ACORN
ENGINEERING, INC.

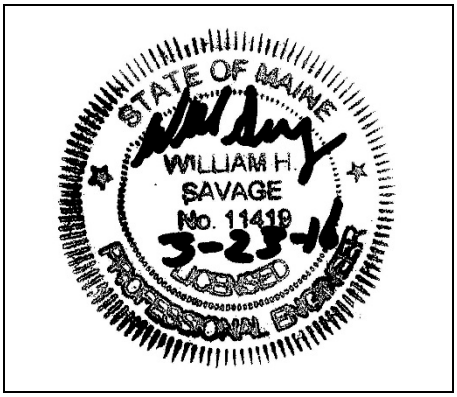
STORMWATER MANAGEMENT REPORT

Prepared For:

215 Foreside Road, LLC
40 O'Brion Redevelopment
40 O'Brion Street
Portland, Maine 04101

Prepared By:

Acorn Engineering, Inc.
158 Danforth Street
Portland, Maine 04102



March 2016

INTRODUCTION

Acorn Engineering, Inc. has been retained by 215 Foreside Road, LLC to provide civil engineering services for the proposed redevelopment of 40 O'Brion Street. The proposed project is a residential 3-unit redevelopment of an existing vacant lot. The lot is currently used as a side yard by the adjacent property which is also owned by 215 Foreside.

A stormwater analysis will be prepared to demonstrate that the project will meet the following requirements of the City of Portland (the City):

- City of Portland Land Use Ordinance Chapter 14, Article V. Site Plan Section 14-523. Required Approvals and Applicability (F) Level III Site Plan Review.
- City of Portland Technical Manual – Section 5 – Portland Stormwater Management Standards and Maine DEP Chapter 500 Stormwater Management.

The proposed project will include the redevelopment of existing, grassy pervious area. The current course of action is to provide water quality treatment to the stormwater through infiltration utilizing a Maine Department of Environmental Protection – Infiltration Trench approved stormwater Best Management Practice (BMP). This development shall incorporate green infrastructure to provide water quality treatment for no less than 95% of the new impervious area and 80% of the developed area.

The project will result in a net increase of impervious area above 1,000 sf, as such, the project is required to include stormwater management features for stormwater quality & quantity control. The stormwater analysis is documented with supporting calculations and reports attached to this narrative.

EXISTING CONDITIONS

The proposed project site is located off of the Eastern Promenade just after Hanson Lane. Portland has zoned this area as an R-6 Residential Zone. A boundary plan has been prepared by Owen Haskell, Inc. of Falmouth, Maine dated March 3rd, 2016.

Abutting Uses:

➢ North	R-6 Zone	Multi-Family Residential
➢ West	R-6 Zone	Multi-Family Residential
➢ South	R-6 Zone	Multi-Family Residential
➢ East	R-6 Zone	Multi-Family Residential

The project area is previously undeveloped with minor landscaping details including stone walls and young sapling trees. The site is relatively flat with an existing grade of approximately 2% that slopes from south to north. The project area presently drains towards O'Brion Street before entering the municipal storm drain system.

The project team is not aware of the presence of any existing significant natural features located on the site. Given the urban setting, and existing free-draining soils at a high point

on the peninsula, a field inventory of significant natural feature was not undertaken. The project is not located within a watershed classified as an Urban Impaired Stream.

PROPOSED DEVELOPMENT

The proposed project is a residential 3-unit redevelopment of an existing undeveloped lot. The existing site has been recently landscaped to include a series of stone walls and small, newly planted trees with DBH at 4" or less; the adjacent property that utilizes this side yard is also owned by 215 Foreside.

To minimize the development's footprint and impervious area the project will include four (4) covered parking spaces with space allocated for bicycle parking and solid waste/recycling storage. The walking paths and portions of the driveway will also be comprised of pervious pavers to allow for stormwater infiltration.

The development will be served by the Portland Water District, underground power/cable/communications, natural gas and the municipal sewer system. The project anticipates incorporating Maine DEP approved stormwater Best Management Practices to meet the General and Flooding Standards.

GENERAL STANDARDS - WATER QUALITY

The development shall provide water quality treatment for no less than 95% of the new impervious area and 80% of the developed area. The project includes the redevelopment of existing impervious, undeveloped area and will therefore be adding new impervious surface to the site. Water quality treatment shall be provided through the use of an Infiltration Trench meeting the specifications of a Maine DEP Infiltration BMPs.

The Infiltration Trench was sized to meet or exceed the requirements set forth within the MDEP Volume III: BMPs Technical Design Manual Section 6.0. Infiltration BMPs have been shown to be very effective at removing a wide range of pollutants from stormwater runoff.

The majority of the impervious area is from the roof. The stormwater runoff from the roof and driveway shall be directed into the pretreatment catch basin acting as a sediment trap. The catch basin distribution pipe will include a hood or trap on the inlet commonly referred to as a snout or casco trap. Traps have been found to be an effective tool to reduce floatables, trash, oils and sediment from becoming transported beyond the catch basin. Beyond the trap stormwater will enter into an 18" diameter perforated distribution pipe to allow for percolation of the stormwater in the surrounding ¾" stone and permeable soil.

The treatment of the impervious surface is as follows:

Table 1 - Impervious Treatment Area Table					
	Existing Impervious Area (SF)	Proposed Total Impervious Area (SF)	Net change in Impervious Area (SF)	Proposed Impervious Area with Treatment (SF)	% Overall New Imp. Area Treated
Infiltration Trench	90	2,338	2,248	2338	104%

As shown above the project anticipates meeting and exceeding the required treatment for new impervious surfaces through the use of the infiltration trench BMP.

In accordance with the Volume III: BMPs Technical Design Manual, a water quality volume of 1.0 inches times the tributary impervious area plus 0.4 inches times the tributary disturbed area is required to be treated by the Infiltration Trench. The water quality volume is calculated by the following formula:

$$\left(\frac{\text{Imp. SF x 1.0"}}{\text{12"/1'}}\right) + \left(\frac{\text{Dist. SF x 0.4"}}{\text{12"/1'}}\right) = \text{Treatment Volume (CF)}$$

The proposed water quality volume is as follows:

Table 3 - Water Quality Volume Table				
	Disturbed Area (SF)	Impervious Area (SF)	Treatment Volume Required (CF)	Treatment Volume Provided (CF)
Rain Garden	0	2,248	**186**	**261**

As shown, the size of the combined water quality volume will meet and exceed the treatment volume requirements. Values from the HydroCAD calculations are attached to this report.

FLOODING STANDARD – WATER QUANTITY

The proposed project was modeled using HydroCAD to verify that the post-development conditions do not exceed the pre-development conditions. A 24-hour SCS Type III storm distribution for the 2, 10, and 25 year storm events were used. The corresponding rainfall amounts for these storms are 3.10", 4.60", and 5.80" respectively. Rainfall amounts are from the Northeast Regional Climate Center website (http://precip.eas.cornell.edu), Extreme Precipitation Tables.

Due to the numerous variables, and inherent inaccuracies with the modeling program used to calculate stormwater runoff it is custom at Acorn Engineering, Inc. to round to the nearest whole number or to the nearest tenth for urban infill project. However due to the of infiltration the stormwater runoff has been rounded to the nearest hundredth of a cubic feet per second (cfs).

Time of Concentration (T_c)

A time of concentration (T_c) of 5 minutes was applied to the subcatchment for both the pre and post-development condition, given the urban setting.

Curve Number

Conservative curve number (CN) runoff values were used within the subcatchment for the landscaped area. The stormwater calculations used the following CN values in the post development condition for vegetated areas, as follows:

- 75% Grass Cover, Good

Pre-development Calculations

The pre-development condition was modeled as one subcatchment to determine the net impact of the development.

- Subcatchment 1 – The subcatchment area is defined by the property line to the edge of O'Brion Street

A Pre-Development Watershed Map developed for this project can be viewed in Attachment A, and a copy of the HydroCAD calculations is included within Attachment C, or this report. Peak flow rates for the storm events are as follows:

Table 4 – Pre-Development Peak Stormwater Flows			
Drainage Area	**2 – Year Storm Event (cfs)**	**10 – Year Storm Event (cfs)**	**25 – Year Storm Event (cfs)**
POI #1	0.00	0.00	0.02

Post-development Calculations:

The one predevelopment subcatchment was broken into two separate subcatchments for the post-development condition.

- Subcatchment 1 – This is comprised of the building's roof and the driveway.
- Subcatchment 2 – This is comprised of the landscaped area and sidewalk.

The post development calculations include changes to the land use, and the compensation provided by the detention facility. The following table represents comparison of predevelopment and post-development condition peak runoff rates for the proposed development and tributary area.

Table 5 – Comparison of Peak Flows						
Drainage Area	**2 – Year Storm Event (cfs)**		**10 – Year Storm Event (cfs)**		**25 – Year Storm Event (cfs)**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
POI #1	0.00	0.00	0.00	0.00	0.02	0.01

As shown in Table 5 the net impact of the post development peak flows shall remain at or below the predevelopment levels. A Post-development Watershed Map developed for this project can be viewed in Attachment B, and a copy of the HydroCAD calculations is included within Attachment C of this report.

The pretreatment catch basin includes a maintenance outlet that is to be used in the event the infiltration trench needs to be dewatered for removal of fines from the 18" perforated pipe. Following maintenance the watertight cap shall be replaced.

SOILS

Onsite soil information includes the following:

- Soil Conservation Service Medium Intensity Soil Survey for Cumberland County

Typical of the East End of Portland the Soil Survey list Hinckley as the existing onsite soil. The Hinckley series consists of very deep, excessively drained soils formed in glaciofluvial materials. The permeability of Hinckley soil is rapid in the surface layer and subsoil and very rapid in the substratum with typically a low groundwater table. Given the soils information, listed above, no onsite wastewater is proposed, the applicant does not intend to perform a more intense hydric soil boundary delineation or permeability test because the waiver requirements set forth in the City of Portland Technical Manual – Section 7 – Soil Survey, Rev. 6/17/12 are met. Acorn has used the conservative exfiltration rate of 2.41 in/hr when modeling the infiltration trench in HydroCAD.

The area within and surrounding the project includes soils types listed in the table below. The susceptibility of soils to erosion is indicated on a relative "K" scale of values over a range of 0.02 to 0.69. Higher "K" values indicate more erodible soils.

Table 3 - "K" Value		
Soils Type	**Subsurface**	**Substratum**
Hinckley	.17	.17

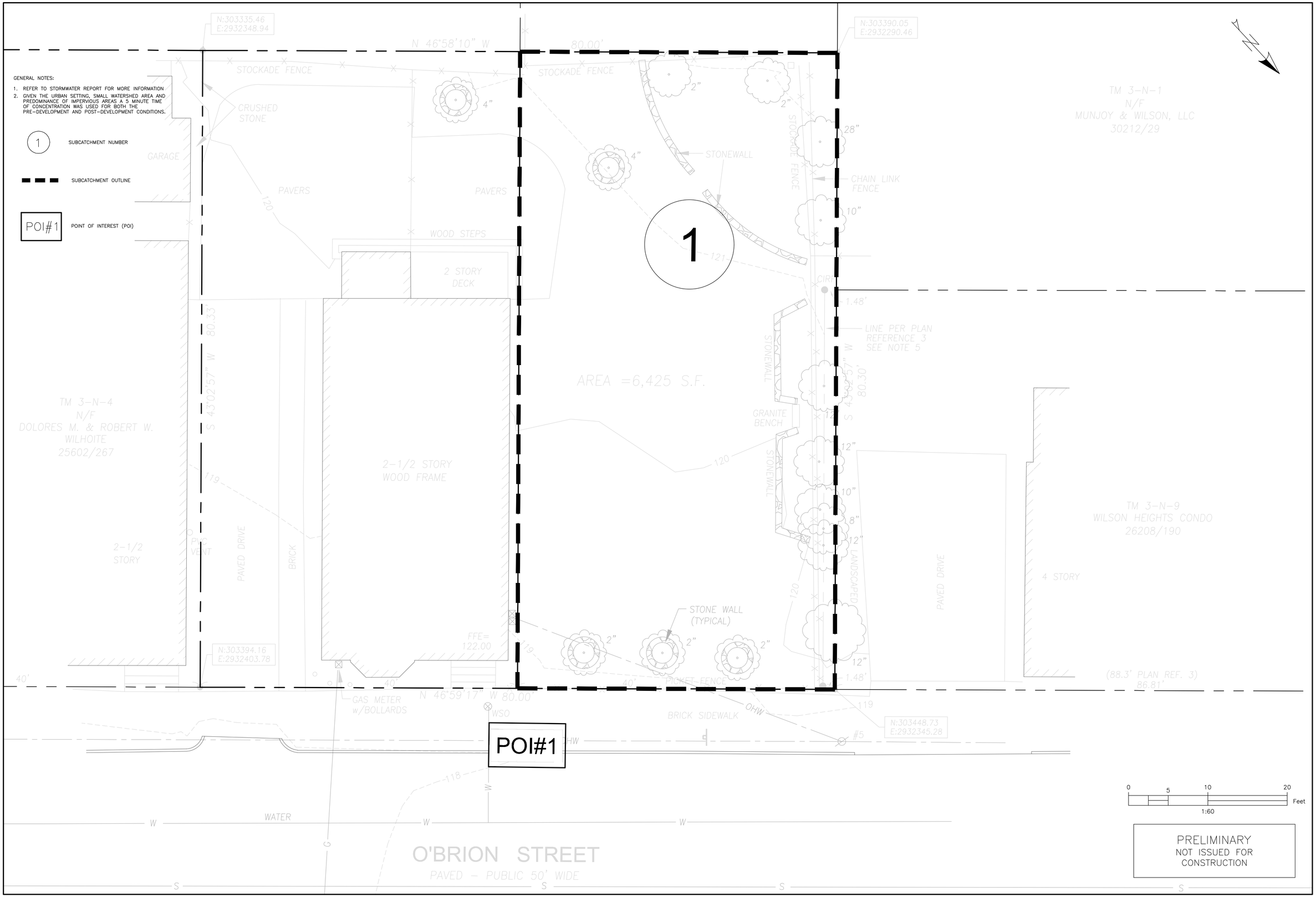
The soil "K" values for the soils, listed above, show a low susceptibility to erosion. The site's susceptibility to erosion is from the Soil Conservation Service Medium Intensity Soil Survey for Cumberland County. Although soil "K" values for the soils show a low susceptibility to erosion, implementation of the proposed Erosion & Sedimentation Measures by the contractor will be of the utmost importance, given the long sustained slopes.

Conclusion

The proposed development was designed to meet the requirements implemented by the MDEP under the Stormwater Management Statute (38 M.R.S.A. § 420-D) as well as the City of Portland Technical Manual – Section 5 – Portland Stormwater Management Standards. As a result the design of the proposed development and stormwater system does not anticipate to create erosion, drainage or runoff problems either in the development or with respect to adjoining properties.

Attachments

Attachment A: Pre Development Watershed Map
Attachment B: Post Development Watershed Map
Attachment C: HydroCAD Calculations
Attachment D: Soils Map



ISSUED FOR	BY	DATE
PRELIM. APPLICATION	WHS	3/22/16

DRAWING NAME: PRE-DEVELOPMENT STORMWATER PLAN

PROJECT NAME: 40 O'BRION STREET REDEVELOPMENT

CLIENT: 215 FORESIDE ROAD, LLC.
215 FORESIDE ROAD FALMOUTH, MAINE 04105

ACORN ENGINEERING, INC.

THIS PLAN SHALL NOT BE MODIFIED WITHOUT WRITTEN PERMISSION FROM ACORN ENGINEERING, INC. ANY ALTERATIONS, AUTHORIZED OR OTHERWISE, SHALL BE AT THE USER'S SOLE RISK AND WITHOUT LIABILITY TO ACORN ENGINEERING, INC.

ACORN ENGINEERING, INC.
158 DANFORTH STREET, PORTLAND MAINE 04102
(207) 775-2655

FILE:	1070_CIVIL
DATE:	1/22/16
JN:	1070
SCALE:	NTS
DESIGNED BY:	WHS
DRAWN BY:	OJD
CHECKED BY:	WHS

STATE OF MAINE
WILLIAM H. SAVAGE
No. 11419
LICENSED
PROFESSIONAL ENGINEER
3-23-16

DRAWING NO.
PRE

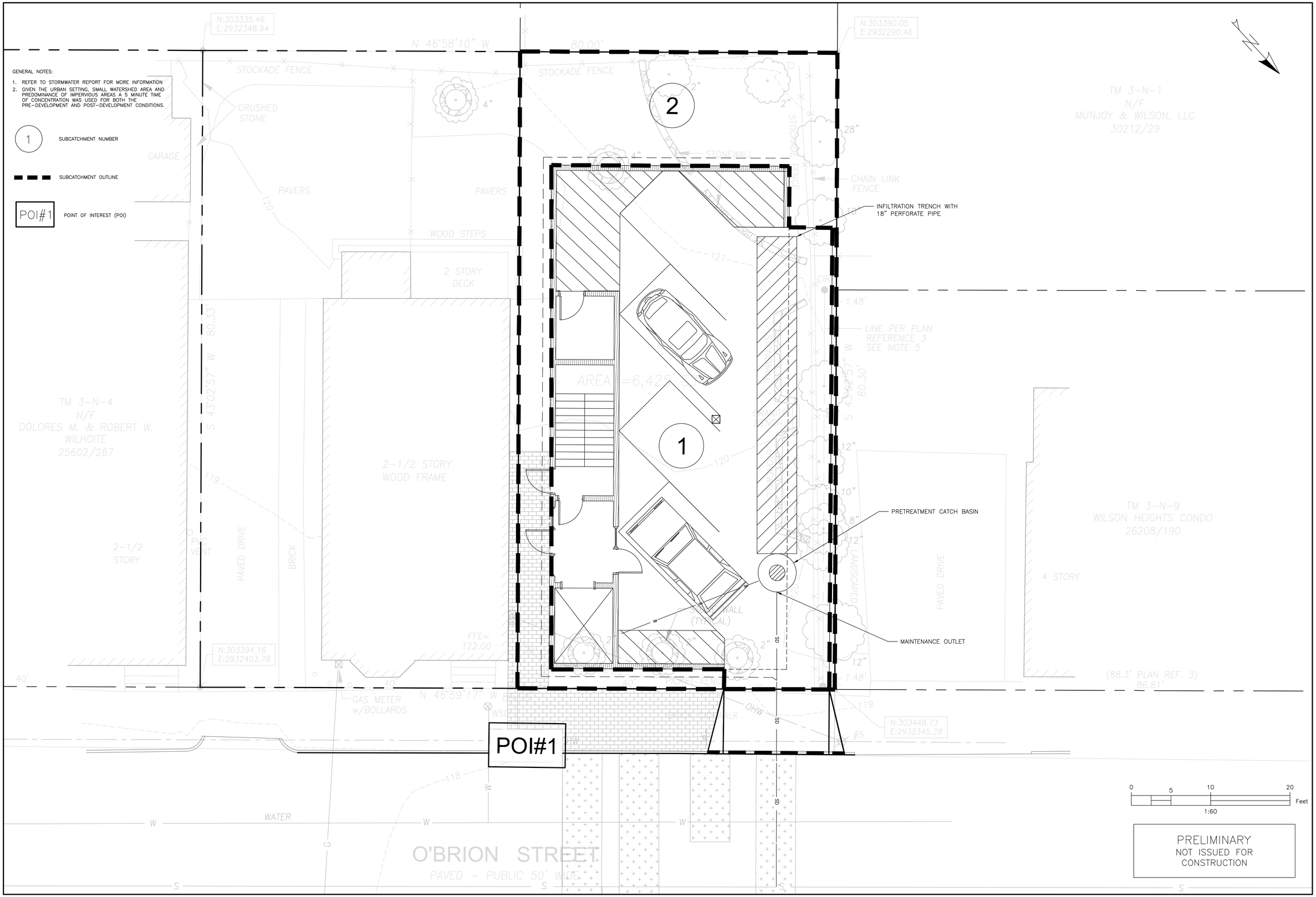
GENERAL NOTES:

1. REFER TO STORMWATER REPORT FOR MORE INFORMATION
2. GIVEN THE URBAN SETTING, SMALL WATERSHED AREA AND PREDOMINANCE OF IMPERVIOUS AREAS A 5 MINUTE TIME OF CONCENTRATION WAS USED FOR BOTH THE PRE-DEVELOPMENT AND POST-DEVELOPMENT CONDITIONS.

1 SUBCATCHMENT NUMBER

SUBCATCHMENT OUTLINE

POI#1 POINT OF INTEREST (POI)



PRELIMINARY
NOT ISSUED FOR CONSTRUCTION

ISSUED FOR	BY	DATE
PRELIM. APPLICATION	WHS	3/22/16

DRAWING NAME: POST-DEVELOPMENT STORMWATER PLAN

PROJECT NAME: 40 O'BRION STREET REDEVELOPMENT

CLIENT: 215 FORESIDE ROAD, LLC.
215 FORESIDE ROAD FALMOUTH, MAINE 04105

ACORN ENGINEERING, INC.

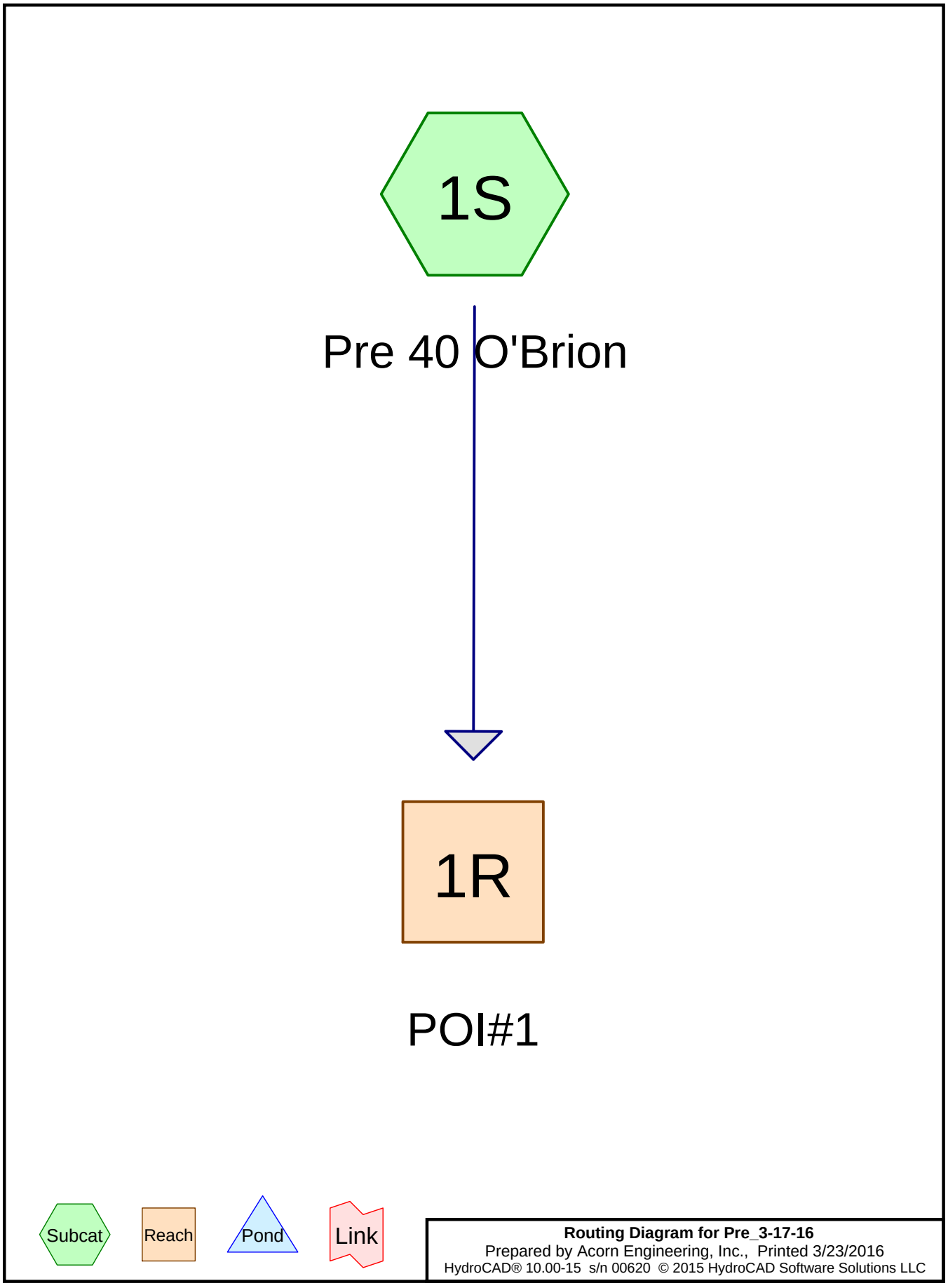
THIS PLAN SHALL NOT BE MODIFIED WITHOUT WRITTEN PERMISSION FROM ACORN ENGINEERING, INC. ANY ALTERATIONS, AUTHORIZED OR OTHERWISE, SHALL BE AT THE USER'S SOLE RISK AND WITHOUT LIABILITY TO ACORN ENGINEERING, INC.

ACORN ENGINEERING, INC.
158 DANFORTH STREET, PORTLAND MAINE 04102
(207) 775-2655

FILE:	1070_CIVIL
DATE:	1/22/16
JN:	1070
SCALE:	NTS
DESIGNED BY:	WHS
DRAWN BY:	OJD
CHECKED BY:	WHS

STATE OF MAINE
WILLIAM H. SAVAGE
No. 11419
LICENSED
PROFESSIONAL ENGINEER
3-23-16

DRAWING NO.
POST



Routing Diagram for Pre_3-17-16
Prepared by Acorn Engineering, Inc., Printed 3/23/2016
HydroCAD® 10.00-15 s/n 00620 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.072	39	>75% Grass cover, Good, HSG A (1S)
0.002	98	Brick Patio (1S)
0.074	**41**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.072	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.002	Other	1S
0.074		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.072	0.000	0.000	0.000	0.000	0.072	>75% Grass cover, Good	1S
0.000	0.000	0.000	0.000	0.002	0.002	Brick Patio	1S
0.072	**0.000**	**0.000**	**0.000**	**0.002**	**0.074**	**TOTAL AREA**	

Time span=1.00-36.00 hrs, dt=0.02 hrs, 1751 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: Pre 40 O'Brion Runoff Area=3,212 sf 2.80% Impervious Runoff Depth=0.00"
Tc=5.0 min CN=41 Runoff=0.00 cfs 0.000 af

Reach 1R: POI#1 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 0.074 ac Runoff Volume = 0.000 af Average Runoff Depth = 0.00"
97.20% Pervious = 0.072 ac 2.80% Impervious = 0.002 ac

Summary for Subcatchment 1S: Pre 40 O'Brion

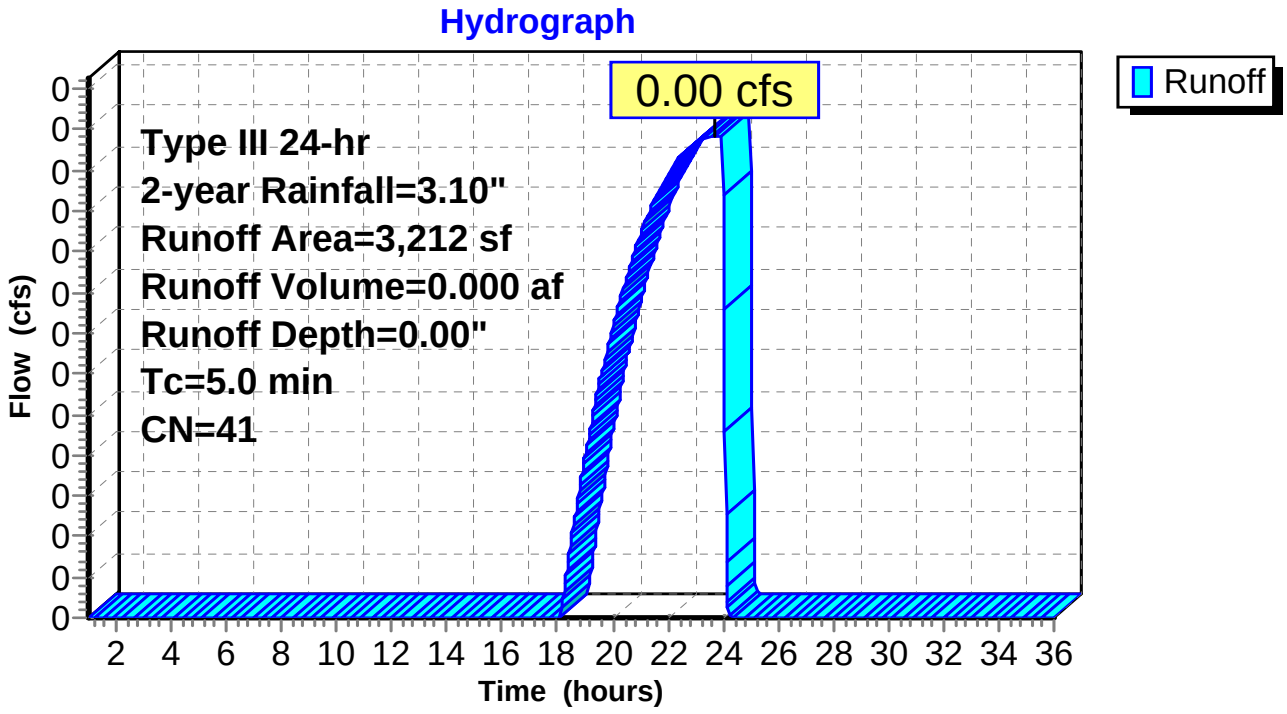
Runoff = 0.00 cfs @ 23.71 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-year Rainfall=3.10"

	Area (sf)	CN	Description
*	90	98	Brick Patio
	3,122	39	>75% Grass cover, Good, HSG A
	3,212	41	Weighted Average
	3,122		97.20% Pervious Area
	90		2.80% Impervious Area

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

Subcatchment 1S: Pre 40 O'Brion

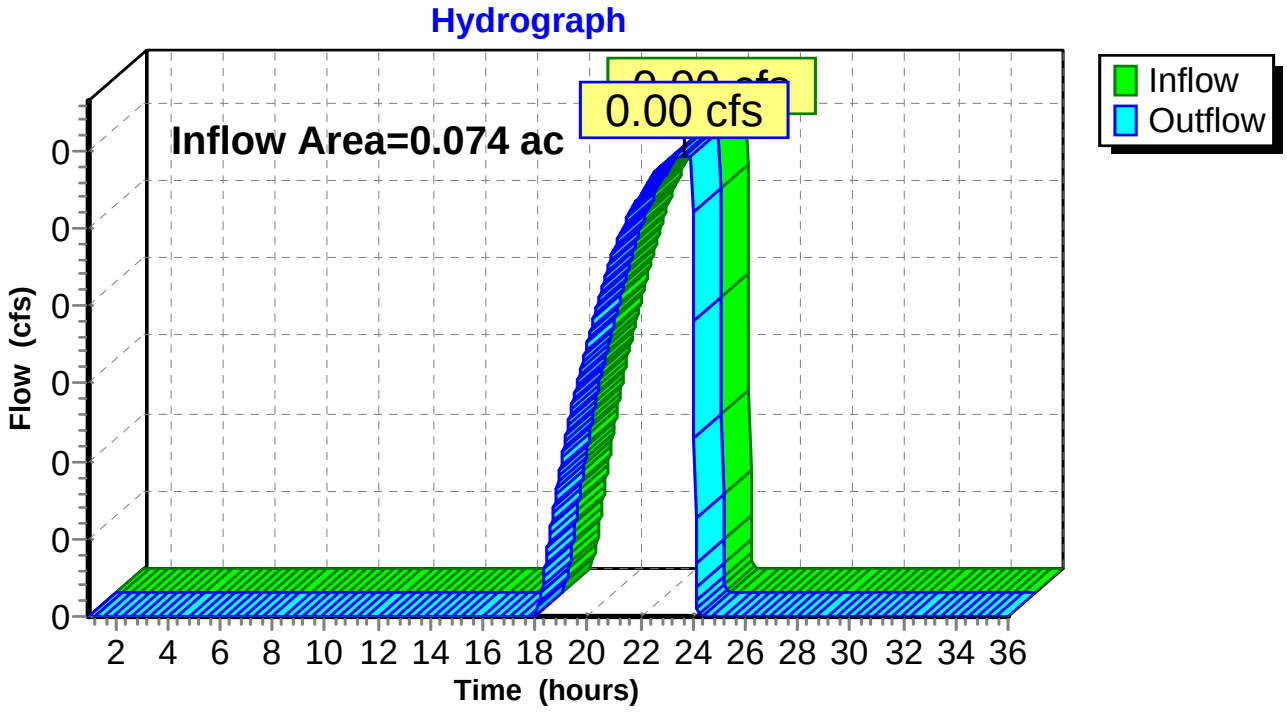


Summary for Reach 1R: POI#1

Inflow Area = 0.074 ac, 2.80% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 23.71 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 23.71 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-36.00 hrs, dt= 0.02 hrs

Reach 1R: POI#1



Time span=1.00-36.00 hrs, dt=0.02 hrs, 1751 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: Pre 40 O'Brion Runoff Area=3,212 sf 2.80% Impervious Runoff Depth=0.18"
Tc=5.0 min CN=41 Runoff=0.00 cfs 0.001 af

Reach 1R: POI#1 Inflow=0.00 cfs 0.001 af
Outflow=0.00 cfs 0.001 af

Total Runoff Area = 0.074 ac Runoff Volume = 0.001 af Average Runoff Depth = 0.18"
97.20% Pervious = 0.072 ac 2.80% Impervious = 0.002 ac

Summary for Subcatchment 1S: Pre 40 O'Brion

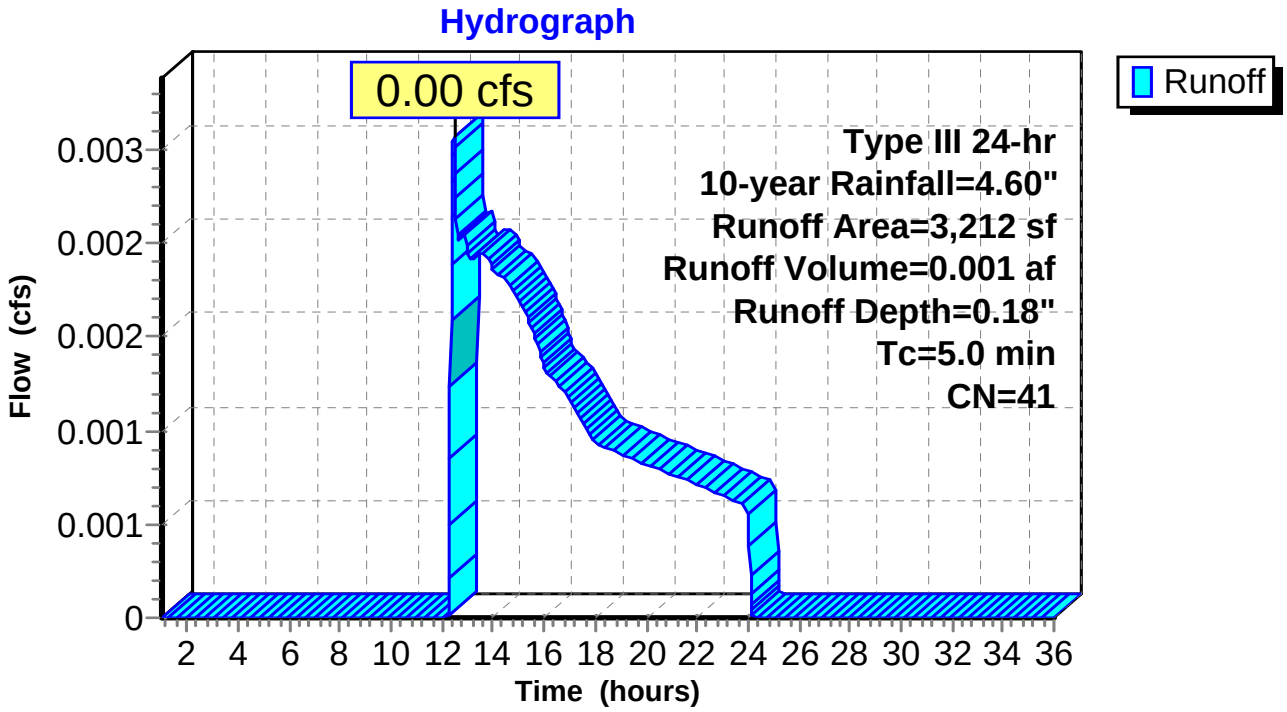
Runoff = 0.00 cfs @ 12.46 hrs, Volume= 0.001 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-year Rainfall=4.60"

	Area (sf)	CN	Description
*	90	98	Brick Patio
	3,122	39	>75% Grass cover, Good, HSG A
	3,212	41	Weighted Average
	3,122		97.20% Pervious Area
	90		2.80% Impervious Area

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

Subcatchment 1S: Pre 40 O'Brion

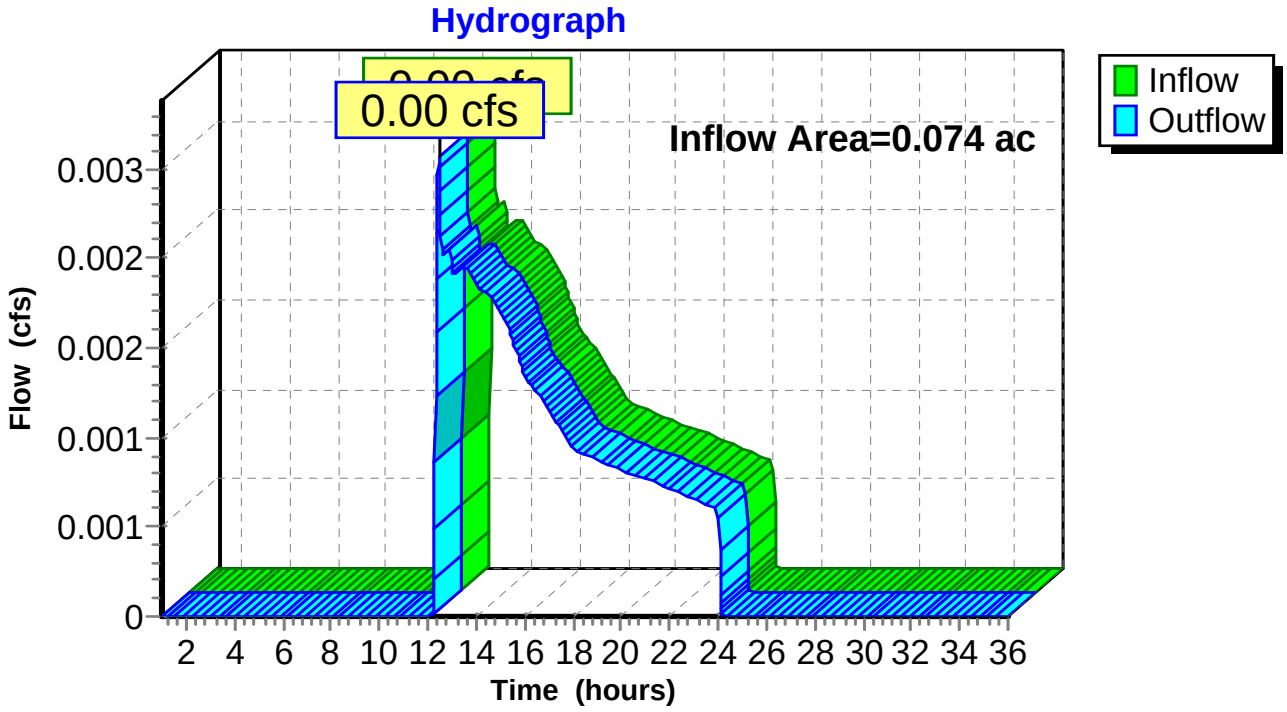


Summary for Reach 1R: POI#1

Inflow Area = 0.074 ac, 2.80% Impervious, Inflow Depth = 0.18" for 10-year event
Inflow = 0.00 cfs @ 12.46 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 12.46 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-36.00 hrs, dt= 0.02 hrs

Reach 1R: POI#1



Time span=1.00-36.00 hrs, dt=0.02 hrs, 1751 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: Pre 40 O'Brion Runoff Area=3,212 sf 2.80% Impervious Runoff Depth=0.49"
Tc=5.0 min CN=41 Runoff=0.02 cfs 0.003 af

Reach 1R: POI#1 Inflow=0.02 cfs 0.003 af
Outflow=0.02 cfs 0.003 af

Total Runoff Area = 0.074 ac Runoff Volume = 0.003 af Average Runoff Depth = 0.49"
97.20% Pervious = 0.072 ac 2.80% Impervious = 0.002 ac

Summary for Subcatchment 1S: Pre 40 O'Brion

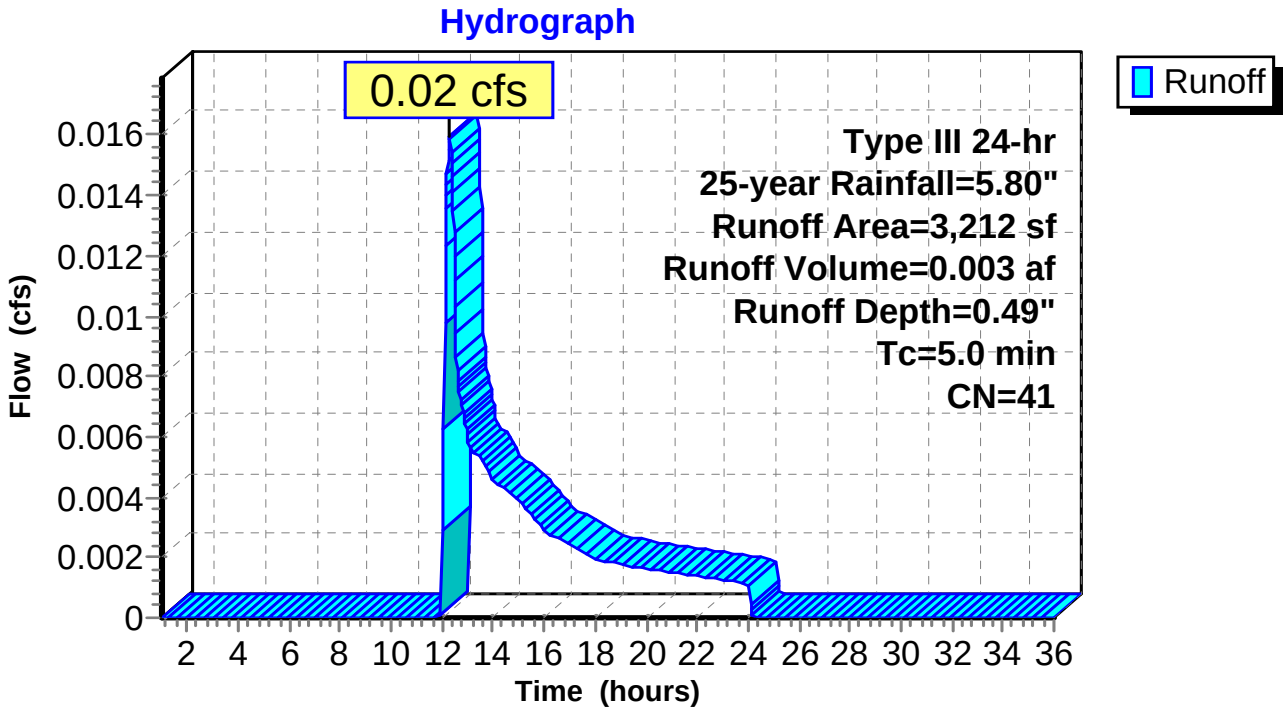
Runoff = 0.02 cfs @ 12.30 hrs, Volume= 0.003 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-year Rainfall=5.80"

	Area (sf)	CN	Description
*	90	98	Brick Patio
	3,122	39	>75% Grass cover, Good, HSG A
	3,212	41	Weighted Average
	3,122		97.20% Pervious Area
	90		2.80% Impervious Area

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

Subcatchment 1S: Pre 40 O'Brion

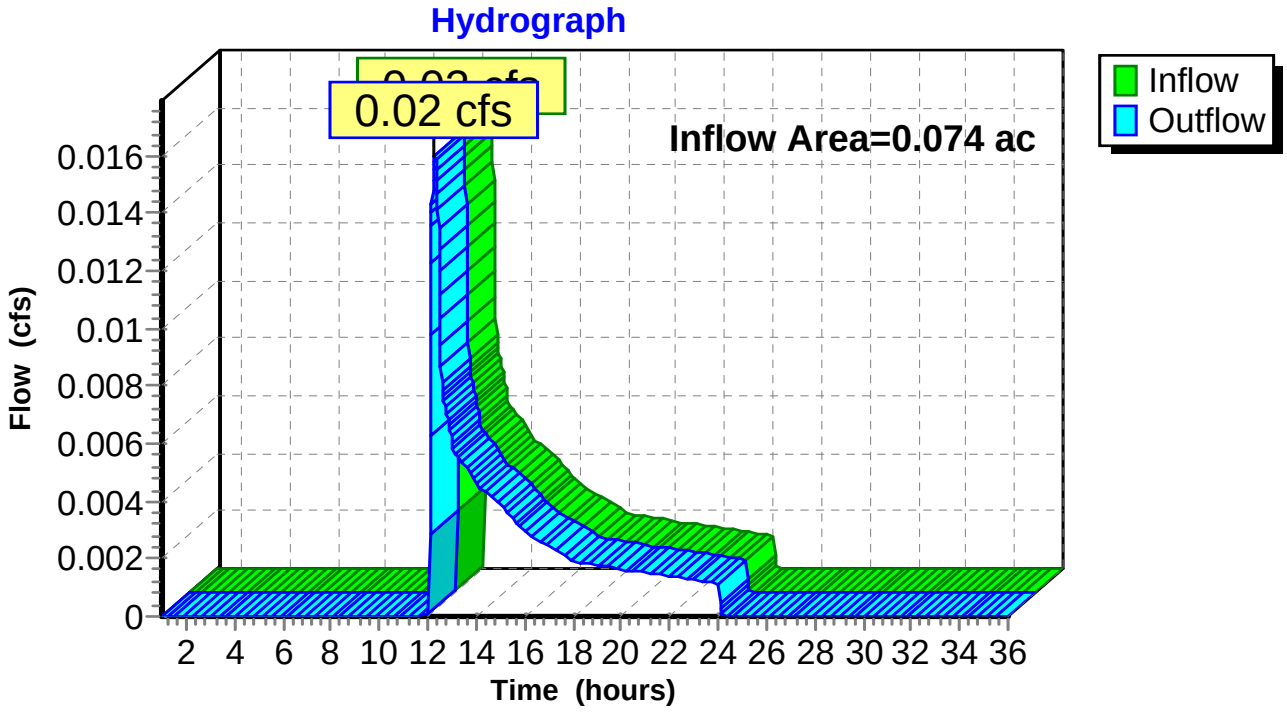


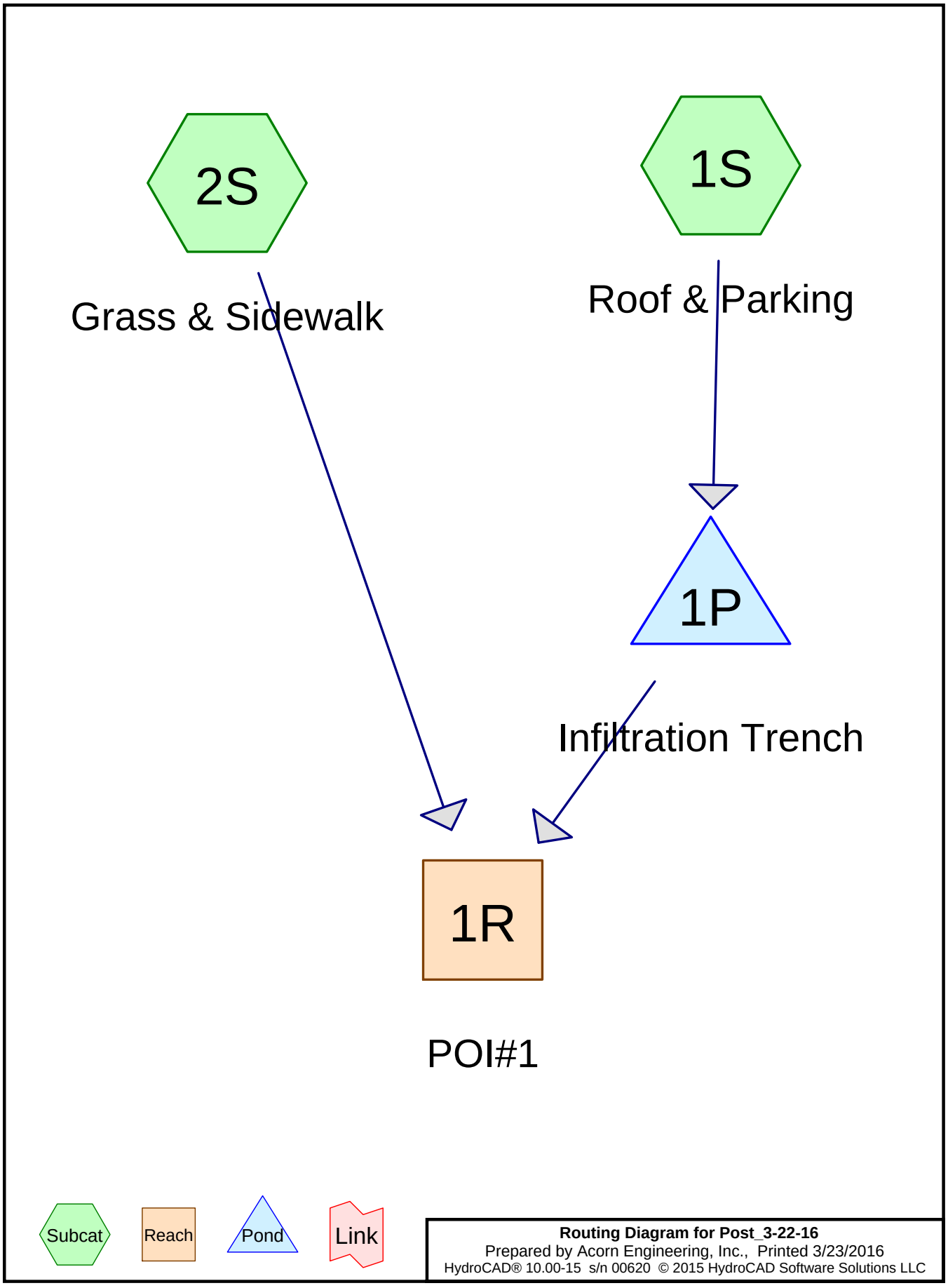
Summary for Reach 1R: POI#1

Inflow Area = 0.074 ac, 2.80% Impervious, Inflow Depth = 0.49" for 25-year event
Inflow = 0.02 cfs @ 12.30 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.30 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-36.00 hrs, dt= 0.02 hrs

Reach 1R: POI#1





Routing Diagram for Post_3-22-16
Prepared by Acorn Engineering, Inc., Printed 3/23/2016
HydroCAD® 10.00-15 s/n 00620 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.020	39	>75% Grass cover, Good, HSG A (2S)
0.003	98	Brick walkway (2S)
0.007	98	Paved parking, HSG A (1S)
0.044	98	Roofs, HSG A (1S)
0.074	**82**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.071	HSG A	1S, 2S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.003	Other	2S
0.074		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.020	0.000	0.000	0.000	0.000	0.020	>75% Grass cover, Good	2S
0.000	0.000	0.000	0.000	0.003	0.003	Brick walkway	2S
0.007	0.000	0.000	0.000	0.000	0.007	Paved parking	1S
0.044	0.000	0.000	0.000	0.000	0.044	Roofs	1S
0.071	**0.000**	**0.000**	**0.000**	**0.003**	**0.074**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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: Roof & Parking Runoff Area=2,218 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.16 cfs 0.012 af

Subcatchment 2S: Grass & Sidewalk Runoff Area=994 sf 12.07% Impervious Runoff Depth=0.05"
Tc=5.0 min CN=46 Runoff=0.00 cfs 0.000 af

Reach 1R: POI#1 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 1P: Infiltration Trench Peak Elev=115.71' Storage=0.004 af Inflow=0.16 cfs 0.012 af
Outflow=0.02 cfs 0.012 af

Total Runoff Area = 0.074 ac Runoff Volume = 0.012 af Average Runoff Depth = 1.99"
27.21% Pervious = 0.020 ac 72.79% Impervious = 0.054 ac

Summary for Subcatchment 1S: Roof & Parking

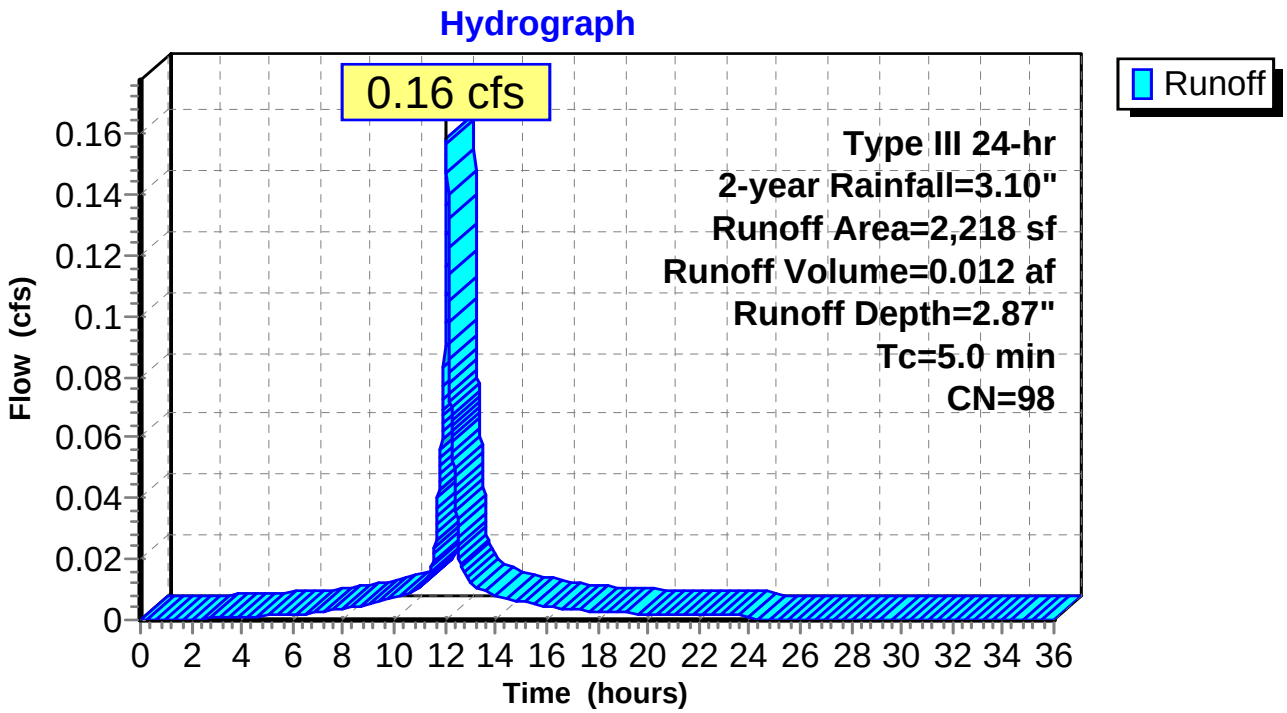
Runoff = 0.16 cfs @ 12.07 hrs, Volume= 0.012 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.10"

Area (sf)	CN	Description
309	98	Paved parking, HSG A
1,909	98	Roofs, HSG A
2,218	98	Weighted Average
2,218		100.00% Impervious Area

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

Subcatchment 1S: Roof & Parking



Summary for Subcatchment 2S: Grass & Sidewalk

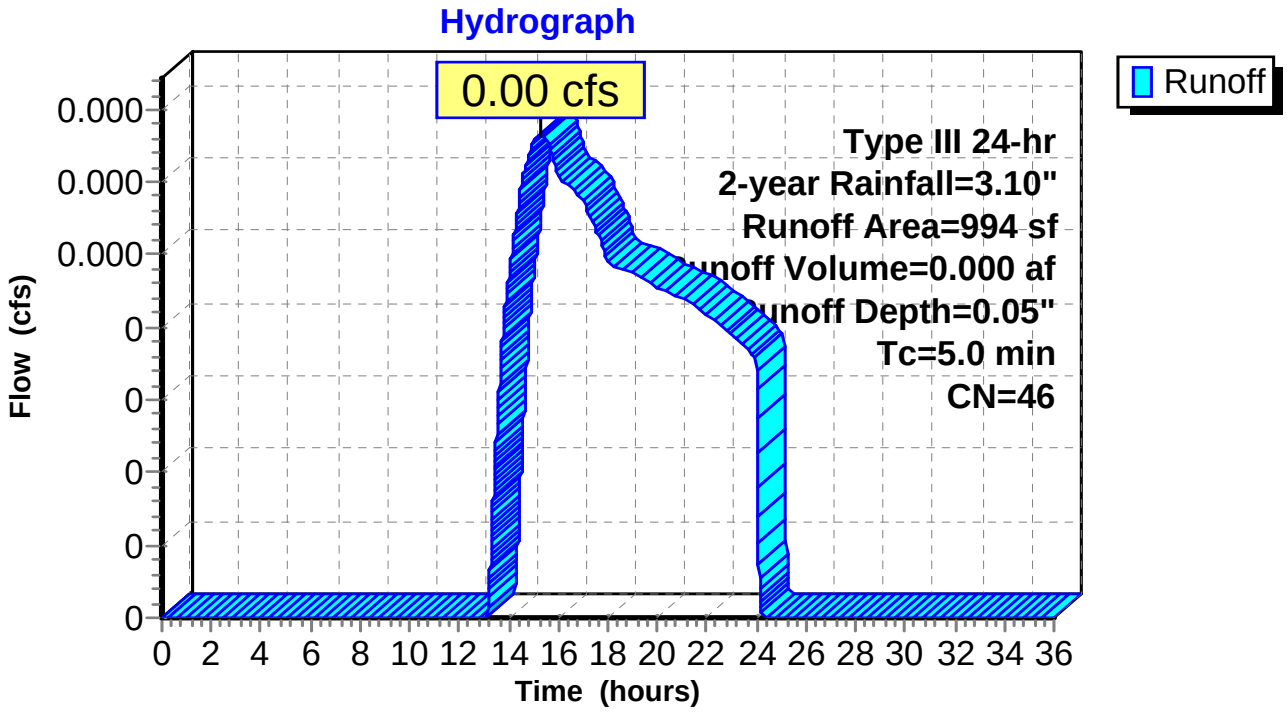
Runoff = 0.00 cfs @ 15.26 hrs, Volume= 0.000 af, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.10"

	Area (sf)	CN	Description
	874	39	>75% Grass cover, Good, HSG A
*	120	98	Brick walkway
	994	46	Weighted Average
	874		87.93% Pervious Area
	120		12.07% Impervious Area

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

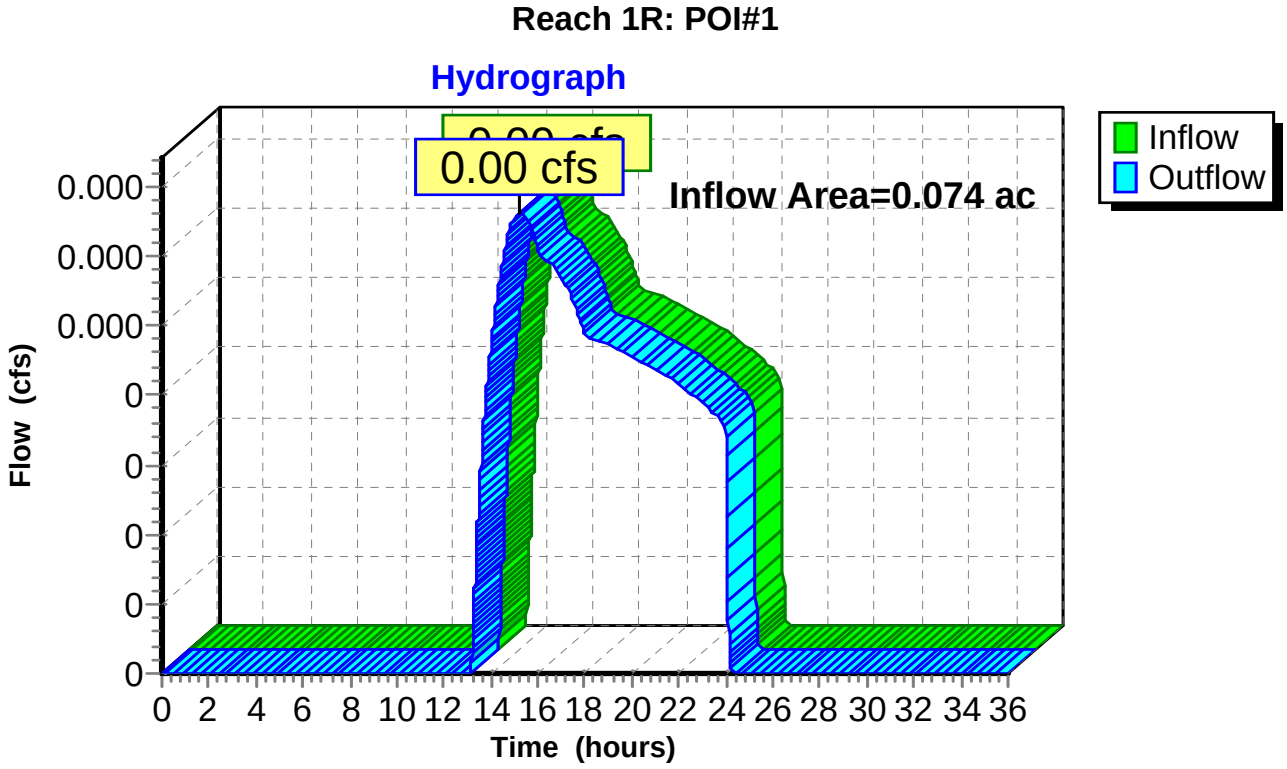
Subcatchment 2S: Grass & Sidewalk



Summary for Reach 1R: POI#1

Inflow Area = 0.074 ac, 72.79% Impervious, Inflow Depth = 0.01" for 2-year event
Inflow = 0.00 cfs @ 15.26 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 15.26 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs



Summary for Pond 1P: Infiltration Trench

Inflow Area = 0.051 ac,100.00% Impervious, Inflow Depth = 2.87" for 2-year event
Inflow = 0.16 cfs @ 12.07 hrs, Volume= 0.012 af
Outflow = 0.02 cfs @ 12.59 hrs, Volume= 0.012 af, Atten= 88%, Lag= 31.3 min
Discarded = 0.02 cfs @ 12.59 hrs, Volume= 0.012 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 115.71' @ 12.59 hrs Surf.Area= 0.005 ac Storage= 0.004 af

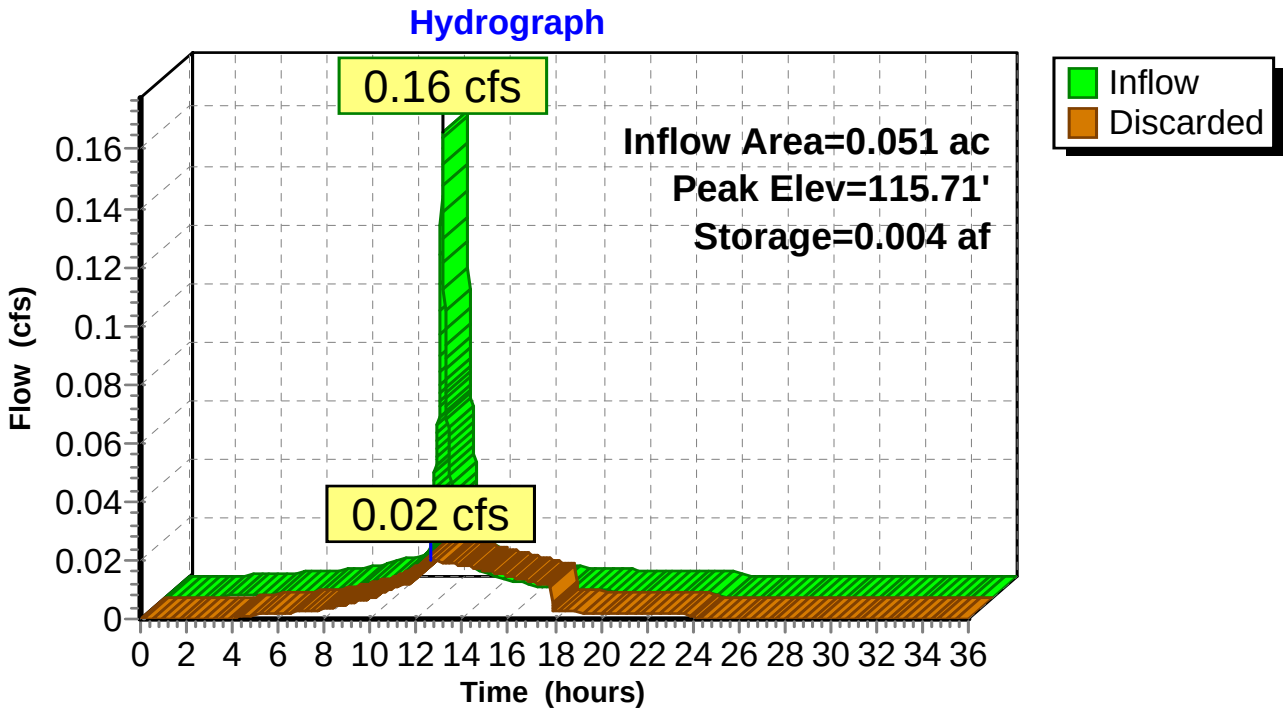
Plug-Flow detention time= 80.5 min calculated for 0.012 af (99% of inflow)
Center-of-Mass det. time= 73.5 min (829.6 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1	114.00'	0.005 af	**5.00'W x 40.00'L x 3.00'H Prismatoid** 0.014 af Overall - 0.001 af Embedded = 0.012 af x 40.0% Voids
#2	115.00'	0.001 af	**18.0" Round Pipe Storage** Inside #1 L= 36.0'
#3	113.50'	0.002 af	**4.00'D x 5.42'H Vertical Cone/Cylinder** -Impervious
#4	118.92'	0.017 af	**5.00'W x 5.00'L x 1.00'H Prismatoid Z=20.0** -Impervious
		0.025 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	114.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.02 cfs @ 12.59 hrs HW=115.71' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond 1P: Infiltration Trench



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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: Roof & Parking Runoff Area=2,218 sf 100.00% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=98 Runoff=0.24 cfs 0.019 af

Subcatchment 2S: Grass & Sidewalk Runoff Area=994 sf 12.07% Impervious Runoff Depth=0.36"
Tc=5.0 min CN=46 Runoff=0.00 cfs 0.001 af

Reach 1R: POI#1 Inflow=0.00 cfs 0.001 af
Outflow=0.00 cfs 0.001 af

Pond 1P: Infiltration Trench Peak Elev=116.82' Storage=0.007 af Inflow=0.24 cfs 0.019 af
Outflow=0.03 cfs 0.018 af

Total Runoff Area = 0.074 ac Runoff Volume = 0.019 af Average Runoff Depth = 3.13"
27.21% Pervious = 0.020 ac 72.79% Impervious = 0.054 ac

Summary for Subcatchment 1S: Roof & Parking

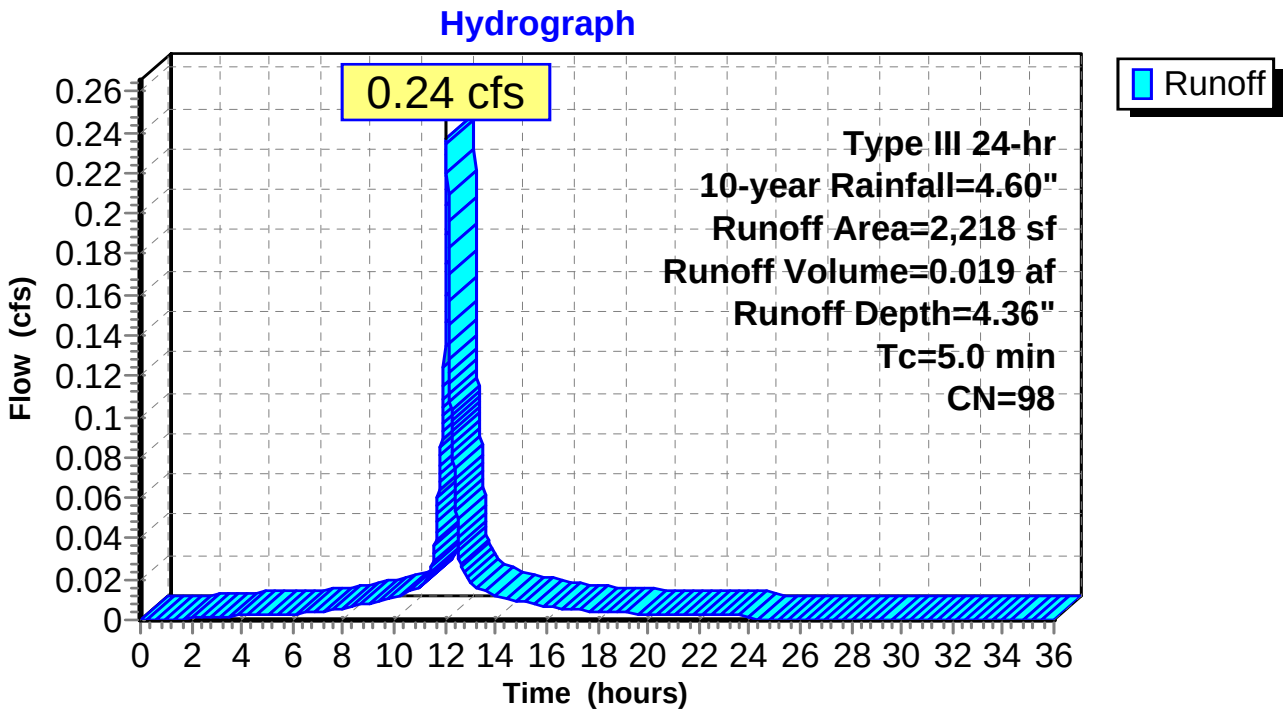
Runoff = 0.24 cfs @ 12.07 hrs, Volume= 0.019 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.60"

Area (sf)	CN	Description
309	98	Paved parking, HSG A
1,909	98	Roofs, HSG A
2,218	98	Weighted Average
2,218		100.00% Impervious Area

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

Subcatchment 1S: Roof & Parking



Summary for Subcatchment 2S: Grass & Sidewalk

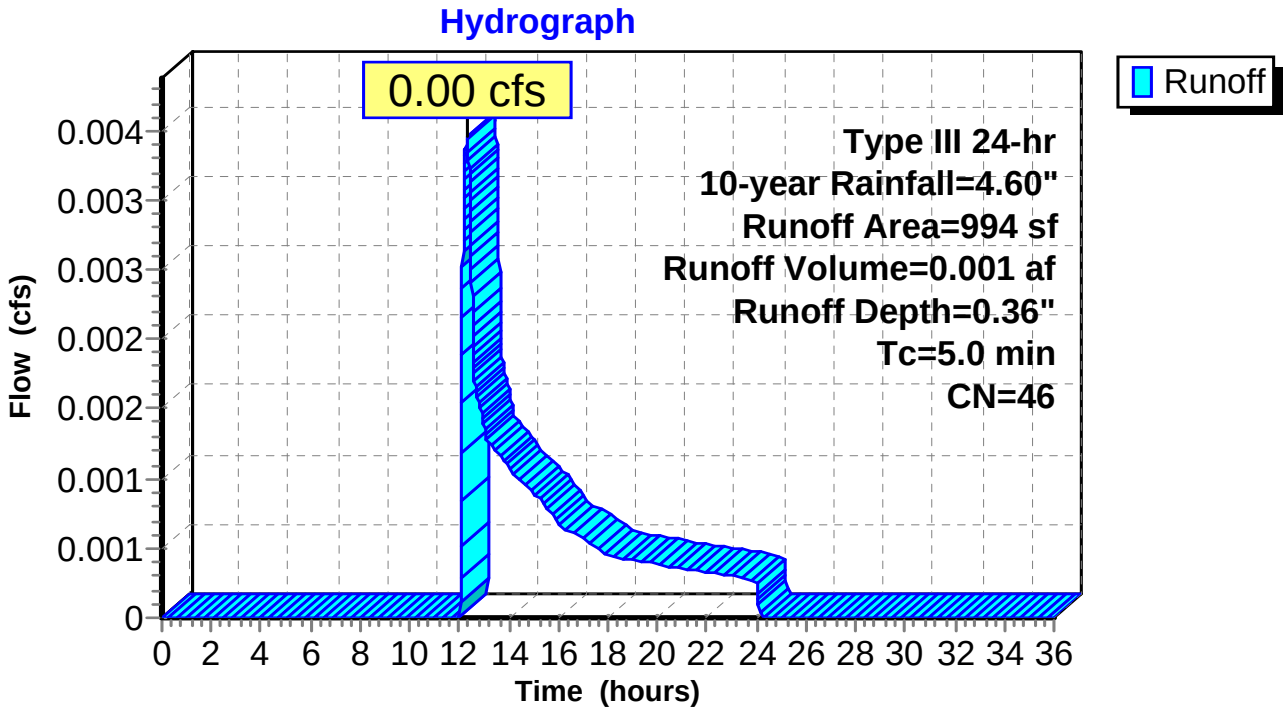
Runoff = 0.00 cfs @ 12.31 hrs, Volume= 0.001 af, Depth= 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.60"

	Area (sf)	CN	Description
	874	39	>75% Grass cover, Good, HSG A
*	120	98	Brick walkway
	994	46	Weighted Average
	874		87.93% Pervious Area
	120		12.07% Impervious Area

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

Subcatchment 2S: Grass & Sidewalk

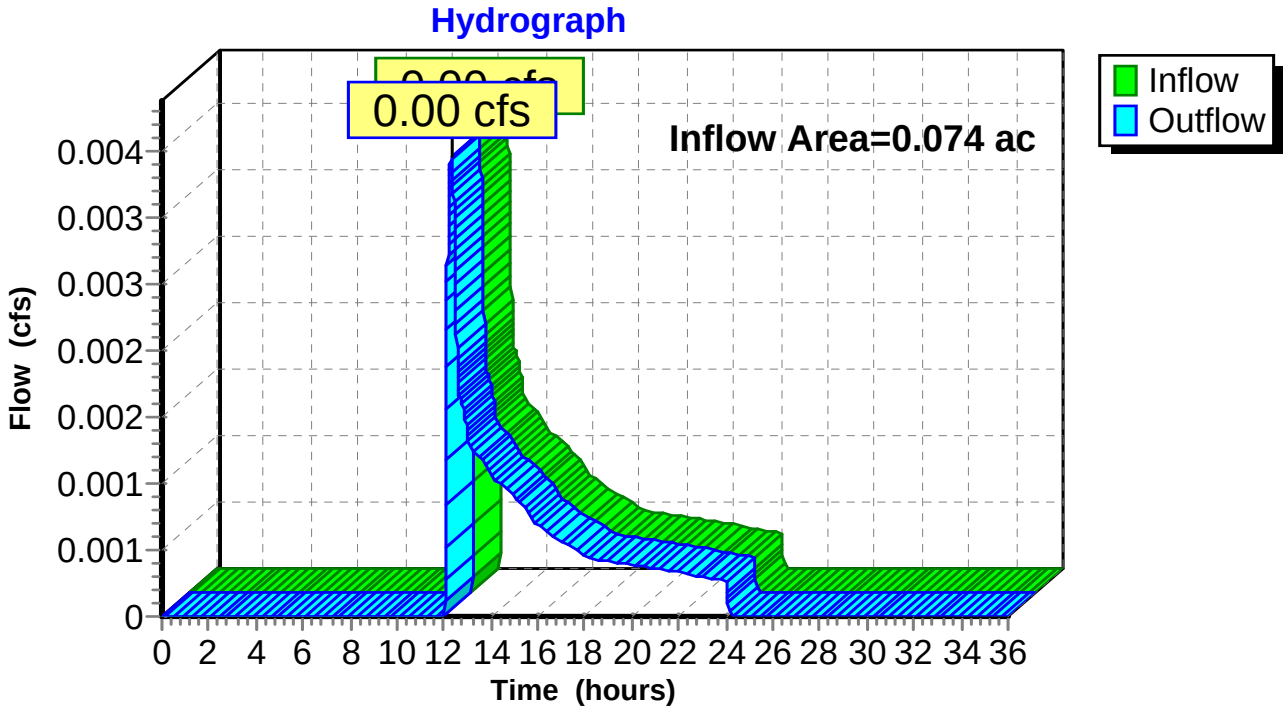


Summary for Reach 1R: POI#1

Inflow Area = 0.074 ac, 72.79% Impervious, Inflow Depth = 0.11" for 10-year event
Inflow = 0.00 cfs @ 12.31 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 12.31 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach 1R: POI#1



Summary for Pond 1P: Infiltration Trench

Inflow Area = 0.051 ac,100.00% Impervious, Inflow Depth = 4.36" for 10-year event
Inflow = 0.24 cfs @ 12.07 hrs, Volume= 0.019 af
Outflow = 0.03 cfs @ 12.70 hrs, Volume= 0.018 af, Atten= 89%, Lag= 38.0 min
Discarded = 0.03 cfs @ 12.70 hrs, Volume= 0.018 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 116.82' @ 12.70 hrs Surf.Area= 0.005 ac Storage= 0.007 af

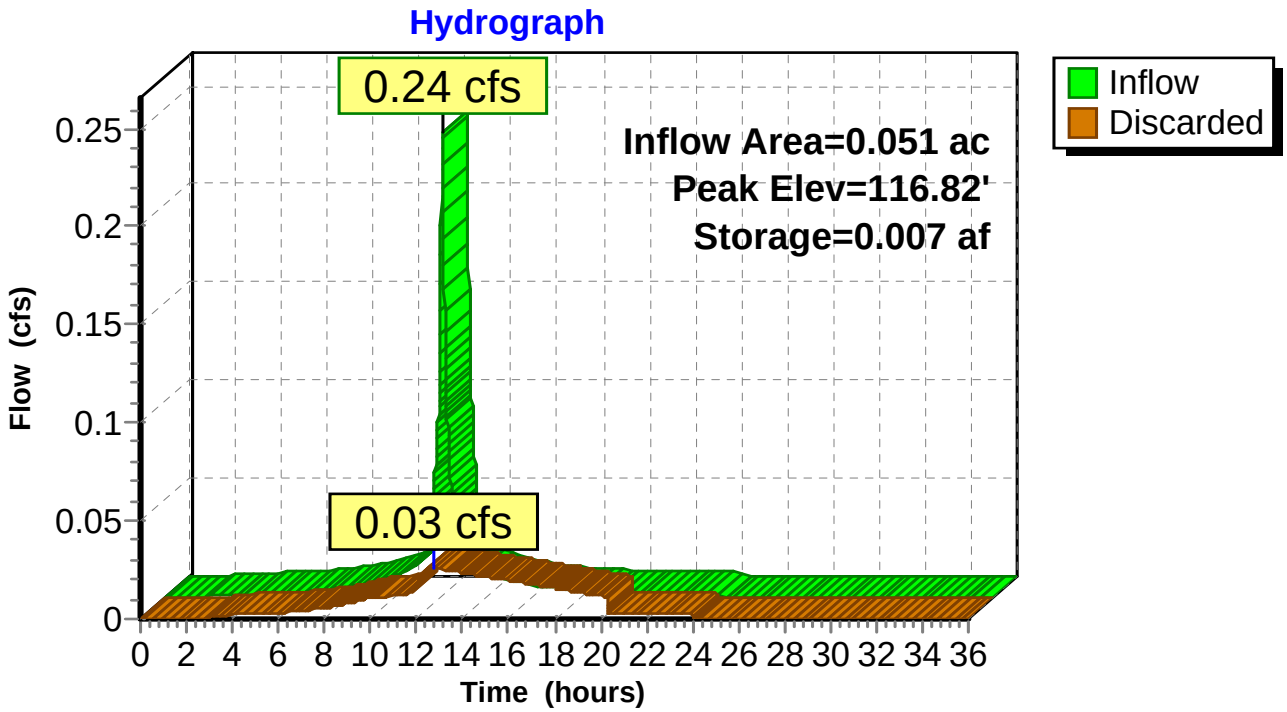
Plug-Flow detention time= 112.0 min calculated for 0.018 af (99% of inflow)
Center-of-Mass det. time= 107.2 min (855.7 - 748.5)

Volume	Invert	Avail.Storage	Storage Description
#1	114.00'	0.005 af	**5.00'W x 40.00'L x 3.00'H Prismatoid** 0.014 af Overall - 0.001 af Embedded = 0.012 af x 40.0% Voids
#2	115.00'	0.001 af	**18.0" Round Pipe Storage** Inside #1 L= 36.0'
#3	113.50'	0.002 af	**4.00'D x 5.42'H Vertical Cone/Cylinder**-Impervious
#4	118.92'	0.017 af	**5.00'W x 5.00'L x 1.00'H Prismatoid Z=20.0**-Impervious
		0.025 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	114.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 12.70 hrs HW=116.82' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 1P: Infiltration Trench



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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: Roof & Parking Runoff Area=2,218 sf 100.00% Impervious Runoff Depth=5.56"
Tc=5.0 min CN=98 Runoff=0.30 cfs 0.024 af

Subcatchment 2S: Grass & Sidewalk Runoff Area=994 sf 12.07% Impervious Runoff Depth=0.78"
Tc=5.0 min CN=46 Runoff=0.01 cfs 0.001 af

Reach 1R: POI#1 Inflow=0.01 cfs 0.001 af
Outflow=0.01 cfs 0.001 af

Pond 1P: Infiltration Trench Peak Elev=119.31' Storage=0.010 af Inflow=0.30 cfs 0.024 af
Outflow=0.03 cfs 0.023 af

Total Runoff Area = 0.074 ac Runoff Volume = 0.025 af Average Runoff Depth = 4.08"
27.21% Pervious = 0.020 ac 72.79% Impervious = 0.054 ac

Summary for Subcatchment 1S: Roof & Parking

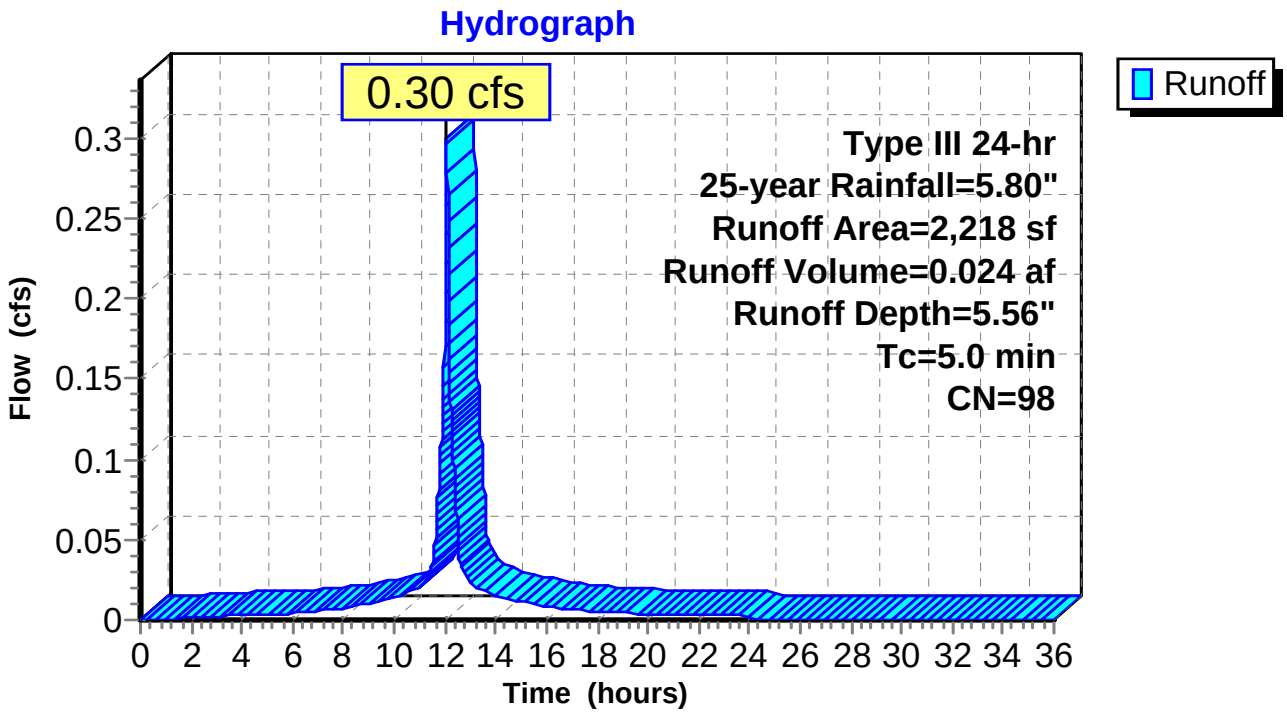
Runoff = 0.30 cfs @ 12.07 hrs, Volume= 0.024 af, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=5.80"

Area (sf)	CN	Description
309	98	Paved parking, HSG A
1,909	98	Roofs, HSG A
2,218	98	Weighted Average
2,218		100.00% Impervious Area

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

Subcatchment 1S: Roof & Parking



Summary for Subcatchment 2S: Grass & Sidewalk

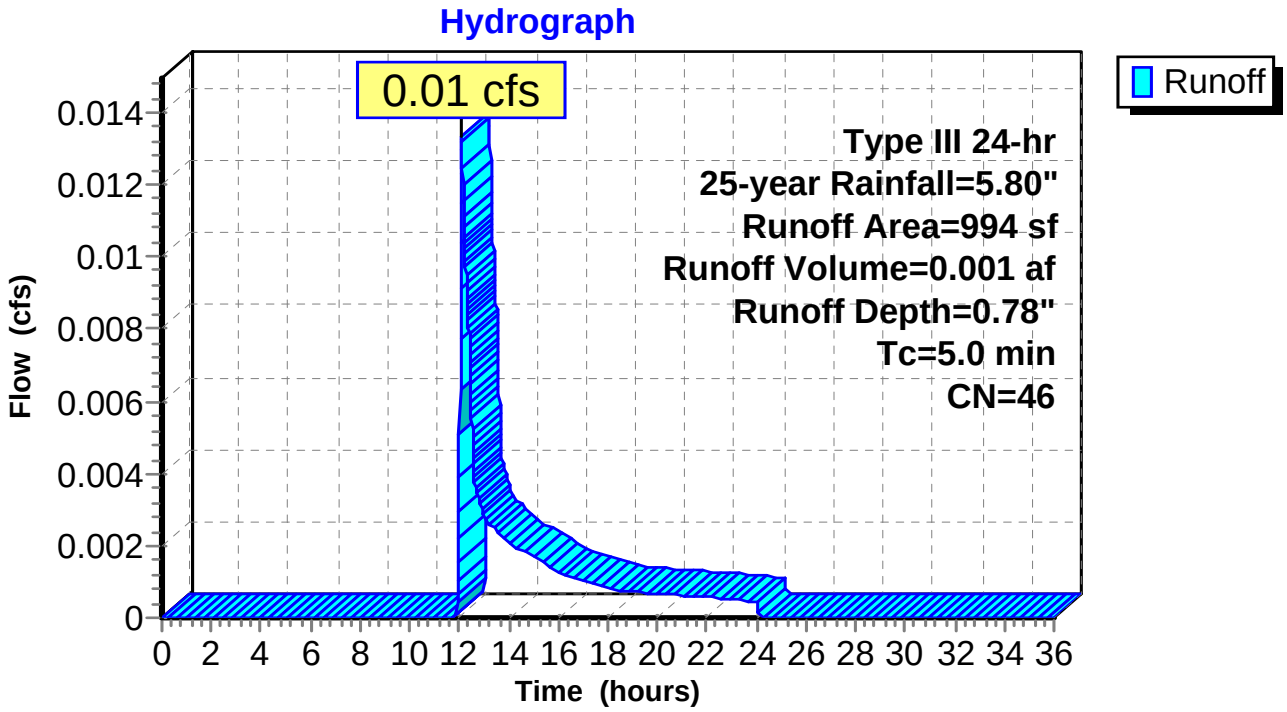
Runoff = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=5.80"

	Area (sf)	CN	Description
	874	39	>75% Grass cover, Good, HSG A
*	120	98	Brick walkway
	994	46	Weighted Average
	874		87.93% Pervious Area
	120		12.07% Impervious Area

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

Subcatchment 2S: Grass & Sidewalk

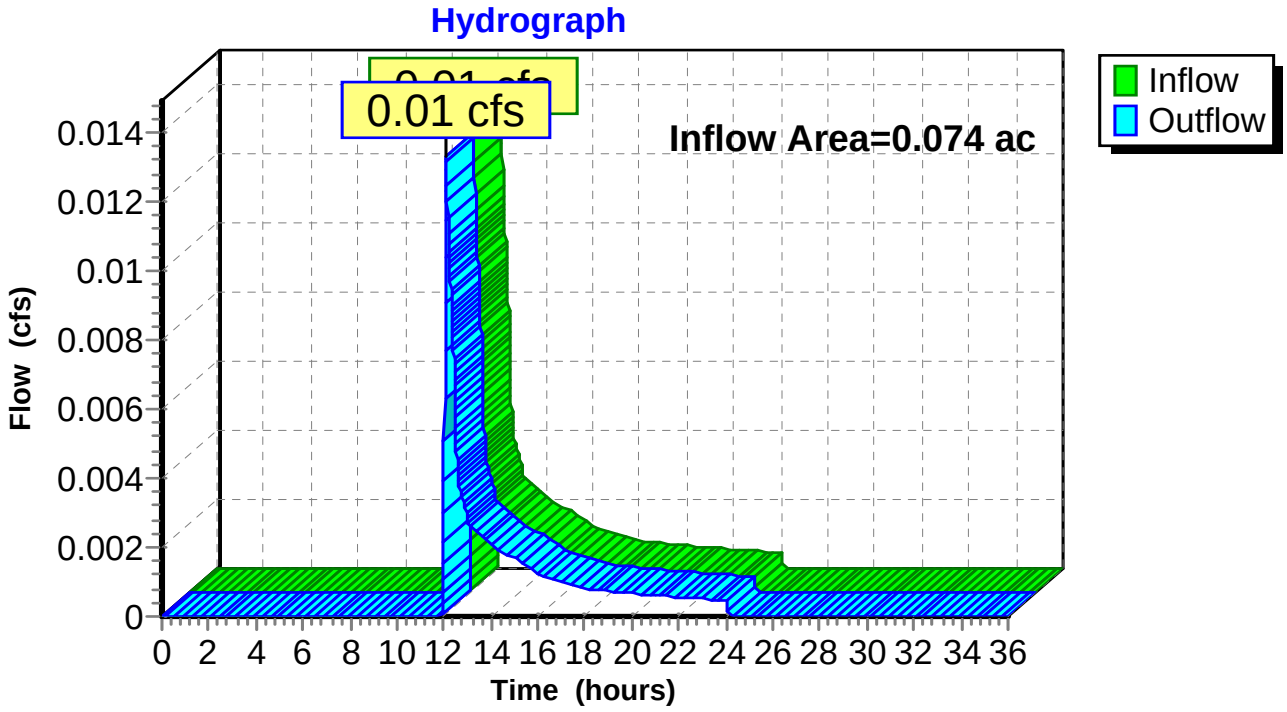


Summary for Reach 1R: POI#1

Inflow Area = 0.074 ac, 72.79% Impervious, Inflow Depth = 0.24" for 25-year event
Inflow = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af
Outflow = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach 1R: POI#1



Summary for Pond 1P: Infiltration Trench

Inflow Area = 0.051 ac,100.00% Impervious, Inflow Depth = 5.56" for 25-year event
Inflow = 0.30 cfs @ 12.07 hrs, Volume= 0.024 af
Outflow = 0.03 cfs @ 12.18 hrs, Volume= 0.023 af, Atten= 91%, Lag= 6.6 min
Discarded = 0.03 cfs @ 12.18 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 119.31' @ 12.91 hrs Surf.Area= 0.005 ac Storage= 0.010 af

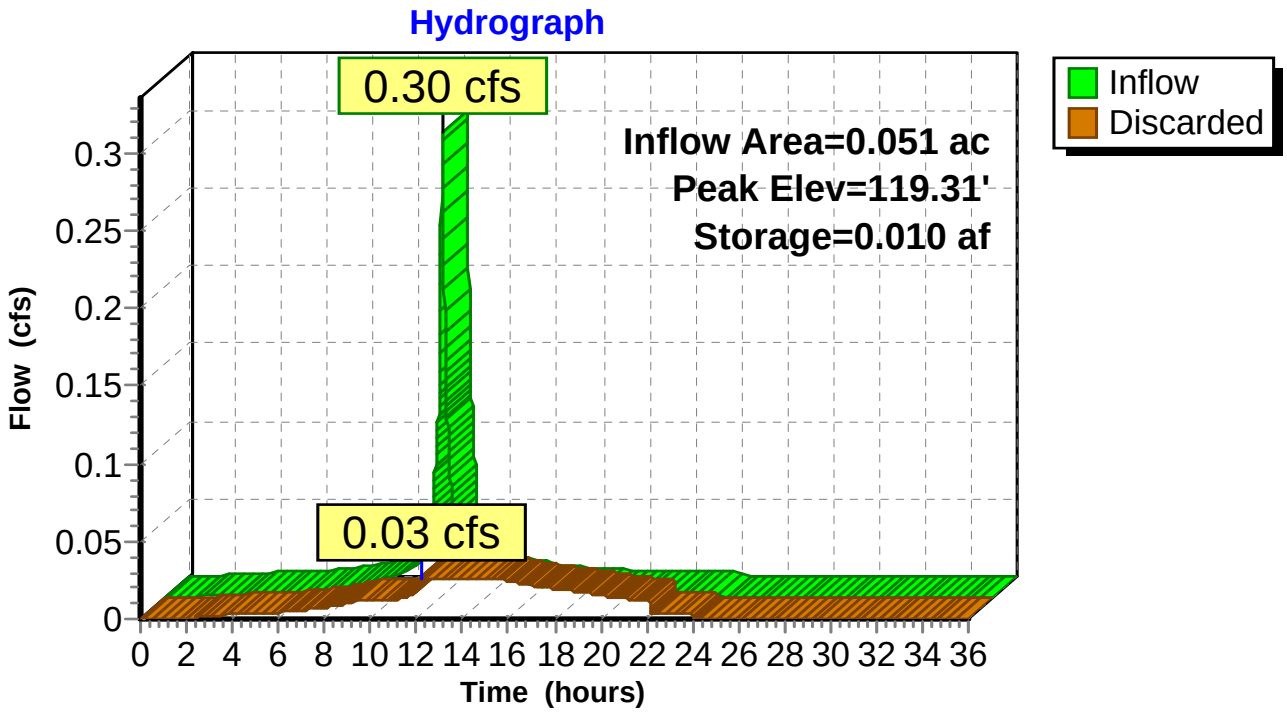
Plug-Flow detention time= 141.7 min calculated for 0.023 af (99% of inflow)
Center-of-Mass det. time= 138.0 min (882.7 - 744.7)

Volume	Invert	Avail.Storage	Storage Description
#1	114.00'	0.005 af	**5.00'W x 40.00'L x 3.00'H Prismatoid** 0.014 af Overall - 0.001 af Embedded = 0.012 af x 40.0% Voids
#2	115.00'	0.001 af	**18.0" Round Pipe Storage** Inside #1 L= 36.0'
#3	113.50'	0.002 af	**4.00'D x 5.42'H Vertical Cone/Cylinder**-Impervious
#4	118.92'	0.017 af	**5.00'W x 5.00'L x 1.00'H Prismatoid Z=20.0**-Impervious
		0.025 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	114.00'	**2.410 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 12.18 hrs HW=117.01' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 1P: Infiltration Trench



SOILS MAP

Locationt: 40 O'Brion St, Portland
Job Number: 1070
Date: 3/17/16
Drawn By: WHS
Data Source: MEGIS, City of Portland

0 25 50 100 Feet

ACORN ENGINEERING, INC