DRAINAGE CALCULATIONS
AND
STORMWATER MANAGEMENT PLAN

For The

Proposed Mixed-Use Development

located at

Lot 3B Madison Street
Worcester, Massachusetts

Submitted to:

City of Worcester
Planning Board
455 Main Street Room 404
Worcester, MA 01608

Prepared for:

Rossi Development
345 Boylston Street
Newton, MA 02459

Prepared by

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December 11, 2024

Table of Contents

Proposed 90-Unit Multifamily Development
Madison Street
Worcester, MA

Project Description

The project consists of the re-development of a property comprised of approximately 32,072± s.f. of land located on Madison Street in Worcester, Massachusetts. The property was previously occupied entirely by commercial building roof area which has since been demolished. The property is identified as Lot #3B on a recorded plan entitled "ALTA/NSPS Land Title Survey" prepared by Control Point Associates dated November 4, 2024. Proposed work will include the construction of a new mixed-use development including 90-unit residential units, two lower level commercial units, a drive under parking facility, bituminous concrete access driveway and parking area, installation of utility services, stormwater management systems and incidental site work.

Site Description

The subject property was previously occupied entirely by commercial building roof area and has since been demolished. The site was previously 100% impervious in the pre-development condition. Stormwater runoff from the previous building roof area drained in two directions: southerly toward Madison Street (DP-1) and northerly toward what is now Spruce Street (DP-2). In the pre-development condition, there are no storm water controls to provide water quality treatment or groundwater recharge.

In the proposed condition, the groundcover of the site will be significantly altered. The groundcover will include building roof area, bituminous concrete parking, concrete walkways, a paver patio and landscaped areas. In the proposed condition, the site will mimic the drainage patterns of the existing condition and will drain in two directions toward Madison Street (DP-1) and Spruce Street (DP-2). A series of stormwater management facilities will be installed to mitigate stormwater runoff from the proposed development. The proposed building roof will drain via roof drain to a proposed subsurface infiltration facility consisting of Cultec 330XLHD Chambers (P2). The northern portion of the property will drain via surface flow to a series of catch basins before entering a water quality unit (Contech CDS or approved equal) and ultimately to subsurface infiltration facility P2. The system will include an outlet control structure that will overflow to the storm drain line in Spruce Street for larger scale storm events. The southern portion of the property will drain via surface flow to a series of catch basins before entering a second water quality unit (Contech CDS or approved equal) and ultimately into a second subsurface infiltration facility consisting of Cultec 330XL HD chambers (P1). The proposed stormwater systems will reduce the peak rates of runoff and improve the quality of storm water runoff being directed to the closed drainage system while promoting groundwater recharge.

Soils information was obtained from boring logs prepared by GZA GeoEnvironmental and available USDA Soil Conservation Service (SCS) Maps for Worcester County. The soils on site are classified as Urban Land (60). Refer to Appendix F for a delineation of the boundaries of the soil with respect to the subject parcel and the attached SCS soil description. As well as the soil boring logs prepared by GZA GeoEnvironmental.

The soil borings indicate the presence of deep fill, underlain by sand and gravel and/or fine sand. Groundwater was observed between approximately 12.5 and 21 feet below grade.

The Flood Insurance Rate Map for the City of Worcester (Community Panel 25027C0618E with an effective date of July 4, 2011) describes the project as Zone X. Zone X is classified as areas determined to be outside the 0.2% chance floodplain.

Pre-Development Condition

Technical Release 20 (TR-20) Program for Project Formulation Hydrology developed by the Soil Conservation Service (SCS) was employed to develop pre and post-development peak flows. Drainage calculations were performed for the pre-development condition for the 2, 10, 25, and 100-year type III 24-hour storm events. Rainfall intensities were obtained from NOAA Atlas 14. Refer to Appendix A for computer results, soil characteristics, cover descriptions and times of concentrations calculations.

In both the pre-development and post-development stormwater analysis two watershed areas were analyzed. Refer to Existing Watershed Plan (EWP) in Appendix A for a delineation of the watershed areas as well as the location of the design points. The same design points were analyzed in both the pre and post development condition.

A summary of the peak rates of the runoff during the Pre-Development Conditions is as follows:

Pre-Development Condition Peak Discharge Summary (in CFS):

	2-Year Storm (3.17 IN)	10-Year Storm (4.90 IN)	25-Year Storm (5.98 IN)	100-Year Storm (7.65 IN)
Design Point #1 (Madison Street)	0.81 CFS	1.26 CFS	1.55 CFS	1.98 CFS
Design Point #2 (Spruce Street)	1.45 CFS	2.26 CFS	2.76 CFS	3.54 CFS

Proposed Development

The proposed project includes the construction of the new mixed-use building, bituminous concrete parking area, concrete walkways, paver patio and landscaped areas. Stormwater management facilities will be installed to mitigate the stormwater runoff generated by the impervious surfaces. The systems will improve the quality of stormwater runoff and promote groundwater recharge. Each system consists of subsurface infiltration facility consisting of Cultec 330XL HD chambers encased in crushed stone and wrapped in filter fabric. Stormwater runoff from the proposed driveway and parking areas will be capture via catch basin and directed to water quality units prior to entering the subsurface infiltration facilities. Subsurface system P2 will include and outlet control structure and will overflow to the closed drainage system in Spruce Street (DP-2). The proposed stormwater system will improve the quality of storm water runoff being directed to the closed drainage system while promoting groundwater recharge.

Again, drainage calculations were performed for the post-development condition for the 2, 10, 25, and 100-year type III 24-hour storm events. Refer to Appendix B for computer results, soil characteristics, cover descriptions, times of concentration calculations, and the Proposed Watershed Plans (PWP). A summary of the peak rates of runoff during the Post-Development Condition is as follows:

Post-Development Condition Peak Discharge Summary (in CFS):

	2-Year Storm (3.17 IN)	10-Year Storm (4.90 IN)	25-Year Storm (5.98 IN)	100-Year Storm (7.65 IN)
Design Point #1 (Madison Street)	0.03 CFS	0.08 CFS	0.12 CFS	0.18 CFS
Design Point #2 (Spruce Street)	0.47 CFS	2.00 CFS	2.60 CFS	3.41 CFS

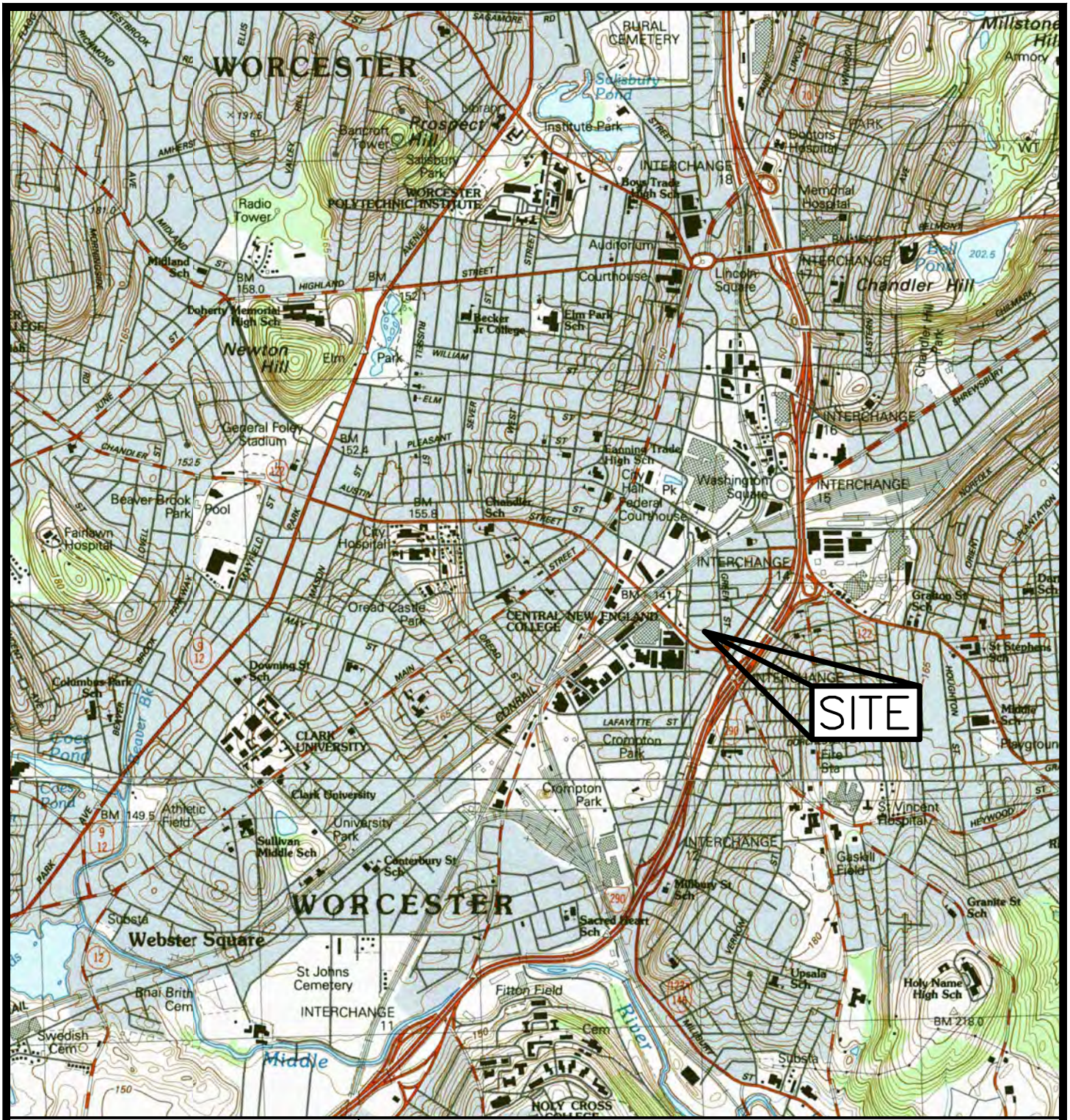
Stormwater Management Facilities

The stormwater facilities were design to attenuate peak flows generated by all storm events up to and including the 100-year storm event. An infiltration rate of 2.41 in/hr was used based on

the Rawls Rate of saturated hydraulic conductivity for a loamy sand soil type. Refer to Appendix B for the Stage Storage Curves and TR-20 computer results for the storage characteristics of the subsurface infiltration facility. Refer to the Site Plans for design details.

Erosion and Siltation Control

Straw wattles and silt fence will be placed at the downhill limit of work prior to the commencement of any construction activity. The integrity of the erosion control devices will be maintained by periodic inspection and replacement as necessary. The straw wattles and silt fence will remain in place until the first course of pavement has been placed and the site has been stabilized.



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PROJECT:

Plan of Land

Lot 3B Madison Street
Worcester, MA

PROJECT: 24-61422	DATE: December 5, 2024
SCALE: 1:25,000	DWG FILE NAME: FIGURES.dwg
DESIGNED BY: Eric Bradanese, P.E.	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:

FIGURE 1 - USGS LOCUS MAP

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PROJECT:

Plan of Land

Lot 3B Madison Street
Worcester, MA

PROJECT: 24-61422	DATE: December 5, 2024
SCALE: 1"=150'	DWG FILE NAME: FIGURES.dwg
DESIGNED BY: Eric Bradanese, P.E.	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:
FIGURE 2 - ORTHO PHOTO

PANEL 618 OF 1075

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
WORCESTER, CITY OF	250349	0618	E

MAP NUMBER
25027C0618E

EFFECTIVE DATE
JULY 4, 2011

PREPARED BY:

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PROJECT:

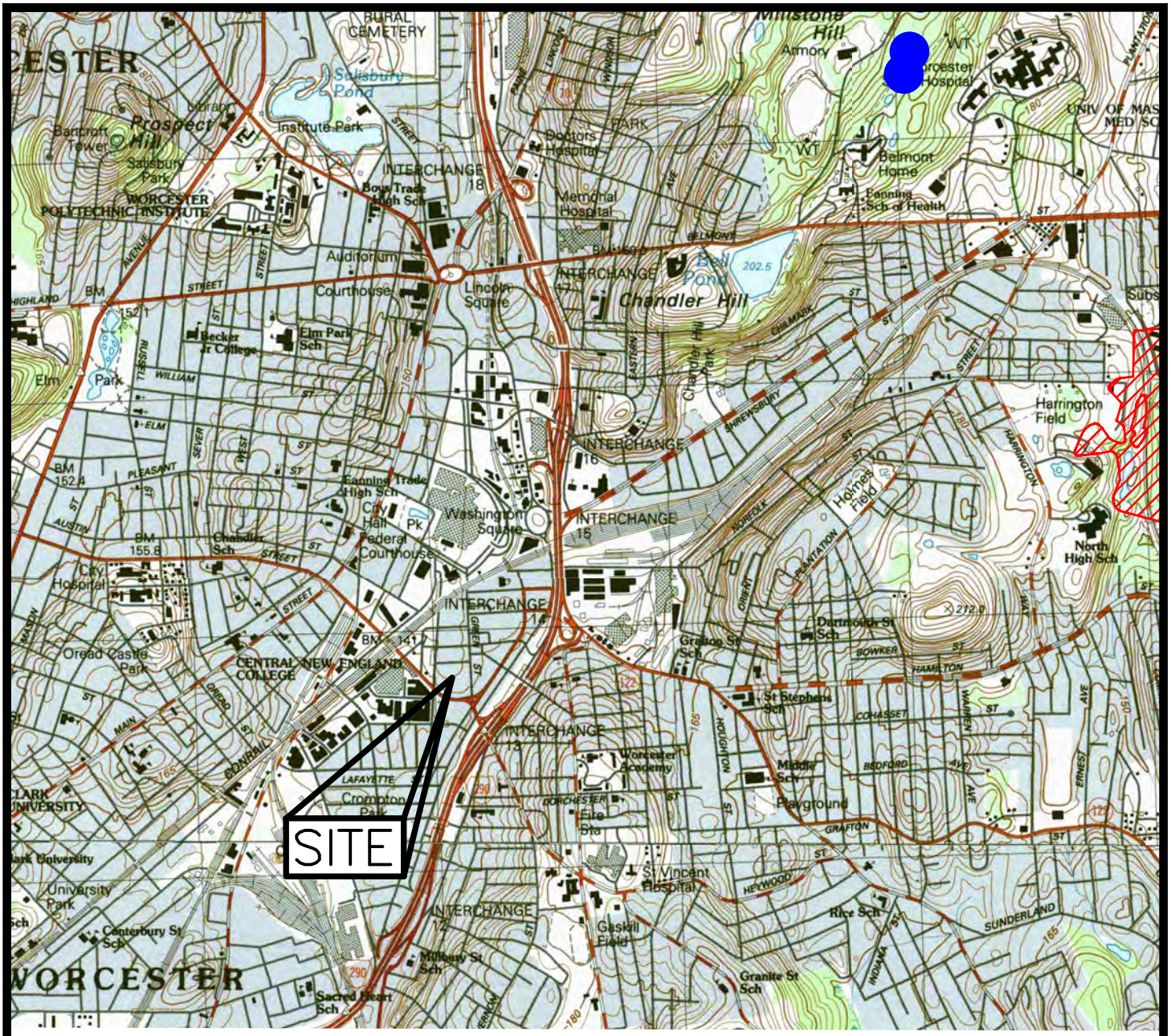
Plan of Land

Lot 3B Madison Street
Worcester, MA

PROJECT: 22-61418	DATE: December 5, 2024
SCALE: 1"=500'	DWG FILE NAME: FIGURES.dwg
DESIGNED BY: Eric Bradanese, P.E.	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:

FIGURE 3 - FEMA FLOOD MAP



LEGEND:

- = NHESP CERTIFIED VERNAL POOL
- = NHESP ESTIMATED HABITATS OF RARE SPECIES
- = NHESP PRIORITY HABITATS OF RARE SPECIES

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PROJECT:

Plan of Land

Lot 3B Madison Street
Worcester, MA

PROJECT: 24-61422	DATE: December 5, 2024
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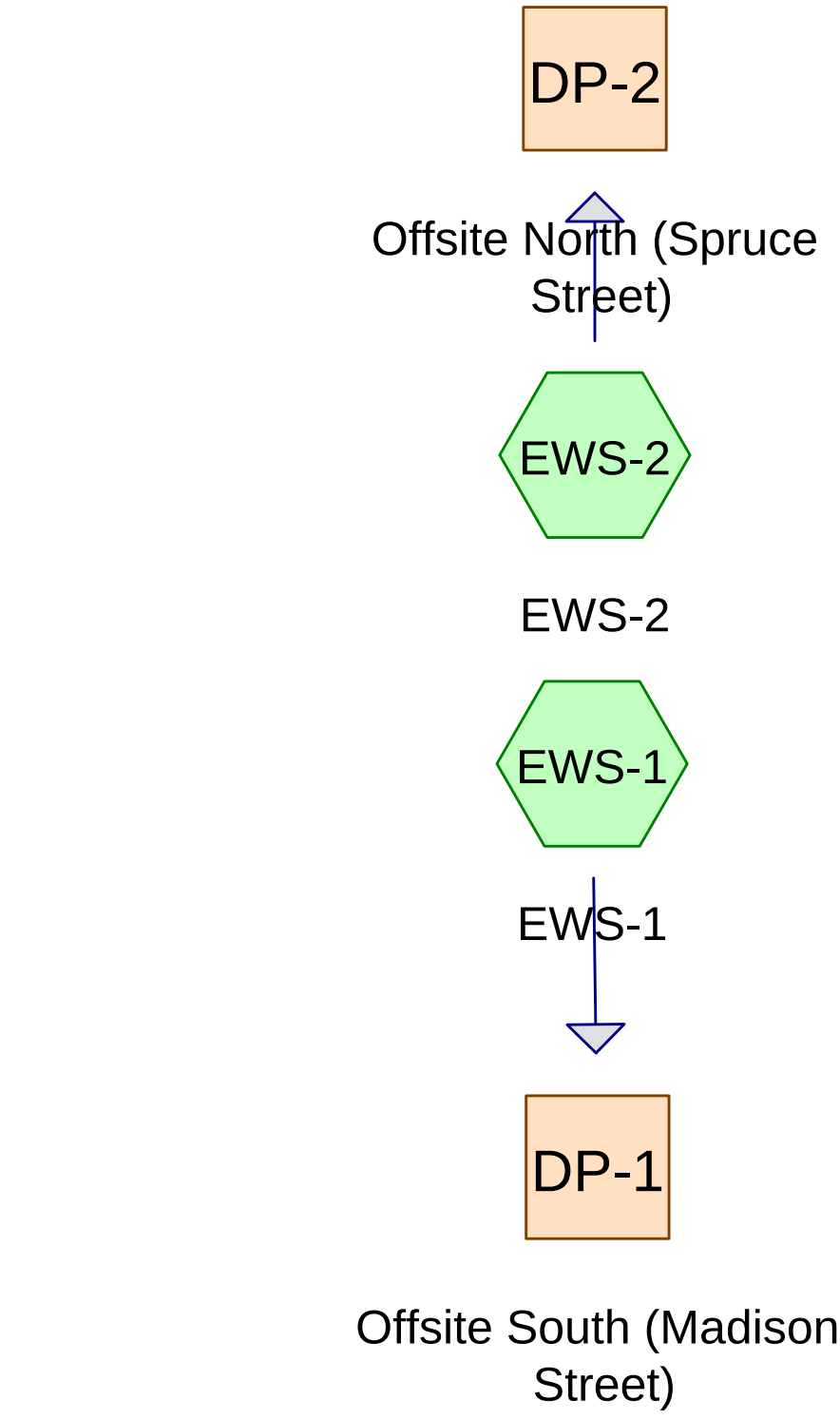
DESIGNED BY: Eric Bradanese, P.E.	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:

FIGURE 4 - NATURAL HERITAGE MAP

APPENDIX A

Existing Conditions Drainage Calculations
Existing Watershed Plan



Subcat Reach Pond Link

Routing Diagram for Pre-Development Condition
Prepared by {enter your company name here}, Printed 12/6/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Storm	Type III 24-hr		Default	24.00	1	3.17	2
2	10-Year Storm	Type III 24-hr		Default	24.00	1	4.90	2
3	25-Year Storm	Type III 24-hr		Default	24.00	1	5.98	2
4	100-Year Storm	Type III 24-hr		Default	24.00	1	7.65	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
32,072	98	Roofs, HSG B (EWS-1, EWS-2)
32,072	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
32,072	HSG B	EWS-1, EWS-2
0	HSG C	
0	HSG D	
0	Other	
32,072		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	32,072	0	0	0	32,072	Roofs	EWS-1, EWS-2
0	**32,072**	**0**	**0**	**0**	**32,072**	**TOTAL AREA**	

Time span=0.00-28.00 hrs, dt=0.02 hrs, 1401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: EWS-1 Runoff Area=11,511 sf 100.00% Impervious Runoff Depth=2.94"
Tc=6.0 min CN=98 Runoff=0.81 cfs 2,818 cf

Subcatchment EWS-2: EWS-2 Runoff Area=20,561 sf 100.00% Impervious Runoff Depth=2.94"
Tc=6.0 min CN=98 Runoff=1.45 cfs 5,033 cf

Reach DP-1: Offsite South (Madison Street) Inflow=0.81 cfs 2,818 cf
Outflow=0.81 cfs 2,818 cf

Reach DP-2: Offsite North (Spruce Street) Inflow=1.45 cfs 5,033 cf
Outflow=1.45 cfs 5,033 cf

Total Runoff Area = 32,072 sf Runoff Volume = 7,851 cf Average Runoff Depth = 2.94"
0.00% Pervious = 0 sf 100.00% Impervious = 32,072 sf

Summary for Subcatchment EWS-1: EWS-1

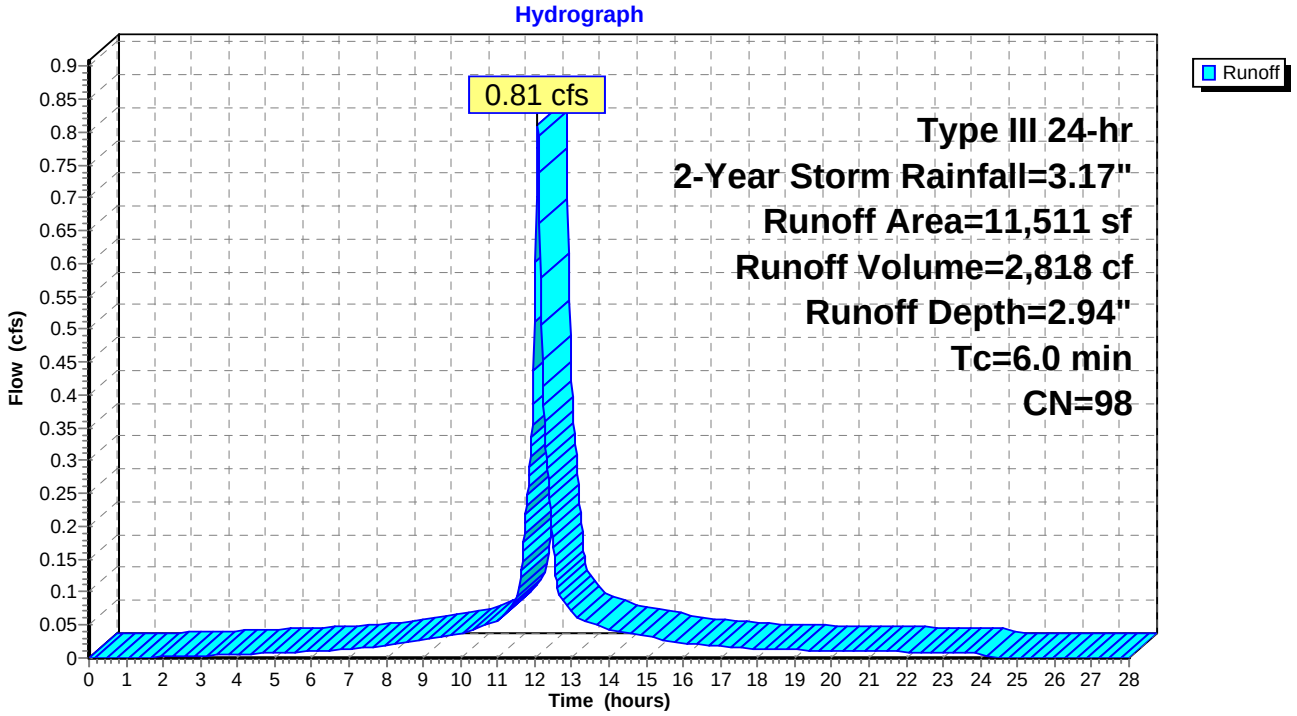
Runoff = 0.81 cfs @ 12.08 hrs, Volume= 2,818 cf, Depth= 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Storm Rainfall=3.17"

Area (sf)	CN	Description
11,511	98	Roofs, HSG B
11,511		100.00% Impervious Area

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

Subcatchment EWS-1: EWS-1



Summary for Subcatchment EWS-2: EWS-2

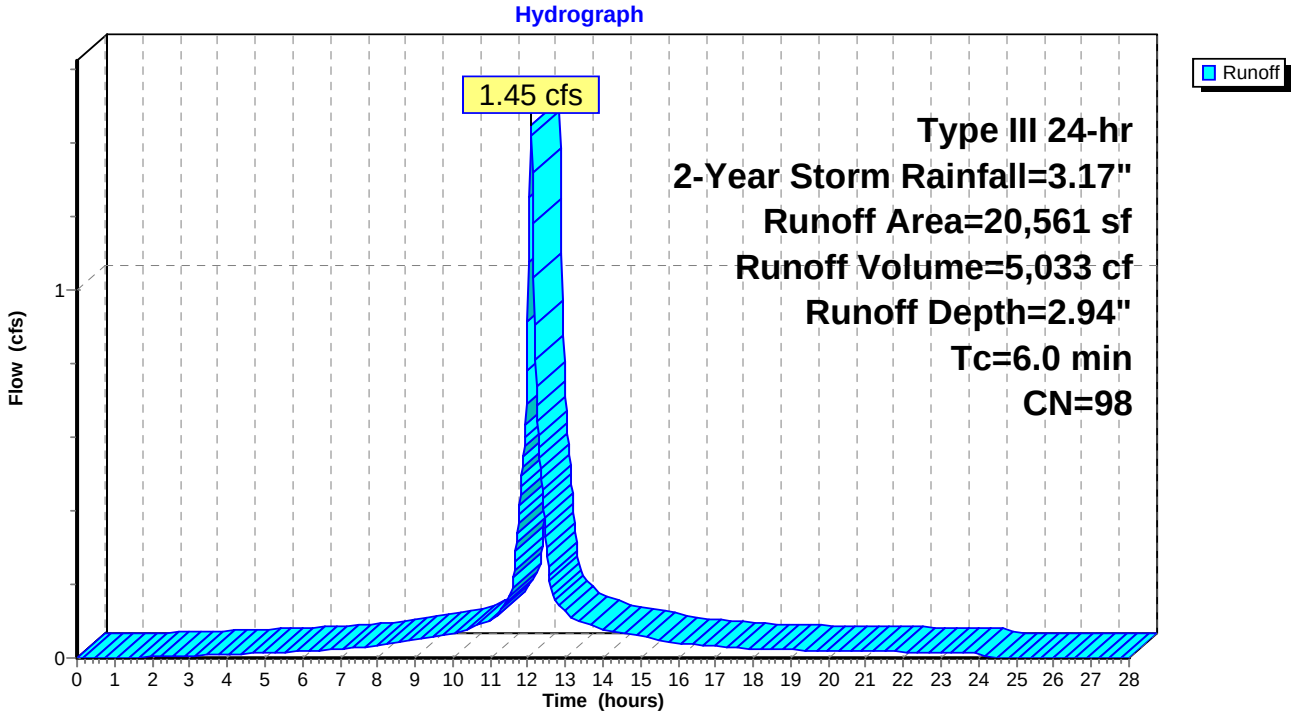
Runoff = 1.45 cfs @ 12.08 hrs, Volume= 5,033 cf, Depth= 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Storm Rainfall=3.17"

Area (sf)	CN	Description
20,561	98	Roofs, HSG B
20,561		100.00% Impervious Area

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

Subcatchment EWS-2: EWS-2

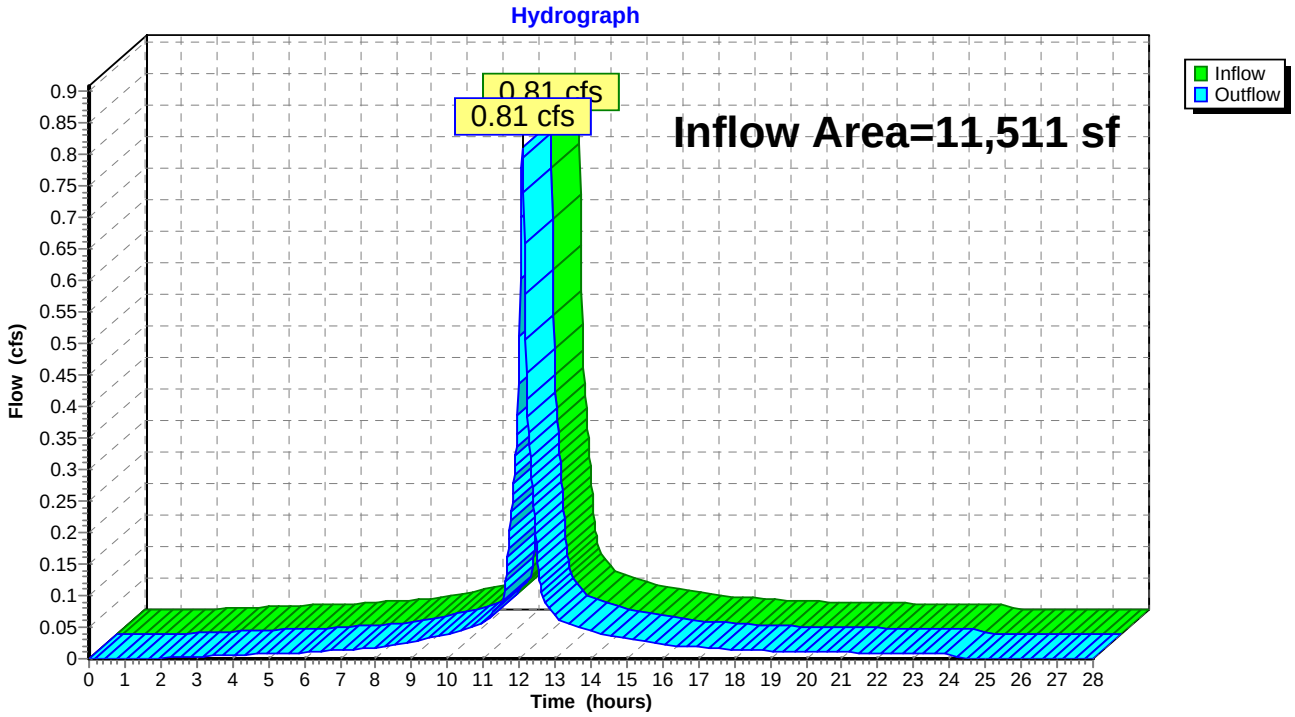


Summary for Reach DP-1: Offsite South (Madison Street)

Inflow Area = 11,511 sf,100.00% Impervious, Inflow Depth = 2.94" for 2-Year Storm event
Inflow = 0.81 cfs @ 12.08 hrs, Volume= 2,818 cf
Outflow = 0.81 cfs @ 12.08 hrs, Volume= 2,818 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-1: Offsite South (Madison Street)

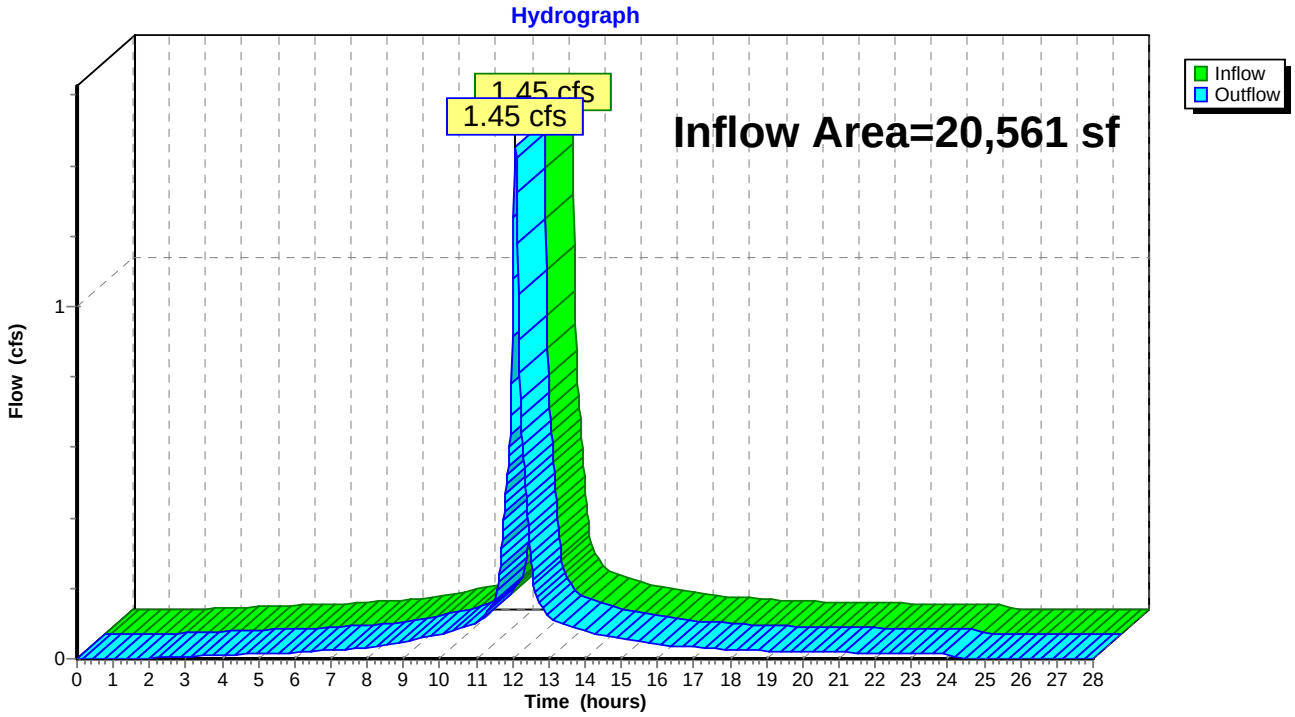


Summary for Reach DP-2: Offsite North (Spruce Street)

Inflow Area = 20,561 sf,100.00% Impervious, Inflow Depth = 2.94" for 2-Year Storm event
Inflow = 1.45 cfs @ 12.08 hrs, Volume= 5,033 cf
Outflow = 1.45 cfs @ 12.08 hrs, Volume= 5,033 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-2: Offsite North (Spruce Street)



Time span=0.00-28.00 hrs, dt=0.02 hrs, 1401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: EWS-1 Runoff Area=11,511 sf 100.00% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=98 Runoff=1.26 cfs 4,473 cf

Subcatchment EWS-2: EWS-2 Runoff Area=20,561 sf 100.00% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=98 Runoff=2.26 cfs 7,990 cf

Reach DP-1: Offsite South (Madison Street) Inflow=1.26 cfs 4,473 cf
Outflow=1.26 cfs 4,473 cf

Reach DP-2: Offsite North (Spruce Street) Inflow=2.26 cfs 7,990 cf
Outflow=2.26 cfs 7,990 cf

Total Runoff Area = 32,072 sf Runoff Volume = 12,464 cf Average Runoff Depth = 4.66"
0.00% Pervious = 0 sf 100.00% Impervious = 32,072 sf

Summary for Subcatchment EWS-1: EWS-1

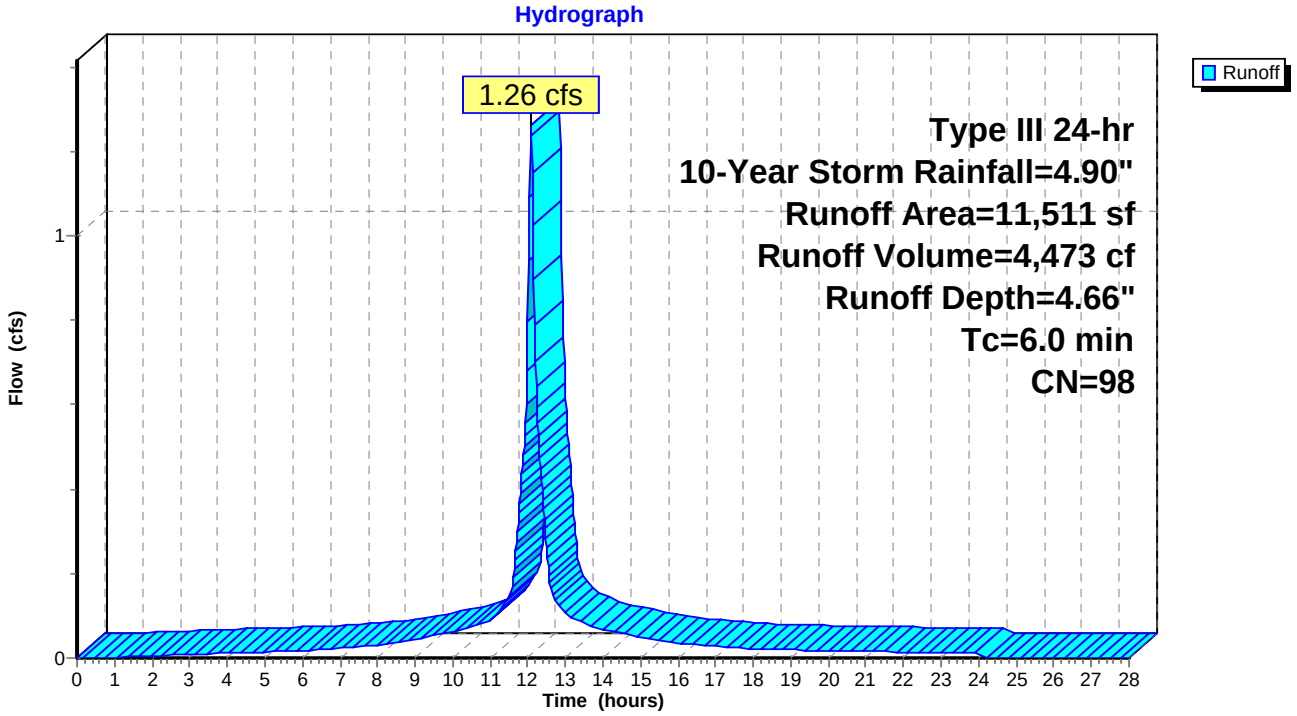
Runoff = 1.26 cfs @ 12.08 hrs, Volume= 4,473 cf, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Storm Rainfall=4.90"

Area (sf)	CN	Description
11,511	98	Roofs, HSG B
11,511		100.00% Impervious Area

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

Subcatchment EWS-1: EWS-1



Summary for Subcatchment EWS-2: EWS-2

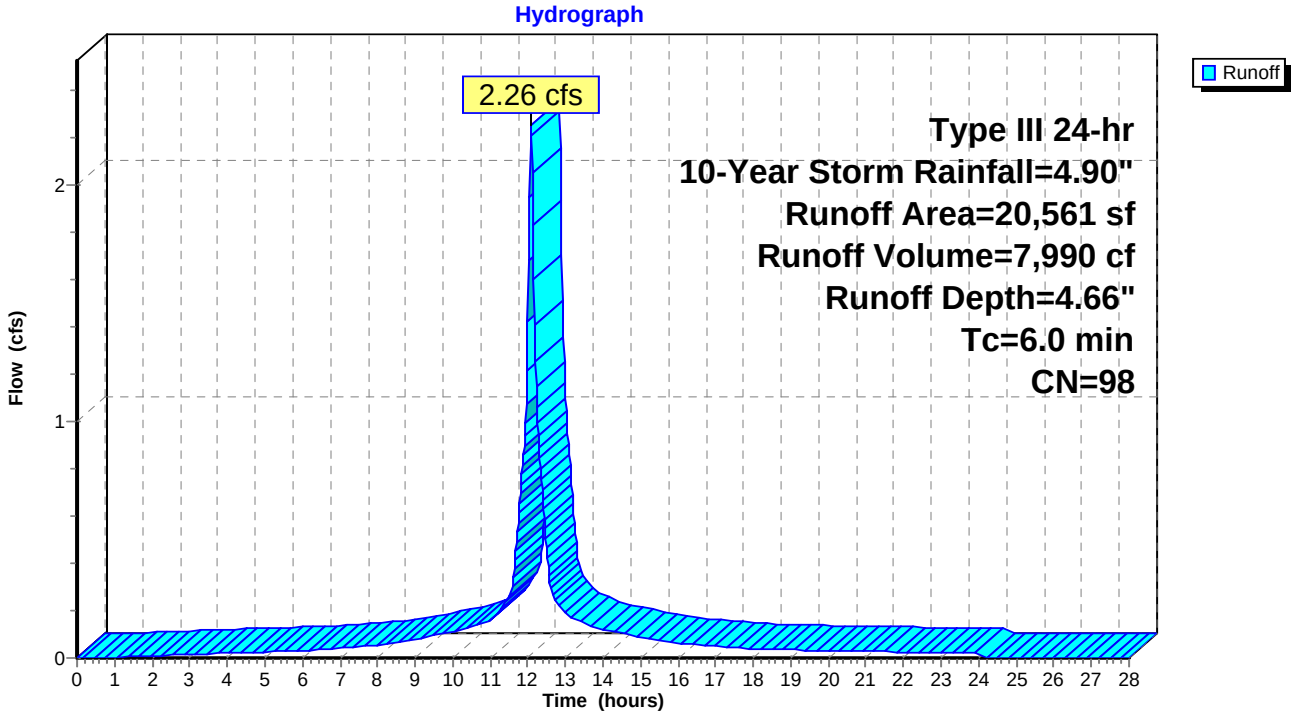
Runoff = 2.26 cfs @ 12.08 hrs, Volume= 7,990 cf, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Storm Rainfall=4.90"

Area (sf)	CN	Description
20,561	98	Roofs, HSG B
20,561		100.00% Impervious Area

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

Subcatchment EWS-2: EWS-2

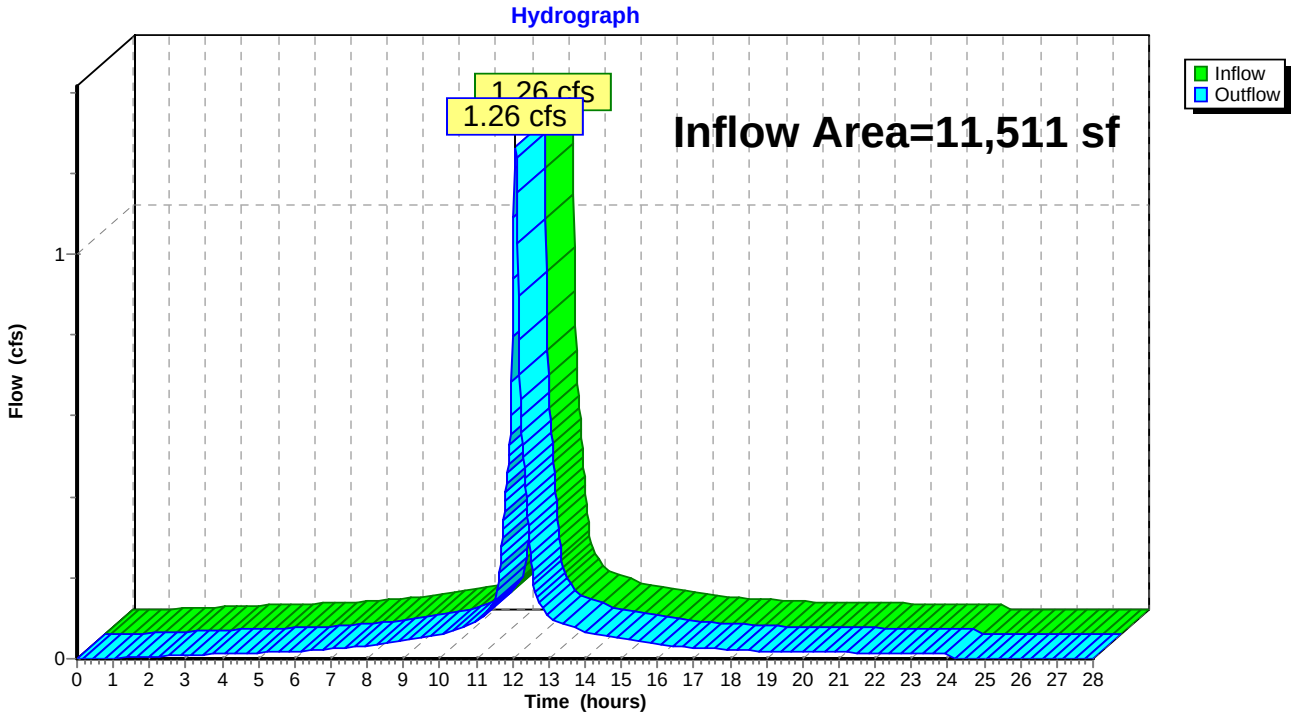


Summary for Reach DP-1: Offsite South (Madison Street)

Inflow Area = 11,511 sf,100.00% Impervious, Inflow Depth = 4.66" for 10-Year Storm event
Inflow = 1.26 cfs @ 12.08 hrs, Volume= 4,473 cf
Outflow = 1.26 cfs @ 12.08 hrs, Volume= 4,473 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-1: Offsite South (Madison Street)

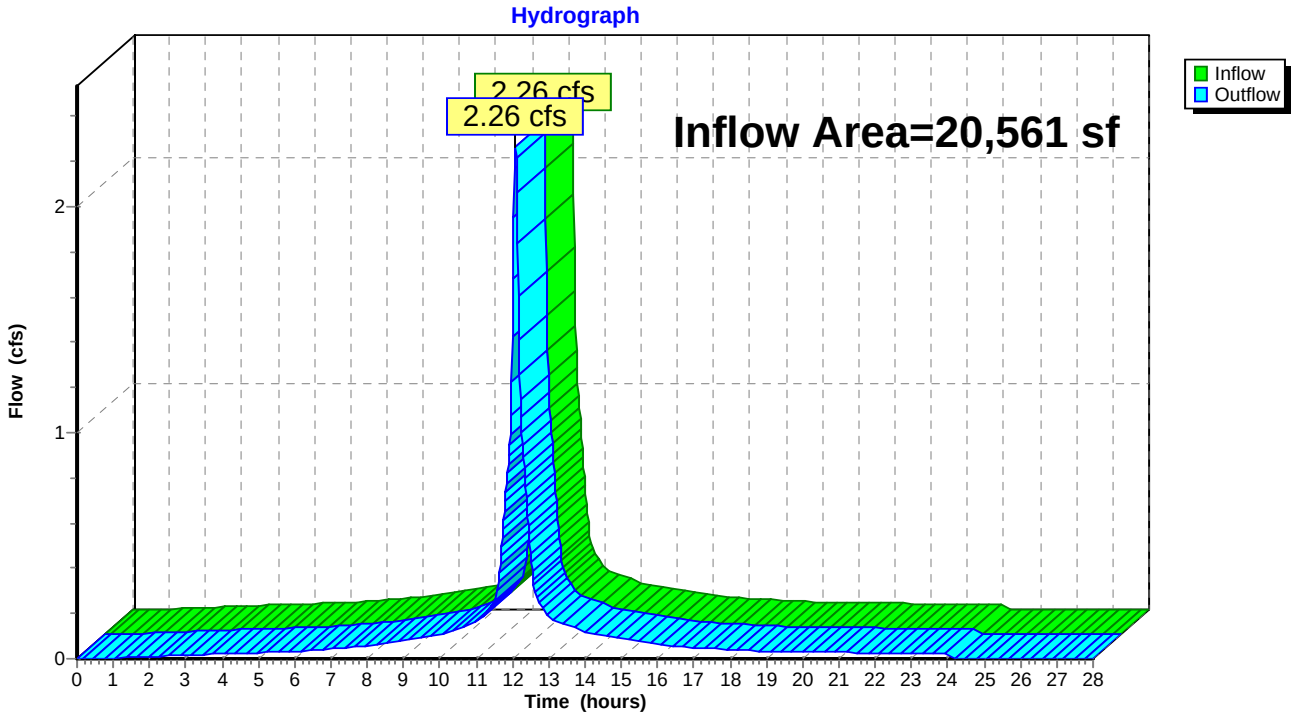


Summary for Reach DP-2: Offsite North (Spruce Street)

Inflow Area = 20,561 sf,100.00% Impervious, Inflow Depth = 4.66" for 10-Year Storm event
Inflow = 2.26 cfs @ 12.08 hrs, Volume= 7,990 cf
Outflow = 2.26 cfs @ 12.08 hrs, Volume= 7,990 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-2: Offsite North (Spruce Street)



Time span=0.00-28.00 hrs, dt=0.02 hrs, 1401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: EWS-1 Runoff Area=11,511 sf 100.00% Impervious Runoff Depth=5.74"
Tc=6.0 min CN=98 Runoff=1.55 cfs 5,508 cf

Subcatchment EWS-2: EWS-2 Runoff Area=20,561 sf 100.00% Impervious Runoff Depth=5.74"
Tc=6.0 min CN=98 Runoff=2.76 cfs 9,838 cf

Reach DP-1: Offsite South (Madison Street) Inflow=1.55 cfs 5,508 cf
Outflow=1.55 cfs 5,508 cf

Reach DP-2: Offsite North (Spruce Street) Inflow=2.76 cfs 9,838 cf
Outflow=2.76 cfs 9,838 cf

Total Runoff Area = 32,072 sf Runoff Volume = 15,346 cf Average Runoff Depth = 5.74"
0.00% Pervious = 0 sf 100.00% Impervious = 32,072 sf

Summary for Subcatchment EWS-1: EWS-1

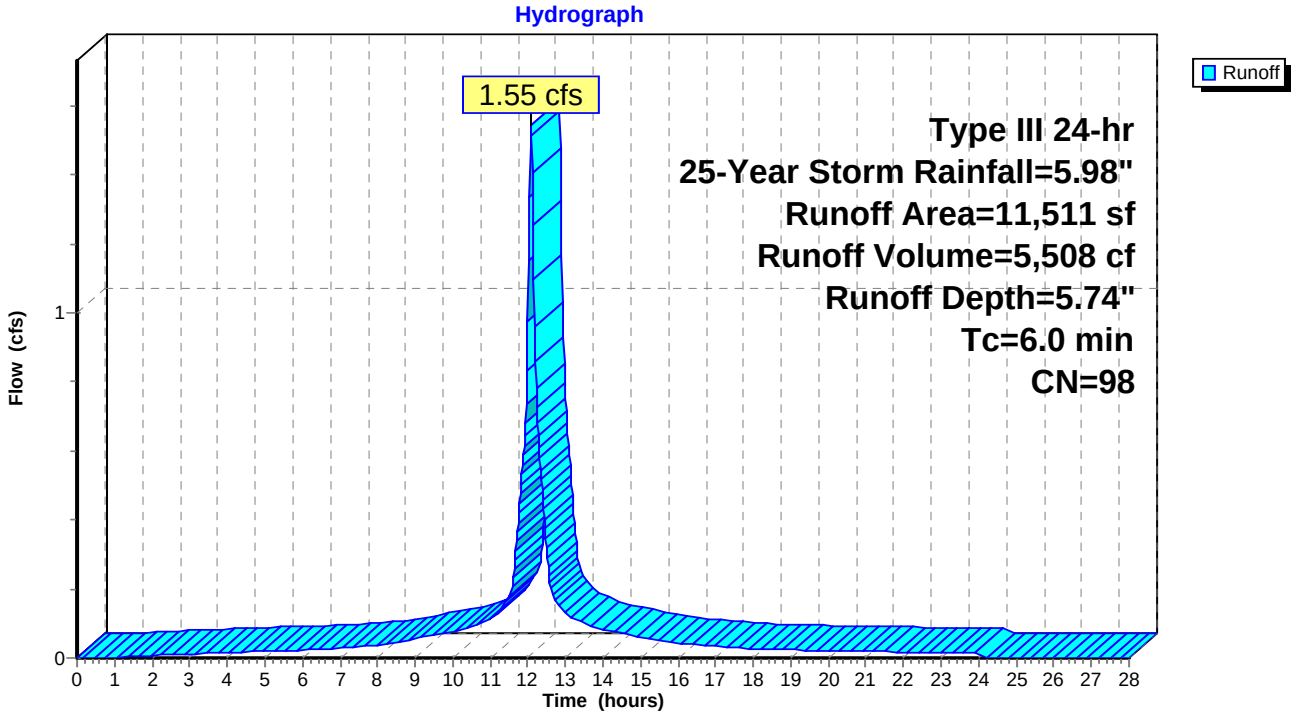
Runoff = 1.55 cfs @ 12.08 hrs, Volume= 5,508 cf, Depth= 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Storm Rainfall=5.98"

Area (sf)	CN	Description
11,511	98	Roofs, HSG B
11,511		100.00% Impervious Area

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

Subcatchment EWS-1: EWS-1



Summary for Subcatchment EWS-2: EWS-2

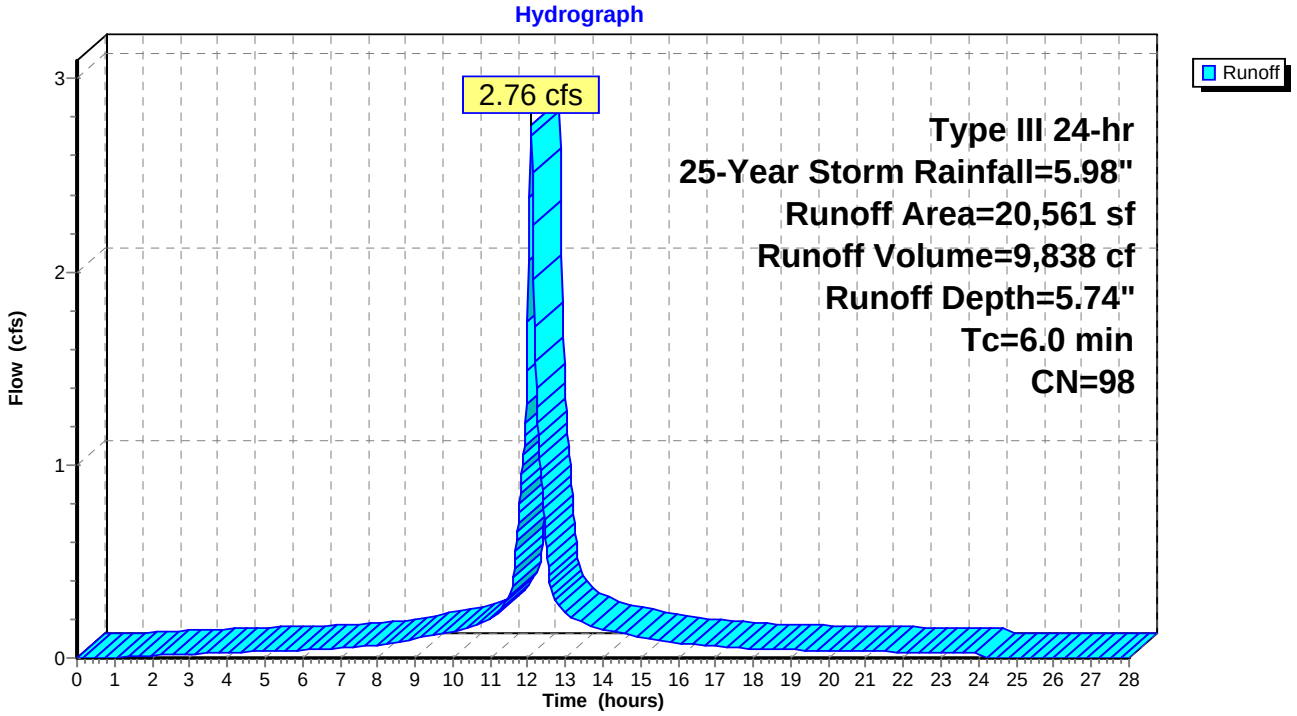
Runoff = 2.76 cfs @ 12.08 hrs, Volume= 9,838 cf, Depth= 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Storm Rainfall=5.98"

Area (sf)	CN	Description
20,561	98	Roofs, HSG B
20,561		100.00% Impervious Area

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

Subcatchment EWS-2: EWS-2

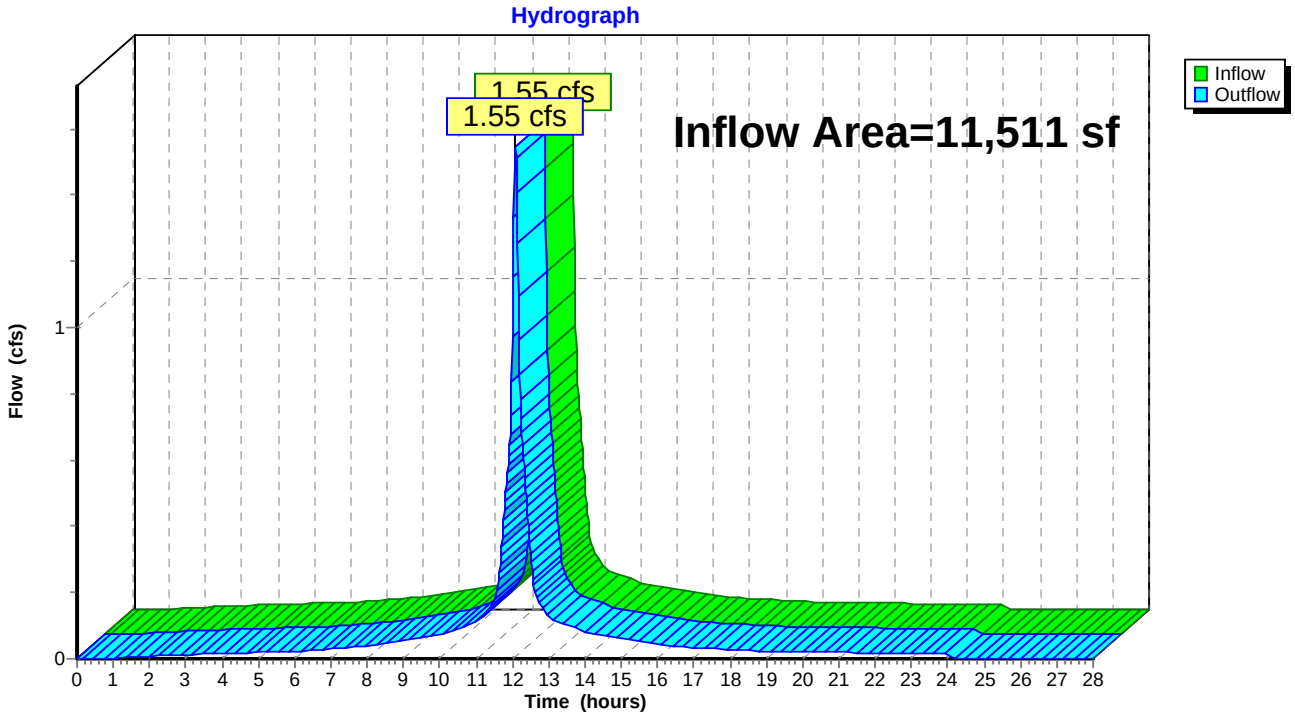


Summary for Reach DP-1: Offsite South (Madison Street)

Inflow Area = 11,511 sf,100.00% Impervious, Inflow Depth = 5.74" for 25-Year Storm event
Inflow = 1.55 cfs @ 12.08 hrs, Volume= 5,508 cf
Outflow = 1.55 cfs @ 12.08 hrs, Volume= 5,508 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-1: Offsite South (Madison Street)

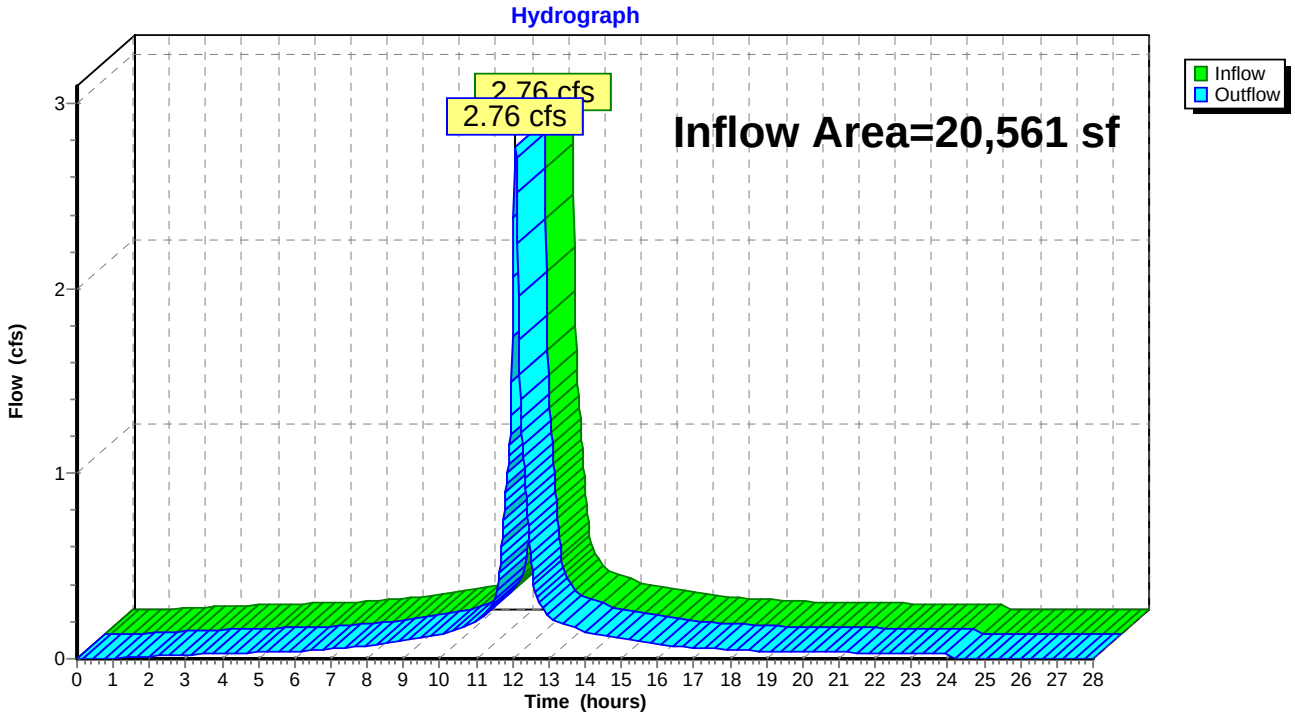


Summary for Reach DP-2: Offsite North (Spruce Street)

Inflow Area = 20,561 sf,100.00% Impervious, Inflow Depth = 5.74" for 25-Year Storm event
Inflow = 2.76 cfs @ 12.08 hrs, Volume= 9,838 cf
Outflow = 2.76 cfs @ 12.08 hrs, Volume= 9,838 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-2: Offsite North (Spruce Street)



Time span=0.00-28.00 hrs, dt=0.02 hrs, 1401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: EWS-1 Runoff Area=11,511 sf 100.00% Impervious Runoff Depth=7.41"
Tc=6.0 min CN=98 Runoff=1.98 cfs 7,108 cf

Subcatchment EWS-2: EWS-2 Runoff Area=20,561 sf 100.00% Impervious Runoff Depth=7.41"
Tc=6.0 min CN=98 Runoff=3.54 cfs 12,697 cf

Reach DP-1: Offsite South (Madison Street) Inflow=1.98 cfs 7,108 cf
Outflow=1.98 cfs 7,108 cf

Reach DP-2: Offsite North (Spruce Street) Inflow=3.54 cfs 12,697 cf
Outflow=3.54 cfs 12,697 cf

Total Runoff Area = 32,072 sf Runoff Volume = 19,806 cf Average Runoff Depth = 7.41"
0.00% Pervious = 0 sf 100.00% Impervious = 32,072 sf

Summary for Subcatchment EWS-1: EWS-1

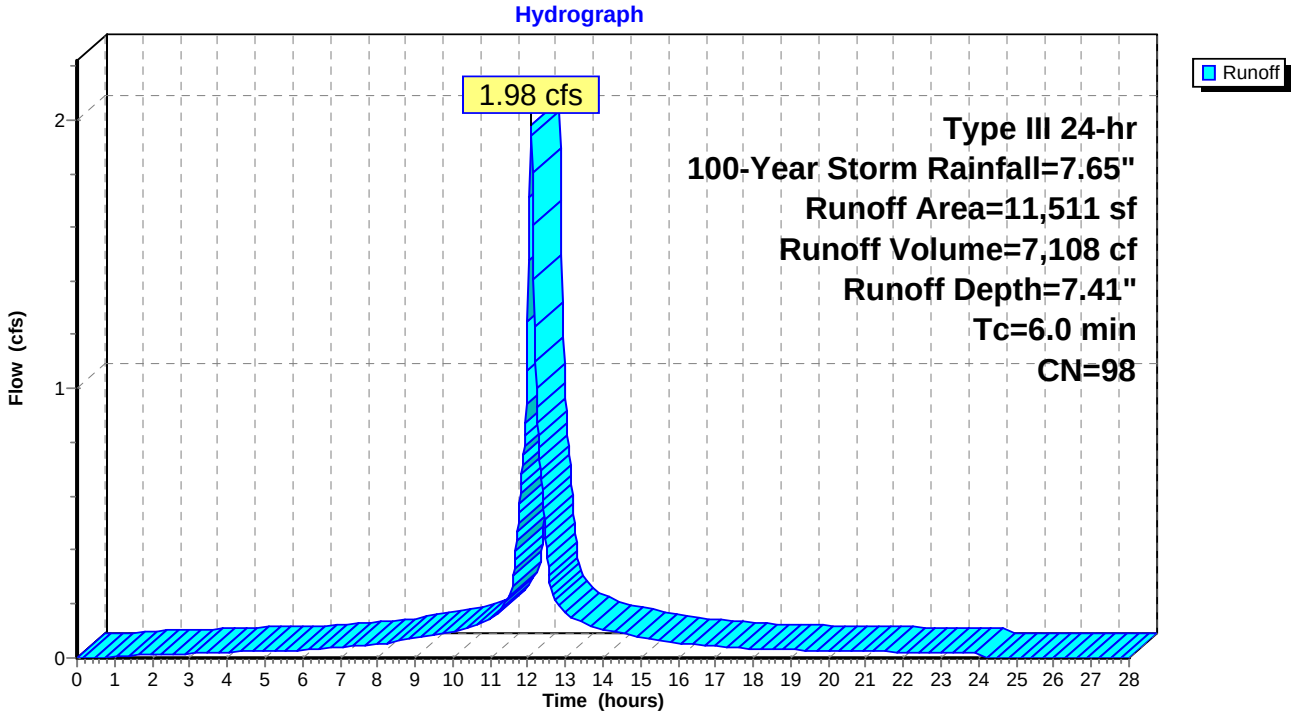
Runoff = 1.98 cfs @ 12.08 hrs, Volume= 7,108 cf, Depth= 7.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Storm Rainfall=7.65"

Area (sf)	CN	Description
11,511	98	Roofs, HSG B
11,511		100.00% Impervious Area

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

Subcatchment EWS-1: EWS-1



Summary for Subcatchment EWS-2: EWS-2

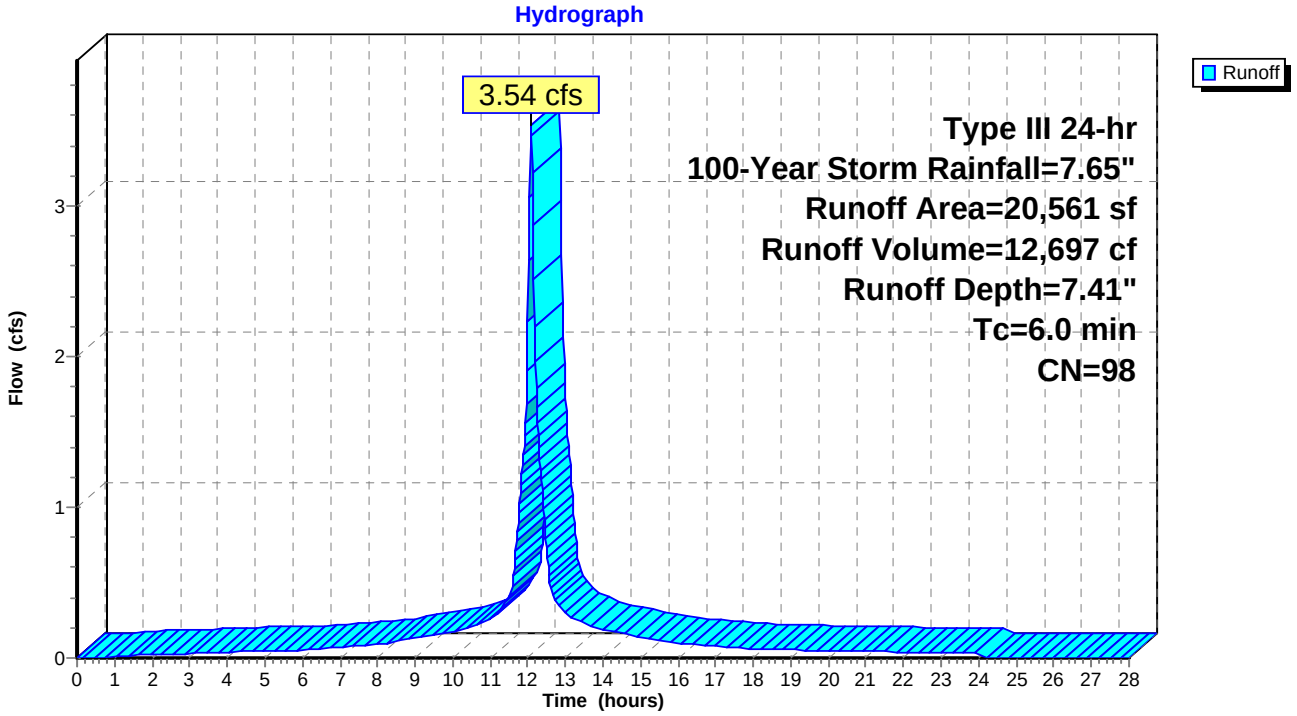
Runoff = 3.54 cfs @ 12.08 hrs, Volume= 12,697 cf, Depth= 7.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Storm Rainfall=7.65"

Area (sf)	CN	Description
20,561	98	Roofs, HSG B
20,561		100.00% Impervious Area

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

Subcatchment EWS-2: EWS-2

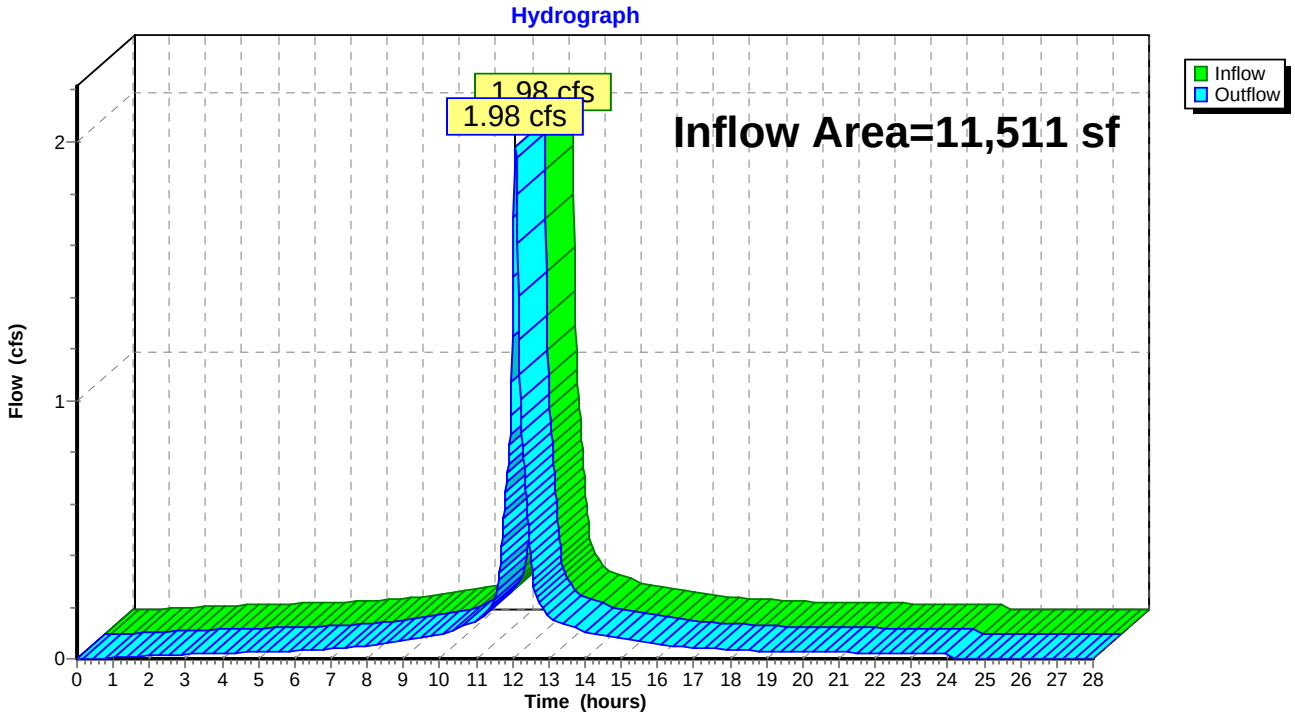


Summary for Reach DP-1: Offsite South (Madison Street)

Inflow Area = 11,511 sf,100.00% Impervious, Inflow Depth = 7.41" for 100-Year Storm event
Inflow = 1.98 cfs @ 12.08 hrs, Volume= 7,108 cf
Outflow = 1.98 cfs @ 12.08 hrs, Volume= 7,108 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-1: Offsite South (Madison Street)

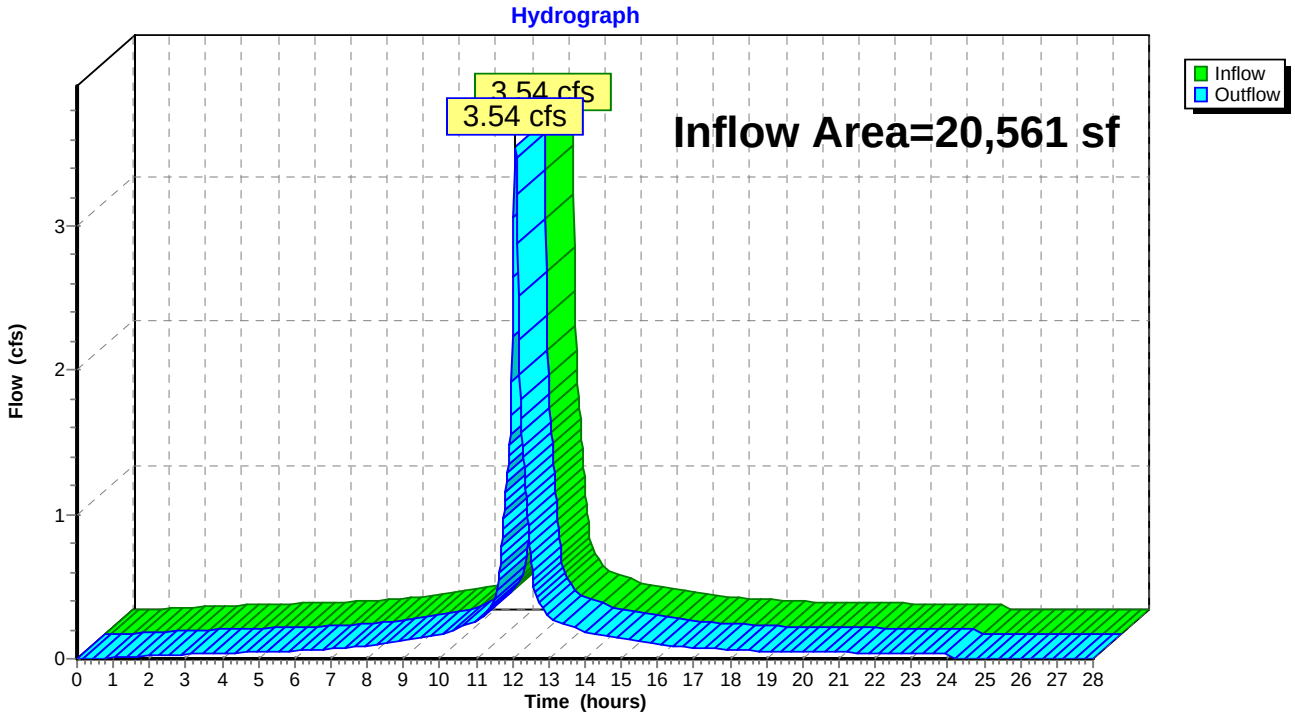


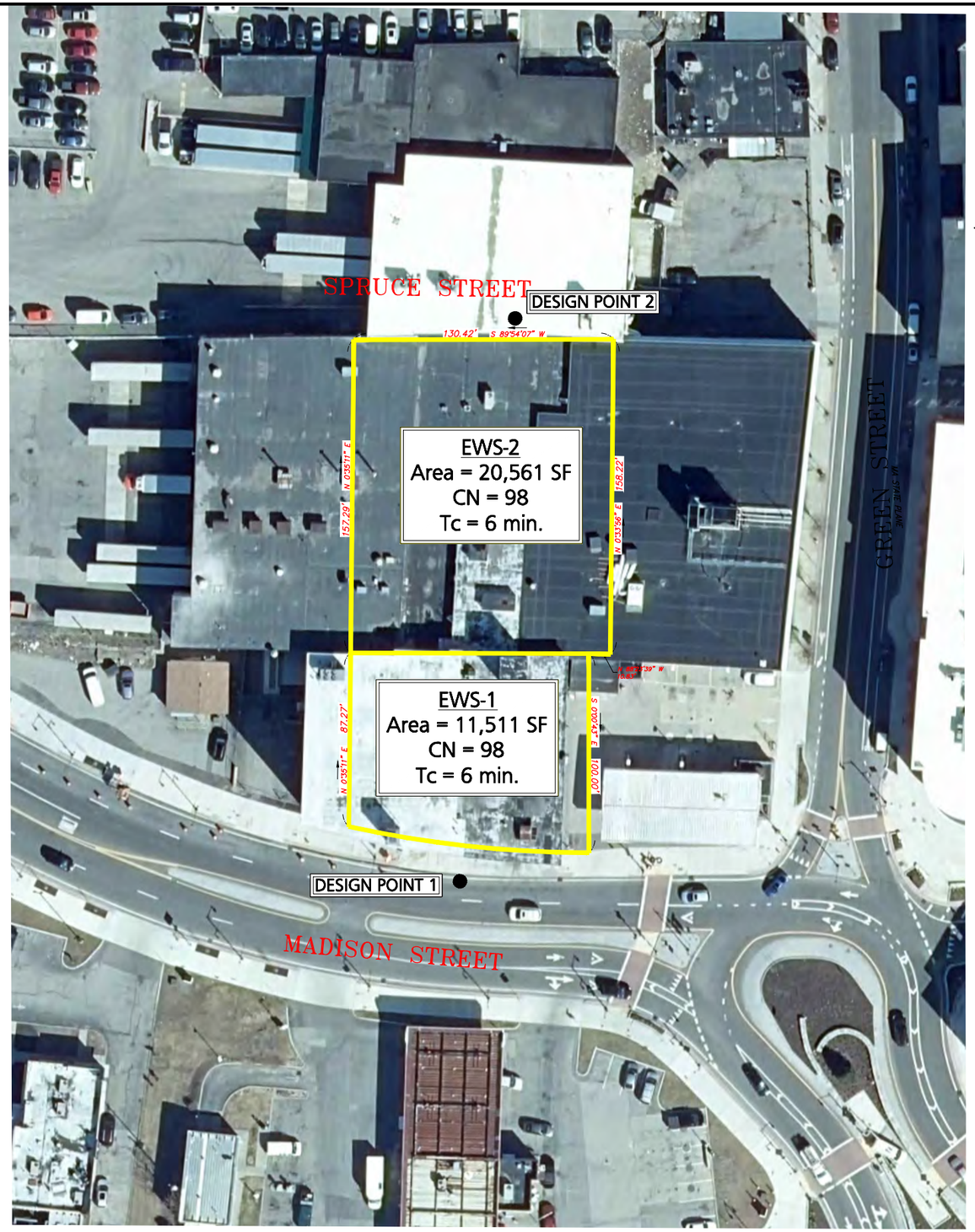
Summary for Reach DP-2: Offsite North (Spruce Street)

Inflow Area = 20,561 sf,100.00% Impervious, Inflow Depth = 7.41" for 100-Year Storm event
Inflow = 3.54 cfs @ 12.08 hrs, Volume= 12,697 cf
Outflow = 3.54 cfs @ 12.08 hrs, Volume= 12,697 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-2: Offsite North (Spruce Street)





GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

APPLICANT:
Rossi Development
345 Boylston Street Suite 300
Newton, MA 02459

DWG. NO.
EWS

DRAWING TITLE:
Existing Watershed Plan

PROJECT:
Proposed Site Plan
Madison Street
Worcester, Massachusetts

PROJECT #: 2461422
DATE: October 15, 2024
SCALE: AS NOTED
DWG FILE NAME: xxxxx.dwg
DESIGN BY: Calvin Reach
CHECKED BY: Richard A. Salvo, P.E.

PREPARED BY:
Engineering Alliance, Inc.
Civil Engineering & Land Planning Consultants
194 Central Street
Saugus, MA 01906
Tel: (781) 231-1349
Fax: (781) 417-4020
1950 Lafayette Road
Portsmouth, NH 03801
Tel: (603) 610-7100
Fax: (603) 610-7101

DESCRIPTION OF REVISION	DATE

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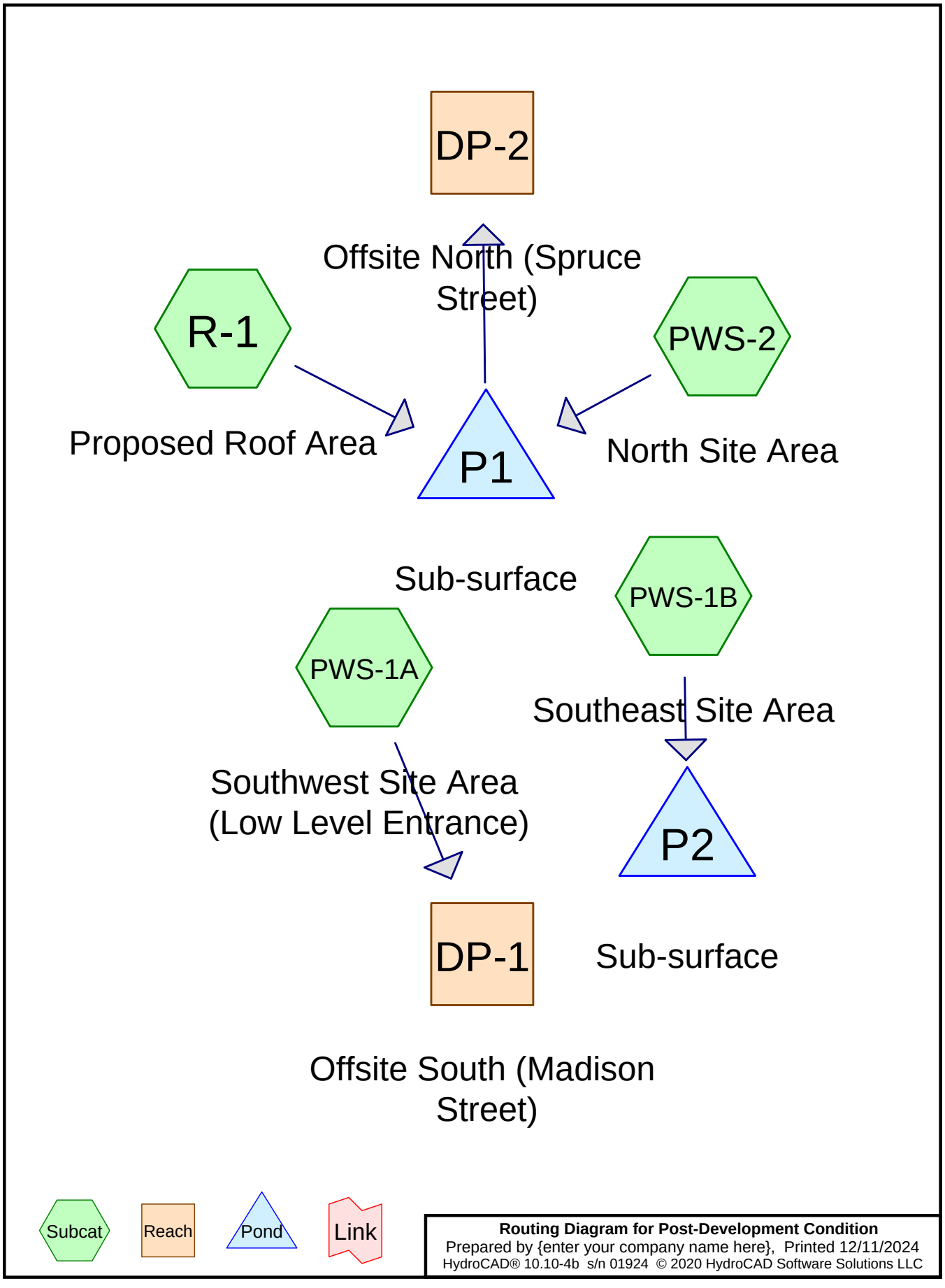
APPENDIX B

Proposed Conditions Drainage Calculations
Proposed Watershed Plan



Routing Diagram for Post-Development Condition

Prepared by {enter your company name here}, Printed 12/11/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Storm	Type III 24-hr		Default	24.00	1	3.17	2
2	10-Year Storm	Type III 24-hr		Default	24.00	1	4.90	2
3	25-Year Storm	Type III 24-hr		Default	24.00	1	5.98	2
4	100-Year Storm	Type III 24-hr		Default	24.00	1	7.65	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
3,814	61	>75% Grass cover, Good, HSG B (PWS-1A, PWS-1B, PWS-2)
14,153	98	Paved parking, HSG B (PWS-1B, PWS-2)
13,800	98	Roofs, HSG B (R-1)
305	98	Walkways & Patio, HSG B (PWS-1A)
32,072	**94**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
32,072	HSG B	PWS-1A, PWS-1B, PWS-2, R-1
0	HSG C	
0	HSG D	
0	Other	
32,072		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	3,814	0	0	0	3,814	>75% Grass cover, Good	
0	14,153	0	0	0	14,153	Paved parking	
0	13,800	0	0	0	13,800	Roofs	
0	305	0	0	0	305	Walkways & Patio	
0	**32,072**	**0**	**0**	**0**	**32,072**	**TOTAL AREA**	

Time span=0.00-28.00 hrs, dt=0.02 hrs, 1401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1A: Southwest Site Runoff Area=1,693 sf 18.02% Impervious Runoff Depth=0.72"
Tc=6.0 min CN=68 Runoff=0.03 cfs 101 cf

Subcatchment PWS-1B: Southeast Site Area Runoff Area=8,864 sf 85.68% Impervious Runoff Depth=2.42"
Tc=6.0 min CN=93 Runoff=0.56 cfs 1,785 cf

Subcatchment PWS-2: North Site Area Runoff Area=7,715 sf 85.00% Impervious Runoff Depth=2.32"
Tc=6.0 min CN=92 Runoff=0.47 cfs 1,493 cf

Subcatchment R-1: Proposed Roof Area Runoff Area=13,800 sf 100.00% Impervious Runoff Depth=2.94"
Tc=6.0 min CN=98 Runoff=0.97 cfs 3,378 cf

Reach DP-1: Offsite South (Madison Street) Inflow=0.03 cfs 101 cf
Outflow=0.03 cfs 101 cf

Reach DP-2: Offsite North (Spruce Street) Inflow=0.47 cfs 751 cf
Outflow=0.47 cfs 751 cf

Pond P1: Sub-surface Peak Elev=463.12' Storage=1,565 cf Inflow=1.44 cfs 4,871 cf
Discarded=0.08 cfs 4,120 cf Primary=0.47 cfs 751 cf Outflow=0.55 cfs 4,871 cf

Pond P2: Sub-surface Peak Elev=452.38' Storage=605 cf Inflow=0.56 cfs 1,785 cf
Outflow=0.07 cfs 1,785 cf

Total Runoff Area = 32,072 sf Runoff Volume = 6,758 cf Average Runoff Depth = 2.53"
11.89% Pervious = 3,814 sf 88.11% Impervious = 28,258 sf

Summary for Subcatchment PWS-1A: Southwest Site Area (Low Level Entrance)

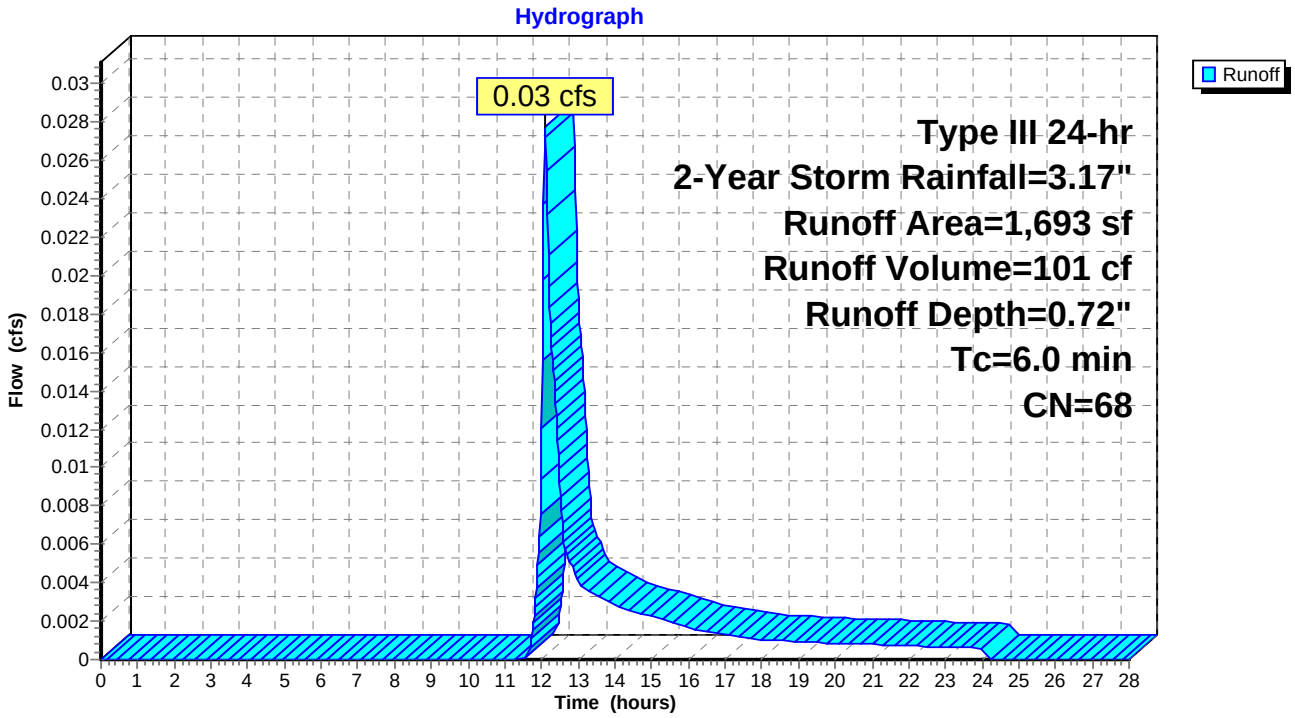
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 101 cf, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Storm Rainfall=3.17"

	Area (sf)	CN	Description
*	305	98	Walkways & Patio, HSG B
	1,388	61	>75% Grass cover, Good, HSG B
	1,693	68	Weighted Average
	1,388		81.98% Pervious Area
	305		18.02% Impervious Area

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

Subcatchment PWS-1A: Southwest Site Area (Low Level Entrance)



Summary for Subcatchment PWS-1B: Southeast Site Area

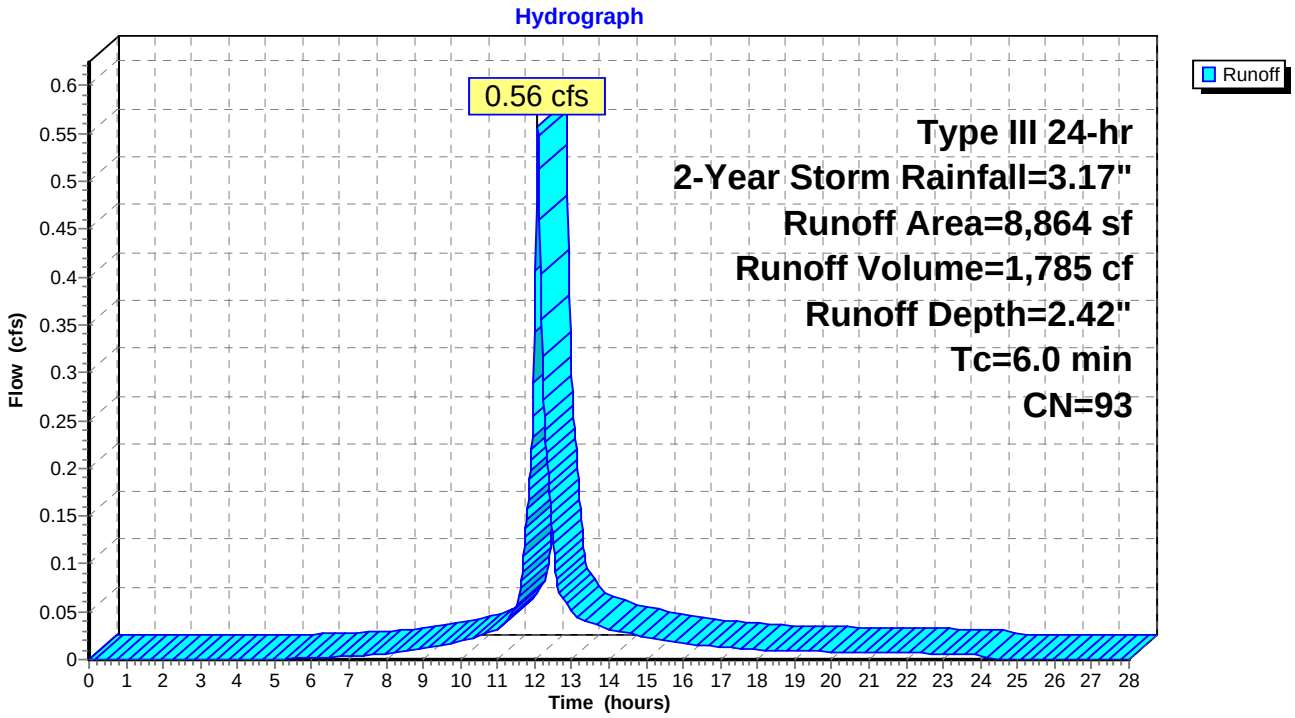
Runoff = 0.56 cfs @ 12.09 hrs, Volume= 1,785 cf, Depth= 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Storm Rainfall=3.17"

Area (sf)	CN	Description
7,595	98	Paved parking, HSG B
1,269	61	>75% Grass cover, Good, HSG B
8,864	93	Weighted Average
1,269		14.32% Pervious Area
7,595		85.68% Impervious Area

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

Subcatchment PWS-1B: Southeast Site Area



Summary for Subcatchment PWS-2: North Site Area

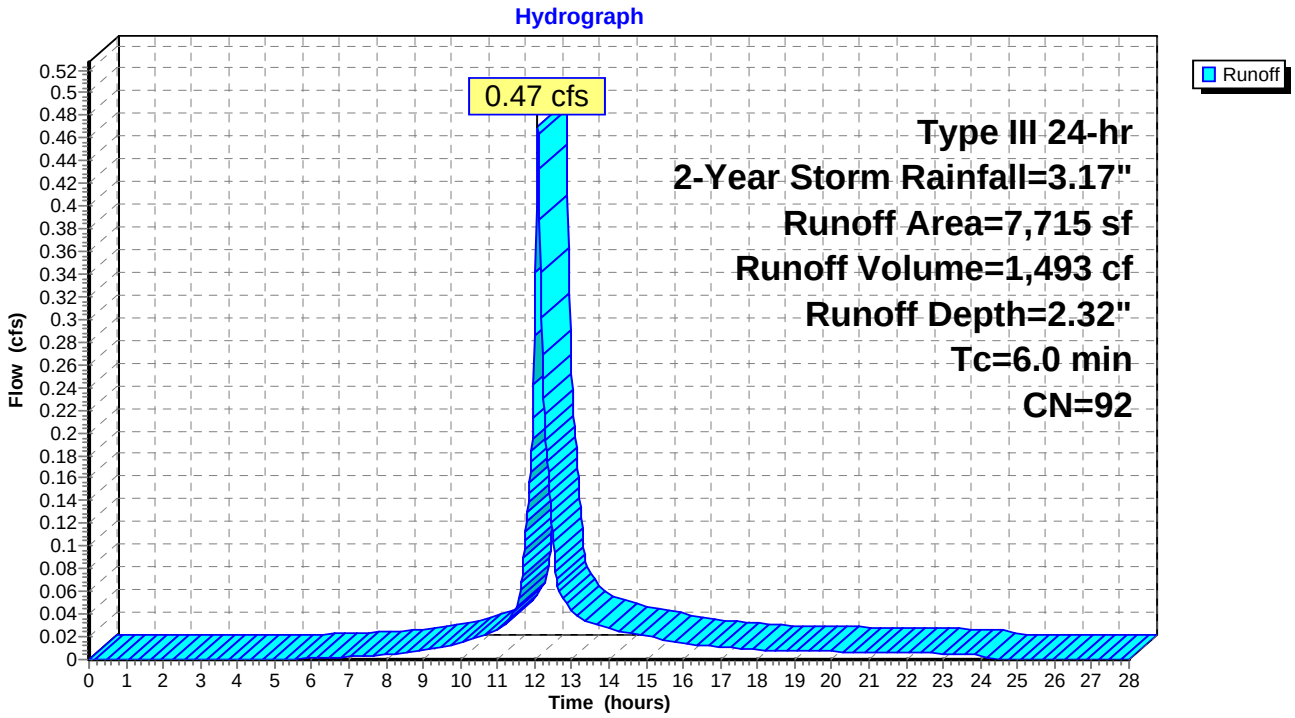
Runoff = 0.47 cfs @ 12.09 hrs, Volume= 1,493 cf, Depth= 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Storm Rainfall=3.17"

Area (sf)	CN	Description
6,558	98	Paved parking, HSG B
1,157	61	>75% Grass cover, Good, HSG B
7,715	92	Weighted Average
1,157		15.00% Pervious Area
6,558		85.00% Impervious Area

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

Subcatchment PWS-2: North Site Area



Summary for Subcatchment R-1: Proposed Roof Area

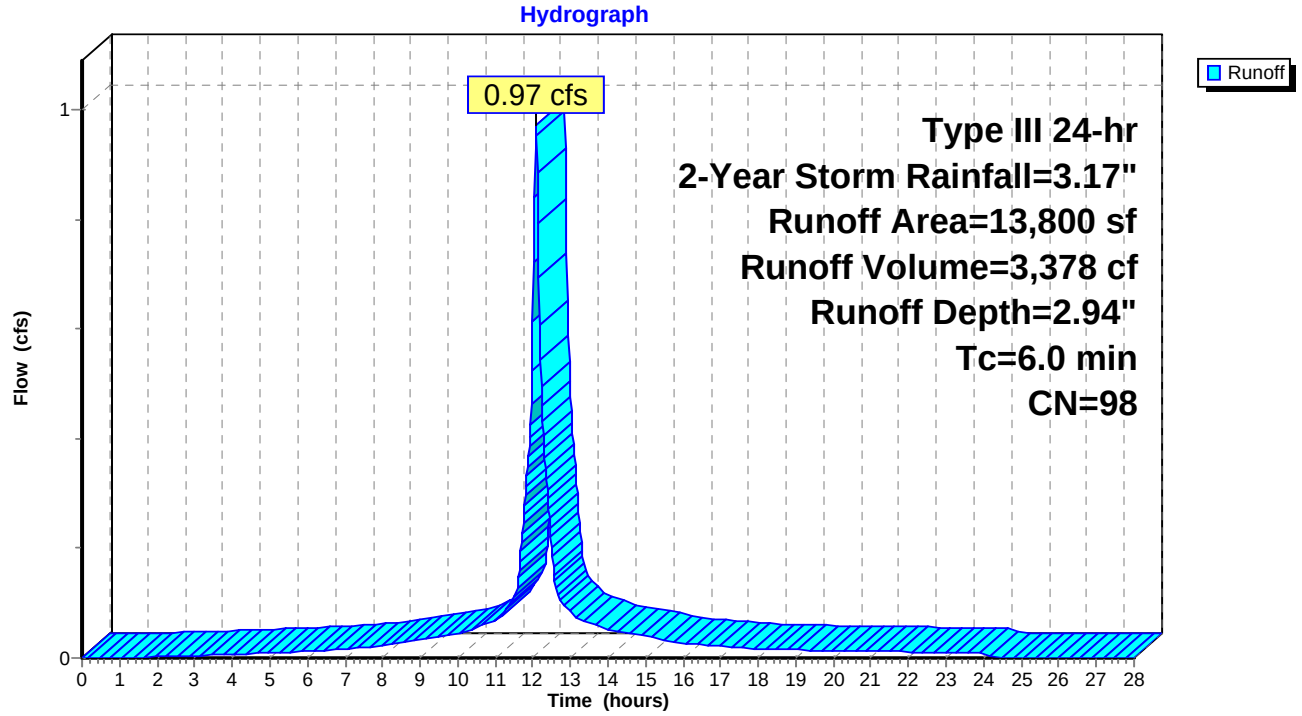
Runoff = 0.97 cfs @ 12.08 hrs, Volume= 3,378 cf, Depth= 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Storm Rainfall=3.17"

Area (sf)	CN	Description
13,800	98	Roofs, HSG B
13,800		100.00% Impervious Area

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

Subcatchment R-1: Proposed Roof Area

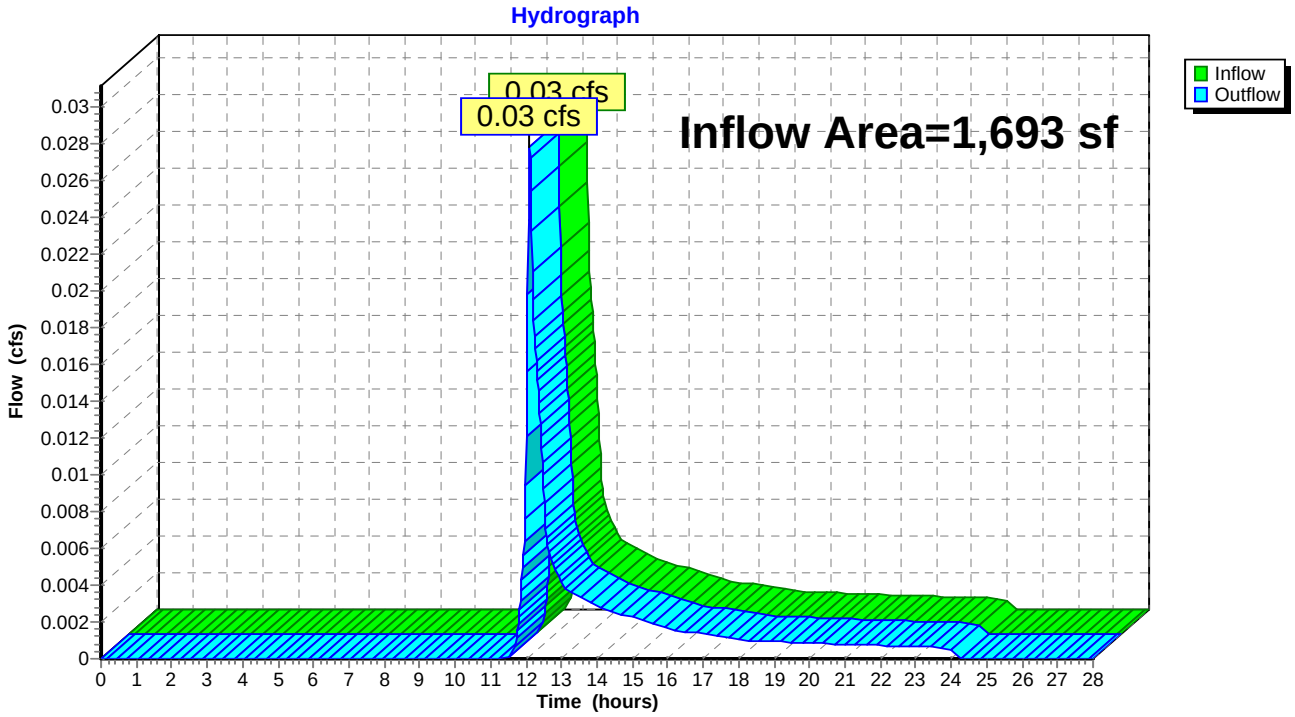


Summary for Reach DP-1: Offsite South (Madison Street)

Inflow Area = 1,693 sf, 18.02% Impervious, Inflow Depth = 0.72" for 2-Year Storm event
Inflow = 0.03 cfs @ 12.10 hrs, Volume= 101 cf
Outflow = 0.03 cfs @ 12.10 hrs, Volume= 101 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-1: Offsite South (Madison Street)

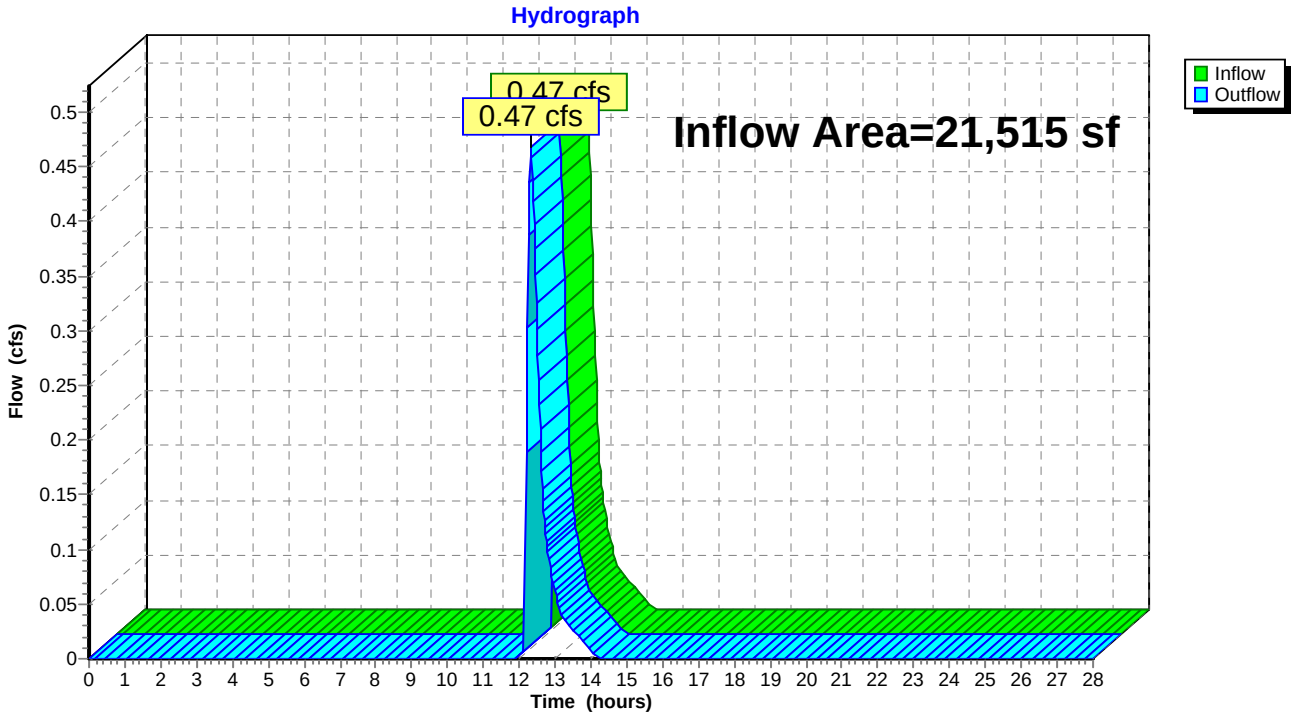


Summary for Reach DP-2: Offsite North (Spruce Street)

Inflow Area = 21,515 sf, 94.62% Impervious, Inflow Depth = 0.42" for 2-Year Storm event
Inflow = 0.47 cfs @ 12.32 hrs, Volume= 751 cf
Outflow = 0.47 cfs @ 12.32 hrs, Volume= 751 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-2: Offsite North (Spruce Street)



Summary for Pond P1: Sub-surface

Inflow Area = 21,515 sf, 94.62% Impervious, Inflow Depth = 2.72" for 2-Year Storm event
Inflow = 1.44 cfs @ 12.08 hrs, Volume= 4,871 cf
Outflow = 0.55 cfs @ 12.32 hrs, Volume= 4,871 cf, Atten= 62%, Lag= 14.4 min
Discarded = 0.08 cfs @ 10.62 hrs, Volume= 4,120 cf
Primary = 0.47 cfs @ 12.32 hrs, Volume= 751 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Peak Elev= 463.12' @ 12.32 hrs Surf.Area= 1,388 sf Storage= 1,565 cf

Plug-Flow detention time= 130.2 min calculated for 4,868 cf (100% of inflow)
Center-of-Mass det. time= 130.1 min (899.4 - 769.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	461.50'	1,188 cf	**30.50'W x 45.50'L x 3.54'H Field A** 4,915 cf Overall - 1,945 cf Embedded = 2,970 cf x 40.0% Voids
#2A	462.00'	1,945 cf	**Cultec R-330XLHD** x 36 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		3,133 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	461.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	460.75'	**12.0" Round 12" Overflow** L= 43.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 460.75' / 460.23' S= 0.0121 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Device 2	463.00'	**4.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.08 cfs @ 10.62 hrs HW=461.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.46 cfs @ 12.32 hrs HW=463.12' (Free Discharge)
└**2=12" Overflow** (Passes 0.46 cfs of 4.09 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.46 cfs @ 0.94 fps)

Pond P1: Sub-surface - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

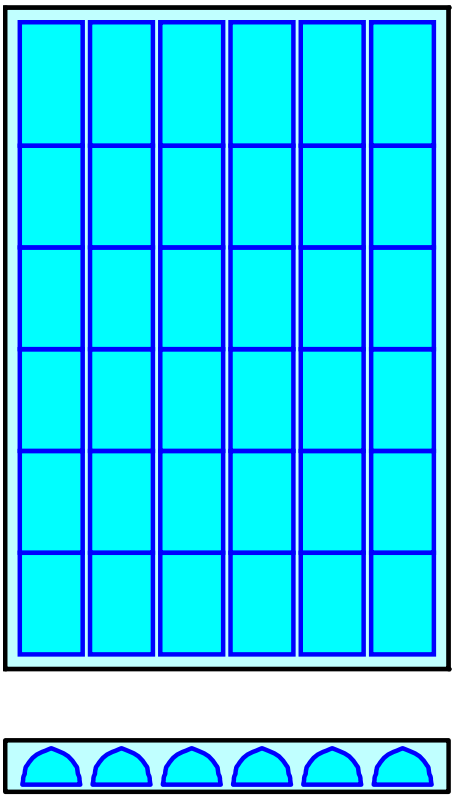
6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

36 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,944.7 cf Chamber Storage

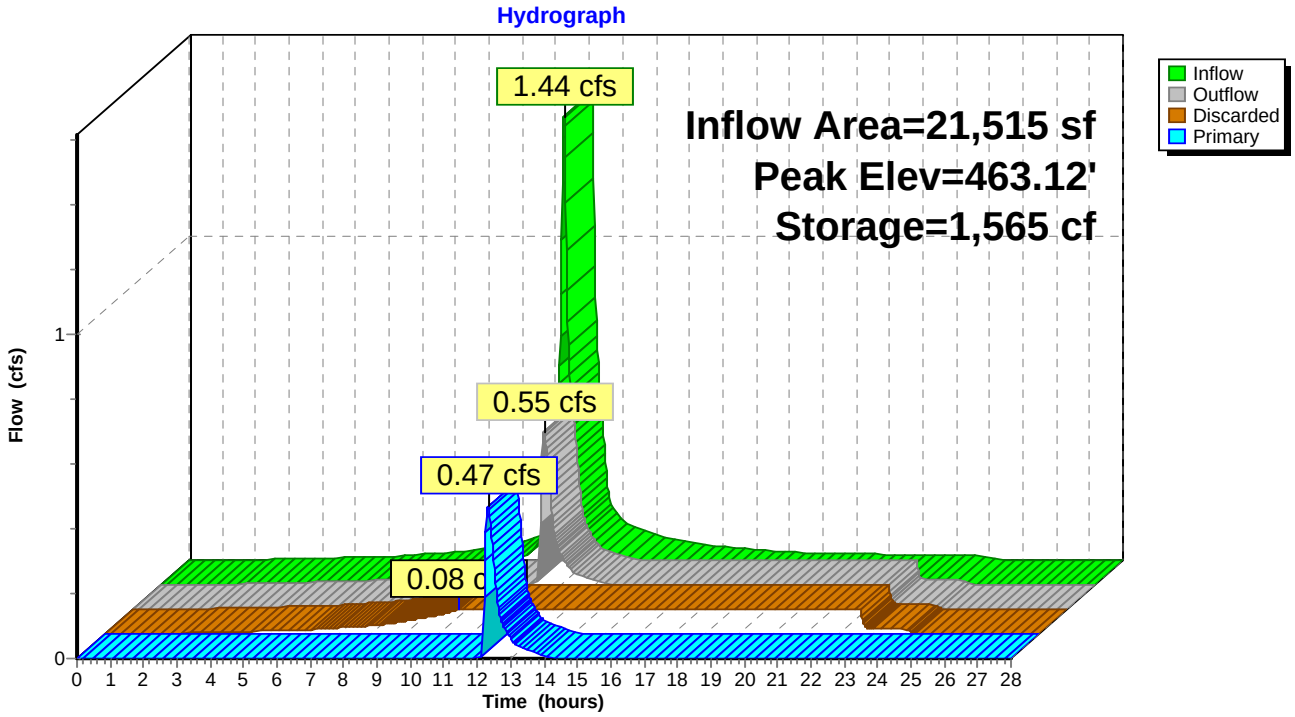
4,914.9 cf Field - 1,944.7 cf Chambers = 2,970.2 cf Stone x 40.0% Voids = 1,188.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,132.8 cf = 0.072 af
Overall Storage Efficiency = 63.7%
Overall System Size = 45.50' x 30.50' x 3.54'

36 Chambers
182.0 cy Field
110.0 cy Stone



Pond P1: Sub-surface



Summary for Pond P2: Sub-surface

Inflow Area = 8,864 sf, 85.68% Impervious, Inflow Depth = 2.42" for 2-Year Storm event
Inflow = 0.56 cfs @ 12.09 hrs, Volume= 1,785 cf
Outflow = 0.07 cfs @ 11.64 hrs, Volume= 1,785 cf, Atten= 88%, Lag= 0.0 min
Discarded = 0.07 cfs @ 11.64 hrs, Volume= 1,785 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Peak Elev= 452.38' @ 12.72 hrs Surf.Area= 1,168 sf Storage= 605 cf

Plug-Flow detention time= 66.4 min calculated for 1,784 cf (100% of inflow)
Center-of-Mass det. time= 66.3 min (859.3 - 793.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	451.50'	1,006 cf	**25.67'W x 45.50'L x 3.54'H Field A** 4,136 cf Overall - 1,621 cf Embedded = 2,515 cf x 40.0% Voids
#2A	452.00'	1,621 cf	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		2,627 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	451.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 11.64 hrs HW=451.54' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Pond P2: Sub-surface - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

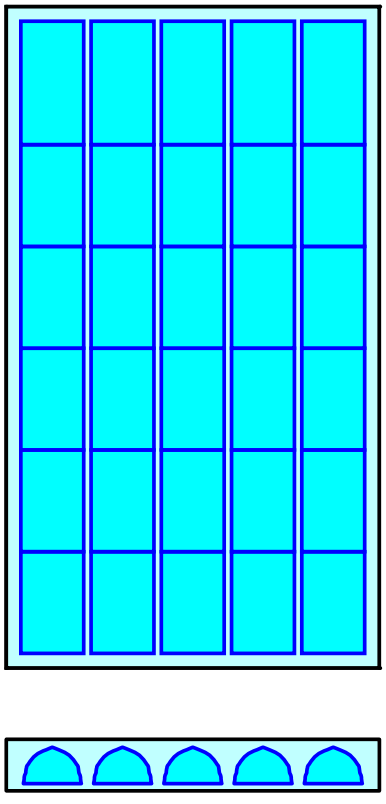
6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length
5 Rows x 52.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.67' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 5 Rows = 1,620.6 cf Chamber Storage

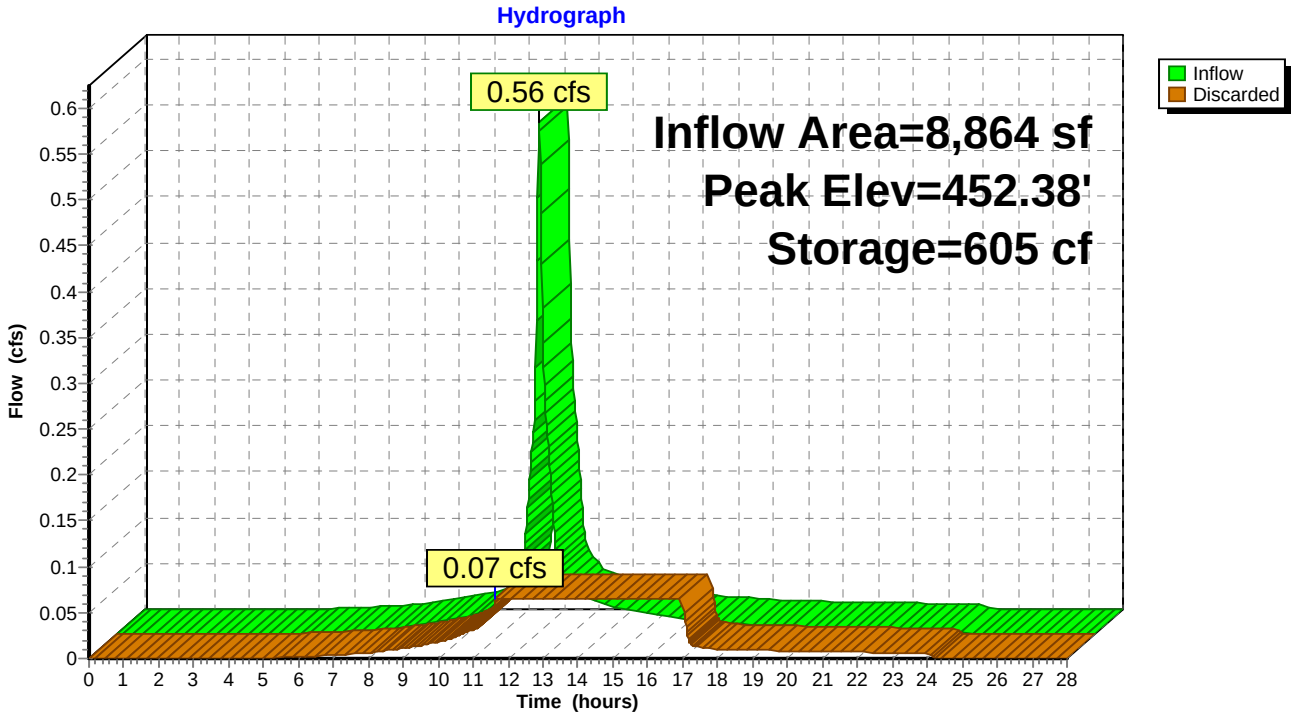
4,136.1 cf Field - 1,620.6 cf Chambers = 2,515.5 cf Stone x 40.0% Voids = 1,006.2 cf Stone Storage

Chamber Storage + Stone Storage = 2,626.8 cf = 0.060 af
Overall Storage Efficiency = 63.5%
Overall System Size = 45.50' x 25.67' x 3.54'

30 Chambers
153.2 cy Field
93.2 cy Stone



Pond P2: Sub-surface



Time span=0.00-28.00 hrs, dt=0.02 hrs, 1401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1A: Southwest Site Runoff Area=1,693 sf 18.02% Impervious Runoff Depth=1.81"
Tc=6.0 min CN=68 Runoff=0.08 cfs 255 cf

Subcatchment PWS-1B: Southeast Site Area Runoff Area=8,864 sf 85.68% Impervious Runoff Depth=4.10"
Tc=6.0 min CN=93 Runoff=0.92 cfs 3,028 cf

Subcatchment PWS-2: North Site Area Runoff Area=7,715 sf 85.00% Impervious Runoff Depth=3.99"
Tc=6.0 min CN=92 Runoff=0.79 cfs 2,566 cf

Subcatchment R-1: Proposed Roof Area Runoff Area=13,800 sf 100.00% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=98 Runoff=1.52 cfs 5,363 cf

Reach DP-1: Offsite South (Madison Street) Inflow=0.08 cfs 255 cf
Outflow=0.08 cfs 255 cf

Reach DP-2: Offsite North (Spruce Street) Inflow=2.00 cfs 2,864 cf
Outflow=2.00 cfs 2,864 cf

Pond P1: Sub-surface Peak Elev=463.32' Storage=1,786 cf Inflow=2.30 cfs 7,929 cf
Discarded=0.08 cfs 5,065 cf Primary=2.00 cfs 2,864 cf Outflow=2.08 cfs 7,929 cf

Pond P2: Sub-surface Peak Elev=453.03' Storage=1,228 cf Inflow=0.92 cfs 3,028 cf
Outflow=0.07 cfs 3,028 cf

Total Runoff Area = 32,072 sf Runoff Volume = 11,213 cf Average Runoff Depth = 4.20"
11.89% Pervious = 3,814 sf 88.11% Impervious = 28,258 sf

Summary for Subcatchment PWS-1A: Southwest Site Area (Low Level Entrance)

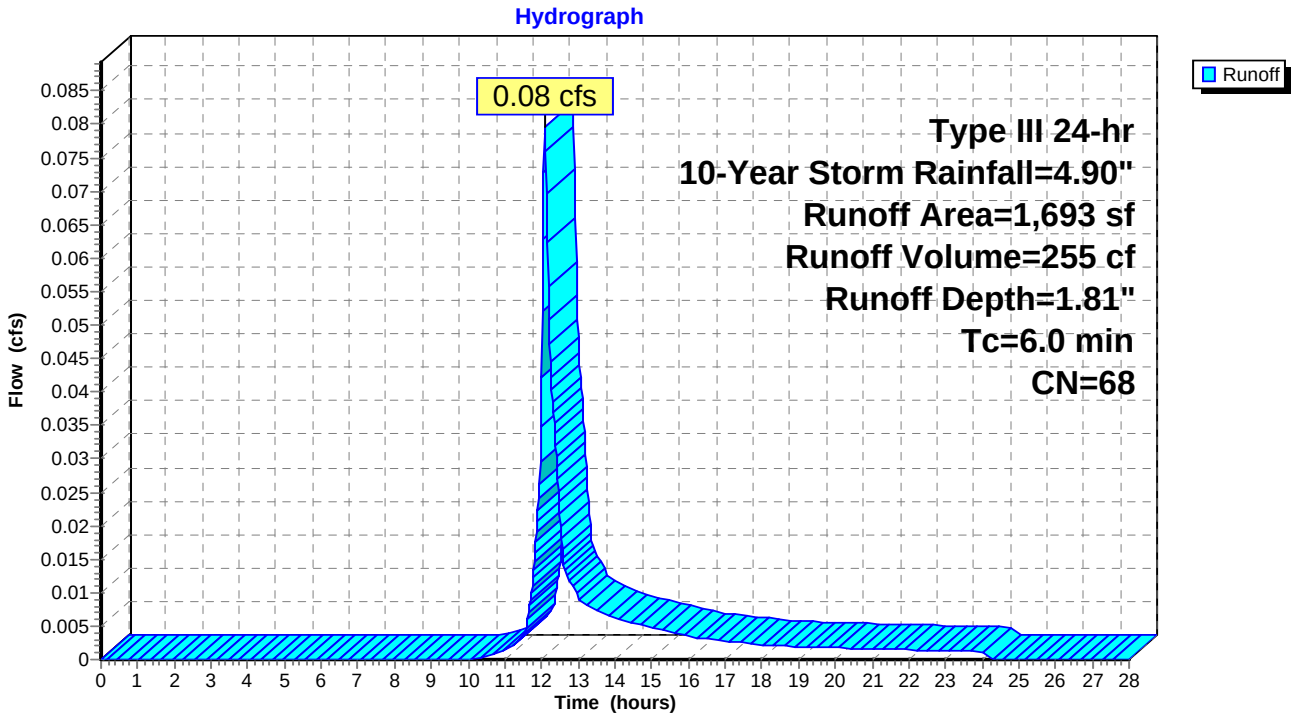
Runoff = 0.08 cfs @ 12.09 hrs, Volume= 255 cf, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Storm Rainfall=4.90"

	Area (sf)	CN	Description
*	305	98	Walkways & Patio, HSG B
	1,388	61	>75% Grass cover, Good, HSG B
	1,693	68	Weighted Average
	1,388		81.98% Pervious Area
	305		18.02% Impervious Area

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

Subcatchment PWS-1A: Southwest Site Area (Low Level Entrance)



Summary for Subcatchment PWS-1B: Southeast Site Area

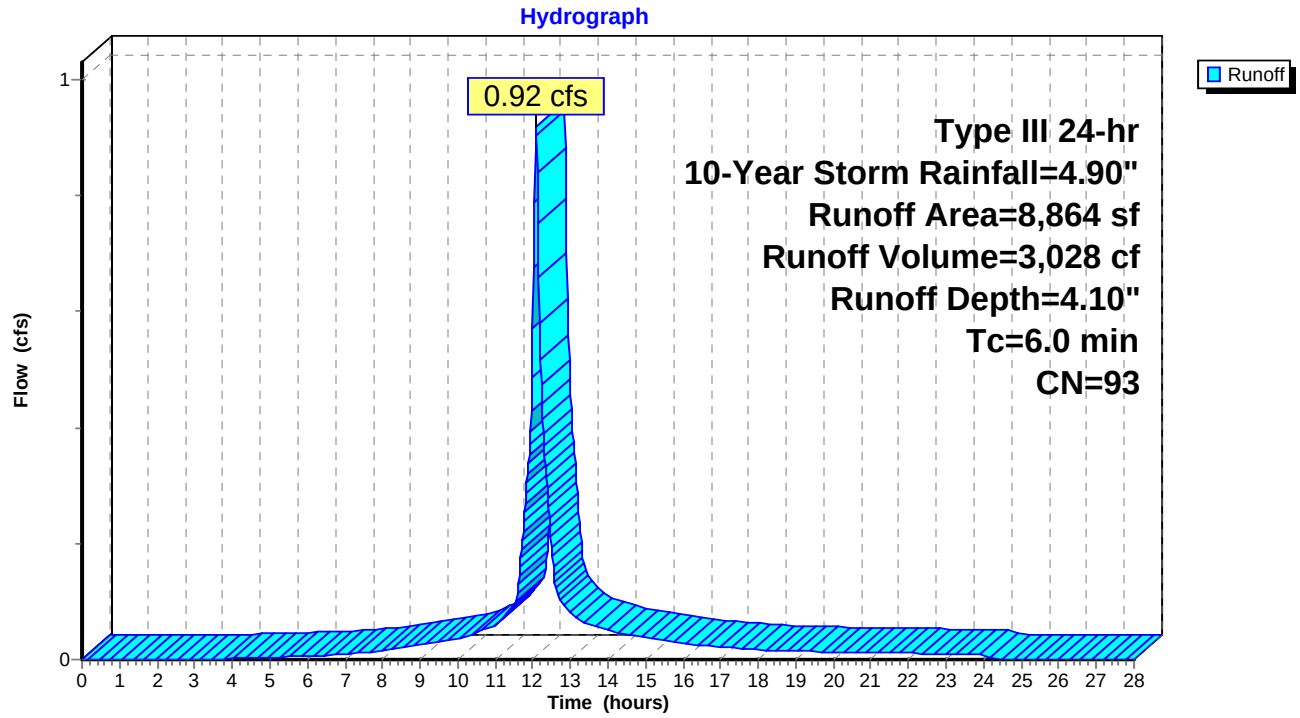
Runoff = 0.92 cfs @ 12.08 hrs, Volume= 3,028 cf, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Storm Rainfall=4.90"

Area (sf)	CN	Description
7,595	98	Paved parking, HSG B
1,269	61	>75% Grass cover, Good, HSG B
8,864	93	Weighted Average
1,269		14.32% Pervious Area
7,595		85.68% Impervious Area

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

Subcatchment PWS-1B: Southeast Site Area



Summary for Subcatchment PWS-2: North Site Area

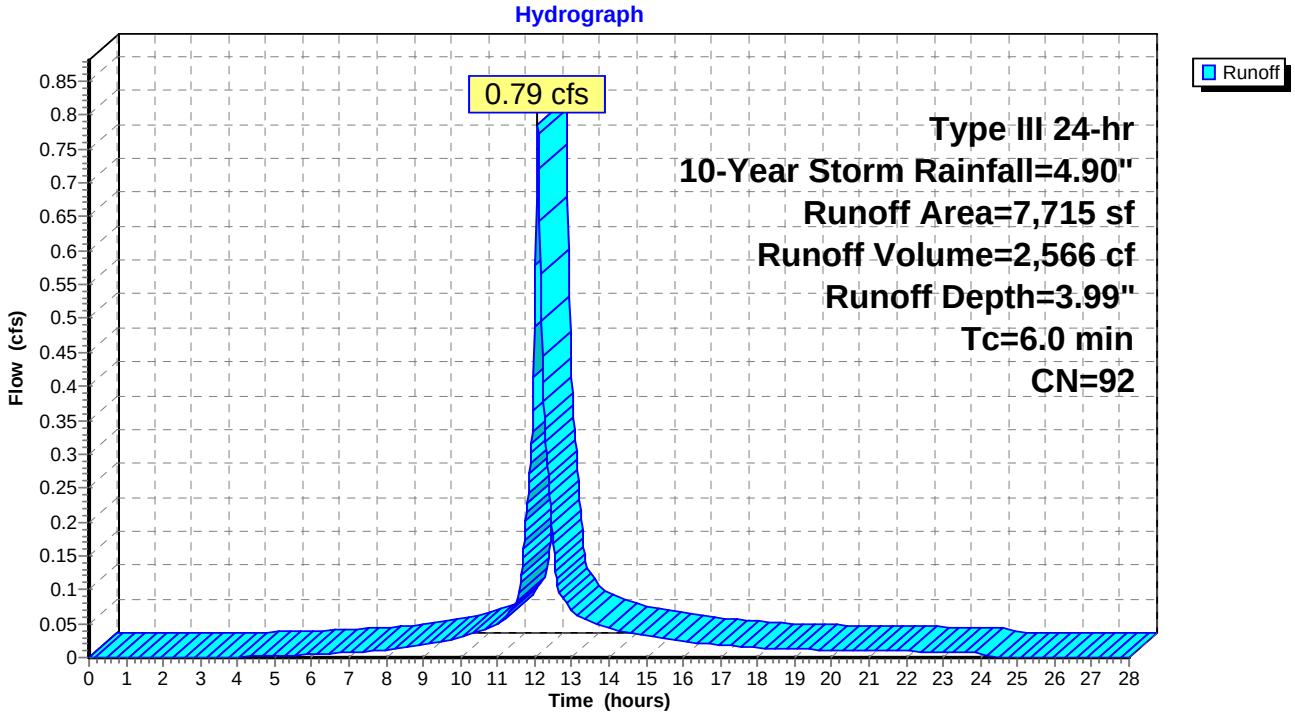
Runoff = 0.79 cfs @ 12.08 hrs, Volume= 2,566 cf, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Storm Rainfall=4.90"

Area (sf)	CN	Description
6,558	98	Paved parking, HSG B
1,157	61	>75% Grass cover, Good, HSG B
7,715	92	Weighted Average
1,157		15.00% Pervious Area
6,558		85.00% Impervious Area

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

Subcatchment PWS-2: North Site Area



Summary for Subcatchment R-1: Proposed Roof Area

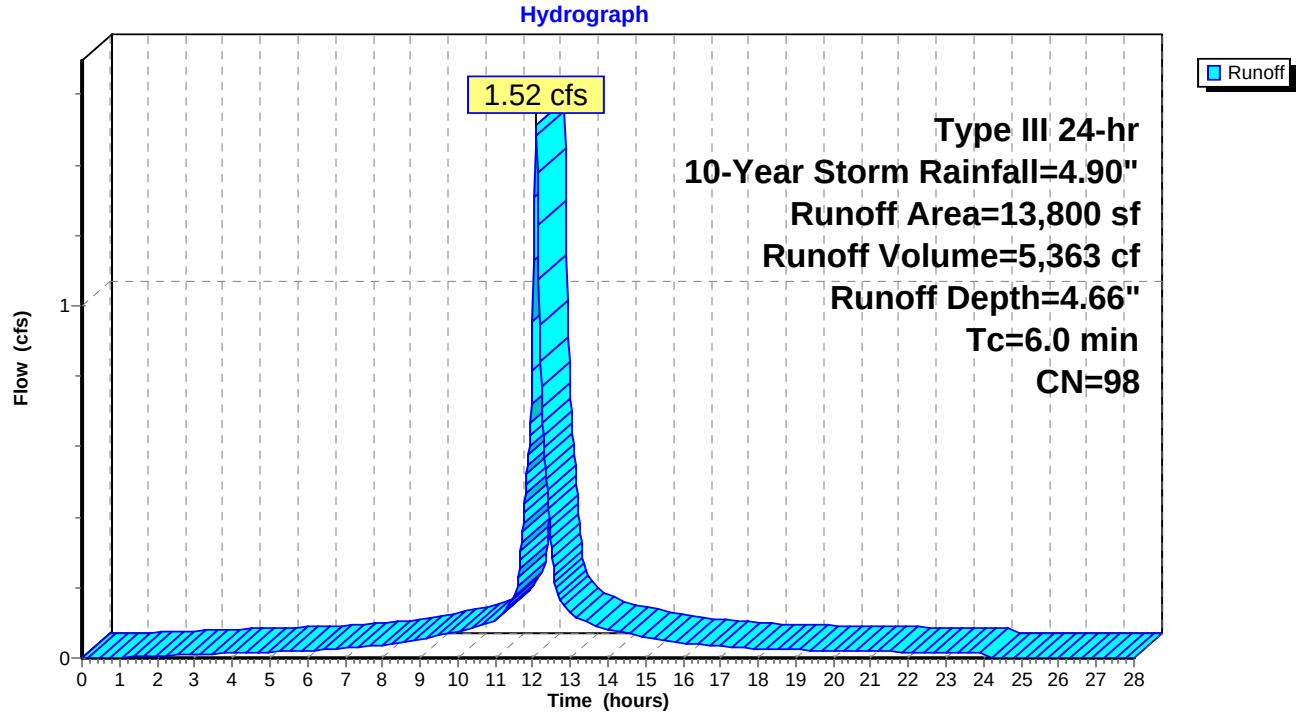
Runoff = 1.52 cfs @ 12.08 hrs, Volume= 5,363 cf, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Storm Rainfall=4.90"

Area (sf)	CN	Description
13,800	98	Roofs, HSG B
13,800		100.00% Impervious Area

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

Subcatchment R-1: Proposed Roof Area

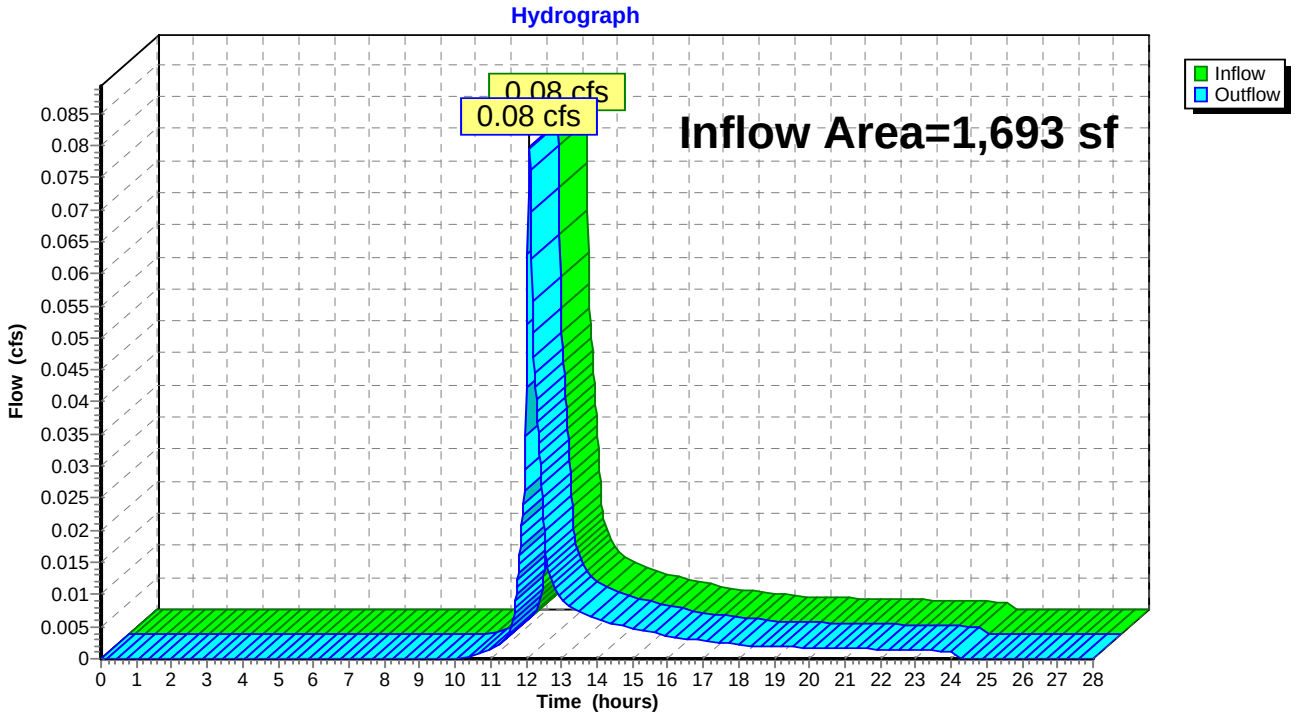


Summary for Reach DP-1: Offsite South (Madison Street)

Inflow Area = 1,693 sf, 18.02% Impervious, Inflow Depth = 1.81" for 10-Year Storm event
Inflow = 0.08 cfs @ 12.09 hrs, Volume= 255 cf
Outflow = 0.08 cfs @ 12.09 hrs, Volume= 255 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-1: Offsite South (Madison Street)

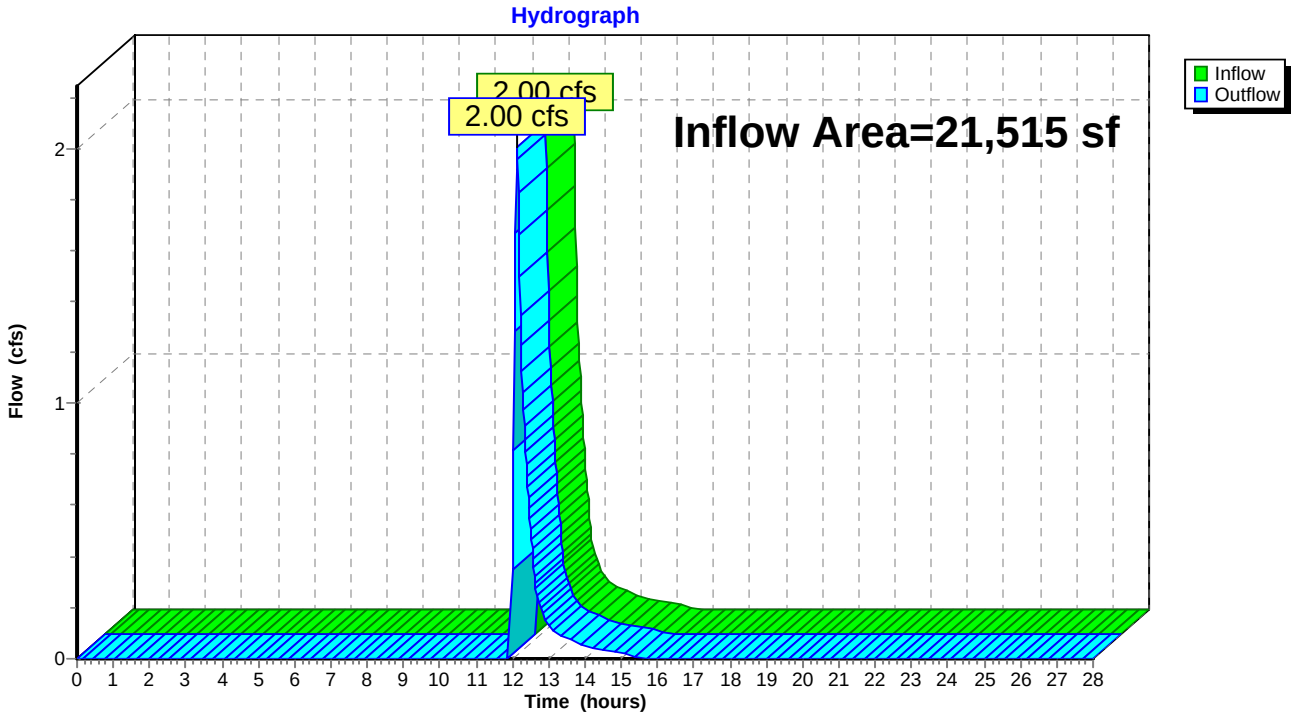


Summary for Reach DP-2: Offsite North (Spruce Street)

Inflow Area = 21,515 sf, 94.62% Impervious, Inflow Depth = 1.60" for 10-Year Storm event
Inflow = 2.00 cfs @ 12.12 hrs, Volume= 2,864 cf
Outflow = 2.00 cfs @ 12.12 hrs, Volume= 2,864 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-2: Offsite North (Spruce Street)



Summary for Pond P1: Sub-surface

Inflow Area = 21,515 sf, 94.62% Impervious, Inflow Depth = 4.42" for 10-Year Storm event
Inflow = 2.30 cfs @ 12.08 hrs, Volume= 7,929 cf
Outflow = 2.08 cfs @ 12.12 hrs, Volume= 7,929 cf, Atten= 10%, Lag= 2.4 min
Discarded = 0.08 cfs @ 9.22 hrs, Volume= 5,065 cf
Primary = 2.00 cfs @ 12.12 hrs, Volume= 2,864 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Peak Elev= 463.32' @ 12.12 hrs Surf.Area= 1,388 sf Storage= 1,786 cf

Plug-Flow detention time= 105.7 min calculated for 7,923 cf (100% of inflow)
Center-of-Mass det. time= 105.6 min (865.3 - 759.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	461.50'	1,188 cf	**30.50'W x 45.50'L x 3.54'H Field A** 4,915 cf Overall - 1,945 cf Embedded = 2,970 cf x 40.0% Voids
#2A	462.00'	1,945 cf	**Cultec R-330XLHD** x 36 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		3,133 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	461.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	460.75'	**12.0" Round 12" Overflow** L= 43.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 460.75' / 460.23' S= 0.0121 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Device 2	463.00'	**4.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.08 cfs @ 9.22 hrs HW=461.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=1.99 cfs @ 12.12 hrs HW=463.32' (Free Discharge)
└**2=12" Overflow** (Passes 1.99 cfs of 4.30 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 1.99 cfs @ 1.54 fps)

Pond P1: Sub-surface - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

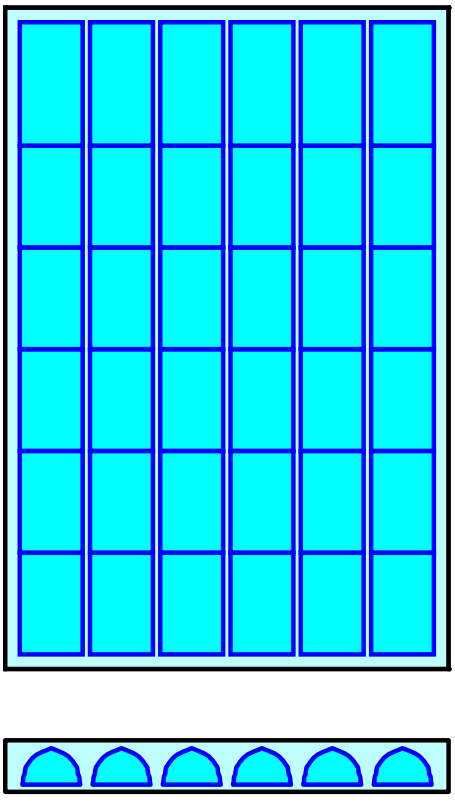
6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

36 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,944.7 cf Chamber Storage

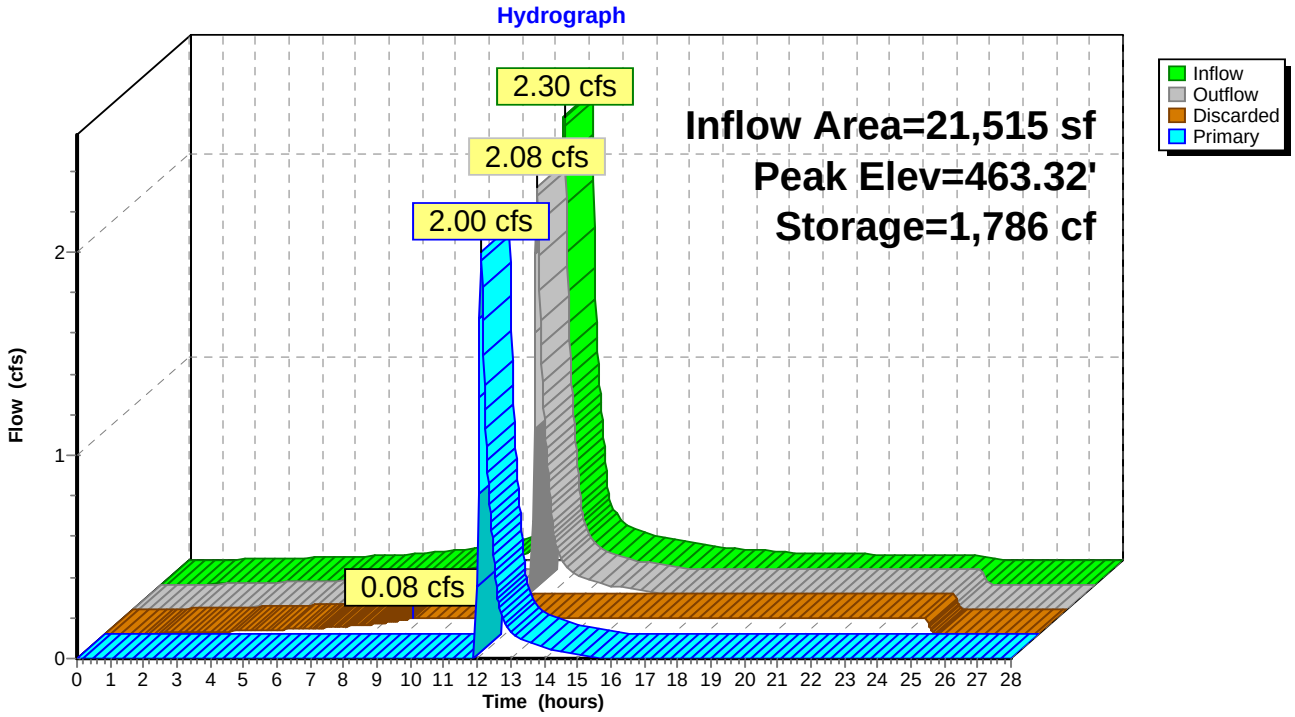
4,914.9 cf Field - 1,944.7 cf Chambers = 2,970.2 cf Stone x 40.0% Voids = 1,188.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,132.8 cf = 0.072 af
Overall Storage Efficiency = 63.7%
Overall System Size = 45.50' x 30.50' x 3.54'

36 Chambers
182.0 cy Field
110.0 cy Stone



Pond P1: Sub-surface



Summary for Pond P2: Sub-surface

Inflow Area = 8,864 sf, 85.68% Impervious, Inflow Depth = 4.10" for 10-Year Storm event
Inflow = 0.92 cfs @ 12.08 hrs, Volume= 3,028 cf
Outflow = 0.07 cfs @ 11.22 hrs, Volume= 3,028 cf, Atten= 93%, Lag= 0.0 min
Discarded = 0.07 cfs @ 11.22 hrs, Volume= 3,028 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Peak Elev= 453.03' @ 13.35 hrs Surf.Area= 1,168 sf Storage= 1,228 cf

Plug-Flow detention time= 151.9 min calculated for 3,026 cf (100% of inflow)
Center-of-Mass det. time= 151.8 min (930.7 - 778.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	451.50'	1,006 cf	**25.67'W x 45.50'L x 3.54'H Field A** 4,136 cf Overall - 1,621 cf Embedded = 2,515 cf x 40.0% Voids
#2A	452.00'	1,621 cf	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		2,627 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	451.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 11.22 hrs HW=451.54' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.07 cfs)

Pond P2: Sub-surface - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

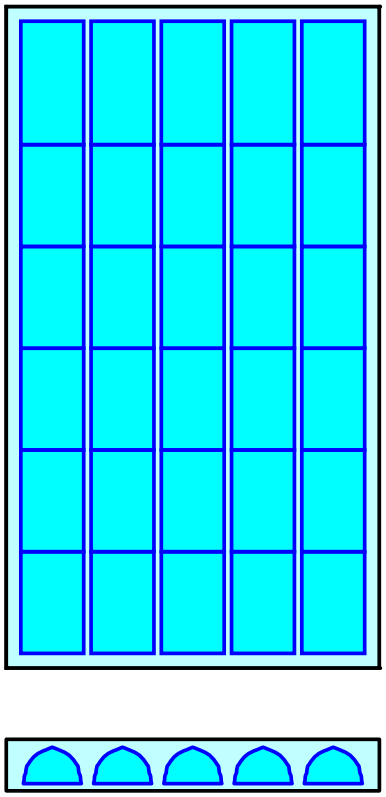
6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length
5 Rows x 52.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.67' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 5 Rows = 1,620.6 cf Chamber Storage

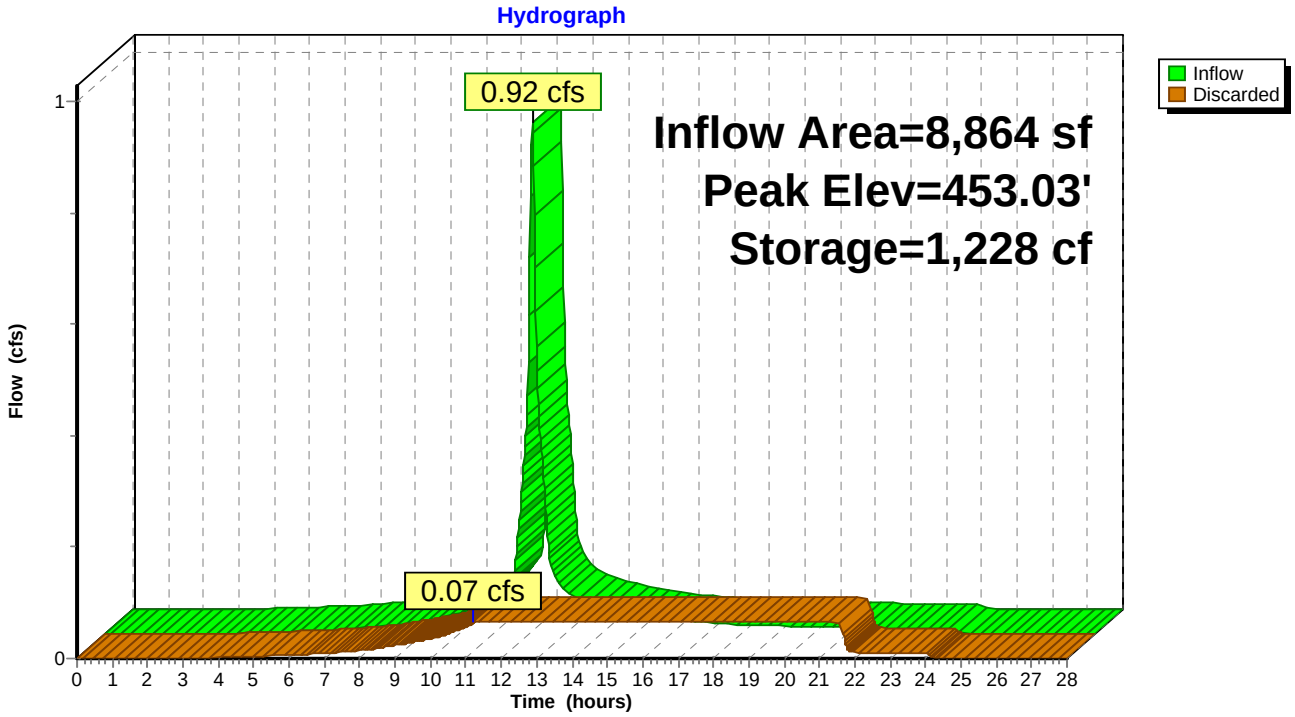
4,136.1 cf Field - 1,620.6 cf Chambers = 2,515.5 cf Stone x 40.0% Voids = 1,006.2 cf Stone Storage

Chamber Storage + Stone Storage = 2,626.8 cf = 0.060 af
Overall Storage Efficiency = 63.5%
Overall System Size = 45.50' x 25.67' x 3.54'

30 Chambers
153.2 cy Field
93.2 cy Stone



Pond P2: Sub-surface



Time span=0.00-28.00 hrs, dt=0.02 hrs, 1401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1A: Southwest Site Runoff Area=1,693 sf 18.02% Impervious Runoff Depth=2.61"
Tc=6.0 min CN=68 Runoff=0.12 cfs 368 cf

Subcatchment PWS-1B: Southeast Site Area Runoff Area=8,864 sf 85.68% Impervious Runoff Depth=5.16"
Tc=6.0 min CN=93 Runoff=1.14 cfs 3,814 cf

Subcatchment PWS-2: North Site Area Runoff Area=7,715 sf 85.00% Impervious Runoff Depth=5.05"
Tc=6.0 min CN=92 Runoff=0.98 cfs 3,247 cf

Subcatchment R-1: Proposed Roof Area Runoff Area=13,800 sf 100.00% Impervious Runoff Depth=5.74"
Tc=6.0 min CN=98 Runoff=1.85 cfs 6,603 cf

Reach DP-1: Offsite South (Madison Street) Inflow=0.12 cfs 368 cf
Outflow=0.12 cfs 368 cf

Reach DP-2: Offsite North (Spruce Street) Inflow=2.60 cfs 4,328 cf
Outflow=2.60 cfs 4,328 cf

Pond P1: Sub-surface Peak Elev=463.39' Storage=1,852 cf Inflow=2.84 cfs 9,850 cf
Discarded=0.08 cfs 5,522 cf Primary=2.60 cfs 4,328 cf Outflow=2.68 cfs 9,850 cf

Pond P2: Sub-surface Peak Elev=453.53' Storage=1,680 cf Inflow=1.14 cfs 3,814 cf
Outflow=0.07 cfs 3,814 cf

Total Runoff Area = 32,072 sf Runoff Volume = 14,031 cf Average Runoff Depth = 5.25"
11.89% Pervious = 3,814 sf 88.11% Impervious = 28,258 sf

Summary for Subcatchment PWS-1A: Southwest Site Area (Low Level Entrance)

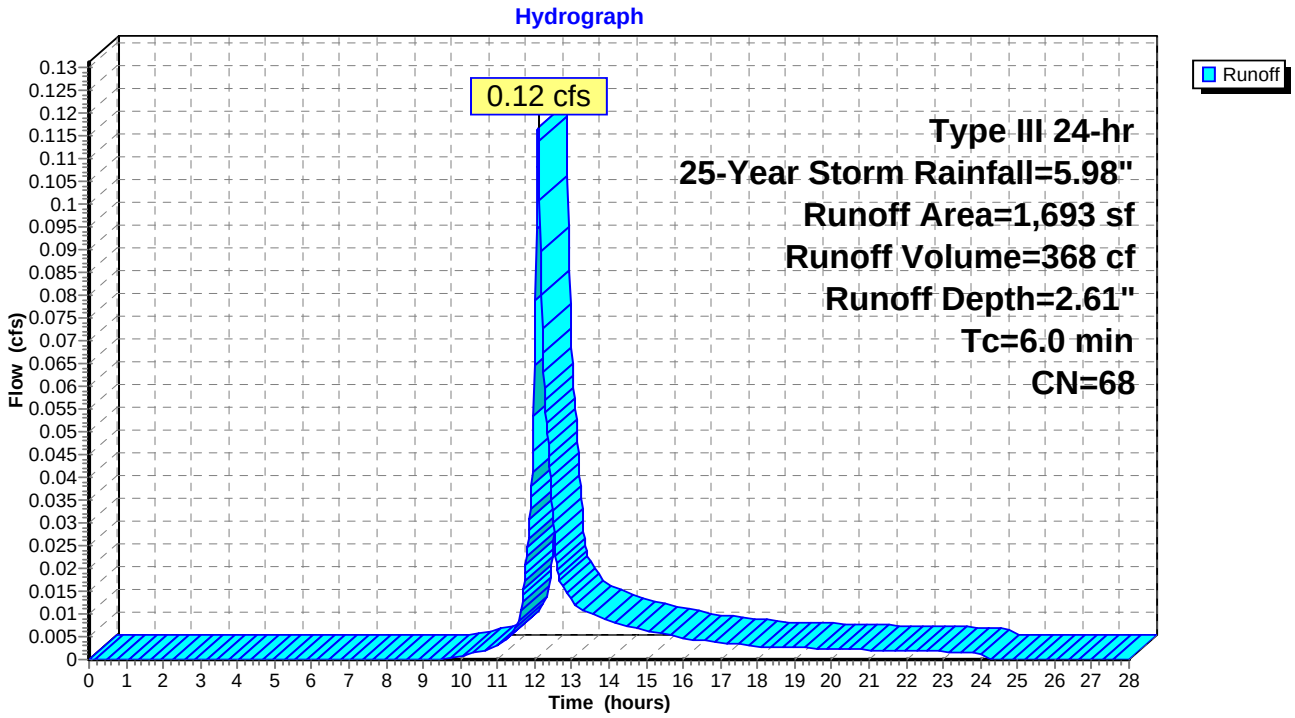
Runoff = 0.12 cfs @ 12.09 hrs, Volume= 368 cf, Depth= 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Storm Rainfall=5.98"

	Area (sf)	CN	Description
*	305	98	Walkways & Patio, HSG B
	1,388	61	>75% Grass cover, Good, HSG B
	1,693	68	Weighted Average
	1,388		81.98% Pervious Area
	305		18.02% Impervious Area

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

Subcatchment PWS-1A: Southwest Site Area (Low Level Entrance)



Summary for Subcatchment PWS-1B: Southeast Site Area

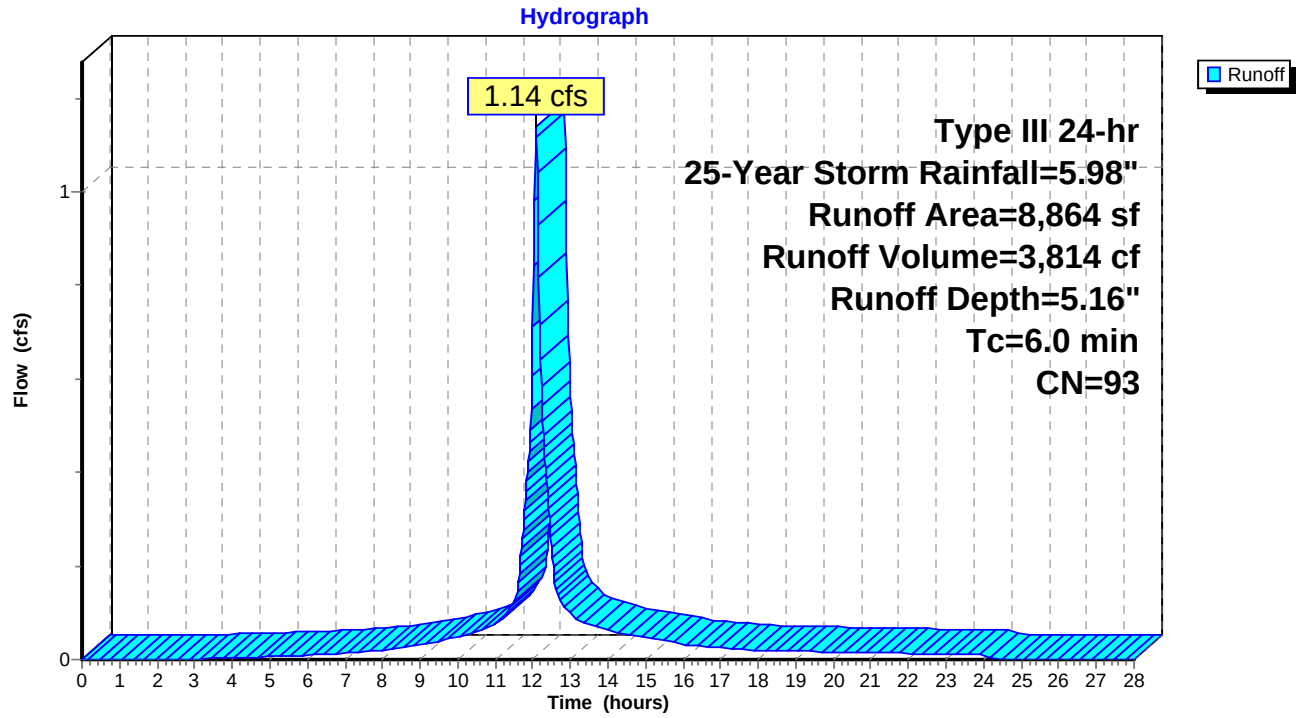
Runoff = 1.14 cfs @ 12.08 hrs, Volume= 3,814 cf, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Storm Rainfall=5.98"

Area (sf)	CN	Description
7,595	98	Paved parking, HSG B
1,269	61	>75% Grass cover, Good, HSG B
8,864	93	Weighted Average
1,269		14.32% Pervious Area
7,595		85.68% Impervious Area

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

Subcatchment PWS-1B: Southeast Site Area



Summary for Subcatchment PWS-2: North Site Area

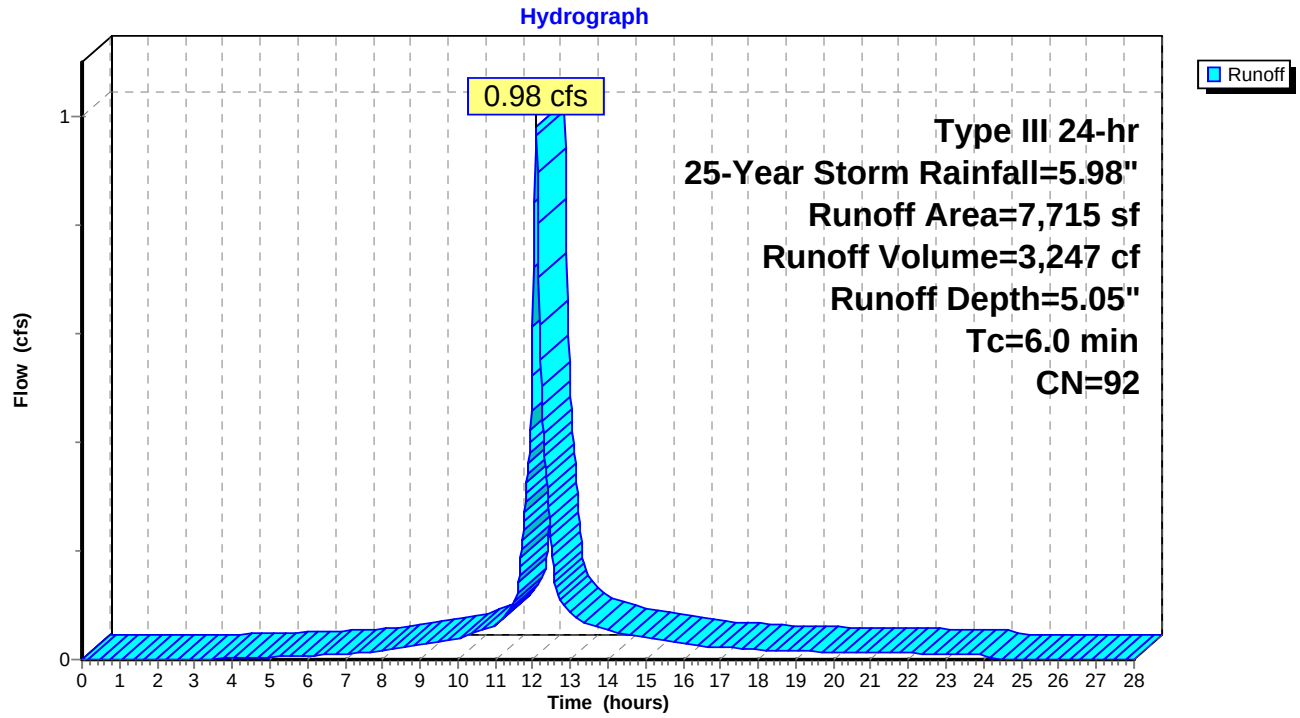
Runoff = 0.98 cfs @ 12.08 hrs, Volume= 3,247 cf, Depth= 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Storm Rainfall=5.98"

Area (sf)	CN	Description
6,558	98	Paved parking, HSG B
1,157	61	>75% Grass cover, Good, HSG B
7,715	92	Weighted Average
1,157		15.00% Pervious Area
6,558		85.00% Impervious Area

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

Subcatchment PWS-2: North Site Area



Summary for Subcatchment R-1: Proposed Roof Area

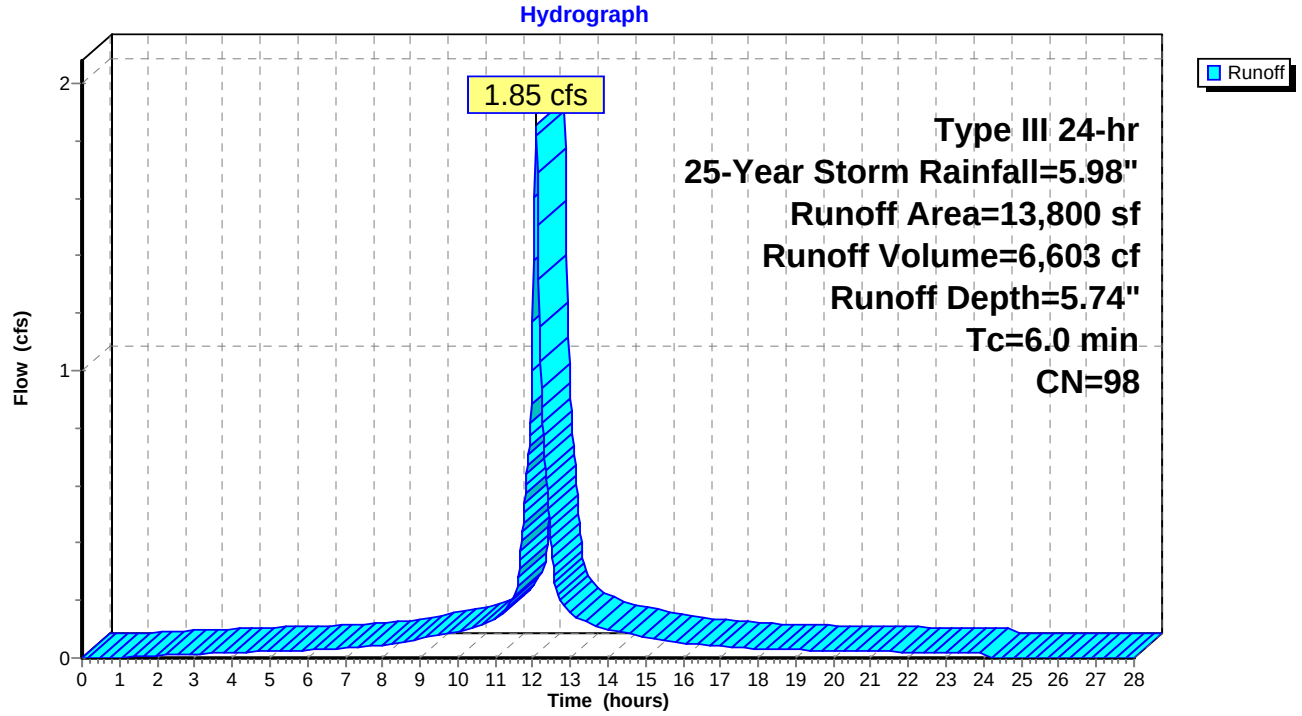
Runoff = 1.85 cfs @ 12.08 hrs, Volume= 6,603 cf, Depth= 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Storm Rainfall=5.98"

Area (sf)	CN	Description
13,800	98	Roofs, HSG B
13,800		100.00% Impervious Area

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

Subcatchment R-1: Proposed Roof Area

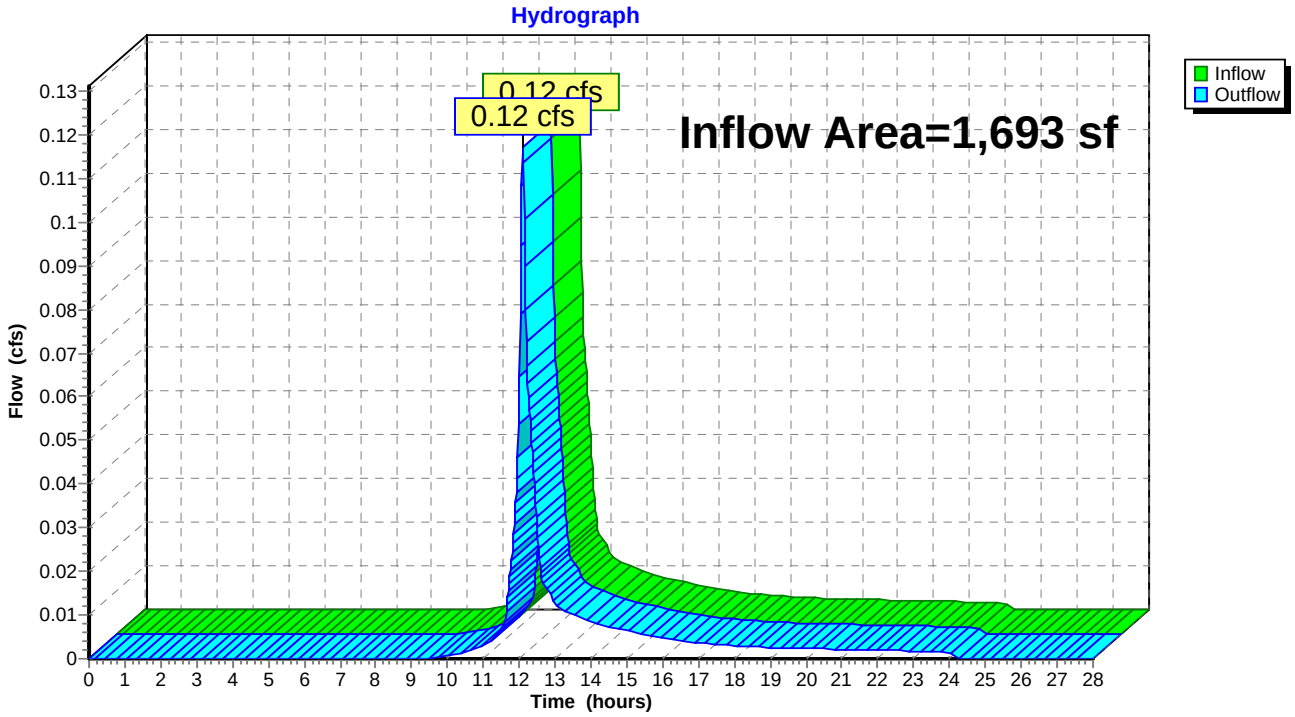


Summary for Reach DP-1: Offsite South (Madison Street)

Inflow Area = 1,693 sf, 18.02% Impervious, Inflow Depth = 2.61" for 25-Year Storm event
Inflow = 0.12 cfs @ 12.09 hrs, Volume= 368 cf
Outflow = 0.12 cfs @ 12.09 hrs, Volume= 368 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-1: Offsite South (Madison Street)

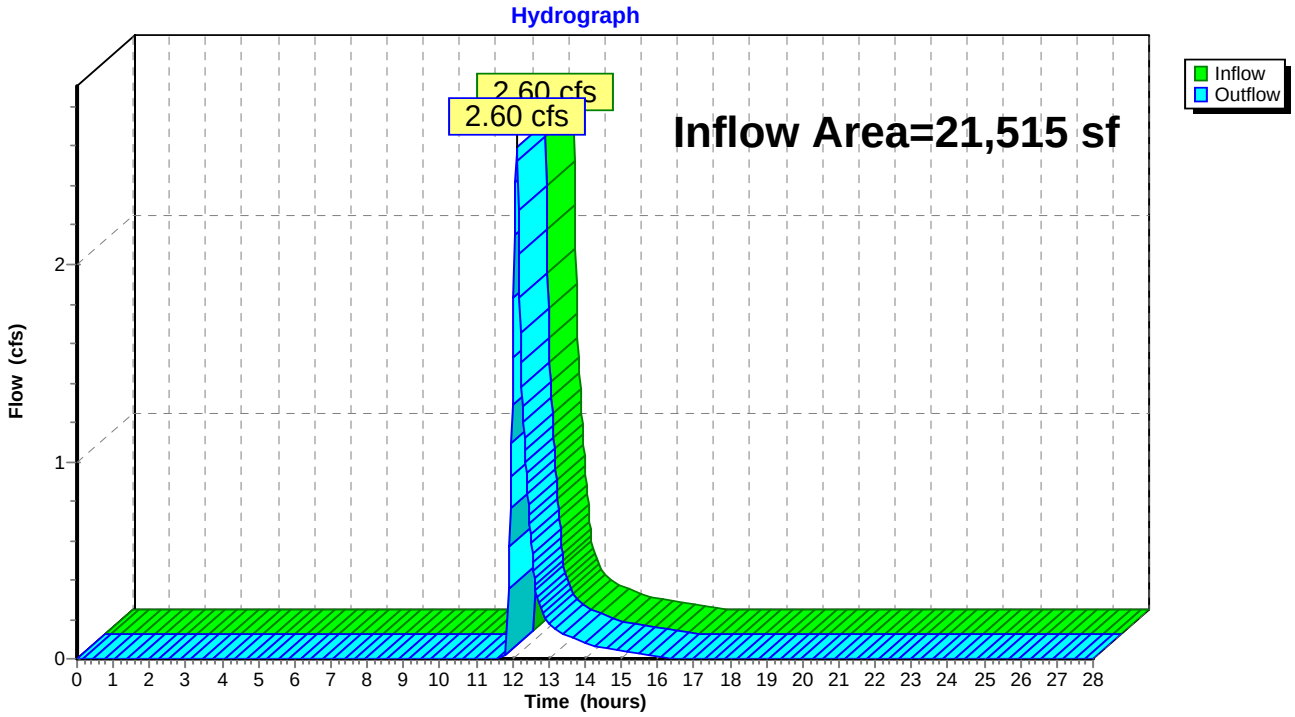


Summary for Reach DP-2: Offsite North (Spruce Street)

Inflow Area = 21,515 sf, 94.62% Impervious, Inflow Depth = 2.41" for 25-Year Storm event
Inflow = 2.60 cfs @ 12.11 hrs, Volume= 4,328 cf
Outflow = 2.60 cfs @ 12.11 hrs, Volume= 4,328 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-2: Offsite North (Spruce Street)



Summary for Pond P1: Sub-surface

Inflow Area = 21,515 sf, 94.62% Impervious, Inflow Depth = 5.49" for 25-Year Storm event
Inflow = 2.84 cfs @ 12.08 hrs, Volume= 9,850 cf
Outflow = 2.68 cfs @ 12.11 hrs, Volume= 9,850 cf, Atten= 6%, Lag= 1.7 min
Discarded = 0.08 cfs @ 8.60 hrs, Volume= 5,522 cf
Primary = 2.60 cfs @ 12.11 hrs, Volume= 4,328 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Peak Elev= 463.39' @ 12.11 hrs Surf.Area= 1,388 sf Storage= 1,852 cf

Plug-Flow detention time= 97.3 min calculated for 9,850 cf (100% of inflow)
Center-of-Mass det. time= 97.3 min (853.1 - 755.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	461.50'	1,188 cf	**30.50'W x 45.50'L x 3.54'H Field A** 4,915 cf Overall - 1,945 cf Embedded = 2,970 cf x 40.0% Voids
#2A	462.00'	1,945 cf	**Cultec R-330XLHD** x 36 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		3,133 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	461.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	460.75'	**12.0" Round 12" Overflow** L= 43.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 460.75' / 460.23' S= 0.0121 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Device 2	463.00'	**4.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.08 cfs @ 8.60 hrs HW=461.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=2.58 cfs @ 12.11 hrs HW=463.38' (Free Discharge)
└**2=12" Overflow** (Passes 2.58 cfs of 4.36 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 2.58 cfs @ 1.68 fps)

Pond P1: Sub-surface - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

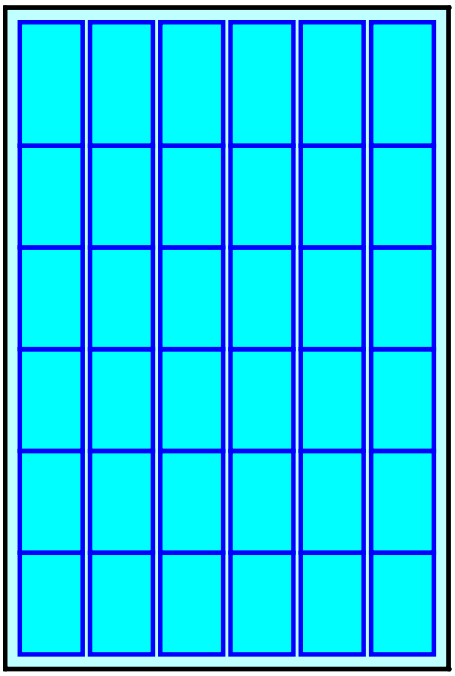
6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

36 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,944.7 cf Chamber Storage

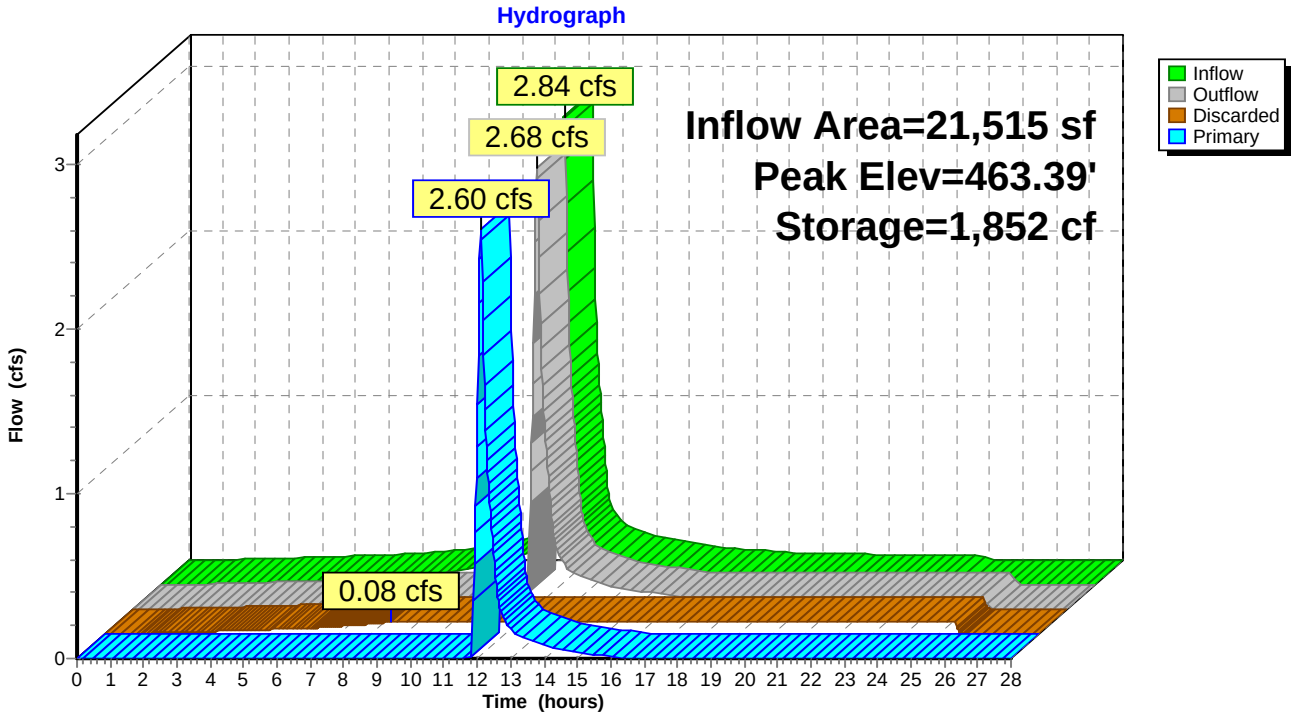
4,914.9 cf Field - 1,944.7 cf Chambers = 2,970.2 cf Stone x 40.0% Voids = 1,188.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,132.8 cf = 0.072 af
Overall Storage Efficiency = 63.7%
Overall System Size = 45.50' x 30.50' x 3.54'

36 Chambers
182.0 cy Field
110.0 cy Stone



Pond P1: Sub-surface



Summary for Pond P2: Sub-surface

Inflow Area = 8,864 sf, 85.68% Impervious, Inflow Depth = 5.16" for 25-Year Storm event
Inflow = 1.14 cfs @ 12.08 hrs, Volume= 3,814 cf
Outflow = 0.07 cfs @ 10.74 hrs, Volume= 3,814 cf, Atten= 94%, Lag= 0.0 min
Discarded = 0.07 cfs @ 10.74 hrs, Volume= 3,814 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Peak Elev= 453.53' @ 13.88 hrs Surf.Area= 1,168 sf Storage= 1,680 cf

Plug-Flow detention time= 216.6 min calculated for 3,811 cf (100% of inflow)
Center-of-Mass det. time= 216.5 min (989.6 - 773.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	451.50'	1,006 cf	**25.67'W x 45.50'L x 3.54'H Field A** 4,136 cf Overall - 1,621 cf Embedded = 2,515 cf x 40.0% Voids
#2A	452.00'	1,621 cf	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		2,627 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	451.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 10.74 hrs HW=451.54' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Pond P2: Sub-surface - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

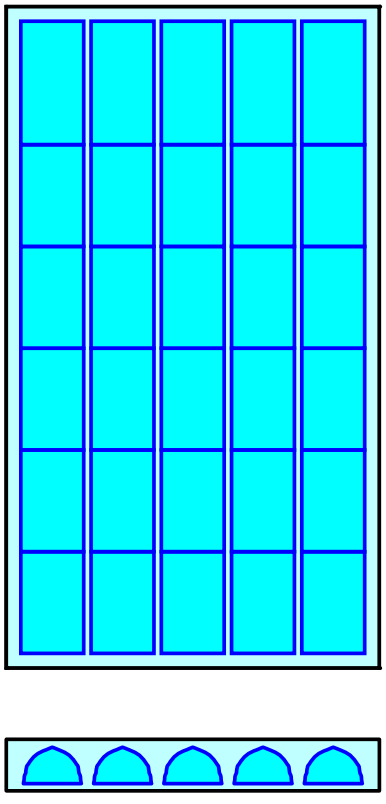
6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length
5 Rows x 52.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.67' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 5 Rows = 1,620.6 cf Chamber Storage

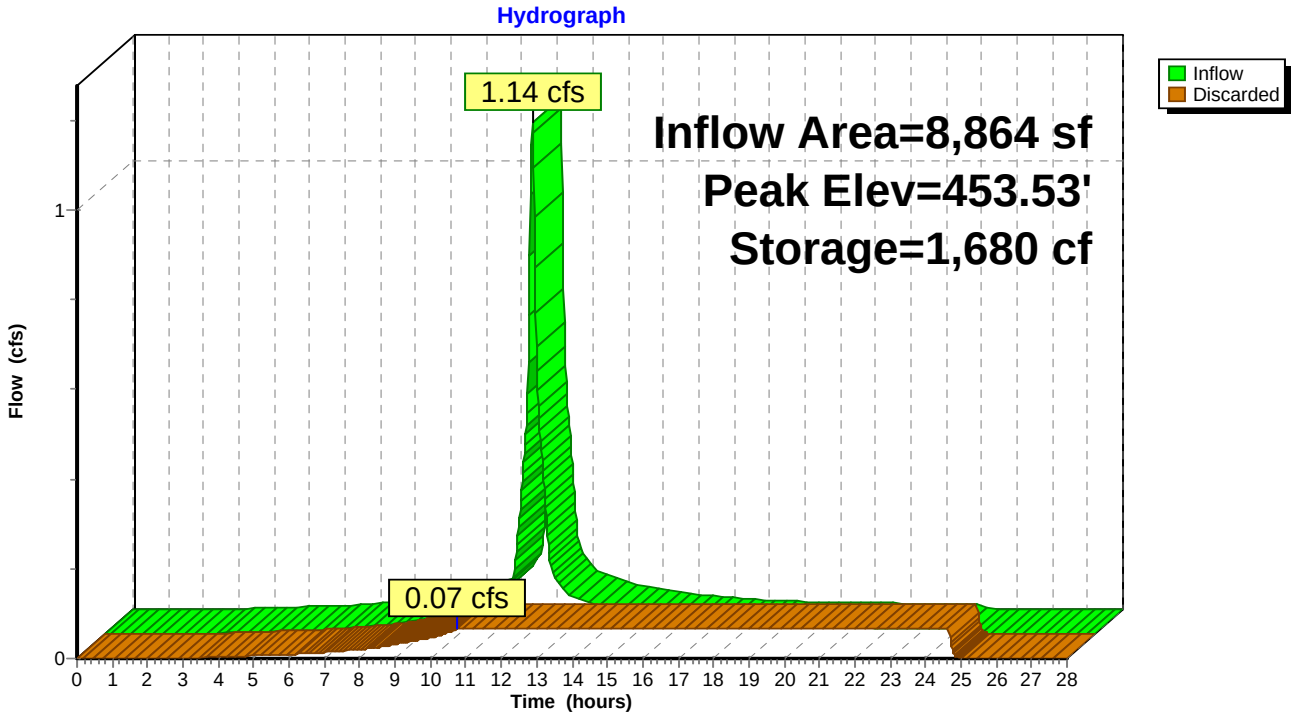
4,136.1 cf Field - 1,620.6 cf Chambers = 2,515.5 cf Stone x 40.0% Voids = 1,006.2 cf Stone Storage

Chamber Storage + Stone Storage = 2,626.8 cf = 0.060 af
Overall Storage Efficiency = 63.5%
Overall System Size = 45.50' x 25.67' x 3.54'

30 Chambers
153.2 cy Field
93.2 cy Stone



Pond P2: Sub-surface



Time span=0.00-28.00 hrs, dt=0.02 hrs, 1401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1A: Southwest Site Runoff Area=1,693 sf 18.02% Impervious Runoff Depth=3.94"
Tc=6.0 min CN=68 Runoff=0.18 cfs 556 cf

Subcatchment PWS-1B: Southeast Site Area Runoff Area=8,864 sf 85.68% Impervious Runoff Depth=6.82"
Tc=6.0 min CN=93 Runoff=1.48 cfs 5,034 cf

Subcatchment PWS-2: North Site Area Runoff Area=7,715 sf 85.00% Impervious Runoff Depth=6.70"
Tc=6.0 min CN=92 Runoff=1.28 cfs 4,306 cf

Subcatchment R-1: Proposed Roof Area Runoff Area=13,800 sf 100.00% Impervious Runoff Depth=7.41"
Tc=6.0 min CN=98 Runoff=2.38 cfs 8,522 cf

Reach DP-1: Offsite South (Madison Street) Inflow=0.18 cfs 556 cf
Outflow=0.18 cfs 556 cf

Reach DP-2: Offsite North (Spruce Street) Inflow=3.41 cfs 6,713 cf
Outflow=3.41 cfs 6,713 cf

Pond P1: Sub-surface Peak Elev=463.46' Storage=1,931 cf Inflow=3.66 cfs 12,828 cf
Discarded=0.08 cfs 6,114 cf Primary=3.41 cfs 6,713 cf Outflow=3.49 cfs 12,828 cf

Pond P2: Sub-surface Peak Elev=454.69' Storage=2,462 cf Inflow=1.48 cfs 5,034 cf
Outflow=0.07 cfs 4,791 cf

Total Runoff Area = 32,072 sf Runoff Volume = 18,418 cf Average Runoff Depth = 6.89"
11.89% Pervious = 3,814 sf 88.11% Impervious = 28,258 sf

Summary for Subcatchment PWS-1A: Southwest Site Area (Low Level Entrance)

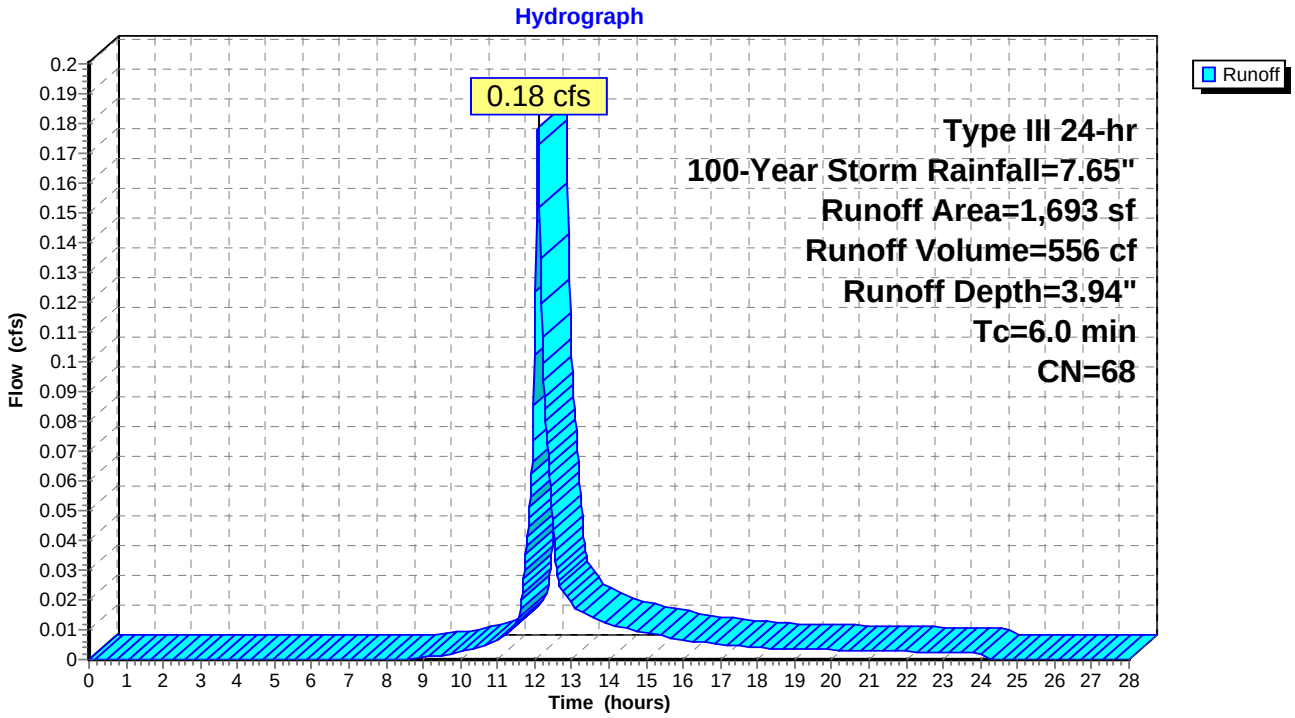
Runoff = 0.18 cfs @ 12.09 hrs, Volume= 556 cf, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Storm Rainfall=7.65"

	Area (sf)	CN	Description
*	305	98	Walkways & Patio, HSG B
	1,388	61	>75% Grass cover, Good, HSG B
	1,693	68	Weighted Average
	1,388		81.98% Pervious Area
	305		18.02% Impervious Area

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

Subcatchment PWS-1A: Southwest Site Area (Low Level Entrance)



Summary for Subcatchment PWS-1B: Southeast Site Area

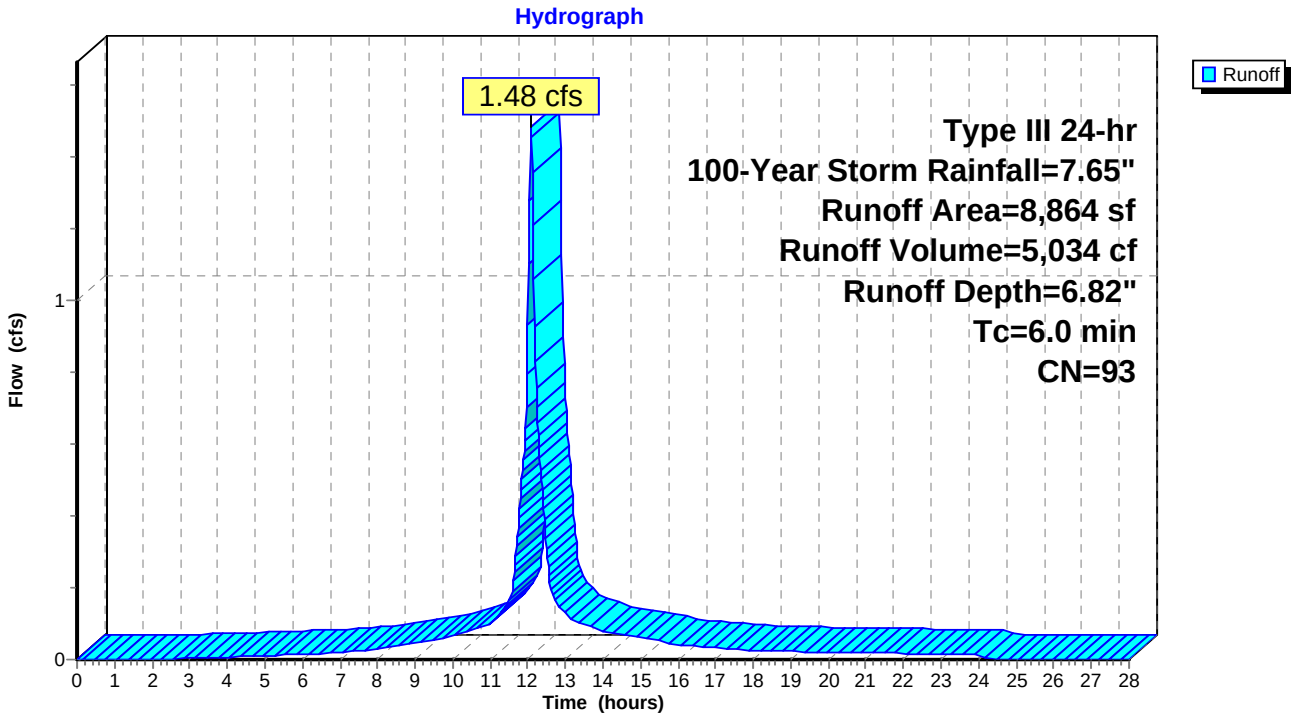
Runoff = 1.48 cfs @ 12.08 hrs, Volume= 5,034 cf, Depth= 6.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Storm Rainfall=7.65"

Area (sf)	CN	Description
7,595	98	Paved parking, HSG B
1,269	61	>75% Grass cover, Good, HSG B
8,864	93	Weighted Average
1,269		14.32% Pervious Area
7,595		85.68% Impervious Area

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

Subcatchment PWS-1B: Southeast Site Area



Summary for Subcatchment PWS-2: North Site Area

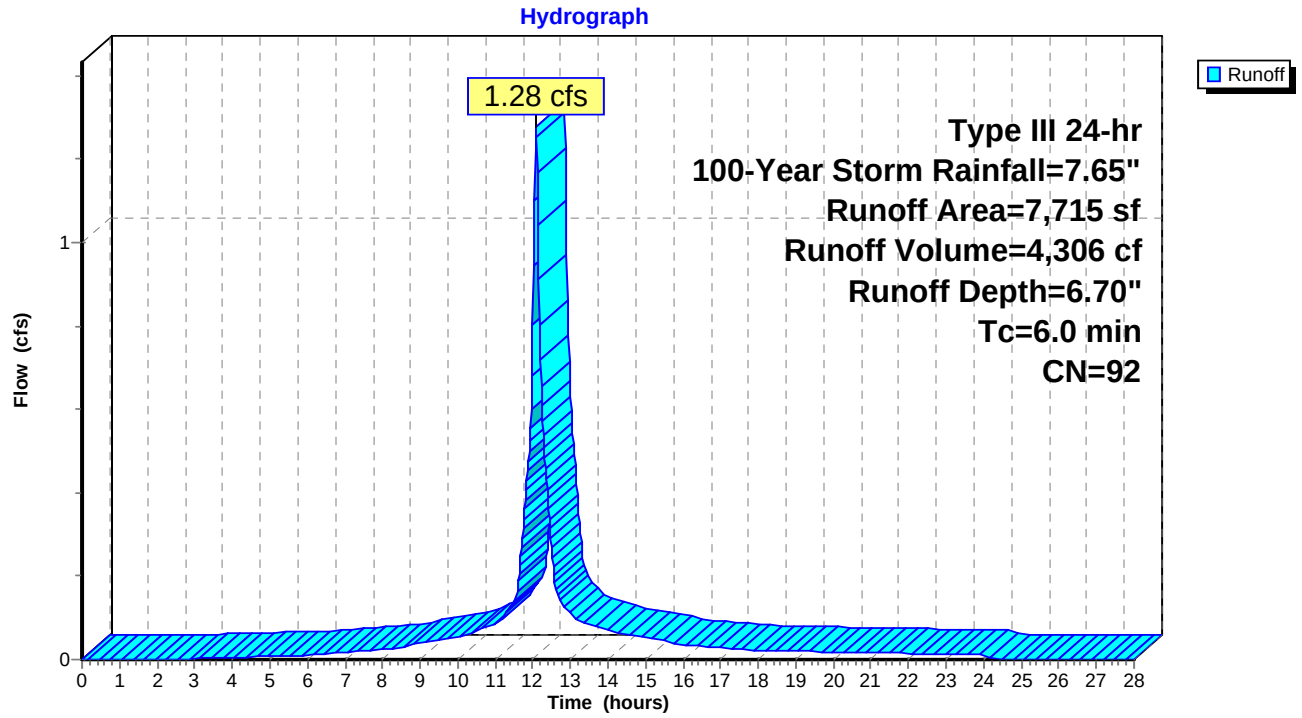
Runoff = 1.28 cfs @ 12.08 hrs, Volume= 4,306 cf, Depth= 6.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Storm Rainfall=7.65"

Area (sf)	CN	Description
6,558	98	Paved parking, HSG B
1,157	61	>75% Grass cover, Good, HSG B
7,715	92	Weighted Average
1,157		15.00% Pervious Area
6,558		85.00% Impervious Area

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

Subcatchment PWS-2: North Site Area



Summary for Subcatchment R-1: Proposed Roof Area

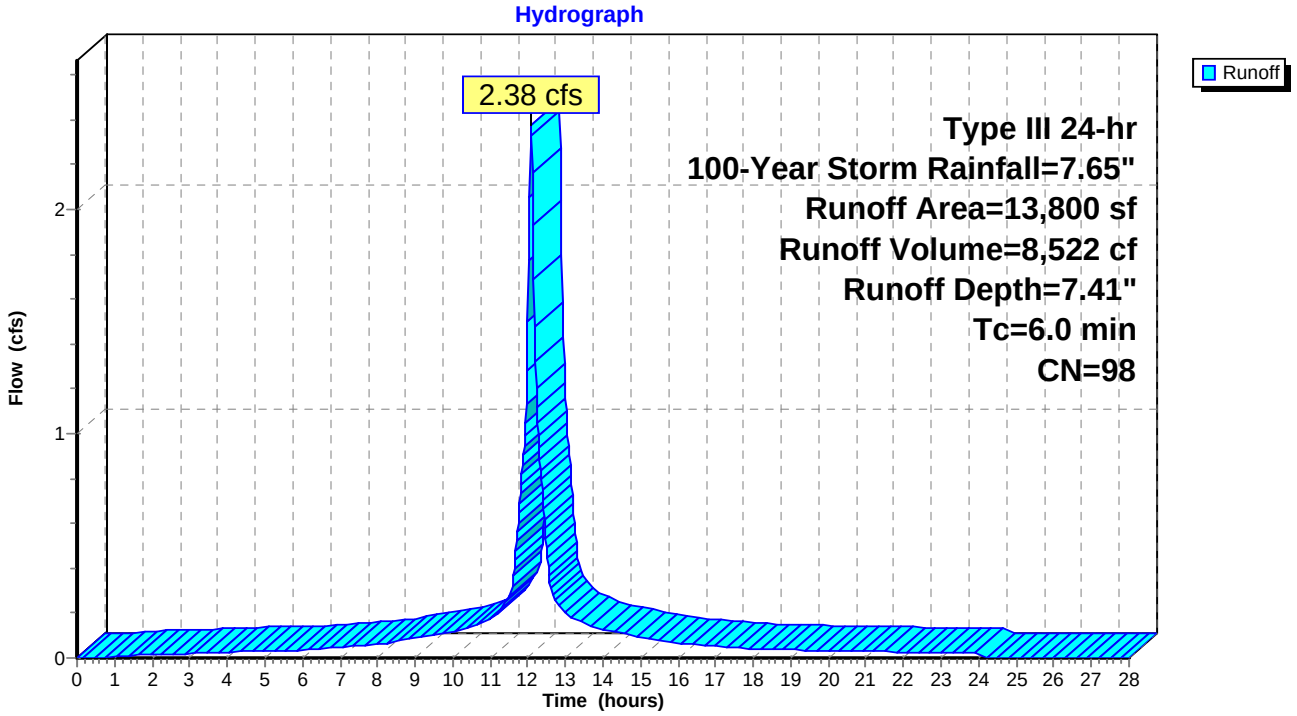
Runoff = 2.38 cfs @ 12.08 hrs, Volume= 8,522 cf, Depth= 7.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Storm Rainfall=7.65"

Area (sf)	CN	Description
13,800	98	Roofs, HSG B
13,800		100.00% Impervious Area

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

Subcatchment R-1: Proposed Roof Area

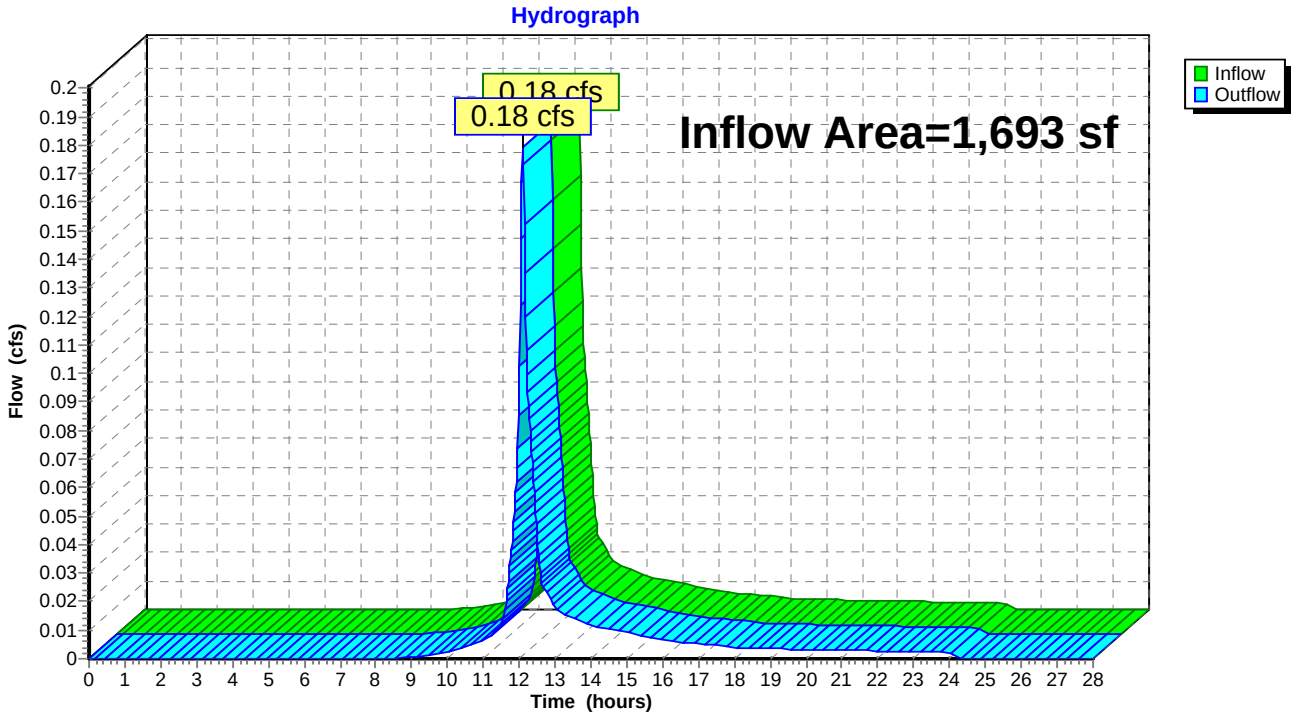


Summary for Reach DP-1: Offsite South (Madison Street)

Inflow Area = 1,693 sf, 18.02% Impervious, Inflow Depth = 3.94" for 100-Year Storm event
Inflow = 0.18 cfs @ 12.09 hrs, Volume= 556 cf
Outflow = 0.18 cfs @ 12.09 hrs, Volume= 556 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-1: Offsite South (Madison Street)

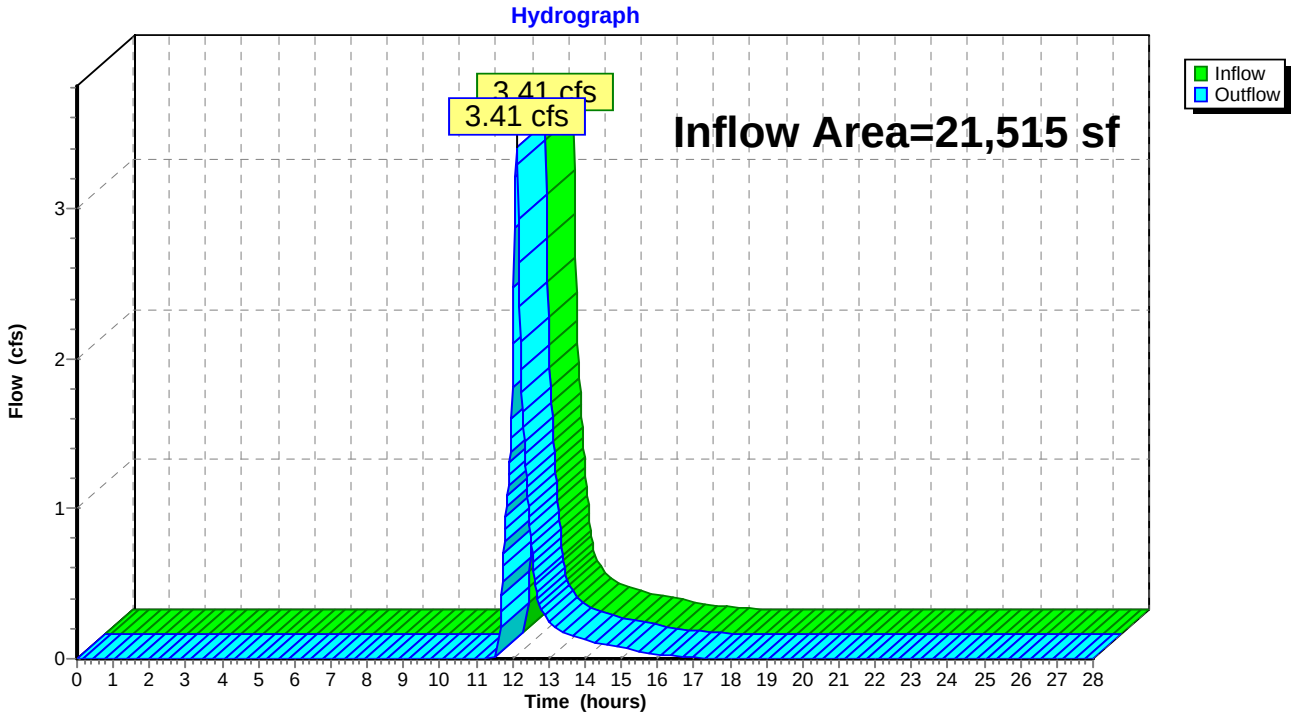


Summary for Reach DP-2: Offsite North (Spruce Street)

Inflow Area = 21,515 sf, 94.62% Impervious, Inflow Depth = 3.74" for 100-Year Storm event
Inflow = 3.41 cfs @ 12.11 hrs, Volume= 6,713 cf
Outflow = 3.41 cfs @ 12.11 hrs, Volume= 6,713 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs

Reach DP-2: Offsite North (Spruce Street)



Summary for Pond P1: Sub-surface

Inflow Area = 21,515 sf, 94.62% Impervious, Inflow Depth = 7.15" for 100-Year Storm event
Inflow = 3.66 cfs @ 12.08 hrs, Volume= 12,828 cf
Outflow = 3.49 cfs @ 12.11 hrs, Volume= 12,828 cf, Atten= 5%, Lag= 1.5 min
Discarded = 0.08 cfs @ 7.76 hrs, Volume= 6,114 cf
Primary = 3.41 cfs @ 12.11 hrs, Volume= 6,713 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Peak Elev= 463.46' @ 12.11 hrs Surf.Area= 1,388 sf Storage= 1,931 cf

Plug-Flow detention time= 88.3 min calculated for 12,819 cf (100% of inflow)
Center-of-Mass det. time= 88.3 min (839.7 - 751.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	461.50'	1,188 cf	**30.50'W x 45.50'L x 3.54'H Field A** 4,915 cf Overall - 1,945 cf Embedded = 2,970 cf x 40.0% Voids
#2A	462.00'	1,945 cf	**Cultec R-330XLHD** x 36 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		3,133 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	461.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	460.75'	**12.0" Round 12" Overflow** L= 43.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 460.75' / 460.23' S= 0.0121 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Device 2	463.00'	**4.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.08 cfs @ 7.76 hrs HW=461.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=3.39 cfs @ 12.11 hrs HW=463.46' (Free Discharge)
└**2=12" Overflow** (Passes 3.39 cfs of 4.44 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 3.39 cfs @ 1.85 fps)

Pond P1: Sub-surface - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

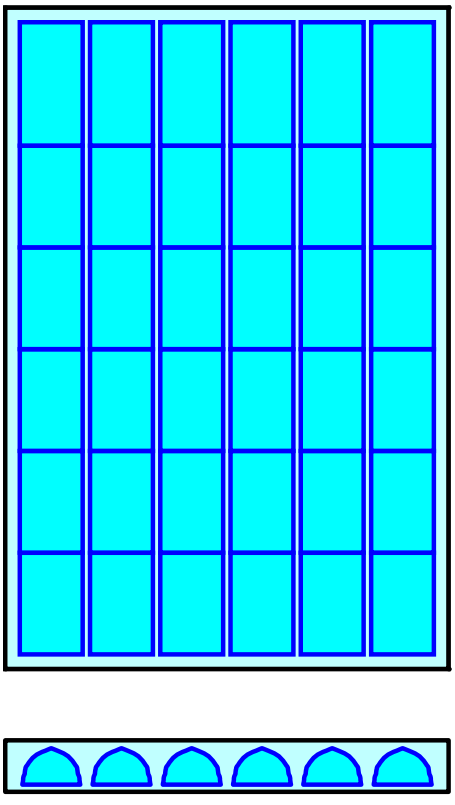
6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

36 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,944.7 cf Chamber Storage

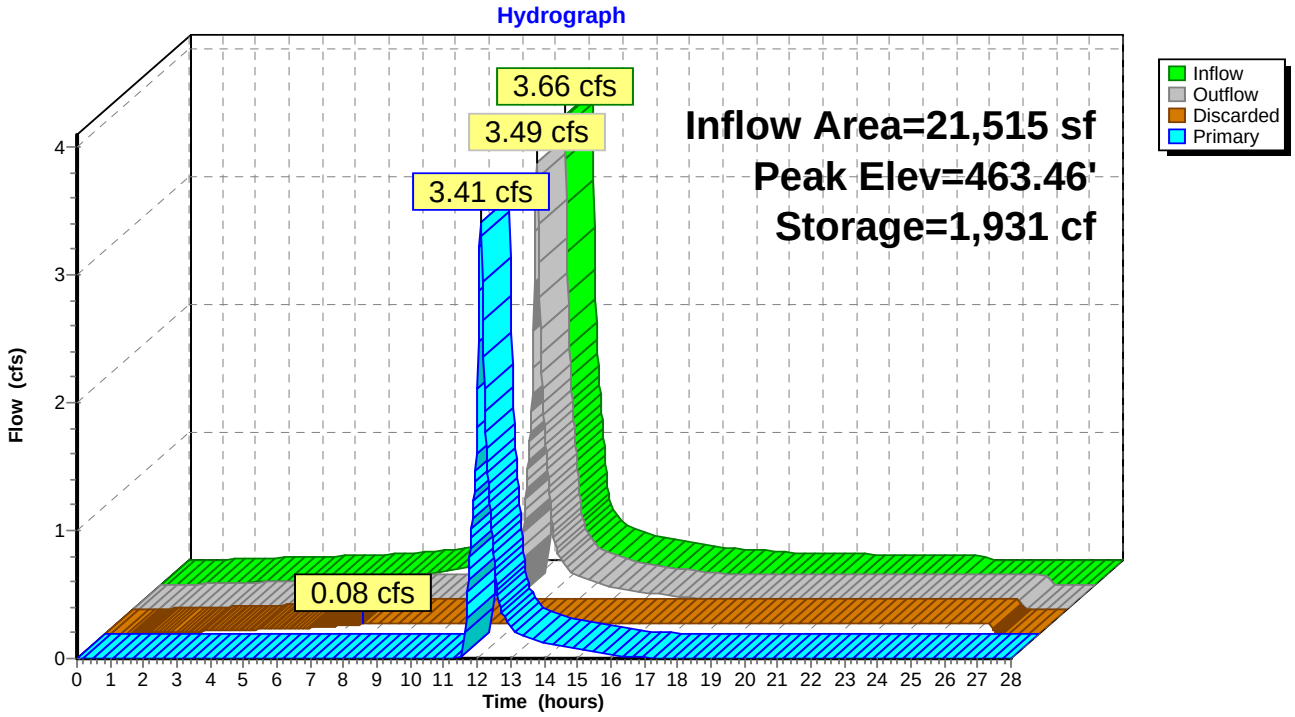
4,914.9 cf Field - 1,944.7 cf Chambers = 2,970.2 cf Stone x 40.0% Voids = 1,188.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,132.8 cf = 0.072 af
Overall Storage Efficiency = 63.7%
Overall System Size = 45.50' x 30.50' x 3.54'

36 Chambers
182.0 cy Field
110.0 cy Stone



Pond P1: Sub-surface



Summary for Pond P2: Sub-surface

Inflow Area = 8,864 sf, 85.68% Impervious, Inflow Depth = 6.82" for 100-Year Storm event
Inflow = 1.48 cfs @ 12.08 hrs, Volume= 5,034 cf
Outflow = 0.07 cfs @ 10.10 hrs, Volume= 4,791 cf, Atten= 96%, Lag= 0.0 min
Discarded = 0.07 cfs @ 10.10 hrs, Volume= 4,791 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.02 hrs
Peak Elev= 454.69' @ 14.70 hrs Surf.Area= 1,168 sf Storage= 2,462 cf

Plug-Flow detention time= 322.7 min calculated for 4,791 cf (95% of inflow)
Center-of-Mass det. time= 294.8 min (1,061.2 - 766.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	451.50'	1,006 cf	**25.67'W x 45.50'L x 3.54'H Field A** 4,136 cf Overall - 1,621 cf Embedded = 2,515 cf x 40.0% Voids
#2A	452.00'	1,621 cf	**Cultec R-330XLHD** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		2,627 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	451.50'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 10.10 hrs HW=451.54' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Pond P2: Sub-surface - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

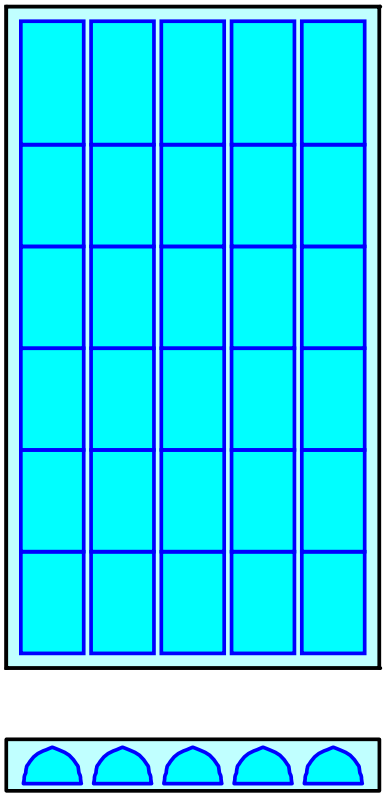
6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length
5 Rows x 52.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.67' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 5 Rows = 1,620.6 cf Chamber Storage

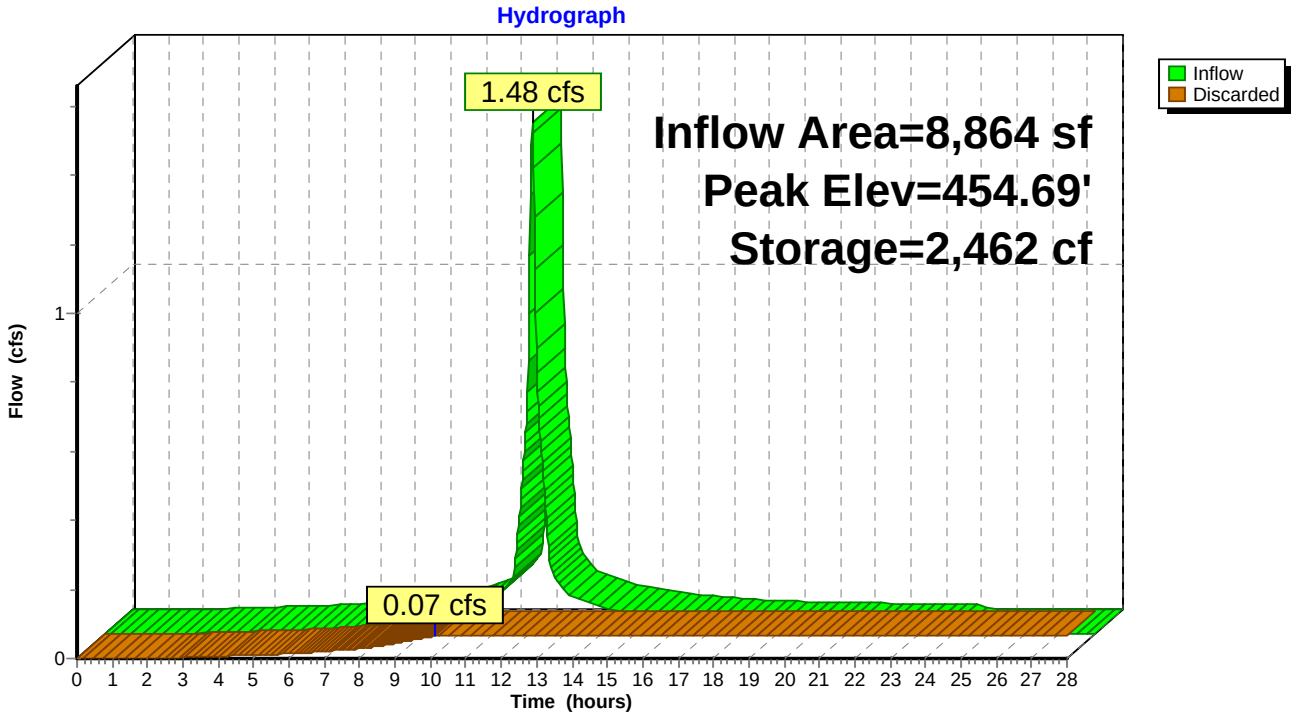
4,136.1 cf Field - 1,620.6 cf Chambers = 2,515.5 cf Stone x 40.0% Voids = 1,006.2 cf Stone Storage

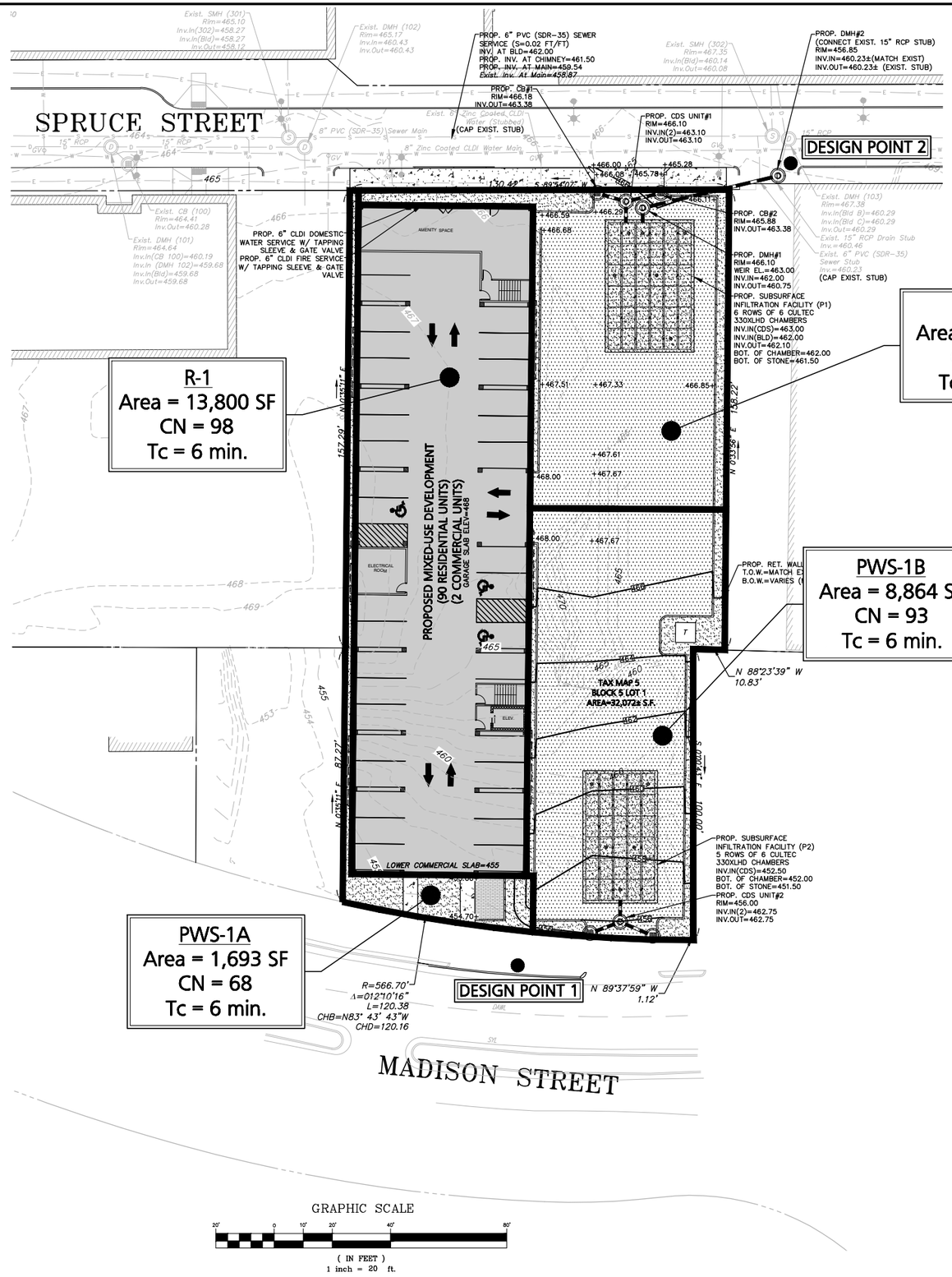
Chamber Storage + Stone Storage = 2,626.8 cf = 0.060 af
Overall Storage Efficiency = 63.5%
Overall System Size = 45.50' x 25.67' x 3.54'

30 Chambers
153.2 cy Field
93.2 cy Stone



Pond P2: Sub-surface





DESCRIPTION OF REVISION	DATE

PREPARED BY:

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Civil Engineering & Land Planning Consultants
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PROJECT:
Proposed Site Plan
Madison Street
Worcester, Massachusetts

PROJECT #: 24461422	DATE: October 15, 2024
SCALE: AS NOTED	DWG FILE NAME: xxxxx.dwg
DESIGN BY: Eric Bradiness, P.E.	CHECKED BY: Richard A. Salvo, P.E.

APPLICANT:
Rossi Development
345 Boylston Street Suite 300
Newton, MA 02459

DWG. NO.: PWS

DRAWING TITLE:
Proposed Watershed Plan

BEST MANAGEMENT PRACTICES OPERATION AND MAINTENANCE PLAN

For The

Proposed 90-Unit Multifamily Development

located at

Madison Street
Worcester, Massachusetts

Submitted to:

City of Worcester
Planning Board
455 Main Street Room 404
Worcester, MA 01608

Prepared for:

Rossi Development
345 Boylston Street
Newton, MA 02459

Prepared by

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December 6, 2024

BEST MANAGEMENT PRACTICES OPERATION AND MAINTENANCE PLAN

The purpose of this Best Management Practices Operation and Maintenance plan is to provide guidance for mandatory maintenance procedures of site preparation and pre and post construction activities for the project located at Madison Street (Tax Map 5 Block 5 Part of Lot 1) in Worcester, Massachusetts.

The Best Management Practices Operation and Maintenance Plan is summarized below and will be incorporated into the construction documents for this project. This plan is broken into two major sections. The first section is construction-related erosion and sedimentation controls. The second section is devoted to a post-development operation and maintenance plan.

Basic Information

Owner/Maintenance Responsibilities:
Rossi Development
345 Boylston Street
Newton, MA 02459
(617) 889-3389

Inspector:
Rossi Development
345 Boylston Street
Newton, MA 02459
(617) 889-3389

In the event that the property ownership changes, this Operation and Maintenance Plan shall continue to run with the land and apply to any successors or assigns. Upon the conveyance of land, the City of Worcester shall be notified in writing indicating the new ownership's contact information within 48 hours of the conveyance.

Prior to the conveyance of the property, an educational meeting shall be held between the current owner, the new owner and the parties responsible for the maintenance of the stormwater management facility. The purpose of the meeting will be to educate the new owner on the maintenance responsibilities for the stormwater management facility including, but not limited to:

- Description of system components
- Required maintenance of each component
- Frequency of maintenance of each component

This document shall be updated to indicate the time and date of the meeting as well as the contact information for the new property owner.

Time and Date of Educational Meeting: _____

New Owner Information

_____

_____

_____

_____

Acknowledgement of Storm Water Management Maintenance Responsibilities:

_____ _____
Owner Signature Date

Acknowledgement of Storm Water Management Maintenance Responsibilities:

_____ _____
Management Company Representative Signature Date

Maintenance Budget

A compounding annual budget of **$2,500 per year** shall be set aside to maintain and/or replace the stormwater management system. This budget shall cover the cost of:

- Parking Lot Sweeping
- Cleaning of Catch Basins and Water Quality Units
- Cleaning of Subsurface Infiltration Systems
- Replacement of Subsurface Infiltration Systems Stone Bed

Section 1 - Construction Activities & Erosion Controls

1. Contact the Worcester Planning Department at least three (3) days prior to start of construction.

2. The contractor shall only disturb the minimum area necessary in order to limit the impact on the surrounding area including the bordering vegetated wetlands and abutting residential developments.

3. A stabilized construction entrance shall be installed per the detail on the plan entitled “Erosion Control Plan” in the plan set entitled “Proposed 90-Unit Multifamily Development, Madison Street, Worcester, Massachusetts”. Vehicle wash down shall occur on the gravel surface that is adjacent to or part of the stabilized construction entrance.
    a. Stabilized construction entrance will be installed from the existing pavement on site to minimize sediment track-out.
    b. Entrance should be maintained in a condition that will prevent tracking or flowing of sediment off the project site. May require periodic topdressing with additional stone.
    c. Entrance and sediment disposal area shall be inspected weekly and after heavy rains or heavy use.
    d. Mud and sediment tracked or washed onto public road shall be immediately removed.
    e. Once mud and soil particles clog the voids in the gravel and the effectiveness of the gravel pad is no longer satisfactory, the pad must be topdressed with new stone. Replacement of the entire pad may be necessary when the pad becomes completely clogged.
    f. Pad shall be reshaped as needed for drainage and runoff control.
    g. Broken road pavement as a result of construction activities on roadways immediately adjacent to the Project Site shall be repaired immediately.

4. Install haybales and silt fence around the proposed work zone to prevent sediment from leaving the subject property. Haybales and silt fence are to be inspected on a weekly basis. Any damaged or compromised erosion control measures are to be replaced immediately.

5. Proper erosion and sediment control must be employed around all material stockpile areas. Regular provisions for dust control must be used, via a water truck or other acceptable method. Erosion and sediment controls around material stockpile areas are to be inspected on a weekly basis. Any damaged or compromised erosion control measures are to be replaced immediately.

6. Waste material is to be stored in a dumpster on site and covered at all times. Waste material dumpster is to be maintained to ensure no overtopping or leaks will occur.

7. Construction materials are to be stored onsite and covered at all times. Upon completion of building framing, construction materials are to be stored inside building.

8. If necessary, dewatering shall include all necessary control, management, and disposal of groundwater on a 24-hour basis as appropriate during construction. Dewatering shall include the lowering of the groundwater table to relieve any hydrostatic head that could cause a decrease in the stability of the excavated subgrade. It shall also include the intercepting seepage which could otherwise emerge from the slope or sides of excavations which could cause a decrease in the stability of the excavated subgrade of the slopes or sides of the excavations.

    Dewatering shall be performed during construction to temporarily protect against the following.
    1. The loss of any material beneath the excavated subgrade or from the slopes or sides of the excavations or the movement of any fine particle materials from the soil.
    2. Any increased vertical or lateral loads on the excavation support systems.
    3. Any disturbance, rupture, instability, build, or heaving of the bottom of the excavated subgrade during excavation and trenching, placement of foundation or bedding materials, construction

of slabs, footings, pipes, conduits, underdrains, and any other structures, and backfilling operations.

The dewatering systems and equipment shall be removed from the site when no longer required.

9. Slopes exceeding 3(H):1(V) shall be stabilized with temporary seeding. All slopes are to be checked periodically to see that vegetation is in good condition. Any damage from erosion or animal burrowing should be repaired immediately to prevent further damage. Areas requiring revegetation should be repaired immediately. Slopes should be limed and fertilized as necessary to keep vegetation healthy. Control undesirable vegetation such as weeds and woody growth to avoid bank stability problems in the future.

10. The entire project area shall be swept upon completion of construction and prior to removal of the erosion control devices.

11. All disturbed areas of the worksite must be stabilized during the winter months (October 15th – April 15th) by placement of approximately six (6) inches of hay mulch or straw.

12. Refueling of machinery is to occur offsite whenever possible. Any necessary onsite refueling shall occur within the designated refueling area.

Construction Sequencing

1. Install erosion control measures per plan.
2. Clear and grub only where necessary.
3. Install building foundations.
4. Begin vertical building construction.
5. Install utilities.
6. Verify limits of proposed stormwater management systems & closed drainage system.
7. Excavate and install individual sections of proposed closed drainage system.
8. Fine grade site.
9. Install binder course.
10. Install top course.
11. Install signing and striping.
12. Install landscaping.
13. Remove erosion control devices.

Spill Prevention and Response

<u>Prevention:</u>

The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff:

1. An effort will be made to store only the amount of material required to do the job.
2. All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
3. Products will be kept in their original containers with the original manufacturer's label.
4. Substances will not be mixed with one another unless recommended by the manufacturer.
5. Whenever possible, all of a product will be used up before disposing of the container.
6. Manufacturer's recommendations for proper use and disposal will be followed.
7. The site superintendent will inspect daily to ensure proper use and disposal of materials onsite.
8. Products will be kept in the original containers unless they are not re-sealable.
9. Original labels and material safety data will be retained; they contain important product information.
10. If surplus product must be disposed of, manufacturers or local and State recommended methods for proper disposal will be followed.
11. Petroleum Products – All onsite vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers that are clearly labeled. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations.
12. Paints – All containers will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewer system but will be properly disposed of according to the manufacturer's instructions or State and local regulations.

13. Fertilizers – Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to stormwater. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.
14. Concrete Trucks - Concrete Trucks will not be allowed to wash out or discharge surplus concrete or drum wash water on the site.

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and clean-up:

1. Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
2. Materials and equipment necessary for spill cleanup will be kept in the material storage area onsite. Equipment and materials will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.
3. All spills will be cleaned up immediately upon discovery.
4. The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
5. Spills of toxic or hazardous substances will be reported to the appropriate State or local government agency, regardless of the size.
6. The spill prevention plan will be adjusted to include measure to prevent this type of spill from reoccurring and how to clean up the spill if there should be another. A description of the spill, what caused it, and the cleanup measure will also be included.
7. The Site Superintendent responsible for the day-to-day site operation will be the spill prevention and cleanup coordinator.

Fueling and Maintenance of Equipment or Vehicles

General**:**
Vehicle and equipment fueling procedures are designed to prevent fuel spills and leaks in order to minimize the discharge of such pollutants into storm drains and waterways.

Implementation:
Offsite fueling stations should be used as much as possible. • When fueling offsite is not practicable, a designated fueling area away from drainage ways must be used. • Locate designated fueling areas a minimum of 50 feet away from concentrated flows of stormwater, drainage ways, and inlets. • An impermeable surface should be used at the designated fueling area. • Containment should be built around the designated fueling areas to prevent the release of spills, as well as runoff and runon. • Absorbent spill cleanup materials should be available at all designated fueling areas. If absorbent materials are used on spills, the material is to be removed immediately and disposed of properly. • Fueling nozzles should be equipped with an automatic shutoff to control drips. • Topping off of fuel tanks should be discouraged. • A sign is to be installed adjacent to each fueling facility to inform equipment operators of the designated fueling location. • For larger equipment, such as cranes and excavators that are not able to travel to a designated fueling area, mobile fueling may be necessary. Absorbent spill cleanup materials and spill kits should be available on all fueling trucks. Drip pans or absorbent pads should be used in mobile fueling operations. • The contractor shall train his/her employees and subcontractors in proper fueling and cleanup procedures. These procedures must be documented.

Inspection/Maintenance:
The contractor should inspect vehicles and equipment for leaks each day they are used. Leaks are to be repaired immediately or the piece of equipment should be removed from the project site. • Designated fueling areas should be inspected for leaks and spills each day they are used. Any leaks or spills are to be cleaned up immediately. • Any leaks or spills discharged through a drainage system will require the preparation of an Incidence of Non-Compliance. • Update the SWPPP anytime a designated fueling location has been removed, relocated, added, modified, or required maintenance.

Washing of Equipment and Vehicles

Wash water from vehicle and equipment cleaning is not to be discharged from construction sites because the rinse water may contain contaminates such as sediment, petroleum/lubricant residues, soaps, or solvents that could enter storm drain systems or receiving waters.

Equipment/vehicle cleaning should be conducted offsite. All vehicles that regularly enter and leave the construction site must be cleaned offsite.

For equipment that must be cleaned on site, the cleaning operations must be fully contained and disposed of offsite. The vehicle wash area must be properly identified by sign and located away from storm drain inlets, drainage facilities, and watercourses. It must be paved with concrete or asphalt and have a berm to contain runoff and prevent run-on. It must be equipped with a sump for the collection and disposal of wash water.

Section 2 – Post Development Operation & Maintenance

1. Paved Areas (Bituminous Concrete) - Paved areas shall be swept by street sweepers periodically during dry weather to remove excess sediments, reducing the amount of sediments that the drainage system will have to remove from the runoff. Salt for de-icing on the paved areas during the winter months should be limited as much as possible, as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities. **At a minimum all paved areas must be swept two times annually, in the fall and in the spring.**

2. Catch Basins – Catch basins shall be inspected monthly for the initial twelve-month period following the completion of the construction of the paved areas. Debris shall be removed from the catch basin grates, sumps and outlet pipes and disposed of in compliance with local, state and federal guidelines.

   Upon a period beginning twelve months after the completion of the site, all catch basins shall be inspected and maintained twice annually, once in April and once in November. Debris shall be removed from the catch basin grates, sumps and outlet pipes and disposed of in compliance with local, state and federal guidelines.

3. Subsurface Infiltration Facility – The sub-surface infiltration system shall be inspected immediately following heavy rain events for the initial twelve-month period following the completion of construction. Should the system or stone surrounding the system become clogged, then the system must be vacuumed and stone must be replaced with washed stone. **After the initial twelve-month period following completion of construction, the subsurface infiltration facilities shall be inspected twice per year (once in the spring and once in the fall).**

4. Water Quality Manhole: Contech CDS unit with manhole cover should be maintained bi-annually, after a large rain event, and when sediment levels exceed maintenance volumes, as required by the manufacturer. **At a minimum, water quality manholes shall be serviced every spring and fall.**

5. Snow removal and storage - Plowed snow shall be placed in pervious areas adjacent to the parking lots where it can slowly infiltrate. Sediments shall be removed from this area every spring. When the amount of snow exceeds the capacity of the snow storage areas, it shall be removed from the site at the owner's expense.

6. Maintenance Responsibilities **-** All post construction maintenance activities shall be documented and kept on file and made available to the City of Worcester annually, or upon request. All post construction maintenance activities shall run with the title of the property in perpetuity.

APPENDIX D

Stormwater Checklist
Stormwater Management Calculations

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

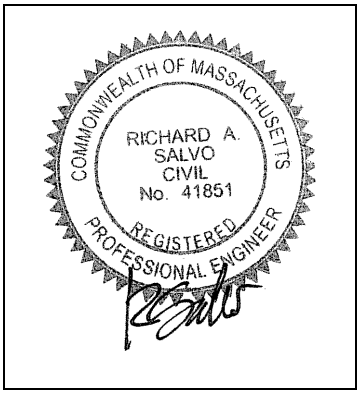
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



12-6-24

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☐ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☒ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☒ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☐ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

ILLICIT DISCHARGE COMPLIANCE STATEMENT

In accordance with the Wetland Regulations found in 310 CMR 10.05(6) and the *Massachusetts Stormwater Handbook* published by the Massachusetts Department of Environmental Protection, the stormwater management system for the proposed project located at Madison Street in Worcester, Massachusetts shall accept no illicit discharges. Illicit discharges are defined as discharges not entirely comprised of stormwater and include, but are not limited to, wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease.

Engineering Alliance, Inc. has performed an investigation of the existing site conditions and did not find any illicit discharges. Prior to construction, additional investigations will take place to identify and remove any and all illicit discharges currently onsite. These actions include, without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system.

Should any illicit discharges enter the stormwater management system after construction has been completed, immediate steps to remove the discharges and their source shall be taken to return the system to its proper working state.

Richard Salvo, P.E.
for Engineering Alliance, Inc.

12-6-24

Date

Project: Proposed 90 Unit Multifamily Development
Client: Rossi Development
Project Number: 24-61422

Prepared By: EJB
Checked By: RAS
Date: 12/06/24

Engineering Alliance, Inc.
Civil Engineering & Land Planning Consultants
194 Central Street
Saugus, MA 01906
Tel: (781) 231-1349
Fax: (781) 417-0020

1950 Lafayette Road
Portsmouth, NH 03801
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Fax: (603) 610-7101

STANDARD 3: REQUIRED RECHARGE VOLUME - Cultec 330XLHD Chambers (P1)

Rv = ***F*** x ***impervious area***

Rv = ***Required Recharge Volume***
F = ***Target Depth associated with each Hydrologic Soil Group***
Impervious Area = ***total impervious area***

Impervious Area: **7,595** sf = **0.17** acres

Hydrologic Group	Volume to Recharge
A	0.60
B	0.35
C	0.25
D	0.10

$$Rv = 0.17 \times 0.35 \times \frac{1\text{ ft}}{12\text{ in.}} \times \frac{43{,}560\text{ sf}}{1\text{ ac.}} = \mathbf{222\ CF}$$

NOTES:
1.Total storage capacity of the of subsurface infiltration facility (Cultec 330XL HD Chambers w/ crushed stone). These value were taken from the HydroCAD model.
. **2,627 CF > 222 CF**

DRAWDOWN WITHIN 72 HOURS

$$Time_{drawdown} = \frac{\text{Recharge Volume}}{K(\text{Bottom Area})}$$

K = Saturated Hydraulic Conductivity

Subsurface Infiltration Facility

$$Time_{drawdown} = \frac{2{,}627}{(2.41\text{ in/hr})(1/12\text{ ft/in})(1168\text{sf})} = 11.20 < 72\text{ HRS}$$

NOTES:
1. K value is for Loamy Sand as shown in Table 2.3.3, entitled "1982 Rawls Rates," in the MADEP Stormwater Management Standards.
2. Bottom Area is equal to the total area of the Subsurface Infiltration Facility [Stone Bed].

Project: Proposed 90 Unit Multifamily Development
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STANDARD 4: WATER QUALITY - Cultec 330XL HD Chambers (P1)

WATER QUALITY TREATMENT VOLUME

V_{WQ} = (D_{WQ} in. / 12 inches/foot) x (A_{IMP} x 43,560 square feet/acre)

V_{WQ}	=	Required Water Quality Volume (in cubic feet)
D_{WQ}	=	Water Quality Depth
A_{IMP}	=	Impervious Area (in acres)

V_{WQ} = (1.0 in. / 12 inches/foot) x 0.17 x 43,560 square feet/acre) = **617 CF**

Stormwater BMP	Volume
Cultec 330XL HD Chambers	2,627
Total	**2,627**

NOTES:

1. Storage volume for the stormwater BMPs obtained from the hydrologic model created in HydroCAD

CONCLUSION:

1. The storage volume provided by the proposed BMPs is greater than the required water quality treatment volume. 2,627 CF > 617 CF

Project: Proposed 90 Unit Multifamily Development
Client: Rossi Development
Project Number: 24-61422

Prepared By: EJB
Checked By: RAS
Date: 12/06/24

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STANDARD 3: REQUIRED RECHARGE VOLUME - Cultec 330XLHD Chambers (P2)

Rv = ***F*** x ***impervious area***

Rv = ***Required Recharge Volume***
F = ***Target Depth associated with each Hydrologic Soil Group***
Impervious Area = ***total impervious area***

Impervious Area: **20,358** sf = **0.47** acres

Hydrologic Group	Volume to Recharge
A	0.60
B	0.35
C	0.25
D	0.10

$$Rv = 0.47 \times 0.35 \times \frac{1\text{ ft}}{12\text{ in.}} \times \frac{43{,}560\text{ sf}}{1\text{ ac.}} = \mathbf{594\ CF}$$

NOTES:
1.Total storage capacity of the of subsurface infiltration facility (Cultec 330XL HD Chambers w/ crushed stone). These value were taken from the HydroCAD model.
. **3,133 CF > 594 CF**

DRAWDOWN WITHIN 72 HOURS

$$Time_{drawdown} = \frac{\text{Recharge Volume}}{K(\text{Bottom Area})}$$

K = Saturated Hydraulic Conductivity

Subsurface Infiltration Facility

$$Time_{drawdown} = \frac{3{,}133}{(2.41\text{ in/hr})(1/12\text{ ft/in})(1{,}388\text{sf})} = 11.24 < 72\text{ HRS}$$

NOTES:
1. K value is for Loamy Sand as shown in Table 2.3.3, entitled "1982 Rawls Rates," in the MADEP Stormwater Management Standards.
2. Bottom Area is equal to the total area of the Subsurface Infiltration Facility [Stone Bed].

Project: Proposed 90 Unit Multifamily Development
Client: Rossi Development
Project Number: 24-61422

Prepared By: EJB
Checked By: RAS
Date: 12/06/24

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STANDARD 4: WATER QUALITY - Cultec 330XL HD Chambers (P1)

WATER QUALITY TREATMENT VOLUME

$V_{WQ} = (D_{WQ}\ in. / 12\ inches/foot) \times (A_{IMP} \times 43{,}560\ square\ feet/acre)$

V_{WQ}	=	Required Water Quality Volume (in cubic feet)
D_{WQ}	=	Water Quality Depth
A_{IMP}	=	Impervious Area (in acres)

V_{WQ} = (1.0 in. / 12 inches/foot) x 0.47 x 43,560 square feet/acre) = **1,706 CF**

Stormwater BMP	Volume
Cultec 330XL HD Chambers	3,133
Total	**3,133**

NOTES:

1. Storage volume for the stormwater BMPs obtained from the hydrologic model created in HydroCAD

CONCLUSION:

1. The storage volume provided by the proposed BMPs is greater than the required water quality treatment volume. 3,133 CF > 1,706 CF

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TSS Removal Calculations

Name:	Proposed 90 Unit Multifamily Development	**Proj. No.:**	24-61422
	Worcester, MA	**Date:**	12/6/2024
Client:	Rossi Development	**Computed by:**	EJB
County:	Worcester	**Checked by:**	RAS
Systems:	CBs to CDS-1 to P1		

A	B	C	D	E
BMP	**TSS Removal Rate**	**Starting TSS Load***	**Amount Removed (BxC)**	**Remaining Load (C-D)**
Deep Sump Hooded Catch Basin	25	1.00	0.25	0.75
Subsurface System with Water Quality Unit**	99.14	0.75	0.74	0.01

**Removal Rate Taken from CDS Sizing Calculation

Total TSS Removal= **99%**

Notes:

*Starting TSS Load for first BMP= 1.00. TSS load for subsequent BMP's is equal to the Remaining Load (E) from the previous BMP.

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TSS Removal Calculations

Name:	Proposed 90 Unit Multifamily Development	**Proj. No.:**	24-61422
	Worcester, MA	**Date:**	12/6/2024
Client:	Rossi Development	**Computed by:**	EJB
County:	Worcester	**Checked by:**	RAS
Systems:	CBs to CDS-2 to P2		

A	B	C	D	E
BMP	**TSS Removal Rate**	**Starting TSS Load***	**Amount Removed (BxC)**	**Remaining Load (C-D)**
Deep Sump Hooded Catch Basin	25	1.00	0.25	0.75
Subsurface System with Water Quality Unit**	97.88	0.75	0.73	0.02

**Removal Rate Taken from CDS Sizing Calculation

Total TSS Removal= **98%**

Notes:

*Starting TSS Load for first BMP= 1.00. TSS load for subsequent BMP's is equal to the Remaining Load (E) from the previous BMP.

APPENDIX E

CONTECH CDS Unit TSS Removal Calculations
CDS Standard Details

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

Madison Street

CDS-1

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%	0.0076	0.0076	1.09%	100.00%	15.15%
0.0800	24.57%	39.72%	24.57%	0.0151	0.0151	2.16%	100.00%	24.57%
0.1200	13.70%	53.42%	13.70%	0.0227	0.0227	3.24%	100.00%	13.70%
0.1600	9.41%	62.83%	9.41%	0.0302	0.0302	4.31%	100.00%	9.41%
0.2000	6.63%	69.46%	6.63%	0.0378	0.0378	5.40%	100.00%	6.63%
0.2400	5.24%	74.70%	5.24%	0.0454	0.0454	6.49%	100.00%	5.24%
0.2800	4.78%	79.48%	4.78%	0.0529	0.0529	7.56%	99.90%	4.78%
0.3200	3.14%	82.62%	3.14%	0.0605	0.0605	8.64%	99.68%	3.13%
0.3600	2.71%	85.33%	2.71%	0.0680	0.0680	9.71%	99.47%	2.70%
0.4000	2.10%	87.43%	2.10%	0.0756	0.0756	10.80%	99.25%	2.08%
0.4800	2.47%	89.90%	2.47%	0.0907	0.0907	12.96%	98.82%	2.44%
0.5600	2.02%	91.92%	2.02%	0.1058	0.1058	15.11%	98.39%	1.99%
0.6400	1.42%	93.34%	1.42%	0.1210	0.1210	17.29%	97.95%	1.39%
0.7200	1.00%	94.34%	1.00%	0.1361	0.1361	19.44%	97.52%	0.98%
0.8000	1.07%	95.41%	1.07%	0.1512	0.1512	21.60%	97.09%	1.04%
1.0000	1.65%	97.06%	1.65%	0.1890	0.1890	27.00%	96.01%	1.58%
1.2000	0.93%	97.99%	0.93%	0.2268	0.2268	32.40%	94.93%	0.88%
1.4000	0.60%	98.59%	0.60%	0.2646	0.2646	37.80%	93.85%	0.56%
1.6000	0.49%	99.08%	0.49%	0.3024	0.3024	43.20%	92.77%	0.45%
1.8000	0.48%	99.56%	0.48%	0.3402	0.3402	48.60%	91.69%	0.44%
								99.14%
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	99.56%
							Predicted Net Annual Load Removal Efficiency =	99.14%
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.								

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

Madison Street

CDS-2

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%	0.0176	0.0176	2.51%	100.00%	15.15%
0.0800	24.57%	39.72%	24.57%	0.0353	0.0353	5.04%	100.00%	24.57%
0.1200	13.70%	53.42%	13.70%	0.0529	0.0529	7.56%	99.90%	13.69%
0.1600	9.41%	62.83%	9.41%	0.0706	0.0706	10.09%	99.39%	9.35%
0.2000	6.63%	69.46%	6.63%	0.0882	0.0882	12.60%	98.89%	6.56%
0.2400	5.24%	74.70%	5.24%	0.1058	0.1058	15.11%	98.39%	5.16%
0.2800	4.78%	79.48%	4.78%	0.1235	0.1235	17.64%	97.88%	4.68%
0.3200	3.14%	82.62%	3.14%	0.1411	0.1411	20.16%	97.38%	3.06%
0.3600	2.71%	85.33%	2.71%	0.1588	0.1588	22.69%	96.87%	2.63%
0.4000	2.10%	87.43%	2.10%	0.1764	0.1764	25.20%	96.37%	2.02%
0.4800	2.47%	89.90%	2.47%	0.2117	0.2117	30.24%	95.36%	2.36%
0.5600	2.02%	91.92%	2.02%	0.2470	0.2470	35.29%	94.35%	1.91%
0.6400	1.42%	93.34%	1.42%	0.2822	0.2822	40.31%	93.34%	1.33%
0.7200	1.00%	94.34%	1.00%	0.3175	0.3175	45.36%	92.33%	0.92%
0.8000	1.07%	95.41%	1.07%	0.3528	0.3528	50.40%	91.32%	0.98%
1.0000	1.65%	97.06%	1.65%	0.4410	0.4410	63.00%	88.80%	1.47%
1.2000	0.93%	97.99%	0.93%	0.5292	0.5292	75.60%	86.28%	0.80%
1.4000	0.60%	98.59%	0.60%	0.6174	0.6174	88.20%	83.76%	0.50%
1.6000	0.49%	99.08%	0.49%	0.7056	0.7000	100.00%	80.75%	0.40%
1.8000	0.48%	99.56%	0.42%	0.7938	0.7000	100.00%	71.78%	0.34%
								97.88%
							Removal Efficiency Adjustment[2] =	
							Predicted % Annual Rainfall Treated =	99.50%
							Predicted Net Annual Load Removal Efficiency =	97.88%

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.

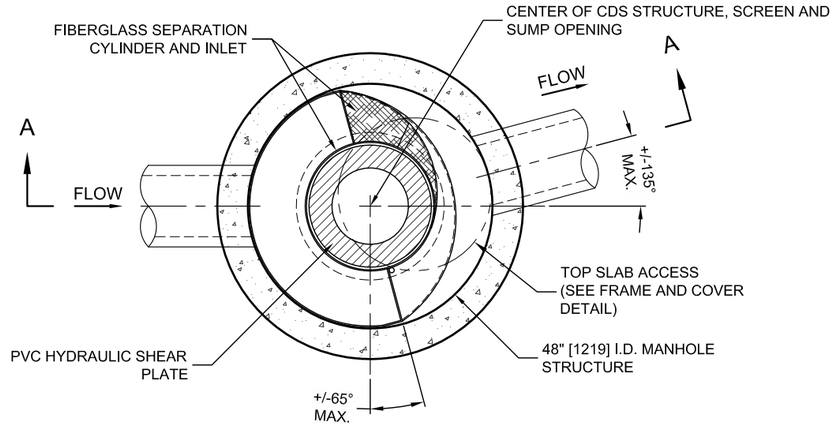
4.3 The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent 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.

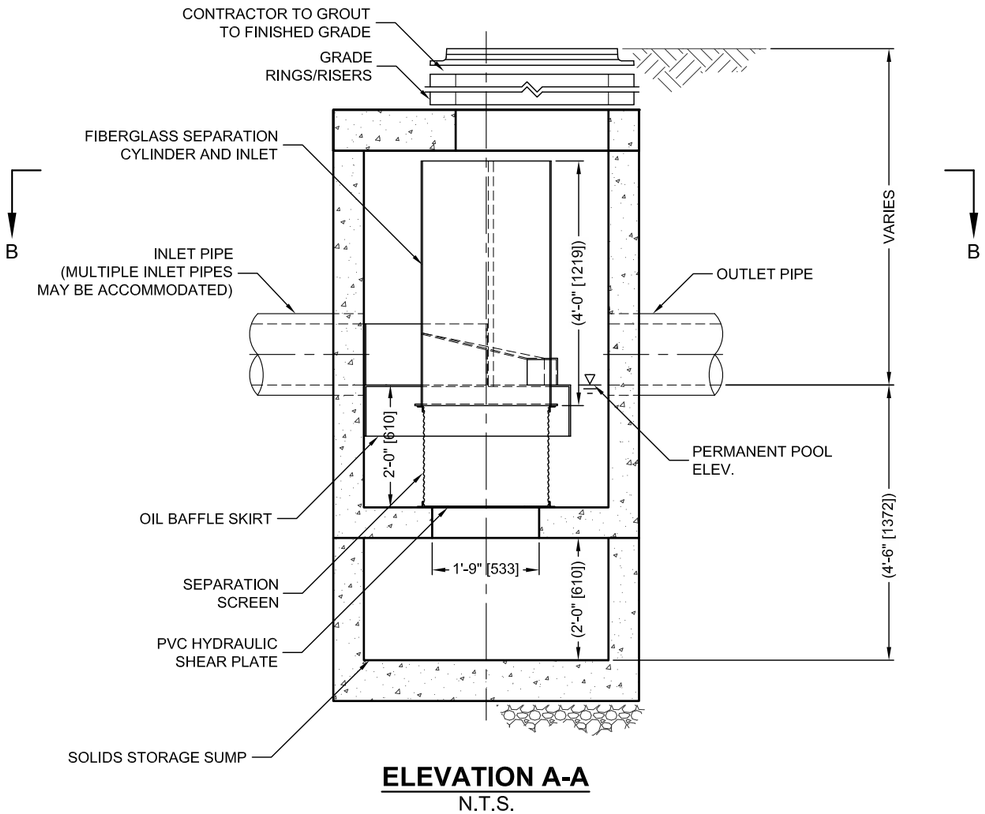
TABLE 1
Storm Water Treatment Device
Storage Capacities

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.



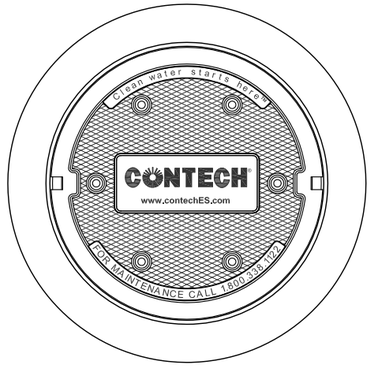
ELEVATION A-A
N.T.S.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,581,782; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

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



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

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.

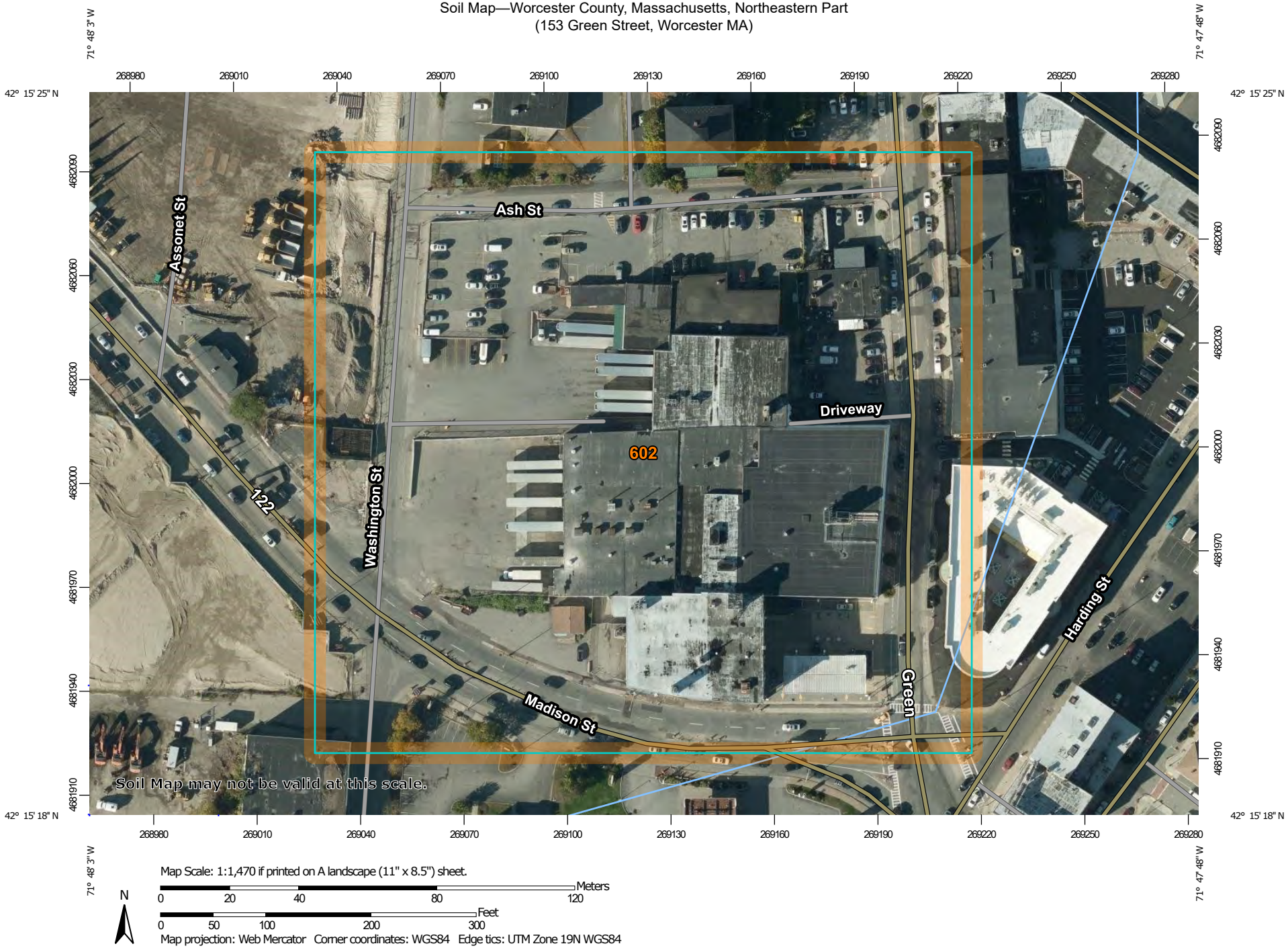
CONTECH® ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2015-4-C INLINE CDS STANDARD DETAIL

APPENDIX F

Soils Information and Boring Logs

Soil Map—Worcester County, Massachusetts, Northeastern Part
(153 Green Street, Worcester MA)



Map Scale: 1:1,470 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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 15, Jun 10, 2020

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

Date(s) aerial images were photographed: Jul 26, 2019—Oct 5, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	8.2	100.0%
Totals for Area of Interest		**8.2**	**100.0%**

APPENDIX B – TEST BORING LOGS

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- GZ-3 — MONITORING WELLS INSTALLED BY DRILEX ENVIRONMENTAL ON 1/7/2021 AND 1/8/2021 OBSERVED BY GZA
- B-2 — HISTORIC MONITORING WELLS INSTALLED BY OTHERS
- GZ-6 — APPROXIMATE SOIL BORING LOCATIONS INSTALLED BY DRILEX ENVIRONMENTAL ON 1/7/2021, 1/8/2021, AND APRIL 28 TO 30, 2021 OBSERVED BY GZA
- APPROXIMATE LOCATIONS OF HISTORIC BUILDINGS DIGITIZED FROM HISTORIC SANDBORN MAP OF 1950
- APPROXIMATE LOCATION OF PROPOSED BUILDING 1 FOOTPRINT AND PARKING GARAGE COMPILED FROM AN ELECTRONIC PLAN: "W211004-ca0-Concept Plan - 2021.04.06.pdf" DESIGNED BY BOHLER ENGINEERING

SOURCE

1) THIS MAP CONTAINS THE ESRI ArcGIS ONLINE WORLD IMAGERY (CLARITY) MAP SERVICE, CREATED JUNE 11, 2020 BY ESRI ATLAS AND UPDATED OFTEN. THIS SERVICE USES UNIFORM NATIONALLY RECOGNIZED DATUM AND CARTOGRAPHY STANDARDS AND A VARIETY OF AVAILABLE SOURCES FROM SEVERAL DATA PROVIDERS.

2) BORING AND MONITORING WELL LOCATIONS WERE BASED ON TAPE MEASURMENTS FROM EXISTING SITE FEATURES.

3) LOCATIONS SHOWN SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

0 25 50 100
SCALE IN FEET

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airb

N W E S

TABLE TALK LOFTS - BUILDING 1 & PARKING GARAGE

WORCESTER, MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: BOSTON CAPITAL DEVELOPMENT, LLC. BOSTON, MASSACHUSETTS	
PROJ MGR: HA	REVIEWED BY: CT	CHECKED BY: CT	FIGURE 2
DESIGNED BY: HA	DRAWN BY: AJP	SCALE: 1 " = 50 FEET	
DATE: 07/14/2021	PROJECT NO. 01.0174853.50	REVISION NO.	

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-1
SHEET: 1 of 1
PROJECT NO: 01.0174853.20
REVIEWED BY: HLA

Drilling Co.: Drilex Environmental, Inc.
Foreman: Jamie Hastings
Logged By: Matthew McGavick

Type of Rig: Track Mounted
Rig Model: CME-55
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 481
Final Boring Depth (ft.): 27
Date Start - Finish: 1/8/2021 - 1/8/2021

H. Datum: NAD 83
V. Datum: WGS 84

Auger/Casing Type: HSA
I.D./O.D.: 4.25"/8.125"
Hmr Weight (lb.): N/A
Hmr Fall (in.): N/A
Other: N/A

Sampler Type: Split Spoon
I.D./O.D (in.): 1.375"/2"
Sampler Hmr Wt: 140
Sampler Hmr Fall: 30
Other: Auto Hammer

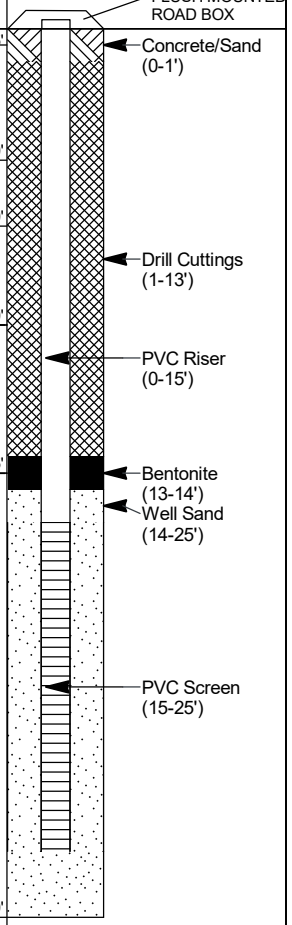
Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/8/21		25	HSA	0

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data
		S-1	0-2	24	12	14 13 12	25	S-1A: ASPHALT. S-1B: Gray to brown, fine to medium SAND,some Gravel, little Silt.	1 2	0.5
		S-2	2-4	24	12	3 4 5 4	9	S-2A: (1-7") Gray to brown, fine to medium SAND,some Gravel, little Silt.	3	0.1
5		S-3	4-6	24	11	5 5 4 5	9	S-2B: (7-11") Gray, fine to coarse SAND, little Silty Gravel.		0.1
		S-4	6-8	24	24	14 19 25 34	44	S-3: Tan, fine SAND and SILT, little Gravel. S-4: Tan, SILT, little fine Sand, little Gravel.		0.1
10		S-5	10-12	24	7	40 44 33 38	77	S-5: Tan, GRAVEL, little fine to medium Sand.		0.1
15		S-6	15-17	24	19	22 31 40 38	71	S-6: Tan, Clayey SILT, little fine Sand, little Gravel.		
20		S-7	20-22	24	24	26 36 38 55	74	S-7: Tan, SILT & CLAY, little Gravel, trace fine to coarse Sand.		ND
25		S-8	25-27	24	21	31 44 46 38	90	S-8A: (0-8") Gray-tan, CLAY & SILT, little fine to medium Sand, little Gravel. S-8B: (8-21") Gray-tan, Silty CLAY, little fine to medium Sand, trace Gravel.		ND
30								Bottom of boring at 27 feet.		
35										

Depth (ft)	Stratum Description	Elev. (ft)
0.5'	ASPHALT	480.5'
4'	FILL	477.0'
6'	SILTY SAND	475.0'
9'	SILT	472.0'
13.5'	GRAVEL	467.5'
27'	GLACIAL TILL	454.0'

Equipment Installed



REMARKS

1. Ground surface estimated from Google Earth.
2. Soil sample collected from 2 to 6 feet below ground surface (bgs) interval.
3. Field testing results represent total organic vapor levels, referenced to a benzene standard, measured in the headspace of sealed soil sample jars using an organic vapor meter (OVM) equipped with a photoionization detector (PID) and 10.6 eV lamp. Results in parts per million by volume (ppmv). ND indicates nothing detected (<0.1 ppmv).

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-1

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-2
SHEET: 1 of 2
PROJECT NO: 01.0174853.20
REVIEWED BY: HLA

Drilling Co.: Drilex Environmental, Inc.
Foreman: Jamie Hastings
Logged By: Matthew McGavick

Type of Rig: Track Mounted
Rig Model: CME-55
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 475
Final Boring Depth (ft.): 37
Date Start - Finish: 1/8/2021 - 1/8/2021

H. Datum: NAD 83
V. Datum: WGS 84

Auger/Casing Type: HSA
I.D./O.D.: 4.25"/8.125"
Hmr Weight (lb.): N/A
Hmr Fall (in.): N/A
Other: N/A

Sampler Type: Split Spoon
I.D./O.D (in.): 1.375"/2"
Sampler Hmr Wt: 140
Sampler Hmr Fall: 30
Other: Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured.			

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Description	Elev. (ft)	Equipment Installed
0		S-1	0-2	24	7	6 5 5 8	10	S-1: Brown, fine to medium SAND, little Silt, little Gravel.	1 2	ND			No Equipment Installed
		S-2	2-4	24	10	2 3 2 4	5	S-2A: (0-4") Brown, fine to medium SAND, little Silt, little Gravel.	3	ND	FILL		
5		S-3	4-6	24	0	5 4 8 11	12	S-2B: (4-10") Black-gray, fine to medium SAND and SILT, little Gravel. S-3: No recovery.		0.1		6' 469.0'	
		S-4	6-8	24	12	16 23 20 16	43	S-4A: (0-5") Brown-tan, fine to coarse SAND, little Gravel, trace Silt.		ND	SAND	7' 468.0'	
		S-5	8-10	24	14	12 12 11 12	23	S-4B: (5-12") Tan, fine to medium SAND, some Gravel, little Silt.		0.1	SILT	8.5' 466.5'	
10								S-5A: (0-5") Brown, SILT, some fine to medium Sand, little Gravel. S-5B: (5-14") Tan, fine to medium SAND, little Gravel, trace Silt.			SAND	12.5' 462.5'	
15		S-6	15-17	24	15	25 25 22 27	47	S-6A: (0-5") Tan, SILT, some Gravel, little fine Sand. S-6B: (5-15") Tan, fine to medium SAND, some Silt, little Gravel.		0.1	SILT	15.5' 459.5'	
											SAND	18.5' 456.5'	
20		S-7	20-22	24	24	18 32 30 38	62	S-7: Tan, CLAY & SILT, little fine Sand, little Gravel.		0.1			
25		S-8	25-27	24	8			S-8: Gray, SILT & CLAY, little fine Sand, little Gravel.		0.1	GLACIAL TILL		
30		S-9	30-32	24	5	60/5"	R	S-9: Gray, SILT & CLAY, little fine Sand, little Gravel.		ND			
35													

REMARKS

1. Ground surface estimated from Google Earth.
2. Soil sample collected from 6 to 8 feet below ground surface (bgs) interval.
3. Field testing results represent total organic vapor levels, referenced to a benzene standard, measured in the headspace of sealed soil sample jars using an organic vapor meter (OVM) equipped with a photoionization detector (PID) and 10.6 eV lamp. Results in parts per million by volume (ppmv). ND indicates nothing detected (<0.1 ppmv).

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-2

TEST BORING LOG

GZA
GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-2
SHEET: 2 of 2
PROJECT NO: 01.0174853.20
REVIEWED BY: HLA

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Depth (ft)	Stratum Description	Stratum Elev. (ft)	Equipment Installed
		S-10	35-37	24	18	30 37 50	87	S-10: Tan, Silty CLAY, little Gravel.			37'	GLACIAL TILL	438.0'	
								Bottom of boring at 37 feet.	4					
40														
45														
50														
55														
60														
65														
70														
75														

REMARKS

4. Borehole was backfilled with soil cuttings and pavement repaired with cold patch asphalt flush with ground surface.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-2

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-3
SHEET: 1 of 1
PROJECT NO: 01.0174853.20
REVIEWED BY: HLA

Drilling Co.: Drilex Environmental, Inc.
Foreman: Brandon Williams
Logged By: Chris Tsinidis

Type of Rig: Truck Mounted
Rig Model: B-57 Mobile
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 470
Final Boring Depth (ft.): 32
Date Start - Finish: 1/7/2021 - 1/7/2021

H. Datum: NAD 83
V. Datum: WGS 84

Auger/Casing Type: HSA
I.D./O.D.: 4.25"/8.125"
Hmr Weight (lb.): N/A
Hmr Fall (in.): N/A
Other: N/A

Sampler Type: Split Spoon
I.D./O.D (in.): 1.375"/2"
Sampler Hmr Wt: 140
Sampler Hmr Fall: 30
Other: Safety Hammer

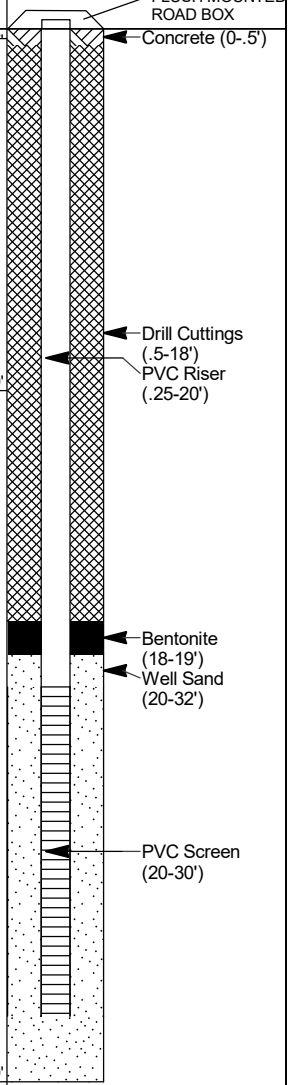
Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered.			

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data
		S-1	0.5-2.5	24	9	12 8 7 6	15	S-1: Medium dense, brown, fine to coarse SAND, some Gravel, little Silt.	1	ND
		S-2	2.5-4.5	24	10	12 13 23 23	36	S-2: Dense, brown, fine to coarse SAND and GRAVEL, trace Silt.		ND
5		S-3	4-6	24	15	14 28 23 32	51	S-3: Very dense, brown, fine to coarse SAND and GRAVEL, trace Silt.	2	ND
		S-4	6-8	24	13	20 21 22 25	43	S-4: Dense, light brown, fine to coarse SAND, some Gravel, trace Silt.		ND
		S-5	8-10	24	12	23 40 30 36	70	S-5: (Top 6") Light brown, fine to coarse SAND and GRAVEL, trace Silt.	3	ND
10		S-6	10-12	24	10	13 20 61 73	81	S-5: (Bottom 6") Gray, Clayey SILT, some fine Sand.		ND
		S-7	12-14	24	8	50 53 50 60	R	S-6: Very dense, grayish brown, fine to coarse SAND and GRAVEL, little Silt.		
15		S-8	15-16.4	17	10	49 63 60/5"	R	S-7: Very dense, grayish brown, fine to coarse SAND, little Gravel, little Silt. S-8: Very dense, grayish brown, fine to coarse SAND, little Gravel, little Silt.		
20		S-9	20-20.7	5	0	60/5"	R	S-9: No recovery.		
									4	
25		S-10	25-26.4	21	10	26 60 75 50/3"	R	S-10: Very dense, brown, fine to coarse SAND and GRAVEL, little Silt.		
30		S-11	30-32	24	1	21 42 48 51	90	S-11: Very dense, fine to medium SAND, some Silt, trace Gravel.		
								Bottom of boring at 32 feet.	5	
35										

Depth (ft)	Stratum Description	Elev. (ft)
0.3'	ASPHALT	469.7'
	FILL	
11'		459.0'
	GLACIAL TILL	
32'		438.0'

Equipment Installed



REMARKS

1. Ground surface estimated from Google Earth.
2. Analytical sample obtained from sample S-3. Field testing results represent total organic vapor levels, referenced to a benzene standard, measured in the headspace of sealed soil sample jars using an organic vapor meter (OVM) equipped with a photoionization detector (PID) and 10.6 eV lamp. Results in parts per million by volume (ppmv). ND indicates nothing detected (<0.1 ppmv).
3. Augers grinding between 8 and 10 feet below ground surface (bgs). Cobbles observed in soil cuttings. Applying down pressure from 10 feet bgs and beyond.
4. Augers grinding from 23 to 25 feet bgs.
5. Upon completion, borehole was converted to a monitoring well with screen set at 30 feet bgs.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-3

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-4
SHEET: 1 of 1
PROJECT NO: 01.0174853.20
REVIEWED BY: HLA

Drilling Co.: Drilex Environmental, Inc.
Foreman: Brandon Williams
Logged By: Chris Tsinidis

Type of Rig: Truck Mounted
Rig Model: B-57 Mobile
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 455
Final Boring Depth (ft.): 22
Date Start - Finish: 1/7/2021 - 1/7/2021

H. Datum: NAD 83
V. Datum: WGS 84

Auger/Casing Type: HSA
I.D./O.D.: 4.25"/8.125"
Hmr Weight (lb.): N/A
Hmr Fall (in.): N/A
Other: N/A

Sampler Type: Split Spoon
I.D./O.D (in.): 1.375"/2"
Sampler Hmr Wt: 140
Sampler Hmr Fall: 30
Other: Safety Hammer

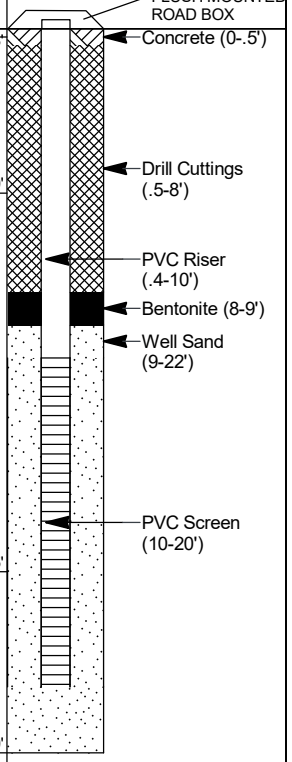
Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/7/21	1630	12.5		6.5 hrs.

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data
		S-1	1-3	24	8	30 22 19 16	41	S-1: Dense, brown, fine to coarse SAND and GRAVEL, little Silt.	1 2 3	0.2
		S-2	3-5	24	0	15 13 15 13	28	S-2: No recovery.		ND
5		S-3	5-7	24	12	3 5 6 6	11	S-3: Medium dense, light brown, fine to medium SAND, trace Silt.		ND
		S-4	7-9	24	14	6 7 5 6	12	S-4: Medium dense, light brown, fine to medium SAND, trace Silt.		ND
10		S-5	9-11	24	8	6 7 8 9	15	S-5: Medium dense, light brown, fine to medium SAND, trace Silt, trace Gravel.		ND
15		S-6	15-17	24	20	4 7 7 8	14	S-6: (Top 14') Brown, fine to medium SAND, trace Silt. S-6: (Bottom 6") Brown, fine Silty SAND, little Clay.	4	ND
20		S-7	20-22	24	17	7 10 14 18	24	S-7: Very stiff, brown, Silty CLAY. Tv=0.1		0.5
								Bottom of boring at 22 feet.	5	
25										
30										
35										

Depth (ft)	Stratum Description	Elev. (ft)
0.25'	ASPHALT	454.8'
	FILL	
5'		450.0'
	SAND	
16.5'		438.5'
	GLACIAL TILL	
22'		433.0'

Equipment Installed



REMARKS

1. Ground surface estimated from Google Earth.
2. Directly beneath the asphalt layer, augers were grinding and driller advanced auger to approximately 1 foot below ground surface (bgs) to begin sampling beyond the possible gravel base course layer.
3. Analytical sample obtained from sample S-1. Field testing results represent total organic vapor levels, referenced to a benzene standard, measured in the headspace of sealed soil sample jars using an organic vapor meter (OVM) equipped with a photoionization detector (PID) and 10.6 eV lamp. Results in parts per million by volume (ppmv). ND indicates nothing detected (<0.1 ppmv).
4. Soil plug appeared wet at 14 feet bgs upon removal.
5. Upon completion, borehole was converted to a monitoring well with screen set at 20 feet bgs.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-4

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-6
SHEET: 1 of 2
PROJECT NO: 01.0174853.20
REVIEWED BY: HLA

Drilling Co.: Drilex Environmental, Inc.
Foreman: Brandon Williams
Logged By: Shiv Bhardwaj

Type of Rig: Truck Mounted
Rig Model: B-57 Mobile
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 458
Final Boring Depth (ft.): 44
Date Start - Finish: 1/7/2021 - 1/8/2021

H. Datum: NAD 83
V. Datum: WGS 84

Auger/Casing Type: HSA
I.D./O.D.: 4.25"/8.125"
Hmr Weight (lb.): N/A
Hmr Fall (in.): N/A
Other: N/A

Sampler Type: Split Spoon
I.D./O.D (in.): 1.375"/2"
Sampler Hmr Wt: 140
Sampler Hmr Fall: 30
Other: Safety Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
1/7/21	1528	22.7	24	5 min.
1/8/21	0723	20.8	24	16 hrs.

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Depth (ft)	Stratum Description	Stratum Elev. (ft)	Equipment Installed
		S-1	1-3	24	14	9 13 25 16	38	S-1: Dense, dark brown, fine to coarse SAND, some Gravel, trace Silt, trace Asphalt.	1	0.1	0.3'	ASPHALT	457.7'	No Equipment Installed
		S-2	3-5	24	16	12 14 22 32	36	S-2: Dense, brown, fine to coarse SAND, some Gravel, trace Silt.		0.1				
5		S-3	5-7	24	9	10 35 13 8	48	S-3: Dense, brown, fine to coarse SAND, some Gravel, trace Silt.		0.1		FILL		
		S-4	7-9	24	10	7 5 5 6	10	S-4: Loose, brown, fine to coarse SAND, little Gravel, trace Silt.		0.1				
10		S-5	9-11	24	13	6 4 4 5	8	S-5: Loose, brown, fine to coarse SAND, trace Silt, trace Brick, trace Asphalt, trace Coal.	2 3	0.1	11'		447.0'	
		S-6	11-13	24	13	5 3 2 6	5	S-6: Loose, light brown, fine to coarse SAND, some Gravel, trace Silt.		0.1				
		S-7	13-15	24	3	4 3 2 6	5	S-7: Loose, light brown, fine to coarse SAND, some Gravel, trace Silt.		0.1		POSSIBLE FILL		
15														
		S-8	16-18	24	12	7 4 5 13	9	S-8: (Top 5") Brown, fine to coarse SAND, some Gravel, trace Silt.	4	0.1	16.5'		441.5'	
		S-9	18-20	24	12	14 13 11 12	24	S-8: (Bottom 7") Brown, fine to coarse SAND, little Silt.		0.1				
20								S-9: Medium dense, brown, fine to coarse SAND, little Gravel, trace Silt.				SAND		
		S-10	24-26	24	21	4 6 5 9	11	S-10: Medium dense, brown, fine to medium SAND, trace Silt. Top 3" contained Silt seam with little fine Sand.	5	0.1				
25														
									6		29'		429.0'	
30		S-11	30-32	24	11	4 5 5 6	10	S-11: Stiff, gray, CLAY & SILT, trace fine to medium Sand.	7	0.1		GLACIAL TILL		
35														

REMARKS

1. Ground surface estimated from Google Earth.
2. Analytical sample obtained from sample S-5. Field testing results represent total organic vapor levels, referenced to a benzene standard, measured in the headspace of sealed soil sample jars using an organic vapor meter (OVM) equipped with a photoionization detector (PID) and 10.6 eV lamp. Results in parts per million by volume (ppmv). ND indicates nothing detected (<0.1 ppmv).
3. The HSA was grinding on cobbles between 10 and 11 feet below ground surface (bgs).
4. Driller overdrilled (advanced HSA too far) to 16 feet bgs after taking sample S-7.
5. Finished drilling on 1/7/21 after taking sample S-10. HSA was left in the borehole. The remainder of the boring was drilled using a CME-55 track-mounted drill rig on 1/8/21.
6. Wash color was gray at approximately 29 feet bgs.
7. Started drilling on 1/8/21 by advancing 3-inch casing (NW) to approximately 30 feet bgs through HSA. Switched to drive and wash method after pulling out HSA. Rest of drilling was open hole.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-6

TEST BORING LOG

GZA
GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-6
SHEET: 2 of 2
PROJECT NO: 01.0174853.20
REVIEWED BY: HLA

Depth (ft)	Casing Blows/ Core Rate Min/ft	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Depth (ft)	Stratum Description	Stratum Elev. (ft)	Equipment Installed
		S-12	35-37	24	14	6 5 13 13	18	S-12: (Top 9") Gray, CLAY & SILT, trace fine to medium Sand. S-12: (Bottom 5") Brown, fine to coarse SAND, some Clay & Silt.	8	0.1		GLACIAL TILL		
											38'		420.0'	
40		S-13	40-42	24	5	16 18 16 14	34	S-13: Dense, brown, GRAVEL and fine to coarse SAND, little Silt.	9	0.1		POSSIBLE WEATHERED BEDROCK		
											42.5'		415.5'	
											44'	WEATHERED BEDROCK	414.0'	
45								Bottom of boring at 44 feet.	10 11 12					
50														
55														
60														
65														
70														
75														

REMARKS

8. Drill rig required slightly increased drill effort at approximately 38 feet bgs using roller cone bit.
9. Driller noted an increase in drill effort at approximately 42.5 feet bgs using roller cone bit.
10. Driller drilled to 44 feet bgs using roller cone bit to conclude possible bedrock surface.
11. Upon completion, borehole caved in to approximately 41 feet bgs.
12. Borehole was backfilled with soil cuttings from approximately 41 to 0.5 feet bgs and pavement repaired with cold patch asphalt flush with ground surface.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-6

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-7
SHEET: 1 of 2
PROJECT NO: 01.0174853.50
REVIEWED BY:

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** Truck Mounted	**Boring Location:** See Plan	**H. Datum:** NAD 83
Foreman: Joe	**Rig Model:** CME 75	**Ground Surface Elev. (ft.):** 458	
Logged By: Leonard Kilmartin	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 32	**V. Datum:** WSG84
		Date Start - Finish: 4/28/2021 - 4/28/2021	

Auger/Casing Type:	HSA
I.D/O.D.(in):	4.25"/7.625"
Hammer Weight (lb.):	
Hammer Fall (in.):	
Other:	

Sampler Type:	Split Spoon
I.D./O.D. (in.):	1.375"/2"
Sampler Hmr Wt (lb):	140
Sampler Hmr Fall (in):	30
Other:	Auto Hammer

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
4/28/21	1300	18		0

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
									1		0.1	ASPHALT	457.9'
											1	CONCRETE	457.0'
		S-1	1-3	24	13	2 2 3 3	5	S-1: (Top 1") CONCRETE. S-1: (Middle 6") Loose, brown, fine to coarse SAND. S-1: (Bottom 6:) Loose, brown, medium to coarse SAND, little Gravel.	2				
		S-2	3-5	24	10	2 2 2 2	4	S-2: Very loose, fine to coarse SAND, little Gravel.					
5		S-3	5-7	24	13	2 2 3 2	5	S-3: Loose, brown, fine to coarse SAND, little Gravel, little Silt, trace Brick, trace Asphalt.				FILL	
		S-4	7-9	24	14	3 4 4 5	8	S-4: Loose, brown, fine to coarse SAND, some Gravel, trace Silt, trace Brick, trace Concrete.					
10		S-5	9-11	24	13	4 2 2 7	4	S-5: Very loose, brown, fine to coarse SAND, little Gravel.					
											11		447.0'
		S-6	11-13	24	15	7 7 5 7	12	S-6: Medium dense, brown, fine to coarse SAND, some Gravel.					
15		S-7	15-17	24	12	8 13 13 10	26	S-7: Medium dense, brown, fine to coarse SAND and GRAVEL.				SAND AND GRAVEL	
20		S-8	20-22	24	20	2 3 5 7	8	S-8: Loose, wet, brown, medium to coarse SAND, trace Gravel.					
											23.5		434.5'
25		S-9	25-27	24	16	3 4 7 8	11	S-9: Medium dense, wet, brown, fine SAND.				FINE SAND	
30													

REMARKS

1. Elevation estimated using Google Earth.
2. Driller cored through approximately 1.5 inches of asphalt and 10 inches of concrete.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-7

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-7
SHEET: 2 of 2
PROJECT NO: 01.0174853.50
REVIEWED BY:

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	Stratum Description	Elev. (ft.)
		S-10	30-32	24	24	2 6 8 9	14	S-10: Medium dense, wet, brown, fine SAND.				FINE SAND	
											32		426.0'
								Bottom of boring at 32 feet.	3				

35
40
45
50
55
60
65

REMARKS

3. Upon completion, borehole backfilled with cuttings and pavement repaired using cold patch asphalt.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-7

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-8
SHEET: 1 of 1
PROJECT NO: 01.0174853.50
REVIEWED BY:

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** Truck Mounted	**Boring Location:** See Plan	**H. Datum:** NAD 83
Foreman: Joe	**Rig Model:** CME 75	**Ground Surface Elev. (ft.):** 457	
Logged By: Leonard Kilmartin	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 14	**V. Datum:** WSG84
		Date Start - Finish: 4/28/2021 - 4/28/2021	

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 4.25"/7.625"	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.):	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.):	**Sampler Hmr Fall (in):** 30	
Other:	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	measured			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	24	15	11 9 9 9	18	S-1: Medium dense, brown, fine to coarse SAND, some Gravel, trace Silt.	1		0.1	ASPHALT	456.9'
		S-2	2-4	18	18	10 11 14 R	25	S-2: (Top 12") Medium dense, brown, fine to coarse SAND and GRAVEL, trace Silt.				FILL	
5		S-3	4-5.5	9	9	15 35 R		S-2: (Bottom 6") Medium dense, light brown, medium to coarse SAND.					
								S-3: Medium dense, brown, fine to coarse SAND and GRAVEL, some Asphalt. Metal plate at top of void.			5.7		451.3'
									2		5.8	METAL PLATE	451.2'
10												VOID	
									3		14		443.0'
15								Bottom of boring at 14 feet.	4 5		14.01	CONCRETE	442.9'
20													
25													
30													

REMARKS

1. Elevation estimated using Google Earth.
2. Obstruction at 5 feet, 9 inches below ground surface (bgs). Auger having difficulty, grinding. Driller went through a thin metal plate and into void below.
3. Lost auger plug; used weighted tape to measure depth of hole. Tape measured 14 feet bgs.
4. Test boring terminated due to large void.
5. Upon completion, metal at top of void repaired using a steel plate and borehole backfilled with cuttings and pavement repaired using cold patch asphalt.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-8

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-9
SHEET: 1 of 1
PROJECT NO: 01.0174853.50
REVIEWED BY:

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** Truck Mounted	**Boring Location:** See Plan	**H. Datum:** NAD 83
Foreman: Joe	**Rig Model:** CME 75	**Ground Surface Elev. (ft.):** 461	
Logged By: Leonard Kilmartin	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 22	**V. Datum:** WSG84
		Date Start - Finish: 4/28/2021 - 4/28/2021	

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 4.25"/7.625"	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.):	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.):	**Sampler Hmr Fall (in):** 30	
Other:	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
See Note 4				

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0-2	18	13	9 9 20 R	29	S-1: (Top 1.25") ASPHALT. S-1: (Bottom 11.75") Medium dense, brown, coarse to fine SAND and GRAVEL, trace Silt.	1		0.1	ASPHALT	460.9'
		S-2	2-4	24	14	8 8 8 4	16	S-2: Medium dense, brown/gray, coarse to fine SAND and GRAVEL, trace Silt.	2			FILL	
5		S-3	5-7	24	12	4 4 4 8	8	S-3: Loose, light brown, coarse to medium SAND, little Gravel, trace Silt.	3		5		456.0'
		S-4	7-9	24	17	6 9 7 7	16	S-4: Medium dense, light brown, coarse to fine SAND, some (+) Gravel, trace Silt.				SAND AND GRAVEL	
10		S-5	9-11	24	15	3 5 5 5	10	S-5: Medium dense, light brown, fine SAND, trace Silt.			9		452.0'
15		S-6	15-17	24	24	3 5 6 8	11	S-6: Medium dense, light brown, fine SAND.				FINE SAND	
20		S-7	20-22			2 4 3 5	7	S-7: Loose, wet, light brown, fine SAND.	4		22		439.0'
								Bottom of boring at 22 feet.	5				
25													
30													

REMARKS

1. Elevation estimated using Google Earth.
2. Obstruction at 1.5 feet below ground surface (bgs). Offset boring 3 feet west.
3. Obstruction at 4 feet bgs. Driller was through obstruction at 5 feet bgs.
4. Groundwater encountered in sample S-7.
5. Upon completion, borehole backfilled with cuttings and pavement repaired using cold patch asphalt.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-9

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-10
SHEET: 1 of 1
PROJECT NO: 01.0174853.50
REVIEWED BY:

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** Truck Mounted	**Boring Location:** See Plan	**H. Datum:** NAD 83
Foreman: Joe	**Rig Model:** CME 75	**Ground Surface Elev. (ft.):** 476	
Logged By: Leonard Kilmartin	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 17	**V. Datum:** WSG84
		Date Start - Finish: 4/28/2021 - 4/28/2021	

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 4.25"/7.625"	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.):	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.):	**Sampler Hmr Fall (in):** 30	
Other:	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
									1		0.33	ASPHALT	475.7'
		S-1	1-3	24	17	12 13 15 9	28	S-1: Medium dense, brown/black, fine to coarse SAND, some Gravel, little Asphalt, trace Silt.				FILL	
		S-2	3-5	24	18	13 20 41 31	61	S-2: Very dense, brown, fine to coarse SAND and GRAVEL, trace (+) Silt.	2		4		472.0'
5		S-3	5-7	24		20 32 21 26	53	S-3: Very dense, brown, fine to coarse SAND and GRAVEL, trace Silt.				SAND AND GRAVEL	
		S-4	7-9			10 24 13 18	37	S-4: Dense, brown, fine to coarse SAND and GRAVEL, little Silt.			8		468.0'
10		S-5	10-12	22	22	13 47 65 R	R	S-5: Very dense, brown/tan, fine to coarse SAND, some Gravel, little (+) Silt.				GLACIAL TILL	
15		S-6	15-17	24	24	84 35 46 56	81	S-6: Very dense, brown/tan, fine to coarse SAND, some Gravel, little Silt.					
											17		459.0'
								Bottom of boring at 17 feet.	3				
20													
25													
30													

REMARKS

1. Elevation estimated using Google Earth.
2. Only one representative sample was obtained in samples S-2 and S-4.
3. Upon completion, borehole backfilled with cuttings and pavement repaired using cold patch asphalt.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-10

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-11
SHEET: 1 of 1
PROJECT NO: 01.0174853.50
REVIEWED BY:

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** Truck Mounted	**Boring Location:** See Plan	**H. Datum:** NAD 83
Foreman: Joe	**Rig Model:** CME 75	**Ground Surface Elev. (ft.):** 470	
Logged By: Leonard Kilmartin	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 27	**V. Datum:** WSG84
		Date Start - Finish: 4/29/2021 - 4/29/2021	

Auger/Casing Type: HSa	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 4.25"/7.625"	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.):	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.):	**Sampler Hmr Fall (in):** 30	
Other:	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
									1		0.25	ASPHALT	469.8'
		S-1	1-3	24	20	3 7 9 10	16	S-1: Medium dense, brown fine to coarse SAND, some Silt, little Gravel.	2				
5		S-2	3-5	24	18	8 12 14 37	26	S-2: Medium dense, brown, fine to coarse SAND, some Silt, little Gravel.					
10		S-3	10-12	24	24	7 17 22 23	39	S-3: Dense, brown, fine to coarse SAND, some Silt, some (-) Gravel.				GLACIAL TILL	
15		S-4	15-17	24	24	13 29 28 47	57	S-4: Very dense, brown/gray, fine to coarse SAND, some Gravel, some (-) Silt.					
20		S-5	20-22	24	20	44 69 52 66	R	S-5: Very dense, gray, fine to coarse SAND, some Gravel, some (-) Silt.					
25		S-6	25-27	24		65 66 43 65	R	S-6: Very dense, gray, fine to coarse SAND, some Gravel, little Silt.			27		443.0'
								Bottom of boring at 27 feet.	3				
30													

REMARKS

1. Elevation estimated using Google Earth.
2. Driller augered through asphalt pavement. Asphalt cuttings observed at the top of sample S-1.
3. Upon completion, borehole backfilled with cuttings and pavement repaired using cold patch asphalt.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-11

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-12
SHEET: 1 of 2
PROJECT NO: 01.0174853.50
REVIEWED BY:

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** Truck Mounted	**Boring Location:** See Plan	**H. Datum:** NAD 83
Foreman: Chris	**Rig Model:** CME 75	**Ground Surface Elev. (ft.):** 461	
Logged By: Leonard Kilmartin	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 32	**V. Datum:** WSG84
		Date Start - Finish: 4/29/2021 - 4/29/2021	

Auger/Casing Type: HSA	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 4.25"/7.625"	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.):	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.):	**Sampler Hmr Fall (in):** 30	
Other:	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	Stratum Description	Elev. (ft.)
		S-1	0.5-2.5	24	8	3 2 2 2	4	S-1: Loose, dark brown, fine to coarse SAND, little Gravel, trace Silt.	1 2		0.58	CONCRETE	460.4'
		S-2	2.5-4.5	24	12	3 2 5 6	7	S-2: Loose, dark brown, fine to coarse SAND, trace Gravel, trace Silt, trace Asphalt.				FILL	
5		S-3	4.5-6.5	24	20	5 9 9 8	18	S-3: Medium dense, tan, Clayey SILT, little fine Sand.			4.5		456.5'
		S-4	6.5-8.5	24	21	6 5 10 12	15	S-4: Medium dense, tan, Clayey SILT, little fine Sand.				CLAYEY SILT	
10		S-5	10-12	24	18	13 21 18 14	39	S-5: Dense, brown/light brown, fine to coarse SAND, some Gravel, trace Silt.			9.3	SAND AND GRAVEL	451.7'
15		S-6	15-17	24	24	14 21 25 39	46	S-6: Dense, gray, fine to coarse SAND, little (+) Gravel, little Silt.			13.5		447.5'
20		S-7	20-22	24	24	10 30 28 37	58	S-7: Very dense, gray, fine to coarse SAND, some Gravel, little Silt.				GLACIAL TILL	
25		S-8	25-27	24	24	10 22 23 57	45	S-8: Dense, gray, fine to coarse SAND, some Gravel, little Silt.					
30													

REMARKS

1. Elevation estimated using Google Earth.
2. The driller cored through 7 inches of concrete at the ground surface.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-12

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-12
SHEET: 2 of 2
PROJECT NO: 01.0174853.50
REVIEWED BY:

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	Stratum Description	Elev. (ft.)
		S-9	30-32	24	24	12 18 20 31	38	S-9: Dense, gray, fine to coarse SAND, some Gravel, little Silt.				GLACIAL TILL	
											32		429.0'
								Bottom of boring at 32 feet.	3				
35													
40													
45													
50													
55													
60													
65													

REMARKS

3. Upon completion, borehole backfilled with cuttings, the concrete core was placed in the borehole, and concrete repaired using cold patch asphalt.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-12

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

Table Talk Lofts
Green Street
Worcester, Massachusetts

BORING NO.: GZ-13
SHEET: 1 of 1
PROJECT NO: 01.0174853.50
REVIEWED BY:

Drilling Co.: Drilex Environmental, Inc.	**Type of Rig:** Truck Mounted	**Boring Location:** See Plan	**H. Datum:** NAD 83
Foreman: Jamie	**Rig Model:** CME 75	**Ground Surface Elev. (ft.):** 455	
Logged By: Leonard Kilmartin	**Drilling Method:** HSA	**Final Boring Depth (ft.):** 27	**V. Datum:** WSG84
		Date Start - Finish: 4/30/2021 - 4/30/2021	

Auger/Casing Type: HSa	**Sampler Type:** Split Spoon	
I.D/O.D.(in): 4.25"/7.625"	**I.D./O.D. (in.):** 1.375"/2"	
Hammer Weight (lb.):	**Sampler Hmr Wt (lb):** 140	
Hammer Fall (in.):	**Sampler Hmr Fall (in):** 30	
Other:	**Other:** Auto Hammer	

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
Not	encountered			

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)
		S-1	0.5-2	18	12	11 13 15	28	S-1: Medium dense, brown, fine to coarse SAND, little Gravel, little Silt, trace Brick.	1 2		0.5	CONCRETE	454.5'
		S-2	2-4	24	18	15 13 18 17	31	S-2: (Top 9") Dense, brown, fine to coarse SAND, some Gravel, trace Silt.				FILL	
5		S-3	4-6	24	16	11 12 14 17	26	S-2: (Bottom 6") Dense, brown, fine to coarse SAND, little (+) Gravel, little Silt. S-3: Medium dense, brown, fine to coarse SAND, little Gravel, little Silt.			3		452.0'
		S-4	6-8	24	19	15 22 32 46	54	S-4: Dense, brown/gray, fine to coarse SAND, some Gravel, little Silt.					
10		S-5	10-12	24	21	5 26 31 43	57	S-5: Very dense, brown/gray, fine to coarse SAND, some Gravel, little Silt.					
15		S-6	15-17	24	12	9 17 27 24	44	S-6: Dense, brown/white, fine to coarse SAND, some Gravel, little Silt.				GLACIAL TILL	
20		S-7	20-22	4	4	60/4"	R	S-7: Very dense, brown, fine to coarse SAND and GRAVEL, little Silt.	3				
25		S-8	25-27	14	12	37 62 62/4"	R	S-8: Very dense, gray, fine to coarse SAND, some Gravel, little Silt.			27		428.0'
								Bottom of boring at 27 feet.	4				
30													

REMARKS

1. Elevation estimated using Google Earth.
2. The driller cored through the concrete slab.
3. Auger had difficulty drilling at 22 feet below ground surface.
4. Upon completion, borehole backfilled with cuttings and concrete repaired using quick-set concrete.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.: GZ-13