Drainage Analysis For

103 ALVARADO AVENUE

WORCESTER, MA

Prepared for & Owned by

RODRIGO M. SALGADO

103 ALVARADO AVE.
WORCESTER, MA
March 14, 2024

Prepared by

ALPHA OMEGA ENGINEERING, INC.

25 Highland View Drive
Sutton, MA 01590

Roumany A. Wasef, P.E.

EXISTING CONDITIONS:

The site is located on the corner Alvarado Avenue and Anna Street. Presently, there is an existing two family home, driveway, and landscaped area. Existing site has two drainage catchment areas. Area A slopes about 6% southwesterly towards the street. Area B slopes 3-4% northeasterly towards abutting property. The predominant soil on site from soil maps and soil testing is Paxton-Urban land complex sandy loam, hydrologic soil type C.

DEVELOPED CONDITIONS:

Development of the site will result in an addition to existing house and the creation of 6 building. The increase of storm water run-off will be sent to two underground detention/infiltration systems to attenuate increased run-off rates as a result of development. The detention/infiltration system will collect the runoff from sub-catchment areas B1 and B2.

ANALYSIS:

The goal of the stormwater management system proposed is to ensure that there is no increase in peak run-off rates downstream of the site. This goal is achieved using the proposed detention/infiltration system that has been carefully sized to attenuate flow rates for the 100 year storm event.

CALCULATIONS:

The storm modeling and routings were performed using HydroCAD version 9.1.

SUMMARY:

A) Runoff Rate - cfs

	2 Year		*10 Year*		*25 Year*		*100 Year*	
Area	***Pre***	***Post***	***Pre***	***Post***	***Pre***	***Post***	***Pre***	***Post***
A	.09	.09	.17	.17	.24	.24	.39	.39
B	.41	.20	.84	.38	1.19	.52	1.93	.82

Table 1

B) Runoff Volume - af

	2 Year		*10 Year*		*25 Year*		*100 Year*	
Area	***Pre***	***Post***	***Pre***	***Post***	***Pre***	***Post***	***Pre***	***Post***
A	.005	.005	.010	.010	.015	.015	.024	.024
B	.027	.014	.056	.027	.080	.037	.132	.059

Table 2

CONCLUSIONS:

From this analysis we conclude that no significant net increase in peak run-off rates will occur as a result of the development of this site. The total net peak run-off rate from this site will be slightly reduced as a result of the development.

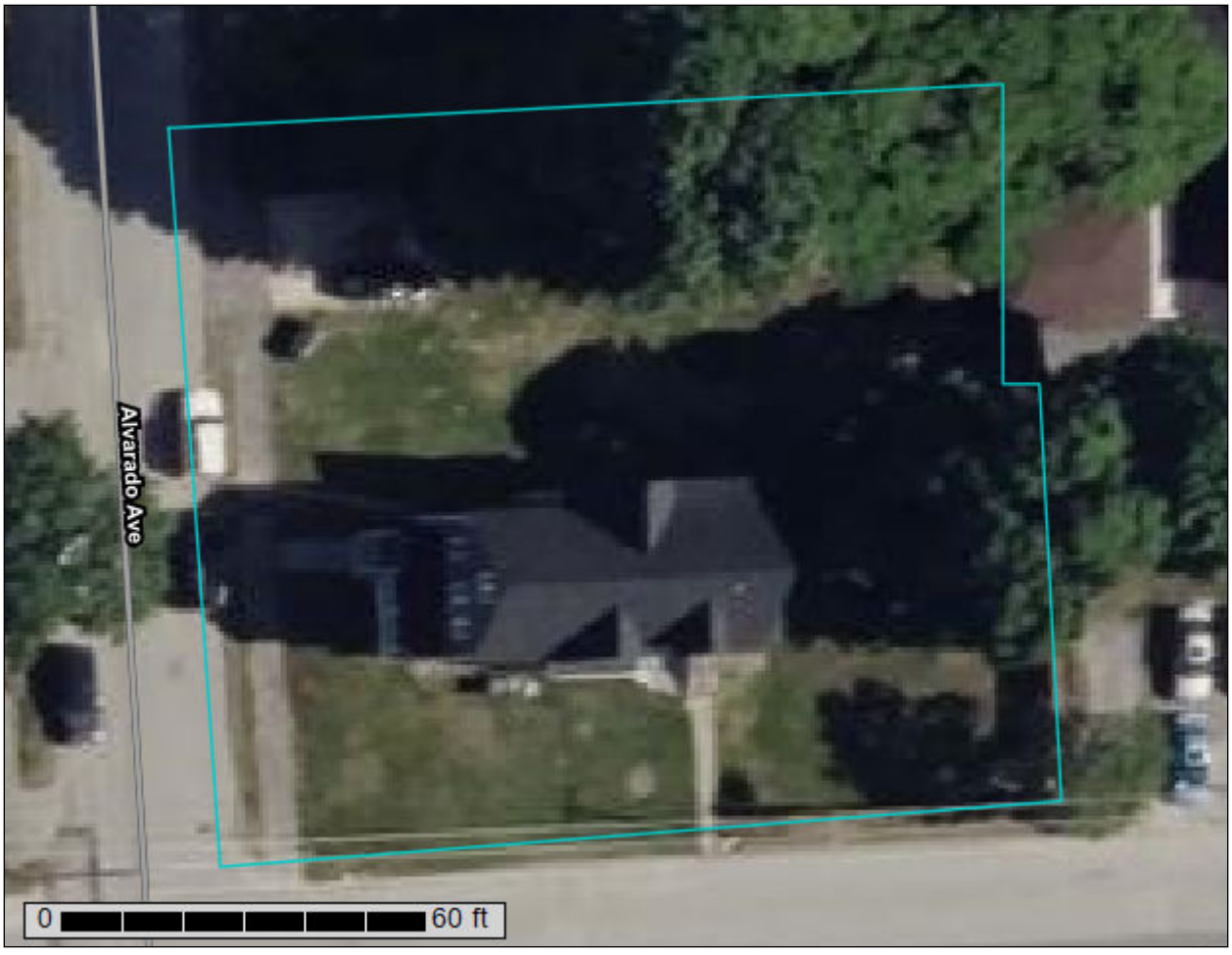
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Worcester County, Massachusetts, Northeastern Part



February 13, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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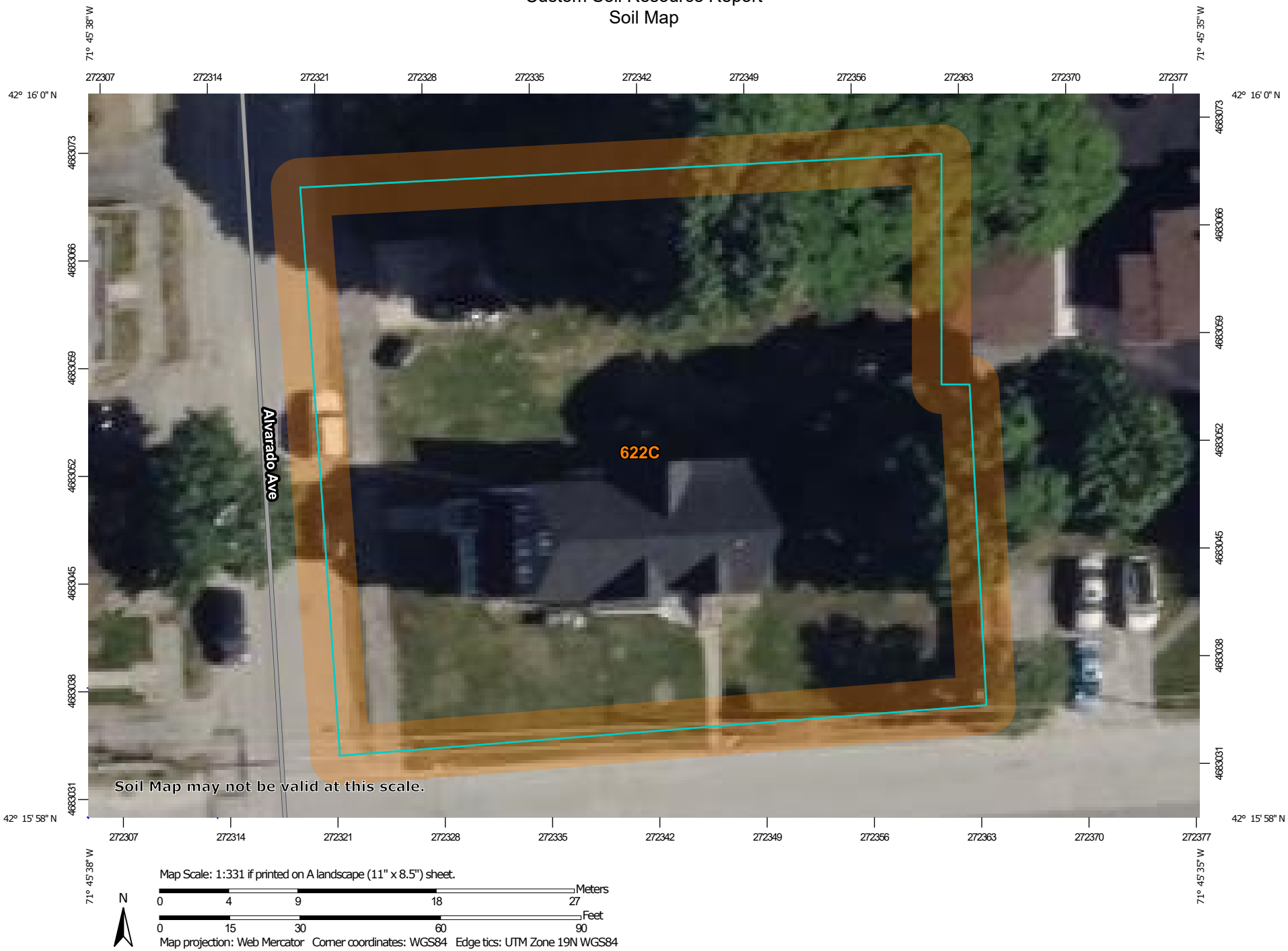
Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:331 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 4 9 18 27

Feet
0 15 30 60 90

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 18, Sep 10, 2023

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
622C	Paxton-Urban land complex, 8 to 15 percent slopes	0.4	100.0%
Totals for Area of Interest		**0.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Worcester County, Massachusetts, Northeastern Part

622C—Paxton-Urban land complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w67n
Elevation: 0 to 1,030 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Paxton and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

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

Minor Components

Udorthents

Percent of map unit: 9 percent
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Canton

Percent of map unit: 7 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge

Percent of map unit: 3 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 1 percent
Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

NOTES TO USERS

is for use in administering the National Flood Insurance Program. It does sarily identify all areas subject to flooding, particularly from local drainage f small size. The **community map repository** should be consulted for pdated or additional flood hazard information.

nore detailed information in areas where **Base Flood Elevations** (BFEs) **odways** have been determined, users are encouraged to consult the Flood nd Floodway Data and/or Summary of Stillwater Elevations tables contained Flood Insurance Study (FIS) Report that accompanies this FIRM. Users e aware that BFEs shown on the FIRM represent rounded whole-foot s. These BFEs are intended for flood insurance rating purposes only and t be used as the sole source of flood elevation information. Accordingly, ation data presented in the FIS Report should be utilized in conjunction with ful purposes of construction and/or floodplain management.

Base Flood Elevations shown on this map apply only landward of 0.0' erican Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be t coastal flood elevations are also provided in the Summary of Stillwater s table in the Flood Insurance Study Report for this jurisdiction. Elevations the Summary of Stillwater Elevations table should be used for construction odplain management purposes when they are higher than the elevations this FIRM.

es of the **floodways** were computed at cross sections and interpolated cross sections. The floodways were based on hydraulic considerations with requirements of the National Flood Insurance Program. Floodway widths pertinent floodway data are provided in the Flood Insurance Study Report sdiction.

eas not in Special Flood Hazard Areas may be protected by **flood control s**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance port for information on flood control structures for this jurisdiction.

ction used in the preparation of this map was Massachusetts State Plane Zone (FIPS zone 2001). The **horizontal datum** was NAD 83, GRS 1980 Differences in datum, spheroid, projection or UTM zones used in the n of FIRMs for adjacent jurisdictions may result in slight positional s in map features across jurisdiction boundaries. These differences do not accuracy of this FIRM.

vations on this map are referred to the North American Vertical Datum of ese flood elevations must be compared to structure and ground elevations d to the same **vertical datum**. For information regarding conversion the National Geodetic Vertical Datum of 1929 and the North American Datum of 1988, visit the National Geodetic Survey website at v.ngs.noaa.gov or contact the National Geodetic Survey at the following

rmation Services
/NGS12
Geodetic Survey
#9202
-West Highway
ng, Maryland 20910-3282
-3242

current elevation, description, and/or location information for **bench marks** this map, please contact the Information Services Branch of the National Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

p information shown on this FIRM was derived from digital orthophotography. files were provided in digital format by Massachusetts Geographic on Systems (MassGIS). Ortho imagery was produced at a scale of 1:5,000. otography is dated April 2005.

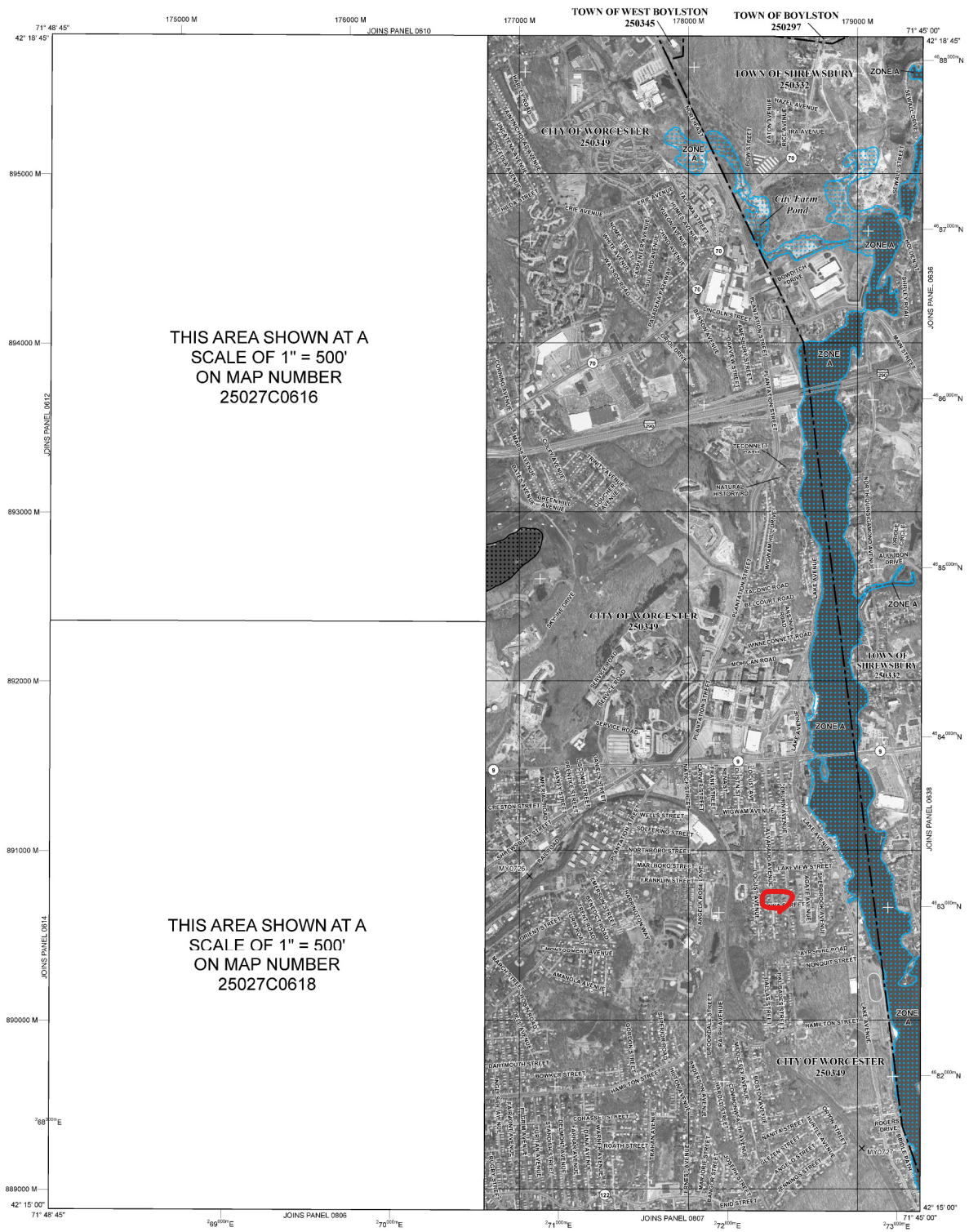
le baselines depicted on this map represent the hydraulic modeling baselines n the flood profiles in the FIS report. As a result of improved topographic data, **le baseline**, in some cases, may deviate significantly from the channel or appear outside the SFHA.

e limits shown on this map are based on the best data available at the time tion. Because changes due to annexations or de-annexations may have after this map was published, map users should contact appropriate y officials to verify current corporate limit locations.

fer to the separately printed **Map Index** for an overview map of the owing the layout of map panels; community map repository addresses; ding of Communities table containing National Flood Insurance Program each community as well as a listing of the **panels** on which each community

mation on available products associated with this FIRM visit the **Map Center (MSC)** website at http://msc.fema.gov. Available products may eviously issued Letters of Map Change, a Flood Insurance Study Report, igital versions of this map. Many of these products can be ordered or directly from the MSC website.

ve **questions about this map**, how to order products, or the National surance Program in general, please call the **FEMA Map Information e (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA t http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Haza include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-s elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood El determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); av depths determined. For areas of alluvial fan flooding, velocities also d

ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual ch flood by a flood control system that was subsequently decertified. Zo AR indicates that the former flood control system is being restored to protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations deter

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood El determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be k encroachment so that the 1% annual chance flood can be carried without substantial inc flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood wi average depths of less than 1 foot or with drainage areas less than 1 squa mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Are

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and bo dividing Special Flood Hazard Areas of different Base Flood flood depths, or flood velocities.

513 Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; ele feet*

*Referenced to the North American Vertical Datum of 1988

A — A Cross section line

23 — 23 Transect line

Culvert

Bridge

45° 02' 08", 93° 02' 12" Geographic coordinates referenced to the North American 1983 (NAD 83) Western Hemisphere

4989000 M 1000-meter ticks: Massachusetts State Plane Mainland Zon (FIPS Zone 2001), Lambert Conformal Conic projection.

5000 N 1000-meter Universal Transverse Mercator grid values, zon

DX5510 Bench mark (see explanation in Notes to Users section of t panel)

M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
July 4, 2011

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Communi Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance a or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

PANEL 0620E

FIRM

FLOOD INSURANCE RATE M

WORCESTER COUNT
MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 620 OF 1075
(SEE MAP INDEX FOR FIRM PANEL LA

CONTAINS:

COMMUNITY	NUMBER	PANEL
BOYLSTON, TOWN OF	250297	0620
SHREWSBURY, TOWN OF	250332	0620
WEST BOYLSTON, TOWN OF	250345	0620
WORCESTER, CITY OF	250349	0620

Notice to User: The **Map Number** sho should be used when placing map or **Community Number** shown above s used on insurance applications for the community.

MAP NU
25027C
EFFECTIVE
JULY 4

Federal Emergency Management

Inlet Calculations							103 Alvarado Ave., Worcester									RM 03/11/24
	Run-off Coefficient						Time of Concentration							Peak Run-off Rate		
	Impervious		Permeable				Smooth Surf.			Rough Surf.						
Inlet	Impervious Area (Acres)	Run-off Coef.	Permeable Area (Acres)	Run-off Coef.	Total Area (Acres)	C (Composite)	Segment Length	Slope	Travel Time	Segment Length	Slope	Travel Time	Time of Concentration	Return Period (Years)	Intencity (in/hr)	Total Run-off (cfs)
CB-1	0.11	0.95	0.03	0.30	0.14	0.82	100.00	0.01	2.70	40.00	0.02	7.23	9.93	25	5.43	0.60

Hydrodynamic Separation Product Calculator

103 ALVARADO AVE

Residential

CDS 2015-4

Project Information					
Project Name	103 ALVARADO AVE			**Option #**	A
Country	UNITED_STATES	**State**	Massachusetts	**City**	Worcester

Contact Information			
First Name	Raouf	**Last Name**	Mankaryous
Company	Alpha Omega Engineering Inc	**Phone #**	508-865-9551
Email	info@alphaomegaeng.com		

Design Criteria					
Site Designation	Residential			**Sizing Method**	Net Annual
Screening Required?	Yes	**Drainage Area (ac)**	0.11	**Peak Flow (cfs)**	0.60
Groundwater Depth (ft)	5 - 10	**Pipe Invert Depth (ft)**	0 - 5	**Bedrock Depth (ft)**	10 - 15
Multiple Inlets?	No	**Grate Inlet Required?**	Yes	**Pipe Size (in)**	8.00
Required Particle Size Distribution?	No	**90° between two inlets?**	N/A	**180° between inlet and outlet?**	No
Runoff Coefficient	0.60	**Rainfall Station**	70 - East Brimfield Lake, MA	**TC (Min)**	10

Treatment Selection					
Treatment Unit	CDS	**System Model**	2015-4		
Target Removal	90%	**Particle Size Distribution (PSD)**	125	**Predicted Net Annual Removal**	99.51%

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

103 ALVARADO AVE

Residential

CDS 2015-4

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0400	15.15%	15.15%	15.15%	0.0026	0.0026	0.37%	100.00%	15.15%
0.0800	24.57%	39.72%	24.57%	0.0053	0.0053	0.76%	100.00%	24.57%
0.1200	13.70%	53.42%	13.70%	0.0079	0.0079	1.13%	100.00%	13.70%
0.1600	9.41%	62.83%	9.41%	0.0106	0.0106	1.51%	100.00%	9.41%
0.2000	6.63%	69.46%	6.63%	0.0132	0.0132	1.89%	100.00%	6.63%
0.2400	5.24%	74.70%	5.24%	0.0158	0.0158	2.26%	100.00%	5.24%
0.2800	4.78%	79.48%	4.78%	0.0185	0.0185	2.64%	100.00%	4.78%
0.3200	3.14%	82.62%	3.14%	0.0211	0.0211	3.01%	100.00%	3.14%
0.3600	2.71%	85.33%	2.71%	0.0238	0.0238	3.40%	100.00%	2.71%
0.4000	2.10%	87.43%	2.10%	0.0264	0.0264	3.77%	100.00%	2.10%
0.4800	2.47%	89.90%	2.47%	0.0317	0.0317	4.53%	100.00%	2.47%
0.5600	2.02%	91.92%	2.02%	0.0370	0.0370	5.29%	100.00%	2.02%
0.6400	1.42%	93.34%	1.42%	0.0422	0.0422	6.03%	100.00%	1.42%
0.7200	1.00%	94.34%	1.00%	0.0475	0.0475	6.79%	100.00%	1.00%
0.8000	1.07%	95.41%	1.07%	0.0528	0.0528	7.54%	99.90%	1.07%
1.0000	1.65%	97.06%	1.65%	0.0660	0.0660	9.43%	99.52%	1.64%
1.2000	0.93%	97.99%	0.93%	0.0792	0.0792	11.31%	99.15%	0.92%
1.4000	0.60%	98.59%	0.60%	0.0924	0.0924	13.20%	98.77%	0.59%
1.6000	0.49%	99.08%	0.49%	0.1056	0.1056	15.09%	98.39%	0.48%
1.8000	0.48%	99.56%	0.48%	0.1188	0.1188	16.97%	98.01%	0.47%
								99.51%
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	99.56%
							Predicted Net Annual Load Removal Efficiency =	99.51%

1 - Based on 14 years of 15-minute rainfall data from NCDC Station 2107, East Brimfield Lake, Worcester County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the CDS® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a CDS® device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

- 2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);
- 2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
- 2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;
- 2.1.4 Aggregates shall conform to ASTM C 33;
- 2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
- 2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
- 2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

- 2.2.1 Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;
- 2.2.2 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
- 2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097
- 2.2.4 Access system(s) conform to the following:
- 2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load with a particle size distribution having a mean particle size (d_{50}) of 125 microns unless otherwise stated.

3.2 The SWTD shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 2.4 millimeters (mm) regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The SWTD shall be designed to retain all previously captured pollutants addressed by this

subsection under all flow conditions. The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff (20 ± 5 mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.

3.3 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. The sump chamber shall be separate from the treatment processing portion(s) of the SWTD to minimize the probability of fine particle re-suspension. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.4 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.5 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.6 The SWTD shall have completed field tested following TARP Tier II protocol requirements

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

4.2 The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

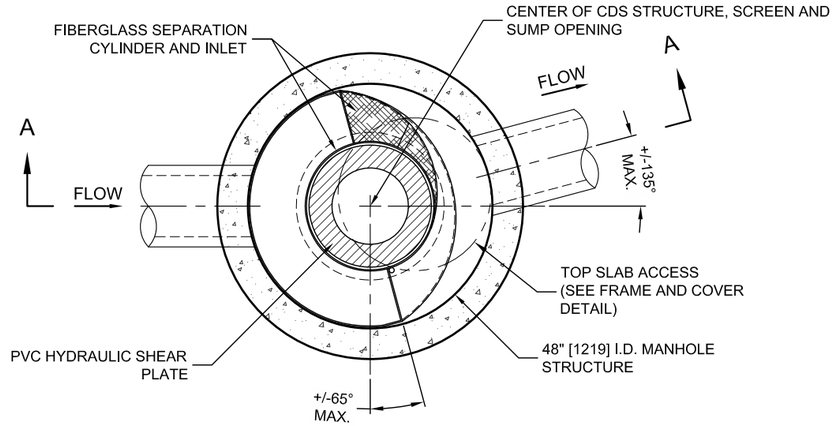
4.3 The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.

4.4 The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

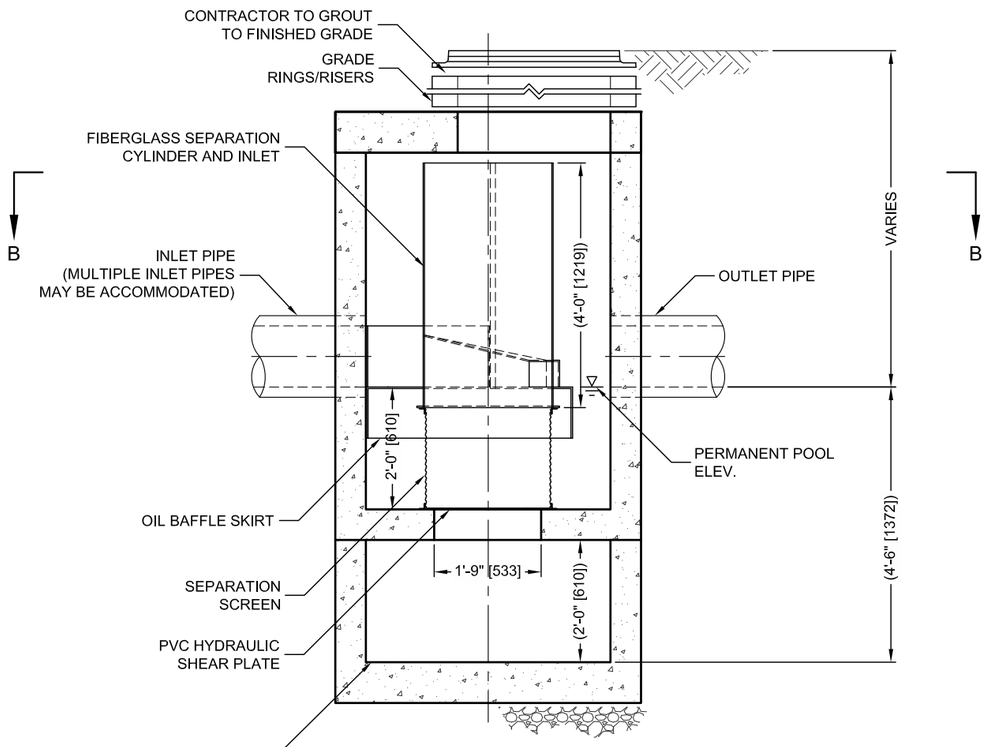
TABLE 1
Storm Water Treatment Device
Storage Capacities

CDS Model	Minimum Sump Storage Capacity $(yd^3)/(m^3)$	Minimum Oil Storage Capacity (gal)/(L)
CDS2015-4	0.9(0.7)	61(232)
CDS2015-5	1.5(1.1)	83(313)
CDS2020-5	1.5(1.1)	99(376)
CDS2025-5	1.5(1.1)	116(439)
CDS3020-6	2.1 (1.6)	184(696)
CDS3025-6	2.1(1.6)	210(795)
CDS3030-6	2.1 (1.6)	236(895)
CDS3035-6	2.1 (1.6)	263(994)
CDS3535-7	2.9(2.2)	377(1426)
CDS4030-8	5.6(4.3)	426(1612)
CDS4040-8	5.6 (4.3)	520(1970)
CDS4045-8	5.6 (4.3)	568(2149)
CDS5640-10	8.7(6.7)	758(2869)
CDS5653-10	8.7(6.7)	965(3652)
CDS5668-10	8.7(6.7)	1172(4435)
CDS5678-10	8.7(6.7)	1309(4956)
CDS7070-DV	3.6(2.8)	914 (3459)
CDS10060-DV	5.0 (3.8)	792 (2997)
CDS10080-DV	5.0 (3.8)	1057 (4000)
CDS100100-DV	5.0 (3.8)	1320 (4996)

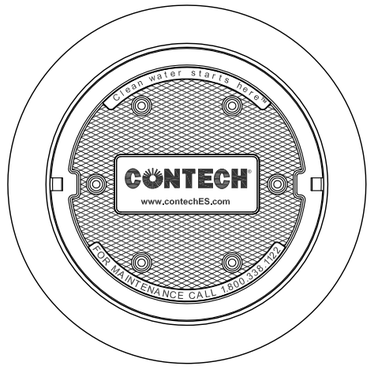
END OF SECTION



PLAN VIEW B-B
N.T.S.



ELEVATION A-A
N.T.S.



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

CDS2015-4-C DESIGN NOTES

THE STANDARD CDS2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2015-4-C
INLINE CDS
STANDARD DETAIL

Alpha Omega Engineering Inc.
25 Highland View Dr
Sutton, MA 01590
Ph: 508-865-9551
Fax: 508-499-6213
info@alphaomegaeng.com
www.alphaomegaeng.com

STORMWATER MANAGEMENT SYSTEM
OPERATION AND MAINTENANCE PLAN

For

103 Alvarado Avenue

Worcester MA

March 11, 2024

The owner and party responsible for the operation and maintenance of the Stormwater Management System within the parking, and driveway areas is the Contractor and owner of the site. 103 Alvarado Avenue, Worcester MA has been designed using the best Stormwater Management practices currently recommended by the Massachusetts DEP. The following components have been used in the design with the recommended maintenance criteria for each one.

1) Cascade Separator recommendations

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the

appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected. The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided. Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen. The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area. In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

Cascade Separator® Maintenance Indicators and Sediment Storage Capacities

Table 6. Sediment Depths Indicating Required Maintenance*		
Model	Distance from Water Surface to Top of Sediment Pile ft	Sediment Storage Capacity y3
CDS2015-4	3.0	0.9

For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

2) Parking lot Maintenance

Parking lot must be swept twice a year.

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STORMWATER POLLUTION PREVENTION PLAN

For

103 Alvarado Avenue

Worcester MA

March 11, 2024

This Storm water Pollution Prevention Plan (SWPPP) was developed consistent with the requirements of the National Pollutant Discharge Elimination System (NPDES) General Storm water Permit for Construction Activities.

The Plan, properly implemented, should result in the discharge of water to the environment without the violation of Water Quality Standards.

1.1 Temporary and Permanent Erosion Control Practices

To prevent soil from washing off the site during construction, the following Construction BMPs will be implemented:

- **Silt fencing and straw wattles barriers:** will be placed along the perimeter of the of the construction site before any clearing or grading takes place.

- **Sediment Basins:** The infiltration basin area (IS-2) will serve as the sediment basins during construction.

  All sediments to be removed from the bottom of the sediment basin and inspected before the installation of the infiltration systems.

- **Diversion Berms:** Throughout site grading activities, diversion berms will be placed at the direction of the SWPPP coordinator to ensure runoff is directed toward the other construction BMPs for treatment.

- **Drainage Inlet Filters:** A filter shall be placed within the proposed catch basin/storm separator at the time the frame and grate are installed. Catch basin filter shall be maintained until all construction has been completed, and all graded areas have been stabilized with vegetation.

- **Stabilization:** All areas which will not be impacted by construction will be seeded. A permanent seed mix consisting of 20% Red Top, 60% Chewings Fescue and 20% Kentucky Bluegrass is recommended. Each area will be "Hydro-seeded" with high fiber content or mulched with 4,000 pounds per acre of straw. The straw mulch is to be tacked into place by a disk with blades set nearly straight.

- **Stockpiling:** Stockpiles of fill material and gravel shall be surrounded with erosion controls. Top soil stockpiles shall be surrounded with erosion controls and, if not required for use within 14 days, stabilized with temporary seed and mulch. The recommended temporary seed is Rye (grain).

Permanent BMPs

To treat stormwater after construction, the following Permanent BMPs will be implemented:

- **Storm Separator:** One hydrodynamic separator is provided to remove suspended solids prior to stormwater entering the infiltration system.
- **Infiltration Systems:** Two infiltration systems are provided to reduce the volume and rate of stormwater runoff and provide for groundwater recharge.

1.2 Construction Practices to Minimize Storm Water Contamination

All waste materials will be collected and stored in a securely lidded metal dumpster rented from a licensed solid waste management company. All trash and construction debris will be deposited in the dumpster. No construction materials will be buried on-site. All personnel will be instructed regarding the current procedure for waste disposal. All sanitary waste will be collected from portable units by a licensed sanitary waste management company. Good housekeeping and spill control practices will be followed during construction to minimize storm water contamination from petroleum products, fertilizers, paints and concrete. Good housekeeping practices for the site are listed below:

- Fertilizers will be applied only in the minimum amounts recommended by the manufacturer.
- Fertilizers will be worked into the soil to limit exposure to storm water.
- All vehicles on-site will be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage.
- Petroleum products will be stored in tightly sealed containers which are clearly labeled.
- Spill kits will be included with all fueling sources and maintenance activities.
- Any asphalt substances used on-site will be applied according to the manufacturer's recommendation.
- Sanitary waste will be collected from portable units a minimum of two times a week.
- A covered dumpster will be used for all waste materials
- All paint containers and curing compounds will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm system, but will be disposed of according to the manufacturer's instructions.
- Materials and equipment necessary for spill cleanup will be kept on-site. Equipment will include, but not be limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, saw dust and plastic and metal trash containers.
- Spray guns will be cleaned on a removable tarp.

- All spills will be cleaned up immediately upon discovery. Spills large enough to reach the storm system will be reported to the National Response Center at 1-800-424-8802
- The paved street adjacent to the site entrance will be swept daily to remove excess mud, dirt or rock tracked from the site.
- Dump trucks hauling material to and from the construction site will be covered with tarpaulins.
- All ruts caused by equipment used for cutting and removing trees will be graded.

1.3 Coordination of BMPs with Construction Activities

BMPs will be coordinated with construction activities so the BMP is in place before construction begins. The following BMPs will be coordinated with construction activities:

- The temporary perimeter controls (compost sock and silt fence) will be installed before any clearing or grading begins.
- Clearing and grading will not occur in an area until it is necessary for construction to proceed.
- Diversion berms and the sediment basin will be constructed, and pumping will be performed at the direction of the SWPPP Coordinator as required throughout construction.
- Once construction activity ceases permanently in an area, that area will be stabilized with permanent seed and mulch.
- After the entire site is stabilized, the accumulated sediment will be removed from all drainage structures.
- The temporary perimeter controls (silt fencing and straw wattles) will not be removed until all construction activities at the site are complete and soils have been stabilized.

1.4 Certification of Compliance with Federal, State and Local Regulations

This SWPPP reflects the requirement for stormwater management, the Water Quality Certification Regulations (314 CMR), and the Federal Water Pollution Control Act Amendments of 1972. To ensure compliance, this plan was prepared in accordance with the *Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas*, published by the Massachusetts Executive Office of Environmental Affairs

2.0 Maintenance and Inspection Procedures

2.1 Inspections

Visual inspections of all cleared and graded areas of the construction site will be performed daily and within 12 hours of the end of a storm with rainfall amounts exceeding 0.5 inches. The inspection will be conducted by the SWPPP Coordinator or his designated stormwater team members. The inspection will verify that the structural BMPs are in good condition and minimizing erosion. The inspection will also verify that the procedures used to prevent stormwater contamination from construction materials and petroleum products are effective. The following inspection and maintenance practices will be used to maintain erosion and sediment controls:

- Built up sediment will be removed from straw wattles when it has reached one-third the height of the sock.
- Temporary and permanent seeding will be inspected for bare spots, washouts and healthy growth.
- The construction entrance will be inspected for sediment tracked on the road.

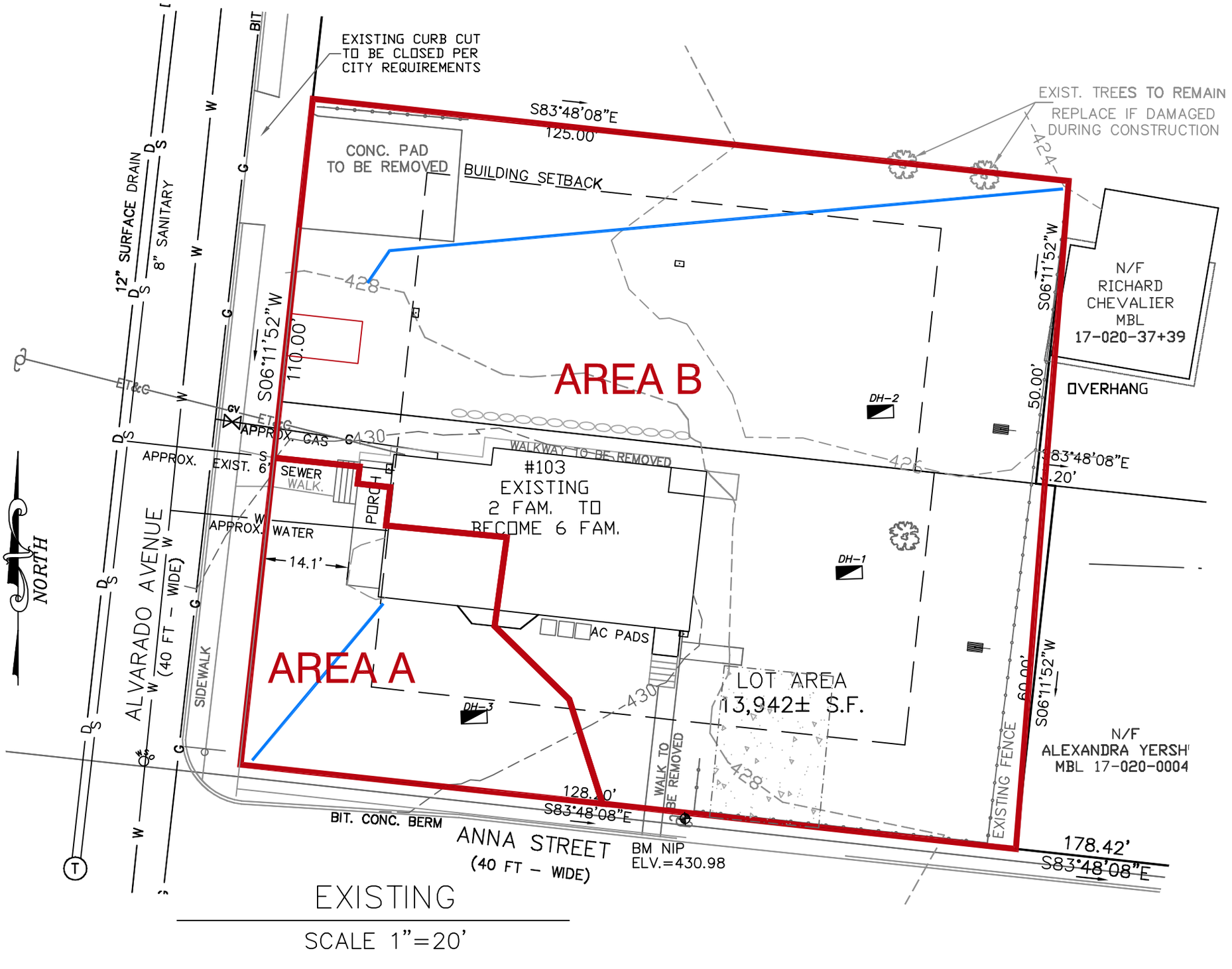
A maintenance inspection report will be made after each inspection. A copy of the report form to be completed by the SWPPP Coordinator. Completed forms will be maintained on-site during the entire construction project. Following construction, the completed forms will be retained at the operators's office for a minimum of 1 year.

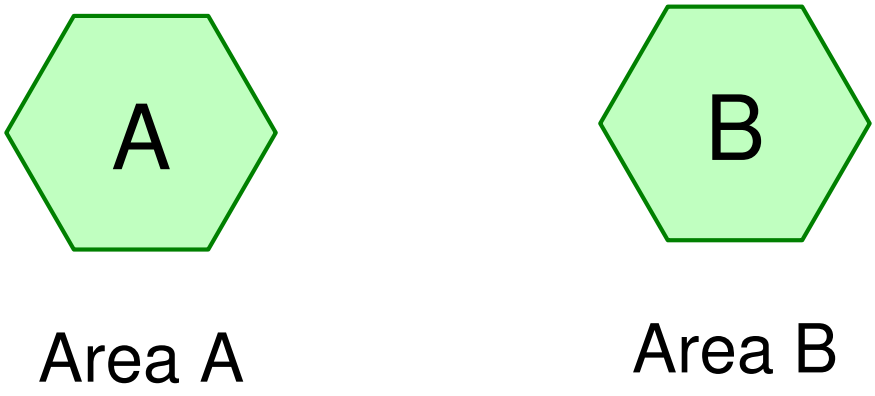
If construction activities or design modifications are made to the site plan which could impact stormwater, this SWPPP will be amended appropriately. The

amended SWPPP will have a description of the new activities that contribute to the increased pollutant loading and the planned source control activities.

2.2 Employee Training

An employee training program will be developed and implemented to educate employees about the requirements of the SWPPP. This education program will include background on the components and goals of the SWPPP and hands-on training in erosion controls, spill prevention and response, good housekeeping, proper material handling, disposal and control of waste, equipment fueling and proper storage, washing and inspection procedures. All employees will be trained prior to their first day on the site.


EXISTING CURB CUT TO BE CLOSED PER CITY REQUIREMENTS
EXIST. TREES TO REMAIN
REPLACE IF DAMAGED DURING CONSTRUCTION
S83°48'08"E
125.00'
CONC. PAD TO BE REMOVED
BUILDING SETBACK
12" SURFACE DRAIN
8" SANITARY
S06°11'52"W
110.00'
AREA B
AREA A
N/F
RICHARD
CHEVALIER
MBL
17-020-37+39
OVERHANG
50.00'
S06°11'52"W
S83°48'08"E
.20'
ET&G
GV
APPROX. GAS
APPROX. EXIST. S
SEWER
WALK.
WALKWAY TO BE REMOVED
#103
EXISTING
2 FAM. TO
BECOME 6 FAM.
PORCH
APPROX. WATER
14.1'
DH-1
DH-2
DH-3
AC PADS
LOT AREA
13,942± S.F.
NORTH
ALVARADO AVENUE
(40 FT - WIDE)
SIDEWALK
WALK TO BE REMOVED
EXISTING FENCE
60.00'
S06°11'52"W
N/F
ALEXANDRA YERSH
MBL 17-020-0004
128.20'
S83°48'08"E
BIT. CONC. BERM
ANNA STREET
(40 FT - WIDE)
BM NIP
ELV.=430.98
178.42'
S83°48'08"E
EXISTING
SCALE 1"=20'



Subcat Reach Pond Link

Drainage Diagram for 23-0696 Pre

Prepared by Alpha Omega Engineering Inc, Printed 3/24/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.268	74	>75% Grass cover, Good, HSG C (A, B)
0.051	98	Roofs, HSG C (A, B)
0.320		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.320	HSG C	A, B
0.000	HSG D	
0.000	Other	
0.320		**TOTAL AREA**

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

Subcatchment A: Area A Runoff Area=2,140 sf 19.02% Impervious Runoff Depth>1.28"
Flow Length=32' Slope=0.0600 '/' Tc=2.5 min CN=79 Runoff=0.09 cfs 0.005 af

Subcatchment B: Area B Runoff Area=11,782 sf 15.47% Impervious Runoff Depth>1.21"
Flow Length=117' Tc=5.2 min CN=78 Runoff=0.41 cfs 0.027 af

Total Runoff Area = 0.320 ac Runoff Volume = 0.033 af Average Runoff Depth = 1.22"
83.98% Pervious = 0.268 ac 16.02% Impervious = 0.051 ac

Summary for Subcatchment A: Area A

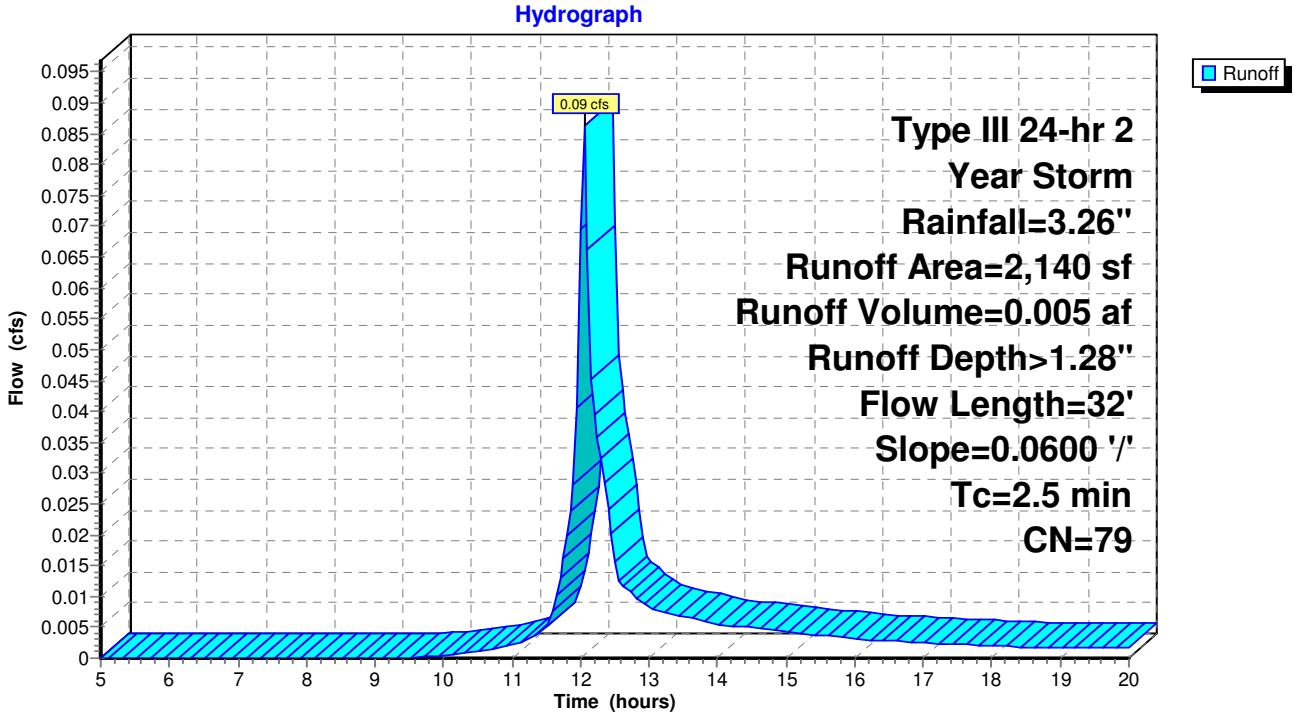
Runoff = 0.09 cfs @ 12.05 hrs, Volume= 0.005 af, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.26"

Area (sf)	CN	Description
1,733	74	>75% Grass cover, Good, HSG C
407	98	Roofs, HSG C
2,140	79	Weighted Average
1,733		80.98% Pervious Area
407		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	32	0.0600	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment A: Area A



Summary for Subcatchment B: Area B

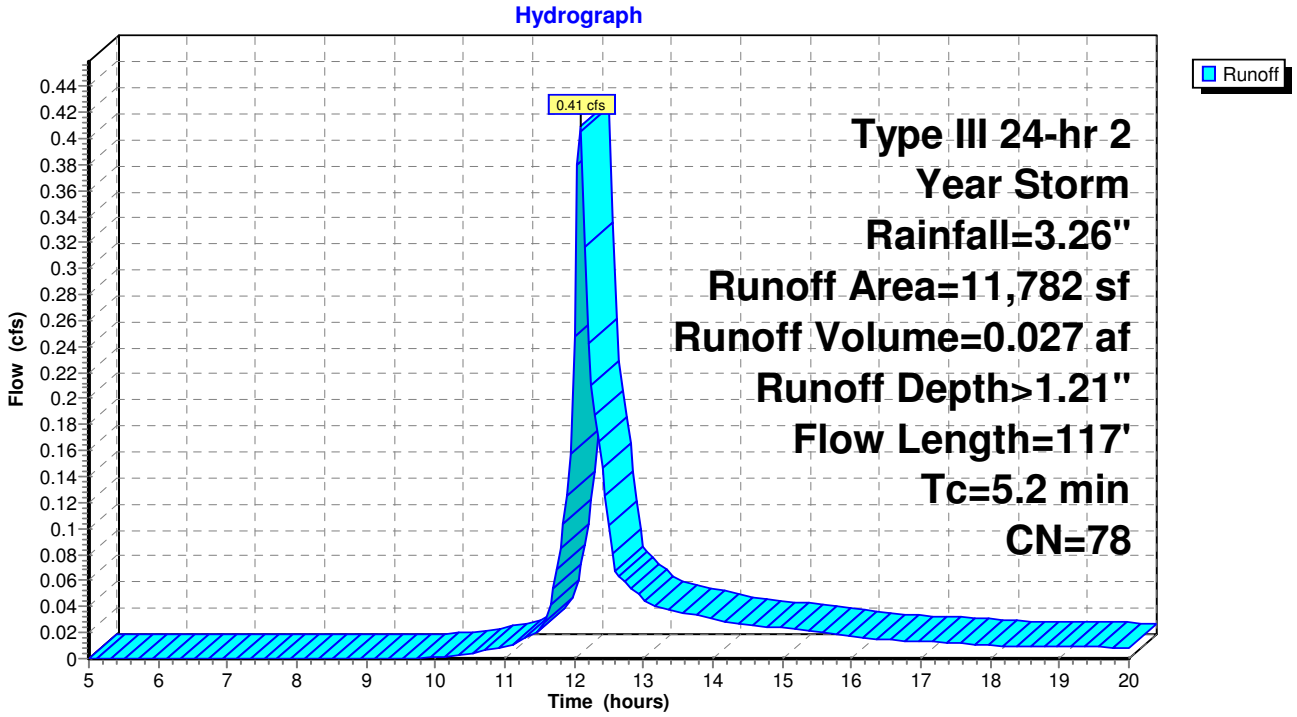
Runoff = 0.41 cfs @ 12.09 hrs, Volume= 0.027 af, Depth> 1.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.26"

Area (sf)	CN	Description
1,823	98	Roofs, HSG C
9,959	74	>75% Grass cover, Good, HSG C
11,782	78	Weighted Average
9,959		84.53% Pervious Area
1,823		15.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9	67	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.2	117	Total			

Subcatchment B: Area B



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

Subcatchment A: Area A Runoff Area=2,140 sf 19.02% Impervious Runoff Depth>2.55"
Flow Length=32' Slope=0.0600 '/' Tc=2.5 min CN=79 Runoff=0.17 cfs 0.010 af

Subcatchment B: Area B Runoff Area=11,782 sf 15.47% Impervious Runoff Depth>2.46"
Flow Length=117' Tc=5.2 min CN=78 Runoff=0.84 cfs 0.056 af

Total Runoff Area = 0.320 ac Runoff Volume = 0.066 af Average Runoff Depth = 2.48"
83.98% Pervious = 0.268 ac 16.02% Impervious = 0.051 ac

Summary for Subcatchment A: Area A

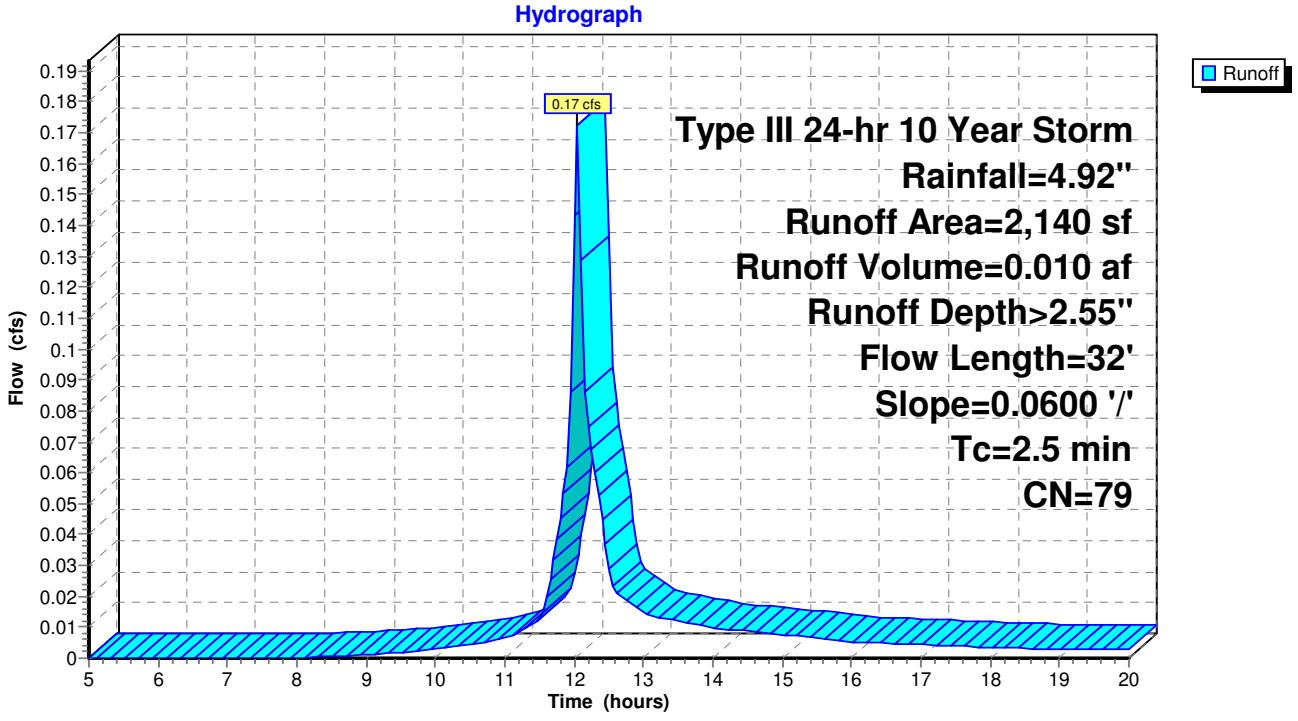
Runoff = 0.17 cfs @ 12.04 hrs, Volume= 0.010 af, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.92"

Area (sf)	CN	Description
1,733	74	>75% Grass cover, Good, HSG C
407	98	Roofs, HSG C
2,140	79	Weighted Average
1,733		80.98% Pervious Area
407		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	32	0.0600	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment A: Area A



Summary for Subcatchment B: Area B

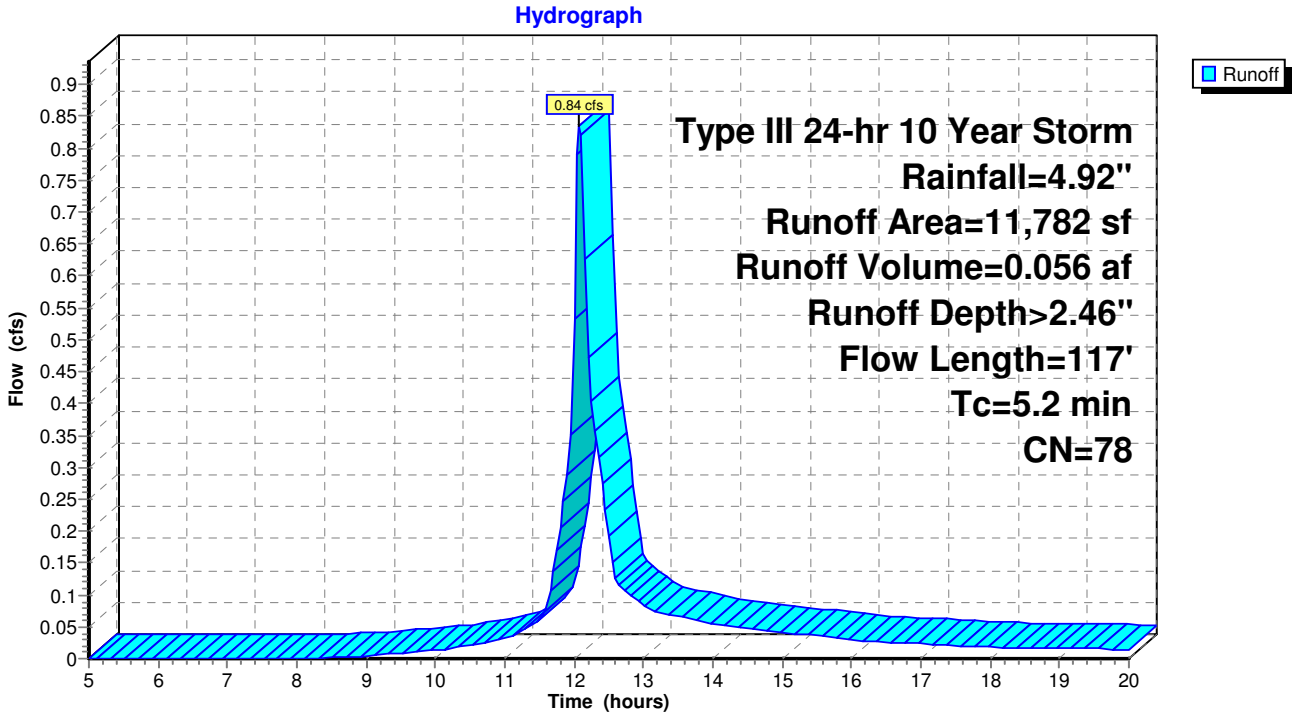
Runoff = 0.84 cfs @ 12.08 hrs, Volume= 0.056 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.92"

Area (sf)	CN	Description
1,823	98	Roofs, HSG C
9,959	74	>75% Grass cover, Good, HSG C
11,782	78	Weighted Average
9,959		84.53% Pervious Area
1,823		15.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9	67	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.2	117	Total			

Subcatchment B: Area B



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

Subcatchment A: Area A Runoff Area=2,140 sf 19.02% Impervious Runoff Depth>3.64"
Flow Length=32' Slope=0.0600 '/' Tc=2.5 min CN=79 Runoff=0.24 cfs 0.015 af

Subcatchment B: Area B Runoff Area=11,782 sf 15.47% Impervious Runoff Depth>3.53"
Flow Length=117' Tc=5.2 min CN=78 Runoff=1.19 cfs 0.080 af

Total Runoff Area = 0.320 ac Runoff Volume = 0.095 af Average Runoff Depth = 3.55"
83.98% Pervious = 0.268 ac 16.02% Impervious = 0.051 ac

Summary for Subcatchment A: Area A

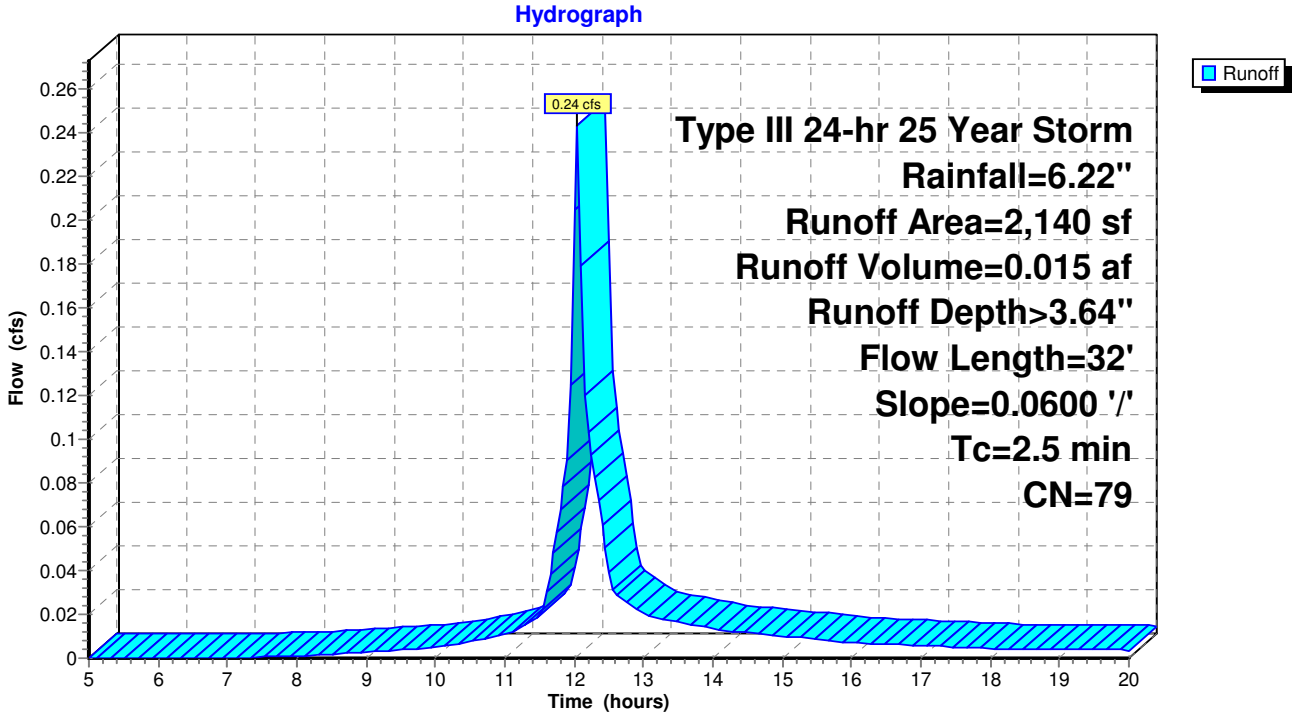
Runoff = 0.24 cfs @ 12.04 hrs, Volume= 0.015 af, Depth> 3.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.22"

Area (sf)	CN	Description
1,733	74	>75% Grass cover, Good, HSG C
407	98	Roofs, HSG C
2,140	79	Weighted Average
1,733		80.98% Pervious Area
407		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	32	0.0600	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment A: Area A



Summary for Subcatchment B: Area B

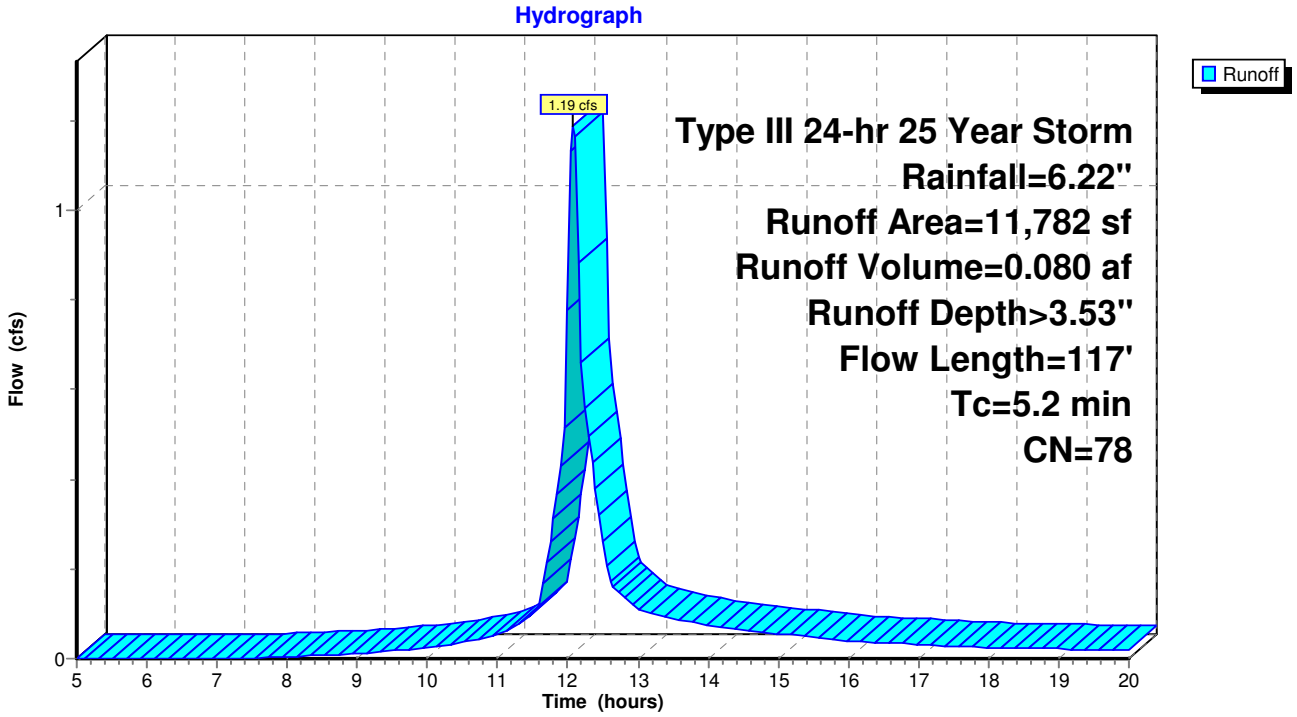
Runoff = 1.19 cfs @ 12.08 hrs, Volume= 0.080 af, Depth> 3.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.22"

Area (sf)	CN	Description
1,823	98	Roofs, HSG C
9,959	74	>75% Grass cover, Good, HSG C
11,782	78	Weighted Average
9,959		84.53% Pervious Area
1,823		15.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9	67	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.2	117	Total			

Subcatchment B: Area B



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

Subcatchment A: Area A Runoff Area=2,140 sf 19.02% Impervious Runoff Depth>5.98"
Flow Length=32' Slope=0.0600 '/' Tc=2.5 min CN=79 Runoff=0.39 cfs 0.024 af

Subcatchment B: Area B Runoff Area=11,782 sf 15.47% Impervious Runoff Depth>5.86"
Flow Length=117' Tc=5.2 min CN=78 Runoff=1.93 cfs 0.132 af

Total Runoff Area = 0.320 ac Runoff Volume = 0.156 af Average Runoff Depth = 5.88"
83.98% Pervious = 0.268 ac 16.02% Impervious = 0.051 ac

Summary for Subcatchment A: Area A

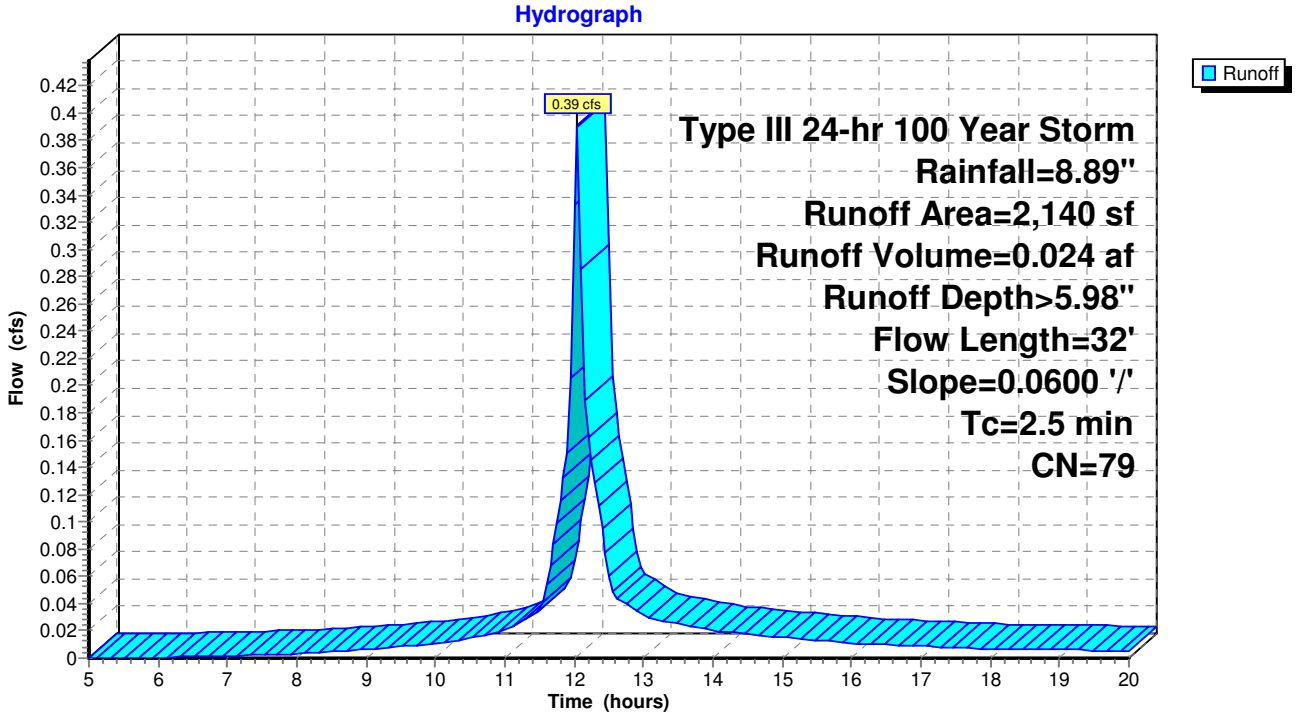
Runoff = 0.39 cfs @ 12.04 hrs, Volume= 0.024 af, Depth> 5.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.89"

Area (sf)	CN	Description
1,733	74	>75% Grass cover, Good, HSG C
407	98	Roofs, HSG C
2,140	79	Weighted Average
1,733		80.98% Pervious Area
407		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	32	0.0600	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment A: Area A



Summary for Subcatchment B: Area B

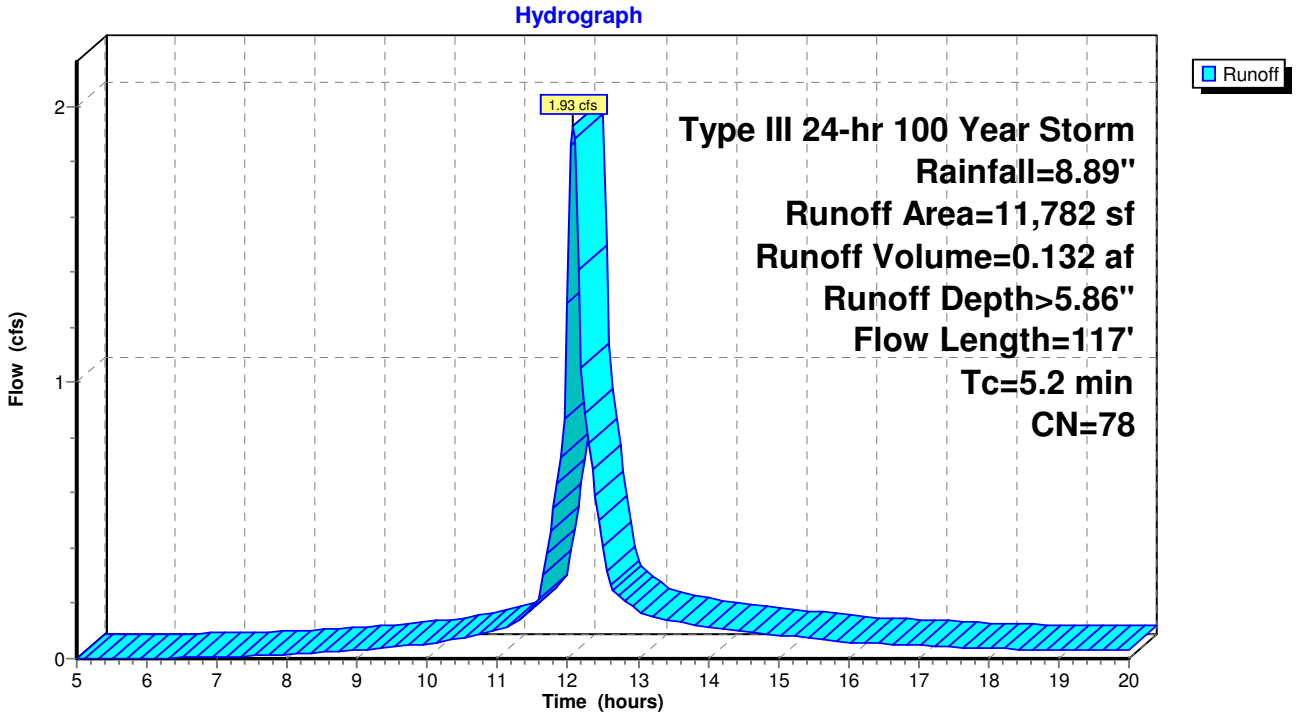
Runoff = 1.93 cfs @ 12.08 hrs, Volume= 0.132 af, Depth> 5.86"

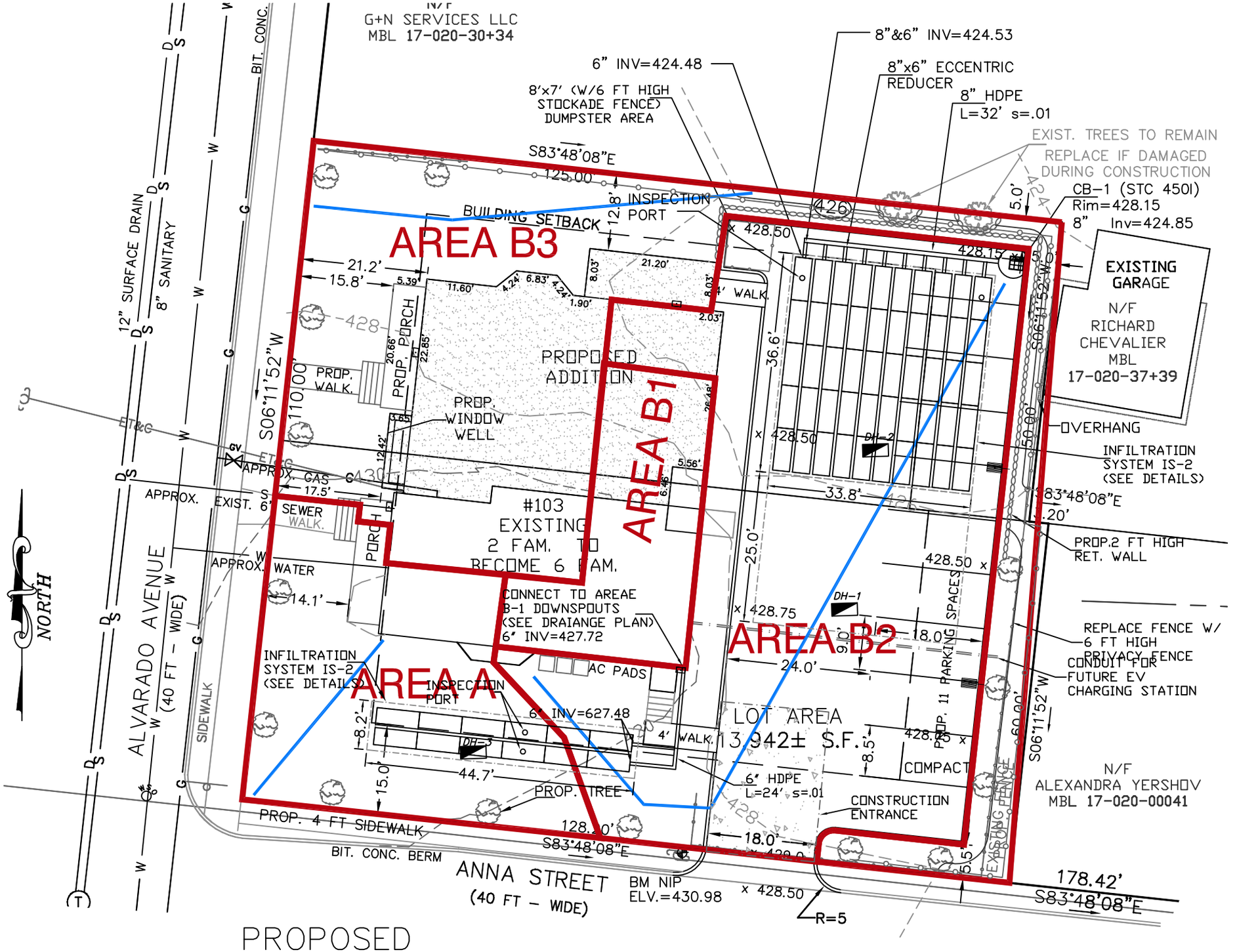
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.89"

Area (sf)	CN	Description
1,823	98	Roofs, HSG C
9,959	74	>75% Grass cover, Good, HSG C
11,782	78	Weighted Average
9,959		84.53% Pervious Area
1,823		15.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.9	67	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.2	117	Total			

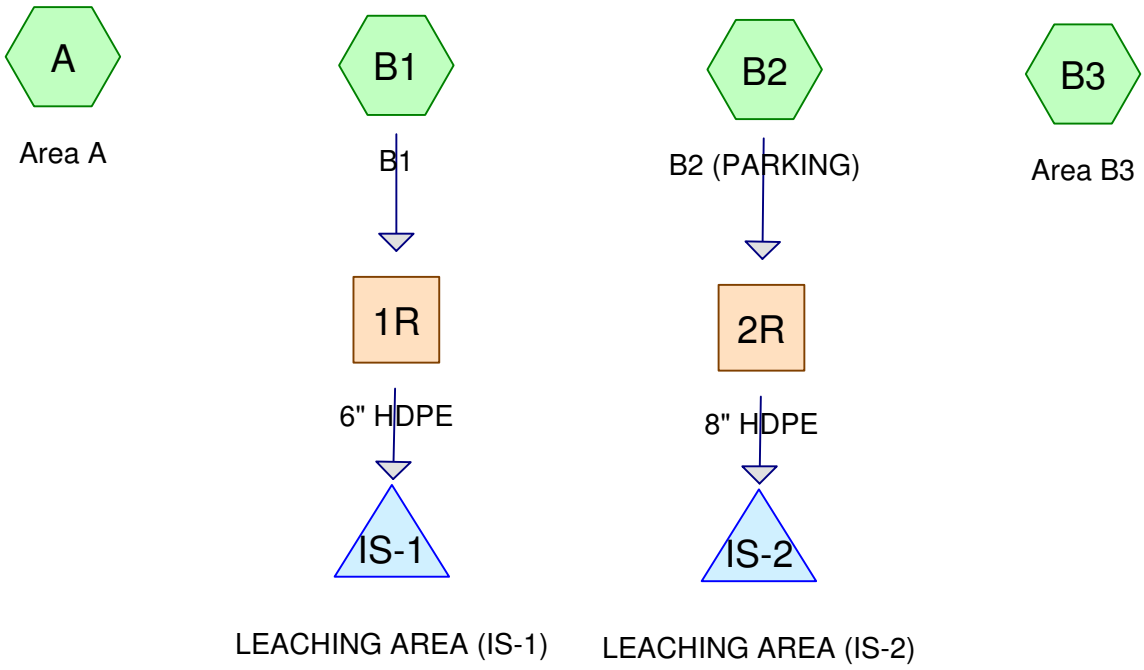
Subcatchment B: Area B





PROPOSED

SCALE 1"=20'



Subcat Reach Pond Link

Drainage Diagram for 23-0696 Post-02222024

Prepared by Alpha Omega Engineering Inc, Printed 3/24/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.136	74	>75% Grass cover, Good, HSG C (A, B2, B3)
0.108	98	Paved parking, HSG C (B2)
0.076	98	Roofs, HSG C (A, B1, B3)
0.320		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.320	HSG C	A, B1, B2, B3
0.000	HSG D	
0.000	Other	
0.320		**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)	Fill (inches)
1	1R	427.72	427.48	24.0	0.0100	0.012	6.0	0.0	0.0
2	2R	424.85	424.53	32.0	0.0100	0.012	8.0	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
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Area A Runoff Area=2,140 sf 19.02% Impervious Runoff Depth>1.28"
Flow Length=32' Slope=0.0600 '/' Tc=2.5 min CN=79 Runoff=0.09 cfs 0.005 af

Subcatchment B1: B1 Runoff Area=1,064 sf 100.00% Impervious Runoff Depth>2.83"
Tc=5.0 min CN=98 Runoff=0.08 cfs 0.006 af

Subcatchment B2: B2 (PARKING) Runoff Area=5,903 sf 79.33% Impervious Runoff Depth>2.37"
Flow Length=140' Tc=5.5 min CN=93 Runoff=0.38 cfs 0.027 af

Subcatchment B3: Area B3 Runoff Area=4,815 sf 38.32% Impervious Runoff Depth>1.54"
Flow Length=109' Tc=7.0 min CN=83 Runoff=0.20 cfs 0.014 af

Reach 1R: 6" HDPE Avg. Flow Depth=0.12' Max Vel=2.11 fps Inflow=0.08 cfs 0.006 af
6.0" Round Pipe n=0.012 L=24.0' S=0.0100 '/' Capacity=0.61 cfs Outflow=0.08 cfs 0.006 af

Reach 2R: 8" HDPE Avg. Flow Depth=0.25' Max Vel=3.24 fps Inflow=0.38 cfs 0.027 af
8.0" Round Pipe n=0.012 L=32.0' S=0.0100 '/' Capacity=1.31 cfs Outflow=0.38 cfs 0.027 af

Pond IS-1: LEACHING AREA (IS-1) Peak Elev=427.27' Storage=137 cf Inflow=0.08 cfs 0.006 af
Outflow=0.01 cfs 0.005 af

Pond IS-2: LEACHING AREA (IS-2) Peak Elev=424.15' Storage=661 cf Inflow=0.38 cfs 0.027 af
Outflow=0.03 cfs 0.020 af

Total Runoff Area = 0.320 ac Runoff Volume = 0.052 af Average Runoff Depth = 1.95"
42.54% Pervious = 0.136 ac 57.46% Impervious = 0.184 ac

Summary for Subcatchment A: Area A

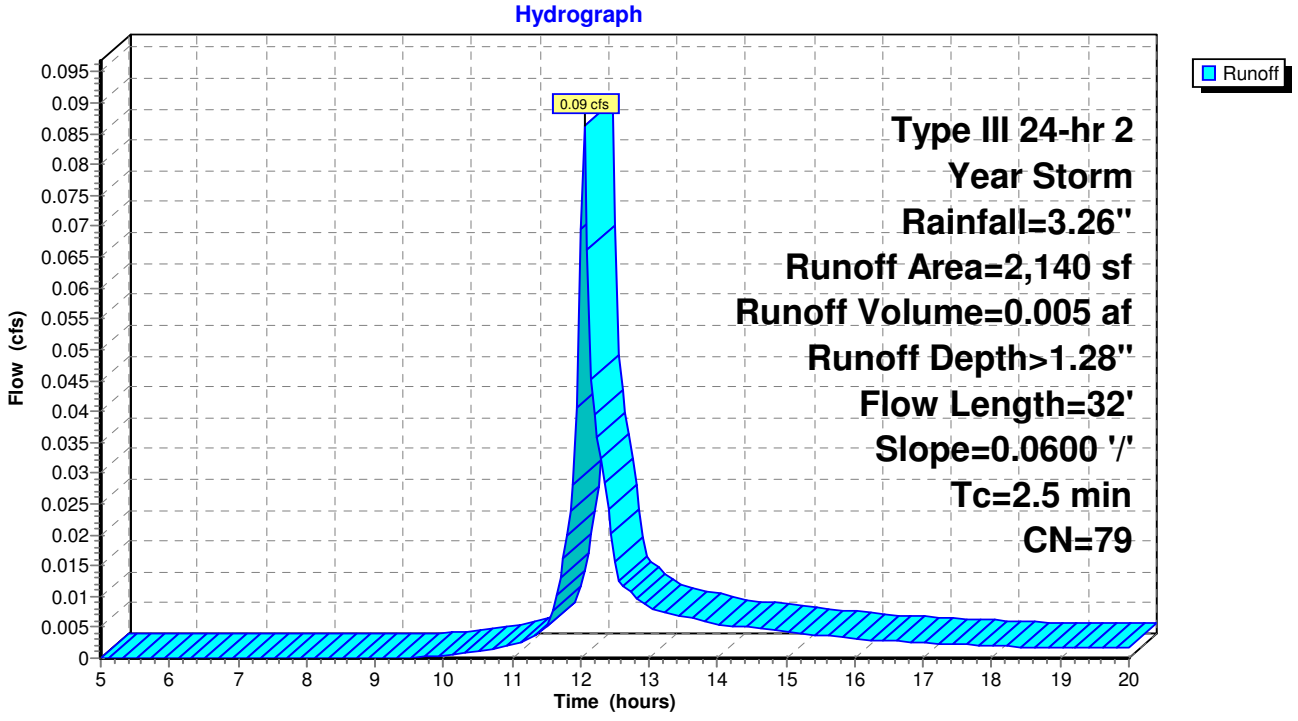
Runoff = 0.09 cfs @ 12.05 hrs, Volume= 0.005 af, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.26"

Area (sf)	CN	Description
1,733	74	>75% Grass cover, Good, HSG C
407	98	Roofs, HSG C
2,140	79	Weighted Average
1,733		80.98% Pervious Area
407		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	32	0.0600	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment A: Area A



Summary for Subcatchment B1: B1

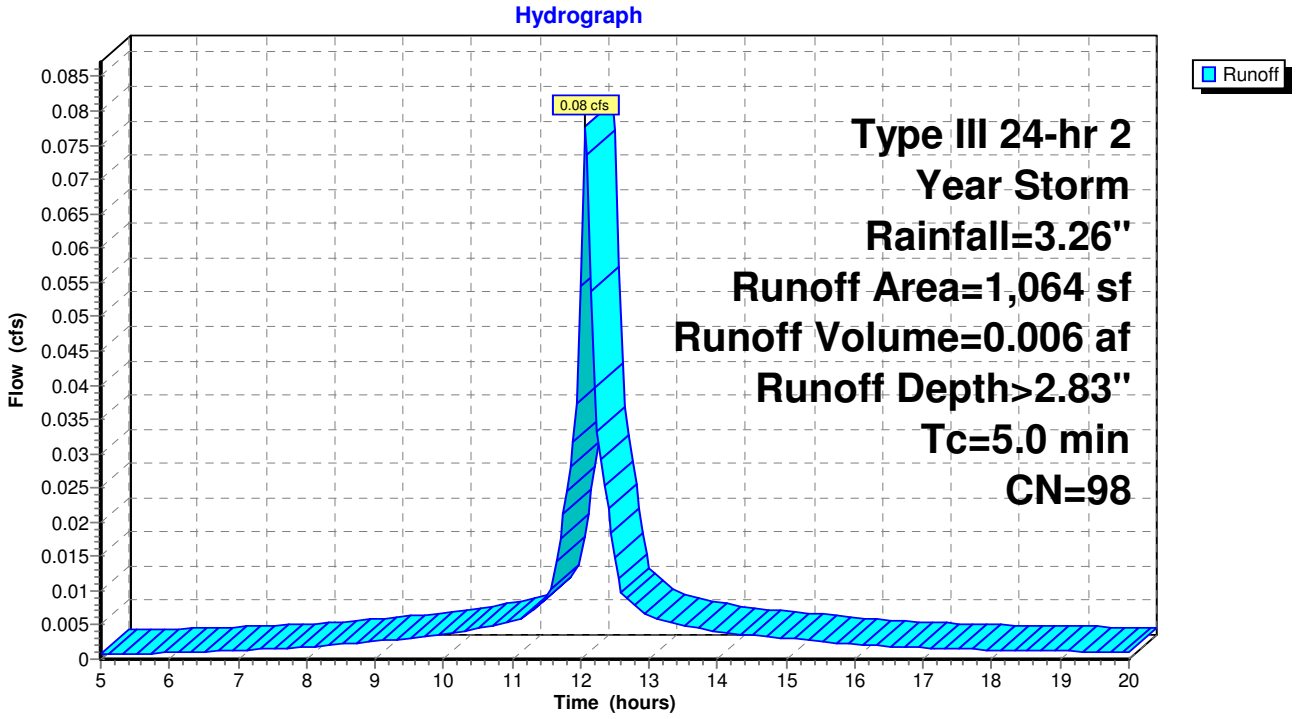
Runoff = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af, Depth> 2.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.26"

Area (sf)	CN	Description
1,064	98	Roofs, HSG C
1,064		100.00% Impervious Area

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

Subcatchment B1: B1



Summary for Subcatchment B2: B2 (PARKING)

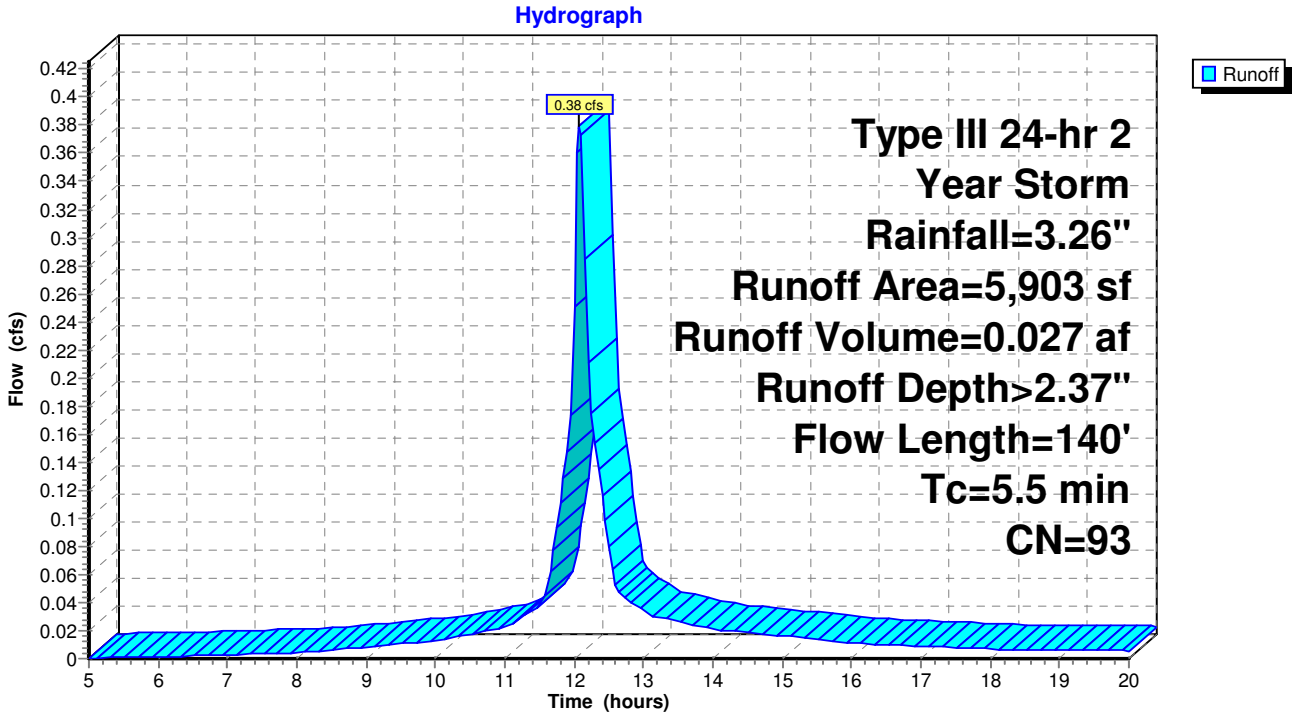
Runoff = 0.38 cfs @ 12.08 hrs, Volume= 0.027 af, Depth> 2.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.26"

Area (sf)	CN	Description
4,683	98	Paved parking, HSG C
1,220	74	>75% Grass cover, Good, HSG C
5,903	93	Weighted Average
1,220		20.67% Pervious Area
4,683		79.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	40	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.8	100	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.5	140	Total			

Subcatchment B2: B2 (PARKING)



Summary for Subcatchment B3: Area B3

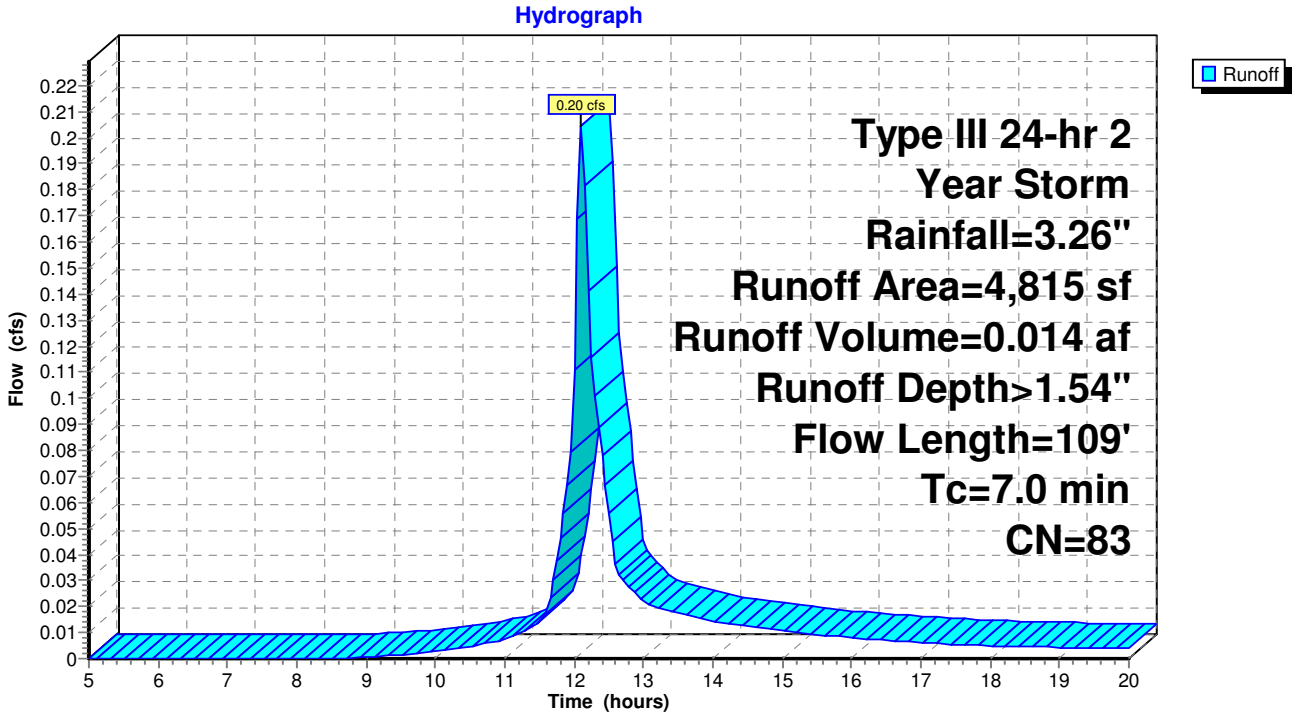
Runoff = 0.20 cfs @ 12.11 hrs, Volume= 0.014 af, Depth> 1.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.26"

Area (sf)	CN	Description
2,970	74	>75% Grass cover, Good, HSG C
1,845	98	Roofs, HSG C
4,815	83	Weighted Average
2,970		61.68% Pervious Area
1,845		38.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.4	59	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.0	109	Total			

Subcatchment B3: Area B3



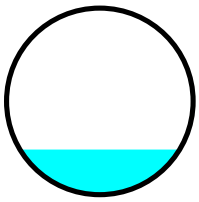
Summary for Reach 1R: 6" HDPE

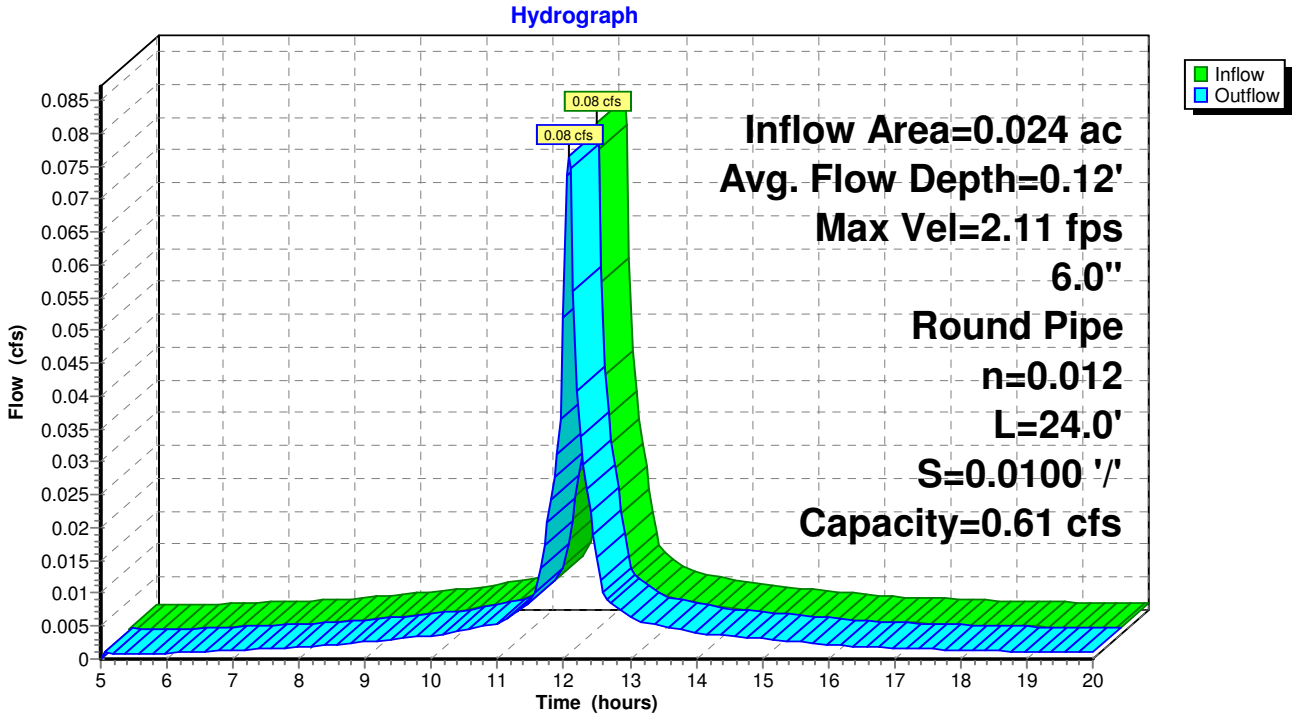
Inflow Area = 0.024 ac,100.00% Impervious, Inflow Depth > 2.83" for 2 Year Storm event
Inflow = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af
Outflow = 0.08 cfs @ 12.08 hrs, Volume= 0.006 af, Atten= 2%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.11 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.80 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 0.61 cfs

6.0" Round Pipe
n= 0.012
Length= 24.0' Slope= 0.0100 '/'
Inlet Invert= 427.72', Outlet Invert= 427.48'





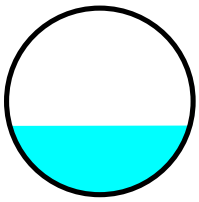
Summary for Reach 2R: 8" HDPE

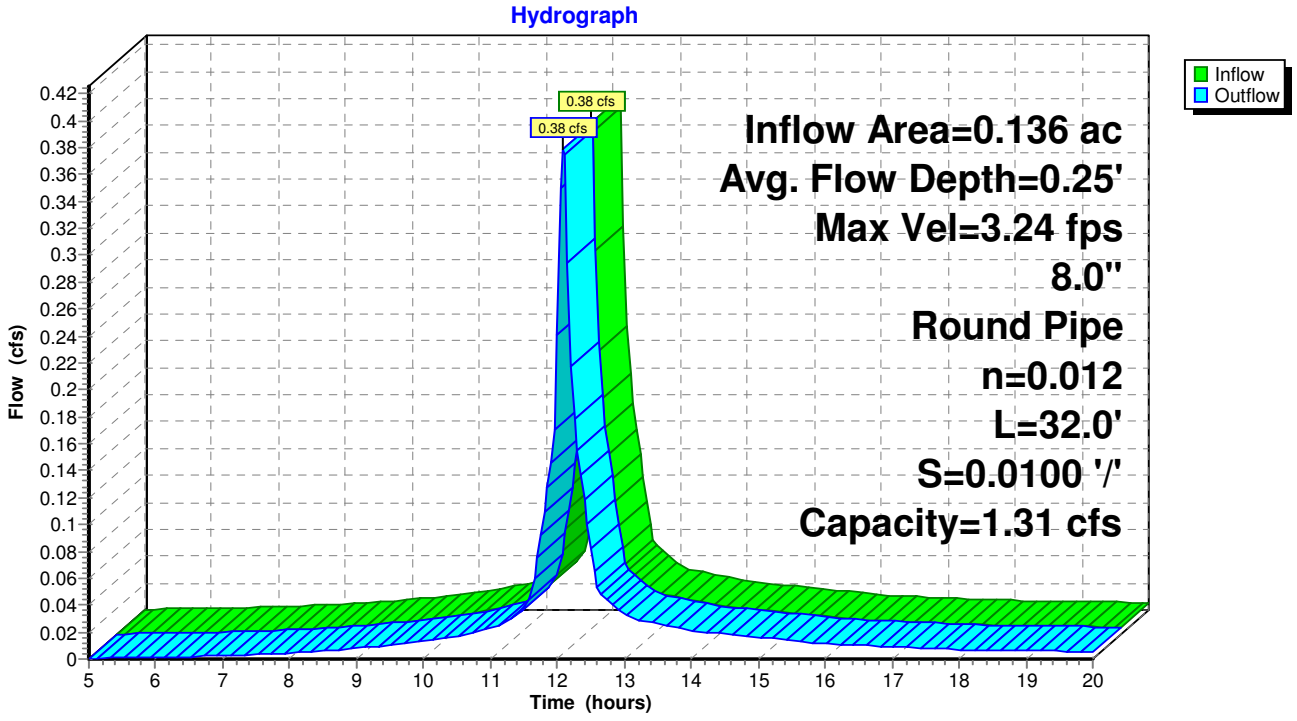
Inflow Area = 0.136 ac, 79.33% Impervious, Inflow Depth > 2.37" for 2 Year Storm event
Inflow = 0.38 cfs @ 12.08 hrs, Volume= 0.027 af
Outflow = 0.38 cfs @ 12.09 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.24 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.18 fps, Avg. Travel Time= 0.5 min

Peak Storage= 4 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.31 cfs

8.0" Round Pipe
n= 0.012
Length= 32.0' Slope= 0.0100 '/'
Inlet Invert= 424.85', Outlet Invert= 424.53'





Summary for Pond IS-1: LEACHING AREA (IS-1)

Inflow Area = 0.024 ac,100.00% Impervious, Inflow Depth > 2.83" for 2 Year Storm event
Inflow = 0.08 cfs @ 12.08 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 12.82 hrs, Volume= 0.005 af, Atten= 90%, Lag= 44.9 min
Discarded = 0.01 cfs @ 12.82 hrs, Volume= 0.005 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 427.27' @ 12.82 hrs Surf.Area= 0 sf Storage= 137 cf

Plug-Flow detention time= 206.0 min calculated for 0.005 af (79% of inflow)
Center-of-Mass det. time= 150.4 min (888.6 - 738.2)

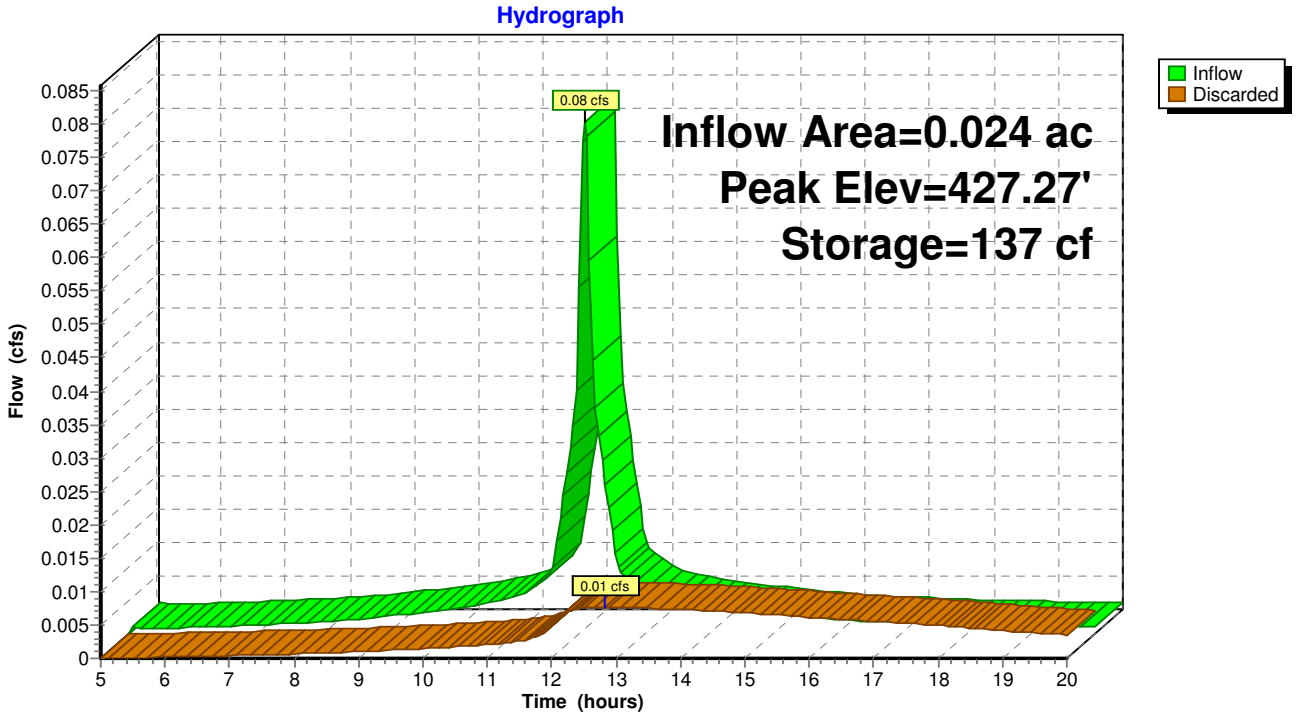
Volume	Invert	Avail.Storage	Storage Description
#1	426.50'	453 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
426.50	0	0
427.00	75	75
428.33	303	378
428.83	75	453

Device	Routing	Invert	Outlet Devices
#1	Discarded	426.50'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00
			Disch. (cfs) 0.000 0.010 0.010 0.010 0.010

Discarded OutFlow Max=0.01 cfs @ 12.82 hrs HW=427.27' (Free Discharge)
1=Exfiltration (Custom Controls 0.01 cfs)

Pond IS-1: LEACHING AREA (IS-1)



Summary for Pond IS-2: LEACHING AREA (IS-2)

Inflow Area = 0.136 ac, 79.33% Impervious, Inflow Depth > 2.36" for 2 Year Storm event
Inflow = 0.38 cfs @ 12.09 hrs, Volume= 0.027 af
Outflow = 0.03 cfs @ 12.20 hrs, Volume= 0.020 af, Atten= 92%, Lag= 6.8 min
Discarded = 0.03 cfs @ 12.20 hrs, Volume= 0.020 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 424.15' @ 13.16 hrs Surf.Area= 0 sf Storage= 661 cf

Plug-Flow detention time= 218.6 min calculated for 0.020 af (74% of inflow)
Center-of-Mass det. time= 157.0 min (918.9 - 761.9)

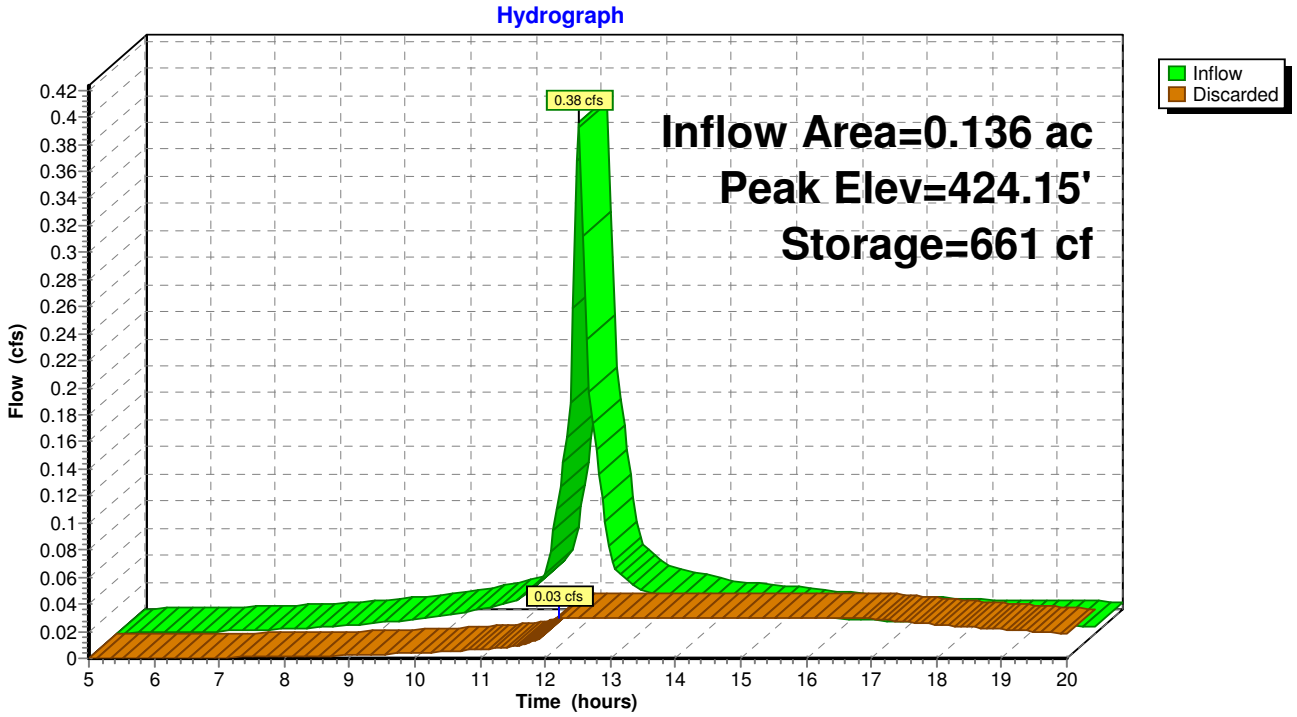
Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	2,685 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
423.00	0	0
424.00	495	495
425.33	1,438	1,933
426.33	752	2,685

Device	Routing	Invert	Outlet Devices
#1	Discarded	423.00'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00
			Disch. (cfs) 0.000 0.030 0.030 0.030 0.030

Discarded OutFlow Max=0.03 cfs @ 12.20 hrs HW=424.02' (Free Discharge)
1=Exfiltration (Custom Controls 0.03 cfs)

Pond IS-2: LEACHING AREA (IS-2)



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

Subcatchment A: Area A Runoff Area=2,140 sf 19.02% Impervious Runoff Depth>2.55"
Flow Length=32' Slope=0.0600 '/' Tc=2.5 min CN=79 Runoff=0.17 cfs 0.010 af

Subcatchment B1: B1 Runoff Area=1,064 sf 100.00% Impervious Runoff Depth>4.35"
Tc=5.0 min CN=98 Runoff=0.12 cfs 0.009 af

Subcatchment B2: B2 (PARKING) Runoff Area=5,903 sf 79.33% Impervious Runoff Depth>3.89"
Flow Length=140' Tc=5.5 min CN=93 Runoff=0.61 cfs 0.044 af

Subcatchment B3: Area B3 Runoff Area=4,815 sf 38.32% Impervious Runoff Depth>2.91"
Flow Length=109' Tc=7.0 min CN=83 Runoff=0.38 cfs 0.027 af

Reach 1R: 6" HDPE Avg. Flow Depth=0.15' Max Vel=2.38 fps Inflow=0.12 cfs 0.009 af
6.0" Round Pipe n=0.012 L=24.0' S=0.0100 '/' Capacity=0.61 cfs Outflow=0.12 cfs 0.009 af

Reach 2R: 8" HDPE Avg. Flow Depth=0.32' Max Vel=3.67 fps Inflow=0.61 cfs 0.044 af
8.0" Round Pipe n=0.012 L=32.0' S=0.0100 '/' Capacity=1.31 cfs Outflow=0.61 cfs 0.044 af

Pond IS-1: LEACHING AREA (IS-1) Peak Elev=427.62' Storage=215 cf Inflow=0.12 cfs 0.009 af
Outflow=0.01 cfs 0.007 af

Pond IS-2: LEACHING AREA (IS-2) Peak Elev=424.65' Storage=1,196 cf Inflow=0.61 cfs 0.044 af
Outflow=0.03 cfs 0.023 af

Total Runoff Area = 0.320 ac Runoff Volume = 0.090 af Average Runoff Depth = 3.38"
42.54% Pervious = 0.136 ac 57.46% Impervious = 0.184 ac

Summary for Subcatchment A: Area A

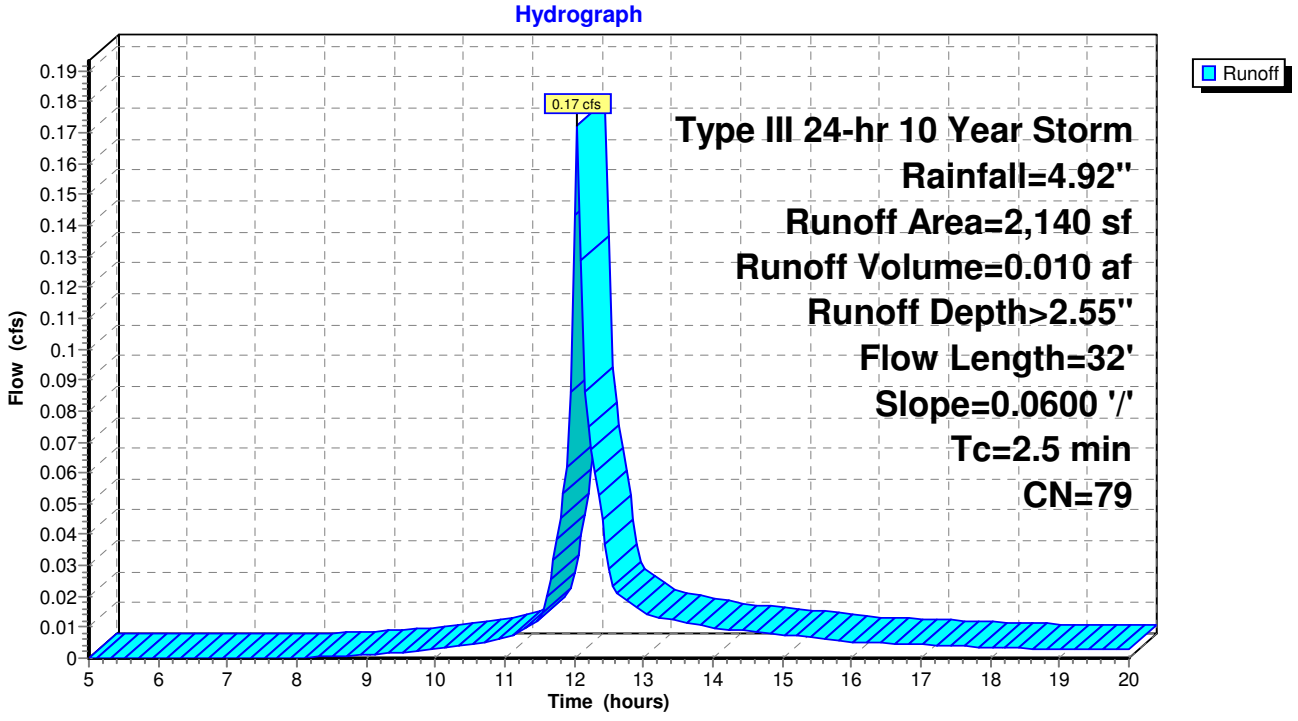
Runoff = 0.17 cfs @ 12.04 hrs, Volume= 0.010 af, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.92"

Area (sf)	CN	Description
1,733	74	>75% Grass cover, Good, HSG C
407	98	Roofs, HSG C
2,140	79	Weighted Average
1,733		80.98% Pervious Area
407		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	32	0.0600	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment A: Area A



Summary for Subcatchment B1: B1

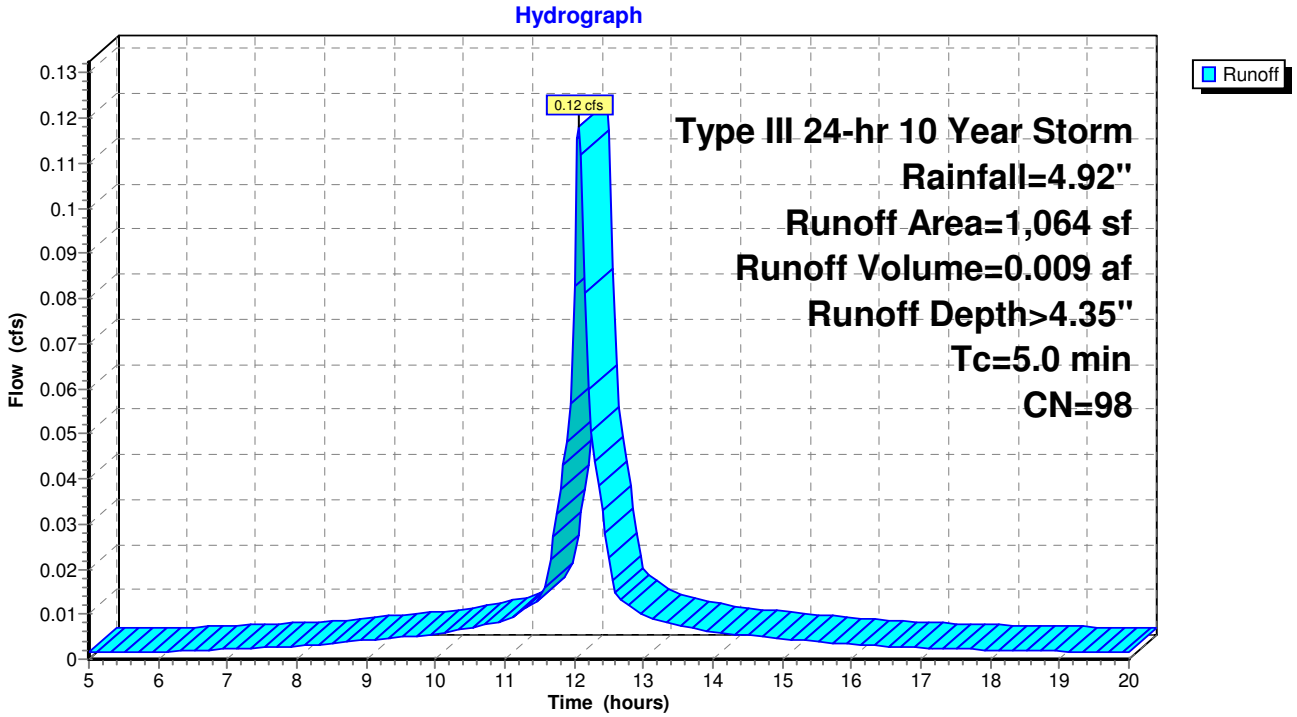
Runoff = 0.12 cfs @ 12.07 hrs, Volume= 0.009 af, Depth> 4.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.92"

Area (sf)	CN	Description
1,064	98	Roofs, HSG C
1,064		100.00% Impervious Area

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

Subcatchment B1: B1



Summary for Subcatchment B2: B2 (PARKING)

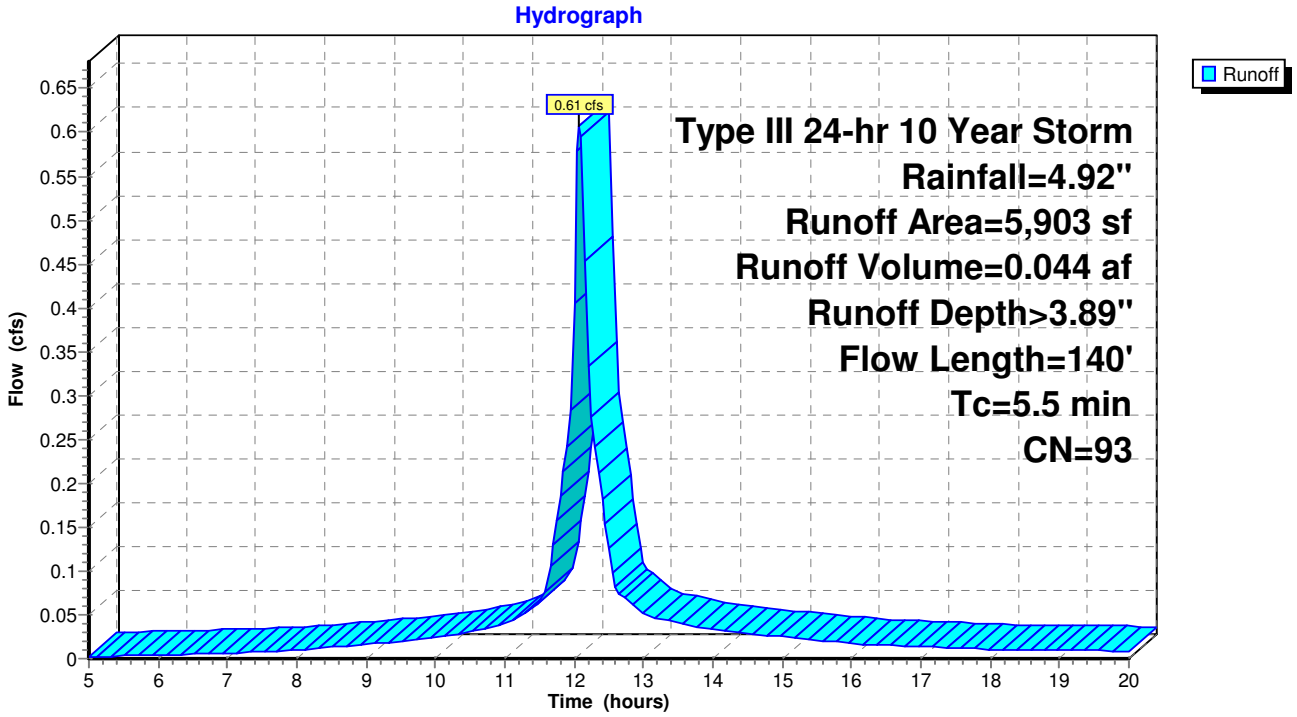
Runoff = 0.61 cfs @ 12.08 hrs, Volume= 0.044 af, Depth> 3.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.92"

Area (sf)	CN	Description
4,683	98	Paved parking, HSG C
1,220	74	>75% Grass cover, Good, HSG C
5,903	93	Weighted Average
1,220		20.67% Pervious Area
4,683		79.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	40	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.8	100	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.5	140	Total			

Subcatchment B2: B2 (PARKING)



Summary for Subcatchment B3: Area B3

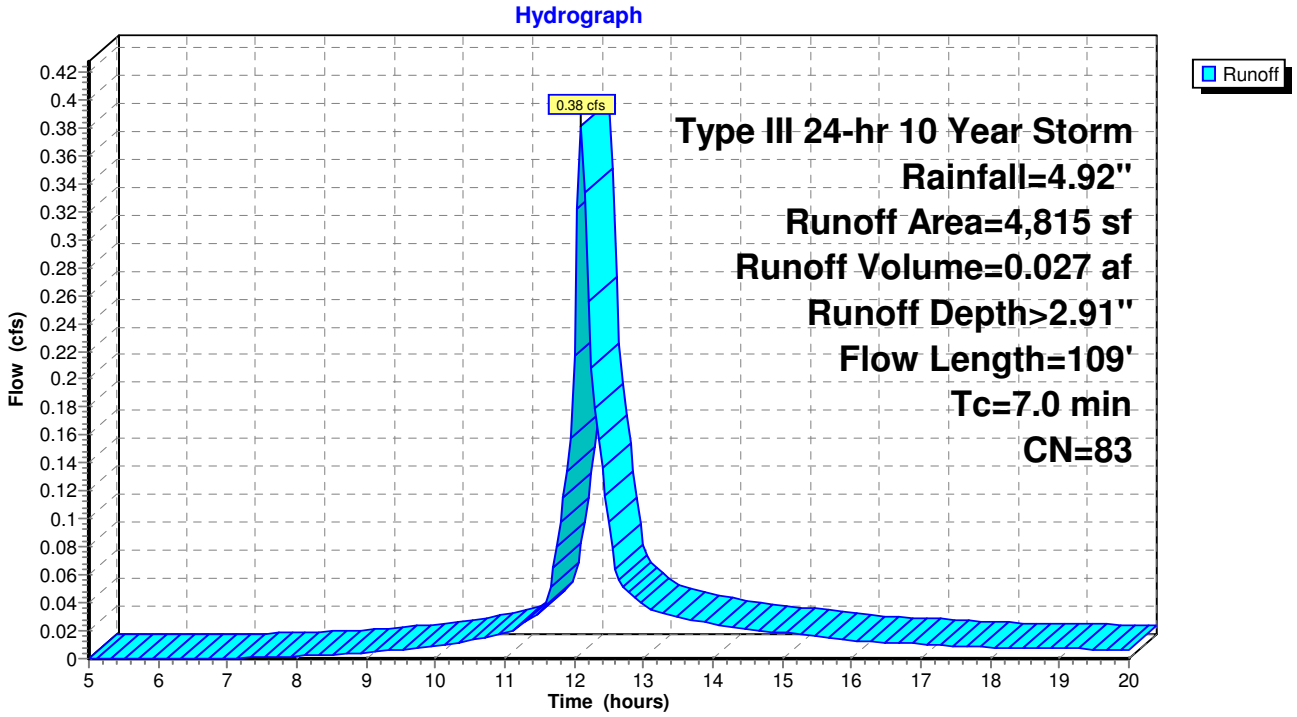
Runoff = 0.38 cfs @ 12.10 hrs, Volume= 0.027 af, Depth> 2.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.92"

Area (sf)	CN	Description
2,970	74	>75% Grass cover, Good, HSG C
1,845	98	Roofs, HSG C
4,815	83	Weighted Average
2,970		61.68% Pervious Area
1,845		38.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.4	59	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.0	109	Total			

Subcatchment B3: Area B3



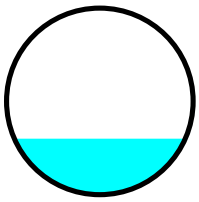
Summary for Reach 1R: 6" HDPE

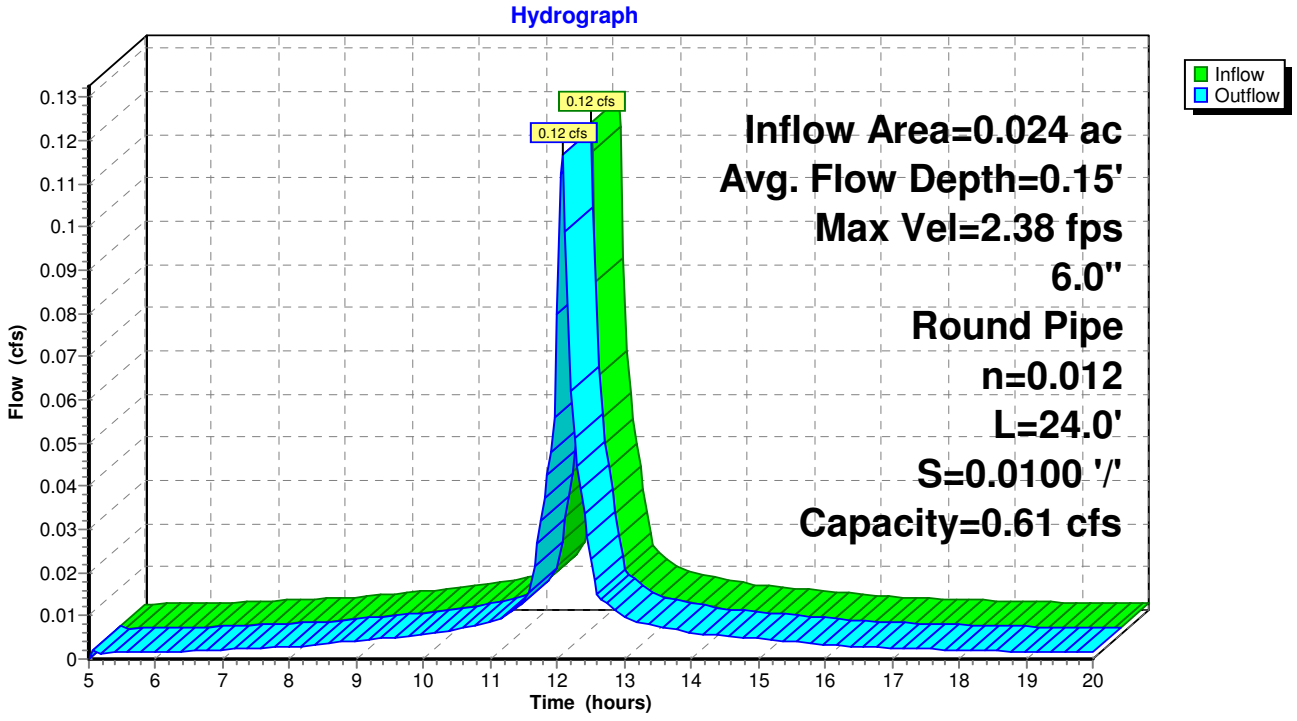
Inflow Area = 0.024 ac,100.00% Impervious, Inflow Depth > 4.35" for 10 Year Storm event
Inflow = 0.12 cfs @ 12.07 hrs, Volume= 0.009 af
Outflow = 0.12 cfs @ 12.08 hrs, Volume= 0.009 af, Atten= 2%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.38 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.91 fps, Avg. Travel Time= 0.4 min

Peak Storage= 1 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 0.61 cfs

6.0" Round Pipe
n= 0.012
Length= 24.0' Slope= 0.0100 '/'
Inlet Invert= 427.72', Outlet Invert= 427.48'





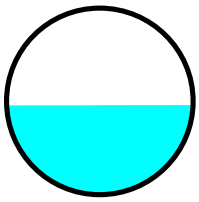
Summary for Reach 2R: 8" HDPE

Inflow Area = 0.136 ac, 79.33% Impervious, Inflow Depth > 3.89" for 10 Year Storm event
Inflow = 0.61 cfs @ 12.08 hrs, Volume= 0.044 af
Outflow = 0.61 cfs @ 12.09 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.3 min

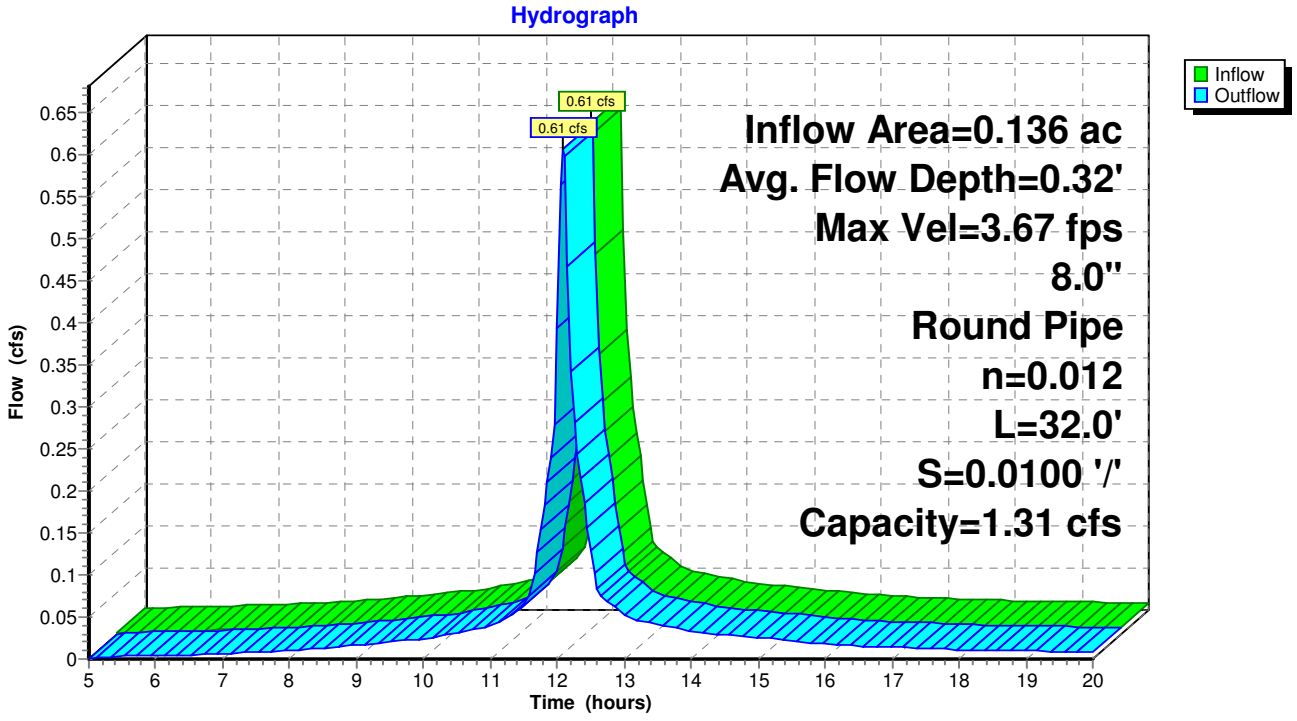
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.67 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.39 fps, Avg. Travel Time= 0.4 min

Peak Storage= 5 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.31 cfs

8.0" Round Pipe
n= 0.012
Length= 32.0' Slope= 0.0100 '/'
Inlet Invert= 424.85', Outlet Invert= 424.53'



Reach 2R: 8" HDPE



Summary for Pond IS-1: LEACHING AREA (IS-1)

Inflow Area = 0.024 ac,100.00% Impervious, Inflow Depth > 4.34" for 10 Year Storm event
Inflow = 0.12 cfs @ 12.08 hrs, Volume= 0.009 af
Outflow = 0.01 cfs @ 12.30 hrs, Volume= 0.007 af, Atten= 91%, Lag= 13.4 min
Discarded = 0.01 cfs @ 12.30 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 427.62' @ 12.98 hrs Surf.Area= 0 sf Storage= 215 cf

Plug-Flow detention time= 216.5 min calculated for 0.007 af (75% of inflow)
Center-of-Mass det. time= 156.0 min (891.0 - 735.0)

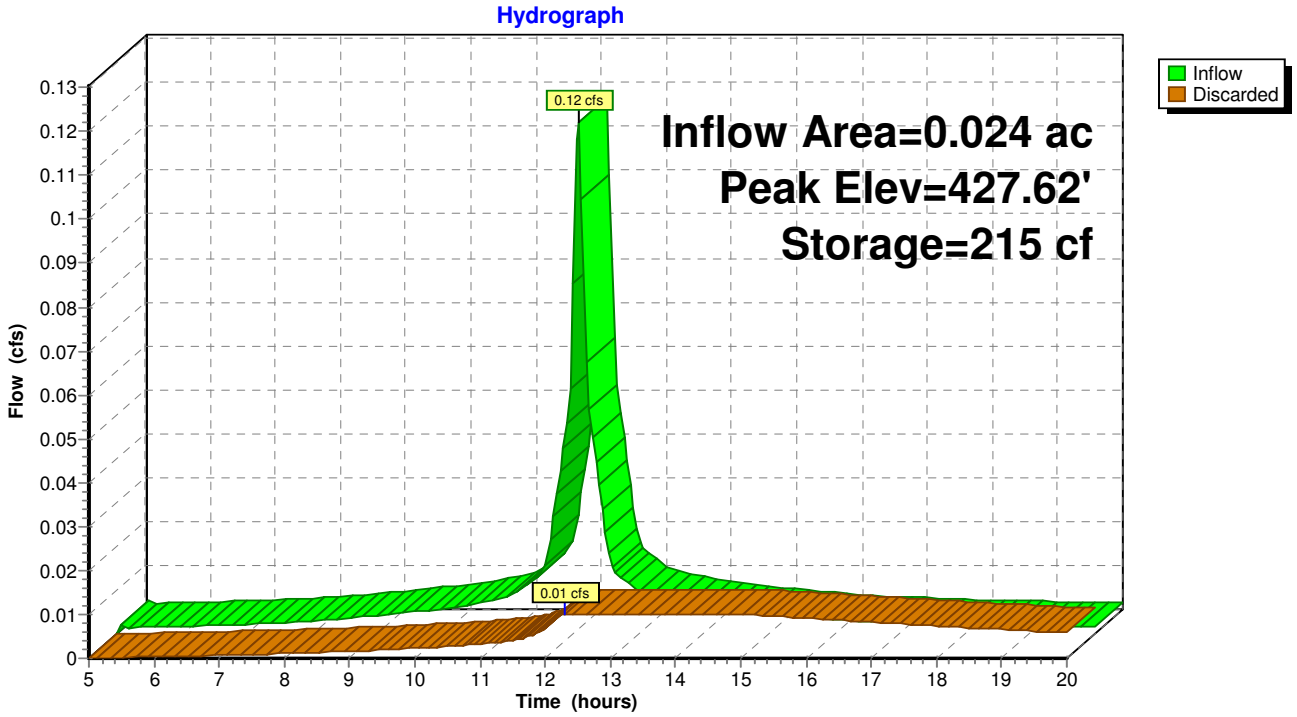
Volume	Invert	Avail.Storage	Storage Description
#1	426.50'	453 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
426.50	0	0
427.00	75	75
428.33	303	378
428.83	75	453

Device	Routing	Invert	Outlet Devices
#1	Discarded	426.50'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00
			Disch. (cfs) 0.000 0.010 0.010 0.010 0.010

Discarded OutFlow Max=0.01 cfs @ 12.30 hrs HW=427.51' (Free Discharge)
↑**1=Exfiltration** (Custom Controls 0.01 cfs)

Pond IS-1: LEACHING AREA (IS-1)



Summary for Pond IS-2: LEACHING AREA (IS-2)

Inflow Area = 0.136 ac, 79.33% Impervious, Inflow Depth > 3.89" for 10 Year Storm event
Inflow = 0.61 cfs @ 12.09 hrs, Volume= 0.044 af
Outflow = 0.03 cfs @ 12.00 hrs, Volume= 0.023 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.03 cfs @ 12.00 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 424.65' @ 14.37 hrs Surf.Area= 0 sf Storage= 1,196 cf

Plug-Flow detention time= 243.2 min calculated for 0.023 af (53% of inflow)
Center-of-Mass det. time= 159.1 min (910.9 - 751.8)

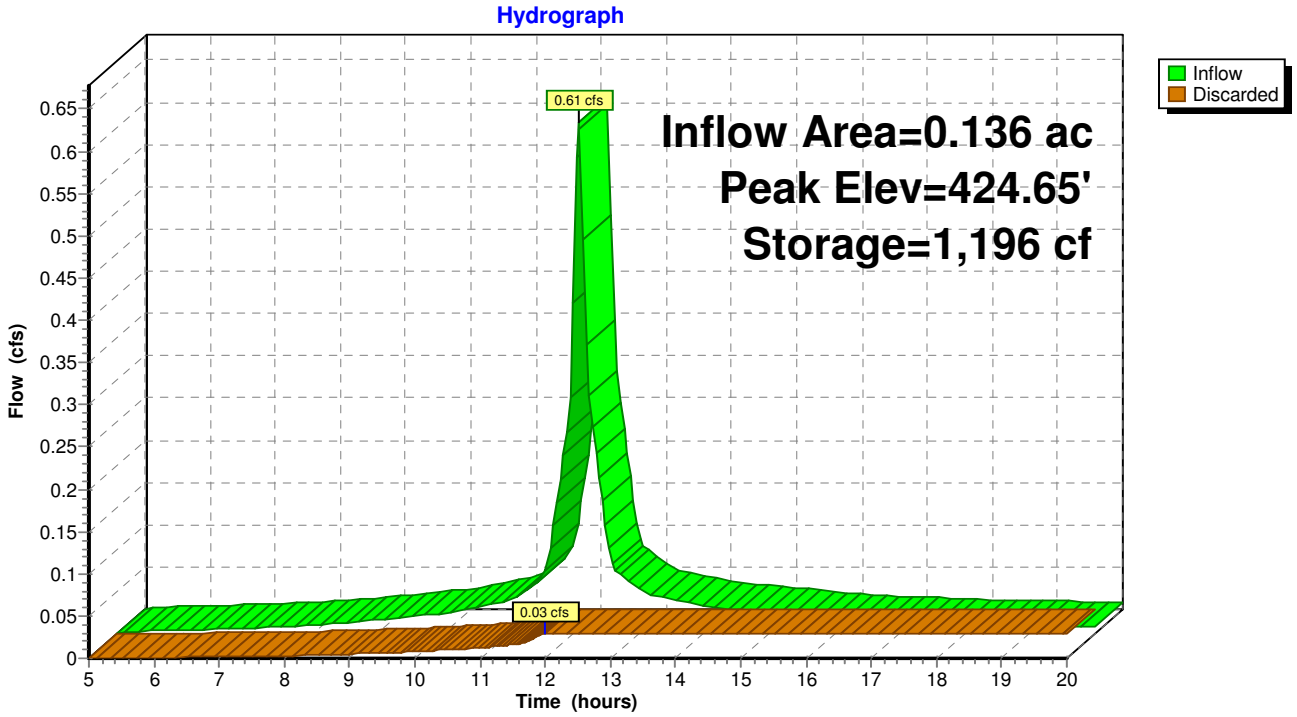
Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	2,685 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
423.00	0	0
424.00	495	495
425.33	1,438	1,933
426.33	752	2,685

Device	Routing	Invert	Outlet Devices
#1	Discarded	423.00'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00
			Disch. (cfs) 0.000 0.030 0.030 0.030 0.030

Discarded OutFlow Max=0.03 cfs @ 12.00 hrs HW=424.04' (Free Discharge)
↑**1=Exfiltration** (Custom Controls 0.03 cfs)

Pond IS-2: LEACHING AREA (IS-2)



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

Subcatchment A: Area A Runoff Area=2,140 sf 19.02% Impervious Runoff Depth>3.64"
Flow Length=32' Slope=0.0600 '/' Tc=2.5 min CN=79 Runoff=0.24 cfs 0.015 af

Subcatchment B1: B1 Runoff Area=1,064 sf 100.00% Impervious Runoff Depth>5.53"
Tc=5.0 min CN=98 Runoff=0.15 cfs 0.011 af

Subcatchment B2: B2 (PARKING) Runoff Area=5,903 sf 79.33% Impervious Runoff Depth>5.09"
Flow Length=140' Tc=5.5 min CN=93 Runoff=0.78 cfs 0.057 af

Subcatchment B3: Area B3 Runoff Area=4,815 sf 38.32% Impervious Runoff Depth>4.04"
Flow Length=109' Tc=7.0 min CN=83 Runoff=0.52 cfs 0.037 af

Reach 1R: 6" HDPE Avg. Flow Depth=0.17' Max Vel=2.54 fps Inflow=0.15 cfs 0.011 af
6.0" Round Pipe n=0.012 L=24.0' S=0.0100 '/' Capacity=0.61 cfs Outflow=0.15 cfs 0.011 af

Reach 2R: 8" HDPE Avg. Flow Depth=0.37' Max Vel=3.90 fps Inflow=0.78 cfs 0.057 af
8.0" Round Pipe n=0.012 L=32.0' S=0.0100 '/' Capacity=1.31 cfs Outflow=0.78 cfs 0.057 af

Pond IS-1: LEACHING AREA (IS-1) Peak Elev=427.92' Storage=284 cf Inflow=0.15 cfs 0.011 af
Outflow=0.01 cfs 0.008 af

Pond IS-2: LEACHING AREA (IS-2) Peak Elev=425.07' Storage=1,654 cf Inflow=0.78 cfs 0.057 af
Outflow=0.03 cfs 0.025 af

Total Runoff Area = 0.320 ac Runoff Volume = 0.121 af Average Runoff Depth = 4.54"
42.54% Pervious = 0.136 ac 57.46% Impervious = 0.184 ac

Summary for Subcatchment A: Area A

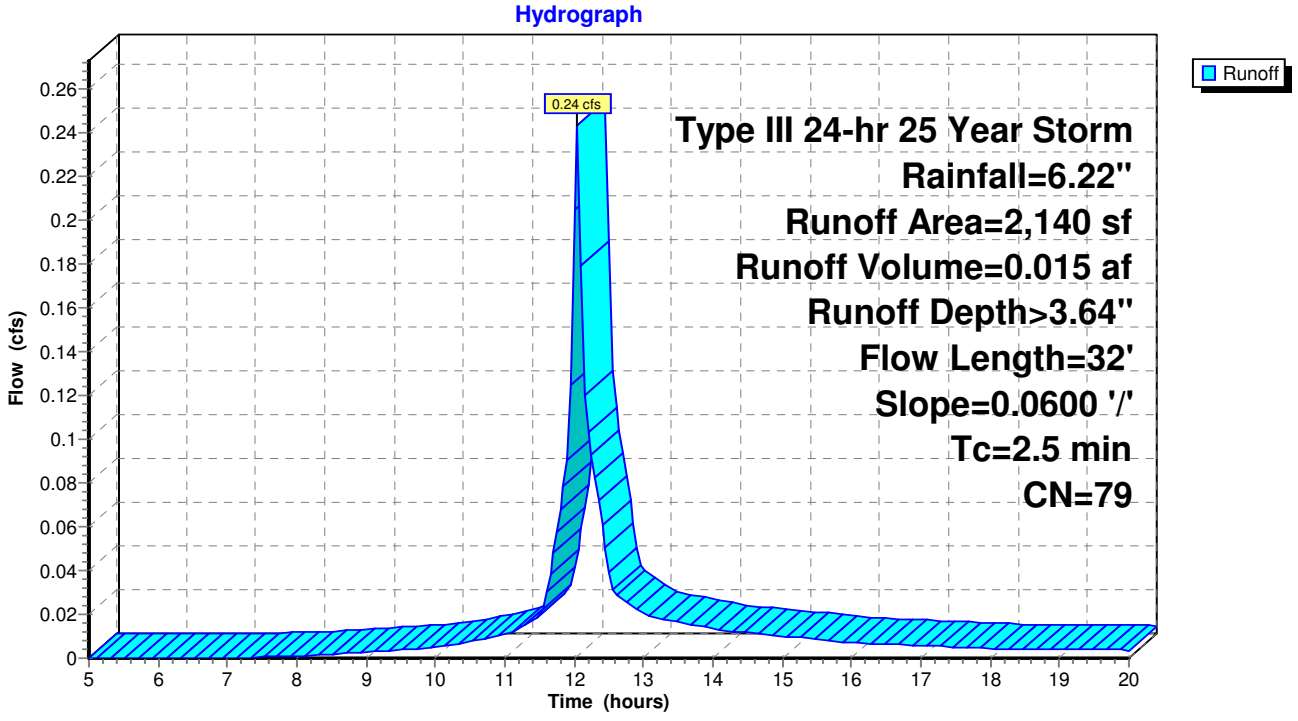
Runoff = 0.24 cfs @ 12.04 hrs, Volume= 0.015 af, Depth> 3.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.22"

Area (sf)	CN	Description
1,733	74	>75% Grass cover, Good, HSG C
407	98	Roofs, HSG C
2,140	79	Weighted Average
1,733		80.98% Pervious Area
407		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	32	0.0600	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment A: Area A



Summary for Subcatchment B1: B1

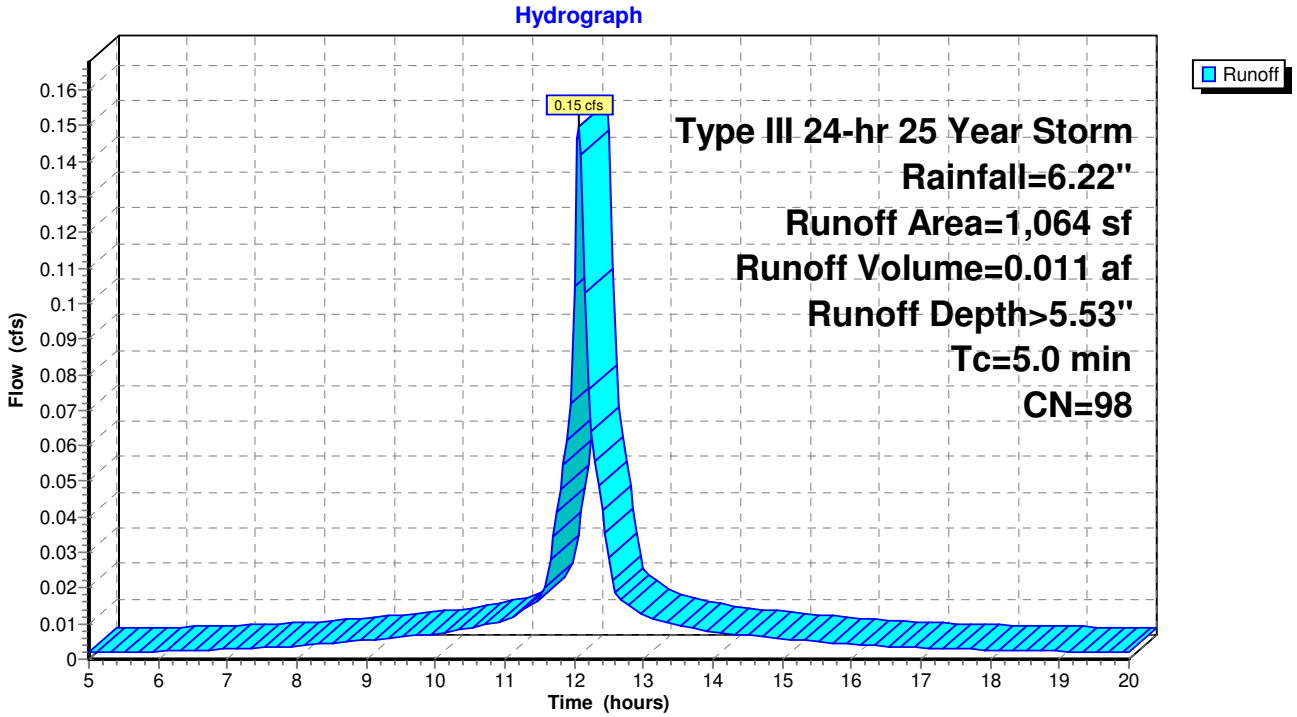
Runoff = 0.15 cfs @ 12.07 hrs, Volume= 0.011 af, Depth> 5.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.22"

Area (sf)	CN	Description
1,064	98	Roofs, HSG C
1,064		100.00% Impervious Area

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

Subcatchment B1: B1



Summary for Subcatchment B2: B2 (PARKING)

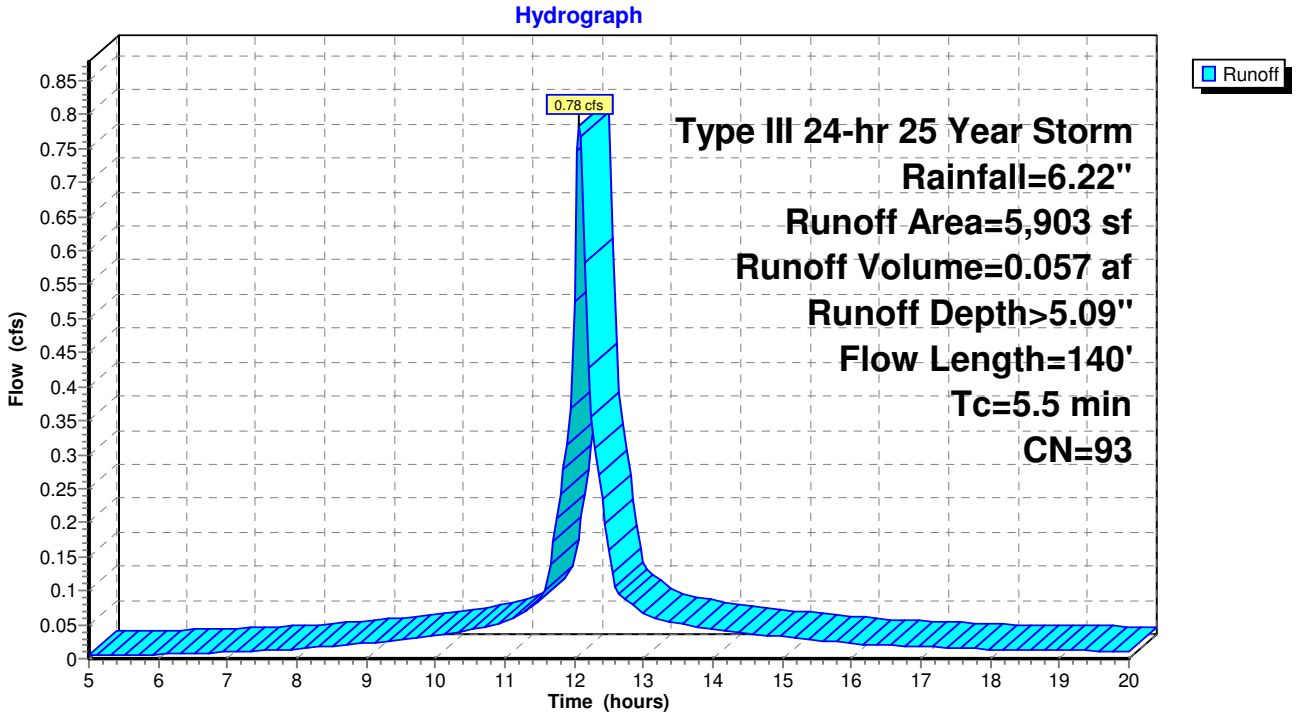
Runoff = 0.78 cfs @ 12.08 hrs, Volume= 0.057 af, Depth> 5.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.22"

Area (sf)	CN	Description
4,683	98	Paved parking, HSG C
1,220	74	>75% Grass cover, Good, HSG C
5,903	93	Weighted Average
1,220		20.67% Pervious Area
4,683		79.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	40	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.8	100	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.5	140	Total			

Subcatchment B2: B2 (PARKING)



Summary for Subcatchment B3: Area B3

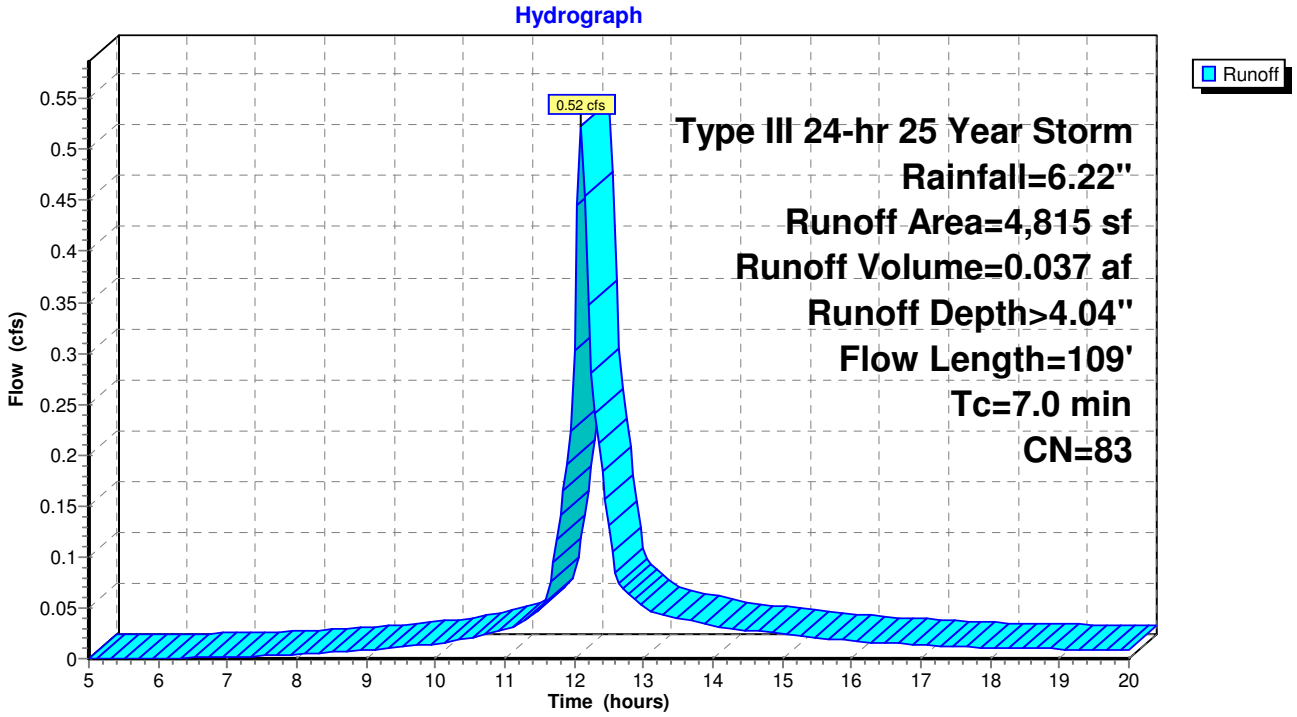
Runoff = 0.52 cfs @ 12.10 hrs, Volume= 0.037 af, Depth> 4.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Storm Rainfall=6.22"

Area (sf)	CN	Description
2,970	74	>75% Grass cover, Good, HSG C
1,845	98	Roofs, HSG C
4,815	83	Weighted Average
2,970		61.68% Pervious Area
1,845		38.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.4	59	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.0	109	Total			

Subcatchment B3: Area B3



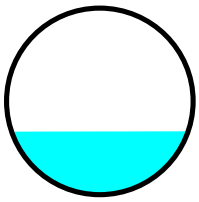
Summary for Reach 1R: 6" HDPE

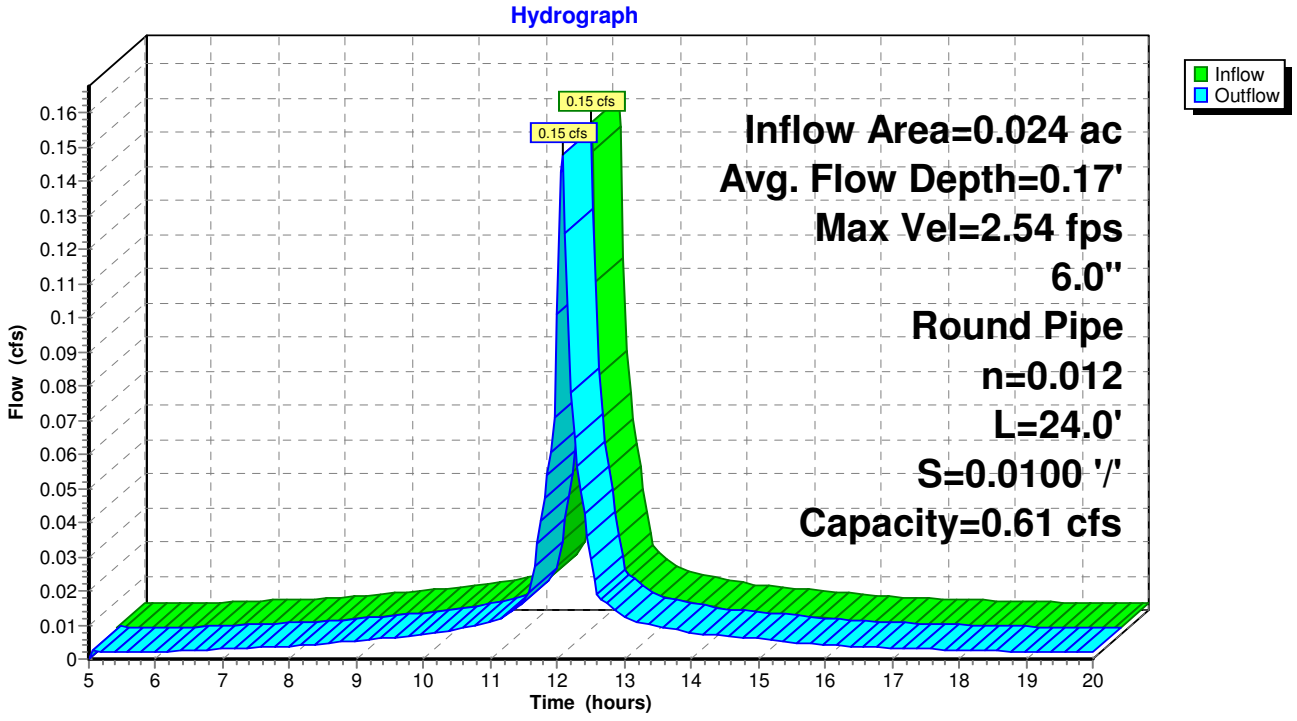
Inflow Area = 0.024 ac,100.00% Impervious, Inflow Depth > 5.53" for 25 Year Storm event
Inflow = 0.15 cfs @ 12.07 hrs, Volume= 0.011 af
Outflow = 0.15 cfs @ 12.08 hrs, Volume= 0.011 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.54 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.99 fps, Avg. Travel Time= 0.4 min

Peak Storage= 1 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 0.61 cfs

6.0" Round Pipe
n= 0.012
Length= 24.0' Slope= 0.0100 '/'
Inlet Invert= 427.72', Outlet Invert= 427.48'





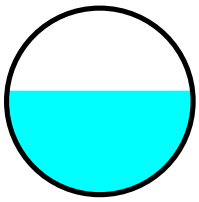
Summary for Reach 2R: 8" HDPE

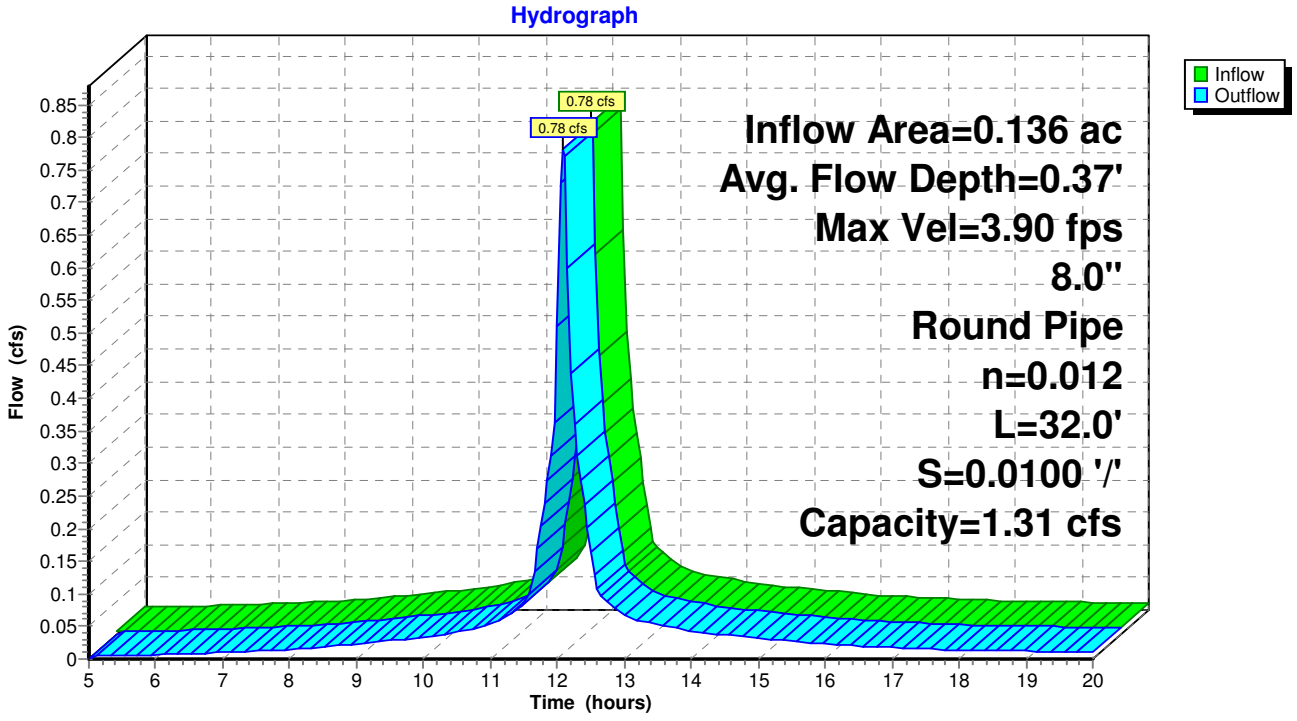
Inflow Area = 0.136 ac, 79.33% Impervious, Inflow Depth > 5.09" for 25 Year Storm event
Inflow = 0.78 cfs @ 12.08 hrs, Volume= 0.057 af
Outflow = 0.78 cfs @ 12.08 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.90 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.52 fps, Avg. Travel Time= 0.4 min

Peak Storage= 6 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.31 cfs

8.0" Round Pipe
n= 0.012
Length= 32.0' Slope= 0.0100 '/'
Inlet Invert= 424.85', Outlet Invert= 424.53'





Summary for Pond IS-1: LEACHING AREA (IS-1)

Inflow Area = 0.024 ac,100.00% Impervious, Inflow Depth > 5.53" for 25 Year Storm event
Inflow = 0.15 cfs @ 12.08 hrs, Volume= 0.011 af
Outflow = 0.01 cfs @ 12.10 hrs, Volume= 0.008 af, Atten= 93%, Lag= 1.5 min
Discarded = 0.01 cfs @ 12.10 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 427.92' @ 13.40 hrs Surf.Area= 0 sf Storage= 284 cf

Plug-Flow detention time= 236.1 min calculated for 0.008 af (69% of inflow)
Center-of-Mass det. time= 166.5 min (900.3 - 733.8)

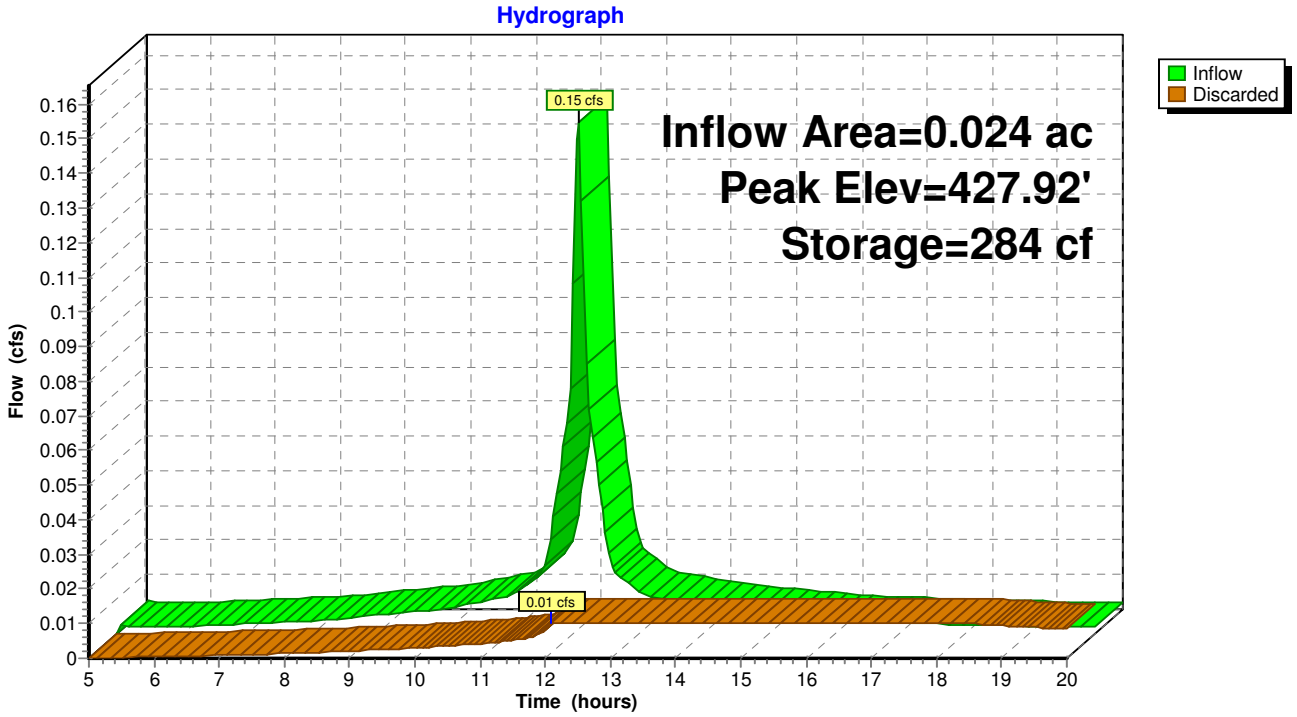
Volume	Invert	Avail.Storage	Storage Description
#1	426.50'	453 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
426.50	0	0
427.00	75	75
428.33	303	378
428.83	75	453

Device	Routing	Invert	Outlet Devices
#1	Discarded	426.50'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00
			Disch. (cfs) 0.000 0.010 0.010 0.010 0.010

Discarded OutFlow Max=0.01 cfs @ 12.10 hrs HW=427.51' (Free Discharge)
↑**1=Exfiltration** (Custom Controls 0.01 cfs)

Pond IS-1: LEACHING AREA (IS-1)



Summary for Pond IS-2: LEACHING AREA (IS-2)

Inflow Area = 0.136 ac, 79.33% Impervious, Inflow Depth > 5.09" for 25 Year Storm event
Inflow = 0.78 cfs @ 12.08 hrs, Volume= 0.057 af
Outflow = 0.03 cfs @ 11.80 hrs, Volume= 0.025 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.80 hrs, Volume= 0.025 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 425.07' @ 15.23 hrs Surf.Area= 0 sf Storage= 1,654 cf

Plug-Flow detention time= 247.4 min calculated for 0.025 af (43% of inflow)
Center-of-Mass det. time= 146.4 min (893.7 - 747.3)

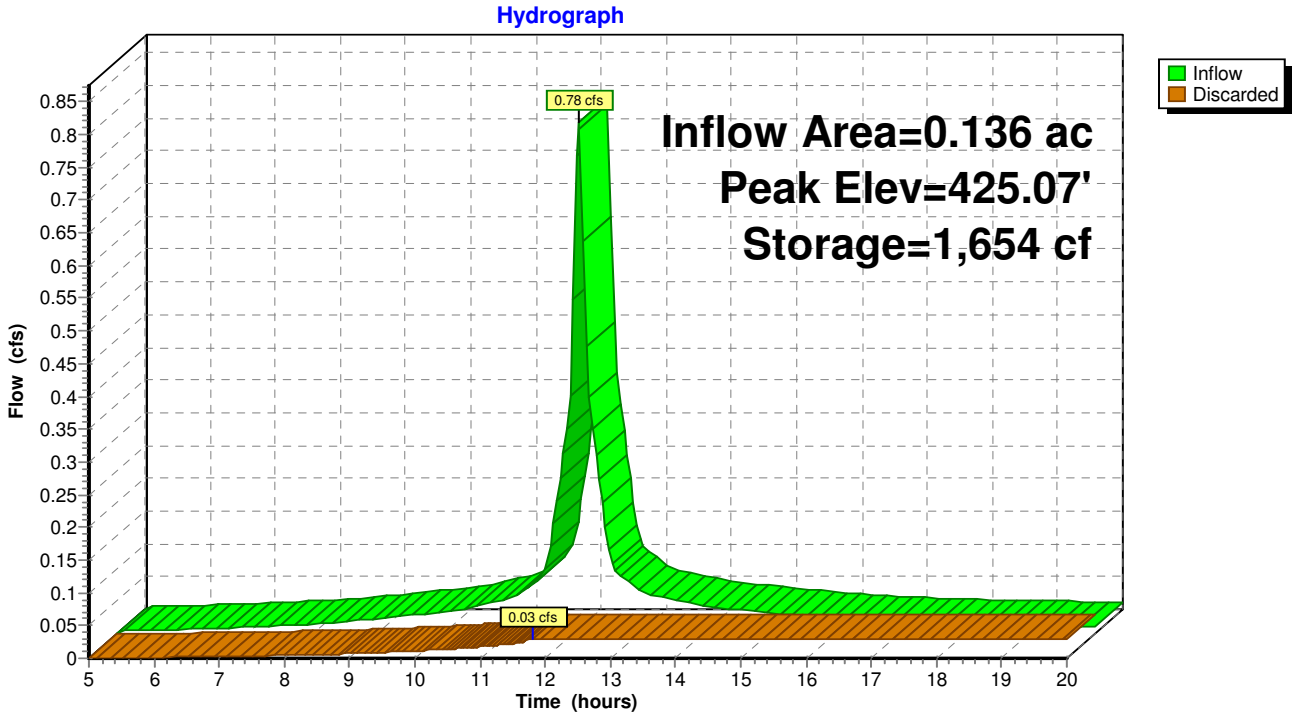
Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	2,685 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
423.00	0	0
424.00	495	495
425.33	1,438	1,933
426.33	752	2,685

Device	Routing	Invert	Outlet Devices
#1	Discarded	423.00'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00
			Disch. (cfs) 0.000 0.030 0.030 0.030 0.030

Discarded OutFlow Max=0.03 cfs @ 11.80 hrs HW=424.01' (Free Discharge)
↑**1=Exfiltration** (Custom Controls 0.03 cfs)

Pond IS-2: LEACHING AREA (IS-2)



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

Subcatchment A: Area A Runoff Area=2,140 sf 19.02% Impervious Runoff Depth>5.98"
Flow Length=32' Slope=0.0600 '/' Tc=2.5 min CN=79 Runoff=0.39 cfs 0.024 af

Subcatchment B1: B1 Runoff Area=1,064 sf 100.00% Impervious Runoff Depth>7.95"
Tc=5.0 min CN=98 Runoff=0.21 cfs 0.016 af

Subcatchment B2: B2 (PARKING) Runoff Area=5,903 sf 79.33% Impervious Runoff Depth>7.55"
Flow Length=140' Tc=5.5 min CN=93 Runoff=1.14 cfs 0.085 af

Subcatchment B3: Area B3 Runoff Area=4,815 sf 38.32% Impervious Runoff Depth>6.45"
Flow Length=109' Tc=7.0 min CN=83 Runoff=0.82 cfs 0.059 af

Reach 1R: 6" HDPE Avg. Flow Depth=0.21' Max Vel=2.80 fps Inflow=0.21 cfs 0.016 af
6.0" Round Pipe n=0.012 L=24.0' S=0.0100 '/' Capacity=0.61 cfs Outflow=0.21 cfs 0.016 af

Reach 2R: 8" HDPE Avg. Flow Depth=0.48' Max Vel=4.22 fps Inflow=1.14 cfs 0.085 af
8.0" Round Pipe n=0.012 L=32.0' S=0.0100 '/' Capacity=1.31 cfs Outflow=1.14 cfs 0.085 af

Pond IS-1: LEACHING AREA (IS-1) Peak Elev=428.73' Storage=438 cf Inflow=0.21 cfs 0.016 af
Outflow=0.01 cfs 0.008 af

Pond IS-2: LEACHING AREA (IS-2) Peak Elev=426.29' Storage=2,652 cf Inflow=1.14 cfs 0.085 af
Outflow=0.03 cfs 0.027 af

Total Runoff Area = 0.320 ac Runoff Volume = 0.185 af Average Runoff Depth = 6.96"
42.54% Pervious = 0.136 ac 57.46% Impervious = 0.184 ac

Summary for Subcatchment A: Area A

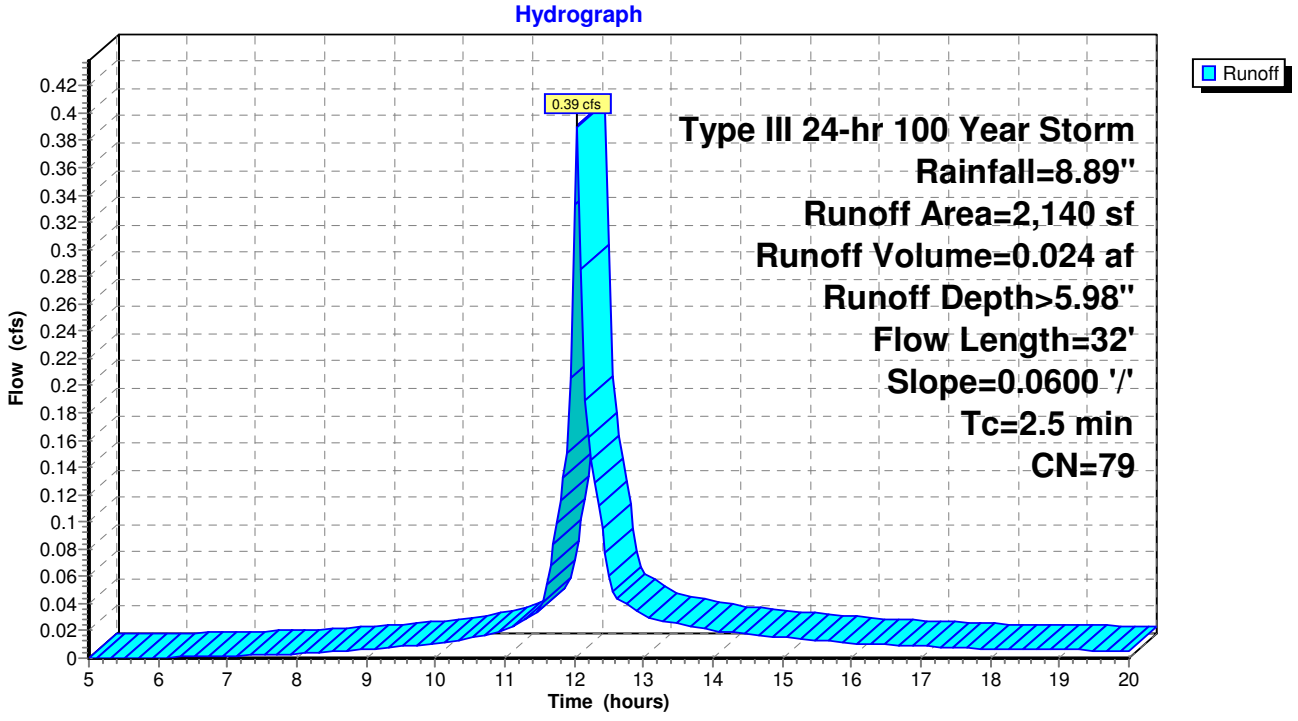
Runoff = 0.39 cfs @ 12.04 hrs, Volume= 0.024 af, Depth> 5.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.89"

Area (sf)	CN	Description
1,733	74	>75% Grass cover, Good, HSG C
407	98	Roofs, HSG C
2,140	79	Weighted Average
1,733		80.98% Pervious Area
407		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	32	0.0600	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment A: Area A



Summary for Subcatchment B1: B1

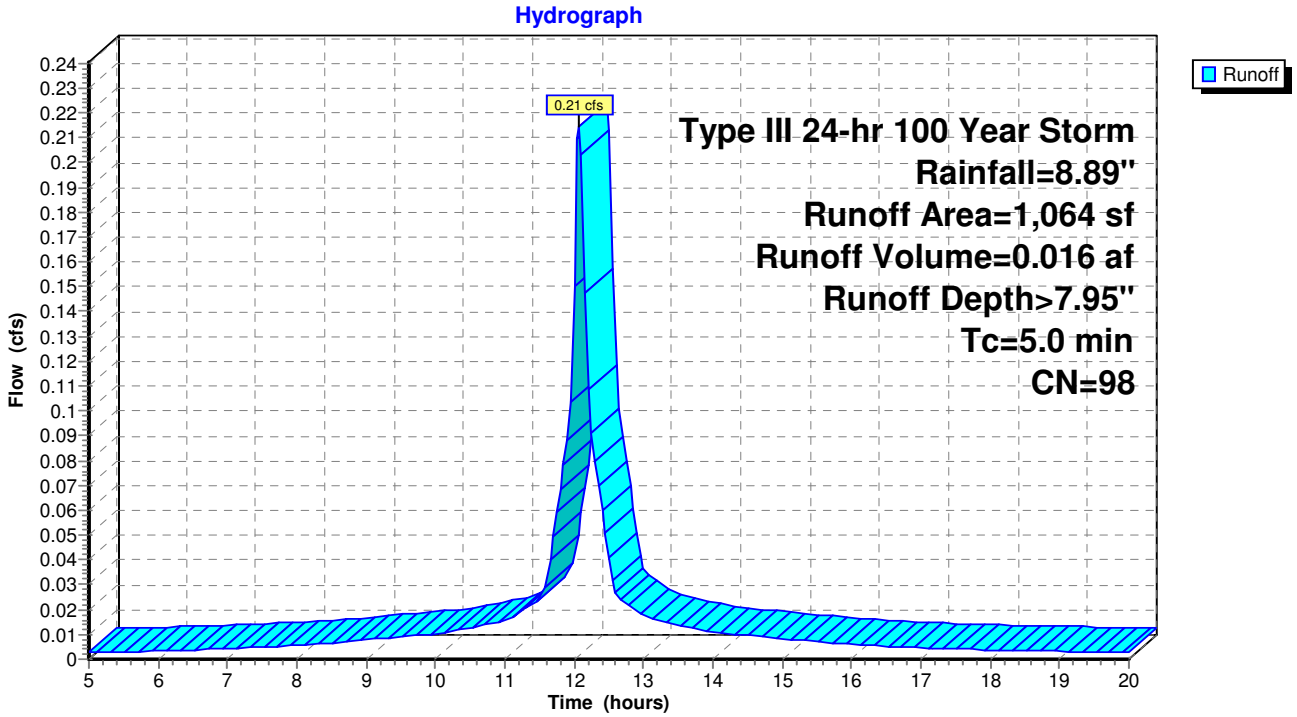
Runoff = 0.21 cfs @ 12.07 hrs, Volume= 0.016 af, Depth> 7.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.89"

Area (sf)	CN	Description
1,064	98	Roofs, HSG C
1,064		100.00% Impervious Area

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

Subcatchment B1: B1



Summary for Subcatchment B2: B2 (PARKING)

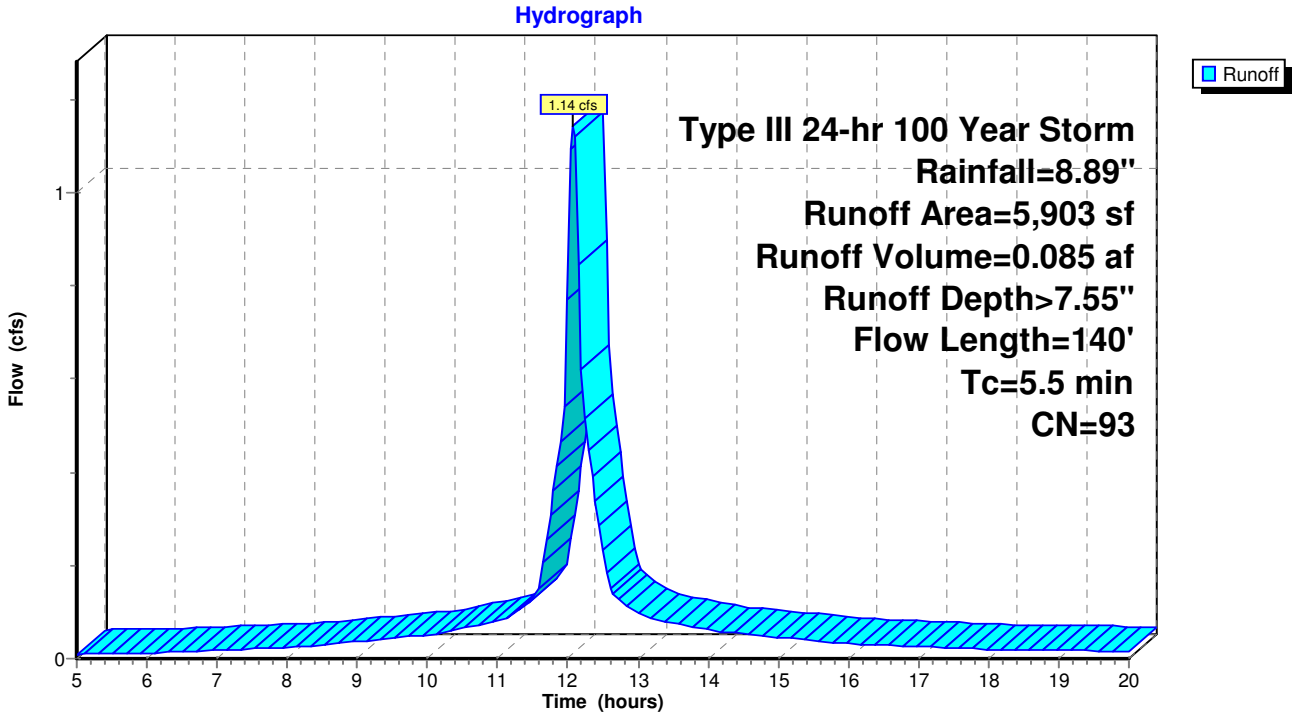
Runoff = 1.14 cfs @ 12.08 hrs, Volume= 0.085 af, Depth> 7.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.89"

Area (sf)	CN	Description
4,683	98	Paved parking, HSG C
1,220	74	>75% Grass cover, Good, HSG C
5,903	93	Weighted Average
1,220		20.67% Pervious Area
4,683		79.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	40	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.8	100	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.5	140	Total			

Subcatchment B2: B2 (PARKING)



Summary for Subcatchment B3: Area B3

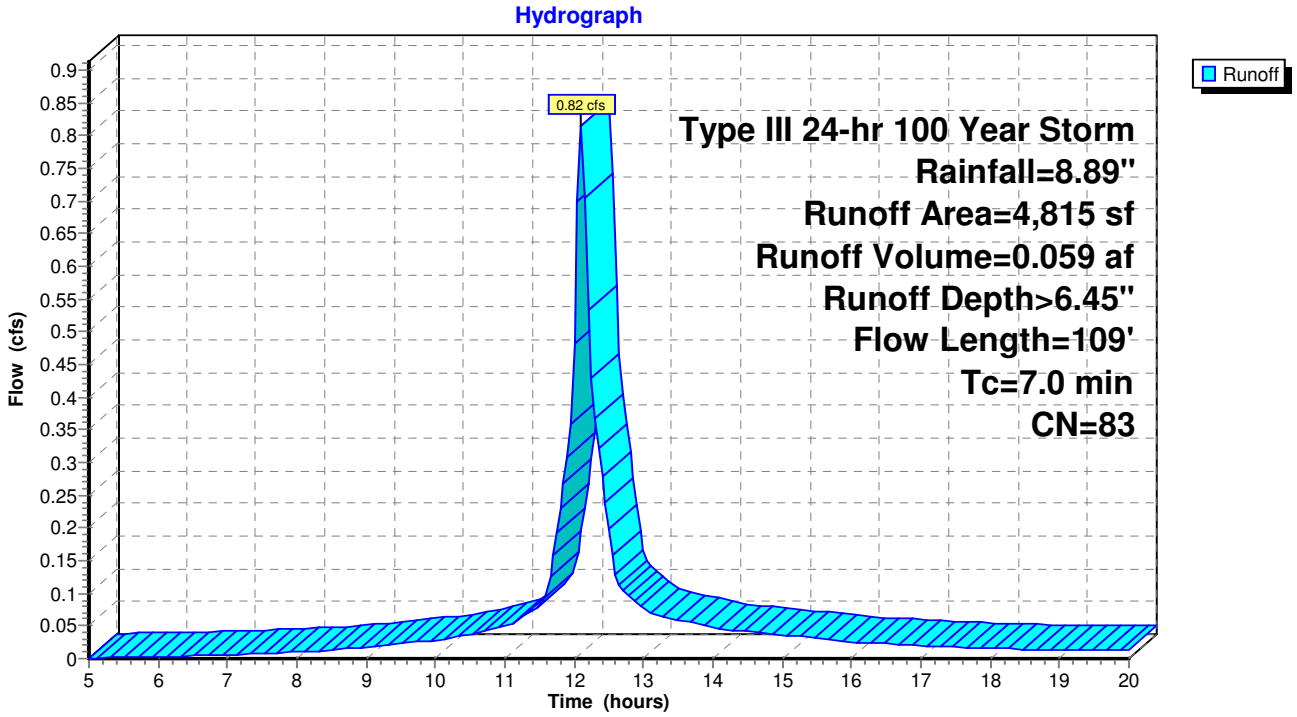
Runoff = 0.82 cfs @ 12.10 hrs, Volume= 0.059 af, Depth> 6.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.89"

Area (sf)	CN	Description
2,970	74	>75% Grass cover, Good, HSG C
1,845	98	Roofs, HSG C
4,815	83	Weighted Average
2,970		61.68% Pervious Area
1,845		38.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.4	59	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.0	109	Total			

Subcatchment B3: Area B3



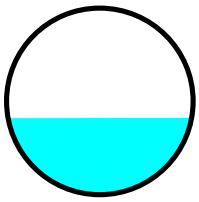
Summary for Reach 1R: 6" HDPE

Inflow Area = 0.024 ac,100.00% Impervious, Inflow Depth > 7.95" for 100 Year Storm event
Inflow = 0.21 cfs @ 12.07 hrs, Volume= 0.016 af
Outflow = 0.21 cfs @ 12.08 hrs, Volume= 0.016 af, Atten= 1%, Lag= 0.3 min

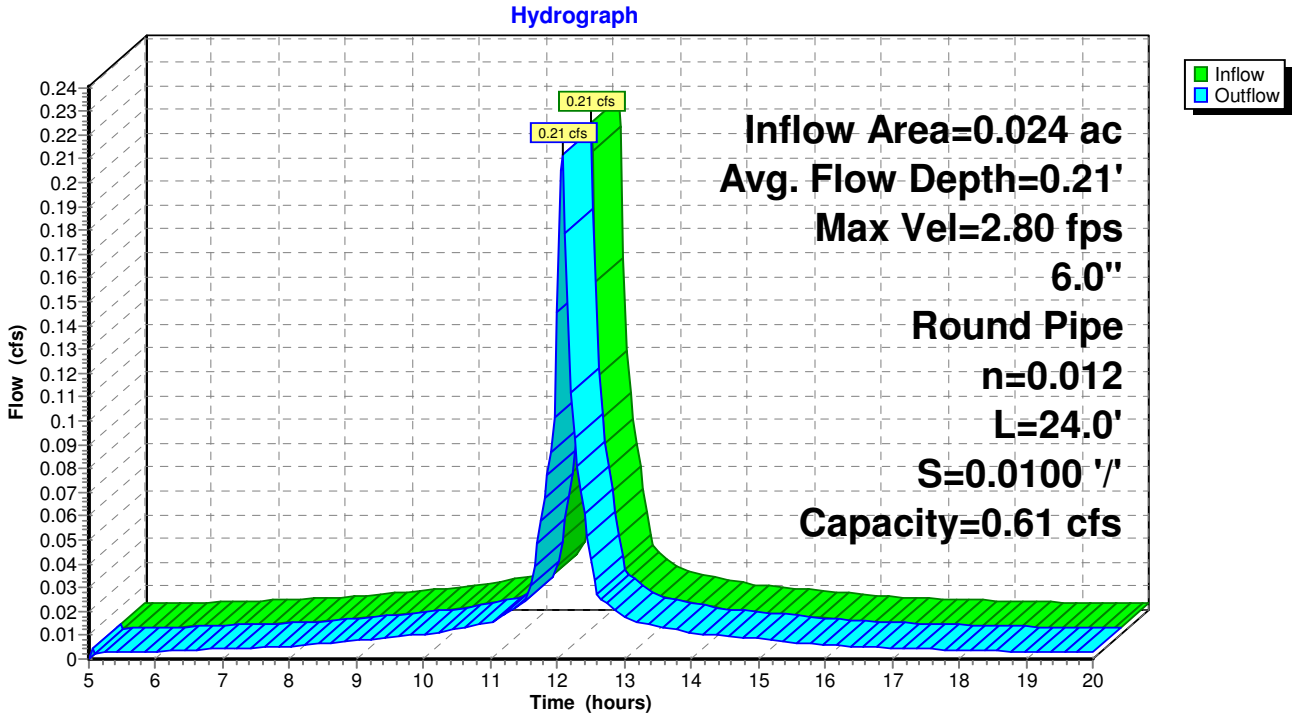
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.80 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 0.4 min

Peak Storage= 2 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 0.61 cfs

6.0" Round Pipe
n= 0.012
Length= 24.0' Slope= 0.0100 '/'
Inlet Invert= 427.72', Outlet Invert= 427.48'



Reach 1R: 6" HDPE



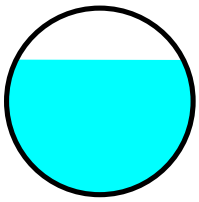
Summary for Reach 2R: 8" HDPE

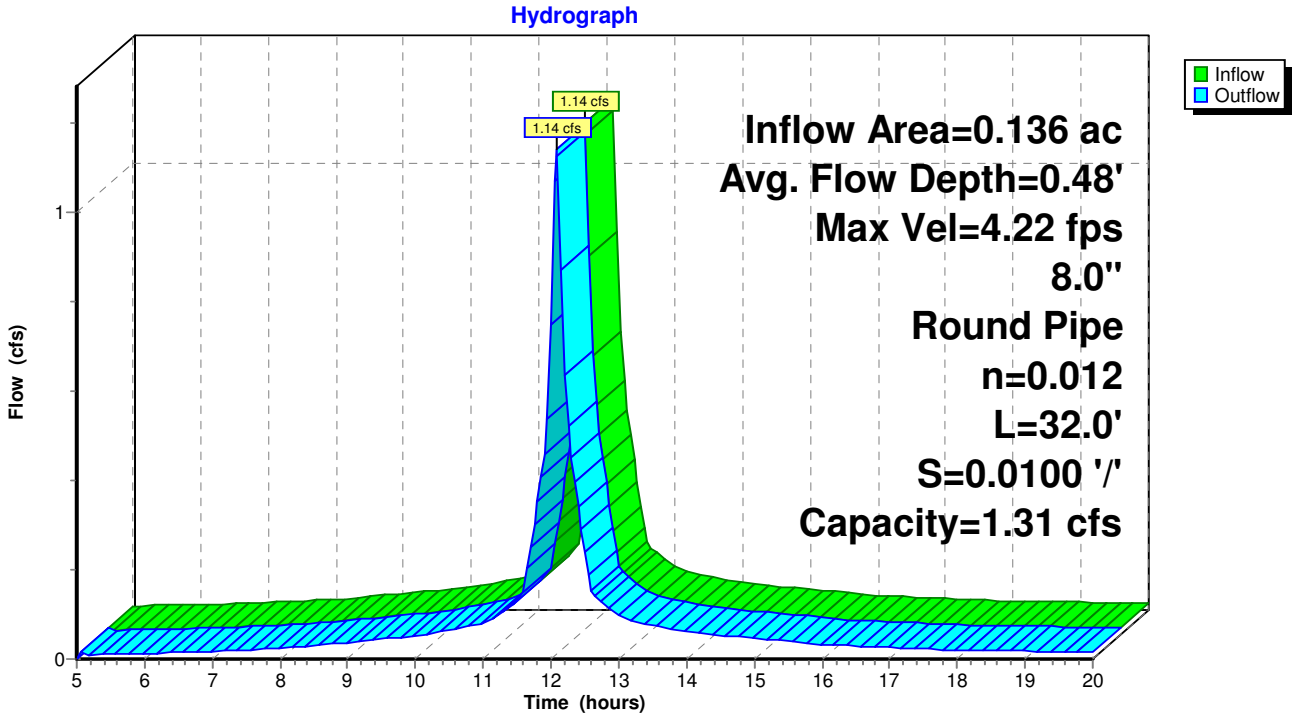
Inflow Area = 0.136 ac, 79.33% Impervious, Inflow Depth > 7.55" for 100 Year Storm event
Inflow = 1.14 cfs @ 12.08 hrs, Volume= 0.085 af
Outflow = 1.14 cfs @ 12.08 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.22 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.72 fps, Avg. Travel Time= 0.3 min

Peak Storage= 9 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.31 cfs

8.0" Round Pipe
n= 0.012
Length= 32.0' Slope= 0.0100 '/'
Inlet Invert= 424.85', Outlet Invert= 424.53'





Summary for Pond IS-1: LEACHING AREA (IS-1)

Inflow Area = 0.024 ac,100.00% Impervious, Inflow Depth > 7.95" for 100 Year Storm event
Inflow = 0.21 cfs @ 12.08 hrs, Volume= 0.016 af
Outflow = 0.01 cfs @ 11.95 hrs, Volume= 0.008 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.95 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 428.73' @ 14.37 hrs Surf.Area= 0 sf Storage= 438 cf

Plug-Flow detention time= 244.5 min calculated for 0.008 af (52% of inflow)
Center-of-Mass det. time= 151.7 min (884.2 - 732.5)

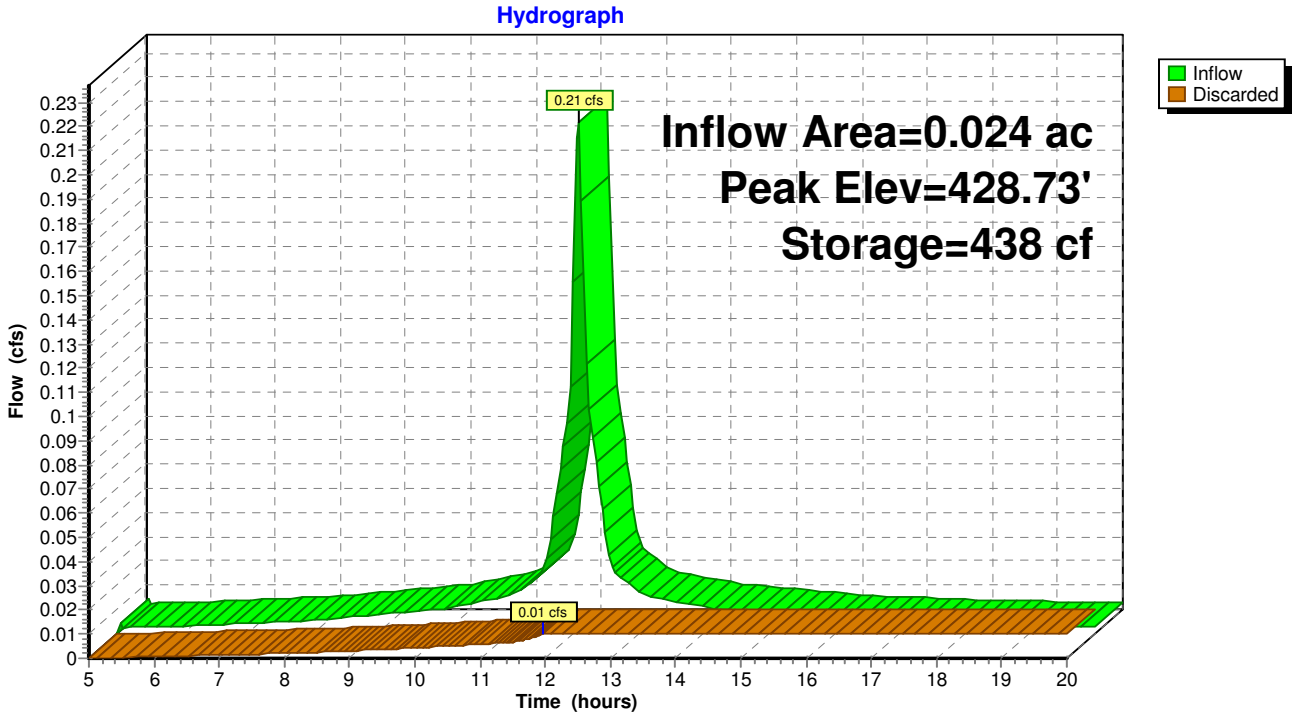
Volume	Invert	Avail.Storage	Storage Description
#1	426.50'	453 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
426.50	0	0
427.00	75	75
428.33	303	378
428.83	75	453

Device	Routing	Invert	Outlet Devices
#1	Discarded	426.50'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00
			Disch. (cfs) 0.000 0.010 0.010 0.010 0.010

Discarded OutFlow Max=0.01 cfs @ 11.95 hrs HW=427.52' (Free Discharge)
↑**1=Exfiltration** (Custom Controls 0.01 cfs)

Pond IS-1: LEACHING AREA (IS-1)



Summary for Pond IS-2: LEACHING AREA (IS-2)

Inflow Area = 0.136 ac, 79.33% Impervious, Inflow Depth > 7.55" for 100 Year Storm event
Inflow = 1.14 cfs @ 12.08 hrs, Volume= 0.085 af
Outflow = 0.03 cfs @ 11.20 hrs, Volume= 0.027 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.20 hrs, Volume= 0.027 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 426.29' @ 16.31 hrs Surf.Area= 0 sf Storage= 2,652 cf

Plug-Flow detention time= 256.0 min calculated for 0.027 af (32% of inflow)
Center-of-Mass det. time= 123.2 min (865.0 - 741.8)

Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	2,685 cf	**Custom Stage Data** Listed below

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
423.00	0	0
424.00	495	495
425.33	1,438	1,933
426.33	752	2,685

Device	Routing	Invert	Outlet Devices
#1	Discarded	423.00'	**Exfiltration**
			Head (feet) 0.00 1.00 2.00 3.00 4.00
			Disch. (cfs) 0.000 0.030 0.030 0.030 0.030

Discarded OutFlow Max=0.03 cfs @ 11.20 hrs HW=424.00' (Free Discharge)
1=Exfiltration (Custom Controls 0.03 cfs)

Pond IS-2: LEACHING AREA (IS-2)