

Stormwater Drainage Report

Rivercrest Condominiums

Ferry Street (Map 47, Parcel 76)
South Hadley, Massachusetts

Project Location:

Ferry Street
Map 47, Parcel 76
South Hadley, Massachusetts

Prepared for:

Ferry Street Nominee Trust
510 New Ludlow Road
South Hadley, Massachusetts 01075

June 18, 2014

Revised: September 25, 2014

R LEVESQUE ASSOCIATES, INC

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I. INTRODUCTION

The project developer, Ferry Street Nominee Trust, is proposing to construct a 29-unit condominium development and associated site improvements. The project includes a 1,100+/- foot long roadway to access the site and a stormwater management system that utilizes catch basins for runoff collection, proprietary sedimentation devices for water quality treatment, subsurface infiltration basins to provide groundwater recharge and a surface infiltration basin to provide peak rate attenuation. All utilities to the site are accessed via Ferry Street including electric service, water service, sanitary sewer service, and gas service. The stormwater management system has been designed to meet the requirements of the Town of South Hadley Stormwater Management Bylaw and the guidelines set forth in the Massachusetts Department of Environmental Protection Stormwater Management Handbook (MassDEP Handbook) to ensure that project will be environmentally responsible.

2. SITE DESCRIPTION

2.1 Predevelopment Conditions

The proposed project is located off of Ferry Street and identified as Assessor's Parcel 76 on Map 47. The parcel to be developed is approximately 10.83 acres and consists of mostly undeveloped woodland in the Residence A-1 district. The property is accessed from Ferry Street which abuts the land to the north. Residential properties abut the land to the east and west and undeveloped land abuts to the south. The elevations of the property range from 212 near the access off of Ferry Street to 155 at the southernmost corner of the property. The topography of the site is such that the highest elevations are at the access off Ferry Street and generally slope in a westerly and southerly direction towards resource areas. See Figure 1 – Site Locus USGS Map.

2.2 Resource Areas

A resource area delineation was performed on the subject property by Charles H. Dauchy, Environmental Consultant, 24 Old Long Plain Road, Leverett, MA 01054 on April 6, 2006, April 20, 2006, and June 29, 2011. Resource areas which were delineated include bordering vegetated wetlands to the south, an isolated vegetated wetland in the south-western corner, and an intermittent stream which follows the eastern-most property line and runs in the north-south direction. Furthermore, there is a perennial stream located just offsite to the south.

The proposed project will not impact the resource areas as the proposed site improvements are only proposed within the 100' buffer zone to the bordering and isolated wetlands and remain outside the 50' buffer zone respectively. Additionally, the project and all of its components will remain outside of the 200' riverfront area associated with the perennial stream to the south. A Notice of Intent filing has been compiled and was submitted to MassDEP and the South Hadley Conservation Commission.

2.3 Floodplain and Endangered Species

R. Levesque & Associates, Inc. performed due diligence research on the property in regards to FEMA flood zone mapping and Natural Heritage and Endangered Species Program areas. The property is not located within any flood hazard areas as defined by the most recent FEMA Flood Insurance Rate Maps, see Figure 2 – FEMA FIRM Map. Furthermore, the property is not located within any areas delineated by NHESP as priority habitats of endangered species, see Figure 3 – NHESP Map.

2.4 Soils

R. Levesque & Associates, Inc. researched the soils located on site with information readily available by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Based on a review of the USDA Soil Survey of Hampden County, Massachusetts, Central Part, the site is comprised of the following soil type:

Windsor Loamy Sand (255A) – Hydrologic Group A: This soil is excessively drained. Depth to groundwater is typically greater than 80 inches;

Windsor Loamy Sand (255B) – Hydrologic Group A: This soil is excessively drained. Depth to groundwater is typically greater than 80 inches;

Amostown Fine Sandy Loam (258B) – Hydrologic Group C: This soil is moderately well drained. Depth to groundwater is typically 18-36 inches;

Agawam Fine Sandy Loam (275B) – Hydrologic Group B: This soil is well drained. Depth to groundwater is typically greater than 80 inches;

Windsor-Scitico-Amostown Complex (750C) – Hydrologic Group A: This soil is excessively drained. Depth to groundwater is typically greater than 80 inches.

A series of test pits were conducted by Gary Weiner, P.E. and witnessed by the Town of South Hadley Board of Health agent Sharon Hart to evaluate the ability of the site to support stormwater drainage system components on May 15, 2014. Additionally, test pit information performed by Mark P. Reed SE2015 of Heritage Surveys, Inc. on December 9, 2010 of a previous submission was utilized for the surface infiltration basin. Test pit findings varied across the site with some test pits showing no signs of groundwater while in some locations, TP-1, TP-6 and H-2, groundwater was observed at about 60", 39", and 40" deep respectively. See Appendix B for soils information.

2.5 Post Development Conditions

Ferry Street Nominee Trust, is proposing to construct a 29-unit condominium development and associated site improvements. The condominium units are to be duplex units varying in size. The proposed site improvements include the construction of a stormwater management system that has been designed to comply with the Town of South Hadley Stormwater Management Bylaw and the guidelines set forth in the Massachusetts Department of Environmental Protection Stormwater Management Handbook. The proposed site improvements will maintain the general drainage patterns of the site by discharging runoff to the same design points in post-development as pre-development conditions. The remaining areas of the property will not be disturbed and will maintain their respective existing runoff characteristics.

3. STORMWATER MANAGEMENT SYSTEM

R. Levesque & Associates, Inc. has prepared the following drainage system calculations for the proposed project site. A detailed hydrologic analysis of the system was completed in order to evaluate the performance of the stormwater management system components, see Appendix C – Pre- and Post-Development Runoff Calculations. The proposed stormwater management system will collect runoff from on-site impervious areas, including the new pavement and roof areas, and utilize stormwater best management practices to provide water quality treatment, groundwater recharge, and peak discharge rate attenuation.

3.1 Hydrologic Calculations

R. Levesque & Associates, Inc. utilized the HydroCAD software program, Version 10.0, developed by HydroCAD Software Solutions LLC, in order to create and analyze the site hydrology. The HydroCAD software is based upon the Soil Conservation Service (SCS) “Technical Release 20 – Urban Hydrology for Small Watersheds” and “Technical Release 55 – Urban Hydrology for small Watersheds” which are generally accepted industry standard methodologies. The analysis was conducted in order to establish the peak discharge rates and estimated run-off volume from the project site. This was accomplished to properly evaluate pre- and post-development conditions during various storm events. Contributing drainage areas were identified and soils, surface cover, watershed slope, and flow paths were evaluated to develop the necessary HydroCAD model input parameters. A minimum Time of Concentration (Tc) of (6) minutes was used in the calculations.

Drainage calculations were performed for the Pre and Post-Development conditions for the 24-hour, 2, 10, and 100-year Type III storm events. The total rainfall for each of the storm events was based upon data provided by the United States Department of Commerce Technical Paper No. 40 – Rainfall Frequency Atlas of the United States. The total rainfall values used in the hydrologic modeling for each event are shown in the following table:

Table 3.1: Design Rainfall Data		
2-year, 24-hour storm	10-year, 24-hour storm	100-year, 24-hour storm
3.00 inches	4.50 inches	6.40 inches

3.1.1 Design Points

In order to compare the difference between pre and post-development peak flows, existing and proposed watersheds were delineated. Multiple Design Points (DP) were established with flow paths representing the longest time of concentration of run-off in each tributary watershed. For this analysis, the design points were chosen as follows:

- DP-1: Offsite to North/West; This design point represents the runoff from the property which flows off site towards the north-west property line; and
- DP-2: Offsite to West; This design point represents the runoff from the property which flows off site towards the north-west property line; and
- DP-3: Offsite to Northeast; This design point represents the runoff from the property which flows off site towards the northeast property line; and
- DP-4: East Edge of Property; This design point represents the runoff from the property which flows in an easterly direction; and
- DP-5: Southwest Corner; This design point represents the runoff from the property which flows in a south-westerly direction; and
- DP-6: South Corner; This design point represents the runoff from the property which flows in a southerly direction.

3.1.2 Pre-Development Hydrology

The project area under existing conditions was broken down into six (6) sub-catchments discharging to the six design points as described above. The sub-catchments were delineated based on existing site topography and the limit-of-work for the proposed development. Any areas down gradient of the limit-of-work were not analyzed as these areas will not be disturbed and maintain their respective runoff characteristics. The existing watershed areas are shown on the attached Figure 4 entitled "Pre-Development Watershed Plan". Peak discharge rates for each watershed are depicted in Table 3.1.4 below.

3.1.3 Post-Development Hydrology

The proposed project site was broken down into nine (13) sub-catchments discharging to the same six design points as the existing conditions. The proposed watershed areas are shown on the attached Figure 5 entitled "Post-Development Watershed Plan". Peak discharge rates for each watershed are depicted in Table 3.1.4 below.

3.1.4 Peak Discharge Rates

The table below summarizes the Pre- and Post-Development peak discharge rates for each design point:

Table 3.1.4: Pre- and Post-Development Peak Discharge Rates						
	2-year storm (cfs)		10-year storm (cfs)		100-year storm (cfs)	
	Pre-	Post-	Pre-	Post-	Pre-	Post-
Design Point #1	0.00	0.00	0.00	0.00	0.01	0.02
Design Point #2	0.00	0.00	0.00	0.00	0.01	0.02
Design Point #3	0.00	0.00	0.00	0.00	0.00	0.01
Design Point #4	0.00	0.00	0.00	0.00	0.02	0.07
Design Point #5	0.00	0.00	0.00	0.00	0.03	0.01
Design Point #6	0.08	0.09	0.55	0.54	1.55	1.28

As shown in the table above, the proposed stormwater management system and site improvements have been designed such that the peak discharge rates in the post-development scenario have been reduced, matched, or brought closely to within a de-minimus factor of runoff.

3.2 Hydraulic Calculations

As part of the Stormwater management system design, a hydraulic analysis was performed on the proposed underground infrastructure. The hydraulic analysis was performed for the 24-hour, 100-year storm event. Please refer to Appendix G for the hydraulic analysis computations of the proposed stormwater management system. The hydraulic analysis was broken down into two segments, the main stormwater drainage infrastructure and the roof leader systems. The following sections describe each of the systems.

3.2.1 Stormwater Drainage Infrastructure

The stormwater management infrastructure includes the main piping of the drainage system which conveys runoff from the inlet points to the subsurface infiltration basins and the surface infiltration basin. The stormwater infrastructure was designed such that the runoff the 100-year storm event will not surcharge the drainage system. Calculations have been provided in Appendix G.

3.2.2 Roof Leader Piping

The roof leader piping includes the lines of the drainage system which convey runoff from the roof leaders to the stormwater management system. Calculations have been provided in Appendix G demonstrating the capacity of an 8-inch PVC pipe sloped at 1%. The most roof area any one roof leader pipe will convey is the roof leader collecting the runoff from units 11 through 18. The maximum discharge for the 100-year storm event from those roof areas is 1.72 cfs. As demonstrated by the channel report, an 8" PVC pipe sloped at 1% is able to convey 1.9 cfs. Therefore, the roof leader piping is sufficient.

3.3 MassDEP Stormwater Management Standards

R. Levesque & Associates, Inc. has designed the proposed stormwater management system to be in compliance with the MassDEP Stormwater Management Standards. Chapter 1, Volume 3 of the MassDEP Handbook outlines specific calculations, and other information, that must be submitted with each report to document compliance. The following summary highlights elements of the proposed project and how they apply to each standard.

- *Standard #1 - No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

The proposed project provides water quality treatment to the guidelines of the Town of South Hadley Stormwater Management Bylaw and the MassDEP Handbook. Therefore, no new untreated stormwater is discharged.

- *Standard #2 – Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

The proposed stormwater management system has been designed such that the post-development peak discharge rates are less than or within a de-minimus factor of the pre-development discharge rates for the 2-year and 10-year 24-hour storms. There are de-minimus increases during the 100-year storm event, in which case, the amount of runoff related to the de-minimus increase will not have adverse effects down gradient. See Appendix C for the Hydrologic Analysis.

- *Standard #3 - Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater BMPs, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required volume as determined in accordance with the Massachusetts Stormwater Handbook.*

The proposed subsurface infiltration basins and surface infiltration basin have been designed with the capacity to infiltrate the required recharge volume. See Appendix D for the Required Recharge Volume Calculations.

- *Standard #4 – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of TSS. It is presumed that this standard is met when:*
 - a. Suitable practices for source control and pollution prevention are identified in a long term pollution prevention plan, and thereafter are implemented and maintained;*
 - b. Structural stormwater BMPs practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
 - c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook*

The proposed stormwater management system has been sized to capture and treat the water quality volume. See Appendix D for the Water Quality Volume Calculations.

- *Standard #5 - For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential*

pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by MassDEP to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

This standard is not applicable.

- *Standard #6 – Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater BMPs determined by MassDEP to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A “storm water discharge” as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.*

This standard is not applicable.

- *Standard #7 – A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural BMPs requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

This Standard is not applicable.

- *Standard #8 – A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention) shall be developed and implemented.*

A Construction Period Erosion Control Plan has been provided in Appendix E.

- *Standard #9 – A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

A Long-term Operation & Maintenance Plan has been provided in Appendix F.

- *Standard #10 - All illicit discharges to the stormwater management system are prohibited.*

An illicit discharge statement will be provided prior to discharge of stormwater to post-construction BMPs.

3.4 Stormwater Best Management Practices

The proposed stormwater management system was designed utilizing stormwater best management practices (BMP) as set forth by the MassDEP Handbook. The BMPs utilized as part of the stormwater management system include roadside catch basins, yard drain inlets, proprietary treatment devices,

subsurface infiltration systems, and a surface infiltration basin. All of the BMPs were designed to meet the requirements of the MassDEP Handbook and will provide water quality treatment, groundwater recharge, and peak rate attenuation in order to mitigate the impacts of the proposed site improvements.

The proposed site improvements include the construction of new impervious surfaces such as the roadway and roof areas. In order to meet the requirements of the MassDEP Handbook, all of the roadway runoff will be collected via roadside catch basins and treated through proprietary sedimentation devices prior to discharge to the infiltration systems in order to provide the required water quality treatment. Additionally, most of the proposed roof area will also be collected and conveyed to the subsurface infiltration systems, however, in some cases the roof runoff will be discharged directly onto lawn areas. In these cases, the runoff will be collected by drainage swales and yard drains and conveyed to the surface infiltration basin in order to provide the proper peak rate attenuation. Since the roof runoff is not required to be treated for total suspended solids, it can be conveyed directly to the infiltration basin.

The subsurface infiltration systems in conjunction with the surface infiltration basin will provide the required groundwater recharge and peak rate attenuation as set forth by the MassDEP Handbook. The stormwater management system has been designed such that the subsurface infiltration systems will overflow to the surface infiltration basin where an outlet control structure will provide the proper control of discharge rates. The discharge from the surface infiltration basin will be conveyed, via the outlet control structure, to a flared end section directing the runoff to the design point. See Appendix D – MassDEP Calculations for the calculations required to document compliance. The following section provides a description of the best management practices (BMPs) being utilized on site.

3.4.1 Deep Sump Catch Basins

Deep sump catch basins equipped with oil/gas hoods are being utilized as structural pretreatment devices within the proposed stormwater management system. The catch basins will be constructed with 4' deep sumps to act as settling chambers and allow for adequate storage of collected sediments. Catch basins are typically first in the line of water quality treatment.

3.4.2 Proprietary Sedimentation Devices

Proprietary sedimentation devices are being utilized on site for the pretreatment of stormwater runoff, in addition to the catch basin, prior to conveyance to the subsurface infiltration basins. Due to the stormwater management system utilizing an underground infiltration system, pre-treatment of the stormwater runoff is essential to the long term effectiveness of the infiltration system. As much sediment should be removed from the stormwater runoff as possible to avoid clogging of the infiltration media. Therefore, maintenance of the proprietary device is crucial to the long-term effectiveness of the subsurface infiltration system. The stormwater management system is utilizing proprietary treatment devices in order to ensure that the amount of sediment reaching the subsurface infiltration basins is minimal.

3.4.3 Subsurface Infiltration Basins

Subsurface Infiltration Basins are well suited to provide groundwater recharge and water quantity control from watershed areas such as those associated with this project. The subsurface infiltration basin attenuates stormwater runoff by holding the peak runoff volumes and retaining the stormwater over a

period of time. The subsurface infiltration basins consist of underground stormwater chambers embedded in stone. The discharge is conveyed to the subsurface infiltration basins via up-gradient drainage infrastructure where it is detained to provide groundwater recharge and peak rate attenuation. During larger storm events, the overflow runoff is discharged via outlet manifolds pipes to down-gradient drainage infrastructure to the surface infiltration basin. The area around the flared end section will also be protected by riprap to prevent scouring and erosion at the outlet.

3.4.4 Surface Infiltration Basin with Sediment Forebay

Surface infiltration basins accompanied by sediment forebays are well suited to meet the water quality and water quantity requirements from watershed areas such as those associated with this project. The infiltration basin, with associated sediment forebay, mitigates the impact of the proposed site improvements by attenuating the peak discharge rates and providing groundwater recharge. The runoff enters the basin via the sediment forebay where it is retained for a period of time as the outlet control structure releases a controlled amount of water. The proposed infiltration basin has been designed to attenuate up to the 100-year storm event without discharge via the emergency overflow weir.

3.5 Protection of Stormwater Best Management Practices during Construction

Protection of the stormwater best management practices during construction will ensure the proper functioning of the stormwater management system and provide protection to the existing infrastructure until the site has been stabilized. Certain specific erosion and sedimentation controls and good practices to be performed by the site contractor have been documented in a Construction Period Erosion Control Plan. See Appendix E – Construction Period Erosion Control Plan.

3.6 Inspection and Maintenance of Stormwater Best Management Practices

Frequent maintenance of the stormwater best management practices is essential to ensuring that the stormwater management system will function properly long-term. The MassDEP provides guidelines for the regular inspection and maintenance of the proposed stormwater best management practices. A Long-Term Stormwater Operation and Maintenance Plan has been prepared which dictates the inspection frequency and maintenance operations for each BMP. See Appendix F – Long-Term Operation and Maintenance Plan.

3.7 Low Impact Development Alternatives Analysis Narrative

A Low Impact Development Alternatives Analysis narrative has been provided as part of the Stormwater Drainage Report, see Appendix H.

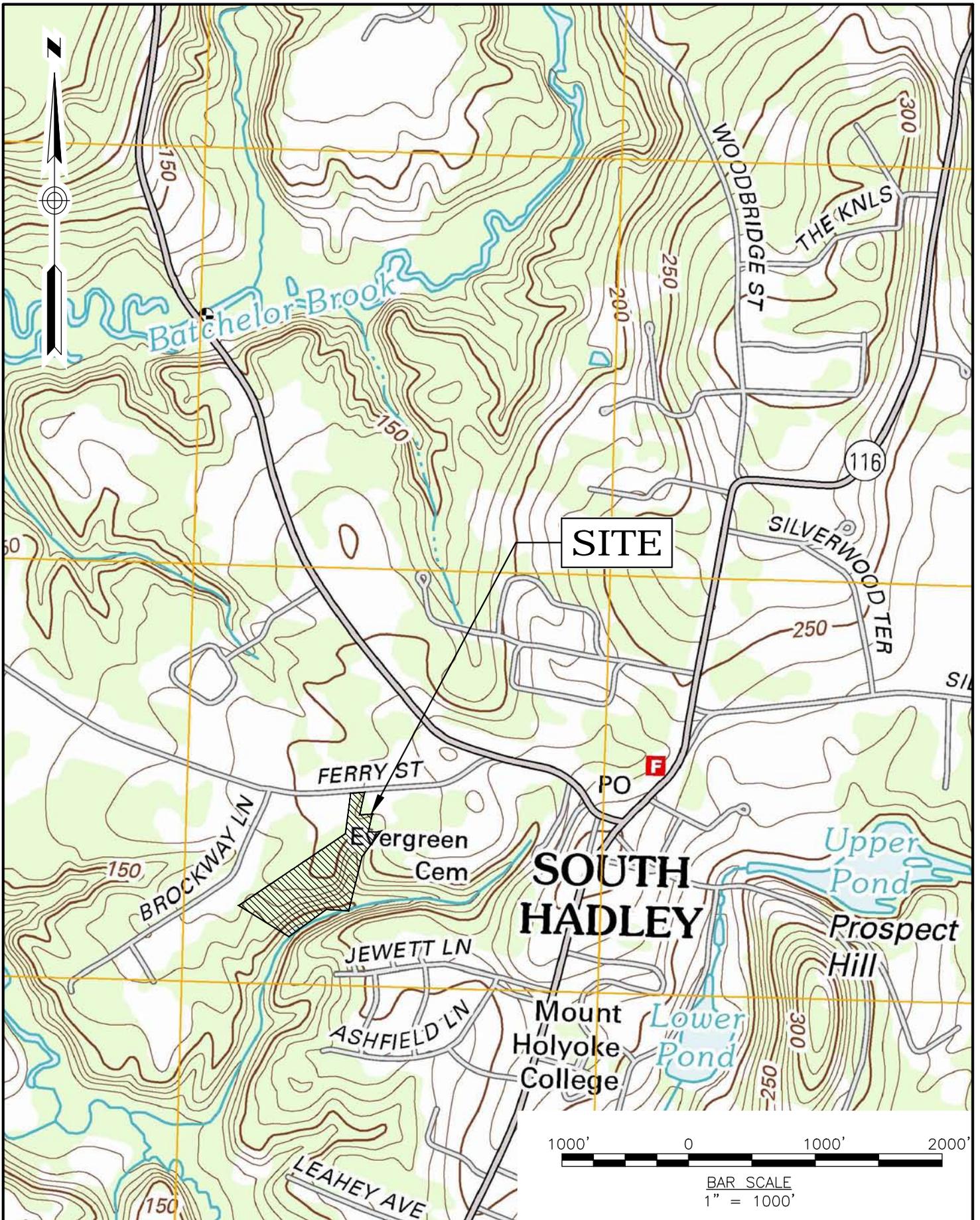
4. Town of South Hadley Inspection Requirements

In accordance with sub-section 6 within Section 16-4 Permit Procedures and Requirements of the Town of South Hadley Stormwater Management Bylaw, R. Levesque Associates has included a "Town of South Hadley Inspection Schedule Sign-Off Sheet" as an appendix to this Report. The inspection schedule sign-off sheet was prepared to document compliance with the Town of South Hadley Stormwater Management Bylaw, see Appendix I – Town of South Hadley Inspection Sheet.

5. CONCLUSION

The stormwater management system has been designed to mitigate the impacts to stormwater runoff from the project due to the construction of the proposed site improvements. The stormwater management system will provide a control for runoff water quality, groundwater recharge, and peak rate attenuation. Implementation of stormwater best management practices such as catch basins, proprietary sedimentation devices, subsurface infiltration systems and a surface infiltration basin allow for a stormwater drainage design that is in conformance with the criteria set forth by the Town of South Hadley Stormwater Management Bylaw and the Massachusetts Department of Environmental Protection Stormwater Management Handbook.

Figure 1: Site Locus – USGS Map



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SITE LOCUS
USGS MAP

DESIGNED BY: N/A CHECKED BY: FJC
 DRAWN BY: JAT Figure 1 - Locus USGS.dwg

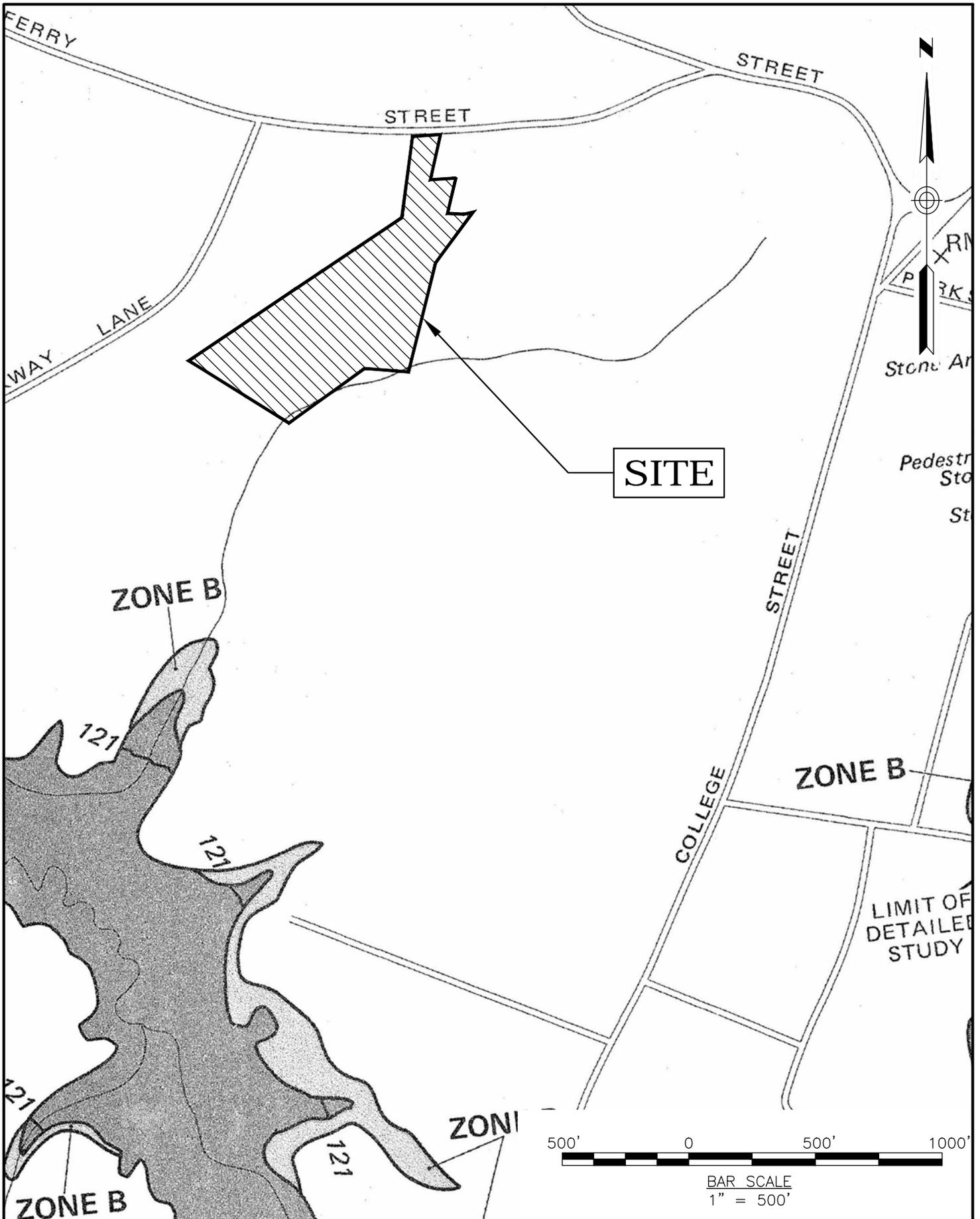
Ferry Street Nominee Trust
 P.O. Box 13 - 510 New Ludlow Road
 South Hadley, MA

Rivercrest Condominiums
 Ferry Street
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JOB NO: 130821
 DATE: 5/30/14
 SCALE: AS NOTED

FIG-1

Figure 2: FEMA Flood Map



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Flood Ins. Rate Map Comm. -
Panel Number 250170 0010 A
Effective Date: Aug. 15, 1979

DESIGNED BY: N/A	CHECKED BY: FJC
DRAWN BY: JAT	Figure 2 - FEMA.dwg

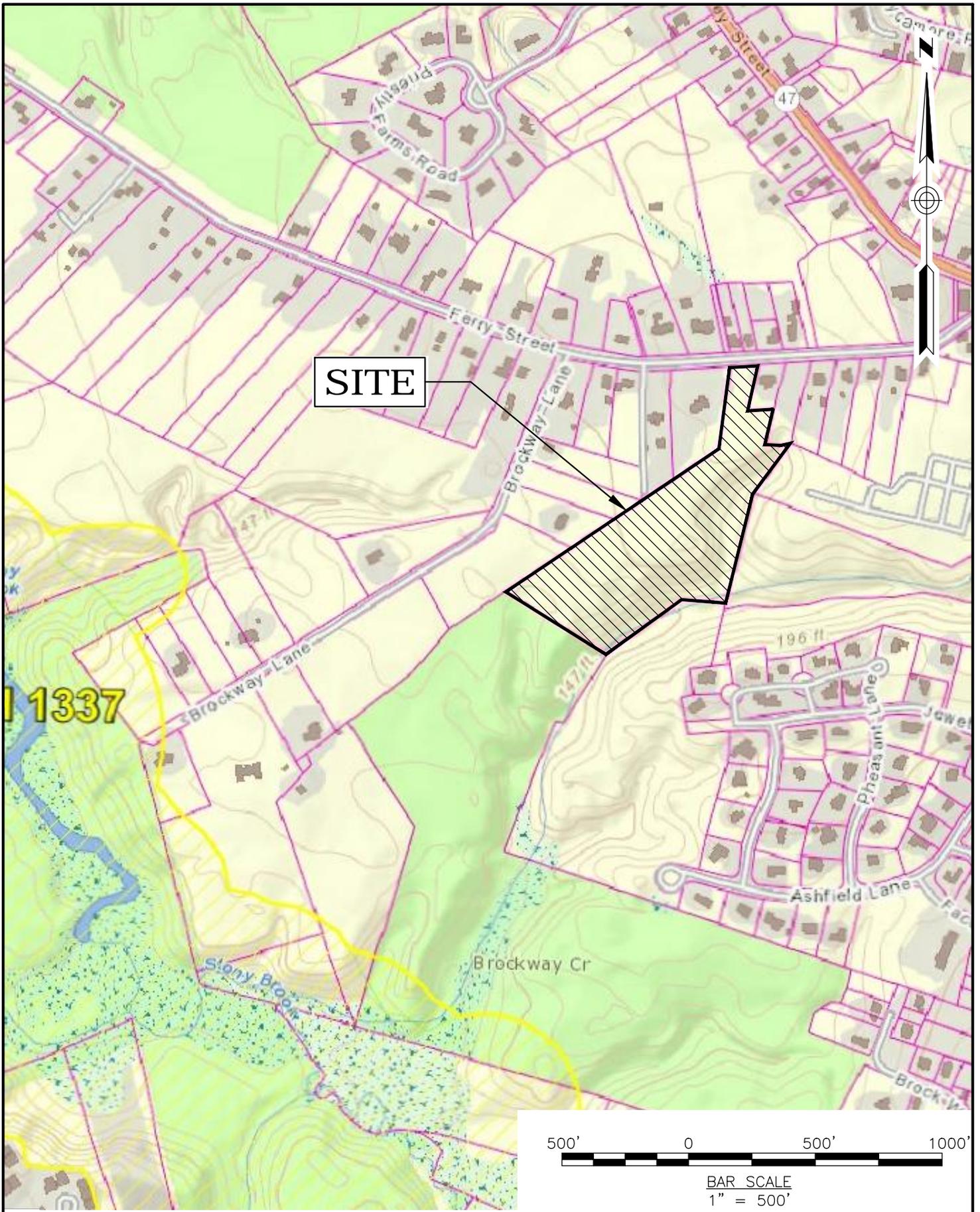
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Rivercrest Condominiums
 Ferry Street
 South Hadley, MA

JOB NO: 131119
 DATE: 5/30/14
 SCALE: AS NOTED

FIG-2

Figure 3: NHESP Map



SITE

1337



BAR SCALE
1" = 500'



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NHESP MAP

DESIGNED BY: N/A	CHECKED BY: N/A
DRAWN BY: JAT	Figure 3 - NHESP.dwg

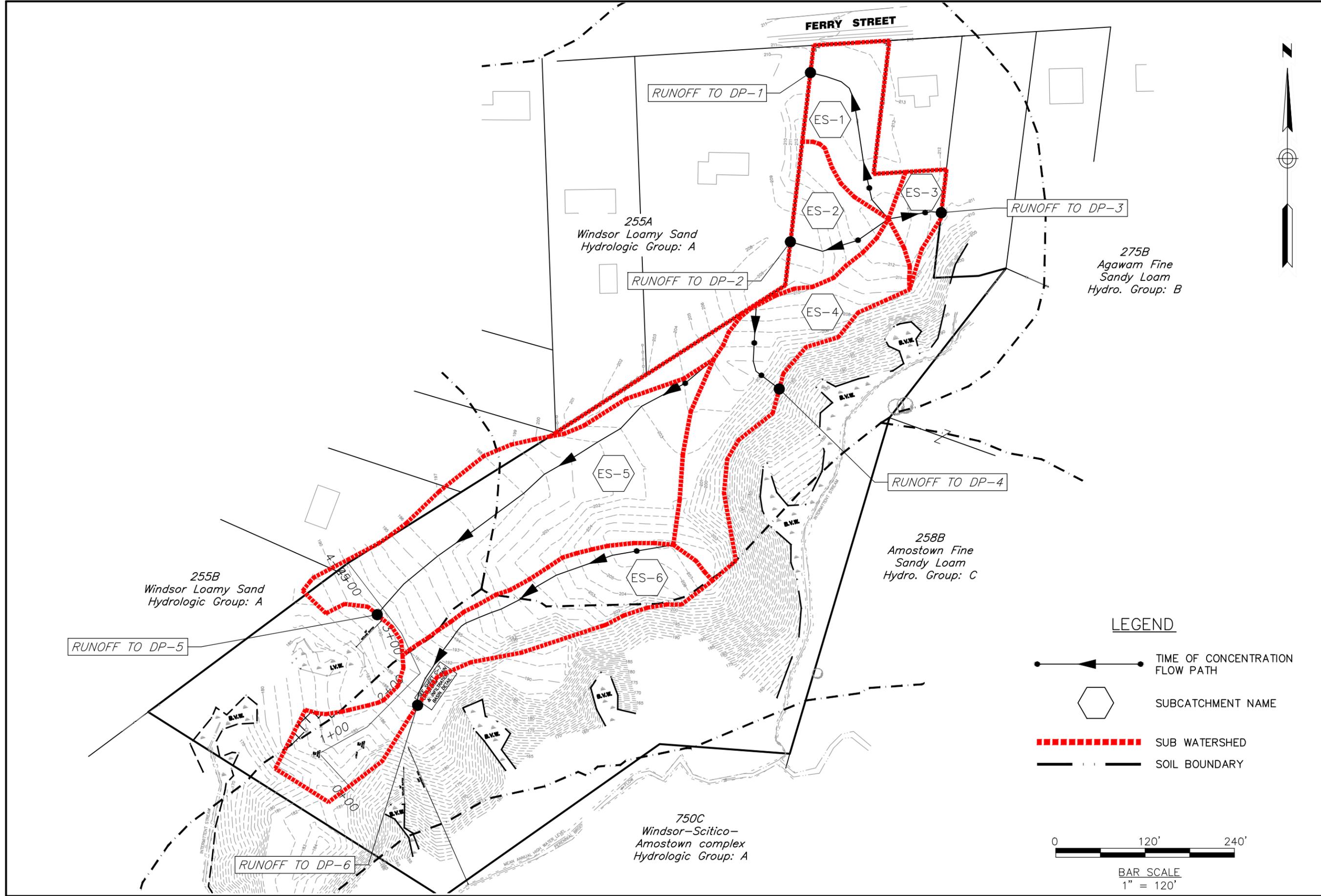
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JOB NO: 13119
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SCALE: AS NOTED

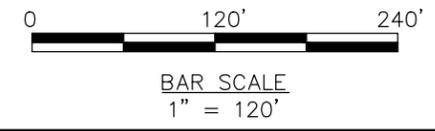
FIG-3

Figure 4: Pre-Development Watershed Plan



LEGEND

-  TIME OF CONCENTRATION FLOW PATH
-  SUBCATCHMENT NAME
-  SUB WATERSHED
-  SOIL BOUNDARY



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Pre-Development Watershed Plan

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 CHECKED BY: FJC
 DRAWN BY: JAT
 13-1119 - HYDRO.dwg

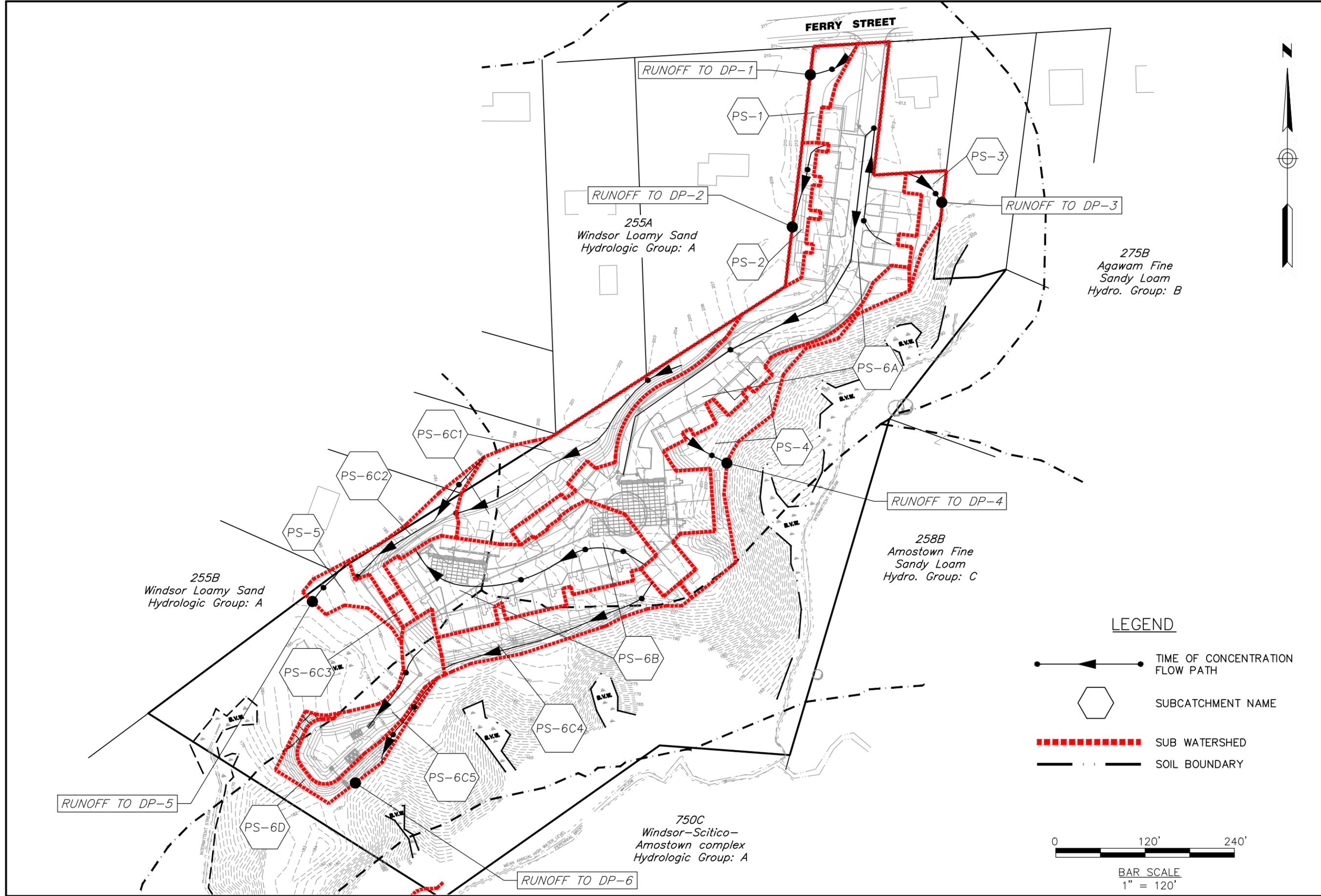
Ferry Street Nominee Trust
 PO Box 13 - 510 New Ludlow Road
 South Hadley, MA 01075

Rivercrest Condominiums
 Ferry Street
 South Hadley, MA

JOB NO: 13-1119
 DATE: 6/16/14
 SCALE: AS NOTED

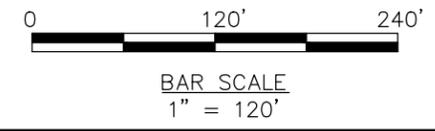
FIG-4

Figure 5: Post-Development Watershed Plan



LEGEND

-  TIME OF CONCENTRATION FLOW PATH
-  SUBCATCHMENT NAME
-  SUB WATERSHED
-  SOIL BOUNDARY



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 40 School Street - Westfield, MA 01086
 rlandand.com

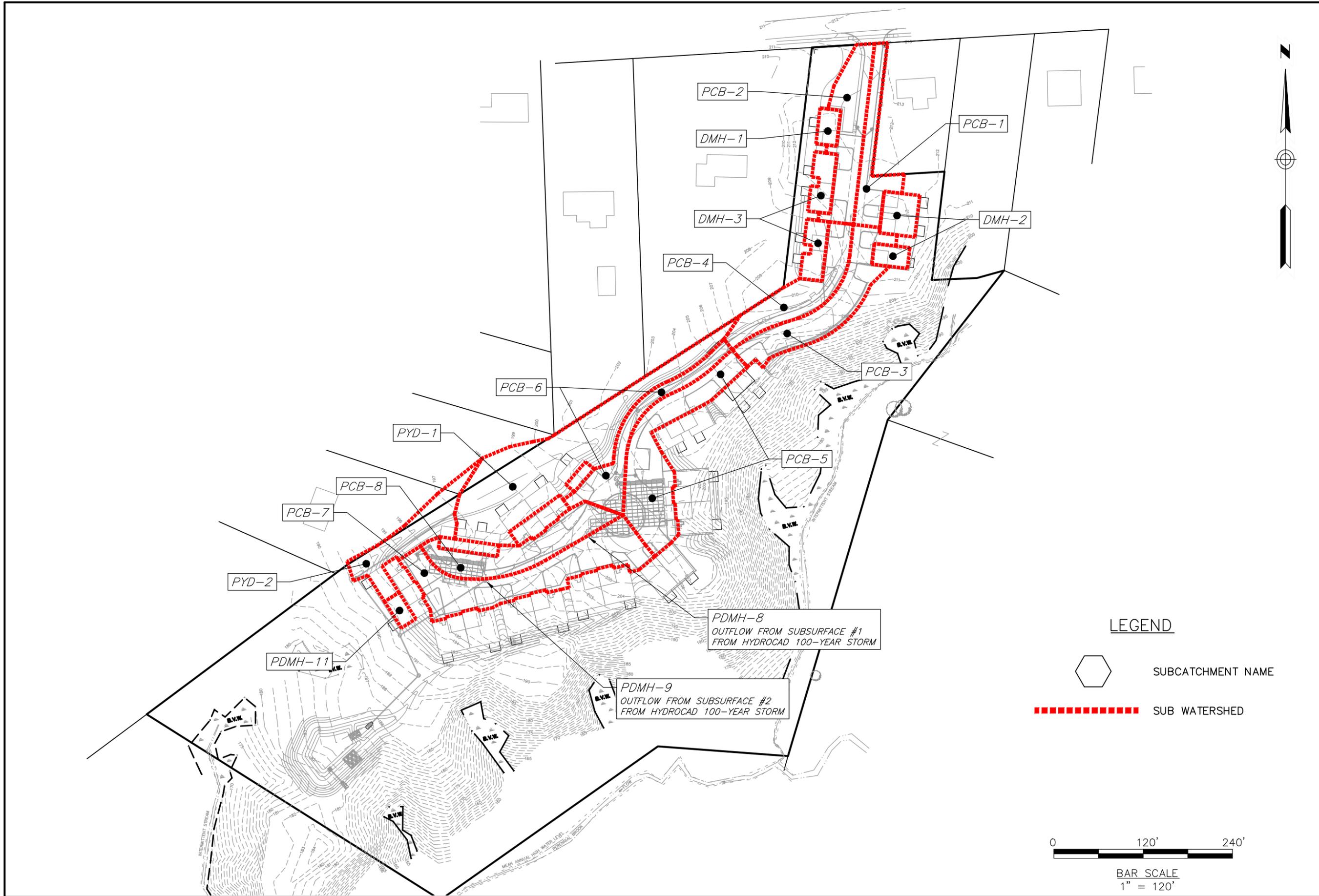
RLA

Post-Development Watershed Plan
 DESIGNED BY: JAT
 CHECKED BY: FJC
 13-1119 - HYDRO.dwg
 DRAWN BY: JAT

Ferry Street Nominee Trust
 PO Box 13 - 510 New Ludlow Road
 South Hadley, MA 01075
 Rivercrest Condominiums
 Ferry Street
 South Hadley, MA

JOB NO: 13-1119
 DATE: 9/25/14
 SCALE: AS NOTED
FIG-5

Figure 6: Inlet Area Plan



R LEVESQUE ASSOCIATES, INC
 A Land Planning Company
 ph: 413.568.0985 fax: 413.568.0986
 40 School Street · Westfield, MA 01086
 rland.com

RLA

Inlet Area Plan

DESIGNED BY: JAT
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 SCALE: AS NOTED

FIG-6

Appendix A: Checklist for Stormwater Report



Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the [Massachusetts Stormwater Handbook](#). The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

¹ The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

² For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

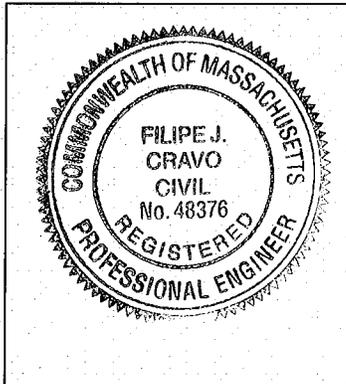
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



[Handwritten Signature] *[Handwritten Date: 9/25/14]*

Signature and Date

Checklist

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

- New development
- Redevelopment
- Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - Static
 - Simple Dynamic
 - Dynamic Field¹
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - Site is comprised solely of C and D soils and/or bedrock at the land surface
 - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - Solid Waste Landfill pursuant to 310 CMR 19.000
 - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - is within the Zone II or Interim Wellhead Protection Area
 - is near or to other critical areas
 - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - involves runoff from land uses with higher potential pollutant loads.
 - The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - The ½" or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - Limited Project
 - Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
 - Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

Appendix B: Soils Information



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 Hampshire County, Massachusetts, Central Part Rivercrest Condos



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 (<http://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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for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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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

Custom Soil Resource Report

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.

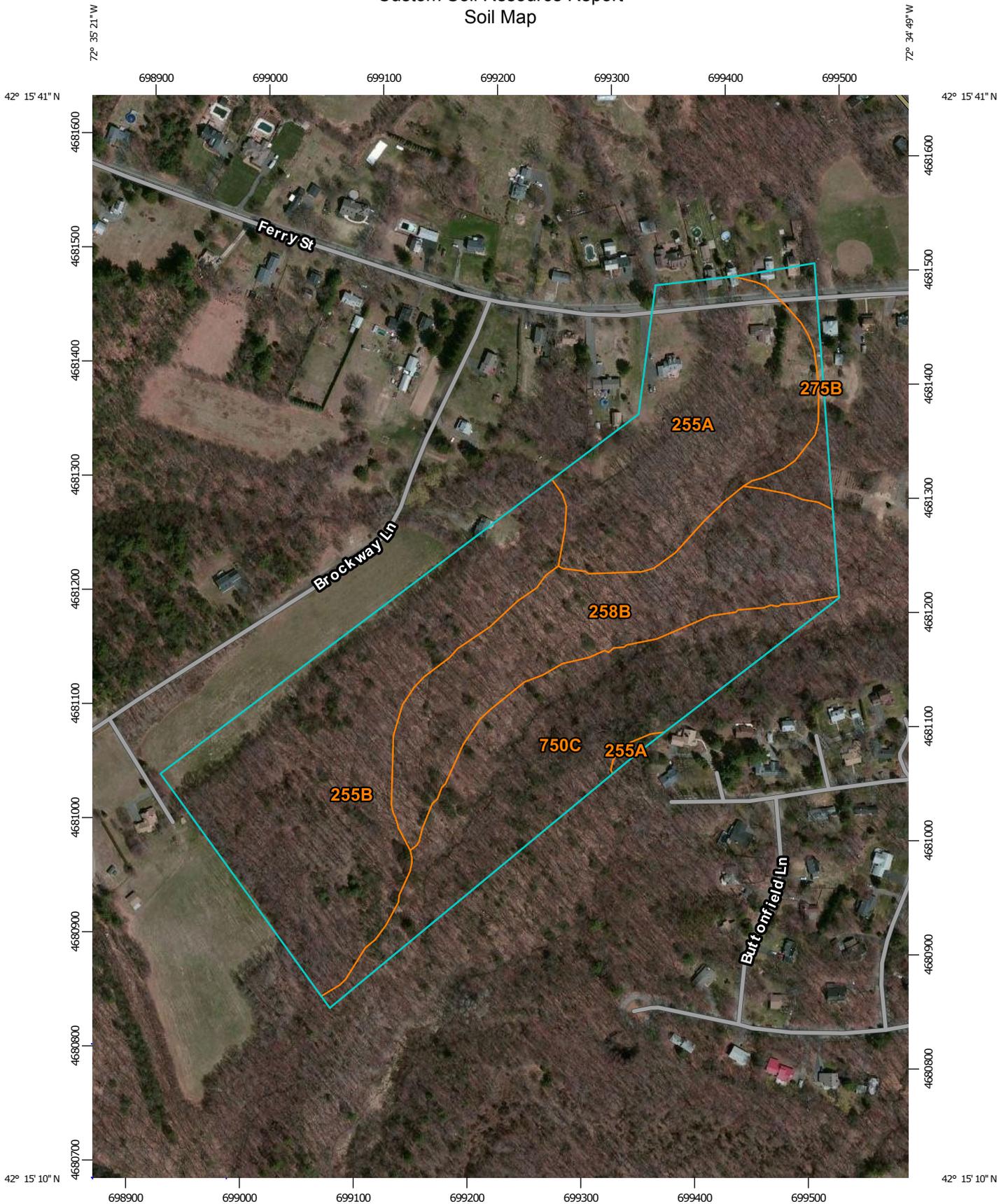
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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.

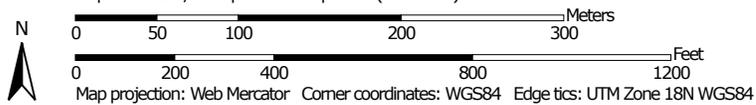
Soil Map

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: 1:4,620 if printed on A portrait (8.5" x 11") sheet.



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
- 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 1:15,800.

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: <http://websoilsurvey.nrcs.usda.gov>
 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: Hampshire County, Massachusetts, Central Part
 Survey Area Data: Version 8, Dec 17, 2013

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

Date(s) aerial images were photographed: Mar 28, 2011—May 12, 2011

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

Hampshire County, Massachusetts, Central Part (MA609)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
255A	Windsor loamy sand, 0 to 3 percent slopes	9.1	22.4%
255B	Windsor loamy sand, 3 to 8 percent slopes	13.3	32.6%
258B	Amostown fine sandy loam, 3 to 8 percent slopes	8.4	20.5%
275B	Agawam fine sandy loam, 3 to 8 percent slopes	1.2	2.9%
750C	Windsor-Scitico-Amostown complex, 0 to 15 percent slopes	8.9	21.7%
Totals for Area of Interest		40.8	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

Custom Soil Resource Report

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.

Hampshire County, Massachusetts, Central Part

255A—Windsor loamy sand, 0 to 3 percent slopes

Map Unit Setting

Mean annual precipitation: 40 to 50 inches

Mean annual air temperature: 45 to 52 degrees F

Frost-free period: 140 to 240 days

Map Unit Composition

Windsor and similar soils: 80 percent

Minor components: 20 percent

Description of Windsor

Setting

Landform: Outwash plains

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Loose sandy glaciofluvial deposits

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 4.8 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance

Land capability (nonirrigated): 3s

Hydrologic Soil Group: A

Typical profile

0 to 8 inches: Loamy sand

8 to 21 inches: Loamy sand

21 to 60 inches: Sand

Minor Components

Unnamed

Percent of map unit: 10 percent

Hinckley

Percent of map unit: 10 percent

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

Map Unit Setting

Mean annual precipitation: 40 to 50 inches

Mean annual air temperature: 45 to 52 degrees F

Frost-free period: 140 to 240 days

Map Unit Composition

Windsor and similar soils: 80 percent

Minor components: 20 percent

Description of Windsor

Setting

Landform: Outwash plains

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Loose sandy glaciofluvial deposits

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 4.8 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance

Land capability (nonirrigated): 3s

Hydrologic Soil Group: A

Typical profile

0 to 8 inches: Loamy sand

8 to 21 inches: Loamy sand

21 to 60 inches: Sand

Minor Components

Hinckley

Percent of map unit: 10 percent

Unnamed

Percent of map unit: 10 percent

258B—Amostown fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

Mean annual precipitation: 40 to 50 inches

Mean annual air temperature: 45 to 52 degrees F

Frost-free period: 140 to 240 days

Map Unit Composition

Amostown and similar soils: 75 percent

Minor components: 25 percent

Description of Amostown

Setting

Landform: Deltas, terraces, outwash plains

Landform position (two-dimensional): Summit, footslope

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Friable sandy glaciofluvial deposits over silty glaciolacustrine deposits

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)

Depth to water table: About 18 to 36 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: High (about 9.3 inches)

Interpretive groups

Farmland classification: All areas are prime farmland

Land capability (nonirrigated): 2w

Hydrologic Soil Group: C

Typical profile

0 to 7 inches: Fine sandy loam

7 to 32 inches: Fine sandy loam

32 to 60 inches: Stratified very fine sand to silt loam

Minor Components

Pollux

Percent of map unit: 15 percent

Agawam

Percent of map unit: 10 percent

275B—Agawam fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

Elevation: 0 to 1,000 feet

Mean annual precipitation: 40 to 50 inches

Mean annual air temperature: 45 to 52 degrees F

Frost-free period: 140 to 240 days

Map Unit Composition

Agawam and similar soils: 85 percent

Minor components: 15 percent

Description of Agawam

Setting

Landform: Outwash plains, outwash terraces

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from granite and gneiss

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: 20 to 35 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 capacity: Low (about 4.3 inches)

Interpretive groups

Farmland classification: All areas are prime farmland

Land capability (nonirrigated): 2e

Hydrologic Soil Group: B

Typical profile

0 to 11 inches: Fine sandy loam

11 to 16 inches: Fine sandy loam

16 to 26 inches: Fine sandy loam

26 to 60 inches: Stratified loamy sand to loamy fine sand

Minor Components

Ninigret

Percent of map unit: 5 percent

Merrimac

Percent of map unit: 4 percent

Deerfield

Percent of map unit: 3 percent

Windsor

Percent of map unit: 3 percent

750C—Windsor-Scitico-Amostown complex, 0 to 15 percent slopes

Map Unit Setting

Mean annual precipitation: 40 to 50 inches

Mean annual air temperature: 45 to 52 degrees F

Frost-free period: 140 to 240 days

Map Unit Composition

Windsor and similar soils: 40 percent

Scitico and similar soils: 20 percent

Amostown and similar soils: 15 percent

Minor components: 25 percent

Description of Windsor

Setting

Landform: Outwash plains

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Riser

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Loose sandy glaciofluvial deposits

Properties and qualities

Slope: 25 to 35 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 4.8 inches)

Interpretive groups

Farmland classification: Not prime farmland

Land capability (nonirrigated): 7s

Hydrologic Soil Group: A

Typical profile

0 to 8 inches: Loamy sand

8 to 21 inches: Loamy sand

Custom Soil Resource Report

21 to 60 inches: Sand

Description of Scitico

Setting

Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Hard silty glaciolacustrine deposits

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 4w
Hydrologic Soil Group: C

Typical profile

0 to 10 inches: Silt loam
10 to 22 inches: Silt loam
22 to 36 inches: Silty clay
36 to 65 inches: Silty clay

Description of Amostown

Setting

Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable sandy glaciofluvial deposits over silty glaciolacustrine deposits

Properties and qualities

Slope: 3 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): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.3 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 2e
Hydrologic Soil Group: C

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Typical profile

0 to 7 inches: Fine sandy loam

7 to 32 inches: Fine sandy loam

32 to 60 inches: Stratified very fine sand to silt loam

Minor Components

Hinckley

Percent of map unit: 10 percent

Boxford

Percent of map unit: 5 percent

Agawam

Percent of map unit: 5 percent

Pollux

Percent of map unit: 5 percent

References

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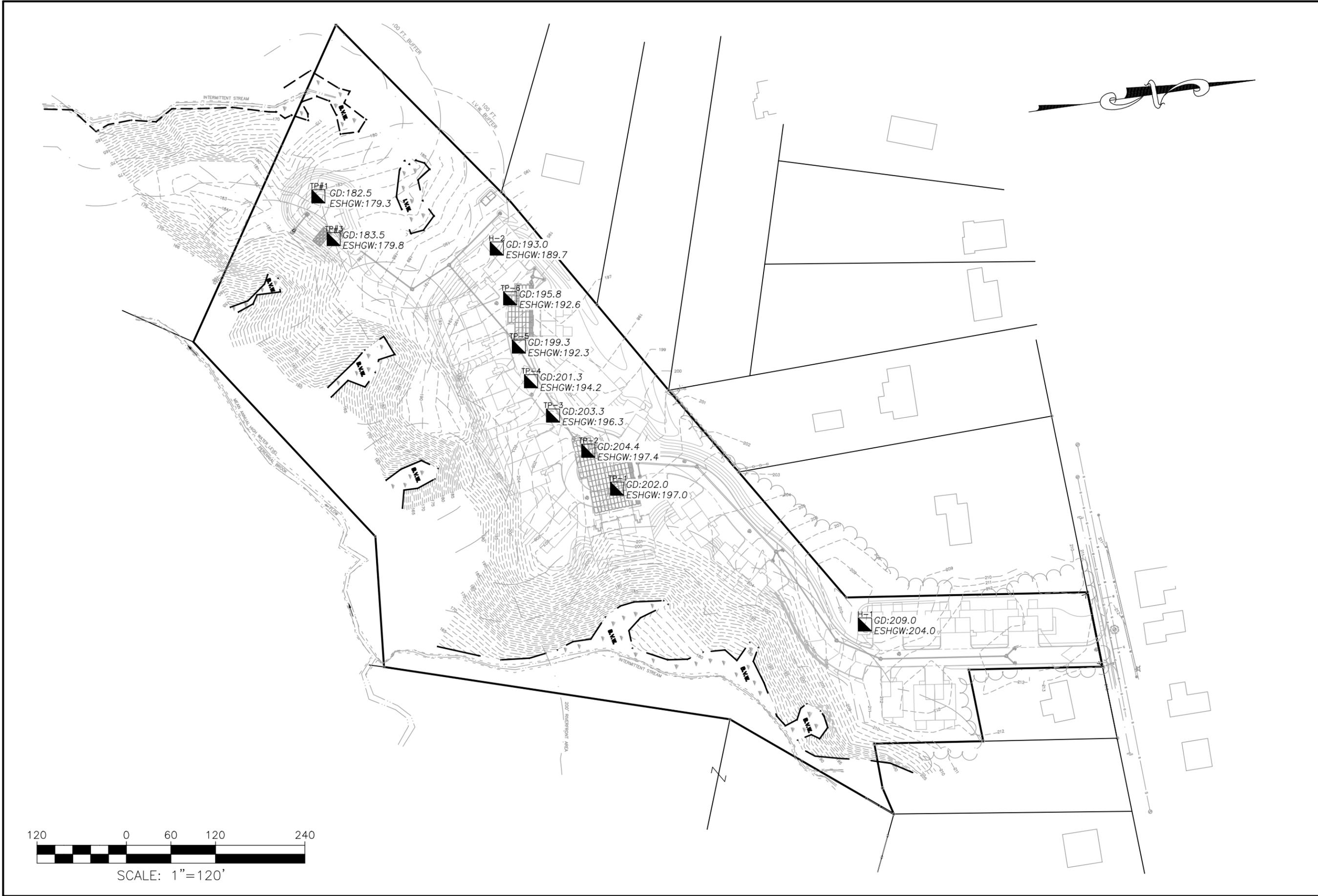
United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

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R LEVESQUE ASSOCIATES, INC
 A Land Planning Company
 ph: 413.568.0985 fax: 413.568.0986
 40 School Street - Westfield, MA 01086
 rland.com



Test Pit Location Plan

DESIGNED BY: JAT
 DRAWN BY: JAT

CHECKED BY: FJC
 13-1119 - SITE.dwg

Ferry Street Nominee Trust
 PO Box 13 - 510 New Ludlow Road
 South Hadley, MA 01075

Rivercrest Condominiums
 Ferry Street
 South Hadley, MA

JOB NO: 13-1119
 DATE: 6/8/14
 SCALE: AS NOTED

TP-1



Commonwealth of Massachusetts
 City/Town of **SOUTH HADLEY - RIVERCREST**
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

5/15/14
 CLOUDY, COOL

C. On-Site Review (continued)

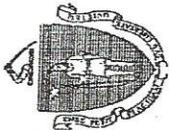
Deep Observation Hole Number: TP-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-10"	AP	10YR 3/3				SL			FRIABLE		FOREST LITTER
10"-24"	B	10YR 5/8				SL			FRIABLE		ROOTS
24"-84"	C ₁	2.5Y 4/6	60"	RED 2.5YR 4/8	>7%	S	<15%	NONE			m-c
84"-135"	C ₂	5YR 4/1				SILT/LOAM			MASSIVE LAMINATED	WET	

Additional Notes:

SEEP @ 70" ; STANDING WATER @ 78" RISING
 CAVING TO 38"

5/15/14



Commonwealth of Massachusetts
 City/Town of **SOUTH HADLEY - RIVERCREST**
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

TP - 2

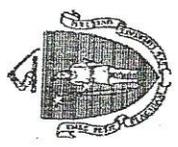
Deep Observation Hole Number:

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-12"	Ap	10YR 3/4				SL			FRIABLE		ROOTS
12"-31"	B	10YR 6/8		NONE		LS					
31"-125"	C	2.5Y 6/6		OBSERV.		S	< 20%	NONE		MOIST	m-c

Additional Notes:

SEEP @ 84" ; STANDING WATER @ 110" RISING

5/15/14



Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

TP-3

Deep Observation Hole Number:

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Consistence (Moist)	Soil Structure	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-12"	AP	10YR 3/4				SL				FRIABLE	ROOTS
12"-24"	B	10YR 6/8		NONE		LS					
24"-130"	C	2.5Y 6/8		OBSERV.		S	< 20%	NONE	MOIST		m

Additional Notes:

SEEP @ 84" ; STANDING WATER @ 110" RISING

5/15/14



Commonwealth of Massachusetts
 City/Town of SOUTH HADLEY - RIVERCREST
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

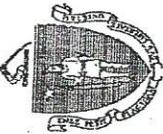
Deep Observation Hole Number: TP-4

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Consistence (Moist)	Soil Structure	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-10"	AP	10YR 3/3				SL			FRIABLE		FOREST LITTER
10"-24"	B	10YR 5/8		NONE		LS					
24"-121"	C	2.5Y 6/6		OBSERV.		S	720%	NONE			MOIST F-M

Additional Notes:

SEEP @ 85" ; STANDING WATER @ 118"
 CAVING @ 60"

5/15/14



Commonwealth of Massachusetts
City/Town of **SOUTH HADLEY- RIVERCREST**

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

TP-5

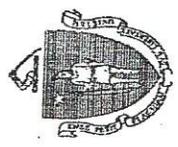
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Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)		Coarse Fragments % by Volume		Soil Consistence (Moist)	Soil Structure	Other
			Depth	Color	Percent	Gravel	Cobbles & Stones					
0"-12"	Ap	10YR ³ / ₃				SL					FRIABLE	ROOTS FOREST LITTER
12"-34"	B	10YR ⁵ / ₈		NONE		LS						
34"-128"	C	2.5Y ⁴ / ₆		OBSERV		S	<15%	NONE				MOIST MED.

Additional Notes:

SEEP @ 84" ; STANDING WATER @ 120"

5/15/14



Commonwealth of Massachusetts
 City/Town of SOUTH HADLEY - RIVERCREST
 Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

TP-6

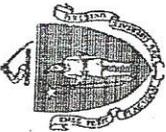
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Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)		Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Consistence (Moist)	Soil Structure	Other
			Depth	Color		Percent	Gravel				Cobbles & Stones
0"-10"	AP	10YR 3/4			SL				FRIABLE	ROOTS
10"-24"	B	10YR 6/8			LS					
24"-80"	C ₁	2.5Y 4/8	39"	RED 2.5YR 4/8	S	15%	NONE	WET		MED.
80"-120"	C ₂	5YR 4/1			SILT/LOAM			WET		

Additional Notes:

SEEP @ 64"; STANDING WATER @ 106" RISING

5/15/14



Commonwealth of Massachusetts
 City/Town of **SOUTH HADLEY - RIVERCREST**
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

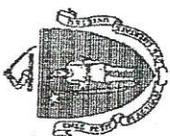
Deep Observation Hole Number: **H-1**

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Consistence (Moist)	Soil Structure	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-11"	AP	10YR 5/8				SL			FRIABLE		
11"-22"	B	10YR 3/3		NONE		LS					ROOTS
22"-126"	C	2.5Y 6/6		OBSERV.		S	415%	NONE			m-f.

Additional Notes:

SEEP @ 60"

5/15/14



Commonwealth of Massachusetts
 City/Town of **SOUTH HADLEY - RIVERCREST**
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

H-2

Deep Observation Hole Number:

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)		Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Consistence (Moist)	Other
			Depth	Color		Gravel	Cobbles & Stones			Soil Structure
0" - 8"	AP	10YR 3/3			SL			FR IABLE	ROOTS
8" - 17"	B	10YR 5/8			LS				ROOTS
17" - 84"	C ₁	2.5Y 6/6	40"	RED	S	< 15%	NONE		MOIST
84" - 120"	C ₂	5YR 4/1			SILT/ LOAM			MASSIVE LAMINATED	WET

Additional Notes:

HEAVY SEEP @ 84" - LT. SEEP @ 60"
 STANDING WATER @ 100" RISING

HERITAGE SURVEYS, INC.
 Professional Surveyors and Engineers
 241 College Hwy & Clark St, P O Box 1
 Southampton, Massachusetts 01073-0001
 Telephone (413) 527-3600 Fax (413) 527-8280

Soil Testing

Project Number: 5560-100113
 Performed by: Mark P. Reed
 Health Inspector: None

Date: December 9, 2010
 Equipment Operator: Marion Excavating

Site Address
 Ferry Street
 South Hadley, MA

Client Name & Address
 Rivercrest Condominiums LLC
 1421 Granby Road
 Chicopee, MA 01020
 Weather: sunny/cool

Deep Hole Number: #1 & 2 Date: 12/9/10 Time: 9:30
 Location (identify on site plan): woods in proposed detention basin

TP 1 DEEP OBSERVATION HOLE LOG					
Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" - 5"	Ap	Sandy Loam	10YR 3/2		Organic Topsoil
5"-26"	Bw	Sandy Loam	10YR 5/6		
26"-60"	C ₁	Sandy Loam	10YR 5/4	@38"	Medium to fine sandy loam, friable to firm with silt
60"-108"	C ₂	Fine Sandy Loam	10YR 6/1		Very fine sandy loam, firm with silt

Parent Material (geologic)

Depth to Groundwater: Standing Water in the Hole: None
 Estimated Seasonal High Ground Water: @38"

Depth to Bedrock: None @ 9'
 Weeping from Pit Face: None

TP 2 DEEP OBSERVATION HOLE LOG					
Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" - 12"	Ap	Sandy Loam	10YR 3/2		Organic Topsoil
12"-26"	Bw	Sandy Loam	10YR 5/6		
26"-72"	C ₁	Sand	10YR 6/6	@54"	Medium to fine sand, loose
72"-108"	C ₂	Sand	10YR 6/2		Fine Sand w/some silt, friable
108"-114"	C ₃	Fine Sandy Loam	10YR 6/1		Very fine sandy loam, firm with silt

Parent Material (geologic)

Depth to Groundwater: Standing Water in the Hole: None
 Estimated Seasonal High Ground Water: @54"

Depth to Bedrock: None @ 9'-6"
 Weeping from Pit Face: @64"

Certification: I certify that in June 1995, I passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. MA soil Eval. Approval No. SE2015

Signature: _____

Mark P. Reed

Date: December 9, 2010

HERITAGE SURVEYS, INC.
 Professional Surveyors and Engineers
 241 College Hwy & Clark St, P O Box 1
 Southampton, Massachusetts 01073-0001
 Telephone (413) 527-3600 Fax (413) 527-8280

Soil Testing

Project Number: 5560-100113
 Performed by: Mark P. Reed
 Health Inspector: None

Date: December 9, 2010
 Equipment Operator: Marion Excavating

Site Address
 Ferry Street
 South Hadley, MA

Client Name & Address
 Rivercrest Condominiums LLC
 1421 Granby Road
 Chicopee, MA 01020
 Weather: sunny/cool

Deep Hole Number: #3 & 4 Date: 12/9/10 Time: 9:30
 Location (identify on site plan): woods in proposed detention basin

TP 3 DEEP OBSERVATION HOLE LOG					
Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" - 8"	Ap	Sandy Loam	10YR 3/2		Organic Topsoil
8"-26"	Bw	Sandy Loam	10YR 5/6		
26"-48"	C ₁	Sandy Loam	10YR 5/4	@44"	Medium to fine sandy loam, friable to firm with silt
48"-114"	C ₂	Fine Sandy Loam	10YR 6/1		Very fine sandy loam, firm with silt

Parent Material (geologic)

Depth to Groundwater: Standing Water in the Hole: None
 Estimated Seasonal High Ground Water: @44"

Depth to Bedrock: None @ 9'-6"
 Weeping from Pit Face: None

TP 4 DEEP OBSERVATION HOLE LOG					
Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0" - 8"	Ap	Sandy Loam	10YR 3/2		Organic Topsoil
8"-14"	Bw	Sandy Loam	10YR 5/6		
14"-34"	C ₁	Sand	10YR 6/6	@40"	Medium to fine sand, loose
34"-102"	C ₂	Sand	10YR 6/2		Fine Sand w/some silt, friable
102"-120"	C ₃	Fine Sandy Loam	10YR 6/1		Very fine sandy loam, firm with silt

Parent Material (geologic)

Depth to Groundwater: Standing Water in the Hole: None
 Estimated Seasonal High Ground Water: @40"

Depth to Bedrock: None @ 10'
 Weeping from Pit Face: @64"

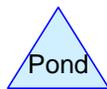
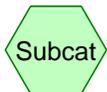
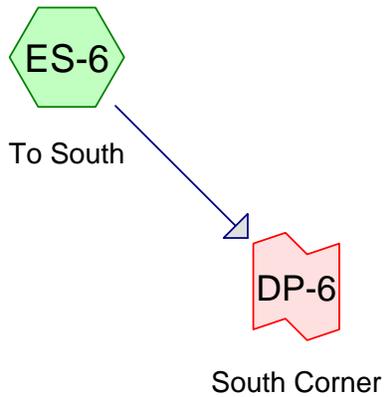
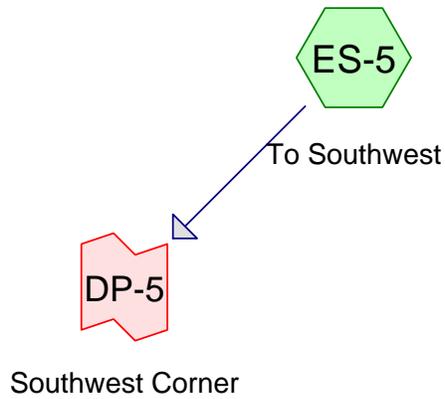
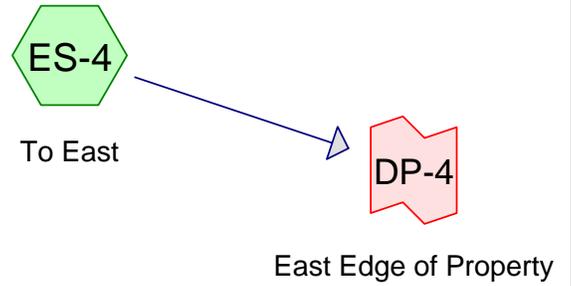
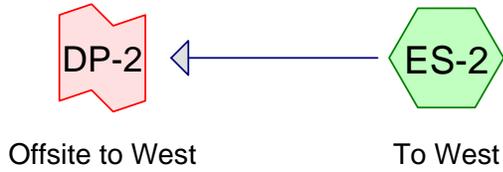
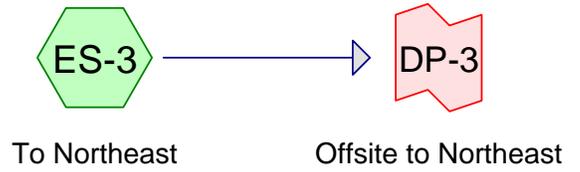
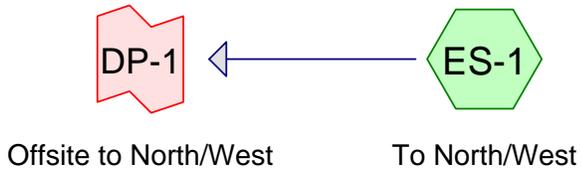
Certification: I certify that in **June 1995**, I passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. MA soil Eval. Approval No. **SE2015**

Signature: _____

Mark P. Reed

Date: **December 9, 2010**

Appendix C: Pre- and Post- Development Runoff Calculations (2, 10, & 100 Year Storm Events)



13-1119 - PRE_2014-06-08

Prepared by R Levesque Associates, Inc

HydroCAD® 10.00 s/n 02175 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
2,603	39	>75% Grass cover, Good, HSG A (ES-1, ES-2, ES-3)
183,964	30	Woods, Good, HSG A (ES-1, ES-2, ES-3, ES-4, ES-5, ES-6)
32,694	70	Woods, Good, HSG C (ES-5, ES-6)
219,261	36	TOTAL AREA

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
 Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES-1: To North/West	Runoff Area=19,380 sf 0.00% Impervious Flow Length=244' Tc=20.8 min CN=30/0	Runoff Depth=0.00" Runoff=0.00 cfs 0 cf
Subcatchment ES-2: To West	Runoff Area=20,946 sf 0.00% Impervious Flow Length=145' Tc=12.1 min CN=31/0	Runoff Depth=0.00" Runoff=0.00 cfs 0 cf
Subcatchment ES-3: To Northeast	Runoff Area=6,422 sf 0.00% Impervious Flow Length=72' Tc=11.5 min CN=31/0	Runoff Depth=0.00" Runoff=0.00 cfs 0 cf
Subcatchment ES-4: To East	Runoff Area=41,789 sf 0.00% Impervious Flow Length=128' Tc=9.2 min CN=30/0	Runoff Depth=0.00" Runoff=0.00 cfs 0 cf
Subcatchment ES-5: To Southwest	Runoff Area=81,273 sf 0.00% Impervious Flow Length=570' Tc=24.6 min CN=30/0	Runoff Depth=0.00" Runoff=0.00 cfs 0 cf
Subcatchment ES-6: To South	Runoff Area=49,451 sf 0.00% Impervious Flow Length=434' Tc=18.5 min CN=56/0	Runoff Depth=0.22" Runoff=0.08 cfs 906 cf
Link DP-1: Offsite to North/West		Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-2: Offsite to West		Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-3: Offsite to Northeast		Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-4: East Edge of Property		Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-5: Southwest Corner		Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-6: South Corner		Inflow=0.08 cfs 906 cf Primary=0.08 cfs 906 cf

Total Runoff Area = 219,261 sf Runoff Volume = 906 cf Average Runoff Depth = 0.05"
 100.00% Pervious = 219,261 sf 0.00% Impervious = 0 sf

Summary for Subcatchment ES-1: To North/West

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

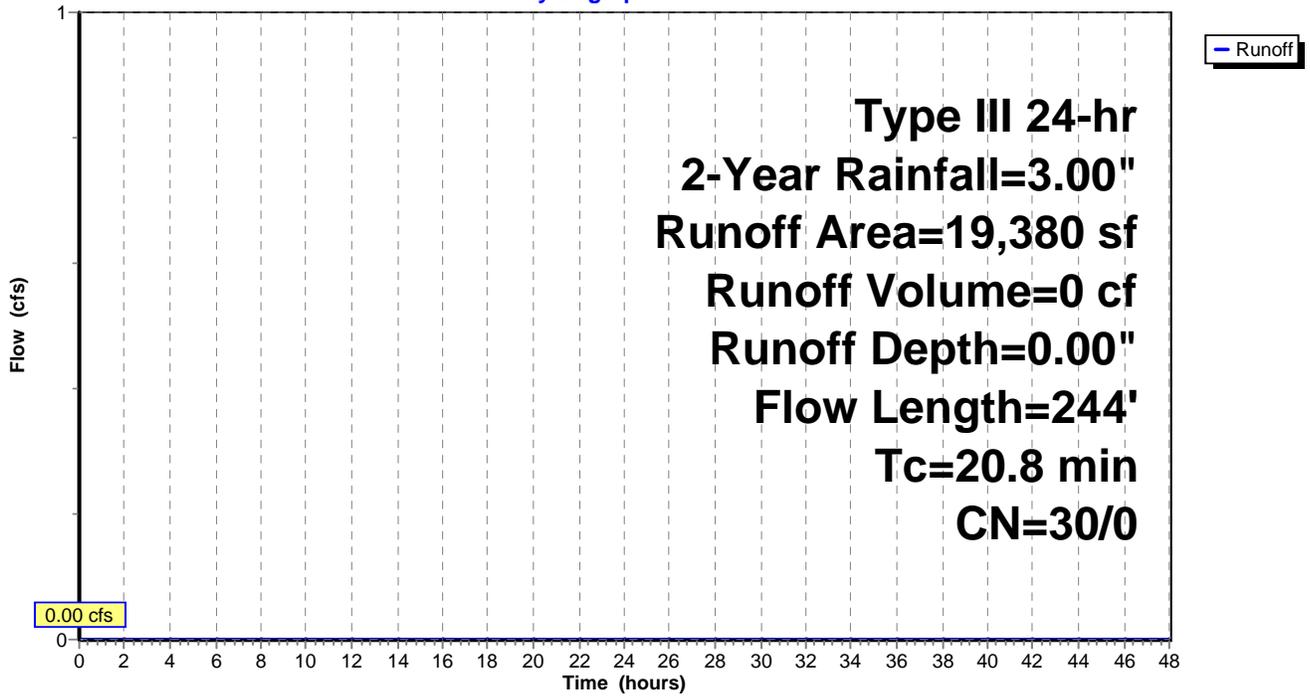
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
18,924	30	Woods, Good, HSG A
456	39	>75% Grass cover, Good, HSG A
19,380	30	Weighted Average
19,380	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	50	0.0170	0.06		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
7.2	194	0.0080	0.45		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
20.8	244	Total			

Subcatchment ES-1: To North/West

Hydrograph



Summary for Subcatchment ES-2: To West

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

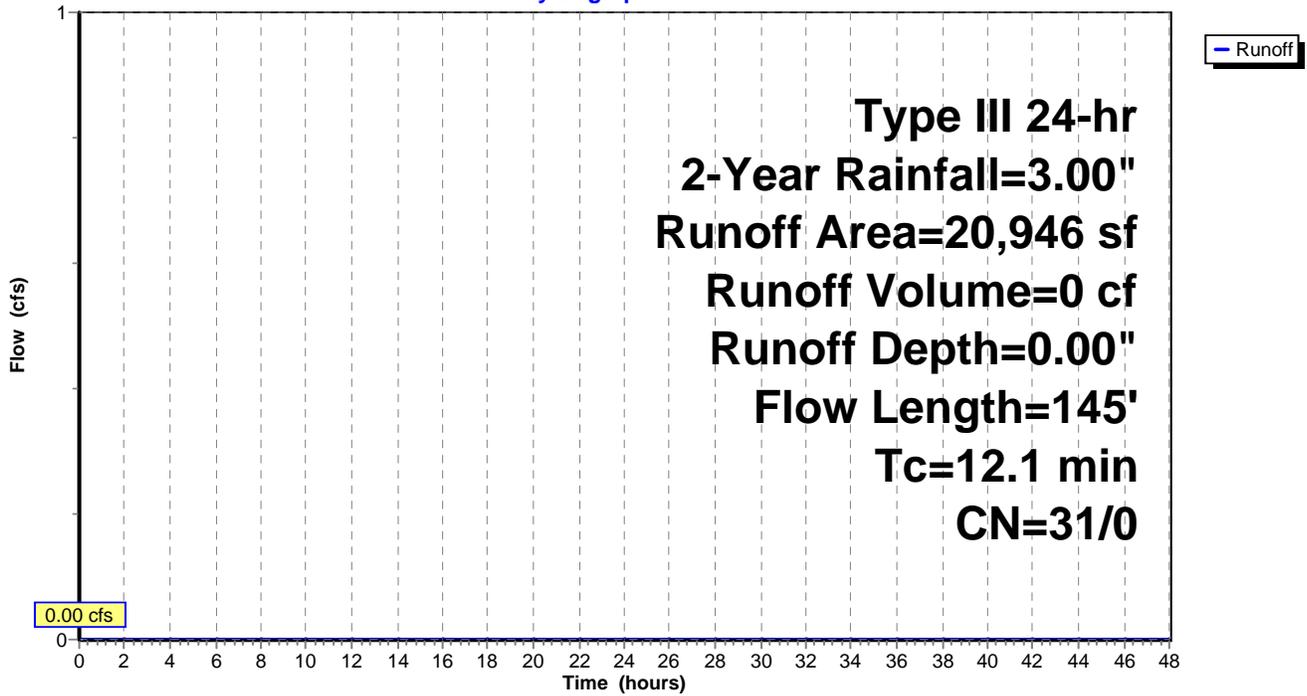
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
19,700	30	Woods, Good, HSG A
1,246	39	>75% Grass cover, Good, HSG A
20,946	31	Weighted Average
20,946	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0450	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
2.9	95	0.0120	0.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.1	145	Total			

Subcatchment ES-2: To West

Hydrograph



Summary for Subcatchment ES-3: To Northeast

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

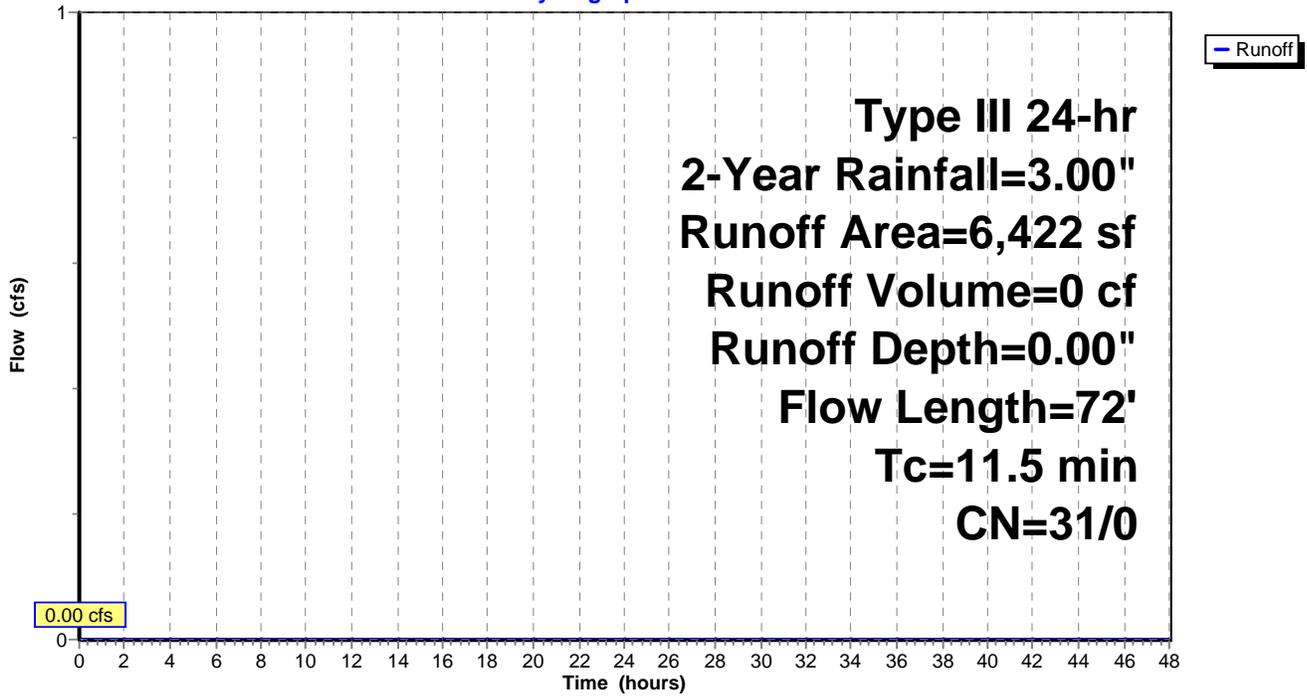
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
5,521	30	Woods, Good, HSG A
901	39	>75% Grass cover, Good, HSG A
6,422	31	Weighted Average
6,422	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.0280	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
0.4	22	0.0270	0.82		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.5	72	Total			

Subcatchment ES-3: To Northeast

Hydrograph



Summary for Subcatchment ES-4: To East

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

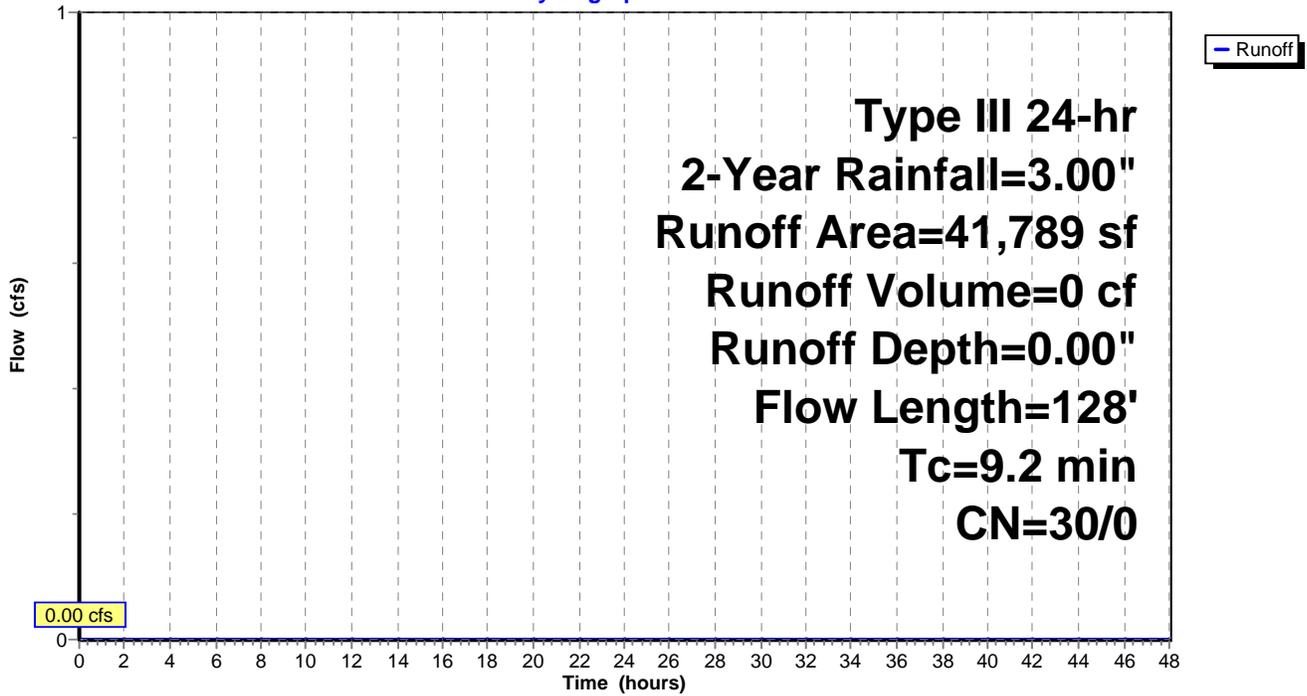
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
41,789	30	Woods, Good, HSG A
41,789	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0580	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
0.7	48	0.0460	1.07		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.2	30	0.2300	2.40		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	128	Total			

Subcatchment ES-4: To East

Hydrograph



Summary for Subcatchment ES-5: To Southwest

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

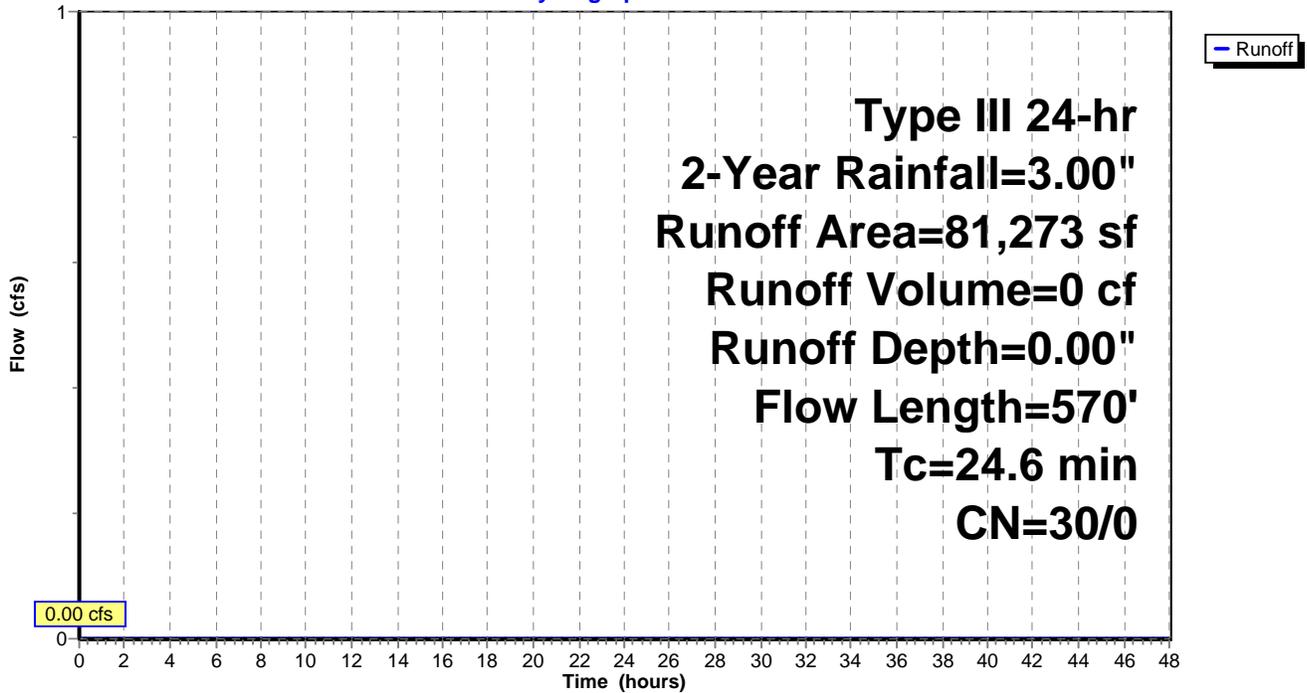
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
80,385	30	Woods, Good, HSG A
888	70	Woods, Good, HSG C
81,273	30	Weighted Average
81,273	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	50	0.0180	0.06		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
9.6	407	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.7	113	0.0490	1.11		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.6	570	Total			

Subcatchment ES-5: To Southwest

Hydrograph



Summary for Subcatchment ES-6: To South

Runoff = 0.08 cfs @ 12.54 hrs, Volume= 906 cf, Depth= 0.22"

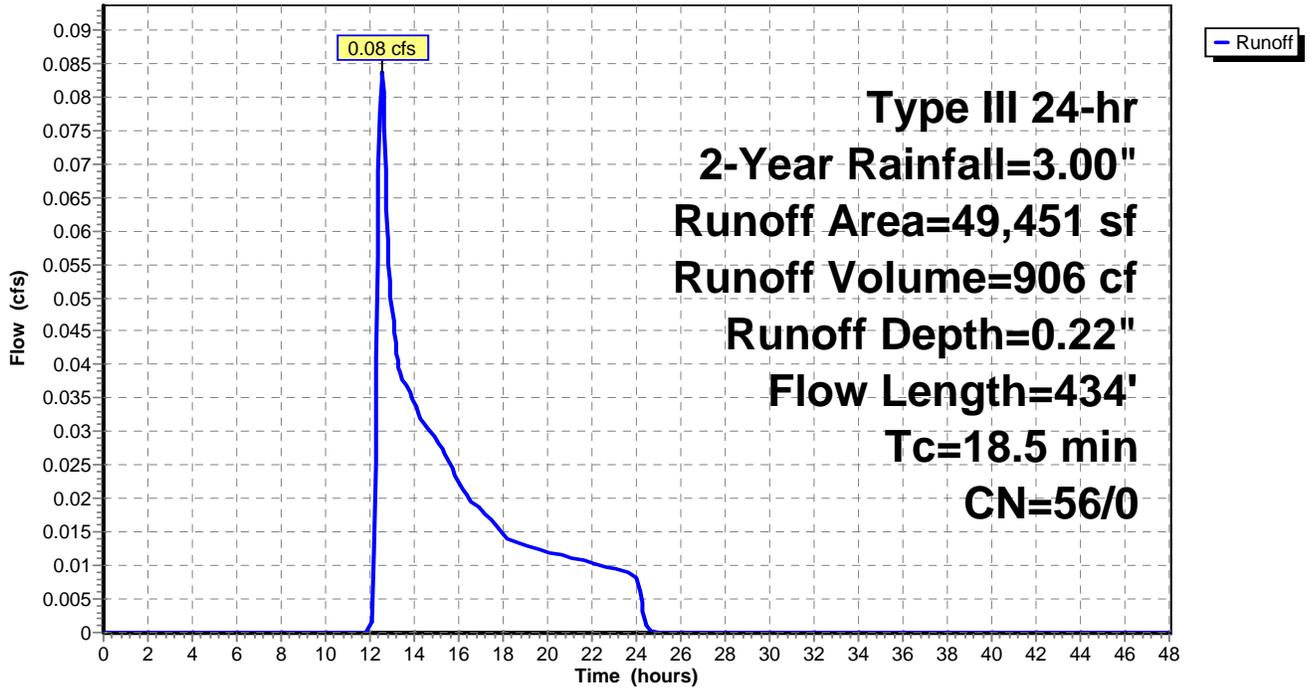
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
17,645	30	Woods, Good, HSG A
31,806	70	Woods, Good, HSG C
49,451	56	Weighted Average
49,451	56	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
5.8	384	0.0480	1.10		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
18.5	434	Total			

Subcatchment ES-6: To South

Hydrograph



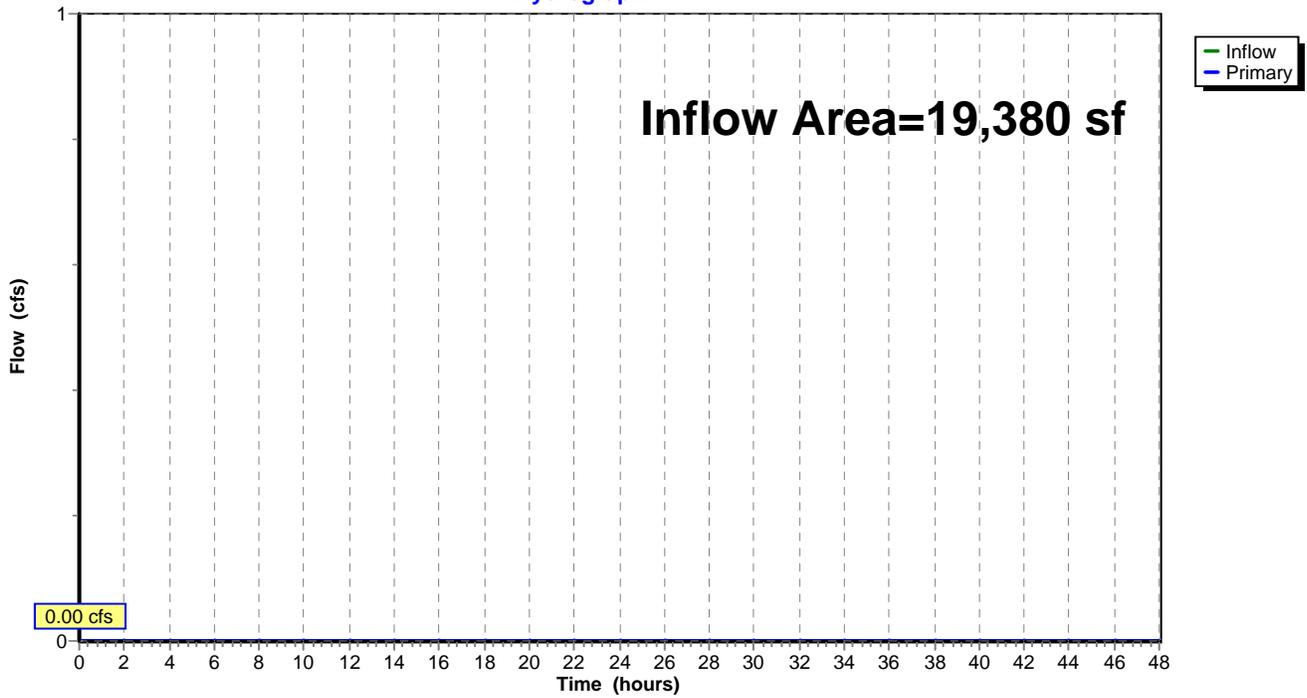
Summary for Link DP-1: Offsite to North/West

Inflow Area = 19,380 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

Hydrograph



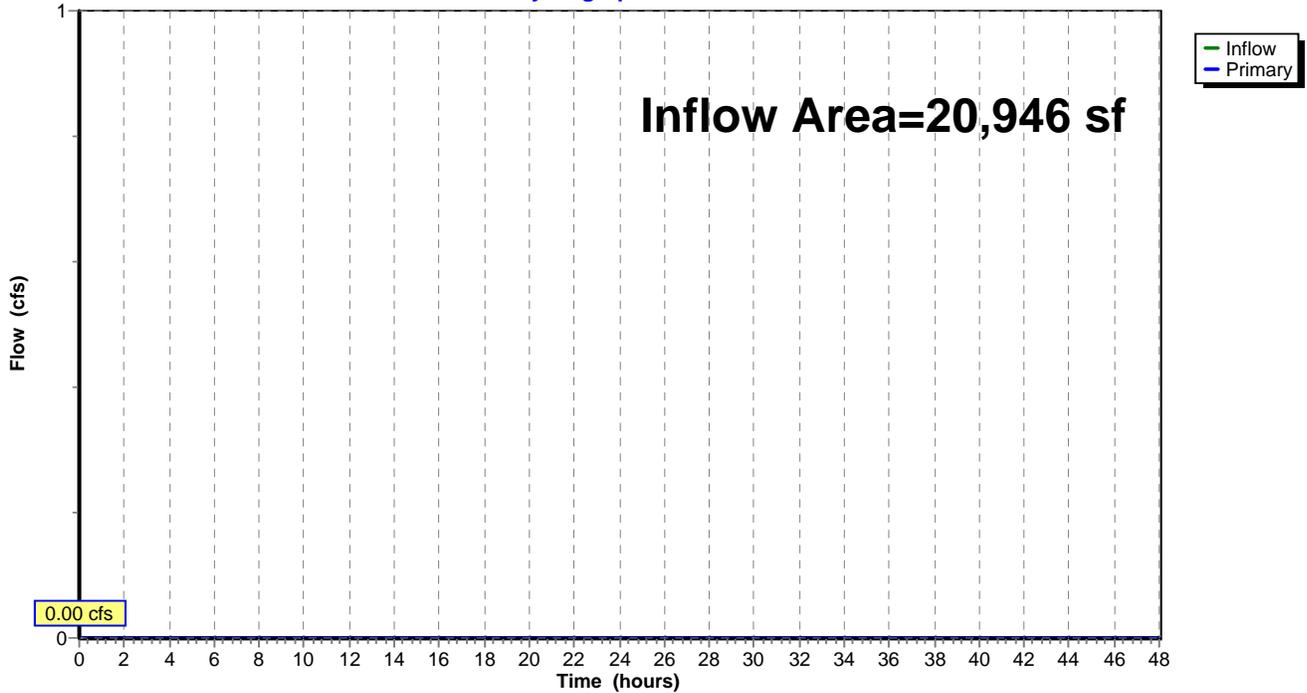
Summary for Link DP-2: Offsite to West

Inflow Area = 20,946 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

Hydrograph



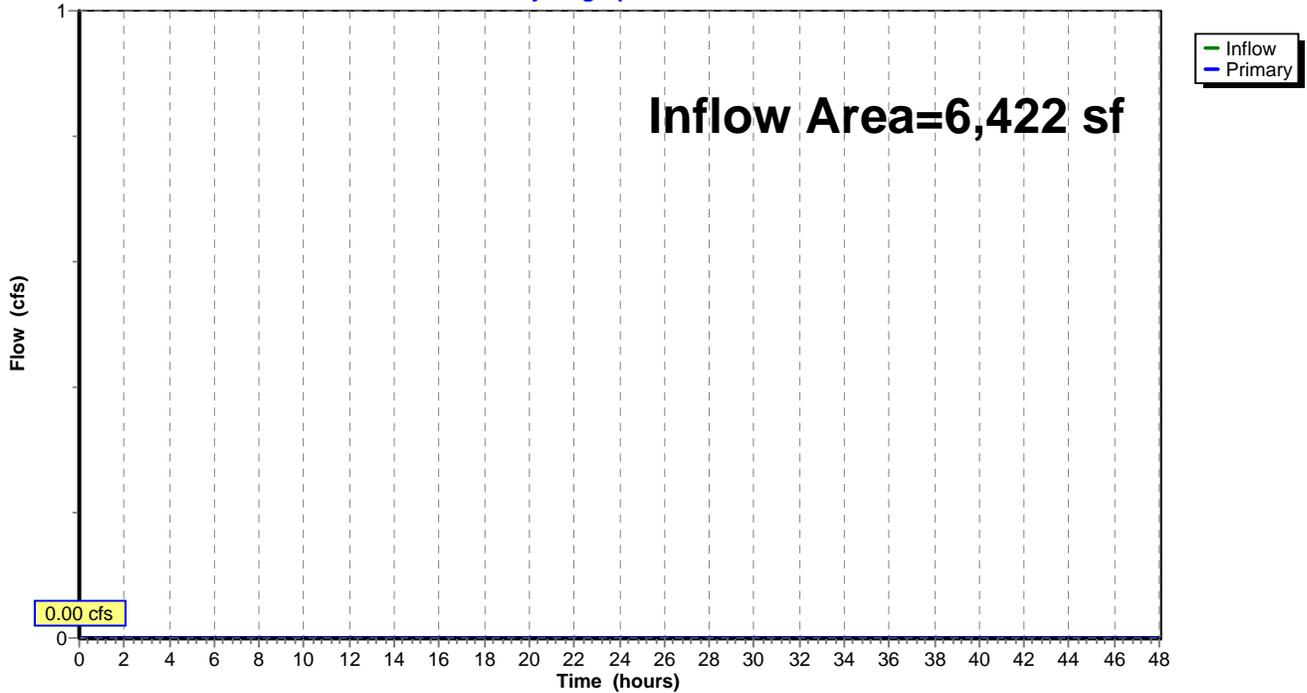
Summary for Link DP-3: Offsite to Northeast

Inflow Area = 6,422 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

Hydrograph



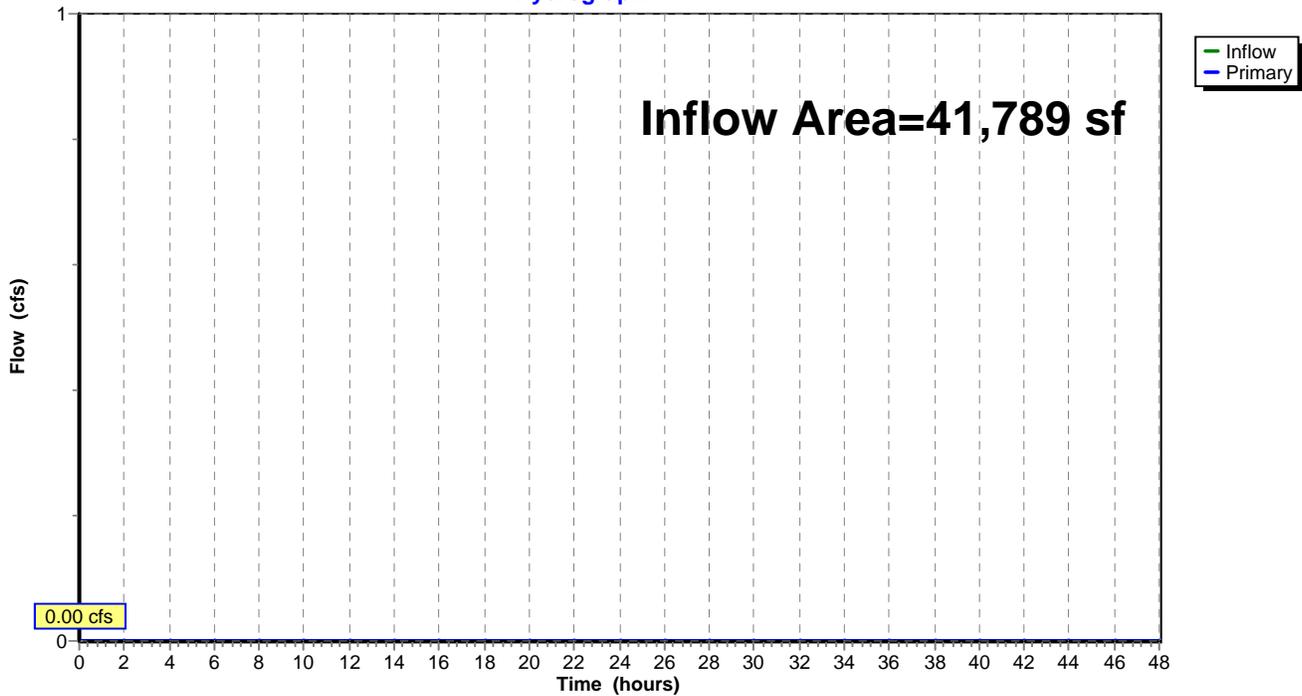
Summary for Link DP-4: East Edge of Property

Inflow Area = 41,789 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

Hydrograph



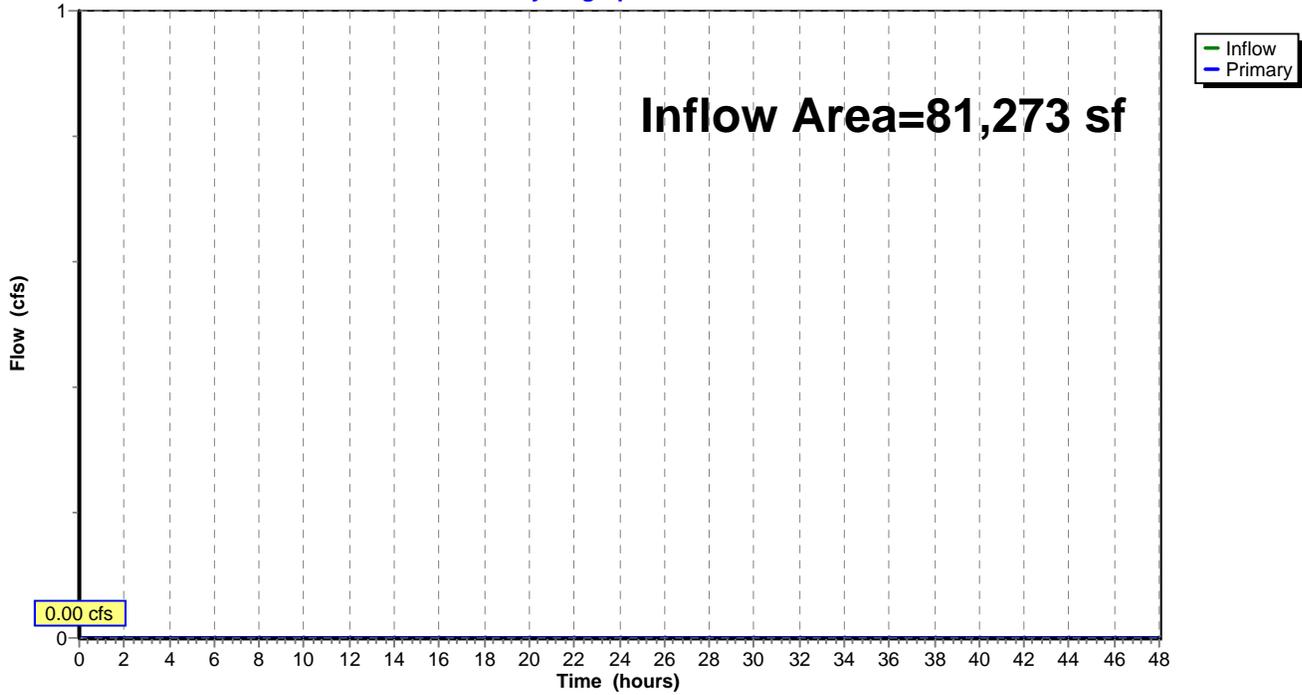
Summary for Link DP-5: Southwest Corner

Inflow Area = 81,273 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

Hydrograph



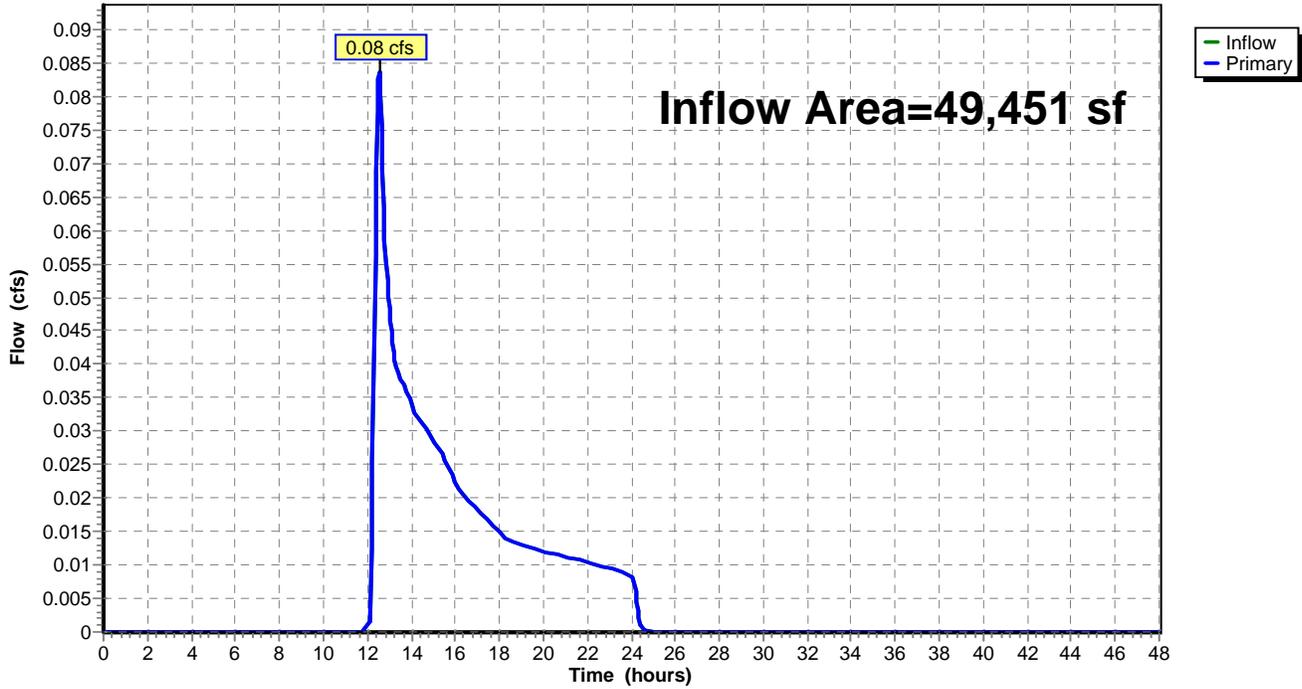
Summary for Link DP-6: South Corner

Inflow Area = 49,451 sf, 0.00% Impervious, Inflow Depth = 0.22" for 2-Year event
Inflow = 0.08 cfs @ 12.54 hrs, Volume= 906 cf
Primary = 0.08 cfs @ 12.54 hrs, Volume= 906 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner

Hydrograph



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
 Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. U1 as Pervious
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES-1: To North/West	Runoff Area=19,380 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=244' Tc=20.8 min CN=30/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-2: To West	Runoff Area=20,946 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=145' Tc=12.1 min CN=31/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-3: To Northeast	Runoff Area=6,422 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=72' Tc=11.5 min CN=31/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-4: To East	Runoff Area=41,789 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=128' Tc=9.2 min CN=30/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-5: To Southwest	Runoff Area=81,273 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=570' Tc=24.6 min CN=30/0 Runoff=0.00 cfs 0 cf
Subcatchment ES-6: To South	Runoff Area=49,451 sf 0.00% Impervious Runoff Depth=0.80" Flow Length=434' Tc=18.5 min CN=56/0 Runoff=0.55 cfs 3,277 cf
Link DP-1: Offsite to North/West	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-2: Offsite to West	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-3: Offsite to Northeast	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-4: East Edge of Property	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-5: Southwest Corner	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Link DP-6: South Corner	Inflow=0.55 cfs 3,277 cf Primary=0.55 cfs 3,277 cf

Total Runoff Area = 219,261 sf Runoff Volume = 3,277 cf Average Runoff Depth = 0.18"
100.00% Pervious = 219,261 sf 0.00% Impervious = 0 sf

Summary for Subcatchment ES-1: To North/West

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

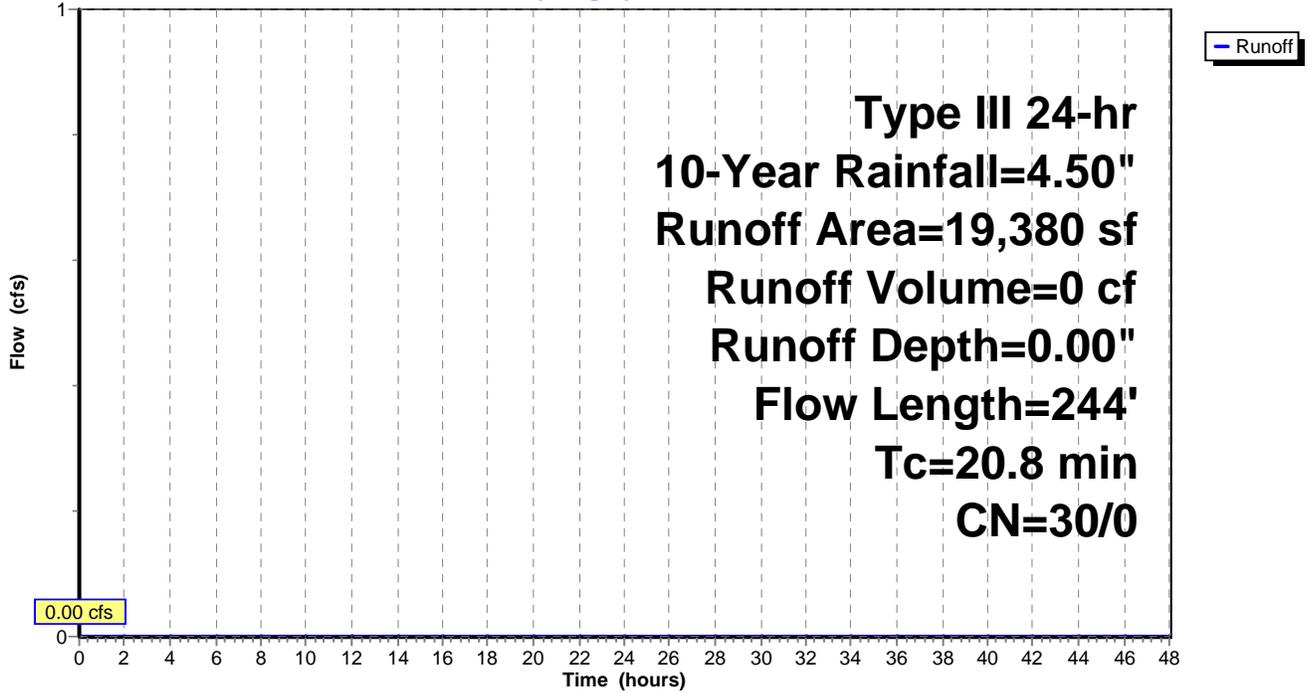
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
18,924	30	Woods, Good, HSG A
456	39	>75% Grass cover, Good, HSG A
19,380	30	Weighted Average
19,380	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	50	0.0170	0.06		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
7.2	194	0.0080	0.45		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
20.8	244	Total			

Subcatchment ES-1: To North/West

Hydrograph



Summary for Subcatchment ES-2: To West

Runoff = 0.00 cfs @ 24.03 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

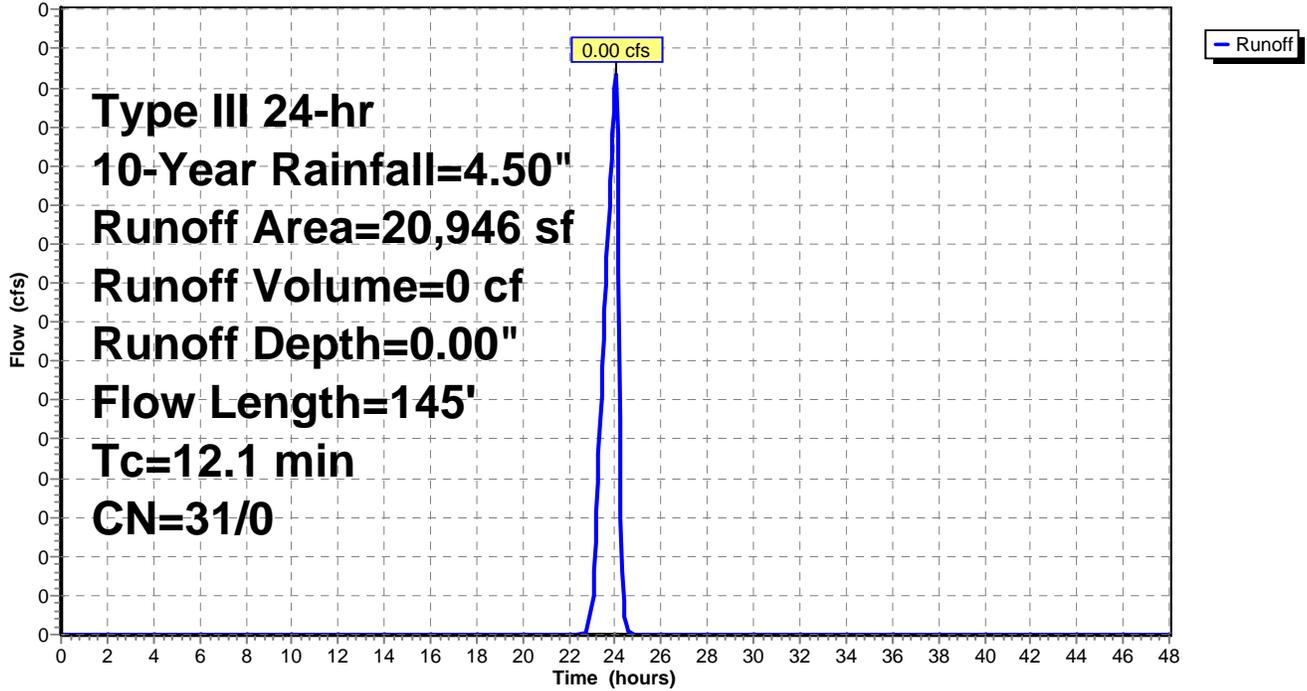
Area (sf)	CN	Description
19,700	30	Woods, Good, HSG A
1,246	39	>75% Grass cover, Good, HSG A
20,946	31	Weighted Average
20,946	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0450	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
2.9	95	0.0120	0.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps

12.1 145 Total

Subcatchment ES-2: To West

Hydrograph



Summary for Subcatchment ES-3: To Northeast

Runoff = 0.00 cfs @ 24.03 hrs, Volume= 0 cf, Depth= 0.00"

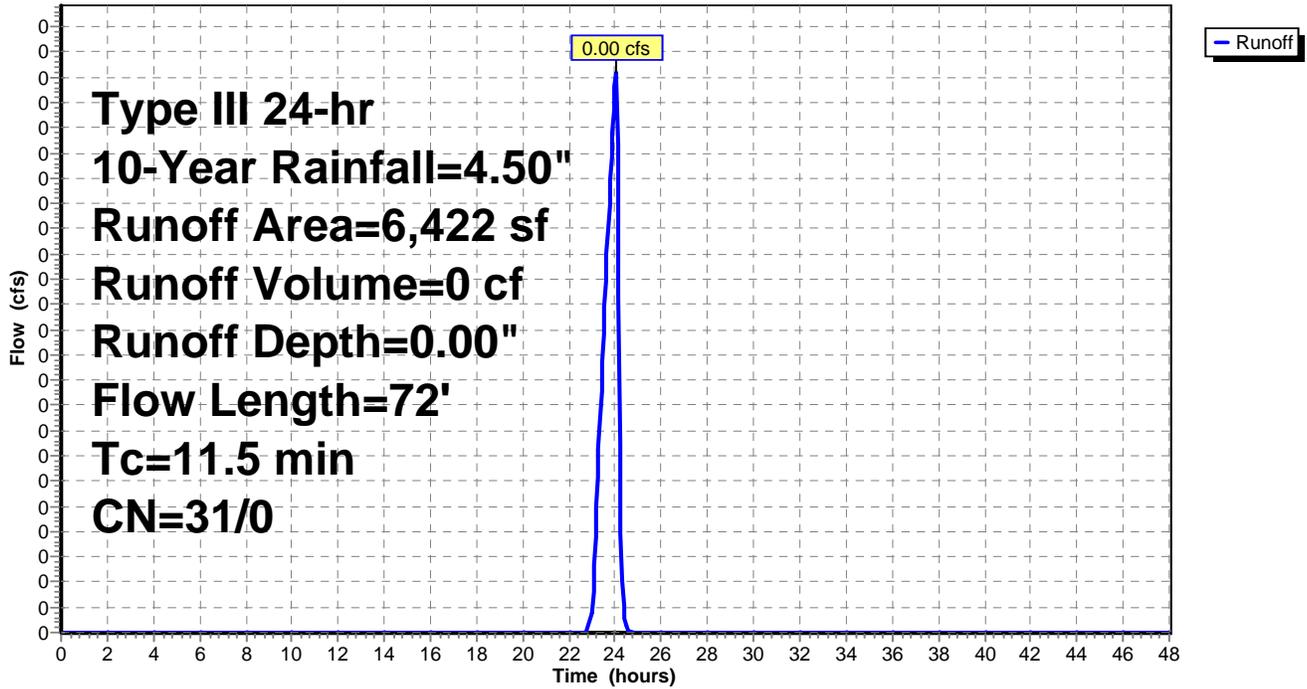
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
5,521	30	Woods, Good, HSG A
901	39	>75% Grass cover, Good, HSG A
6,422	31	Weighted Average
6,422	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.0280	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
0.4	22	0.0270	0.82		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.5	72	Total			

Subcatchment ES-3: To Northeast

Hydrograph



Summary for Subcatchment ES-4: To East

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

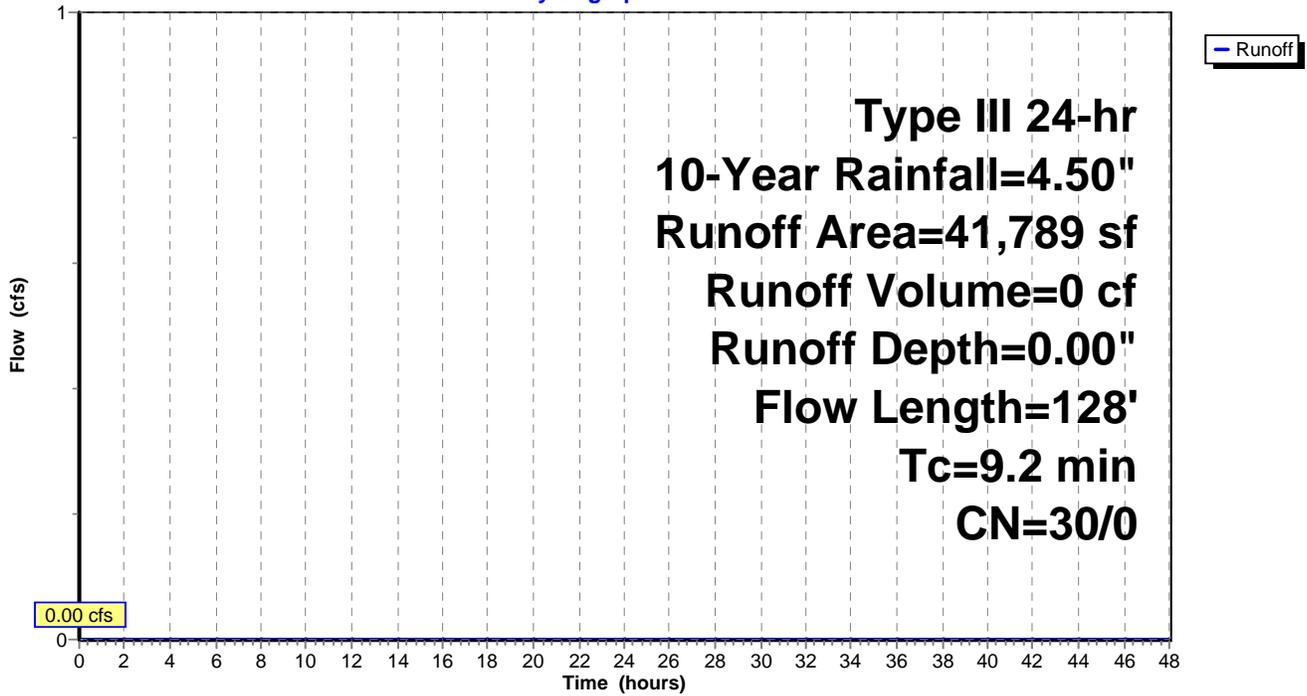
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
41,789	30	Woods, Good, HSG A
41,789	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0580	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
0.7	48	0.0460	1.07		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.2	30	0.2300	2.40		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	128	Total			

Subcatchment ES-4: To East

Hydrograph



Summary for Subcatchment ES-5: To Southwest

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

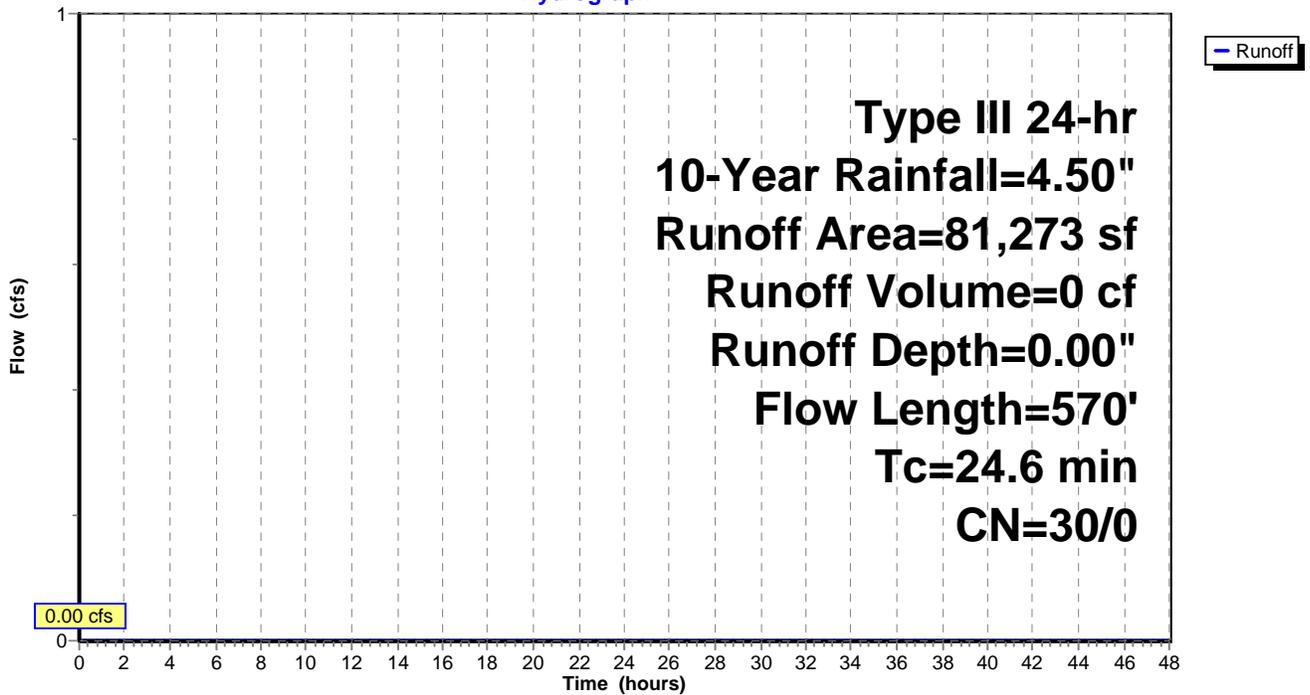
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
80,385	30	Woods, Good, HSG A
888	70	Woods, Good, HSG C
81,273	30	Weighted Average
81,273	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	50	0.0180	0.06		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
9.6	407	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.7	113	0.0490	1.11		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.6	570	Total			

Subcatchment ES-5: To Southwest

Hydrograph



Summary for Subcatchment ES-6: To South

Runoff = 0.55 cfs @ 12.33 hrs, Volume= 3,277 cf, Depth= 0.80"

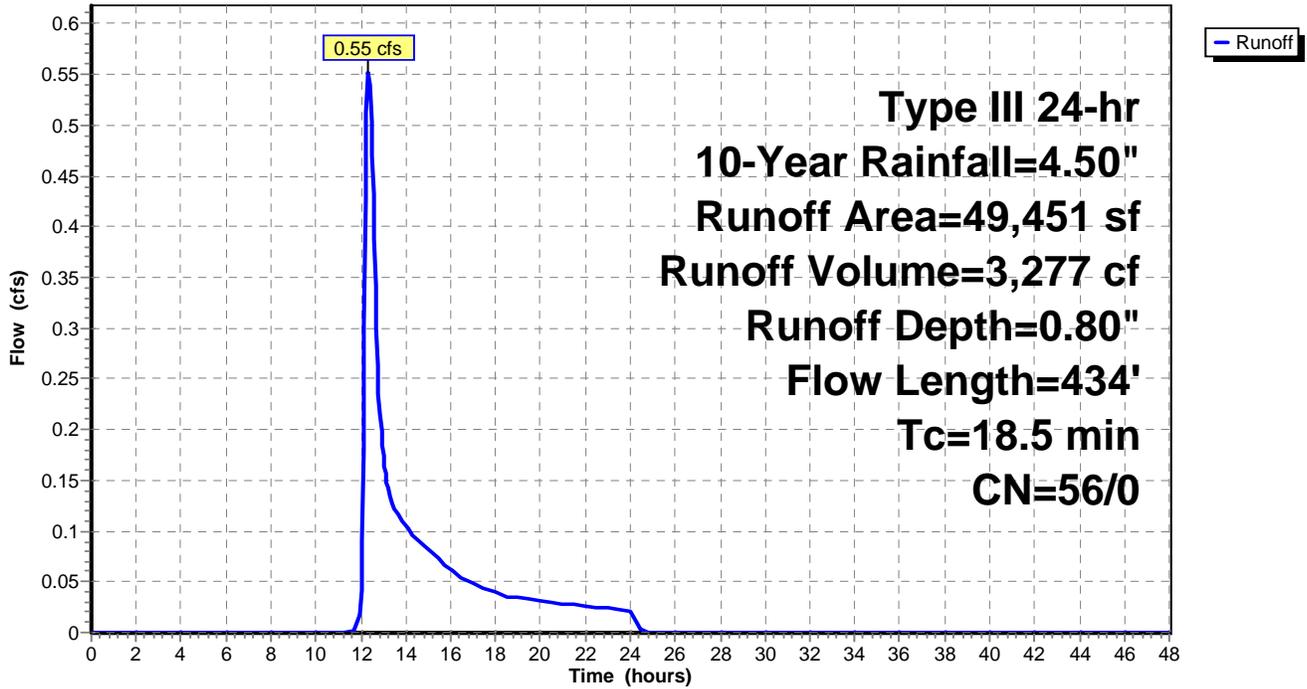
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
17,645	30	Woods, Good, HSG A
31,806	70	Woods, Good, HSG C
49,451	56	Weighted Average
49,451	56	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
5.8	384	0.0480	1.10		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
18.5	434	Total			

Subcatchment ES-6: To South

Hydrograph



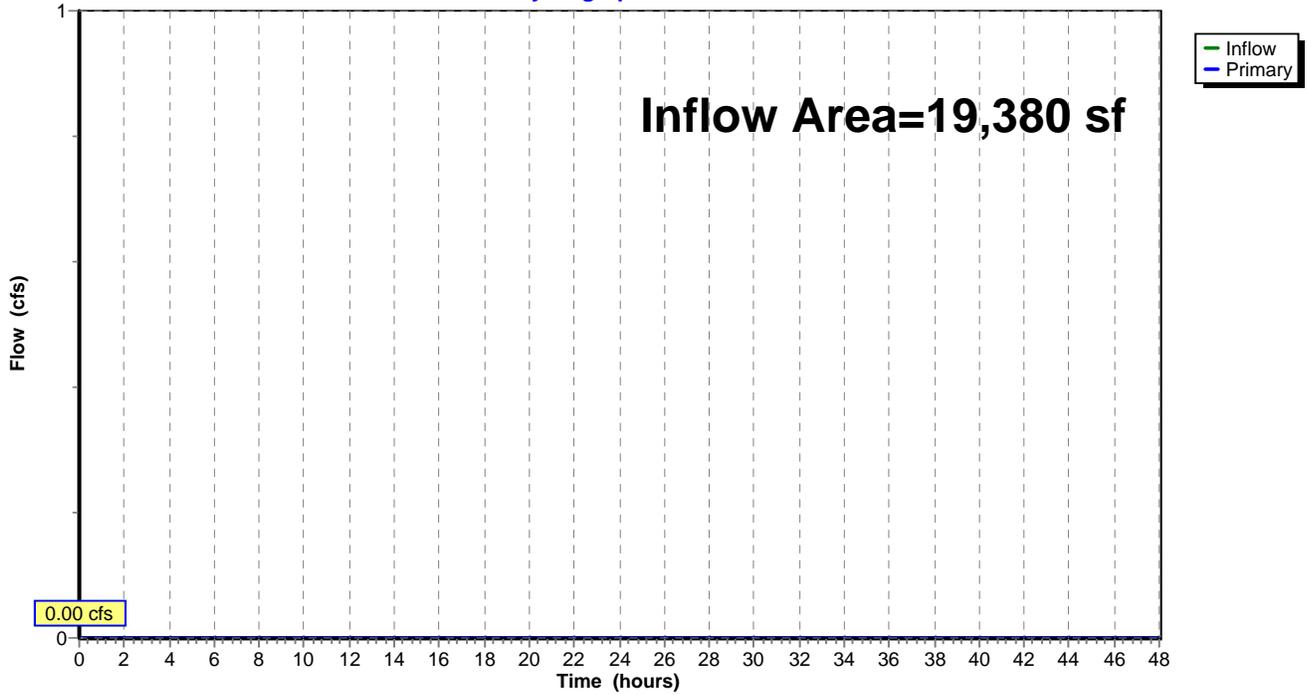
Summary for Link DP-1: Offsite to North/West

Inflow Area = 19,380 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

Hydrograph



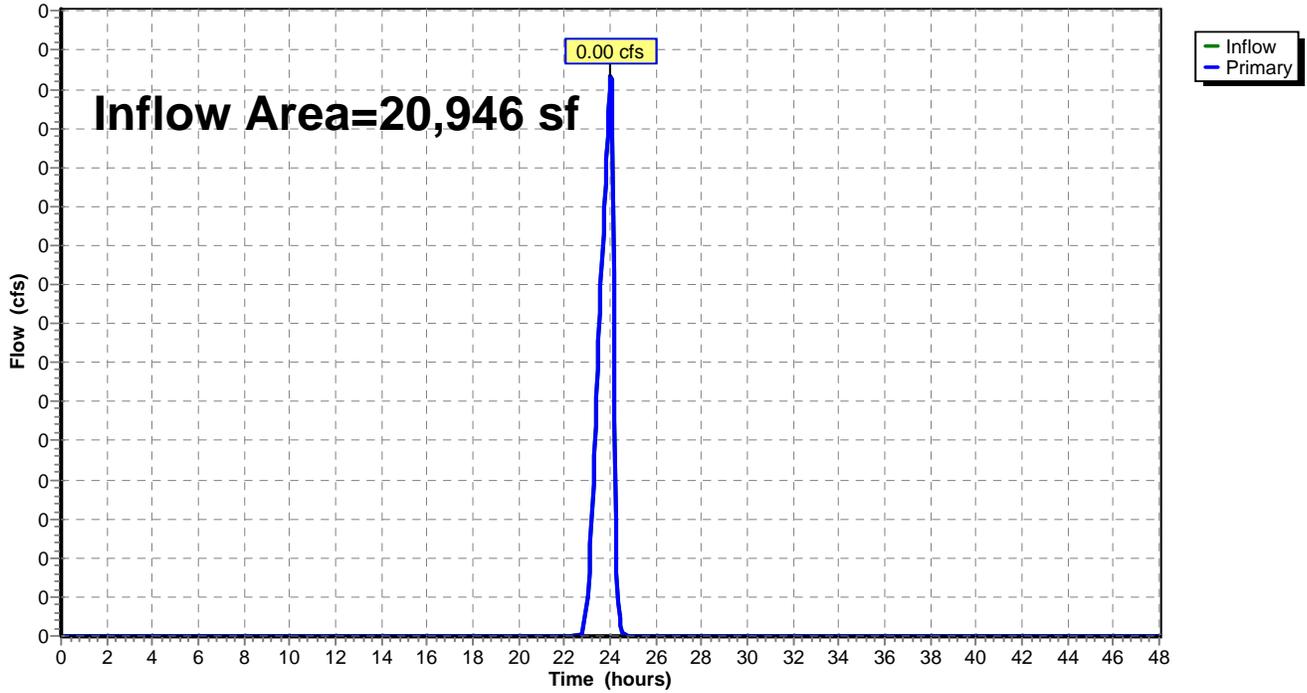
Summary for Link DP-2: Offsite to West

Inflow Area = 20,946 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 24.03 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 24.03 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

Hydrograph



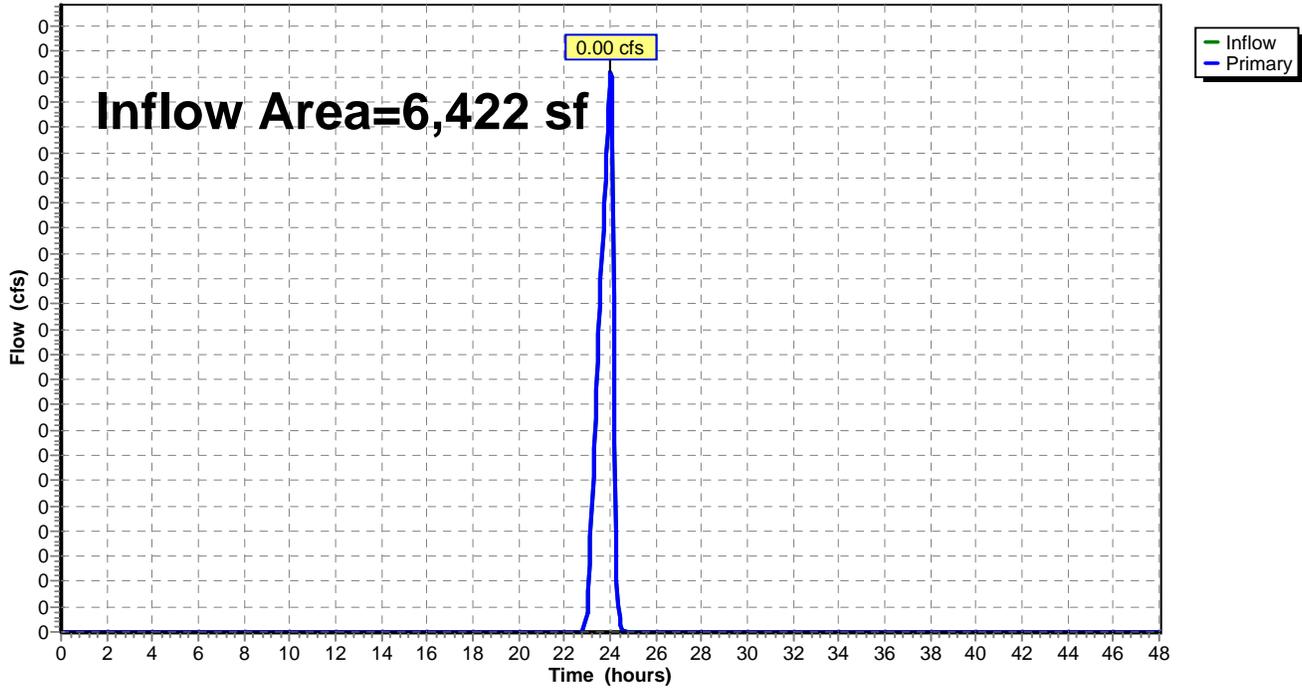
Summary for Link DP-3: Offsite to Northeast

Inflow Area = 6,422 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 24.03 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 24.03 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

Hydrograph



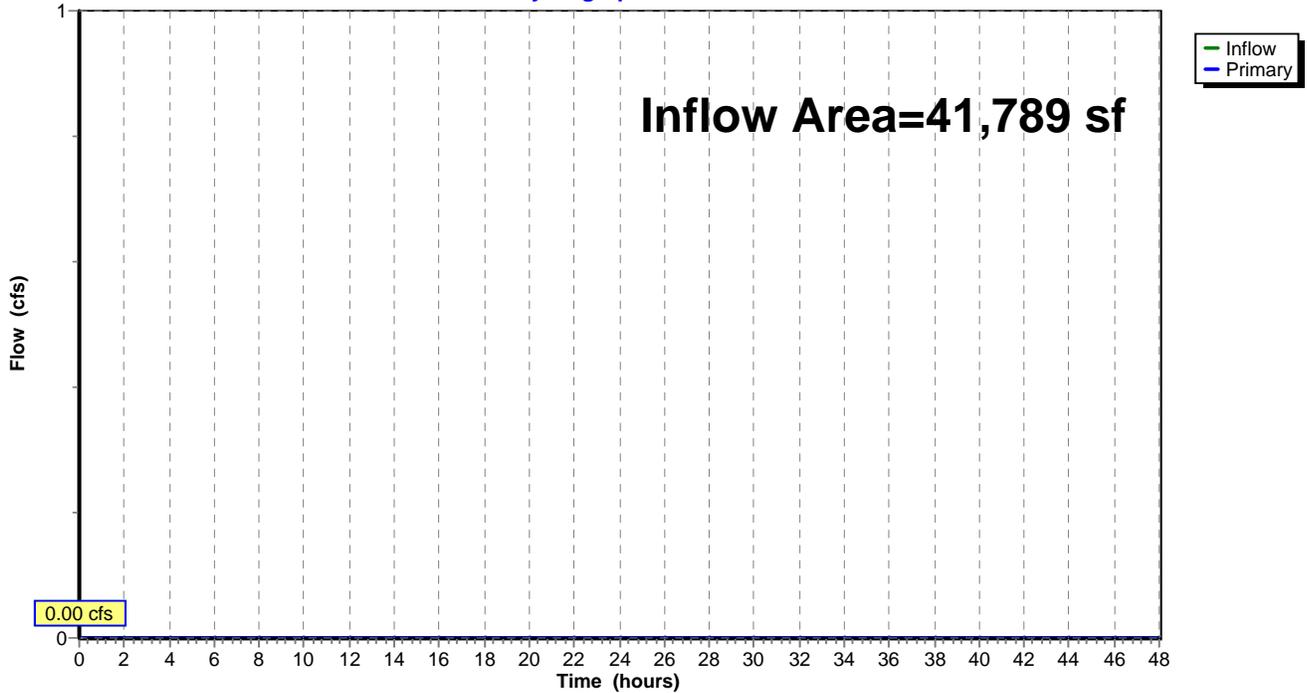
Summary for Link DP-4: East Edge of Property

Inflow Area = 41,789 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

Hydrograph



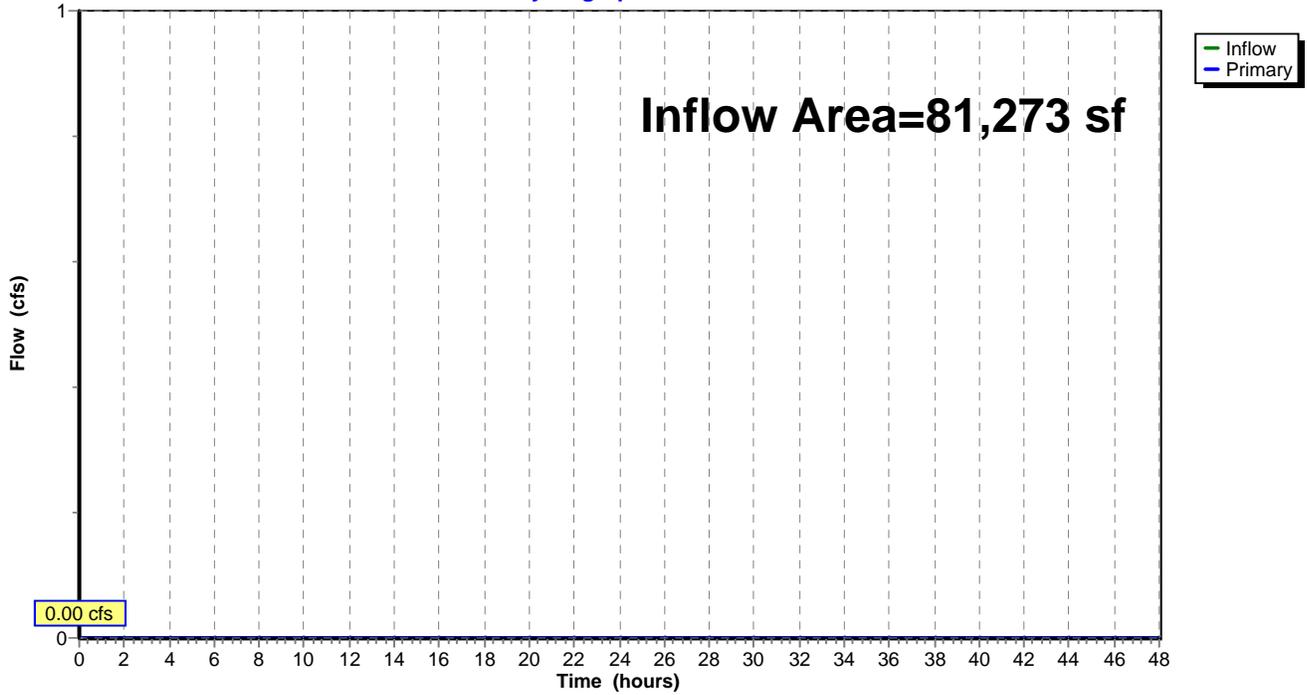
Summary for Link DP-5: Southwest Corner

Inflow Area = 81,273 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

Hydrograph



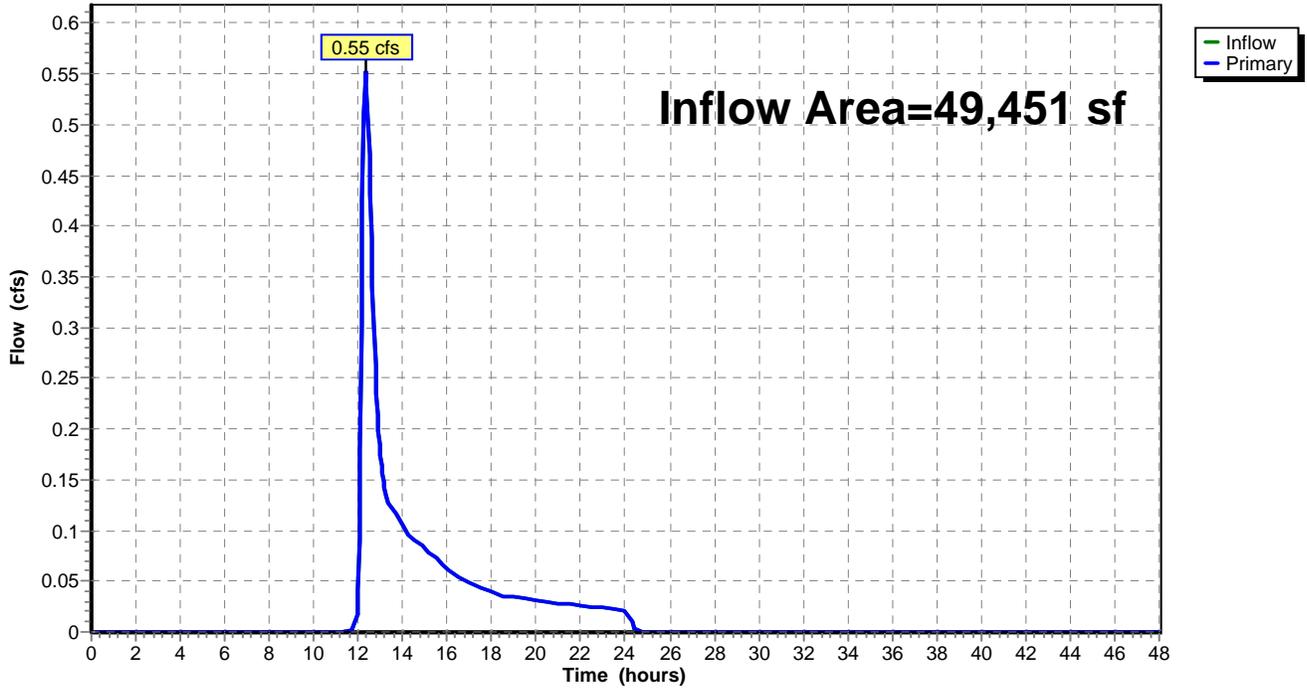
Summary for Link DP-6: South Corner

Inflow Area = 49,451 sf, 0.00% Impervious, Inflow Depth = 0.80" for 10-Year event
Inflow = 0.55 cfs @ 12.33 hrs, Volume= 3,277 cf
Primary = 0.55 cfs @ 12.33 hrs, Volume= 3,277 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner

Hydrograph



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
 Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. U1 as Pervious
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES-1: To North/West	Runoff Area=19,380 sf 0.00% Impervious Runoff Depth=0.12" Flow Length=244' Tc=20.8 min CN=30/0 Runoff=0.01 cfs 194 cf
Subcatchment ES-2: To West	Runoff Area=20,946 sf 0.00% Impervious Runoff Depth=0.16" Flow Length=145' Tc=12.1 min CN=31/0 Runoff=0.01 cfs 274 cf
Subcatchment ES-3: To Northeast	Runoff Area=6,422 sf 0.00% Impervious Runoff Depth=0.16" Flow Length=72' Tc=11.5 min CN=31/0 Runoff=0.00 cfs 84 cf
Subcatchment ES-4: To East	Runoff Area=41,789 sf 0.00% Impervious Runoff Depth=0.12" Flow Length=128' Tc=9.2 min CN=30/0 Runoff=0.02 cfs 417 cf
Subcatchment ES-5: To Southwest	Runoff Area=81,273 sf 0.00% Impervious Runoff Depth=0.12" Flow Length=570' Tc=24.6 min CN=30/0 Runoff=0.03 cfs 812 cf
Subcatchment ES-6: To South	Runoff Area=49,451 sf 0.00% Impervious Runoff Depth=1.84" Flow Length=434' Tc=18.5 min CN=56/0 Runoff=1.55 cfs 7,574 cf
Link DP-1: Offsite to North/West	Inflow=0.01 cfs 194 cf Primary=0.01 cfs 194 cf
Link DP-2: Offsite to West	Inflow=0.01 cfs 274 cf Primary=0.01 cfs 274 cf
Link DP-3: Offsite to Northeast	Inflow=0.00 cfs 84 cf Primary=0.00 cfs 84 cf
Link DP-4: East Edge of Property	Inflow=0.02 cfs 417 cf Primary=0.02 cfs 417 cf
Link DP-5: Southwest Corner	Inflow=0.03 cfs 812 cf Primary=0.03 cfs 812 cf
Link DP-6: South Corner	Inflow=1.55 cfs 7,574 cf Primary=1.55 cfs 7,574 cf

Total Runoff Area = 219,261 sf Runoff Volume = 9,354 cf Average Runoff Depth = 0.51"
 100.00% Pervious = 219,261 sf 0.00% Impervious = 0 sf

Summary for Subcatchment ES-1: To North/West

Runoff = 0.01 cfs @ 15.25 hrs, Volume= 194 cf, Depth= 0.12"

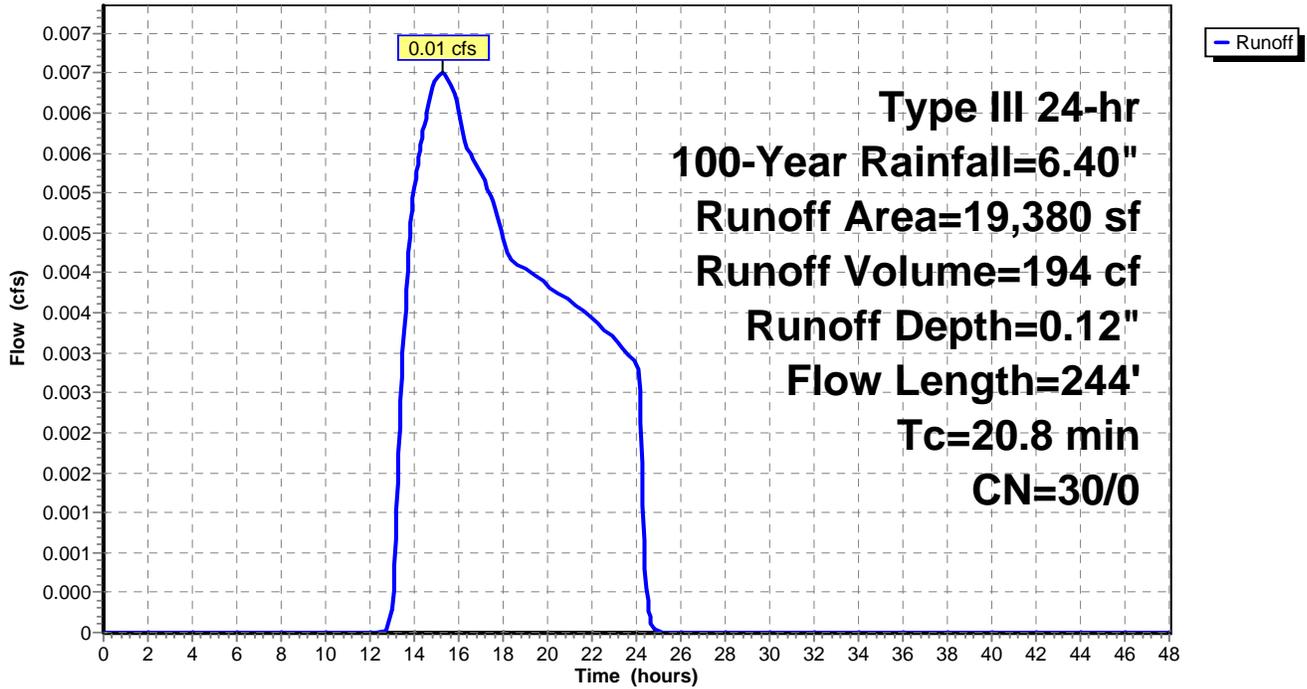
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
18,924	30	Woods, Good, HSG A
456	39	>75% Grass cover, Good, HSG A
19,380	30	Weighted Average
19,380	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	50	0.0170	0.06		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
7.2	194	0.0080	0.45		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
20.8	244	Total			

Subcatchment ES-1: To North/West

Hydrograph



Summary for Subcatchment ES-2: To West

Runoff = 0.01 cfs @ 14.81 hrs, Volume= 274 cf, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

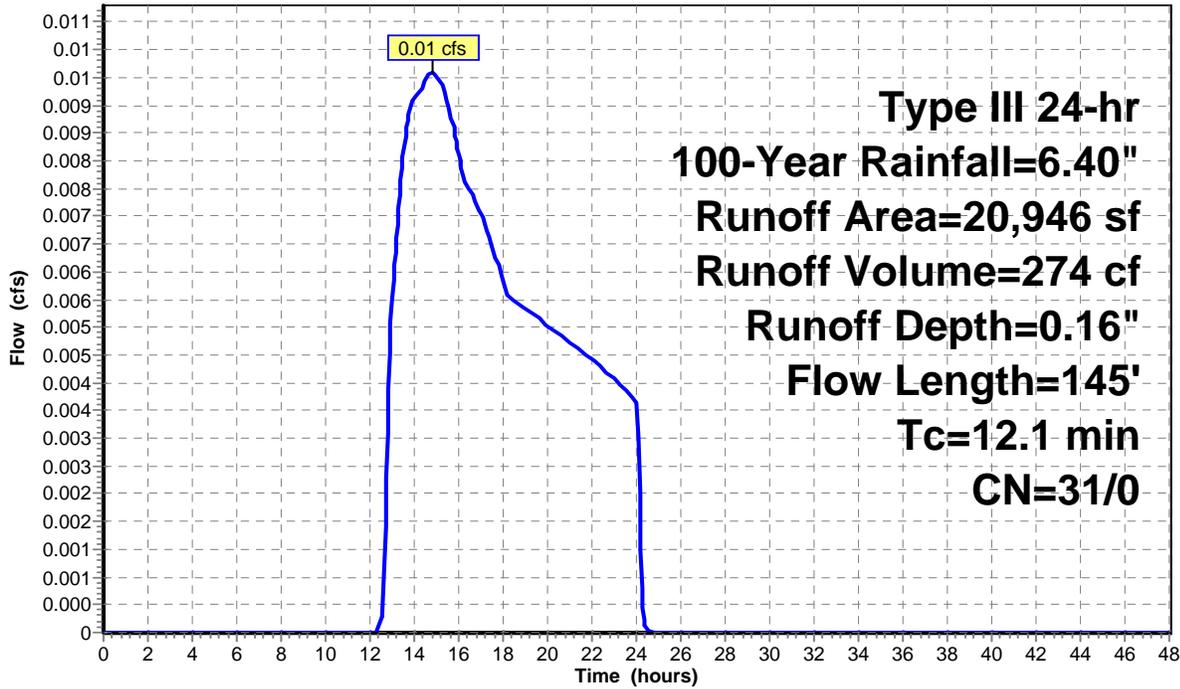
Area (sf)	CN	Description
19,700	30	Woods, Good, HSG A
1,246	39	>75% Grass cover, Good, HSG A
20,946	31	Weighted Average
20,946	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0450	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
2.9	95	0.0120	0.55		Shallow Concentrated Flow, Woodland Kv= 5.0 fps

12.1 145 Total

Subcatchment ES-2: To West

Hydrograph



Summary for Subcatchment ES-3: To Northeast

Runoff = 0.00 cfs @ 14.80 hrs, Volume= 84 cf, Depth= 0.16"

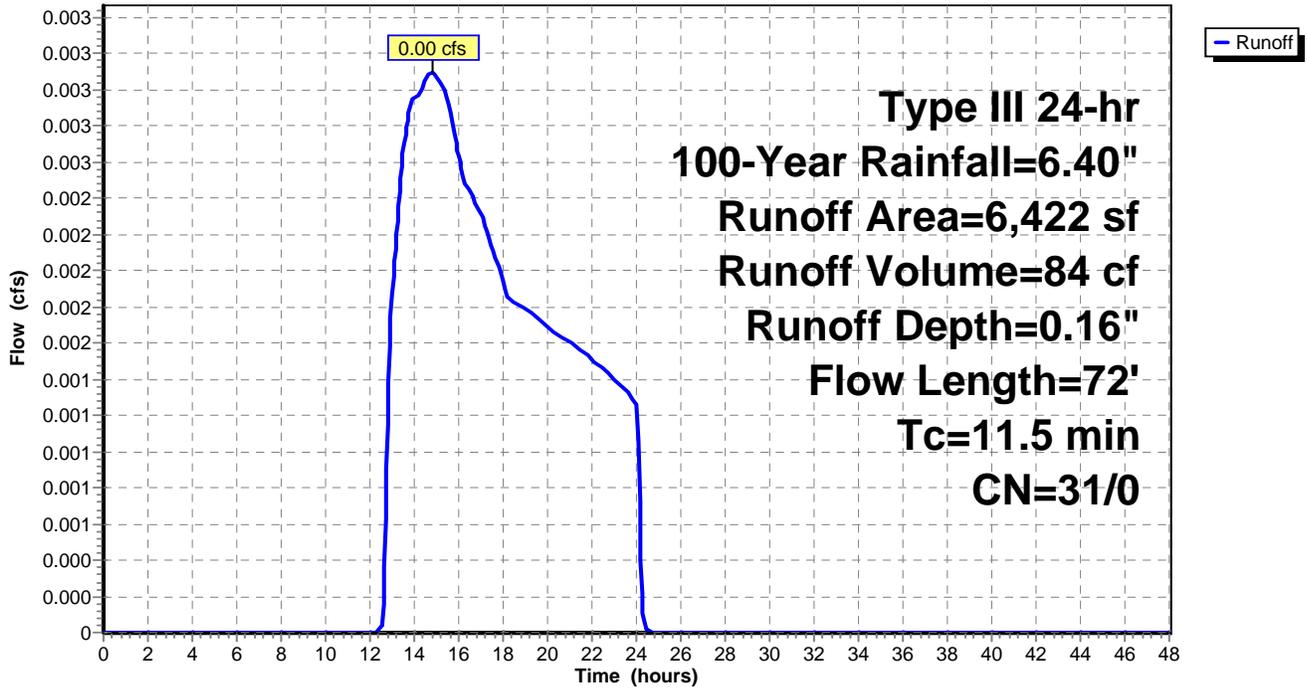
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
5,521	30	Woods, Good, HSG A
901	39	>75% Grass cover, Good, HSG A
6,422	31	Weighted Average
6,422	31	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.0280	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
0.4	22	0.0270	0.82		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.5	72	Total			

Subcatchment ES-3: To Northeast

Hydrograph



Summary for Subcatchment ES-4: To East

Runoff = 0.02 cfs @ 15.07 hrs, Volume= 417 cf, Depth= 0.12"

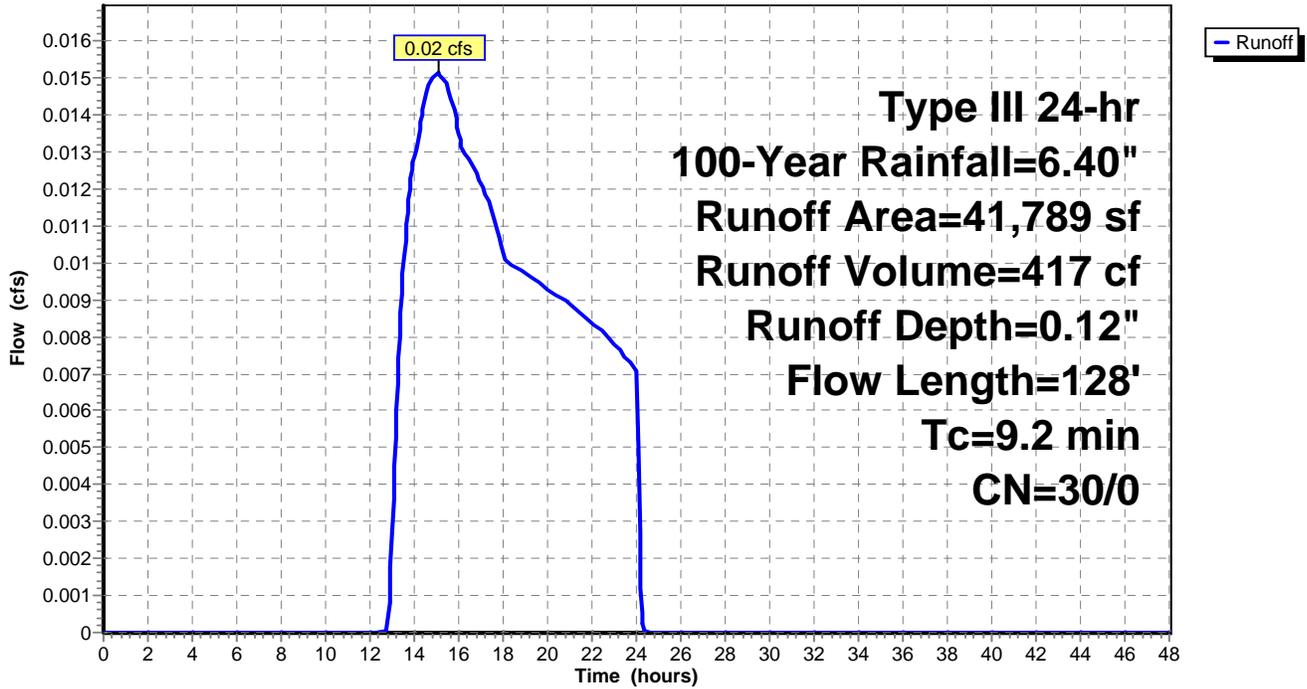
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
41,789	30	Woods, Good, HSG A
41,789	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0580	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
0.7	48	0.0460	1.07		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.2	30	0.2300	2.40		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.2	128	Total			

Subcatchment ES-4: To East

Hydrograph



Summary for Subcatchment ES-5: To Southwest

Runoff = 0.03 cfs @ 15.31 hrs, Volume= 812 cf, Depth= 0.12"

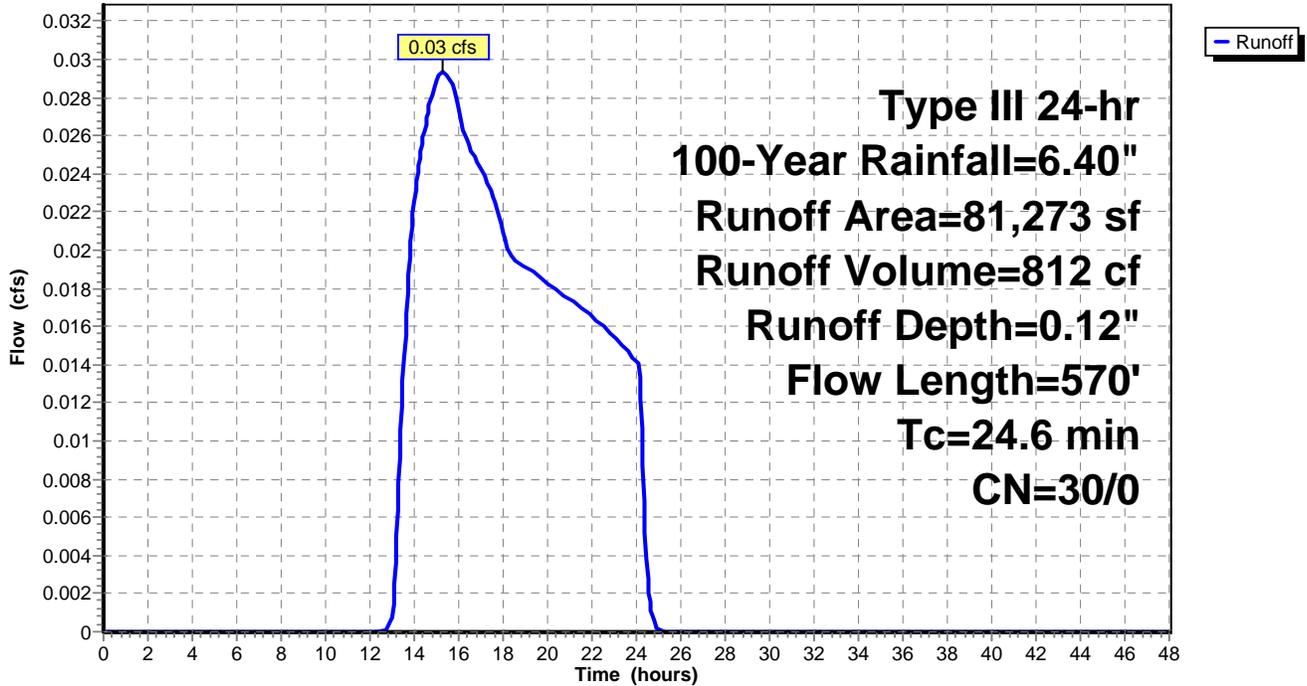
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
80,385	30	Woods, Good, HSG A
888	70	Woods, Good, HSG C
81,273	30	Weighted Average
81,273	30	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	50	0.0180	0.06		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
9.6	407	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.7	113	0.0490	1.11		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.6	570	Total			

Subcatchment ES-5: To Southwest

Hydrograph



Summary for Subcatchment ES-6: To South

Runoff = 1.55 cfs @ 12.28 hrs, Volume= 7,574 cf, Depth= 1.84"

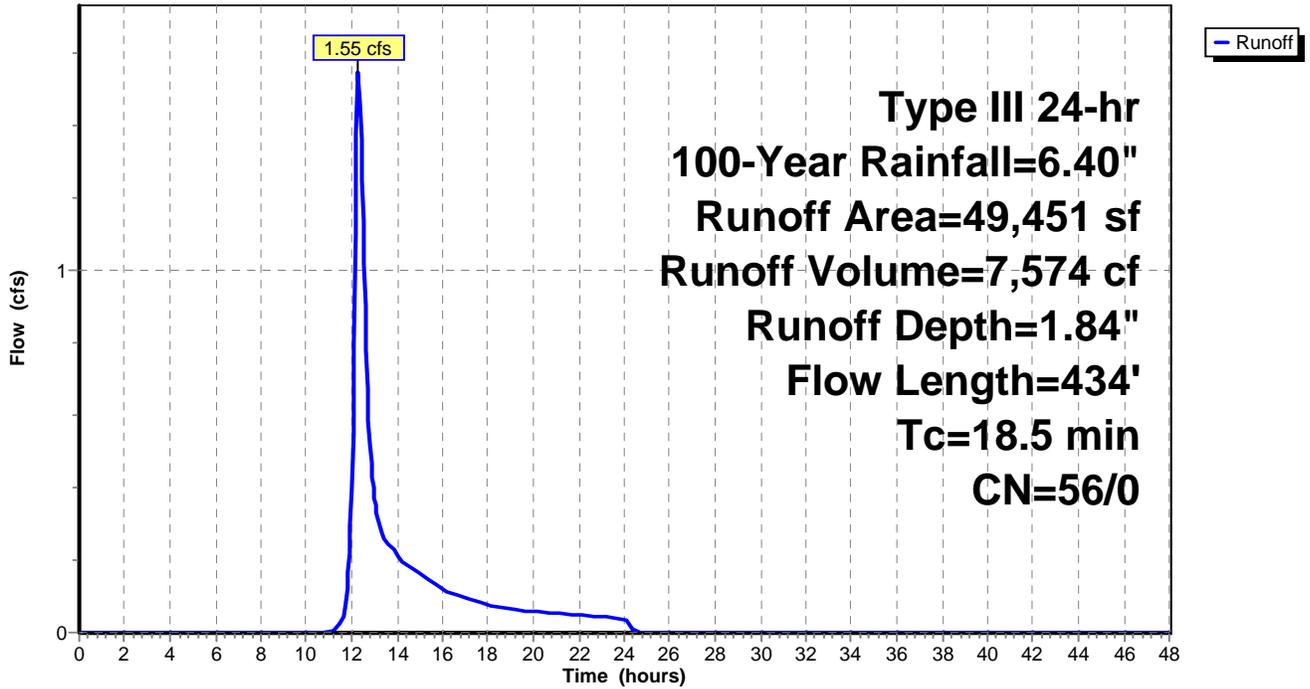
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
17,645	30	Woods, Good, HSG A
31,806	70	Woods, Good, HSG C
49,451	56	Weighted Average
49,451	56	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
5.8	384	0.0480	1.10		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
18.5	434	Total			

Subcatchment ES-6: To South

Hydrograph



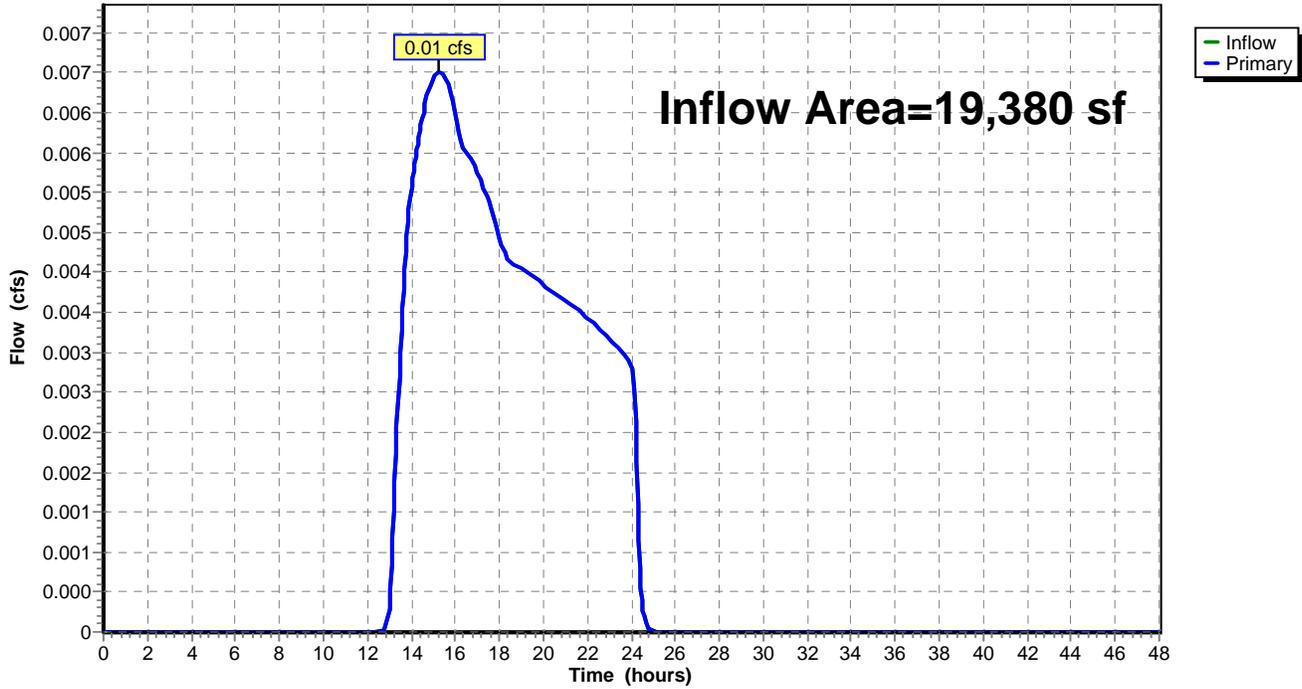
Summary for Link DP-1: Offsite to North/West

Inflow Area = 19,380 sf, 0.00% Impervious, Inflow Depth = 0.12" for 100-Year event
Inflow = 0.01 cfs @ 15.25 hrs, Volume= 194 cf
Primary = 0.01 cfs @ 15.25 hrs, Volume= 194 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

Hydrograph



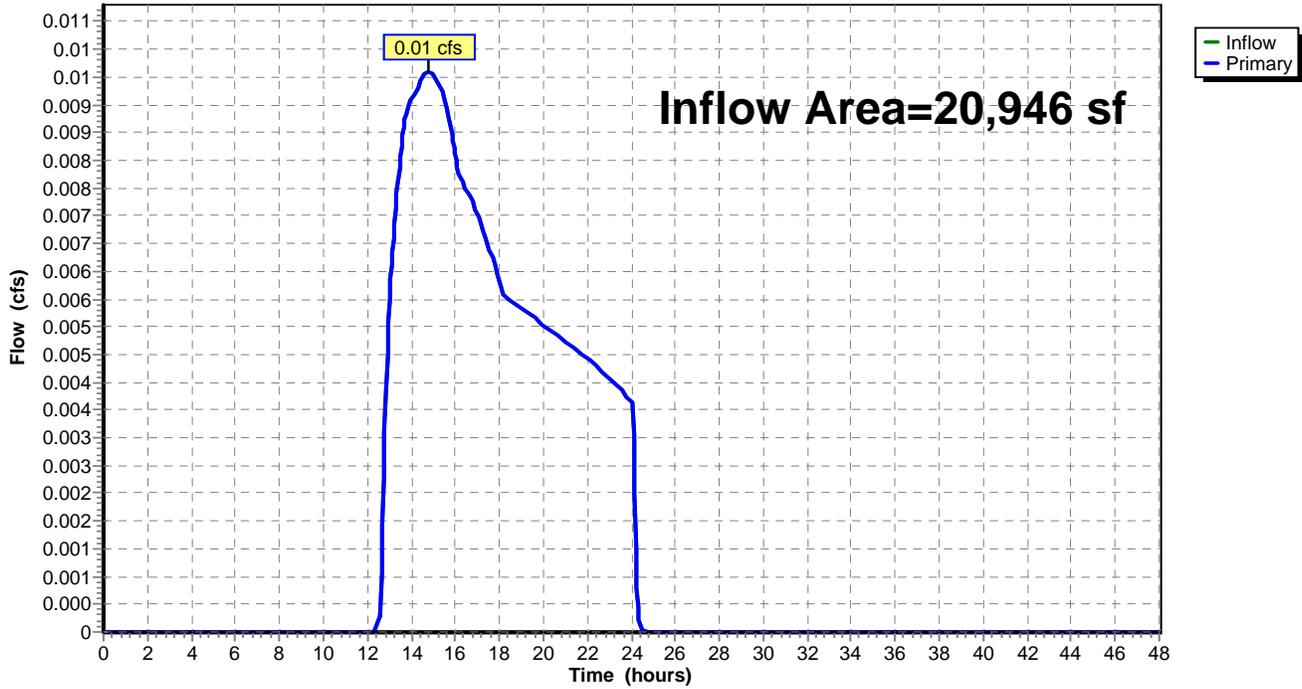
Summary for Link DP-2: Offsite to West

Inflow Area = 20,946 sf, 0.00% Impervious, Inflow Depth = 0.16" for 100-Year event
Inflow = 0.01 cfs @ 14.81 hrs, Volume= 274 cf
Primary = 0.01 cfs @ 14.81 hrs, Volume= 274 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

Hydrograph



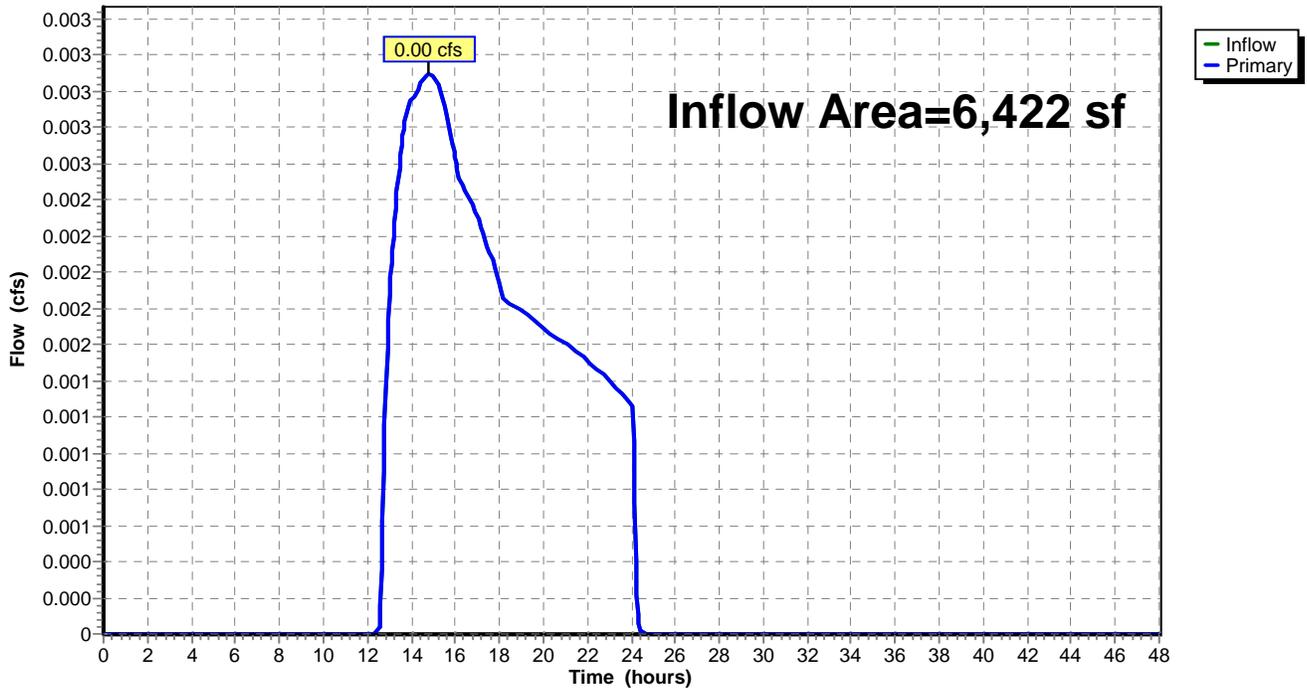
Summary for Link DP-3: Offsite to Northeast

Inflow Area = 6,422 sf, 0.00% Impervious, Inflow Depth = 0.16" for 100-Year event
Inflow = 0.00 cfs @ 14.80 hrs, Volume= 84 cf
Primary = 0.00 cfs @ 14.80 hrs, Volume= 84 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

Hydrograph



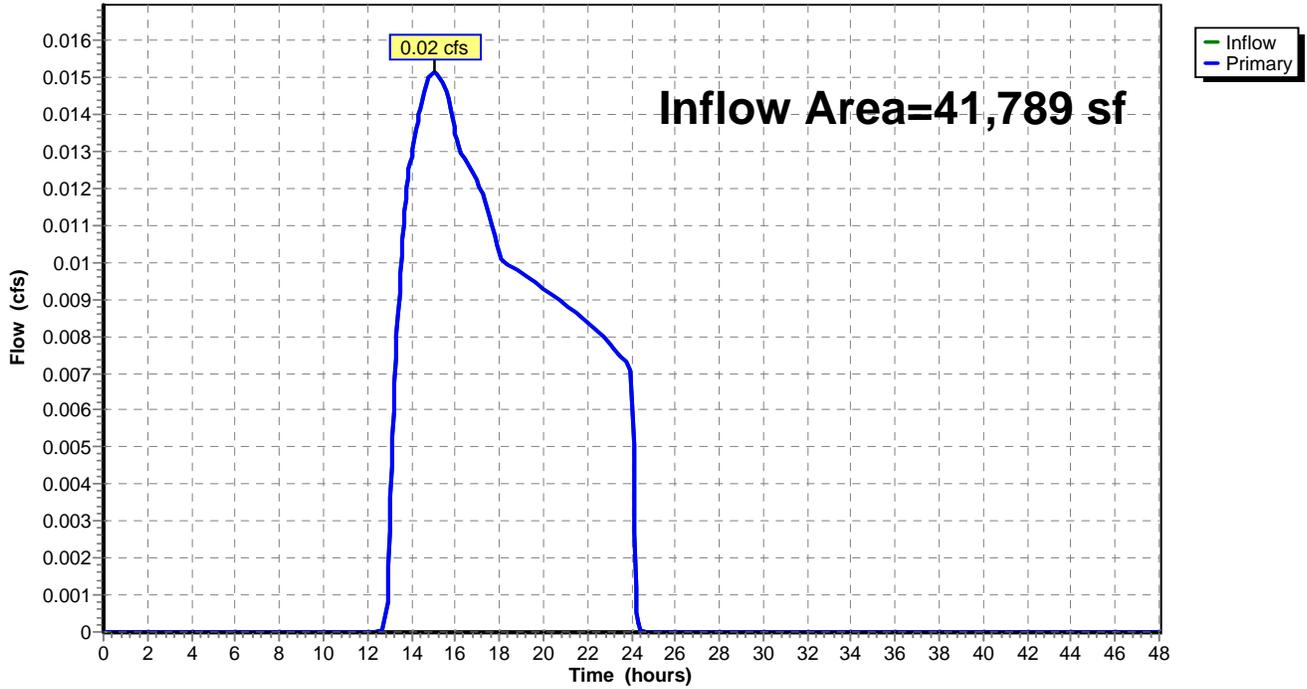
Summary for Link DP-4: East Edge of Property

Inflow Area = 41,789 sf, 0.00% Impervious, Inflow Depth = 0.12" for 100-Year event
Inflow = 0.02 cfs @ 15.07 hrs, Volume= 417 cf
Primary = 0.02 cfs @ 15.07 hrs, Volume= 417 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

Hydrograph



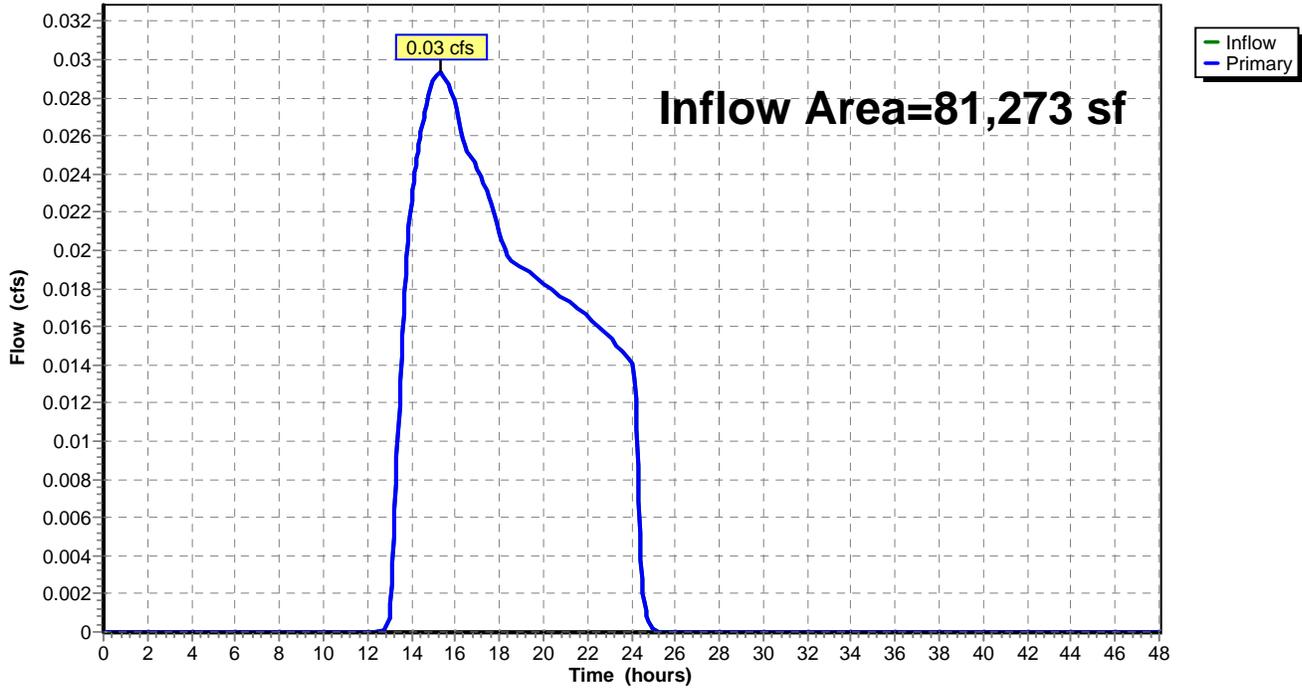
Summary for Link DP-5: Southwest Corner

Inflow Area = 81,273 sf, 0.00% Impervious, Inflow Depth = 0.12" for 100-Year event
Inflow = 0.03 cfs @ 15.31 hrs, Volume= 812 cf
Primary = 0.03 cfs @ 15.31 hrs, Volume= 812 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

Hydrograph



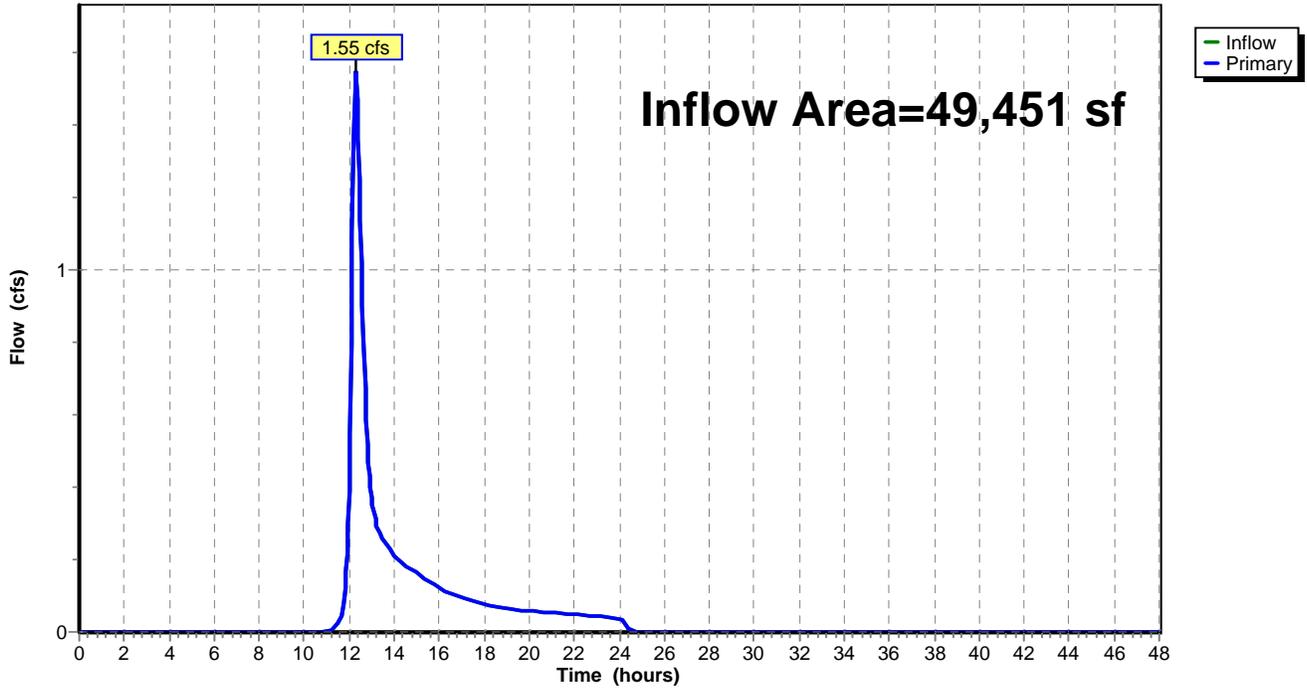
Summary for Link DP-6: South Corner

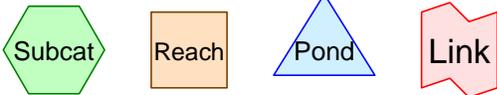
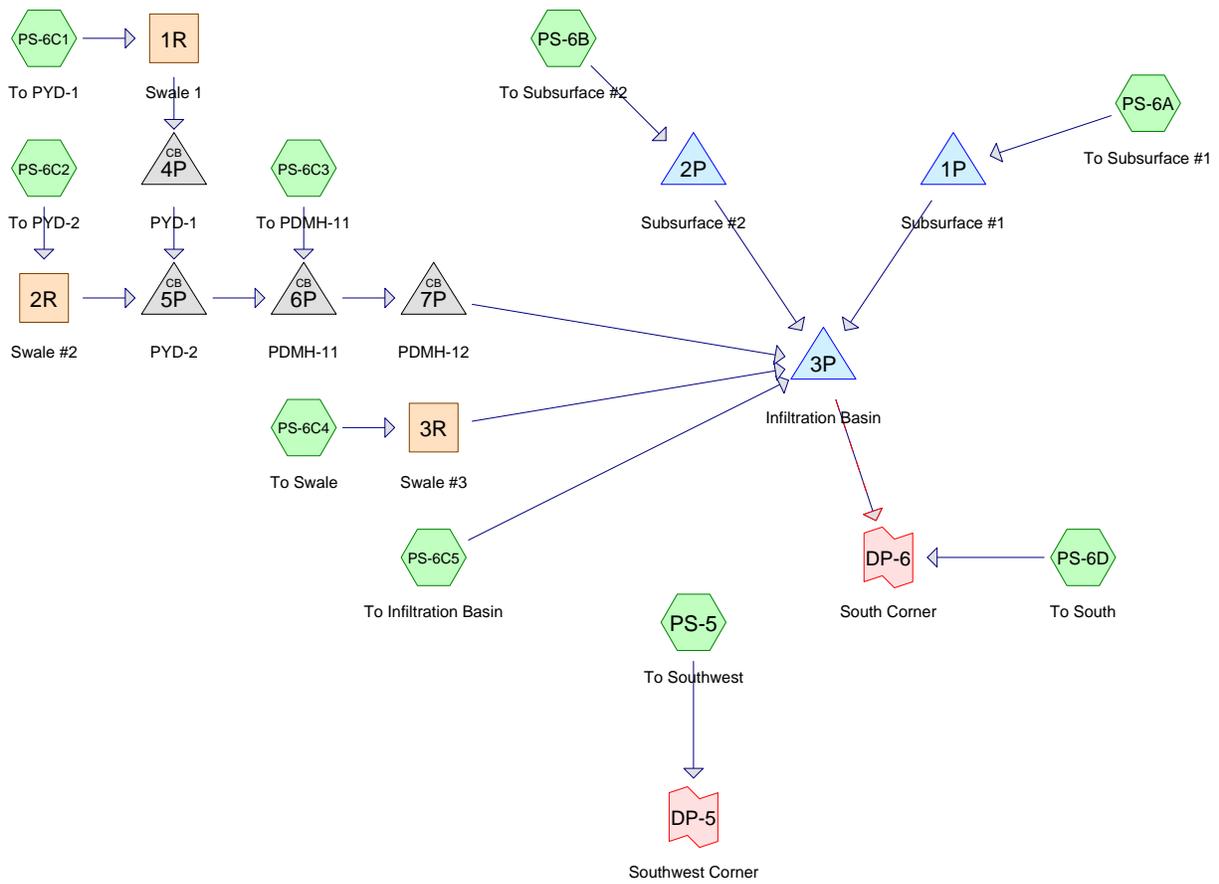
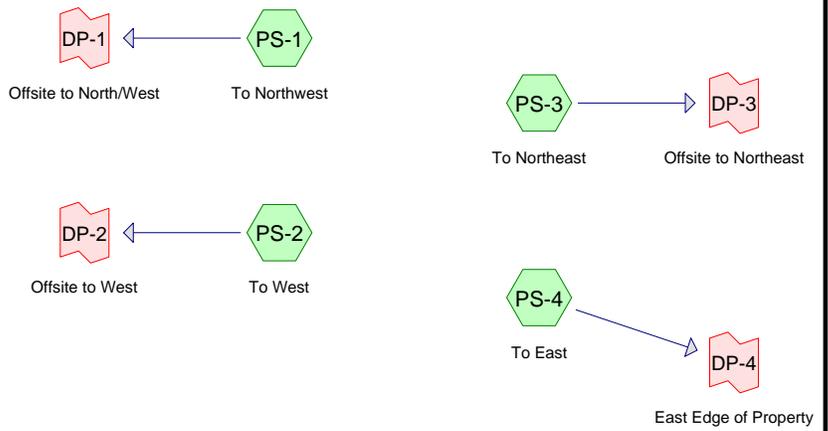
Inflow Area = 49,451 sf, 0.00% Impervious, Inflow Depth = 1.84" for 100-Year event
Inflow = 1.55 cfs @ 12.28 hrs, Volume= 7,574 cf
Primary = 1.55 cfs @ 12.28 hrs, Volume= 7,574 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner

Hydrograph





Routing Diagram for 13-1119 - POST 2014-09-25
 Prepared by R Levesque Associates, Inc
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13-1119 - POST_2014-09-25

Prepared by R Levesque Associates, Inc

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Page 2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
78,963	39	>75% Grass cover, Good, HSG A (PS-1, PS-2, PS-3, PS-4, PS-5, PS-6A, PS-6B, PS-6C1, PS-6C2, PS-6C4, PS-6C5, PS-6D)
23,560	74	>75% Grass cover, Good, HSG C (PS-6B, PS-6C4, PS-6C5, PS-6D)
51,112	98	Paved parking, HSG A (PS-6A, PS-6B)
514	98	Paved parking, HSG C (PS-6B)
28,920	98	Roofs, HSG A (PS-6A, PS-6B, PS-6C2, PS-6C3)
2,914	98	Roofs, HSG C (PS-6B)
5,420	98	Unconnected roofs, HSG A (PS-6C1, PS-6C4)
3,928	98	Unconnected roofs, HSG C (PS-6C4)
1,778	98	Water Surface, HSG C (PS-6C5)
22,152	30	Woods, Good, HSG A (PS-3, PS-4, PS-5, PS-6C1, PS-6C2)
219,261	67	TOTAL AREA

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
 Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS-1: To Northwest	Runoff Area=4,495 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=80' Slope=0.0100 '/' Tc=11.5 min CN=39/0 Runoff=0.00 cfs 0 cf
Subcatchment PS-2: To West	Runoff Area=4,426 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=129' Tc=12.6 min CN=39/0 Runoff=0.00 cfs 0 cf
Subcatchment PS-3: To Northeast	Runoff Area=4,223 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=66' Slope=0.0100 '/' Tc=11.4 min CN=35/0 Runoff=0.00 cfs 0 cf
Subcatchment PS-4: To East	Runoff Area=18,101 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=72' Tc=13.0 min CN=37/0 Runoff=0.00 cfs 0 cf
Subcatchment PS-5: To Southwest	Runoff Area=5,338 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=74' Tc=9.6 min CN=34/0 Runoff=0.00 cfs 0 cf
Subcatchment PS-6A: To Subsurface #1	Runoff Area=79,064 sf 69.61% Impervious Runoff Depth=1.93" Flow Length=804' Tc=15.1 min CN=39/98 Runoff=2.78 cfs 12,697 cf
Subcatchment PS-6B: To Subsurface #2	Runoff Area=34,605 sf 76.54% Impervious Runoff Depth=2.12" Flow Length=345' Tc=11.8 min CN=41/98 Runoff=1.46 cfs 6,111 cf
Subcatchment PS-6C1: To PYD-1	Runoff Area=24,468 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=371' Tc=13.1 min CN=42/0 Runoff=0.00 cfs 8 cf
Subcatchment PS-6C2: To PYD-2	Runoff Area=7,775 sf 12.42% Impervious Runoff Depth=0.34" Flow Length=237' Tc=11.4 min CN=34/98 Runoff=0.05 cfs 223 cf
Subcatchment PS-6C3: To PDMH-11	Runoff Area=966 sf 100.00% Impervious Runoff Depth=2.77" Tc=6.0 min CN=0/98 Runoff=0.06 cfs 223 cf
Subcatchment PS-6C4: To Swale	Runoff Area=15,577 sf 0.00% Impervious Runoff Depth=1.19" Flow Length=311' Tc=9.1 min CN=79/0 Runoff=0.43 cfs 1,543 cf
Subcatchment PS-6C5: To Infiltration Basin	Runoff Area=14,436 sf 12.32% Impervious Runoff Depth=0.93" Flow Length=127' Tc=7.1 min CN=69/98 Runoff=0.29 cfs 1,117 cf
Subcatchment PS-6D: To South	Runoff Area=5,787 sf 0.00% Impervious Runoff Depth=0.67" Flow Length=137' Tc=6.7 min CN=69/0 Runoff=0.09 cfs 323 cf
Reach 1R: Swale 1	Avg. Flow Depth=0.00' Max Vel=0.24 fps Inflow=0.00 cfs 8 cf n=0.025 L=2.0' S=0.0200 '/' Capacity=9.66 cfs Outflow=0.00 cfs 8 cf
Reach 2R: Swale #2	Avg. Flow Depth=0.02' Max Vel=0.70 fps Inflow=0.05 cfs 223 cf n=0.025 L=2.0' S=0.0200 '/' Capacity=9.66 cfs Outflow=0.05 cfs 223 cf
Reach 3R: Swale #3	Avg. Flow Depth=0.07' Max Vel=1.98 fps Inflow=0.43 cfs 1,543 cf n=0.025 L=130.0' S=0.0450 '/' Capacity=14.49 cfs Outflow=0.41 cfs 1,543 cf
Pond 1P: Subsurface #1	Peak Elev=202.66' Storage=4,633 cf Inflow=2.78 cfs 12,697 cf Discarded=0.31 cfs 12,697 cf Primary=0.00 cfs 0 cf Outflow=0.31 cfs 12,697 cf
Pond 2P: Subsurface #2	Peak Elev=198.21' Storage=2,413 cf Inflow=1.46 cfs 6,111 cf Discarded=0.12 cfs 6,111 cf Primary=0.00 cfs 0 cf Outflow=0.12 cfs 6,111 cf

Pond 3P: Infiltration Basin Peak Elev=184.68' Storage=1,434 cf Inflow=0.78 cfs 3,113 cf
Discarded=0.06 cfs 3,113 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.06 cfs 3,113 cf

Pond 4P: PYD-1 Peak Elev=192.50' Inflow=0.00 cfs 8 cf
12.0" Round Culvert n=0.012 L=153.0' S=0.0359 '/ Outflow=0.00 cfs 8 cf

Pond 5P: PYD-2 Peak Elev=187.13' Inflow=0.05 cfs 231 cf
12.0" Round Culvert n=0.012 L=93.0' S=0.0053 '/ Outflow=0.05 cfs 231 cf

Pond 6P: PDMH-11 Peak Elev=186.69' Inflow=0.11 cfs 454 cf
12.0" Round Culvert n=0.012 L=55.0' S=0.0055 '/ Outflow=0.11 cfs 454 cf

Pond 7P: PDMH-12 Peak Elev=186.37' Inflow=0.11 cfs 454 cf
12.0" Round Culvert n=0.012 L=87.0' S=0.0145 '/ Outflow=0.11 cfs 454 cf

Link DP-1: Offsite to North/West Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link DP-2: Offsite to West Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link DP-3: Offsite to Northeast Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link DP-4: East Edge of Property Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link DP-5: Southwest Corner Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link DP-6: South Corner Inflow=0.09 cfs 323 cf
Primary=0.09 cfs 323 cf

Total Runoff Area = 219,261 sf Runoff Volume = 22,244 cf Average Runoff Depth = 1.22"
61.12% Pervious = 134,023 sf 38.88% Impervious = 85,238 sf

Summary for Subcatchment PS-1: To Northwest

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

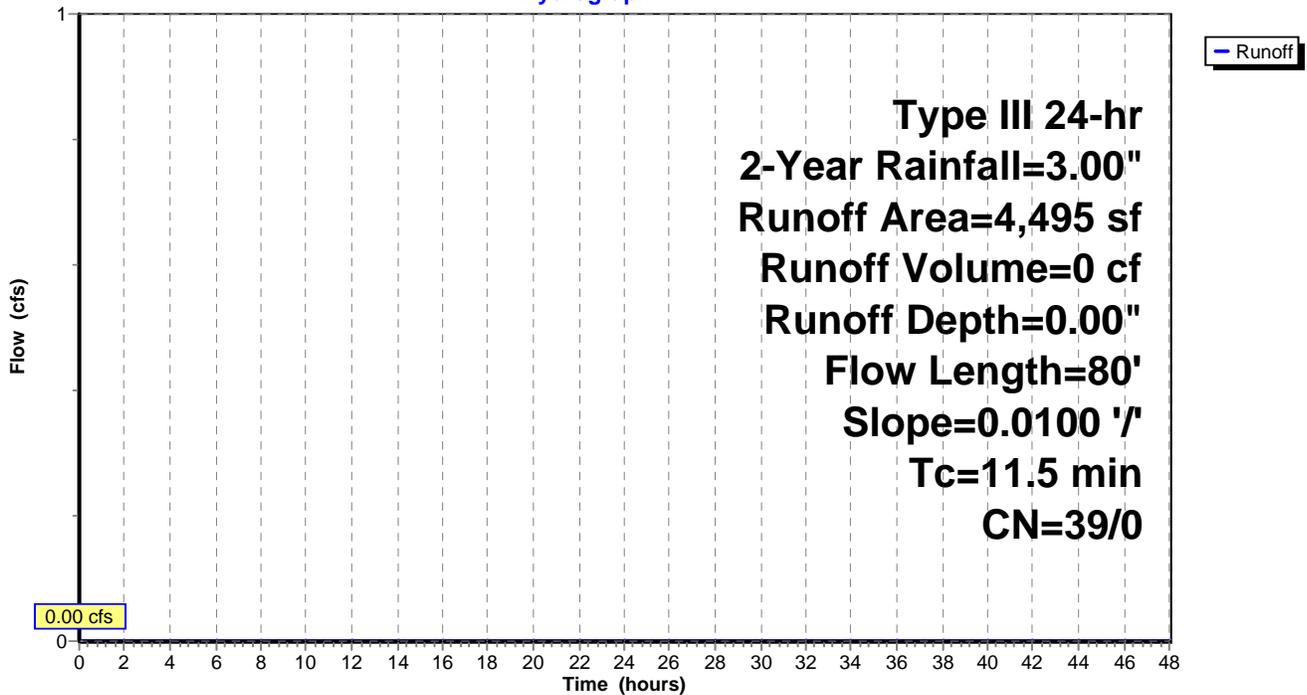
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
4,495	39	>75% Grass cover, Good, HSG A
4,495	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	30	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.5	80	Total			

Subcatchment PS-1: To Northwest

Hydrograph



Summary for Subcatchment PS-2: To West

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

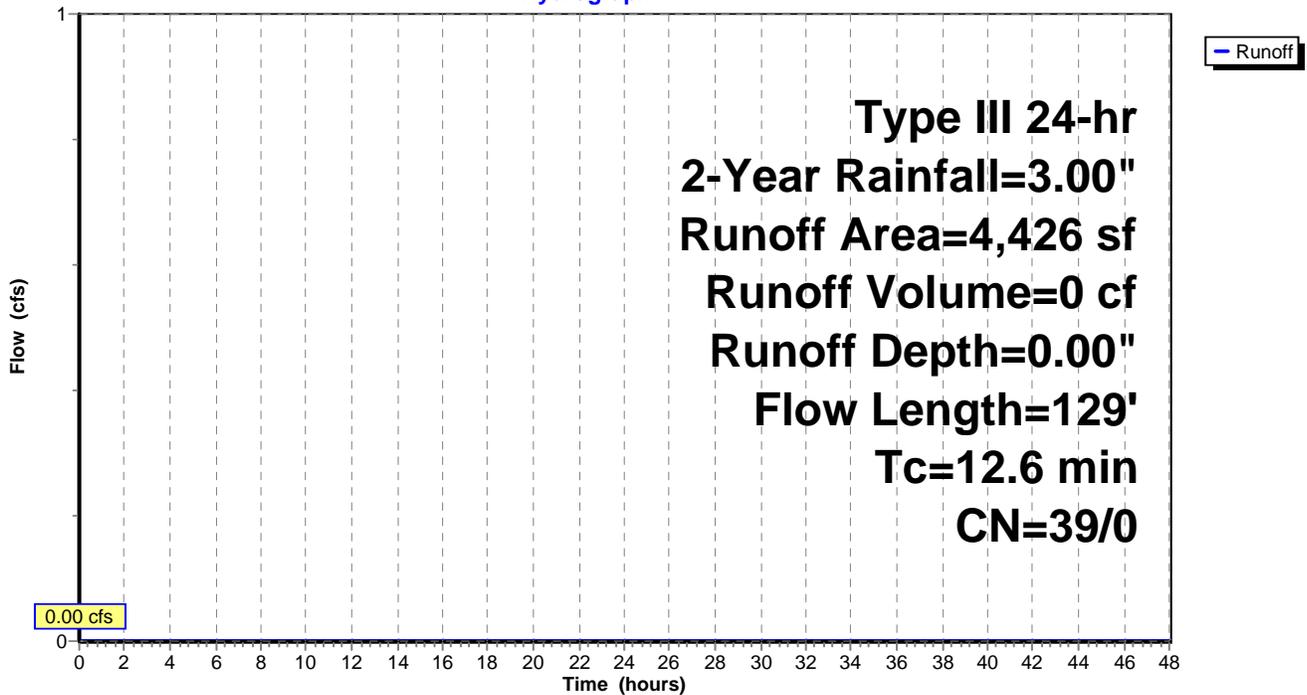
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
4,426	39	>75% Grass cover, Good, HSG A
4,426	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0080	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.4	79	0.0400	3.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
12.6	129	Total			

Subcatchment PS-2: To West

Hydrograph



Summary for Subcatchment PS-3: To Northeast

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

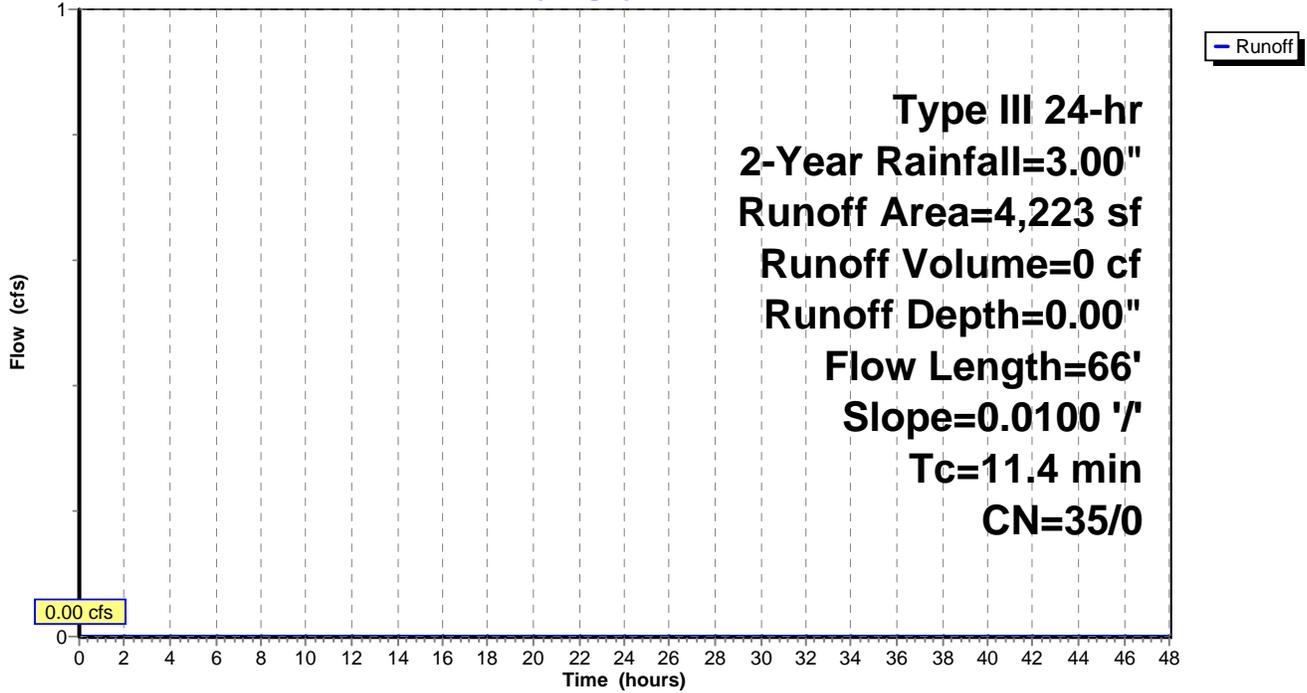
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
2,427	39	>75% Grass cover, Good, HSG A
1,796	30	Woods, Good, HSG A
4,223	35	Weighted Average
4,223	35	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.2	16	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.4	66	Total			

Subcatchment PS-3: To Northeast

Hydrograph



Summary for Subcatchment PS-4: To East

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

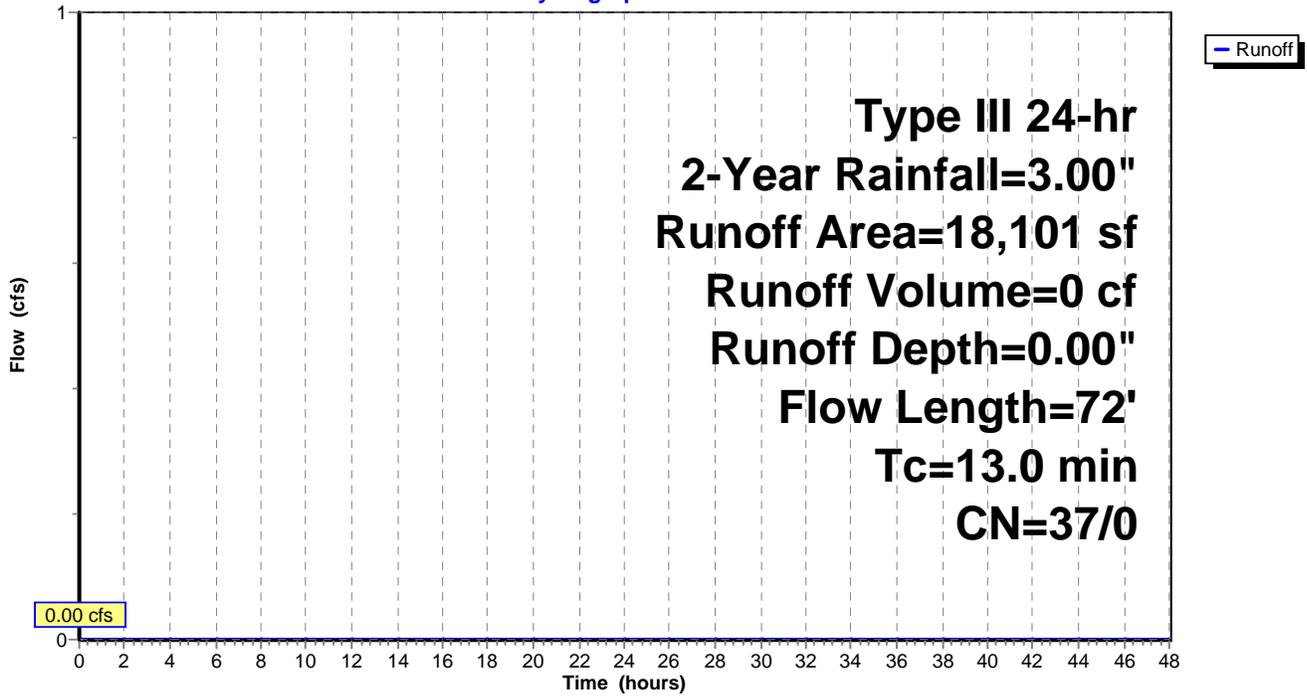
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
14,935	39	>75% Grass cover, Good, HSG A
3,166	30	Woods, Good, HSG A
18,101	37	Weighted Average
18,101	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0070	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.1	22	0.1800	6.83		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.0	72	Total			

Subcatchment PS-4: To East

Hydrograph



Summary for Subcatchment PS-5: To Southwest

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

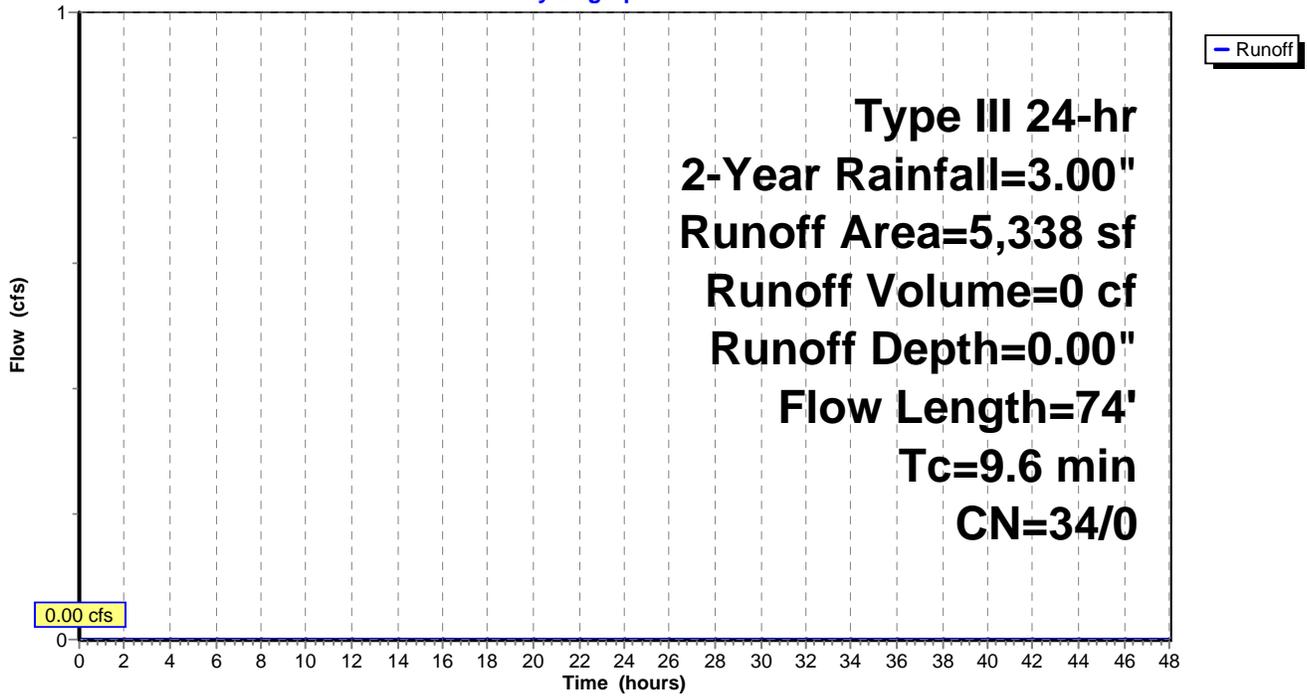
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
2,173	39	>75% Grass cover, Good, HSG A
3,165	30	Woods, Good, HSG A
5,338	34	Weighted Average
5,338	34	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0420	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
0.1	24	0.0440	3.38		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.6	74	Total			

Subcatchment PS-5: To Southwest

Hydrograph



Summary for Subcatchment PS-6A: To Subsurface #1

Runoff = 2.78 cfs @ 12.20 hrs, Volume= 12,697 cf, Depth= 1.93"

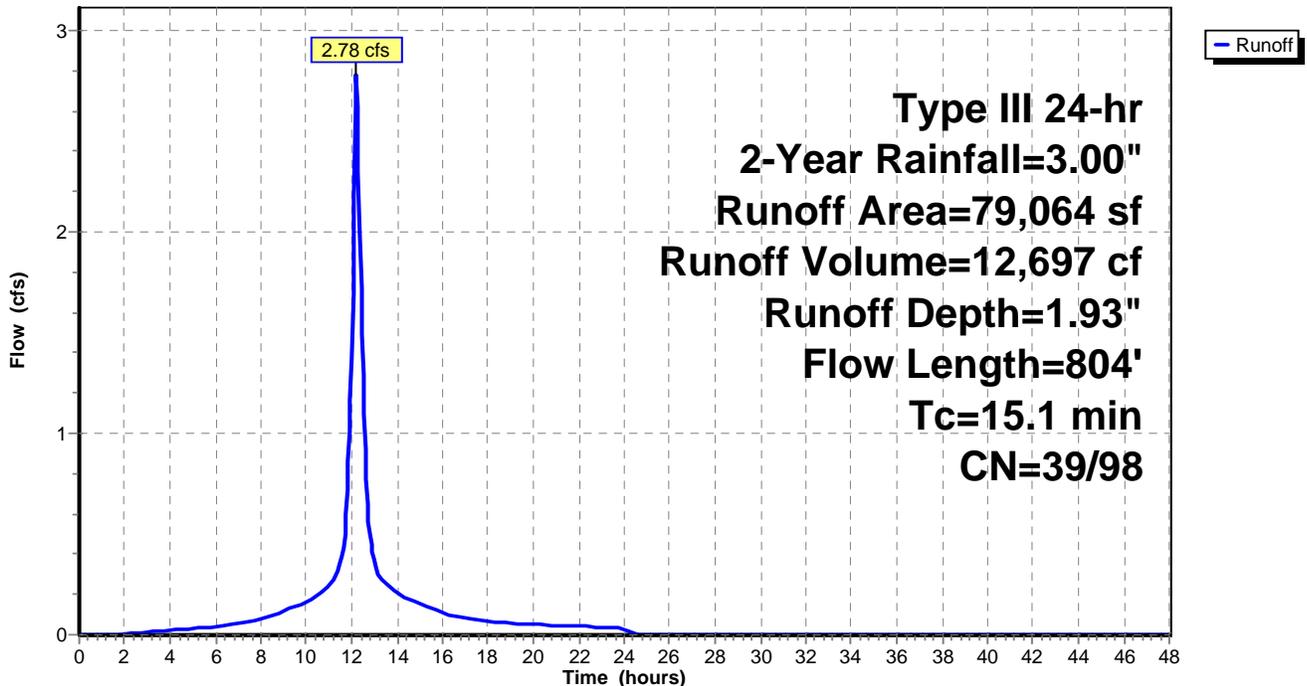
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
34,605	98	Paved parking, HSG A
20,435	98	Roofs, HSG A
24,024	39	>75% Grass cover, Good, HSG A
79,064	80	Weighted Average
24,024	39	30.39% Pervious Area
55,040	98	69.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0090	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
1.4	124	0.0050	1.44		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.1	392	0.0150	6.02	4.73	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.9	238	0.0050	4.55	8.05	Pipe Channel, 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
15.1	804	Total			

Subcatchment PS-6A: To Subsurface #1

Hydrograph



Summary for Subcatchment PS-6B: To Subsurface #2

Runoff = 1.46 cfs @ 12.16 hrs, Volume= 6,111 cf, Depth= 2.12"

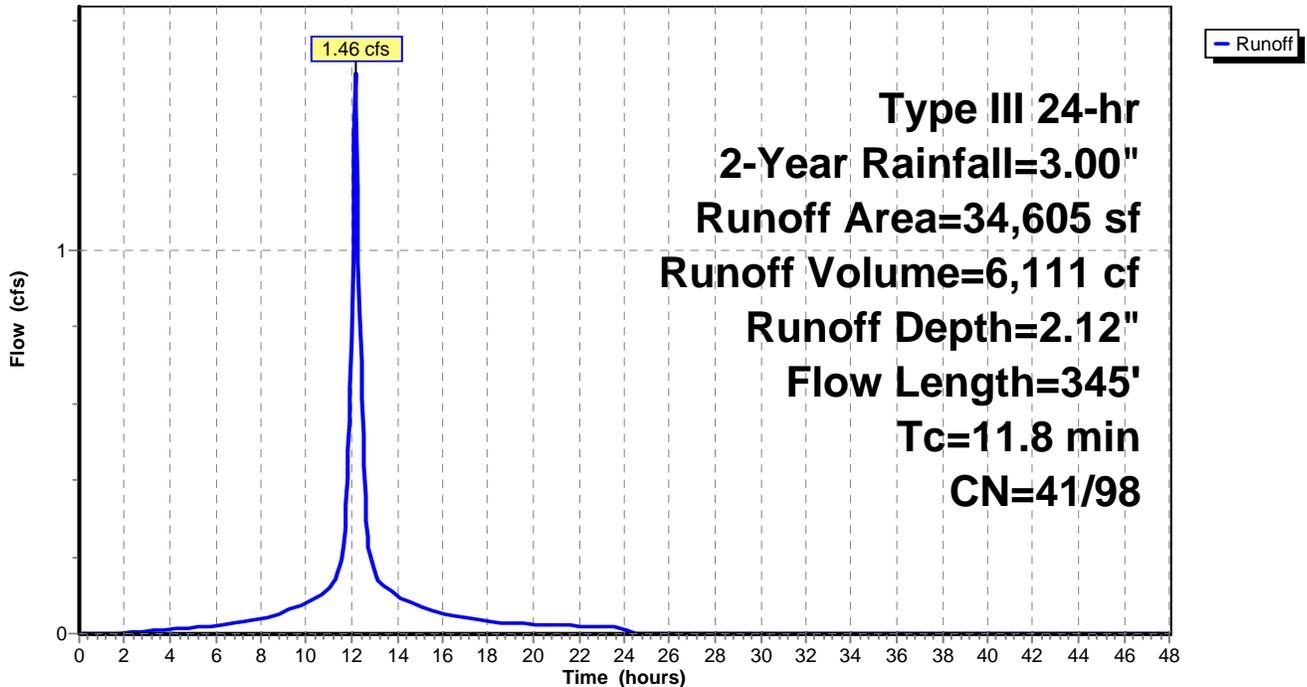
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
16,507	98	Paved parking, HSG A
6,553	98	Roofs, HSG A
7,595	39	>75% Grass cover, Good, HSG A
514	98	Paved parking, HSG C
2,914	98	Roofs, HSG C
522	74	>75% Grass cover, Good, HSG C
34,605	85	Weighted Average
8,117	41	23.46% Pervious Area
26,488	98	76.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	35	0.0080	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.0150	2.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	96	0.0420	4.16		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	162	0.0050	1.44		Shallow Concentrated Flow, Paved Kv= 20.3 fps
11.8	345	Total			

Subcatchment PS-6B: To Subsurface #2

Hydrograph



Summary for Subcatchment PS-6C2: To PYD-2

Runoff = 0.05 cfs @ 12.15 hrs, Volume= 223 cf, Depth= 0.34"

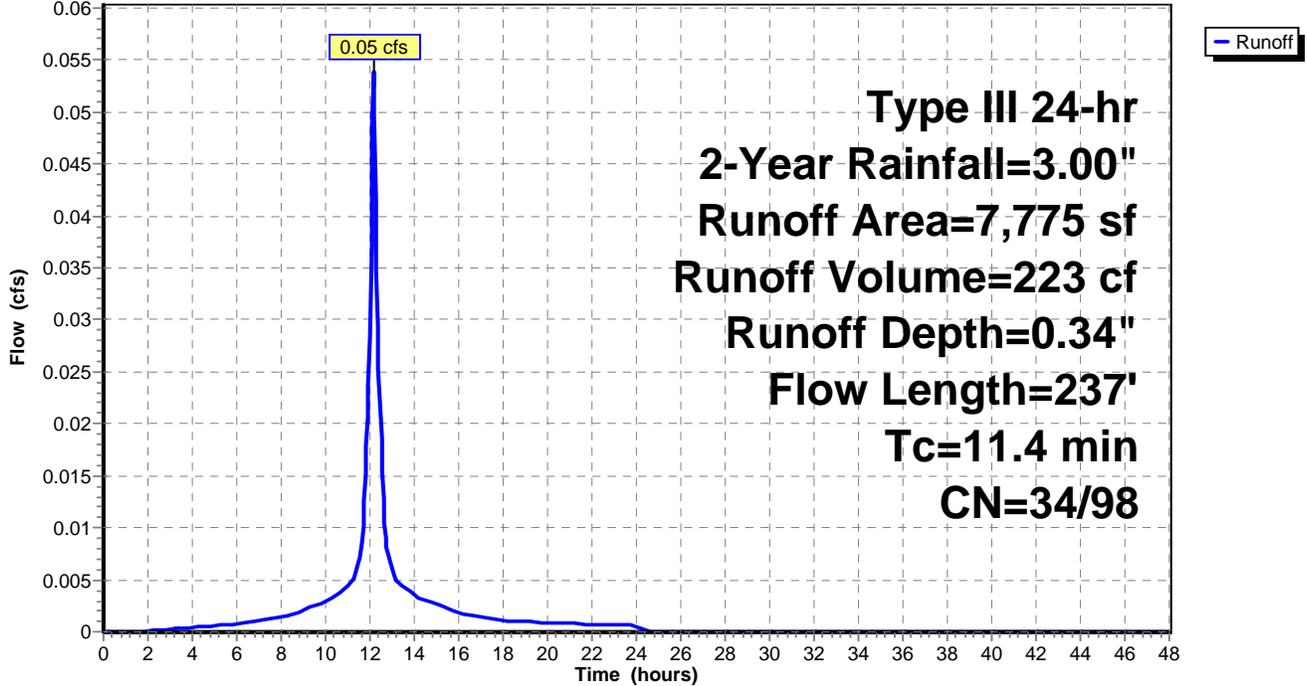
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
966	98	Roofs, HSG A
3,165	39	>75% Grass cover, Good, HSG A
3,644	30	Woods, Good, HSG A
7,775	42	Weighted Average
6,809	34	87.58% Pervious Area
966	98	12.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0120	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
1.0	187	0.0390	3.18		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.4	237	Total			

Subcatchment PS-6C2: To PYD-2

Hydrograph



Summary for Subcatchment PS-6C3: To PDMH-11

Runoff = 0.06 cfs @ 12.09 hrs, Volume= 223 cf, Depth= 2.77"

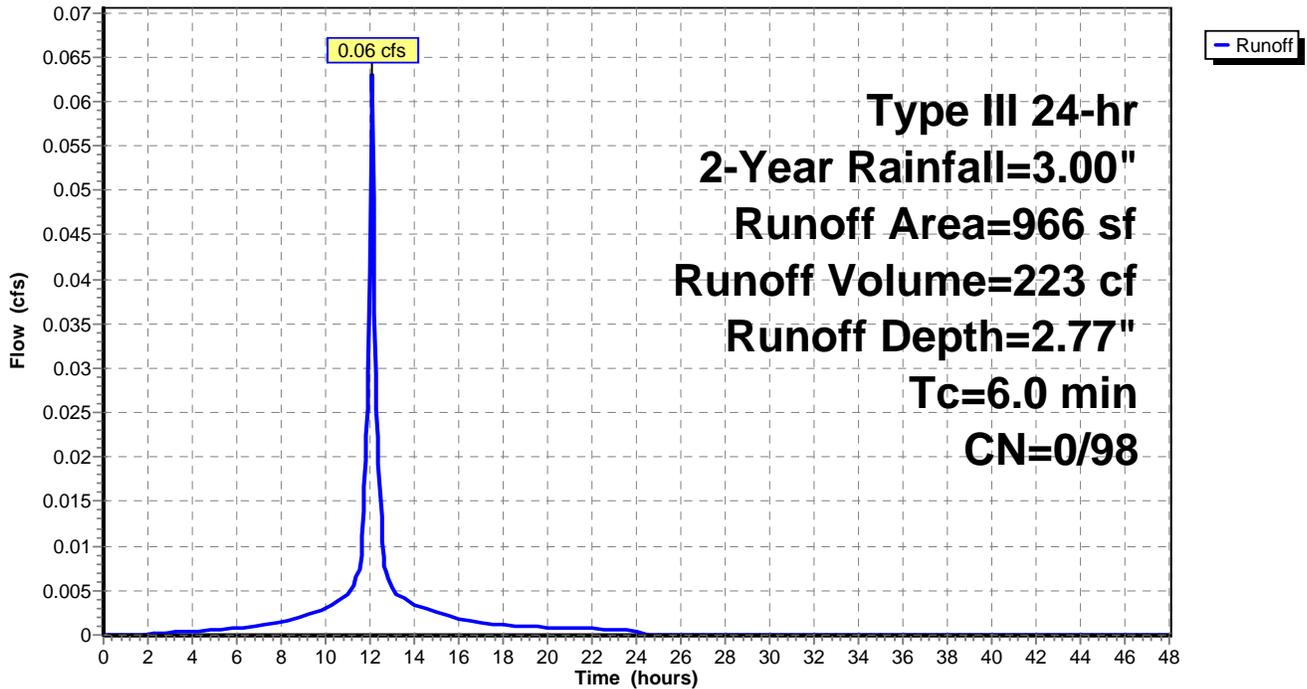
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
966	98	Roofs, HSG A
966	98	100.00% Impervious Area

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

Subcatchment PS-6C3: To PDMH-11

Hydrograph



Summary for Subcatchment PS-6C4: To Swale

Runoff = 0.43 cfs @ 12.14 hrs, Volume= 1,543 cf, Depth= 1.19"

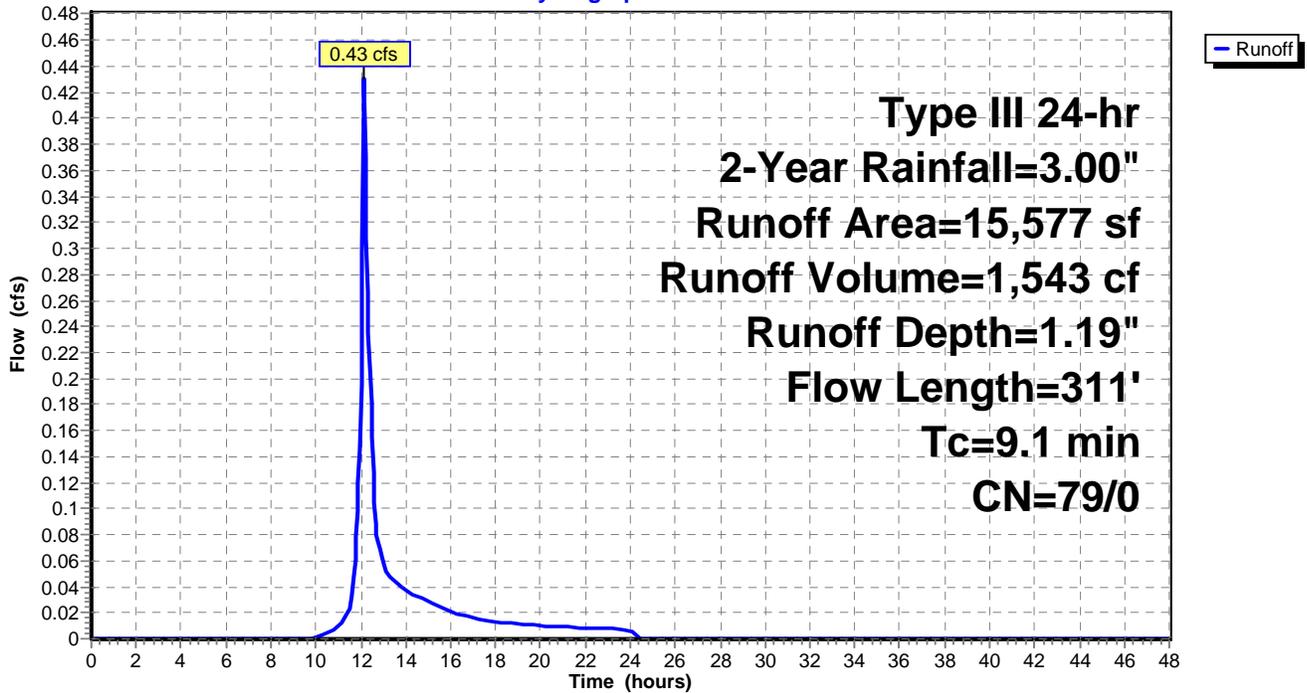
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
2,520	98	Unconnected roofs, HSG A
1,994	39	>75% Grass cover, Good, HSG A
3,928	98	Unconnected roofs, HSG C
7,135	74	>75% Grass cover, Good, HSG C
15,577	79	Weighted Average
15,577	79	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	28	0.0080	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
1.4	283	0.0450	3.42		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.1	311	Total			

Subcatchment PS-6C4: To Swale

Hydrograph



Summary for Subcatchment PS-6C5: To Infiltration Basin

Runoff = 0.29 cfs @ 12.11 hrs, Volume= 1,117 cf, Depth= 0.93"

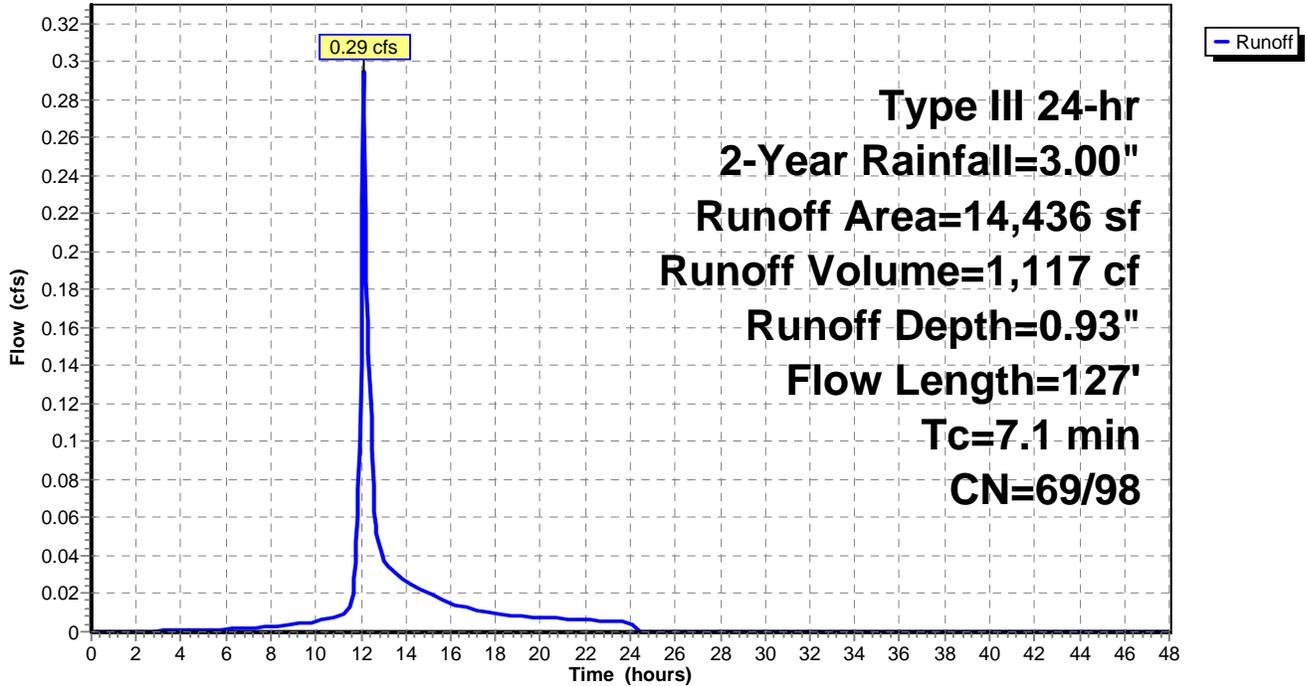
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
1,725	39	>75% Grass cover, Good, HSG A
10,933	74	>75% Grass cover, Good, HSG C
1,778	98	Water Surface, HSG C
14,436	73	Weighted Average
12,658	69	87.68% Pervious Area
1,778	98	12.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	40	0.0220	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	87	0.0770	4.47		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.1	127	Total			

Subcatchment PS-6C5: To Infiltration Basin

Hydrograph



Summary for Subcatchment PS-6D: To South

Runoff = 0.09 cfs @ 12.12 hrs, Volume= 323 cf, Depth= 0.67"

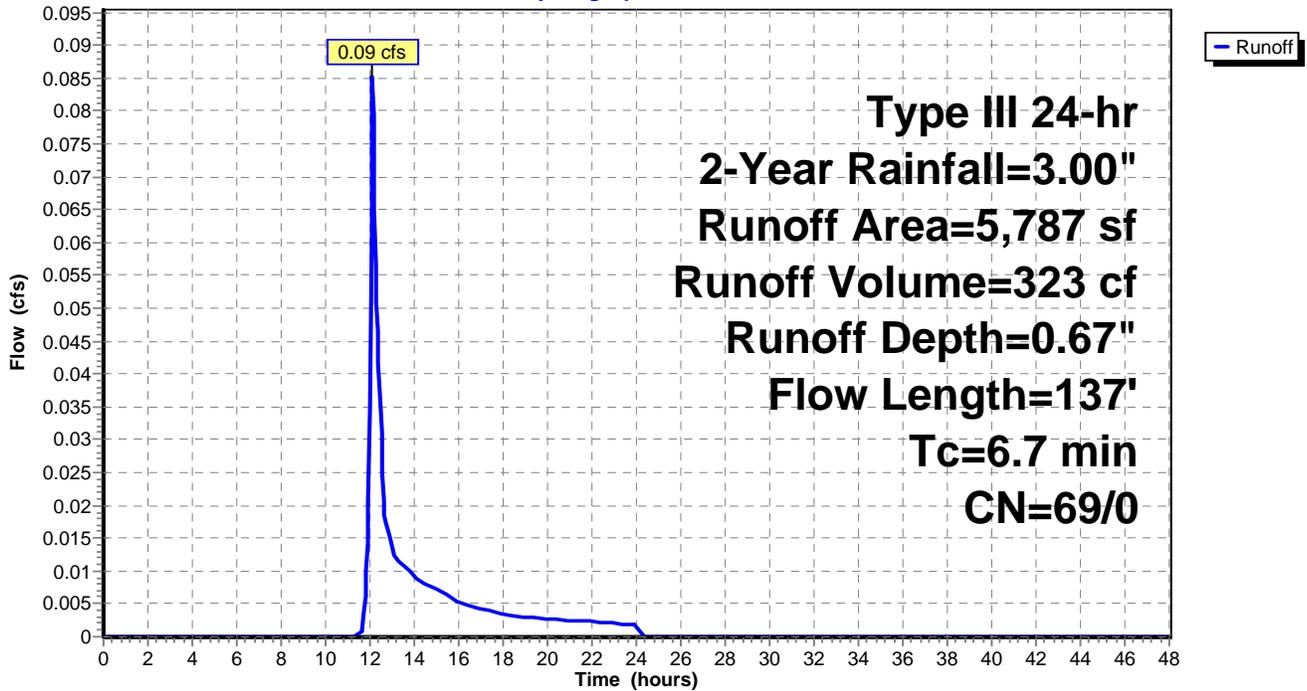
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
817	39	>75% Grass cover, Good, HSG A
4,970	74	>75% Grass cover, Good, HSG C
5,787	69	Weighted Average
5,787	69	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.2	46	0.0420	3.30		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.1	41	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.7	137	Total			

Subcatchment PS-6D: To South

Hydrograph



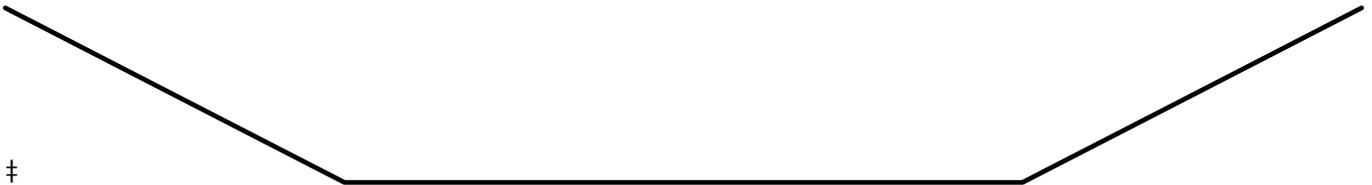
Summary for Reach 1R: Swale 1

Inflow Area = 24,468 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
 Inflow = 0.00 cfs @ 23.55 hrs, Volume= 8 cf
 Outflow = 0.00 cfs @ 23.56 hrs, Volume= 8 cf, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Max. Velocity= 0.24 fps, Min. Travel Time= 0.1 min
 Avg. Velocity = 0.24 fps, Avg. Travel Time= 0.1 min

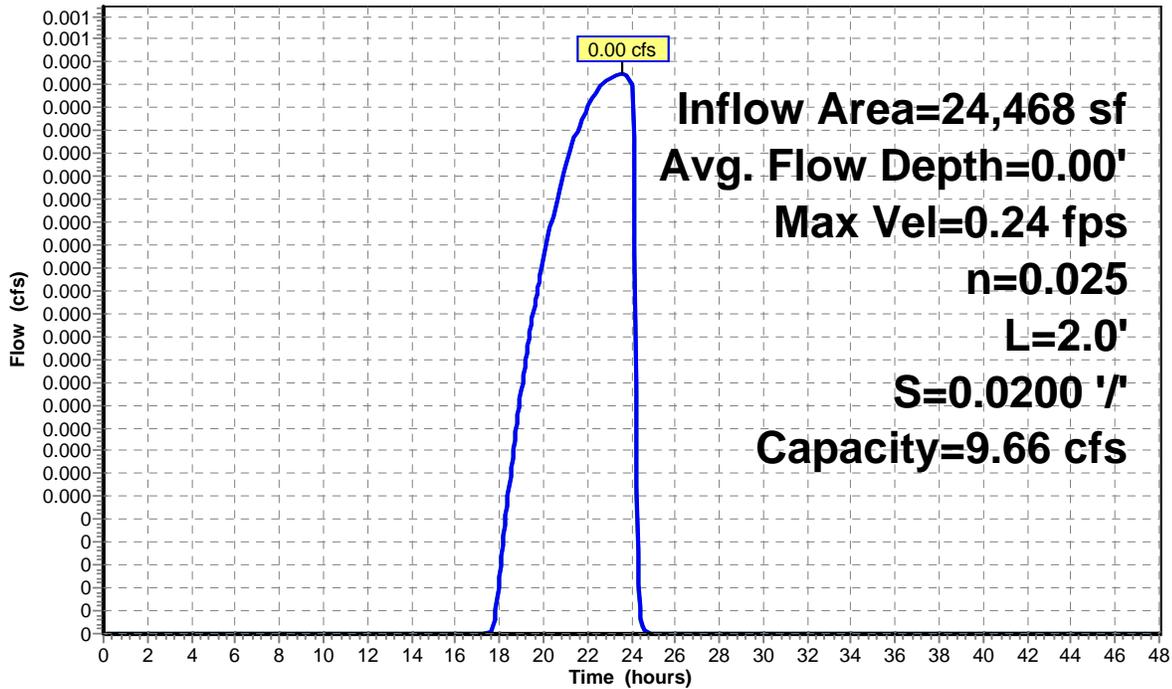
Peak Storage= 0 cf @ 23.55 hrs
 Average Depth at Peak Storage= 0.00'
 Bank-Full Depth= 0.50' Flow Area= 2.3 sf, Capacity= 9.66 cfs

3.00' x 0.50' deep channel, n= 0.025 Earth, clean & winding
 Side Slope Z-value= 3.0 '/' Top Width= 6.00'
 Length= 2.0' Slope= 0.0200 '/'
 Inlet Invert= 196.54', Outlet Invert= 196.50'



Reach 1R: Swale 1

Hydrograph



Summary for Reach 2R: Swale #2

Inflow Area = 7,775 sf, 12.42% Impervious, Inflow Depth = 0.34" for 2-Year event
 Inflow = 0.05 cfs @ 12.15 hrs, Volume= 223 cf
 Outflow = 0.05 cfs @ 12.15 hrs, Volume= 223 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Max. Velocity= 0.70 fps, Min. Travel Time= 0.0 min
 Avg. Velocity = 0.26 fps, Avg. Travel Time= 0.1 min

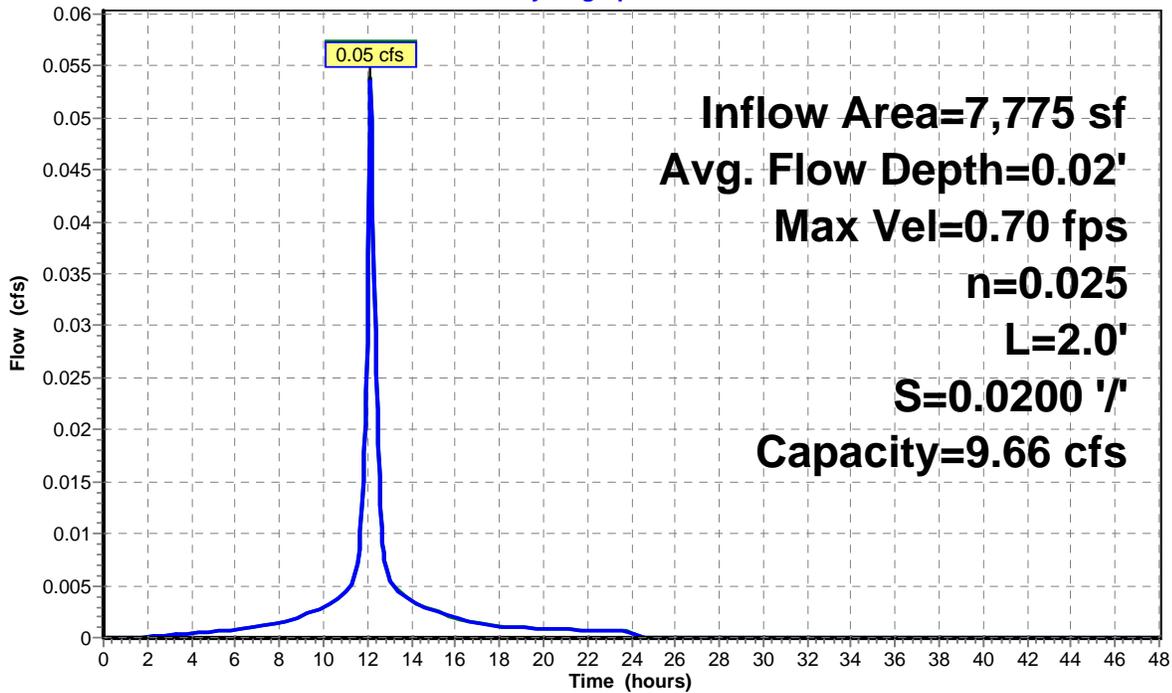
Peak Storage= 0 cf @ 12.15 hrs
 Average Depth at Peak Storage= 0.02'
 Bank-Full Depth= 0.50' Flow Area= 2.3 sf, Capacity= 9.66 cfs

3.00' x 0.50' deep channel, n= 0.025 Earth, clean & winding
 Side Slope Z-value= 3.0 '/' Top Width= 6.00'
 Length= 2.0' Slope= 0.0200 '/'
 Inlet Invert= 190.54', Outlet Invert= 190.50'



Reach 2R: Swale #2

Hydrograph



Summary for Reach 3R: Swale #3

Inflow Area = 15,577 sf, 0.00% Impervious, Inflow Depth = 1.19" for 2-Year event
 Inflow = 0.43 cfs @ 12.14 hrs, Volume= 1,543 cf
 Outflow = 0.41 cfs @ 12.17 hrs, Volume= 1,543 cf, Atten= 4%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Max. Velocity= 1.98 fps, Min. Travel Time= 1.1 min
 Avg. Velocity = 0.61 fps, Avg. Travel Time= 3.5 min

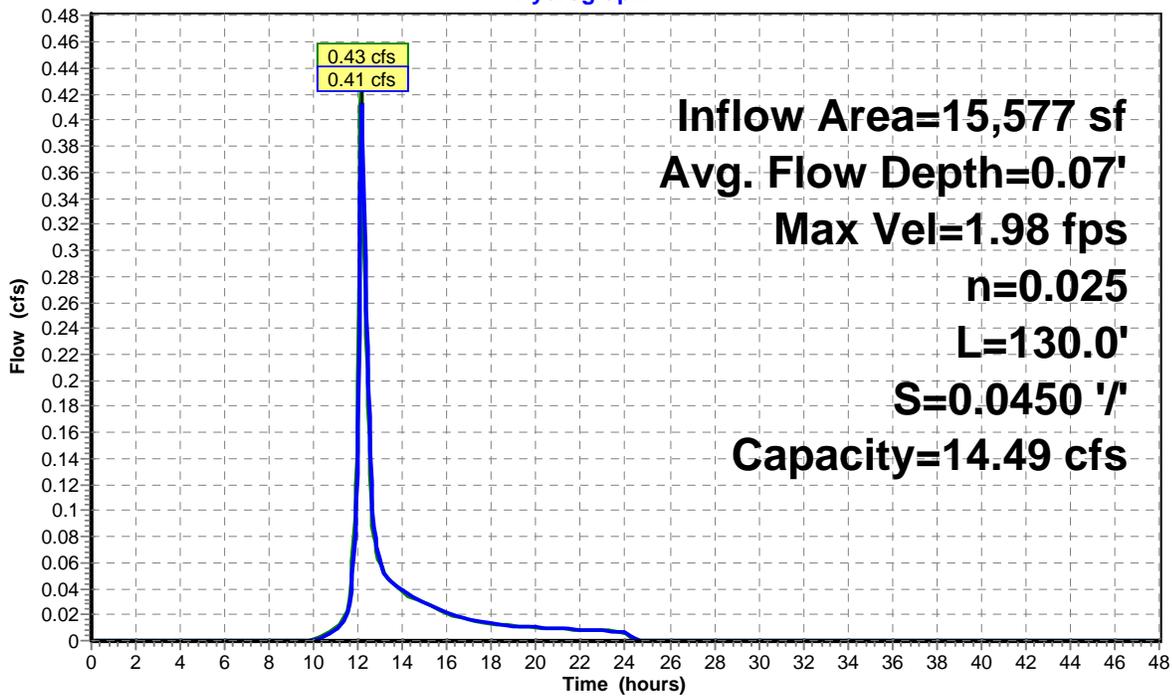
Peak Storage= 28 cf @ 12.15 hrs
 Average Depth at Peak Storage= 0.07'
 Bank-Full Depth= 0.50' Flow Area= 2.3 sf, Capacity= 14.49 cfs

3.00' x 0.50' deep channel, n= 0.025 Earth, clean & winding
 Side Slope Z-value= 3.0 '/' Top Width= 6.00'
 Length= 130.0' Slope= 0.0450 '/'
 Inlet Invert= 190.85', Outlet Invert= 185.00'



Reach 3R: Swale #3

Hydrograph



Inflow Area=15,577 sf
Avg. Flow Depth=0.07'
Max Vel=1.98 fps
n=0.025
L=130.0'
S=0.0450 '/'
Capacity=14.49 cfs

Summary for Pond 1P: Subsurface #1

Inflow Area = 79,064 sf, 69.61% Impervious, Inflow Depth = 1.93" for 2-Year event
 Inflow = 2.78 cfs @ 12.20 hrs, Volume= 12,697 cf
 Outflow = 0.31 cfs @ 11.50 hrs, Volume= 12,697 cf, Atten= 89%, Lag= 0.0 min
 Discarded = 0.31 cfs @ 11.50 hrs, Volume= 12,697 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 202.66' @ 13.15 hrs Surf.Area= 5,558 sf Storage= 4,633 cf
 Flood Elev= 204.90' Surf.Area= 5,558 sf Storage= 12,104 cf

Plug-Flow detention time= 109.2 min calculated for 12,684 cf (100% of inflow)
 Center-of-Mass det. time= 109.1 min (875.3 - 766.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	201.40'	4,900 cf	63.25'W x 87.88'L x 3.50'H Field A 19,454 cf Overall - 7,203 cf Embedded = 12,251 cf x 40.0% Voids
#2A	201.90'	7,203 cf	ADS_StormTech SC-740 x 156 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 13 rows
#3	206.40'	120 cf	Roadway Flooding (Irregular) Listed below (Recalc) -Impervious
		12,223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
206.40	2	4.0	0	0	2
206.60	138	76.0	10	10	460
206.80	1,108	1,939.0	109	120	299,190

Device	Routing	Invert	Outlet Devices
#1	Discarded	201.40'	2.410 in/hr Exfiltration over Surface area
#2	Primary	201.40'	12.0" Round Culvert L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 201.40' / 197.10' S= 0.0277 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	202.90'	4.0" Vert. Orifice/Grate C= 0.600
#4	Device 2	204.90'	4.0' long Overflow Weir 2 End Contraction(s)

Discarded OutFlow Max=0.31 cfs @ 11.50 hrs HW=201.46' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=201.40' (Free Discharge)
 ↑2=Culvert (Controls 0.00 cfs)
 ↑3=Orifice/Grate (Controls 0.00 cfs)
 ↑4=Overflow Weir (Controls 0.00 cfs)

Pond 1P: Subsurface #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 (ADS StormTech® SC-740)

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 6.45 sf x 13 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

12 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 85.88' Row Length +12.0" End Stone x 2 = 87.88' Base Length

13 Rows x 51.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 63.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

156 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 13 Rows = 7,203.4 cf Chamber Storage

19,454.1 cf Field - 7,203.4 cf Chambers = 12,250.7 cf Stone x 40.0% Voids = 4,900.3 cf Stone Storage

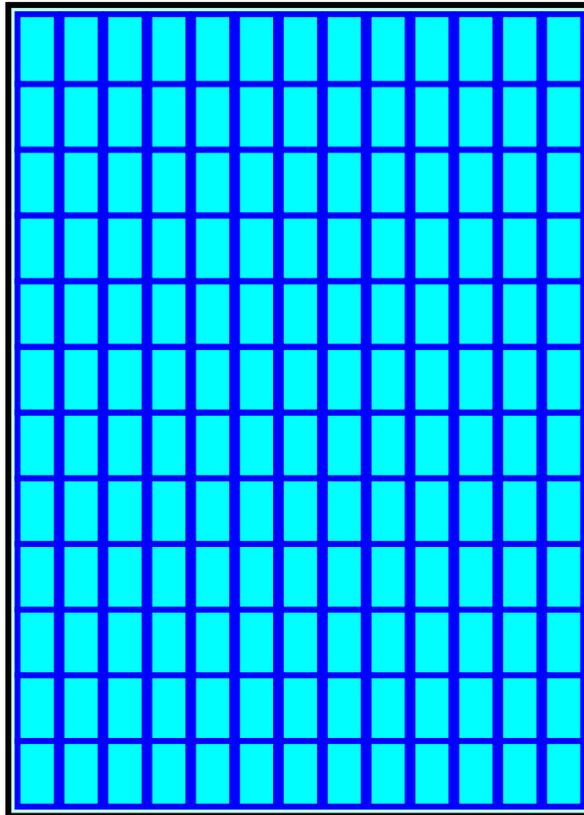
Chamber Storage + Stone Storage = 12,103.7 cf = 0.278 af

Overall Storage Efficiency = 62.2%

156 Chambers

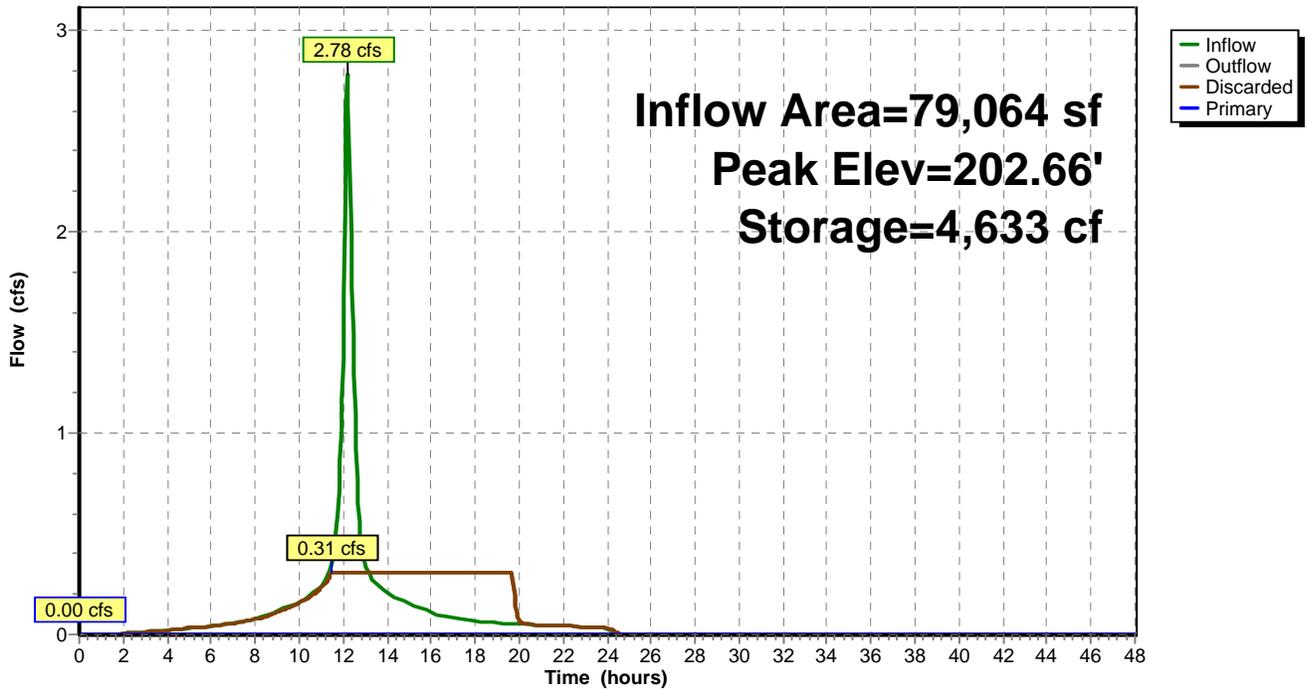
720.5 cy Field

453.7 cy Stone



Pond 1P: Subsurface #1

Hydrograph



Summary for Pond 2P: Subsurface #2

Inflow Area = 34,605 sf, 76.54% Impervious, Inflow Depth = 2.12" for 2-Year event
 Inflow = 1.46 cfs @ 12.16 hrs, Volume= 6,111 cf
 Outflow = 0.12 cfs @ 11.20 hrs, Volume= 6,111 cf, Atten= 92%, Lag= 0.0 min
 Discarded = 0.12 cfs @ 11.20 hrs, Volume= 6,111 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 198.21' @ 13.42 hrs Surf.Area= 2,209 sf Storage= 2,413 cf
 Flood Elev= 200.10' Surf.Area= 2,209 sf Storage= 4,757 cf

Plug-Flow detention time= 151.3 min calculated for 6,105 cf (100% of inflow)
 Center-of-Mass det. time= 151.1 min (914.4 - 763.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	196.60'	1,983 cf	30.00'W x 73.64'L x 3.50'H Field A 7,732 cf Overall - 2,773 cf Embedded = 4,959 cf x 40.0% Voids
#2A	197.10'	2,773 cf	ADS_StormTech SC-740 x 60 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 6 rows
#3	201.92'	84 cf	Roadway Flooding (Irregular) Listed below (Recalc) -Impervious
		4,841 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
201.92	2	4.0	0	0	2
202.00	37	38.0	1	1	116
202.20	1,009	242.0	83	84	4,661

Device	Routing	Invert	Outlet Devices
#1	Discarded	196.60'	2.410 in/hr Exfiltration over Surface area
#2	Primary	196.60'	12.0" Round Culvert L= 135.0' Ke= 0.500 Inlet / Outlet Invert= 196.60' / 187.51' S= 0.0673 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	198.35'	4.0" Vert. Orifice/Grate C= 0.600
#4	Device 2	200.10'	4.0' long Overflow Weir 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 11.20 hrs HW=196.66' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=196.60' (Free Discharge)
 ↑2=Culvert (Controls 0.00 cfs)
 ↑3=Orifice/Grate (Controls 0.00 cfs)
 ↑4=Overflow Weir (Controls 0.00 cfs)

Pond 2P: Subsurface #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 (ADS StormTech® SC-740)

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 6.45 sf x 6 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

10 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 71.64' Row Length +12.0" End Stone x 2 = 73.64' Base Length

6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

60 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 6 Rows = 2,773.4 cf Chamber Storage

7,732.0 cf Field - 2,773.4 cf Chambers = 4,958.7 cf Stone x 40.0% Voids = 1,983.5 cf Stone Storage

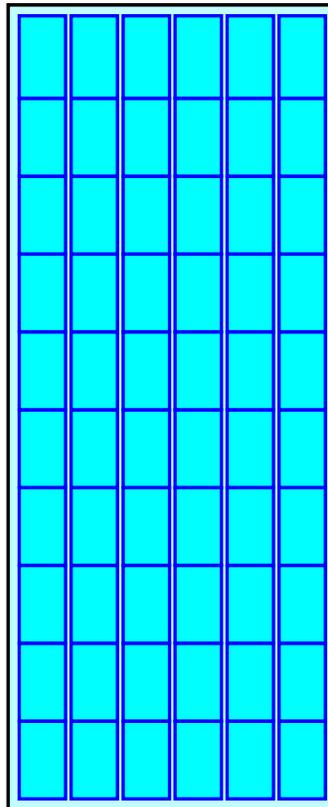
Chamber Storage + Stone Storage = 4,756.8 cf = 0.109 af

Overall Storage Efficiency = 61.5%

60 Chambers

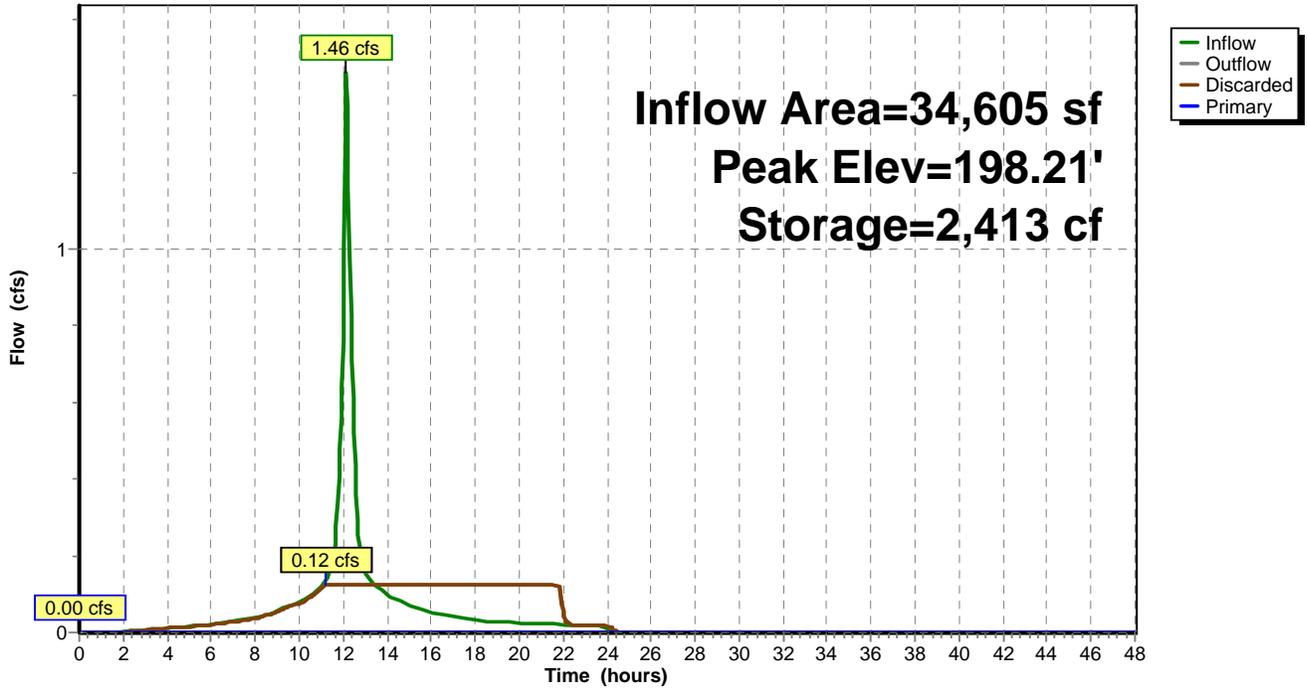
286.4 cy Field

183.7 cy Stone



Pond 2P: Subsurface #2

Hydrograph



Summary for Pond 3P: Infiltration Basin

Inflow Area = 176,891 sf, 48.19% Impervious, Inflow Depth = 0.21" for 2-Year event
 Inflow = 0.78 cfs @ 12.14 hrs, Volume= 3,113 cf
 Outflow = 0.06 cfs @ 14.84 hrs, Volume= 3,113 cf, Atten= 93%, Lag= 161.7 min
 Discarded = 0.06 cfs @ 14.84 hrs, Volume= 3,113 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 184.68' @ 14.84 hrs Surf.Area= 2,423 sf Storage= 1,434 cf
 Flood Elev= 186.50' Surf.Area= 4,720 sf Storage= 7,819 cf

Plug-Flow detention time= 268.5 min calculated for 3,110 cf (100% of inflow)
 Center-of-Mass det. time= 268.4 min (1,105.8 - 837.4)

Volume	Invert	Avail.Storage	Storage Description
#1	184.00'	10,362 cf	Basin Storage (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
184.00	1,832	199.3	0	0	1,832
185.00	2,736	234.3	2,269	2,269	3,059
186.00	4,034	311.9	3,364	5,633	6,443
187.00	5,460	373.5	4,729	10,362	9,820

Device	Routing	Invert	Outlet Devices
#1	Discarded	184.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	183.00'	12.0" Round Culvert L= 24.0' Ke= 0.500 Inlet / Outlet Invert= 183.00' / 182.04' S= 0.0400 1/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	185.00'	7.0" Vert. Orifice C= 0.600
#4	Device 2	186.25'	4.0" x 4.0" Horiz. Outlet Structure Grate C= 0.600 Limited to weir flow at low heads
#5	Secondary	186.50'	10.0' long x 10.0' breadth Emergency Overflow Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

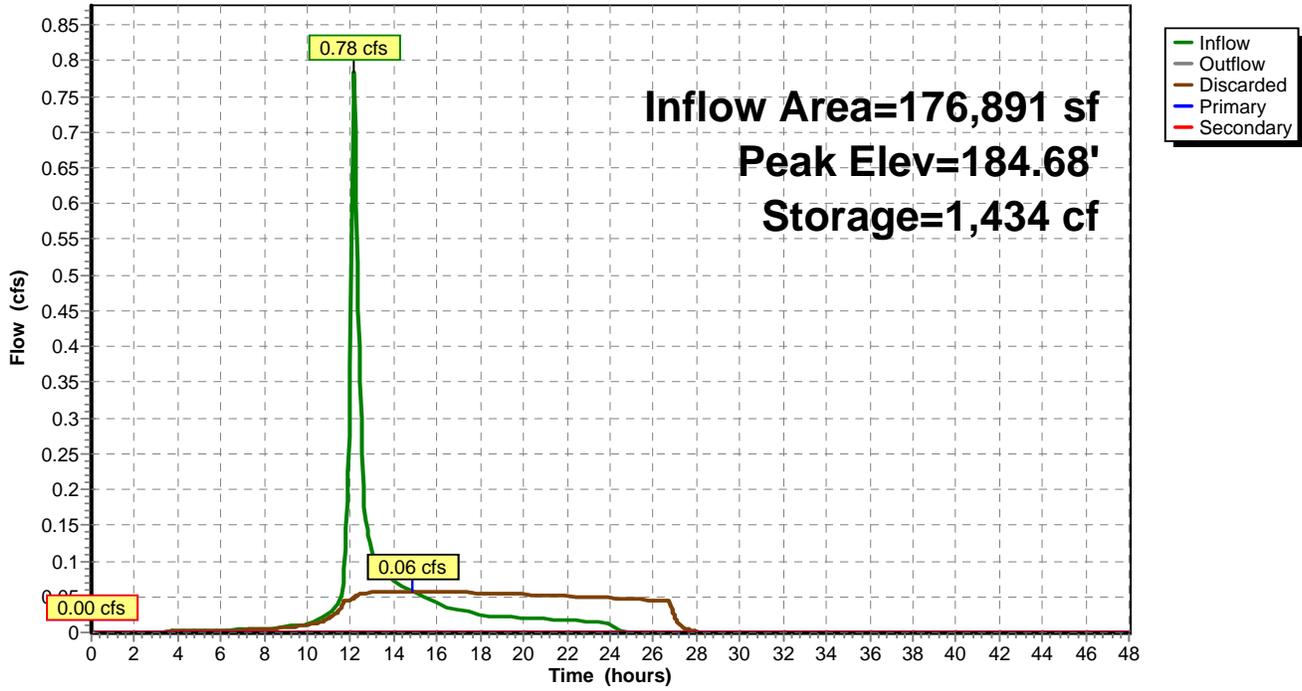
Discarded OutFlow Max=0.06 cfs @ 14.84 hrs HW=184.68' (Free Discharge)
 ↳1=**Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=184.00' (Free Discharge)
 ↳2=**Culvert** (Passes 0.00 cfs of 2.67 cfs potential flow)
 ↳3=**Orifice** (Controls 0.00 cfs)
 ↳4=**Outlet Structure Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=184.00' (Free Discharge)
 ↳5=**Emergency Overflow** (Controls 0.00 cfs)

Pond 3P: Infiltration Basin

Hydrograph



Summary for Pond 4P: PYD-1

Inflow Area = 24,468 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
 Inflow = 0.00 cfs @ 23.56 hrs, Volume= 8 cf
 Outflow = 0.00 cfs @ 23.56 hrs, Volume= 8 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.00 cfs @ 23.56 hrs, Volume= 8 cf

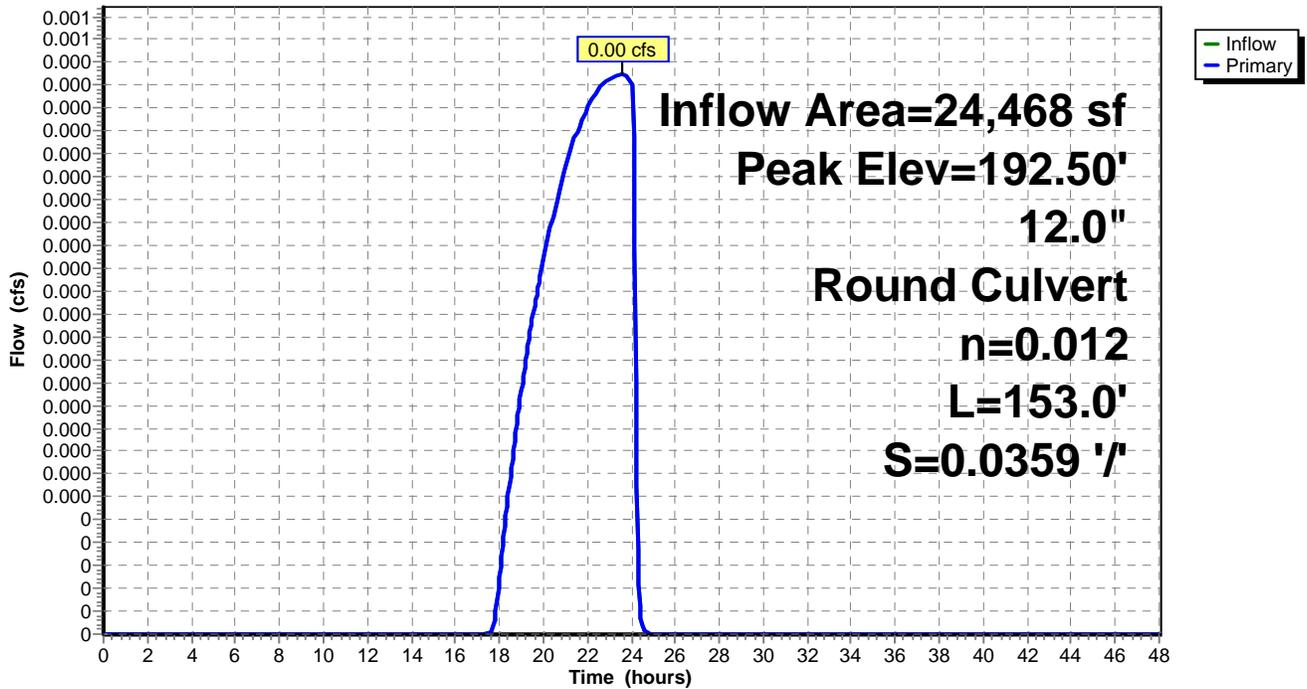
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 192.50' @ 23.56 hrs
 Flood Elev= 196.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	192.50'	12.0" Round Culvert L= 153.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 187.00' S= 0.0359 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 23.56 hrs HW=192.50' (Free Discharge)
 1=Culvert (Inlet Controls 0.00 cfs @ 0.18 fps)

Pond 4P: PYD-1

Hydrograph



Summary for Pond 5P: PYD-2

Inflow Area = 32,243 sf, 3.00% Impervious, Inflow Depth = 0.09" for 2-Year event
 Inflow = 0.05 cfs @ 12.15 hrs, Volume= 231 cf
 Outflow = 0.05 cfs @ 12.15 hrs, Volume= 231 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.05 cfs @ 12.15 hrs, Volume= 231 cf

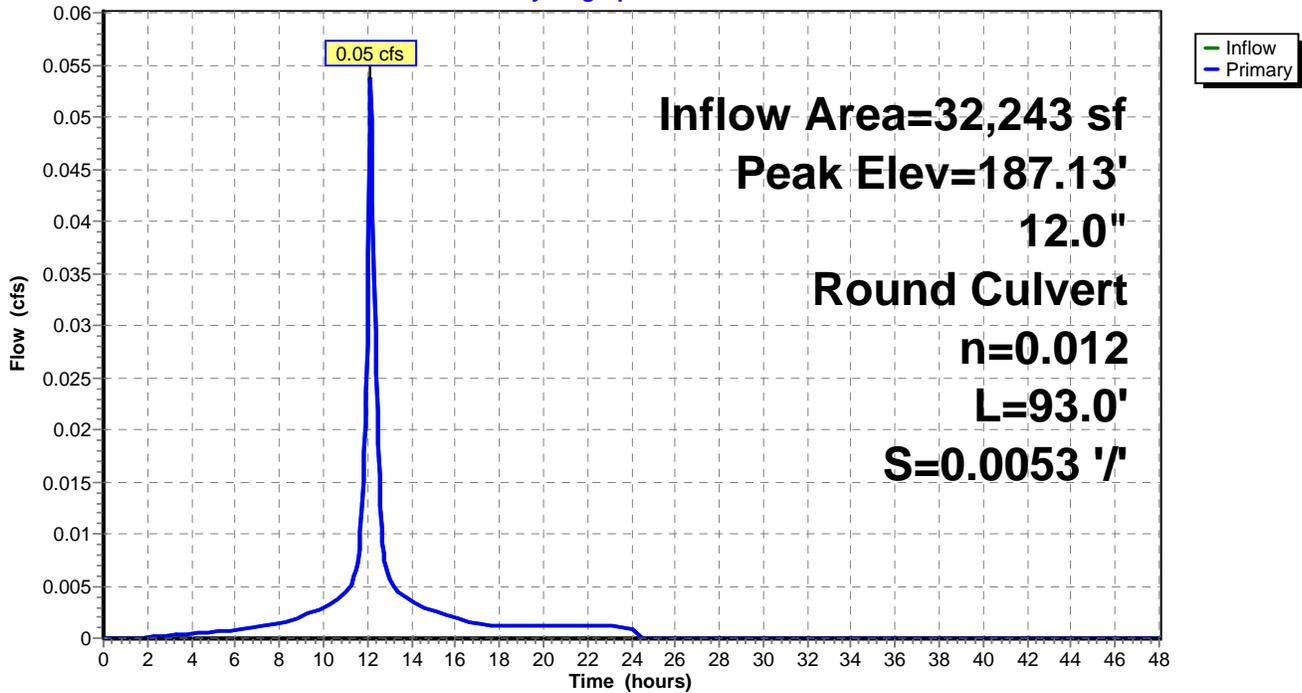
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 187.13' @ 12.15 hrs
 Flood Elev= 190.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	12.0" Round Culvert L= 93.0' Ke= 0.500 Inlet / Outlet Invert= 187.00' / 186.51' S= 0.0053 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.05 cfs @ 12.15 hrs HW=187.13' (Free Discharge)
 1=Culvert (Barrel Controls 0.05 cfs @ 1.37 fps)

Pond 5P: PYD-2

Hydrograph



Summary for Pond 6P: PDMH-11

Inflow Area = 33,209 sf, 5.82% Impervious, Inflow Depth = 0.16" for 2-Year event
 Inflow = 0.11 cfs @ 12.11 hrs, Volume= 454 cf
 Outflow = 0.11 cfs @ 12.11 hrs, Volume= 454 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.11 cfs @ 12.11 hrs, Volume= 454 cf

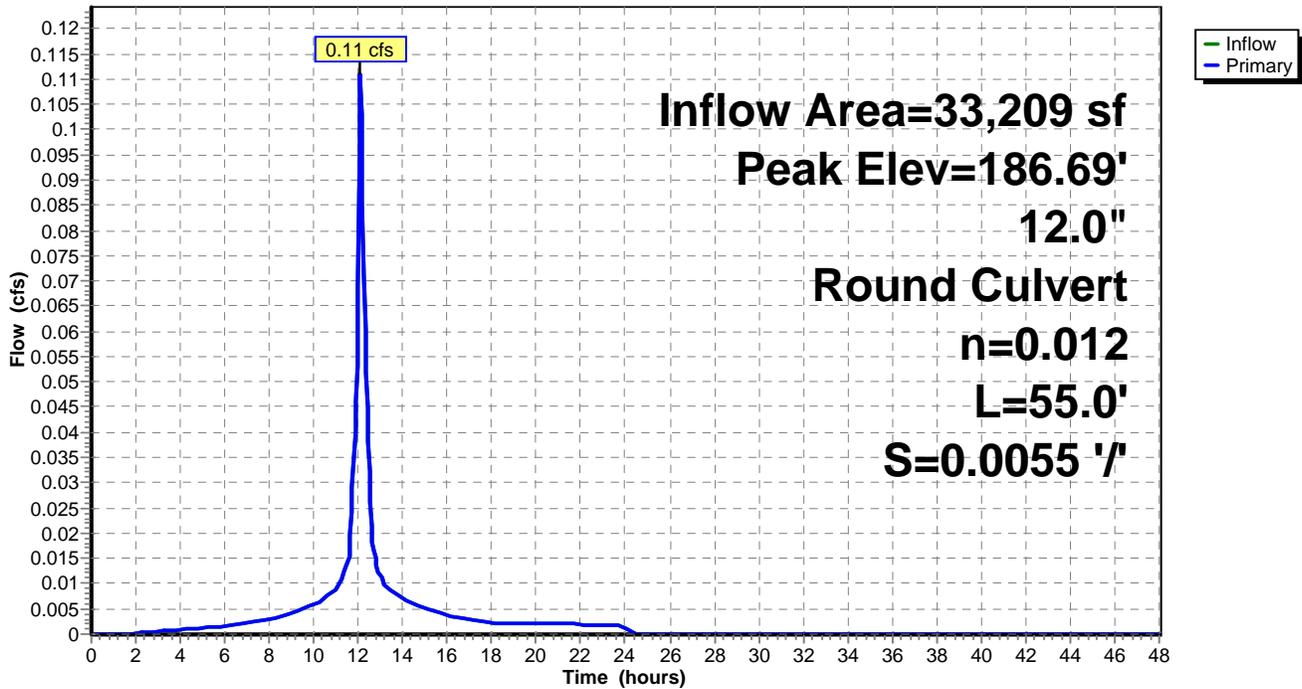
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 186.69' @ 12.11 hrs
 Flood Elev= 191.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	186.51'	12.0" Round Culvert L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 186.51' / 186.21' S= 0.0055 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.11 cfs @ 12.11 hrs HW=186.69' (Free Discharge)
 1=Culvert (Barrel Controls 0.11 cfs @ 1.69 fps)

Pond 6P: PDMH-11

Hydrograph



Summary for Pond 7P: PDMH-12

Inflow Area = 33,209 sf, 5.82% Impervious, Inflow Depth = 0.16" for 2-Year event
 Inflow = 0.11 cfs @ 12.11 hrs, Volume= 454 cf
 Outflow = 0.11 cfs @ 12.11 hrs, Volume= 454 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.11 cfs @ 12.11 hrs, Volume= 454 cf

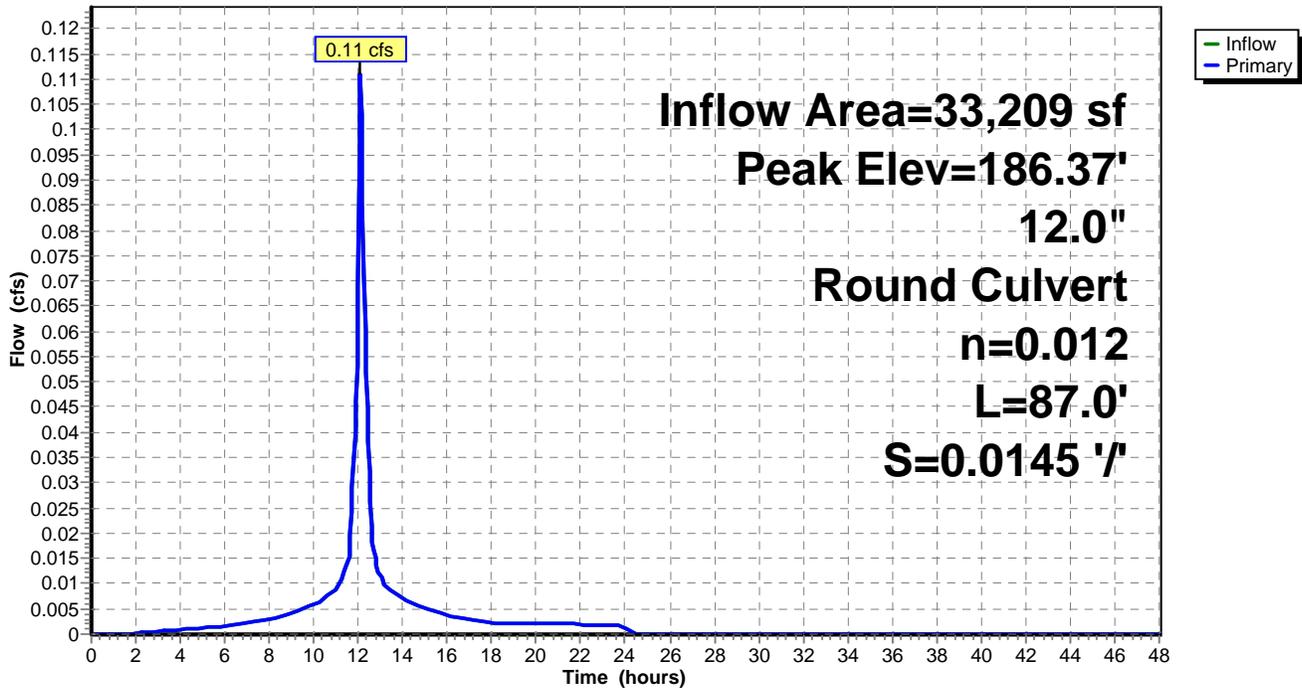
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 186.37' @ 12.11 hrs
 Flood Elev= 190.15'

Device	Routing	Invert	Outlet Devices
#1	Primary	186.21'	12.0" Round Culvert L= 87.0' Ke= 0.500 Inlet / Outlet Invert= 186.21' / 184.95' S= 0.0145 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.11 cfs @ 12.11 hrs HW=186.37' (Free Discharge)
 1=Culvert (Inlet Controls 0.11 cfs @ 1.36 fps)

Pond 7P: PDMH-12

Hydrograph



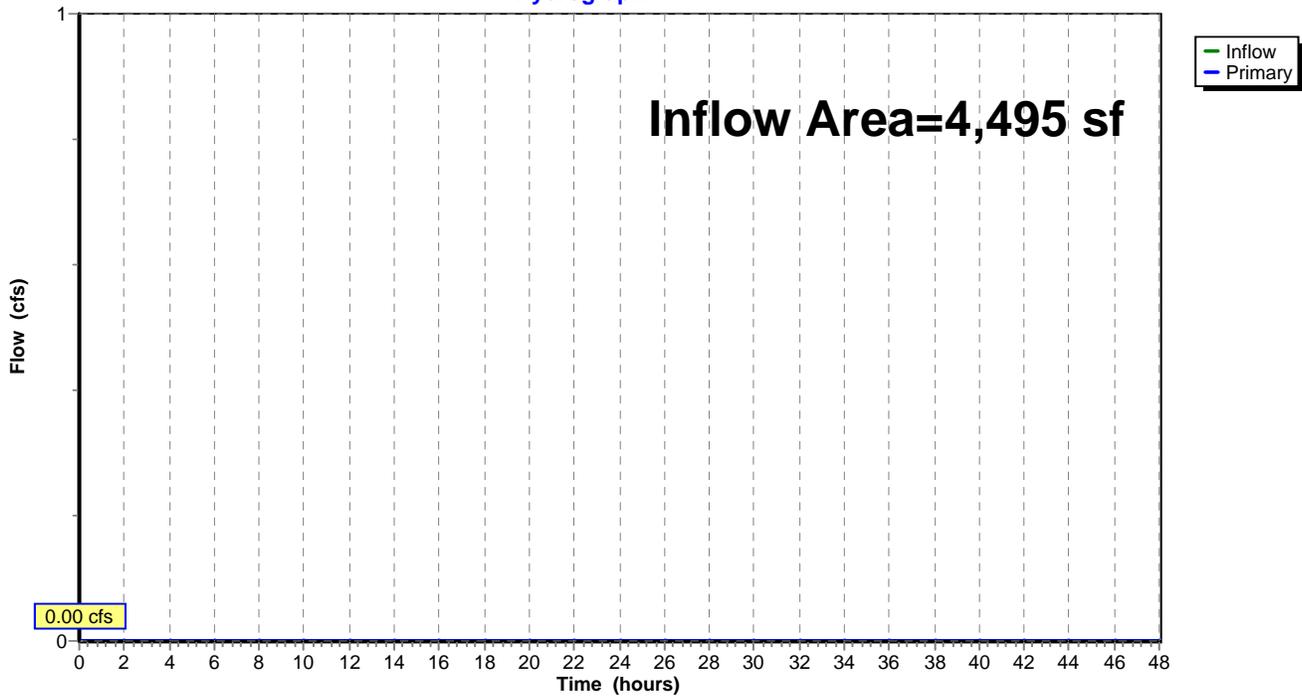
Summary for Link DP-1: Offsite to North/West

Inflow Area = 4,495 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

Hydrograph



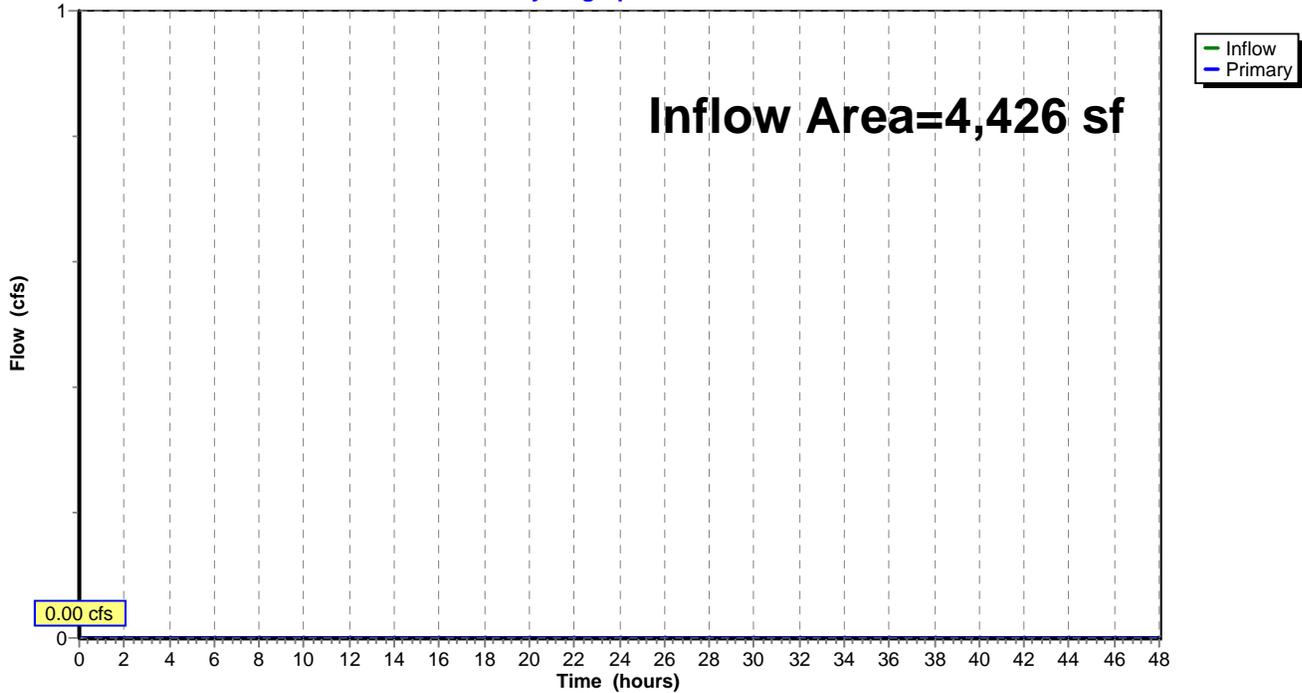
Summary for Link DP-2: Offsite to West

Inflow Area = 4,426 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

Hydrograph



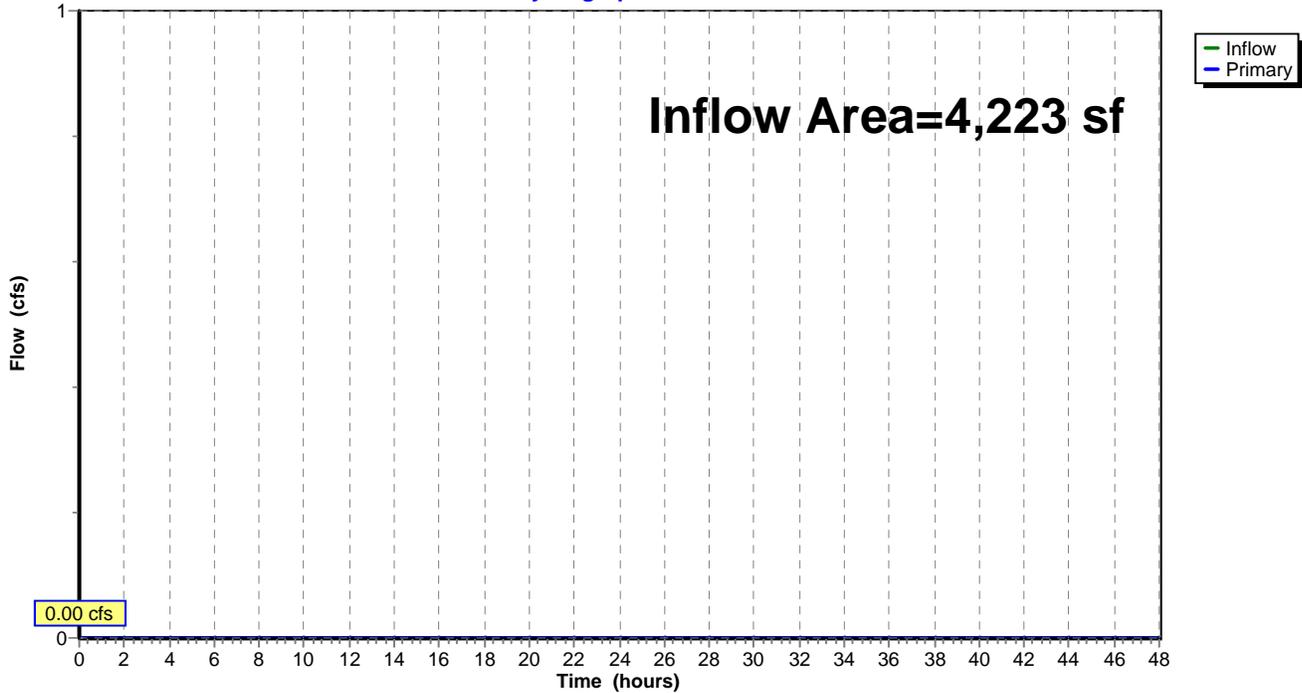
Summary for Link DP-3: Offsite to Northeast

Inflow Area = 4,223 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

Hydrograph



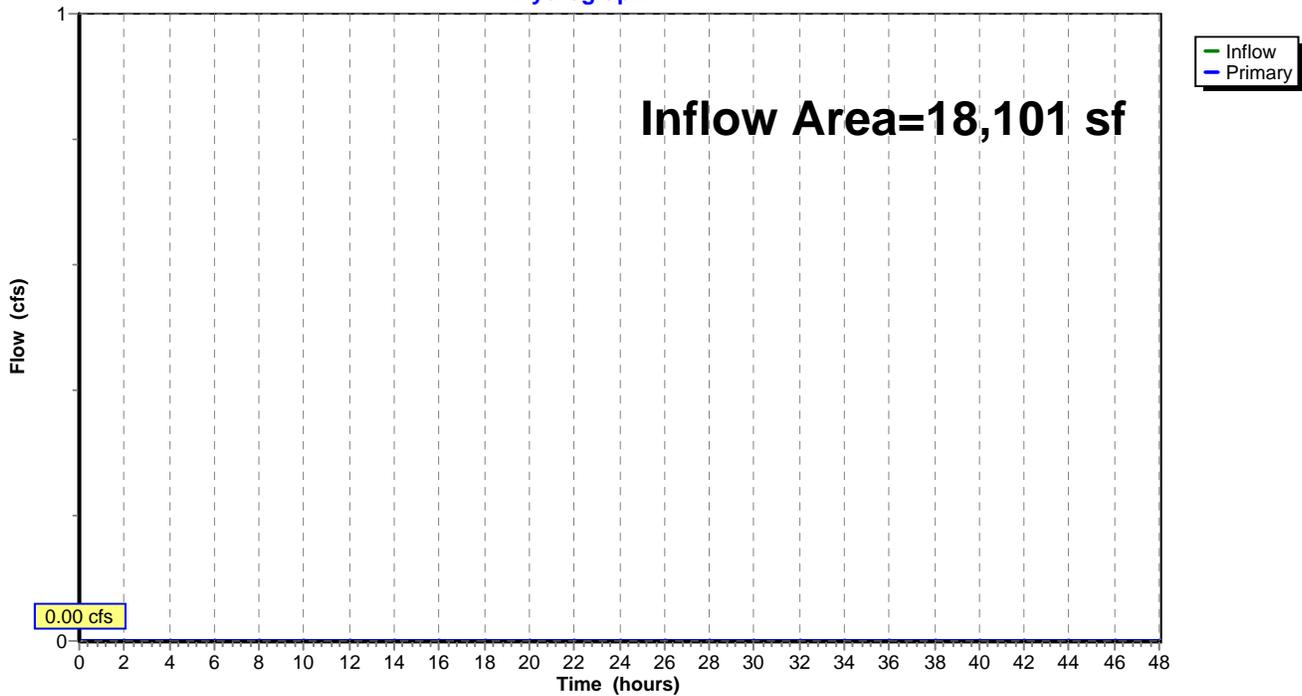
Summary for Link DP-4: East Edge of Property

Inflow Area = 18,101 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

Hydrograph



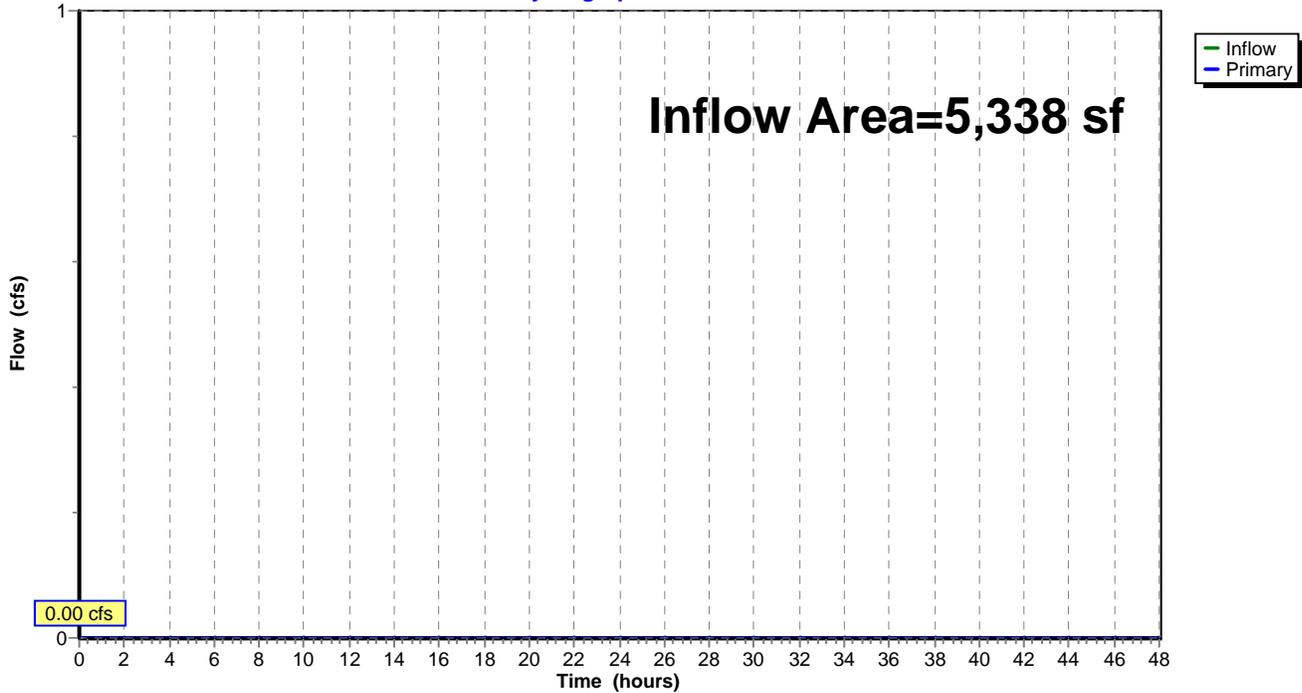
Summary for Link DP-5: Southwest Corner

Inflow Area = 5,338 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

Hydrograph



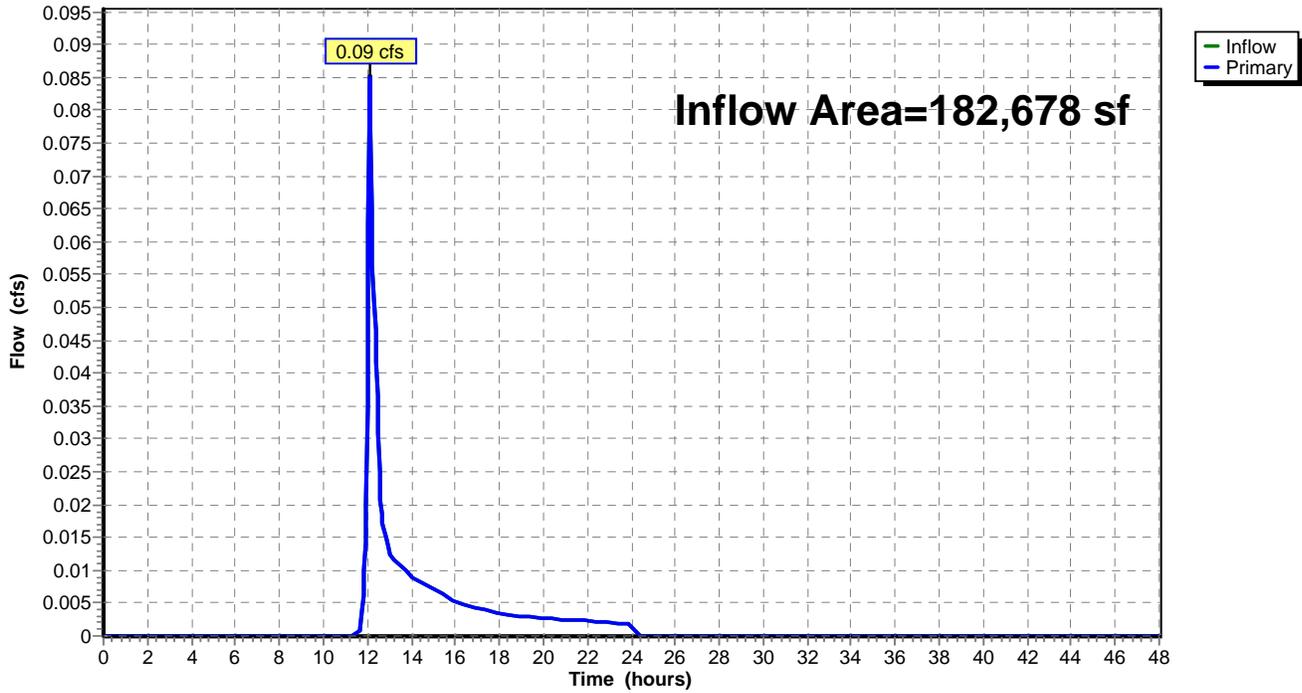
Summary for Link DP-6: South Corner

Inflow Area = 182,678 sf, 46.66% Impervious, Inflow Depth = 0.02" for 2-Year event
Inflow = 0.09 cfs @ 12.12 hrs, Volume= 323 cf
Primary = 0.09 cfs @ 12.12 hrs, Volume= 323 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner

Hydrograph



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
 Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS-1: To Northwest	Runoff Area=4,495 sf 0.00% Impervious Runoff Depth=0.11" Flow Length=80' Slope=0.0100 '/' Tc=11.5 min CN=39/0 Runoff=0.00 cfs 41 cf
Subcatchment PS-2: To West	Runoff Area=4,426 sf 0.00% Impervious Runoff Depth=0.11" Flow Length=129' Tc=12.6 min CN=39/0 Runoff=0.00 cfs 41 cf
Subcatchment PS-3: To Northeast	Runoff Area=4,223 sf 0.00% Impervious Runoff Depth=0.03" Flow Length=66' Slope=0.0100 '/' Tc=11.4 min CN=35/0 Runoff=0.00 cfs 11 cf
Subcatchment PS-4: To East	Runoff Area=18,101 sf 0.00% Impervious Runoff Depth=0.07" Flow Length=72' Tc=13.0 min CN=37/0 Runoff=0.00 cfs 100 cf
Subcatchment PS-5: To Southwest	Runoff Area=5,338 sf 0.00% Impervious Runoff Depth=0.02" Flow Length=74' Tc=9.6 min CN=34/0 Runoff=0.00 cfs 8 cf
Subcatchment PS-6A: To Subsurface #1	Runoff Area=79,064 sf 69.61% Impervious Runoff Depth=3.00" Flow Length=804' Tc=15.1 min CN=39/98 Runoff=4.21 cfs 19,779 cf
Subcatchment PS-6B: To Subsurface #2	Runoff Area=34,605 sf 76.54% Impervious Runoff Depth=3.30" Flow Length=345' Tc=11.8 min CN=41/98 Runoff=2.21 cfs 9,523 cf
Subcatchment PS-6C1: To PYD-1	Runoff Area=24,468 sf 0.00% Impervious Runoff Depth=0.19" Flow Length=371' Tc=13.1 min CN=42/0 Runoff=0.02 cfs 396 cf
Subcatchment PS-6C2: To PYD-2	Runoff Area=7,775 sf 12.42% Impervious Runoff Depth=0.55" Flow Length=237' Tc=11.4 min CN=34/98 Runoff=0.08 cfs 354 cf
Subcatchment PS-6C3: To PDMH-11	Runoff Area=966 sf 100.00% Impervious Runoff Depth=4.26" Tc=6.0 min CN=0/98 Runoff=0.10 cfs 343 cf
Subcatchment PS-6C4: To Swale	Runoff Area=15,577 sf 0.00% Impervious Runoff Depth=2.38" Flow Length=311' Tc=9.1 min CN=79/0 Runoff=0.88 cfs 3,085 cf
Subcatchment PS-6C5: To Infiltration Basin	Runoff Area=14,436 sf 12.32% Impervious Runoff Depth=1.93" Flow Length=127' Tc=7.1 min CN=69/98 Runoff=0.67 cfs 2,322 cf
Subcatchment PS-6D: To South	Runoff Area=5,787 sf 0.00% Impervious Runoff Depth=1.60" Flow Length=137' Tc=6.7 min CN=69/0 Runoff=0.23 cfs 773 cf
Reach 1R: Swale 1	Avg. Flow Depth=0.01' Max Vel=0.49 fps Inflow=0.02 cfs 396 cf n=0.025 L=2.0' S=0.0200 '/' Capacity=9.66 cfs Outflow=0.02 cfs 396 cf
Reach 2R: Swale #2	Avg. Flow Depth=0.03' Max Vel=0.83 fps Inflow=0.08 cfs 354 cf n=0.025 L=2.0' S=0.0200 '/' Capacity=9.66 cfs Outflow=0.08 cfs 354 cf
Reach 3R: Swale #3	Avg. Flow Depth=0.10' Max Vel=2.57 fps Inflow=0.88 cfs 3,085 cf n=0.025 L=130.0' S=0.0450 '/' Capacity=14.49 cfs Outflow=0.85 cfs 3,085 cf
Pond 1P: Subsurface #1	Peak Elev=203.38' Storage=7,668 cf Inflow=4.21 cfs 19,779 cf Discarded=0.31 cfs 17,893 cf Primary=0.23 cfs 1,886 cf Outflow=0.54 cfs 19,779 cf
Pond 2P: Subsurface #2	Peak Elev=198.99' Storage=3,619 cf Inflow=2.21 cfs 9,523 cf Discarded=0.12 cfs 7,879 cf Primary=0.29 cfs 1,644 cf Outflow=0.41 cfs 9,523 cf

Pond 3P: Infiltration Basin Peak Elev=185.46' Storage=3,650 cf Inflow=1.63 cfs 10,031 cf
Discarded=0.08 cfs 5,292 cf Primary=0.52 cfs 4,739 cf Secondary=0.00 cfs 0 cf Outflow=0.60 cfs 10,031 cf

Pond 4P: PYD-1 Peak Elev=192.57' Inflow=0.02 cfs 396 cf
12.0" Round Culvert n=0.012 L=153.0' S=0.0359 '/' Outflow=0.02 cfs 396 cf

Pond 5P: PYD-2 Peak Elev=187.16' Inflow=0.08 cfs 750 cf
12.0" Round Culvert n=0.012 L=93.0' S=0.0053 '/' Outflow=0.08 cfs 750 cf

Pond 6P: PDMH-11 Peak Elev=186.73' Inflow=0.17 cfs 1,094 cf
12.0" Round Culvert n=0.012 L=55.0' S=0.0055 '/' Outflow=0.17 cfs 1,094 cf

Pond 7P: PDMH-12 Peak Elev=186.41' Inflow=0.17 cfs 1,094 cf
12.0" Round Culvert n=0.012 L=87.0' S=0.0145 '/' Outflow=0.17 cfs 1,094 cf

Link DP-1: Offsite to North/West Inflow=0.00 cfs 41 cf
Primary=0.00 cfs 41 cf

Link DP-2: Offsite to West Inflow=0.00 cfs 41 cf
Primary=0.00 cfs 41 cf

Link DP-3: Offsite to Northeast Inflow=0.00 cfs 11 cf
Primary=0.00 cfs 11 cf

Link DP-4: East Edge of Property Inflow=0.00 cfs 100 cf
Primary=0.00 cfs 100 cf

Link DP-5: Southwest Corner Inflow=0.00 cfs 8 cf
Primary=0.00 cfs 8 cf

Link DP-6: South Corner Inflow=0.54 cfs 5,512 cf
Primary=0.54 cfs 5,512 cf

Total Runoff Area = 219,261 sf Runoff Volume = 36,777 cf Average Runoff Depth = 2.01"
61.12% Pervious = 134,023 sf 38.88% Impervious = 85,238 sf

Summary for Subcatchment PS-2: To West

Runoff = 0.00 cfs @ 14.81 hrs, Volume= 41 cf, Depth= 0.11"

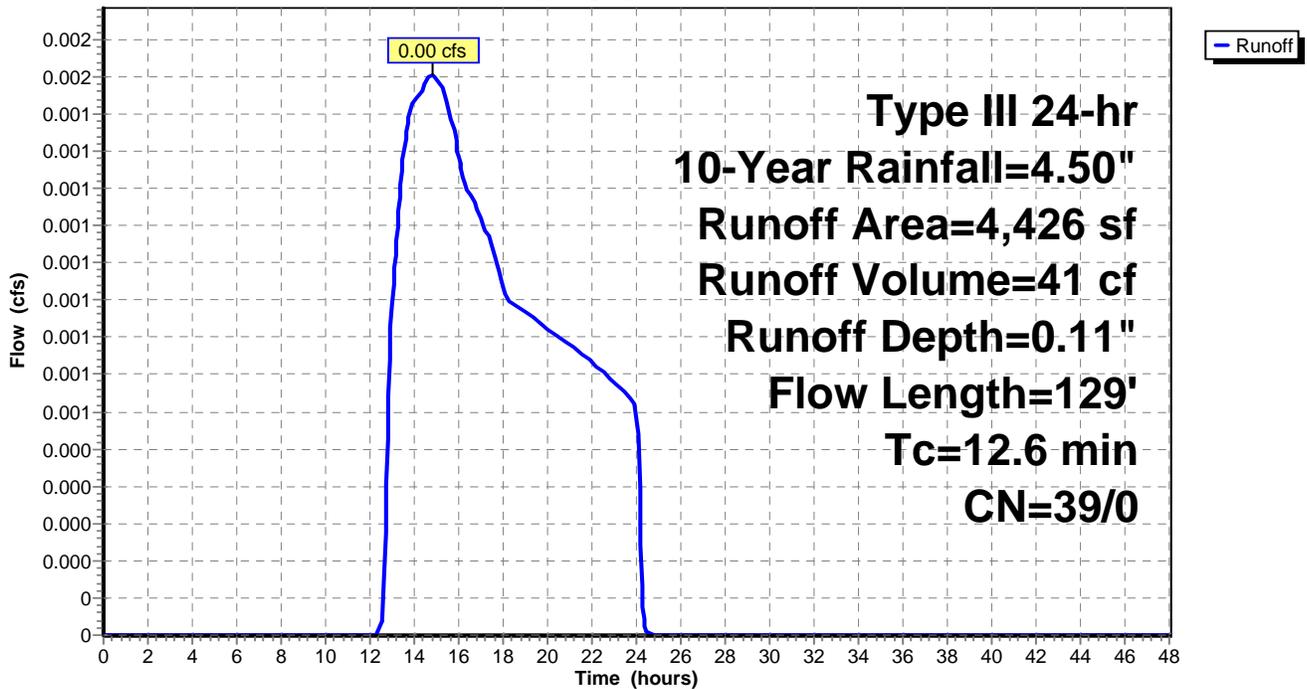
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
4,426	39	>75% Grass cover, Good, HSG A
4,426	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0080	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.4	79	0.0400	3.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
12.6	129	Total			

Subcatchment PS-2: To West

Hydrograph



Summary for Subcatchment PS-4: To East

Runoff = 0.00 cfs @ 15.39 hrs, Volume= 100 cf, Depth= 0.07"

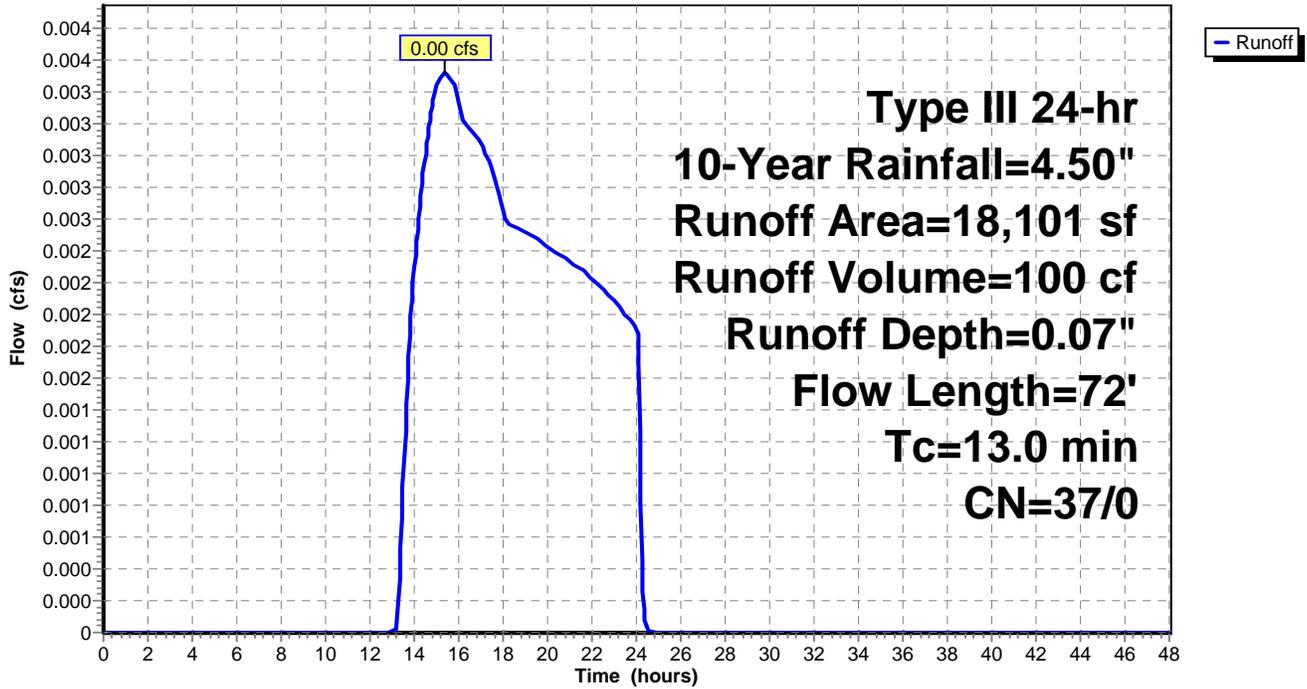
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
14,935	39	>75% Grass cover, Good, HSG A
3,166	30	Woods, Good, HSG A
18,101	37	Weighted Average
18,101	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0070	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.1	22	0.1800	6.83		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.0	72	Total			

Subcatchment PS-4: To East

Hydrograph



Summary for Subcatchment PS-6A: To Subsurface #1

Runoff = 4.21 cfs @ 12.20 hrs, Volume= 19,779 cf, Depth= 3.00"

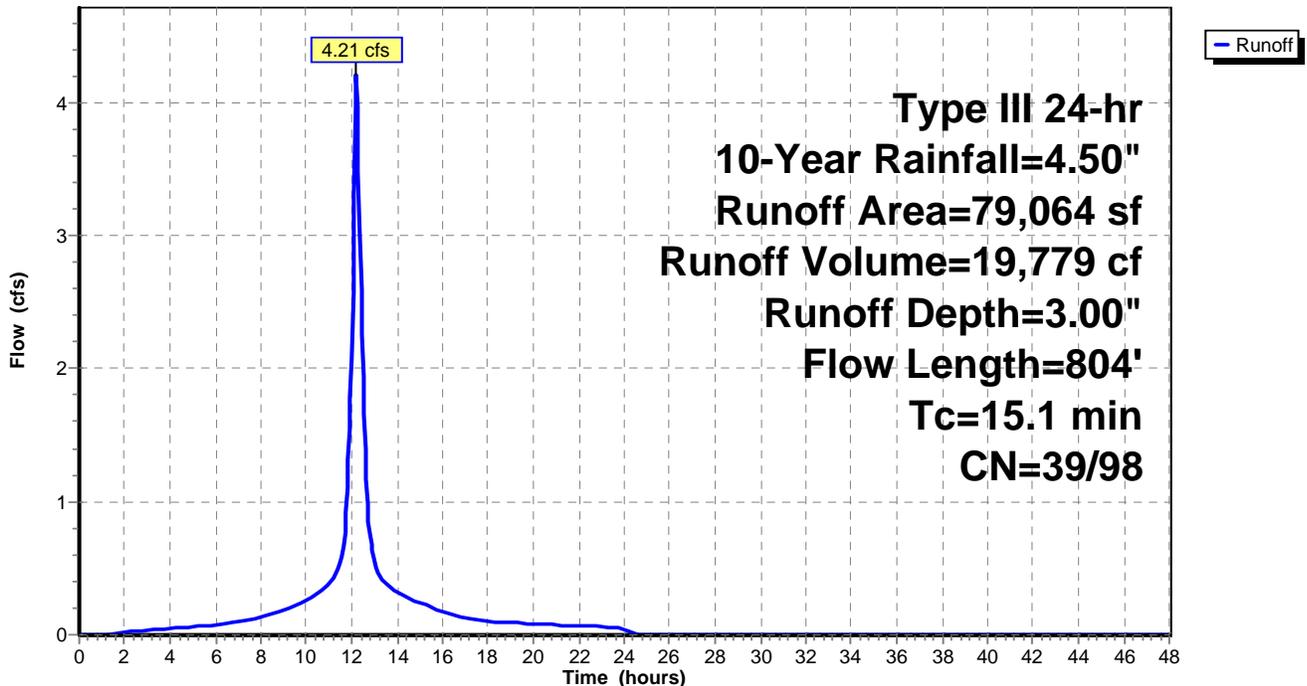
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
34,605	98	Paved parking, HSG A
20,435	98	Roofs, HSG A
24,024	39	>75% Grass cover, Good, HSG A
79,064	80	Weighted Average
24,024	39	30.39% Pervious Area
55,040	98	69.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0090	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
1.4	124	0.0050	1.44		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.1	392	0.0150	6.02	4.73	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.9	238	0.0050	4.55	8.05	Pipe Channel, 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
15.1	804	Total			

Subcatchment PS-6A: To Subsurface #1

Hydrograph



Summary for Subcatchment PS-6B: To Subsurface #2

Runoff = 2.21 cfs @ 12.16 hrs, Volume= 9,523 cf, Depth= 3.30"

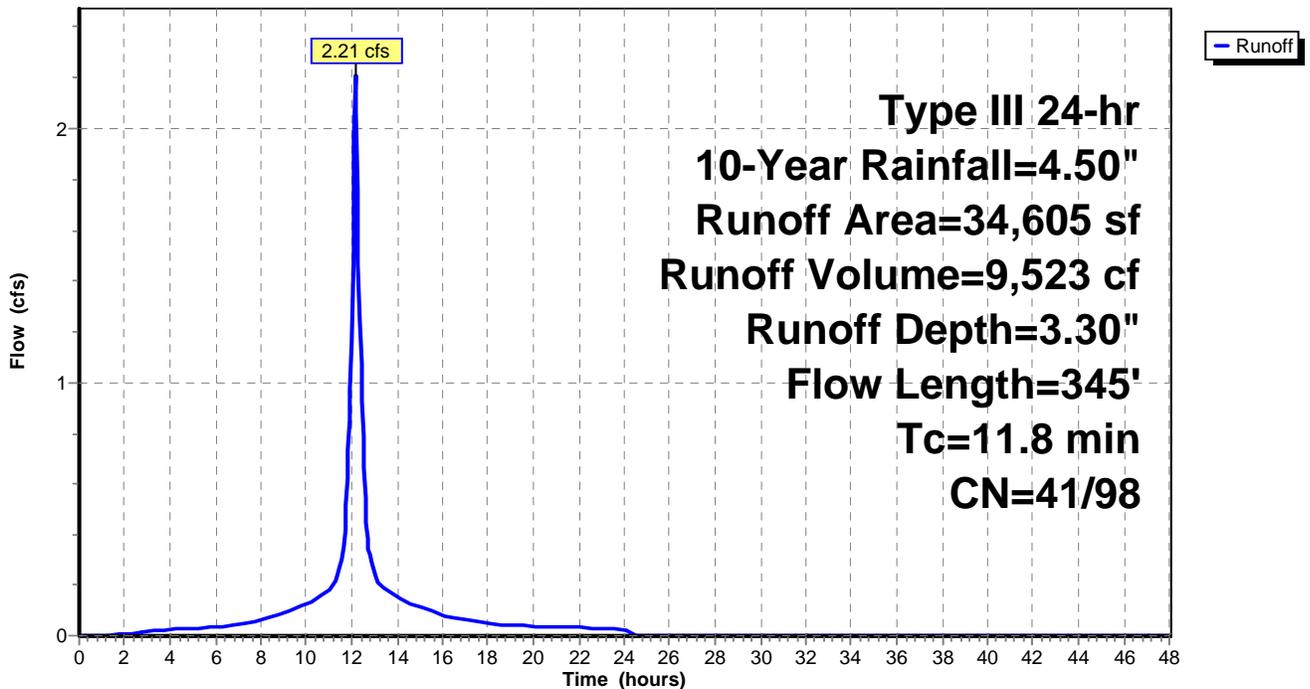
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
16,507	98	Paved parking, HSG A
6,553	98	Roofs, HSG A
7,595	39	>75% Grass cover, Good, HSG A
514	98	Paved parking, HSG C
2,914	98	Roofs, HSG C
522	74	>75% Grass cover, Good, HSG C
34,605	85	Weighted Average
8,117	41	23.46% Pervious Area
26,488	98	76.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	35	0.0080	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.0150	2.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	96	0.0420	4.16		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	162	0.0050	1.44		Shallow Concentrated Flow, Paved Kv= 20.3 fps
11.8	345	Total			

Subcatchment PS-6B: To Subsurface #2

Hydrograph



Summary for Subcatchment PS-6C1: To PYD-1

Runoff = 0.02 cfs @ 12.57 hrs, Volume= 396 cf, Depth= 0.19"

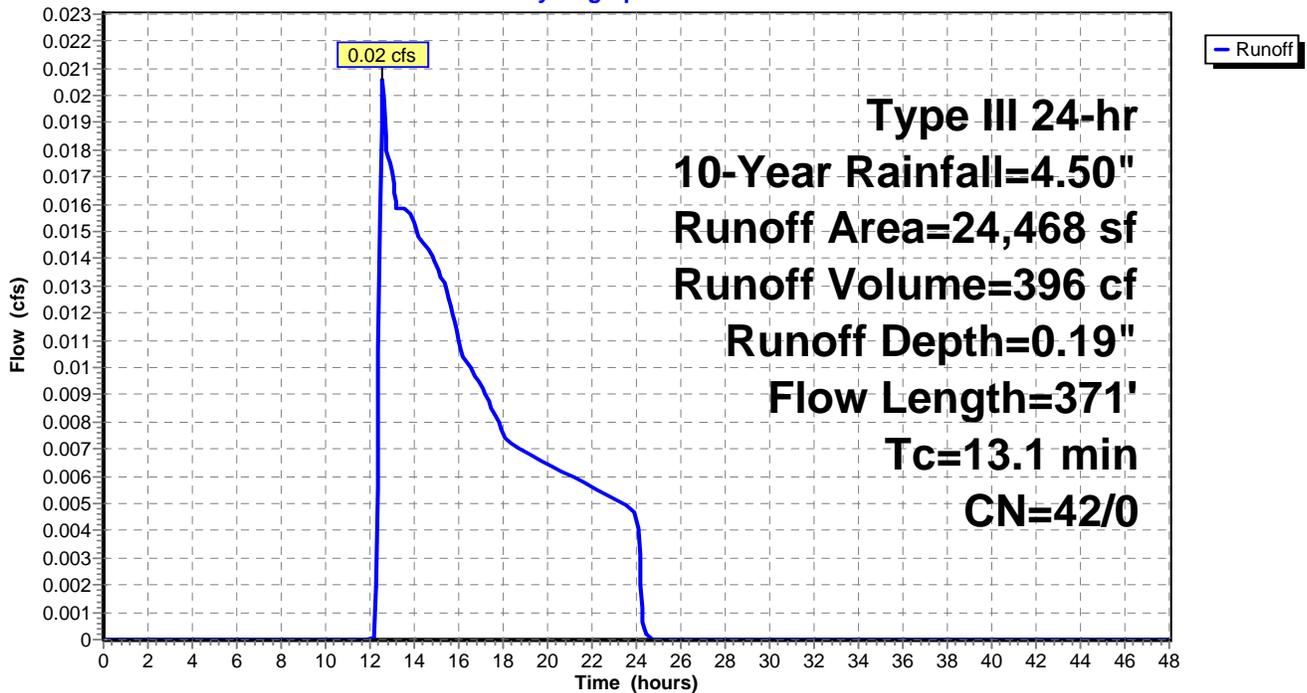
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,900	98	Unconnected roofs, HSG A
11,187	39	>75% Grass cover, Good, HSG A
10,381	30	Woods, Good, HSG A
24,468	42	Weighted Average
24,468	42	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0110	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
2.3	321	0.0210	2.33		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.1	371	Total			

Subcatchment PS-6C1: To PYD-1

Hydrograph



Summary for Subcatchment PS-6C2: To PYD-2

Runoff = 0.08 cfs @ 12.15 hrs, Volume= 354 cf, Depth= 0.55"

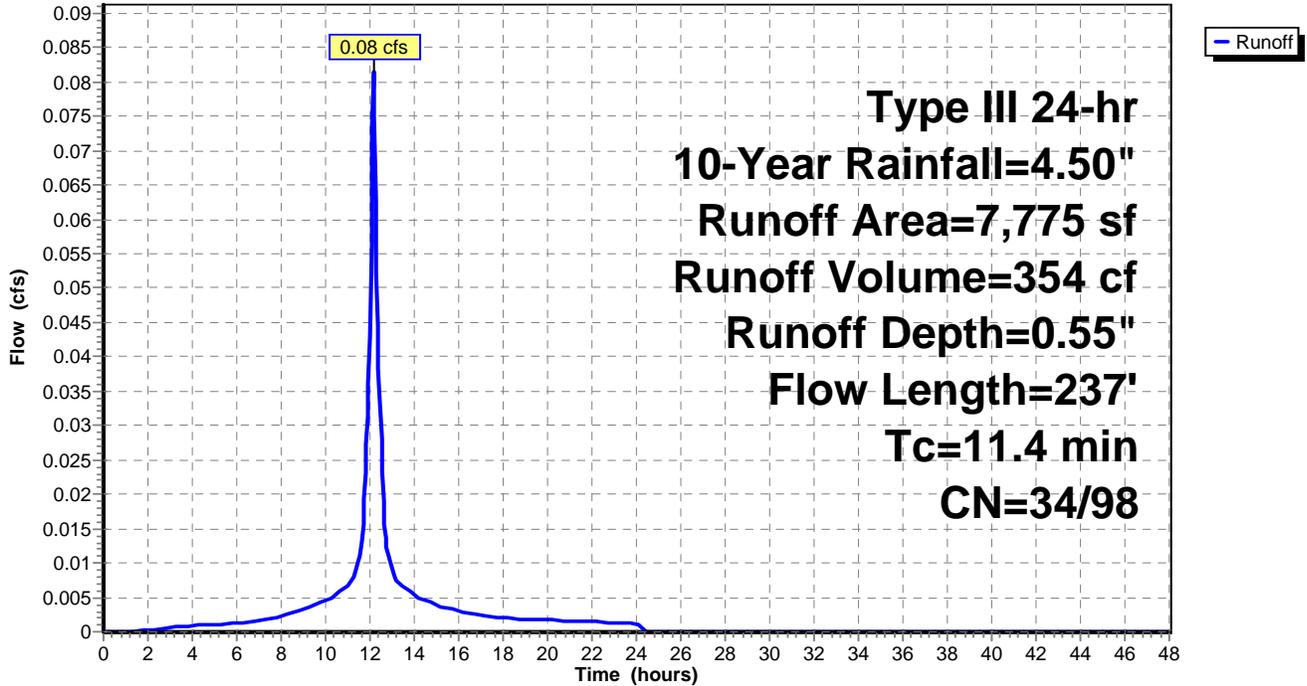
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
966	98	Roofs, HSG A
3,165	39	>75% Grass cover, Good, HSG A
3,644	30	Woods, Good, HSG A
7,775	42	Weighted Average
6,809	34	87.58% Pervious Area
966	98	12.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0120	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
1.0	187	0.0390	3.18		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.4	237	Total			

Subcatchment PS-6C2: To PYD-2

Hydrograph



Summary for Subcatchment PS-6C3: To PDMH-11

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 343 cf, Depth= 4.26"

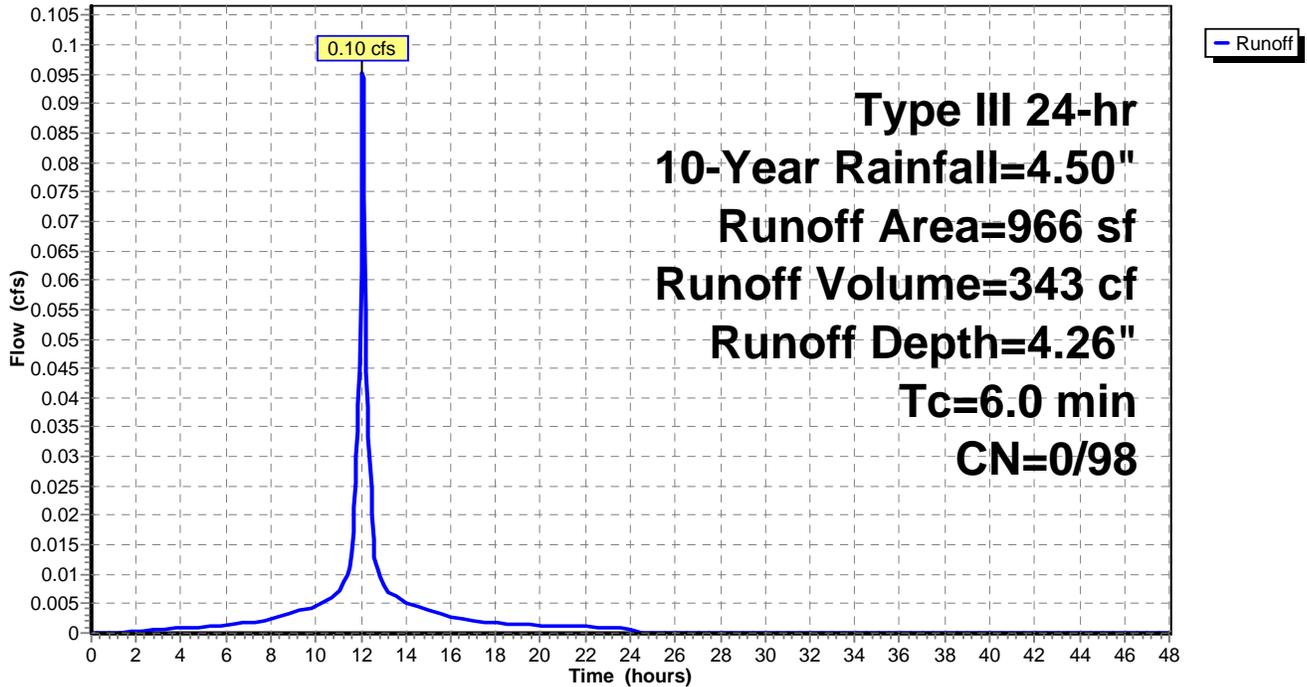
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
966	98	Roofs, HSG A
966	98	100.00% Impervious Area

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

Subcatchment PS-6C3: To PDMH-11

Hydrograph



Summary for Subcatchment PS-6C4: To Swale

Runoff = 0.88 cfs @ 12.13 hrs, Volume= 3,085 cf, Depth= 2.38"

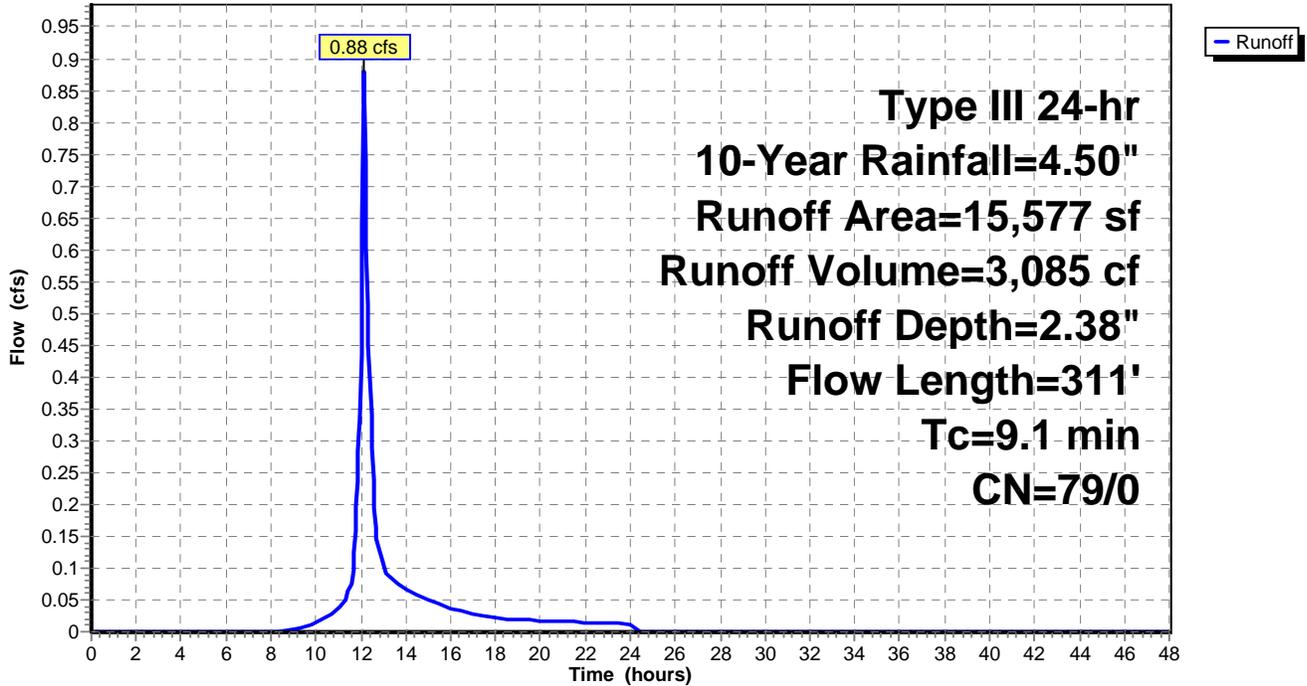
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,520	98	Unconnected roofs, HSG A
1,994	39	>75% Grass cover, Good, HSG A
3,928	98	Unconnected roofs, HSG C
7,135	74	>75% Grass cover, Good, HSG C
15,577	79	Weighted Average
15,577	79	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	28	0.0080	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
1.4	283	0.0450	3.42		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.1	311	Total			

Subcatchment PS-6C4: To Swale

Hydrograph



Summary for Subcatchment PS-6C5: To Infiltration Basin

Runoff = 0.67 cfs @ 12.11 hrs, Volume= 2,322 cf, Depth= 1.93"

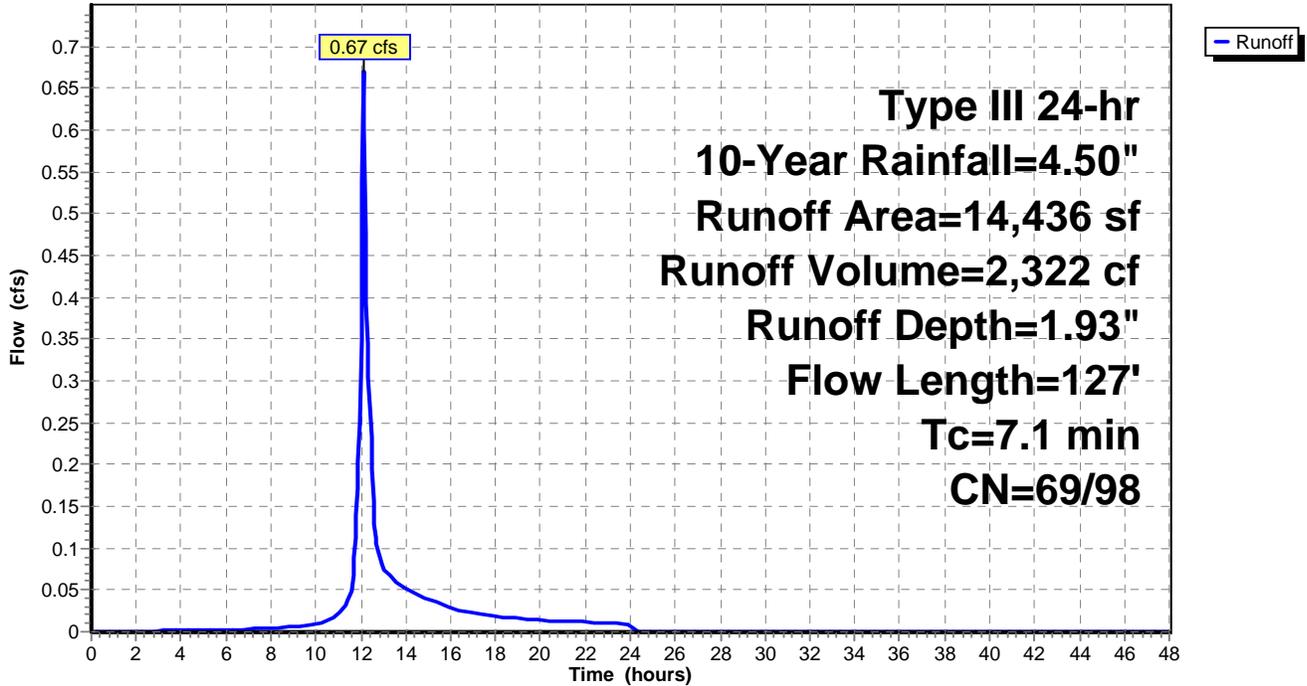
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,725	39	>75% Grass cover, Good, HSG A
10,933	74	>75% Grass cover, Good, HSG C
1,778	98	Water Surface, HSG C
14,436	73	Weighted Average
12,658	69	87.68% Pervious Area
1,778	98	12.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	40	0.0220	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	87	0.0770	4.47		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.1	127	Total			

Subcatchment PS-6C5: To Infiltration Basin

Hydrograph



Summary for Subcatchment PS-6D: To South

Runoff = 0.23 cfs @ 12.11 hrs, Volume= 773 cf, Depth= 1.60"

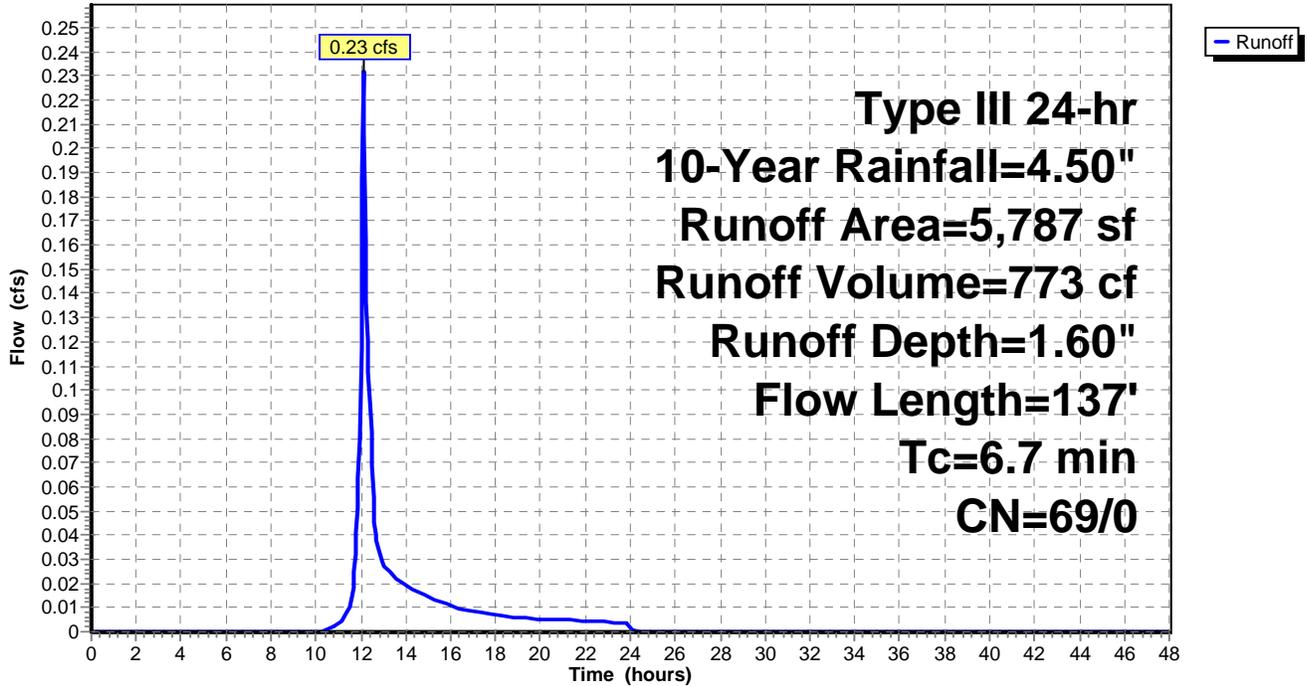
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
817	39	>75% Grass cover, Good, HSG A
4,970	74	>75% Grass cover, Good, HSG C
5,787	69	Weighted Average
5,787	69	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.2	46	0.0420	3.30		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.1	41	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.7	137	Total			

Subcatchment PS-6D: To South

Hydrograph



Summary for Reach 1R: Swale 1

Inflow Area = 24,468 sf, 0.00% Impervious, Inflow Depth = 0.19" for 10-Year event
 Inflow = 0.02 cfs @ 12.57 hrs, Volume= 396 cf
 Outflow = 0.02 cfs @ 12.57 hrs, Volume= 396 cf, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Max. Velocity= 0.49 fps, Min. Travel Time= 0.1 min
 Avg. Velocity = 0.35 fps, Avg. Travel Time= 0.1 min

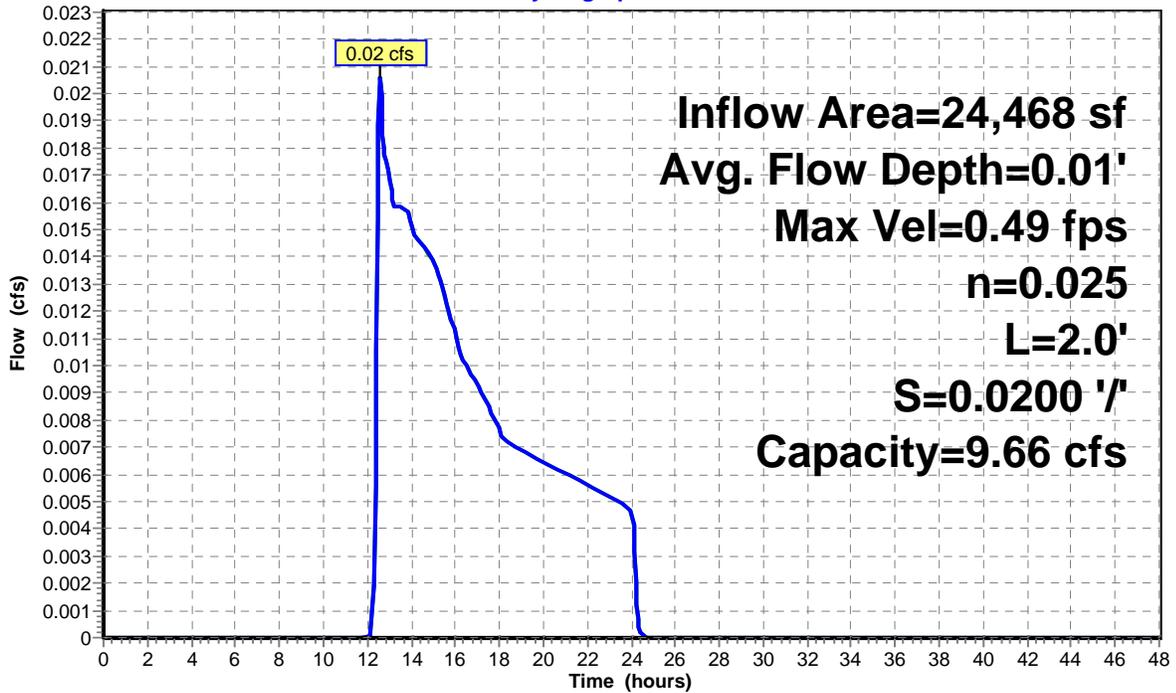
Peak Storage= 0 cf @ 12.57 hrs
 Average Depth at Peak Storage= 0.01'
 Bank-Full Depth= 0.50' Flow Area= 2.3 sf, Capacity= 9.66 cfs

3.00' x 0.50' deep channel, n= 0.025 Earth, clean & winding
 Side Slope Z-value= 3.0 '/ Top Width= 6.00'
 Length= 2.0' Slope= 0.0200 '/
 Inlet Invert= 196.54', Outlet Invert= 196.50'



Reach 1R: Swale 1

Hydrograph



Summary for Reach 2R: Swale #2

Inflow Area = 7,775 sf, 12.42% Impervious, Inflow Depth = 0.55" for 10-Year event
 Inflow = 0.08 cfs @ 12.15 hrs, Volume= 354 cf
 Outflow = 0.08 cfs @ 12.15 hrs, Volume= 354 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Max. Velocity= 0.83 fps, Min. Travel Time= 0.0 min
 Avg. Velocity = 0.27 fps, Avg. Travel Time= 0.1 min

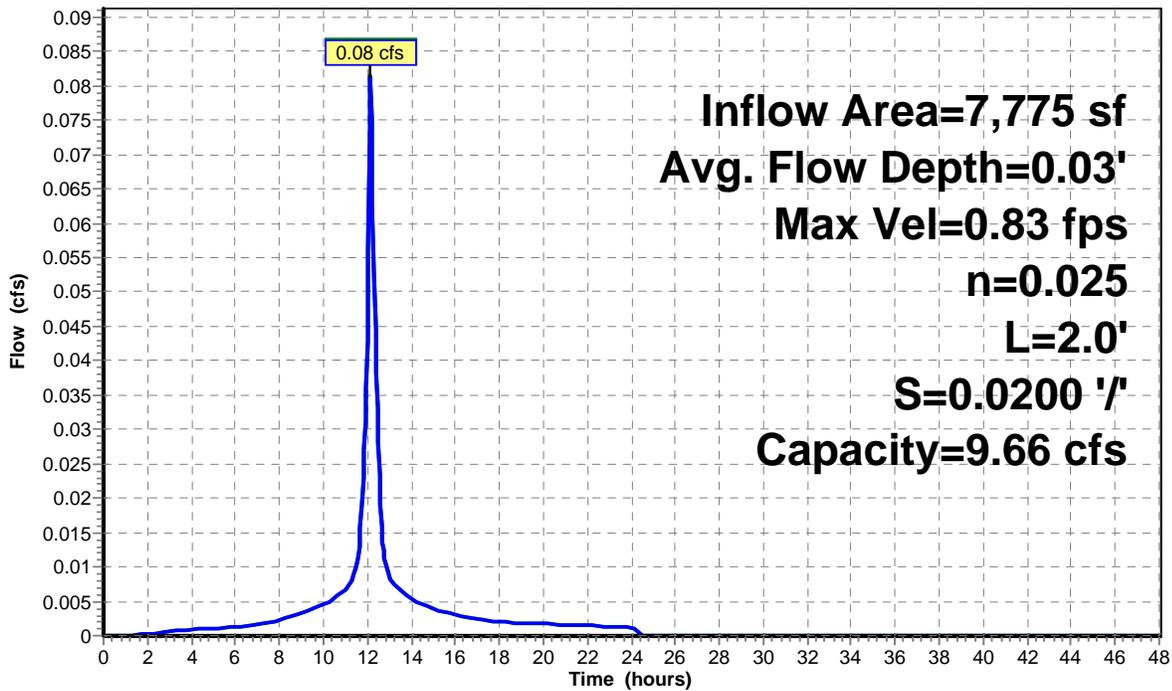
Peak Storage= 0 cf @ 12.15 hrs
 Average Depth at Peak Storage= 0.03'
 Bank-Full Depth= 0.50' Flow Area= 2.3 sf, Capacity= 9.66 cfs

3.00' x 0.50' deep channel, n= 0.025 Earth, clean & winding
 Side Slope Z-value= 3.0 '/' Top Width= 6.00'
 Length= 2.0' Slope= 0.0200 '/'
 Inlet Invert= 190.54', Outlet Invert= 190.50'



Reach 2R: Swale #2

Hydrograph



Inflow
 Outflow

Summary for Reach 3R: Swale #3

Inflow Area = 15,577 sf, 0.00% Impervious, Inflow Depth = 2.38" for 10-Year event
 Inflow = 0.88 cfs @ 12.13 hrs, Volume= 3,085 cf
 Outflow = 0.85 cfs @ 12.16 hrs, Volume= 3,085 cf, Atten= 3%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Max. Velocity= 2.57 fps, Min. Travel Time= 0.8 min
 Avg. Velocity = 0.74 fps, Avg. Travel Time= 2.9 min

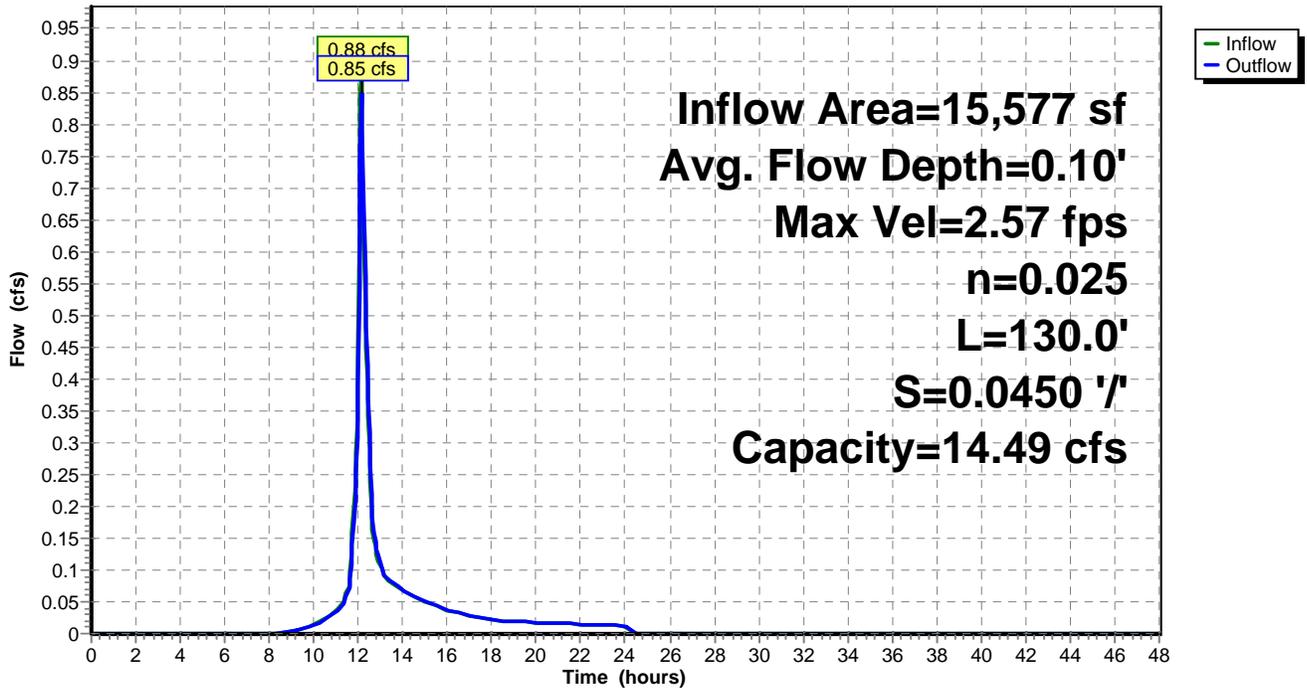
Peak Storage= 44 cf @ 12.14 hrs
 Average Depth at Peak Storage= 0.10'
 Bank-Full Depth= 0.50' Flow Area= 2.3 sf, Capacity= 14.49 cfs

3.00' x 0.50' deep channel, n= 0.025 Earth, clean & winding
 Side Slope Z-value= 3.0 '/' Top Width= 6.00'
 Length= 130.0' Slope= 0.0450 '/'
 Inlet Invert= 190.85', Outlet Invert= 185.00'



Reach 3R: Swale #3

Hydrograph



Summary for Pond 1P: Subsurface #1

Inflow Area = 79,064 sf, 69.61% Impervious, Inflow Depth = 3.00" for 10-Year event
 Inflow = 4.21 cfs @ 12.20 hrs, Volume= 19,779 cf
 Outflow = 0.54 cfs @ 13.02 hrs, Volume= 19,779 cf, Atten= 87%, Lag= 49.3 min
 Discarded = 0.31 cfs @ 10.65 hrs, Volume= 17,893 cf
 Primary = 0.23 cfs @ 13.02 hrs, Volume= 1,886 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 203.38' @ 13.02 hrs Surf.Area= 5,558 sf Storage= 7,668 cf
 Flood Elev= 204.90' Surf.Area= 5,558 sf Storage= 12,104 cf

Plug-Flow detention time= 158.2 min calculated for 19,759 cf (100% of inflow)
 Center-of-Mass det. time= 158.1 min (919.8 - 761.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	201.40'	4,900 cf	63.25'W x 87.88'L x 3.50'H Field A 19,454 cf Overall - 7,203 cf Embedded = 12,251 cf x 40.0% Voids
#2A	201.90'	7,203 cf	ADS_StormTech SC-740 x 156 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 13 rows
#3	206.40'	120 cf	Roadway Flooding (Irregular) Listed below (Recalc) -Impervious
		12,223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
206.40	2	4.0	0	0	2
206.60	138	76.0	10	10	460
206.80	1,108	1,939.0	109	120	299,190

Device	Routing	Invert	Outlet Devices
#1	Discarded	201.40'	2.410 in/hr Exfiltration over Surface area
#2	Primary	201.40'	12.0" Round Culvert L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 201.40' / 197.10' S= 0.0277 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	202.90'	4.0" Vert. Orifice/Grate C= 0.600
#4	Device 2	204.90'	4.0' long Overflow Weir 2 End Contraction(s)

Discarded OutFlow Max=0.31 cfs @ 10.65 hrs HW=201.45' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.23 cfs @ 13.02 hrs HW=203.38' (Free Discharge)
 ↑2=Culvert (Passes 0.23 cfs of 4.60 cfs potential flow)
 ↑3=Orifice/Grate (Orifice Controls 0.23 cfs @ 2.68 fps)
 ↑4=Overflow Weir (Controls 0.00 cfs)

Pond 1P: Subsurface #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 (ADS StormTech® SC-740)

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 6.45 sf x 13 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

12 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 85.88' Row Length +12.0" End Stone x 2 = 87.88' Base Length

13 Rows x 51.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 63.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

156 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 13 Rows = 7,203.4 cf Chamber Storage

19,454.1 cf Field - 7,203.4 cf Chambers = 12,250.7 cf Stone x 40.0% Voids = 4,900.3 cf Stone Storage

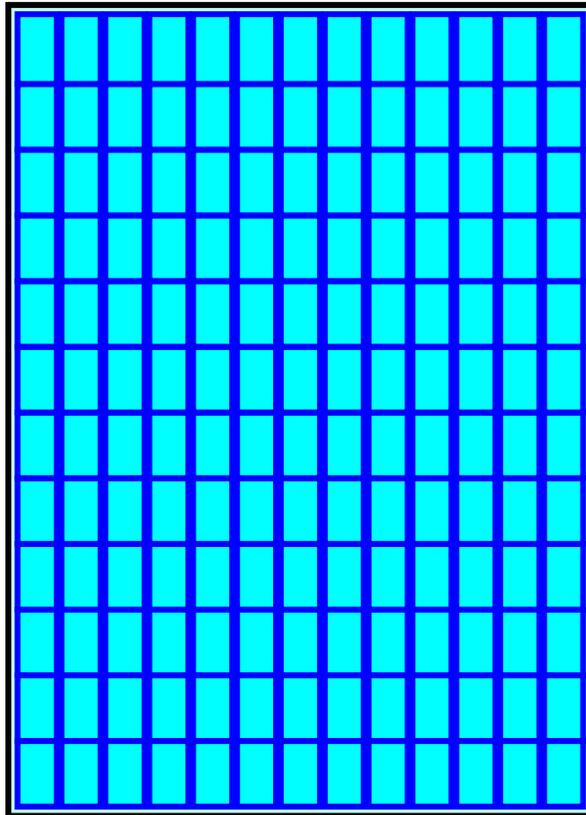
Chamber Storage + Stone Storage = 12,103.7 cf = 0.278 af

Overall Storage Efficiency = 62.2%

156 Chambers

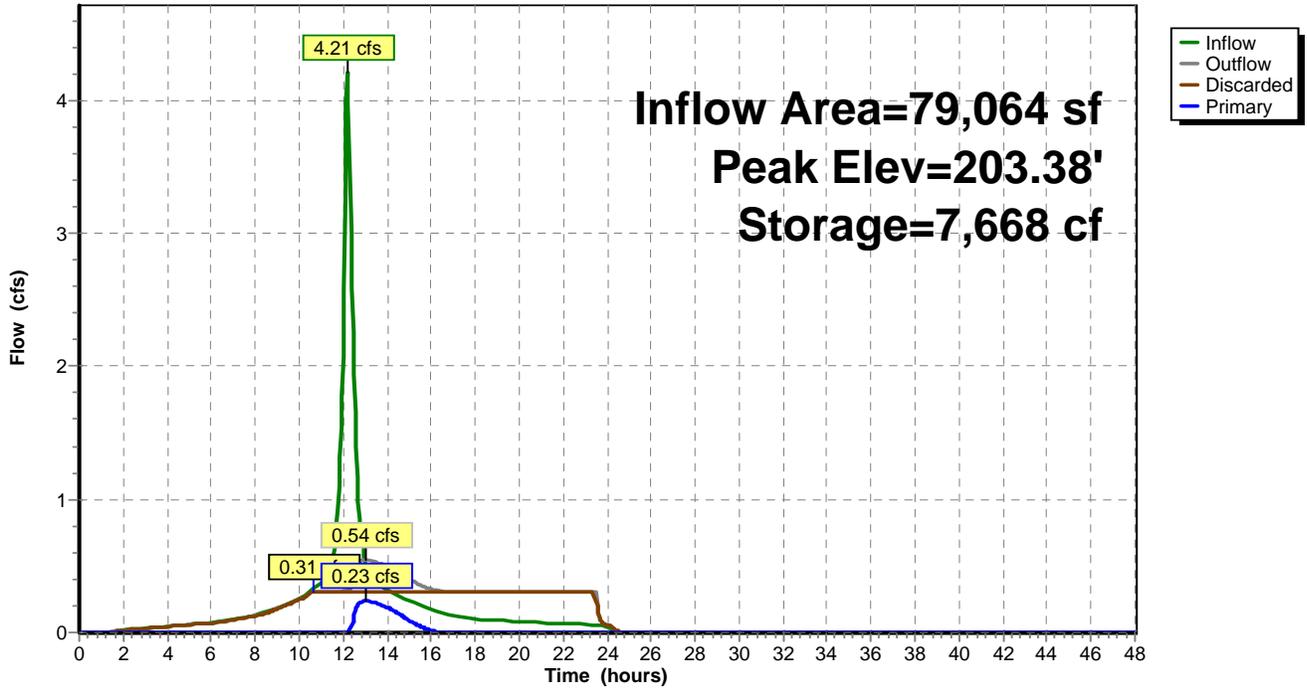
720.5 cy Field

453.7 cy Stone



Pond 1P: Subsurface #1

Hydrograph



Summary for Pond 2P: Subsurface #2

Inflow Area = 34,605 sf, 76.54% Impervious, Inflow Depth = 3.30" for 10-Year event
 Inflow = 2.21 cfs @ 12.16 hrs, Volume= 9,523 cf
 Outflow = 0.41 cfs @ 12.68 hrs, Volume= 9,523 cf, Atten= 81%, Lag= 31.4 min
 Discarded = 0.12 cfs @ 10.10 hrs, Volume= 7,879 cf
 Primary = 0.29 cfs @ 12.68 hrs, Volume= 1,644 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 198.99' @ 12.68 hrs Surf.Area= 2,209 sf Storage= 3,619 cf
 Flood Elev= 200.10' Surf.Area= 2,209 sf Storage= 4,757 cf

Plug-Flow detention time= 162.7 min calculated for 9,513 cf (100% of inflow)
 Center-of-Mass det. time= 162.6 min (920.9 - 758.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	196.60'	1,983 cf	30.00'W x 73.64'L x 3.50'H Field A 7,732 cf Overall - 2,773 cf Embedded = 4,959 cf x 40.0% Voids
#2A	197.10'	2,773 cf	ADS_StormTech SC-740 x 60 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 6 rows
#3	201.92'	84 cf	Roadway Flooding (Irregular) Listed below (Recalc) -Impervious
		4,841 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
201.92	2	4.0	0	0	2
202.00	37	38.0	1	1	116
202.20	1,009	242.0	83	84	4,661

Device	Routing	Invert	Outlet Devices
#1	Discarded	196.60'	2.410 in/hr Exfiltration over Surface area
#2	Primary	196.60'	12.0" Round Culvert L= 135.0' Ke= 0.500 Inlet / Outlet Invert= 196.60' / 187.51' S= 0.0673 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	198.35'	4.0" Vert. Orifice/Grate C= 0.600
#4	Device 2	200.10'	4.0' long Overflow Weir 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 10.10 hrs HW=196.66' (Free Discharge)
 ↗1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.29 cfs @ 12.68 hrs HW=198.99' (Free Discharge)
 ↗2=Culvert (Passes 0.29 cfs of 5.20 cfs potential flow)
 ↗3=Orifice/Grate (Orifice Controls 0.29 cfs @ 3.31 fps)
 ↗4=Overflow Weir (Controls 0.00 cfs)

Pond 2P: Subsurface #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 (ADS StormTech® SC-740)

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 6.45 sf x 6 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

10 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 71.64' Row Length +12.0" End Stone x 2 = 73.64' Base Length

6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

60 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 6 Rows = 2,773.4 cf Chamber Storage

7,732.0 cf Field - 2,773.4 cf Chambers = 4,958.7 cf Stone x 40.0% Voids = 1,983.5 cf Stone Storage

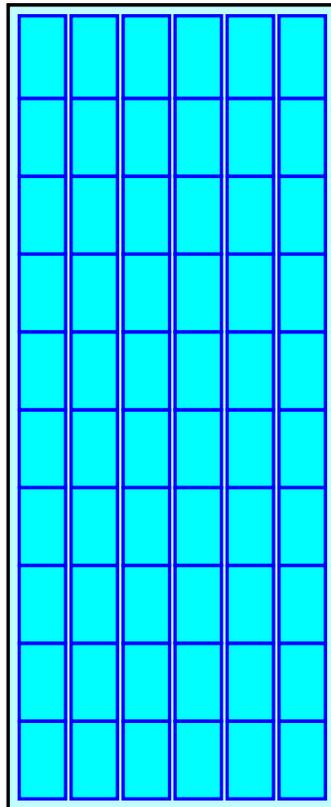
Chamber Storage + Stone Storage = 4,756.8 cf = 0.109 af

Overall Storage Efficiency = 61.5%

60 Chambers

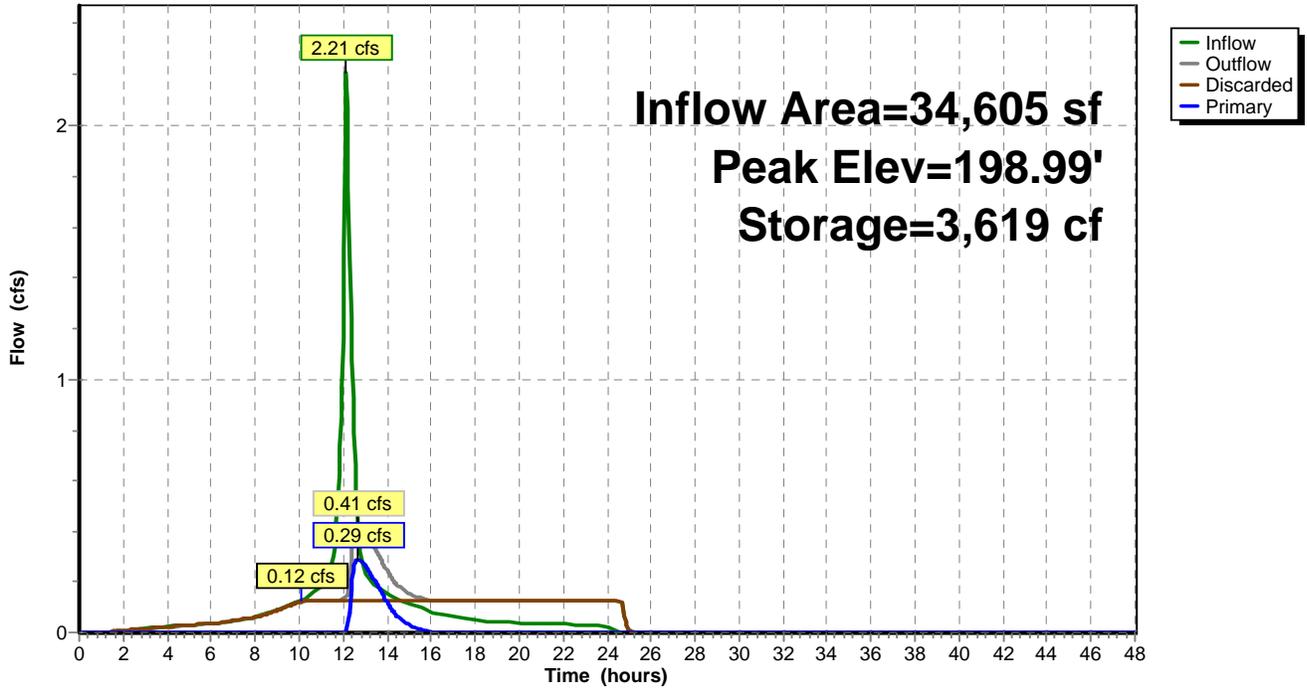
286.4 cy Field

183.7 cy Stone



Pond 2P: Subsurface #2

Hydrograph



Summary for Pond 3P: Infiltration Basin

Inflow Area = 176,891 sf, 48.19% Impervious, Inflow Depth = 0.68" for 10-Year event
 Inflow = 1.63 cfs @ 12.13 hrs, Volume= 10,031 cf
 Outflow = 0.60 cfs @ 13.46 hrs, Volume= 10,031 cf, Atten= 63%, Lag= 79.7 min
 Discarded = 0.08 cfs @ 13.46 hrs, Volume= 5,292 cf
 Primary = 0.52 cfs @ 13.46 hrs, Volume= 4,739 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 185.46' @ 13.46 hrs Surf.Area= 3,300 sf Storage= 3,650 cf
 Flood Elev= 186.50' Surf.Area= 4,720 sf Storage= 7,819 cf

Plug-Flow detention time= 239.1 min calculated for 10,020 cf (100% of inflow)
 Center-of-Mass det. time= 239.5 min (1,067.2 - 827.8)

Volume	Invert	Avail.Storage	Storage Description			
#1	184.00'	10,362 cf	Basin Storage (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
184.00	1,832	199.3	0	0	1,832	
185.00	2,736	234.3	2,269	2,269	3,059	
186.00	4,034	311.9	3,364	5,633	6,443	
187.00	5,460	373.5	4,729	10,362	9,820	

Device	Routing	Invert	Outlet Devices			
#1	Discarded	184.00'	1.020 in/hr Exfiltration over Surface area			
#2	Primary	183.00'	12.0" Round Culvert L= 24.0' Ke= 0.500 Inlet / Outlet Invert= 183.00' / 182.04' S= 0.0400 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf			
#3	Device 2	185.00'	7.0" Vert. Orifice C= 0.600			
#4	Device 2	186.25'	4.0" x 4.0" Horiz. Outlet Structure Grate C= 0.600 Limited to weir flow at low heads			
#5	Secondary	186.50'	10.0' long x 10.0' breadth Emergency Overflow Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64			

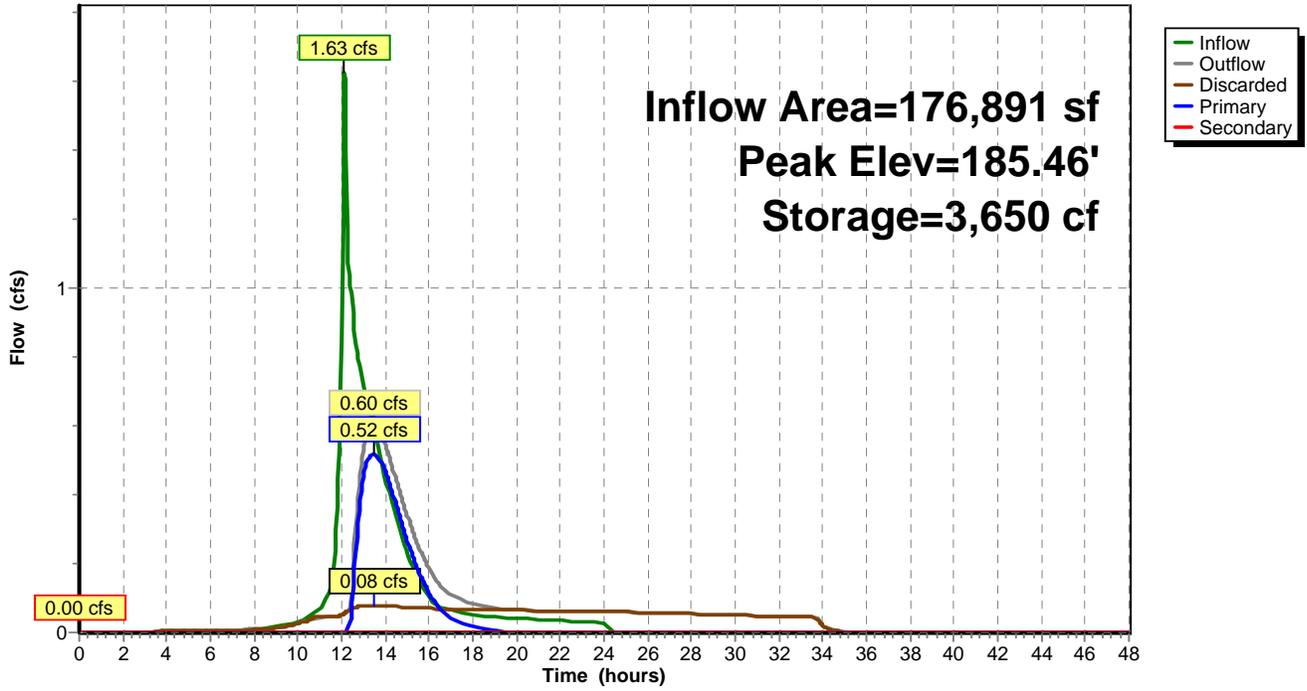
Discarded OutFlow Max=0.08 cfs @ 13.46 hrs HW=185.46' (Free Discharge)
 ↳1=**Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.52 cfs @ 13.46 hrs HW=185.46' (Free Discharge)
 ↳2=**Culvert** (Passes 0.52 cfs of 5.29 cfs potential flow)
 ↳3=**Orifice** (Orifice Controls 0.52 cfs @ 2.31 fps)
 ↳4=**Outlet Structure Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=184.00' (Free Discharge)
 ↳5=**Emergency Overflow** (Controls 0.00 cfs)

Pond 3P: Infiltration Basin

Hydrograph



Summary for Pond 4P: PYD-1

Inflow Area = 24,468 sf, 0.00% Impervious, Inflow Depth = 0.19" for 10-Year event
 Inflow = 0.02 cfs @ 12.57 hrs, Volume= 396 cf
 Outflow = 0.02 cfs @ 12.57 hrs, Volume= 396 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.02 cfs @ 12.57 hrs, Volume= 396 cf

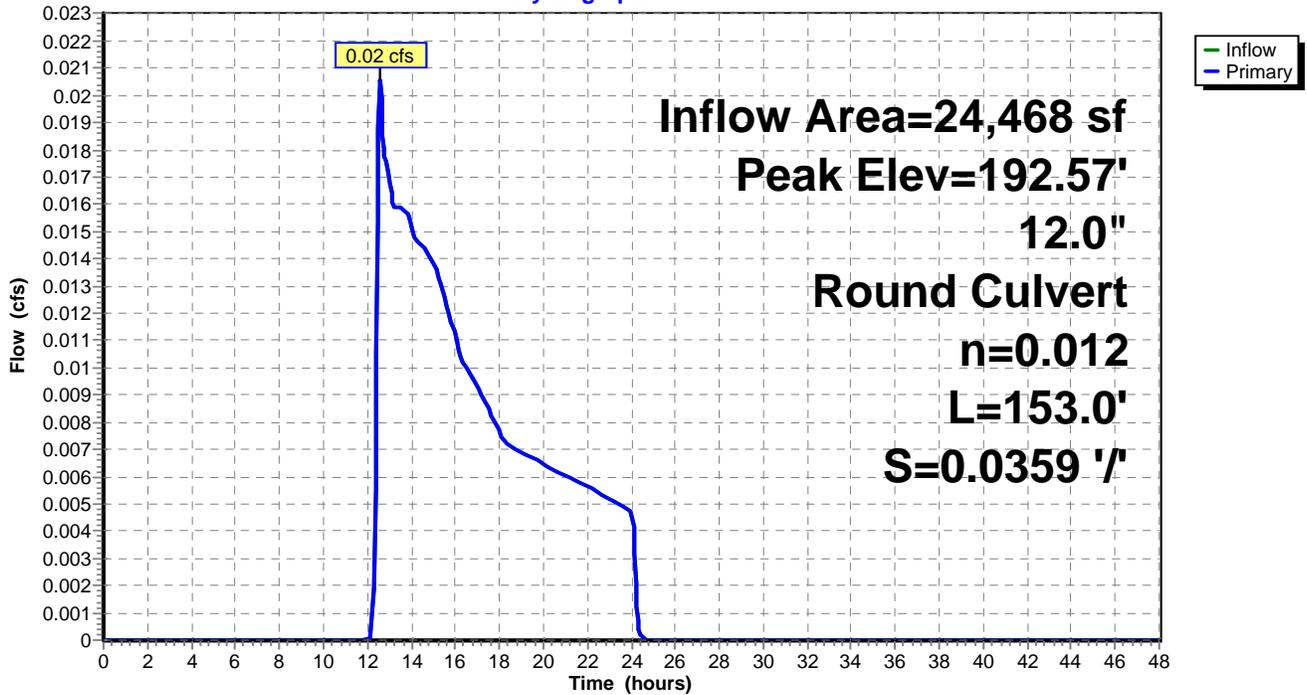
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 192.57' @ 12.57 hrs
 Flood Elev= 196.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	192.50'	12.0" Round Culvert L= 153.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 187.00' S= 0.0359 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.02 cfs @ 12.57 hrs HW=192.56' (Free Discharge)
 1=Culvert (Inlet Controls 0.02 cfs @ 0.87 fps)

Pond 4P: PYD-1

Hydrograph



Summary for Pond 5P: PYD-2

Inflow Area = 32,243 sf, 3.00% Impervious, Inflow Depth = 0.28" for 10-Year event
 Inflow = 0.08 cfs @ 12.15 hrs, Volume= 750 cf
 Outflow = 0.08 cfs @ 12.15 hrs, Volume= 750 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.08 cfs @ 12.15 hrs, Volume= 750 cf

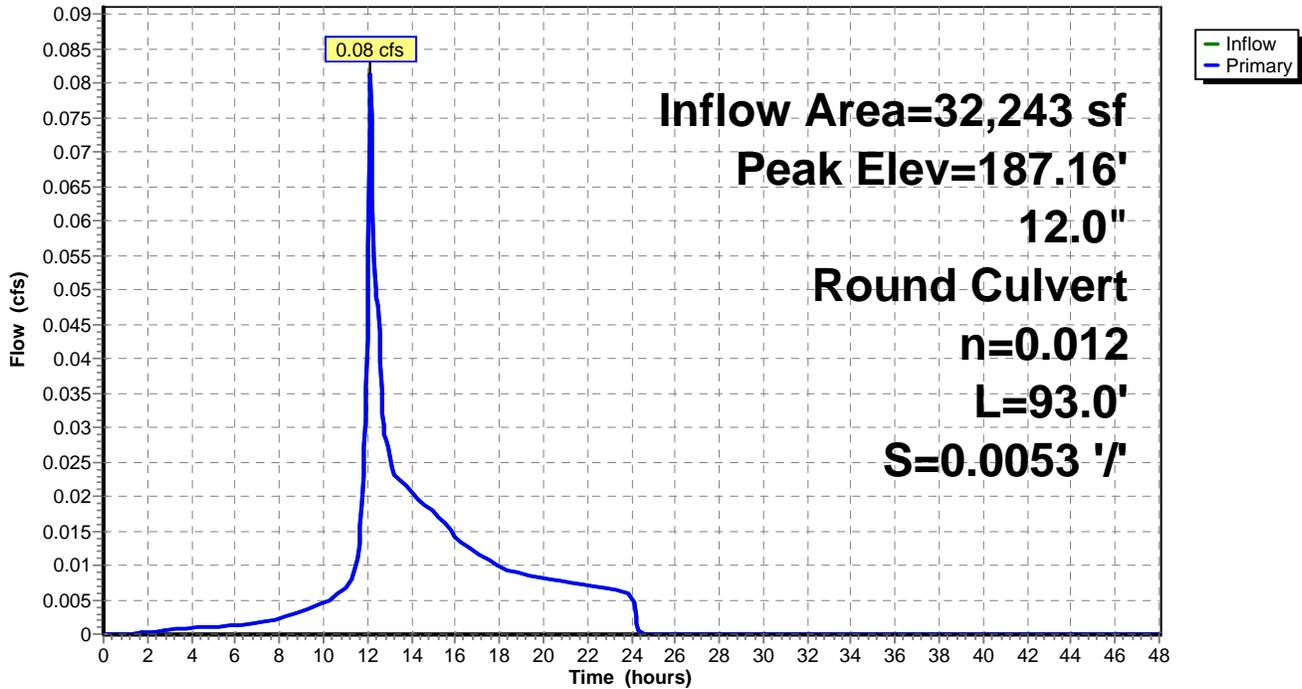
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 187.16' @ 12.15 hrs
 Flood Elev= 190.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	12.0" Round Culvert L= 93.0' Ke= 0.500 Inlet / Outlet Invert= 187.00' / 186.51' S= 0.0053 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.08 cfs @ 12.15 hrs HW=187.16' (Free Discharge)
 1=Culvert (Barrel Controls 0.08 cfs @ 1.55 fps)

Pond 5P: PYD-2

Hydrograph



Summary for Pond 6P: PDMH-11

Inflow Area = 33,209 sf, 5.82% Impervious, Inflow Depth = 0.40" for 10-Year event
 Inflow = 0.17 cfs @ 12.11 hrs, Volume= 1,094 cf
 Outflow = 0.17 cfs @ 12.11 hrs, Volume= 1,094 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.17 cfs @ 12.11 hrs, Volume= 1,094 cf

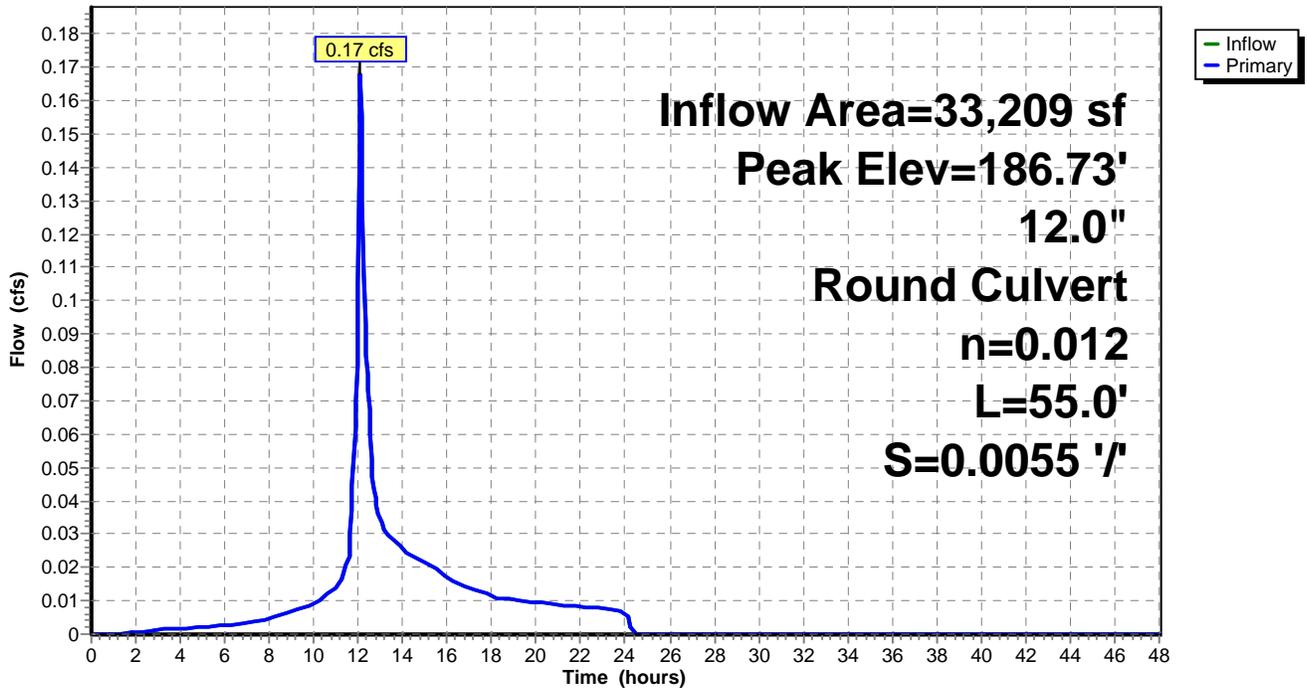
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 186.73' @ 12.11 hrs
 Flood Elev= 191.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	186.51'	12.0" Round Culvert L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 186.51' / 186.21' S= 0.0055 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.16 cfs @ 12.11 hrs HW=186.73' (Free Discharge)
 1=Culvert (Barrel Controls 0.16 cfs @ 1.90 fps)

Pond 6P: PDMH-11

Hydrograph



Summary for Pond 7P: PDMH-12

Inflow Area = 33,209 sf, 5.82% Impervious, Inflow Depth = 0.40" for 10-Year event
 Inflow = 0.17 cfs @ 12.11 hrs, Volume= 1,094 cf
 Outflow = 0.17 cfs @ 12.11 hrs, Volume= 1,094 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.17 cfs @ 12.11 hrs, Volume= 1,094 cf

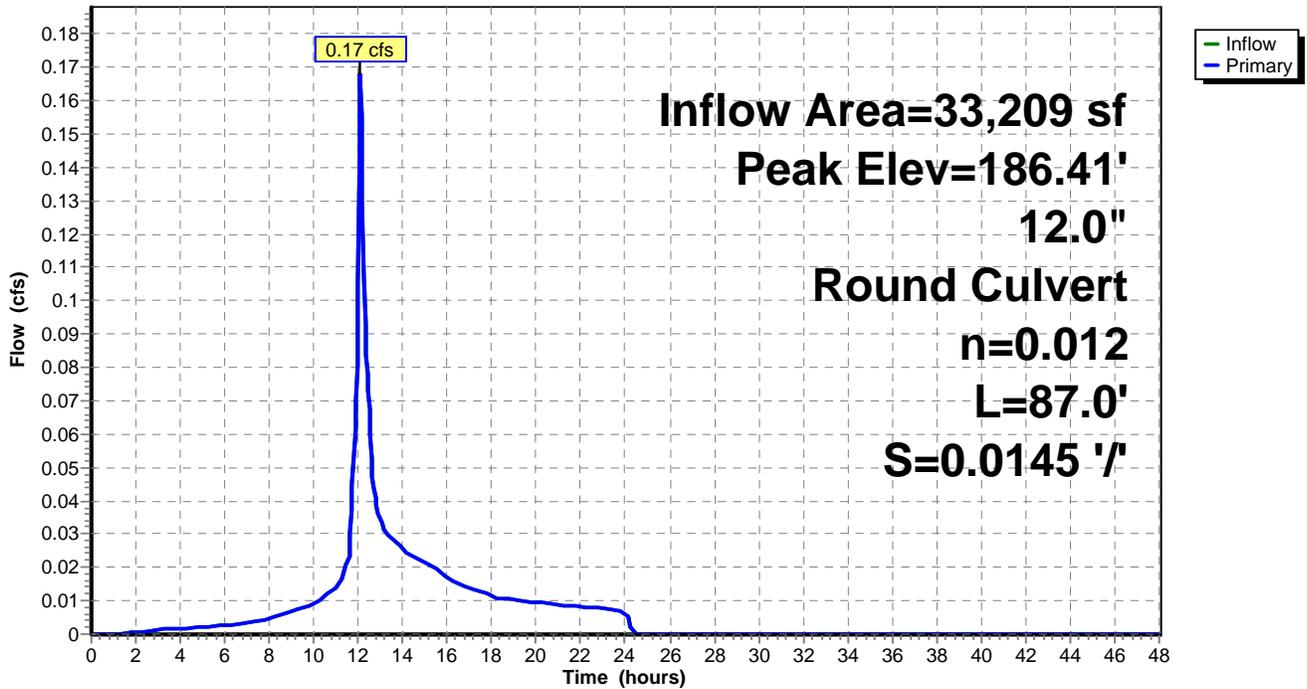
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 186.41' @ 12.11 hrs
 Flood Elev= 190.15'

Device	Routing	Invert	Outlet Devices
#1	Primary	186.21'	12.0" Round Culvert L= 87.0' Ke= 0.500 Inlet / Outlet Invert= 186.21' / 184.95' S= 0.0145 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.17 cfs @ 12.11 hrs HW=186.41' (Free Discharge)
 ←1=Culvert (Inlet Controls 0.17 cfs @ 1.51 fps)

Pond 7P: PDMH-12

Hydrograph



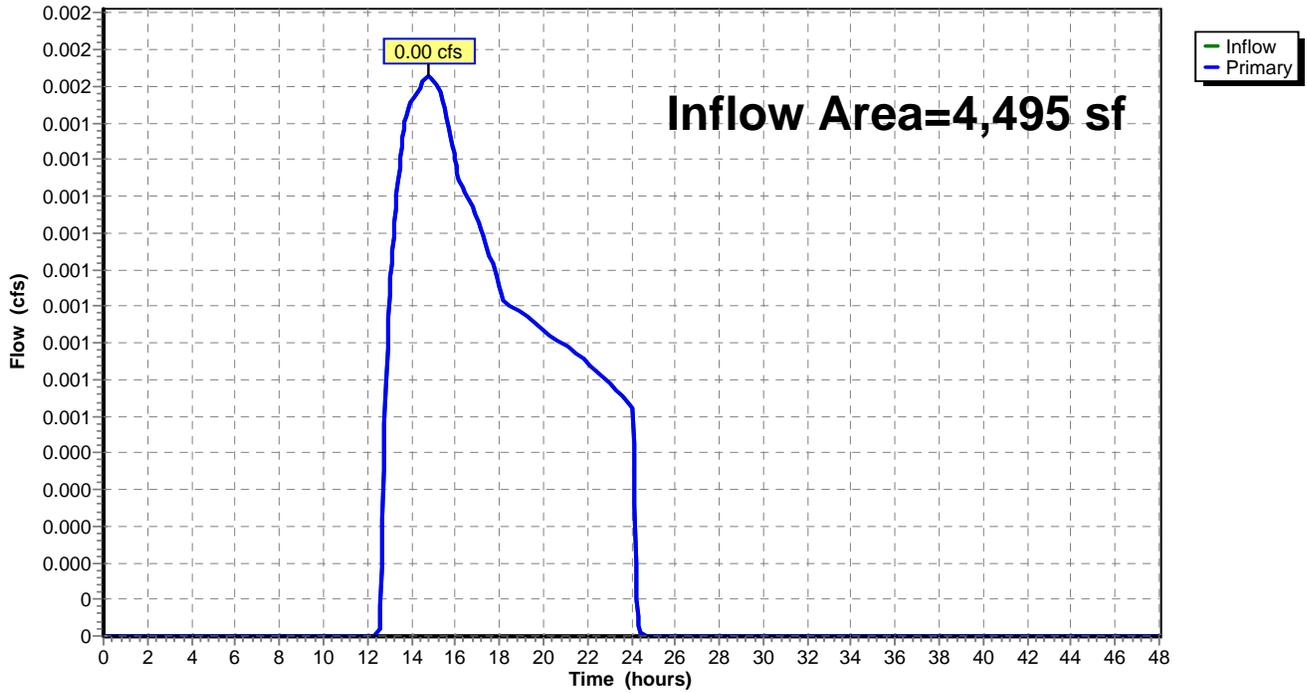
Summary for Link DP-1: Offsite to North/West

Inflow Area = 4,495 sf, 0.00% Impervious, Inflow Depth = 0.11" for 10-Year event
Inflow = 0.00 cfs @ 14.79 hrs, Volume= 41 cf
Primary = 0.00 cfs @ 14.79 hrs, Volume= 41 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

Hydrograph



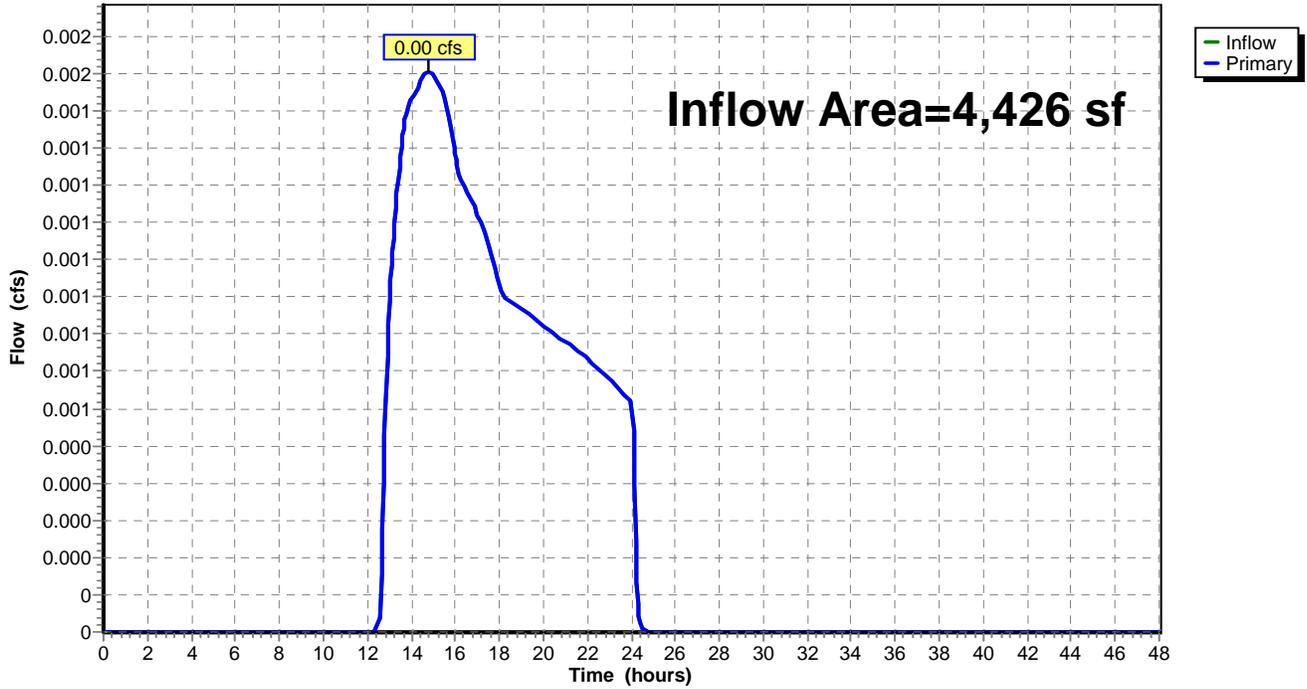
Summary for Link DP-2: Offsite to West

Inflow Area = 4,426 sf, 0.00% Impervious, Inflow Depth = 0.11" for 10-Year event
Inflow = 0.00 cfs @ 14.81 hrs, Volume= 41 cf
Primary = 0.00 cfs @ 14.81 hrs, Volume= 41 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

Hydrograph



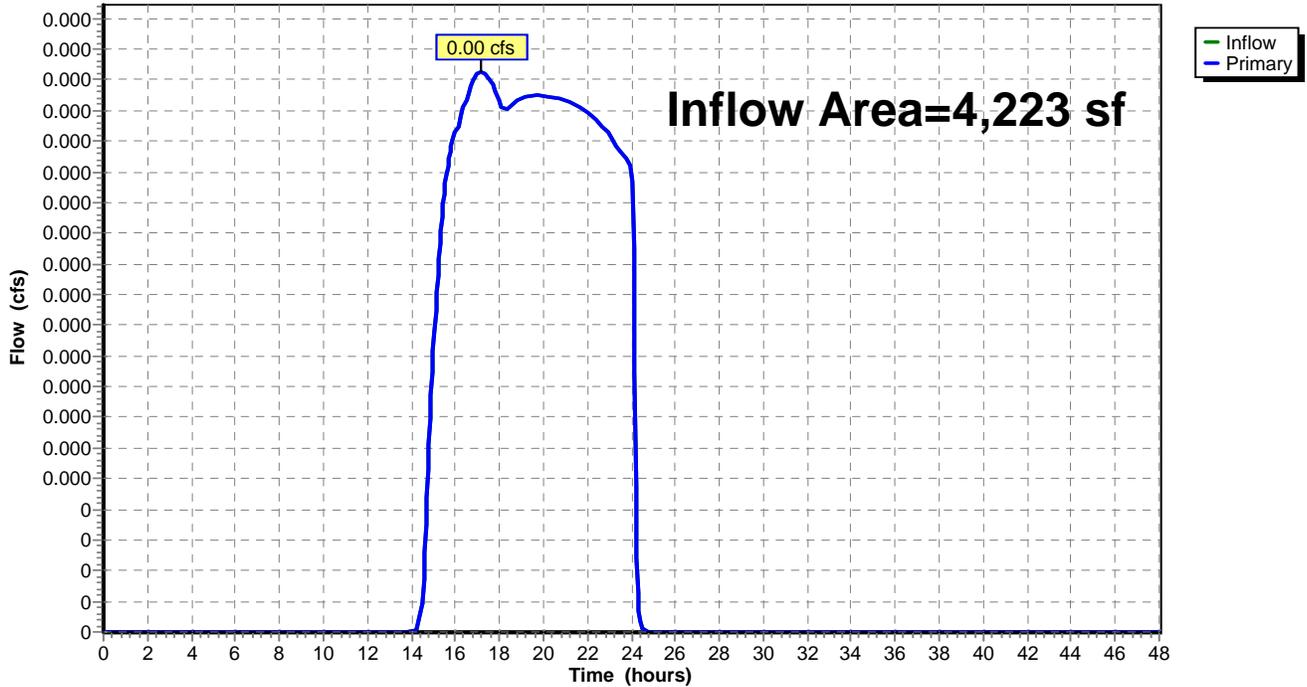
Summary for Link DP-3: Offsite to Northeast

Inflow Area = 4,223 sf, 0.00% Impervious, Inflow Depth = 0.03" for 10-Year event
Inflow = 0.00 cfs @ 17.20 hrs, Volume= 11 cf
Primary = 0.00 cfs @ 17.20 hrs, Volume= 11 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

Hydrograph



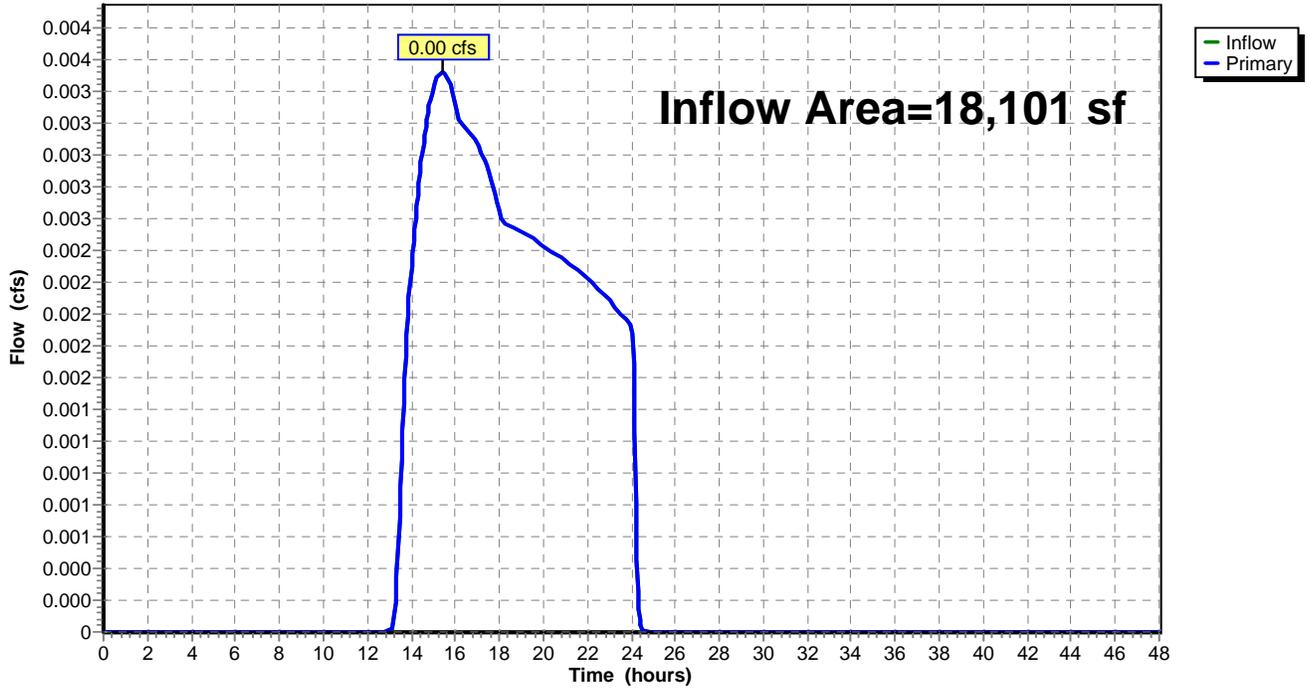
Summary for Link DP-4: East Edge of Property

Inflow Area = 18,101 sf, 0.00% Impervious, Inflow Depth = 0.07" for 10-Year event
Inflow = 0.00 cfs @ 15.39 hrs, Volume= 100 cf
Primary = 0.00 cfs @ 15.39 hrs, Volume= 100 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

Hydrograph



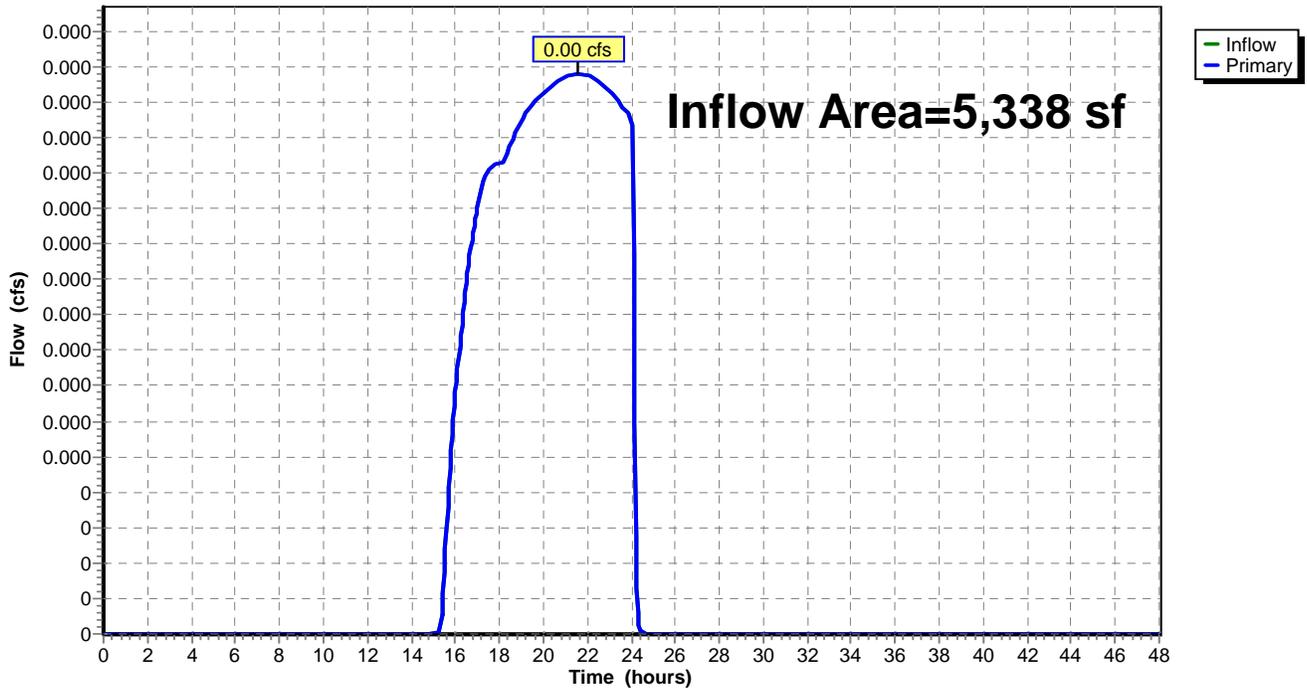
Summary for Link DP-5: Southwest Corner

Inflow Area = 5,338 sf, 0.00% Impervious, Inflow Depth = 0.02" for 10-Year event
Inflow = 0.00 cfs @ 21.59 hrs, Volume= 8 cf
Primary = 0.00 cfs @ 21.59 hrs, Volume= 8 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

Hydrograph



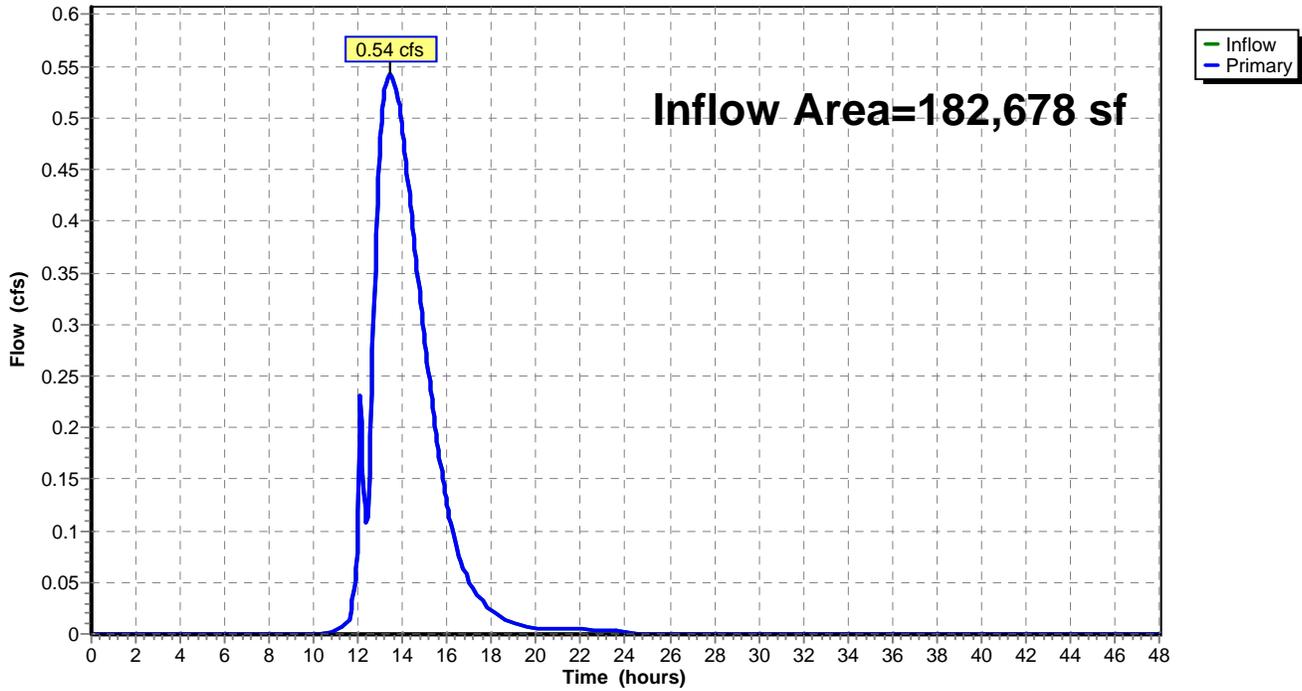
Summary for Link DP-6: South Corner

Inflow Area = 182,678 sf, 46.66% Impervious, Inflow Depth = 0.36" for 10-Year event
Inflow = 0.54 cfs @ 13.44 hrs, Volume= 5,512 cf
Primary = 0.54 cfs @ 13.44 hrs, Volume= 5,512 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner

Hydrograph



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
 Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS-1: To Northwest	Runoff Area=4,495 sf 0.00% Impervious Runoff Depth=0.57" Flow Length=80' Slope=0.0100 '/' Tc=11.5 min CN=39/0 Runoff=0.02 cfs 212 cf
Subcatchment PS-2: To West	Runoff Area=4,426 sf 0.00% Impervious Runoff Depth=0.57" Flow Length=129' Tc=12.6 min CN=39/0 Runoff=0.02 cfs 209 cf
Subcatchment PS-3: To Northeast	Runoff Area=4,223 sf 0.00% Impervious Runoff Depth=0.34" Flow Length=66' Slope=0.0100 '/' Tc=11.4 min CN=35/0 Runoff=0.01 cfs 119 cf
Subcatchment PS-4: To East	Runoff Area=18,101 sf 0.00% Impervious Runoff Depth=0.45" Flow Length=72' Tc=13.0 min CN=37/0 Runoff=0.07 cfs 676 cf
Subcatchment PS-5: To Southwest	Runoff Area=5,338 sf 0.00% Impervious Runoff Depth=0.29" Flow Length=74' Tc=9.6 min CN=34/0 Runoff=0.01 cfs 129 cf
Subcatchment PS-6A: To Subsurface #1	Runoff Area=79,064 sf 69.61% Impervious Runoff Depth=4.46" Flow Length=804' Tc=15.1 min CN=39/98 Runoff=6.07 cfs 29,394 cf
Subcatchment PS-6B: To Subsurface #2	Runoff Area=34,605 sf 76.54% Impervious Runoff Depth=4.88" Flow Length=345' Tc=11.8 min CN=41/98 Runoff=3.20 cfs 14,069 cf
Subcatchment PS-6C1: To PYD-1	Runoff Area=24,468 sf 0.00% Impervious Runoff Depth=0.76" Flow Length=371' Tc=13.1 min CN=42/0 Runoff=0.22 cfs 1,547 cf
Subcatchment PS-6C2: To PYD-2	Runoff Area=7,775 sf 12.42% Impervious Runoff Depth=1.02" Flow Length=237' Tc=11.4 min CN=34/98 Runoff=0.12 cfs 660 cf
Subcatchment PS-6C3: To PDMH-11	Runoff Area=966 sf 100.00% Impervious Runoff Depth=6.16" Tc=6.0 min CN=0/98 Runoff=0.14 cfs 496 cf
Subcatchment PS-6C4: To Swale	Runoff Area=15,577 sf 0.00% Impervious Runoff Depth=4.04" Flow Length=311' Tc=9.1 min CN=79/0 Runoff=1.49 cfs 5,243 cf
Subcatchment PS-6C5: To Infiltration Basin	Runoff Area=14,436 sf 12.32% Impervious Runoff Depth=3.41" Flow Length=127' Tc=7.1 min CN=69/98 Runoff=1.22 cfs 4,107 cf
Subcatchment PS-6D: To South	Runoff Area=5,787 sf 0.00% Impervious Runoff Depth=3.03" Flow Length=137' Tc=6.7 min CN=69/0 Runoff=0.45 cfs 1,460 cf
Reach 1R: Swale 1	Avg. Flow Depth=0.06' Max Vel=1.20 fps Inflow=0.22 cfs 1,547 cf n=0.025 L=2.0' S=0.0200 '/' Capacity=9.66 cfs Outflow=0.22 cfs 1,548 cf
Reach 2R: Swale #2	Avg. Flow Depth=0.04' Max Vel=0.95 fps Inflow=0.12 cfs 660 cf n=0.025 L=2.0' S=0.0200 '/' Capacity=9.66 cfs Outflow=0.12 cfs 660 cf
Reach 3R: Swale #3	Avg. Flow Depth=0.14' Max Vel=3.10 fps Inflow=1.49 cfs 5,243 cf n=0.025 L=130.0' S=0.0450 '/' Capacity=14.49 cfs Outflow=1.44 cfs 5,243 cf
Pond 1P: Subsurface #1	Peak Elev=204.80' Storage=11,882 cf Inflow=6.07 cfs 29,394 cf Discarded=0.31 cfs 21,825 cf Primary=0.55 cfs 7,569 cf Outflow=0.86 cfs 29,394 cf
Pond 2P: Subsurface #2	Peak Elev=200.31' Storage=4,757 cf Inflow=3.20 cfs 14,069 cf Discarded=0.12 cfs 9,197 cf Primary=1.84 cfs 4,872 cf Outflow=1.97 cfs 14,069 cf

Pond 3P: Infiltration Basin Peak Elev=186.22' Storage=6,536 cf Inflow=3.72 cfs 24,495 cf
Discarded=0.10 cfs 6,392 cf Primary=1.24 cfs 18,102 cf Secondary=0.00 cfs 0 cf Outflow=1.34 cfs 24,495 cf

Pond 4P: PYD-1 Peak Elev=192.73' Inflow=0.22 cfs 1,548 cf
12.0" Round Culvert n=0.012 L=153.0' S=0.0359 '/' Outflow=0.22 cfs 1,548 cf

Pond 5P: PYD-2 Peak Elev=187.30' Inflow=0.30 cfs 2,208 cf
12.0" Round Culvert n=0.012 L=93.0' S=0.0053 '/' Outflow=0.30 cfs 2,208 cf

Pond 6P: PDMH-11 Peak Elev=186.85' Inflow=0.37 cfs 2,704 cf
12.0" Round Culvert n=0.012 L=55.0' S=0.0055 '/' Outflow=0.37 cfs 2,704 cf

Pond 7P: PDMH-12 Peak Elev=186.51' Inflow=0.37 cfs 2,704 cf
12.0" Round Culvert n=0.012 L=87.0' S=0.0145 '/' Outflow=0.37 cfs 2,704 cf

Link DP-1: Offsite to North/West Inflow=0.02 cfs 212 cf
Primary=0.02 cfs 212 cf

Link DP-2: Offsite to West Inflow=0.02 cfs 209 cf
Primary=0.02 cfs 209 cf

Link DP-3: Offsite to Northeast Inflow=0.01 cfs 119 cf
Primary=0.01 cfs 119 cf

Link DP-4: East Edge of Property Inflow=0.07 cfs 676 cf
Primary=0.07 cfs 676 cf

Link DP-5: Southwest Corner Inflow=0.01 cfs 129 cf
Primary=0.01 cfs 129 cf

Link DP-6: South Corner Inflow=1.28 cfs 19,563 cf
Primary=1.28 cfs 19,563 cf

Total Runoff Area = 219,261 sf Runoff Volume = 58,320 cf Average Runoff Depth = 3.19"
61.12% Pervious = 134,023 sf 38.88% Impervious = 85,238 sf

Summary for Subcatchment PS-1: To Northwest

Runoff = 0.02 cfs @ 12.39 hrs, Volume= 212 cf, Depth= 0.57"

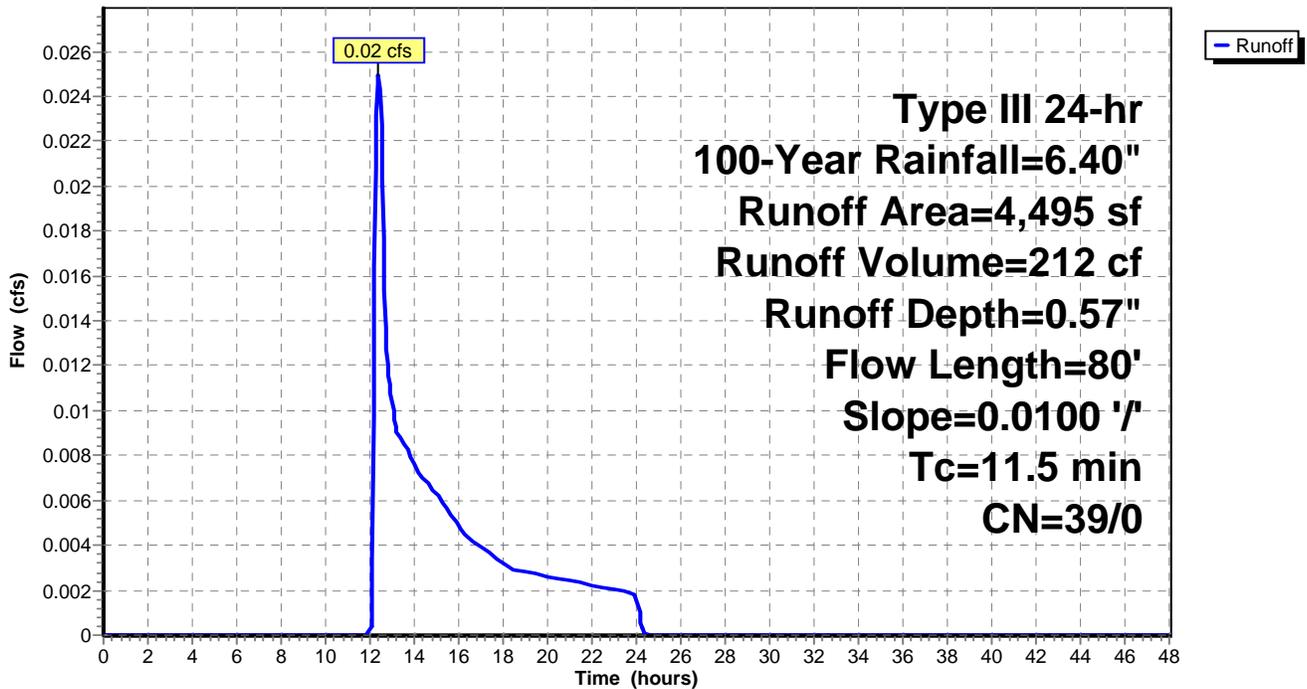
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
4,495	39	>75% Grass cover, Good, HSG A
4,495	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	30	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.5	80	Total			

Subcatchment PS-1: To Northwest

Hydrograph



Summary for Subcatchment PS-2: To West

Runoff = 0.02 cfs @ 12.41 hrs, Volume= 209 cf, Depth= 0.57"

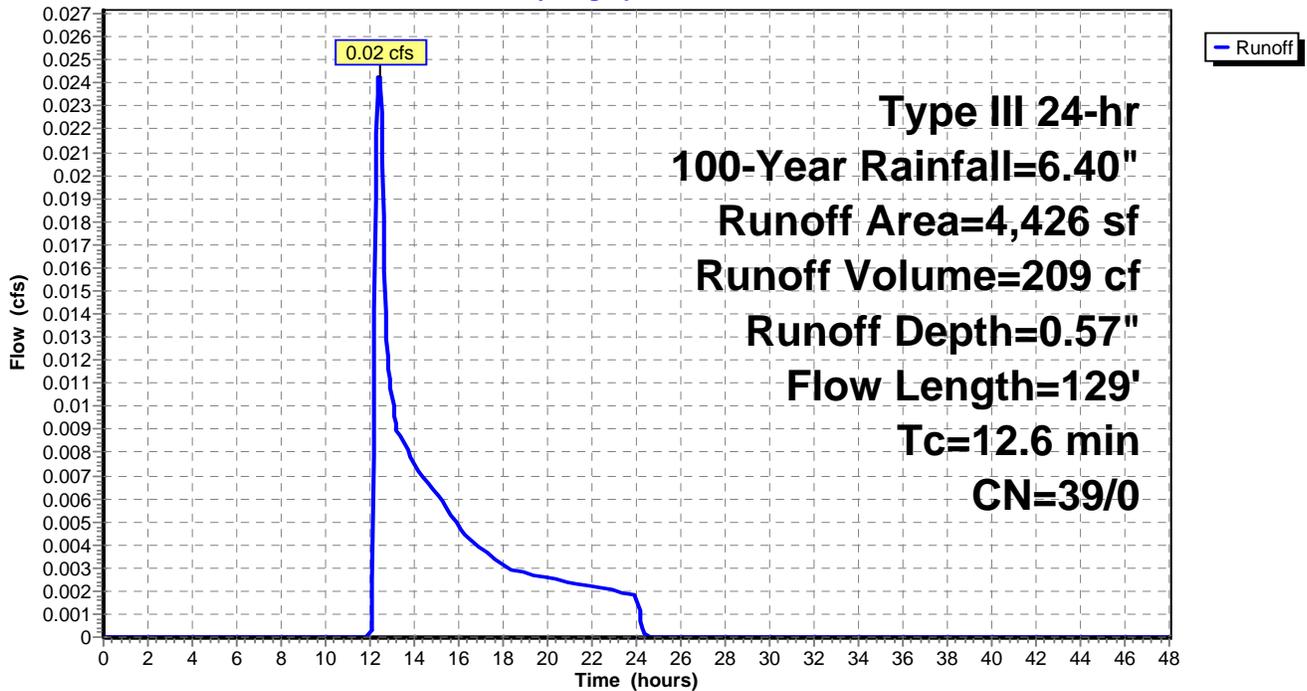
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
4,426	39	>75% Grass cover, Good, HSG A
4,426	39	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.2	50	0.0080	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.4	79	0.0400	3.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
12.6	129	Total			

Subcatchment PS-2: To West

Hydrograph



Summary for Subcatchment PS-3: To Northeast

Runoff = 0.01 cfs @ 12.50 hrs, Volume= 119 cf, Depth= 0.34"

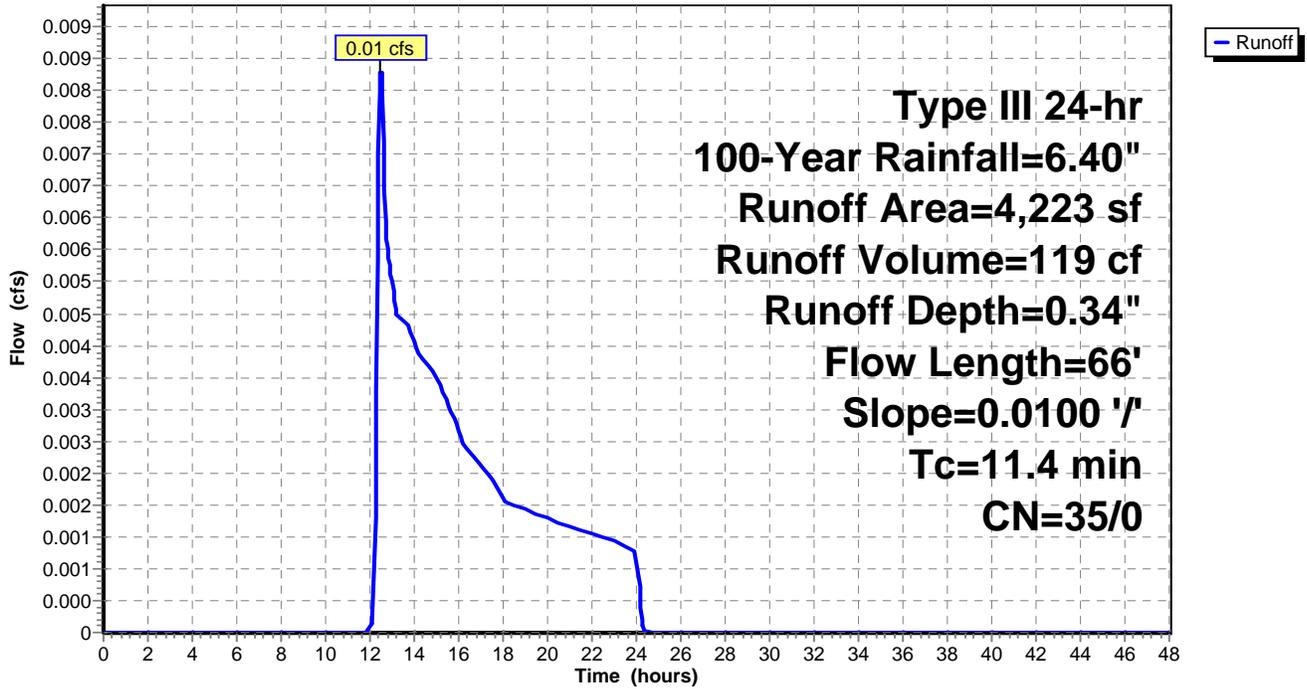
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
2,427	39	>75% Grass cover, Good, HSG A
1,796	30	Woods, Good, HSG A
4,223	35	Weighted Average
4,223	35	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0100	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.2	16	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.4	66	Total			

Subcatchment PS-3: To Northeast

Hydrograph



Summary for Subcatchment PS-4: To East

Runoff = 0.07 cfs @ 12.47 hrs, Volume= 676 cf, Depth= 0.45"

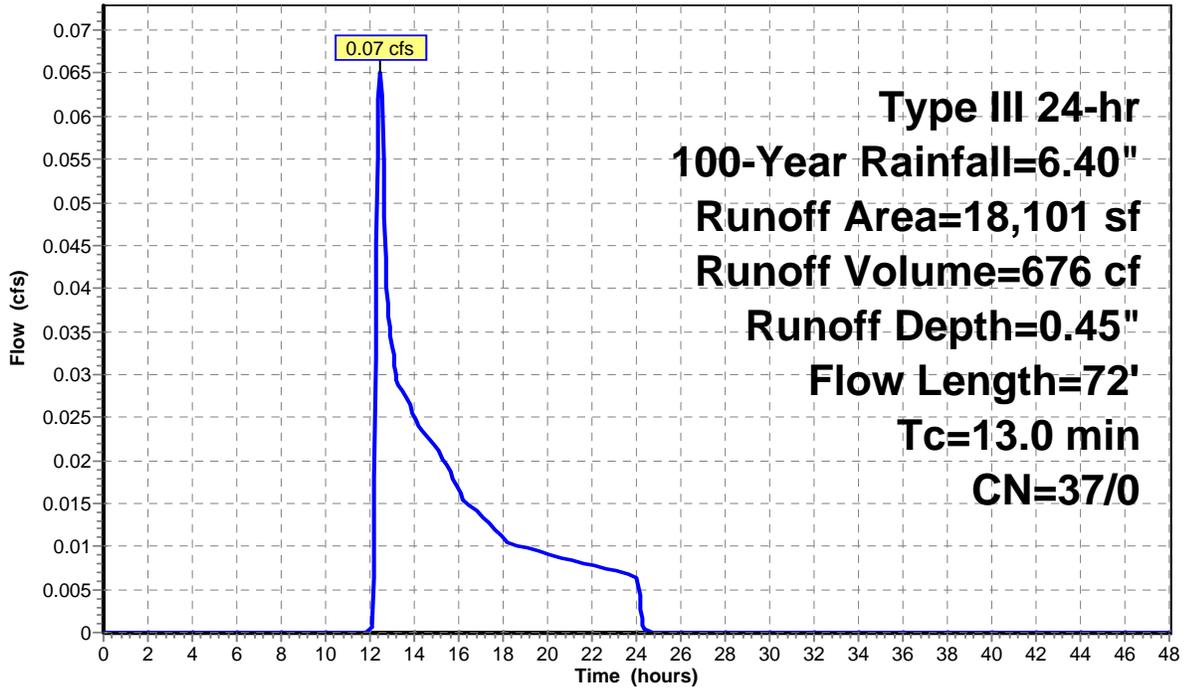
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
14,935	39	>75% Grass cover, Good, HSG A
3,166	30	Woods, Good, HSG A
18,101	37	Weighted Average
18,101	37	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0070	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.1	22	0.1800	6.83		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.0	72	Total			

Subcatchment PS-4: To East

Hydrograph



Summary for Subcatchment PS-5: To Southwest

Runoff = 0.01 cfs @ 12.51 hrs, Volume= 129 cf, Depth= 0.29"

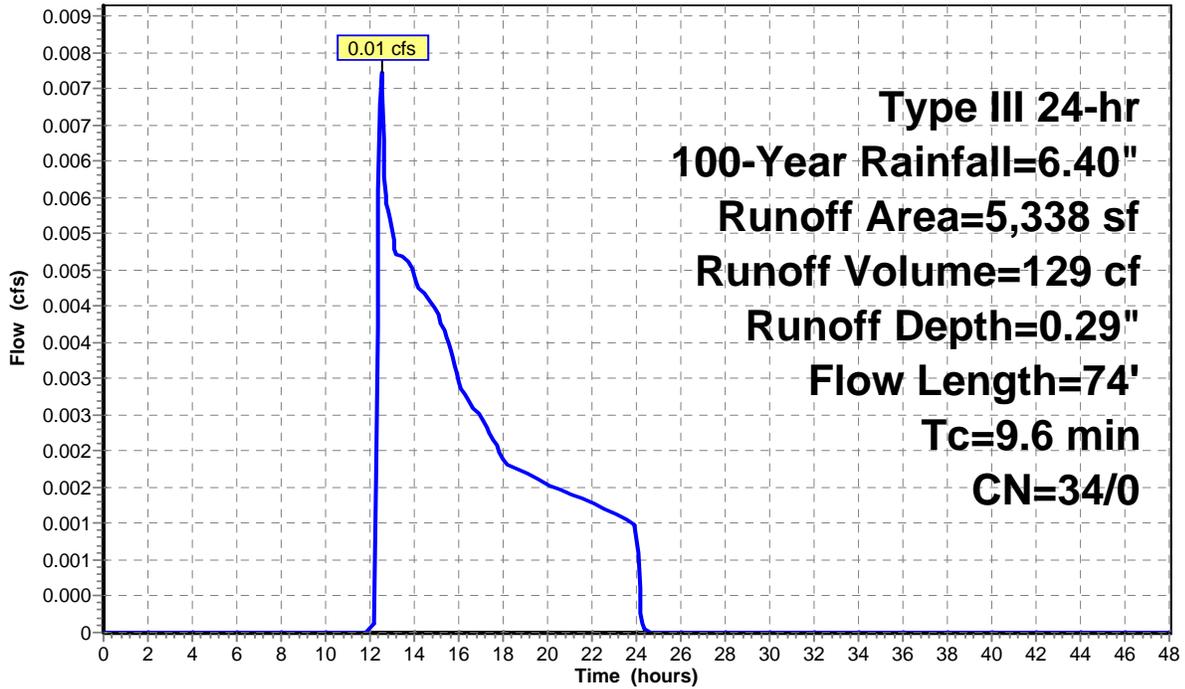
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
2,173	39	>75% Grass cover, Good, HSG A
3,165	30	Woods, Good, HSG A
5,338	34	Weighted Average
5,338	34	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0420	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.00"
0.1	24	0.0440	3.38		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.6	74	Total			

Subcatchment PS-5: To Southwest

Hydrograph



Summary for Subcatchment PS-6A: To Subsurface #1

Runoff = 6.07 cfs @ 12.20 hrs, Volume= 29,394 cf, Depth= 4.46"

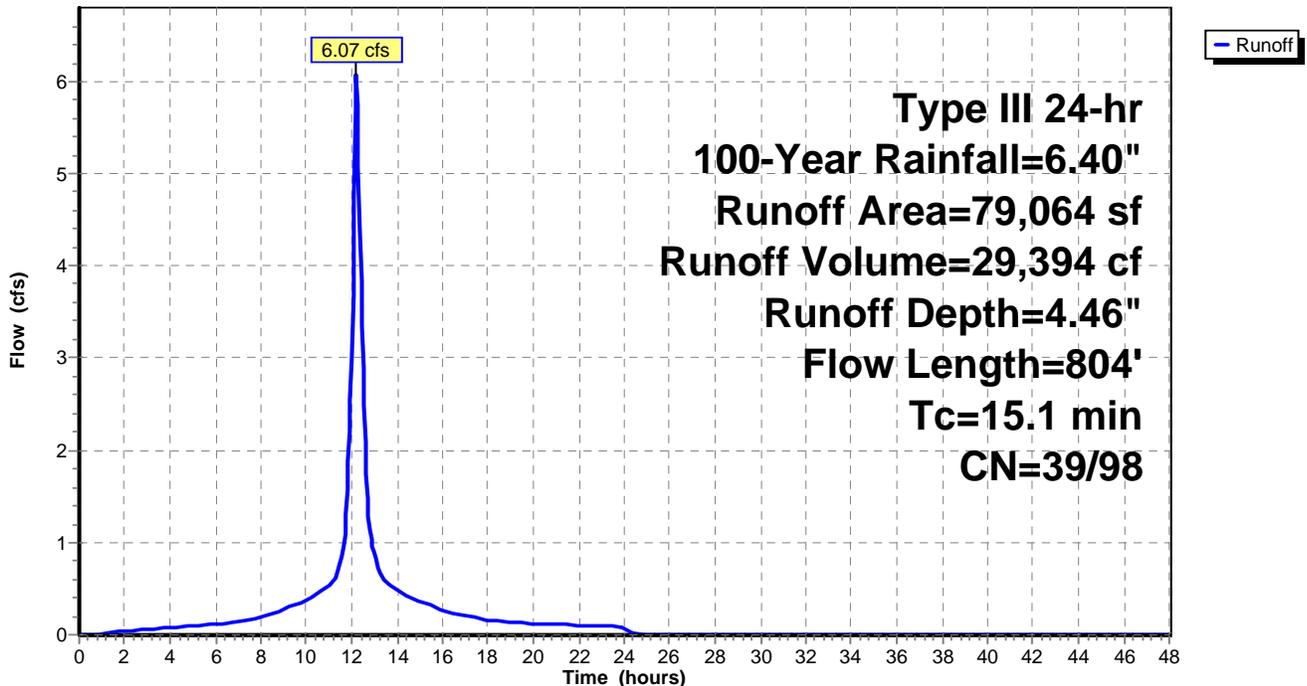
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
34,605	98	Paved parking, HSG A
20,435	98	Roofs, HSG A
24,024	39	>75% Grass cover, Good, HSG A
79,064	80	Weighted Average
24,024	39	30.39% Pervious Area
55,040	98	69.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0090	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
1.4	124	0.0050	1.44		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.1	392	0.0150	6.02	4.73	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.9	238	0.0050	4.55	8.05	Pipe Channel, 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
15.1	804	Total			

Subcatchment PS-6A: To Subsurface #1

Hydrograph



Summary for Subcatchment PS-6B: To Subsurface #2

Runoff = 3.20 cfs @ 12.16 hrs, Volume= 14,069 cf, Depth= 4.88"

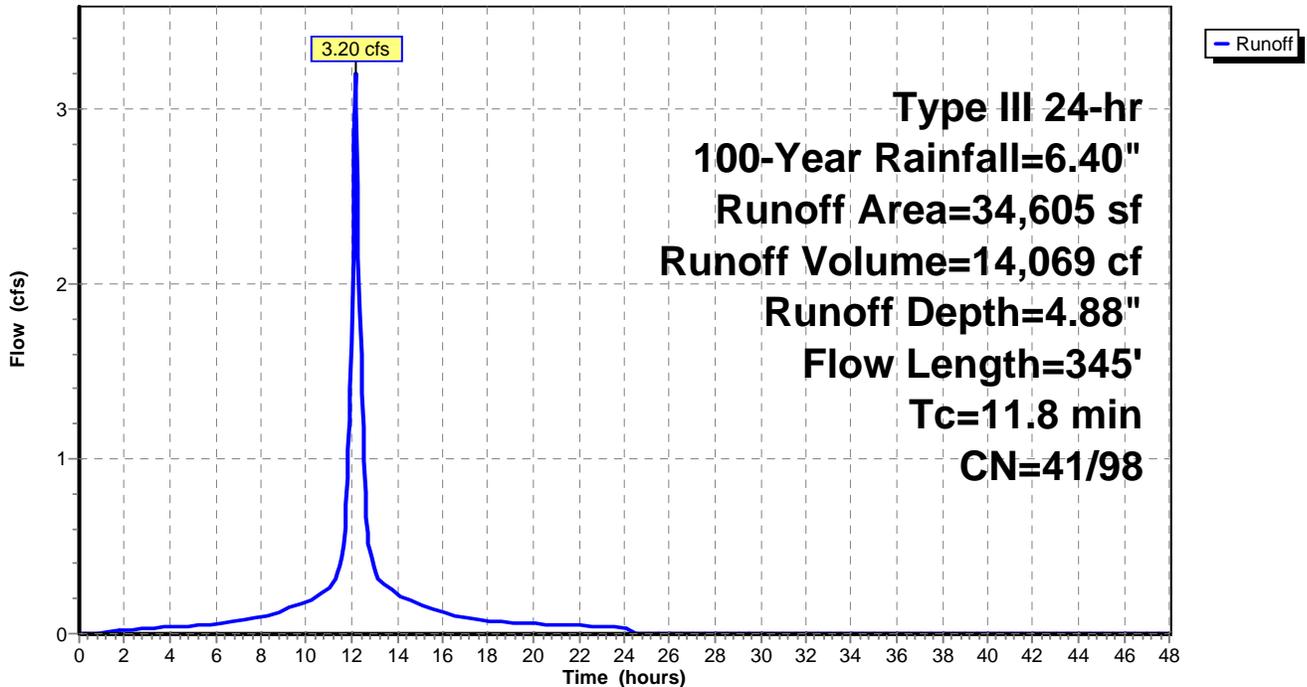
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
16,507	98	Paved parking, HSG A
6,553	98	Roofs, HSG A
7,595	39	>75% Grass cover, Good, HSG A
514	98	Paved parking, HSG C
2,914	98	Roofs, HSG C
522	74	>75% Grass cover, Good, HSG C
34,605	85	Weighted Average
8,117	41	23.46% Pervious Area
26,488	98	76.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	35	0.0080	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.0150	2.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	96	0.0420	4.16		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.9	162	0.0050	1.44		Shallow Concentrated Flow, Paved Kv= 20.3 fps
11.8	345	Total			

Subcatchment PS-6B: To Subsurface #2

Hydrograph



Summary for Subcatchment PS-6C1: To PYD-1

Runoff = 0.22 cfs @ 12.32 hrs, Volume= 1,547 cf, Depth= 0.76"

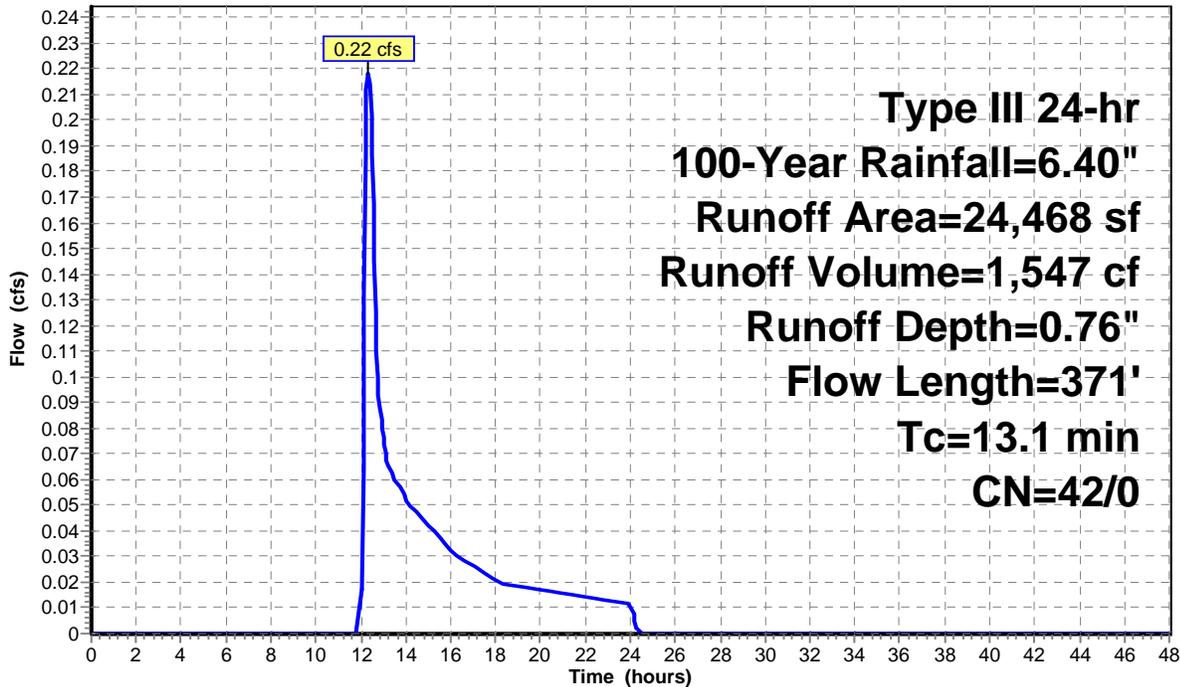
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
2,900	98	Unconnected roofs, HSG A
11,187	39	>75% Grass cover, Good, HSG A
10,381	30	Woods, Good, HSG A
24,468	42	Weighted Average
24,468	42	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0110	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
2.3	321	0.0210	2.33		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.1	371	Total			

Subcatchment PS-6C1: To PYD-1

Hydrograph



Summary for Subcatchment PS-6C2: To PYD-2

Runoff = 0.12 cfs @ 12.15 hrs, Volume= 660 cf, Depth= 1.02"

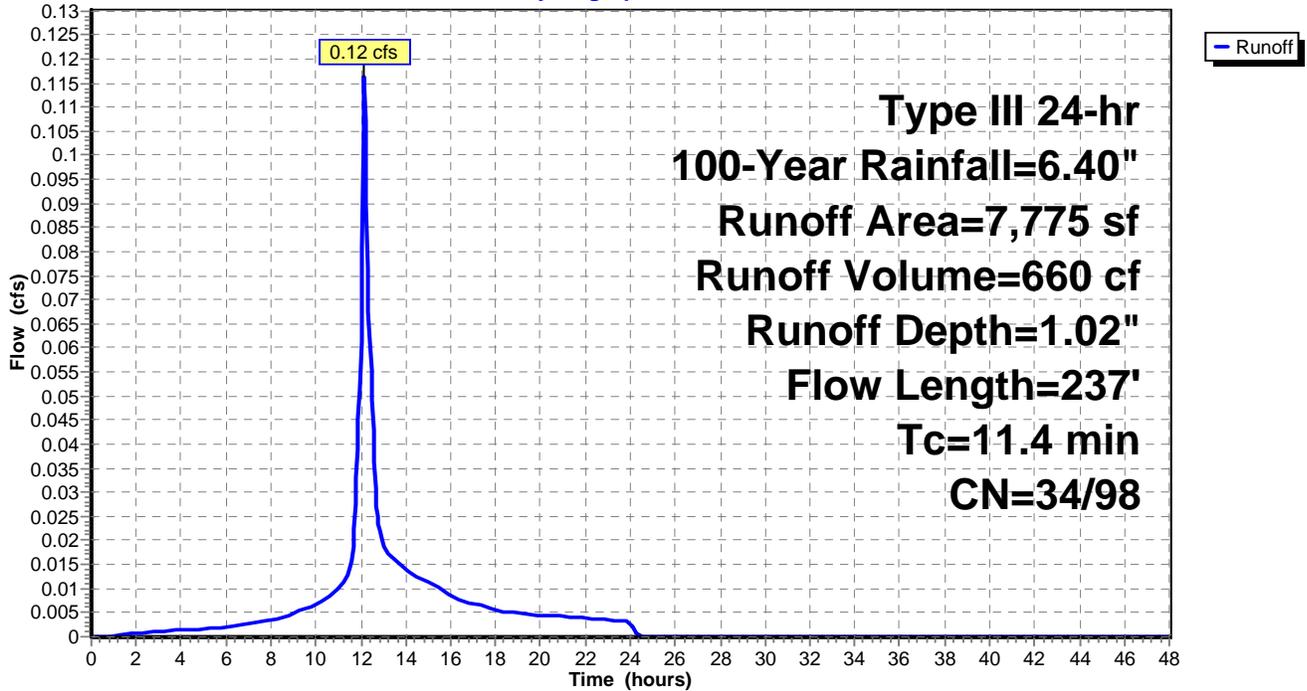
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
966	98	Roofs, HSG A
3,165	39	>75% Grass cover, Good, HSG A
3,644	30	Woods, Good, HSG A
7,775	42	Weighted Average
6,809	34	87.58% Pervious Area
966	98	12.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0120	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
1.0	187	0.0390	3.18		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.4	237	Total			

Subcatchment PS-6C2: To PYD-2

Hydrograph



Summary for Subcatchment PS-6C3: To PDMH-11

Runoff = 0.14 cfs @ 12.09 hrs, Volume= 496 cf, Depth= 6.16"

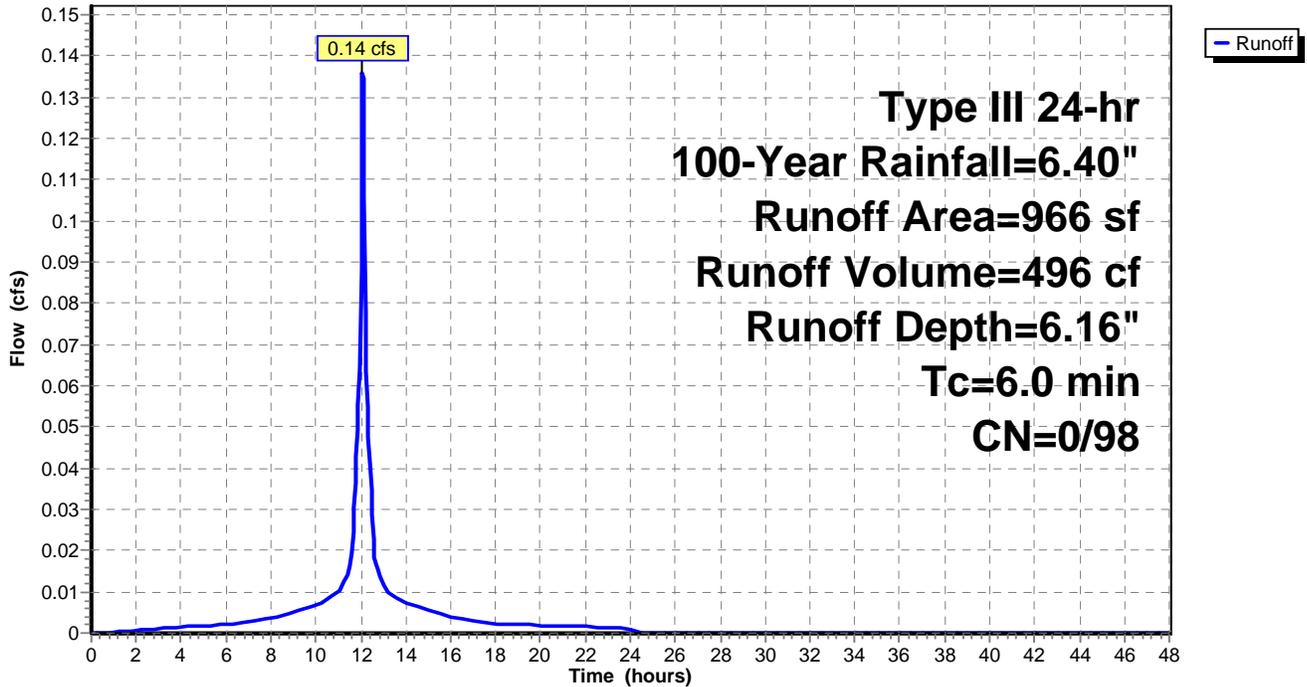
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
966	98	Roofs, HSG A
966	98	100.00% Impervious Area

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

Subcatchment PS-6C3: To PDMH-11

Hydrograph



Summary for Subcatchment PS-6C4: To Swale

Runoff = 1.49 cfs @ 12.13 hrs, Volume= 5,243 cf, Depth= 4.04"

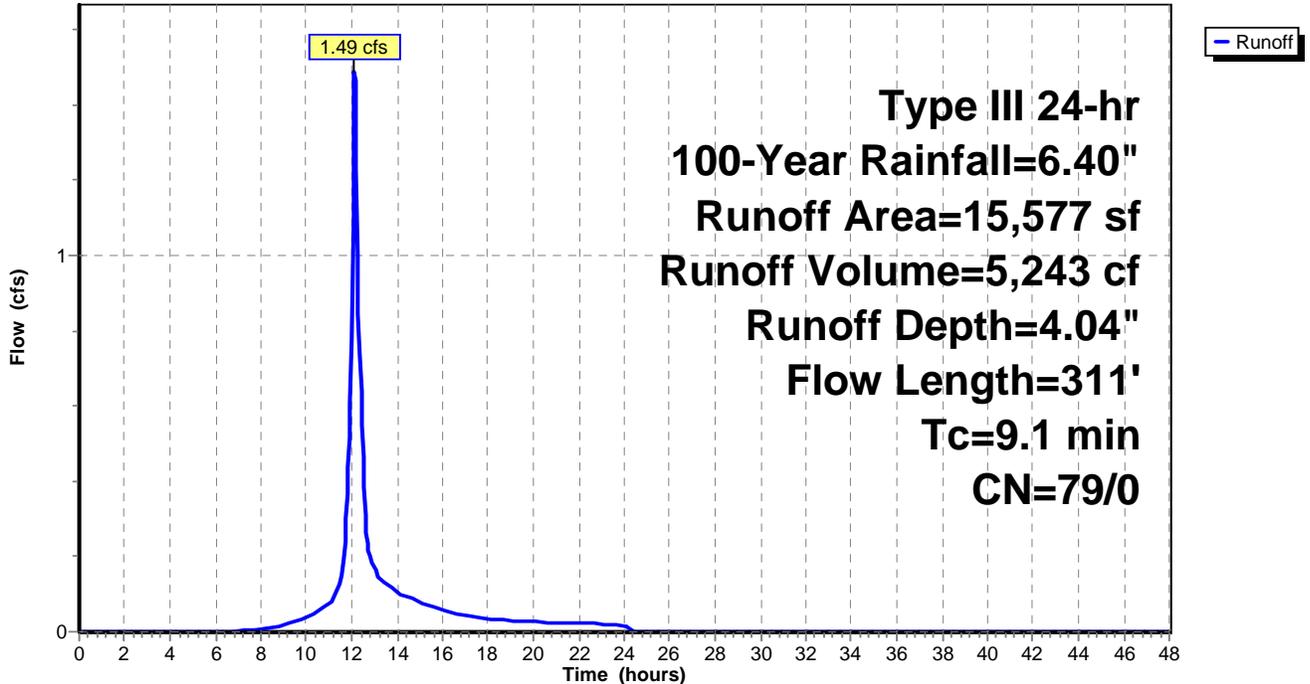
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
2,520	98	Unconnected roofs, HSG A
1,994	39	>75% Grass cover, Good, HSG A
3,928	98	Unconnected roofs, HSG C
7,135	74	>75% Grass cover, Good, HSG C
15,577	79	Weighted Average
15,577	79	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	28	0.0080	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
1.4	283	0.0450	3.42		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
9.1	311	Total			

Subcatchment PS-6C4: To Swale

Hydrograph



Summary for Subcatchment PS-6C5: To Infiltration Basin

Runoff = 1.22 cfs @ 12.11 hrs, Volume= 4,107 cf, Depth= 3.41"

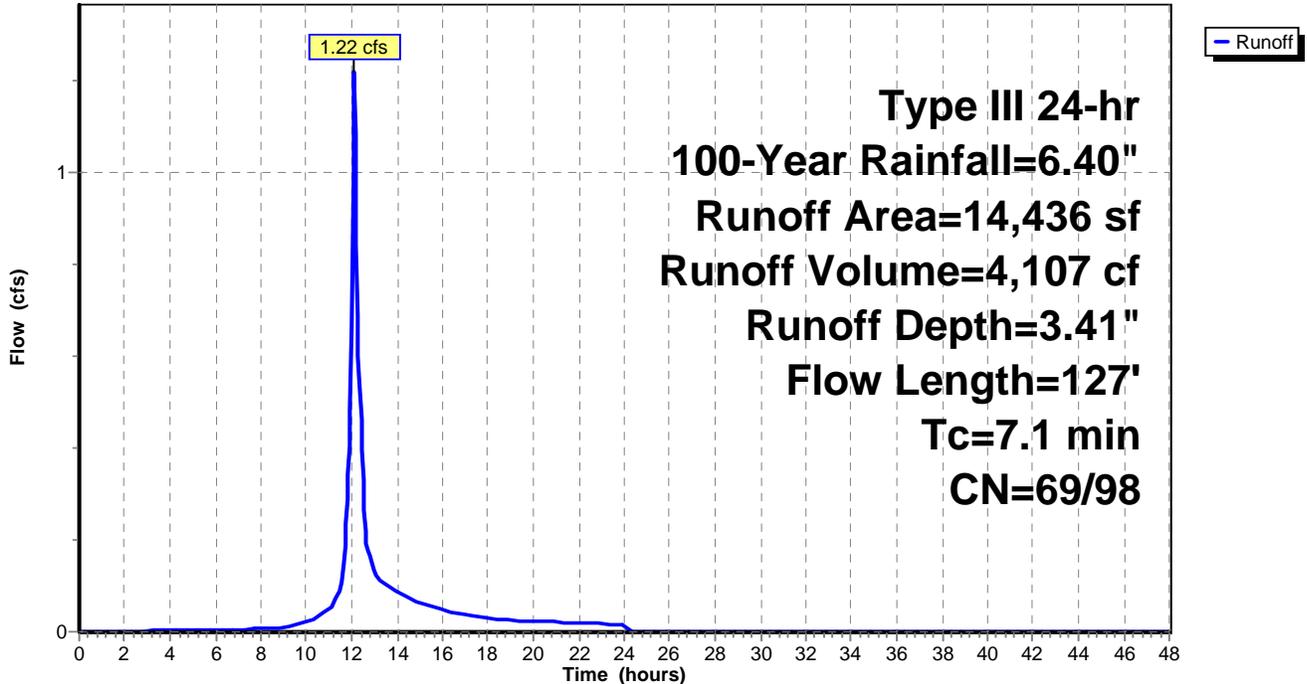
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
1,725	39	>75% Grass cover, Good, HSG A
10,933	74	>75% Grass cover, Good, HSG C
1,778	98	Water Surface, HSG C
14,436	73	Weighted Average
12,658	69	87.68% Pervious Area
1,778	98	12.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	40	0.0220	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.3	87	0.0770	4.47		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.1	127	Total			

Subcatchment PS-6C5: To Infiltration Basin

Hydrograph



Summary for Subcatchment PS-6D: To South

Runoff = 0.45 cfs @ 12.10 hrs, Volume= 1,460 cf, Depth= 3.03"

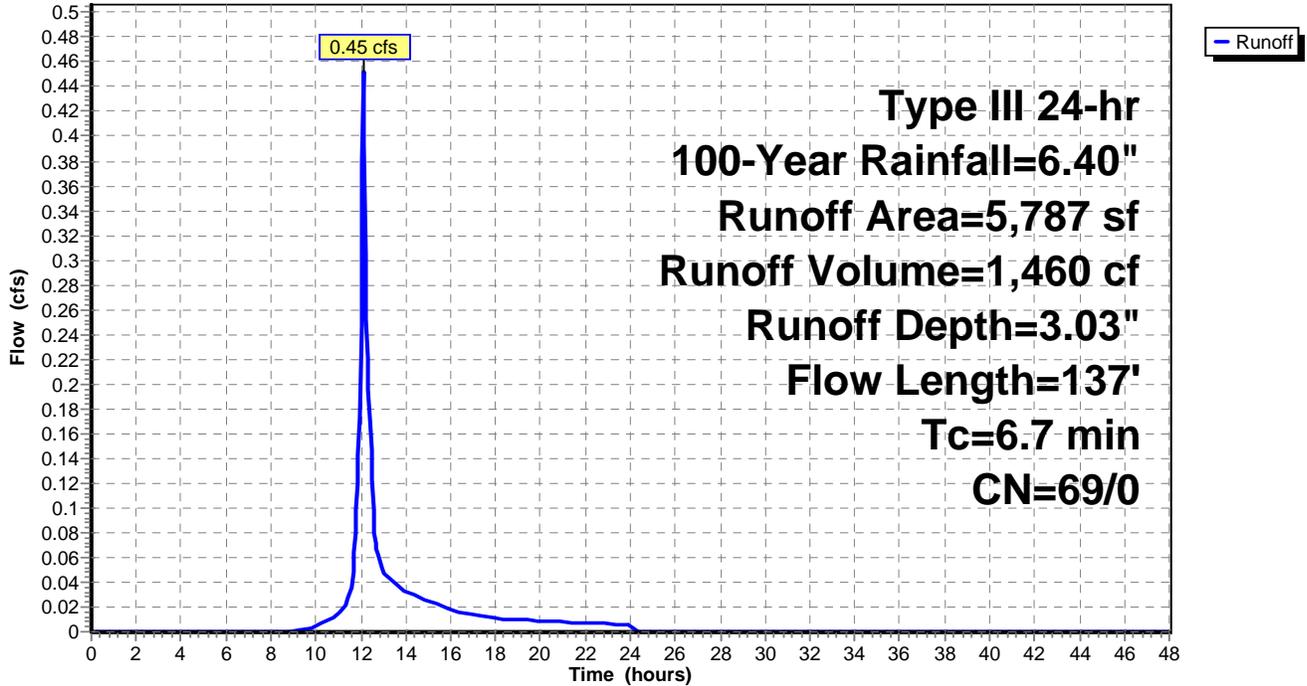
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv. UI as Pervious, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
817	39	>75% Grass cover, Good, HSG A
4,970	74	>75% Grass cover, Good, HSG C
5,787	69	Weighted Average
5,787	69	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.0400	0.13		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
0.2	46	0.0420	3.30		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.1	41	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.7	137	Total			

Subcatchment PS-6D: To South

Hydrograph



Summary for Reach 1R: Swale 1

Inflow Area = 24,468 sf, 0.00% Impervious, Inflow Depth = 0.76" for 100-Year event
 Inflow = 0.22 cfs @ 12.32 hrs, Volume= 1,547 cf
 Outflow = 0.22 cfs @ 12.32 hrs, Volume= 1,548 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Max. Velocity= 1.20 fps, Min. Travel Time= 0.0 min
 Avg. Velocity = 0.54 fps, Avg. Travel Time= 0.1 min

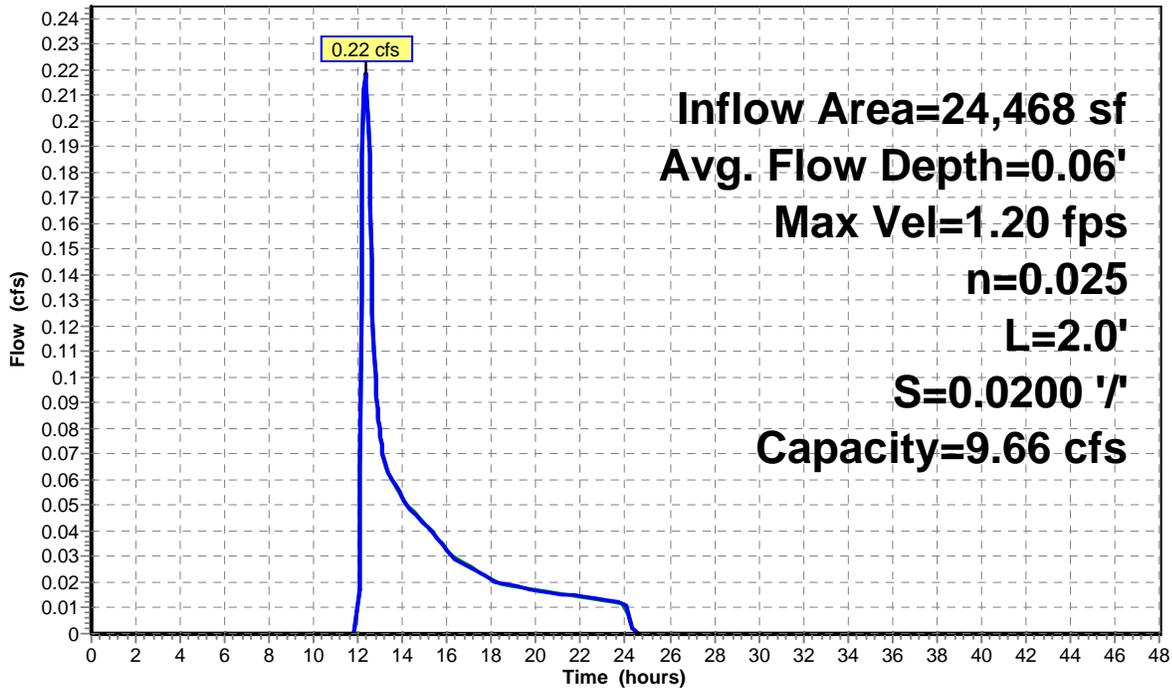
Peak Storage= 0 cf @ 12.32 hrs
 Average Depth at Peak Storage= 0.06'
 Bank-Full Depth= 0.50' Flow Area= 2.3 sf, Capacity= 9.66 cfs

3.00' x 0.50' deep channel, n= 0.025 Earth, clean & winding
 Side Slope Z-value= 3.0 '/' Top Width= 6.00'
 Length= 2.0' Slope= 0.0200 '/'
 Inlet Invert= 196.54', Outlet Invert= 196.50'



Reach 1R: Swale 1

Hydrograph



Summary for Reach 2R: Swale #2

Inflow Area = 7,775 sf, 12.42% Impervious, Inflow Depth = 1.02" for 100-Year event
 Inflow = 0.12 cfs @ 12.15 hrs, Volume= 660 cf
 Outflow = 0.12 cfs @ 12.15 hrs, Volume= 660 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Max. Velocity= 0.95 fps, Min. Travel Time= 0.0 min
 Avg. Velocity = 0.31 fps, Avg. Travel Time= 0.1 min

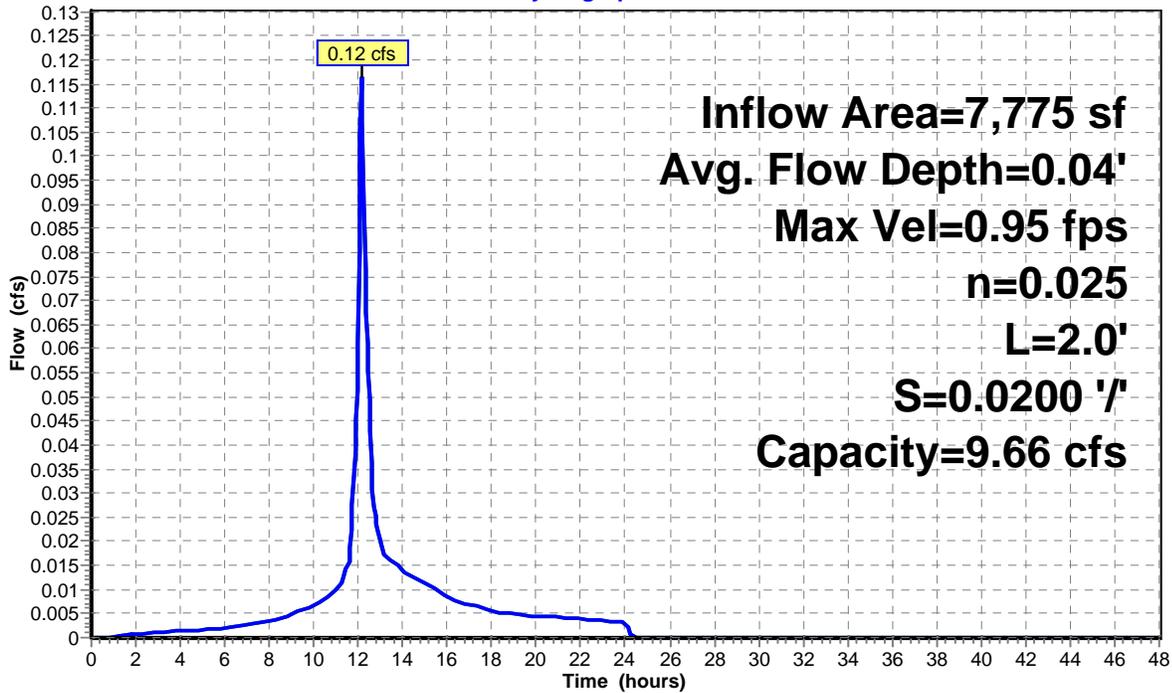
Peak Storage= 0 cf @ 12.15 hrs
 Average Depth at Peak Storage= 0.04'
 Bank-Full Depth= 0.50' Flow Area= 2.3 sf, Capacity= 9.66 cfs

3.00' x 0.50' deep channel, n= 0.025 Earth, clean & winding
 Side Slope Z-value= 3.0 '/' Top Width= 6.00'
 Length= 2.0' Slope= 0.0200 '/'
 Inlet Invert= 190.54', Outlet Invert= 190.50'



Reach 2R: Swale #2

Hydrograph



— Inflow
 — Outflow

Summary for Reach 3R: Swale #3

Inflow Area = 15,577 sf, 0.00% Impervious, Inflow Depth = 4.04" for 100-Year event
 Inflow = 1.49 cfs @ 12.13 hrs, Volume= 5,243 cf
 Outflow = 1.44 cfs @ 12.15 hrs, Volume= 5,243 cf, Atten= 3%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Max. Velocity= 3.10 fps, Min. Travel Time= 0.7 min
 Avg. Velocity = 0.86 fps, Avg. Travel Time= 2.5 min

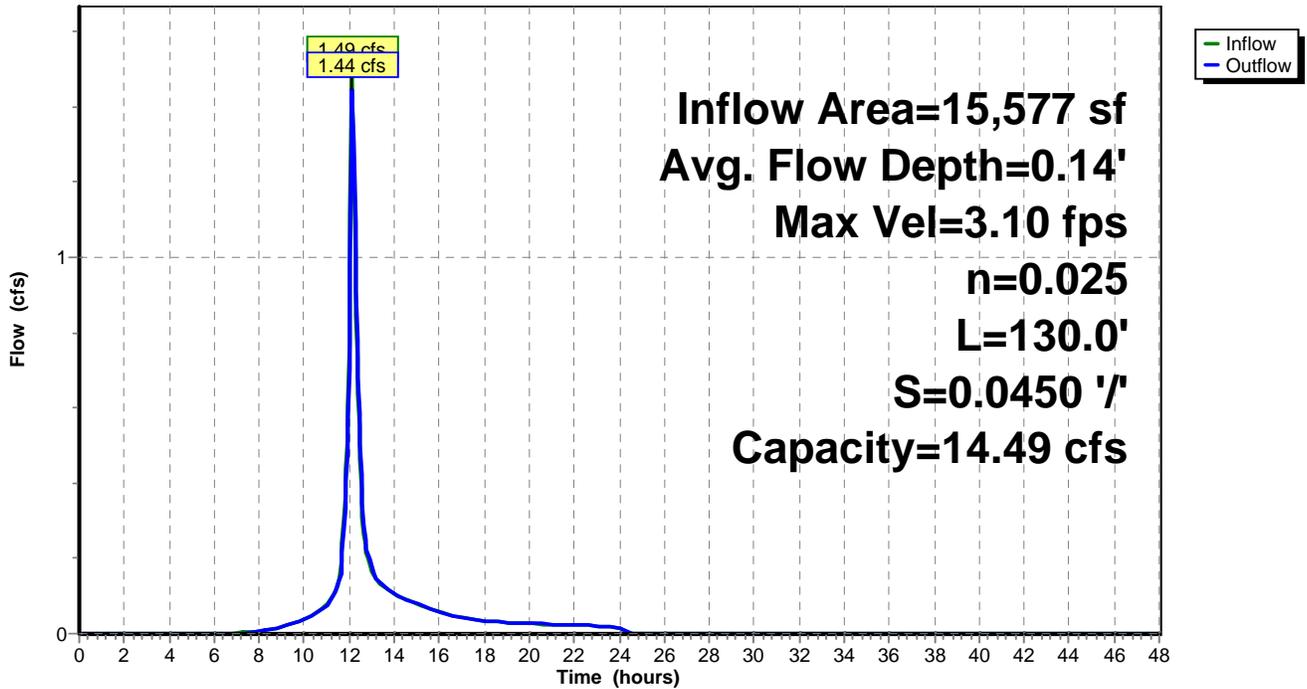
Peak Storage= 62 cf @ 12.14 hrs
 Average Depth at Peak Storage= 0.14'
 Bank-Full Depth= 0.50' Flow Area= 2.3 sf, Capacity= 14.49 cfs

3.00' x 0.50' deep channel, n= 0.025 Earth, clean & winding
 Side Slope Z-value= 3.0 '/' Top Width= 6.00'
 Length= 130.0' Slope= 0.0450 '/'
 Inlet Invert= 190.85', Outlet Invert= 185.00'



Reach 3R: Swale #3

Hydrograph



Summary for Pond 1P: Subsurface #1

Inflow Area = 79,064 sf, 69.61% Impervious, Inflow Depth = 4.46" for 100-Year event
 Inflow = 6.07 cfs @ 12.20 hrs, Volume= 29,394 cf
 Outflow = 0.86 cfs @ 12.98 hrs, Volume= 29,394 cf, Atten= 86%, Lag= 46.9 min
 Discarded = 0.31 cfs @ 9.50 hrs, Volume= 21,825 cf
 Primary = 0.55 cfs @ 12.98 hrs, Volume= 7,569 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 204.80' @ 12.98 hrs Surf.Area= 5,558 sf Storage= 11,882 cf
 Flood Elev= 204.90' Surf.Area= 5,558 sf Storage= 12,104 cf

Plug-Flow detention time= 174.9 min calculated for 29,363 cf (100% of inflow)
 Center-of-Mass det. time= 174.8 min (935.2 - 760.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	201.40'	4,900 cf	63.25'W x 87.88'L x 3.50'H Field A 19,454 cf Overall - 7,203 cf Embedded = 12,251 cf x 40.0% Voids
#2A	201.90'	7,203 cf	ADS_StormTech SC-740 x 156 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 13 rows
#3	206.40'	120 cf	Roadway Flooding (Irregular) Listed below (Recalc) -Impervious
		12,223 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
206.40	2	4.0	0	0	2
206.60	138	76.0	10	10	460
206.80	1,108	1,939.0	109	120	299,190

Device	Routing	Invert	Outlet Devices
#1	Discarded	201.40'	2.410 in/hr Exfiltration over Surface area
#2	Primary	201.40'	12.0" Round Culvert L= 155.0' Ke= 0.500 Inlet / Outlet Invert= 201.40' / 197.10' S= 0.0277 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	202.90'	4.0" Vert. Orifice/Grate C= 0.600
#4	Device 2	204.90'	4.0' long Overflow Weir 2 End Contraction(s)

Discarded OutFlow Max=0.31 cfs @ 9.50 hrs HW=201.45' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.55 cfs @ 12.98 hrs HW=204.80' (Free Discharge)
 ↑2=Culvert (Passes 0.55 cfs of 6.44 cfs potential flow)
 ↑3=Orifice/Grate (Orifice Controls 0.55 cfs @ 6.34 fps)
 ↑4=Overflow Weir (Controls 0.00 cfs)

Pond 1P: Subsurface #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 (ADS StormTech® SC-740)

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 6.45 sf x 13 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

12 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 85.88' Row Length +12.0" End Stone x 2 = 87.88' Base Length

13 Rows x 51.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 63.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

156 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 13 Rows = 7,203.4 cf Chamber Storage

19,454.1 cf Field - 7,203.4 cf Chambers = 12,250.7 cf Stone x 40.0% Voids = 4,900.3 cf Stone Storage

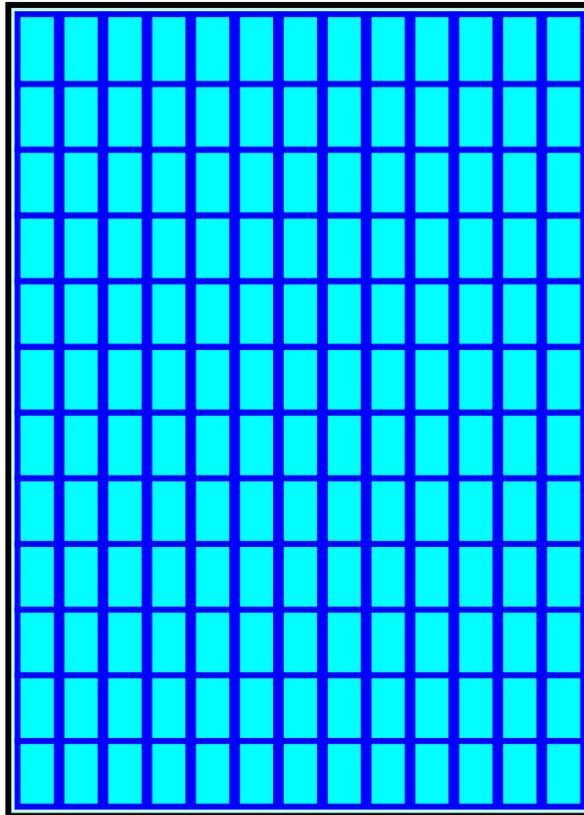
Chamber Storage + Stone Storage = 12,103.7 cf = 0.278 af

Overall Storage Efficiency = 62.2%

156 Chambers

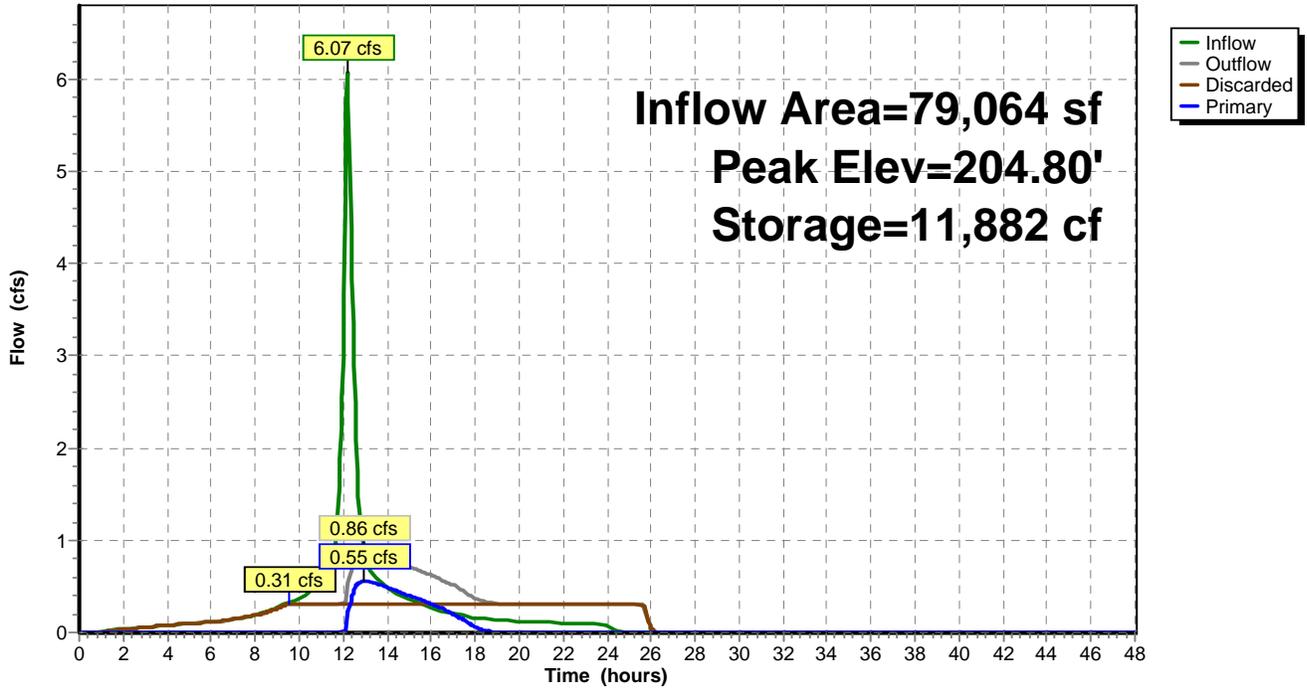
720.5 cy Field

453.7 cy Stone



Pond 1P: Subsurface #1

Hydrograph



Summary for Pond 2P: Subsurface #2

Inflow Area = 34,605 sf, 76.54% Impervious, Inflow Depth = 4.88" for 100-Year event
 Inflow = 3.20 cfs @ 12.16 hrs, Volume= 14,069 cf
 Outflow = 1.97 cfs @ 12.39 hrs, Volume= 14,069 cf, Atten= 39%, Lag= 14.0 min
 Discarded = 0.12 cfs @ 8.90 hrs, Volume= 9,197 cf
 Primary = 1.84 cfs @ 12.39 hrs, Volume= 4,872 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 200.31' @ 12.39 hrs Surf.Area= 2,209 sf Storage= 4,757 cf
 Flood Elev= 200.10' Surf.Area= 2,209 sf Storage= 4,757 cf

Plug-Flow detention time= 146.6 min calculated for 14,069 cf (100% of inflow)
 Center-of-Mass det. time= 146.5 min (902.3 - 755.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	196.60'	1,983 cf	30.00'W x 73.64'L x 3.50'H Field A 7,732 cf Overall - 2,773 cf Embedded = 4,959 cf x 40.0% Voids
#2A	197.10'	2,773 cf	ADS_StormTech SC-740 x 60 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 6 rows
#3	201.92'	84 cf	Roadway Flooding (Irregular) Listed below (Recalc) -Impervious
		4,841 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
201.92	2	4.0	0	0	2
202.00	37	38.0	1	1	116
202.20	1,009	242.0	83	84	4,661

Device	Routing	Invert	Outlet Devices
#1	Discarded	196.60'	2.410 in/hr Exfiltration over Surface area
#2	Primary	196.60'	12.0" Round Culvert L= 135.0' Ke= 0.500 Inlet / Outlet Invert= 196.60' / 187.51' S= 0.0673 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	198.35'	4.0" Vert. Orifice/Grate C= 0.600
#4	Device 2	200.10'	4.0' long Overflow Weir 2 End Contraction(s)

Discarded OutFlow Max=0.12 cfs @ 8.90 hrs HW=196.66' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=1.73 cfs @ 12.39 hrs HW=200.30' (Free Discharge)
 ↑2=Culvert (Passes 1.73 cfs of 6.77 cfs potential flow)
 ↑3=Orifice/Grate (Orifice Controls 0.56 cfs @ 6.43 fps)
 ↑4=Overflow Weir (Weir Controls 1.17 cfs @ 1.47 fps)

Pond 2P: Subsurface #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 (ADS StormTech® SC-740)

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 6.45 sf x 6 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

10 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 71.64' Row Length +12.0" End Stone x 2 = 73.64' Base Length

6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

60 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 6 Rows = 2,773.4 cf Chamber Storage

7,732.0 cf Field - 2,773.4 cf Chambers = 4,958.7 cf Stone x 40.0% Voids = 1,983.5 cf Stone Storage

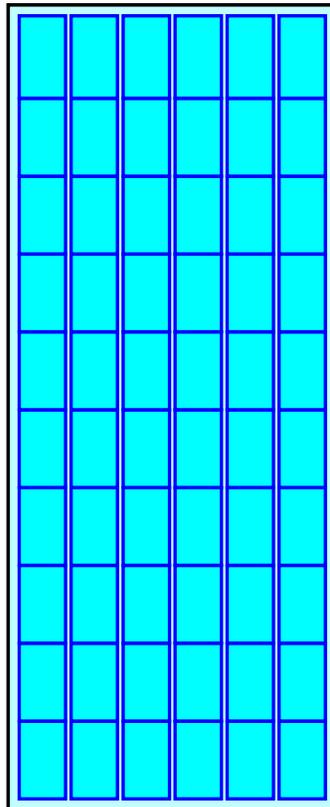
Chamber Storage + Stone Storage = 4,756.8 cf = 0.109 af

Overall Storage Efficiency = 61.5%

60 Chambers

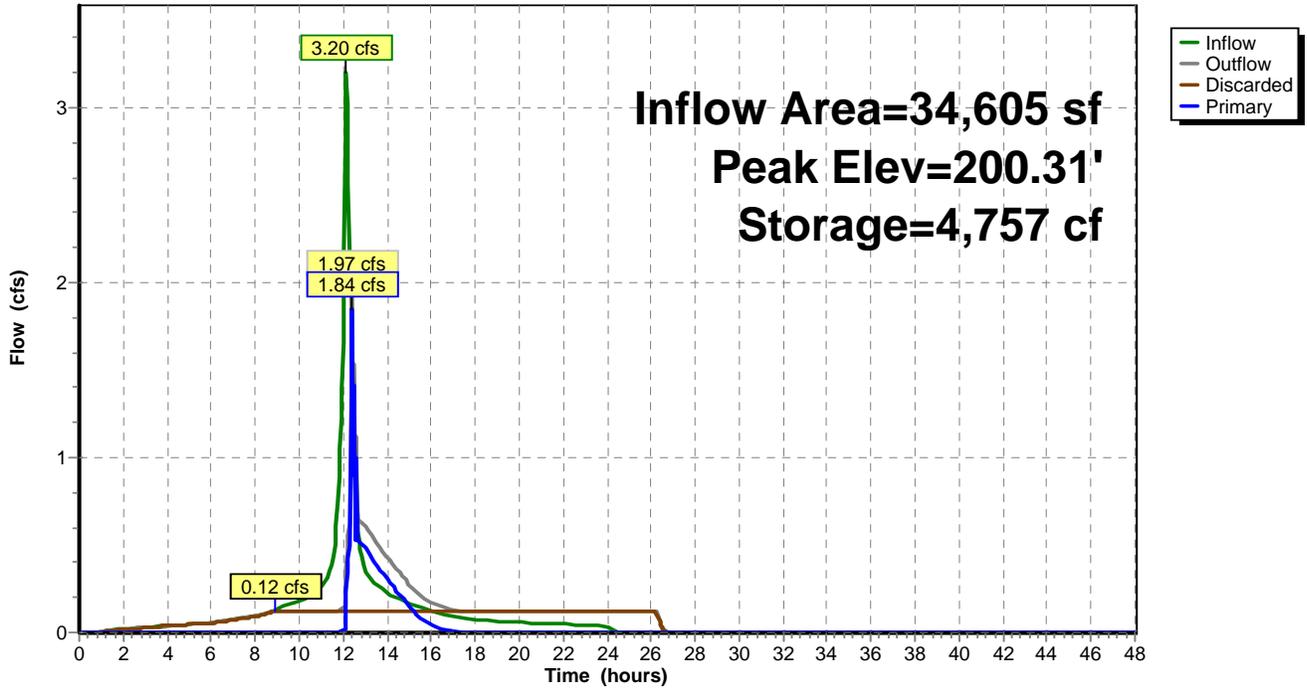
286.4 cy Field

183.7 cy Stone



Pond 2P: Subsurface #2

Hydrograph



Summary for Pond 3P: Infiltration Basin

Inflow Area = 176,891 sf, 48.19% Impervious, Inflow Depth = 1.66" for 100-Year event
 Inflow = 3.72 cfs @ 12.39 hrs, Volume= 24,495 cf
 Outflow = 1.34 cfs @ 13.22 hrs, Volume= 24,495 cf, Atten= 64%, Lag= 49.9 min
 Discarded = 0.10 cfs @ 13.22 hrs, Volume= 6,392 cf
 Primary = 1.24 cfs @ 13.22 hrs, Volume= 18,102 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 186.22' @ 13.22 hrs Surf.Area= 4,324 sf Storage= 6,536 cf
 Flood Elev= 186.50' Surf.Area= 4,720 sf Storage= 7,819 cf

Plug-Flow detention time= 141.0 min calculated for 24,469 cf (100% of inflow)
 Center-of-Mass det. time= 141.6 min (979.4 - 837.8)

Volume	Invert	Avail.Storage	Storage Description
#1	184.00'	10,362 cf	Basin Storage (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
184.00	1,832	199.3	0	0	1,832
185.00	2,736	234.3	2,269	2,269	3,059
186.00	4,034	311.9	3,364	5,633	6,443
187.00	5,460	373.5	4,729	10,362	9,820

Device	Routing	Invert	Outlet Devices
#1	Discarded	184.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	183.00'	12.0" Round Culvert L= 24.0' Ke= 0.500 Inlet / Outlet Invert= 183.00' / 182.04' S= 0.0400 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	185.00'	7.0" Vert. Orifice C= 0.600
#4	Device 2	186.25'	4.0" x 4.0" Horiz. Outlet Structure Grate C= 0.600 Limited to weir flow at low heads
#5	Secondary	186.50'	10.0' long x 10.0' breadth Emergency Overflow Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

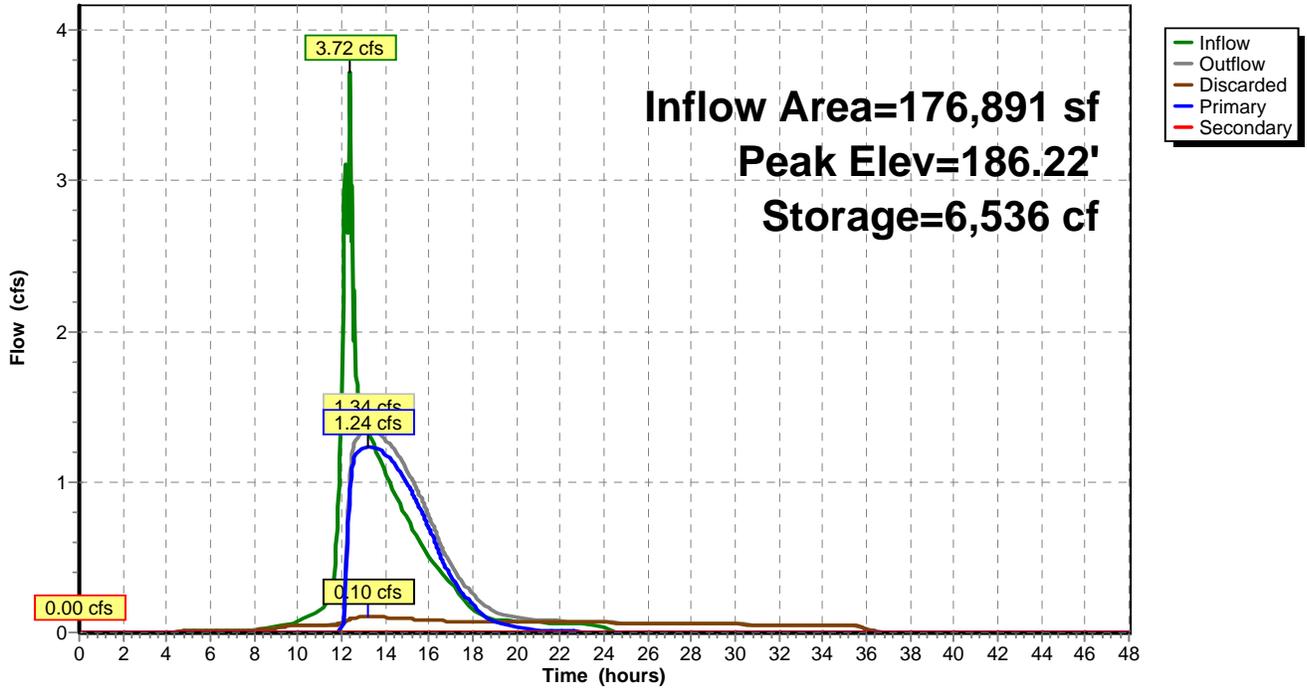
Discarded OutFlow Max=0.10 cfs @ 13.22 hrs HW=186.22' (Free Discharge)
 ↑1=**Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=1.24 cfs @ 13.22 hrs HW=186.22' (Free Discharge)
 ↑2=**Culvert** (Passes 1.24 cfs of 6.23 cfs potential flow)
 ↑3=**Orifice** (Orifice Controls 1.24 cfs @ 4.63 fps)
 ↑4=**Outlet Structure Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=184.00' (Free Discharge)
 ↑5=**Emergency Overflow** (Controls 0.00 cfs)

Pond 3P: Infiltration Basin

Hydrograph



Summary for Pond 4P: PYD-1

Inflow Area = 24,468 sf, 0.00% Impervious, Inflow Depth = 0.76" for 100-Year event
 Inflow = 0.22 cfs @ 12.32 hrs, Volume= 1,548 cf
 Outflow = 0.22 cfs @ 12.32 hrs, Volume= 1,548 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.22 cfs @ 12.32 hrs, Volume= 1,548 cf

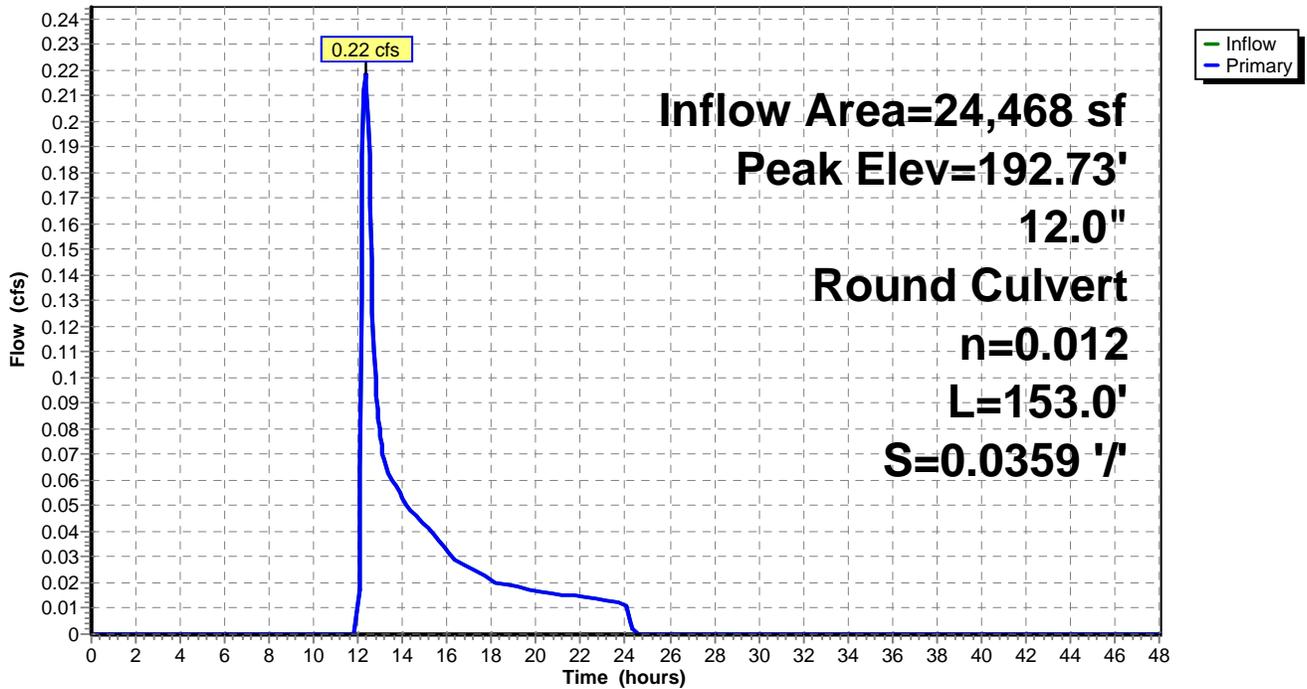
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 192.73' @ 12.32 hrs
 Flood Elev= 196.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	192.50'	12.0" Round Culvert L= 153.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 187.00' S= 0.0359 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.22 cfs @ 12.32 hrs HW=192.73' (Free Discharge)
 1=Culvert (Inlet Controls 0.22 cfs @ 1.62 fps)

Pond 4P: PYD-1

Hydrograph



Summary for Pond 5P: PYD-2

Inflow Area = 32,243 sf, 3.00% Impervious, Inflow Depth = 0.82" for 100-Year event
 Inflow = 0.30 cfs @ 12.25 hrs, Volume= 2,208 cf
 Outflow = 0.30 cfs @ 12.25 hrs, Volume= 2,208 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.30 cfs @ 12.25 hrs, Volume= 2,208 cf

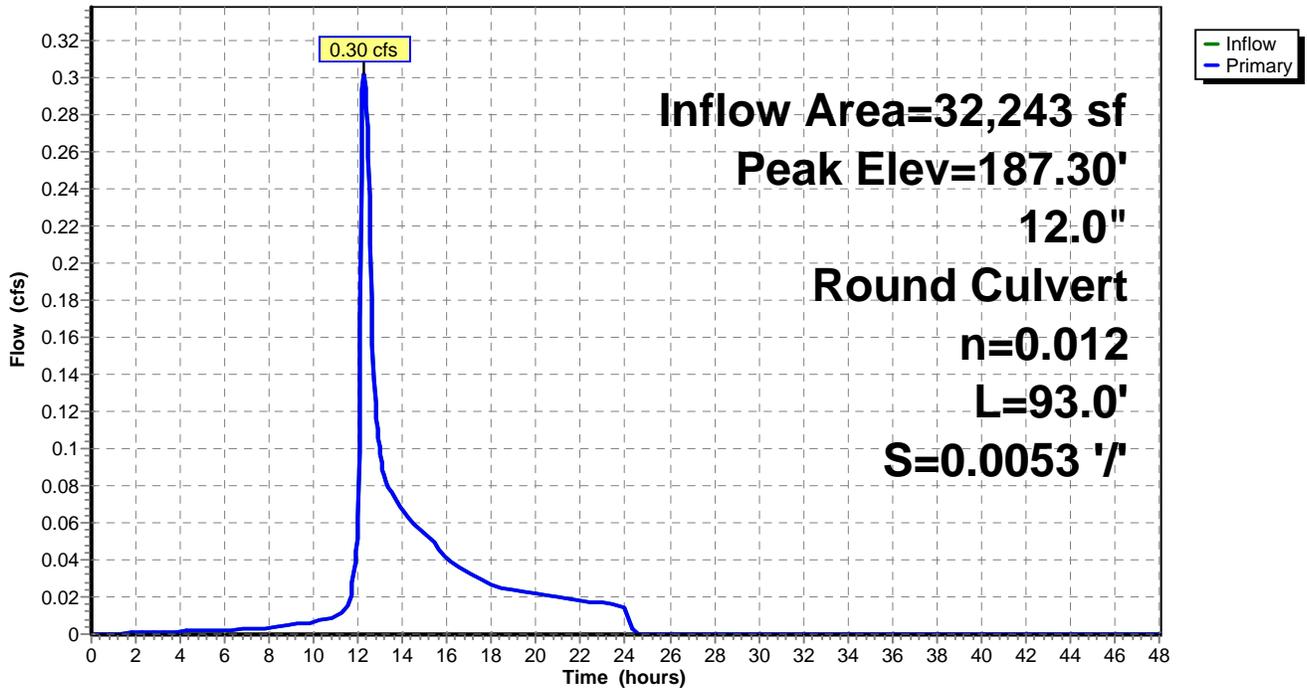
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 187.30' @ 12.25 hrs
 Flood Elev= 190.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	187.00'	12.0" Round Culvert L= 93.0' Ke= 0.500 Inlet / Outlet Invert= 187.00' / 186.51' S= 0.0053 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.30 cfs @ 12.25 hrs HW=187.30' (Free Discharge)
 1=Culvert (Barrel Controls 0.30 cfs @ 2.25 fps)

Pond 5P: PYD-2

Hydrograph



Summary for Pond 6P: PDMH-11

Inflow Area = 33,209 sf, 5.82% Impervious, Inflow Depth = 0.98" for 100-Year event
 Inflow = 0.37 cfs @ 12.21 hrs, Volume= 2,704 cf
 Outflow = 0.37 cfs @ 12.21 hrs, Volume= 2,704 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.37 cfs @ 12.21 hrs, Volume= 2,704 cf

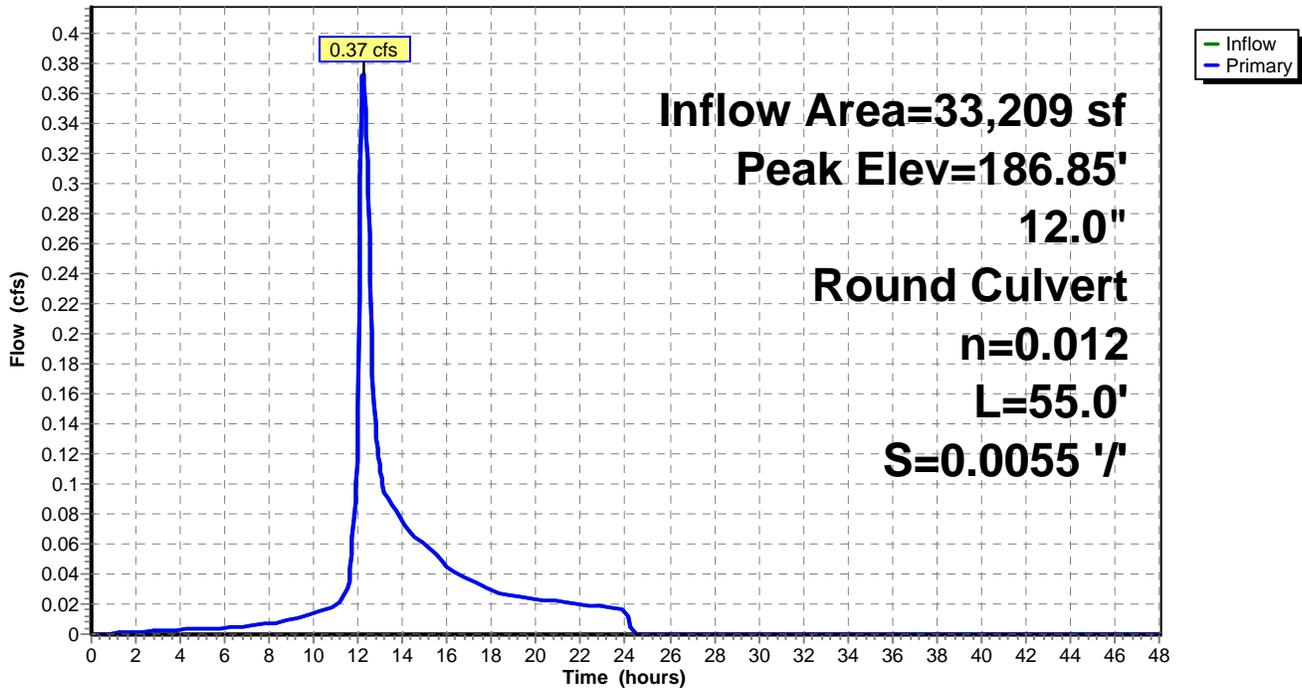
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 186.85' @ 12.21 hrs
 Flood Elev= 191.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	186.51'	12.0" Round Culvert L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 186.51' / 186.21' S= 0.0055 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.37 cfs @ 12.21 hrs HW=186.85' (Free Discharge)
 1=Culvert (Barrel Controls 0.37 cfs @ 2.36 fps)

Pond 6P: PDMH-11

Hydrograph



Summary for Pond 7P: PDMH-12

Inflow Area = 33,209 sf, 5.82% Impervious, Inflow Depth = 0.98" for 100-Year event
 Inflow = 0.37 cfs @ 12.21 hrs, Volume= 2,704 cf
 Outflow = 0.37 cfs @ 12.21 hrs, Volume= 2,704 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.37 cfs @ 12.21 hrs, Volume= 2,704 cf

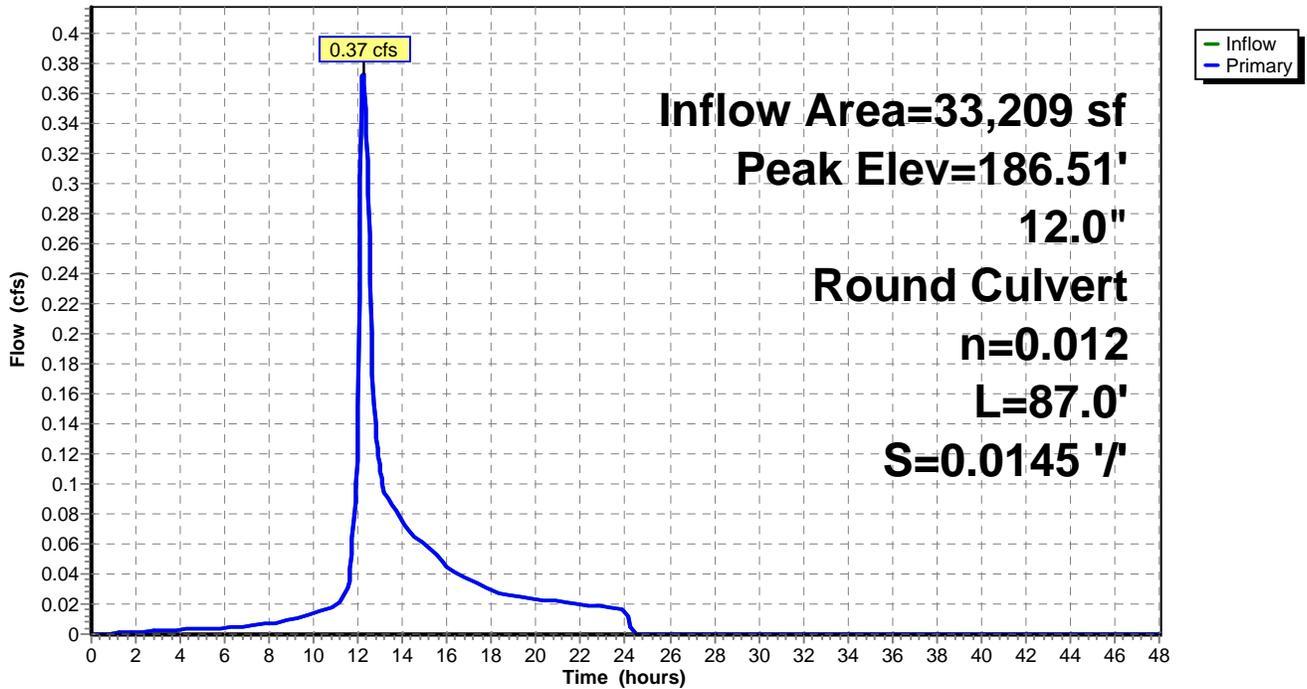
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 186.51' @ 12.21 hrs
 Flood Elev= 190.15'

Device	Routing	Invert	Outlet Devices
#1	Primary	186.21'	12.0" Round Culvert L= 87.0' Ke= 0.500 Inlet / Outlet Invert= 186.21' / 184.95' S= 0.0145 '/ Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.37 cfs @ 12.21 hrs HW=186.51' (Free Discharge)
 1=Culvert (Inlet Controls 0.37 cfs @ 1.86 fps)

Pond 7P: PDMH-12

Hydrograph



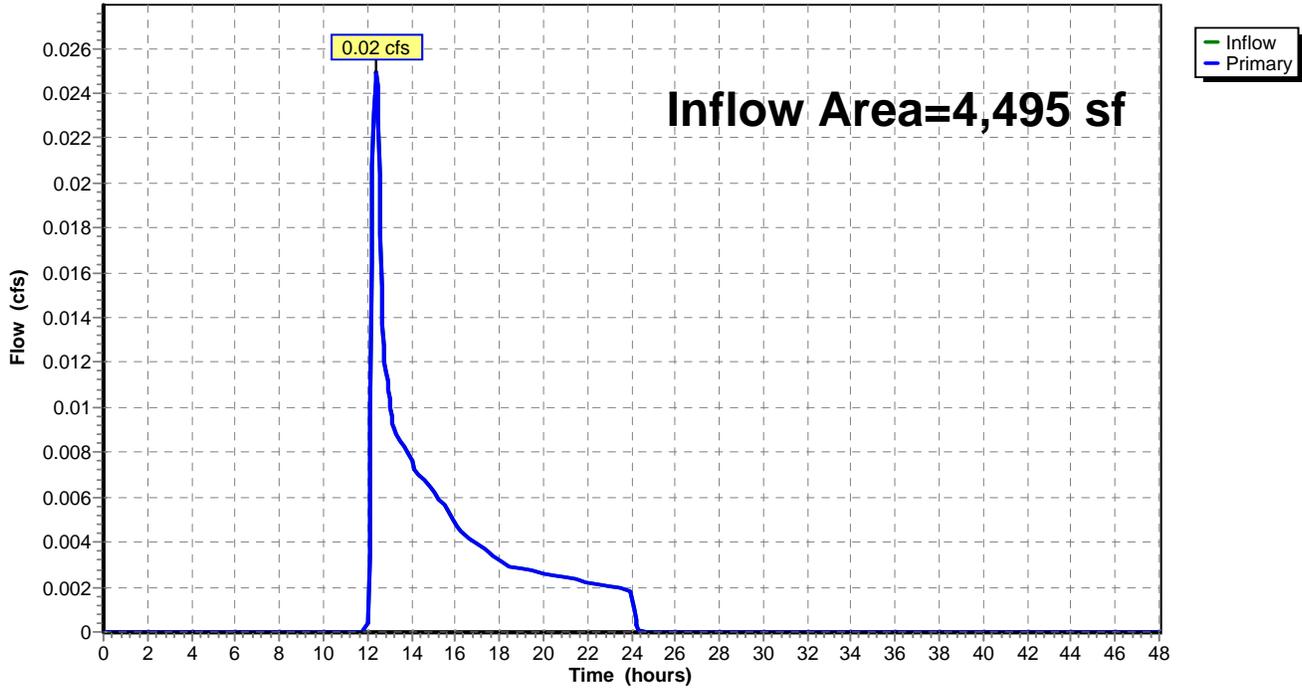
Summary for Link DP-1: Offsite to North/West

Inflow Area = 4,495 sf, 0.00% Impervious, Inflow Depth = 0.57" for 100-Year event
Inflow = 0.02 cfs @ 12.39 hrs, Volume= 212 cf
Primary = 0.02 cfs @ 12.39 hrs, Volume= 212 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-1: Offsite to North/West

Hydrograph



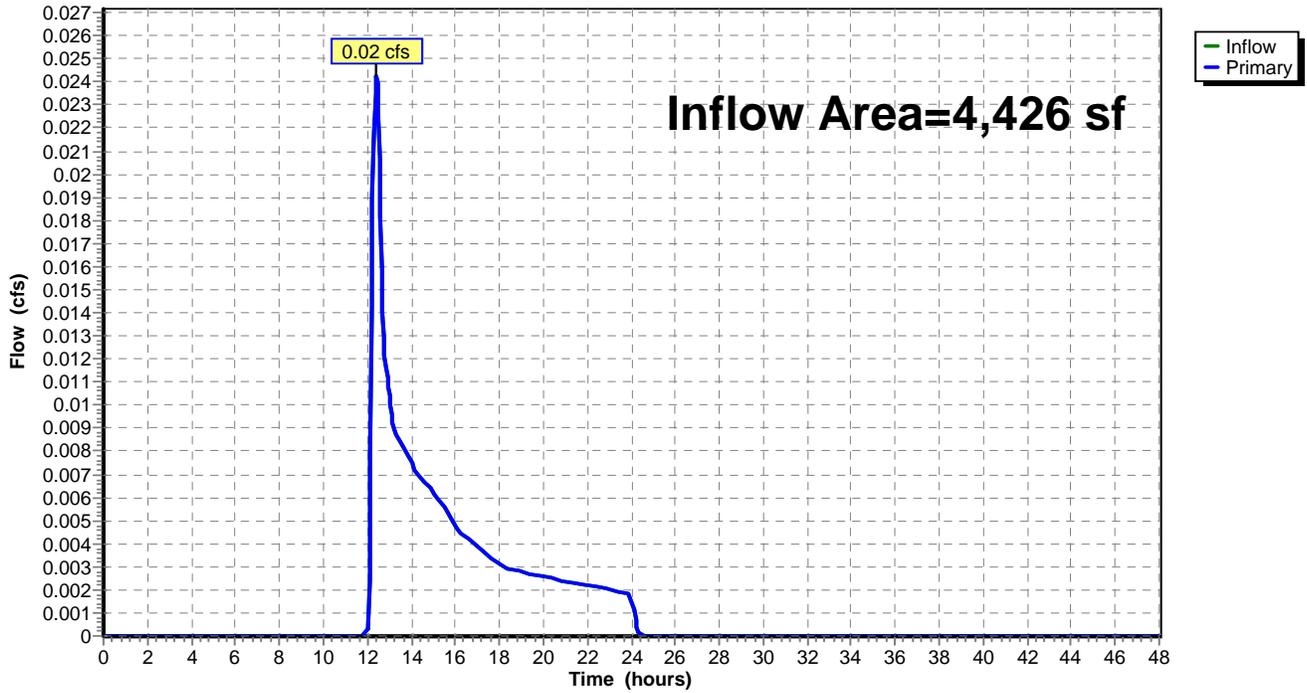
Summary for Link DP-2: Offsite to West

Inflow Area = 4,426 sf, 0.00% Impervious, Inflow Depth = 0.57" for 100-Year event
Inflow = 0.02 cfs @ 12.41 hrs, Volume= 209 cf
Primary = 0.02 cfs @ 12.41 hrs, Volume= 209 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to West

Hydrograph



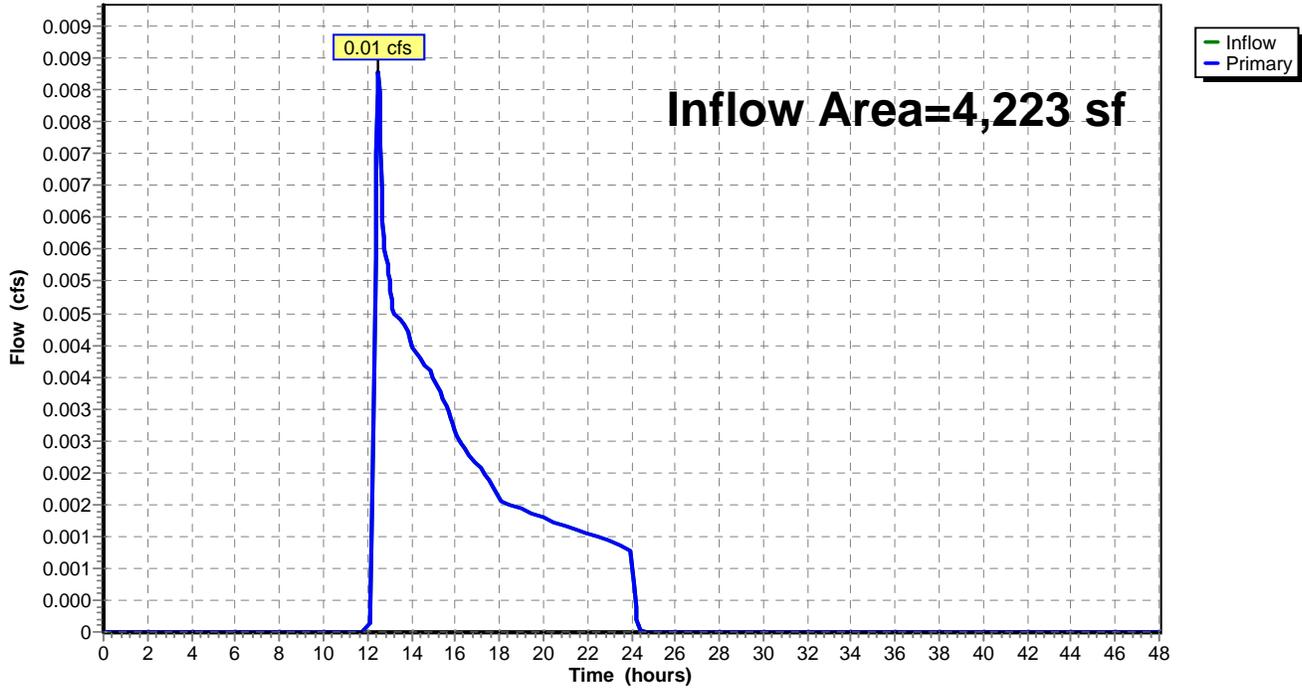
Summary for Link DP-3: Offsite to Northeast

Inflow Area = 4,223 sf, 0.00% Impervious, Inflow Depth = 0.34" for 100-Year event
Inflow = 0.01 cfs @ 12.50 hrs, Volume= 119 cf
Primary = 0.01 cfs @ 12.50 hrs, Volume= 119 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-3: Offsite to Northeast

Hydrograph



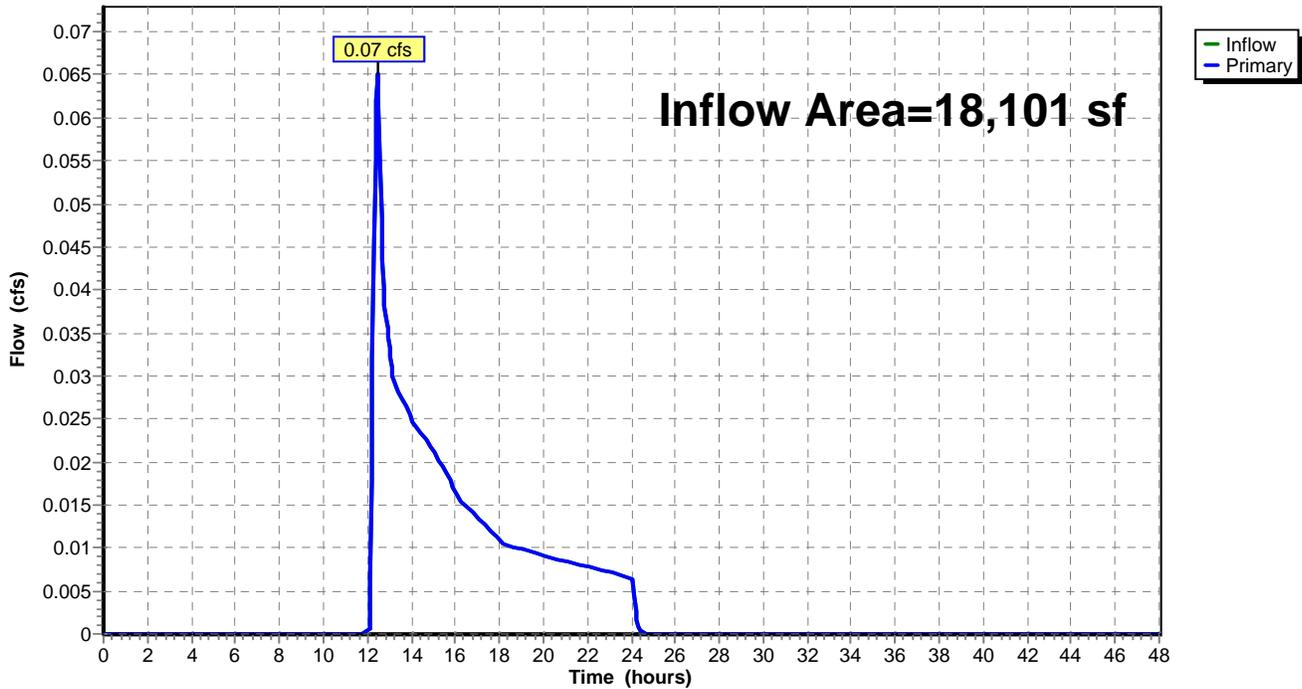
Summary for Link DP-4: East Edge of Property

Inflow Area = 18,101 sf, 0.00% Impervious, Inflow Depth = 0.45" for 100-Year event
Inflow = 0.07 cfs @ 12.47 hrs, Volume= 676 cf
Primary = 0.07 cfs @ 12.47 hrs, Volume= 676 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-4: East Edge of Property

Hydrograph



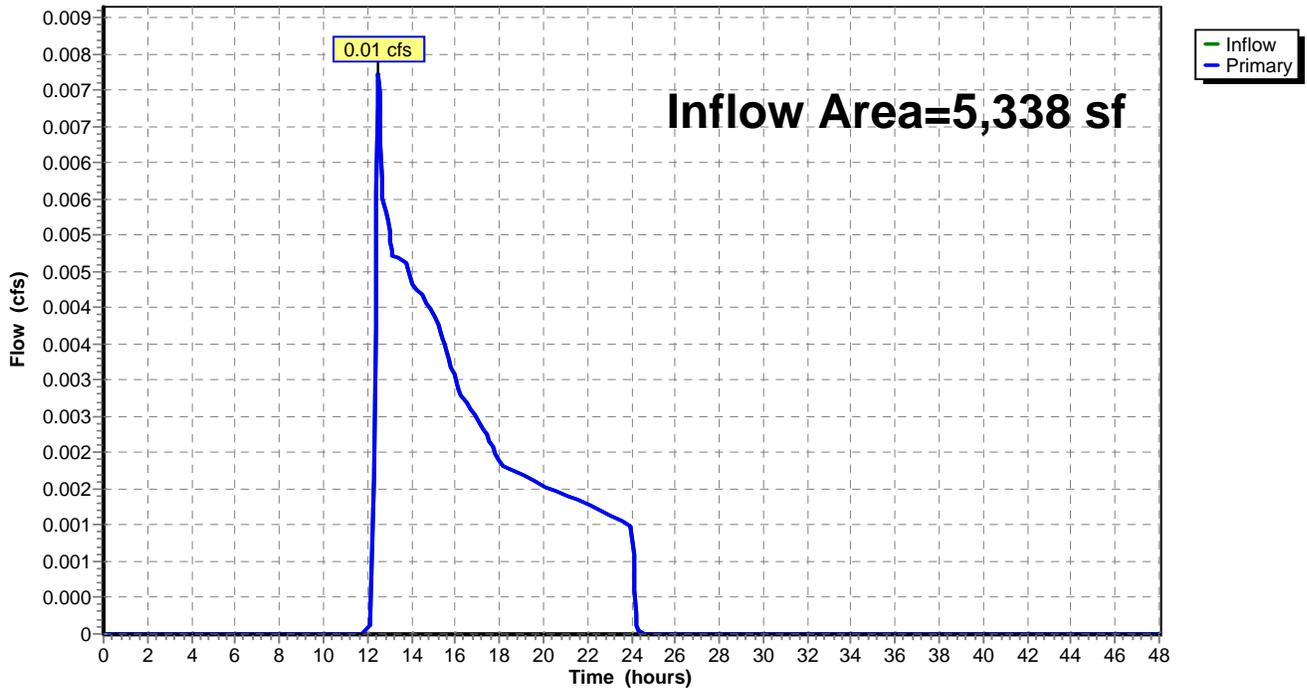
Summary for Link DP-5: Southwest Corner

Inflow Area = 5,338 sf, 0.00% Impervious, Inflow Depth = 0.29" for 100-Year event
Inflow = 0.01 cfs @ 12.51 hrs, Volume= 129 cf
Primary = 0.01 cfs @ 12.51 hrs, Volume= 129 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-5: Southwest Corner

Hydrograph



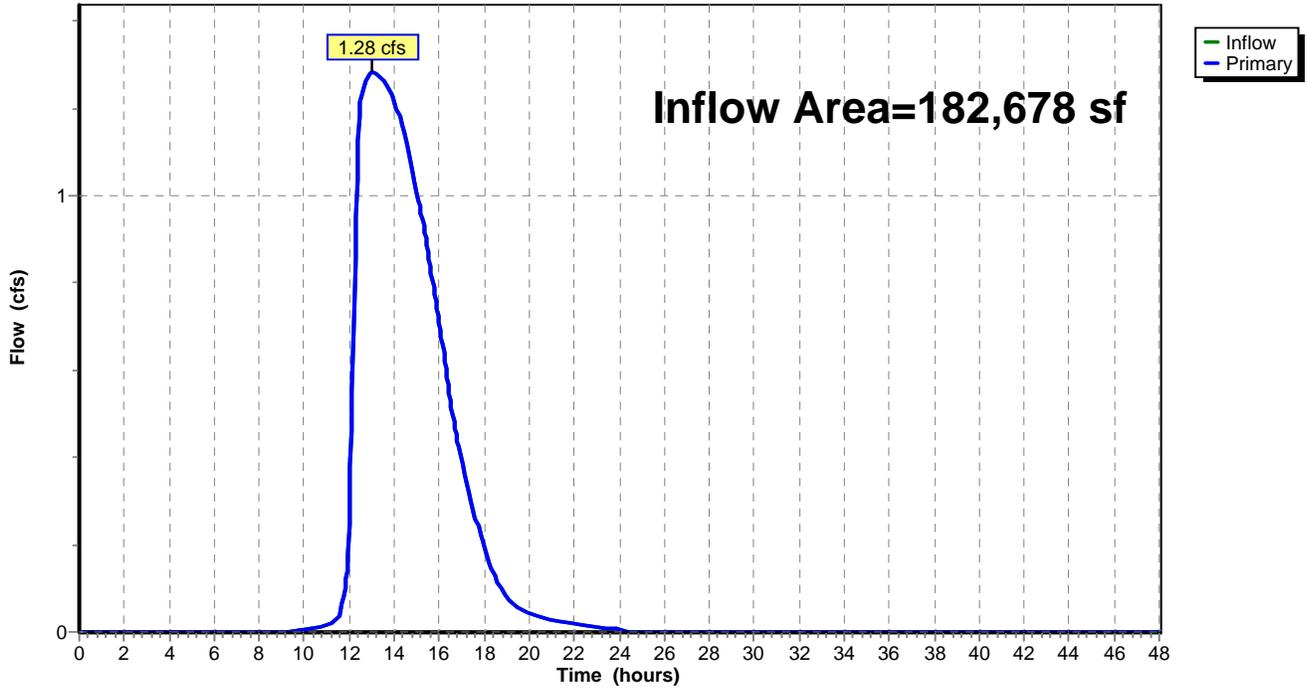
Summary for Link DP-6: South Corner

Inflow Area = 182,678 sf, 46.66% Impervious, Inflow Depth = 1.29" for 100-Year event
Inflow = 1.28 cfs @ 13.05 hrs, Volume= 19,563 cf
Primary = 1.28 cfs @ 13.05 hrs, Volume= 19,563 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link DP-6: South Corner

Hydrograph



Appendix D: MassDEP Calculations

- Required Recharge Volume
- Drawdown Calculations
- Water Quality Calculations
- TSS Removal Worksheets
- Forebay Sizing Calculations
- MASTEP Tech Summary
- Stormceptor Water Quality Rate Sheet
- Water Quality Flow Rate Conversion Table
- Riprap Sizing Calculations

Standard 3: Recharge Calculations - Subsurface Basin #1

Required Recharge Volume Sizing (R_v)

$$R_v \text{ (required)} = F \times \text{Impervious Area}$$

where: R_v = Required Recharge Volume (cu. ft.)

F = Target Depth Factor	0.60 inch (A-soils)
	0.35 inch (B-soils)
	0.25 inch (C-soils)
	0.10 inch (D-soils)

New Impervious Area by Hydrologic Soil Type

Impervious Area (A-soils)	55,040 sq. ft.	100.0%
Impervious Area (B-soils)	0 sq. ft.	0.0%
Impervious Area (C-soils)	0 sq. ft.	0.0%
Impervious Area (D-soils)	0 sq. ft.	0.0%
<hr/>		
Total Impervious area	55,040 sq. ft.	100.0%

$$R_v \text{ (required)} = \sum [F_{\text{Soil Type}} \times \text{Impervious Area}_{\text{Soil Type}}] \times 1 \text{ ft./12 in.}$$

$$R_v \text{ (required)} = 2,752 \text{ cu. ft.}$$

Recharge Volume Storage Provided - Subsurface Basin #1

$$R_v \text{ (provided)} \quad 5,677 \text{ cu. ft.} > \quad 2,752 \text{ cu. ft. (A-soils)}$$

Volume represents the available storage in Subsurface Basin #1 to outlet:

Elevation = 202.9 (depth of water in basin above stone bottom = 1.50 feet)

Standard 3: Recharge Calculations - Subsurface Basin #2

Required Recharge Volume Sizing (R_v)

$$R_v \text{ (required)} = F \times \text{Impervious Area}$$

where: R_v = Required Recharge Volume (cu. ft.)

F = Target Depth Factor	0.60 inch (A-soils)
	0.35 inch (B-soils)
	0.25 inch (C-soils)
	0.10 inch (D-soils)

New Impervious Area by Hydrologic Soil Type

Impervious Area (A-soils)	23,060 sq. ft.	87.1%
Impervious Area (B-soils)	0 sq. ft.	0.0%
Impervious Area (C-soils)	3,428 sq. ft.	12.9%
Impervious Area (D-soils)	0 sq. ft.	0.0%
<hr/>		
Total Impervious area	26,488 sq. ft.	100.0%

$$R_v \text{ (required)} = \sum [F_{\text{Soil Type}} \times \text{Impervious Area}_{\text{Soil Type}}] \times 1 \text{ ft./12 in.}$$

$$R_v \text{ (required)} = 1,224 \text{ cu. ft.}$$

Recharge Volume Storage Provided - Subsurface Basin #2

$$R_v \text{ (provided)} \quad 2,644 \text{ cu. ft.} > \quad 1,224 \text{ cu. ft. (A-soils)}$$

Volume represents the available storage in Subsurface Basin #2 to outlet:

Elevation = 198.35 (depth of water in basin above stone bottom = 1.75 feet)

Standard 3: Recharge Calculations - Surface Basin

Required Recharge Volume Sizing (R_v)

$$R_v \text{ (required)} = F \times \text{Impervious Area}$$

where: R_v = Required Recharge Volume (cu. ft.)

F = Target Depth Factor	0.60 inch (A-soils)
	0.35 inch (B-soils)
	0.25 inch (C-soils)
	0.10 inch (D-soils)

New Impervious Area by Hydrologic Soil Type

Impervious Area (A-soils)	7,352 sq. ft.	65.2%
Impervious Area (B-soils)	0 sq. ft.	0.0%
Impervious Area (C-soils)	3,928 sq. ft.	34.8%
Impervious Area (D-soils)	0 sq. ft.	0.0%
<hr/>		
Total Impervious area	11,280 sq. ft.	100.0%

$$R_v \text{ (required)} = \sum [F_{\text{Soil Type}} \times \text{Impervious Area}_{\text{Soil Type}}] \times 1 \text{ ft./12 in.}$$

$$R_v \text{ (required)} = 449 \text{ cu. ft.}$$

Recharge Volume Storage Provided - Surface Basin

$$R_v \text{ (provided)} \quad 2,269 \text{ cu. ft.} > \quad 449 \text{ cu. ft. (C-soils)}$$

Volume represents the available storage in the Infiltration Basin to outlet:

Elevation = 185.00 (depth of water in basin = 1.0 feet)

Drawdown Analysis

$$T_{\text{DRAWDOWN}} = \frac{R_V}{KA}$$

where: T_{DRAWDOWN} = time in hours

R_V = required recharge volume (cu. ft.)

K = Rawls rate 2.41 inches/hour (A-soils)*
 0.52 inches/hour (B-soils)*
 0.27 inches/hour (C-soils)*

A = bottom area of recharge facility (cu. ft.)

*Most conservative Rawls rate values for given soil type used for analysis purposes

Subsurface Basin #1

$$R_V = 5,677 \text{ cu. ft.}$$

$$A = 5,558 \text{ cu. ft.}$$

$$T_{\text{DRAWDOWN}} = 5.1 \text{ hours} < 72 \text{ hours} \quad (\text{A-soils})$$

Subsurface Basin #2

$$R_V = 2,644 \text{ cu. ft.}$$

$$A = 2,209 \text{ cu. ft.}$$

$$T_{\text{DRAWDOWN}} = 6.0 \text{ hours} < 72 \text{ hours} \quad (\text{A-soils})$$

Infiltration Basin

$$R_V = 2,269 \text{ cu. ft.}$$

$$A = 1,832 \text{ cu. ft.}$$

$$T_{\text{DRAWDOWN}} = 55.0 \text{ hours} < 72 \text{ hours} \quad (\text{C-soils})$$

Standard 4: Water Quality

Water Quality Volume Conversion to Flow Rate

Note: Required water quality volume based on 0.5-inch of runoff

$$Q_{0.5} = (qu) (A) (WQV)$$

where: $Q_{0.5}$ = peak flow rate associated with first 0.5-inch of runoff (c.f.s.)

qu = unit peak discharge (csm/in) - value taken from table based on t_c

A = impervious surface drainage area (sq. mi.)

WQV = water quality volume in watershed inches (0.5-inch)

· Proposed Water Quality Unit #1 (PWQU-1)

t_c =	0.250 hrs	
qu =	606 csm/in	(from table)
A =	0.00160 sq. mi.*	
WQV =	0.5 inch	

$$Q_{0.5} = 0.48 \text{ c.f.s}$$

The Stormceptor STC-900 provides 80% TSS removal for flows up to 0.89 c.f.s., however, a 25% TSS removal credit has been utilized for design purposes

· Proposed Water Quality Unit #2 (PWQU-2)

t_c =	0.197 hrs	(Use $T_C = 0.183$ hrs)
qu =	662 csm/in	(from table)
A =	0.00061 sq. mi.*	
WQV =	0.5 inch	

$$Q_{0.5} = 0.20 \text{ c.f.s}$$

The Stormceptor STC-450i provides 80% TSS removal for flows up to 0.40 c.f.s., however, a 25% TSS removal credit has been utilized for design purposes

* Excludes roof runoff that ties directly into subsurface system

TSS Removal Form - Subsurface Basin #1

	BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Total TSS Removal	Deep Sump, Hooded CB	0.25	1.00	0.25	0.75
	Stormceptor Manhole (STC-900)	0.25	0.75	0.19	0.56
	Subsurface Basin #1	0.80	0.56	0.45	0.11
Total TSS Removal =					89%

TSS Removal Form - Subsurface Basin #2

	BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Total TSS Removal	Deep Sump, Hooded CB	0.25	1.00	0.25	0.75
	Stormceptor Manhole (STC-450i)	0.25	0.75	0.19	0.56
	Subsurface Basin #2	0.80	0.56	0.45	0.11
Total TSS Removal =					89%

Sediment Forebay Sizing - Infiltration Basin

$$V_{SF} \text{ (required)} = \frac{0.1\text{-inch}}{\text{Impervious Acre}}$$

where: $V_{SF} \text{ (required)}$ = required volume of the
sediment forebay (cu. ft.)

Impervious Acre = amount of impervious area tributary
to recharge facility (acres)
= **0.26 acres ***

$$V_{SF} \text{ (required)} = 94 \text{ cu.ft.}$$

$$V_{SF} \text{ (provided)} = 170 \text{ cu. ft.}$$

* Includes both "connected" and "unconnected" impervious area



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MASTEP Technology Review

Technology Name: Stormceptor

Studies Reviewed: Final NJCAT Technology Verification Stormceptor STC900 September 2004; Coventry University Study, 1996; Technology Assessment, University of Massachusetts, 1997; SeaTac Stormceptor Performance report 2001; SWAMP report Ontario 2004; Phoenix Group Edmonton report 1995; Stormceptor 1200 Field Evaluation report 2004; Applied Hydrology Associates Denver report 2003; Rinker Materials Como Park St. Paul MN report 2002; VA DOT / UVA "Testing of Ultra-Urban Stormwater Best Management Practices" report 2001. Hydrodynamic Separator Sediment Retention Testing, Mohseni, 2010.

Date: September 17, 2013

Reviewer: Jerry Schoen

Rating: 2

Brief rationale for rating: This rating is primarily based on the 2005 NJCAT Technology Verification study.

In general, this was a well-conducted test, which in large part followed NJDEP test guidelines for laboratory studies, which MASTEP considers as the laboratory equivalent of TARP field protocols. Issues of concern: the study measured suspended sediment concentration (SSC) rather than total suspended solids (TSS). Although SSC is considered by many scientists to be the preferred method, it is at odds with Massachusetts stormwater regulations, which are based on TSS treatment. Comparing SSC and TSS results is considered an inexact science. The test was conducted with higher influent sediment concentrations than is preferred, but results were fairly consistent across all ranges studied. The particle size distribution also appears to be slightly higher than the target test range. There are additional field studies that in general support the results obtained in this laboratory studies. These studies do not satisfy TARP protocols, but they do not contradict results obtained in the NJCAT study.

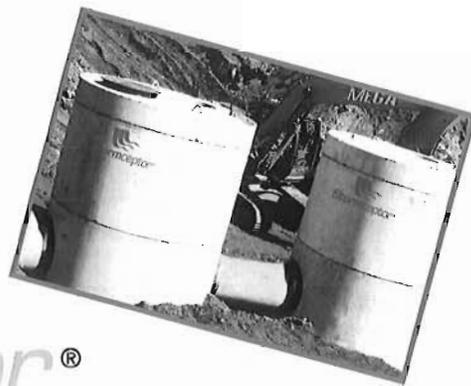
TARP Requirements Not Met*:

- Measurements in TSS.
- Influent sediment concentration is 100 – 300 mg/l: actual was 153-460.
- No documentation of a Quality Assurance Project Plan
- Third party studies are preferred. This was conducted by Stormceptor personnel, with sample analyses conducted by an external laboratory.

Other Comments:

* The 2010 Mohseni study evaluates the susceptibility of the Stormceptor to scouring, or washout of collected sediments. Report concluded that the unit does not scour at high flows as long as sediment depth does not exceed maintenance level.

* Criteria also based on NJDEP laboratory testing guidelines.



Stormceptor®

-----STC

Stormceptor® is an underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention. With thousands of systems operating worldwide, Stormceptor delivers protection every day in every storm.

With patented technology, optimal treatment occurs by allowing free oil to rise and sediment to settle. The Stormceptor design prohibits scour and release of previously captured pollutants, ensuring superior treatment and protection during even the most extreme storm events.

Stormceptor is very easy to design and provides flexibility under varying site constraints such as tight right-of-ways, zero lot lines and retrofit projects. Design flexibility allows for a cost-effective approach to stormwater treatment. Stormceptor has proven performance backed by the longest record of lab and field verification in the industry.

Tested Performance

- Fine particle capture
- Prevents scour or release
- 95%+ Oil removal

Massachusetts – Water Quality (Q) Flow Rate

Stormceptor STC Model	Inside Diameter	Typical Depth Below Inlet Pipe Invert ¹	Water Quality Flow Rate Q ²	Peak Conveyance Flow Rate ³	Hydrocarbon Capacity ⁴	Maximum Sediment Capacity ⁴
	(ft)	(in)	(cfs)	(cfs)	(Gallons)	(ft ³)
STC 450i	4	68	0.40	5.5	86	46
STC 900	6	63	0.89	22	251	89
STC 2400	8	104	1.58	22	840	205
STC 4800	10	140	2.47	22	909	543
STC 7200	12	148	3.56	22	1,059	839
STC 11000	2 x 10	142	4.94	48	2,792	1,086
STC 16000	2 x 12	148	7.12	48	3,055	1,677

¹ Depth Below Pipe Inlet Invert to the Bottom of Base Slab, and Maximum Sediment Capacity can vary to accommodate specific site designs and pollutant loads.

Depths can vary to accommodate special designs or site conditions. Contact your local representative for assistance.

² Water Quality Flow Rate (Q) is based on 80% annual average TSS removal of the OK110 particle size distribution.

³ Peak Conveyance Flow Rate is based upon ideal velocity of 3 feet per second and outlet pipe diameters of 18-inch, 36-inch, and 54-inch diameters.

⁴ Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

Figure 2: For First ½-inch of Runoff, Table of qu values for Ia/P Curve = 0.058, listed by tc, for Type III Storm Distribution

Tc (Hours)	qu (csm/in)							
0.01	821	1.8	246	5.3	116	8.8	77	
0.03	821	1.9	238	5.4	115	8.9	76	
0.05	813	2	230	5.5	113	9	76	
0.067	794	2.1	223	5.6	112	9.1	75	
0.083	773	2.2	217	5.7	110	9.2	74	
0.1	752	2.3	211	5.8	109	9.3	74	
0.116	733	2.4	205	5.9	107	9.4	73	
0.133	713	2.5	200	6	106	9.5	72	
0.15	694	2.6	194	6.1	104	9.6	72	
0.167	677	2.7	190	6.2	103	9.7	71	
PWQU-2	0.183	662	2.8	185	6.3	102	9.8	70
	0.2	646	2.9	181	6.4	100	9.9	70
	0.217	632	3	176	6.5	99	10	69
	0.233	619	3.1	173	6.6	98		
PWQU-1	0.25	606	3.2	169	6.7	97		
	0.3	572	3.3	165	6.8	96		
	0.333	552	3.4	162	6.9	94		
	0.35	542	3.5	158	7	93		
	0.4	516	3.6	155	7.1	92		
	0.416	508	3.7	152	7.2	91		
	0.5	472	3.8	149	7.3	90		
	0.583	443	3.9	147	7.4	89		
	0.6	437	4	144	7.5	88		
	0.667	417	4.1	141	7.6	87		
	0.7	408	4.2	139	7.7	86		
	0.8	383	4.3	136	7.8	85		
	0.9	361	4.4	134	7.9	84		
	1	342	4.5	132	8	84		
	1.1	325	4.6	130	8.1	83		
	1.2	311	4.7	128	8.2	82		
	1.3	297	4.8	126	8.3	81		
	1.4	285	4.9	124	8.4	80		
	1.5	274	5	122	8.5	79		
	1.6	264	5.1	120	8.6	79		
	1.7	254	5.2	118	8.7	78		



R LEVESQUE ASSOCIATES, INC.

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Client: Ferry Street Nominee Trust
Project: Ferry Street - Rivercrest Condominiums
Designed By: Filipe Cravo, P.E. Date: 09-25-2014
Checked By: _____ Date: _____
RLA Project Number: 13-1119 Sheet: 1 of 1

RipRap Calculations

FES-1

Description		Unit	Notes
Outlet Diameter, Do=	12	in	Inlet pipe diameter to FES-1
Discharge*=	3	cfs	Sum of inflow from both subsurface basins and yard drains
Velocity=	5	fps	Calculated based on mannings equation
d50=	4	in	Median stone size in well-graded riprap, taken from chart
Min. Apron Length=	8	ft	Taken from attached chart
dmax=	6	in	1.5x the d50
Apron thickness**=	9	in	1.5x the dmax

FES-2

Description		Unit	Notes
Outlet Diameter, Do=	12	in	Inlet pipe diameter to FES-1
Discharge*=	1.25	cfs	Sum of inflow from both subsurface basins and yard drains
Velocity=	5	fps	Calculated based on mannings equation
d50=	4	in	Median stone size in well-graded riprap, taken from chart
Min. Apron Length=	8	ft	Taken from attached chart
dmax=	6	in	1.5x the d50
Apron thickness**=	9	in	1.5x the dmax

*Due to the discharge rates being below the values on the design chart, the minimum design standards were utilized.
**A minimum 1-foot standard section was provided in an effort to remain conservative in the approach.

OUTLET PROTECTION FOR A PIPE FLOWING FULL WITH LOW TAILWATER

RIPRAP SIZE - D50 (inches)
PIPE DIAMETER

DISCHARGE	PIPE DIAMETER											
	12"	15"	18"	21"	24"	27"	30"	36"	42"	48"	54"	60"
3cfs	4											
5cfs	4											
8cfs	5	4										
10cfs	6	5	4									
12cfs	8	6	6									
15cfs	8	6	8	5								
17cfs		8	8	5								
20cfs		10	10	6	5							
25cfs		12	12	6	6							
30cfs				8	8	6						
40cfs				12	10	8	6					
50cfs				16	12	10	8	6				
60cfs				18	16	12	10	8				
70cfs					18	15	12	8				
80cfs					20	16	15	10	8			
90cfs						18	16	12	10			
100cfs						20	18	12	10			
125cfs						24	20	16	12	10		
150cfs							24	20	16	12	10	
200cfs								24	20	18	15	12

MINIMUM LENGTH OF APRON (FEET)
PIPE DIAMETER

DISCHARGE	PIPE DIAMETER											
	12"	15"	18"	21"	24"	27"	30"	36"	42"	48"	54"	60"
3cfs	8											
5cfs	8											
8cfs	11	10										
10cfs	14	12	10									
15cfs	18	16	14	12								
20cfs		18	18	16	12							
30cfs			22	20	18	16						
40cfs			26	24	24	20	18					
50cfs				26	26	24	22	18				
70cfs					30	30	28	25				
100cfs						36	36	33	27			
150cfs						42	42	42	38	33	28	
200cfs								48	45	42	37	32

From USDA Soil Conservation Service

Appendix E: Construction Period Erosion Control Plan

Construction Period Erosion Control Plan

Rivercrest Condominiums

Ferry Street (Map 47, Parcel 76)
South Hadley, Massachusetts

Project Location:

Ferry Street
Map 47, Parcel 76
South Hadley, Massachusetts

Prepared for:

Ferry Street Nominee Trust
510 New Ludlow Road
South Hadley, Massachusetts 01075

June 18, 2014

R LEVESQUE ASSOCIATES, INC

A LAND PLANNING SERVICES COMPANY

40 School Street · Westfield, MA 01085

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The project shall implement a construction period erosion control plan. The following provides descriptions and guidelines to ensure that the areas surrounding the project site will be protected from excessive sedimentation and runoff during construction.

1.1 Construction Period Pollution Prevention And Erosion Control Measures

1.1.1 Preconstruction Notifications And Meetings

Prior to the start of construction, the contractor shall call together a pre-construction meeting including a representative from the Town of South Hadley, the design engineer, contractor, and any pertinent persons that should be in attendance. These requirements shall be the responsibility of the Contractor to arrange, attend, and document.

1.1.2 Sediment Barrier And Work Limit

Before installation of the sediment barriers, the location shall be staked in the field for review and approval by the owner or their representative. To facilitate sediment barrier installation, woody vegetation may then be removed and any required trench may be cut by machine, provided all other ground cover is left intact. No excavation, grading, filling, or removal of vegetative ground cover shall begin until sediment barriers have been installed as shown on the plans and have been inspected by the owner or their representative.

1.1.3 Silt Fence

The bottom of the fence shall be trenched into the ground a minimum of 6" and back-filled with compacted soil. Where trenching is not feasible, silt fence skirt shall be covered with compacted soil or crushed stone. The top of the fabric shall be stretched as tightly as is practical, with intermediate stakes added to correct excessive sags. Stakes shall be driven at least 12" into the ground. Splices between sections shall be made by rolling end stakes together one complete turn and driving into the ground together.

1.1.4 Straw Bales

Straw bales may be used as temporary and moveable control measures, temporary check dams, or as reinforcement for silt fence in areas of concentrated runoff or high fills. Bales shall be tightly butted and staked 12" into the ground. Where used without silt fence in front, the bales shall be trenched 4" into the ground, back-filled with compacted soil, and the spaces between bales shall be chinked with loose hay.

1.1.5 Filter Sock (Filtrexx Or Equivalent)

In areas of expected sheet flow, filter sock may be placed directly on the ground without trenching or stakes. In areas of expected concentrated flow, mulch or crushed stone shall be placed along the up-slope face to control and filter underflow. Additional layers of Filter Sock may be required for adequate freeboard. The filter sock shall be staked at 10 feet on-center or in cases where they cannot be staked, utilize heavy concrete blocks to hold in place.

1.1.6 Temporary Sedimentation Basins

Temporary sediment basins may be excavations or bermed stormwater detention structures (depending on grading) that will retain runoff for a sufficient period of time to allow suspended soil particles to settle out prior to discharge. These temporary basins will be located based on construction needs as determined by the contractor and outlet devices will be designed to control velocity and sediment. Points of discharge from sediment basins will be stabilized to minimize erosion. If the temporary basin is to be located within an area of future infiltration as part of the stormwater management system, the excavation for the temporary sedimentation basin shall be limited to one foot above final grade of the infiltration structure.

1.1.7 Stocking Additional Materials

A stock of additional erosion control materials shall be available on the site for emergency repairs and temporary measures. Stock shall be replenished when decreased to 50% of the numbers below. Stock shall include:

Straw Bales – 10 (kept dry) with 20 oak stakes

Or

Silt Fence – 30 Linear feet.

Or

Filter Sock – 4 – 8 foot sections (kept dry)

Washed Stone – One (1) cubic yard, ¾" to 2" diameter

1.1.8 Trench Protection

Open trenches shall be protected from accumulation of surface water or groundwater that could result in erosion of the trench and discharge of sediment. Where feasible, spoil shall be stockpiled on the up-slope side of the trench to prevent entrance of surface runoff. Backfill shall be crowned to allow for settlement and to avoid concentration of runoff on top of the trench.

1.1.9 Site Stabilization – Temporary

Where a portion of the site will not be subject to construction activity for over 14 days, measures shall be taken to provide temporary stabilization of that inactive portion of the site, within 14 days of the cessation of construction activity. Stabilization measures may include seeding for temporary cover, mulching, or other measures to protect exposed soil from erosion and prevent sediment movement.

1.1.10 Site Stabilization – Permanent

Within 14 days of completion of loaming and finish grading on any portion of the site, that area shall be seeded or planted for permanent cover (season permitting) in accordance with USDA NRCS guidelines or equivalent.

1.1.11 Roadway Sweeping

The entrance to the site and affected portions of the access drive or paved project areas shall be swept as needed to control sediment runoff into storm drains or waterways and to control blowing dust.

1.2 Short-Term Erosion Control Maintenance

The following provides short-term erosion control maintenance guidelines and requirements.

1. The contractor or subcontractor will be responsible for implementing each control shown on the sedimentation and erosion control plan.
2. All erosion and sediment control devices shall be properly maintained during all phases of construction until the completion of all construction activities and all disturbed areas have been stabilized. Additional control measures will be installed during construction in order to control erosion and/or off-site sedimentation if deemed necessary by on-site inspection.
3. Effective erosion control measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operations that will disturb the natural protection.
4. All sediment and erosion control devices shall be inspected at least once every seven (7) calendar days and after any storm event greater than 0.5 inches of precipitation during any 24-hour period, and the inspection shall be documented in writing. Damaged or ineffective devices shall be repaired or replaced, as necessary.
5. The contractor shall take all reasonable precautions to avoid excess erosion of the site due to the construction of this project.
6. Silt shall be removed from behind barriers if greater than 6-inches deep or as needed. Sediment that is collected in structures shall be disposed of properly and covered if stored on-site
7. Damaged or deteriorated items will be repaired immediately after identification.
8. All ditches shall be stabilized as soon as is practicable to minimize erosion.
9. The contractor shall maintain all erosion control devices in a good, working state of repair. Upon complete stabilization of any tributary areas, the erosion control devices shall be removed and disposed of so as to cause no off-site siltation.
10. Inspect and maintain construction entrance stone such that sediment does not track onto the street. Any sediment tracked onto the street shall be swept daily.
11. After catch basins have been constructed, the contractor shall protect the inlets by constructing inlet protection as shown on the plans.
12. Once the site has been paved, all catch basin inlets shall receive a silt sack type protection.
13. Erosion control measures shall remain in place until all disturbed earth has been substantially stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

Appendix F: Long-Term Operation And Maintenance Plan

Long-Term Operation & Maintenance Plan

Rivercrest Condominiums

Ferry Street (Map 47, Parcel 76)
South Hadley, Massachusetts

Project Location:

Ferry Street
Map 47, Parcel 76
South Hadley, Massachusetts

Prepared for:

Ferry Street Nominee Trust
510 New Ludlow Road
South Hadley, Massachusetts 01075

June 18, 2014

Revised: September 25, 2014

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I. Long-Term Stormwater Maintenance Program:

This Long-Term Operation and Maintenance Plan (O&M) identifies inspection and maintenance requirements for the proposed stormwater management system. The O&M references guidelines set forth by the Stormwater Management Handbook developed by the Massachusetts Department of Environmental Protection.

Owner*:

Ferry Street Nominee Trust
510 New Ludlow Road
South Hadley, Massachusetts 01075

Responsible Party*:

Ferry Street Nominee Trust
510 New Ludlow Road
South Hadley, Massachusetts 01075

*The party listed shall be responsible for implementation and record keeping of the requirements listed in this operation and maintenance plan. Upon completion of construction, the responsible party shall be reinstated as the homeowner's association or any other group created as part of the condominium governance. Each individual owner shall be responsible to contribute to the operation and maintenance of the stormwater management system or as decided and agreed upon in the homeowner's association/governing group documents.

2. Inspection and Maintenance Program:

Regular inspection and routine maintenance are necessary to ensure that the stormwater management system continues to control and treat runoff. The following lists the inspection schedule and maintenance procedures for the proposed stormwater Best Management Practices:

BMP	Inspection Schedule	Maintenance Schedule	Maintenance Procedures
Bituminous Concrete Roadway	Four times per year	Twice per year	<ul style="list-style-type: none"> Roadway to be swept in March or April following snow melt and again in late November or early December to remove fallen leaves and debris
Deep-Sump Catch Basins	Four times per year	Four times per year	<ul style="list-style-type: none"> Remove sediment once deposits reach one half the depth from the bottom sump to the lowest invert.
Stormwater Piping	Once per year	Once per year	<ul style="list-style-type: none"> Inspect pipe entrances in catch basins and manholes and remove any blockages
Proprietary Sedimentation Device*	As specified by the manufacturer	As specified by the manufacturer	<ul style="list-style-type: none"> Clean the unit using the method specified by the manufacturer. Vector trucks are typically used to clean these units.
Subsurface Infiltration Basins	Twice per year	Twice per Year	<ul style="list-style-type: none"> Verify that the inlet structure has no accumulation of sediment; Clean Isolator Row as specified by manufacturer
Sediment Forebay	Monthly	Four times per year	<ul style="list-style-type: none"> Remove sediment when it reaches one foot; Mow the grass to no less than 3 inches and no greater than 6 inches; Replace vegetation damaged during sediment removal.
Infiltration Basin	<ul style="list-style-type: none"> After ever major storm for the first three months; Twice per year thereafter. 	Twice Per year	<ul style="list-style-type: none"> Check for signs of differential settlement, cracking, erosion, leakage in the embankments, tree growth, riprap condition, sediment accumulation, and health of the turf; Mow side slopes and basin bottom and remove clippings; Remove accumulated trash and debris.

See the attached Long-Term Operation & Maintenance Inspection Checklist for record keeping purposes.

*See attached Device Operation and Maintenance Guide

3. Additional Long-Term Operation and Maintenance Items

The following is a list of additional operation and maintenance items to be implemented by the owner/governing group to maintain the features proposed in this project.

- A. Proper storage, use, and disposal of hazardous chemicals, including automobile fluids, pesticides, paints, solvents, etc. shall be required. Information should be provided on chemicals of concern, proper use, and disposal options. Recycling programs for used motor oil, antifreeze, and other products should be developed, promoted and distributed to the homeowners.
- B. Vehicle Washing. This management measure involves educating the owner on the water quality impacts of the outdoor washing of vehicles and how to avoid allowing polluted runoff to enter the storm drain system. Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons which is conveyed by the detergent-rich water into storm drains.
- C. Recycling, spill prevention and response plans, and proper material storage and disposal of potentially hazardous materials shall be implemented. It will be the responsibility of each owner to contain and legally remove any materials that are spilled onsite. The use of dry floor cleaners and absorbent materials and limiting the use of water to clean driveways is encouraged. Care should be taken to avoid accidental disposal of hazardous materials.
- D. Provisions for storing trash and waste products shall be implemented. The waste materials shall be collected by the owner and all materials shall be properly disposed of.
- E. Requirements for routine inspections and maintenance of stormwater best management practices. Routine inspections shall be performed to ensure the correct functioning of stormwater best management practices. See the specific maintenance criteria for detail regarding inspections and maintenance frequency.
- F. Requirements for Storage and Use of Fertilizers, Herbicides, and Pesticides. Fertilizers, pesticides, herbicides, lawn care chemicals, or other leachable materials shall be used in accordance with the Lawn Care Regulations of the Massachusetts Pesticide Board, 33 CMR 10.03 (30,31), as amended, with manufacturer's label instructions and all other necessary precautions to minimize adverse impacts on surface and groundwater. The storage of any such materials shall be within structure designed to prevent the escape of contaminated runoff or leachate.
- G. Provisions for prevention of illicit discharges to the stormwater management system shall be implemented. Any illicit discharges to the stormwater management system shall be prohibited. It will be the owner's responsibility to ensure compliance with the legal disposal of all materials and containment/cleanup of any illicit discharges.
- H. Training for staff or personnel involved with implementation of the Long-Term Pollution Prevention Plan shall be required. The owner/governing group will be responsible for the implementation of the measures set forth in the Long-Term Pollution Prevention Plan. Documentation that personnel and owners involved with the implementation of the Long-Term Pollution Prevention Plan have been trained to conduct such tasks shall be documented.

4. Winter and Snow Conditions

The following is a list of additional operation and maintenance items to be implemented by the owner during winter and snow conditions.

- A. Snowfall amounts of 4-inches or less may be stored on the grassed areas surrounding the paved areas, excluding any areas utilized for stormwater management practices. As needed, any snow event greater than 4-inches shall be cleared from paved surfaces and trucked off site and disposed of properly. Based on a typical homeowners association, all snow removal will be contracted to a qualified snow removal contractor who will be provided the Order of Conditions and any other restrictions
- B. Winter road salt and/or sand use and storage restrictions shall be implemented based on the Order of Conditions issued for the project. Sodium chloride for ice control shall be used at the minimum salt to sand ratio which is consistent with the Massachusetts Department of Environmental Protection's guidelines. Sodium chloride, calcium chloride, chemically treated abrasives or other chemicals used for the removal of ice and snow on roads/drives shall not be stored on site.

5. Estimated Cost of Maintenance

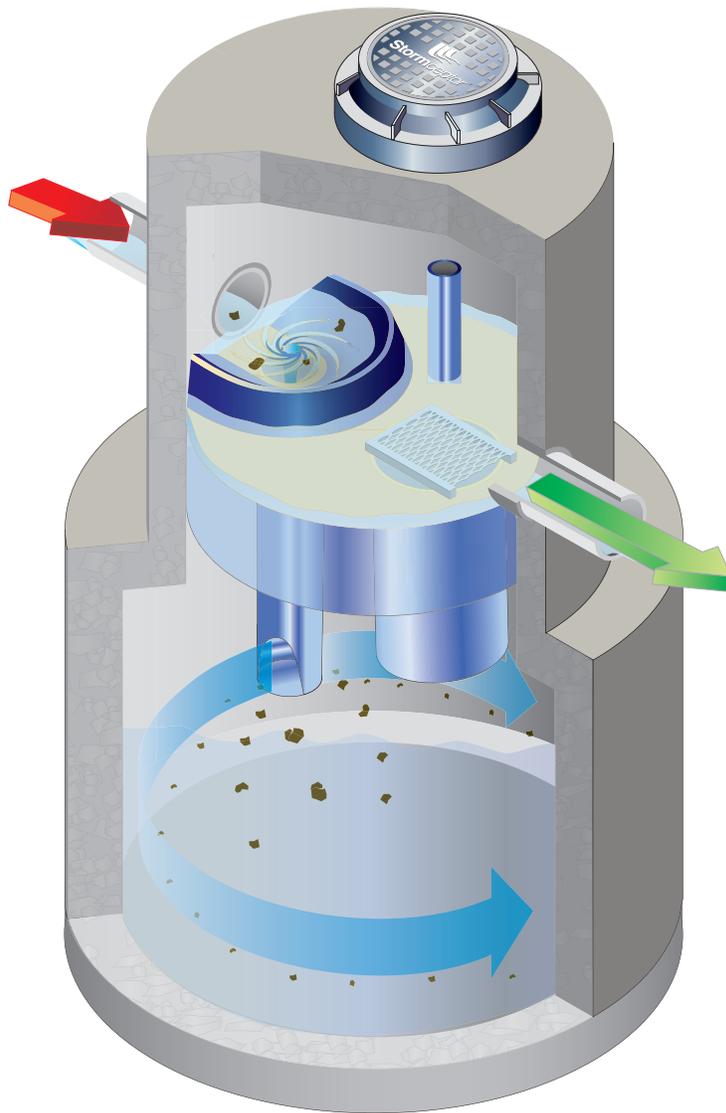
The following budget was prepared as an estimate of inspection and maintenance costs for the stormwater management system. The budget is an estimate only as the costs may vary depending on the level of sediment accumulation and frequency of maintenance tasks required.

BMP Inspections	Number of Occurrences	Maintenance Cost	Numer of Structures	Sum
Catch Basin	4/year	\$50	8	\$1,600
Stormceptor	2/year	\$100	2	\$400
Subsurface Infiltration Basin	2/year	\$100	2	\$400
Sediment Forebay	1/month	\$50	1	\$600
Infiltration Basin	2/year	\$100	1	\$200
Total Estimated Annual Cost of Inspections				\$3,200

BMP Maintenance	Number of Occurrences	Maintenance Cost	Numer of Structures	Sum
Catch Basin Maintenance (estimate)	4/year	\$80	8	\$2,560
Stormceptor Maintenance (estimate)	2/year	\$300	2	\$1,200
Subsurface Infiltration Basin Maintenance (estimate)	2/year	\$300	2	\$1,200
Sediment Forebay Maintenance (estimate)	4/year	\$250	1	\$1,000
Infiltration Basin Maintenance (estimate)	2/year	\$200	1	\$400
Total Estimated Annual Cost of Maintenance				\$6,360

Stormceptor[®]

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693,164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Japan Patent No. 9-11476
Korean Patent No. 0519212
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

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1 – Stormceptor Overview

2 – Stormceptor Operation & Components

3 – Stormceptor Identification

4 – Stormceptor Inspection & Maintenance

 Recommended Stormceptor Inspection Procedure

 Recommended Stormceptor Maintenance Procedure

5 – Contact Information (Stormceptor Licensees)

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a “Hydrodynamic Separator (HDS)” or an “Oil Grit Separator (OGS)”, engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- “STORMCEPTOR” is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site’s tailwater conditions)
- Series Unit (combines treatment in two systems)

Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

Figure 1.

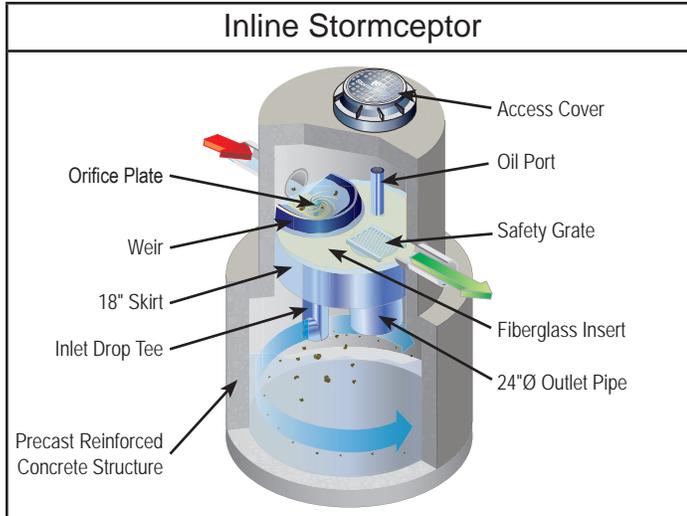
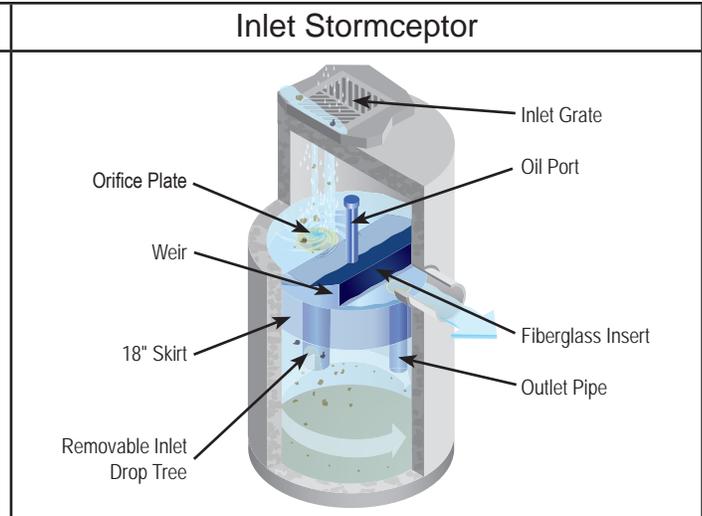


Figure 2.



- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name “Stormceptor” embossed on each access cover at the surface. To determine the location of “inlet” Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name “Stormceptor” is not embossed on inlet models due to the variability of inlet grates used/ approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe’s invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2**. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (in.)	EOS Model	Insert to Base (in.)	OSR Model	Insert to Base (in.)	Typical STF m (in.)
450	60	4-175	60	65	60	1.5 (60)
900	55	9-365	55	140	55	1.5 (61)
1200	71	12-950	71			1.8 (73)
1800	105					2.9 (115)
2400	94	24-1400	94	250	94	2.3 (89)
3600	134	36-1700	134			3.2 (127)
4800	128	48-2000	128	390	128	2.9 (113)
6000	150	60-2500	150			3.5 (138)
7200	134	72-3400	134	560	134	3.3 (128)
11000*	128	110-5000*	128	780*	128	
13000*	150	130-6000*	150			
16000*	134	160-7800*	134	1125*	134	

Notes:

1. Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.

*Consist of two chamber structures in series.

Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (m)	EOS Model	Insert to Base (m)	OSR Model	Insert to Base (m)	Typical STF m (in.)
300	1.5	300	1.5	300	1.7	1.5 (60)
750	1.5	750	1.5	750	1.6	1.5 (61)
1000	1.8	1000	1.8			1.8 (73)
1500	2.8					2.9 (115)
2000	2.8	2000	2.8	2000	2.6	2.3 (89)
3000	3.7	3000	3.7			3.2 (127)
4000	3.4	4000	3.4	4000	3.6	2.9 (113)
5000	4.0	5000	4.0			3.5 (138)
6000	3.7	6000	3.7	6000	3.7	3.3 (128)
9000*	3.4	9000*	3.4	9000*	3.6	
11000*	4.0	10000*	4.0			
14000*	3.7	14000*	3.7	14000*	3.7	

Notes:

1. Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.

**Consist of two chamber structures in series.*

Table 2A. (US) Storage Capacities

STC Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft ³	EOS Model	Hydrocarbon Storage Capacity gal	OSR Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft ³
450	86	46	4-175	175	065	115	46
900	251	75	9-365	365	140	233	58
1200	251	113	12-950	591			
1800	251	193					
2400	840	155	24-1400	1457	250	792	156
3600	840	232	36-1700	1773			
4800	909	465	48-2000	2005	390	1233	465
6000	909	609	60-2500	2514			
7200	1059	726	72-3400	3418	560	1384	690
11000*	2797	942	110-5000*	5023	780*	2430	930
13000*	2797	1230	130-6000*	6041			
16000*	3055	1470	160-7800*	7850	1125*	2689	1378

Notes:

1. Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

**Consist of two chamber structures in series.*

Table 2B. (CA & Int'l) Storage Capacities

STC Model	Hydrocarbon Storage Capacity	Sediment Capacity	EOS Model	Hydrocarbon Storage Capacity	OSR Model	Hydrocarbon Storage Capacity	Sediment Capacity
	L	L		L		L	L
300	300	1450	300	662	300	300	1500
750	915	3000	750	1380	750	900	3000
1000	915	3800	1000	2235			
1500	915	6205					
2000	2890	7700	2000	5515	2000	2790	7700
3000	2890	11965	3000	6710			
4000	3360	16490	4000	7585	4000	4700	22200
5000	3360	20940	5000	9515			
6000	3930	26945	6000	12940	6000	5200	26900
9000*	10555	32980	9000*	19010	9000*	9300	33000
11000*	10555	37415	10000*	22865			
14000*	11700	53890	14000*	29715	14000*	10500	53900

Notes:

1. Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

**Consist of two chamber structures in series.*

4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor’s patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit’s total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

What equipment is typically required for inspection?

- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Recommended Stormceptor Inspection Procedure:

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.

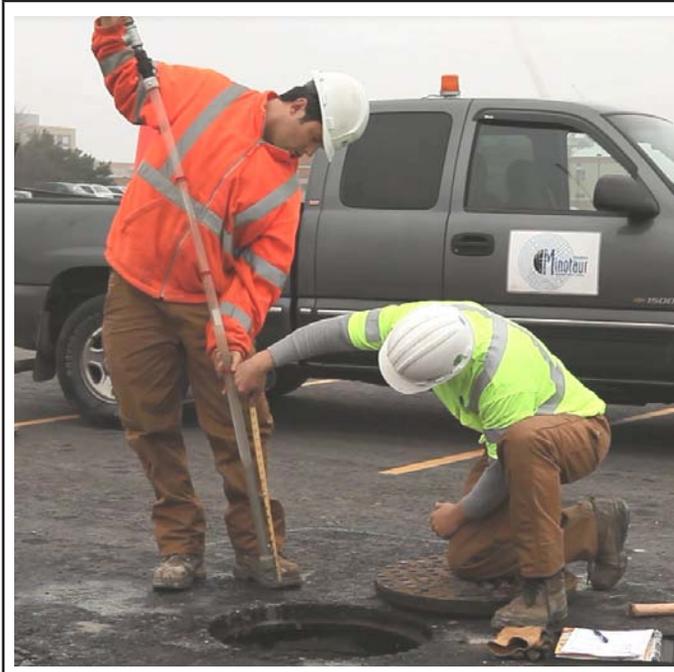
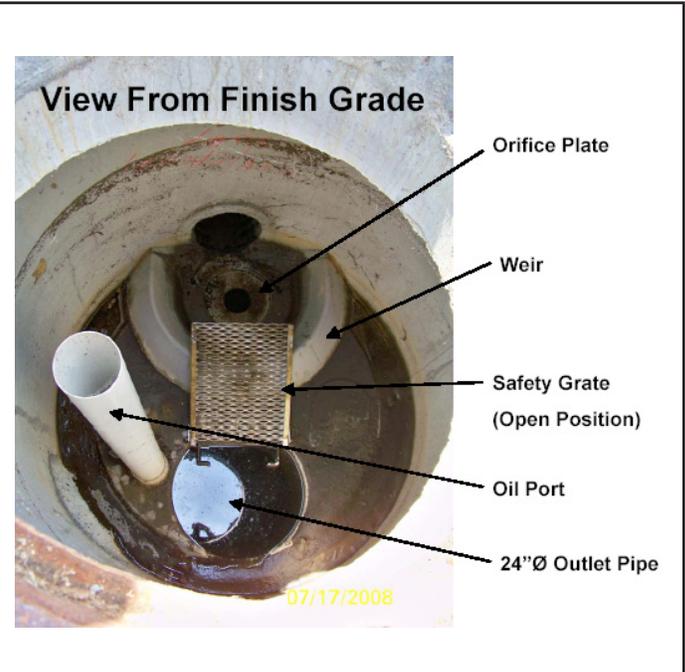


Figure 4.



What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. **DO NOT ENTER THE STORMCEPTOR CHAMBER** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
 - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
 - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

Figure 5.

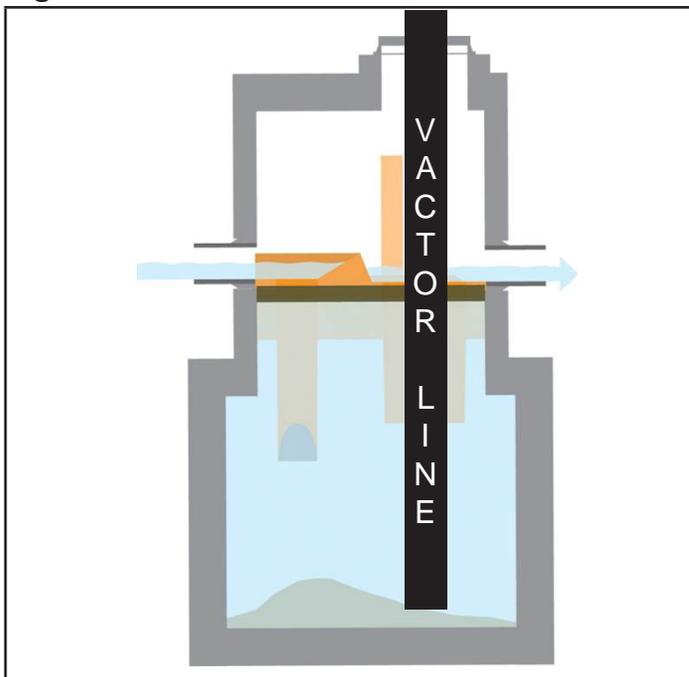
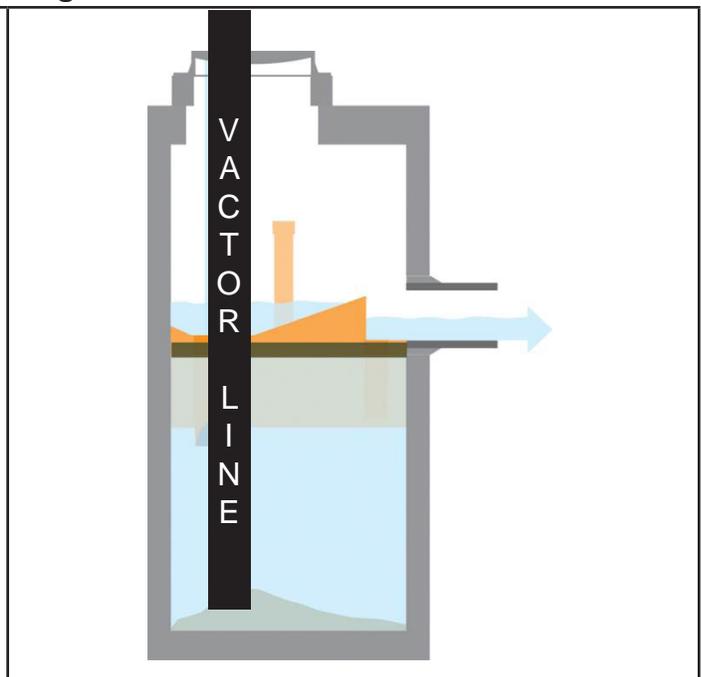


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

Figure 7.



Figure 8.



A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at

very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that the unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?

The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?

Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

Table 3A. (US) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (in)	EOS Model	Maintenance Sediment depth (in)	Oil Storage Depth (in)	OSR Model	Maintenance Sediment depth (in)
450	8	4-175	9	24	065	8
900	8	9-365	9	24	140	8
1200	10	12-590	11	39		
1800	15					
2400	12	24-1400	14	68	250	12
3600	17	36-1700	19	79		
4800	15	48-2000	16	68	390	17
6000	18	60-2500	20	79		
7200	15	72-3400	17	79	560	17
11000*	17	110-5000*	16	68	780*	17
13000*	20	130-6000*	20	79		
16000*	17	160-7800*	17	79	1125*	17

Note:

1. The values above are for typical standard units.

*Per structure.

Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (mm)	EOS Model	Maintenance Sediment depth (mm)	Oil Storage Depth (mm)	OSR Model	Maintenance Sediment depth (mm)
300	225	300	225	610	300	200
750	230	750	230	610	750	200
1000	275	1000	275	990		
1500	400					
2000	350	2000	350	1727	2000	300
3000	475	3000	475	2006		
4000	400	4000	400	1727	4000	375
5000	500	5000	500	2006		
6000	425	6000	425	2006	6000	375
9000*	400	9000*	400	1727	9000*	425
11000*	500	10000*	500	2006		
14000*	425	14000*	425	2006	14000*	425

Note:

1. The values above are for typical standard units.

*Per structure.

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor’s long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: _____

Allowable Sediment Depth: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Other Comments: _____

Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

Stormceptor Licensees:

CANADA

Lafarge Canada Inc.
www.lafargepipe.com
403-292-9502 / 1-888-422-4022
780-468-5910
204-958-6348

Calgary, AB
Edmonton, AB
Winnipeg, MB, NW. ON, SK

Langley Concrete Group
www.langleyconcretigroup.com
604-502-5236

BC

Hanson Pipe & Precast Inc.
www.hansonpipeandprecast.com
519-622-7574 / 1-888-888-3222

ON

Lécuyer et Fils Ltée.
www.lecuyerbeton.com
450-454-3928 / 1-800-561-0970

QC

Strescon Limited
www.strescon.com
902-494-7400
506-633-8877

NS, NF
NB, PE

UNITED STATES

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

AUSTRALIA & SOUTHEAST ASIA, including New Zealand & Japan

Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

Imbrium Systems Inc. & Imbrium Systems LLC

Canada 1-416-960-9900 / 1-800-565-4801
United States 1-301-279-8827 / 1-888-279-8826
International +1-416-960-9900 / +1-301-279-8827
Email info@imbriumsystems.com

www.imbriumsystems.com
www.stormceptor.com

**Save Valuable Land and
Protect Water Resources**



Isolator[®] Row O&M Manual
StormTech[®] Chamber System for Stormwater Management

1.0 The Isolator[®] Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patented technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.



Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

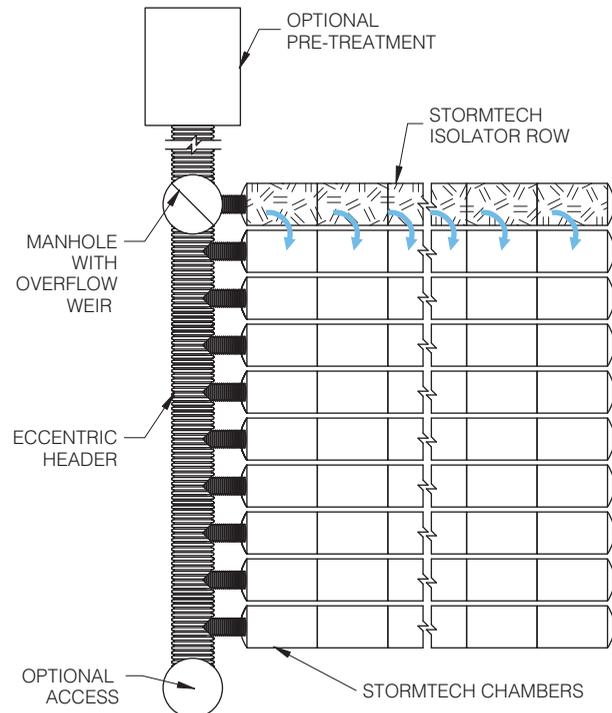
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway (not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

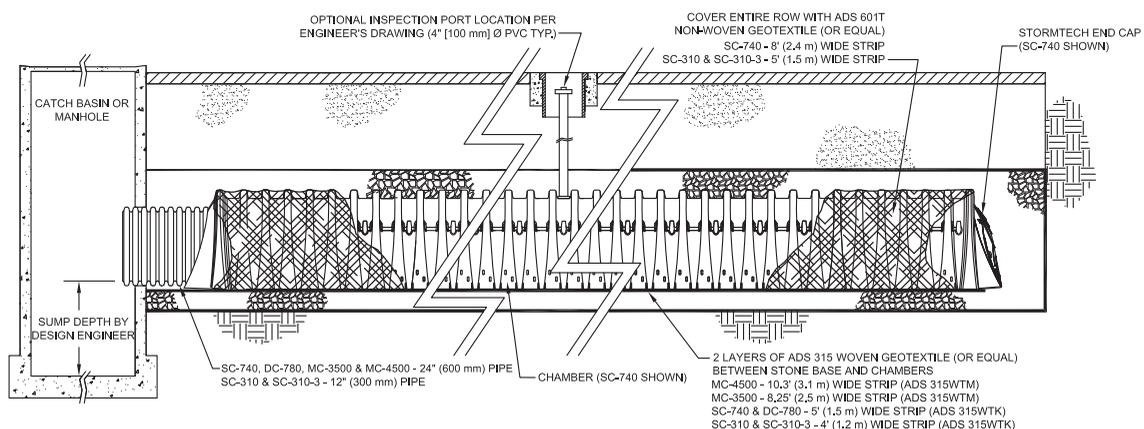
The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



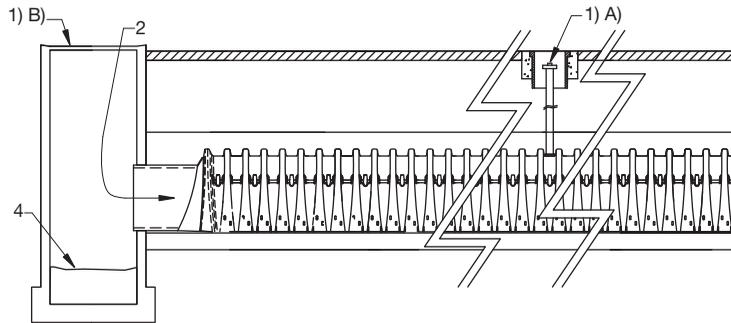
NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

- A) Inspection ports (if present)
 - i. Remove lid from floor box frame
 - ii. Remove cap from inspection riser
 - iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
 - iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.
- B) All Isolator Rows
 - i. Remove cover from manhole at upstream end of Isolator Row
 - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
 1. Mirrors on poles or cameras may be used to avoid a confined space entry
 2. Follow OSHA regulations for confined space entry if entering manhole
 - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

- A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm



70 Inwood Road, Suite 3 | Rocky Hill | Connecticut | 06067
 860.529.8188 | 888.892.2694 | fax 866.328.8401 | www.stormtech.com

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 Stormtech® and the Isolator® Row are registered trademarks of StormTech, Inc.
 Green Building Council Member logo is a registered trademark of the U.S. Green Building Council.

Project: Rivercrest Condominiums
 Address: Ferry Street
 Responsible Party:
 Date:

Operation & Maintenance Inspection Checklist

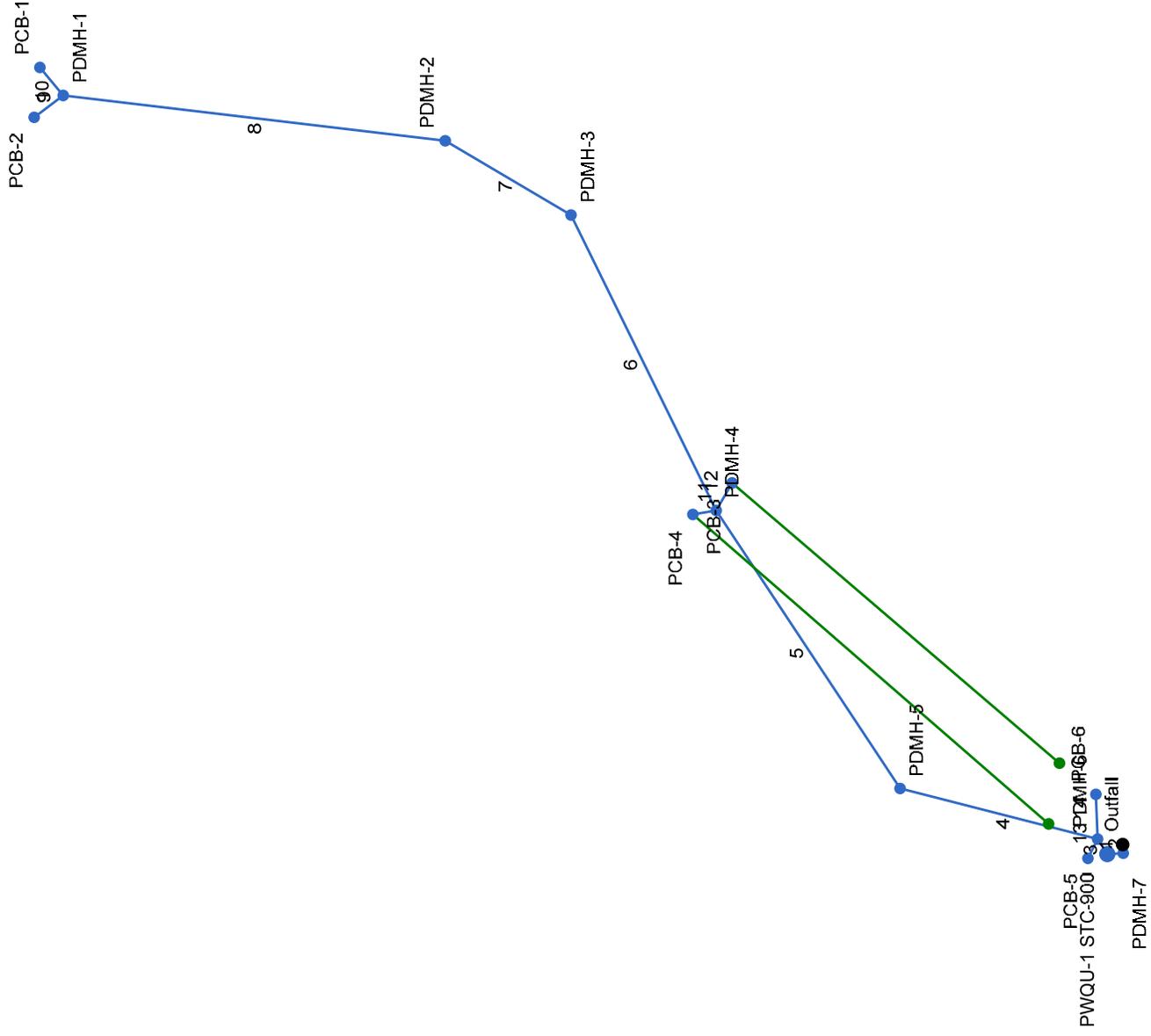
BMP Element:	Potential Problem:	Resolution:	Passed	Failed	Recommended Remediation
Bituminous Concrete Roadway	Build-up of sediment over the winter months and collection of leaves during the fall months.	Sweep roadway using a high-efficiency street sweeper.			
Deep-Sump Catch Basins	Sediment has accumulated to a depth greater than the original design depth for sediment storage, approximately 2-feet of sediment.	Remove the sediment and dispose of in accordance with local and state regulations.			
Stormwater Piping	Blockage of inlet/outlet pipes due to debris or sediment accumulation.	Remove any debris and sediment via proper means. Dispose of debris/sediment in accordance with local and state regulations.			
Proprietary Treatment Device	Sediment has accumulated to a depth greater than the original design depth for sediment storage.	Remove sediment and disposed of in accordance with local and state regulations.			
Subsurface Infiltration Basin	Accumulation of sediment at the inlet structure above the maintenance level.	Remove the sediment and conduct the proper maintenance to the up-gradient pretreatment devices.			
Sediment Forebay	Excessive sediment accumulation.	Remove sediment and debris.			
	Erosion is occurring on the side slope or around the flared end section.	Remedy scoured area and/or replace riprap immediately.			
	Debris has collected inside the basin.	Remove debris and remedy any damage caused.			
Infiltration Basin	Standing water inside basin.	Verify that sediment is not entering the basin. Remove collected sediment and scour basin bottom. Replace damaged vegetation			
	Erosion is occurring on the side slope or around the flared end section.	Remedy scoured area and replace vegetation.			
	Trees/Shrubs are starting to grow within the basin.	Remove trees/shrubs and vegetate with grass.			
Flared End Sections	Debris has collected inside the basin.	Remove debris and remedy any damage caused.			
	Vegetation has started to grow within the riprap area.	Remove vegetation immediately.			
	Accumulation of sediment/debris at the culvert inlet.	Remove sediment or debris such that the culvert has free flow.			
	Erosion is occurring where riprap has been dislodged.	Remedy scoured area and replace riprap immediately.			

Inspector's Signature _____ Date _____

Appendix G: Hydraulic Calculations

- Stormwater Infrastructure Hydraulic Calculations
- Roof Leader Hydraulic Calculations
- Springfield IDF Curve
- 18" Grate Inlet Capacity Chart
- Trash Rack Design

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Project File: Storm - PR1_2014-09-25rev.stm

Number of lines: 14

Date: 9/25/2014

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	D-PIPE-8	7.23	18	Cir	3.800	201.90	201.90	0.000	203.17	203.19	0.31	203.50	End	Manhole
2	D-PIPE-7	7.24	18	Cir	6.993	201.90	201.96	0.858	203.50*	203.53*	0.23	203.77	1	Manhole
3	D-PIPE-6	7.25	18	Cir	7.769	202.22	202.28	0.772	203.77	203.78	0.26	204.04	2	Manhole
4	D-PIPE-5	4.97	18	Cir	89.598	202.28	202.72	0.491	204.04	204.21	0.09	204.30	3	Manhole
5	D-PIPE-4	5.16	18	Cir	145.978	202.73	203.45	0.493	204.30	204.55	0.20	204.75	4	Manhole
6	D-PIPE-3	3.19	12	Cir	144.242	203.95	204.67	0.499	204.95*	205.93*	0.15	206.09	5	Manhole
7	D-PIPE-2	2.53	12	Cir	63.996	204.67	206.00	2.078	206.09	206.68	n/a	206.68 j	6	Manhole
8	D-PIPE-1	2.01	12	Cir	169.000	206.00	206.85	0.503	206.68	207.46	0.18	207.65	7	Manhole
9	D-LAT-2	1.06	12	Cir	15.914	206.84	207.00	1.005	207.65	207.43	n/a	207.43	8	Grate
10	D-LAT-1	0.76	12	Cir	15.914	206.84	207.00	1.005	207.65	207.36	n/a	207.36	8	Grate
11	D-LAT-4	0.97	12	Cir	10.375	203.70	203.80	0.964	204.75	204.76	0.02	204.78	5	Grate
12	D-LAT-3	1.35	12	Cir	13.887	203.70	203.83	0.936	204.75	204.77	0.05	204.81	5	Grate
13	D-LAT-6	1.05	12	Cir	9.435	202.53	202.62	0.954	204.04*	204.05*	0.03	204.08	3	Grate
14	D-LAT-5	1.80	12	Cir	19.621	202.53	202.72	0.968	204.04*	204.08*	0.08	204.17	3	Grate

Project File: Storm - PR1_2014-09-25rev.stm

Number of lines: 14

Run Date: 9/25/2014

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station	Line	To Line	Len (ft)	Drng Area (ac)		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev Dn (ft)	Invert Elev Up (ft)	HGL Elev		Grnd / Rim Elev Dn (ft)	Grnd / Rim Elev Up (ft)	Line ID
				Incr	Total		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)			Dn (ft)	Up (ft)				Dn (ft)	Up (ft)
1	End		3.800	0.00	1.50	0.00	0.00	1.03	0.0	9.7	7.0	7.23	0.00	4.50	18	0.00	201.90	201.90	203.17	203.19	206.70	206.70	D-PIPE-8
2	1		6.993	0.00	1.50	0.00	0.00	1.03	0.0	9.7	7.0	7.24	10.54	4.10	18	0.86	201.90	201.90	203.50	203.53	206.70	206.60	D-PIPE-7
3	2		7.769	0.00	1.50	0.00	0.00	1.03	0.0	9.6	7.0	7.25	10.00	4.10	18	0.77	202.22	202.28	203.77	203.78	206.60	206.60	D-PIPE-6
4	3		89.598	0.00	1.00	0.00	0.00	0.69	0.0	9.1	7.2	4.97	7.97	2.82	18	0.49	202.28	202.72	204.04	204.21	206.60	207.03	D-PIPE-5
5	4		145.978	0.00	1.00	0.00	0.00	0.69	0.0	8.3	7.5	5.16	7.99	3.31	18	0.49	202.73	203.45	204.30	204.55	207.03	207.89	D-PIPE-4
6	5		144.242	0.10	0.57	0.90	0.09	0.42	6.0	7.7	7.7	3.19	2.73	4.06	12	0.50	203.95	204.67	204.95	205.93	207.89	209.15	D-PIPE-3
7	6		63.996	0.09	0.47	0.90	0.08	0.33	6.0	7.4	7.8	2.53	5.56	3.84	12	2.08	204.67	206.00	206.09	206.68	209.15	211.41	D-PIPE-2
8	7		169.000	0.03	0.38	0.90	0.03	0.24	6.0	6.3	8.3	2.01	2.74	3.76	12	0.50	206.00	206.85	206.68	207.46	211.41	211.38	D-PIPE-1
9	8		15.914	0.21	0.21	0.60	0.13	0.13	6.0	6.0	8.4	1.06	3.87	2.41	12	1.01	206.84	207.00	207.65	207.43	211.38	211.13	D-LAT-2
10	8		15.914	0.14	0.14	0.65	0.09	0.09	6.0	6.0	8.4	0.76	3.87	2.04	12	1.01	206.84	207.00	207.65	207.36	211.38	211.13	D-LAT-1
11	5		10.375	0.19	0.19	0.61	0.12	0.12	6.0	6.0	8.4	0.97	3.79	1.25	12	0.96	203.70	203.80	204.75	204.76	207.89	207.73	D-LAT-4
12	5		13.887	0.24	0.24	0.67	0.16	0.16	6.0	6.0	8.4	1.35	3.73	1.74	12	0.94	203.70	203.83	204.75	204.77	207.89	207.73	D-LAT-3
13	3		9.435	0.17	0.17	0.74	0.13	0.13	6.0	6.0	8.4	1.05	3.77	1.34	12	0.95	202.53	202.62	204.04	204.05	206.60	206.40	D-LAT-6
14	3		19.621	0.33	0.33	0.65	0.21	0.21	6.0	6.0	8.4	1.80	3.80	2.29	12	0.97	202.53	202.72	204.04	204.08	206.60	206.40	D-LAT-5

Project File: Storm - PR1_2014-09-25rev.stm

Number of lines: 14

Run Date: 9/25/2014

NOTES: Intensity = 36.41 / (Inlet time + 4.90) ^ 0.61; Return period = Yrs. 100 ; c = cir e = ellip b = box

Bypass Qs

Line No.	Inlet ID	Q Capt (cfs)	Q Carry (cfs)	Q Byp (cfs)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Byp Ln No	Gutter Slope (ft/ft)	Gutter Depth (ft)	Gutter Spread (ft)	Gutter Width (ft)	Junct Type	n-val Gutter	Local Depr (in)
1	PDMH-7	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
2	PWQU-1 STC-900	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
3	PDMH-6	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
4	PDMH-5	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
5	PDMH-4	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
6	PDMH-3	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
7	PDMH-2	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
8	PDMH-1	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
9	PCB-2	1.06	0.00	0.00	4.00	2.00	2.00	0.020	0.020	Sag	Sag	0.17	8.54	2.00	Grate	...	0.0
10	PCB-1	0.76	0.00	0.00	4.00	2.00	2.00	0.020	0.020	Sag	Sag	0.14	7.07	2.00	Grate	...	0.0
11	PCB-4	0.63	0.00	0.34	...	2.00	2.00	0.020	0.020	13	0.005	0.15	7.56	2.00	Grate	0.013	0.0
12	PCB-3	0.84	0.00	0.51	...	2.00	2.00	0.020	0.020	14	0.010	0.15	7.51	2.00	Grate	0.013	0.0
13	PCB-5	1.39	0.34	0.00	4.00	2.00	2.00	0.020	0.020	Sag	Sag	0.20	10.07	2.00	Grate	...	0.0
14	PCB-6	2.31	0.51	0.00	4.00	2.00	2.00	0.020	0.020	Sag	Sag	0.27	13.71	2.00	Grate	...	0.0

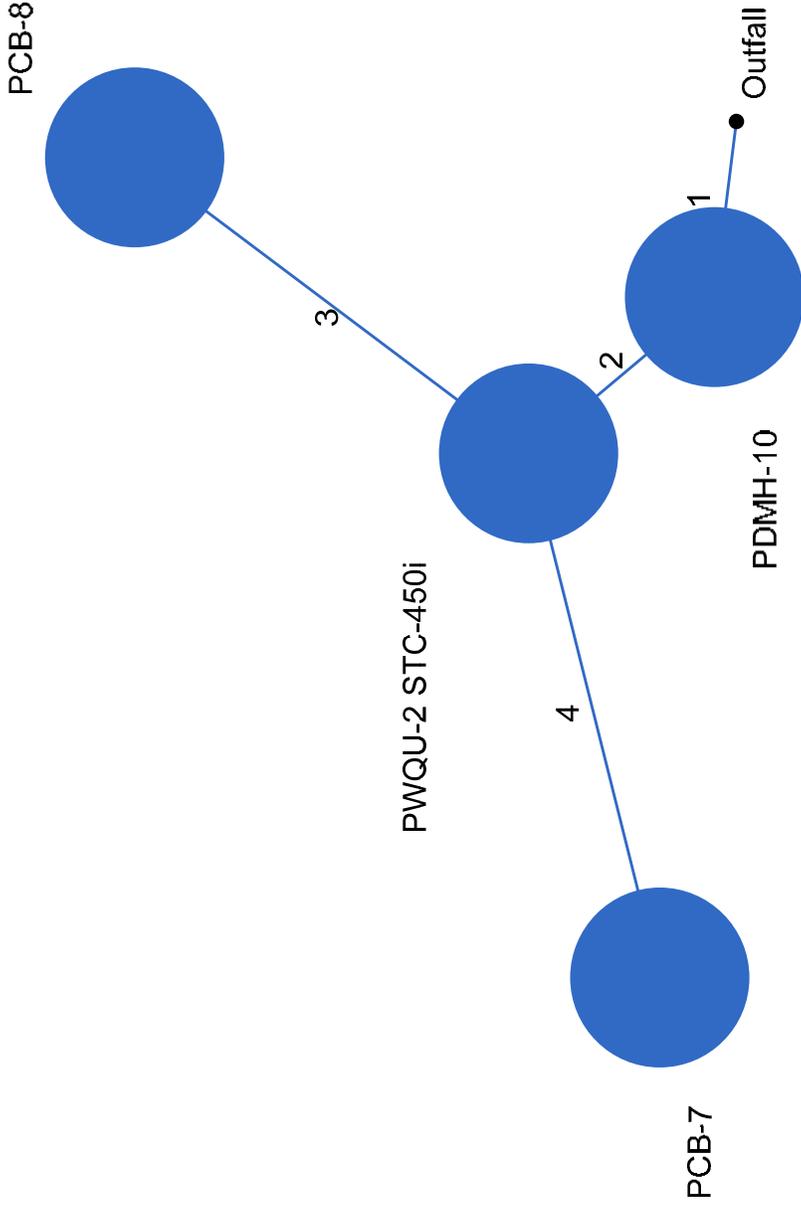
Project File: Storm - PR1_2014-09-25rev.stm

Number of lines: 14

Date: 9/25/2014

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	D-PIPE-13	3.24	12	Cir	4.000	197.10	197.20	2.500	197.62	197.97	0.27	197.97	End	Manhole
2	D-PIPE-12	3.24	12	Cir	5.489	197.20	197.30	1.822	197.97	198.07	n/a	198.07	1	Manhole
3	D-LAT-8	1.18	12	Cir	11.217	197.56	197.78	1.961	198.07	198.24	n/a	198.24 j	2	Grate
4	D-LAT-7	2.08	12	Cir	12.173	197.56	197.80	1.972	198.07	198.42	n/a	198.42	2	Grate

Project File: Storm - PR2_2014-09-25rev.stm
 Number of lines: 4
 Run Date: 9/25/2014

NOTES: Return period = 100 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station	Line	To Line	Len (ft)	Drng Area (ac)		Rnoff coeff (C)	Area x C		Tc (min)		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev (ft)		HGL Elev (ft)		Grnd / Rim Elev (ft)		Line ID
				Incr	Total		Incr	Total	Inlet	Syst					Size (in)	Slope (%)	Dn	Up	Dn	Up	Dn	Up	
1	End		4.000	0.00	0.57	0.00	0.00	0.39	0.0	6.1	8.3	3.24	6.10	6.43	12	2.50	197.10	197.20	197.62	197.97	202.20	202.20	D-PIPE-13
2	1		5.489	0.00	0.57	0.00	0.00	0.39	0.0	6.1	8.3	3.24	5.21	4.99	12	1.82	197.20	197.30	197.97	198.07	202.20	202.19	D-PIPE-12
3	2		11.217	0.21	0.21	0.67	0.14	0.14	6.0	6.0	8.4	1.18	5.40	3.15	12	1.96	197.56	197.78	198.07	198.24	202.19	201.95	D-LAT-8
4	2		12.173	0.36	0.36	0.69	0.25	0.25	6.0	6.0	8.4	2.08	5.42	4.64	12	1.97	197.56	197.80	198.07	198.42	202.19	201.95	D-LAT-7

Project File: Storm - PR2_2014-09-25rev.stm

Number of lines: 4

Run Date: 9/25/2014

NOTES: Intensity = 36.41 / (Inlet time + 4.90) ^ 0.61; Return period = Yrs. 100 ; c = cir e = ellip b = box

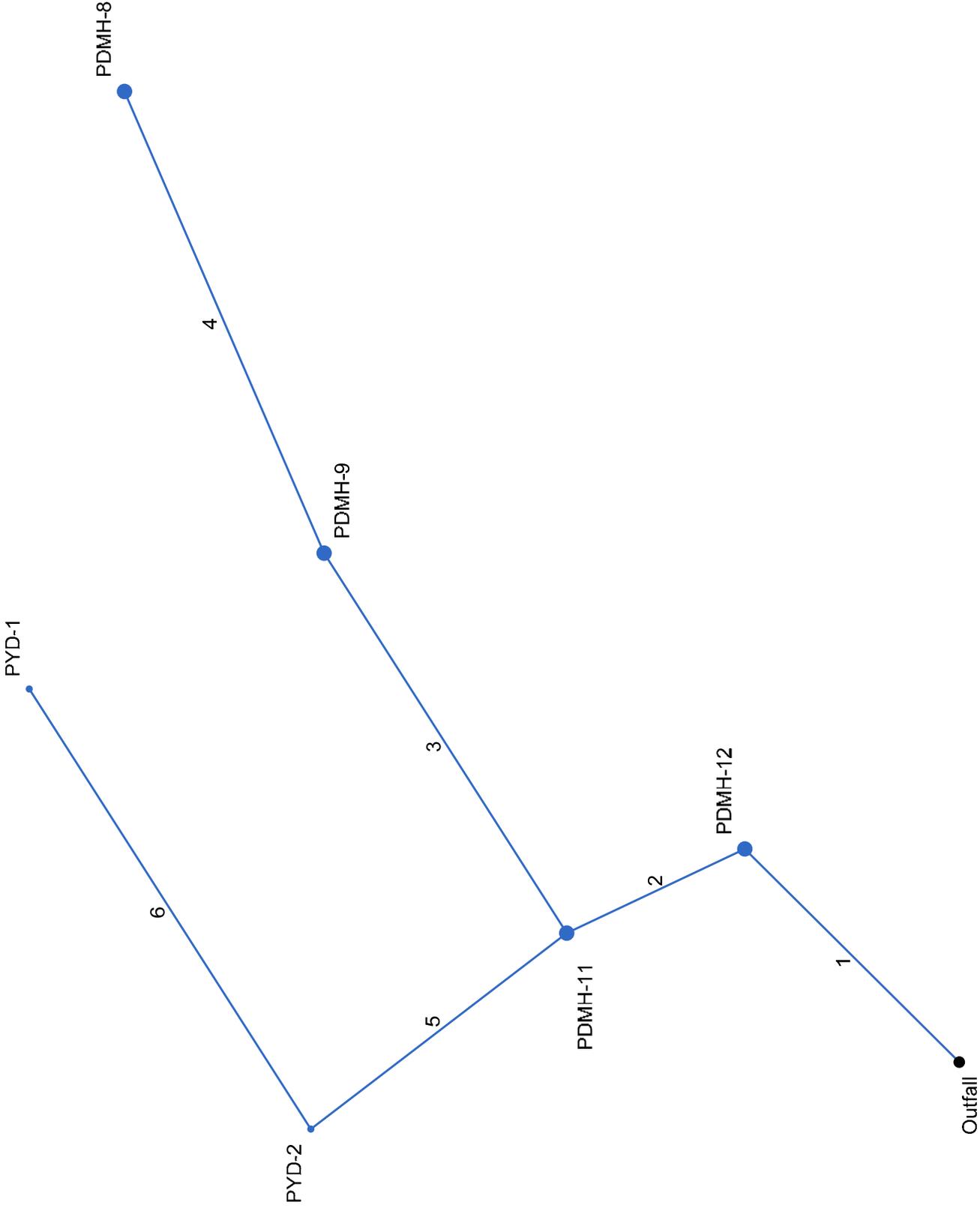
Bypass Qs

Line No.	Inlet ID	Q Capt (cfs)	Q Carry (cfs)	Q Byp (cfs)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Byp Ln No	Gutter Slope (ft/ft)	Gutter Depth (ft)	Gutter Spread (ft)	Gutter Width (ft)	Junct Type	n-val Gutter	Local Depr (in)
1	PDMH-10	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
2	PWQU-2 STC-450i	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
3	PCB-8	1.18	0.00	0.00	4.00	2.00	2.00	0.020	0.020	Sag	Sag	0.18	9.12	2.00	Grate	...	0.0
4	PCB-7	2.08	0.00	0.00	4.00	2.00	2.00	0.020	0.020	Sag	Sag	0.26	12.86	2.00	Grate	...	0.0

Project File: Storm - PR2_2014-09-25rev.stm Number of lines: 4 Date: 9/25/2014

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	D-PIPE-17	3.67	12	Cir	91.174	185.00	186.21	1.327	185.69	187.03	0.42	187.45	End	Manhole
2	D-PIPE-16	3.68	12	Cir	59.431	186.21	186.51	0.505	187.45*	187.99*	0.34	188.33	1	Manhole
3	D-PIPE-11	2.39	12	Cir	135.907	187.51	196.60	6.688	188.33	197.26	n/a	197.26 j	2	Manhole
4	D-PIPE-10	0.55	12	Cir	151.490	197.10	201.40	2.838	197.30	201.71	0.11	201.71	3	Manhole
5	D-PIPE-15	1.23	12	Cir	97.348	186.51	187.00	0.503	188.33*	188.43*	0.06	188.48	2	Grate
6	D-PIPE-14	1.00	12	Cir	157.422	187.00	192.50	3.494	188.48	192.92	n/a	192.92 j	5	Grate

Project File: Storm - PR3_2014-09-25rev.stm

Number of lines: 6

Run Date: 9/25/2014

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station	Line	To Line	Len (ft)	Drng Area (ac)		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev (ft)		HGL Elev (ft)		Grnd / Rim Elev (ft)		Line ID
				Incr	Total		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn	Up	Dn	Up	Dn	Up	
1	End		91.174	0.00	0.76	0.00	0.00	0.23	0.0	16.4	5.6	3.67	4.44	5.84	12	1.33	185.00	186.21	185.69	187.03	185.68	190.15	D-PIPE-17
2	1		59.431	0.02	0.76	0.90	0.02	0.23	6.0	16.2	5.6	3.68	2.74	4.69	12	0.50	186.21	186.51	187.45	187.99	190.15	191.62	D-PIPE-16
3	2		135.907	0.00	0.00	0.00	0.00	0.00	0.0	3.6	0.0	2.39	9.98	3.90	12	6.69	187.51	196.60	188.33	197.26	191.62	202.62	D-PIPE-11
4	3		151.490	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.55	6.50	3.86	12	2.84	197.10	201.40	197.30	201.71	202.62	206.60	D-PIPE-10
5	2		97.348	0.18	0.74	0.28	0.05	0.21	6.0	15.2	5.8	1.23	2.74	1.56	12	0.50	186.51	187.00	188.33	188.43	191.62	190.50	D-PIPE-15
6	5		157.422	0.56	0.56	0.29	0.16	0.16	13.1	13.1	6.2	1.00	7.21	2.24	12	3.49	187.00	192.50	188.48	192.92	190.50	196.50	D-PIPE-14

Project File: Storm - PR3_2014-09-25rev.stm

Number of lines: 6

Run Date: 9/25/2014

NOTES: Intensity = 36.41 / (Inlet time + 4.90) ^ 0.61; Return period = Yrs. 100 ; c = cir e = ellip b = box

Bypass Qs

Line No.	Inlet ID	Q Capt (cfs)	Q Carry (cfs)	Q Byp (cfs)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Byp Ln No	Gutter Slope (ft/ft)	Gutter Depth (ft)	Gutter Spread (ft)	Gutter Width (ft)	Junct Type	n-val Gutter	Local Depr (in)
1	PDMH-12	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
2	PDMH-11	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
3	PDMH-9	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
4	PDMH-8	...	...	...	...	...	...	...	...	n/a	...	...	...	...	MH	...	...
5	PYD-2	0.42	0.00	0.00	4.00	2.00	2.00	0.050	0.020	Sag	Sag	0.13	3.59	2.00	Grate	...	0.0
6	PYD-1	1.00	0.00	0.00	...	2.00	2.00	0.050	0.020	Offsite	1.500	0.10	1.94	2.00	Grate	0.027	0.0

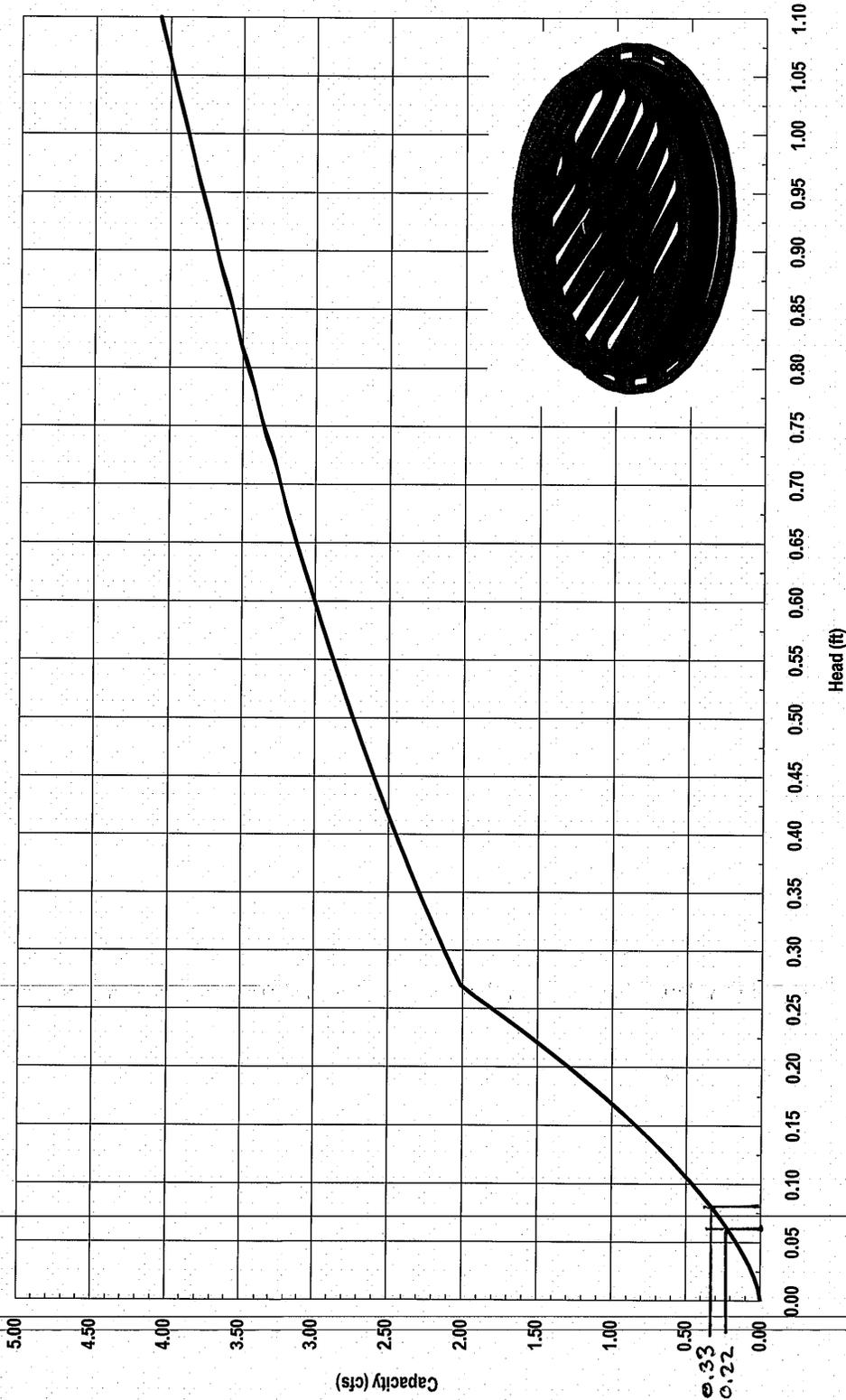
Project File: Storm - PR3_2014-09-25rev.stm

Number of lines: 6

Date: 9/25/2014

NOTES: ** Critical depth

Nyloplast 18" Standard Grate Inlet Capacity Chart



YD-1

Inflow Q = 0.22 cfs
Depth = 0.06 ft

YD-2

Inflow Q = 0.12 cfs
Depth = 0.08 ft

Inlet Capacity @ Q = 0.22 cfs for YD-1
Inlet Capacity @ Q = 0.33 cfs for YD-2



Nyloplast

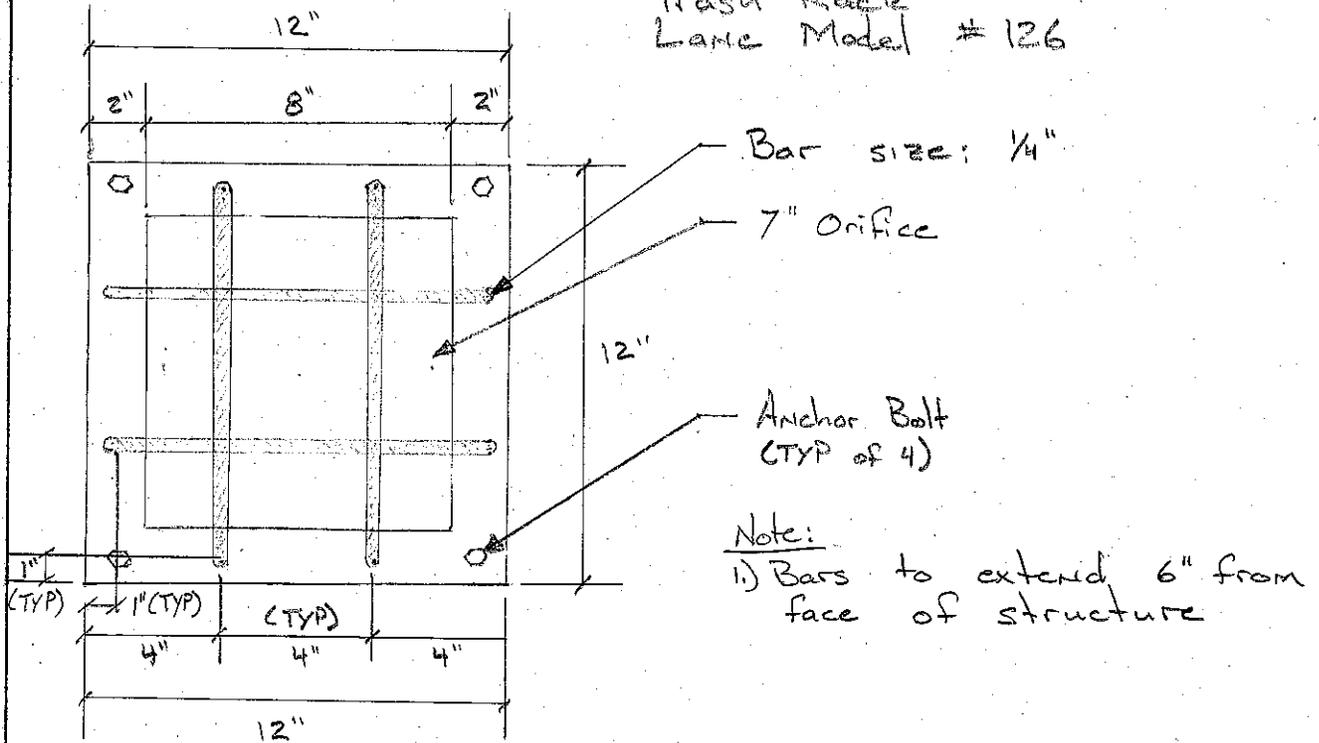
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Project: Rivercrest Condominiums
 Client: Ferry Street Nominee Trust
 Designed By: Filipe Cravo, P.E.
 Date: 9-25-2014
 Sheet: 1 of 1

Trash Rack Design:

- Outlet Control Structure Orifice = 7" Diameter
 Open Area of orifice = 1.06 ft²

- Proposed Trash Rack: Lane Enterprises, Inc.
 Trash Rack
 Lane Model # 126



Trash Rack Open Area:

- Face of Rack = 12" - 0.25" - 0.25" = 11.5" x 11.5" = 132 in² → 1.9 ft²
 - Top/Bottom/Right/Left side = 6" x 11.5" = 69 in² → 0.48 ft²
 x 4 sides = 1.9 ft²

∴ Trash Rack Open Area = 1.9 ft² + 1.9 ft² = 3.8 ft²

$3.8 \text{ ft}^2 > 1.06 \text{ ft}^2$
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Appendix H: Low-Impact Development Alternatives Analysis Narrative

LOW IMPACT DEVELOPMENT CONSIDERATIONS

Rivercrest Condominiums
Map 47, Parcel 76
Ferry Street, South Hadley, MA

INTRODUCTION

Per the Massachusetts Stormwater Handbook, project proponents must consider environmentally sensitive site design and low impact development techniques to effectively manage stormwater. As a part of the proposed Condominium Community, the project proponent has considered a number of environmentally sensitive, low impact development techniques to prevent the generation of stormwater and non-point source pollution. The following is a detailed description of the considerations for each low impact development measure. For ease of review, RLA has provided the consideration of each measure as detailed in the Massachusetts Stormwater Report Checklist.

LOW IMPACT DEVELOPMENT (LID) MEASURES

Environmentally Sensitive Project Approach

During the design feasibility effort for the subject property, RLA considered many design scenarios for the development and layout of the proposed project.

The proposed Condominium Community design is for a 29-unit community. The project has been proposed in the least-intrusive manner possible while avoiding potential impacts to the resource areas on-site.

No disturbance to any Wetland Resource Areas

In the initial site planning, the project was designed in the least intrusive manner possible to avoid impacts to the resource areas on-site. No wetland resource areas will be disturbed as part of this project.

A portion of the site falls within the Riverfront Area of the perennial stream known as Stony Brook. No work is proposed within the Riverfront Area.

Site Design Practices (e.g. clustered development, reduced frontage setbacks)

As mentioned above, the project will entail the creation of an access road and home sites. The roadway and condominiums are laid out in the most efficient manner possible, effectively utilizing the upland areas within the property with the protection of the resource areas in mind. The project proponent and RLA developed what is believed to be an efficient use of the site which avoids impacts to the resource areas on-site to the maximum extent feasible. In addition to not impacting resource areas, the 50' buffer zone has been protected and will not be impacted.

Reduced Impervious Area (Redevelopment Only)

The proposed project is not part of a redevelopment project.

Minimizing disturbance to existing trees and shrubs

The goal of the project proponent is to maintain as much of the existing vegetative cover on-site as possible. The proposed project has been designed to cluster the layout of the condominiums, as well as the impervious surfaces and stormwater basins. The areas of permanent disturbance which will require the removal of vegetation are those which encompass the homes, roadway, and associated grading. Special care has been taken to avoid the 50' buffer and provide buffering to the neighboring property.

LID Site Design Credit Requested

No LID Site Design Credit is requested for the proposed project.

Use of "country drainage" versus curb and gutter conveyance and pipe

Country drainage systems are often times much less costly than closed drainage systems such as gutter conveyance and pipe. Unfortunately, the proposed project and subject site are not suitable for such a system.

Due to the site layout, other than grassed swales, the project proponent was unable to take advantage of country drainage systems. It is not feasible to match the existing drainage patterns on-site and transport the water to a treatment and infiltration area that meets the DEP standards by country drainage methods.

With a condominium community, it is also very important, from a liability standpoint, that the project site be free of any potential ponding on surface drainage areas or paths of travel or that could cause temporary or long-term safety hazards.

Bioretention Cells (includes Rain Gardens)

Due to the clustered design and requirement to avoid the 50' buffer zone, the majority of the drainage system had to be located under the drives.

Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

There are no wetland impacts proposed, therefore, a constructed wetland is not logical and would create additional regulated area.

Treebox Filter

Treebox filters have been considered for the project, however based on the site layout and design, the extensive costs associated with such a method and the climatic conditions of the area, it is believed that such methods would be detrimental to the proposed project and would only provide a maintenance problem and a potential hazard for the occupants of the community. Such devices would be much more suitable to a coastal location that is not subject to the same winter conditions as are experienced in Western Massachusetts.

Water Quality Swale

A grassed swale has been included as part of the stormwater management system.

Grass Channel

A grass channel was considered for the proposed project; however, it is not feasible. Space considerations, lot layout, pedestrian and vehicular movements, and topography restrict the use of a grassed channel. Other, more appropriate BMPs have been implemented.

Green Roof

Green roofs are not suitable or marketable for the proposed project.

Other

Please see the Stormwater Report for more information.

Appendix I: Town of South Hadley Inspection Sheet

Town of South Hadley Inspection Schedule Sign-Off Sheet

Inspection Schedule	Description	Date of Inspection	Inspector	Passed	Failed	Notes
Initial Inspection	Prior to approval of any plan.					
Erosion and Sediment Control Inspections	After site clearing					
	Rough Grading					
	Final Grading					
Bury Inspection	Prior to backfilling of any underground drainage or stormwater conveyance structures.					
Final Inspection	Conducted when all work, including construction of stormwater management facilities and landscaping have been completed. Final inspection shall include a full, dated TV inspection of all stormwater pipes installed.					