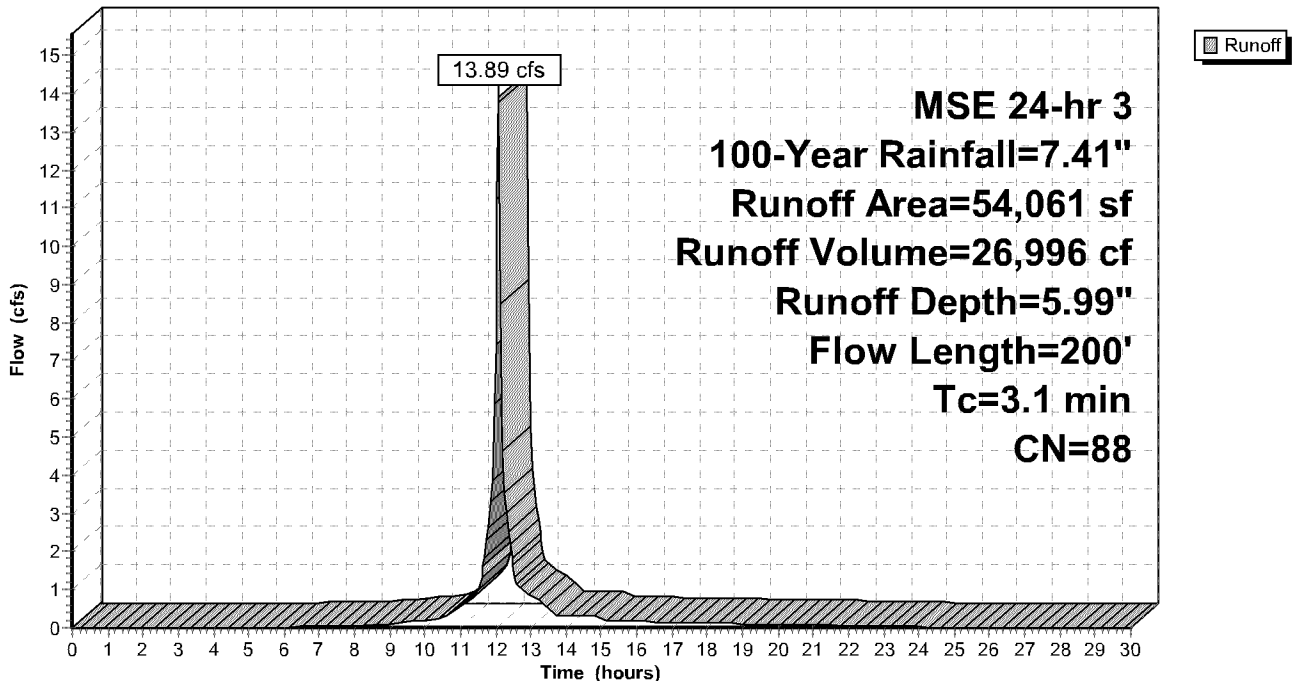
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year Rainfall=7.41"

	Area (sf)	CN	Description
*	19,175	98	Roofs
*	590	98	Walks
*	19,091	98	Parking
	15,205	61	>75% Grass cover, Good, HSG B
	54,061	88	Weighted Average
	15,205		28.13% Pervious Area
	38,856		71.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	150	0.0100	1.06		Sheet Flow, Roof
					Smooth surfaces n= 0.011 P2= 2.80"
0.7	50	0.0200	1.12		Sheet Flow, Parking
					Smooth surfaces n= 0.011 P2= 2.80"
3.1	200	Total			

Subcatchment 1S: Existing

Hydrograph



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MSE 24-hr 3 100-Year Rainfall=7.41"

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Summary for Subcatchment 2S: Proposed Draining to Rainwater Garden

[49] Hint: $T_c < 2dt$ may require smaller dt

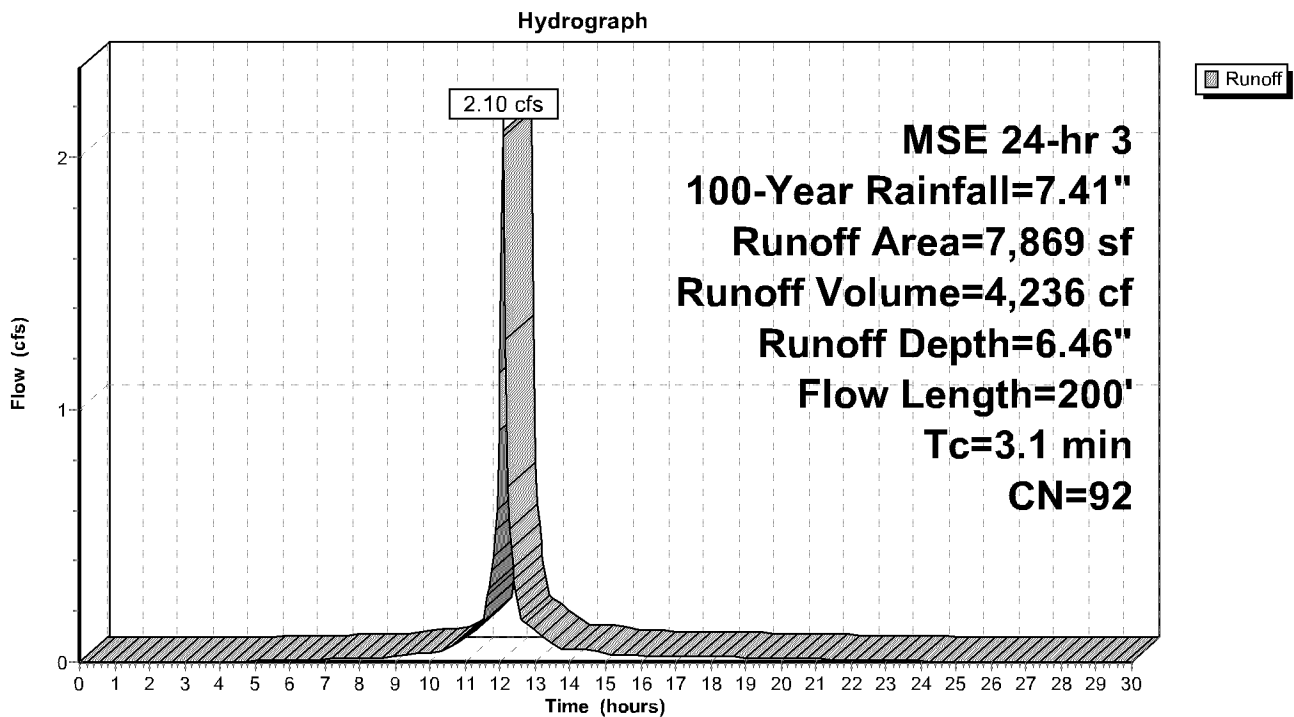
Runoff = 2.10 cfs @ 12.09 hrs, Volume= 4,236 cf, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, $dt= 0.05$ hrs
 MSE 24-hr 3 100-Year Rainfall=7.41"

	Area (sf)	CN	Description
*	6,525	98	Roof Draining to Pond
	1,344	61	>75% Grass cover, Good, HSG B
	7,869	92	Weighted Average
	1,344		17.08% Pervious Area
	6,525		82.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	150	0.0100	1.06		Sheet Flow, Roof
					Smooth surfaces n= 0.011 P2= 2.80"
0.7	50	0.0200	1.12		Sheet Flow, Parking
					Smooth surfaces n= 0.011 P2= 2.80"
3.1	200	Total			

Subcatchment 2S: Proposed Draining to Rainwater Garden



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MSE 24-hr 3 100-Year Rainfall=7.41"

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Summary for Subcatchment 3S: Proposed NOT Draining to Rainwater Garden

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 12.24 cfs @ 12.09 hrs, Volume= 24,414 cf, Depth= 6.34"

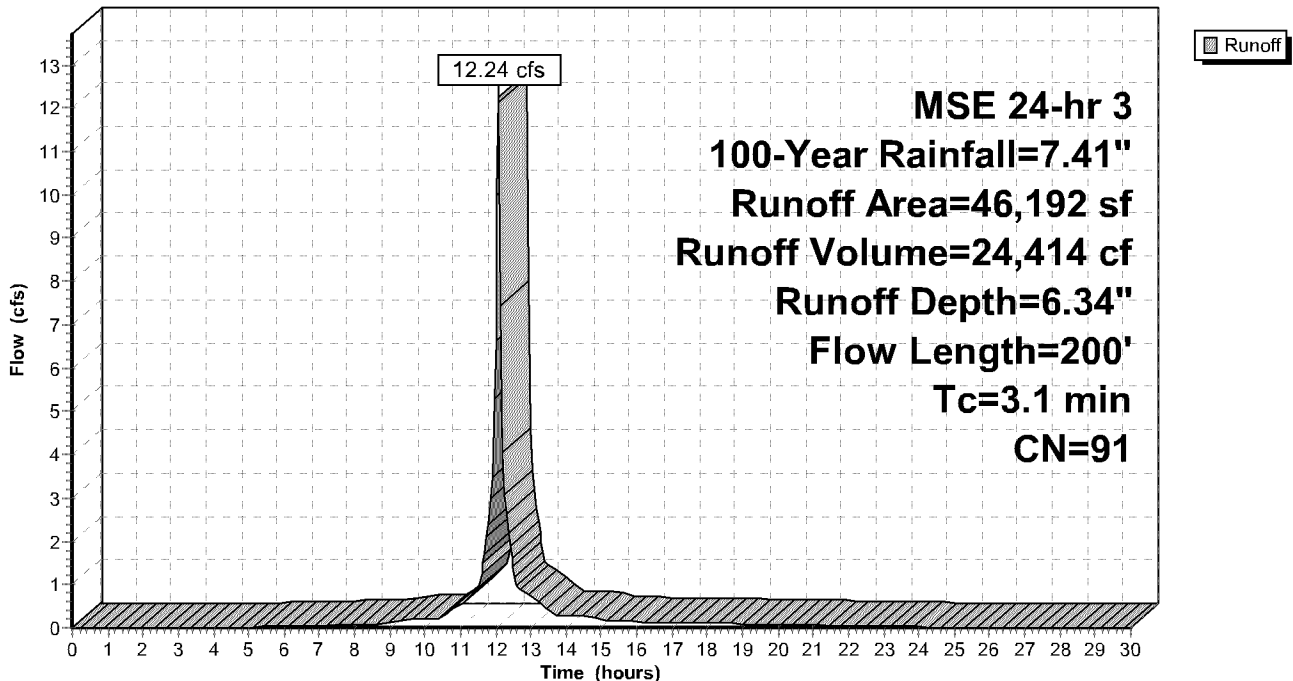
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, $dt= 0.05$ hrs
 MSE 24-hr 3 100-Year Rainfall=7.41"

	Area (sf)	CN	Description
*	14,932	98	Roofs
*	1,812	98	Walks
*	21,209	98	Parking
	8,239	61	>75% Grass cover, Good, HSG B
	46,192	91	Weighted Average
	8,239		17.84% Pervious Area
	37,953		82.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	150	0.0100	1.06		Sheet Flow, Roof
					Smooth surfaces n= 0.011 P2= 2.80"
0.7	50	0.0200	1.12		Sheet Flow, Parking
					Smooth surfaces n= 0.011 P2= 2.80"
3.1	200	Total			

Subcatchment 3S: Proposed NOT Draining to Rainwater Garden

Hydrograph



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MSE 24-hr 3 100-Year Rainfall=7.41"

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Summary for Pond 3P: Rainwater Garden

Inflow Area = 7,869 sf, 82.92% Impervious, Inflow Depth = 6.46" for 100-Year event
 Inflow = 2.10 cfs @ 12.09 hrs, Volume= 4,236 cf
 Outflow = 1.13 cfs @ 12.17 hrs, Volume= 4,181 cf, Atten= 46%, Lag= 4.5 min
 Discarded = 0.02 cfs @ 12.17 hrs, Volume= 1,014 cf
 Primary = 1.10 cfs @ 12.17 hrs, Volume= 3,167 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Peak Elev= 830.24' @ 12.17 hrs Surf.Area= 911 sf Storage= 1,025 cf

Plug-Flow detention time= 83.5 min calculated for 4,174 cf (99% of inflow)
 Center-of-Mass det. time= 76.4 min (836.8 - 760.5)

Volume	Invert	Avail.Storage	Storage Description
#1	828.50'	1,278 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
828.50	300	0	0
829.50	621	461	461
830.50	1,014	818	1,278

Device	Routing	Invert	Outlet Devices
#1	Device 3	829.25'	4.0" Vert. Orifice/Grate C= 0.600
#2	Device 3	829.75'	27.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	826.00'	5.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 826.00' / 825.25' S= 0.0150 ' / ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.14 sf
#4	Discarded	828.50'	1.000 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.02 cfs @ 12.17 hrs HW=830.22' (Free Discharge)
 ↑ **4=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.10 cfs @ 12.17 hrs HW=830.22' (Free Discharge)
 ↑ **3=Culvert** (Barrel Controls 1.10 cfs @ 8.09 fps)
 ↑ **1=Orifice/Grate** (Passes < 0.38 cfs potential flow)
 ↑ **2=Orifice/Grate** (Passes < 7.49 cfs potential flow)

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Pond 3P: Rainwater Garden

Hydrograph

