Transportation
Land Development
Environmental
Services

Vanasse Hangen Brustlin, Inc.

To: City of Somerville
Planning Board
93 Highland Avenue
Somerville, MA 02143

Date: February 1, 2013
Rev. September 26, 2014

Project No.: 12109.00

From: Conor Nagle, P.E.
Jocelyn Mayer, E.I.T.

Re: Stormwater Management Memorandum
60-70 Cross Street East
Somerville, Massachusetts

Introduction

Vanasse Hangen Brustlin, Inc. (VHB), on behalf of CPC-T Holdings, LLC (Applicant), has conducted a stormwater analysis for the proposed residential development to be located at 60-70 Cross Street East in Somerville, Massachusetts (Figure 1). The Project Site includes the area of Stop & Shop property to the east of Garfield Avenue, the portion of Cross Street East directly abutting the Stop & Shop property and Harris Park. The following memorandum describes the comprehensive stormwater management system designed for the Project Site.

Presuming the City of Somerville's discontinuance of Cross Street East from Pennsylvania to Mystic Avenue, the 1.87 acre project site is comprised of two lots, including 0.46 acres of the City of Somerville's Harris Park, 1.41 acre "Lot B", which is part of the Stop & Shop Supermarket Subdivision including half the width of discontinued Cross Street East. The Site is bounded by an existing Stop & Shop Supermarket to the north, Mystic Avenue to the east, residences to the south and to the west is Quality Graphics, an existing business, (Figure 1). The site is currently within the City of Somerville's Business A (BA) District, Open Space (OS) District and portions of the Site are within the Planned Unit Development B (PUD B) Overlay District. The proposed development is located within Flood Zone X as shown on the FEMA Flood Insurance Rate Map for Somerville, Massachusetts, Community Panel Map Number 25017C0439E, dated June 4, 2010 (Figure 2). Flood Zone X is defined by FEMA as "areas determined to be outside of the 0.2% annual chance floodplain".

The stormwater management system has been designed to comply to the extent practicable with the Massachusetts State Stormwater Management Regulations and Performance Standards. In addition to these regulations, the City of Somerville requires volume mitigation. The underlying soils in this location do not appear to be conducive to infiltration, and as such volume mitigation does not appear to be feasible at this location.

Existing Conditions

"Lot B" is currently comprised of an overflow parking lot utilized by Stop & Shop Supermarket customers and a 20,000 ± square foot grassed area, originally permitted for a 12,000 ± square foot office building. Harris Park is currently predominately paved, containing a playground and basketball court. The portion of Cross Street East between Pennsylvania and Mystic Avenue, to be abandoned by the City of Somerville, is currently paved. The soils on Site are classified as urban land, wet stratum. A detailed

NRCS soil map and report has been included as Attachment A. A preliminary geotechnical investigation indicated that groundwater was encountered between three (3) and six (6) feet below ground surface. Borings performed at the Project Site indicate that soil conditions consist of fill over natural deposits of clay (clay and silt, and silty clay) overlying glacial till and/ or bedrock. Two (2) soil gradation tests were performed on soil samples collected and indicated that the soils present on site have an infiltration rate between 0.02 and 0.05 inches per hour based on the Rawls Rate Table.

Under existing conditions stormwater runoff from Lot "B" is collected by two (2) catchbasins connected to the municipal drainage system running through the Stop & Shop Supermarket parking lot to Mystic Avenue. A 1,600 square foot subsurface infiltration system is located under the overflow parking lot. It was designed to collect and infiltrate the rooftop runoff from the previously proposed office building. The system is currently offline and does not infiltrate any stormwater.

Stormwater runoff in Harris Park sheet flows to two (2) landscape area drains and discharges, untreated to the municipal drainage system located in Cross Street East. Lastly, stormwater in Cross Street East is collected by a series of catchbasins connected to the City of Somerville's drainage system in Mystic Avenue.

Proposed Conditions

The proposed project includes the construction of a three (3) story apartment building comprised of an at-grade parking garage, with several at-grade dwelling units facing Cross Street, and two (2) stories of dwelling units above. In addition to the residential building, the City of Somerville's Harris Park will be redeveloped, significantly increasing the pervious landscaped area over today's current condition. The proposed development of the Project Site will maintain grading and drainage patterns to the maximum extent practicable.

Under proposed conditions, approximately 42,600 square feet of rooftop runoff will be collected by subsurface infiltration system consisting of a series of Stormtech infiltration units (Model No. SC-310) located on-site. Stormwater runoff from Harris Park will be collected by two landscape drains and infiltrated through a 12" HDPE perforated pipe. In the event of a large storm the infiltration systems are equipped with an overflow, allowing stormwater to bypass the system and discharge to the municipal drainage system in Cross Street East.

The stormwater management system is designed to reduce peak rates of runoff from the Project Site and improve the quality of stormwater runoff in accordance with the Massachusetts Stormwater Management regulations.

The underlying soils on the Project Site include clays and silts and a shallow depth to groundwater. The Project site is not conducive to infiltration, and as such volume mitigation does not appear to be feasible at this location. However, a recharge volume, in excess of the volume required by the Massachusetts Stormwater Management Regulations is provided within the infiltration system below the invert of the Stormtech units as requested by the City of Somerville Director of Engineering in February 2013. This direction is consistent with the design approach taken for the Stop & Shop facility (circa 2000).

Hydrologic Analysis & Results

The rainfall-runoff response of the Site under existing and proposed conditions was evaluated for storm events with recurrence intervals of 2, 10, 25, and 100-years. Rainfall volumes used for this analysis were based on the Natural Resources Conservation Service (NRCS) Type III, 24-hour storm event for Middlesex County; they were 3.2, 4.6, 5.5, and 6.6 respectively. Runoff coefficients for the pre- and post-development conditions were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD.

Drainage areas used in the analyses are shown on Figures 3 and 4. The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology. Detailed printouts of the HydroCAD analyses are included in Appendix B. Tables 1 and 2 present a summary of the existing and proposed conditions peak discharge rates and peak runoff volumes, respectively.

Table 1
Peak Discharge Rates (cfs*)

Design Point	2-year	10-year	25-year	100-year
Design Point 1: City of Somerville Drainage System				
Existing	4.9	7.6	9.3	11.4
Proposed	4.7	7.0	8.5	10.8

* Expressed in cubic feet per second

Table 2
Stormwater Volume Analysis (af)

Design Point	2-year	10-year	25-year	100-year
Design Point 1: City of Somerville Drainage System				
Existing	0.38	0.60	0.74	0.91
Proposed	0.39	0.60	0.74	0.92

* Expressed in acre-feet

The results of the analysis indicate that there is no increase in peak discharge rates between the pre- and post-development conditions for the 2, 10, 25 and 100-year storm events; complying with the Massachusetts State Stormwater Management Regulations and Performance Standards as set forth in the Stormwater Handbook.

In addition to complying with the Massachusetts Stormwater Management Regulations, the City of Somerville requires that there is no increase in runoff volumes between pre- and post-development conditions. The soils present on Site, in conjunction with the high groundwater table create less than ideal infiltration conditions. Approximately 2,930 cubic feet of infiltration have been provided on Site to mitigate a portion of the volume increase, however due to poor soil conditions on site, the system ultimately behaves as a stormwater detention system.

Figures:

Figure 1: Site Locus
Figure 2: FEMA Flood Map
Figure 3: Existing Conditions Drainage Figure
Figure 4: Proposed Conditions Drainage Figure

Appendix:

Appendix A: Stormwater Management Regulations

Stormwater Checklist
Recharge Requirement Calculation
TSS Removal Calculation

Appendix B: NRCS Web Soil Survey
Appendix C: Long Term Stormwater Operations & Maintenance Plan
Appendix D: Erosion & Sediment Control Plan
Appendix E: Existing Conditions HydroCAD Report
Proposed Conditions HydroCAD Report

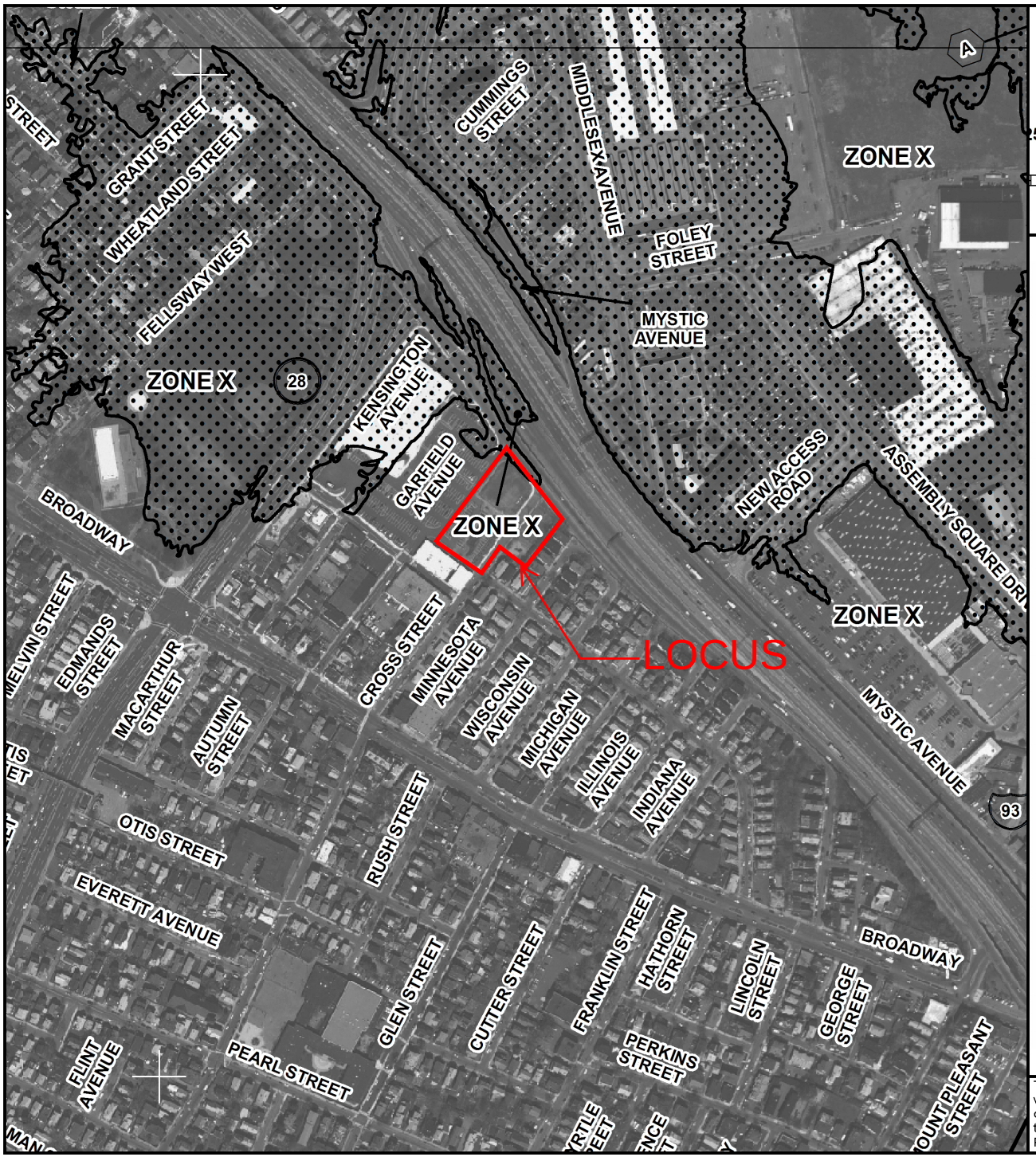
\\vhb\proj\Wat-LD\12109.00\cad\ld\Planmisc\Drainage Memo\12109_Figure 1 - Locus.dwg

Vanasse Hangen Brustlin, Inc.

0 250 500 Feet

Site Locus
Proposed Residential Development
60-70 Cross Street East
Somerville, Massachusetts

Figure 1
January 28, 2013



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0439E

FIRM

FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 439 OF 656

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EVERETT, CITY OF	250192	0439	E
MEDFORD, CITY OF	250205	0439	E
SOMERVILLE, CITY OF	250214	0439	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.

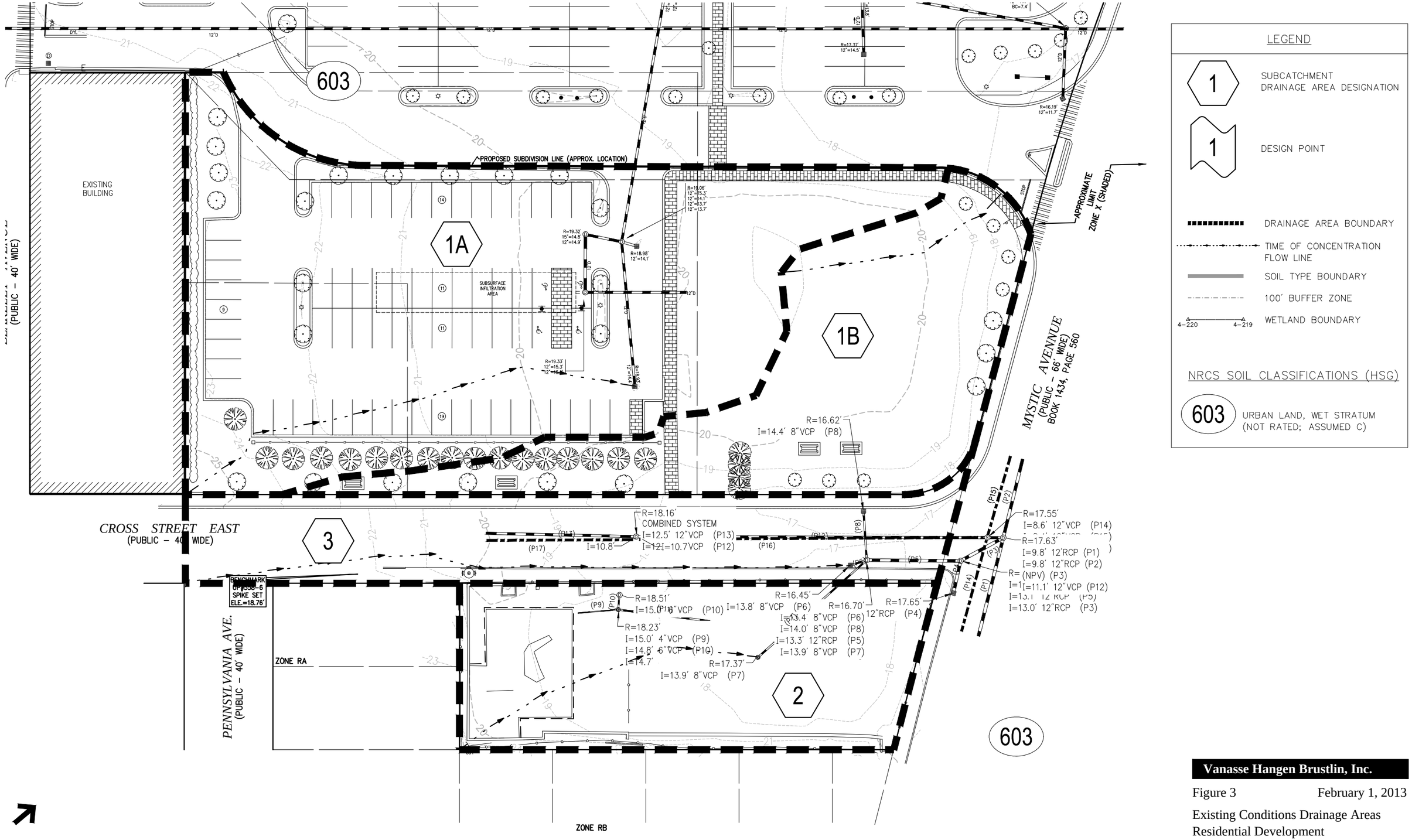
MAP NUMBER
25017C0439E

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

FIGURE 2



LEGEND

- 1 — SUBCATCHMENT DRAINAGE AREA DESIGNATION
- 1 — DESIGN POINT
- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- SOIL TYPE BOUNDARY
- 100' BUFFER ZONE
- 4-220 — 4-219 WETLAND BOUNDARY

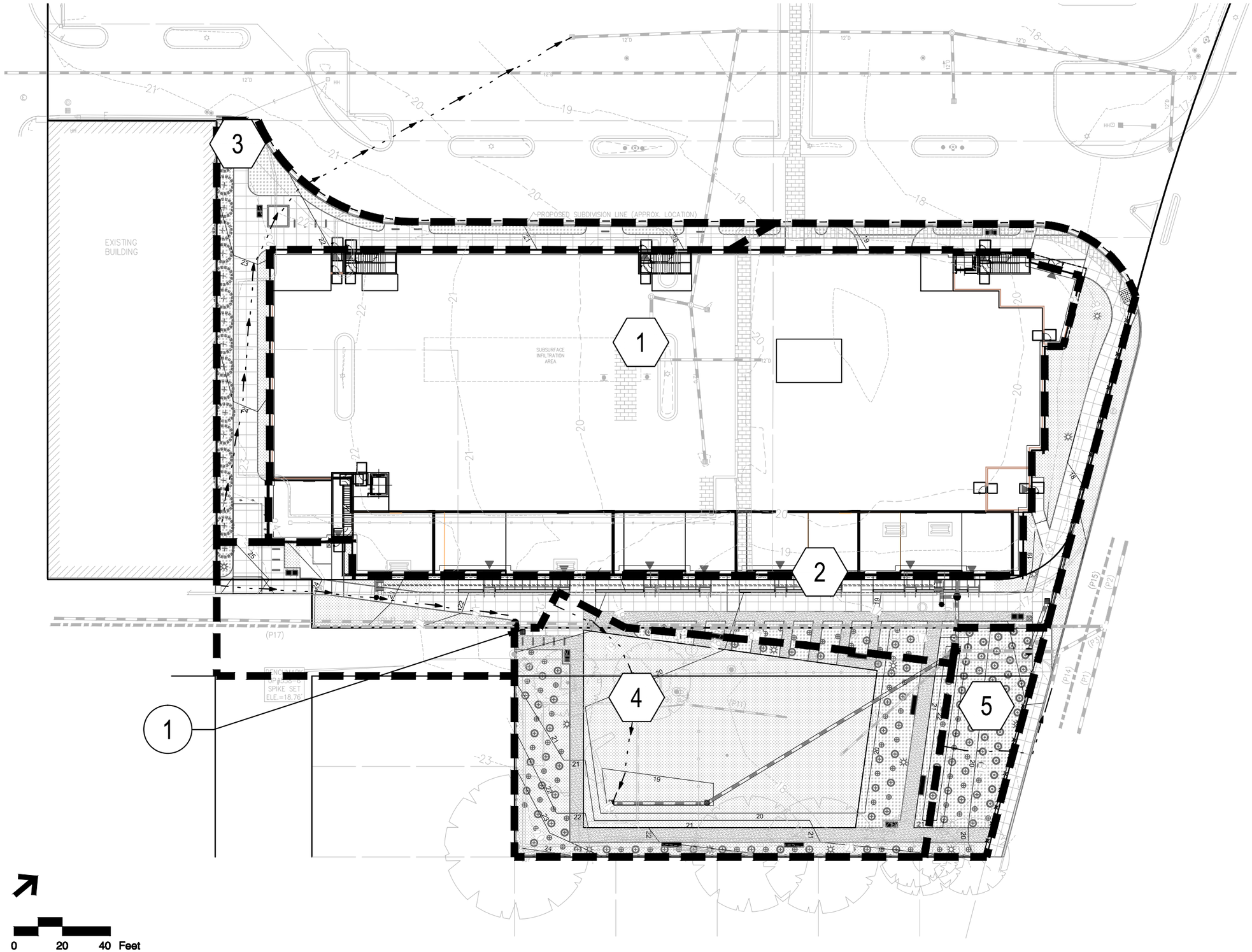
NRCS SOIL CLASSIFICATIONS (HSG)

603 URBAN LAND, WET STRATUM (NOT RATED; ASSUMED C)

Vanasse Hangen Brustlin, Inc.

Figure 3 February 1, 2013

Existing Conditions Drainage Areas
Residential Development
60-70 Cross Street East
Somerville, Massachuetts



LEGEND

- 1 — SUBCATCHMENT DRAINAGE AREA DESIGNATION
- 1 — POND
- 1 — DESIGN POINT
- 1 — WATER QUALITY UNIT
- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- SOIL TYPE BOUNDARY
- 100' BUFFER ZONE
- 4–220 4–219 WETLAND BOUNDARY

Vanasse Hangen Brustlin, Inc.

Figure 4 September 26, 2014

Proposed Conditions Drainage Areas
Residential Development
60-70 Cross Street East
Somerville, Massachuetts

Appendix A:
Stormwater Management Regulations

Stormwater Checklist

Recharge Calculation

TSS Removal Calculation

Stormwater Management Regulations

The purpose of the Stormwater Management Plan (the Plan) is to provide long-term protection of natural resources in and around the Project Site. The Project Site is defined as the area of the Stop & Shop property east of Garfield Avenue, Cross Street as it abuts the Stop & Shop property and Harris Park. Long term protection of natural resources is achieved by implementing water quality and quantity control measures designed to decrease the amount of pollutants discharged from the Site, increase the quality of stormwater recharged on the Site, and control discharge rates.

The following sections describe the regulations pertinent to stormwater management and the specific components of the Plan to be implemented.

Stormwater Regulations and Permitting

The following stormwater related regulations and guidelines apply to the proposed site development:

- Massachusetts State Stormwater Management Regulations and Performance Standards included in the Stormwater Handbook, (Department of Environmental Protection February 2008).

- Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Stormwater Permit for Construction Activities disturbing greater than one acre (EPA, Federal Register, December 8, 1999 and amendments)

Compliance with these regulations is described in the following sections.

Stormwater Management Standards and Guidelines

The methods for compliance with the ten stormwater performance standards developed by the MA DEP are summarized below.

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

   Stormwater will be treated in accordance with Standard 4, and discharge will not cause erosion in wetlands or waters of the Commonwealth.

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

   The Project Site has been designed to comply with Standard 2. The rainfall-runoff response of the Site under existing and proposed conditions was analyzed for storm events with recurrence intervals of 2, 10, 25 and 100-years. The results (below) of the analysis indicate that there is no increase in peak discharge rates between existing and proposed conditions. Computations and supporting information regarding the hydrologic modeling are included in Appendix E.

   Peak Discharge Rates (cfs*)

Design Point	2-year	10-year	25-year	100-year
Design Point 1: City of Somerville Drainage System				
Existing	4.9	7.6	9.3	11.4
Proposed	4.7	7.0	8.5	10.8

* Expressed in cubic feet per second

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

   A recharge volume, in excess of the volume required by the Massachusetts Stormwater Management Regulations is provided within the infiltration system below the invert of the Stormtech units as requested by the City of

Somerville Director of Engineering in February 2013. This direction is consistent with the design approach taken for the Stop & Shop facility (circa 2000). A recharge calculation is provided herein.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:*
   - *Suitable practices for source control and pollution prevention are identified in a long- term pollution prevention plan, and thereafter are implemented and maintained;*
   - *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
   - *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

   The Project Site does not propose any vehicular areas that will runoff to the stormwater system. The garage parking will discharge floor drains to the sewer system as required. The balance of the Project Site area will be rooftop and landscape/ hardscape pedestrian areas. The rooftop runoff will be directed to a subsurface infiltration area. As such the Project Site does not include surfaces from which runoff is required to be treated for TSS removal before discharge.
   Runoff from a small area of Cross Street to the south west of the Project Site will be collected and treated by a proprietary separator before discharging to the municipal stormwater system in Cross Street. The runoff from Cross Street is currently untreated.

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

   The Project Site does not meet the definition of a LUHPPL.

6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and*

the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area, if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply

The Project will not discharge stormwater near or to a critical area.

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

   While the project is a redevelopment, the stormwater design meets the requirements of the Stormwater Management Regulations.

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

   The Project will disturb greater than one acre of land and therefore is required to obtain coverage under the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As required under this permit, a Stormwater Pollution Prevention Plan (SWPPP) is to be developed and submitted prior to land disturbance. Recommended construction period pollution prevention measures, erosion and sedimentation controls and inspection checklists have been provided in Appendix E.

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

   Recommended practices for operating and maintaining long term stormwater BMPs is included in Appendix D. A recommended checklist for maintenance inspections and follow up is also included.

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

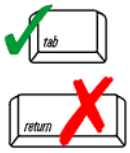
    Sanitary sewer and storm drainage structures remaining from previous development which are part of the redevelopment area will be removed or will be incorporated into updated sanitary sewer and separate stormwater sewer systems. The design plans submitted with this report have been designed so that the components included therein are in full compliance with current standards. No statement is made with regard to the drainage system in portions of the site not included in the redevelopment project area. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges.

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

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:

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

Standard 1: No New Untreated Discharges

- [X] No new untreated discharges
- [X] 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 = 0 due to reduction in impervious area.

☐ 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.

Recharge Calculations

Project Name: PR Residential | **Proj. No.:** 12109.00
Project Location: Somerville, MA | **Date:** 9/29/2014
Calculated by: JRM
Checked by: CPN

Proposed Impervious Surface Summary

Net Proposed Impervious Areas by Hydrologic Soil Group (HSG) in acres

Subcatchment	HSG A	HSG B	HSG C	HSG D	Total Area
1				0.1	0.1
2					0.0
3					0.0
4					0.0
5					0.0
TOTAL	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**

Required Recharge Volume (Cubic Feet)

HSG	Area (acres)	Recharge Depth * (in.)	Volume (c.f.)
A	0.0	0.60	0
B	0.0	0.35	0
C	0.0	0.25	0
D	0.1	0.10	50
TOTAL			**50**

* Per 2008 Massachusetts DEP Recharge Requirement

Provided Recharge Volume (Cubic Feet)

Infiltration Volumes Provided in Infiltration System

Vol. of Stone below outlet = **8.16' x 230.3' x 6 " Stone = 940 CF**
Vol. Storage within stone = **940 CF x 30% = 282 CF**

VOLUME REQ. = 50 CF
VOLUME PROVIDED = 282 CF

Vanasse Hangen Brustlin, Inc.
Consulting Engineers and Planners
101 Walnut Street
Watertown, MA 02471
(617) 924-1770

TSS Removal Calculation Worksheet

Project Name:	**Proposed Residential**	Sheet:	**1 of 1**
Project Number:	12109	Date:	**26-Sep-2014**
Location:	**Cross Street, Somerville, MA**	Computed by:	**JRM**
Discharge Point:	**Muncipal Draiange**	Checked by:	**CPN**
Drainage Area(s):			

1. Pre-Treatment prior to Infiltration

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (B*C)	Remaining Load (D-E)
STC-450i	**75%**	**100%**	**75%**	**25%**
	0%	**25%**	**0%**	**25%**
	0%	**25%**	**0%**	**25%**
		Pre-Treatment TSS Removal =		**75%**

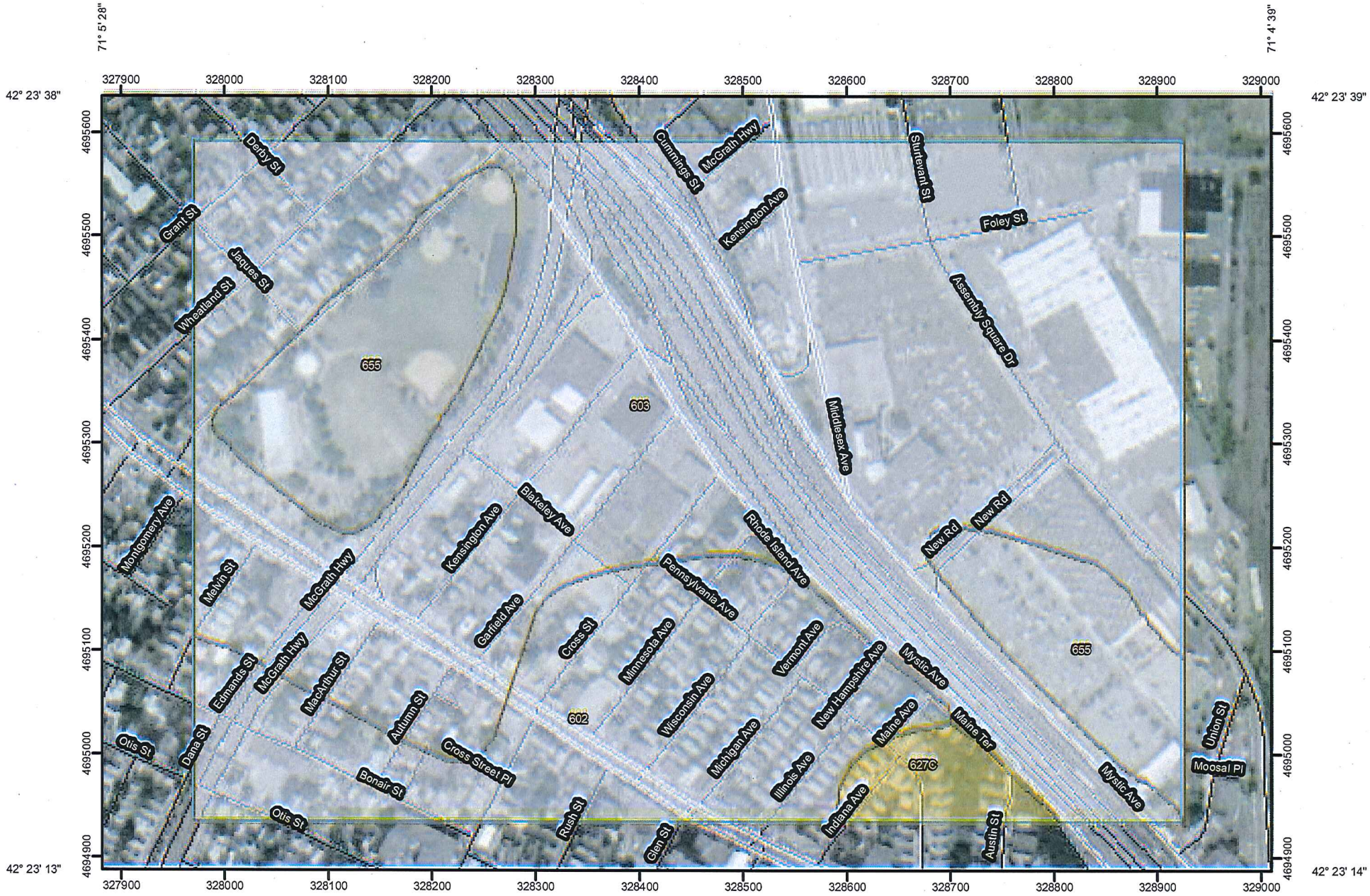
2. Total TSS Removal including Pretreatment 1.

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (B*C)	Remaining Load (D-E)
STC-450i	**75%**	**100%**	**75%**	**25%**
	0%	**25%**	**0%**	**25%**
	0%	**25%**	**0%**	**25%**
	0%	**25%**	**0%**	**25%**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1. Removal rates for proprietary devices are from approved studies and/or manufacturer data (attach study or data source, or remove this sentence if not applicable).
** Equals remaining load from previous BMP (E)

Appendix B:
NRCS Web Soil Survey

Hydrologic Soil Group—Middlesex County, Massachusetts
(Cross Street, Somerville, MA)



Map Scale: 1:5,350 if printed on A size (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1,000 1,500

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

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

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:5,350 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 19N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 12, Feb 26, 2010

Date(s) aerial images were photographed: 7/10/2003

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 — Middlesex County, Massachusetts (MA017)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
602	Urban land		28.8	18.7%
603	Urban land, wet substratum		101.9	65.9%
627C	Newport-Urban land complex, 3 to 15 percent slopes	C	3.4	2.2%
655	Udorthents, wet substratum		20.5	13.2%
Totals for Area of Interest			**154.7**	**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.

Appendix C
Long Term Stormwater & Maintenance Plan

Project Information

Site

Proposed Residential Development
60-70 Cross Street East
Somerville, MA

Developer

CPC-T Holdings, LLC
c/ o Criterion Development Partners
1601 Trapelo Road, Suite 280
Waltham, MA 02451
781-890-5600

Site Supervisor

TBD

Site Contact

Name: _____

Telephone: _____

Cell phone: _____

Email: _____

Long Term Stormwater Maintenance Measures

The following maintenance program is proposed to ensure the continued effectiveness of the structural water quality controls previously described.

- Clean all catch basins twice annually to remove accumulated sand, sediment, and floatable products or as needed based on use.
- Paved areas will be swept, at a minimum, *four* times per year.
- Routinely pick up and remove litter from the parking areas, islands and perimeter landscape areas in addition to regular pavement sweeping.
- Routinely inspect all dumpster and compactor locations for spills. Remove all trash litter from the enclosure and dispose of properly.

Pavement Systems

Standard Asphalt Pavement

- Sweep or vacuum standard asphalt pavement areas at least two times per year and properly dispose of removed material.
- Recommended sweeping schedule:
  - Oct/ Nov
  - Apr/ May
  - More frequent sweeping of paved surfaces will result in less accumulation in catch basins, less cleaning of subsurface structures, and less disposal costs.
- Check loading docks and dumpster areas frequently for spillage and/ or pavement staining and clean as necessary.

Structural Stormwater Management Devices

Catch Basins

- All catch basins shall be inspected bi-annually and cleaned a minimum of at least once per year.
- Sediment (if more than six inches deep) and/ or floatable pollutants shall be pumped from the basin and disposed of at an approved offsite facility in accordance with all applicable regulations.
- Any structural damage or other indication of malfunction will be reported to the site manager and repaired as necessary
- During colder periods, the catch basin grates must be kept free of snow and ice.

- During warmer periods, the catch basin grates must be kept free of leaves, litter, sand, and debris.

Subsurface Infiltration System

- The subsurface infiltration systems will be inspected at least once a year by removing the manhole/ access port covers and determining the thickness of sediment that has accumulated in the sediment removal row. Initially the system should be inspected monthly for the first year of operation.
- If sediment is more than three inches deep, it must be suspended via flushing with clean water and removed using a vactor truck.
- Manufacturer's specifications and instructions for cleaning the sediment removal row are provided as an attachment to this section.
- Emergency overflow pipes will be examined at least once each year and verified that no blockage has occurred.
- System will be observed after rainfalls to see if it is properly draining.

Structural Water Quality Devices

- Inspect devices monthly for the first three months after construction.
- After initial three month period, all water quality units are to be inspected at least two times per year and cleaned a minimum of at least once per year or when sediment reaches 8" in depth.
- Follow manufacturer instructions for inspection and cleaning and contact manufacturer if system is malfunctioning.

Roof Drain Leaders

- Perform routine roof inspections quarterly.
- Keep roofs clean and free of debris.
- Keep roof drainage systems clear.
- Keep roof access limited to authorized personnel.
- Clean inlets draining to the subsurface bed twice per year as necessary.

Vegetated Stormwater Management Devices

Vegetated Areas Maintenance

Although not a structural component of the drainage system, the maintenance of vegetated areas may affect the functioning of stormwater management practices. This includes the health/ density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings.

- Inspect planted areas on a semi-annual basis and remove any litter.

- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.
- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Plant alternative mixture of grass species in the event of unsuccessful establishment.
- The grass vegetation should be cut to a height between three and four inches.
- Pesticide/ Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application.
- Fertilizer usage should be avoided. If deemed necessary, slow release fertilizer should be used. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary.

Long Term Best Management Practices Checklist

Proposed Residential Development – Somerville, MA

Long Term Best Management Practices – Maintenance/ Evaluation Checklist

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
Infiltration System	Annually			- Observe after rainfall events to ensure proper operation - Sediment greater than 3” deep shall be removed - Examine overflow pipes and remove blockage	☐yes ☐no		
Water Quality Inlet	Bi-annually			- Sediment greater than 8” deep and or/ floatable pollutants shall be removed - Grates shall be kept clear of snow, ice, leaves, litter, sand and debris	☐yes ☐no		
Deep Sump and Hooded Catch basin	Bi-annually			- Sediment greater than 6” deep and or/ floatable pollutants shall be removed - Grates shall be kept clear of snow, ice, leaves, litter, sand and debris	☐yes ☐no		
Street Sweeping	Bi-annually			- Check loading docks and dumpster areas frequently for spillage and/or pavement staining and clean as necessary	☐yes ☐no		
Roof Drain Leaders	Quarterly			- Keep roofs clean and free of debris	☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		
					☐yes ☐no		

Stormwater Control Manager _____

Appendix D:
Erosion & Sediment Control Plan

Erosion and Sedimentation Control Measures

The following erosion and sedimentation controls are for use during the earthwork and construction phases of the project. The following controls are provided as recommendations for the site contractor and do not constitute or replace the final Stormwater Pollution Prevention Plan that must be fully implemented by the Contractor and owner in Compliance with EPA NPDES regulations.

Straw Bale Barriers

Straw bale barriers will be placed to trap sediment transported by runoff before it reaches the drainage system or leaves the construction site. Bales will be set at least four inches into the existing ground to minimize undercutting by runoff.

Silt Fencing

In areas where high runoff velocities or high sediment loads are expected, straw bale barriers will be backed up with silt fencing. This semi-permeable barrier made of a synthetic porous fabric will provide additional protection. The silt fences and hay bale barrier will be replaced as determined by periodic field inspections.

Catch Basin Protection

Newly constructed and existing catch basins will be protected with straw bale barriers (where appropriate) or silt sacks throughout construction.

Gravel and Construction Entrance/Exit

A temporary crushed-stone construction entrance/ exit will be constructed. A cross slope will be placed in the entrance to direct runoff to a protected catch basin inlet or settling area. If deemed necessary after construction begins, a wash pad may be included to wash off vehicle wheels before leaving the project site.

Diversion Channels

Diversion channels will be used to collect runoff from construction areas and discharge to either sedimentation basins or protected catch basin inlets.

Temporary Sediment Basins

Temporary sediment basins will be designed either as excavations or bermed stormwater detention structures (depending on grading) that will retain runoff for a sufficient period of time to allow suspended soil particles to settle out prior to discharge. These temporary basins will be located based on construction needs as

determined by the contractor and outlet devices will be designed to control velocity and sediment. Points of discharge from sediment basins will be stabilized to minimize erosion.

Vegetative Slope Stabilization

Stabilization of open soil surfaces will be implemented within 14 days after grading or construction activities have temporarily or permanently ceased, unless there is sufficient snow cover to prohibit implementation. Vegetative slope stabilization will be used to minimize erosion on slopes of 3:1 or flatter. Annual grasses, such as annual rye, will be used to ensure rapid germination and production of root mass. Permanent stabilization will be completed with the planting of perennial grasses or legumes. Establishment of temporary and permanent vegetative cover may be established by hydro-seeding or sodding. A suitable topsoil, good seedbed preparation, and adequate lime, fertilizer and water will be provided for effective establishment of these vegetative stabilization methods. Mulch will also be used after permanent seeding to protect soil from the impact of falling rain and to increase the capacity of the soil to absorb water.

Maintenance

- The contractor or subcontractor will be responsible for implementing each control shown on the Sedimentation and Erosion Control 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 on-site contractor will inspect all sediment and erosion control structures periodically and after each rainfall event. Records of the inspections will be prepared and maintained on-site by the contractor.

- 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 hay 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 on-site.

- 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.

Construction Best Management Practices - Maintenance/Evaluation Checklist

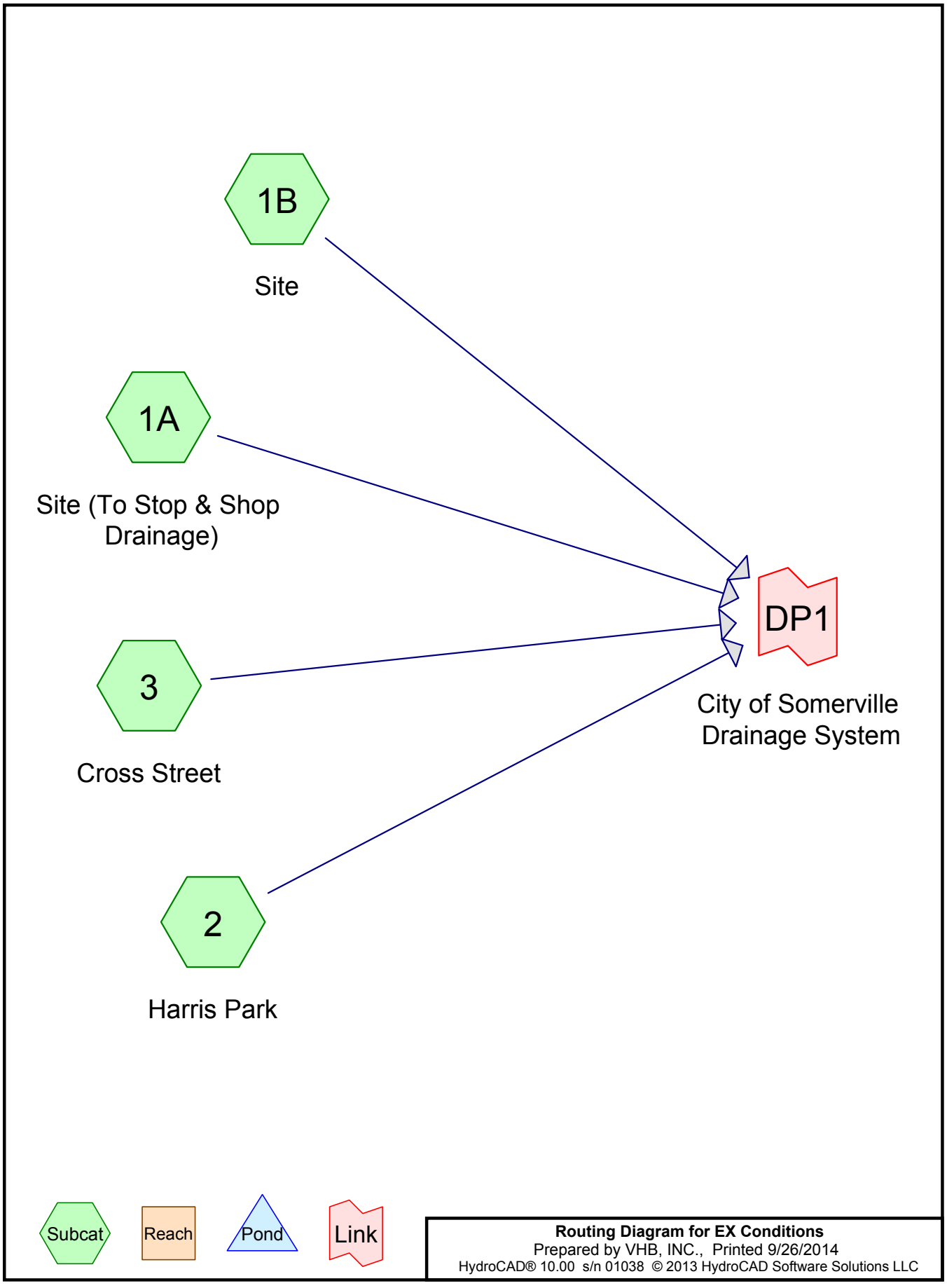
Proposed Residential Development – Somerville, MA
Construction Best Management Practices – Maintenance/ Evaluation Checklist

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:
Straw Bales/Silt Fencing	Weekly and after storm events				☐yes ☐no		
Gravel Construction Entrance	Weekly and after storm events				☐yes ☐no		
Catch Basin Protection	Weekly and after storm events				☐yes ☐no		
Diversion Channels	Weekly and after storm events				☐yes ☐no		
Temporary Sedimentation Basins	Weekly and after storm events				☐yes ☐no		
Vegetated Slope Stabilization	Weekly and after storm events				☐yes ☐no		
					☐yes ☐no		

Stormwater Control Manager _____

Appendix F:
Hydrologic Analysis

HydroCAD Analysis: Existing Conditions



Routing Diagram for EX Conditions
Prepared by VHB, INC., Printed 9/26/2014

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.716	80	>75% Grass cover, Good, HSG D (1A, 1B, 2, 3)
0.045	96	Gravel surface, HSG D (Pavers) (1A, 1B)
1.095	98	Paved parking, HSG D (1A, 1B, 2, 3)
0.088	98	Sidewalk (3)
0.002	98	Sidewalks (1A, 1B)
1.946	**91**	**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1A	0.00	0.00	66.0	0.0050	0.012	12.0	0.0	0.0
2	1A	0.00	0.00	115.0	0.0040	0.012	12.0	0.0	0.0
3	1A	0.00	0.00	88.0	0.0125	0.012	12.0	0.0	0.0
4	1A	0.00	0.00	92.0	0.0010	0.012	12.0	0.0	0.0
5	2	0.00	0.00	64.0	0.0001	0.013	8.0	0.0	0.0

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1A: Site (To Stop & Shop Runoff Area=38,300 sf 61.61% Impervious Runoff Depth=2.35"
Flow Length=581' Tc=6.4 min CN=92 Runoff=2.33 cfs 0.172 af

Subcatchment1B: Site Runoff Area=17,168 sf 2.31% Impervious Runoff Depth=1.47"
Flow Length=160' Tc=6.2 min CN=81 Runoff=0.67 cfs 0.048 af

Subcatchment2: Harris Park Runoff Area=15,400 sf 91.17% Impervious Runoff Depth=2.75"
Flow Length=212' Tc=5.3 min CN=96 Runoff=1.09 cfs 0.081 af

Subcatchment3: Cross Street Runoff Area=13,886 sf 97.73% Impervious Runoff Depth=2.97"
Flow Length=301' Tc=1.7 min CN=98 Runoff=1.15 cfs 0.079 af

Link DP1: City of Somerville Drainage System Inflow=4.89 cfs 0.380 af
Primary=4.89 cfs 0.380 af

Total Runoff Area = 1.946 ac Runoff Volume = 0.380 af Average Runoff Depth = 2.35"
39.11% Pervious = 0.761 ac 60.89% Impervious = 1.185 ac

Summary for Subcatchment 1A: Site (To Stop & Shop Drainage)

Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.172 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
	23,582	98	Paved parking, HSG D
*	16	98	Sidewalks
*	1,588	96	Gravel surface, HSG D (Pavers)
	13,114	80	>75% Grass cover, Good, HSG D
	38,300	92	Weighted Average
	14,702		38.39% Pervious Area
	23,598		61.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	42	0.0590	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.0	178	0.0228	3.07		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	66	0.0050	3.47	2.73	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.6	115	0.0040	3.11	2.44	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.3	88	0.0125	5.49	4.32	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
1.0	92	0.0010	1.55	1.22	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.4	581	Total			

Summary for Subcatchment 1B: Site

Runoff = 0.67 cfs @ 12.09 hrs, Volume= 0.048 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
	325	98	Paved parking, HSG D
*	72	98	Sidewalks
*	386	96	Gravel surface, HSG D (Pavers)
	16,385	80	>75% Grass cover, Good, HSG D
	17,168	81	Weighted Average
	16,771		97.69% Pervious Area
	397		2.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.3	60	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	50	0.0162	2.58		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	160	Total			

Summary for Subcatchment 2: Harris Park

Runoff = 1.09 cfs @ 12.07 hrs, Volume= 0.081 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

Area (sf)	CN	Description
14,040	98	Paved parking, HSG D
1,360	80	>75% Grass cover, Good, HSG D
15,400	96	Weighted Average
1,360		8.83% Pervious Area
14,040		91.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	12	0.0830	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	38	0.0263	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.7	98	0.0145	2.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.1	64	0.0001	0.35	0.12	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Clay tile
5.3	212	Total			

Summary for Subcatchment 3: Cross Street

Runoff = 1.15 cfs @ 12.02 hrs, Volume= 0.079 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
	9,733	98	Paved parking, HSG D
*	3,838	98	Sidewalk
	315	80	>75% Grass cover, Good, HSG D
	13,886	98	Weighted Average
	315		2.27% Pervious Area
	13,571		97.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.2	251	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	301	Total			

Summary for Link DP1: City of Somerville Drainage System

Inflow Area = 1.946 ac, 60.89% Impervious, Inflow Depth = 2.35" for 2 YR event
Inflow = 4.89 cfs @ 12.07 hrs, Volume= 0.380 af
Primary = 4.89 cfs @ 12.07 hrs, Volume= 0.380 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1A: Site (To Stop & Shop Runoff Area=38,300 sf 61.61% Impervious Runoff Depth=3.70"
Flow Length=581' Tc=6.4 min CN=92 Runoff=3.59 cfs 0.271 af

Subcatchment1B: Site Runoff Area=17,168 sf 2.31% Impervious Runoff Depth=2.63"
Flow Length=160' Tc=6.2 min CN=81 Runoff=1.21 cfs 0.087 af

Subcatchment2: Harris Park Runoff Area=15,400 sf 91.17% Impervious Runoff Depth=4.14"
Flow Length=212' Tc=5.3 min CN=96 Runoff=1.60 cfs 0.122 af

Subcatchment3: Cross Street Runoff Area=13,886 sf 97.73% Impervious Runoff Depth=4.36"
Flow Length=301' Tc=1.7 min CN=98 Runoff=1.67 cfs 0.116 af

Link DP1: City of Somerville Drainage System Inflow=7.57 cfs 0.595 af
Primary=7.57 cfs 0.595 af

Total Runoff Area = 1.946 ac Runoff Volume = 0.595 af Average Runoff Depth = 3.67"
39.11% Pervious = 0.761 ac 60.89% Impervious = 1.185 ac

Summary for Subcatchment 1A: Site (To Stop & Shop Drainage)

Runoff = 3.59 cfs @ 12.09 hrs, Volume= 0.271 af, Depth= 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.60"

	Area (sf)	CN	Description
	23,582	98	Paved parking, HSG D
*	16	98	Sidewalks
*	1,588	96	Gravel surface, HSG D (Pavers)
	13,114	80	>75% Grass cover, Good, HSG D
	38,300	92	Weighted Average
	14,702		38.39% Pervious Area
	23,598		61.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	42	0.0590	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.0	178	0.0228	3.07		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	66	0.0050	3.47	2.73	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.6	115	0.0040	3.11	2.44	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.3	88	0.0125	5.49	4.32	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
1.0	92	0.0010	1.55	1.22	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.4	581	Total			

Summary for Subcatchment 1B: Site

Runoff = 1.21 cfs @ 12.09 hrs, Volume= 0.087 af, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.60"

	Area (sf)	CN	Description
	325	98	Paved parking, HSG D
*	72	98	Sidewalks
*	386	96	Gravel surface, HSG D (Pavers)
	16,385	80	>75% Grass cover, Good, HSG D
	17,168	81	Weighted Average
	16,771		97.69% Pervious Area
	397		2.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.3	60	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	50	0.0162	2.58		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	160	Total			

Summary for Subcatchment 2: Harris Park

Runoff = 1.60 cfs @ 12.07 hrs, Volume= 0.122 af, Depth= 4.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.60"

Area (sf)	CN	Description
14,040	98	Paved parking, HSG D
1,360	80	>75% Grass cover, Good, HSG D
15,400	96	Weighted Average
1,360		8.83% Pervious Area
14,040		91.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	12	0.0830	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	38	0.0263	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.7	98	0.0145	2.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.1	64	0.0001	0.35	0.12	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Clay tile
5.3	212	Total			

Summary for Subcatchment 3: Cross Street

Runoff = 1.67 cfs @ 12.02 hrs, Volume= 0.116 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.60"

	Area (sf)	CN	Description
	9,733	98	Paved parking, HSG D
*	3,838	98	Sidewalk
	315	80	>75% Grass cover, Good, HSG D
	13,886	98	Weighted Average
	315		2.27% Pervious Area
	13,571		97.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.2	251	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	301	Total			

Summary for Link DP1: City of Somerville Drainage System

Inflow Area = 1.946 ac, 60.89% Impervious, Inflow Depth = 3.67" for 10 YR event
Inflow = 7.57 cfs @ 12.07 hrs, Volume= 0.595 af
Primary = 7.57 cfs @ 12.07 hrs, Volume= 0.595 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1A: Site (To Stop & Shop Runoff Area=38,300 sf 61.61% Impervious Runoff Depth=4.58"
Flow Length=581' Tc=6.4 min CN=92 Runoff=4.39 cfs 0.335 af

Subcatchment1B: Site Runoff Area=17,168 sf 2.31% Impervious Runoff Depth=3.43"
Flow Length=160' Tc=6.2 min CN=81 Runoff=1.57 cfs 0.113 af

Subcatchment2: Harris Park Runoff Area=15,400 sf 91.17% Impervious Runoff Depth=5.03"
Flow Length=212' Tc=5.3 min CN=96 Runoff=1.93 cfs 0.148 af

Subcatchment3: Cross Street Runoff Area=13,886 sf 97.73% Impervious Runoff Depth=5.26"
Flow Length=301' Tc=1.7 min CN=98 Runoff=2.00 cfs 0.140 af

Link DP1: City of Somerville Drainage System Inflow=9.29 cfs 0.736 af
Primary=9.29 cfs 0.736 af

Total Runoff Area = 1.946 ac Runoff Volume = 0.736 af Average Runoff Depth = 4.54"
39.11% Pervious = 0.761 ac 60.89% Impervious = 1.185 ac

Summary for Subcatchment 1A: Site (To Stop & Shop Drainage)

Runoff = 4.39 cfs @ 12.09 hrs, Volume= 0.335 af, Depth= 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.50"

	Area (sf)	CN	Description
	23,582	98	Paved parking, HSG D
*	16	98	Sidewalks
*	1,588	96	Gravel surface, HSG D (Pavers)
	13,114	80	>75% Grass cover, Good, HSG D
	38,300	92	Weighted Average
	14,702		38.39% Pervious Area
	23,598		61.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	42	0.0590	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.0	178	0.0228	3.07		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	66	0.0050	3.47	2.73	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.6	115	0.0040	3.11	2.44	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.3	88	0.0125	5.49	4.32	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
1.0	92	0.0010	1.55	1.22	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.4	581	Total			

Summary for Subcatchment 1B: Site

Runoff = 1.57 cfs @ 12.09 hrs, Volume= 0.113 af, Depth= 3.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.50"

	Area (sf)	CN	Description
	325	98	Paved parking, HSG D
*	72	98	Sidewalks
*	386	96	Gravel surface, HSG D (Pavers)
	16,385	80	>75% Grass cover, Good, HSG D
	17,168	81	Weighted Average
	16,771		97.69% Pervious Area
	397		2.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.3	60	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	50	0.0162	2.58		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	160	Total			

Summary for Subcatchment 2: Harris Park

Runoff = 1.93 cfs @ 12.07 hrs, Volume= 0.148 af, Depth= 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.50"

Area (sf)	CN	Description
14,040	98	Paved parking, HSG D
1,360	80	>75% Grass cover, Good, HSG D
15,400	96	Weighted Average
1,360		8.83% Pervious Area
14,040		91.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	12	0.0830	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	38	0.0263	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.7	98	0.0145	2.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.1	64	0.0001	0.35	0.12	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Clay tile
5.3	212	Total			

Summary for Subcatchment 3: Cross Street

Runoff = 2.00 cfs @ 12.02 hrs, Volume= 0.140 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.50"

	Area (sf)	CN	Description
	9,733	98	Paved parking, HSG D
*	3,838	98	Sidewalk
	315	80	>75% Grass cover, Good, HSG D
	13,886	98	Weighted Average
	315		2.27% Pervious Area
	13,571		97.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.2	251	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	301	Total			

Summary for Link DP1: City of Somerville Drainage System

Inflow Area = 1.946 ac, 60.89% Impervious, Inflow Depth = 4.54" for 25 YR event
Inflow = 9.29 cfs @ 12.07 hrs, Volume= 0.736 af
Primary = 9.29 cfs @ 12.07 hrs, Volume= 0.736 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1A: Site (To Stop & Shop Runoff Area=38,300 sf 61.61% Impervious Runoff Depth=5.66"
Flow Length=581' Tc=6.4 min CN=92 Runoff=5.36 cfs 0.415 af

Subcatchment1B: Site Runoff Area=17,168 sf 2.31% Impervious Runoff Depth=4.43"
Flow Length=160' Tc=6.2 min CN=81 Runoff=2.02 cfs 0.146 af

Subcatchment2: Harris Park Runoff Area=15,400 sf 91.17% Impervious Runoff Depth=6.13"
Flow Length=212' Tc=5.3 min CN=96 Runoff=2.32 cfs 0.180 af

Subcatchment3: Cross Street Runoff Area=13,886 sf 97.73% Impervious Runoff Depth=6.36"
Flow Length=301' Tc=1.7 min CN=98 Runoff=2.41 cfs 0.169 af

Link DP1: City of Somerville Drainage System Inflow=11.39 cfs 0.910 af
Primary=11.39 cfs 0.910 af

Total Runoff Area = 1.946 ac Runoff Volume = 0.910 af Average Runoff Depth = 5.61"
39.11% Pervious = 0.761 ac 60.89% Impervious = 1.185 ac

Summary for Subcatchment 1A: Site (To Stop & Shop Drainage)

Runoff = 5.36 cfs @ 12.09 hrs, Volume= 0.415 af, Depth= 5.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.60"

	Area (sf)	CN	Description
	23,582	98	Paved parking, HSG D
*	16	98	Sidewalks
*	1,588	96	Gravel surface, HSG D (Pavers)
	13,114	80	>75% Grass cover, Good, HSG D
	38,300	92	Weighted Average
	14,702		38.39% Pervious Area
	23,598		61.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	42	0.0590	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.0	178	0.0228	3.07		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	66	0.0050	3.47	2.73	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.6	115	0.0040	3.11	2.44	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.3	88	0.0125	5.49	4.32	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
1.0	92	0.0010	1.55	1.22	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
6.4	581	Total			

Summary for Subcatchment 1B: Site

Runoff = 2.02 cfs @ 12.09 hrs, Volume= 0.146 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.60"

	Area (sf)	CN	Description
	325	98	Paved parking, HSG D
*	72	98	Sidewalks
*	386	96	Gravel surface, HSG D (Pavers)
	16,385	80	>75% Grass cover, Good, HSG D
	17,168	81	Weighted Average
	16,771		97.69% Pervious Area
	397		2.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.3	60	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	50	0.0162	2.58		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	160	Total			

Summary for Subcatchment 2: Harris Park

Runoff = 2.32 cfs @ 12.07 hrs, Volume= 0.180 af, Depth= 6.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.60"

Area (sf)	CN	Description
14,040	98	Paved parking, HSG D
1,360	80	>75% Grass cover, Good, HSG D
15,400	96	Weighted Average
1,360		8.83% Pervious Area
14,040		91.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	12	0.0830	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	38	0.0263	1.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.7	98	0.0145	2.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.1	64	0.0001	0.35	0.12	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.013 Clay tile
5.3	212	Total			

Summary for Subcatchment 3: Cross Street

Runoff = 2.41 cfs @ 12.02 hrs, Volume= 0.169 af, Depth= 6.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.60"

	Area (sf)	CN	Description
	9,733	98	Paved parking, HSG D
*	3,838	98	Sidewalk
	315	80	>75% Grass cover, Good, HSG D
	13,886	98	Weighted Average
	315		2.27% Pervious Area
	13,571		97.73% Impervious Area

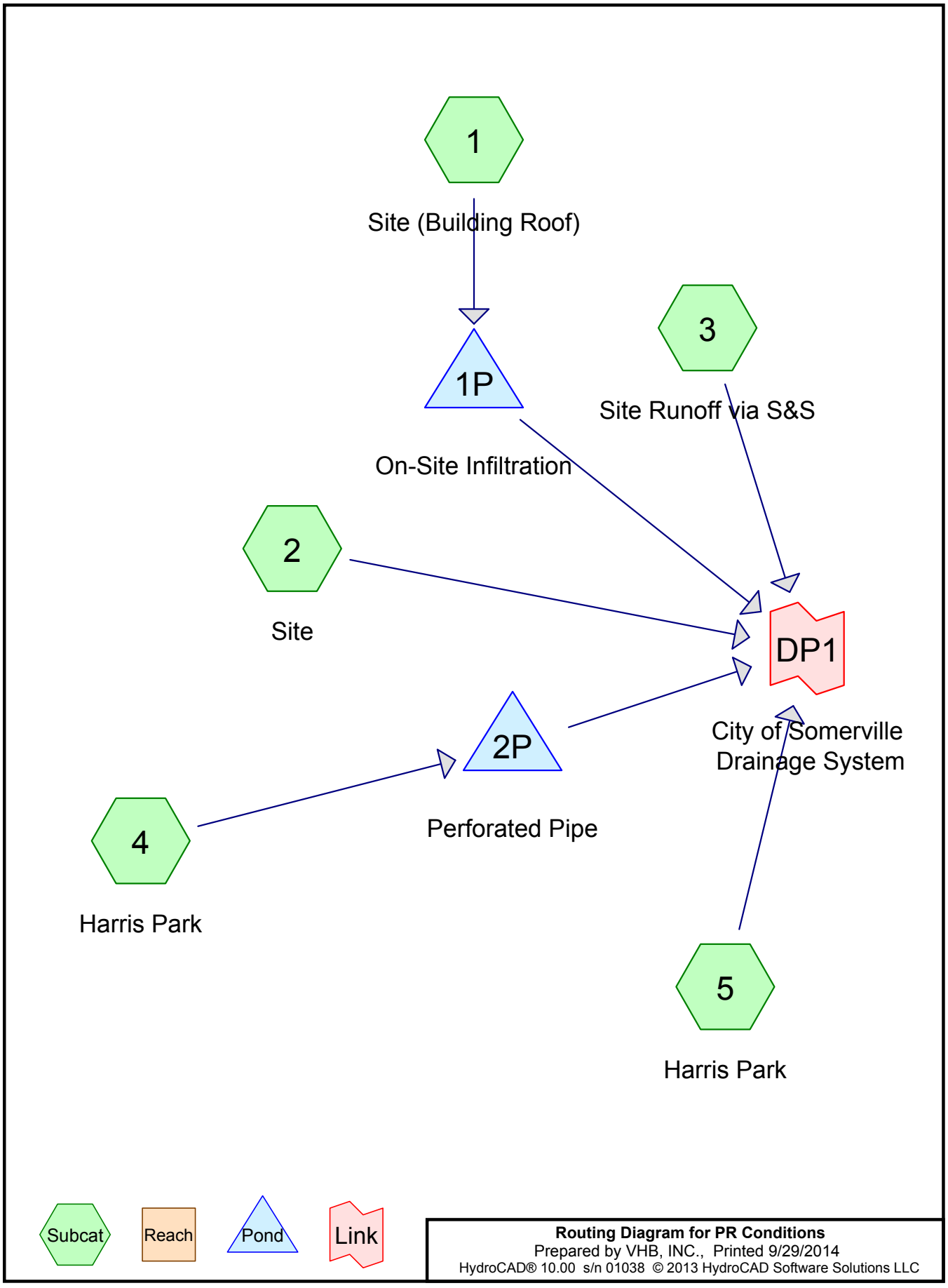
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0400	1.58		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.2	251	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.7	301	Total			

Summary for Link DP1: City of Somerville Drainage System

Inflow Area = 1.946 ac, 60.89% Impervious, Inflow Depth = 5.61" for 100 YR event
Inflow = 11.39 cfs @ 12.07 hrs, Volume= 0.910 af
Primary = 11.39 cfs @ 12.07 hrs, Volume= 0.910 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

HydroCAD Analysis: Proposed Conditions



Routing Diagram for PR Conditions
Prepared by VHB, INC., Printed 9/29/2014
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.251	80	>75% Grass cover, Good, HSG D (2, 4)
0.079	85	Gravel, HSG D (2, 4, 5)
0.074	98	Paved parking, HSG D (2)
0.296	80	Planting Area, HSG D (2, 3, 4, 5)
0.982	98	Roofs, HSG D (1)
0.007	98	Sidewalk (4)
0.256	98	Sidewalks (2, 3, 5)
1.946	**92**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Site (Building Roof) Runoff Area=42,791 sf 100.00% Impervious Runoff Depth=2.97"
Tc=5.0 min CN=98 Runoff=3.16 cfs 0.243 af

Subcatchment2: Site Runoff Area=16,233 sf 65.18% Impervious Runoff Depth=2.35"
Tc=5.0 min CN=92 Runoff=1.04 cfs 0.073 af

Subcatchment3: Site Runoff via S&S Runoff Area=6,665 sf 55.92% Impervious Runoff Depth=2.17"
Tc=5.0 min CN=90 Runoff=0.40 cfs 0.028 af

Subcatchment4: Harris Park Runoff Area=16,104 sf 1.80% Impervious Runoff Depth=1.47"
Tc=5.0 min CN=81 Runoff=0.66 cfs 0.045 af

Subcatchment5: Harris Park Runoff Area=2,960 sf 2.16% Impervious Runoff Depth=1.47"
Tc=5.0 min CN=81 Runoff=0.12 cfs 0.008 af

Pond 1P: On-Site Infiltration Peak Elev=16.20' Storage=1,311 cf Inflow=3.16 cfs 0.243 af
Discarded=0.00 cfs 0.006 af Primary=2.62 cfs 0.232 af Outflow=2.62 cfs 0.238 af

Pond 2P: Perforated Pipe Peak Elev=13.80' Storage=0.001 af Inflow=0.66 cfs 0.045 af
Discarded=0.00 cfs 0.000 af Primary=0.65 cfs 0.045 af Outflow=0.65 cfs 0.045 af

Link DP1: City of Somerville Drainage System Inflow=4.69 cfs 0.386 af
Primary=4.69 cfs 0.386 af

Total Runoff Area = 1.946 ac Runoff Volume = 0.397 af Average Runoff Depth = 2.45"
32.21% Pervious = 0.627 ac 67.79% Impervious = 1.319 ac

Summary for Subcatchment 1: Site (Building Roof)

Runoff = 3.16 cfs @ 12.07 hrs, Volume= 0.243 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	42,791	98	Roofs, HSG D
	42,791		100.00% Impervious Area

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

Summary for Subcatchment 2: Site

Runoff = 1.04 cfs @ 12.07 hrs, Volume= 0.073 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
	3,240	98	Paved parking, HSG D
*	7,340	98	Sidewalks
	2,300	80	>75% Grass cover, Good, HSG D
*	2,252	80	Planting Area, HSG D
*	1,101	85	Gravel, HSG D
	16,233	92	Weighted Average
	5,653		34.82% Pervious Area
	10,580		65.18% Impervious Area

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

Summary for Subcatchment 3: Site Runoff via S&S

Runoff = 0.40 cfs @ 12.07 hrs, Volume= 0.028 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	3,727	98	Sidewalks
*	2,938	80	Planting Area, HSG D
	6,665	90	Weighted Average
	2,938		44.08% Pervious Area
	3,727		55.92% Impervious Area

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

Summary for Subcatchment 4: Harris Park

Runoff = 0.66 cfs @ 12.08 hrs, Volume= 0.045 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	290	98	Sidewalk
	8,650	80	>75% Grass cover, Good, HSG D
*	4,965	80	Planting Area, HSG D
*	2,199	85	Gravel, HSG D
	16,104	81	Weighted Average
	15,814		98.20% Pervious Area
	290		1.80% Impervious Area

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

Summary for Subcatchment 5: Harris Park

Runoff = 0.12 cfs @ 12.08 hrs, Volume= 0.008 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.20"

	Area (sf)	CN	Description
*	64	98	Sidewalks
*	2,737	80	Planting Area, HSG D
*	159	85	Gravel, HSG D
	2,960	81	Weighted Average
	2,896		97.84% Pervious Area
	64		2.16% Impervious Area

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

Summary for Pond 1P: On-Site Infiltration

Inflow Area = 0.982 ac,100.00% Impervious, Inflow Depth = 2.97" for 2 YR event
Inflow = 3.16 cfs @ 12.07 hrs, Volume= 0.243 af
Outflow = 2.62 cfs @ 12.12 hrs, Volume= 0.238 af, Atten= 17%, Lag= 3.0 min
Discarded = 0.00 cfs @ 12.12 hrs, Volume= 0.006 af
Primary = 2.62 cfs @ 12.12 hrs, Volume= 0.232 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 16.20' @ 12.12 hrs Surf.Area= 1,881 sf Storage= 1,311 cf

Plug-Flow detention time= 79.4 min calculated for 0.238 af (98% of inflow)
Center-of-Mass det. time= 65.7 min (821.2 - 755.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	15.00'	1,377 cf	**8.17'W x 230.28'L x 2.33'H Field A** 4,388 cf Overall - 945 cf Embedded = 3,443 cf x 40.0% Voids
#2A	15.50'	945 cf	**ADS_StormTech SC-310** x 64 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 Row Length Adjustment= +0.44' x 2.07 sf x 2 rows
		2,322 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	15.00'	**0.020 in/hr Exfiltration over Wetted area**
#2	Primary	17.33'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	16.95'	**90.0 deg x 3.0' long x 0.38' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#4	Primary	15.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	15.50'	**9.0" Vert. Orifice/Grate X 2.00** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 12.12 hrs HW=16.20' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=2.62 cfs @ 12.12 hrs HW=16.20' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
├**3=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)
├**4=Orifice/Grate** (Orifice Controls 0.18 cfs @ 3.65 fps)
└**5=Orifice/Grate** (Orifice Controls 2.44 cfs @ 2.85 fps)

Summary for Pond 2P: Perforated Pipe

Inflow Area = 0.370 ac, 1.80% Impervious, Inflow Depth = 1.47" for 2 YR event
Inflow = 0.66 cfs @ 12.08 hrs, Volume= 0.045 af
Outflow = 0.65 cfs @ 12.09 hrs, Volume= 0.045 af, Atten= 2%, Lag= 0.9 min
Discarded = 0.00 cfs @ 10.23 hrs, Volume= 0.000 af
Primary = 0.65 cfs @ 12.09 hrs, Volume= 0.045 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 13.80' @ 12.09 hrs Surf.Area= 0.008 ac Storage= 0.001 af

Plug-Flow detention time= 4.8 min calculated for 0.045 af (100% of inflow)
Center-of-Mass det. time= 4.8 min (843.4 - 838.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	13.40'	0.010 af	**3.50'W x 102.00'L x 3.50'H Field A** 0.029 af Overall - 0.004 af Embedded = 0.025 af x 40.0% Voids
#2A	14.40'	0.004 af	**CMP_Round 18** x 5 Inside #1 Effective Size= 18.0"W x 18.0"H => 1.76 sf x 20.00'L = 35.2 cf Overall Size= 18.0"W x 18.0"H x 20.00'L
		0.014 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	13.40'	**0.020 in/hr Exfiltration over Surface area**
#2	Primary	13.40'	**12.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 10.23 hrs HW=13.44' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.64 cfs @ 12.09 hrs HW=13.80' (Free Discharge)
↑└**2=Orifice/Grate** (Orifice Controls 0.64 cfs @ 2.16 fps)

Summary for Link DP1: City of Somerville Drainage System

Inflow Area = 1.946 ac, 67.79% Impervious, Inflow Depth = 2.38" for 2 YR event
Inflow = 4.69 cfs @ 12.10 hrs, Volume= 0.386 af
Primary = 4.69 cfs @ 12.10 hrs, Volume= 0.386 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Site (Building Roof) Runoff Area=42,791 sf 100.00% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=98 Runoff=4.57 cfs 0.357 af

Subcatchment2: Site Runoff Area=16,233 sf 65.18% Impervious Runoff Depth=3.70"
Tc=5.0 min CN=92 Runoff=1.60 cfs 0.115 af

Subcatchment3: Site Runoff via S&S Runoff Area=6,665 sf 55.92% Impervious Runoff Depth=3.49"
Tc=5.0 min CN=90 Runoff=0.63 cfs 0.045 af

Subcatchment4: Harris Park Runoff Area=16,104 sf 1.80% Impervious Runoff Depth=2.63"
Tc=5.0 min CN=81 Runoff=1.18 cfs 0.081 af

Subcatchment5: Harris Park Runoff Area=2,960 sf 2.16% Impervious Runoff Depth=2.63"
Tc=5.0 min CN=81 Runoff=0.22 cfs 0.015 af

Pond 1P: On-Site Infiltration Peak Elev=16.51' Storage=1,669 cf Inflow=4.57 cfs 0.357 af
Discarded=0.00 cfs 0.006 af Primary=3.62 cfs 0.346 af Outflow=3.62 cfs 0.352 af

Pond 2P: Perforated Pipe Peak Elev=13.96' Storage=0.002 af Inflow=1.18 cfs 0.081 af
Discarded=0.00 cfs 0.000 af Primary=1.17 cfs 0.081 af Outflow=1.17 cfs 0.081 af

Link DP1: City of Somerville Drainage System Inflow=6.99 cfs 0.602 af
Primary=6.99 cfs 0.602 af

Total Runoff Area = 1.946 ac Runoff Volume = 0.613 af Average Runoff Depth = 3.78"
32.21% Pervious = 0.627 ac 67.79% Impervious = 1.319 ac

Summary for Subcatchment 1: Site (Building Roof)

Runoff = 4.57 cfs @ 12.07 hrs, Volume= 0.357 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.60"

	Area (sf)	CN	Description
*	42,791	98	Roofs, HSG D
	42,791		100.00% Impervious Area

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

Summary for Subcatchment 2: Site

Runoff = 1.60 cfs @ 12.07 hrs, Volume= 0.115 af, Depth= 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.60"

	Area (sf)	CN	Description
	3,240	98	Paved parking, HSG D
*	7,340	98	Sidewalks
	2,300	80	>75% Grass cover, Good, HSG D
*	2,252	80	Planting Area, HSG D
*	1,101	85	Gravel, HSG D
	16,233	92	Weighted Average
	5,653		34.82% Pervious Area
	10,580		65.18% Impervious Area

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

Summary for Subcatchment 3: Site Runoff via S&S

Runoff = 0.63 cfs @ 12.07 hrs, Volume= 0.045 af, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.60"

	Area (sf)	CN	Description
*	3,727	98	Sidewalks
*	2,938	80	Planting Area, HSG D
	6,665	90	Weighted Average
	2,938		44.08% Pervious Area
	3,727		55.92% Impervious Area

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

Summary for Subcatchment 4: Harris Park

Runoff = 1.18 cfs @ 12.07 hrs, Volume= 0.081 af, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.60"

	Area (sf)	CN	Description
*	290	98	Sidewalk
	8,650	80	>75% Grass cover, Good, HSG D
*	4,965	80	Planting Area, HSG D
*	2,199	85	Gravel, HSG D
	16,104	81	Weighted Average
	15,814		98.20% Pervious Area
	290		1.80% Impervious Area

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

Summary for Subcatchment 5: Harris Park

Runoff = 0.22 cfs @ 12.07 hrs, Volume= 0.015 af, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.60"

	Area (sf)	CN	Description
*	64	98	Sidewalks
*	2,737	80	Planting Area, HSG D
*	159	85	Gravel, HSG D
	2,960	81	Weighted Average
	2,896		97.84% Pervious Area
	64		2.16% Impervious Area

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

Summary for Pond 1P: On-Site Infiltration

Inflow Area = 0.982 ac,100.00% Impervious, Inflow Depth = 4.36" for 10 YR event
Inflow = 4.57 cfs @ 12.07 hrs, Volume= 0.357 af
Outflow = 3.62 cfs @ 12.13 hrs, Volume= 0.352 af, Atten= 21%, Lag= 3.4 min
Discarded = 0.00 cfs @ 12.13 hrs, Volume= 0.006 af
Primary = 3.62 cfs @ 12.13 hrs, Volume= 0.346 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 16.51' @ 12.13 hrs Surf.Area= 1,881 sf Storage= 1,669 cf

Plug-Flow detention time= 58.9 min calculated for 0.352 af (99% of inflow)
Center-of-Mass det. time= 49.3 min (797.8 - 748.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	15.00'	1,377 cf	**8.17'W x 230.28'L x 2.33'H Field A** 4,388 cf Overall - 945 cf Embedded = 3,443 cf x 40.0% Voids
#2A	15.50'	945 cf	**ADS_StormTech SC-310** x 64 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 Row Length Adjustment= +0.44' x 2.07 sf x 2 rows
		2,322 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	15.00'	**0.020 in/hr Exfiltration over Wetted area**
#2	Primary	17.33'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	16.95'	**90.0 deg x 3.0' long x 0.38' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#4	Primary	15.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	15.50'	**9.0" Vert. Orifice/Grate X 2.00** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 12.13 hrs HW=16.51' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=3.62 cfs @ 12.13 hrs HW=16.51' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
├**3=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)
├**4=Orifice/Grate** (Orifice Controls 0.22 cfs @ 4.53 fps)
└**5=Orifice/Grate** (Orifice Controls 3.40 cfs @ 3.84 fps)

Summary for Pond 2P: Perforated Pipe

Inflow Area = 0.370 ac, 1.80% Impervious, Inflow Depth = 2.63" for 10 YR event
Inflow = 1.18 cfs @ 12.07 hrs, Volume= 0.081 af
Outflow = 1.17 cfs @ 12.09 hrs, Volume= 0.081 af, Atten= 1%, Lag= 0.7 min
Discarded = 0.00 cfs @ 8.86 hrs, Volume= 0.000 af
Primary = 1.17 cfs @ 12.09 hrs, Volume= 0.081 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 13.96' @ 12.09 hrs Surf.Area= 0.008 ac Storage= 0.002 af

Plug-Flow detention time= 3.7 min calculated for 0.081 af (100% of inflow)
Center-of-Mass det. time= 3.7 min (825.5 - 821.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	13.40'	0.010 af	**3.50'W x 102.00'L x 3.50'H Field A** 0.029 af Overall - 0.004 af Embedded = 0.025 af x 40.0% Voids
#2A	14.40'	0.004 af	**CMP_Round 18** x 5 Inside #1 Effective Size= 18.0"W x 18.0"H => 1.76 sf x 20.00'L = 35.2 cf Overall Size= 18.0"W x 18.0"H x 20.00'L
		0.014 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	13.40'	**0.020 in/hr Exfiltration over Surface area**
#2	Primary	13.40'	**12.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 8.86 hrs HW=13.44' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.17 cfs @ 12.09 hrs HW=13.96' (Free Discharge)
↑└**2=Orifice/Grate** (Orifice Controls 1.17 cfs @ 2.56 fps)

Summary for Link DP1: City of Somerville Drainage System

Inflow Area = 1.946 ac, 67.79% Impervious, Inflow Depth = 3.71" for 10 YR event
Inflow = 6.99 cfs @ 12.09 hrs, Volume= 0.602 af
Primary = 6.99 cfs @ 12.09 hrs, Volume= 0.602 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Site (Building Roof) Runoff Area=42,791 sf 100.00% Impervious Runoff Depth=5.26"
Tc=5.0 min CN=98 Runoff=5.48 cfs 0.431 af

Subcatchment2: Site Runoff Area=16,233 sf 65.18% Impervious Runoff Depth=4.58"
Tc=5.0 min CN=92 Runoff=1.95 cfs 0.142 af

Subcatchment3: Site Runoff via S&S Runoff Area=6,665 sf 55.92% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=90 Runoff=0.78 cfs 0.056 af

Subcatchment4: Harris Park Runoff Area=16,104 sf 1.80% Impervious Runoff Depth=3.43"
Tc=5.0 min CN=81 Runoff=1.54 cfs 0.106 af

Subcatchment5: Harris Park Runoff Area=2,960 sf 2.16% Impervious Runoff Depth=3.43"
Tc=5.0 min CN=81 Runoff=0.28 cfs 0.019 af

Pond 1P: On-Site Infiltration Peak Elev=16.78' Storage=1,908 cf Inflow=5.48 cfs 0.431 af
Discarded=0.00 cfs 0.006 af Primary=4.31 cfs 0.420 af Outflow=4.31 cfs 0.426 af

Pond 2P: Perforated Pipe Peak Elev=14.06' Storage=0.002 af Inflow=1.54 cfs 0.106 af
Discarded=0.00 cfs 0.000 af Primary=1.52 cfs 0.105 af Outflow=1.52 cfs 0.106 af

Link DP1: City of Somerville Drainage System Inflow=8.51 cfs 0.743 af
Primary=8.51 cfs 0.743 af

Total Runoff Area = 1.946 ac Runoff Volume = 0.754 af Average Runoff Depth = 4.65"
32.21% Pervious = 0.627 ac 67.79% Impervious = 1.319 ac

Summary for Subcatchment 1: Site (Building Roof)

Runoff = 5.48 cfs @ 12.07 hrs, Volume= 0.431 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.50"

	Area (sf)	CN	Description
*	42,791	98	Roofs, HSG D
	42,791		100.00% Impervious Area

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

Summary for Subcatchment 2: Site

Runoff = 1.95 cfs @ 12.07 hrs, Volume= 0.142 af, Depth= 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.50"

	Area (sf)	CN	Description
	3,240	98	Paved parking, HSG D
*	7,340	98	Sidewalks
	2,300	80	>75% Grass cover, Good, HSG D
*	2,252	80	Planting Area, HSG D
*	1,101	85	Gravel, HSG D
	16,233	92	Weighted Average
	5,653		34.82% Pervious Area
	10,580		65.18% Impervious Area

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

Summary for Subcatchment 3: Site Runoff via S&S

Runoff = 0.78 cfs @ 12.07 hrs, Volume= 0.056 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.50"

	Area (sf)	CN	Description
*	3,727	98	Sidewalks
*	2,938	80	Planting Area, HSG D
	6,665	90	Weighted Average
	2,938		44.08% Pervious Area
	3,727		55.92% Impervious Area

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

Summary for Subcatchment 4: Harris Park

Runoff = 1.54 cfs @ 12.07 hrs, Volume= 0.106 af, Depth= 3.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.50"

	Area (sf)	CN	Description
*	290	98	Sidewalk
	8,650	80	>75% Grass cover, Good, HSG D
*	4,965	80	Planting Area, HSG D
*	2,199	85	Gravel, HSG D
	16,104	81	Weighted Average
	15,814		98.20% Pervious Area
	290		1.80% Impervious Area

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

Summary for Subcatchment 5: Harris Park

Runoff = 0.28 cfs @ 12.07 hrs, Volume= 0.019 af, Depth= 3.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=5.50"

	Area (sf)	CN	Description
*	64	98	Sidewalks
*	2,737	80	Planting Area, HSG D
*	159	85	Gravel, HSG D
	2,960	81	Weighted Average
	2,896		97.84% Pervious Area
	64		2.16% Impervious Area

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

Summary for Pond 1P: On-Site Infiltration

Inflow Area = 0.982 ac,100.00% Impervious, Inflow Depth = 5.26" for 25 YR event
Inflow = 5.48 cfs @ 12.07 hrs, Volume= 0.431 af
Outflow = 4.31 cfs @ 12.13 hrs, Volume= 0.426 af, Atten= 21%, Lag= 3.5 min
Discarded = 0.00 cfs @ 12.13 hrs, Volume= 0.006 af
Primary = 4.31 cfs @ 12.13 hrs, Volume= 0.420 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 16.78' @ 12.13 hrs Surf.Area= 1,881 sf Storage= 1,908 cf

Plug-Flow detention time= 51.0 min calculated for 0.426 af (99% of inflow)
Center-of-Mass det. time= 42.9 min (788.5 - 745.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	15.00'	1,377 cf	**8.17'W x 230.28'L x 2.33'H Field A** 4,388 cf Overall - 945 cf Embedded = 3,443 cf x 40.0% Voids
#2A	15.50'	945 cf	**ADS_StormTech SC-310** x 64 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 Row Length Adjustment= +0.44' x 2.07 sf x 2 rows
		2,322 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	15.00'	**0.020 in/hr Exfiltration over Wetted area**
#2	Primary	17.33'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	16.95'	**90.0 deg x 3.0' long x 0.38' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#4	Primary	15.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	15.50'	**9.0" Vert. Orifice/Grate X 2.00** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 12.13 hrs HW=16.78' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=4.31 cfs @ 12.13 hrs HW=16.78' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
├**3=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)
├**4=Orifice/Grate** (Orifice Controls 0.25 cfs @ 5.18 fps)
└**5=Orifice/Grate** (Orifice Controls 4.05 cfs @ 4.59 fps)

Summary for Pond 2P: Perforated Pipe

Inflow Area = 0.370 ac, 1.80% Impervious, Inflow Depth = 3.43" for 25 YR event
Inflow = 1.54 cfs @ 12.07 hrs, Volume= 0.106 af
Outflow = 1.52 cfs @ 12.08 hrs, Volume= 0.106 af, Atten= 1%, Lag= 0.6 min
Discarded = 0.00 cfs @ 8.18 hrs, Volume= 0.000 af
Primary = 1.52 cfs @ 12.08 hrs, Volume= 0.105 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 14.06' @ 12.08 hrs Surf.Area= 0.008 ac Storage= 0.002 af

Plug-Flow detention time= 3.3 min calculated for 0.106 af (100% of inflow)
Center-of-Mass det. time= 3.4 min (817.5 - 814.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	13.40'	0.010 af	**3.50'W x 102.00'L x 3.50'H Field A** 0.029 af Overall - 0.004 af Embedded = 0.025 af x 40.0% Voids
#2A	14.40'	0.004 af	**CMP_Round 18** x 5 Inside #1 Effective Size= 18.0"W x 18.0"H => 1.76 sf x 20.00'L = 35.2 cf Overall Size= 18.0"W x 18.0"H x 20.00'L
		0.014 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	13.40'	**0.020 in/hr Exfiltration over Surface area**
#2	Primary	13.40'	**12.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 8.18 hrs HW=13.44' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.52 cfs @ 12.08 hrs HW=14.06' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 1.52 cfs @ 2.76 fps)

Summary for Link DP1: City of Somerville Drainage System

Inflow Area = 1.946 ac, 67.79% Impervious, Inflow Depth = 4.58" for 25 YR event
Inflow = 8.51 cfs @ 12.09 hrs, Volume= 0.743 af
Primary = 8.51 cfs @ 12.09 hrs, Volume= 0.743 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: Site (Building Roof) Runoff Area=42,791 sf 100.00% Impervious Runoff Depth=6.36"
Tc=5.0 min CN=98 Runoff=6.59 cfs 0.521 af

Subcatchment2: Site Runoff Area=16,233 sf 65.18% Impervious Runoff Depth=5.66"
Tc=5.0 min CN=92 Runoff=2.39 cfs 0.176 af

Subcatchment3: Site Runoff via S&S Runoff Area=6,665 sf 55.92% Impervious Runoff Depth=5.43"
Tc=5.0 min CN=90 Runoff=0.96 cfs 0.069 af

Subcatchment4: Harris Park Runoff Area=16,104 sf 1.80% Impervious Runoff Depth=4.43"
Tc=5.0 min CN=81 Runoff=1.97 cfs 0.137 af

Subcatchment5: Harris Park Runoff Area=2,960 sf 2.16% Impervious Runoff Depth=4.43"
Tc=5.0 min CN=81 Runoff=0.36 cfs 0.025 af

Pond 1P: On-Site Infiltration Peak Elev=17.10' Storage=2,150 cf Inflow=6.59 cfs 0.521 af
Discarded=0.00 cfs 0.006 af Primary=5.59 cfs 0.510 af Outflow=5.59 cfs 0.516 af

Pond 2P: Perforated Pipe Peak Elev=14.17' Storage=0.003 af Inflow=1.97 cfs 0.137 af
Discarded=0.00 cfs 0.000 af Primary=1.95 cfs 0.136 af Outflow=1.95 cfs 0.137 af

Link DP1: City of Somerville Drainage System Inflow=10.76 cfs 0.916 af
Primary=10.76 cfs 0.916 af

Total Runoff Area = 1.946 ac Runoff Volume = 0.927 af Average Runoff Depth = 5.72"
32.21% Pervious = 0.627 ac 67.79% Impervious = 1.319 ac

Summary for Subcatchment 1: Site (Building Roof)

Runoff = 6.59 cfs @ 12.07 hrs, Volume= 0.521 af, Depth= 6.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.60"

	Area (sf)	CN	Description
*	42,791	98	Roofs, HSG D
	42,791		100.00% Impervious Area

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

Summary for Subcatchment 2: Site

Runoff = 2.39 cfs @ 12.07 hrs, Volume= 0.176 af, Depth= 5.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.60"

	Area (sf)	CN	Description
	3,240	98	Paved parking, HSG D
*	7,340	98	Sidewalks
	2,300	80	>75% Grass cover, Good, HSG D
*	2,252	80	Planting Area, HSG D
*	1,101	85	Gravel, HSG D
	16,233	92	Weighted Average
	5,653		34.82% Pervious Area
	10,580		65.18% Impervious Area

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

Summary for Subcatchment 3: Site Runoff via S&S

Runoff = 0.96 cfs @ 12.07 hrs, Volume= 0.069 af, Depth= 5.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.60"

	Area (sf)	CN	Description
*	3,727	98	Sidewalks
*	2,938	80	Planting Area, HSG D
	6,665	90	Weighted Average
	2,938		44.08% Pervious Area
	3,727		55.92% Impervious Area

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

Summary for Subcatchment 4: Harris Park

Runoff = 1.97 cfs @ 12.07 hrs, Volume= 0.137 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.60"

	Area (sf)	CN	Description
*	290	98	Sidewalk
	8,650	80	>75% Grass cover, Good, HSG D
*	4,965	80	Planting Area, HSG D
*	2,199	85	Gravel, HSG D
	16,104	81	Weighted Average
	15,814		98.20% Pervious Area
	290		1.80% Impervious Area

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

Summary for Subcatchment 5: Harris Park

Runoff = 0.36 cfs @ 12.07 hrs, Volume= 0.025 af, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=6.60"

	Area (sf)	CN	Description
*	64	98	Sidewalks
*	2,737	80	Planting Area, HSG D
*	159	85	Gravel, HSG D
	2,960	81	Weighted Average
	2,896		97.84% Pervious Area
	64		2.16% Impervious Area

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

Summary for Pond 1P: On-Site Infiltration

Inflow Area = 0.982 ac,100.00% Impervious, Inflow Depth = 6.36" for 100 YR event
Inflow = 6.59 cfs @ 12.07 hrs, Volume= 0.521 af
Outflow = 5.59 cfs @ 12.12 hrs, Volume= 0.516 af, Atten= 15%, Lag= 2.8 min
Discarded = 0.00 cfs @ 12.12 hrs, Volume= 0.006 af
Primary = 5.59 cfs @ 12.12 hrs, Volume= 0.510 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 17.10' @ 12.12 hrs Surf.Area= 1,881 sf Storage= 2,150 cf

Plug-Flow detention time= 43.7 min calculated for 0.515 af (99% of inflow)
Center-of-Mass det. time= 37.3 min (780.1 - 742.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	15.00'	1,377 cf	**8.17'W x 230.28'L x 2.33'H Field A** 4,388 cf Overall - 945 cf Embedded = 3,443 cf x 40.0% Voids
#2A	15.50'	945 cf	**ADS_StormTech SC-310** x 64 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 Row Length Adjustment= +0.44' x 2.07 sf x 2 rows
		2,322 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	15.00'	**0.020 in/hr Exfiltration over Wetted area**
#2	Primary	17.33'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	16.95'	**90.0 deg x 3.0' long x 0.38' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#4	Primary	15.50'	**3.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	15.50'	**9.0" Vert. Orifice/Grate X 2.00** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 12.12 hrs HW=17.10' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=5.58 cfs @ 12.12 hrs HW=17.10' (Free Discharge)
├**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
├**3=Sharp-Crested Vee/Trap Weir** (Weir Controls 0.58 cfs @ 1.21 fps)
├**4=Orifice/Grate** (Orifice Controls 0.29 cfs @ 5.85 fps)
└**5=Orifice/Grate** (Orifice Controls 4.71 cfs @ 5.33 fps)

Summary for Pond 2P: Perforated Pipe

Inflow Area = 0.370 ac, 1.80% Impervious, Inflow Depth = 4.43" for 100 YR event
Inflow = 1.97 cfs @ 12.07 hrs, Volume= 0.137 af
Outflow = 1.95 cfs @ 12.08 hrs, Volume= 0.137 af, Atten= 1%, Lag= 0.6 min
Discarded = 0.00 cfs @ 7.38 hrs, Volume= 0.000 af
Primary = 1.95 cfs @ 12.08 hrs, Volume= 0.136 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 14.17' @ 12.08 hrs Surf.Area= 0.008 ac Storage= 0.003 af

Plug-Flow detention time= 3.0 min calculated for 0.137 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (809.9 - 806.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	13.40'	0.010 af	**3.50'W x 102.00'L x 3.50'H Field A** 0.029 af Overall - 0.004 af Embedded = 0.025 af x 40.0% Voids
#2A	14.40'	0.004 af	**CMP_Round 18** x 5 Inside #1 Effective Size= 18.0"W x 18.0"H => 1.76 sf x 20.00'L = 35.2 cf Overall Size= 18.0"W x 18.0"H x 20.00'L
		0.014 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	13.40'	**0.020 in/hr Exfiltration over Surface area**
#2	Primary	13.40'	**12.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 7.38 hrs HW=13.44' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.95 cfs @ 12.08 hrs HW=14.17' (Free Discharge)
↑└**2=Orifice/Grate** (Orifice Controls 1.95 cfs @ 2.99 fps)

Summary for Link DP1: City of Somerville Drainage System

Inflow Area = 1.946 ac, 67.79% Impervious, Inflow Depth = 5.65" for 100 YR event
Inflow = 10.76 cfs @ 12.10 hrs, Volume= 0.916 af
Primary = 10.76 cfs @ 12.10 hrs, Volume= 0.916 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs