

STORMWATER ANALYSIS AND CALCULATIONS

for

**7 SOHIER ROAD
BEVERLY, MASSACHUSETTS**

Prepared for:

Briscoe Village LLC
c/o Beacon Communities
Two Center Plaza, Suite 700
Boston, Massachusetts 02108

Prepared by:

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

May 13, 2020



TABLE OF CONTENTS

Calculation Methods

Source of Data

Report Summary:

- * Calculation Objectives
- * Selection of Storm Events
- * Classification of Soils
- * Existing Conditions Overview
- * Proposed Conditions Overview
- * Summary of Flows at All Design Points
- * Conclusion

Stormwater Analysis:

- * Existing Conditions
 - Watershed Routing Diagram
 - 2-Year 24 Hour Storm Event Analysis
 - 10-Year 24 Hour Storm Event Analysis
 - 100-Year 24 Hour Storm Event Analysis
- * Proposed Conditions
 - Watershed Routing Diagram
 - 2-Year 24 Hour Storm Event Analysis
 - 10-Year 24 Hour Storm Event Analysis
 - 100-Year 24 Hour Storm Event Analysis

Appendix:

- * NRCS Soil Map
- * NOAA Atlas 14 Precipitation Frequency Estimates
- * Existing Watershed Plan
- * Proposed Watershed Plan

CALCULATION METHODS

- TR 20 SCS Unit Hydrograph Procedure
- Runoff Curve Numbers
- Time of Concentration by TR55 Methodology
- Reach and Pond Rating by the Storage-Indication Method
- Manning Equation

SOURCE OF DATA

- Technical Report No. 20
- Technical Report No. 55
- NOAA Atlas 14, Volume 10
- 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 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. It is worth noting that the project is not subject to the Wetlands Protection Act but is subject to the City of Beverly Stormwater and Construction Site Management Ordinance. In accordance with the Ordinance, the design incorporates techniques from the MA Stormwater Management Standards to promote treatment, recharge and mitigation of stormwater from the proposed development.

Selection of Storm Events

The storm events have been compiled from the Soil Conservation Service Technical Report No. 55 and NOAA Atlas 14, Volume 10, point precipitation frequency estimates. Rainfall frequency data has been provided as follows:

<u>Frequency (Years)</u>	<u>Rainfall [24-Hour Event (inches)]</u>
2	3.17
10	5.01
100	7.92

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 and confirmed by 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:

602: Urban Land - no hydrologic soil group rating defined

Hydrologic soil groups are assigned to each soil type by NRCS based on their potential rate of water infiltration. Urban Land is area comprised of excavated, filled and manmade land. Due to the variable condition, no hydrologic group rating is defined by NRCS. Soil testing on the locus property confirm the presence of loamy sand parent materials. We have therefore utilized a hydrologic group rating of B for the property. Group B soils typically have moderate infiltration rates when thoroughly wet and consist of loamy sands and sandy loams.

Existing Conditions Overview

The locus property is comprised of approximately 8.4 acres located at the intersection of Sohier Road and Colon Street with an address of 7 Sohier Road, Beverly Massachusetts. The project site is currently occupied by the now vacant Briscoe Middle School building, associated parking,

driveways, turf bowl green space as well as an open playing field. The remaining groundcovers onsite are limited wooded and brush areas along the property boundary. The topography of the site consists of mild slopes ranging from 1% to 5% on the majority of the property. Slopes within portions of the vegetated outer edges of the property lines increase to upwards of 10%-15%. The site is surrounded by residentially developed properties.

For the purpose of analyzing existing and proposed stormwater runoff, two design points have been designated for comparison. Each design point is a structure within the municipal stormwater system which directs flow towards a different outfall in the city.

Existing Design Points and Subcatchment Area:

Design Point #1 selected is existing DMH5 which directs stormwater into the Rantoul Street municipal culvert system. A single subcatchment area, SC#2, contributes stormwater to this design point. SC#2 includes the southern portion of the property and generates stormwater runoff via overland flow either over lawn or roadways culminating at existing CB4 and ultimately DMH5.

Design Point #2 is an existing municipal 18" drain line located in Sohier Road just north of the locus property between Swan Street and Mason Street. This municipal line collects stormwater from varying structures and directs stormwater west towards Cabot Street and ultimately Shoe Pond. Five subcatchment areas direct stormwater runoff to this design point as part of this hydrologic study. These subcatchment areas include the existing Briscoe building, parking areas, the existing playing field and runoff from the neighbor at 33 Sohier Road. Each separate subcatchment area directs stormwater into a conventional pipe and structure system which gradually ties together within the municipal system at design point #2.

Proposed Conditions Overview

The applicant is proposing to preserve the historic school and rehabilitate the building with the creation of affordable senior housing apartments and renovations to maintain the existing internal theatre. Creation of dedicated parking areas as well as walkways and terraces are proposed. Associated grading, utilities and stormwater management improvements have been incorporated into the design as well. Additionally, two existing green spaces within the locus area (the turf bowl at the south and playing field at the east) comprise greater than two acres of land and will remain as part of this project.

Stormwater Management:

This proposal utilizes conventional stormwater management techniques for recharge, treatment and mitigation of stormwater. Incorporated in this design are CDS hydrodynamic water quality treatment structures, subsurface infiltration facilities and deep sump catchbasin structures. 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 portions of the new paved driveways and parking areas. A TSS removal rate of 80% is achieved by this BMP.

Contech CDS Hydrodynamic Water Quality Unit:

The Contech CDS is a continuous deflective separation technology which screens, separates and traps debris, sediment, oil and grease from stormwater runoff. Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber. Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where floatables and neutrally buoyant debris larger than screen apertures are trapped. Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

This BMP achieves a TSS Removal Rate of 80% based on proprietary structure sizing calculations issued by MA DEP effective on October 15, 2013.

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 Point and Subcatchment Areas:

The design points remain the same in the existing and proposed conditions and are defined as such on both the watershed plans and in the hydrologic model. Each proposed subcatchment area encompass a similar overall area to the existing conditions. Subcatchment areas which have not changed from existing to proposed condition have the same numerical designation. General descriptions are as follows:

Subcatchments SC#20 and SC#21 contribute stormwater to Design Point #1. SC#20 contributes overland flow from the southern portion of the locus through the turf bowl area in a similar manner to existing subcatchment SC#2. SC#21 includes the proposed parking and access area along Colon Street. Stormwater will be directed into conventional structures for treatment and culminate into infiltration facility #1 for recharge and mitigation of runoff. Overflow from this facility is directed to Design Point #1.

The remaining 7 subcatchment areas ultimately contribute runoff to Design Point #2. These include the existing building (delineated as SC#1 in each analysis as it does not change), proposed parking areas, proposed residential terrace and lawn, runoff from #33 Sohier as well as the existing playing field to remain. Each area apart from SC#31 directs runoff into conventional pipe and structure systems which culminate at Design Point #2. Stormwater

directly discharging towards the municipal system from the parking areas will receive additional treatment via CDS water quality units. Runoff from SC#31 is directed into proposed infiltration basin #2 for recharge and mitigation of runoff. Overflow is directed to Design Point #2.

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:

	<u>2-Year 24-Hour Storm Event</u>	<u>10-Year 24-Hour Storm Event</u>	<u>100-Year 24-Hour Storm Event</u>
Existing	5.1 CFS	10.6 CFS	19.8 CFS
Proposed	3.4 CFS	9.7 CFS	18.4 CFS

Design Point #2:

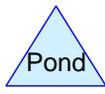
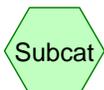
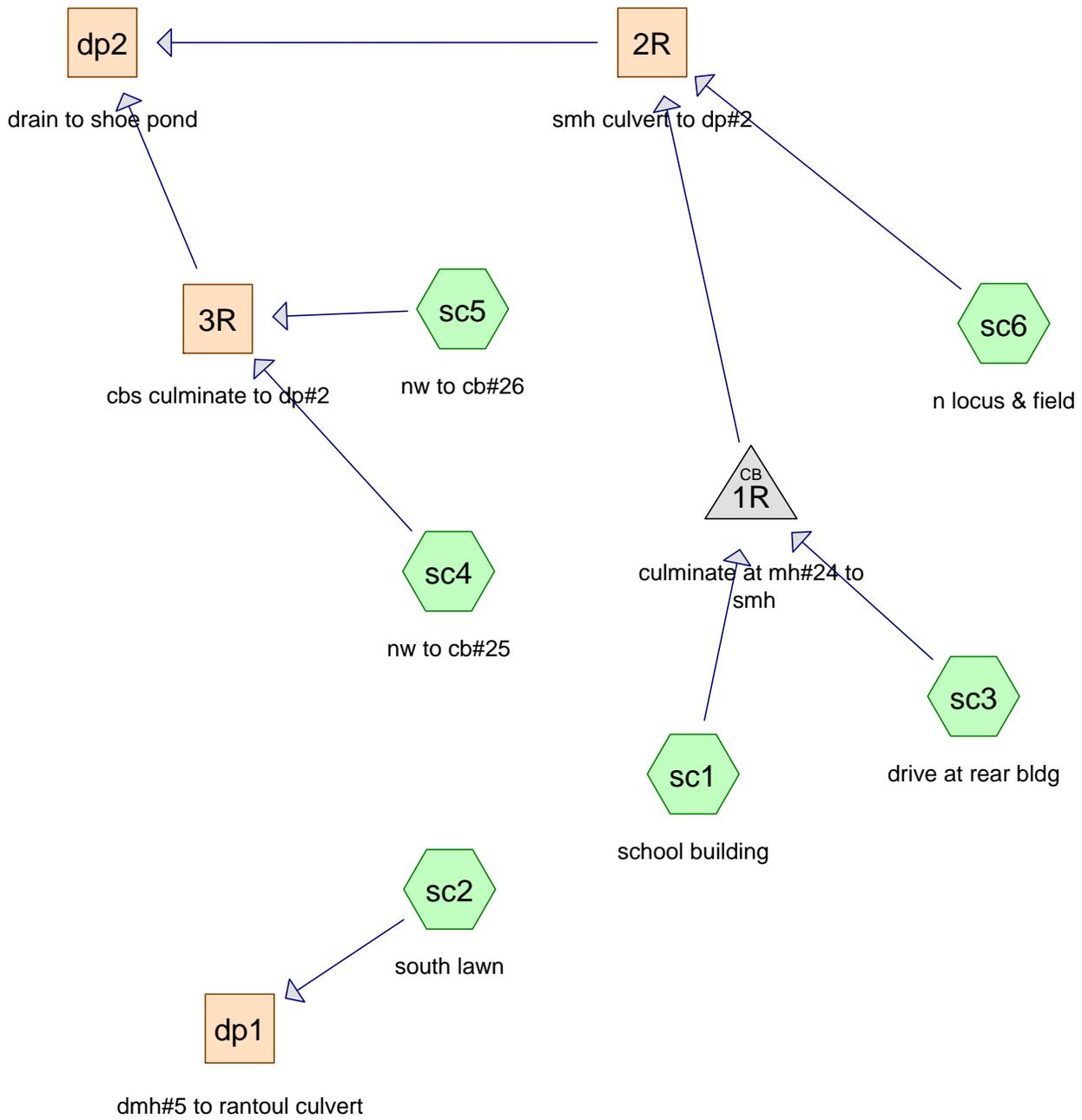
	<u>2-Year 24-Hour Storm Event</u>	<u>10-Year 24-Hour Storm Event</u>	<u>100-Year 24-Hour Storm Event</u>
Existing	9.2 CFS	16.6 CFS	29.4 CFS
Proposed	8.5 CFS	16.1 CFS	29.3 CFS

Conclusion

The calculations indicate peak flows have been met or reduced for the 2-year, 10-year and 100-year storm events. In addition, the design incorporates strategies from the MA DEP Stormwater Management Standards to promote stormwater treatment and recharge.

P:\6293_7 Sohler Rd., Beverly\ADMIN\Reports\Stormwater Analysis&Calcs_2020-05-13\6293-Analysis.doc

**EXISTING CONDITIONS
WATERSHED ROUTING DIAGRAM**



**EXISTING CONDITIONS
2-YEAR 24-HOUR STORM EVENT ANALYSIS**

Summary for Subcatchment sc1: school building

Runoff = 4.2 cfs @ 12.08 hrs, Volume= 14,538 cf, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

Area (sf)	CN	Description
* 59,435	98	impervious area
59,435		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 sc2: south lawn

Runoff = 5.1 cfs @ 12.13 hrs, Volume= 17,705 cf, Depth> 1.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

Area (sf)	CN	Description
* 78,390	98	impervious area
68,890	61	>75% Grass cover, Good, HSG B
147,280	81	Weighted Average
68,890		46.77% Pervious Area
78,390		53.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.2		Sheet Flow, at bowl Grass: Short n= 0.150 P2= 3.17"
4.3	198	0.0120	0.8		Shallow Concentrated Flow, overland thru lawn Short Grass Pasture Kv= 7.0 fps
0.1	21	0.0380	4.0		Shallow Concentrated Flow, to cb Paved Kv= 20.3 fps
9.2	269	Total			

Summary for Subcatchment sc3: drive at rear bldg

Runoff = 2.8 cfs @ 12.09 hrs, Volume= 8,859 cf, Depth> 2.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

	Area (sf)	CN	Description
*	36,415	98	impervious area
	9,550	61	>75% Grass cover, Good, HSG B
	3,745	85	Gravel roads, HSG B
	49,710	90	Weighted Average
	13,295		26.75% Pervious Area
	36,415		73.25% 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: nw to cb#25

Runoff = 1.7 cfs @ 12.08 hrs, Volume= 5,459 cf, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

	Area (sf)	CN	Description
*	22,980	98	impervious area
	2,090	61	>75% Grass cover, Good, HSG B
	25,070	95	Weighted Average
	2,090		8.34% Pervious Area
	22,980		91.66% Impervious Area

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

Summary for Subcatchment sc5: nw to cb#26

Runoff = 0.6 cfs @ 12.15 hrs, Volume= 2,084 cf, Depth> 1.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

	Area (sf)	CN	Description
*	8,675	98	impervious area
	6,880	61	>75% Grass cover, Good, HSG B
	1,300	85	Gravel roads, HSG B
	1,485	58	Woods/grass comb., Good, HSG B
	1,695	55	Woods, Good, HSG B
	20,035	78	Weighted Average
	11,360		56.70% Pervious Area
	8,675		43.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0120	0.1		Sheet Flow, grass high point Grass: Short n= 0.150 P2= 3.17"
2.5	105	0.0100	0.7		Shallow Concentrated Flow, overland to sohier Short Grass Pasture Kv= 7.0 fps
0.9	98	0.0080	1.8		Shallow Concentrated Flow, sohier to cb Paved Kv= 20.3 fps
10.3	253	Total			

Summary for Subcatchment sc6: n locus & field

Runoff = 0.6 cfs @ 12.41 hrs, Volume= 4,384 cf, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

Area (sf)	CN	Description
* 1,060	98	impervious area
85,680	61	>75% Grass cover, Good, HSG B
3,740	85	Gravel roads, HSG B
10,895	58	Woods/grass comb., Good, HSG B
21,450	55	Woods, Good, HSG B
122,825	61	Weighted Average
121,765		99.14% Pervious Area
1,060		0.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0050	0.1		Sheet Flow, field Grass: Short n= 0.150 P2= 3.17"
9.6	360	0.0080	0.6		Shallow Concentrated Flow, length of field to woods Short Grass Pasture Kv= 7.0 fps
0.9	85	0.0940	1.5		Shallow Concentrated Flow, to bowl cb Woodland Kv= 5.0 fps
20.3	495	Total			

Summary for Reach 2R: smh culvert to dp#2

Inflow Area = 231,970 sf, 41.78% Impervious, Inflow Depth > 1.44" for noaa-2yr event

Inflow = 7.1 cfs @ 12.09 hrs, Volume= 27,781 cf

Outflow = 7.1 cfs @ 12.09 hrs, Volume= 27,781 cf, 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 3R: cbs culminate to dp#2

Inflow Area = 45,105 sf, 70.18% Impervious, Inflow Depth > 2.01" for noaa-2yr event
 Inflow = 2.1 cfs @ 12.10 hrs, Volume= 7,544 cf
 Outflow = 2.1 cfs @ 12.10 hrs, Volume= 7,544 cf, 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: dmh#5 to rantoul culvert

Inflow Area = 147,280 sf, 53.23% Impervious, Inflow Depth > 1.44" for noaa-2yr event
 Inflow = 5.1 cfs @ 12.13 hrs, Volume= 17,705 cf
 Outflow = 5.1 cfs @ 12.13 hrs, Volume= 17,705 cf, 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 dp2: drain to shoe pond

Inflow Area = 277,075 sf, 46.40% Impervious, Inflow Depth > 1.53" for noaa-2yr event
 Inflow = 9.2 cfs @ 12.09 hrs, Volume= 35,325 cf
 Outflow = 9.2 cfs @ 12.09 hrs, Volume= 35,325 cf, 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 1R: culminate at mh#24 to smh

Inflow Area = 109,145 sf, 87.82% Impervious, Inflow Depth > 2.57" for noaa-2yr event
 Inflow = 7.0 cfs @ 12.08 hrs, Volume= 23,397 cf
 Outflow = 7.0 cfs @ 12.08 hrs, Volume= 23,397 cf, Atten= 0%, Lag= 0.0 min
 Primary = 7.0 cfs @ 12.08 hrs, Volume= 23,397 cf

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

Peak Elev= 29.84' @ 12.08 hrs

Flood Elev= 35.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.80'	15.0" Round Culvert L= 360.0' Ke= 0.500 Inlet / Outlet Invert= 27.80' / 22.70' S= 0.0142 1/1' Cc= 0.900 n= 0.013 Clay tile, Flow Area= 1.23 sf

Primary OutFlow Max=7.0 cfs @ 12.08 hrs HW=29.84' TW=0.00' (Dynamic Tailwater)

↑1=Culvert (Inlet Controls 7.0 cfs @ 5.7 fps)

**EXISTING CONDITIONS
10-YEAR 24-HOUR STORM EVENT ANALYSIS**

Summary for Subcatchment sc1: school building

Runoff = 6.7 cfs @ 12.08 hrs, Volume= 23,622 cf, Depth> 4.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

Area (sf)	CN	Description
* 59,435	98	impervious area
59,435		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 sc2: south lawn

Runoff = 10.6 cfs @ 12.13 hrs, Volume= 36,684 cf, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

Area (sf)	CN	Description
* 78,390	98	impervious area
68,890	61	>75% Grass cover, Good, HSG B
147,280	81	Weighted Average
68,890		46.77% Pervious Area
78,390		53.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.2		Sheet Flow, at bowl Grass: Short n= 0.150 P2= 3.17"
4.3	198	0.0120	0.8		Shallow Concentrated Flow, overland thru lawn Short Grass Pasture Kv= 7.0 fps
0.1	21	0.0380	4.0		Shallow Concentrated Flow, to cb Paved Kv= 20.3 fps
9.2	269	Total			

Summary for Subcatchment sc3: drive at rear bldg

Runoff = 5.0 cfs @ 12.09 hrs, Volume= 16,083 cf, Depth> 3.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

	Area (sf)	CN	Description
*	36,415	98	impervious area
	9,550	61	>75% Grass cover, Good, HSG B
	3,745	85	Gravel roads, HSG B
	49,710	90	Weighted Average
	13,295		26.75% Pervious Area
	36,415		73.25% 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: nw to cb#25

Runoff = 2.7 cfs @ 12.08 hrs, Volume= 9,246 cf, Depth> 4.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr noaa-10yr Rainfall=5.01"

	Area (sf)	CN	Description
*	22,980	98	impervious area
	2,090	61	>75% Grass cover, Good, HSG B
	25,070	95	Weighted Average
	2,090		8.34% Pervious Area
	22,980		91.66% Impervious Area

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

Summary for Subcatchment sc5: nw to cb#26

Runoff = 1.3 cfs @ 12.14 hrs, Volume= 4,532 cf, Depth> 2.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr noaa-10yr Rainfall=5.01"

	Area (sf)	CN	Description
*	8,675	98	impervious area
	6,880	61	>75% Grass cover, Good, HSG B
	1,300	85	Gravel roads, HSG B
	1,485	58	Woods/grass comb., Good, HSG B
	1,695	55	Woods, Good, HSG B
	20,035	78	Weighted Average
	11,360		56.70% Pervious Area
	8,675		43.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0120	0.1		Sheet Flow, grass high point Grass: Short n= 0.150 P2= 3.17"
2.5	105	0.0100	0.7		Shallow Concentrated Flow, overland to sohier Short Grass Pasture Kv= 7.0 fps
0.9	98	0.0080	1.8		Shallow Concentrated Flow, sohier to cb Paved Kv= 20.3 fps
10.3	253	Total			

Summary for Subcatchment sc6: n locus & field

Runoff = 2.7 cfs @ 12.31 hrs, Volume= 13,992 cf, Depth> 1.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

Area (sf)	CN	Description
* 1,060	98	impervious area
85,680	61	>75% Grass cover, Good, HSG B
3,740	85	Gravel roads, HSG B
10,895	58	Woods/grass comb., Good, HSG B
21,450	55	Woods, Good, HSG B
122,825	61	Weighted Average
121,765		99.14% Pervious Area
1,060		0.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0050	0.1		Sheet Flow, field Grass: Short n= 0.150 P2= 3.17"
9.6	360	0.0080	0.6		Shallow Concentrated Flow, length of field to woods Short Grass Pasture Kv= 7.0 fps
0.9	85	0.0940	1.5		Shallow Concentrated Flow, to bowl cb Woodland Kv= 5.0 fps
20.3	495	Total			

Summary for Reach 2R: smh culvert to dp#2

Inflow Area = 231,970 sf, 41.78% Impervious, Inflow Depth > 2.78" for noaa-10yr event
 Inflow = 12.8 cfs @ 12.09 hrs, Volume= 53,697 cf
 Outflow = 12.8 cfs @ 12.09 hrs, Volume= 53,697 cf, 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 3R: cbs culminate to dp#2

Inflow Area = 45,105 sf, 70.18% Impervious, Inflow Depth > 3.67" for noaa-10yr event
 Inflow = 3.8 cfs @ 12.10 hrs, Volume= 13,778 cf
 Outflow = 3.8 cfs @ 12.10 hrs, Volume= 13,778 cf, 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: dmh#5 to rantoul culvert

Inflow Area = 147,280 sf, 53.23% Impervious, Inflow Depth > 2.99" for noaa-10yr event
 Inflow = 10.6 cfs @ 12.13 hrs, Volume= 36,684 cf
 Outflow = 10.6 cfs @ 12.13 hrs, Volume= 36,684 cf, 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 dp2: drain to shoe pond

Inflow Area = 277,075 sf, 46.40% Impervious, Inflow Depth > 2.92" for noaa-10yr event
 Inflow = 16.6 cfs @ 12.09 hrs, Volume= 67,475 cf
 Outflow = 16.6 cfs @ 12.09 hrs, Volume= 67,475 cf, 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 1R: culminate at mh#24 to smh

Inflow Area = 109,145 sf, 87.82% Impervious, Inflow Depth > 4.37" for noaa-10yr event
 Inflow = 11.7 cfs @ 12.08 hrs, Volume= 39,705 cf
 Outflow = 11.7 cfs @ 12.08 hrs, Volume= 39,705 cf, Atten= 0%, Lag= 0.0 min
 Primary = 11.7 cfs @ 12.08 hrs, Volume= 39,705 cf

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

Peak Elev= 37.92' @ 12.08 hrs

Flood Elev= 35.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.80'	15.0" Round Culvert L= 360.0' Ke= 0.500 Inlet / Outlet Invert= 27.80' / 22.70' S= 0.0142 1/ S Cc= 0.900 n= 0.013 Clay tile, Flow Area= 1.23 sf

Primary OutFlow Max=11.7 cfs @ 12.08 hrs HW=37.87' TW=0.00' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 11.7 cfs @ 9.5 fps)

**EXISTING CONDITIONS
100-YEAR 24-HOUR STORM EVENT ANALYSIS**

Summary for Subcatchment sc1: school building

Runoff = 10.6 cfs @ 12.08 hrs, Volume= 38,010 cf, Depth> 7.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

Area (sf)	CN	Description
* 59,435	98	impervious area
59,435		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 sc2: south lawn

Runoff = 19.8 cfs @ 12.13 hrs, Volume= 69,443 cf, Depth> 5.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

Area (sf)	CN	Description
* 78,390	98	impervious area
68,890	61	>75% Grass cover, Good, HSG B
147,280	81	Weighted Average
68,890		46.77% Pervious Area
78,390		53.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.2		Sheet Flow, at bowl Grass: Short n= 0.150 P2= 3.17"
4.3	198	0.0120	0.8		Shallow Concentrated Flow, overland thru lawn Short Grass Pasture Kv= 7.0 fps
0.1	21	0.0380	4.0		Shallow Concentrated Flow, to cb Paved Kv= 20.3 fps
9.2	269	Total			

Summary for Subcatchment sc3: drive at rear bldg

Runoff = 8.4 cfs @ 12.08 hrs, Volume= 27,842 cf, Depth> 6.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

	Area (sf)	CN	Description
*	36,415	98	impervious area
	9,550	61	>75% Grass cover, Good, HSG B
	3,745	85	Gravel roads, HSG B
	49,710	90	Weighted Average
	13,295		26.75% Pervious Area
	36,415		73.25% 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: nw to cb#25

Runoff = 4.4 cfs @ 12.08 hrs, Volume= 15,284 cf, Depth> 7.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

	Area (sf)	CN	Description
*	22,980	98	impervious area
	2,090	61	>75% Grass cover, Good, HSG B
	25,070	95	Weighted Average
	2,090		8.34% Pervious Area
	22,980		91.66% Impervious Area

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

Summary for Subcatchment sc5: nw to cb#26

Runoff = 2.5 cfs @ 12.14 hrs, Volume= 8,861 cf, Depth> 5.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

	Area (sf)	CN	Description
*	8,675	98	impervious area
	6,880	61	>75% Grass cover, Good, HSG B
	1,300	85	Gravel roads, HSG B
	1,485	58	Woods/grass comb., Good, HSG B
	1,695	55	Woods, Good, HSG B
	20,035	78	Weighted Average
	11,360		56.70% Pervious Area
	8,675		43.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0120	0.1		Sheet Flow, grass high point Grass: Short n= 0.150 P2= 3.17"
2.5	105	0.0100	0.7		Shallow Concentrated Flow, overland to sohier Short Grass Pasture Kv= 7.0 fps
0.9	98	0.0080	1.8		Shallow Concentrated Flow, sohier to cb Paved Kv= 20.3 fps
10.3	253	Total			

Summary for Subcatchment sc6: n locus & field

Runoff = 7.4 cfs @ 12.29 hrs, Volume= 34,469 cf, Depth> 3.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

Area (sf)	CN	Description
* 1,060	98	impervious area
85,680	61	>75% Grass cover, Good, HSG B
3,740	85	Gravel roads, HSG B
10,895	58	Woods/grass comb., Good, HSG B
21,450	55	Woods, Good, HSG B
122,825	61	Weighted Average
121,765		99.14% Pervious Area
1,060		0.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0050	0.1		Sheet Flow, field Grass: Short n= 0.150 P2= 3.17"
9.6	360	0.0080	0.6		Shallow Concentrated Flow, length of field to woods Short Grass Pasture Kv= 7.0 fps
0.9	85	0.0940	1.5		Shallow Concentrated Flow, to bowl cb Woodland Kv= 5.0 fps
20.3	495	Total			

Summary for Reach 2R: smh culvert to dp#2

Inflow Area = 231,970 sf, 41.78% Impervious, Inflow Depth > 5.19" for noaa-100yr event

Inflow = 22.8 cfs @ 12.09 hrs, Volume= 100,321 cf

Outflow = 22.8 cfs @ 12.09 hrs, Volume= 100,321 cf, 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 3R: cbs culminate to dp#2

Inflow Area = 45,105 sf, 70.18% Impervious, Inflow Depth > 6.42" for noaa-100yr event
 Inflow = 6.6 cfs @ 12.10 hrs, Volume= 24,145 cf
 Outflow = 6.6 cfs @ 12.10 hrs, Volume= 24,145 cf, 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: dmh#5 to rantoul culvert

Inflow Area = 147,280 sf, 53.23% Impervious, Inflow Depth > 5.66" for noaa-100yr event
 Inflow = 19.8 cfs @ 12.13 hrs, Volume= 69,443 cf
 Outflow = 19.8 cfs @ 12.13 hrs, Volume= 69,443 cf, 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 dp2: drain to shoe pond

Inflow Area = 277,075 sf, 46.40% Impervious, Inflow Depth > 5.39" for noaa-100yr event
 Inflow = 29.3 cfs @ 12.09 hrs, Volume= 124,466 cf
 Outflow = 29.3 cfs @ 12.09 hrs, Volume= 124,466 cf, 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 1R: culminate at mh#24 to smh

Inflow Area = 109,145 sf, 87.82% Impervious, Inflow Depth > 7.24" for noaa-100yr event
 Inflow = 19.0 cfs @ 12.08 hrs, Volume= 65,852 cf
 Outflow = 19.0 cfs @ 12.08 hrs, Volume= 65,852 cf, Atten= 0%, Lag= 0.0 min
 Primary = 19.0 cfs @ 12.08 hrs, Volume= 65,852 cf

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

Peak Elev= 60.89' @ 12.08 hrs

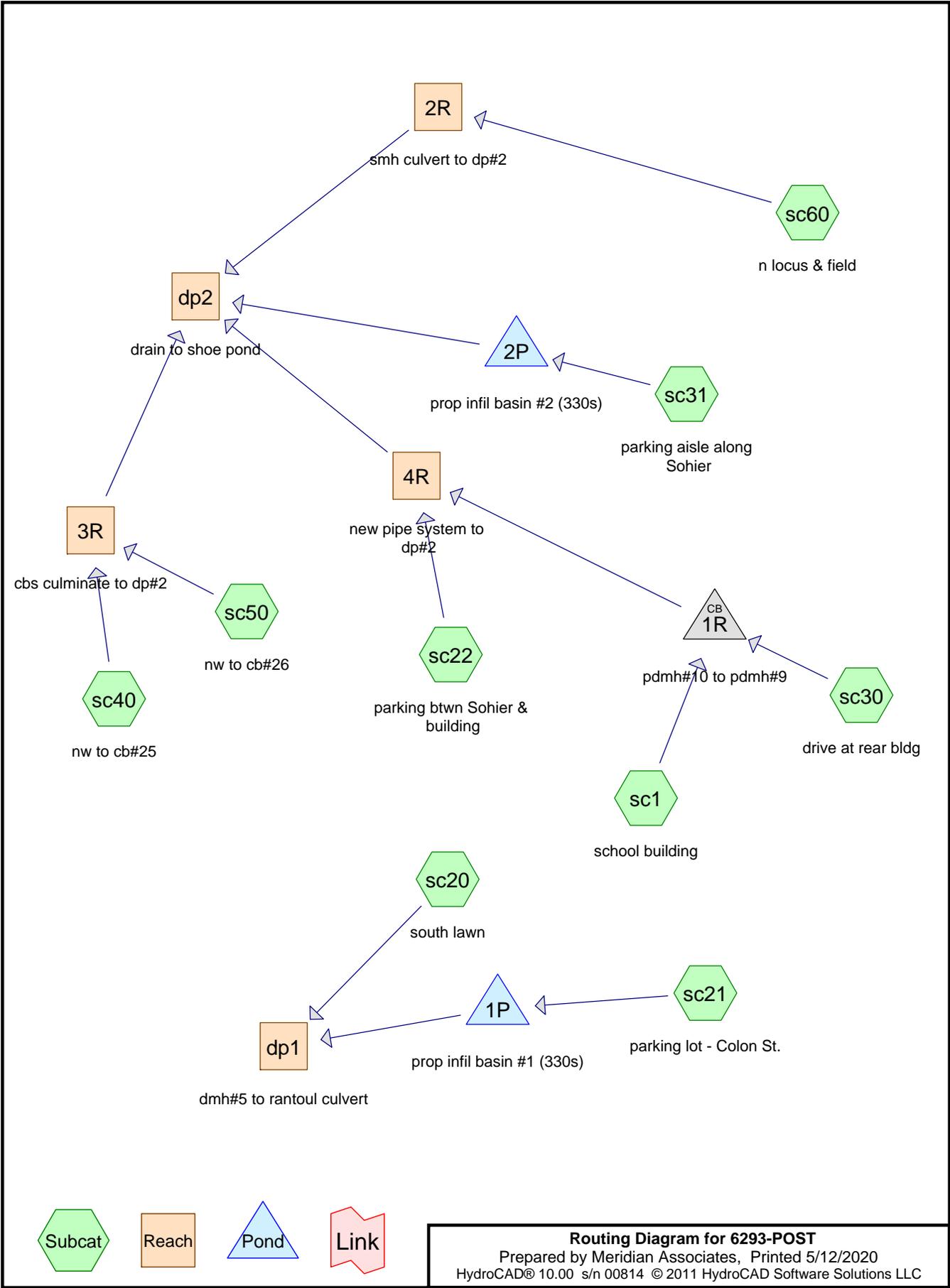
Flood Elev= 35.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.80'	15.0" Round Culvert L= 360.0' Ke= 0.500 Inlet / Outlet Invert= 27.80' / 22.70' S= 0.0142 1' Cc= 0.900 n= 0.013 Clay tile, Flow Area= 1.23 sf

Primary OutFlow Max=19.0 cfs @ 12.08 hrs HW=60.76' TW=0.00' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 19.0 cfs @ 15.5 fps)

**PROPOSED CONDITIONS
WATERSHED ROUTING DIAGRAM**



Routing Diagram for 6293-POST
 Prepared by Meridian Associates, Printed 5/12/2020
 HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

**PROPOSED CONDITIONS
2-YEAR 24-HOUR STORM EVENT ANALYSIS**

6293-POST

Prepared by Meridian Associates

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr noaa-2yr Rainfall=3.17"

Printed 5/12/2020

Page 1

Summary for Subcatchment sc1: school building

Runoff = 4.2 cfs @ 12.08 hrs, Volume= 14,538 cf, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

Area (sf)	CN	Description
* 59,435	98	impervious area
59,435		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 sc20: south lawn

Runoff = 3.4 cfs @ 12.13 hrs, Volume= 11,826 cf, Depth> 1.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

Area (sf)	CN	Description
* 54,015	98	impervious area
44,365	61	>75% Grass cover, Good, HSG B
98,380	81	Weighted Average
44,365		45.10% Pervious Area
54,015		54.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.2		Sheet Flow, at bowl Grass: Short n= 0.150 P2= 3.17"
4.3	198	0.0120	0.8		Shallow Concentrated Flow, overland thru lawn Short Grass Pasture Kv= 7.0 fps
0.1	21	0.0380	4.0		Shallow Concentrated Flow, to cb Paved Kv= 20.3 fps
9.2	269	Total			

Summary for Subcatchment sc21: parking lot - Colon St.

Runoff = 2.4 cfs @ 12.09 hrs, Volume= 7,372 cf, Depth> 2.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

6293-POST

Type III 24-hr noaa-2yr Rainfall=3.17"

Prepared by Meridian Associates

Printed 5/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 2

	Area (sf)	CN	Description
*	31,965	98	impervious area
	8,740	61	>75% Grass cover, Good, HSG B
	660	85	Gravel roads, HSG B
	41,365	90	Weighted Average
	9,400		22.72% Pervious Area
	31,965		77.28% Impervious Area

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

Summary for Subcatchment sc22: parking btwn Sohier & building

Runoff = 0.6 cfs @ 12.08 hrs, Volume= 1,999 cf, Depth> 2.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

	Area (sf)	CN	Description
*	8,645	98	impervious area
	905	61	>75% Grass cover, Good, HSG B
	9,550	94	Weighted Average
	905		9.48% Pervious Area
	8,645		90.52% Impervious Area

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

Summary for Subcatchment sc30: drive at rear bldg

Runoff = 2.8 cfs @ 12.09 hrs, Volume= 8,608 cf, Depth> 1.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

	Area (sf)	CN	Description
*	35,815	98	impervious area
	23,695	61	>75% Grass cover, Good, HSG B
	5,755	85	Gravel roads, HSG B
	65,265	83	Weighted Average
	29,450		45.12% Pervious Area
	35,815		54.88% Impervious Area

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

Summary for Subcatchment sc31: parking aisle along Sohier

Runoff = 1.3 cfs @ 12.08 hrs, Volume= 4,257 cf, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

	Area (sf)	CN	Description
*	12,240	98	impervious area
	800	61	>75% Grass cover, Good, HSG B
*	5,620	98	impervious area
	890	61	>75% Grass cover, Good, HSG B
	19,550	95	Weighted Average
	1,690		8.64% Pervious Area
	17,860		91.36% Impervious Area

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

Summary for Subcatchment sc40: nw to cb#25

Runoff = 0.5 cfs @ 12.09 hrs, Volume= 1,489 cf, Depth> 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

	Area (sf)	CN	Description
*	6,535	98	impervious area
	2,940	61	>75% Grass cover, Good, HSG B
	9,475	87	Weighted Average
	2,940		31.03% Pervious Area
	6,535		68.97% 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 to cb#26

Runoff = 0.4 cfs @ 12.09 hrs, Volume= 1,276 cf, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

6293-POST

Type III 24-hr noaa-2yr Rainfall=3.17"

Prepared by Meridian Associates

Printed 5/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 4

Area (sf)	CN	Description
* 5,225	98	impervious area
4,265	61	>75% Grass cover, Good, HSG B
635	85	Gravel roads, HSG B
10,125	82	Weighted Average
4,900		48.40% Pervious Area
5,225		51.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.2		Sheet Flow, grass high point Grass: Short n= 0.150 P2= 3.17"
0.2	16	0.0380	1.4		Shallow Concentrated Flow, overland to sohier Short Grass Pasture Kv= 7.0 fps
1.3	135	0.0070	1.7		Shallow Concentrated Flow, sohier to cb Paved Kv= 20.3 fps
6.3	201	Total			

Summary for Subcatchment sc60: n locus & field

Runoff = 0.6 cfs @ 12.41 hrs, Volume= 3,969 cf, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-2yr Rainfall=3.17"

Area (sf)	CN	Description
* 1,005	98	impervious area
83,710	61	>75% Grass cover, Good, HSG B
1,845	85	Gravel roads, HSG B
9,600	58	Woods/grass comb., Good, HSG B
15,050	55	Woods, Good, HSG B
111,210	61	Weighted Average
110,205		99.10% Pervious Area
1,005		0.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0050	0.1		Sheet Flow, field Grass: Short n= 0.150 P2= 3.17"
9.6	360	0.0080	0.6		Shallow Concentrated Flow, length of field to woods Short Grass Pasture Kv= 7.0 fps
0.9	85	0.0940	1.5		Shallow Concentrated Flow, to bowl cb Woodland Kv= 5.0 fps
20.3	495	Total			

Summary for Reach 2R: smh culvert to dp#2

Inflow Area = 111,210 sf, 0.90% Impervious, Inflow Depth > 0.43" for noaa-2yr event
 Inflow = 0.6 cfs @ 12.41 hrs, Volume= 3,969 cf
 Outflow = 0.6 cfs @ 12.41 hrs, Volume= 3,969 cf, 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 3R: cbs culminate to dp#2

Inflow Area = 19,600 sf, 60.00% Impervious, Inflow Depth > 1.69" for noaa-2yr event
 Inflow = 0.9 cfs @ 12.09 hrs, Volume= 2,765 cf
 Outflow = 0.9 cfs @ 12.09 hrs, Volume= 2,765 cf, 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 4R: new pipe system to dp#2

Inflow Area = 134,250 sf, 77.39% Impervious, Inflow Depth > 2.25" for noaa-2yr event
 Inflow = 7.6 cfs @ 12.09 hrs, Volume= 25,145 cf
 Outflow = 7.6 cfs @ 12.09 hrs, Volume= 25,145 cf, 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: dmh#5 to rantoul culvert

Inflow Area = 139,745 sf, 61.53% Impervious, Inflow Depth > 1.10" for noaa-2yr event
 Inflow = 3.4 cfs @ 12.13 hrs, Volume= 12,802 cf
 Outflow = 3.4 cfs @ 12.13 hrs, Volume= 12,802 cf, 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 dp2: drain to shoe pond

Inflow Area = 284,610 sf, 47.26% Impervious, Inflow Depth > 1.35" for noaa-2yr event
 Inflow = 8.5 cfs @ 12.09 hrs, Volume= 32,097 cf
 Outflow = 8.5 cfs @ 12.09 hrs, Volume= 32,097 cf, 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: prop infil basin #1 (330s)

Inflow Area = 41,365 sf, 77.28% Impervious, Inflow Depth > 2.14" for noaa-2yr event
 Inflow = 2.4 cfs @ 12.09 hrs, Volume= 7,372 cf
 Outflow = 0.5 cfs @ 12.51 hrs, Volume= 7,366 cf, Atten= 78%, Lag= 25.3 min
 Discarded = 0.1 cfs @ 11.34 hrs, Volume= 6,391 cf
 Primary = 0.4 cfs @ 12.51 hrs, Volume= 975 cf

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

6293-POST

Type III 24-hr noaa-2yr Rainfall=3.17"

Prepared by Meridian Associates

Printed 5/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 6

Peak Elev= 32.30' @ 12.51 hrs Surf.Area= 2,211 sf Storage= 2,836 cf

Plug-Flow detention time= 169.1 min calculated for 7,366 cf (100% of inflow)

Center-of-Mass det. time= 168.6 min (975.2 - 806.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	30.50'	1,854 cf	30.08'W x 73.50'L x 3.54'H Field A 7,831 cf Overall - 3,196 cf Embedded = 4,635 cf x 40.0% Voids
#2A	31.00'	3,196 cf	Cultec R-330XL x 60 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
		5,050 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	12.0" Round Culvert to design point L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 31.00' / 25.00' S= 0.0600 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	32.10'	8.0" Vert. Orifice/Grate X 3.00 C= 0.600
#3	Discarded	30.50'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 11.34 hrs HW=30.54' (Free Discharge)↑**3=Exfiltration** (Exfiltration Controls 0.1 cfs)**Primary OutFlow** Max=0.4 cfs @ 12.51 hrs HW=32.30' TW=0.00' (Dynamic Tailwater)↑**1=Culvert to design point** (Passes 0.4 cfs of 3.4 cfs potential flow)↑**2=Orifice/Grate** (Orifice Controls 0.4 cfs @ 1.5 fps)**Summary for Pond 1R: pdmh#10 to pdmh#9**

Inflow Area = 124,700 sf, 76.38% Impervious, Inflow Depth > 2.23" for noaa-2yr event
 Inflow = 7.0 cfs @ 12.09 hrs, Volume= 23,146 cf
 Outflow = 7.0 cfs @ 12.09 hrs, Volume= 23,146 cf, Atten= 0%, Lag= 0.0 min
 Primary = 7.0 cfs @ 12.09 hrs, Volume= 23,146 cf

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

Peak Elev= 28.61' @ 12.09 hrs

Flood Elev= 35.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.20'	18.0" Round Culvert L= 73.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 27.20' / 26.40' S= 0.0110 '/' Cc= 0.900 n= 0.013 Clay tile, Flow Area= 1.77 sf

Primary OutFlow Max=7.0 cfs @ 12.09 hrs HW=28.61' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 7.0 cfs @ 4.0 fps)

Summary for Pond 2P: prop infil basin #2 (330s)

Inflow Area = 19,550 sf, 91.36% Impervious, Inflow Depth > 2.61" for noaa-2yr event
 Inflow = 1.3 cfs @ 12.08 hrs, Volume= 4,257 cf
 Outflow = 0.2 cfs @ 12.64 hrs, Volume= 4,257 cf, Atten= 87%, Lag= 33.4 min
 Discarded = 0.1 cfs @ 11.54 hrs, Volume= 4,039 cf
 Primary = 0.1 cfs @ 12.64 hrs, Volume= 218 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 30.57' @ 12.64 hrs Surf.Area= 1,829 sf Storage= 1,554 cf

Plug-Flow detention time= 103.8 min calculated for 4,257 cf (100% of inflow)
 Center-of-Mass det. time= 103.7 min (884.4 - 780.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	29.30'	1,537 cf	34.83'W x 52.50'L x 3.54'H Field A 6,477 cf Overall - 2,634 cf Embedded = 3,843 cf x 40.0% Voids
#2A	29.80'	2,634 cf	Cultec R-330XL x 49 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 7 rows
		4,171 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	12.0" Round Culvert towards design point L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 30.00' / 29.50' S= 0.0100 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	30.40'	4.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	31.90'	4.0" Vert. Orifice/Grate C= 0.600
#4	Discarded	29.30'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 11.54 hrs HW=29.34' (Free Discharge)
 ↳4=Exfiltration (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.1 cfs @ 12.64 hrs HW=30.57' TW=0.00' (Dynamic Tailwater)
 ↳1=Culvert towards design point (Passes 0.1 cfs of 1.1 cfs potential flow)
 ↳2=Orifice/Grate (Orifice Controls 0.1 cfs @ 1.4 fps)
 ↳3=Orifice/Grate (Controls 0.0 cfs)

**PROPOSED CONDITIONS
10-YEAR 24-HOUR STORM EVENT ANALYSIS**

Summary for Subcatchment sc1: school building

Runoff = 6.7 cfs @ 12.08 hrs, Volume= 23,622 cf, Depth> 4.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

Area (sf)	CN	Description
* 59,435	98	impervious area
59,435		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 sc20: south lawn

Runoff = 7.1 cfs @ 12.13 hrs, Volume= 24,504 cf, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

Area (sf)	CN	Description
* 54,015	98	impervious area
44,365	61	>75% Grass cover, Good, HSG B
98,380	81	Weighted Average
44,365		45.10% Pervious Area
54,015		54.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.2		Sheet Flow, at bowl Grass: Short n= 0.150 P2= 3.17"
4.3	198	0.0120	0.8		Shallow Concentrated Flow, overland thru lawn Short Grass Pasture Kv= 7.0 fps
0.1	21	0.0380	4.0		Shallow Concentrated Flow, to cb Paved Kv= 20.3 fps
9.2	269	Total			

Summary for Subcatchment sc21: parking lot - Colon St.

Runoff = 4.2 cfs @ 12.09 hrs, Volume= 13,383 cf, Depth> 3.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

6293-POST

Type III 24-hr noaa-10yr Rainfall=5.01"

Prepared by Meridian Associates

Printed 5/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 2

	Area (sf)	CN	Description
*	31,965	98	impervious area
	8,740	61	>75% Grass cover, Good, HSG B
	660	85	Gravel roads, HSG B
	41,365	90	Weighted Average
	9,400		22.72% Pervious Area
	31,965		77.28% Impervious Area

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

Summary for Subcatchment sc22: parking btwn Sohier & building

Runoff = 1.0 cfs @ 12.08 hrs, Volume= 3,433 cf, Depth> 4.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

	Area (sf)	CN	Description
*	8,645	98	impervious area
	905	61	>75% Grass cover, Good, HSG B
	9,550	94	Weighted Average
	905		9.48% Pervious Area
	8,645		90.52% Impervious Area

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

Summary for Subcatchment sc30: drive at rear bldg

Runoff = 5.6 cfs @ 12.09 hrs, Volume= 17,294 cf, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

	Area (sf)	CN	Description
*	35,815	98	impervious area
	23,695	61	>75% Grass cover, Good, HSG B
	5,755	85	Gravel roads, HSG B
	65,265	83	Weighted Average
	29,450		45.12% Pervious Area
	35,815		54.88% Impervious Area

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

Summary for Subcatchment sc31: parking aisle along Sohier

Runoff = 2.1 cfs @ 12.08 hrs, Volume= 7,210 cf, Depth> 4.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

	Area (sf)	CN	Description
*	12,240	98	impervious area
	800	61	>75% Grass cover, Good, HSG B
*	5,620	98	impervious area
	890	61	>75% Grass cover, Good, HSG B
	19,550	95	Weighted Average
	1,690		8.64% Pervious Area
	17,860		91.36% Impervious Area

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

Summary for Subcatchment sc40: nw to cb#25

Runoff = 0.9 cfs @ 12.09 hrs, Volume= 2,821 cf, Depth> 3.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

	Area (sf)	CN	Description
*	6,535	98	impervious area
	2,940	61	>75% Grass cover, Good, HSG B
	9,475	87	Weighted Average
	2,940		31.03% Pervious Area
	6,535		68.97% 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 to cb#26

Runoff = 0.8 cfs @ 12.09 hrs, Volume= 2,603 cf, Depth> 3.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

6293-POST

Type III 24-hr noaa-10yr Rainfall=5.01"

Prepared by Meridian Associates

Printed 5/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 4

Area (sf)	CN	Description
* 5,225	98	impervious area
4,265	61	>75% Grass cover, Good, HSG B
635	85	Gravel roads, HSG B
10,125	82	Weighted Average
4,900		48.40% Pervious Area
5,225		51.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.2		Sheet Flow, grass high point Grass: Short n= 0.150 P2= 3.17"
0.2	16	0.0380	1.4		Shallow Concentrated Flow, overland to sohier Short Grass Pasture Kv= 7.0 fps
1.3	135	0.0070	1.7		Shallow Concentrated Flow, sohier to cb Paved Kv= 20.3 fps
6.3	201	Total			

Summary for Subcatchment sc60: n locus & field

Runoff = 2.5 cfs @ 12.31 hrs, Volume= 12,669 cf, Depth> 1.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-10yr Rainfall=5.01"

Area (sf)	CN	Description
* 1,005	98	impervious area
83,710	61	>75% Grass cover, Good, HSG B
1,845	85	Gravel roads, HSG B
9,600	58	Woods/grass comb., Good, HSG B
15,050	55	Woods, Good, HSG B
111,210	61	Weighted Average
110,205		99.10% Pervious Area
1,005		0.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0050	0.1		Sheet Flow, field Grass: Short n= 0.150 P2= 3.17"
9.6	360	0.0080	0.6		Shallow Concentrated Flow, length of field to woods Short Grass Pasture Kv= 7.0 fps
0.9	85	0.0940	1.5		Shallow Concentrated Flow, to bowl cb Woodland Kv= 5.0 fps
20.3	495	Total			

Summary for Reach 2R: smh culvert to dp#2

Inflow Area = 111,210 sf, 0.90% Impervious, Inflow Depth > 1.37" for noaa-10yr event
 Inflow = 2.5 cfs @ 12.31 hrs, Volume= 12,669 cf
 Outflow = 2.5 cfs @ 12.31 hrs, Volume= 12,669 cf, 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 3R: cbs culminate to dp#2

Inflow Area = 19,600 sf, 60.00% Impervious, Inflow Depth > 3.32" for noaa-10yr event
 Inflow = 1.7 cfs @ 12.09 hrs, Volume= 5,424 cf
 Outflow = 1.7 cfs @ 12.09 hrs, Volume= 5,424 cf, 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 4R: new pipe system to dp#2

Inflow Area = 134,250 sf, 77.39% Impervious, Inflow Depth > 3.96" for noaa-10yr event
 Inflow = 13.3 cfs @ 12.09 hrs, Volume= 44,350 cf
 Outflow = 13.3 cfs @ 12.09 hrs, Volume= 44,350 cf, 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: dmh#5 to rantoul culvert

Inflow Area = 139,745 sf, 61.53% Impervious, Inflow Depth > 2.56" for noaa-10yr event
 Inflow = 9.7 cfs @ 12.14 hrs, Volume= 29,850 cf
 Outflow = 9.7 cfs @ 12.14 hrs, Volume= 29,850 cf, 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 dp2: drain to shoe pond

Inflow Area = 284,610 sf, 47.26% Impervious, Inflow Depth > 2.72" for noaa-10yr event
 Inflow = 16.1 cfs @ 12.09 hrs, Volume= 64,399 cf
 Outflow = 16.1 cfs @ 12.09 hrs, Volume= 64,399 cf, 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: prop infil basin #1 (330s)

Inflow Area = 41,365 sf, 77.28% Impervious, Inflow Depth > 3.88" for noaa-10yr event
 Inflow = 4.2 cfs @ 12.09 hrs, Volume= 13,383 cf
 Outflow = 2.9 cfs @ 12.17 hrs, Volume= 12,480 cf, Atten= 31%, Lag= 4.9 min
 Discarded = 0.1 cfs @ 10.12 hrs, Volume= 7,135 cf
 Primary = 2.8 cfs @ 12.17 hrs, Volume= 5,345 cf

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

6293-POST

Type III 24-hr noaa-10yr Rainfall=5.01"

Prepared by Meridian Associates

Printed 5/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 6

Peak Elev= 32.73' @ 12.17 hrs Surf.Area= 2,211 sf Storage= 3,560 cf

Plug-Flow detention time= 119.1 min calculated for 12,480 cf (93% of inflow)

Center-of-Mass det. time= 83.4 min (873.4 - 790.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	30.50'	1,854 cf	30.08'W x 73.50'L x 3.54'H Field A 7,831 cf Overall - 3,196 cf Embedded = 4,635 cf x 40.0% Voids
#2A	31.00'	3,196 cf	Cultec R-330XL x 60 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
		5,050 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	12.0" Round Culvert to design point L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 31.00' / 25.00' S= 0.0600 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	32.10'	8.0" Vert. Orifice/Grate X 3.00 C= 0.600
#3	Discarded	30.50'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 10.12 hrs HW=30.54' (Free Discharge)↑**3=Exfiltration** (Exfiltration Controls 0.1 cfs)**Primary OutFlow** Max=2.8 cfs @ 12.17 hrs HW=32.73' TW=0.00' (Dynamic Tailwater)↑**1=Culvert to design point** (Passes 2.8 cfs of 4.2 cfs potential flow)↑**2=Orifice/Grate** (Orifice Controls 2.8 cfs @ 2.7 fps)**Summary for Pond 1R: pdmh#10 to pdmh#9**

Inflow Area = 124,700 sf, 76.38% Impervious, Inflow Depth > 3.94" for noaa-10yr event
 Inflow = 12.3 cfs @ 12.09 hrs, Volume= 40,916 cf
 Outflow = 12.3 cfs @ 12.09 hrs, Volume= 40,916 cf, Atten= 0%, Lag= 0.0 min
 Primary = 12.3 cfs @ 12.09 hrs, Volume= 40,916 cf

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

Peak Elev= 30.02' @ 12.09 hrs

Flood Elev= 35.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.20'	18.0" Round Culvert L= 73.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 27.20' / 26.40' S= 0.0110 '/ Cc= 0.900 n= 0.013 Clay tile, Flow Area= 1.77 sf

Primary OutFlow Max=12.2 cfs @ 12.09 hrs HW=30.02' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 12.2 cfs @ 6.9 fps)

Summary for Pond 2P: prop infil basin #2 (330s)

Inflow Area = 19,550 sf, 91.36% Impervious, Inflow Depth > 4.43" for noaa-10yr event
 Inflow = 2.1 cfs @ 12.08 hrs, Volume= 7,210 cf
 Outflow = 0.4 cfs @ 12.50 hrs, Volume= 7,209 cf, Atten= 79%, Lag= 25.0 min
 Discarded = 0.1 cfs @ 10.68 hrs, Volume= 5,252 cf
 Primary = 0.3 cfs @ 12.50 hrs, Volume= 1,957 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 31.23' @ 12.50 hrs Surf.Area= 1,829 sf Storage= 2,536 cf

Plug-Flow detention time= 95.1 min calculated for 7,206 cf (100% of inflow)
 Center-of-Mass det. time= 94.9 min (862.6 - 767.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	29.30'	1,537 cf	34.83'W x 52.50'L x 3.54'H Field A 6,477 cf Overall - 2,634 cf Embedded = 3,843 cf x 40.0% Voids
#2A	29.80'	2,634 cf	Cultec R-330XL x 49 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 7 rows
		4,171 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	12.0" Round Culvert towards design point L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 30.00' / 29.50' S= 0.0100 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	30.40'	4.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	31.90'	4.0" Vert. Orifice/Grate C= 0.600
#4	Discarded	29.30'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 10.68 hrs HW=29.34' (Free Discharge)
 ↳4=Exfiltration (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.3 cfs @ 12.50 hrs HW=31.23' TW=0.00' (Dynamic Tailwater)
 ↳1=Culvert towards design point (Passes 0.3 cfs of 3.2 cfs potential flow)
 ↳2=Orifice/Grate (Orifice Controls 0.3 cfs @ 3.9 fps)
 ↳3=Orifice/Grate (Controls 0.0 cfs)

PROPOSED CONDITIONS
100-YEAR 24-HOUR STORM EVENT ANALYSIS

6293-POST

Prepared by Meridian Associates

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr noaa-100yr Rainfall=7.92"

Printed 5/12/2020

Page 1

Summary for Subcatchment sc1: school building

Runoff = 10.6 cfs @ 12.08 hrs, Volume= 38,010 cf, Depth> 7.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

Area (sf)	CN	Description
* 59,435	98	impervious area
59,435		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 sc20: south lawn

Runoff = 13.2 cfs @ 12.13 hrs, Volume= 46,386 cf, Depth> 5.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

Area (sf)	CN	Description
* 54,015	98	impervious area
44,365	61	>75% Grass cover, Good, HSG B
98,380	81	Weighted Average
44,365		45.10% Pervious Area
54,015		54.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.2		Sheet Flow, at bowl Grass: Short n= 0.150 P2= 3.17"
4.3	198	0.0120	0.8		Shallow Concentrated Flow, overland thru lawn Short Grass Pasture Kv= 7.0 fps
0.1	21	0.0380	4.0		Shallow Concentrated Flow, to cb Paved Kv= 20.3 fps
9.2	269	Total			

Summary for Subcatchment sc21: parking lot - Colon St.

Runoff = 7.0 cfs @ 12.08 hrs, Volume= 23,168 cf, Depth> 6.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

6293-POST

Type III 24-hr noaa-100yr Rainfall=7.92"

Prepared by Meridian Associates

Printed 5/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 2

	Area (sf)	CN	Description
*	31,965	98	impervious area
	8,740	61	>75% Grass cover, Good, HSG B
	660	85	Gravel roads, HSG B
	41,365	90	Weighted Average
	9,400		22.72% Pervious Area
	31,965		77.28% Impervious Area

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

Summary for Subcatchment sc22: parking btwn Sohier & building

Runoff = 1.7 cfs @ 12.08 hrs, Volume= 5,727 cf, Depth> 7.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

	Area (sf)	CN	Description
*	8,645	98	impervious area
	905	61	>75% Grass cover, Good, HSG B
	9,550	94	Weighted Average
	905		9.48% Pervious Area
	8,645		90.52% Impervious Area

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

Summary for Subcatchment sc30: drive at rear bldg

Runoff = 10.1 cfs @ 12.09 hrs, Volume= 32,063 cf, Depth> 5.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

	Area (sf)	CN	Description
*	35,815	98	impervious area
	23,695	61	>75% Grass cover, Good, HSG B
	5,755	85	Gravel roads, HSG B
	65,265	83	Weighted Average
	29,450		45.12% Pervious Area
	35,815		54.88% Impervious Area

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

Summary for Subcatchment sc31: parking aisle along Sohier

Runoff = 3.4 cfs @ 12.08 hrs, Volume= 11,919 cf, Depth> 7.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

	Area (sf)	CN	Description
*	12,240	98	impervious area
	800	61	>75% Grass cover, Good, HSG B
*	5,620	98	impervious area
	890	61	>75% Grass cover, Good, HSG B
	19,550	95	Weighted Average
	1,690		8.64% Pervious Area
	17,860		91.36% Impervious Area

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

Summary for Subcatchment sc40: nw to cb#25

Runoff = 1.6 cfs @ 12.08 hrs, Volume= 5,027 cf, Depth> 6.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

	Area (sf)	CN	Description
*	6,535	98	impervious area
	2,940	61	>75% Grass cover, Good, HSG B
	9,475	87	Weighted Average
	2,940		31.03% Pervious Area
	6,535		68.97% 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 to cb#26

Runoff = 1.5 cfs @ 12.09 hrs, Volume= 4,875 cf, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

6293-POST

Type III 24-hr noaa-100yr Rainfall=7.92"

Prepared by Meridian Associates

Printed 5/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 4

Area (sf)	CN	Description
* 5,225	98	impervious area
4,265	61	>75% Grass cover, Good, HSG B
635	85	Gravel roads, HSG B
10,125	82	Weighted Average
4,900		48.40% Pervious Area
5,225		51.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.2		Sheet Flow, grass high point Grass: Short n= 0.150 P2= 3.17"
0.2	16	0.0380	1.4		Shallow Concentrated Flow, overland to sohier Short Grass Pasture Kv= 7.0 fps
1.3	135	0.0070	1.7		Shallow Concentrated Flow, sohier to cb Paved Kv= 20.3 fps
6.3	201	Total			

Summary for Subcatchment sc60: n locus & field

Runoff = 6.7 cfs @ 12.29 hrs, Volume= 31,209 cf, Depth> 3.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr noaa-100yr Rainfall=7.92"

Area (sf)	CN	Description
* 1,005	98	impervious area
83,710	61	>75% Grass cover, Good, HSG B
1,845	85	Gravel roads, HSG B
9,600	58	Woods/grass comb., Good, HSG B
15,050	55	Woods, Good, HSG B
111,210	61	Weighted Average
110,205		99.10% Pervious Area
1,005		0.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0050	0.1		Sheet Flow, field Grass: Short n= 0.150 P2= 3.17"
9.6	360	0.0080	0.6		Shallow Concentrated Flow, length of field to woods Short Grass Pasture Kv= 7.0 fps
0.9	85	0.0940	1.5		Shallow Concentrated Flow, to bowl cb Woodland Kv= 5.0 fps
20.3	495	Total			

Summary for Reach 2R: smh culvert to dp#2

Inflow Area = 111,210 sf, 0.90% Impervious, Inflow Depth > 3.37" for noaa-100yr event
 Inflow = 6.7 cfs @ 12.29 hrs, Volume= 31,209 cf
 Outflow = 6.7 cfs @ 12.29 hrs, Volume= 31,209 cf, 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 3R: cbs culminate to dp#2

Inflow Area = 19,600 sf, 60.00% Impervious, Inflow Depth > 6.06" for noaa-100yr event
 Inflow = 3.1 cfs @ 12.09 hrs, Volume= 9,902 cf
 Outflow = 3.1 cfs @ 12.09 hrs, Volume= 9,902 cf, 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 4R: new pipe system to dp#2

Inflow Area = 134,250 sf, 77.39% Impervious, Inflow Depth > 6.78" for noaa-100yr event
 Inflow = 22.4 cfs @ 12.08 hrs, Volume= 75,801 cf
 Outflow = 22.4 cfs @ 12.08 hrs, Volume= 75,801 cf, 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: dmh#5 to rantoul culvert

Inflow Area = 139,745 sf, 61.53% Impervious, Inflow Depth > 5.13" for noaa-100yr event
 Inflow = 18.4 cfs @ 12.13 hrs, Volume= 59,788 cf
 Outflow = 18.4 cfs @ 12.13 hrs, Volume= 59,788 cf, 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 dp2: drain to shoe pond

Inflow Area = 284,610 sf, 47.26% Impervious, Inflow Depth > 5.15" for noaa-100yr event
 Inflow = 29.3 cfs @ 12.09 hrs, Volume= 122,262 cf
 Outflow = 29.3 cfs @ 12.09 hrs, Volume= 122,262 cf, 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: prop infil basin #1 (330s)

Inflow Area = 41,365 sf, 77.28% Impervious, Inflow Depth > 6.72" for noaa-100yr event
 Inflow = 7.0 cfs @ 12.08 hrs, Volume= 23,168 cf
 Outflow = 5.4 cfs @ 12.15 hrs, Volume= 21,351 cf, Atten= 24%, Lag= 4.0 min
 Discarded = 0.1 cfs @ 8.54 hrs, Volume= 7,949 cf
 Primary = 5.2 cfs @ 12.15 hrs, Volume= 13,402 cf

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

6293-POST

Type III 24-hr noaa-100yr Rainfall=7.92"

Prepared by Meridian Associates

Printed 5/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 6

Peak Elev= 33.51' @ 12.15 hrs Surf.Area= 2,211 sf Storage= 4,581 cf

Plug-Flow detention time= 80.3 min calculated for 21,351 cf (92% of inflow)

Center-of-Mass det. time= 39.7 min (815.3 - 775.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	30.50'	1,854 cf	30.08'W x 73.50'L x 3.54'H Field A 7,831 cf Overall - 3,196 cf Embedded = 4,635 cf x 40.0% Voids
#2A	31.00'	3,196 cf	Cultec R-330XL x 60 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
		5,050 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	12.0" Round Culvert to design point L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 31.00' / 25.00' S= 0.0600 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	32.10'	8.0" Vert. Orifice/Grate X 3.00 C= 0.600
#3	Discarded	30.50'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 8.54 hrs HW=30.54' (Free Discharge)↑**3=Exfiltration** (Exfiltration Controls 0.1 cfs)**Primary OutFlow** Max=5.2 cfs @ 12.15 hrs HW=33.51' TW=0.00' (Dynamic Tailwater)↑**1=Culvert to design point** (Passes 5.2 cfs of 5.4 cfs potential flow)↑**2=Orifice/Grate** (Orifice Controls 5.2 cfs @ 5.0 fps)**Summary for Pond 1R: pdmh#10 to pdmh#9**

Inflow Area = 124,700 sf, 76.38% Impervious, Inflow Depth > 6.74" for noaa-100yr event

Inflow = 20.7 cfs @ 12.08 hrs, Volume= 70,074 cf

Outflow = 20.7 cfs @ 12.08 hrs, Volume= 70,074 cf, Atten= 0%, Lag= 0.0 min

Primary = 20.7 cfs @ 12.08 hrs, Volume= 70,074 cf

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

Peak Elev= 33.94' @ 12.08 hrs

Flood Elev= 35.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	27.20'	18.0" Round Culvert L= 73.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 27.20' / 26.40' S= 0.0110 '/' Cc= 0.900 n= 0.013 Clay tile, Flow Area= 1.77 sf

Primary OutFlow Max=20.7 cfs @ 12.08 hrs HW=33.92' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Barrel Controls 20.7 cfs @ 11.7 fps)

Summary for Pond 2P: prop infil basin #2 (330s)

Inflow Area = 19,550 sf, 91.36% Impervious, Inflow Depth > 7.32" for noaa-100yr event
 Inflow = 3.4 cfs @ 12.08 hrs, Volume= 11,919 cf
 Outflow = 1.1 cfs @ 12.38 hrs, Volume= 11,916 cf, Atten= 69%, Lag= 18.0 min
 Discarded = 0.1 cfs @ 9.18 hrs, Volume= 6,566 cf
 Primary = 1.0 cfs @ 12.38 hrs, Volume= 5,350 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 32.77' @ 12.38 hrs Surf.Area= 1,829 sf Storage= 4,118 cf

Plug-Flow detention time= 91.9 min calculated for 11,911 cf (100% of inflow)
 Center-of-Mass det. time= 91.7 min (848.5 - 756.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	29.30'	1,537 cf	34.83'W x 52.50'L x 3.54'H Field A 6,477 cf Overall - 2,634 cf Embedded = 3,843 cf x 40.0% Voids
#2A	29.80'	2,634 cf	Cultec R-330XL x 49 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 7 rows
		4,171 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	12.0" Round Culvert towards design point L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 30.00' / 29.50' S= 0.0100 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	30.40'	4.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	31.90'	4.0" Vert. Orifice/Grate C= 0.600
#4	Discarded	29.30'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 9.18 hrs HW=29.34' (Free Discharge)
 ↳4=Exfiltration (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=1.0 cfs @ 12.38 hrs HW=32.77' TW=0.00' (Dynamic Tailwater)
 ↳1=Culvert towards design point (Passes 1.0 cfs of 5.4 cfs potential flow)
 ↳2=Orifice/Grate (Orifice Controls 0.6 cfs @ 7.1 fps)
 ↳3=Orifice/Grate (Orifice Controls 0.4 cfs @ 4.0 fps)

APPENDIX

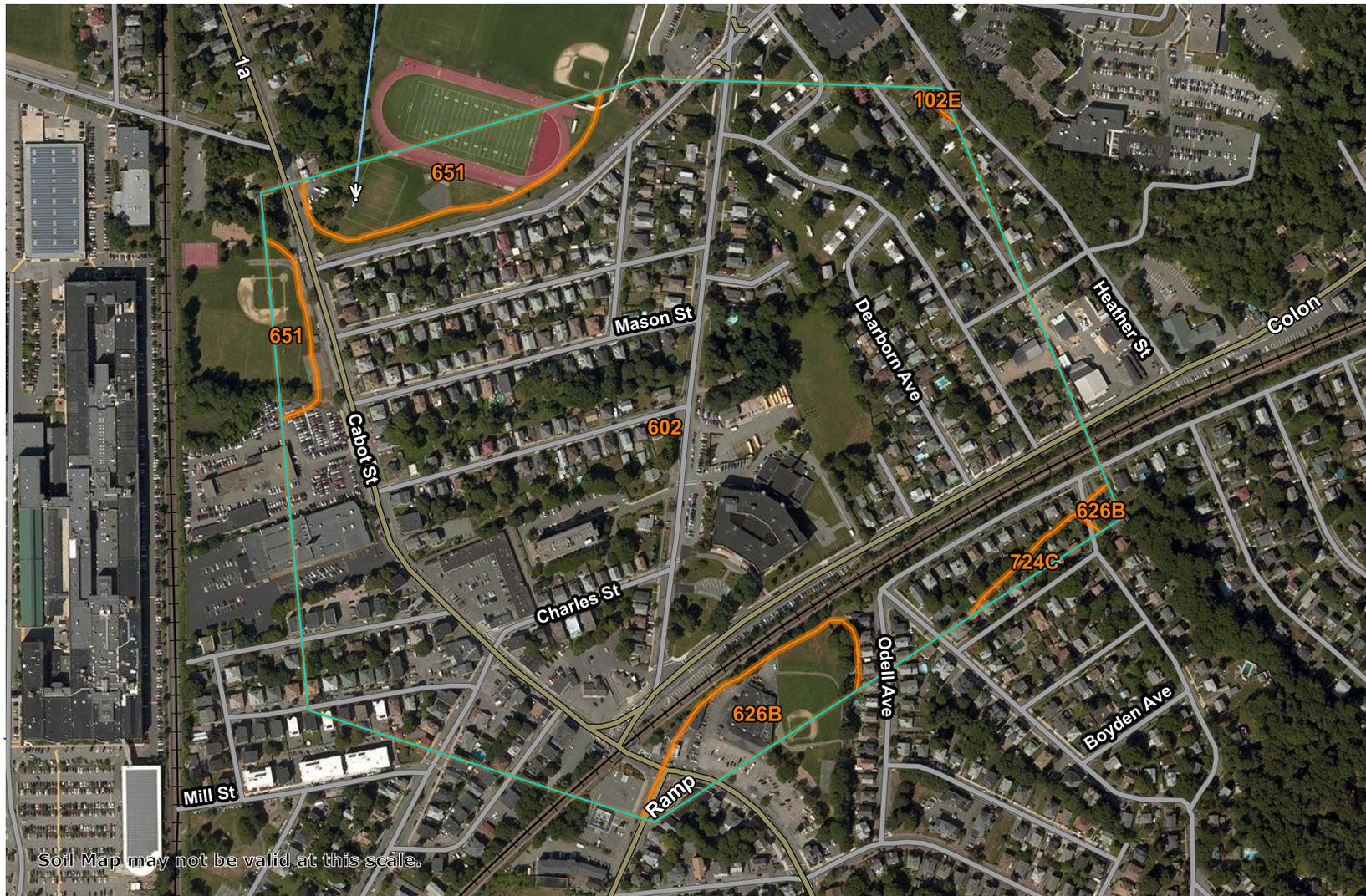
Soil Map—Essex County, Massachusetts, Southern Part
(Briscoe School)

70° 53' 13" W

70° 52' 19" W

42° 33' 49" N

42° 33' 49" N

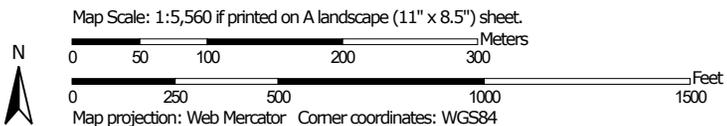


42° 33' 23" N

42° 33' 23" N

70° 53' 13" W

70° 52' 19" W



Soil Map—Essex County, Massachusetts, Southern Part
(Briscoe School)

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 16, Sep 13, 2019

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
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	0.1	0.1%
602	Urban land	81.7	90.0%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	3.5	3.8%
651	Udorthents, smoothed	5.0	5.5%
724C	Hollis-Urban land-Rock outcrop complex, sloping	0.5	0.6%
Totals for Area of Interest		90.8	100.0%



NOAA Atlas 14, Volume 10, Version 3
Location name: Beverly, Massachusetts, USA*
Latitude: 42.5597°, Longitude: -70.8789°
Elevation: 37.68 ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

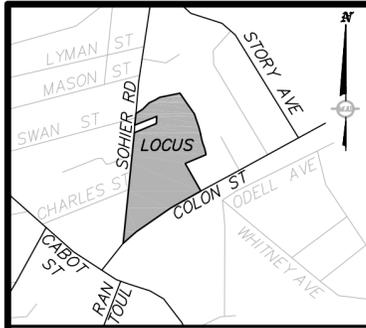
PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.301 (0.234-0.379)	0.366 (0.284-0.462)	0.472 (0.365-0.597)	0.560 (0.431-0.713)	0.681 (0.508-0.905)	0.772 (0.565-1.05)	0.868 (0.619-1.22)	0.980 (0.659-1.40)	1.15 (0.742-1.69)	1.29 (0.814-1.93)
10-min	0.426 (0.331-0.537)	0.518 (0.402-0.654)	0.668 (0.517-0.847)	0.793 (0.610-1.01)	0.965 (0.720-1.28)	1.09 (0.801-1.48)	1.23 (0.877-1.73)	1.39 (0.934-1.98)	1.63 (1.05-2.39)	1.82 (1.15-2.73)
15-min	0.501 (0.390-0.632)	0.609 (0.473-0.769)	0.786 (0.608-0.996)	0.933 (0.718-1.19)	1.14 (0.847-1.51)	1.29 (0.942-1.75)	1.45 (1.03-2.04)	1.63 (1.10-2.33)	1.91 (1.24-2.82)	2.14 (1.36-3.22)
30-min	0.686 (0.533-0.865)	0.833 (0.647-1.05)	1.07 (0.831-1.36)	1.27 (0.980-1.62)	1.55 (1.16-2.06)	1.75 (1.29-2.38)	1.97 (1.41-2.78)	2.23 (1.50-3.18)	2.62 (1.69-3.85)	2.94 (1.86-4.41)
60-min	0.871 (0.677-1.10)	1.06 (0.821-1.34)	1.36 (1.05-1.73)	1.62 (1.24-2.06)	1.96 (1.47-2.61)	2.22 (1.63-3.02)	2.50 (1.79-3.53)	2.83 (1.90-4.04)	3.32 (2.15-4.89)	3.74 (2.36-5.60)
2-hr	1.13 (0.886-1.42)	1.39 (1.09-1.74)	1.81 (1.41-2.27)	2.15 (1.67-2.73)	2.63 (1.99-3.49)	2.99 (2.21-4.05)	3.37 (2.44-4.76)	3.85 (2.60-5.46)	4.59 (2.98-6.72)	5.24 (3.32-7.80)
3-hr	1.31 (1.03-1.64)	1.62 (1.27-2.02)	2.11 (1.66-2.65)	2.53 (1.97-3.18)	3.09 (2.34-4.09)	3.51 (2.61-4.75)	3.97 (2.88-5.60)	4.54 (3.07-6.42)	5.44 (3.54-7.94)	6.23 (3.96-9.24)
6-hr	1.69 (1.34-2.10)	2.08 (1.65-2.58)	2.72 (2.14-3.39)	3.25 (2.55-4.07)	3.98 (3.03-5.22)	4.51 (3.37-6.06)	5.10 (3.73-7.14)	5.84 (3.96-8.20)	6.99 (4.56-10.1)	7.99 (5.10-11.8)
12-hr	2.14 (1.71-2.63)	2.62 (2.09-3.23)	3.41 (2.71-4.23)	4.07 (3.22-5.07)	4.98 (3.81-6.49)	5.65 (4.24-7.52)	6.38 (4.67-8.84)	7.27 (4.96-10.1)	8.65 (5.67-12.5)	9.85 (6.30-14.4)
24-hr	2.56 (2.06-3.13)	3.17 (2.55-3.89)	4.18 (3.35-5.14)	5.01 (3.99-6.19)	6.16 (4.75-7.98)	7.00 (5.30-9.28)	7.92 (5.85-11.0)	9.08 (6.22-12.6)	10.9 (7.15-15.6)	12.4 (7.99-18.1)
2-day	2.93 (2.38-3.56)	3.70 (3.00-4.51)	4.97 (4.01-6.06)	6.02 (4.82-7.38)	7.46 (5.81-9.64)	8.51 (6.51-11.3)	9.69 (7.24-13.4)	11.2 (7.71-15.4)	13.7 (9.01-19.4)	15.9 (10.2-22.9)
3-day	3.22 (2.62-3.90)	4.05 (3.30-4.91)	5.42 (4.39-6.59)	6.55 (5.28-8.01)	8.11 (6.34-10.5)	9.24 (7.10-12.2)	10.5 (7.89-14.5)	12.2 (8.39-16.7)	14.9 (9.84-21.1)	17.3 (11.2-24.9)
4-day	3.49 (2.85-4.21)	4.35 (3.55-5.26)	5.76 (4.68-6.98)	6.93 (5.60-8.45)	8.54 (6.70-11.0)	9.71 (7.47-12.8)	11.0 (8.29-15.2)	12.7 (8.80-17.4)	15.6 (10.3-22.0)	18.1 (11.7-25.9)
7-day	4.22 (3.47-5.07)	5.12 (4.20-6.15)	6.58 (5.38-7.94)	7.79 (6.34-9.45)	9.46 (7.46-12.1)	10.7 (8.26-14.0)	12.0 (9.08-16.4)	13.8 (9.58-18.8)	16.7 (11.1-23.4)	19.3 (12.5-27.5)
10-day	4.89 (4.04-5.86)	5.81 (4.80-6.97)	7.32 (6.01-8.80)	8.57 (6.99-10.4)	10.3 (8.13-13.0)	11.5 (8.93-15.0)	12.9 (9.74-17.5)	14.7 (10.2-19.9)	17.6 (11.7-24.6)	20.1 (13.0-28.6)
20-day	6.82 (5.68-8.11)	7.84 (6.52-9.33)	9.50 (7.87-11.3)	10.9 (8.95-13.1)	12.8 (10.1-16.0)	14.2 (11.0-18.1)	15.7 (11.7-20.7)	17.5 (12.2-23.4)	20.1 (13.4-27.8)	22.2 (14.5-31.4)
30-day	8.41 (7.04-9.97)	9.51 (7.94-11.3)	11.3 (9.39-13.4)	12.8 (10.6-15.3)	14.8 (11.8-18.3)	16.3 (12.7-20.6)	17.9 (13.3-23.4)	19.7 (13.8-26.3)	22.0 (14.8-30.4)	23.9 (15.6-33.7)
45-day	10.4 (8.76-12.3)	11.6 (9.73-13.7)	13.5 (11.3-16.0)	15.1 (12.5-18.0)	17.3 (13.7-21.2)	18.9 (14.7-23.7)	20.6 (15.3-26.5)	22.3 (15.7-29.6)	24.5 (16.5-33.6)	26.1 (17.0-36.5)
60-day	12.1 (10.2-14.3)	13.3 (11.2-15.7)	15.3 (12.9-18.1)	17.0 (14.2-20.2)	19.3 (15.4-23.6)	21.1 (16.3-26.2)	22.8 (16.9-29.1)	24.4 (17.3-32.3)	26.5 (17.9-36.2)	27.9 (18.2-39.0)

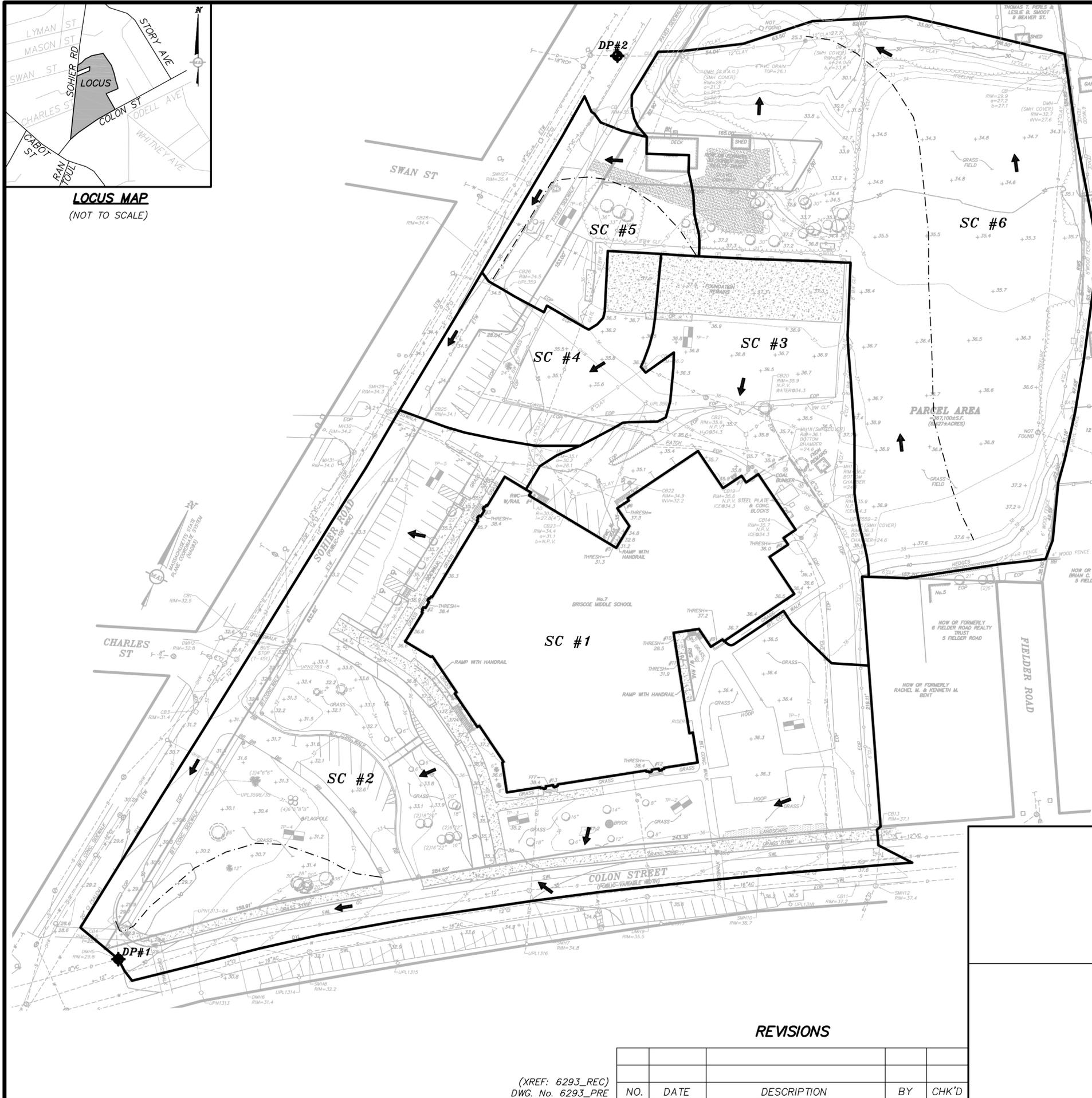
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical



LOCUS MAP
(NOT TO SCALE)



LEGEND

- SC #1 — SUBCATCHMENT
- DP #1 STUDY POINT #1 (DESIGN POINT)
- ➔ OVERLAND FLOW DIRECTION
- 602 SOIL TYPE
- - - OVERLAND FLOW PATH

- NOTES:**
- LOCATIONS AND TYPES OF SOIL DESIGNATIONS WITHIN THE LOCUS PROPERTY SUBCATCHMENT LIMITS HAVE BEEN DELINEATED BY USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS).
 - BASED ON NRCS, THE ENTIRE STUDY AREA IS CLASSIFIED AS SOIL TYPE 602. THIS SOIL DESIGNATION IS NOT ASSOCIATED WITH A SPECIFIC HYDROLOGIC SOIL GROUP.
602 - URBAN LAND
 - ADDITIONAL TOPOGRAPHY DEPICTED TO THE NORTH OF 33 SOHIER ROAD COMPILED FROM GIS DATA PROVIDED BY THE CITY OF BEVERLY.

7 SOHIER ROAD
EXISTING CONDITIONS WATERSHED
LOCATED IN
BEVERLY, MASSACHUSETTS
(ESSEX COUNTY)

PREPARED FOR
BRISCOE VILLAGE LLC
SCALE: 1" = 60' DATE: MAY 13, 2020

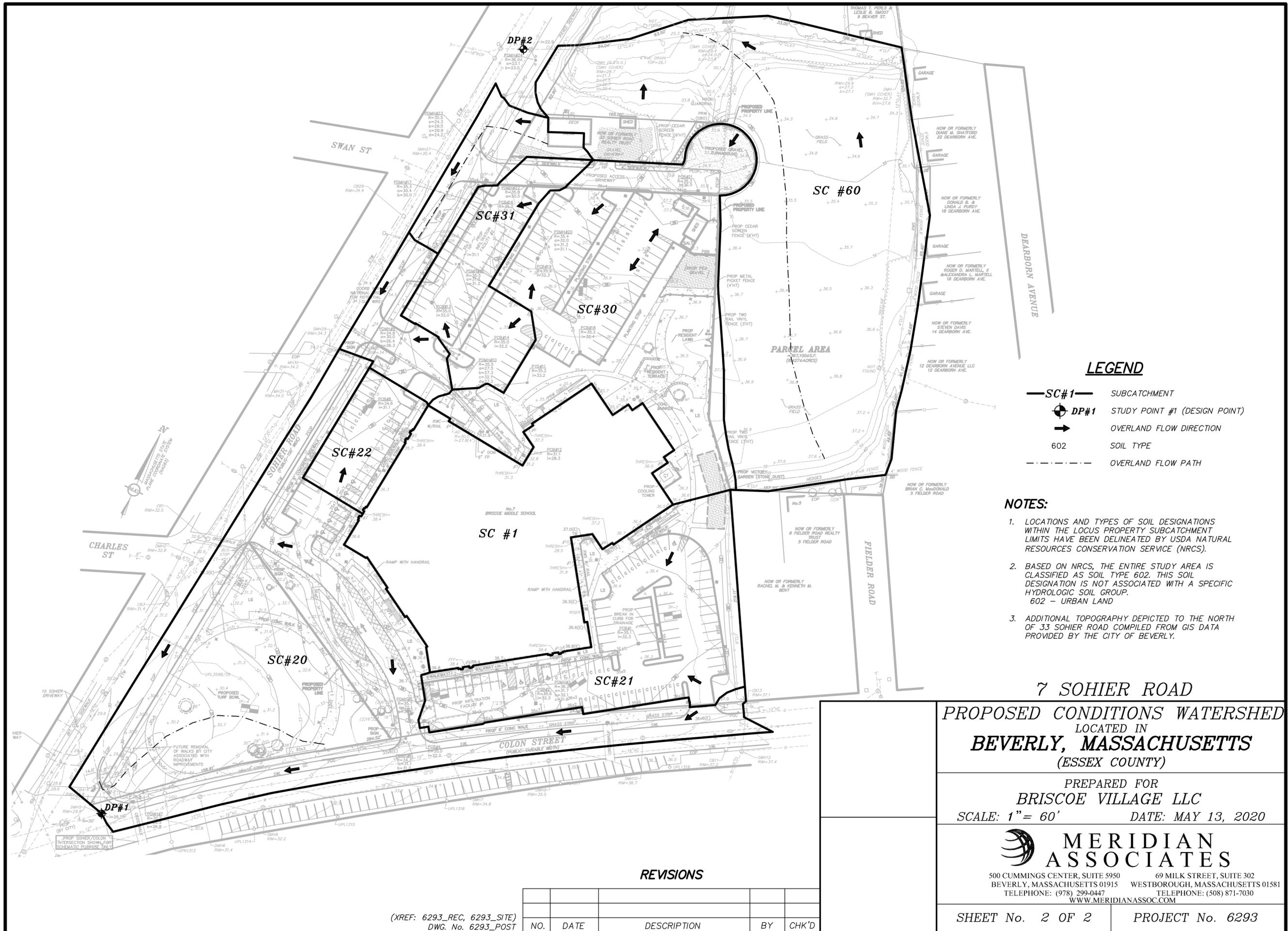

MERIDIAN ASSOCIATES
 500 CUMMINGS CENTER, SUITE 5950 69 MILK STREET, SUITE 302
 BEVERLY, MASSACHUSETTS 01915 WESTBOROUGH, MASSACHUSETTS 01581
 TELEPHONE: (978) 299-0447 TELEPHONE: (508) 871-7030
 WWW.MERIDIANASSOC.COM

SHEET No. 1 OF 2 PROJECT No. 6293

REVISIONS

NO.	DATE	DESCRIPTION	BY	CHK'D

(XREF: 6293_REC)
DWG. No. 6293_PRE



LEGEND

- SC#1 — SUBCATCHMENT
- ⊙ DP#1 STUDY POINT #1 (DESIGN POINT)
- ➔ OVERLAND FLOW DIRECTION
- 602 SOIL TYPE
- - - OVERLAND 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 ENTIRE STUDY AREA IS CLASSIFIED AS SOIL TYPE 602. THIS SOIL DESIGNATION IS NOT ASSOCIATED WITH A SPECIFIC HYDROLOGIC SOIL GROUP.
602 - URBAN LAND
3. ADDITIONAL TOPOGRAPHY DEPICTED TO THE NORTH OF 33 SOHIER ROAD COMPILED FROM GIS DATA PROVIDED BY THE CITY OF BEVERLY.

**7 SOHIER ROAD
PROPOSED CONDITIONS WATERSHED
LOCATED IN
BEVERLY, MASSACHUSETTS
(ESSEX COUNTY)**

PREPARED FOR
BRISCOE VILLAGE LLC
SCALE: 1" = 60' DATE: MAY 13, 2020


MERIDIAN ASSOCIATES
 500 CUMMINGS CENTER, SUITE 5950 69 MILK STREET, SUITE 302
 BEVERLY, MASSACHUSETTS 01915 WESTBOROUGH, MASSACHUSETTS 01581
 TELEPHONE: (978) 299-0447 TELEPHONE: (508) 871-7030
 WWW.MERIDIANASSOC.COM

SHEET No. 2 OF 2 PROJECT No. 6293

REVISIONS

NO.	DATE	DESCRIPTION	BY	CHK'D

(XREF: 6293_REC, 6293_SITE)
DWG. No. 6293_POST