



STORMWATER MANAGEMENT REPORT

FOR

8 CURTIS STREET

**2 Residential Units
8 Curtis Street
Somerville, MA**

Prepared for:

Shree Ganesh Realty Trust
1274 Broadway Apt 2
Somerville, MA 02144

Prepared by:

Design Consultants, Inc.
120 Middlesex Avenue, Suite 20
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Project 2013-146
March 11, 2014



Design Consultants, Inc.

CIVIL ENGINEERS and LAND SURVEYORS

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- G. Domestic Water Demand Calculations and Pipe Sizing

INTRODUCTION

Shree Ganesh Realty Trust proposes the development of the property at 8 Curtis Street in Somerville, MA. The site is zoned Residential A (RA). The existing parcel covers 5,548 square feet (0.127 acres). The parcel is currently a paved parking lot. There is an existing curb cut on Curtis Street that provides access to the property.

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 is currently 100% impervious and slopes gently from the north to south. There is no onsite stormwater management. All site runoff enters the combined sewer at the intersection of Curtis Street and Broadway, southwest of the property.

According to FEMA Flood Insurance Rate Map Number 25017C0419E, 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 field, described below, have been designed for minimal cover. If necessary, shallower storage methods can be substituted to provide better separation to groundwater.

PROPOSED CONDITION

The proposed development includes the conversion of the existing parking lot into a 2-unit townhouse development. Parking is provided at grade. The site is accessed by modifying an existing curb cut on Curtis 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 65% impervious.

The catchments in the proposed condition are very similar to the catchments in the existing condition. (See Appendix D, *Figure 2*)

Drainage:

Drainage calculations were conducted to evaluate peak discharges from the project site under the pre-development and post-development conditions (See Appendix E). As required under the City of Somerville's Stormwater Management Policy, peak discharges under post development conditions will not exceed the pre-development conditions.

The proposed stormwater management system includes roof drains and infiltration chambers in addition to areas of porous brick pavers for detention and groundwater recharge. Roof runoff is collected by gutters and downspouts that are connected to the infiltration chambers. Overflow will occur through the downspouts, at grade, into landscape areas. Runoff from the parking area is allowed to flow overland, eventually into Curtis Street. A portion of the parking lot runoff will be intercepted by the areas of porous pavers. Other landscaped areas will flow, uncollected, into Curtis Street.

4:1 Infiltration/Inflow Removal:

The 4:1 I-I requirement, for projects adding more than 2,000 gallons per day of sewage flow to the combined sewers, stipulates that for every increased gallon of sewage flow per day, four gallons of stormwater are stored and infiltrated onsite. The volume of stormwater represents the required amount to be stored/infiltrated per year. This project proposes to add only 660 gallons per day of sewage to the combined system. Therefore, the 4:1 I-I requirement does not apply to this project. However, since the project is introducing pervious area as well as a means for runoff infiltration on site, overall storm flows into the combined system will still be reduced.

HYDROLOGIC MODEL

The hydrologic model used for this analysis is based upon the SCS Method. Both existing and proposed conditions are modeled for the 2-year, 10-year, 25-year, and 100-year storm events. The SCS Method allows for variable rainfall intensity throughout the storm duration, peaking near the middle of the Type III, 24-hour storm. The drainage area's time of concentration (t_c), is assumed to be six minutes for this site.

The designed on-site stormwater management system collects and infiltrates site runoff reducing off-site flows for all storm events.

Table 1

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

Description	Existing Conditions		Proposed Conditions	
Drainage Area	0.127 Acres		0.127 Acres	
Storm Event (Years)	Offsite Peak Runoff (CFS)	Offsite Runoff Volume (CF)	Offsite Peak Runoff (CFS)	Offsite Runoff Volume (CF)
2	0.37	1,324	0.29	950
10	0.55	1,967	0.52	1,570
25	0.66	2,379	0.65	1,975
100	0.79	2,882	0.76	2,474

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 does not apply to this project. DCI concludes that the proposed development at 8 Curtis Street, Somerville, MA adheres to all applicable stormwater management policies.

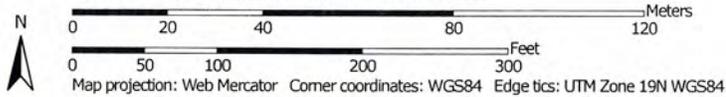
Appendix A

Appendix B

Soil Map—Middlesex County, Massachusetts
(8 Curtis Street, Somerville)



Map Scale: 1:1,520 if printed on A portrait (8.5" x 11") sheet.



MAP LEGEND

 Area of Interest (AOI)	 Soil Area
 Soils	 Stony Spot
 Soil Map Unit Polygons	 Very Stony Spot
 Soil Map Unit Lines	 Wet Spot
 Soil Map Unit Points	 Other
 Special Point Features	 Special Line Features
 Blowout	 Streams and Canals
 Borrow Pit	 Transportation
 Clay Spot	 Rails
 Closed Depression	 Interstate Highways
 Gravel Pit	 US Routes
 Gravelly Spot	 Major Roads
 Landfill	 Local Roads
 Lava Flow	 Background
 Marsh or swamp	 Aerial Photography
 Mine or Quarry	
 Miscellaneous Water	
 Perennial Water	
 Rock Outcrop	
 Saline Spot	
 Sandy Spot	
 Severely Eroded Spot	
 Sinkhole	
 Slide or Slip	
 Sodic Spot	

MAP INFORMATION

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 map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 13, Dec 17, 2013

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

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Middlesex County, Massachusetts (MA017)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	9.9	99.9%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.0	0.1%
Totals for Area of Interest		9.9	100.0%

Appendix C

Appendix D

ROOF AND PAVEMENT

ROOF AREA INTO DRYWELL

N/E
JAMES, SOPHIE &
STEPHEN J. BREMIS
BK 39198 PG. 380
12 CURTIS ST.

3 STORY
WOOD FRAME
BUILDING

GARAGE

EXISTING BITUMINOUS
BERM TO BE REMOVED

PROP. INFILTRATION
SYSTEM BOTTOM OF
STONE EL.=92.00

PERVIOUS BRICK PAVERS
AT 2 PARKING SPACES.
SEE LANDSCAPE PLANS

PERVIOUS BRICK PAVERS
CURBED FRONT
GARDEN AREAS
SEE LANDSCAPE PLANS

VERTICAL GRANITE
CURBING (TYP.)
BIT. CONC.

1 STORY
BRICK BUILDING

LANDSCAPED AREAS (SEE
LANDSCAPE PLANS FOR
PLANTING INFO)

1 STORY
CONC. BLOCK
BUILDING

1 STORY
WOOD FRAME
BUILDING

INFILTRATION CHAMBERS
UNDER POROUS PAVERS

GRASS/LANDSCAPING

N/E
NICHOLA'S P. FOURTOUNIS
BK. 10627 PG. 590
1157 BROADWAY

LANDSCAPED AREA (SEE
LANDSCAPE PLANS FOR
PLANTING INFO)

1 STORY
BRICK BUILDING

DESIGN POINT

12" COMBINED SEWER

N/E
OET OLYMPIUS REALTY TRUST
BK 10083 PG 272
1153 BROADWAY

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Consulting Engineers and Surveyors



120 MIDDLESEX AVENUE
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8 CURTIS STREET
SOMERVILLE, MA

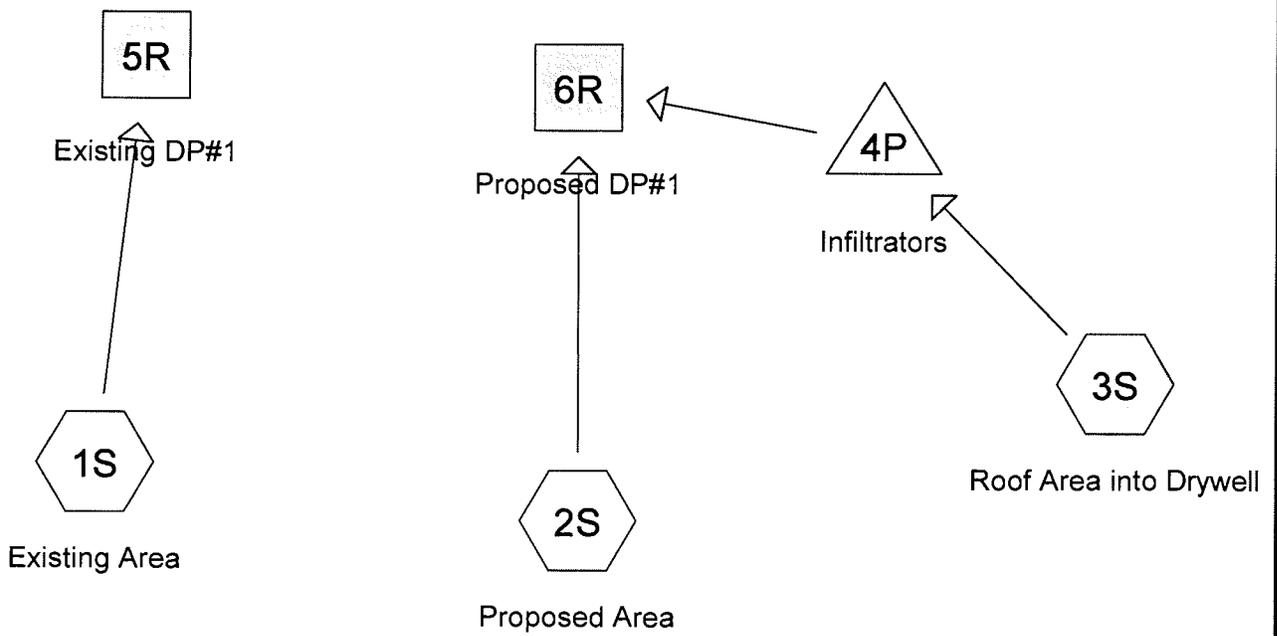
FIGURE 2
PROPOSED
CATCHMENT
AREAS

SCALE: 1" = 20'

2013-146



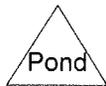
Appendix E



Subcat



Reach



Pond



Link

Drainage Diagram for 13-146 Exist & Prop
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Type III 24-hr 2-yr Rainfall=3.10"

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Page 2

Summary for Subcatchment 1S: Existing Area

Runoff = 0.37 cfs @ 12.09 hrs, Volume= 1,324 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 5,548	98	pavement
5,548		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: Proposed Area

Runoff = 0.29 cfs @ 12.09 hrs, Volume= 925 cf, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 1,250	74	Landscape & grass areas, Good Condition
* 3,673	98	impervious areas to street
4,923	92	Weighted Average
1,250		25.39% Pervious Area
3,673		74.61% Impervious Area

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

Summary for Subcatchment 3S: Roof Area into Drywell

Runoff = 0.04 cfs @ 12.09 hrs, Volume= 149 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 625	98	roof area
625		100.00% Impervious Area

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

13-146 Exist & Prop

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Type III 24-hr 2-yr Rainfall=3.10"

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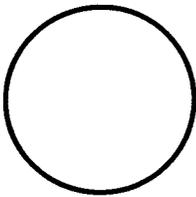
Summary for Reach 5R: Existing DP#1

Inflow Area = 5,548 sf, 100.00% Impervious, Inflow Depth > 2.86" for 2-yr event
Inflow = 0.37 cfs @ 12.09 hrs, Volume= 1,324 cf
Outflow = 0.37 cfs @ 12.09 hrs, Volume= 1,324 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.77 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.15 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 8.25', Capacity at Bank-Full= 1,287.10 cfs

99.0" Round Pipe
n= 0.010
Length= 1.0' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -0.01'



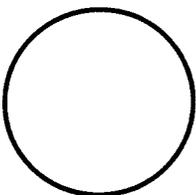
Summary for Reach 6R: Proposed DP#1

Inflow Area = 5,548 sf, 77.47% Impervious, Inflow Depth > 2.06" for 2-yr event
Inflow = 0.29 cfs @ 12.09 hrs, Volume= 950 cf
Outflow = 0.29 cfs @ 12.09 hrs, Volume= 950 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.52 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.14 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 8.25', Capacity at Bank-Full= 1,287.10 cfs

99.0" Round Pipe
n= 0.010
Length= 1.0' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -0.01'



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Type III 24-hr 2-yr Rainfall=3.10"

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Summary for Pond 4P: Infiltrators

Inflow Area = 625 sf, 100.00% Impervious, Inflow Depth > 2.86" for 2-yr event
 Inflow = 0.04 cfs @ 12.09 hrs, Volume= 149 cf
 Outflow = 0.01 cfs @ 12.54 hrs, Volume= 66 cf, Atten= 75%, Lag= 27.4 min
 Discarded = 0.00 cfs @ 12.50 hrs, Volume= 41 cf
 Primary = 0.01 cfs @ 12.54 hrs, Volume= 25 cf

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 85.01' @ 12.55 hrs Surf.Area= 85 sf Storage= 86 cf

Plug-Flow detention time= 262.1 min calculated for 66 cf (44% of inflow)
 Center-of-Mass det. time= 127.1 min (884.1 - 757.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	82.00'	58 cf	5.00'W x 17.00'L x 2.04'H Field A 174 cf Overall - 28 cf Embedded = 146 cf x 40.0% Voids
#2A	82.50'	28 cf	Cultec C-100 x 2 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
		86 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	4.0" Horiz. Orifice/Grate X 2.00 C= 0.600 Limited to weir flow at low heads
#2	Discarded	82.00'	0.170 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.00 cfs @ 12.50 hrs HW=85.00' (Free Discharge)
 ↑ **2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 12.54 hrs HW=85.01' (Free Discharge)
 ↑ **1=Orifice/Grate** (Weir Controls 0.00 cfs @ 0.28 fps)

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Type III 24-hr 10-yr Rainfall=4.50"

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Summary for Subcatchment 1S: Existing Area

Runoff = 0.55 cfs @ 12.09 hrs, Volume= 1,967 cf, Depth> 4.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 5,548	98	pavement
5,548		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: Proposed Area

Runoff = 0.45 cfs @ 12.09 hrs, Volume= 1,477 cf, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 1,250	74	Landscape & grass areas, Good Condition
* 3,673	98	impervious areas to street
4,923	92	Weighted Average
1,250		25.39% Pervious Area
3,673		74.61% Impervious Area

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

Summary for Subcatchment 3S: Roof Area into Drywell

Runoff = 0.06 cfs @ 12.09 hrs, Volume= 222 cf, Depth> 4.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 625	98	roof area
625		100.00% Impervious Area

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

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Type III 24-hr 10-yr Rainfall=4.50"

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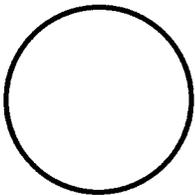
Summary for Reach 5R: Existing DP#1

Inflow Area = 5,548 sf, 100.00% Impervious, Inflow Depth > 4.25" for 10-yr event
Inflow = 0.55 cfs @ 12.09 hrs, Volume= 1,967 cf
Outflow = 0.55 cfs @ 12.09 hrs, Volume= 1,966 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.08 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.15 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 8.25', Capacity at Bank-Full= 1,287.10 cfs

99.0" Round Pipe
n= 0.010
Length= 1.0' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -0.01'



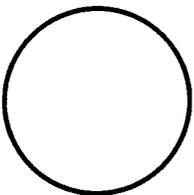
Summary for Reach 6R: Proposed DP#1

Inflow Area = 5,548 sf, 77.47% Impervious, Inflow Depth > 3.39" for 10-yr event
Inflow = 0.52 cfs @ 12.10 hrs, Volume= 1,570 cf
Outflow = 0.52 cfs @ 12.10 hrs, Volume= 1,570 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.06 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.15 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 8.25', Capacity at Bank-Full= 1,287.10 cfs

99.0" Round Pipe
n= 0.010
Length= 1.0' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -0.01'



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Type III 24-hr 10-yr Rainfall=4.50"

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Summary for Pond 4P: Infiltrators

Inflow Area = 625 sf, 100.00% Impervious, Inflow Depth > 4.25" for 10-yr event
 Inflow = 0.06 cfs @ 12.09 hrs, Volume= 222 cf
 Outflow = 0.08 cfs @ 12.10 hrs, Volume= 136 cf, Atten= 0%, Lag= 1.1 min
 Discarded = 0.00 cfs @ 12.10 hrs, Volume= 43 cf
 Primary = 0.08 cfs @ 12.10 hrs, Volume= 93 cf

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 85.05' @ 12.10 hrs Surf.Area= 85 sf Storage= 86 cf

Plug-Flow detention time= 183.4 min calculated for 136 cf (61% of inflow)
 Center-of-Mass det. time= 76.0 min (826.6 - 750.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	82.00'	58 cf	5.00'W x 17.00'L x 2.04'H Field A 174 cf Overall - 28 cf Embedded = 146 cf x 40.0% Voids
#2A	82.50'	28 cf	Cultec C-100 x 2 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
		86 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	4.0" Horiz. Orifice/Grate X 2.00 C= 0.600 Limited to weir flow at low heads
#2	Discarded	82.00'	0.170 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.00 cfs @ 12.10 hrs HW=85.05' (Free Discharge)
 ↳ **2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.07 cfs @ 12.10 hrs HW=85.05' (Free Discharge)
 ↳ **1=Orifice/Grate** (Weir Controls 0.07 cfs @ 0.72 fps)

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Type III 24-hr 25-yr Rainfall=5.40"

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Summary for Subcatchment 1S: Existing Area

Runoff = 0.66 cfs @ 12.09 hrs, Volume= 2,379 cf, Depth> 5.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 5,548	98	pavement
5,548		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: Proposed Area

Runoff = 0.55 cfs @ 12.09 hrs, Volume= 1,837 cf, Depth> 4.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 1,250	74	Landscape & grass areas, Good Condition
* 3,673	98	impervious areas to street
4,923	92	Weighted Average
1,250		25.39% Pervious Area
3,673		74.61% Impervious Area

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

Summary for Subcatchment 3S: Roof Area into Drywell

Runoff = 0.07 cfs @ 12.09 hrs, Volume= 268 cf, Depth> 5.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 625	98	roof area
625		100.00% Impervious Area

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

13-146 Exist & Prop

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Type III 24-hr 25-yr Rainfall=5.40"

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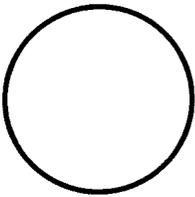
Summary for Reach 5R: Existing DP#1

Inflow Area = 5,548 sf, 100.00% Impervious, Inflow Depth > 5.15" for 25-yr event
Inflow = 0.66 cfs @ 12.09 hrs, Volume= 2,379 cf
Outflow = 0.66 cfs @ 12.09 hrs, Volume= 2,379 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.21 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.16 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 8.25', Capacity at Bank-Full= 1,287.10 cfs

99.0" Round Pipe
n= 0.010
Length= 1.0' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -0.01'



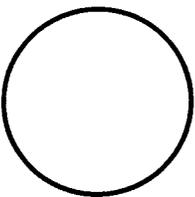
Summary for Reach 6R: Proposed DP#1

Inflow Area = 5,548 sf, 77.47% Impervious, Inflow Depth > 4.27" for 25-yr event
Inflow = 0.65 cfs @ 12.09 hrs, Volume= 1,975 cf
Outflow = 0.65 cfs @ 12.09 hrs, Volume= 1,975 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.20 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.16 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 8.25', Capacity at Bank-Full= 1,287.10 cfs

99.0" Round Pipe
n= 0.010
Length= 1.0' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -0.01'



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Summary for Pond 4P: Infiltrators

Inflow Area = 625 sf, 100.00% Impervious, Inflow Depth > 5.15" for 25-yr event
 Inflow = 0.07 cfs @ 12.09 hrs, Volume= 268 cf
 Outflow = 0.10 cfs @ 12.10 hrs, Volume= 182 cf, Atten= 0%, Lag= 0.7 min
 Discarded = 0.00 cfs @ 12.00 hrs, Volume= 44 cf
 Primary = 0.10 cfs @ 12.10 hrs, Volume= 138 cf

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 85.06' @ 12.10 hrs Surf.Area= 85 sf Storage= 86 cf

Plug-Flow detention time= 166.0 min calculated for 182 cf (68% of inflow)
 Center-of-Mass det. time= 68.0 min (816.1 - 748.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	82.00'	58 cf	5.00'W x 17.00'L x 2.04'H Field A 174 cf Overall - 28 cf Embedded = 146 cf x 40.0% Voids
#2A	82.50'	28 cf	Cultec C-100 x 2 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
		86 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	4.0" Horiz. Orifice/Grate X 2.00 C= 0.600 Limited to weir flow at low heads
#2	Discarded	82.00'	0.170 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.00 cfs @ 12.00 hrs HW=85.05' (Free Discharge)
 ↑2=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.10 cfs @ 12.10 hrs HW=85.06' (Free Discharge)
 ↑1=Orifice/Grate (Weir Controls 0.10 cfs @ 0.79 fps)

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Type III 24-hr 100-yr Rainfall=6.50"

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Summary for Subcatchment 1S: Existing Area

Runoff = 0.79 cfs @ 12.09 hrs, Volume= 2,882 cf, Depth> 6.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 5,548	98	pavement
5,548		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: Proposed Area

Runoff = 0.67 cfs @ 12.09 hrs, Volume= 2,280 cf, Depth> 5.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 1,250	74	Landscape & grass areas, Good Condition
* 3,673	98	impervious areas to street
4,923	92	Weighted Average
1,250		25.39% Pervious Area
3,673		74.61% Impervious Area

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

Summary for Subcatchment 3S: Roof Area into Drywell

Runoff = 0.09 cfs @ 12.09 hrs, Volume= 325 cf, Depth> 6.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 625	98	roof area
625		100.00% Impervious Area

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

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Type III 24-hr 100-yr Rainfall=6.50"

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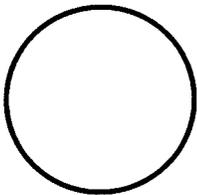
Summary for Reach 5R: Existing DP#1

Inflow Area = 5,548 sf, 100.00% Impervious, Inflow Depth > 6.23" for 100-yr event
Inflow = 0.79 cfs @ 12.09 hrs, Volume= 2,882 cf
Outflow = 0.79 cfs @ 12.09 hrs, Volume= 2,882 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.33 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.16 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 8.25', Capacity at Bank-Full= 1,287.10 cfs

99.0" Round Pipe
n= 0.010
Length= 1.0' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -0.01'



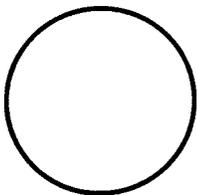
Summary for Reach 6R: Proposed DP#1

Inflow Area = 5,548 sf, 77.47% Impervious, Inflow Depth > 5.35" for 100-yr event
Inflow = 0.76 cfs @ 12.09 hrs, Volume= 2,474 cf
Outflow = 0.76 cfs @ 12.09 hrs, Volume= 2,474 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.31 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.16 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 8.25', Capacity at Bank-Full= 1,287.10 cfs

99.0" Round Pipe
n= 0.010
Length= 1.0' Slope= 0.0100 '/'
Inlet Invert= 0.00', Outlet Invert= -0.01'



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Type III 24-hr 100-yr Rainfall=6.50"

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Summary for Pond 4P: Infiltrators

Inflow Area = 625 sf, 100.00% Impervious, Inflow Depth > 6.23" for 100-yr event
 Inflow = 0.09 cfs @ 12.09 hrs, Volume= 325 cf
 Outflow = 0.09 cfs @ 12.08 hrs, Volume= 239 cf, Atten= 1%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 11.80 hrs, Volume= 45 cf
 Primary = 0.09 cfs @ 12.08 hrs, Volume= 194 cf

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 85.05' @ 12.08 hrs Surf.Area= 85 sf Storage= 86 cf

Plug-Flow detention time= 152.0 min calculated for 238 cf (73% of inflow)
 Center-of-Mass det. time= 63.6 min (809.6 - 746.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	82.00'	58 cf	5.00'W x 17.00'L x 2.04'H Field A 174 cf Overall - 28 cf Embedded = 146 cf x 40.0% Voids
#2A	82.50'	28 cf	Cultec C-100 x 2 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
		86 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	4.0" Horiz. Orifice/Grate X 2.00 C= 0.600 Limited to weir flow at low heads
#2	Discarded	82.00'	0.170 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.00 cfs @ 11.80 hrs HW=85.02' (Free Discharge)
 ↑2=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.08 cfs @ 12.08 hrs HW=85.05' (Free Discharge)
 ↑1=Orifice/Grate (Weir Controls 0.08 cfs @ 0.75 fps)

Appendix F

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	6
Average Daily Flow (110 gal/day/bedroom)	660 gpd
Peaking Factor	5.5
Total Peak Flow	2.52 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

