# STORMWATER MANAGEMENT REPORT

**FOR**

## BEECH STREET RESIDENCES

**3 Residential Units**
**10 Beech Street**
**Somerville, MA**

**Prepared for:**
Beech Street, LLC
70 Oxford Street
Somerville, MA 02143

**Prepared by:**
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120 Middlesex Avenue, Suite 20
Somerville, Massachusetts 02145-1104

Project 2013-078
March 11, 2014

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CIVIL ENGINEERS and LAND SURVEYORS
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## INTRODUCTION

**Beech Street, LLC** proposes the development of the property at 10 Beech Street in Somerville, MA. The site is zoned Residential B (RB). The existing parcel covers 5,634 square feet (0.129 acres). There is currently a two-story, wood framed, single family home on the subject site. There is an existing curb cut on Pitman Street that provides access to a grass and dirt area used for parking.

## STORM WATER MANAGEMENT POLICY

The reference document used for developing the proposed stormwater management system for the proposed project is the City of Somerville's Zoning Ordinance, Version June 25, 2009. Section 5.4.6.4 of the document describes the stormwater management standards that control quality, quantity, and groundwater recharge. The following report explains how the standards are met.

## EXISTING CONDITION

The runoff from the lot is one drainage area (subcatchment). (See Appendix C, Figure 1) The site imperviousness is approximately 27% impervious and slopes gently from the northwest to the southeast. Roof runoff is collected by gutters and discharged at grade through several downspouts. There is no other onsite stormwater management. All site runoff enters the combined sewer in Beech Street.

According to FEMA Flood Insurance Rate Map Number 25017C0438E, with an effective date of June 4, 2010, the site is not located in a flood zone. (See Appendix A).

## SOILS

The NRCS Web Soil Survey characterizes the soil at the site as entirely Urban Land and does not specify a Hydrologic Soil Group. (See Appendix B)

For calculation purposes, a Hydrologic Soils Group of C was used for all subsurface soils. Per the Massachusetts Stormwater Handbook, Table 2.3.3 1982 Rawls Rates, an infiltration rate of 0.17 in/hr has been used in the hydrologic model. A planned soil test will determine the groundwater elevation. The proposed storage and infiltration fields, described below, have been designed for minimal cover. If necessary, shallower storage chambers can be substituted to provide better separation to groundwater.

## PROPOSED CONDITION

The proposed development includes the demolition of the existing building to accommodate a three-story building with 3 residential units. Parking is provided at grade. The site is accessed by modifying an existing curb cut on Pitman Street. Extensive landscaping is proposed for the site, including trees and shrubs along the perimeter and planter areas around the building. The proposed site is approximately 68% impervious.

## Table 1

Total Offsite Runoff
Peak Discharges (cubic feet per second, CFS) and Volumes cubic feet (CF)

| Description | Existing Conditions | | Proposed Conditions | |
|---|---|---|---|---|
| Drainage Area | 0.129 Acres | | 0.129 Acres | |
| Storm Event (Years) | Offsite Peak Runoff (CFS) | Offsite Runoff Volume (CF) | Offsite Peak Runoff (CFS) | Offsite Runoff Volume (CF) |
| 2 | 0.16 | 785 | 0.09 | 472 |
| 10 | 0.28 | 1,366 | 0.21 | 1,063 |
| 25 | 0.36 | 1,712 | 0.29 | 1,211 |
| 100 | 0.46 | 2,242 | 0.36 | 2,025 |

## CONCLUSION

Based on DCI's analysis of the existing and proposed conditions, the proposed site condition meets the criteria set forth by the City of Somerville. Off-site runoff volume and peak flow rate for the 2, 10, 25 and 100-year storm events is decreased. If an illicit stormwater connection to the sanitary sewer is found, it will be eliminated and a new connection will be made to the appropriate storm sewer. The 4:1 I/I requirement will be met. DCI concludes that the proposed development at 10 Beech Street, Somerville, MA adheres to all applicable stormwater management policies.

# Appendix A


MAP SCALE 1" = 500'

250 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0438E

# FIRM

## FLOOD INSURANCE RATE MAP

**MIDDLESEX COUNTY, MASSACHUSETTS**
**(ALL JURISDICTIONS)**

**PANEL 438 OF 656**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| CAMBRIDGE, CITY OF | 250186 | 0438 | E |
| MEDFORD, CITY OF | 250205 | 0438 | E |
| SOMERVILLE, CITY OF | 250214 | 0438 | 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.

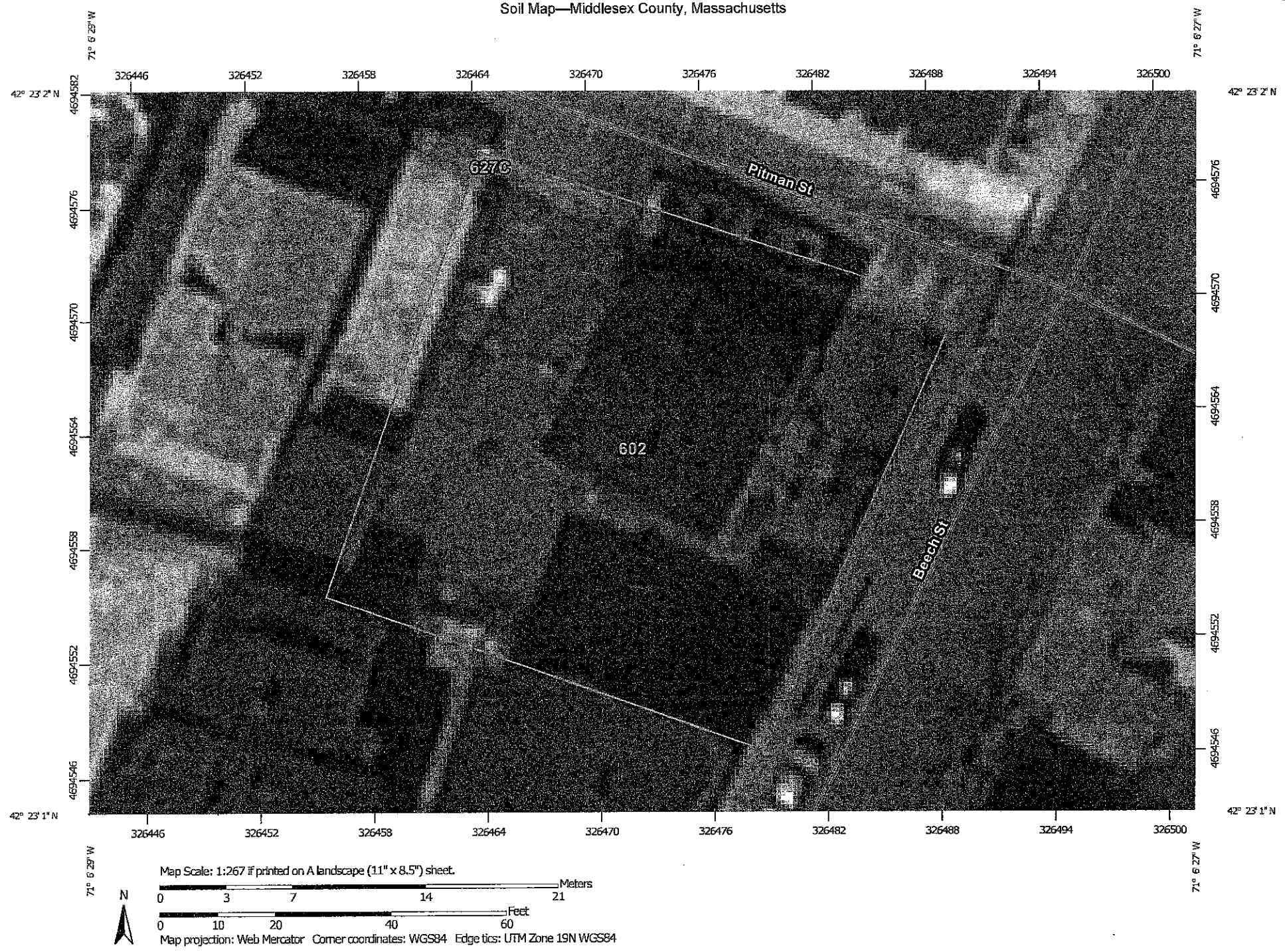
**MAP NUMBER**
**25017C0438E**

**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

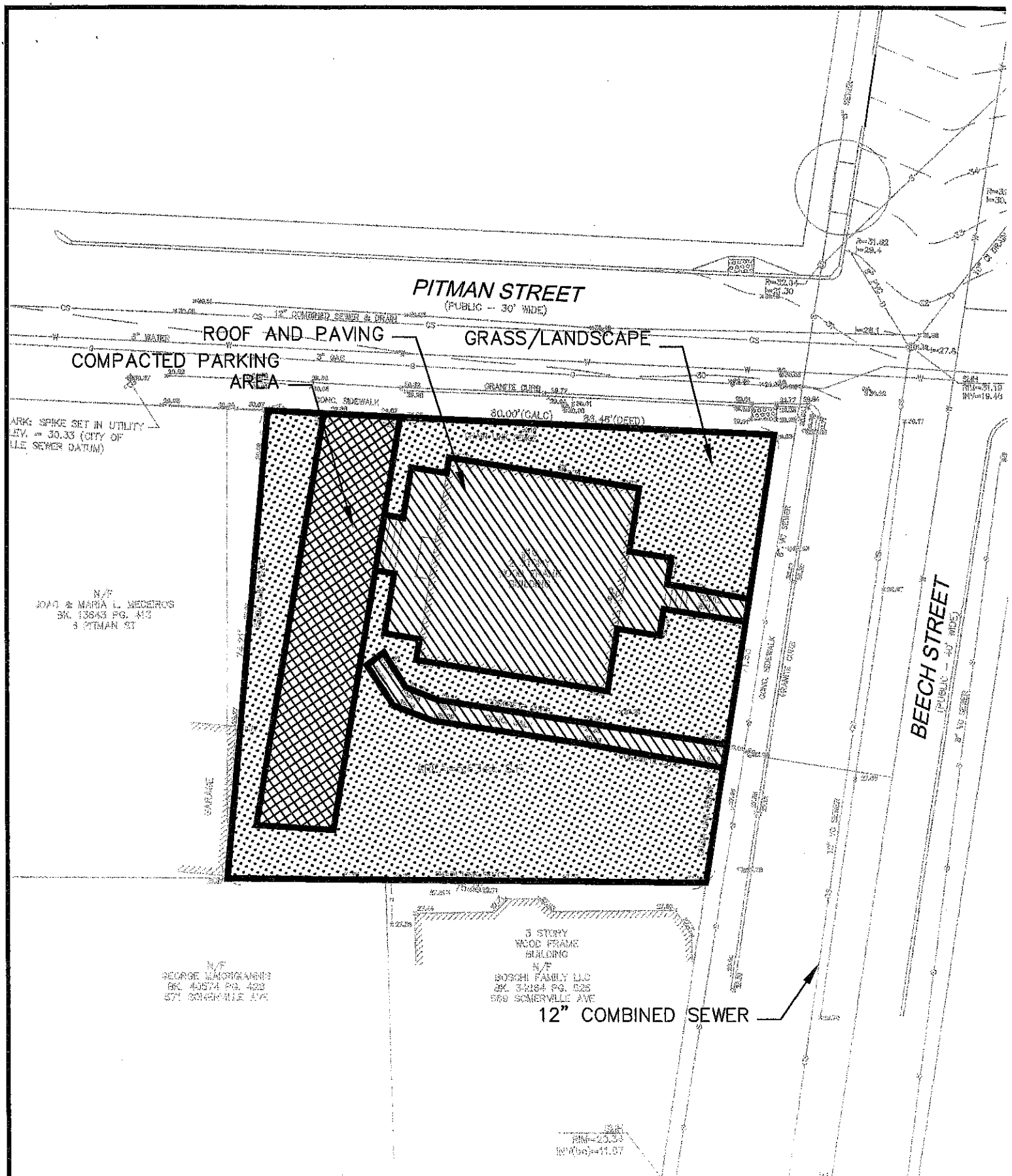
# Appendix B


71° 6' 29" W
71° 6' 27" W
42° 23' 2" N
42° 23' 1" N
326446
326452
326458
326464
326470
326476
326482
326488
326494
326500
4694582
4694576
4694570
4694564
4694558
4694552
4694546
627C
602
Pitman St
Beech St
Map Scale: 1:267 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 3 7 14 21
Feet
0 10 20 40 60
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

# Map Unit Legend

| Middlesex County, Massachusetts (MA017) | | | |
|---|---|---|---|
| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
| 602 | Urban land | 0.2 | 99.6% |
| 627C | Newport-Urban land complex, 3 to 15 percent slopes | 0.0 | 0.4% |
| **Totals for Area of Interest** | | **0.2** | **100.0%** |

# Appendix C

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SOMERVILLE, MA 02145
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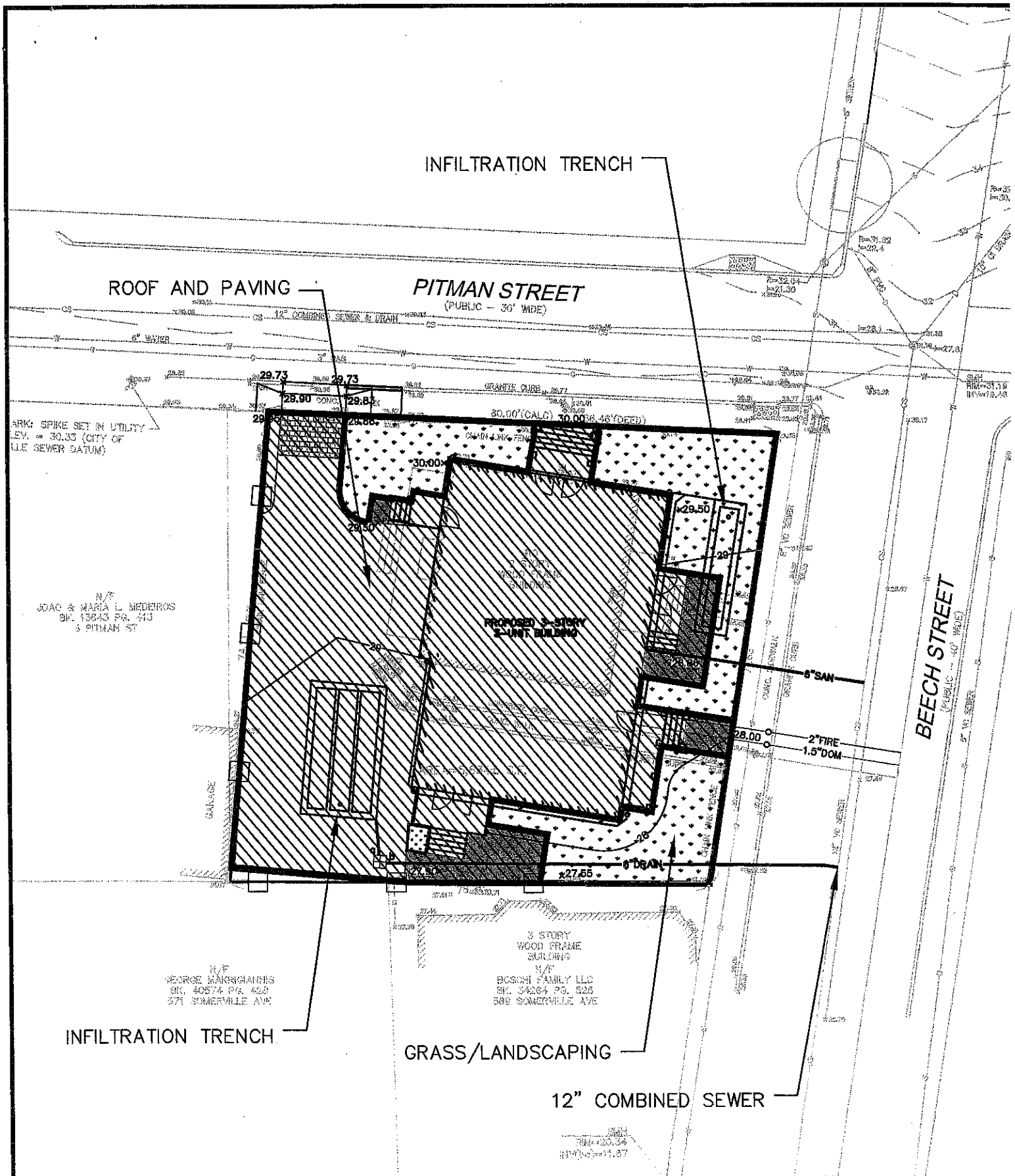
*10 BEECH STREET*
*SOMERVILLE, MA*

*FIGURE 1*
*EXISTING CATCHMENT AREAS*

SCALE: 1" = 20'

2013-078

# Appendix D





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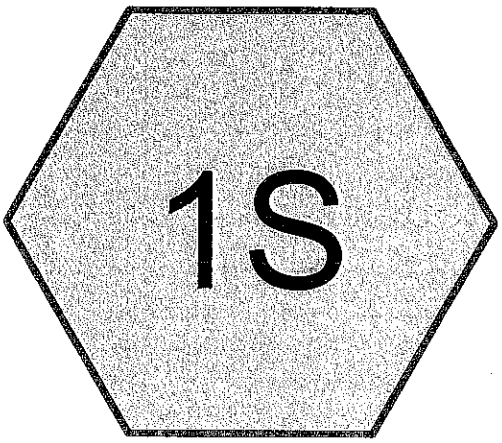
# 10 BEECH STREET SOMERVILLE, MA

## FIGURE 2 PROPOSED CATCHMENT AREAS

SCALE: 1" = 20'

2013-07

# Appendix E




# Existing

Subcat Reach Pond Link

**Drainage Diagram for 13-078 EX**
Prepared by Microsoft, Printed 3/7/2014

## Summary for Subcatchment 1S: Existing

Runoff = 0.16 cfs @ 12.07 hrs, Volume= 785 cf, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs
Type III 24-hr 2-Year Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 1,504 | 98 | Paved parking, HSG C |
| | 3,330 | 79 | 50-75% Grass cover, Fair, HSG C |
| * | 800 | 87 | Compacted Dirt Parking Area |
| | 5,634 | 85 | Weighted Average |
| | 4,130 | | 73.30% Pervious Area |
| | 1,504 | | 26.70% Impervious Area |

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

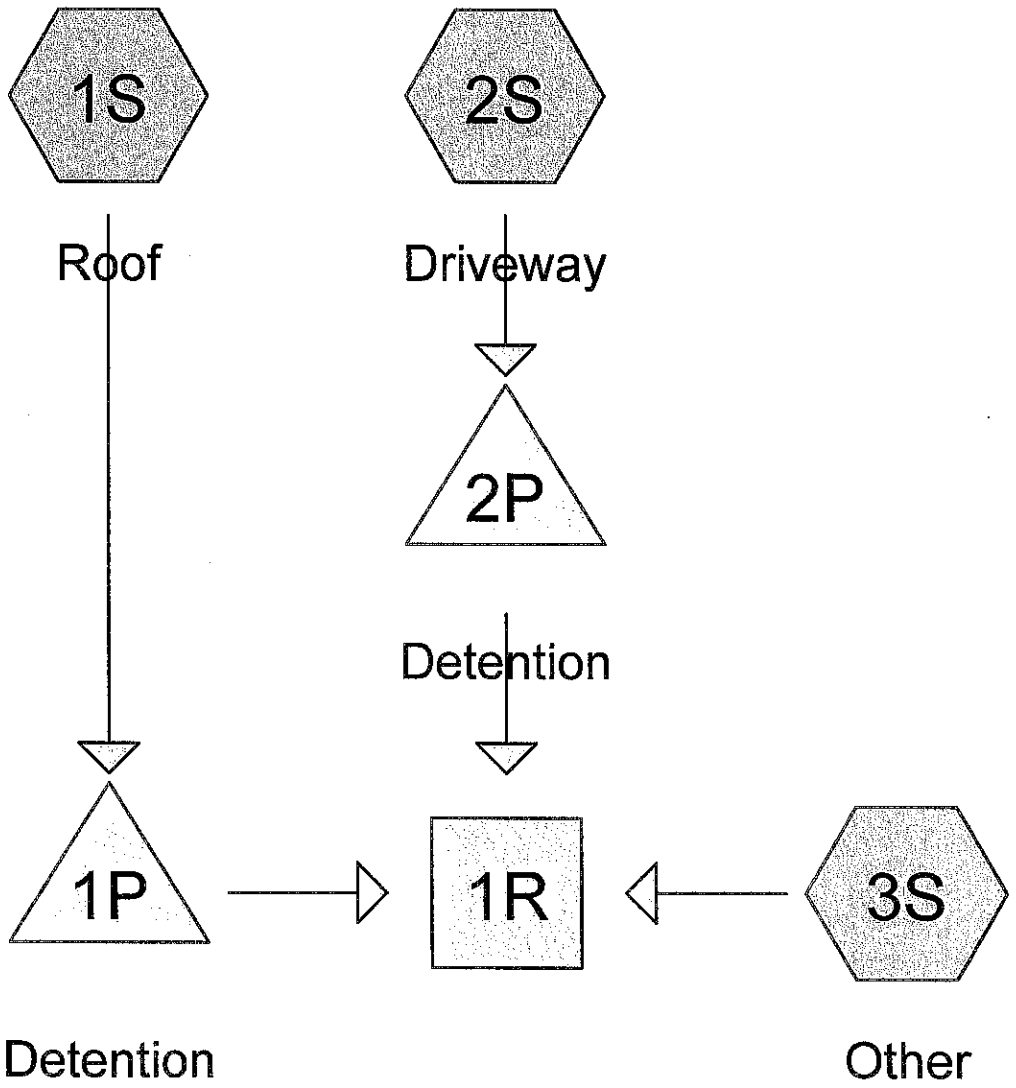
## Summary for Subcatchment 1S: Existing

Runoff = 0.36 cfs @ 12.06 hrs, Volume= 1,712 cf, Depth= 3.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs
Type III 24-hr 25-Year Rainfall=5.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 1,504 | 98 | Paved parking, HSG C |
| | 3,330 | 79 | 50-75% Grass cover, Fair, HSG C |
| * | 800 | 87 | Compacted Dirt Parking Area |
| | 5,634 | 85 | Weighted Average |
| | 4,130 | | 73.30% Pervious Area |
| | 1,504 | | 26.70% Impervious Area |

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




Subcat Reach Pond Link

**Drainage Diagram for 13-078 PR**
Prepared by Microsoft, Printed 3/10/2014
HydroCAD® 9.10 s/n 00884 © 2010 HydroCAD Software Solutions LLC

## Summary for Subcatchment 1S: Roof

Runoff = 0.08 cfs @ 12.05 hrs, Volume= 426 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs
Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|---|---|---|
| 1,781 | 98 | Roofs, HSG C |
| 1,781 | | 100.00% Impervious Area |

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

## Summary for Subcatchment 2S: Driveway

Runoff = 0.08 cfs @ 12.05 hrs, Volume= 391 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs
Type III 24-hr 2-Year Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 1,630 | 98 | Paved parking, HSG C |
| * | 70 | 82 | Permeable Apron |
| | 1,700 | 97 | Weighted Average |
| | 70 | | 4.12% Pervious Area |
| | 1,630 | | 95.88% Impervious Area |

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

## Summary for Subcatchment 3S: Other

Runoff = 0.05 cfs @ 12.09 hrs, Volume= 226 cf, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs
Type III 24-hr 2-Year Rainfall=3.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 419 | 98 | Paved parking, HSG C |
| * | 1,734 | 74 | Landscaping |
| | 2,153 | 79 | Weighted Average |
| | 1,734 | | 80.54% Pervious Area |
| | 419 | | 19.46% Impervious Area |

## Summary for Pond 2P: Detention

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 1,700 sf, | 95.88% Impervious, | Inflow Depth = | 2.76" | for 2-Year event |
| Inflow = | 0.08 cfs @ | 12.05 hrs, | Volume= | 391 cf | |
| Outflow = | 0.00 cfs @ | 6.30 hrs, | Volume= | 88 cf, | Atten= 99%, Lag= 0.0 min |
| Discarded = | 0.00 cfs @ | 6.30 hrs, | Volume= | 88 cf | |
| Primary = | 0.00 cfs @ | 0.00 hrs, | Volume= | 0 cf | |

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs / 2
Peak Elev= 26.47' @ 23.85 hrs Surf.Area= 241 sf Storage= 324 cf

Plug-Flow detention time= 472.2 min calculated for 87 cf (22% of inflow)
Center-of-Mass det. time= 272.1 min ( 1,038.8 - 766.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 24.33' | 183 cf | **11.50'W x 20.99'L x 2.71'H Field A**<br>654 cf Overall - 196 cf Embedded = 458 cf x 40.0% Voids |
| #2A | 24.83' | 196 cf | **Cultec R-180** x 9 Inside #1<br>Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf<br>Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap |
| | | 379 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 24.33' | **0.170 in/hr Exfiltration over Surface area** |
| #2 | Primary | 26.50' | **6.0" Round Culvert**<br>L= 30.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 26.50' / 25.90' S= 0.0200 '/' Cc= 0.900<br>n= 0.010 PVC, smooth interior |

**Discarded OutFlow** Max=0.00 cfs @ 6.30 hrs HW=24.36' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=24.33' (Free Discharge)
↑—**2=Culvert** ( Controls 0.00 cfs)

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

## Summary for Reach 1R:

Inflow Area = 5,634 sf, 67.98% Impervious, Inflow Depth = 2.26" for 10-Year event
Inflow = 0.21 cfs @ 12.05 hrs, Volume= 1,063 cf
Outflow = 0.21 cfs @ 12.05 hrs, Volume= 1,063 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs

## Summary for Pond 1P: Detention

Inflow Area = 1,781 sf,100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.12 cfs @ 12.04 hrs, Volume= 633 cf
Outflow = 0.13 cfs @ 12.04 hrs, Volume= 489 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 3.00 hrs, Volume= 42 cf
Primary = 0.13 cfs @ 12.04 hrs, Volume= 448 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs
Peak Elev= 30.11' @ 12.00 hrs Surf.Area= 105 sf Storage= 153 cf

Plug-Flow detention time= 162.4 min calculated for 489 cf (77% of inflow)
Center-of-Mass det. time= 80.0 min ( 829.6 - 749.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 24.00' | 88 cf | **5.00'W x 20.99'L x 2.71'H Field A**<br>284 cf Overall - 65 cf Embedded = 219 cf x 40.0% Voids |
| #2A | 24.50' | 65 cf | **Cultec R-180** x 3 Inside #1<br>Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf<br>Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap |
| | | 153 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 24.00' | **0.170 in/hr Exfiltration over Surface area** |
| #2 | Primary | 30.00' | **4.0" Vert. Overflow at Downspouts X 4.00** C= 0.600 |

**Discarded OutFlow** Max=0.00 cfs @ 3.00 hrs HW=24.07' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.11 cfs @ 12.04 hrs HW=30.11' (Free Discharge)
↑—**2=Overflow at Downspouts** (Orifice Controls 0.11 cfs @ 1.12 fps)

## Summary for Subcatchment 1S: Roof

Runoff = 0.14 cfs @ 12.04 hrs, Volume= 751 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs
Type III 24-hr 25-Year Rainfall=5.30"

| Area (sf) | CN | Description |
|---|---|---|
| 1,781 | 98 | Roofs, HSG C |
| 1,781 | | 100.00% Impervious Area |

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

## Summary for Subcatchment 2S: Driveway

Runoff = 0.13 cfs @ 12.04 hrs, Volume= 701 cf, Depth= 4.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs
Type III 24-hr 25-Year Rainfall=5.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 1,630 | 98 | Paved parking, HSG C |
| * | 70 | 82 | Permeable Apron |
| | 1,700 | 97 | Weighted Average |
| | 70 | | 4.12% Pervious Area |
| | 1,630 | | 95.88% Impervious Area |

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

## Summary for Subcatchment 3S: Other

Runoff = 0.11 cfs @ 12.07 hrs, Volume= 549 cf, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs
Type III 24-hr 25-Year Rainfall=5.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 419 | 98 | Paved parking, HSG C |
| * | 1,734 | 74 | Landscaping |
| | 2,153 | 79 | Weighted Average |
| | 1,734 | | 80.54% Pervious Area |
| | 419 | | 19.46% Impervious Area |

## Summary for Pond 2P: Detention

Inflow Area = 1,700 sf, 95.88% Impervious, Inflow Depth = 4.95" for 25-Year event
Inflow = 0.13 cfs @ 12.04 hrs, Volume= 701 cf
Outflow = 0.12 cfs @ 12.33 hrs, Volume= 447 cf, Atten= 10%, Lag= 17.2 min
Discarded = 0.00 cfs @ 3.90 hrs, Volume= 94 cf
Primary = 0.12 cfs @ 12.33 hrs, Volume= 353 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs / 2
Peak Elev= 26.76' @ 12.42 hrs Surf.Area= 241 sf Storage= 353 cf

Plug-Flow detention time= 224.0 min calculated for 447 cf (64% of inflow)
Center-of-Mass det. time= 120.6 min ( 875.0 - 754.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 24.33' | 183 cf | **11.50'W x 20.99'L x 2.71'H Field A**<br>654 cf Overall - 196 cf Embedded = 458 cf x 40.0% Voids |
| #2A | 24.83' | 196 cf | **Cultec R-180** x 9 Inside #1<br>Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf<br>Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap |
| | | 379 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 24.33' | **0.170 in/hr Exfiltration over Surface area** |
| #2 | Primary | 26.50' | **6.0" Round Culvert**<br>L= 30.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 26.50' / 25.90' S= 0.0200 '/' Cc= 0.900<br>n= 0.010 PVC, smooth interior |

**Discarded OutFlow** Max=0.00 cfs @ 3.90 hrs HW=24.36' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.11 cfs @ 12.33 hrs HW=26.70' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.11 cfs @ 1.51 fps)

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

## Summary for Reach 1R:

Inflow Area = 5,634 sf, 67.98% Impervious, Inflow Depth = 4.31" for 100-Year event
Inflow = 0.36 cfs @ 12.10 hrs, Volume= 2,025 cf
Outflow = 0.36 cfs @ 12.10 hrs, Volume= 2,025 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs

## Summary for Pond 1P: Detention

Inflow Area = 1,781 sf,100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
Inflow = 0.17 cfs @ 12.04 hrs, Volume= 929 cf
Outflow = 0.18 cfs @ 12.04 hrs, Volume= 961 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 2.10 hrs, Volume= 43 cf
Primary = 0.18 cfs @ 12.04 hrs, Volume= 918 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.30 hrs / 2
Peak Elev= 30.14' @ 12.04 hrs Surf.Area= 105 sf Storage= 153 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 97.2 min ( 840.9 - 743.8 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 24.00' | 88 cf | **5.00'W x 20.99'L x 2.71'H Field A**<br>284 cf Overall - 65 cf Embedded = 219 cf x 40.0% Voids |
| #2A | 24.50' | 65 cf | **Cultec R-180** x 3 Inside #1<br>Effective Size= 33.6"W x 20.0"H => 3.44 sf x 6.33'L = 21.8 cf<br>Overall Size= 36.0"W x 20.5"H x 7.33'L with 1.00' Overlap |
| | | 153 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 24.00' | **0.170 in/hr Exfiltration over Surface area** |
| #2 | Primary | 30.00' | **4.0" Vert. Overflow at Downspouts X 4.00** C= 0.600 |

**Discarded OutFlow** Max=0.00 cfs @ 2.10 hrs HW=24.08' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.16 cfs @ 12.04 hrs HW=30.13' (Free Discharge)
↑—**2=Overflow at Downspouts** (Orifice Controls 0.16 cfs @ 1.25 fps)

# Appendix F

# SEWER CALCULATIONS

## I. INTRODUCTION

The following sewerage calculations are based upon 310 CMR 15.203, 314 CMR 7.15 and architectural floor plans provided by KDI.

## II. CALCULATIONS

| | |
|---|---|
| Number of Bedrooms | 9 |
| Average Daily Flow (110 gal/day/bedroom) | 990 gpd |
| Peaking Factor | 5.5 |
| Total Peak Flow | 3.78 gal/min |
| Slope | 0.020 |
| Pipe Size | 6" |

## III. DESIGN

PVC pipe (Manning's roughness coefficient = 0.011) at the calculated slope and diameter is adequate for flows of 385 gal/min and less (see attached nomograph). The proposed design falls within acceptable limits.

## IV. CONCLUSION

Six-inch (6") PVC, SDR 35, ASTM D3034 is proposed for the sewer line.

# Appendix G

# INFILTRATION/INFLOW REMOVAL CALCULATIONS

## I. INTRODUCTION

The following infiltration/inflow removal calculations are based upon 310 CMR 15.203, the sewer calculations presented above, and the storm drainage calculations summarized in Table I. The City of Somerville requires that infiltration/inflow removal of four times the proposed additional average daily sewer flow must be provided by the project.

## II. CALCULATIONS

| | |
|---|---|
| Existing Average Daily Sewer Flow | 440 gpd |
| Proposed Average Daily Sewer Flow | 990 gpd |
| Additional Average Daily Flow | 550 gpd |
| Four Times Additional Average Daily Flow | 2,200 gpd = 0.0034 cfs |

## III. REMOVAL

The required 0.0034 cfs of infiltration/ inflow will be removed from the combined sewer system by peak flow reduction in the storm drainage from the site. Subtraction of the proposed flow rates from the existing flow rates given in Table 1 indicates flow reductions of 0.08 cfs, 0.07 cfs, 0.07 cfs, and 0.10 cfs for the 2 yr., 10yr., 25 yr., and 100 yr. Storms respectively. All of these flow reductions exceed the required removal of 0.0034 cfs.

## IV. CONCLUSION

Because the storm drainage flow reductions provided by the project exceed the required infiltration/inflow removal rate we conclude that the proposed design meets and exceeds the requirement for infiltration/inflow removal.

# Appendix H

Design Consultants, Inc.
120 Middlesex Ave Suite 20
Somerville, MA 02145

3/10/2014

# DOMESTIC WATER DEMAND
# CALCULATIONS AND PIPE SIZING

LOCATION: 10 Beech Street — Design Consultants, Inc.

DESCRIPTION OF FACILITY: Mixed Use — Calc by: RLB

Architectural Reference Plans: by KDI — Date: 3/7/2014

| UNITS | DESCRIPTION (DCI Job#: 2013-0078) | FACTOR | HOT | COLD |
|---|---|---|---|---|
| 6 | BATHTUBS (W/WO SHOWERHEAD) | 2 | 12 | 12 |
| 3 | DISHWASHER (DOMESTIC) | 2 | 6 | 6 |
| 3 | KITCHEN SINKS (RESIDENTIAL) | 2 | 6 | 6 |
| 9 | LAVATORIES | 1 | 9 | 9 |
| 3 | WASHING MACHINE/LAUNDRY TRAY | 2 | 0 | 6 |
| 9 | WATER CLOSETS (TANK TYPE) | 1 | N/A | 9 |
| 1 | HOSE FAUCET/SILL COCK/HOSE BIBBS | 2 | N/A | 2 |

adding HOT & COLD values yields... FIXTURE UNITS: 83 = 33 + 50

SELECT PROPER DEMAND FACTOR FROM TBL 2 (SEE BELOW) 0.35

MULTIPLY TOTAL x DEMAND FACTOR (FROM TABLE 2) 83 x 0.35 = 29.1

A CAPACITY VALUE OF 29.1 WOULD REQUIRE A WATER SERVICE SIZE OF : 1.5"

(SEE TABLE 3 BELOW)

TABLE 2

| OCCUPANCY USE | | DEMAND FACTOR |
|---|---|---|
| RES. | 1 OR 2 FAMILY | 0.50 |
| | MULTI-RESIDENTIAL | 0.35 |
| | HOTEL | 0.70 |
| BUS. | GENERAL | 0.25 |
| | RESTAURANT/CAFÉ | 0.70 |

TABLE 3

| SERVICE PIPE SIZE | CAPACITY VALUE | | |
|---|---|---|---|
| 3/4 " | NOT RECOMMENDED | | |
| 1 " | 9.1 | TO | 16.5 |
| 1 1/2 " | 16.6 | TO | 55.0 |
| 2 " | 55.1 | TO | 107.499 |
| 4 " | 107.5 | TO | 700 |

Note: Calculations based upon Mass. Plumbing Codes (248 CMR 10.14)

Note: Calculations are preliminary, to be confirmed by Registered MEP Engineer.