Stormwater Drainage Report

Proposed Drive-Through Restaurant

Haydenville, Massachusetts

Project Location:

142 Main Street
Map K, Parcel 192
Haydenville, Massachusetts

Prepared for:

Sao Joao Realty, LLC
475 Southampton Road
Westfield, Massachusetts

RLA Project File: 150407

July 30, 2015

R LEVESQUE ASSOCIATES, INC

A LAND PLANNING SERVICES COMPANY

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I. INTRODUCTION

The project applicant, Mr. Emanuel Sardinha of Sao Joao Realty, LLC, is proposing to construct a drive-through restaurant on approximately 1.3 acres of previously developed land located at the intersection of Main Street and Bridge Street in Haydenville, Massachusetts. A stormwater management system has been designed to meet the guidelines set forth in the Massachusetts Department of Environmental Protection Stormwater Management Handbook. The proposed project involves the following:

- Demolition of an existing bank building and construction of a drive-through restaurant (2,190 sq. ft. ±);
- Associated site improvements including a parking lot and access drives;
- Construction of a stormwater management system to provide water quality treatment and attenuate peak discharge rates from the proposed development.

2. SITE DESCRIPTION

2.1 Predevelopment Conditions

The proposed project site is located at the intersection of Main Street and Bridge Street identified as Assessor's Parcel 192 on Map K, with an address of 142 Main Street in Haydenville, MA. The previously developed 1.3 acre ± parcel is zoned Village Mixed according to the town of Williamsburg zoning map. The Mill River runs along the southerly portion of the project site. The existing bank building, centrally located on the parcel, is also the highpoint of the site at elevation 232.5±. From this highpoint, the topography gradually slopes away from the building down to a low point at elevation 422.0 near the stone retaining wall that runs along the edge of the Mill River. See Figure 1 – USGS Map for the location of the proposed development.

2.2 Resource Areas

The subject property does not contain or abut any bordering or isolated vegetated wetlands; however, the project does abut the Mill River to the south. The mean annual high water line has been delineated by R Levesque Associates, Inc. as the face of the stone retaining wall running along the river. The location of the flags (MAHW-1 through MAHW-7) as well as the 100-foot Inner Riparian Zone and 200-foot Riverfront Area are shown on the project plans. Please refer to the Notice of Intent for additional information regarding the resource areas.

2.3 Floodplain

R. Levesque Associates, Inc. performed due diligence research on the property in regards to FEMA flood zone mapping. A portion of the property (south of the retaining wall) is located within a special flood zone area according to FEMA Flood Insurance Rate Mapping. The elevation of the theoretical 100-year flood event at the site is approximately 419.3 (NAVD88). All proposed work is located above elevation 419.3.

2.4 Natural Heritage and Endangered Species Program

R. Levesque Associates, Inc. performed due diligence research on the property in regards to Natural Heritage and Endangered Species Program (NHESP) areas. The entire parcel is located within an area delineated by NHESP as priority habitat of endangered species; see Figure 3 – NHESP Map.

2.5 Soils

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

Table 2.4: Hydrologic Soil Group Classification		
Soil Description	Map Unit Symbol	Hydrologic Soil Group
Raynham Silt Loam	30A	C/D
Woodbridge Fine Sandy Loam	310B	C/D
Udorthents	651	C

A series of test pits were conducted by Gary P. Weiner, PE, SE to evaluate the ability of the site to support the stormwater drainage system components. The depth to estimated seasonal groundwater varied from 72-inches to 86-inches across the site with one test hole showing no signs of groundwater. See Appendix B for additional soils information.

2.6 Post Development Conditions

The applicant is proposing to construct a new drive-through restaurant. The project involves demolition of an existing bank building and the construction of a new building (2,190 sq. ft. ±), associated site improvements including parking lot and driveway areas, and a stormwater management system. Utilities to provide services to the new building will be brought on site via Main Street. The proposed stormwater management system will collect and convey runoff from the paved areas via catch basin inlets and underground infrastructure towards a proposed subsurface infiltration basin. Roof runoff from the proposed building will tie directly into the subsurface basin. The proposed site improvements will maintain the general drainage patterns of the site. R Levesque Associates, Inc. has designed the components of the stormwater management system utilizing the guidelines set forth in the Massachusetts Department of Environmental Protection Stormwater Management Handbook.

3. STORMWATER MANAGEMENT SYSTEM

R. Levesque Associates, Inc. has prepared the following drainage system calculations for the proposed project site. These calculations were performed to document compliance with the guidelines set forth by the Massachusetts Department of Environmental Protection Stormwater Management Handbook (MassDEP Handbook). A detailed hydrologic analysis of the system was completed in order to evaluate the performance of the stormwater management system components. See Appendix C – Pre- and Post-Development Hydrologic Analysis. The proposed stormwater management system will collect stormwater runoff and utilize stormwater best management practices to provide water quality treatment, groundwater recharge, and peak discharge rate attenuation.

3.1 Drainage Calculations

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

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

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

3.1.1 Design Points

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

- DP-1; This design point represents the runoff from the site which flows to the Mill River;
- DP-2; This design point represents the runoff from the property which flows off-site to the storm drain in Main Street;
- DP-3; This design point represents the runoff from the property which flows to a low point on-site.

3.1.2 Pre-Development Hydrology

The project area under existing conditions was broken down into three (3) sub-catchments discharging to the three design points as described above. The sub-catchments were delineated based on existing site topography, the limit-of-work, and the property line. The existing watershed areas are shown on the attached Figure 4 entitled "Pre-Development Watershed Plan". Peak discharge rates for each watershed are depicted in Table 3.1.4 below.

3.1.3 Post-Development Hydrology

The proposed project site was broken down into two (2) sub-catchment areas discharging to a single design point. The post-development subcatchments were delineated based on the proposed grading and proposed stormwater infrastructure. The proposed watershed areas are shown on the attached Figure 5 entitled "Post-Development Watershed Plan". Peak discharge rates for each watershed are depicted in Table 3.1.4 below.

3.1.4 Peak Discharge Rates

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

Table 3.1.4 Pre- and Post-Development Peak Discharge Rates						
	2-year storm (cfs)		10-year storm (cfs)		100-year storm (cfs)	
	Pre-	Post-	Pre-	Post-	Pre-	Post-
Design Point 1	1.22	1.20	2.39	2.23	3.96	3.60
Design Point 2	0.13	0.00	0.21	0.00	0.31	0.00
Design Point 3	0.03	0.00	0.08	0.00	0.14	0.00

As depicted in the table, the post-development peak discharge rate does not increase over pre-development peak discharge rate conditions for each of the storm events presented.

3.2 Hydraulic Analysis

As part of the stormwater management system design, a hydraulic analysis was performed on the proposed underground infrastructure. The hydraulic analysis was performed to evaluate the performance of the proposed stormwater inlet structures and conveyance piping. Figure 6 – Hydraulic Analysis Watershed Plan demonstrates the catchment areas for each inlet. The proposed stormwater infrastructure has been sized to convey storm events up to and including the 24-hour, 100-year storm event. Please refer to Appendix D for the hydraulic analysis of the proposed stormwater management system.

3.3 MassDEP Stormwater Management Standards

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

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

  The proposed project provides water quality treatment to the guidelines of the MassDEP Handbook. Therefore, no new untreated stormwater is discharged.

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

The proposed stormwater management system has been designed such that the post-development peak discharge rates are less than the pre-development discharge rates for the 2-year, 10-year, and 100-year 24-hour storms. See Appendix C for the Hydrologic Analysis.

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

  The proposed subsurface infiltration basin has been designed with the capacity to infiltrate the required recharge volume. See Appendix E for the Required Recharge Volume Calculations.

- *Standard #4 – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of TSS. It is presumed that this standard is met when:*

  a. Suitable practices for source control and pollution prevention are identified in a long term pollution prevention plan, and thereafter are implemented and maintained;

  b. Structural stormwater BMPs practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and

  c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook

  The proposed stormwater management utilizes deep-sump hooded catch basins and proprietary sedimentation devices as part of the treatment train. The proprietary sedimentation devices have been sized to treat the water quality flow rates associated with the first 0.5-inch of runoff. See Appendix E for the Water Quality Volume Conversion to Flow Rate Calculations.

- *Standard #5 - For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by MassDEP to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land* *uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

This standard is not applicable.

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

  This standard is not applicable.

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

  This standard is not applicable.

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

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

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

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

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

An illicit discharge statement will be provided prior to discharge of stormwater to post-construction BMPs. See Appendix H for a copy of the Illicit Discharge Statement.

3.4 Stormwater Best Management Practices

The proposed stormwater management system was designed utilizing stormwater best management practices (BMP) as set forth by the MassDEP Handbook. The BMPs utilized as part of the stormwater management system include deep-sump catch basins, proprietary sedimentation devices and a subsurface infiltration basin. All of the BMPs were designed to meet the requirements of the MassDEP Handbook and will provide water quality treatment, groundwater recharge, and peak rate attenuation in order to mitigate the impacts of the proposed site improvements. See Appendix E – MassDEP Calculations for the calculations required to document compliance. The following section provides a description of the best management practices (BMPs) being utilized on site.

3.4.1 Deep-sump Catch Basins

Deep-sump catch basins equipped with oil/gas hoods are being utilized as structural pretreatment devices within the existing and proposed stormwater management system. The catch basins will be constructed with a 4'-0" deep-sump to act as a settling chamber and allow for adequate storage of collected sediments. Catch basins are typically first in the line of water-quality treatment.

3.4.2 Proprietary Sedimentation Devices

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

3.4.3 Subsurface Infiltration Basins

Subsurface Infiltration Basins are well suited to provide groundwater recharge from watershed areas such as those associated with this project. The subsurface infiltration basin provides groundwater recharge by providing storage of runoff prior to discharge out of the system from the overflow device. The subsurface infiltration basins consist of underground stormwater chambers embedded in stone. The discharge is conveyed to the subsurface infiltration basins via up-gradient drainage infrastructure where it is detained to provide groundwater recharge. During larger storm events when the recharge volume has been exceeded, the overflow is discharged via an outlet manifold pipe and outlet control structure to down-gradient drainage infrastructure.

3.5 Protection of Stormwater Best Management Practices during Construction

Protection of the stormwater best management practices during construction is crucial to ensure the proper functioning of the stormwater management system once the site has been stabilized. Certain specific erosion and sedimentation controls and good practices to be performed by the site contractor have been documented in a Construction Period Erosion Control Plan. See Appendix F – Construction Period Erosion Control Plan.

3.6 Inspection and Maintenance of Stormwater Best Management Practices

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

3.7 Illicit Discharge Compliance Statement

RLA has prepared an Illicit Discharge Compliance Statement to document compliance with the Massachusetts Department of Environmental Protection Stormwater Management Handbook, see Appendix H.

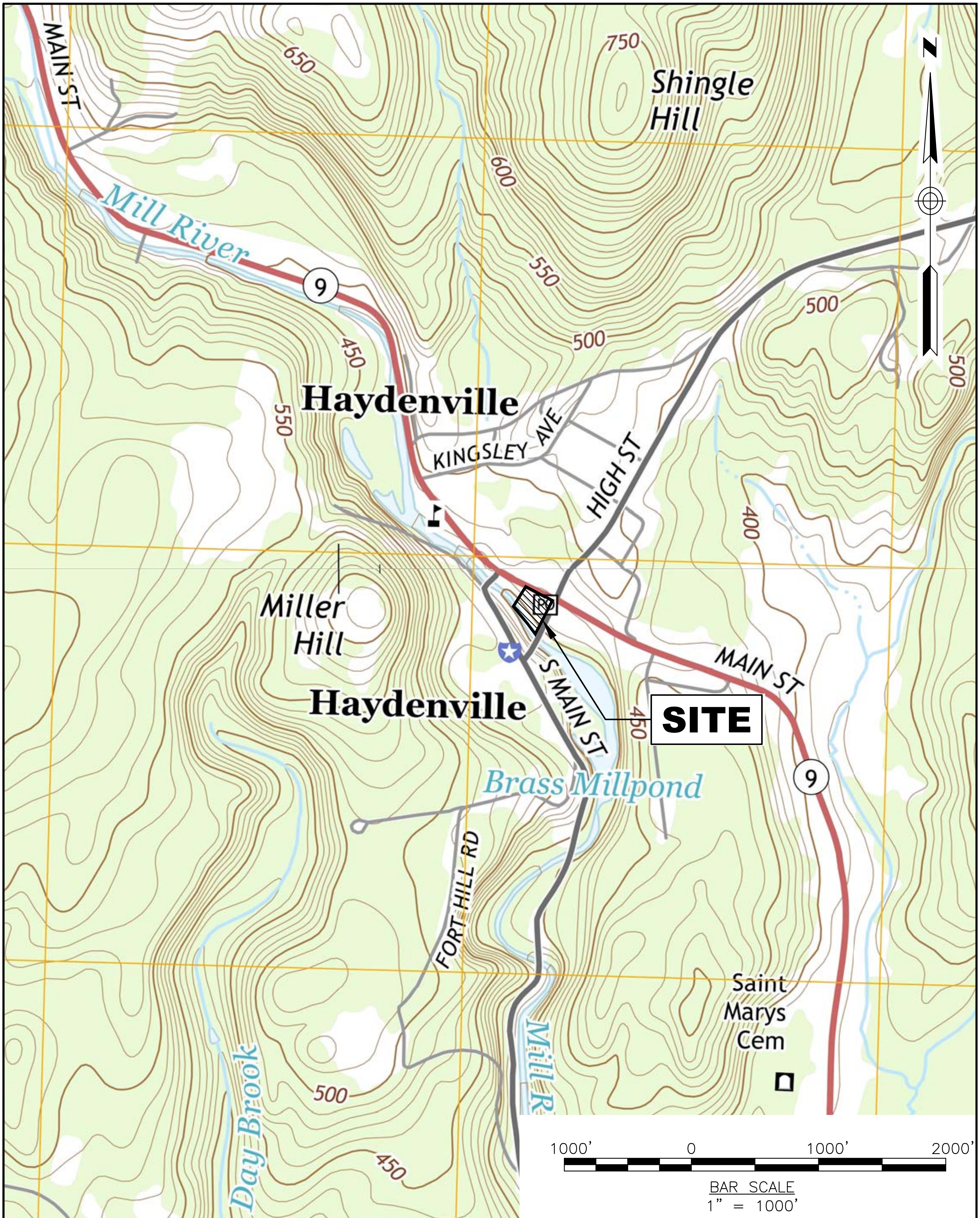
3.8 Low-Impact Development Alternatives Analysis Narrative

RLA has prepared a Low-Impact Development Alternatives Analysis Narrative as part of the Stormwater Drainage Report, see Appendix I.

4. CONCLUSION

The proposed stormwater management system has been designed to mitigate the increase in stormwater runoff volume due to the construction of the proposed project while providing a control for runoff water quality and water quantity. Implementation of stormwater best management practices such as deep-sump hooded catch basins, proprietary sedimentation devices and a subsurface infiltration basin allow for a stormwater drainage design that meets the guidelines set forth in the Massachusetts Department of Environmental Protection Stormwater Management Handbook.

Figure 1: Site Locus – USGS Map



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SITE LOCUS
USGS MAP

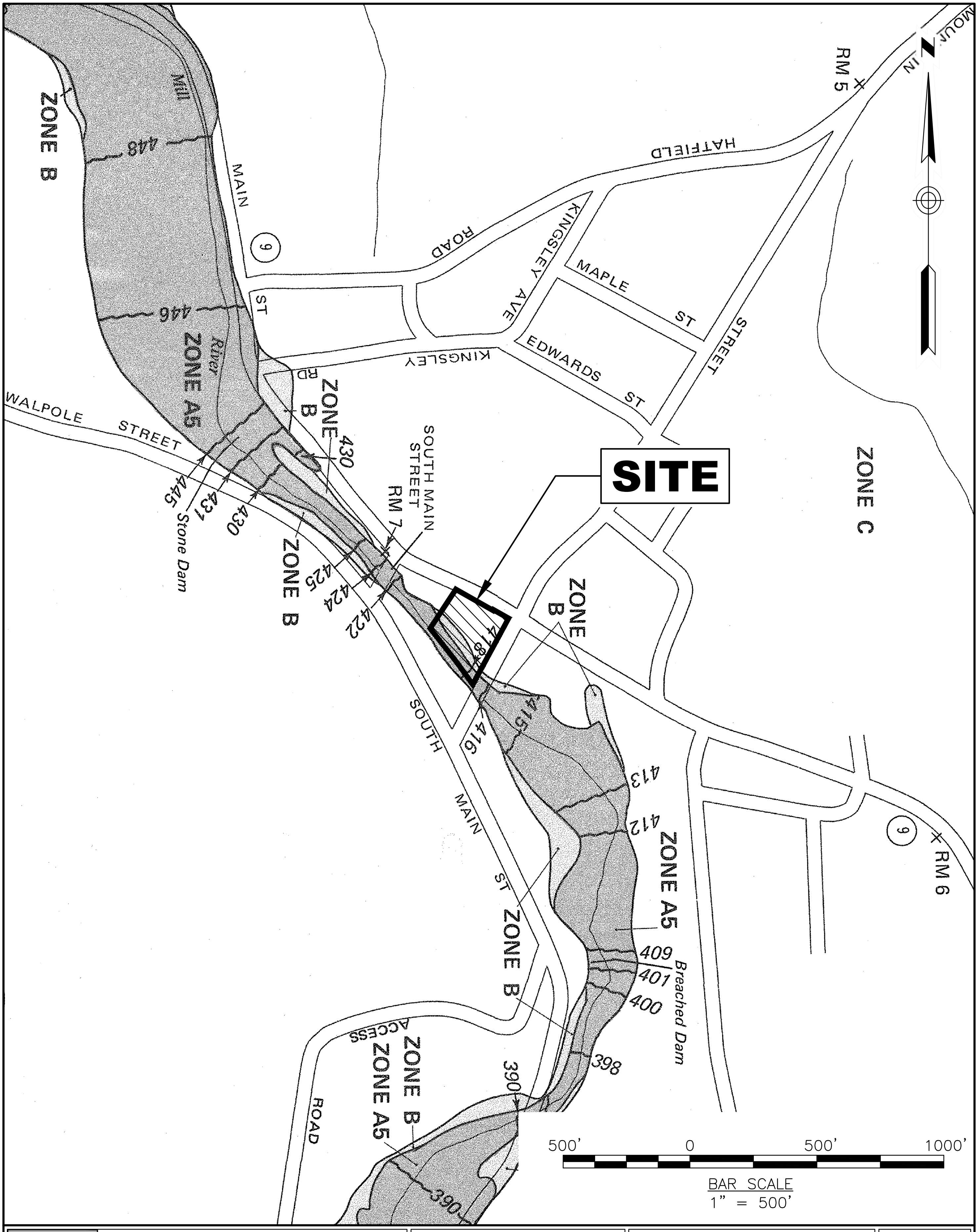
Sao Joao Realty, LLC
475 Southampton Road
Westfield, Massachusetts

Proposed Drive-Thru Restaurant
142 Main Street
Haydenville, Massachusetts

JOB NO:	150407
DATE:	7/31/15
SCALE:	AS NOTED

FIG-1

Figure 2: FEMA Flood Map



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FLOOD RATE
INSURANCE MAP
PANEL: 2501740002B
DATE: JUNE 1, 1981

Sao Joao Realty, LLC
475 Southampton Road
Westfield, Massachusetts

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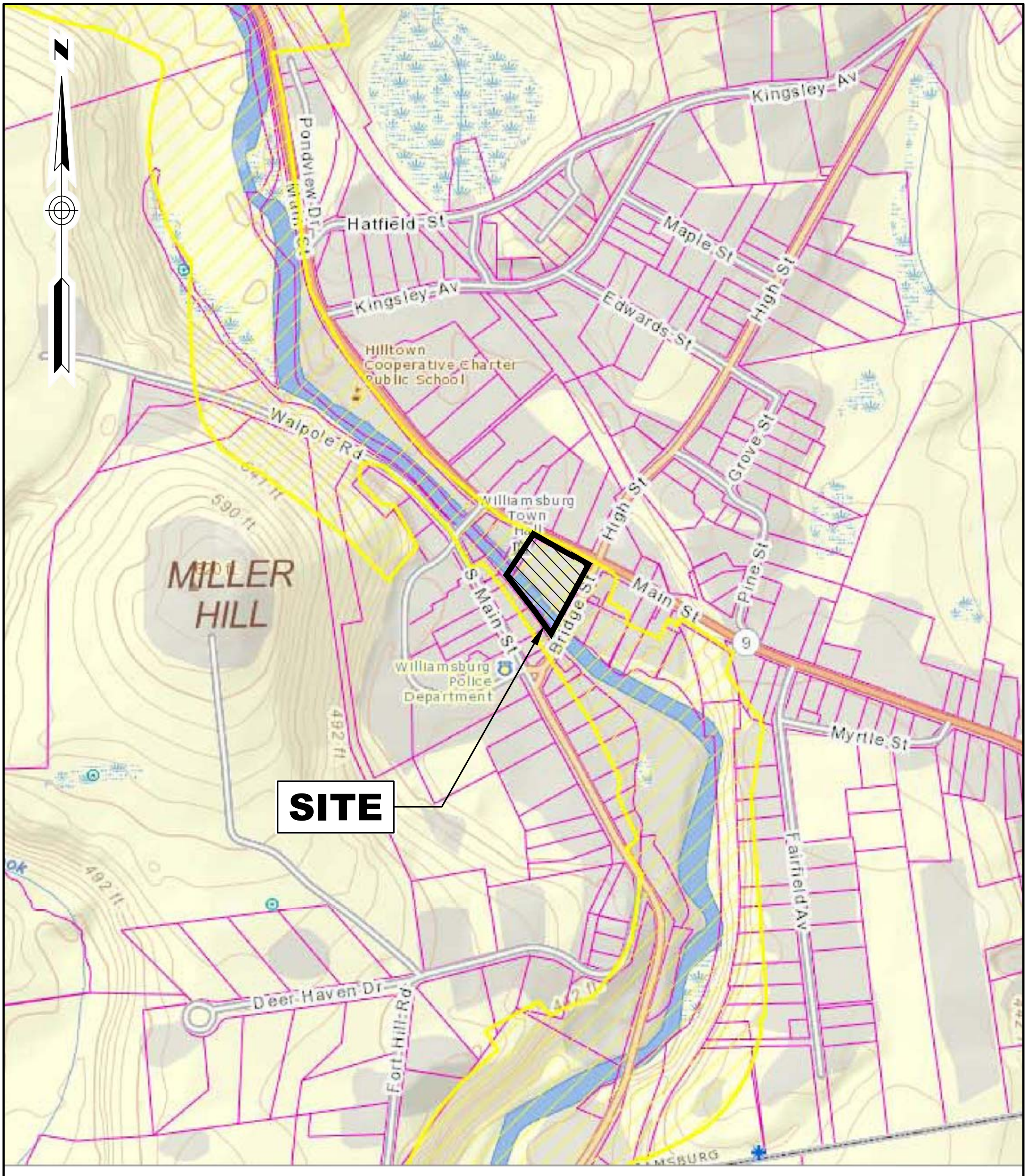
142 Main Street
Haydenville, Massachusetts

JOB NO:	150407
DATE:	7/31/15
SCALE:	AS NOTED

FIG-2

Figure 3: Natural Heritage and Endangered Species Program Map



500' 0 500' 1000'

BAR SCALE
1" = 500'

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Natural Heritage and Endangered Species Map

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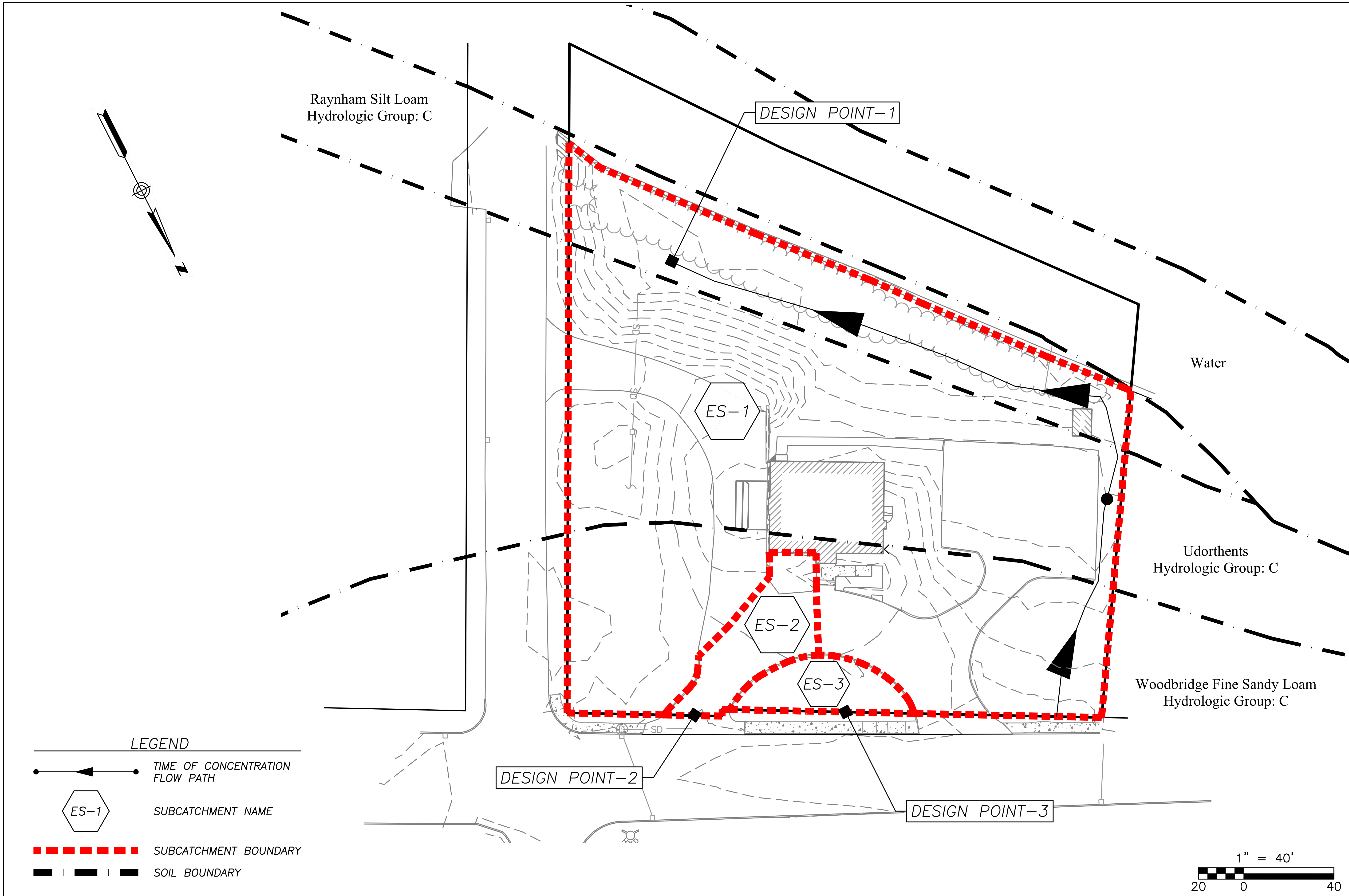
475 Southampton Road
Westfield, Massachusetts

Proposed Drive-Thru Restaurant
142 Main Street
Haydenville, Massachusetts

JOB NO:	150407
DATE:	7/31/15
SCALE:	AS NOTED

FIG-3

Figure 4: Pre-Development Watershed Plan



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Pre-Development Watershed Plan

Proposed Drive-thru Restaurant
142 Main Street
Haydenville, MA

Sao Joao Realty, LLC
475 Southampton Road
Westfeild, MA

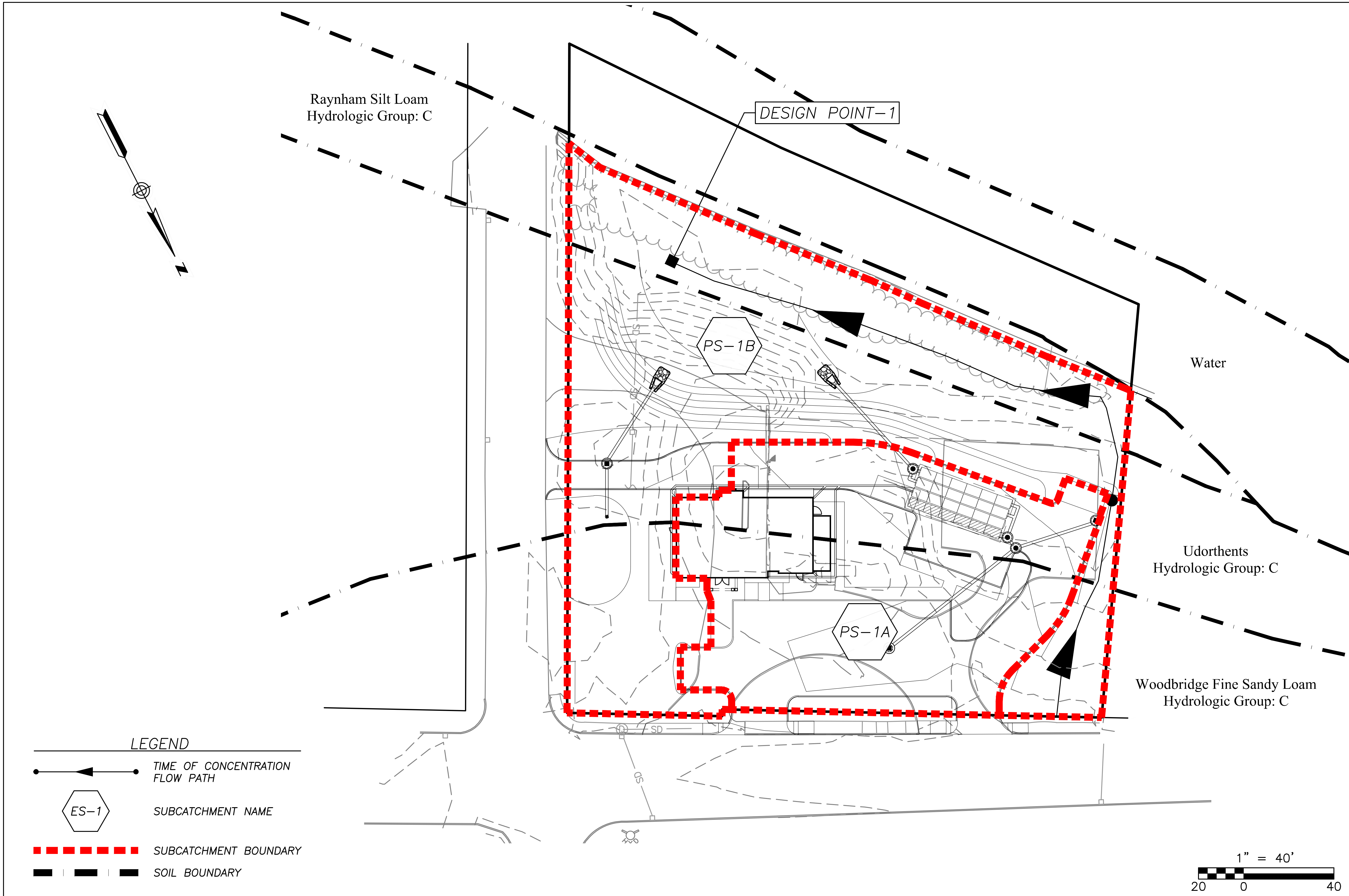
JOB NO.: 150407

DATE: 7/30/15

SCALE: 1" = 40'

FIG-4

Figure 5: Post-Development Watershed Plan



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Post-Development Watershed Plan

Proposed Drive-thru Restaurant
142 Main Street
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475 Southampton Road
Westfeild, MA

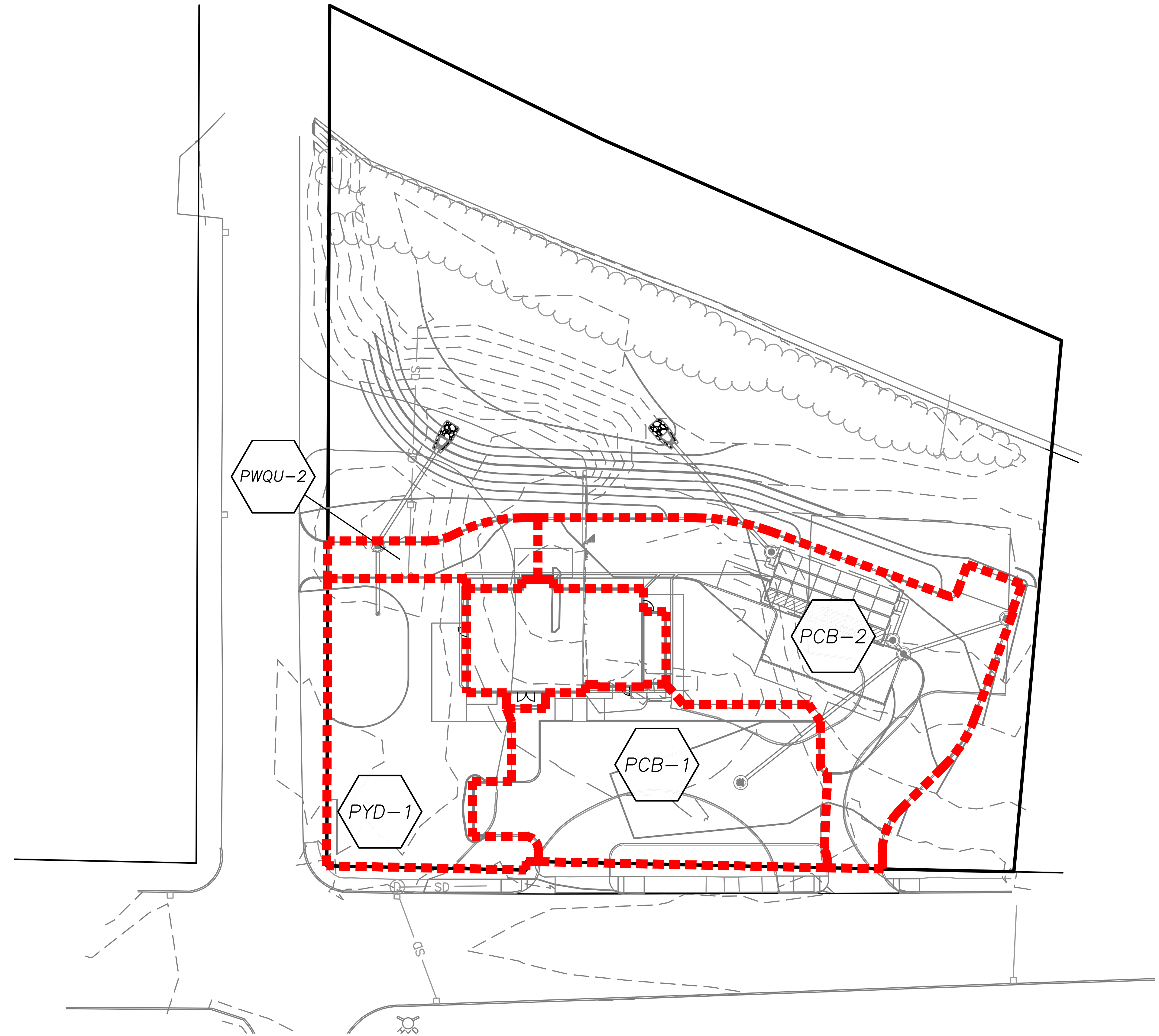
JOB NO.: 150407

DATE: 7/30/15

SCALE: 1" = 40'

FIG-5

Figure 6: Hydraulic Analysis Watershed Plan



LEGEND

PCB-1 — AREA NAME

INLET AREA BOUNDARY

1" = 40'

20 0 40

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Inlet Area Plan

Proposed Drive-thru Restaurant
142 Main Street
Haydenville, MA

Sao Joao Realty, LLC
475 Southampton Road
Westfeild, MA

JOB NO.: 150407

DATE: 7/30/15

SCALE: 1" = 40'

FIG-6

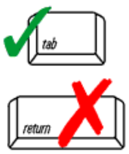
Appendix A: Checklist for Stormwater Report

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

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 (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist (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 (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.

Appendix B: Soils Information

- NRCS Soils Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Hampshire County, Massachusetts, Central Part

Main Street - Haydenville, MA

July 21, 2015

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

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.

Soil Map

Map Scale: 1:682 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 10, 20, 40, 60

Feet: 0, 30, 60, 120, 180

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 9, Sep 19, 2014

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**
1	Water	0.0	0.4%
30A	Raynham silt loam, 0 to 3 percent slopes	0.2	20.3%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	0.4	36.9%
651	Udorthents, smoothed	0.5	42.4%
Totals for Area of Interest		**1.2**	**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

1—Water

Map Unit Setting

National map unit symbol: 9b24
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 120 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

30A—Raynham silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9b1h
Elevation: 50 to 500 feet
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

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

Description of Raynham

Setting

Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Silty glaciolacustrine deposits

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 37 inches: silt loam
H3 - 37 to 60 inches: stratified loamy fine sand to fine sandy loam to silt loam

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): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 31 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: High (about 11.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D

Minor Components

Belgrade

Percent of map unit: 5 percent

Maybid

Percent of map unit: 5 percent
Landform: Depressions

Scitico

Percent of map unit: 5 percent
Landform: Depressions

310B—Woodbridge fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2ql
Elevation: 0 to 1,470 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodbridge, fine sandy loam, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Fine Sandy Loam

Setting

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

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam

Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D

Minor Components

Paxton

Percent of map unit: 10 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex

Ridgebury

Percent of map unit: 8 percent
Landform: Ground moraines, hills, depressions, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave

651—Udorthents, smoothed

Map Unit Setting

National map unit symbol: 9b23
Elevation: 0 to 3,000 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 120 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 100 percent

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

Description of Udorthents

Setting

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

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

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6/26/15

Commonwealth of Massachusetts
City/Town of HAYDENVILLE - 142 MAIN STREET

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

C. On-Site Review (continued)

Deep Observation Hole Number: 01

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-6"	Ap	10YR 3/6				SL			FRIABLE		
6"-19"	B	10YR 5/8				LS			FRIABLE		ROOTS
19"-51"	FILL	10YR 5/8				LS					
51"-86"	C1	10YR 4/4	86"	RED 5YR 4/6	>7%	LS/S	>20%	MANY LG COBBLE			
86"-115"	C2	7.5YR 4/1				SL/L	—	NONE		MOIST	

Additional Notes:

41" - 4" CONC. PIPE

FILL - BRICKS, PIPE, ORGANICS

SLOW SEEP @ 89"

6/26/15

Commonwealth of Massachusetts
City/Town of HAYDENVILLE - 142 MAIN STREET

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

C. On-Site Review (continued)

Deep Observation Hole Number: 02

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-12"	Ap	10YR 3/2				SL			FRIABLE		
12"-16"	B	10YR 5/6				LS			FRIABLE		
16"-108"	C	10YR 4/4	78"	RED 5YR4/6		LS/S	>35%	many large		DRY	

Additional Notes: OUTWASH SAND/GRAVEL

6/26/15

Commonwealth of Massachusetts
City/Town of HAYDENVILLE - 142 MAIN STREET

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

C. On-Site Review (continued)

Deep Observation Hole Number: 03

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-7"	Ap	10YR 3/2				SL			FRIABLE		
7"-17"	B	10YR 5/6				LS			FRIABLE		
17"-32"	FILL MIXED	—				SL					
32"-48"	C_1	2.5Y 4/2		NONE		SL	>30%	MANY LARGE	WELL DRAINED		
48"-110"	C_2	10YR 4/4		OBSERV.		LS/S	>25%	MANY LARGE		DRY	

Additional Notes:

C_1 & C_2 - VERY BONY

C_2 - OUTWASH SAND/GRAVEL

NO SEEPS ; NO STANDING

6/26/16

Commonwealth of Massachusetts
City/Town of HAYDENVILLE / WILLIAMSBURG

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

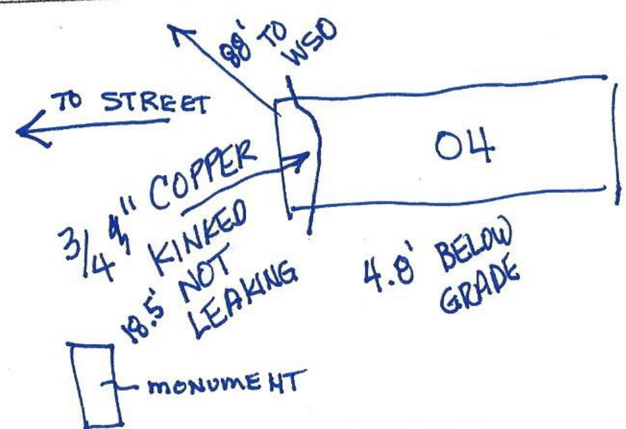
C. On-Site Review (continued)

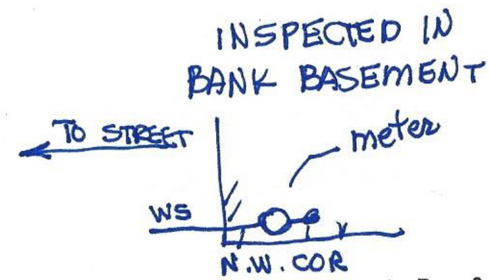
Deep Observation Hole Number: 04

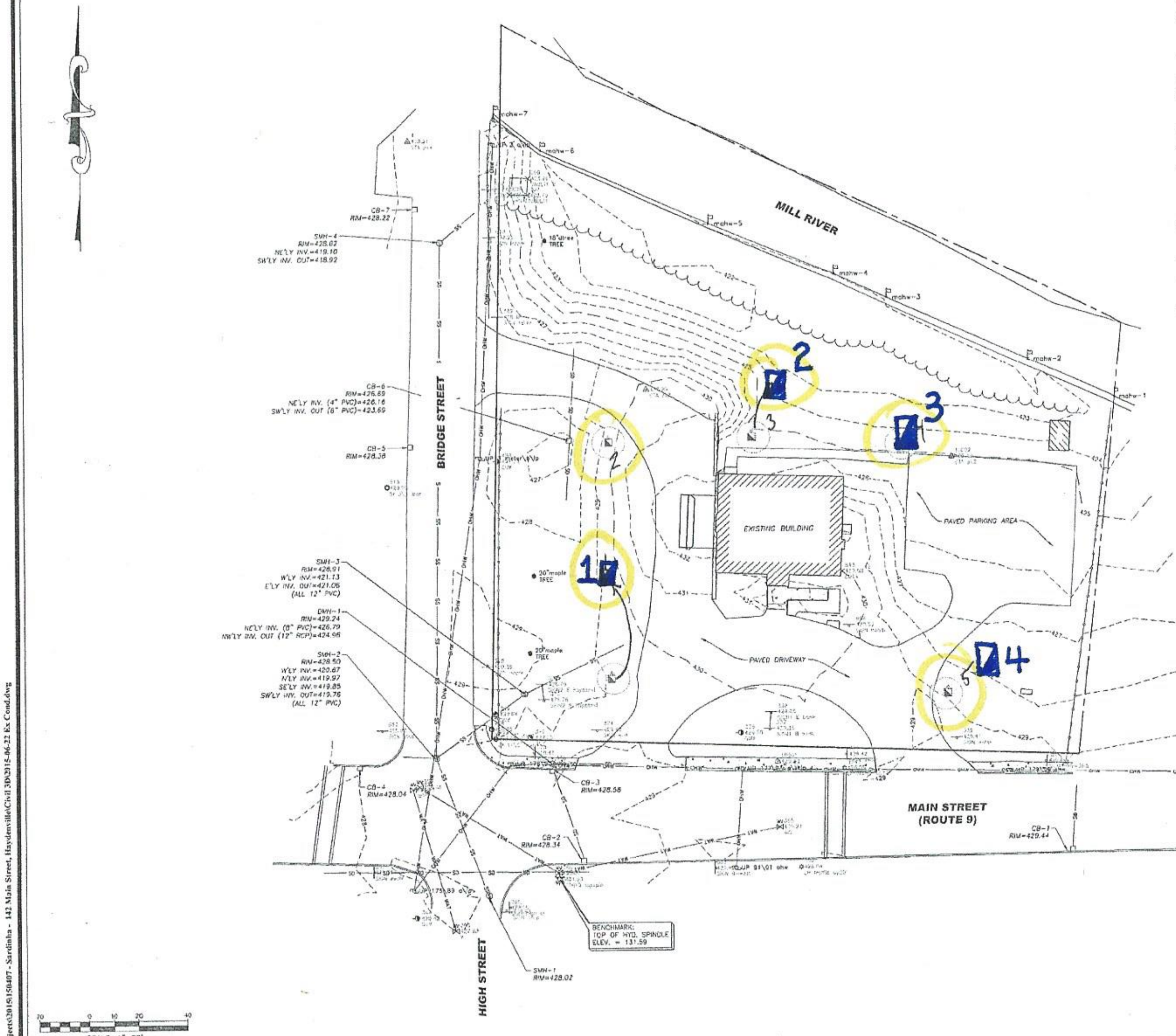
Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-5"	Ap	10YR 3/3							FRIABLE		
5"-16"	B	10YR 5/6							FRIABLE		
16-45"	FILL	—				LS/S	>25%	MANY			
45-72"	C1	2.5Y 4/2	72"	RED 5YR 4/6		SL		LARGE			
72"-96"	C2	10YR 4/4				S/LS	>30%	MANY			

Additional Notes:

STANDING WATER @ 86"







NOTES

1. THE RECORD OWNER OF THE SUBJECT PARCEL IS _____. SEE HAMPDEN COUNTY REGISTRY OF DEEDS BOOK __ PAGE ___
2. THE PROPERTY LINES SHOWN HEREON ARE BASED UPON A PLAN TITLED, "_____" PREPARED BY ____ DATED ____. SEE HAMPDEN COUNTY REGISTRY OF DEEDS BOOK OF PLANS __ PAGE __. ***(OR REFERENCE RLA BOUNDARY SURVEY OR CITY/TOWN GIS IF APPROXIMATE PROPERTY LINES)***
3. THIS PLAN HAS BEEN PREPARED FOR SITE PLANNING PURPOSES AND SHALL NOT BE USED FOR THE CONVEYANCE OF LAND OR FOR ANY OTHER USE.
4. SUBJECT PARCEL CONTAINS ____ S.F./ACRES.
5. THE SUBJECT PROPERTIES SHOWN HEREON MAY BE SUBJECT TO RIGHTS AND EASEMENTS AS CONTAINED IN THE VARIOUS DEEDS OF RECORD DESCRIBING SAID PROPERTIES. THE LOCATION AND EXTENT OF ANY SUCH RIGHTS AND EASEMENTS IS NOT THE SUBJECT OF THIS PLAN.
6. WETLANDS ***(AND M.A.H.W.)*** DELINEATED BY ___ ON _____
7. THE EXISTING CONDITIONS INFORMATION SHOWN IS BASED UPON A TOPOGRAPHIC SURVEY PERFORMED BY R LEVESQUE ASSOCIATES, INC. ON JUNE 18TH, 2015.
8. THE UNDERGROUND UTILITIES SHOWN HEREON HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION, AVAILABLE RECORD DATA, ***(CITY/TOWN GIS?)*** AND ____. THE SURVEYOR MAKES NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN HEREON COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN HERE ARE IN THE EXACT LOCATION INDICATED, ALTHOUGH THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM AVAILABLE INFORMATION.
9. ADJACENT PROPERTY LINES AND ABUTTERS SHOWN HEREON ARE REFERENCED FROM THE ***(CITY/TOWN GIS MAPPING OR WHEREVER)*** AND/OR ***(CERTIFIED CITY/TOWN ASSESSOR LIST)***.
10. SUBJECT PARCEL IS ZONED VILLAGE MIXED ACCORDING TO THE TOWN OF WILLIAMSBURG ZONING MAP.
11. THE SUBJECT PARCEL IS NOT LOCATED WITHIN A SPECIAL FLOOD ZONE AREA ACCORDING TO FLOOD INSURANCE RATE MAP NUMBER 2501740002B – EFFECTIVE DATE: JUNE 1ST, 1981.
12. THE SUBJECT PROPERTY IS NOT LOCATED WITHIN NATURAL HERITAGE & ENDANGERED SPECIES PROGRAM (NHESP) JURISDICTION.

PRELIMINARY

RLA
R LEVESQUE ASSOCIATES INC.
Landscape Architects
Civil Engineers · Land Surveyors
Environmental Consultants
ph: 413.568.0985 fax: 413.568.0986
40 School Street · P.O. Box 640
Westfield, MA 01086
rlaland.com

EXISTING SITE CONDITIONS

Proposed Drive-Thru Restaurant
142 Main Street
Haydenville, MA

PREPARED FOR:
Sao Joao Realty, LLC
c/o Emanuel Sardinha
16 Harvard Street
Westfield, MA 01085

ISSUANCE DATE: JUNE 19, 2015

REVISIONS:	DATE:

UNAUTHORIZED ALTERATION OF THIS DOCUMENT IS A VIOLATION OF MASSACHUSETTS STATE LAW

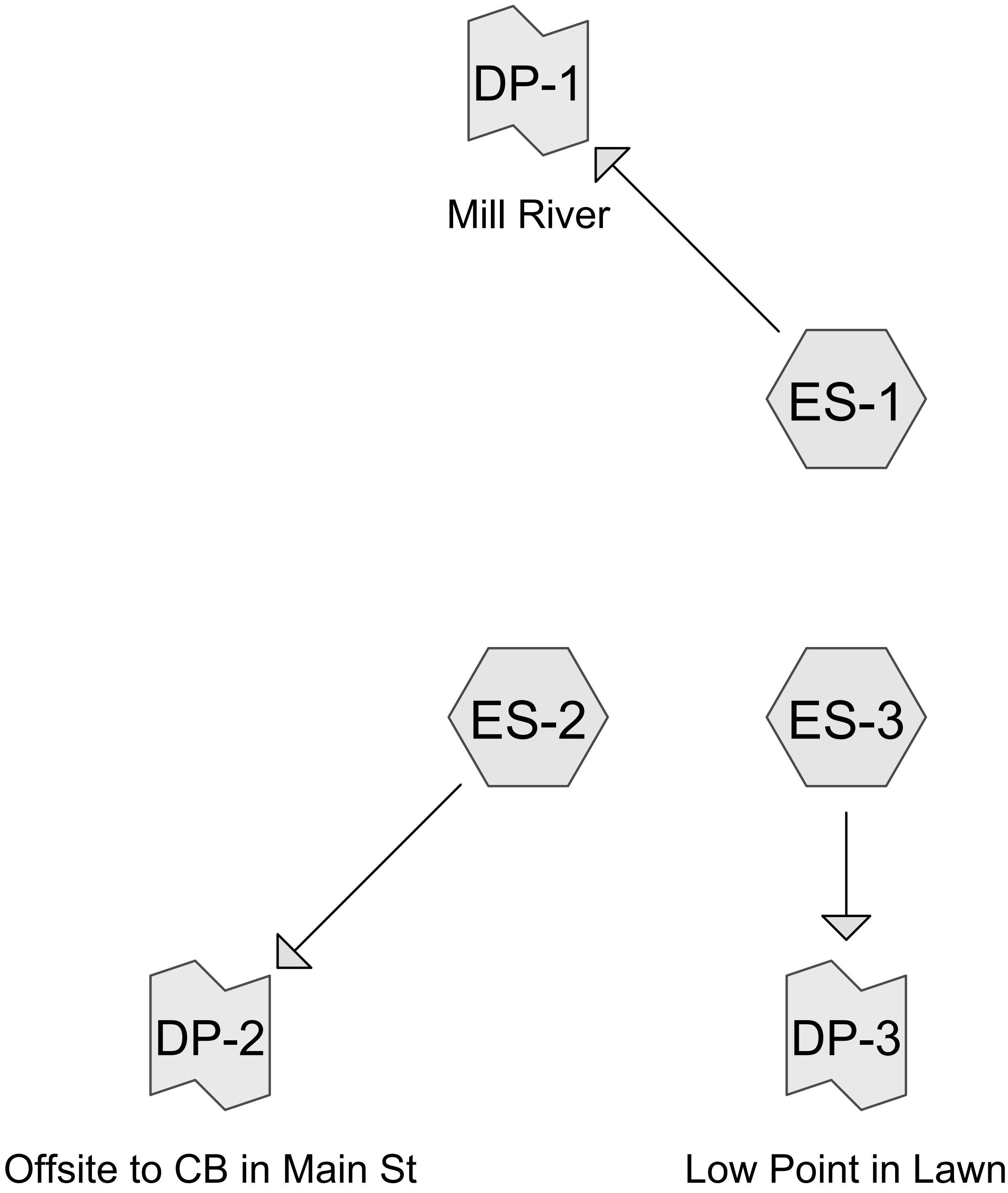
SCALE: AS NOTED

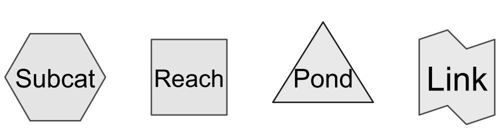
RLA PROJ. NUMBER: 150407

DRAWING#	REV.
EX-1	0

S:\Projects\2015\150407 - Sardinha - 142 Main Street, Haydenville\Civil 3D\2015-06-22 Ex Cond.dwg

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





Routing Diagram for 150407 - PRE
Prepared by R Levesque Assoc., Printed 8/3/2015
HydroCAD® 10.00 s/n 02175 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
32,468	74	>75% Grass cover, Good, HSG C (ES-1, ES-2, ES-3)
12,974	98	Paved parking, HSG C (ES-1, ES-2, ES-3)
2,411	98	Roofs, HSG C (ES-1, ES-2)
47,853	**82**	**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES-1: Runoff Area=44,131 sf 30.52% Impervious Runoff Depth=1.31"
Flow Length=347' Tc=13.0 min CN=81 Runoff=1.22 cfs 4,831 cf

Subcatchment ES-2: Runoff Area=2,259 sf 84.38% Impervious Runoff Depth=2.35"
Tc=6.0 min CN=94 Runoff=0.13 cfs 442 cf

Subcatchment ES-3: Runoff Area=1,462 sf 0.54% Impervious Runoff Depth=0.91"
Tc=6.0 min CN=74 Runoff=0.03 cfs 111 cf

Link DP-1: Mill River Inflow=1.22 cfs 4,831 cf
Primary=1.22 cfs 4,831 cf

Link DP-2: Offsite to CB in Main St Inflow=0.13 cfs 442 cf
Primary=0.13 cfs 442 cf

Link DP-3: Low Point in Lawn Inflow=0.03 cfs 111 cf
Primary=0.03 cfs 111 cf

Total Runoff Area = 47,853 sf Runoff Volume = 5,384 cf Average Runoff Depth = 1.35"
67.85% Pervious = 32,468 sf 32.15% Impervious = 15,385 sf

Summary for Subcatchment ES-1:

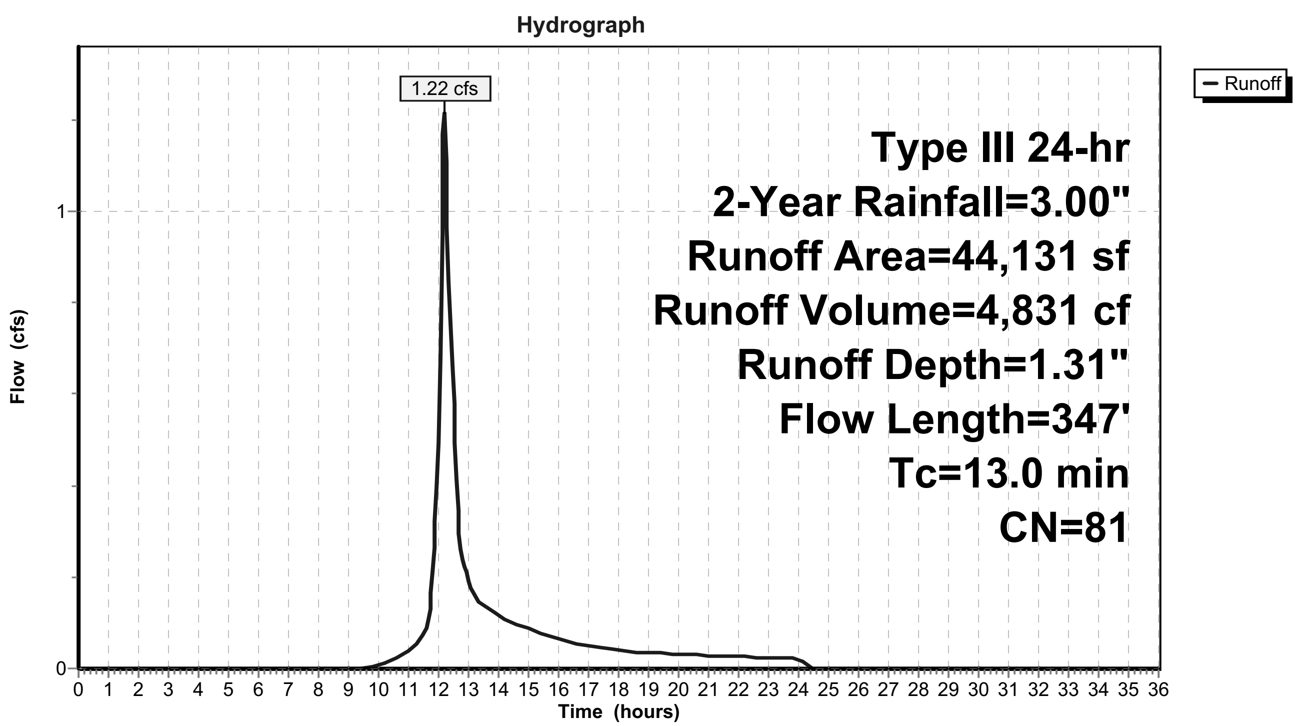
Runoff = 1.22 cfs @ 12.19 hrs, Volume= 4,831 cf, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
30,661	74	>75% Grass cover, Good, HSG C
11,060	98	Paved parking, HSG C
2,411	98	Roofs, HSG C
44,131	81	Weighted Average
30,661	74	69.48% Pervious Area
13,471	98	30.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0430	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
2.1	247	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	347	Total			

Subcatchment ES-1:



Summary for Subcatchment ES-2:

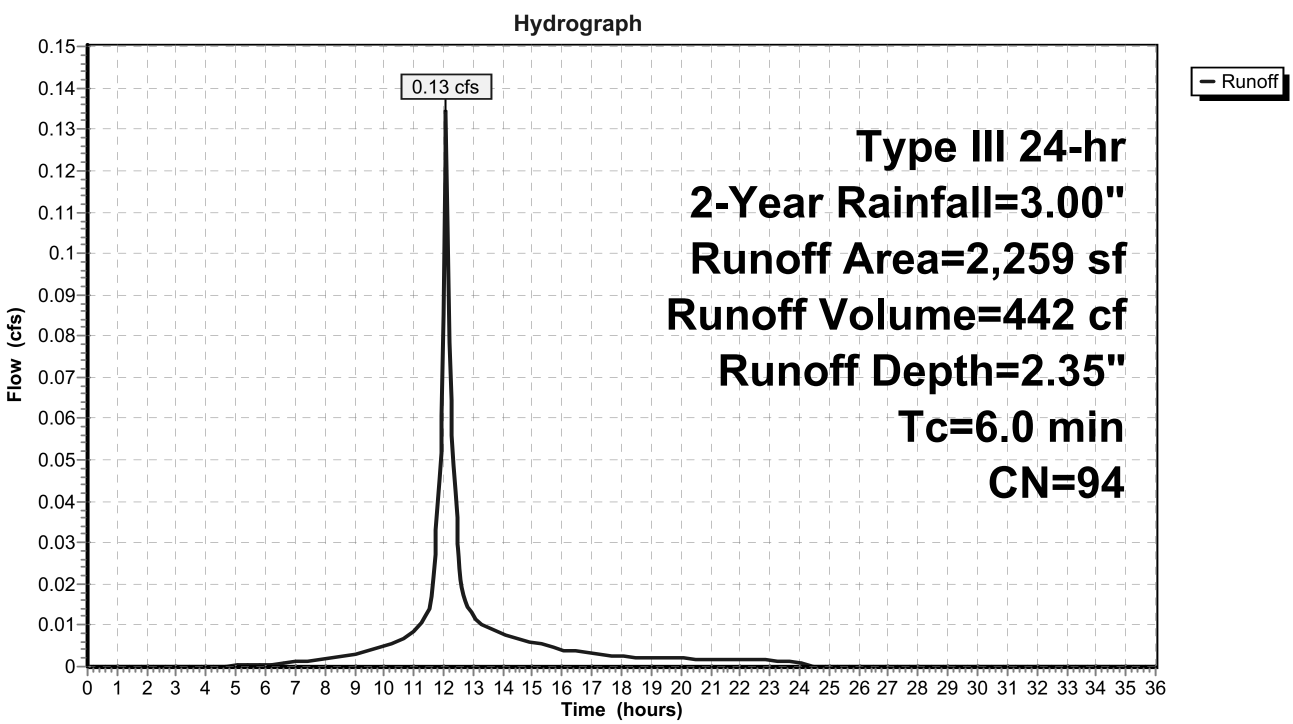
Runoff = 0.13 cfs @ 12.09 hrs, Volume= 442 cf, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
353	74	>75% Grass cover, Good, HSG C
1,906	98	Paved parking, HSG C
0	98	Roofs, HSG C
2,259	94	Weighted Average
353	74	15.62% Pervious Area
1,906	98	84.38% Impervious Area

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

Subcatchment ES-2:



Summary for Subcatchment ES-3:

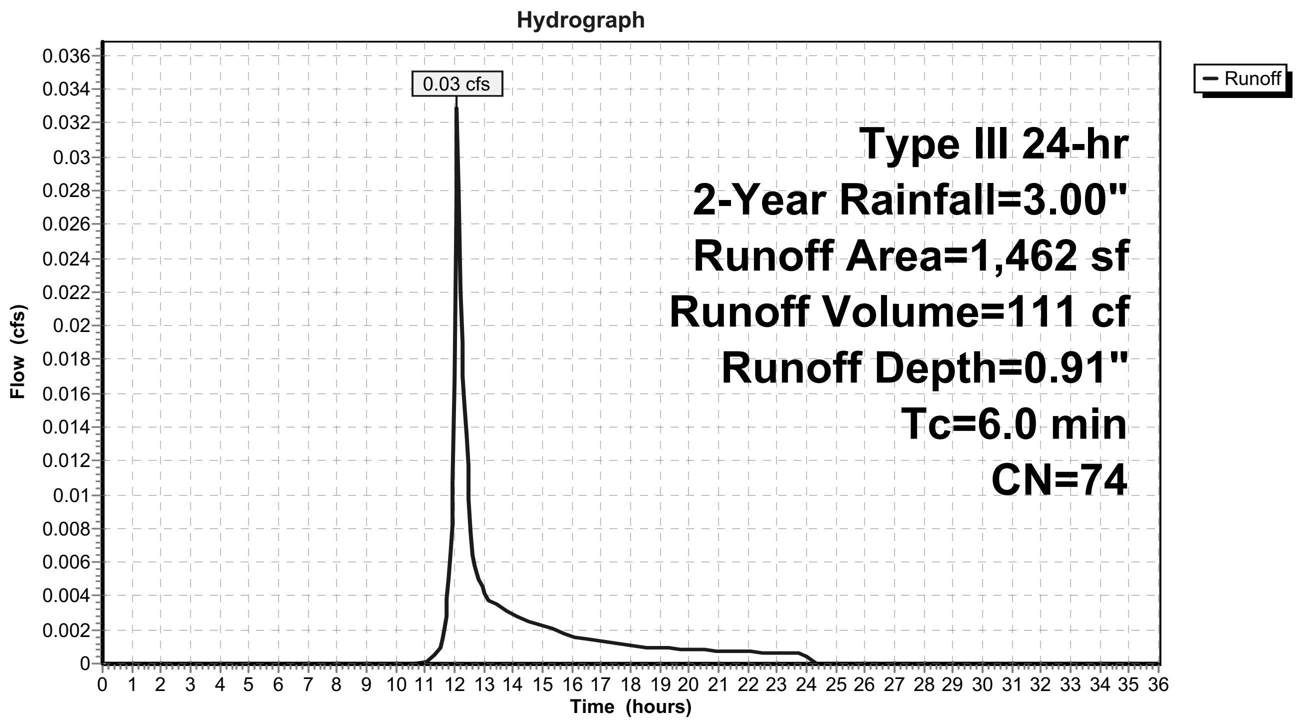
Runoff = 0.03 cfs @ 12.10 hrs, Volume= 111 cf, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
1,454	74	>75% Grass cover, Good, HSG C
8	98	Paved parking, HSG C
1,462	74	Weighted Average
1,454	74	99.46% Pervious Area
8	98	0.54% Impervious Area

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

Subcatchment ES-3:

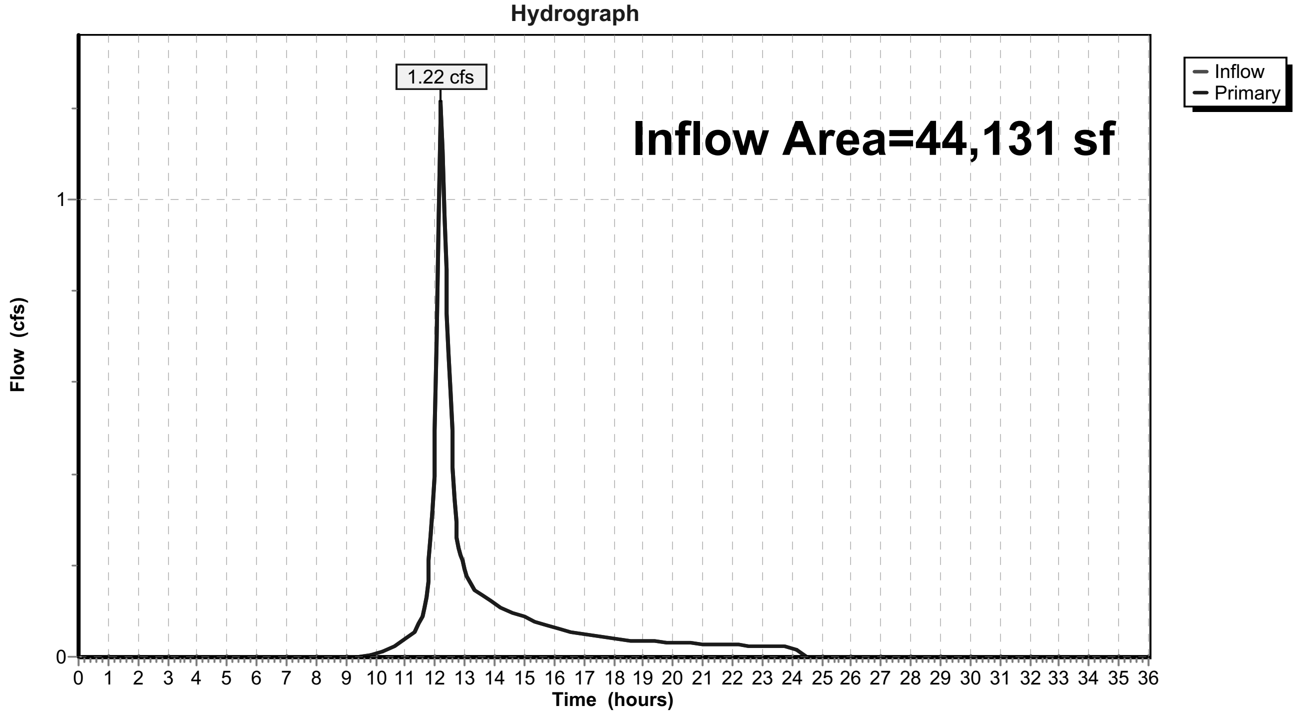


Summary for Link DP-1: Mill River

Inflow Area = 44,131 sf, 30.52% Impervious, Inflow Depth = 1.31" for 2-Year event
Inflow = 1.22 cfs @ 12.19 hrs, Volume= 4,831 cf
Primary = 1.22 cfs @ 12.19 hrs, Volume= 4,831 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-1: Mill River

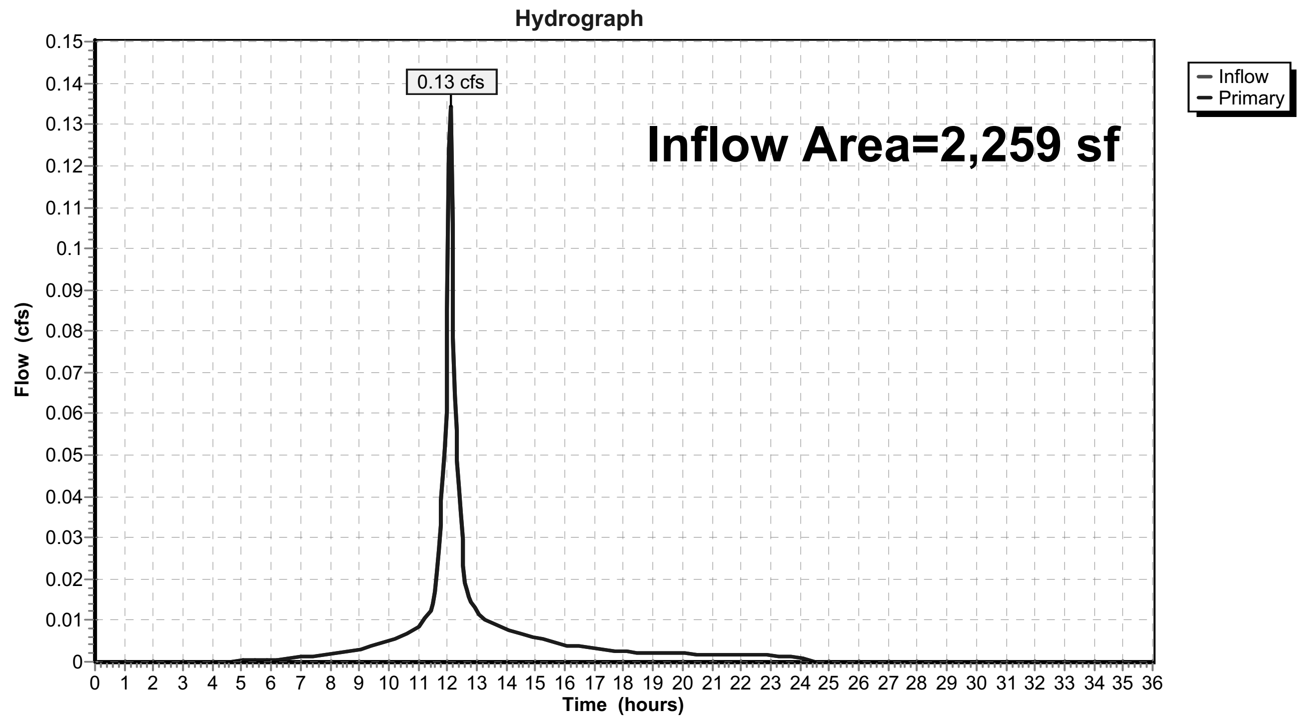


Summary for Link DP-2: Offsite to CB in Main St

Inflow Area =	2,259 sf, 84.38% Impervious,	Inflow Depth = 2.35"	for 2-Year event
Inflow =	0.13 cfs @ 12.09 hrs, Volume=	442 cf	
Primary =	0.13 cfs @ 12.09 hrs, Volume=	442 cf, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to CB in Main St

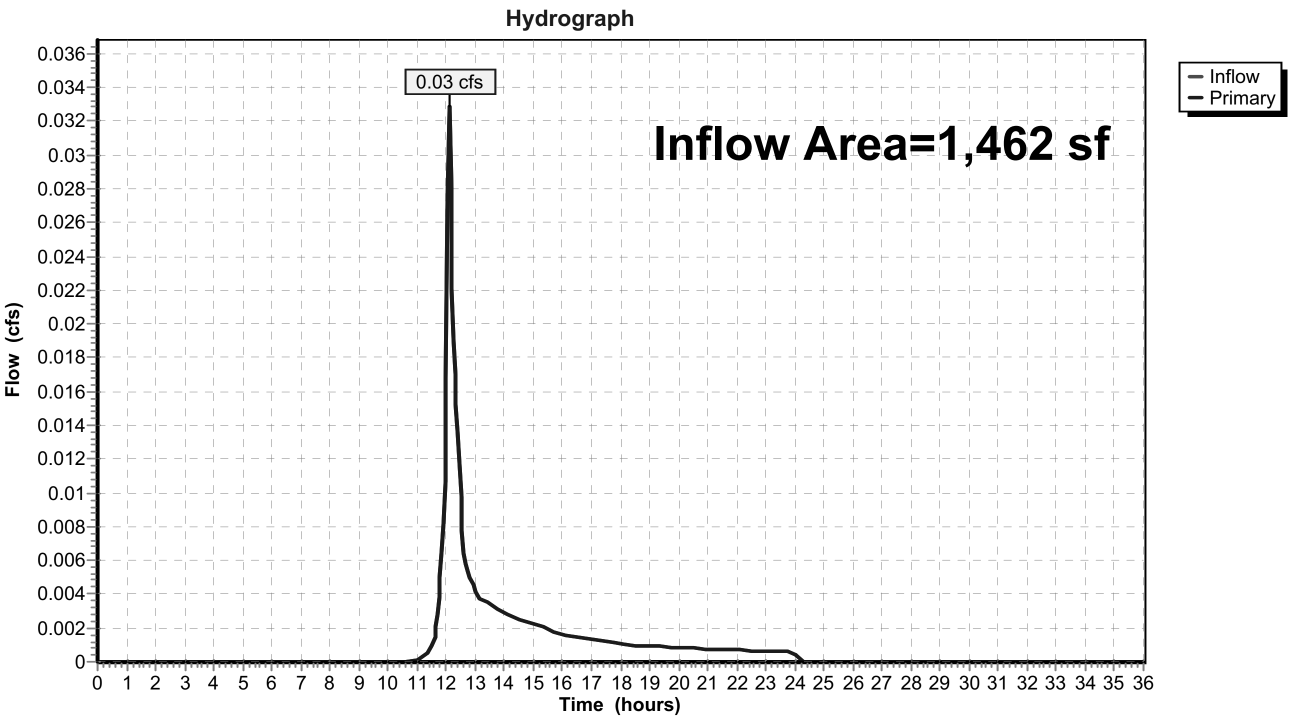


Summary for Link DP-3: Low Point in Lawn

Inflow Area =	1,462 sf,	0.54% Impervious,	Inflow Depth = 0.91"	for 2-Year event
Inflow =	0.03 cfs @	12.10 hrs, Volume=	111 cf	
Primary =	0.03 cfs @	12.10 hrs, Volume=	111 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-3: Low Point in Lawn



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES-1: Runoff Area=44,131 sf 30.52% Impervious Runoff Depth=2.55"
Flow Length=347' Tc=13.0 min CN=81 Runoff=2.39 cfs 9,371 cf

Subcatchment ES-2: Runoff Area=2,259 sf 84.38% Impervious Runoff Depth=3.82"
Tc=6.0 min CN=94 Runoff=0.21 cfs 718 cf

Subcatchment ES-3: Runoff Area=1,462 sf 0.54% Impervious Runoff Depth=1.97"
Tc=6.0 min CN=74 Runoff=0.08 cfs 240 cf

Link DP-1: Mill River Inflow=2.39 cfs 9,371 cf
Primary=2.39 cfs 9,371 cf

Link DP-2: Offsite to CB in Main St Inflow=0.21 cfs 718 cf
Primary=0.21 cfs 718 cf

Link DP-3: Low Point in Lawn Inflow=0.08 cfs 240 cf
Primary=0.08 cfs 240 cf

Total Runoff Area = 47,853 sf Runoff Volume = 10,329 cf Average Runoff Depth = 2.59"
67.85% Pervious = 32,468 sf 32.15% Impervious = 15,385 sf

Summary for Subcatchment ES-1:

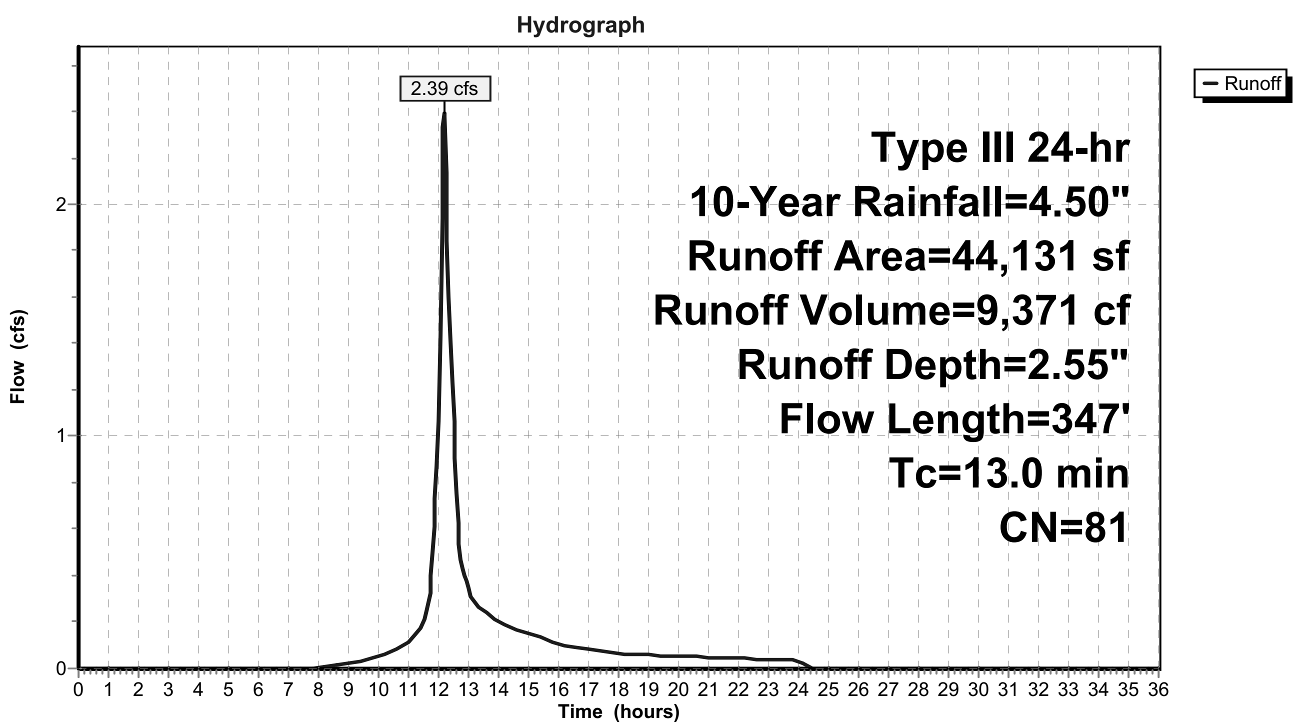
Runoff = 2.39 cfs @ 12.18 hrs, Volume= 9,371 cf, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
30,661	74	>75% Grass cover, Good, HSG C
11,060	98	Paved parking, HSG C
2,411	98	Roofs, HSG C
44,131	81	Weighted Average
30,661	74	69.48% Pervious Area
13,471	98	30.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0430	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
2.1	247	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	347	Total			

Subcatchment ES-1:



Summary for Subcatchment ES-2:

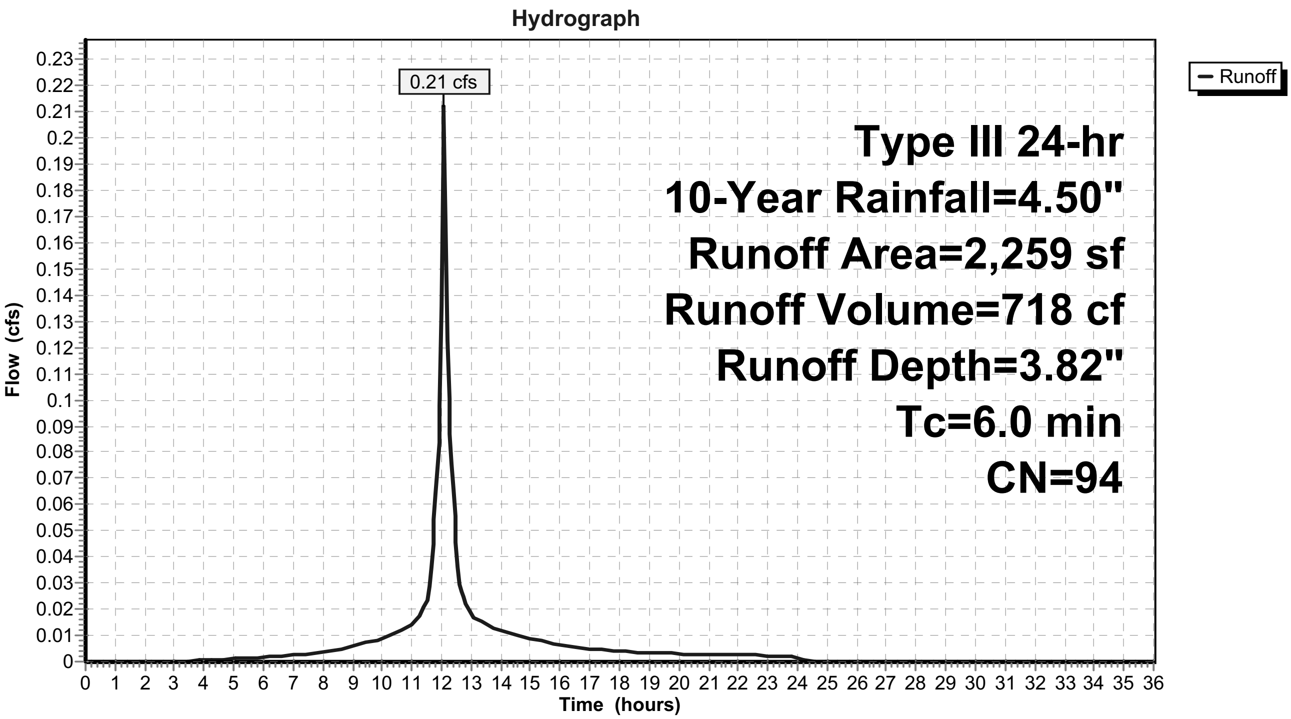
Runoff = 0.21 cfs @ 12.09 hrs, Volume= 718 cf, Depth= 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
353	74	>75% Grass cover, Good, HSG C
1,906	98	Paved parking, HSG C
0	98	Roofs, HSG C
2,259	94	Weighted Average
353	74	15.62% Pervious Area
1,906	98	84.38% Impervious Area

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

Subcatchment ES-2:



Summary for Subcatchment ES-3:

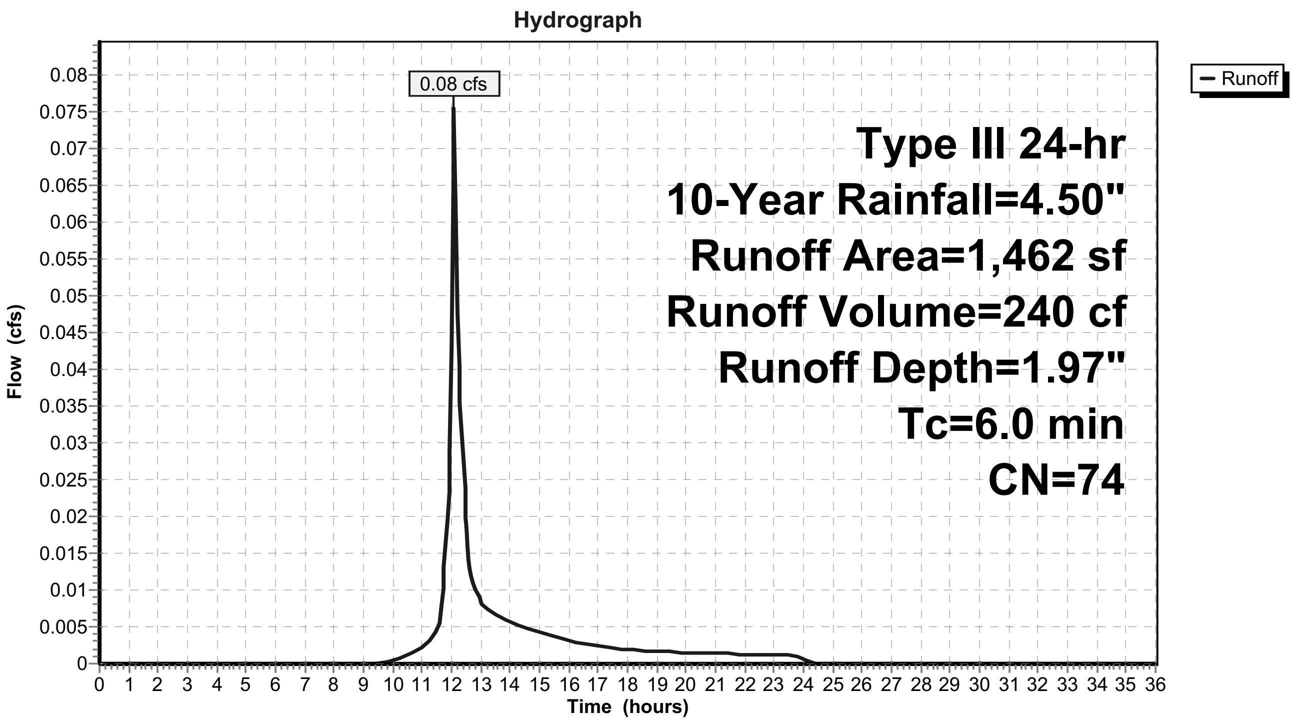
Runoff = 0.08 cfs @ 12.10 hrs, Volume= 240 cf, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,454	74	>75% Grass cover, Good, HSG C
8	98	Paved parking, HSG C
1,462	74	Weighted Average
1,454	74	99.46% Pervious Area
8	98	0.54% Impervious Area

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

Subcatchment ES-3:

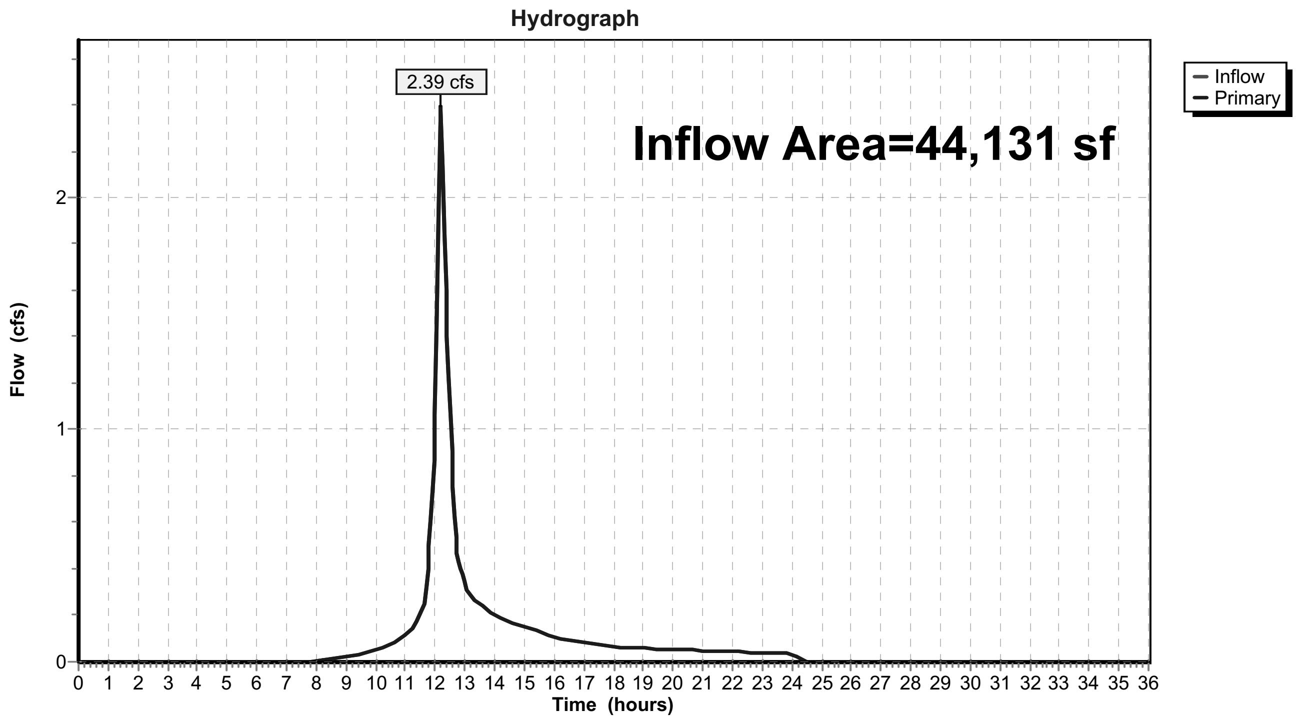


Summary for Link DP-1: Mill River

Inflow Area =	44,131 sf, 30.52% Impervious,	Inflow Depth = 2.55"	for 10-Year event
Inflow =	2.39 cfs @ 12.18 hrs,	Volume= 9,371 cf	
Primary =	2.39 cfs @ 12.18 hrs,	Volume= 9,371 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-1: Mill River

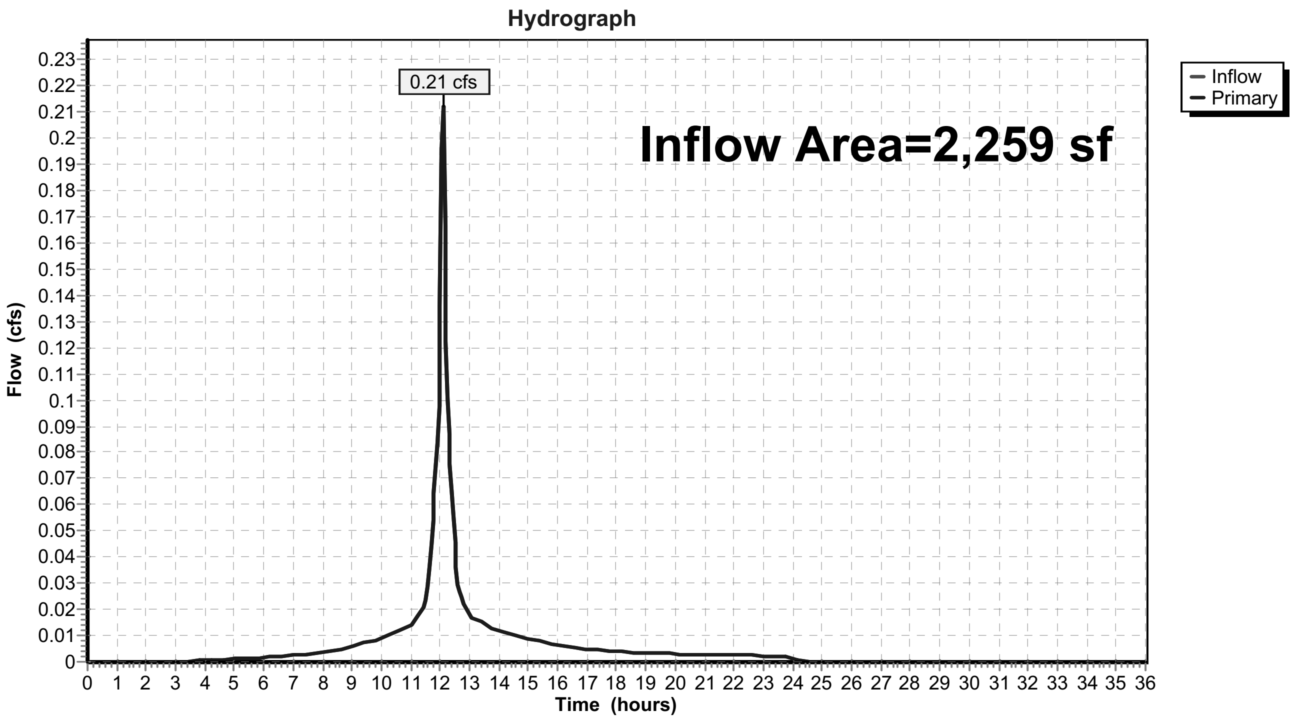


Summary for Link DP-2: Offsite to CB in Main St

Inflow Area =	2,259 sf,	84.38% Impervious,	Inflow Depth = 3.82"	for 10-Year event	
Inflow =	0.21 cfs @	12.09 hrs,	Volume=	718 cf	
Primary =	0.21 cfs @	12.09 hrs,	Volume=	718 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to CB in Main St

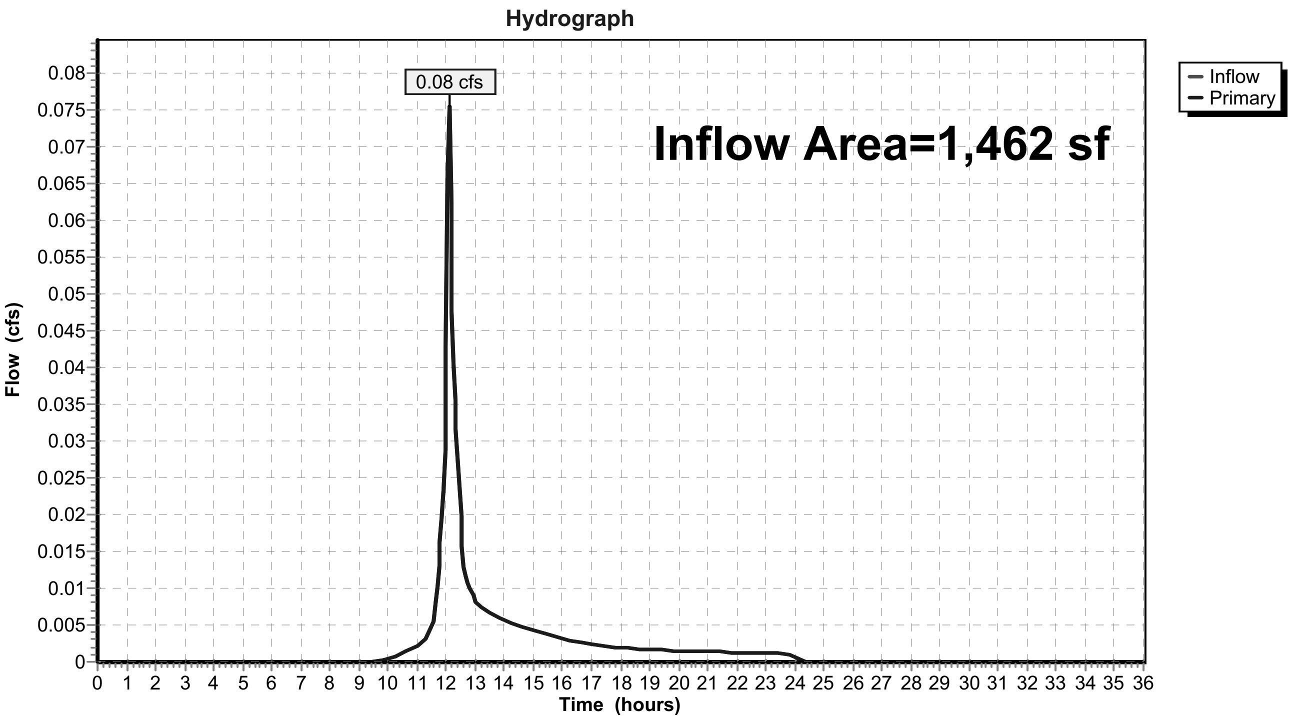


Summary for Link DP-3: Low Point in Lawn

Inflow Area =	1,462 sf,	0.54% Impervious,	Inflow Depth = 1.97"	for 10-Year event
Inflow =	0.08 cfs @	12.10 hrs, Volume=	240 cf	
Primary =	0.08 cfs @	12.10 hrs, Volume=	240 cf, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-3: Low Point in Lawn



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment ES-1: Runoff Area=44,131 sf 30.52% Impervious Runoff Depth=4.25"
Flow Length=347' Tc=13.0 min CN=81 Runoff=3.96 cfs 15,630 cf

Subcatchment ES-2: Runoff Area=2,259 sf 84.38% Impervious Runoff Depth=5.69"
Tc=6.0 min CN=94 Runoff=0.31 cfs 1,072 cf

Subcatchment ES-3: Runoff Area=1,462 sf 0.54% Impervious Runoff Depth=3.52"
Tc=6.0 min CN=74 Runoff=0.14 cfs 429 cf

Link DP-1: Mill River Inflow=3.96 cfs 15,630 cf
Primary=3.96 cfs 15,630 cf

Link DP-2: Offsite to CB in Main St Inflow=0.31 cfs 1,072 cf
Primary=0.31 cfs 1,072 cf

Link DP-3: Low Point in Lawn Inflow=0.14 cfs 429 cf
Primary=0.14 cfs 429 cf

Total Runoff Area = 47,853 sf Runoff Volume = 17,131 cf Average Runoff Depth = 4.30"
67.85% Pervious = 32,468 sf 32.15% Impervious = 15,385 sf

Summary for Subcatchment ES-1:

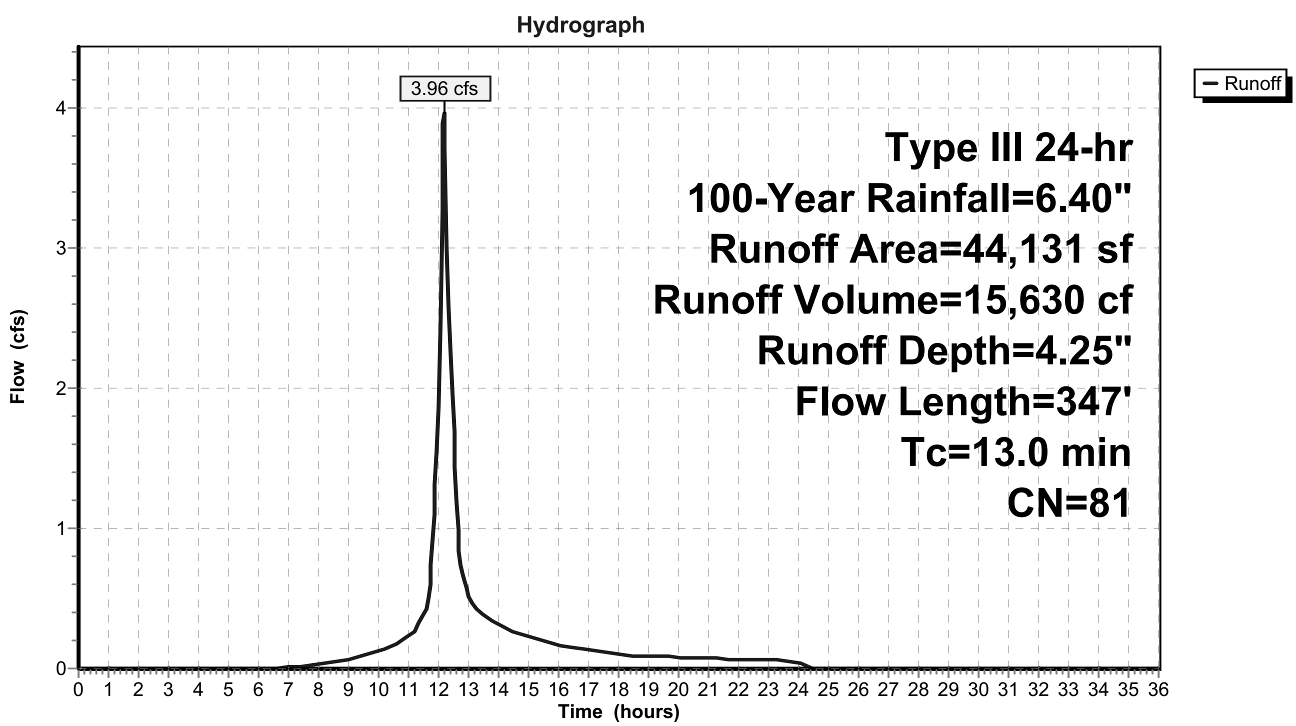
Runoff = 3.96 cfs @ 12.18 hrs, Volume= 15,630 cf, Depth= 4.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
30,661	74	>75% Grass cover, Good, HSG C
11,060	98	Paved parking, HSG C
2,411	98	Roofs, HSG C
44,131	81	Weighted Average
30,661	74	69.48% Pervious Area
13,471	98	30.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0430	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
2.1	247	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	347	Total			

Subcatchment ES-1:



Summary for Subcatchment ES-2:

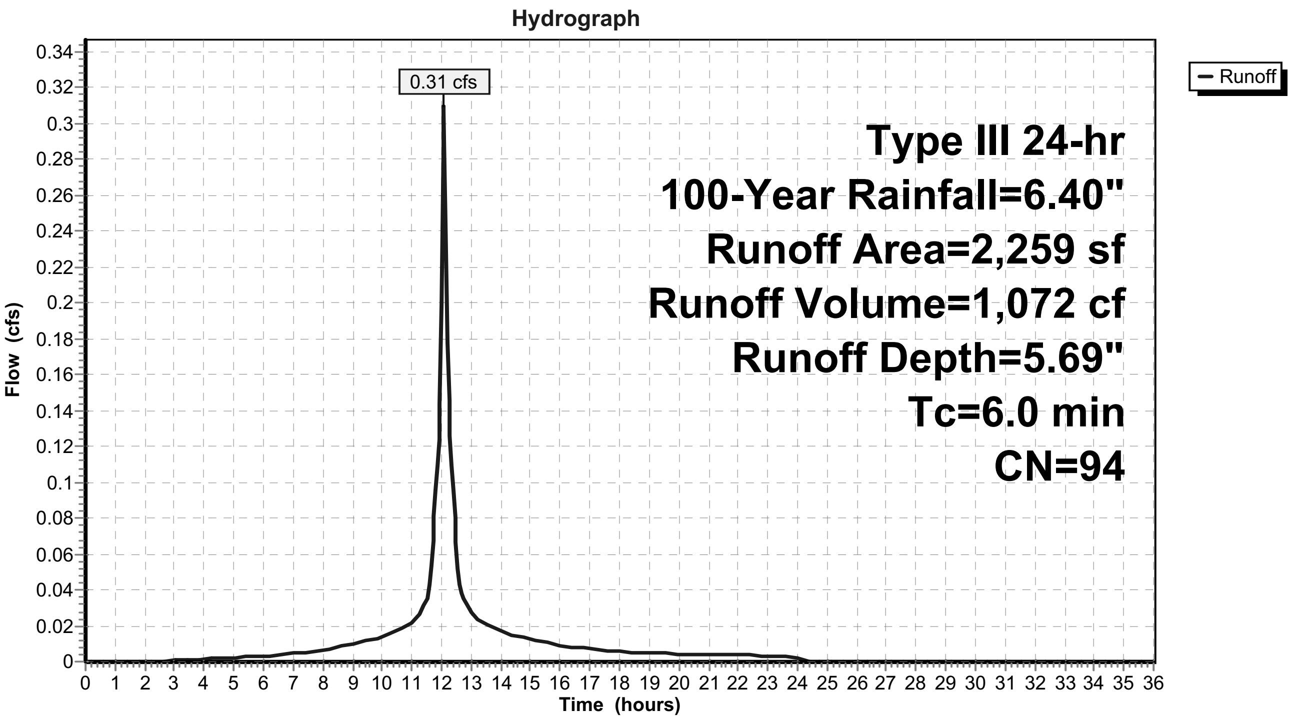
Runoff = 0.31 cfs @ 12.09 hrs, Volume= 1,072 cf, Depth= 5.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
353	74	>75% Grass cover, Good, HSG C
1,906	98	Paved parking, HSG C
0	98	Roofs, HSG C
2,259	94	Weighted Average
353	74	15.62% Pervious Area
1,906	98	84.38% Impervious Area

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

Subcatchment ES-2:



Summary for Subcatchment ES-3:

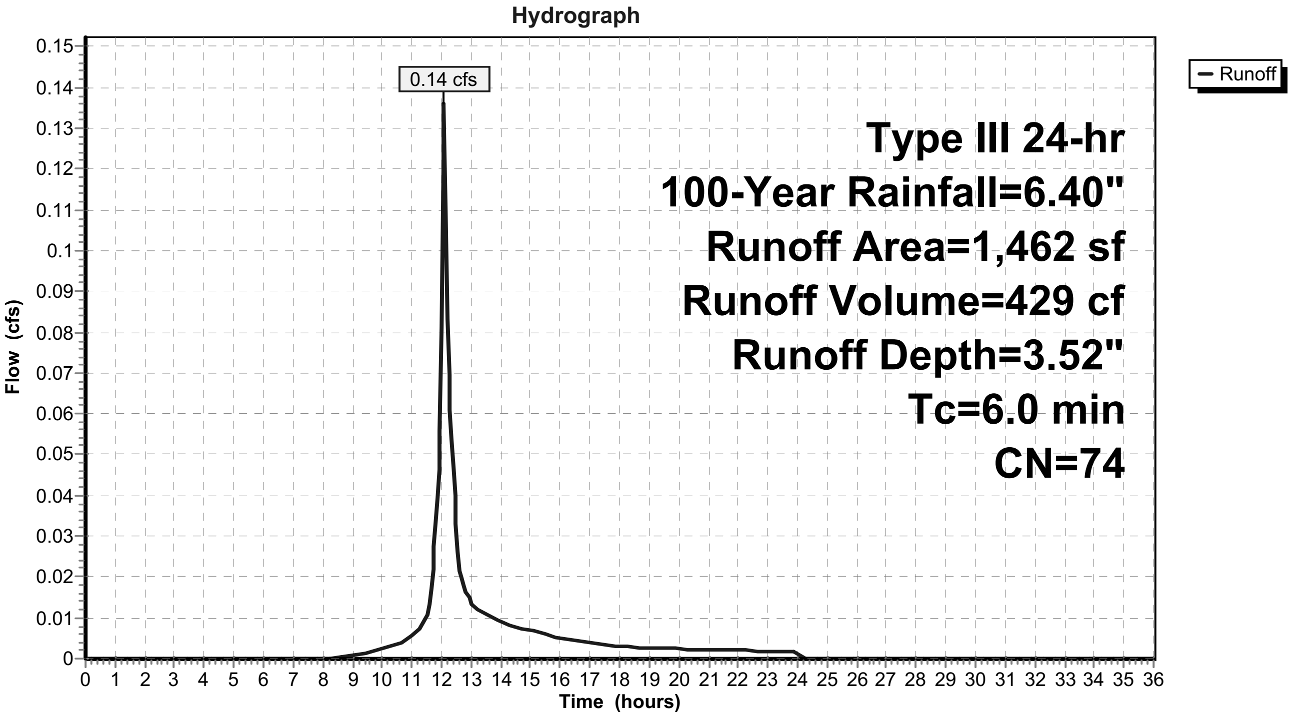
Runoff = 0.14 cfs @ 12.09 hrs, Volume= 429 cf, Depth= 3.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
1,454	74	>75% Grass cover, Good, HSG C
8	98	Paved parking, HSG C
1,462	74	Weighted Average
1,454	74	99.46% Pervious Area
8	98	0.54% Impervious Area

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

Subcatchment ES-3:

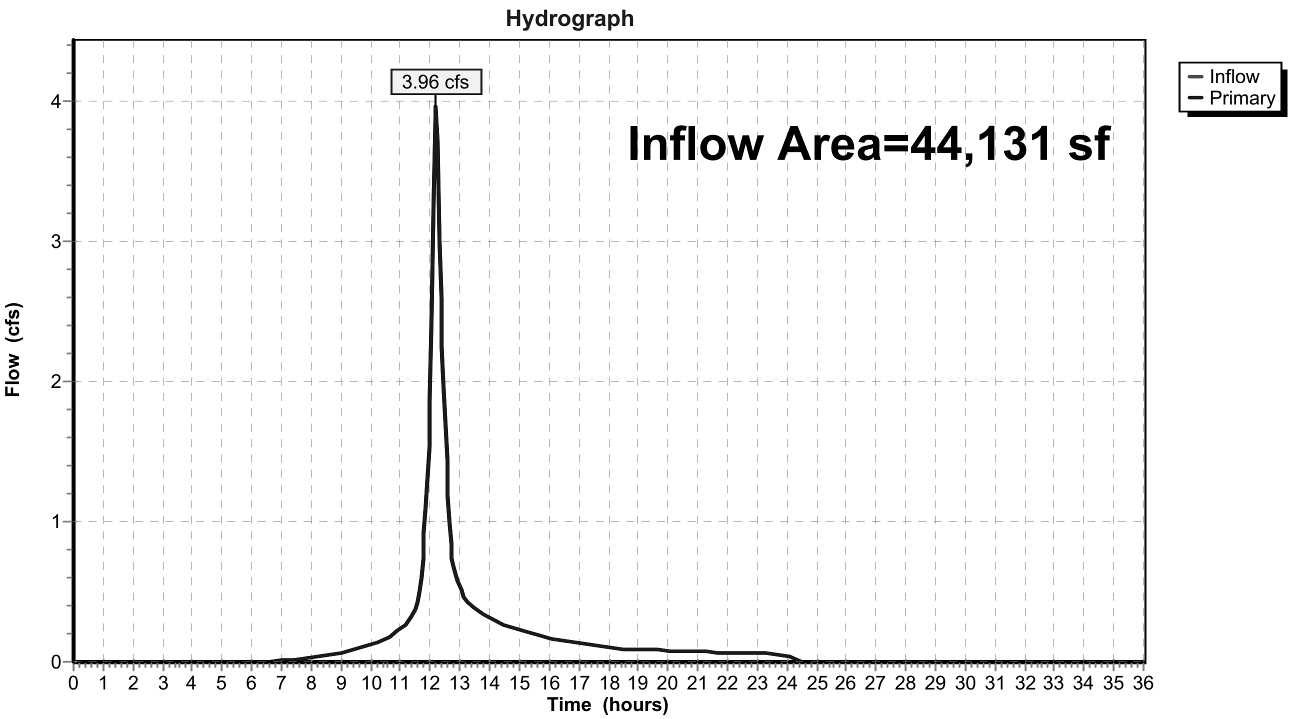


Summary for Link DP-1: Mill River

Inflow Area =	44,131 sf,	30.52% Impervious,	Inflow Depth = 4.25"	for 100-Year event	
Inflow =	3.96 cfs @	12.18 hrs,	Volume=	15,630 cf	
Primary =	3.96 cfs @	12.18 hrs,	Volume=	15,630 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-1: Mill River

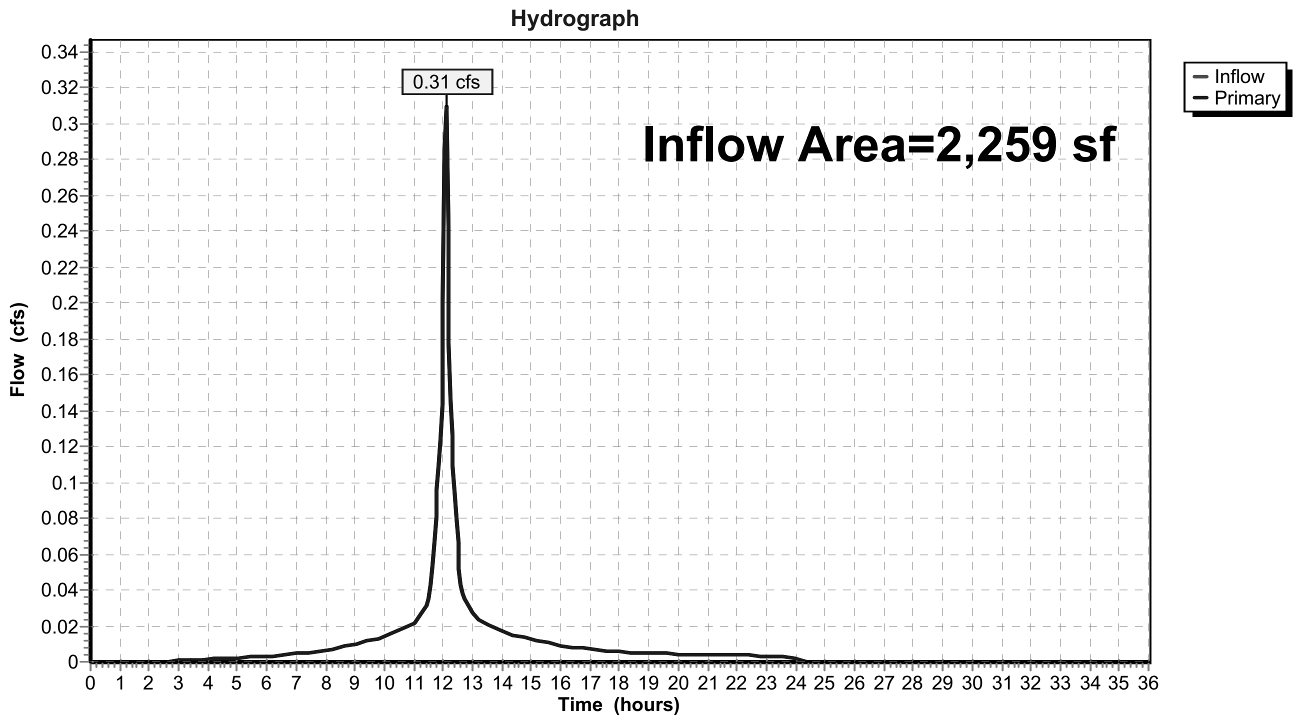


Summary for Link DP-2: Offsite to CB in Main St

Inflow Area =	2,259 sf,	84.38% Impervious,	Inflow Depth = 5.69"	for 100-Year event
Inflow =	0.31 cfs @	12.09 hrs, Volume=	1,072 cf	
Primary =	0.31 cfs @	12.09 hrs, Volume=	1,072 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to CB in Main St

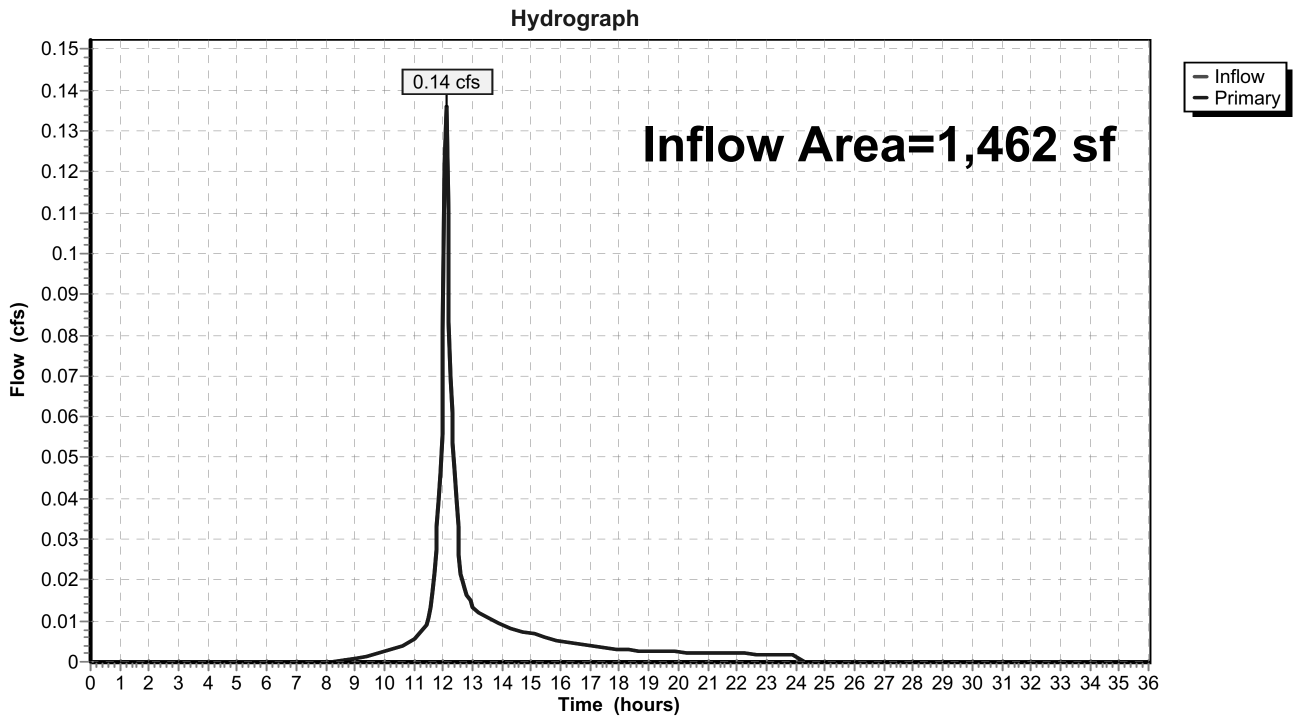


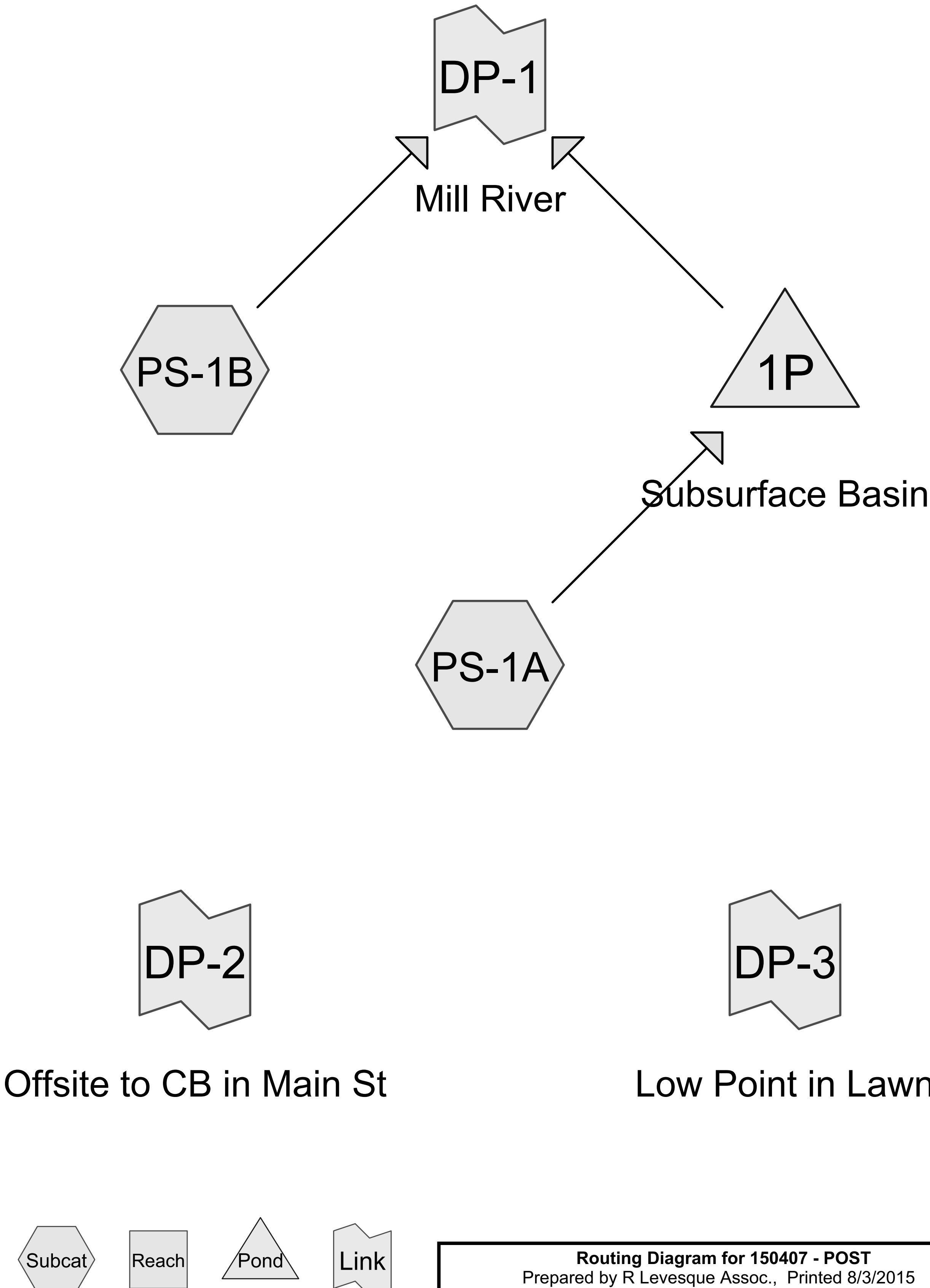
Summary for Link DP-3: Low Point in Lawn

Inflow Area =	1,462 sf,	0.54% Impervious,	Inflow Depth = 3.52"	for 100-Year event
Inflow =	0.14 cfs @	12.09 hrs, Volume=	429 cf	
Primary =	0.14 cfs @	12.09 hrs, Volume=	429 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-3: Low Point in Lawn





Routing Diagram for 150407 - POST
Prepared by R Levesque Assoc., Printed 8/3/2015
HydroCAD® 10.00 s/n 02175 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
30,695	74	>75% Grass cover, Good, HSG C (PS-1A, PS-1B)
14,706	98	Paved parking, HSG C (PS-1A, PS-1B)
2,451	98	Roofs, HSG C (PS-1A)
47,853	**83**	**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS-1A: Runoff Area=17,947 sf 86.09% Impervious Runoff Depth=2.45"
Tc=6.0 min CN=95 Runoff=1.10 cfs 3,663 cf

Subcatchment PS-1B: Runoff Area=29,906 sf 5.71% Impervious Runoff Depth=0.96"
Flow Length=347' Tc=13.0 min CN=75 Runoff=0.57 cfs 2,394 cf

Pond 1P: Subsurface Basin Peak Elev=423.59' Storage=980 cf Inflow=1.10 cfs 3,663 cf
Discarded=0.04 cfs 1,944 cf Primary=0.63 cfs 1,719 cf Outflow=0.67 cfs 3,663 cf

Link DP-1: Mill River Inflow=1.20 cfs 4,113 cf
Primary=1.20 cfs 4,113 cf

Link DP-2: Offsite to CB in Main St
Primary=0.00 cfs 0 cf

Link DP-3: Low Point in Lawn
Primary=0.00 cfs 0 cf

Total Runoff Area = 47,853 sf Runoff Volume = 6,058 cf Average Runoff Depth = 1.52"
64.14% Pervious = 30,695 sf 35.86% Impervious = 17,158 sf

Summary for Subcatchment PS-1A:

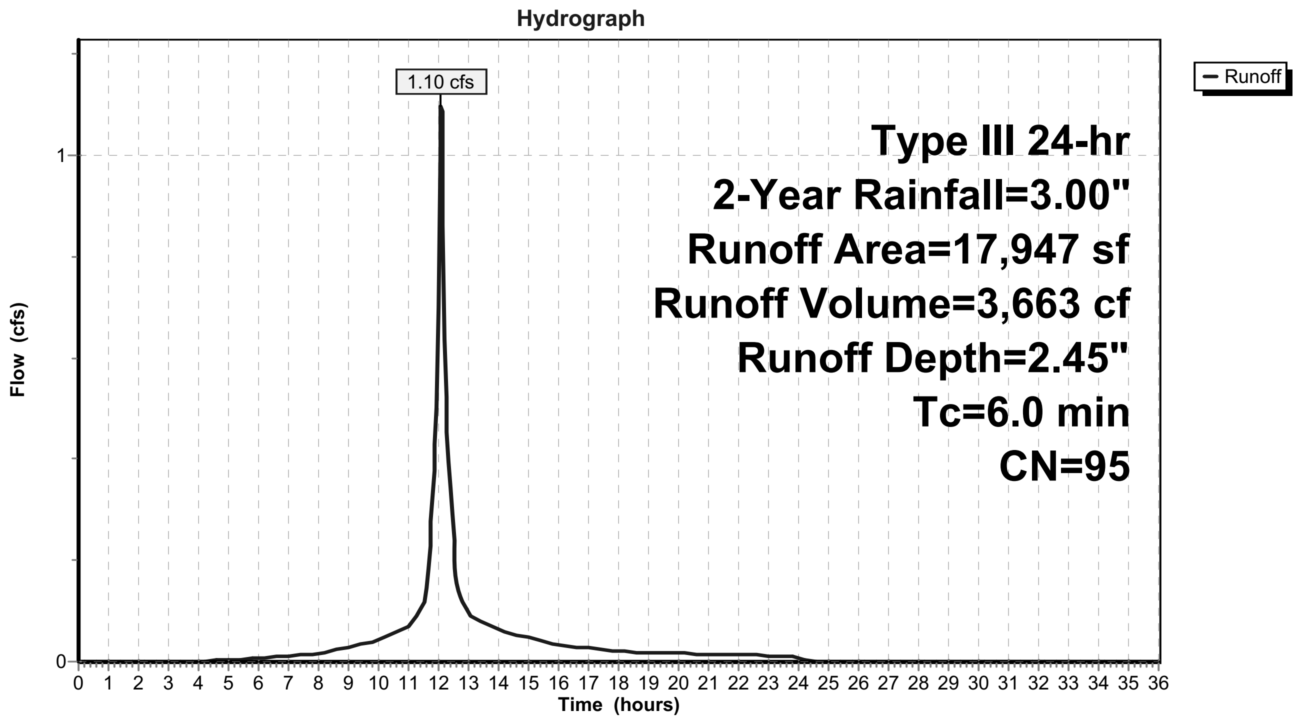
Runoff = 1.10 cfs @ 12.09 hrs, Volume= 3,663 cf, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
2,497	74	>75% Grass cover, Good, HSG C
12,999	98	Paved parking, HSG C
2,451	98	Roofs, HSG C
17,947	95	Weighted Average
2,497	74	13.91% Pervious Area
15,450	98	86.09% Impervious Area

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

Subcatchment PS-1A:



Summary for Subcatchment PS-1B:

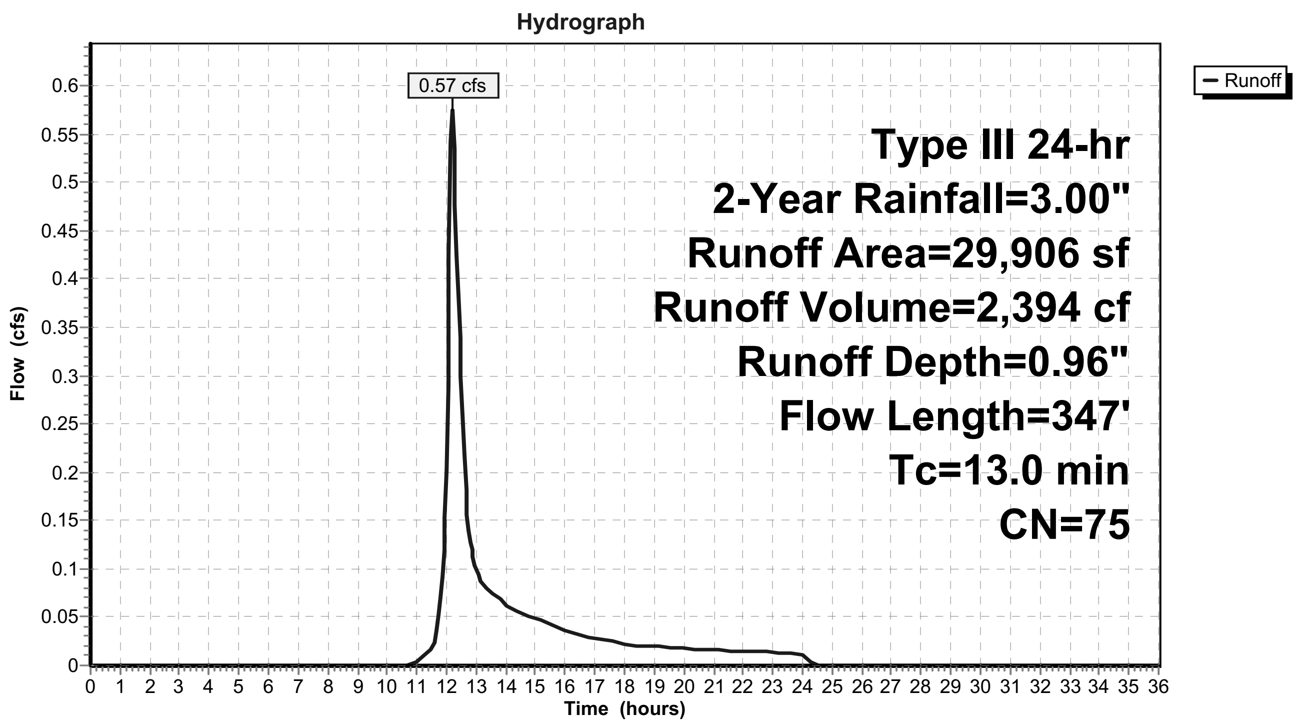
Runoff = 0.57 cfs @ 12.20 hrs, Volume= 2,394 cf, Depth= 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
28,198	74	>75% Grass cover, Good, HSG C
1,708	98	Paved parking, HSG C
29,906	75	Weighted Average
28,198	74	94.29% Pervious Area
1,708	98	5.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0430	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
2.1	247	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	347	Total			

Subcatchment PS-1B:



Summary for Pond 1P: Subsurface Basin

Inflow Area = 17,947 sf, 86.09% Impervious, Inflow Depth = 2.45" for 2-Year event
Inflow = 1.10 cfs @ 12.09 hrs, Volume= 3,663 cf
Outflow = 0.67 cfs @ 12.20 hrs, Volume= 3,663 cf, Atten= 39%, Lag= 6.9 min
Discarded = 0.04 cfs @ 12.20 hrs, Volume= 1,944 cf
Primary = 0.63 cfs @ 12.20 hrs, Volume= 1,719 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 423.59' @ 12.20 hrs Surf.Area= 926 sf Storage= 980 cf

Plug-Flow detention time= 98.0 min calculated for 3,658 cf (100% of inflow)
Center-of-Mass det. time= 98.0 min (881.0 - 783.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	422.00'	851 cf	**20.50'W x 45.16'L x 3.50'H Field A** 3,240 cf Overall - 1,114 cf Embedded = 2,126 cf x 40.0% Voids
#2A	422.50'	1,114 cf	**ADS_StormTech SC-740** x 24 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 4 rows
		1,964 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	422.50'	**12.0" Round Culvert** L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 422.50' / 422.00' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	422.90'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	425.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	422.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 420.00' Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 12.20 hrs HW=423.59' (Free Discharge)
└─**4=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.63 cfs @ 12.20 hrs HW=423.59' (Free Discharge)
└─**1=Culvert** (Passes 0.63 cfs of 2.90 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.63 cfs @ 3.19 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Subsurface Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-740
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 6.45 sf x 4 rows

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

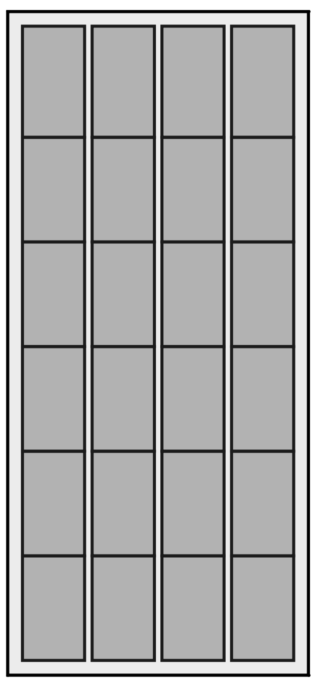
6 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 43.16' Row Length +12.0" End Stone x 2 = 45.16' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

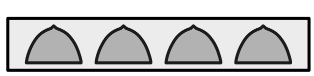
24 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 4 Rows = 1,113.9 cf Chamber Storage

3,240.2 cf Field - 1,113.9 cf Chambers = 2,126.3 cf Stone x 40.0% Voids = 850.5 cf Stone Storage

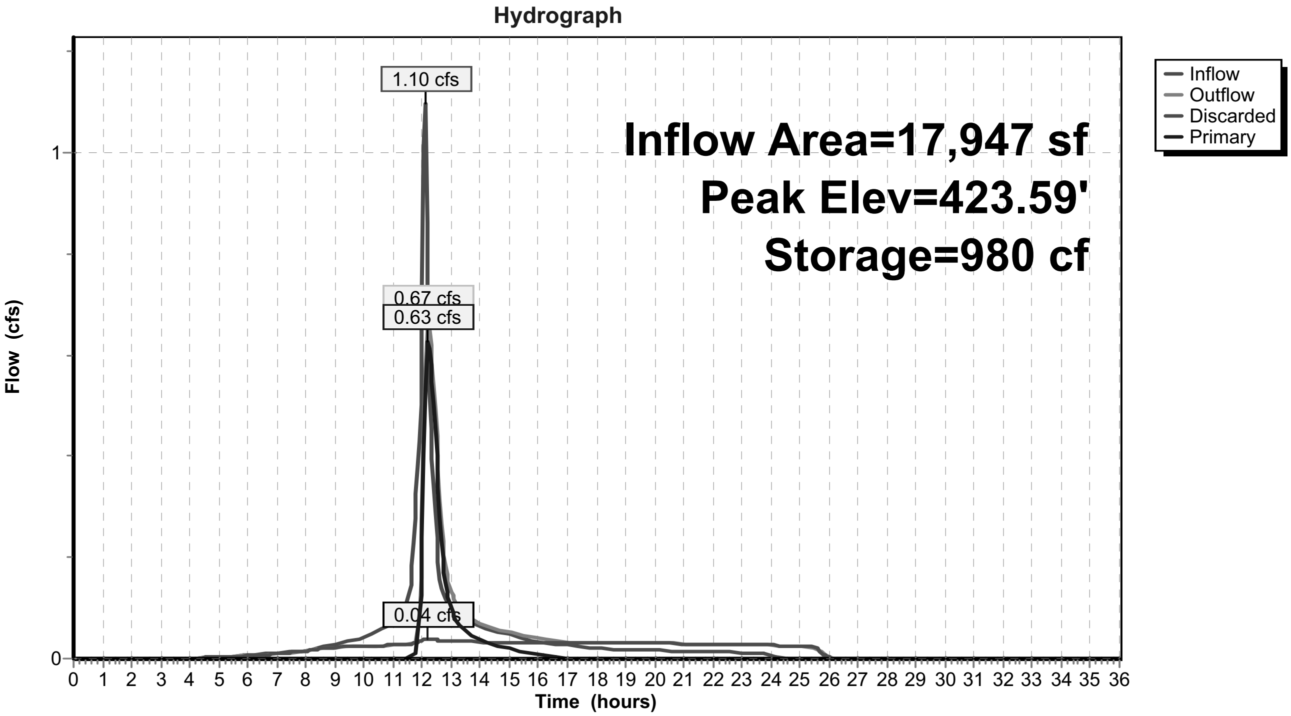
Chamber Storage + Stone Storage = 1,964.4 cf = 0.045 af
Overall Storage Efficiency = 60.6%

24 Chambers
120.0 cy Field
78.8 cy Stone





Pond 1P: Subsurface Basin

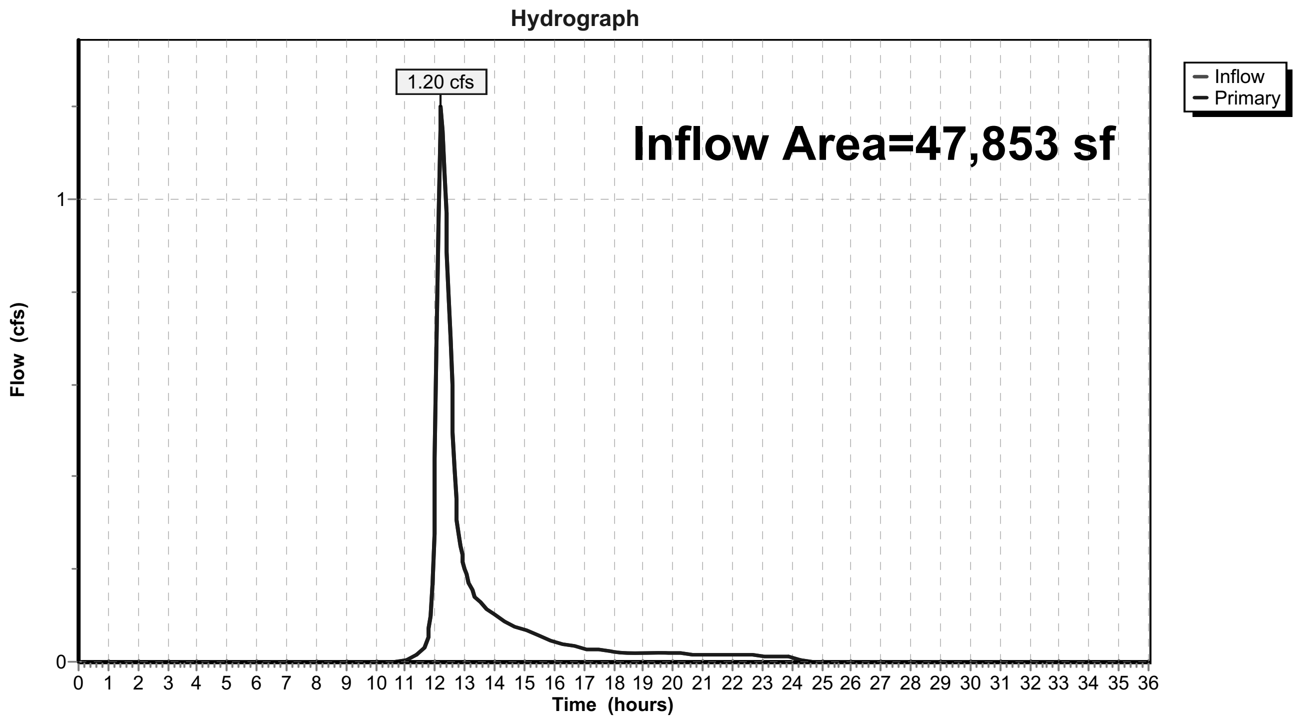


Summary for Link DP-1: Mill River

Inflow Area =	47,853 sf,	35.86% Impervious,	Inflow Depth = 1.03"	for 2-Year event	
Inflow =	1.20 cfs @	12.20 hrs,	Volume=	4,113 cf	
Primary =	1.20 cfs @	12.20 hrs,	Volume=	4,113 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-1: Mill River



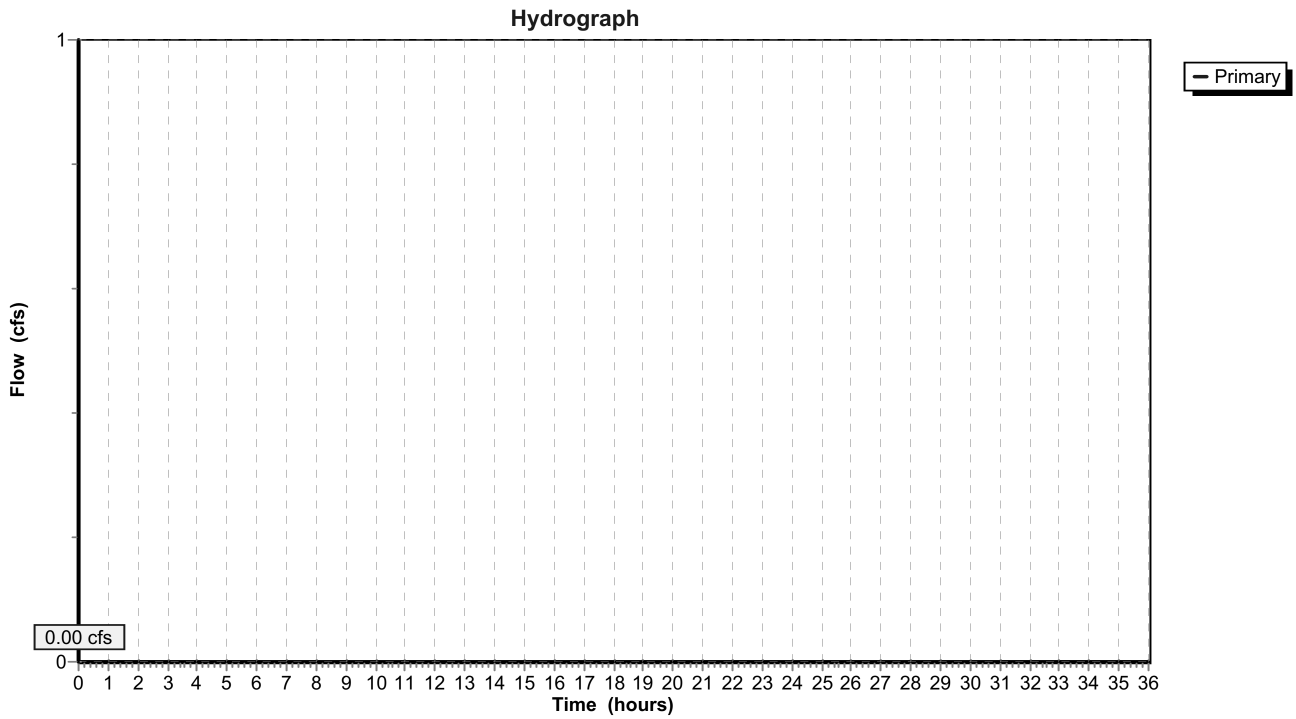
Summary for Link DP-2: Offsite to CB in Main St

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to CB in Main St



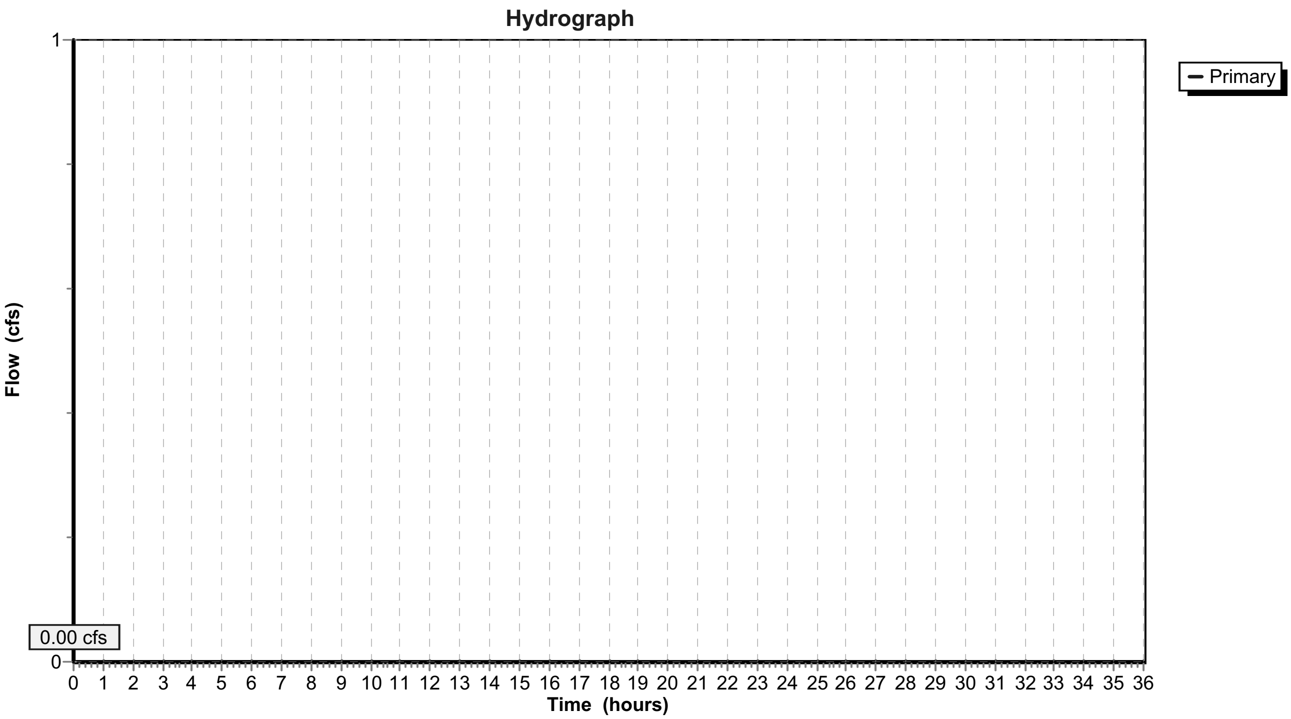
Summary for Link DP-3: Low Point in Lawn

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-3: Low Point in Lawn



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS-1A: Runoff Area=17,947 sf 86.09% Impervious Runoff Depth=3.92"
Tc=6.0 min CN=95 Runoff=1.71 cfs 5,870 cf

Subcatchment PS-1B: Runoff Area=29,906 sf 5.71% Impervious Runoff Depth=2.05"
Flow Length=347' Tc=13.0 min CN=75 Runoff=1.29 cfs 5,110 cf

Pond 1P: Subsurface Basin Peak Elev=424.14' Storage=1,343 cf Inflow=1.71 cfs 5,870 cf
Discarded=0.05 cfs 2,361 cf Primary=0.94 cfs 3,509 cf Outflow=0.99 cfs 5,870 cf

Link DP-1: Mill River Inflow=2.23 cfs 8,619 cf
Primary=2.23 cfs 8,619 cf

Link DP-2: Offsite to CB in Main St
Primary=0.00 cfs 0 cf

Link DP-3: Low Point in Lawn
Primary=0.00 cfs 0 cf

Total Runoff Area = 47,853 sf Runoff Volume = 10,980 cf Average Runoff Depth = 2.75"
64.14% Pervious = 30,695 sf 35.86% Impervious = 17,158 sf

Summary for Subcatchment PS-1A:

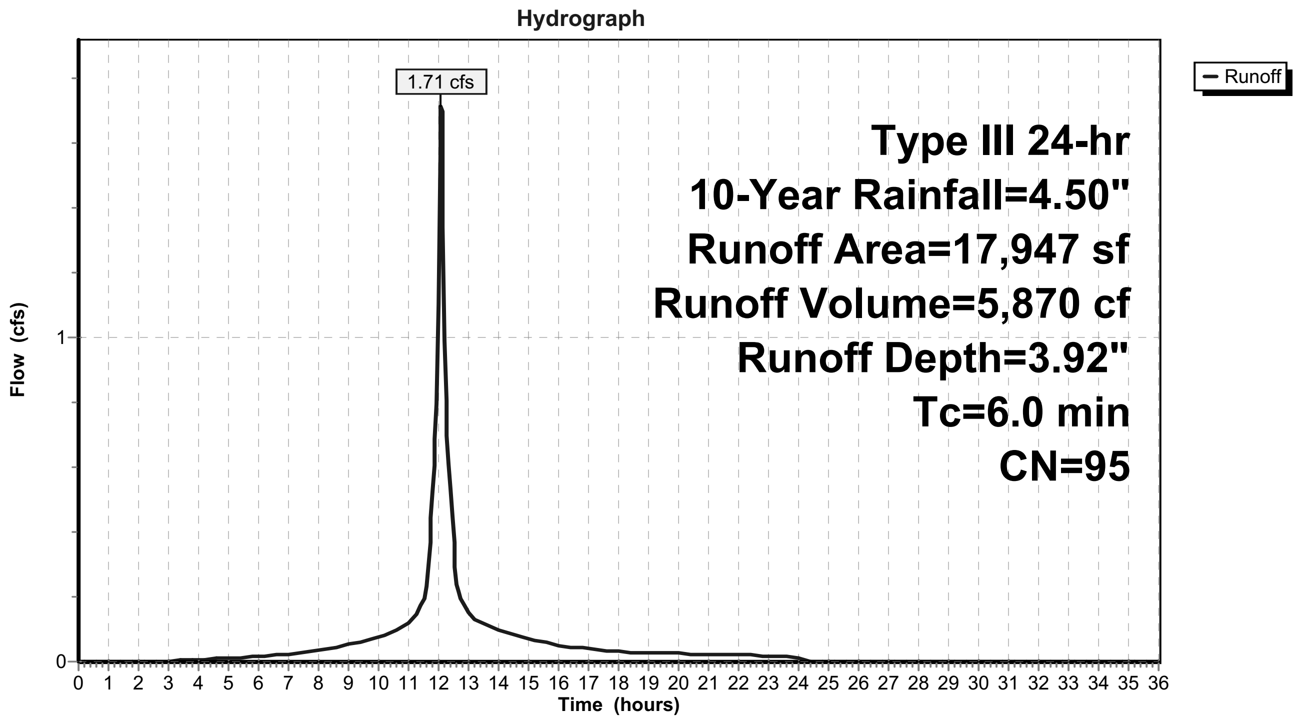
Runoff = 1.71 cfs @ 12.09 hrs, Volume= 5,870 cf, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
2,497	74	>75% Grass cover, Good, HSG C
12,999	98	Paved parking, HSG C
2,451	98	Roofs, HSG C
17,947	95	Weighted Average
2,497	74	13.91% Pervious Area
15,450	98	86.09% Impervious Area

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

Subcatchment PS-1A:



Summary for Subcatchment PS-1B:

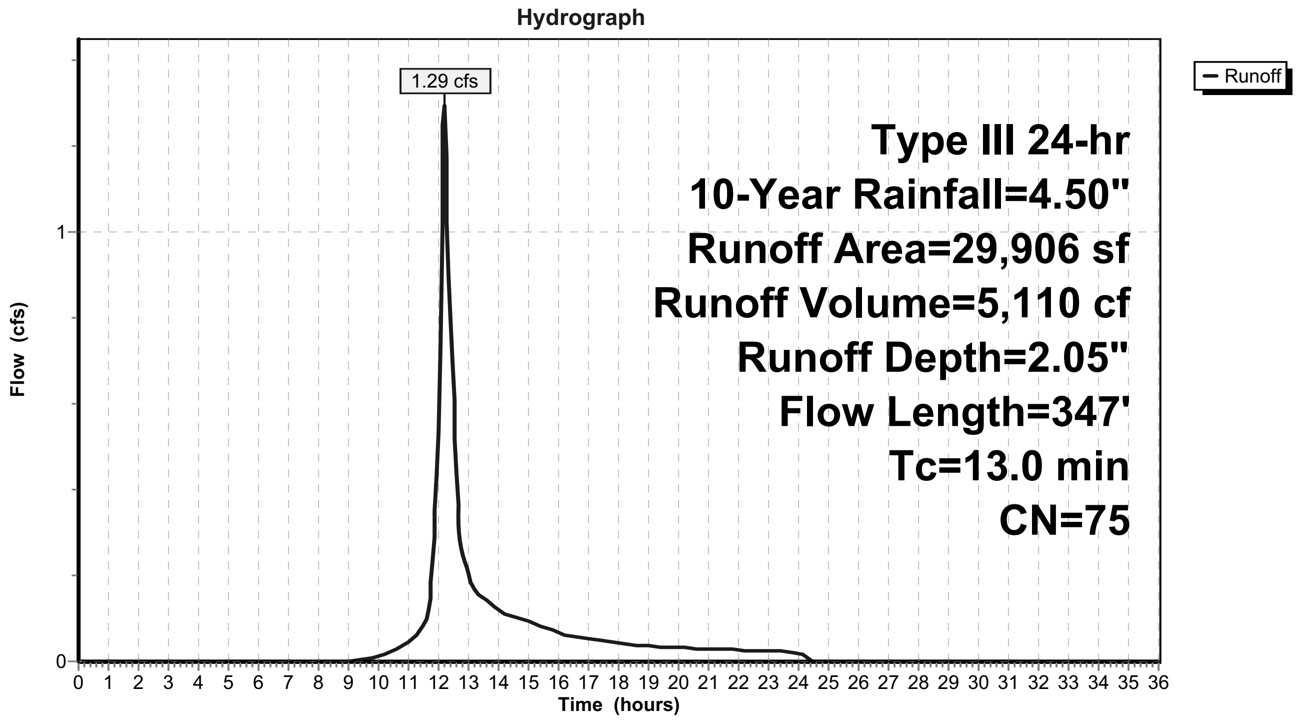
Runoff = 1.29 cfs @ 12.19 hrs, Volume= 5,110 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
28,198	74	>75% Grass cover, Good, HSG C
1,708	98	Paved parking, HSG C
29,906	75	Weighted Average
28,198	74	94.29% Pervious Area
1,708	98	5.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0430	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
2.1	247	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	347	Total			

Subcatchment PS-1B:



Summary for Pond 1P: Subsurface Basin

Inflow Area =	17,947 sf, 86.09% Impervious,	Inflow Depth = 3.92"	for 10-Year event
Inflow =	1.71 cfs @ 12.09 hrs, Volume=	5,870 cf	
Outflow =	0.99 cfs @ 12.21 hrs, Volume=	5,870 cf, Atten= 42%, Lag= 7.4 min	
Discarded =	0.05 cfs @ 12.21 hrs, Volume=	2,361 cf	
Primary =	0.94 cfs @ 12.21 hrs, Volume=	3,509 cf	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 424.14' @ 12.21 hrs Surf.Area= 926 sf Storage= 1,343 cf

Plug-Flow detention time= 83.8 min calculated for 5,870 cf (100% of inflow)
Center-of-Mass det. time= 83.6 min (854.7 - 771.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	422.00'	851 cf	**20.50'W x 45.16'L x 3.50'H Field A** 3,240 cf Overall - 1,114 cf Embedded = 2,126 cf x 40.0% Voids
#2A	422.50'	1,114 cf	**ADS_StormTech SC-740** x 24 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 4 rows
		1,964 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	422.50'	**12.0" Round Culvert** L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 422.50' / 422.00' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	422.90'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	425.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	422.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 420.00' Phase-In= 0.01'

Discarded OutFlow Max=0.05 cfs @ 12.21 hrs HW=424.14' (Free Discharge)
└─**4=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.94 cfs @ 12.21 hrs HW=424.14' (Free Discharge)
└─**1=Culvert** (Passes 0.94 cfs of 3.99 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.94 cfs @ 4.78 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Subsurface Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-740
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 6.45 sf x 4 rows

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

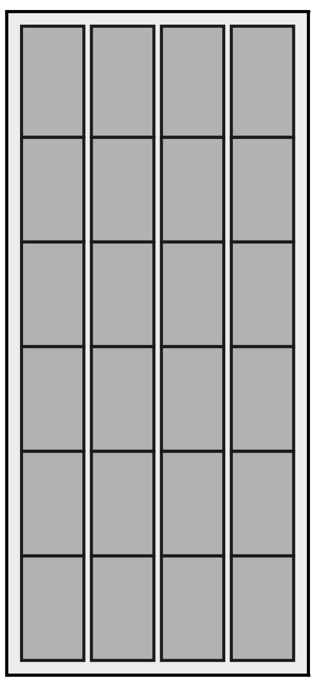
6 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 43.16' Row Length +12.0" End Stone x 2 = 45.16' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

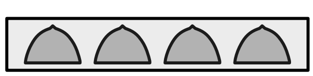
24 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 4 Rows = 1,113.9 cf Chamber Storage

3,240.2 cf Field - 1,113.9 cf Chambers = 2,126.3 cf Stone x 40.0% Voids = 850.5 cf Stone Storage

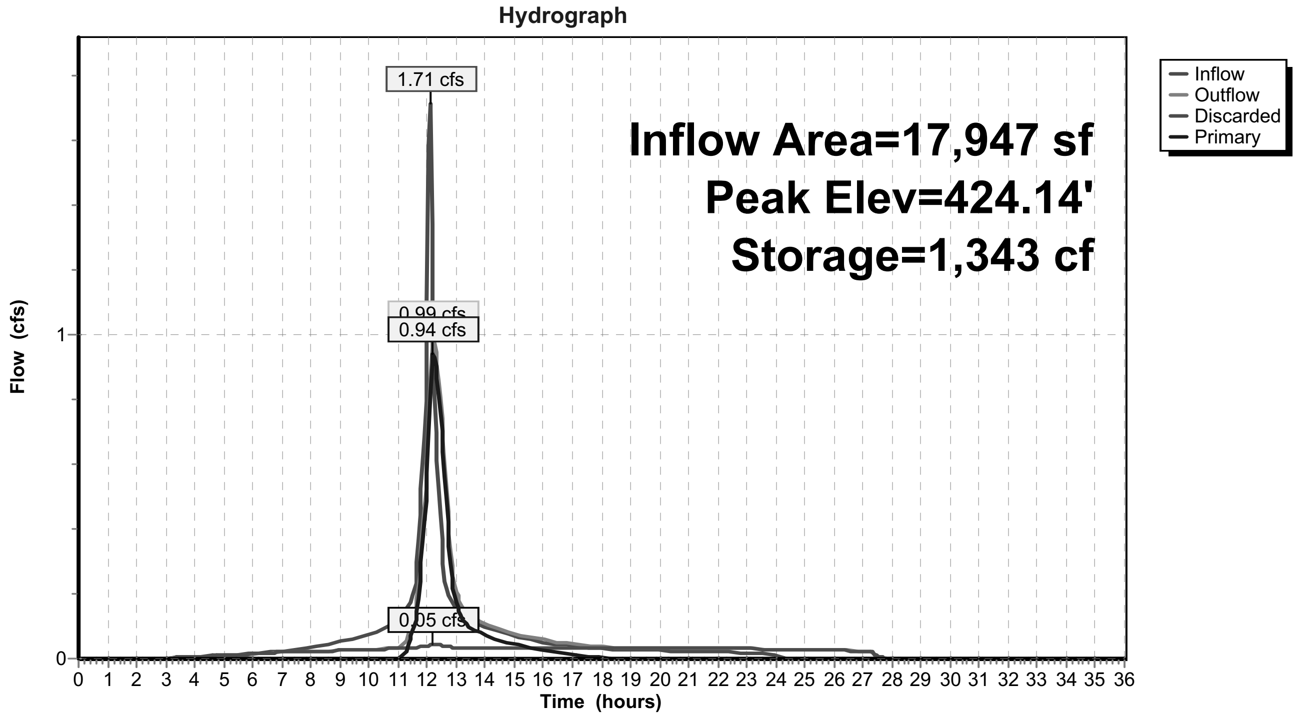
Chamber Storage + Stone Storage = 1,964.4 cf = 0.045 af
Overall Storage Efficiency = 60.6%

24 Chambers
120.0 cy Field
78.8 cy Stone





Pond 1P: Subsurface Basin

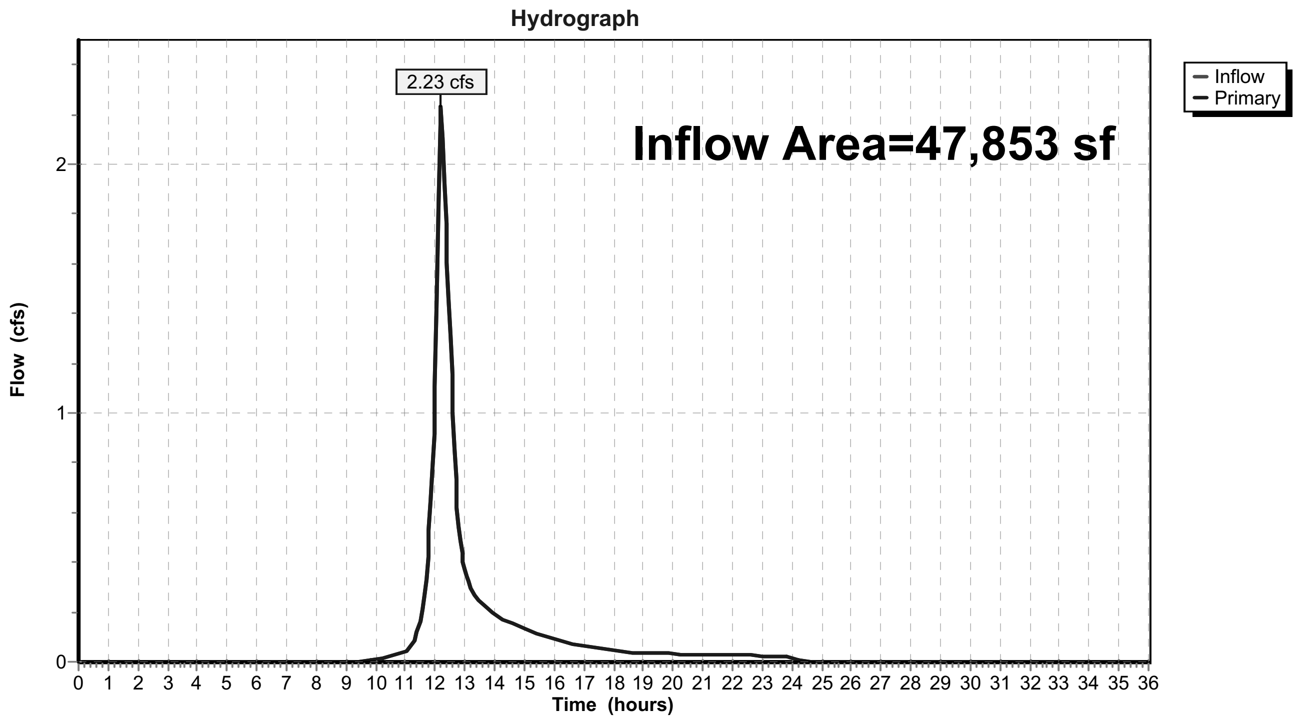


Summary for Link DP-1: Mill River

Inflow Area =	47,853 sf,	35.86% Impervious,	Inflow Depth = 2.16"	for 10-Year event
Inflow =	2.23 cfs @	12.19 hrs, Volume=	8,619 cf	
Primary =	2.23 cfs @	12.19 hrs, Volume=	8,619 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-1: Mill River



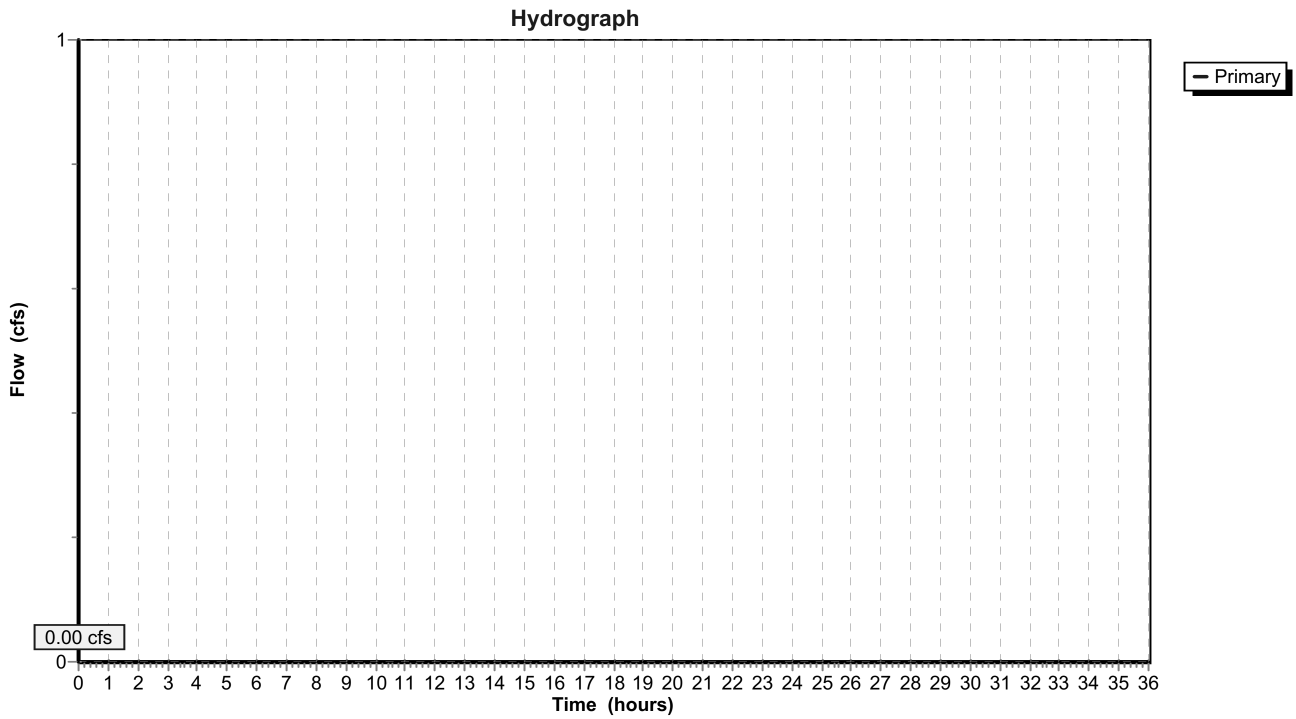
Summary for Link DP-2: Offsite to CB in Main St

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-2: Offsite to CB in Main St



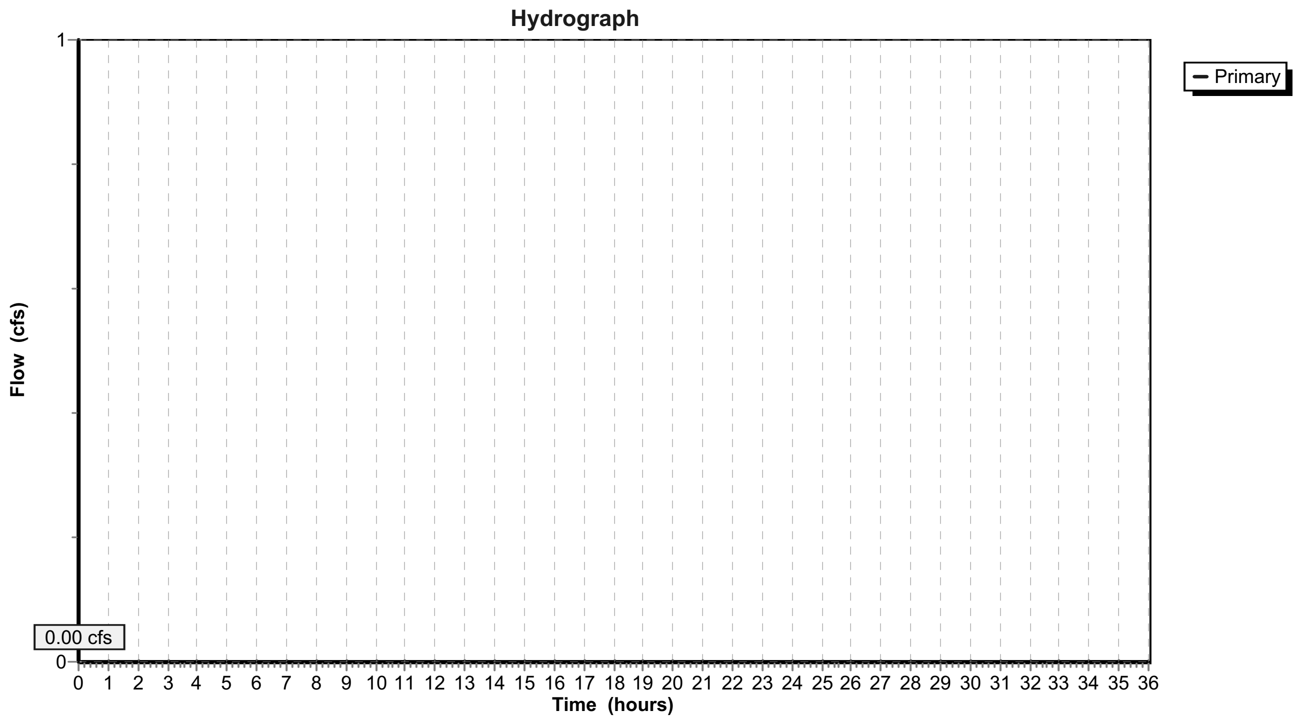
Summary for Link DP-3: Low Point in Lawn

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-3: Low Point in Lawn



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PS-1A: Runoff Area=17,947 sf 86.09% Impervious Runoff Depth=5.81"
Tc=6.0 min CN=95 Runoff=2.48 cfs 8,688 cf

Subcatchment PS-1B: Runoff Area=29,906 sf 5.71% Impervious Runoff Depth=3.63"
Flow Length=347' Tc=13.0 min CN=75 Runoff=2.31 cfs 9,035 cf

Pond 1P: Subsurface Basin Peak Elev=425.07' Storage=1,804 cf Inflow=2.48 cfs 8,688 cf
Discarded=0.06 cfs 2,724 cf Primary=1.31 cfs 5,964 cf Outflow=1.36 cfs 8,688 cf

Link DP-1: Mill River Inflow=3.60 cfs 14,999 cf
Primary=3.60 cfs 14,999 cf

Link DP-2: Offsite to CB in Main St
Primary=0.00 cfs 0 cf

Link DP-3: Low Point in Lawn
Primary=0.00 cfs 0 cf

Total Runoff Area = 47,853 sf Runoff Volume = 17,723 cf Average Runoff Depth = 4.44"
64.14% Pervious = 30,695 sf 35.86% Impervious = 17,158 sf

Summary for Subcatchment PS-1A:

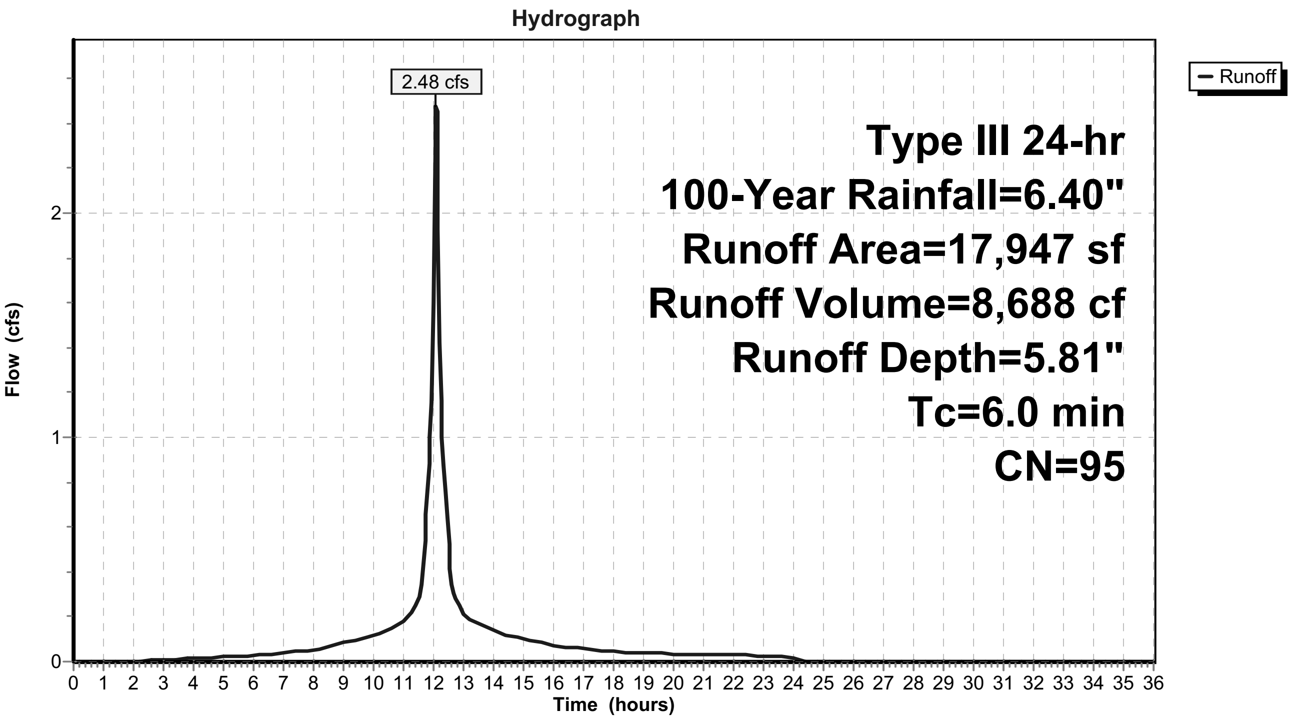
Runoff = 2.48 cfs @ 12.09 hrs, Volume= 8,688 cf, Depth= 5.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
2,497	74	>75% Grass cover, Good, HSG C
12,999	98	Paved parking, HSG C
2,451	98	Roofs, HSG C
17,947	95	Weighted Average
2,497	74	13.91% Pervious Area
15,450	98	86.09% Impervious Area

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

Subcatchment PS-1A:



Summary for Subcatchment PS-1B:

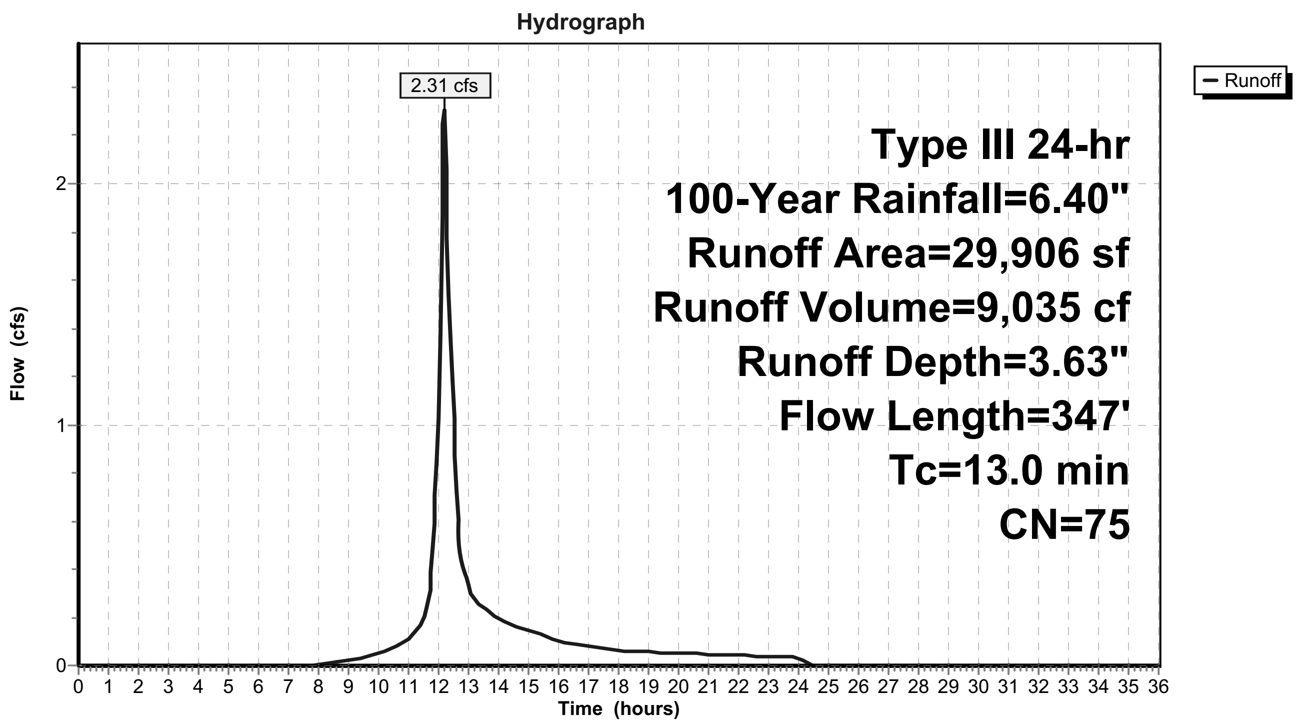
Runoff = 2.31 cfs @ 12.18 hrs, Volume= 9,035 cf, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.40"

Area (sf)	CN	Description
28,198	74	>75% Grass cover, Good, HSG C
1,708	98	Paved parking, HSG C
29,906	75	Weighted Average
28,198	74	94.29% Pervious Area
1,708	98	5.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0430	0.15		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.00"
2.1	247	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	347	Total			

Subcatchment PS-1B:



Summary for Pond 1P: Subsurface Basin

Inflow Area = 17,947 sf, 86.09% Impervious, Inflow Depth = 5.81" for 100-Year event
Inflow = 2.48 cfs @ 12.09 hrs, Volume= 8,688 cf
Outflow = 1.36 cfs @ 12.22 hrs, Volume= 8,688 cf, Atten= 45%, Lag= 7.9 min
Discarded = 0.06 cfs @ 12.22 hrs, Volume= 2,724 cf
Primary = 1.31 cfs @ 12.22 hrs, Volume= 5,964 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 425.07' @ 12.22 hrs Surf.Area= 926 sf Storage= 1,804 cf

Plug-Flow detention time= 71.6 min calculated for 8,676 cf (100% of inflow)
Center-of-Mass det. time= 71.8 min (833.9 - 762.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	422.00'	851 cf	**20.50'W x 45.16'L x 3.50'H Field A** 3,240 cf Overall - 1,114 cf Embedded = 2,126 cf x 40.0% Voids
#2A	422.50'	1,114 cf	**ADS_StormTech SC-740** x 24 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 4 rows
		1,964 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	422.50'	**12.0" Round Culvert** L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 422.50' / 422.00' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	422.90'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	425.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	422.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 420.00' Phase-In= 0.01'

Discarded OutFlow Max=0.06 cfs @ 12.22 hrs HW=425.04' (Free Discharge)
└─**4=Exfiltration** (Controls 0.06 cfs)

Primary OutFlow Max=1.30 cfs @ 12.22 hrs HW=425.04' (Free Discharge)
└─**1=Culvert** (Passes 1.30 cfs of 5.35 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.30 cfs @ 6.63 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Subsurface Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-740
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 6.45 sf x 4 rows

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

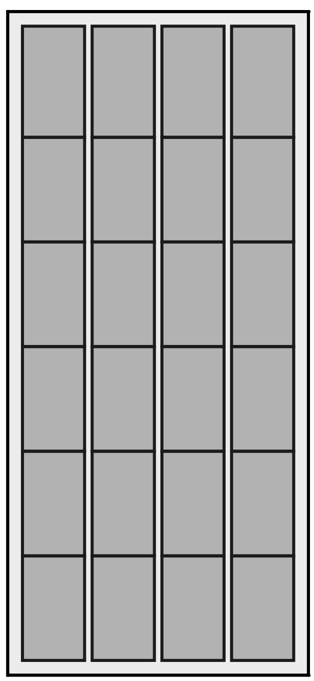
6 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 43.16' Row Length +12.0" End Stone x 2 = 45.16' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

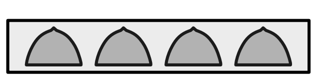
24 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 4 Rows = 1,113.9 cf Chamber Storage

3,240.2 cf Field - 1,113.9 cf Chambers = 2,126.3 cf Stone x 40.0% Voids = 850.5 cf Stone Storage

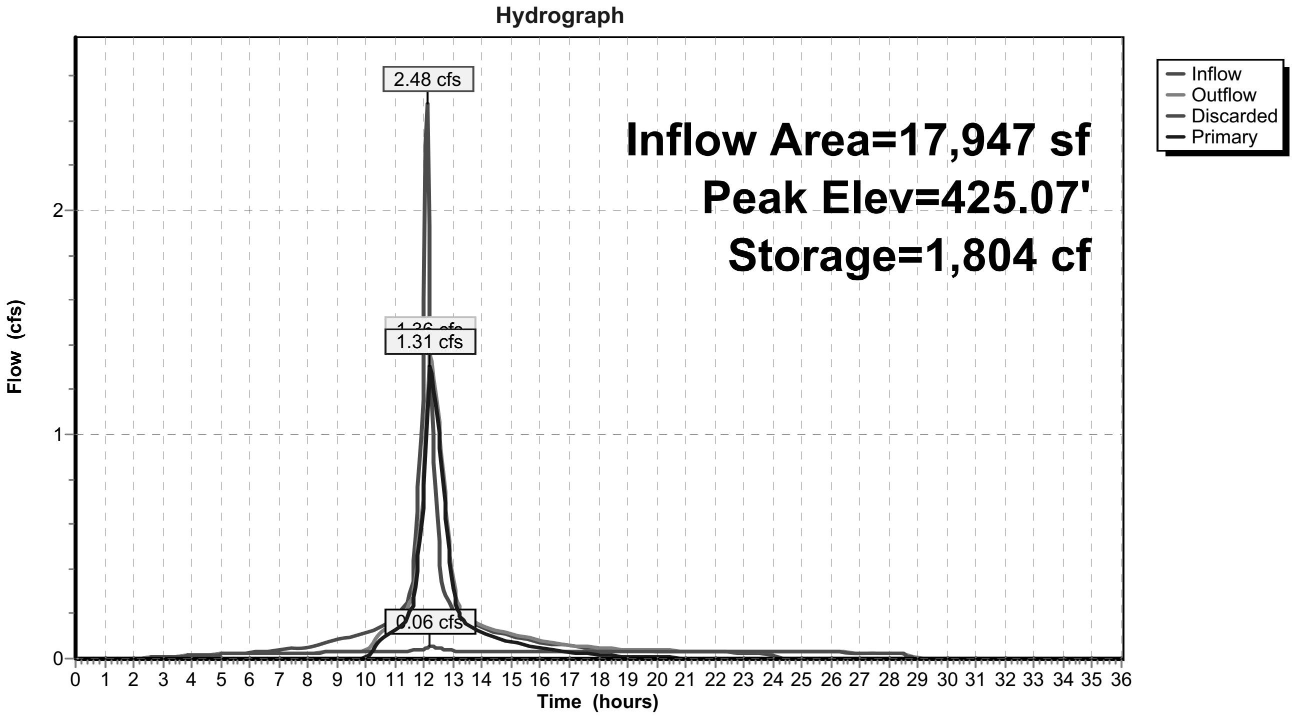
Chamber Storage + Stone Storage = 1,964.4 cf = 0.045 af
Overall Storage Efficiency = 60.6%

24 Chambers
120.0 cy Field
78.8 cy Stone





Pond 1P: Subsurface Basin

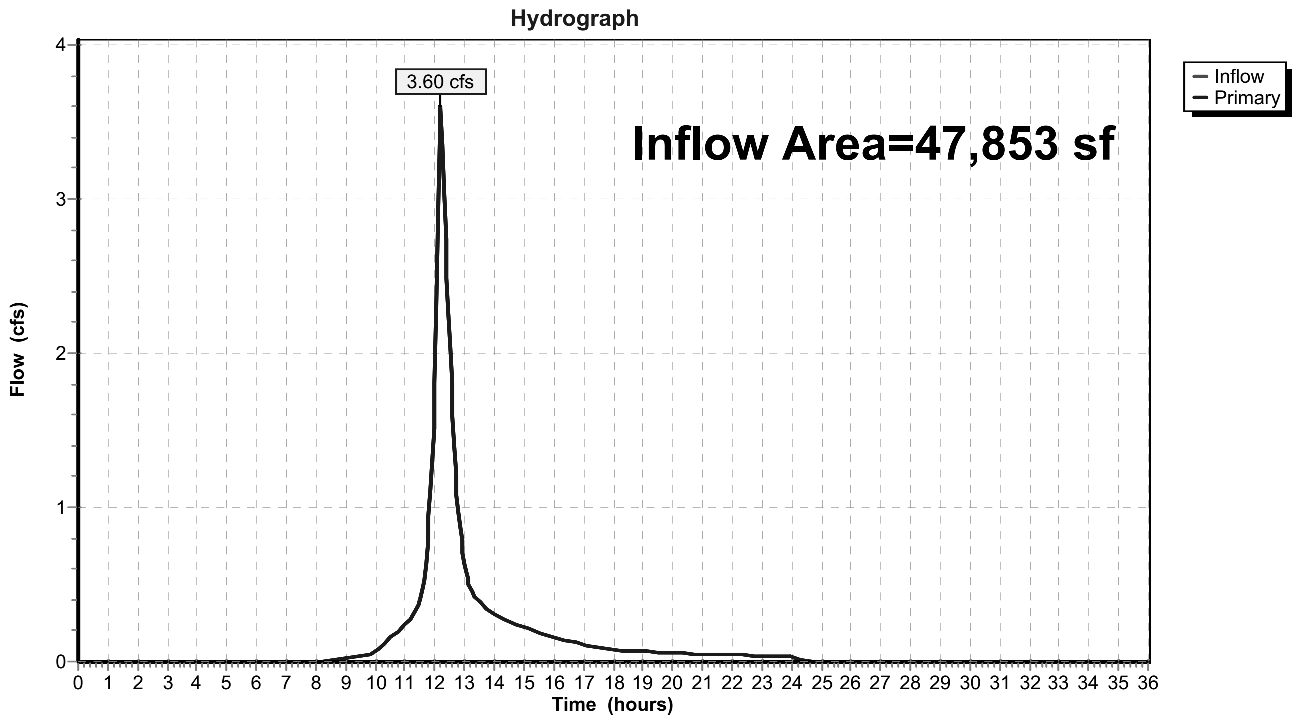


Summary for Link DP-1: Mill River

Inflow Area =	47,853 sf,	35.86% Impervious,	Inflow Depth = 3.76"	for 100-Year event
Inflow =	3.60 cfs @	12.19 hrs, Volume=	14,999 cf	
Primary =	3.60 cfs @	12.19 hrs, Volume=	14,999 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link DP-1: Mill River

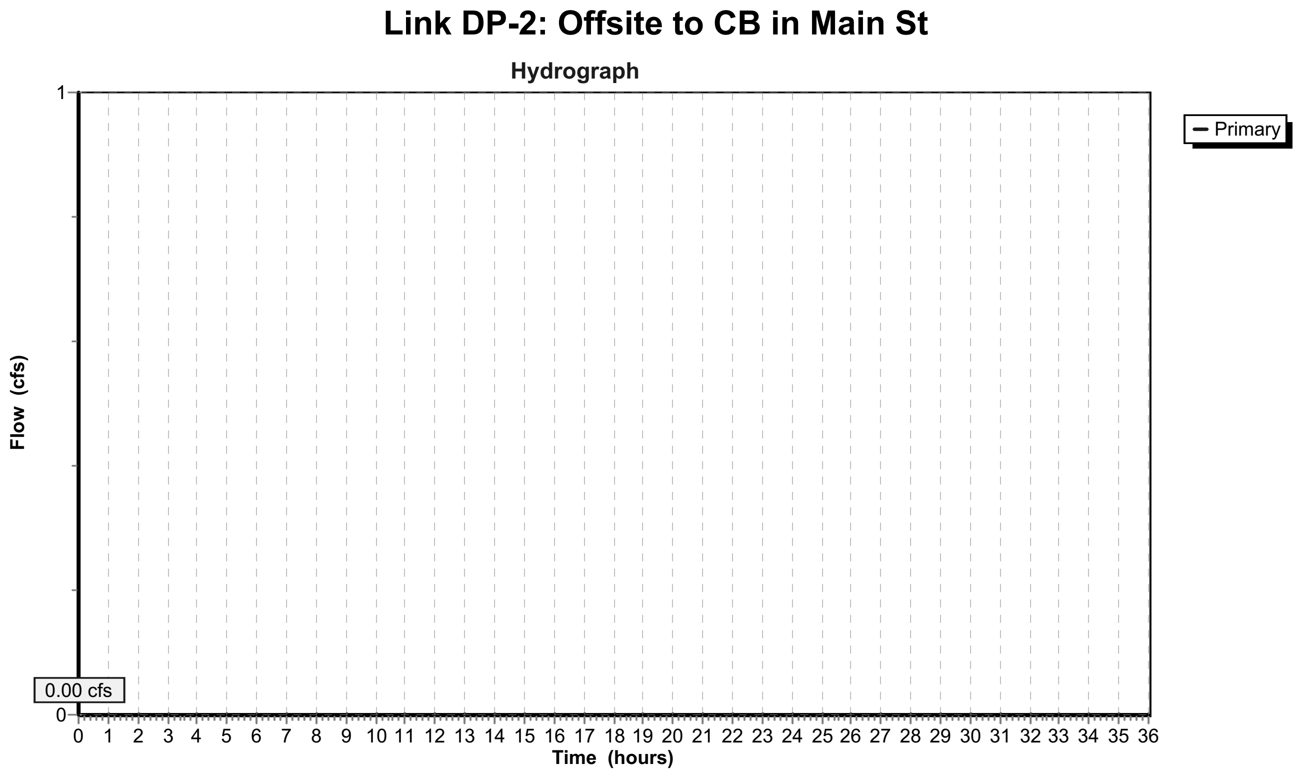


Summary for Link DP-2: Offsite to CB in Main St

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

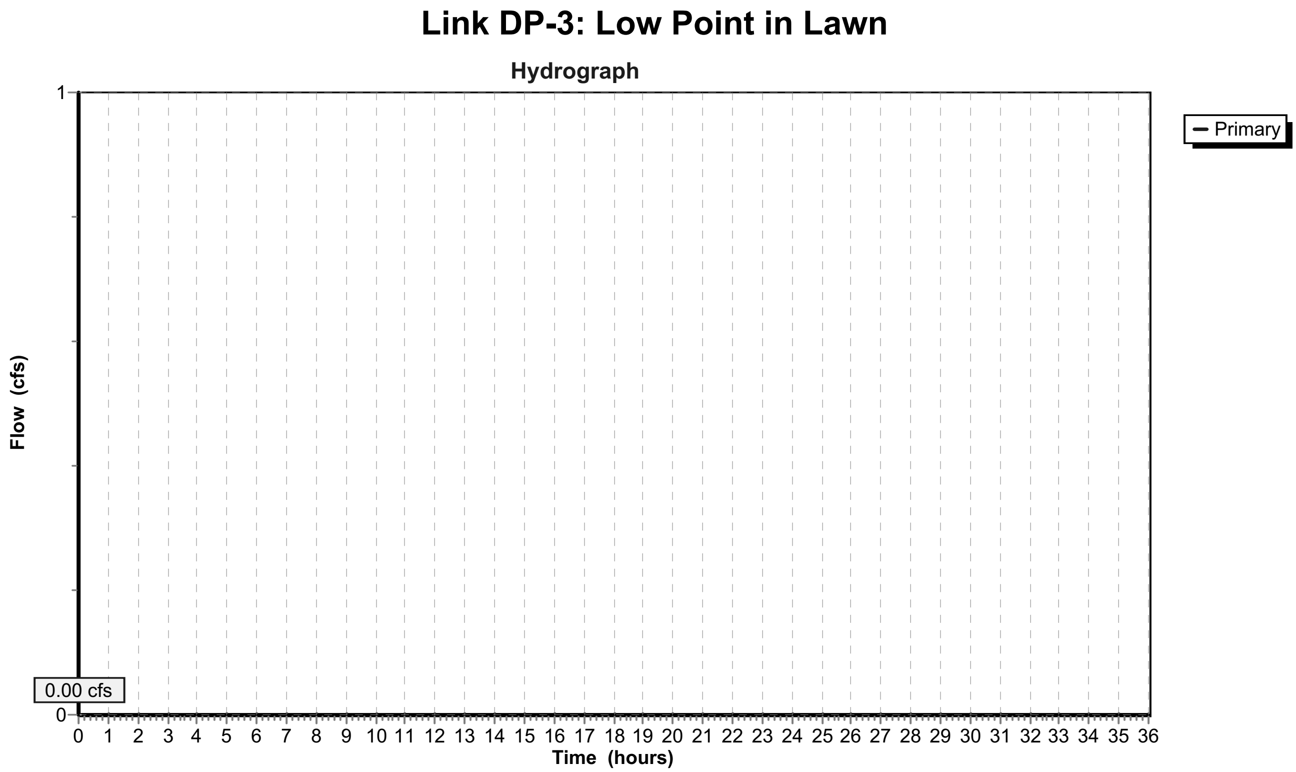


Summary for Link DP-3: Low Point in Lawn

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

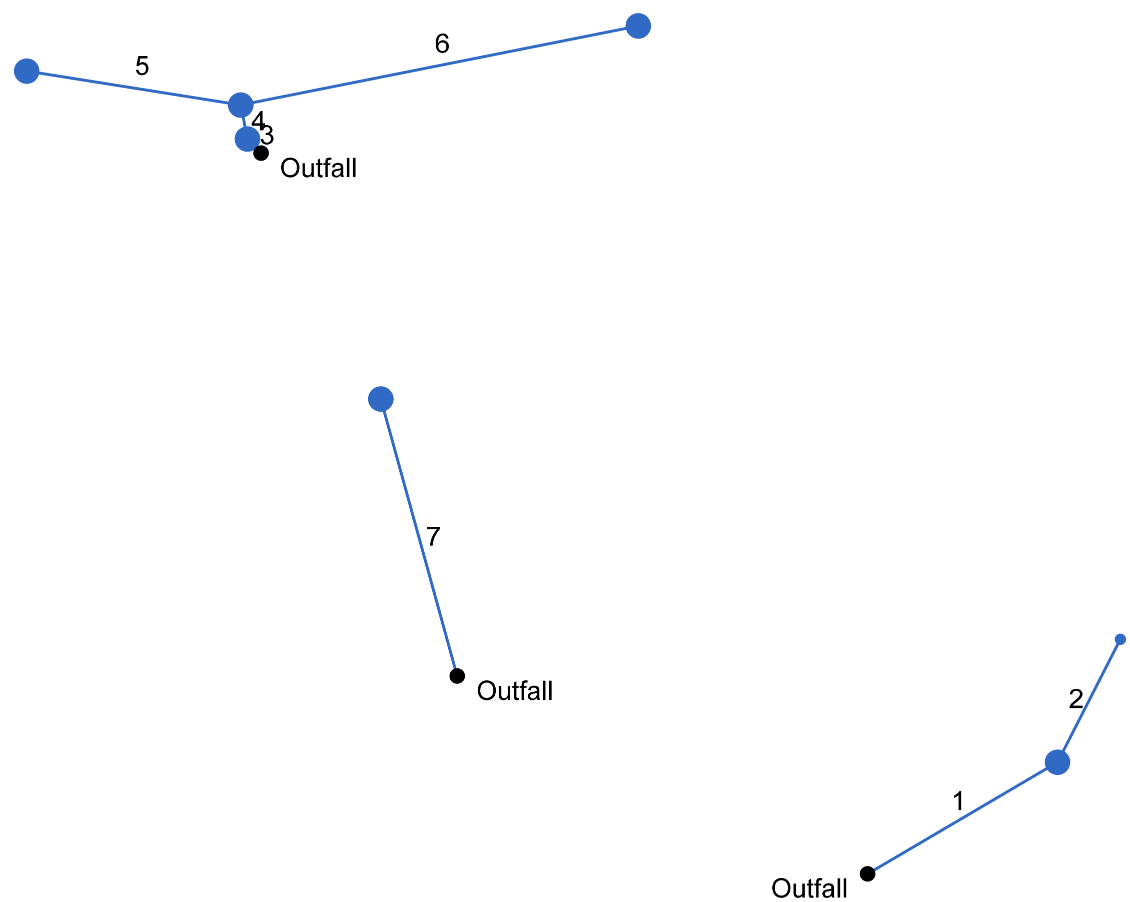
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs



Appendix D: Hydraulic Analysis

- Pipe Capacity Analysis

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Project File: 150407 - STORM.stm	Number of lines: 7	Date: 8/3/2015

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	38.864	0.03	0.16	0.90	0.03	0.10	6.0	6.5	8.1	0.79	3.81	2.14	12	0.98	424.02	424.40	424.71	424.78	425.21	428.50	P-D-PIPE-(5)
2	1	24.500	0.13	0.13	0.54	0.07	0.07	6.0	6.0	8.4	0.59	3.90	2.65	12	1.02	424.75	425.00	425.08	425.33	428.50	428.00	P-D-PIPE-(3)
3	End	3.500	0.00	0.36	0.00	0.00	0.31	0.0	6.9	8.0	2.44	0.00	1.15	24	0.00	422.00	422.00	423.28	423.28	424.27	427.91	P-D-PIPE-(8)
4	3	6.000	0.00	0.36	0.00	0.00	0.31	0.0	6.9	8.0	2.44	4.98	4.42	12	1.67	423.77	423.87	424.43	424.53	427.91	428.01	P-D-PIPE-(7)
5	4	38.214	0.21	0.21	0.84	0.18	0.18	6.0	6.0	8.4	1.48	3.42	1.88	12	0.79	422.45	422.75	424.53	424.59	428.01	426.00	P-D-PIPE-(2)
6	4	71.513	0.15	0.15	0.86	0.13	0.13	6.0	6.0	8.4	1.08	6.92	2.31	12	3.22	422.45	424.75	424.53	425.19	428.01	428.50	P-D-PIPE-(1)
7	End	50.893	0.00	0.00	0.00	0.00	0.00	0.0	0.0	8.4	1.40	3.82	2.88	12	0.98	422.00	422.50	422.75	423.00	423.19	427.86	P-D-PIPE-(29)

Project File: 150407 - STORM.stm | Number of lines: 7 | Run Date: 8/3/2015

NOTES:Intensity = 36.41 / (Inlet time + 4.90) ^ 0.61; Return period =Yrs. 100 ; c = cir e = ellip b = box

Appendix E: MassDEP Calculations

- Required Recharge Volume
- Drawdown Calculations
- Water Quality Calculations
- Stormceptor Water Quality Rates
- Water Quality Conversion Table
- TSS Removal Worksheet
- Infiltration Basin Stage-Storage Chart
- MASTEP Tech Summary Report - Stormceptor

Standard 3: Recharge Calculations

Required Recharge Volume Sizing (R_V) with Capture Area Adjustment

R_V (required) = F x Impervious Area

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

F = Target Depth Factor

0.60	inch	(A-soils)
0.35	inch	(B-soils)
0.25	inch	(C-soils)
0.10	inch	(D-soils)

New Impervious Area by Hydrologic Soil Type

Impervious Area (A-soils)	0	sq. ft.	0.0%
Impervious Area (B-soils)	0	sq. ft.	0.0%
Impervious Area (C-soils)	17,157	sq. ft.	100.0%
Impervious Area (D-soils)	0	sq. ft.	0.0%
Total Impervious area	17,157	sq. ft.	100.0%

R_v (required) = $\sum$ [$F_{Soil\ Type}$ x Impervious $Area_{Soil\ Type}$] x 1 ft./12 in.

R_v (required) = 357 cu. ft.

Capture Area Adjustment

Total Impervious Area = 17,157 sq. ft.

Total Imperv. Area to Recharge Facility = 15,450 sq. ft.

Percent Imperv. To Recharge Facility* = 90.1%

*Impervious Area tributary to recharge facilities must be greater than 65%

Adjustment Factor = 1.11

Adjusted R_V (required) = 397 cu. ft.

Recharge Volume Storage Provided - Subsurface Basin

R_V (provided) 485 cu. ft. > 397 cu. ft. (C-soils)

Volume represents the available storage in Subsurface Basin to outlet:
Elevation = 422.9 (depth of water in basin above stone bottom = 0.9 feet)

Drawdown Analysis

$$T_{DRAWDOWN} = \frac{R_V}{KA}$$

where: $T_{DRAWDOWN}$ = time in hours

R_V = required recharge volume **(cu. ft.)**

K = Rawls rate **2.41 inches/hour** (A-soils)*

0.52 inches/hour (B-soils)*

0.27 inches/hour (C-soils)*

A = bottom area of recharge facility **(sq. ft.)**

*Most conservative Rawls rate values for given soil type used for analysis purposes

Subsurface Infiltration Basin

R_V = 397 cu. ft.

A = 926 sq. ft.

$T_{DRAWDOWN}$ = **19.1 hours < 72 hours (C-soils)**

Standard 4: Water Quality - PWQU-1

Water Quality Volume Conversion to Flow Rate

Note: Required water quality volume based on 0.5-inch of runoff

$$Q = (qu)\,(A)\,(WQV)$$

where: **Q** = peak flow rate associated with first 0.5-inch of runoff (c.f.s.)

qu = unit peak discharge (csm/in) - value taken from table based on t_c

A = impervious surface drainage area (sq. mi.)

WQV = water quality volume in watershed inches (0.5-inch)

· Proposed Water Quality Unit (PWQU-1)

t_c =	0.100	hrs	
qu =	752	csm/in	(from table)
A =	0.00047	sq. mi.*	
WQV =	0.5	inch	

$Q_{0.5}$ = **0.17 c.f.s**

The Stormceptor STC-450i provides 80% TSS removal for flows up to 0.40 c.f.s.

* Only includes impervious area (parking lot) tributary to water quality unit (PWQU-1) and excludes "clean" roof runoff.

Standard 4: Water Quality - PWQU-2

Water Quality Volume Conversion to Flow Rate

Note: Required water quality volume based on 0.5-inch of runoff

$$Q = (qu)\ (A)\ (WQV)$$

where: **Q** = peak flow rate associated with first 0.5-inch of runoff (c.f.s.)

qu = unit peak discharge (csm/in) - value taken from table based on t_c

A = impervious surface drainage area (sq. mi.)

WQV = water quality volume in watershed inches (0.5-inch)

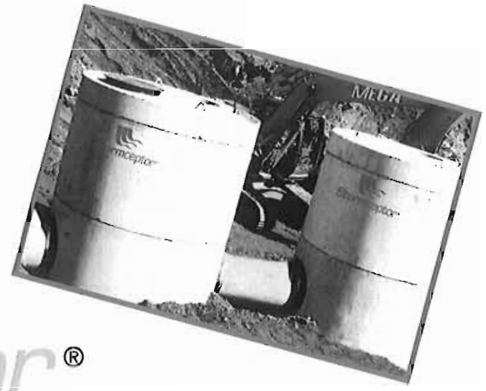
· **Proposed Water Quality Unit (PWQU-1)**

t_c =	0.100	hrs	
qu =	752	csm/in	(from table)
A =	0.00004	sq. mi.*	
WQV =	0.5	inch	

$Q_{0.5}$ = **0.02 c.f.s**

The Stormceptor STC-450i provides 80% TSS removal for flows up to 0.40 c.f.s.

* Only includes impervious area (parking lot) tributary to water quality unit (PWQU-2).



Stormceptor® STC

Stormceptor® is an underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention. With thousands of systems operating worldwide, Stormceptor delivers protection every day in every storm.

With patented technology, optimal treatment occurs by allowing free oil to rise and sediment to settle. The Stormceptor design prohibits scour and release of previously captured pollutants, ensuring superior treatment and protection during even the most extreme storm events.

Stormceptor is very easy to design and provides flexibility under varying site constraints such as tight right-of-ways, zero lot lines and retrofit projects. Design flexibility allows for a cost-effective approach to stormwater treatment. Stormceptor has proven performance backed by the longest record of lab and field verification in the industry.

Tested Performance

- Fine particle capture
- Prevents scour or release
- 95%+ Oil removal

Massachusetts – Water Quality (Q) Flow Rate

Stormceptor STC Model	Inside Diameter (ft)	Typical Depth Below Inlet Pipe Invert [1] (in)	Water Quality Flow Rate Q [2] (cfs)	Peak Conveyance Flow Rate [3] (cfs)	Hydrocarbon Capacity [4] (Gallons)	Maximum Sediment Capacity [4] (ft^3)
STC 450i	4	68	0.40	5.5	86	46
STC 900	6	63	0.89	22	251	89
STC 2400	8	104	1.58	22	840	205
STC 4800	10	140	2.47	22	909	543
STC 7200	12	148	3.56	22	1,059	839
STC 11000	2 x 10	142	4.94	48	2,792	1,086
STC 16000	2 x 12	148	7.12	48	3,055	1,677

[1] Depth Below Pipe Inlet Invert to the Bottom of Base Slab, and Maximum Sediment Capacity can vary to accommodate specific site designs and pollutant loads. Depths can vary to accommodate special designs or site conditions. Contact your local representative for assistance.
[2] Water Quality Flow Rate (Q) is based on 80% annual average TSS removal of the OK110 particle size distribution.
[3] Peak Conveyance Flow Rate is based upon ideal velocity of 3 feet per second and outlet pipe diameters of 18-inch, 36-inch, and 54-inch diameters.
[4] Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

Rinker MATERIALS™
www.rinkerstormceptor.com
Manufacturing Plant: Westfield, MA
Phone: (413) 562-3647
11-22-13-R13-802 MDEP

Stormceptor®
www.stormceptor.com

Figure 2: For First ½-inch of Runoff, Table of qu values for Ia/P Curve = 0.0.058, listed by tc, for Type III Storm Distribution

	Tc (Hours)	qu (csm/in)	Tc (Hours)	qu (csm/in)	Tc (Hours)	qu (csm/in)	Tc (Hours)	qu (csm/in)
	0.01	821	1.8	246	5.3	116	8.8	77
	0.03	821	1.9	238	5.4	115	8.9	76
	0.05	813	2	230	5.5	113	9	76
	0.067	794	2.1	223	5.6	112	9.1	75
PWQU-1	0.083	773	2.2	217	5.7	110	9.2	74
PWQU-2	0.1	752	2.3	211	5.8	109	9.3	74
	0.116	733	2.4	205	5.9	107	9.4	73
	0.133	713	2.5	200	6	106	9.5	72
	0.15	694	2.6	194	6.1	104	9.6	72
	0.167	677	2.7	190	6.2	103	9.7	71
	0.183	662	2.8	185	6.3	102	9.8	70
	0.2	646	2.9	181	6.4	100	9.9	70
	0.217	632	3	176	6.5	99	10	69
	0.233	619	3.1	173	6.6	98		
	0.25	606	3.2	169	6.7	97		
	0.3	572	3.3	165	6.8	96		
	0.333	552	3.4	162	6.9	94		
	0.35	542	3.5	158	7	93		
	0.4	516	3.6	155	7.1	92		
	0.416	508	3.7	152	7.2	91		
	0.5	472	3.8	149	7.3	90		
	0.583	443	3.9	147	7.4	89		
	0.6	437	4	144	7.5	88		
	0.667	417	4.1	141	7.6	87		
	0.7	408	4.2	139	7.7	86		
	0.8	383	4.3	136	7.8	85		
	0.9	361	4.4	134	7.9	84		
	1	342	4.5	132	8	84		
	1.1	325	4.6	130	8.1	83		
	1.2	311	4.7	128	8.2	82		
	1.3	297	4.8	126	8.3	81		
	1.4	285	4.9	124	8.4	80		
	1.5	274	5	122	8.5	79		
	1.6	264	5.1	120	8.6	79		
	1.7	254	5.2	118	8.7	78		

TSS Removal Form - PFES-1

Total TSS Removal

BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Deep Sump Hooded CB	0.25	1.00	0.25	0.75
Stormceptor 450i	0.80	0.75	0.60	0.15
Subsurface Infiltration Basin	0.80	0.15	0.12	0.03

Total TSS Removal = 97%

TSS Removal Form - PFES-2

Total TSS Removal

BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Deep Sump Hooded CB	0.25	1.00	0.25	0.75
Stormceptor 450i	0.80	0.75	0.60	0.15
Subsurface Infiltration Basin	0.80	0.15	0.12	0.03

Total TSS Removal = 97%

Stage Area Storage for Pond P Subsurface Basin

Elevation (feet)	Surface (sq ft)	Storage (cubic feet)	Elevation (feet)	Surface (sq ft)	Storage (cubic feet)

UNIVERSITY OF MASSACHUSETTS
AT AMHERST
Water Resources Research Center
Blaisdell House, UMass
310 Hicks Way
Amherst, MA 01003

Massachusetts Stormwater Evaluation Project

(413) 545-5532
(413) 545-2304 FAX
www.mastep.net

MASTEP Technology Review

Technology Name: Stormceptor

Studies Reviewed: Final NJCAT Technology Verification Stormceptor STC900 September 2004; Coventry University Study, 1996; Technology Assessment, University of Massachusetts, 1997; SeaTac Stormceptor Performance report 2001; SWAMP report Ontario 2004; Phoenix Group Edmonton report 1995; Stormceptor 1200 Field Evaluation report 2004; Applied Hydrology Associates Denver report 2003; Rinker Materials Como Park St. Paul MN report 2002; VA DOT / UVA "Testing of Ultra-Urban Stormwater Best Management Practices" report 2001.
Hydrodynamic Separator Sediment Retention Testing, Mohseni, 2010.

Date: September 17, 2013

Reviewer: Jerry Schoen

Rating: 2

Brief rationale for rating: This rating is primarily based on the 2005 NJCAT Technology Verification study. In general, this was a well-conducted test, which in large part followed NJDEP test guidelines for laboratory studies, which MASTEP considers as the laboratory equivalent of TARP field protocols. Issues of concern: the study measured suspended sediment concentration (SSC) rather than total suspended solids (TSS). Although SSC is considered by many scientists to be the preferred method, it is at odds with Massachusetts stormwater regulations, which are based on TSS treatment. Comparing SSC and TSS results is considered an inexact science. The test was conducted with higher influent sediment concentrations than is preferred, but results were fairly consistent across all ranges studied. The particle size distribution also appears to be slightly higher than the target test range. There are additional field studies that in general support the results obtained in this laboratory studies. These studies do not satisfy TARP protocols, but they do not contradict results obtained in the NJCAT study.

TARP Requirements Not Met*:

- Measurements in TSS.
- Influent sediment concentration is 100 – 300 mg/l: actual was 153-460.
- No documentation of a Quality Assurance Project Plan
- Third party studies are preferred. This was conducted by Stormceptor personnel, with sample analyses conducted by an external laboratory.

Other Comments:
* The 2010 Mohseni study evaluates the susceptibility of the Stormceptor to scouring, or washout of collected sediments. Report concluded that the unit does not scour at high flows as long as sediment depth does not exceed maintenance level.

* Criteria also based on NJDEP laboratory testing guidelines.

Appendix F: Construction Period Erosion Control Plan

Construction Period Erosion Control Plan

Proposed Drive-Through Restaurant

Haydenville, Massachusetts

Project Location:

142 Main Street
Map K, Parcel 192
Haydenville, Massachusetts

Prepared for:

Sao Joao Realty, LLC
475 Southampton Road
Westfield, Massachusetts

RLA Project File: 150407

July 30, 2015

R LEVESQUE ASSOCIATES, INC

A LAND PLANNING SERVICES COMPANY

40 School Street · Westfield, MA 01085

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RLA

The project shall implement a construction period erosion control plan. The following provides descriptions and guidelines to ensure that the areas surrounding the project site will be protected from excessive sedimentation and runoff during construction.

1.1 Construction Period Pollution Prevention And Erosion Control Measures

1.1.1 Preconstruction Notifications And Meetings

Prior to the start of construction, the contractor shall call together a pre-construction meeting including a representative from the City/Town, the design engineer, contractor, and any pertinent persons that should be in attendance. These requirements shall be the responsibility of the Contractor to arrange, attend, and document.

1.1.2 Sediment Barrier And Work Limit

Before installation of the sediment barriers, the location shall be staked in the field for review and approval by the owner or their representative. To facilitate sediment barrier installation, woody vegetation may then be removed and any required trench may be cut by machine, provided all other ground cover is left intact. No excavation, grading, filling, or removal of vegetative ground cover shall begin until sediment barriers have been installed as shown on the plans and have been inspected by the owner or their representative.

1.1.3 Silt Fence

The bottom of the fence shall be trenched into the ground a minimum of 6" and back-filled with compacted soil. Where trenching is not feasible, silt fence skirt shall be covered with compacted soil or crushed stone. The top of the fabric shall be stretched as tightly as is practical, with intermediate stakes added to correct excessive sags. Stakes shall be driven at least 12" into the ground. Splices between sections shall be made by rolling end stakes together one complete turn and driving into the ground together.

1.1.4 Straw Bales

Straw bales may be used as temporary and moveable control measures, temporary check dams, or as reinforcement for silt fence in areas of concentrated runoff or high fills. Bales shall be tightly butted and staked 12" into the ground. Where used without silt fence in front, the bales shall be trenched 4" into the ground, back-filled with compacted soil, and the spaces between bales shall be chinked with loose hay.

1.1.5 Filter Sock (Filtrexx Or Equivalent)

In areas of expected sheet flow, filter sock may be placed directly on the ground without trenching or stakes. In areas of expected concentrated flow, mulch or crushed stone shall be placed along the up-slope face to control and filter underflow. Additional layers of Filter Sock may be required for adequate freeboard. The filter sock shall be staked at 10 feet on-center or in cases where they cannot be staked, utilize heavy concrete blocks to hold in place.

1.1.6 Temporary Sedimentation Basins

Temporary sediment basins may be excavations or bermed stormwater detention structures (depending on grading) that will retain runoff for a sufficient period of time to allow suspended soil particles to settle out prior to discharge. These temporary basins will be located based on construction needs as determined by the contractor and outlet devices will be designed to control velocity and sediment. Points of discharge from sediment basins will be stabilized to minimize erosion. If the temporary basin is to be located within an area of future infiltration as part of the stormwater management system, the excavation shall be limited to one foot above final grade of the infiltration structure.

1.1.7 Stocking Additional Materials

A stock of additional erosion control materials shall be available on the site for emergency repairs and temporary measures. Stock shall be replenished when decreased to 50% of the numbers below. Stock shall include:

Straw Bales – 10 (kept dry) with 20 oak stakes

Or

Silt Fence – 30 Linear feet.

Or

Filter Sock – 4 – 8 foot sections (kept dry)

Washed Stone – One (1) cubic yard, ¾" to 2" diameter

1.1.8 Trench Protection

Open trenches shall be protected from accumulation of surface water or groundwater that could result in erosion of the trench and discharge of sediment. Where feasible, spoil shall be stockpiled on the up-slope side of the trench to prevent entrance of surface runoff. Backfill shall be crowned to allow for settlement and to avoid concentration of runoff on top of the trench.

1.1.9 Site Stabilization – Temporary

Where a portion of the site will not be subject to construction activity for over 14 days, measures shall be taken to provide temporary stabilization of that inactive portion of the site, within 14 days of the cessation of construction activity. Stabilization measures may include seeding for temporary cover, mulching, or other measures to protect exposed soil from erosion and prevent sediment movement.

1.1.10 Site Stabilization – Permanent

Within 14 days of completion of loaming and finish grading on any portion of the site, that area shall be seeded or planted for permanent cover (season permitting) in accordance with USDA NRCS guidelines or equivalent.

1.1.11 Roadway Sweeping

The entrance to the site and affected portions of the access drive or paved project areas shall be swept as needed to control sediment runoff into storm drains or waterways and to control blowing dust.

1.2 Short-Term Erosion Control Maintenance

The following provides short-term erosion control maintenance guidelines and requirements.

1. The contractor or subcontractor will be responsible for implementing each control shown on the sedimentation and erosion control plan.
2. All erosion and sediment control devices shall be properly maintained during all phases of construction until the completion of all construction activities and all disturbed areas have been stabilized. Additional control measures will be installed during construction in order to control erosion and/or off-site sedimentation if deemed necessary by on-site inspection.
3. Effective erosion control measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operations that will disturb the natural protection.
4. All sediment and erosion control devices shall be inspected at least once every seven (7) calendar days and after any storm event greater than 0.5 inches of precipitation during any 24-hour period, and the inspection shall be documented in writing. Damaged or ineffective devices shall be repaired or replaced, as necessary.
5. The contractor shall take all reasonable precautions to avoid excess erosion of the site due to the construction of this project.
6. Silt shall be removed from behind barriers if greater than 6-inches deep or as needed. Sediment that is collected in structures shall be disposed of properly and covered if stored on-site
7. Damaged or deteriorated items will be repaired immediately after identification.
8. All ditches shall be stabilized as soon as is practicable to minimize erosion.
9. The contractor shall maintain all erosion control devices in a good, working state of repair. Upon complete stabilization of any tributary areas, the erosion control devices shall be removed and disposed of so as to cause no off-site siltation.
10. Inspect and maintain construction entrance stone such that sediment does not track onto the street. Any sediment tracked onto the street shall be swept daily.
11. After catch basins have been constructed, the contractor shall protect the inlets by constructing inlet protection as shown on the plans.
12. Once the site has been paved, all catch basin inlets shall receive a silt sack type protection.
13. Erosion control measures shall remain in place until all disturbed earth has been substantially stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

Appendix G: Long-Term Operation And Maintenance Plan

- Long-Term Operation & Maintenance Plan
- O&M Checklist

Long-Term Operation & Maintenance Plan

Proposed Drive-Through Restaurant

Haydenville, Massachusetts

Project Location:

142 Main Street
Map K, Parcel 192
Haydenville, Massachusetts

Prepared for:

Sao Joao Reatly, LLC
475 Southampton Road
Westfield, Massachusetts

RLA Project File: 150407

July 30, 2015

R LEVESQUE ASSOCIATES, INC

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I. Long-Term Stormwater Maintenance Program:

This Long-Term Operation and Maintenance Plan (O&M) identifies inspection and maintenance requirements for the proposed stormwater management system. The O&M references guidelines set forth by the Stormwater Management Handbook developed by the Massachusetts Department of Environmental Protection.

Owner:

Sao Joao Realty, LLC
c/o Emanuel Sardinha
475 Southampton Road
Westfield, Massachusetts

Responsible Party:

Sao Joao Realty, LLC
c/o Emanuel Sardinha
475 Southampton Road
Westfield, Massachusetts

2. Inspection and Maintenance Program:

Regular inspection and routine maintenance are necessary to ensure that the stormwater management system continues to control and treat runoff. The following lists the inspection schedule and maintenance procedures for the proposed stormwater Best Management Practices:

BMP	Inspection Schedule	Maintenance Schedule	Maintenance Procedures
Bituminous Concrete Pavement	Four times per year	Twice per year	• Pavement to be swept in March or April following snow melt and again in late November or early December to remove fallen leaves and debris
Deep Sump Catch Basins	Four times per year	Four times per year	• Remove sediment once deposits reach one half the depth from the bottom sump to the lowest invert.
Roof Leaders	Once per year	Once per year	• Inspect downspout connections at grade and remove any blockages
Stormwater Piping	Once per year	Once per year	• Inspect pipe entrances in catch basins and manholes and remove any blockages
Proprietary Sedimentation Device*	As specified by the manufacturer	As specified by the manufacturer	• Clean the unit using the method specified by the manufacturer. Vactor trucks are typically used to clean these units.
Subsurface Infiltration Basins	Four times per year	As needed	• Verify that the inlet structure has no accumulation of sediment; • Clean Isolator Row as specified by manufacturer
Flared End Section	Four times per year	As needed	• Remove any debris or vegetation around the flared end section such that flow out of the structure is not impeded

*See attached device maintenance guide

See the attached Long-Term Operation & Maintenance Inspection Checklist for record keeping purposes.

3. Additional Long-Term Operation and Maintenance Items

The following is a list of additional operation and maintenance items to be implemented by the owner to maintain the features proposed in this project.

A. Proper storage, use, and disposal of hazardous chemicals, including automobile fluids, pesticides, paints, solvents, etc. shall be required. Information should be provided on chemicals of concern, proper use, and disposal options. Recycling programs for used motor oil, antifreeze, and other products should be developed, promoted and distributed to the homeowners.

B. Vehicle Washing. This management measure involves educating the owner on the water quality impacts of the outdoor washing of vehicles and how to avoid allowing polluted runoff to enter the storm drain system. Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons which is conveyed by the detergent-rich water into storm drains.

C. Recycling, spill prevention and response plans, and proper material storage and disposal shall be implemented. It will be the responsibility of each owner to contain and legally remove any materials that are spilled onsite. The use of dry floor cleaners and absorbent materials and limiting the use of water to clean driveways is encouraged. Care should be taken to avoid accidental disposal of hazardous materials.

D. Provisions for storing trash and waste products shall be implemented. The waste materials shall be collected by the owner and all materials shall be properly disposed of.

E. Requirements for routine inspections and maintenance of stormwater best management practices. Routine inspections shall be performed to ensure the correct functioning of stormwater best management practices. See the specific maintenance criteria for detail regarding inspections and maintenance frequency.

F. Requirements for Storage and Use of Fertilizers, Herbicides, and Pesticides. Fertilizers, pesticides, herbicides, lawn care chemicals, or other leachable materials shall be used in accordance with the Lawn Care Regulations of the Massachusetts Pesticide Board, 33 CMR 10.03 (30,31), as amended, with manufacturer's label instructions and all other necessary precautions to minimize adverse impacts on surface and groundwater. The storage of any such materials shall be within structure designed to prevent the generation an escape of contaminated runoff or leachate.

G. Provisions for prevention of illicit discharges to the stormwater management system shall be implemented. Any illicit discharges to the stormwater management system shall be prohibited. It will be the owner's responsibility to ensure compliance with the legal disposal of all materials and containment/cleanup of any illicit discharges.

H. Training for staff or personnel involved with implementation of the Long-Term Pollution Prevention Plan shall be required. The owner will be responsible for the implementation of the measures set forth in the Long-Term Pollution Prevention Plan. Documentation that personnel and owners involved with the implementation of the Long-Term Pollution Prevention Plan have been trained to conduct such tasks shall be documented.

4. Winter and Snow Conditions

The following is a list of additional operation and maintenance items to be implemented by the owner during winter and snow conditions.

A. Snowfall shall be stored on the grassed areas surrounding the roadway areas, excluding any areas within the buffer zone to wetland areas or areas utilized for stormwater management practices. As needed, any snow that cannot be stored on the roadside shall be trucked off site and disposed of properly.

B. Winter road salt and/or sand use and storage restrictions shall be implemented based on any restrictions issued for the project. Sodium chloride for ice control shall be used at the minimum salt to sand ratio which is consistent with the Massachusetts Department of Environmental Protections guidelines.

5. Public Safety Features

The proposed site design utilizes the following features which have been incorporated to ensure the safety of the public:

A. Control and collection of stormwater runoff through positive drainage and curbing directing it towards the drainage inlets;

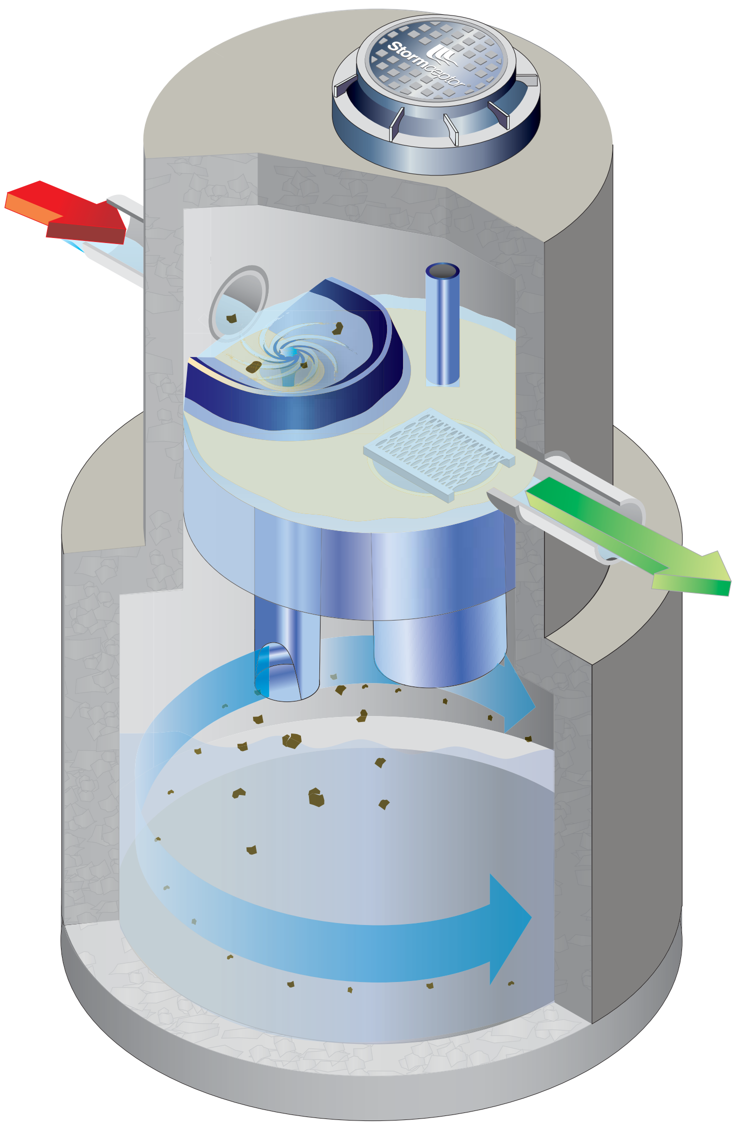
B. Heavy-duty stormwater drain manhole covers and catch basin grates have been designed to withstand H20 loading;

C. Reduction of peak discharge rates from the site in the post-development condition as compared to the pre-developed conditions;

D. Development and implementation of an Operations & Maintenance Plan to ensure the stormwater management system continues to function as designed.

Stormceptor®

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Japan Patent No. 9-11476
Korean Patent No. 0519212
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

Table of Contents

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a “Hydrodynamic Separator (HDS)” or an “Oil Grit Separator (OGS)”, engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- “STORMCEPTOR” is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site’s tailwater conditions)
- Series Unit (combines treatment in two systems)

Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

Figure 1.

Inline Stormceptor

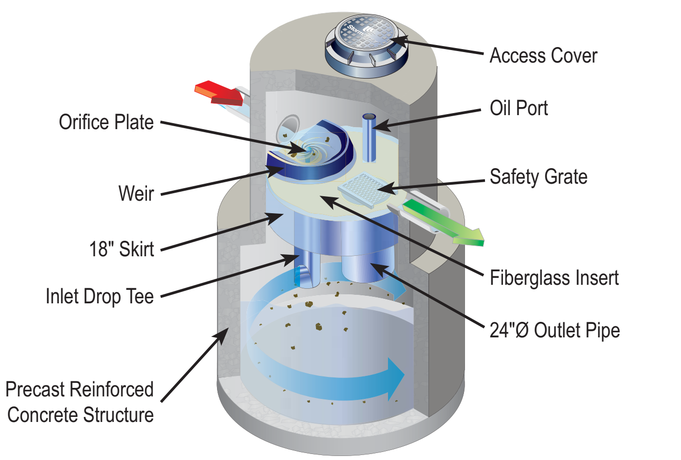
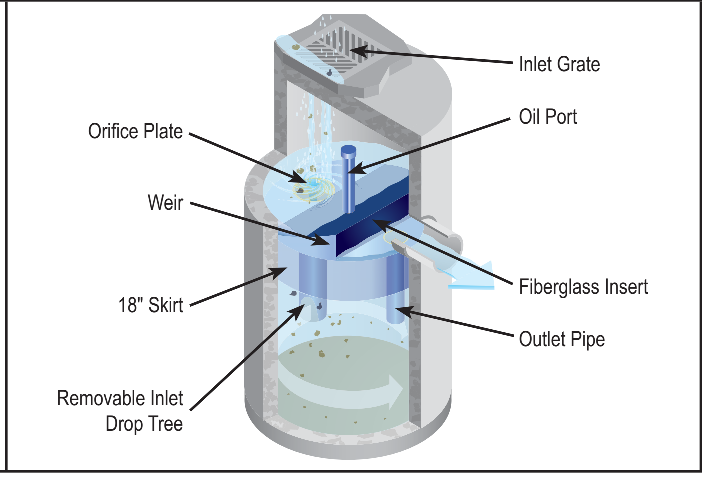


Figure 2.

Inlet Stormceptor



- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/ approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2**. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (in.)
450	60
900	55
1200	71
1800	105
2400	94
3600	134
4800	128
6000	150
7200	134
11000*	128
13000*	150
16000*	134

EOS Model	Insert to Base (in.)
4-175	60
9-365	55
12-950	71
24-1400	94
36-1700	134
48-2000	128
60-2500	150
72-3400	134
110-5000*	128
130-6000*	150
160-7800*	134

OSR Model	Insert to Base (in.)
65	60
140	55
250	94
390	128
560	134
780*	128
1125*	134

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (m)
300	1.5
750	1.5
1000	1.8
1500	2.8
2000	2.8
3000	3.7
4000	3.4
5000	4.0
6000	3.7
9000*	3.4
11000*	4.0
14000*	3.7

EOS Model	Insert to Base (m)
300	1.5
750	1.5
1000	1.8
2000	2.8
3000	3.7
4000	3.4
5000	4.0
6000	3.7
9000*	3.4
10000*	4.0
14000*	3.7

OSR Model	Insert to Base (m)
300	1.7
750	1.6
2000	2.6
4000	3.6
6000	3.7
9000*	3.6
14000*	3.7

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 2A. (US) Storage Capacities

STC Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3	**EOS Model**	Hydrocarbon Storage Capacity gal	**OSR Model**	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3
450	86	46	**4-175**	175	**065**	115	46
900	251	75	**9-365**	365	**140**	233	58
1200	251	113	**12-950**	591			
1800	251	193					
2400	840	155	**24-1400**	1457	**250**	792	156
3600	840	232	**36-1700**	1773			
4800	909	465	**48-2000**	2005	**390**	1233	465
6000	909	609	**60-2500**	2514			
7200	1059	726	**72-3400**	3418	**560**	1384	690
11000*	2797	942	**110-5000***	5023	**780***	2430	930
13000*	2797	1230	**130-6000***	6041			
16000*	3055	1470	**160-7800***	7850	**1125***	2689	1378

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 2B. (CA & Int'l) Storage Capacities

STC Model	Hydrocarbon Storage Capacity L	Sediment Capacity L	EOS Model	Hydrocarbon Storage Capacity L	OSR Model	Hydrocarbon Storage Capacity L	Sediment Capacity L
300	300	1450	**300**	662	**300**	300	1500
750	915	3000	**750**	1380	**750**	900	3000
1000	915	3800	**1000**	2235			
1500	915	6205					
2000	2890	7700	**2000**	5515	**2000**	2790	7700
3000	2890	11965	**3000**	6710			
4000	3360	16490	**4000**	7585	**4000**	4700	22200
5000	3360	20940	**5000**	9515			
6000	3930	26945	**6000**	12940	**6000**	5200	26900
9000*	10555	32980	**9000***	19010	**9000***	9300	33000
11000*	10555	37415	**10000***	22865			
14000*	11700	53890	**14000***	29715	**14000***	10500	53900

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

What equipment is typically required for inspection?

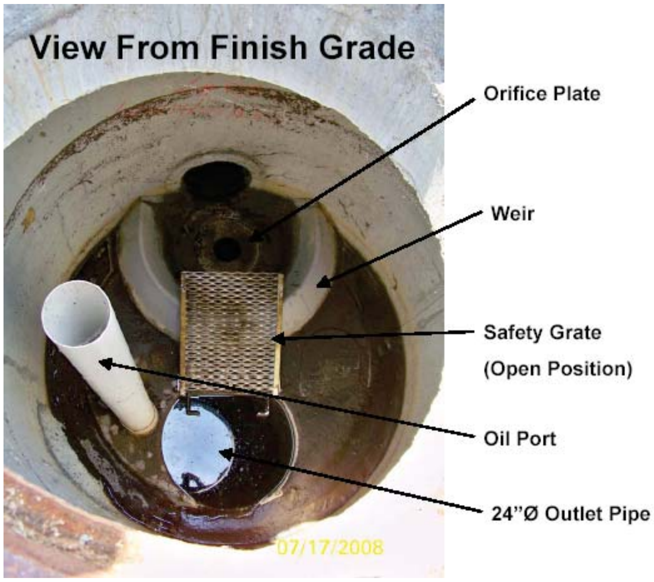
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Recommended Stormceptor Inspection Procedure:

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.

Figure 4.



What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. ***DO NOT ENTER THE STORMCEPTOR CHAMBER*** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
    - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
    - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

Figure 5.

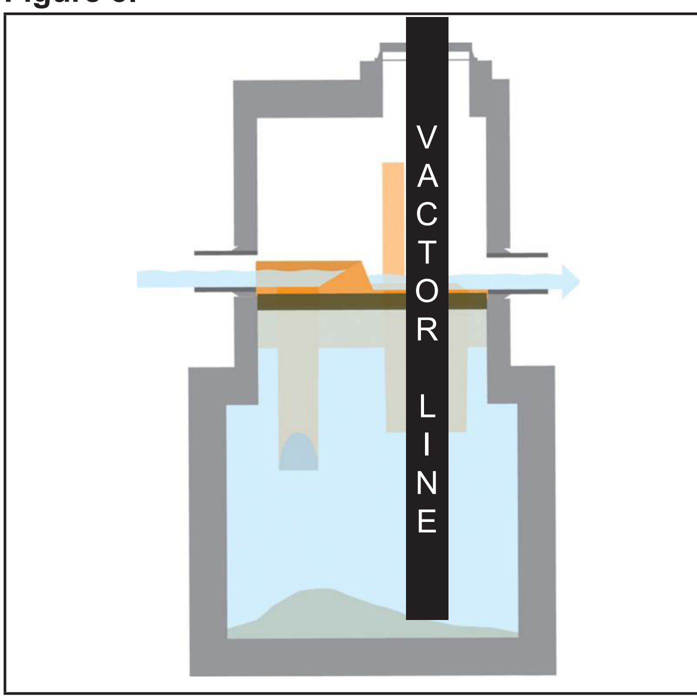
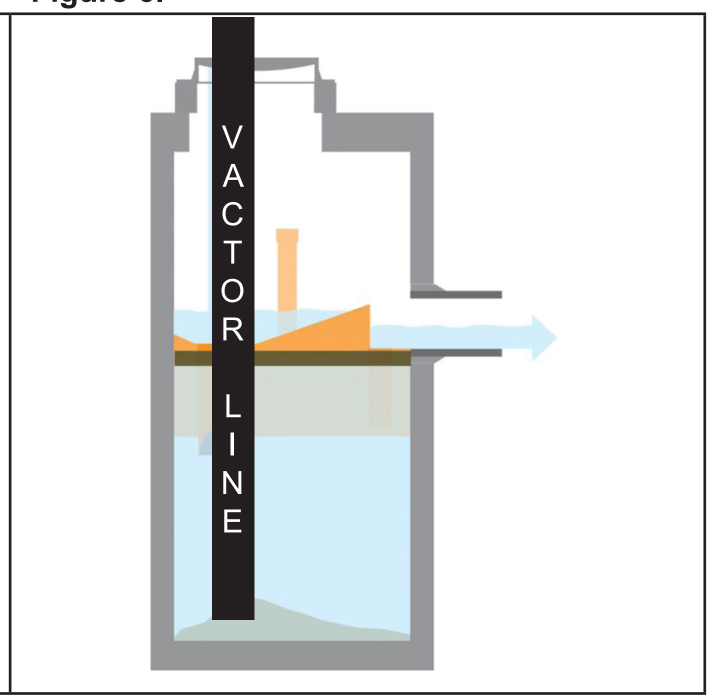


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

Figure 7.

Figure 8.

A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that the unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?
The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?
Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

Table 3A. (US) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (in)	EOS Model	Maintenance Sediment depth (in)	Oil Storage Depth (in)	OSR Model	Maintenance Sediment depth (in)
450	8	**4-175**	9	24	**065**	8
900	8	**9-365**	9	24	**140**	8
1200	10	**12-590**	11	39		
1800	15					
2400	12	**24-1400**	14	68	**250**	12
3600	17	**36-1700**	19	79		
4800	15	**48-2000**	16	68	**390**	17
6000	18	**60-2500**	20	79		
7200	15	**72-3400**	17	79	**560**	17
11000*	17	**110-5000***	16	68	**780***	17
13000*	20	**130-6000***	20	79		
16000*	17	**160-7800***	17	79	**1125***	17

Note:
1. *The values above are for typical standard units.*

**Per structure.*

Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (mm)	EOS Model	Maintenance Sediment depth (mm)	Oil Storage Depth (mm)	OSR Model	Maintenance Sediment depth (mm)
300	225	**300**	225	610	**300**	200
750	230	**750**	230	610	**750**	200
1000	275	**1000**	275	990		
1500	400					
2000	350	**2000**	350	1727	**2000**	300
3000	475	**3000**	475	2006		
4000	400	**4000**	400	1727	**4000**	375
5000	500	**5000**	500	2006		
6000	425	**6000**	425	2006	**6000**	375
9000*	400	**9000***	400	1727	**9000***	425
11000*	500	**10000***	500	2006		
14000*	425	**14000***	425	2006	**14000***	425

Note:

1. *The values above are for typical standard units.*

   **Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: ______________________

Allowable Sediment Depth: ______________________

Serial Number: ______________________

Installation Date: ______________________

Location Description of Unit: ______________________

Other Comments: ______________________

Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

Stormceptor Licensees:

CANADA

Lafarge Canada Inc.
www.lafargepipe.com

403-292-9502 / 1-888-422-4022	Calgary, AB
780-468-5910	Edmonton, AB
204-958-6348	Winnipeg, MB, NW. ON, SK

Langley Concrete Group
www.langleyconcretegroup.com

604-502-5236	BC

Hanson Pipe & Precast Inc.
www.hansonpipeandprecast.com

519-622-7574 / 1-888-888-3222	ON

Lécuyer et Fils Ltée.
www.lecuyerbeton.com

450-454-3928 / 1-800-561-0970	QC

Strescon Limited
www.strescon.com

902-494-7400	NS, NF
506-633-8877	NB, PE

UNITED STATES

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

AUSTRALIA & SOUTHEAST ASIA, including New Zealand & Japan

Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

Imbrium Systems Inc. & Imbrium Systems LLC

Canada	1-416-960-9900 / 1-800-565-4801
United States	1-301-279-8827 / 1-888-279-8826
International	+1-416-960-9900 / +1-301-279-8827
Email	info@imbriumsystems.com

www.imbriumsystems.com
www.stormceptor.com

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Save Valuable Land and Protect Water Resources

Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

U.S. GREEN BUILDING COUNCIL MEMBER

1.0 The Isolator® Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patented technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

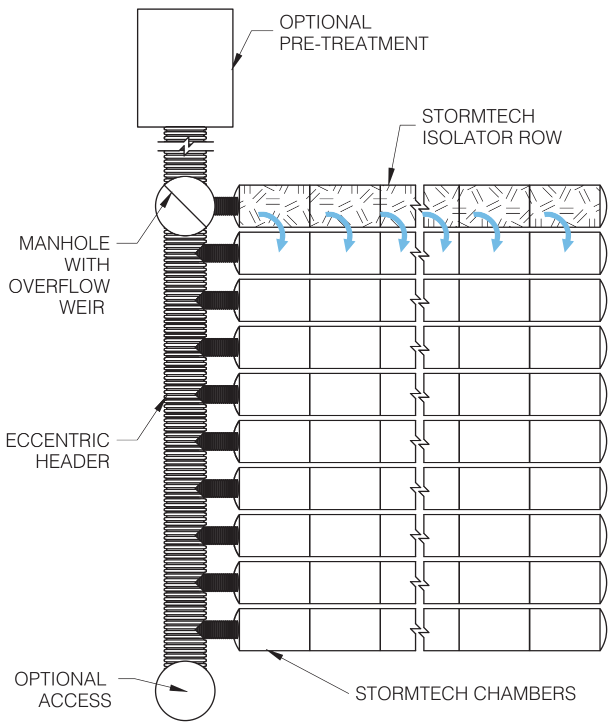
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

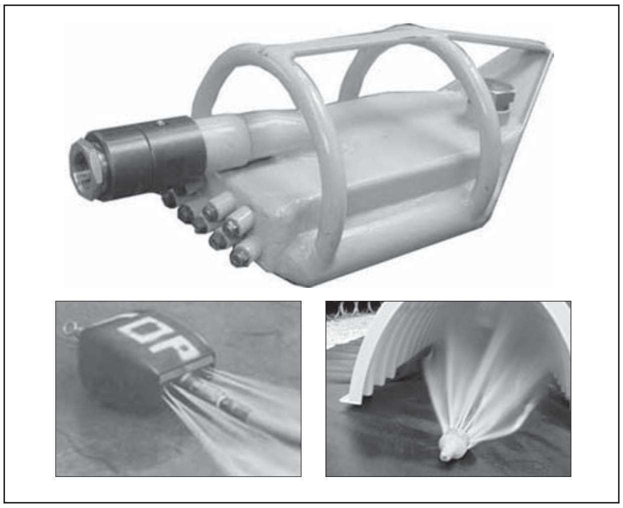
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

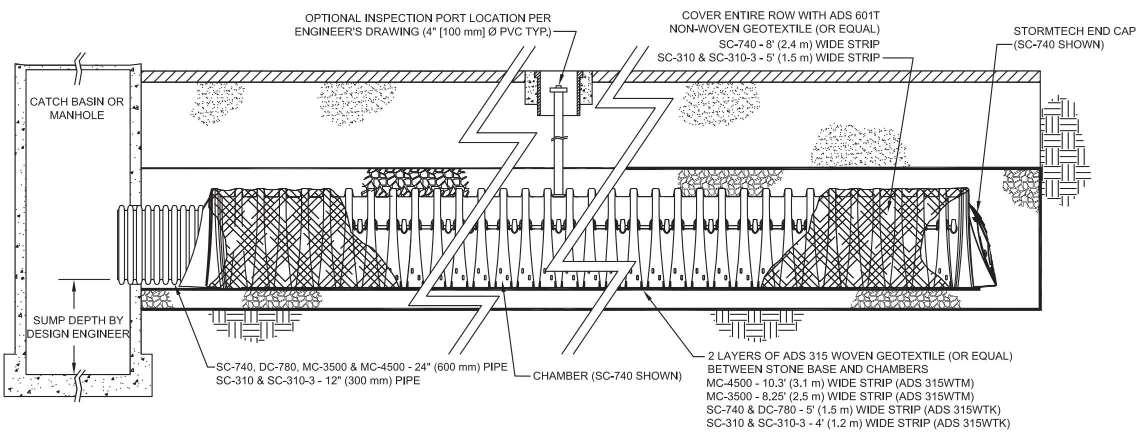
The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

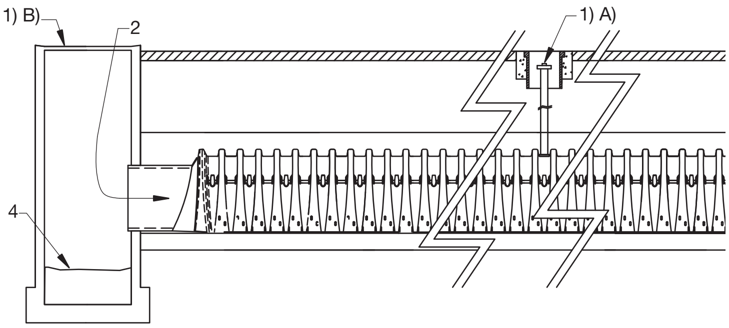
i. Remove cover from manhole at upstream end of Isolator Row

ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry
2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings: Fixed point to chamber bottom (1)	Stadia Rod Readings: Fixed point to top of sediment (2)	Sediment Depth (1) - (2)	Observations/Actions	Inspector
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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A division of ADS

70 Inwood Road, Suite 3 | Rocky Hill | Connecticut | 06067
860.529.8188 | 888.892.2694 | fax 866.328.8401 | www.stormtech.com

Project: ______________________ Responsible Party: ______________________

Address: ______________________ Date: ______________________

BPM Name: ______________________

Operation & Maintenance Inspection Checklist

BMP Element:	Potential Problem:	Resolution:	Pass	Fail	Recommended Remediation
Bituminous Concrete Roadway	Build-up of sediment over the winter months and collection of leaves during the fall months.	Sweep roadway using a high-efficiency street sweeper.			
Deep-Sump Catch Basins	Sediment has accumulated to a depth greater than the original design depth for sediment storage, approximately 2-feet of sediment.	Remove the sediment and dispose of in accordance with local and state regulations.			
Stormwater Piping	Blockage of inlet/outlet pipes due to debris or sediment accumulation.	Remove any debris and sediment via proper means. Dispose of debris/sediment in accordance with local & state regulations			
Proprietary Treatment Device	Sediment has accumulated to a depth greater than the original design depth for sediment storage.	Remove sediment and disposed of in accordance with local and state regulations.			
Subsurface Infiltration Basin	Accumulation of sediment at the inlet structure above maintenance level.	Remove the sediment and conduct proper maintenance to the up-gradient pretreatment devices.			
Flared End Sections	Vegetation has started to grow within the riprap area.	Remove vegetation immediately.			
	Accumulation of sediment/debris at the culvert inlet.	Remove sediment or debris such that the culvert has free flow.			
	Erosion is occuring where riprap has been dislodged.	Remedy scoured area and replace riprap immediately.			

______________________ Inspector's Signature

______________________ Date

Appendix H: Illicit Discharge Compliance Statement

Illicit Discharge Compliance Statement

The owners of the land/responsible party will be responsible for prohibiting illicit discharges to the stormwater management system during construction and during its life of operation. The stormwater management system is comprised of the components for conveying, treating, and infiltrating stormwater runoff on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. An illicit discharge shall constitute any connection or discharge to the stormwater management system including, but not limited to, wastewater discharges, discharge of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease.

Responsible Party:

Sao Joao Realty, LLC
475 Southampton Road
Westfield, Massachusetts

____ __________________

Signature of Responsible Party Representative Date

Appendix H: Low Impact Development Narrative

Low Impact Development Considerations

Proposed Drive-Through Restaurant

Haydenville, Massachusetts

Project Location:

142 Main Street
Map K, Parcel 192
Haydenville, Massachusetts

Prepared for:

Sao Joao Realty, LLC
475 Southampton Road
Westfield, Massachusetts

RLA Project File: 150407

July 30, 2015

R LEVESQUE ASSOCIATES, INC
A LAND PLANNING SERVICES COMPANY
40 School Street · Westfield, MA 01085
p 413.568.0985 · f 413.568.0986 · www.rlaland.com

Introduction

Per the Massachusetts Stormwater Handbook, project proponents must consider environmentally sensitive site design and low impact development techniques to effectively manage stormwater. As a part of the proposed project, the proponent has considered a number of environmentally sensitive, low impact development techniques to prevent the generation of stormwater and non-point source pollution.

The following is a detailed description of the considerations for each low impact development measure. For ease of review, RLA has provided the consideration of each measure as detailed in the Massachusetts Stormwater Report Checklist.

Low Impact Development (Lid) Measures

1. Environmentally Sensitive Project Approach

   During the design feasibility effort for the project, RLA considered several design scenarios for the development and layout of the proposed project. The proposed design is for the construction of a drive-through restaurant and associated site improvements on a previously developed site. The proposed building and paved areas have been moved further away from the river and stormwater controls have been added.

2. No disturbance to any Wetland Resource Areas

   The project was designed in the least intrusive manner possible. There is no work proposed within any wetland resource areas.

3. Site Design Practices (e.g. clustered development, reduced frontage setbacks)

   The project will entail the construction of a drive-through restaurant and paved parking and access aisles. The building has been situated outside the 100-foot Inner Riparian Zone and parking has been placed in front of the building, within the zoning setback line, in an attempt to limit impervious areas and disturbance to land adjacent to the river.

4. Reduced Impervious Area (Redevelopment Only)

   The proposed project is not part of a redevelopment project.

5. Minimizing disturbance to existing trees and shrubs

   The goal of the project proponent is to maintain as much of the existing vegetative cover on-site as possible. Since the property was previously developed, the area is already mostly cleared. The few larger trees along the easterly edge of the site are to remain as is a line of vegetation between the stone retaining wall along the river and the existing lawn area. Additional plantings are proposed within a 4,000 sq. ft. "Restoration Area" adjacent to the river.

6. LID Site Design Credit Requested

   No LID Site Design Credit is requested for the proposed project.

7. Use of "country drainage" versus curb and gutter conveyance and pipe

   Country drainage systems are often times much less costly than closed drainage systems such as gutter conveyance and pipe. Alternatives to the proposed curb and gutter, catch basin, and underground infrastructure were considered. It was discovered that due to the site layout, the project proponent was unable to take advantage of country drainage systems. It was not feasible to convey the water to a pre-treatment and infiltration area that meets the DEP standards by country drainage methods.

8. Bioretention Cells (includes Rain Gardens)

   Due to the site layout along with the proposed curb and gutter stormwater management system, a viable location to include a bioretention cell was not feasible.

9. Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

   There are no wetland impacts proposed, therefore, a constructed wetland is not logical and would create additional regulated area.

10. Treebox Filter

    Treebox filters were considered for the project, however, based on the site layout and design, the extensive costs associated with such a method and the climatic conditions of the area, it is believed that such methods would be detrimental to the proposed project and would only provide a maintenance problem and a potential hazard for the owner.

11. Water Quality Swale

    Due to the layout of the site, a water quality swale has not been included as part of the treatment train process for the stormwater management system.

12. Grass Channel

    Due to the layout of the site, a grassed channel has not been included as part of the treatment train process for the stormwater management system.

13. Green Roof

    Green roofs are not suitable or marketable for the proposed project.

14. Other

    Please see the Stormwater Report for more information.