DRAINAGE SUMMARY

219 MELROSE STREET

NEWTON, MASSACHUSETTS

November 28, 2022

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P.O. Box 787
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DRAINAGE SUMMARY
219 MELROSE STREET
NEWTON, MASSACHUSETTS

The proposed project consists of the re-development of an existing, single family house lot at 19 Melrose Street into a two family dwelling, under the requirements of the City of Newton, including Stormwater Management & Erosion Control requirements. The proposed project includes the demolition of the existing structure & driveway and the construction of a new, two family house, site grading, retaining walls, a new driveway and associated work. Overall, the proposed impervious area on the lot will be approximately 8.5% greater than existing conditions, due to the new house footprint. The on-line soil survey for the area shows "Merrimact Urban Land Complex" or a Class A sandy gravel as the predominant soils for the area. The on-site soil evaluation determined the soils to be "Sandy Loam" and under State Stormwater Management guidelines would be considered a Class B soil. Typically, Sandy Loam as a Class B soil would have a "Rawls" rate of 1.02 in. / hr. or 0.0014 feet / minute. On-site soil testing indicated a medium sandy loam soil with some gravelly material and cobbles with some larger boulders. As such, the drainage controls have been designed with the standard "Rawls" infiltration rate component for pre & post runoff calculations.

Ground cover on the existing site is a typical residential lawn area in the immediate area of the house, with few trees. The drainage on the site is from the house to all sides of the lot and to the "Common Driveway". The proposed grading and flow paths will be similar to the existing conditions, with slightly more impervious surface due to the larger house footprint. Overall, the site will maintain the current flow patterns, with the house roof and driveway areas being collected and discharged to the infiltration systems. There are no wetland resource areas on or near the site. The proposed project will maintain the existing, residential use in the area. The proposed drainage controls are designed to capture & contain the roof area and the new driveway area. The roof runoff will be collected by the roof leader collection piping and the driveway area by trench drain, all of which will discharge to the "Cultec" galley infiltration systems. These system will store a large portion of the runoff from these areas and allow the stored water to slowly infiltrate during & after the storm event.

As noted, the design soil at the site is a sandy loam material. Under the proposed conditions, with the site being developed and loamed & seeded and the use of the infiltration systems, the rate & volume of site runoff from the existing lot will be reduced for all design storm events. The reduction in rate & volume over the existing conditions, meets the City's requirement to handle the differential increase in runoff, as well as store a minimum of two inches of runoff from the total impervious area of the new project. In addition, the proposed controls will provide some additional, long term recharge of the groundwater at the site.

Tables No. 1 & 2 provide a summary of the existing and proposed conditions used in the runoff calculations.

Table No. 1 – Existing Conditions

Subcatchment	Ground Cover	Curve Number	Area (Sq. Ft.)	Tc (Min.)	Comments
A-1	Ex. Imp.	98	2,782	5.0	Incl. Driveway, Walks & Walls
	Ex. Porch	90	105	5.0	
	Ex. Lawn	74	437	5.0	
A-2	Ex. Lawn	74	2,782	5.0	
A-3	Ex. Lawn	74	3,705	5.0	
A-4	Ex. Imp.	98	1,631	5.0	Incl. Roof, Drive, Walks & Walls
	Ex. Porch	90	373	5.0	
	Ex. Lawn	74	3,386	5.0	
A-5	Ex. Imp.	98	790	5.0	Incl. Driveway, Walks & Walls
	Ex. Lawn	74	985	5.0	

Total Imp. Area= 5,203 Sq. ft.

Table No. 2 – Proposed Conditions

Subcatchment	Ground Cover	Curve Number	Area (Sq. Ft.)	Tc (Min.)	Comments
B-1	Prop. Imp.	98	1,954	5.0	Drive & Walk
	Lawn	74	552	5.0	
B-2	Prop. Imp.	98	148	5.0	Walkway
	Porch	90	55	5.0	
	Lawn	74	1,733	5.0	
B-3	Prop. Imp.	98	168	5.0	Ret. Wall
	Porch	90	223	5.0	
	Lawn	74	3,577	5.0	
B-4	Porch	90	223	5.0	
	Lawn	74	3,005	5.0	

B-5	Porch	90	19	5.0	
	Lawn	74	1,944	5.0	
B-6	Prop. Bldg.	98	3,375	5.0	Roof Area

Total Imp. Area= 5,645 Sq. ft.

The runoff conditions at the site were evaluated for both pre and post-development conditions using the SCS TR-20 based Hydrocad computer program. Based on this evaluation (see attached) and as noted above, it is evident that the proposed work will be able to maintain a similar runoff flow pattern as exists today, with reduced rate & volume for up to the 100 year storm event. The following summarizes the results of the computer evaluation under pre, post and controlled conditions:

EXISTING CONDITIONS

Storm Event
Runoff (Rate/Volume)

Drainage Area	2 Yr. Storm (cfs/af)	10 Yr. Storm (cfs/af)	25 Yr. Storm (cfs/af)	100 Yr. Storm (cfs/af)
Subcatchment A-1	0.23 / 0.016	0.38 / 0.027	0.47 / 0.034	0.66 / 0.049
Subcatchment A-2	0.08 / 0.005	0.19 / 0.012	0.26 / 0.017	0.42 / 0.028
Subcatchment A-3	0.10 / 0.007	0.25 / 0.016	0.35 / 0.023	0.56 / 0.037
Subcatchment A-4	0.23 / 0.015	0.47 / 0.031	0.62 / 0.042	0.94 / 0.064
Subcatchment A-5	0.09 / 0.006	0.17 / 0.011	0.22 / 0.015	0.32 / 0.022
Weighted Summary	0.73 / 0.050	1.44 / 0.099	1.92 / 0.131	2.90 / 0.200

POSTDEVELOPMENT RUNOFF CONDITIONS

Storm Event
Runoff (Rate/Volume)

Drainage Area	2 Yr. Storm (cfs/af)	10 Yr. Storm (cfs/af)	25 Yr. Storm (cfs/af)	100 Yr. Storm (cfs/af)
Subcatchment B-1	0.17 / 0.011	0.28 / 0.020	0.35 / 0.025	0.49 / 0.036
Subcatchment B-2	0.06 / 0.004	0.14 / 0.009	0.19 / 0.013	0.30 / 0.020
Subcatchment B-3	0.13 / 0.008	0.29 / 0.019	0.39 / 0.026	0.62 / 0.042
Subcatchment B-4	0.10 / 0.007	0.22 / 0.015	0.31 / 0.021	0.50 / 0.033
Subcatchment B-5	0.06 / 0.004	0.13 / 0.009	0.18 / 0.012	0.30 / 0.020
Subcatchment B-6	0.25 / 0.018	0.39 / 0.030	0.49 / 0.036	0.67 / 0.051
Non-Weighted Summary	0.77 / 0.052	1.45 / 0.102	1.91 / 0.133	2.88 / 0.202

CONTROLLED POSTDEVELOPMENT CONDITIONS*

Storm Event
Runoff (Rate/Volume)

Drainage Area	2 Yr. Storm (cfs/af)	10 Yr. Storm (cfs/af)	25 Yr. Storm (cfs/af)	100 Yr. Storm (cfs/af)
Pond No. 1 (B-1)	0.00 / 0.000	0.09 / 0.003	0.30 / 0.007	0.49 / 0.016
Subcatchment B-2	0.06 / 0.004	0.14 / 0.009	0.19 / 0.013	0.30 / 0.020
Subcatchment B-3	0.13 / 0.008	0.29 / 0.019	0.39 / 0.026	0.62 / 0.042
Subcatchment B-4	0.10 / 0.007	0.22 / 0.015	0.31 / 0.021	0.50 / 0.033
Subcatchment B-5	0.06 / 0.004	0.13 / 0.009	0.18 / 0.012	0.30 / 0.020
Pond No. 2 (B-6)	0.00 / 0.000	0.00 / 0.000	0.07 / 0.005	1.01 / 0.018
Totals (Weighted)**	0.34 / 0.023	0.78 / 0.054	1.12 / 0.083	2.61 / 0.150

* As modified by the Infiltration Systems for Subcatchments B-1 & B-6!
** Totals are Time Weighted per Summary Node

PRE & POST-DEVELOPMENT RUNOFF SUMMARY

Drainage Area	Storm Event Runoff (Rate/Volume) 2 Yr. Storm (cfs/af)	10 Yr. Storm (cfs/af)	25 Yr. Storm (cfs/af)	100 Yr. Storm (cfs/af)
Predevelopment	0.73 / 0.050	1.44 / 0.099	1.92 / 0.131	2.90 / 0.200
Postdevelopment	0.34 / 0.023	0.78 / 0.054	1.12 / 0.083	2.61 / 0.150

As noted above, the subsurface stormwater infiltration systems will contain & infiltrate a large portion of site runoff, up to the 100 year storm, maintaining discharge rates and volumes below existing conditions. Currently, the site discharges to the abutting properties and the common driveway. The new flow pattern will maintain this flow pattern. The infiltration system will infiltrate large volumes of stormwater runoff during and after the storm event due to the retained volume of runoff below the outlet, for additional groundwater recharge. This infiltrated volume more than approximates the infiltration volume of the existing site conditions that will be replaced with the new developed surfaces.

City Infiltration Requirement:

The City of Newton has adopted an additional requirement for projects with regard to retention & infiltration of runoff, based on the project type. The proposed project falls within the criteria of a "Minor Stormwater Permit" with a teardown and construction of a new dwelling & site work, as such, the City requires that the equivalent of two (2) inches of runoff from the total impervious area of the site be retained & infiltrated. The proposed on-site infiltration system will meet this requirement, as follows:

Total Proposed Impervious Area (See Table 2)- 5,645 Square Feet!

Retention Requirement: Two (2) inches = 2" / 12" per foot = 0.167 feet
Multipled by 5,645 square feet = 942.7 cubic feet

Calculated Infiltration Systems Storage = 1,259 cubic feet or 133.5% of requirement!

City Phosphorus Removal Requirement:

The City of Newton has adopted an additional requirement for major stormwater permits with regard to removal of phosphorus from site runoff. The required removal is 50% of site loading. The proposed infiltration systems will capture & infiltrate 56% of the site runoff during the two year storm, 47% during the 10 year storm and 38% during the 25 year storm for an average of 49% of site runoff being infiltrated. This is also equivalent to a 49% phosphorus removal rate. Even though the removal rate does not apply to the minor permits such as this site, the design approximates an average of the required removal rate.

State Stormwater Standards:

The Massachusetts DEP has developed a set of standards that have been adopted by the City as part of their Stormwater Management and Erosion Control Rules & Regulations. These standards and the projects compliance are noted as follows:

Standard No. 1 - Untreated Stormwater

The project does not proposed any stormwater runoff from impervious surface that is not treated prior to discharge.

Standard No. 2 - Postdevelopment Peak Runoff Increase

The project does not proposed any increase in stormwater runoff rates or volumes, as noted above in the Pre & Post Development Runoff Summary.

Standard No. 3 – Recharge to Groundwater

The proposed impervious area of 5,645 sq. ft. or 0.130 acres times 0.25 inches or 0.021 feet required recharge for a Class C soil = 0.0027 acre feet (118.54 cu. ft.). The storage within the infiltration systems under a two (2) storm is 668 cu. ft. which meets this requirement.

Standard No. 4 – Water Quality

The project requires a minimum of 0.5 inches of runoff times the impervious area of the watershed be treated for solids removal and that an average of 80% removal be accomplished for the project. The proposed impervious area for the project is treated by the infiltration systems and the sediment manhole which yield a combined treatment level of 85%.

Standard No. 5 – Land Use with Potentially Higher Pollutant Loading

The project is a residential use lot and does not have any potential for higher pollutant load levels.

Standard No. 6 – Water Quality Treatment

The project is a residentialuse lot and does not discharge to any critical resource area.

Standard No. 7 – Redevelopment Projects

The project is a demolition & redevelopment of the residential use and meets the standard as well as the City requirements.

Standard No. 8 – Erosion Control

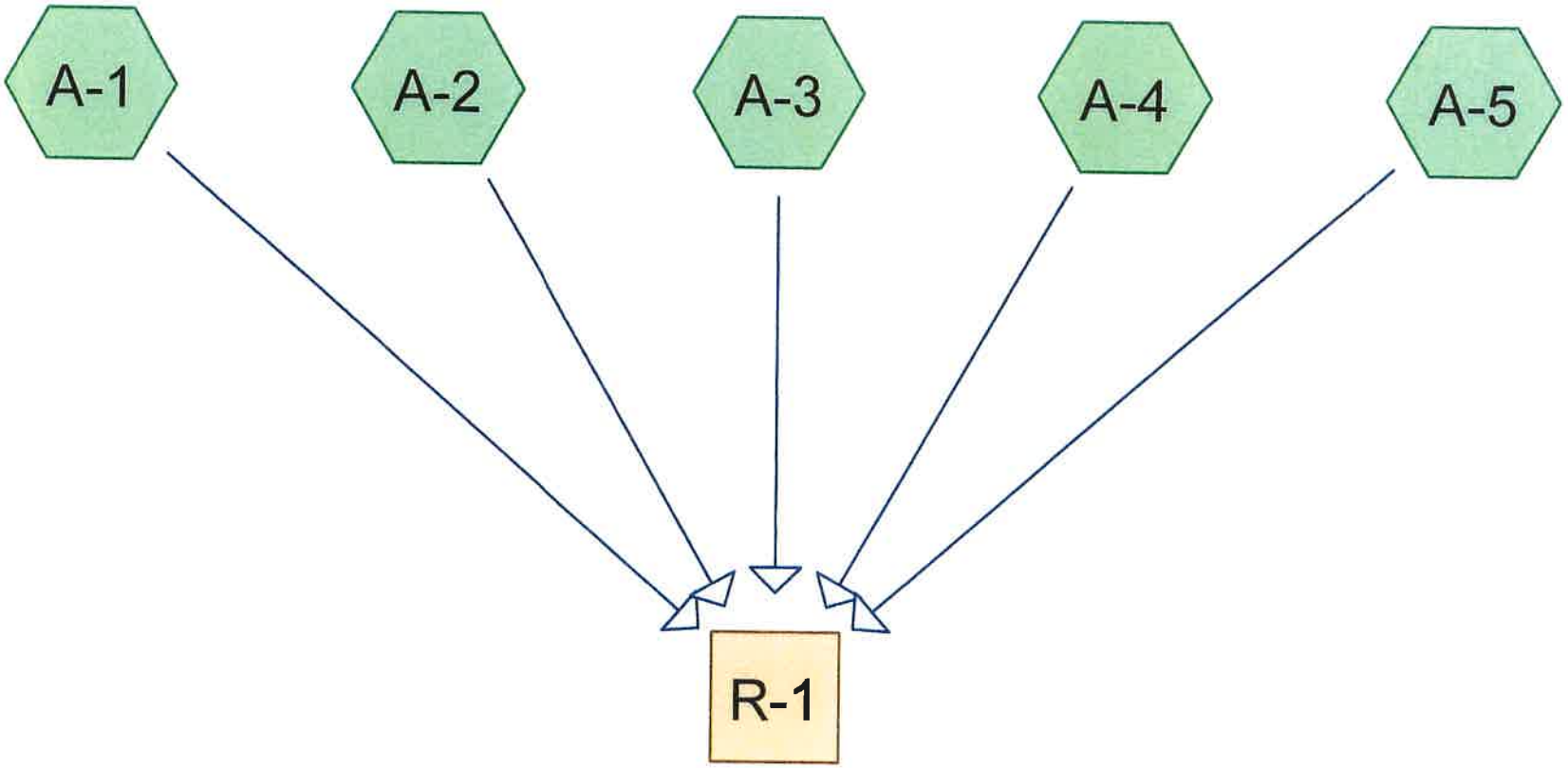
The project has erosion controls incorporated into the work.

Standard No. 9 – Operation & Maintenance Plan

The project is has a proposed O & M plan for all aspects of the design.

Standard No. 10 – Potential Illicit Discharges

The project is a residential use lot and does not have potential for illicit discharges.



Subcat Reach Pond Link

Drainage Diagram for 219 Melrose_Pre

Prepared by {enter your company name here} 11/27/2022

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=3.29"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A-1: Offsite to Common Drive
Tc=5.0 min CN=95 Area=3,324 sf Runoff= 0.23 cfs 0.016 af

Subcatchment A-2: Offsite to East
Tc=5.0 min CN=74 Area=2,782 sf Runoff= 0.08 cfs 0.005 af

Subcatchment A-3: Offsite to North
Tc=5.0 min CN=74 Area=3,705 sf Runoff= 0.10 cfs 0.007 af

Subcatchment A-4: Offsite to West
Tc=5.0 min CN=82 Area=5,390 sf Runoff= 0.23 cfs 0.015 af

Subcatchment A-5: Offsite to South
Tc=5.0 min CN=85 Area=1,775 sf Runoff= 0.09 cfs 0.006 af

Reach R-1: Summary Node
Inflow= 0.73 cfs 0.050 af
Outflow= 0.73 cfs 0.050 af

Runoff Area = 0.390 ac Volume = 0.050 af Average Depth = 1.54"

Subcatchment A-1: Offsite to Common Drive

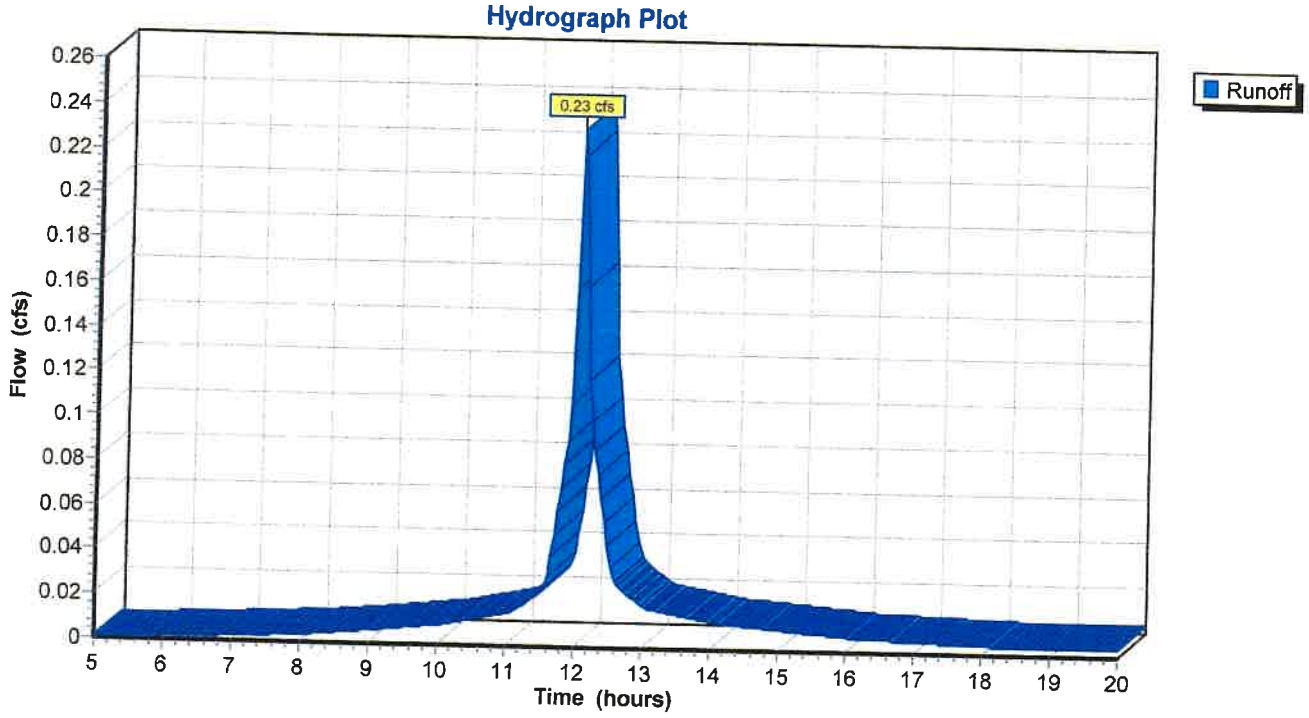
Runoff = 0.23 cfs @ 12.07 hrs, Volume= 0.016 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
2,782	98	Paved parking & roofs
105	90	Porch
437	74	>75% Grass cover, Good, HSG C
3,324	95	Weighted Average

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

Subcatchment A-1: Offsite to Common Drive



Subcatchment A-2: Offsite to East

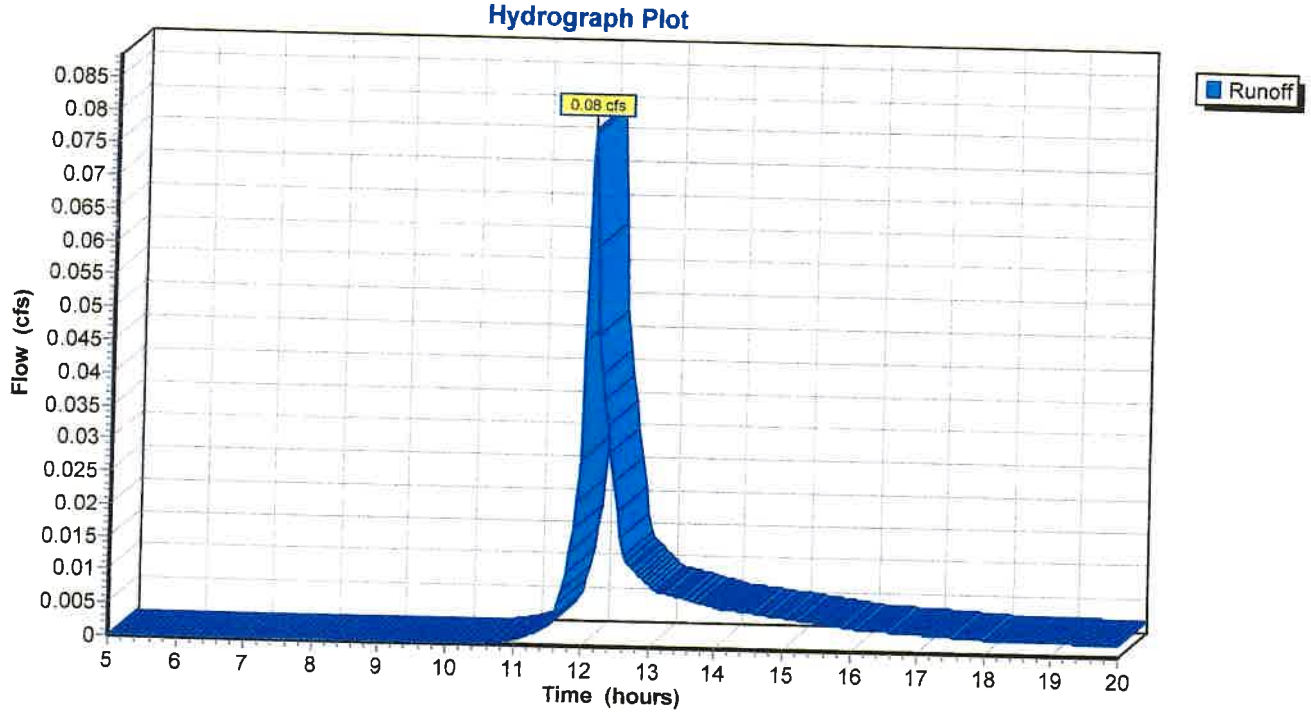
Runoff = 0.08 cfs @ 12.09 hrs, Volume= 0.005 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
2,782	74	>75% Grass cover, Good, HSG C

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

Subcatchment A-2: Offsite to East



Subcatchment A-3: Offsite to North

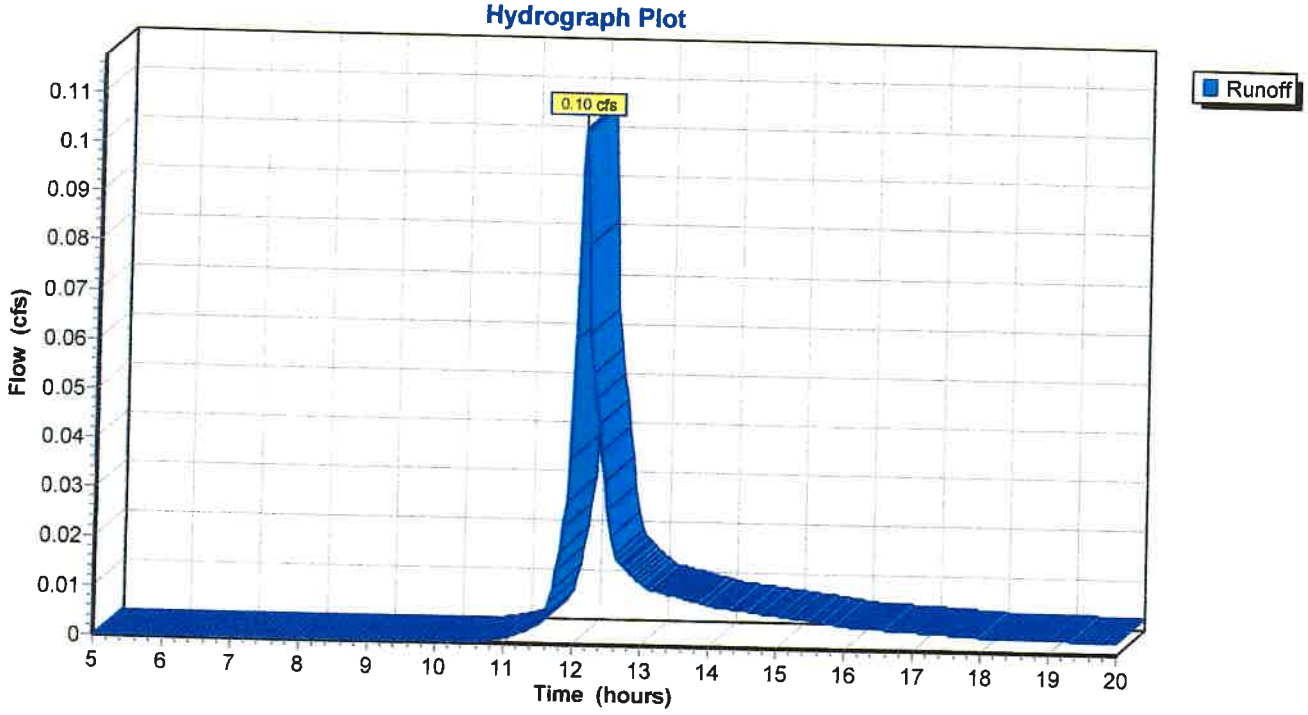
Runoff = 0.10 cfs @ 12.09 hrs, Volume= 0.007 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
3,705	74	>75% Grass cover, Good, HSG C

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

Subcatchment A-3: Offsite to North



Subcatchment A-4: Offsite to West

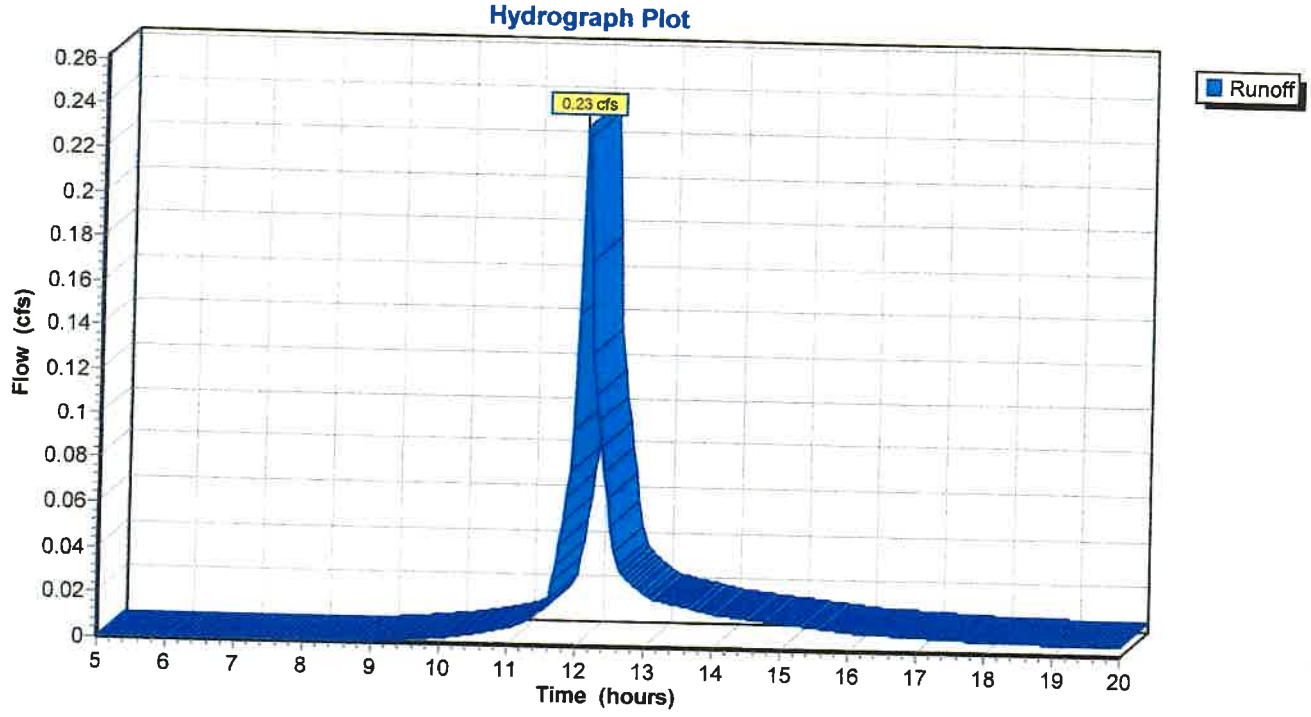
Runoff = 0.23 cfs @ 12.08 hrs, Volume= 0.015 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
1,631	98	Paved parking & roofs
373	90	Porch
3,386	74	>75% Grass cover, Good, HSG C
5,390	82	Weighted Average

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

Subcatchment A-4: Offsite to West



Subcatchment A-5: Offsite to South

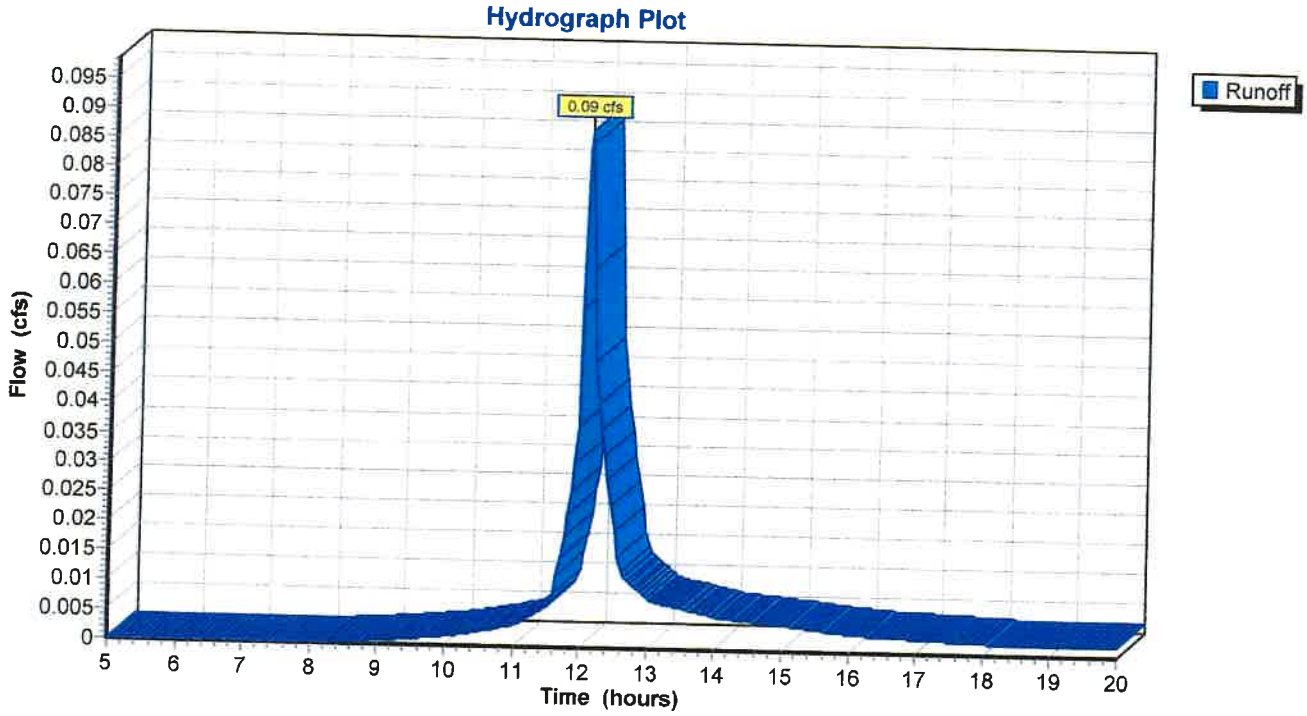
Runoff = 0.09 cfs @ 12.08 hrs, Volume= 0.006 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
790	98	Paved parking & roofs
985	74	>75% Grass cover, Good, HSG C
1,775	85	Weighted Average

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

Subcatchment A-5: Offsite to South

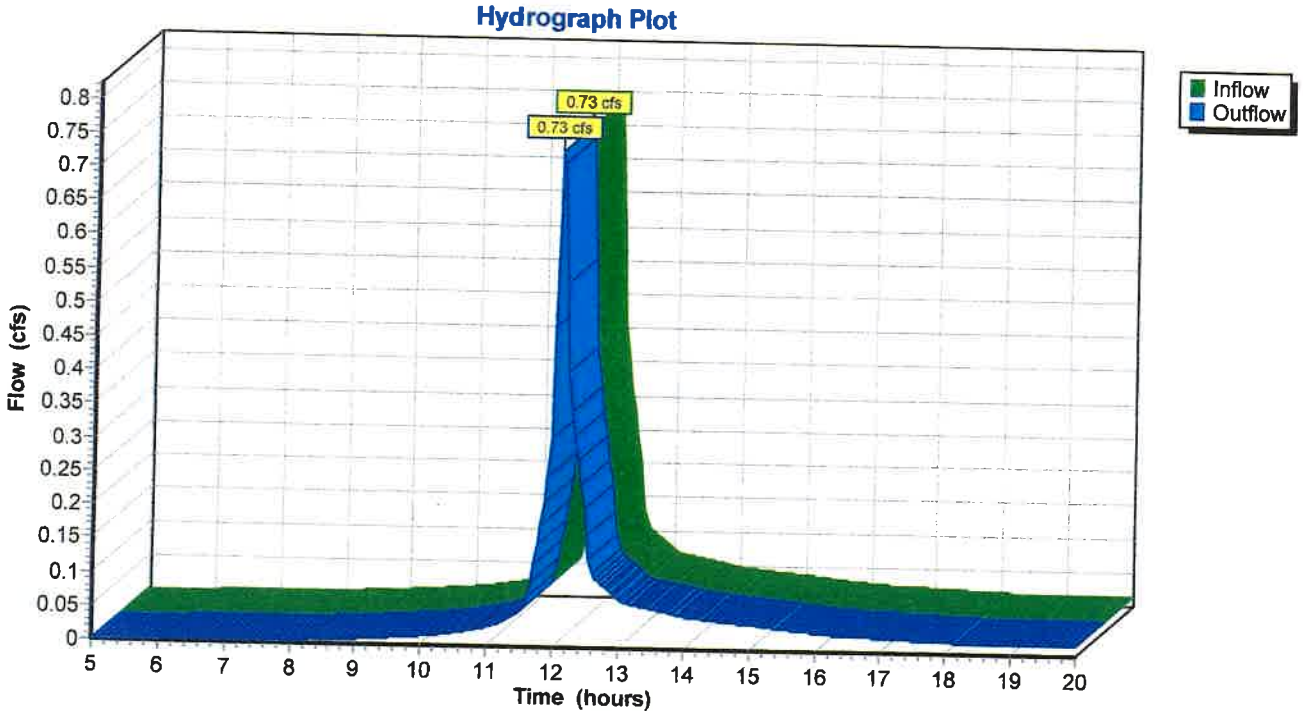


Reach R-1: Summary Node

Inflow = 0.73 cfs @ 12.08 hrs, Volume= 0.050 af
Outflow = 0.73 cfs @ 12.08 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.0 min

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

Reach R-1: Summary Node



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=5.17"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A-1: Offsite to Common Drive
Tc=5.0 min CN=95 Area=3,324 sf Runoff= 0.38 cfs 0.027 af

Subcatchment A-2: Offsite to East
Tc=5.0 min CN=74 Area=2,782 sf Runoff= 0.19 cfs 0.012 af

Subcatchment A-3: Offsite to North
Tc=5.0 min CN=74 Area=3,705 sf Runoff= 0.25 cfs 0.016 af

Subcatchment A-4: Offsite to West
Tc=5.0 min CN=82 Area=5,390 sf Runoff= 0.47 cfs 0.031 af

Subcatchment A-5: Offsite to South
Tc=5.0 min CN=85 Area=1,775 sf Runoff= 0.17 cfs 0.011 af

Reach R-1: Summary Node
Inflow= 1.44 cfs 0.099 af
Outflow= 1.44 cfs 0.099 af

Runoff Area = 0.390 ac Volume = 0.099 af Average Depth = 3.04"

Subcatchment A-1: Offsite to Common Drive

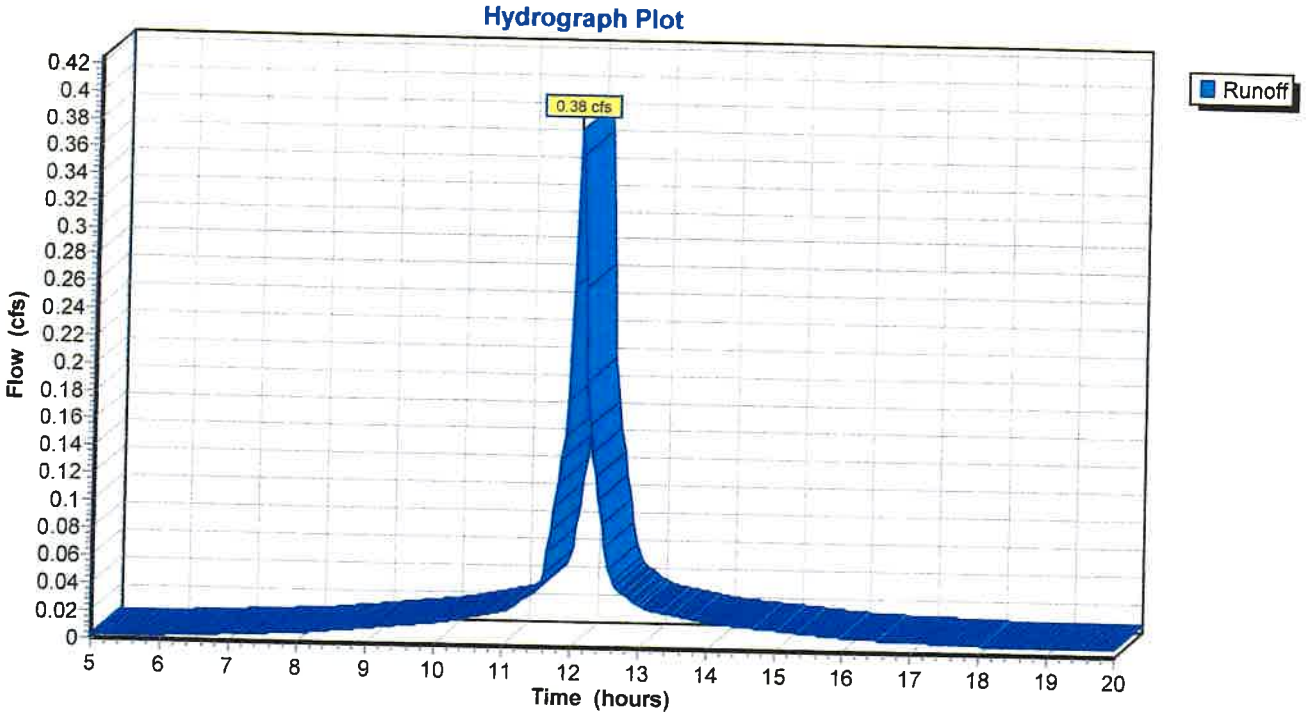
Runoff = 0.38 cfs @ 12.07 hrs, Volume= 0.027 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
2,782	98	Paved parking & roofs
105	90	Porch
437	74	>75% Grass cover, Good, HSG C
3,324	95	Weighted Average

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

Subcatchment A-1: Offsite to Common Drive



Subcatchment A-2: Offsite to East

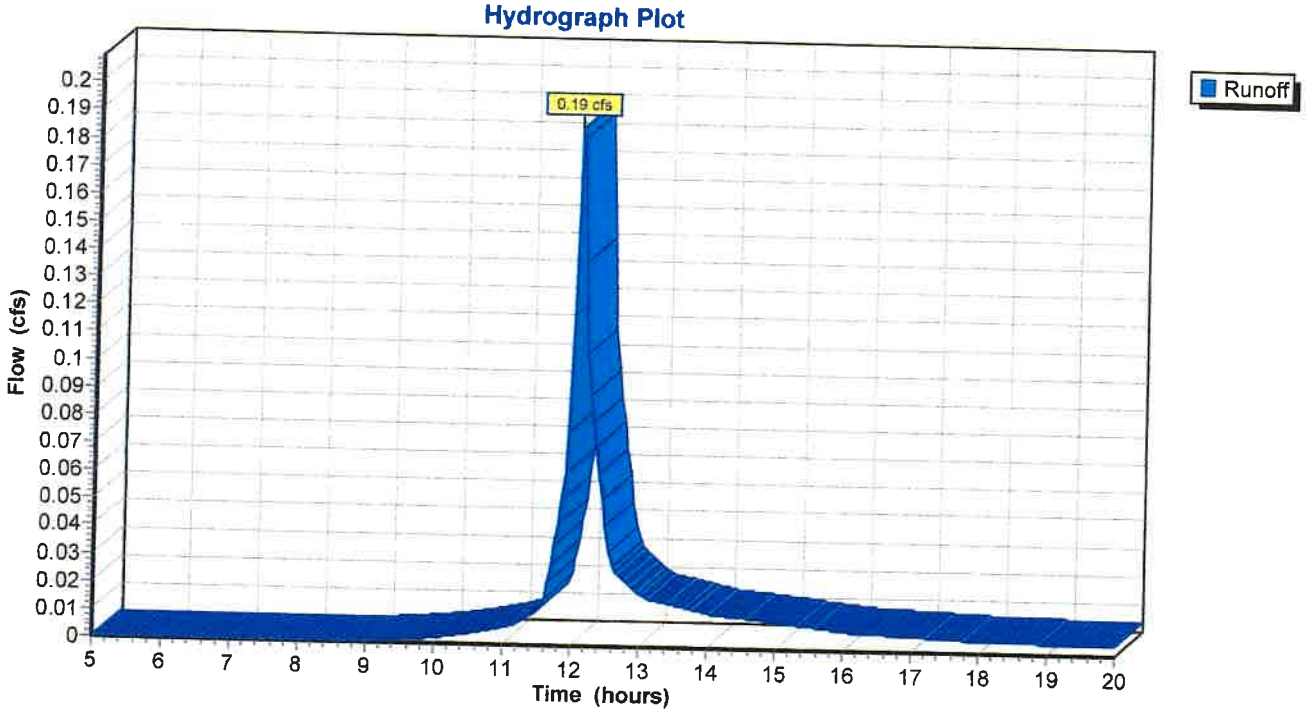
Runoff = 0.19 cfs @ 12.08 hrs, Volume= 0.012 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
2,782	74	>75% Grass cover, Good, HSG C

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

Subcatchment A-2: Offsite to East



Subcatchment A-3: Offsite to North

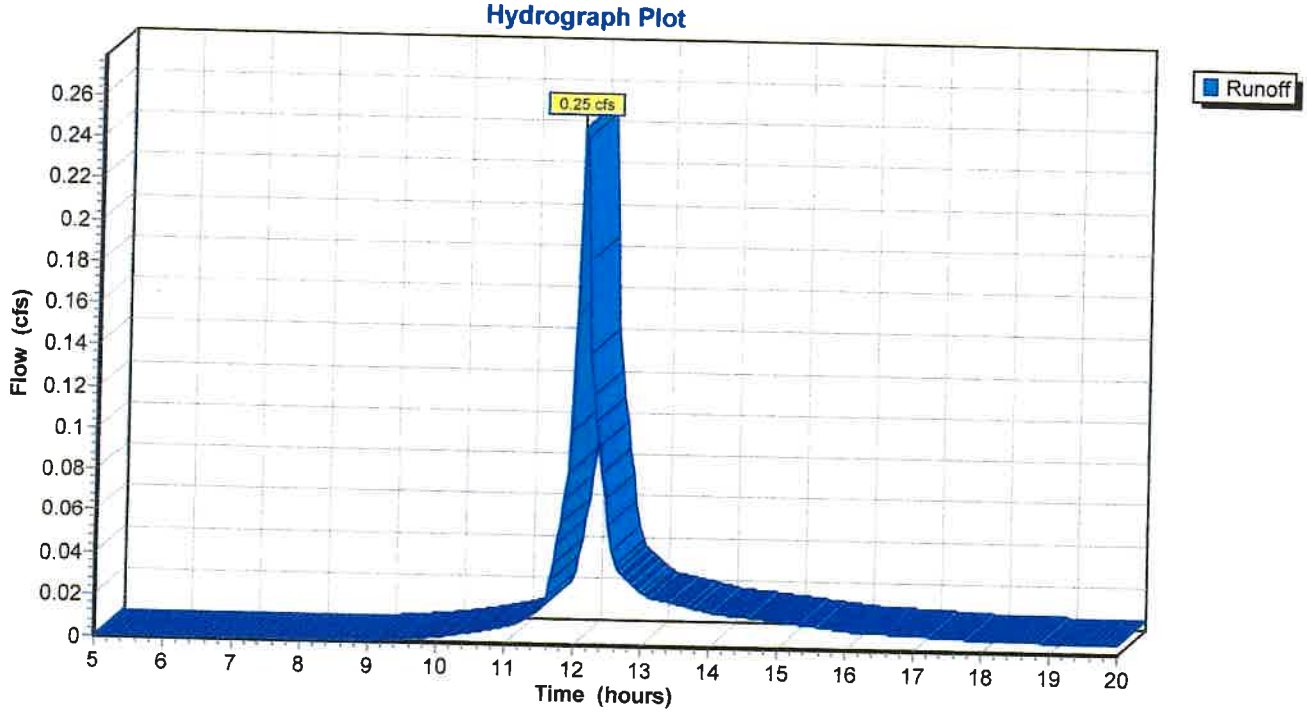
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.016 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
3,705	74	>75% Grass cover, Good, HSG C

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

Subcatchment A-3: Offsite to North



Subcatchment A-4: Offsite to West

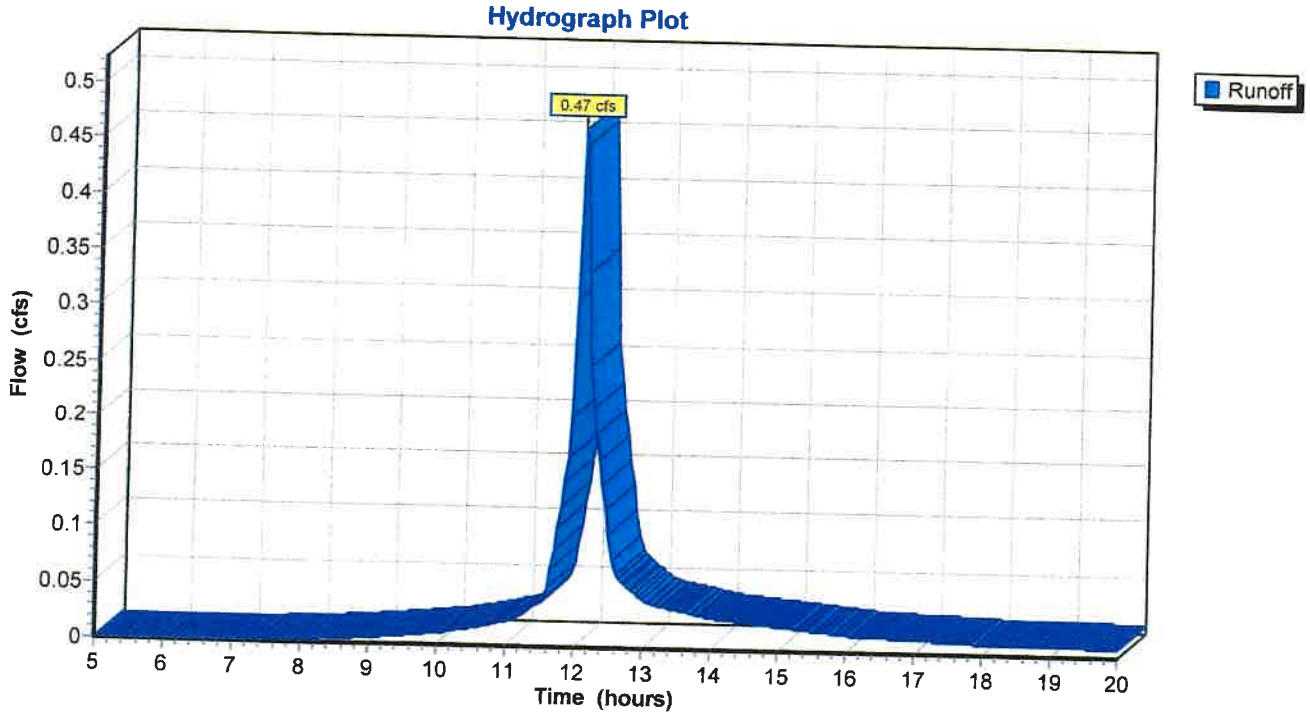
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.031 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
1,631	98	Paved parking & roofs
373	90	Porch
3,386	74	>75% Grass cover, Good, HSG C
5,390	82	Weighted Average

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

Subcatchment A-4: Offsite to West



Subcatchment A-5: Offsite to South

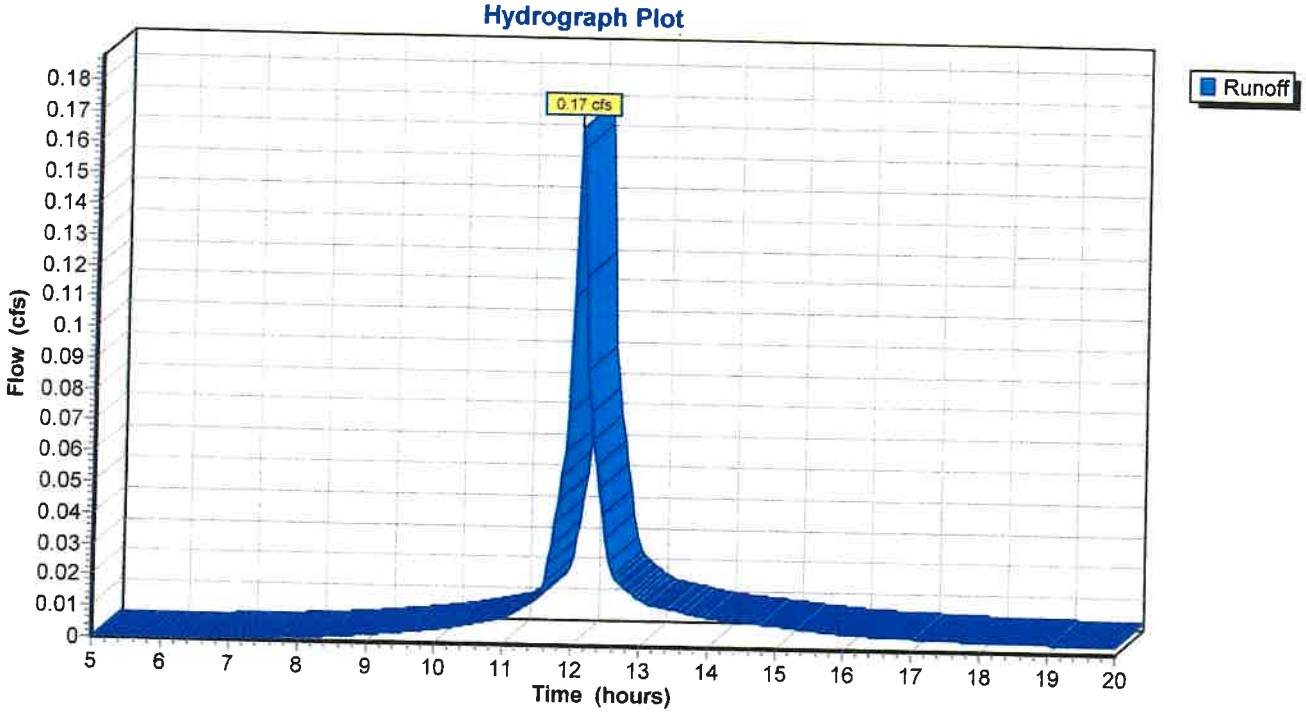
Runoff = 0.17 cfs @ 12.07 hrs, Volume= 0.011 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
790	98	Paved parking & roofs
985	74	>75% Grass cover, Good, HSG C
1,775	85	Weighted Average

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

Subcatchment A-5: Offsite to South

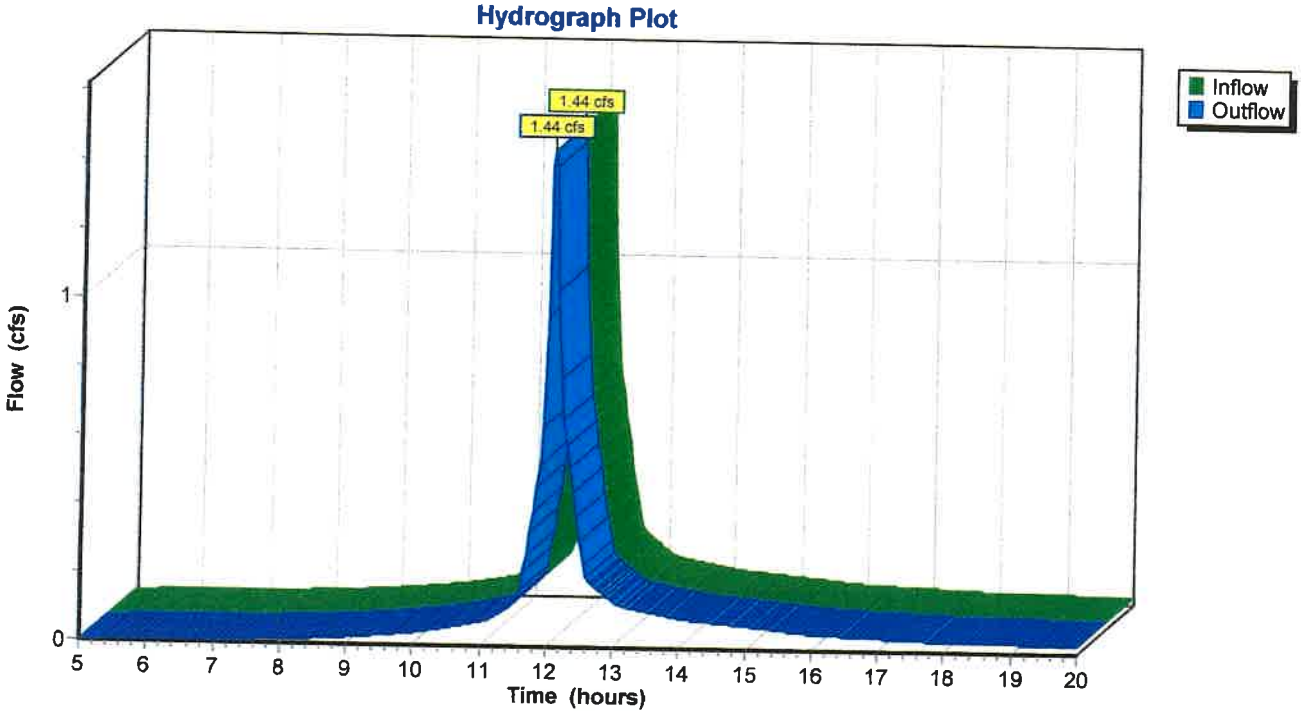


Reach R-1: Summary Node

Inflow = 1.44 cfs @ 12.08 hrs, Volume= 0.099 af
Outflow = 1.44 cfs @ 12.08 hrs, Volume= 0.099 af, Atten= 0%, Lag= 0.0 min

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

Reach R-1: Summary Node



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=6.35"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A-1: Offsite to Common Drive
Tc=5.0 min CN=95 Area=3,324 sf Runoff= 0.47 cfs 0.034 af

Subcatchment A-2: Offsite to East
Tc=5.0 min CN=74 Area=2,782 sf Runoff= 0.26 cfs 0.017 af

Subcatchment A-3: Offsite to North
Tc=5.0 min CN=74 Area=3,705 sf Runoff= 0.35 cfs 0.023 af

Subcatchment A-4: Offsite to West
Tc=5.0 min CN=82 Area=5,390 sf Runoff= 0.62 cfs 0.042 af

Subcatchment A-5: Offsite to South
Tc=5.0 min CN=85 Area=1,775 sf Runoff= 0.22 cfs 0.015 af

Reach R-1: Summary Node
Inflow= 1.92 cfs 0.131 af
Outflow= 1.92 cfs 0.131 af

Runoff Area = 0.390 ac Volume = 0.131 af Average Depth = 4.04"

Subcatchment A-1: Offsite to Common Drive

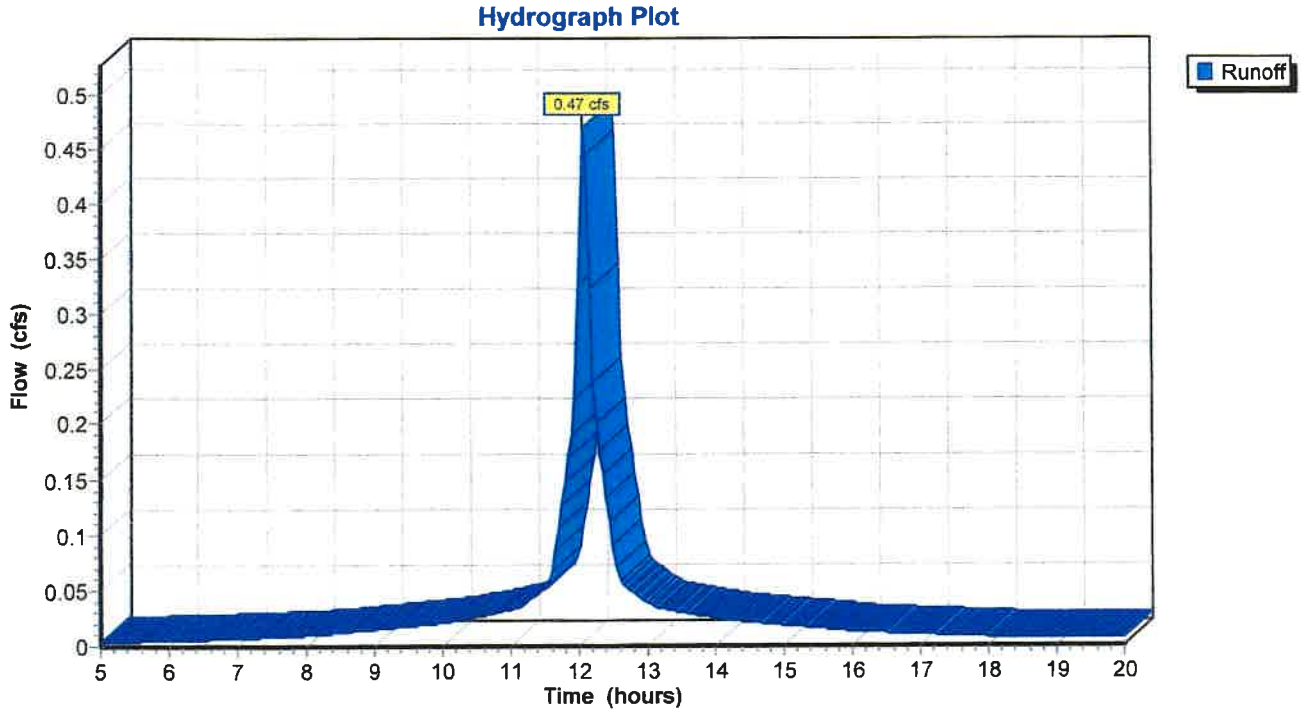
Runoff = 0.47 cfs @ 12.07 hrs, Volume= 0.034 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
2,782	98	Paved parking & roofs
105	90	Porch
437	74	>75% Grass cover, Good, HSG C
3,324	95	Weighted Average

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

Subcatchment A-1: Offsite to Common Drive



Subcatchment A-2: Offsite to East

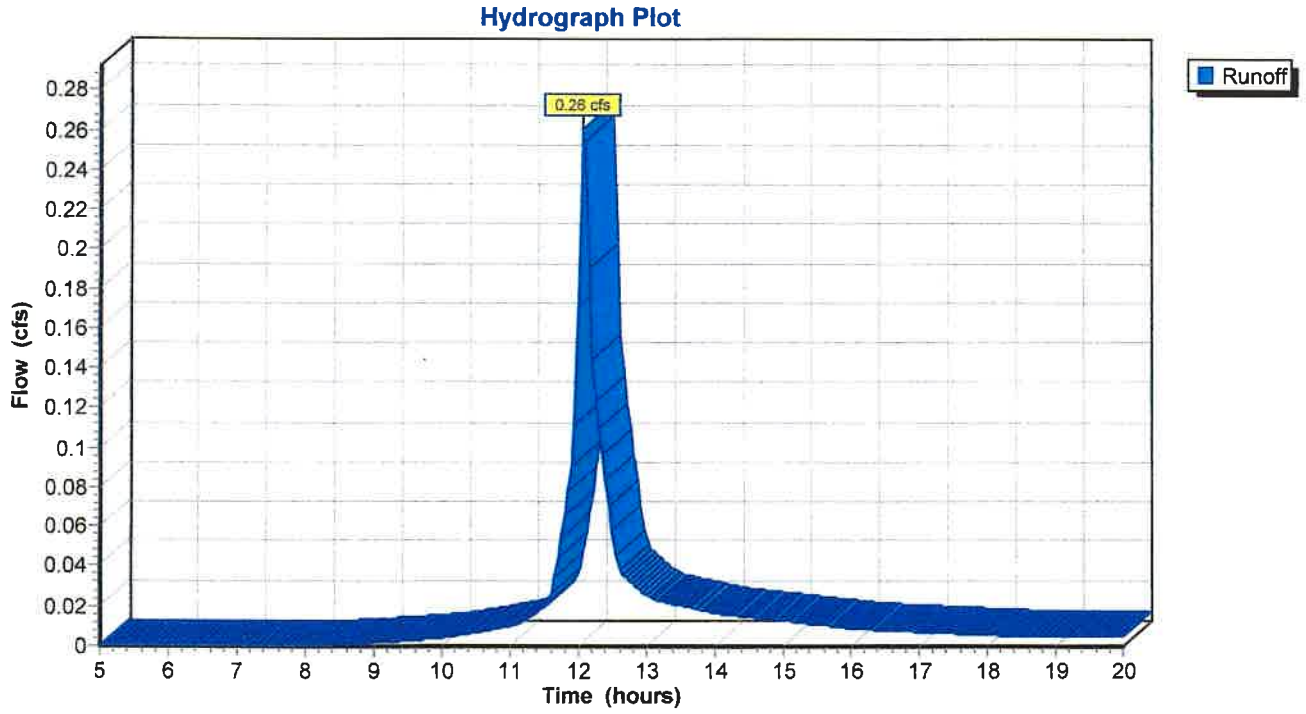
Runoff = 0.26 cfs @ 12.08 hrs, Volume= 0.017 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
2,782	74	>75% Grass cover, Good, HSG C

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

Subcatchment A-2: Offsite to East



Subcatchment A-3: Offsite to North

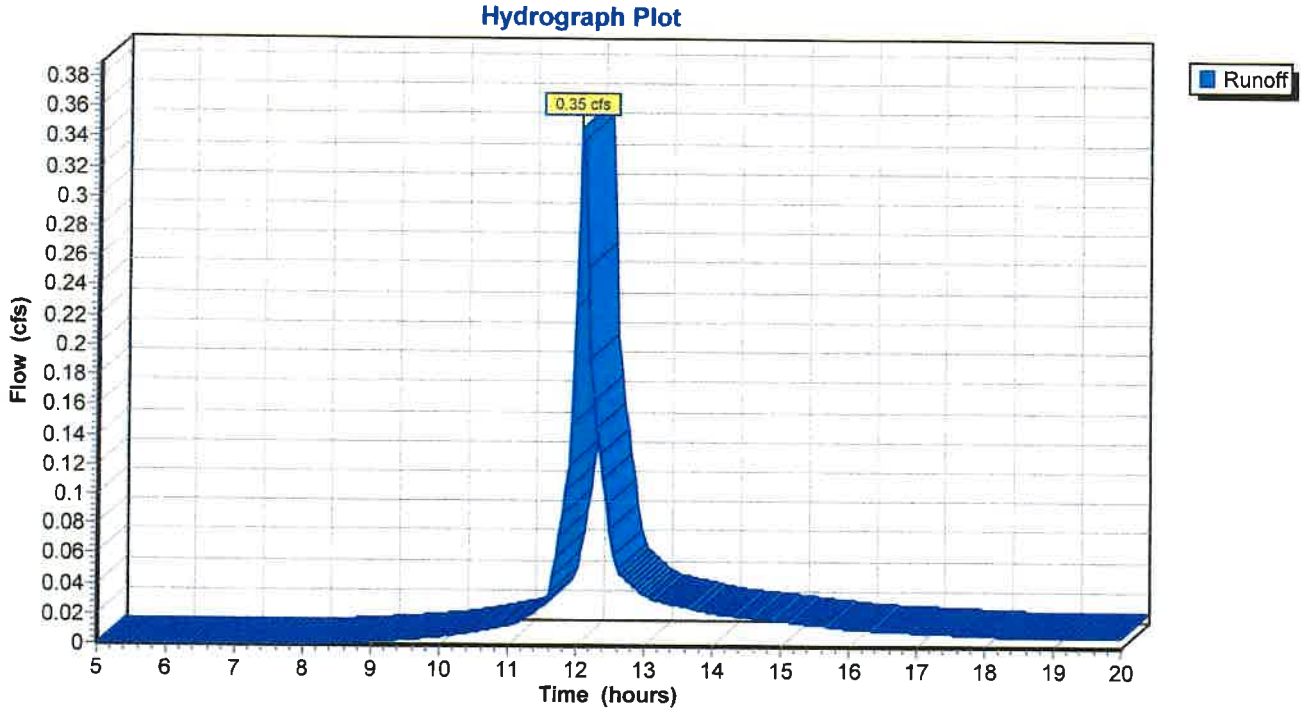
Runoff = 0.35 cfs @ 12.08 hrs, Volume= 0.023 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
3,705	74	>75% Grass cover, Good, HSG C

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

Subcatchment A-3: Offsite to North



Subcatchment A-4: Offsite to West

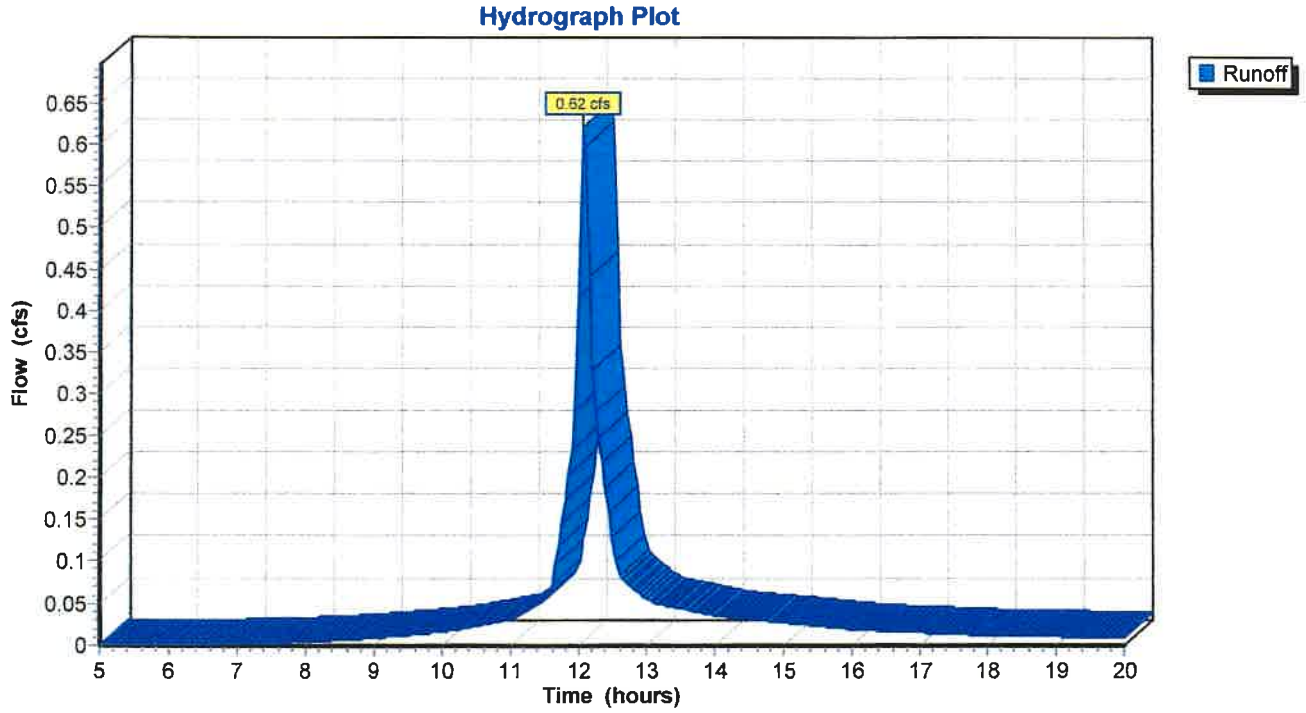
Runoff = 0.62 cfs @ 12.07 hrs, Volume= 0.042 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
1,631	98	Paved parking & roofs
373	90	Porch
3,386	74	>75% Grass cover, Good, HSG C
5,390	82	Weighted Average

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

Subcatchment A-4: Offsite to West



Subcatchment A-5: Offsite to South

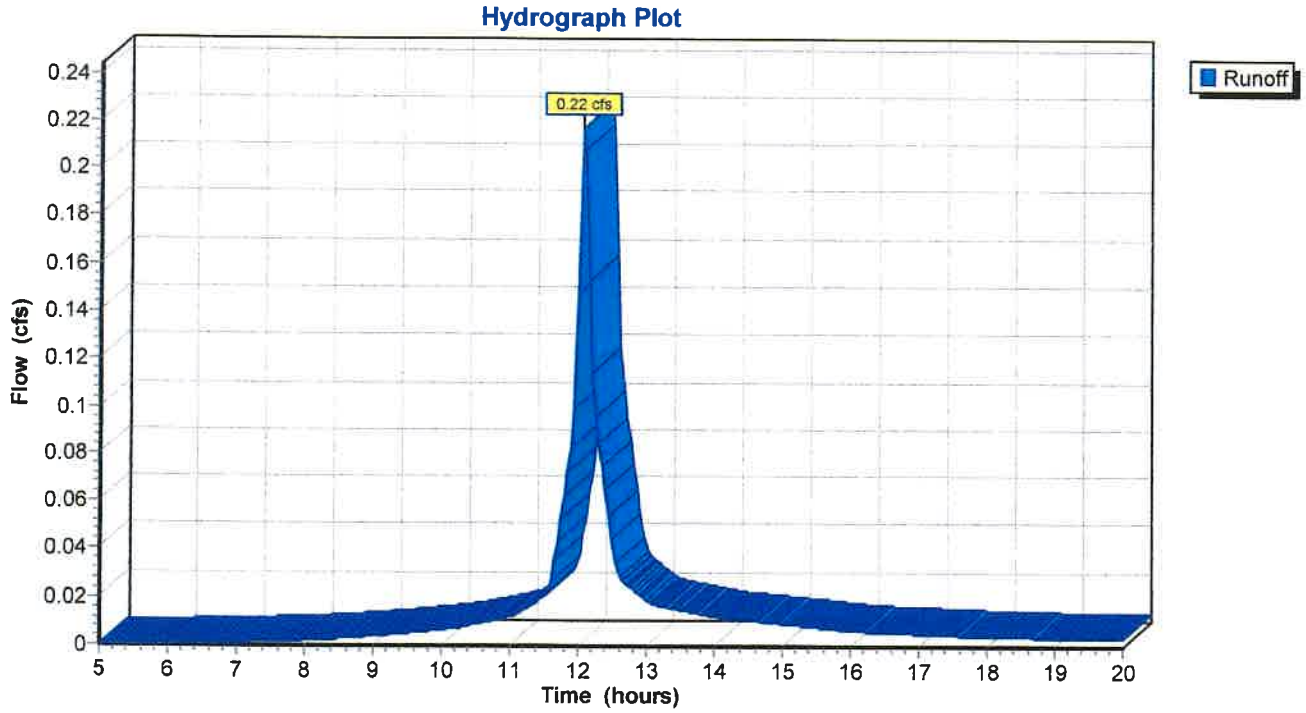
Runoff = 0.22 cfs @ 12.07 hrs, Volume= 0.015 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
790	98	Paved parking & roofs
985	74	>75% Grass cover, Good, HSG C
1,775	85	Weighted Average

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

Subcatchment A-5: Offsite to South

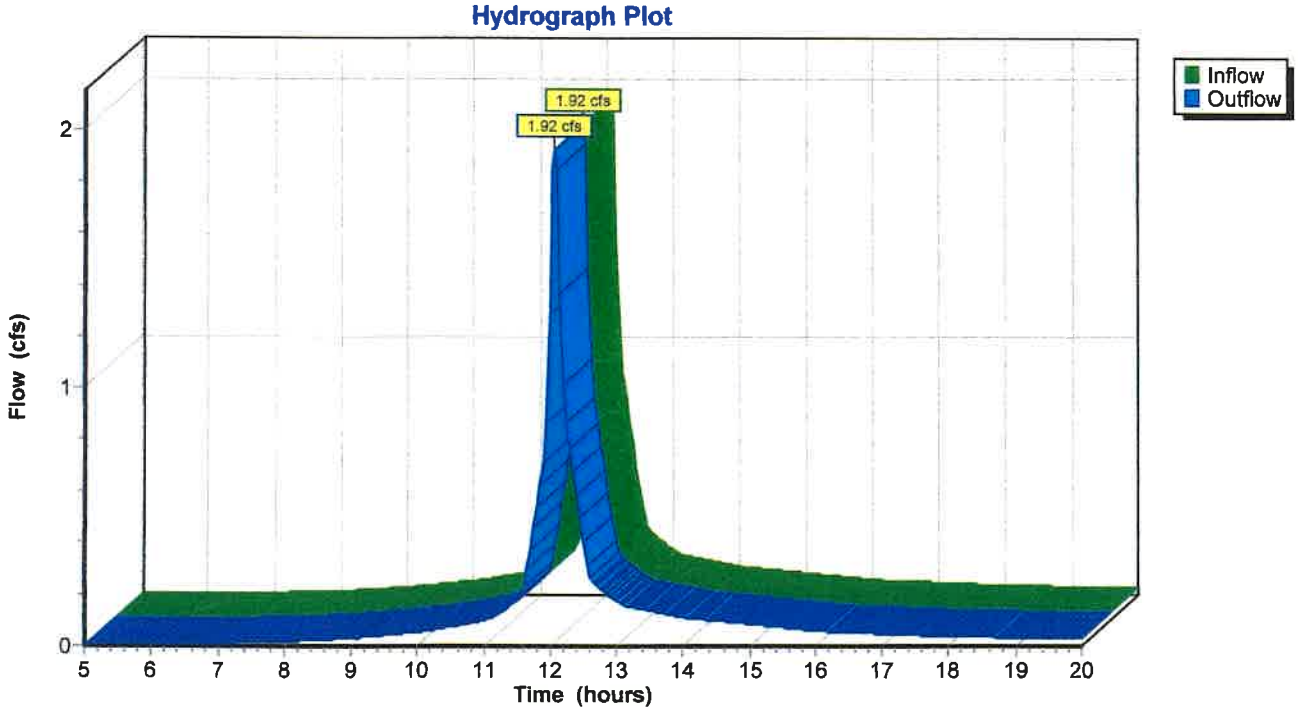


Reach R-1: Summary Node

Inflow = 1.92 cfs @ 12.07 hrs, Volume= 0.131 af
Outflow = 1.92 cfs @ 12.07 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min

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

Reach R-1: Summary Node



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=8.78"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A-1: Offsite to Common Drive
Tc=5.0 min CN=95 Area=3,324 sf Runoff= 0.66 cfs 0.049 af

Subcatchment A-2: Offsite to East
Tc=5.0 min CN=74 Area=2,782 sf Runoff= 0.42 cfs 0.028 af

Subcatchment A-3: Offsite to North
Tc=5.0 min CN=74 Area=3,705 sf Runoff= 0.56 cfs 0.037 af

Subcatchment A-4: Offsite to West
Tc=5.0 min CN=82 Area=5,390 sf Runoff= 0.94 cfs 0.064 af

Subcatchment A-5: Offsite to South
Tc=5.0 min CN=85 Area=1,775 sf Runoff= 0.32 cfs 0.022 af

Reach R-1: Summary Node
Inflow= 2.90 cfs 0.201 af
Outflow= 2.90 cfs 0.201 af

Runoff Area = 0.390 ac Volume = 0.201 af Average Depth = 6.18"

Subcatchment A-1: Offsite to Common Drive

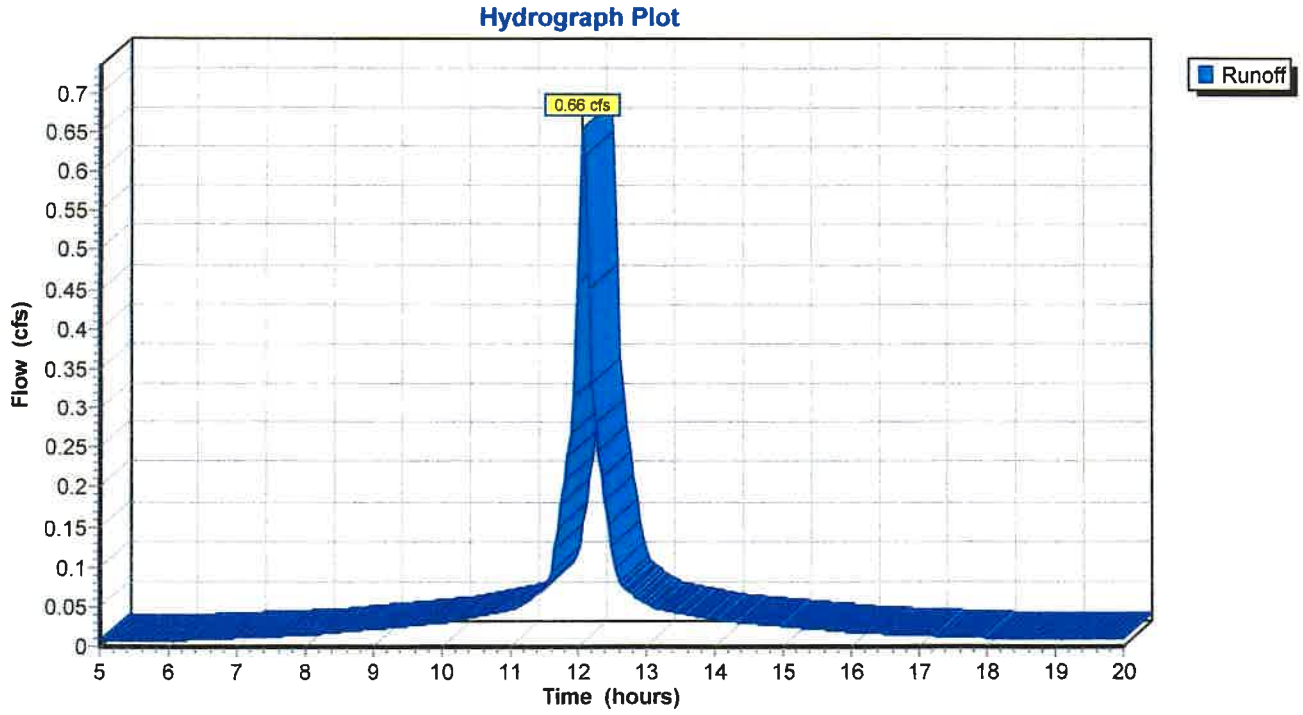
Runoff = 0.66 cfs @ 12.07 hrs, Volume= 0.049 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
2,782	98	Paved parking & roofs
105	90	Porch
437	74	>75% Grass cover, Good, HSG C
3,324	95	Weighted Average

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

Subcatchment A-1: Offsite to Common Drive



Subcatchment A-2: Offsite to East

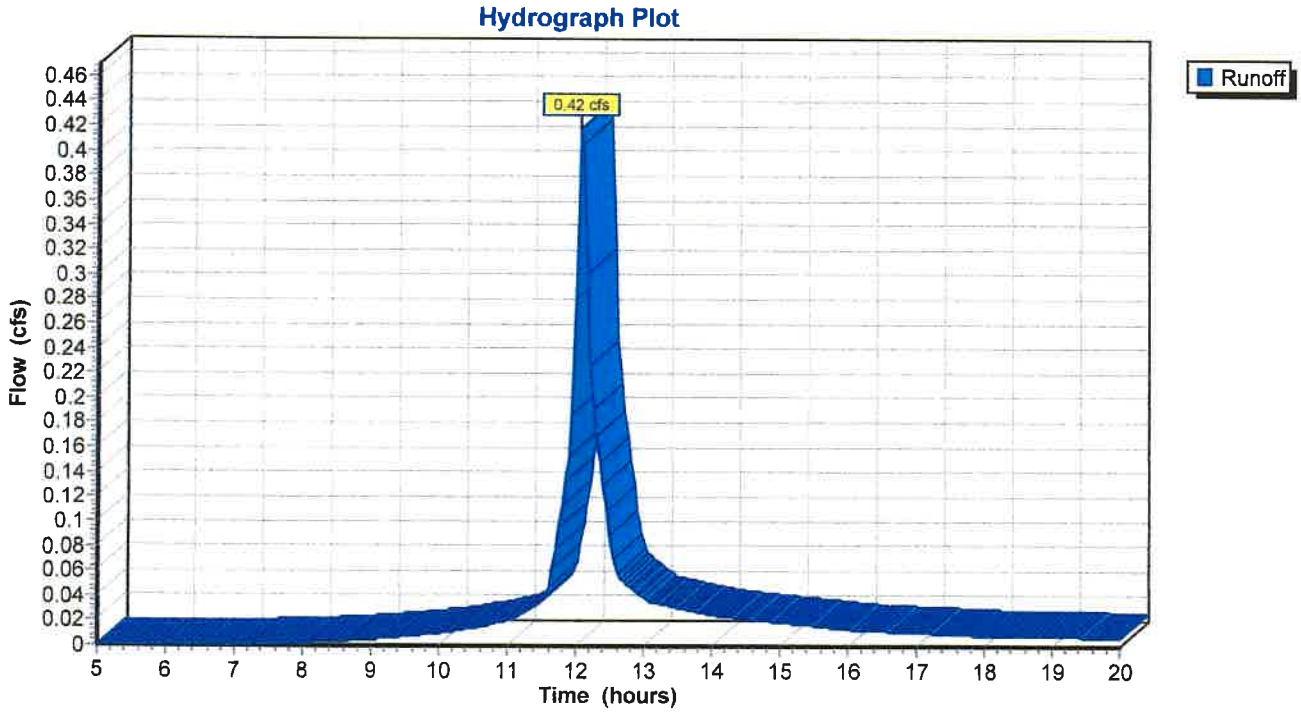
Runoff = 0.42 cfs @ 12.08 hrs, Volume= 0.028 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
2,782	74	>75% Grass cover, Good, HSG C

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

Subcatchment A-2: Offsite to East



Subcatchment A-3: Offsite to North

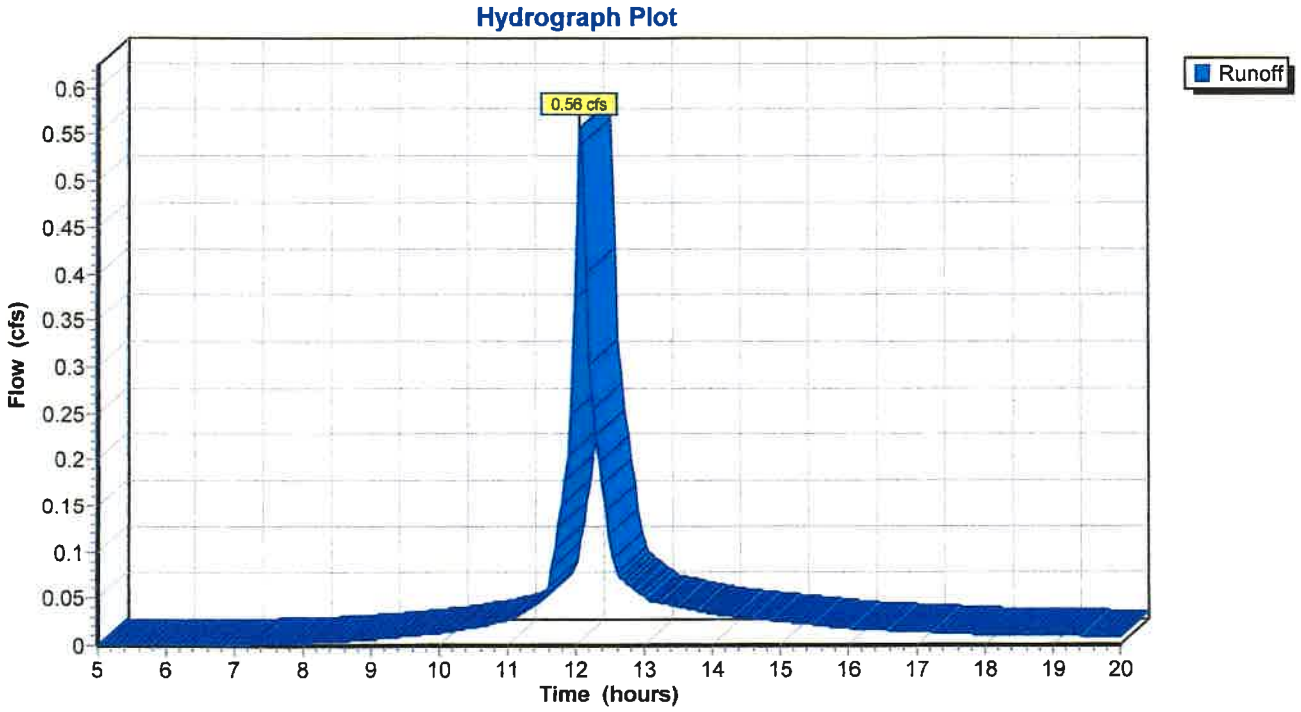
Runoff = 0.56 cfs @ 12.08 hrs, Volume= 0.037 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
3,705	74	>75% Grass cover, Good, HSG C

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

Subcatchment A-3: Offsite to North



Subcatchment A-4: Offsite to West

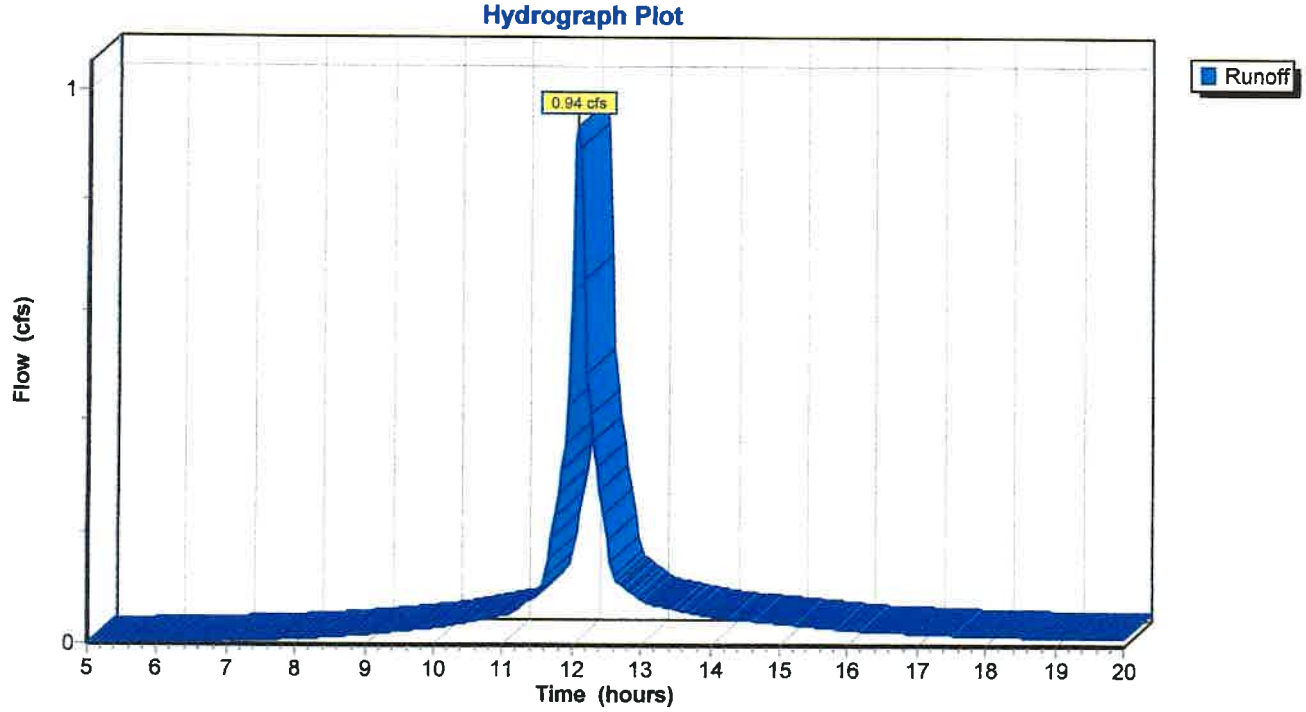
Runoff = 0.94 cfs @ 12.07 hrs, Volume= 0.064 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
1,631	98	Paved parking & roofs
373	90	Porch
3,386	74	>75% Grass cover, Good, HSG C
5,390	82	Weighted Average

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

Subcatchment A-4: Offsite to West



Subcatchment A-5: Offsite to South

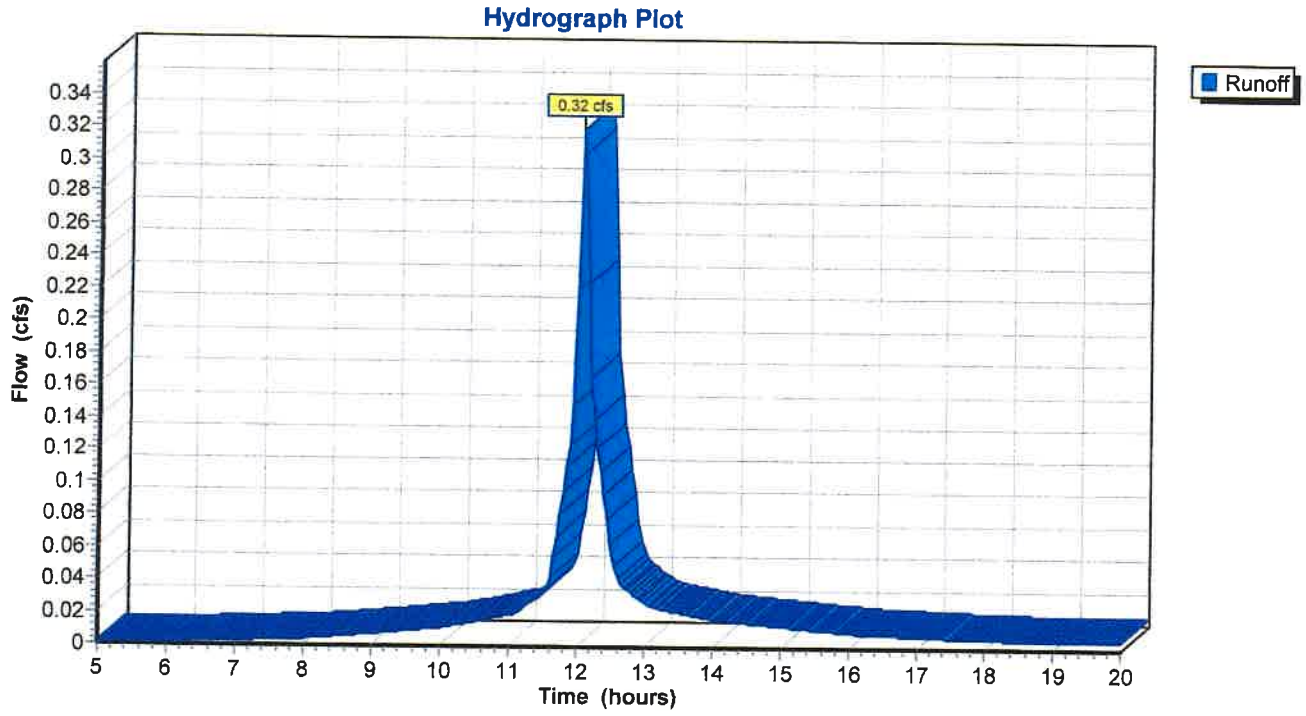
Runoff = 0.32 cfs @ 12.07 hrs, Volume= 0.022 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
790	98	Paved parking & roofs
985	74	>75% Grass cover, Good, HSG C
1,775	85	Weighted Average

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

Subcatchment A-5: Offsite to South

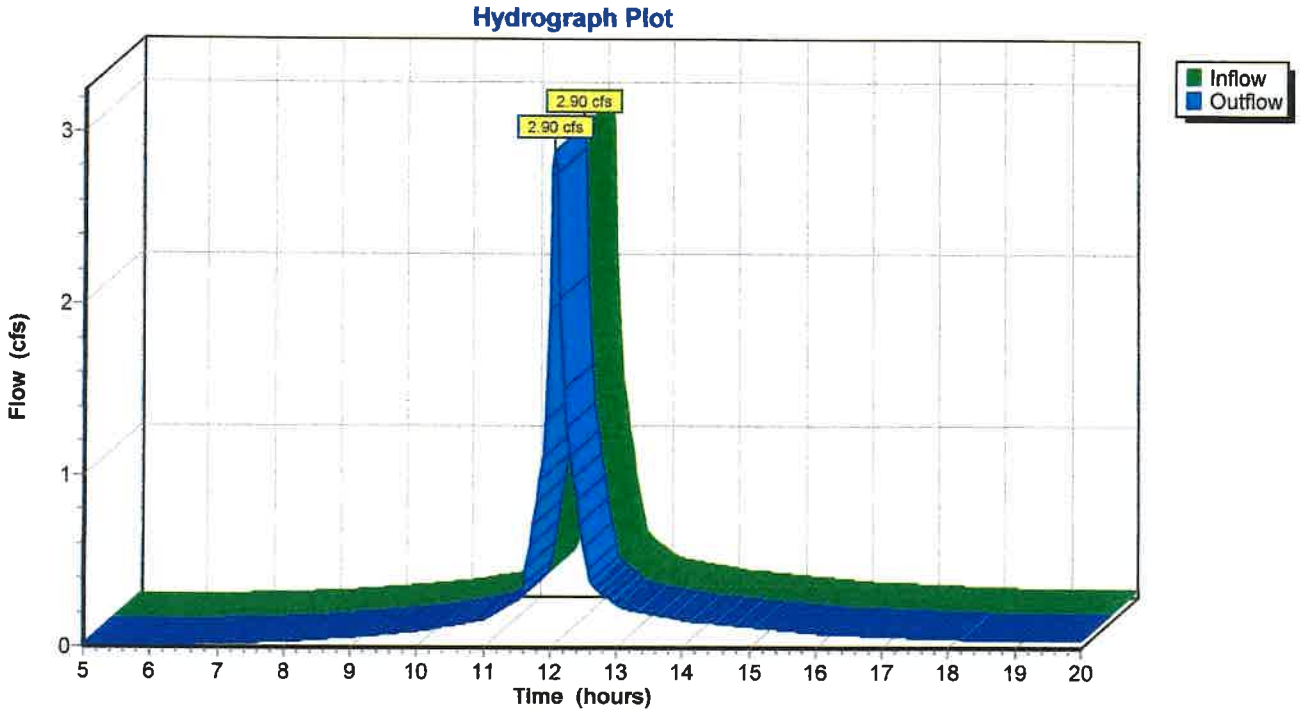


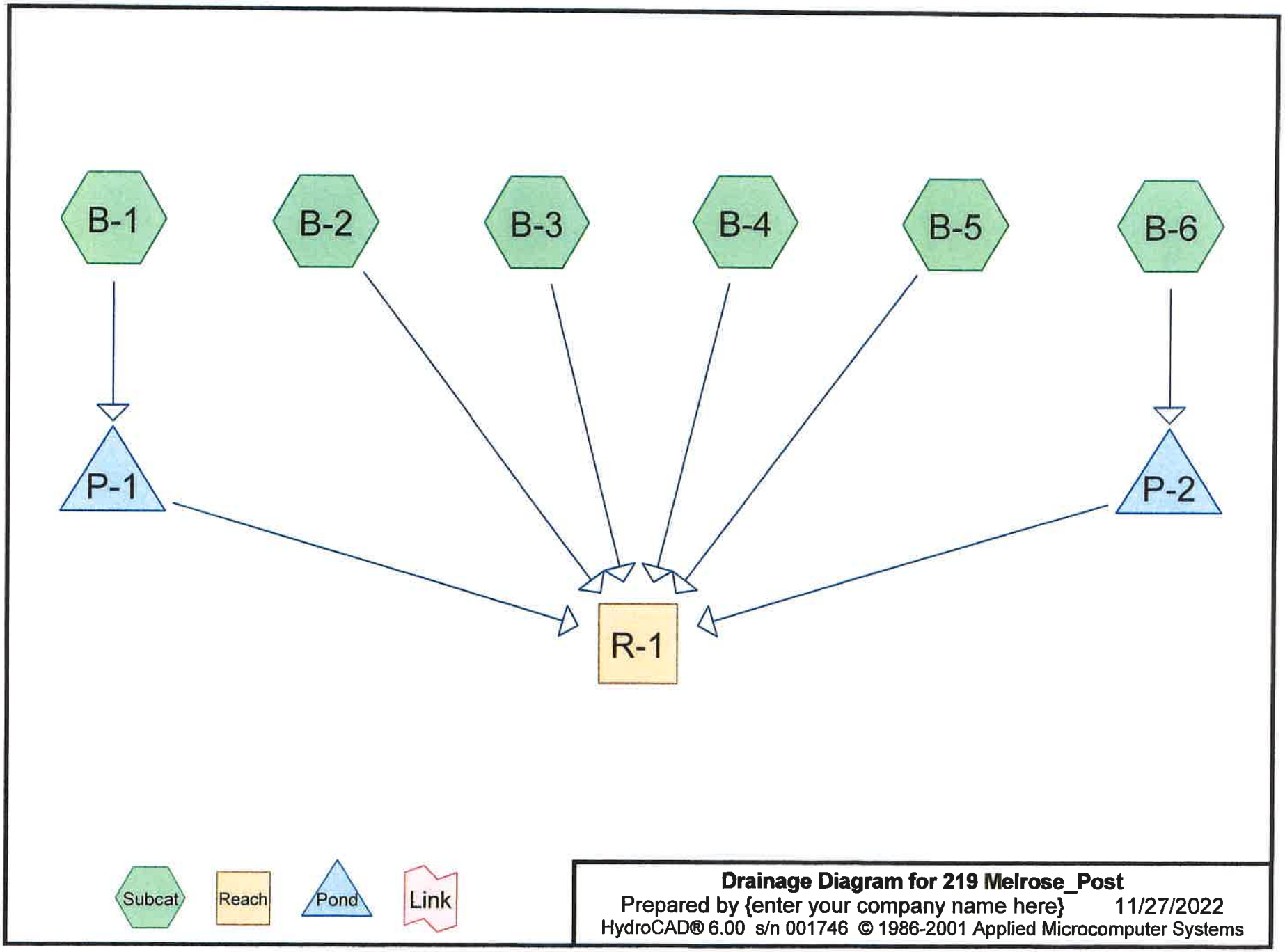
Reach R-1: Summary Node

Inflow = 2.90 cfs @ 12.07 hrs, Volume= 0.201 af
Outflow = 2.90 cfs @ 12.07 hrs, Volume= 0.201 af, Atten= 0%, Lag= 0.0 min

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

Reach R-1: Summary Node





Drainage Diagram for 219 Melrose_Post

Prepared by {enter your company name here} 11/27/2022

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=3.29"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment B-1: Tributary to Trench Drain
Tc=5.0 min CN=93 Area=2,506 sf Runoff= 0.17 cfs 0.011 af

Subcatchment B-2: Offsite to East
Tc=5.0 min CN=76 Area=1,936 sf Runoff= 0.06 cfs 0.004 af

Subcatchment B-3: Offsite to North
Tc=5.0 min CN=76 Area=3,968 sf Runoff= 0.13 cfs 0.008 af

Subcatchment B-4: Offsite to West
Tc=5.0 min CN=75 Area=3,228 sf Runoff= 0.10 cfs 0.007 af

Subcatchment B-5: Offsite to South
Tc=5.0 min CN=74 Area=1,963 sf Runoff= 0.06 cfs 0.004 af

Subcatchment B-6: Roof Area to Infiltration System
Tc=5.0 min CN=98 Area=3,375 sf Runoff= 0.25 cfs 0.018 af

Reach R-1: Summary Node
Inflow= 0.34 cfs 0.023 af
Outflow= 0.34 cfs 0.023 af

Pond P-1: Driveway Infiltration System Peak Storage= 234 cf Inflow= 0.17 cfs 0.011 af
Discarded= 0.01 cfs 0.009 af Primary= 0.00 cfs 0.000 af Outflow= 0.01 cfs 0.009 af

Pond P-2: roof Infiltration System Peak Storage= 434 cf Inflow= 0.25 cfs 0.018 af
Discarded= 0.01 cfs 0.010 af Primary= 0.00 cfs 0.000 af Outflow= 0.01 cfs 0.010 af

Runoff Area = 0.390 ac Volume = 0.053 af Average Depth = 1.63"

Subcatchment B-1: Tributary to Trench Drain

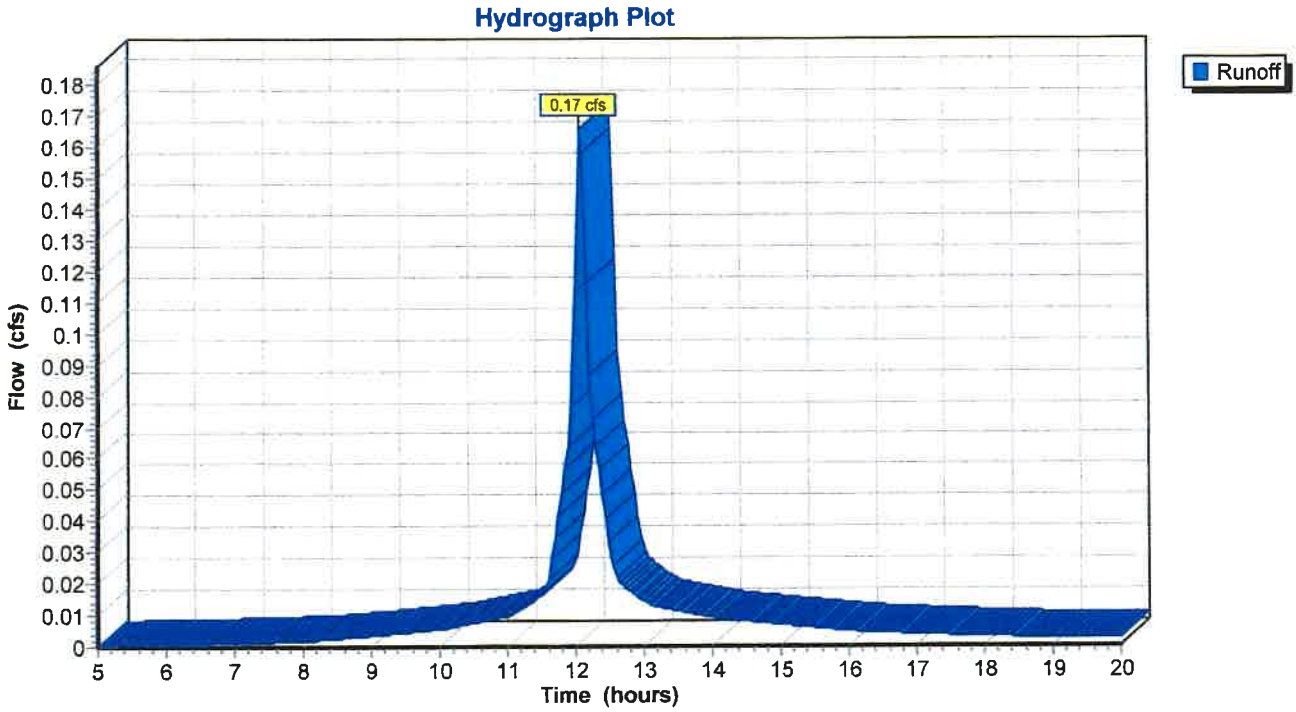
Runoff = 0.17 cfs @ 12.07 hrs, Volume= 0.011 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
1,954	98	Paved parking & roofs
552	74	>75% Grass cover, Good, HSG C
2,506	93	Weighted Average

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

Subcatchment B-1: Tributary to Trench Drain



Subcatchment B-2: Offsite to East

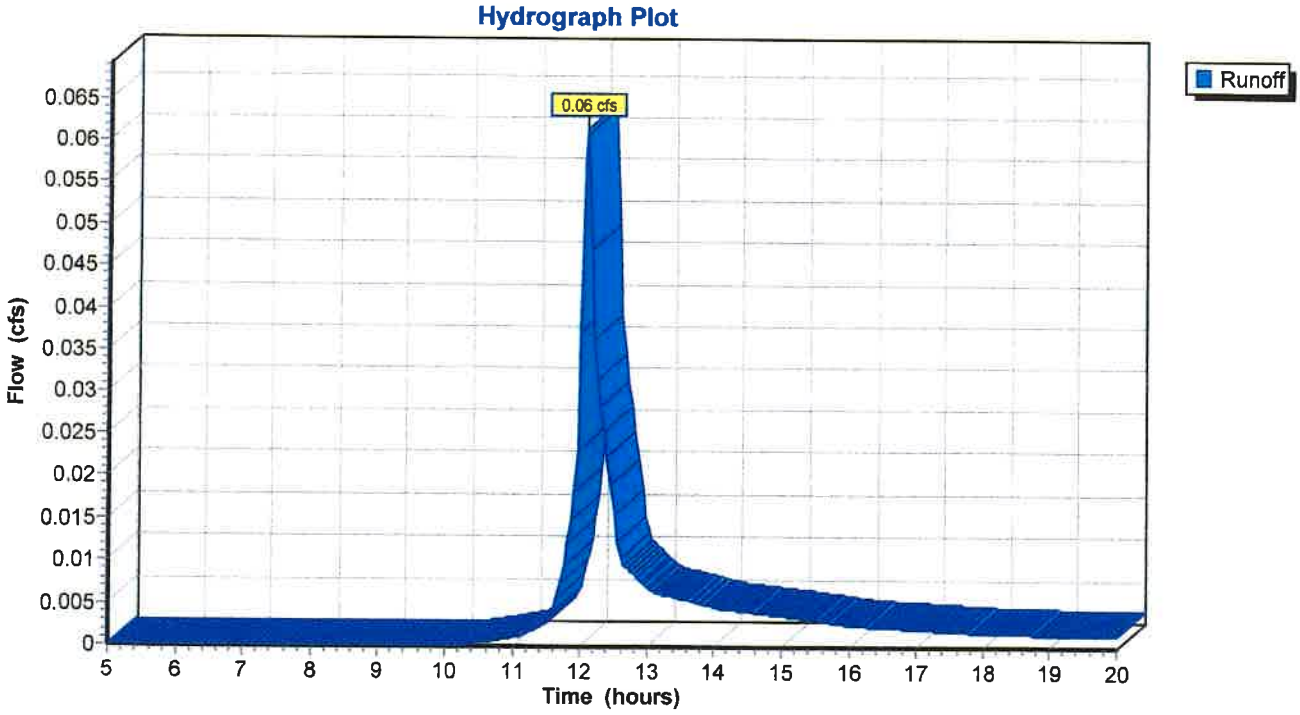
Runoff = 0.06 cfs @ 12.08 hrs, Volume= 0.004 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
148	98	Paved parking & roofs
55	90	Porch
1,733	74	>75% Grass cover, Good, HSG C
1,936	76	Weighted Average

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

Subcatchment B-2: Offsite to East



Subcatchment B-3: Offsite to North

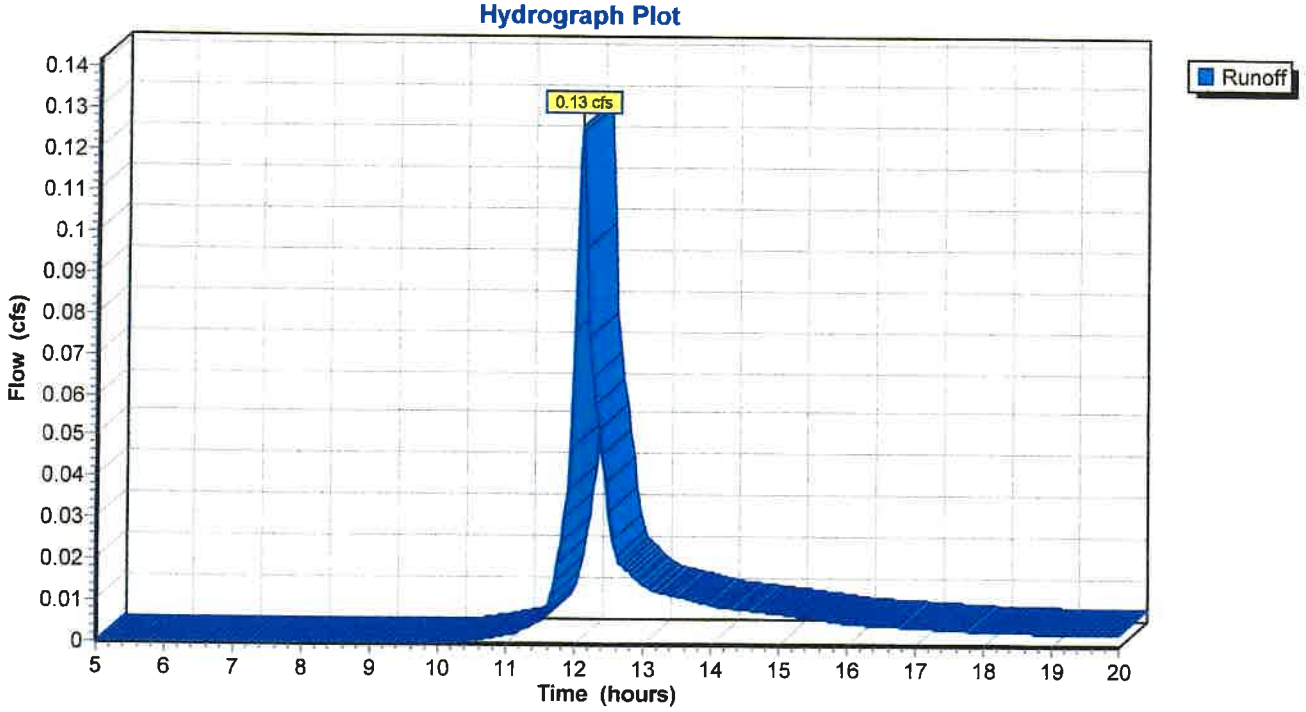
Runoff = 0.13 cfs @ 12.08 hrs, Volume= 0.008 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
168	98	Paved parking & roofs
223	90	Porch
3,577	74	>75% Grass cover, Good, HSG C
3,968	76	Weighted Average

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

Subcatchment B-3: Offsite to North



Subcatchment B-4: Offsite to West

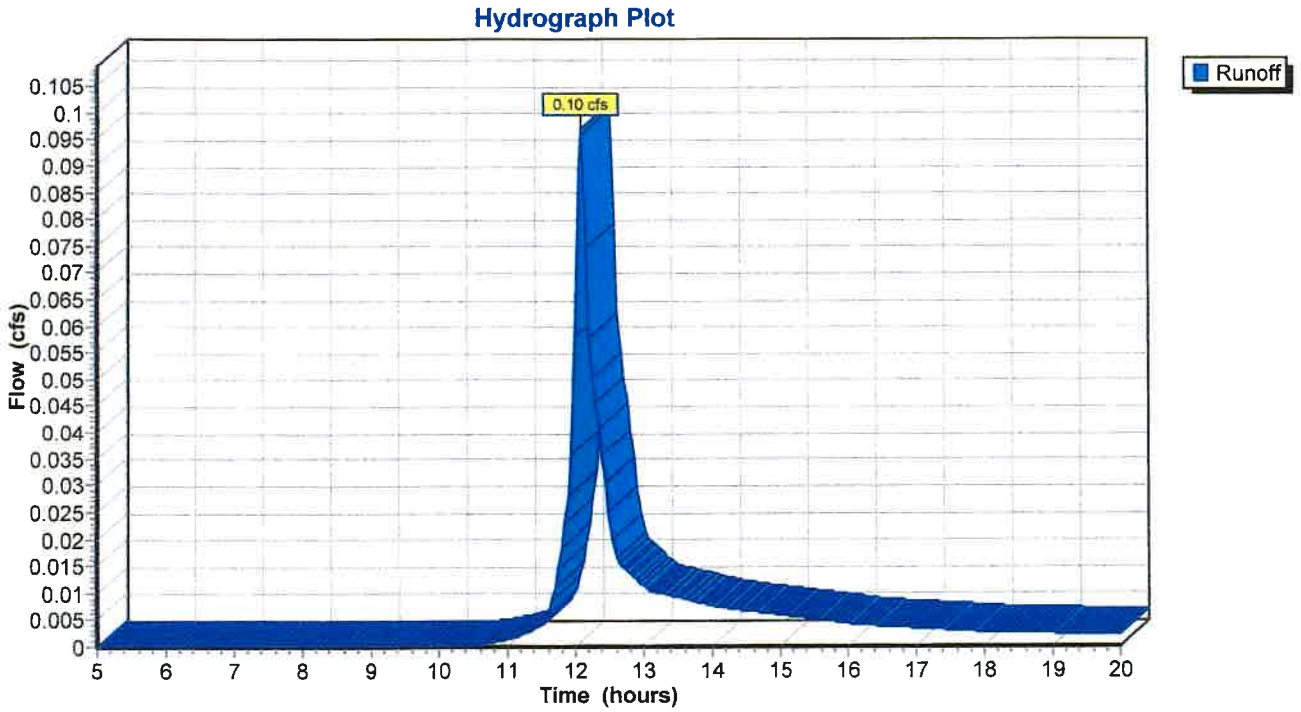
Runoff = 0.10 cfs @ 12.09 hrs, Volume= 0.007 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
223	90	Porch
3,005	74	>75% Grass cover, Good, HSG C
3,228	75	Weighted Average

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

Subcatchment B-4: Offsite to West



Subcatchment B-5: Offsite to South

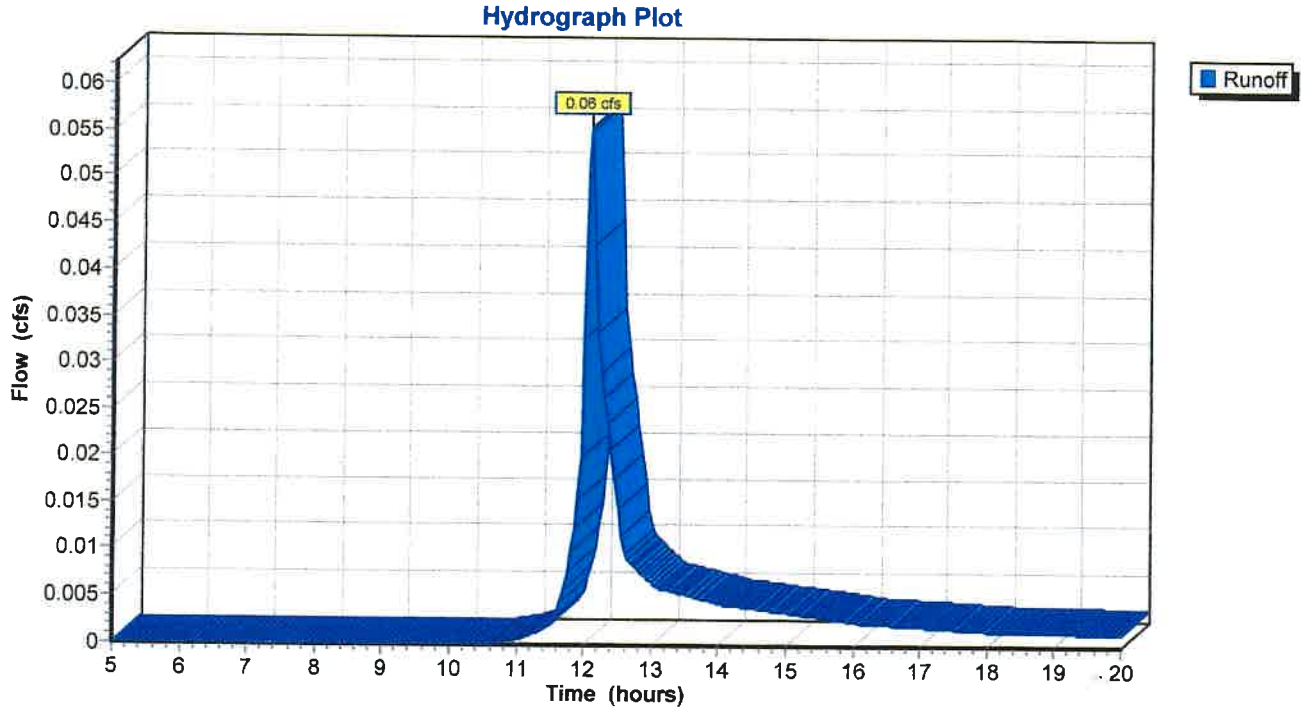
Runoff = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
19	90	Porch
1,944	74	>75% Grass cover, Good, HSG C
1,963	74	Weighted Average

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

Subcatchment B-5: Offsite to South



Subcatchment B-6: Roof Area to Infiltration System

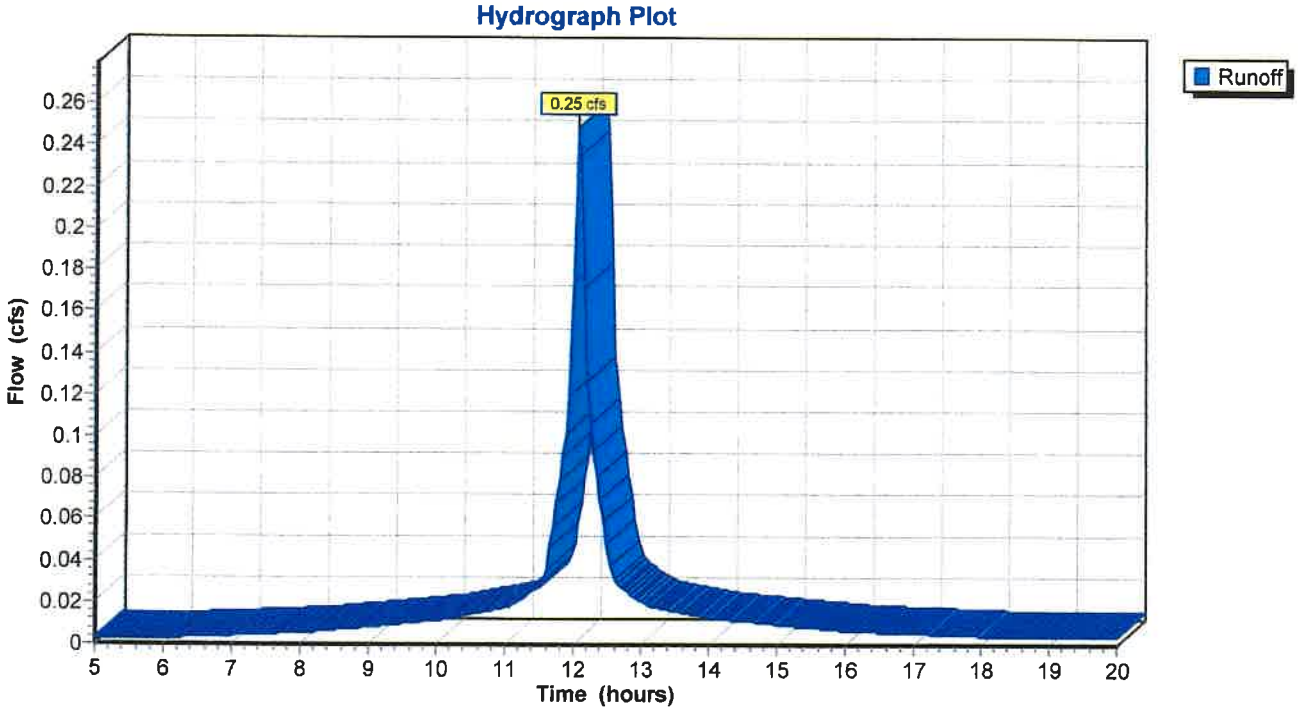
Runoff = 0.25 cfs @ 12.07 hrs, Volume= 0.018 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.29"

Area (sf)	CN	Description
3,375	98	Paved parking & roofs

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

Subcatchment B-6: Roof Area to Infiltration System

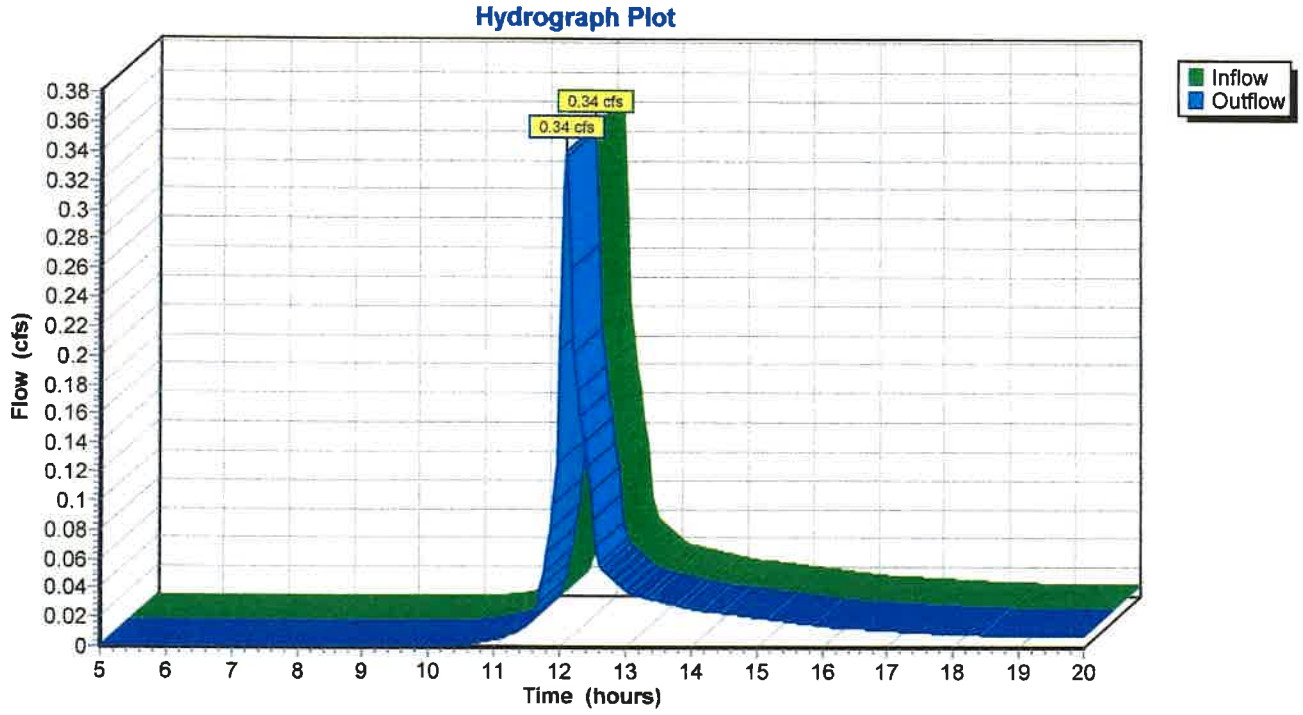


Reach R-1: Summary Node

Inflow = 0.34 cfs @ 12.09 hrs, Volume= 0.023 af
Outflow = 0.34 cfs @ 12.09 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min

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

Reach R-1: Summary Node



Pond P-1: Driveway Infiltration System

Inflow	=	0.17 cfs @	12.07 hrs, Volume=	0.011 af
Outflow	=	0.01 cfs @	11.15 hrs, Volume=	0.009 af, Atten= 94%, Lag= 0.0 min
Discarded	=	0.01 cfs @	11.15 hrs, Volume=	0.009 af
Primary	=	0.00 cfs @	5.00 hrs, Volume=	0.000 af

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

Peak Elev= 83.85' Storage= 234 cf
Plug-Flow detention time= 170.4 min calculated for 0.009 af (77% of inflow)

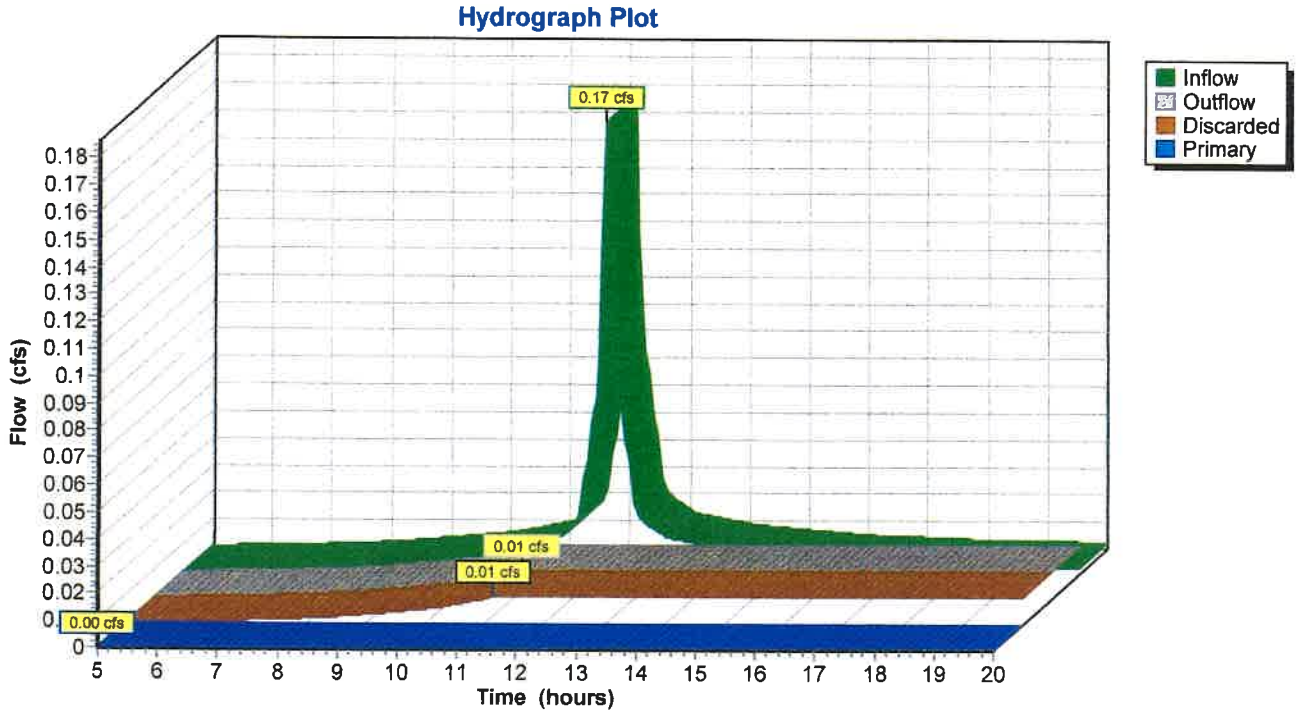
Elevation (feet)	Cum.Store (cubic-feet)
81.80	0
82.30	39
83.30	165
84.30	291
84.80	357
85.30	366
86.20	370

Discarded OutFlow (Free Discharge)
└2=Exfiltration

Primary OutFlow (Free Discharge)
└1=Broad-Crested Rectangular Weir

#	Routing	Invert	Outlet Devices
1	Primary	86.10'	**12.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
2	Discarded	81.80'	**0.01 cfs Exfiltration when above invert**

Pond P-1: Driveway Infiltration System



Pond P-2: roof Infiltration System

Inflow	=	0.25 cfs @	12.07 hrs, Volume=	0.018 af
Outflow	=	0.01 cfs @	9.75 hrs, Volume=	0.010 af, Atten= 96%, Lag= 0.0 min
Discarded	=	0.01 cfs @	9.75 hrs, Volume=	0.010 af
Primary	=	0.00 cfs @	5.00 hrs, Volume=	0.000 af

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

Peak Elev= 84.56' Storage= 434 cf
Plug-Flow detention time= 165.1 min calculated for 0.010 af (56% of inflow)

Elevation (feet)	Cum.Store (cubic-feet)
82.00	0
83.00	118
84.00	320
85.00	523
86.00	725
86.75	877
87.25	884
88.00	888
89.00	892

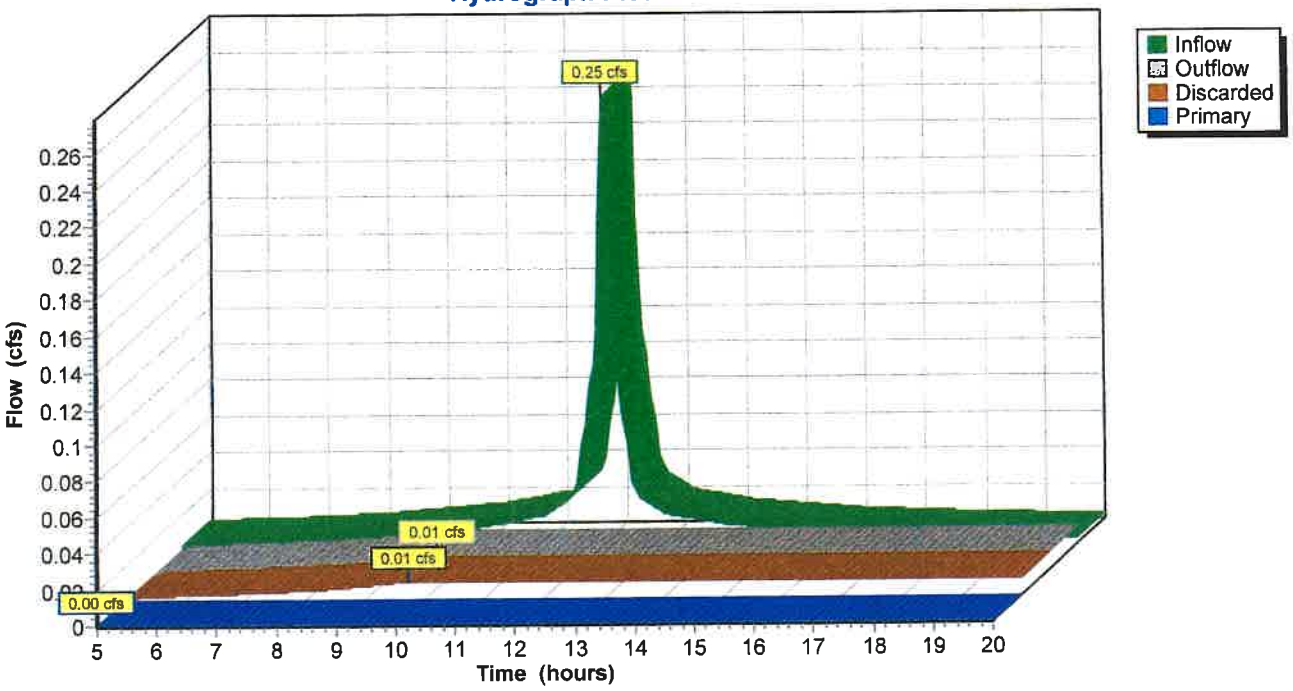
Discarded OutFlow (Free Discharge)
└2=Exfiltration

Primary OutFlow (Free Discharge)
└1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	88.50'	**4.0" Horiz. Orifice/Grate X 2.00** Limited to weir flow C= 0.600
2	Discarded	82.00'	**0.01 cfs Exfiltration when above invert**

Pond P-2: roof Infiltration System

Hydrograph Plot



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=5.17"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment B-1: Tributary to Trench Drain
Tc=5.0 min CN=93 Area=2,506 sf Runoff= 0.28 cfs 0.020 af

Subcatchment B-2: Offsite to East
Tc=5.0 min CN=76 Area=1,936 sf Runoff= 0.14 cfs 0.009 af

Subcatchment B-3: Offsite to North
Tc=5.0 min CN=76 Area=3,968 sf Runoff= 0.29 cfs 0.019 af

Subcatchment B-4: Offsite to West
Tc=5.0 min CN=75 Area=3,228 sf Runoff= 0.22 cfs 0.015 af

Subcatchment B-5: Offsite to South
Tc=5.0 min CN=74 Area=1,963 sf Runoff= 0.13 cfs 0.009 af

Subcatchment B-6: Roof Area to Infiltration System
Tc=5.0 min CN=98 Area=3,375 sf Runoff= 0.39 cfs 0.030 af

Reach R-1: Summary Node
Inflow= 0.78 cfs 0.054 af
Outflow= 0.78 cfs 0.054 af

Pond P-1: Driveway Infiltration System
Peak Storage= 370 cf Inflow= 0.28 cfs 0.020 af
Discarded= 0.01 cfs 0.010 af Primary= 0.09 cfs 0.003 af Outflow= 0.10 cfs 0.013 af

Pond P-2: roof Infiltration System
Peak Storage= 830 cf Inflow= 0.39 cfs 0.030 af
Discarded= 0.01 cfs 0.011 af Primary= 0.00 cfs 0.000 af Outflow= 0.01 cfs 0.011 af

Runoff Area = 0.390 ac Volume = 0.101 af Average Depth = 3.11"

Subcatchment B-1: Tributary to Trench Drain

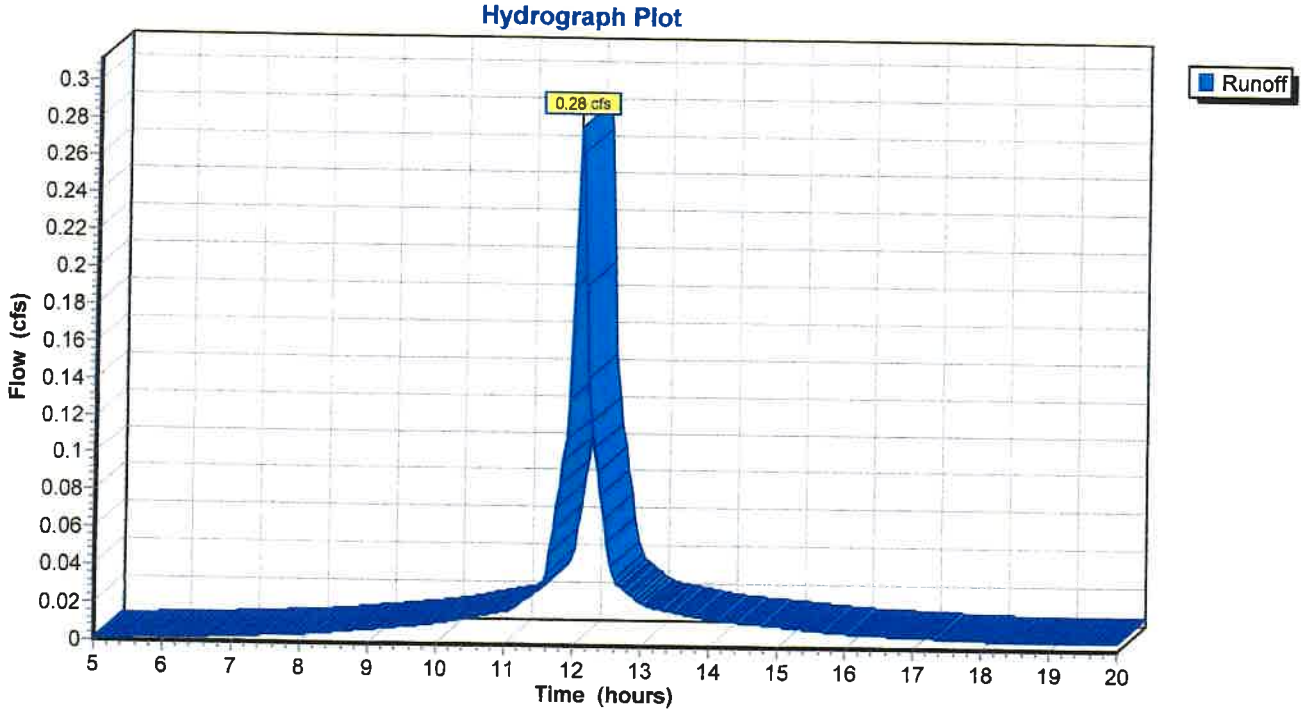
Runoff = 0.28 cfs @ 12.07 hrs, Volume= 0.020 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
1,954	98	Paved parking & roofs
552	74	>75% Grass cover, Good, HSG C
2,506	93	Weighted Average

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

Subcatchment B-1: Tributary to Trench Drain



Subcatchment B-2: Offsite to East

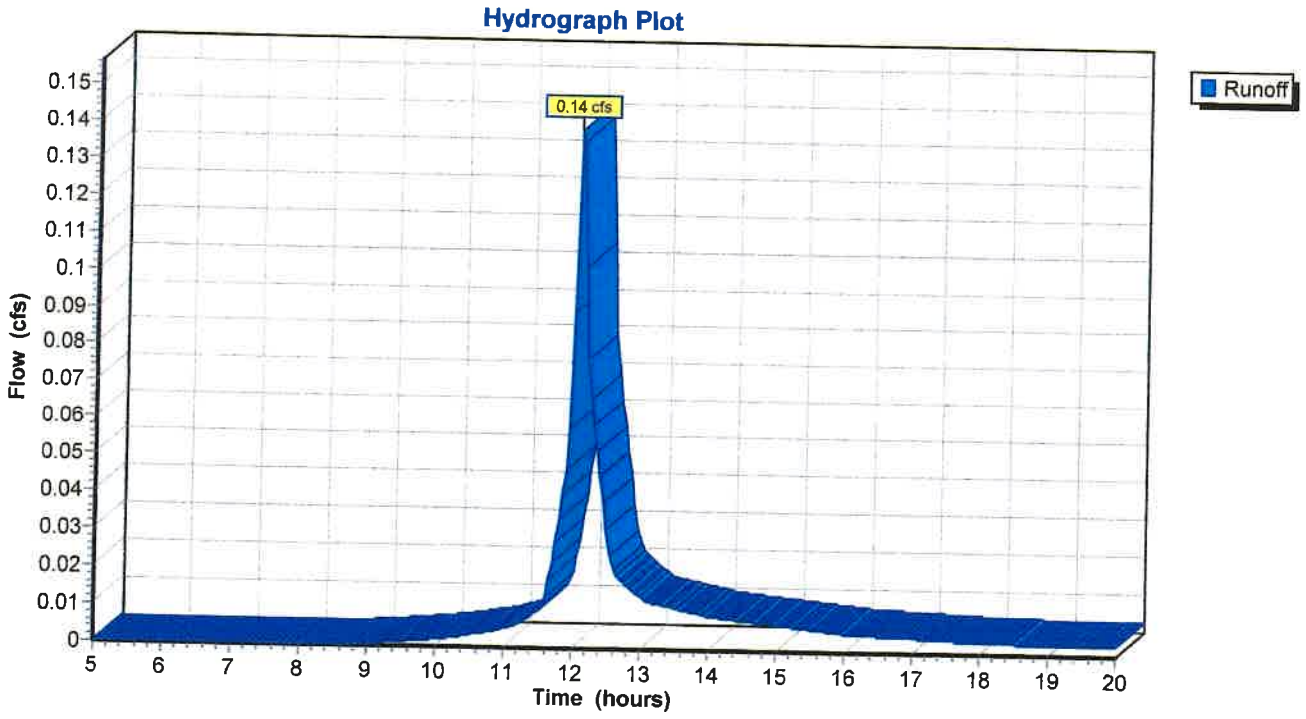
Runoff = 0.14 cfs @ 12.08 hrs, Volume= 0.009 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
148	98	Paved parking & roofs
55	90	Porch
1,733	74	>75% Grass cover, Good, HSG C
1,936	76	Weighted Average

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

Subcatchment B-2: Offsite to East



Subcatchment B-3: Offsite to North

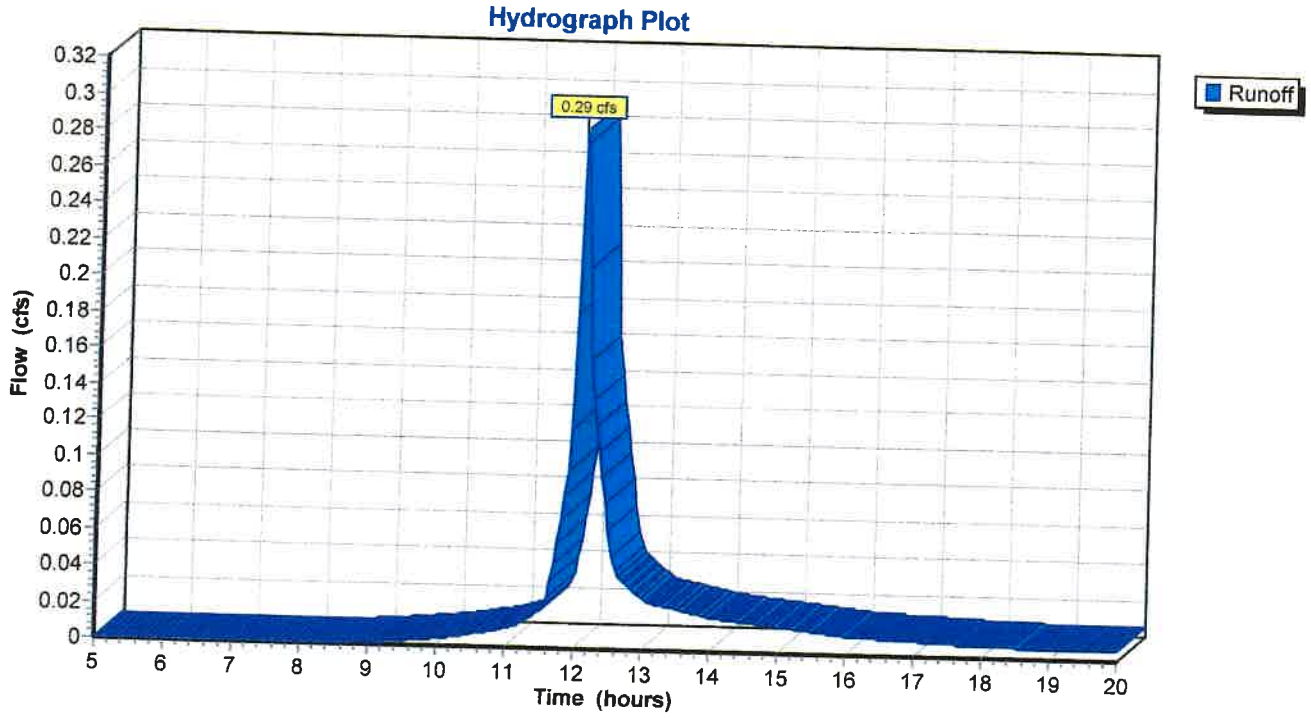
Runoff = 0.29 cfs @ 12.08 hrs, Volume= 0.019 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
168	98	Paved parking & roofs
223	90	Porch
3,577	74	>75% Grass cover, Good, HSG C
3,968	76	Weighted Average

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

Subcatchment B-3: Offsite to North



Subcatchment B-4: Offsite to West

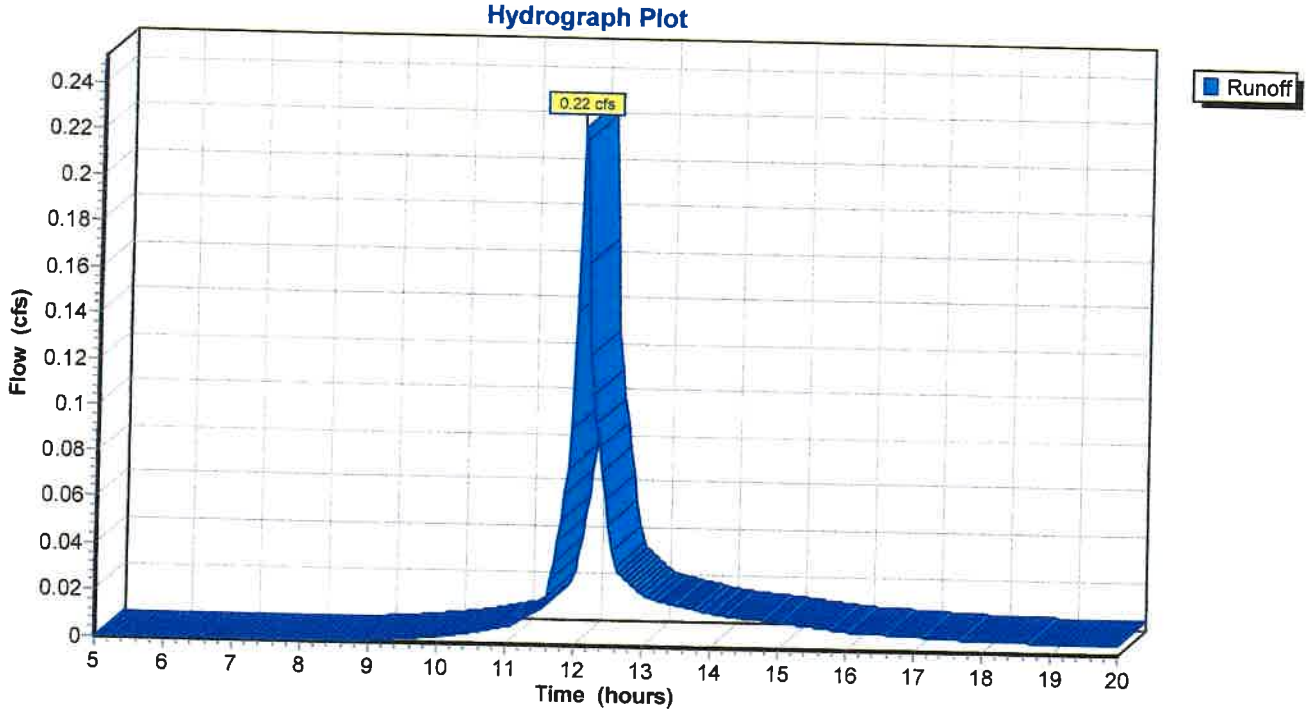
Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.015 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
223	90	Porch
3,005	74	>75% Grass cover, Good, HSG C
3,228	75	Weighted Average

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

Subcatchment B-4: Offsite to West



Subcatchment B-5: Offsite to South

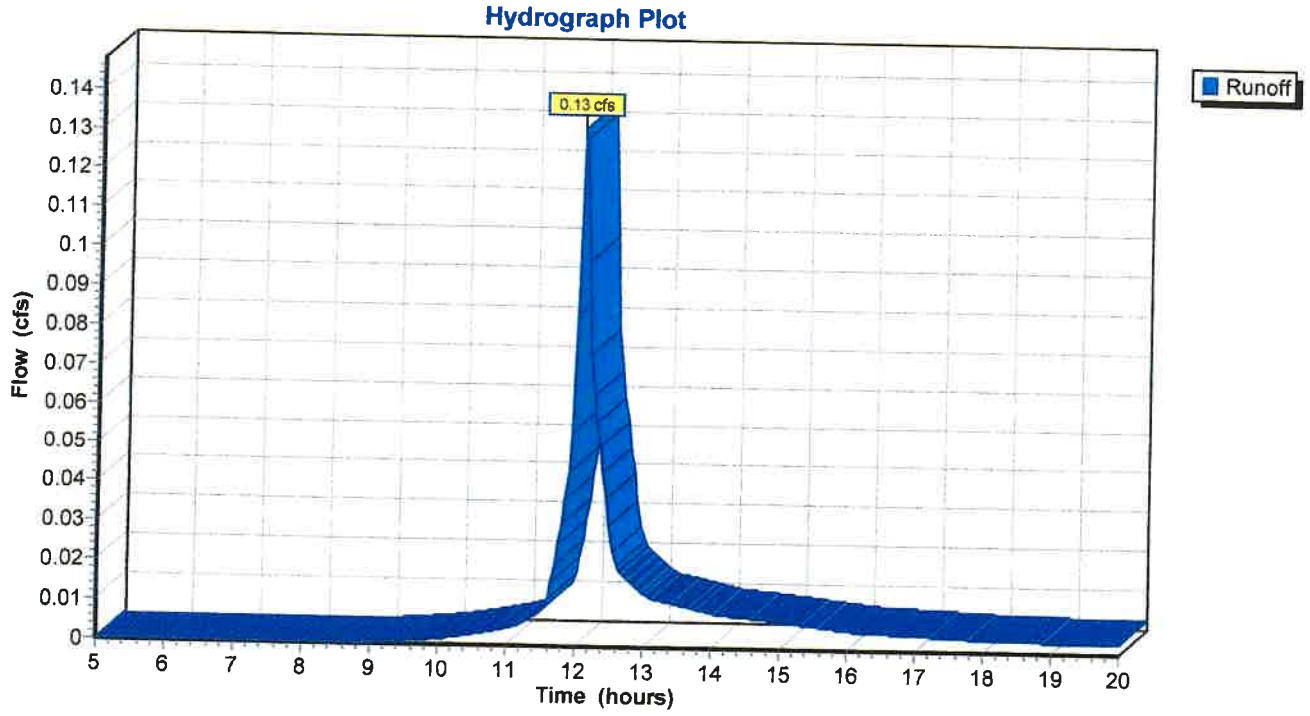
Runoff = 0.13 cfs @ 12.08 hrs, Volume= 0.009 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
19	90	Porch
1,944	74	>75% Grass cover, Good, HSG C
1,963	74	Weighted Average

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

Subcatchment B-5: Offsite to South



Subcatchment B-6: Roof Area to Infiltration System

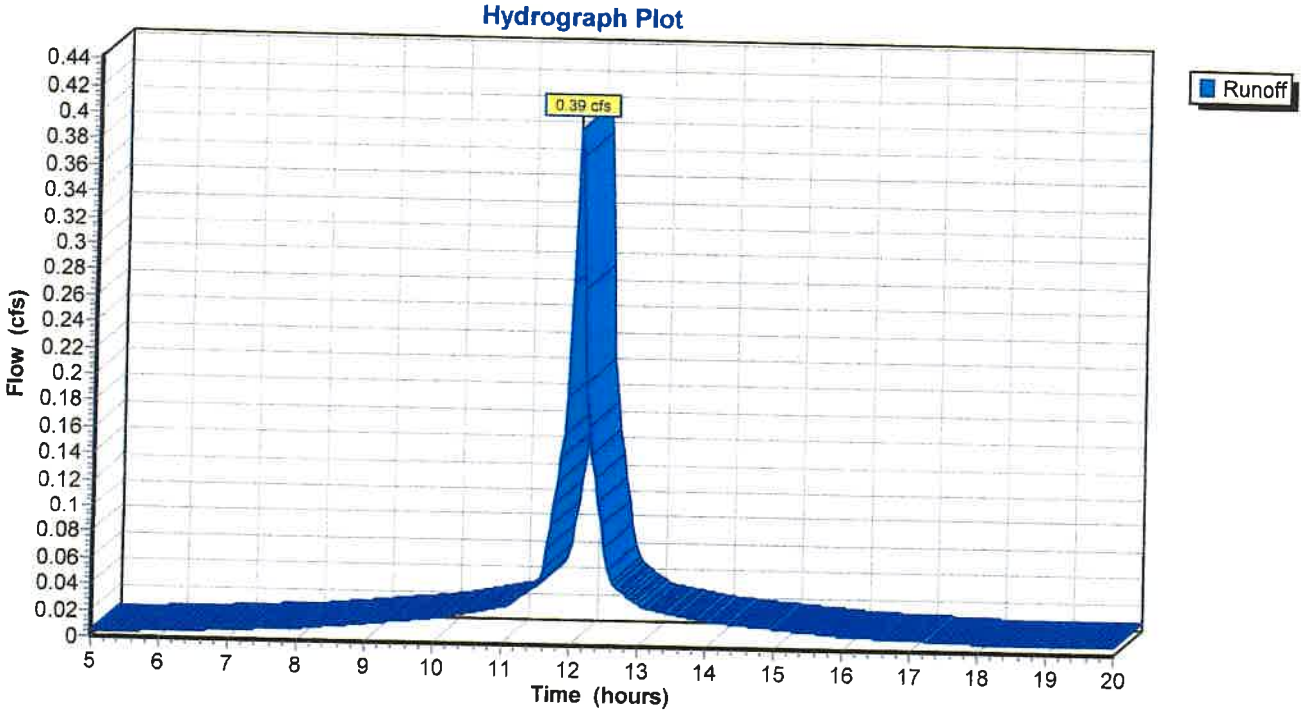
Runoff = 0.39 cfs @ 12.07 hrs, Volume= 0.030 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.17"

Area (sf)	CN	Description
3,375	98	Paved parking & roofs

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

Subcatchment B-6: Roof Area to Infiltration System

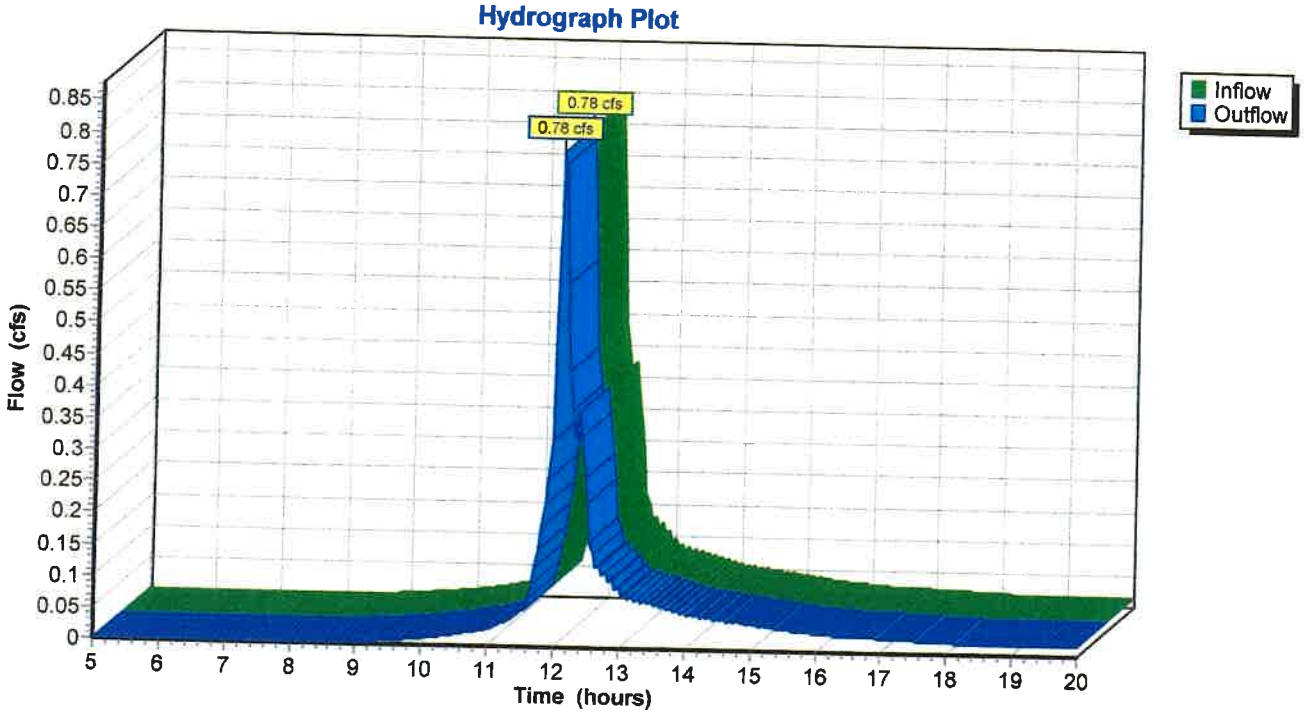


Reach R-1: Summary Node

Inflow = 0.78 cfs @ 12.08 hrs, Volume= 0.054 af
Outflow = 0.78 cfs @ 12.08 hrs, Volume= 0.054 af, Atten= 0%, Lag= 0.0 min

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

Reach R-1: Summary Node



Pond P-1: Driveway Infiltration System

Inflow	=	0.28 cfs @	12.07 hrs, Volume=	0.020 af	
Outflow	=	0.10 cfs @	12.37 hrs, Volume=	0.013 af,	Atten= 66%, Lag= 18.2 min
Discarded	=	0.01 cfs @	9.85 hrs, Volume=	0.010 af	
Primary	=	0.09 cfs @	12.37 hrs, Volume=	0.003 af	

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

Peak Elev= 86.12' Storage= 370 cf
Plug-Flow detention time= 139.8 min calculated for 0.013 af (65% of inflow)

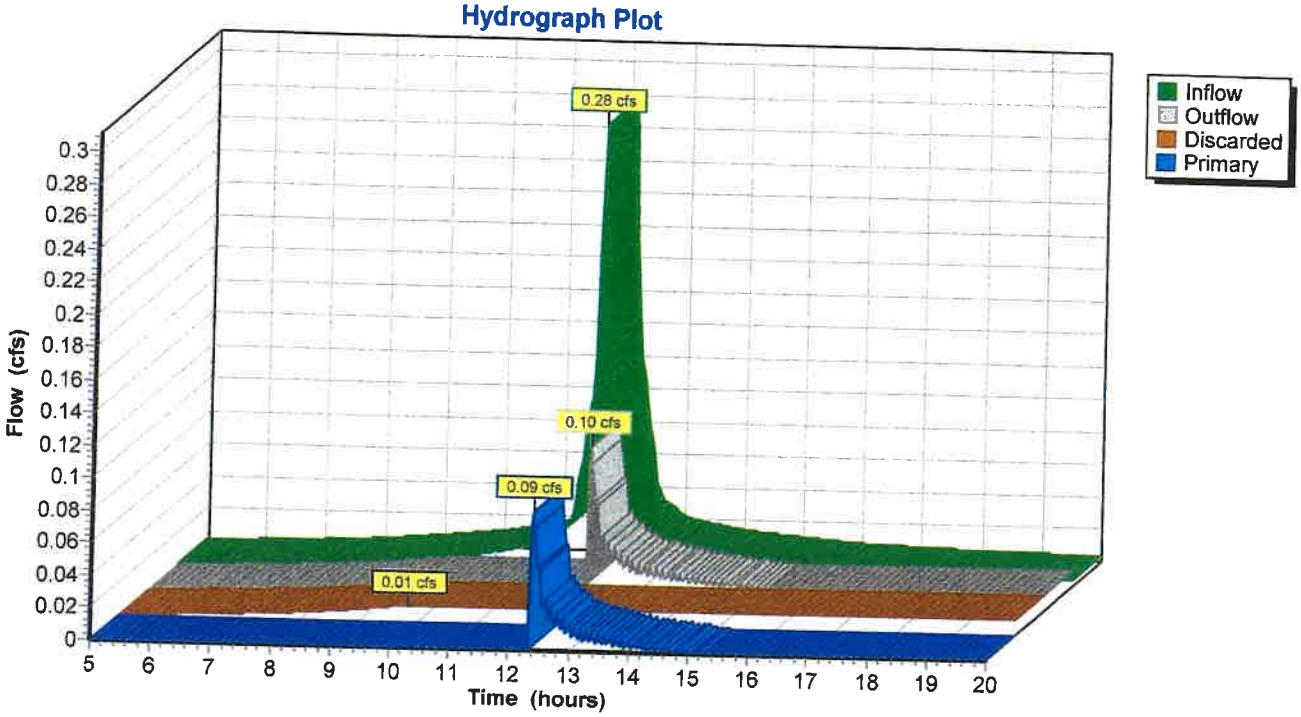
Elevation (feet)	Cum.Store (cubic-feet)
81.80	0
82.30	39
83.30	165
84.30	291
84.80	357
85.30	366
86.20	370

Discarded OutFlow (Free Discharge)
└2=Exfiltration

Primary OutFlow (Free Discharge)
└1=Broad-Crested Rectangular Weir

#	Routing	Invert	Outlet Devices
1	Primary	86.10'	**12.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
2	Discarded	81.80'	**0.01 cfs Exfiltration when above invert**

Pond P-1: Driveway Infiltration System



Pond P-2: roof Infiltration System

Inflow	=	0.39 cfs @	12.07 hrs,	Volume=	0.030 af
Outflow	=	0.01 cfs @	8.35 hrs,	Volume=	0.011 af, Atten= 97%, Lag= 0.0 min
Discarded	=	0.01 cfs @	8.35 hrs,	Volume=	0.011 af
Primary	=	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

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

Peak Elev= 86.52' Storage= 830 cf
Plug-Flow detention time= 171.6 min calculated for 0.011 af (39% of inflow)

Elevation (feet)	Cum.Store (cubic-feet)
82.00	0
83.00	118
84.00	320
85.00	523
86.00	725
86.75	877
87.25	884
88.00	888
89.00	892

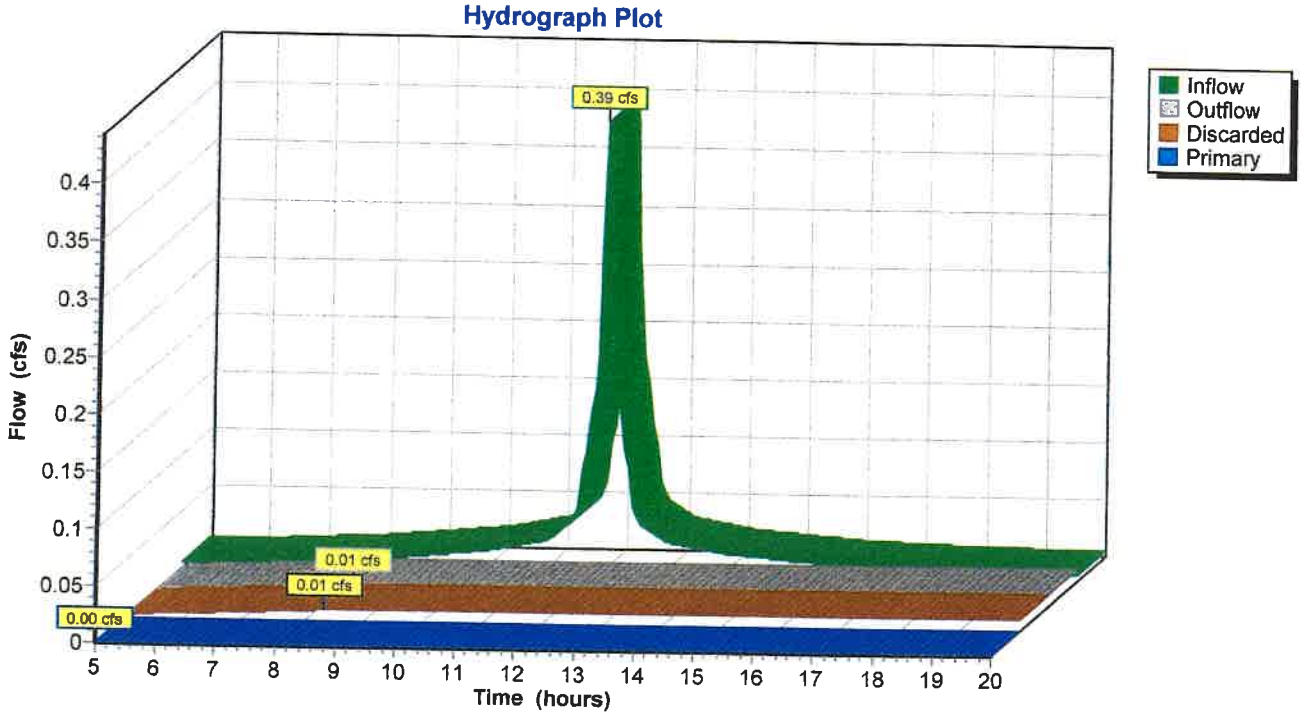
Discarded OutFlow (Free Discharge)
└2=Exfiltration

Primary OutFlow (Free Discharge)
└1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	88.50'	**4.0" Horiz. Orifice/Grate X 2.00** Limited to weir flow C= 0.600
2	Discarded	82.00'	**0.01 cfs Exfiltration when above invert**

Pond P-2: roof Infiltration System

Hydrograph Plot



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=6.35"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment B-1: Tributary to Trench Drain
Tc=5.0 min CN=93 Area=2,506 sf Runoff= 0.35 cfs 0.025 af

Subcatchment B-2: Offsite to East
Tc=5.0 min CN=76 Area=1,936 sf Runoff= 0.19 cfs 0.013 af

Subcatchment B-3: Offsite to North
Tc=5.0 min CN=76 Area=3,968 sf Runoff= 0.39 cfs 0.026 af

Subcatchment B-4: Offsite to West
Tc=5.0 min CN=75 Area=3,228 sf Runoff= 0.31 cfs 0.021 af

Subcatchment B-5: Offsite to South
Tc=5.0 min CN=74 Area=1,963 sf Runoff= 0.18 cfs 0.012 af

Subcatchment B-6: Roof Area to Infiltration System
Tc=5.0 min CN=98 Area=3,375 sf Runoff= 0.49 cfs 0.036 af

Reach R-1: Summary Node
Inflow= 1.12 cfs 0.083 af
Outflow= 1.12 cfs 0.083 af

Pond P-1: Driveway Infiltration System Peak Storage= 370 cf Inflow= 0.35 cfs 0.025 af
Discarded= 0.01 cfs 0.011 af Primary= 0.30 cfs 0.007 af Outflow= 0.31 cfs 0.018 af

Pond P-2: roof Infiltration System Peak Storage= 890 cf Inflow= 0.49 cfs 0.036 af
Discarded= 0.01 cfs 0.012 af Primary= 0.07 cfs 0.005 af Outflow= 0.08 cfs 0.017 af

Runoff Area = 0.390 ac Volume = 0.133 af Average Depth = 4.10"

Subcatchment B-1: Tributary to Trench Drain

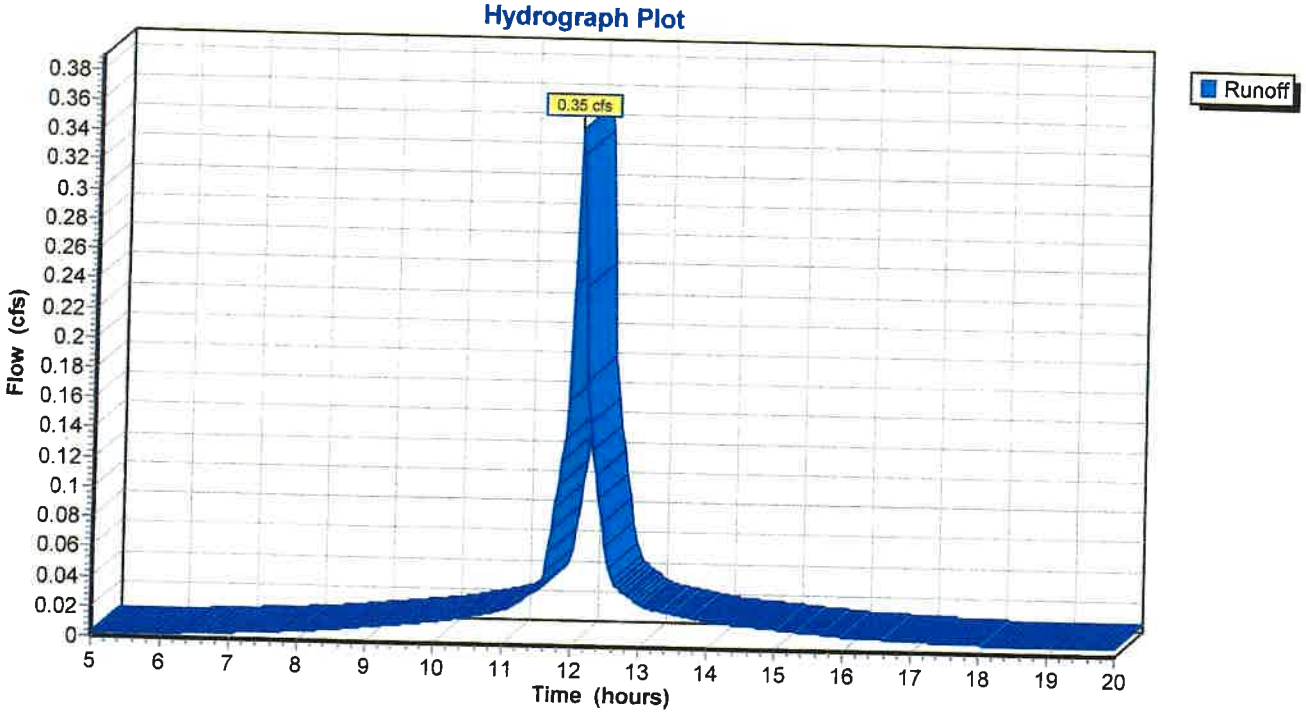
Runoff = 0.35 cfs @ 12.07 hrs, Volume= 0.025 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
1,954	98	Paved parking & roofs
552	74	>75% Grass cover, Good, HSG C
2,506	93	Weighted Average

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

Subcatchment B-1: Tributary to Trench Drain



Subcatchment B-2: Offsite to East

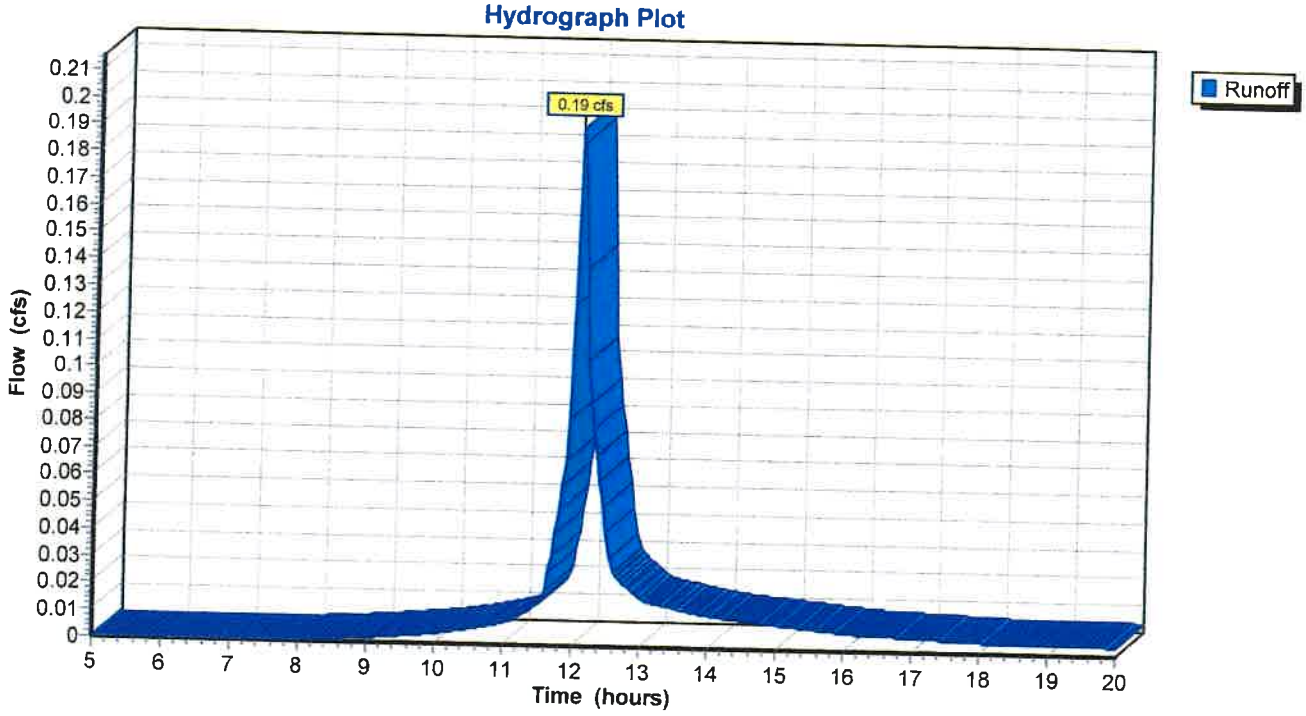
Runoff = 0.19 cfs @ 12.08 hrs, Volume= 0.013 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
148	98	Paved parking & roofs
55	90	Porch
1,733	74	>75% Grass cover, Good, HSG C
1,936	76	Weighted Average

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

Subcatchment B-2: Offsite to East



Subcatchment B-3: Offsite to North

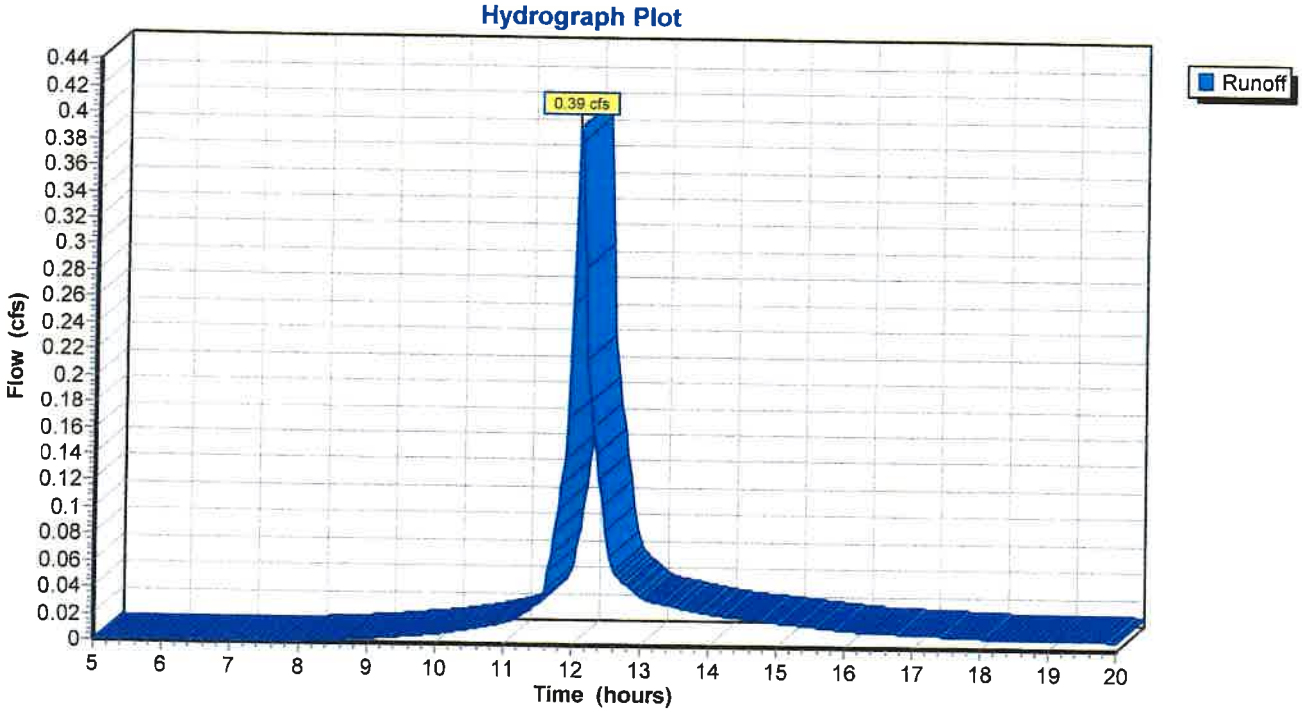
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.026 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
168	98	Paved parking & roofs
223	90	Porch
3,577	74	>75% Grass cover, Good, HSG C
3,968	76	Weighted Average

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

Subcatchment B-3: Offsite to North



Subcatchment B-4: Offsite to West

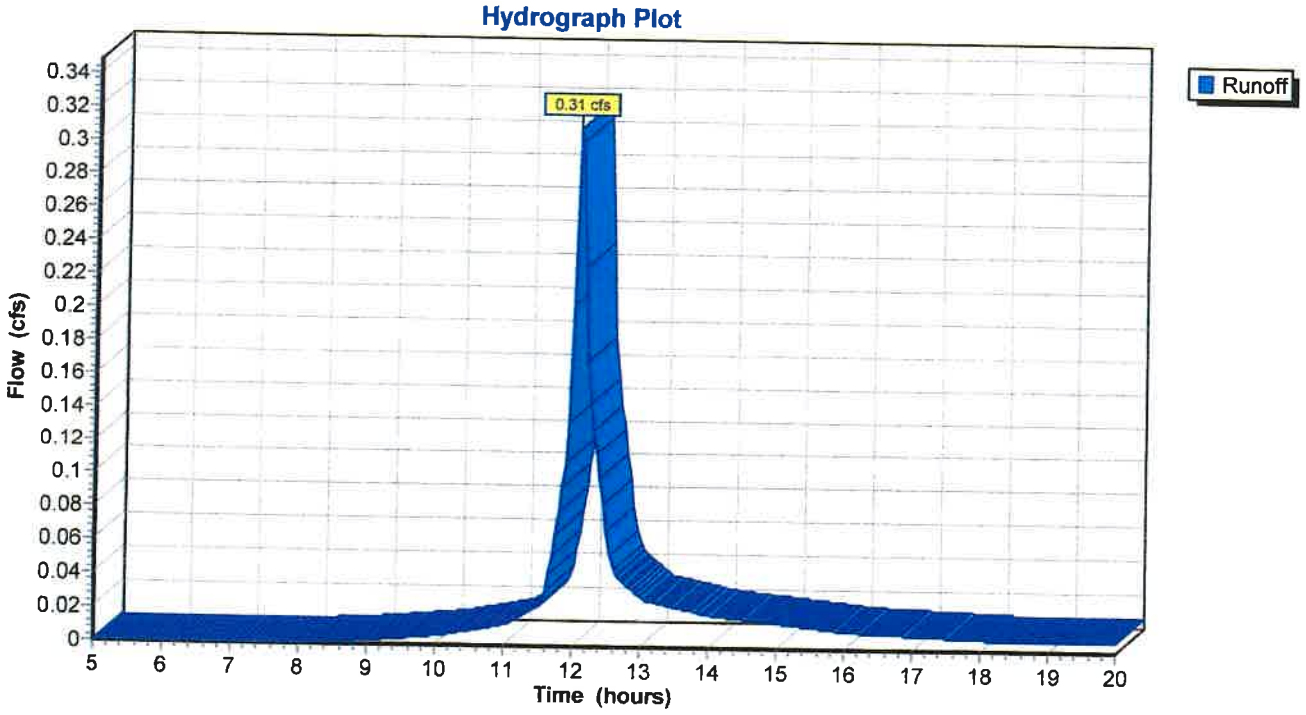
Runoff = 0.31 cfs @ 12.08 hrs, Volume= 0.021 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
223	90	Porch
3,005	74	>75% Grass cover, Good, HSG C
3,228	75	Weighted Average

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

Subcatchment B-4: Offsite to West



Subcatchment B-5: Offsite to South

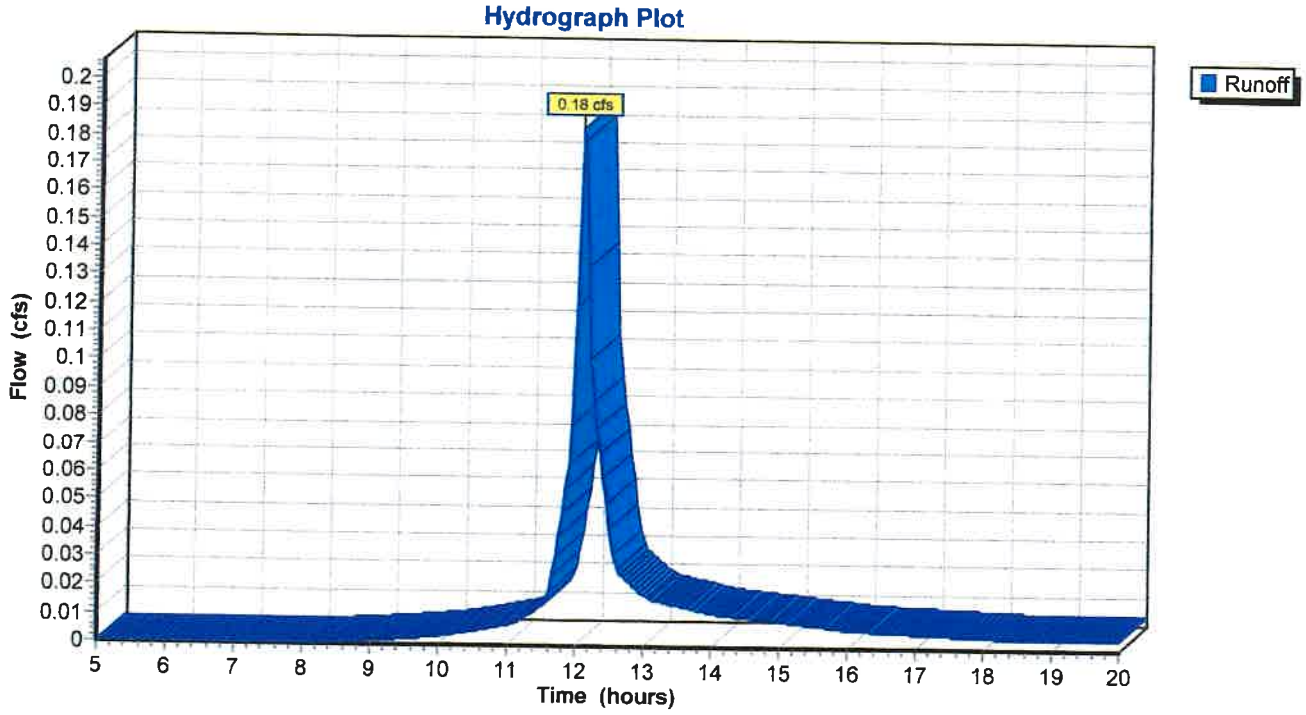
Runoff = 0.18 cfs @ 12.08 hrs, Volume= 0.012 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
19	90	Porch
1,944	74	>75% Grass cover, Good, HSG C
1,963	74	Weighted Average

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

Subcatchment B-5: Offsite to South



Subcatchment B-6: Roof Area to Infiltration System

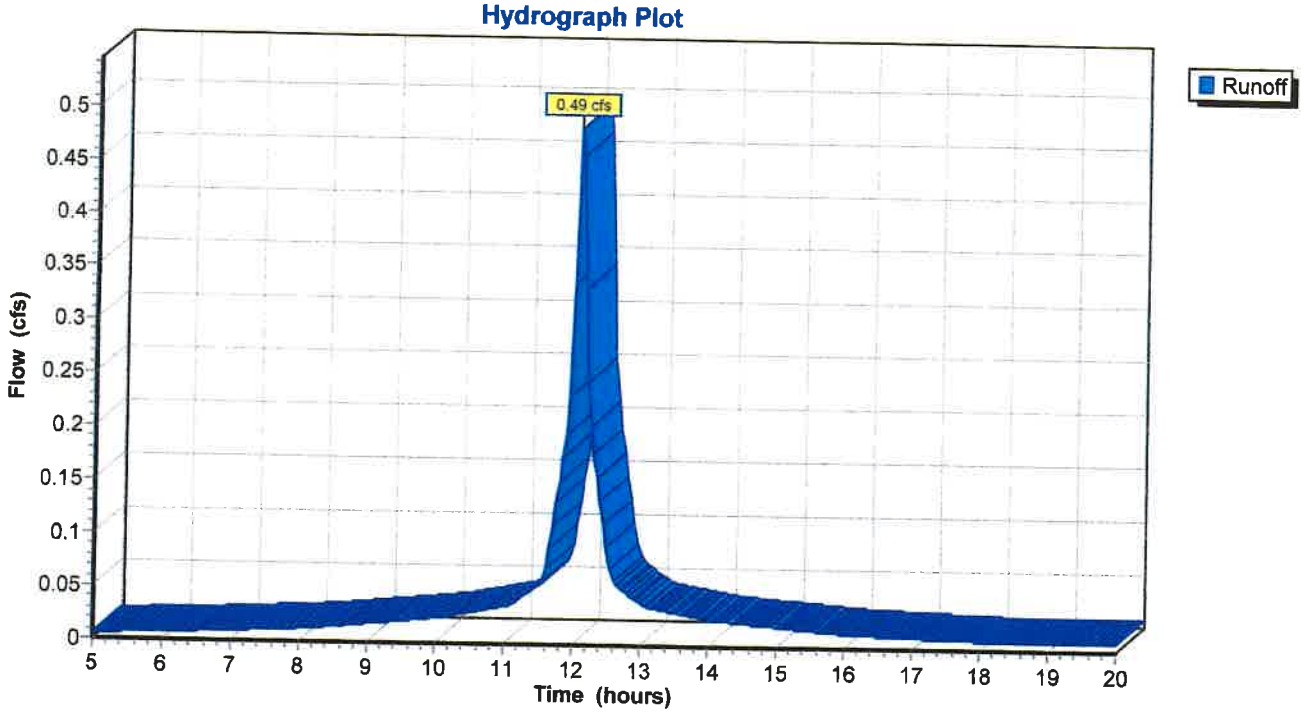
Runoff = 0.49 cfs @ 12.07 hrs, Volume= 0.036 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=6.35"

Area (sf)	CN	Description
3,375	98	Paved parking & roofs

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

Subcatchment B-6: Roof Area to Infiltration System

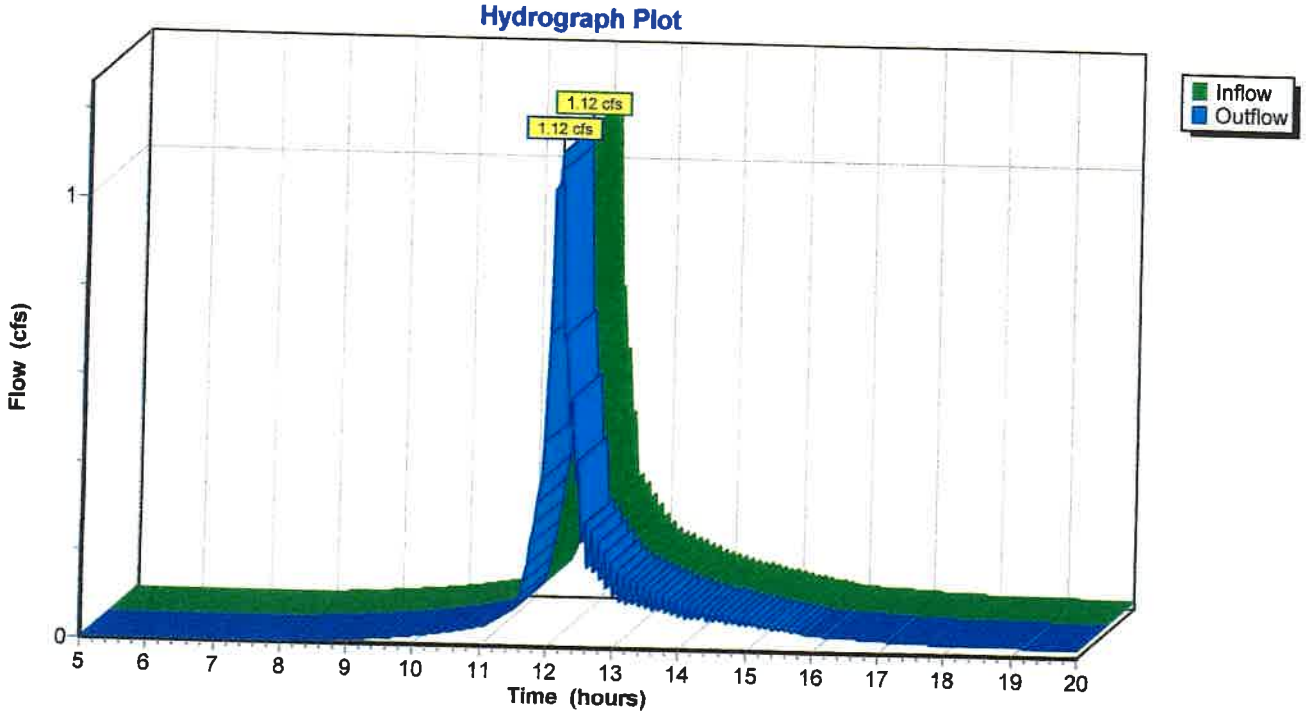


Reach R-1: Summary Node

Inflow = 1.12 cfs @ 12.13 hrs, Volume= 0.083 af
Outflow = 1.12 cfs @ 12.13 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min

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

Reach R-1: Summary Node



Pond P-1: Driveway Infiltration System

Inflow	=	0.35 cfs @	12.07 hrs, Volume=	0.025 af	
Outflow	=	0.31 cfs @	12.16 hrs, Volume=	0.018 af,	Atten= 11%, Lag= 5.0 min
Discarded	=	0.01 cfs @	9.10 hrs, Volume=	0.011 af	
Primary	=	0.30 cfs @	12.16 hrs, Volume=	0.007 af	

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

Peak Elev= 86.14' Storage= 370 cf
Plug-Flow detention time= 111.5 min calculated for 0.018 af (70% of inflow)

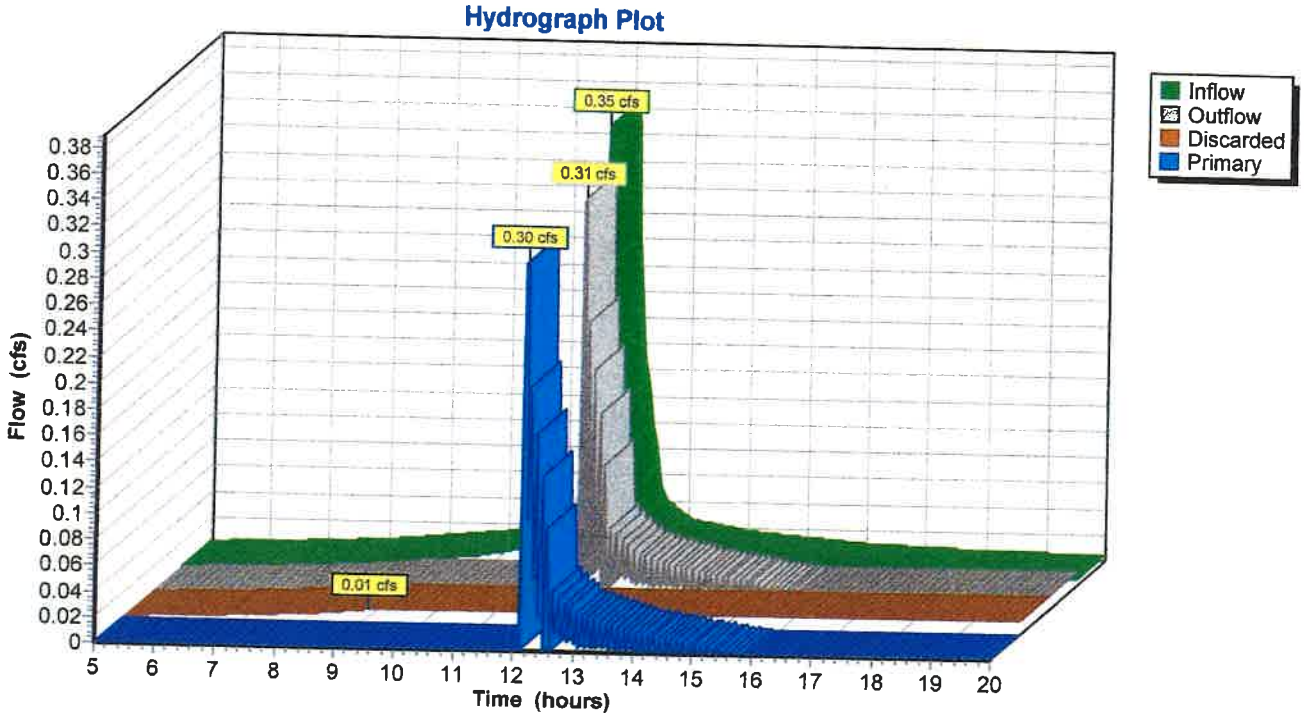
Elevation (feet)	Cum.Store (cubic-feet)
81.80	0
82.30	39
83.30	165
84.30	291
84.80	357
85.30	366
86.20	370

Discarded OutFlow (Free Discharge)
└2=Exfiltration

Primary OutFlow (Free Discharge)
└1=Broad-Crested Rectangular Weir

#	Routing	Invert	Outlet Devices
1	Primary	86.10'	**12.0' long x 1.0' 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
			Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
2	Discarded	81.80'	**0.01 cfs Exfiltration when above invert**

Pond P-1: Driveway Infiltration System



Pond P-2: roof Infiltration System

Inflow	=	0.49 cfs @	12.07 hrs, Volume=	0.036 af	
Outflow	=	0.08 cfs @	12.65 hrs, Volume=	0.017 af,	Atten= 83%, Lag= 34.7 min
Discarded	=	0.01 cfs @	7.50 hrs, Volume=	0.012 af	
Primary	=	0.07 cfs @	12.65 hrs, Volume=	0.005 af	

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

Peak Elev= 88.54' Storage= 890 cf
Plug-Flow detention time= 159.3 min calculated for 0.016 af (45% of inflow)

Elevation (feet)	Cum.Store (cubic-feet)
82.00	0
83.00	118
84.00	320
85.00	523
86.00	725
86.75	877
87.25	884
88.00	888
89.00	892

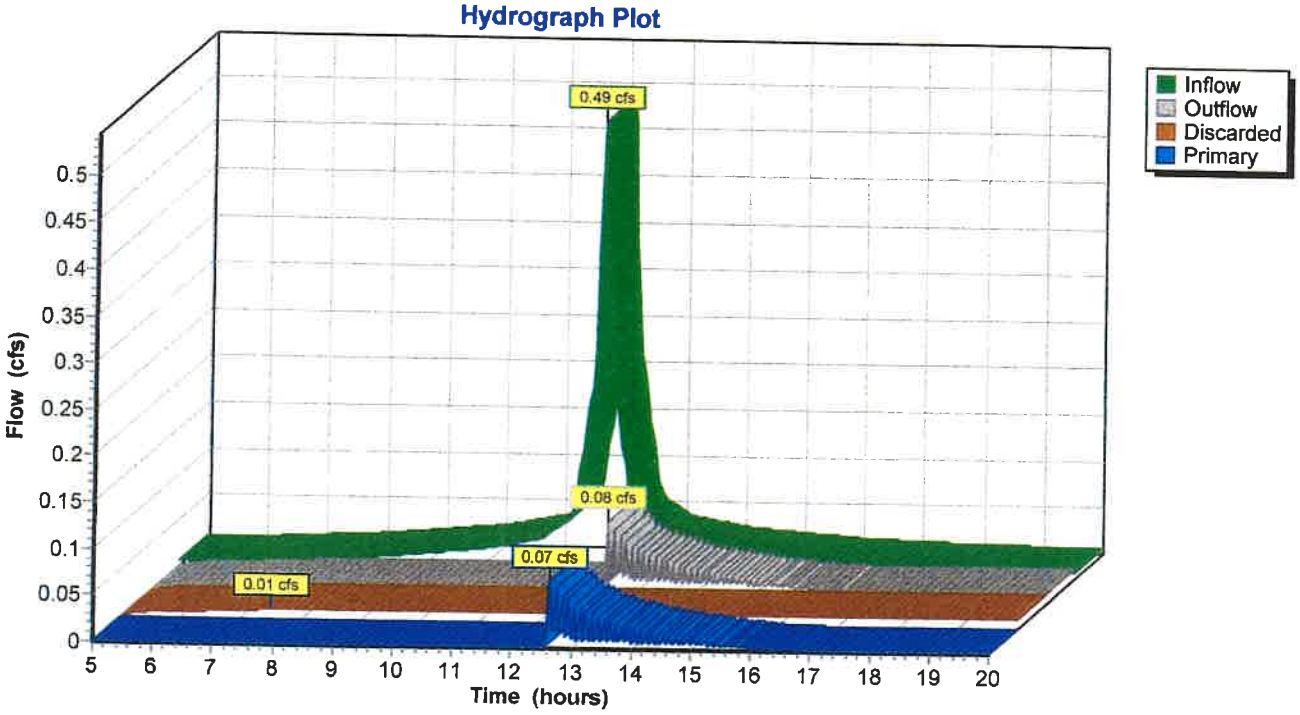
Discarded OutFlow (Free Discharge)
└2=Exfiltration

Primary OutFlow (Free Discharge)
└1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	88.50'	**4.0" Horiz. Orifice/Grate X 2.00** Limited to weir flow C= 0.600
2	Discarded	82.00'	**0.01 cfs Exfiltration when above invert**

Pond P-2: roof Infiltration System

Hydrograph Plot



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Type III 24-hr Rainfall=8.78"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment B-1: Tributary to Trench Drain
Tc=5.0 min CN=93 Area=2,506 sf Runoff= 0.49 cfs 0.036 af

Subcatchment B-2: Offsite to East
Tc=5.0 min CN=76 Area=1,936 sf Runoff= 0.30 cfs 0.020 af

Subcatchment B-3: Offsite to North
Tc=5.0 min CN=76 Area=3,968 sf Runoff= 0.62 cfs 0.042 af

Subcatchment B-4: Offsite to West
Tc=5.0 min CN=75 Area=3,228 sf Runoff= 0.50 cfs 0.033 af

Subcatchment B-5: Offsite to South
Tc=5.0 min CN=74 Area=1,963 sf Runoff= 0.30 cfs 0.020 af

Subcatchment B-6: Roof Area to Infiltration System
Tc=5.0 min CN=98 Area=3,375 sf Runoff= 0.67 cfs 0.051 af

Reach R-1: Summary Node
Inflow= 2.61 cfs 0.150 af
Outflow= 2.61 cfs 0.150 af

Pond P-1: Driveway Infiltration System Peak Storage= 370 cf Inflow= 0.49 cfs 0.036 af
Discarded= 0.01 cfs 0.011 af Primary= 0.49 cfs 0.016 af Outflow= 0.50 cfs 0.028 af

Pond P-2: roof Infiltration System Peak Storage= 895 cf Inflow= 0.67 cfs 0.051 af
Discarded= 0.01 cfs 0.012 af Primary= 1.01 cfs 0.018 af Outflow= 1.02 cfs 0.030 af

Runoff Area = 0.390 ac Volume = 0.202 af Average Depth = 6.22"

Subcatchment B-1: Tributary to Trench Drain

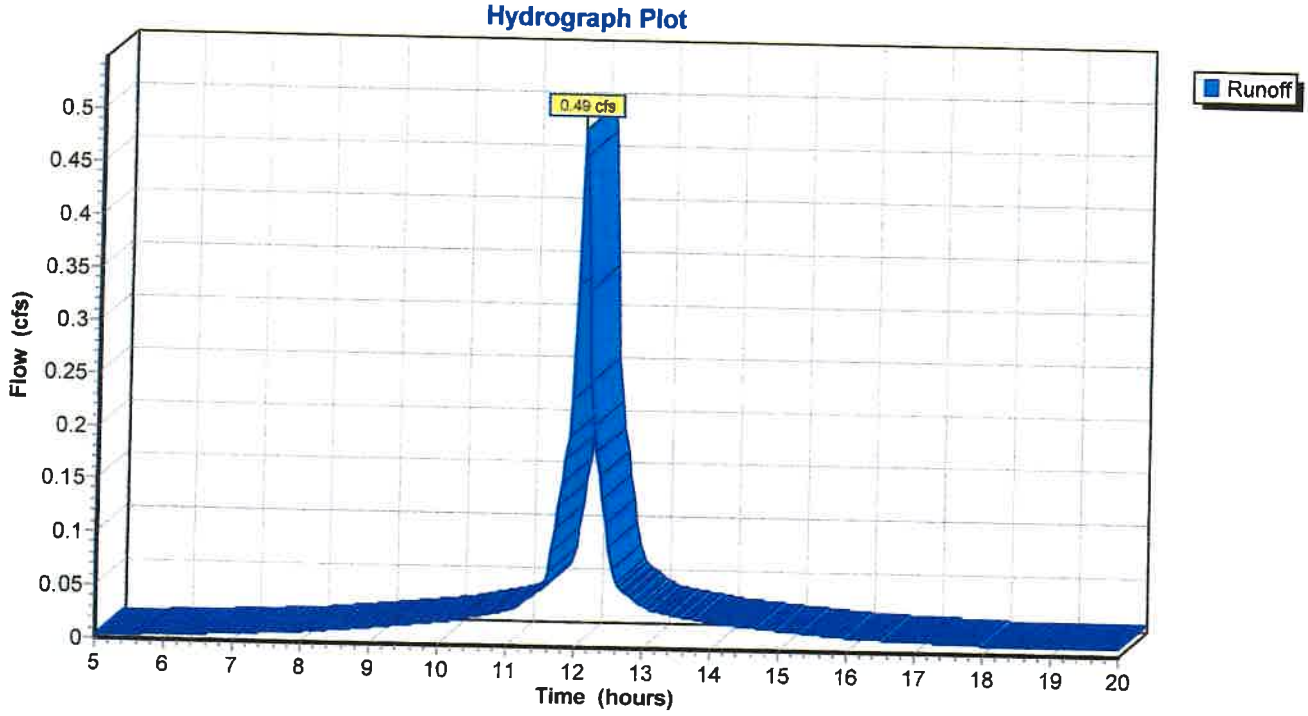
Runoff = 0.49 cfs @ 12.07 hrs, Volume= 0.036 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
1,954	98	Paved parking & roofs
552	74	>75% Grass cover, Good, HSG C
2,506	93	Weighted Average

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

Subcatchment B-1: Tributary to Trench Drain



Subcatchment B-2: Offsite to East

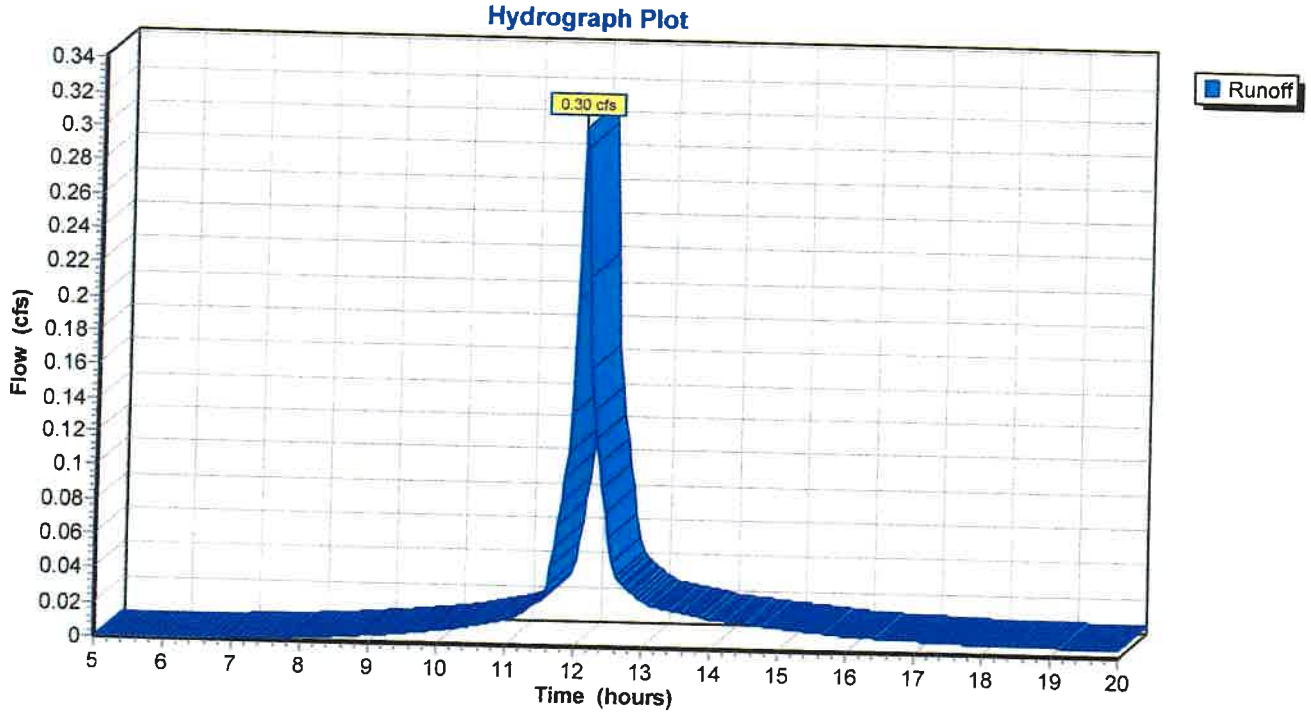
Runoff = 0.30 cfs @ 12.07 hrs, Volume= 0.020 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
148	98	Paved parking & roofs
55	90	Porch
1,733	74	>75% Grass cover, Good, HSG C
1,936	76	Weighted Average

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

Subcatchment B-2: Offsite to East



Subcatchment B-3: Offsite to North

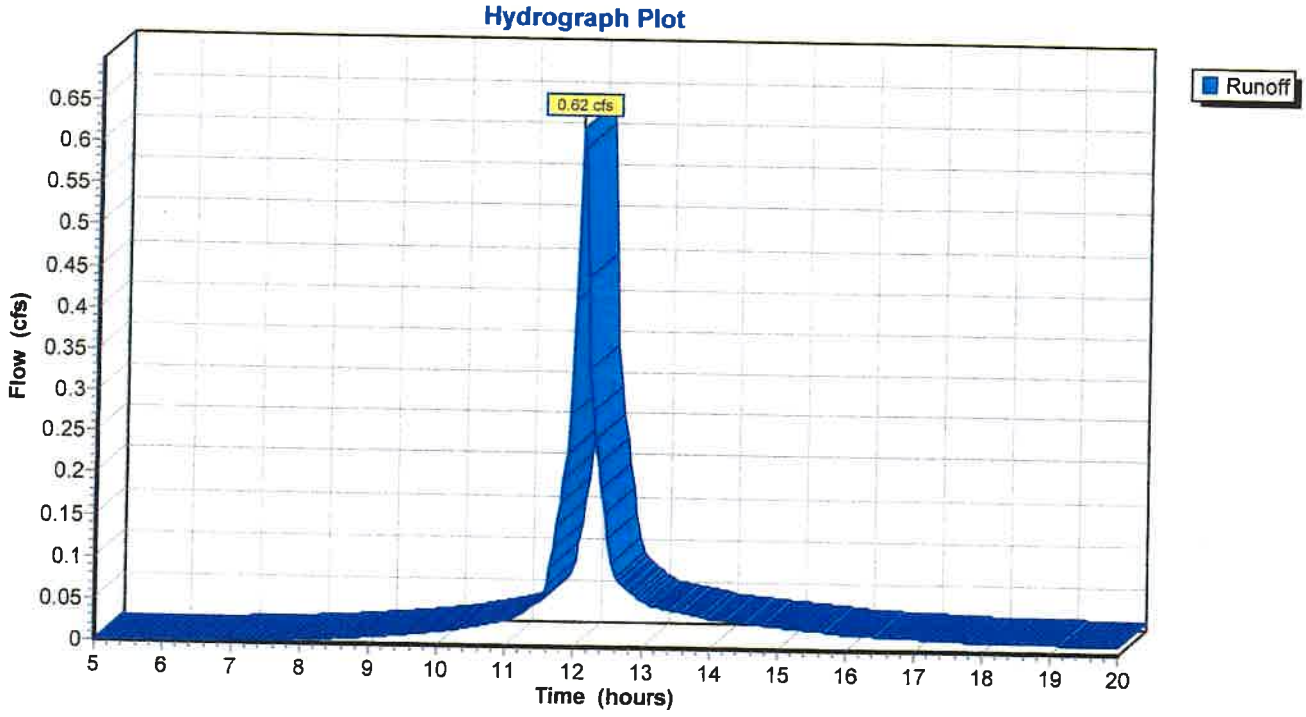
Runoff = 0.62 cfs @ 12.07 hrs, Volume= 0.042 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
168	98	Paved parking & roofs
223	90	Porch
3,577	74	>75% Grass cover, Good, HSG C
3,968	76	Weighted Average

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

Subcatchment B-3: Offsite to North



Subcatchment B-4: Offsite to West

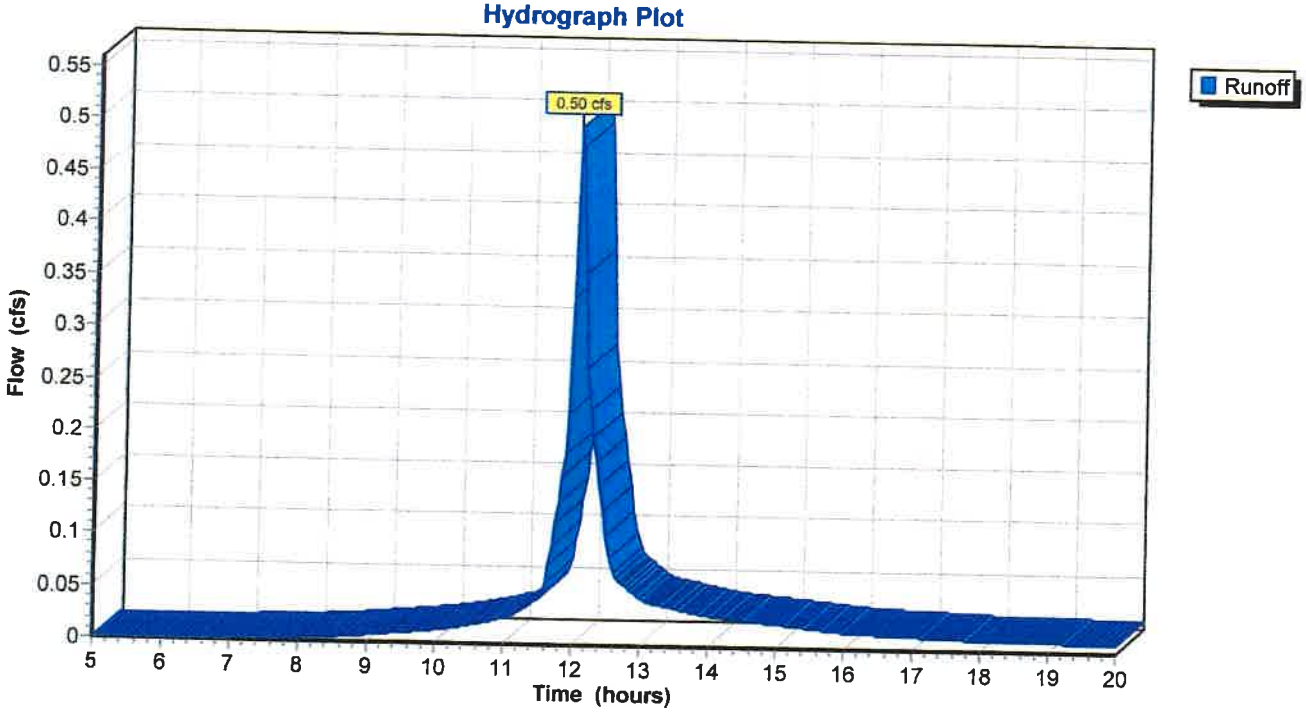
Runoff = 0.50 cfs @ 12.07 hrs, Volume= 0.033 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
223	90	Porch
3,005	74	>75% Grass cover, Good, HSG C
3,228	75	Weighted Average

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

Subcatchment B-4: Offsite to West



Subcatchment B-5: Offsite to South

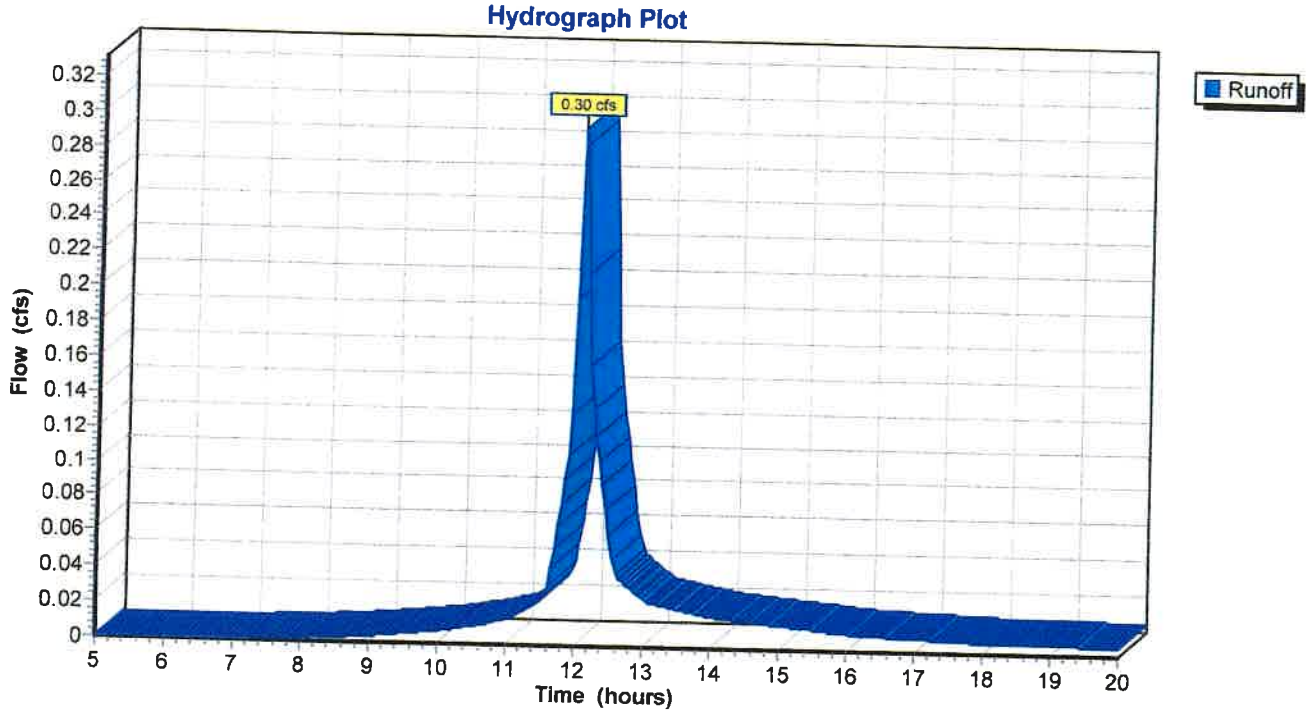
Runoff = 0.30 cfs @ 12.08 hrs, Volume= 0.020 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
19	90	Porch
1,944	74	>75% Grass cover, Good, HSG C
1,963	74	Weighted Average

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

Subcatchment B-5: Offsite to South



Subcatchment B-6: Roof Area to Infiltration System

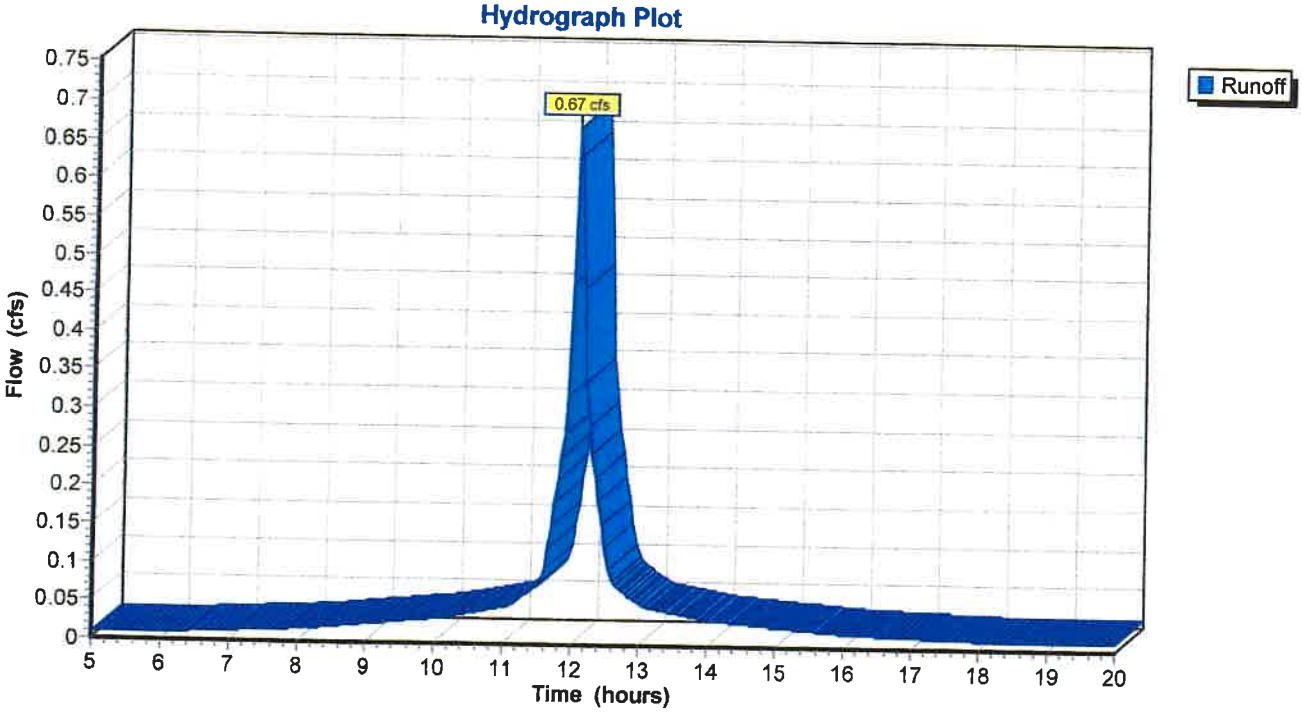
Runoff = 0.67 cfs @ 12.07 hrs, Volume= 0.051 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=8.78"

Area (sf)	CN	Description
3,375	98	Paved parking & roofs

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

Subcatchment B-6: Roof Area to Infiltration System

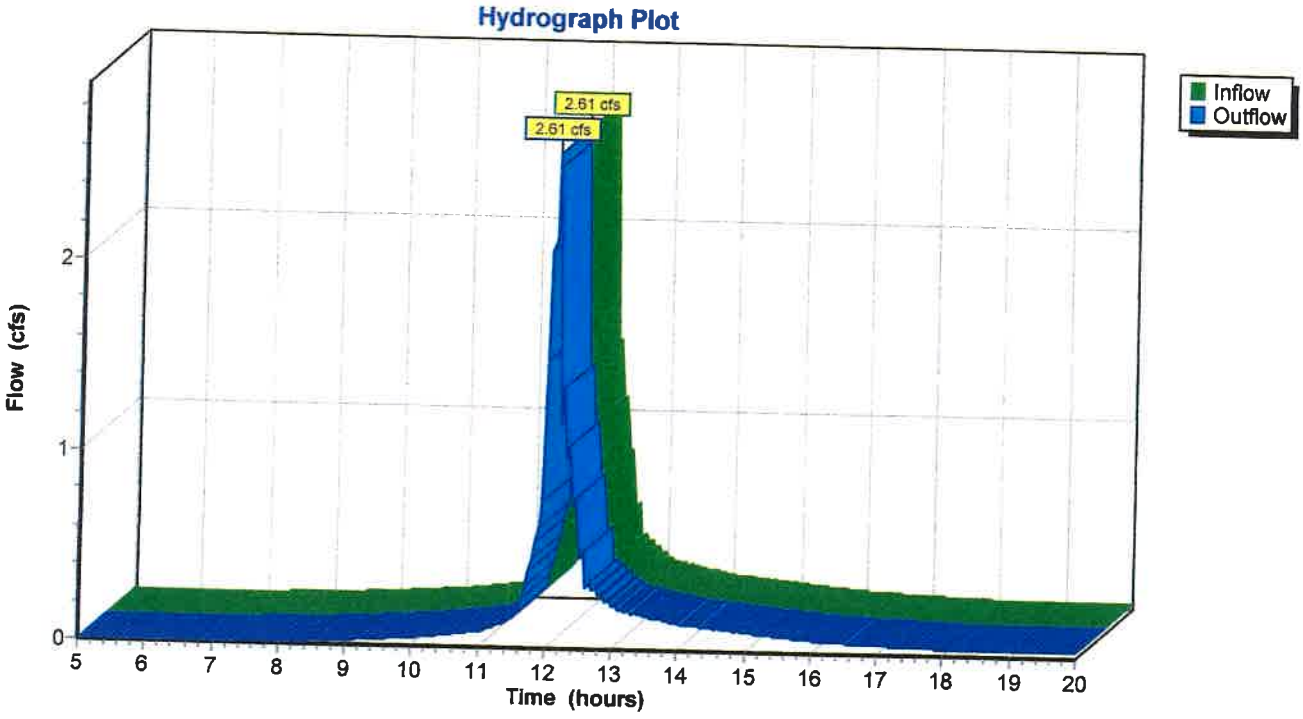


Reach R-1: Summary Node

Inflow = 2.61 cfs @ 12.14 hrs, Volume= 0.150 af
Outflow = 2.61 cfs @ 12.14 hrs, Volume= 0.150 af, Atten= 0%, Lag= 0.0 min

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

Reach R-1: Summary Node



Pond P-1: Driveway Infiltration System

Inflow	=	0.49 cfs @	12.07 hrs,	Volume=	0.036 af
Outflow	=	0.50 cfs @	12.09 hrs,	Volume=	0.028 af, Atten= 0%, Lag= 0.9 min
Discarded	=	0.01 cfs @	8.10 hrs,	Volume=	0.011 af
Primary	=	0.49 cfs @	12.09 hrs,	Volume=	0.016 af

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

Peak Elev= 86.16' Storage= 370 cf
Plug-Flow detention time= 85.4 min calculated for 0.028 af (77% of inflow)

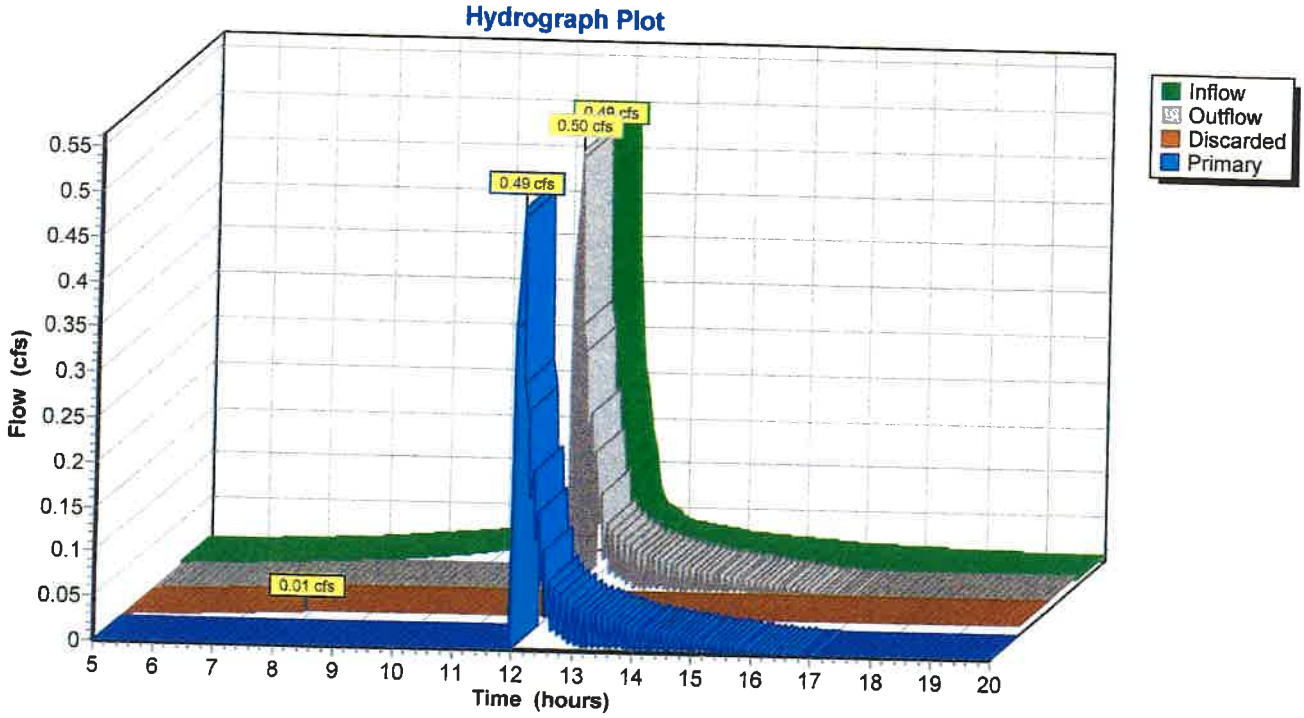
Elevation (feet)	Cum.Store (cubic-feet)
81.80	0
82.30	39
83.30	165
84.30	291
84.80	357
85.30	366
86.20	370

Discarded OutFlow (Free Discharge)
└2=Exfiltration

Primary OutFlow (Free Discharge)
└1=Broad-Crested Rectangular Weir

#	Routing	Invert	Outlet Devices
1	Primary	86.10'	**12.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
2	Discarded	81.80'	**0.01 cfs Exfiltration when above invert**

Pond P-1: Driveway Infiltration System



Pond P-2: roof Infiltration System

Inflow	=	0.67 cfs @	12.07 hrs,	Volume=	0.051 af
Outflow	=	1.02 cfs @	12.15 hrs,	Volume=	0.030 af, Atten= 0%, Lag= 4.8 min
Discarded	=	0.01 cfs @	6.15 hrs,	Volume=	0.012 af
Primary	=	1.01 cfs @	12.15 hrs,	Volume=	0.018 af

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

Peak Elev= 89.77' Storage= 895 cf
Plug-Flow detention time= 124.7 min calculated for 0.030 af (60% of inflow)

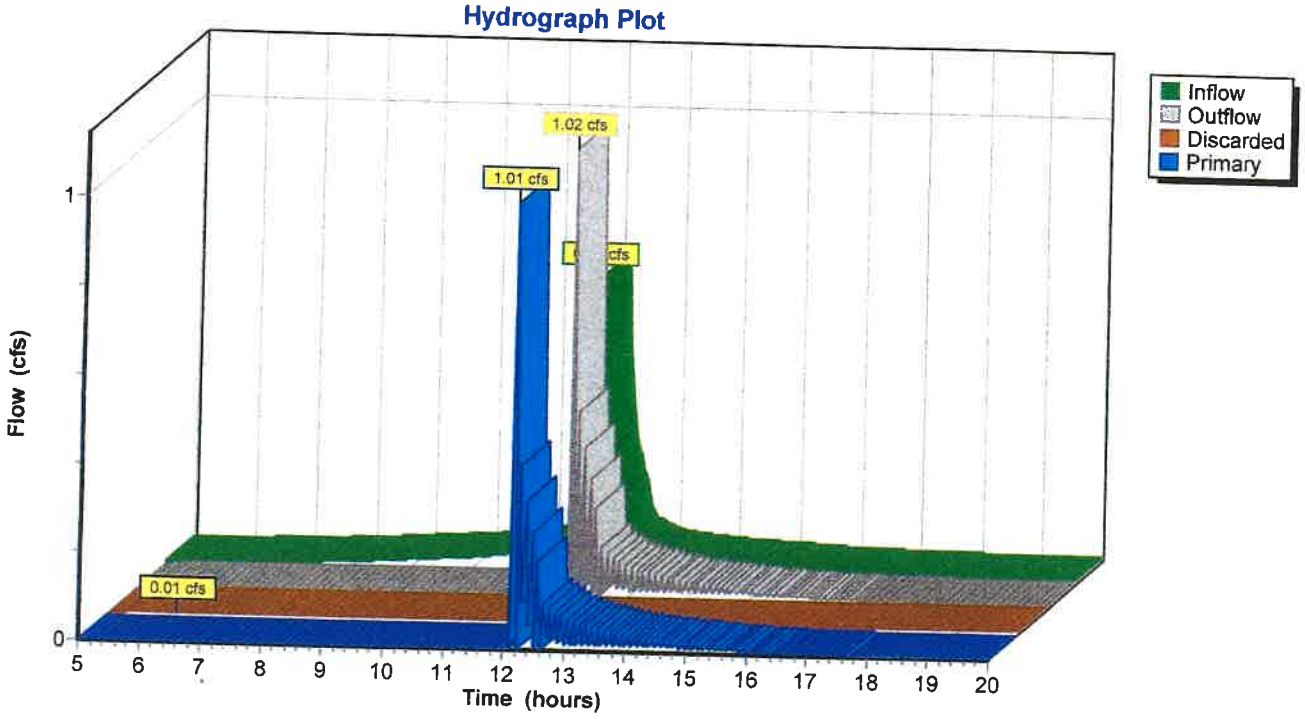
Elevation (feet)	Cum.Store (cubic-feet)
82.00	0
83.00	118
84.00	320
85.00	523
86.00	725
86.75	877
87.25	884
88.00	888
89.00	892

Discarded OutFlow (Free Discharge)
└2=Exfiltration

Primary OutFlow (Free Discharge)
└1=Orifice/Grate

#	Routing	Invert	Outlet Devices
1	Primary	88.50'	**4.0" Horiz. Orifice/Grate X 2.00** Limited to weir flow C= 0.600
2	Discarded	82.00'	**0.01 cfs Exfiltration when above invert**

Pond P-2: roof Infiltration System



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.301 (0.241-0.377)	0.372 (0.298-0.467)	0.488 (0.389-0.615)	0.585 (0.463-0.742)	0.718 (0.549-0.964)	0.817 (0.611-1.13)	0.924 (0.670-1.33)	1.05 (0.711-1.55)	1.24 (0.803-1.90)	1.39 (0.881-2.19)
10-min	0.427 (0.342-0.535)	0.528 (0.422-0.662)	0.693 (0.552-0.873)	0.830 (0.658-1.05)	1.02 (0.778-1.37)	1.16 (0.866-1.60)	1.31 (0.949-1.89)	1.49 (1.01-2.19)	1.75 (1.14-2.69)	1.97 (1.25-3.10)
15-min	0.502 (0.402-0.629)	0.621 (0.497-0.779)	0.815 (0.650-1.03)	0.976 (0.773-1.24)	1.20 (0.915-1.61)	1.36 (1.02-1.88)	1.54 (1.12-2.22)	1.75 (1.19-2.58)	2.06 (1.34-3.16)	2.32 (1.47-3.65)
30-min	0.686 (0.549-0.859)	0.849 (0.679-1.07)	1.12 (0.889-1.41)	1.34 (1.06-1.70)	1.64 (1.25-2.20)	1.87 (1.40-2.58)	2.11 (1.53-3.05)	2.40 (1.63-3.54)	2.84 (1.84-4.36)	3.21 (2.03-5.04)
60-min	0.869 (0.697-1.09)	1.08 (0.862-1.35)	1.42 (1.13-1.78)	1.70 (1.34-2.15)	2.08 (1.60-2.80)	2.37 (1.78-3.27)	2.68 (1.95-3.88)	3.05 (2.07-4.50)	3.62 (2.35-5.56)	4.10 (2.59-6.44)
2-hr	1.12 (0.905-1.40)	1.40 (1.13-1.74)	1.85 (1.48-2.31)	2.22 (1.77-2.80)	2.74 (2.11-3.66)	3.11 (2.35-4.28)	3.53 (2.59-5.10)	4.04 (2.75-5.91)	4.84 (3.15-7.37)	5.54 (3.52-8.61)
3-hr	1.31 (1.06-1.62)	1.63 (1.32-2.02)	2.15 (1.73-2.68)	2.59 (2.07-3.24)	3.18 (2.46-4.24)	3.62 (2.74-4.96)	4.10 (3.02-5.91)	4.71 (3.21-6.85)	5.66 (3.69-8.56)	6.48 (4.12-10.0)
6-hr	1.70 (1.39-2.10)	2.11 (1.71-2.60)	2.77 (2.24-3.43)	3.31 (2.66-4.13)	4.07 (3.16-5.37)	4.62 (3.52-6.28)	5.23 (3.87-7.46)	5.99 (4.10-8.63)	7.16 (4.69-10.7)	8.19 (5.22-12.5)
12-hr	2.19 (1.79-2.68)	2.69 (2.20-3.30)	3.50 (2.86-4.31)	4.18 (3.38-5.18)	5.11 (3.99-6.69)	5.80 (4.43-7.79)	6.55 (4.85-9.22)	7.46 (5.12-10.6)	8.85 (5.82-13.1)	10.1 (6.44-15.2)
24-hr	2.66 (2.19-3.23)	3.29 (2.71-4.00)	4.32 (3.54-5.28)	5.17 (4.21-6.36)	6.35 (4.99-8.25)	7.21 (5.54-9.63)	8.16 (6.08-11.4)	9.33 (6.43-13.2)	11.1 (7.34-16.4)	12.7 (8.16-19.1)
2-day	3.05 (2.53-3.68)	3.84 (3.18-4.65)	5.14 (4.24-6.25)	6.22 (5.10-7.60)	7.71 (6.10-9.99)	8.79 (6.81-11.7)	10.00 (7.53-14.0)	11.5 (7.99-16.2)	14.0 (9.27-20.4)	16.2 (10.4-24.1)
3-day	3.36 (2.79-4.04)	4.22 (3.51-5.08)	5.63 (4.66-6.80)	6.79 (5.59-8.27)	8.40 (6.68-10.8)	9.57 (7.45-12.7)	10.9 (8.24-15.2)	12.6 (8.72-17.6)	15.3 (10.1-22.2)	17.8 (11.4-26.2)
4-day	3.64 (3.04-4.37)	4.53 (3.78-5.45)	5.99 (4.97-7.22)	7.20 (5.93-8.73)	8.86 (7.06-11.4)	10.1 (7.86-13.3)	11.4 (8.67-15.9)	13.2 (9.16-18.3)	16.0 (10.6-23.1)	18.6 (12.0-27.3)
7-day	4.41 (3.70-5.27)	5.34 (4.47-6.38)	6.86 (5.72-8.22)	8.12 (6.72-9.79)	9.85 (7.88-12.6)	11.1 (8.69-14.6)	12.5 (9.51-17.2)	14.3 (9.99-19.8)	17.3 (11.5-24.7)	19.9 (12.9-29.0)
10-day	5.13 (4.31-6.10)	6.08 (5.11-7.24)	7.63 (6.39-9.12)	8.92 (7.41-10.7)	10.7 (8.57-13.5)	12.0 (9.39-15.6)	13.4 (10.2-18.3)	15.3 (10.7-20.9)	18.1 (12.1-25.8)	20.6 (13.4-29.9)
20-day	7.19 (6.09-8.49)	8.21 (6.95-9.71)	9.89 (8.33-11.7)	11.3 (9.43-13.5)	13.2 (10.6-16.4)	14.6 (11.4-18.6)	16.1 (12.1-21.4)	17.9 (12.6-24.2)	20.4 (13.7-28.7)	22.5 (14.6-32.3)
30-day	8.88 (7.55-10.4)	9.96 (8.46-11.7)	11.7 (9.92-13.9)	13.2 (11.1-15.7)	15.2 (12.2-18.8)	16.8 (13.1-21.1)	18.3 (13.7-23.9)	20.0 (14.1-26.9)	22.2 (15.0-31.0)	24.0 (15.6-34.2)
45-day	11.0 (9.38-12.9)	12.1 (10.3-14.2)	14.0 (11.9-16.5)	15.5 (13.1-18.4)	17.7 (14.2-21.6)	19.3 (15.1-24.1)	21.0 (15.6-26.9)	22.5 (16.0-30.1)	24.5 (16.6-34.0)	26.0 (16.9-36.8)
60-day	12.8 (10.9-14.9)	13.9 (11.9-16.3)	15.9 (13.5-18.6)	17.5 (14.8-20.6)	19.7 (15.9-24.0)	21.4 (16.8-26.6)	23.1 (17.2-29.5)	24.6 (17.5-32.7)	26.5 (17.9-36.5)	27.7 (18.1-39.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

OPERATION & MAINTENANCE PLAN

STORMWATER MANAGEMENT FACILITIES

219 MELROSE STREET

NEWTON, MASSACHUSETTS

November 28, 2022

Lakeview Engineering Associates
P.O. Box 787
Hudson, Massachusetts 01749

OPERATION & MAINTENANCE PLAN
STORMWATER MANAGEMENT FACILITIES
219 MELROSE STREET
NEWTON, MASSACHUSETTS

The proposed project includes stormwater runoff controls associated with the re-development of the existing house lot, including a new, duplex house, access driveway & site grading, that will require continued maintenance by the property owner. The major components associated with maintenance needs are the Cultec leaching galley systems, the trench drain and the sediment trap manhole, as well as the roof runoff downspouts. These will need to be cleaned periodically as noted below. Cleaning of these structures shall be done by the property owner or by a specialty contractor with hydraulic cleaning ability. The following outlines the major maintenance issues associated with the project:

Gutters & Downspouts Cleaning:

The roof gutters & downspouts should be inspected after completion of construction to assure that all debris was removed and no construction material will be cause the system to clog or restrict the outlet.

Maintenance of the gutter system should be performed at least twice a year (Spring & Fall) to assure the gutters & downspouts are functional.

Cultec Galley Infiltration Systems:

The Cultec galley infiltration systems should be inspected after completion of construction to assure that all debris was removed and no construction material will be cause the system to clog.

The proposed systems are intended to be used for collection & storage of roof and driveway runoff, for infiltration after a storm event. As part of this process, some soil and debris could collect in these galleys. This should be removed periodically, every four to five years, to maximize infiltration and storage capabilities. The debris / soil must be removed by means of hydraulic vacuuming by a specialty contractor.

Trench Drain Cleaning:

The trench drain should be inspected after completion of construction to assure that all debris was removed and no construction material will be cause the system to clog or restrict the outlet.

Maintenance of this system is subject to continuous monitoring after storm events to determine frequency of maintenance needs. The trench drain should be cleaned manually, after all major storms or as a minimum, once per month to remove accumulated solids and debris. This is required to prevent clogging and overflow of runoff and solids to the Common Driveway. Assuming the trench drain is maintained and cleaning is routinely performed, the driveway runoff and associated solids should be routed to the sediment trap manhole for removal, prior to entering the infiltration system.

Sediment Trap Manhole:

The sediment trap manhole should be inspected after completion of construction to assure that all debris was removed and no construction material will be cause the system to clog.

Maintenance of this system is subject to on-site evaluation and catchbasin type maintenance. Initially, this system should be inspected on a monthly / storm event schedule to note any solids carry over. After the first year of operation, the system should receive quarterly inspections. It is recommended that the sediment trap manhole should be cleaned at least twice yearly (Spring & Fall).

Maintenance Responsibilities

The maintenance of the various drainage system components is the responsibility of the Property Owner. Some of the work (trench drain) can be accomplished by the Owner or a landscape contractor. The infiltration systems and the sediment manhole must be contracted to a company that specializes in the cleaning of storm drainage facilities. Inspections should be performed by independent individual such as the design engineer or other experienced individual in the field.

STORMWATER MANAGEMENT REPORT
219 MELROSE STREET
NEWTON, MASSACHUSETTS

INSPECTION REPORT:

Inspection Firm: _____

Inspectors Name: _____ Date: _____

Components Inspected: _____

_____

Signed: _____

SYSTEM MAINTENANCE:

Maintenance Firm : _____ Date : _____

Trench Drain Inspected: Yes ____ No ____ Comments: _____

_____

_____

_____

Trench Drain Cleaned: Yes ____ No ____ Comments : _____

_____

_____

_____

Sediment Trap Manhole Inspected: Yes ____ No ____ Comments: _____

_____

_____

_____

Sediment Trap Manhole Cleaned: Yes ____ No ____ Comments : _____

_____

_____

_____

Cultec Galleys Inspected: Yes ____ No ____ Comments: _____

_____

_____

_____

Cultec Galleys Cleaned: Yes ____ No ____ Comments : _____

Gutters & Downspouts Inspected: Yes ____ No ____ Comments: _____

Gutters & Downspouts Cleaned: Yes ____ No ____ Comments : _____

Estimate of Material Removed: _____

Other Comments: _____

Signed: _____

Soil Map—Middlesex County, Massachusetts
(219 Melrose Street)

Map Scale: 1:787 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	3.1	100.0%
Totals for Area of Interest		**3.1**	**100.0%**

Middlesex County, Massachusetts

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)

Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex

Across-slope shape: Convex, linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

Commonwealth of Massachusetts
City/Town of Newton

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name

219 Melrose Street
Street Address

Newton
City

MA
State

Map/Lot #
02452
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Published Soil Survey Available? ☒ Yes ☐ No If yes: 1995 Year Published; 1:25,000 Publication Scale; 626B(NRCS) Soil Map Unit
   Merrimac-Urban Land Complex
   Soil Name
   High Infiltration Rate
   Soil Limitations

3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: Year Published; Publication Scale; Map Unit
   Glacial Till
   Geologic Material
   Drumlin
   Landform

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☐ Yes ☒ No

   Within the 500-year flood boundary? ☐ Yes ☒ No Within a velocity zone? ☐ Yes ☒ No

5. Wetland Area: National Wetland Inventory Map — N/A (Map Unit); Name

   Wetlands Conservancy Program Map — N/.A (Map Unit); Name

6. Current Water Resource Conditions (USGS): Nov. 2022 (Month/Year) Range: ☐ Above Normal ☒ Normal ☐ Below Normal

7. Other references reviewed: N/A

Commonwealth of Massachusetts
City/Town of Newton

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserved disposal area)*

Deep Observation Hole Number: DH-1 | 11/17/22 (Date) | AM (Time) | Fair (Weather)

1. Location

   Ground Elevation at Surface of Hole: 86.4 | Location (identify on plan): See Site Plan

2. Land Use: Residential (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Surface Stones) | 3% (Slope (%))

   Lawn (Vegetation) | Drumlin (Landform) | See Site PLan (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	> 100 feet	Drainage Way	> 100 feet	Possible Wet Area	>100 feet
Property Line	25 feet	Drinking Water Well	> 100 feet	Other	feet

4. Parent Material: Glacial Till | Unsuitable Materials Present: ☒ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No | If yes: N/A (Depth Weeping from Pit) | N/A (Depth Standing Water in Hole)

   Estimated Depth to High Groundwater: >66" inches | 79.8 elevation

Commonwealth of Massachusetts
City/Town of Newton

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: DH-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
10'	Loam	N/A				Fill					
10-14"	Ash	N/A				Fill					
14-25"	B	10 YR 6/8				Sandy Loam			Massive	Dry	Fine, Rooted
25-66"	C	2.5 Y 5/3				Sandy Loam	10%	25%	Massive	Dry	Medium, Loose

Additional Notes:

No Mottling Observed - Base on Landscape Position, Groundwater would not be encountered within ten (10) feet.

Commonwealth of Massachusetts
City/Town of Newton

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: DH-2 | 11/17/22 (Date) | AM (Time) | Fair (Weather)

1. Location

Ground Elevation at Surface of Hole: 86.0 | Location (identify on plan): See Site plan

2. Land Use: Residential (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Surface Stones) | 5% (Slope (%))

Lawn (Vegetation) | Drumlin (Landform) | See Site Plan (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	<100 feet	Drainage Way	<100 feet	Possible Wet Area	< 100 feet
Property Line	30 feet	Drinking Water Well	<100 feet	Other	feet

4. Parent Material: Glacial Till | Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☒ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No | If yes: N/A (Depth Weeping from Pit) | N/A (Depth Standing Water in Hole)

Estimated Depth to High Groundwater: >74" inches | 79.8 elevation

Commonwealth of Massachusetts
City/Town of Newton

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: DH-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-19"	A	10 YR 3/3				Sandy Loam			Massive	Dry	Fine
19-38"	B	10 YR 6/8				Sandy Loam			Massive	Dry	Fine
38-74"	C	2.5 Y 5/2				Sandy Loam	25%	25%	Massive	Dry	Medium, Loose

Additional Notes:

See Note on DH-1 109 1,

Commonwealth of Massachusetts
City/Town of Newton

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserved disposal area)*

Deep Observation Hole Number: DH-3 | 11/17/22 (Date) | AM (Time) | Fair (Weather)

1. Location

   Ground Elevation at Surface of Hole: 85.7 | Location (identify on plan): See Site Plan

2. Land Use: Residential (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Surface Stones) | 5% (Slope (%))

   Lawn (Vegetation) | Drumlin (Landform) | See Site PLan (Position on Landscape (attach sheet))

3. Distances from:

Open Water Body	> 100 feet	Drainage Way	> 100 feet	Possible Wet Area	>100 feet
Property Line	25 feet	Drinking Water Well	> 100 feet	Other	feet

4. Parent Material: Glacial Till | Unsuitable Materials Present: ☒ Yes ☐ No

   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No | If yes: N/A (Depth Weeping from Pit) | N/A (Depth Standing Water in Hole)

   Estimated Depth to High Groundwater: inches | 81.0 elevation

Commonwealth of Massachusetts
City/Town of Newton

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: DH-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-11"	A	10 YR 3/3				Sandy Loam			Massive	Dry	Fine
11-25"	B	10 YR 6/8				Sandy Loam			Massive	Dry	Fine
25-56"	C	2.5 Y 5/2				Sandy Loam	10%	10%	Massive	Dry	Medium, Loose

Additional Notes:

See Note on Bthl Log!

Commonwealth of Massachusetts
City/Town of Newton

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

☐ Depth observed standing water in observation hole	A. _____ inches	B. _____ inches
☐ Depth weeping from side of observation hole	A. _____ inches	B. _____ inches
☐ Depth to soil redoximorphic features (mottles)	A. _____ inches	B. _____ inches
☐ Groundwater adjustment (USGS methodology)	A. _____ inches	B. _____ inches

2. _____ Index Well Number _____ Reading Date _____ Index Well Level

_____ Adjustment Factor _____ Adjusted Groundwater Level

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 14" inches Lower boundary: 74" inches

Commonwealth of Massachusetts
City/Town of Newton

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

11/25/22
Date

Stephen E. Poole SE1955
Typed or Printed Name of Soil Evaluator / License #

July 1995
Date of Soil Evaluator Exam

None
Name of Board of Health Witness

N/A
Board of Health

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of Newton

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams: