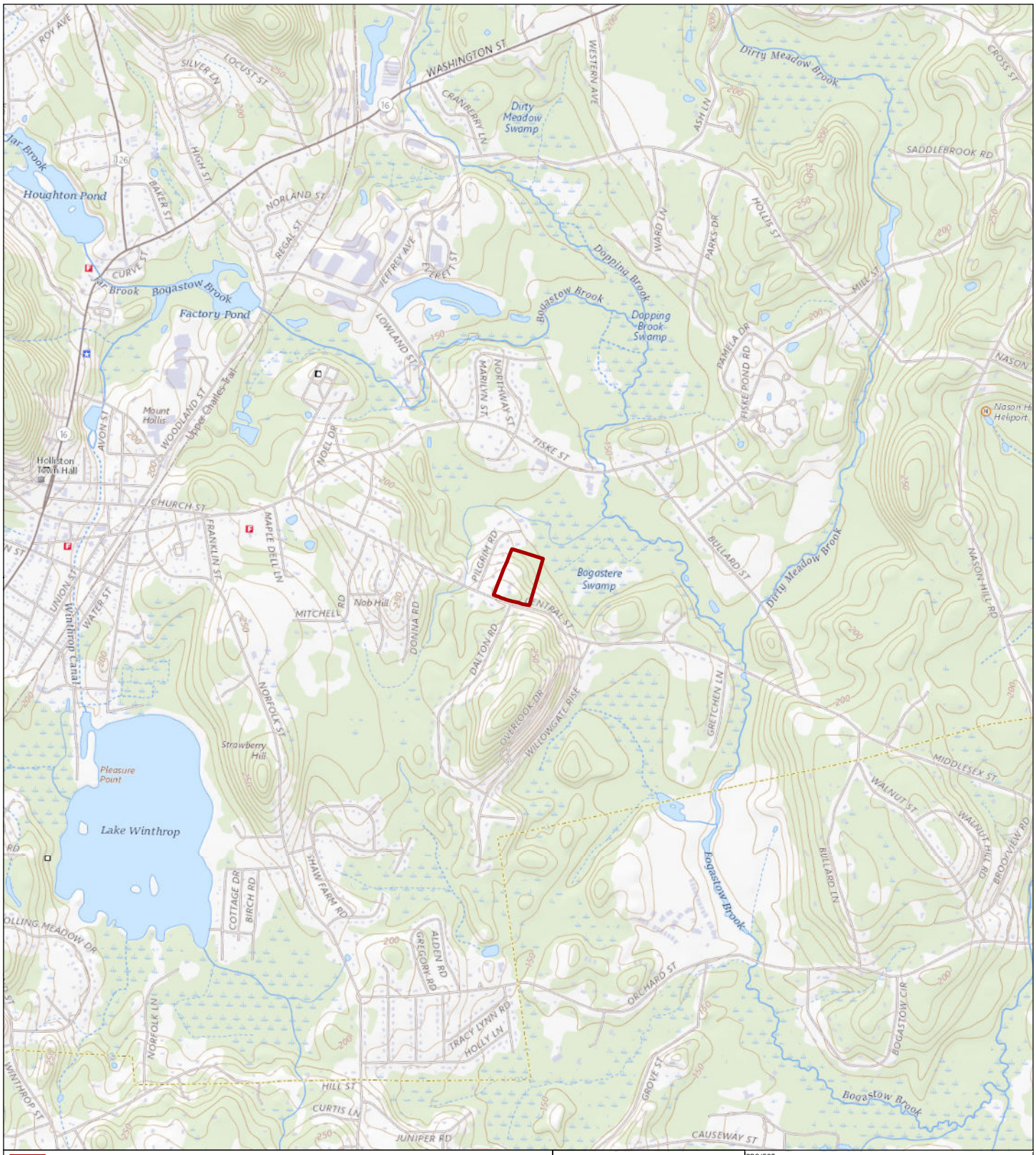
Attachment B: Figures, Maps, and Pre- and Post- Development Drainage Plans



PROJECT: BLUEWAVE

BATTERY STORAGE - HOLLISTON

TITLE:

LOCATION MAP
HOLLISTAN, MA

DRAWN BY:	S. MOTURI	PROJECT NO:	4125899.0000.0001
CHECKED BY:	S. TRACY		
APPROVED BY:	S. TRACY		
DATE:	JUNE 2022		

FIGURE 1

TRC
Wannalancit Mills
650 Suffolk Street
Lowell, MA 01854
(978-970-5600)

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

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

The **projection** used in the preparation of this map was Massachusetts State Plane Mainland zone (FIPSZONE 2001), meters. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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

Base map information shown on this FIRM was provided in digital format by the Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs. This information was derived from digital orthophotos produced at a scale of 1:5,000 from aerial photography dated April 2005.

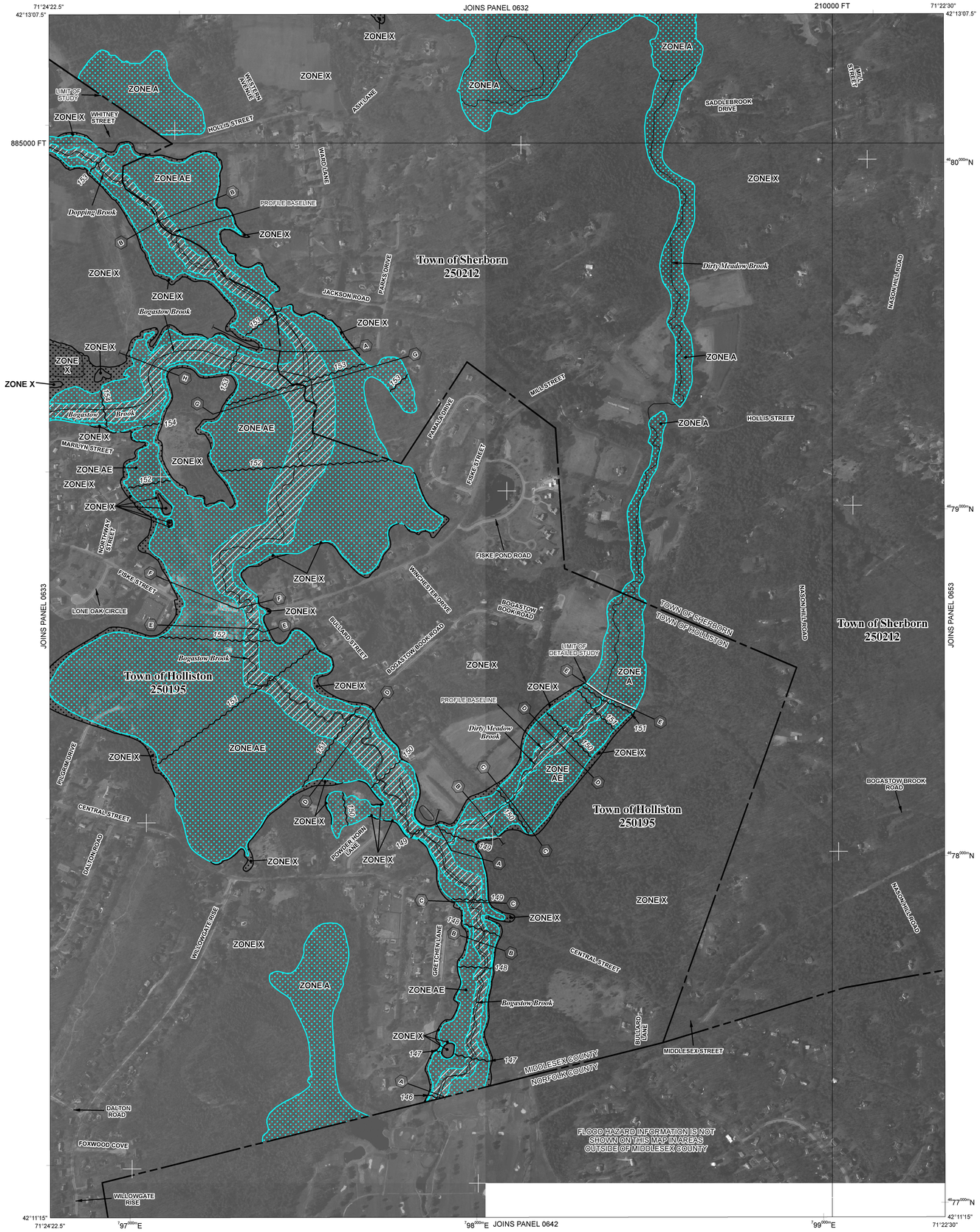
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

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

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.



LEGEND

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

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

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4676000mN — 1000-meter Universal Transverse Mercator grid values, zone 19
- 600000 FT — 5000-foot grid values: Massachusetts State Plane coordinate system, Mainland zone (FIPSZONE 2001), Lambert Conformal Conic projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 4, 2010

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

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0634E

FIRM

FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 634 OF 656
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
HOLLISTON, TOWN OF	250195	0634	E
SHERBORN, TOWN OF	250212	0634	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25017C0634E

EFFECTIVE DATE
JUNE 4, 2010

Federal Emergency Management Agency

Custom Soil Resource Report
Soil Map

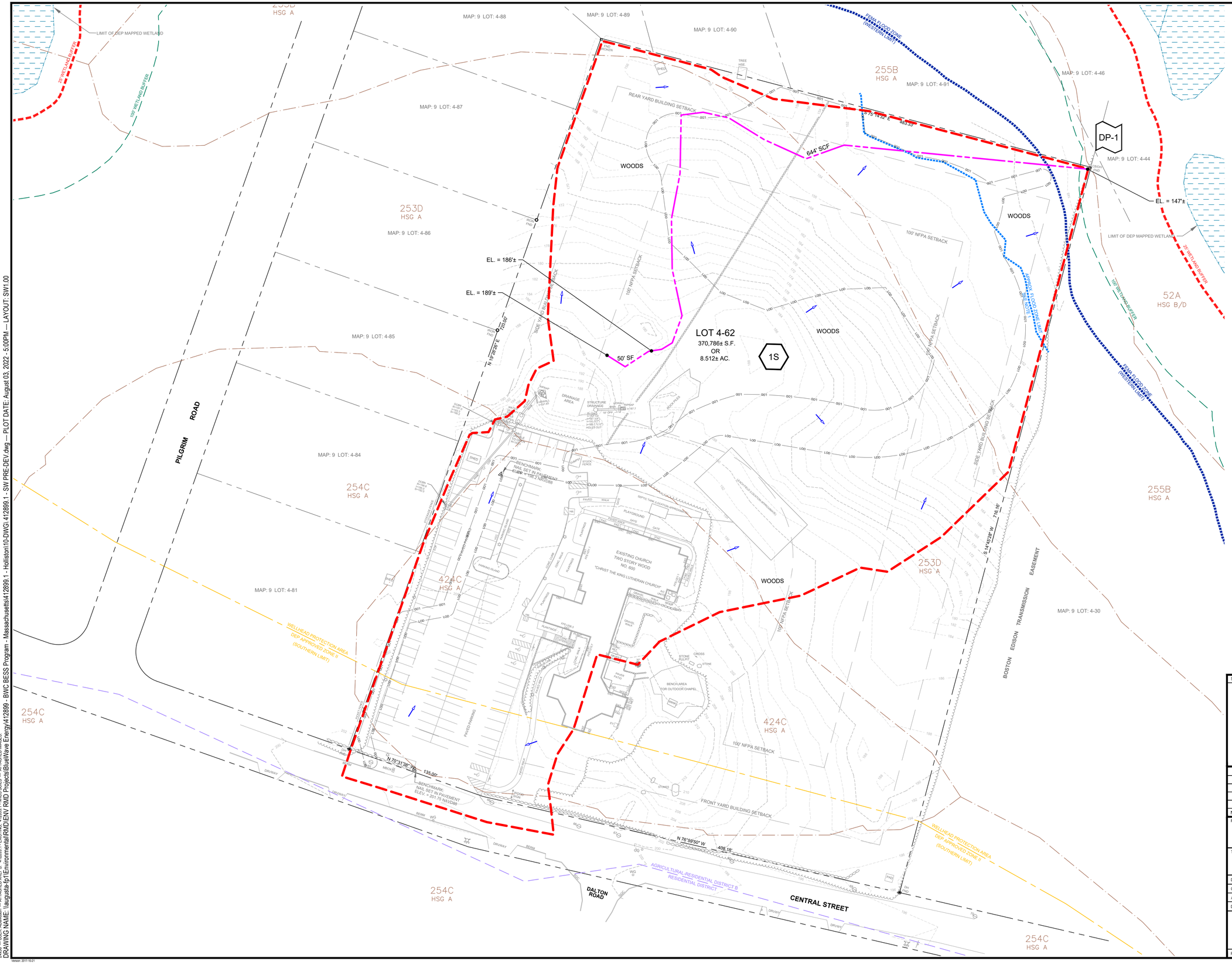
Map Scale: 1:4,740 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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



LEGEND

- 1S — SUBCATCHMENT
- DP-1 — ANALYSIS POINT
- SURVEYED PROPERTY BOUNDARY
- TC FLOWPATH
- SUBCATCHMENT BOUNDARY
- 253D HSG A — NRCS SOILS DATA
- STORMWATER RUNOFF FLOW DIRECTION

GENERAL NOTES

1. THE PROJECT HORIZONTAL COORDINATES SYSTEM IS BASED ON NAD83 MASSACHUSETTS STATE PLANE (US SURVEY FEET, MAINLAND ZONE, MA83F). ELEVATIONS ARE BASED ON NAVD88 (US SURVEY FEET).
2. PROJECT PROPERTY BOUNDARIES AND SITE TOPOGRAPHIC INFORMATION ARE BASED UPON ON-THE-GROUND FIELD SURVEY COMPLETED BY LAND PLANNING, INC. IN JANUARY 2022 AS PROVIDED IN A PLAN ENTITLED "EXISTING CONDITIONS PLAN, 600 CENTRAL STREET, IN HOLLISTON, MA" AND DATED JANUARY 19, 2022. SURVEY PLANS SEALED BY A LICENSED PROFESSIONAL LAND SURVEYOR ARE PROVIDED UNDER SEPARATE COVER.
3. UTILITY INFORMATION DEPICTED IS COMPILED USING PHYSICAL SURFACE EVIDENCE LOCATED IN THE FIELD IN CONJUNCTION WITH ANY RECORD INFORMATION AVAILABLE AT THE TIME OF THE FIELD SURVEY AND MAY NOT NECESSARILY REPRESENT ALL EXISTING UTILITIES. THEREFORE ALL UTILITY LOCATIONS SHOULD BE CONSIDERED APPROXIMATE AND BE VERIFIED BY THE CONTRACTOR. DIGSAFE SHALL BE NOTIFIED A MINIMUM OF 72-HOURS PRIOR TO COMMENCING ANY EXCAVATION. FULL UTILITY COORDINATION WITH NON-MEMBER UTILITIES AND USE OF GROUND-PENETRATING RADAR TO LOCATE UTILITIES SHOULD BE PERFORMED AS NECESSARY.
4. WETLAND DELINEATION WITHIN THE PROJECT AREA WAS PERFORMED BY TRC IN THE SUMMER OF 2021 AND LOCATED USING MAPPING GRADE GPS UNITS. ADDITIONAL NATURAL RESOURCE AND ZONING INFORMATION IS COMPILED FROM A COMBINATION OF SOURCES INCLUDING STATE OF MASSACHUSETTS GIS DATA.
5. SOIL MAP INFORMATION IS BASED UPON UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE SOIL MAP DATA. A GEOTECHNICAL SUBSURFACE INVESTIGATION TO OBTAIN SITE-SPECIFIC SOIL DATA AND DEPTH TO GROUNDWATER IS PLANNED TO OCCUR PRIOR TO CONSTRUCTION.

0 40 80 120 160
SCALE IN FEET

PERMITTING
NOT FOR CONSTRUCTION

SEAL:

PROFESSIONAL ENGINEER:

DATE:

NO.	BY	DATE	REVISION	APP'D.

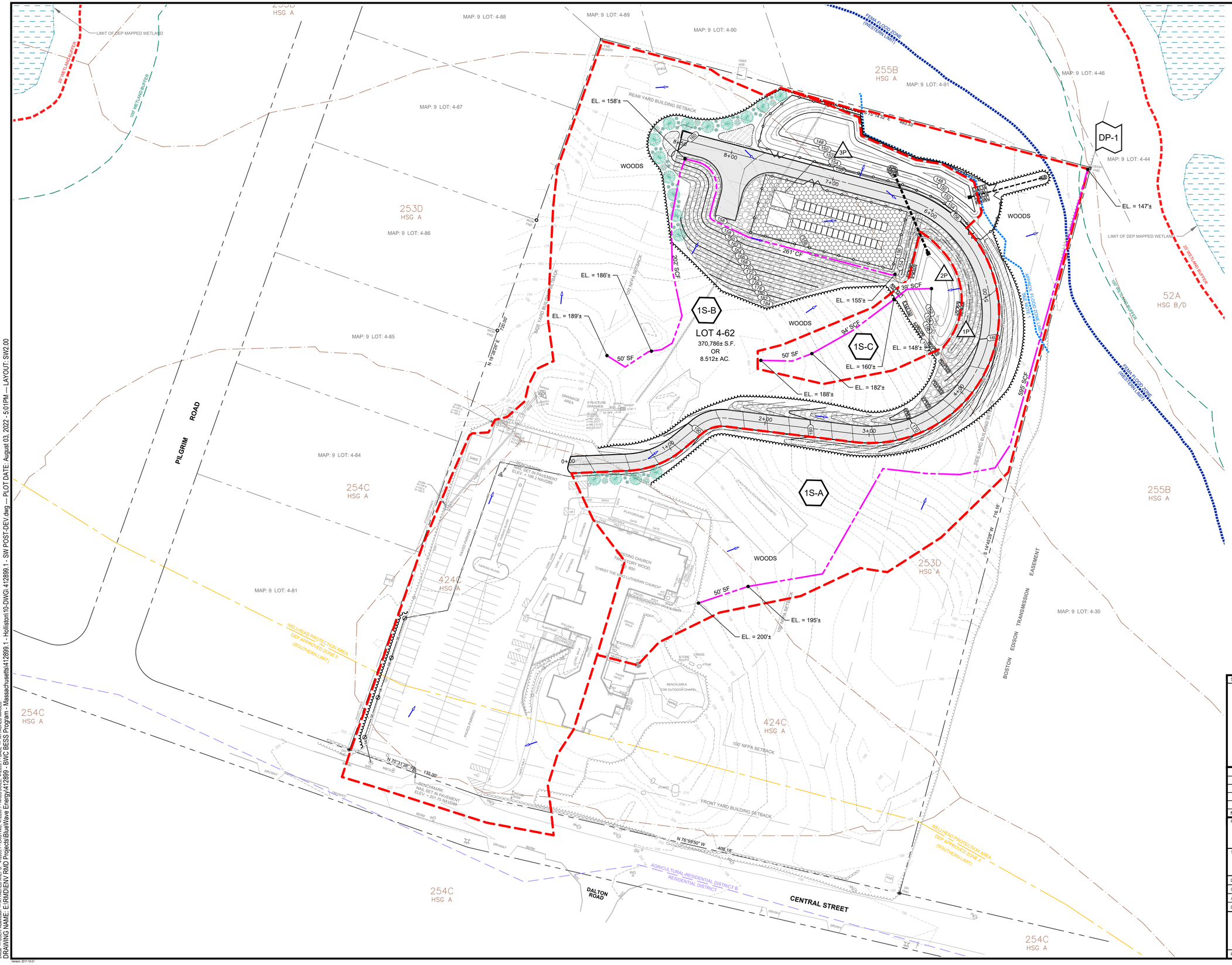
PROJECT:
BLUEWAVE SOLAR
BWC BOGASTOW BROOK, LLC
HOLLISTON BATTERY ENERGY STORAGE SYSTEM
CENTRAL STREET, HOLLISTON, MASSACHUSETTS

TITLE:
PRE-DEVELOPMENT DRAINAGE PLAN

DRAWN BY:	TRC	PROJ. NO.:	412899.0001
CHECKED BY:	TND		
APPROVED BY:	TND		**SW1.00**
DATE:	AUGUST 2022		

TRC
650 Suffolk Street
Suite 200
Lowell, MA 01854
Phone: 978.970.5600

FILE NO.: 412899.1 - SW PRE-DEV.dwg



LEGEND

- 1S — SUBCATCHMENT
- DP-1 — ANALYSIS POINT
- SURVEYED PROPERTY BOUNDARY
- TC FLOWPATH
- SUBCATCHMENT BOUNDARY
- 253D HSG A — NRCS SOILS DATA
- STORMWATER RUNOFF FLOW DIRECTION

GENERAL NOTES

1. THE PROJECT HORIZONTAL COORDINATES SYSTEM IS BASED ON NAD83 MASSACHUSETTS STATE PLANE (US SURVEY FEET, MAINLAND ZONE, MA83F). ELEVATIONS ARE BASED ON NAVD88 (US SURVEY FEET).
2. PROJECT PROPERTY BOUNDARIES AND SITE TOPOGRAPHIC INFORMATION ARE BASED UPON ON-THE-GROUND FIELD SURVEY COMPLETED BY LAND PLANNING, INC. IN JANUARY 2022 AS PROVIDED IN A PLAN ENTITLED "EXISTING CONDITIONS PLAN, 600 CENTRAL STREET, IN HOLLISTON, MA" AND DATED JANUARY 19, 2022. SURVEY PLANS SEALED BY A LICENSED PROFESSIONAL LAND SURVEYOR ARE PROVIDED UNDER SEPARATE COVER.
3. UTILITY INFORMATION DEPICTED IS COMPILED USING PHYSICAL SURFACE EVIDENCE LOCATED IN THE FIELD IN CONJUNCTION WITH ANY RECORD INFORMATION AVAILABLE AT THE TIME OF THE FIELD SURVEY AND MAY NOT NECESSARILY REPRESENT ALL EXISTING UTILITIES. THEREFORE ALL UTILITY LOCATIONS SHOULD BE CONSIDERED APPROXIMATE AND BE VERIFIED BY THE CONTRACTOR. DIGSAFE SHALL BE NOTIFIED A MINIMUM OF 72-HOURS PRIOR TO COMMENCING ANY EXCAVATION. FULL UTILITY COORDINATION WITH NON-MEMBER UTILITIES AND USE OF GROUND-PENETRATING RADAR TO LOCATE UTILITIES SHOULD BE PERFORMED AS NECESSARY.
4. WETLAND DELINEATION WITHIN THE PROJECT AREA WAS PERFORMED BY TRC IN THE SUMMER OF 2021 AND LOCATED USING MAPPING GRADE GPS UNITS. ADDITIONAL NATURAL RESOURCE AND ZONING INFORMATION IS COMPILED FROM A COMBINATION OF SOURCES INCLUDING STATE OF MASSACHUSETTS GIS DATA.
5. SOIL MAP INFORMATION IS BASED UPON UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE SOIL MAP DATA. A GEOTECHNICAL SUBSURFACE INVESTIGATION TO OBTAIN SITE-SPECIFIC SOIL DATA AND DEPTH TO GROUNDWATER IS PLANNED TO OCCUR PRIOR TO CONSTRUCTION.

0 40 80 120 160
SCALE IN FEET

PERMITTING
NOT FOR CONSTRUCTION

SEAL:

PROFESSIONAL ENGINEER:

DATE:

NO.	BY	DATE	REVISION	APP'D

PROJECT:
BLUEWAVE SOLAR
BWC BOGASTOW BROOK, LLC
HOLLISTON BATTERY ENERGY STORAGE SYSTEM
CENTRAL STREET, HOLLISTON, MASSACHUSETTS

TITLE:
POST-DEVELOPMENT DRAINAGE PLAN

DRAWN BY:	TRC	PROJ. NO.:	412899.0001
CHECKED BY:	TND		
APPROVED BY:	TND		**SW2.00**
DATE:	AUGUST 2022		

650 Suffolk Street
Suite 200
Lowell, MA 01854
Phone: 978.970.5600

FILE NO.: 412899.1 - SW POST-DEV.dwg

Attachment C: Stormwater Calculations & Supporting Documents

HOLLISTON BATTERY ENERGY STORAGE SYSTEM

Land Use Summary

PROJECT NO.: 412899.0001
CALC. BY: A.DAVIDSON
CHECKED BY: T. DANIELS
DATE: 2022.08.04

PRE- AND POST-DEVELOPMENT LAND USE COMPARISON TABLE

Subcatchment ID: 1S Subcatchment Area: 6.317 Ac.

PRE-DEVELOPMENT CONDITIONS			*POST-DEVELOPMENT CONDITIONS*			
Cover Description	***CN***	***Area (Ac.)***	***Cover Description***	***CN***	***Area (Ac.)***	***NET CHANGE (Ac.)***
Pavement, Roofs, Concrete Pads	98	1.294	Pavement, Roofs, Concrete Pads	98	1.339	0.045
Compacted Gravel	96	0.024	Compacted Gravel	96	0.374	0.349
Crushed Stone Yard, Rip Rap Surfaces	55	0.000	Crushed Stone Yard, Rip Rap Surfaces	55	0.572	0.572
Lawn, Good (HSG A)	39	0.490	Lawn, Good (HSG A)	39	0.474	-0.016
Meadow (HSG A)	30	0.000	Meadow (HSG A)	30	0.818	0.818
Woods, Good (HSG A)	30	4.508	Woods, Good (HSG A)	30	2.750	-1.758
						0.000
						0.000
						0.000
						0.000
						0.000
						0.000
Total:	**44.9**	**6.317**	**Total:**	**51.2**	**6.328**	

Notes:

Description: This worksheet provides the equations and constants used to determine the time of concentrations calculated in the subsequent worksheets using the Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service (SCS)) velocity method.

Time of Concentration Equations:

1. Where	$T_t = \frac{0.007(n\ell)^{0.8}}{(P_2)^{0.5} S^{0.4}}$	from NRCS TR-55 where P_2 = 2-Year, 24 Hour Rainfall (in)	For Sheet Flow (300 feet or less, typically no more than 100 feet) (NRCC Extreme Precipitation Tables: P2= 3.21 inches)
2. Where	$T_t = \frac{\ell}{3{,}600V}$	from the SCS Upland Method *Channel Flow Chart*	Travel time equation
3. Where	$V = 20.328(s)^{0.5}$	from the SCS Upland Method *Channel Flow Chart*	For Shallow Concentrated Flow - Paved surfaces
4. Where	$V = 16.1345(s)^{0.5}$	from the SCS Upland Method *Channel Flow Chart*	For Shallow Concentrated Flow - Unpaved surfaces and grassed waterways
5. Where	$V = 6.962(s)^{0.5}$	from the SCS Upland Method *Channel Flow Chart*	For Shallow Concentrated Flow - Short-grass pasture
6. Where	$V = 5.032(s)^{0.5}$	from the SCS Upland Method *Channel Flow Chart*	For Shallow Concentrated Flow - Woodlands
7. Where	$V = 12(s)^{0.5}$	from the SCS Upland Method *Channel Flow Chart*	For Channel Flow - Waterways and swamps, no channels
8. Where	$V = 15(s)^{0.5}$	from the SCS Upland Method *Channel Flow Chart*	For Channel Flow - Grassed waterways and roadside ditches
9. Where	$V = 21(s)^{0.5}$	from the SCS Upland Method *Channel Flow Chart*	For Channel Flow - Small tributary & swamp w/ channels
10. Where	$V = 35(s)^{0.5}$	from the SCS Upland Method *Channel Flow Chart*	For Channel Flow - Large tributary
11. Where	$V = 60(s)^{0.5}$	from the SCS Upland Method *Channel Flow Chart*	For Channel Flow - Main river
12. Where	$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n}$		For Channel Flow - Culvert flow

Manning's Roughness Coefficients for Sheet Flow

Surface Description	n - value
Smooth surface	0.011
Crushed stone/Substation yard	0.025
Fallow	0.050
Cultivated: Residue<=20%	0.060
Cultivated: Residue>20%	0.170
Grass: Short	0.150
Grass: Dense	0.240
Grass: Bermuda	0.410
Range	0.130
Woods: Light underbrush	0.400
Woods: Dense underbrush	0.800

Subcatchment ID: Pre-Development 1S

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7	Seg 8	
SHEET FLOW									
Manning's No.	0.400								
Length, ft	50								
$P_{2,}$ in	3.2								
Slope, ft/ft	0.060								
T_t^1, hr	0.132								0.1323
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[3], ft/sec									
T_t^2, hr									0.0000
Unpaved Surfaces & Grassed Waterways									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t^2, hr									0.0000
Short-Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[5], ft/sec									
T_t^2, hr									0.0000
Woodland									
Length, ft		644							
Slope, ft/ft		0.061							
Velocity[6], ft/sec		1.2383							
T_t^2, hr		0.144							0.1445
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t^2, hr									0.0000
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t^2, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[9], ft/sec									
T_t^2, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[10], ft/sec									
T_t^2, hr									0.0000
Main River									
Length, ft									
Slope, ft/ft									
Velocity[11], ft/sec									
T_t^2, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t^2, hr									0.0000

Time of Concentration, T_c, hr:	0.277
Time of Concentration, T_c, min:	**16.60**

Subcatchment ID: Post-Development 1S-A

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7	Seg 8	
SHEET FLOW									
Manning's No.	0.400								
Length, ft	50								
$P_{2,}$ in	3.2								
Slope, ft/ft	0.100								
T_t^1, hr	0.108								0.1078
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[3], ft/sec									
T_t^2, hr									0.0000
Unpaved Surfaces & Grassed Waterways									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t^2, hr									0.0000
Short-Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[5], ft/sec									
T_t^2, hr									0.0000
Woodland									
Length, ft		595							
Slope, ft/ft		0.081							
Velocity[6], ft/sec		1.4292							
T_t^2, hr		0.116							0.1156
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t^2, hr									0.0000
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t^2, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[9], ft/sec									
T_t^2, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[10], ft/sec									
T_t^2, hr									0.0000
Main River									
Length, ft									
Slope, ft/ft									
Velocity[11], ft/sec									
T_t^2, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t^2, hr									0.0000

Time of Concentration, T_c, hr:	0.223
Time of Concentration, T_c, min:	**13.41**

Subcatchment ID: Post-Development 1S-B

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7	Seg 8	
SHEET FLOW									
Manning's No.	0.400								
Length, ft	50								
P_2, in	3.2								
Slope, ft/ft	0.060								
T_t^1, hr	0.132								0.1323
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[3], ft/sec									
T_t^2, hr									0.0000
Unpaved Surfaces & Grassed Waterways									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t^2, hr									0.0000
Short-Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[5], ft/sec									
T_t^2, hr									0.0000
Woodland									
Length, ft		202							
Slope, ft/ft		0.139							
Velocity[6], ft/sec		1.8735							
T_t^2, hr		0.030							0.0300
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t^2, hr									0.0000
Grassed Waterways/Roadside Ditches									
Length, ft			261						
Slope, ft/ft			0.011						
Velocity[8], ft/sec			1.608						
T_t^2, hr			0.045						0.0451
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[9], ft/sec									
T_t^2, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[10], ft/sec									
T_t^2, hr									0.0000
Main River									
Length, ft									
Slope, ft/ft									
Velocity[11], ft/sec									
T_t^2, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t^2, hr									0.0000

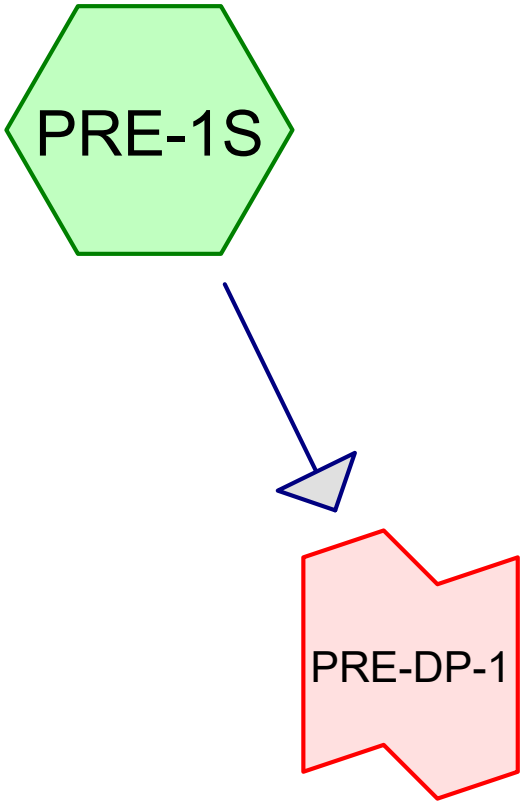
Time of Concentration, T_c, hr:	0.207
Time of Concentration, T_c, min:	**12.44**

Subcatchment ID: Post-Development 1S-C

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7	Seg 8	
SHEET FLOW									
Manning's No.	0.400								
Length, ft	50								
$P_{2,}$ in	3.2								
Slope, ft/ft	0.120								
T_t^1, hr	0.100								0.1002
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[3], ft/sec									
T_t^2, hr									0.0000
Unpaved Surfaces & Grassed Waterways									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t^2, hr									0.0000
Short-Grass Pasture									
Length, ft			39						
Slope, ft/ft			0.308						
Velocity[5], ft/sec			3.8618						
T_t^2, hr			0.003						0.0028
Woodland									
Length, ft		94							
Slope, ft/ft		0.234							
Velocity[6], ft/sec		2.4344							
T_t^2, hr		0.011							0.0107
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t^2, hr									0.0000
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t^2, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[9], ft/sec									
T_t^2, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[10], ft/sec									
T_t^2, hr									0.0000
Main River									
Length, ft									
Slope, ft/ft									
Velocity[11], ft/sec									
T_t^2, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t^2, hr									0.0000

Time of Concentration, T_c, hr:	0.114
Time of Concentration, T_c, min:	**6.83**

PRE-DEVELOPMENT



Analysis Point

Subcat Reach Pond Link

Routing Diagram for Holliston - Stormwater Model
Prepared by TRC, Printed 8/4/2022

Summary for Subcatchment PRE-1S:

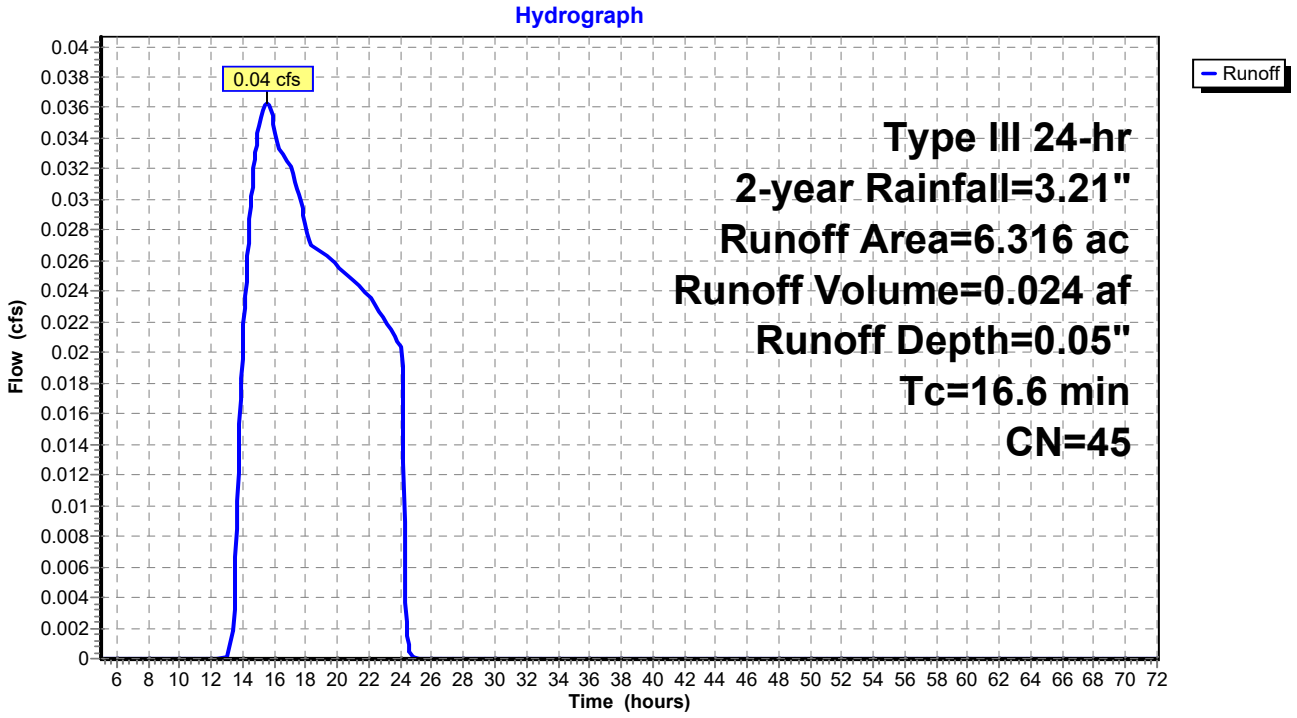
Runoff = 0.04 cfs @ 15.49 hrs, Volume= 0.024 af, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.21"

	Area (ac)	CN	Description
*	1.294	98	Pavement, Roofs, Concrete Pads
*	0.024	96	Compacted Gravel
*	0.000	76	Crushed Stone Yard
	0.490	39	>75% Grass cover, Good, HSG A
	0.000	30	Meadow, non-grazed, HSG A
	4.508	30	Woods, Good, HSG A
	6.316	45	Weighted Average
	5.022		79.51% Pervious Area
	1.294		20.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6					**Direct Entry, See Tc calc sheet**

Subcatchment PRE-1S:

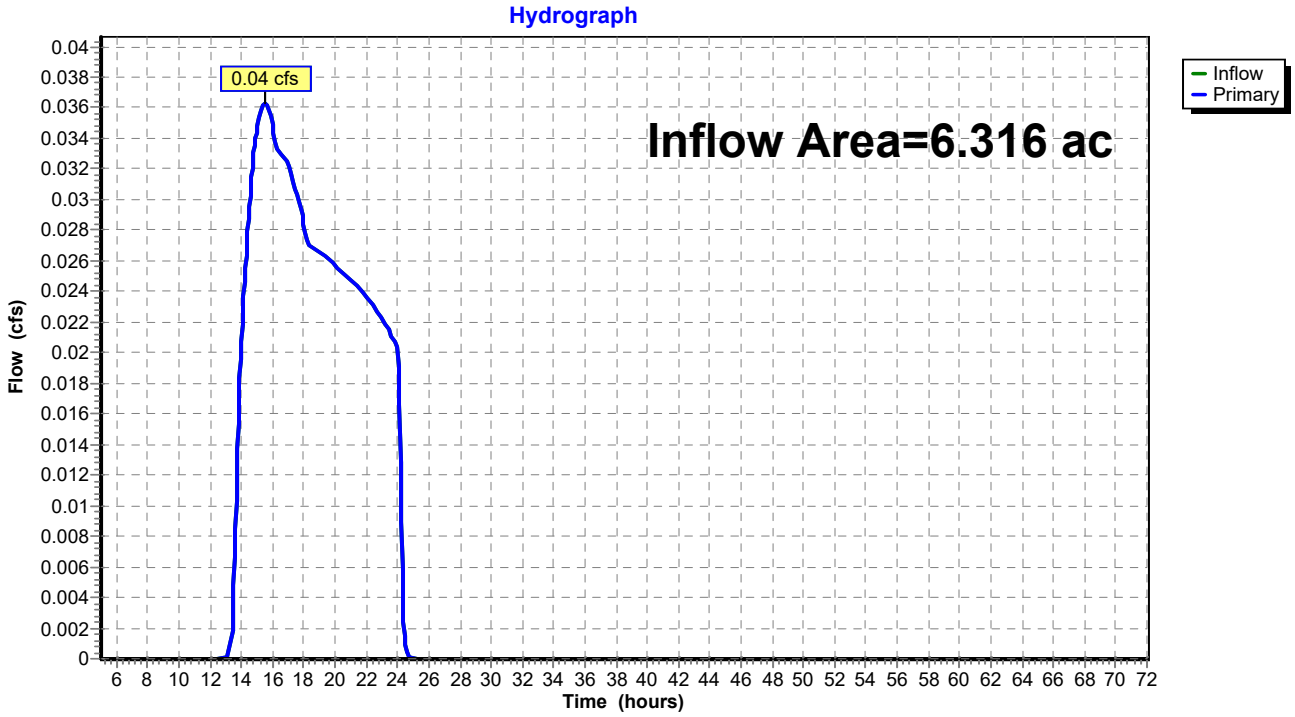


Summary for Link PRE-DP-1: Analysis Point

Inflow Area = 6.316 ac, 20.49% Impervious, Inflow Depth = 0.05" for 2-year event
Inflow = 0.04 cfs @ 15.49 hrs, Volume= 0.024 af
Primary = 0.04 cfs @ 15.49 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs

Link PRE-DP-1: Analysis Point



Summary for Subcatchment PRE-1S:

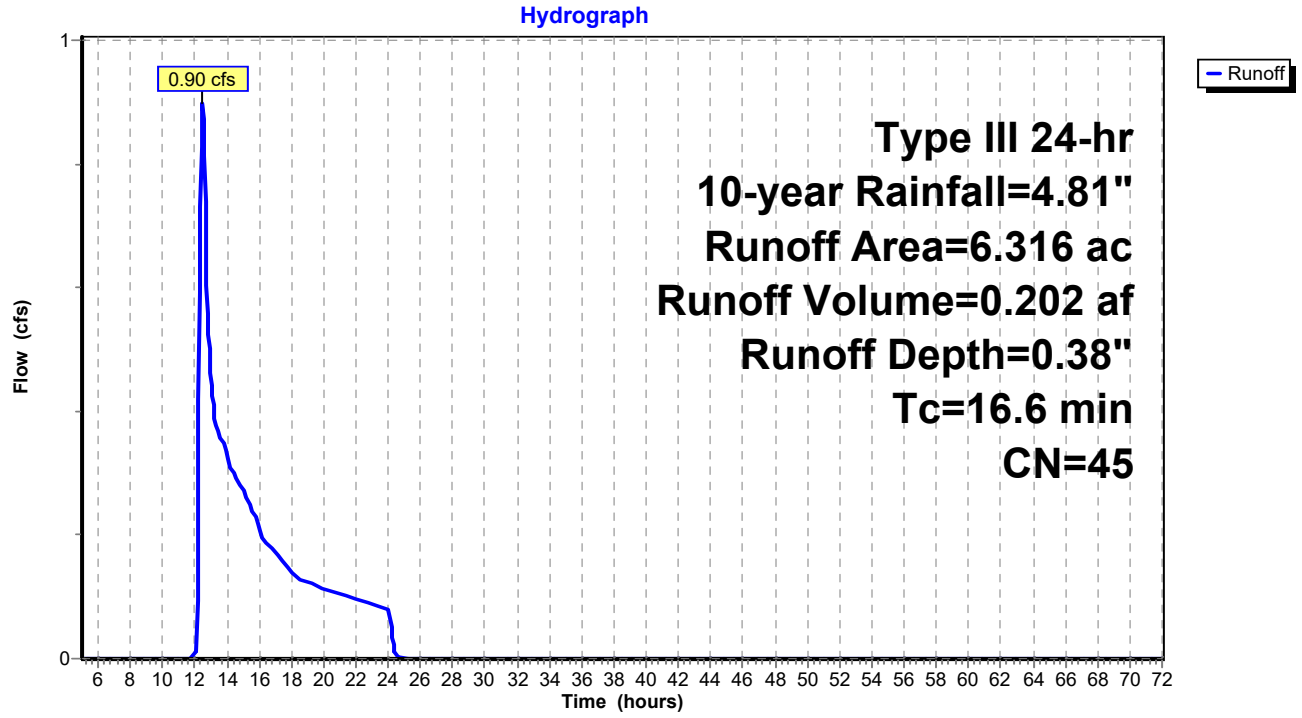
Runoff = 0.90 cfs @ 12.49 hrs, Volume= 0.202 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.81"

	Area (ac)	CN	Description
*	1.294	98	Pavement, Roofs, Concrete Pads
*	0.024	96	Compacted Gravel
*	0.000	76	Crushed Stone Yard
	0.490	39	>75% Grass cover, Good, HSG A
	0.000	30	Meadow, non-grazed, HSG A
	4.508	30	Woods, Good, HSG A
	6.316	45	Weighted Average
	5.022		79.51% Pervious Area
	1.294		20.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6					**Direct Entry, See Tc calc sheet**

Subcatchment PRE-1S:

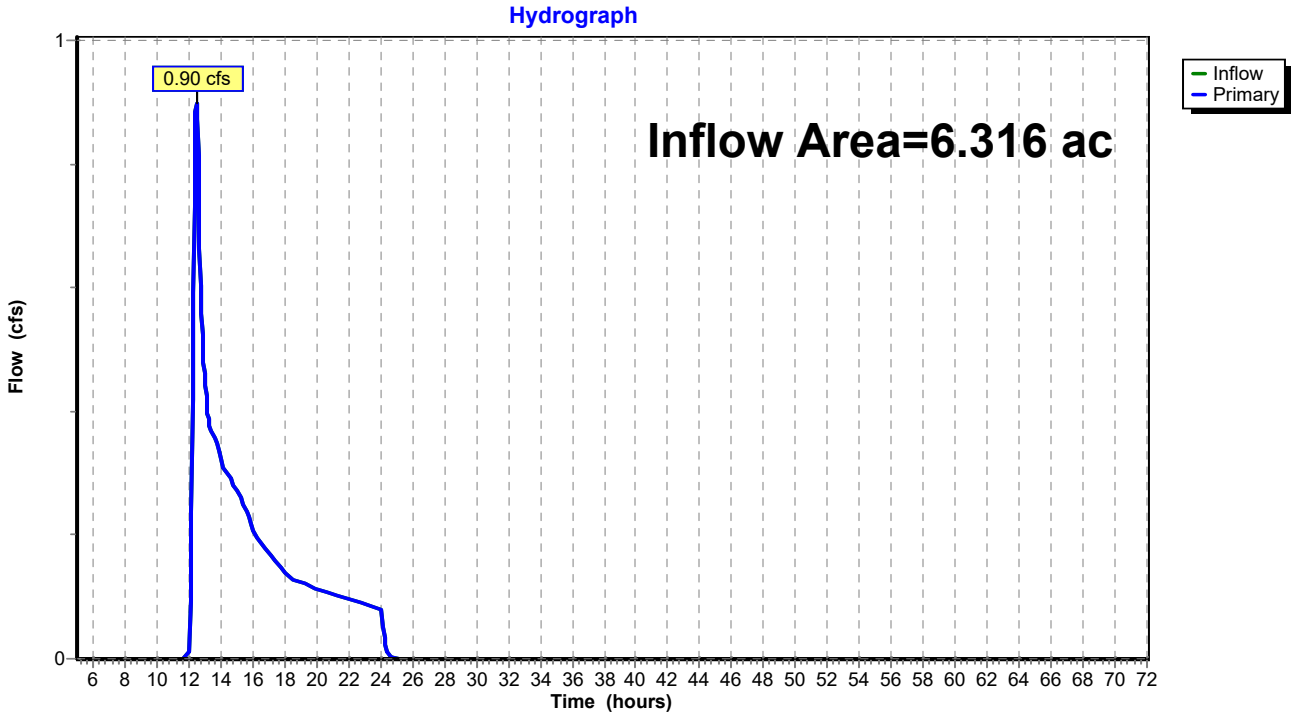


Summary for Link PRE-DP-1: Analysis Point

Inflow Area = 6.316 ac, 20.49% Impervious, Inflow Depth = 0.38" for 10-year event
Inflow = 0.90 cfs @ 12.49 hrs, Volume= 0.202 af
Primary = 0.90 cfs @ 12.49 hrs, Volume= 0.202 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs

Link PRE-DP-1: Analysis Point



Summary for Subcatchment PRE-1S:

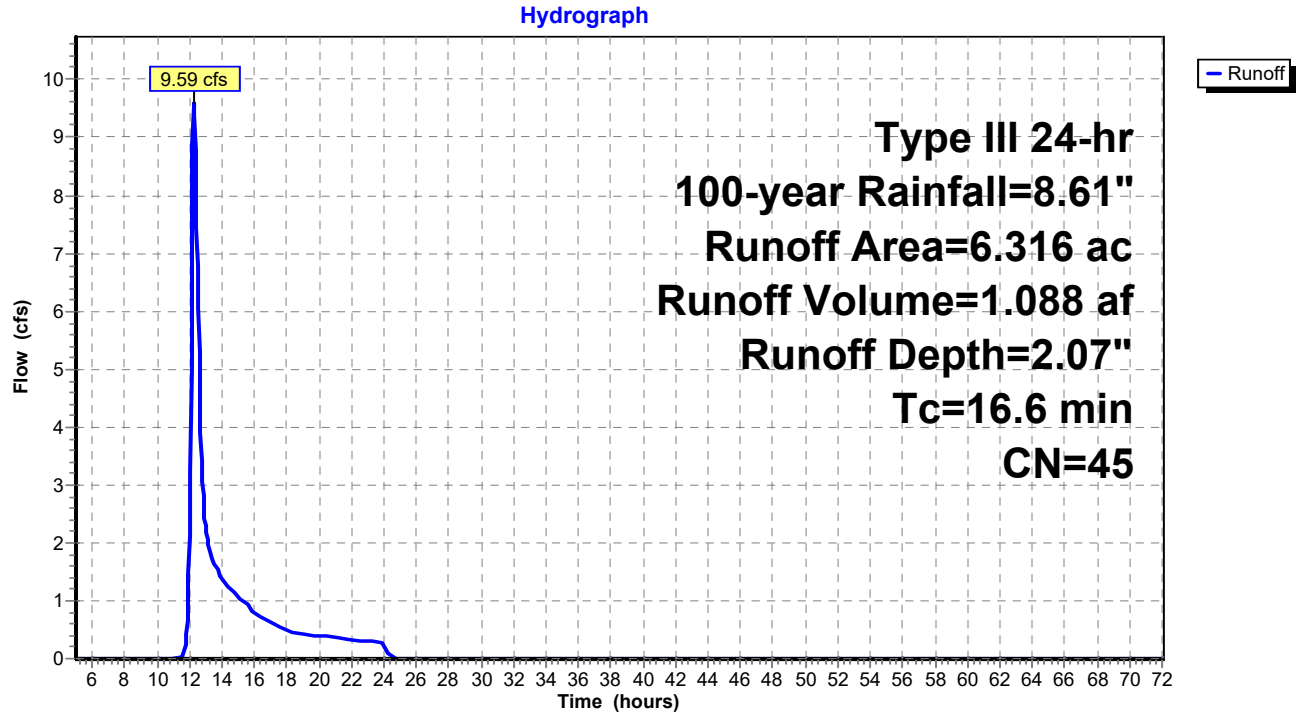
Runoff = 9.59 cfs @ 12.26 hrs, Volume= 1.088 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.61"

	Area (ac)	CN	Description
*	1.294	98	Pavement, Roofs, Concrete Pads
*	0.024	96	Compacted Gravel
*	0.000	76	Crushed Stone Yard
	0.490	39	>75% Grass cover, Good, HSG A
	0.000	30	Meadow, non-grazed, HSG A
	4.508	30	Woods, Good, HSG A
	6.316	45	Weighted Average
	5.022		79.51% Pervious Area
	1.294		20.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.6					**Direct Entry, See Tc calc sheet**

Subcatchment PRE-1S:

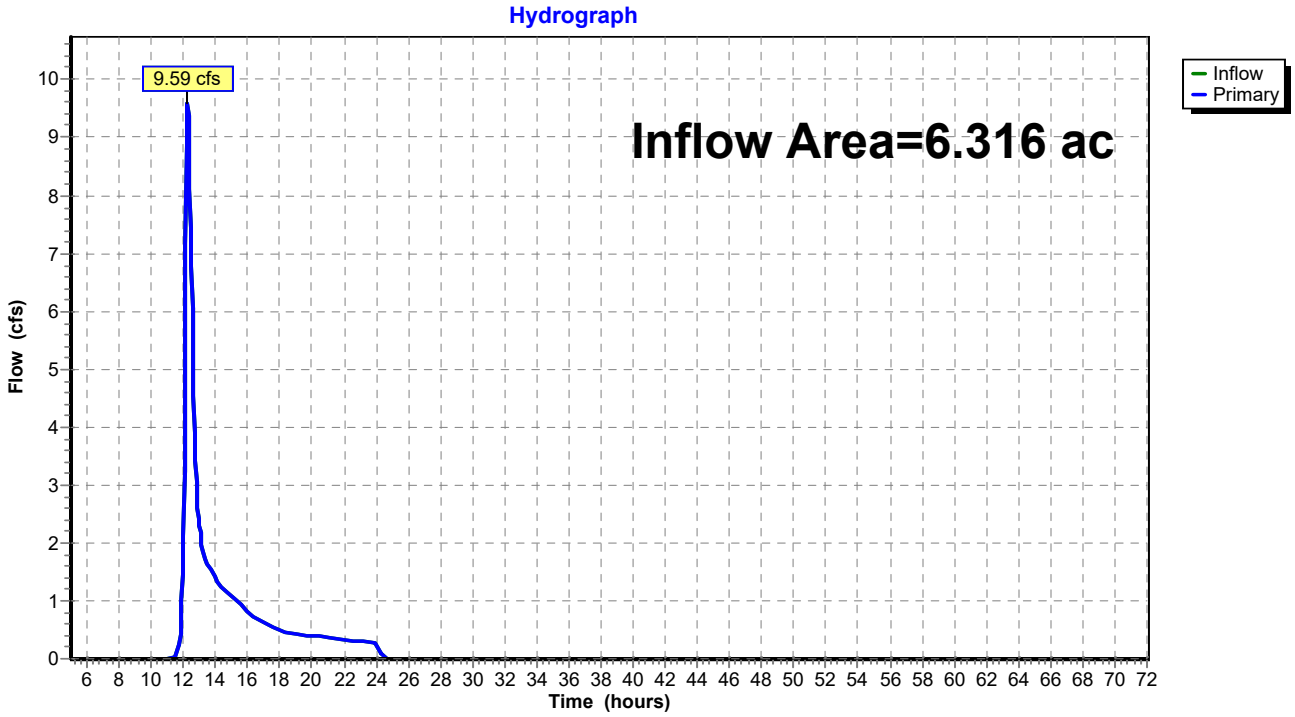


Summary for Link PRE-DP-1: Analysis Point

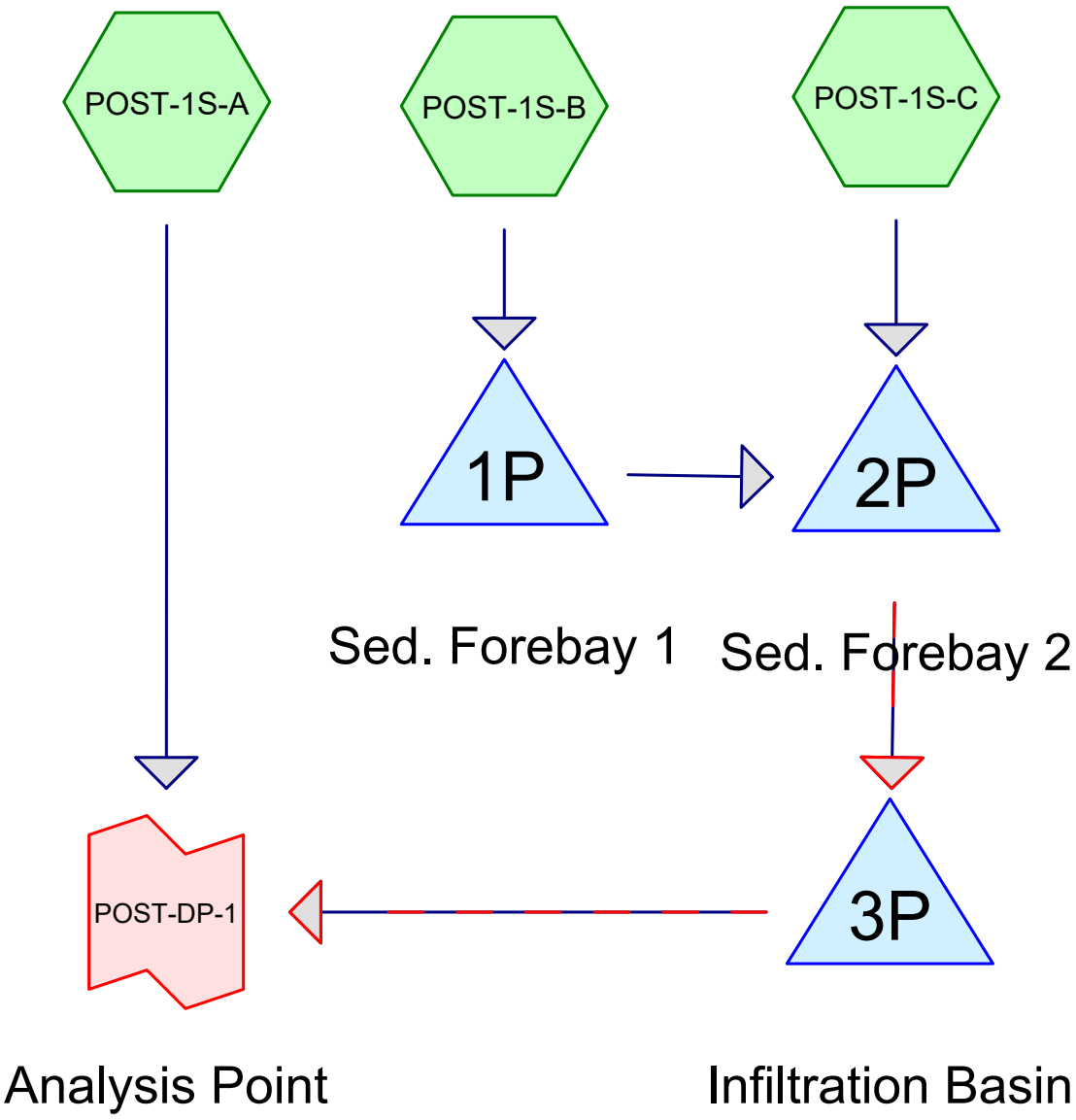
Inflow Area = 6.316 ac, 20.49% Impervious, Inflow Depth = 2.07" for 100-year event
Inflow = 9.59 cfs @ 12.26 hrs, Volume= 1.088 af
Primary = 9.59 cfs @ 12.26 hrs, Volume= 1.088 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs

Link PRE-DP-1: Analysis Point



POST-DEVELOPMENT



Subcat Reach Pond Link

Routing Diagram for Holliston - Stormwater Model
Prepared by TRC, Printed 8/4/2022

Summary for Subcatchment POST-1S-A:

[45] Hint: Runoff=Zero

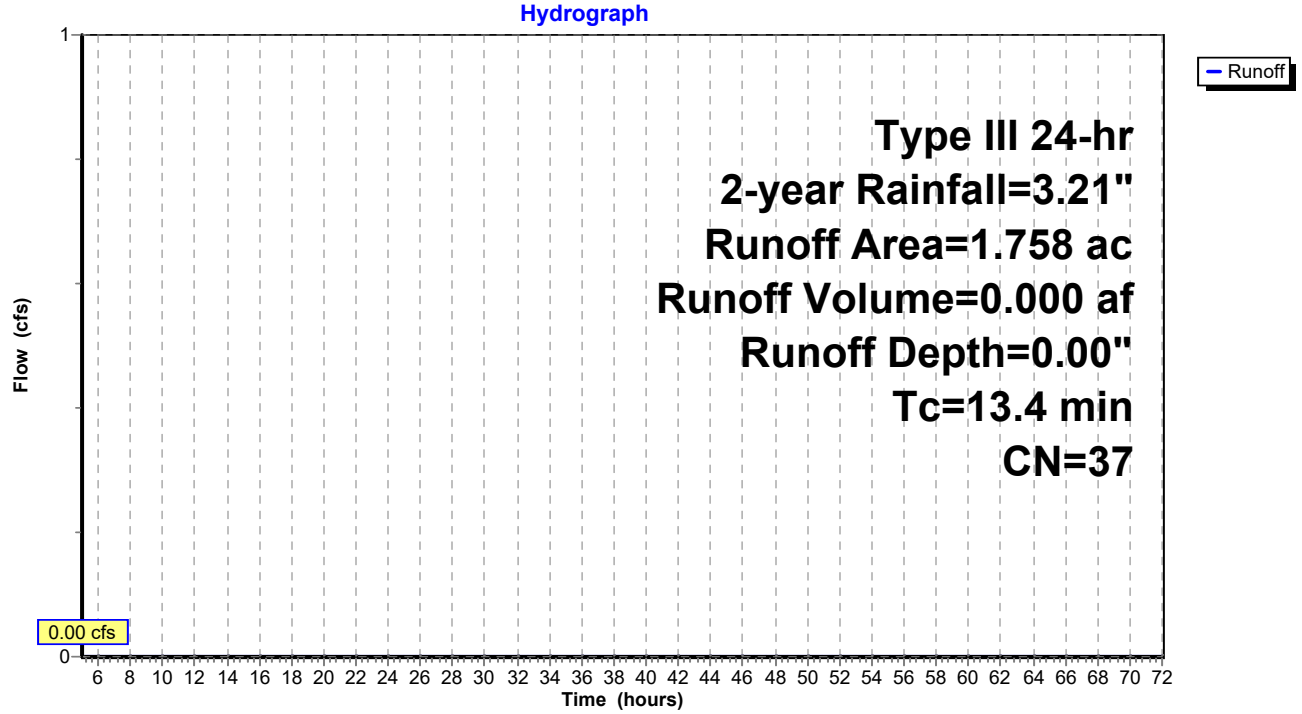
Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.21"

	Area (ac)	CN	Description
*	0.127	98	Pavement, Roofs, Concrete Pads
*	0.024	96	Compacted Gravel
*	0.000	55	Crushed Stone Yard
	0.191	39	>75% Grass cover, Good, HSG A
	0.259	30	Meadow, non-grazed, HSG A
	1.157	30	Woods, Good, HSG A
	1.758	37	Weighted Average
	1.631		92.78% Pervious Area
	0.127		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4					**Direct Entry, See Tc calc sheet**

Subcatchment POST-1S-A:



Summary for Subcatchment POST-1S-B:

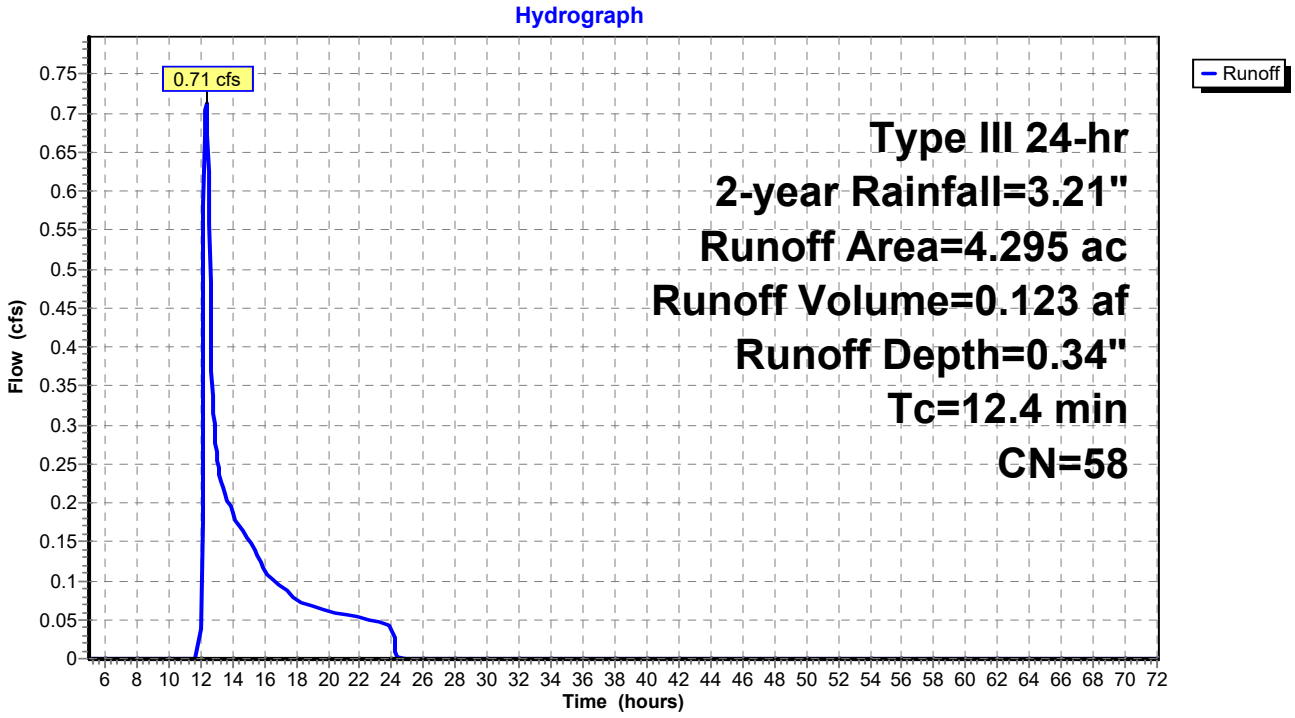
Runoff = 0.71 cfs @ 12.35 hrs, Volume= 0.123 af, Depth= 0.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.21"

	Area (ac)	CN	Description
*	1.212	98	Pavement, Roofs, Concrete Pads
*	0.350	96	Compacted Gravel
*	0.572	55	Crushed Stone Yard
	0.283	39	>75% Grass cover, Good, HSG A
	0.456	30	Meadow, non-grazed, HSG A
	1.422	30	Woods, Good, HSG A
	4.295	58	Weighted Average
	3.083		71.78% Pervious Area
	1.212		28.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4					**Direct Entry, See Tc calc sheet**

Subcatchment POST-1S-B:



Summary for Subcatchment POST-1S-C:

[45] Hint: Runoff=Zero

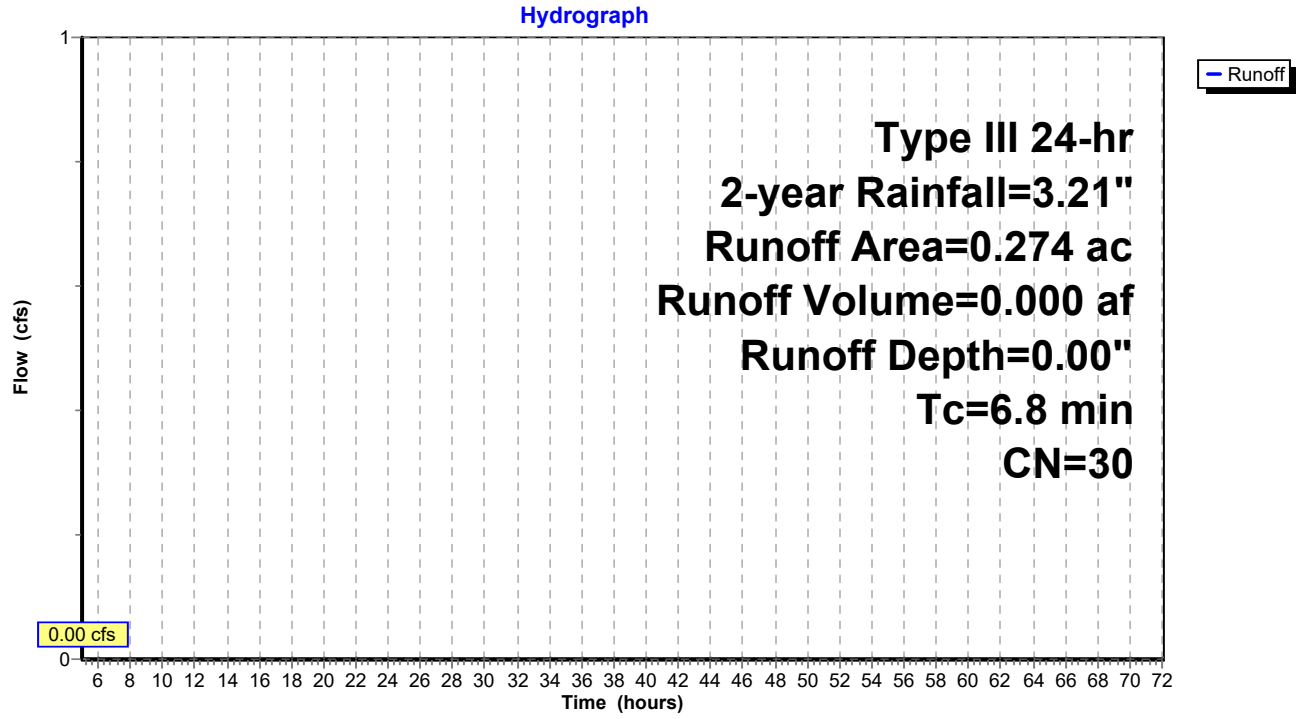
Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.21"

	Area (ac)	CN	Description
*	0.000	98	Pavement, Roofs, Concrete Pads
*	0.000	96	Compacted Gravel
*	0.000	55	Crushed Stone Yard
	0.000	39	>75% Grass cover, Good, HSG A
	0.103	30	Meadow, non-grazed, HSG A
	0.171	30	Woods, Good, HSG A
	0.274	30	Weighted Average
	0.274		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8					**Direct Entry, See Tc calc sheet**

Subcatchment POST-1S-C:



Summary for Pond 1P: Sed. Forebay 1

Inflow Area = 4.295 ac, 28.22% Impervious, Inflow Depth = 0.34" for 2-year event
Inflow = 0.71 cfs @ 12.35 hrs, Volume= 0.123 af
Outflow = 0.16 cfs @ 14.92 hrs, Volume= 0.062 af, Atten= 78%, Lag= 154.3 min
Primary = 0.16 cfs @ 14.92 hrs, Volume= 0.062 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 155.23' @ 14.92 hrs Surf.Area= 2,431 sf Storage= 2,752 cf
Flood Elev= 156.00' Surf.Area= 3,291 sf Storage= 4,959 cf

Plug-Flow detention time= 326.6 min calculated for 0.062 af (50% of inflow)
Center-of-Mass det. time= 167.1 min (1,105.3 - 938.2)

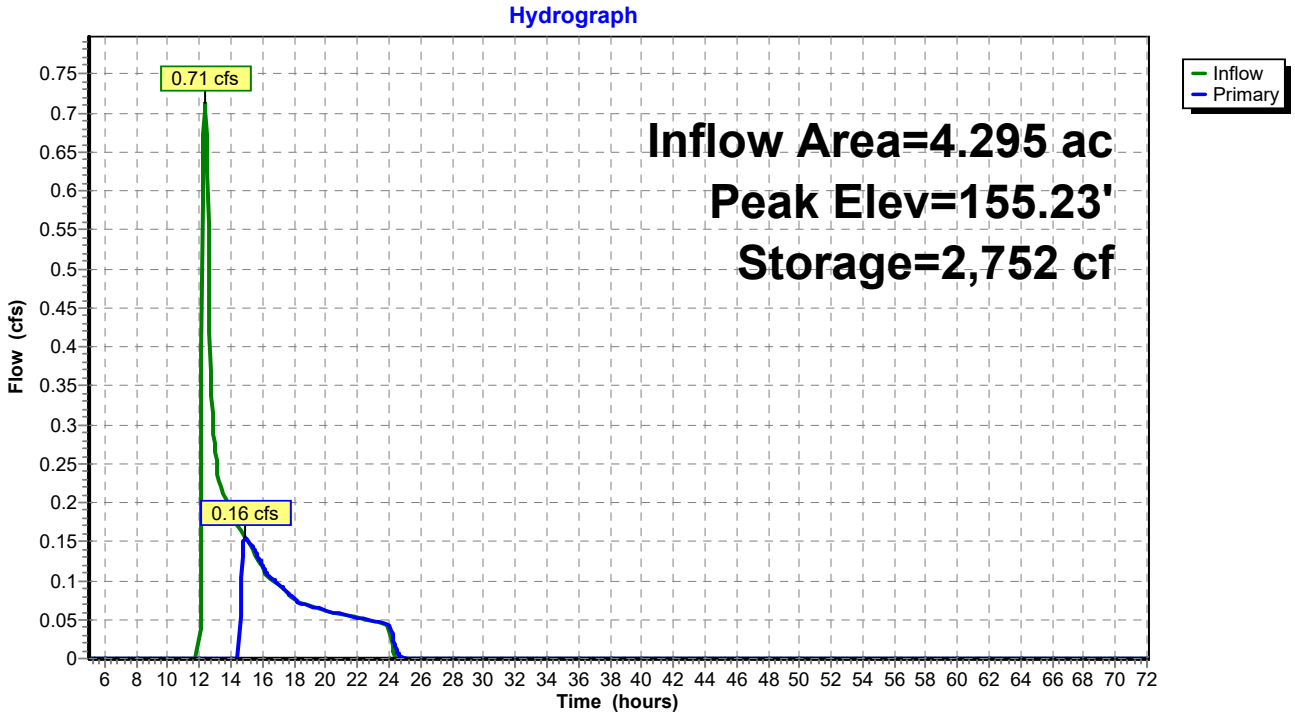
Volume	Invert	Avail.Storage	Storage Description
#1	153.00'	4,959 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
153.00	150	395.0	0	0	150
154.00	1,158	411.0	575	575	1,253
155.00	2,205	427.0	1,654	2,229	2,399
156.00	3,291	607.0	2,730	4,959	17,219

Device	Routing	Invert	Outlet Devices
#1	Primary	155.20'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	155.25'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.13 cfs @ 14.92 hrs HW=155.23' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.13 cfs @ 0.52 fps)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Sed. Forebay 1



Summary for Pond 2P: Sed. Forebay 2

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 0.16" for 2-year event
Inflow = 0.16 cfs @ 14.92 hrs, Volume= 0.062 af
Outflow = 0.05 cfs @ 23.58 hrs, Volume= 0.007 af, Atten= 71%, Lag= 519.4 min
Primary = 0.05 cfs @ 23.58 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 153.73' @ 23.58 hrs Surf.Area= 1,870 sf Storage= 2,447 cf
Flood Elev= 156.00' Surf.Area= 3,180 sf Storage= 8,196 cf

Plug-Flow detention time= 537.4 min calculated for 0.007 af (11% of inflow)
Center-of-Mass det. time= 325.0 min (1,430.3 - 1,105.3)

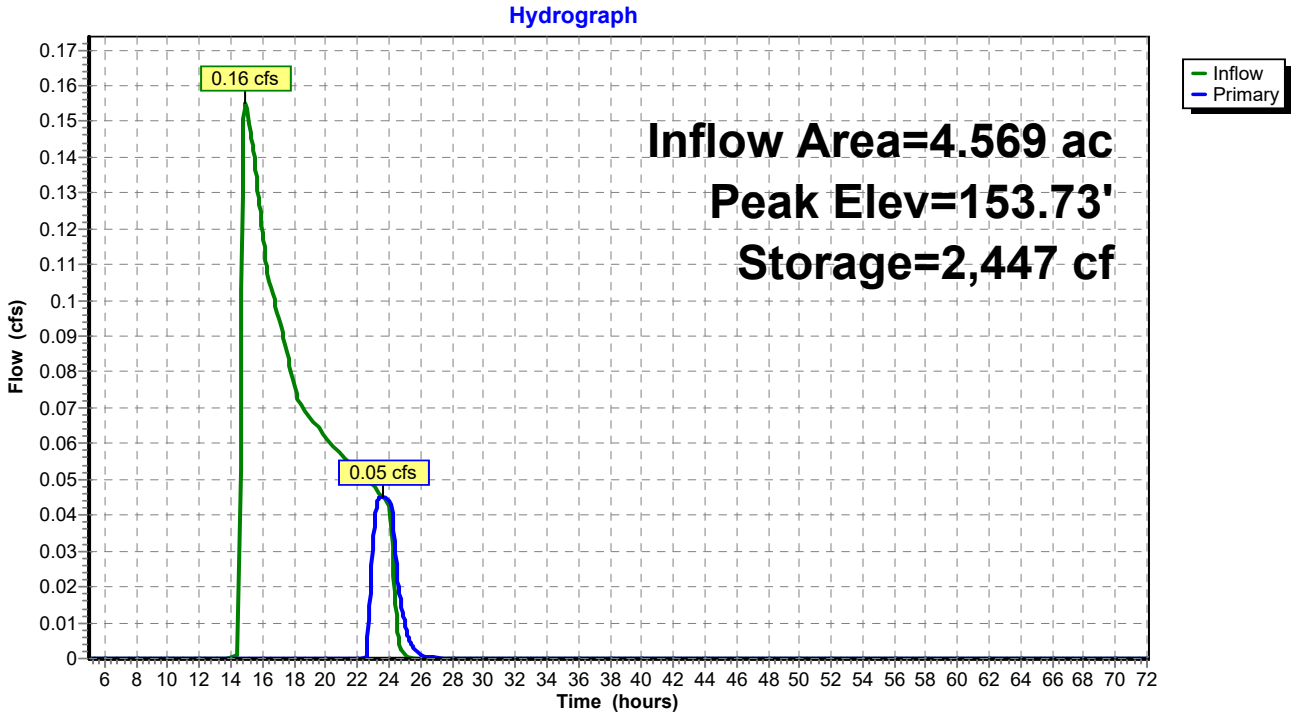
Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	8,196 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
152.00	1,173	149.0	0	0	1,173
153.00	1,370	153.0	1,270	1,270	1,352
154.00	2,075	195.0	1,710	2,981	2,528
156.00	3,180	235.0	5,216	8,196	3,963

Device	Routing	Invert	Outlet Devices
#1	Primary	153.00'	**24.0" Round Culvert** L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 153.00' / 152.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	153.70'	**30.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	155.00'	**30.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 23.58 hrs HW=153.73' (Free Discharge)
↑**1=Culvert** (Passes 0.04 cfs of 3.01 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 0.55 fps)
3=Orifice/Grate (Controls 0.00 cfs)

Pond 2P: Sed. Forebay 2



Summary for Pond 3P: Infiltration Basin

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 0.02" for 2-year event
Inflow = 0.05 cfs @ 23.58 hrs, Volume= 0.007 af
Outflow = 0.05 cfs @ 23.60 hrs, Volume= 0.007 af, Atten= 0%, Lag= 1.3 min
Discarded = 0.05 cfs @ 23.60 hrs, Volume= 0.007 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 146.00' @ 23.60 hrs Surf.Area= 1,456 sf Storage= 3 cf
Flood Elev= 152.25' Surf.Area= 5,856 sf Storage= 15,303 cf

Plug-Flow detention time= 1.2 min calculated for 0.007 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (1,431.5 - 1,430.3)

Volume	Invert	Avail.Storage	Storage Description
#1	145.99'	15,303 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
145.99	1,456	342.0	0.0	0	0	1,456
146.00	1,456	342.0	40.0	6	6	1,459
147.99	1,456	342.0	40.0	1,159	1,165	2,140
148.00	1,456	342.0	100.0	15	1,179	2,143
150.00	3,530	444.0	100.0	4,835	6,015	8,572
152.00	5,856	480.0	100.0	9,288	15,303	11,375

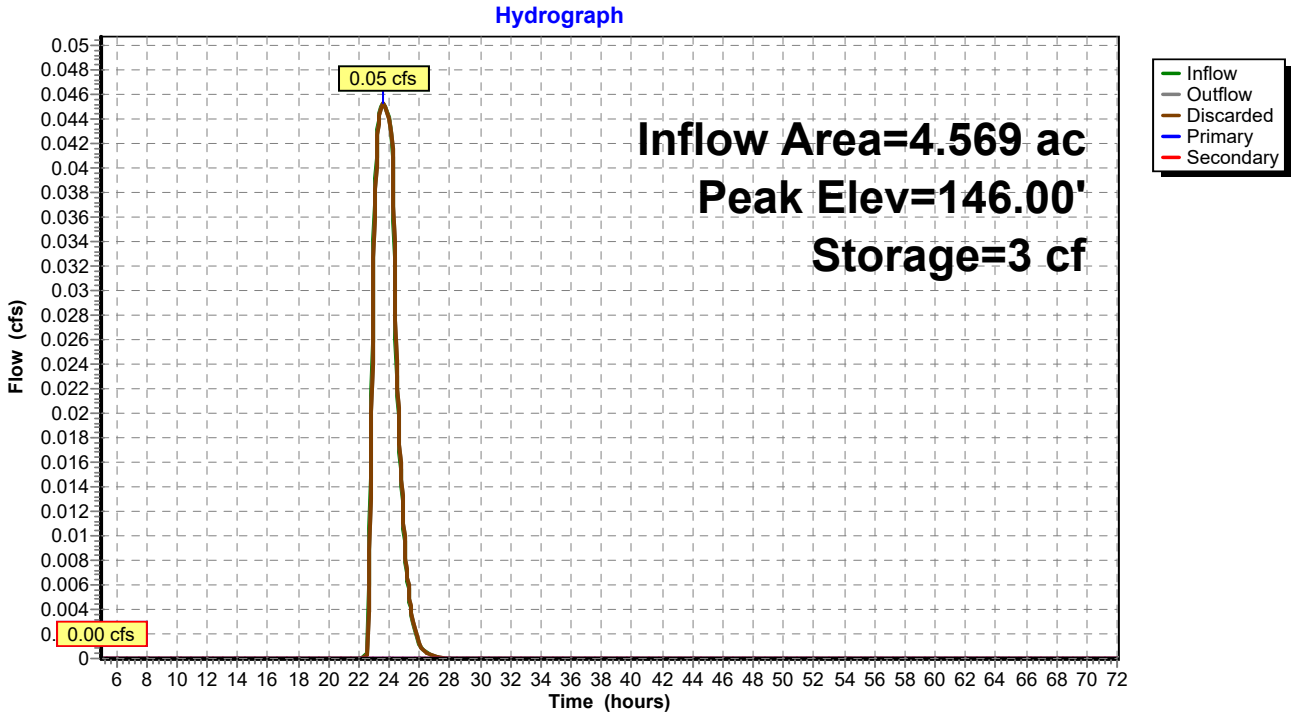
Device	Routing	Invert	Outlet Devices
#1	Discarded	145.99'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	149.00'	**12.0" Round Culvert** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 149.00' / 148.25' S= 0.0107 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	149.08'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	150.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	151.00'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.08 cfs @ 23.60 hrs HW=146.00' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=145.99' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=145.99' (Free Discharge)
└**5=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Infiltration Basin

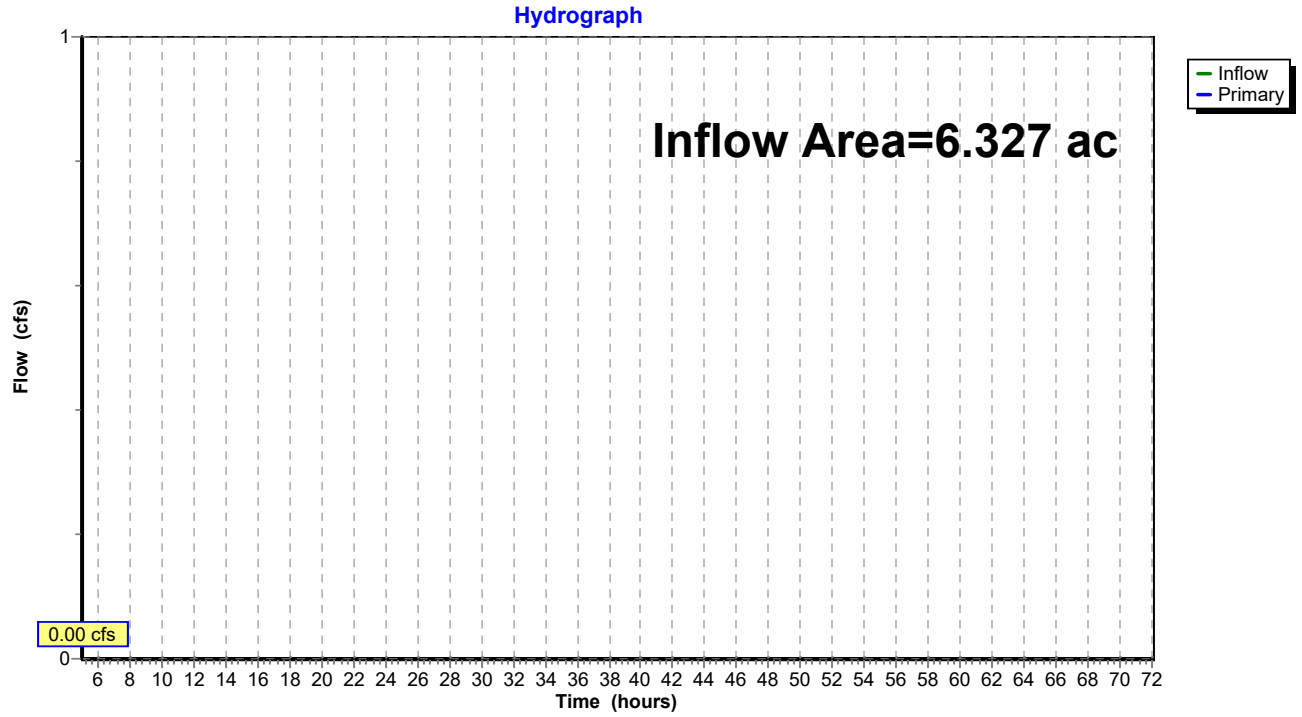


Summary for Link POST-DP-1: Analysis Point

Inflow Area = 6.327 ac, 21.16% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs

Link POST-DP-1: Analysis Point



Summary for Subcatchment POST-1S-A:

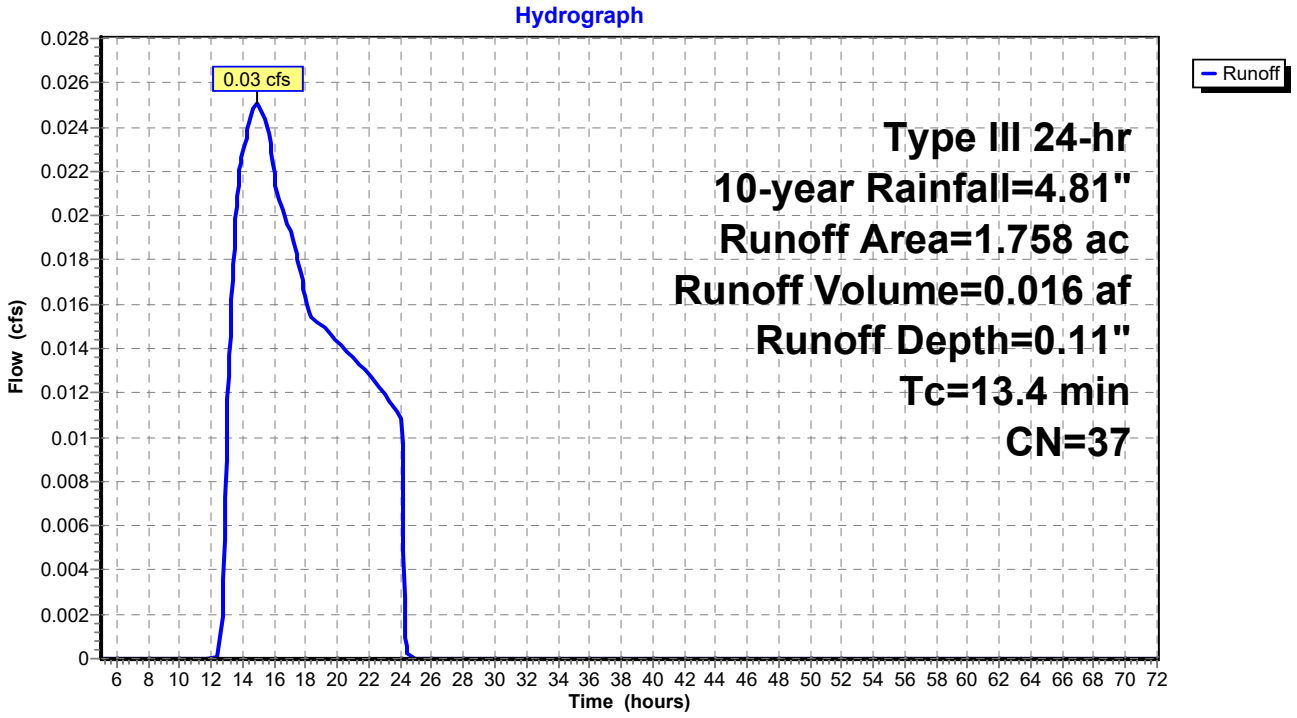
Runoff = 0.03 cfs @ 14.94 hrs, Volume= 0.016 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.81"

	Area (ac)	CN	Description
*	0.127	98	Pavement, Roofs, Concrete Pads
*	0.024	96	Compacted Gravel
*	0.000	55	Crushed Stone Yard
	0.191	39	>75% Grass cover, Good, HSG A
	0.259	30	Meadow, non-grazed, HSG A
	1.157	30	Woods, Good, HSG A
	1.758	37	Weighted Average
	1.631		92.78% Pervious Area
	0.127		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4					**Direct Entry, See Tc calc sheet**

Subcatchment POST-1S-A:



Summary for Subcatchment POST-1S-B:

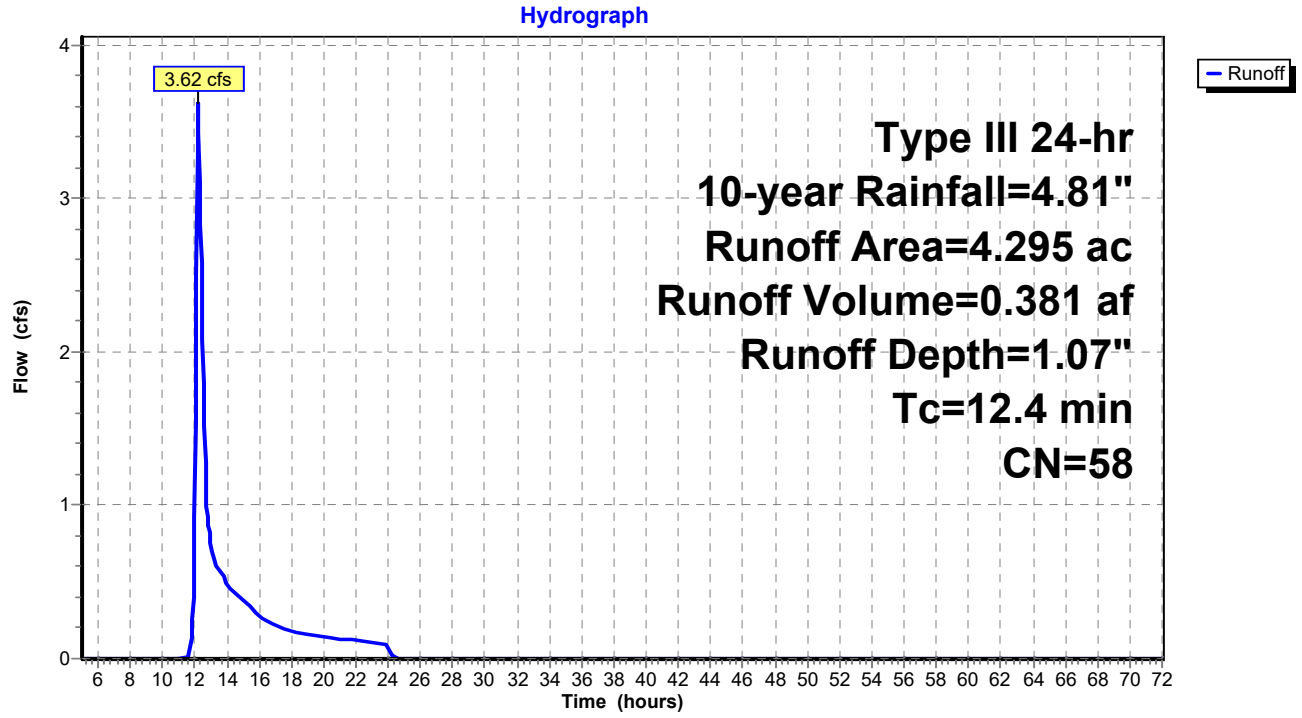
Runoff = 3.62 cfs @ 12.20 hrs, Volume= 0.381 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.81"

	Area (ac)	CN	Description
*	1.212	98	Pavement, Roofs, Concrete Pads
*	0.350	96	Compacted Gravel
*	0.572	55	Crushed Stone Yard
	0.283	39	>75% Grass cover, Good, HSG A
	0.456	30	Meadow, non-grazed, HSG A
	1.422	30	Woods, Good, HSG A
	4.295	58	Weighted Average
	3.083		71.78% Pervious Area
	1.212		28.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4					**Direct Entry, See Tc calc sheet**

Subcatchment POST-1S-B:



Summary for Subcatchment POST-1S-C:

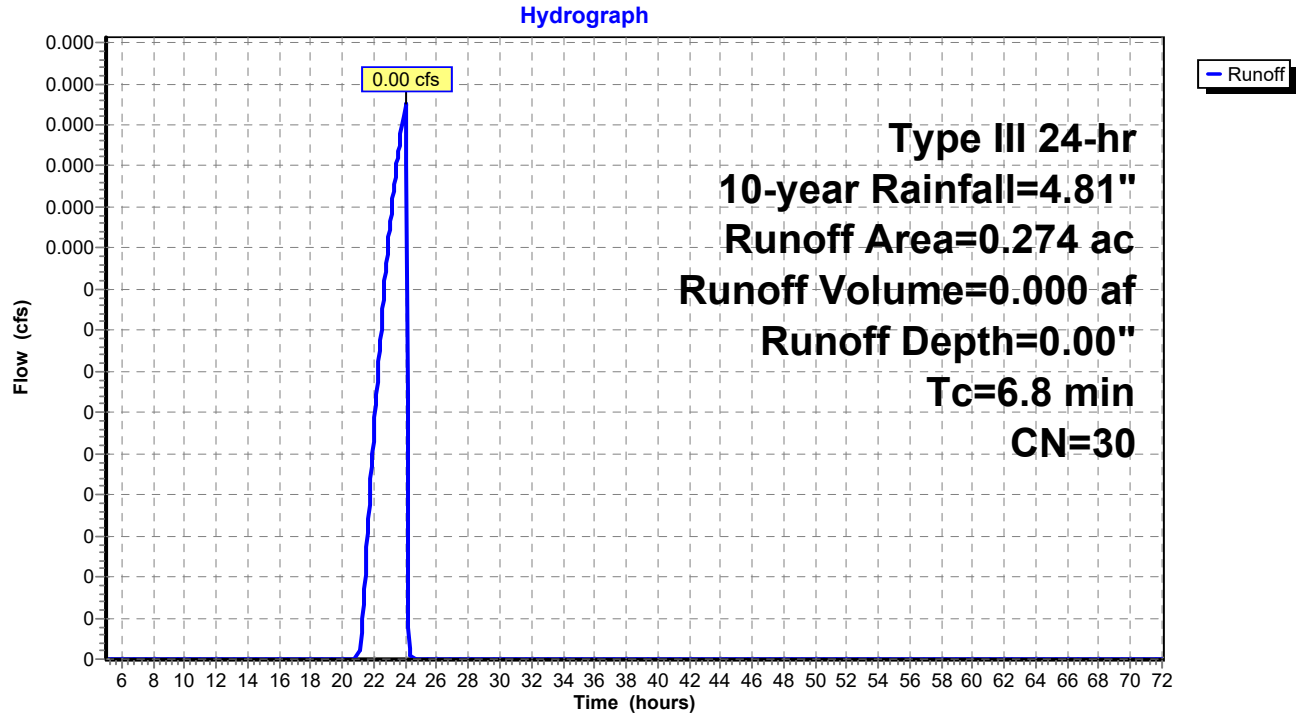
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.81"

	Area (ac)	CN	Description
*	0.000	98	Pavement, Roofs, Concrete Pads
*	0.000	96	Compacted Gravel
*	0.000	55	Crushed Stone Yard
	0.000	39	>75% Grass cover, Good, HSG A
	0.103	30	Meadow, non-grazed, HSG A
	0.171	30	Woods, Good, HSG A
	0.274	30	Weighted Average
	0.274		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8					**Direct Entry, See Tc calc sheet**

Subcatchment POST-1S-C:



Summary for Pond 1P: Sed. Forebay 1

Inflow Area = 4.295 ac, 28.22% Impervious, Inflow Depth = 1.07" for 10-year event
Inflow = 3.62 cfs @ 12.20 hrs, Volume= 0.381 af
Outflow = 2.99 cfs @ 12.34 hrs, Volume= 0.320 af, Atten= 17%, Lag= 8.4 min
Primary = 2.99 cfs @ 12.34 hrs, Volume= 0.320 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 155.35' @ 12.34 hrs Surf.Area= 2,562 sf Storage= 3,065 cf
Flood Elev= 156.00' Surf.Area= 3,291 sf Storage= 4,959 cf

Plug-Flow detention time= 107.8 min calculated for 0.320 af (84% of inflow)
Center-of-Mass det. time= 36.5 min (927.5 - 891.1)

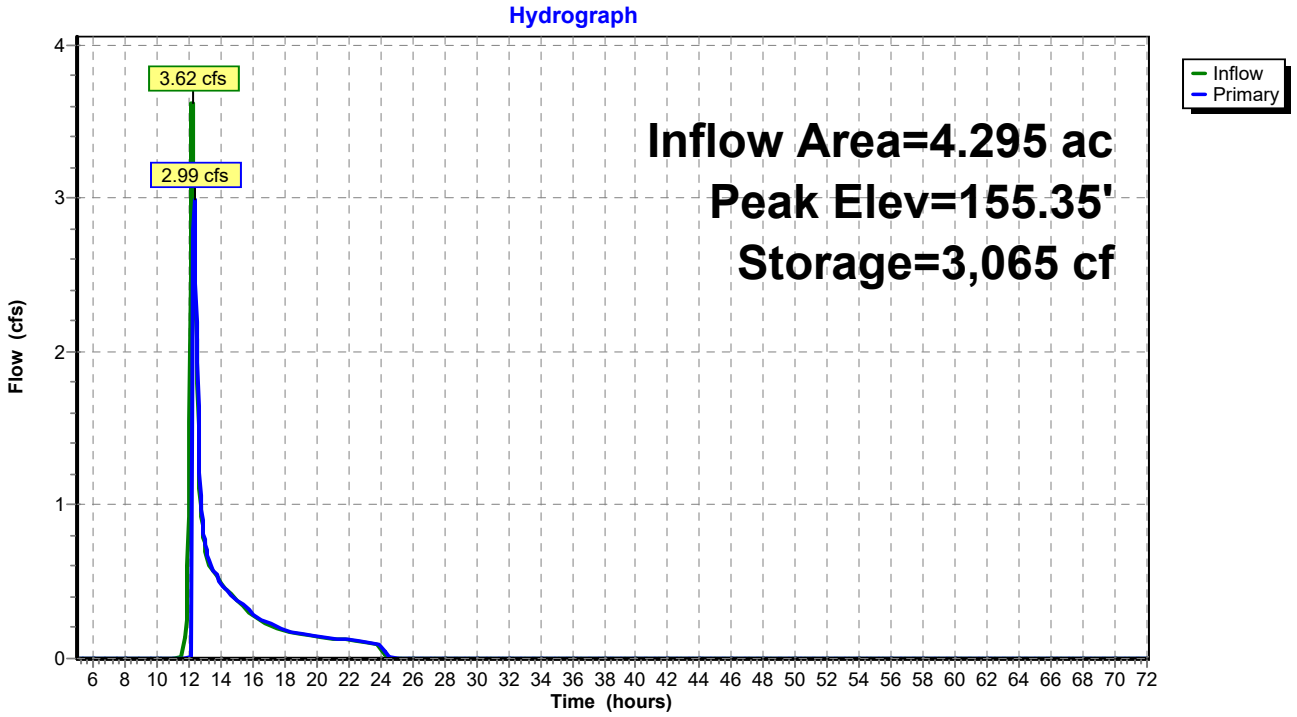
Volume	Invert	Avail.Storage	Storage Description
#1	153.00'	4,959 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
153.00	150	395.0	0	0	150
154.00	1,158	411.0	575	575	1,253
155.00	2,205	427.0	1,654	2,229	2,399
156.00	3,291	607.0	2,730	4,959	17,219

Device	Routing	Invert	Outlet Devices
#1	Primary	155.20'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	155.25'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=2.95 cfs @ 12.34 hrs HW=155.35' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Weir Controls 1.91 cfs @ 1.27 fps)
2=Sharp-Crested Rectangular Weir (Weir Controls 1.04 cfs @ 1.04 fps)

Pond 1P: Sed. Forebay 1



Summary for Pond 2P: Sed. Forebay 2

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 0.84" for 10-year event
Inflow = 2.99 cfs @ 12.34 hrs, Volume= 0.320 af
Outflow = 1.17 cfs @ 12.72 hrs, Volume= 0.265 af, Atten= 61%, Lag= 22.6 min
Primary = 1.17 cfs @ 12.72 hrs, Volume= 0.265 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 153.98' @ 12.72 hrs Surf.Area= 2,056 sf Storage= 2,931 cf
Flood Elev= 156.00' Surf.Area= 3,180 sf Storage= 8,196 cf

Plug-Flow detention time= 124.7 min calculated for 0.265 af (83% of inflow)
Center-of-Mass det. time= 49.7 min (977.3 - 927.6)

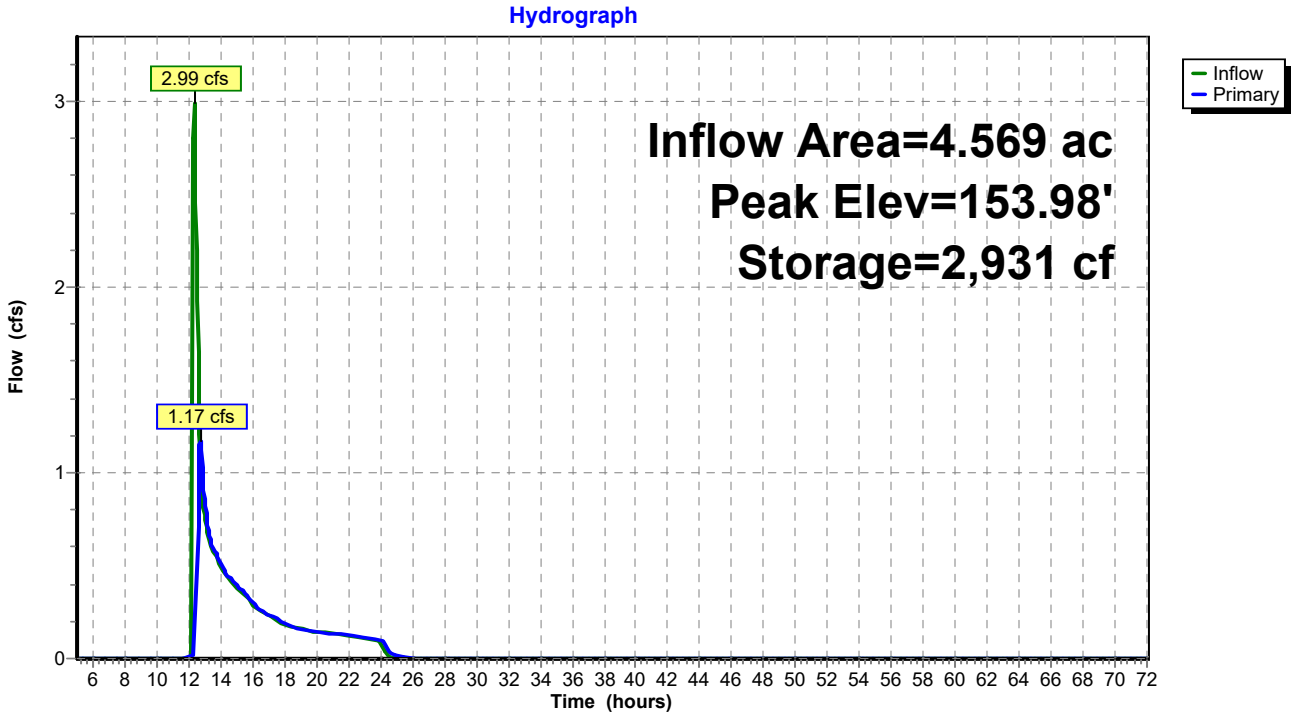
Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	8,196 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
152.00	1,173	149.0	0	0	1,173
153.00	1,370	153.0	1,270	1,270	1,352
154.00	2,075	195.0	1,710	2,981	2,528
156.00	3,180	235.0	5,216	8,196	3,963

Device	Routing	Invert	Outlet Devices
#1	Primary	153.00'	**24.0" Round Culvert** L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 153.00' / 152.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	153.70'	**30.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	155.00'	**30.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.15 cfs @ 12.72 hrs HW=153.97' (Free Discharge)
↑**1=Culvert** (Passes 1.15 cfs of 5.10 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 1.15 cfs @ 1.68 fps)
3=Orifice/Grate (Controls 0.00 cfs)

Pond 2P: Sed. Forebay 2



Summary for Pond 3P: Infiltration Basin

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 0.70" for 10-year event
Inflow = 1.17 cfs @ 12.72 hrs, Volume= 0.265 af
Outflow = 0.40 cfs @ 14.99 hrs, Volume= 0.265 af, Atten= 66%, Lag= 135.9 min
Discarded = 0.15 cfs @ 14.99 hrs, Volume= 0.204 af
Primary = 0.25 cfs @ 14.99 hrs, Volume= 0.061 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 149.24' @ 14.99 hrs Surf.Area= 2,640 sf Storage= 3,692 cf
Flood Elev= 152.25' Surf.Area= 5,856 sf Storage= 15,303 cf

Plug-Flow detention time= 262.3 min calculated for 0.265 af (100% of inflow)
Center-of-Mass det. time= 262.5 min (1,239.8 - 977.3)

Volume	Invert	Avail.Storage	Storage Description
#1	145.99'	15,303 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
145.99	1,456	342.0	0.0	0	0	1,456
146.00	1,456	342.0	40.0	6	6	1,459
147.99	1,456	342.0	40.0	1,159	1,165	2,140
148.00	1,456	342.0	100.0	15	1,179	2,143
150.00	3,530	444.0	100.0	4,835	6,015	8,572
152.00	5,856	480.0	100.0	9,288	15,303	11,375

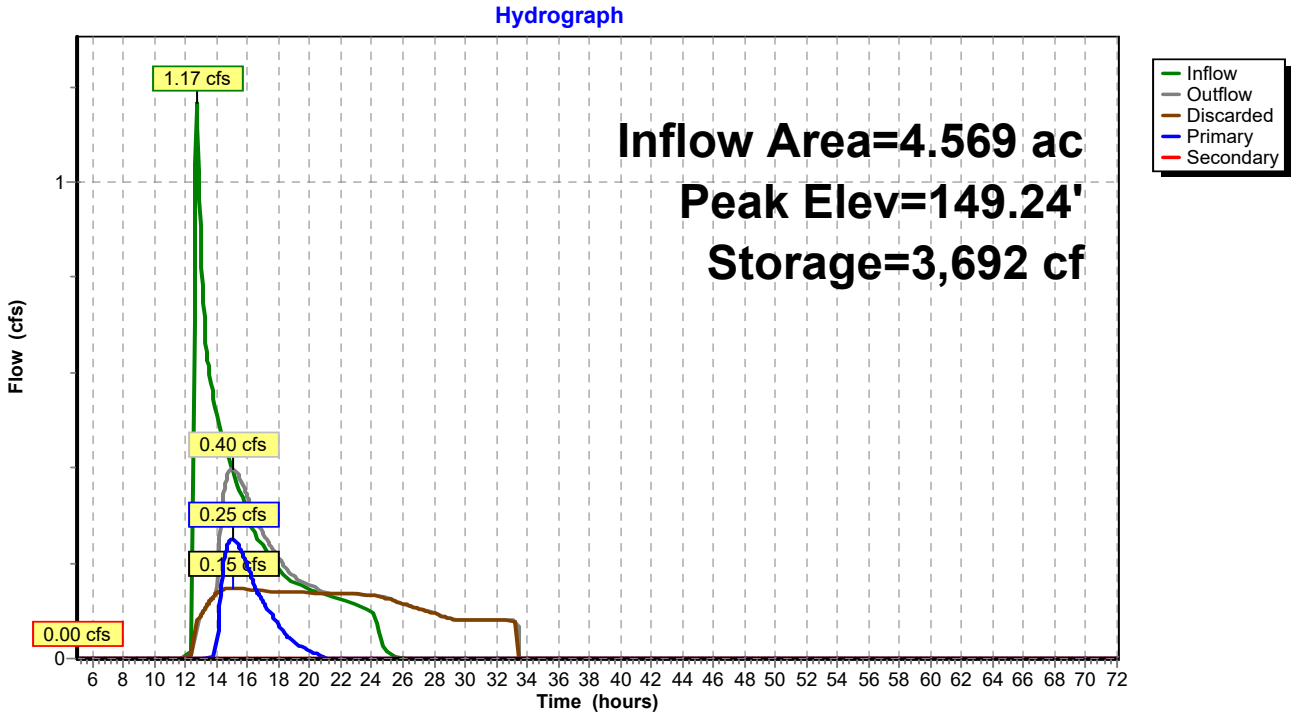
Device	Routing	Invert	Outlet Devices
#1	Discarded	145.99'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	149.00'	**12.0" Round Culvert** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 149.00' / 148.25' S= 0.0107 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	149.08'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	150.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	151.00'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.15 cfs @ 14.99 hrs HW=149.24' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=0.25 cfs @ 14.99 hrs HW=149.24' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.25 cfs @ 1.68 fps)
  ├**3=Orifice/Grate** (Passes 0.25 cfs of 0.43 cfs potential flow)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=145.99' (Free Discharge)
└**5=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Infiltration Basin

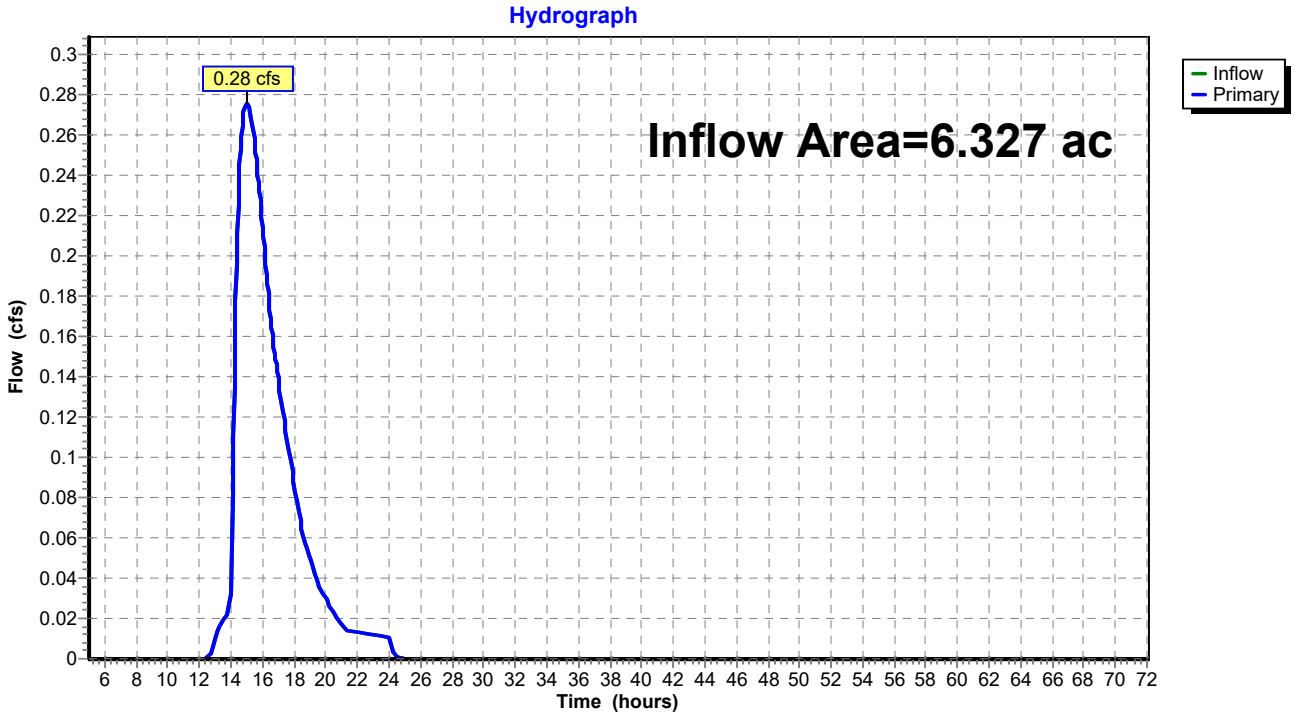


Summary for Link POST-DP-1: Analysis Point

Inflow Area = 6.327 ac, 21.16% Impervious, Inflow Depth = 0.15" for 10-year event
Inflow = 0.28 cfs @ 14.98 hrs, Volume= 0.077 af
Primary = 0.28 cfs @ 14.98 hrs, Volume= 0.077 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs

Link POST-DP-1: Analysis Point



Summary for Subcatchment POST-1S-A:

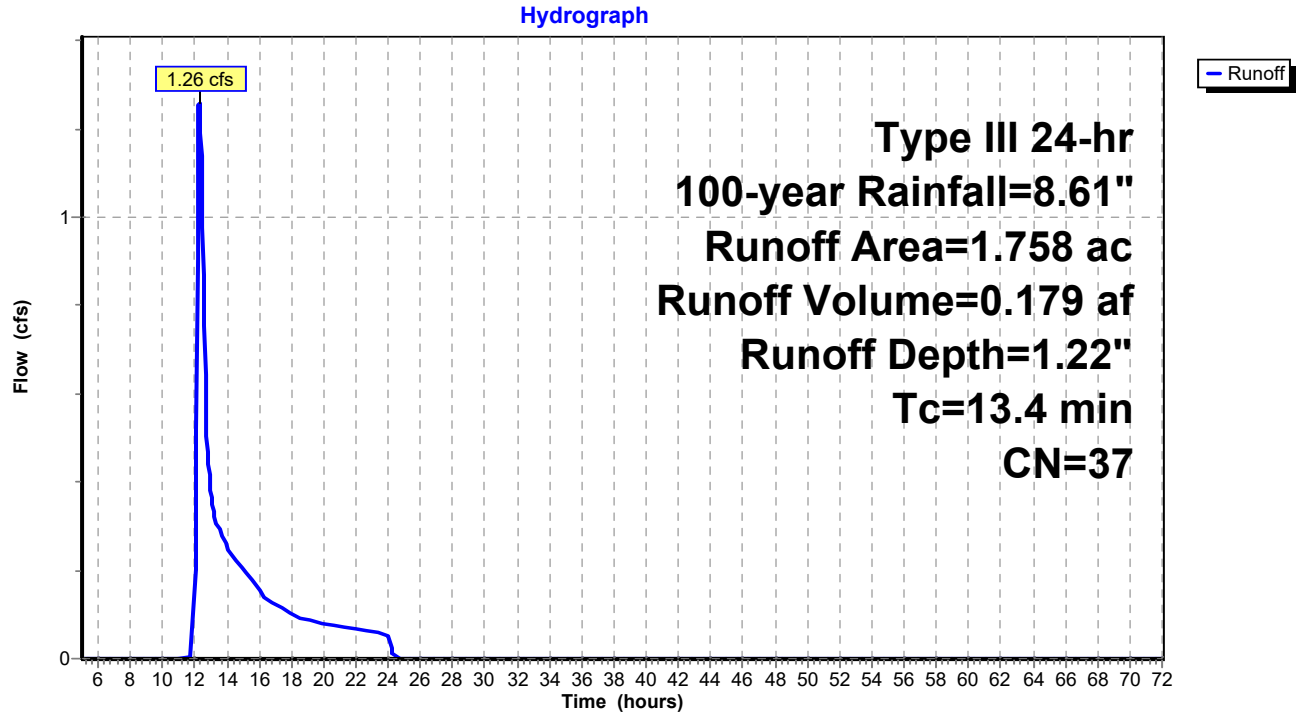
Runoff = 1.26 cfs @ 12.27 hrs, Volume= 0.179 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.61"

	Area (ac)	CN	Description
*	0.127	98	Pavement, Roofs, Concrete Pads
*	0.024	96	Compacted Gravel
*	0.000	55	Crushed Stone Yard
	0.191	39	>75% Grass cover, Good, HSG A
	0.259	30	Meadow, non-grazed, HSG A
	1.157	30	Woods, Good, HSG A
	1.758	37	Weighted Average
	1.631		92.78% Pervious Area
	0.127		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4					**Direct Entry, See Tc calc sheet**

Subcatchment POST-1S-A:



Summary for Subcatchment POST-1S-B:

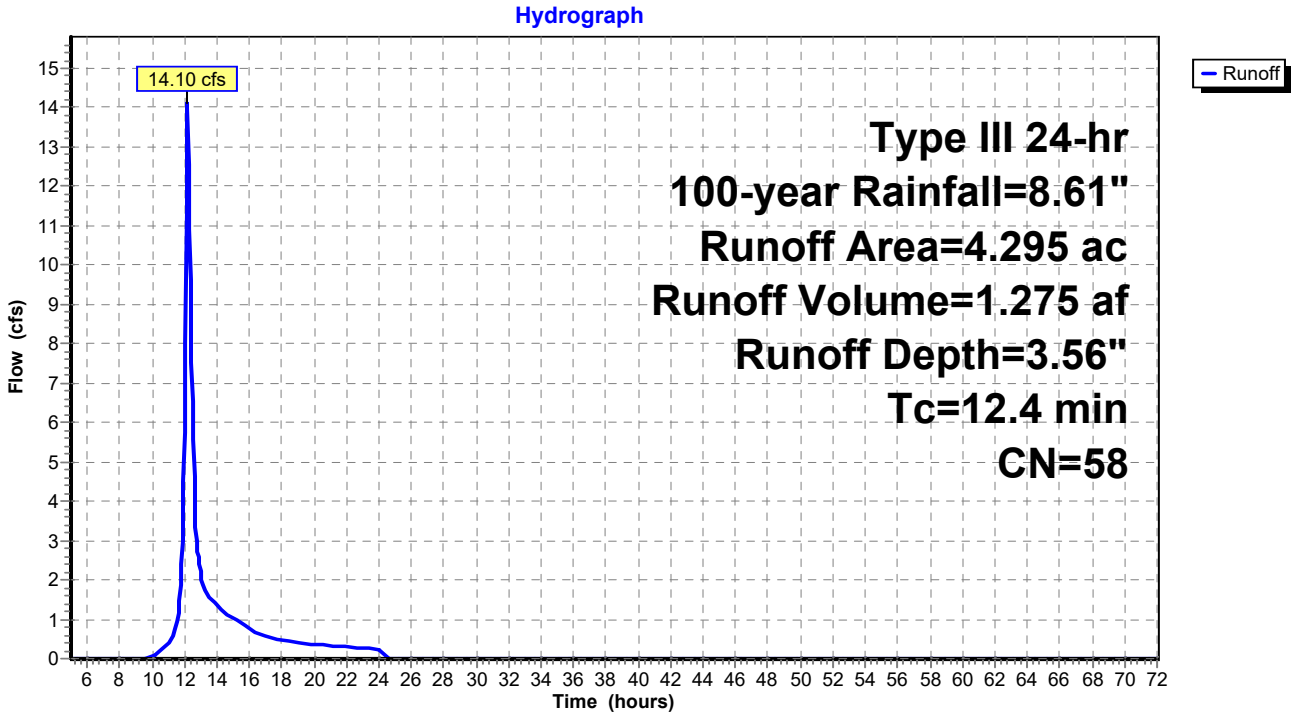
Runoff = 14.10 cfs @ 12.18 hrs, Volume= 1.275 af, Depth= 3.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.61"

	Area (ac)	CN	Description
*	1.212	98	Pavement, Roofs, Concrete Pads
*	0.350	96	Compacted Gravel
*	0.572	55	Crushed Stone Yard
	0.283	39	>75% Grass cover, Good, HSG A
	0.456	30	Meadow, non-grazed, HSG A
	1.422	30	Woods, Good, HSG A
	4.295	58	Weighted Average
	3.083		71.78% Pervious Area
	1.212		28.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4					**Direct Entry, See Tc calc sheet**

Subcatchment POST-1S-B:



Summary for Subcatchment POST-1S-C:

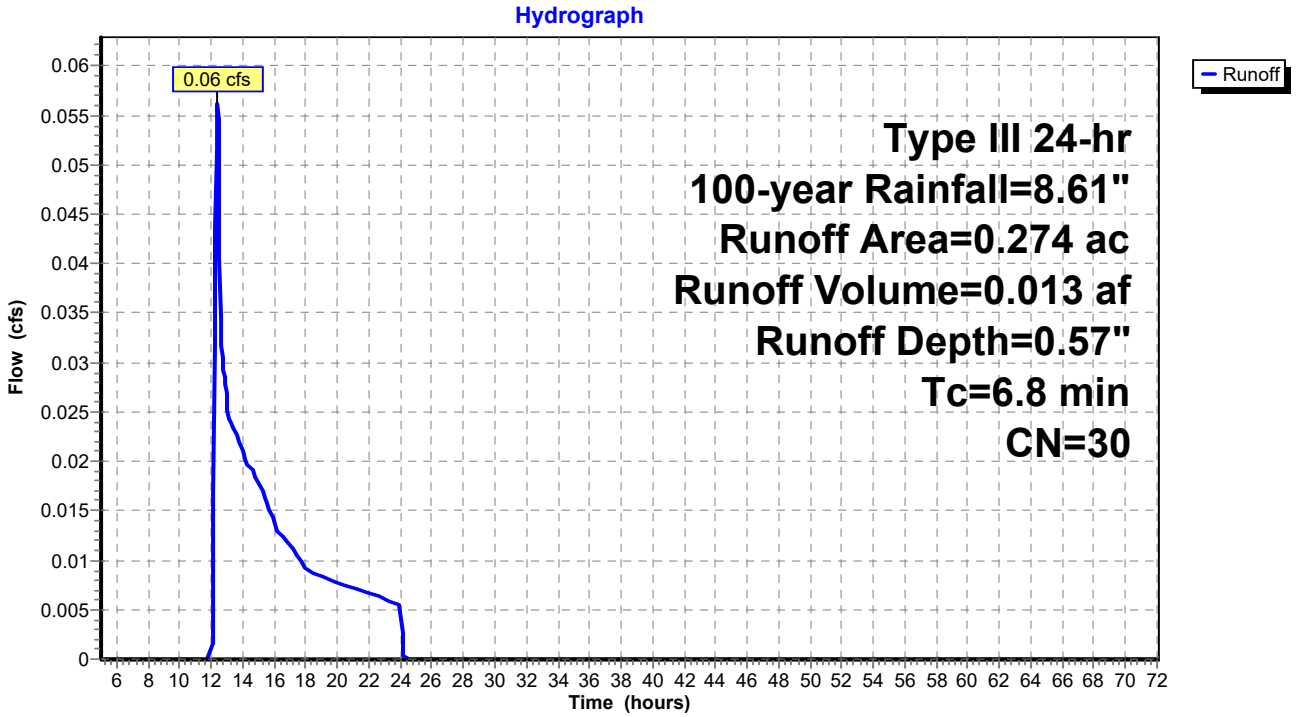
Runoff = 0.06 cfs @ 12.38 hrs, Volume= 0.013 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.61"

	Area (ac)	CN	Description
*	0.000	98	Pavement, Roofs, Concrete Pads
*	0.000	96	Compacted Gravel
*	0.000	55	Crushed Stone Yard
	0.000	39	>75% Grass cover, Good, HSG A
	0.103	30	Meadow, non-grazed, HSG A
	0.171	30	Woods, Good, HSG A
	0.274	30	Weighted Average
	0.274		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8					**Direct Entry, See Tc calc sheet**

Subcatchment POST-1S-C:



Summary for Pond 1P: Sed. Forebay 1

Inflow Area = 4.295 ac, 28.22% Impervious, Inflow Depth = 3.56" for 100-year event
Inflow = 14.10 cfs @ 12.18 hrs, Volume= 1.275 af
Outflow = 14.10 cfs @ 12.20 hrs, Volume= 1.213 af, Atten= 0%, Lag= 1.0 min
Primary = 14.10 cfs @ 12.20 hrs, Volume= 1.213 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 155.59' @ 12.20 hrs Surf.Area= 2,815 sf Storage= 3,695 cf
Flood Elev= 156.00' Surf.Area= 3,291 sf Storage= 4,959 cf

Plug-Flow detention time= 38.0 min calculated for 1.213 af (95% of inflow)
Center-of-Mass det. time= 11.8 min (864.4 - 852.6)

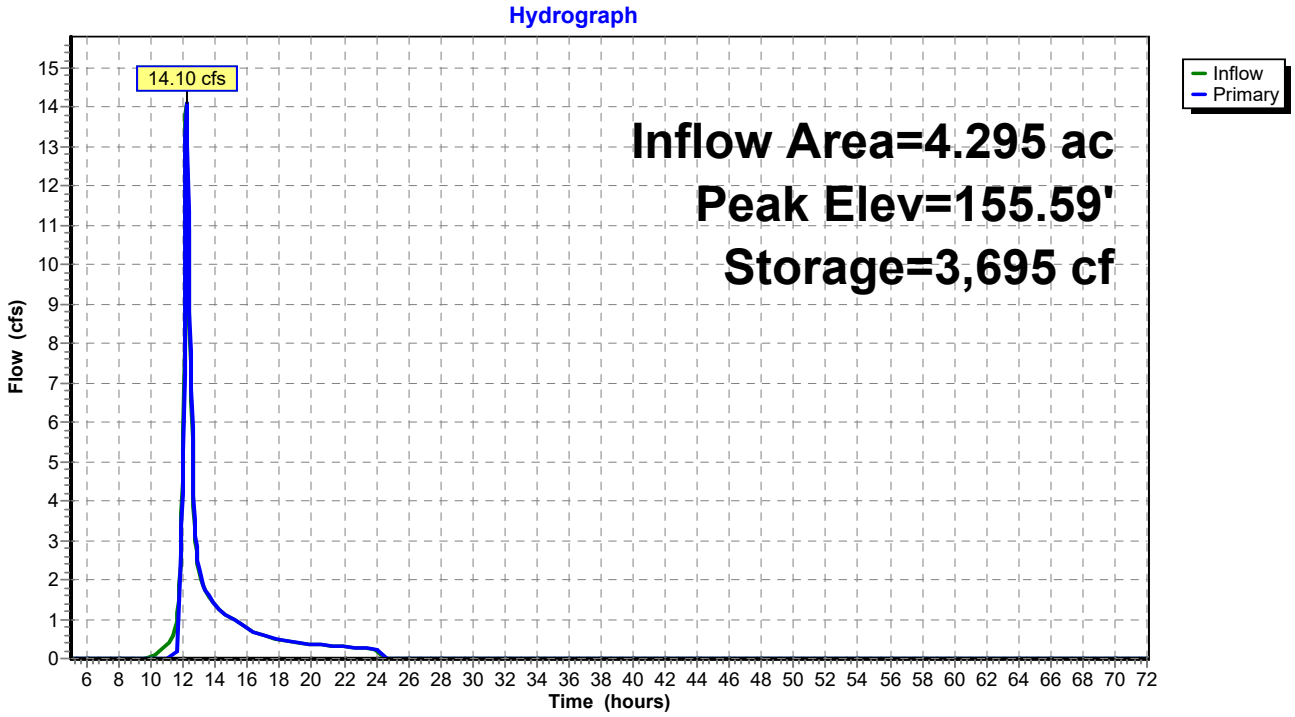
Volume	Invert	Avail.Storage	Storage Description
#1	153.00'	4,959 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
153.00	150	395.0	0	0	150
154.00	1,158	411.0	575	575	1,253
155.00	2,205	427.0	1,654	2,229	2,399
156.00	3,291	607.0	2,730	4,959	17,219

Device	Routing	Invert	Outlet Devices
#1	Primary	155.20'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	155.25'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=14.04 cfs @ 12.20 hrs HW=155.58' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 7.75 cfs @ 2.03 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 6.29 cfs @ 1.89 fps)

Pond 1P: Sed. Forebay 1



Summary for Pond 2P: Sed. Forebay 2

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 3.22" for 100-year event
Inflow = 14.13 cfs @ 12.20 hrs, Volume= 1.226 af
Outflow = 13.34 cfs @ 12.26 hrs, Volume= 1.171 af, Atten= 6%, Lag= 3.6 min
Primary = 13.34 cfs @ 12.26 hrs, Volume= 1.171 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 155.14' @ 12.26 hrs Surf.Area= 2,678 sf Storage= 5,692 cf
Flood Elev= 156.00' Surf.Area= 3,180 sf Storage= 8,196 cf

Plug-Flow detention time= 38.5 min calculated for 1.171 af (96% of inflow)
Center-of-Mass det. time= 14.0 min (879.5 - 865.5)

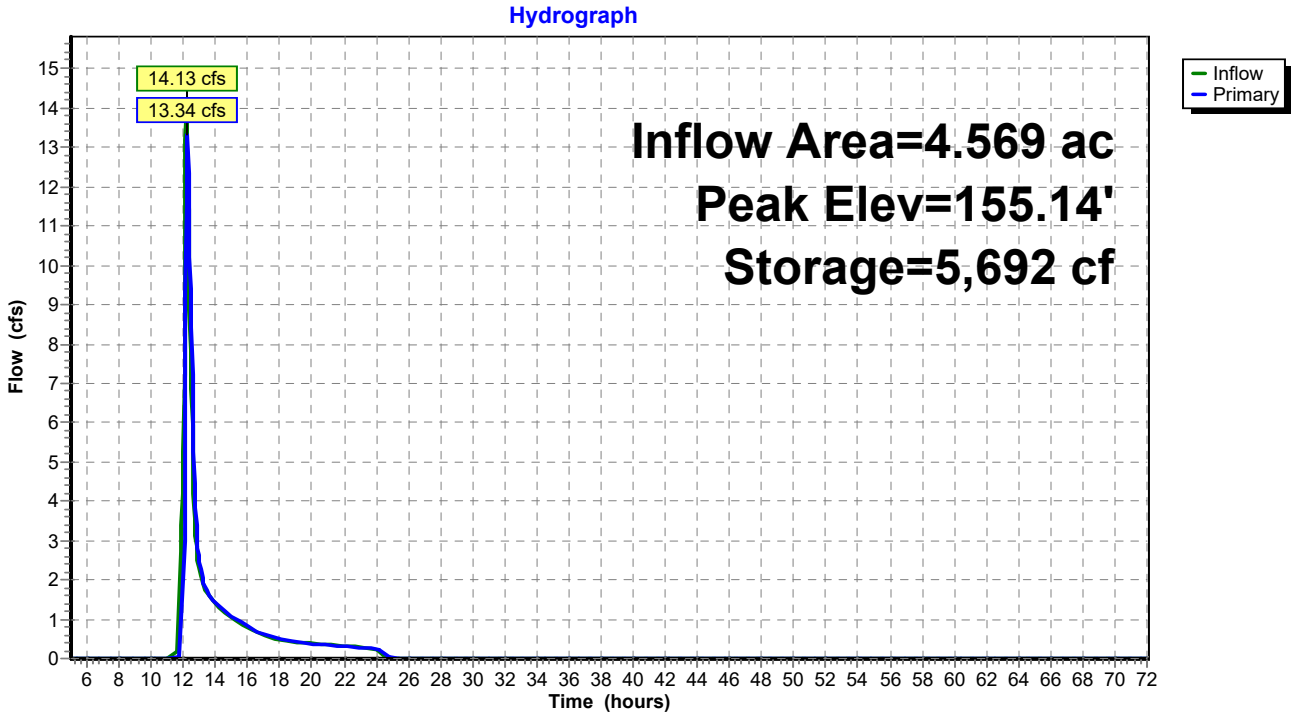
Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	8,196 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
152.00	1,173	149.0	0	0	1,173
153.00	1,370	153.0	1,270	1,270	1,352
154.00	2,075	195.0	1,710	2,981	2,528
156.00	3,180	235.0	5,216	8,196	3,963

Device	Routing	Invert	Outlet Devices
#1	Primary	153.00'	**24.0" Round Culvert** L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 153.00' / 152.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	153.70'	**30.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	155.00'	**30.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=13.15 cfs @ 12.26 hrs HW=155.14' (Free Discharge)
└**1=Culvert** (Passes 13.15 cfs of 16.12 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 11.50 cfs @ 4.60 fps)
  └**3=Orifice/Grate** (Weir Controls 1.65 cfs @ 1.21 fps)

Pond 2P: Sed. Forebay 2



Summary for Pond 3P: Infiltration Basin

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 3.08" for 100-year event
Inflow = 13.34 cfs @ 12.26 hrs, Volume= 1.171 af
Outflow = 8.36 cfs @ 12.51 hrs, Volume= 1.171 af, Atten= 37%, Lag= 15.3 min
Discarded = 0.27 cfs @ 12.51 hrs, Volume= 0.246 af
Primary = 4.61 cfs @ 12.51 hrs, Volume= 0.864 af
Secondary = 3.48 cfs @ 12.51 hrs, Volume= 0.061 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 151.22' @ 12.51 hrs Surf.Area= 4,884 sf Storage= 11,143 cf
Flood Elev= 152.25' Surf.Area= 5,856 sf Storage= 15,303 cf

Plug-Flow detention time= 82.0 min calculated for 1.170 af (100% of inflow)
Center-of-Mass det. time= 82.4 min (961.9 - 879.5)

Volume	Invert	Avail.Storage	Storage Description
#1	145.99'	15,303 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
145.99	1,456	342.0	0.0	0	0	1,456
146.00	1,456	342.0	40.0	6	6	1,459
147.99	1,456	342.0	40.0	1,159	1,165	2,140
148.00	1,456	342.0	100.0	15	1,179	2,143
150.00	3,530	444.0	100.0	4,835	6,015	8,572
152.00	5,856	480.0	100.0	9,288	15,303	11,375

Device	Routing	Invert	Outlet Devices
#1	Discarded	145.99'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	149.00'	**12.0" Round Culvert** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 149.00' / 148.25' S= 0.0107 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	149.08'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	150.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	151.00'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

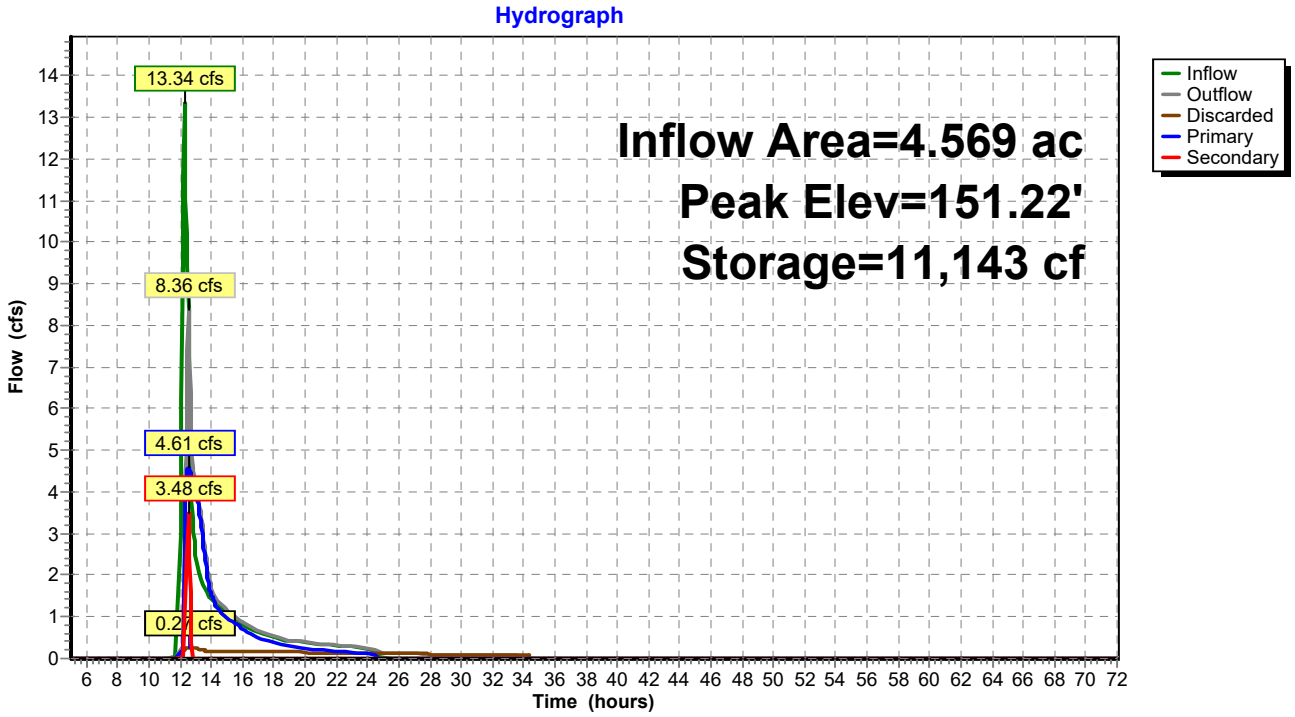
Discarded OutFlow Max=0.27 cfs @ 12.51 hrs HW=151.22' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=4.60 cfs @ 12.51 hrs HW=151.22' (Free Discharge)
└**2=Culvert** (Barrel Controls 4.60 cfs @ 5.86 fps)
  ├**3=Orifice/Grate** (Passes < 6.61 cfs potential flow)
  └**4=Orifice/Grate** (Passes < 15.97 cfs potential flow)

Secondary OutFlow Max=3.35 cfs @ 12.51 hrs HW=151.22' (Free Discharge)
└**5=Sharp-Crested Rectangular Weir** (Weir Controls 3.35 cfs @ 1.53 fps)

Design provides for 1' of freeboard.

Pond 3P: Infiltration Basin

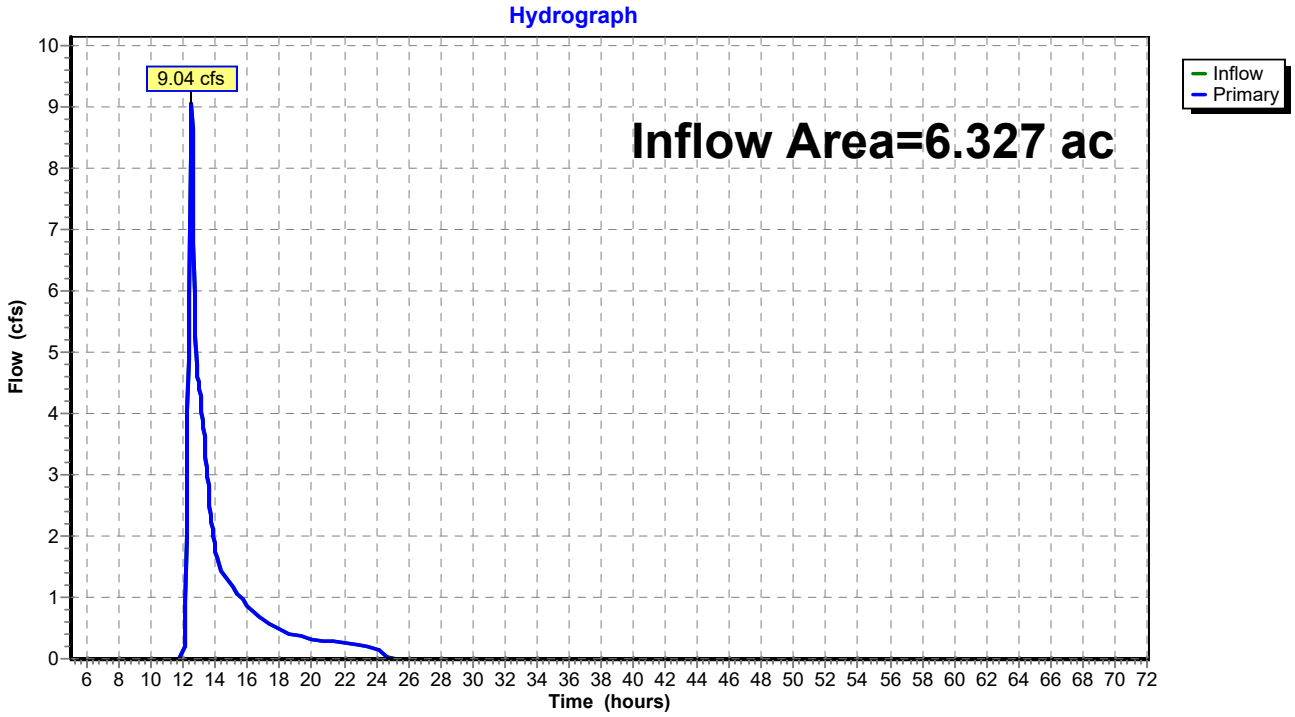


Summary for Link POST-DP-1: Analysis Point

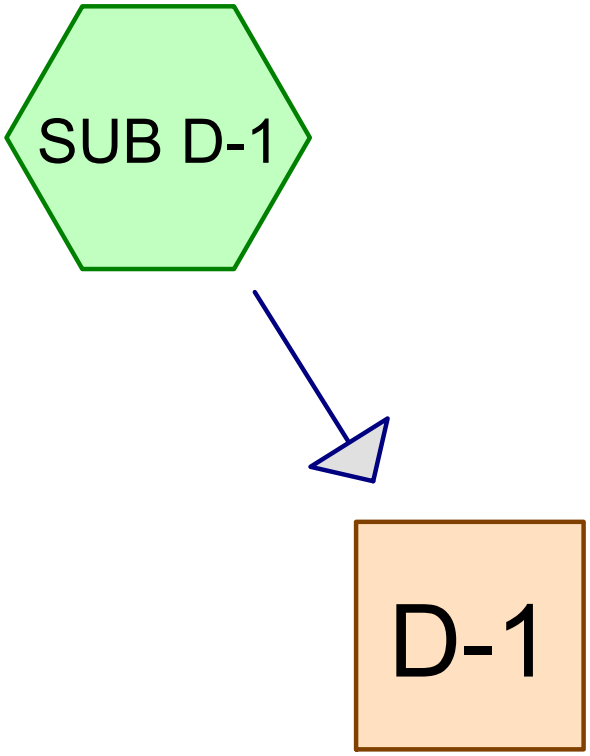
Inflow Area = 6.327 ac, 21.16% Impervious, Inflow Depth = 2.09" for 100-year event
Inflow = 9.04 cfs @ 12.51 hrs, Volume= 1.104 af
Primary = 9.04 cfs @ 12.51 hrs, Volume= 1.104 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs

Link POST-DP-1: Analysis Point



ACCESS ROAD SWALE



RIP RAP SWALE

Subcat Reach Pond Link

Routing Diagram for Holliston - Stormwater Model
Prepared by TRC, Printed 8/4/2022

Summary for Subcatchment SUB D-1:

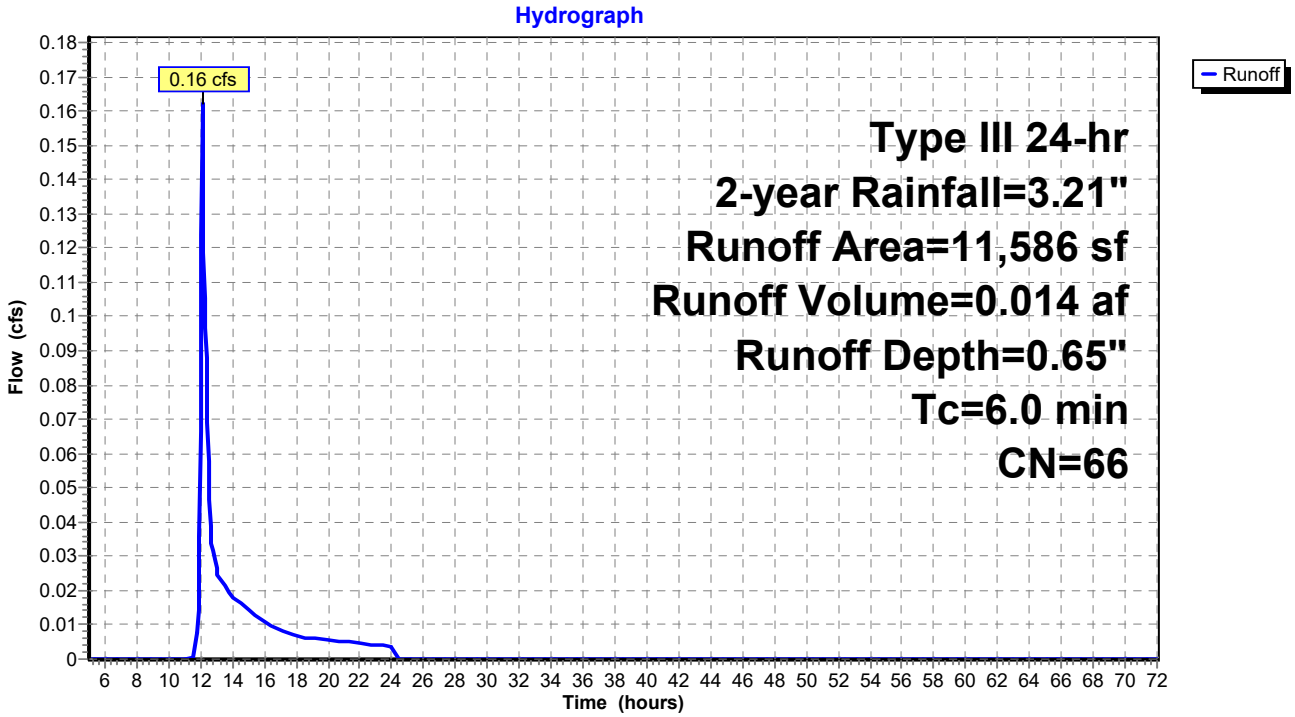
Runoff = 0.16 cfs @ 12.11 hrs, Volume= 0.014 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.21"

	Area (sf)	CN	Description
*	0	98	Pavement, Roofs, Concrete Pads
*	5,653	96	Compacted Gravel
*	1,762	55	Crushed Stone Yard
	0	39	>75% Grass cover, Good, HSG A
	1,300	30	Meadow, non-grazed, HSG A
	2,871	30	Woods, Good, HSG A
	11,586	66	Weighted Average
	11,586		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum of 6 mins for HydroCAD model**

Subcatchment SUB D-1:



Summary for Reach D-1: RIP RAP SWALE

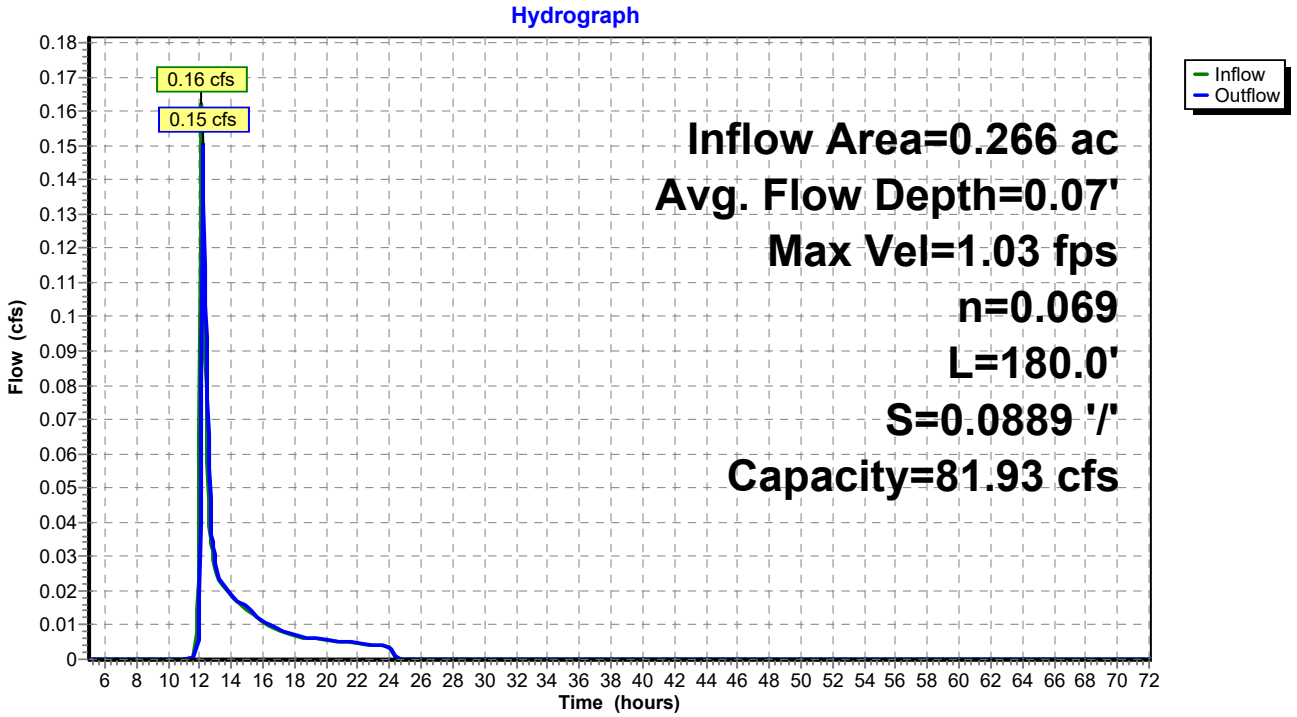
Inflow Area = 0.266 ac, 0.00% Impervious, Inflow Depth = 0.65" for 2-year event
Inflow = 0.16 cfs @ 12.11 hrs, Volume= 0.014 af
Outflow = 0.15 cfs @ 12.20 hrs, Volume= 0.014 af, Atten= 7%, Lag= 5.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.03 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 0.49 fps, Avg. Travel Time= 6.1 min

Peak Storage= 26 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.07' , Surface Width= 2.27'
Defined Flood Depth= 2.00' Flow Area= 12.0 sf, Capacity= 81.93 cfs
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 81.93 cfs

2.00' x 2.00' deep channel, n= 0.069 Riprap, 6-inch
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 180.0' Slope= 0.0889 '/'
Inlet Invert= 184.00', Outlet Invert= 168.00'

Reach D-1: RIP RAP SWALE



Summary for Subcatchment SUB D-1:

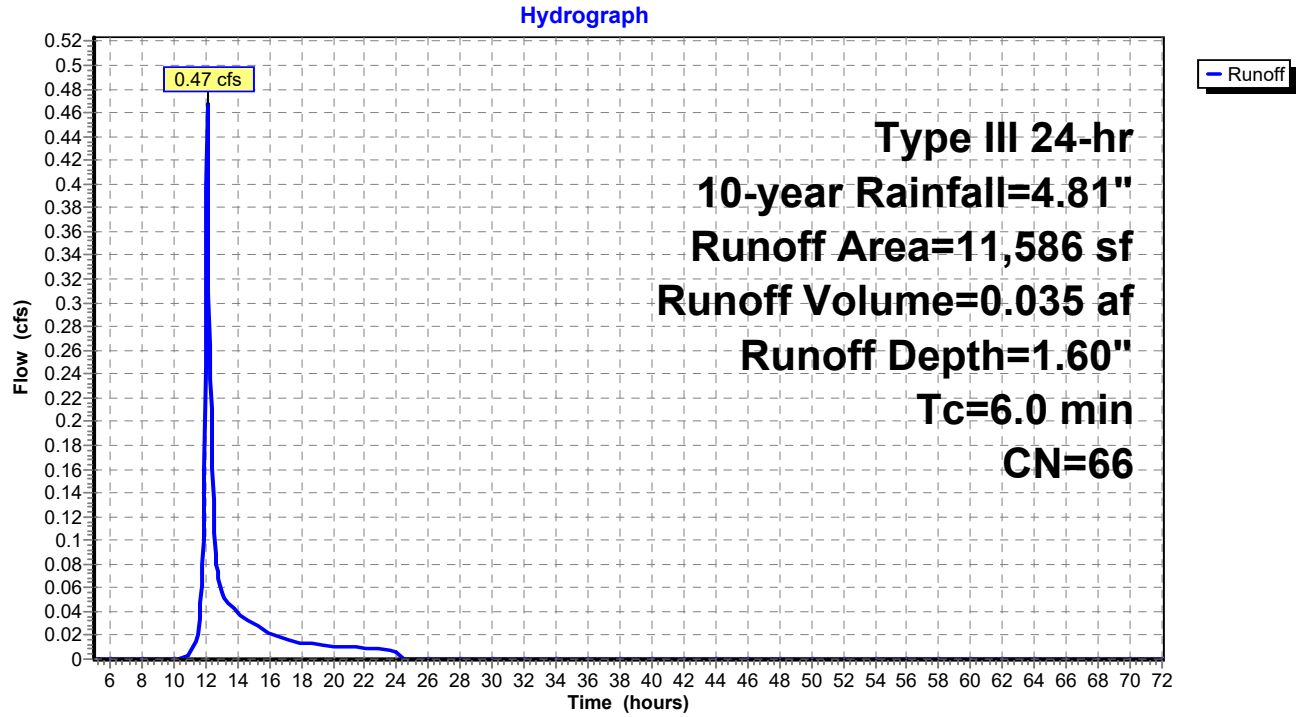
Runoff = 0.47 cfs @ 12.10 hrs, Volume= 0.035 af, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.81"

	Area (sf)	CN	Description
*	0	98	Pavement, Roofs, Concrete Pads
*	5,653	96	Compacted Gravel
*	1,762	55	Crushed Stone Yard
	0	39	>75% Grass cover, Good, HSG A
	1,300	30	Meadow, non-grazed, HSG A
	2,871	30	Woods, Good, HSG A
	11,586	66	Weighted Average
	11,586		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum of 6 mins for HydroCAD model**

Subcatchment SUB D-1:



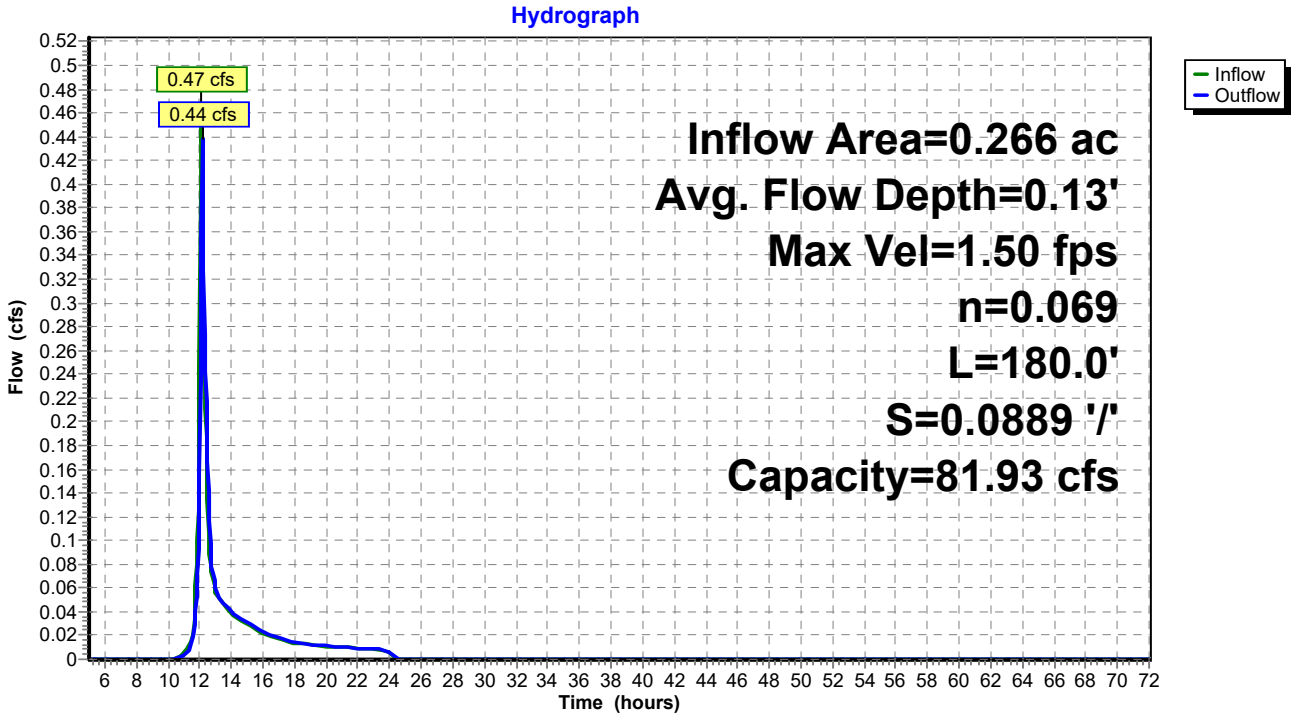
Summary for Reach D-1: RIP RAP SWALE

Inflow Area = 0.266 ac, 0.00% Impervious, Inflow Depth = 1.60" for 10-year event
Inflow = 0.47 cfs @ 12.10 hrs, Volume= 0.035 af
Outflow = 0.44 cfs @ 12.16 hrs, Volume= 0.035 af, Atten= 6%, Lag= 3.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.50 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.55 fps, Avg. Travel Time= 5.5 min

Peak Storage= 53 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.13' , Surface Width= 2.52'
Defined Flood Depth= 2.00' Flow Area= 12.0 sf, Capacity= 81.93 cfs
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 81.93 cfs

2.00' x 2.00' deep channel, n= 0.069 Riprap, 6-inch
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 180.0' Slope= 0.0889 '/'
Inlet Invert= 184.00', Outlet Invert= 168.00'



Summary for Subcatchment SUB D-1:

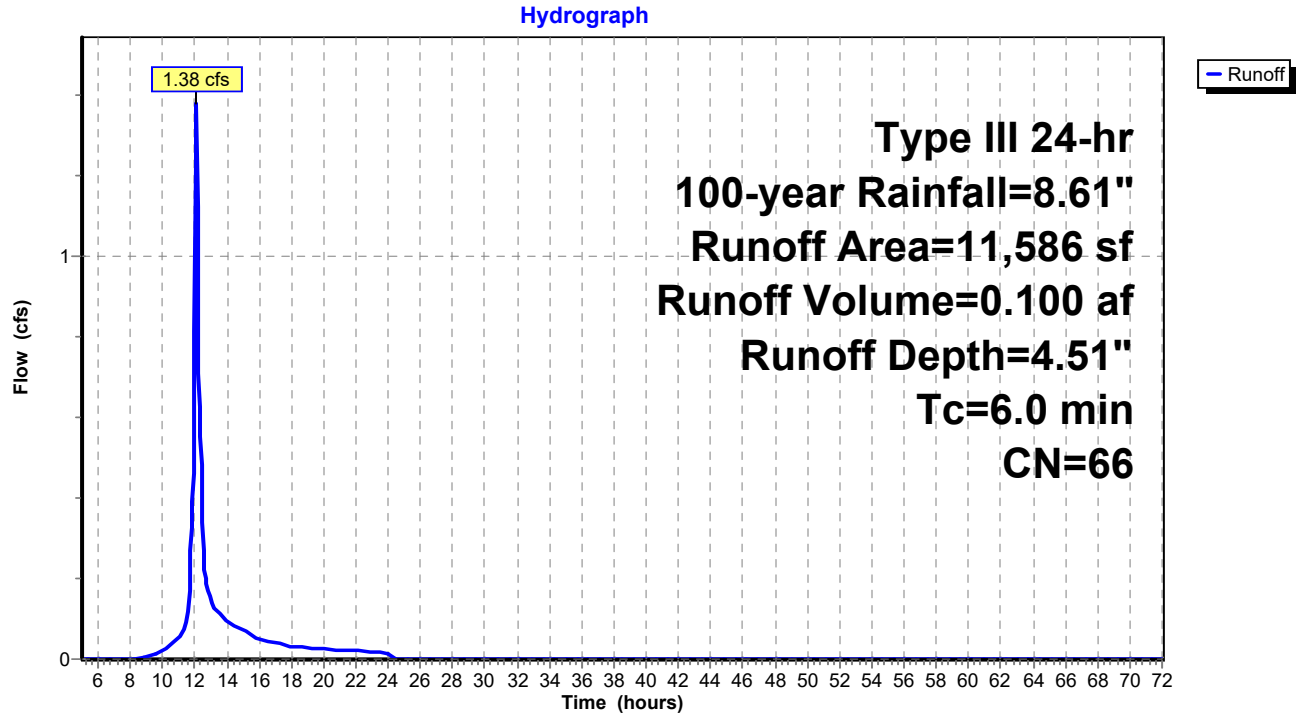
Runoff = 1.38 cfs @ 12.09 hrs, Volume= 0.100 af, Depth= 4.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.61"

	Area (sf)	CN	Description
*	0	98	Pavement, Roofs, Concrete Pads
*	5,653	96	Compacted Gravel
*	1,762	55	Crushed Stone Yard
	0	39	>75% Grass cover, Good, HSG A
	1,300	30	Meadow, non-grazed, HSG A
	2,871	30	Woods, Good, HSG A
	11,586	66	Weighted Average
	11,586		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum of 6 mins for HydroCAD model**

Subcatchment SUB D-1:



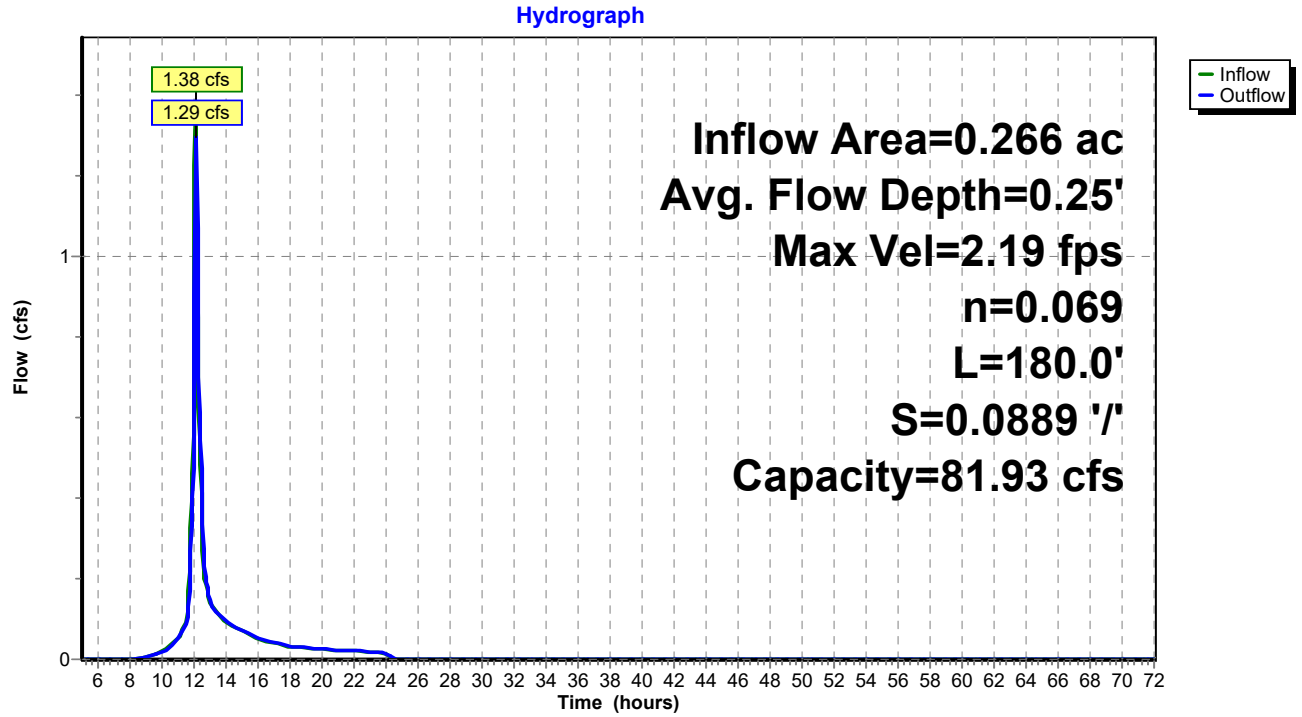
Summary for Reach D-1: RIP RAP SWALE

Inflow Area = 0.266 ac, 0.00% Impervious, Inflow Depth = 4.51" for 100-year event
Inflow = 1.38 cfs @ 12.09 hrs, Volume= 0.100 af
Outflow = 1.29 cfs @ 12.14 hrs, Volume= 0.100 af, Atten= 6%, Lag= 2.5 min

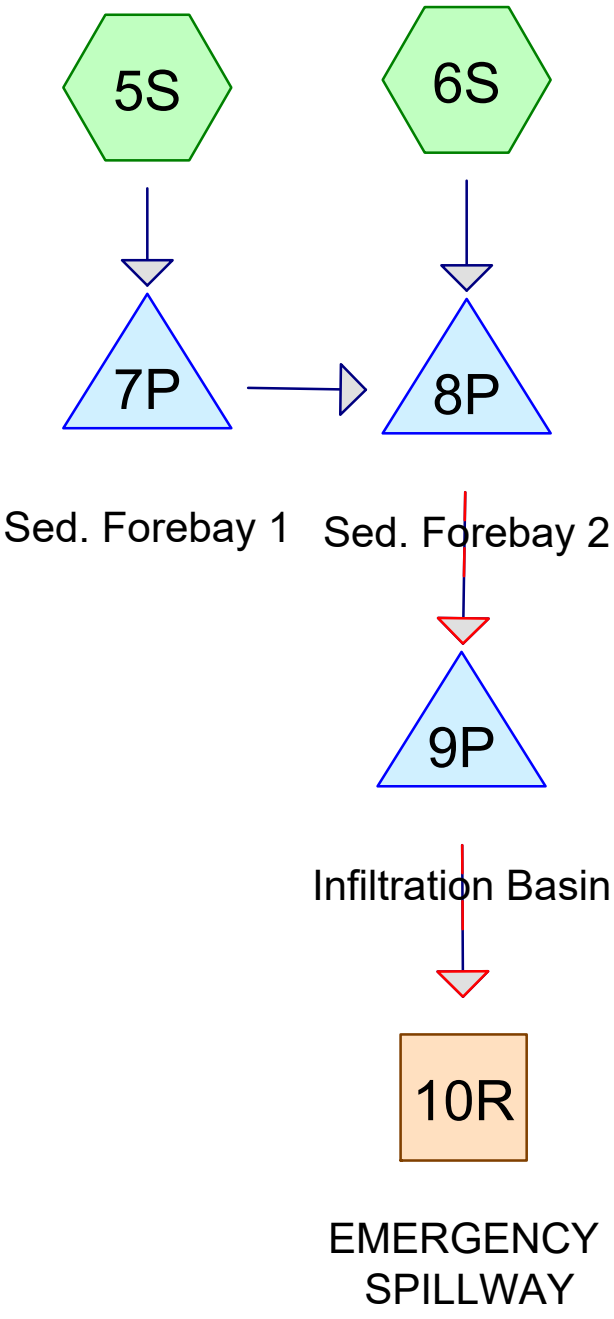
Routing by Stor-Ind+Trans method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.19 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.67 fps, Avg. Travel Time= 4.5 min

Peak Storage= 112 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.25' , Surface Width= 2.99'
Defined Flood Depth= 2.00' Flow Area= 12.0 sf, Capacity= 81.93 cfs
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 81.93 cfs

2.00' x 2.00' deep channel, n= 0.069 Riprap, 6-inch
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 180.0' Slope= 0.0889 '/'
Inlet Invert= 184.00', Outlet Invert= 168.00'



EMERGENCY SPILLWAY



Subcat Reach Pond Link

Routing Diagram for Holliston - Stormwater Model
Prepared by TRC, Printed 8/4/2022

Summary for Subcatchment 5S:

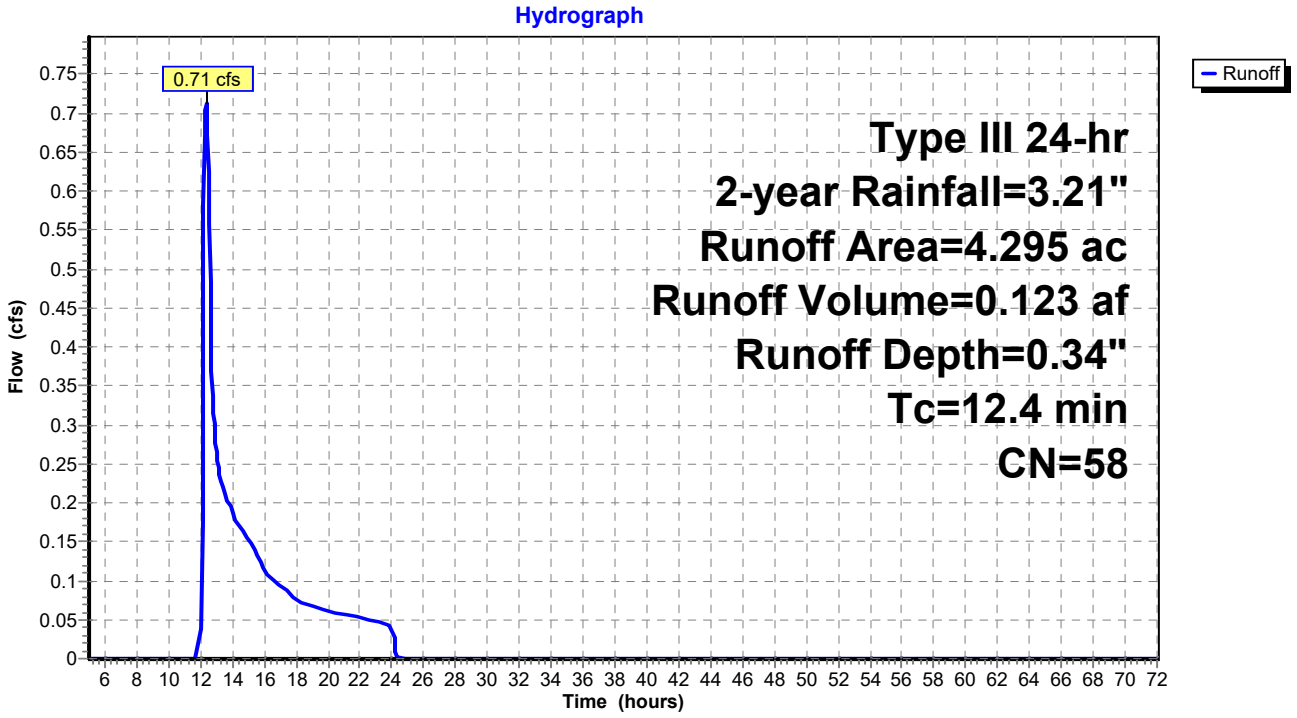
Runoff = 0.71 cfs @ 12.35 hrs, Volume= 0.123 af, Depth= 0.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.21"

	Area (ac)	CN	Description
*	1.212	98	Pavement, Roofs, Concrete Pads
*	0.350	96	Compacted Gravel
*	0.572	55	Crushed Stone Yard
	0.283	39	>75% Grass cover, Good, HSG A
	0.456	30	Meadow, non-grazed, HSG A
	1.422	30	Woods, Good, HSG A
	4.295	58	Weighted Average
	3.083		71.78% Pervious Area
	1.212		28.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4					**Direct Entry, See Tc calc sheet**

Subcatchment 5S:



Summary for Subcatchment 6S:

[45] Hint: Runoff=Zero

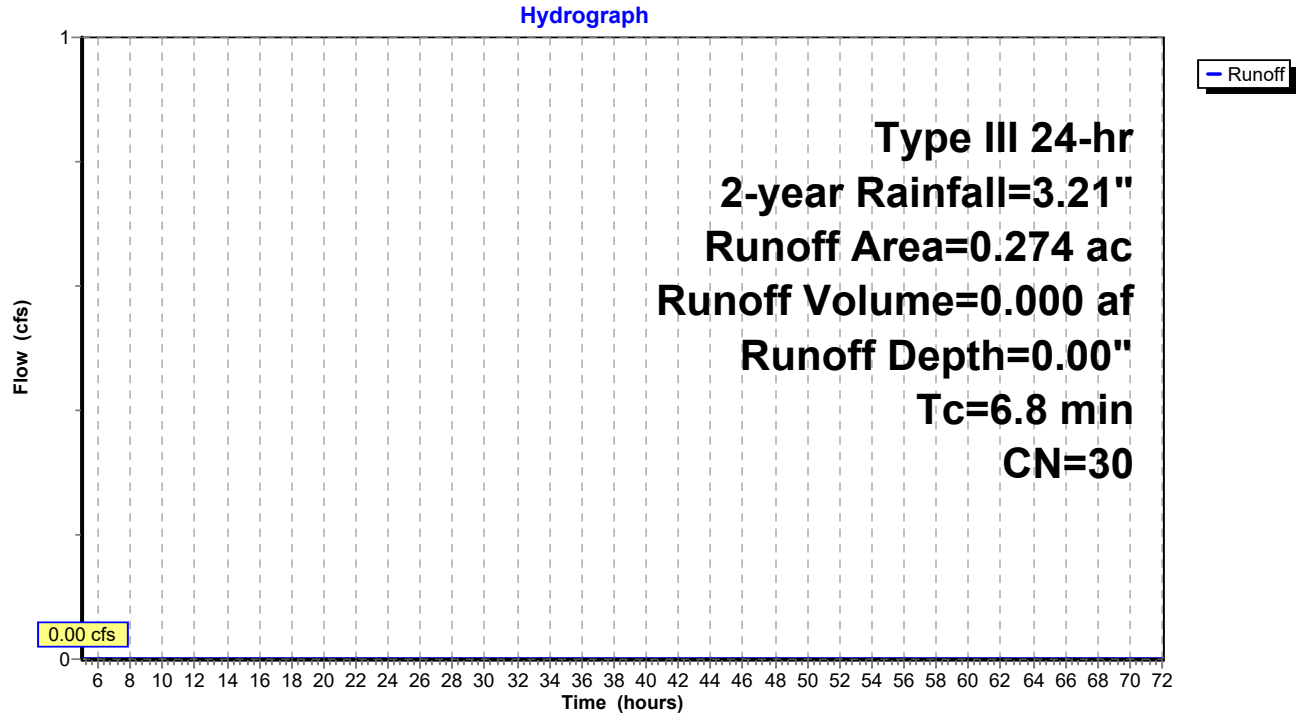
Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.21"

	Area (ac)	CN	Description
*	0.000	98	Pavement, Roofs, Concrete Pads
*	0.000	96	Compacted Gravel
*	0.000	55	Crushed Stone Yard
	0.000	39	>75% Grass cover, Good, HSG A
	0.103	30	Meadow, non-grazed, HSG A
	0.171	30	Woods, Good, HSG A
	0.274	30	Weighted Average
	0.274		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8					**Direct Entry, See Tc calc sheet**

Subcatchment 6S:



Summary for Reach 10R: EMERGENCY SPILLWAY

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

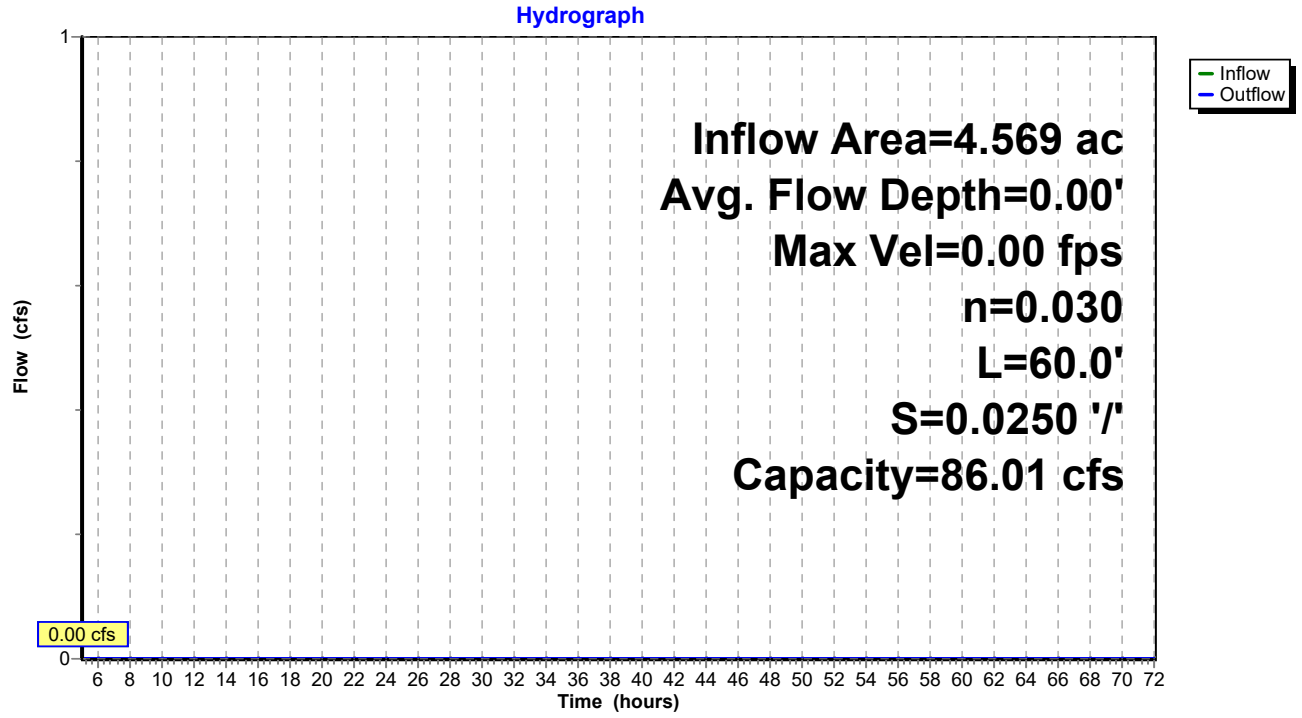
Routing by Stor-Ind+Trans method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 5.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.25' Flow Area= 31.3 sf, Capacity= 86.01 cfs

100.00' x 0.25' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 100.0 '/' Top Width= 150.00'
Length= 60.0' Slope= 0.0250 '/'
Inlet Invert= 150.50', Outlet Invert= 149.00'

‡

Reach 10R: EMERGENCY SPILLWAY



Summary for Pond 7P: Sed. Forebay 1

Inflow Area = 4.295 ac, 28.22% Impervious, Inflow Depth = 0.34" for 2-year event
Inflow = 0.71 cfs @ 12.35 hrs, Volume= 0.123 af
Outflow = 0.16 cfs @ 14.92 hrs, Volume= 0.062 af, Atten= 78%, Lag= 154.3 min
Primary = 0.16 cfs @ 14.92 hrs, Volume= 0.062 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 155.23' @ 14.92 hrs Surf.Area= 2,431 sf Storage= 2,752 cf
Flood Elev= 156.00' Surf.Area= 3,291 sf Storage= 4,959 cf

Plug-Flow detention time= 326.6 min calculated for 0.062 af (50% of inflow)
Center-of-Mass det. time= 167.1 min (1,105.3 - 938.2)

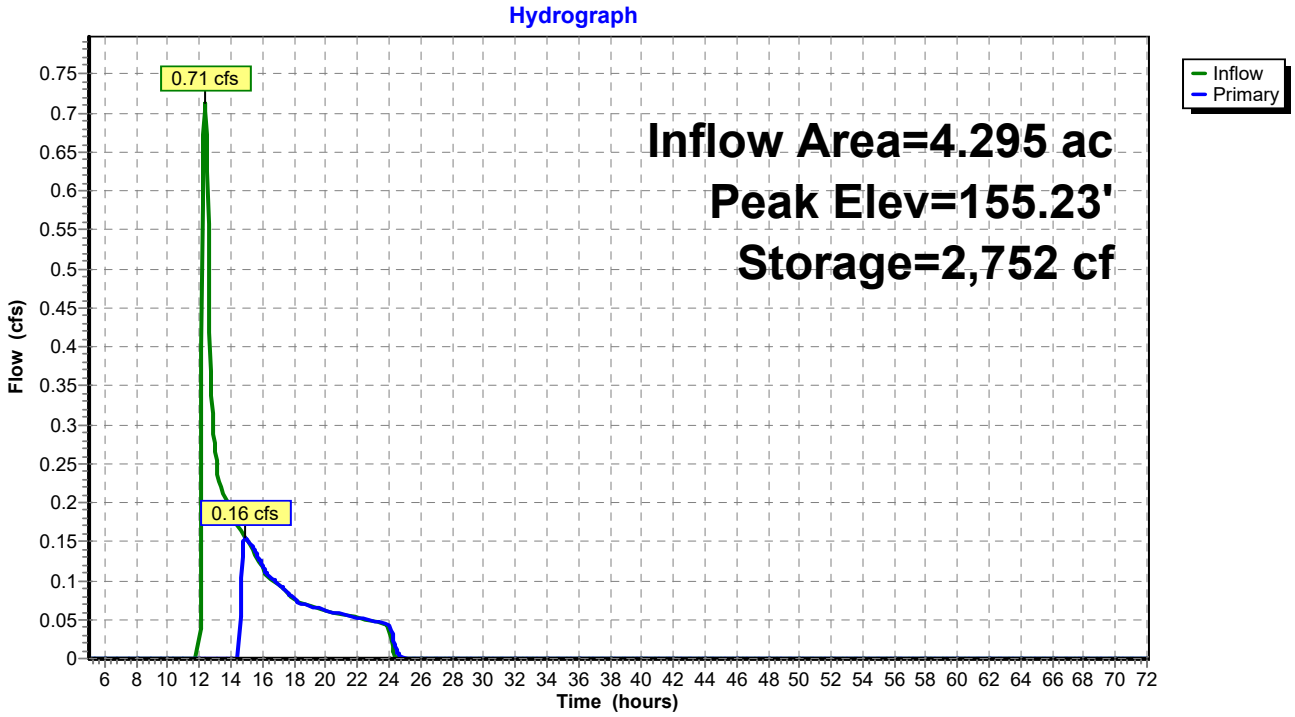
Volume	Invert	Avail.Storage	Storage Description
#1	153.00'	4,959 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
153.00	150	395.0	0	0	150
154.00	1,158	411.0	575	575	1,253
155.00	2,205	427.0	1,654	2,229	2,399
156.00	3,291	607.0	2,730	4,959	17,219

Device	Routing	Invert	Outlet Devices
#1	Primary	155.20'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	155.25'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.13 cfs @ 14.92 hrs HW=155.23' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Weir Controls 0.13 cfs @ 0.52 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 7P: Sed. Forebay 1



Summary for Pond 8P: Sed. Forebay 2

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 0.16" for 2-year event
Inflow = 0.16 cfs @ 14.92 hrs, Volume= 0.062 af
Outflow = 0.05 cfs @ 23.58 hrs, Volume= 0.007 af, Atten= 71%, Lag= 519.4 min
Primary = 0.05 cfs @ 23.58 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 153.73' @ 23.58 hrs Surf.Area= 1,870 sf Storage= 2,447 cf
Flood Elev= 156.00' Surf.Area= 3,180 sf Storage= 8,196 cf

Plug-Flow detention time= 537.4 min calculated for 0.007 af (11% of inflow)
Center-of-Mass det. time= 325.0 min (1,430.3 - 1,105.3)

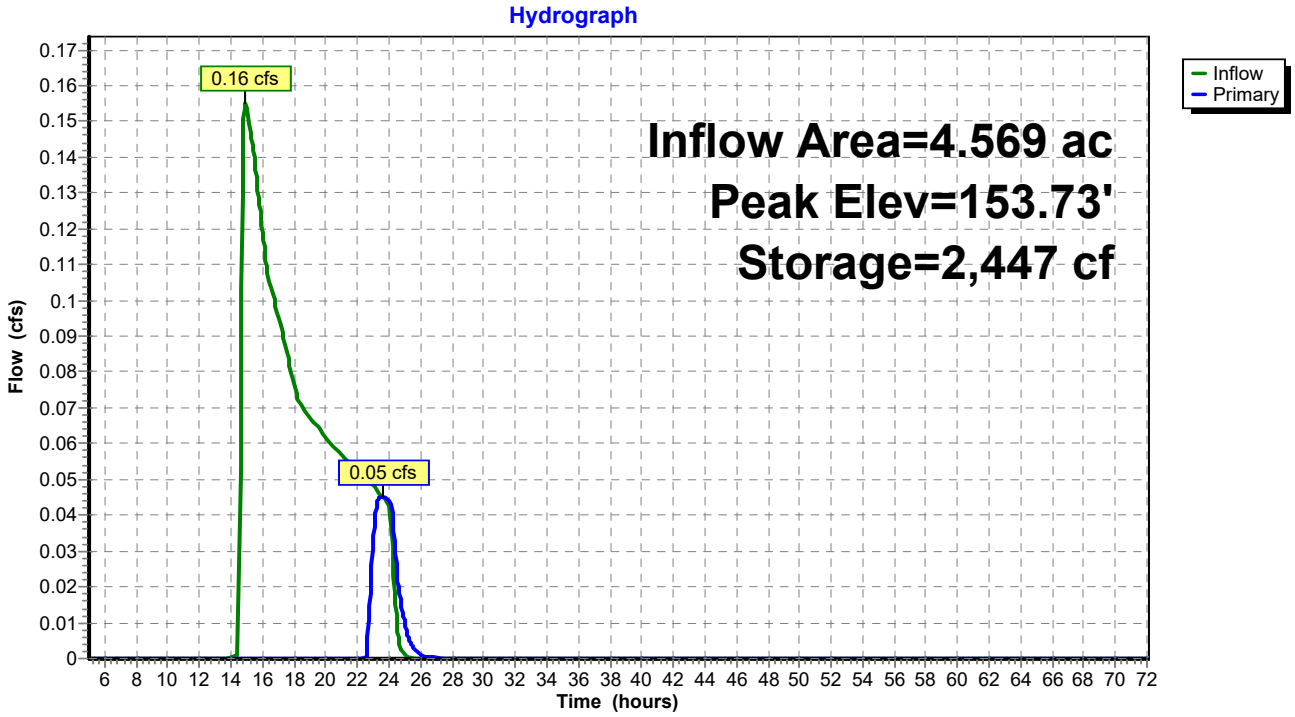
Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	8,196 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
152.00	1,173	149.0	0	0	1,173
153.00	1,370	153.0	1,270	1,270	1,352
154.00	2,075	195.0	1,710	2,981	2,528
156.00	3,180	235.0	5,216	8,196	3,963

Device	Routing	Invert	Outlet Devices
#1	Primary	153.00'	**24.0" Round Culvert** L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 153.00' / 152.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	153.70'	**30.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	155.00'	**30.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 23.58 hrs HW=153.73' (Free Discharge)
↑**1=Culvert** (Passes 0.04 cfs of 3.01 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 0.55 fps)
3=Orifice/Grate (Controls 0.00 cfs)

Pond 8P: Sed. Forebay 2



Summary for Pond 9P: Infiltration Basin

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 0.02" for 2-year event
Inflow = 0.05 cfs @ 23.58 hrs, Volume= 0.007 af
Outflow = 0.05 cfs @ 23.60 hrs, Volume= 0.007 af, Atten= 0%, Lag= 1.3 min
Discarded = 0.05 cfs @ 23.60 hrs, Volume= 0.007 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 146.00' @ 23.60 hrs Surf.Area= 1,456 sf Storage= 3 cf
Flood Elev= 152.25' Surf.Area= 5,856 sf Storage= 15,303 cf

Plug-Flow detention time= 1.2 min calculated for 0.007 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (1,431.5 - 1,430.3)

Volume	Invert	Avail.Storage	Storage Description
#1	145.99'	15,303 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

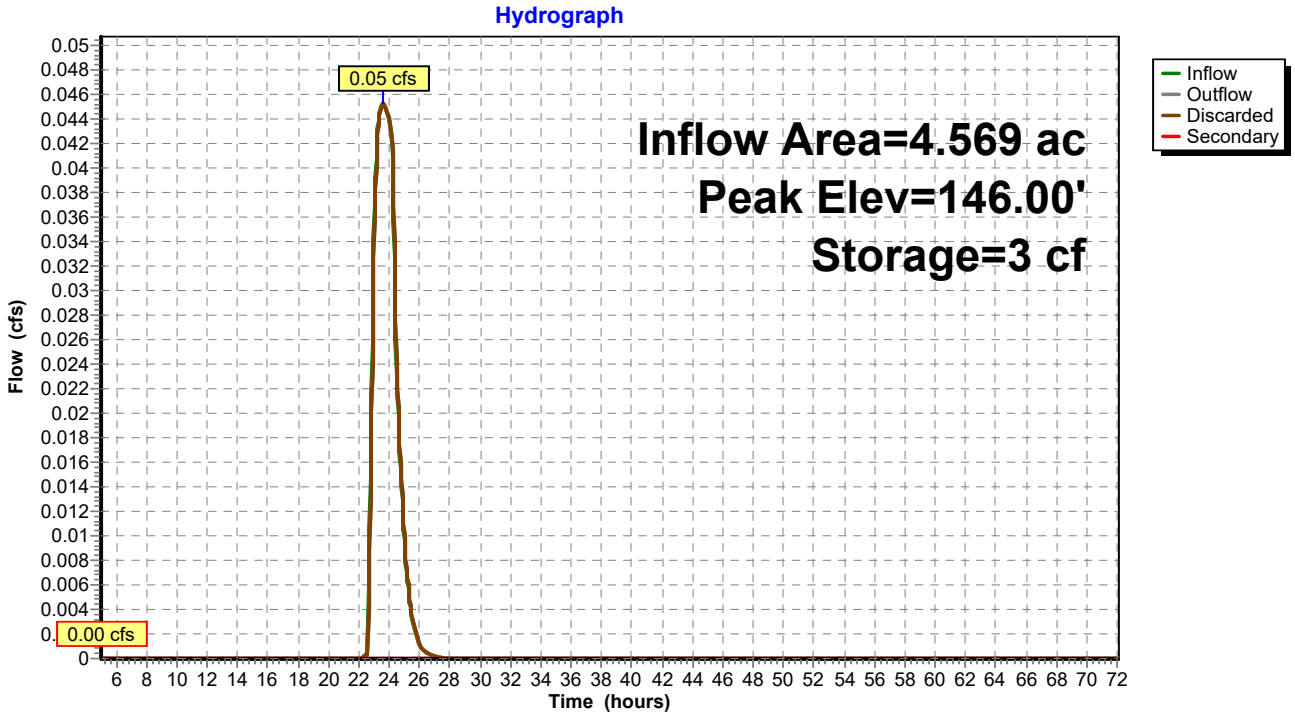
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
145.99	1,456	342.0	0.0	0	0	1,456
146.00	1,456	342.0	40.0	6	6	1,459
147.99	1,456	342.0	40.0	1,159	1,165	2,140
148.00	1,456	342.0	100.0	15	1,179	2,143
150.00	3,530	444.0	100.0	4,835	6,015	8,572
152.00	5,856	480.0	100.0	9,288	15,303	11,375

Device	Routing	Invert	Outlet Devices
#1	Discarded	145.99'	**2.410 in/hr Exfiltration over Surface area**
#2	Secondary	151.00'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.08 cfs @ 23.60 hrs HW=146.00' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.08 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=145.99' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 9P: Infiltration Basin



Summary for Subcatchment 5S:

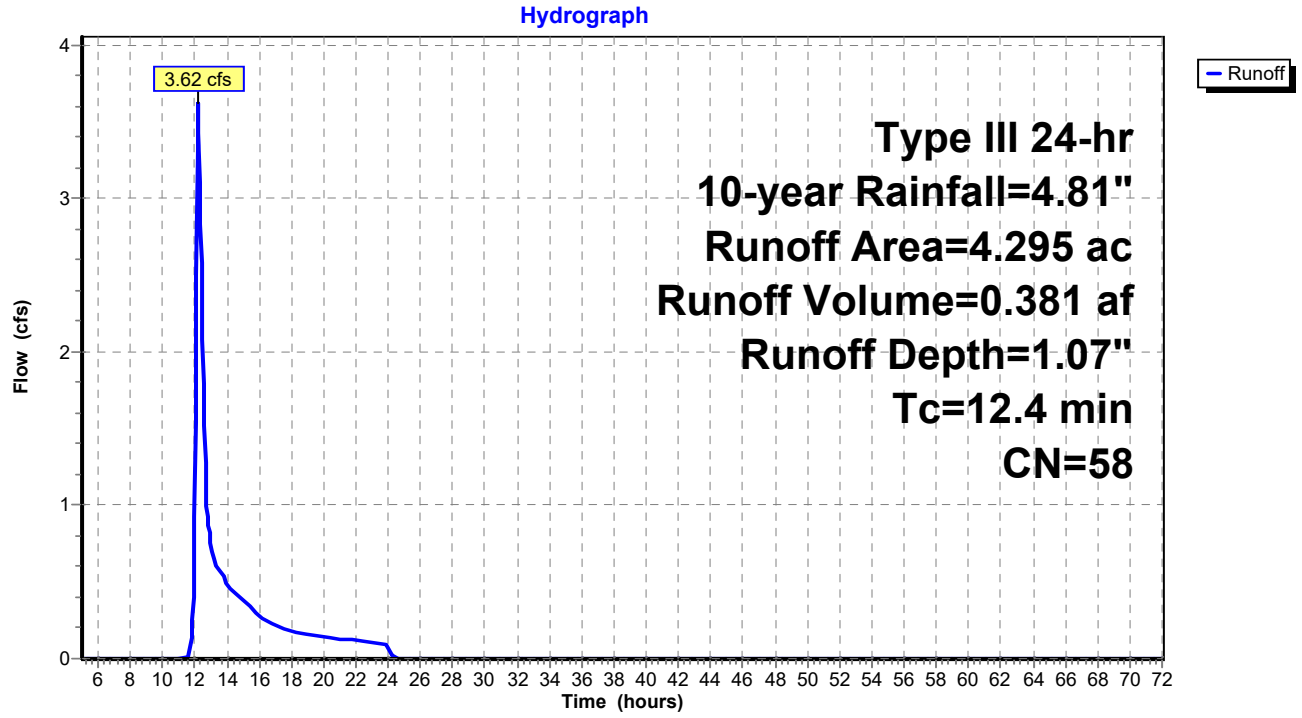
Runoff = 3.62 cfs @ 12.20 hrs, Volume= 0.381 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.81"

	Area (ac)	CN	Description
*	1.212	98	Pavement, Roofs, Concrete Pads
*	0.350	96	Compacted Gravel
*	0.572	55	Crushed Stone Yard
	0.283	39	>75% Grass cover, Good, HSG A
	0.456	30	Meadow, non-grazed, HSG A
	1.422	30	Woods, Good, HSG A
	4.295	58	Weighted Average
	3.083		71.78% Pervious Area
	1.212		28.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4					**Direct Entry, See Tc calc sheet**

Subcatchment 5S:



Summary for Subcatchment 6S:

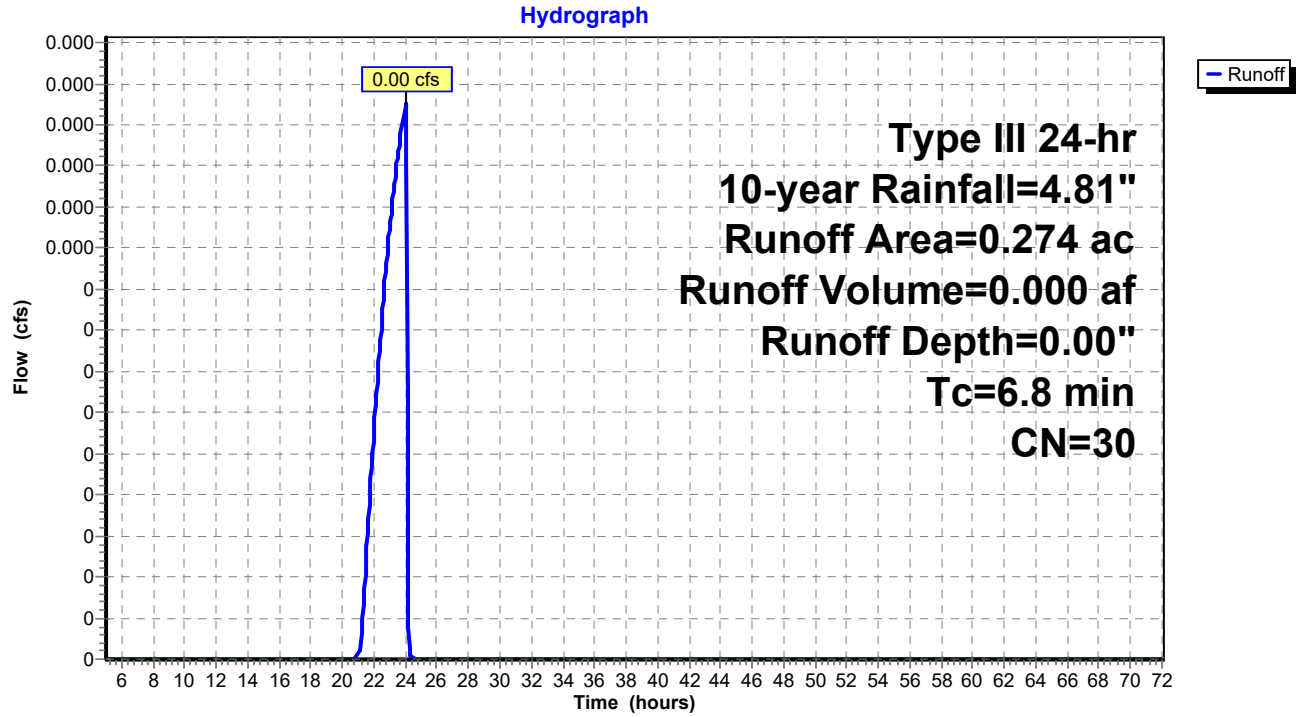
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.81"

	Area (ac)	CN	Description
*	0.000	98	Pavement, Roofs, Concrete Pads
*	0.000	96	Compacted Gravel
*	0.000	55	Crushed Stone Yard
	0.000	39	>75% Grass cover, Good, HSG A
	0.103	30	Meadow, non-grazed, HSG A
	0.171	30	Woods, Good, HSG A
	0.274	30	Weighted Average
	0.274		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8					**Direct Entry, See Tc calc sheet**

Subcatchment 6S:



Summary for Reach 10R: EMERGENCY SPILLWAY

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 0.00" for 10-year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

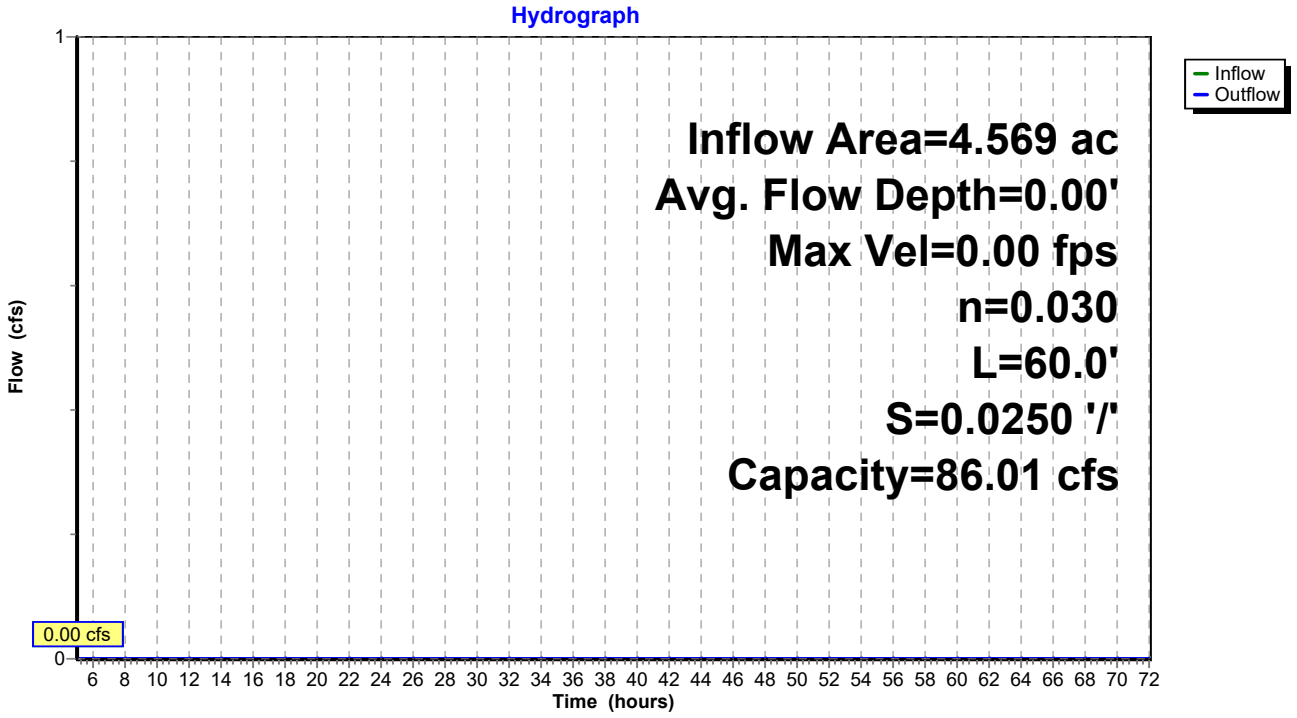
Routing by Stor-Ind+Trans method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 5.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.25' Flow Area= 31.3 sf, Capacity= 86.01 cfs

100.00' x 0.25' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 100.0 '/' Top Width= 150.00'
Length= 60.0' Slope= 0.0250 '/'
Inlet Invert= 150.50', Outlet Invert= 149.00'

‡

Reach 10R: EMERGENCY SPILLWAY



Summary for Pond 7P: Sed. Forebay 1

Inflow Area = 4.295 ac, 28.22% Impervious, Inflow Depth = 1.07" for 10-year event
Inflow = 3.62 cfs @ 12.20 hrs, Volume= 0.381 af
Outflow = 2.99 cfs @ 12.34 hrs, Volume= 0.320 af, Atten= 17%, Lag= 8.4 min
Primary = 2.99 cfs @ 12.34 hrs, Volume= 0.320 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 155.35' @ 12.34 hrs Surf.Area= 2,562 sf Storage= 3,065 cf
Flood Elev= 156.00' Surf.Area= 3,291 sf Storage= 4,959 cf

Plug-Flow detention time= 107.8 min calculated for 0.320 af (84% of inflow)
Center-of-Mass det. time= 36.5 min (927.5 - 891.1)

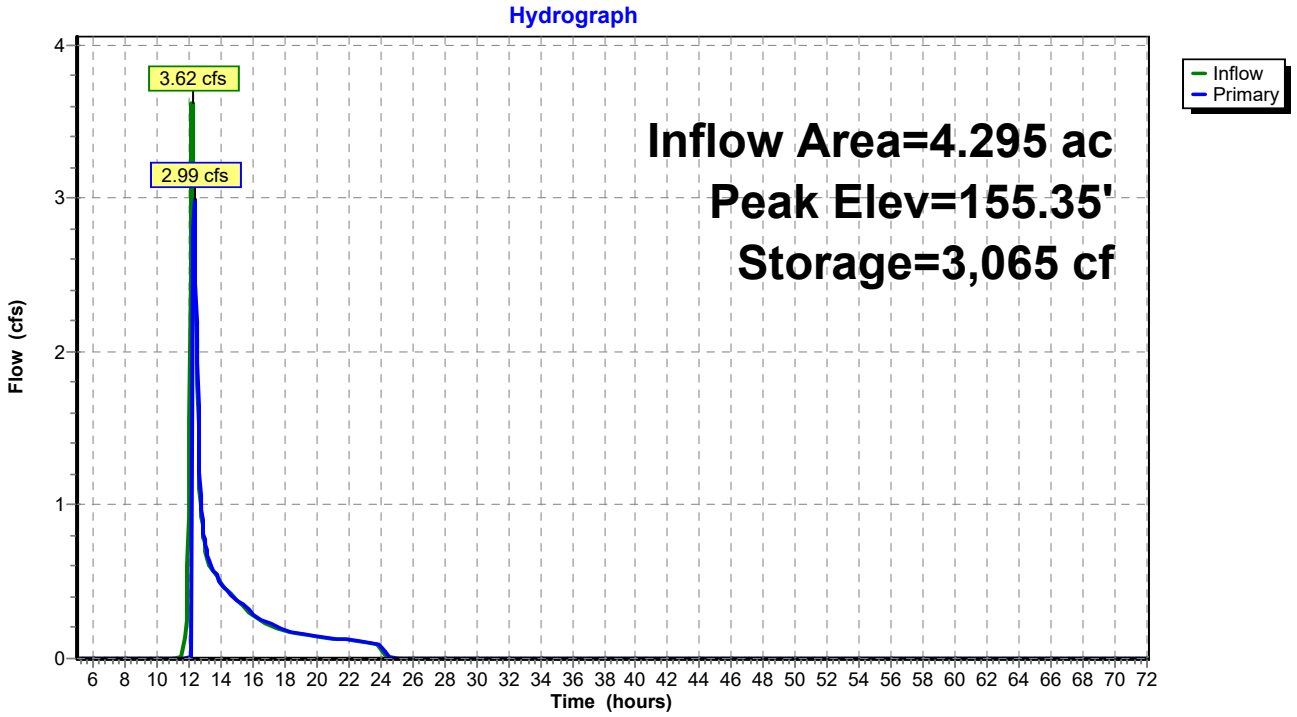
Volume	Invert	Avail.Storage	Storage Description
#1	153.00'	4,959 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
153.00	150	395.0	0	0	150
154.00	1,158	411.0	575	575	1,253
155.00	2,205	427.0	1,654	2,229	2,399
156.00	3,291	607.0	2,730	4,959	17,219

Device	Routing	Invert	Outlet Devices
#1	Primary	155.20'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	155.25'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=2.95 cfs @ 12.34 hrs HW=155.35' (Free Discharge)
1=Sharp-Crested Rectangular Weir (Weir Controls 1.91 cfs @ 1.27 fps)
2=Sharp-Crested Rectangular Weir (Weir Controls 1.04 cfs @ 1.04 fps)

Pond 7P: Sed. Forebay 1



Summary for Pond 8P: Sed. Forebay 2

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 0.84" for 10-year event
Inflow = 2.99 cfs @ 12.34 hrs, Volume= 0.320 af
Outflow = 1.17 cfs @ 12.72 hrs, Volume= 0.265 af, Atten= 61%, Lag= 22.6 min
Primary = 1.17 cfs @ 12.72 hrs, Volume= 0.265 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 153.98' @ 12.72 hrs Surf.Area= 2,056 sf Storage= 2,931 cf
Flood Elev= 156.00' Surf.Area= 3,180 sf Storage= 8,196 cf

Plug-Flow detention time= 124.7 min calculated for 0.265 af (83% of inflow)
Center-of-Mass det. time= 49.7 min (977.3 - 927.6)

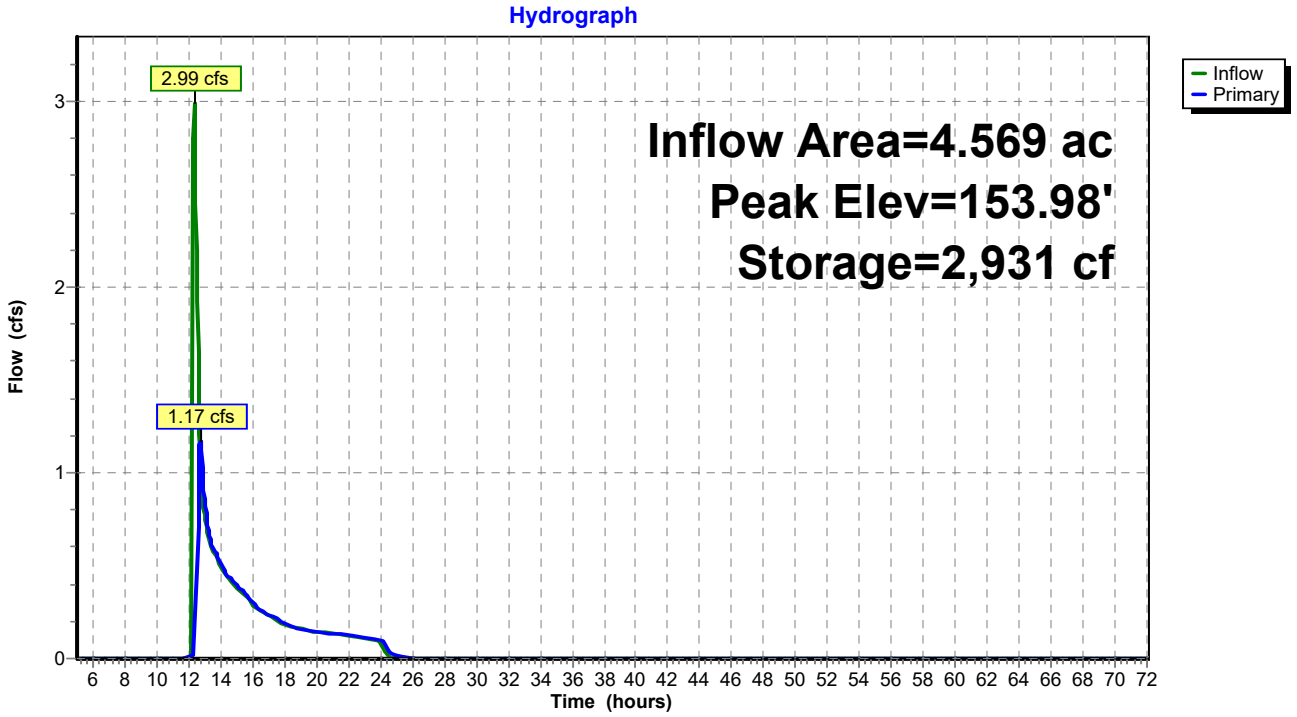
Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	8,196 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
152.00	1,173	149.0	0	0	1,173
153.00	1,370	153.0	1,270	1,270	1,352
154.00	2,075	195.0	1,710	2,981	2,528
156.00	3,180	235.0	5,216	8,196	3,963

Device	Routing	Invert	Outlet Devices
#1	Primary	153.00'	**24.0" Round Culvert** L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 153.00' / 152.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	153.70'	**30.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	155.00'	**30.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.15 cfs @ 12.72 hrs HW=153.97' (Free Discharge)
↑**1=Culvert** (Passes 1.15 cfs of 5.10 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 1.15 cfs @ 1.68 fps)
3=Orifice/Grate (Controls 0.00 cfs)

Pond 8P: Sed. Forebay 2



Summary for Pond 9P: Infiltration Basin

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 0.70" for 10-year event
Inflow = 1.17 cfs @ 12.72 hrs, Volume= 0.265 af
Outflow = 0.18 cfs @ 18.09 hrs, Volume= 0.265 af, Atten= 84%, Lag= 322.1 min
Discarded = 0.18 cfs @ 18.09 hrs, Volume= 0.265 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 149.81' @ 18.09 hrs Surf.Area= 3,300 sf Storage= 5,383 cf
Flood Elev= 152.25' Surf.Area= 5,856 sf Storage= 15,303 cf

Plug-Flow detention time= 395.4 min calculated for 0.265 af (100% of inflow)
Center-of-Mass det. time= 395.7 min (1,373.0 - 977.3)

Volume	Invert	Avail.Storage	Storage Description
#1	145.99'	15,303 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

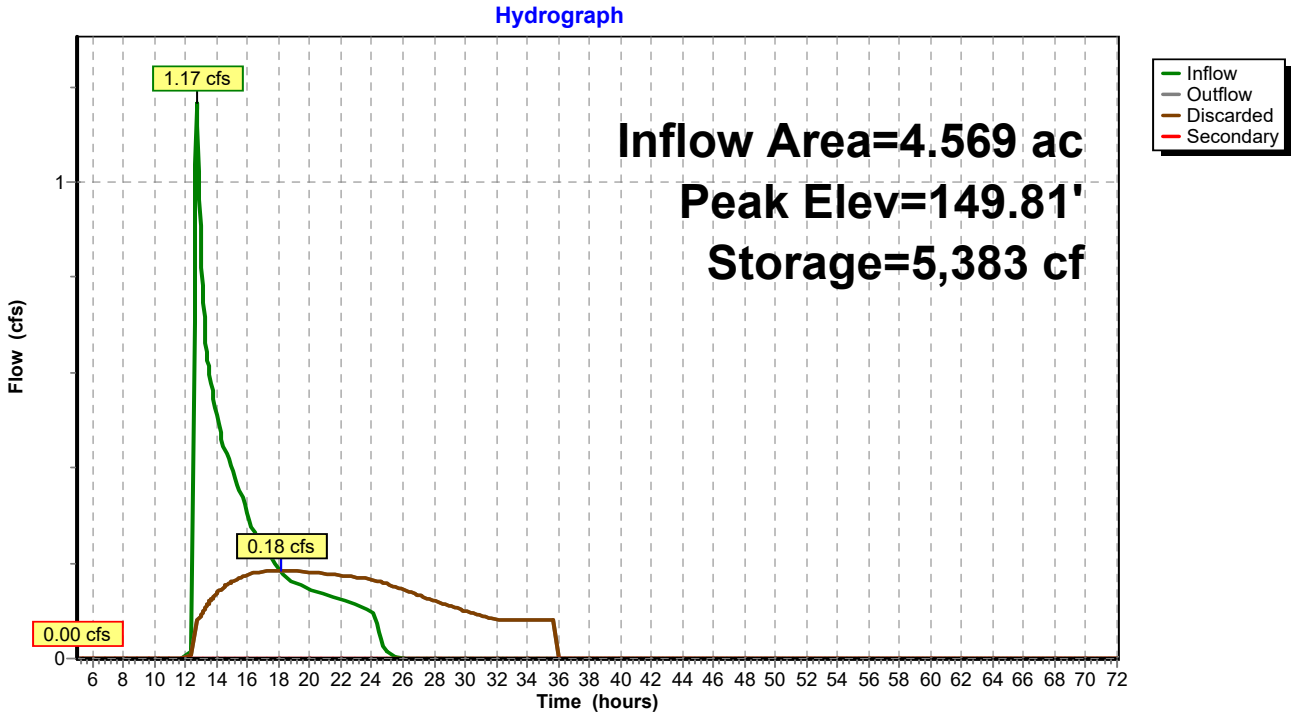
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
145.99	1,456	342.0	0.0	0	0	1,456
146.00	1,456	342.0	40.0	6	6	1,459
147.99	1,456	342.0	40.0	1,159	1,165	2,140
148.00	1,456	342.0	100.0	15	1,179	2,143
150.00	3,530	444.0	100.0	4,835	6,015	8,572
152.00	5,856	480.0	100.0	9,288	15,303	11,375

Device	Routing	Invert	Outlet Devices
#1	Discarded	145.99'	**2.410 in/hr Exfiltration over Surface area**
#2	Secondary	151.00'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.18 cfs @ 18.09 hrs HW=149.81' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.18 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=145.99' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 9P: Infiltration Basin



Summary for Subcatchment 5S:

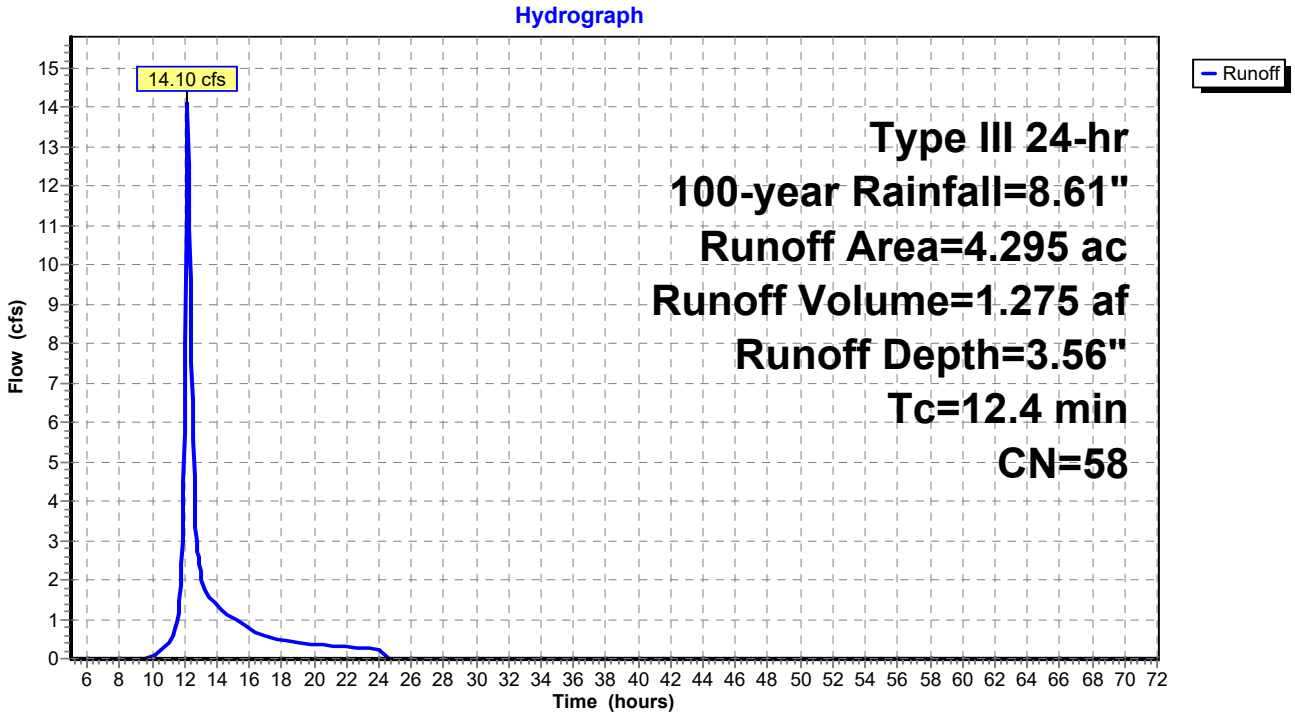
Runoff = 14.10 cfs @ 12.18 hrs, Volume= 1.275 af, Depth= 3.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.61"

	Area (ac)	CN	Description
*	1.212	98	Pavement, Roofs, Concrete Pads
*	0.350	96	Compacted Gravel
*	0.572	55	Crushed Stone Yard
	0.283	39	>75% Grass cover, Good, HSG A
	0.456	30	Meadow, non-grazed, HSG A
	1.422	30	Woods, Good, HSG A
	4.295	58	Weighted Average
	3.083		71.78% Pervious Area
	1.212		28.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4					**Direct Entry, See Tc calc sheet**

Subcatchment 5S:



Summary for Subcatchment 6S:

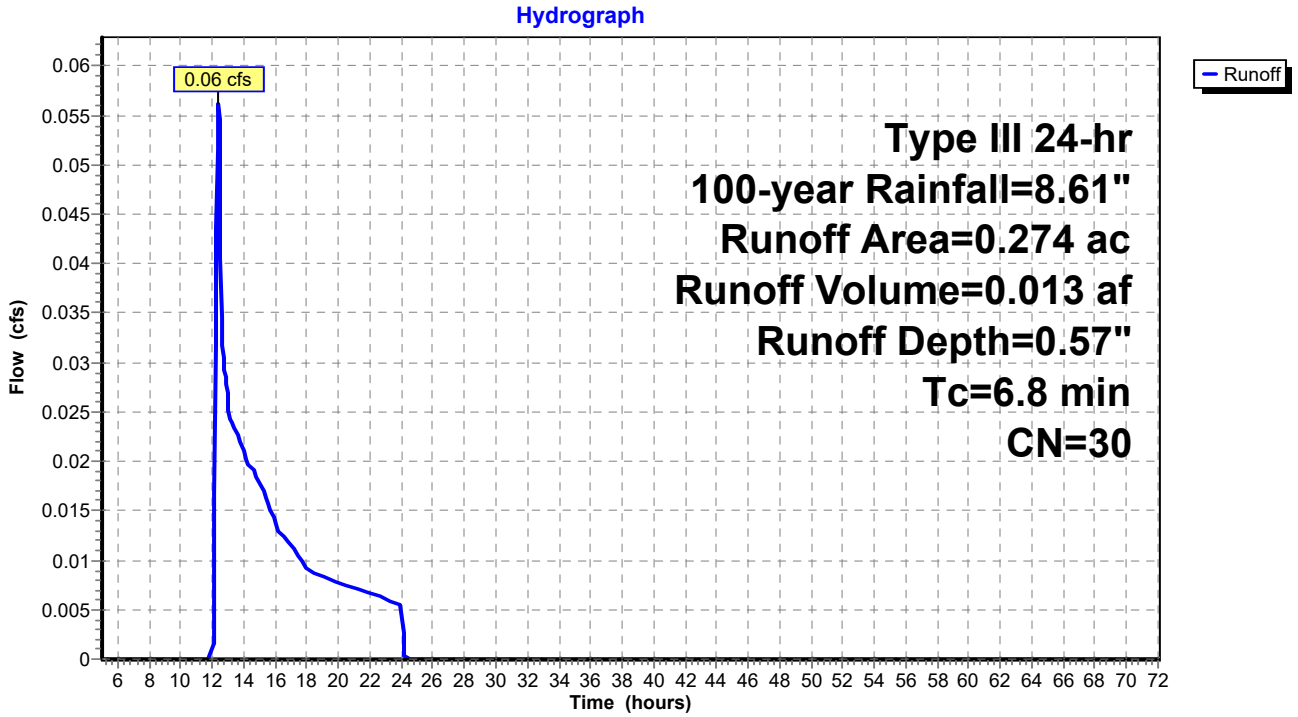
Runoff = 0.06 cfs @ 12.38 hrs, Volume= 0.013 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.61"

	Area (ac)	CN	Description
*	0.000	98	Pavement, Roofs, Concrete Pads
*	0.000	96	Compacted Gravel
*	0.000	55	Crushed Stone Yard
	0.000	39	>75% Grass cover, Good, HSG A
	0.103	30	Meadow, non-grazed, HSG A
	0.171	30	Woods, Good, HSG A
	0.274	30	Weighted Average
	0.274		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8					**Direct Entry, See Tc calc sheet**

Subcatchment 6S:



Summary for Reach 10R: EMERGENCY SPILLWAY

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 1.77" for 100-year event
Inflow = 8.96 cfs @ 12.47 hrs, Volume= 0.673 af
Outflow = 8.70 cfs @ 12.50 hrs, Volume= 0.673 af, Atten= 3%, Lag= 1.9 min

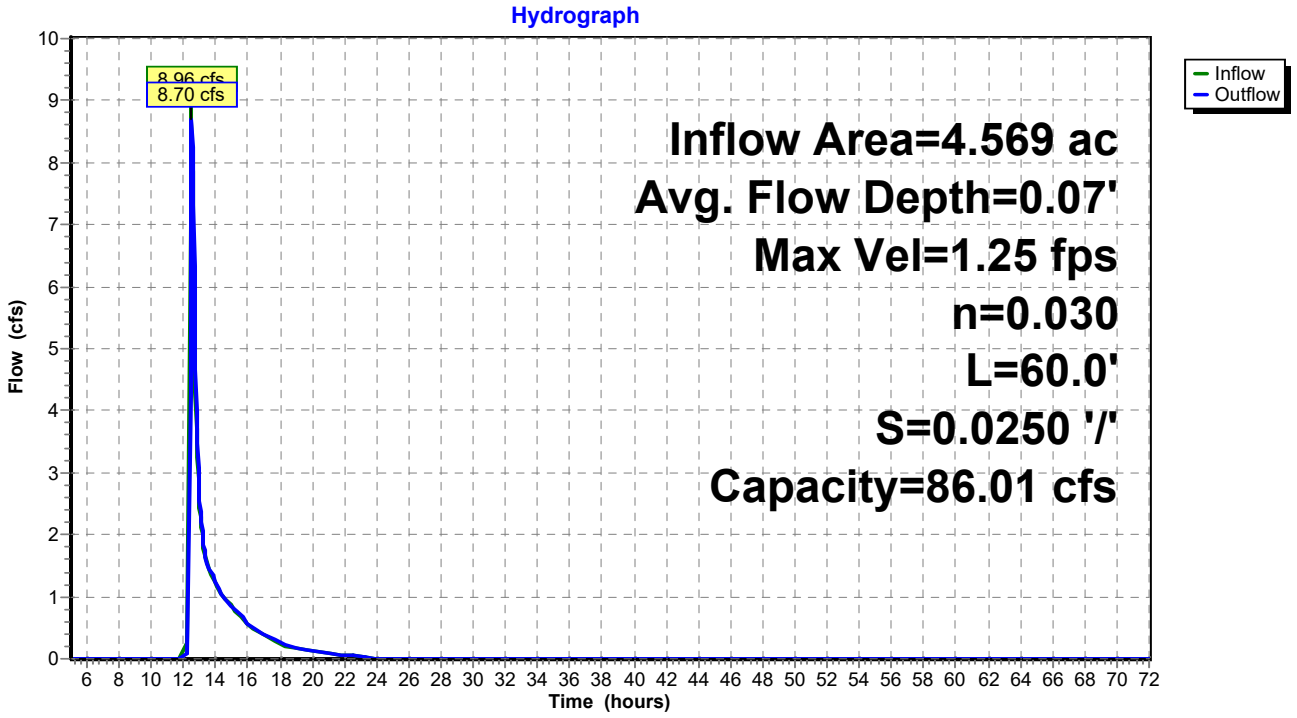
Routing by Stor-Ind+Trans method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.25 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.36 fps, Avg. Travel Time= 2.8 min

Peak Storage= 443 cf @ 12.47 hrs
Average Depth at Peak Storage= 0.07' , Surface Width= 113.82'
Bank-Full Depth= 0.25' Flow Area= 31.3 sf, Capacity= 86.01 cfs

100.00' x 0.25' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 100.0 '/' Top Width= 150.00'
Length= 60.0' Slope= 0.0250 '/'
Inlet Invert= 150.50', Outlet Invert= 149.00'

‡

Reach 10R: EMERGENCY SPILLWAY



Summary for Pond 7P: Sed. Forebay 1

Inflow Area = 4.295 ac, 28.22% Impervious, Inflow Depth = 3.56" for 100-year event
Inflow = 14.10 cfs @ 12.18 hrs, Volume= 1.275 af
Outflow = 14.10 cfs @ 12.20 hrs, Volume= 1.213 af, Atten= 0%, Lag= 1.0 min
Primary = 14.10 cfs @ 12.20 hrs, Volume= 1.213 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 155.59' @ 12.20 hrs Surf.Area= 2,815 sf Storage= 3,695 cf
Flood Elev= 156.00' Surf.Area= 3,291 sf Storage= 4,959 cf

Plug-Flow detention time= 38.0 min calculated for 1.213 af (95% of inflow)
Center-of-Mass det. time= 11.8 min (864.4 - 852.6)

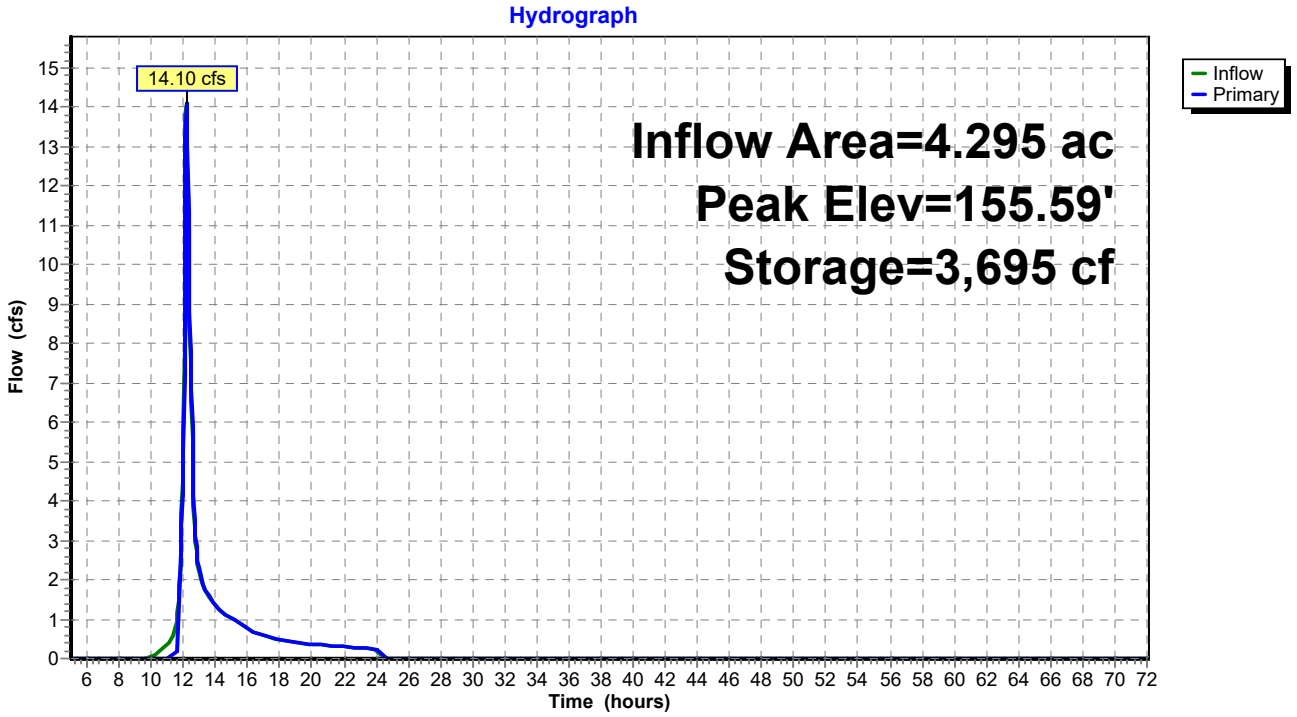
Volume	Invert	Avail.Storage	Storage Description
#1	153.00'	4,959 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
153.00	150	395.0	0	0	150
154.00	1,158	411.0	575	575	1,253
155.00	2,205	427.0	1,654	2,229	2,399
156.00	3,291	607.0	2,730	4,959	17,219

Device	Routing	Invert	Outlet Devices
#1	Primary	155.20'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	155.25'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=14.04 cfs @ 12.20 hrs HW=155.58' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 7.75 cfs @ 2.03 fps)
└**2=Sharp-Crested Rectangular Weir** (Weir Controls 6.29 cfs @ 1.89 fps)

Pond 7P: Sed. Forebay 1



Summary for Pond 8P: Sed. Forebay 2

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 3.22" for 100-year event
Inflow = 14.13 cfs @ 12.20 hrs, Volume= 1.226 af
Outflow = 13.34 cfs @ 12.26 hrs, Volume= 1.171 af, Atten= 6%, Lag= 3.6 min
Primary = 13.34 cfs @ 12.26 hrs, Volume= 1.171 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 155.14' @ 12.26 hrs Surf.Area= 2,678 sf Storage= 5,692 cf
Flood Elev= 156.00' Surf.Area= 3,180 sf Storage= 8,196 cf

Plug-Flow detention time= 38.5 min calculated for 1.171 af (96% of inflow)
Center-of-Mass det. time= 14.0 min (879.5 - 865.5)

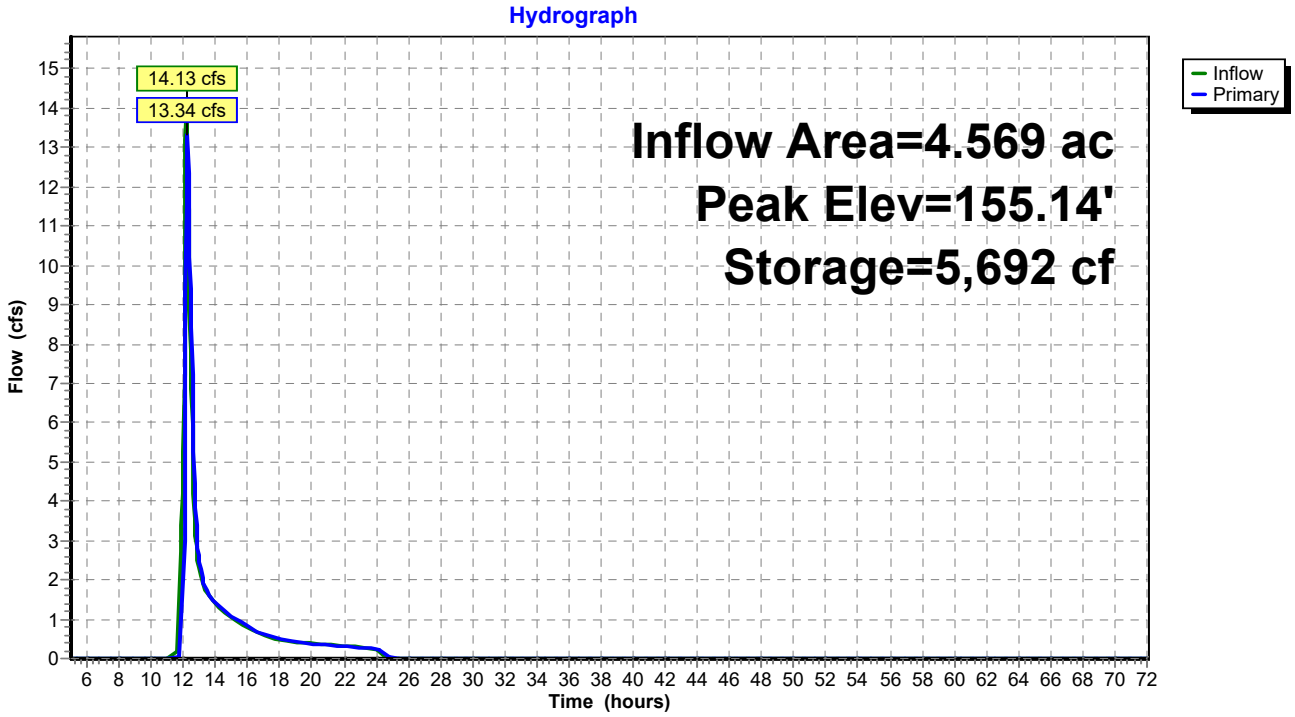
Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	8,196 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
152.00	1,173	149.0	0	0	1,173
153.00	1,370	153.0	1,270	1,270	1,352
154.00	2,075	195.0	1,710	2,981	2,528
156.00	3,180	235.0	5,216	8,196	3,963

Device	Routing	Invert	Outlet Devices
#1	Primary	153.00'	**24.0" Round Culvert** L= 80.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 153.00' / 152.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	153.70'	**30.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	155.00'	**30.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=13.15 cfs @ 12.26 hrs HW=155.14' (Free Discharge)
└**1=Culvert** (Passes 13.15 cfs of 16.12 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 11.50 cfs @ 4.60 fps)
  └**3=Orifice/Grate** (Weir Controls 1.65 cfs @ 1.21 fps)

Pond 8P: Sed. Forebay 2



Summary for Pond 9P: Infiltration Basin

Inflow Area = 4.569 ac, 26.53% Impervious, Inflow Depth = 3.08" for 100-year event
Inflow = 13.34 cfs @ 12.26 hrs, Volume= 1.171 af
Outflow = 9.24 cfs @ 12.47 hrs, Volume= 1.171 af, Atten= 31%, Lag= 12.9 min
Discarded = 0.29 cfs @ 12.47 hrs, Volume= 0.498 af
Secondary = 8.96 cfs @ 12.47 hrs, Volume= 0.673 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 151.42' @ 12.47 hrs Surf.Area= 5,126 sf Storage= 12,142 cf
Flood Elev= 152.25' Surf.Area= 5,856 sf Storage= 15,303 cf

Plug-Flow detention time= 236.0 min calculated for 1.170 af (100% of inflow)
Center-of-Mass det. time= 236.7 min (1,116.2 - 879.5)

Volume	Invert	Avail.Storage	Storage Description
#1	145.99'	15,303 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
145.99	1,456	342.0	0.0	0	0	1,456
146.00	1,456	342.0	40.0	6	6	1,459
147.99	1,456	342.0	40.0	1,159	1,165	2,140
148.00	1,456	342.0	100.0	15	1,179	2,143
150.00	3,530	444.0	100.0	4,835	6,015	8,572
152.00	5,856	480.0	100.0	9,288	15,303	11,375

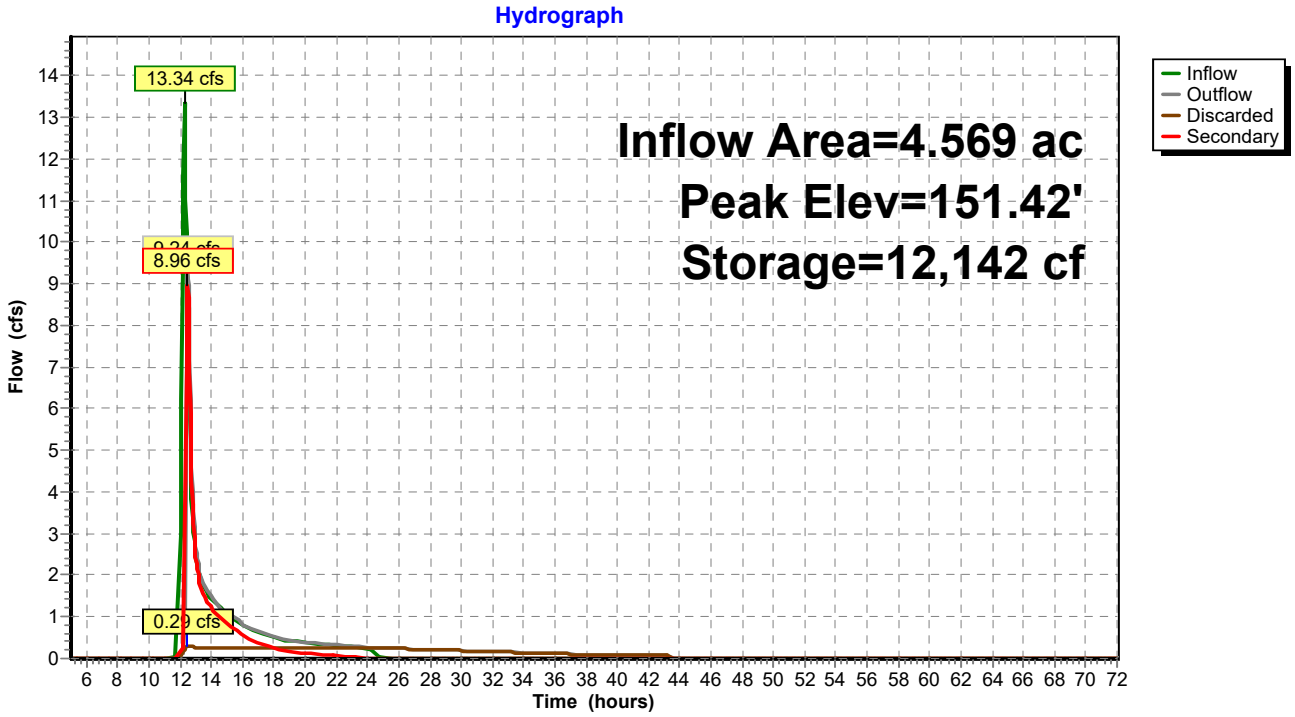
Device	Routing	Invert	Outlet Devices
#1	Discarded	145.99'	**2.410 in/hr Exfiltration over Surface area**
#2	Secondary	151.00'	**10.0' long x 1.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.29 cfs @ 12.47 hrs HW=151.42' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.29 cfs)

Secondary OutFlow Max=8.71 cfs @ 12.47 hrs HW=151.42' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Weir Controls 8.71 cfs @ 2.11 fps)

This assessment demonstrates that emergency spillway can adequately manage flows and downgradient areas will remain stable if outlet structure fails.

Pond 9P: Infiltration Basin



INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Holliston BESS Project - Stormwater Pretreatment

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Sediment Forebay	0.25	1.00	0.25	0.75
Sediment Forebay	0.25	0.75	0.19	0.56
	0.00	0.56	0.00	0.56
	0.00	0.56	0.00	0.56
	0.00	0.56	0.00	0.56

Total TSS Removal = 44%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 412899.0001
Prepared By: TRC/ARD
Date: 8/3/2022

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Holliston BESS Project - Stormwater Final Treatment

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin	0.80	1.00	0.80	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

Total TSS Removal = 80%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 412899.0001
Prepared By: TRC/ARD
Date: 8/3/2022

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Middlesex County, Massachusetts

April 15, 2022

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:4,740 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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 1:25,000.

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: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Aug 31, 2020—Oct 22, 2020

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
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	10.1	10.7%
33B	Raypol silt loam, 0 to 5 percent slopes	0.6	0.6%
52A	Freetown muck, 0 to 1 percent slopes	36.1	38.1%
253D	Hinckley loamy sand, 15 to 25 percent slopes	12.7	13.4%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	12.1	12.8%
255B	Windsor loamy sand, 3 to 8 percent slopes	11.3	11.9%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	4.8	5.1%
416C	Narragansett silt loam, 8 to 15 percent slopes, very stony	3.4	3.6%
424C	Canton fine sandy loam, 8 to 15 percent slopes, extremely bouldery	3.0	3.2%
653	Udorthents, sandy	0.5	0.6%
Totals for Area of Interest		**94.8**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties

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

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

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

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

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

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

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

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

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

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

Middlesex County, Massachusetts

6A—Scarboro mucky fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svky
Elevation: 0 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Drainageways, outwash deltas, outwash terraces, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from schist and/or sandy glaciofluvial deposits derived from gneiss and/or sandy glaciofluvial deposits derived from granite

Typical profile

Oe - 0 to 3 inches: mucky peat
A - 3 to 11 inches: mucky fine sandy loam
Cg1 - 11 to 21 inches: sand
Cg2 - 21 to 65 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wareham

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Walpole

Percent of map unit: 5 percent
Landform: Deltas, depressions, outwash terraces, depressions, outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

33B—Raypol silt loam, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: vqnf
Elevation: 50 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Raypol and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Raypol

Setting

Landform: Depressions, terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave

Parent material: Loamy glaciolacustrine deposits over loose sandy and gravelly glaciofluvial deposits derived from igneous and sedimentary rock

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 19 inches: silt loam
H3 - 19 to 48 inches: very gravelly loamy sand
H4 - 48 to 65 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Ecological site: F144AY028MA - Wet Outwash
Hydric soil rating: Yes

Minor Components

Raynham

Percent of map unit: 8 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wareham

Percent of map unit: 8 percent
Landform: Deltas, depressions, terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Tisbury

Percent of map unit: 2 percent
Landform: Terraces, plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Birdsall

Percent of map unit: 2 percent
Landform: Flats, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Depressions, depressions, swamps, kettles, marshes, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Whitman

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 5 percent
Landform: Bogs, swamps, marshes, depressions, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

253D—Hinckley loamy sand, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2svmc
Elevation: 0 to 1,460 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, outwash plains, kames, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Eskers, outwash terraces, kames, outwash plains, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest, head slope, nose slope, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent

Landform: Kames, kame terraces, moraines, eskers, outwash deltas, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Eskers, kame terraces, outwash deltas, moraines, outwash plains, outwash terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Convex, concave, linear
Across-slope shape: Convex, concave, linear
Hydric soil rating: No

254C—Merrimac fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2tyqt
Elevation: 0 to 1,030 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Merrimac and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Eskers, outwash plains, moraines, kames, outwash terraces
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand

2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Outwash plains, dunes, deltas, outwash terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor, Loamy Sand

Setting

Landform: Dunes, outwash plains, deltas, outwash terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash

Hydric soil rating: No

Minor Components

Hinckley, loamy sand

Percent of map unit: 10 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

260B—Sudbury fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9915
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sudbury

Setting

Landform: Plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: fine sandy loam

H2 - 8 to 20 inches: fine sandy loam
H3 - 20 to 27 inches: loamy sand
H4 - 27 to 65 inches: stratified gravelly coarse sand to sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Terraces, plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Wareham

Percent of map unit: 4 percent
Landform: Depressions, deltas, terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Windsor

Percent of map unit: 2 percent
Landform: Flats, deltas, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent

416C—Narragansett silt loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 9941
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Narragansett and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Narragansett

Setting

Landform: Ground moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable silty eolian deposits and/or friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from metamorphic rock and/or friable sandy basal till derived from metamorphic rock

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: silt loam
Bw - 7 to 35 inches: silt loam
2C1 - 35 to 60 inches: very gravelly loamy sand
2C2 - 60 to 65 inches: very gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 18 to 35 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Charlton
Percent of map unit: 10 percent
Landform: Ground moraines, drumlins
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

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

Scituate
Percent of map unit: 3 percent
Landform: Hillslopes, depressions
Landform position (two-dimensional): Toeslope, summit
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

424C—Canton fine sandy loam, 8 to 15 percent slopes, extremely bouldery

Map Unit Setting
National map unit symbol: vqs4
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Canton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable sandy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 21 inches: fine sandy loam
H3 - 21 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 18 to 30 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Charlton

Percent of map unit: 10 percent
Landform: Ground moraines, drumlins
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Scituate

Percent of map unit: 5 percent
Landform: Depressions, hillslopes
Landform position (two-dimensional): Summit, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

653—Udorthents, sandy

Map Unit Setting

National map unit symbol: vr1k
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, sandy, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Sandy

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Udorthents, loamy

Percent of map unit: 5 percent
Hydric soil rating: No

Urban land

Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Unnamed

Percent of map unit: 5 percent

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United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.404 degrees West
Latitude	42.198 degrees North
Elevation	0 feet
Date/Time	Tue, 01 Feb 2022 16:04:47 -0500

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.29	0.44	0.55	0.72	0.89	1.13	**1yr**	0.77	1.07	1.31	1.66	2.10	2.68	2.93	**1yr**	2.37	2.81	3.27	3.93	4.59	**1yr**
2yr	0.35	0.54	0.68	0.89	1.12	1.41	**2yr**	0.97	1.30	1.63	2.05	2.56	3.21	3.52	**2yr**	2.85	3.39	3.89	4.64	5.26	**2yr**
5yr	0.42	0.65	0.82	1.10	1.41	1.79	**5yr**	1.21	1.62	2.07	2.60	3.24	4.04	4.50	**5yr**	3.58	4.32	4.96	5.87	6.55	**5yr**
10yr	0.48	0.75	0.95	1.29	1.67	2.14	**10yr**	1.44	1.92	2.49	3.12	3.89	4.81	5.41	**10yr**	4.26	5.20	5.96	7.01	7.74	**10yr**
25yr	0.57	0.90	1.15	1.58	2.10	2.71	**25yr**	1.81	2.39	3.16	3.96	4.92	6.06	6.91	**25yr**	5.36	6.64	7.59	8.88	9.65	**25yr**
50yr	0.64	1.03	1.32	1.86	2.50	3.25	**50yr**	2.16	2.83	3.81	4.77	5.90	7.22	8.32	**50yr**	6.39	8.00	9.13	10.61	11.41	**50yr**
100yr	0.74	1.19	1.54	2.18	2.98	3.90	**100yr**	2.57	3.35	4.57	5.73	7.06	8.61	10.02	**100yr**	7.62	9.64	10.98	12.70	13.50	**100yr**
200yr	0.85	1.39	1.80	2.58	3.55	4.67	**200yr**	3.07	3.97	5.48	6.86	8.45	10.27	12.08	**200yr**	9.09	11.62	13.21	15.19	15.97	**200yr**
500yr	1.04	1.70	2.22	3.21	4.49	5.94	**500yr**	3.87	4.97	6.97	8.73	10.72	12.98	15.48	**500yr**	11.49	14.88	16.88	19.27	19.95	**500yr**

Lower Confidence Limits

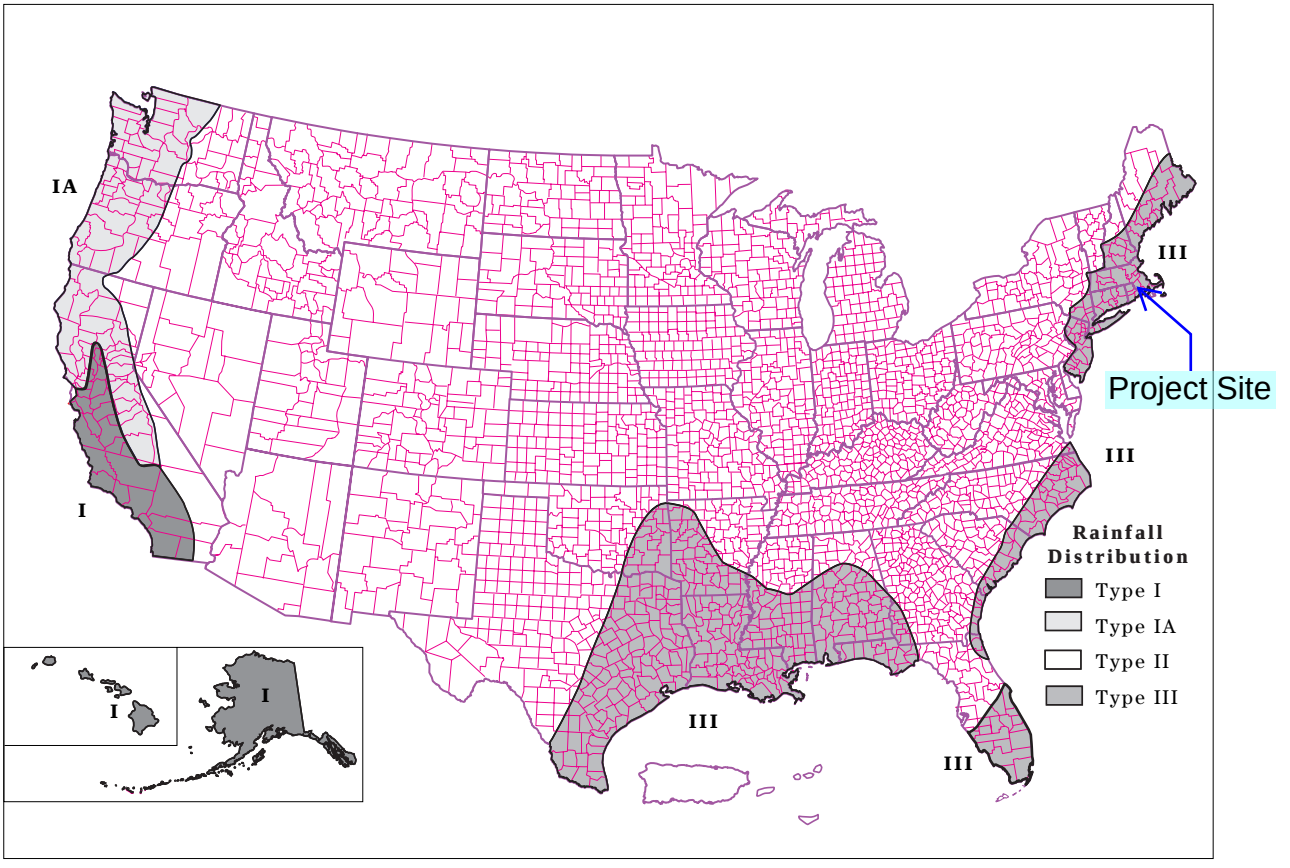
	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.44	0.59	0.72	0.93	**1yr**	0.62	0.91	1.06	1.41	1.85	2.31	2.54	**1yr**	2.04	2.44	2.96	3.26	3.98	**1yr**
2yr	0.34	0.53	0.65	0.88	1.08	1.28	**2yr**	0.93	1.25	1.46	1.93	2.47	3.09	3.38	**2yr**	2.74	3.25	3.74	4.49	5.09	**2yr**
5yr	0.38	0.59	0.73	1.01	1.28	1.53	**5yr**	1.11	1.49	1.73	2.27	2.89	3.66	4.08	**5yr**	3.24	3.92	4.58	5.43	6.06	**5yr**
10yr	0.42	0.65	0.81	1.13	1.46	1.74	**10yr**	1.26	1.70	1.96	2.57	3.24	4.14	4.69	**10yr**	3.67	4.51	5.30	6.20	6.91	**10yr**
25yr	0.49	0.74	0.92	1.32	1.73	2.06	**25yr**	1.50	2.02	2.32	3.03	3.79	4.90	5.64	**25yr**	4.33	5.42	6.44	7.43	8.24	**25yr**
50yr	0.54	0.82	1.02	1.46	1.97	2.34	**50yr**	1.70	2.29	2.64	3.43	4.27	5.55	6.50	**50yr**	4.91	6.25	7.46	8.51	9.41	**50yr**
100yr	0.59	0.90	1.12	1.62	2.23	2.66	**100yr**	1.92	2.60	2.99	3.88	4.81	6.29	7.51	**100yr**	5.57	7.22	8.65	9.76	10.76	**100yr**
200yr	0.65	0.98	1.25	1.80	2.52	3.03	**200yr**	2.17	2.97	3.40	4.41	5.42	7.16	8.64	**200yr**	6.34	8.31	10.04	11.21	12.32	**200yr**
500yr	0.74	1.10	1.42	2.06	2.94	3.60	**500yr**	2.53	3.52	4.01	5.22	6.36	8.50	10.51	**500yr**	7.53	10.11	12.20	13.47	14.78	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.32	0.49	0.60	0.81	1.00	1.19	**1yr**	0.86	1.17	1.37	1.78	2.31	2.97	3.14	**1yr**	2.63	3.02	3.67	4.30	5.11	**1yr**
2yr	0.37	0.57	0.70	0.95	1.17	1.37	**2yr**	1.01	1.34	1.58	2.06	2.64	3.38	3.72	**2yr**	2.99	3.57	4.11	4.84	5.45	**2yr**
5yr	0.46	0.71	0.88	1.21	1.54	1.80	**5yr**	1.33	1.76	2.06	2.66	3.36	4.47	4.93	**5yr**	3.95	4.74	5.35	6.39	7.07	**5yr**
10yr	0.56	0.85	1.06	1.48	1.91	2.22	**10yr**	1.65	2.17	2.54	3.23	4.04	5.51	6.14	**10yr**	4.88	5.91	6.64	7.88	8.61	**10yr**
25yr	0.72	1.09	1.36	1.94	2.55	2.94	**25yr**	2.20	2.87	3.33	4.16	5.16	7.31	8.23	**25yr**	6.47	7.91	8.84	10.40	11.18	**25yr**
50yr	0.87	1.32	1.64	2.36	3.18	3.62	**50yr**	2.74	3.54	4.10	5.04	6.20	9.04	10.26	**50yr**	8.00	9.87	10.97	12.86	13.61	**50yr**
100yr	1.06	1.60	2.00	2.89	3.96	4.48	**100yr**	3.42	4.38	5.05	6.11	7.47	11.20	12.77	**100yr**	9.91	12.28	13.61	15.89	16.57	**100yr**
200yr	1.29	1.94	2.45	3.55	4.95	5.54	**200yr**	4.27	5.41	6.23	7.41	8.99	13.86	15.90	**200yr**	12.26	15.29	16.89	19.64	20.17	**200yr**
500yr	1.69	2.51	3.23	4.70	6.68	7.32	**500yr**	5.76	7.16	8.23	9.58	11.48	18.35	21.26	**500yr**	16.24	20.45	22.48	25.98	26.13	**500yr**

Powered by ACIS Northeast Regional Climate Center

Figure B-2 Approximate geographic boundaries for NRCS (SCS) rainfall distributions



Rainfall data sources

This section lists the most current 24-hour rainfall data published by the National Weather Service (NWS) for various parts of the country. Because NWS Technical Paper 40 (TP-40) is out of print, the 24-hour rainfall maps for areas east of the 105th meridian are included here as figures B-3 through B-8. For the area generally west of the 105th meridian, TP-40 has been superseded by NOAA Atlas 2, the Precipitation-Frequency Atlas of the Western United States, published by the National Ocean and Atmospheric Administration.

East of 105th meridian

Hershfield, D.M. 1961. Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 40. Washington, DC. 155 p.

West of 105th meridian

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. Precipitation-frequency atlas of the Western United States. Vol. I Montana; Vol. II, Wyoming; Vol III, Colorado; Vol. IV, New Mexico; Vol V, Idaho; Vol. VI, Utah; Vol. VII, Nevada; Vol. VIII, Arizona; Vol. IX, Washington; Vol. X, Oregon; Vol. XI, California. U.S. Dept. of Commerce, National Weather Service, NOAA Atlas 2. Silver Spring, MD.

Alaska

Miller, John F. 1963. Probable maximum precipitation and rainfall-frequency data for Alaska for areas to 400 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. of Commerce, Weather Bur. Tech. Pap. No. 47. Washington, DC. 69 p.

Hawaii

Weather Bureau. 1962. Rainfall-frequency atlas of the Hawaiian Islands for areas to 200 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 43. Washington, DC. 60 p.

Puerto Rico and Virgin Islands

Weather Bureau. 1961. Generalized estimates of probable maximum precipitation and rainfall-frequency data for Puerto Rico and Virgin Islands for areas to 400 square miles, durations to 24 hours, and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 42. Washington, DC. 94 P.

Attachment D: Construction & Post-Construction Stormwater Inspection Maintenance Forms

CONSTRUCTION STORMWATER SITE INSPECTION REPORT
Holliston Battery Energy Storage System Project

General Information			
Project Name	Holliston Battery Energy Storage System Project		
Permit No.		**Location**	Holliston, MA
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your Stormwater Management Report on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1		❑Yes ❑No	❑Yes ❑No	
2		❑Yes ❑No	❑Yes ❑No	
3		❑Yes ❑No	❑Yes ❑No	
4		❑Yes ❑No	❑Yes ❑No	
5		❑Yes ❑No	❑Yes ❑No	
6		❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	
8		❑Yes ❑No	❑Yes ❑No	
9		❑Yes ❑No	❑Yes ❑No	
10		❑Yes ❑No	❑Yes ❑No	

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes

Overall Site Issues

- *Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.*

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are perimeter controls and sediment barriers adequately installed?	❑Yes ❑No	❑Yes ❑No	
3	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
4	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
5	Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
6	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
7	Are vehicle and equipment cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	
8	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
9	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
10	Are areas beneath solar array drip edges properly stabilized?	❑Yes ❑No	❑Yes ❑No	
11	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature:_____ Date:_____

STORMWATER MANAGEMENT SYSTEM: POST-CONSTRUCTION MAINTENANCE & INSPECTION LOG				
	SCHEDULE		INITIALS & DATE	COMMENTS
	QRTLY INSP.	MAINTENANCE		
REVEGETATED AREAS AND EMBANKMENTS				
Inspect revegetated areas and embankments	X			
Replant bare areas or areas with sparse growth		As Required		
Armor areas with rill erosion with an appropriate lining		As Required		
DRAINAGE CONVEYANCE SYSTEMS & STORMWATER BMPS				
Inspect swales, areas of concentrated flow, sediment forebays, infiltration BMPs, outlet structures, outlet protection/plunge pools, and emergency spillways for evidence of erosion, debris, woody growth, and excessive sediment accumulation	X			
Remove any obstructions and accumulated sediments or debris		As Required		
Control vegetated growth and woody vegetation (as allowed)		As Required		
Repair any erosion of the swale lining		As Required		
Clean-out any accumulation of sediment		As Required		
Remove woody vegetation growing through rip-rap		As Required		
Repair any slumping side slopes		As Required		
Replace rip-rap where underlying filter fabric is showing or where stones have dislodged		As Required		
CULVERTS				
Inspect Culvert inlets, outlets, and armoring	X			
Remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit		As Required		
Repair any erosion damage at the culvert's inlet and outlet		As Required		
ACCESS DRIVE SURFACES				
Inspect access drive surfaces and shoulders for erosion, false ditches, rutting, or excess accumulation of fines that could impede water flow	X			
Remove excess fines either manually or with a front-end loader		As Required		
Re-grade roads and shoulders		As Required		
VEGETATED BUFFERS				
Inspect meadow buffers for existing or developing erosion, rutting, debris, unwanted vegetation, concentrated runoff	X			
Correct any erosion/rutting/concentrated flows and remove debris		As Required		
Maintain dense cover of grasses (mow no more than twice per year, and cut vegetation no shorter than 6 inches)		As Required		
MAINTENANCE NEEDED AND WHEN:				

Attachment E: Stormwater Management System Long-Term Operation and Maintenance Plan

STORMWATER MANAGEMENT SYSTEM
LONG-TERM OPERATION AND MAINTENANCE PLAN

Prepared for the

HOLLISTON BATTERY ENERGY STORAGE SYSTEM PROJECT

Location

600 Central Street
Holliston, Massachusetts

Owner

BLUEWAVE

BWC Bogastow Brook, LLC
c/o BlueWave Solar
501 Boylston Street, Suite 10B134
Boston, MA 02116

Prepared by

TRC

650 Suffolk Street, Suite 200
Lowell, MA 01854

August 2022

TABLE OF CONTENTS

ATTACHMENTS

1.0 Objective

This Stormwater Management System Long-Term Operation and Maintenance Plan has been prepared for the BWC Bogastow Brook, LLC Holliston Battery Energy Storage System (BESS) Project (the Project). BWC Bogastow Brook, LLC (BWC Bogastow Brook) will be the owner of the BESS and per Massachusetts stormwater requirements will be responsible for long term maintenance of all components of the stormwater management system. BWC Bogastow Brook will also be responsible for the operation and maintenance of the BESS. These components must be periodically inspected and maintained in effective operating condition. This plan is designed to provide guidance to properly inspect and maintain the stormwater facilities. Should the BESS be decommissioned, the Property Owner will be responsible for maintenance of the stormwater facilities if necessary.

2.0 Maintenance Responsibility

BWC Bogastow Brook will be responsible for the maintenance and inspection of stormwater management facilities during BESS operations. All stormwater maintenance and inspection work will be performed under the direction and supervision of BWC Bogastow Brook. BWC Bogastow Brook may select to hire a contractor to perform the stormwater operation and maintenance work. The emergency contact for the project will be the current Property Owner.

Contact information for these parties are as follows:

BESS Owner and Operator:

BWC Bogastow Brook, LLC
c/o BlueWave Solar
501 Boylston Street, Suite 10B134
Boston, MA 02116
Contact Person: _____
Contact Number: _____

Property Owner:

Christ the King Lutheran Church
600 Central Street
Holliston, MA 01746
Contact Person: _____
Contact Number: _____

A copy of the legal instrument that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs is provided as **Attachment A**.

3.0 Public Safety Features

A 7-foot high perimeter security fence is provided around the BESS and infiltration BMP. Access gates provide access control but also have Knox box or similar locking systems. These locking systems will maintain public safety by keeping trespassers away from the array but will not prevent emergency services, maintenance personnel, or other

authorized entrants from gaining access. An emergency vehicle turnaround is provided at the BESS.

In the event of an emergency at the facility, dial 911. For non-emergency events, the Town of Holliston Fire and Police Departments can be contacted directly as follows:

- Holliston Fire Department: (508) 429-4631
- Holliston Police Department: (508) 429-1212

4.0 General Inspection and Maintenance Requirements

The components of the stormwater management system must be adequately maintained to ensure that the system operates as designed, and as approved by the state of Massachusetts. At a minimum, BWC Bogastow Brook, or its designated contractor will inspect stormwater management features at the site on a quarterly basis. Additional inspections may occur, as needed, depending on the results of routine inspections and site conditions. Stormwater system maintenance and repairs will be performed on an as-needed basis, in accordance with recommendations made by the site inspector.

A Site Maintenance Plan depicting the locations of the stormwater BMPs is provided as **Attachment B**. The proposed access road shown in the plan will provide maintenance access. A post-construction maintenance and inspection log will be completed as part of the quarterly onsite inspections, refer to **Attachment C** for a template of this inspection log. A copy of the log shall be retained by BWC Bogastow Brook for a period of at least five years from the completion of permanent stabilization.

5.0 Facilities to be Maintained

The stormwater management facilities to be maintained at the Holliston Landfill Solar Array Project include:

- Access Drive;
- Stormwater Pretreatment Facility and Infiltration BMP;
- Rip rap Swales; and
- Revegetated Areas and Embankments.

Potential maintenance activities associated with these specific areas and stormwater management features at the facility are identified in the following paragraphs.

Access Drive

The access drive will typically require little ongoing maintenance, owing to their primary and limited use by light-duty vehicles. These areas will be inspected for signs of existing or developing erosion, rutting, trash or unwanted vegetation which will be removed/repaired as needed. Additionally, shoulders shall be inspected for low spots or

evidence of channelized flow and false ditching. Repair/maintenance shall be completed as necessary to ensure runoff from the roadways is conveyed as sheet flow to the downgradient stabilized areas.

Stormwater Pretreatment Facility and Infiltration BMP

The two sediment forebays and infiltration BMP (including associated emergency spillways, outlet structures, culverts, outlet protection and plunge pools) shall be inspected periodically, at least twice a year and after major rain events. They will be inspected for evidence of erosion, sediment accumulation, outlet structure obstructions, debris, or other conditions that may present operational difficulties. Overall condition of the culvert barrel sections shall be assessed for signs of damage, heaving, settlement, deflection, or other structural damage. BMPs shall be cleaned, as needed, by removing accumulated sediment, trash, debris, leaves, grass clippings from mowing, and tree seedlings before they become firmly established. The sediment forebays shall have sediment markers to determine the height of sediment accumulation. After removing the sediment, replace any vegetation damaged during the clean-out by either reseeding or resodding. When mowing grasses in the sediment forebays, keep the grass height no greater than 6 inches and set mower blades no lower than 3 to 4 inches. Mowing of the infiltration basin will be limited to twice per year to ensure a healthy grass cover is present. Weeding, pruning, and removal of woody growth on basin embankments shall be completed as necessary.

If there is water ponding on the surface of the infiltration trench, even after removal of visible sediment and debris, the sand filter material shall be replaced. If there is water ponding inside the basin as observed in the observation well (even after a 72-hour drawdown period following a storm), it may be an indication that the bottom of the basin has failed. To rehabilitate the basin, all accumulated sediment must be stripped from the bottom, the bottom of the basin must be scarified and tilled to induce infiltration, and all stone aggregate and filter fabric must be removed and replaced.

Rip Rap Swales

Swale shall be inspected in the spring and fall of each year and following major storm events (25-year 24-hour storms). Swales shall be inspected for signs of failure including but not limited to evidence of erosion, newly formed channels or gullies, bare spots, and sediment accumulation. Bare spots should be re-stabilized as soon as practicable. Woody vegetation within the banks or flow path of the ditch shall be controlled. Sediment, leaf litter, sand from winter operations, etc. shall be removed from ditches when it reduces the capacity of the channel. Addition of stone checkdams to reduce velocity may be necessary following maintenance or repair activities.

Revegetated Areas and Embankments

Revegetated areas and embankments will be inspected quarterly. Any signs of erosion or inadequate revegetation of these areas will be corrected as needed.

6.0 Miscellaneous Maintenance Activities

Snow removal activities for the BESS are anticipated to be minimal. A Site Maintenance Plan depicting the locations of snow storage areas is provided as **Attachment B**. If access to system components within the fenced-in BESS facility is restricted by substantial snow, then a limited area would be cleared as needed, likely by shoveling.

7.0 Stormwater and BESS Decommissioning Plan

BWC Bogastow Brook would implement the following measures should it be decided that the BESS be decommissioned.

- The electrical equipment will be de-energized by licensed electricians;
- Electrical equipment, wiring, copper and aluminum will be removed and recycled;
- Conduits, both above and below grade and other electrical assemblies will be removed;
- Fencing and fence posts will be removed and taken to a recycling facility. Some portions or all of the fence may remain in place as coordinated with the Property Owner;
- Concrete foundations for inverters, transformers, switchgear, and ballast supports will be fractured into manageable sizes and removed from the site for recycling;
- Disturbed areas or areas of bare soil resulting from decommissioning the BESS will be graded to match into surrounding areas and stabilized with loam, seed, and mulch;
- Underground raceways will be pulled out of the ground using an excavator. Depressions and voids left from removal of raceways and equipment will be backfilled and graded to proper elevation; and
- Stormwater BMPs and other control improvements will be maintained by the Property Owner following BESS decommissioning.

8.0 Illicit Discharge Compliance Statement

Stormwater management system operation and maintenance will be performed according to this plan and all specified pollution prevention measures will be implemented as needed to prevent illicit discharges. In the post-development condition, stormwater will generally maintain the existing on-site flow conditions generated during a 100-year, 24-hour design storm, for all drainage areas. The Site will be surrounded by fencing and access to the Site will be further limited by locked gates to limit the probability of illicit discharges to the Site stormwater BMPs.

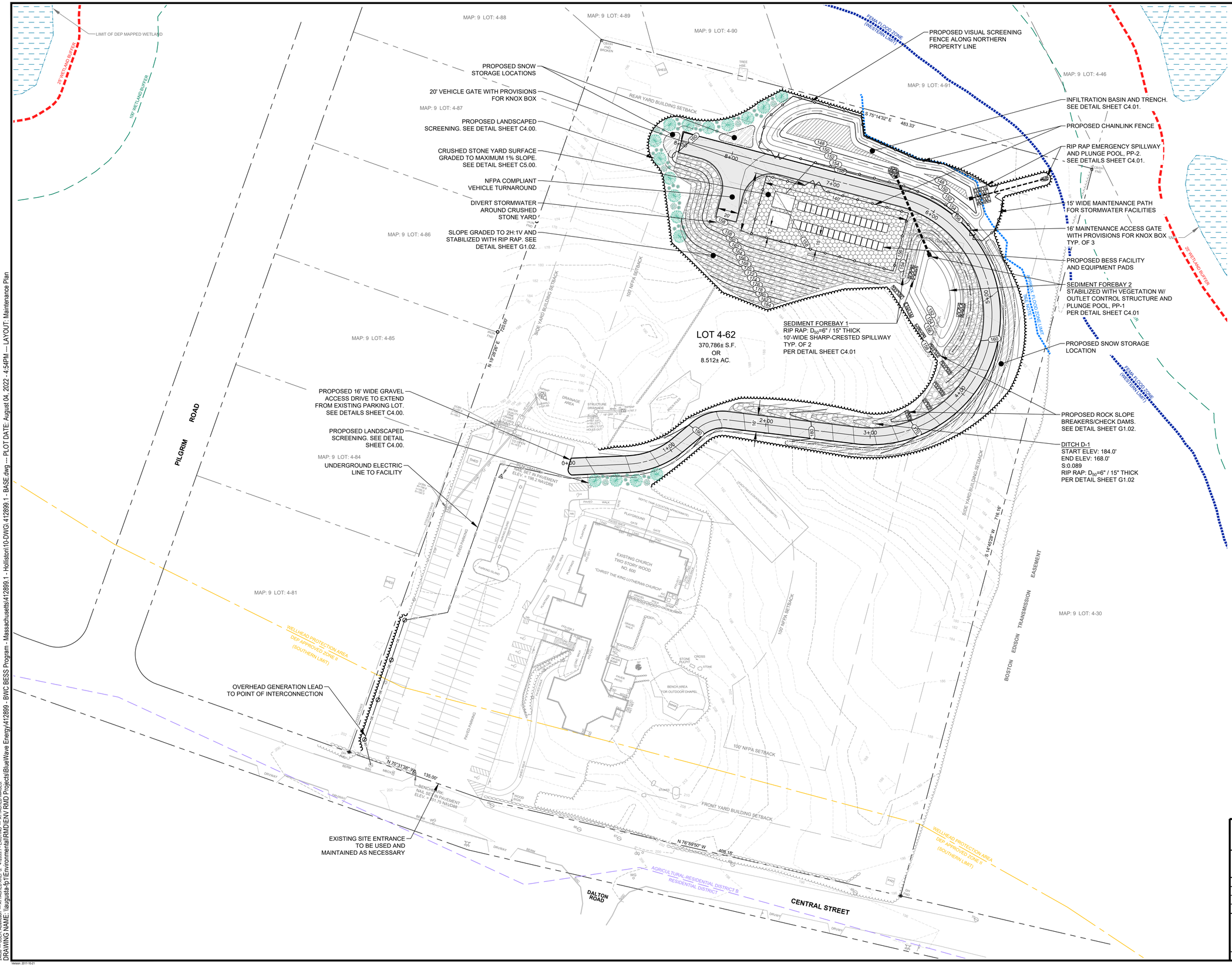
The Site Maintenance Plan, provided as **Attachment B**, depicts the stormwater facility locations at the site and shows that these systems do not allow the entry of any illicit discharges into the stormwater management system. There are no connections between stormwater and wastewater management systems.

ATTACHMENT A

Legal Responsibility for Stormwater O&M

ATTACHMENT B

Site Maintenance Plan



LEGEND

- SURVEYED PROPERTY BOUNDARY
- APPROXIMATE ABUTTING PROPERTY BOUNDARY
- BOUNDARY MONUMENT, FOUND
- IRON PIPE, FOUND
- WATER HYDRANT
- BENCHMARK, FOUND
- LIGHT POST
- EXISTING EDGE OF PAVEMENT/CONCRETE
- EXISTING EDGE OF GRAVEL
- EXISTING FENCE
- EXISTING OVERHEAD ELECTRIC & POLES
- EXISTING RIP RAP
- EXISTING TREE
- EXISTING BUILDING
- 280 EXISTING MAJOR CONTOUR
- 278 EXISTING MINOR CONTOUR
- x 269.7 EXISTING SPOT ELEVATION
- EXISTING TREES AND/OR BRUSH
- FIELD DELINEATED WETLAND
- DEP WETLAND
- ## WETLAND FLAG & I.D.
- CERTIFIED VERNAL POOL IDENTIFIED
- POTENTIAL VERNAL POOL IDENTIFIED
- FIELD DELINEATED STREAM OR WATERBODY
- DEP MAPPED STREAM
- 25' NO-DISTURBANCE BUFFER
- 100' WETLAND BUFFER
- 200' RIVERFRONT AREA
- FEMA 100-YEAR FLOOD ZONE
- APPROXIMATE FLOOD ZONE LIMIT
- PROPOSED GRAVEL ACCESS
- PROPOSED CONCRETE EQUIPMENT PAD
- 279 PROPOSED MINOR CONTOUR
- 280 PROPOSED MAJOR CONTOUR
- PROPOSED TREE LINE/CLEARING LIMITS
- PROPOSED CHAIN LINK FENCE
- PROPOSED OVERHEAD ELECTRIC LINE AND POLE
- PROPOSED MV UNDERGROUND ELECTRIC LINE

NOTES

1. APPROXIMATE FLOOD ZONE LIMIT IS ESTIMATED BASED ON BASE FLOOD ELEVATION OF 151 FEET. ACTUAL FLOOD ZONE LIMIT SHOULD BE CONFIRMED BY A SURVEYOR.
2. PROJECT PROPERTY BOUNDARIES AND SITE TOPOGRAPHIC INFORMATION ARE BASED UPON ON-THE-GROUND FIELD SURVEY COMPLETED BY LAND PLANNING, INC. IN JANUARY 2022 AS PROVIDED IN A PLAN ENTITLED "EXISTING CONDITIONS PLAN, 600 CENTRAL STREET, IN HOLLISTON, MA" AND DATED JANUARY 19, 2022.
3. PROPOSED FEATURES ARE BASED ON ISSUED FOR PERMITTING PROJECT DRAWINGS DATED AUGUST 2022 AND DO NOT REPRESENT AS-BUILT CONDITIONS.

N

0 40 80 120 160
SCALE IN FEET

PERMITTING
NOT FOR CONSTRUCTION

PROJECT: **BLUEWAVE SOLAR**
BWC BOGASTOW BROOK, LLC
HOLLISTON BATTERY ENERGY STORAGE SYSTEM
CENTRAL STREET, HOLLISTON, MASSACHUSETTS

TITLE: **SITE MAINTENANCE PLAN**

PERMITTING

DRAWN BY:	TRC	PROJ NO.:	412899.0001
CHECKED BY:	TND		
APPROVED BY:	TND		**FIGURE 1**
DATE:	AUGUST 2022		

TRC
650 Suffolk Street
Suite 200
Lowell, MA 01854
Phone: 978.970.5600

FILE NO.: 412899.1 - BASE.dwg

ATTACHMENT C

Post-Construction Maintenance and Inspection Log Example

STORMWATER MANAGEMENT SYSTEM: POST-CONSTRUCTION MAINTENANCE & INSPECTION LOG				
	SCHEDULE		INITIALS & DATE	COMMENTS
	QRTLY INSP.	MAINTENANCE		
REVEGETATED AREAS AND EMBANKMENTS				
Inspect revegetated areas and embankments	X			
Replant bare areas or areas with sparse growth		As Required		
Armor areas with rill erosion with an appropriate lining		As Required		
DRAINAGE CONVEYANCE SYSTEMS & STORMWATER BMPS				
Inspect swales, areas of concentrated flow, sediment forebays, infiltration BMPs, outlet structures, outlet protection/plunge pools, and emergency spillways for evidence of erosion, debris, woody growth, and excessive sediment accumulation	X			
Remove any obstructions and accumulated sediments or debris		As Required		
Control vegetated growth and woody vegetation (as allowed)		As Required		
Repair any erosion of the swale lining		As Required		
Clean-out any accumulation of sediment		As Required		
Remove woody vegetation growing through rip-rap		As Required		
Repair any slumping side slopes		As Required		
Replace rip-rap where underlying filter fabric is showing or where stones have dislodged		As Required		
CULVERTS				
Inspect Culvert inlets, outlets, and armoring	X			
Remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit		As Required		
Repair any erosion damage at the culvert's inlet and outlet		As Required		
ACCESS DRIVE SURFACES				
Inspect access drive surfaces and shoulders for erosion, false ditches, rutting, or excess accumulation of fines that could impede water flow	X			
Remove excess fines either manually or with a front-end loader		As Required		
Re-grade roads and shoulders		As Required		
VEGETATED BUFFERS				
Inspect meadow buffers for existing or developing erosion, rutting, debris, unwanted vegetation, concentrated runoff	X			
Correct any erosion/rutting/concentrated flows and remove debris		As Required		
Maintain dense cover of grasses (mow no more than twice per year, and cut vegetation no shorter than 6 inches)		As Required		
MAINTENANCE NEEDED AND WHEN:				