12. STORMWATER MANAGEMENT PLAN & CALCULATIONS

The MMC staff parking garage project site consists of portions of the 222 St. John Street (Cowcatcher), 184 St. John Street (Eagles), and the Union Station Plaza property through an access easement. Within the stormwater design, these properties have been combined and evaluated as a single project site. Applicable regulations that govern stormwater management on this site include Section 5 of the City of Portland Technical Manual, Chapter 32 of the City of Portland Code of Ordinances, and the Maine Stormwater Best Management Practices (BMP) Manual. Under Section 5 of the City Technical Manual, the project is subject to the Redevelopment Standards and is required to adhere to the General Standards of the Maine Department of Environmental Protection Chapter 500 Stormwater Regulations.

The project will disturb greater than one acre of land; will result in a decrease of approximately 14,506 square feet (SF) of impervious area; and will result in the redevelopment of a non-roof impervious area greater than 5,000 SF. The project will therefore be required to meet the Basic Standards for erosion & sedimentation control, and the General Standards for treatment of redeveloped area. The project is not required to meet the Flooding Standard, as there is no new impervious surface proposed, however the project has been designed to minimize the impact of project flows on the surrounding stormdrain system. A small portion of the project area on the 184 St. John Street property will be connected to the existing separated stormdrain in St. John Street, east of the site. Drainage was not previously connected in this direction. The remainder of the post-development flows for the redeveloped site will be managed to reduce the flow to the existing downstream stormwater collection system west of the site. Adequate provisions have been made to collect, treat, and detain the required amount of stormwater runoff generated from the site. The following sections describe the design methodology and the proposed means of compliance with these standards.

12.1 Stormwater Modeling Methodology

Stormwater modeling was completed using the HydroCAD 10.0 Stormwater Modeling System by Applied Microcomputer Systems, which uses TR-20 runoff calculations methodology. The HydroCAD output for both the pre- and post-development models are attached to this section. The Chapter 500 Stormwater regulations define standard rainfall amounts for the 2-year, 10-year, and 25-year, 24-hour storm events; a Type III rainfall distribution was applied to the storm events.

Subcatchment drainage areas were delineated based on topographical information. HydroCAD provides a lookup table for curve number (CN), which is a measure of the retention and runoff properties of various surfaces based on the Hydrological Soil Group (HSG) and land cover type. The calculation of CN is based on TR-55 methodology. The HSG for the site was taken from the USDA Natural Resources Conservation Service Web Soil Survey, a copy of the survey map is attached; the Site consists of HSG Type A (representative of the most permeable soils) within the 184 St. John Street property and unclassifiable soils within the current 222 St. John Street Parking lot. The unclassifiable soils have been modeled as HSG Type D, the HSG representing the least permeable soil condition. The area of each land cover type was delineated using ground cover information from existing condition survey and GIS sources, and HydroCAD computed the final CN for each subcatchment based on the area-weighted average.

The Time of Concentration (Tc) is the time required for runoff to travel from the most hydrologically distant point of a watershed to the point of discharge. The Tc for each subcatchment drainage area was computed within HydroCAD using TR-55 methodology as the sum of the travel times for each consecutive flow segments along the longest hydraulic flow path. The longest hydraulic flow path was delineated utilizing contour data and partitioned into segments based on flow types, land cover, and slopes. The primary types of flow consist of sheet flow, shallow concentrated flow, and channel flow. A minimum Tc of six minutes was utilized for all subcatchments.

12.2 Pre- and Post-Development Site Conditions

For the purpose of this stormwater analysis, the model has been limited to the project area, which includes portions of the following properties:

- 222 St. John Street Property parking lot (Cowcatcher LLC);
- 184 St. John Street Property parking lot (Fraternal Order of Eagles); and
- A portion of the Union Station Plaza Parcel parking lot (Union Station Plaza Limited Partnership).

Areas proposed to be redeveloped as part of the design have been included within stormwater calculations described below. Two stormwater study points have been defined, an existing 30-inch stormdrain in St. John Street to the east of the site and an existing 18-inch stormdrain crossing the railroad tracks to the west of the site.

12.2.1 Pre-Development

Currently, stormwater runoff generated from the existing parking lot collects via catch basins into a closed storm drain system installed within the parking lots. The parking lot area is primarily flat and allows for additional relief along the western property line adjacent to the neighboring railroad tracks. The project area connects to a stormdrain system that continues through the main parking lot for 222 St. John Street and Union Station Plaza. These existing 18-inch diameter stormdrain pipes convey stormwater runoff from the site, to the west under the railroad tracks into the City of Portland's separated stormwater system that crosses Ogdensburg Street / County Way into the County Jail property.

Existing drainage patterns and site features are shown on the Pre-Development Drainage Plan provided in this section. For the purposes of our analysis, we have used the existing 18-inch stormdrain system as the pre-development study point. A closed circuit television (CCTV) inspection of a portion of the downstream stormdrain system was completed by the applicant, and the results of that inspection show that the existing 18-inch concrete pipe is in good condition.

12.2.2 Post-Development

The proposed redevelopment will consist of the construction of a new free-standing parking garage, entrance driveways, a surface parking lot, walkways, landscaping and associated stormwater management systems. Proposed work will primarily consist of the redevelopment of existing paved parking lot areas. Drainage from the project area will discharge to two locations. The majority of the redeveloped area will continue to discharge via direct pipe connection into the exiting 18-inch stormdrain that discharges to the west under the railroad tracks into the City's stormwater infrastructure. The redeveloped area along St. John Street, including an access driveway and associated landscaping, will be redirected to the existing stormwater drainage utilities within St. John Street. Proposed drainage patterns and features are shown on the Post-Development Stormwater figure provided in this section.

12.2.2.1 West Stormdrain

Stormwater runoff from the majority of the project site will be intercepted by a closed stormwater system that connects to a proprietary subsurface stormwater treatment system which will store and treat stormwater runoff generated from the following areas:

- Top deck of the parking garage and lobby structure roof, discharged to the system via internal garage plumbing;
- Crushed stone planting area which extends along the southern and western faces of the parking garage; and

- Northern surface parking lot, an adjacent grade level entrance driveway, and associated landscaping.

Details of the proposed treatment and storage are provided in the discussions of the General and Flooding Standards that follow in this report.

12.2.2.2 East Stormdrain

Stormwater runoff from the redeveloped area along St. John Street will be intercepted by a closed stormwater system that connects to a proprietary stormwater treatment system which will be installed within a new catch basin in the proposed entrance drive. The existing condition in this area is a parking lot that connects to the stormdrain to the west. This project proposes to instead direct stormwater from this area to the east into the existing 30-inch separated stormdrain in St. John Street. This is a small part of the overall project site, and the flow from this area will not be significant (see the Flooding Standard discussion below). Discussions with Brad Roland from the City of Portland Department of Public Works have indicated that the St. John Street stormdrain should have adequate capacity for the proposed connection.

12.3 Basic Standards (Soil Erosion and Sedimentation Control)

These standards address erosion and sedimentation control, inspection and maintenance, and good housekeeping practices. The application includes erosion and sediment control plans, details, and notes. These notes cover good housekeeping practices. The Erosion and Sedimentation Control Plan for the proposed project is provided below. Additional erosion and sedimentation controls are located within the construction management plan and detail the sequence of the management practice installation.

12.3.1 Erosion and Sedimentation Control Plan

The overall goal of the Soil Erosion and Sedimentation Plan is to restrict the potential for erosion and sedimentation at the site and down-gradient of the site. A variety of erosion control techniques will be implemented to achieve this goal. During construction, these include:

- Positive grades throughout the construction site to direct flow to sediment control barriers;
- Diversion barriers to keep upslope runoff from flowing through the construction site;
- Installation and maintenance of sedimentation barriers adjacent to downhill areas of the perimeter of the project site;
- Installation and maintenance of construction entrances at the travelled interface between stabilized and non-stabilized portions of the project site;
- Controls for fugitive dust, debris, and other materials;
- Permanent seeding or mulching applied as soon as areas are at final grades; and
- Inspection of all in-place measures after every significant rainfall until permanent measures are in place.

Structural measures for erosion and sedimentation control will be installed where shown on the Demolition Plan, which is included in the drawings attached to Section 3 of this Report; details for the proposed measures are also included in the drawings. Erosion and sedimentation control measures will be implemented in accordance with the "Maine Erosion and Sedimentation Handbook for Construction: Best Management Practices" and will be installed prior to earth disturbing activities. Temporary measures will be removed after the areas are permanently stabilized.

Permanent erosion control measures will include surface ground cover, including vegetation, pavement, crushed stone, and rip rap. Areas of concentrated flow will be protected from erosion by establishing vegetation and riprap. All

measures will be maintained in effective operating condition. The Contractor will be responsible for implementing and maintaining all erosion and sediment control measures and will use the attached inspection report form or equivalent.

Due to the size of the site, the project will be required to conform with the Maine Construction General Permit. A Notice of Intent to Comply will be filed for the project prior to the start of construction, and will be provided to the City upon filing.

12.4 General Standard (Water Quality)

The City of Portland Technical Manual requires that all projects, not subject to the requirements of an existing Site Law or Stormwater Management Law Permit, that include redevelopment of non-roof impervious area greater than 5,000 square feet, and are subject to the City of Portland Review, provide stormwater quality treatment in accordance with the General Standard for no less than 50% of the redeveloped non-roof impervious area.

No new developed area will be created as part of this project, as the Site is already entirely developed. A majority of the site will be disturbed. The project will result in a net decrease of approximately 14,506 SF of impervious area. The project will result in approximately 146,887 square feet of redeveloped non-roof impervious area; it should be noted that the garage top deck is not considered "roof" under this analysis and is therefore counted toward the redeveloped area requiring treatment. The redevelopment standard requires 50% of this redevelopment area to be treated, requiring that a minimum 73,444 square feet of area be treated for this project.

A Jellyfish Filter with below-grade R-Tanks for water quality volume storage has been selected as the primary water quality treatment BMP for the Site. This system will provide treatment for the west stormdrain area (as described earlier under post-development site conditions). Alternative methods were considered, such as an underdrained subsurface sand filter, but were not selected due to elevation constraints associated with discharging to the existing stormdrain system located on the Union Station Plaza property. Above-grade storage systems, like underdrained soil filters and rain gardens, were also ruled out as there is limited available space on the Site.

Adequate provisions have been made to collect stormwater runoff from the project area via a series of catch basins and inlets, which drain to an underground R-Tank storage system designed to store the Water Quality Volume prior to treatment by the Jellyfish Filter. The proposed R-Tank System and Jellyfish Filter are proposed to be installed below-grade in the surface parking lot to the north of the parking garage and will collect, store and treat stormwater runoff generated from the post-development areas described above in Section 12.1.1.2.

The Jellyfish Filter is a proprietary system, which has been reviewed and approved for use by the MaineDEP; a copy of the approval letter is attached in this section. The proposed Jellyfish Filter has been sized to meet the MaineDEP approval standards to treat a minimum Water Quality Volume of 1-inch runoff from impervious areas and 0.4-inch runoff from pervious areas. Please see attached calculations demonstrating that the filter has been adequately sized to treat the required Water Quality Volume.

The Jellyfish Filter will be installed to provide treatment of greater than the minimum required area. The entire area of the site that is tributary to the proposed treatment system is approximately 157,512 square feet. Of this area, 125,012 square feet is redeveloped, non-roof impervious surface which exceeds the 73,444 square feet required for 50% treatment of the redeveloped impervious area.

A second treatment system is proposed for the east stormdrain area, which ties into St. John Street. This StormBasin catch basin filter will be installed within the redeveloped garage entrance along St. John Street. While the StormBasin filter is not an approved Maine DEP proprietary treatment option, the proposed stormdrain will aid in removal of pollutants generated within the highly trafficked entrance, providing treatment beyond the total amount required by the City's standards.

Table 12-1 outlines the areas as described, demonstrating conformance with the City of Portland Redevelopment Standards.

Table 12-1: Stormwater Treatment Area Breakdown

	Area (SF)	Area(AC)
Total Project Area:	229,656	5.27
Proposed Disturbed Area:	204,783	4.70
Total Impervious Surface Area:		
Existing:	190,582	4.38
Proposed:	176,076	4.01
Reduction:	(14,506)	0.33
Redeveloped Non-Roof Impervious Area:		
Total (includes top floor of garage):	146,887	3.37
Required Treatment Area (50%):	73,444	1.69
Provided Treatment Area:		
Jellyfish Filter & R-tanks		
Total Area Treated:	157,512	3.62
Total Redeveloped Non-Roof Impervious Area Treated:	**125,012**	**2.87**
Percentage of Redeveloped Non-Roof Impervious Area Treated:	**85%**	
StormBasin Catch Basin Filter		
Total Area Treated:	**10,000**	**0.75**
Total Redeveloped Non-Roof Impervious Area Treated:	**4,743**	**0.21**
Percentage of Redeveloped Non-Roof Impervious Area Treated:	**3.2%**	
Total Percentage of Redeveloped Non-Roof Impervious Area Treated by Both Systems:	**88.2%**	

12.5 Flooding Standard (Water Quantity)

In accordance with the City of Portland's Redevelopment Standards, the adherence to the Flooding Standard is not required for the site, as there is no new impervoius or new developed surface proposed. However, based upon good engineering practices, and current site constraints, the stormwater management system has been evaluated for the 24-hour, Type III storm event of the 2-,10-, and 25-year frequencies to ensure that peak flows from the Post-Development design of the site do not result in a negative impact on their tributary drainage systems.

The existing parking lot currently discharges to a stormdrain system that runs through the Union Station Plaza property and underneath the railroad tracks, connecting to an existing City-owned stormdrain system on Ogdensburg Street and County Way at the County Jail property located west of the project site. Examination of existing conditions on the site shows that the existing 18-inch stormdrain piping is not sized to adequately to handle current flows, and anecdotal

evidence notes that ponding does occur in the parking lot during larger storm events. CCTV inspection of the existing pipe has shown that the existing RCP pipe is in good condition.

The intent of our design is to manage stormwater such that the post-development peak flows are reduced to flow rates that can be accommodated within the existing 18-inch stormdrain pipe west of the site. This is accomplished by increasing the size of the R-tank storage system. An 18-inch pipe is able to convey 20.81 cfs of flow at 95% of its full capacity. Reviewing the peak flow calculations for this study point (see **Table 12-2**), the pipe capacity is exceeded in the existing condition during a 10-year storm event. The proposed stormwater system will provide adequate storage such that flow from the project site will be reduced to a rate that is below the 18-inch pipe's capacity during all evaluated storm events, including the 25-year storm event.

The small portion of the site that will connect to the St. John Street stormdrain to the east of the site will result in flow to the 30-inch separated stormdrain system, where stormwater does not currently exist. The City has indicated that this increase can be handled by the existing infrastructure.

Adequate provisions have been made to collect and discharge stormwater generated from the developed area of the Site. The HydroCAD reports for both Pre-and Post-Development Conditions are attached to this Section. The tables below provides a summary of the peak runoff rates for the 24-hour, 2-year, 10-year, and 25-year Type III storm events.

Table 12-2: Summary of Peak Runoff Rates to Study Point 1 – 18-inch Stormdrain

	PEAK RUNOFF RATE (CFS)		
	2-YEAR STORM	10-YEAR STORM	25-YEAR STORM
Pre-Development (Existing) Site	11.20	21.56	27.70
Post-Development Site	2.38	11.73	18.80
Difference	**-8.82**	**-9.83**	**-8.90**

Table 12-3: Summary of Peak Runoff Rates to Study Point 2 – 30-inch St. John Street Stormdrain

	PEAK RUNOFF RATE (CFS)		
	2-YEAR STORM	10-YEAR STORM	25-YEAR STORM
Pre-Development (Existing) Site	**No Connection**		
Post-Development Site	0.80	2.14	2.99
Difference	**+0.80**	**+2.14**	**+2.99**

Table 12-4: Summary of Peak Runoff Rates Overall Project Site

	PEAK RUNOFF RATE (CFS)		
	2-YEAR STORM	10-YEAR STORM	25-YEAR STORM
Pre-Developed (Existing) Site	11.20	21.56	27.70
Post-Development	3.18	13.87	21.79
Difference	**-8.02**	**-7.69**	**-5.91**

As the Site's peak runoff rate has been reduced, the proposed development is not anticipated to result in adverse effects, including flooding and erosion to abutting and downstream properties. All on-site piping has been designed to accommodate the 25-year storm event without resulting in flooding onto adjacent properties.

12.6 Inspection and Maintenance of Stormwater Systems

General inspection and maintenance during and after construction must take place in accordance with the requirements outlined in Chapter 500, Stormwater Management, Appendix B, Inspection and Maintenance and Stormwater Management, Maine Department of Environmental Protection Publication No. DEPLW0738. During construction, the contractor will be responsible for inspection and maintaining the Site. Upon completion, the property owner will be responsible for implementing the maintenance and inspection requirements for the stormwater management system associated with the new development. The responsible party will ensure that stormwater management facilities are properly maintained and inspected in accordance with the Stormwater Inspection and Maintenance Plan provided in this section.

12.7 Attachments

- Stormwater Erosion & Sedimentation Control Inspection Report Form
- USDA Natural Resources Conservation Service Web Soil Survey HSG Map
- Jellyfish Filter Sizing Calculations
- MaineDEP Jellyfish Filter approval letter
- Pre-Development Stormwater Figure
- Post-Development Stormwater Figure
- Pre-Development HydroCAD Report
- Post-Development HydroCAD Report
- Inspection and Maintenance Plan
- Jellyfish Filter Maintenance Guide
- BMP Maintenance Log
- StormBasin Maintenance Guide

STORMWATER EROSION & SEDIMENTATION CONTROL
INSPECTION REPORT FORM

Inspectors: Date: ___ / ___ / _____

_____ of _____ (Project Owner)
_____ of _____ (Contractor)
_____ of _____
_____ of _____

Storm Event? ☐ Yes ☐ No Rainfall Amount _____ Storm Duration _____ hours

Visual Observations of Activity and Site Conditions:
Disturbed Soil Areas:

Storage of Soils:

Sediment & Erosion Control Measures:

Construction Site Entrance:

Surface Stabilization:

Corrective Actions Taken

Attachments (if any):

Signature:

_____

Representing:

_____

Representing:

Custom Soil Resource Report
Map—Hydrologic Soil Group (Soils)

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

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 1:24,000.

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: Cumberland County and Part of Oxford County, Maine
Survey Area Data: Version 13, Sep 11, 2017

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

Date(s) aerial images were photographed: Data not available.

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.

Table—Hydrologic Soil Group (Soils)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Cu	Cut and fill land		4.9	44.0%
HlB	Hinckley loamy sand, 3 to 8 percent slopes	A	6.2	56.0%
Totals for Area of Interest			**11.1**	**100.0%**

Rating Options—Hydrologic Soil Group (Soils)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

WOODARD &CURRAN
41 HUTCHINS DRIVE
PORTLAND, MAINE 04102
TEL. (207) 774-2112
FAX (207) 774-6635

CLIENT MAINE MEDICAL CENTER
PROJECT 222 St. John Street Garage
DESIGNED BY CMS DATE 6-14-18
CHECKED BY _____ DATE _____
PROJECT NO. 0231168 SHEET NO. 1 OF 1

WATER Quality Volume for Jellyfish filter System

WQV = (1" • Impervious AREA) + (0.4" • Pervious AREA)

→ Impervious AREA = 128,334 SF
→ Pervious AREA = 31,783 SF

= ($1\frac{1}{12}$"/ft • 128,334 SF) + (0.4"/12"/ft • 31,783 SF)
10,964.50 CF 1,059.44 CF

= 11,754 CF

★ WQV PROVIDED = 11,832 CF > 11,754 CF

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PAUL R. LEPAGE
GOVERNOR

PATRICIA W. AHO
COMMISSIONER

January 21, 2015

CONTECH Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074
ATTN: Derek Berg

Dear Mr. Berg:

This letter is to inform you that the Department of Environmental Protection (Department) will review and approve, on a case-by-case basis, applicants' requests to use the Jellyfish Filter, manhole or vault housing, a cartridge deck supporting membrane filtration cartridges, as a low flow rate filter meeting the requirements of the General Standards (Section 4.B.) of the Stormwater Management Rules (Chapter 500) when sized, installed and maintained in accordance with the following provisions:

1. The Jellyfish Filter must be sized in accordance with the tested hydraulic loading rate, and is approved for a maximum rate of 80 gallons per minute (gpm) for each 54-inch long membrane filter cartridge (1.48 gpm per inch of cartridge length). The structure must include at least one draindown cartridge, which is approved for a hydraulic loading rate of 40 gpm per 54" cartridge (0.74 gpm per inch of cartridge length).
2. Upstream storage must be provided for the water quality/channel protection volume (WQv) consisting of the first 1.0 inch of runoff from impervious areas and 0.4 inch of runoff from lawns and landscaped areas. The WQv should be hydraulically isolated from any additional storage provided onsite by weirs or other means so that only the WQv is routed through the Jellyfish Filter. Additionally, the WQv must be detained for a minimum of 24 hours and a maximum of 48 hours (emptying time). Storage can typically be provided in an underground facility such as corrugated metal pipe, polypropylene chambers, concrete vaults or similar means.
3. All storage systems must include sufficient maintenance access for the removal of accumulated sediment and debris. It is desirable that a pretreatment structure be located upstream of the WQv storage to facilitate capture of coarse solids and trash.
4. The Jellyfish Filter must be delivered to the site and installed under the supervision of the manufacturer's representative.
5. The system must be inspected at least once every six months, and the filters maintained yearly per the manufacturer's guidelines to maintain the established efficiency for pollutant removal. A five-year binding inspection and maintenance contract must be provided prior to review and approval by the Department, and must be renewed before contract expiration.
6. The overall stormwater management design must meet all Department criteria and sizing specifications and shall be reviewed and approved by the Department prior to use.
7. Review and approval by the manufacturer for the proposed use and sizing of the Jellyfish Filter at each specific project is required to ensure conformance with the manufacturer's design specifications.

8. This approval is conditional to on-the-ground experience confirming that the Jellyfish Filter's pollutant removal efficiency and sizing are appropriate. The "permit shield" provision (Section 14) of the Chapter 500 rules will apply, and the Department will not require the replacement of the system if pollutant removals do not satisfy the General Standard Best Management Practices.

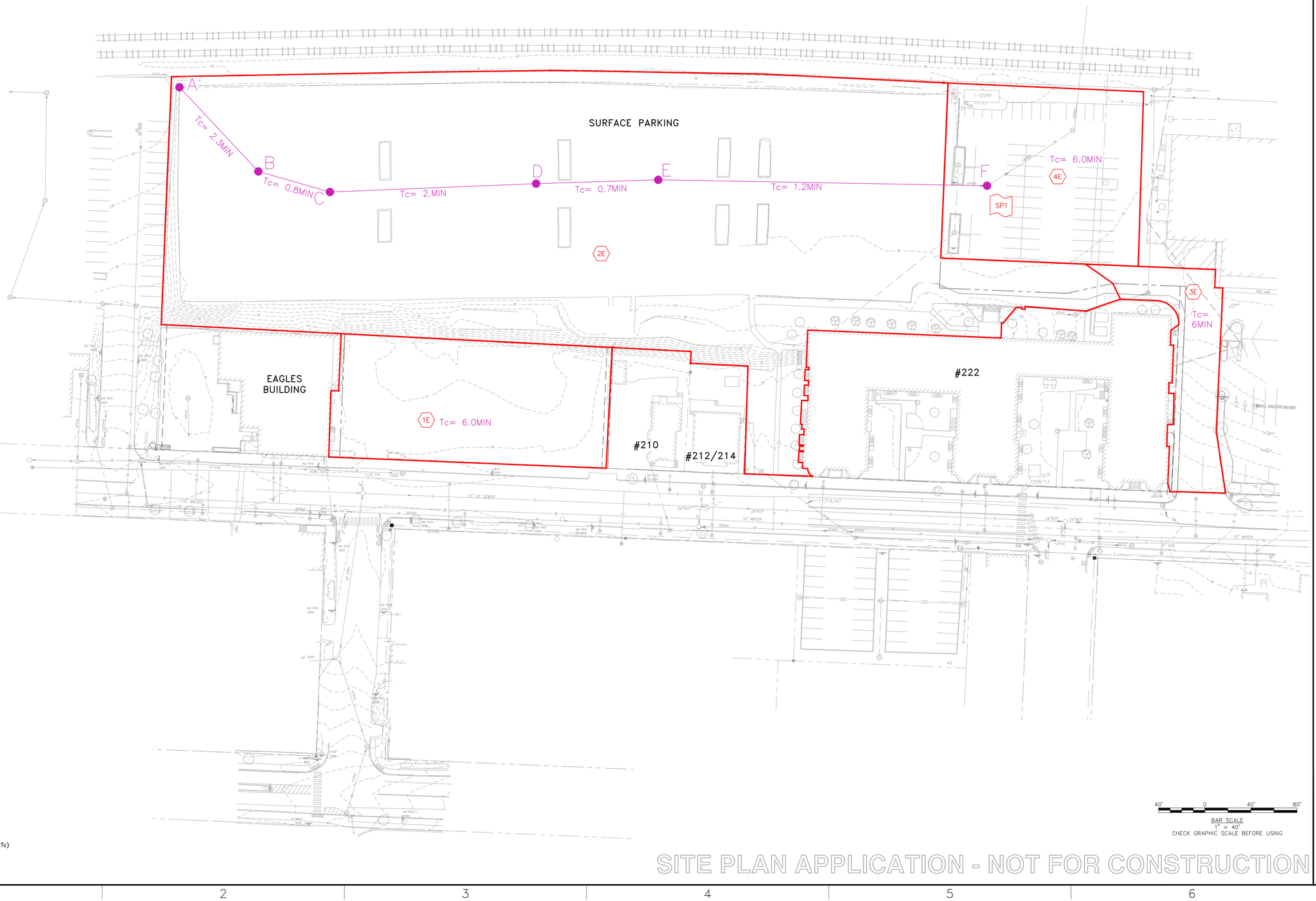
We look forward to working with you as these stormwater management structures are installed on new projects. And, we hope that this stormwater BMP will be included in our manual in the near future.

Questions concerning this decision should be directed to Marianne Hubert at (207) 215-6485 or Jeff Dennis at (207) 215-6376.

Sincerely,

Mark Bergeron, P.E.
Director, Division of Land Resource Regulation
Bureau of Land & Water Quality

C: Don Witherill, Maine DEP



STORMWATER LEGEND

- 1X — SUBCATCHMENT AREAS
- SP1 — STUDY POINT
- TIME OF CONCENTRATION (Tc) FLOW LINE
- LIMIT OF DRAINAGE AREA

BAR SCALE
1" = 40'
CHECK GRAPHIC SCALE BEFORE USING

SITE PLAN APPLICATION - NOT FOR CONSTRUCTION

41 Hutchins Drive
Portland, Maine 04102
800.426.4262 | www.woodardcurran.com

COMMITMENT & INTEGRITY DRIVE RESULTS

REV	DESCRIPTION	DATE
DRAWN BY: BCM	DESIGNED BY: CMS	CHECKED BY: DAS

0231158 C100-101 SW.dwg

PRE DEVELOPMENT STORMWATER FIGURE

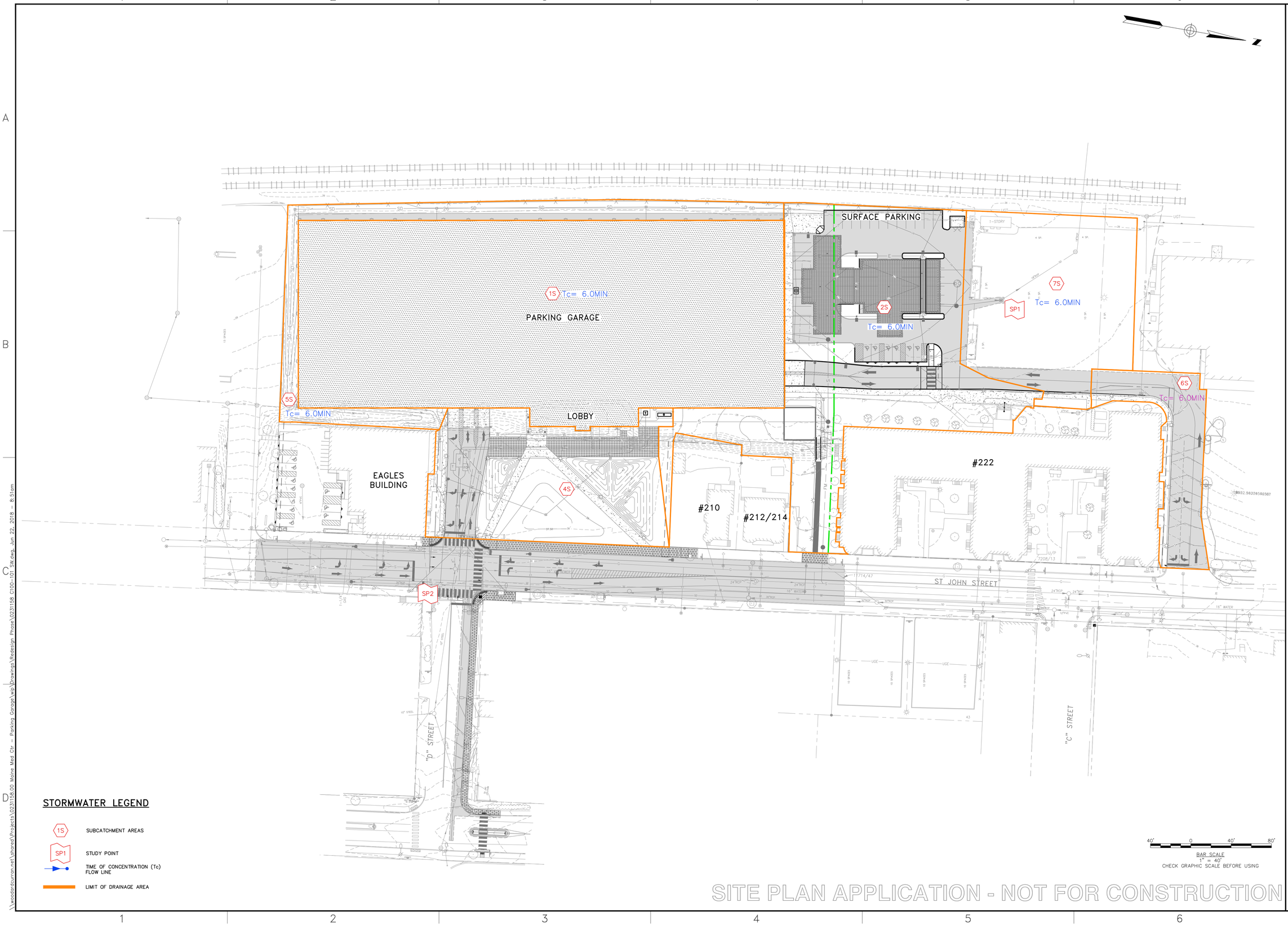
MAINE MEDICAL CENTER
22 BRAMHALL STREET
PORTLAND, ME 04102

MMC ST. JOHN STREET
EMPLOYEE PARKING GARAGE

JOB NO.:0231158.00
DATE: JUNE 22, 2018
SCALE: 1" = 40'
SHEET: 1 OF 2

PRE

24x36 SHEET
1:1



STORMWATER LEGEND

- 1S — SUBCATCHMENT AREAS
- SP1 — STUDY POINT
- TIME OF CONCENTRATION (Tc) FLOW LINE
- LIMIT OF DRAINAGE AREA

BAR SCALE
1" = 40'
CHECK GRAPHIC SCALE BEFORE USING
40' 0 40' 80'

SITE PLAN APPLICATION - NOT FOR CONSTRUCTION

41 Hutchins Drive
Portland, Maine 04102
800.426.4262 | www.woodardcurran.com

COMMITMENT & INTEGRITY DRIVE RESULTS

REV	DESCRIPTION	DATE
DESIGNED BY: CMS	CHECKED BY: DAS	
DRAWN BY: BCM	0231158 C100-101 SW.dwg	

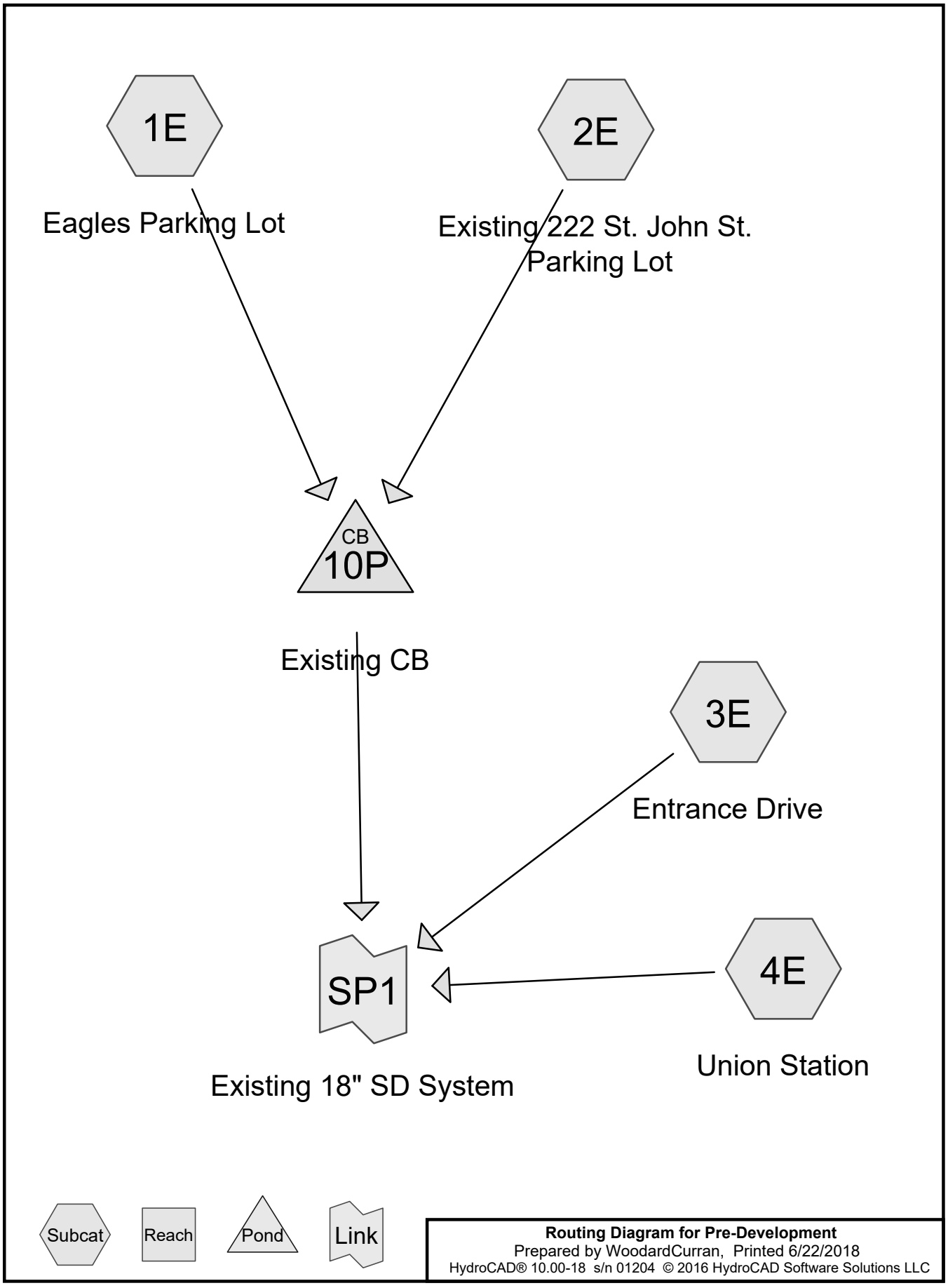
POST DEVELOPMENT STORMWATER FIGURE

MAINE MEDICAL CENTER
22 BRAMHALL STREET
PORTLAND, ME 04102

MMC ST. JOHN STREET
EMPLOYEE PARKING GARAGE

JOB NO.:0231158.00
DATE: JUNE 22, 2018
SCALE: 1" = 40'
SHEET: 2 OF 2

POST



Routing Diagram for Pre-Development
Prepared by WoodardCurran, Printed 6/22/2018

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
35,714	98	(3E, 4E)
18,343	79	50-75% Grass cover, Fair, HSG C (2E)
3,718	70	Brush, Fair, HSG C (1E)
129,899	98	Paved parking, HSG B (2E)
20,184	76	Woods/grass comb., Fair, HSG C (2E)
21,798	98	parking lot (1E)
229,656	**94**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
129,899	HSG B	2E
42,245	HSG C	1E, 2E
0	HSG D	
57,512	Other	1E, 3E, 4E
229,656		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	0	0	0	35,714	35,714		
0	0	18,343	0	0	18,343	50-75% Grass cover, Fair	
0	0	3,718	0	0	3,718	Brush, Fair	
0	129,899	0	0	0	129,899	Paved parking	
0	0	20,184	0	0	20,184	Woods/grass comb., Fair	
0	0	0	0	21,798	21,798	parking lot	
0	**129,899**	**42,245**	**0**	**57,512**	**229,656**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2E	0.00	0.00	179.0	0.0009	0.012	12.0	0.0	0.0
2	2E	0.00	0.00	105.0	0.0029	0.012	12.0	0.0	0.0
3	2E	0.00	0.00	285.0	0.0047	0.012	15.0	0.0	0.0
4	10P	20.50	19.15	281.0	0.0048	0.011	18.0	0.0	0.0

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

Subcatchment1E: Eagles Parking Lot Runoff Area=25,516 sf 85.43% Impervious Runoff Depth>2.31"
Tc=6.0 min CN=94 Runoff=1.58 cfs 4,917 cf

Subcatchment2E: Existing 222 St. John Runoff Area=168,426 sf 77.13% Impervious Runoff Depth>2.22"
Flow Length=734' Tc=7.0 min CN=93 Runoff=9.85 cfs 31,138 cf

Subcatchment3E: Entrance Drive Runoff Area=9,847 sf 100.00% Impervious Runoff Depth>2.68"
Tc=6.0 min CN=98 Runoff=0.66 cfs 2,201 cf

Subcatchment4E: Union Station Runoff Area=25,867 sf 100.00% Impervious Runoff Depth>2.68"
Tc=6.0 min CN=98 Runoff=1.74 cfs 5,781 cf

Pond 10P: Existing CB Peak Elev=24.27' Inflow=11.42 cfs 36,055 cf
18.0" Round Culvert n=0.011 L=281.0' S=0.0048 '/' Outflow=11.42 cfs 36,055 cf

Link SP1: Existing 18" SD System Inflow=13.81 cfs 44,037 cf
Primary=13.81 cfs 44,037 cf

Total Runoff Area = 229,656 sf Runoff Volume = 44,037 cf Average Runoff Depth = 2.30"
18.39% Pervious = 42,245 sf 81.61% Impervious = 187,411 sf

Summary for Subcatchment 1E: Eagles Parking Lot

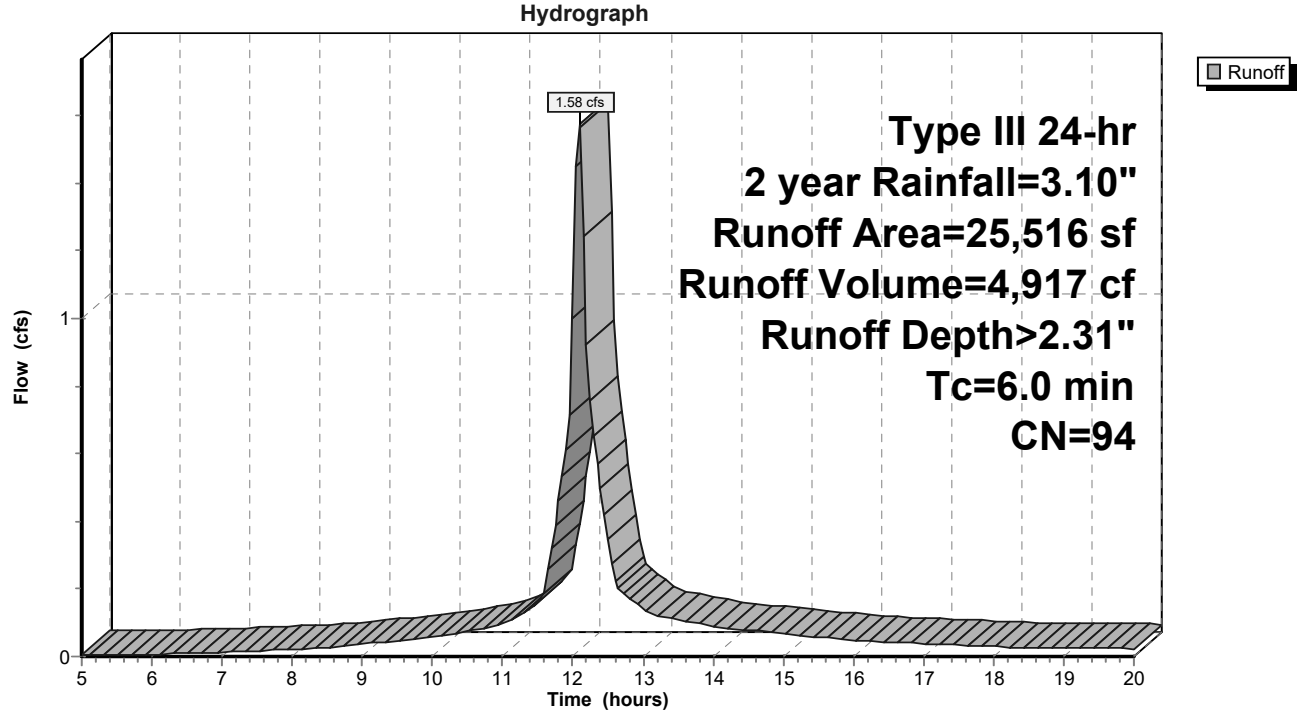
Runoff = 1.58 cfs @ 12.09 hrs, Volume= 4,917 cf, Depth> 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.10"

	Area (sf)	CN	Description
	3,718	70	Brush, Fair, HSG C
*	21,798	98	parking lot
	25,516	94	Weighted Average
	3,718		14.57% Pervious Area
	21,798		85.43% Impervious Area

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

Subcatchment 1E: Eagles Parking Lot



Summary for Subcatchment 2E: Existing 222 St. John St. Parking Lot

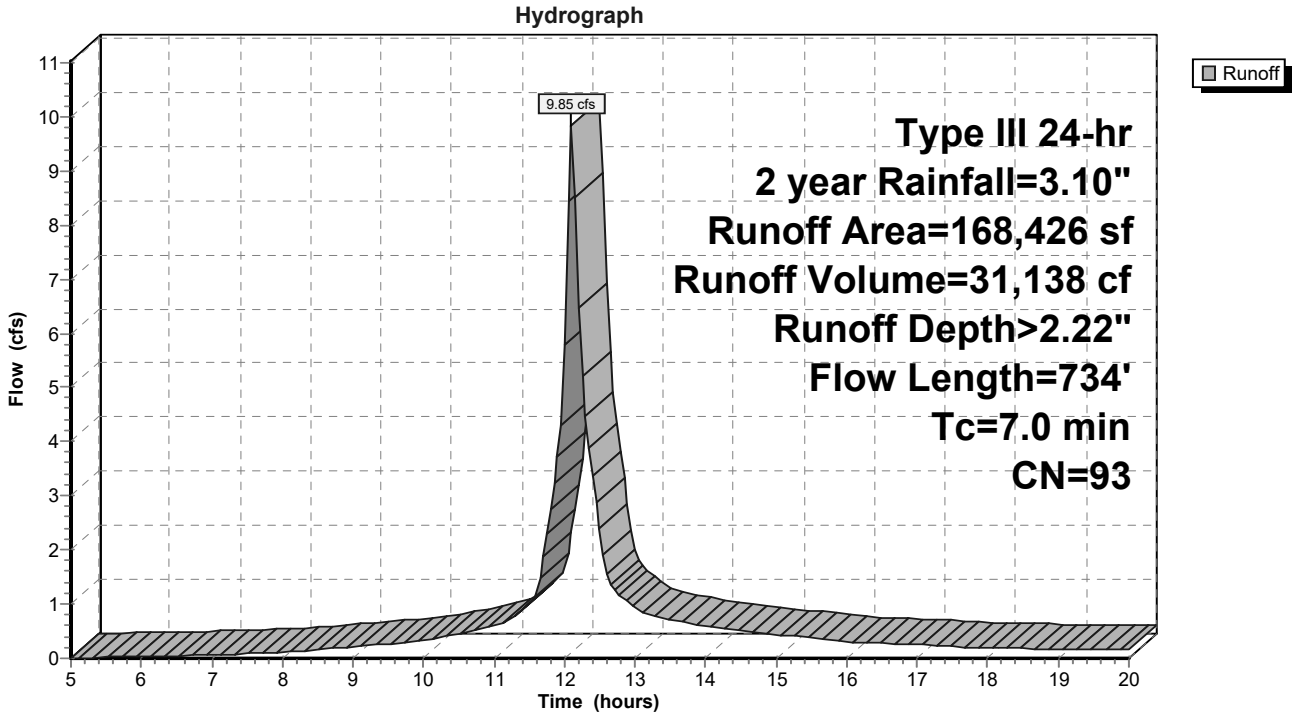
Runoff = 9.85 cfs @ 12.10 hrs, Volume= 31,138 cf, Depth> 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.10"

Area (sf)	CN	Description
129,899	98	Paved parking, HSG B
18,343	79	50-75% Grass cover, Fair, HSG C
20,184	76	Woods/grass comb., Fair, HSG C
168,426	93	Weighted Average
38,527		22.87% Pervious Area
129,899		77.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	100	0.0044	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.8	65	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.0	179	0.0009	1.47	1.16	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.7	105	0.0029	2.65	2.08	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
1.2	285	0.0047	3.91	4.80	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
7.0	734	Total			

Subcatchment 2E: Existing 222 St. John St. Parking Lot



Summary for Subcatchment 3E: Entrance Drive

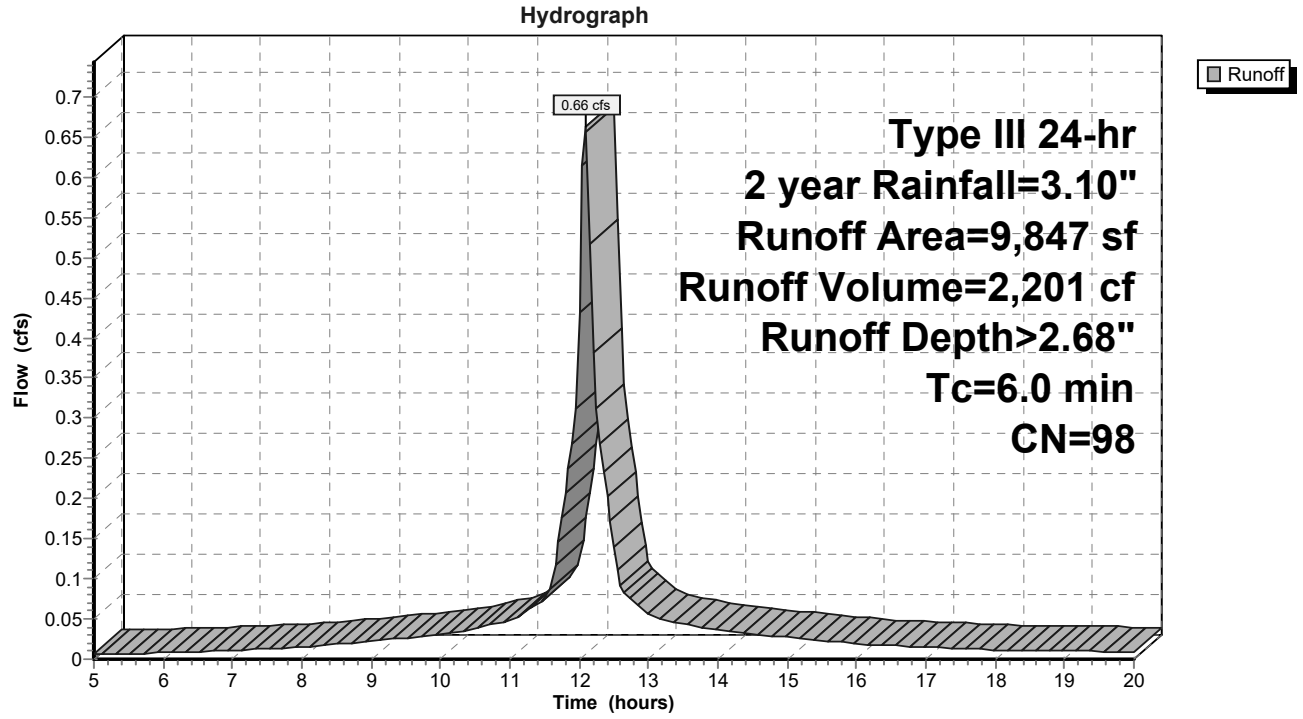
Runoff = 0.66 cfs @ 12.09 hrs, Volume= 2,201 cf, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.10"

	Area (sf)	CN	Description
*	9,847	98	
	9,847		100.00% Impervious Area

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

Subcatchment 3E: Entrance Drive



Summary for Subcatchment 4E: Union Station

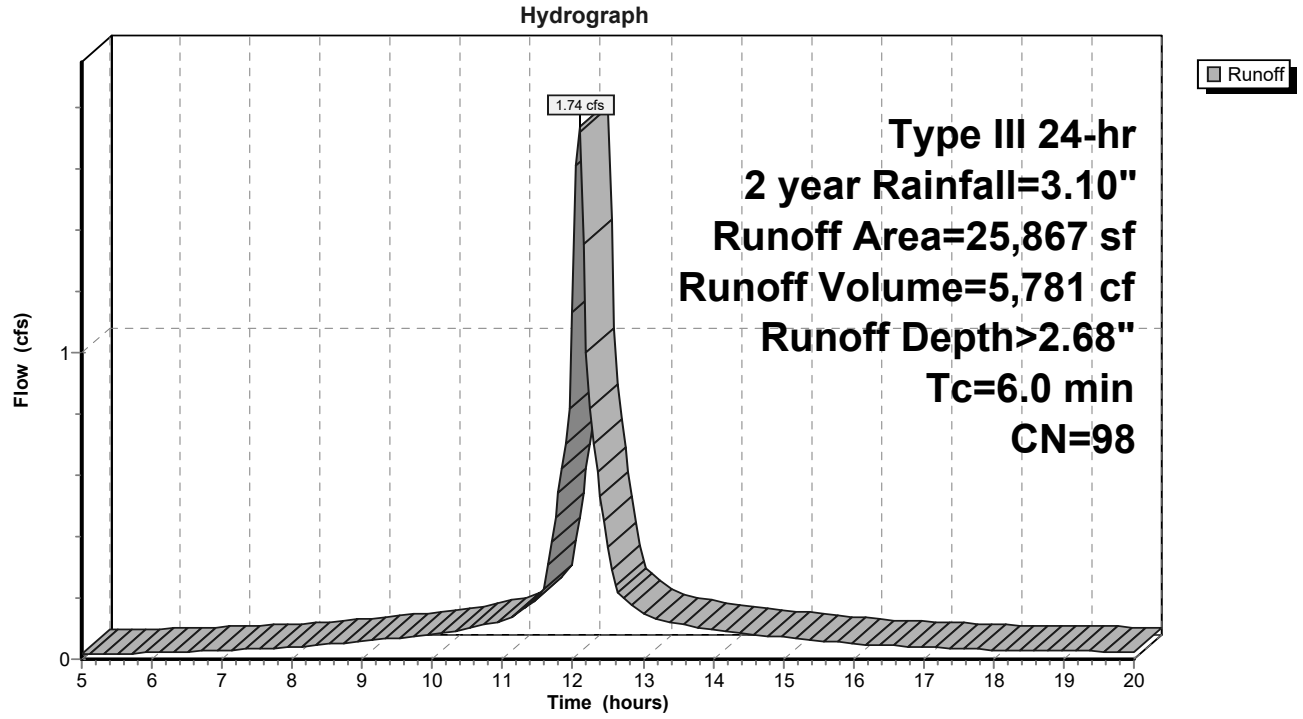
Runoff = 1.74 cfs @ 12.09 hrs, Volume= 5,781 cf, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 year Rainfall=3.10"

	Area (sf)	CN	Description
*	25,867	98	
	25,867		100.00% Impervious Area

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

Subcatchment 4E: Union Station



Summary for Pond 10P: Existing CB

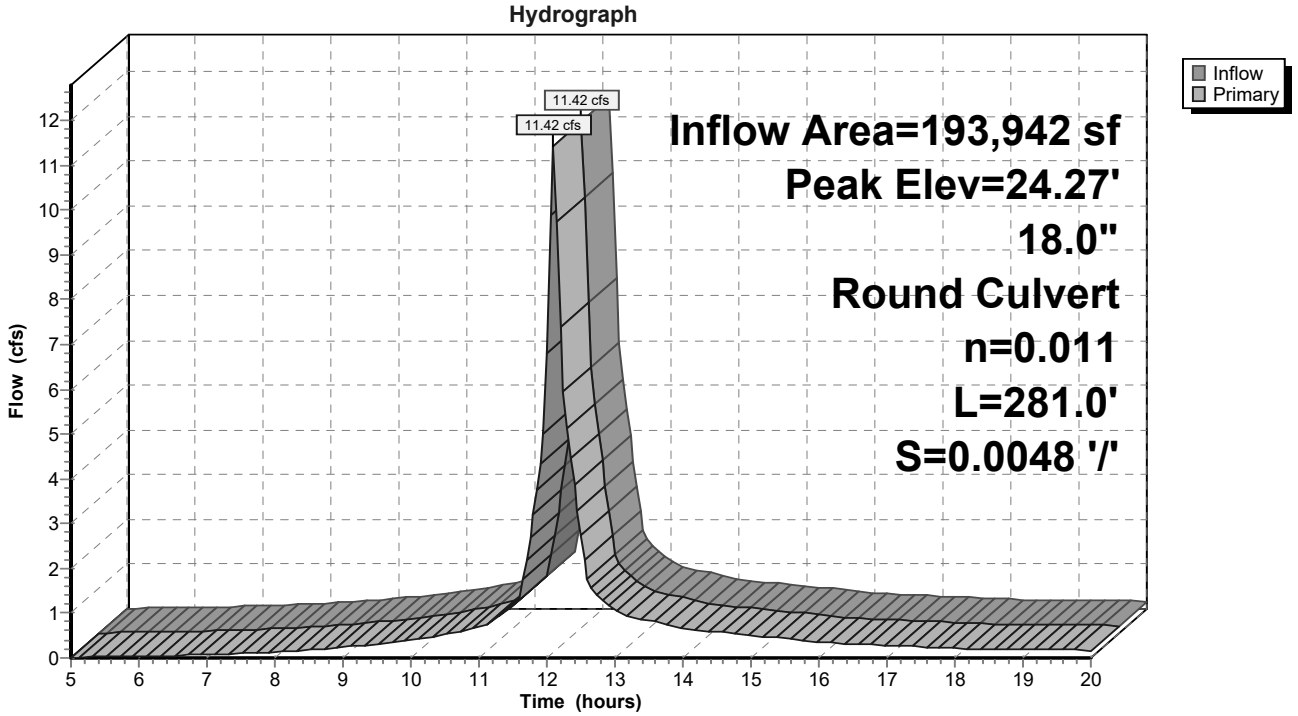
Inflow Area = 193,942 sf, 78.22% Impervious, Inflow Depth > 2.23" for 2 year event
Inflow = 11.42 cfs @ 12.10 hrs, Volume= 36,055 cf
Outflow = 11.42 cfs @ 12.10 hrs, Volume= 36,055 cf, Atten= 0%, Lag= 0.0 min
Primary = 11.42 cfs @ 12.10 hrs, Volume= 36,055 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 24.27' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	20.50'	**18.0" Round Culvert** L= 281.0' Ke= 0.900 Inlet / Outlet Invert= 20.50' / 19.15' S= 0.0048 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

Primary OutFlow Max=11.38 cfs @ 12.10 hrs HW=24.25' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 11.38 cfs @ 6.44 fps)

Pond 10P: Existing CB

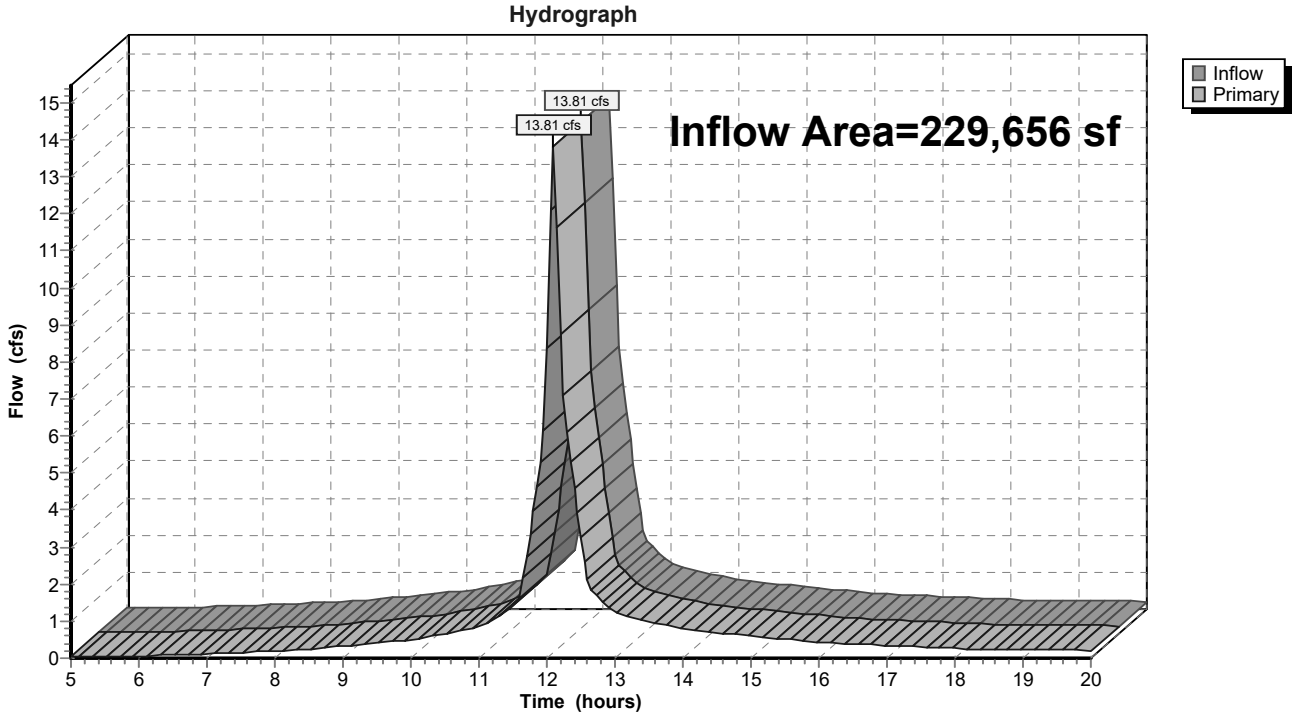


Summary for Link SP1: Existing 18" SD System

Inflow Area = 229,656 sf, 81.61% Impervious, Inflow Depth > 2.30" for 2 year event
Inflow = 13.81 cfs @ 12.10 hrs, Volume= 44,037 cf
Primary = 13.81 cfs @ 12.10 hrs, Volume= 44,037 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link SP1: Existing 18" SD System



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

Subcatchment1E: Eagles Parking Lot Runoff Area=25,516 sf 85.43% Impervious Runoff Depth>3.69"
Tc=6.0 min CN=94 Runoff=2.45 cfs 7,856 cf

Subcatchment2E: Existing 222 St. John Runoff Area=168,426 sf 77.13% Impervious Runoff Depth>3.60"
Flow Length=734' Tc=7.0 min CN=93 Runoff=15.54 cfs 50,460 cf

Subcatchment3E: Entrance Drive Runoff Area=9,847 sf 100.00% Impervious Runoff Depth>4.05"
Tc=6.0 min CN=98 Runoff=0.99 cfs 3,327 cf

Subcatchment4E: Union Station Runoff Area=25,867 sf 100.00% Impervious Runoff Depth>4.05"
Tc=6.0 min CN=98 Runoff=2.61 cfs 8,739 cf

Pond 10P: Existing CB Peak Elev=29.62' Inflow=17.98 cfs 58,316 cf
18.0" Round Culvert n=0.011 L=281.0' S=0.0048 '/' Outflow=17.98 cfs 58,316 cf

Link SP1: Existing 18" SD System Inflow=21.56 cfs 70,381 cf
Primary=21.56 cfs 70,381 cf

Total Runoff Area = 229,656 sf Runoff Volume = 70,381 cf Average Runoff Depth = 3.68"
18.39% Pervious = 42,245 sf 81.61% Impervious = 187,411 sf

Summary for Subcatchment 1E: Eagles Parking Lot

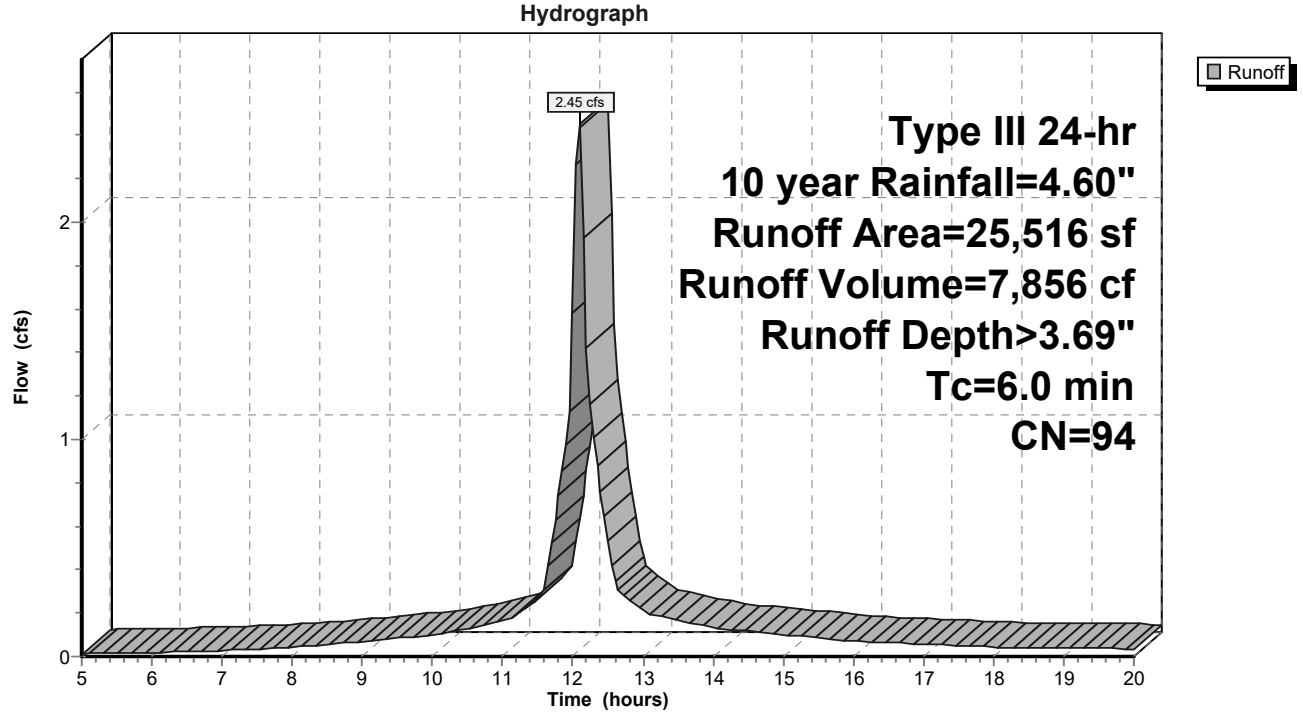
Runoff = 2.45 cfs @ 12.09 hrs, Volume= 7,856 cf, Depth> 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.60"

	Area (sf)	CN	Description
	3,718	70	Brush, Fair, HSG C
*	21,798	98	parking lot
	25,516	94	Weighted Average
	3,718		14.57% Pervious Area
	21,798		85.43% Impervious Area

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

Subcatchment 1E: Eagles Parking Lot



Summary for Subcatchment 2E: Existing 222 St. John St. Parking Lot

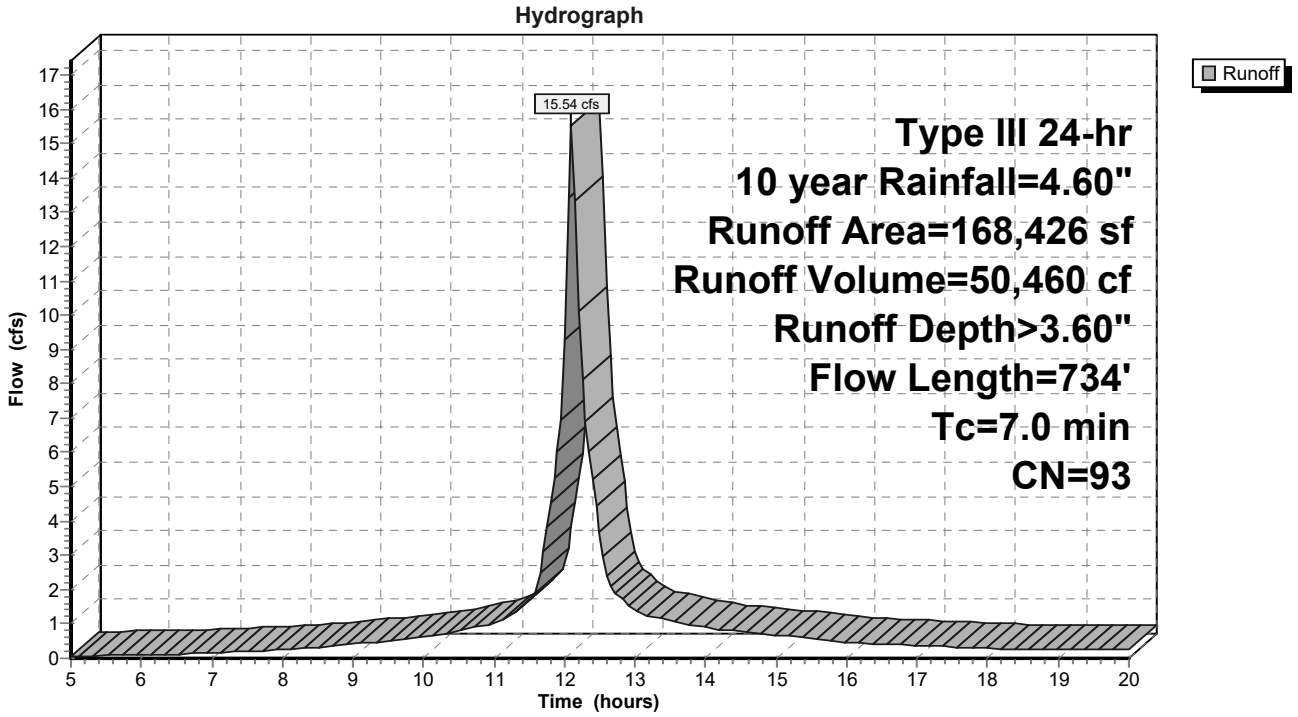
Runoff = 15.54 cfs @ 12.10 hrs, Volume= 50,460 cf, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.60"

Area (sf)	CN	Description
129,899	98	Paved parking, HSG B
18,343	79	50-75% Grass cover, Fair, HSG C
20,184	76	Woods/grass comb., Fair, HSG C
168,426	93	Weighted Average
38,527		22.87% Pervious Area
129,899		77.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	100	0.0044	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.8	65	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.0	179	0.0009	1.47	1.16	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.7	105	0.0029	2.65	2.08	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
1.2	285	0.0047	3.91	4.80	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
7.0	734	Total			

Subcatchment 2E: Existing 222 St. John St. Parking Lot



Summary for Subcatchment 3E: Entrance Drive

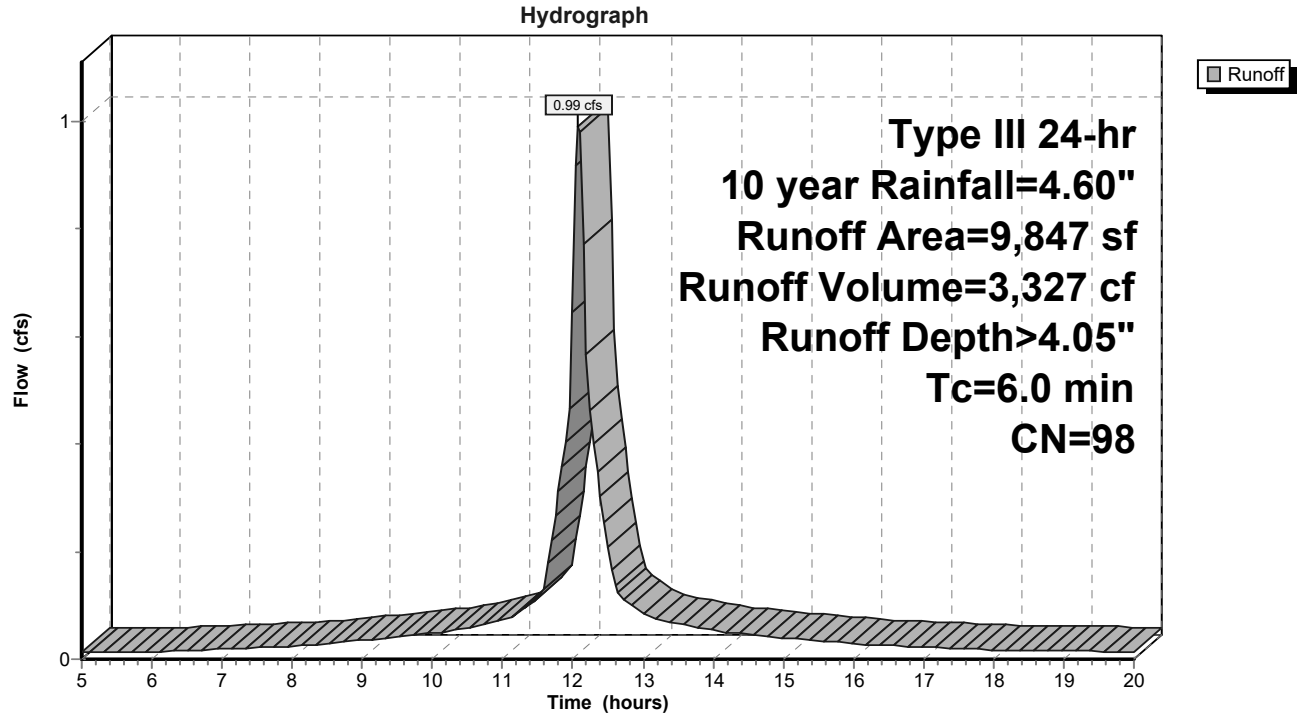
Runoff = 0.99 cfs @ 12.09 hrs, Volume= 3,327 cf, Depth> 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.60"

	Area (sf)	CN	Description
*	9,847	98	
	9,847		100.00% Impervious Area

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

Subcatchment 3E: Entrance Drive



Summary for Subcatchment 4E: Union Station

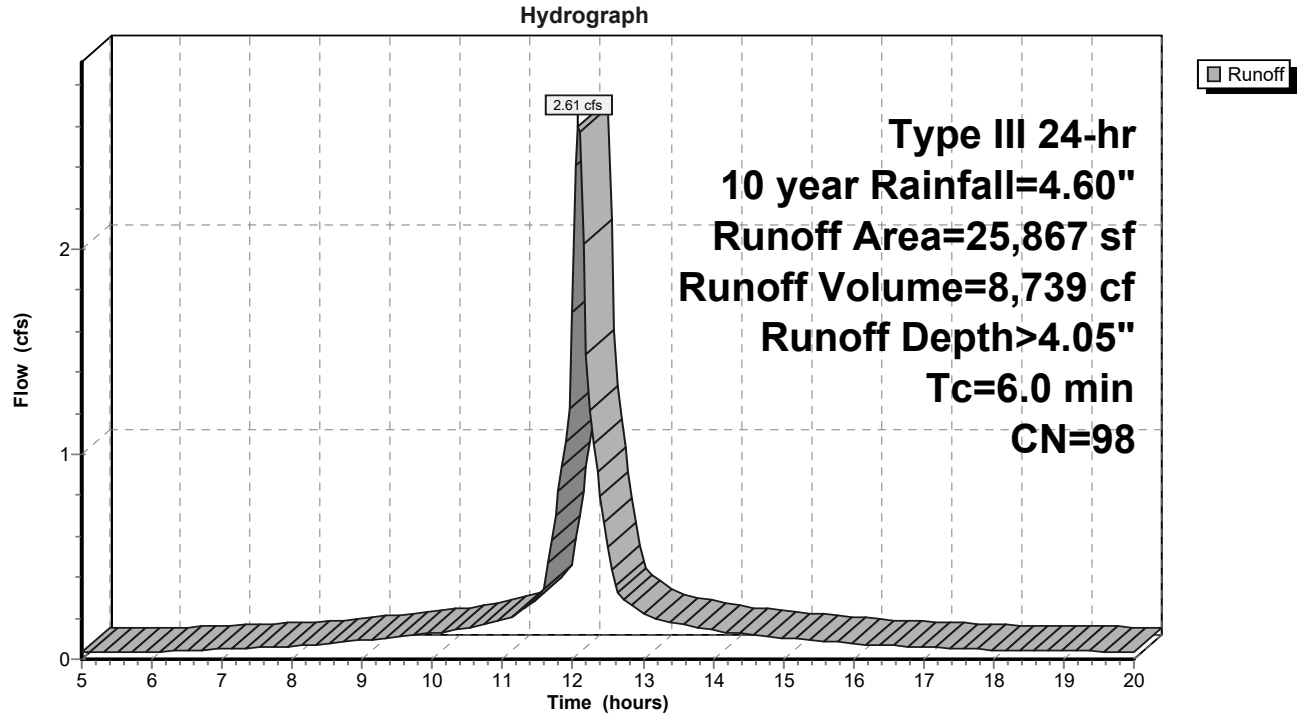
Runoff = 2.61 cfs @ 12.09 hrs, Volume= 8,739 cf, Depth> 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 year Rainfall=4.60"

	Area (sf)	CN	Description
*	25,867	98	
	25,867		100.00% Impervious Area

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

Subcatchment 4E: Union Station



Summary for Pond 10P: Existing CB

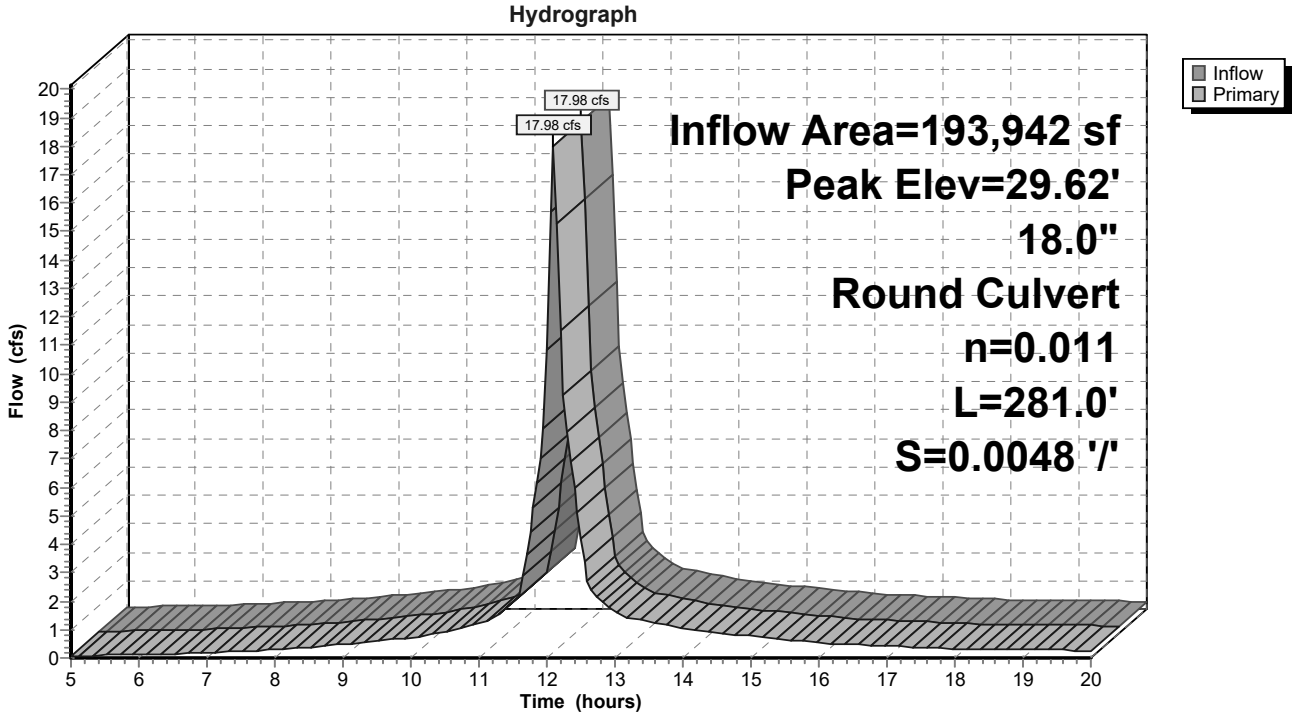
Inflow Area = 193,942 sf, 78.22% Impervious, Inflow Depth > 3.61" for 10 year event
Inflow = 17.98 cfs @ 12.10 hrs, Volume= 58,316 cf
Outflow = 17.98 cfs @ 12.10 hrs, Volume= 58,316 cf, Atten= 0%, Lag= 0.0 min
Primary = 17.98 cfs @ 12.10 hrs, Volume= 58,316 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.62' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	20.50'	**18.0" Round Culvert** L= 281.0' Ke= 0.900 Inlet / Outlet Invert= 20.50' / 19.15' S= 0.0048 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

Primary OutFlow Max=17.89 cfs @ 12.10 hrs HW=29.53' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 17.89 cfs @ 10.12 fps)

Pond 10P: Existing CB

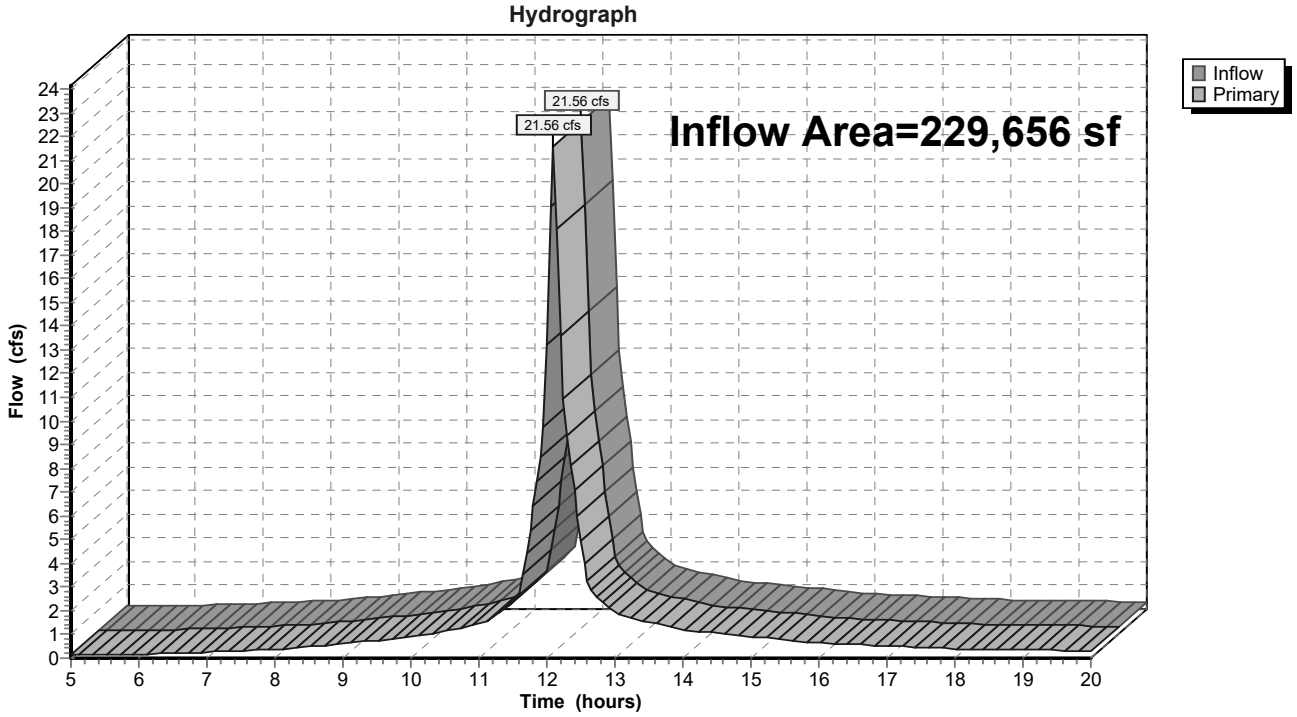


Summary for Link SP1: Existing 18" SD System

Inflow Area = 229,656 sf, 81.61% Impervious, Inflow Depth > 3.68" for 10 year event
Inflow = 21.56 cfs @ 12.10 hrs, Volume= 70,381 cf
Primary = 21.56 cfs @ 12.10 hrs, Volume= 70,381 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link SP1: Existing 18" SD System



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

Subcatchment1E: Eagles Parking Lot Runoff Area=25,516 sf 85.43% Impervious Runoff Depth>4.80"
Tc=6.0 min CN=94 Runoff=3.15 cfs 10,212 cf

Subcatchment2E: Existing 222 St. John Runoff Area=168,426 sf 77.13% Impervious Runoff Depth>4.70"
Flow Length=734' Tc=7.0 min CN=93 Runoff=20.05 cfs 66,005 cf

Subcatchment3E: Entrance Drive Runoff Area=9,847 sf 100.00% Impervious Runoff Depth>5.15"
Tc=6.0 min CN=98 Runoff=1.25 cfs 4,224 cf

Subcatchment4E: Union Station Runoff Area=25,867 sf 100.00% Impervious Runoff Depth>5.15"
Tc=6.0 min CN=98 Runoff=3.29 cfs 11,095 cf

Pond 10P: Existing CB Peak Elev=35.55' Inflow=23.18 cfs 76,217 cf
18.0" Round Culvert n=0.011 L=281.0' S=0.0048 '/' Outflow=23.18 cfs 76,217 cf

Link SP1: Existing 18" SD System Inflow=27.70 cfs 91,536 cf
Primary=27.70 cfs 91,536 cf

Total Runoff Area = 229,656 sf Runoff Volume = 91,536 cf Average Runoff Depth = 4.78"
18.39% Pervious = 42,245 sf 81.61% Impervious = 187,411 sf

Summary for Subcatchment 1E: Eagles Parking Lot

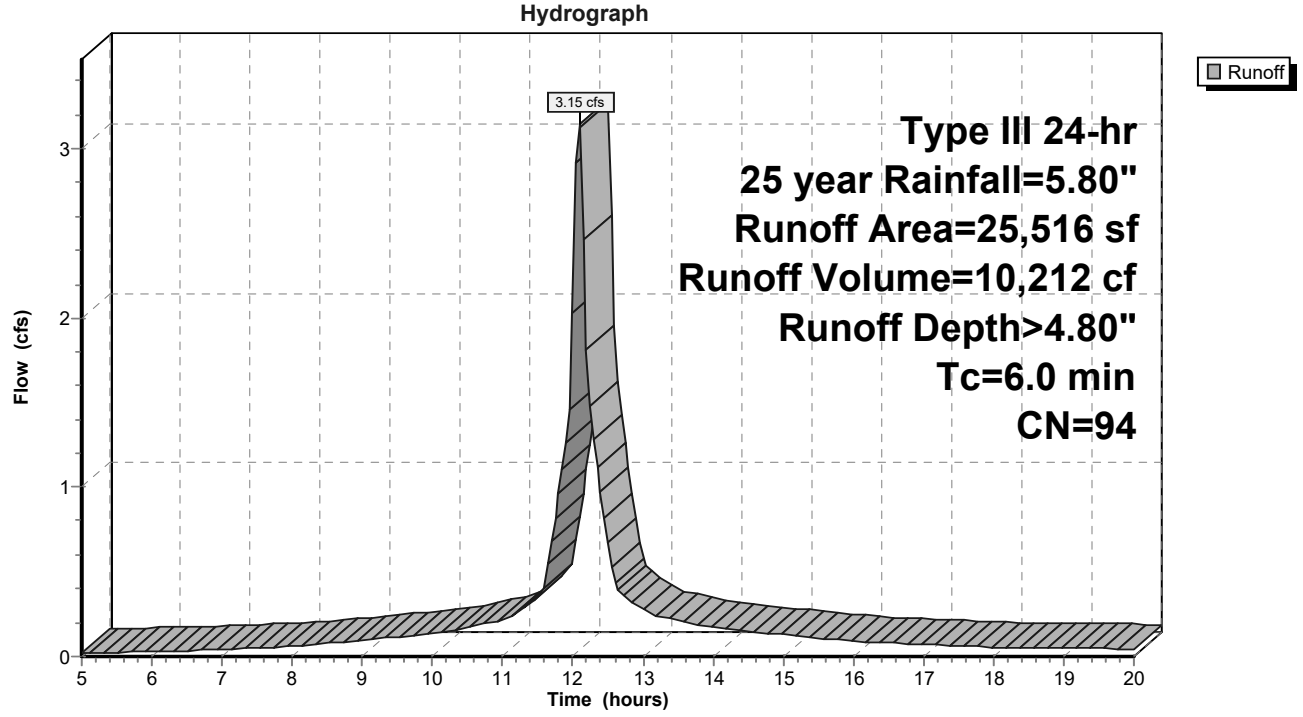
Runoff = 3.15 cfs @ 12.09 hrs, Volume= 10,212 cf, Depth> 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=5.80"

	Area (sf)	CN	Description
	3,718	70	Brush, Fair, HSG C
*	21,798	98	parking lot
	25,516	94	Weighted Average
	3,718		14.57% Pervious Area
	21,798		85.43% Impervious Area

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

Subcatchment 1E: Eagles Parking Lot



Summary for Subcatchment 2E: Existing 222 St. John St. Parking Lot

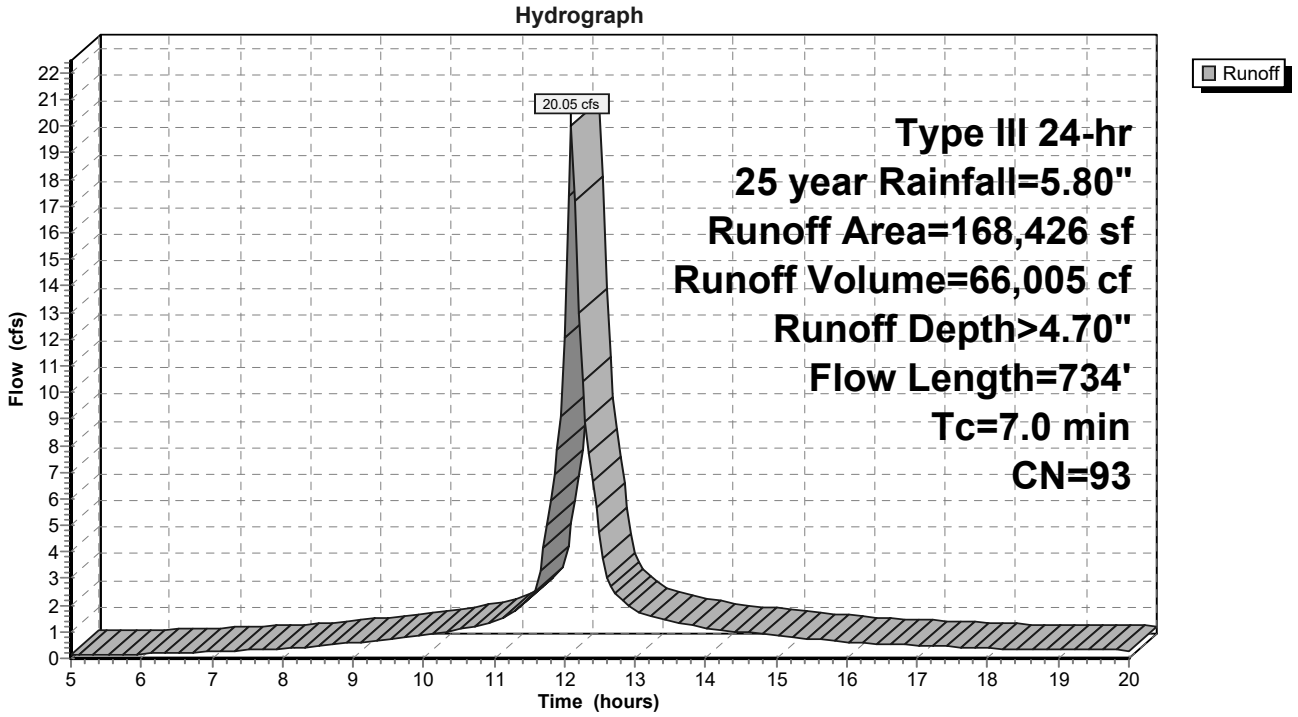
Runoff = 20.05 cfs @ 12.10 hrs, Volume= 66,005 cf, Depth> 4.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=5.80"

Area (sf)	CN	Description
129,899	98	Paved parking, HSG B
18,343	79	50-75% Grass cover, Fair, HSG C
20,184	76	Woods/grass comb., Fair, HSG C
168,426	93	Weighted Average
38,527		22.87% Pervious Area
129,899		77.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	100	0.0044	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.8	65	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.0	179	0.0009	1.47	1.16	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.7	105	0.0029	2.65	2.08	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
1.2	285	0.0047	3.91	4.80	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
7.0	734	Total			

Subcatchment 2E: Existing 222 St. John St. Parking Lot



Summary for Subcatchment 3E: Entrance Drive

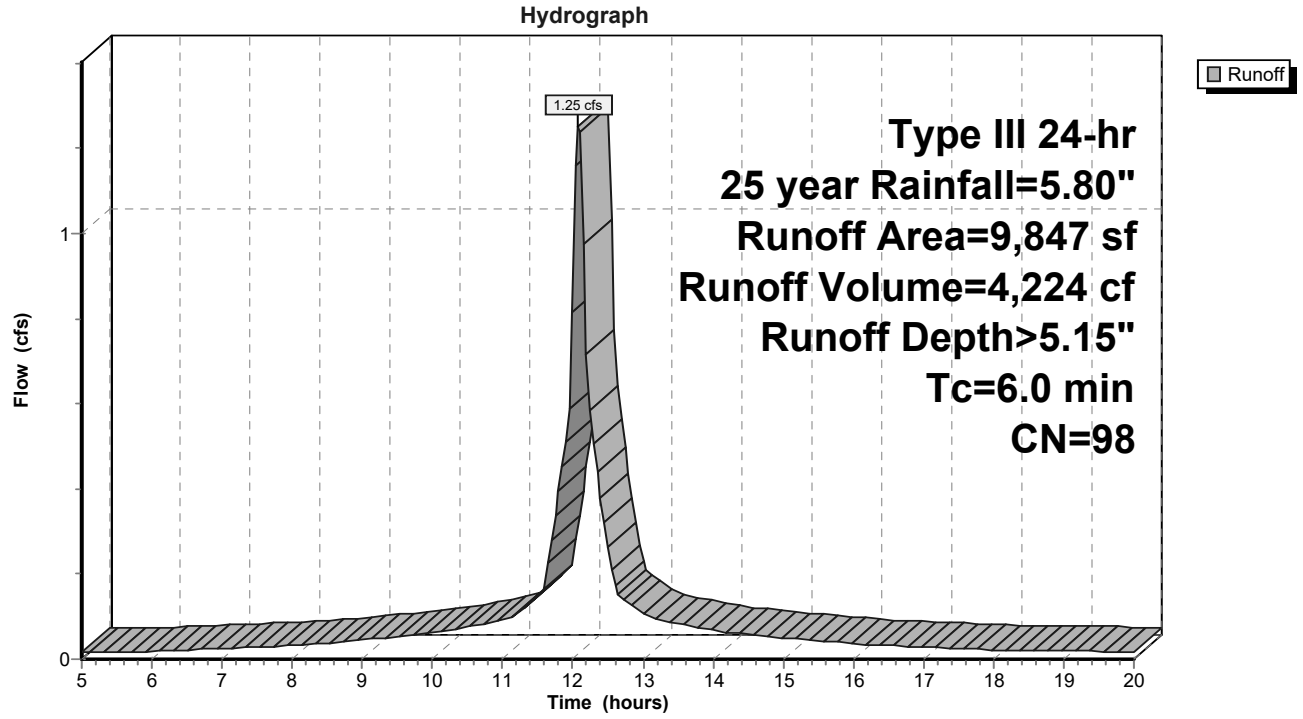
Runoff = 1.25 cfs @ 12.09 hrs, Volume= 4,224 cf, Depth> 5.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=5.80"

	Area (sf)	CN	Description
*	9,847	98	
	9,847		100.00% Impervious Area

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

Subcatchment 3E: Entrance Drive



Summary for Subcatchment 4E: Union Station

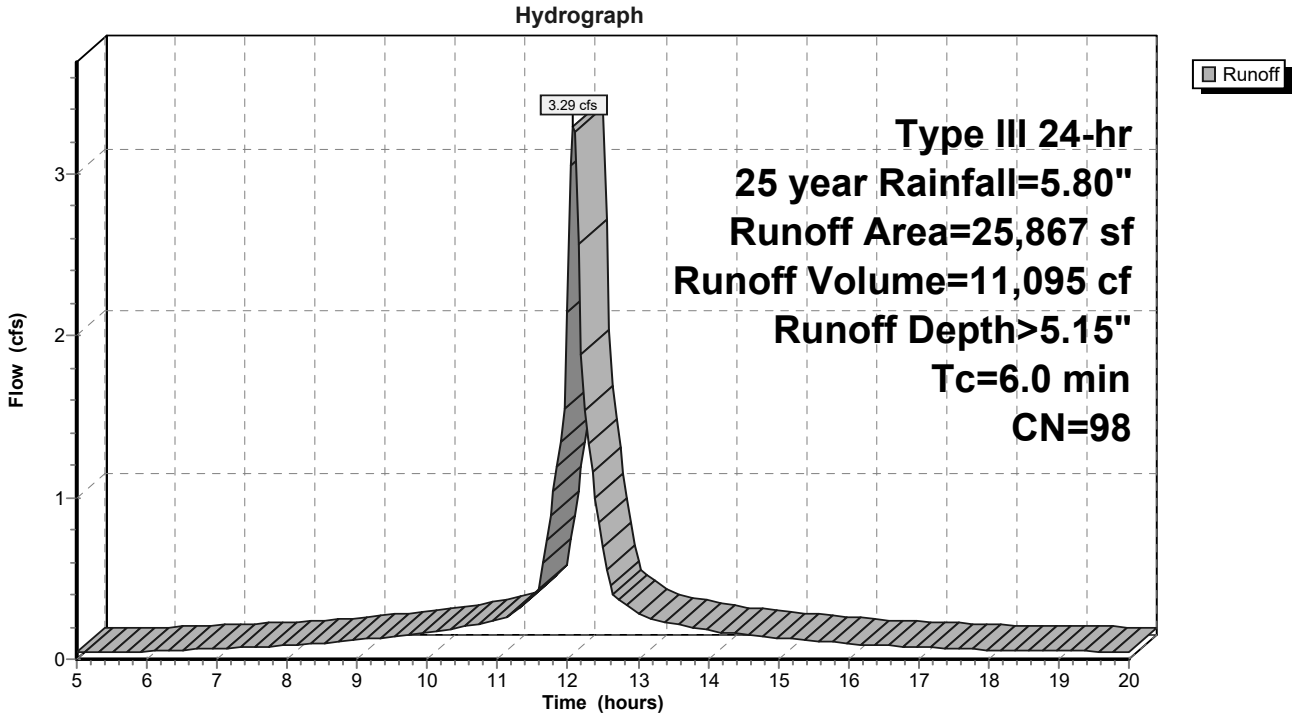
Runoff = 3.29 cfs @ 12.09 hrs, Volume= 11,095 cf, Depth> 5.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 year Rainfall=5.80"

	Area (sf)	CN	Description
*	25,867	98	
	25,867		100.00% Impervious Area

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

Subcatchment 4E: Union Station



Summary for Pond 10P: Existing CB

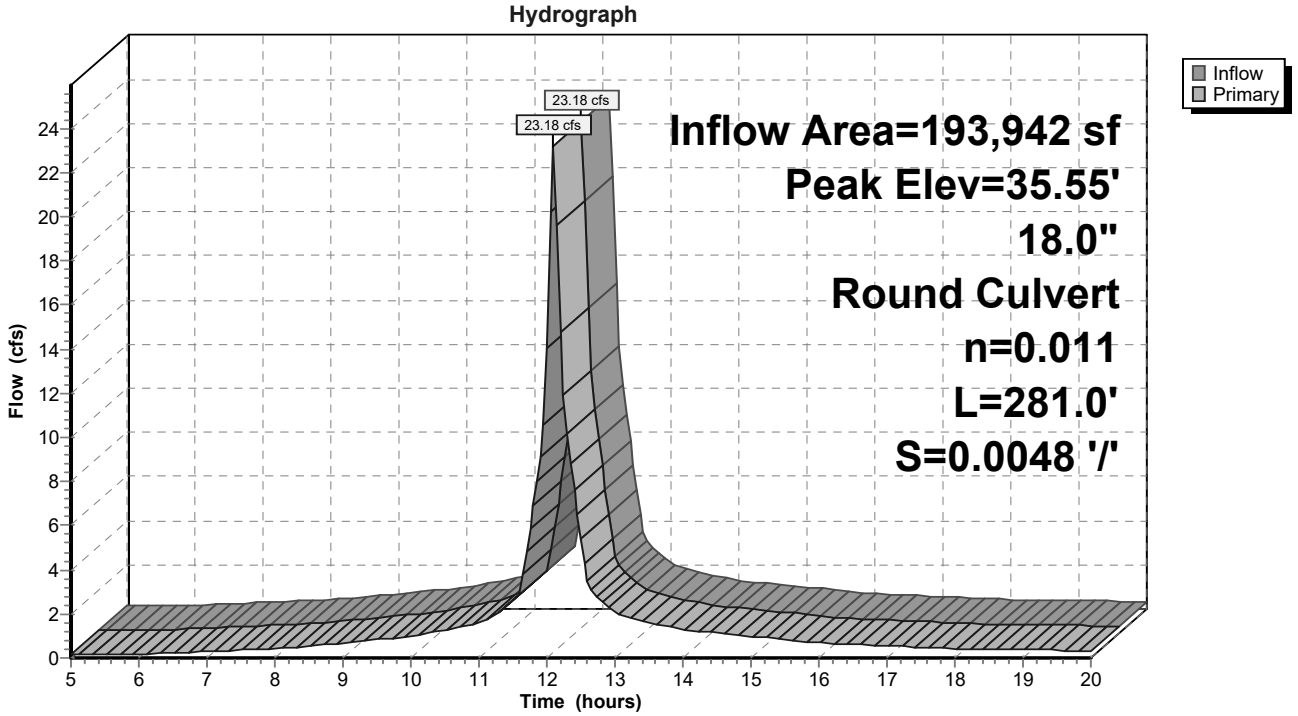
Inflow Area = 193,942 sf, 78.22% Impervious, Inflow Depth > 4.72" for 25 year event
Inflow = 23.18 cfs @ 12.10 hrs, Volume= 76,217 cf
Outflow = 23.18 cfs @ 12.10 hrs, Volume= 76,217 cf, Atten= 0%, Lag= 0.0 min
Primary = 23.18 cfs @ 12.10 hrs, Volume= 76,217 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 35.55' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	20.50'	**18.0" Round Culvert** L= 281.0' Ke= 0.900 Inlet / Outlet Invert= 20.50' / 19.15' S= 0.0048 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

Primary OutFlow Max=23.04 cfs @ 12.10 hrs HW=35.37' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 23.04 cfs @ 13.04 fps)

Pond 10P: Existing CB

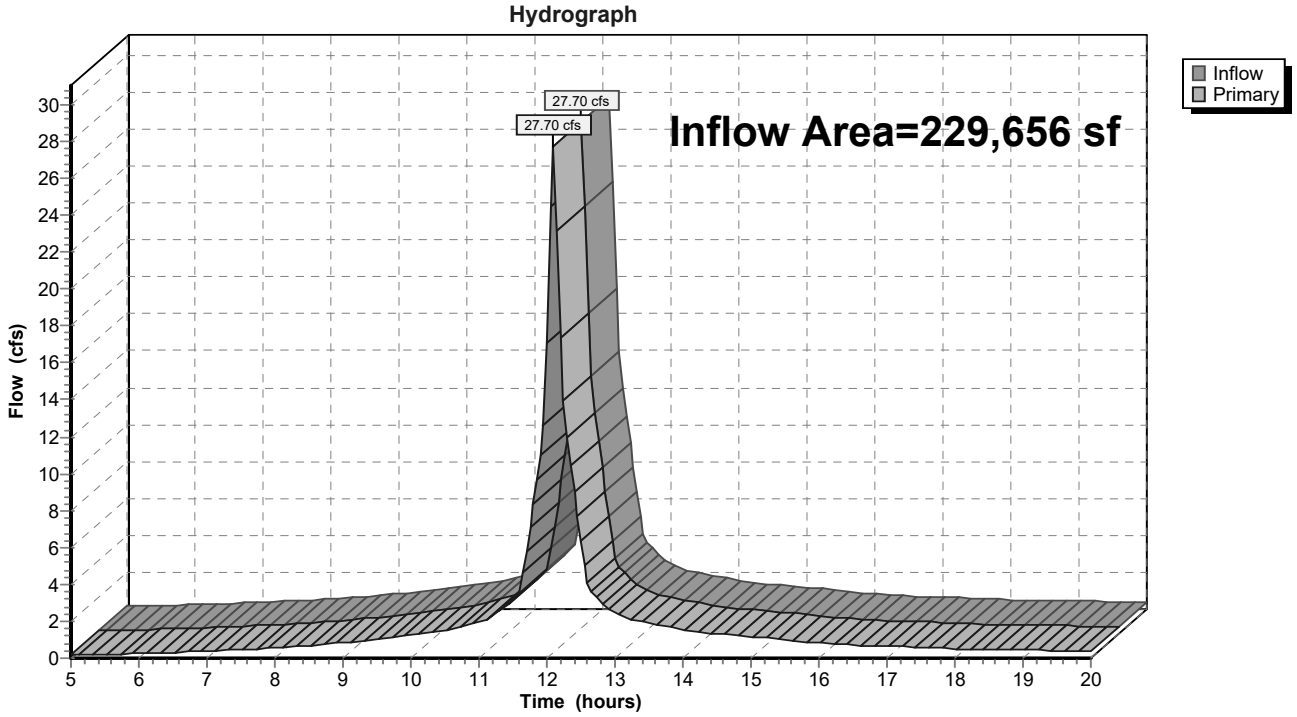


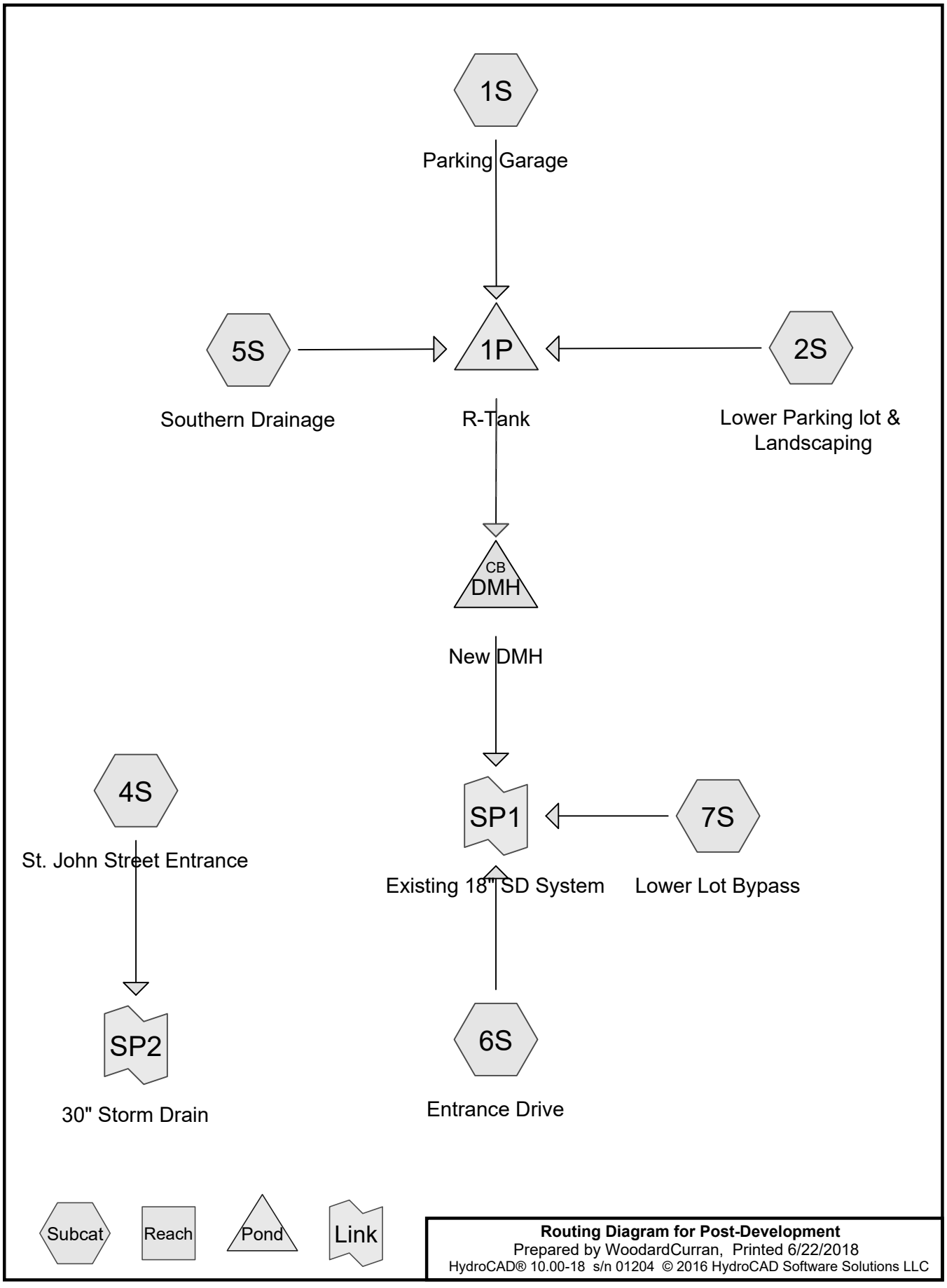
Summary for Link SP1: Existing 18" SD System

Inflow Area = 229,656 sf, 81.61% Impervious, Inflow Depth > 4.78" for 25 year event
Inflow = 27.70 cfs @ 12.10 hrs, Volume= 91,536 cf
Primary = 27.70 cfs @ 12.10 hrs, Volume= 91,536 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link SP1: Existing 18" SD System




1S
Parking Garage
5S
Southern Drainage
1P
R-Tank
2S
Lower Parking lot & Landscaping
CB
DMH
New DMH
4S
St. John Street Entrance
SP1
Existing 18" SD System
7S
Lower Lot Bypass
SP2
30" Storm Drain
6S
Entrance Drive
Subcat
Reach
Pond
Link
Routing Diagram for Post-Development
Prepared by WoodardCurran, Printed 6/22/2018
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
513	84	50-75% Grass cover, Fair, HSG D (6S)
20,799	74	>75% Grass cover, Good, HSG C (4S)
20,397	80	>75% Grass cover, Good, HSG D (2S)
11,388	89	Crushed Stone (5S)
28,534	98	Entrance Drive & Walks (7S)
9,891	98	Entrance Road (6S)
483	79	Landscaped area (7S)
9,319	98	New entrane drive and walks (4S)
32,944	98	Paved Parking Lot (2S)
89,825	98	Paved parking, HSG B (1S)
2,186	98	Roofs, HSG B (1S)
3,377	98	Sidewalk (5S)
229,656	**94**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
92,011	HSG B	1S
20,799	HSG C	4S
20,910	HSG D	2S, 6S
95,936	Other	2S, 4S, 5S, 6S, 7S
229,656		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	0	513	0	513	50-75% Grass cover, Fair
0	0	20,799	20,397	0	41,196	>75% Grass cover, Good
0	0	0	0	11,388	11,388	Crushed Stone
0	0	0	0	28,534	28,534	Entrance Drive & Walks
0	0	0	0	9,891	9,891	Entrance Road
0	0	0	0	483	483	Landscaped area
0	0	0	0	9,319	9,319	New entrane drive and walks
0	0	0	0	32,944	32,944	Paved Parking Lot
0	89,825	0	0	0	89,825	Paved parking
0	2,186	0	0	0	2,186	Roofs
0	0	0	0	3,377	3,377	Sidewalk
0	**92,011**	**20,799**	**20,910**	**95,936**	**229,656**	**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	19.58	19.58	15.0	0.0000	0.012	15.0	0.0	0.0
2	1P	21.13	21.00	15.0	0.0087	0.012	15.0	0.0	0.0
3	DMH	19.25	19.15	40.0	0.0025	0.013	18.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Parking Garage Runoff Area=92,011 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=6.35 cfs 21,990 cf

Subcatchment2S: Lower Parking lot & Runoff Area=53,341 sf 61.76% Impervious Runoff Depth=2.16"
Tc=6.0 min CN=91 Runoff=3.06 cfs 9,622 cf

Subcatchment4S: St. John Street Entrance Runoff Area=30,118 sf 30.94% Impervious Runoff Depth=1.39"
Tc=6.0 min CN=81 Runoff=1.12 cfs 3,491 cf

Subcatchment5S: Southern Drainage Runoff Area=14,765 sf 22.87% Impervious Runoff Depth=2.16"
Tc=6.0 min CN=91 Runoff=0.85 cfs 2,663 cf

Subcatchment6S: Entrance Drive Runoff Area=10,404 sf 95.07% Impervious Runoff Depth=2.76"
Tc=5.0 min CN=97 Runoff=0.73 cfs 2,391 cf

Subcatchment7S: Lower Lot Bypass Runoff Area=29,017 sf 98.34% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=2.00 cfs 6,935 cf

Pond 1P: R-Tank Peak Elev=21.86' Storage=17,421 cf Inflow=10.26 cfs 34,275 cf
Primary=0.03 cfs 4,370 cf Secondary=3.44 cfs 20,262 cf Outflow=3.47 cfs 24,632 cf

Pond DMH: New DMH Peak Elev=20.44' Inflow=3.47 cfs 24,632 cf
18.0" Round Culvert n=0.013 L=40.0' S=0.0025 '/' Outflow=3.47 cfs 24,632 cf

Link SP1: Existing 18" SD System Inflow=4.45 cfs 33,957 cf
Primary=4.45 cfs 33,957 cf

Link SP2: 30" Storm Drain Inflow=1.12 cfs 3,491 cf
Primary=1.12 cfs 3,491 cf

Total Runoff Area = 229,656 sf Runoff Volume = 47,091 cf Average Runoff Depth = 2.46"
23.33% Pervious = 53,580 sf 76.67% Impervious = 176,076 sf

Summary for Subcatchment 1S: Parking Garage

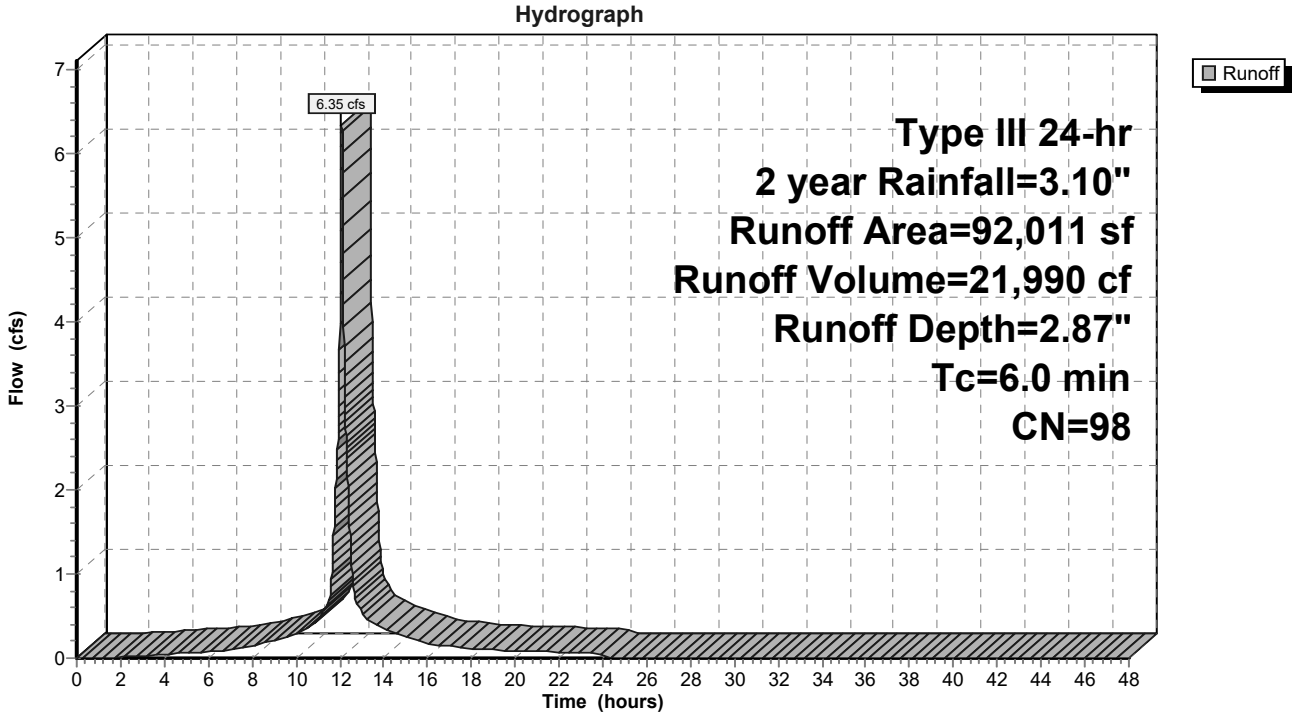
Runoff = 6.35 cfs @ 12.08 hrs, Volume= 21,990 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.10"

Area (sf)	CN	Description
89,825	98	Paved parking, HSG B
2,186	98	Roofs, HSG B
92,011	98	Weighted Average
92,011		100.00% Impervious Area

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

Subcatchment 1S: Parking Garage



Summary for Subcatchment 2S: Lower Parking lot & Landscaping

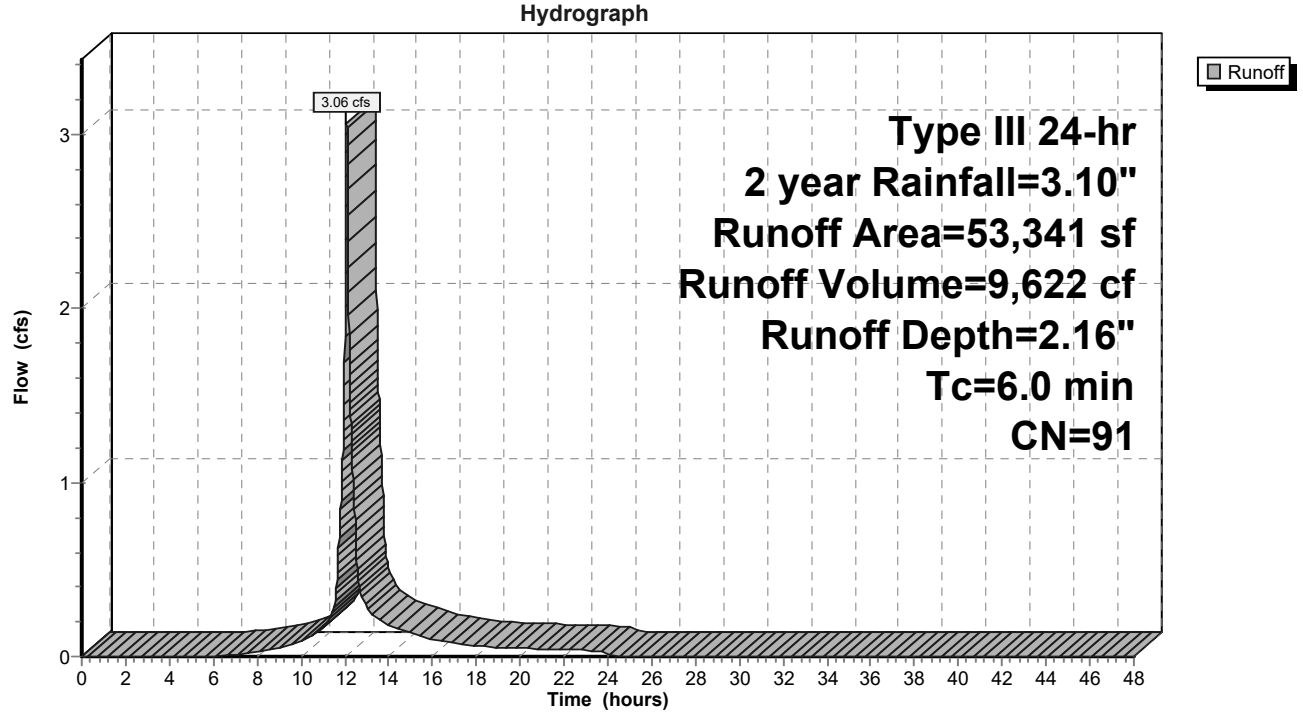
Runoff = 3.06 cfs @ 12.09 hrs, Volume= 9,622 cf, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.10"

	Area (sf)	CN	Description
*	32,944	98	Paved Parking Lot
	20,397	80	>75% Grass cover, Good, HSG D
	53,341	91	Weighted Average
	20,397		38.24% Pervious Area
	32,944		61.76% Impervious Area

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

Subcatchment 2S: Lower Parking lot & Landscaping



Summary for Subcatchment 4S: St. John Street Entrance

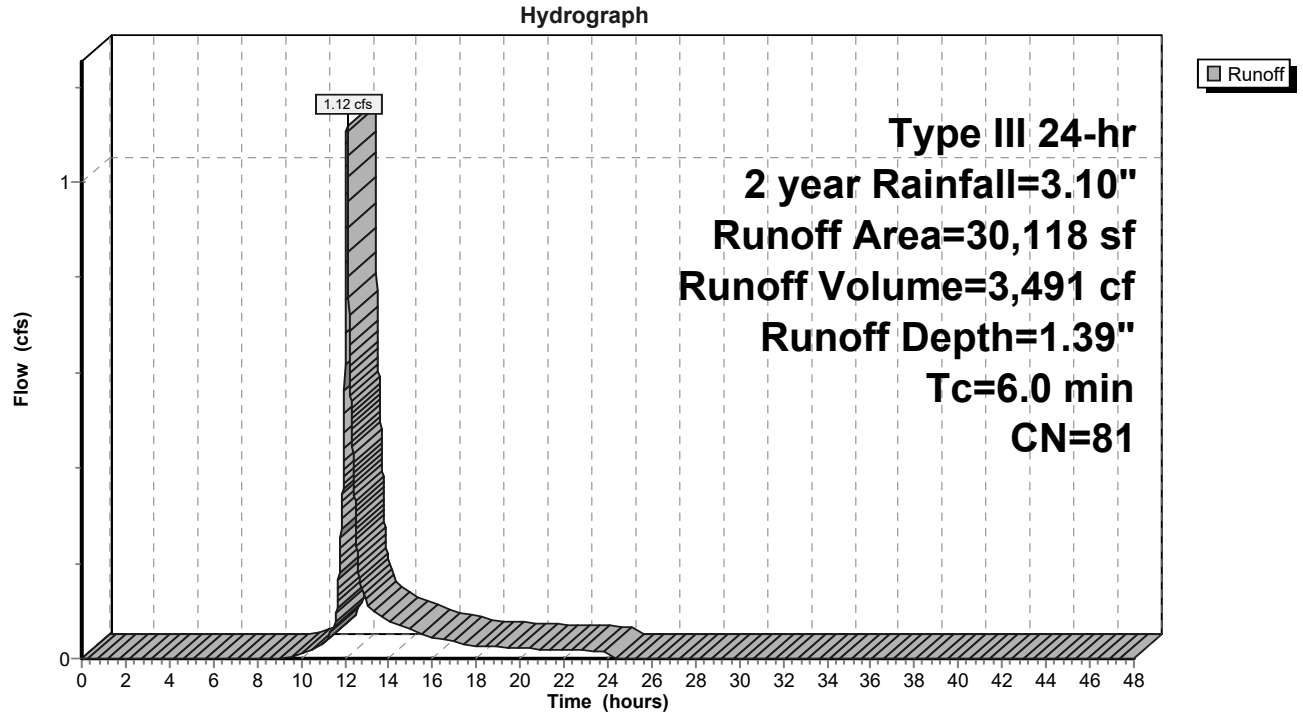
Runoff = 1.12 cfs @ 12.09 hrs, Volume= 3,491 cf, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.10"

	Area (sf)	CN	Description
*	9,319	98	New entrane drive and walks
	20,799	74	>75% Grass cover, Good, HSG C
	30,118	81	Weighted Average
	20,799		69.06% Pervious Area
	9,319		30.94% Impervious Area

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

Subcatchment 4S: St. John Street Entrance



Summary for Subcatchment 5S: Southern Drainage

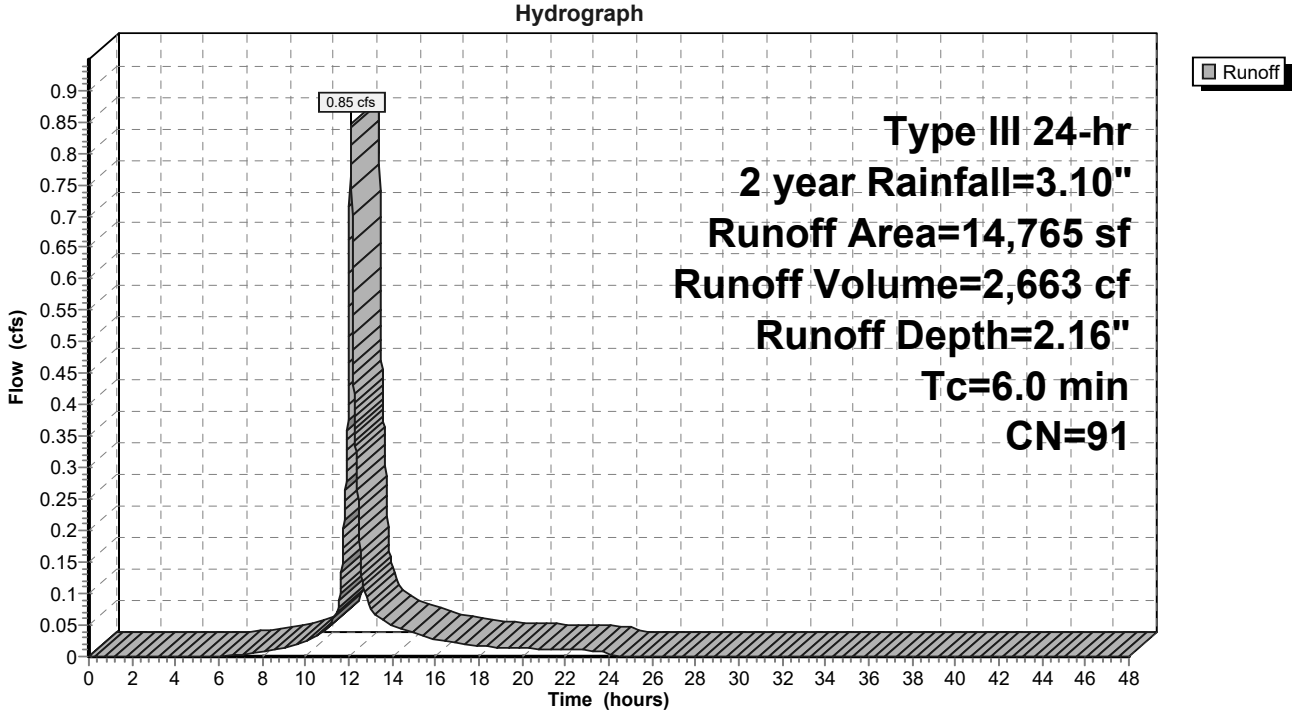
Runoff = 0.85 cfs @ 12.09 hrs, Volume= 2,663 cf, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.10"

	Area (sf)	CN	Description
*	11,388	89	Crushed Stone
*	3,377	98	Sidewalk
	14,765	91	Weighted Average
	11,388		77.13% Pervious Area
	3,377		22.87% Impervious Area

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

Subcatchment 5S: Southern Drainage



Summary for Subcatchment 6S: Entrance Drive

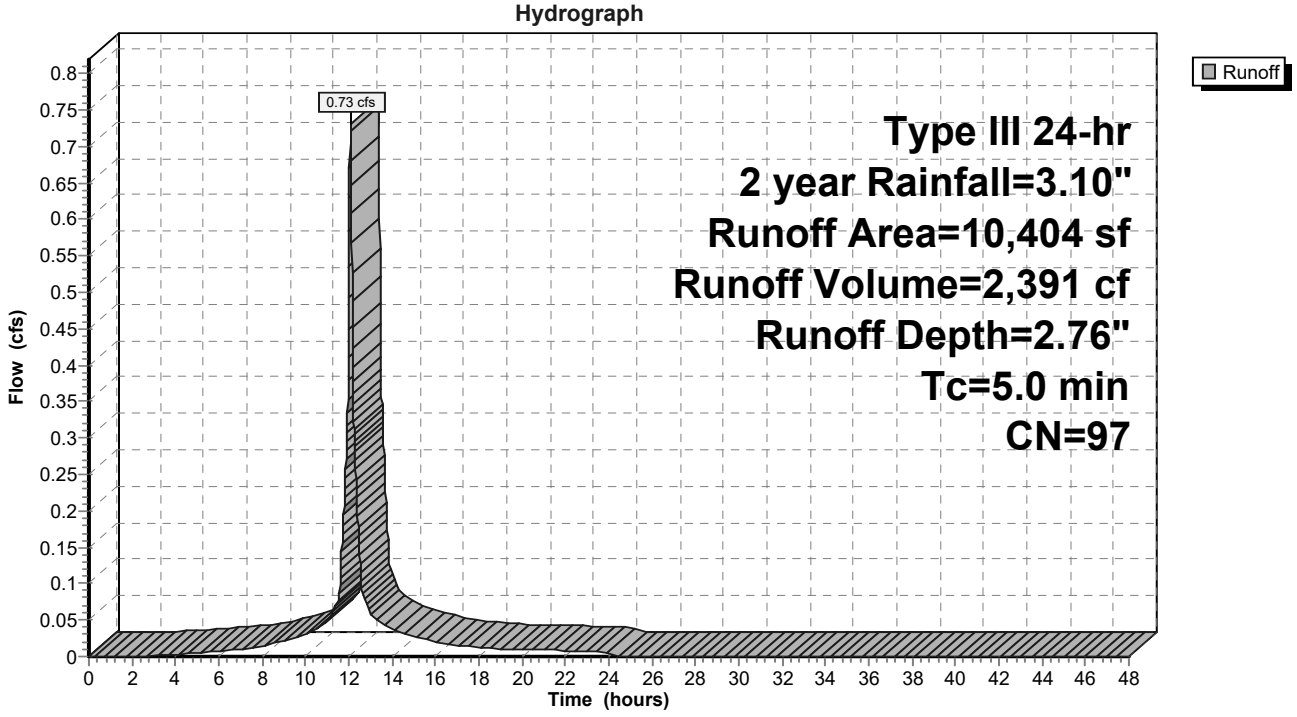
Runoff = 0.73 cfs @ 12.07 hrs, Volume= 2,391 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.10"

	Area (sf)	CN	Description
*	9,891	98	Entrance Road
	513	84	50-75% Grass cover, Fair, HSG D
	10,404	97	Weighted Average
	513		4.93% Pervious Area
	9,891		95.07% Impervious Area

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

Subcatchment 6S: Entrance Drive



Summary for Subcatchment 7S: Lower Lot Bypass

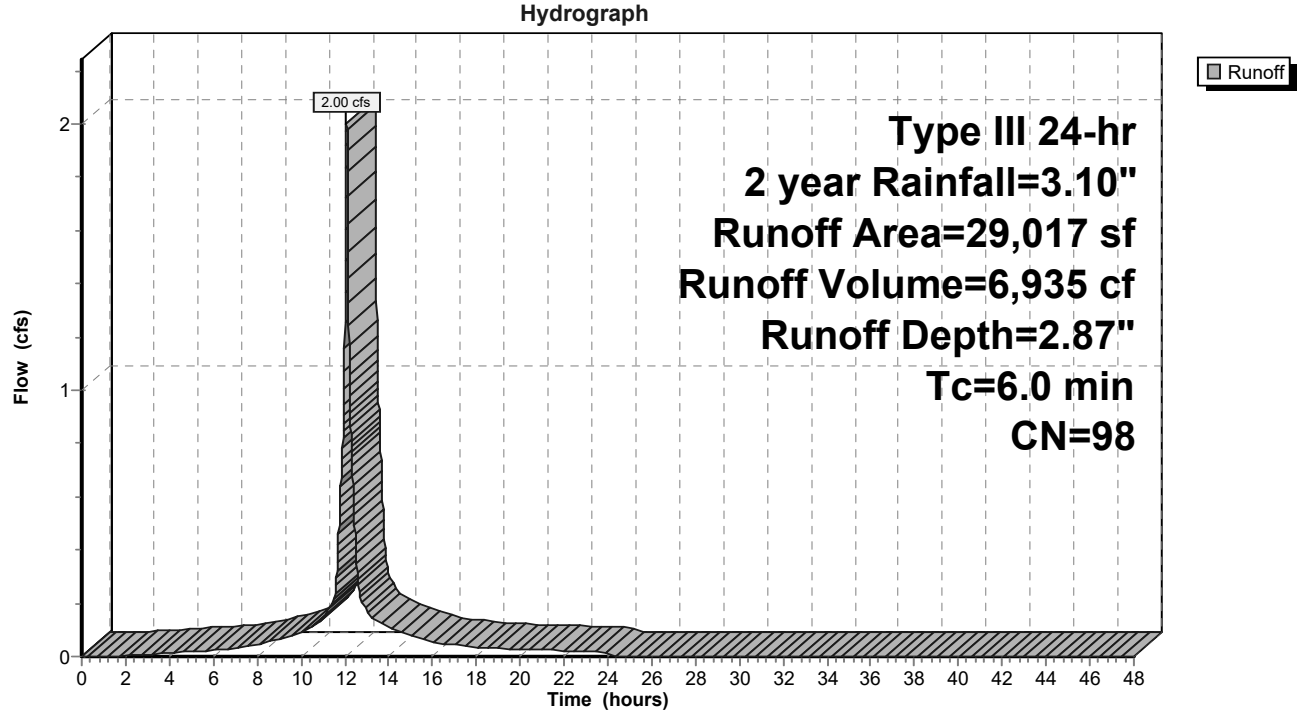
Runoff = 2.00 cfs @ 12.08 hrs, Volume= 6,935 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.10"

	Area (sf)	CN	Description
*	28,534	98	Entrance Drive & Walks
*	483	79	Landscaped area
	29,017	98	Weighted Average
	483		1.66% Pervious Area
	28,534		98.34% Impervious Area

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

Subcatchment 7S: Lower Lot Bypass



Summary for Pond 1P: R-Tank

Inflow Area = 160,117 sf, 80.15% Impervious, Inflow Depth = 2.57" for 2 year event
Inflow = 10.26 cfs @ 12.08 hrs, Volume= 34,275 cf
Outflow = 3.47 cfs @ 12.36 hrs, Volume= 24,632 cf, Atten= 66%, Lag= 16.8 min
Primary = 0.03 cfs @ 15.85 hrs, Volume= 4,370 cf
Secondary = 3.44 cfs @ 12.36 hrs, Volume= 20,262 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 21.86' @ 12.36 hrs Surf.Area= 8,682 sf Storage= 17,421 cf

Plug-Flow detention time= 345.8 min calculated for 24,627 cf (72% of inflow)
Center-of-Mass det. time= 255.0 min (1,028.8 - 773.8)

Volume	Invert	Avail.Storage	Storage Description
#1	19.58'	4,733 cf	**Stone Envelope (Prismatic)** Listed below (Recalc) 33,165 cf Overall - 21,333 cf Embedded = 11,832 cf x 40.0% Voids
#2	19.58'	20,267 cf	**R-Tank Modules (Prismatic)** Listed below (Recalc) Inside #1 21,333 cf Overall x 95.0% Voids
		24,999 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.58	8,682	0	0
23.40	8,682	33,165	33,165

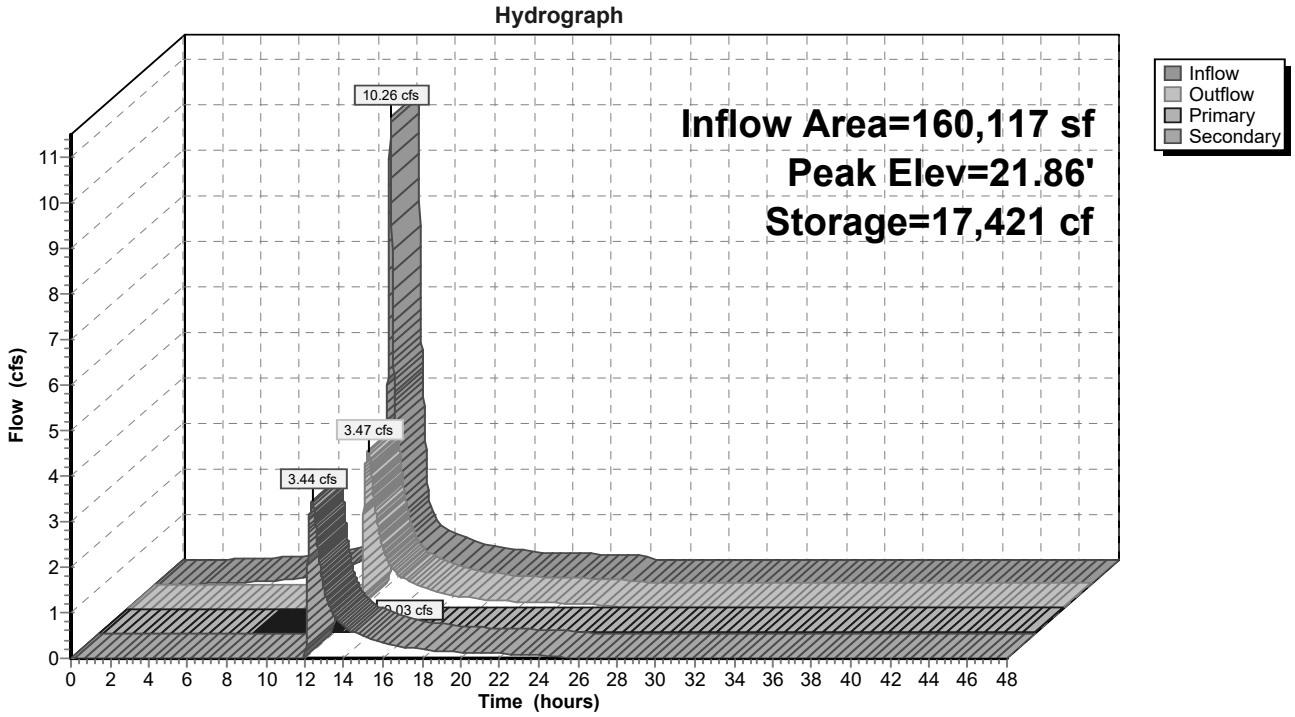
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.58	7,565	0	0
22.40	7,565	21,333	21,333

Device	Routing	Invert	Outlet Devices
#1	Primary	19.58'	**15.0" Round Culvert** L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 19.58' / 19.58' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	19.58'	**1.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	19.75'	**1.7" Vert. Orifice/Grate** C= 0.600
#4	Secondary	21.13'	**15.0" Round Culvert X 2.00** L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 21.13' / 21.00' S= 0.0087 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=0.03 cfs @ 15.85 hrs HW=21.34' TW=19.62' (Dynamic Tailwater)
↑└**1=Culvert** (Passes 0.03 cfs of 5.25 cfs potential flow)
↑└**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 6.31 fps)
↑└**3=Orifice/Grate** (Passes 0.03 cfs of 0.09 cfs potential flow)

Secondary OutFlow Max=3.44 cfs @ 12.36 hrs HW=21.86' TW=20.44' (Dynamic Tailwater)
↑└**4=Culvert** (Barrel Controls 3.44 cfs @ 3.31 fps)

Pond 1P: R-Tank



Summary for Pond DMH: New DMH

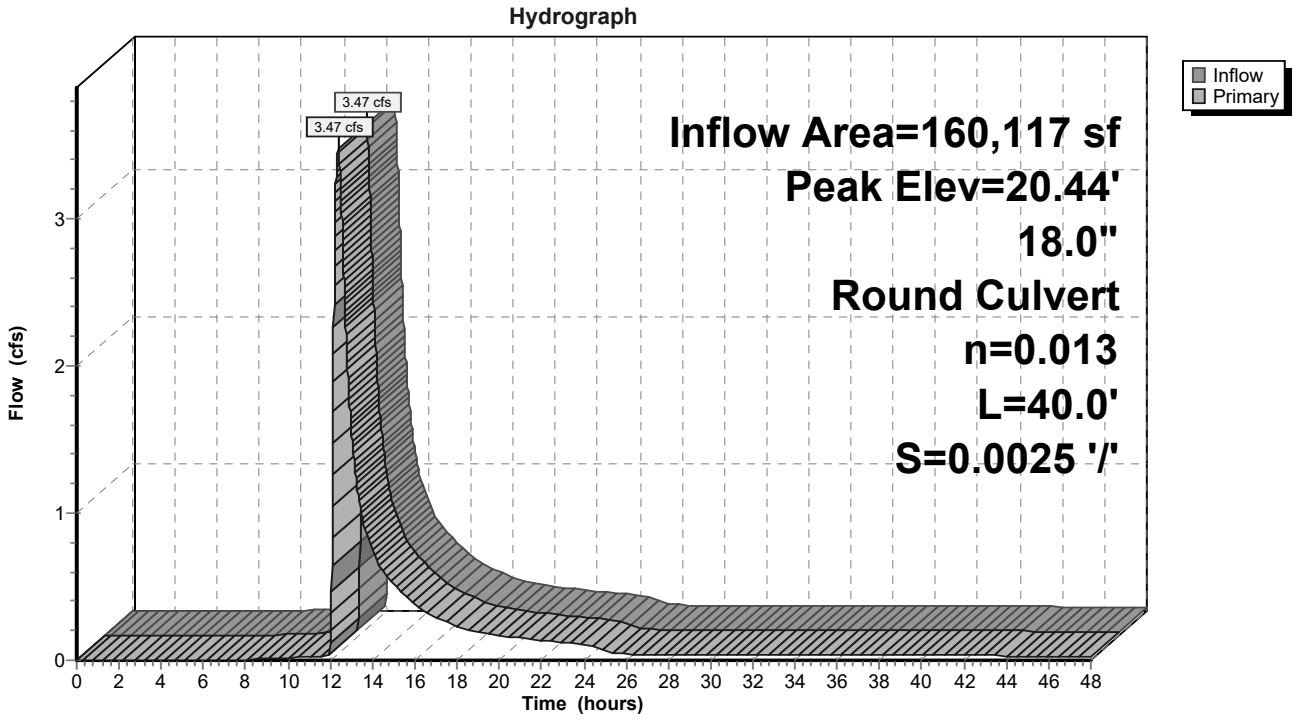
Inflow Area = 160,117 sf, 80.15% Impervious, Inflow Depth > 1.85" for 2 year event
Inflow = 3.47 cfs @ 12.36 hrs, Volume= 24,632 cf
Outflow = 3.47 cfs @ 12.36 hrs, Volume= 24,632 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.47 cfs @ 12.36 hrs, Volume= 24,632 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 20.44' @ 12.36 hrs
Flood Elev= 26.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	19.25'	**18.0" Round Culvert** L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 19.25' / 19.15' S= 0.0025 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=3.47 cfs @ 12.36 hrs HW=20.44' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 3.47 cfs @ 3.17 fps)

Pond DMH: New DMH

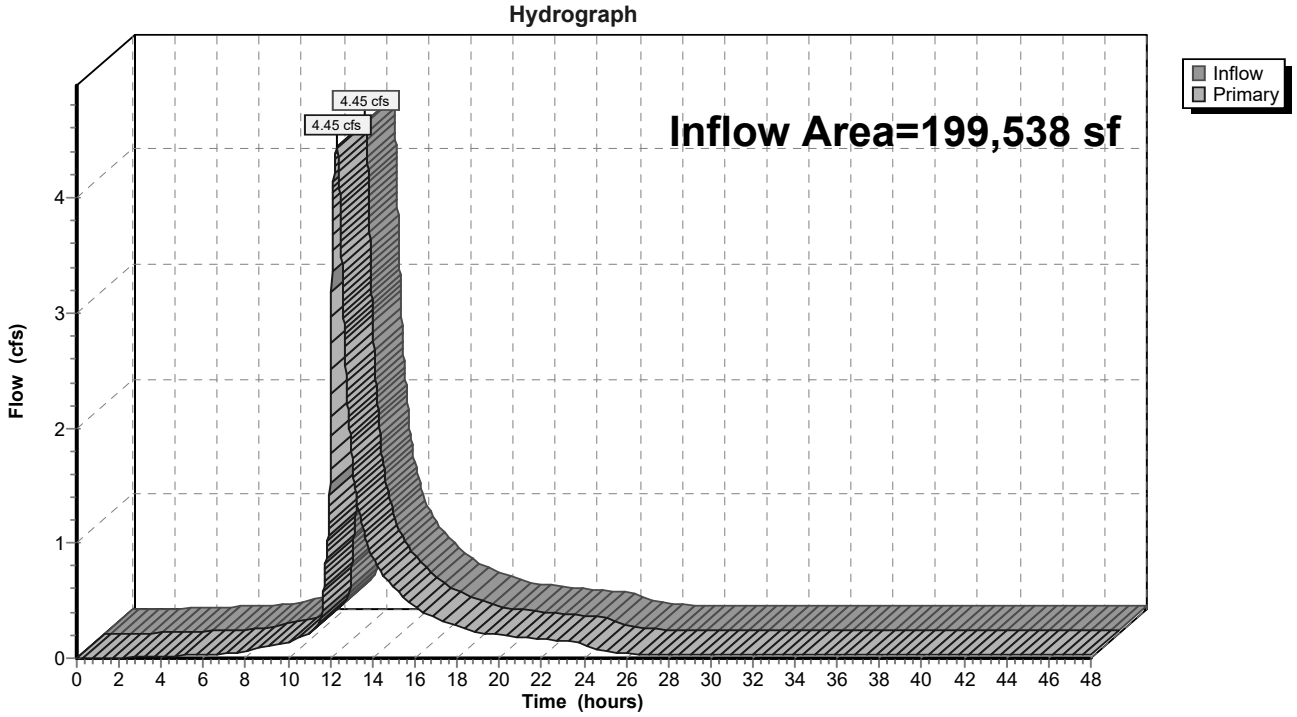


Summary for Link SP1: Existing 18" SD System

Inflow Area = 199,538 sf, 83.57% Impervious, Inflow Depth > 2.04" for 2 year event
Inflow = 4.45 cfs @ 12.30 hrs, Volume= 33,957 cf
Primary = 4.45 cfs @ 12.30 hrs, Volume= 33,957 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link SP1: Existing 18" SD System

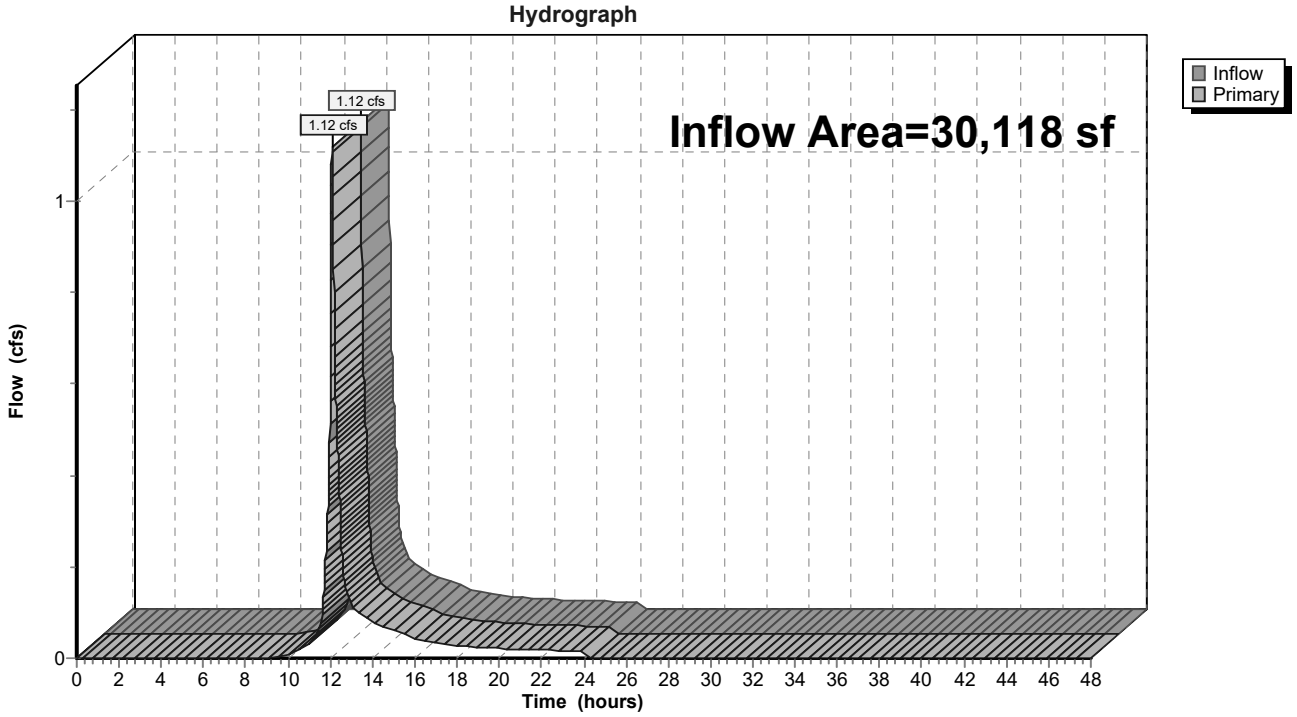


Summary for Link SP2: 30" Storm Drain

Inflow Area = 30,118 sf, 30.94% Impervious, Inflow Depth = 1.39" for 2 year event
Inflow = 1.12 cfs @ 12.09 hrs, Volume= 3,491 cf
Primary = 1.12 cfs @ 12.09 hrs, Volume= 3,491 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link SP2: 30" Storm Drain



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Parking Garage Runoff Area=92,011 sf 100.00% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=98 Runoff=9.50 cfs 33,460 cf

Subcatchment2S: Lower Parking lot & Runoff Area=53,341 sf 61.76% Impervious Runoff Depth=3.59"
Tc=6.0 min CN=91 Runoff=4.97 cfs 15,978 cf

Subcatchment4S: St. John Street Entrance Runoff Area=30,118 sf 30.94% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=81 Runoff=2.14 cfs 6,613 cf

Subcatchment5S: Southern Drainage Runoff Area=14,765 sf 22.87% Impervious Runoff Depth=3.59"
Tc=6.0 min CN=91 Runoff=1.38 cfs 4,423 cf

Subcatchment6S: Entrance Drive Runoff Area=10,404 sf 95.07% Impervious Runoff Depth=4.25"
Tc=5.0 min CN=97 Runoff=1.10 cfs 3,684 cf

Subcatchment7S: Lower Lot Bypass Runoff Area=29,017 sf 98.34% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=98 Runoff=2.99 cfs 10,552 cf

Pond 1P: R-Tank Peak Elev=22.52' Storage=21,935 cf Inflow=15.84 cfs 53,861 cf
Primary=0.03 cfs 4,533 cf Secondary=9.20 cfs 39,639 cf Outflow=9.22 cfs 44,173 cf

Pond DMH: New DMH Peak Elev=21.89' Inflow=9.22 cfs 44,173 cf
18.0" Round Culvert n=0.013 L=40.0' S=0.0025 '/' Outflow=9.22 cfs 44,173 cf

Link SP1: Existing 18" SD System Inflow=11.73 cfs 58,409 cf
Primary=11.73 cfs 58,409 cf

Link SP2: 30" Storm Drain Inflow=2.14 cfs 6,613 cf
Primary=2.14 cfs 6,613 cf

Total Runoff Area = 229,656 sf Runoff Volume = 74,710 cf Average Runoff Depth = 3.90"
23.33% Pervious = 53,580 sf 76.67% Impervious = 176,076 sf

Summary for Subcatchment 1S: Parking Garage

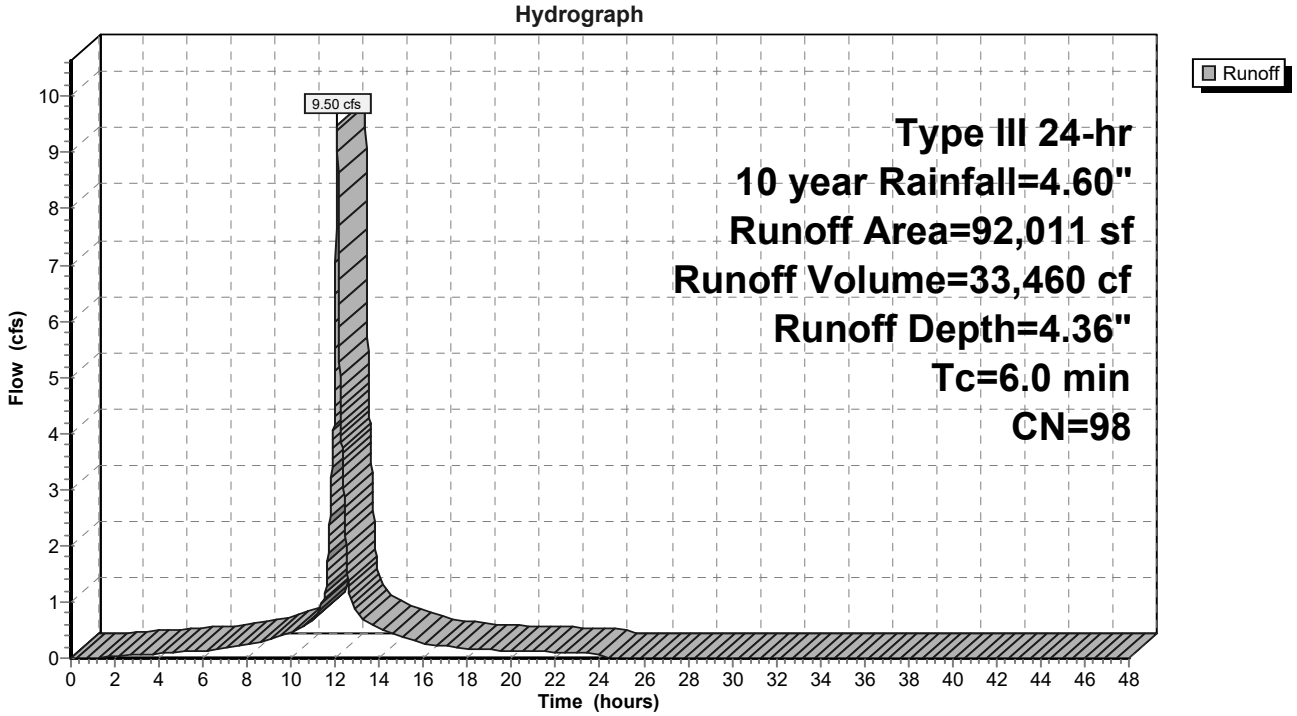
Runoff = 9.50 cfs @ 12.08 hrs, Volume= 33,460 cf, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.60"

Area (sf)	CN	Description
89,825	98	Paved parking, HSG B
2,186	98	Roofs, HSG B
92,011	98	Weighted Average
92,011		100.00% Impervious Area

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

Subcatchment 1S: Parking Garage



Summary for Subcatchment 2S: Lower Parking lot & Landscaping

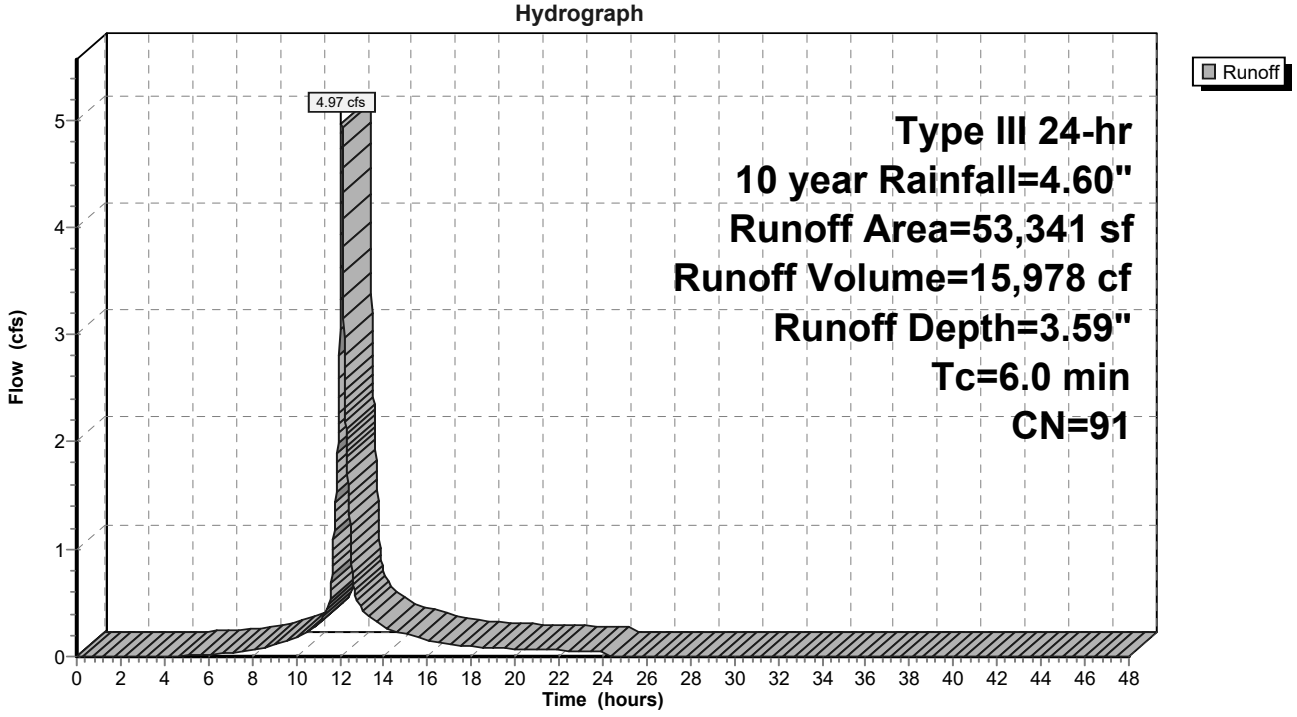
Runoff = 4.97 cfs @ 12.08 hrs, Volume= 15,978 cf, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.60"

	Area (sf)	CN	Description
*	32,944	98	Paved Parking Lot
	20,397	80	>75% Grass cover, Good, HSG D
	53,341	91	Weighted Average
	20,397		38.24% Pervious Area
	32,944		61.76% Impervious Area

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

Subcatchment 2S: Lower Parking lot & Landscaping



Summary for Subcatchment 4S: St. John Street Entrance

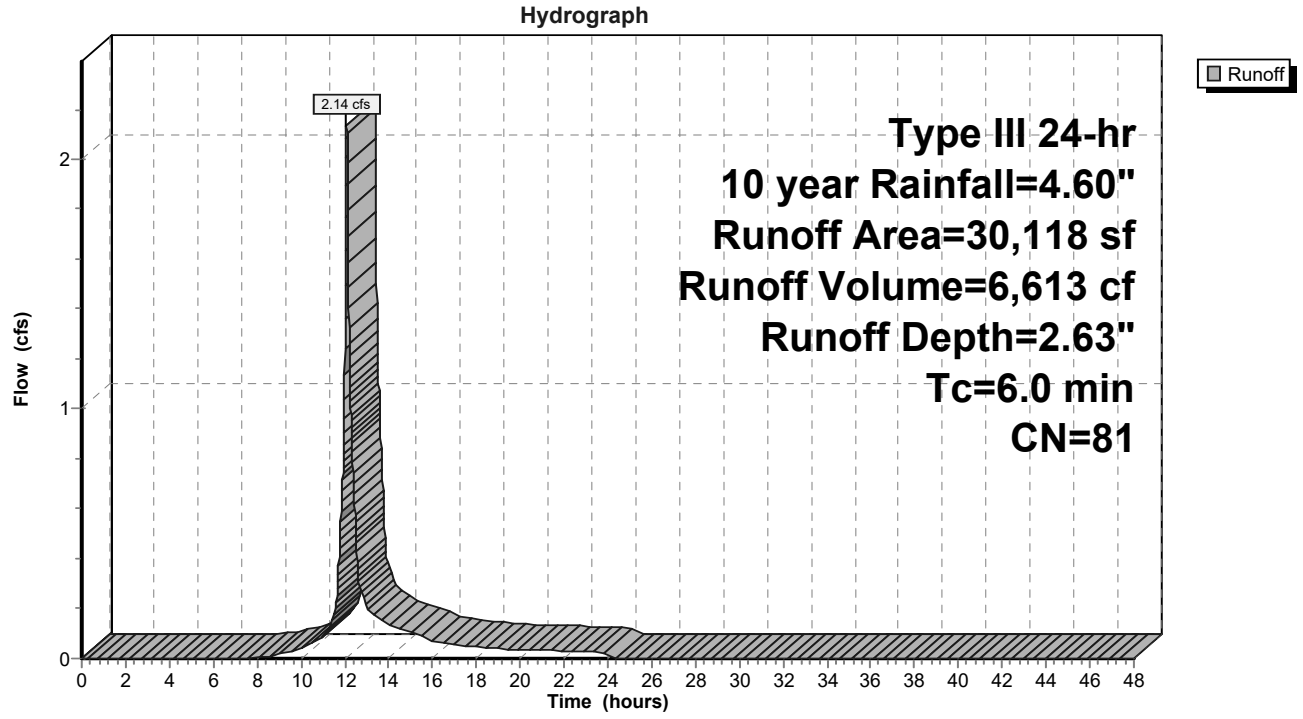
Runoff = 2.14 cfs @ 12.09 hrs, Volume= 6,613 cf, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.60"

	Area (sf)	CN	Description
*	9,319	98	New entrane drive and walks
	20,799	74	>75% Grass cover, Good, HSG C
	30,118	81	Weighted Average
	20,799		69.06% Pervious Area
	9,319		30.94% Impervious Area

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

Subcatchment 4S: St. John Street Entrance



Summary for Subcatchment 5S: Southern Drainage

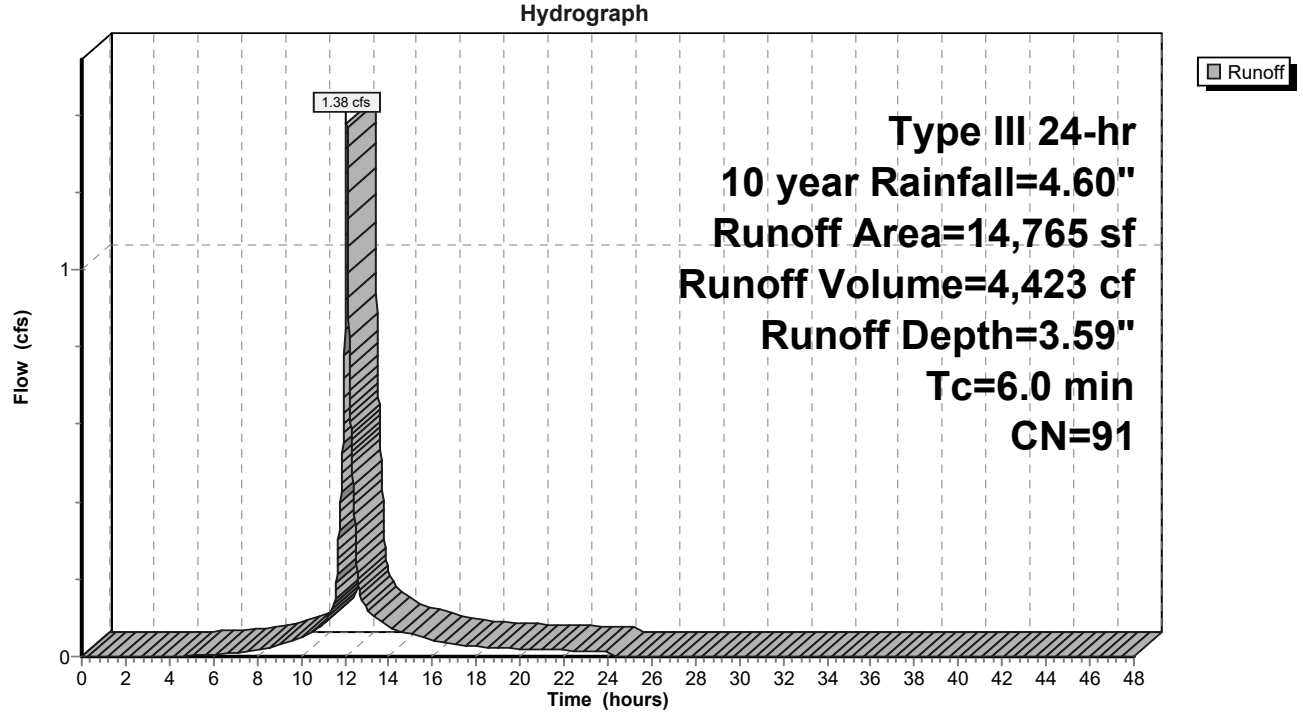
Runoff = 1.38 cfs @ 12.08 hrs, Volume= 4,423 cf, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.60"

	Area (sf)	CN	Description
*	11,388	89	Crushed Stone
*	3,377	98	Sidewalk
	14,765	91	Weighted Average
	11,388		77.13% Pervious Area
	3,377		22.87% Impervious Area

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

Subcatchment 5S: Southern Drainage



Summary for Subcatchment 6S: Entrance Drive

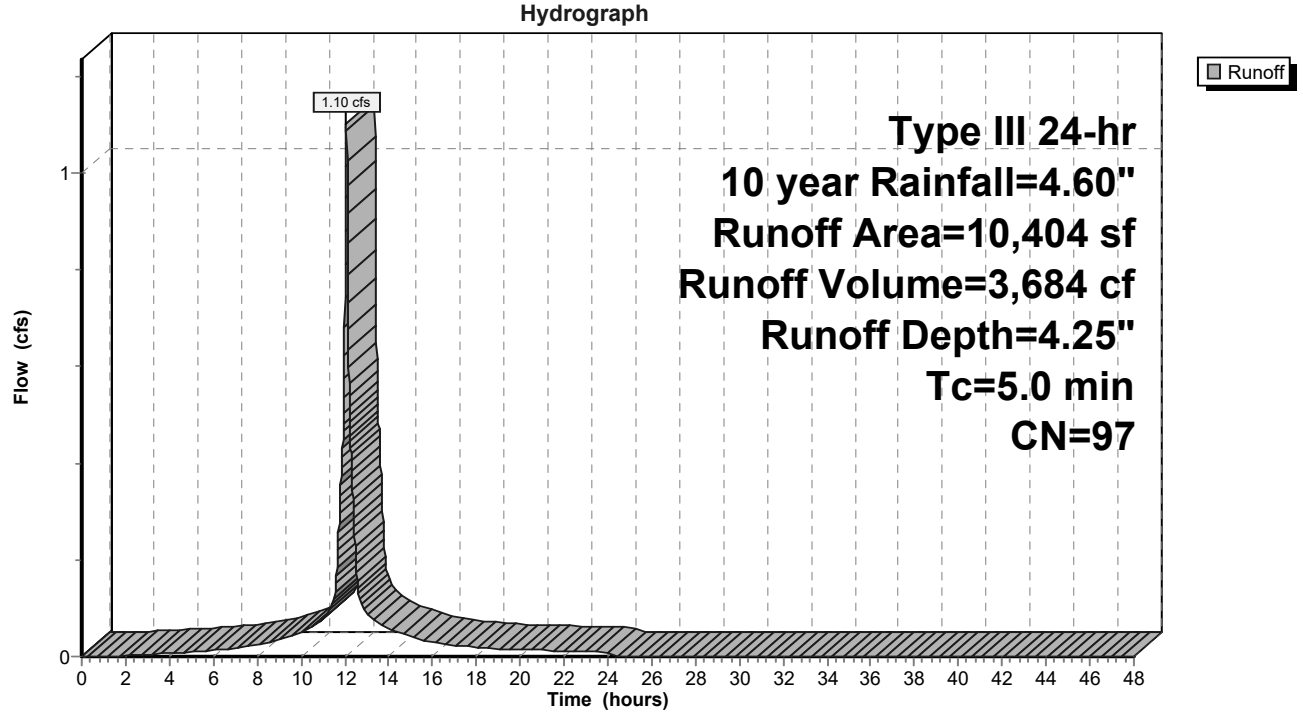
Runoff = 1.10 cfs @ 12.07 hrs, Volume= 3,684 cf, Depth= 4.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.60"

	Area (sf)	CN	Description
*	9,891	98	Entrance Road
	513	84	50-75% Grass cover, Fair, HSG D
	10,404	97	Weighted Average
	513		4.93% Pervious Area
	9,891		95.07% Impervious Area

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

Subcatchment 6S: Entrance Drive



Summary for Subcatchment 7S: Lower Lot Bypass

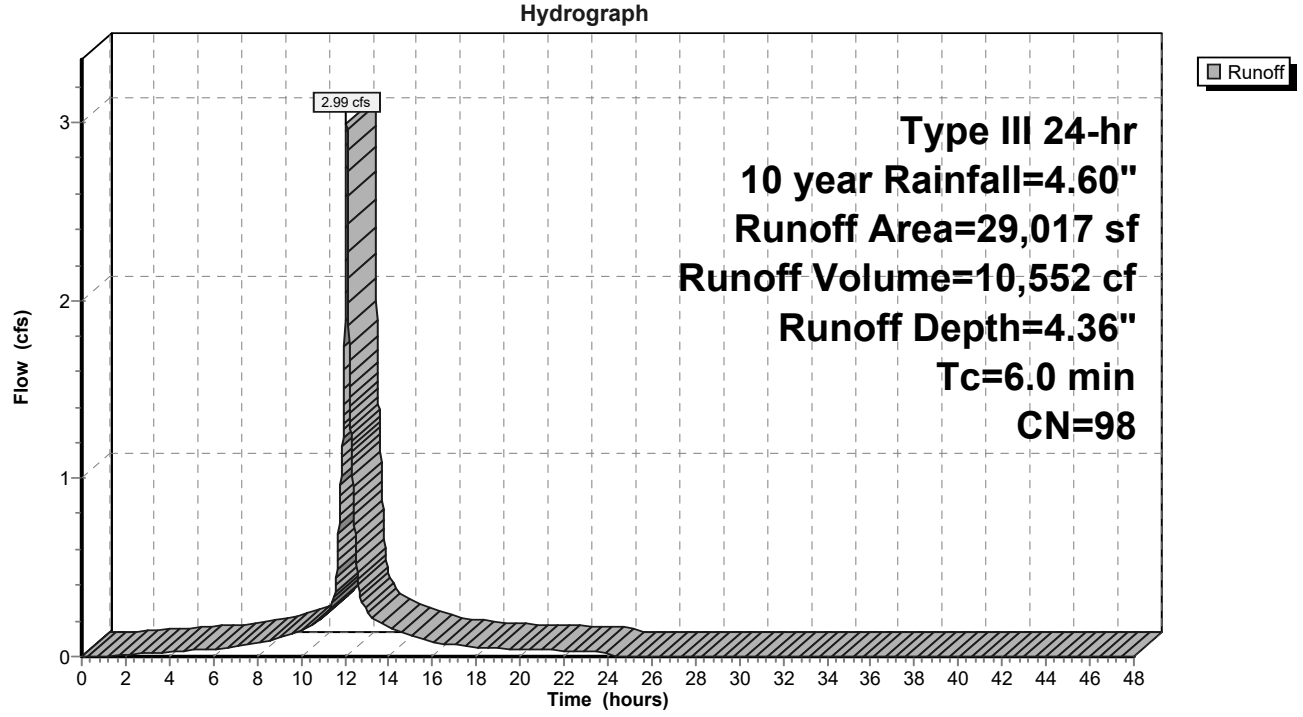
Runoff = 2.99 cfs @ 12.08 hrs, Volume= 10,552 cf, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.60"

	Area (sf)	CN	Description
*	28,534	98	Entrance Drive & Walks
*	483	79	Landscaped area
	29,017	98	Weighted Average
	483		1.66% Pervious Area
	28,534		98.34% Impervious Area

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

Subcatchment 7S: Lower Lot Bypass



Summary for Pond 1P: R-Tank

Inflow Area = 160,117 sf, 80.15% Impervious, Inflow Depth = 4.04" for 10 year event
Inflow = 15.84 cfs @ 12.08 hrs, Volume= 53,861 cf
Outflow = 9.22 cfs @ 12.19 hrs, Volume= 44,173 cf, Atten= 42%, Lag= 6.5 min
Primary = 0.03 cfs @ 17.24 hrs, Volume= 4,533 cf
Secondary = 9.20 cfs @ 12.19 hrs, Volume= 39,639 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 22.52' @ 12.19 hrs Surf.Area= 8,682 sf Storage= 21,935 cf

Plug-Flow detention time= 242.2 min calculated for 44,173 cf (82% of inflow)
Center-of-Mass det. time= 170.1 min (934.8 - 764.7)

Volume	Invert	Avail.Storage	Storage Description
#1	19.58'	4,733 cf	**Stone Envelope (Prismatic)** Listed below (Recalc) 33,165 cf Overall - 21,333 cf Embedded = 11,832 cf x 40.0% Voids
#2	19.58'	20,267 cf	**R-Tank Modules (Prismatic)** Listed below (Recalc) Inside #1 21,333 cf Overall x 95.0% Voids
		24,999 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.58	8,682	0	0
23.40	8,682	33,165	33,165

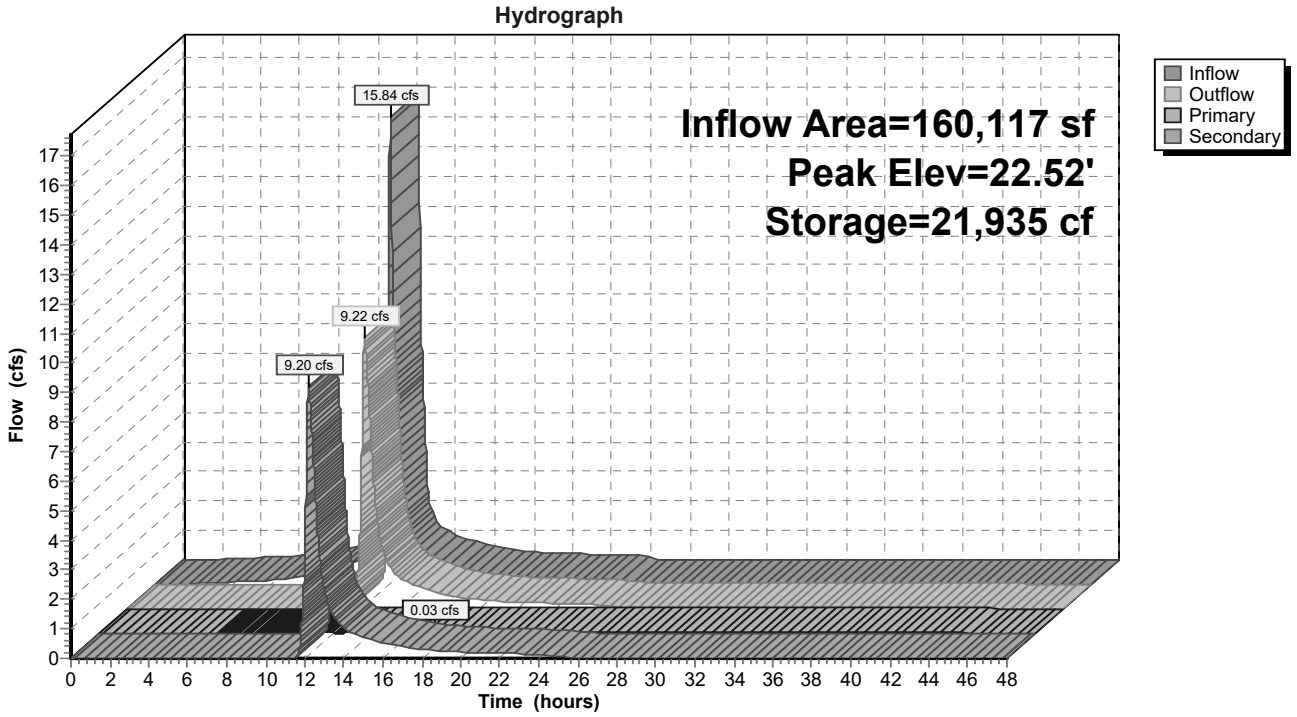
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.58	7,565	0	0
22.40	7,565	21,333	21,333

Device	Routing	Invert	Outlet Devices
#1	Primary	19.58'	**15.0" Round Culvert** L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 19.58' / 19.58' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	19.58'	**1.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	19.75'	**1.7" Vert. Orifice/Grate** C= 0.600
#4	Secondary	21.13'	**15.0" Round Culvert X 2.00** L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 21.13' / 21.00' S= 0.0087 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=0.03 cfs @ 17.24 hrs HW=21.34' TW=19.62' (Dynamic Tailwater)
↑└**1=Culvert** (Passes 0.03 cfs of 5.25 cfs potential flow)
↑└**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 6.31 fps)
↑└**3=Orifice/Grate** (Passes 0.03 cfs of 0.09 cfs potential flow)

Secondary OutFlow Max=9.20 cfs @ 12.19 hrs HW=22.52' TW=21.88' (Dynamic Tailwater)
↑└**4=Culvert** (Barrel Controls 9.20 cfs @ 4.21 fps)

Pond 1P: R-Tank



Summary for Pond DMH: New DMH

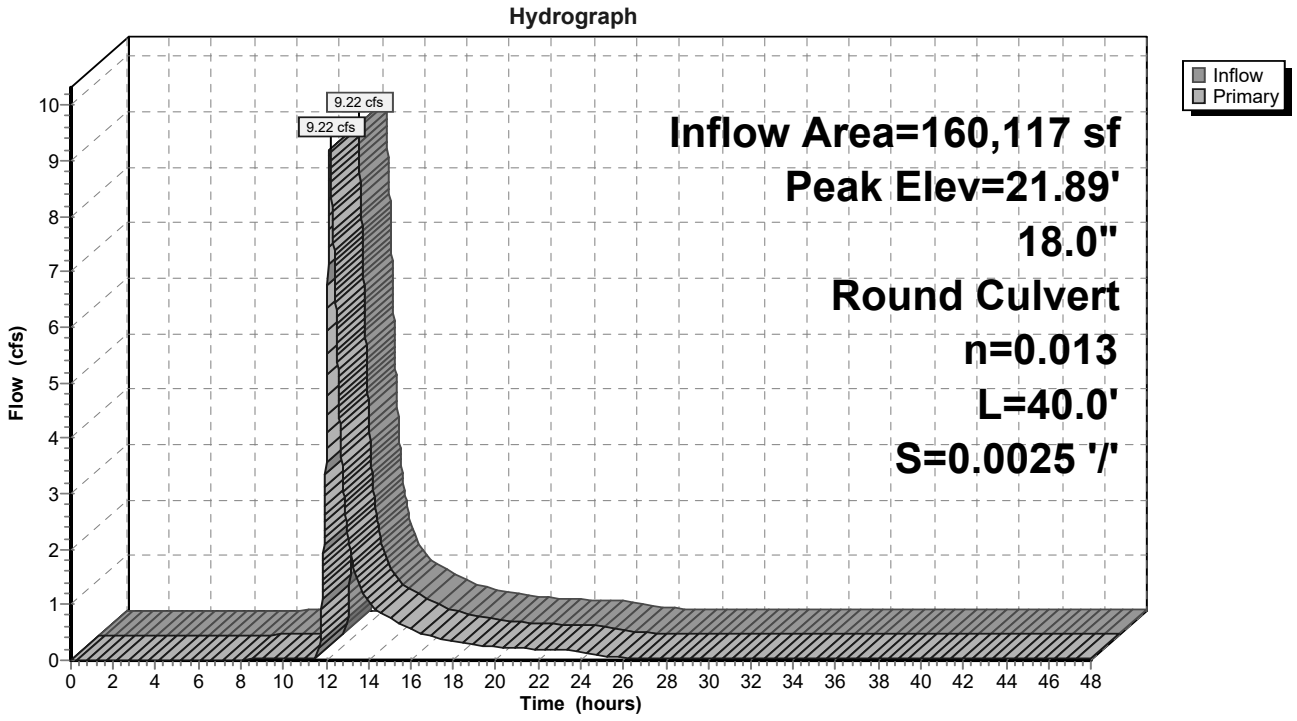
Inflow Area = 160,117 sf, 80.15% Impervious, Inflow Depth > 3.31" for 10 year event
Inflow = 9.22 cfs @ 12.19 hrs, Volume= 44,173 cf
Outflow = 9.22 cfs @ 12.19 hrs, Volume= 44,173 cf, Atten= 0%, Lag= 0.0 min
Primary = 9.22 cfs @ 12.19 hrs, Volume= 44,173 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 21.89' @ 12.19 hrs
Flood Elev= 26.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	19.25'	**18.0" Round Culvert** L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 19.25' / 19.15' S= 0.0025 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=9.22 cfs @ 12.19 hrs HW=21.88' TW=0.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 9.22 cfs @ 5.22 fps)

Pond DMH: New DMH

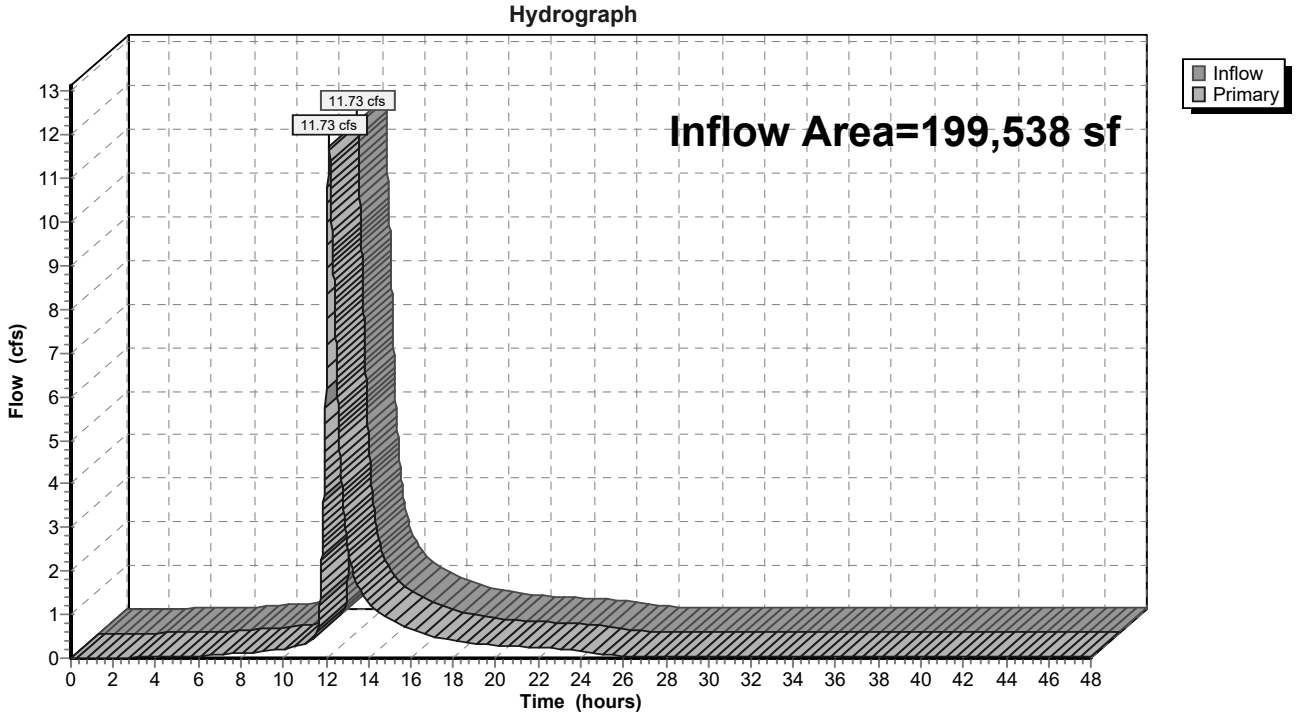


Summary for Link SP1: Existing 18" SD System

Inflow Area = 199,538 sf, 83.57% Impervious, Inflow Depth > 3.51" for 10 year event
Inflow = 11.73 cfs @ 12.16 hrs, Volume= 58,409 cf
Primary = 11.73 cfs @ 12.16 hrs, Volume= 58,409 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link SP1: Existing 18" SD System

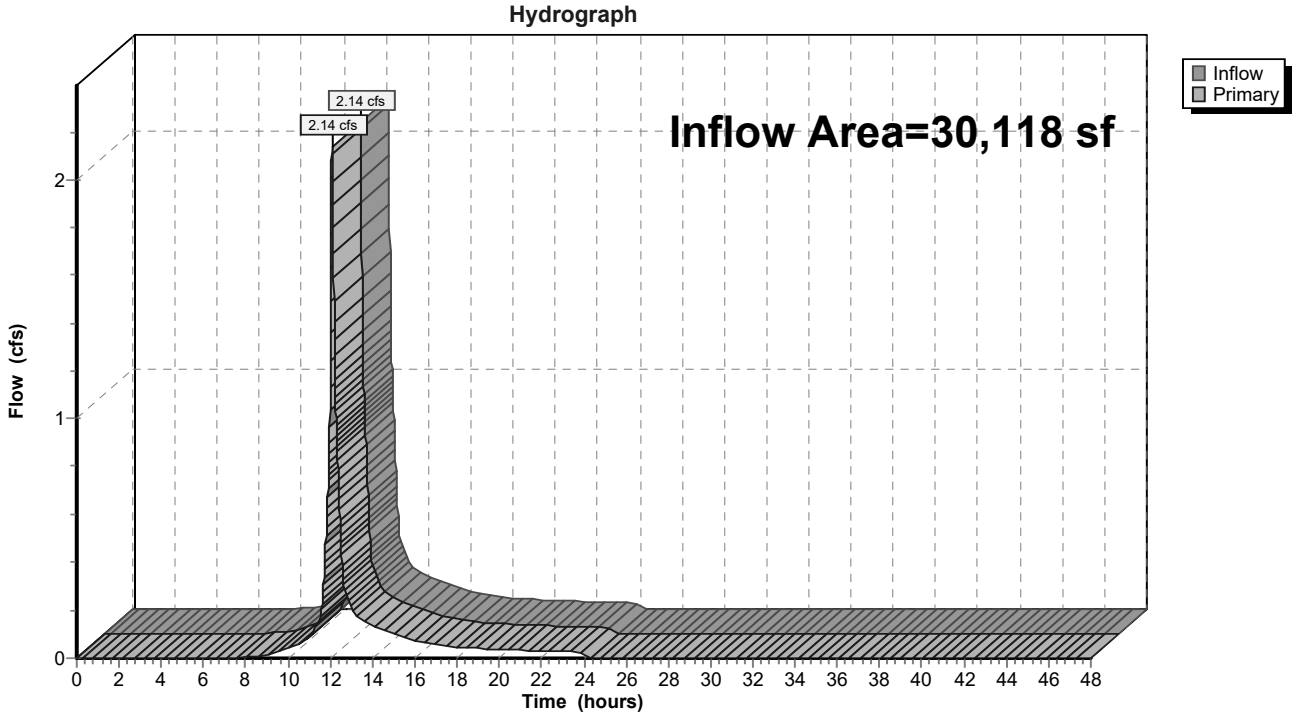


Summary for Link SP2: 30" Storm Drain

Inflow Area = 30,118 sf, 30.94% Impervious, Inflow Depth = 2.63" for 10 year event
Inflow = 2.14 cfs @ 12.09 hrs, Volume= 6,613 cf
Primary = 2.14 cfs @ 12.09 hrs, Volume= 6,613 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link SP2: 30" Storm Drain



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Parking Garage Runoff Area=92,011 sf 100.00% Impervious Runoff Depth=5.56"
Tc=6.0 min CN=98 Runoff=12.00 cfs 42,648 cf

Subcatchment2S: Lower Parking lot & Runoff Area=53,341 sf 61.76% Impervious Runoff Depth=4.76"
Tc=6.0 min CN=91 Runoff=6.48 cfs 21,166 cf

Subcatchment4S: St. John Street Entrance Runoff Area=30,118 sf 30.94% Impervious Runoff Depth=3.70"
Tc=6.0 min CN=81 Runoff=2.99 cfs 9,291 cf

Subcatchment5S: Southern Drainage Runoff Area=14,765 sf 22.87% Impervious Runoff Depth=4.76"
Tc=6.0 min CN=91 Runoff=1.79 cfs 5,859 cf

Subcatchment6S: Entrance Drive Runoff Area=10,404 sf 95.07% Impervious Runoff Depth=5.44"
Tc=5.0 min CN=97 Runoff=1.40 cfs 4,721 cf

Subcatchment7S: Lower Lot Bypass Runoff Area=29,017 sf 98.34% Impervious Runoff Depth=5.56"
Tc=6.0 min CN=98 Runoff=3.79 cfs 13,450 cf

Pond 1P: R-Tank Peak Elev=23.27' Storage=24,553 cf Inflow=20.28 cfs 69,672 cf
Primary=0.05 cfs 4,666 cf Secondary=14.55 cfs 55,737 cf Outflow=14.60 cfs 59,961 cf

Pond DMH: New DMH Peak Elev=24.73' Inflow=14.60 cfs 60,403 cf
18.0" Round Culvert n=0.013 L=40.0' S=0.0025 '/' Outflow=14.60 cfs 60,403 cf

Link SP1: Existing 18" SD System Inflow=18.80 cfs 78,573 cf
Primary=18.80 cfs 78,573 cf

Link SP2: 30" Storm Drain Inflow=2.99 cfs 9,291 cf
Primary=2.99 cfs 9,291 cf

Total Runoff Area = 229,656 sf Runoff Volume = 97,134 cf Average Runoff Depth = 5.08"
23.33% Pervious = 53,580 sf 76.67% Impervious = 176,076 sf

Summary for Subcatchment 1S: Parking Garage

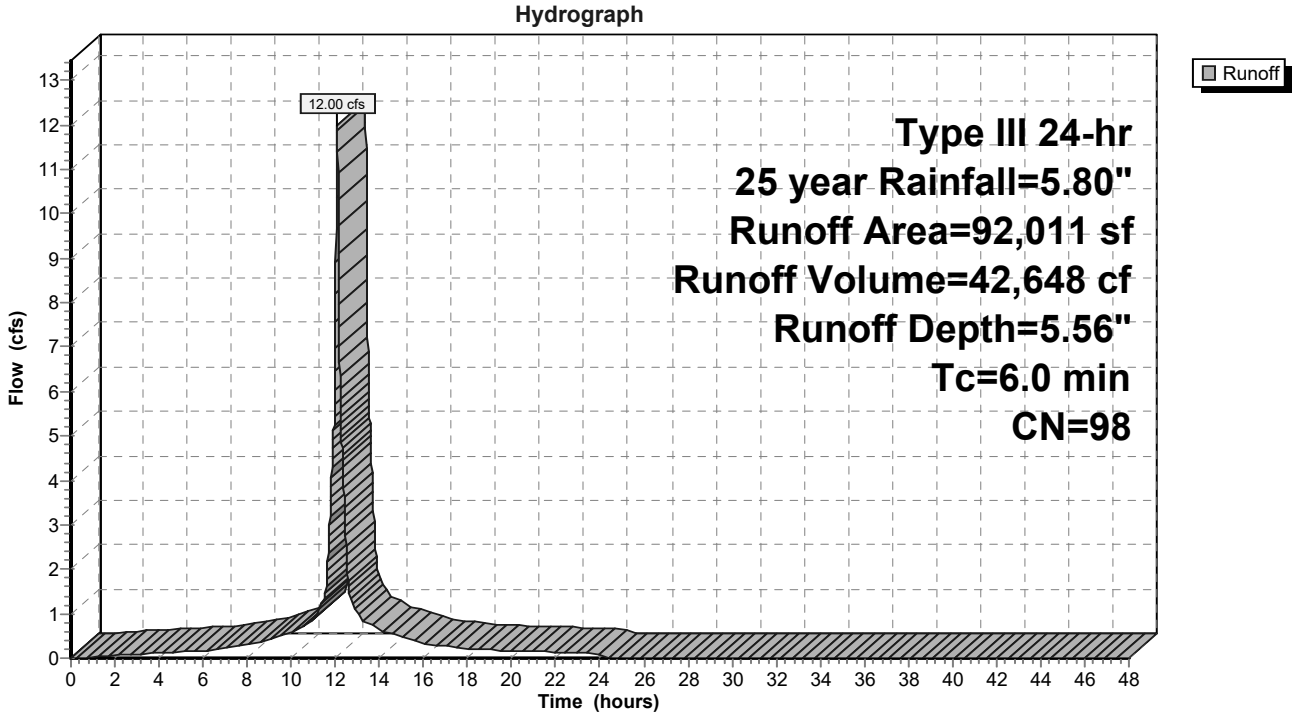
Runoff = 12.00 cfs @ 12.08 hrs, Volume= 42,648 cf, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 year Rainfall=5.80"

Area (sf)	CN	Description
89,825	98	Paved parking, HSG B
2,186	98	Roofs, HSG B
92,011	98	Weighted Average
92,011		100.00% Impervious Area

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

Subcatchment 1S: Parking Garage



Summary for Subcatchment 2S: Lower Parking lot & Landscaping

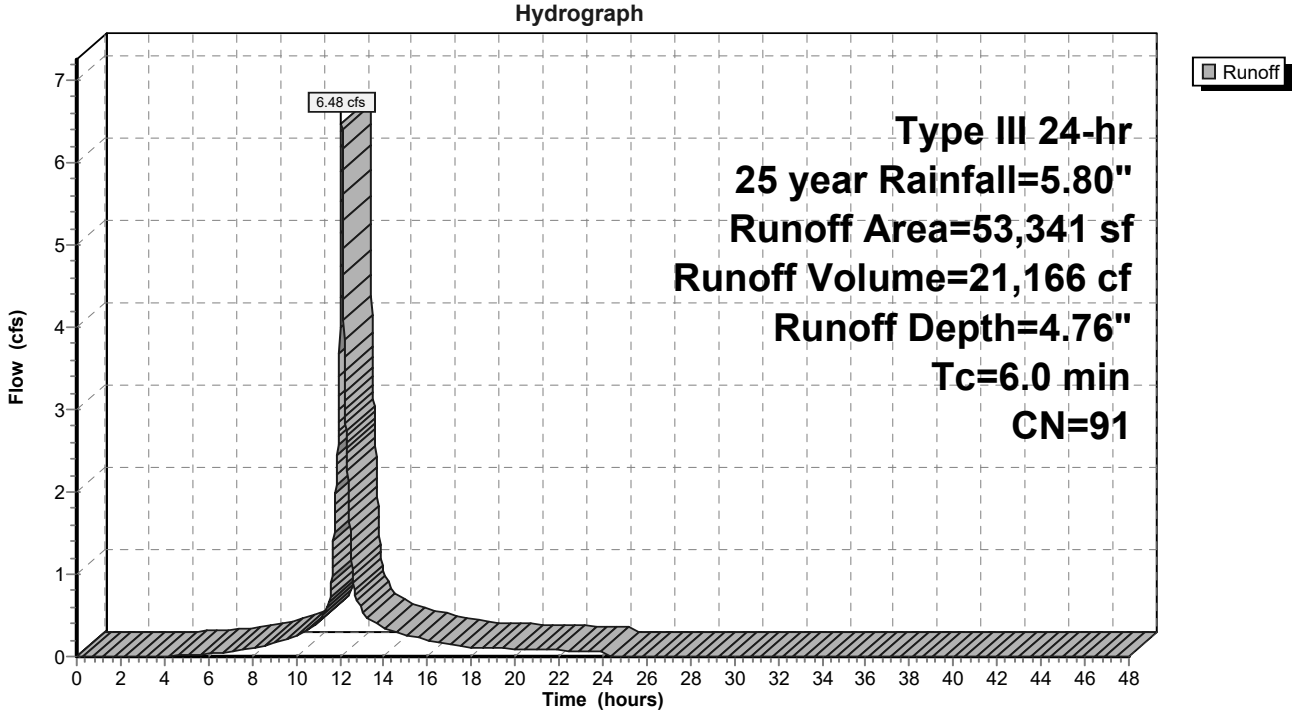
Runoff = 6.48 cfs @ 12.08 hrs, Volume= 21,166 cf, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 year Rainfall=5.80"

	Area (sf)	CN	Description
*	32,944	98	Paved Parking Lot
	20,397	80	>75% Grass cover, Good, HSG D
	53,341	91	Weighted Average
	20,397		38.24% Pervious Area
	32,944		61.76% Impervious Area

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

Subcatchment 2S: Lower Parking lot & Landscaping



Summary for Subcatchment 4S: St. John Street Entrance

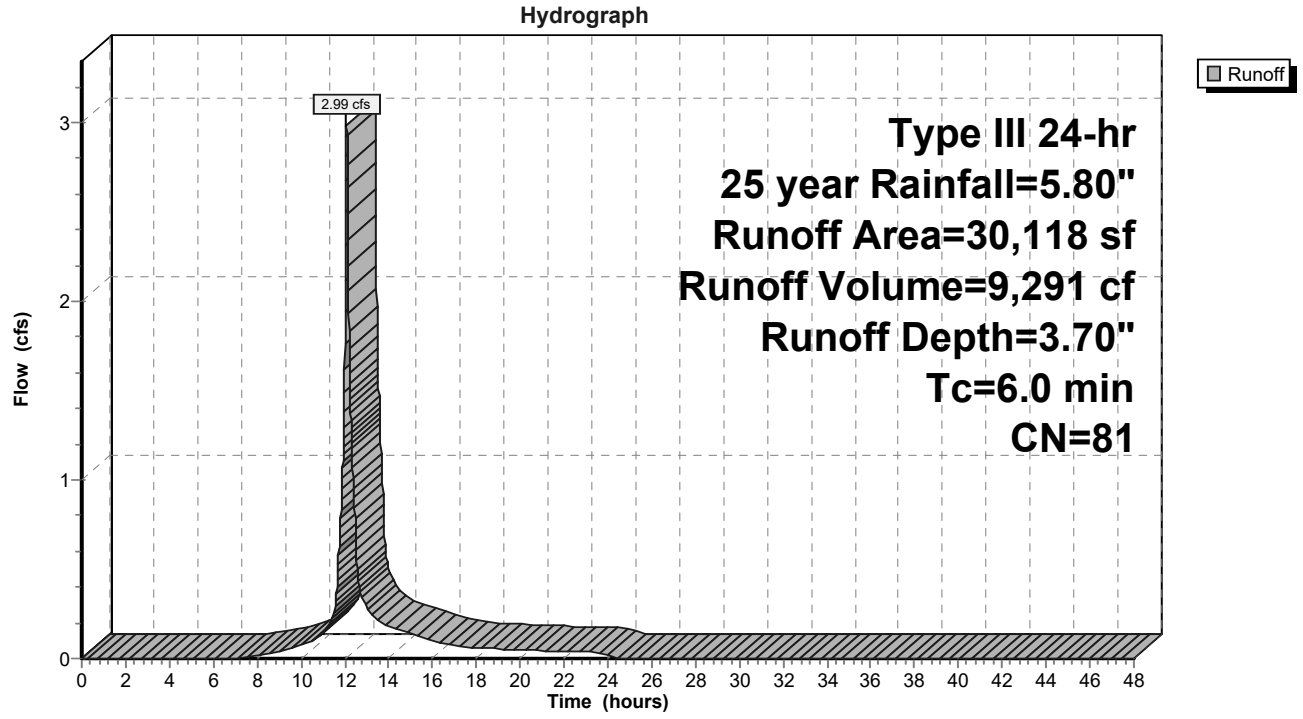
Runoff = 2.99 cfs @ 12.09 hrs, Volume= 9,291 cf, Depth= 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 year Rainfall=5.80"

	Area (sf)	CN	Description
*	9,319	98	New entrane drive and walks
	20,799	74	>75% Grass cover, Good, HSG C
	30,118	81	Weighted Average
	20,799		69.06% Pervious Area
	9,319		30.94% Impervious Area

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

Subcatchment 4S: St. John Street Entrance



Summary for Subcatchment 5S: Southern Drainage

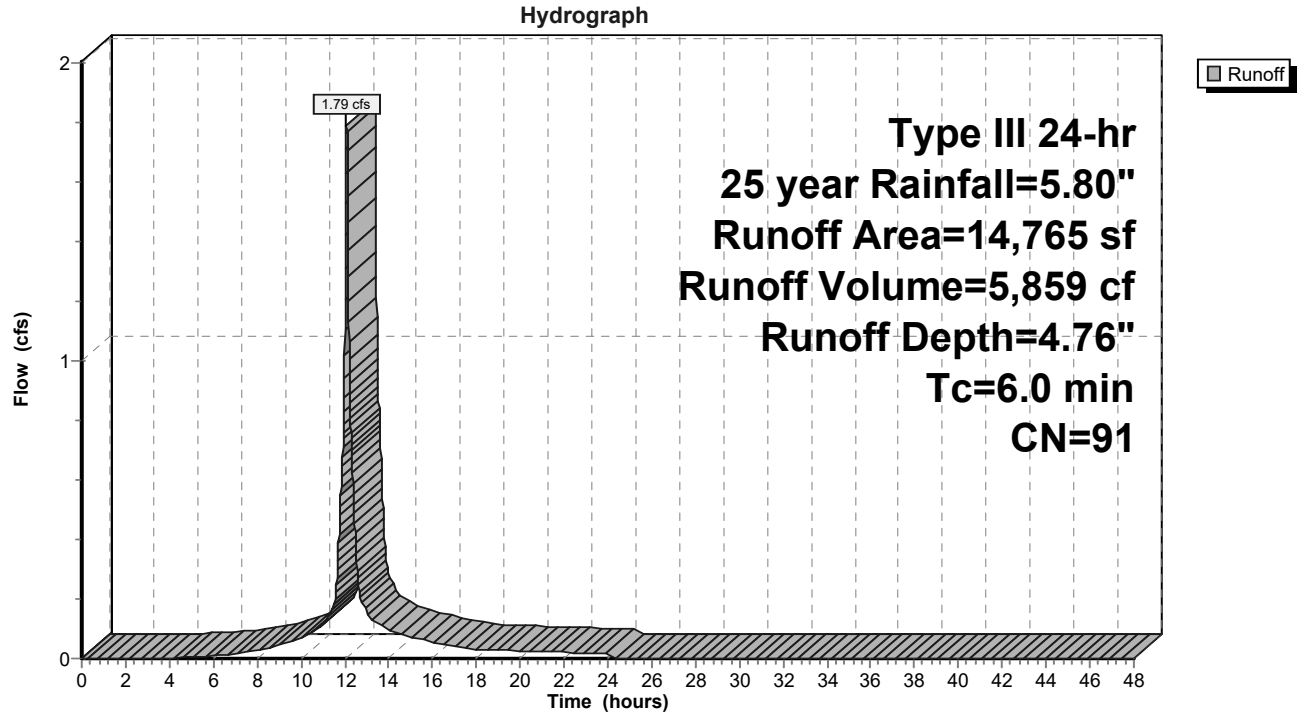
Runoff = 1.79 cfs @ 12.08 hrs, Volume= 5,859 cf, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 year Rainfall=5.80"

	Area (sf)	CN	Description
*	11,388	89	Crushed Stone
*	3,377	98	Sidewalk
	14,765	91	Weighted Average
	11,388		77.13% Pervious Area
	3,377		22.87% Impervious Area

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

Subcatchment 5S: Southern Drainage



Summary for Subcatchment 6S: Entrance Drive

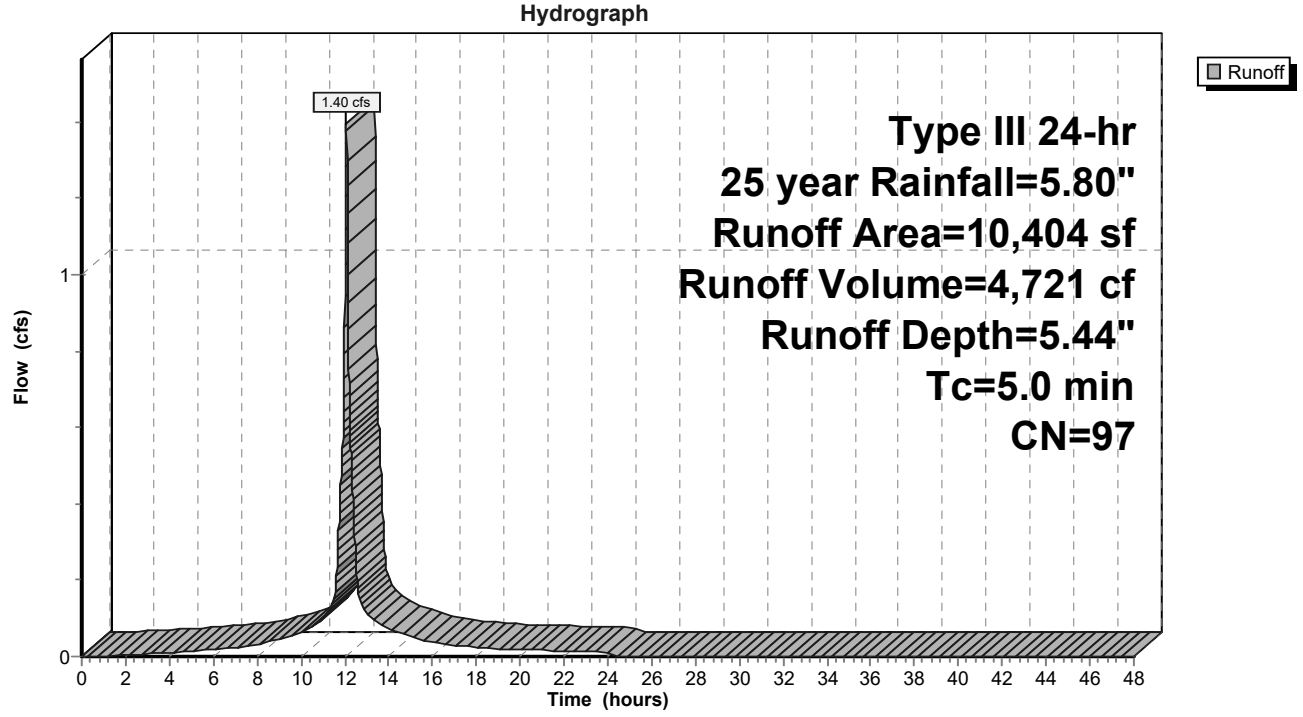
Runoff = 1.40 cfs @ 12.07 hrs, Volume= 4,721 cf, Depth= 5.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 year Rainfall=5.80"

	Area (sf)	CN	Description
*	9,891	98	Entrance Road
	513	84	50-75% Grass cover, Fair, HSG D
	10,404	97	Weighted Average
	513		4.93% Pervious Area
	9,891		95.07% Impervious Area

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

Subcatchment 6S: Entrance Drive



Summary for Subcatchment 7S: Lower Lot Bypass

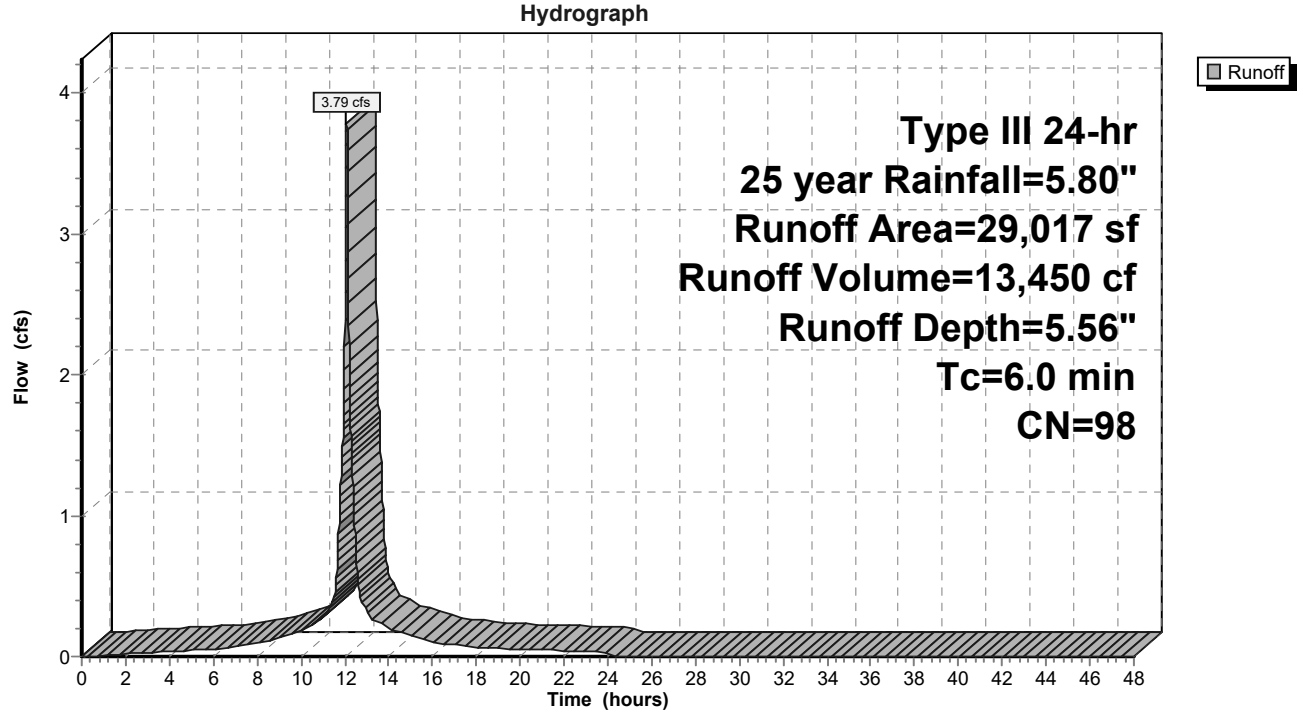
Runoff = 3.79 cfs @ 12.08 hrs, Volume= 13,450 cf, Depth= 5.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 year Rainfall=5.80"

	Area (sf)	CN	Description
*	28,534	98	Entrance Drive & Walks
*	483	79	Landscaped area
	29,017	98	Weighted Average
	483		1.66% Pervious Area
	28,534		98.34% Impervious Area

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

Subcatchment 7S: Lower Lot Bypass



Summary for Pond 1P: R-Tank

Inflow Area = 160,117 sf, 80.15% Impervious, Inflow Depth = 5.22" for 25 year event
Inflow = 20.28 cfs @ 12.08 hrs, Volume= 69,672 cf
Outflow = 14.60 cfs @ 12.16 hrs, Volume= 59,961 cf, Atten= 28%, Lag= 4.5 min
Primary = 0.05 cfs @ 12.16 hrs, Volume= 4,666 cf
Secondary = 14.55 cfs @ 12.16 hrs, Volume= 55,737 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 23.27' @ 12.16 hrs Surf.Area= 8,682 sf Storage= 24,553 cf

Plug-Flow detention time= 202.4 min calculated for 59,949 cf (86% of inflow)
Center-of-Mass det. time= 140.8 min (900.6 - 759.8)

Volume	Invert	Avail.Storage	Storage Description
#1	19.58'	4,733 cf	**Stone Envelope (Prismatic)** Listed below (Recalc) 33,165 cf Overall - 21,333 cf Embedded = 11,832 cf x 40.0% Voids
#2	19.58'	20,267 cf	**R-Tank Modules (Prismatic)** Listed below (Recalc) Inside #1 21,333 cf Overall x 95.0% Voids
		24,999 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.58	8,682	0	0
23.40	8,682	33,165	33,165

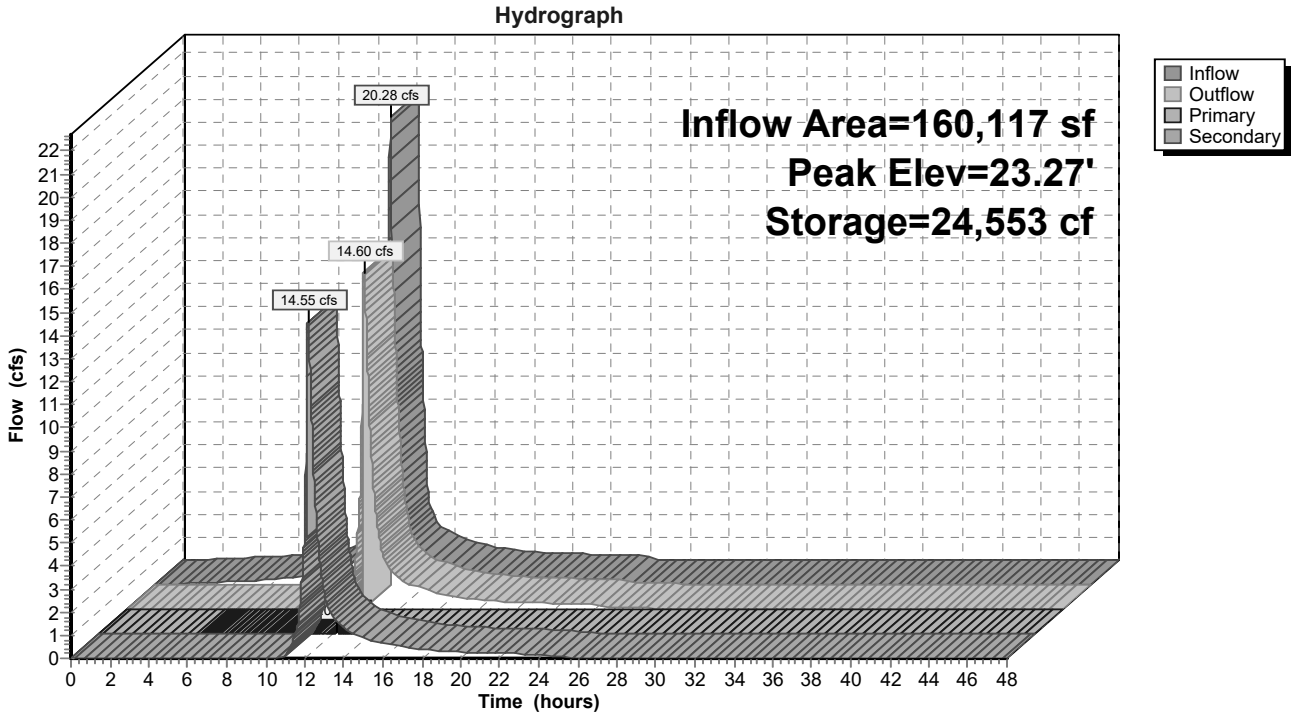
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
19.58	7,565	0	0
22.40	7,565	21,333	21,333

Device	Routing	Invert	Outlet Devices
#1	Primary	19.58'	**15.0" Round Culvert** L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 19.58' / 19.58' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	19.58'	**1.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	19.75'	**1.7" Vert. Orifice/Grate** C= 0.600
#4	Secondary	21.13'	**15.0" Round Culvert X 2.00** L= 15.0' Ke= 0.500 Inlet / Outlet Invert= 21.13' / 21.00' S= 0.0087 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=0.00 cfs @ 12.16 hrs HW=23.27' TW=24.72' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 12.16 hrs HW=23.27' TW=24.72' (Dynamic Tailwater)
└**4=Culvert** (Controls 0.00 cfs)

Pond 1P: R-Tank



Summary for Pond DMH: New DMH

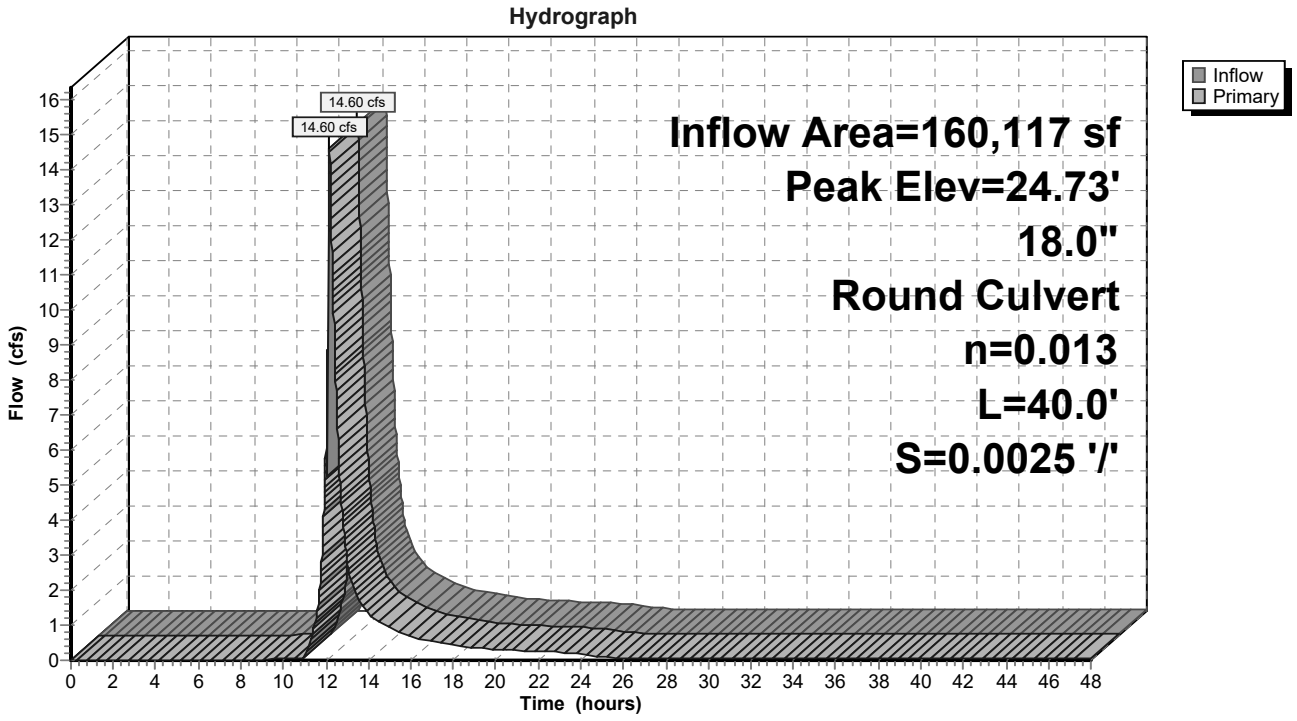
Inflow Area = 160,117 sf, 80.15% Impervious, Inflow Depth > 4.53" for 25 year event
Inflow = 14.60 cfs @ 12.16 hrs, Volume= 60,403 cf
Outflow = 14.60 cfs @ 12.16 hrs, Volume= 60,403 cf, Atten= 0%, Lag= 0.0 min
Primary = 14.60 cfs @ 12.16 hrs, Volume= 60,403 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 24.73' @ 12.16 hrs
Flood Elev= 26.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	19.25'	**18.0" Round Culvert** L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 19.25' / 19.15' S= 0.0025 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=14.60 cfs @ 12.16 hrs HW=24.72' TW=0.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 14.60 cfs @ 8.26 fps)

Pond DMH: New DMH

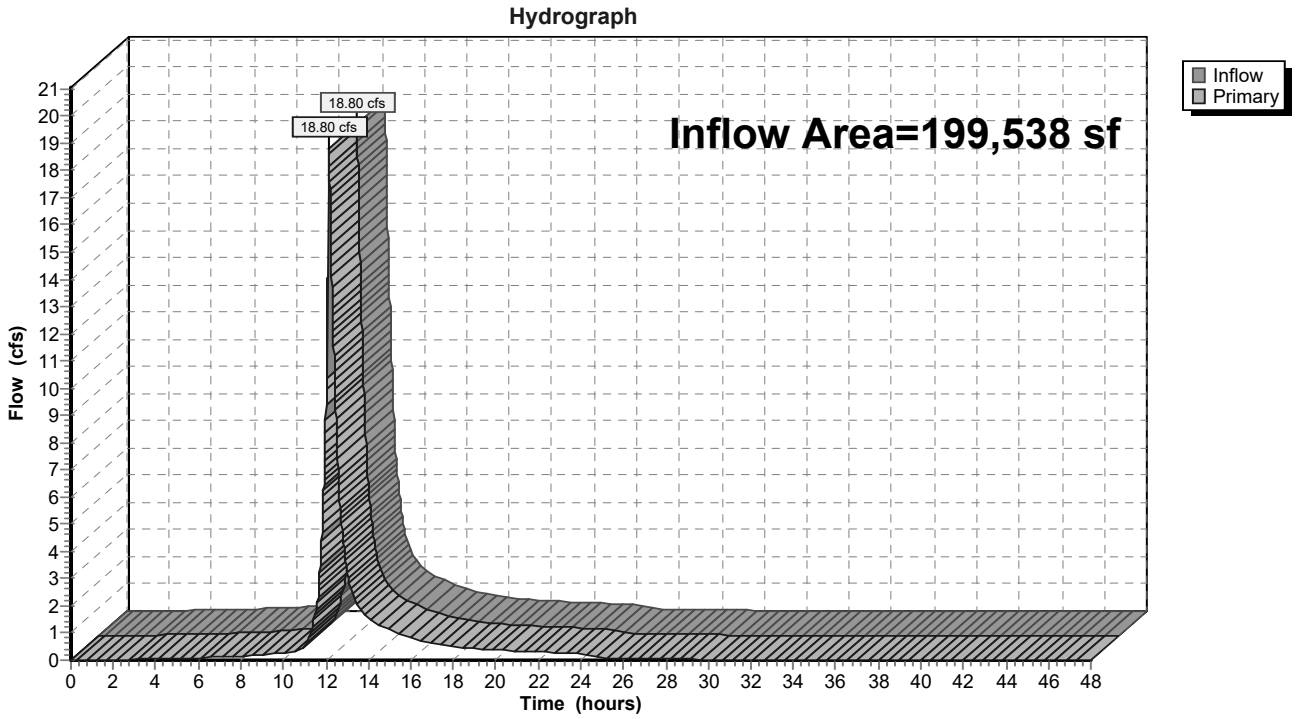


Summary for Link SP1: Existing 18" SD System

Inflow Area = 199,538 sf, 83.57% Impervious, Inflow Depth > 4.73" for 25 year event
Inflow = 18.80 cfs @ 12.12 hrs, Volume= 78,573 cf
Primary = 18.80 cfs @ 12.12 hrs, Volume= 78,573 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link SP1: Existing 18" SD System

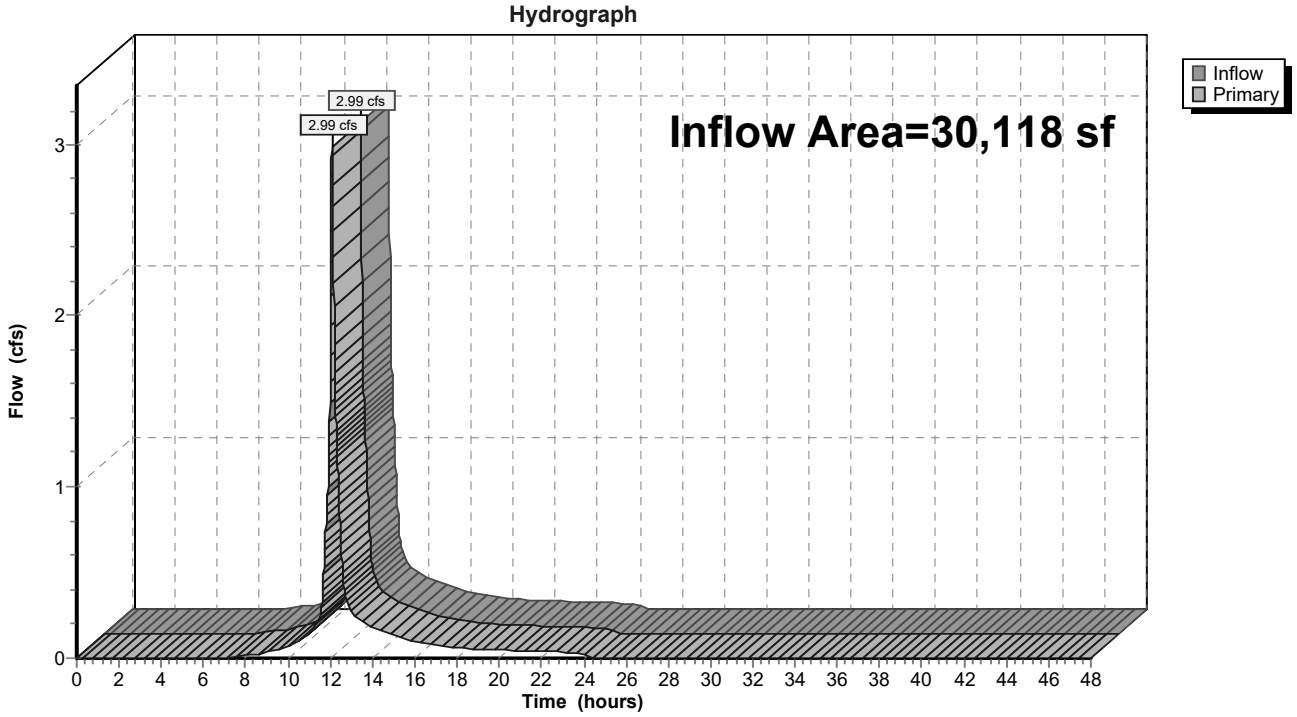


Summary for Link SP2: 30" Storm Drain

Inflow Area = 30,118 sf, 30.94% Impervious, Inflow Depth = 3.70" for 25 year event
Inflow = 2.99 cfs @ 12.09 hrs, Volume= 9,291 cf
Primary = 2.99 cfs @ 12.09 hrs, Volume= 9,291 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link SP2: 30" Storm Drain



STORMWATER INSPECTIONS & MAINTENANCE PLAN

Maine Medical Center St. John Street Employee Parking Garage

General inspection and maintenance during and after construction must take place in accordance with the requirements outlined in Appendix B of the Maine Department of Environmental Protection (MaineDEP) Chapter 500 Rules. Upon completion of the project, the Maine Medical Center will assume responsibility for overseeing the property, including the inspection and maintenance of the Site's stormwater drainage system and treatment measures outlined herein. A person with knowledge of stormwater management and erosion and sediment control, including the standards and conditions in the permit, shall conduct the inspections and perform maintenance of the facilities.

Inspection and maintenance activities will be performed per the attached checklist, schedule, and Jellyfish Filter guidelines; an example page of the BMP Maintenance Log that shall be kept on-site is also attached.

INSPECTION AND MAINTENANCE OF STORMWATER SYSTEMS

In accordance with Ordinance Section 32-38, a qualified post-construction inspector will be hired with knowledge of stormwater management and erosion and sediment control, including the standards and conditions in the permit, to conduct the inspections and perform maintenance of the facilities. On or by June 30th of each year, a certification that the stormwater management system has been inspected, cleaned, and maintained shall be submitted to the Public Works Department in a form provided by that Department.

The inspection and maintenance criteria outlined in Chapter 500 Stormwater Regulations will be followed. Monitoring and maintenance is critical for the proper operation of the stormwater infrastructure. First year post-construction monitoring differs primarily by its increased frequency to assure proper system functioning. Post-construction routine monitoring is based on USEPA requirements for good housekeeping practices.

Post-Construction:

Trash, debris, and sediment shall be removed from storm drain pipes and catch basins as needed on a semi-annual basis. In addition to the inspection and maintenance of stormwater systems, parking and paved areas, such as the parking lot, will be inspected annually each spring. Visual inspections will enable parking areas to be kept clean and clear through periodic sweeping and winter plowing as required. The inspections will also ensure pavement markings are repainted as needed to maintain proper traffic circulation and parking space delineation. Paved areas will be plowed and sanded as often as necessary to maintain public safety. Periodic sweeping of pavement will keep the parking areas clean and will reduce the amount of sediment available to enter the stormwater systems, in turn reducing the need to clean the stormwater systems.

R-Tank Subsurface Storage

The R-Tank system must be inspected for accumulation of sediments at least quarterly through the first year of operation and at least yearly thereafter. This is done by removing the cap of the port and using a measuring device long enough to reach the bottom of the R-Tank system and stiff enough to push through lose sediments allowing a depth measurement. If sediment has accumulated to the level noted in the R-Tank Maintenance Guide or beyond a level acceptable to the Owner's engineer, the R-Tank system should be flushed. A flushing event consists of pumping water into the maintenance port and/or adjacent structure, allowing turbulent flows through the R-Tank system to re-suspend the fine sediments. If multiple maintenance ports have been installed water should be pumped into each port to maximize flushing efficiency. Sediment-laden water can be filtered through a dirtbag or approved equivalent.

Stormbasin

The stormbasin shall be cleaned out a minimum of twice per year by removing debris, sand and silt, and filters maintained per manufacturer's guidelines, which are outlined in the attached guidance document.

Jellyfish Filter System

The Jellyfish Filter system must be inspected at least once every six months, and the filters maintained annually per the manufacturer's guidelines, which are outlined in the attached guidance document. Inspection frequency should be at least once every six months and after every major storm in the first year following construction.

- ❑ Perform sediment removal for depths reaching 12 inches or greater, or within 3 years.
- ❑ Removal all floatable trash and debris
- ❑ Filter cartridges shall be rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing.
- ❑ Replace tentacles if rinsing does not restore adequate hydraulic capacity, remove accumulated sediment or if damaged or missing. Tentacles should remain in service for no longer than 5 years.

Attachments

- Stormwater Inspection Checklist
- Stormwater Management Maintenance Task and Recommended Schedule
- BMP Maintenance Log
- Stormbasin Manufacturer's guidelines
- Jellyfish Filter Manufactures Guidelines

STORMWATER INSPECTION CHECKLIST

Inspection by: _____ Date: _____

Stormwater Management Feature	Condition						Comments
Vegetative cover on slopes	no bare spots, no evidence of rill erosion		some bare spots, some rill erosion		large bare areas, extensive erosion		
Drainage channels/ditches	no erosion, channels clear		some erosion and siltation		major erosion, channels clogged		
Stormbasin	no siltation		some siltation		heavily silted in		
Stormbasin	no clogging/flooding		some clogging/flooding		heavy clogging/flooding		
Subsurface Detention System	no siltation		some siltation		heavily silted in		
Subsurface Detention System	no clogging/flooding		some clogging/flooding		heavy clogging/flooding		
Subsurface Detention System	outlet free of erosion		some erosion at outlet		outlet heavily eroded		
Subsurface Detention System	inlet/outlet clear		some debris		completely blocked		
Jellyfish Filter System*	Cartridges are in good condition		Cartridges in need of cleaning		Cartridges in need of replacement		
Jellyfish Filter System*	no clogging/flooding		some clogging/flooding		heavy clogging/flooding		

**See attached manufacturer's guidelines for Jellyfish Filter System maintenance and inspection.*

Recommended Actions: _____

_____

Actions Completed: _____ Date: _____

STORMWATER MANAGEMENT MAINTENANCE TASKS AND RECOMMENDED SCHEDULE

TASKS	DETENTION AND JELLYFISH FILTER SYSTEM	R-TANK	STORMBASIN	SCHEDULE
Inspect for sediment accumulation	X	X	X	Spring and Fall
Remove sediment accumulation	X	X	X	As needed
Clean debris	X	X	X	As needed
Inspect structural elements during wet weather and compare to as-built plans	X	X	X	Annually
Make adjustments or replacements as determined by wet weather observations	X	X	X	As needed
Keep records of all inspections and maintenance activities	X	X	X	Annually
Have a professional engineer perform emergency inspections upon identification of severe problems	X	X	X	As needed

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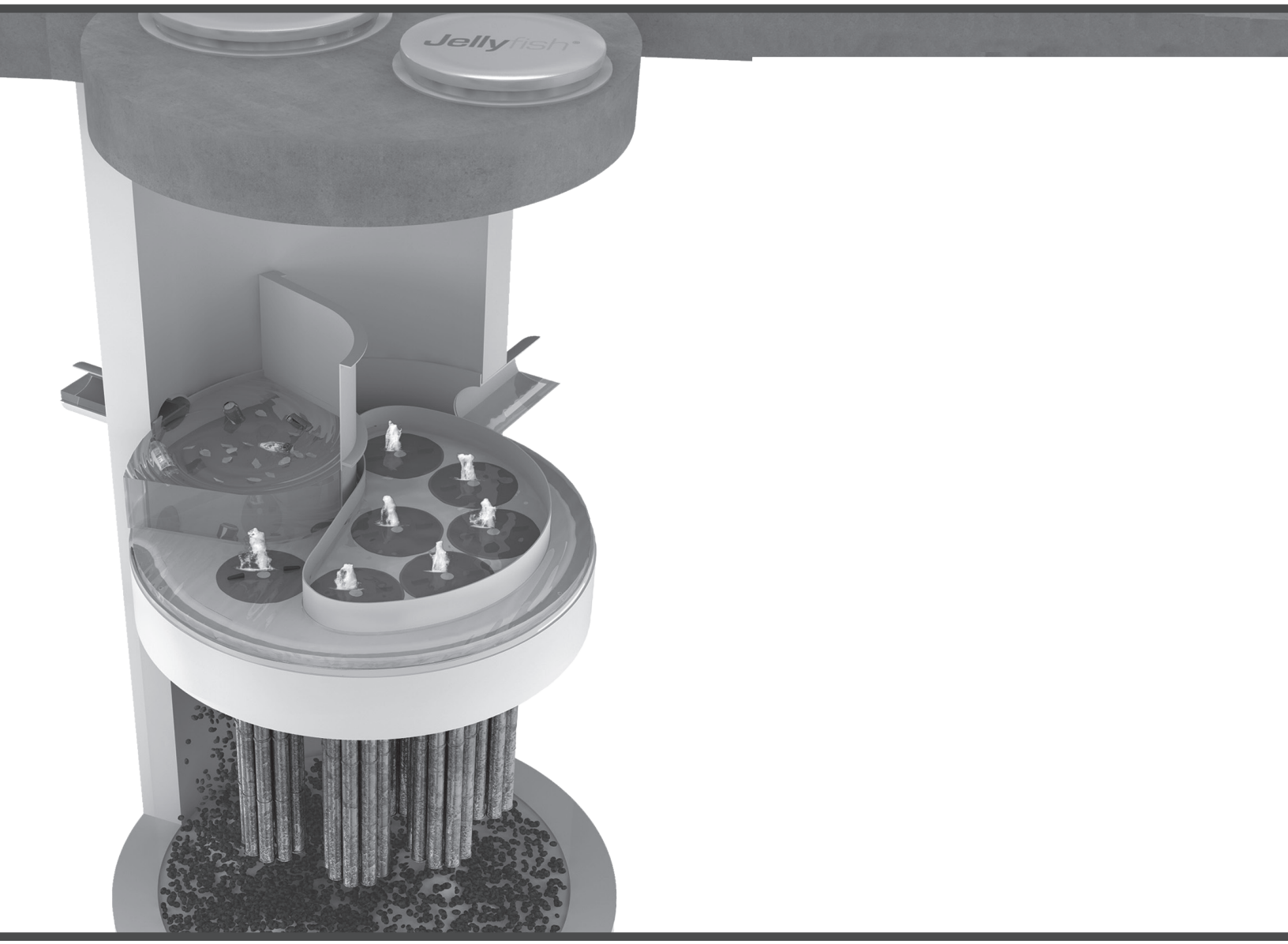
JellyFish® Filter Maintenance Guide



Jellyfish®

JELLYFISH® FILTER MANHOLE CONFIGURATIONS
INSPECTION & MAINTENANCE GUIDE

TABLE OF CONTENTS

1.0 Inspection and Maintenance Overview

The primary purpose of the Jellyfish® Filter is to capture and remove pollutants from stormwater runoff. As with any filtration system, these pollutants must be removed to maintain the filter's maximum treatment performance. Regular inspection and maintenance are required to insure proper functioning of the system.

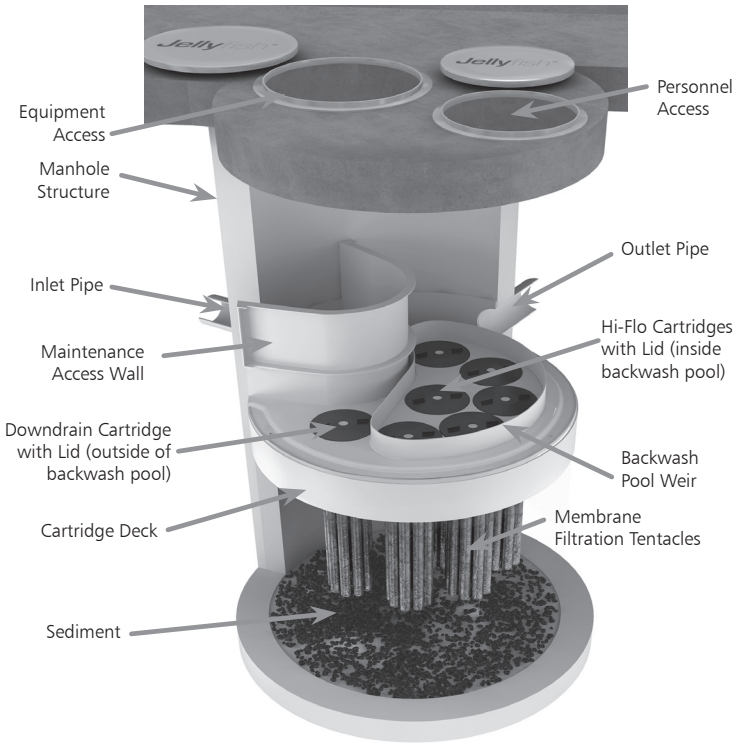
Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Additional maintenance activities may be required in the event of non-storm event runoff, such as base-flow or seasonal flow, an upstream chemical spill or due to excessive sediment loading from site erosion or extreme runoff events. It is a good practice to inspect the system after major storm events.

Inspection activities are typically conducted from surface observations and include:

- Observe if standing water is present
- Observe if there is any physical damage to the deck or cartridge lids
- Observe the amount of debris in the Maintenance Access Wall (MAW)

Maintenance activities typically include:

- Removal of oil, floatable trash and debris
- Removal of collected sediments
- Rinsing and re-installing the filter cartridges
- Replace filter cartridge tentacles, as needed



Note: Separator Skirt not shown

2.0 Inspection Timing

Inspection of the Jellyfish Filter is key in determining the maintenance requirements for, and to develop a history of the site's pollutant loading characteristics. In general, inspections should be performed at the times indicated below; *or per the approved project stormwater quality documents (if applicable), whichever is more frequent*.

1. Post-construction inspection is required prior to putting the Jellyfish Filter into service. All construction debris or construction-related sediment within the device must be removed, and any damage to system components repaired, before installing the filter cartridges.
2. A minimum of two inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and to ensure proper functioning of the system.
3. Inspection frequency in subsequent years is based on the inspection and maintenance plan developed in the first year of operation. Minimum frequency should be once per year.
4. Inspection is recommended after each major storm event.
5. Inspection is required immediately after an upstream oil, fuel or other chemical spill.

3.0 Inspection Procedure

The following procedure is recommended when performing inspections:

1. Provide traffic control measures as necessary.
2. Inspect the MAW for floatable pollutants such as trash, debris, and oil sheen.
3. Measure oil and sediment depth in several locations, by lowering a sediment probe through the MAW opening until contact is made with the floor of the structure. Record sediment depth, and presences of any oil layers.
4. Inspect cartridge lids. Missing or damaged cartridge lids to be replaced.
5. Inspect the MAW, cartridge deck, and backwash pool weir, for cracks or broken components. If damaged, repair is required.

3.1 Dry weather inspections

- Inspect the cartridge deck for standing water, and/or sediment on the deck.
- No standing water under normal operating conditions.
- Standing water inside the backwash pool, but not outside the backwash pool indicates that the filter cartridges need to be rinsed.

Inspection Utilitzing Sediment Probe

- Standing water outside the backwash pool may indicate a backwater condition caused by high water elevation in the receiving water body, or possibly a blockage in downstream infrastructure.
- Any appreciable sediment (≥1/16") accumulated on the deck surface should be removed.

3.2 Wet weather inspections

- Observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the MAW.
- Less than 6 inches, flow should be exiting the cartridge lids of each of the draindown cartridges (i.e. cartridges located outside the backwash pool).
- Greater than 6 inches, flow should be exiting the cartridge lids of each of the draindown cartridges and each of the hi-flo cartridges (i.e. cartridges located inside the backwash pool), and water should be overflowing the backwash pool weir.
- 18 inches or greater and relatively little flow is exiting the cartridge lids and outlet pipe, this condition indicates that the filter cartridges are occluded with sediment and need to be rinsed

4.0 Maintenance Requirements

Required maintenance for the Jellyfish Filter is based upon results of the most recent inspection, historical maintenance records, or the site specific water quality management plan; whichever is more frequent. In general, maintenance requires some combination of the following:

1. Sediment removal for depths reaching 12 inches or greater, or within 3 years of the most recent sediment cleaning, whichever occurs sooner.
2. Floatable trash, debris, and oil removal.
3. Deck cleaned and free from sediment.
4. Filter cartridges rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing, whichever occurs sooner.
5. Replace tentacles if rinsing does not restore adequate hydraulic capacity, remove accumulated sediment, or if damaged or missing. It is recommended that tentacles should remain in service no longer than 5 years before replacement.
6. Damaged or missing cartridge deck components must be repaired or replaced as indicated by results of the most recent inspection.
7. The unit must be cleaned out and filter cartridges inspected immediately after an upstream oil, fuel, or chemical spill. Filter cartridge tentacles should be replaced if damaged or compromised by the spill.

5.0 Maintenance Procedure

The following procedures are recommended when maintaining the Jellyfish Filter:

1. Provide traffic control measures as necessary.
2. Open all covers and hatches. Use ventilation equipment as required, according to confined space entry procedures.
3. Caution: Dropping objects onto the cartridge deck may cause damage.
4. Perform Inspection Procedure prior to maintenance activity.
5. To access the cartridge deck for filter cartridge service, descend the ladder and step directly onto the deck. Caution: Do not step onto the maintenance access wall (MAW) or backwash pool weir, as damage may result. Note that the cartridge deck may be slippery.
6. Maximum weight of maintenance crew and equipment on the cartridge deck not to exceed 450 lbs.

5.1 Filter Cartridge Removal

1. Remove a cartridge lid.
2. Remove cartridges from the deck using the lifting loops in the cartridge head plate. Rope or a lifting device (available from Contech) should be used. Caution: Should a snag occur, do not force the cartridge upward as damage to the tentacles may result. Wet cartridges typically weigh between 100 and 125 lbs.
3. Replace and secure the cartridge lid on the exposed empty receptacle as a safety precaution. Contech does not recommend exposing more than one empty cartridge receptacle at a time.

5.2 Filter Cartridge Rinsing

1. Remove all 11 tentacles from the cartridge head plate. Take care not to damage or break the plastic threaded nut or connector.
2. Position tentacles in a container (or over the MAW), with the

Cartridge Removal & Lifting Device

threaded connector (open end) facing down, so rinse water is flushed through the membrane and captured in the container.

3. Using the Jellyfish rinse tool (available from Contech) or a low-pressure garden hose sprayer, direct water spray onto the tentacle membrane, sweeping from top to bottom along the length of the tentacle. Rinse until all sediment is removed from the membrane. Caution: Do not use a high pressure sprayer or focused stream of water on the membrane. Excessive water pressure may damage the membrane.

4. Collected rinse water is typically removed by vacuum hose.
5. Reattach tentacles to cartridge head plate. Reuse O-rings and nuts, ensuring proper placement on each tentacle.

5.3 Cleaning Procedure

1. Perform vacuum cleaning of the Jellyfish Filter only after filter cartridges have been removed from the system. Access the lower chamber for vacuum cleaning only through the maintenance access wall (MAW) opening, being careful not to damage the flexible plastic separator skirt that is attached to the underside of the deck. The separator skirt surrounds the filter cartridge zone, and could be torn if contacted by the wand. Do not lower the vacuum wand through a cartridge receptacle, as damage to the receptacle will result.
2. Vacuum floatable trash, debris, and oil, from the MAW opening. Alternatively, floatable solids may be removed by a net or skimmer.

Tentacle Rinse Using Jellyfish Rinse Tool

3. Pressure wash cartridge deck and receptacles to remove all sediment and debris. Sediment should be rinsed into the sump area. Take care not to flush rinse water into the outlet pipe.
4. Remove water from the sump area. Vacuum or pump equipment should only be introduced through the MAW.
5. Remove the sediment from the bottom of the unit through the MAW opening.

Vacuuming Sump Through MAW

6. For larger diameter Jellyfish Filter manholes (≥8-ft) and vaults without an MAW opening, complete sediment removal may be facilitated by removing a cartridge lid from an empty receptacle and inserting a jetting wand (not a vacuum wand) through the receptacle. Use the sprayer to rinse loosened sediment toward the vacuum hose in the MAW opening, being careful not to damage the receptacle.
7. After the unit is clean, re-fill the lower chamber with water if required by the local jurisdiction, and re-install filter cartridges.
8. Dispose of sediment, floatable trash and debris, oil, spent tentacles, and water according to local regulatory requirements.

5.4 Filter Cartridge Replacement

1. Cartridges should be installed after the deck has been cleaned. It is important that the receptacle surfaces be free from grit and debris.
2. If rinsing is ineffective in removing sediment from the tentacles, or if tentacles are damaged, provisions must be made to replace the spent or damaged tentacles with new tentacles. Contact Contech to order replacement tentacles.
3. Lower filter cartridge to the cartridge deck. Remove cartridge lid from deck and carefully lower the filter cartridge into the receptacle until head plate gasket is seated squarely in receptacle. Caution: Should a snag occur when lowering the cartridge into the receptacle, do not force the cartridge downward; damage may occur.
4. Replace the cartridge lid and check fit before completing rotation to a firm hand-tight attachment.

5.5 Chemical Spills

Caution: If a chemical spill has been captured, do not attempt maintenance. Immediately contact the local hazard response agency and contact Contech.

6.0 Related Maintenance Activities

Jellyfish units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

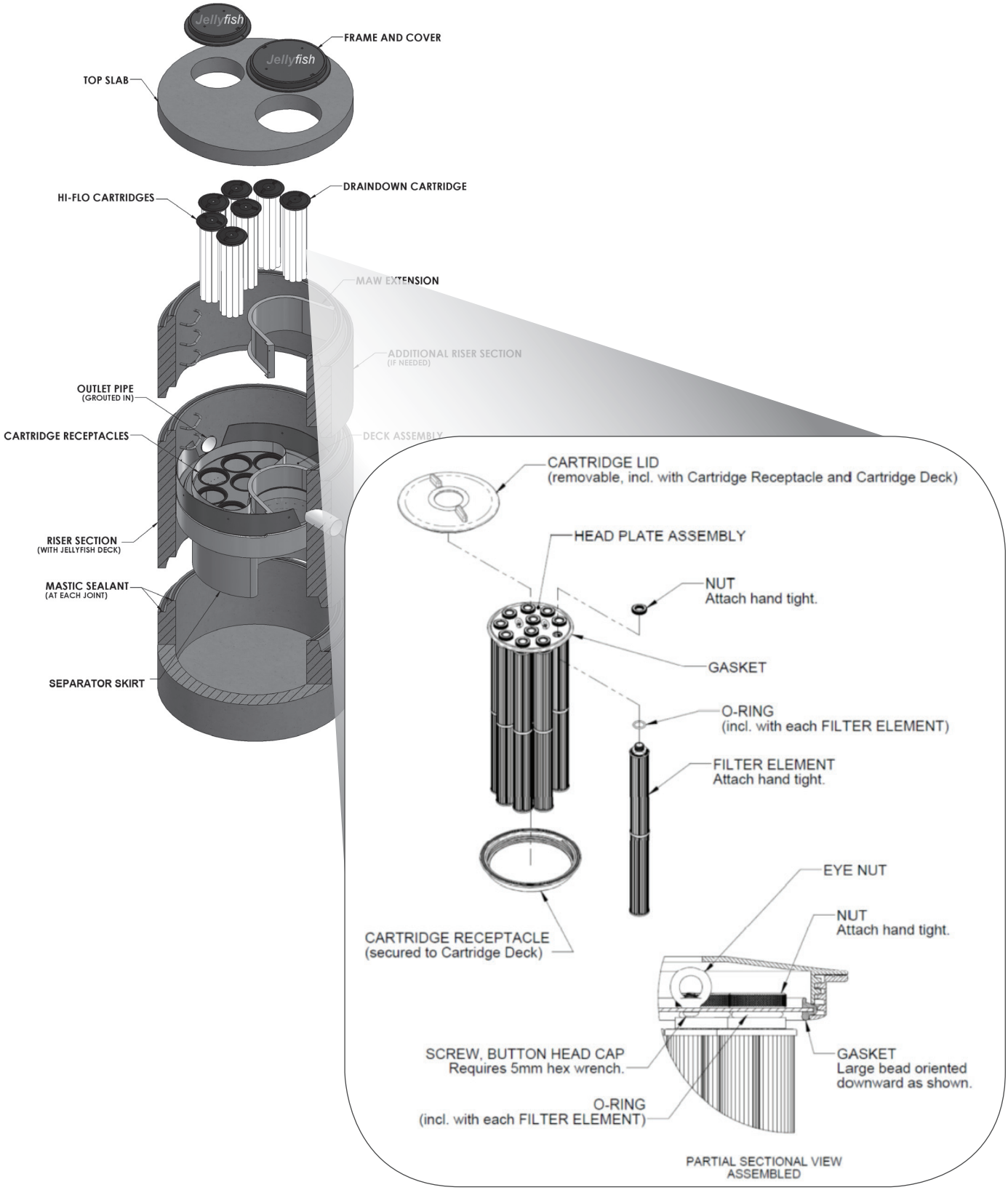
In order for maintenance of the Jellyfish filter to be successful, it is imperative that all other components be properly maintained. The maintenance and repair of upstream facilities should be carried out prior to Jellyfish maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

7.0 Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads. Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Jellyfish Filter Components & Filter Cartridge



Jellyfish Filter Inspection and Maintenance Log

Owner:				Jellyfish Model No:		
Location:				GPS Coordinates:		
Lande Use:	Commercial:		Industrial:		Service Station:	
	Roadway/Highway:		Airport:		Residential:	

Date/Time:						
Inspector:						
Maintenance Contractor:						
Visible Oil Present: (Y/N)						
Oil Quantity Removed:						
Floatable Debris Present: (Y/N)						
Floatable Debris Removed: (Y/N)						
Water Depth in Backwash Pool						
Draindown Cartridges externally rinsed and recommissioned: (Y/N)						
New tentacles put on Cartridges: (Y/N)						
Hi-Flo Cartridges externally rinsed and recommissioned: (Y/N)						
New tentacles put on Hi-Flo Cartridges: (Y/N)						
Sediment Depth Measured: (Y/N)						
Sediment Depth (inches or mm):						
Sediment Removed: (Y/N)						
Cartridge Lids intact: (Y/N)						
Observed Damage:						
Comments:						

Jellyfish®

CONTECH ENGINEERED SOLUTIONS

Support

- Drawings and specifications are available at ContechES.com/jellyfish.
- Site-specific design support is available from Contech Engineered Solutions.

800.338.1122
www.ContechES.com

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, wastewater treatment and earth stabilization products. For information on other Contech segment offerings, visit ContechES.com or call 800.338.1122

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; related foreign patents or other patents pending.

MMC Stormwater BMP Maintenance Log

BMP Structure	Inspector (Name)	Work Performed	Date Performed	Comments
Pavement Sweeping				
Catch Basins				
Jelly Fish System				
R-Tank Subsurface Storage				
Stormbasin				
Other				

Additional Comments:

StormBasin

Modular Stormwater Filtration System

Maintenance Guide

For
Nassau County Item 504A – Type “A”
Catch Basin Insert - Filter Type
Combination Inlet

Caution
Do not step, stand, sit or in anyway use the StormBasin device to support your weight during the maintenance procedure.

Caution
StormBasin units maybe installed into street level drain inlets. The StormBasin should be maintained by trained individuals who are familiar with all Traffic safety regulations.

StormBasin™

Maintenance Guide

Pre-installation Cleaning

The StormBasin like any other storm water remediation device requires maintenance to remain efficient as a storm water filter. Fabco Industries highly recommends inspecting the perspective catch basin storm sewer before installing a StormBasin unit and thoroughly cleaning it if necessary.

Cleaning Frequency

After installation the StormBasin requires periodic cleaning. There are no hard and fast rules in this regard. Small units and installation sites with higher than expected sediment loads or areas with significant trees and foliage require more maintenance. In general, Fabco Industries recommends cleaning out the unit(s) a minimum twice per year by removing the debris, sand and silt.

Cleaning out the StormBasin: Combination style drain inlets

Do not lift or remove the StormBasin from the grated inlet during cleaning. Be sure to follow proper road safety rules & regulations when working in the street. Begin by removing the grate from the inlet. CAUTION: Grates are extremely heavy. Some type of lifting mechanism is highly recommended. Place it carefully on the ground away from the work area.	
With the grate removed the StormBasin is available for cleaning. Do not step, stand, sit or in anyway use the StormBasin to support your weight. Be sure to follow all Safety and Traffic protocols. Remove the sediment and debris from the basin. This can be done manually or with a vacuum device. Be sure you are wearing gloves, safety glasses and that traffic safety procedures are observed.	
With the debris and sediment removed the filter cartridge(s) will be visible at the bottom of the unit. We suggest removing the cartridge(s) from the StormBasin and removing any loose debris, sediment, trash from the blue foam pre-filter. (See Removing the filter Cartridge). Cartridge replacement is recommended annually.	
With the StormBasin and cartridges cleaned and re-installed the maintenance process is complete. Re-install the drain grate to complete the job.	

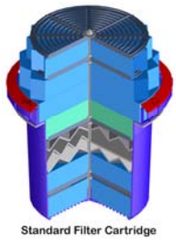
StormBasin™

Maintenance Guide

Selecting, Removing and Installing the StormBasin Cartridges

The Fabco filter cartridges used in the StormBasin product are designed primarily to capture: floating materials, sediments and suspended solids and emulsified products such as hydrocarbon compounds, dissolved heavy metals, nutrients (P&N) and pathogens (bacteria). Before ordering your cartridges make sure you select the correct type. Each cartridge type can be identified by a colored “Ring” located at the top of the cartridge.

Selecting the right cartridge(s)


Standard Filter Cartridge

Part Number	Effectiveness	Ring color code
9718-1	**Standard Cartridge** Good All-purpose cartridge for common surface runoff that may contain a little bit of everything.	Red
9718-2	**Pathogens Cartridge** 2x’s more pathogen treatment Vs. Std Cartridge. Use near sensitive water ways to keep beaches and shell fishing areas open.	Yellow
9718-3	**HV Hydrocarbon Cartridge** 25% more hydrocarbon filter media Vs Std cartridge. Excellent for vehicle or maintenance related applications.	Blue
9718-4	**HV Metals Cartridge** Uses unique FABLITE filter media for HV metals. Suggested for industrial usage where persistent HV metals have been identified in surface runoff	Grey
9718-5	**Standard short Cartridge** Reduced height version of std Cart.	Mint
9718-6	**Nutrients Cartridge** Uses proprietary FABPHOS media for nutrients. Highly effective on the critical dissolved Ortho-Phosphates. Helps reduce algae blooms keeping the water clean and healthy.	Green

StormBasin™

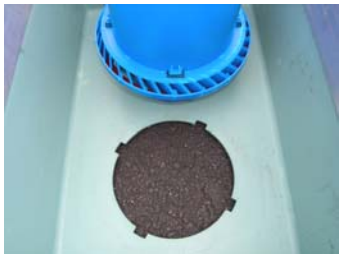
Maintenance Guide

Referring to the pollutant concentrations stated in the NYS stormwater design manual, the standard cartridge should be expected to last a minimum of 1 year. Fabco's special short cartridge should be replaced twice per year.

Removing the Filter Cartridge(s)

With all debris removed from the StormBasin the filter cartridge(s) will be exposed at the bottom. To remove the cartridge(s) reach down into the basin and firmly grasp the plastic outer rim of the cartridge body just below the foam. Twist the cartridge body Counter-Clock-wise about ¼ turn until it stops. Lift the cartridge straight up to remove.	

Installing new Filter Cartridge(s)

The StormBasin filter cartridge(s) install through a hole in the bottom of the collection basin. The hole has four (4) slots that accept 4 tabs molded into the underside of the cartridge body.	
Insert the StormBasin cartridge down through the hole in the base of the unit. The colored ring on the cartridge should be facing upwards. Push the cartridge all the way through the hole until it rests on the bottom. Slowly turn the cartridge in a Clock-wise direction until the Tabs align with the slots and the cartridge body drops about ¼' further down.	
Once the Tabs fall through the slots, continue turning firmly in a Clock-wise direction until the Tabs contact the STOPS. The Cartridge is now installed.