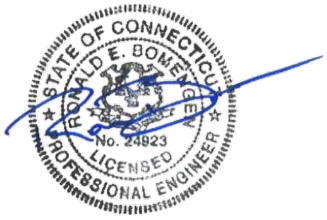
Stormwater Management Report
Root Center for Advanced Recovery

392 Washington Street
Middletown, Connecticut

July 24, 2020



FUSS & O'NEILL

146 Hartford Road
Manchester, CT 06040

Project No. 2020 0586.A10

FUSS & O'NEILL

Table of Contents

Stormwater Management Report
Root Center for Advanced Recovery

Table of Contents

Stormwater Management Report
Root Center for Advanced Recovery

1 Executive Summary

Root Center for Advanced Recovery proposes to construct a clinic at 392 Washington Street in Middletown, Connecticut. The site is comprised of 1.1 acres with State Route 66 (Washington Street) to the south, Main Switch Beauty Salon and Midtown Tire to the east, railroad to the north, and Nardelli's Grinder Shoppe to the west. The site is currently occupied by Fine Tunes auto repair along with associated parking. A USGS site location map is presented in *Figure 1*.

Fuss & O'Neill evaluated existing (pre-development) and proposed (post-development) hydrologic conditions for the site. This report presents the design calculations for the peak stormwater runoff flow rates leaving the site. This report also discusses proposed water quality improvement measures for the stormwater runoff. The evaluation demonstrates a net decrease in the stormwater peak discharge rate for the proposed development for the 2-, 10-, 25-, and 100-year design storm events. Reductions in the stormwater peak discharge rates were achieved using Low Impact Development (LID) design techniques.

A plan was developed to establish erosion and sediment controls to stabilize the site during construction and protect receiving stormwater systems adjacent to the development. Silt fence, stormwater inlet protection, and other erosion control devices will be used to ensure proper site stabilization during construction. Once construction has been completed and the site is stabilized, water quality of the stormwater runoff will be improved by the use of LID design techniques as well as accepted Best Management Practices (BMPs). These BMPs have been designed using recommendations from the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control. These efforts will remove a minimum of 80% of the Total Suspended Solids that may be present in runoff from the developed site. The design meets the guidelines of the City of Middletown and the Connecticut Stormwater Quality Manual (CTSWQM).

2 Existing Conditions

The site is bounded by State Route 66 (Washington Street) to the south, Main Switch Beauty Salon and Midtown Tire to the east, railroad to the north, and Nardelli's Grinder Shoppe to the west. The site consists primarily of existing developed land including a building, driveway, parking lot, walkway, and vegetated area. A small wooded area is present on site. The site has moderate to steep grade changes.

The Natural Resources Conservation Service (NCRS) characterizes the site with the following soil type and hydrological soil group:

- Ludlow silt loam, 3 to 8 percent slopes – Hydrologic Soil Group C
- Wethersfield-Urban land complex, 3 to 8 percent slopes – Hydrologic Soil Group C

An NRCS soil survey map is included as *Figure 2*.

The site is located within the Mattabesset Regional Basin of the Connecticut Major Basin, specifically within the Coginchaug River sub-basin area as presented in *Figure 3*.

The site lies outside of the Regulated Floodway and the 500-year flood plain in an area of minimal flood hazard, denoted as "Zone X". The relevant FEMA Flood Insurance Rate Map (Map Number 09007C0116G), Effective Date: August 28, 2008) is presented as *Figure 4*.

The existing hydrologic evaluation, included as *Appendix A*, determined that the 1.12 acre drainage area is comprised of two subcatchment areas and two design points.

Existing conditions, drainage characteristics, and discharge locations for the subcatchments are as follows:

- Subcatchment 1S-EX consists of pavement and adjacent grassed area. Stormwater runoff flows to the southwest overland towards Washington Street, design point 1L-EX.

- Subcatchment 2S-EX consists of pavement, building, grassed area, and small woodlands. Stormwater runoff flows to the west overland towards the adjacent property, design point 2L-EX.

3 Proposed Conditions

Root Center for Advanced Recovery proposes to construct a clinic at 392 Washington Street in Middletown, Connecticut. The site is comprised of 1.1 acres with State Route 66 (Washington Street) to the south, Main Switch Beauty Salon and Midtown Tire to the east, railroad to the north, and Nardelli's Grinder Shoppe to the west. In addition to the building, site improvements will include parking, walkways, landscaping, utilities, and stormwater management system.

The project area was analyzed to evaluate proposed hydrologic conditions. The proposed watershed analysis ultimate design points are consistent with the existing watershed analysis. The proposed subsurface infiltration system will provide on-site storage capacity for the attenuation of the peak flows for the design storms.

The proposed hydrologic evaluation, included in *Appendix B*, determined that the project area is comprised of three sub catchment areas, which drain to one of two design points.

Proposed conditions, drainage characteristics, and discharge locations for the subcatchments are as follows:

- Subcatchment 1S-PR consists of pavement and adjacent grassed area. Stormwater runoff flows to the southwest overland towards Washington Street, design point 1L-PR.

- Subcatchment 2SA-PR consists of a parking lot, sidewalks, building, and grassed area. Stormwater runoff flows overland into a proposed stormwater system and through a hydrodynamic separator before being conveyed into the subsurface infiltration system. The subsurface infiltration system discharges outlet controlled stormwater to a scour hole towards the adjacent property, design point 2L-PR.

- Subcatchment 2SB-PR consists of a grassed area to the rear of the site. Stormwater runoff flows to the west overland towards the adjacent property, design point 2L-PR.

Results from modeling pre- and post- development peak flow rates at the design point are shown in the tables below. These results are taken from the HydroCAD models of existing and proposed conditions found in *Appendices A & B.*

2 Year Design Storm				
Design Point	Existing Flow (CFS)	Proposed Flow (CFS)	Net Change (CFS)	Net Change (%)
1L - Washington Street	0.38	0.04	-0.34	-89%
2L - Adjacent Property (Northwest)	2.18	2.03	-0.15	-7%
Total	2.56	2.07	-0.49	-19%

10 Year Design Storm				
Design Point	Existing Flow (CFS)	Proposed Flow (CFS)	Net Change (CFS)	Net Change (%)
1L - Washington Street	0.61	0.08	-0.53	-87%
2L - Adjacent Property (Northwest)	3.72	3.50	-0.22	-6%
Total	4.33	3.58	-0.75	-17%

25 Year Design Storm				
Design Point	Existing Flow (CFS)	Proposed Flow (CFS)	Net Change (CFS)	Net Change (%)
1L - Washington Street	0.78	0.11	-0.67	-86%
2L - Adjacent Property (Northwest)	4.90	4.68	-0.22	-4%
Total	5.68	4.79	-0.89	-16%

100 Year Design Storm				
Design Point	Existing Flow (CFS)	Proposed Flow (CFS)	Net Change (CFS)	Net Change (%)
1L - Washington Street	1.12	0.18	-0.94	-84%
2L - Adjacent Property (Northwest)	7.26	6.62	-0.64	-9%
Total	8.38	6.80	-1.58	-19%

The watershed model predicts a decrease in the calculated proposed development peak flow rates when compared to existing conditions.

Calculations for the storm sewer piping analysis are presented in *Appendix C*. Modeling indicates that the proposed pipes will have adequate capacity to convey the 25-year design storm.

Outlet protection for new pipe discharge point was calculated using the Connecticut Department of Transportation Drainage Manual, Section 11.13 – Outlet Protection, revised dated May 2002. Outlet protection calculations are provided in *Appendix D*.

4 Construction Stormwater Management and Soil Erosion and Sedimentation Control

An erosion and sediment control plan has been prepared for the project. During construction, measures will be taken to reduce erosion and manage sedimentation from disturbed surfaces. The following BMPs will be implemented:

- Stormwater inlet protection will be installed at all stormwater collection structures to remove sediment from the run-off prior to entering the receiving drainage systems.
- Silt fence will be installed at clearing limits and down-gradient perimeter of the disturbed portion of the development.
- Construction entrance will be installed at the main point of entry to prevent tracking of sediment onto state and local roads.

These BMPs will protect downstream stormwater collection systems following construction. E&S control details and plans are provided in the site plans. Erosion and sediment control details and procedures are consistent with the 2002 Guidelines for Soil Erosion and Sedimentation Control (CTDEEP Bulletin 34), and City Requirements.

5 Post-Construction Stormwater Management

The water quality of stormwater runoff from the developed site will be improved using Best Management Practices (BMPs). A proposed hydrodynamic separator and subsurface infiltration system will help achieve the removal of 80% of Total Suspended Solids that may be present in the stormwater runoff.

Water quality volume (WQV) will be achieved through the use of a hydrodynamic separator and subsurface infiltration system. WQV is equivalent to the first inch of rainfall in any storm event that should be captured and treated to remove a majority of the stormwater pollutants on an annual basis. Calculations based on section 7.4.1 of the CTSWQM are provided in *Appendix E*.

To ensure these measures continue to operate adequately over time, the following maintenance procedures should be followed:

- **Hydrodynamic Separator** – The hydrodynamic separator must be inspected at regular intervals and maintained when necessary to ensure optimum performance. At a minimum, inspections should be conducted twice per year; once in the spring and again in the fall. More

inspections may be required during winter months where heavy sanding operations may lead to rapid sediment accumulation within the structure. The structure should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when appreciable level of hydrocarbons and trash has accumulated. Cleaning operations are typically done using a vacuum truck.

- **Scour Hole** – The structures must be inspected annually and after each major rainfall for damage and deterioration. If damaged, repairs to the outlet protection must be completed immediately. Sediment removal operations can be done using a vacuum truck or by hand. Mechanical removal of sediment is not recommended as it may disturb established plantings.

- **Subsurface Infiltration System** - At a minimum, the subsurface infiltration system should be inspected annually, semi-annually for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition. The system incorporates a combination of a standard manhole and strategically located inspection ports to visually inspect the system. The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes. If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the first row of the system, clean-out should be performed, per the manufacturer's recommendations.

These design measures incorporate commonly used Best Management Practices and follows guidelines set forth by the CTDEEP Stormwater Quality Manual and the Connecticut and federal stormwater regulations.

6 Methods

The existing and proposed drainage analysis for the development was completed using the HydroCAD Software Solutions computer program. The HydroCAD program runoff method selected for the watershed modeling is based on NRCS TR-20 methods. The methods described in the NRCS TR-55 manual were followed to calculate the curve number and time of concentration input data for this model. NOAA Atlas 14, Volume 10, Version 3 precipitation frequency estimates were used for rainfall data.

The following curve numbers were used to model the impervious and pervious surfaces, and are acceptable for surface over Hydrological Group – 'C' soils per the NRCS TR-55 Drainage Manual:

Cover Type	Hydrologic Soil Type
	C
Paved Parking	98
Roofs	98
> 75% Grass Cover, Good	74
Woods/Grass Comb., Good	72

The drainage analysis for the proposed stormwater management system was completed using Bentley System's StormCAD computer program. Input information for the model was derived using the Rational Formula. Times of concentration for paved areas was assumed to be the minimal allowable time of 5 minutes. The StormCAD output indicates that all of the proposed pipe and catch basins will have adequate capacity to convey and drain the 25-year design storm.

7 Summary

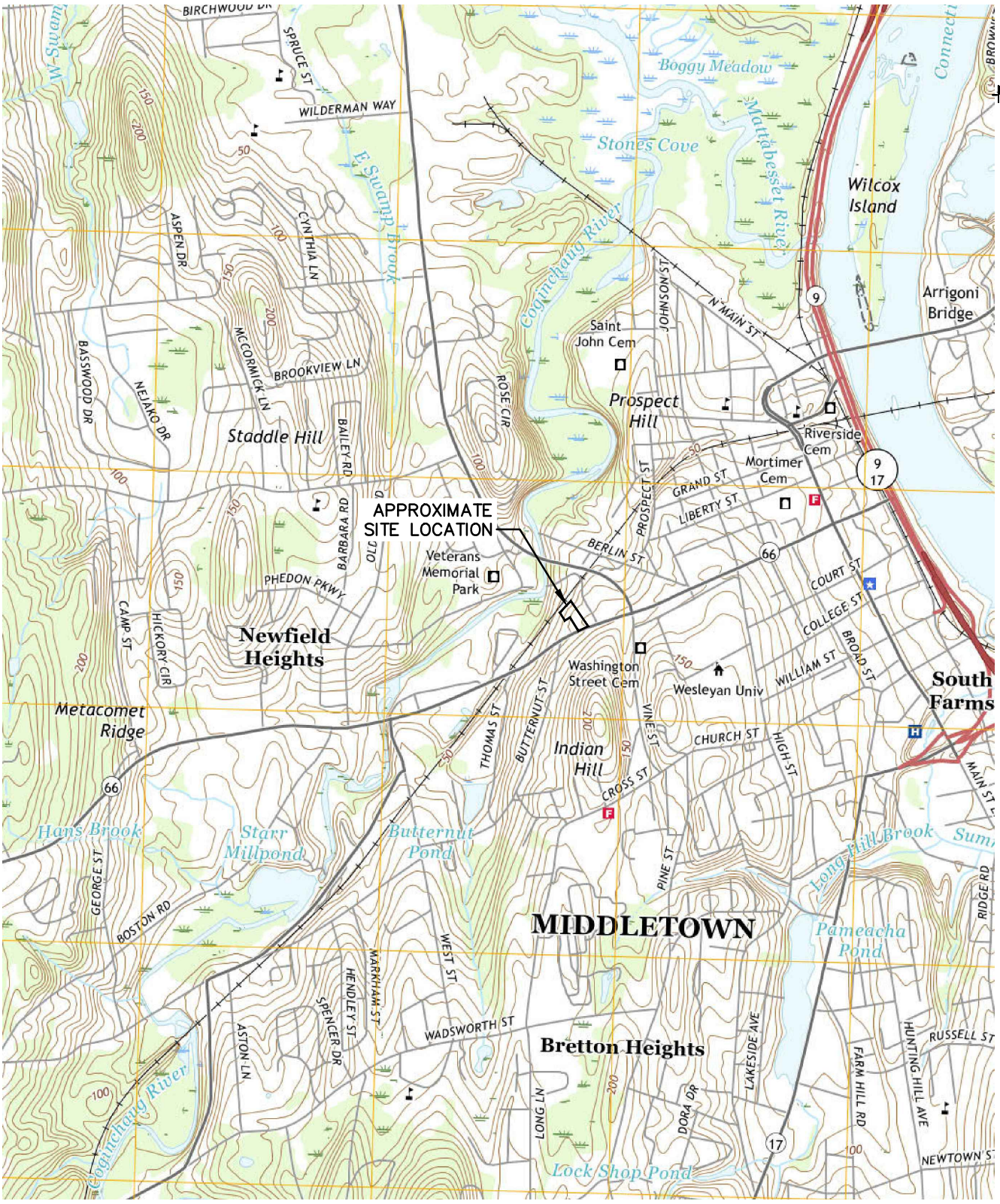
The proposed development has been design to effectively convey and attenuate the peak discharge flows leaving the site as compared to the existing conditions for the 2-, 10-, 25-, and 100-year design storm event. The subsurface infiltration system have been designed to mitigate the increase in peak flows as well as encourage groundwater recharge. The stormwater management pipe network has been designed to convey the 25-year design storm.

Post-construction water quality improvements for the stormwater runoff will be achieved by the use of BMPs designed to remove 80% of Total Suspended Solids that may be present in runoff from the site.

The stormwater management design meets the guidelines of the Connecticut Stormwater Quality Manual.

Figure 1

Site Location Map



MAP REFERENCE

THIS MAP WAS PREPARED FROM THE FOLLOWING USGS 7.5 MINUTE SERIES TOPOGRAPHICAL MAP: MIDDLETOWN QUADRANGLE, CONNECTICUT, 2018

SCALE:	
HORZ.:	1" = 2000'
VERT.:	
DATUM:	
HORZ.:	
VERT.:	

0 1000 2000

GRAPHIC SCALE

FUSS & O'NEILL
146 HARTFORD ROAD
MANCHESTER, CONNECTICUT 06040
860.646.2469
www.fando.com

ROOT CENTER FOR ADVANCED RECOVERY

SITE LOCATION MAP

392 WASHINGTON STREET

MIDDLETOWN CONNECTICUT

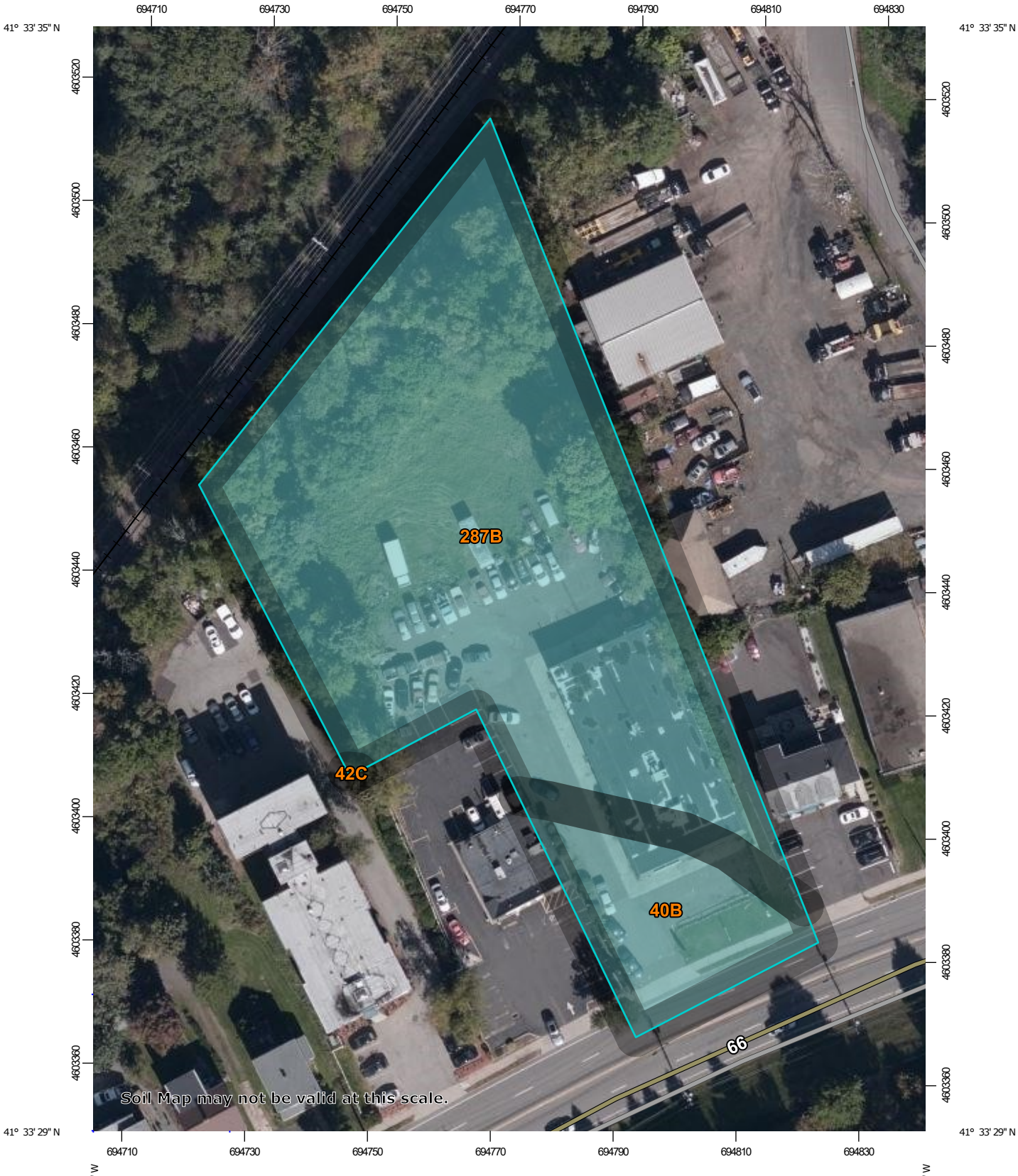
PROJ. No.: 20200586.A10
DATE: JULY 2020

FIGURE 1

FUSS & O'NEILL

Figure 2

NRCS Soils Map



Map Scale: 1:873 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 40 80 160 240

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

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 1:12,000.

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: State of Connecticut
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Aug 30, 2019—Oct 15, 2019

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
40B	Ludlow silt loam, 3 to 8 percent slopes	C	0.2	14.8%
42C	Ludlow silt loam, 2 to 15 percent slopes, extremely stony	C	0.0	0.0%
287B	Wethersfield-Urban land complex, 3 to 8 percent slopes	C	1.4	85.2%
Totals for Area of Interest			**1.6**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be

considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

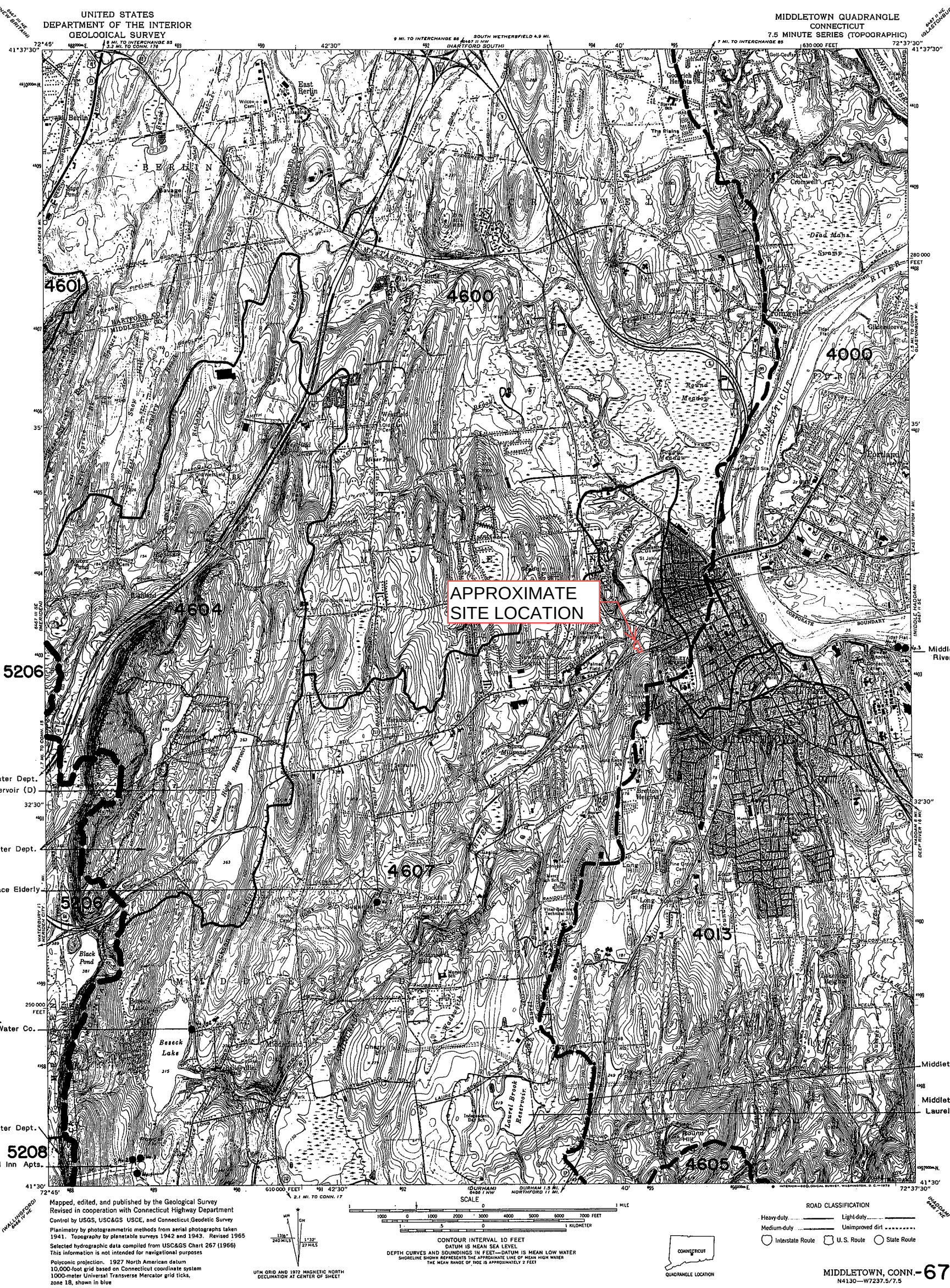
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

FUSS & O'NEILL

Figure 3

Drainage Basin Map



Notes:

4 Connecticut Major Basin
46 Mattabesset Regional Basin
4607 Coginchaug River Sub-basin

FUSS & O'NEILL

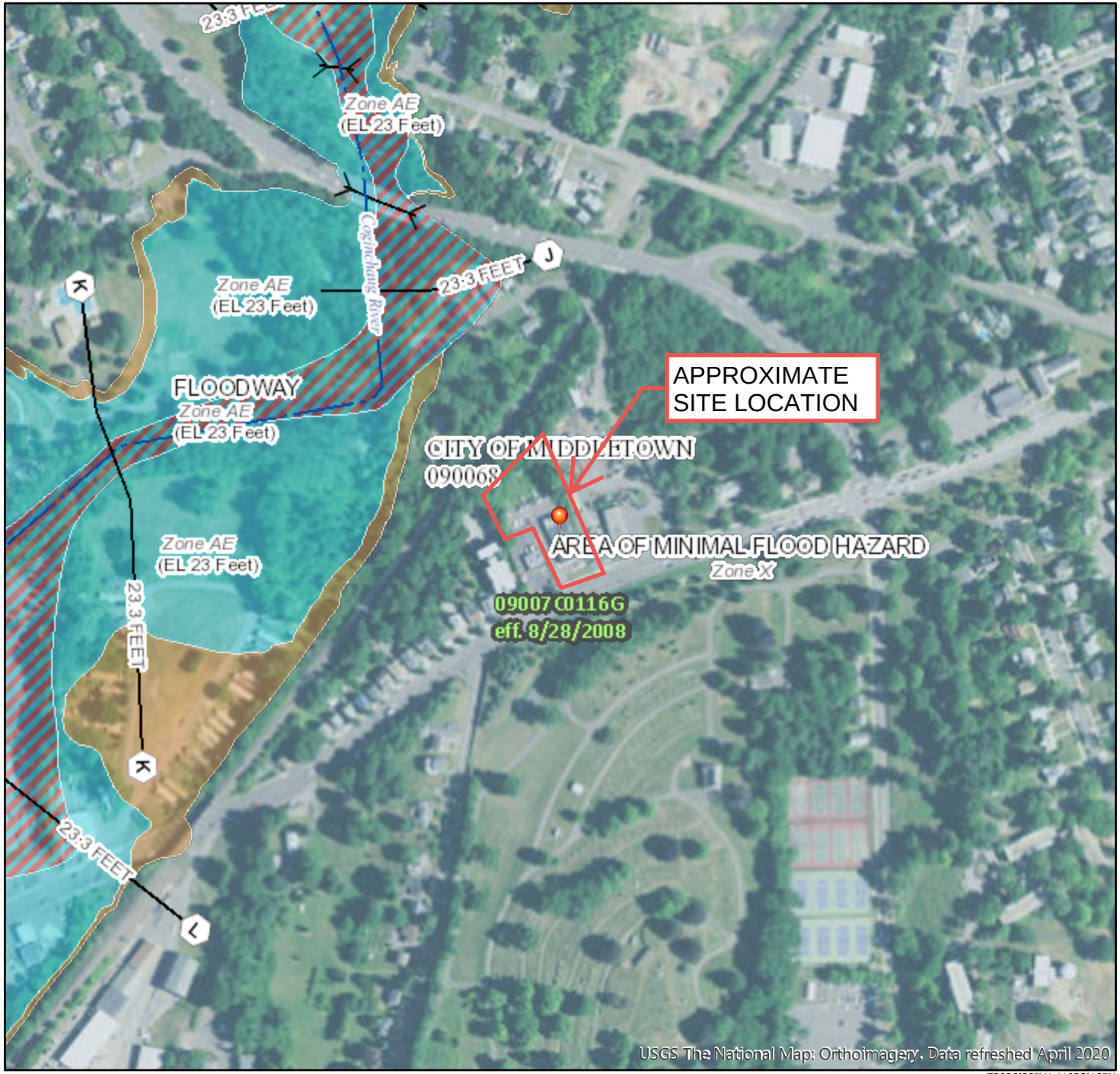
Figure 4

FEMA Flood Insurance Map

National Flood Hazard Layer FIRMette

FEMA

72°40'9"W 41°33'45"N



72°39'32"W 41°33'18"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

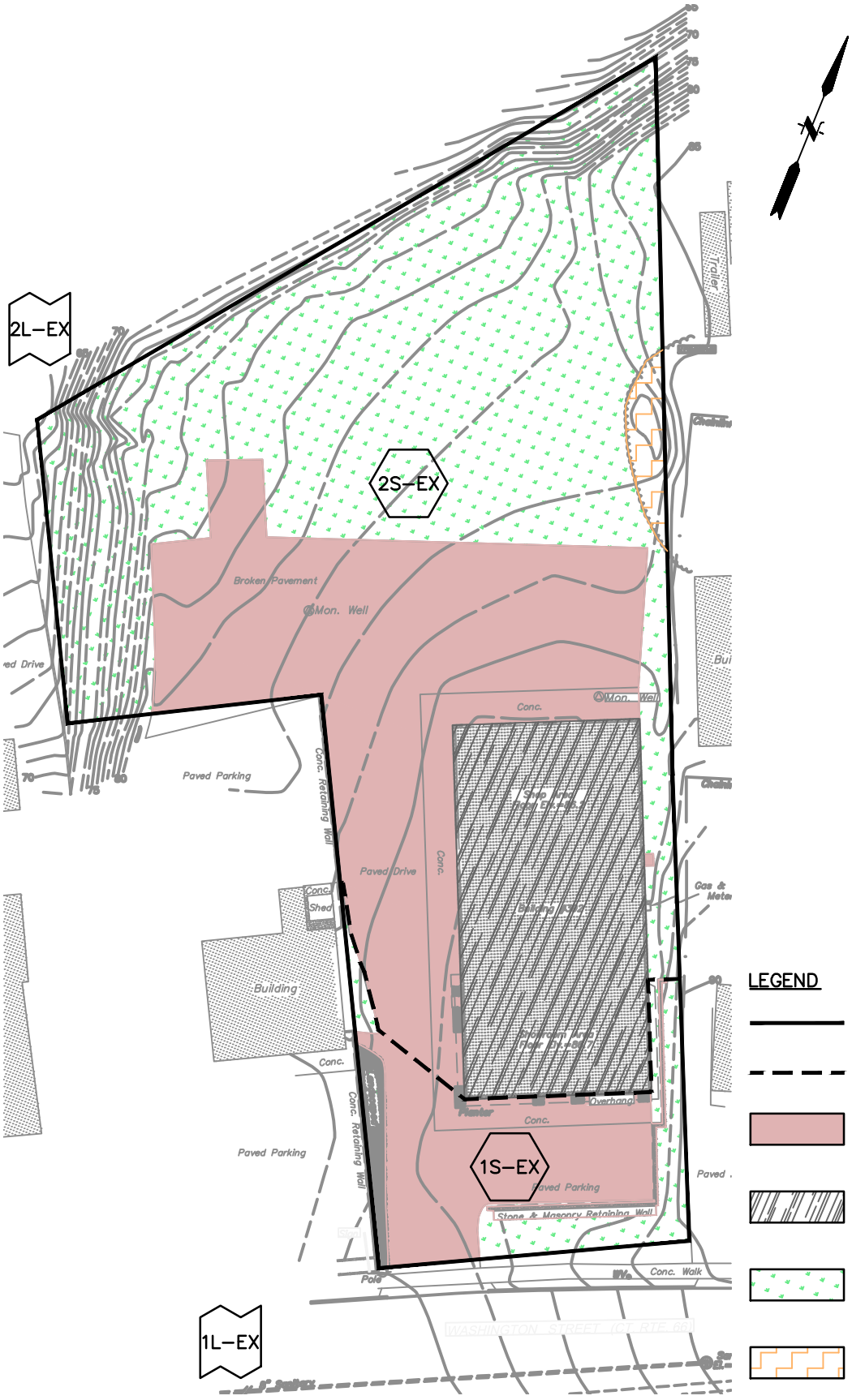
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/8/2020 at 8:59 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

FUSS & O'NEILL

Appendix A

Existing Watershed Analysis



File Path: J:\DWG\P20200586A10\Civil\Plan\20200586A10_DRA01.dwg Layout: DR-101 Plotted: Thu, July 23, 2020 - 1:30 PM User: jdeninger
Plotter: DWG TO PDF.PC3 CTB File: FO.STB
LAYER STATE:
MS VIEW:

SCALE:
HORZ.: 1" = 50'
VERT.:
DATUM:
HORZ.:
VERT.:
0 25 50
GRAPHIC SCALE

FUSS & O'NEILL
146 HARTFORD ROAD
MANCHESTER, CONNECTICUT 06040
860.646.2469
www.fando.com

ROOT CENTER FOR ADVANCED RECOVERY

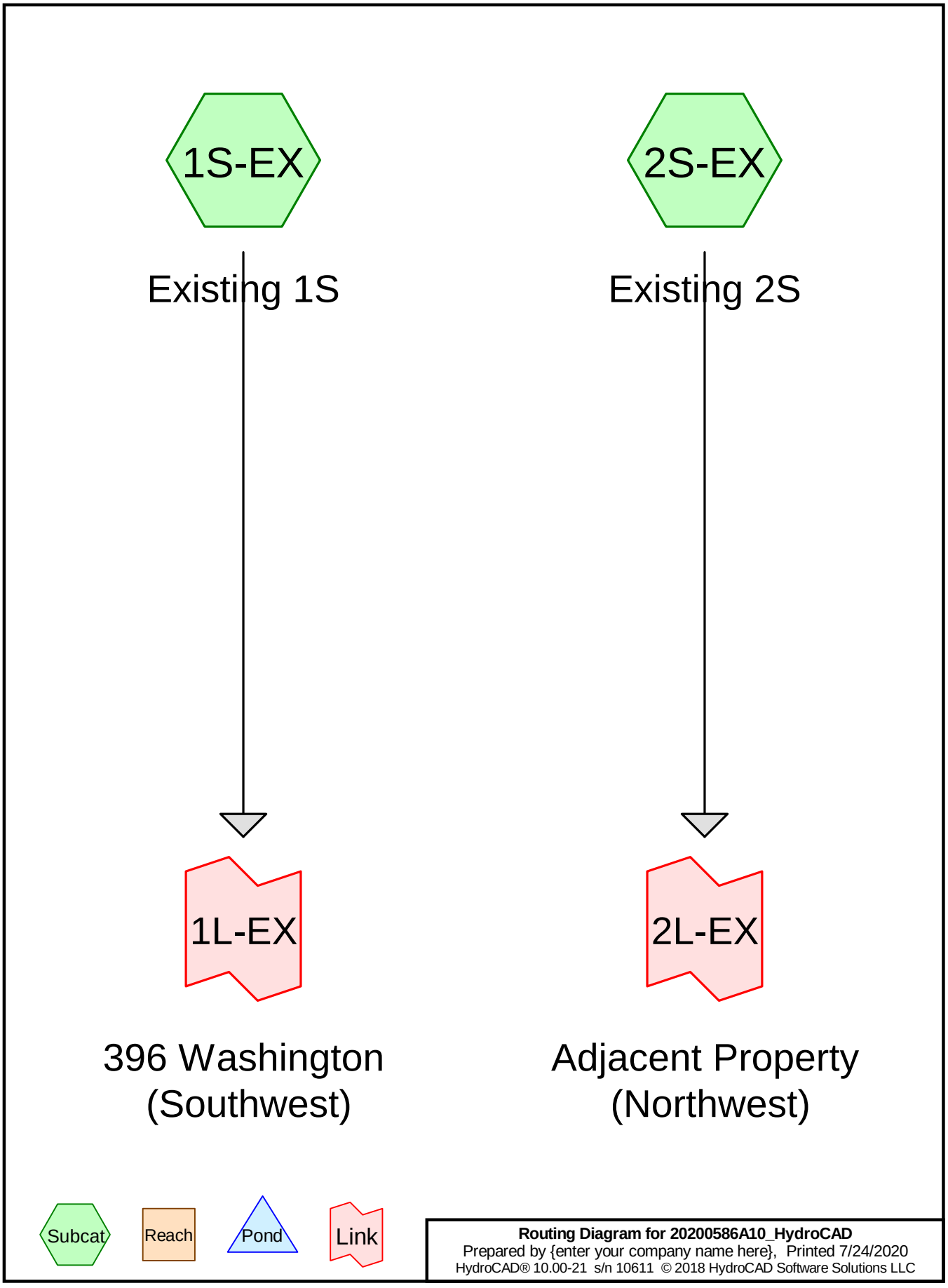
EXISTING WATERSHED ANALYSIS MAP

392 WASHINGTON STREET

MIDDLETOWN CONNECTICUT

PROJ. No.: 20200586.A10
DATE: 07/24/2020

DR-101



Routing Diagram for 20200586A10_HydroCAD
Prepared by {enter your company name here}, Printed 7/24/2020

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.542	74	>75% Grass cover, Good, HSG C (1S-EX, 2S-EX)
0.395	98	Paved parking, HSG C (1S-EX, 2S-EX)
0.165	98	Roofs, HSG C (2S-EX)
0.013	72	Woods/grass comb., Good, HSG C (2S-EX)
1.116	**86**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.116	HSG C	1S-EX, 2S-EX
0.000	HSG D	
0.000	Other	
1.116		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.542	0.000	0.000	0.542	>75% Grass cover, Good	1S-EX, 2S-EX
0.000	0.000	0.395	0.000	0.000	0.395	Paved parking	1S-EX, 2S-EX
0.000	0.000	0.165	0.000	0.000	0.165	Roofs	2S-EX
0.000	0.000	0.013	0.000	0.000	0.013	Woods/grass comb., Good	2S-EX
0.000	**0.000**	**1.116**	**0.000**	**0.000**	**1.116**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-EX: Existing 1S Runoff Area=6,173 sf 66.63% Impervious Runoff Depth=2.26"
Tc=5.0 min CN=90 Runoff=0.38 cfs 0.027 af

Subcatchment 2S-EX: Existing 2S Runoff Area=42,427 sf 47.84% Impervious Runoff Depth=1.84"
Tc=5.0 min CN=85 Runoff=2.18 cfs 0.150 af

Link 1L-EX: 396 Washington (Southwest) Inflow=0.38 cfs 0.027 af
Primary=0.38 cfs 0.027 af

Link 2L-EX: Adjacent Property (Northwest) Inflow=2.18 cfs 0.150 af
Primary=2.18 cfs 0.150 af

Total Runoff Area = 1.116 ac Runoff Volume = 0.176 af Average Runoff Depth = 1.90"
49.77% Pervious = 0.555 ac 50.23% Impervious = 0.560 ac

Summary for Subcatchment 1S-EX: Existing 1S

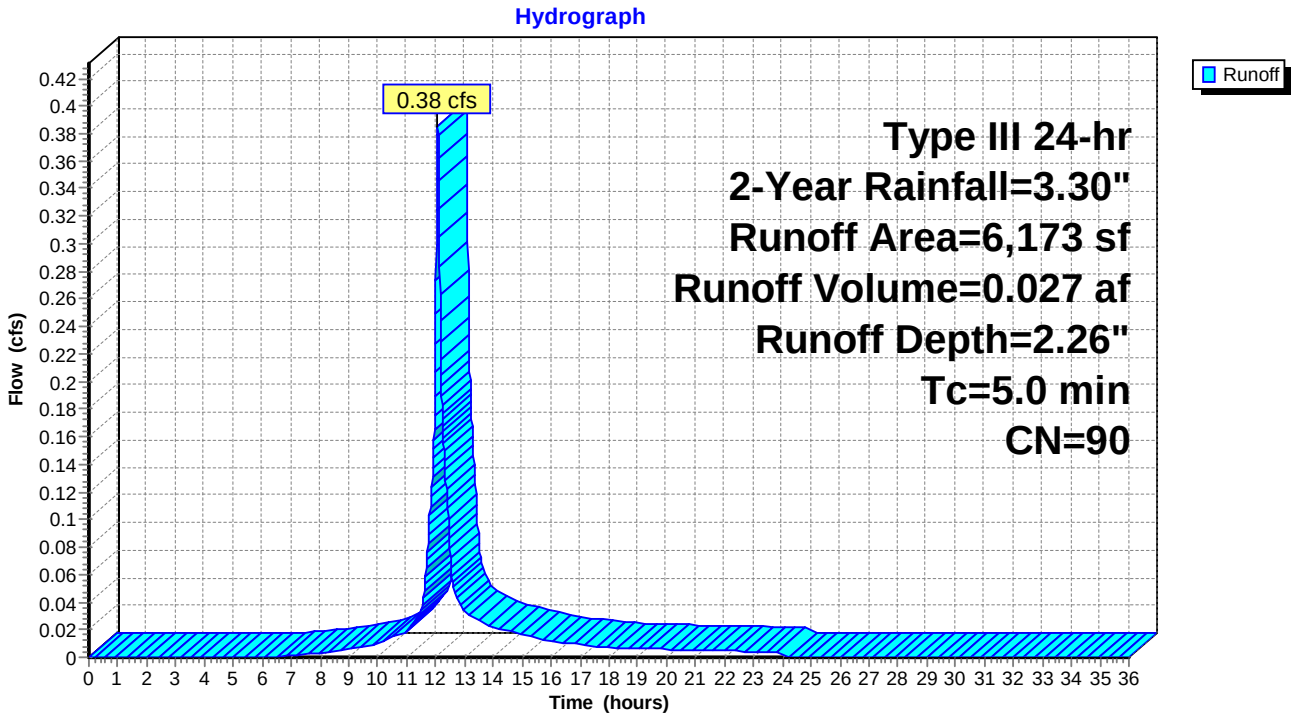
Runoff = 0.38 cfs @ 12.07 hrs, Volume= 0.027 af, Depth= 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
2,060	74	>75% Grass cover, Good, HSG C
4,113	98	Paved parking, HSG C
6,173	90	Weighted Average
2,060		33.37% Pervious Area
4,113		66.63% Impervious Area

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

Subcatchment 1S-EX: Existing 1S



Summary for Subcatchment 2S-EX: Existing 2S

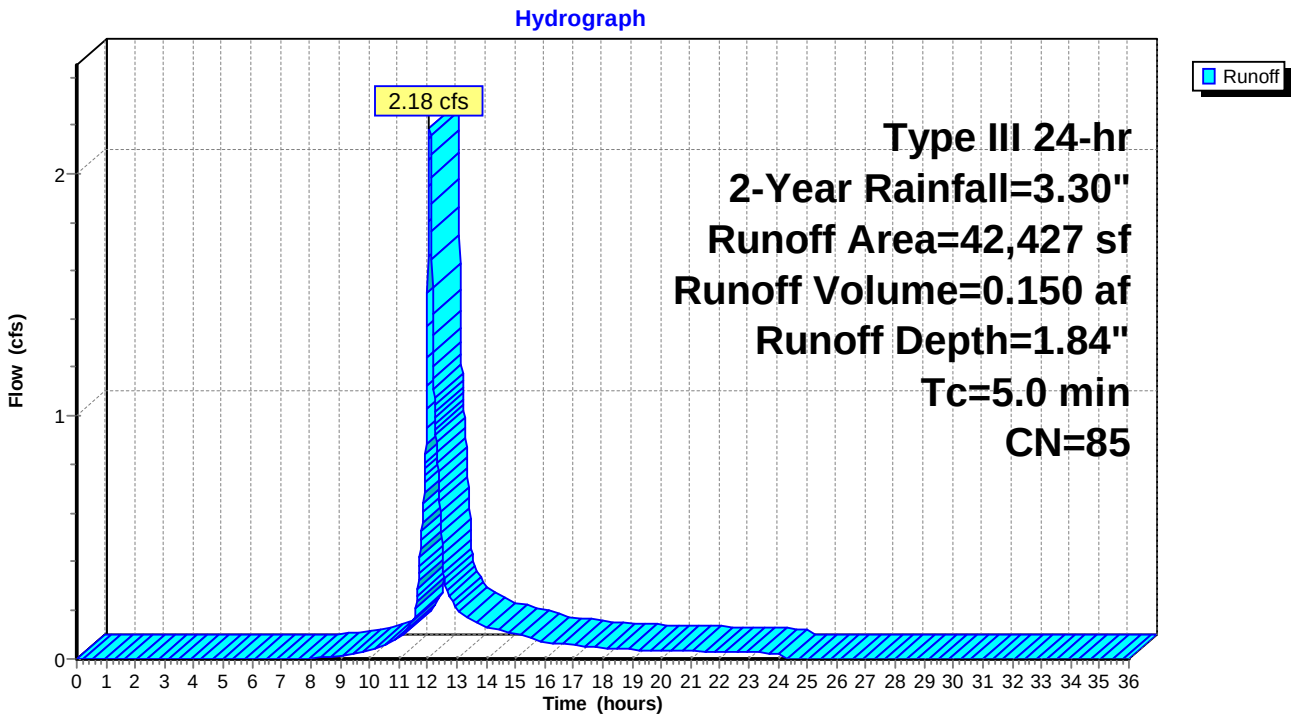
Runoff = 2.18 cfs @ 12.07 hrs, Volume= 0.150 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
21,571	74	>75% Grass cover, Good, HSG C
13,090	98	Paved parking, HSG C
558	72	Woods/grass comb., Good, HSG C
7,208	98	Roofs, HSG C
42,427	85	Weighted Average
22,129		52.16% Pervious Area
20,298		47.84% Impervious Area

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

Subcatchment 2S-EX: Existing 2S

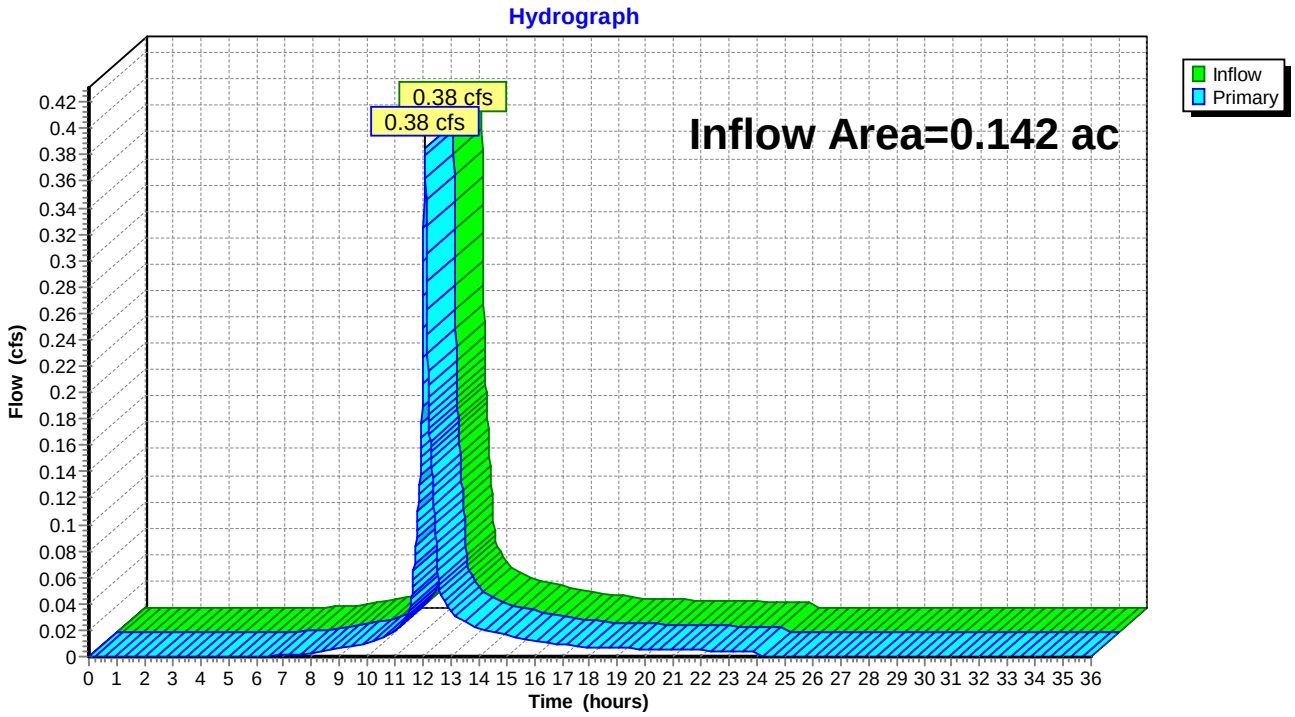


Summary for Link 1L-EX: 396 Washington (Southwest)

Inflow Area = 0.142 ac, 66.63% Impervious, Inflow Depth = 2.26" for 2-Year event
Inflow = 0.38 cfs @ 12.07 hrs, Volume= 0.027 af
Primary = 0.38 cfs @ 12.07 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1L-EX: 396 Washington (Southwest)

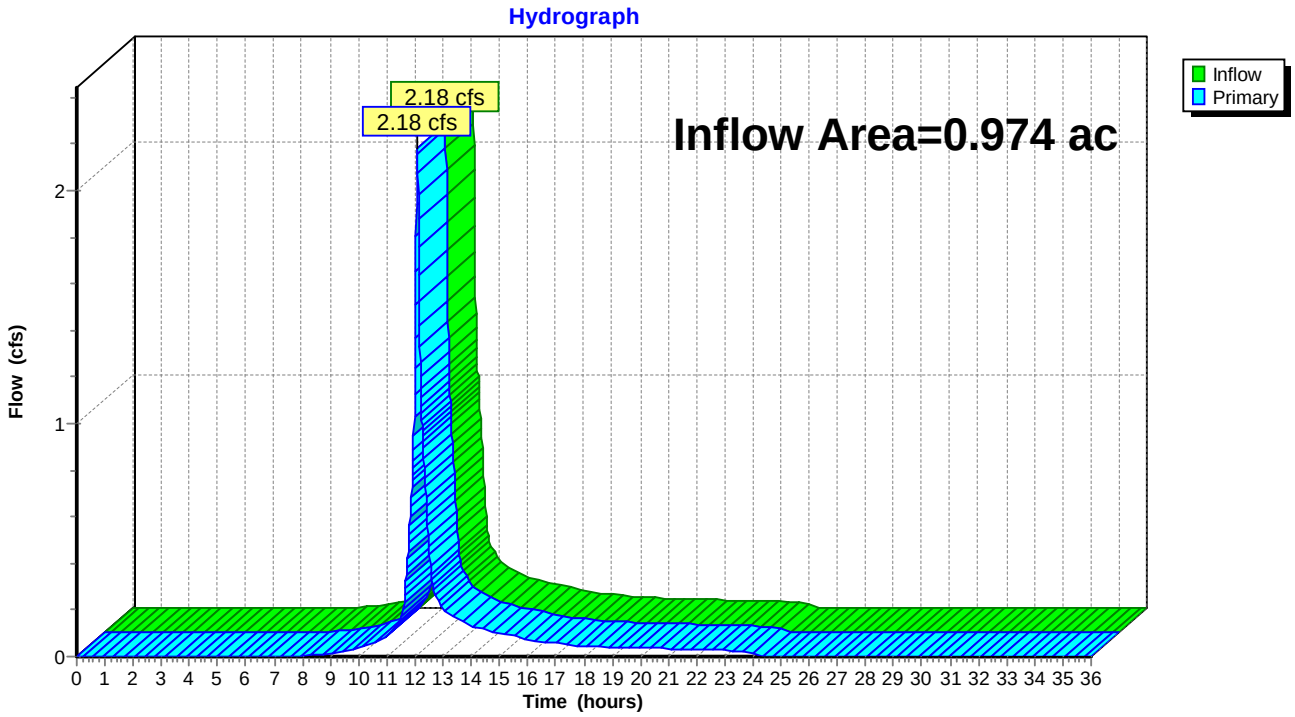


Summary for Link 2L-EX: Adjacent Property (Northwest)

Inflow Area = 0.974 ac, 47.84% Impervious, Inflow Depth = 1.84" for 2-Year event
Inflow = 2.18 cfs @ 12.07 hrs, Volume= 0.150 af
Primary = 2.18 cfs @ 12.07 hrs, Volume= 0.150 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2L-EX: Adjacent Property (Northwest)



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-EX: Existing 1S Runoff Area=6,173 sf 66.63% Impervious Runoff Depth=3.66"
Tc=5.0 min CN=90 Runoff=0.61 cfs 0.043 af

Subcatchment 2S-EX: Existing 2S Runoff Area=42,427 sf 47.84% Impervious Runoff Depth=3.17"
Tc=5.0 min CN=85 Runoff=3.72 cfs 0.257 af

Link 1L-EX: 396 Washington (Southwest) Inflow=0.61 cfs 0.043 af
Primary=0.61 cfs 0.043 af

Link 2L-EX: Adjacent Property (Northwest) Inflow=3.72 cfs 0.257 af
Primary=3.72 cfs 0.257 af

Total Runoff Area = 1.116 ac Runoff Volume = 0.300 af Average Runoff Depth = 3.23"
49.77% Pervious = 0.555 ac 50.23% Impervious = 0.560 ac

Summary for Subcatchment 1S-EX: Existing 1S

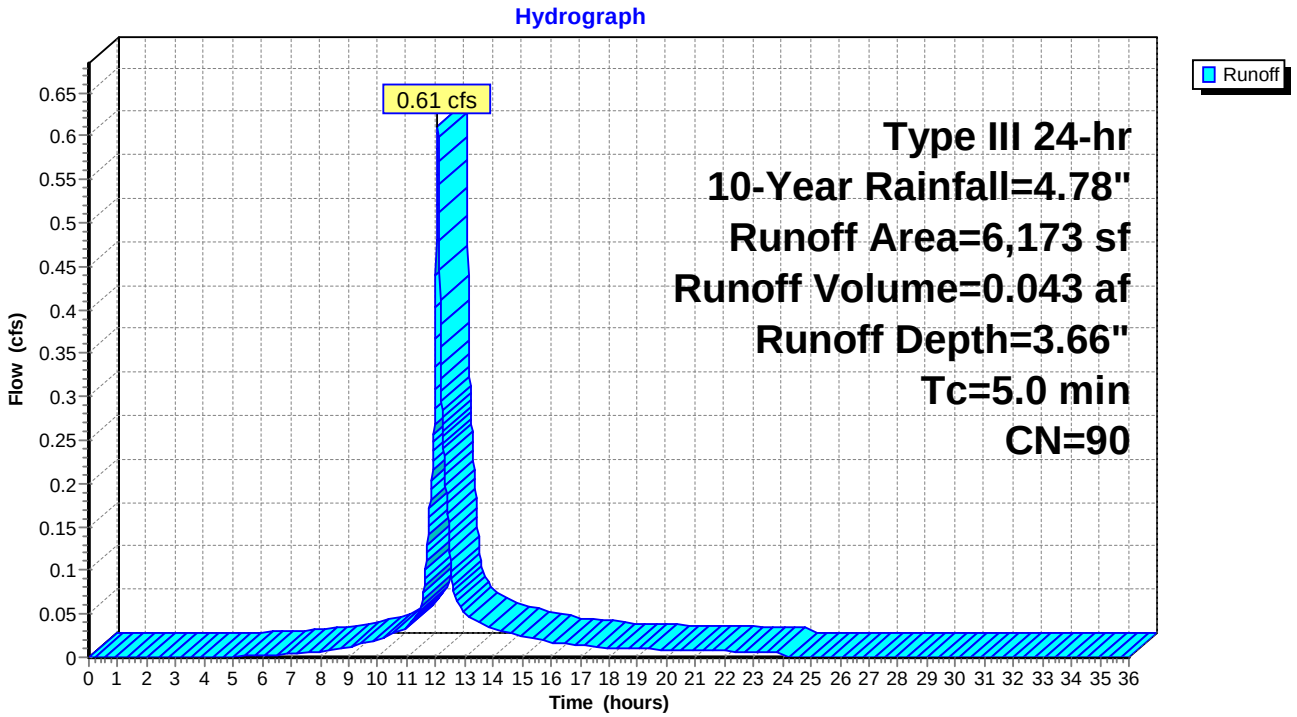
Runoff = 0.61 cfs @ 12.07 hrs, Volume= 0.043 af, Depth= 3.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.78"

Area (sf)	CN	Description
2,060	74	>75% Grass cover, Good, HSG C
4,113	98	Paved parking, HSG C
6,173	90	Weighted Average
2,060		33.37% Pervious Area
4,113		66.63% Impervious Area

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

Subcatchment 1S-EX: Existing 1S



Summary for Subcatchment 2S-EX: Existing 2S

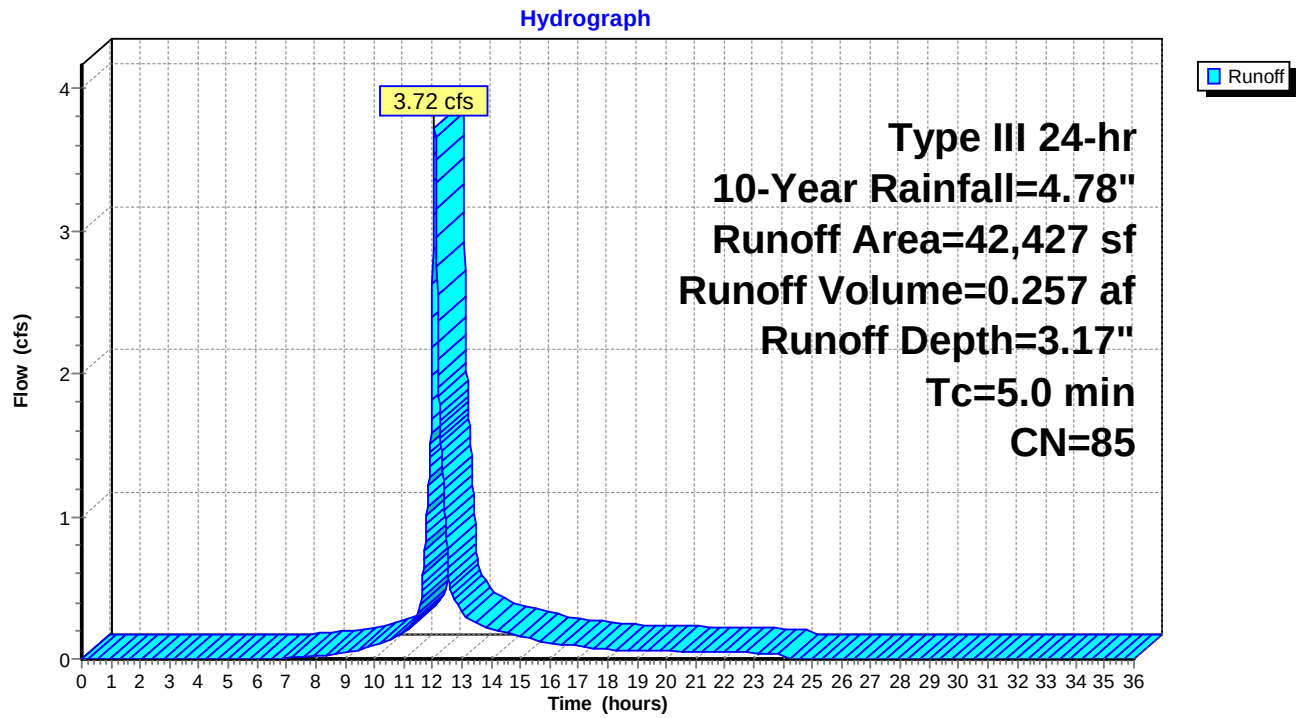
Runoff = 3.72 cfs @ 12.07 hrs, Volume= 0.257 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.78"

Area (sf)	CN	Description
21,571	74	>75% Grass cover, Good, HSG C
13,090	98	Paved parking, HSG C
558	72	Woods/grass comb., Good, HSG C
7,208	98	Roofs, HSG C
42,427	85	Weighted Average
22,129		52.16% Pervious Area
20,298		47.84% Impervious Area

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

Subcatchment 2S-EX: Existing 2S

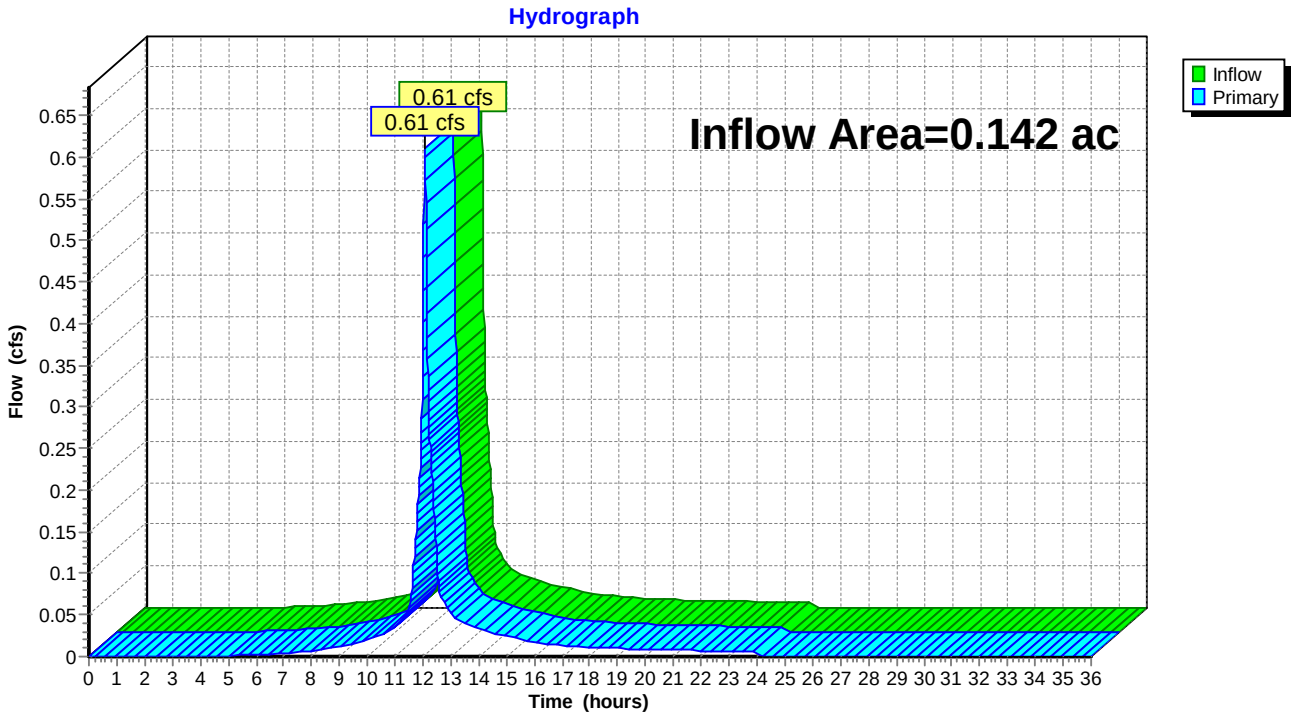


Summary for Link 1L-EX: 396 Washington (Southwest)

Inflow Area = 0.142 ac, 66.63% Impervious, Inflow Depth = 3.66" for 10-Year event
Inflow = 0.61 cfs @ 12.07 hrs, Volume= 0.043 af
Primary = 0.61 cfs @ 12.07 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1L-EX: 396 Washington (Southwest)

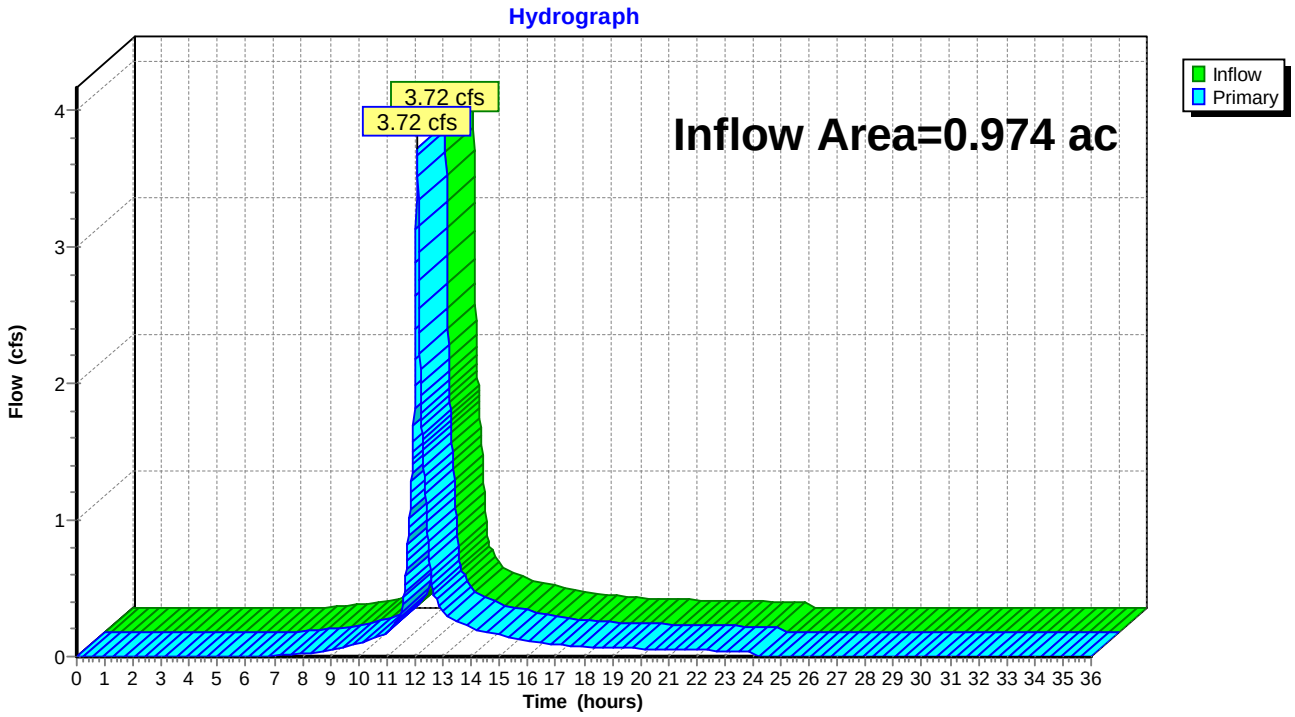


Summary for Link 2L-EX: Adjacent Property (Northwest)

Inflow Area = 0.974 ac, 47.84% Impervious, Inflow Depth = 3.17" for 10-Year event
Inflow = 3.72 cfs @ 12.07 hrs, Volume= 0.257 af
Primary = 3.72 cfs @ 12.07 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2L-EX: Adjacent Property (Northwest)



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-EX: Existing 1S Runoff Area=6,173 sf 66.63% Impervious Runoff Depth=4.76"
Tc=5.0 min CN=90 Runoff=0.78 cfs 0.056 af

Subcatchment 2S-EX: Existing 2S Runoff Area=42,427 sf 47.84% Impervious Runoff Depth=4.22"
Tc=5.0 min CN=85 Runoff=4.90 cfs 0.342 af

Link 1L-EX: 396 Washington (Southwest) Inflow=0.78 cfs 0.056 af
Primary=0.78 cfs 0.056 af

Link 2L-EX: Adjacent Property (Northwest) Inflow=4.90 cfs 0.342 af
Primary=4.90 cfs 0.342 af

Total Runoff Area = 1.116 ac Runoff Volume = 0.399 af Average Runoff Depth = 4.29"
49.77% Pervious = 0.555 ac 50.23% Impervious = 0.560 ac

Summary for Subcatchment 1S-EX: Existing 1S

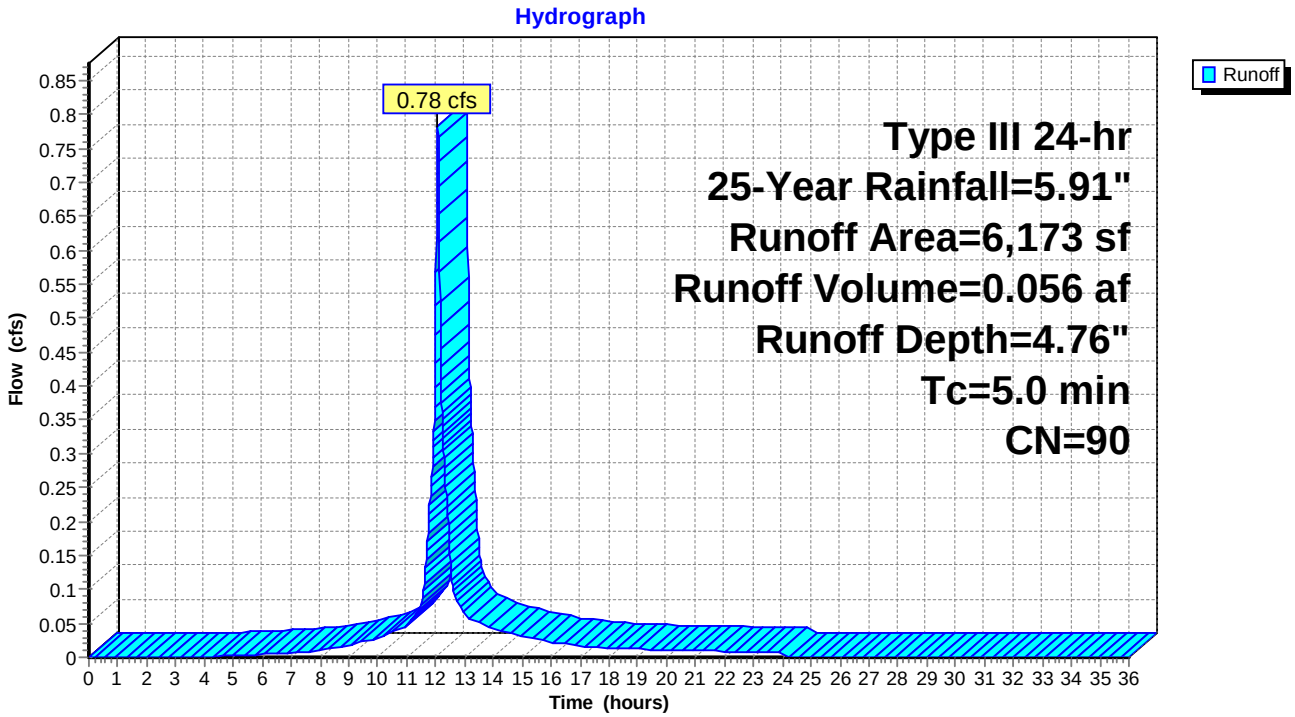
Runoff = 0.78 cfs @ 12.07 hrs, Volume= 0.056 af, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.91"

Area (sf)	CN	Description
2,060	74	>75% Grass cover, Good, HSG C
4,113	98	Paved parking, HSG C
6,173	90	Weighted Average
2,060		33.37% Pervious Area
4,113		66.63% Impervious Area

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

Subcatchment 1S-EX: Existing 1S



Summary for Subcatchment 2S-EX: Existing 2S

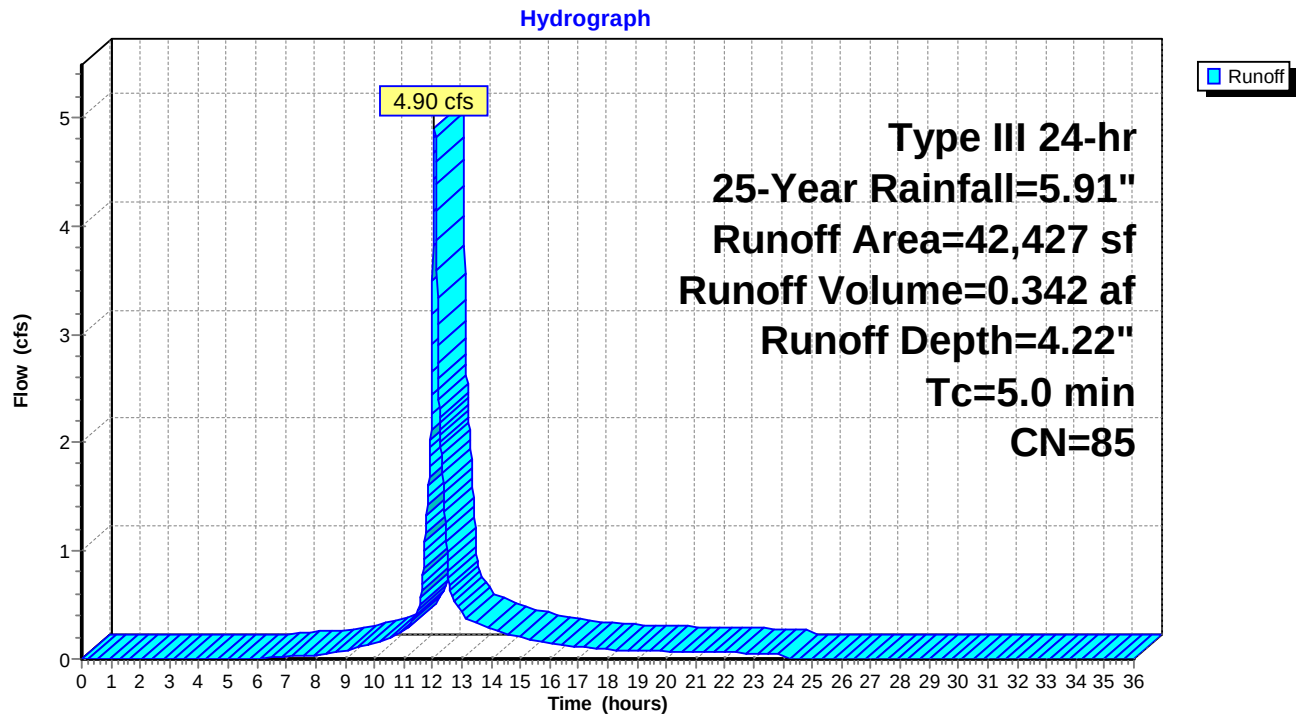
Runoff = 4.90 cfs @ 12.07 hrs, Volume= 0.342 af, Depth= 4.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.91"

Area (sf)	CN	Description
21,571	74	>75% Grass cover, Good, HSG C
13,090	98	Paved parking, HSG C
558	72	Woods/grass comb., Good, HSG C
7,208	98	Roofs, HSG C
42,427	85	Weighted Average
22,129		52.16% Pervious Area
20,298		47.84% Impervious Area

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

Subcatchment 2S-EX: Existing 2S

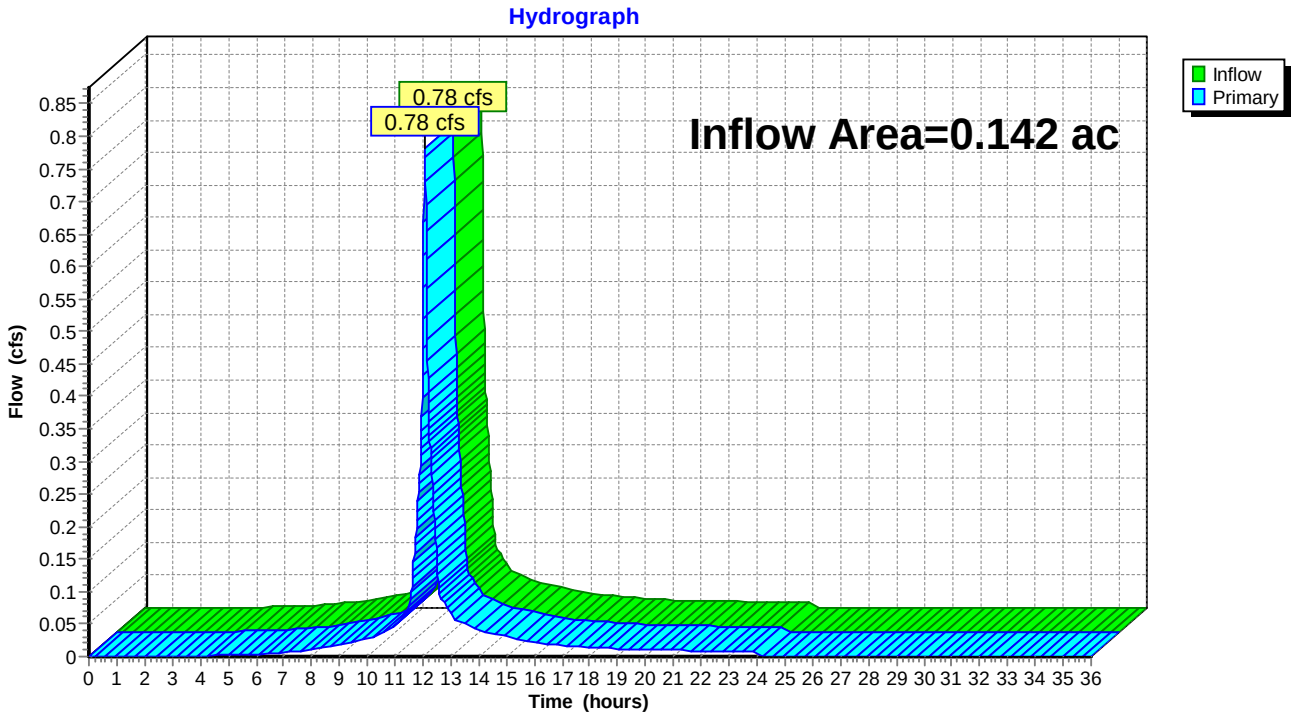


Summary for Link 1L-EX: 396 Washington (Southwest)

Inflow Area = 0.142 ac, 66.63% Impervious, Inflow Depth = 4.76" for 25-Year event
Inflow = 0.78 cfs @ 12.07 hrs, Volume= 0.056 af
Primary = 0.78 cfs @ 12.07 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1L-EX: 396 Washington (Southwest)

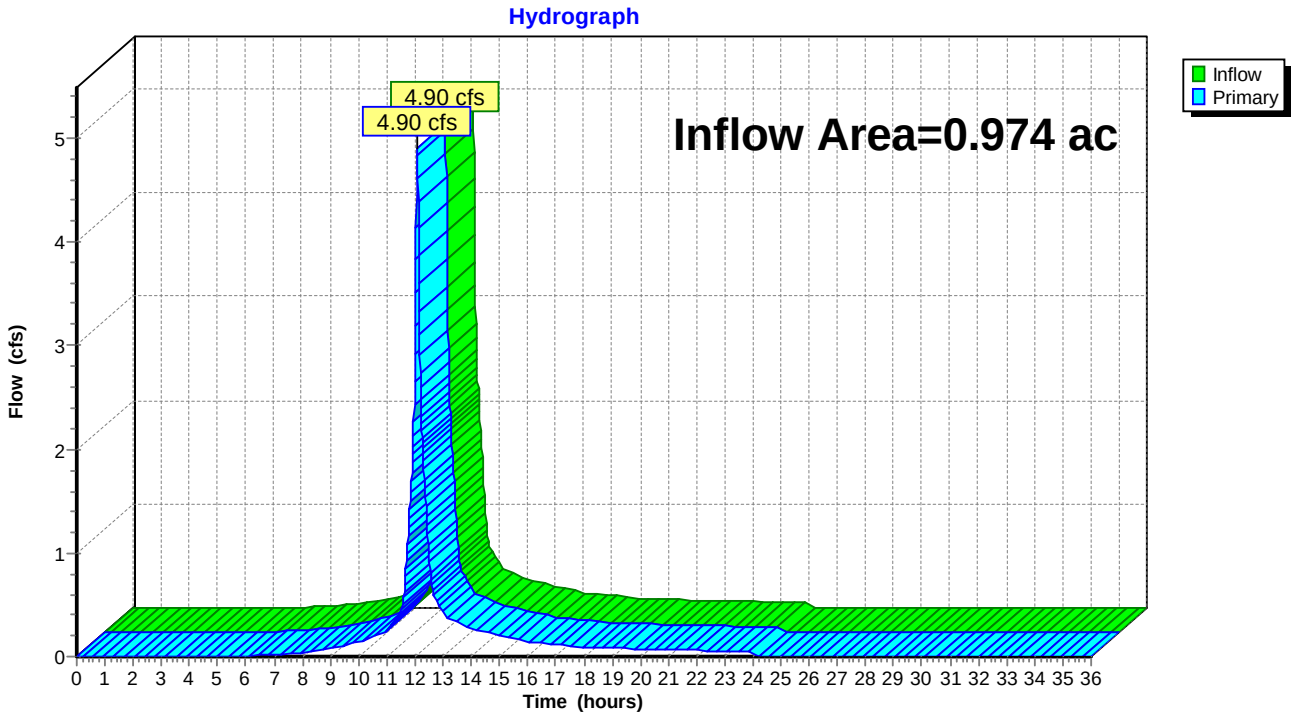


Summary for Link 2L-EX: Adjacent Property (Northwest)

Inflow Area = 0.974 ac, 47.84% Impervious, Inflow Depth = 4.22" for 25-Year event
Inflow = 4.90 cfs @ 12.07 hrs, Volume= 0.342 af
Primary = 4.90 cfs @ 12.07 hrs, Volume= 0.342 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2L-EX: Adjacent Property (Northwest)



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-EX: Existing 1S Runoff Area=6,173 sf 66.63% Impervious Runoff Depth=6.96"
Tc=5.0 min CN=90 Runoff=1.12 cfs 0.082 af

Subcatchment 2S-EX: Existing 2S Runoff Area=42,427 sf 47.84% Impervious Runoff Depth=6.37"
Tc=5.0 min CN=85 Runoff=7.26 cfs 0.517 af

Link 1L-EX: 396 Washington (Southwest) Inflow=1.12 cfs 0.082 af
Primary=1.12 cfs 0.082 af

Link 2L-EX: Adjacent Property (Northwest) Inflow=7.26 cfs 0.517 af
Primary=7.26 cfs 0.517 af

Total Runoff Area = 1.116 ac Runoff Volume = 0.599 af Average Runoff Depth = 6.44"
49.77% Pervious = 0.555 ac 50.23% Impervious = 0.560 ac

Summary for Subcatchment 1S-EX: Existing 1S

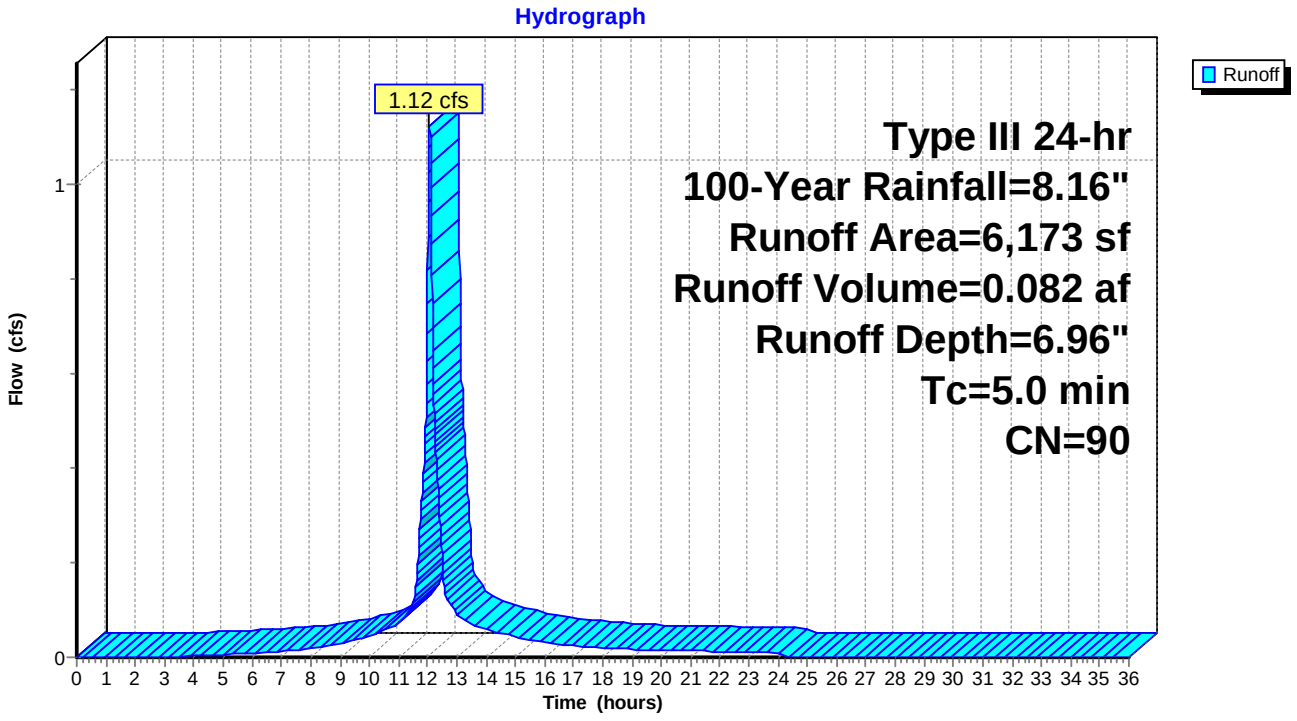
Runoff = 1.12 cfs @ 12.07 hrs, Volume= 0.082 af, Depth= 6.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
2,060	74	>75% Grass cover, Good, HSG C
4,113	98	Paved parking, HSG C
6,173	90	Weighted Average
2,060		33.37% Pervious Area
4,113		66.63% Impervious Area

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

Subcatchment 1S-EX: Existing 1S



Summary for Subcatchment 2S-EX: Existing 2S

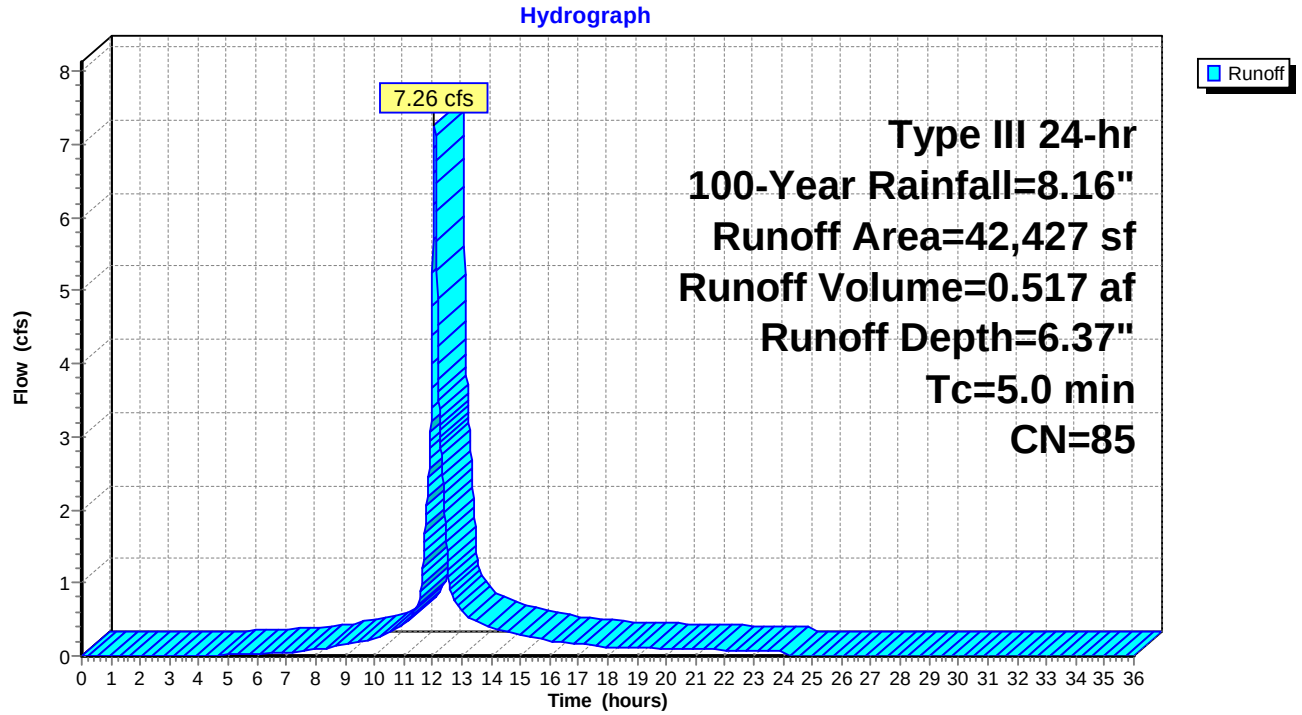
Runoff = 7.26 cfs @ 12.07 hrs, Volume= 0.517 af, Depth= 6.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
21,571	74	>75% Grass cover, Good, HSG C
13,090	98	Paved parking, HSG C
558	72	Woods/grass comb., Good, HSG C
7,208	98	Roofs, HSG C
42,427	85	Weighted Average
22,129		52.16% Pervious Area
20,298		47.84% Impervious Area

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

Subcatchment 2S-EX: Existing 2S

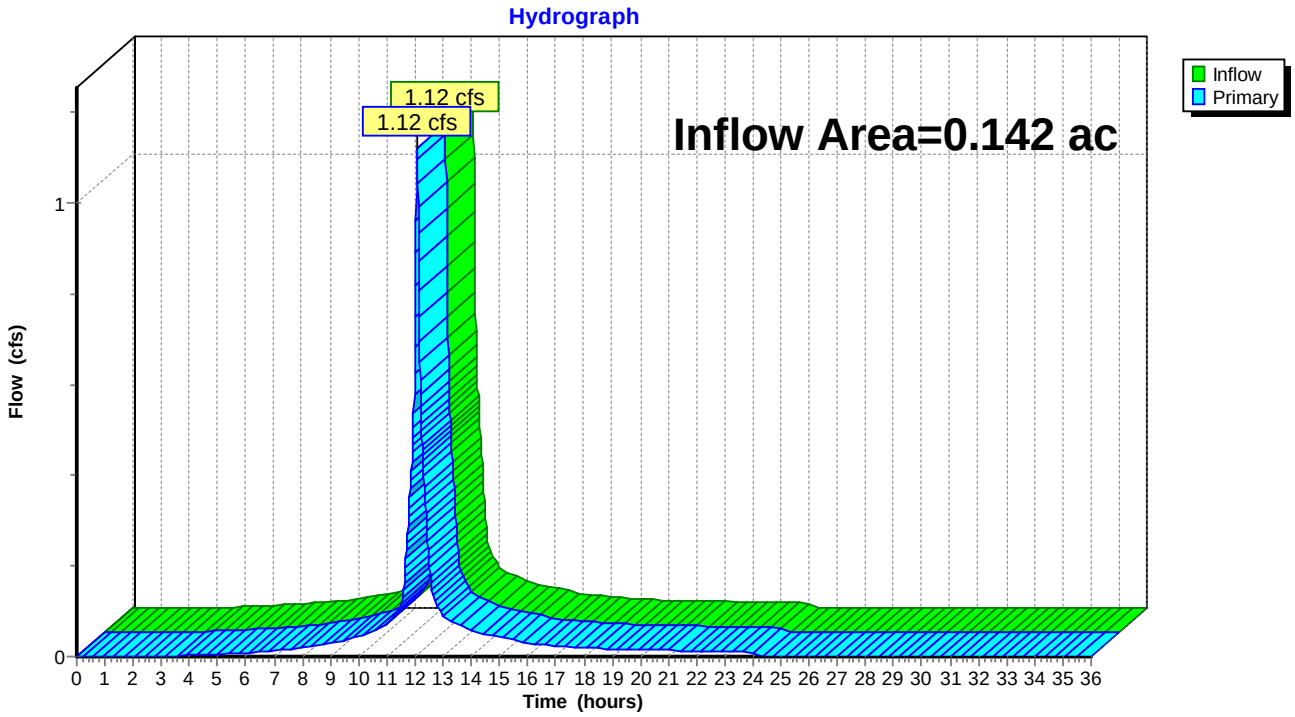


Summary for Link 1L-EX: 396 Washington (Southwest)

Inflow Area = 0.142 ac, 66.63% Impervious, Inflow Depth = 6.96" for 100-Year event
Inflow = 1.12 cfs @ 12.07 hrs, Volume= 0.082 af
Primary = 1.12 cfs @ 12.07 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1L-EX: 396 Washington (Southwest)

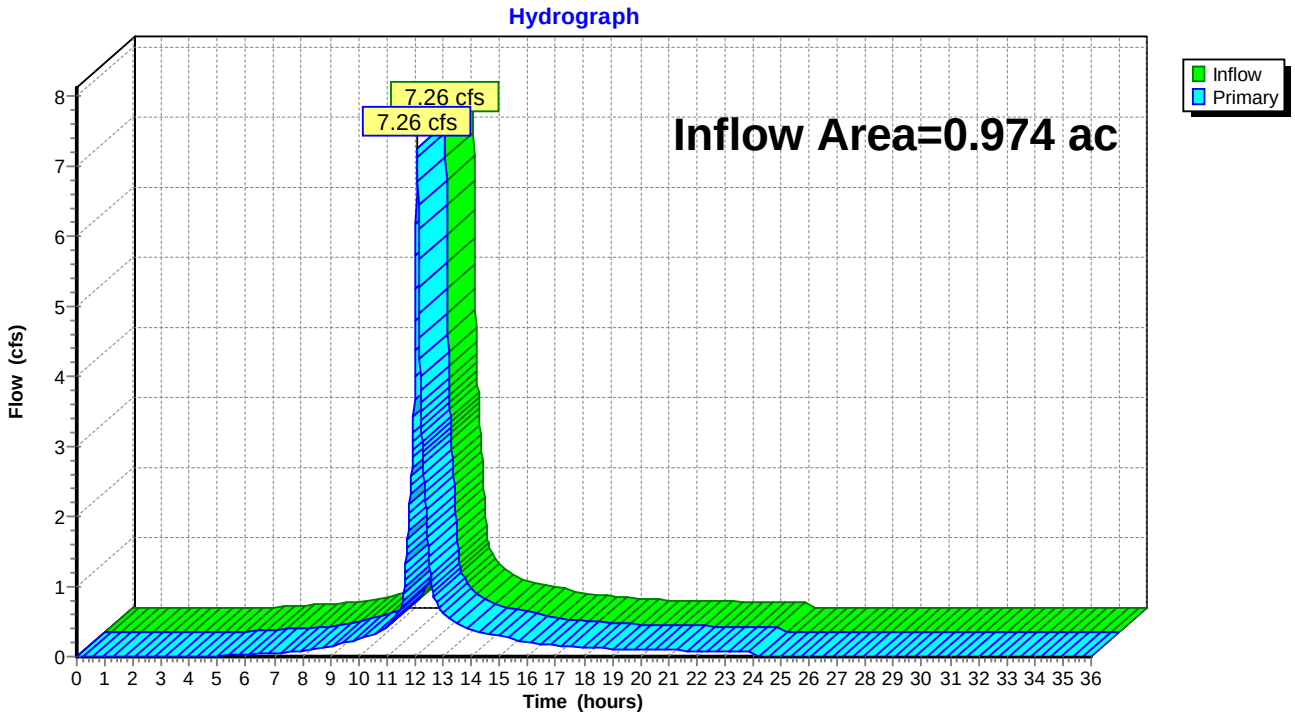


Summary for Link 2L-EX: Adjacent Property (Northwest)

Inflow Area = 0.974 ac, 47.84% Impervious, Inflow Depth = 6.37" for 100-Year event
Inflow = 7.26 cfs @ 12.07 hrs, Volume= 0.517 af
Primary = 7.26 cfs @ 12.07 hrs, Volume= 0.517 af, Atten= 0%, Lag= 0.0 min

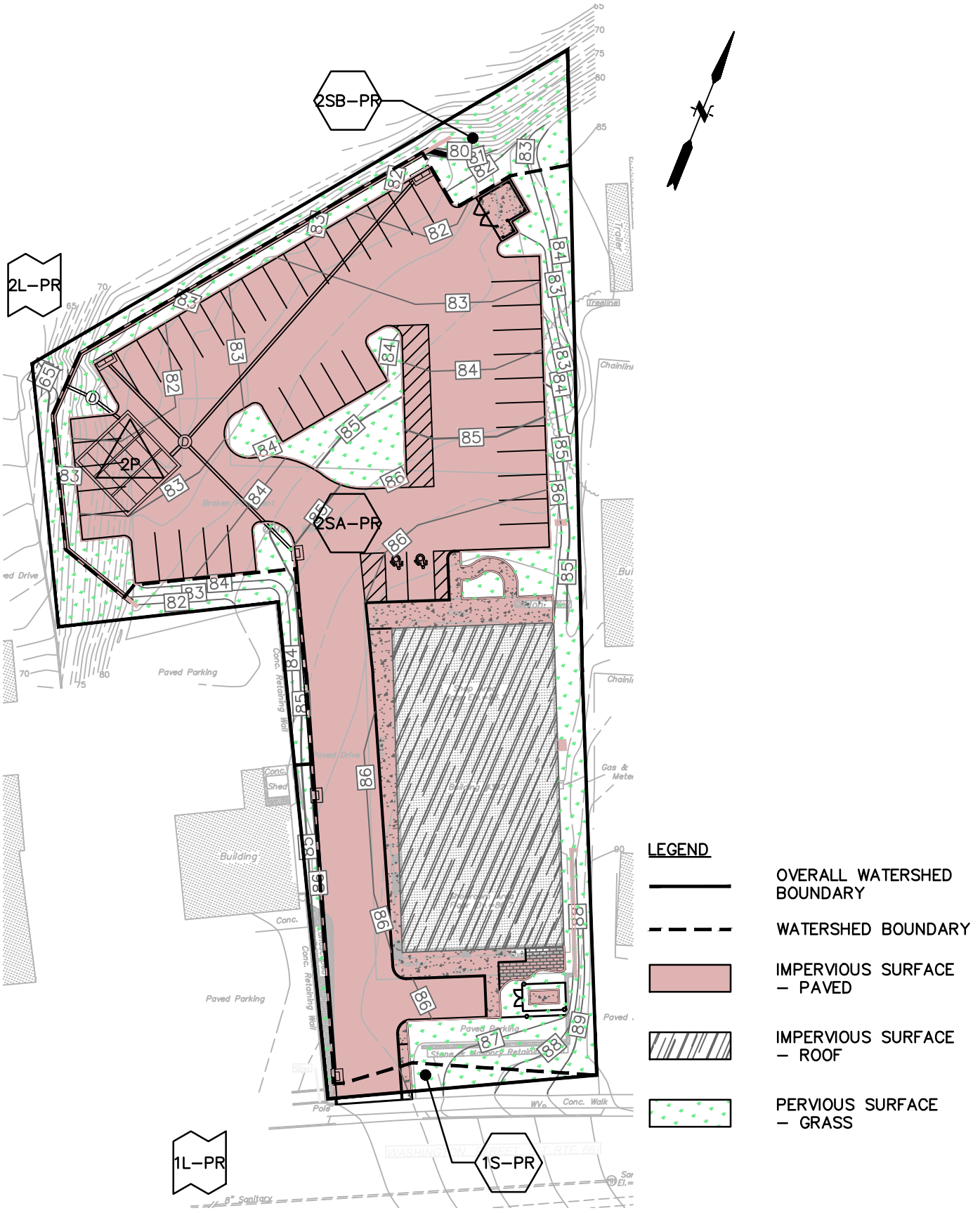
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2L-EX: Adjacent Property (Northwest)



Appendix B

Proposed Watershed Analysis



File Path: J:\DWG\P20200586\A10\Civil\Plan\20200586A10_DRA01.dwg Layout: DR-201 Plotted: Fri, July 24, 2020 - 10:13 AM User: jdeninger
Plotter: DWG TO PDF.PC3 CTB File: FO.STB
LAYER STATE:
MS VIEW:

SCALE:
HORZ.: 1" = 50'
VERT.:
DATUM:
HORZ.:
VERT.:
0 25 50
GRAPHIC SCALE

FUSS & O'NEILL
146 HARTFORD ROAD
MANCHESTER, CONNECTICUT 06040
860.646.2469
www.fando.com

ROOT CENTER FOR ADVANCED RECOVERY

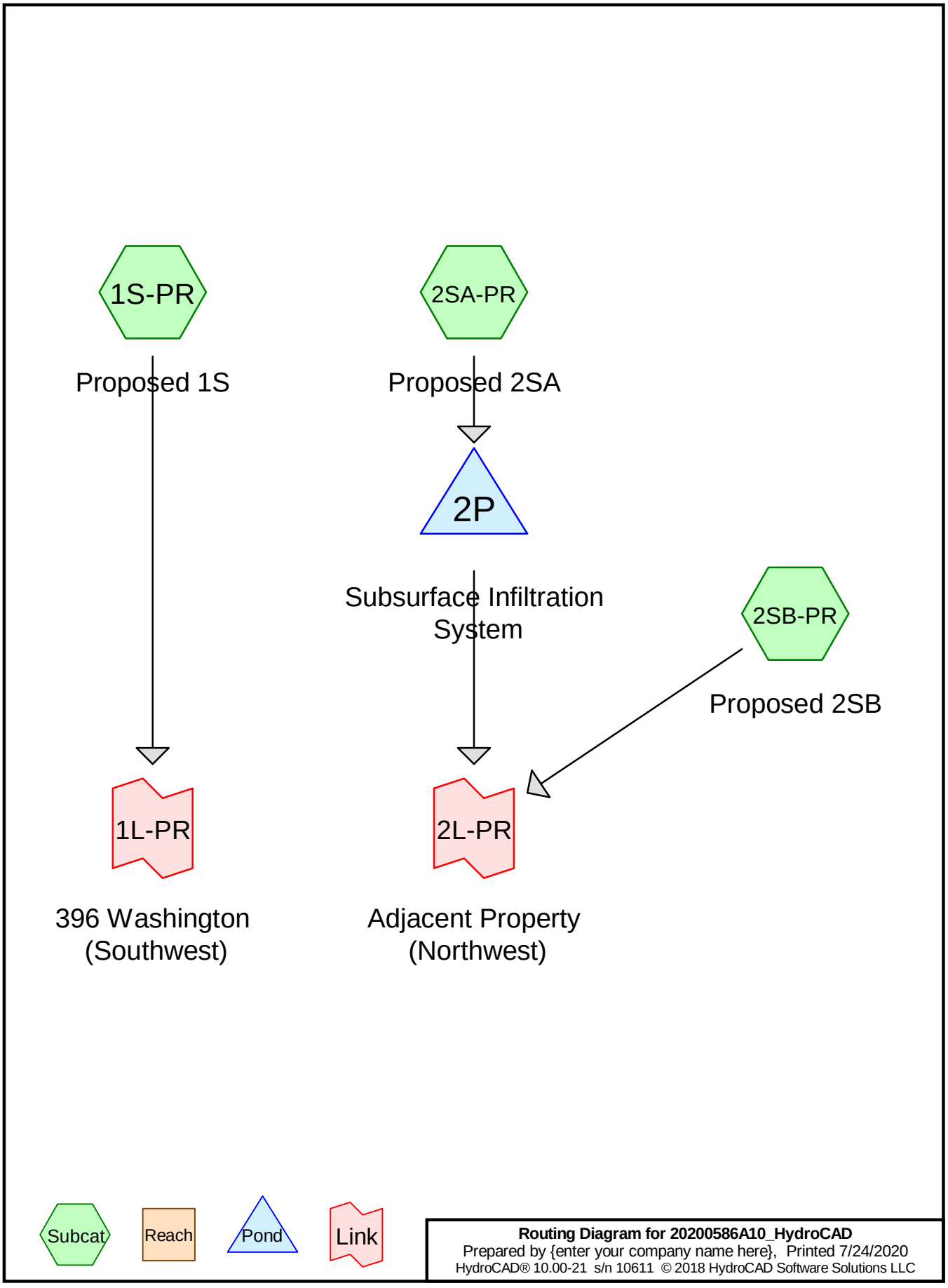
PROPOSED WATERSHED ANALYSIS MAP

392 WASHINGTON STREET

MIDDLETOWN CONNECTICUT

PROJ. No.: 20200586.A10
DATE: 07/24/2020

DR-201



Routing Diagram for 20200586A10_HydroCAD
Prepared by {enter your company name here}, Printed 7/24/2020

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.341	74	>75% Grass cover, Good, HSG C (1S-PR, 2SA-PR, 2SB-PR)
0.609	98	Paved parking, HSG C (1S-PR, 2SA-PR)
0.165	98	Roofs, HSG C (2SA-PR)
0.000	98	Unconnected pavement, HSG C (2SB-PR)
1.116	**91**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.116	HSG C	1S-PR, 2SA-PR, 2SB-PR
0.000	HSG D	
0.000	Other	
1.116		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.341	0.000	0.000	0.341	>75% Grass cover, Good	1S-PR, 2SA-PR, 2SB-PR
0.000	0.000	0.609	0.000	0.000	0.609	Paved parking	1S-PR, 2SA-PR
0.000	0.000	0.165	0.000	0.000	0.165	Roofs	2SA-PR
0.000	0.000	0.000	0.000	0.000	0.000	Unconnected pavement	2SB-PR
0.000	**0.000**	**1.116**	**0.000**	**0.000**	**1.116**	**TOTAL AREA**	

Pipe Listing (selected 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	2P	66.20	66.00	9.0	0.0222	0.013	12.0	0.0	0.0

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-PR: Proposed 1S Runoff Area=1,151 sf 18.59% Impervious Runoff Depth=1.35"
Tc=5.0 min CN=78 Runoff=0.04 cfs 0.003 af

Subcatchment 2SA-PR: Proposed 2SA Runoff Area=42,582 sf 78.69% Impervious Runoff Depth=2.54"
Tc=5.0 min CN=93 Runoff=2.92 cfs 0.207 af

Subcatchment 2SB-PR: Proposed 2SB Runoff Area=4,874 sf 0.37% Impervious Runoff Depth=1.10"
Tc=5.0 min CN=74 Runoff=0.14 cfs 0.010 af

Pond 2P: Subsurface Infiltration System Peak Elev=74.64' Storage=1,225 cf Inflow=2.92 cfs 0.207 af
Discarded=0.01 cfs 0.008 af Primary=1.92 cfs 0.196 af Outflow=1.92 cfs 0.204 af

Link 1L-PR: 396 Washington (Southwest) Inflow=0.04 cfs 0.003 af
Primary=0.04 cfs 0.003 af

Link 2L-PR: Adjacent Property (Northwest) Inflow=2.03 cfs 0.207 af
Primary=2.03 cfs 0.207 af

Total Runoff Area = 1.116 ac Runoff Volume = 0.220 af Average Runoff Depth = 2.37"
30.59% Pervious = 0.341 ac 69.41% Impervious = 0.775 ac

Summary for Subcatchment 1S-PR: Proposed 1S

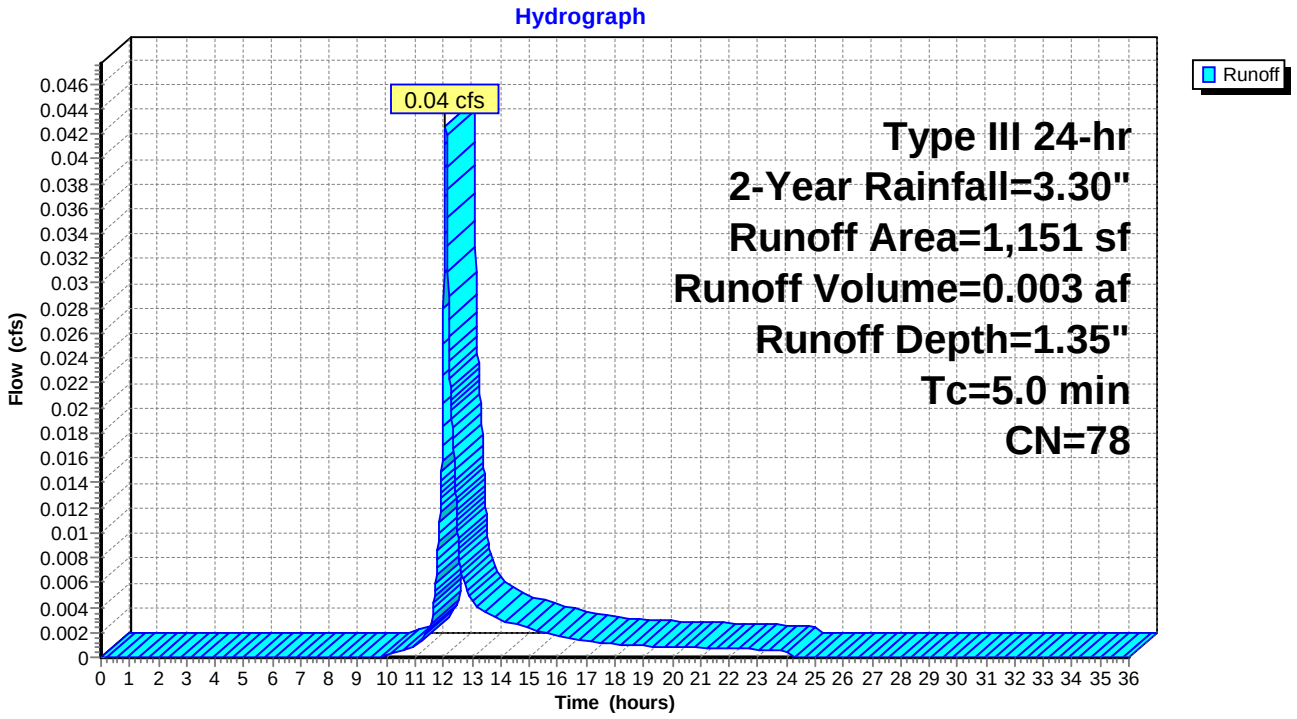
Runoff = 0.04 cfs @ 12.08 hrs, Volume= 0.003 af, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
937	74	>75% Grass cover, Good, HSG C
214	98	Paved parking, HSG C
1,151	78	Weighted Average
937		81.41% Pervious Area
214		18.59% Impervious Area

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

Subcatchment 1S-PR: Proposed 1S



Summary for Subcatchment 2SA-PR: Proposed 2SA

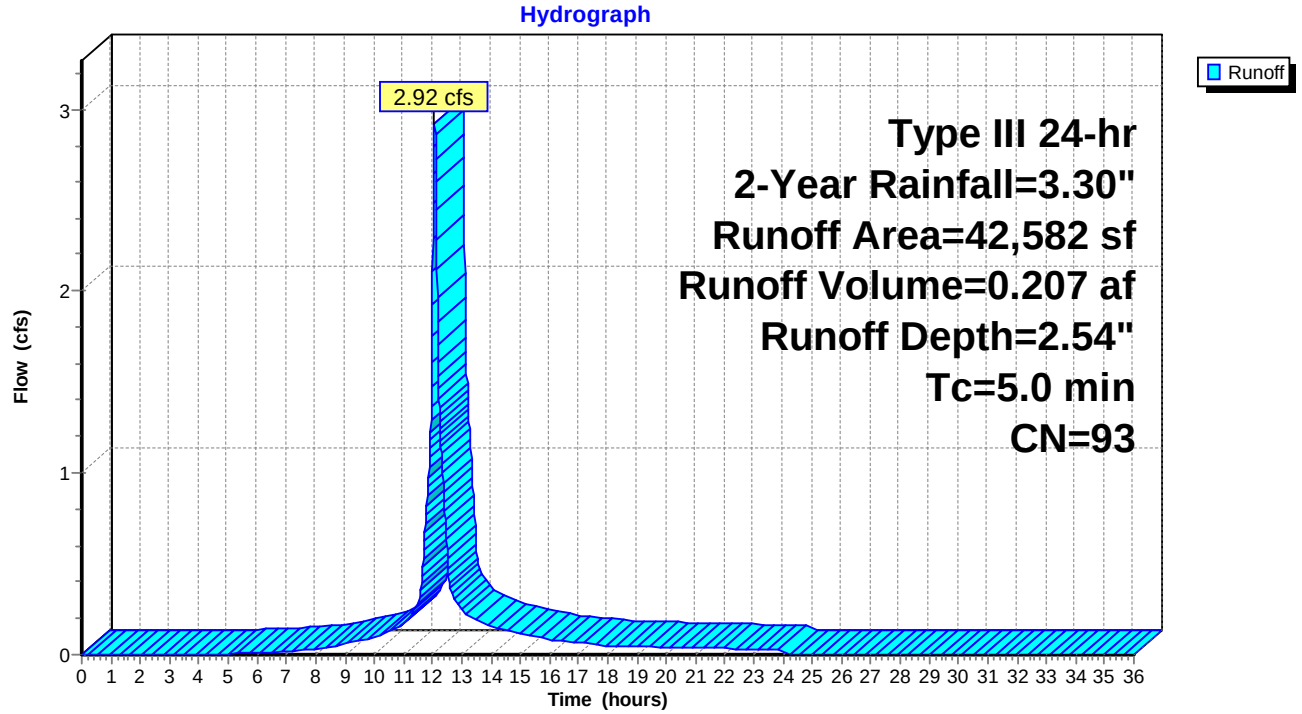
Runoff = 2.92 cfs @ 12.07 hrs, Volume= 0.207 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
9,074	74	>75% Grass cover, Good, HSG C
26,300	98	Paved parking, HSG C
7,208	98	Roofs, HSG C
42,582	93	Weighted Average
9,074		21.31% Pervious Area
33,508		78.69% Impervious Area

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

Subcatchment 2SA-PR: Proposed 2SA



Summary for Subcatchment 2SB-PR: Proposed 2SB

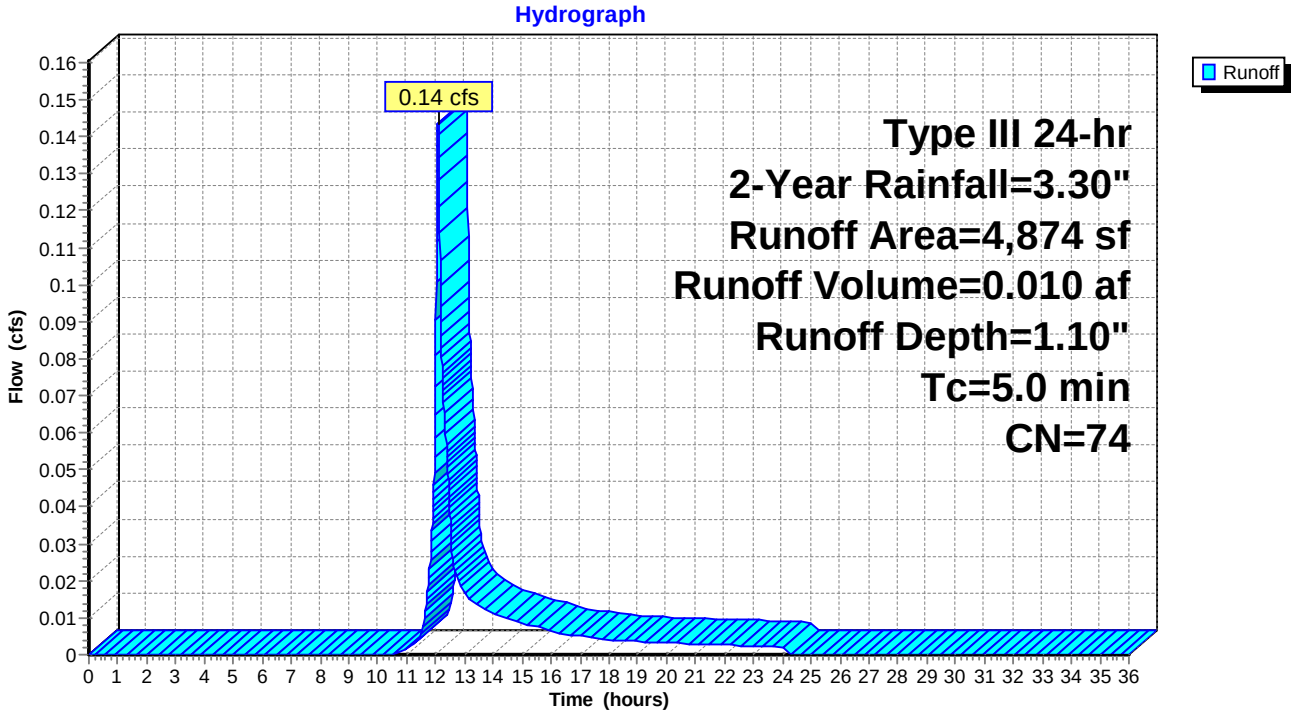
Runoff = 0.14 cfs @ 12.08 hrs, Volume= 0.010 af, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
4,856	74	>75% Grass cover, Good, HSG C
18	98	Unconnected pavement, HSG C
4,874	74	Weighted Average
4,856		99.63% Pervious Area
18		0.37% Impervious Area
18		100.00% Unconnected

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

Subcatchment 2SB-PR: Proposed 2SB



Summary for Pond 2P: Subsurface Infiltration System

Inflow Area = 0.978 ac, 78.69% Impervious, Inflow Depth = 2.54" for 2-Year event
Inflow = 2.92 cfs @ 12.07 hrs, Volume= 0.207 af
Outflow = 1.92 cfs @ 12.15 hrs, Volume= 0.204 af, Atten= 34%, Lag= 4.9 min
Discarded = 0.01 cfs @ 12.15 hrs, Volume= 0.008 af
Primary = 1.92 cfs @ 12.15 hrs, Volume= 0.196 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 74.64' @ 12.15 hrs Surf.Area= 776 sf Storage= 1,225 cf

Plug-Flow detention time= 42.7 min calculated for 0.204 af (99% of inflow)
Center-of-Mass det. time= 34.2 min (824.8 - 790.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.25'	1,372 cf	**28.50'W x 27.24'L x 6.75'H Field A** 5,241 cf Overall - 1,812 cf Embedded = 3,429 cf x 40.0% Voids
#2A	73.00'	1,812 cf	**ADS_StormTech MC-4500 +Cap** x 15 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 3 Rows of 5 Chambers Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf
		3,183 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	66.20'	**12.0" Round Culvert** L= 9.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 66.20' / 66.00' S= 0.0222 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	77.75'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height
#3	Device 1	73.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	75.10'	**8.0" Vert. Orifice/Grate** C= 0.600
#5	Discarded	72.25'	**0.100 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 71.25'

Discarded OutFlow Max=0.01 cfs @ 12.15 hrs HW=74.63' (Free Discharge)
└**5=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=1.92 cfs @ 12.15 hrs HW=74.63' (Free Discharge)
└**1=Culvert** (Passes 1.92 cfs of 10.65 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Orifice Controls 1.92 cfs @ 5.49 fps)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: Subsurface Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

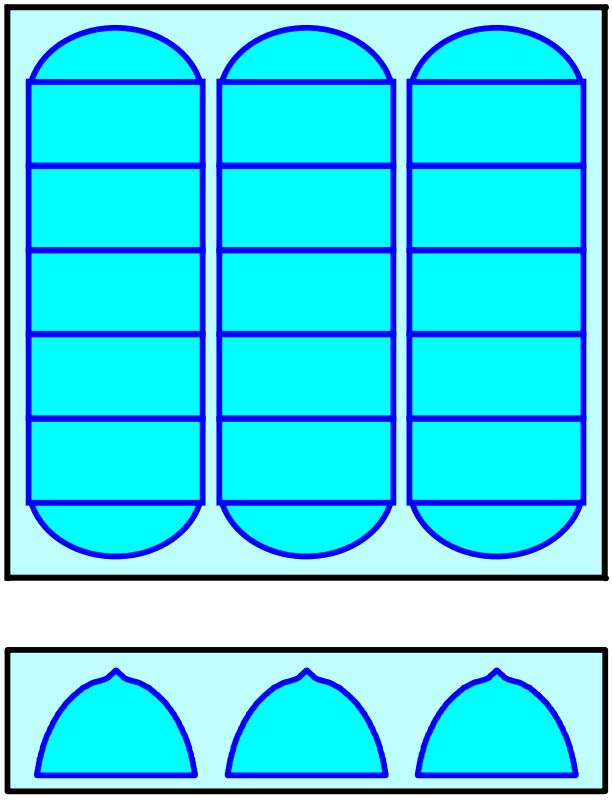
5 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 25.24' Row Length +12.0" End Stone x 2 = 27.24' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

15 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 3 Rows = 1,811.6 cf Chamber Storage

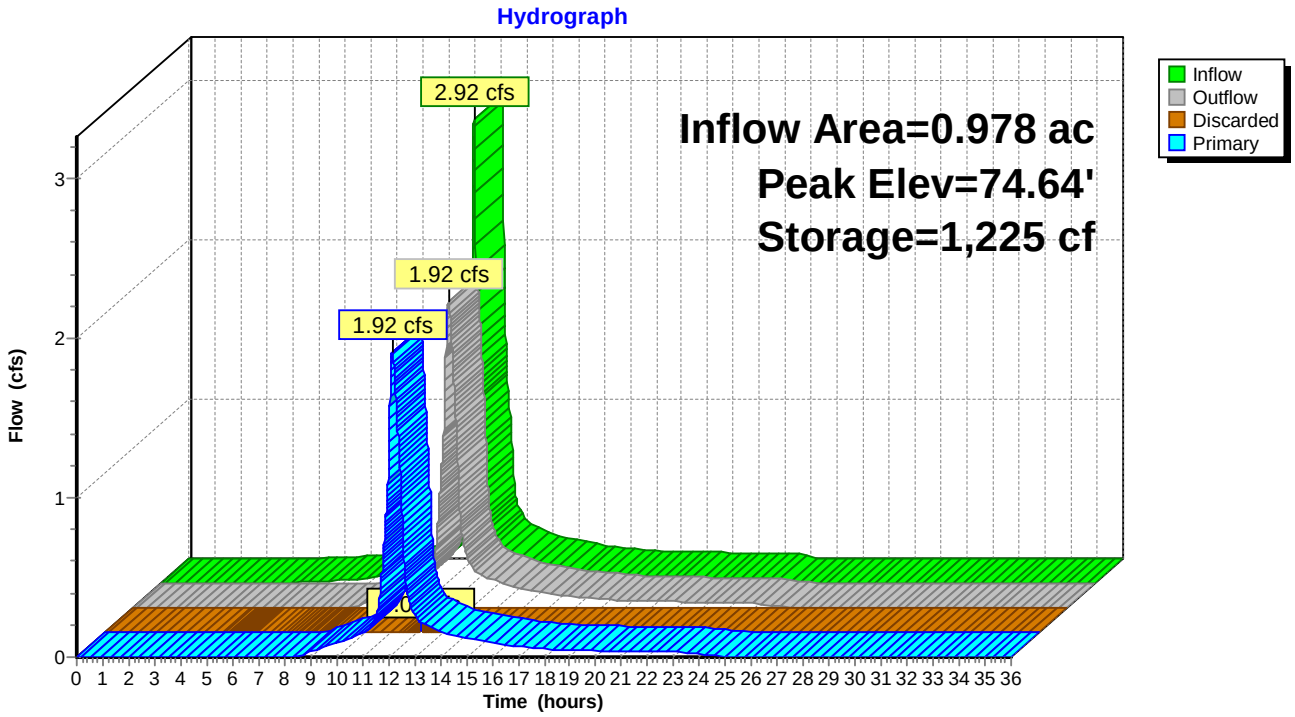
5,240.6 cf Field - 1,811.6 cf Chambers = 3,429.1 cf Stone x 40.0% Voids = 1,371.6 cf Stone Storage

Chamber Storage + Stone Storage = 3,183.2 cf = 0.073 af
Overall Storage Efficiency = 60.7%
Overall System Size = 27.24' x 28.50' x 6.75'

15 Chambers
194.1 cy Field
127.0 cy Stone



Pond 2P: Subsurface Infiltration System

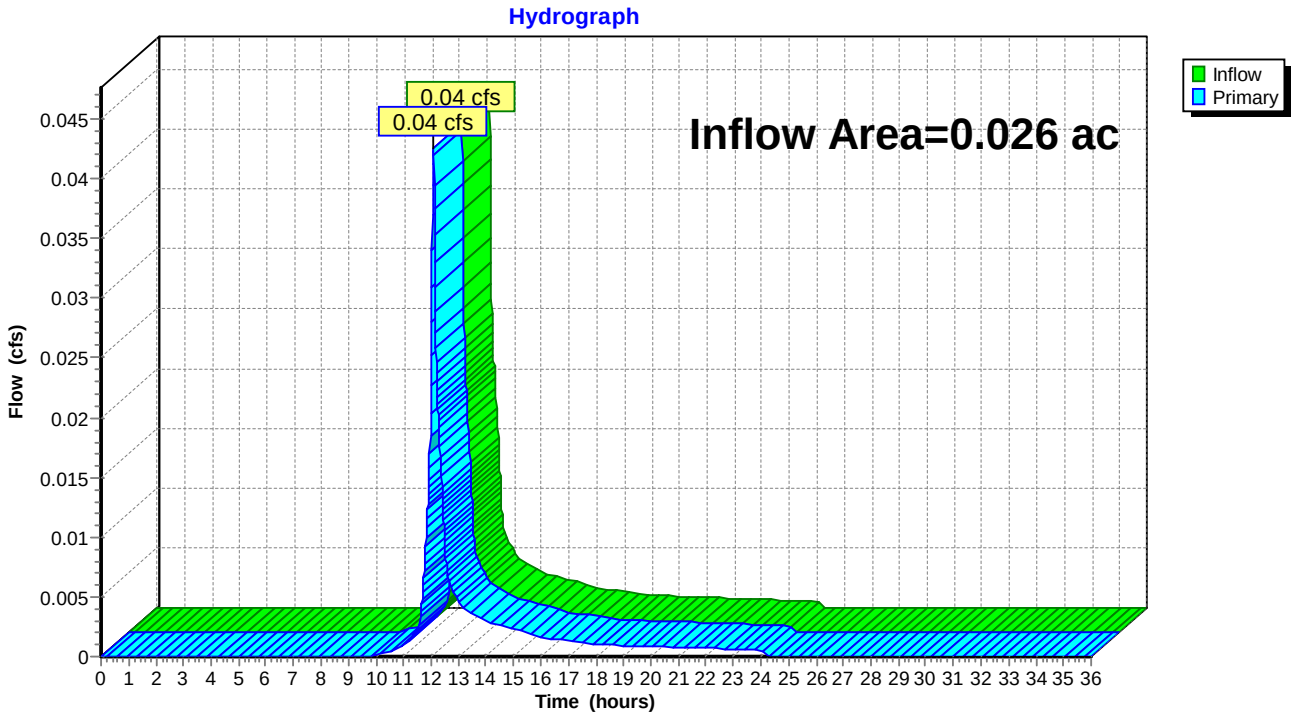


Summary for Link 1L-PR: 396 Washington (Southwest)

Inflow Area = 0.026 ac, 18.59% Impervious, Inflow Depth = 1.35" for 2-Year event
Inflow = 0.04 cfs @ 12.08 hrs, Volume= 0.003 af
Primary = 0.04 cfs @ 12.08 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1L-PR: 396 Washington (Southwest)

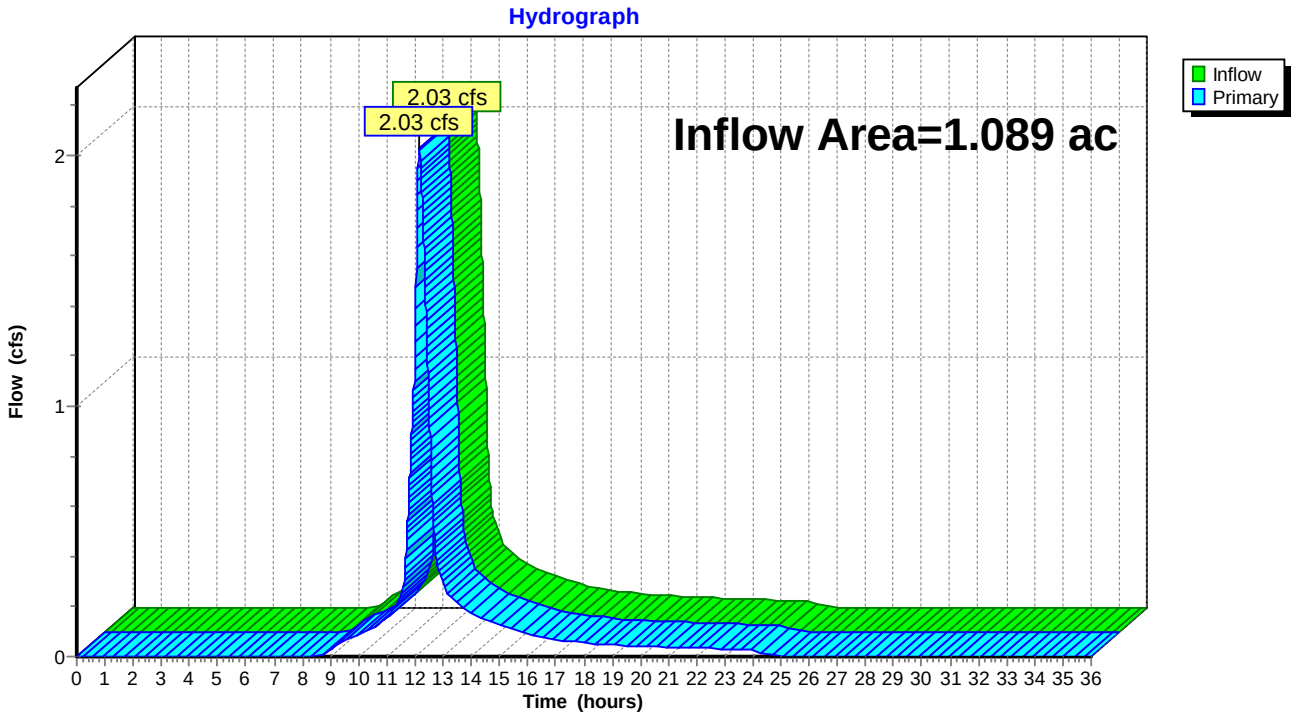


Summary for Link 2L-PR: Adjacent Property (Northwest)

Inflow Area = 1.089 ac, 70.65% Impervious, Inflow Depth = 2.28" for 2-Year event
Inflow = 2.03 cfs @ 12.14 hrs, Volume= 0.207 af
Primary = 2.03 cfs @ 12.14 hrs, Volume= 0.207 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2L-PR: Adjacent Property (Northwest)



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-PR: Proposed 1S Runoff Area=1,151 sf 18.59% Impervious Runoff Depth=2.53"
Tc=5.0 min CN=78 Runoff=0.08 cfs 0.006 af

Subcatchment 2SA-PR: Proposed 2SA Runoff Area=42,582 sf 78.69% Impervious Runoff Depth=3.98"
Tc=5.0 min CN=93 Runoff=4.46 cfs 0.324 af

Subcatchment 2SB-PR: Proposed 2SB Runoff Area=4,874 sf 0.37% Impervious Runoff Depth=2.19"
Tc=5.0 min CN=74 Runoff=0.30 cfs 0.020 af

Pond 2P: Subsurface Infiltration System Peak Elev=75.62' Storage=1,789 cf Inflow=4.46 cfs 0.324 af
Discarded=0.01 cfs 0.009 af Primary=3.27 cfs 0.313 af Outflow=3.28 cfs 0.321 af

Link 1L-PR: 396 Washington (Southwest) Inflow=0.08 cfs 0.006 af
Primary=0.08 cfs 0.006 af

Link 2L-PR: Adjacent Property (Northwest) Inflow=3.50 cfs 0.333 af
Primary=3.50 cfs 0.333 af

Total Runoff Area = 1.116 ac Runoff Volume = 0.350 af Average Runoff Depth = 3.77"
30.59% Pervious = 0.341 ac 69.41% Impervious = 0.775 ac

Summary for Subcatchment 1S-PR: Proposed 1S

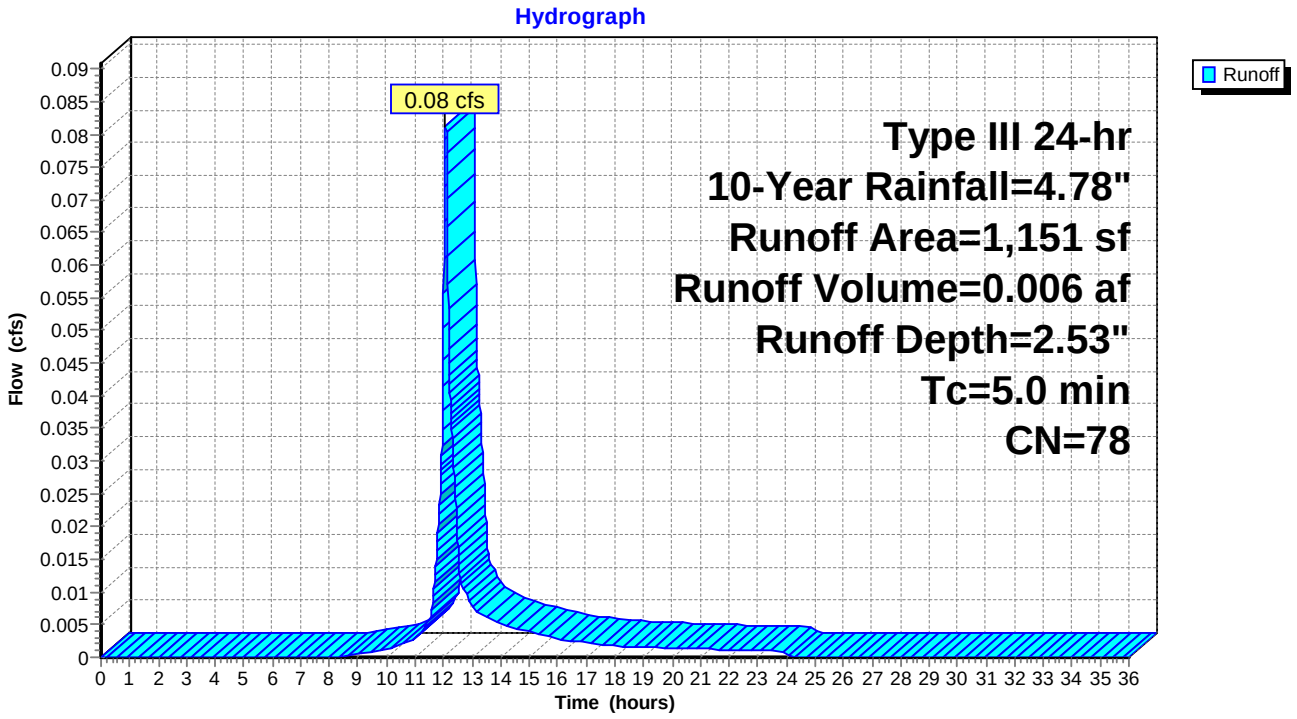
Runoff = 0.08 cfs @ 12.08 hrs, Volume= 0.006 af, Depth= 2.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.78"

Area (sf)	CN	Description
937	74	>75% Grass cover, Good, HSG C
214	98	Paved parking, HSG C
1,151	78	Weighted Average
937		81.41% Pervious Area
214		18.59% Impervious Area

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

Subcatchment 1S-PR: Proposed 1S



Summary for Subcatchment 2SA-PR: Proposed 2SA

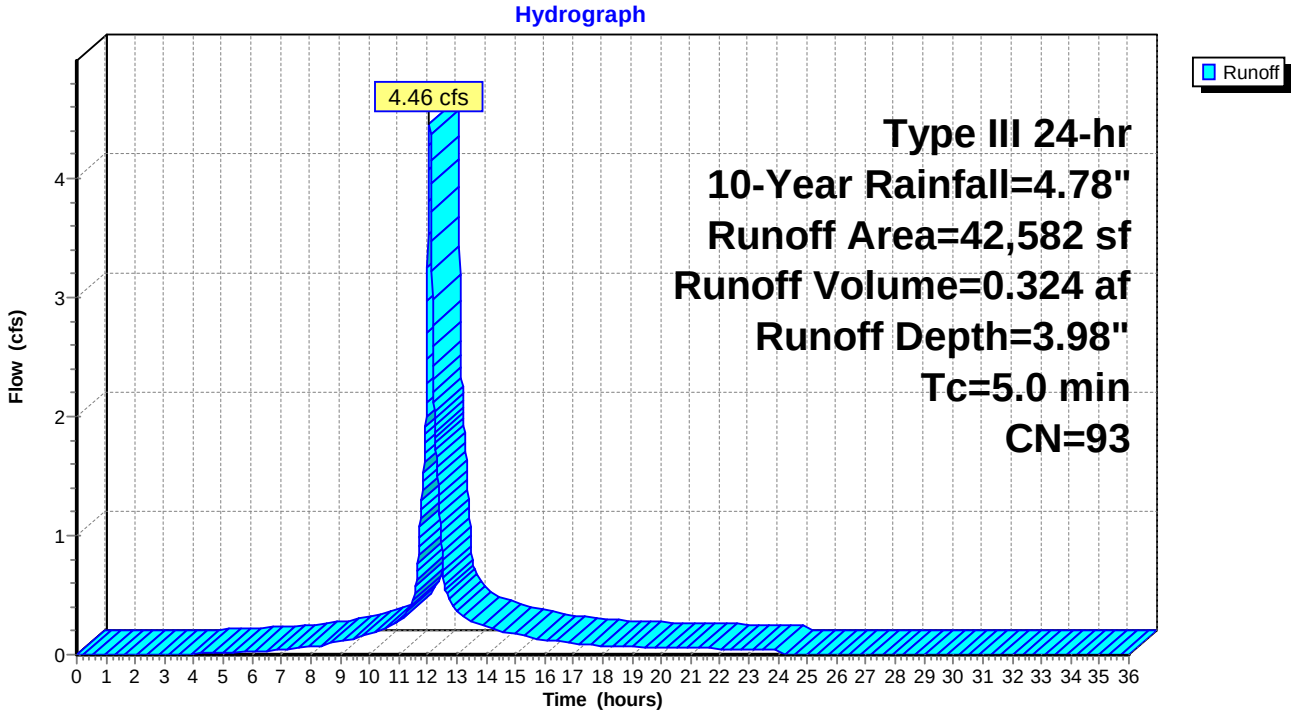
Runoff = 4.46 cfs @ 12.07 hrs, Volume= 0.324 af, Depth= 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.78"

Area (sf)	CN	Description
9,074	74	>75% Grass cover, Good, HSG C
26,300	98	Paved parking, HSG C
7,208	98	Roofs, HSG C
42,582	93	Weighted Average
9,074		21.31% Pervious Area
33,508		78.69% Impervious Area

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

Subcatchment 2SA-PR: Proposed 2SA



Summary for Subcatchment 2SB-PR: Proposed 2SB

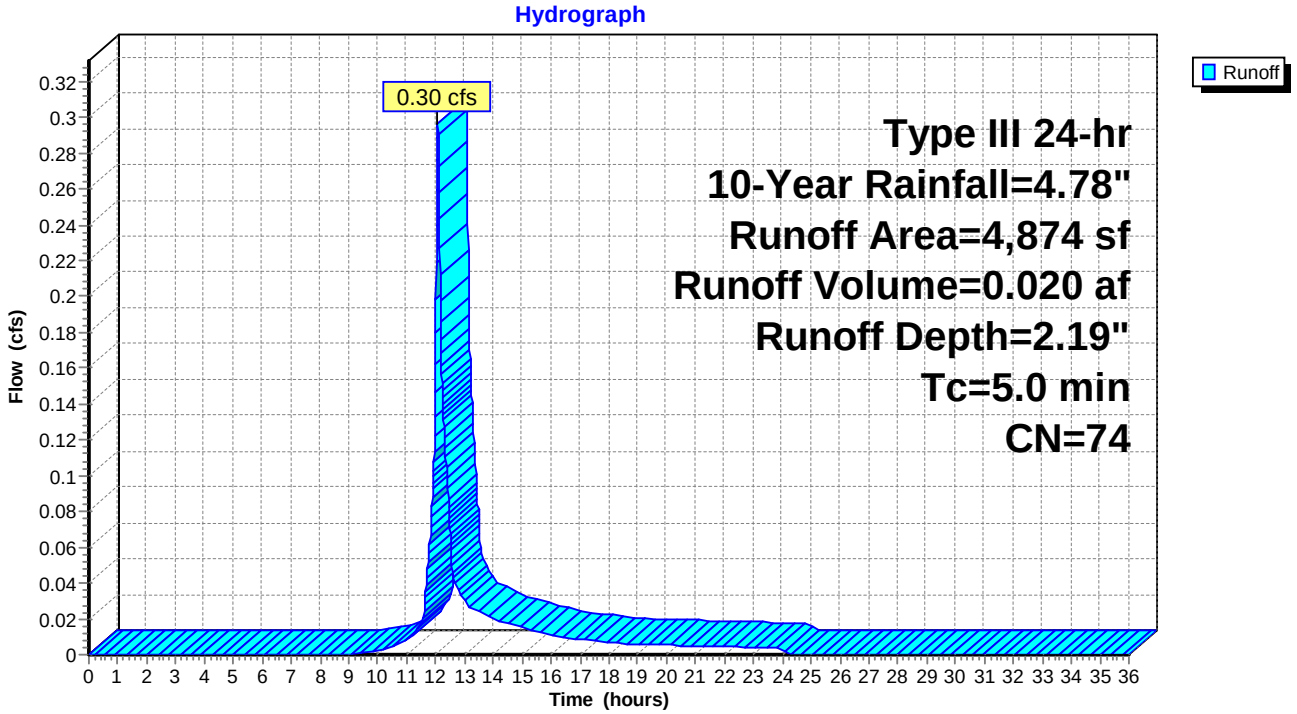
Runoff = 0.30 cfs @ 12.08 hrs, Volume= 0.020 af, Depth= 2.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.78"

Area (sf)	CN	Description
4,856	74	>75% Grass cover, Good, HSG C
18	98	Unconnected pavement, HSG C
4,874	74	Weighted Average
4,856		99.63% Pervious Area
18		0.37% Impervious Area
18		100.00% Unconnected

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

Subcatchment 2SB-PR: Proposed 2SB



Summary for Pond 2P: Subsurface Infiltration System

Inflow Area = 0.978 ac, 78.69% Impervious, Inflow Depth = 3.98" for 10-Year event
Inflow = 4.46 cfs @ 12.07 hrs, Volume= 0.324 af
Outflow = 3.28 cfs @ 12.14 hrs, Volume= 0.321 af, Atten= 27%, Lag= 4.0 min
Discarded = 0.01 cfs @ 12.14 hrs, Volume= 0.009 af
Primary = 3.27 cfs @ 12.14 hrs, Volume= 0.313 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 75.62' @ 12.14 hrs Surf.Area= 776 sf Storage= 1,789 cf

Plug-Flow detention time= 32.3 min calculated for 0.321 af (99% of inflow)
Center-of-Mass det. time= 26.6 min (805.4 - 778.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.25'	1,372 cf	**28.50'W x 27.24'L x 6.75'H Field A** 5,241 cf Overall - 1,812 cf Embedded = 3,429 cf x 40.0% Voids
#2A	73.00'	1,812 cf	**ADS_StormTech MC-4500 +Cap** x 15 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 3 Rows of 5 Chambers Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf
		3,183 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	66.20'	**12.0" Round Culvert** L= 9.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 66.20' / 66.00' S= 0.0222 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	77.75'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height
#3	Device 1	73.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	75.10'	**8.0" Vert. Orifice/Grate** C= 0.600
#5	Discarded	72.25'	**0.100 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 71.25'

Discarded OutFlow Max=0.01 cfs @ 12.14 hrs HW=75.62' (Free Discharge)
└**5=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=3.27 cfs @ 12.14 hrs HW=75.62' (Free Discharge)
└**1=Culvert** (Passes 3.27 cfs of 11.30 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Orifice Controls 2.54 cfs @ 7.29 fps)
  └**4=Orifice/Grate** (Orifice Controls 0.72 cfs @ 2.46 fps)

Pond 2P: Subsurface Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

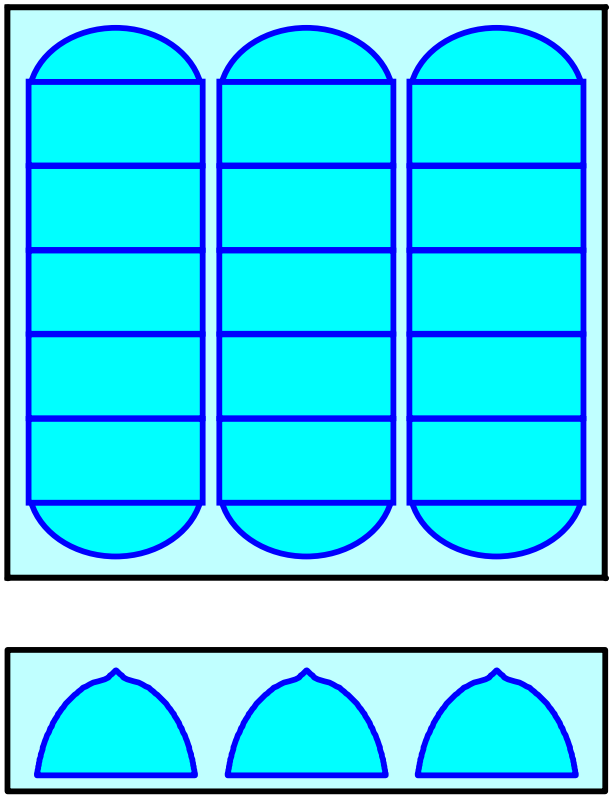
5 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 25.24' Row Length +12.0" End Stone x 2 = 27.24' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

15 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 3 Rows = 1,811.6 cf Chamber Storage

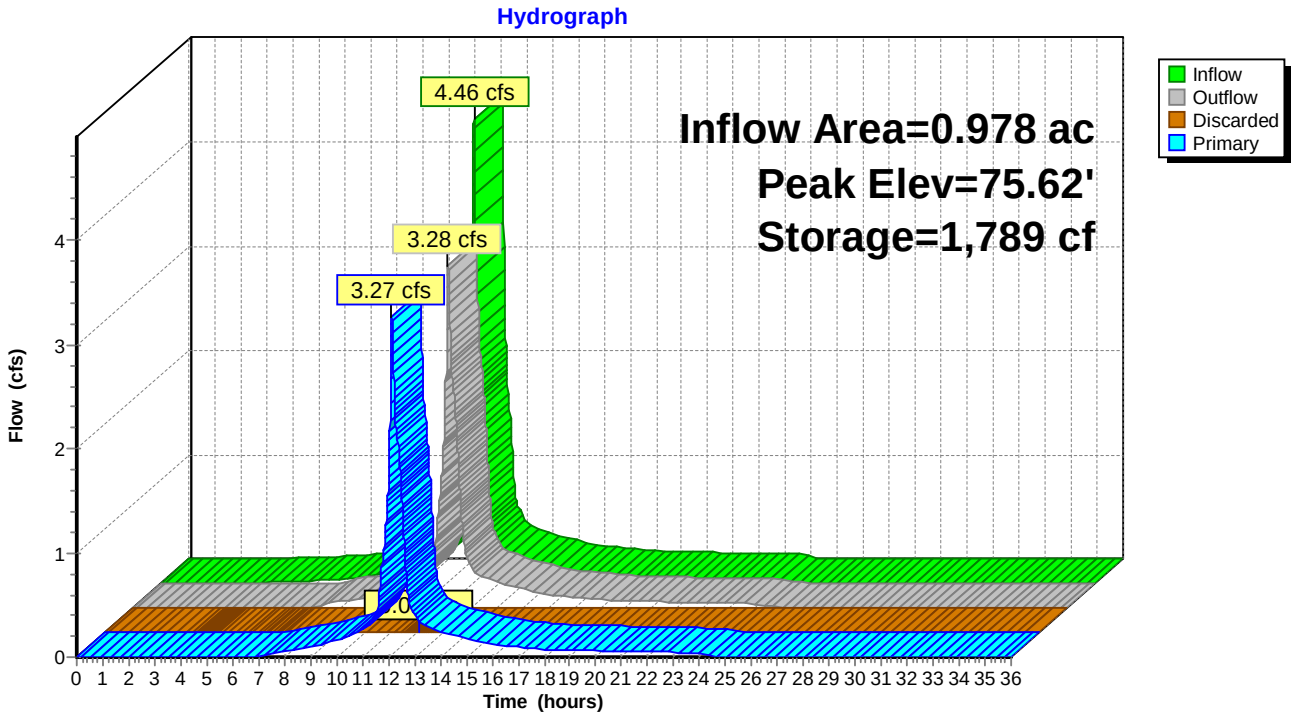
5,240.6 cf Field - 1,811.6 cf Chambers = 3,429.1 cf Stone x 40.0% Voids = 1,371.6 cf Stone Storage

Chamber Storage + Stone Storage = 3,183.2 cf = 0.073 af
Overall Storage Efficiency = 60.7%
Overall System Size = 27.24' x 28.50' x 6.75'

15 Chambers
194.1 cy Field
127.0 cy Stone



Pond 2P: Subsurface Infiltration System

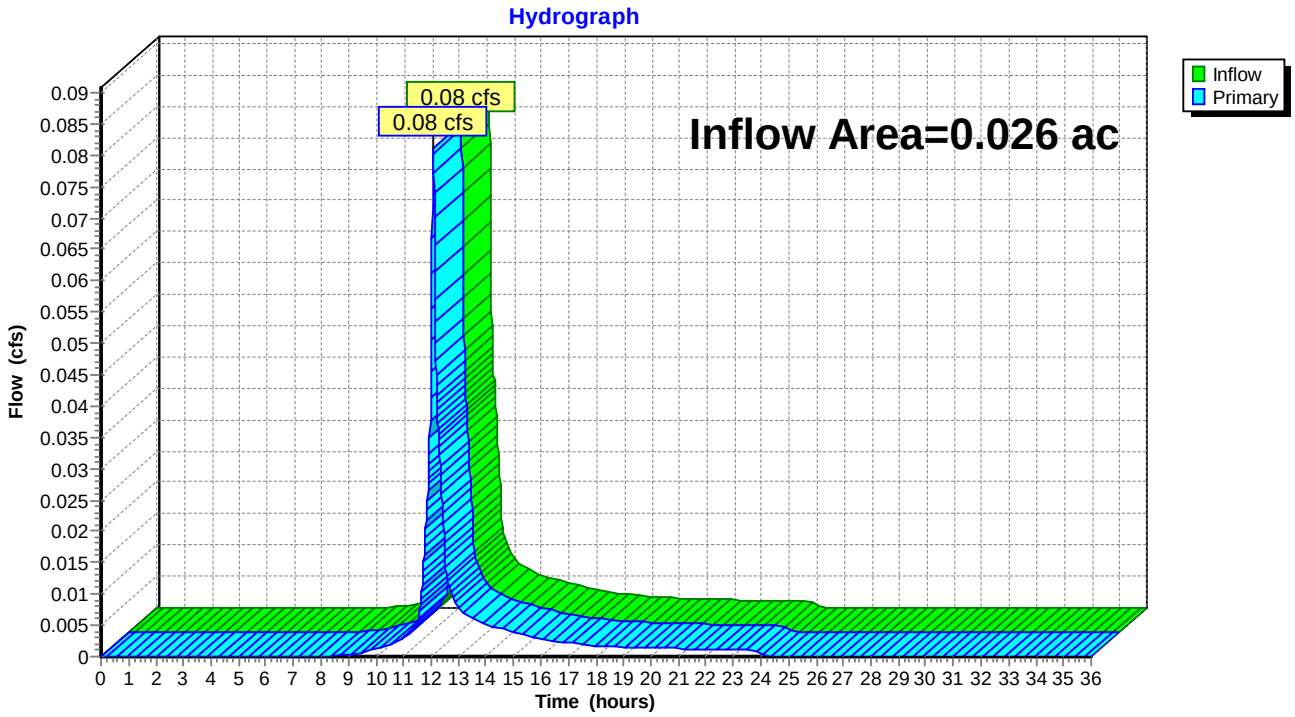


Summary for Link 1L-PR: 396 Washington (Southwest)

Inflow Area = 0.026 ac, 18.59% Impervious, Inflow Depth = 2.53" for 10-Year event
Inflow = 0.08 cfs @ 12.08 hrs, Volume= 0.006 af
Primary = 0.08 cfs @ 12.08 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1L-PR: 396 Washington (Southwest)

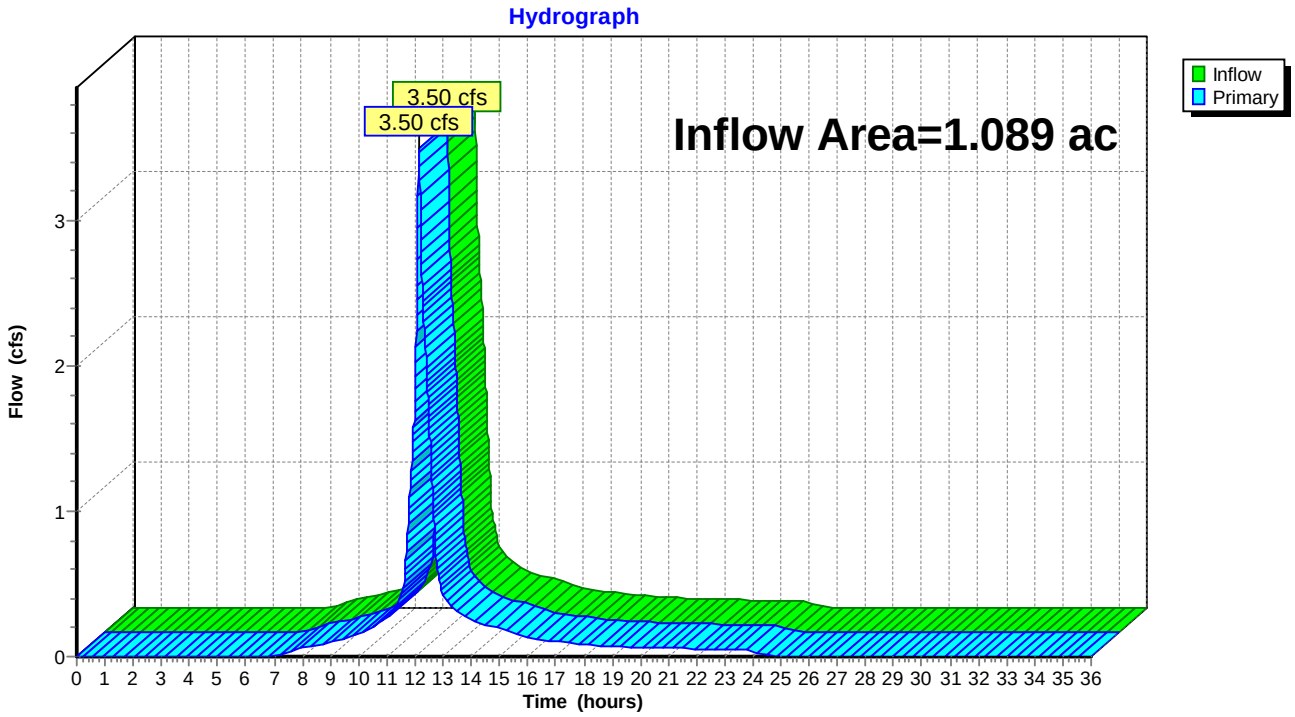


Summary for Link 2L-PR: Adjacent Property (Northwest)

Inflow Area = 1.089 ac, 70.65% Impervious, Inflow Depth = 3.67" for 10-Year event
Inflow = 3.50 cfs @ 12.13 hrs, Volume= 0.333 af
Primary = 3.50 cfs @ 12.13 hrs, Volume= 0.333 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2L-PR: Adjacent Property (Northwest)



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-PR: Proposed 1S Runoff Area=1,151 sf 18.59% Impervious Runoff Depth=3.50"
Tc=5.0 min CN=78 Runoff=0.11 cfs 0.008 af

Subcatchment 2SA-PR: Proposed 2SA Runoff Area=42,582 sf 78.69% Impervious Runoff Depth=5.09"
Tc=5.0 min CN=93 Runoff=5.62 cfs 0.415 af

Subcatchment 2SB-PR: Proposed 2SB Runoff Area=4,874 sf 0.37% Impervious Runoff Depth=3.11"
Tc=5.0 min CN=74 Runoff=0.42 cfs 0.029 af

Pond 2P: Subsurface Infiltration System Peak Elev=76.21' Storage=2,102 cf Inflow=5.62 cfs 0.415 af
Discarded=0.01 cfs 0.009 af Primary=4.33 cfs 0.403 af Outflow=4.34 cfs 0.412 af

Link 1L-PR: 396 Washington (Southwest) Inflow=0.11 cfs 0.008 af
Primary=0.11 cfs 0.008 af

Link 2L-PR: Adjacent Property (Northwest) Inflow=4.68 cfs 0.432 af
Primary=4.68 cfs 0.432 af

Total Runoff Area = 1.116 ac Runoff Volume = 0.452 af Average Runoff Depth = 4.86"
30.59% Pervious = 0.341 ac 69.41% Impervious = 0.775 ac

Summary for Subcatchment 1S-PR: Proposed 1S

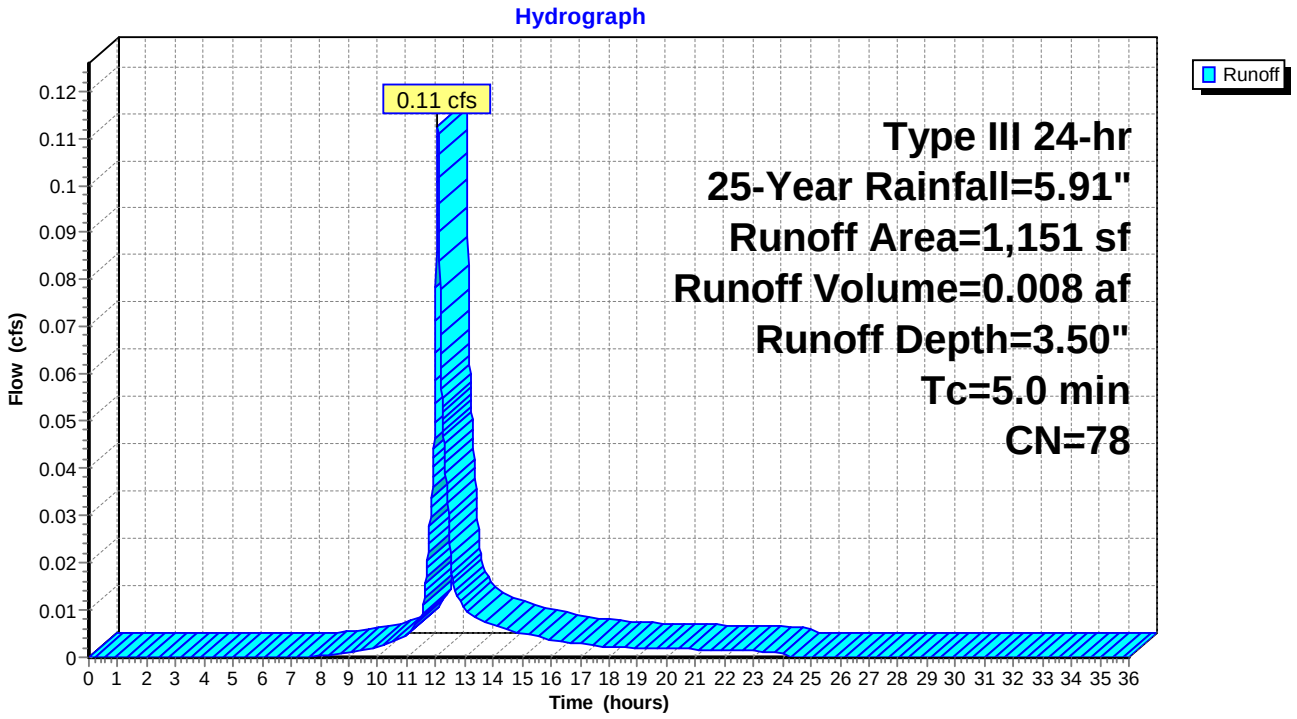
Runoff = 0.11 cfs @ 12.07 hrs, Volume= 0.008 af, Depth= 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.91"

Area (sf)	CN	Description
937	74	>75% Grass cover, Good, HSG C
214	98	Paved parking, HSG C
1,151	78	Weighted Average
937		81.41% Pervious Area
214		18.59% Impervious Area

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

Subcatchment 1S-PR: Proposed 1S



Summary for Subcatchment 2SA-PR: Proposed 2SA

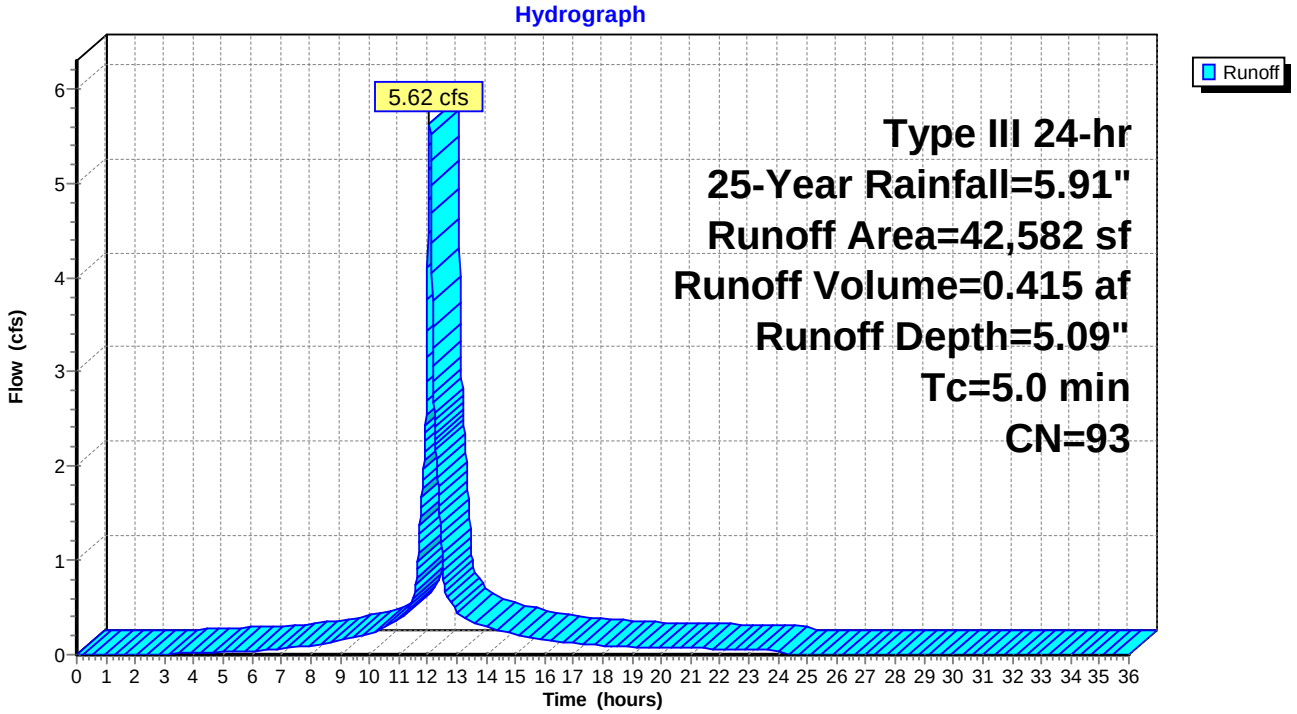
Runoff = 5.62 cfs @ 12.07 hrs, Volume= 0.415 af, Depth= 5.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.91"

Area (sf)	CN	Description
9,074	74	>75% Grass cover, Good, HSG C
26,300	98	Paved parking, HSG C
7,208	98	Roofs, HSG C
42,582	93	Weighted Average
9,074		21.31% Pervious Area
33,508		78.69% Impervious Area

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

Subcatchment 2SA-PR: Proposed 2SA



Summary for Subcatchment 2SB-PR: Proposed 2SB

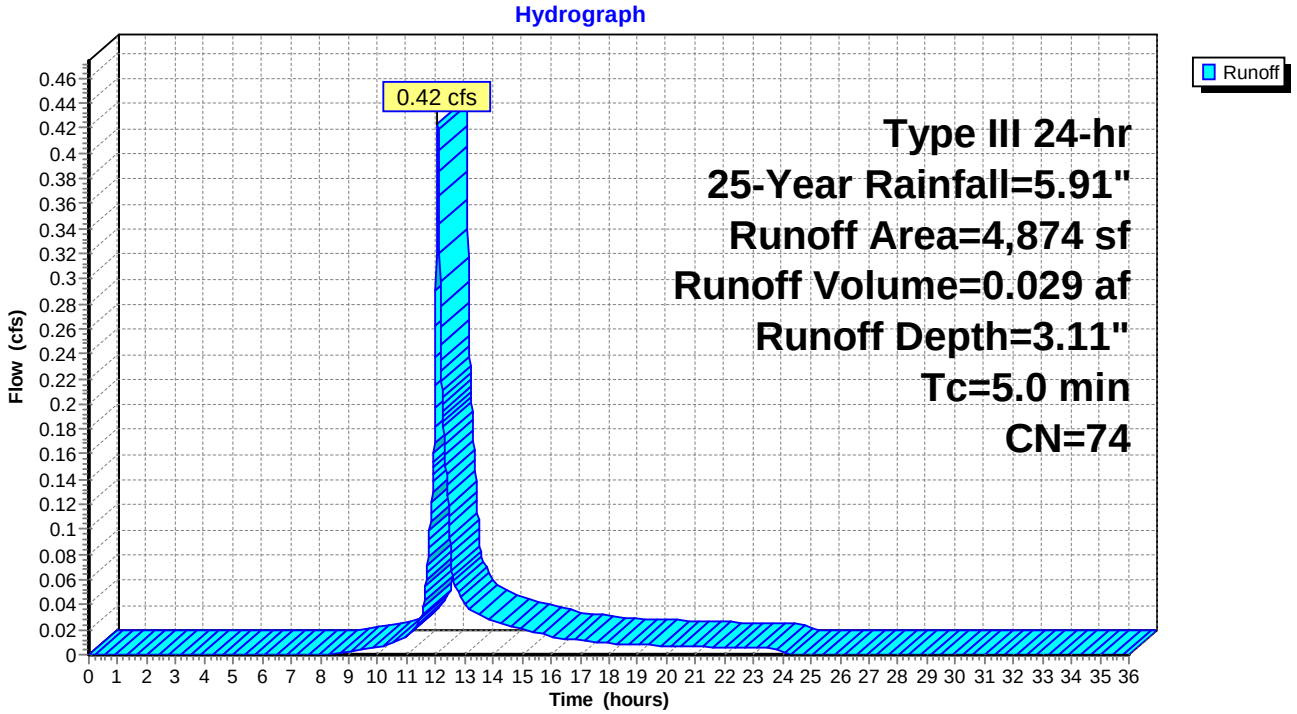
Runoff = 0.42 cfs @ 12.08 hrs, Volume= 0.029 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.91"

Area (sf)	CN	Description
4,856	74	>75% Grass cover, Good, HSG C
18	98	Unconnected pavement, HSG C
4,874	74	Weighted Average
4,856		99.63% Pervious Area
18		0.37% Impervious Area
18		100.00% Unconnected

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

Subcatchment 2SB-PR: Proposed 2SB



Summary for Pond 2P: Subsurface Infiltration System

Inflow Area = 0.978 ac, 78.69% Impervious, Inflow Depth = 5.09" for 25-Year event
Inflow = 5.62 cfs @ 12.07 hrs, Volume= 0.415 af
Outflow = 4.34 cfs @ 12.13 hrs, Volume= 0.412 af, Atten= 23%, Lag= 3.6 min
Discarded = 0.01 cfs @ 12.13 hrs, Volume= 0.009 af
Primary = 4.33 cfs @ 12.13 hrs, Volume= 0.403 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 76.21' @ 12.13 hrs Surf.Area= 776 sf Storage= 2,102 cf

Plug-Flow detention time= 27.6 min calculated for 0.412 af (99% of inflow)
Center-of-Mass det. time= 23.2 min (795.7 - 772.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.25'	1,372 cf	**28.50'W x 27.24'L x 6.75'H Field A** 5,241 cf Overall - 1,812 cf Embedded = 3,429 cf x 40.0% Voids
#2A	73.00'	1,812 cf	**ADS_StormTech MC-4500 +Cap** x 15 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 3 Rows of 5 Chambers Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf
		3,183 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	66.20'	**12.0" Round Culvert** L= 9.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 66.20' / 66.00' S= 0.0222 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	77.75'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height
#3	Device 1	73.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	75.10'	**8.0" Vert. Orifice/Grate** C= 0.600
#5	Discarded	72.25'	**0.100 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 71.25'

Discarded OutFlow Max=0.01 cfs @ 12.13 hrs HW=76.21' (Free Discharge)
└**5=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=4.33 cfs @ 12.13 hrs HW=76.21' (Free Discharge)
└**1=Culvert** (Passes 4.33 cfs of 11.66 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Orifice Controls 2.85 cfs @ 8.16 fps)
  └**4=Orifice/Grate** (Orifice Controls 1.48 cfs @ 4.23 fps)

Pond 2P: Subsurface Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

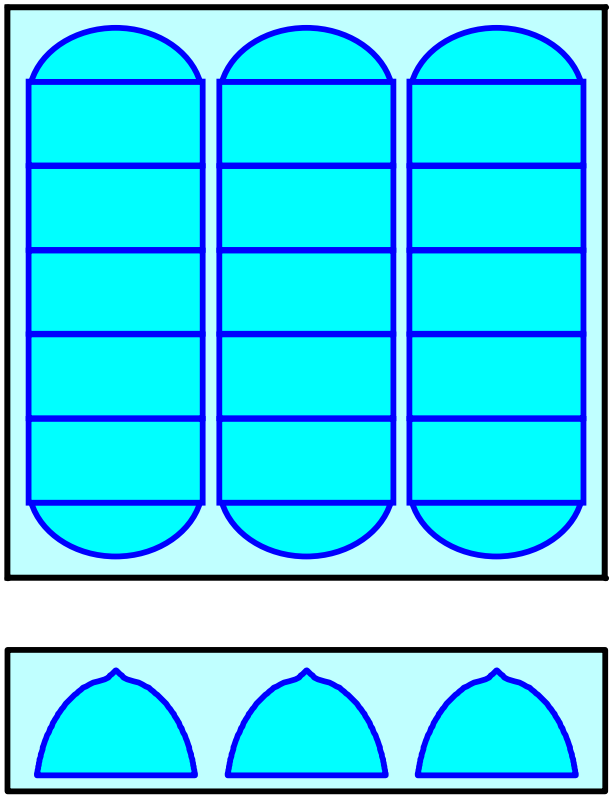
5 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 25.24' Row Length +12.0" End Stone x 2 = 27.24' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

15 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 3 Rows = 1,811.6 cf Chamber Storage

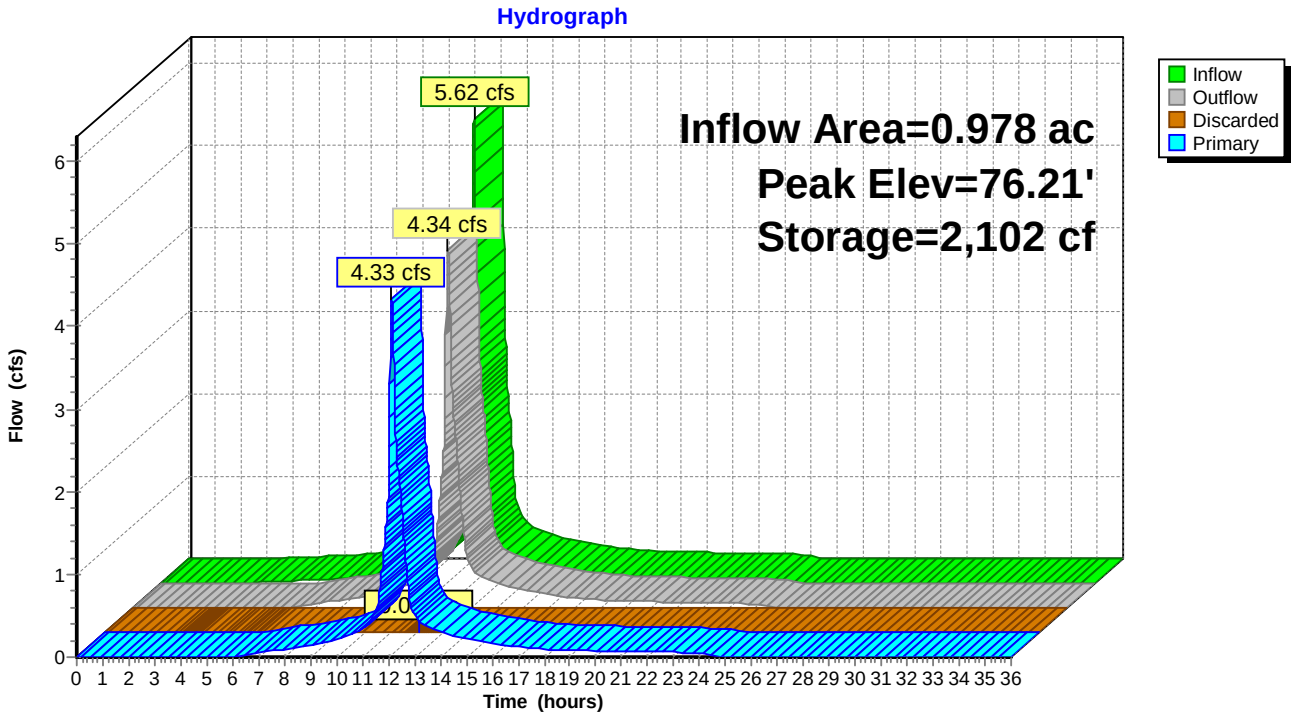
5,240.6 cf Field - 1,811.6 cf Chambers = 3,429.1 cf Stone x 40.0% Voids = 1,371.6 cf Stone Storage

Chamber Storage + Stone Storage = 3,183.2 cf = 0.073 af
Overall Storage Efficiency = 60.7%
Overall System Size = 27.24' x 28.50' x 6.75'

15 Chambers
194.1 cy Field
127.0 cy Stone



Pond 2P: Subsurface Infiltration System

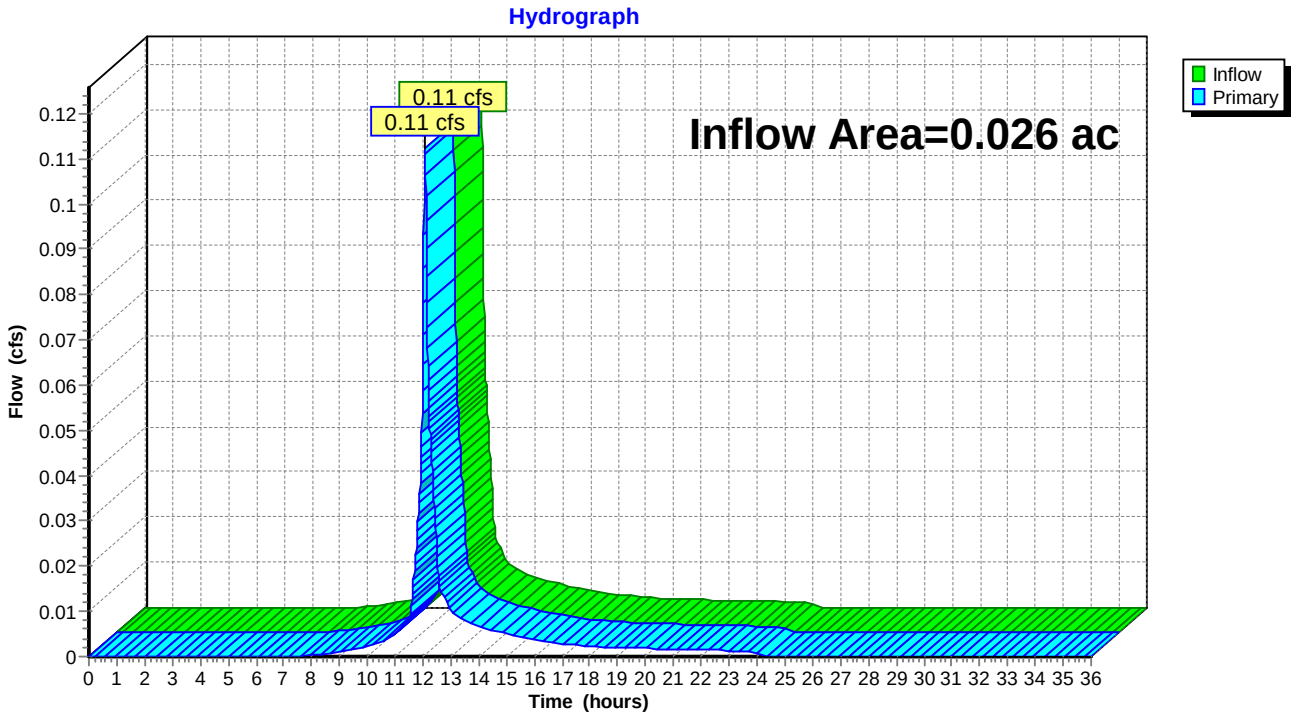


Summary for Link 1L-PR: 396 Washington (Southwest)

Inflow Area = 0.026 ac, 18.59% Impervious, Inflow Depth = 3.50" for 25-Year event
Inflow = 0.11 cfs @ 12.07 hrs, Volume= 0.008 af
Primary = 0.11 cfs @ 12.07 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1L-PR: 396 Washington (Southwest)

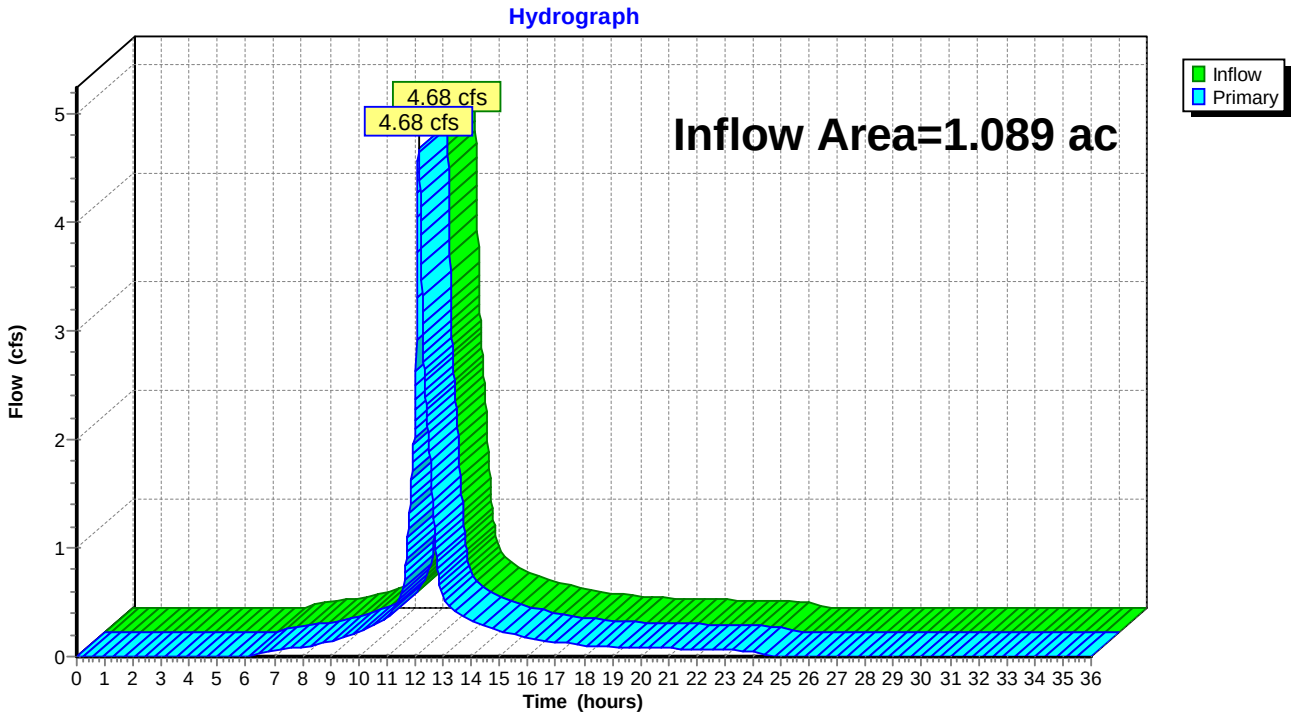


Summary for Link 2L-PR: Adjacent Property (Northwest)

Inflow Area = 1.089 ac, 70.65% Impervious, Inflow Depth = 4.76" for 25-Year event
Inflow = 4.68 cfs @ 12.12 hrs, Volume= 0.432 af
Primary = 4.68 cfs @ 12.12 hrs, Volume= 0.432 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2L-PR: Adjacent Property (Northwest)



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S-PR: Proposed 1S Runoff Area=1,151 sf 18.59% Impervious Runoff Depth=5.54"
Tc=5.0 min CN=78 Runoff=0.18 cfs 0.012 af

Subcatchment 2SA-PR: Proposed 2SA Runoff Area=42,582 sf 78.69% Impervious Runoff Depth=7.32"
Tc=5.0 min CN=93 Runoff=7.92 cfs 0.596 af

Subcatchment 2SB-PR: Proposed 2SB Runoff Area=4,874 sf 0.37% Impervious Runoff Depth=5.07"
Tc=5.0 min CN=74 Runoff=0.69 cfs 0.047 af

Pond 2P: Subsurface Infiltration System Peak Elev=77.72' Storage=2,780 cf Inflow=7.92 cfs 0.596 af
Discarded=0.01 cfs 0.009 af Primary=6.06 cfs 0.584 af Outflow=6.07 cfs 0.593 af

Link 1L-PR: 396 Washington (Southwest) Inflow=0.18 cfs 0.012 af
Primary=0.18 cfs 0.012 af

Link 2L-PR: Adjacent Property (Northwest) Inflow=6.62 cfs 0.631 af
Primary=6.62 cfs 0.631 af

Total Runoff Area = 1.116 ac Runoff Volume = 0.656 af Average Runoff Depth = 7.05"
30.59% Pervious = 0.341 ac 69.41% Impervious = 0.775 ac

Summary for Subcatchment 1S-PR: Proposed 1S

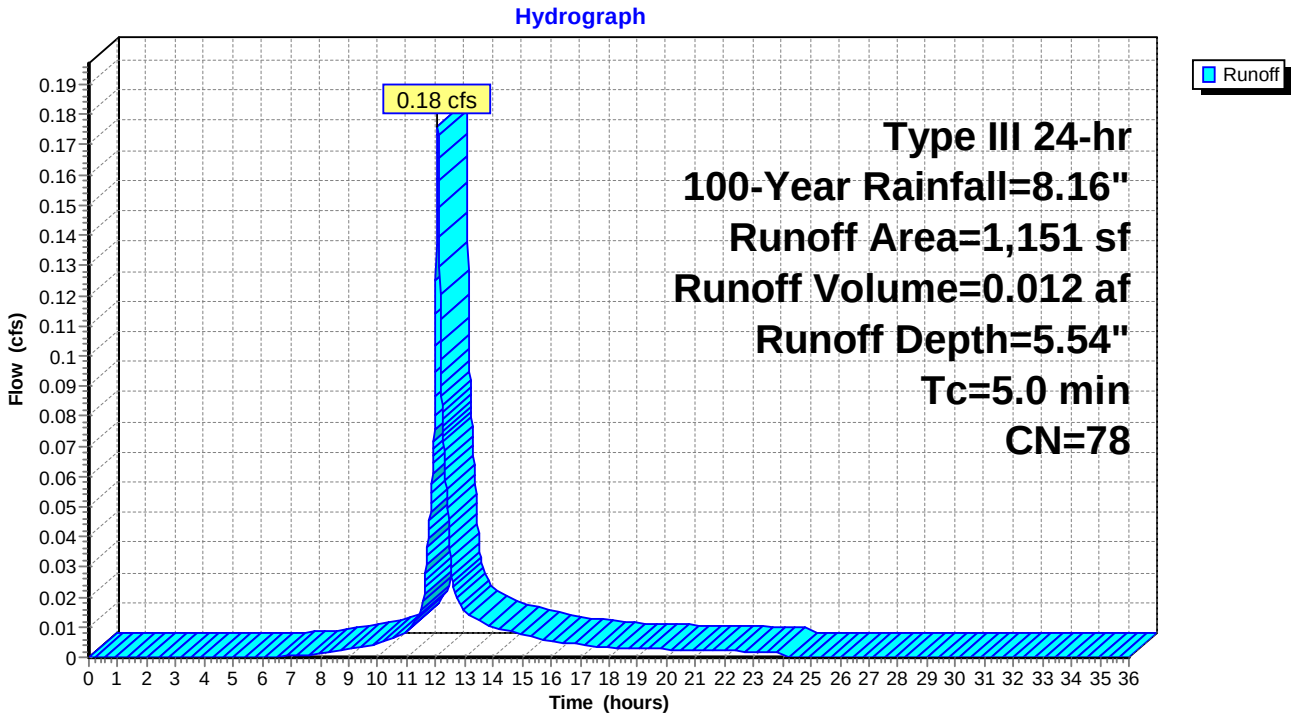
Runoff = 0.18 cfs @ 12.07 hrs, Volume= 0.012 af, Depth= 5.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
937	74	>75% Grass cover, Good, HSG C
214	98	Paved parking, HSG C
1,151	78	Weighted Average
937		81.41% Pervious Area
214		18.59% Impervious Area

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

Subcatchment 1S-PR: Proposed 1S



Summary for Subcatchment 2SA-PR: Proposed 2SA

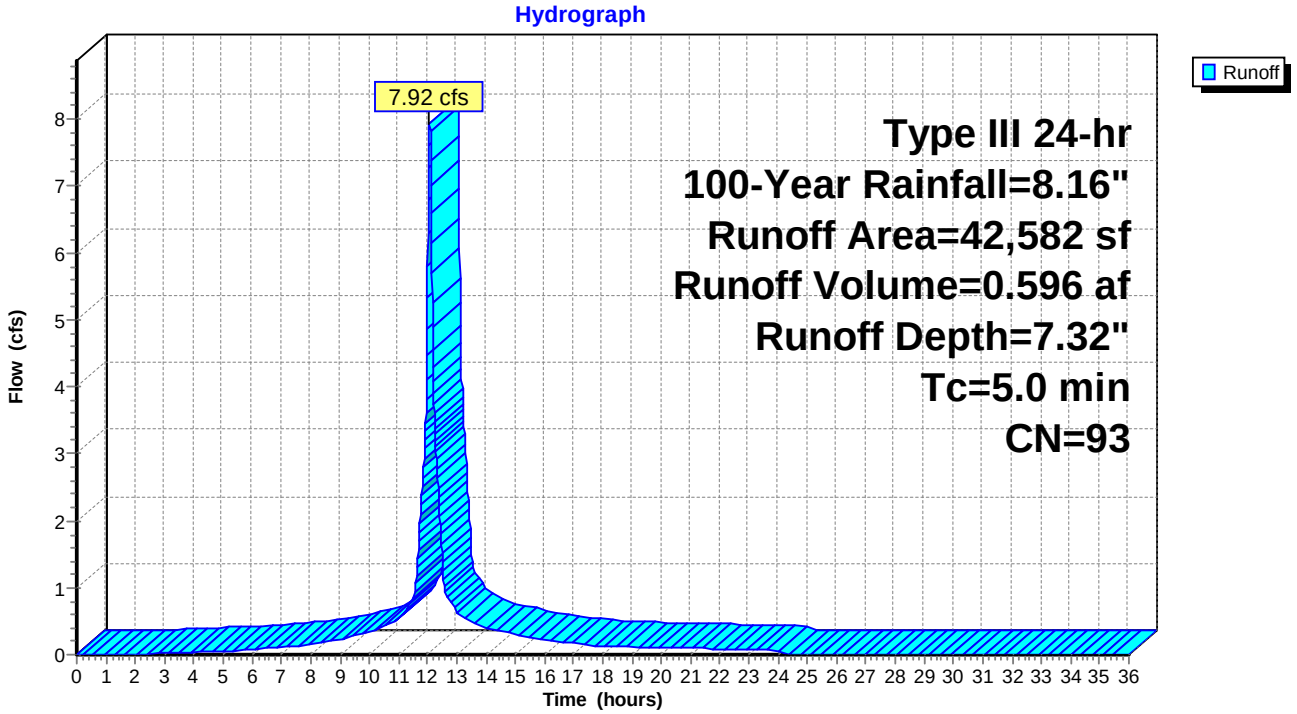
Runoff = 7.92 cfs @ 12.07 hrs, Volume= 0.596 af, Depth= 7.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
9,074	74	>75% Grass cover, Good, HSG C
26,300	98	Paved parking, HSG C
7,208	98	Roofs, HSG C
42,582	93	Weighted Average
9,074		21.31% Pervious Area
33,508		78.69% Impervious Area

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

Subcatchment 2SA-PR: Proposed 2SA



Summary for Subcatchment 2SB-PR: Proposed 2SB

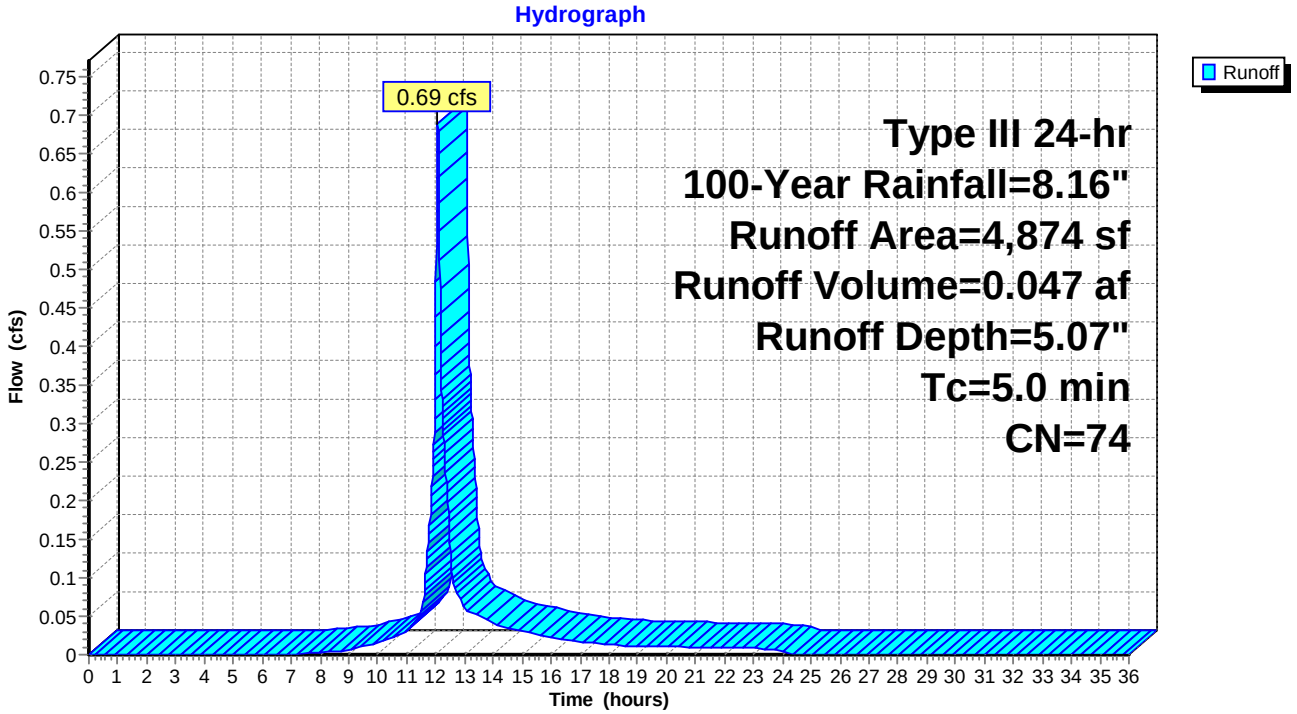
Runoff = 0.69 cfs @ 12.07 hrs, Volume= 0.047 af, Depth= 5.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
4,856	74	>75% Grass cover, Good, HSG C
18	98	Unconnected pavement, HSG C
4,874	74	Weighted Average
4,856		99.63% Pervious Area
18		0.37% Impervious Area
18		100.00% Unconnected

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

Subcatchment 2SB-PR: Proposed 2SB



Summary for Pond 2P: Subsurface Infiltration System

Inflow Area = 0.978 ac, 78.69% Impervious, Inflow Depth = 7.32" for 100-Year event
Inflow = 7.92 cfs @ 12.07 hrs, Volume= 0.596 af
Outflow = 6.07 cfs @ 12.13 hrs, Volume= 0.593 af, Atten= 23%, Lag= 3.7 min
Discarded = 0.01 cfs @ 12.13 hrs, Volume= 0.009 af
Primary = 6.06 cfs @ 12.13 hrs, Volume= 0.584 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 77.72' @ 12.13 hrs Surf.Area= 776 sf Storage= 2,780 cf

Plug-Flow detention time= 22.3 min calculated for 0.593 af (100% of inflow)
Center-of-Mass det. time= 19.0 min (782.9 - 763.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.25'	1,372 cf	**28.50'W x 27.24'L x 6.75'H Field A** 5,241 cf Overall - 1,812 cf Embedded = 3,429 cf x 40.0% Voids
#2A	73.00'	1,812 cf	**ADS_StormTech MC-4500 +Cap** x 15 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 3 Rows of 5 Chambers Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf
		3,183 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	66.20'	**12.0" Round Culvert** L= 9.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 66.20' / 66.00' S= 0.0222 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	77.75'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height
#3	Device 1	73.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	75.10'	**8.0" Vert. Orifice/Grate** C= 0.600
#5	Discarded	72.25'	**0.100 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 71.25'

Discarded OutFlow Max=0.01 cfs @ 12.13 hrs HW=77.71' (Free Discharge)
└**5=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=6.05 cfs @ 12.13 hrs HW=77.71' (Free Discharge)
└**1=Culvert** (Passes 6.05 cfs of 12.55 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Orifice Controls 3.52 cfs @ 10.08 fps)
  └**4=Orifice/Grate** (Orifice Controls 2.54 cfs @ 7.27 fps)

Pond 2P: Subsurface Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

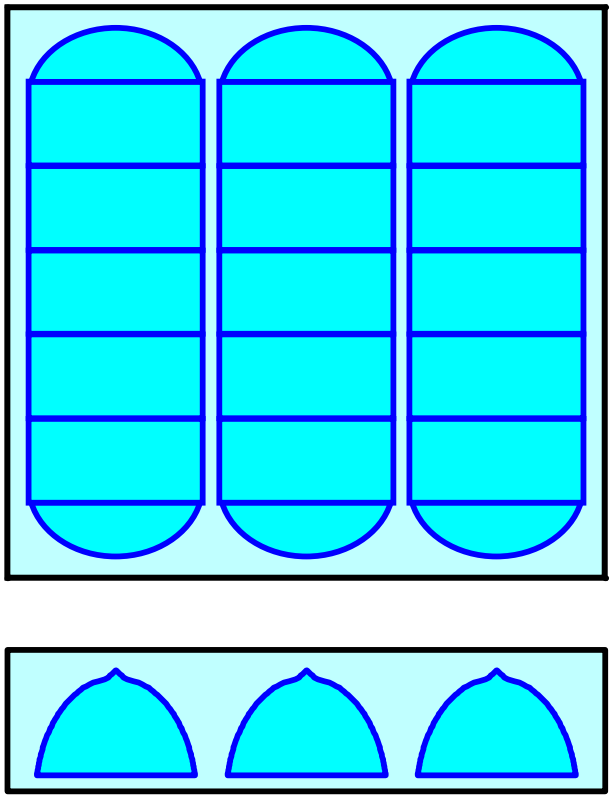
5 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 25.24' Row Length +12.0" End Stone x 2 = 27.24' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

15 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 3 Rows = 1,811.6 cf Chamber Storage

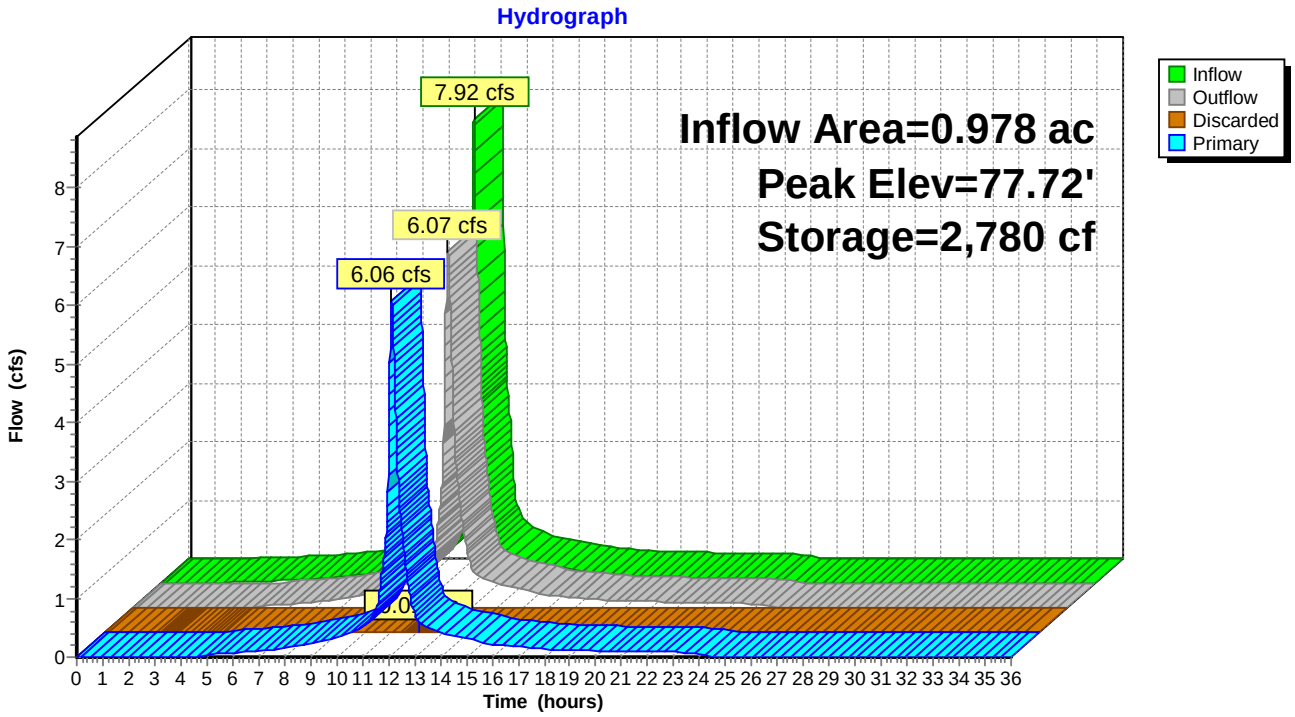
5,240.6 cf Field - 1,811.6 cf Chambers = 3,429.1 cf Stone x 40.0% Voids = 1,371.6 cf Stone Storage

Chamber Storage + Stone Storage = 3,183.2 cf = 0.073 af
Overall Storage Efficiency = 60.7%
Overall System Size = 27.24' x 28.50' x 6.75'

15 Chambers
194.1 cy Field
127.0 cy Stone



Pond 2P: Subsurface Infiltration System

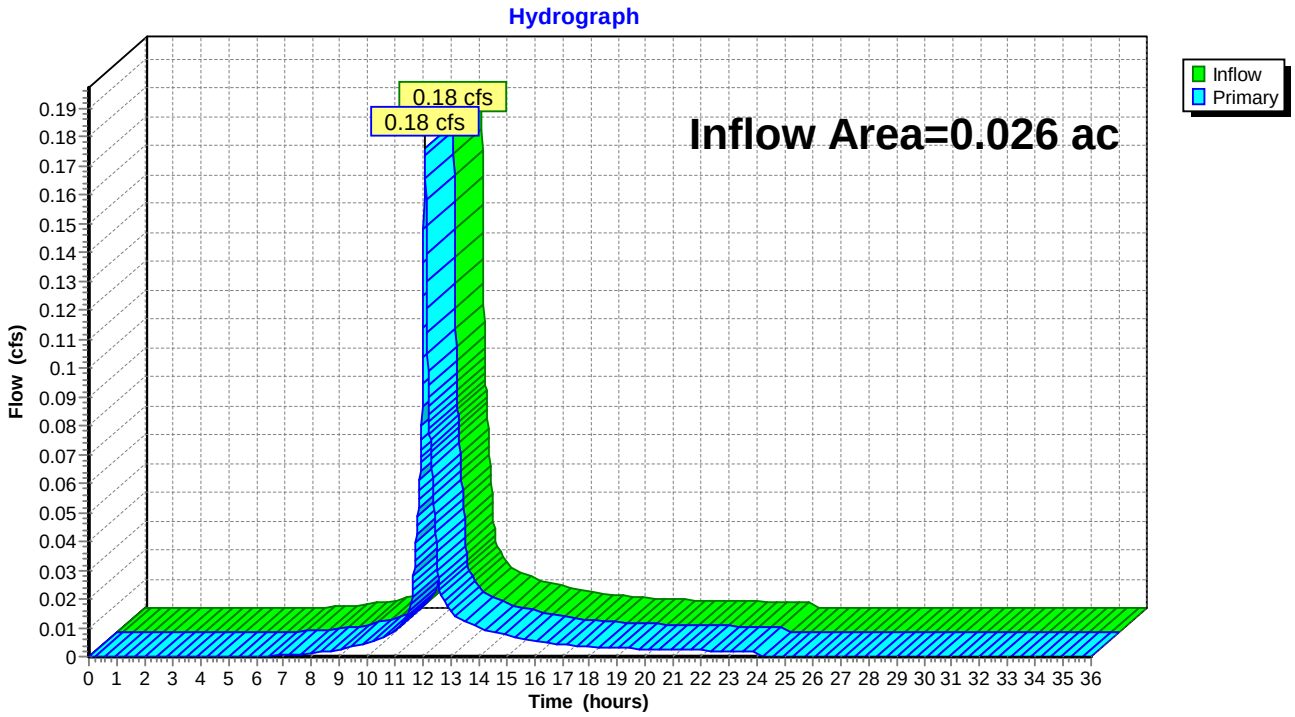


Summary for Link 1L-PR: 396 Washington (Southwest)

Inflow Area = 0.026 ac, 18.59% Impervious, Inflow Depth = 5.54" for 100-Year event
Inflow = 0.18 cfs @ 12.07 hrs, Volume= 0.012 af
Primary = 0.18 cfs @ 12.07 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 1L-PR: 396 Washington (Southwest)

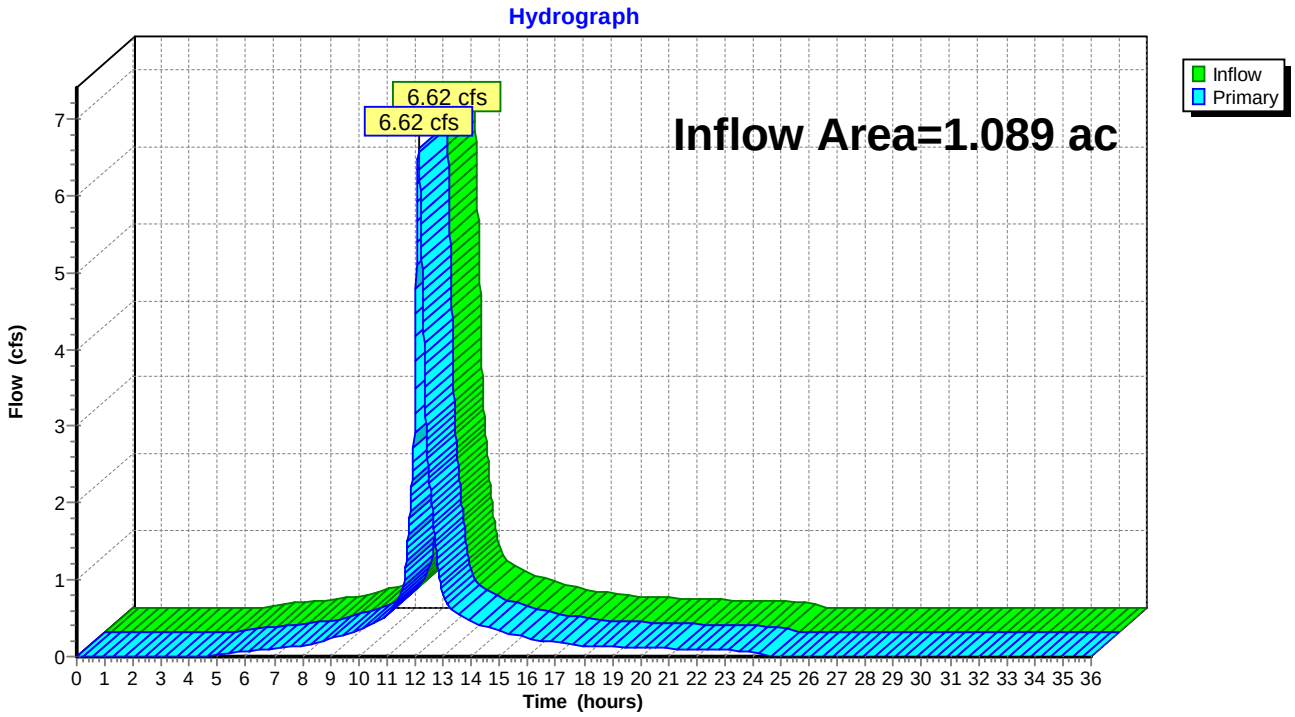


Summary for Link 2L-PR: Adjacent Property (Northwest)

Inflow Area = 1.089 ac, 70.65% Impervious, Inflow Depth = 6.95" for 100-Year event
Inflow = 6.62 cfs @ 12.12 hrs, Volume= 0.631 af
Primary = 6.62 cfs @ 12.12 hrs, Volume= 0.631 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 2L-PR: Adjacent Property (Northwest)



FUSS & O'NEILL

Appendix C

Proposed Stormwater System Analysis

SCALE:	
HORZ.:	1" = 50'
VERT.:	
DATUM:	
HORZ.:	
VERT.:	

0 25 50

GRAPHIC SCALE

FUSS & O'NEILL

146 HARTFORD ROAD
MANCHESTER, CONNECTICUT 06040
860.646.2469
www.fando.com

ROOT CENTER FOR ADVANCED RECOVERY

CATCHMENT AREA MAP

392 WASHINGTON STREET

MIDDLETOWN CONNECTICUT

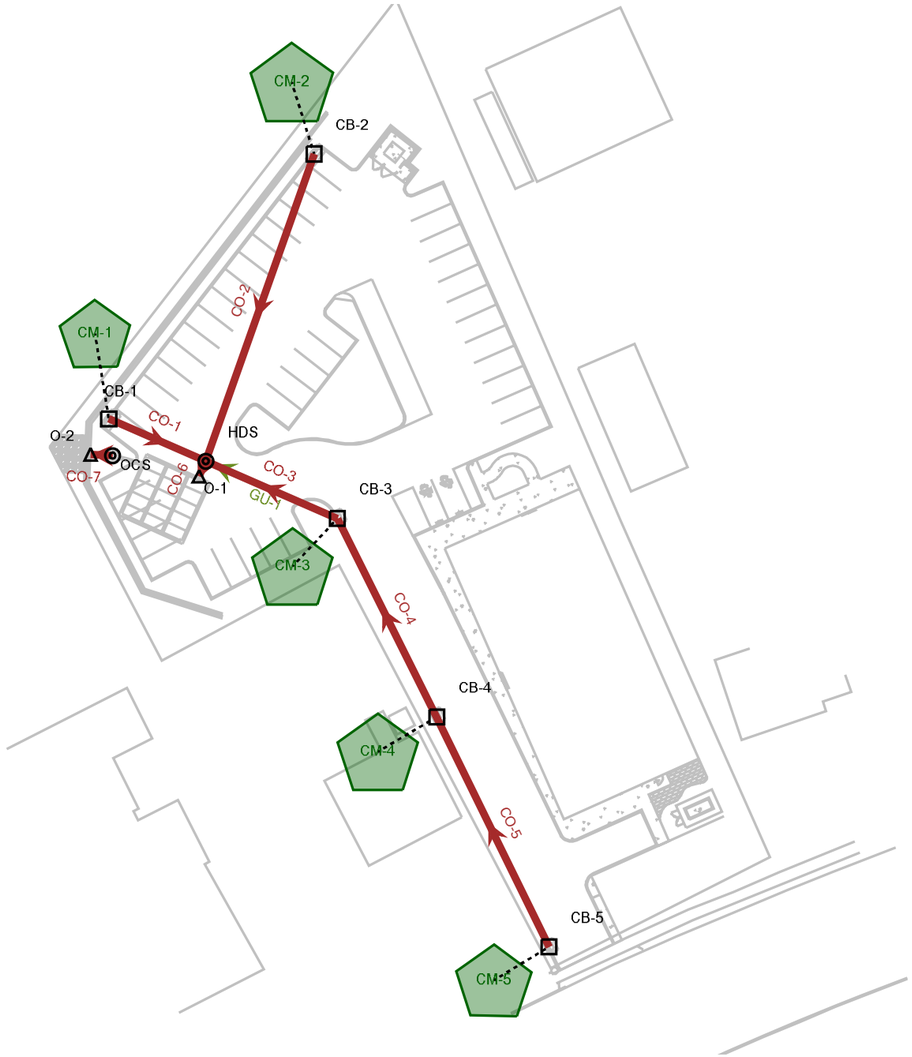
PROJ. No.: 20200586.A10

DATE: 07/24/2020

DR-301

File Path: J:\DWG\P20200586\A10\Civil\Plan\20200586A10_DRA02.dwg Layout: DR-301 Plotted: Fri, July 24, 2020 - 10:23 AM User: jdeninger
Plotter: DWG TO PDF.PC3 CTB File: FO.STB
MS VIEW: LAYER STATE:

Scenario: 25 YR



FlexTable: Catchment Table

Label	Area (User Defined) (ft²)	Runoff Coefficient (Rational)	Catchment CA (ft²)	Time of Concentration (min)	Outflow Element	Catchment Intensity (in/h)	Catchment Rational Flow (cfs)
CM-1	10,149.000	0.768	7,794.432	5.000	CB-1	9.040	1.63
CM-2	17,815.000	0.744	13,254.360	5.000	CB-2	9.040	2.77
CM-3	884.000	0.900	795.600	5.000	CB-3	9.040	0.17
CM-4	5,874.000	0.900	5,286.600	5.000	CB-4	9.040	1.11
CM-5	7,434.000	0.732	5,441.688	5.000	CB-5	9.040	1.14

FlexTable: Catch Basin Table

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Inlet Drainage Area (ft^2)	Inlet C	Local Flow Time (min)	Flow (Known) (cfs)	Flow (Captured) (cfs)	Spread / Top Width (ft)	Inlet Location	Inlet
CB-1	81.50	78.50	10,149.000	0.768	5.000	0.00	1.64	5.7	In Sag	Combination Type C Double Grate - Type II - Grate Type A - Plain Curb
CB-2	81.20	78.20	17,815.000	0.744	5.000	0.00	2.77	8.6	In Sag	Combination Type C Double Grate - Type II - Grate Type A - Plain Curb
CB-3	85.10	78.00	884.000	0.900	5.000	0.00	0.16	2.4	On Grade	Combination Type C Single Grate - Grate Type A - Plain Curb
CB-4	85.40	79.90	5,874.000	0.900	5.000	0.00	1.11	6.2	In Sag	Combination Type C Single Grate - Grate Type A - Plain Curb
CB-5	85.10	82.00	7,434.000	0.732	5.000	0.00	1.14	6.3	In Sag	Combination Type C Single Grate - Grate Type A - Plain Curb

FlexTable: Manhole Table

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Local Flow Time (min)	Flow (Known) (cfs)
HDS	82.50	82.50	76.65	6.54	77.68	5.000	0.00
OCS	82.50	82.50	66.20	4.33	67.07	5.000	4.33

FlexTable: Conduit Table

Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Material	System CA (ft²)	System Intensity (in/h)	Flow (cfs)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
CO-1	CB-1	HDS	78.50	76.90	43.0	0.037	12.0	0.012	Corrugated HDPE (Smooth Interior)	7,829.703	9.040	1.64	7.44	7.60	79.04	77.68
CO-2	CB-2	HDS	78.20	76.90	132.3	0.010	12.0	0.012	Corrugated HDPE (Smooth Interior)	13,254.359	9.040	2.77	3.83	5.31	78.91	77.68
CO-3	CB-3	HDS	78.00	76.90	58.3	0.019	12.0	0.012	Corrugated HDPE (Smooth Interior)	11,488.617	8.753	2.33	5.30	6.53	78.65	77.68
CO-4	CB-4	CB-3	79.90	78.10	90.1	0.020	12.0	0.012	Corrugated HDPE (Smooth Interior)	10,728.288	8.874	2.20	5.45	6.57	80.53	78.54
CO-5	CB-5	CB-4	82.00	79.90	103.9	0.020	12.0	0.012	Corrugated HDPE (Smooth Interior)	5,441.688	9.040	1.14	5.49	5.51	82.45	80.53
CO-6	HDS	O-1	76.65	76.50	6.8	0.022	15.0	0.012	Corrugated HDPE (Smooth Interior)	32,572.680	8.675	6.54	10.41	8.96	77.68	77.37
CO-7	OCS	O-2	66.20	66.00	8.9	0.022	12.0	0.012	Corrugated HDPE (Smooth Interior)	0.000	9.040	4.33	5.78	8.07	67.07	66.73

FlexTable: Outfall Table

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
O-1	82.60	76.50	User Defined Tailwater	76.21	77.37	6.53
O-2	66.00	66.00	Free Outfall		66.73	4.33

Appendix D

Outlet Protection Calculations

FUSS & O'NEILL

Outlet Protection Calculations
Root Center for Advanced Recovery
Middletown, Connecticut

	Description	Symbol	Unit of Measure	Quantity
	Input			
Design Criteria[1]	Flow Rate at Discharge Point	Q	cfs	4.33
	Outlet Pipe Diameter	D	in	12
	Flow Velocity at Discharge Point	V	ft/s	8.07
	Maximum Inside Pipe Rise	R_p	ft	1
	Inside Diameter for Circular Sections of Maximum Inside Pipe Span for non-circular sections	S_p	ft	1
	Tailwater[2]	T_w	ft	0.73
Preformed Scour Hole[3]	**Input**			
	Scour Hole Depression (Type 1 or 2)			Type 1
	Calculations			
	Basin Depression	F	ft	0.5
	Basin Inlet and Outlet Width	B	ft	5
	Basin Length	C	ft	6
	Type 1 Scour Hole Depression	d_{50}	ft	0.120
Riprap Stone Design	**Calculations**			
	Riprap Stone Size		in	5
	Riprap Specification			Modified
Date: 7/24/2020		By: JHD	Checked By: REB	

Notes:

1. Based on Connecticut DOT Drainage Manual, Section 11.13
2. At a free outfall, the equivalent hydraulic grade line is applied.
3. Type 1 = scour hole depression is one-half pipe rise (larger stone size, smaller dimensions)
   Type 2 = scour hole depression is full pipe rise (smaller stone size, larger dimensions)
4. If the velocity (V) is less than 8 ft/s, use Modified Riprap

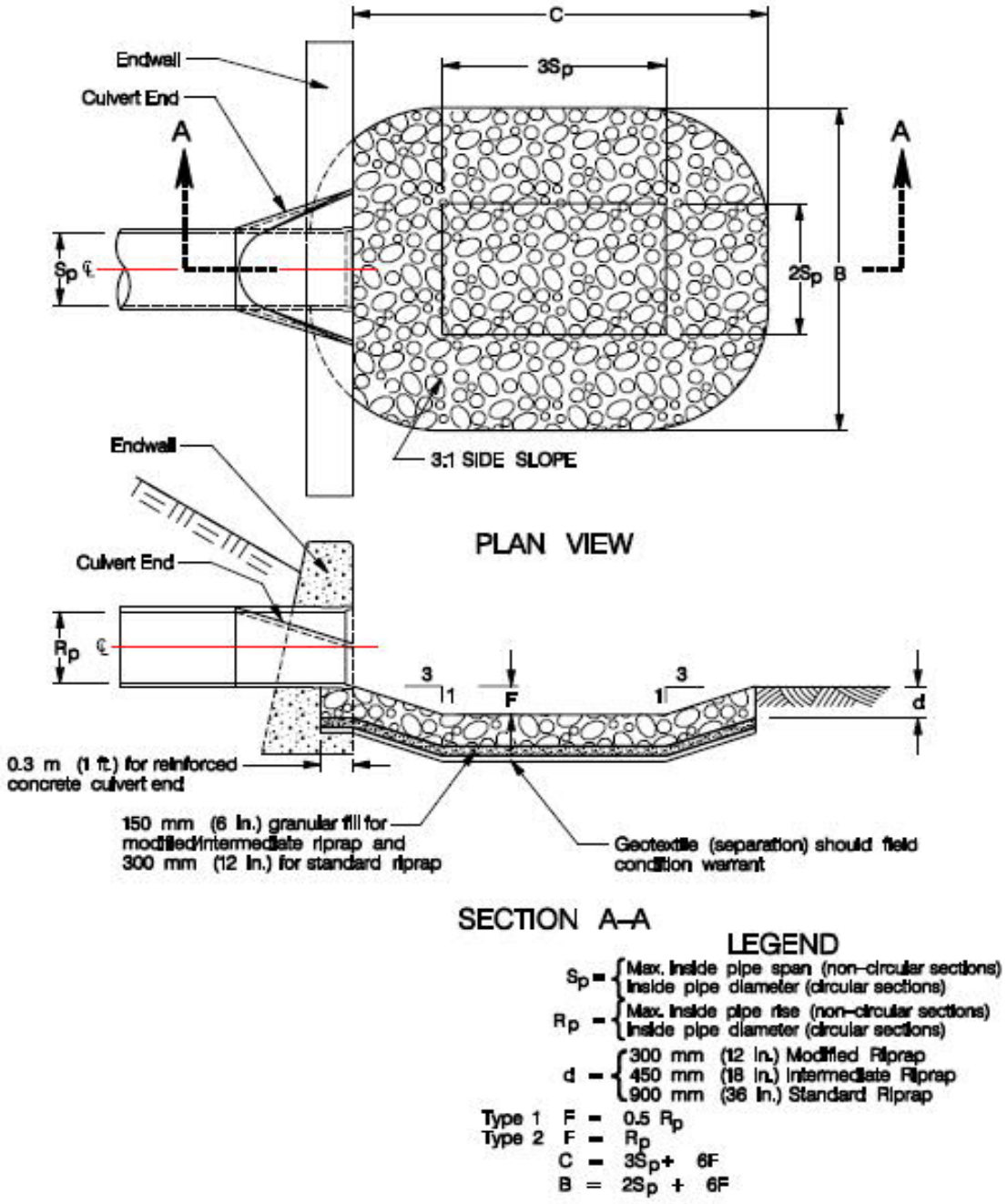


Figure 11-15 Preformed Scour Hole Type 1 and Type 2

Appendix E

Water Quality Calculations

FUSS & O'NEILL

Water Quality Volume & Flow Calculations
Root Center for Advanced Recovery
Middletown, Connecticut

Hydrodynamic Separator

	Description	Symbol	Unit of Measure	Quantity
Water Quality Volume (WQV)	**Input**			
	Upstream Drainage Area	A	AC	0.977
	Percent Impervious Cover	I	%	79%
	Volumetric Runoff Coefficient	R		0.759
	Water Quality Volume	WQV	ac-ft	**0.062**

Water Quality Flow (WQF)	**Input**			
	Design Precipitation	P	IN	1
	Calculations			
	Runoff Depth	Q	IN	0.759
	Runoff Curve Number	CN		98
	Initial Abstraction (From Table 4-1, Ch 4, TR-55 Manual)	I_A		0.041
	I_A/P (Rounded)			0.05
	Time of Concentration (Min .167 Hours)	T_C	Hr	0.167
	Unit Peak Discharge (from Exhibit 4-III, Ch 4, TR-55 Manual)	q_u	csm/ (mi^2*in)	680
	Drainage Area	A	mi^2	0.002
	Water Quality Flow	WQF	cfs	**0.79**
Date: 07/24/2020		Prepared By: JHD		

Notes:
1. All water quality calculations based on 2004 Connecticut Stormwater Quality Manual.
2. Shaded cells indicate numbers inputted from other sources.