STORMWATER MANAGEMENT PLAN

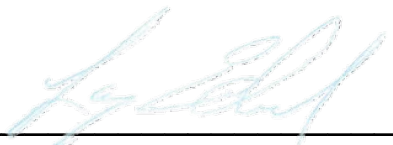
FOR

STEFAN ABELIN

40 FAR HORIZON DRIVE

EASTON, CONNECTICUT

NOVEMBER 18, 2019
Revised 2/6/20
Revised 2/19/20
Revised 3/4/20
Revised 3/6/20
Revised 5/1/20



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PROJECT NARRATIVE

The project consists of 17.041 acres. Each contains an existing single family home. It is proposed to subdivide the parcel into 2 lots. Lot 1 will contain the existing house. Lot 2 will contain 1 new house and associated site improvements. Our drainage analysis will include only lot 2.. Access to lot 2 t will be off Far Horizon Drive using a private driveway. The property is presently wooded with a large wetland area along the easterly boundary. The USDA has classified the upland areas as soil group C and the wetlands as group D.

It is proposed to direct the majority of the runoff from the new driveway to a water quality rain garden for treatment. Roof runoff from the new home will be discharged directly into an infiltration systems consisting of 84lf of Cultec R280 plastic leaching units. This system has been designed to handle the first 2" of runoff from a typical 3000sf house.

The drainage analysis for the project was performed using the SCS TR55 computer model. Storm frequencies of 2, 10, 25 and 100 years have been evaluated. The basin outlet has been sized to handle a 100 year storm..

The water quality basin is located in the upland area along the edge of the site wetlands. The basin has been designed assuming dry. Soils testing will be required in the area of the water quality basins and infiltration systems to verify soil conditions.

DRAINAGE CALCULATIONS

SUMMARY STUDY AREA

TOTAL SITE	2 YR EXIST	**2 YR PROP**	10 YR EXIST	**10 YR PROP**	25 YR EXIST	**25 YR PROP**	100 YR EXIST	**100 YR PROP**
	7.31	**7.09**	15.43	**15.14**	19.0	**18.63**	26.85	**26.32**

STORM WATER QUALITY CALCULATIONS

Water Quality Volume
This volume represents the amount of storm water runoff that should be captured and treated in order to remove the majority pollutants on an average annual basis. The building runoff will be collected separately and discharged to a infiltration system.

The total drainage area flowing to the water quality garden =0.34 acres

WQV = (1")(R)(A)/12
R = (0.05) + (0.009)(% impervious)

WQ Basin	**Area**	**Imperv. Area**	**% Imperv.**	**R**	**WQV Required (cf)**	**WQV Proposed (cf)**
1	0.34	0.16	47.1	0.47	580	1605

Ground Water Recharge Volume
This requirement is intended to maintain pre-development annual groundwater recharge volume by capturing and infiltrating the storm water runoff.
Ground water recharge will be provided through the roof runoff infiltration systems. The total site impervious area is 0.9 acres.

GWV = DxIxA/12

Soil recharge depth calculation:
Soil group C D =0.10

Site	Area	% Imperv.	GWV Required (cf)	GWV Proposed (cf)
1	0.34	47.1	60	1605

Stream Channel Protection
The total site impervious area is less than 1 acre and therefore stream channel protection is not required to be evaluated. In addition, the total recharge volume for the site, including the water quality basins is 7079cf. This exceeds the total 2 year existing channel protection volume of 6316cf.

Outlet Protection
Rip rap protection has been provided at each point of discharge
Calculations based on E&S manual

LENGTH = La =1.7(Q) / $(Do)^{3/2}$ +8(Do)
WIDTH = 3(D0) + La

<u>DRIVEWAY CULVERT</u>
Q 25 yr =30.2cfs (NOAA) pipe size =36”
La = 1.7(30.2) / (5.2) + 8(3) = 34ft (35’ provided*)
Width =(3 + 3) +34 =40’ (45’ provided)
Type 1 scour hole proposed

Rip rap size:
d =(0.0125)(R_2)/Tw x $(Q/R_{2.5})^{1.33}$ = 0.45’ (DOT manual equation)
Use 18” layer of intermediate rip rap

<u>RAIN GARDEN</u>
Q 10yr =0.79cfs (hydrocadd) outlet area -0.48’ V =Q/A =1.6fps
Velocity is less than 3.0fps for silty loam, therefore no additional protection required
10’ spreader proposed

Conveyance Protection
In accordance with the Town of Easton land use regulations, All project drainage improvements have been designed to handle a minimum 10 year storm event with outlet overflow from the basin designed to handle a 100 year storm. Reference is made to complete drainage report for supporting documentation.

Peak Runoff Attenuation
The storm management system for this project will control post development peak runoff for the 2, 10, 25 and 100 year storm events to levels less than or equal to the pre development rates. There will be no development activities within the limit of the 100 year flood plain. See Drainage Summary Addendum attached to this report as well as the complete Drainage Report for supporting documentation..

Emergency Outlet Protection
The emergency outlet control has been designed to handle a 100 year storm event. See Drainage Summary Addendum attached to this report as well as the complete Drainage Report for supporting documentation.

Downstream Analysis
The drainage study for this project has also looked at the overall project impact to downstream off site water courses. Peak runoff from the total site will not exceed pre development levels. See Drainage Summary Addendum attached to this report as well as the complete Drainage Report for supporting documentation.

Driveway culvert crossing
Design with rational method for 50 yr storm

Drainage area =33.6 acre

Based on DOT manual

Runoff coefficient using DOT table 6-4
6.0 acres undisturbed w/ C =0.10-0.30 use 0.20
27.6 ac residential (1.2 ac or more) w/ C =0.30-0.45 use 0.37
C =(6/33.6 x0.20) + (27.6/33.6 x0.37) =0.34 use 0.35

Time of concentration DOT manual
Design for 50yr storm
Sheet flow 300' max
Tc =0.007(nL)0.8 /(P0.5)(S0.4) = 0.58hr =35 min
n =0.40 L =300' P =3.3 S =.1.5%

Shallow concentrated Flow
200'@2.5%
V =16.1345(S0.5) =2.7fps S=2.5%
200/2.7 =74sec =1.2 min
800'@1.0%
V=1.6fps
800'/1.6 =500sec =8.3 min

Open channel flow
700' @5%
4' wide x 1' deep
A =4 P =8
R =0.5 n =0.04
V=(1.49)(R.067)(S0.5)/n =5.2fps
700/5.2 =135 sec =2.2min

Total Tc =35 + 1.2 + 8.3 + 2.2 =46.7min

i for 50yr storm from NOAA chart
i @ 30 min =3.79”
i @ 60 min =2.43”
i @ 47 min =2.57”

Q =CIA = 0.35 X 2.57 X 33.6 =30.2cfs

Tail water calculations

Downstream of the outfall is a wide level swale 30’ wide with a slope of 10%.
A 6” depth in the downstream swale would provide the following capacity:

Q = (A)(1.49/n)(R2/3)(S1/2) =192cfs
A =30’x0.5’ =15sf
P =30/32 =0.93
n =0.035

The culvert outlet will be set 6” above existing ground and therefore the pipe would not be subject to tail water conditions Therefore design with inlet control.

Pipe Capacity

36” concrete pipe w/ square edge to headwall
Q =30.2cfs
V =Q/A =30.2/7.0 =4.3fps

using HDS-5 chart 1B HW = <1’

Rip rap swale

Area =0.3ac tc =5 (min) assume C =0.90 i (50yr) = 9.78 (NOAA table)
Q = 0.3 x 0.90 x 9.78 =2.6cfs

Swale capacity: @3” depth
Q = (A)(1.49/n)(R2/3)(S1/2) =2.3cfs V =Q/A =1.8/.375 =4.8fps
A =0.375sf
P =1.7
R =0.22
n =0.030
S =12%

ADDENDUM #1 EROSION AND SEDIMENT CONTROL PLAN NARRATIVE

STORM POLLUTION CONTROL PLAN

A. GENERAL STATEMENT

1. Work on this project is expected to commence upon approval by the Planning and Zoning Commission. Final stabilization shall be completed as soon as possible after completion of work. In all cases disturbed areas shall be stabilized by the end of the growing season so that grass cover can be established. Construction shall be completed in accordance with the attached schedule.

2. The Storm Pollution control program for this site shall include the following as shown on the approved map:

   a. Installation of a filter fence as shown on the plan.
   b. Installation of anti-tracking apron on the driveways and at entrance to the roads.
   c. Installation of detention/sediment basins and traps

3. Prior to any construction on the site, a pre-construction meeting shall be held with the owner, contractor, design engineer, and the authorized town official to review the site and the required erosion/ sedimentation and storm pollution control program.

4. The approved site plans, erosion control plan, engineering report and land use applications are considered part of this plan.

B. SCHEDULING OF GRADING AND CONSTRUCTION ACTIVITIES

Prior to starting construction on the site, all erosion and sediment control measures shall be installed as directed by the design engineer, permittee and/or authorized town agent.

<u>See construction sequence which is included on construction drawings</u>

C. MEASURES TO BE USED DURING CONSTRUCTION

1. SILT FENCE

Silt fence consists of wooden post and filter fabric. Fences will be secured in place by wood posts set a maximum of five feet on-center. The filter fabric will be three feet in height. Fabric at the base of the fence will be buried at least six inches into the ground. Twine will be used to secure the fence on the uphill side to prevent overturning. The purpose of silt fences is to intercept and detain sediment contained in overland runoff from disturbed areas of limited extent. (Envirofence by Mirafi Inc. is an acceptable alternative to the system described above.)

Installation and Maintenance shall conform to the following:
Sediment will be removed from behind silt fences when sediment has accumulated to 50% of original height of the fence.

2. ANTI-TRACKING APRON

A ramp of crushed stone extending a minimum distance of 50 feet will be installed at the point of ingress and egress to the site. The purpose of the device is to minimize the potential of tracking mud from the site onto public right-of-way.

Installation and Maintenance shall conform to the following:
Minimum length will be 50 feet.
Stone size will meet CT DOT standards for two inch crushed gravel.
Stone will be placed upon the full width of the entrance roads.
Thickness of stone will be four inches or greater.
All sediment spilled, dropped, washed, or tracked onto public right-of-way will be removed immediately.

3. TEMPORARY WATER BREAKS

This temporary device consists of a swale constructed across proposed roadways. The purpose of this device is to direct runoff away from the road surface and minimize sediment from entering the drainage system. This shortens the length of disturbed slope by intercepting runoff and diverting it away from the roadway catch basins.

Installation and Maintenance shall conform to the following:
Swales will be placed across roads, which are to be constructed in fill:
Every 200 feet on slopes of 5-10%
Every 300 feet on slopes less than 5%
Contributory drainage areas, which are less than five acres.
Swales drain to hay bale check dams.

4. HAY BALE CHECK DAMS

Hay bale check dams of tightly bound, steel pin anchored, hay bales embedded four inches below grade in drainage swales adjacent to roadways or at the toe of an exposed slope. The purpose of a hay bale check dam is to reduce runoff velocity, and promote deposition and filtering of sediment from runoff. Hay bale check dams will be used where the runoff velocities will be less than three feet per second.

Installation and Maintenance shall conform to the following:
Compacted backfill will be placed against the up slope side of the Hay bales to a height of 4" above the ground.
Check dams will be placed in drainage swales:
Every 100 feet on slopes greater than 10%
Every 200 feet on slopes 5-10%
Every 300 feet on slopes less than 5%
Sediment shall be removed from hay bale check dams when sediment has accumulated to 50% of the original height.

5. TEMPORARY SEDIMENT TRAPS

Runoff collected in roadway interceptor swales or other swales will be directed to a sediment trap. The trap consists of a small excavation and/or embankment. The purpose of the trap is to collect runoff, promote settling of sediment, and de-concentrate and distribute clean runoff overland through natural vegetation before it enters existing watercourses and wetlands

6. CATCH BASIN FILTERS

Temporary catch basin filters will be utilized to prevent the deposition of sediment into the storm sewer system prior to the stabilization of exposed areas with vegetation and/or pavement. These filters will consist of tightly bound, pin-anchored hay bales embedded four inches below grade, surrounding each catch basin inlet.

Installation and Maintenance shall conform to the following:
Placed around each catch basin inlet prior to paving or stabilization with vegetation.
Sediment shall be removed from the filters when sediment has accumulated to 50% of the filter's original height.

7. TEMPORARY GRADE TO DRAINS AND DIVERSION SWALES

This is a temporary raised berm of compacted soil, placed across a disturbed slope that intercepts runoff from disturbed areas and directs it to an appropriate outlet. This device will be used mostly on steep slopes above deep excavations.

Installation and Maintenance shall conform to the following:
Temporary grade to drain:
Temporary grade to drains may be placed on cut and fill slopes exceeding 10 feet in height.
Contributory drainage area should not be greater than one acre.
Runoff will be diverted overland by the berms to sediment traps, sedimentation basins, swales, or check dams.
On slopes over 5%, additional stabilization is required in the form of stone rip-rap eight inches vertically up the upslope side of the berm and seven feet upslope from the upslope toe of the berm.
Top width of berm will be two feet. Side slopes will be 2:1 or flatter.
All berms shall be machine compacted.
Temporary diversion swale:
Temporary diversion swales to be constructed upslope of proposed construction limits and are intended to divert runoff away from construction area. (see detail)

8. RIP-RAP OUTFALL PROTECTION

As a permanent erosion control measure to protect the soil surface from the erosive forces and to slow the velocity of concentrated runoff while enhancing the potential for infiltration, velocity reducers in the form of crushed stone rip-rap will be used at the outfalls of all drainage structures that discharge to wetlands or other sensitive areas. The minimum thickness of the rip-rap layer will be 1.5 times the maximum stone diameter but not less than six inches. Sizing the stone and determining the dimensions of the rip-rap pads will be completed upon further design of the project using the methods described in the Connecticut Guidelines for Soil Erosion and Sediment Control.

9. Names, addresses and phone numbers of all persons and organizations that will be responsible for the installation and maintenance of the erosion and sedimentation devices will be provided prior to any earth moving or any other construction activity.

10. Construction area to be kept clean from all litter, debris and other building materials collected and disposed of offsite in approved manner. All fuels, oils and other controlled

chemicals to be stored in approved areas. Such areas to be bermed as necessary to prevent spills from entering open watercourses. Fueling of equipment shall not be allowed in other than approved areas. In the event of a fuel or chemical spill, immediate measures to be taken to control damage and local and state officials are to be notified immediately.

11. Where construction activities have permanently ceased or have temporarily been suspended for more than seven days, or when final grades are reached in any portion of the site, stabilization practices shall be implemented within three days. Areas that remain disturbed but inactive for at least thirty days shall receive temporary seeding in accordance with the guidelines.

D. MAINTENANCE PROGRAM DURING CONSTRUCTION

1. The designated site monitor will inspect disturbed areas of the construction activity that have not been finally stabilized, structural control measures, and locations where vehicles enter or exit the site at least once every seven calendar days and within 24 hours of the end of a storm that is 0.1 inches or greater. Where sites have been temporarily or finally stabilized, such inspection shall be conducted at least once every month for three months.

2. Additional control measures will be installed and the plan revised as appropriate as soon as practicable after such inspection. Such modifications shall provide for timely implementation of any changes to the site within 24 hours and implementation of any changes to the plan with 3 calendar days following the inspection. The plan shall be revised and the site controls updated in accordance with sound engineering practices, and applicable state and local regulations.

3. All control measures shall be maintained in effective working condition throughout the construction period.

4. Control measures found to be in disrepair shall be repaired or replaced immediately.

5. Sediment removed from control structures will be disposed of in a neat manner and disposed of in areas designated by the authorized town official or design engineer.

6. A report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Stormwater Pollution Control Plan, and actions taken shall be made and retained as part of the Plan for at least three years after the date of inspection. The permittee, or his authorized representative shall sign the report.

7. The Owner, or his designated agent is assigned the responsibility for implementing this erosion and storm pollution control plan. This responsibility includes site inspections, preparation of reports, the installation and maintenance of control measures, informing all parties engaged on the construction site of the requirements and objectives of the plan, notifying the Planning and Zoning Commission of any transfer of this responsibility, and for conveying a copy of the Erosion and Sediment Control Plan and the Implementation Schedule for Erosion and Sedimentation Control if the title to the land is transferred.

E. POST-CONSTRUCTION STORM MANAGEMENT

1. After completion of site disturbance and satisfactory stabilization, all permanent control structures including detention basins, storm water ditches, and catch basins to be cleaned of all sediment and debris. At time of transfer of ownership and/or responsibility for controls, the new owner or designated agent shall be advised of the sedimentation control maintenance requirements for the project.

MAINTENANCE PROGRAM

Spring season

1. In the spring sweep sand deposits from the driveway areas and deposit at approved site.
2. Inspect catchbasin sumps and clean out when filled to half full level
3. Inspect driveway surface for signs of wear and cracking. Repair damaged areas
4. Inspect the detention basin areas for excessive sediment buildup and clean forebay when half full
5. Inspect water detention basin outlet structure to assure that there are no obstructions
6. Check plantings along the driveway and basin. Remove and replace any damaged or dead plants

Summer season

1. Mow driveway shoulder as required
2. Prior to a major storm event, inspect basin outlet and clean as required
3. Water street and basin planting as conditions require.

Fall season

1. Remove all leaf debis from driveway and basin areas to avoid excessive loading of the basin and rain garden.
2. Mow basin area to remove unwanted plant spieces.
3. Inspect all catchbasins and detention basin outlet and clean or repair as required

Winter season:

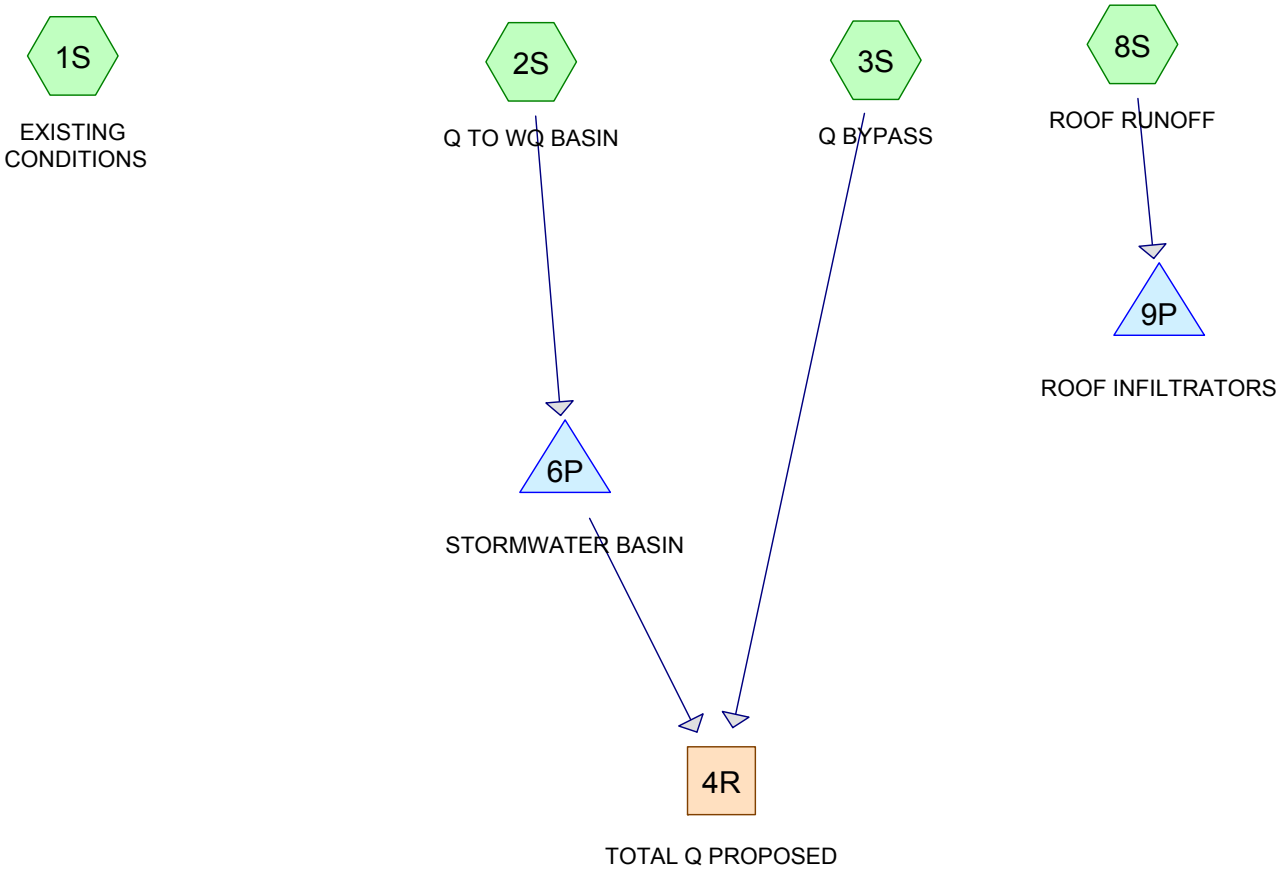
1. Plow driveway as conditions require
2. Avoid excessive use of sand and salt using only when conditions require
3. After snow event, inspect catchbasin inlets and detention basin outlet to assure they are functioning properly

F. REPORTING AND RECORD KEEPING REQUIREMENTS

1. The permittee shall retain copies of Stormwater Pollution Control Plans and all reports required by this general permit, and records of all data used to complete the registration to be authorized by this general permit, for a period of at least three years from the date that construction at the site is completed unless the commissioner specifies another time period in writing.

2. The permittee shall retain an updated copy of the Stormwater Pollution Control Plan required by this general permit at the construction site from the date construction is initiated at the site until the date construction at the site is completed.

3. Upon completion of construction, for sites authorized by the General Permit for the Discharge of Stormwater, the Stormwater Pollution Control Plan shall be kept as an appendix to the Stormwater Management Plan or Stormwater Pollution Prevention Plan (as applicable) for a period of at least three years from the date of completion of construction. A notice of termination form shall be completed by the permittee and forwarded to DEP upon completion of all site construction.



Subcat Reach Pond Link

Drainage Diagram for 386-abelin NEW 2019
Prepared by Microsoft, Printed 3/5/2020

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EXISTING CONDITIONS Runoff Area=14.760 ac 0.00% Impervious Runoff Depth>1.14"
Flow Length=3,745' Tc=75.3 min CN=77 Runoff=7.31 cfs 1.408 af

Subcatchment 2S: Q TO WQ BASIN Runoff Area=18,488 sf 38.19% Impervious Runoff Depth>1.57"
Flow Length=290' Tc=12.6 min CN=83 Runoff=0.67 cfs 0.055 af

Subcatchment 3S: Q BYPASS Runoff Area=14.320 ac 0.14% Impervious Runoff Depth>1.14"
Tc=75.3 min CN=77 Runoff=7.09 cfs 1.366 af

Subcatchment 8S: ROOF RUNOFF Runoff Area=2,300 sf 100.00% Impervious Runoff Depth>2.87"
Tc=5.0 min CN=98 Runoff=0.17 cfs 0.013 af

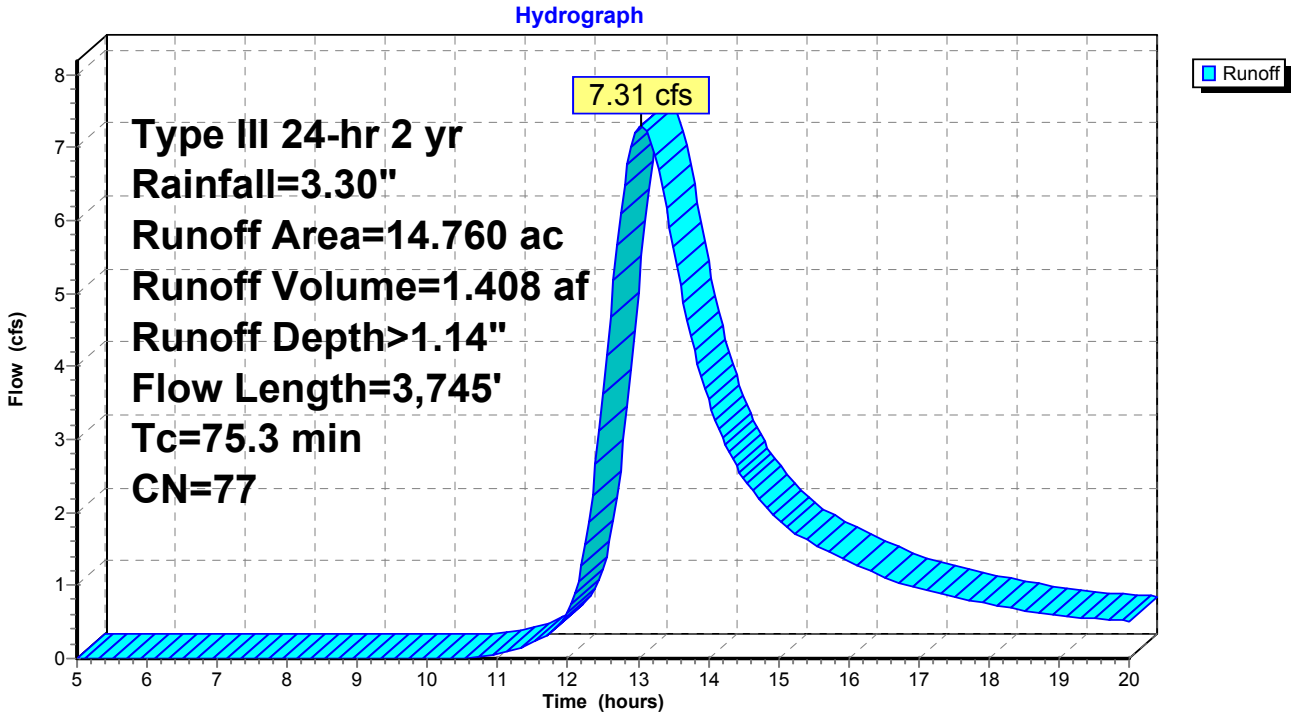
Reach 4R: TOTAL Q PROPOSED Inflow=7.09 cfs 1.371 af
Outflow=7.09 cfs 1.371 af

Pond 6P: STORMWATER BASIN Peak Elev=396.04' Storage=1,638 cf Inflow=0.67 cfs 0.055 af
Discarded=0.02 cfs 0.013 af Primary=0.03 cfs 0.005 af Outflow=0.05 cfs 0.019 af

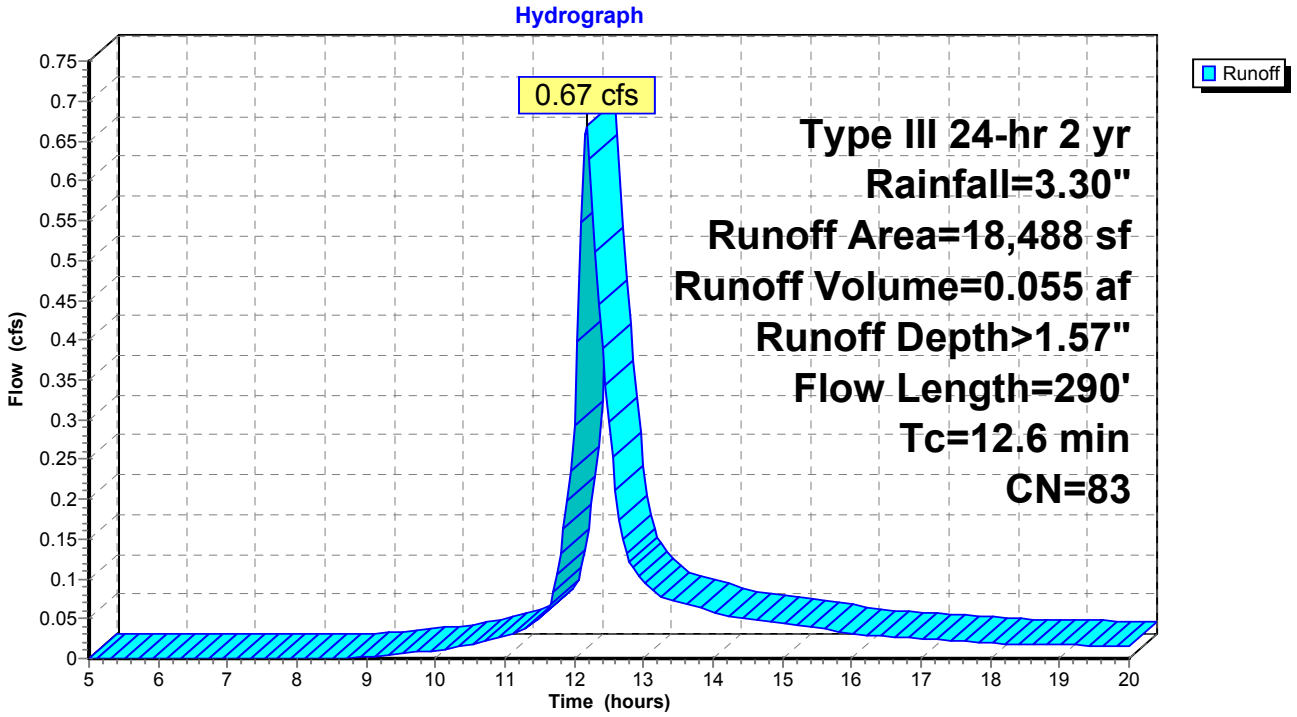
Pond 9P: ROOF INFILTRATORS Peak Elev=412.47' Storage=166 cf Inflow=0.17 cfs 0.013 af
Outflow=0.03 cfs 0.013 af

Total Runoff Area = 29.557 ac Runoff Volume = 2.842 af Average Runoff Depth = 1.15"
99.21% Pervious = 29.322 ac 0.79% Impervious = 0.235 ac

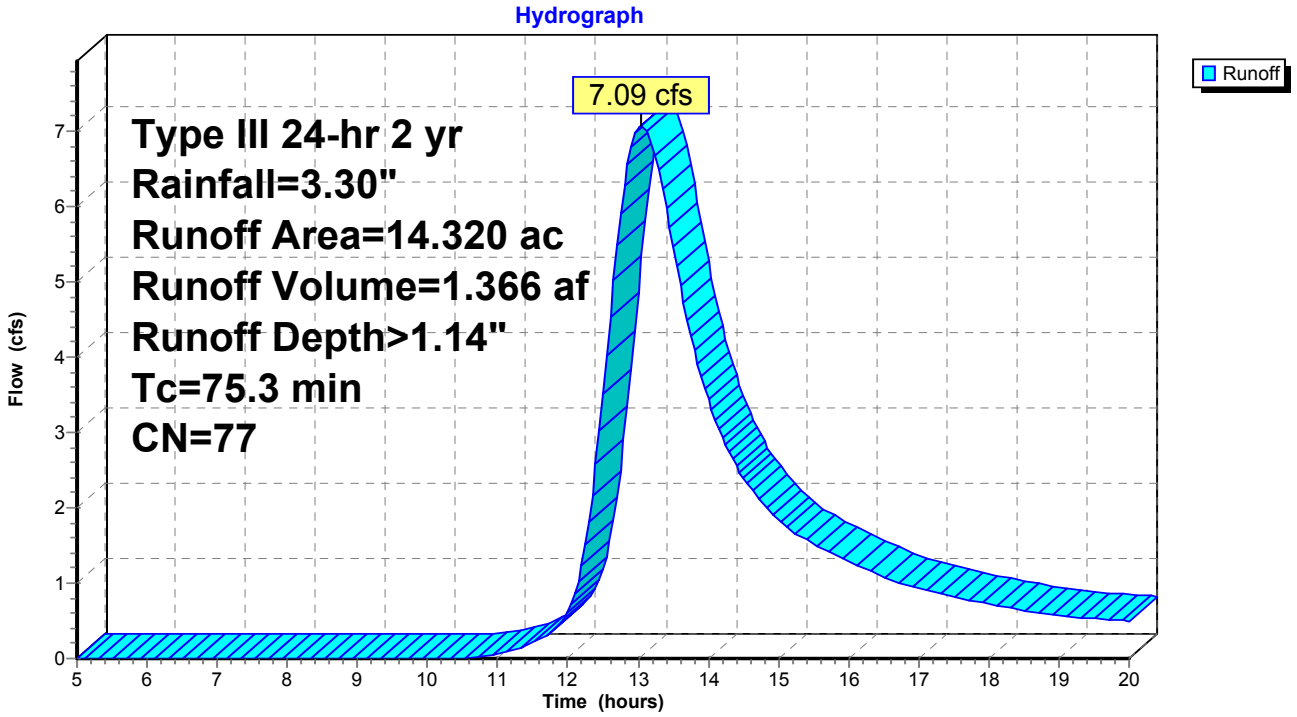
Subcatchment 1S: EXISTING CONDITIONS



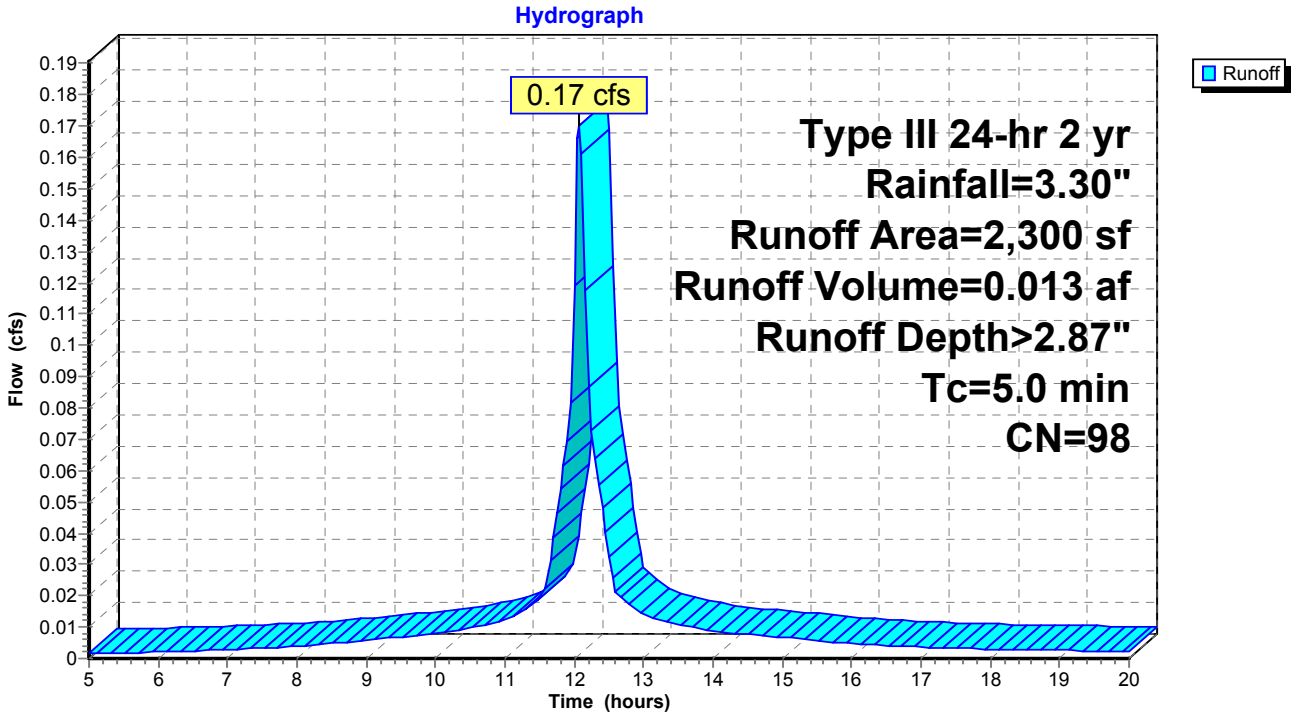
Subcatchment 2S: Q TO WQ BASIN



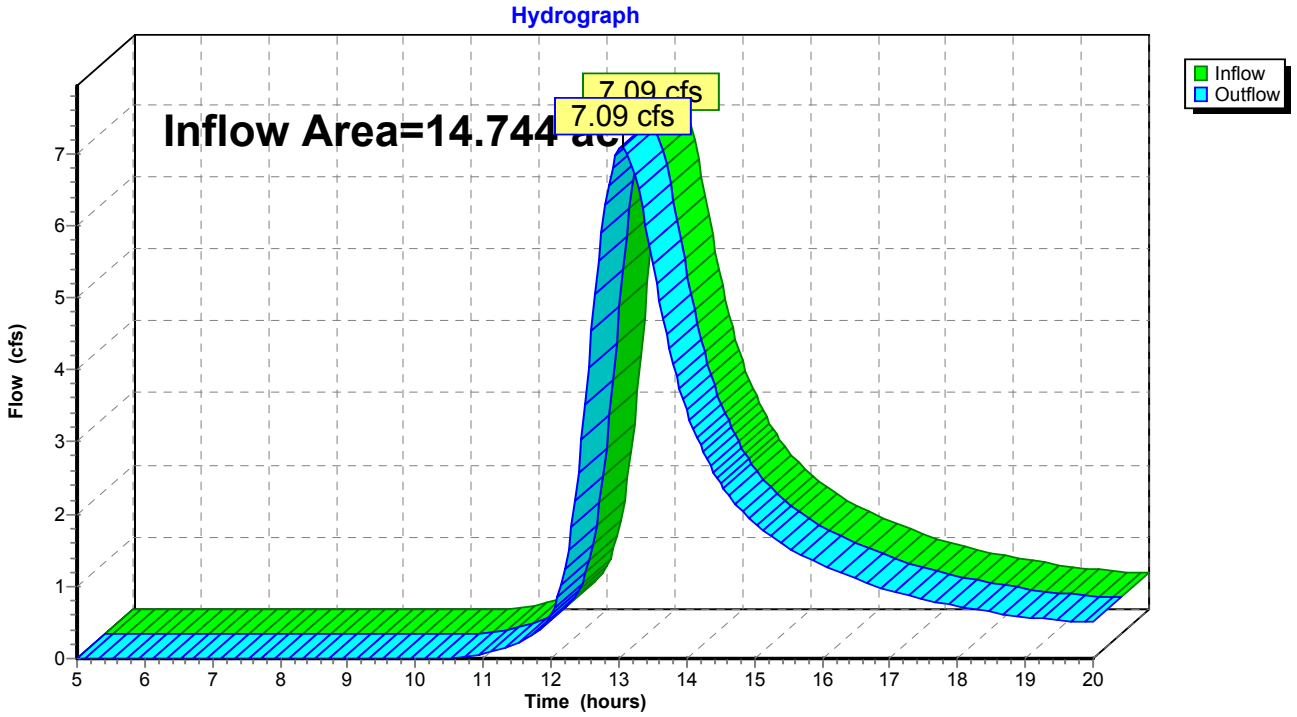
Subcatchment 3S: Q BYPASS



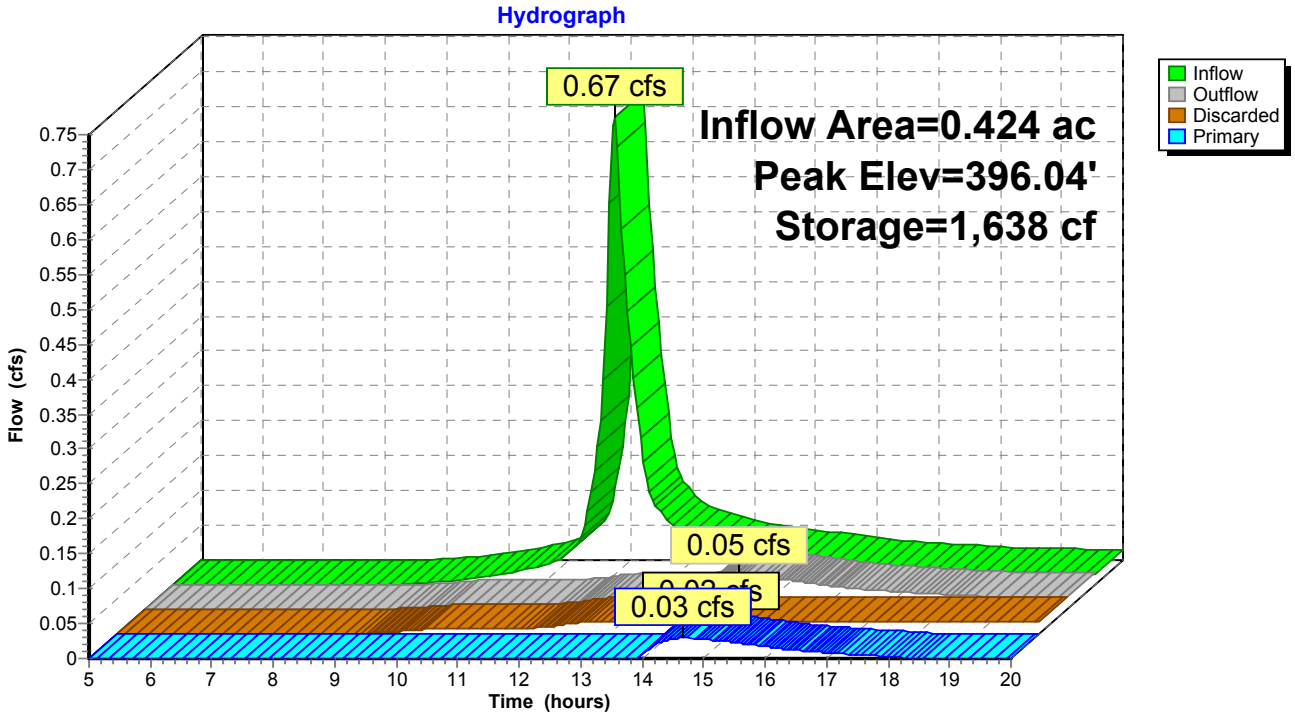
Subcatchment 8S: ROOF RUNOFF



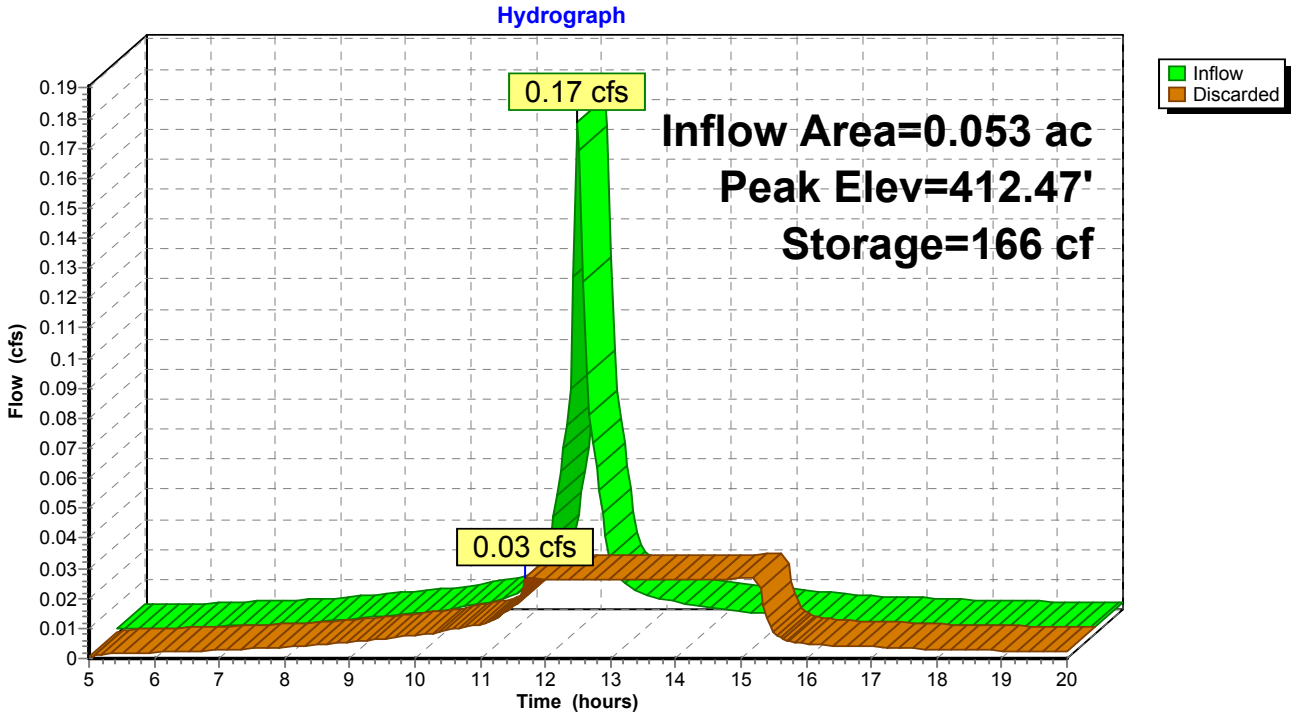
Reach 4R: TOTAL Q PROPOSED



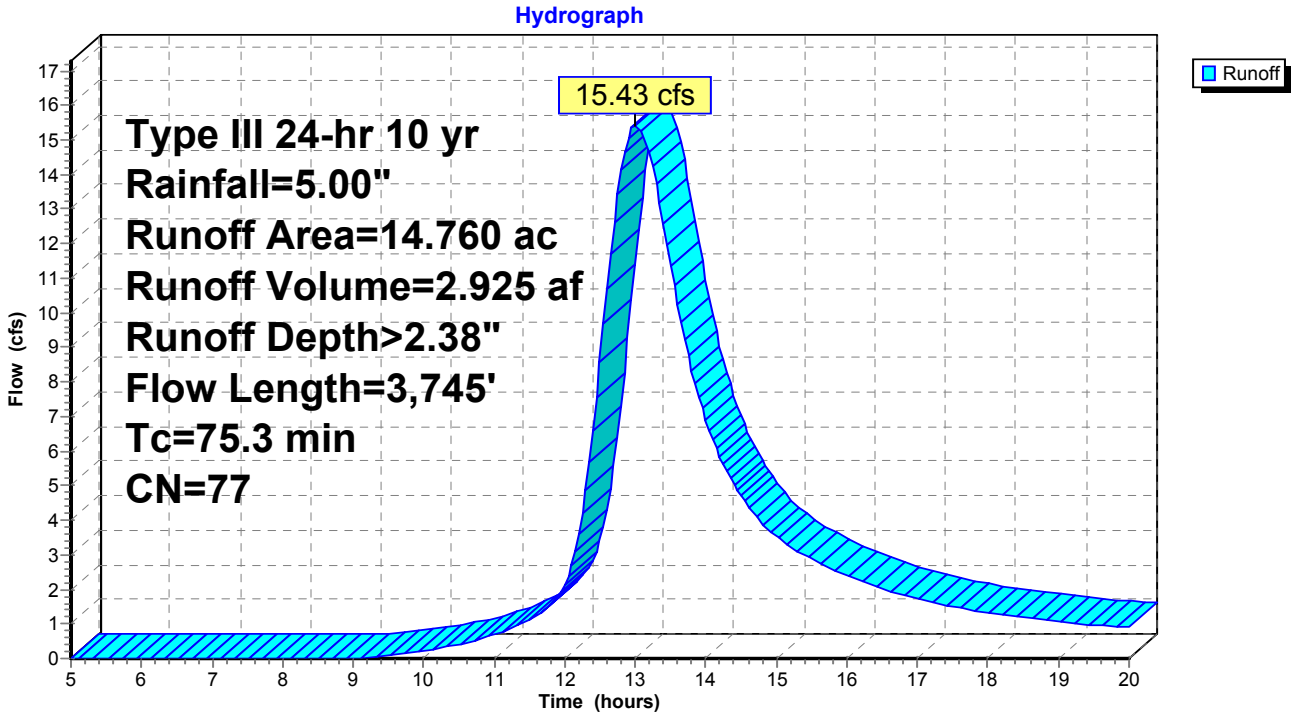
Pond 6P: STORMWATER BASIN



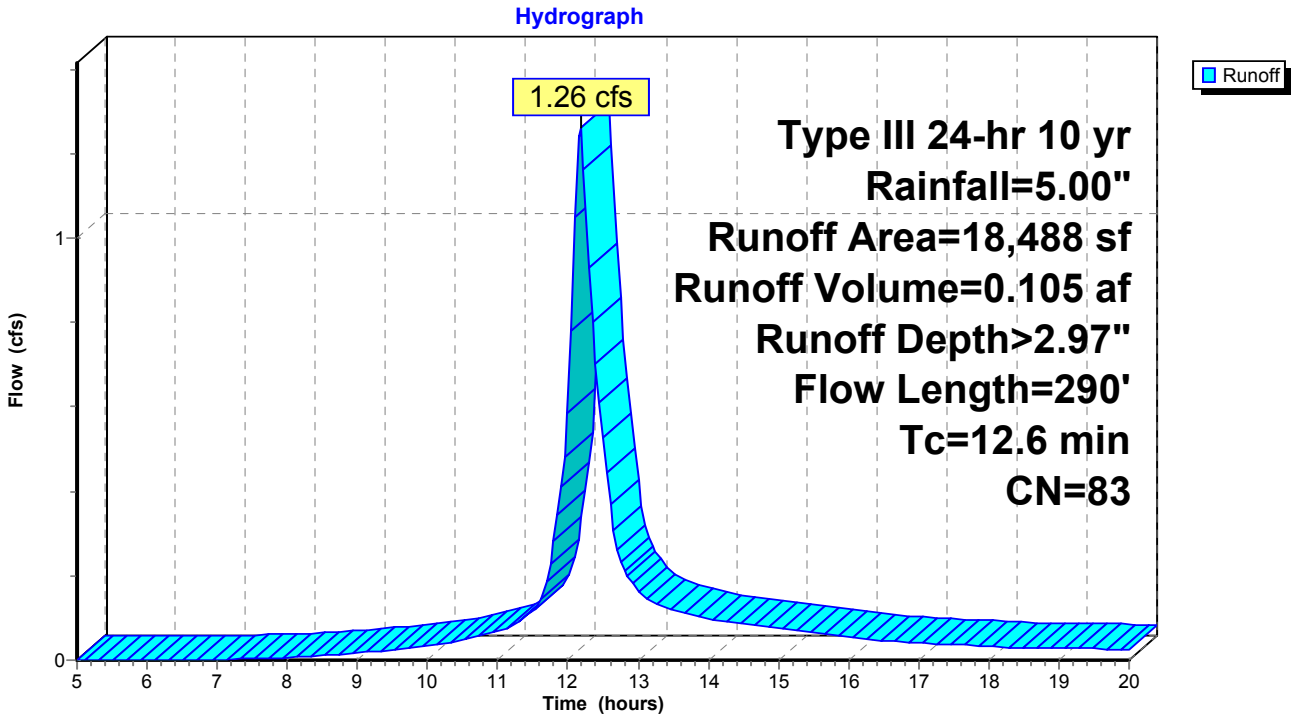
Pond 9P: ROOF INFILTRATORS



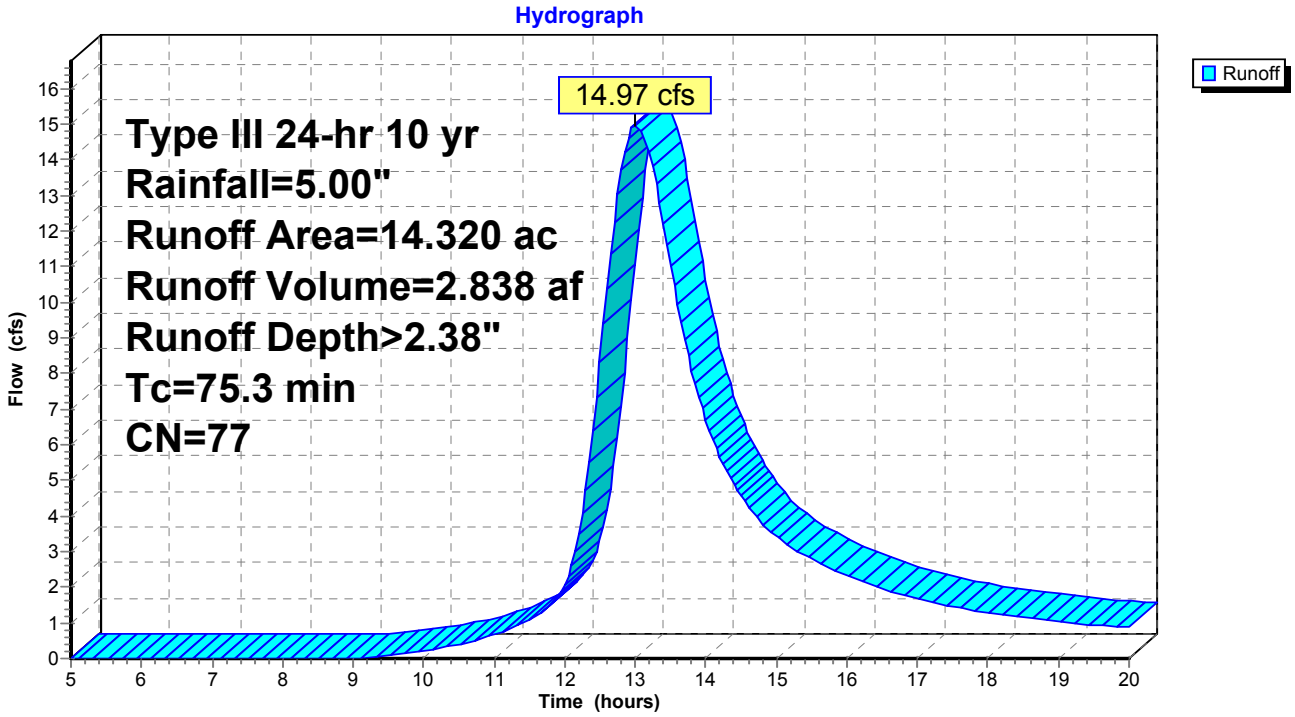
Subcatchment 1S: EXISTING CONDITIONS



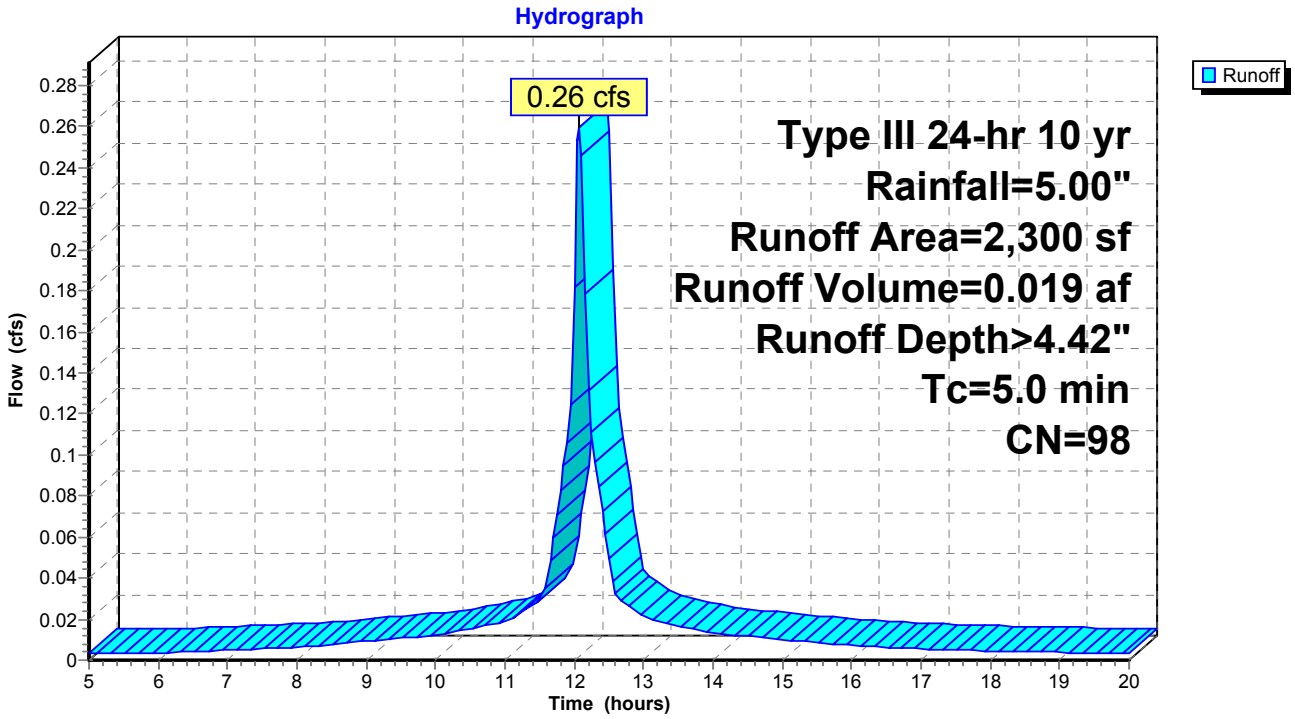
Subcatchment 2S: Q TO WQ BASIN



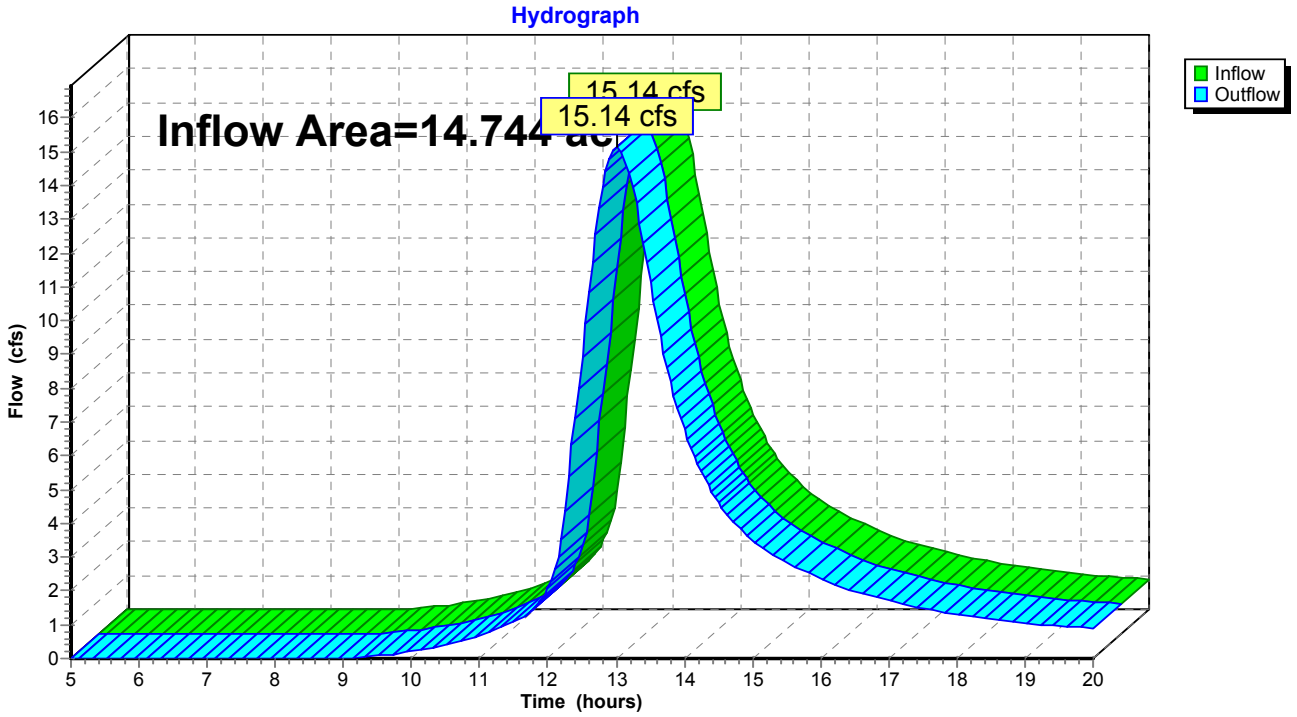
Subcatchment 3S: Q BYPASS



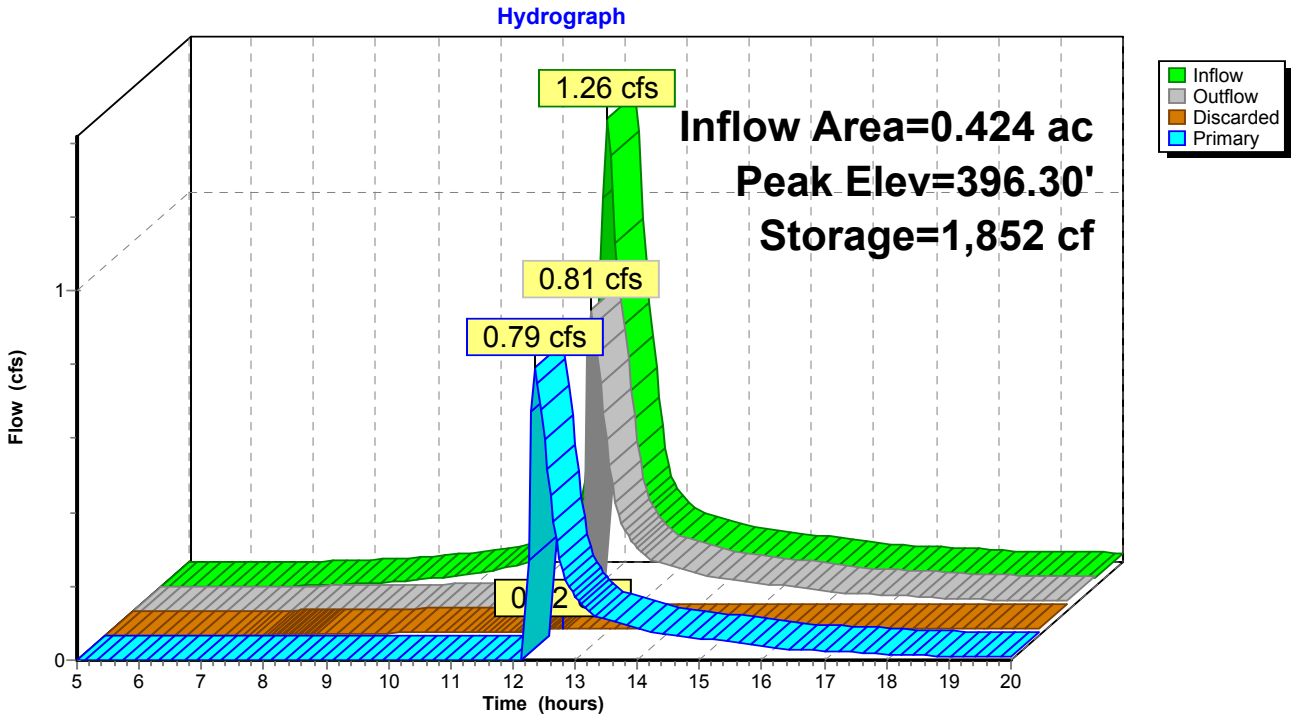
Subcatchment 8S: ROOF RUNOFF



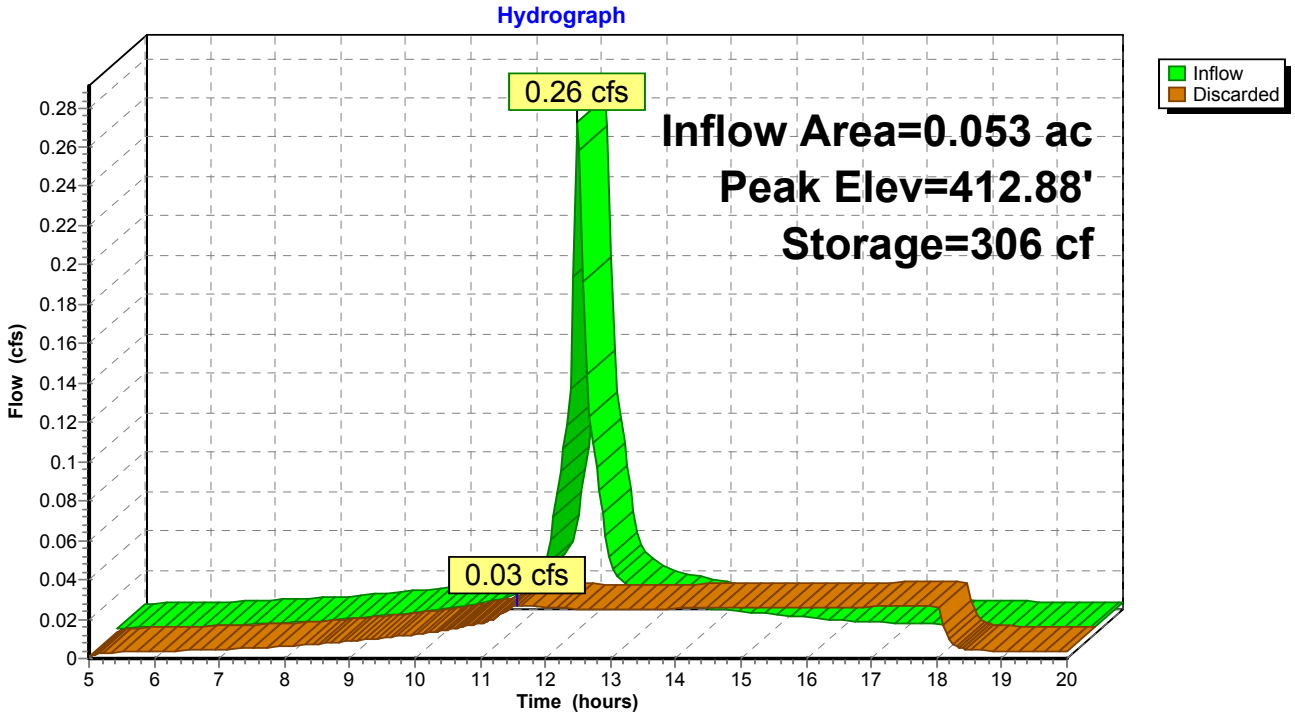
Reach 4R: TOTAL Q PROPOSED



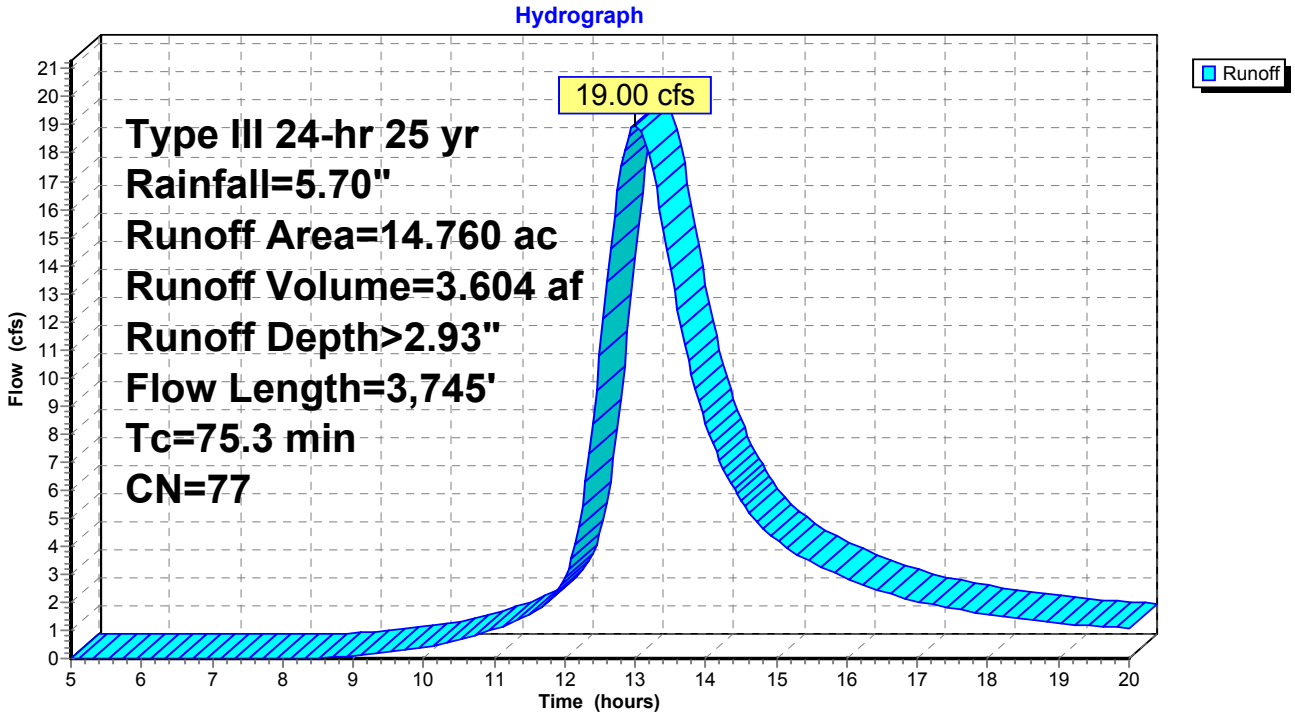
Pond 6P: STORMWATER BASIN



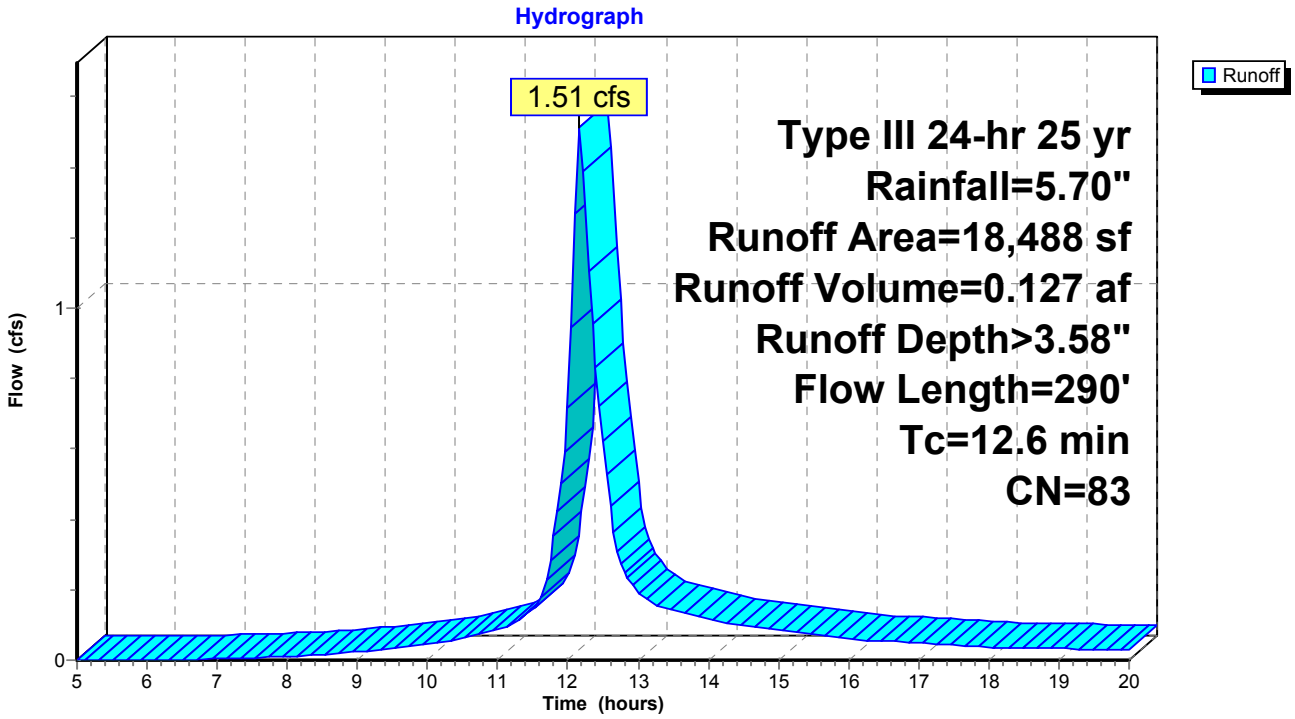
Pond 9P: ROOF INFILTRATORS



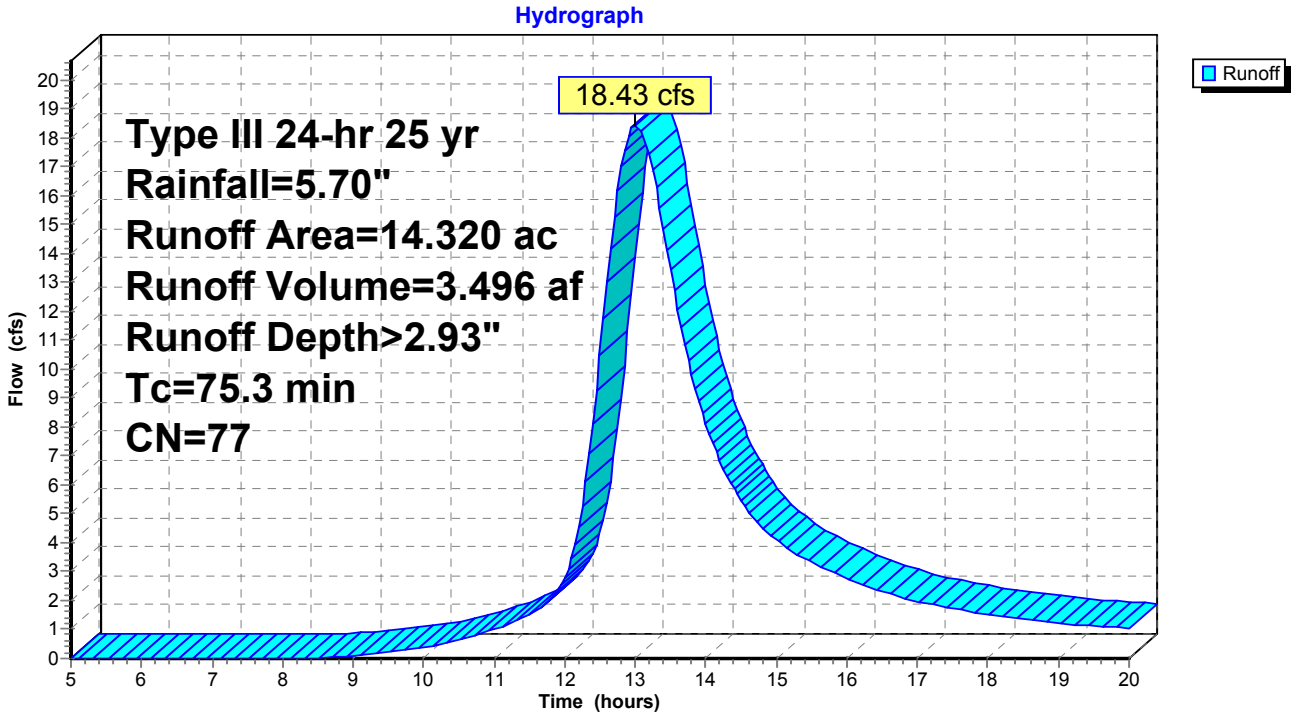
Subcatchment 1S: EXISTING CONDITIONS



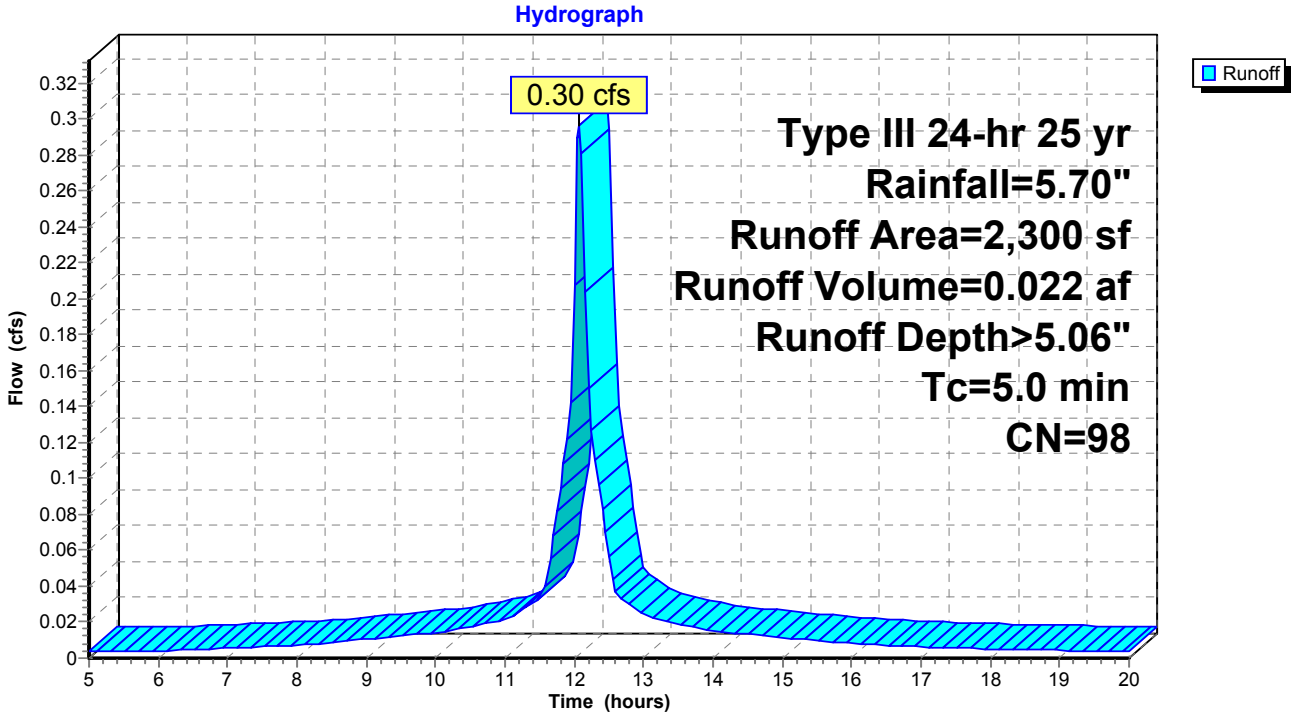
Subcatchment 2S: Q TO WQ BASIN



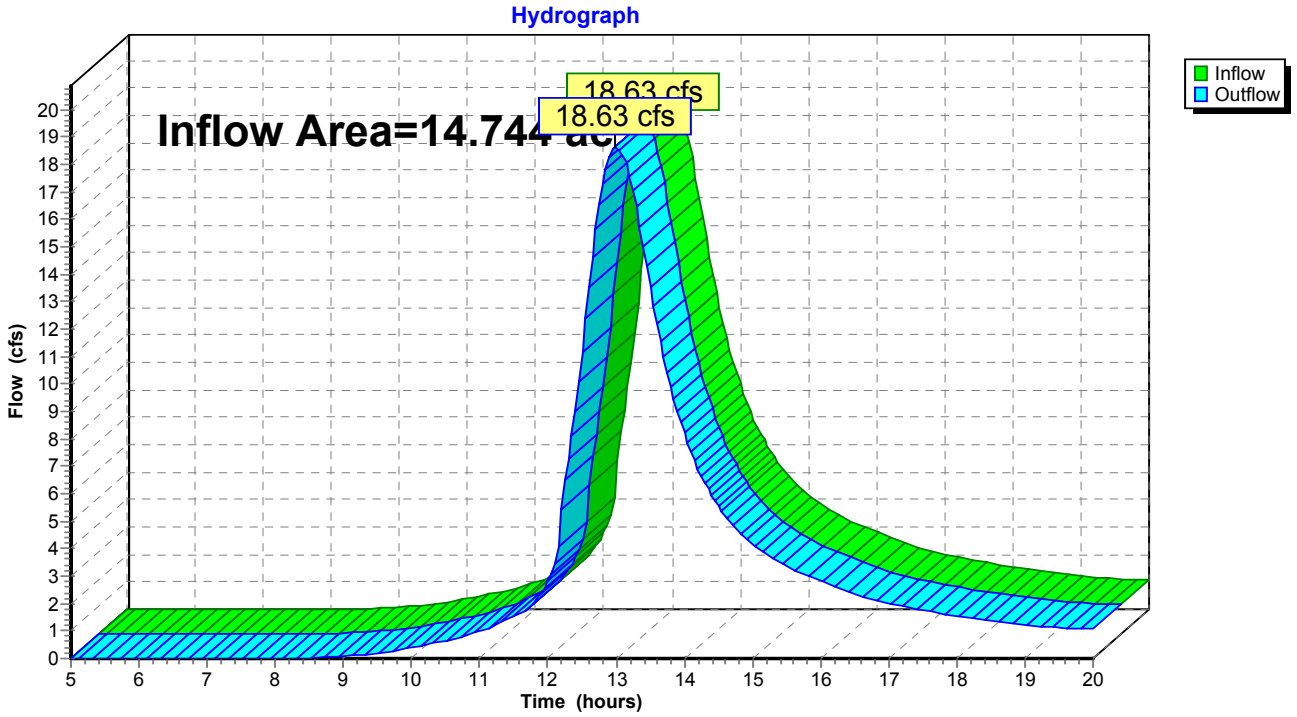
Subcatchment 3S: Q BYPASS



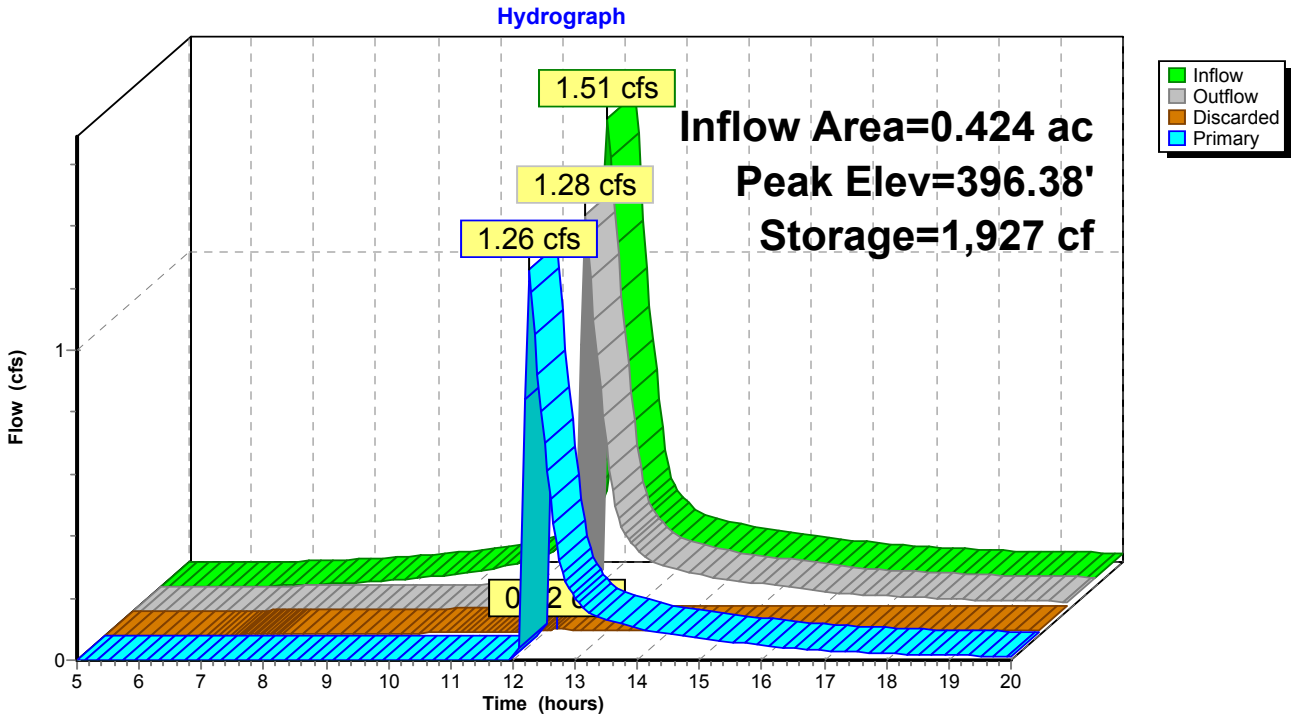
Subcatchment 8S: ROOF RUNOFF



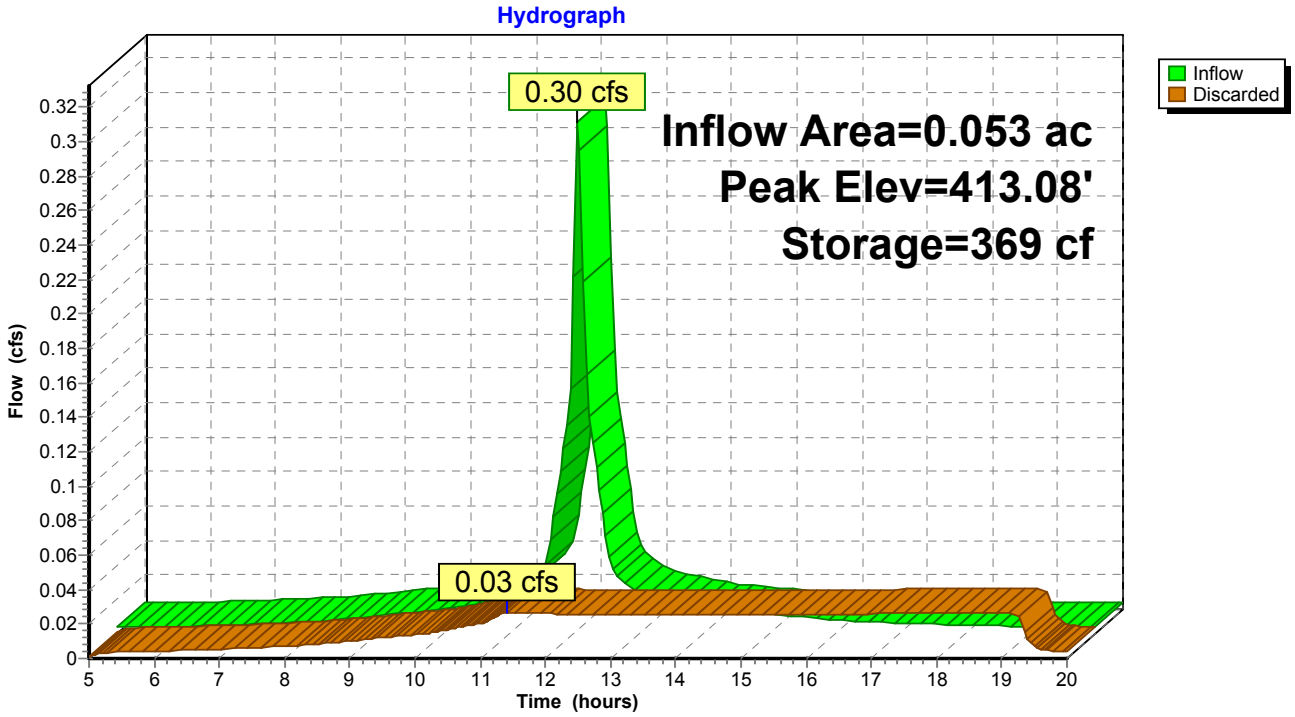
Reach 4R: TOTAL Q PROPOSED



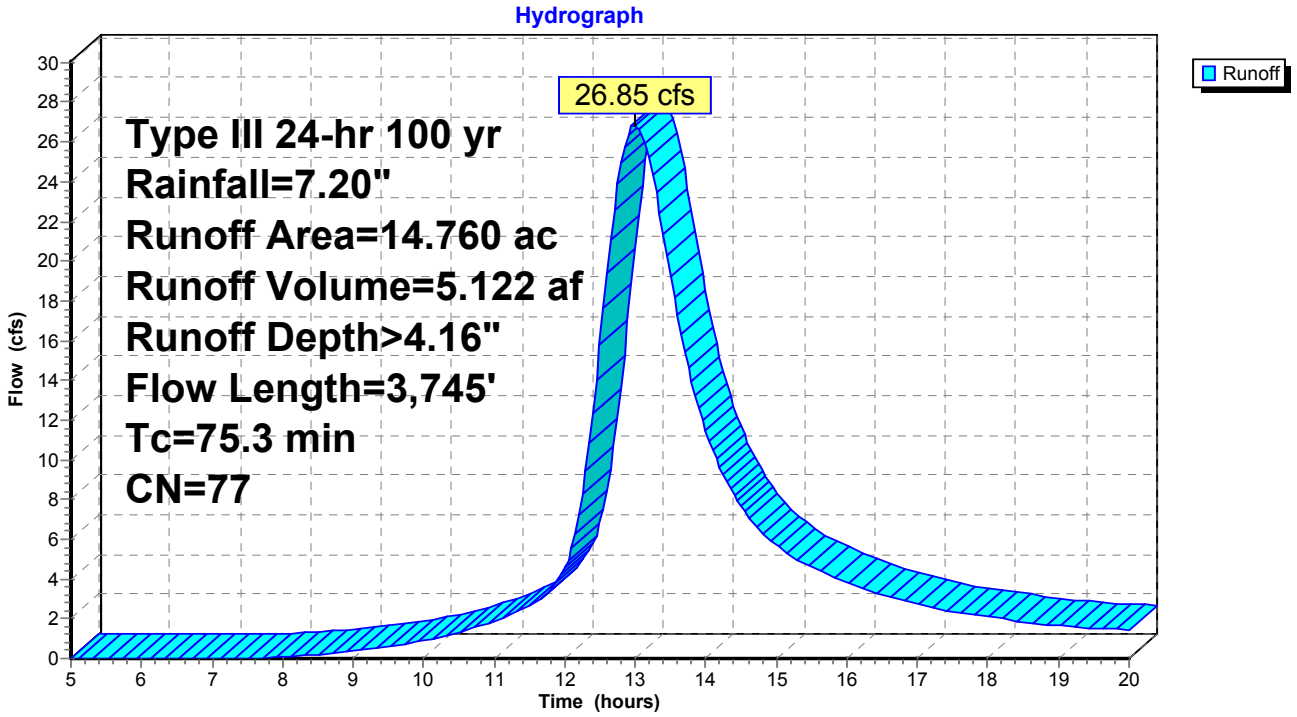
Pond 6P: STORMWATER BASIN



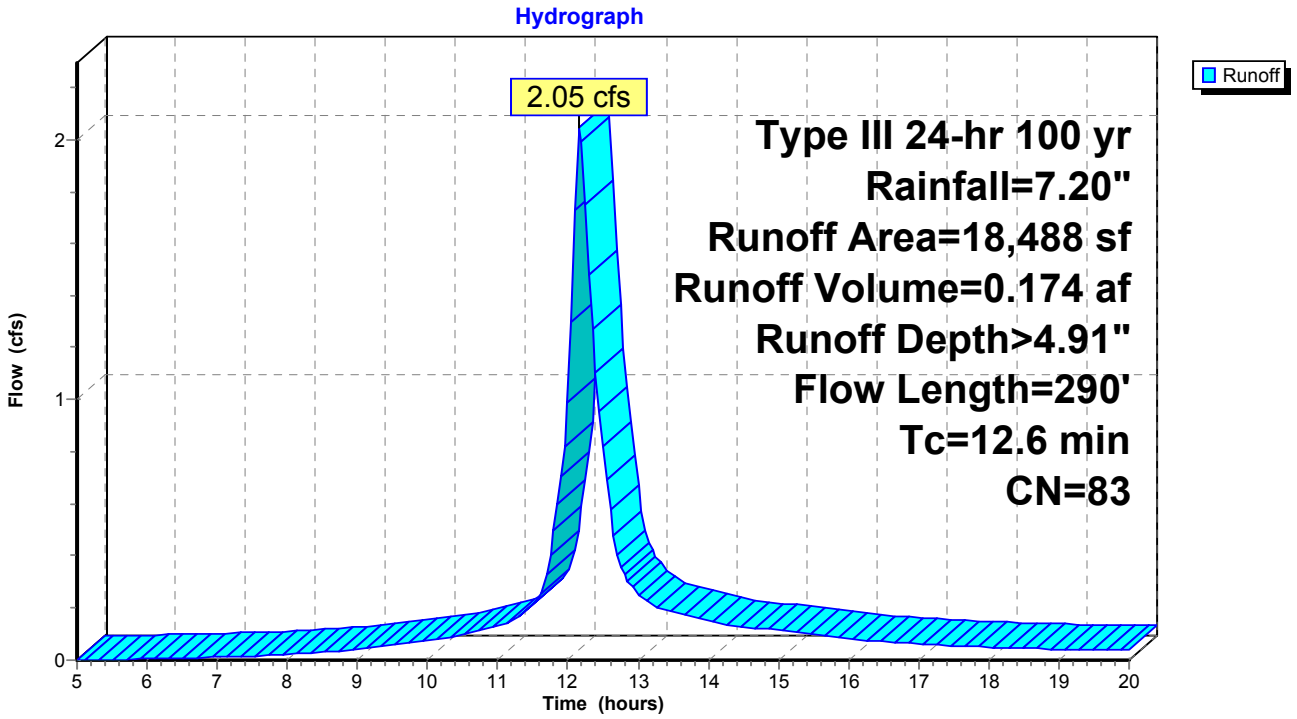
Pond 9P: ROOF INFILTRATORS



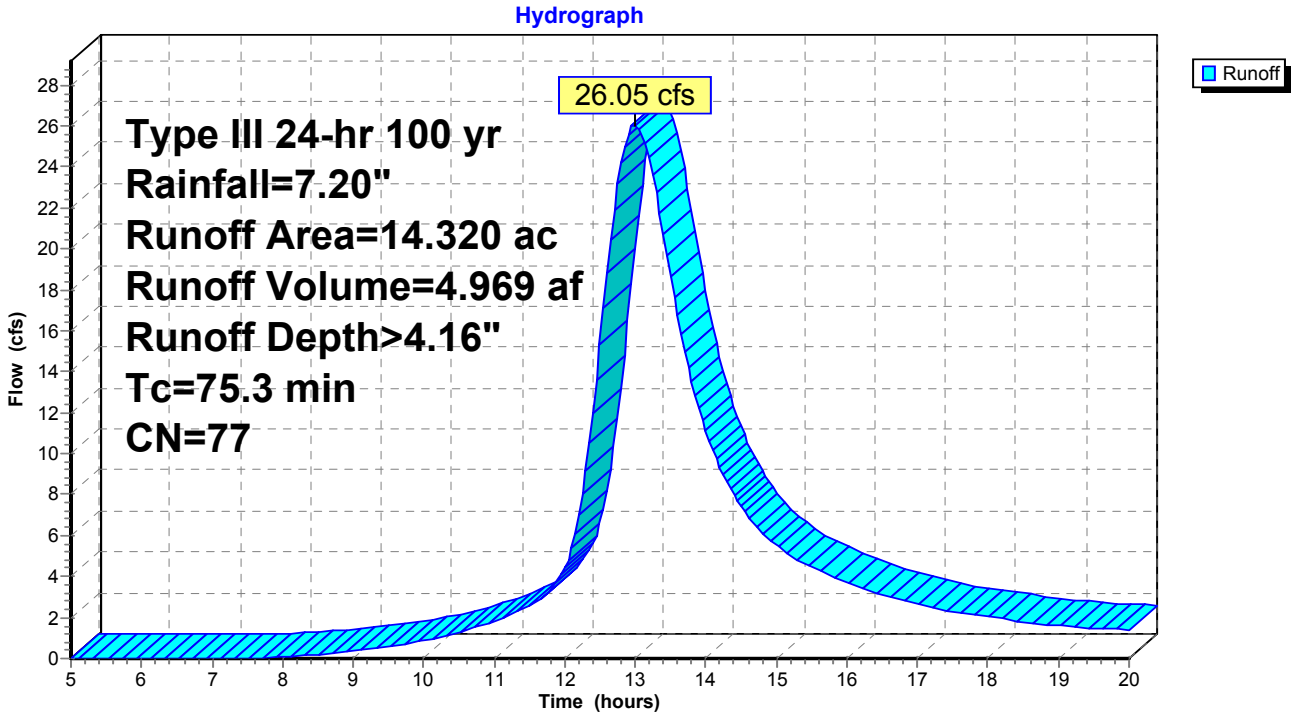
Subcatchment 1S: EXISTING CONDITIONS



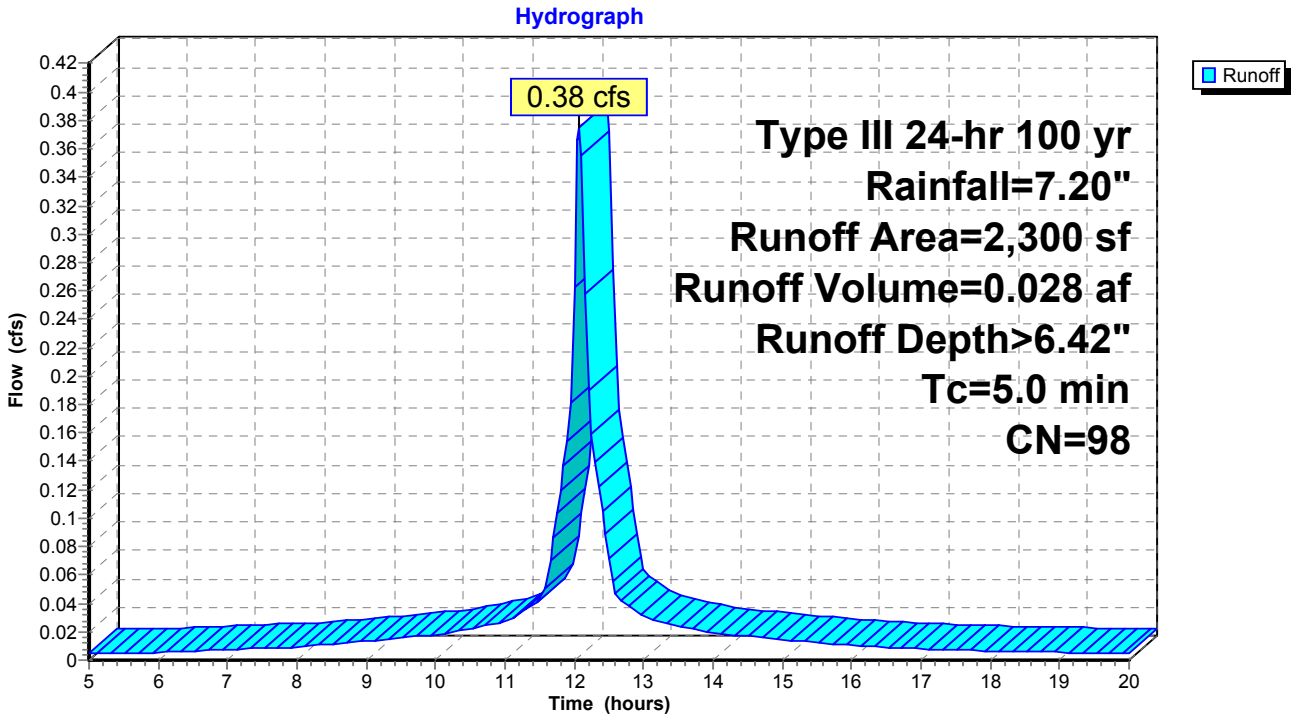
Subcatchment 2S: Q TO WQ BASIN



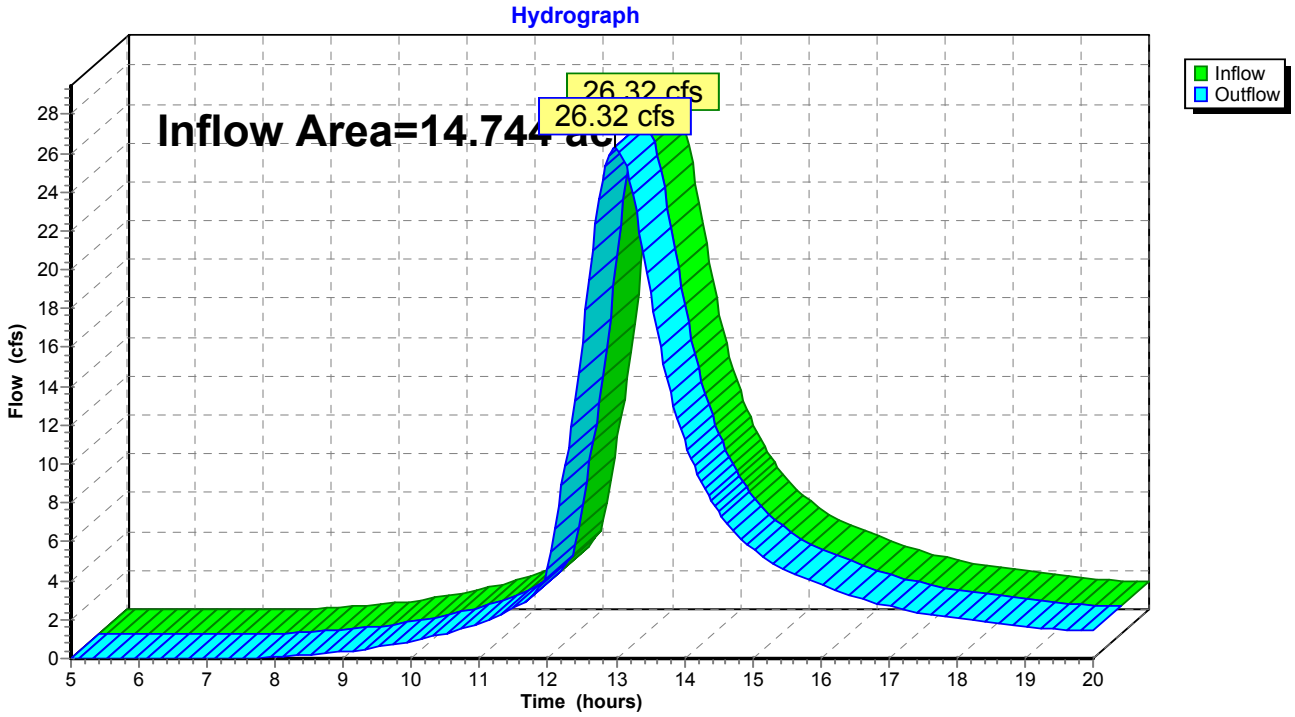
Subcatchment 3S: Q BYPASS



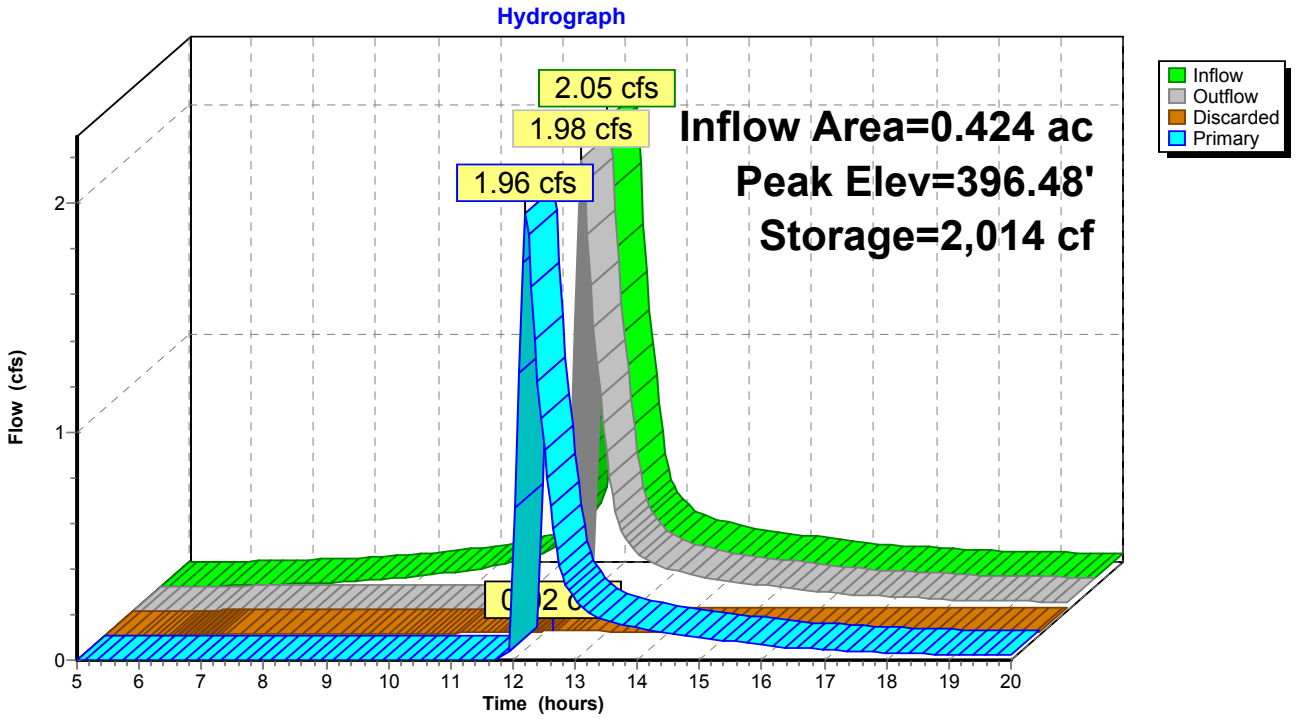
Subcatchment 8S: ROOF RUNOFF



Reach 4R: TOTAL Q PROPOSED



Pond 6P: STORMWATER BASIN



Pond 9P: ROOF INFILTRATORS