STORMWATER ANALYSIS AND CALCULATIONS

for

108 Sohier Road
Beverly, Massachusetts

Prepared for:

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September 17, 2018
Revised: October 15, 2019

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SOURCE OF DATA

- Technical Report No. 20
- Technical Report No. 55
- Technical Paper No. 40
- Partial Field Survey by MAI
- Massachusetts Stormwater Management Handbook, February 2008

REPORT SUMMARY:

Calculation Objectives

The objective of these calculations is to document that the proposed project described in the Stormwater Management Report does not result in an increase of offsite rates of runoff or flooding down gradient of the site. The analysis is separated into existing and proposed conditions. Watershed plans have been incorporated into this report to depict existing and proposed watershed areas.

Revision October 15, 2019

Reconfiguration of the Community Building with associated play yard and pickleball court. Minor associated grading and corresponding minor adjustments to subcatchment areas. Drainage facilities and configurations remain largely the same.

Selection of Storm Events

The storm events have been compiled from the Soil Conservation Service Technical Report No. 55 and Technical Paper No. 40. Rainfall frequency data has been provided as follows:

Frequency (Years)	Rainfall [24-Hour Event (inches)]
2	3.1
10	4.5
100	7.0

Classification of Soils

Drainage classes have been established based on soil maps provided by U.S. Department of Agriculture Natural Resources Conservation Service Web Soil Survey as well as onsite soil testing. Soil maps and descriptions are part of "Soil Survey of Essex County, Southern Part". According to NRCS, the following soil types and hydrologic groups are delineated within the limit of the hydrologic study:

306: Paxton - fine sandy loam - hydrologic soil group C
311: Woodbridge – fine sandy loam - hydrologic soil group C
651: Udorthents - area of soil material excavation and deposition*
*Udorthents are undesignated and contain variable soils. These areas are modeled in the hydrology calculations with a conservative hydrologic soil group rating of C

Hydrologic soil groups are assigned to each soil type by SCS based on their potential rate of water infiltration. Group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. At the other extreme, group D soils have very slow infiltration rates when thoroughly wet and thus a high runoff potential. These soils consist 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.

Existing Conditions Overview

The locus property is comprised of approximately 5.1 acres located at 108 Sohier Road at the intersection of Sohier and Tozer Roads. The property is bound by Sohier Road on the east, Tozer Road on the west and the Northshore Education Consortium to the north. There is a residential development directly across the street from the property along Sohier Road and Beverly High School is located approximately 0.2 miles to the south west on Sohier Road.

The property has been developed previously with a portion being part of the Old Salem Reservoir back in the 1940s. More recently, the locus was utilized as overflow parking with over 2 acres of pavement onsite. The site continues to be occupied by the bituminous concrete, broken bituminous and gravel. There are grassed areas along the roadways as well as wooded areas abutting the paved portions of the site. Topography of the site ranges from 5% within the paved areas to 20%-30% within the surrounding wooded areas. It is worth noting that the slope of Sohier Road increases exponentially from 3% upwards of 10% by the time it intersects with Tozer Road.

For the purpose of analyzing existing and proposed stormwater runoff, two design points have been designated for comparison.

Existing Design Points and Subcatchment Areas:

An existing drop inlet located at the west corner of the property was selected as design point #1. One subcatchment area directs stormwater from the property into this design point. Stormwater flows overland from paved surfaces through wooded areas and ultimately into an existing swale along Tozer Road which directly discharges to the drop inlet.

The second design point selected is existing drain manhole dmh#11 located at the intersection of Sohier and Tozer Roads. Four subcatchment areas contribute stormwater to this design point. Three of the subcatchment areas direct stormwater from paved surfaces and roadways into existing catchbasins which culminate at dmh#11. The remaining subcatchment area, SC #4 includes the majority of the locus property and directs stormwater from onsite paved surfaces, through wooded areas and into another existing swale on Tozer. This swale heads south directing stormwater into catchbasin cb#7 and culminating at dmh#11.

See the existing condition watershed plan and associated hydrologic model for detail of subcatchment areas and connections.

Proposed Conditions Overview

The applicant is proposing three new buildings onsite. Two of the buildings will house a total 77 units of affordable apartments for families. The third building will house multi-purpose community spaces and offices. Associated parking, utilities and landscaping is proposed throughout the site. Access to the site will be via two driveway openings off Sohier Road which interconnect within the property.

Stormwater Management:

This project utilizes conventional stormwater management techniques. Incorporated into the design are deep sump catchbasins and subsurface infiltration facilities for recharge, treatment and mitigation of stormwater. Design strategies for the stormwater systems follow methods from the Massachusetts Stormwater Handbook.

Subsurface Infiltration Facilities:

Subsurface infiltration facilities have been incorporated into this design to provide recharge of stormwater from impervious surfaces. Each facility consists of plastic chambers with open bottoms placed atop a stone bed. Chambers are constructed to store stormwater temporarily and let it infiltrate into the underlying soil. The facilities have been designed to recharge stormwater from the proposed roofs as well as a portion of the new driveways and hardscapes. A TSS removal rate of 80% is achieved by this BMP.

Deep Sump Catchbasin:

Similar to an ordinary catchbasin but fitted with an outlet hood to separate floatables such as oil, grease, trash and debris. They also have four foot deep sumps that promote settling of suspended solids. A TSS removal rate of 25% is achieved by this BMP.

Proposed Design Points and Subcatchment Areas:

The design points remain the same in the existing and proposed conditions as the existing drop inlet at the west of the property as well as existing dmh#11 located in the intersection of Sohier and Tozer Roads. There are eleven (11) proposed subcatchment areas which contribute stormwater to the design points. One of the subcatchment areas outside the locus property will remain the same in existing and proposed conditions. This subcatchment, SC#3, is listed with the same numeric configuration within both hydrologic models. General descriptions of the remaining subcatchment areas are as follows:

Subcatchments SC#10 and SC#20 are located along the eastern property line and include portions of the two new driveways as well as portions of Sohier Road. These subcatchment areas direct stormwater from paved or grassed surfaces into existing catchbasin structures within Sohier Road that culminate at dmh#11.

Subcatchments SC#11, SC#13, SC#14, SC#15 and SC#17 contribute stormwater runoff from proposed buildings, parking areas and lawn areas. Runoff is directed into a series of deep sump catchbasins and subsurface infiltration facilities for recharge and treatment. Excess stormwater will be directed from the facilities into the existing swale along Tozer and culminate at dmh#11.

There are only two (2) subcatchments which direct stormwater to design point #1 and those are SC#12 and SC#50. SC#12 includes the smaller community building and associated parking and recreation area which direct stormwater into a catchbasin and subsurface infiltration facility. Excess stormwater from the facility will be directed into the existing swale heading north on Tozer to the existing drop inlet. SC#50 is located along the north and northwest property lines and includes parking from the abutting property, lawn and patio behind the community building

and an existing wooded area along Tozer Road. Stormwater flows overland from the property into the wooded area and directly to the existing swale within Tozer Road.

See Included proposed watershed plan and associated proposed hydrologic model for connection details.

Summary of Flows at All Design Points (CFS)

A detailed analysis of existing and proposed subcatchment areas, ponds, and reaches is included in the HydroCAD analysis section of this report.

Design Point #1:

	2-Year 24-Hour Storm Event	10-Year 24-Hour Storm Event	100-Year 24-Hour Storm Event
Existing	2.4 CFS	4.5 CFS	8.3 CFS
Proposed	2.2 CFS	4.1 CFS	8.3 CFS

Design Point #2:

	2-Year 24-Hour Storm Event	10-Year 24-Hour Storm Event	100-Year 24-Hour Storm Event
Existing	8.6 CFS	14.2 CFS	24.3 CFS
Proposed	8.1 CFS	14.2 CFS	23.8 CFS

Conclusion

The calculations indicate peak flows have been met or reduced for the 2-year, 10-year, and 100-year storm events. We can therefore anticipate no adverse impacts with the completion of this project. In addition, the design provides for the required TSS removal and recharge volumes required by the MA DEP Stormwater Management Requirements.

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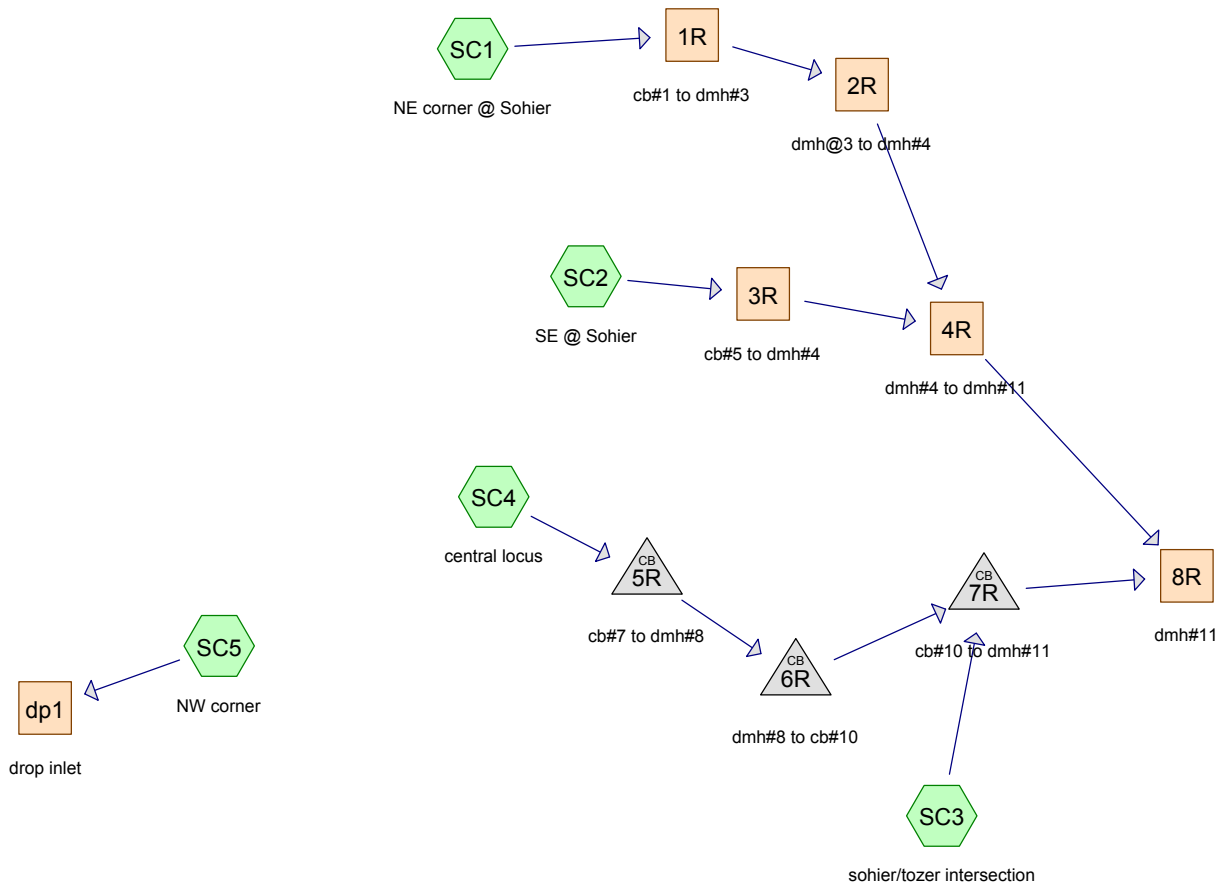
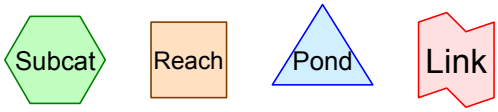
EXISTING CONDITIONS
WATERSHED ROUTING DIAGRAM





Routing Diagram for 6063-PRE
Prepared by Meridian Associates, Printed 10/3/2019
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EXISTING CONDITIONS
2-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment SC1: NE corner @ Sohier

Runoff = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af, Depth> 2.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	11,625	98	impervious area
	5,200	74	>75% Grass cover, Good, HSG C
	16,825	91	Weighted Average
	5,200		30.91% Pervious Area
	11,625		69.09% Impervious Area

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

Summary for Subcatchment SC2: SE @ Sohier

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	3,045	98	impervious area
	715	74	>75% Grass cover, Good, HSG C
	3,760	93	Weighted Average
	715		19.02% Pervious Area
	3,045		80.98% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 0.9 cfs @ 12.08 hrs, Volume= 0.07 af, Depth> 2.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment SC4: central locus

Runoff = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	103,540	98	impervious area
	63,280	70	Woods, Good, HSG C
	1,680	74	>75% Grass cover, Good, HSG C
	7,030	79	50-75% Grass cover, Fair, HSG C
	175,530	87	Weighted Average
	71,990		41.01% Pervious Area
	103,540		58.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0760	0.1		**Sheet Flow, high point woods** Woods: Light underbrush n= 0.400 P2= 3.10"
5.0	383	0.0660	1.3		**Shallow Concentrated Flow, overland woods** Woodland Kv= 5.0 fps
0.1	16	0.1400	2.6		**Shallow Concentrated Flow, overland to cb7** Short Grass Pasture Kv= 7.0 fps
12.4	449	Total			

Summary for Subcatchment SC5: NW corner

Runoff = 2.4 cfs @ 12.14 hrs, Volume= 0.20 af, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	24,435	98	impervious area
	38,315	70	Woods, Good, HSG C
	11,065	79	50-75% Grass cover, Fair, HSG C
	73,815	81	Weighted Average
	49,380		66.90% Pervious Area
	24,435		33.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0900	0.1		**Sheet Flow, high point woods** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	72	0.2100	2.3		**Shallow Concentrated Flow, overland woods** Woodland Kv= 5.0 fps
2.3	460	0.0440	3.4		**Shallow Concentrated Flow, within swale** Unpaved Kv= 16.1 fps
9.7	582	Total			

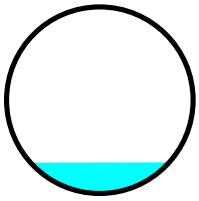
Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 2.16" for 2-yr event
Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af
Outflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.2 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.8 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 17.0' Slope= 0.2000 '/'
Inlet Invert= 111.60', Outlet Invert= 108.20'



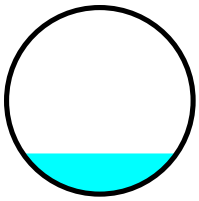
Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 2.16" for 2-yr event
Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af
Outflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.6 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.6 fps, Avg. Travel Time= 1.2 min

Peak Storage= 24 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 188.0' Slope= 0.0670 '/'
Inlet Invert= 108.10', Outlet Invert= 95.50'



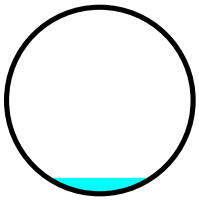
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.086 ac, 80.98% Impervious, Inflow Depth > 2.35" for 2-yr event
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.2 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.1 min

Peak Storage= 0 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



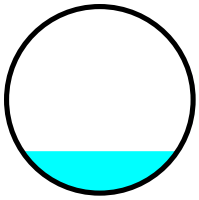
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 0.473 ac, 71.27% Impervious, Inflow Depth > 2.20" for 2-yr event
Inflow = 1.2 cfs @ 12.09 hrs, Volume= 0.09 af
Outflow = 1.2 cfs @ 12.09 hrs, Volume= 0.09 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.1 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.0 fps, Avg. Travel Time= 1.1 min

Peak Storage= 26 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 200.0' Slope= 0.0925 '/'
Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.818 ac, 62.73% Impervious, Inflow Depth > 1.92" for 2-yr event
Inflow = 8.6 cfs @ 12.15 hrs, Volume= 0.77 af
Outflow = 8.6 cfs @ 12.15 hrs, Volume= 0.77 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach dp1: drop inlet

Inflow Area = 1.695 ac, 33.10% Impervious, Inflow Depth > 1.39" for 2-yr event
Inflow = 2.4 cfs @ 12.14 hrs, Volume= 0.20 af
Outflow = 2.4 cfs @ 12.14 hrs, Volume= 0.20 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 5R: cb#7 to dmh#8

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 1.82" for 2-yr event
Inflow = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af
Outflow = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af, Atten= 0%, Lag= 0.0 min
Primary = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 93.06' @ 12.17 hrs
Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	**12.0" Round Culvert** L= 17.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=7.0 cfs @ 12.17 hrs HW=93.05' TW=89.64' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 7.0 cfs @ 8.9 fps)

Summary for Pond 6R: dmh#8 to cb#10

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 1.82" for 2-yr event
Inflow = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af
Outflow = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af, Atten= 0%, Lag= 0.0 min
Primary = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 89.64' @ 12.17 hrs
Flood Elev= 90.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	**12.0" Round Culvert** L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=7.0 cfs @ 12.17 hrs HW=89.64' TW=83.98' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 7.0 cfs @ 8.9 fps)

Summary for Pond 7R: cb#10 to dmh#11

Inflow Area = 4.346 ac, 61.80% Impervious, Inflow Depth > 1.89" for 2-yr event
Inflow = 7.6 cfs @ 12.16 hrs, Volume= 0.68 af
Outflow = 7.6 cfs @ 12.16 hrs, Volume= 0.68 af, Atten= 0%, Lag= 0.0 min
Primary = 7.6 cfs @ 12.16 hrs, Volume= 0.68 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 83.99' @ 12.16 hrs
Flood Elev= 84.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	**12.0" Round Culvert** L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=7.6 cfs @ 12.16 hrs HW=83.99' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 7.6 cfs @ 9.7 fps)

EXISTING CONDITIONS
10-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment SC1: NE corner @ Sohier

Runoff = 1.5 cfs @ 12.09 hrs, Volume= 0.11 af, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	11,625	98	impervious area
	5,200	74	>75% Grass cover, Good, HSG C
	16,825	91	Weighted Average
	5,200		30.91% Pervious Area
	11,625		69.09% Impervious Area

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

Summary for Subcatchment SC2: SE @ Sohier

Runoff = 0.4 cfs @ 12.08 hrs, Volume= 0.03 af, Depth> 3.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	3,045	98	impervious area
	715	74	>75% Grass cover, Good, HSG C
	3,760	93	Weighted Average
	715		19.02% Pervious Area
	3,045		80.98% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 1.4 cfs @ 12.08 hrs, Volume= 0.11 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment SC4: central locus

Runoff = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af, Depth> 3.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	103,540	98	impervious area
	63,280	70	Woods, Good, HSG C
	1,680	74	>75% Grass cover, Good, HSG C
	7,030	79	50-75% Grass cover, Fair, HSG C
	175,530	87	Weighted Average
	71,990		41.01% Pervious Area
	103,540		58.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0760	0.1		**Sheet Flow, high point woods** Woods: Light underbrush n= 0.400 P2= 3.10"
5.0	383	0.0660	1.3		**Shallow Concentrated Flow, overland woods** Woodland Kv= 5.0 fps
0.1	16	0.1400	2.6		**Shallow Concentrated Flow, overland to cb7** Short Grass Pasture Kv= 7.0 fps
12.4	449	Total			

Summary for Subcatchment SC5: NW corner

Runoff = 4.5 cfs @ 12.14 hrs, Volume= 0.36 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	24,435	98	impervious area
	38,315	70	Woods, Good, HSG C
	11,065	79	50-75% Grass cover, Fair, HSG C
	73,815	81	Weighted Average
	49,380		66.90% Pervious Area
	24,435		33.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0900	0.1		**Sheet Flow, high point woods** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	72	0.2100	2.3		**Shallow Concentrated Flow, overland woods** Woodland Kv= 5.0 fps
2.3	460	0.0440	3.4		**Shallow Concentrated Flow, within swale** Unpaved Kv= 16.1 fps
9.7	582	Total			

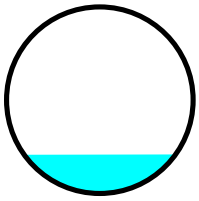
Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 3.49" for 10-yr event
Inflow = 1.5 cfs @ 12.09 hrs, Volume= 0.11 af
Outflow = 1.5 cfs @ 12.09 hrs, Volume= 0.11 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 12.8 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.2 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 17.0' Slope= 0.2000 '/'
Inlet Invert= 111.60', Outlet Invert= 108.20'



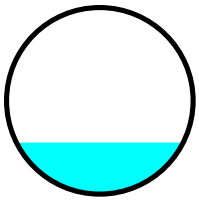
Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 3.49" for 10-yr event
Inflow = 1.5 cfs @ 12.09 hrs, Volume= 0.11 af
Outflow = 1.5 cfs @ 12.09 hrs, Volume= 0.11 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.7 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.9 fps, Avg. Travel Time= 1.1 min

Peak Storage= 33 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 188.0' Slope= 0.0670 '/'
Inlet Invert= 108.10', Outlet Invert= 95.50'



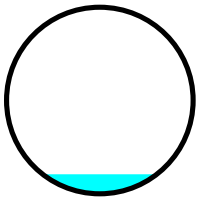
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.086 ac, 80.98% Impervious, Inflow Depth > 3.70" for 10-yr event
Inflow = 0.4 cfs @ 12.08 hrs, Volume= 0.03 af
Outflow = 0.4 cfs @ 12.08 hrs, Volume= 0.03 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.2 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.8 fps, Avg. Travel Time= 0.1 min

Peak Storage= 0 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



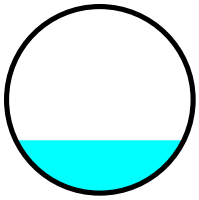
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 0.473 ac, 71.27% Impervious, Inflow Depth > 3.53" for 10-yr event
Inflow = 1.9 cfs @ 12.09 hrs, Volume= 0.14 af
Outflow = 1.9 cfs @ 12.09 hrs, Volume= 0.14 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 10.3 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.4 fps, Avg. Travel Time= 1.0 min

Peak Storage= 36 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 200.0' Slope= 0.0925 '/'
Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.818 ac, 62.73% Impervious, Inflow Depth > 3.20" for 10-yr event
Inflow = 14.2 cfs @ 12.15 hrs, Volume= 1.29 af
Outflow = 14.2 cfs @ 12.15 hrs, Volume= 1.29 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach dp1: drop inlet

Inflow Area = 1.695 ac, 33.10% Impervious, Inflow Depth > 2.54" for 10-yr event
Inflow = 4.5 cfs @ 12.14 hrs, Volume= 0.36 af
Outflow = 4.5 cfs @ 12.14 hrs, Volume= 0.36 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 5R: cb#7 to dmh#8

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 3.09" for 10-yr event
Inflow = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af
Outflow = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af, Atten= 0%, Lag= 0.0 min
Primary = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 114.63' @ 12.18 hrs
Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	**12.0" Round Culvert** L= 17.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=11.6 cfs @ 12.17 hrs HW=114.45' TW=104.98' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 11.6 cfs @ 14.8 fps)

Summary for Pond 6R: dmh#8 to cb#10

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 3.09" for 10-yr event
Inflow = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af
Outflow = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af, Atten= 0%, Lag= 0.0 min
Primary = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 105.01' @ 12.17 hrs
Flood Elev= 90.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	**12.0" Round Culvert** L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=11.8 cfs @ 12.17 hrs HW=104.98' TW=91.17' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 11.8 cfs @ 15.0 fps)

Summary for Pond 7R: cb#10 to dmh#11

Inflow Area = 4.346 ac, 61.80% Impervious, Inflow Depth > 3.17" for 10-yr event
Inflow = 12.7 cfs @ 12.16 hrs, Volume= 1.15 af
Outflow = 12.7 cfs @ 12.16 hrs, Volume= 1.15 af, Atten= 0%, Lag= 0.0 min
Primary = 12.7 cfs @ 12.16 hrs, Volume= 1.15 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 91.23' @ 12.16 hrs
Flood Elev= 84.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	**12.0" Round Culvert** L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=12.7 cfs @ 12.16 hrs HW=91.22' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 12.7 cfs @ 16.2 fps)

EXISTING CONDITIONS
100-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment SC1: NE corner @ Sohier

Runoff = 2.5 cfs @ 12.08 hrs, Volume= 0.19 af, Depth> 5.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	11,625	98	impervious area
	5,200	74	>75% Grass cover, Good, HSG C
	16,825	91	Weighted Average
	5,200		30.91% Pervious Area
	11,625		69.09% Impervious Area

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

Summary for Subcatchment SC2: SE @ Sohier

Runoff = 0.6 cfs @ 12.08 hrs, Volume= 0.04 af, Depth> 6.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	3,045	98	impervious area
	715	74	>75% Grass cover, Good, HSG C
	3,760	93	Weighted Average
	715		19.02% Pervious Area
	3,045		80.98% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 2.2 cfs @ 12.08 hrs, Volume= 0.17 af, Depth> 6.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment SC4: central locus

Runoff = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af, Depth> 5.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	103,540	98	impervious area
	63,280	70	Woods, Good, HSG C
	1,680	74	>75% Grass cover, Good, HSG C
	7,030	79	50-75% Grass cover, Fair, HSG C
	175,530	87	Weighted Average
	71,990		41.01% Pervious Area
	103,540		58.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0760	0.1		**Sheet Flow, high point woods** Woods: Light underbrush n= 0.400 P2= 3.10"
5.0	383	0.0660	1.3		**Shallow Concentrated Flow, overland woods** Woodland Kv= 5.0 fps
0.1	16	0.1400	2.6		**Shallow Concentrated Flow, overland to cb7** Short Grass Pasture Kv= 7.0 fps
12.4	449	Total			

Summary for Subcatchment SC5: NW corner

Runoff = 8.3 cfs @ 12.13 hrs, Volume= 0.68 af, Depth> 4.80"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	24,435	98	impervious area
	38,315	70	Woods, Good, HSG C
	11,065	79	50-75% Grass cover, Fair, HSG C
	73,815	81	Weighted Average
	49,380		66.90% Pervious Area
	24,435		33.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0900	0.1		**Sheet Flow, high point woods** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	72	0.2100	2.3		**Shallow Concentrated Flow, overland woods** Woodland Kv= 5.0 fps
2.3	460	0.0440	3.4		**Shallow Concentrated Flow, within swale** Unpaved Kv= 16.1 fps
9.7	582	Total			

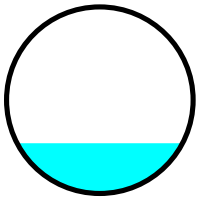
Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 5.93" for 100-yr event
Inflow = 2.5 cfs @ 12.08 hrs, Volume= 0.19 af
Outflow = 2.5 cfs @ 12.08 hrs, Volume= 0.19 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.8 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.8 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 17.0' Slope= 0.2000 '/'
Inlet Invert= 111.60', Outlet Invert= 108.20'



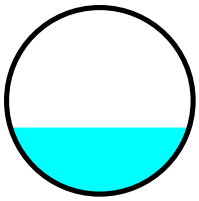
Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 5.93" for 100-yr event
Inflow = 2.5 cfs @ 12.08 hrs, Volume= 0.19 af
Outflow = 2.5 cfs @ 12.09 hrs, Volume= 0.19 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 10.0 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.3 fps, Avg. Travel Time= 0.9 min

Peak Storage= 47 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 188.0' Slope= 0.0670 '/'
Inlet Invert= 108.10', Outlet Invert= 95.50'



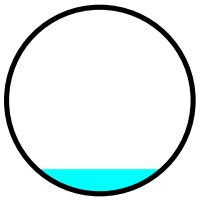
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.086 ac, 80.98% Impervious, Inflow Depth > 6.17" for 100-yr event
Inflow = 0.6 cfs @ 12.08 hrs, Volume= 0.04 af
Outflow = 0.6 cfs @ 12.08 hrs, Volume= 0.04 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.4 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.1 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



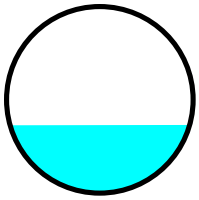
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 0.473 ac, 71.27% Impervious, Inflow Depth > 5.97" for 100-yr event
Inflow = 3.1 cfs @ 12.09 hrs, Volume= 0.24 af
Outflow = 3.1 cfs @ 12.09 hrs, Volume= 0.24 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.9 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.9 fps, Avg. Travel Time= 0.9 min

Peak Storage= 52 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 200.0' Slope= 0.0925 '/'
Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.818 ac, 62.73% Impervious, Inflow Depth > 5.59" for 100-yr event
Inflow = 24.3 cfs @ 12.15 hrs, Volume= 2.25 af
Outflow = 24.3 cfs @ 12.15 hrs, Volume= 2.25 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach dp1: drop inlet

Inflow Area = 1.695 ac, 33.10% Impervious, Inflow Depth > 4.80" for 100-yr event
Inflow = 8.3 cfs @ 12.13 hrs, Volume= 0.68 af
Outflow = 8.3 cfs @ 12.13 hrs, Volume= 0.68 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 5R: cb#7 to dmh#8

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 5.47" for 100-yr event
Inflow = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af
Outflow = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af, Atten= 0%, Lag= 0.0 min
Primary = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 183.07' @ 12.17 hrs
Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	**12.0" Round Culvert** L= 17.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=20.1 cfs @ 12.17 hrs HW=182.50' TW=154.23' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 20.1 cfs @ 25.6 fps)

Summary for Pond 6R: dmh#8 to cb#10

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 5.47" for 100-yr event
Inflow = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af
Outflow = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af, Atten= 0%, Lag= 0.0 min
Primary = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 154.37' @ 12.17 hrs
Flood Elev= 90.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	**12.0" Round Culvert** L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=20.3 cfs @ 12.17 hrs HW=154.23' TW=113.11' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 20.3 cfs @ 25.9 fps)

Summary for Pond 7R: cb#10 to dmh#11

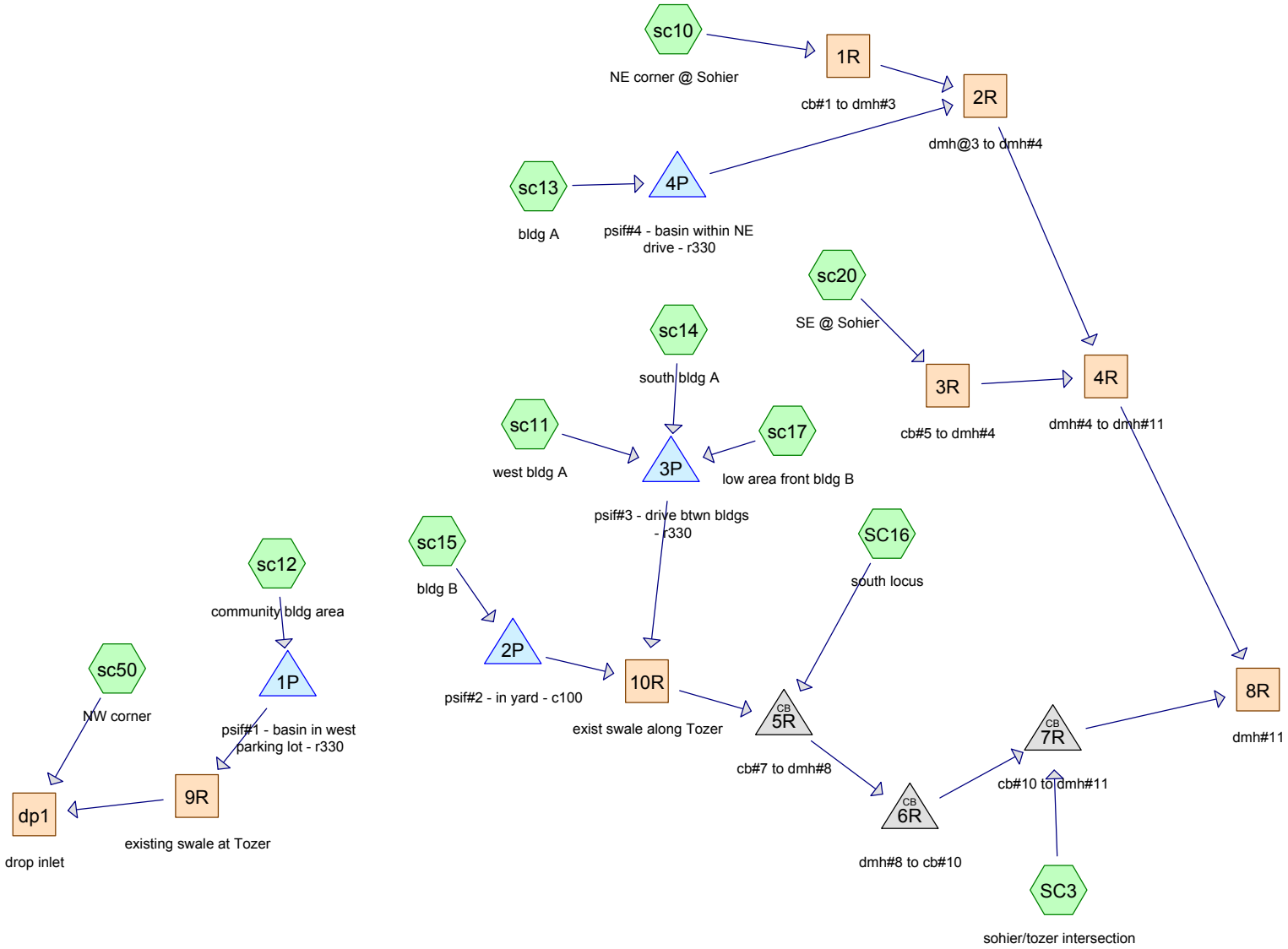
Inflow Area = 4.346 ac, 61.80% Impervious, Inflow Depth > 5.55" for 100-yr event
Inflow = 21.8 cfs @ 12.16 hrs, Volume= 2.01 af
Outflow = 21.8 cfs @ 12.16 hrs, Volume= 2.01 af, Atten= 0%, Lag= 0.0 min
Primary = 21.8 cfs @ 12.16 hrs, Volume= 2.01 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 113.26' @ 12.16 hrs
Flood Elev= 84.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	**12.0" Round Culvert** L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=21.8 cfs @ 12.16 hrs HW=113.24' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 21.8 cfs @ 27.8 fps)

PROPOSED CONDITIONS
WATERSHED ROUTING DIAGRAM



Subcat Reach Pond Link

Routing Diagram for 6063-POST

Prepared by Meridian Associates, Printed 10/3/2019

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PROPOSED CONDITIONS
2-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment sc10: NE corner @ Sohier

Runoff = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	10,985	98	impervious area
	9,440	74	>75% Grass cover, Good, HSG C
	20,425	87	Weighted Average
	9,440		46.22% Pervious Area
	10,985		53.78% Impervious Area

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

Summary for Subcatchment sc11: west bldg A

Runoff = 2.7 cfs @ 12.09 hrs, Volume= 0.20 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	35,035	98	impervious area
	8,695	74	>75% Grass cover, Good, HSG C
	43,730	93	Weighted Average
	8,695		19.88% Pervious Area
	35,035		80.12% Impervious Area

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

Summary for Subcatchment sc12: community bldg area

Runoff = 1.6 cfs @ 12.08 hrs, Volume= 0.12 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	21,130	98	impervious area
	3,380	74	>75% Grass cover, Good, HSG C
	24,510	95	Weighted Average
	3,380		13.79% Pervious Area
	21,130		86.21% Impervious Area

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

Summary for Subcatchment sc13: bldg A

Runoff = 1.3 cfs @ 12.08 hrs, Volume= 0.10 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	18,995	98	impervious area
	18,995		100.00% Impervious Area

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

Summary for Subcatchment sc14: south bldg A

Runoff = 0.7 cfs @ 12.08 hrs, Volume= 0.05 af, Depth> 2.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	9,155	98	impervious area
	990	74	>75% Grass cover, Good, HSG C
	10,145	96	Weighted Average
	990		9.76% Pervious Area
	9,155		90.24% Impervious Area

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

Summary for Subcatchment sc15: bldg B

Runoff = 1.1 cfs @ 12.08 hrs, Volume= 0.09 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	16,055	98	impervious area
	16,055		100.00% Impervious Area

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

Summary for Subcatchment SC16: south locus

Runoff = 1.2 cfs @ 12.15 hrs, Volume= 0.10 af, Depth> 1.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	11,355	98	impervious area
	12,345	70	Woods, Good, HSG C
	19,170	74	>75% Grass cover, Good, HSG C
	42,870	79	Weighted Average
	31,515		73.51% Pervious Area
	11,355		26.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.0200	0.1		**Sheet Flow, yard** Grass: Short n= 0.150 P2= 3.10"
1.9	20	0.3500	0.2		**Sheet Flow, wooded slope** Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	31	0.0960	1.5		**Shallow Concentrated Flow, wooded to exist swale** Woodland Kv= 5.0 fps
4.3	325	0.0330	1.3		**Shallow Concentrated Flow, exist grass** Short Grass Pasture Kv= 7.0 fps
10.3	406	Total			

Summary for Subcatchment sc17: low area front bldg B

Runoff = 0.0 cfs @ 12.11 hrs, Volume= 0.00 af, Depth> 1.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	220	98	impervious area
	1,180	74	>75% Grass cover, Good, HSG C
	1,400	78	Weighted Average
	1,180		84.29% Pervious Area
	220		15.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0100	0.1		**Sheet Flow, corner to pyd** Grass: Short n= 0.150 P2= 3.10"

Summary for Subcatchment sc20: SE @ Sohier

Runoff = 1.4 cfs @ 12.09 hrs, Volume= 0.10 af, Depth> 2.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	16,810	98	impervious area
	7,190	74	>75% Grass cover, Good, HSG C
	24,000	91	Weighted Average
	7,190		29.96% Pervious Area
	16,810		70.04% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 0.9 cfs @ 12.08 hrs, Volume= 0.07 af, Depth> 2.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment sc50: NW corner

Runoff = 2.2 cfs @ 12.12 hrs, Volume= 0.17 af, Depth> 1.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	21,395	98	impervious area
	28,300	70	Woods, Good, HSG C
	11,245	74	>75% Grass cover, Good, HSG C
	6,855	79	50-75% Grass cover, Fair, HSG C
	67,795	80	Weighted Average
	46,400		68.44% Pervious Area
	21,395		31.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.1		**Sheet Flow, within woods** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	57	0.2100	2.3		**Shallow Concentrated Flow, overland thru woods** Woodland Kv= 5.0 fps
2.0	407	0.0440	3.4		**Shallow Concentrated Flow, thru swale** Unpaved Kv= 16.1 fps
8.5	514	Total			

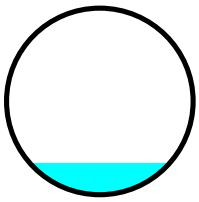
Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.469 ac, 53.78% Impervious, Inflow Depth > 1.82" for 2-yr event
Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af
Outflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.3 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.0 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 17.0' Slope= 0.2000 '/'
Inlet Invert= 111.60', Outlet Invert= 108.20'



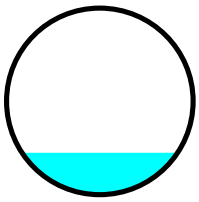
Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.905 ac, 76.05% Impervious, Inflow Depth > 1.37" for 2-yr event
Inflow = 1.0 cfs @ 12.21 hrs, Volume= 0.10 af
Outflow = 1.0 cfs @ 12.22 hrs, Volume= 0.10 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.7 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.9 fps, Avg. Travel Time= 1.1 min

Peak Storage= 25 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 188.0' Slope= 0.0670 '/'
Inlet Invert= 108.10', Outlet Invert= 95.50'



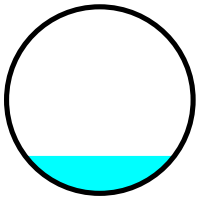
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.551 ac, 70.04% Impervious, Inflow Depth > 2.16" for 2-yr event
Inflow = 1.4 cfs @ 12.09 hrs, Volume= 0.10 af
Outflow = 1.4 cfs @ 12.09 hrs, Volume= 0.10 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 12.2 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.1 fps, Avg. Travel Time= 0.0 min

Peak Storage= 1 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



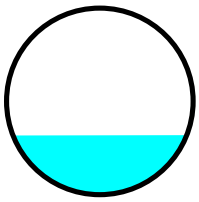
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 1.456 ac, 73.78% Impervious, Inflow Depth > 1.67" for 2-yr event
Inflow = 2.4 cfs @ 12.09 hrs, Volume= 0.20 af
Outflow = 2.4 cfs @ 12.09 hrs, Volume= 0.20 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.1 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.8 fps, Avg. Travel Time= 0.9 min

Peak Storage= 43 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 200.0' Slope= 0.0925 '/'
Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.394 ac, 69.00% Impervious, Inflow Depth > 1.66" for 2-yr event
Inflow = 8.1 cfs @ 12.12 hrs, Volume= 0.61 af
Outflow = 8.1 cfs @ 12.12 hrs, Volume= 0.61 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

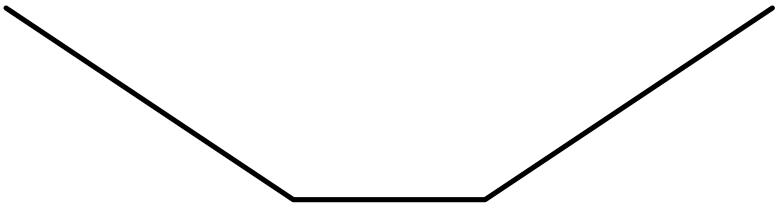
Summary for Reach 9R: existing swale at Tozer

Inflow Area = 0.563 ac, 86.21% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.0 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.0 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 32.4 cfs

1.00' x 1.00' deep channel, n= 0.016 Asphalt, rough
Side Slope Z-value= 1.5 '/' Top Width= 4.00'
Length= 490.0' Slope= 0.0440 '/'
Inlet Invert= 105.00', Outlet Invert= 83.44'



Summary for Reach 10R: exist swale along Tozer

Inflow Area = 1.638 ac, 84.77% Impervious, Inflow Depth > 1.68" for 2-yr event
Inflow = 3.9 cfs @ 12.12 hrs, Volume= 0.23 af
Outflow = 3.9 cfs @ 12.13 hrs, Volume= 0.23 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.4 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 2.7 min

Peak Storage= 180 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 37.0 cfs

2.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 '/' Top Width= 10.00'
Length= 158.0' Slope= 0.0316 '/'
Inlet Invert= 98.00', Outlet Invert= 93.00'

‡

Summary for Reach dp1: drop inlet

Inflow Area = 2.119 ac, 46.07% Impervious, Inflow Depth > 0.97" for 2-yr event
Inflow = 2.2 cfs @ 12.12 hrs, Volume= 0.17 af
Outflow = 2.2 cfs @ 12.12 hrs, Volume= 0.17 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: psif#1 - basin in west parking lot - r330

Inflow Area = 0.563 ac, 86.21% Impervious, Inflow Depth > 2.54" for 2-yr event
Inflow = 1.6 cfs @ 12.08 hrs, Volume= 0.12 af
Outflow = 0.1 cfs @ 11.40 hrs, Volume= 0.12 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.1 cfs @ 11.40 hrs, Volume= 0.12 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 113.86' @ 13.49 hrs Surf.Area= 1,936 sf Storage= 2,143 cf

Plug-Flow detention time= 162.6 min calculated for 0.12 af (100% of inflow)
Center-of-Mass det. time= 162.5 min (943.8 - 781.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.25'	1,678 cf	**26.17'W x 74.00'L x 3.54'H Field A** 6,858 cf Overall - 2,664 cf Embedded = 4,194 cf x 40.0% Voids
#2A	112.75'	2,664 cf	**Cultec R-330XL** x 50 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		4,341 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	113.80'	**12.0" Round DR#2- to exist swale** L= 58.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 113.80' / 106.00' S= 0.1345 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	115.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	114.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Discarded	112.25'	**2.400 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 11.40 hrs HW=112.29' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=112.25' TW=105.00' (Dynamic Tailwater)
└─**1=DR#2- to exist swale** (Controls 0.0 cfs)
  ├─**2=Orifice/Grate** (Controls 0.0 cfs)
  └─**3=Orifice/Grate** (Controls 0.0 cfs)

Summary for Pond 2P: psif#2 - in yard - c100

Inflow Area = 0.369 ac,100.00% Impervious, Inflow Depth > 2.87" for 2-yr event
Inflow = 1.1 cfs @ 12.08 hrs, Volume= 0.09 af
Outflow = 1.1 cfs @ 12.10 hrs, Volume= 0.08 af, Atten= 3%, Lag= 1.2 min
Primary = 1.1 cfs @ 12.10 hrs, Volume= 0.08 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 103.90' @ 12.10 hrs Surf.Area= 600 sf Storage= 502 cf

Plug-Flow detention time= 88.0 min calculated for 0.08 af (90% of inflow)
Center-of-Mass det. time= 40.8 min (797.3 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	102.50'	377 cf	**15.00'W x 40.00'L x 2.04'H Field A** 1,225 cf Overall - 283 cf Embedded = 942 cf x 40.0% Voids
#2A	103.00'	283 cf	**Cultec C-100** x 20 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 Row Length Adjustment= +0.50' x 1.86 sf x 4 rows
		660 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	99.60'	**8.0" Round Culvert - DR#3** L= 28.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 99.60' / 96.00' S= 0.1286 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	103.50'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600

Primary OutFlow Max=1.1 cfs @ 12.10 hrs HW=103.90' TW=98.33' (Dynamic Tailwater)
└─**1=Culvert - DR#3** (Passes 1.1 cfs of 3.3 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 1.1 cfs @ 2.1 fps)

Summary for Pond 3P: psif#3 - drive btwn bldgs - r330

Inflow Area =	1.269 ac,	80.34% Impervious,	Inflow Depth >	2.37"	for 2-yr event
Inflow =	3.4 cfs @	12.09 hrs,	Volume=	0.25 af	
Outflow =	2.9 cfs @	12.13 hrs,	Volume=	0.21 af,	Atten= 15%, Lag= 3.0 min
Discarded =	0.0 cfs @	8.54 hrs,	Volume=	0.06 af	
Primary =	2.8 cfs @	12.13 hrs,	Volume=	0.15 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 115.11' @ 12.13 hrs Surf.Area= 1,666 sf Storage= 2,665 cf

Plug-Flow detention time= 104.4 min calculated for 0.21 af (82% of inflow)
Center-of-Mass det. time= 34.7 min (824.8 - 790.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.80'	1,599 cf	**65.33'W x 25.50'L x 3.71'H Field A** 6,178 cf Overall - 2,179 cf Embedded = 3,999 cf x 40.0% Voids
#2A	113.30'	2,179 cf	**Cultec R-330XL** x 39 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		3,779 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	**18.0" Round Culvert** L= 158.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 114.00' / 102.00' S= 0.0759 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	115.20'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 1	114.50'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#4	Discarded	112.80'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 8.54 hrs HW=112.84' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.8 cfs @ 12.13 hrs HW=115.11' TW=98.34' (Dynamic Tailwater)
└─**1=Culvert** (Passes 2.8 cfs of 5.0 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.0 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 2.8 cfs @ 2.9 fps)

Summary for Pond 4P: psif#4 - basin within NE drive - r330

Inflow Area =	0.436 ac,100.00% Impervious, Inflow Depth > 2.87" for 2-yr event				
Inflow =	1.3 cfs @	12.08 hrs,	Volume=	0.10 af	
Outflow =	0.5 cfs @	12.28 hrs,	Volume=	0.08 af,	Atten= 58%, Lag= 11.9 min
Discarded =	0.0 cfs @	8.60 hrs,	Volume=	0.04 af	
Primary =	0.5 cfs @	12.28 hrs,	Volume=	0.03 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 121.02' @ 12.28 hrs Surf.Area= 1,174 sf Storage= 1,769 cf

Plug-Flow detention time= 167.2 min calculated for 0.08 af (72% of inflow)
Center-of-Mass det. time= 77.6 min (834.2 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	118.90'	1,011 cf	**30.50'W x 38.50'L x 3.54'H Field A** 4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	119.40'	1,632 cf	**Cultec R-330XL** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		2,643 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	119.00'	**12.0" Round Culvert - to exist swale** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 119.00' / 118.00' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	120.70'	**6.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Discarded	118.90'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 8.60 hrs HW=118.94' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.5 cfs @ 12.28 hrs HW=121.02' TW=108.32' (Dynamic Tailwater)
└─**1=Culvert - to exist swale** (Passes 0.5 cfs of 4.7 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 0.5 cfs @ 1.9 fps)

Summary for Pond 5R: cb#7 to dmh#8

Inflow Area = 2.622 ac, 62.89% Impervious, Inflow Depth > 1.52" for 2-yr event
Inflow = 5.1 cfs @ 12.14 hrs, Volume= 0.33 af
Outflow = 5.1 cfs @ 12.14 hrs, Volume= 0.33 af, Atten= 0%, Lag= 0.0 min
Primary = 5.1 cfs @ 12.14 hrs, Volume= 0.33 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 89.81' @ 12.14 hrs
Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	**12.0" Round Culvert** L= 17.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=5.1 cfs @ 12.14 hrs HW=89.80' TW=88.01' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 5.1 cfs @ 6.4 fps)

Summary for Pond 6R: dmh#8 to cb#10

Inflow Area = 2.622 ac, 62.89% Impervious, Inflow Depth > 1.52" for 2-yr event
Inflow = 5.1 cfs @ 12.14 hrs, Volume= 0.33 af
Outflow = 5.1 cfs @ 12.14 hrs, Volume= 0.33 af, Atten= 0%, Lag= 0.0 min
Primary = 5.1 cfs @ 12.14 hrs, Volume= 0.33 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 88.01' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	**12.0" Round Culvert** L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=5.1 cfs @ 12.14 hrs HW=88.01' TW=82.30' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 5.1 cfs @ 6.5 fps)

Summary for Pond 7R: cb#10 to dmh#11

Inflow Area =	2.938 ac,	66.64% Impervious,	Inflow Depth >	1.65"	for 2-yr event
Inflow =	5.9 cfs @	12.13 hrs, Volume=	0.41 af		
Outflow =	5.9 cfs @	12.13 hrs, Volume=	0.41 af,	Atten= 0%,	Lag= 0.0 min
Primary =	5.9 cfs @	12.13 hrs, Volume=	0.41 af		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 82.32' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	**12.0" Round Culvert** L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=5.9 cfs @ 12.13 hrs HW=82.32' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 5.9 cfs @ 7.5 fps)

PROPOSED CONDITIONS
10-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment sc10: NE corner @ Sohier

Runoff = 1.7 cfs @ 12.09 hrs, Volume= 0.12 af, Depth> 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	10,985	98	impervious area
	9,440	74	>75% Grass cover, Good, HSG C
	20,425	87	Weighted Average
	9,440		46.22% Pervious Area
	10,985		53.78% Impervious Area

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

Summary for Subcatchment sc11: west bldg A

Runoff = 4.1 cfs @ 12.08 hrs, Volume= 0.31 af, Depth> 3.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	35,035	98	impervious area
	8,695	74	>75% Grass cover, Good, HSG C
	43,730	93	Weighted Average
	8,695		19.88% Pervious Area
	35,035		80.12% Impervious Area

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

Summary for Subcatchment sc12: community bldg area

Runoff = 2.4 cfs @ 12.08 hrs, Volume= 0.18 af, Depth> 3.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	21,130	98	impervious area
	3,380	74	>75% Grass cover, Good, HSG C
	24,510	95	Weighted Average
	3,380		13.79% Pervious Area
	21,130		86.21% Impervious Area

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

Summary for Subcatchment sc13: bldg A

Runoff = 1.9 cfs @ 12.08 hrs, Volume= 0.15 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	18,995	98	impervious area
	18,995		100.00% Impervious Area

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

Summary for Subcatchment sc14: south bldg A

Runoff = 1.0 cfs @ 12.08 hrs, Volume= 0.08 af, Depth> 4.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	9,155	98	impervious area
	990	74	>75% Grass cover, Good, HSG C
	10,145	96	Weighted Average
	990		9.76% Pervious Area
	9,155		90.24% Impervious Area

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

Summary for Subcatchment sc15: bldg B

Runoff = 1.6 cfs @ 12.08 hrs, Volume= 0.13 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	16,055	98	impervious area
	16,055		100.00% Impervious Area

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

Summary for Subcatchment SC16: south locus

Runoff = 2.4 cfs @ 12.14 hrs, Volume= 0.19 af, Depth> 2.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	11,355	98	impervious area
	12,345	70	Woods, Good, HSG C
	19,170	74	>75% Grass cover, Good, HSG C
	42,870	79	Weighted Average
	31,515		73.51% Pervious Area
	11,355		26.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.0200	0.1		**Sheet Flow, yard** Grass: Short n= 0.150 P2= 3.10"
1.9	20	0.3500	0.2		**Sheet Flow, wooded slope** Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	31	0.0960	1.5		**Shallow Concentrated Flow, wooded to exist swale** Woodland Kv= 5.0 fps
4.3	325	0.0330	1.3		**Shallow Concentrated Flow, exist grass** Short Grass Pasture Kv= 7.0 fps
10.3	406	Total			

Summary for Subcatchment sc17: low area front bldg B

Runoff = 0.1 cfs @ 12.11 hrs, Volume= 0.01 af, Depth> 2.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	220	98	impervious area
	1,180	74	>75% Grass cover, Good, HSG C
	1,400	78	Weighted Average
	1,180		84.29% Pervious Area
	220		15.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0100	0.1		**Sheet Flow, corner to pyd** Grass: Short n= 0.150 P2= 3.10"

Summary for Subcatchment sc20: SE @ Sohier

Runoff = 2.2 cfs @ 12.09 hrs, Volume= 0.16 af, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	16,810	98	impervious area
	7,190	74	>75% Grass cover, Good, HSG C
	24,000	91	Weighted Average
	7,190		29.96% Pervious Area
	16,810		70.04% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 1.4 cfs @ 12.08 hrs, Volume= 0.11 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment sc50: NW corner

Runoff = 4.1 cfs @ 12.12 hrs, Volume= 0.32 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	21,395	98	impervious area
	28,300	70	Woods, Good, HSG C
	11,245	74	>75% Grass cover, Good, HSG C
	6,855	79	50-75% Grass cover, Fair, HSG C
	67,795	80	Weighted Average
	46,400		68.44% Pervious Area
	21,395		31.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.1		**Sheet Flow, within woods** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	57	0.2100	2.3		**Shallow Concentrated Flow, overland thru woods** Woodland Kv= 5.0 fps
2.0	407	0.0440	3.4		**Shallow Concentrated Flow, thru swale** Unpaved Kv= 16.1 fps
8.5	514	Total			

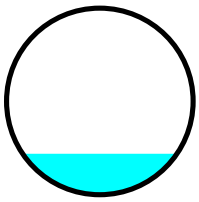
Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.469 ac, 53.78% Impervious, Inflow Depth > 3.10" for 10-yr event
Inflow = 1.7 cfs @ 12.09 hrs, Volume= 0.12 af
Outflow = 1.7 cfs @ 12.09 hrs, Volume= 0.12 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 13.2 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.4 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 17.0' Slope= 0.2000 '/'
Inlet Invert= 111.60', Outlet Invert= 108.20'



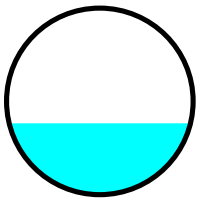
Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.905 ac, 76.05% Impervious, Inflow Depth > 2.61" for 10-yr event
Inflow = 2.9 cfs @ 12.10 hrs, Volume= 0.20 af
Outflow = 2.9 cfs @ 12.11 hrs, Volume= 0.20 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 10.4 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.3 fps, Avg. Travel Time= 1.0 min

Peak Storage= 52 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 188.0' Slope= 0.0670 '/'
Inlet Invert= 108.10', Outlet Invert= 95.50'



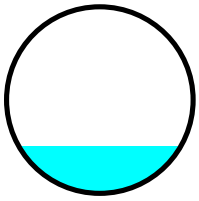
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.551 ac, 70.04% Impervious, Inflow Depth > 3.49" for 10-yr event
Inflow = 2.2 cfs @ 12.09 hrs, Volume= 0.16 af
Outflow = 2.2 cfs @ 12.09 hrs, Volume= 0.16 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.0 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.6 fps, Avg. Travel Time= 0.0 min

Peak Storage= 2 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



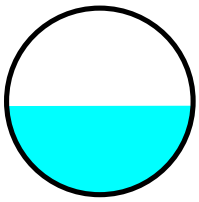
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 1.456 ac, 73.78% Impervious, Inflow Depth > 2.94" for 10-yr event
Inflow = 5.0 cfs @ 12.10 hrs, Volume= 0.36 af
Outflow = 5.0 cfs @ 12.10 hrs, Volume= 0.36 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 13.5 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.3 fps, Avg. Travel Time= 0.8 min

Peak Storage= 74 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 200.0' Slope= 0.0925 '/'
Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.394 ac, 69.00% Impervious, Inflow Depth > 2.92" for 10-yr event
Inflow = 14.2 cfs @ 12.12 hrs, Volume= 1.07 af
Outflow = 14.2 cfs @ 12.12 hrs, Volume= 1.07 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

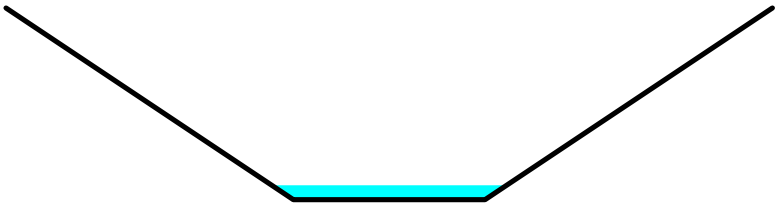
Summary for Reach 9R: existing swale at Tozer

Inflow Area = 0.563 ac, 86.21% Impervious, Inflow Depth = 0.69" for 10-yr event
Inflow = 0.3 cfs @ 12.56 hrs, Volume= 0.03 af
Outflow = 0.3 cfs @ 12.59 hrs, Volume= 0.03 af, Atten= 0%, Lag= 1.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.2 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 4.4 min

Peak Storage= 41 cf @ 12.59 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 32.4 cfs

1.00' x 1.00' deep channel, n= 0.016 Asphalt, rough
Side Slope Z-value= 1.5 '/' Top Width= 4.00'
Length= 490.0' Slope= 0.0440 '/'
Inlet Invert= 105.00', Outlet Invert= 83.44'



Summary for Reach 10R: exist swale along Tozer

Inflow Area = 1.638 ac, 84.77% Impervious, Inflow Depth > 3.00" for 10-yr event
Inflow = 5.9 cfs @ 12.13 hrs, Volume= 0.41 af
Outflow = 5.9 cfs @ 12.13 hrs, Volume= 0.41 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.8 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.2 fps, Avg. Travel Time= 2.2 min

Peak Storage= 244 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 37.0 cfs

2.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 '/' Top Width= 10.00'
Length= 158.0' Slope= 0.0316 '/'
Inlet Invert= 98.00', Outlet Invert= 93.00'

‡

Summary for Reach dp1: drop inlet

Inflow Area = 2.119 ac, 46.07% Impervious, Inflow Depth > 1.99" for 10-yr event
Inflow = 4.1 cfs @ 12.12 hrs, Volume= 0.35 af
Outflow = 4.1 cfs @ 12.12 hrs, Volume= 0.35 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: psif#1 - basin in west parking lot - r330

Inflow Area = 0.563 ac, 86.21% Impervious, Inflow Depth > 3.92" for 10-yr event
Inflow = 2.4 cfs @ 12.08 hrs, Volume= 0.18 af
Outflow = 0.4 cfs @ 12.56 hrs, Volume= 0.18 af, Atten= 84%, Lag= 28.7 min
Discarded = 0.1 cfs @ 10.59 hrs, Volume= 0.14 af
Primary = 0.3 cfs @ 12.56 hrs, Volume= 0.03 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 114.56' @ 12.56 hrs Surf.Area= 1,936 sf Storage= 3,165 cf

Plug-Flow detention time= 172.3 min calculated for 0.18 af (96% of inflow)
Center-of-Mass det. time= 148.2 min (918.6 - 770.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.25'	1,678 cf	**26.17'W x 74.00'L x 3.54'H Field A** 6,858 cf Overall - 2,664 cf Embedded = 4,194 cf x 40.0% Voids
#2A	112.75'	2,664 cf	**Cultec R-330XL** x 50 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		4,341 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	113.80'	**12.0" Round DR#2- to exist swale** L= 58.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 113.80' / 106.00' S= 0.1345 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	115.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	114.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Discarded	112.25'	**2.400 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 10.59 hrs HW=112.29' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.3 cfs @ 12.56 hrs HW=114.56' TW=105.07' (Dynamic Tailwater)
└─**1=DR#2- to exist swale** (Passes 0.3 cfs of 1.9 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.0 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 0.3 cfs @ 3.0 fps)

Summary for Pond 2P: psif#2 - in yard - c100

Inflow Area = 0.369 ac,100.00% Impervious, Inflow Depth > 4.26" for 10-yr event
Inflow = 1.6 cfs @ 12.08 hrs, Volume= 0.13 af
Outflow = 1.6 cfs @ 12.11 hrs, Volume= 0.12 af, Atten= 4%, Lag= 1.4 min
Primary = 1.6 cfs @ 12.11 hrs, Volume= 0.12 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 104.05' @ 12.11 hrs Surf.Area= 600 sf Storage= 542 cf

Plug-Flow detention time= 68.6 min calculated for 0.12 af (94% of inflow)
Center-of-Mass det. time= 33.0 min (782.3 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	102.50'	377 cf	**15.00'W x 40.00'L x 2.04'H Field A** 1,225 cf Overall - 283 cf Embedded = 942 cf x 40.0% Voids
#2A	103.00'	283 cf	**Cultec C-100** x 20 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 Row Length Adjustment= +0.50' x 1.86 sf x 4 rows
		660 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	99.60'	**8.0" Round Culvert - DR#3** L= 28.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 99.60' / 96.00' S= 0.1286 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	103.50'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600

Primary OutFlow Max=1.6 cfs @ 12.11 hrs HW=104.05' TW=98.41' (Dynamic Tailwater)
└─**1=Culvert - DR#3** (Passes 1.6 cfs of 3.4 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 1.6 cfs @ 2.6 fps)

Summary for Pond 3P: psif#3 - drive btwn bldgs - r330

Inflow Area =	1.269 ac,	80.34% Impervious,	Inflow Depth >	3.73"	for 10-yr event
Inflow =	5.2 cfs @	12.08 hrs,	Volume=	0.39 af	
Outflow =	4.4 cfs @	12.13 hrs,	Volume=	0.35 af,	Atten= 15%, Lag= 3.0 min
Discarded =	0.0 cfs @	6.98 hrs,	Volume=	0.06 af	
Primary =	4.4 cfs @	12.13 hrs,	Volume=	0.29 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 115.50' @ 12.13 hrs Surf.Area= 1,666 sf Storage= 3,065 cf

Plug-Flow detention time= 81.8 min calculated for 0.35 af (89% of inflow)
Center-of-Mass det. time= 28.6 min (807.0 - 778.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.80'	1,599 cf	**65.33'W x 25.50'L x 3.71'H Field A** 6,178 cf Overall - 2,179 cf Embedded = 3,999 cf x 40.0% Voids
#2A	113.30'	2,179 cf	**Cultec R-330XL** x 39 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		3,779 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	**18.0" Round Culvert** L= 158.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 114.00' / 102.00' S= 0.0759 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	115.20'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 1	114.50'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#4	Discarded	112.80'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 6.98 hrs HW=112.84' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=4.4 cfs @ 12.13 hrs HW=115.50' TW=98.42' (Dynamic Tailwater)
└─**1=Culvert** (Passes 4.4 cfs of 7.4 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.3 cfs @ 1.9 fps)
  └─**3=Orifice/Grate** (Orifice Controls 4.1 cfs @ 4.2 fps)

Summary for Pond 4P: psif#4 - basin within NE drive - r330

Inflow Area =	0.436 ac,100.00% Impervious, Inflow Depth > 4.26" for 10-yr event				
Inflow =	1.9 cfs @	12.08 hrs,	Volume=	0.15 af	
Outflow =	1.4 cfs @	12.16 hrs,	Volume=	0.12 af,	Atten= 29%, Lag= 4.7 min
Discarded =	0.0 cfs @	7.07 hrs,	Volume=	0.05 af	
Primary =	1.3 cfs @	12.16 hrs,	Volume=	0.08 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 121.44' @ 12.16 hrs Surf.Area= 1,174 sf Storage= 2,107 cf

Plug-Flow detention time= 125.4 min calculated for 0.12 af (79% of inflow)
Center-of-Mass det. time= 47.3 min (796.6 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	118.90'	1,011 cf	**30.50'W x 38.50'L x 3.54'H Field A** 4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	119.40'	1,632 cf	**Cultec R-330XL** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		2,643 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	119.00'	**12.0" Round Culvert - to exist swale** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 119.00' / 118.00' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	120.70'	**6.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Discarded	118.90'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 7.07 hrs HW=118.94' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=1.3 cfs @ 12.16 hrs HW=121.44' TW=108.46' (Dynamic Tailwater)
└─**1=Culvert - to exist swale** (Passes 1.3 cfs of 5.3 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 1.3 cfs @ 3.4 fps)

Summary for Pond 5R: cb#7 to dmh#8

Inflow Area =	2.622 ac,	62.89% Impervious,	Inflow Depth >	2.76"	for 10-yr event
Inflow =	8.2 cfs @	12.14 hrs,	Volume=	0.60 af	
Outflow =	8.2 cfs @	12.14 hrs,	Volume=	0.60 af,	Atten= 0%, Lag= 0.0 min
Primary =	8.2 cfs @	12.14 hrs,	Volume=	0.60 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 97.54' @ 12.15 hrs
Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	**12.0" Round Culvert** L= 17.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=8.1 cfs @ 12.14 hrs HW=97.41' TW=92.81' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 8.1 cfs @ 10.3 fps)

Summary for Pond 6R: dmh#8 to cb#10

Inflow Area =	2.622 ac,	62.89% Impervious,	Inflow Depth >	2.76"	for 10-yr event
Inflow =	8.2 cfs @	12.14 hrs,	Volume=	0.60 af	
Outflow =	8.2 cfs @	12.14 hrs,	Volume=	0.60 af,	Atten= 0%, Lag= 0.0 min
Primary =	8.2 cfs @	12.14 hrs,	Volume=	0.60 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 92.84' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	**12.0" Round Culvert** L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=8.3 cfs @ 12.14 hrs HW=92.81' TW=86.04' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 8.3 cfs @ 10.5 fps)

Summary for Pond 7R: cb#10 to dmh#11

Inflow Area =	2.938 ac,	66.64% Impervious,	Inflow Depth >	2.91"	for 10-yr event
Inflow =	9.4 cfs @	12.13 hrs, Volume=	0.71 af		
Outflow =	9.4 cfs @	12.13 hrs, Volume=	0.71 af,	Atten= 0%,	Lag= 0.0 min
Primary =	9.4 cfs @	12.13 hrs, Volume=	0.71 af		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 86.09' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	**12.0" Round Culvert** L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=9.4 cfs @ 12.13 hrs HW=86.08' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 9.4 cfs @ 12.0 fps)

PROPOSED CONDITIONS
100-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment sc10: NE corner @ Sohier

Runoff = 2.9 cfs @ 12.08 hrs, Volume= 0.21 af, Depth> 5.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	10,985	98	impervious area
	9,440	74	>75% Grass cover, Good, HSG C
	20,425	87	Weighted Average
	9,440		46.22% Pervious Area
	10,985		53.78% Impervious Area

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

Summary for Subcatchment sc11: west bldg A

Runoff = 6.7 cfs @ 12.08 hrs, Volume= 0.52 af, Depth> 6.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	35,035	98	impervious area
	8,695	74	>75% Grass cover, Good, HSG C
	43,730	93	Weighted Average
	8,695		19.88% Pervious Area
	35,035		80.12% Impervious Area

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

Summary for Subcatchment sc12: community bldg area

Runoff = 3.8 cfs @ 12.08 hrs, Volume= 0.30 af, Depth> 6.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	21,130	98	impervious area
	3,380	74	>75% Grass cover, Good, HSG C
	24,510	95	Weighted Average
	3,380		13.79% Pervious Area
	21,130		86.21% Impervious Area

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

Summary for Subcatchment sc13: bldg A

Runoff = 3.0 cfs @ 12.08 hrs, Volume= 0.25 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	18,995	98	impervious area
	18,995		100.00% Impervious Area

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

Summary for Subcatchment sc14: south bldg A

Runoff = 1.6 cfs @ 12.08 hrs, Volume= 0.13 af, Depth> 6.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	9,155	98	impervious area
	990	74	>75% Grass cover, Good, HSG C
	10,145	96	Weighted Average
	990		9.76% Pervious Area
	9,155		90.24% Impervious Area

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

Summary for Subcatchment sc15: bldg B

Runoff = 2.5 cfs @ 12.08 hrs, Volume= 0.21 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	16,055	98	impervious area
	16,055		100.00% Impervious Area

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

Summary for Subcatchment SC16: south locus

Runoff = 4.6 cfs @ 12.14 hrs, Volume= 0.38 af, Depth> 4.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	11,355	98	impervious area
	12,345	70	Woods, Good, HSG C
	19,170	74	>75% Grass cover, Good, HSG C
	42,870	79	Weighted Average
	31,515		73.51% Pervious Area
	11,355		26.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.0200	0.1		**Sheet Flow, yard** Grass: Short n= 0.150 P2= 3.10"
1.9	20	0.3500	0.2		**Sheet Flow, wooded slope** Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	31	0.0960	1.5		**Shallow Concentrated Flow, wooded to exist swale** Woodland Kv= 5.0 fps
4.3	325	0.0330	1.3		**Shallow Concentrated Flow, exist grass** Short Grass Pasture Kv= 7.0 fps
10.3	406	Total			

Summary for Subcatchment sc17: low area front bldg B

Runoff = 0.2 cfs @ 12.11 hrs, Volume= 0.01 af, Depth> 4.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	220	98	impervious area
	1,180	74	>75% Grass cover, Good, HSG C
	1,400	78	Weighted Average
	1,180		84.29% Pervious Area
	220		15.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0100	0.1		**Sheet Flow, corner to pyd** Grass: Short n= 0.150 P2= 3.10"

Summary for Subcatchment sc20: SE @ Sohier

Runoff = 3.6 cfs @ 12.08 hrs, Volume= 0.27 af, Depth> 5.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	16,810	98	impervious area
	7,190	74	>75% Grass cover, Good, HSG C
	24,000	91	Weighted Average
	7,190		29.96% Pervious Area
	16,810		70.04% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 2.2 cfs @ 12.08 hrs, Volume= 0.17 af, Depth> 6.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment sc50: NW corner

Runoff = 7.8 cfs @ 12.12 hrs, Volume= 0.61 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	21,395	98	impervious area
	28,300	70	Woods, Good, HSG C
	11,245	74	>75% Grass cover, Good, HSG C
	6,855	79	50-75% Grass cover, Fair, HSG C
	67,795	80	Weighted Average
	46,400		68.44% Pervious Area
	21,395		31.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.1		**Sheet Flow, within woods** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	57	0.2100	2.3		**Shallow Concentrated Flow, overland thru woods** Woodland Kv= 5.0 fps
2.0	407	0.0440	3.4		**Shallow Concentrated Flow, thru swale** Unpaved Kv= 16.1 fps
8.5	514	Total			

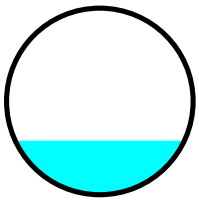
Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.469 ac, 53.78% Impervious, Inflow Depth > 5.47" for 100-yr event
Inflow = 2.9 cfs @ 12.08 hrs, Volume= 0.21 af
Outflow = 2.9 cfs @ 12.09 hrs, Volume= 0.21 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.4 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 5.1 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 17.0' Slope= 0.2000 '/'
Inlet Invert= 111.60', Outlet Invert= 108.20'



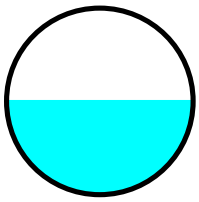
Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.905 ac, 76.05% Impervious, Inflow Depth > 4.96" for 100-yr event
Inflow = 4.8 cfs @ 12.10 hrs, Volume= 0.37 af
Outflow = 4.8 cfs @ 12.11 hrs, Volume= 0.37 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.8 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.9 fps, Avg. Travel Time= 0.8 min

Peak Storage= 76 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 188.0' Slope= 0.0670 '/'
Inlet Invert= 108.10', Outlet Invert= 95.50'



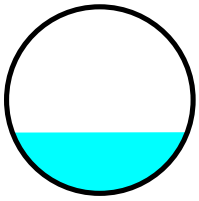
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.551 ac, 70.04% Impervious, Inflow Depth > 5.93" for 100-yr event
Inflow = 3.6 cfs @ 12.08 hrs, Volume= 0.27 af
Outflow = 3.6 cfs @ 12.08 hrs, Volume= 0.27 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.1 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 5.3 fps, Avg. Travel Time= 0.0 min

Peak Storage= 2 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



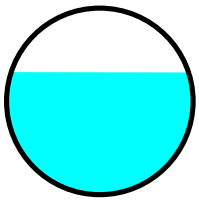
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 1.456 ac, 73.78% Impervious, Inflow Depth > 5.33" for 100-yr event
Inflow = 8.3 cfs @ 12.09 hrs, Volume= 0.65 af
Outflow = 8.3 cfs @ 12.10 hrs, Volume= 0.65 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.2 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.1 fps, Avg. Travel Time= 0.7 min

Peak Storage= 109 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 200.0' Slope= 0.0925 '/'
Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.394 ac, 69.00% Impervious, Inflow Depth > 5.29" for 100-yr event
Inflow = 23.8 cfs @ 12.12 hrs, Volume= 1.94 af
Outflow = 23.8 cfs @ 12.12 hrs, Volume= 1.94 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 9R: existing swale at Tozer

Inflow Area = 0.563 ac, 86.21% Impervious, Inflow Depth = 2.50" for 100-yr event
Inflow = 1.7 cfs @ 12.24 hrs, Volume= 0.12 af
Outflow = 1.7 cfs @ 12.26 hrs, Volume= 0.12 af, Atten= 0%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.8 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 2.4 fps, Avg. Travel Time= 3.4 min

Peak Storage= 141 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 32.4 cfs

1.00' x 1.00' deep channel, n= 0.016 Asphalt, rough
Side Slope Z-value= 1.5 '/' Top Width= 4.00'
Length= 490.0' Slope= 0.0440 '/'
Inlet Invert= 105.00', Outlet Invert= 83.44'

Summary for Reach 10R: exist swale along Tozer

Inflow Area = 1.638 ac, 84.77% Impervious, Inflow Depth > 5.42" for 100-yr event
Inflow = 9.4 cfs @ 12.13 hrs, Volume= 0.74 af
Outflow = 9.4 cfs @ 12.14 hrs, Volume= 0.74 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.3 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.4 fps, Avg. Travel Time= 1.9 min

Peak Storage= 344 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 37.0 cfs

2.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 4.0 '/' Top Width= 10.00'
Length= 158.0' Slope= 0.0316 '/'
Inlet Invert= 98.00', Outlet Invert= 93.00'

‡

Summary for Reach dp1: drop inlet

Inflow Area = 2.119 ac, 46.07% Impervious, Inflow Depth > 4.11" for 100-yr event
Inflow = 8.3 cfs @ 12.14 hrs, Volume= 0.73 af
Outflow = 8.3 cfs @ 12.14 hrs, Volume= 0.73 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: psif#1 - basin in west parking lot - r330

Inflow Area = 0.563 ac, 86.21% Impervious, Inflow Depth > 6.40" for 100-yr event
Inflow = 3.8 cfs @ 12.08 hrs, Volume= 0.30 af
Outflow = 1.8 cfs @ 12.24 hrs, Volume= 0.28 af, Atten= 53%, Lag= 9.6 min
Discarded = 0.1 cfs @ 9.12 hrs, Volume= 0.16 af
Primary = 1.7 cfs @ 12.24 hrs, Volume= 0.12 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 115.79' @ 12.24 hrs Surf.Area= 1,936 sf Storage= 4,338 cf

Plug-Flow detention time= 130.4 min calculated for 0.28 af (92% of inflow)
Center-of-Mass det. time= 89.3 min (848.8 - 759.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.25'	1,678 cf	**26.17'W x 74.00'L x 3.54'H Field A** 6,858 cf Overall - 2,664 cf Embedded = 4,194 cf x 40.0% Voids
#2A	112.75'	2,664 cf	**Cultec R-330XL** x 50 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		4,341 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	113.80'	**12.0" Round DR#2- to exist swale** L= 58.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 113.80' / 106.00' S= 0.1345 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	115.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	114.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Discarded	112.25'	**2.400 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 9.12 hrs HW=112.29' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=1.7 cfs @ 12.24 hrs HW=115.79' TW=105.22' (Dynamic Tailwater)
└─**1=DR#2- to exist swale** (Passes 1.7 cfs of 4.6 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.1 cfs @ 3.2 fps)
  └─**3=Orifice/Grate** (Orifice Controls 0.5 cfs @ 6.1 fps)

Summary for Pond 2P: psif#2 - in yard - c100

Inflow Area = 0.369 ac,100.00% Impervious, Inflow Depth > 6.76" for 100-yr event
Inflow = 2.5 cfs @ 12.08 hrs, Volume= 0.21 af
Outflow = 2.4 cfs @ 12.11 hrs, Volume= 0.20 af, Atten= 6%, Lag= 1.8 min
Primary = 2.4 cfs @ 12.11 hrs, Volume= 0.20 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 104.45' @ 12.11 hrs Surf.Area= 600 sf Storage= 638 cf

Plug-Flow detention time= 49.5 min calculated for 0.20 af (96% of inflow)
Center-of-Mass det. time= 24.8 min (767.2 - 742.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	102.50'	377 cf	**15.00'W x 40.00'L x 2.04'H Field A** 1,225 cf Overall - 283 cf Embedded = 942 cf x 40.0% Voids
#2A	103.00'	283 cf	**Cultec C-100** x 20 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 Row Length Adjustment= +0.50' x 1.86 sf x 4 rows
		660 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	99.60'	**8.0" Round Culvert - DR#3** L= 28.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 99.60' / 96.00' S= 0.1286 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	103.50'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600

Primary OutFlow Max=2.4 cfs @ 12.11 hrs HW=104.45' TW=98.52' (Dynamic Tailwater)
└─**1=Culvert - DR#3** (Passes 2.4 cfs of 3.6 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 2.4 cfs @ 4.0 fps)

Summary for Pond 3P: psif#3 - drive btwn bldgs - r330

Inflow Area =	1.269 ac,	80.34% Impervious,	Inflow Depth >	6.19"	for 100-yr event
Inflow =	8.4 cfs @	12.08 hrs,	Volume=	0.65 af	
Outflow =	7.1 cfs @	12.13 hrs,	Volume=	0.61 af,	Atten= 16%, Lag= 3.0 min
Discarded =	0.0 cfs @	4.76 hrs,	Volume=	0.07 af	
Primary =	7.1 cfs @	12.13 hrs,	Volume=	0.54 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 116.46' @ 12.13 hrs Surf.Area= 1,666 sf Storage= 3,747 cf

Plug-Flow detention time= 62.4 min calculated for 0.61 af (93% of inflow)
Center-of-Mass det. time= 25.0 min (791.3 - 766.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.80'	1,599 cf	**65.33'W x 25.50'L x 3.71'H Field A** 6,178 cf Overall - 2,179 cf Embedded = 3,999 cf x 40.0% Voids
#2A	113.30'	2,179 cf	**Cultec R-330XL** x 39 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		3,779 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	**18.0" Round Culvert** L= 158.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 114.00' / 102.00' S= 0.0759 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	115.20'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 1	114.50'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600
#4	Discarded	112.80'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 4.76 hrs HW=112.84' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=7.1 cfs @ 12.13 hrs HW=116.46' TW=98.53' (Dynamic Tailwater)
└─**1=Culvert** (Passes 7.1 cfs of 11.1 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.9 cfs @ 5.0 fps)
  └─**3=Orifice/Grate** (Orifice Controls 6.2 cfs @ 6.3 fps)

Summary for Pond 4P: psif#4 - basin within NE drive - r330

Inflow Area =	0.436 ac,100.00% Impervious, Inflow Depth > 6.76" for 100-yr event				
Inflow =	3.0 cfs @	12.08 hrs,	Volume=	0.25 af	
Outflow =	2.1 cfs @	12.16 hrs,	Volume=	0.21 af,	Atten= 29%, Lag= 4.6 min
Discarded =	0.0 cfs @	4.42 hrs,	Volume=	0.05 af	
Primary =	2.1 cfs @	12.16 hrs,	Volume=	0.16 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 122.19' @ 12.16 hrs Surf.Area= 1,174 sf Storage= 2,526 cf

Plug-Flow detention time= 101.9 min calculated for 0.21 af (86% of inflow)
Center-of-Mass det. time= 39.6 min (782.0 - 742.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	118.90'	1,011 cf	**30.50'W x 38.50'L x 3.54'H Field A** 4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	119.40'	1,632 cf	**Cultec R-330XL** x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		2,643 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	119.00'	**12.0" Round Culvert - to exist swale** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 119.00' / 118.00' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	120.70'	**6.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Discarded	118.90'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 4.42 hrs HW=118.94' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.1 cfs @ 12.16 hrs HW=122.19' TW=108.58' (Dynamic Tailwater)
└─**1=Culvert - to exist swale** (Passes 2.1 cfs of 6.2 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 2.1 cfs @ 5.4 fps)

Summary for Pond 5R: cb#7 to dmh#8

Inflow Area = 2.622 ac, 62.89% Impervious, Inflow Depth > 5.10" for 100-yr event
Inflow = 13.9 cfs @ 12.14 hrs, Volume= 1.11 af
Outflow = 13.9 cfs @ 12.14 hrs, Volume= 1.11 af, Atten= 0%, Lag= 0.0 min
Primary = 13.9 cfs @ 12.14 hrs, Volume= 1.11 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 129.96' @ 12.15 hrs
Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	**12.0" Round Culvert** L= 17.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=13.7 cfs @ 12.14 hrs HW=129.67' TW=116.46' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 13.7 cfs @ 17.5 fps)

Summary for Pond 6R: dmh#8 to cb#10

Inflow Area = 2.622 ac, 62.89% Impervious, Inflow Depth > 5.10" for 100-yr event
Inflow = 13.9 cfs @ 12.14 hrs, Volume= 1.11 af
Outflow = 13.9 cfs @ 12.14 hrs, Volume= 1.11 af, Atten= 0%, Lag= 0.0 min
Primary = 13.9 cfs @ 12.14 hrs, Volume= 1.11 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 116.50' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	**12.0" Round Culvert** L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=14.0 cfs @ 12.14 hrs HW=116.46' TW=97.11' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 14.0 cfs @ 17.8 fps)

Summary for Pond 7R: cb#10 to dmh#11

Inflow Area = 2.938 ac, 66.64% Impervious, Inflow Depth > 5.27" for 100-yr event
Inflow = 15.7 cfs @ 12.13 hrs, Volume= 1.29 af
Outflow = 15.7 cfs @ 12.13 hrs, Volume= 1.29 af, Atten= 0%, Lag= 0.0 min
Primary = 15.7 cfs @ 12.13 hrs, Volume= 1.29 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 97.24' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	**12.0" Round Culvert** L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=15.7 cfs @ 12.13 hrs HW=97.23' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 15.7 cfs @ 20.0 fps)

APPENDIX

Soil Map—Essex County, Massachusetts, Southern Part
(108 Sohier Road, Beverly, MA)

Map Scale: 1:2,670 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Essex County, Massachusetts, Southern Part
Survey Area Data: Version 14, Oct 6, 2017

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	1.0	3.8%
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	2.5	10.0%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	10.0	39.2%
306D	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	1.6	6.4%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	0.0	0.0%
310C	Woodbridge fine sandy loam, 8 to 15 percent slopes	0.3	1.0%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	5.9	23.3%
602	Urban land	0.0	0.0%
651	Udorthents, smoothed	4.1	16.2%
Totals for Area of Interest		**25.4**	**100.0%**

STORMWATER MANAGEMENT REPORT

for

108 Sohier Road
Beverly, Massachusetts

Prepared for:

Harborlight Community Partners, Inc.
P.O. Box 507
Beverly, Massachusetts 01915

Prepared by:

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September 17, 2018
Revised: October 15, 2019

MERIDIAN ASSOCIATES
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TABLE OF CONTENTS

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  - Checklist for Stormwater Report
- Appendix
  - Stage-Area Storage Calculations for Infiltration Facilities
  - TSS Removal Calculation Worksheet
  - Construction Period Pollution Prevention Plan for a Proposed Stormwater Management System
  - Operation and Long Term Maintenance Plan

STORMWATER NARRATIVE

Project Narrative:

The locus property is comprised of approximately 5.1 acres located at 108 Sohier Road at the intersection of Sohier and Tozer Roads. The property is bound by Sohier Road on the east, Tozer Road on the west and the Northshore Education Consortium to the north. There is a residential development directly across the street from the property along Sohier Road and Beverly High School is located approximately 0.2 miles to the south west on Sohier Road.

The property has been developed previously with a portion being part of the Old Salem Reservoir back in the 1940s. More recently, the locus was utilized as overflow parking with over 2 acres of pavement onsite. The site continues to be occupied by the bituminous concrete, broken bituminous and gravel. There are grassed areas along the roadways as well as wooded areas abutting the paved portions of the site. Topography of the site ranges from 5% within the paved areas to 20%-30% within the surrounding wooded areas. It is worth noting that the slope of Sohier Road increases exponentially from 3% upwards of 10% by the time it intersects with Tozer Road.

The applicant, Harborlight Community Partners, Inc. (HCP) is proposing a mixed use development which will include two (2) residential buildings (consisting of 77 units of affordable two and three-bedroom rental apartments for families), and one (1) multi-use building that will house multi-purpose community spaces, management offices, and new corporate offices for HCP. Site access will be provided via two (2) connected driveways off Sohier Road. Associated parking, utilities and open spaces are also provided.

The proposal utilizes conventional stormwater management techniques for treatment, recharge and peak mitigation. This project incorporates deep sump catchbasins and subsurface infiltration facilities for treatment, recharge and mitigation of stormwater.

Revision October 15, 2019:

Reconfiguration of Community Building layout with additional play yard and pickleball court. Minor associated grading adjustments. Drainage facilities and configurations remain largely the same as previous.

The following are the DEP Stormwater Standards as outlined in the Wetlands Regulations:

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

There are no new stormwater discharges proposed which discharge to waters of the Commonwealth with the completion of this project. Stormwater from the project will be discharged to existing swales which direct stormwater to either an existing drop inlet at the NW property corner along Tozer Road or existing catchbasin at the intersection of Sohier and Tozer roads. In addition, all stormwater from paved surfaces discharging to subsurface infiltration facilities will be treated utilizing proposed deep sump catchbasins as well as receive further treatment within the infiltration facility itself prior to discharge towards the existing swales.

Standard 2: Peak Rate Attenuation - 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.

Reference is made to the report entitled "Stormwater Analysis and Calculations for 108 Sohier Road" dated September 17, 2018 and revised October 15, 2019.

The Stormwater Analysis utilizes the Soil Conservation Service Technical Report No. 55 and the U.S. Department of Commerce Technical Paper No. 40 to calculate peak runoff rates. Full detail of peak rate attenuation along with supplemental stormwater calculations utilizing HydroCAD as well as existing and post development drainage plans can be found in the referenced report.

The table below illustrates the predicted existing and post development stormwater flows for the 2, 10 and 100-year storm events.

Design Point #1:

	2-Year 24-Hour Storm Event	10-Year 24-Hour Storm Event	100-Year 24-Hour Storm Event
Existing	2.4 CFS	4.5 CFS	8.3 CFS
Proposed	2.2 CFS	4.1 CFS	8.3 CFS

Design Point #2:

	2-Year 24-Hour Storm Event	10-Year 24-Hour Storm Event	100-Year 24-Hour Storm Event
Existing	8.6 CFS	14.2 CFS	24.3 CFS
Proposed	8.1 CFS	14.2 CFS	23.8 CFS

The details of this report show that the peak rates of runoff for the 2, 10, and 100 year events have been either matched or reduced from existing to proposed conditions as required. We anticipate no adverse impacts with the completion of this project.

Standard 3: Recharge - Loss of annual recharge to groundwater shall be eliminated or minimized…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 in accordance with the Mass Stormwater Handbook.

Loss of annual recharge to groundwater has been minimized through the use of stormwater Best Management Practices (BMP's), proposed subsurface infiltration facilities, and a proposed operation and maintenance program. Based on soil maps provided by U.S. Department of Agriculture Soil Conservation Service the locus property consists of hydrologic soil group C.

Utilizing the current regulations, the required recharge volume (Rv) is based on the following calculation:

Rv = Fx
Rv = Required Recharge Volume
F = Target Depth Factor associated with hydrologic soil groups located in table 2.3.2 in Volume 3 of the Stormwater Management Handbook
x = total onsite impervious area
X_{HSGC} = 126,595 sf
F_C = 0.25 inches
R_V = 2,638 cf
Volume of storage provided under the lowest outlet of the proposed infiltration basins for recharge purpose:
Facility #4 = 1,484 cf
Facility #3 = 1,925 cf
Facility #2 = 350 cf
Facility #1 = 2,361 cf
Total Volume = 6,120 cf

The Stormwater Handbook also requires recharge facilities be installed in soils capable of absorbing the recharge volume with the ability to drain within 72 hours. The formula for drawdown is as follows:

General Formula:

$$T_{DR} = \frac{required storage volume *}{(Infiltration Rate)(Bottom Surface Area of System)}$$

(*Required storage volume is equal to the larger of the overall calculated required recharge or treatment volumes. In this case, treatment volume calculations are greater.)

Infiltration Facility #1:

Storage volume: 21,130 sf x (0.5"/12) = 881 cf

$$T_{DR} = \frac{881}{\left(\frac{2.41 in/hr}{12 in/ft}\right)(1{,}936) sf} = 2.3 hrs$$

$2.3 hrs < 72 hrs$

Infiltration Facility #2:

Storage volume: 16,055 sf x (0.5"/12) = 669 *cf*

$$T_{DR} = \frac{669}{\left(\frac{1.02in/hr}{12in/ft}\right)(600)sf} = 13.1hrs$$

13.1*hrs* < 72*hrs*

Infiltration Facility #3:

Storage volume: 44,410 sf x (0.5"/12) = 1,851 *cf*

$$T_{DR} = \frac{1,851}{\left(\frac{1.02in/hr}{12in/ft}\right)(1,665)sf} = 13.1hrs$$

13.1*hrs* < 72*hrs*

Infiltration Facility #4:

Storage volume: 18,995 sf x (0.5"/12) = 792 *cf*

$$T_{DR} = \frac{792}{\left(\frac{1.02in/hr}{12in/ft}\right)(1,174)sf} = 8.0hrs$$

8.0*hrs* < 72*hrs*

A portion of the total onsite impervious area is not directed into one of the proposed infiltration facilities. In accordance with the Stormwater Handbook, a capture area adjustment calculation is required when runoff from only a portion of the impervious area on a site is directed to one or more infiltration BMPs. The following are steps of the capture area adjustment calculation to demonstrate the required minimum of 65% of the impervious area onsite is being directed to an infiltration BMP. The calculation also determines the increase in storage capacity of the infiltration BMPs to ensure they are able to capture sufficient runoff from the impervious surfaces within the contributing drainage area to infiltrate the required recharge volume.

1. Calculate Rv for the project:
   From above Rv = 2,638 cf

2. Calculate the onsite impervious area draining to recharge facilities:
   Area = 95,105 sf

3. Divide total onsite impervious by the impervious area draining to recharge facilities:
   Total site impervious area = 126,595 sf
   126,595sf/95,105sf = 1.33

4. Multiply quotient from step 3 by the original Rv to determine the adjusted minimum storage volume needed to meet the recharge requirement:
   1.33 x 2,638 = 3,509 cf
   (Infiltration facilities provide 6,120 cf of storage)

5. Insure minimum of 65% of the site impervious area is being directed to the infiltration facilities:
   95,105sf/126,595sf = 75%

In summary, the proposed infiltration facilities will provide a total recharge storage volume of 6,120 cf which is greater than the required recharge volume calculated by the capture area adjustment. The project also directs greater than 65% of the total proposed impervious areas into the recharge facilities which, in accordance with the Stormwater Handbook, will provide sufficient runoff to infiltrate the required recharge volume. This ensures the post development annual recharge rate will approximate the annual rate from pre-development conditions.

Standard 4: Water Quality – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The standard is met with pollution prevention plans, stormwater BMP's sized to capture required water quality volume, and pretreatment measures.

As discussed above, there are no untreated stormwater discharges from the proposed project. The stormwater management system has been designed to remove a minimum of 80% of the average annual post-construction load of Total Suspended Solids (TSS) through the use of deep sump catchbasins and subsurface infiltration facilities.

The Stormwater Management Handbook assigns TSS removal percentages to each treatment BMP. Each treatment BMP is sized to capture the required water quality volume calculated in accordance with the Handbook in order to achieve the assigned TSS removal rates. The TSS removal rate for subsurface facilities is 80%. Deep sump catchbasins are assigned a TSS removal rate of 25%.

A separate document entitled "Operation and Long Term Maintenance Plan" is included in the appendix of this report. Suitable practices for source control and long term pollution prevention have been identified and shall be implemented as discussed.

The utilization of properly sized treatment BMP's combined with the operation and maintenance plan provides compliance with this standard.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs) – Source control and pollution prevention shall be implemented in accordance with the Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable or provide specific structural BMPs determined by the Department to be suitable for such uses.

Stormwater Standard 5 is not applicable to this project. The proposed development will not subject the site to higher potential pollutant loads as defined in the Massachusetts Department of Environmental Protection Wetlands and Water Quality Regulations.

LUHPPLs are identified in 310 CMR 22.20B(2) and C(2)(a)-(k) and (m) and CMR 22.21(2)(a)(1)-(8) and (b)(1)-(6), areas within a site that are the location of activities that are subject to an individual National Pollutant Discharge Elimination System (NPDES) permit or the NPDES Multi-sector General Permit; auto fueling facilities, exterior fleet storage areas, exterior vehicle service and equipment cleaning areas; marinas and boatyards; parking lots with high-intensity-use; confined disposal facilities and disposal sites.

Standard 6: Critical Areas – Stormwater discharges to critical areas require the use of specific source control and pollution prevention measures and specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas.

Standard 6 is not applicable to this project given that stormwater will not be discharged to a critical area. Critical areas are defined as Outstanding Resource Waters and Special Resource Waters as designated in 314 CMR 4.0, recharge areas for public water supplies as defined in 310 CMR 22.02 (including Zone II and Interim Wellhead Protection Areas), bathing beaches as defined in 105 CMR 445.000, cold-water fisheries and shellfish growing areas as defined in 314 CMR 9.02 and 310 CMR 10.04.

Standard 7: Redevelopments – A redevelopment project is required to meet Standards 1-6 only to the maximum extent practicable. Remaining standards shall be met as well as the project shall improve the existing conditions.

Stormwater Standard 7 is not applicable to this project. Within the Stormwater Management Handbook (volume 1, chapter 1, page 20), the definition of a redevelopment project includes, "development, rehabilitation, expansion and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area".

Although this proposal consists of rehabilitation on a previously developed site, the project will create an increase in the total site impervious area and is therefore not applicable to this standard. This project therefore meets each of the standards set forth in the Stormwater Handbook.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan shall be implemented.

A *Construction Period Pollution Prevention Plan for a Proposed Stormwater Management System* report is included in the Appendix of this report. This program details the construction period operation and maintenance plan and sequencing for pollution prevention measures and erosion and sedimentation controls. Locations of erosion control measures for the project are depicted on the site plan set accompanying this report.

Standard 9: A long term Operation and Maintenance Plan shall be implemented.

An *Operation and Long Term Maintenance Plan* is included in the Appendix of this report. This long term operation and maintenance program provides details and the schedule for routine and non-routine maintenance tasks to be implemented at the completion of the project.

Standard 10: Prohibition of Illicit Discharges – Illicit discharges to the stormwater management system are prohibited.

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Discharges to the stormwater management system from the following activities or facilities are permissible: Firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents. All other illicit discharges are prohibited.

There are no known illicit discharges anticipated through the completion of this project. During construction and post construction procedures are provided to dissipate the potential for illicit discharges to the drainage system. Post construction preventions of illicit discharges are described in the Operation and Long Term Maintenance Plan under the Good Housekeeping Practices section of the report.

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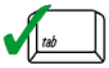
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

COMMONWEALTH OF MASSACHUSETTS
APRIL C. FERRARO
CIVIL
No. 49240
REGISTERED PROFESSIONAL ENGINEER

9-17-18

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

APPENDIX

Stage-Area-Storage for Pond 1P: psif#1 - basin in west parking lot - r330

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
112.25	**1,936**	0
112.30	1,936	39
112.35	1,936	77
112.40	1,936	116
112.45	1,936	155
112.50	1,936	194
112.55	1,936	232
112.60	1,936	271
112.65	1,936	310
112.70	1,936	349
112.75	1,936	387
112.80	1,936	469
112.85	1,936	550
112.90	1,936	631
112.95	1,936	711
113.00	1,936	792
113.05	1,936	872
113.10	1,936	953
113.15	1,936	1,033
113.20	1,936	1,113
113.25	1,936	1,193
113.30	1,936	1,273
113.35	1,936	1,353
113.40	1,936	1,432
113.45	1,936	1,510
113.50	1,936	1,589
113.55	1,936	1,667
113.60	1,936	1,744
113.65	1,936	1,822
113.70	1,936	1,900
113.75	1,936	1,977
113.80	1,936	2,054
113.85	1,936	2,131
113.90	1,936	2,208
113.95	1,936	2,285
114.00	1,936	2,361
114.05	1,936	2,436
114.10	1,936	2,511
114.15	1,936	2,585
114.20	1,936	2,658
114.25	1,936	2,730
114.30	1,936	2,802
114.35	1,936	2,873
114.40	1,936	2,943
114.45	1,936	3,012
114.50	1,936	3,080
114.55	1,936	3,148
114.60	1,936	3,214
114.65	1,936	3,279
114.70	1,936	3,344
114.75	1,936	3,406
114.80	1,936	3,468
114.85	1,936	3,528
114.90	1,936	3,585
114.95	1,936	3,641
115.00	1,936	3,695
115.05	1,936	3,745
115.10	1,936	3,793
115.15	1,936	3,839
115.20	1,936	3,881
115.25	1,936	3,922
115.30	1,936	3,961
115.35	1,936	3,999
115.40	1,936	4,038
115.45	1,936	4,077
115.50	1,936	4,115
115.55	1,936	4,154
115.60	1,936	4,193
115.65	1,936	4,232
115.70	1,936	4,270
115.75	1,936	**4,309**

Stage-Area-Storage for Pond 2P: psif#2 - in yard - c100

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
102.50	0	103.54	367
102.52	5	103.56	376
102.54	10	103.58	384
102.56	14	103.60	393
102.58	19	103.62	401
102.60	24	103.64	409
102.62	29	103.66	417
102.64	34	103.68	425
102.66	38	103.70	433
102.68	43	103.72	441
102.70	48	103.74	449
102.72	53	103.76	456
102.74	58	103.78	464
102.76	62	103.80	471
102.78	67	103.82	478
102.80	72	103.84	484
102.82	77	103.86	491
102.84	82	103.88	497
102.86	86	103.90	503
102.88	91	103.92	509
102.90	96	103.94	514
102.92	101	103.96	520
102.94	106	103.98	525
102.96	110	104.00	530
102.98	115	104.02	535
103.00	120	104.04	539
103.02	130	104.06	544
103.04	139	104.08	549
103.06	149	104.10	554
103.08	158	104.12	559
103.10	168	104.14	563
103.12	177	104.16	568
103.14	186	104.18	573
103.16	196	104.20	578
103.18	205	104.22	583
103.20	214	104.24	587
103.22	223	104.26	592
103.24	233	104.28	597
103.26	242	104.30	602
103.28	251	104.32	607
103.30	260	104.34	611
103.32	270	104.36	616
103.34	279	104.38	621
103.36	288	104.40	626
103.38	297	104.42	631
103.40	306	104.44	635
103.42	315	104.46	640
103.44	324	104.48	645
103.46	332	104.50	650
103.48	341	104.52	655
103.50	350	104.54	**659**
103.52	359		

Stage-Area-Storage for Pond 3P: psif#3 - drive btwn bldgs - r330

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
112.80	**1,666**	0
112.85	1,666	33
112.90	1,666	67
112.95	1,666	100
113.00	1,666	133
113.05	1,666	167
113.10	1,666	200
113.15	1,666	233
113.20	1,666	267
113.25	1,666	300
113.30	1,666	333
113.35	1,666	401
113.40	1,666	469
113.45	1,666	537
113.50	1,666	605
113.55	1,666	672
113.60	1,666	740
113.65	1,666	807
113.70	1,666	875
113.75	1,666	942
113.80	1,666	1,009
113.85	1,666	1,076
113.90	1,666	1,143
113.95	1,666	1,209
114.00	1,666	1,275
114.05	1,666	1,341
114.10	1,666	1,406
114.15	1,666	1,471
114.20	1,666	1,537
114.25	1,666	1,602
114.30	1,666	1,667
114.35	1,666	1,731
114.40	1,666	1,796
114.45	1,666	1,861
114.50	1,666	1,925
114.55	1,666	1,989
114.60	1,666	2,052
114.65	1,666	2,115
114.70	1,666	2,177
114.75	1,666	2,238
114.80	1,666	2,299
114.85	1,666	2,359
114.90	1,666	2,419
114.95	1,666	2,478
115.00	1,666	2,536
115.05	1,666	2,594
115.10	1,666	2,651
115.15	1,666	2,707
115.20	1,666	2,762
115.25	1,666	2,816
115.30	1,666	2,869
115.35	1,666	2,921
115.40	1,666	2,971
115.45	1,666	3,020
115.50	1,666	3,068
115.55	1,666	3,113
115.60	1,666	3,156
115.65	1,666	3,197
115.70	1,666	3,236
115.75	1,666	3,272
115.80	1,666	3,307
115.85	1,666	3,340
115.90	1,666	3,373
115.95	1,666	3,407
116.00	1,666	3,440
116.05	1,666	3,473
116.10	1,666	3,507
116.15	1,666	3,540
116.20	1,666	3,573
116.25	1,666	3,607
116.30	1,666	3,640
116.35	1,666	3,673
116.40	1,666	3,707
116.45	1,666	3,740
116.50	1,666	**3,773**

Stage-Area-Storage for Pond 4P: psif#4 - basin within NE drive - r330

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
118.90	**1,174**	0
118.95	1,174	23
119.00	1,174	47
119.05	1,174	70
119.10	1,174	94
119.15	1,174	117
119.20	1,174	141
119.25	1,174	164
119.30	1,174	188
119.35	1,174	211
119.40	1,174	235
119.45	1,174	284
119.50	1,174	334
119.55	1,174	383
119.60	1,174	432
119.65	1,174	482
119.70	1,174	531
119.75	1,174	580
119.80	1,174	629
119.85	1,174	677
119.90	1,174	726
119.95	1,174	775
120.00	1,174	824
120.05	1,174	872
120.10	1,174	920
120.15	1,174	967
120.20	1,174	1,015
120.25	1,174	1,062
120.30	1,174	1,109
120.35	1,174	1,157
120.40	1,174	1,204
120.45	1,174	1,251
120.50	1,174	1,298
120.55	1,174	1,345
120.60	1,174	1,391
120.65	1,174	1,438
120.70	1,174	1,484
120.75	1,174	1,529
120.80	1,174	1,574
120.85	1,174	1,619
120.90	1,174	1,663
120.95	1,174	1,706
121.00	1,174	1,750
121.05	1,174	1,792
121.10	1,174	1,835
121.15	1,174	1,876
121.20	1,174	1,917
121.25	1,174	1,958
121.30	1,174	1,998
121.35	1,174	2,037
121.40	1,174	2,075
121.45	1,174	2,112
121.50	1,174	2,149
121.55	1,174	2,184
121.60	1,174	2,218
121.65	1,174	2,250
121.70	1,174	2,281
121.75	1,174	2,310
121.80	1,174	2,338
121.85	1,174	2,364
121.90	1,174	2,388
121.95	1,174	2,412
122.00	1,174	2,435
122.05	1,174	2,459
122.10	1,174	2,482
122.15	1,174	2,506
122.20	1,174	2,529
122.25	1,174	2,553
122.30	1,174	2,576
122.35	1,174	2,600
122.40	1,174	**2,623**

Non-automated: Mar.4, 2008

INSTRUCTIONS:
1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structureal BMP Table
2. The calcualtions must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 108 Sohier Road, Beverly, MA

Train: Treatment Train

TSS Removal Calculation Worksheet

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catchbasin	25%	1.00	0.25	0.75
Subsurface Infiltration Facilities	80%	0.75	0.60	0.15

Total TSS Removal = 85.0%

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

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

Project: 6063
Prepared By: Meridian Associates, Inc.
Date: 9/17/2018

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

CONSTRUCTION PERIOD POLLUTION PREVENTION PLAN FOR A PROPOSED STORMWATER MANAGEMENT SYSTEM

located at

108 SOHIER ROAD
BEVERLY, MASSACHUSETTS

Prepared for:

Harborlight Community Partners, Inc.
P.O. Box 507
Beverly, Massachusetts 01915

Prepared by:

Meridian Associates, Inc.
500 Cummings Center, Suite 5950
Beverly, Massachusetts 01915
(978) 299-0447

September 17, 2018
Revised: October 15, 2019

Project Name: Anchor Point - 108 Sohier Road
Beverly, Massachusetts

Owner Name: 108 Sohier, LLC
208 Main Street
Wenham, Massachusetts 01984

Party Responsible for Maintenance: Harborlight Community Partners, Inc.
P.O. Box 507
Beverly, Massachusetts 01915
Kristin Carlson, RA, LEED GA
978-922-1305 x210

Project Description:

The locus property is comprised of approximately 5.07± acres located at 108 Sohier Road in Beverly, Massachusetts. The site is bound by Sohier Road to the east, Tozer Road to the west and Northshore Education Consortium to the north.

The site has been previously developed as a 2.6± acre parking lot and recently used as a construction staging area. Topography ranges from 3-5% within the existing paved areas. An undeveloped wooded portion of the site is located along Tozer Road where the existing grades range from 35%-45% slopes.

The applicant, Harborlight Community Partners, Inc. (HCP) is proposing a mixed use development which will include two (2) residential buildings (consisting of 77 units of affordable two and three-bedroom rental apartments for families), and one (1) multi-use building that will house multi-purpose community spaces, management offices, and new corporate offices for HCP. Site access will be provided via two (2) connected driveways off Sohier Road. Associated parking, utilities and open spaces are also provided.

<u>Erosion and Sedimentation Control Measures During Construction Activities</u>

Erosion Control Sock

Erosion Control Socks are proposed to be installed, as shown on the site plan, around the perimeter of the redevelopment. The barriers are burlap fabric mitts filled with compost blends and shall be installed prior to the commencement of any work on-site and in accordance with the design plans. An additional supply of socks shall be on-site to replace and/or repair socks that have been disturbed. The lines of socks shall be inspected and maintained on a weekly basis during construction. Deposited sediments shall be removed when the level of deposition reaches approximately one-half the height of the Erosion Control Sock.

Storm Drain Inlet Protection

A temporary storm inlet protection filter will be placed around all catchbasin units. The purpose of the filter is to prevent the inflow of sediments into the closed drainage system. The filter shall remain in place until a permanent vegetative cover is established and the transport of sediment is no longer visibly apparent. The filter shall be inspected and maintained on a weekly basis and after every storm of 0.25 inches or more of rainfall/precipitation.

Surface Stabilization

The surface of all disturbed areas shall be stabilized during and after construction as soon as practical but no more than fourteen (14) days after construction activity has temporarily or permanently ceased on that portion of the site. Temporary measures shall be taken during construction to prevent erosion and siltation. No construction sediment shall be allowed to enter any infiltration systems or the raingarden. All disturbed slopes will be stabilized with a permanent vegetative cover. Stabilization netting or tackifier applied with hydroseeding shall be used on all slopes 3:1 or greater. Some or all of the following measures will be utilized on this project as conditions may warrant.

a. Temporary Seeding
b. Temporary Mulching
c. Permanent Seeding
d. Placement of Sod
e. Hydroseeding
f. Placement of Hay
g. Placement of Jute Netting

Street Sweeping

Any sediment tracked onto public right-of-ways or parking areas shall be swept at the end of each working day.

Subsurface Infiltration

The performance of the subsurface infiltration facilities shall be checked weekly and after every major storm event during construction. No construction period runoff should be directed into the subsurface infiltration facilities. Excavation for the facility shall be performed from the edge of the facility location to avoid compaction of the parent material. Prior to the installation of the top surface, implement erosion and sediment controls around the perimeter of the open system to prevent sheet flow or windblown sediment from entering the system.

Deep Sump Catchbasins

The performance of the deep sump catchbasins shall be checked weekly and after every major storm event during construction. Prevent construction period runoff from being discharged into the units until construction is complete and soil is stabilized.

Interim Erosion Control

Additional erosion control measures shall be implemented as conditions warrant during construction or as directed by the owner or owner's representative.

Construction Entrance

Install the construction entrance as shown on the detail sheet. The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic topdressing with additional stone. Inspect entrance/exit pad and sediment disposal area weekly and after heavy rains or heavy use. Remove mud and sediment tracked or washed onto public roads immediately. Mud and soil particles will eventually clog the voids in the gravel and the effectiveness of the gravel pad will not be satisfactory. When this occurs, the pad should be top dressed with new stone. Complete replacement of the pad may be necessary when the pad becomes completely clogged. Reshape pad as needed for drainage and runoff control. Repair any broken road pavement immediately.

Topsoil Stockpile

Locate the topsoil stockpile so it does not interfere with work on the site maintaining a 50' buffer from conservation areas. Side slopes of the stockpile should not exceed 2:1. Surround all stockpiles with silt fence or erosion control socks. Either seed or cover stockpiles with clear plastic or other mulching materials within 7 days of the formation of the stockpile.

Outlet Protection

Inspect rip rap outlet structures after heavy rains for erosion at sides and ends of apron and for stone displacement. Rock may need to be added if sediment builds up in the pore spaces of the outlet pad. Make repairs immediately using appropriate stone sizes. Do not place stones above finished grade.

Removal

When construction is complete, the contractor shall remove all siltation devices after re-vegetation of disturbed areas and after approval from the City and project engineer.

Provisions for storing paints, cleaners, automotive waste and other potentially hazardous household waste products inside or under cover

- All materials on site will be stored inside in a neat, orderly, manner in their appropriate containers with the original manufacturer's label. Appropriate cover of materials shall be provided to prevent these chemicals from contact with rainwater.
- Only store enough material necessary. Whenever possible, all of a product shall be used up before disposing of container
- Manufacturer, local, and State recommendations for proper use and disposal shall be followed.

Construction Vehicles & Equipment

- At the end of each work day, all construction vehicles shall be parked outside conservation jurisdiction.
- All fueling and maintenance of vehicles and equipment shall be performed outside resource buffer zones. Storage, handling and disposal of fuels and liquids in relation to construction vehicles and equipment shall be conducted in compliance with National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges from Construction Activities (CGP) 2012 Section 2.3.

Spill prevention and response plans

- Spill Control Practices shall be in conformance with the guidelines set forth in the National Pollutant Discharge Elimination System (NPDES) CGP 2012.
- Clean up spills immediately, using dry cleanup methods where possible and dispose of used materials properly. Do not clean surfaces or spills by hosing the area down. Eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.
- Spill kits shall be readily available onsite during construction.

Provisions for maintenance of lawns, gardens, and other landscaped areas

- Grass shall not be cut shorter than 2 to 3 inches.
- Refer to landscape plans for maintenance of planted areas.
- Use low volume water approaches such as drip-type or sprinkler systems. Water plants only when needed to enhance root growth and avoid runoff problems.
- Mulch shall be utilized where possible. Mulch helps retain water and prevents erosion.

Requirements for storage and use of fertilizers, herbicides and pesticides

- Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.
- Do not fertilize before a rainstorm.
- Consider using organic fertilizers. They release nutrients more slowly.
- Pesticides shall be applied on lawns and gardens only when necessary and applied only in the minimum amounts recommended by the manufacturer.

Provisions for solid waste management

- All solid waste shall be disposed of or recycled in accordance with local city regulations.

Snow disposal and plowing

- Snow shall be plowed and stored on gravel, grass, or other permeable surfaces to allow filtration to occur.
- Avoid disposing snow on top of storm drain catchbasins or stormwater drainage swale.

Winter Road Salt and/or Sand use and storage restrictions

- Salt storage should be located outside conservation jurisdiction and shall be covered at all times.
- The amount of road salt applied should be regulated to prevent over salting of roadways and increasing runoff concentrations. Alternative materials, such as sand or gravel, should be used in especially sensitive areas.

Roadway and Parking Lot sweeping schedule

- Pavement sweeping shall be conducted at a frequency of not less than once per year
- Removal of any accumulated sand, grit, and debris from driveway winter maintenance shall be completed in the spring after snow melts for the season.

STORMWATER MANAGEMENT
CONSTRUCTION PHASE

INSPECTION SCHEDULE AND EVALUATION CHECKLIST

PROJECT LOCATION: 108 Sohier Road, Beverly, Massachusetts

Major Event = Rainstorm of ¼-inch or more

Inspection Date	Inspector	Area Inspected	Best Management Practice (yes/no)	Required Inspection Frequency if BMP	Comments	Recommendation	Follow-up Inspection Required (yes/no)
		Erosion Control Sock	No	Weekly and After Major Storm Events			
		Storm Drain Inlet Protection	Yes	Weekly and After Major Storm Events			
		Deep Sump Catchbasins	Yes	Weekly and After Major Storm Events			
		Subsurface Infiltration Facility	Yes	Weekly and After Major Storm Events			
		Construction Entrance	No	Weekly and After Major Storm Events			
		Soil Stockpile Area	No	Weekly and After Major Storm Events			
		Outlet Protection	Yes	Weekly and After Major Storm Events			

(1) Refer to the Massachusetts Stormwater Handbook, Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspection and maintenance of specific BMP's.

(2) Inspections to be conducted by a qualified professional knowledgeable in the principles & practice of erosion and sediment controls and pollution prevention

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.
Other notes: (Include deviations from: Con. Comm. Order of Conditions, PB Approval, Construction Sequence and Approved Plan)
Stormwater Control Manager: _____

OPERATION AND
LONG TERM MAINTENANCE PLAN

located at

108 SOHIER ROAD
BEVERLY, MASSACHUSETTS

Applicant:

Harborlight Community Partners, Inc.
P.O. Box 507
Beverly, Massachusetts 01915

Prepared by:

Meridian Associates, Inc.
500 Cummings Center, Suite 5950
Beverly, Massachusetts 01915
(978) 299-0447

September 17, 2018
Revised: October 15, 2019

Project Name: Anchor Point - 108 Sohier Road
Beverly, Massachusetts

Owner Name: 108 Sohier, LLC
208 Main Street
Wenham, Massachusetts 01984

Party Responsible for Maintenance: Harborlight Community Partners, Inc.
P.O. Box 507
Beverly, Massachusetts 01915
Kristin Carlson, RA, LEED GA
978-922-1305 x210

Project Description:

The locus property is comprised of approximately 5.07± acres located at 108 Sohier Road in Beverly, Massachusetts. The site is bound by Sohier Road to the east, Tozer Road to the west and Northshore Education Consortium to the north.

The site has been previously developed as a 2.6± acre parking lot and recently used as a construction staging area. Topography ranges from 3-5% within the existing paved areas. An undeveloped wooded portion of the site is located along Tozer Road where the existing grades range from 35%-45% slopes.

The applicant, Harborlight Community Partners, Inc. (HCP) is proposing a mixed use development which will include two (2) residential buildings (consisting of 77 units of affordable two and three-bedroom rental apartments for families), and one (1) multi-use building that will house multi-purpose community spaces, management offices, and new corporate offices for HCP. Site access will be provided via two (2) connected driveways off Sohier Road. Associated parking, utilities and open spaces are also provided.

<u>Inspection and Maintenance Measures After Construction</u>

In accordance with the City of Beverly requirements, inspection and maintenance documents shall be submitted to the Planning Department once annually due by December 31 of the calendar year in which the inspections were performed. Documents shall include an account of any maintenance activity performed as well as any discovered deficiencies and associated repairs.

Erosion Control

Eroded sediments can adversely affect the performance of the stormwater management system. Eroding or barren areas should be immediately re-vegetated.

Subsurface Infiltration Facilities

The facilities should be inspected after the first several rainfall events or first few months after construction, after all major storms (2-year), and on regular bi-annual scheduled dates. Open provided inspection ports and visually inspect for sediment and or ponded water. Ponded water inside the system after several days often indicates that the bottom of the system is clogged. A stadia rod may be used to measure the depth of sediment if any in the row. If the depth of sediment is in excess of 3" then

the row should be cleaned with high pressure water through a culvert cleaning nozzle. Refer to maintenance guide from manufacturer for additional detail.

Debris and Litter Removal

Trash may collect in the BMP's, potentially causing clogging of the facilities. All debris and litter shall be removed when necessary, and after each storm event.

Deep Sump Catchbasins

The catchbasins shall be inspected two (2) times per year, and if necessary, any maintenance shall be performed so that it functions as designed. The catchbasins shall be cleaned once per year or when sediment in the bottom of the sump reaches 24 inches below the bottom of the outlet. Inlet and outlet pipes should be checked for clogging. Catchbasin grates shall be kept free of snow and ice in the winter months and kept free of leaves, sand and debris during warmer months. At a minimum, inspection of the catchbasin shall be performed during the last week of April and the first week of October each year.

Outlet Protection

Inspect rip rap outlet structures after heavy rains for erosion at sides and ends of apron and for stone displacement. Rock may need to be added if sediment builds up in the pore spaces of the outlet pad. Make repairs immediately using appropriate stone sizes. Do not place stones above finished grade.

<u>Good Housekeeping Practices</u> (in accordance with Standard 10 of the Stormwater Management Handbook to prevent illicit discharges)

Provisions for storing paints, cleaners, automotive waste and other potentially hazardous household waste products inside or under cover

- All materials on site will be stored inside in a neat, orderly, manner in their appropriate containers with the original manufacturer's label.
- Only store enough material necessary. Whenever possible, all of a product shall be used up before disposing of container
- Manufacturer, local, and State recommendations for proper use and disposal shall be followed.

Vehicle washing controls

- A commercial car wash shall be used when possible. Car washes treat and/or recycle water.
- Cars shall be washed on gravel, grass, or other permeable surfaces to allow filtration to occur.
- Use biodegradable soaps.
- A water hose with a nozzle that automatically turns off when left unattended.

Requirements for routine inspection and maintenance of stormwater BMPs

- See Inspection and Maintenance Measures after Construction.

Spill prevention and response plans

- Spill Control Practices shall be in conformance with the guidelines set forth in the National Pollutant Discharge Elimination System (NPDES) Stormwater Pollution Prevention Plan (SWPPP)

General provisions for maintenance of lawns, gardens, and other landscaped areas

- Refer to landscape construction plans for maintenance of planted areas.
- Grass shall not be cut shorter than 2 to 3 inches.
- Use low volume water approaches such as drip-type or sprinkler systems. Water plants only when needed to enhance root growth and avoid runoff problems.
- Mulch shall be utilized where possible. Mulch helps retain water and prevents erosion.

Requirements for storage and use of fertilizers, herbicides and pesticides

- Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.
- Do not fertilize before a rainstorm.
- Consider using organic fertilizers. They release nutrients more slowly.
- Pesticides shall be applied on lawns and gardens only when necessary and applied only in the minimum amounts recommended by the manufacturer.

Pet waste management

- Scoop up and seal pet wastes in a plastic bag. Dispose of properly, in the garbage.

Provisions for operation and management of septic systems

- Not Applicable

Provisions for solid waste management

- All solid waste shall be disposed of or recycled in accordance with local city regulations.

Roadway and Parking Lot sweeping schedule

- Pavement sweeping shall be conducted at a frequency of not less than once per year
- Removal of any accumulated sand, grit, and debris from driveway winter maintenance shall be completed in the spring, shortly after snow melts for the season.

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

- Not Applicable

Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan

- To be determined by the owner.

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

- To be determined by the owner.

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STORMWATER MANAGEMENT
POST-CONSTRUCTION PHASE

INSPECTION SCHEDULE AND EVALUATION CHECKLIST

PROJECT LOCATION: 108 Sohier Road, Beverly, Massachusetts

Inspection Date	Inspector	Area Inspected	Best Management Practice (yes/no)	Required Inspection Frequency if BMP	Recommendation	Follow-up Inspection Required (yes/no)
		Deep Sump Catchbasins	Yes	2 Times per year (Inspect and clean as necessary)		
		Subsurface Infiltration Facility	Yes	Twice a year		
		Outlet Protection	Yes	Once a year		

Comments: _____

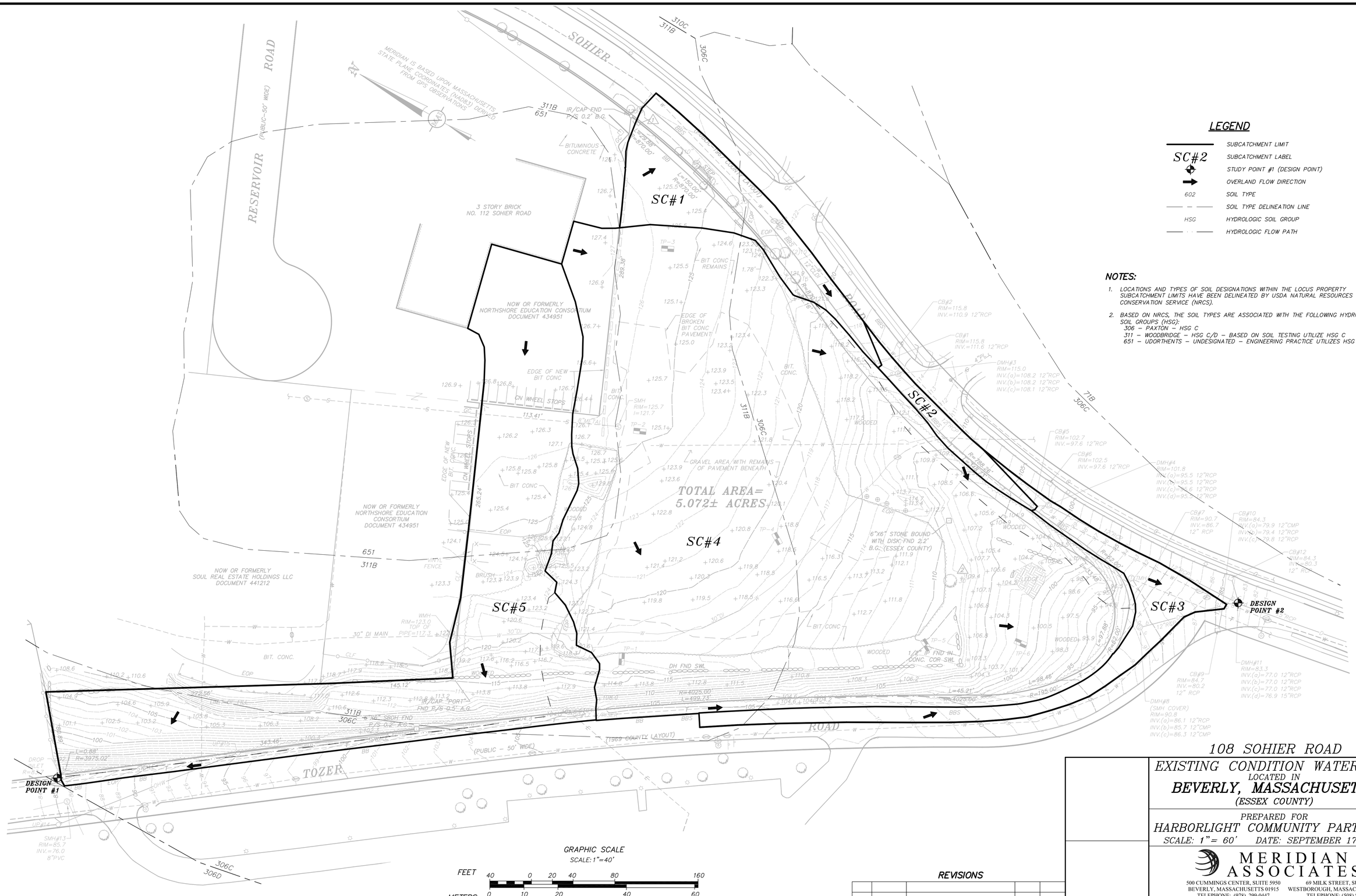
_____

(1) Refer to the Massachusetts Stormwater Handbook, Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspection and maintenance of specific BMP's.

(2) Inspections to be conducted by a qualified professional knowledgeable in the principles & practice of erosion and sediment controls and pollution prevention

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.
Other notes: (Include deviations from: Con. Comm. Order of Conditions, PB Approval and Approved Plan)

Stormwater Control Manager: _____



LEGEND

———	SUBCATCHMENT LIMIT
SC#2	SUBCATCHMENT LABEL
⊕	STUDY POINT #1 (DESIGN POINT)
➡	OVERLAND FLOW DIRECTION
602	SOIL TYPE
—— – ——	SOIL TYPE DELINEATION LINE
HSG	HYDROLOGIC SOIL GROUP
—— · · ——	HYDROLOGIC FLOW PATH

NOTES:

1. LOCATIONS AND TYPES OF SOIL DESIGNATIONS WITHIN THE LOCUS PROPERTY SUBCATCHMENT LIMITS HAVE BEEN DELINEATED BY USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS).
2. BASED ON NRCS, THE SOIL TYPES ARE ASSOCIATED WITH THE FOLLOWING HYDROLOGIC SOIL GROUPS (HSG):
   306 – PAXTON – HSG C
   311 – WOODBRIDGE – HSG C/D – BASED ON SOIL TESTING UTILIZE HSG C
   651 – UDORTHENTS – UNDESIGNATED – ENGINEERING PRACTICE UTILIZES HSG C

REVISIONS

NO.	DATE	DESCRIPTION	BY	CHK'D
1	10/15/19	NO REVISIONS TO THIS SHEET	ACF	ACF

DWG. No. 6063_PRE
(XREF: 6063_REC)

108 SOHIER ROAD

EXISTING CONDITION WATERSHED

LOCATED IN

BEVERLY, MASSACHUSETTS

(ESSEX COUNTY)

PREPARED FOR

HARBORLIGHT COMMUNITY PARTNERS

SCALE: 1"= 60' DATE: SEPTEMBER 17, 2018

MERIDIAN ASSOCIATES
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SHEET No. 1 OF 2 PROJECT No. 6063

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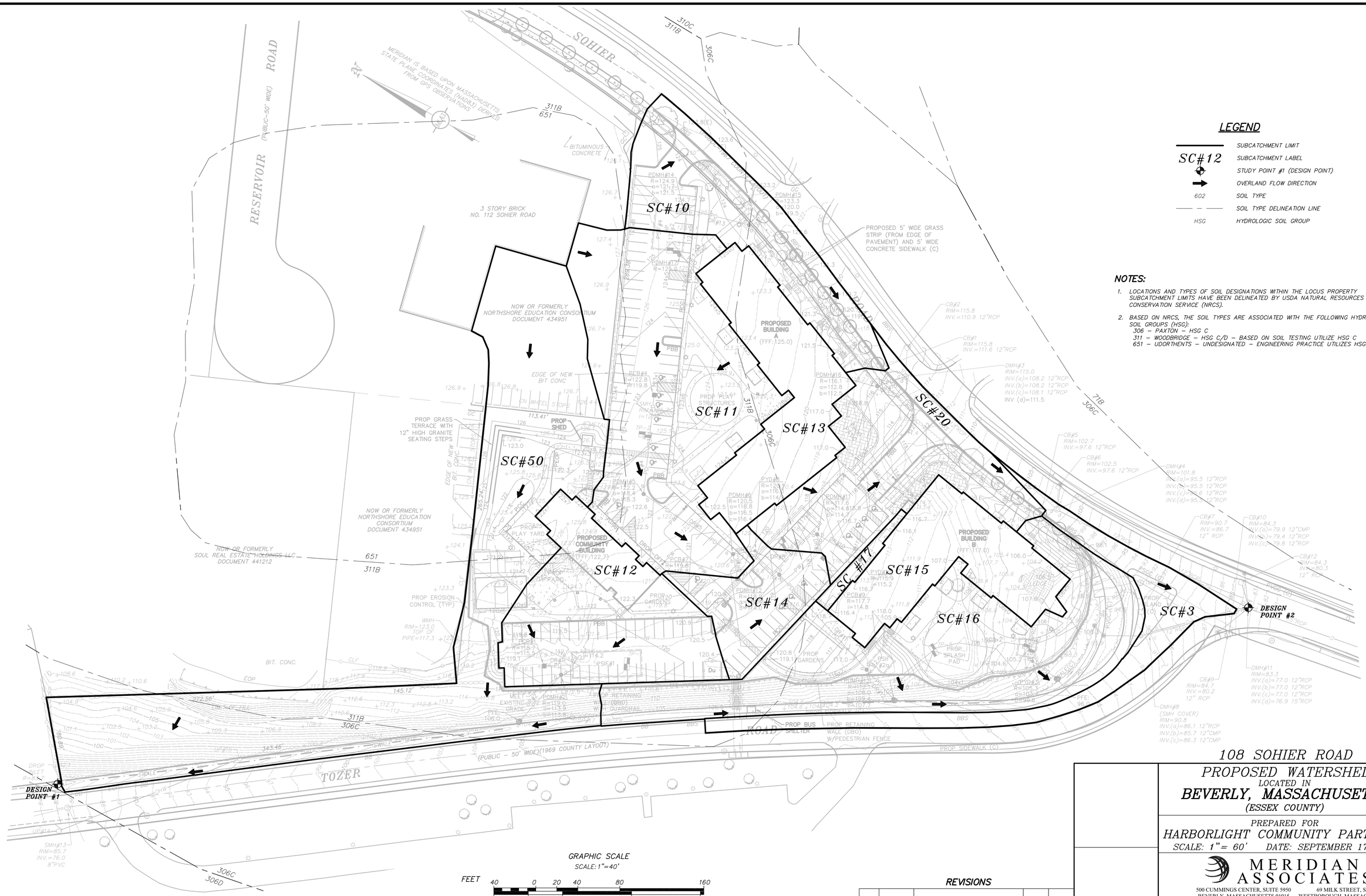

LEGEND

———	SUBCATCHMENT LIMIT
SC#12	SUBCATCHMENT LABEL
⊕	STUDY POINT #1 (DESIGN POINT)
➡	OVERLAND FLOW DIRECTION
602	SOIL TYPE
—— – ——	SOIL TYPE DELINEATION LINE
HSG	HYDROLOGIC SOIL GROUP

NOTES:

1. LOCATIONS AND TYPES OF SOIL DESIGNATIONS WITHIN THE LOCUS PROPERTY SUBCATCHMENT LIMITS HAVE BEEN DELINEATED BY USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS).
2. BASED ON NRCS, THE SOIL TYPES ARE ASSOCIATED WITH THE FOLLOWING HYDROLOGIC SOIL GROUPS (HSG):
   306 – PAXTON – HSG C
   311 – WOODBRIDGE – HSG C/D – BASED ON SOIL TESTING UTILIZE HSG C
   651 – UDORTHENTS – UNDESIGNATED – ENGINEERING PRACTICE UTILIZES HSG C

GRAPHIC SCALE
SCALE: 1"=40'

FEET 40 0 20 40 80 160
METERS 0 10 20 40 60

REVISIONS

NO.	DATE	DESCRIPTION	BY	CHK'D
1	10/15/19	RECONFIG COMMUNITY BLDG AREA	ACF	ACF

DWG. No. 6063_POST
(XREF: 6063_REC)

108 SOHIER ROAD

PROPOSED WATERSHED
LOCATED IN
BEVERLY, MASSACHUSETTS
(ESSEX COUNTY)

PREPARED FOR
HARBORLIGHT COMMUNITY PARTNERS

SCALE: 1"= 60' DATE: SEPTEMBER 17, 2018

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