DRAINAGE REPORT

THE DASCOMB ROAD PROJECT

146 DASCOMB ROAD
ANDOVER, MASSACHUSETTS

Prepared for:

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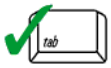
Stormwater Checklist

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.

[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.

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

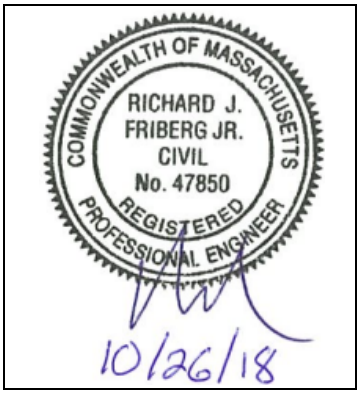
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



10/26/2018

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☐ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

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1

Narrative

Introduction

The proposed project is located on a 16.23-acre parcel of land located at 146 Dascomb Road in Andover, Massachusetts, identified as Assessor's Map 203, Lot 2A-1 (the "Site"). Approximately 0.38-acres of the parcel is located within the Town of Tewksbury, identified as Assessor's Map 113, Lot 24. The Site is abutted by Dascomb Road, Smith Drive, and the Hewlett Packard Site to the north; I-93 to the east; Restaurant Depot, wetlands and a rail road right of way to the south; and Smith Drive and other industrial properties to the west. The Site is identified on the Project Location Map (Figure 1), at the end of this section.

The Applicant is proposing to redevelop the Site by constructing a multi building mixed use development consisting of approximately 524,000 square feet (SF) of retail, office, hotel, fitness, grocery store and restaurant uses with associated parking, landscape, utility and stormwater management infrastructure improvements (the "Project"). The Project is consistent with the vision the Town of Andover developed with the new zoning for the ID-2 District, which was developed to provide amenities in certain industrial and commercial areas of Town.

The drainage study was performed in order to assess the potential impact of the Project. The Site currently consists of a vacant warehouse and office building and paved parking areas. Runoff from the existing site is primarily collected in catch basins and roof drains and conveyed in pipes to a large detention basin located within a drainage easement on the southerly side of the Restaurant Depot property to the south. The Project will provide a stormwater management system incorporating traditional and Low Impact Design (LID) Best Management Practices (BMPs) elements. This analysis has been prepared to verify that the Project will not have an adverse effect on the stormwater conditions both on-site and off-site.

The proposed Stormwater Management Plan has been designed to meet the Stormwater Standards identified in the Massachusetts Department of Environmental Protection (DEP) Massachusetts Stormwater Handbook and the Town of Andover Stormwater Management and Erosion Control

Regulations. The Stormwater Management Design reduces peak runoff rates, reduces the risk of erosion and sedimentation, and improves stormwater runoff quality.

Existing Site Conditions

The existing site is primarily developed consisting of a 153,000 sf warehouse and office building, with associated paved parking and loading areas. Along the frontage of the property to Dascomb Road, the property is primarily wooded area with a cell phone tower located on the north easterly corner adjacent to Dascomb Road and Interstate 93. An intermittent stream and associated bordering vegetated wetlands are located at the north westerly corner adjacent Dascomb Road and Smith Way. The Site ranges in elevation from approximately elevation 152 feet at the top of a hill adjacent to the cell tower and slopes towards the south west to an elevation of approximately 120 feet at the elevation of the office entrance and 110 feet at the Smith Way driveway connection. The existing building has two entry locations, with the warehouse elevation at approximately 112 feet.

Wetland Resource Areas

There is an intermittent stream and associated bordering vegetated wetland located on the north westerly edge of the Property that have been defined in an Outstanding Resource Area Delineation (ORAD) by the Andover + Conservation Commission on August 26, 2013. Additionally, in April 2015, Wetlands Preservation, Inc. flagged additional bordering vegetated wetland at the far southerly finger of the Property. Refer to the Notice of Intent (DEP file number 090-1247) for additional information on jurisdictional wetland areas at the Property.

100-Year Flood Plain

According to the FEMA Flood Insurance Rate Maps (FIRM), map number 25009C0356F, dated July 3, 2012, the site is not located within the 100-year floodplain. Refer to the attached FIRM Figure at the end of this section (Figure 3).

Subsurface Conditions

According to the National Resource Conservation Service (NRCS), the site is comprised of Hinkley loamy sand, Charlton-Rock outcrop-Hollis complex and Urban land. This soil surrounding the Urban land is classified as hydrologic soil group (HSG) A. Refer to the NRCS Soils Map (Figure 2) at the end of this section.

Two sets of test pits, nine in total, were performed on site. The first set of test pits (4) were performed on June 1st , 2015 by S&R Corporation under the supervision of TEC, Inc. and Merrimack Engineering Services. The second set of test pits (5) were performed on November 16, 2017 by S&R Corporation under the supervision of TEC, Inc. The test pits were logged by a licensed

soil evaluator to confirm the soil types onsite and estimate seasonal high groundwater (ESHGW) elevation at nine different locations. The test pit logs and a map showing the pit locations can be found in Appendix F.

Test pit logs shows that the ESHGW onsite was found between 30" and >80" below the ground surface at the four different test pits. The soils onsite range from a coarse sand to a fine sandy loam, which is consistent with NRCS data.

For the purposes of stormwater management and infiltration best management practices (BMPs), an infiltration rate of 2.41 inches per hour (in/hr) will be used as a conservative value for a HSG A soil group.
The proposed stormwater BMPs have been designed to incorporate the findings of the soil evaluations. All infiltrating BMPs have been designed to provide four feet minimum separation from ESHGW. A Geotechnical Report will be developed for the Project prior to start of construction.

Proposed Site Conditions

The proposed Site will convert the Property to a desirable commercial development including approximately 524,000 SF of retail, office, hotel, fitness, grocery store and restaurant uses with associated parking, landscape, utility and stormwater management infrastructure improvements. The proposed site layout includes seven separate buildings totaling approximately 165,000 SF of footprint area. Associated parking to support the development will be located at-grade and also within a three-level parking deck to be constructed beneath portions of the site.

Proposed Construction Sequencing Plan

The following outline presents key construction activities in typical sequences that are generally anticipated for the project:

1. Perform survey layout of erosion and sediment control measures
2. Selectively remove vegetation for haybale/silt fence installation
3. Install hay bales/silt fence
4. Install construction fencing as needed
5. Stabilize construction entrance
6. Construct temporary stormwater features as needed
7. Clear and grub areas according to Site Plans
8. Strip and stockpile soil
9. Conduct earthwork cuts and fills as needed
10. Temporarily stabilize open cut and fill areas as needed
11. Construct wetland replication area
12. Construct utilities/permanent stormwater features
13. Initiate building construction
14. Construct parking/driveways through binder course
15. Complete building construction
16. Finish grade green space areas

17. Permanently stabilize green space areas
18. Construct parking/driveways through top course
19. Install pavement markings/signage
20. Remove all erosion and sediment control measures upon completion of construction

Methodology

The overall Stormwater Management Plan, which will be implemented as part of the Project, will improve the collection, management, and treatment of the stormwater.

Existing and proposed hydrologic conditions were analyzed using HydroCAD, an SCS TR-20 based program, to calculate existing and proposed peak discharge rates. This method takes into account existing and proposed pervious and impervious areas including soil types and hydrologic classifications. Runoff curve numbers from the Town of Andover regulations were used in the drainage study. The 2, 10, 25, and 100-year, 24-hour storm frequencies were used in the analysis in accordance with the MassDEP and the Town of Andover requirements.

The "Regulatory Compliance" portion of this report addresses the MassDEP Stormwater Management Performance Standards under the Wetlands Protection Act.

Pre-Development Runoff

The existing site is divided into six subcatchment areas discharging to four design points. Design Point 1 (DP-1) consists of runoff from the northerly portion of the site, which ultimately flows towards Dascomb Road and into the intermittent stream at the north westerly edge of the Property. Design Point 2 (DP-2) consists of runoff from the parking lot and half of the building rooftop, which ultimately flows towards the southerly property line and into the existing closed drainage system. Design Point 3 (DP-3) consists of runoff from the easterly portion of the site, which flows to the southeasterly corner of the site and discharges to an existing drainage swale flowing parallel to the existing building. Design Point 4 (DP-4) consists of runoff from the second driveway along Smith Drive and discharges into the drainage system in Smith Drive. Refer to Figure D-1, *Pre-Development Drainage Areas,* for the existing conditions drainage areas. The subcatchments are described in more detail below.

The northern portion of the site (EX-1) is comprised of 136,858 SF of wooded/vegetated area, 14,866 SF of pervious grass area, and 7,602 SF of gravel road area (leading up to cell tower). Stormwater runoff from EX-1

flows over land northerly toward Dascomb Road and ultimately into the intermittent stream at the northwesterly corner of the Property (DP-1).

Subcatchment area EX-2a is comprised of approximately 14,656 SF of wooded/vegetated area, 54,046 SF of pervious grass area, 833 SF of gravel roads, 8,360 SF of rooftop, and 151,738 SF of impervious pavement. The rooftop runoff is collected by roof drains and conveyed by piping to the existing closed drainage system (DP-2). The remaining stormwater runoff from EX-2a flows overland and is collected by the same existing closed drainage system. The runoff is conveyed by piping to the southerly property line (DP-2).

Subcatchment area EX-2b is comprised of approximately 76,387 SF of rooftop area. Stormwater runoff from EX-2b is collected by roof drains and conveyed by piping to the southerly property line (DP-2).

The easterly portion of the site (EX-3a) is comprised of approximately 67,324 SF of wooded/vegetated area, and 27,087 SF of pervious grass area. Stormwater runoff from EX-3a flows over land to an existing drainage swale at the southeasterly corner of the Property (DP-3).

The easterly portion of the site (EX-3b) is comprised of approximately 76,790 SF of rooftop area. Stormwater runoff from EX-3b is collected by roof drains and conveyed to an existing drainage swale at the southeasterly corner of the Property (DP-3).

Subcatchment area EX-4 is comprised of approximately 5,000 SF of pervious grass area and 4,450 SF of impervious pavement. Runoff from EX-4 sheet flows over land and down the second driveway along Smith Drive where it is collected by catch basins and enters the existing drainage system along Smith Drive.

Post-Development Runoff

The Project consists of construction of approximately 165,000 square feet of retail/office building footprint, with associated parking, landscape, utility and stormwater management infrastructure. There is an overall increase in impervious area with the proposed site due to the undeveloped nature of a portion of the existing site.

The proposed stormwater management system for this project involves traditional and low impact design BMPs. BMPs proposed for the site include pavement sweeping, deep sump catch basins with hoods, water quality units, infiltration basins, and subsurface infiltration basins with isolator row technology.

The proposed stormwater management system is designed to mitigate the effects of the proposed development by reducing the peak rates of runoff as compared to the existing conditions. In the proposed conditions analysis, the same design points identified and analyzed under the existing conditions were analyzed. The post-development subcatchment areas are identified in Figure D-2, *Post-Development Drainage Areas*, and described in more detail below.

Proposed Subcatchment Area #1 (PR-1) has a total area of 55,733 SF, all of which is green area, located along the northern border of the Property. Runoff from PR-1 flows overland and discharges directly into the intermittent stream along Dascomb Road (DP-1).

Proposed Subcatchment Area #2 (PR-2) consists of the northern drive entrance, parking, impervious sidewalk, roof area and green space in the northern corner of the Property. PR-2 totals 136,422 SF, comprised of 53,929 SF of green space, 17,745 SF of roof area and 64,748 SF of impervious parking, driveway and sidewalk. Runoff from PR-2 is collected by catch basins and conveyed into the proposed subsurface infiltration basin P1 for infiltration. Overflow from the subsurface infiltration basin will be conveyed by piping to the existing closed drainage system at the southerly Property line (DP-2).

Proposed Subcatchment Area #3 (PR-3) consists of roof area, parking, impervious sidewalk, and greenspace. PR-3 totals 174,957 SF, comprised of 88,030 SF of roof area, 14,354 SF of green space, and 72,573 SF of impervious parking, driveway, and sidewalk. Runoff from PR-3 is collected by catch basins and is conveyed into the proposed subsurface infiltration basin P1 for infiltration. Overflow from the subsurface infiltration basin will be conveyed by piping to the existing closed drainage system at the southerly Property line (DP-2).

Proposed Subcatchment Area #4 (PR-4) consists of parking, roof area, and green space .The total area for PR-4 is 84,569 SF and is comprised of 6,476 SF of green space, 48,795 SF of roof space and 29,298 SF of impervious parking and sidewalks. Runoff from PR-4 is collected by catch basins and is conveyed by piping and treated in a subsurface infiltration basin P2. Overflow from the subsurface infiltration basin is conveyed by piping to the existing closed drainage system at the southerly Property line (DP-2).

Proposed Subcatchment Area #5 (PR-5) consists of parking, sidewalks, and green space. The total area for PR-5 is 81,090 SF and is comprised of 27,244 SF of green space and 53,846 SF of impervious parking and sidewalks. Runoff from PR-5 is collected by catch basins and conveyed by piping and treated in a subsurface infiltration basin P3. Overflow from the subsurface infiltration basin is conveyed by piping to the existing closed drainage system at the southerly Property line (DP-2).

Proposed Subcatchment Area #6 (PR-6) consists of parking, roof area, and green space. The total area for PR-6 is 22,193 SF and is comprised of 1,570 SF of green space, 10,085 SF of roof space and 30,362 SF of impervious parking and sidewalks. Runoff from PR-6 is conveyed by piping to the existing closed drainage system at the Southerly Property line (DP-2).

Proposed Subcatchment Area #7 (PR-7) consists of parking, impervious sidewalk, and green space in the eastern side of the Property. PR-7 area totals 79,925 SF, comprised of 28,730 SF of proposed green space and 51,195 SF of impervious parking and sidewalk. Runoff from PR-7 will be collected by catch basins and conveyed to DP-3.

Proposed Subcatchment Area #8 (PR-8) consists of impervious driveway area along the southwesterly side of the Property. PR-8 area totals 2,011 SF and is comprised entirely of 2,011 SF of impervious driveway. Runoff from PR-8 will be conveyed to the existing drainage system along Smith Drive (DP-4).

Table 1 presents a summary of the pre and post development hydrologic analysis comparing the peak flow rates generated from the 2-, 10-, 25-, and 100-year storm events.

Table 1 Peak Flow Summary

	2-Year Storm		10-Year Storm		25-Year Storm		100-Year Storm	
Discharge Point	**Exist (cfs)**	**Prop (cfs)**	**Exist (cfs)**	**Prop (cfs)**	**Exist (cfs)**	**Prop (cfs)**	**Exist (cfs)**	**Prop (cfs)**
DP-1	0.00	0.00	0.03	0.02	0.10	0.13	0.58	0.42
DP-2	16.20	5.18	26.73	12.20	33.07	21.23	41.50	31.61
DP-3	5.18	3.93	7.74	6.81	9.27	8.54	11.35	10.84
DP-4	0.37	.14	0.69	.21	0.89	.25	1.17	.31

The proposed project does not increase peak runoff rates over the existing conditions for the 2, 10, 25, and 100-Year storm events, in accordance with local and state regulations.

Refer to Appendix A for the hydrologic modeling calculations.

The closed drainage system has been designed to control the 10-year storm event at a minimum. Additionally, the 100-year storm event was analyzed and adequate pipe capacity is available within the pipe network to control the discharge from the subsurface infiltration basins.

TSS Removal

The stormwater management plan for this project utilizes BMPs including street sweeping, deep sump catch basins with hoods, water quality units, and

subsurface infiltration basins with an isolator row. No credit has been taken for street sweeping in the TSS removal calculations; however, the Operations and Maintenance plan calls for at least quarterly sweeping of the property.

The Site is considered a Land Use with Higher Potential Pollutant Loads (LUHPPL) due to the projected traffic generation in excess of 1,000 vehicle trips per day. LUHPPLs require a 44% pretreatment rate for stormwater runoff prior to entering an infiltrating device. Also, LUHPPLs require a 1" water quality volume be provided for all BMPs.

The BMP treatment trains were designed to provide a minimum of 44% pretreatment prior to discharge into an infiltrating device and achieving a minimum of 80% TSS removal, for 1" of runoff, as required by the Massachusetts Stormwater Regulations. Two treatment trains have been incorporated into the Stormwater Management System.

Treatment Train #1, consists of:

1. Deep sump catch basins with hoods
2. Water quality unit (Stormceptor)
3. Isolator Row (Stormtech)
4. Subsurface Infiltration Basin (Stormtech Chambers)

Treatment Train #2, consists of:

1. Deep sump catch basins with hoods
2. Water Quality Unit (Stormceptor)

Refer to *Appendix B-Water Quality Data* for TSS Removal Spreadsheets and data supporting the use and effectiveness of the water quality units.

Regulatory Compliance

The DEP/CZM Stormwater Management Policy prescribes ten performance standards for site development projects. Because the project will increase the overall impervious area onsite, it cannot be considered a redevelopment project, and has been designed to comply with the MassDEP Stormwater Management Standards completely. Compliance with the standards is outlined below.

1. *No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth*.

This project proposes no new untreated stormwater discharges or will cause erosion in the wetlands or waters of the Commonwealth.

2. *Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates*.

As summarized in Table 1 Peak Flow Summary, the project reduces peak discharge rates for the 2, 10, 25, and 100-Year storm events. The HydroCAD analysis and output can be found in Appendix A, *Hydrology Calculations*.

3. *Loss of annual recharge to groundwater should be minimized through the use of infiltration measures where feasible*.

The proposed stormwater management utilizes three subsurface infiltration basins to provide groundwater recharge. The required recharge volume is determined based on the total proposed impervious area and the classification of the soils on site (Hydrologic Soil Type A).

Calculation Method 1 (Mass DEP Stormwater Handbook)
Rv = F x Impervious Area

Rv = Required Recharge Volume, expressed in cubic feet

F = Target Depth Factor associated with each Hydrologic Soil Group

Impervious Area = Pavement and rooftop area on site

NRCS HYDROLOGIC SOIL TYPE	APPROX. SOIL TEXTURE	TARGET DEPTH FACTOR (F)
A	**sand**	**0.6-inch**
B	loam	0.35-inch
C	silty loam	0.25-inch
D	clay	0.1-inch

Recharge Target Depth by Hydrologic Soil Group

Rv = (0.60-inch) x 448,886 SF of Total Impervious Area
Rv = 22,445 cubic feet of Required Recharge Volume

Volume Infiltrated during 2-year storm event (From HydroCAD):
P1 = 0.839 af = 36,547 cubic feet
P2 = 0.329 af = 14,331 cubic feet
P3 = 0.165 af = 7,188 cubic feet
Total Proposed Rv = 58,066 cubic feet
Therefore, storage volume of the basins and volume of stormwater infiltrated exceed the requirements of Standard 3.

Calculation Method 2 (Town of Andover Stormwater Regulations Section IX.A.1)
$Re_v = [(S)(R_v)(A)]/12$, where
Re_v = Recharge volume (acre*feet)
$R_v = 0.05 + 0.009(I)$ where I is the percent impervious cover
A = site area in acres
S = Soil specific recharge factor

Hydrologic Group	Soil Specific Recharge Factor
A	0.60
B	0.35
C	0.25
D	0.10

For A Soils
I=70.5, R_v = 0.685, A=14.62, S=0.60
Re_v = [(0.60)(0.685)(14.62)]/12 = 0.501 acre*feet
Re_v = 21,812 CF
Total Proposed Re_v = 58,066 CF

Confirm that P1 will empty within 72 hours:
Volume of Storage Below Outlet = 12,457 CF
Infiltration Rate (HSG A soil) = 2.4"/hr
Footprint Area of P1 bottom = 9,100 SF
Time to Drain = 12,457 CF / (2.4"/hr) x (9,100 SF) = **6.84 hr < 72 hr**

Confirm that P2 will empty within 72 hours:
Volume of Storage Below Outlet = 3,064 CF
Infiltration Rate (HSG A soil) = 2.4"/hr
Footprint Area of P2 = 5,757 SF
Time to Drain = 3,064 CF / (2.4"/hr) x (5,757 SF) = **2.66 hr < 72 hr**

Confirm that P3 will empty within 72 hours:
Volume of Storage Below Outlet = 4,655 CF
Infiltration Rate (HSG A soil) = 2.4"/hr
Footprint Area of P3 = 6,350 SF
Time to Drain = 4,655 CF / (2.4"/hr) x (6,350 SF) = **3.67 hr < 72 hr**

4. *For new development, stormwater management systems must be designed to remove 80 percent of Total Suspended Solids*.

The proposed stormwater management design will implement BMP's including street sweeping, deep sump catch basins with hoods, water quality units, and subsurface infiltration basin with an isolator row to exceed the 80% TSS removal rate for all on-site runoff. The project proposes two different treatment trains that all meet the 80% minimum TSS removal requirement. Treatment train 1 achieves a 99% removal rate and treatment train 2 achieves a 83% removal rate. Please see the attached TSS removal sheets for reference.

The proposed BMPs have been sized to accommodate 1-year worth of sediment as required by Town of Andover Stormwater Regulations. Please see below calculations:

Sediment volume = Area to be sanded (acres) x 750 (lb/acre-storm) / 90 (pounds/cf) x 10 (storms/year) = (cf of sediment/year)

Sediment volume (WQU 1) = 1.18 ac x 750lb/ac-storm / 90lb/cf x 10storm/yr
Sediment volume (WQU 1) = 98 cf of sediment/year < **127 cf (STC 1200)**

Sediment volume (WQU 2) = 3.15 ac x 750lb/ac-storm / 90lb/cf x 10storm/yr
Sediment volume (WQU 2) = 263 cf of sediment/year < **373 cf (STC 3600)**

Sediment volume (WQU 3) = 0.67 ac x 750lb/ac-storm / 90lb/cf x 10storm/yr
Sediment volume (WQU 3) = 56 cf of sediment/year < **89 cf (STC 900)**

Sediment volume (WQU 4) = 1.24 ac x 750lb/ac-storm / 90lb/cf x 10storm/yr
Sediment volume (WQU 4) = 103 cf of sediment/year < **127 cf (STC 1200)**

Sediment volume (WQU 5) = 0.24 ac x 750lb/ac-storm / 90lb/cf x 10storm/yr
Sediment volume (WQU 5) = 20 cf of sediment/year < **46 cf (STC 450)**

5. *Stormwater discharges from areas with higher potential pollutant loads require the use of specific stormwater management BMPs*.

The proposed project is considered a LUHPPL due to the traffic generation associated with the development. All stormwater will receive a 44% minimum TSS pretreatment rate prior to entering an infiltrating device. Also, all BMPs have been sized to provide a 1" minimum water quality volume.

Water Quality Volumes for P1:
Impervious pavement flowing to P1 = 137,321 SF
Required 1" WQV = 11,444 CF
Provided WQV below lowest outlet = 12,457 CF

Water Quality Volumes for P2:
Impervious pavement flowing to P2 = 29,298 SF
Required 1" WQV = 2,442 CF
Provided WQV below lowest outlet = 3,064 CF

Water Quality Volumes for P3:
Impervious pavement flowing to P3 = 53,846 SF
Required 1" WQV = 4,487 CF
Provided WQV below lowest outlet = 4,655 CF

Overall Site Water Quality Volume:
Impervious pavement area = 220,465 SF
Required 1" WQV = 18,372 CF
Provided WQV below onsite = 20,176 CF

6. *Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas. Critical areas are Outstanding Resource Waters, shell fish beds, swimming beaches, cold water fisheries and recharge areas for public water supplies*.

The site is not located within a critical area.

7. *Redevelopment of previously developed areas must meet the Stormwater Management Standards to the maximum extent practicable*.

The project is not considered a redevelopment.

8. *Erosion and sediment controls must be implemented to prevent impacts during construction or land disturbance activities*.

The project has been designed to include erosion and sedimentation controls to prevent impacts to downgradient property. Construction activities will be isolated from downgradient areas by creating an erosion control barrier with a compost filter sock/tube, silt sacks for existing and proposed catch basins and construction exits.

9. *All stormwater management systems must have an operation and maintenance plan to ensure that systems function as designed*.

The project will include a long-term Operation and Maintenance Plan, see Appendix C, to provide efficient operation of the features of the proposed drainage system.

10*. Illicit Discharges*

Only stormwater will be conveyed to the stormwater management system. No illicit materials will be permitted.

Conclusion

This proposed project will provide a stormwater management system to mitigate the additional impervious area associated with the project. The stormwater management plan controls the flow of stormwater, reduces peak runoff rates, and provides water quality treatment and groundwater recharge. The stormwater management plan provides erosion and sediment control resulting in cleaner stormwater runoff and a Long Term Operation and Maintenance plan to ensure the proper functioning of the system over time. The project has been designed in accordance with the Stormwater Management Policy.

1" = 400'

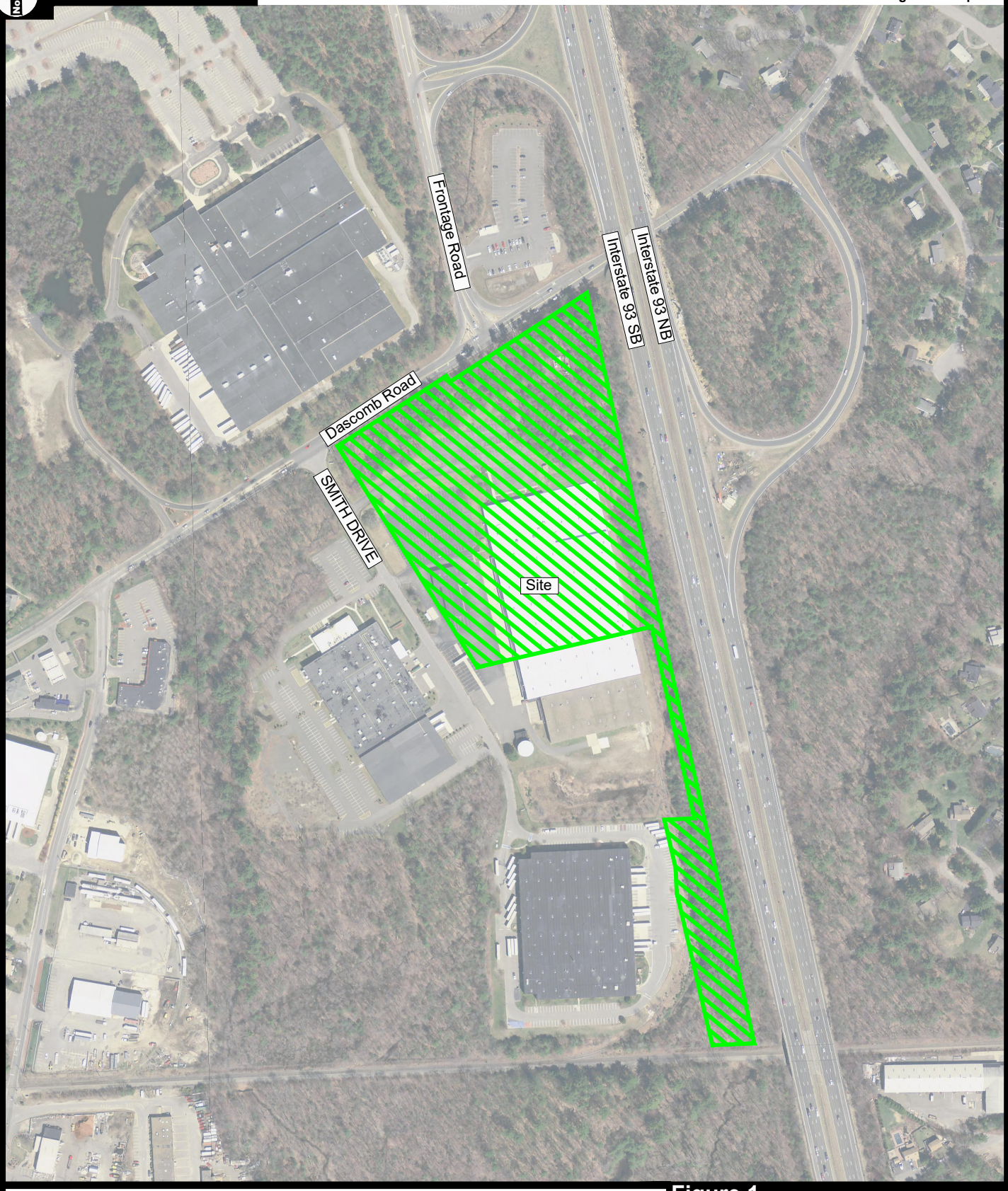

Figure 1

Project Location Map

TEC, Inc.

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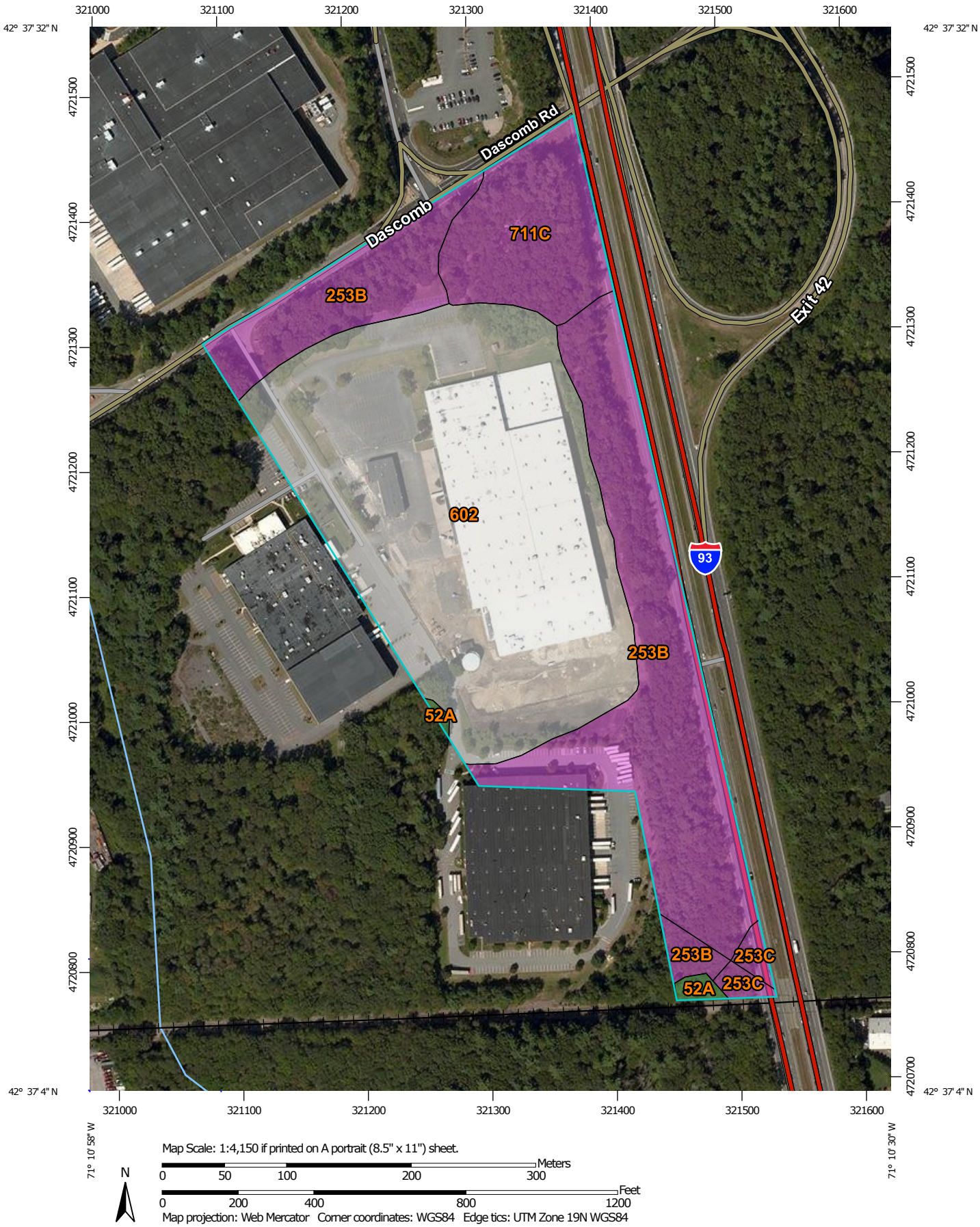

71° 10' 58" W
71° 10' 30" W
321000
321100
321200
321300
321400
321500
321600
42° 37' 32" N
42° 37' 4" N
4721500
4721400
4721300
4721200
4721100
4721000
4720900
4720800
4720700
Dascomb Rd
Dascomb
711C
253B
602
253B
52A
253B
253C
52A
253C
Exit 42
93
Map Scale: 1:4,150 if printed on A portrait (8.5" x 11") sheet.
Meters
0 50 100 200 300
Feet
0 200 400 800 1200
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 scales ranging from 1:15,800 to 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: 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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 10, Sep 19, 2014

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 14, Sep 19, 2014

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Aug 29, 2014—Sep 19, 2014

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Essex County, Massachusetts, Northern Part (MA605)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
52A	Freetown muck, 0 to 1 percent slopes	A/D	0.1	0.2%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	11.7	33.6%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	0.2	0.6%
602	Urban land		18.4	52.9%
711C	Charlton-Rock outcrop-Hollis complex, 8 to 15 percent slopes	A	3.7	10.6%
Subtotals for Soil Survey Area			**34.0**	**97.8%**
Totals for Area of Interest			**34.8**	**100.0%**

Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts (MA017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
52A	Freetown muck, 0 to 1 percent slopes	A/D	0.2	0.5%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	0.4	1.1%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	0.2	0.6%
Subtotals for Soil Survey Area			**0.8**	**2.2%**
Totals for Area of Interest			**34.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

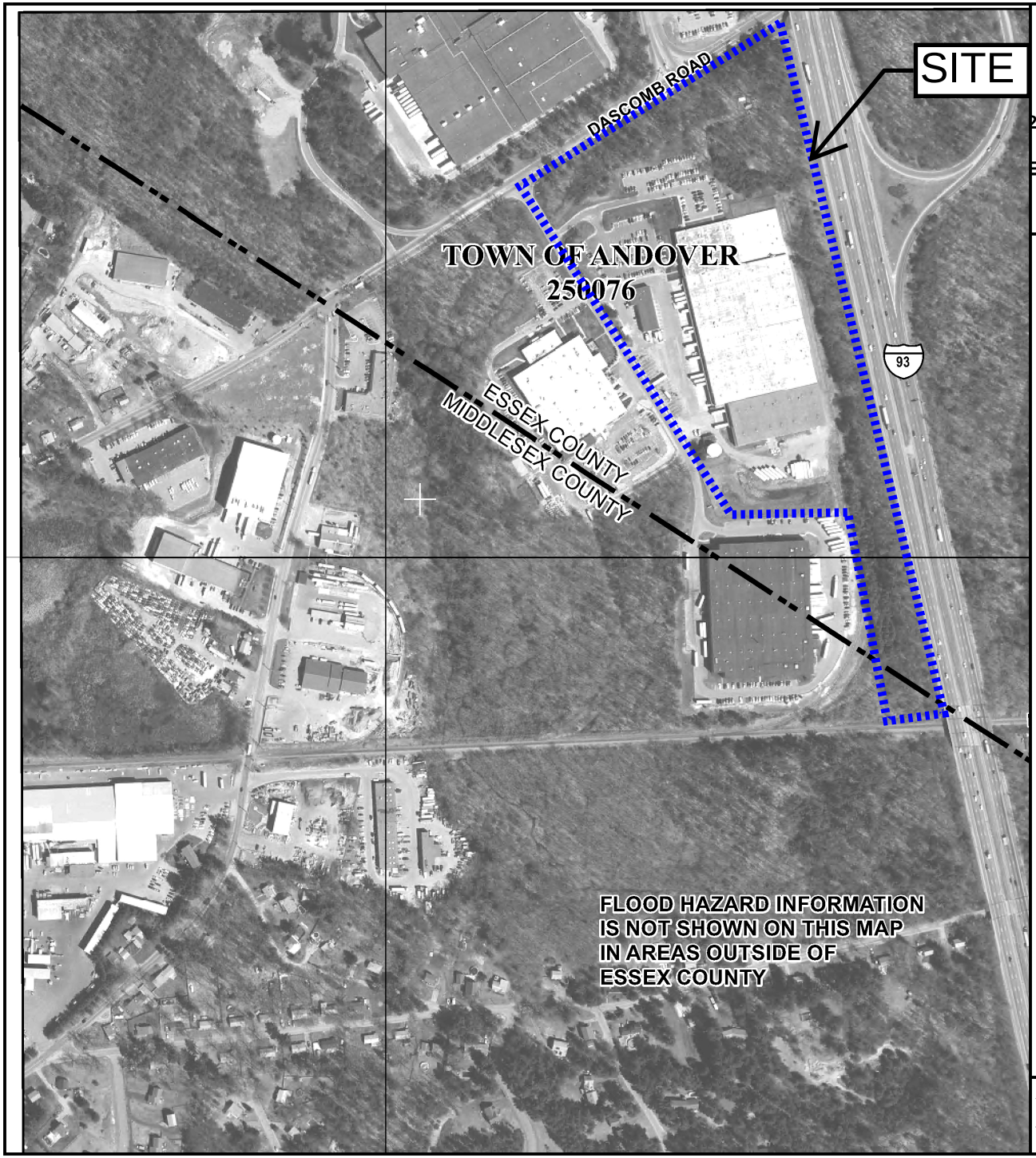
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Essex County



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0356F

FIRM

FLOOD INSURANCE RATE MAP

ESSEX COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

PANEL 356 OF 600

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ANDOVER, TOWN OF	250076	0356	F

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

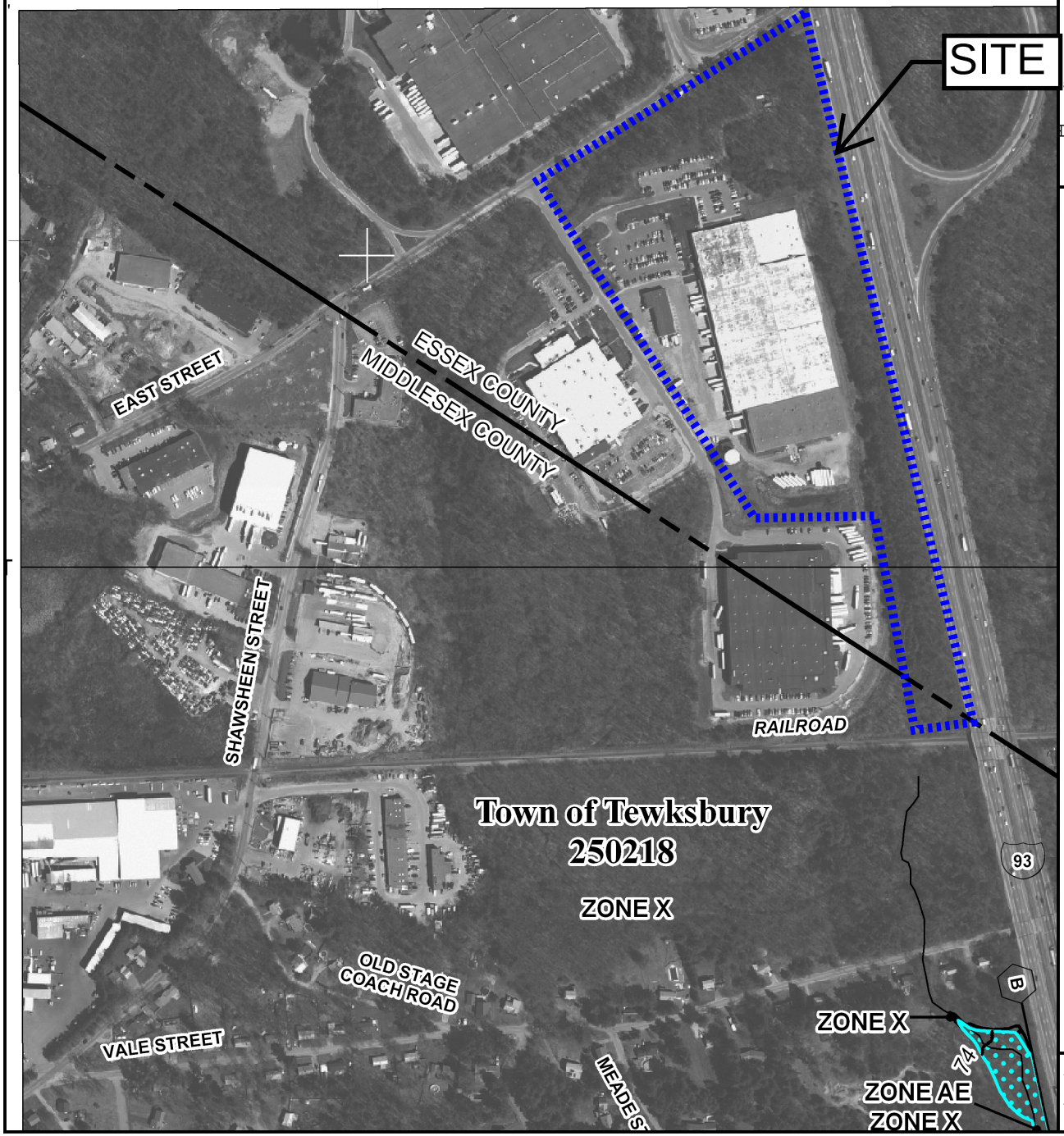
MAP NUMBER
25009C0356F

EFFECTIVE DATE
JULY 3, 2012

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

11'15"



MAP SCALE 1" = 500'

50 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0281E

FIRM

FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 281 OF 656

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
TEWKSBURY, TOWN OF	250218	0281	E
WILMINGTON, TOWN OF	250227	0281	E

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

MAP NUMBER
25017C0281E

EFFECTIVE DATE
JUNE 4, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

146 Dascomb Road - Andover, Massachussets

Scale: 1" = 125'

52A FREETOWN MUCK (HSG D)

253B HINCKLEY LOAMY SAND (HSG A)

602 URBAN LAND (HSG A)

711C CHARLTON–ROCK OUTCROP–HOLLIS COMPLEX (HSG A)

TEWKSBURY
ANDOVER

SMITH WAY

DASCOMB ROAD

INTERSTATE HIGHWAY (ROUTE 93)

PROPOSED
LOT 2B–1
AREA=407,073 S.F.
≈ 9.345 ACRES
AREA IN ANDOVER = 390,382 S.F.
AREA IN TEWKSBURY = 16,691 S.F.

PROPOSED LOT 2A–1
AREA=607,820 S.F.
≈ 13.954 ACRES

MATCHLINE

MATCHLINE

T:\T0681\Docs\Various\Drainage\All Commercial Submittal\CAD\T0681_EXIST.dwg 10/30/2018 9:07:28 PM

LEGEND

EX-1 SUBCATCHMENT AREA

256B SOIL CLASSIFICATION

DP1 DESIGN POINT

DRAINAGE AREA BOUNDARY

SOIL AREA BOUNDARY

Figure D-1

Pre Development
Drainage Areas

146 Dascomb Road - Andover, Massachussets

Scale: 1" = 125'

52A FREETOWN MUCK (HSG D)

253B HINCKLEY LOAMY SAND (HSG A)

602 URBAN LAND (HSG A)

711C CHARLTON–ROCK OUTCROP–HOLLIS COMPLEX (HSG A)

602

52A

TEWKSBURY
ANDOVER

SMITH WAY
(40' WIDE RIGHT OF WAY)

DASCOMB ROAD
(PUBLIC – 60' WIDE)

253B

DP-1

DP-2

DP-3

DP-4

PR-1

PR-2

PR-3

PR-4

PR-5

PR-6

PR-7

PR-8

P2

P3

25' NO DISTURB

50' NO BUILD

100' WETLANDS BUFFER

INTERSTATE HIGHWAY (ROUTE 93)
(PUBLIC – 300' WIDE)
(LAYOUT #4645 ~ LAYOUT #4507)

253B

711C

60 0 60 120
SCALE IN FEET

LEGEND

PR-1 SUBCATCHMENT AREA

256B SOIL CLASSIFICATION

DP1 DESIGN POINT

DRAINAGE AREA BOUNDARY

SOIL AREA BOUNDARY

TEC, Inc.

Figure D-2

Post Development
Drainage Areas

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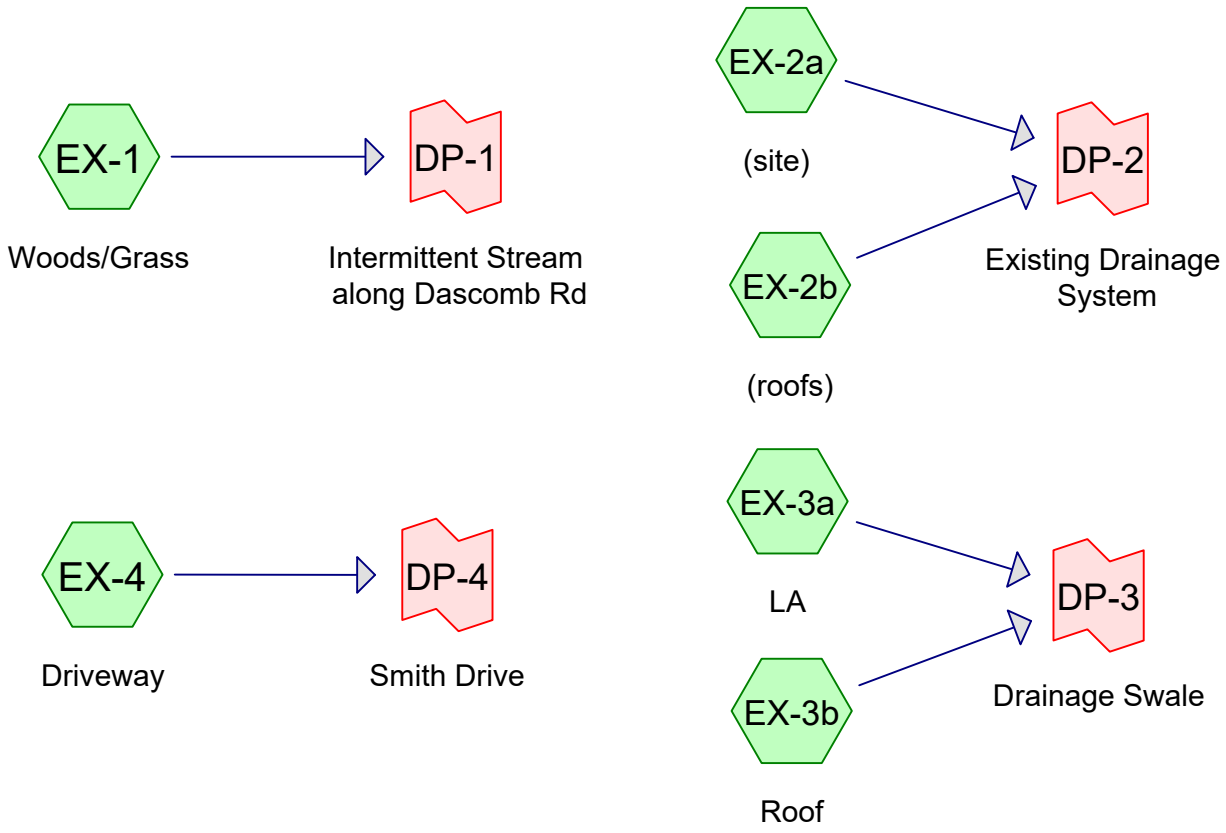
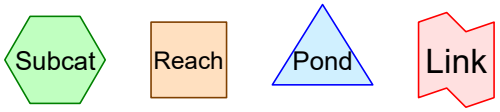
2

Appendix

A

Hydrology Calculations





Routing Diagram for T0681_PRE
Prepared by {enter your company name here}, Printed 10/31/2018
HydroCAD® 10.00-22 s/n 09547 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.319	68	<50% Grass cover, Poor, HSG A (EX-1, EX-2a, EX-3a, EX-4)
0.194	76	Gravel roads, HSG A (EX-1, EX-2a)
3.586	98	Paved parking, HSG A (EX-2a, EX-4)
0.192	98	Roofs, HSG A (EX-2a)
3.516	98	Unconnected roofs, HSG A (EX-2b, EX-3b)
5.024	30	Woods, Good, HSG A (EX-1, EX-2a, EX-3a)
14.830	**70**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
14.830	HSG A	EX-1, EX-2a, EX-2b, EX-3a, EX-3b, EX-4
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
14.830		**TOTAL AREA**

Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 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 EX-1: Woods/Grass Runoff Area=159,326 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=503' Tc=16.5 min CN=36 Runoff=0.00 cfs 0.000 af

Subcatchment EX-2a: (site) Runoff Area=229,633 sf 69.72% Impervious Runoff Depth=1.83"
Tc=6.0 min CN=87 Runoff=11.05 cfs 0.802 af

Subcatchment EX-2b: (roofs) Runoff Area=76,387 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=5.15 cfs 0.419 af

Subcatchment EX-3a: LA Runoff Area=94,411 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=763' Tc=23.3 min CN=41 Runoff=0.00 cfs 0.001 af

Subcatchment EX-3b: Roof Runoff Area=76,790 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=5.18 cfs 0.421 af

Subcatchment EX-4: Driveway Runoff Area=9,450 sf 47.09% Impervious Runoff Depth=1.46"
Tc=5.0 min CN=82 Runoff=0.37 cfs 0.026 af

Link DP-1: Intermittent Stream along Dascomb Rd Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP-2: Existing Drainage System Inflow=16.20 cfs 1.222 af
Primary=16.20 cfs 1.222 af

Link DP-3: Drainage Swale Inflow=5.18 cfs 0.422 af
Primary=5.18 cfs 0.422 af

Link DP-4: Smith Drive Inflow=0.37 cfs 0.026 af
Primary=0.37 cfs 0.026 af

Total Runoff Area = 14.830 ac Runoff Volume = 1.670 af Average Runoff Depth = 1.35"
50.82% Pervious = 7.536 ac 49.18% Impervious = 7.294 ac

Summary for Subcatchment EX-1: Woods/Grass

[45] Hint: Runoff=Zero

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
136,858	30	Woods, Good, HSG A
2,348	76	Gravel roads, HSG A
5,254	76	Gravel roads, HSG A
1,953	68	<50% Grass cover, Poor, HSG A
12,913	68	<50% Grass cover, Poor, HSG A
159,326	36	Weighted Average
159,326		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.0	453	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.5	503	Total			

Summary for Subcatchment EX-2a: (site)

Runoff = 11.05 cfs @ 12.09 hrs, Volume= 0.802 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
151,738	98	Paved parking, HSG A
54,046	68	<50% Grass cover, Poor, HSG A
14,656	30	Woods, Good, HSG A
833	76	Gravel roads, HSG A
8,360	98	Roofs, HSG A
229,633	87	Weighted Average
69,535		30.28% Pervious Area
160,098		69.72% Impervious Area

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

Summary for Subcatchment EX-2b: (roofs)

Runoff = 5.15 cfs @ 12.09 hrs, Volume= 0.419 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
76,387	98	Unconnected roofs, HSG A
76,387		100.00% Impervious Area
76,387		100.00% Unconnected

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

Summary for Subcatchment EX-3a: LA

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
67,324	30	Woods, Good, HSG A
27,087	68	<50% Grass cover, Poor, HSG A
94,411	41	Weighted Average
94,411		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.3	513	0.0740	1.36		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	200	0.0200	4.93	11.33	**Channel Flow,** Area= 2.3 sf Perim= 3.9' r= 0.59' n= 0.030 Stream, clean & straight
23.3	763	Total			

Summary for Subcatchment EX-3b: Roof

Runoff = 5.18 cfs @ 12.09 hrs, Volume= 0.421 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
76,790	98	Unconnected roofs, HSG A
76,790		100.00% Impervious Area
76,790		100.00% Unconnected

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

Summary for Subcatchment EX-4: Driveway

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.026 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
4,450	98	Paved parking, HSG A
5,000	68	<50% Grass cover, Poor, HSG A
9,450	82	Weighted Average
5,000		52.91% Pervious Area
4,450		47.09% Impervious Area

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

Summary for Link DP-1: Intermittent Stream along Dascomb Rd

Inflow Area = 3.658 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-YEAR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Existing Drainage System

Inflow Area = 7.025 ac, 77.28% Impervious, Inflow Depth = 2.09" for 2-YEAR event
Inflow = 16.20 cfs @ 12.09 hrs, Volume= 1.222 af
Primary = 16.20 cfs @ 12.09 hrs, Volume= 1.222 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: Drainage Swale

Inflow Area = 3.930 ac, 44.85% Impervious, Inflow Depth = 1.29" for 2-YEAR event
Inflow = 5.18 cfs @ 12.09 hrs, Volume= 0.422 af
Primary = 5.18 cfs @ 12.09 hrs, Volume= 0.422 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: Smith Drive

Inflow Area = 0.217 ac, 47.09% Impervious, Inflow Depth = 1.46" for 2-YEAR event
Inflow = 0.37 cfs @ 12.08 hrs, Volume= 0.026 af
Primary = 0.37 cfs @ 12.08 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 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 EX-1: Woods/Grass Runoff Area=159,326 sf 0.00% Impervious Runoff Depth=0.06"
Flow Length=503' Tc=16.5 min CN=36 Runoff=0.03 cfs 0.018 af

Subcatchment EX-2a: (site) Runoff Area=229,633 sf 69.72% Impervious Runoff Depth=3.19"
Tc=6.0 min CN=87 Runoff=19.03 cfs 1.402 af

Subcatchment EX-2b: (roofs) Runoff Area=76,387 sf 100.00% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=98 Runoff=7.70 cfs 0.638 af

Subcatchment EX-3a: LA Runoff Area=94,411 sf 0.00% Impervious Runoff Depth=0.18"
Flow Length=763' Tc=23.3 min CN=41 Runoff=0.06 cfs 0.033 af

Subcatchment EX-3b: Roof Runoff Area=76,790 sf 100.00% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=98 Runoff=7.74 cfs 0.641 af

Subcatchment EX-4: Driveway Runoff Area=9,450 sf 47.09% Impervious Runoff Depth=2.72"
Tc=5.0 min CN=82 Runoff=0.69 cfs 0.049 af

Link DP-1: Intermittent Stream along Dascomb Rd Inflow=0.03 cfs 0.018 af
Primary=0.03 cfs 0.018 af

Link DP-2: Existing Drainage System Inflow=26.73 cfs 2.040 af
Primary=26.73 cfs 2.040 af

Link DP-3: Drainage Swale Inflow=7.74 cfs 0.674 af
Primary=7.74 cfs 0.674 af

Link DP-4: Smith Drive Inflow=0.69 cfs 0.049 af
Primary=0.69 cfs 0.049 af

Total Runoff Area = 14.830 ac Runoff Volume = 2.781 af Average Runoff Depth = 2.25"
50.82% Pervious = 7.536 ac 49.18% Impervious = 7.294 ac

Summary for Subcatchment EX-1: Woods/Grass

Runoff = 0.03 cfs @ 15.62 hrs, Volume= 0.018 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
136,858	30	Woods, Good, HSG A
2,348	76	Gravel roads, HSG A
5,254	76	Gravel roads, HSG A
1,953	68	<50% Grass cover, Poor, HSG A
12,913	68	<50% Grass cover, Poor, HSG A
159,326	36	Weighted Average
159,326		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.0	453	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.5	503	Total			

Summary for Subcatchment EX-2a: (site)

Runoff = 19.03 cfs @ 12.09 hrs, Volume= 1.402 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
151,738	98	Paved parking, HSG A
54,046	68	<50% Grass cover, Poor, HSG A
14,656	30	Woods, Good, HSG A
833	76	Gravel roads, HSG A
8,360	98	Roofs, HSG A
229,633	87	Weighted Average
69,535		30.28% Pervious Area
160,098		69.72% Impervious Area

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

Summary for Subcatchment EX-2b: (roofs)

Runoff = 7.70 cfs @ 12.09 hrs, Volume= 0.638 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
76,387	98	Unconnected roofs, HSG A
76,387		100.00% Impervious Area
76,387		100.00% Unconnected

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

Summary for Subcatchment EX-3a: LA

Runoff = 0.06 cfs @ 13.04 hrs, Volume= 0.033 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
67,324	30	Woods, Good, HSG A
27,087	68	<50% Grass cover, Poor, HSG A
94,411	41	Weighted Average
94,411		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.3	513	0.0740	1.36		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	200	0.0200	4.93	11.33	**Channel Flow,** Area= 2.3 sf Perim= 3.9' r= 0.59' n= 0.030 Stream, clean & straight
23.3	763	Total			

Summary for Subcatchment EX-3b: Roof

Runoff = 7.74 cfs @ 12.09 hrs, Volume= 0.641 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
76,790	98	Unconnected roofs, HSG A
76,790		100.00% Impervious Area
76,790		100.00% Unconnected

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

Summary for Subcatchment EX-4: Driveway

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.69 cfs @ 12.08 hrs, Volume= 0.049 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
4,450	98	Paved parking, HSG A
5,000	68	<50% Grass cover, Poor, HSG A
9,450	82	Weighted Average
5,000		52.91% Pervious Area
4,450		47.09% Impervious Area

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

Summary for Link DP-1: Intermittent Stream along Dascomb Rd

Inflow Area = 3.658 ac, 0.00% Impervious, Inflow Depth = 0.06" for 10-YEAR event
Inflow = 0.03 cfs @ 15.62 hrs, Volume= 0.018 af
Primary = 0.03 cfs @ 15.62 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Existing Drainage System

Inflow Area = 7.025 ac, 77.28% Impervious, Inflow Depth = 3.48" for 10-YEAR event
Inflow = 26.73 cfs @ 12.09 hrs, Volume= 2.040 af
Primary = 26.73 cfs @ 12.09 hrs, Volume= 2.040 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: Drainage Swale

Inflow Area = 3.930 ac, 44.85% Impervious, Inflow Depth = 2.06" for 10-YEAR event
Inflow = 7.74 cfs @ 12.09 hrs, Volume= 0.674 af
Primary = 7.74 cfs @ 12.09 hrs, Volume= 0.674 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: Smith Drive

Inflow Area = 0.217 ac, 47.09% Impervious, Inflow Depth = 2.72" for 10-YEAR event
Inflow = 0.69 cfs @ 12.08 hrs, Volume= 0.049 af
Primary = 0.69 cfs @ 12.08 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 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 EX-1: Woods/Grass Runoff Area=159,326 sf 0.00% Impervious Runoff Depth=0.19"
Flow Length=503' Tc=16.5 min CN=36 Runoff=0.10 cfs 0.058 af

Subcatchment EX-2a: (site) Runoff Area=229,633 sf 69.72% Impervious Runoff Depth=4.04"
Tc=6.0 min CN=87 Runoff=23.85 cfs 1.775 af

Subcatchment EX-2b: (roofs) Runoff Area=76,387 sf 100.00% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=98 Runoff=9.22 cfs 0.769 af

Subcatchment EX-3a: LA Runoff Area=94,411 sf 0.00% Impervious Runoff Depth=0.40"
Flow Length=763' Tc=23.3 min CN=41 Runoff=0.27 cfs 0.073 af

Subcatchment EX-3b: Roof Runoff Area=76,790 sf 100.00% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=98 Runoff=9.27 cfs 0.773 af

Subcatchment EX-4: Driveway Runoff Area=9,450 sf 47.09% Impervious Runoff Depth=3.53"
Tc=5.0 min CN=82 Runoff=0.89 cfs 0.064 af

Link DP-1: Intermittent Stream along Dascomb Rd Inflow=0.10 cfs 0.058 af
Primary=0.10 cfs 0.058 af

Link DP-2: Existing Drainage System Inflow=33.07 cfs 2.544 af
Primary=33.07 cfs 2.544 af

Link DP-3: Drainage Swale Inflow=9.27 cfs 0.846 af
Primary=9.27 cfs 0.846 af

Link DP-4: Smith Drive Inflow=0.89 cfs 0.064 af
Primary=0.89 cfs 0.064 af

Total Runoff Area = 14.830 ac Runoff Volume = 3.512 af Average Runoff Depth = 2.84"
50.82% Pervious = 7.536 ac 49.18% Impervious = 7.294 ac

Summary for Subcatchment EX-1: Woods/Grass

Runoff = 0.10 cfs @ 13.80 hrs, Volume= 0.058 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
136,858	30	Woods, Good, HSG A
2,348	76	Gravel roads, HSG A
5,254	76	Gravel roads, HSG A
1,953	68	<50% Grass cover, Poor, HSG A
12,913	68	<50% Grass cover, Poor, HSG A
159,326	36	Weighted Average
159,326		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.0	453	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.5	503	Total			

Summary for Subcatchment EX-2a: (site)

Runoff = 23.85 cfs @ 12.09 hrs, Volume= 1.775 af, Depth= 4.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
151,738	98	Paved parking, HSG A
54,046	68	<50% Grass cover, Poor, HSG A
14,656	30	Woods, Good, HSG A
833	76	Gravel roads, HSG A
8,360	98	Roofs, HSG A
229,633	87	Weighted Average
69,535		30.28% Pervious Area
160,098		69.72% Impervious Area

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

Summary for Subcatchment EX-2b: (roofs)

Runoff = 9.22 cfs @ 12.09 hrs, Volume= 0.769 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
76,387	98	Unconnected roofs, HSG A
76,387		100.00% Impervious Area
76,387		100.00% Unconnected

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

Summary for Subcatchment EX-3a: LA

Runoff = 0.27 cfs @ 12.60 hrs, Volume= 0.073 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
67,324	30	Woods, Good, HSG A
27,087	68	<50% Grass cover, Poor, HSG A
94,411	41	Weighted Average
94,411		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.3	513	0.0740	1.36		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	200	0.0200	4.93	11.33	**Channel Flow,** Area= 2.3 sf Perim= 3.9' r= 0.59' n= 0.030 Stream, clean & straight
23.3	763	Total			

Summary for Subcatchment EX-3b: Roof

Runoff = 9.27 cfs @ 12.09 hrs, Volume= 0.773 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
76,790	98	Unconnected roofs, HSG A
76,790		100.00% Impervious Area
76,790		100.00% Unconnected

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

Summary for Subcatchment EX-4: Driveway

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.89 cfs @ 12.08 hrs, Volume= 0.064 af, Depth= 3.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
4,450	98	Paved parking, HSG A
5,000	68	<50% Grass cover, Poor, HSG A
9,450	82	Weighted Average
5,000		52.91% Pervious Area
4,450		47.09% Impervious Area

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

Summary for Link DP-1: Intermittent Stream along Dascomb Rd

Inflow Area = 3.658 ac, 0.00% Impervious, Inflow Depth = 0.19" for 25-YEAR event
Inflow = 0.10 cfs @ 13.80 hrs, Volume= 0.058 af
Primary = 0.10 cfs @ 13.80 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Existing Drainage System

Inflow Area = 7.025 ac, 77.28% Impervious, Inflow Depth = 4.35" for 25-YEAR event
Inflow = 33.07 cfs @ 12.09 hrs, Volume= 2.544 af
Primary = 33.07 cfs @ 12.09 hrs, Volume= 2.544 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: Drainage Swale

Inflow Area = 3.930 ac, 44.85% Impervious, Inflow Depth = 2.58" for 25-YEAR event
Inflow = 9.27 cfs @ 12.09 hrs, Volume= 0.846 af
Primary = 9.27 cfs @ 12.09 hrs, Volume= 0.846 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: Smith Drive

Inflow Area = 0.217 ac, 47.09% Impervious, Inflow Depth = 3.53" for 25-YEAR event
Inflow = 0.89 cfs @ 12.08 hrs, Volume= 0.064 af
Primary = 0.89 cfs @ 12.08 hrs, Volume= 0.064 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 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 EX-1: Woods/Grass Runoff Area=159,326 sf 0.00% Impervious Runoff Depth=0.47"
Flow Length=503' Tc=16.5 min CN=36 Runoff=0.58 cfs 0.144 af

Subcatchment EX-2a: (site) Runoff Area=229,633 sf 69.72% Impervious Runoff Depth=5.19"
Tc=6.0 min CN=87 Runoff=30.25 cfs 2.280 af

Subcatchment EX-2b: (roofs) Runoff Area=76,387 sf 100.00% Impervious Runoff Depth=6.46"
Tc=6.0 min CN=98 Runoff=11.25 cfs 0.944 af

Subcatchment EX-3a: LA Runoff Area=94,411 sf 0.00% Impervious Runoff Depth=0.80"
Flow Length=763' Tc=23.3 min CN=41 Runoff=0.78 cfs 0.145 af

Subcatchment EX-3b: Roof Runoff Area=76,790 sf 100.00% Impervious Runoff Depth=6.46"
Tc=6.0 min CN=98 Runoff=11.31 cfs 0.949 af

Subcatchment EX-4: Driveway Runoff Area=9,450 sf 47.09% Impervious Runoff Depth=4.64"
Tc=5.0 min CN=82 Runoff=1.17 cfs 0.084 af

Link DP-1: Intermittent Stream along Dascomb Rd Inflow=0.58 cfs 0.144 af
Primary=0.58 cfs 0.144 af

Link DP-2: Existing Drainage System Inflow=41.50 cfs 3.224 af
Primary=41.50 cfs 3.224 af

Link DP-3: Drainage Swale Inflow=11.35 cfs 1.094 af
Primary=11.35 cfs 1.094 af

Link DP-4: Smith Drive Inflow=1.17 cfs 0.084 af
Primary=1.17 cfs 0.084 af

Total Runoff Area = 14.830 ac Runoff Volume = 4.546 af Average Runoff Depth = 3.68"
50.82% Pervious = 7.536 ac 49.18% Impervious = 7.294 ac

Summary for Subcatchment EX-1: Woods/Grass

Runoff = 0.58 cfs @ 12.52 hrs, Volume= 0.144 af, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
136,858	30	Woods, Good, HSG A
2,348	76	Gravel roads, HSG A
5,254	76	Gravel roads, HSG A
1,953	68	<50% Grass cover, Poor, HSG A
12,913	68	<50% Grass cover, Poor, HSG A
159,326	36	Weighted Average
159,326		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.0	453	0.0640	1.26		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.5	503	Total			

Summary for Subcatchment EX-2a: (site)

Runoff = 30.25 cfs @ 12.09 hrs, Volume= 2.280 af, Depth= 5.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
151,738	98	Paved parking, HSG A
54,046	68	<50% Grass cover, Poor, HSG A
14,656	30	Woods, Good, HSG A
833	76	Gravel roads, HSG A
8,360	98	Roofs, HSG A
229,633	87	Weighted Average
69,535		30.28% Pervious Area
160,098		69.72% Impervious Area

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

Summary for Subcatchment EX-2b: (roofs)

Runoff = 11.25 cfs @ 12.09 hrs, Volume= 0.944 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
76,387	98	Unconnected roofs, HSG A
76,387		100.00% Impervious Area
76,387		100.00% Unconnected

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

Summary for Subcatchment EX-3a: LA

Runoff = 0.78 cfs @ 12.50 hrs, Volume= 0.145 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
67,324	30	Woods, Good, HSG A
27,087	68	<50% Grass cover, Poor, HSG A
94,411	41	Weighted Average
94,411		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.3	513	0.0740	1.36		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.7	200	0.0200	4.93	11.33	**Channel Flow,** Area= 2.3 sf Perim= 3.9' r= 0.59' n= 0.030 Stream, clean & straight
23.3	763	Total			

Summary for Subcatchment EX-3b: Roof

Runoff = 11.31 cfs @ 12.09 hrs, Volume= 0.949 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
76,790	98	Unconnected roofs, HSG A
76,790		100.00% Impervious Area
76,790		100.00% Unconnected

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

Summary for Subcatchment EX-4: Driveway

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.17 cfs @ 12.07 hrs, Volume= 0.084 af, Depth= 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
4,450	98	Paved parking, HSG A
5,000	68	<50% Grass cover, Poor, HSG A
9,450	82	Weighted Average
5,000		52.91% Pervious Area
4,450		47.09% Impervious Area

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

Summary for Link DP-1: Intermittent Stream along Dascomb Rd

Inflow Area = 3.658 ac, 0.00% Impervious, Inflow Depth = 0.47" for 100-YEAR event
Inflow = 0.58 cfs @ 12.52 hrs, Volume= 0.144 af
Primary = 0.58 cfs @ 12.52 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Existing Drainage System

Inflow Area = 7.025 ac, 77.28% Impervious, Inflow Depth = 5.51" for 100-YEAR event
Inflow = 41.50 cfs @ 12.09 hrs, Volume= 3.224 af
Primary = 41.50 cfs @ 12.09 hrs, Volume= 3.224 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: Drainage Swale

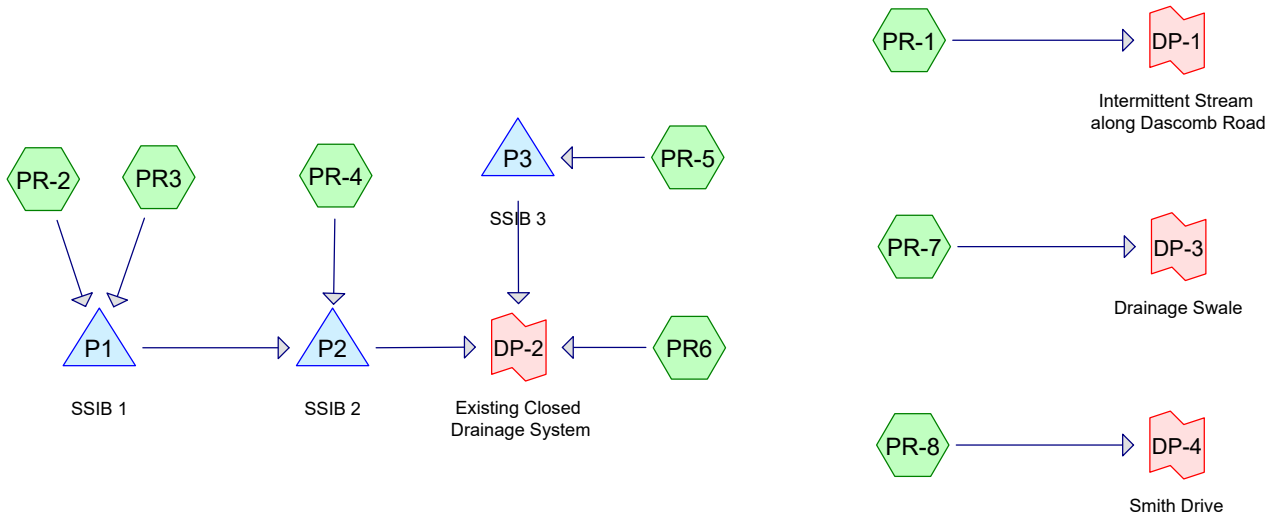
Inflow Area = 3.930 ac, 44.85% Impervious, Inflow Depth = 3.34" for 100-YEAR event
Inflow = 11.35 cfs @ 12.09 hrs, Volume= 1.094 af
Primary = 11.35 cfs @ 12.09 hrs, Volume= 1.094 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: Smith Drive

Inflow Area = 0.217 ac, 47.09% Impervious, Inflow Depth = 4.64" for 100-YEAR event
Inflow = 1.17 cfs @ 12.07 hrs, Volume= 0.084 af
Primary = 1.17 cfs @ 12.07 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs



Subcat Reach Pond Link

Routing Diagram for T0681_POST

Prepared by {enter your company name here}, Printed 10/31/2018

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.046	68	<50% Grass cover, Poor, HSG A (PR-2, PR-4, PR-7)
0.138	79	<50% Grass cover, Poor, HSG B (PR3)
2.132	39	>75% Grass cover, Good, HSG A (PR-1, PR-5, PR3, PR6)
6.525	98	Paved parking, HSG A (PR-2, PR-4, PR-5, PR-7, PR-8, PR3, PR6)
3.780	98	Roofs, HSG A (PR-2, PR-4, PR3, PR6)
14.621	**85**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
14.483	HSG A	PR-1, PR-2, PR-4, PR-5, PR-7, PR-8, PR3, PR6
0.138	HSG B	PR3
0.000	HSG C	
0.000	HSG D	
0.000	Other	
14.621		**TOTAL AREA**

Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-1: Runoff Area=55,733 sf 0.00% Impervious Runoff Depth=0.00"
Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af

SubcatchmentPR-2: Runoff Area=136,422 sf 60.47% Impervious Runoff Depth=1.75"
Tc=5.0 min CN=86 Runoff=6.42 cfs 0.456 af

SubcatchmentPR-4: Runoff Area=84,569 sf 92.34% Impervious Runoff Depth=2.65"
Tc=5.0 min CN=96 Runoff=5.66 cfs 0.429 af

SubcatchmentPR-5: Runoff Area=81,090 sf 66.40% Impervious Runoff Depth=1.20"
Tc=5.0 min CN=78 Runoff=2.57 cfs 0.186 af

SubcatchmentPR-7: Runoff Area=79,925 sf 64.05% Impervious Runoff Depth=1.83"
Tc=5.0 min CN=87 Runoff=3.93 cfs 0.279 af

SubcatchmentPR-8: Runoff Area=2,011 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.14 cfs 0.011 af

SubcatchmentPR3: Runoff Area=174,957 sf 91.80% Impervious Runoff Depth=2.55"
Tc=5.0 min CN=95 Runoff=11.43 cfs 0.853 af

SubcatchmentPR6: Runoff Area=22,193 sf 92.93% Impervious Runoff Depth=2.45"
Tc=5.0 min CN=94 Runoff=1.41 cfs 0.104 af

Pond P1: SSIB 1 Peak Elev=127.77' Storage=19,990 cf Inflow=17.88 cfs 1.309 af
Discarded=0.57 cfs 0.839 af Primary=5.48 cfs 0.470 af Outflow=6.05 cfs 1.309 af

Pond P2: SSIB 2 Peak Elev=120.58' Storage=9,700 cf Inflow=7.49 cfs 0.899 af
Discarded=0.37 cfs 0.360 af Primary=4.95 cfs 0.539 af Outflow=5.32 cfs 0.899 af

Pond P3: SSIB 3 Peak Elev=109.54' Storage=2,505 cf Inflow=2.57 cfs 0.186 af
Discarded=0.37 cfs 0.186 af Primary=0.00 cfs 0.000 af Outflow=0.37 cfs 0.186 af

Link DP-1: Intermittent Stream along Dascomb Road Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP-2: Existing Closed Drainage System Inflow=5.18 cfs 0.643 af
Primary=5.18 cfs 0.643 af

Link DP-3: Drainage Swale Inflow=3.93 cfs 0.279 af
Primary=3.93 cfs 0.279 af

Link DP-4: Smith Drive Inflow=0.14 cfs 0.011 af
Primary=0.14 cfs 0.011 af

Total Runoff Area = 14.621 ac Runoff Volume = 2.318 af Average Runoff Depth = 1.90"
29.52% Pervious = 4.317 ac 70.48% Impervious = 10.304 ac

Summary for Subcatchment PR-1:

[49] Hint: Tc<2dt may require smaller dt
[45] Hint: Runoff=Zero

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
55,733	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
55,733	39	Weighted Average
55,733		100.00% Pervious Area

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

Summary for Subcatchment PR-2:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 6.42 cfs @ 12.08 hrs, Volume= 0.456 af, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
17,745	98	Roofs, HSG A
53,929	68	<50% Grass cover, Poor, HSG A
64,748	98	Paved parking, HSG A
136,422	86	Weighted Average
53,929		39.53% Pervious Area
82,493		60.47% Impervious Area

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

Summary for Subcatchment PR-4:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 5.66 cfs @ 12.07 hrs, Volume= 0.429 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
6,476	68	<50% Grass cover, Poor, HSG A
13,000	98	Roofs, HSG A
22,113	98	Roofs, HSG A
13,682	98	Roofs, HSG A
29,298	98	Paved parking, HSG A
84,569	96	Weighted Average
6,476		7.66% Pervious Area
78,093		92.34% Impervious Area

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

Summary for Subcatchment PR-5:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.57 cfs @ 12.08 hrs, Volume= 0.186 af, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
27,244	39	>75% Grass cover, Good, HSG A
53,846	98	Paved parking, HSG A
81,090	78	Weighted Average
27,244		33.60% Pervious Area
53,846		66.40% Impervious Area

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

Summary for Subcatchment PR-7:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.93 cfs @ 12.08 hrs, Volume= 0.279 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
28,730	68	<50% Grass cover, Poor, HSG A
51,195	98	Paved parking, HSG A
79,925	87	Weighted Average
28,730		35.95% Pervious Area
51,195		64.05% Impervious Area

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

Summary for Subcatchment PR-8:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.14 cfs @ 12.07 hrs, Volume= 0.011 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
2,011	98	Paved parking, HSG A
2,011		100.00% Impervious Area

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

Summary for Subcatchment PR3:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 11.43 cfs @ 12.07 hrs, Volume= 0.853 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
43,802	98	Roofs, HSG A
20,988	98	Roofs, HSG A
23,240	98	Roofs, HSG A
6,018	79	<50% Grass cover, Poor, HSG B
8,336	39	>75% Grass cover, Good, HSG A
72,573	98	Paved parking, HSG A
174,957	95	Weighted Average
14,354		8.20% Pervious Area
160,603		91.80% Impervious Area

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

Summary for Subcatchment PR6:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.41 cfs @ 12.07 hrs, Volume= 0.104 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.10"

Area (sf)	CN	Description
10,085	98	Roofs, HSG A
1,570	39	>75% Grass cover, Good, HSG A
10,538	98	Paved parking, HSG A
22,193	94	Weighted Average
1,570		7.07% Pervious Area
20,623		92.93% Impervious Area

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

Summary for Pond P1: SSIB 1

Inflow Area = 7.148 ac, 78.07% Impervious, Inflow Depth = 2.20" for 2-YEAR event
Inflow = 17.88 cfs @ 12.07 hrs, Volume= 1.309 af
Outflow = 6.05 cfs @ 12.36 hrs, Volume= 1.309 af, Atten= 66%, Lag= 17.2 min
Discarded = 0.57 cfs @ 12.36 hrs, Volume= 0.839 af
Primary = 5.48 cfs @ 12.36 hrs, Volume= 0.470 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 127.77' @ 12.36 hrs Surf.Area= 9,073 sf Storage= 19,990 cf

Plug-Flow detention time= 162.5 min calculated for 1.307 af (100% of inflow)
Center-of-Mass det. time= 162.5 min (958.2 - 795.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	124.75'	14,457 cf	**64.83'W x 139.94'L x 6.75'H Field A** 61,242 cf Overall - 25,099 cf Embedded = 36,143 cf x 40.0% Voids
#2A	125.50'	25,099 cf	**ADS_StormTech MC-4500 +Cap** x 231 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 7 Rows of 33 Chambers Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		39,556 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	125.25'	**18.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 125.25' / 125.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	126.75'	**20.0" W x 15.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	128.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 4.0' Crest Height
#4	Discarded	124.75'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.57 cfs @ 12.36 hrs HW=127.76' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.57 cfs)

Primary OutFlow Max=5.46 cfs @ 12.36 hrs HW=127.76' (Free Discharge)
└**1=Culvert** (Passes 5.46 cfs of 11.30 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 5.46 cfs @ 3.23 fps)
  └**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)

Summary for Pond P2: SSIB 2

Inflow Area =	9.090 ac, 81.12% Impervious, Inflow Depth = 1.19"		for 2-YEAR event	
Inflow =	7.49 cfs @	12.29 hrs, Volume=	0.899 af	
Outflow =	5.32 cfs @	12.56 hrs, Volume=	0.899 af, Atten= 29%, Lag= 16.3 min	
Discarded =	0.37 cfs @	12.56 hrs, Volume=	0.360 af	
Primary =	4.95 cfs @	12.56 hrs, Volume=	0.539 af	

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 120.58' @ 12.56 hrs Surf.Area= 5,941 sf Storage= 9,700 cf

Plug-Flow detention time= 53.6 min calculated for 0.899 af (100% of inflow)
Center-of-Mass det. time= 53.5 min (833.6 - 780.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	118.25'	9,580 cf	**64.83'W x 91.64'L x 6.75'H Field A** 40,105 cf Overall - 16,154 cf Embedded = 23,951 cf x 40.0% Voids
#2A	119.00'	16,154 cf	**ADS_StormTech MC-4500 +Cap** x 147 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 7 Rows of 21 Chambers Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		25,734 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	115.00'	**18.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 115.00' / 114.00' S= 0.0286 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	119.25'	**15.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	124.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.7' Crest Height
#4	Discarded	118.25'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.37 cfs @ 12.56 hrs HW=120.57' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=4.94 cfs @ 12.56 hrs HW=120.57' (Free Discharge)
└**1=Culvert** (Passes 4.94 cfs of 18.69 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 4.94 cfs @ 4.03 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P3: SSIB 3

Inflow Area = 1.862 ac, 66.40% Impervious, Inflow Depth = 1.20" for 2-YEAR event
Inflow = 2.57 cfs @ 12.08 hrs, Volume= 0.186 af
Outflow = 0.37 cfs @ 12.73 hrs, Volume= 0.186 af, Atten= 86%, Lag= 39.1 min
Discarded = 0.37 cfs @ 12.73 hrs, Volume= 0.186 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 109.54' @ 12.73 hrs Surf.Area= 6,338 sf Storage= 2,505 cf

Plug-Flow detention time= 52.7 min calculated for 0.186 af (100% of inflow)
Center-of-Mass det. time= 52.7 min (902.7 - 850.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	108.80'	4,429 cf	**41.50'W x 152.72'L x 2.33'H Field A** 14,788 cf Overall - 3,715 cf Embedded = 11,073 cf x 40.0% Voids
#2A	109.30'	3,715 cf	**ADS_StormTech SC-310 +Cap** x 252 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Rows of 21 Chambers
		8,144 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	108.50'	**12.0" Round Culvert** L= 45.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 108.50' / 104.50' S= 0.0889 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	110.00'	**12.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	110.25'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s)

1.7' Crest Height
#4 Discarded 108.80' **2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.37 cfs @ 12.73 hrs HW=109.54' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.37 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=108.80' (Free Discharge)
└**1=Culvert** (Passes 0.00 cfs of 0.37 cfs potential flow)
  └**2=Orifice/Grate** (Controls 0.00 cfs)
  └**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)

Summary for Link DP-1: Intermittent Stream along Dascomb Road

Inflow Area = 1.279 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-YEAR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Existing Closed Drainage System

Inflow Area = 11.461 ac, 79.25% Impervious, Inflow Depth = 0.67" for 2-YEAR event
Inflow = 5.18 cfs @ 12.52 hrs, Volume= 0.643 af
Primary = 5.18 cfs @ 12.52 hrs, Volume= 0.643 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: Drainage Swale

Inflow Area = 1.835 ac, 64.05% Impervious, Inflow Depth = 1.83" for 2-YEAR event
Inflow = 3.93 cfs @ 12.08 hrs, Volume= 0.279 af
Primary = 3.93 cfs @ 12.08 hrs, Volume= 0.279 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: Smith Drive

Inflow Area = 0.046 ac,100.00% Impervious, Inflow Depth = 2.87" for 2-YEAR event
Inflow = 0.14 cfs @ 12.07 hrs, Volume= 0.011 af
Primary = 0.14 cfs @ 12.07 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-1: Runoff Area=55,733 sf 0.00% Impervious Runoff Depth=0.13"
Tc=5.0 min CN=39 Runoff=0.02 cfs 0.013 af

SubcatchmentPR-2: Runoff Area=136,422 sf 60.47% Impervious Runoff Depth=3.10"
Tc=5.0 min CN=86 Runoff=11.31 cfs 0.808 af

SubcatchmentPR-4: Runoff Area=84,569 sf 92.34% Impervious Runoff Depth=4.14"
Tc=5.0 min CN=96 Runoff=8.62 cfs 0.669 af

SubcatchmentPR-5: Runoff Area=81,090 sf 66.40% Impervious Runoff Depth=2.38"
Tc=5.0 min CN=78 Runoff=5.19 cfs 0.369 af

SubcatchmentPR-7: Runoff Area=79,925 sf 64.05% Impervious Runoff Depth=3.19"
Tc=5.0 min CN=87 Runoff=6.81 cfs 0.488 af

SubcatchmentPR-8: Runoff Area=2,011 sf 100.00% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=98 Runoff=0.21 cfs 0.017 af

SubcatchmentPR3: Runoff Area=174,957 sf 91.80% Impervious Runoff Depth=4.02"
Tc=5.0 min CN=95 Runoff=17.60 cfs 1.347 af

SubcatchmentPR6: Runoff Area=22,193 sf 92.93% Impervious Runoff Depth=3.91"
Tc=5.0 min CN=94 Runoff=2.20 cfs 0.166 af

Pond P1: SSIB 1 Peak Elev=128.90' Storage=27,681 cf Inflow=28.91 cfs 2.155 af
Discarded=0.60 cfs 0.993 af Primary=14.48 cfs 1.161 af Outflow=15.08 cfs 2.155 af

Pond P2: SSIB 2 Peak Elev=123.48' Storage=21,982 cf Inflow=21.94 cfs 1.830 af
Discarded=0.42 cfs 0.453 af Primary=11.21 cfs 1.377 af Outflow=11.64 cfs 1.830 af

Pond P3: SSIB 3 Peak Elev=110.29' Storage=5,843 cf Inflow=5.19 cfs 0.369 af
Discarded=0.38 cfs 0.326 af Primary=0.59 cfs 0.043 af Outflow=0.97 cfs 0.369 af

Link DP-1: Intermittent Stream along Dascomb Road Inflow=0.02 cfs 0.013 af
Primary=0.02 cfs 0.013 af

Link DP-2: Existing Closed Drainage System Inflow=12.20 cfs 1.586 af
Primary=12.20 cfs 1.586 af

Link DP-3: Drainage Swale Inflow=6.81 cfs 0.488 af
Primary=6.81 cfs 0.488 af

Link DP-4: Smith Drive Inflow=0.21 cfs 0.017 af
Primary=0.21 cfs 0.017 af

Total Runoff Area = 14.621 ac Runoff Volume = 3.877 af Average Runoff Depth = 3.18"
29.52% Pervious = 4.317 ac 70.48% Impervious = 10.304 ac

Summary for Subcatchment PR-1:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.02 cfs @ 14.56 hrs, Volume= 0.013 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
55,733	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
55,733	39	Weighted Average
55,733		100.00% Pervious Area

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

Summary for Subcatchment PR-2:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 11.31 cfs @ 12.07 hrs, Volume= 0.808 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
17,745	98	Roofs, HSG A
53,929	68	<50% Grass cover, Poor, HSG A
64,748	98	Paved parking, HSG A
136,422	86	Weighted Average
53,929		39.53% Pervious Area
82,493		60.47% Impervious Area

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

Summary for Subcatchment PR-4:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 8.62 cfs @ 12.07 hrs, Volume= 0.669 af, Depth= 4.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
6,476	68	<50% Grass cover, Poor, HSG A
13,000	98	Roofs, HSG A
22,113	98	Roofs, HSG A
13,682	98	Roofs, HSG A
29,298	98	Paved parking, HSG A
84,569	96	Weighted Average
6,476		7.66% Pervious Area
78,093		92.34% Impervious Area

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

Summary for Subcatchment PR-5:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 5.19 cfs @ 12.08 hrs, Volume= 0.369 af, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
27,244	39	>75% Grass cover, Good, HSG A
53,846	98	Paved parking, HSG A
81,090	78	Weighted Average
27,244		33.60% Pervious Area
53,846		66.40% Impervious Area

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

Summary for Subcatchment PR-7:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 6.81 cfs @ 12.07 hrs, Volume= 0.488 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
28,730	68	<50% Grass cover, Poor, HSG A
51,195	98	Paved parking, HSG A
79,925	87	Weighted Average
28,730		35.95% Pervious Area
51,195		64.05% Impervious Area

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

Summary for Subcatchment PR-8:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.21 cfs @ 12.07 hrs, Volume= 0.017 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
2,011	98	Paved parking, HSG A
2,011		100.00% Impervious Area

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

Summary for Subcatchment PR3:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 17.60 cfs @ 12.07 hrs, Volume= 1.347 af, Depth= 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
43,802	98	Roofs, HSG A
20,988	98	Roofs, HSG A
23,240	98	Roofs, HSG A
6,018	79	<50% Grass cover, Poor, HSG B
8,336	39	>75% Grass cover, Good, HSG A
72,573	98	Paved parking, HSG A
174,957	95	Weighted Average
14,354		8.20% Pervious Area
160,603		91.80% Impervious Area

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

Summary for Subcatchment PR6:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.20 cfs @ 12.07 hrs, Volume= 0.166 af, Depth= 3.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.60"

Area (sf)	CN	Description
10,085	98	Roofs, HSG A
1,570	39	>75% Grass cover, Good, HSG A
10,538	98	Paved parking, HSG A
22,193	94	Weighted Average
1,570		7.07% Pervious Area
20,623		92.93% Impervious Area

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

Summary for Pond P1: SSIB 1

Inflow Area = 7.148 ac, 78.07% Impervious, Inflow Depth = 3.62" for 10-YEAR event
Inflow = 28.91 cfs @ 12.07 hrs, Volume= 2.155 af
Outflow = 15.08 cfs @ 12.21 hrs, Volume= 2.155 af, Atten= 48%, Lag= 8.2 min
Discarded = 0.60 cfs @ 12.21 hrs, Volume= 0.993 af
Primary = 14.48 cfs @ 12.21 hrs, Volume= 1.161 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 128.90' @ 12.21 hrs Surf.Area= 9,073 sf Storage= 27,681 cf

Plug-Flow detention time= 128.2 min calculated for 2.152 af (100% of inflow)
Center-of-Mass det. time= 128.4 min (911.9 - 783.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	124.75'	14,457 cf	**64.83'W x 139.94'L x 6.75'H Field A** 61,242 cf Overall - 25,099 cf Embedded = 36,143 cf x 40.0% Voids
#2A	125.50'	25,099 cf	**ADS_StormTech MC-4500 +Cap** x 231 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 7 Rows of 33 Chambers Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		39,556 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	125.25'	**18.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 125.25' / 125.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	126.75'	**20.0" W x 15.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	128.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 4.0' Crest Height
#4	Discarded	124.75'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.60 cfs @ 12.21 hrs HW=128.89' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.60 cfs)

Primary OutFlow Max=14.46 cfs @ 12.21 hrs HW=128.89' (Free Discharge)
└**1=Culvert** (Inlet Controls 14.46 cfs @ 8.18 fps)
  ├**2=Orifice/Grate** (Passes < 12.25 cfs potential flow)
  └**3=Sharp-Crested Rectangular Weir** (Passes < 10.74 cfs potential flow)

Summary for Pond P2: SSIB 2

Inflow Area = 9.090 ac, 81.12% Impervious, Inflow Depth = 2.42" for 10-YEAR event
Inflow = 21.94 cfs @ 12.11 hrs, Volume= 1.830 af
Outflow = 11.64 cfs @ 12.51 hrs, Volume= 1.830 af, Atten= 47%, Lag= 23.9 min
Discarded = 0.42 cfs @ 12.51 hrs, Volume= 0.453 af
Primary = 11.21 cfs @ 12.51 hrs, Volume= 1.377 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 123.48' @ 12.51 hrs Surf.Area= 5,941 sf Storage= 21,982 cf

Plug-Flow detention time= 44.2 min calculated for 1.828 af (100% of inflow)
Center-of-Mass det. time= 44.2 min (819.1 - 774.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	118.25'	9,580 cf	**64.83'W x 91.64'L x 6.75'H Field A** 40,105 cf Overall - 16,154 cf Embedded = 23,951 cf x 40.0% Voids
#2A	119.00'	16,154 cf	**ADS_StormTech MC-4500 +Cap** x 147 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 7 Rows of 21 Chambers Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		25,734 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	115.00'	**18.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 115.00' / 114.00' S= 0.0286 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	119.25'	**15.0" Vert. Orifice/Grate** C= 0.600

#3	Device 1	124.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.7' Crest Height
#4	Discarded	118.25'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.42 cfs @ 12.51 hrs HW=123.46' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=11.20 cfs @ 12.51 hrs HW=123.46' (Free Discharge)
└**1=Culvert** (Passes 11.20 cfs of 23.63 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 11.20 cfs @ 9.12 fps)
  └**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P3: SSIB 3

Inflow Area = 1.862 ac, 66.40% Impervious, Inflow Depth = 2.38" for 10-YEAR event
Inflow = 5.19 cfs @ 12.08 hrs, Volume= 0.369 af
Outflow = 0.97 cfs @ 12.55 hrs, Volume= 0.369 af, Atten= 81%, Lag= 28.2 min
Discarded = 0.38 cfs @ 12.55 hrs, Volume= 0.326 af
Primary = 0.59 cfs @ 12.55 hrs, Volume= 0.043 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 110.29' @ 12.55 hrs Surf.Area= 6,338 sf Storage= 5,843 cf

Plug-Flow detention time= 111.6 min calculated for 0.368 af (100% of inflow)
Center-of-Mass det. time= 111.5 min (941.5 - 830.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	108.80'	4,429 cf	**41.50'W x 152.72'L x 2.33'H Field A** 14,788 cf Overall - 3,715 cf Embedded = 11,073 cf x 40.0% Voids
#2A	109.30'	3,715 cf	**ADS_StormTech SC-310 +Cap** x 252 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Rows of 21 Chambers
		8,144 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	108.50'	**12.0" Round Culvert** L= 45.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 108.50' / 104.50' S= 0.0889 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	110.00'	**12.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	110.25'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.7' Crest Height
#4	Discarded	108.80'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.38 cfs @ 12.55 hrs HW=110.29' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.38 cfs)

Primary OutFlow Max=0.59 cfs @ 12.55 hrs HW=110.29' (Free Discharge)
└**1=Culvert** (Passes 0.59 cfs of 4.30 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.48 cfs @ 1.91 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.11 cfs @ 0.67 fps)

Summary for Link DP-1: Intermittent Stream along Dascomb Road

Inflow Area = 1.279 ac, 0.00% Impervious, Inflow Depth = 0.13" for 10-YEAR event
Inflow = 0.02 cfs @ 14.56 hrs, Volume= 0.013 af
Primary = 0.02 cfs @ 14.56 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Existing Closed Drainage System

Inflow Area = 11.461 ac, 79.25% Impervious, Inflow Depth = 1.66" for 10-YEAR event
Inflow = 12.20 cfs @ 12.50 hrs, Volume= 1.586 af
Primary = 12.20 cfs @ 12.50 hrs, Volume= 1.586 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: Drainage Swale

Inflow Area = 1.835 ac, 64.05% Impervious, Inflow Depth = 3.19" for 10-YEAR event
Inflow = 6.81 cfs @ 12.07 hrs, Volume= 0.488 af
Primary = 6.81 cfs @ 12.07 hrs, Volume= 0.488 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: Smith Drive

Inflow Area = 0.046 ac,100.00% Impervious, Inflow Depth = 4.36" for 10-YEAR event
Inflow = 0.21 cfs @ 12.07 hrs, Volume= 0.017 af
Primary = 0.21 cfs @ 12.07 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-1: Runoff Area=55,733 sf 0.00% Impervious Runoff Depth=0.31"
Tc=5.0 min CN=39 Runoff=0.13 cfs 0.033 af

SubcatchmentPR-2: Runoff Area=136,422 sf 60.47% Impervious Runoff Depth=3.94"
Tc=5.0 min CN=86 Runoff=14.26 cfs 1.027 af

SubcatchmentPR-4: Runoff Area=84,569 sf 92.34% Impervious Runoff Depth=5.03"
Tc=5.0 min CN=96 Runoff=10.38 cfs 0.814 af

SubcatchmentPR-5: Runoff Area=81,090 sf 66.40% Impervious Runoff Depth=3.14"
Tc=5.0 min CN=78 Runoff=6.86 cfs 0.487 af

SubcatchmentPR-7: Runoff Area=79,925 sf 64.05% Impervious Runoff Depth=4.04"
Tc=5.0 min CN=87 Runoff=8.54 cfs 0.618 af

SubcatchmentPR-8: Runoff Area=2,011 sf 100.00% Impervious Runoff Depth=5.26"
Tc=5.0 min CN=98 Runoff=0.25 cfs 0.020 af

SubcatchmentPR3: Runoff Area=174,957 sf 91.80% Impervious Runoff Depth=4.92"
Tc=5.0 min CN=95 Runoff=21.26 cfs 1.645 af

SubcatchmentPR6: Runoff Area=22,193 sf 92.93% Impervious Runoff Depth=4.80"
Tc=5.0 min CN=94 Runoff=2.67 cfs 0.204 af

Pond P1: SSIB 1 Peak Elev=129.82' Storage=33,065 cf Inflow=35.52 cfs 2.672 af
Discarded=0.62 cfs 1.064 af Primary=16.64 cfs 1.608 af Outflow=17.25 cfs 2.672 af

Pond P2: SSIB 2 Peak Elev=124.57' Storage=24,712 cf Inflow=25.19 cfs 2.422 af
Discarded=0.44 cfs 0.501 af Primary=18.34 cfs 1.921 af Outflow=18.78 cfs 2.422 af

Pond P3: SSIB 3 Peak Elev=110.50' Storage=6,504 cf Inflow=6.86 cfs 0.487 af
Discarded=0.39 cfs 0.368 af Primary=2.34 cfs 0.119 af Outflow=2.73 cfs 0.487 af

Link DP-1: Intermittent Stream along Dascomb Road Inflow=0.13 cfs 0.033 af
Primary=0.13 cfs 0.033 af

Link DP-2: Existing Closed Drainage System Inflow=21.23 cfs 2.245 af
Primary=21.23 cfs 2.245 af

Link DP-3: Drainage Swale Inflow=8.54 cfs 0.618 af
Primary=8.54 cfs 0.618 af

Link DP-4: Smith Drive Inflow=0.25 cfs 0.020 af
Primary=0.25 cfs 0.020 af

Total Runoff Area = 14.621 ac Runoff Volume = 4.849 af Average Runoff Depth = 3.98"
29.52% Pervious = 4.317 ac 70.48% Impervious = 10.304 ac

Summary for Subcatchment PR-1:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.13 cfs @ 12.38 hrs, Volume= 0.033 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
55,733	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
55,733	39	Weighted Average
55,733		100.00% Pervious Area

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

Summary for Subcatchment PR-2:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 14.26 cfs @ 12.07 hrs, Volume= 1.027 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
17,745	98	Roofs, HSG A
53,929	68	<50% Grass cover, Poor, HSG A
64,748	98	Paved parking, HSG A
136,422	86	Weighted Average
53,929		39.53% Pervious Area
82,493		60.47% Impervious Area

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

Summary for Subcatchment PR-4:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 10.38 cfs @ 12.07 hrs, Volume= 0.814 af, Depth= 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
6,476	68	<50% Grass cover, Poor, HSG A
13,000	98	Roofs, HSG A
22,113	98	Roofs, HSG A
13,682	98	Roofs, HSG A
29,298	98	Paved parking, HSG A
84,569	96	Weighted Average
6,476		7.66% Pervious Area
78,093		92.34% Impervious Area

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

Summary for Subcatchment PR-5:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 6.86 cfs @ 12.08 hrs, Volume= 0.487 af, Depth= 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
27,244	39	>75% Grass cover, Good, HSG A
53,846	98	Paved parking, HSG A
81,090	78	Weighted Average
27,244		33.60% Pervious Area
53,846		66.40% Impervious Area

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

Summary for Subcatchment PR-7:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 8.54 cfs @ 12.07 hrs, Volume= 0.618 af, Depth= 4.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
28,730	68	<50% Grass cover, Poor, HSG A
51,195	98	Paved parking, HSG A
79,925	87	Weighted Average
28,730		35.95% Pervious Area
51,195		64.05% Impervious Area

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

Summary for Subcatchment PR-8:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.25 cfs @ 12.07 hrs, Volume= 0.020 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
2,011	98	Paved parking, HSG A
2,011		100.00% Impervious Area

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

Summary for Subcatchment PR3:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 21.26 cfs @ 12.07 hrs, Volume= 1.645 af, Depth= 4.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
43,802	98	Roofs, HSG A
20,988	98	Roofs, HSG A
23,240	98	Roofs, HSG A
6,018	79	<50% Grass cover, Poor, HSG B
8,336	39	>75% Grass cover, Good, HSG A
72,573	98	Paved parking, HSG A
174,957	95	Weighted Average
14,354		8.20% Pervious Area
160,603		91.80% Impervious Area

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

Summary for Subcatchment PR6:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.67 cfs @ 12.07 hrs, Volume= 0.204 af, Depth= 4.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
10,085	98	Roofs, HSG A
1,570	39	>75% Grass cover, Good, HSG A
10,538	98	Paved parking, HSG A
22,193	94	Weighted Average
1,570		7.07% Pervious Area
20,623		92.93% Impervious Area

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

Summary for Pond P1: SSIB 1

Inflow Area = 7.148 ac, 78.07% Impervious, Inflow Depth = 4.49" for 25-YEAR event
Inflow = 35.52 cfs @ 12.07 hrs, Volume= 2.672 af
Outflow = 17.25 cfs @ 12.22 hrs, Volume= 2.672 af, Atten= 51%, Lag= 9.0 min
Discarded = 0.62 cfs @ 12.22 hrs, Volume= 1.064 af
Primary = 16.64 cfs @ 12.22 hrs, Volume= 1.608 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 129.82' @ 12.22 hrs Surf.Area= 9,073 sf Storage= 33,065 cf

Plug-Flow detention time= 116.5 min calculated for 2.669 af (100% of inflow)
Center-of-Mass det. time= 116.8 min (895.1 - 778.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	124.75'	14,457 cf	**64.83'W x 139.94'L x 6.75'H Field A** 61,242 cf Overall - 25,099 cf Embedded = 36,143 cf x 40.0% Voids
#2A	125.50'	25,099 cf	**ADS_StormTech MC-4500 +Cap** x 231 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 7 Rows of 33 Chambers Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		39,556 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	125.25'	**18.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 125.25' / 125.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	126.75'	**20.0" W x 15.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	128.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 4.0' Crest Height
#4	Discarded	124.75'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.62 cfs @ 12.22 hrs HW=129.80' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.62 cfs)

Primary OutFlow Max=16.59 cfs @ 12.22 hrs HW=129.80' (Free Discharge)
└**1=Culvert** (Inlet Controls 16.59 cfs @ 9.39 fps)
  ├**2=Orifice/Grate** (Passes < 15.58 cfs potential flow)
  └**3=Sharp-Crested Rectangular Weir** (Passes < 30.38 cfs potential flow)

Summary for Pond P2: SSIB 2

Inflow Area = 9.090 ac, 81.12% Impervious, Inflow Depth = 3.20" for 25-YEAR event
Inflow = 25.19 cfs @ 12.09 hrs, Volume= 2.422 af
Outflow = 18.78 cfs @ 12.41 hrs, Volume= 2.422 af, Atten= 25%, Lag= 18.8 min
Discarded = 0.44 cfs @ 12.41 hrs, Volume= 0.501 af
Primary = 18.34 cfs @ 12.41 hrs, Volume= 1.921 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 124.57' @ 12.41 hrs Surf.Area= 5,941 sf Storage= 24,712 cf

Plug-Flow detention time= 41.1 min calculated for 2.419 af (100% of inflow)
Center-of-Mass det. time= 41.1 min (816.2 - 775.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	118.25'	9,580 cf	**64.83'W x 91.64'L x 6.75'H Field A** 40,105 cf Overall - 16,154 cf Embedded = 23,951 cf x 40.0% Voids
#2A	119.00'	16,154 cf	**ADS_StormTech MC-4500 +Cap** x 147 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 7 Rows of 21 Chambers Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		25,734 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	115.00'	**18.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 115.00' / 114.00' S= 0.0286 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	119.25'	**15.0" Vert. Orifice/Grate** C= 0.600

#3	Device 1	124.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.7' Crest Height
#4	Discarded	118.25'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.44 cfs @ 12.41 hrs HW=124.57' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.44 cfs)

Primary OutFlow Max=18.26 cfs @ 12.41 hrs HW=124.57' (Free Discharge)
└**1=Culvert** (Passes 18.26 cfs of 25.26 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 12.80 cfs @ 10.43 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 5.46 cfs @ 2.49 fps)

Summary for Pond P3: SSIB 3

Inflow Area = 1.862 ac, 66.40% Impervious, Inflow Depth = 3.14" for 25-YEAR event
Inflow = 6.86 cfs @ 12.08 hrs, Volume= 0.487 af
Outflow = 2.73 cfs @ 12.32 hrs, Volume= 0.487 af, Atten= 60%, Lag= 14.9 min
Discarded = 0.39 cfs @ 12.32 hrs, Volume= 0.368 af
Primary = 2.34 cfs @ 12.32 hrs, Volume= 0.119 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 110.50' @ 12.32 hrs Surf.Area= 6,338 sf Storage= 6,504 cf

Plug-Flow detention time= 99.4 min calculated for 0.487 af (100% of inflow)
Center-of-Mass det. time= 99.4 min (921.3 - 822.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	108.80'	4,429 cf	**41.50'W x 152.72'L x 2.33'H Field A** 14,788 cf Overall - 3,715 cf Embedded = 11,073 cf x 40.0% Voids
#2A	109.30'	3,715 cf	**ADS_StormTech SC-310 +Cap** x 252 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Rows of 21 Chambers
		8,144 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	108.50'	**12.0" Round Culvert** L= 45.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 108.50' / 104.50' S= 0.0889 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	110.00'	**12.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	110.25'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.7' Crest Height
#4	Discarded	108.80'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.39 cfs @ 12.32 hrs HW=110.49' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.39 cfs)

Primary OutFlow Max=2.30 cfs @ 12.32 hrs HW=110.49' (Free Discharge)
└**1=Culvert** (Passes 2.30 cfs of 4.62 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.72 cfs @ 2.90 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.58 cfs @ 1.63 fps)

Summary for Link DP-1: Intermittent Stream along Dascomb Road

Inflow Area = 1.279 ac, 0.00% Impervious, Inflow Depth = 0.31" for 25-YEAR event
Inflow = 0.13 cfs @ 12.38 hrs, Volume= 0.033 af
Primary = 0.13 cfs @ 12.38 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Existing Closed Drainage System

Inflow Area = 11.461 ac, 79.25% Impervious, Inflow Depth = 2.35" for 25-YEAR event
Inflow = 21.23 cfs @ 12.39 hrs, Volume= 2.245 af
Primary = 21.23 cfs @ 12.39 hrs, Volume= 2.245 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: Drainage Swale

Inflow Area = 1.835 ac, 64.05% Impervious, Inflow Depth = 4.04" for 25-YEAR event
Inflow = 8.54 cfs @ 12.07 hrs, Volume= 0.618 af
Primary = 8.54 cfs @ 12.07 hrs, Volume= 0.618 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: Smith Drive

Inflow Area = 0.046 ac,100.00% Impervious, Inflow Depth = 5.26" for 25-YEAR event
Inflow = 0.25 cfs @ 12.07 hrs, Volume= 0.020 af
Primary = 0.25 cfs @ 12.07 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Time span=0.00-40.00 hrs, dt=0.05 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPR-1: Runoff Area=55,733 sf 0.00% Impervious Runoff Depth=0.66"
Tc=5.0 min CN=39 Runoff=0.42 cfs 0.071 af

SubcatchmentPR-2: Runoff Area=136,422 sf 60.47% Impervious Runoff Depth=5.08"
Tc=5.0 min CN=86 Runoff=18.19 cfs 1.325 af

SubcatchmentPR-4: Runoff Area=84,569 sf 92.34% Impervious Runoff Depth=6.22"
Tc=5.0 min CN=96 Runoff=12.72 cfs 1.007 af

SubcatchmentPR-5: Runoff Area=81,090 sf 66.40% Impervious Runoff Depth=4.20"
Tc=5.0 min CN=78 Runoff=9.14 cfs 0.652 af

SubcatchmentPR-7: Runoff Area=79,925 sf 64.05% Impervious Runoff Depth=5.19"
Tc=5.0 min CN=87 Runoff=10.84 cfs 0.794 af

SubcatchmentPR-8: Runoff Area=2,011 sf 100.00% Impervious Runoff Depth=6.46"
Tc=5.0 min CN=98 Runoff=0.31 cfs 0.025 af

SubcatchmentPR3: Runoff Area=174,957 sf 91.80% Impervious Runoff Depth=6.11"
Tc=5.0 min CN=95 Runoff=26.12 cfs 2.044 af

SubcatchmentPR6: Runoff Area=22,193 sf 92.93% Impervious Runoff Depth=5.99"
Tc=5.0 min CN=94 Runoff=3.29 cfs 0.254 af

Pond P1: SSIB 1 Peak Elev=131.46' Storage=39,412 cf Inflow=44.31 cfs 3.369 af
Discarded=0.66 cfs 1.135 af Primary=19.88 cfs 2.235 af Outflow=20.54 cfs 3.369 af

Pond P2: SSIB 2 Peak Elev=124.96' Storage=25,633 cf Inflow=29.58 cfs 3.242 af
Discarded=0.45 cfs 0.560 af Primary=25.16 cfs 2.682 af Outflow=25.61 cfs 3.242 af

Pond P3: SSIB 3 Peak Elev=110.78' Storage=7,257 cf Inflow=9.14 cfs 0.652 af
Discarded=0.39 cfs 0.418 af Primary=5.05 cfs 0.234 af Outflow=5.45 cfs 0.652 af

Link DP-1: Intermittent Stream along Dascomb Road Inflow=0.42 cfs 0.071 af
Primary=0.42 cfs 0.071 af

Link DP-2: Existing Closed Drainage System Inflow=31.61 cfs 3.170 af
Primary=31.61 cfs 3.170 af

Link DP-3: Drainage Swale Inflow=10.84 cfs 0.794 af
Primary=10.84 cfs 0.794 af

Link DP-4: Smith Drive Inflow=0.31 cfs 0.025 af
Primary=0.31 cfs 0.025 af

Total Runoff Area = 14.621 ac Runoff Volume = 6.172 af Average Runoff Depth = 5.07"
29.52% Pervious = 4.317 ac 70.48% Impervious = 10.304 ac

Summary for Subcatchment PR-1:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.42 cfs @ 12.15 hrs, Volume= 0.071 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
55,733	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
55,733	39	Weighted Average
55,733		100.00% Pervious Area

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

Summary for Subcatchment PR-2:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 18.19 cfs @ 12.07 hrs, Volume= 1.325 af, Depth= 5.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
17,745	98	Roofs, HSG A
53,929	68	<50% Grass cover, Poor, HSG A
64,748	98	Paved parking, HSG A
136,422	86	Weighted Average
53,929		39.53% Pervious Area
82,493		60.47% Impervious Area

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

Summary for Subcatchment PR-4:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 12.72 cfs @ 12.07 hrs, Volume= 1.007 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
6,476	68	<50% Grass cover, Poor, HSG A
13,000	98	Roofs, HSG A
22,113	98	Roofs, HSG A
13,682	98	Roofs, HSG A
29,298	98	Paved parking, HSG A
84,569	96	Weighted Average
6,476		7.66% Pervious Area
78,093		92.34% Impervious Area

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

Summary for Subcatchment PR-5:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 9.14 cfs @ 12.08 hrs, Volume= 0.652 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
27,244	39	>75% Grass cover, Good, HSG A
53,846	98	Paved parking, HSG A
81,090	78	Weighted Average
27,244		33.60% Pervious Area
53,846		66.40% Impervious Area

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

Summary for Subcatchment PR-7:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 10.84 cfs @ 12.07 hrs, Volume= 0.794 af, Depth= 5.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
28,730	68	<50% Grass cover, Poor, HSG A
51,195	98	Paved parking, HSG A
79,925	87	Weighted Average
28,730		35.95% Pervious Area
51,195		64.05% Impervious Area

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

Summary for Subcatchment PR-8:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.31 cfs @ 12.07 hrs, Volume= 0.025 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
2,011	98	Paved parking, HSG A
2,011		100.00% Impervious Area

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

Summary for Subcatchment PR3:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 26.12 cfs @ 12.07 hrs, Volume= 2.044 af, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
43,802	98	Roofs, HSG A
20,988	98	Roofs, HSG A
23,240	98	Roofs, HSG A
6,018	79	<50% Grass cover, Poor, HSG B
8,336	39	>75% Grass cover, Good, HSG A
72,573	98	Paved parking, HSG A
174,957	95	Weighted Average
14,354		8.20% Pervious Area
160,603		91.80% Impervious Area

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

Summary for Subcatchment PR6:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.29 cfs @ 12.07 hrs, Volume= 0.254 af, Depth= 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YEAR Rainfall=6.70"

Area (sf)	CN	Description
10,085	98	Roofs, HSG A
1,570	39	>75% Grass cover, Good, HSG A
10,538	98	Paved parking, HSG A
22,193	94	Weighted Average
1,570		7.07% Pervious Area
20,623		92.93% Impervious Area

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

Summary for Pond P1: SSIB 1

Inflow Area = 7.148 ac, 78.07% Impervious, Inflow Depth = 5.66" for 100-YEAR event
Inflow = 44.31 cfs @ 12.07 hrs, Volume= 3.369 af
Outflow = 20.54 cfs @ 12.23 hrs, Volume= 3.369 af, Atten= 54%, Lag= 9.7 min
Discarded = 0.66 cfs @ 12.23 hrs, Volume= 1.135 af
Primary = 19.88 cfs @ 12.23 hrs, Volume= 2.235 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 131.46' @ 12.23 hrs Surf.Area= 9,073 sf Storage= 39,412 cf

Plug-Flow detention time= 104.8 min calculated for 3.369 af (100% of inflow)
Center-of-Mass det. time= 104.7 min (877.7 - 773.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	124.75'	14,457 cf	**64.83'W x 139.94'L x 6.75'H Field A** 61,242 cf Overall - 25,099 cf Embedded = 36,143 cf x 40.0% Voids
#2A	125.50'	25,099 cf	**ADS_StormTech MC-4500 +Cap** x 231 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 7 Rows of 33 Chambers Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		39,556 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	125.25'	**18.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 125.25' / 125.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	126.75'	**20.0" W x 15.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	128.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 4.0' Crest Height
#4	Discarded	124.75'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.66 cfs @ 12.23 hrs HW=131.44' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.66 cfs)

Primary OutFlow Max=19.85 cfs @ 12.23 hrs HW=131.44' (Free Discharge)
└**1=Culvert** (Inlet Controls 19.85 cfs @ 11.23 fps)
  ├**2=Orifice/Grate** (Passes < 20.22 cfs potential flow)
  └**3=Sharp-Crested Rectangular Weir** (Passes < 76.50 cfs potential flow)

Summary for Pond P2: SSIB 2

Inflow Area = 9.090 ac, 81.12% Impervious, Inflow Depth = 4.28" for 100-YEAR event
Inflow = 29.58 cfs @ 12.10 hrs, Volume= 3.242 af
Outflow = 25.61 cfs @ 12.25 hrs, Volume= 3.242 af, Atten= 13%, Lag= 9.1 min
Discarded = 0.45 cfs @ 12.25 hrs, Volume= 0.560 af
Primary = 25.16 cfs @ 12.25 hrs, Volume= 2.682 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 124.96' @ 12.25 hrs Surf.Area= 5,941 sf Storage= 25,633 cf

Plug-Flow detention time= 37.8 min calculated for 3.242 af (100% of inflow)
Center-of-Mass det. time= 37.7 min (814.0 - 776.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	118.25'	9,580 cf	**64.83'W x 91.64'L x 6.75'H Field A** 40,105 cf Overall - 16,154 cf Embedded = 23,951 cf x 40.0% Voids
#2A	119.00'	16,154 cf	**ADS_StormTech MC-4500 +Cap** x 147 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 7 Rows of 21 Chambers Cap Storage= +35.7 cf x 2 x 7 rows = 499.8 cf
		25,734 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	115.00'	**18.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 115.00' / 114.00' S= 0.0286 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	119.25'	**15.0" Vert. Orifice/Grate** C= 0.600

#3	Device 1	124.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.7' Crest Height
#4	Discarded	118.25'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.45 cfs @ 12.25 hrs HW=124.96' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.45 cfs)

Primary OutFlow Max=25.19 cfs @ 12.25 hrs HW=124.96' (Free Discharge)
└**1=Culvert** (Passes 25.19 cfs of 25.82 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 13.32 cfs @ 10.85 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 11.87 cfs @ 3.26 fps)

Summary for Pond P3: SSIB 3

Inflow Area = 1.862 ac, 66.40% Impervious, Inflow Depth = 4.20" for 100-YEAR event
Inflow = 9.14 cfs @ 12.08 hrs, Volume= 0.652 af
Outflow = 5.45 cfs @ 12.19 hrs, Volume= 0.652 af, Atten= 40%, Lag= 6.9 min
Discarded = 0.39 cfs @ 12.19 hrs, Volume= 0.418 af
Primary = 5.05 cfs @ 12.19 hrs, Volume= 0.234 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 110.78' @ 12.19 hrs Surf.Area= 6,338 sf Storage= 7,257 cf

Plug-Flow detention time= 87.7 min calculated for 0.651 af (100% of inflow)
Center-of-Mass det. time= 87.6 min (901.3 - 813.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	108.80'	4,429 cf	**41.50'W x 152.72'L x 2.33'H Field A** 14,788 cf Overall - 3,715 cf Embedded = 11,073 cf x 40.0% Voids
#2A	109.30'	3,715 cf	**ADS_StormTech SC-310 +Cap** x 252 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 12 Rows of 21 Chambers
		8,144 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	108.50'	**12.0" Round Culvert** L= 45.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 108.50' / 104.50' S= 0.0889 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	110.00'	**12.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	110.25'	**4.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.7' Crest Height
#4	Discarded	108.80'	**2.400 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.39 cfs @ 12.19 hrs HW=110.78' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.39 cfs)

Primary OutFlow Max=5.04 cfs @ 12.19 hrs HW=110.78' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.04 cfs @ 6.42 fps)
  ├**2=Orifice/Grate** (Passes < 0.97 cfs potential flow)
  └**3=Sharp-Crested Rectangular Weir** (Passes < 5.19 cfs potential flow)

Summary for Link DP-1: Intermittent Stream along Dascomb Road

Inflow Area = 1.279 ac, 0.00% Impervious, Inflow Depth = 0.66" for 100-YEAR event
Inflow = 0.42 cfs @ 12.15 hrs, Volume= 0.071 af
Primary = 0.42 cfs @ 12.15 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Existing Closed Drainage System

Inflow Area = 11.461 ac, 79.25% Impervious, Inflow Depth = 3.32" for 100-YEAR event
Inflow = 31.61 cfs @ 12.24 hrs, Volume= 3.170 af
Primary = 31.61 cfs @ 12.24 hrs, Volume= 3.170 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: Drainage Swale

Inflow Area = 1.835 ac, 64.05% Impervious, Inflow Depth = 5.19" for 100-YEAR event
Inflow = 10.84 cfs @ 12.07 hrs, Volume= 0.794 af
Primary = 10.84 cfs @ 12.07 hrs, Volume= 0.794 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Summary for Link DP-4: Smith Drive

Inflow Area = 0.046 ac,100.00% Impervious, Inflow Depth = 6.46" for 100-YEAR event
Inflow = 0.31 cfs @ 12.07 hrs, Volume= 0.025 af
Primary = 0.31 cfs @ 12.07 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

B

Water Quality Data

TSS Removal Calculation Worksheet

Location: Treatment Train 1

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Water Quality Unit (Stormceptor)	0.77	0.75	0.58	0.17
Isolator Row (Stormtech)	0.66	0.17	0.11	0.06
Infiltration Basin	0.80	0.06	0.05	0.01

Total TSS Removal = 99%

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

Project: 146 Dascomb Road
Prepared By: TEC, Inc.
Date: 10/26/2018

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

TSS Removal Calculation Worksheet

Location: Treatment Train 2

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Water Quality Unit (Stormceptor)	0.77	0.75	0.58	0.17

Total TSS Removal = 83%

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

Project: 146 Dascomb Road
Prepared By: TEC, Inc.
Date: 10/26/2018

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

Fact Sheet #4

Stormwater Technology: Stormceptor

(Hydro Conduit, formerly CSR New England Pipe)

Revised February 2003

*The **Stormceptor Fact Sheet** is one in a series of fact sheets for stormwater technologies and related performance evaluations, which are undertaken by the **Massachusetts STrategic Envirotechnology Partnership (STEP).***

The STEP evaluation entitled, *Technology Assessment, Stormceptor CSR New England Pipe*, January 1998 is the information source for this fact sheet. When a more thorough understanding of a system is required, the full *Technology Assessment* should be reviewed. Copies are available for downloading from the STEP Web site (www.STEPSITE.org/) or by contacting the STEP Program (Phone: 617/626/1197, FAX: 617/626/1180, email: linda.benevides@state.ma.us). This fact sheet is subject to future updates as additional performance information becomes available.

Description/Definition

Stormceptor is a prefabricated, underground unit that separates oils, grease, and sediment from stormwater runoff when installed with an existing or new pipe conveyance system. The unit is divided into two chambers–a treatment and a flow bypass chamber. During typical storm events, runoff is directed by the inflow weir through a drop pipe into the lower treatment chamber where sediment, oil, and grease are separated from the flow by gravity. The bypass chamber is designed to convey excess stormwater, which overtops the inflow weir, through the system without treatment.

Equipment and Sizing

The on-line Stormceptor units are available in eight sizes ranging from six and twelve feet in diameter with capacities of 900 to 7200 gallons. Since issuing the STEP assessment in 1998, the manufacturer has expanded the Stormceptor product line to include a storm drain inlet (STC 450i) and three units (Models STC 11000, STC 13000, and STC16000). These systems are not included in the STEP evaluation. Users and decision-makers may require additional field test results and new data for these new systems in order to accept performance ratings, particularly if they are higher than those reported in the STEP technology assessment and this fact sheet.

Stormceptor units are available in either precast concrete or fiberglass for special applications. Concrete units are pre-engineered for HS-20 min. traffic loading at the surface. Fiberglass units can be used in areas where there is a potential for oil and chemical spills.

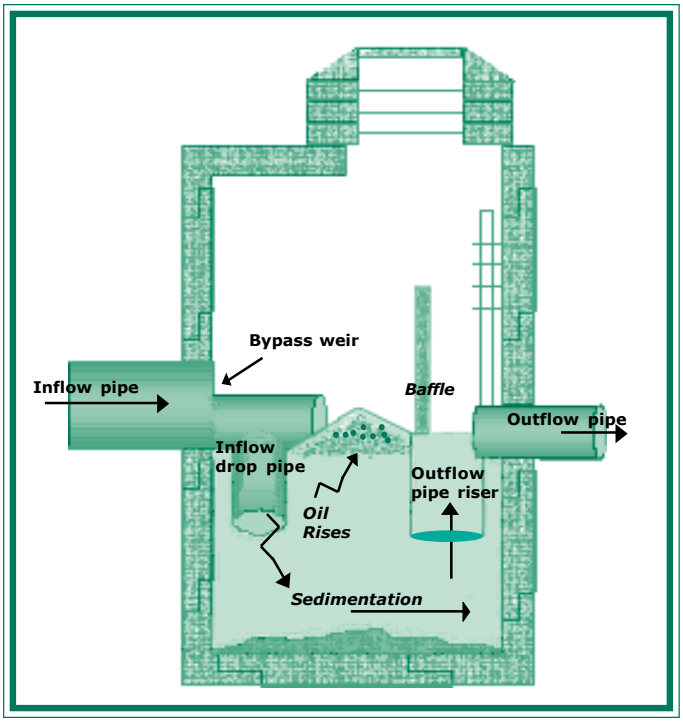


Figure 1. Stormceptor operation during average flow conditions.

Performance/Effectiveness

The system is designed to provide separation of sediment, oil, and grease from stormwater by routing runoff into a low-turbulence environment where solids settle and oils float out of solution. The system sizing is based on the drainage area, historical rainfall data, and the solids removal efficiency required. It is recommended that the system be used in combination with other stormwater controls to conform with the Massachusetts Stormwater Management Policy and standards.

An Imperial Model STC 2000 (equivalent to the Model STC 2400) in Edmonton, Canada treats flow from a 9.8 acre commercial parking lot. This system was monitored during four storm events in 1996 and shown to have an average total suspended solids (TSS) removal efficiency of 52 percent. In designing a system to achieve a comparable removal efficiency, the relationship between system size and impervious drainage area should be considered, as detailed in Table 1 and the Technology Assessment Report.

A Model STC 1200 in Westwood, Massachusetts treats flow from 0.65 acres consisting of a paved truck loading area at a manufacturing facility. The unit was monitored for six storm events in 1997, but only four events had measurable TSS influent concentrations. Of these four events, the average TSS removal efficiency was calculated to be 77 percent, which is less than the 80 percent removal targeted by the manufacturer.

Based on these field monitoring results, and when the unit sizing follows the guidance in Table 1, removal efficiencies between 52 percent and 77 percent may be achieved where installations have similar rainfall and land use characteristics as those reviewed for the STEP evaluation. It is recommended that additional field research and new data be evaluated to validate performance ratings higher than those verified by STEP.

Specific performance claims for oil and grease were not evaluated by STEP. However, total petroleum hydrocarbons (TPH) were analyzed during the Westwood study. Results indicated that the unit was effective in capturing oils.

Stormceptor Model Number	Maximum Impervious Area (acres)	
	77% TSS removal	52% TSS removal
STC 900	0.45	0.9
STC 1200	0.7	1.45
STC 1800	1.25	2.55
STC 2400	1.65	3.35
STC 3600	2.6	5.3
STC 4800	3.6	7.25
STC 6000	4.6	9.25
STC 7200	5.55	11.25

Table 1: Sizing for TSS removal (adapted from the manufacturer's sizing in the 1998 STEP Report) Use the table to determine a TSS removal rate. Use the new Rinker method for sizing Stormceptor units. The sizing method has been changed since publication of the STEP Report. **Note:** To achieve 52% and 77% TSS removal rates on some sites, it may be necessary to use lower maximum impervious areas than those in Table 1.

Technology Status

The Stormceptor system provides greater solids separation and higher TSS removal efficiencies than oil and grit separators. Stormceptor systems are among the category of hydrodynamic separators, which are flow-through devices with the capacity to settle or separate grit, oil, sediment, or other pollutants from stormwater. According to the U.S. Environmental Protection Agency, "Hydrodynamic separators are most effective where the materials to be removed from runoff are heavy particulates - which can be settled - or floatables - which can be captured, rather than solids with poor settleability or dissolved pollutants."

The field studies evaluated for the STEP assessment predate the Stormwater Best Management Practice Demonstration Tier II Protocol (2001), which is applicable in Massachusetts and other states in the Technology Acceptance Reciprocity Partnership (TARP), to ensure quality controlled studies that can be shared among participating states. Therefore, interstate reciprocity is not available to the manufacturer, based on performance claims that were evaluated by STEP in 1998. If the TARP Protocol requirements are fulfilled in the future, the manufacturer could pursue reciprocal verification for Stormceptor systems in participating TARP states. More information on the TARP Protocol is available on the following Web site: www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp.

Applications/Advantages

- Stormceptor systems identified in Table 1 should be used in combination with other BMPs to remove 80 percent of the average annual load of TSS (DEP Stormwater Policy Standard 4). Systems may be well suited for pretreatment in a mixed component system designed for stormwater recharge.
- Performance data show that Stormceptor may provide TSS removal rates in the range of 52 percent to 77 percent when sized according to Table 1. Higher TSS removal rates were achieved during low flow, low intensity storms with less than one third of an inch of runoff. Also, by reducing the impervious drainage area, relative to the system size, the STEP Technology Assessment Report indicated that higher removal efficiencies may be achievable. However, STEP recommends collection of additional data "representing a varied set of operating conditions over a realistic maintenance cycle to verify TSS removal rates greater than 80 percent."
- The Stormceptor system is suitable for new and retrofit applications. For retrofit applications, it should not

take the place of a catch basin for the systems that have been verified. Also, for retrofit applications, it should be installed in lateral lines and not main trunk lines.

- The system is particularly well suited in constricted areas and where space is limited.
- It also is suitable for use in areas of high potential pollutant loads (DEP Stormwater Policy Standard 5), where it may be used effectively in capturing and containing oil and chemical spills. *Web site:* www.state.ma.us/dep/brp/stormwtr/stormpub.htm.

Considerations/Limitations

- Systems are not expected to provide significant nutrient (nitrogen and phosphorus) or fecal coliform removal.
- The systems are not recommended for use in critical areas, such as public drinking water supplies, certified vernal pools, public swimming beaches, shellfish growing areas, cold water fisheries, and some Areas of Critical Environmental Concern (ACECs), except as a pretreatment device for BMPs that have been approved by DEP for use in critical areas. The structural BMPs approved for use in critical areas are described in Standard 6 of the Stormwater Management Policy, www.state.ma.us/dep/brp/stormwtr/stormpub.htm.
- There is a limited set of useful data for predicting the relationship between treatment efficiency and loading rates. Removal efficiencies have not been demonstrated for all unit sizes.
- Further research is needed to determine how much TSS bypasses the treatment chamber during certain, higher velocity storm events which recur less frequently.
- Systems require regular maintenance to minimize the potential for washout of the accumulated sediments.

Reliability/Maintenance

All BMPs require scheduled, routine maintenance to ensure that they operate as efficiently as possible. Although maintenance requirements are site specific, a general relationship between cleaning needs and depths of sediment has been established by the manufacturer. Inspection of the Stormceptor interior should be done after major storm events, particularly in the first year of operation. It is recommended that material in the treatment chamber be pumped out by a vacuum truck semiannually, or when the sediment and pollutant loads reach about 15 percent of the total storage. If the unit is used for spill containment, it should be pumped after the event is contained. Typical cleaning costs were estimated by the manufacturer in 1998 to be $250, with disposal costs averaging $300 to $500. The expected life of a system has been estimated to be 50 to 100 years.

Sediment Depths Indicating Required Maintenance	
Model Number	**Sediment Depth (feet)**
STC 900	0.5
STC 1200	0.75
STC 1800	1
STC 2400	1
STC 3600	1.25
STC 4800	1
STC 6000	1.5
STC 7200	1.25

Table 2: The Stormceptor clean out is based on 15 percent of the sediment storage volume in the

References

Winkler, E.S. 1998. "Technology Assessment, Stormceptor." University of Massachusetts, Amherst, MA. *STEP Web site:* www.STEPSITE.org/

Massachusetts Department of Environmental Protection and Office of Coastal Zone Management. 1997. "Stormwater Management Handbooks, Volumes One and Two." Boston, MA. *Handbooks Web site:* www.state.ma.us/dep/brp/stormwtr/stormpub.htm.

United States Environmental Protection Agency. "Storm Water Technology Fact Sheet Hydrodynamic Separators." EPA 832-F-99-017.

Stormceptor Web sites: www.rinkermaterials.com/stormceptor

TARP Web site: www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp

STEP Verification vs. Regulatory Approval

STEP assistance to developers of innovative technologies and STEP verification of stormwater treatment systems is not required to receive necessary approvals from conservation commissions or the Department of Environmental Protection (DEP). However, if a system has received verfication, a conservation commission shall presume that the technology will function as proposed, provided the conditions are similar to those in which performance was verified. STEP reports are not technology approvals, and do not constitute an endorsement or recommendation for use. Questions on regulatory issues should be referred to the DEP regional offices.

C

Operation and Maintenance Plan

STORMWATER MANAGEMENT OPERATIONS AND MAINTENANCE PLAN

THE DASCOMB ROAD PROJECT

146 DASCOMB ROAD
ANDOVER, MASSACHUSETTS

Prepared for:

Dascomb Road Redevelopment, LLC
354 Merrimack Street, Ste 1
Lawrence, MA 01843

Prepared by:

TEC, Inc.
169 Ocean Blvd.
Unit 101, P.O. Box 249
Hampton, NH 03842

October 26, 2018

Stormwater Management Operation and Maintenance Plan
October 26, 2018

Name of Applicant: Salvatore N. Lupoli
Name of Facility: Proposed Dascomb Road Redevelopment
Location: 146 Dascomb Road, Andover, MA 01810

A detailed, written log of all scheduled preventative and corrective maintenance performed for the stormwater management measures must be kept on site, including a record of all inspections and copies of maintenance-related work orders.
Attachment 1, "Inspection and Maintenance Check List" shall be maintained as a record of regularly scheduled inspection and maintenance items as outlined below for every year. Maintenance required and actions taken shall be recorded in Attachment 2, Inspection and Maintenance Log". The funding, operation, and maintenance of all stormwater management Best Management Practices (BMPs) shall be provided by the Applicant, or their appointee.

Maintenance routine and schedule: Routine inspections will be conducted on a monthly basis and thorough investigations will be conducted twice a year. Tasks that are common to all systems include regular removal of accumulated sediments, floatables and debris. Inspections will occur after every major storm event for the first six (6) months after construction. Inspections will be conducted by a Professional Engineer registered in the Commonwealth of Massachusetts experienced in drainage design. Annual reports will be prepared detailing the status of the stormwater system and the maintenance performed. A copy of the annual report will be sent to the Town of Andover.

The owner agrees to comply with a minimum maintenance schedule as follows:

1. **Monthly inspection for damaged or clogged catch basin grates.**
   Catch basin grates shall be inspected and cleared of debris to maintain inlet capacity.

2. **Quarterly sweeping of the parking lot.**
   The parking lot shall be swept four (4) times per year. Sweepings should be concentrated in the late spring after winter sanding and late fall after the leaves have fallen. Sweeping of the parking areas shall be performed with a mechanical sweeper (rotary broom).

3. **Annual cleaning of catch basins**
   Sumps and inlets shall be cleaned once per year and inspected on a monthly basis. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

4. Inspection and cleaning of drainage pipes and manholes.

Drainage pipes and manhole structures, including those associated with the sub surface infiltration systems, shall be inspected and cleaned of sediment at least every five (5) years or as required to maintain adequate functionality of the stormwater conveyance system. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

5. Water Quality Unit Maintenance

The water quality units, which include all sub-surface infiltration structures and particle separator structures, shall be monitored and maintained on a regular basis according to manufacturer's specifications. All structures shall be cleaned of sediment buildup at least twice annually.

6. Subsurface Infiltration Basin

The subsurface infiltration system shall be inspected annually to ensure that its performance has not become sacrificed. The outlet weirs and overflows shall also be inspected to maintain proper hydraulics.

7. Bioretention Swale/Rain Garden

The Bioretention Swale/Rain Garden shall be inspected monthly to remove any accumulated trash and debris as well as repair eroded areas. Re-mulch areas annually (spring). Treat diseased vegetation as needed and Replace dead vegetation twice per year (spring and fall). No snow shall be stored in the rain garden during the winter months.

8. Grass Landscaping

The grass landscaping will be inspected after every major storm event for the first two (2) months after seeding to ensure functionality. Thereafter, inspections should take place every six (6) months in the spring and fall and after severe storm events. Grass and mulched landscaping showing signs of wear and erosion will be re-loamed/re-seeded or re-mulched as necessary to prevent further erosion from taking place.

9. Snow Removal

Snow shall be plowed from driveway system/parking garage and stored in the designated snow storage areas.

The Long-Term Pollution Prevention Plan

The Owner agrees to comply with the following Long-Term Pollution Prevention Plan to ensure long-term stormwater quality discharge from the site:

- *Good housekeeping practices:* The project is retail, professional office, and restaurant development that will be maintained by the owner, including snow removal, de-icing, and BMP inspection/maintenance.

- *Provisions for storing materials and waste products inside or under cover*: No materials or waste products will be stored on-site.

- *Vehicle washing controls:* Vehicle washing is not anticipated as a reasonably foreseeable use of the site.

- *Requirements for routine inspections and maintenance of stormwater BMPs:* The owner will be responsible for providing the necessary inspections and maintenance for the stormwater BMPs.

- *Spill prevention and response plans:* There are no proposed uses at the site that would provide an opportunity for a spill of oil or hazardous materials, other than a sudden, catastrophic, vehicle failure. If a vehicle release is the result of an accident, the police and fire department will respond and address any release.

- *Provisions for maintenance of lawns, gardens, and other landscaped areas:* The owner will provide long-term maintenance for the landscaped areas, BMPs, and possible future great lawn.

- *Requirements for storage and use of fertilizers, herbicides, and pesticides:* At this time there would be no foreseeable need for fertilizers, herbicides, and pesticides.

- *Provisions for operation and management of septic systems:* Not Applicable

- *Provisions for solid waste management:* The owner will provide trash receptacles for each tenant of the proposed redevelopment. The trash receptacles will have lids of the type and nature to prevent windblown trash from escaping and will be emptied regularly.

- *Snow disposal and plowing plans relative to Wetland Resource Areas:* Snow will be stored in the various landscaped islands onsite temporarily.

During large storm events, snow will be trucked off site. Snow disposal will be prohibited within the 100' wetland buffer.

- *Street sweeping schedules:* The owner will be responsible for monthly street sweeping with sweepings concentrated in the Spring and Fall as stated in the Operations and Maintenance plan. Sweeping will be performed with a mechanical sweeper (rotary broom).

- *Provisions for prevention of illicit discharges to the stormwater management system:* Only stormwater is proposed to be conveyed through the stormwater management system. No illicit materials will be permitted. The owner will be responsible to maintain this 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:* The BMPs selected provide adequate containment of contaminants in the unlikely event of a spill.

- *Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan:* Prior to implementation of the LTPPP, the owner shall provide an on-site meeting with the maintenance personnel to present the contents and requirements of the Stormwater Operation and Maintenance Plan and the LTPPP.

- *List of Emergency contacts for implementing Long-Term Pollution Prevention Plan*:

  Riverwalk Properties
  (978)681-7777 x 24
  290 Merrimack Street
  Lawrence, MA 01843

D

Construction Period Pollution Prevention and Erosion and Sediment Control Plan

CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN

THE DASCOMB ROAD PROJECT

146 DASCOMB ROAD
ANDOVER, MASSACHUSETTS

Prepared for:

Dascomb Road Redevelopment, LLC
354 Merrimack Street, Ste 1
Lawrence, MA 01843

Prepared by:

TEC, Inc.
169 Ocean Blvd,
Unit 101, P.O. Box 249
Hampton, NH 03842

October 26, 2018

CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN
October 26, 2018

Name of Applicant: Salvatore N. Lupoli
Name of Facility: Proposed Dascomb Road Redevelopment
Location: 146 Dascomb Road
Andover, MA

Good Housekeeping BMPs

Goals

Minimize the potential for contaminants to enter or runoff the site during construction activities. Fuel and other equipment related fluids will be properly stored. The Contractor shall establish secure storage areas that collect any spillage to meet requirements of the Town of Andover Fire Department regarding the storage of flammable materials. The Contractor shall complete and submit the plans to the Engineer.

General Requirements

The following presents a proactive approach to all of the best management practices, erosion and sedimentation controls, mitigation measures, and monitoring activities for this Project.

Compost Filter Sock

A compost filter sock is a type of contained compost filter berm. It is a mesh tube filled with composted material that is placed perpendicular to sheet-flow runoff to control erosion and retain sediment in disturbed areas. The filter sock can be used in place of a traditional sediment and erosion control tool such as a silt fence or straw bale barrier.

Compost filter socks are flexible and can be placed along the perimeter of a site, or at intervals along a slope, to capture and treat stormwater that runs off as sheet flow. Filter socks can also be used on pavement as inlet protection for storm drains and to slow water flow in small ditches. Filter socks used for erosion control are usually 12 inches in diameter, although 8 inch, 18 inch, and 24 inch– diameter socks are used in some applications. The smaller, 8 inch–diameter filter socks are commonly used for stormwater inlet protection. The outer shell of a compost filter sock is typically biodegradable and can remain on pervious surfaces post construction versus having to be removed as construction waste.

Temporary Stabilized Construction Vehicle Entrance/Exit

The purpose of stabilized entrances to a construction site is to minimize the amount of sediment leaving the area as mud and sediment attached to vehicles. Installing a pad of gravel over filter cloth where construction traffic leaves a site can help stabilize a construction entrance. As a vehicle drives over the pad, the pad removes mud and sediment from the wheels and reduces soil transport off the site. The filter cloth separates the gravel from the soil below, keeping the gravel from being ground into the soil. The fabric also reduces the amount of rutting caused by vehicle tires. It spreads the vehicle's weight over a soil area larger than the tire width.

Storm Drain Inlet Protection
Storm drain inlet protection measures prevent soil and debris from entering storm drain inlets. These measures will be implemented before the Site is disturbed by using silt sacks, compost filter socks, or staked bales in combination with silt fence. Storm drain inlet protection will be installed at all down gradient catch basins adjacent to the project site outside the protection of other erosion control barriers, all catch basins within the construction site, and at low points within the construction site that are connected to the storm drainage system.

General Maintenance
Refer to the Inspection and Maintenance Checklist (at the end of this section) identifying inspection and maintenance measures for each specific practice.

The contractor or subcontractor will be responsible for implementing each control shown on the Plan. In accordance with EPA regulations, the contractor must sign a copy of a certification to verify that a plan has been prepared and that permit regulations are understood.

The onsite contractor will inspect all sediment and erosion control structures weekly and after each rainfall event meeting the minimum requirements as defined in the Plan. Records of the inspections will be prepared and maintained onsite by the contractor as required by the Plan.

- Silt shall be removed from behind barriers if greater than 6-inches deep or as needed.
- Damaged or deteriorated items will be repaired immediately after identification.
- The underside of straw bales should be kept in close contact with the earth and reset as necessary.
- Sediment that is collected in structures shall be disposed of properly and covered if stored onsite.
- At a minimum establish good housekeeping BMPs for:
    - Material handling and waste management
    - Staging areas
    - Designate washout areas
    - Equipment vehicle fueling and maintenance
    - Spill prevention and control

Erosion control structures shall remain in place until all disturbed earth has been securely stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

Spill Prevention and Control

The Contractor will actively maintain and manage the site activities with the procedures outlined in this Plan. In the event of petroleum or other deleterious substance spill, action will be taken by the Contractor to contain and remove the spill. The Contractor will comply with the relevant section(s) of the Oil Pollution Prevention Act, 40 CFR 112.7.

Responsibility

All project personnel share the responsibility for the initial control and reporting of the oil and other substance spill, especially the personnel that first discover the spill. The Site Safety and Health Officer (SSHO) will be responsible for determining the necessary safety equipment and for establishing safety practices to be followed by the Contractor during the clean-up operations. All personnel will be trained in the use of and location of this equipment, prior to the commencement of the construction.

The Contractor's goal is to provide effective, efficient and coordinated action to minimize or mitigate damages to the environment and public health and welfare from oil or other substance discharges, conforming to applicable federal, state, and local regulations, as well as other provisions and restrictions. In the event of spills or releases that may occur during the Project, a representative on-site qualified by OSHA training requirements (29 CFR 1910.120) for a Level 3 Hazmat Technician will be provided and will have the responsibility and authority for supervising the cleanup. If the representative determines that the clean up operations are beyond the capacity of the Contractor, assistance shall be requested from its Subcontractor.

In the event of an emergency spill, the Contractor will be responsible for retaining the environmental Subcontractor. The selected environmental subcontractor will develop a Hazardous Materials Health and Safety Plan, which will be referenced when a spill or release is discovered, and the control of the spill or release is beyond the scope of the Spill Prevention Control and Countermeasure plan. The Contractor's Project Manager is responsible for giving the SSHO directions for initiating the Hazardous Materials Health and Safety Plan.

Alert and reporting procedures will become effective immediately upon observance and indication of a spill or discharge of oil or other substances on the project.

Reportable observations are:

1. Leaks or spills
2. Soils which are discolored or have an odor
3. Discharge of oil or other similar substances from drain pipes

The Engineer will be informed immediately of all substantial spills, releases, or other substance discharges. All telephone numbers for the Emergency Response agencies will be posted on site. The Contractor or its Subcontractors will implement control and countermeasures immediately.

Fuel and Oil Delivery Trucks

The equipment superintendent or designee will monitor all truck unloading procedures to verify all hoses are tight and do not leak, and if necessary, will tighten, adjust, or replace them to prevent a release of any kind. In the event of a major spill, alert and initial report procedures will be implemented, and an emergency response contractor will be called in to perform the cleanup.

Equipment

Motorized equipment that require fuel and oil to operate will be inspected prior to the start of each work shift by the operator (in the field) to ensure there is no leakage of oil, fuel, or other material. Trucks will be inspected prior to use for potential leaks or drips. If a leak is found, repairs will be made immediately, and spillage will be cleaned up manually using sorbent material. Vehicles that are found to be leaking will be immediately taken out of service until repairs can be made.

Drum Storage

Drum storage, if any, will be located in a secure area within the Project limits away from environmental areas of concern. Petroleum liquids and other substances stored in drums will be kept in a drum container that consists of a drum rack and drip containment pan that is capable of containing 110% of the stored volume should the drum rupture.

Lubrication / Oil Maintenance

Replacement lubrication will be directly deposited from the lubrication truck to the equipment lubrication reservoir. No other container system will be used to transport oil to the equipment. Mobile equipment will be serviced off site or in the lay-down area. Equipment that cannot be moved will be serviced in the field. The Contractor will place a containment pan or absorbent below the service area prior to initiating service activities in the field. Waste disposal will be completed by the Contractor or by a waste disposal firm. Miscellaneous lubricants for operating equipment will be limited to daily quantities.

Spent Oil

Oil that has already been used on the job will be disposed of via a certified waste disposal firm. Spent oil will be stored in a labeled (hazardous waste signs) and vented fuel storage cell located at the staging area awaiting disposal by a certified waste disposal firm (i.e. Enpro, Inc.). The staging area will be located within the boundary of the project and inspected daily for leaks or spills. The storage cell will be bermed to contain 110% of the largest container or 10% of the total volume in storage, whichever is greater.

Special Oil Spill Equipment

Sorbent Pads

Sorbent pads will be available to absorb oil and petroleum compounds. If necessary, the pads will be used to absorb oil spills or leaks by placing them on the oil and giving them antiquated time to absorb it. The sorbent pads will be stored in equipment box located in the maintenance area. The pads shall float and be water repellent, so they can absorb oil on water. Saturated/contaminated pads will be placed in an appropriate container and stored within the maintenance area. A certified waste disposal firm will dispose of the approved containers.

Sorbent Compound

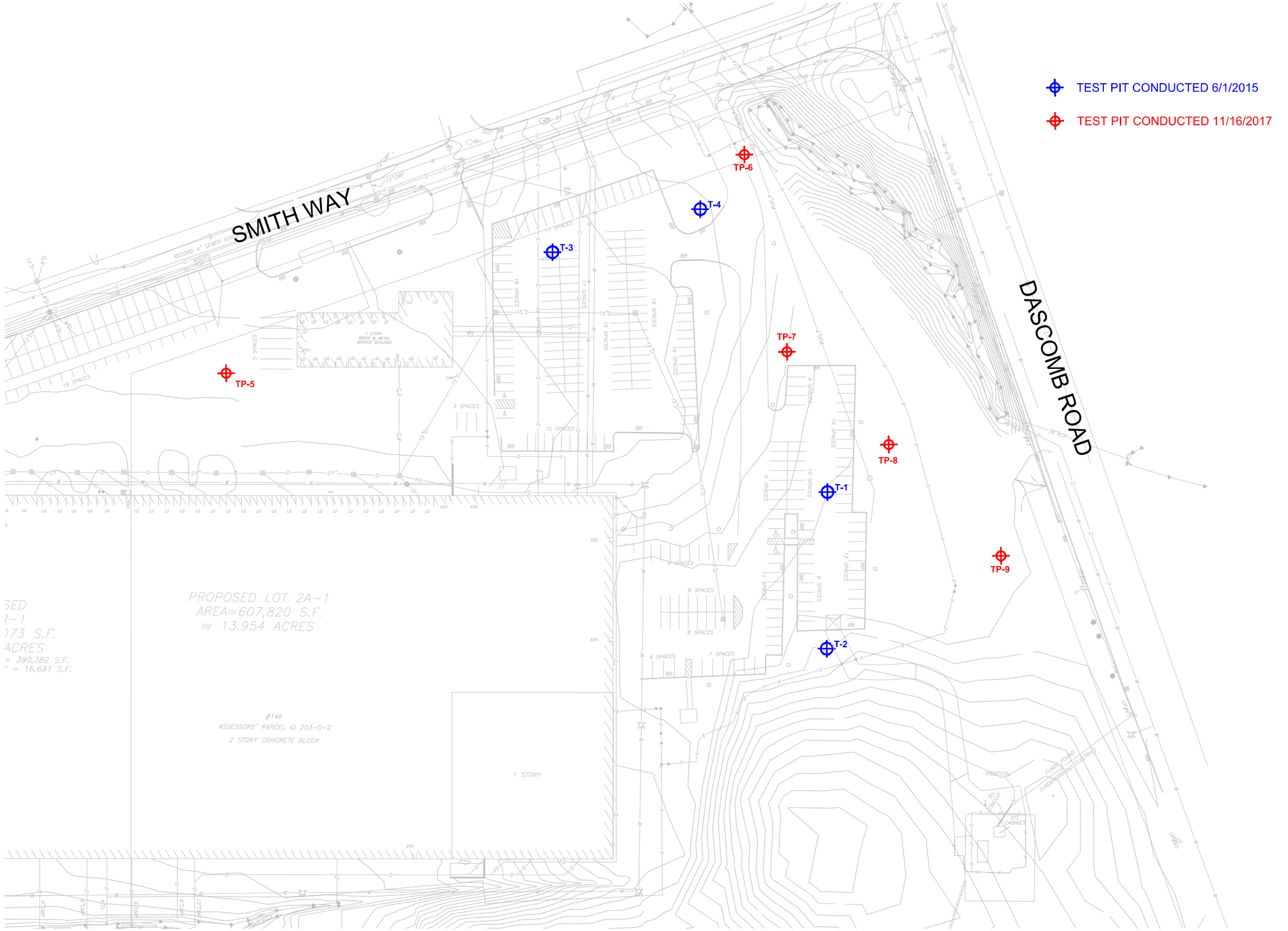
The compound will be used for contaminants spilled on decks or hard surfaces. In most cases, it can be applied directly to spills, but if the spill is large, it can be used to form a dike around the spill to prevent further migration.

Best Management Practices – Maintenance/Evaluation Checklist
Construction Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed ☐yes ☐no (List Items)	Date of Cleaning/Repair	Performed by
Compost Filter Sock	Inspect at least once per week and after each rainstorm of 0.25 inch or greater.			• Ensure that compost filter sock is intact and the area behind the sock is not filled with sediment. If there is excessive ponding behind the filter sock or accumulated sediments reach the top of the sock, an additional sock should be added on top or in front of the existing filter sock in these areas, without disturbing the soil or accumulated sediment. • If the filter sock was overtopped during a storm event, the operator should consider installing an additional filter sock on top of the original, placing an additional filter sock further up the slope.			
Catch Basin Inlet Protection	Inspect at least once per week and after each rainstorm of 0.25 inch or greater.			• Check all temporary control measures after each storm event. • To maintain the capacity, remove accumulated sediment when the capacity is reduced by half.			
Stabilized Construction Exit	Inspect at least once per week and after each rainstorm of 0.25 inch or greater.			• The exit shall be maintained in a condition that will prevent tracking of sediment onto public rights-of-way. • When the control pad becomes ineffective, the stone shall be removed along with the collected soil material and redistributed on site in a stable manner. The entrance should then be reconstructed. • The contractor shall sweep or wash pavement at exits, which have experienced mud-tracking on to the pavement or traveled way. • When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment trapping device. • All sediment shall be prevented from entering storm drains, ditches, or waterways		

E

Test Pit Data and Soil Evaluations



TEC, Inc.

65 Glenn Street
Lawrence, MA 01843
(978) 794-1792

169 Ocean Boulevard
Unit 101, PO Box 249
Hampton, NH 03842
(603) 601-8154

www.TheEngineeringCorp.com

DESIGNED BY	CPR
DRAWN BY	CPR
CHECKED BY	RJF
DATE	12/5/2017
SCALE	N.T.S.

PREPARED FOR

Lupoli Companies
290 Merrimack Street
Lawrence, MA 01843

REVISIONS

ISSUED FOR

Test Pits

PROJECT TITLE

Dascomb Road
Redevlopment

PROJECT LOCATION

Andover,
Massachusetts

DRAWING TITLE

Test Pit Locations

PROJECT NO.
T0681

TEC CAD FILE
T0681_TEST PITS.dwg

DRAWING NO.
1

SHEET 1 OF 1

Location: 146 DASCOMB RD.	Owner's Name: TEC
Map/Parcel: 203 / 2	Address: 65 GLEN ST - LAWRENCE
Installer:	Tel #: ____ New (S150) ____ Repair ____

Date: 6-1-15 Wetlands >100 Zone II — Soil Symbol 253 Soil Name HINKLEY Soil Class A

RAINEY - 600
0-3% (PARKING LOT)

Deep Observation Hole Logs BACK HOE: S&R - LOWELL

Elevation	Depth	Soil Horizon	Soil Texture	Soil Color	Soil Mottling	% Gravel, Stones, etc:
T-3	0-10"	BIT. CONC. GR. BASE	—	—	—	—
	10-20"	B	L.S.	10YR4/6		MASSIVE - FRIABLE
	20+60"	C	FINE SAND	2.5Y6/2	REDOX @ 30"	MASSIVE V. FRIABLE

Parent Material OUTWASH Depth to Bedrock — Standing Water in the Hole: 45" Weeping from Pit Face 40" ESHGW: 30"

T-4	0-8"	LOAM/FILL				
	8-32"	C	V. FINE SAND	2.5Y6/4	—	MASSIVE - FRIABLE
	32+84"	C2	MED. SAND	2.5Y6/2	REDOX @ 32"	LOOSE / SINGLE GRAIN

Parent Material OUTWASH Depth to Bedrock — Standing Water in the Hole: 82" Weeping from Pit Face 65" ESHGW: 32"

Date 6-1-15

Percolation Tests

Observation Hole #				
Depth of Perc				
Start Pre-soak				
Time at 12"				
Time at 9"				
Time at 6"				
Time (9"-6")				
Rate Min/Inch	2			

Performed By: WILLIAM DUFRESNE Witnessed By: DAVID DARGIE / ANDOVER DPW

Location: 146 DASCOMB RD.	Owner's Name: TEC
Map/Parcel: 203 / 2	Address: 65 GLEN ST - LAWRENCE
Installer:	Tel #: ____ New (5150) ____ Repair ____

Date: 6-1-15 Wetlands >100 Zone II — Soil Symbol 253 Soil Name HINKLEY Soil Class A

RANDY - 600
0-3% (PARKING LOT)

Deep Observation Hole Logs BACK HOE: S&R - LOWELL

Elevation	Depth	Soil Horizon	Soil Texture	Soil Color	Soil Mottling	% Gravel, Stones, etc:
T-1	0-3"	BTT. COVE				
	3-45"	C_1	COARSE GR. SAND	2.5Y5/3	—	LOOSE / SINGLE GRAIN
	45-130"	C_2	FINE SAND	2.5Y6/2	REDOX 80" 7.5YR4/6	MASSIVE - U FRIABLE
Parent Material OUTWASH	Depth to Bedrock —	Standing Water in the Hole: —	Weeping from Pit Face —	ESHGW: 80"		
T-2	0-12"	A	F.S.L.	10YR3/2	—	WK. GRANULAR FRIABLE
	12-29"	B	S.L.	10YR5/6	—	MASSIVE - FRIABLE
	29-71"	C_1	COARSE GR. SAND	2.5Y5/3	—	LOOSE / SINGLE GRAIN
	71-115"	C_2	FINE SAND	2.5Y6/2	REDOX 72" 5YR4/6	MASSIVE V. FRIABLE
Parent Material OUTWASH	Depth to Bedrock —	Standing Water in the Hole: —	Weeping from Pit Face —	ESHGW: 72"		

Date 6-1-15

Percolation Tests

Observation Hole #				
Depth of Perc				
Start Pre-soak				
Time at 12"				
Time at 9"				
Time at 6"				
Time (9"-6")				
Rate Min/Inch	2.2			

Performed By: ELIJAH DUPRESNE Witnessed By: DAVID DARGIE / AUTOCAD PPW

65 Glenn Street
Lawrence, MA 01843
T:978.794.1792

169 Ocean Blvd.
Unit 101, PO Box 249
Hampton, NH 03842
T:603.601.8154

TheEngineeringCorp.com

Location: 146 Dascomb Road
Andover, MA

Client: Dascomb Road Development, LLC
Address: 354 Merrimack Street, Suite 1, Lawrence, MA 01843
Telephone: 978-681-7777

Date: 11/16/2017 **Wetlands:** >100' **Zone II:** N/A **Soil Symbol:** 602 **Soil Name:** Urban Land **Soil Class:** A

Test Pit: TP-5 **Elevation:** 109.3' (See Test Pit Plan)

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-4	Pavement										
4-14	Fill	10 YR 5/4				Sandy Loam			Massive	Friable	
14-60	C	10 YR 7/2	30	10 YR 6/8	20	Fine Sand			Massive	Friable	

Parent Material: N/A **Depth to Bedrock:** N/A **Standing Water:** N/A **ESHGW:** 30"

Additional Notes:

Test Pit Performed by: Peter F. Ellison, PE **Soil Evaluator Number:** SE13866

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TheEngineeringCorp.com

Location: 146 Dascomb Road
Andover, MA

Client: Dascomb Road Development, LLC
Address: 354 Merrimack Street, Suite 1, Lawrence, MA 01843
Telephone: 978-681-7777

Date: 11/16/2017 **Wetlands:** 35' **Zone II:** N/A **Soil Symbol:** 602 **Soil Name:** Urban Land **Soil Class:** A

Test Pit: TP-6 **Elevation:** 117.8' (See Test Pit Plan)

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6	Ap	10 YR 3/1				Sandy Loam			Massive	Friable	
6-18	Bw	10 YR 5/6				Sandy Loam			Massive	Friable	
18-40	C1	10 YR 7/3				Fine Sand			Massive	Friable	
40-50	C2	10 YR 5/4				Coarse Sand	15-25		Massive	Friable	
50-72	C3	10 YR 7/2				Fine Sand			Massive	Friable	

Parent Material: N/A **Depth to Bedrock:** N/A **Standing Water:** N/A **ESHGW:** N/A

Additional Notes:

Test Pit Performed by: Peter F. Ellison, PE **Soil Evaluator Number:** SE13866

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Location: 146 Dascomb Road
Andover, MA

Client: Dascomb Road Development, LLC
Address: 354 Merrimack Street, Suite 1, Lawrence, MA 01843
Telephone: 978-681-7777

Date: 11/16/2017 **Wetlands:** >100' **Zone II:** N/A **Soil Symbol:** 602 **Soil Name:** Urban Land **Soil Class:** A

Test Pit: TP-7 **Elevation:** 122.0' (See Test Pit Plan)

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6	Ap	10 YR 3/2				Sandy Loam			Massive	Friable	
6-24	Fill	10 YR 3/2				Sandy Loam			Massive	Friable	
24-31	Bw	10 YR 4/4				Sandy Loam			Massive	Friable	
31-37	C1	10 YR 6/3				Coarse Sand	5-10		Massive	Friable	
37-72	C2	10 YR 7/2				Fine Sand			Massive	Friable	

Parent Material: N/A **Depth to Bedrock:** N/A **Standing Water:** N/A **ESHGW:** N/A

Additional Notes:

Test Pit Performed by: Peter F. Ellison, PE **Soil Evaluator Number:** SE13866

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Location: 146 Dascomb Road
Andover, MA

Client: Dascomb Road Development, LLC
Address: 354 Merrimack Street, Suite 1, Lawrence, MA 01843
Telephone: 978-681-7777

Date: 11/16/2017 **Wetlands:** 100' **Zone II:** N/A **Soil Symbol:** 253B **Soil Name:** Hinckley Loamy Sand **Soil Class:** A

Test Pit: TP-8 **Elevation:** 126.0' (See Test Pit Plan)

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-7	Ap	10 YR 4/2				Sandy Loam			Massive	Friable	
7-21	Bw	10 YR 5/6				Sandy Loam			Massive	Friable	
21-46	C1	10 YR 6/2				Coarse Sand	35-50		Massive	Friable	
46-68	C2	10 YR 7/2				Fine Sand			Massive	Friable	

Parent Material: Glacial Outwash **Depth to Bedrock:** N/A **Standing Water:** N/A **ESHGW:** N/A

Additional Notes:

Test Pit Performed by: Peter F. Ellison, PE **Soil Evaluator Number:** SE13866

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TheEngineeringCorp.com

Location: 146 Dascomb Road
Andover, MA

Client: Dascomb Road Development, LLC
Address: 354 Merrimack Street, Suite 1, Lawrence, MA 01843
Telephone: 978-681-7777

Date: 11/16/2017 **Wetlands:** >100' **Zone II:** N/A **Soil Symbol:** 253B **Soil Name:** Hinckley Loamy Sand **Soil Class:** A

Test Pit: TP-9 **Elevation:** 127.8 (See Test Pit Plan)

Depth	Soil Horizon	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6	Ap	10 YR 4/2				Sandy Loam			Massive	Friable	
6-48	Fill	10 YR 5/2				Sandy Loam			Massive	Friable	
48-54	C1	10 YR 5/8				Sandy Loam			Massive	Friable	
54-84	C2	10 YR 5/4	72	10 YR 6/8	15	Coarse Sand	10-15		Massive	Friable	

Parent Material: Glacial Outwash **Depth to Bedrock:** N/A **Standing Water:** N/A **ESHGW:** 72"

Additional Notes:

Test Pit Performed by: Peter F. Ellison, PE **Soil Evaluator Number:** SE13866