FORM SWP

SOUTH HADLEY PLANNING BOARD

APPLICATION FOR STORMWATER PERMIT

Date 1-28-2016

Pursuant to the provisions of Article XVI of the Bylaws of the Town of South Hadley, the undersigned herewith submits the accompanying application for a Stormwater Management Permit as described below and detailed in the supporting documentation which is incorporated into and made part of this application.

PROJECT/SITE INFORMATION

Project/Site Name: South Hadley High School Athletic Field Renovations

Project/Site Location (Street Address): 153 Newton Street

Assessor's Map # 17 Parcel # 15 Total Parcel Size (square feet): 36 acres

Estimated Amount of Area to be Disturbed (square feet): 141,648 sf (3.25 ac)

Total Area of Impervious Surfaces (square feet): Existing: 6,000 Proposed: 16,200

Date Site Plan, Special Permit, or Definitive Subdivision Plan was approved: N/A

General Description of Project Renovations of the Athletic Field

APPLICANT INFORMATION

Name: Peter Spanos, Gale Associates Inc.

Address: 163 Libbey Parkway, Weymouth, MA

Telephone: 781-335-6465

Email: ps@gainc.com

OWNER INFORMATION
(if different from Applicant)

Name: Andrew Rogers, South Hadley Recreation

Address: 116 Main St, South Hadley, MA

Telephone: 413-538-5017

Email: arogers@southhadleyma.gov

CONSULTING ENGINEER INFORMATION

Name: Peter Spanos, Gale Associates Inc.

Address 163 Libbey Parkway, Weymouth, MA 02189

Telephone 781-335-6465

Email Address: ps@gainc.com

I, as applicant, certify that the application and all attachments are correct and complete.

Signature of Applicant **Date** 1-28-2016

FOR PLANNING BOARD OFFICE USE:

Amount of Application Fee: _____ Fee Paid? Yes ____ No ____

STORMWATER MANAGEMENT REPORT

SOUTH HADLEY HIGH SCHOOL
ATHLETIC CAMPUS IMPROVEMENTS
SOUTH HADLEY, MASSACHUSETTS

January 28, 2016

Prepared for:

Town of South Hadley
116 Main Street, Room 109
South Hadley, MA 01075

Prepared by:

Gale Associates, Inc.
163 Libbey Industrial Parkway
Weymouth, MA 02189
Gale JN 717000

COMMONWEALTH OF MASSACHUSETTS
PETER
SPANOS
CIVIL
No. 48407
REGISTERED
PROFESSIONAL ENGINEER

1-28-16

Prepared by: _____
Peter Spanos, P.E., LEED AP

STORMWATER MANAGEMENT REPORT

SOUTH HADLEY HIGH SCHOOL
ATHLETIC CAMPUS IMPROVEMENTS
SOUTH HADLEY, MASSACHUSETTS

TABLE OF CONTENTS

1.0 CHECKLIST FOR STORMWATER REPORT

2.0 PROJECT DESCRIPTION

3.0 EXISTING CONDITIONS INFORMATION

4.0 STORMWATER MANAGEMENT CONCEPT
- 4.1 Pre-Development Condition Hydrologic Sub Areas
- 4.2 Post-Development Condition Hydrologic Sub Areas

5.0 COMPLIANCE WITH STORMWATER STANDARDS
- 5.1 Untreated Stormwater (Standard 1)
- 5.2 Post-Development Peak Rates (Standard 2)
  - 5.2.1 Proposed Conditions
  - 5.2.2 Peak Rate Summary
- 5.3 Recharge to Groundwater (Standard 3)
- 5.4 Water Quality (Standard 4)
- 5.5 Land Uses With Higher Potential Pollutant Loads (Standard 5)
- 5.6 Critical Areas (Standard 6)
- 5.7 Redevelopment (Standard 7)
- 5.8 Erosion and Sedimentation Control Plan (Standard 8)
- 5.9 Operation and Maintenance Plan (Standard 9)
- 5.10 Prohibition of Illicit Discharges (Standard 10)

6.0 SUMMARY

TABLE OF CONTENTS (continued)

	ATTACHMENTS
	Attachment 1: United States Soil Conservation Services Mapping
	Attachment 2: Pre & Post Development Conditions Map
	Attachment 3: Pre & Post Development Hydrology
	Attachment 4: Operation and Maintenance & Erosion and Sediment Control Plan

1.0 CHECKLIST FOR STORMWATER REPORT

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

COMMONWEALTH OF MASSACHUSETTS
PETER
SPANOS
CIVIL
No. 48407
REGISTERED
PROFESSIONAL ENGINEER

1-28-16

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): Synthetic Turf Field Base Stone

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist (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 (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.

2.0 PROJECT DESCRIPTION

South Hadley High School (SHHS) is proposing a number of improvements to their athletic campus at 153 Newton Street in South Hadley, Massachusetts. The athletic facilities are currently used by the school students and athletes as well as local communities and youth sport organizations. The image below shows an overview of the SHHS campus and the adjacent parcels. The project site is bounded by Lincoln Avenue and residential area to the north, the school building and baseball field to the west and south, town DPW facility to the east and wooded conservation area to the east and southeast.

The proposed project includes improvements to main rectangular game field area and the improvements are described below:

Game Field

Improvements to the Game Field include converting the existing natural turf field inside the stone dust/cinder running track to synthetic turf. This will involve removing the existing topsoil and drainage infrastructure inside the field and installing a new drainage system and synthetic turf base stone. The majority of the stone dust/cinder track will be removed in order to maximize

athletic field footprint needed for a true multipurpose rectangular field. Other improvements include accessible walkways to access the field and the existing grandstands.

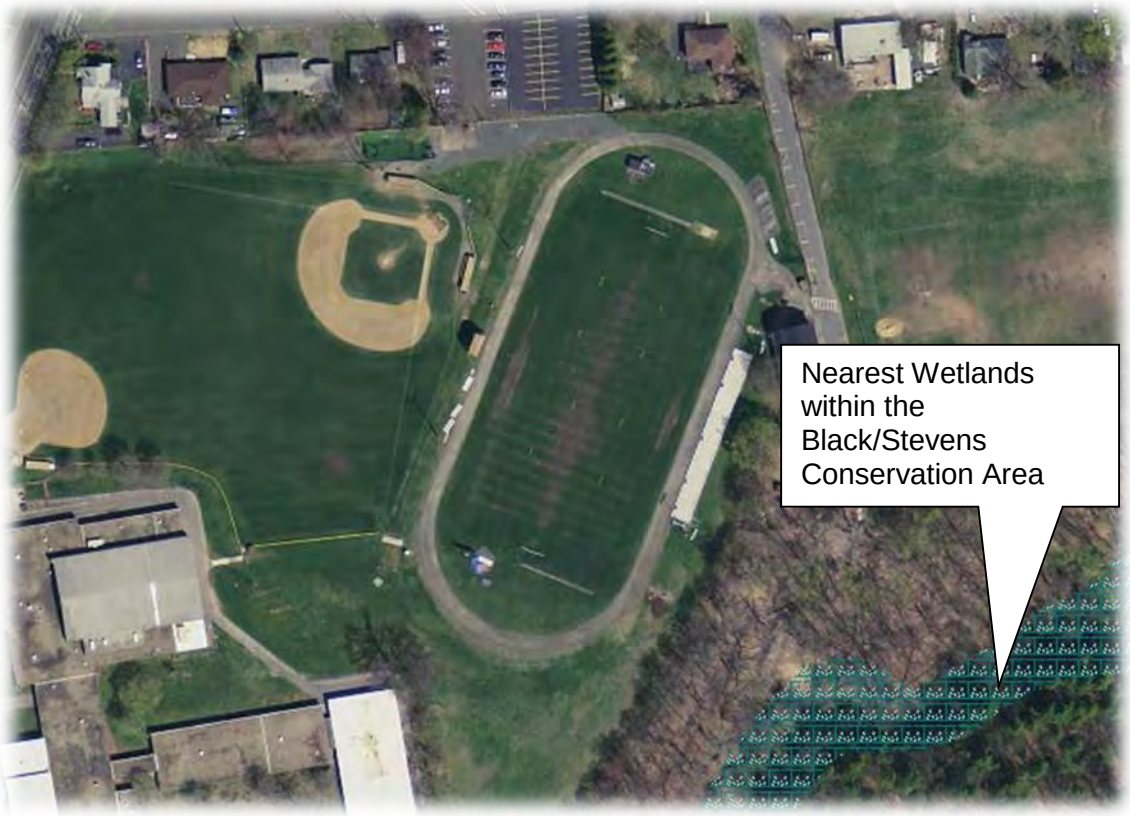
There is no portion of the proposed work that is located within 100' Bordering Vegetated Wetland (BVW) buffer protected under the Town of South Hadley and MA DEP Wetland Protection Act. An Application for Stormwater Permit and associated Stormwater Management Report has been filed with the Town of South Hadley Planning Board for the proposed work. The proposed work areas are discussed in more detail below and are depicted within the accompanying plan set and supporting information.

3.0 EXISTING CONDITION INFORMATION

Gale Associates Inc. (Gale) completed the existing conditions survey, in the fall of 2015. Overall, the field area are approximately 3± acres.

Bordering Vegetated Wetlands (BVW)

There are no Bordering vegetated wetlands (BVW) present within the project site. The nearest BVW is located to the south and is part of the Black/Stevens Conservation Area. The nearest disturbance associated with proposed work is well outside the 100-ft buffer. The schematic wetlands lines are shown on the image below.



Flood Plain

No portion of this project is within the 100-year flood plain, according to the FEMA FIRM Mapping.

Natural Heritage

According to the *Massachusetts Natural Heritage Atlas (13th Edition*), the site does not lie within a priority habitat of rare species.

Soils Investigation

Based on Natural Resources Conservation Service (NRCS) soil report, the underlying soils within the project area consist primarily of Hinckley-Merrimac Urban Land Complex (745C) with 3% – 15% slopes.

Curve number (CN) values for infiltration computations were based on Hydrologic Soil Group B (HSG B) and the surface cover material (e.g., grass, pavement). HSG B has an infiltration rate of 1.02 in./hr. for sandy loam, according to the Massachusetts Stormwater Handbook. This is generally consistent with the field investigation and was used for the recharge calculations. The breakdown of curve numbers can be seen in the drainage calculations, which are included in Attachment 1.

4.0 STORMWATER MANAGEMENT CONCEPT

The majority of the work pertains to the construction of a new infilled synthetic turf field. In general, synthetic turf fields drain stormwater runoff vertically, as opposed to natural turf fields, which tend to sheet flow runoff. The proposed synthetic turf fields have been designed with an engineered stone base (12-inch avg. depth, with 33% voids) and be drained via flat panel drains. The time required for stormwater to travel through the stone base and fill the voids, before reaching the underdrain system as well as the use of outlet control structures, will enable the synthetic turf field to release stormwater at a controlled rate, as well as provide storage to attenuate flows and promote additional recharge. The field has been designed so that post-development peak rates of runoff do not exceed pre-development peak rates for the 2, 10, and 100 year storm events.

4.1 Pre-Development Condition Hydrologic Sub Areas

The site, as analyzed by Gale, is broken down into one (1) watershed, which drain towards one (1) analysis point or design point (DP). The watershed is shown on the Pre-Development Watershed Map included in Attachment 2 and the area is summarized as follows:

Watershed Area 1 (WS-1):

WS-1 consists of the rectangular game field, bleachers and compacted stone dust/cinder track and handicap parking areas. Runoff from WS-1 flows overland down a slope before being collect by several catch basins and ultimately reaching existing drainage manhole on the southern portion of the project site (DP-1). WS-1 is approximately 3.55± acres and it has a time of concentration of 9.1 minutes, with a weighted curve number of 65 (CN=65).

4.2 Post-Development Condition Hydrologic Sub Areas

The site, as analyzed by Gale, is broken down into two (2) watersheds, generally maintaining flow patterns and design points consistent with pre-development conditions. Each watershed is shown on the Post-Development Watershed Map included in Attachment 2 and the areas are summarized as follows:

Watershed Area 1 (WS-1):

WS-1, in the proposed condition, contains synthetic turf field. In the proposed condition, WS-1 is approximately 1.91± acres and consists of the synthetic turf area. It has a time of concentration of 6.0 minutes, with a curve number of 98 (CN=98). Synthetic turf is modeled in HydroCAD with a CN of 98 to model the direct contribution of runoff to the underlying dynamic base stone, similar to the modeling of a pond. However, in reality it is a highly permeable surface. Runoff from WS-1 contributes to the dynamic base stone, which acts as a detention/infiltration basin that will detain runoff and promote recharge to groundwater. Runoff is released at a controlled rate and discharged through the existing 16” pipe to an existing drainage manhole.

Watershed Area 2 (WS-2):

WS-2, in the proposed condition, contains the area surrounding the field area and is essentially unchanged from the pre-development condition with the exception of new walkways and the removal of sections of existing track stone dust and replacing with new loam and seed. WS-2 is approximately 1.63± acres and consists of several ground covers, including grass, stone dust/cinder and impervious areas. It has a time of concentration of 11.0 minutes, with a weighted curve number of 67 (CN=67). Runoff from WS-2 flows into a series of catch basins, which connect via a closed drainage system and discharges to the existing drainage manhole (DP-1).

5.0 COMPLIANCE WITH STORMWATER STANDARDS (MASWMS)

5.1 Untreated Stormwater (Standard 1)

The project is designed so that new stormwater conveyances (outfalls/discharges) do not discharge untreated stormwater into or cause erosion to wetlands, to the maximum extent practicable.

5.2 Post-Development Peak Rates (Standard 2)

A hydrologic study was performed to determine the rate of runoff for the 2, 10, and 100-year storm events under pre-development (existing) conditions. Post-development rates were then computed in a similar manner. The study point where the peak rates were compared were taken at one design point which has been designated as the adjacent downgradient drainage structure at the southern end of the field. From these analyses, it was determined that the proposed project and its stormwater management system would not increase the peak runoff rates above existing levels. It is the intent of the stormwater management system to minimize impacts to drainage patterns, downstream property and wetlands, while simultaneously providing water quality treatment to runoff prior to its release from the site.

The U.S.D.A. Soil Conservation Service (SCS) Technical Release 55 (TR-55), 1986, was used as the procedure for estimating runoff. A HydroCAD SCS TR-20-based computer program was used for estimating peak discharges. TR-55 is a generally accepted model for use on small sites, and begins with a rainfall amount uniformly imposed on the watershed over a specified time distribution. Mass rainfall is converted to mass runoff by using a runoff curve number (CN). The CN is based on soils, plant cover, impervious areas, interception and surface storage. Runoff is then transformed into a hydrograph that depends on runoff travel time through segments of the watershed. Calculations can be found in Attachment 3.

5.2.1 Proposed Conditions

The post-development curve numbers are greater than pre-development, which generally increases the runoff potential of the site. In the Hydro-CAD software, synthetic turf is modeled with a CN of 98, to model the direct contribution of stormwater into the dynamic base stone beneath the synthetic turf fields, which is modeled as a detention/infiltration basin. The dynamic base stone serves to collect, detain and control the release of the majority of the stormwater runoff, to not increase the peak rates of runoff. The stone base will allow recharge and will promote infiltration to the maximum extent feasible.

5.2.2 Peak Rate Summary

The Table 1 below shows the peak rate of runoff for the existing site as well as for the developed site at 2, 10, and 100-year design storms.

Table 1

Analysis Point	Design Storm	Existing Runoff (CFS)	Proposed Runoff (CFS)
DP-1	2-yr	1.37	0.74
(Exist MH)	10-yr	4.78	2.34
	100-yr	9.85	4.65

5.3 Recharge to Groundwater (Standard 3)

The project controls the stormwater runoff from the site by attenuating and treating the runoff by the use of proposed synthetic turf base stone. After permeating through the base stone, the runoff will infiltrate into the soils beneath the field, with the excess stormwater draining through perforated flat panel under drains and perforated collector pipes. The flow from the dynamic base stone is constricted by the outlet control structures prior to release toward the existing drainage manhole. Also, the flat panel drains are spaced at 25' on-center, which leaves ample opportunity for groundwater recharge, rather than downstream conveyance.

Required Recharge Volume for the site was calculated in accordance with the Standards given a Type B soil:

Rev = [(S)(Rv)(A)]/12
Rev = [(0.35)(0.144)(3.55)/12 = .0150 Ac-ft = 650 CF

Rev = Required Recharge Volume (acre-feet)
S = Target Depth Factor (0.35 in for soils of Hydrologic Soil Group B)
Rv = 0.05+0.009(I) where I is the percent impervious cover
Impervious Area = sidewalks, and roofs (16,200 SF or 0.371 Ac.)
I = 0.371 / 3.55 = 10.48%
A = site area in acres = 3.55 Ac.

Required minimum Surface Area of the bottom of the infiltration structure was calculated in accordance with the Simple Dynamic Method, as outlined in the Massachusetts Stormwater Management Standards:

A = Rev / (D + KT)
A = 650 CF / (1.0 ft + 0.085 ft/h * 2h) = 556 SF

A = Minimum required surface area of the bottom of the infiltration structure

Rev = Required Recharge Volume
D = Depth of the Infiltration Facility = 1.0 ft)
K = Saturated Hydraulic Conductivity (1.02 in/h = 0.085 ft/h)
T = Allowable drawdown during the peak of the storm (2h)

The synthetic turf field is used to meet this standard, as it is separated by two feet (2') from the estimated seasonal high groundwater (ESHGW) table. The synthetic turf field is approximately 83,600 SF in surface area. This amount of infiltrative surface area allows for the vertical transport of stormwater into the underlying dynamic base stone, which contains 33% voids.

The drawdown time from the dynamic base stone was calculated as follows:

$$\textbf{Time}_{\textbf{drawdown}} = \textbf{Rev / [(K)*(Bottom Area)]}$$
$$= \textbf{(650 ft}^3\textbf{) / [(0.085 ft/hr)*(83,600 ft}^2\textbf{)]}$$
$$= \textbf{0.09 hrs}$$

Rev = Required Recharge Volume (ft^3)
K = Saturated Hydraulic Conductivity (ft/hr)
Bottom Area = Bottom Area of Recharge Structure (ft^2)

The drawdown time for the infiltration areas was calculated to be 0.09 hours, well below the required drawdown time of 72 hours.

5.4 Water Quality (Standard 4)

The proposed synthetic turf athletic field has a low potential for accumulation of Total Suspended Solids (TSS). The turf is not subject to vehicle traffic, fertilization, sedimentation, irrigation or rigorous maintenance, thus lessening the ability to acquire TSS. Runoff generated by the synthetic turf field will travel vertically, through approximately twelve inches (12") of engineered stone base, where it will either infiltrate into the soils below or travel laterally through the stone base and into the flat drains leading to the collector pipe. The perforated pipes are embedded within stone trenches. Runoff from the proposed track will drain to the proposed dynamic base stone.

Additionally, the proposed sidewalk improvements have low potential for accumulation of (TSS). They are not subject to salting or sanding operations, or to oil contamination from vehicles, thus lessening the ability to acquire TSS. It is our opinion that runoff generated from the surfaces is clean and does not require water quality treatment.

5.5 Land Uses with Higher Potential Pollutant Loads (Standard 5)

The proposed project does not qualify for a LUHPPL. No untreated runoff will leave the site or discharge into the adjacent wetlands, as various perimeter treatment techniques are proposed, including infiltration basins.

5.6 Critical Areas (Standard 6)

This site does not lie within or discharge to or near any critical areas.

5.7 Redevelopment (Standard 7)

The project is, in essence, a redevelopment project. However, it does result in an increase of impervious area and therefore does not meet the requirement of Standard 7 to be classified as a redevelopment project. As documented in this report, all applicable standards have been met.

5.8 Erosion and Sedimentation Controls (Standard 8)

An Erosion and Sedimentation Control Plan is provided as part of the Stormwater Permit Application to the Planning Board.

Also, the project will be covered by a NPDES Construction General Permit and SWPPP Plan. The contractor will provide these items prior to the start of construction.

5.9 Operation and Maintenance Plan (Standard 9)

An Operation and Maintenance Plan is provided as part of the Notice of Intent Application to the Conservation Commission. See Attachment 4 for the Operation and Maintenance & Erosion and Sediment Control Plan.

5.10 Prohibition of Illicit Discharges (Standard 10)

There are no illicit discharges to the proposed stormwater management system. A template for an illicit discharge compliance statement has been provided as part of the Stormwater Permit Application to the Planning Board. A completed statement will be submitted prior to the discharge of stormwater to the post-construction stormwater management system. Refer to Attachment 4.

6.0 SUMMARY

The project, as proposed, is the "best fit" for this site, and an improvement to the adjacent resource areas. The project maintains the existing drainage patterns for the site, with only minor revisions to the existing stormwater management techniques. A synthetic turf field is an optimal facility for sites where there are concerns of stormwater flows or degradation of adjacent natural resources. The project proves to be a betterment to the environment and meets the Massachusetts Stormwater Management Standards.

Attachment 1:
United States Soil Conservation Services Mapping

United States Department of Agriculture

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

January 29, 2016

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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Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....7
Soil Map.....8
Legend.....9
Map Unit Legend.....10
Map Unit Descriptions.....10
Hampshire County, Massachusetts, Central Part.....12
745C—Hinckley-Merrimac-Urban land complex, 3 to 15 percent slopes....12
750C—Windsor-Scitico-Amostown complex, 0 to 15 percent slopes.....14
References.....17

How Soil Surveys Are Made

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

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

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

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

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

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,810 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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 10, Sep 28, 2015

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—Apr 18, 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**
745C	Hinckley-Merrimac-Urban land complex, 3 to 15 percent slopes	13.7	89.3%
750C	Windsor-Scitico-Amostown complex, 0 to 15 percent slopes	1.6	10.7%
Totals for Area of Interest		**15.3**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments

on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Hampshire County, Massachusetts, Central Part

745C—Hinckley-Merrimac-Urban land complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9b0c
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: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hinckley and similar soils: 30 percent
Merrimac and similar soils: 25 percent
Urban land: 25 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loose sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 13 inches: loamy sand
H3 - 13 to 29 inches: gravelly sand
H4 - 29 to 60 inches: Error

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
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 storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A

Description of Merrimac

Setting

Landform: Outwash plains

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from granite and gneiss

Typical profile

H1 - 0 to 16 inches: gravelly fine sandy loam
H2 - 16 to 24 inches: gravelly sandy loam
H3 - 24 to 60 inches: stratified sand to very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
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 storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A

Description of Urban Land

Setting

Parent material: Paved/fill

Minor Components

Windsor

Percent of map unit: 4 percent

Ninigret

Percent of map unit: 4 percent

Sudbury

Percent of map unit: 4 percent

Walpole

Percent of map unit: 4 percent
Landform: Terraces

Agawam

Percent of map unit: 4 percent

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

Map Unit Setting

National map unit symbol: 9b2n
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

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
Estimates are based on observations, descriptions, and transects of the mapunit.

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

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 21 inches: loamy sand
H3 - 21 to 60 inches: sand

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Medium
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 storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A

Description of Scitico

Setting

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

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 22 inches: silt loam
H3 - 22 to 36 inches: silty clay
H4 - 36 to 65 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
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 storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D

Description of Amostown

Setting

Landform: Outwash plains, deltas, terraces
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

Typical profile

H1 - 0 to 7 inches: fine sandy loam
H2 - 7 to 32 inches: fine sandy loam
H3 - 32 to 60 inches: stratified very fine sand to silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium
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 storage in profile: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Hinckley

Percent of map unit: 10 percent

Agawam

Percent of map unit: 5 percent

Pollux

Percent of map unit: 5 percent

Boxford

Percent of map unit: 5 percent

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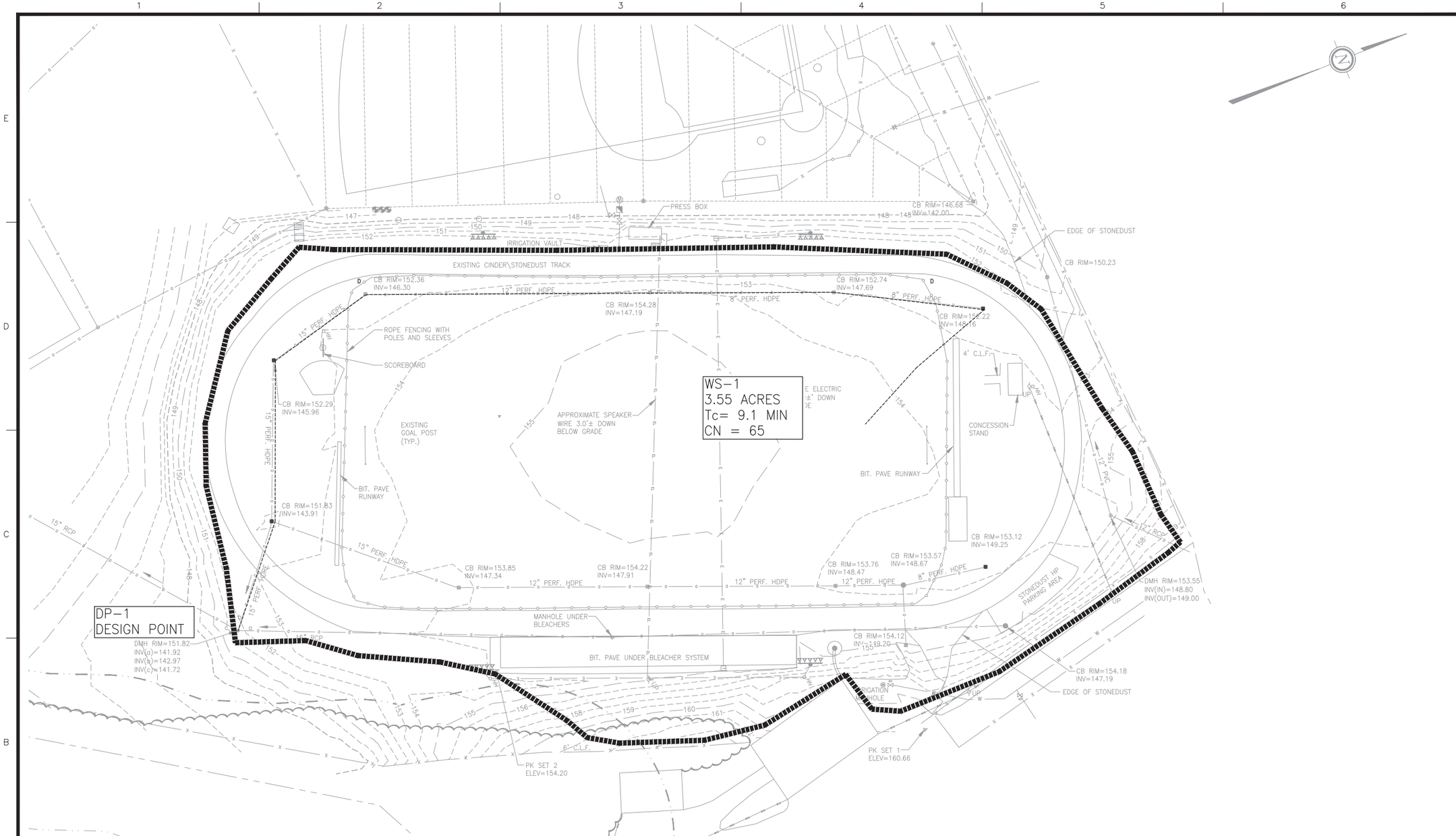
Attachment 2:
Pre & Post Development Conditions Map



LEGEND

- WATERSHED BOUNDARY
- TIME OF CONC. / FLOW PATH
- WETLAND BUFFER

PERMIT SET

GALE

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PROJECT

TRACK AND FIELD PROJECT
SOUTH HADLEY HIGH SCHOOL
153 NEWTON STREET
SOUTH HADLEY, MA 01075

OWNER

TOWN OF SOUTH HADLEY
116 MAIN STREET
SOUTH HADLEY, MA 01075

REVISIONS

NO.	DATE	DESCRIPTION

CADD FILE	717000_PRE
DESIGNED BY	PS
DRAWN BY	HAM
CHECKED BY	WJS
DATE	01/28/2016
DRAWING SCALE	1"=30'

GRAPHIC SCALE

0 30' 60'

SHEET TITLE

PRE DEVELOPMENT WATERSHED PLAN

DRAWING NO.

PRE

PROJECT NO. 717000

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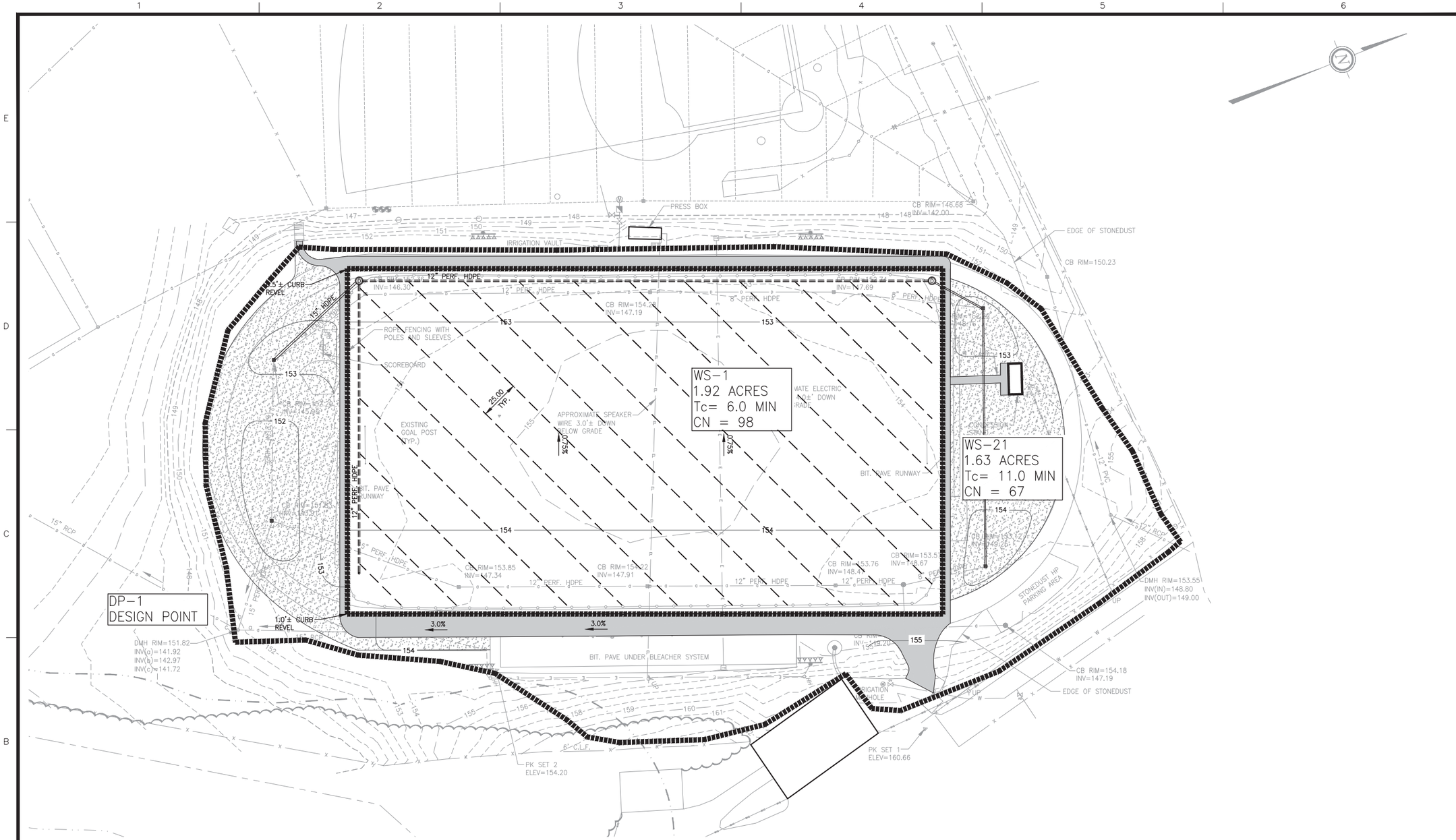

LEGEND

- WATERSHED BOUNDARY
- TIME OF CONC. / FLOW PATH
- WETLAND BUFFER

PERMIT SET

GALE

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PROJECT

TRACK AND FIELD PROJECT
SOUTH HADLEY HIGH SCHOOL
153 NEWTON STREET
SOUTH HADLEY, MA 01075

OWNER

TOWN OF SOUTH HADLEY
116 MAIN STREET
SOUTH HADLEY, MA 01075

REVISIONS

NO.	DATE	DESCRIPTION

CADD FILE	717000_POST
DESIGNED BY	PS
DRAWN BY	HAM
CHECKED BY	WJS
DATE	01/28/2016
DRAWING SCALE	1"=30'

GRAPHIC SCALE

0 30' 60'

SHEET TITLE

POST DEVELOPMENT WATERSHED PLAN

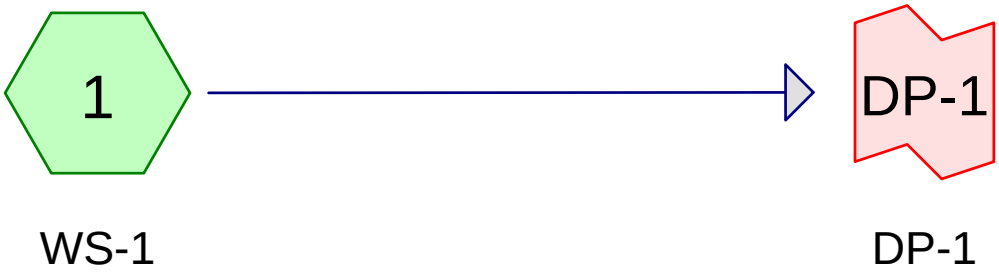
DRAWING NO.

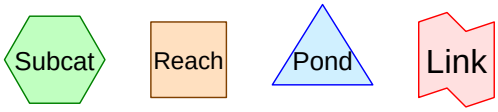
POST

PROJECT NO. 717000

F:\717000\plots\Permit Drawings\717000_POST.dwg, C102

Attachment 3:
Pre & Post Development Hydrology





Drainage Diagram for 717000_South Hadley_PRE
Prepared by Hewlett-Packard Company, Printed 1/28/2016
HydroCAD® 9.10 s/n 04420 © 2010 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.952	61	>75% Grass cover, Good, HSG B (1)
0.465	85	Stone Dust Track, HSG B (1)
0.137	98	Unconnected pavement, HSG B (1)
3.553	66	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.553	HSG B	1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
3.553		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	1	0.00	0.00	213.0	0.0050	0.013	8.0	0.0	0.0
2	1	0.00	0.00	183.0	0.0100	0.013	12.0	0.0	0.0
3	1	0.00	0.00	248.0	0.0150	0.013	15.0	0.0	0.0

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: WS-1 Runoff Area=154,790 sf 3.84% Impervious Runoff Depth=0.51"
Flow Length=754' Tc=9.1 min UI Adjusted CN=65 Runoff=1.37 cfs 0.150 af

Link DP-1: DP-1 Inflow=1.37 cfs 0.150 af
Primary=1.37 cfs 0.150 af

Total Runoff Area = 3.553 ac Runoff Volume = 0.150 af Average Runoff Depth = 0.51"
96.16% Pervious = 3.417 ac 3.84% Impervious = 0.137 ac

Summary for Subcatchment 1: WS-1

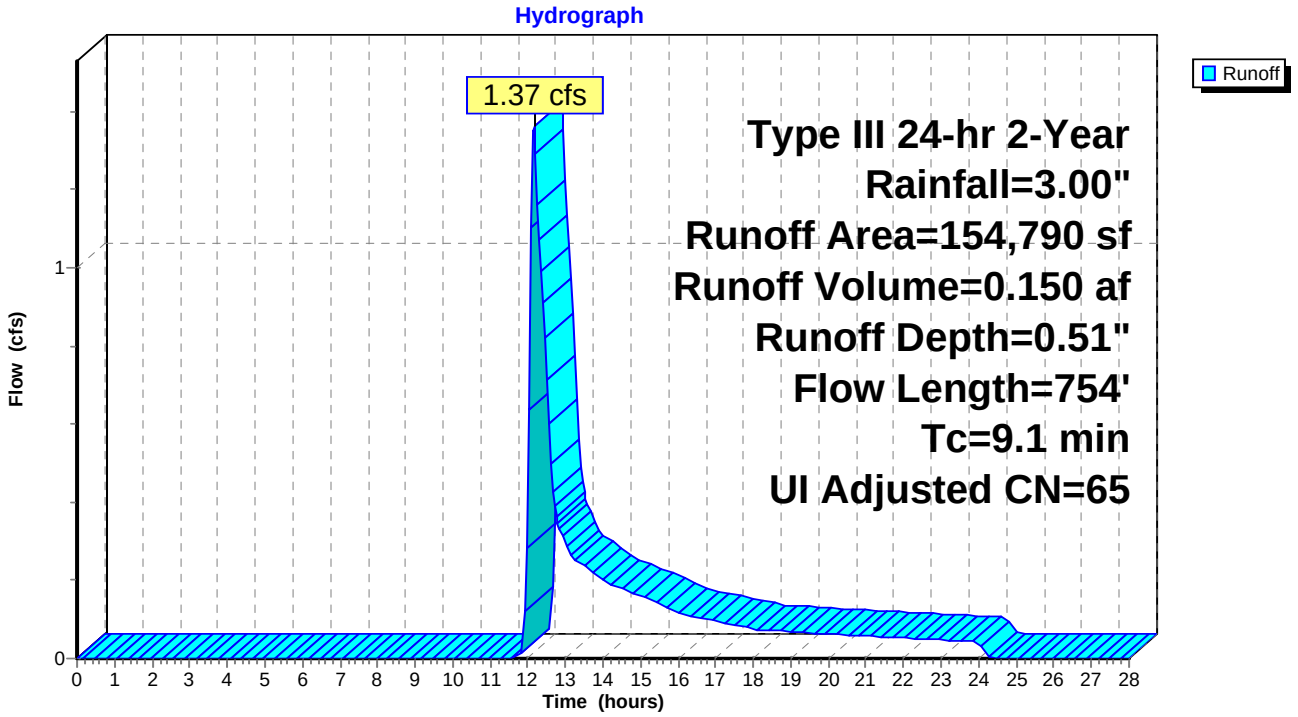
Runoff = 1.37 cfs @ 12.17 hrs, Volume= 0.150 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

	Area (sf)	CN	Description
*	20,253	85	Stone Dust Track, HSG B
	5,950	98	Unconnected pavement, HSG B
	128,587	61	>75% Grass cover, Good, HSG B
	154,790	66	Weighted Average, UI Adjusted CN = 65
	148,840		96.16% Pervious Area
	5,950		3.84% Impervious Area
	5,950		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
0.6	60	0.0126	1.81		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.5	213	0.0050	2.45	0.85	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
0.7	183	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	248	0.0150	6.45	7.91	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
9.1	754	Total			

Subcatchment 1: WS-1

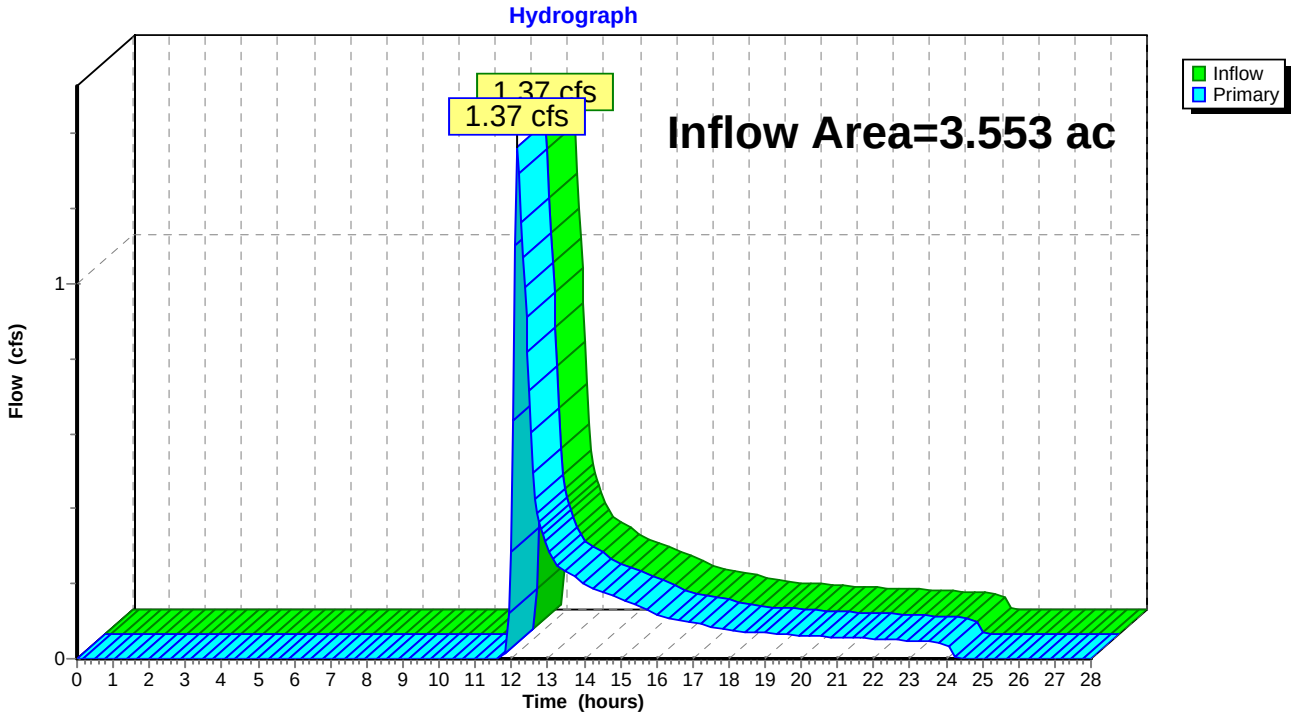


Summary for Link DP-1: DP-1

Inflow Area = 3.553 ac, 3.84% Impervious, Inflow Depth = 0.51" for 2-Year event
Inflow = 1.37 cfs @ 12.17 hrs, Volume= 0.150 af
Primary = 1.37 cfs @ 12.17 hrs, Volume= 0.150 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: DP-1



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: WS-1 Runoff Area=154,790 sf 3.84% Impervious Runoff Depth=1.39"
Flow Length=754' Tc=9.1 min UI Adjusted CN=65 Runoff=4.78 cfs 0.413 af

Link DP-1: DP-1 Inflow=4.78 cfs 0.413 af
Primary=4.78 cfs 0.413 af

Total Runoff Area = 3.553 ac Runoff Volume = 0.413 af Average Runoff Depth = 1.39"
96.16% Pervious = 3.417 ac 3.84% Impervious = 0.137 ac

Summary for Subcatchment 1: WS-1

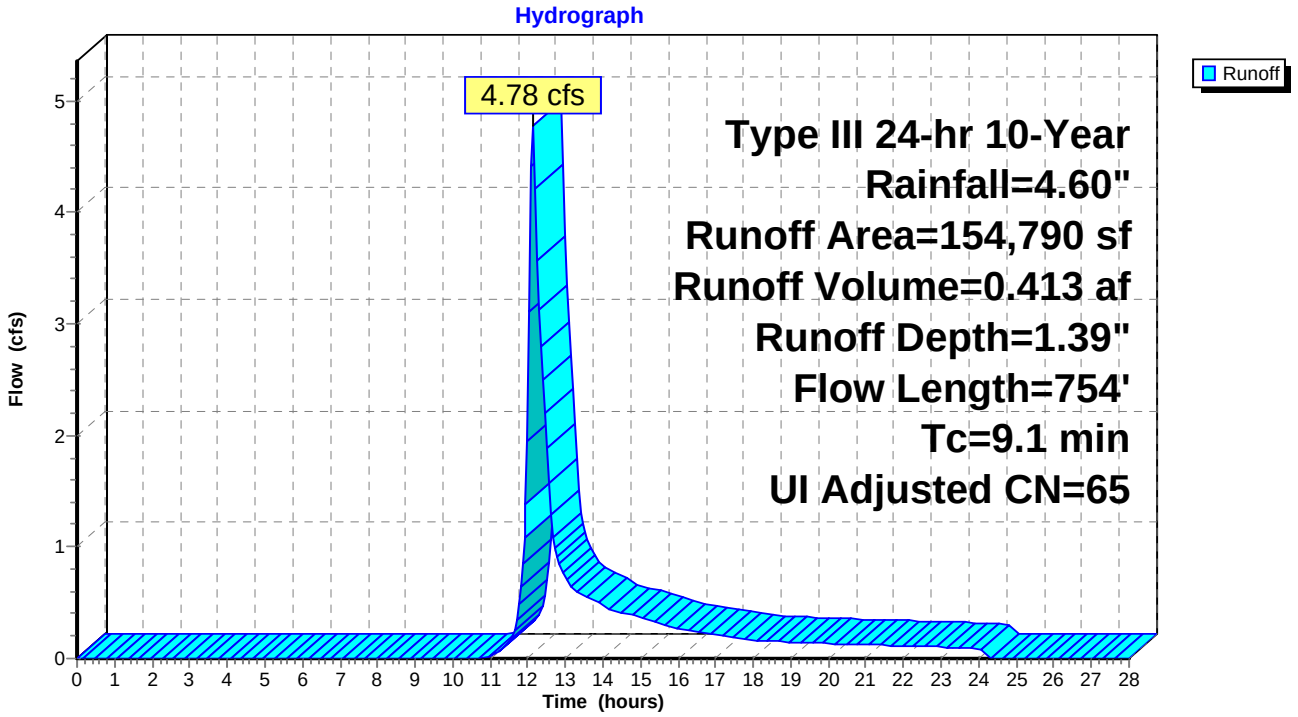
Runoff = 4.78 cfs @ 12.14 hrs, Volume= 0.413 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.60"

	Area (sf)	CN	Description
*	20,253	85	Stone Dust Track, HSG B
	5,950	98	Unconnected pavement, HSG B
	128,587	61	>75% Grass cover, Good, HSG B
	154,790	66	Weighted Average, UI Adjusted CN = 65
	148,840		96.16% Pervious Area
	5,950		3.84% Impervious Area
	5,950		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
0.6	60	0.0126	1.81		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.5	213	0.0050	2.45	0.85	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
0.7	183	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	248	0.0150	6.45	7.91	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
9.1	754	Total			

Subcatchment 1: WS-1

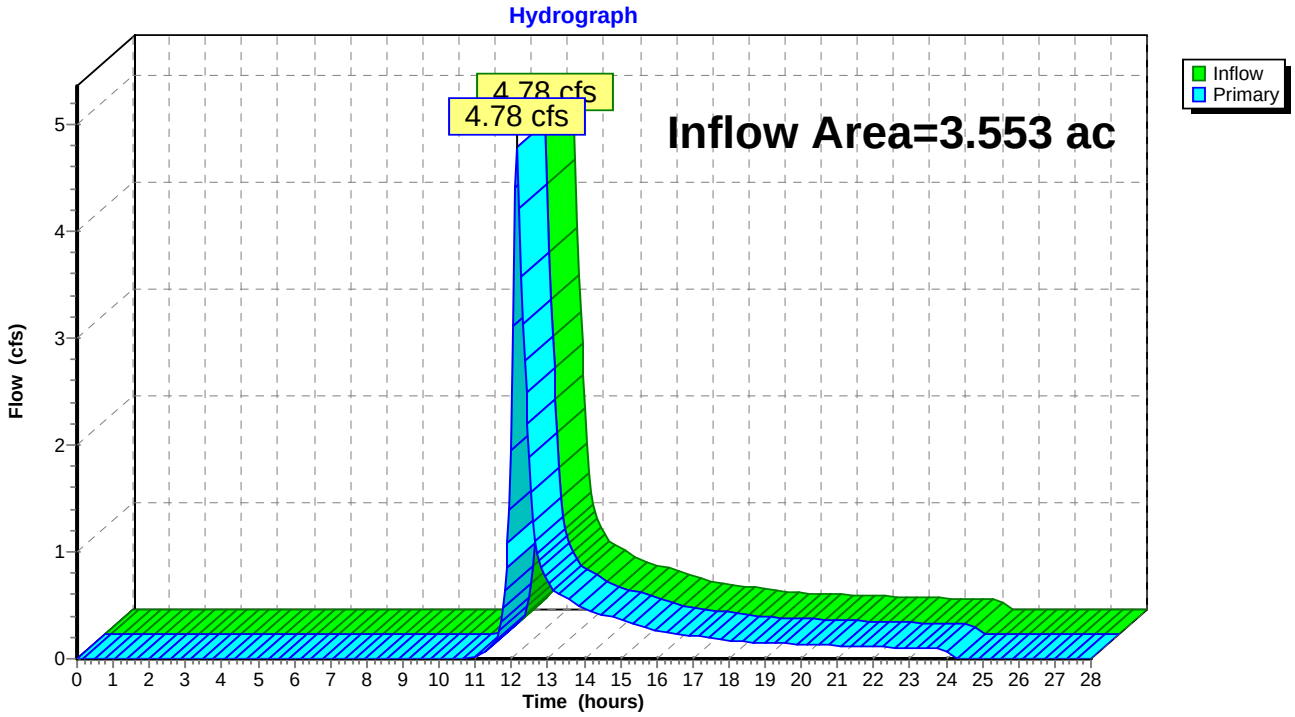


Summary for Link DP-1: DP-1

Inflow Area = 3.553 ac, 3.84% Impervious, Inflow Depth = 1.39" for 10-Year event
Inflow = 4.78 cfs @ 12.14 hrs, Volume= 0.413 af
Primary = 4.78 cfs @ 12.14 hrs, Volume= 0.413 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: DP-1



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: WS-1 Runoff Area=154,790 sf 3.84% Impervious Runoff Depth=2.72"
Flow Length=754' Tc=9.1 min UI Adjusted CN=65 Runoff=9.85 cfs 0.806 af

Link DP-1: DP-1 Inflow=9.85 cfs 0.806 af
Primary=9.85 cfs 0.806 af

Total Runoff Area = 3.553 ac Runoff Volume = 0.806 af Average Runoff Depth = 2.72"
96.16% Pervious = 3.417 ac 3.84% Impervious = 0.137 ac

Summary for Subcatchment 1: WS-1

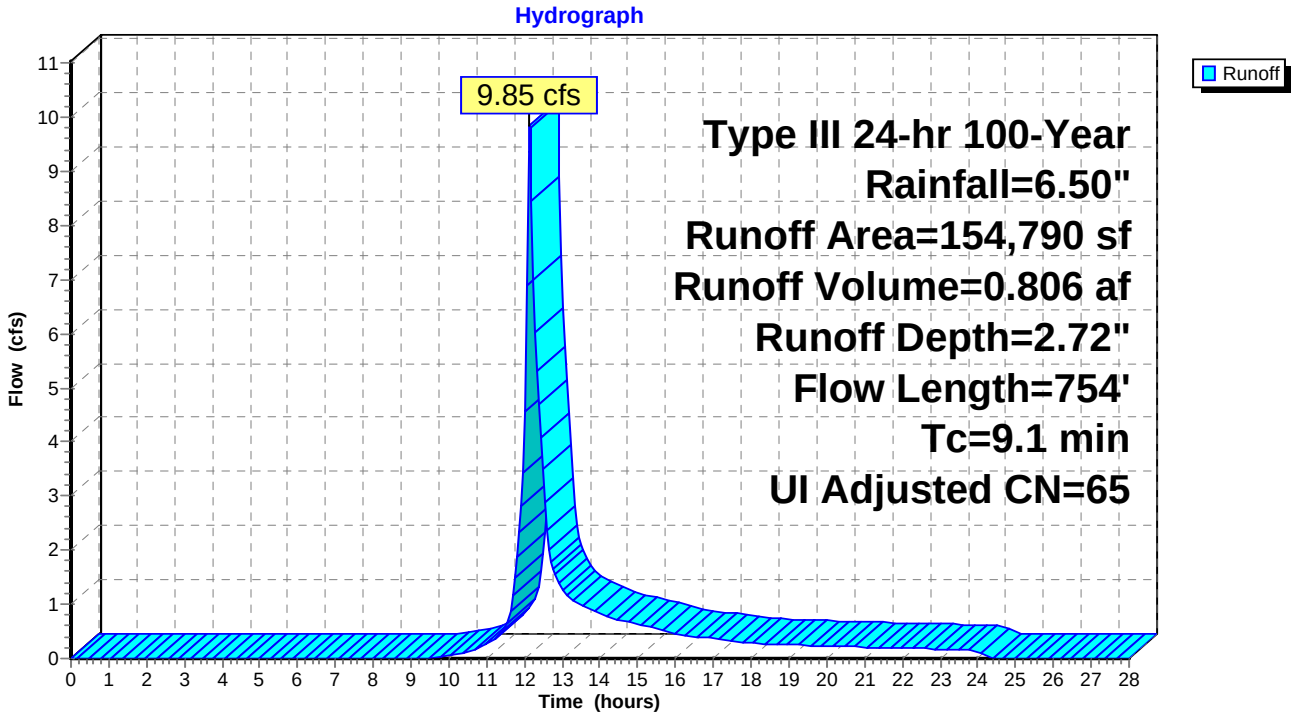
Runoff = 9.85 cfs @ 12.14 hrs, Volume= 0.806 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	20,253	85	Stone Dust Track, HSG B
	5,950	98	Unconnected pavement, HSG B
	128,587	61	>75% Grass cover, Good, HSG B
	154,790	66	Weighted Average, UI Adjusted CN = 65
	148,840		96.16% Pervious Area
	5,950		3.84% Impervious Area
	5,950		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
0.6	60	0.0126	1.81		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.5	213	0.0050	2.45	0.85	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Corrugated PE, smooth interior
0.7	183	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.6	248	0.0150	6.45	7.91	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
9.1	754	Total			

Subcatchment 1: WS-1

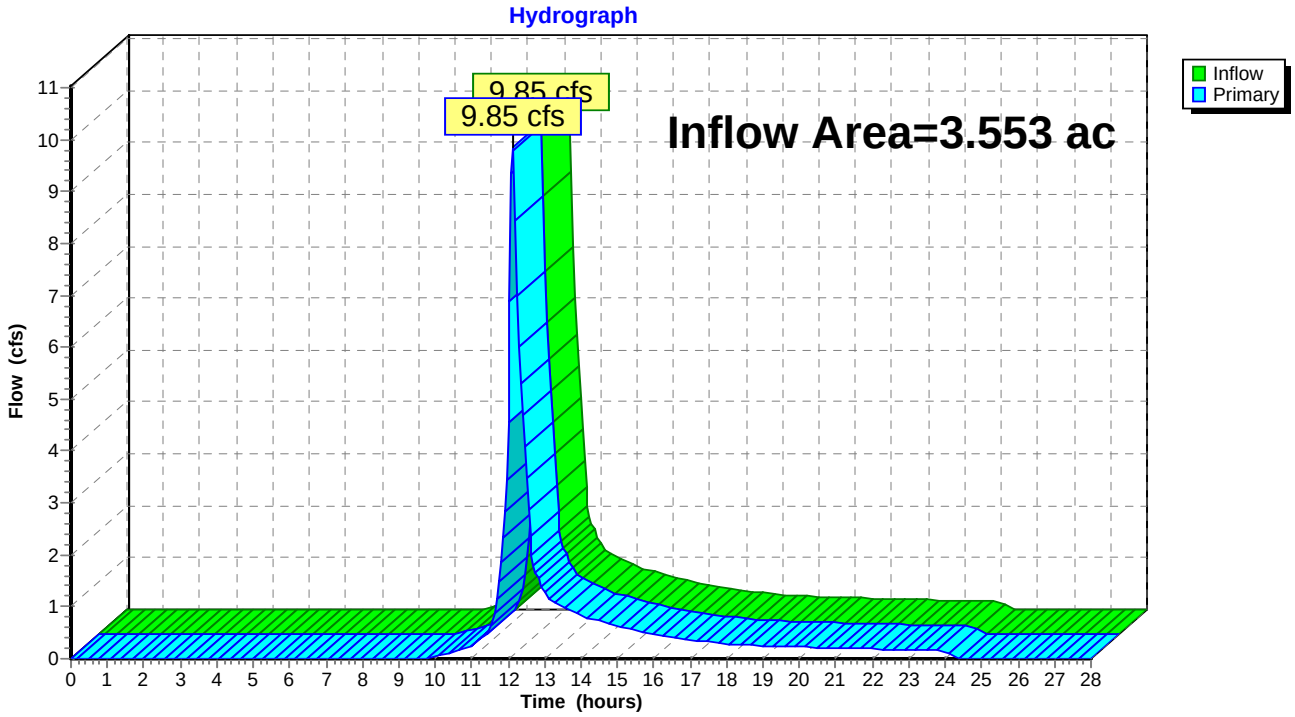


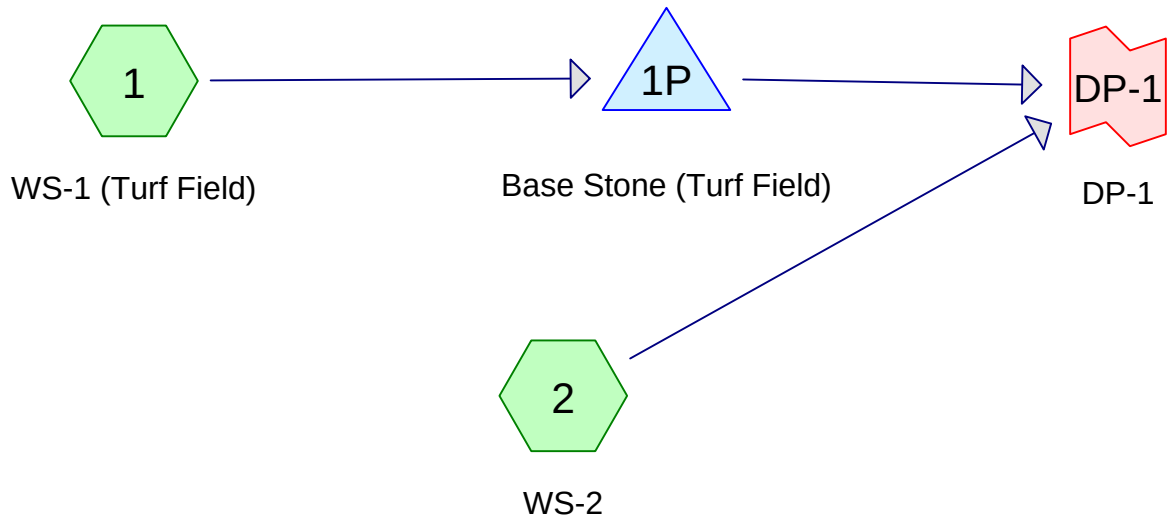
Summary for Link DP-1: DP-1

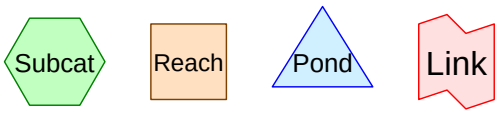
Inflow Area = 3.553 ac, 3.84% Impervious, Inflow Depth = 2.72" for 100-Year event
Inflow = 9.85 cfs @ 12.14 hrs, Volume= 0.806 af
Primary = 9.85 cfs @ 12.14 hrs, Volume= 0.806 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: DP-1







Drainage Diagram for 717000_South Hadley_POST
Prepared by Hewlett-Packard Company, Printed 1/28/2016
HydroCAD® 9.10 s/n 04420 © 2010 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.156	61	>75% Grass cover, Good, HSG B (2)
0.107	85	Stone Dust Track, HSG B (2)
1.919	98	Synthetic Turf Field, 0% imp, HSG B (1)
0.372	98	Unconnected pavement, HSG B (2)
3.553	86	**TOTAL AREA**

Soil Listing (all nodes)

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

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	1P	145.96	143.91	101.0	0.0203	0.013	15.0	0.0	0.0

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: WS-1 (Turf Field) Runoff Area=83,600 sf 0.00% Impervious Runoff Depth=2.77"
Tc=6.0 min CN=98 Runoff=5.45 cfs 0.443 af

Subcatchment 2: WS-2 Runoff Area=71,190 sf 22.76% Impervious Runoff Depth=0.58"
Flow Length=527' Tc=11.0 min UI Adjusted CN=67 Runoff=0.74 cfs 0.080 af

Pond 1P: Base Stone (Turf Field) Peak Elev=151.85' Storage=2,637 cf Inflow=5.45 cfs 0.443 af
Discarded=1.97 cfs 0.443 af Primary=0.00 cfs 0.000 af Outflow=1.97 cfs 0.443 af

Link DP-1: DP-1 Inflow=0.74 cfs 0.080 af
Primary=0.74 cfs 0.080 af

Total Runoff Area = 3.553 ac Runoff Volume = 0.522 af Average Runoff Depth = 1.76"
89.53% Pervious = 3.182 ac 10.47% Impervious = 0.372 ac

Summary for Subcatchment 1: WS-1 (Turf Field)

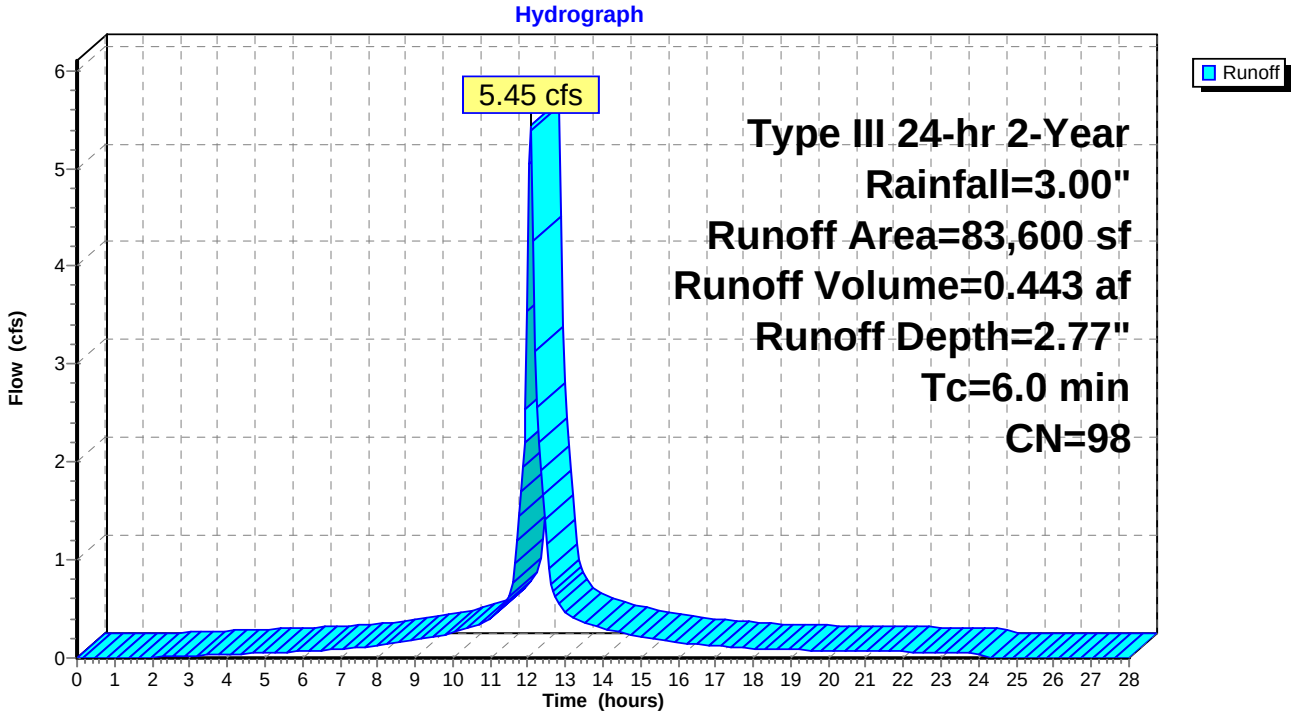
Runoff = 5.45 cfs @ 12.09 hrs, Volume= 0.443 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

	Area (sf)	CN	Description
*	83,600	98	Synthetic Turf Field, 0% imp, HSG B
	83,600		100.00% Pervious Area

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

Subcatchment 1: WS-1 (Turf Field)



Summary for Subcatchment 2: WS-2

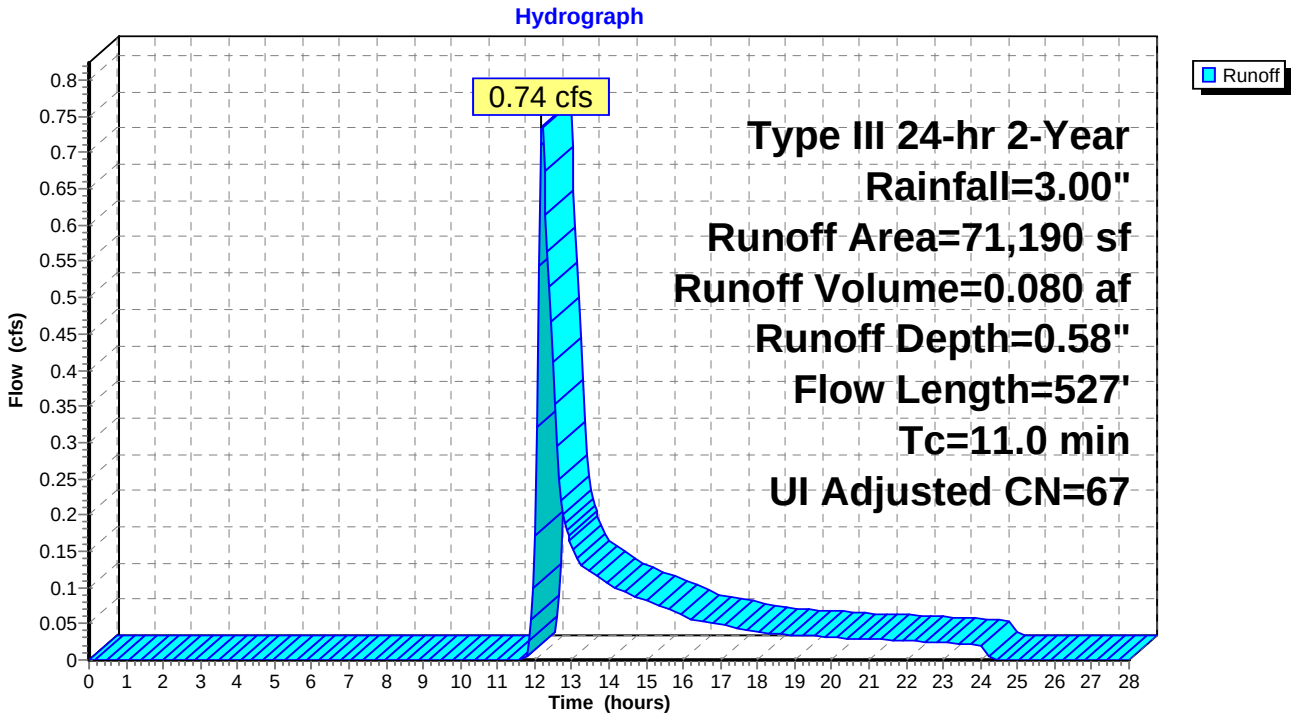
Runoff = 0.74 cfs @ 12.19 hrs, Volume= 0.080 af, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

	Area (sf)	CN	Description
*	4,650	85	Stone Dust Track, HSG B
	16,200	98	Unconnected pavement, HSG B
	50,340	61	>75% Grass cover, Good, HSG B
	71,190	71	Weighted Average, UI Adjusted CN = 67
	54,990		77.24% Pervious Area
	16,200		22.76% Impervious Area
	16,200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0140	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
4.4	477	0.0126	1.81		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
11.0	527	Total			

Subcatchment 2: WS-2



Summary for Pond 1P: Base Stone (Turf Field)

Inflow Area =	1.919 ac,	0.00% Impervious,	Inflow Depth =	2.77"	for 2-Year event
Inflow =	5.45 cfs @	12.09 hrs,	Volume=	0.443 af	
Outflow =	1.97 cfs @	11.90 hrs,	Volume=	0.443 af,	Atten= 64%, Lag= 0.0 min
Discarded =	1.97 cfs @	11.90 hrs,	Volume=	0.443 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 151.85' @ 12.34 hrs Surf.Area= 83,600 sf Storage= 2,637 cf

Plug-Flow detention time= 7.0 min calculated for 0.442 af (100% of inflow)
Center-of-Mass det. time= 7.0 min (764.8 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	151.75'	27,588 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 83,600 cf Overall x 33.0% Voids

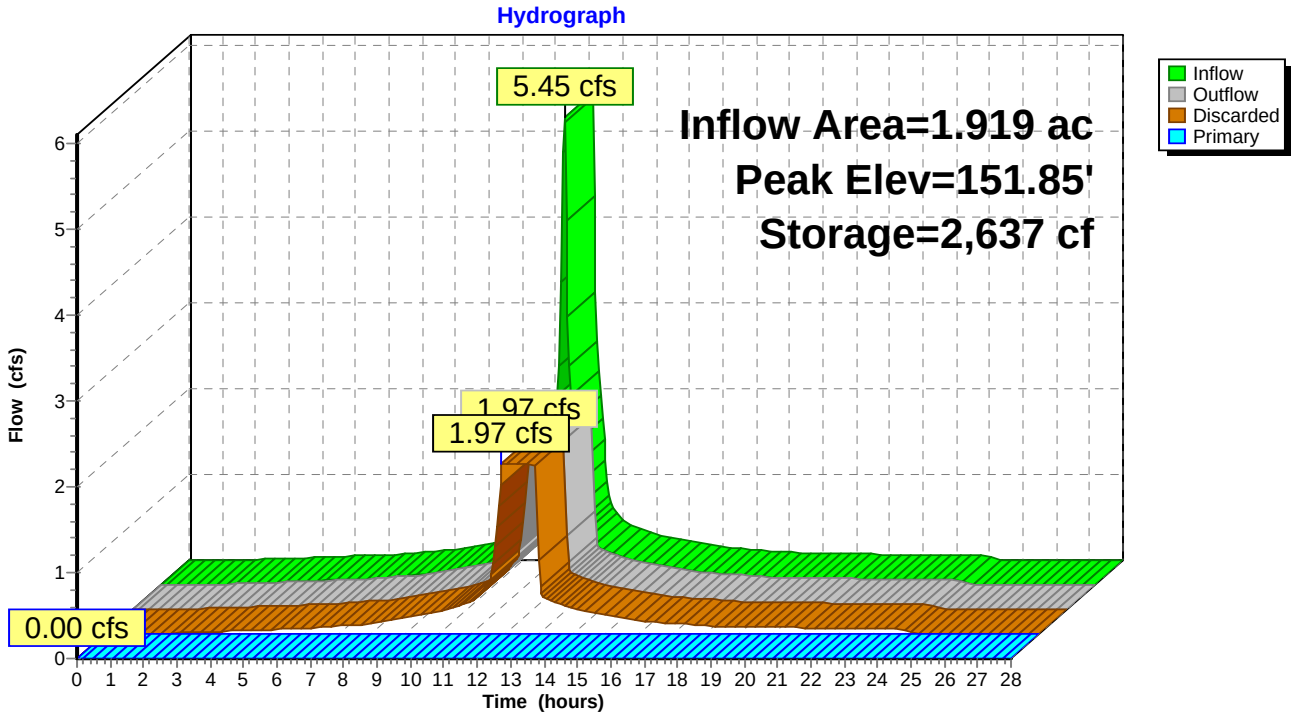
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
151.75	83,600	0	0
152.75	83,600	83,600	83,600

Device	Routing	Invert	Outlet Devices
#1	Discarded	151.75'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	145.96'	**15.0" Round Culvert** L= 101.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 145.96' / 143.91' S= 0.0203 '/' Cc= 0.900 n= 0.013 Cast iron, coated
#3	Device 2	152.00'	**10.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=1.97 cfs @ 11.90 hrs HW=151.76' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.97 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=151.75' (Free Discharge)
└─**2=Culvert** (Passes 0.00 cfs of 12.88 cfs potential flow)
└─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Base Stone (Turf Field)

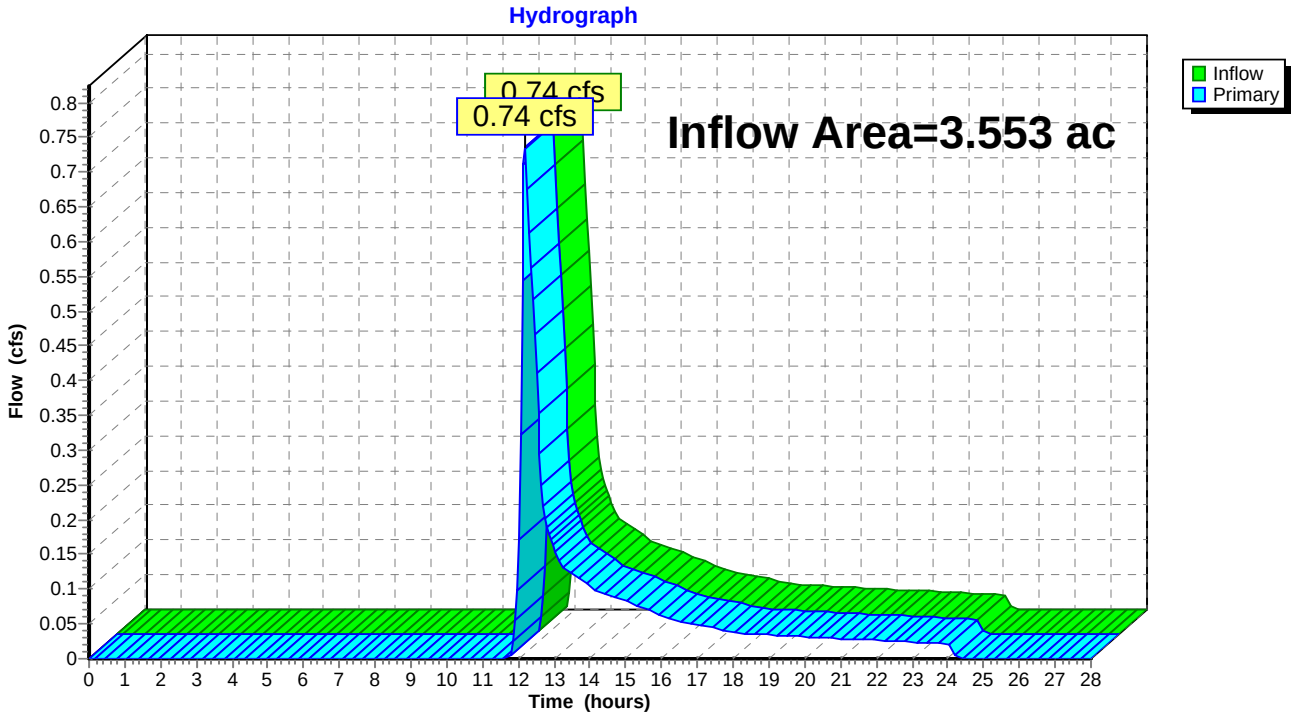


Summary for Link DP-1: DP-1

Inflow Area = 3.553 ac, 10.47% Impervious, Inflow Depth = 0.27" for 2-Year event
Inflow = 0.74 cfs @ 12.19 hrs, Volume= 0.080 af
Primary = 0.74 cfs @ 12.19 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: DP-1



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: WS-1 (Turf Field) Runoff Area=83,600 sf 0.00% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=98 Runoff=8.43 cfs 0.698 af

Subcatchment 2: WS-2 Runoff Area=71,190 sf 22.76% Impervious Runoff Depth=1.53"
Flow Length=527' Tc=11.0 min UI Adjusted CN=67 Runoff=2.34 cfs 0.208 af

Pond 1P: Base Stone (Turf Field) Peak Elev=151.98' Storage=6,341 cf Inflow=8.43 cfs 0.698 af
Discarded=1.97 cfs 0.698 af Primary=0.00 cfs 0.000 af Outflow=1.97 cfs 0.698 af

Link DP-1: DP-1 Inflow=2.34 cfs 0.208 af
Primary=2.34 cfs 0.208 af

Total Runoff Area = 3.553 ac Runoff Volume = 0.906 af Average Runoff Depth = 3.06"
89.53% Pervious = 3.182 ac 10.47% Impervious = 0.372 ac

Summary for Subcatchment 1: WS-1 (Turf Field)

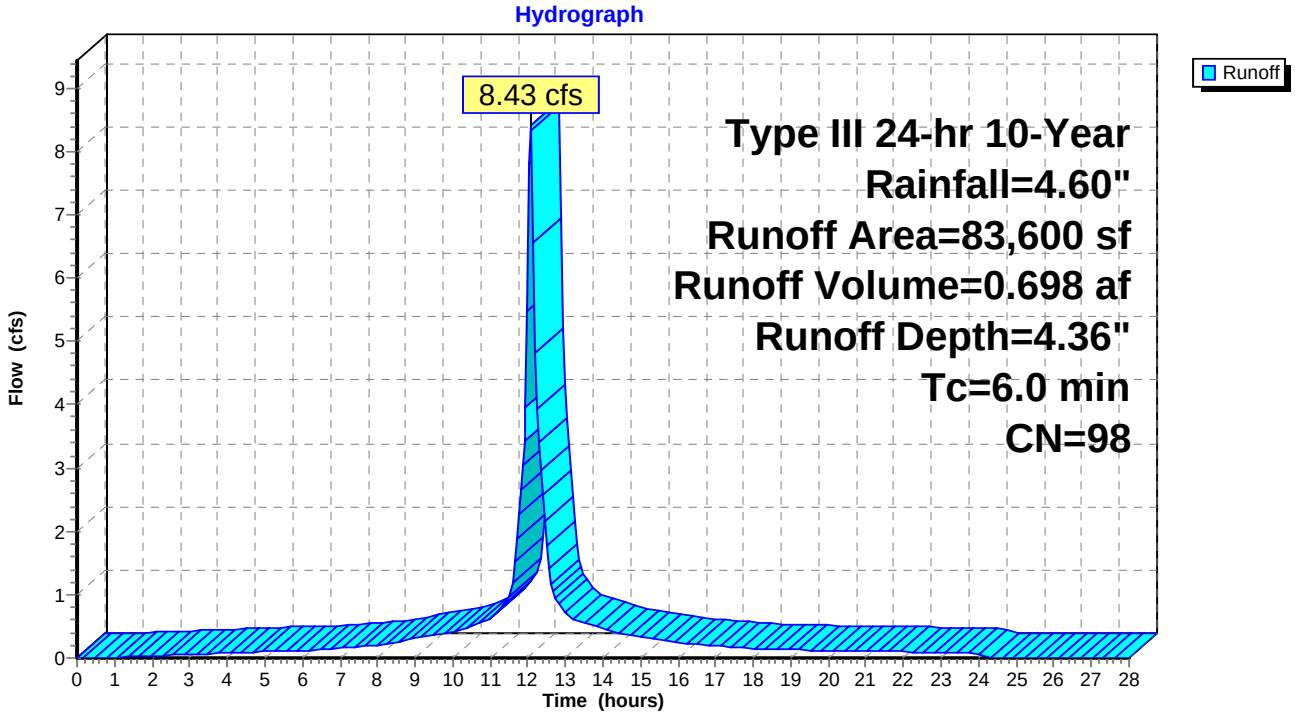
Runoff = 8.43 cfs @ 12.09 hrs, Volume= 0.698 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.60"

	Area (sf)	CN	Description
*	83,600	98	Synthetic Turf Field, 0% imp, HSG B
	83,600		100.00% Pervious Area

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

Subcatchment 1: WS-1 (Turf Field)



Summary for Subcatchment 2: WS-2

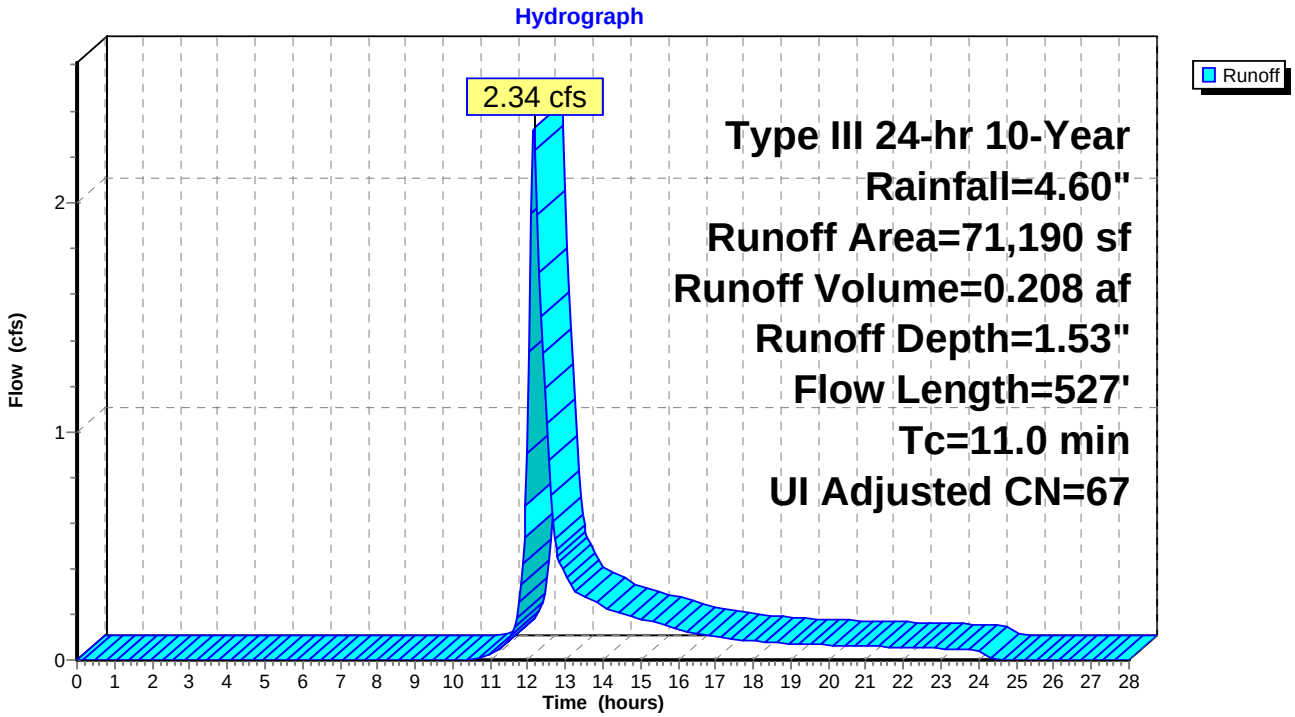
Runoff = 2.34 cfs @ 12.17 hrs, Volume= 0.208 af, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.60"

	Area (sf)	CN	Description
*	4,650	85	Stone Dust Track, HSG B
	16,200	98	Unconnected pavement, HSG B
	50,340	61	>75% Grass cover, Good, HSG B
	71,190	71	Weighted Average, UI Adjusted CN = 67
	54,990		77.24% Pervious Area
	16,200		22.76% Impervious Area
	16,200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0140	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
4.4	477	0.0126	1.81		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
11.0	527	Total			

Subcatchment 2: WS-2



Summary for Pond 1P: Base Stone (Turf Field)

Inflow Area =	1.919 ac,	0.00% Impervious,	Inflow Depth =	4.36"	for 10-Year event
Inflow =	8.43 cfs @	12.09 hrs,	Volume=	0.698 af	
Outflow =	1.97 cfs @	11.80 hrs,	Volume=	0.698 af,	Atten= 77%, Lag= 0.0 min
Discarded =	1.97 cfs @	11.80 hrs,	Volume=	0.698 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 151.98' @ 12.48 hrs Surf.Area= 83,600 sf Storage= 6,341 cf

Plug-Flow detention time= 16.3 min calculated for 0.697 af (100% of inflow)
Center-of-Mass det. time= 16.3 min (765.7 - 749.4)

Volume	Invert	Avail.Storage	Storage Description
#1	151.75'	27,588 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 83,600 cf Overall x 33.0% Voids

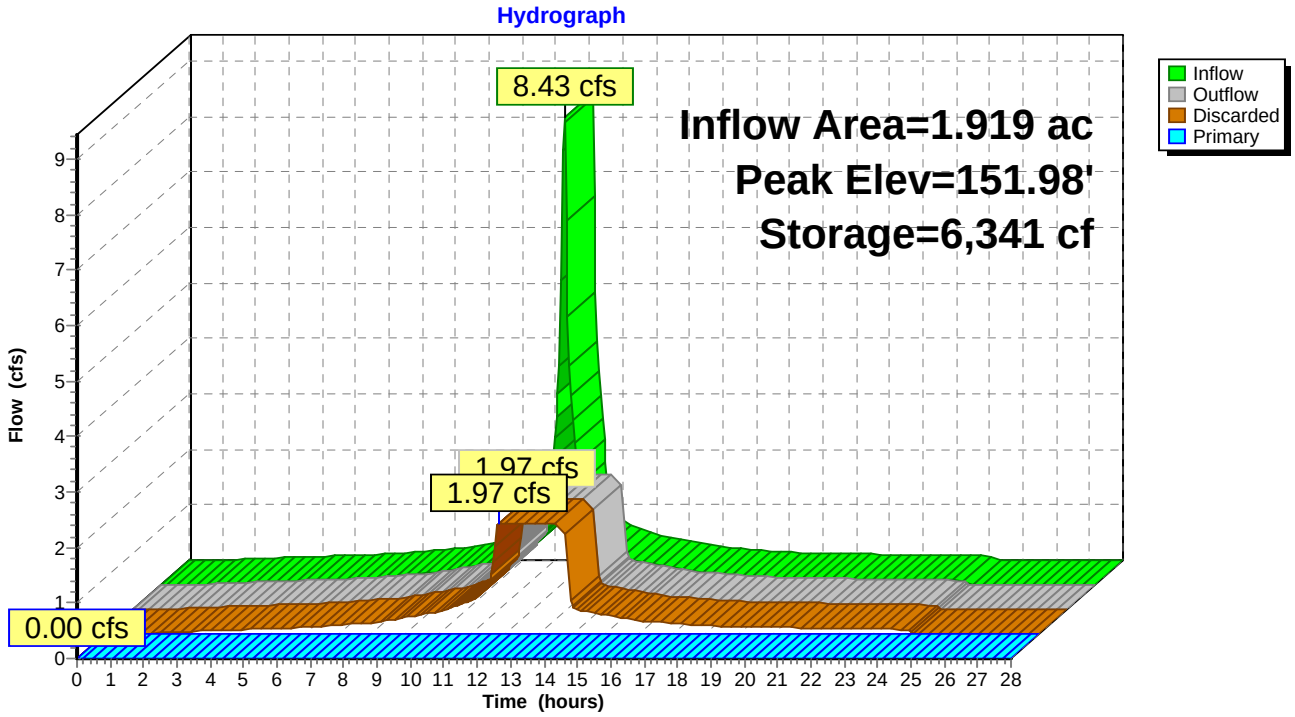
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
151.75	83,600	0	0
152.75	83,600	83,600	83,600

Device	Routing	Invert	Outlet Devices
#1	Discarded	151.75'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	145.96'	**15.0" Round Culvert** L= 101.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 145.96' / 143.91' S= 0.0203 '/' Cc= 0.900 n= 0.013 Cast iron, coated
#3	Device 2	152.00'	**10.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=1.97 cfs @ 11.80 hrs HW=151.76' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.97 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=151.75' (Free Discharge)
└─**2=Culvert** (Passes 0.00 cfs of 12.88 cfs potential flow)
└─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Base Stone (Turf Field)

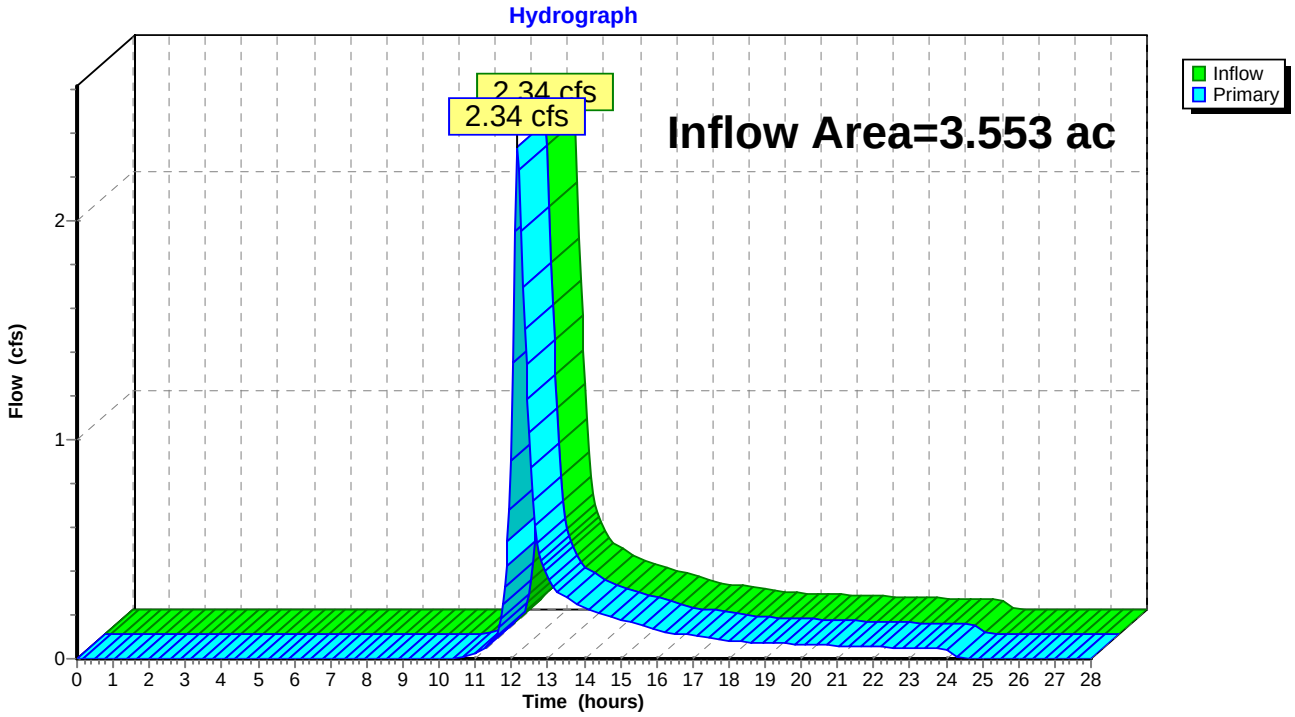


Summary for Link DP-1: DP-1

Inflow Area = 3.553 ac, 10.47% Impervious, Inflow Depth = 0.70" for 10-Year event
Inflow = 2.34 cfs @ 12.17 hrs, Volume= 0.208 af
Primary = 2.34 cfs @ 12.17 hrs, Volume= 0.208 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: DP-1



Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: WS-1 (Turf Field) Runoff Area=83,600 sf 0.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=11.94 cfs 1.001 af

Subcatchment 2: WS-2 Runoff Area=71,190 sf 22.76% Impervious Runoff Depth=2.91"
Flow Length=527' Tc=11.0 min UI Adjusted CN=67 Runoff=4.64 cfs 0.397 af

Pond 1P: Base Stone (Turf Field) Peak Elev=152.16' Storage=11,290 cf Inflow=11.94 cfs 1.001 af
Discarded=1.97 cfs 0.995 af Primary=0.10 cfs 0.006 af Outflow=2.07 cfs 1.001 af

Link DP-1: DP-1 Inflow=4.65 cfs 0.403 af
Primary=4.65 cfs 0.403 af

Total Runoff Area = 3.553 ac Runoff Volume = 1.398 af Average Runoff Depth = 4.72"
89.53% Pervious = 3.182 ac 10.47% Impervious = 0.372 ac

Summary for Subcatchment 1: WS-1 (Turf Field)

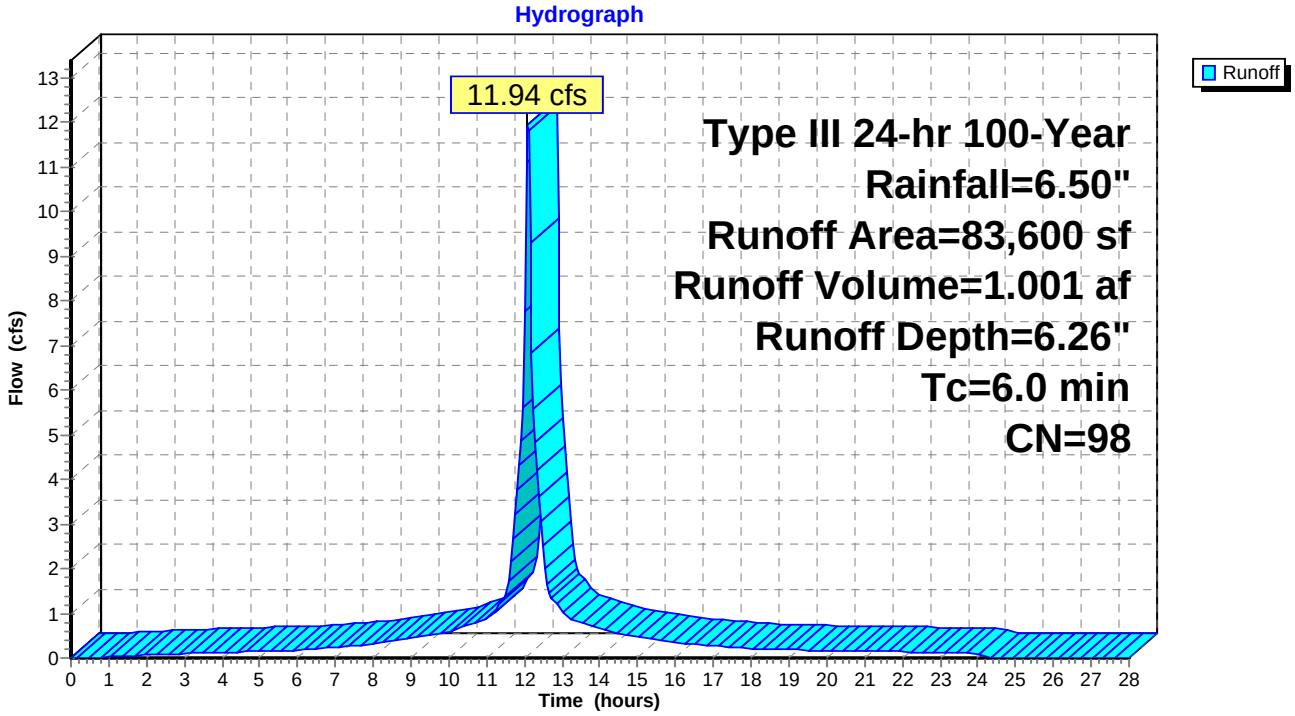
Runoff = 11.94 cfs @ 12.09 hrs, Volume= 1.001 af, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	83,600	98	Synthetic Turf Field, 0% imp, HSG B
	83,600		100.00% Pervious Area

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

Subcatchment 1: WS-1 (Turf Field)



Summary for Subcatchment 2: WS-2

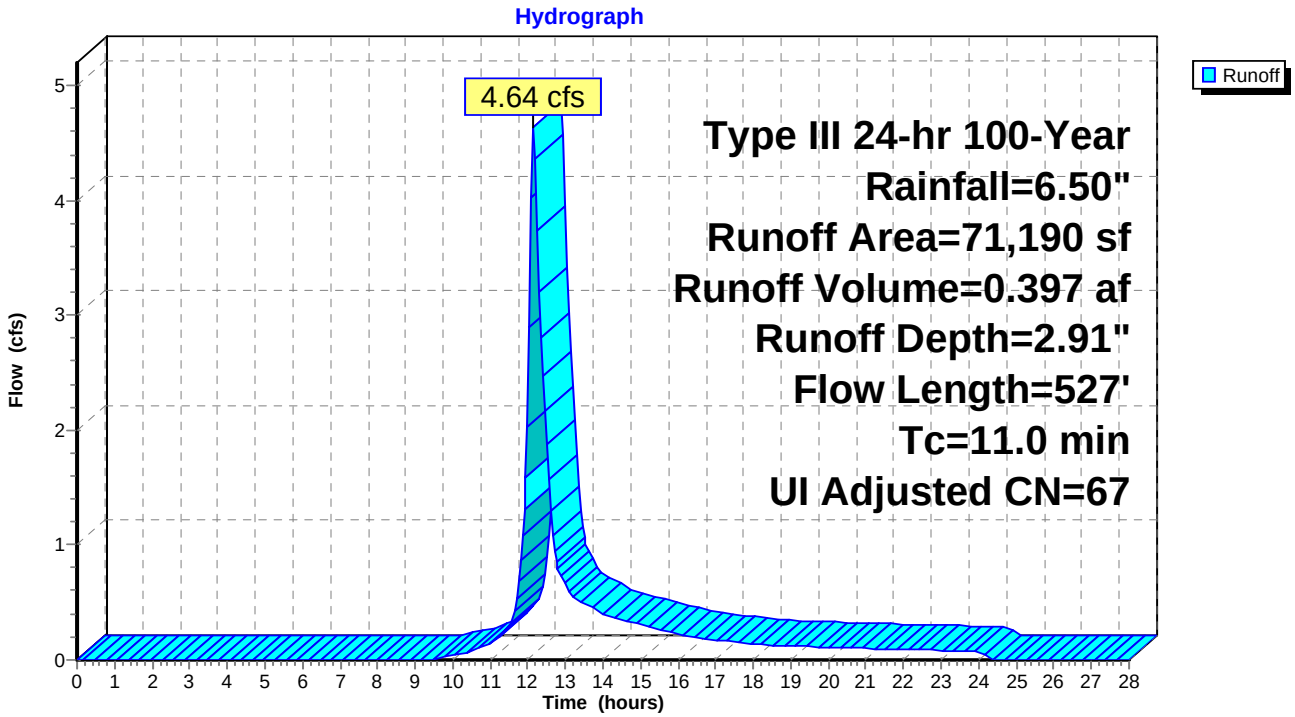
Runoff = 4.64 cfs @ 12.16 hrs, Volume= 0.397 af, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
*	4,650	85	Stone Dust Track, HSG B
	16,200	98	Unconnected pavement, HSG B
	50,340	61	>75% Grass cover, Good, HSG B
	71,190	71	Weighted Average, UI Adjusted CN = 67
	54,990		77.24% Pervious Area
	16,200		22.76% Impervious Area
	16,200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0140	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
4.4	477	0.0126	1.81		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
11.0	527	Total			

Subcatchment 2: WS-2



Summary for Pond 1P: Base Stone (Turf Field)

Inflow Area =	1.919 ac,	0.00% Impervious,	Inflow Depth =	6.26"	for 100-Year event
Inflow =	11.94 cfs @	12.09 hrs,	Volume=	1.001 af	
Outflow =	2.07 cfs @	12.55 hrs,	Volume=	1.001 af,	Atten= 83%, Lag= 27.6 min
Discarded =	1.97 cfs @	11.70 hrs,	Volume=	0.995 af	
Primary =	0.10 cfs @	12.55 hrs,	Volume=	0.006 af	

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 152.16' @ 12.55 hrs Surf.Area= 83,600 sf Storage= 11,290 cf

Plug-Flow detention time= 30.9 min calculated for 1.001 af (100% of inflow)
Center-of-Mass det. time= 30.8 min (774.8 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	151.75'	27,588 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 83,600 cf Overall x 33.0% Voids

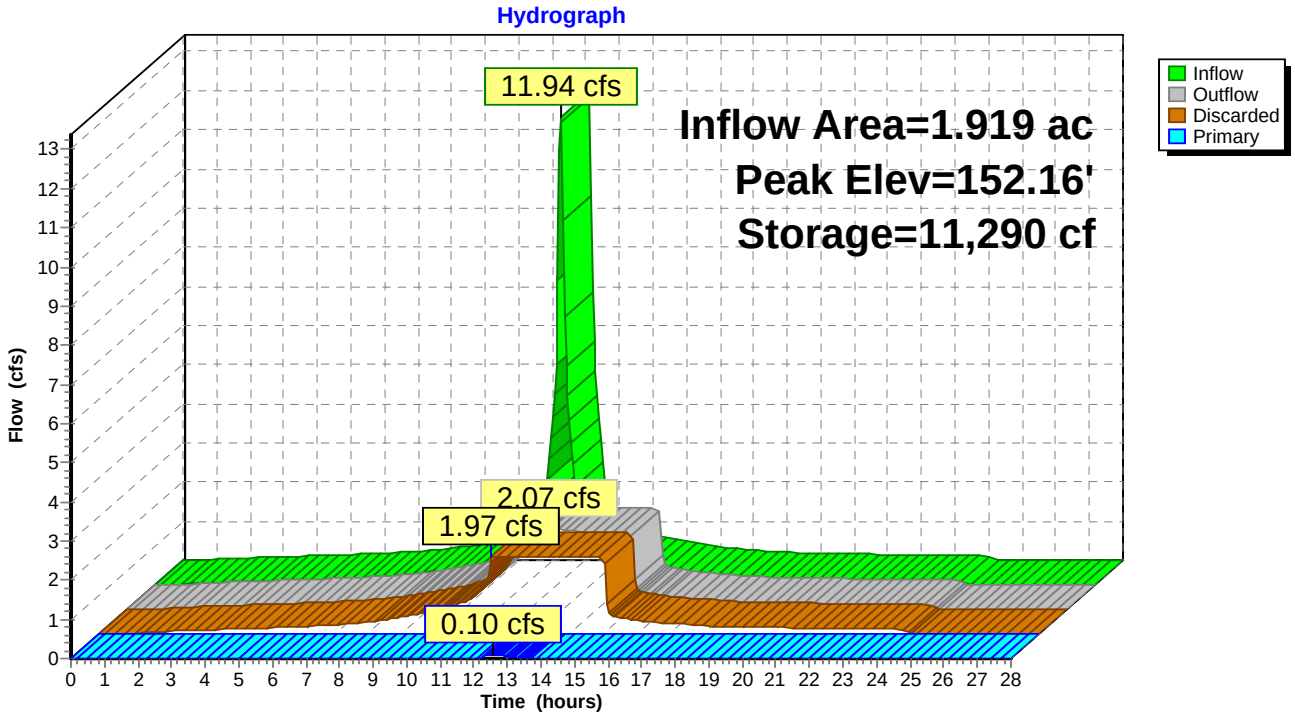
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
151.75	83,600	0	0
152.75	83,600	83,600	83,600

Device	Routing	Invert	Outlet Devices
#1	Discarded	151.75'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	145.96'	**15.0" Round Culvert** L= 101.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 145.96' / 143.91' S= 0.0203 '/' Cc= 0.900 n= 0.013 Cast iron, coated
#3	Device 2	152.00'	**10.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=1.97 cfs @ 11.70 hrs HW=151.76' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.97 cfs)

Primary OutFlow Max=0.10 cfs @ 12.55 hrs HW=152.16' (Free Discharge)
└─**2=Culvert** (Passes 0.10 cfs of 13.27 cfs potential flow)
└─**3=Orifice/Grate** (Orifice Controls 0.10 cfs @ 1.36 fps)

Pond 1P: Base Stone (Turf Field)

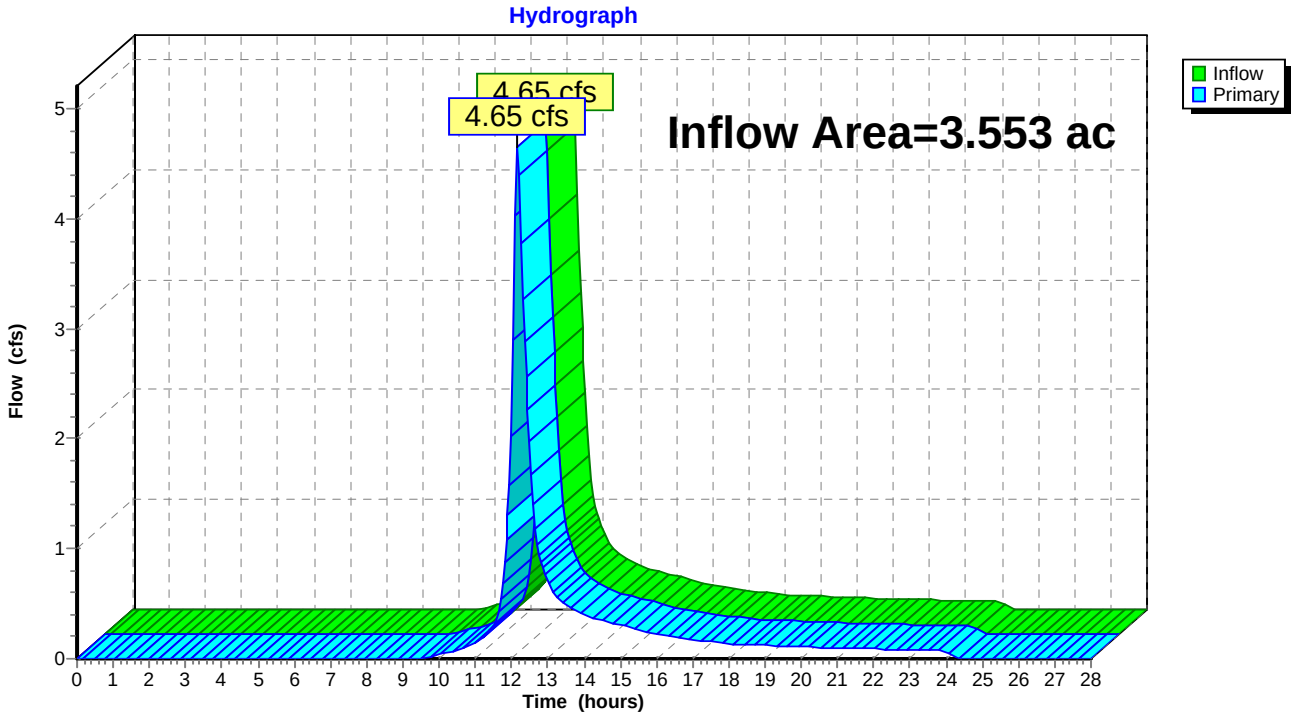


Summary for Link DP-1: DP-1

Inflow Area = 3.553 ac, 10.47% Impervious, Inflow Depth = 1.36" for 100-Year event
Inflow = 4.65 cfs @ 12.16 hrs, Volume= 0.403 af
Primary = 4.65 cfs @ 12.16 hrs, Volume= 0.403 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Link DP-1: DP-1



Attachment 4:
Operation and Maintenance & Erosion and Sediment Control Plan

OPERATION & MAINTENANCE PLAN

South Hadley High School
Athletic Campus Improvements

January 2016

TABLE OF CONTENTS

SECTION I CONSTRUCTION ACTIVITIES

SECTION II POST-DEVELOPMENT ACTIVITIES
PART A – GENERAL
PART B – BMP MANAGEMENT

SECTION III LONG TERM POLLUTION PREVENTION PLAN
(INSPECTION & MAINTENANCE LOGS INCLUDED)

SECTION IV ILLICIT DISCHARGE STATEMENT

OPERATION & MAINTENANCE PLAN

South Hadley High School
Athletic Campus Improvements

January 2016

Basic Information

Project Address:	153 Newton Street, South Hadley, MA
Owner:	South Hadley High School
Operator:	South Hadley High School
Town:	South Hadley, MA

SECTION I: CONSTRUCTION ACTIVITIES

1. Contact the Owner in writing at least seven (7) days prior to the start of construction.
2. Place the site sign (with contact numbers) prior to any work on site.
3. Install the erosion control BMPs, as shown on the construction documents.
4. The silt fence and hay bales line shall be inspected on a weekly basis; any breaks in the line shall be repaired as soon as possible.
5. All erosion and sedimentation controls shall be in accordance with the DEP's Erosion and Sedimentation Control Guidelines and the USDA SCS Erosion and Sedimentation Control during site development.
6. All stockpile areas are to be protected by silt fence and silt socks, and shall be covered with a tarp with weights to prevent moisture intrusion and dust concerns.
7. All disturbed areas shall be stabilized with mulch or seed immediately upon completion of construction activity. In no case shall an area be left unstabilized for more than 14 days after the construction activity in that area has ceased.
8. All erosion control measures shall be inspected after any rainfall of 0.5" or greater.
9. All catch basins are to be ringed with silt socks and covered with a sediment filter until all up-gradient disturbed areas are stabilized.
10. All outlet orifices are to be ringed with silt socks until the detention structure or infiltration area is stabilized.
11. All slopes greater than 3:1 shall be stabilized with an erosion control blanket.
12. The contractor shall keep additional silt fence and hay bales on site to mitigate any emergency condition.
13. All proposed drainage structures (catch basins, manholes, and infiltration chambers) should be cleaned at the end of construction and at any time the sediment within the structures equals 12" deep.
14. The contractor shall only disturb the minimum area necessary.
15. All illicit discharges are prohibited.

OPERATION & MAINTENANCE PLAN

South Hadley High School
Athletic Campus Improvements

January 2016

SECTION II: POST-DEVELOPMENT ACTIVITIES

PART A - GENERAL

- It shall be the responsibility of South Hadley High School to implement the procedures outlined herein.
- The entire project area shall be stabilized with vegetation upon completion of construction and prior to the removal of the erosion control devices.
- The closed drainage system shall be inspected every 6 months and any excess sediment within the structures or detention systems shall be properly disposed of.
- Any problems found with the drainage system shall be repaired in a timely manner.
- The Owner shall employ a qualified professional to perform frequent maintenance, as described herein.
- All maintenance personnel shall be trained annually on the operation and maintenance procedures. A training log shall be maintained for records to document the annual training of employees.
- Inspection logs are included with this O&M plan. The qualified professional shall provide the Owner with maintenance logs after each inspection or corrective action. The Owner shall keep record of these logs for at least three (3) years and shall provide copies to the Town, if requested.
- In the event that an infiltration BMP (Dynamic Stone Base) fails to drain within 72-hours of a storm event, a qualified professional should be consulted to determine what corrective actions may be necessary.
- All illicit discharges are prohibited.
- A major storm event shall be considered 2” or more rainfall.
- Copies of O & M Maintenance Logs shall be furnished to Town’s engineering division annually.

PART B - BMP MANAGEMENT

Each Best Management Practice shall be maintained per the below requirements:

CONVEYANCE SWALES & OVERLAND FLOW

- Inspect swales to make sure vegetation is adequate and that there are no signs of rilling and gullying. Perform inspection the first few months after construction and twice a year thereafter. Repair any rills or gullies and replace dead vegetation, as necessary.
- Mow as necessary. Grass height shall not exceed six inches (6”).

- Remove sediment and debris manually, at least once a year.
- Reseed, as necessary. Use of road salt or other deicers during the winter will necessitate yearly reseeding in the spring.

CATCH BASINS / DRAIN MANHOLES

- Inspect and clean at least four times per year (quarterly).
- Sediment must also be removed whenever the depth of deposits is greater than one half the depth from the bottom invert, use of a vacuum truck is preferred

SYNTHETIC TURF FIELD

- Perform preventative maintenance twice a year.
- Inspect cleanouts after every major storm during the first 3 months of operation and twice a year thereafter, and also when there are discharges.
- Inspect and clean pre-treatment devices (catch basins) every other month and at least twice a year, and after every major storm event.

SYNTHETIC TURF FIELD SNOW PLOWING

- Use Low Ground Pressure (LGP) equipment with a specifically outfitted plow edge recommended by the turf manufacture.
- Inspect vehicles prior to each snow removal operation to make sure they aren't leaking contaminants.
- Maintain plow elevation at 2-3 inches above carpet to the extent practical.
- Vehicles should only be allowed to turn on a wide radius or when in forward motion, and should not be left idling or unattended. Vehicles should avoid braking and sharp turns.
- Snow stockpiles shall be located outside jurisdictional buffer zones (i.e. 100' wetland buffer, riverfront area, ACEC).
- Plowing operations shall occur to avoid accumulation of snow above 4-6 inches to allow for manageable snow depths during the duration of a storm.
- Collect migrated infill from plowing operations and redistribute back into the field. Alternatively, collect and dispose of displaced rubber crumb and supplement field with new infill as needed.
- Inspect and clean cleanouts and pre-treatment devices (catch basins, ACO drains) after the completion of snow plowing operations.
- Groom the field prior to use to redistribute infill.
- Use of chemical melting agents shall be prohibited.

OPERATION & MAINTENANCE PLAN

South Hadley High School
Athletic Campus Improvements

January 2016

SECTION III – LONG TERM POLLUTION PREVENTION PLAN

GOOD HOUSEKEEPING PRACTICES

- Prevent or reduce pollutant runoff from the project development through the use of street sweeping, landscaping maintenance, trash clean up, erosion control measures and frequent site cleaning.

STORING MATERIALS AND WASTE PRODUCTS

- All materials stored on site shall be stored in a neat and orderly fashion, in their appropriate containers, and under a roof or other secure enclosure. Waste products should be placed in secure receptacles until they are emptied by a licensed solid waste management company.

ROUTINE INSPECTIONS AND MAINTENANCE OF STORMWATER BMPS:

- Follow the guidelines outlined above.

MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPED AREAS

- The owner will be responsible for these activities.

OPERATION & MAINTENANCE PLAN
South Hadley High School

INSPECTION & MAINTENANCE LOG

Inspected by:_____ Date:_____.

Days since last rainfall:_____ Amount of last Rainfall:_____Inches

BMP Being Inspected:

Description or sketch of BMP Location:

Opened inspection ports or manhole covers	YES	NO
Standing water observed	YES	NO
Depth of standing water (inches)		Not Applicable
Sediment observed	YES	NO
Depth of sediment (inches)		Not Applicable

Corrective Actions taken:

Other Remarks:

OPERATION & MAINTENANCE PLAN
South Hadley High School

SECTION IV – ILLICIT DISCHARGE STATEMENT

Standard 10 of the Massachusetts Stormwater Regulations prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating and infiltrating stormwater on site, including stormwater best management practices and any pipes intended to transport stormwater to the ground water, a surface water, or municipal separate storm sewer system.

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated ground water, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing, and water used to clean residential buildings without detergents.

I, _____(print name), certify that I have conducted a proper site investigation and verify that to the best of my knowledge there are no illicit discharges located at the South Hadley High School.

Signature_____

Date_____