Stormwater Management Report

Eversource Wareham – Parking Lot Expansion
Wareham, MA | December 3, 2021

Prepared For:
Eversource Energy
Doty Street
Wareham, MA 02576

Shive-Hattery Project Number: 7211970

JEFF RATH, PE 61591 12/03/2021

SHIVEHATTERY
ARCHITECTURE + ENGINEERING

440 North Wells Street | Suite 320 | Chicago, Illinois 60654

312.324.5500 | fax 319.364.4251 | shive-hattery.com

Table of Contents

List of Appendices

1. Introduction

a. Project Description

This project involves constructing a gravel parking lot for Eversource Energy (the applicant) located on the west side of their property at 5 Doty Street, Wareham, MA 02576. The purpose of the gravel parking lot is to provide additional vehicle storage area so Eversource Energy can increase their fleet to meet the energy demands intensified by recent and future storm events.

The project area is approximately 0.83 acres with about 0.42 acres being disturbed by the activities of this project. In addition to the construction of a gravel parking lot, an infiltration basin will be installed north of the proposed lot. Demolition work includes tree removal and clearing and grubbing a wooded area. To the east of the project is a residential property, to the north are undeveloped wetland and wooded areas and the Blue Star memorial Highway, to the south is Doty Street and a residential property, and to the west is Eversource Energy's existing facilities and North Carver Road. The site and surrounding properties are zoned Commercial Strip.

b. Pre-Development Conditions

In the existing conditions, the project's 0.83 acres are composed of paved roads, gravel, woods, and general open space, with woods being comprising over 55% of the drainage area. There are two existing drainage areas within the project footprint. Drainage Area 1 drains overland through the woods to the north and eventually discharges to an off-site wetland northwest of the property. Drainage Area 2 surface flows to the east towards an unintended low point at the edge of an existing gravel drive. This low point spills over to the east towards an existing storm intake which discharges to the existing on-site basin.

According to the Web Soil Survey of Plymouth County published by Natural Resources Conservation Service (NRCS), the project area is comprised of Carver loamy coarse sand and Udorthents – Urban land complex which are both Hydrologic Soil Group A.

See below table for pre-development drainage area characteristics. Calculations for these characteristics are shown in Appendix E.

Table 1: Pre-Development Drainage Area Characteristics

	Area (acres)	CN Value	Time of Concentration (minutes)
Pre-Development Drainage Area 1	0.80	44	20
Pre-Development Drainage Area 2	0.04	55	5

c. Post-Development Conditions

The proposed conditions consist of approximately 0.27 acres of a gravel parking lot. Approximately 0.2 acres of woodland will be removed to make room for the parking lot. An infiltration basin will be constructed to accommodate the 100-year storm event and infiltrate the recharge volume. Runoff produced by the gravel parking lot will flow overland to the north towards the proposed infiltration basin.

There are two drainage areas in the proposed conditions within the project's footprint. Drainage Area 1 drains northerly to the proposed infiltration basin where it will seep into the ground. Drainage Area 2 flows to an easterly existing low point. From there it will spill over towards an existing area intake and enter the

existing storm sewer system, which discharges to the existing basin. There is no proposed storm sewer; all stormwater will flow overland.

The proposed stormwater management system has been designed to meet the requirements of the Massachusetts (MA) Department of Environmental Protection (DEP) Stormwater Handbook, the MA DEP Hydrology Handbook for Conservation Commissioners, and the bylaws of the Town of Wareham. Specifics of the project's stormwater management system is discussed in the following sections.

See the below table for post-development drainage area characteristics. Calculations for these characteristics are shown in Appendix E.

Table 2: Post-Development Drainage Area Characteristics

	Area (acres)	CN Value	Time of Concentration (minutes)
Post-Development Drainage Area 1	0.83	56	20
Post-Development Drainage Area 2	0.04	69	5

2. Standard 1 – New Stormwater Discharges

Mass DEP Standard 1 states that no new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. This project meets the requirements of Standard 1 because it is not proposing any stormwater discharges that are untreated or cause erosion. Per Volume 3 Chapter 1 of the MA DEP Stormwater Handbook, computations for Standards 4 – 6 may also demonstrate compliance with adequately treating stormwater for Standard 1. These computations are presented in the following Standard 4, Standard 5, and Standard 6 sections.

This project is proposing all stormwater runoff is directed towards an infiltration basin. The basin is sized to infiltrate a 100-year storm event. There is no proposed channelized outfall from the basin, therefore there is no concern of downstream erosion. Additionally, the surface runoff from the parking lot to the infiltration basin is considered to be sheet flow and not concentrated. It travels through existing, undisturbed wooded area. Therefore, there is no concern of erosion between the proposed gravel parking lot and the proposed infiltration basin.

3. Standard 2 – Stormwater Runoff Rates

Mass DEP Standard 2 states that post-development peak discharge rates shall not exceed pre-development peak discharge rates for the 2-year, 10-year, and 100-year 24-hour storm events. Per the MA DEP Stormwater Handbook Volume 1 Chapter 1 and the Hydrology Handbook for Commissioners, TR 55 and SCS Type III methods were used to calculate the peak discharges from each drainage area.

An infiltration basin is proposed to manage stormwater runoff from Drainage Area 1. Because the basin is designed to infiltrate a 100-year 24-hour post-development storm event, it will prevent an increase in peak discharge rates at the site's northwesterly outfall from pre-development to post-development conditions for a 2-year, 10-year, and 100-year 24-hour storm events. Details on the basin sizing and calculations can be found in the next section.

Drainage Area 2 surface flows to an existing area intake which discharges to the existing basin. No stormwater reports were available for the existing basin. Drainage Area 2 has a 1.6% increase in surface runoff from 0.10 cfs pre-development to 0.16 cfs post-development conditions for a 100-year 24-hour

storm event. Given the miniscule increase in runoff from pre-development to post-development conditions for Drainage Area 2, it is assumed that the existing basin has capacity to detain this additional runoff. Therefore, under this assumption, there is not an expected increase in peak discharge rates at the outfall of the existing basin.

The Bentley SewerGEMS program was used to model the proposed stormwater management system and compare pre-development to post-development conditions. The modeling output is included in Appendix G.

Table 3: Peak Surface Runoff (cfs)

	2-Year, 24-hr Storm	10-Year, 24-hr Storm	100-Year, 24-hr Storm
Pre-Development Drainage Area 1	0.01	0.12	0.71
Post-Development Drainage Area 1	0.13	0.57	1.58
Pre-Development Drainage Area 2	0.01	0.04	0.10
Post-Development Drainage Area 2	0.04	0.08	0.16

Table 4: Peak Outfall Flowrates (cfs)

	2-Year, 24-hr Storm	10-Year, 24-hr Storm	100-Year, 24-hr Storm
Pre-Development Drainage Area 1 - (Unrestricted Free Outfall)	0.01	0.12	0.71
Post-Development Drainage Area 1 - (Restricted by Proposed Infiltration Basin)	0	0	0

4. Standard 3 – Groundwater Recharge Volume

Standard 3 requires infiltration of the calculated recharge volume which is based on impervious area. In confirmation with MA DEP and Town of Wareham representatives, gravel is not considered impervious area per MA DEP Stormwater Handbook. However, the characteristics of this project provides the opportunity to easily infiltrate the recharge volume even though it is not technically required.

The recharge volume is calculated using Equation 1 from MA DEP Stormwater Handbook Volume 3 Chapter 1.

$$Rv = F * A$$

Rv = Required Recharge Volume
F = Target Depth Factor
A = Impervious Area

Since there is no impervious area per the MA DEP definition, the proposed gravel area is substituted for this variable. The target depth factor is determined using Table 2.3.2 in the MA DEP Stormwater Handbook Volume 3 Chapter 1. As previously stated, the soils at the location of proposed infiltration are Hydrologic Soil Type A based on Web Soil Survey by NRCS. Referring to Table 2.3.2, the target depth factor is 0.6-inch for Type A. Applying the Static Method, this results in the Required Recharge Volume is 590 CF. The proposed basin volume is 4,372 CF (see below). Therefore, the proposed stormwater management system meets Standard 3.

The bottom area of the infiltration basin was sized to ensure all stormwater runoff infiltrates within 72 hours using the formula presented in MA DEP Stormwater Handbook Volume 3 Chapter 1, as listed below:

$$T = Rv / (K*1/12*Bottom\ Area)$$

T = Drawdown time (hours)
Rv = Recharge Volume
K = Sautrated Hydraulic Conductivity
Bottom Area = Bottom Area of Recharge Structure

For the Static Method of infiltration, Rawls Rate is used for K and is obtained from Table 2.3.3 in the MA DEP Stormwater Handbook Volume 3 Chapter 1. Using the data from NRCS and Table 2.3.3, K is approximately 1.02 in/hr. However, the minimum required value of K is 0.17 in/hr. That value was used when calculating the bottom area to ensure a conservative design. As shown below, the provided bottom area and provided recharge volume are greater than the required amounts.

Table 5: Recharge Volume Calculations

Drainage Area 1		
Infiltration Method	Static	
NRCS Hydrologic Soil Type	A	
Target Depth Factor (Table 2.3.2)	0.6	in
Gravel Area	11,797	SF
*Rv = F * A * 1/12 (Eq. 1)*		
Rv	590	CF
Time to Infiltrate (maximum 72 hours)		
Time	72	hours
Rv	590	CF
K (min. = 0.17 in/hr)	0.17	in/hour
*T = Rv / (K*1/12*Bottom Area)*		
Required Bottom Area	578	SF
Provided Bottom Area	777	SF
Provided Recharge Volume	4,372	CF
Required Recharge Volume	590	CF
Required Input Fields		
Output Fields		

A soil boring has been requested for this location to confirm soil conditions, but the results were not available at the time of this report. Therefore, the assumption is that the in-situ soils at the proposed infiltration location are Hydrologic Soil Type A. Once the conclusions of the geotechnical report are available this site will be reanalyzed for infiltration effectiveness.

In addition to accommodating the Recharge Volume, the infiltration basin was sized to infiltrate the 100-year 24-hour storm event of Post-Development Drainage Area 1. The basin was sized using Bentley SewerGEMS program with the Green Ampt seepage method applied in the model. Below are the assumed infiltration characteristics based on NRCS Web Soil Survey and Rawls Rate Table 2.3.3 from the MA DEP Stormwater Handbook. These values air on the conservative side of realistic field conditions.

Table 6: Assumed Basin Infiltration Characteristics

Suction Head (in) (Average Value of Soil Capillary Suction along the Wetting Front)	3.0
Conductivity (in/hr)	0.75
Initial Deficit (fraction) (Fraction of Soil Volume that is Initially Dry)	0.50

The bottom of the basin is at 67.50 and the top of the basin is at 70.50. The emergency overflow elevation is also at 70.50. As previously discussed, the basin has been sized to prevent an increase of peak discharge from pre-development to post-development conditions for Drainage Area 1. Results from SewerGEMS model can be found in Appendix G.

Table 7: Proposed Basin Characteristics

	2-Year, 24-hr Storm	10-Year, 24-hr Storm	100-Year, 24-hr Storm
High Water Level (ft)	67.79	68.87	70.50
Required Basin Volume (CF)	244	1,475	4,372
Basin Release Rate (cfs) (Restricted by Infiltration)	0	0	0
Infiltration Time (hour)	25.4	40.5	61.9

5. Standard 4 – Water Quality & TSS Removal

a. Required Water Quality Volume and TSS Removal

Per MA DEP Stormwater Standard 4 requires 80% Total Suspended Solids (TSS) removal of the calculated water quality volume. The water quality volume is calculated using Equation 3 from the MA DEP Stormwater Handbook Volume 3 Chapter 1. The water quality volume is determined based on proposed impervious surface area. As previously stated, the MA DEP and Town of Wareham do not recognize proposed gravel as impervious area. Therefore, Standard 4 TSS removal and treating water quality volume do not apply for this project.

b. Long-term Pollution Prevention Plan

The long-term pollution prevention plan has been combined with the Operation and Maintenance Plan required by Standard 9. Refer to the Standard 9 section of this report for more details.

6. Standard 5 – Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

This project is constructing a gravel parking lot that is intended for vehicle storage. Therefore, this project is not considered a land use with higher potential pollutant loads and Standard 5 does not apply.

7. Standard 6 – Critical Areas

According to the state of Massachusetts's online MassMapper, this project does not fall within the Zone I, Zone A, Zone II, or Interim Wellhead Protection Area of a public water supply. This project does not discharge to an Outstanding Resource Water or Special Resource Water. Therefore, this project meets the requirements of Standard 6.

8. Standard 7 – Redevelopment Projects

This project is considered new development and has been designed to fully comply with the MA DEP Stormwater Handbook. Therefore, Standard 7 does not apply.

9. Standard 8 – Erosion and Sedimentation Control Plan

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan has been prepared and is included in Appendix H. Additionally, Erosion and Sediment Control Plans have been included in the project plan set.

This project is planning to disturb less than 1-acre, therefore an NPDES Construction General Permit is not required.

10. Standard 9 – Operation and Maintenance Plan

A long-term operation and maintenance plan has been prepared and is included in Appendix I. The document is intended to satisfy the requirements of Standard 4 and Standard 9.

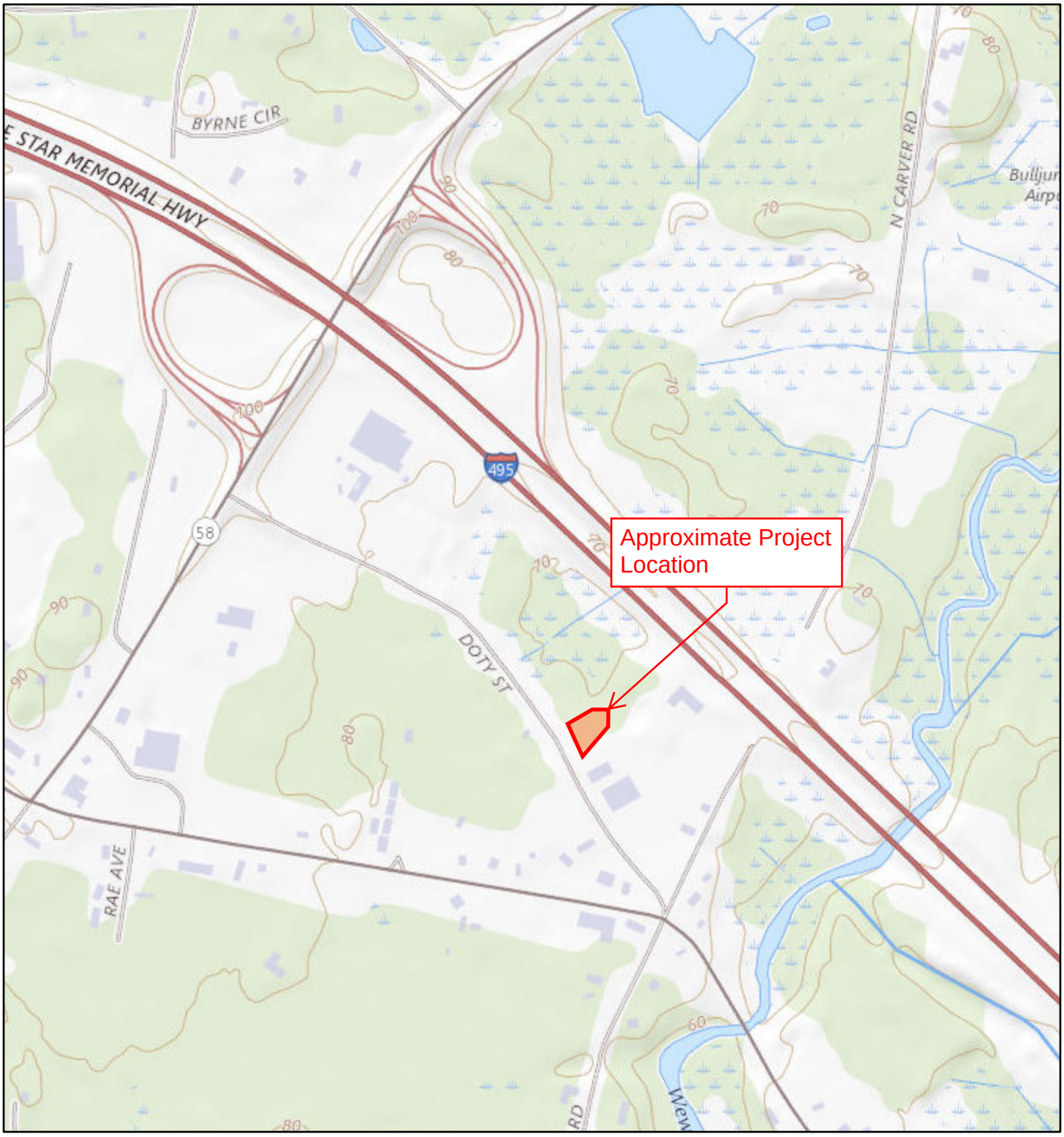
11. Standard 10 – Prohibition of Illicit Discharges

This project does not propose any new illicit discharges to the stormwater management system and therefore meets the requirements of Standard 10.

APPENDIX A

USGS LOCATION MAP

USGS National Map - Wareham, MA



11/29/2021, 1:36:34 PM

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census

APPENDIX B

FEMA MAP

National Flood Hazard Layer FIRMette

FEMA

70°46'14"W 41°48'17"N

70°45'37"W 41°47'51"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

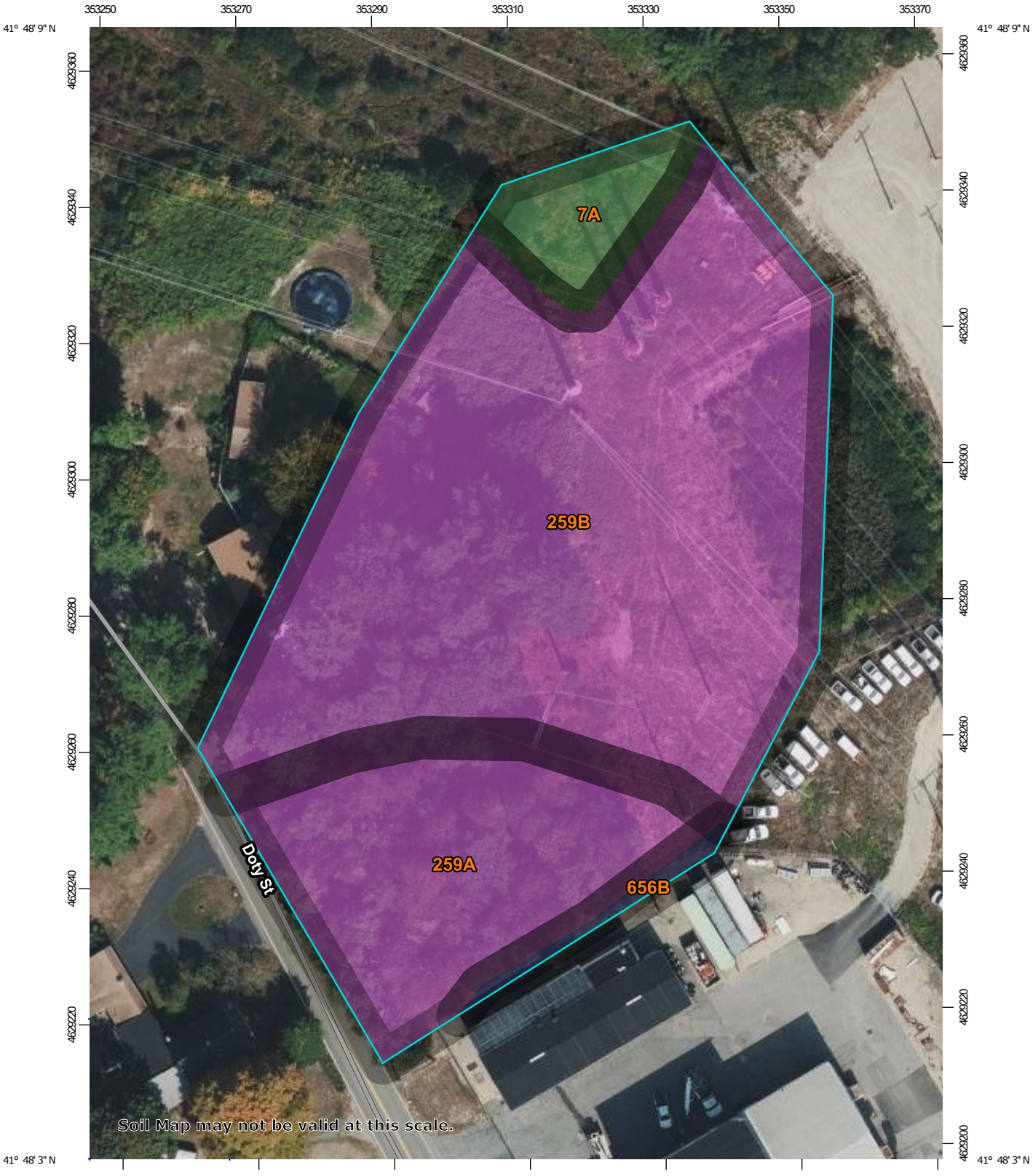
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/14/2021 at 4:43 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX C

NRCS WEB SOIL SURVEY MAP

Hydrologic Soil Group—Plymouth County, Massachusetts
(Wareham - Hydrologic Soil Group)



Map Scale: 1:810 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

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 Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

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 1:12,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Plymouth County, Massachusetts
Survey Area Data: Version 14, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 25, 2020—Oct 9, 2020

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
7A	Rainberry coarse sand, 0 to 3 percent slopes, sanded surface	A/D	0.1	6.0%
259A	Carver loamy coarse sand, 0 to 3 percent slopes	A	0.5	23.4%
259B	Carver loamy coarse sand, 3 to 8 percent slopes	A	1.4	69.6%
656B	Udorthents - Urban land complex, 0 to 8 percent slopes	B	0.0	1.0%
Totals for Area of Interest			**2.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX D

PRE-DEVELOPMENT AND POST-DEVELOPMENT STORMWATER EXHIBITS

SHIVEHATTERY
ARCHITECTURE + ENGINEERING
440 North Wells Street, Suite 320 | Chicago, Illinois 60654
312.324.5500 | www.shive-hattery.com
Iowa | Illinois | Indiana | Nebraska

JEFF RATH, PE 61591 12/03/2021

EVERSOURCE WAREHAM PARKING LOT

EVERSOURCE ENERGY
DOTY STREET, WAREHAM, MA 02576

PRELIMINARY - NOT FOR CONSTRUCTION

DRAWN: EAW
APPROVED: JMR
ISSUED FOR: PERMIT
DATE: 12/03/2021
PROJECT NO: 7211970
FIELD BOOK: ---
CLIENT NO: ---

STORMWATER EXHIBIT

EX. 1A

Pre-Drainage Area 1				
Hydrologic Soil Group	A			
	CN Value	Area (Acres)	Area (Percent)	Area (Fraction)
Gravel	76	0.12	15%	0.15
Pavement	98	0.02	2%	0.02
Woods, Good	30	0.44	55%	0.55
Open Space, Fair	49	0.22	27%	0.27
Total		0.80	100%	1.00
Composite CN Value	44			
Pre-Drainage Area 2				
Hydrologic Soil Group	A			
	CN Value	Area (Acres)	Area (Percent)	Area (Fraction)
Gravel	76	0.03	75%	0.75
Pavement	98	0.00	0%	0.00
Woods, Good	30	0.00	0%	0.00
Open Space, Fair	49	0.01	25%	0.25
Total		0.04	100%	1.00
Composite CN Value	55			
Post-Drainage Area 1				
Hydrologic Soil Group	A			
	CN Value	Area (Acres)	Area (Percent)	Area (Fraction)
Gravel	76	0.12	0.15	0.15
Pavement	98	0.02	0.02	0.02
Woods, Good	30	0.44	0.53	0.53
Open Space, Fair	49	0.24	0.29	0.29
Total		0.83	100%	1.00
Composite CN Value	56			
Post-Drainage Area 2				
Hydrologic Soil Group	A			
	CN Value	Area (Acres)	Area (Percent)	Area (Fraction)
Gravel	76	0.03	0.75	0.75
Pavement	98	0.00	0.00	0.00
Woods, Good	30	0.00	0.00	0.00
Open Space, Fair	49	0.01	0.25	0.25
Total		0.04	100%	1.00
Composite CN Value	69			

Time of Concentration - Pre-Development Area 1		
Total Length (ft)	304.51	
TR 55 Sheet Flow		Notes:
Start Elevation (ft)	78.64	
End Elevation (ft)	76.36	
Length (ft)	100	
Slope (ft/ft)	0.0228	
n (woods & pavement)	0.36	Table 3-1
P2 (in)	3.43	
T (hr)	0.30	Eq. 3-3
T (min)	18.1	
TR 55 Shallow Concentrated Flow		Notes:
Length (ft)	205	
Start Elevation (ft)	76.36	
End Elevation (ft)	70.03	
Slope (ft/ft)	0.0310	
Velocity (ft/s) (unpaved)	2.800	Figure 3-1
T (hr)	0.020	Eq. 3-1
T (min)	1.2	
Tc (min)	19.4	
Round to (min)	20	
Tc (hour)	0.33	

Time of Concentration - Post-Development Area 1		
Total Length (ft)	307.43	
TR 55 Sheet Flow		Notes:
Start Elevation (ft)	78.6	
End Elevation (ft)	76.43	
Length (ft)	100	
Slope (ft/ft)	0.0217	
n (woods & pavement)	0.36	Table 3-1
P2 (in)	3.43	
T (hr)	0.31	Eq. 3-3
T (min)	18.5	
TR 55 Shallow Concentrated Flow		Notes:
Length (ft)	59	
Start Elevation (ft)	76.43	
End Elevation (ft)	75.38	
Slope (ft/ft)	0.0179	
Velocity (ft/s) (paved)	2.700	Figure 3-1
T (hr)	0.006	Eq. 3-1
T (min)	0.4	
TR 55 Shallow Concentrated Flow		Notes:
Length (ft)	48	
Start Elevation (ft)	75.3800	
End Elevation (ft)	75	
Slope (ft/ft)	0.0079	
Velocity (ft/s) (unpaved)	1.400	Figure 3-1
T (hr)	0.010	Eq. 3-1
T (min)	0.6	
TR 55 Shallow Concentrated Flow		Notes:
Length (ft)	100	
Start Elevation (ft)	0.0000	
End Elevation (ft)	70.42	
Slope (ft/ft)	-0.7029	
Velocity (ft/s) (unpaved)	3.400	Figure 3-1
T (hr)	0.008	Eq. 3-1
T (min)	0.5	
Tc (min)	19.9	
Round to (min)	20	
Tc (hour)	0.33	

Time of Concentration - Pre-Development Area 2		
Total Length	65.19	
TR 55 Sheet Flow		Notes:
Start Elevation (ft)	76.34	
End Elevation (ft)	74.74	
Length (ft)	65.19	
Slope (ft/ft)	0.025	
n (open grass & gravel)	0.10	Table 3-1
P2 (in)	3.43	
T (hr)	0.08	Eq. 3-3
T (min)	4.6	
Tc (min)	4.6	
Round to (min)	5	
Tc (hour)	0.083	

Time of Concentration - Post-Development Area 2		
Total Length	62.02	
TR 55 Sheet Flow		Notes:
Start Elevation (ft)	76.27	
End Elevation (ft)	75.09	
Length (ft)	62.02	
Slope (ft/ft)	0.019	
n (Gravel)	0.011	Table 3-1
P2 (in)	3.43	
T (hr)	0.01	Eq. 3-3
T (min)	0.8	
Tc (min)	0.8	Min. ToC Allowed for SewerGEMS Model is 5 minutes
Round to (min)	1.00	
Tc (hour)	0.017	

Outfall 1	Area (Acres)	CN Value	100-yr Flow (cfs)	5-yr Flow (cfs)	Outfall Characteristic
Pre-Drainage Area 1	0.80	44	0.71	0.04	No Restriction
Post-Drainage Area 1	0.83	56	0	0	0 cfs (Restricted by Infiltration Basin)
	Total Pre-Flow to Outfall 1 (cfs)		0.71		
	Total Post-Flow to Outfall 1 (cfs)		0		
	Change in Flow to Outfall 1 (%)		0%		
Outfall 2	Area (Acres)	CN Value	100-yr Flow (cfs)	5-yr Flow (cfs)	Outfall Characteristic
Pre-Drainage Area 2	0.04	55	0.10	0.02	No Restriction
Post-Drainage Area 2	0.04	69	0	0	0 cfs (Restricted by Existing Retention Basin)
	Total Pre-Flow to Outfall 1 (cfs)		0.10		
	Total Post-Flow to Outfall 1 (cfs)		0		
	Change in Flow to Outfall 1 (%)		0%		

DESIGN METHOD STATEMENT:
STORMWATER CALCULATIONS WERE DETERMINED USING SCS TYPE III METHOD AND TR55 PER THE REQUIREMENTS SPECIFIED IN THE MA DEP STORMWATER HANDBOOK AND THE HYDROLOGY HANDBOOK FOR CONSERVATION COMMISSIONERS

SHIVEHATTERY
ARCHITECTURE + ENGINEERING
440 North Wells Street, Suite 320 | Chicago, Illinois 60654
312.324.5500 | www.shive-hattery.com
Iowa | Illinois | Indiana | Nebraska

JEFF RATH, PE 61591 12/03/2021

EVERSOURCE WAREHAM PARKING LOT

EVERSOURCE ENERGY
DOTY STREET, WAREHAM, MA 02576

PRELIMINARY - NOT FOR CONSTRUCTION

DRAWN: EAW
APPROVED: JMR
ISSUED FOR: PERMIT
DATE: 12/03/2021
PROJECT NO: 7211970
FIELD BOOK: ---
CLIENT NO: ---

STORMWATER EXHIBIT

EX. 1B

APPENDIX E

CN & TIME OF CONCENTRATION CALCULATIONS

Pre-Drainage Area 1				
Hydrologic Soil Group	A			
	CN Value	Area (Acres)	Area (Percent)	Area (Fraction)
Gravel	76	0.12	15%	0.15
Pavement	98	0.02	2%	0.02
Woods, Good	30	0.44	55%	0.55
Open Space, Fair	49	0.22	27%	0.27
Total		0.80	100%	1.00
Composite CN Value	44			
Pre-Drainage Area 2				
Hydrologic Soil Group	A			
	CN Value	Area (Acres)	Area (Percent)	Area (Fraction)
Gravel	76	0.03	75%	0.75
Pavement	98	0.00	0%	0.00
Woods, Good	30	0.00	0%	0.00
Open Space, Fair	49	0.01	25%	0.25
Total		0.04	100%	1.00
Composite CN Value	55			
Post-Drainage Area 1				
Hydrologic Soil Group	A			
	CN Value	Area (Acres)	Area (Percent)	Area (Fraction)
Gravel	76	0.12	0.15	0.15
Pavement	98	0.02	0.02	0.02
Woods, Good	30	0.44	0.53	0.53
Open Space, Fair	49	0.24	0.29	0.29
Total		0.83	100%	1.00
Composite CN Value	56			
Post-Drainage Area 2				
Hydrologic Soil Group	A			
	CN Value	Area (Acres)	Area (Percent)	Area (Fraction)
Gravel	76	0.03	0.75	0.75
Pavement	98	0.00	0.00	0.00
Woods, Good	30	0.00	0.00	0.00
Open Space, Fair	49	0.01	0.25	0.25
Total		0.04	100%	1.00
Composite CN Value	69			

Time of Concentration - Pre-Development Area 1		
Total Length (ft)	304.51	
TR 55 Sheet Flow		Notes:
Start Elevation (ft)	78.64	
End Elevation (ft)	76.36	
Length (ft)	100	
Slope (ft/ft)	0.0228	
n (woods & pavement)	0.36	Table 3-1
P_2 (in)	3.43	
T (hr)	0.30	Eq. 3-3
T (min)	18.1	
TR 55 Shallow Concentrated Flow		Notes:
Length (ft)	205	
Start Elevation (ft)	76.36	
End Elevation (ft)	70.03	
Slope (ft/ft)	0.0310	
Velocity (ft/s) (unpaved)	2.800	Figure 3-1
T (hr)	0.020	Eq. 3-1
T (min)	1.2	
Tc (min)	19.4	
Round to (min)	20	
Tc (hour)	0.33	

Time of Concentration - Post-Development Area 1		
Total Length (ft)	307.43	
TR 55 Sheet Flow		Notes:
Start Elevation (ft)	78.6	
End Elevation (ft)	76.43	
Length (ft)	100	
Slope (ft/ft)	0.0217	
n (woods & pavement)	0.36	Table 3-1
P_2 (in)	3.43	
T (hr)	0.31	Eq. 3-3
T (min)	18.5	
TR 55 Shallow Concentrated Flow		Notes:
Length (ft)	59	
Start Elevation (ft)	76.43	
End Elevation (ft)	75.38	
Slope (ft/ft)	0.0179	
Velocity (ft/s) (paved)	2.700	Figure 3-1
T (hr)	0.006	Eq. 3-1
T (min)	0.4	
TR 55 Shallow Concentrated Flow		Notes:
Length (ft)	48	
Start Elevation (ft)	75.3800	
End Elevation (ft)	75	
Slope (ft/ft)	0.0079	
Velocity (ft/s) (unpaved)	1.400	Figure 3-1
T (hr)	0.010	Eq. 3-1
T (min)	0.6	
TR 55 Shallow Concentrated Flow		Notes:
Length (ft)	100	
Start Elevation (ft)	0.0000	
End Elevation (ft)	70.42	
Slope (ft/ft)	-0.7029	
Velocity (ft/s) (unpaved)	3.400	Figure 3-1
T (hr)	0.008	Eq. 3-1
T (min)	0.5	
Tc (min)	19.9	
Round to (min)	20	
Tc (hour)	0.33	

Time of Concentration - Pre-Development Area 2		
Total Length	65.19	
TR 55 Sheet Flow		Notes:
Start Elevation (ft)	76.34	
End Elevation (ft)	74.74	
Length (ft)	65.19	
Slope (ft/ft)	0.025	
n (open grass & gravel)	0.10	Table 3-1
P_2 (in)	3.43	
T (hr)	0.08	Eq. 3-3
T (min)	4.6	
Tc (min)	4.6	
Round to (min)	5	
Tc (hour)	0.083	

Time of Concentration - Post-Development Area 2		
Total Length	62.02	
TR 55 Sheet Flow		Notes:
Start Elevation (ft)	76.27	
End Elevation (ft)	75.09	
Length (ft)	62.02	
Slope (ft/ft)	0.019	
n (Gravel)	0.011	Table 3-1
P_2 (in)	3.43	
T (hr)	0.01	Eq. 3-3
T (min)	0.8	
Tc (min)	0.8	Min. ToC Allowed for
Round to (min)	1.00	SewerGEMS Model is
Tc (hour)	0.017	5 minutes

APPENDIX F

NOAA RAINFALL DATA

NOAA Atlas 14, Volume 10, Version 3
Location name: West Wareham, Massachusetts, USA*
Latitude: 41.8009°, Longitude: -70.7654°
Elevation: 75.19 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_&_aerials

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	**0.295** (0.237-0.362)	**0.366** (0.294-0.449)	**0.482** (0.386-0.593)	**0.578** (0.460-0.713)	**0.711** (0.550-0.912)	**0.810** (0.615-1.06)	**0.916** (0.677-1.24)	**1.04** (0.724-1.41)	**1.23** (0.822-1.71)	**1.39** (0.908-1.96)
10-min	**0.418** (0.336-0.512)	**0.519** (0.417-0.636)	**0.684** (0.548-0.841)	**0.820** (0.653-1.01)	**1.01** (0.779-1.29)	**1.15** (0.871-1.50)	**1.30** (0.959-1.75)	**1.47** (1.02-2.00)	**1.74** (1.17-2.42)	**1.97** (1.29-2.78)
15-min	**0.492** (0.396-0.603)	**0.611** (0.490-0.748)	**0.804** (0.644-0.989)	**0.965** (0.768-1.19)	**1.19** (0.916-1.52)	**1.35** (1.02-1.76)	**1.53** (1.13-2.06)	**1.74** (1.21-2.35)	**2.05** (1.37-2.85)	**2.31** (1.51-3.27)
30-min	**0.703** (0.565-0.861)	**0.872** (0.700-1.07)	**1.15** (0.919-1.41)	**1.38** (1.10-1.70)	**1.69** (1.31-2.17)	**1.93** (1.46-2.52)	**2.18** (1.61-2.94)	**2.48** (1.72-3.36)	**2.92** (1.96-4.07)	**3.30** (2.16-4.66)
60-min	**0.914** (0.735-1.12)	**1.13** (0.910-1.39)	**1.49** (1.20-1.84)	**1.79** (1.43-2.21)	**2.20** (1.70-2.82)	**2.50** (1.90-3.27)	**2.83** (2.09-3.82)	**3.22** (2.24-4.36)	**3.80** (2.54-5.28)	**4.29** (2.81-6.05)
2-hr	**1.22** (0.986-1.48)	**1.52** (1.23-1.85)	**2.02** (1.62-2.46)	**2.42** (1.94-2.97)	**2.99** (2.33-3.81)	**3.41** (2.61-4.42)	**3.86** (2.89-5.18)	**4.41** (3.09-5.92)	**5.25** (3.54-7.23)	**5.97** (3.94-8.34)
3-hr	**1.43** (1.17-1.74)	**1.78** (1.45-2.16)	**2.36** (1.91-2.87)	**2.83** (2.28-3.46)	**3.49** (2.73-4.42)	**3.97** (3.05-5.13)	**4.50** (3.38-6.01)	**5.13** (3.62-6.86)	**6.11** (4.15-8.38)	**6.95** (4.62-9.67)
6-hr	**1.88** (1.53-2.26)	**2.30** (1.88-2.76)	**2.98** (2.43-3.60)	**3.56** (2.88-4.31)	**4.34** (3.42-5.46)	**4.92** (3.81-6.30)	**5.55** (4.20-7.33)	**6.30** (4.48-8.34)	**7.44** (5.09-10.1)	**8.40** (5.63-11.6)
12-hr	**2.40** (1.98-2.86)	**2.87** (2.36-3.43)	**3.64** (2.98-4.36)	**4.28** (3.49-5.15)	**5.16** (4.08-6.41)	**5.82** (4.52-7.34)	**6.51** (4.93-8.46)	**7.31** (5.24-9.58)	**8.47** (5.86-11.4)	**9.43** (6.38-12.8)
24-hr	**2.90** (2.40-3.44)	**3.43** (2.84-4.08)	**4.31** (3.56-5.13)	**5.04** (4.14-6.02)	**6.04** (4.82-7.44)	**6.80** (5.32-8.49)	**7.59** (5.77-9.72)	**8.46** (6.13-11.0)	**9.70** (6.77-12.9)	**10.7** (7.31-14.4)
2-day	**3.32** (2.77-3.91)	**3.96** (3.30-4.67)	**5.00** (4.15-5.90)	**5.86** (4.85-6.95)	**7.04** (5.66-8.60)	**7.94** (6.26-9.83)	**8.87** (6.80-11.3)	**9.90** (7.23-12.7)	**11.4** (8.02-15.0)	**12.6** (8.66-16.8)
3-day	**3.64** (3.05-4.27)	**4.31** (3.61-5.06)	**5.41** (4.52-6.37)	**6.32** (5.25-7.47)	**7.58** (6.11-9.21)	**8.53** (6.75-10.5)	**9.51** (7.33-12.0)	**10.6** (7.78-13.6)	**12.1** (8.59-15.9)	**13.4** (9.26-17.7)
4-day	**3.92** (3.30-4.59)	**4.61** (3.87-5.40)	**5.74** (4.81-6.73)	**6.67** (5.56-7.86)	**7.96** (6.44-9.63)	**8.94** (7.09-11.0)	**9.95** (7.68-12.5)	**11.0** (8.14-14.1)	**12.6** (8.95-16.4)	**13.8** (9.60-18.2)
7-day	**4.67** (3.95-5.44)	**5.39** (4.56-6.28)	**6.57** (5.54-7.66)	**7.55** (6.32-8.83)	**8.89** (7.23-10.7)	**9.91** (7.90-12.0)	**11.0** (8.48-13.6)	**12.1** (8.96-15.2)	**13.5** (9.71-17.5)	**14.7** (10.3-19.2)
10-day	**5.38** (4.57-6.23)	**6.12** (5.19-7.10)	**7.34** (6.20-8.53)	**8.35** (7.02-9.73)	**9.73** (7.94-11.6)	**10.8** (8.64-13.0)	**11.9** (9.21-14.6)	**13.0** (9.68-16.3)	**14.4** (10.4-18.5)	**15.5** (10.9-20.2)
20-day	**7.47** (6.38-8.59)	**8.29** (7.08-9.54)	**9.64** (8.21-11.1)	**10.8** (9.11-12.4)	**12.3** (10.1-14.5)	**13.5** (10.9-16.1)	**14.7** (11.4-17.8)	**15.8** (11.9-19.6)	**17.2** (12.5-21.8)	**18.2** (12.9-23.4)
30-day	**9.21** (7.91-10.6)	**10.1** (8.67-11.6)	**11.6** (9.89-13.3)	**12.8** (10.9-14.7)	**14.4** (11.9-16.9)	**15.8** (12.7-18.7)	**17.0** (13.3-20.4)	**18.2** (13.8-22.4)	**19.5** (14.3-24.7)	**20.5** (14.7-26.2)
45-day	**11.4** (9.83-13.0)	**12.4** (10.7-14.1)	**14.0** (12.0-16.0)	**15.3** (13.1-17.6)	**17.2** (14.2-20.0)	**18.6** (15.1-21.9)	**20.0** (15.7-23.8)	**21.2** (16.2-26.0)	**22.6** (16.6-28.3)	**23.5** (16.9-29.9)
60-day	**13.3** (11.5-15.1)	**14.3** (12.4-16.3)	**16.0** (13.8-18.3)	**17.5** (15.0-20.0)	**19.4** (16.2-22.6)	**21.0** (17.1-24.6)	**22.5** (17.7-26.7)	**23.7** (18.2-29.0)	**25.1** (18.6-31.4)	**26.0** (18.8-32.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

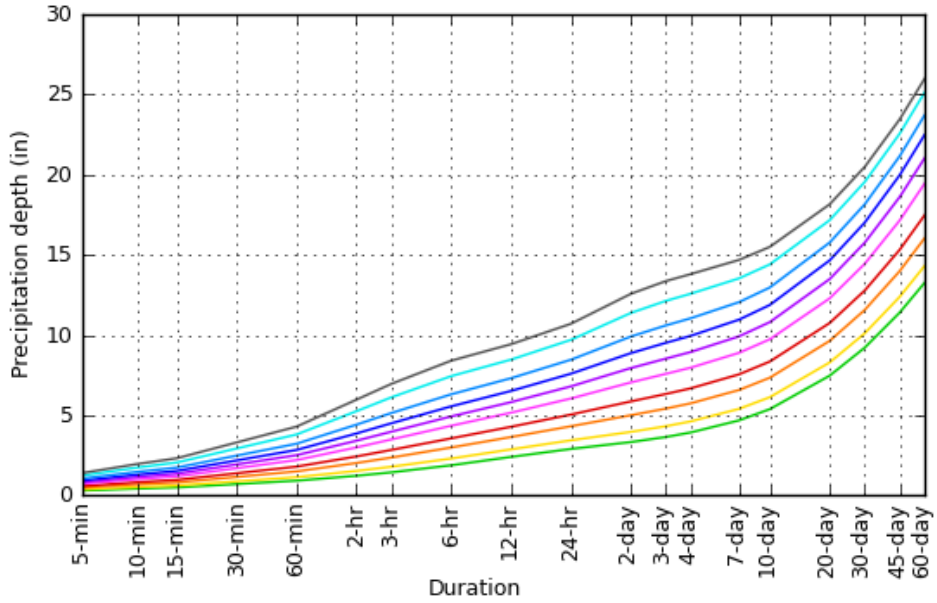
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

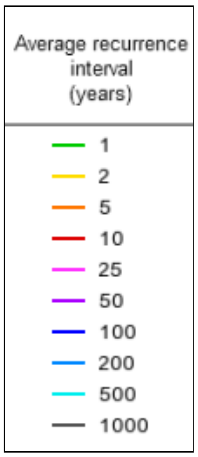
Please refer to NOAA Atlas 14 document for more information.

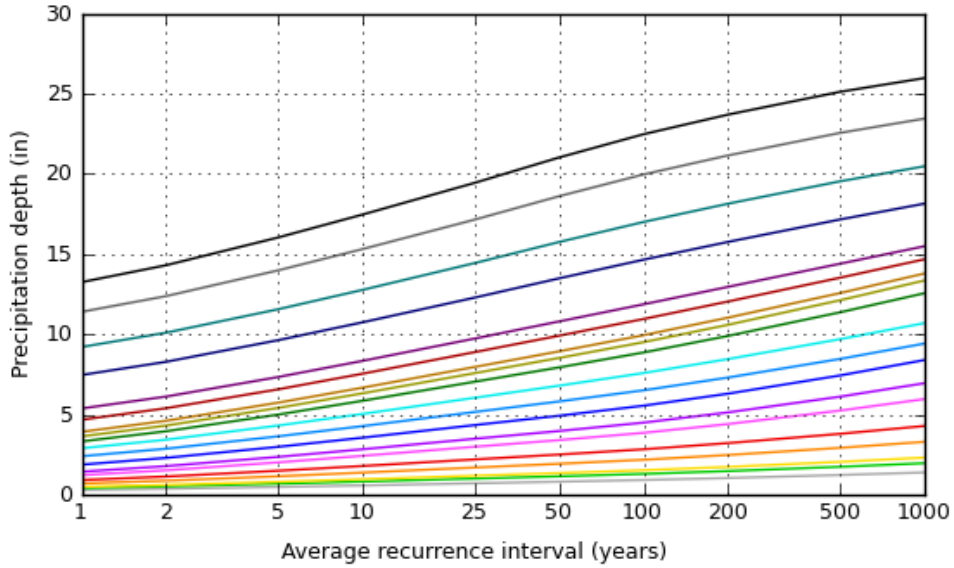
Back to Top

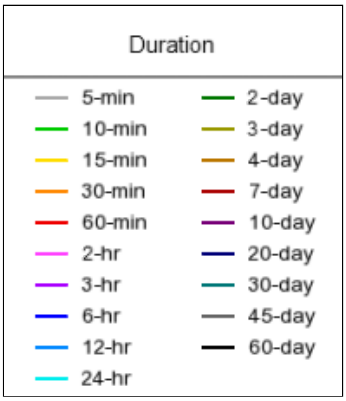
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 41.8009°, Longitude: -70.7654°







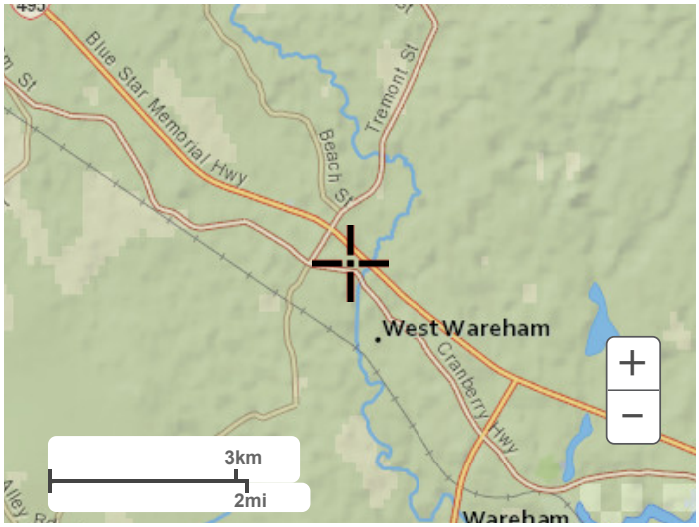


NOAA Atlas 14, Volume 10, Version 3 Created (GMT): Thu Nov 11 20:42:42 2021

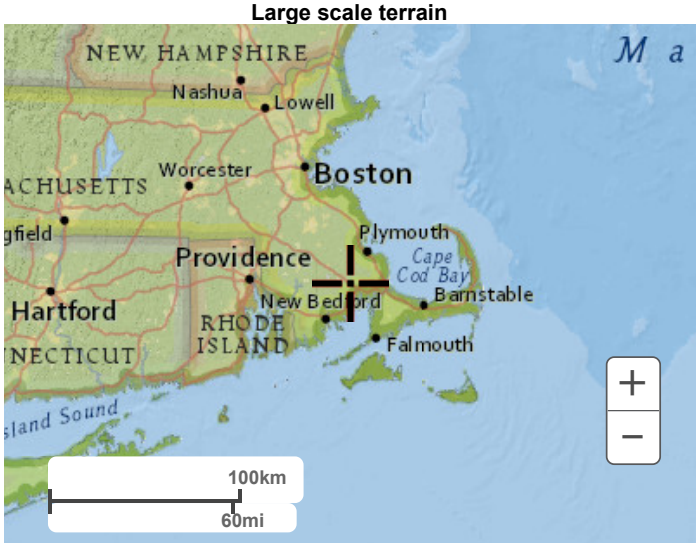
Back to Top

Maps & aerials

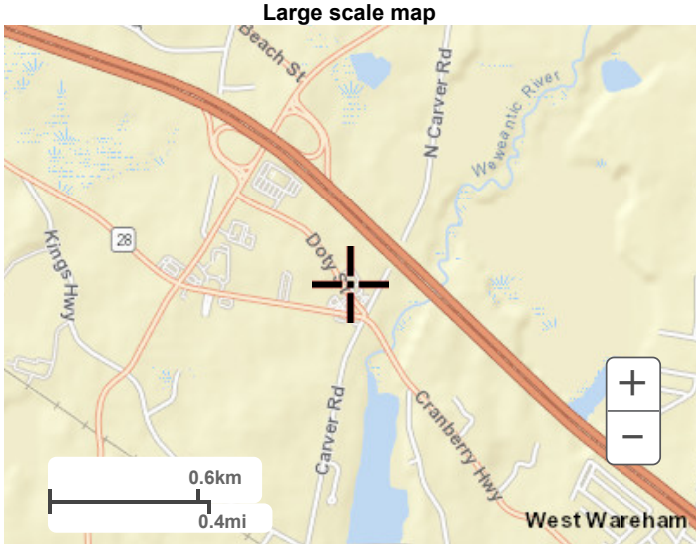
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

NOAA Atlas 14, Volume 10, Version 3
Location name: West Wareham, Massachusetts, USA*
Latitude: 41.8009°, Longitude: -70.7654°
Elevation: 75.19 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_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**3.54** (2.84-4.34)	**4.39** (3.53-5.39)	**5.78** (4.63-7.12)	**6.94** (5.52-8.56)	**8.53** (6.60-10.9)	**9.72** (7.38-12.7)	**11.0** (8.12-14.8)	**12.5** (8.69-16.9)	**14.7** (9.86-20.5)	**16.6** (10.9-23.5)
10-min	**2.51** (2.02-3.07)	**3.11** (2.50-3.82)	**4.10** (3.29-5.05)	**4.92** (3.92-6.07)	**6.05** (4.67-7.75)	**6.88** (5.23-8.99)	**7.78** (5.75-10.5)	**8.84** (6.15-12.0)	**10.4** (6.99-14.5)	**11.8** (7.72-16.7)
15-min	**1.97** (1.58-2.41)	**2.44** (1.96-2.99)	**3.22** (2.58-3.96)	**3.86** (3.07-4.76)	**4.74** (3.66-6.08)	**5.40** (4.09-7.04)	**6.10** (4.52-8.23)	**6.94** (4.82-9.41)	**8.19** (5.48-11.4)	**9.25** (6.05-13.1)
30-min	**1.41** (1.13-1.72)	**1.74** (1.40-2.14)	**2.30** (1.84-2.82)	**2.76** (2.19-3.40)	**3.39** (2.62-4.34)	**3.86** (2.92-5.03)	**4.36** (3.22-5.87)	**4.95** (3.44-6.71)	**5.84** (3.91-8.13)	**6.60** (4.32-9.32)
60-min	**0.914** (0.735-1.12)	**1.13** (0.910-1.39)	**1.49** (1.20-1.84)	**1.79** (1.43-2.21)	**2.20** (1.70-2.82)	**2.50** (1.90-3.27)	**2.83** (2.09-3.82)	**3.22** (2.24-4.36)	**3.80** (2.54-5.28)	**4.29** (2.81-6.05)
2-hr	**0.610** (0.493-0.741)	**0.760** (0.615-0.926)	**1.01** (0.812-1.23)	**1.21** (0.972-1.49)	**1.49** (1.16-1.90)	**1.70** (1.30-2.21)	**1.93** (1.44-2.59)	**2.20** (1.54-2.96)	**2.62** (1.77-3.62)	**2.98** (1.97-4.17)
3-hr	**0.478** (0.388-0.578)	**0.594** (0.482-0.720)	**0.785** (0.635-0.954)	**0.943** (0.759-1.15)	**1.16** (0.909-1.47)	**1.32** (1.02-1.71)	**1.50** (1.13-2.00)	**1.71** (1.20-2.29)	**2.04** (1.38-2.79)	**2.32** (1.54-3.22)
6-hr	**0.313** (0.256-0.377)	**0.383** (0.313-0.462)	**0.498** (0.406-0.602)	**0.594** (0.481-0.719)	**0.725** (0.571-0.911)	**0.822** (0.636-1.05)	**0.927** (0.701-1.22)	**1.05** (0.748-1.39)	**1.24** (0.851-1.69)	**1.40** (0.940-1.93)
12-hr	**0.199** (0.164-0.238)	**0.238** (0.196-0.285)	**0.302** (0.248-0.362)	**0.355** (0.290-0.427)	**0.428** (0.339-0.532)	**0.483** (0.375-0.609)	**0.540** (0.409-0.702)	**0.607** (0.435-0.795)	**0.703** (0.486-0.944)	**0.782** (0.529-1.07)
24-hr	**0.121** (0.100-0.143)	**0.143** (0.119-0.170)	**0.180** (0.148-0.214)	**0.210** (0.172-0.251)	**0.252** (0.201-0.310)	**0.283** (0.222-0.354)	**0.316** (0.240-0.405)	**0.353** (0.255-0.458)	**0.404** (0.282-0.537)	**0.446** (0.305-0.602)
2-day	**0.069** (0.058-0.082)	**0.082** (0.069-0.097)	**0.104** (0.087-0.123)	**0.122** (0.101-0.145)	**0.147** (0.118-0.179)	**0.165** (0.130-0.205)	**0.185** (0.142-0.235)	**0.206** (0.151-0.265)	**0.237** (0.167-0.312)	**0.262** (0.180-0.349)
3-day	**0.051** (0.042-0.059)	**0.060** (0.050-0.070)	**0.075** (0.063-0.088)	**0.088** (0.073-0.104)	**0.105** (0.085-0.128)	**0.118** (0.094-0.146)	**0.132** (0.102-0.167)	**0.147** (0.108-0.188)	**0.168** (0.119-0.220)	**0.186** (0.129-0.246)
4-day	**0.041** (0.034-0.048)	**0.048** (0.040-0.056)	**0.060** (0.050-0.070)	**0.070** (0.058-0.082)	**0.083** (0.067-0.100)	**0.093** (0.074-0.114)	**0.104** (0.080-0.130)	**0.115** (0.085-0.147)	**0.131** (0.093-0.171)	**0.144** (0.100-0.190)
7-day	**0.028** (0.024-0.032)	**0.032** (0.027-0.037)	**0.039** (0.033-0.046)	**0.045** (0.038-0.053)	**0.053** (0.043-0.063)	**0.059** (0.047-0.072)	**0.065** (0.050-0.081)	**0.072** (0.053-0.091)	**0.081** (0.058-0.104)	**0.087** (0.061-0.114)
10-day	**0.022** (0.019-0.026)	**0.026** (0.022-0.030)	**0.031** (0.026-0.036)	**0.035** (0.029-0.041)	**0.041** (0.033-0.048)	**0.045** (0.036-0.054)	**0.049** (0.038-0.061)	**0.054** (0.040-0.068)	**0.060** (0.043-0.077)	**0.065** (0.046-0.084)
20-day	**0.016** (0.013-0.018)	**0.017** (0.015-0.020)	**0.020** (0.017-0.023)	**0.022** (0.019-0.026)	**0.026** (0.021-0.030)	**0.028** (0.023-0.033)	**0.031** (0.024-0.037)	**0.033** (0.025-0.041)	**0.036** (0.026-0.045)	**0.038** (0.027-0.049)
30-day	**0.013** (0.011-0.015)	**0.014** (0.012-0.016)	**0.016** (0.014-0.018)	**0.018** (0.015-0.020)	**0.020** (0.017-0.024)	**0.022** (0.018-0.026)	**0.024** (0.018-0.028)	**0.025** (0.019-0.031)	**0.027** (0.020-0.034)	**0.028** (0.020-0.036)
45-day	**0.011** (0.009-0.012)	**0.011** (0.010-0.013)	**0.013** (0.011-0.015)	**0.014** (0.012-0.016)	**0.016** (0.013-0.019)	**0.017** (0.014-0.020)	**0.018** (0.014-0.022)	**0.020** (0.015-0.024)	**0.021** (0.015-0.026)	**0.022** (0.016-0.028)
60-day	**0.009** (0.008-0.010)	**0.010** (0.009-0.011)	**0.011** (0.010-0.013)	**0.012** (0.010-0.014)	**0.014** (0.011-0.016)	**0.015** (0.012-0.017)	**0.016** (0.012-0.019)	**0.016** (0.013-0.020)	**0.017** (0.013-0.022)	**0.018** (0.013-0.023)

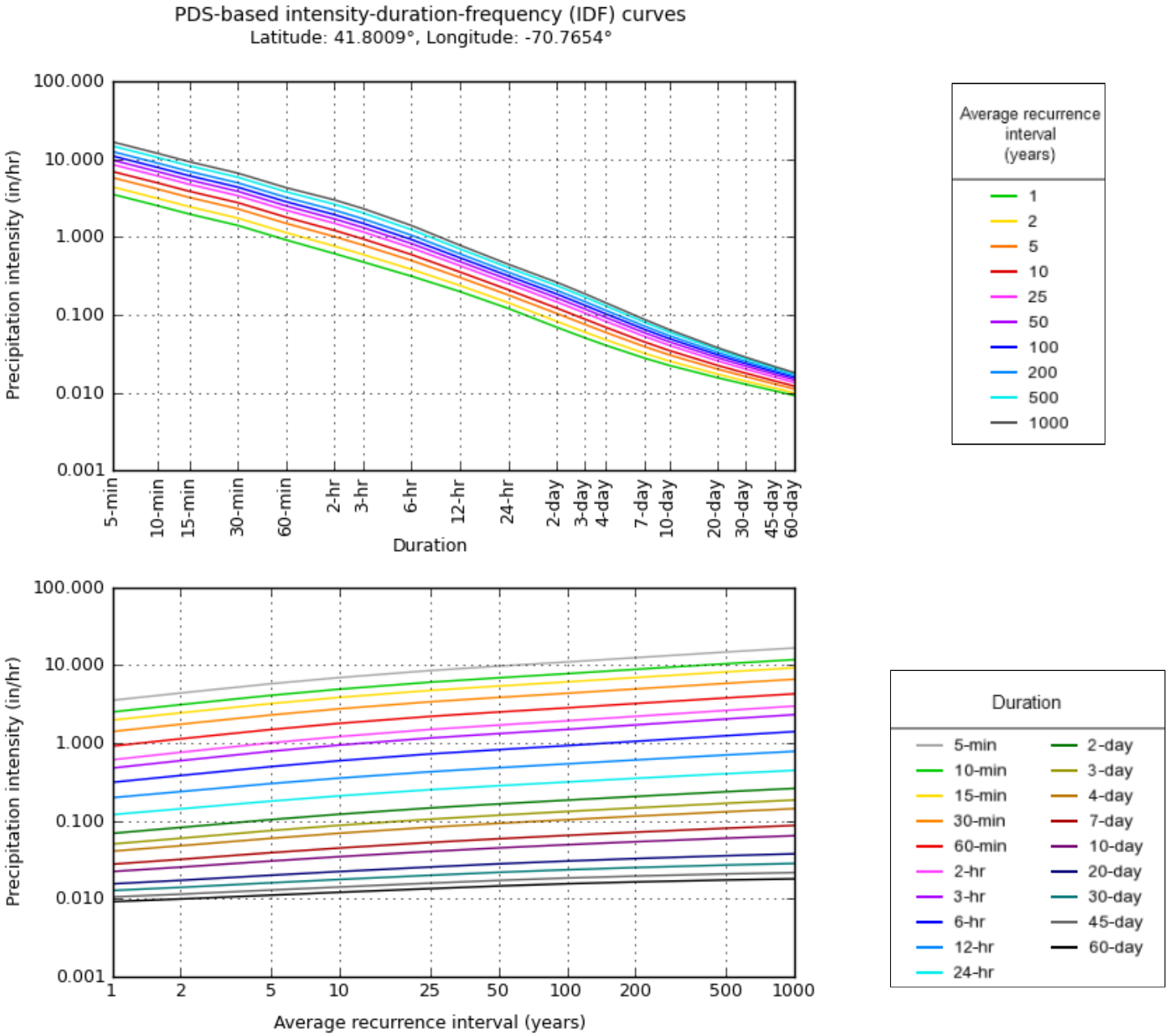
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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



NOAA Atlas 14, Volume 10, Version 3

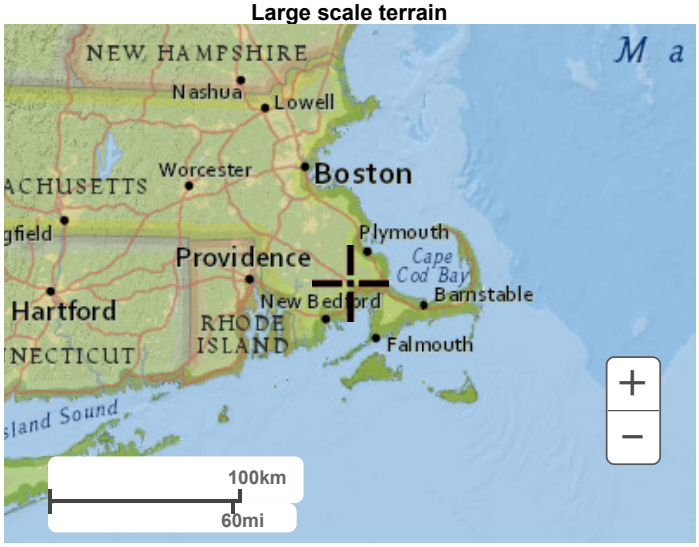
Created (GMT): Thu Nov 11 20:44:12 2021

Back to Top

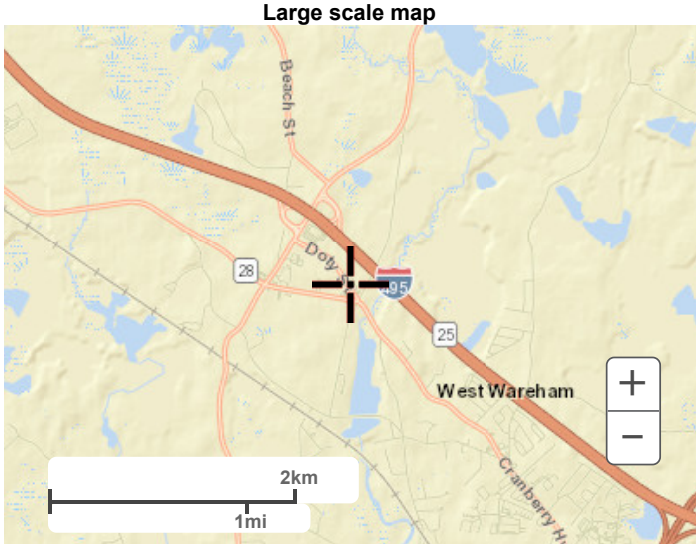
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX G

SEWERGEMS OUTPUT

Pre-Development
2-year Storm Event

Drainage Area 1

<General>			
ID	91	Notes	
Label	Drainage Area 1	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.044 acres	Area (User Defined)	0.800 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-143.39	-53.75
-170.39	-34.44
-197.10	-54.16
-186.60	-85.65
-153.41	-85.39

Active Topology	
Is Active?	True

Catchment	
Outflow Element	O-1

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.322 hours
SCS CN	44.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	44.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	100.0 ft	Slope	0.023 ft/ft

Drainage Area 1

TR-55 Sheet Flow			
Manning's n	0.360	2 Year 24 Hour Depth	3.4 in

TR-55 Shallow Concentrated Flow			
Hydraulic Length	205.0 ft	Slope	0.031 ft/ft
Land Cover	Grassed Waterway		

Results (Extended Catchment)			
Precipitation (Cumulative)	3.0 in	Precipitation (Incremental)	0.0 in

Results (Flow)			
Flow (Total Out)	0.01 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.01 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.01 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	15.282 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.800 acres	Volume (Total Runoff)	167.0 ft³

Calculation Messages

Time (hours)	Message

O-1

Pre-Development
2-year Storm Event

<General>			
ID	94	Hyperlinks	<Collection: 0 items>
Label	O-1	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-140.78 ft	Y	30.68 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	70.03 ft
Elevation (Ground)	70.03 ft	Elevation (Invert)	70.03 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.01 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	34.2 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-1

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	15.283 hours	Hydraulic Grade	70.03 ft
Local Inflow (Total Volume)	166.9 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	70.03 ft
Local Inflow (Maximum)	0.01 cfs	Time to Maximum Inflow	15.283 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.01 cfs

Calculation Messages

Time (hours)	Message

Drainage Area 1

Post-Development
2-year Storm Event

<General>			
ID	91	Notes	
Label	Drainage Area 1	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.044 acres	Area (User Defined)	0.830 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-143.39	-53.75
-170.39	-34.44
-197.10	-54.16
-186.60	-85.65
-153.41	-85.39

Active Topology	
Is Active?	True

Catchment	
Outflow Element	PO-1

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.331 hours
SCS CN	56.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	56.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	100.0 ft	Slope	0.022 ft/ft

Drainage Area 1

TR-55 Sheet Flow			
Manning's n	0.360	2 Year 24 Hour Depth	3.4 in

TR-55 Shallow Concentrated Flow			
Hydraulic Length	59.0 ft	Slope	0.018 ft/ft
Land Cover	Paved		

TR-55 Shallow Concentrated Flow			
Hydraulic Length	48.0 ft	Slope	0.008 ft/ft
Land Cover	Grassed Waterway		

TR-55 Shallow Concentrated Flow			
Hydraulic Length	100.0 ft	Slope	0.046 ft/ft
Land Cover	Grassed Waterway		

Results (Extended Catchment)			
Precipitation (Cumulative)	2.3 in	Precipitation (Incremental)	0.1 in

Results (Flow)			
Flow (Total Out)	0.13 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.13 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.13 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.458 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.830 acres	Volume (Total Runoff)	1,071.0 ft³

Calculation Messages

Time (hours)	Message

O-1

Post-Development
2-year Storm Event

<General>			
ID	94	Hyperlinks	<Collection: 0 items>
Label	O-1	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-140.78 ft	Y	30.68 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	67.50 ft
Elevation (Ground)	67.50 ft	Elevation (Invert)	67.50 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.00 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	0.0 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-1

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	0.000 hours	Hydraulic Grade	67.50 ft
Local Inflow (Total Volume)	0.0 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	67.50 ft
Local Inflow (Maximum)	0.00 cfs	Time to Maximum Inflow	0.000 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.00 cfs

Calculation Messages

Time (hours)	Message

PO-1

Post-Development
2-year Storm Event

<General>			
ID	93	Notes	
Label	PO-1	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>	
Scaled Area	0.013 acres

Geometry

X (ft)	Y (ft)
-135.34	-29.51
-117.03	-29.70
-111.19	-12.35
-125.89	-1.44
-140.81	-12.04

Active Topology	
Is Active?	True

Infiltration/Inflow & Seepage			
Pond Seepage Method	Green Ampt	Conductivity	0.750 in/h
Suction Head	3.0 in	Initial Deficit	0.500

Inflow (Wet) Collection

Physical			
Volume Type	Elevation-Area	Depth (Maximum Curve)	0.00 ft

Elevation-Area

Elevation (ft)	Area (acres)	Percent Void Space (%)
67.50	0.018	100.0
68.00	0.023	100.0
69.00	0.033	100.0
70.00	0.045	100.0
70.50	0.050	100.0
71.00	1.000	100.0

Simulation Initial Condition	
Initial Elevation Type	Invert

PO-1

SWMM Extended Data	
Evaporation Factor	0.000

Water Quality			
Temperature (H2S)	68.0 F	BOD (Local Inflow)	0.0 mg/L
H2S (Local Inflow)	0.0 mg/L	Apply Treatment?	False
Reaction Rate (H2S)	0.0 /day		

Pollutograph Collection

Pollutograph

Results (Extended Node)			
Volume	243.5 ft³	Freeboard Height	3.2 ft
Depth (Flooding)	0.00 ft		

Results (Flow)			
Flow (Total In)	0.02 cfs	Local Inflow?	False
Flow (Total Out)	0.00 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (H2S)			
H2S (Out)	(N/A) mg/L	Detention Time (average)	0.000 min
BOD (Out)	(N/A) mg/L		

Results			
Percent Full (Average)	0.2 %	Depth (Node)	0.29 ft
Exfiltration Loss	100.0 %	Hydraulic Grade	67.79 ft
Depth (Maximum)	0.29 ft	Time to Maximum Hydraulic Grade	16.004 hours
Depth (Average)	0.04 ft	Hydraulic Grade (Maximum)	67.79 ft
Percent Full (Maximum)	1.5 %	Time to Maximum Overflow	0.000 hours
Evaporation Loss	0.0 %	Flow (Overflow Maximum)	0.00 cfs
Volume (Average)	29.6 ft³	Time to Maximum Inflow	12.460 hours
Time to Maximum Depth	16.004 hours	Flow (Total In Maximum)	0.13 cfs
Local Inflow (Total Volume)	1,070.9 ft³	Flow (Overflow)	0.00 cfs
Time to Local Inflow (Maximum)	12.460 hours	Time to Maximum Storage	16.004 hours
Local Inflow (Maximum)	0.13 cfs	Storage (Maximum)	243.5 ft³
Is Overflowing?	False	Flow (Seepage loss)	0.12 cfs
Is Ever Overflowing?	False	Flow (Evaporation loss)	0.00 cfs

Calculation Messages

Time (hours)	Message

Drainage Area 2

Pre-Development
2-year Storm Event

<General>			
ID	92	Notes	
Label	Drainage Area 2	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.017 acres	Area (User Defined)	0.040 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-92.52	-63.58
-108.54	-50.83
-125.62	-62.12
-120.16	-81.85
-99.71	-82.76

Active Topology	
Is Active?	True

Catchment	
Outflow Element	O-2

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.083 hours
SCS CN	55.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	55.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	65.2 ft	Slope	0.025 ft/ft

Drainage Area 2

TR-55 Sheet Flow			
Manning's n	0.100	2 Year 24 Hour Depth	3.4 in

Results (Extended Catchment)			
Precipitation (Cumulative)	1.8 in	Precipitation (Incremental)	0.2 in

Results (Flow)			
Flow (Total Out)	0.01 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.01 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.01 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.126 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.040 acres	Volume (Total Runoff)	47.0 ft³

Calculation Messages

Time (hours)	Message
(N/A)	The difference between calculated peak flow and interpolated peak flow 2.6 % is greater than 1.5 %. Computed peak flow= 0.01 cfs Interp. peak flow= 0.01 cfs. Output increment for this catchment may be too large.

Pre-Development

O-2 2-year Storm Event

<General>			
ID	96	Hyperlinks	<Collection: 0 items>
Label	O-2	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-78.28 ft	Y	24.02 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	75.09 ft
Elevation (Ground)	75.09 ft	Elevation (Invert)	75.09 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.01 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	2.3 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-2

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	12.128 hours	Hydraulic Grade	75.09 ft
Local Inflow (Total Volume)	46.9 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	75.09 ft
Local Inflow (Maximum)	0.01 cfs	Time to Maximum Inflow	12.128 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.01 cfs

Calculation Messages

Time (hours)	Message

Post-Development
2-year Storm Event

Drainage Area 2

<General>			
ID	92	Notes	
Label	Drainage Area 2	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.017 acres	Area (User Defined)	0.040 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-92.52	-63.58
-108.54	-50.83
-125.62	-62.12
-120.16	-81.85
-99.71	-82.76

Active Topology	
Is Active?	True

Catchment	
Outflow Element	O-2

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.083 hours
SCS CN	69.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	69.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	62.0 ft	Slope	0.019 ft/ft

Drainage Area 2

TR-55 Sheet Flow			
Manning's n	0.011	2 Year 24 Hour Depth	3.4 in

Results (Extended Catchment)			
Precipitation (Cumulative)	1.8 in	Precipitation (Incremental)	0.2 in

Results (Flow)			
Flow (Total Out)	0.04 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.04 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.04 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.126 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.040 acres	Volume (Total Runoff)	133.0 ft³

Calculation Messages

Time (hours)	Message

O-2

Post-Development
2-year Storm Event

<General>			
ID	96	Hyperlinks	<Collection: 0 items>
Label	O-2	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-78.28 ft	Y	24.02 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	75.09 ft
Elevation (Ground)	75.09 ft	Elevation (Invert)	75.09 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.04 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	31.3 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-2

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	12.128 hours	Hydraulic Grade	75.09 ft
Local Inflow (Total Volume)	132.8 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	75.09 ft
Local Inflow (Maximum)	0.04 cfs	Time to Maximum Inflow	12.128 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.04 cfs

Calculation Messages

Time (hours)	Message

Pre-Development
10-year Storm Event

Drainage Area 1

<General>			
ID	91	Notes	
Label	Drainage Area 1	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.044 acres	Area (User Defined)	0.800 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-143.39	-53.75
-170.39	-34.44
-197.10	-54.16
-186.60	-85.65
-153.41	-85.39

Active Topology	
Is Active?	True

Catchment	
Outflow Element	O-1

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.322 hours
SCS CN	44.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	44.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	100.0 ft	Slope	0.023 ft/ft

Drainage Area 1

TR-55 Sheet Flow			
Manning's n	0.360	2 Year 24 Hour Depth	3.4 in

TR-55 Shallow Concentrated Flow			
Hydraulic Length	205.0 ft	Slope	0.031 ft/ft
Land Cover	Grassed Waterway		

Results (Extended Catchment)			
Precipitation (Cumulative)	3.4 in	Precipitation (Incremental)	0.1 in

Results (Flow)			
Flow (Total Out)	0.12 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.12 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.12 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.458 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.800 acres	Volume (Total Runoff)	1,187.0 ft³

Calculation Messages

Time (hours)	Message

Pre-Development

O-1 10-year Storm Event

<General>			
ID	94	Hyperlinks	<Collection: 0 items>
Label	O-1	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-140.78 ft	Y	30.68 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	70.03 ft
Elevation (Ground)	70.03 ft	Elevation (Invert)	70.03 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.12 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	106.5 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-1

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	12.460 hours	Hydraulic Grade	70.03 ft
Local Inflow (Total Volume)	1,187.0 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	70.03 ft
Local Inflow (Maximum)	0.12 cfs	Time to Maximum Inflow	12.460 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.12 cfs

Calculation Messages

Time (hours)	Message

Drainage Area 1

Post-Development
10-year Storm Event

<General>			
ID	91	Notes	
Label	Drainage Area 1	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.044 acres	Area (User Defined)	0.830 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-143.39	-53.75
-170.39	-34.44
-197.10	-54.16
-186.60	-85.65
-153.41	-85.39

Active Topology	
Is Active?	True

Catchment	
Outflow Element	PO-1

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.331 hours
SCS CN	56.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	56.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	100.0 ft	Slope	0.022 ft/ft

Drainage Area 1

TR-55 Sheet Flow			
Manning's n	0.360	2 Year 24 Hour Depth	3.4 in

TR-55 Shallow Concentrated Flow			
Hydraulic Length	59.0 ft	Slope	0.018 ft/ft
Land Cover	Paved		

TR-55 Shallow Concentrated Flow			
Hydraulic Length	48.0 ft	Slope	0.008 ft/ft
Land Cover	Grassed Waterway		

TR-55 Shallow Concentrated Flow			
Hydraulic Length	100.0 ft	Slope	0.046 ft/ft
Land Cover	Grassed Waterway		

Results (Extended Catchment)			
Precipitation (Cumulative)	3.2 in	Precipitation (Incremental)	0.2 in

Results (Flow)			
Flow (Total Out)	0.57 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.57 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.57 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.292 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.830 acres	Volume (Total Runoff)	3,199.0 ft³

Calculation Messages

Time (hours)	Message

Post-Development
O-1
10-year Storm Event

<General>			
ID	94	Hyperlinks	<Collection: 0 items>
Label	O-1	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-140.78 ft	Y	30.68 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	67.50 ft
Elevation (Ground)	67.50 ft	Elevation (Invert)	67.50 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.00 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	0.0 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-1

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	0.000 hours	Hydraulic Grade	67.50 ft
Local Inflow (Total Volume)	0.0 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	67.50 ft
Local Inflow (Maximum)	0.00 cfs	Time to Maximum Inflow	0.000 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.00 cfs

Calculation Messages

Time (hours)	Message

PO-1

Post-Development
10-year Storm Event

<General>			
ID	93	Notes	
Label	PO-1	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>	
Scaled Area	0.013 acres

Geometry

X (ft)	Y (ft)
-135.34	-29.51
-117.03	-29.70
-111.19	-12.35
-125.89	-1.44
-140.81	-12.04

Active Topology	
Is Active?	True

Infiltration/Inflow & Seepage			
Pond Seepage Method	Green Ampt	Conductivity	0.750 in/h
Suction Head	3.0 in	Initial Deficit	0.500

Inflow (Wet) Collection

Physical			
Volume Type	Elevation-Area	Depth (Maximum Curve)	0.00 ft

Elevation-Area

Elevation (ft)	Area (acres)	Percent Void Space (%)
67.50	0.018	100.0
68.00	0.023	100.0
69.00	0.033	100.0
70.00	0.045	100.0
70.50	0.050	100.0
71.00	1.000	100.0

Simulation Initial Condition	
Initial Elevation Type	Invert

PO-1

SWMM Extended Data	
Evaporation Factor	0.000

Water Quality			
Temperature (H2S)	68.0 F	BOD (Local Inflow)	0.0 mg/L
H2S (Local Inflow)	0.0 mg/L	Apply Treatment?	False
Reaction Rate (H2S)	0.0 /day		

Pollutograph Collection

Pollutograph

Results (Extended Node)			
Volume	1,475.3 ft³	Freeboard Height	2.1 ft
Depth (Flooding)	0.00 ft		

Results (Flow)			
Flow (Total In)	0.04 cfs	Local Inflow?	False
Flow (Total Out)	0.00 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (H2S)			
H2S (Out)	(N/A) mg/L	Detention Time (average)	0.000 min
BOD (Out)	(N/A) mg/L		

Results			
Percent Full (Average)	2.2 %	Depth (Node)	1.37 ft
Exfiltration Loss	100.0 %	Hydraulic Grade	68.87 ft
Depth (Maximum)	1.37 ft	Time to Maximum Hydraulic Grade	17.256 hours
Depth (Average)	0.34 ft	Hydraulic Grade (Maximum)	68.87 ft
Percent Full (Maximum)	9.3 %	Time to Maximum Overflow	0.000 hours
Evaporation Loss	0.0 %	Flow (Overflow Maximum)	0.00 cfs
Volume (Average)	346.6 ft³	Time to Maximum Inflow	12.293 hours
Time to Maximum Depth	17.256 hours	Flow (Total In Maximum)	0.57 cfs
Local Inflow (Total Volume)	3,199.3 ft³	Flow (Overflow)	0.00 cfs
Time to Local Inflow (Maximum)	12.293 hours	Time to Maximum Storage	17.256 hours
Local Inflow (Maximum)	0.57 cfs	Storage (Maximum)	1,475.3 ft³
Is Overflowing?	False	Flow (Seepage loss)	0.21 cfs
Is Ever Overflowing?	False	Flow (Evaporation loss)	0.00 cfs

Calculation Messages

Time (hours)	Message

Drainage Area 2

Pre-Development
10-year Storm Event

<General>			
ID	92	Notes	
Label	Drainage Area 2	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.017 acres	Area (User Defined)	0.040 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-92.52	-63.58
-108.54	-50.83
-125.62	-62.12
-120.16	-81.85
-99.71	-82.76

Active Topology	
Is Active?	True

Catchment	
Outflow Element	O-2

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.083 hours
SCS CN	55.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	55.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	65.2 ft	Slope	0.025 ft/ft

Drainage Area 2

TR-55 Sheet Flow			
Manning's n	0.100	2 Year 24 Hour Depth	3.4 in

Results (Extended Catchment)			
Precipitation (Cumulative)	2.7 in	Precipitation (Incremental)	0.4 in

Results (Flow)			
Flow (Total Out)	0.04 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.04 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.04 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.126 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.040 acres	Volume (Total Runoff)	145.0 ft³

Calculation Messages

Time (hours)	Message

O-2

Pre-Development
10-year Storm Event

<General>			
ID	96	Hyperlinks	<Collection: 0 items>
Label	O-2	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-78.28 ft	Y	24.02 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	75.09 ft
Elevation (Ground)	75.09 ft	Elevation (Invert)	75.09 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.04 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	25.8 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-2

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	12.128 hours	Hydraulic Grade	75.09 ft
Local Inflow (Total Volume)	145.5 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	75.09 ft
Local Inflow (Maximum)	0.04 cfs	Time to Maximum Inflow	12.128 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.04 cfs

Calculation Messages

Time (hours)	Message

Drainage Area 2

Post-Development
10-year Storm Event

<General>			
ID	92	Notes	
Label	Drainage Area 2	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.017 acres	Area (User Defined)	0.040 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-92.52	-63.58
-108.54	-50.83
-125.62	-62.12
-120.16	-81.85
-99.71	-82.76

Active Topology	
Is Active?	True

Catchment	
Outflow Element	O-2

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.083 hours
SCS CN	69.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	69.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	62.0 ft	Slope	0.019 ft/ft

Drainage Area 2

TR-55 Sheet Flow			
Manning's n	0.011	2 Year 24 Hour Depth	3.4 in

Results (Extended Catchment)			
Precipitation (Cumulative)	2.7 in	Precipitation (Incremental)	0.4 in

Results (Flow)			
Flow (Total Out)	0.08 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.08 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.08 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.126 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.040 acres	Volume (Total Runoff)	289.0 ft³

Calculation Messages

Time (hours)	Message
(N/A)	The difference between calculated peak flow and interpolated peak flow 2.3 % is greater than 1.5 %. Computed peak flow= 0.08 cfs Interp. peak flow= 0.08 cfs. Output increment for this catchment may be too large.

O-2

Post-Development
10-year Storm Event

<General>			
ID	96	Hyperlinks	<Collection: 0 items>
Label	O-2	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-78.28 ft	Y	24.02 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	75.09 ft
Elevation (Ground)	75.09 ft	Elevation (Invert)	75.09 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.08 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	92.1 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-2

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	12.127 hours	Hydraulic Grade	75.09 ft
Local Inflow (Total Volume)	289.2 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	75.09 ft
Local Inflow (Maximum)	0.08 cfs	Time to Maximum Inflow	12.127 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.08 cfs

Calculation Messages

Time (hours)	Message

Drainage Area 1

Pre-Development
100-year Storm Event

<General>			
ID	91	Notes	
Label	Drainage Area 1	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.044 acres	Area (User Defined)	0.800 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-143.39	-53.75
-170.39	-34.44
-197.10	-54.16
-186.60	-85.65
-153.41	-85.39

Active Topology	
Is Active?	True

Catchment	
Outflow Element	O-1

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.322 hours
SCS CN	44.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	44.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	100.0 ft	Slope	0.023 ft/ft

Drainage Area 1

TR-55 Sheet Flow			
Manning's n	0.360	2 Year 24 Hour Depth	3.4 in

TR-55 Shallow Concentrated Flow			
Hydraulic Length	205.0 ft	Slope	0.031 ft/ft
Land Cover	Grassed Waterway		

Results (Extended Catchment)			
Precipitation (Cumulative)	4.8 in	Precipitation (Incremental)	0.3 in

Results (Flow)			
Flow (Total Out)	0.71 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.71 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.71 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.292 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.800 acres	Volume (Total Runoff)	4,157.0 ft³

Calculation Messages

Time (hours)	Message

O-1

Pre-Development
100-year Storm Event

<General>			
ID	94	Hyperlinks	<Collection: 0 items>
Label	O-1	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-140.78 ft	Y	30.68 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	70.03 ft
Elevation (Ground)	70.03 ft	Elevation (Invert)	70.03 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.71 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	621.2 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-1

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	12.295 hours	Hydraulic Grade	70.03 ft
Local Inflow (Total Volume)	4,157.0 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	70.03 ft
Local Inflow (Maximum)	0.71 cfs	Time to Maximum Inflow	12.295 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.71 cfs

Calculation Messages

Time (hours)	Message

Drainage Area 1

Post-Development
100-year Storm Event

<General>			
ID	91	Notes	
Label	Drainage Area 1	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.044 acres	Area (User Defined)	0.830 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-143.39	-53.75
-170.39	-34.44
-197.10	-54.16
-186.60	-85.65
-153.41	-85.39

Active Topology	
Is Active?	True

Catchment	
Outflow Element	PO-1

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.331 hours
SCS CN	56.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	56.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	100.0 ft	Slope	0.022 ft/ft

Drainage Area 1

TR-55 Sheet Flow			
Manning's n	0.360	2 Year 24 Hour Depth	3.4 in

TR-55 Shallow Concentrated Flow			
Hydraulic Length	59.0 ft	Slope	0.018 ft/ft
Land Cover	Paved		

TR-55 Shallow Concentrated Flow			
Hydraulic Length	48.0 ft	Slope	0.008 ft/ft
Land Cover	Grassed Waterway		

TR-55 Shallow Concentrated Flow			
Hydraulic Length	100.0 ft	Slope	0.046 ft/ft
Land Cover	Grassed Waterway		

Results (Extended Catchment)			
Precipitation (Cumulative)	4.8 in	Precipitation (Incremental)	0.3 in

Results (Flow)			
Flow (Total Out)	1.58 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	1.58 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	1.58 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.292 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.830 acres	Volume (Total Runoff)	7,863.0 ft³

Calculation Messages

Time (hours)	Message

O-1

Post-Development
100-year Storm Event

<General>			
ID	94	Hyperlinks	<Collection: 0 items>
Label	O-1	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-140.78 ft	Y	30.68 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	67.50 ft
Elevation (Ground)	67.50 ft	Elevation (Invert)	67.50 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.00 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	0.0 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-1

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	0.000 hours	Hydraulic Grade	67.50 ft
Local Inflow (Total Volume)	0.0 ft³	Time to Maximum Hydraulic Grade	15.563 hours
Time to Maximum Depth	15.563 hours	Hydraulic Grade (Maximum)	67.52 ft
Local Inflow (Maximum)	0.00 cfs	Time to Maximum Inflow	15.563 hours
Depth (Maximum)	0.02 ft	Flow (Total In Maximum)	0.04 cfs

Calculation Messages

Time (hours)	Message

PO-1

Post-Development
100-year Storm Event

<General>			
ID	93	Notes	
Label	PO-1	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>	
Scaled Area	0.013 acres

Geometry

X (ft)	Y (ft)
-135.34	-29.51
-117.03	-29.70
-111.19	-12.35
-125.89	-1.44
-140.81	-12.04

Active Topology	
Is Active?	True

Infiltration/Inflow & Seepage			
Pond Seepage Method	Green Ampt	Conductivity	0.750 in/h
Suction Head	3.0 in	Initial Deficit	0.500

Inflow (Wet) Collection

Physical			
Volume Type	Elevation-Area	Depth (Maximum Curve)	0.00 ft

Elevation-Area

Elevation (ft)	Area (acres)	Percent Void Space (%)
67.50	0.018	100.0
68.00	0.023	100.0
69.00	0.033	100.0
70.00	0.045	100.0
70.50	0.050	100.0
71.00	1.000	100.0

Simulation Initial Condition	
Initial Elevation Type	Invert

PO-1

SWMM Extended Data	
Evaporation Factor	0.000

Water Quality			
Temperature (H2S)	68.0 F	BOD (Local Inflow)	0.0 mg/L
H2S (Local Inflow)	0.0 mg/L	Apply Treatment?	False
Reaction Rate (H2S)	0.0 /day		

Pollutograph Collection

Pollutograph

Results (Extended Node)			
Volume	4,367.0 ft³	Freeboard Height	0.5 ft
Depth (Flooding)	0.00 ft		

Results (Flow)			
Flow (Total In)	0.14 cfs	Local Inflow?	False
Flow (Total Out)	0.00 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (H2S)			
H2S (Out)	(N/A) mg/L	Detention Time (average)	0.000 min
BOD (Out)	(N/A) mg/L		

Results			
Percent Full (Average)	9.7 %	Depth (Node)	3.00 ft
Exfiltration Loss	98.1 %	Hydraulic Grade	70.50 ft
Depth (Maximum)	3.00 ft	Time to Maximum Hydraulic Grade	15.559 hours
Depth (Average)	1.19 ft	Hydraulic Grade (Maximum)	70.50 ft
Percent Full (Maximum)	27.7 %	Time to Maximum Overflow	0.000 hours
Evaporation Loss	0.0 %	Flow (Overflow Maximum)	0.00 cfs
Volume (Average)	1,527.9 ft³	Time to Maximum Inflow	12.293 hours
Time to Maximum Depth	15.559 hours	Flow (Total In Maximum)	1.58 cfs
Local Inflow (Total Volume)	7,862.7 ft³	Flow (Overflow)	0.00 cfs
Time to Local Inflow (Maximum)	12.293 hours	Time to Maximum Storage	15.559 hours
Local Inflow (Maximum)	1.58 cfs	Storage (Maximum)	4,372.4 ft³
Is Overflowing?	False	Flow (Seepage loss)	0.45 cfs
Is Ever Overflowing?	False	Flow (Evaporation loss)	0.00 cfs

Calculation Messages

Time (hours)	Message

Pre-Development
100-year Storm Event

Drainage Area 2

<General>			
ID	92	Notes	
Label	Drainage Area 2	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.017 acres	Area (User Defined)	0.040 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-92.52	-63.58
-108.54	-50.83
-125.62	-62.12
-120.16	-81.85
-99.71	-82.76

Active Topology	
Is Active?	True

Catchment	
Outflow Element	O-2

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.083 hours
SCS CN	55.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	55.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	65.2 ft	Slope	0.025 ft/ft

Drainage Area 2

TR-55 Sheet Flow			
Manning's n	0.100	2 Year 24 Hour Depth	3.4 in

Results (Extended Catchment)			
Precipitation (Cumulative)	4.1 in	Precipitation (Incremental)	0.5 in

Results (Flow)			
Flow (Total Out)	0.10 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.10 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.10 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.126 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.040 acres	Volume (Total Runoff)	365.0 ft³

Calculation Messages

Time (hours)	Message
(N/A)	The difference between calculated peak flow and interpolated peak flow 1.8 % is greater than 1.5 %. Computed peak flow= 0.10 cfs Interp. peak flow= 0.10 cfs. Output increment for this catchment may be too large.

Pre-Development

O-2

100-year Storm Event

<General>			
ID	96	Hyperlinks	<Collection: 0 items>
Label	O-2	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-78.28 ft	Y	24.02 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	75.09 ft
Elevation (Ground)	75.09 ft	Elevation (Invert)	75.09 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.10 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	102.5 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-2

Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	12.127 hours	Hydraulic Grade	75.09 ft
Local Inflow (Total Volume)	365.0 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	75.09 ft
Local Inflow (Maximum)	0.10 cfs	Time to Maximum Inflow	12.127 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.10 cfs

Calculation Messages

Time (hours)	Message

Drainage Area 2

Post-Development
100-year Storm Event

<General>			
ID	92	Notes	
Label	Drainage Area 2	Hyperlinks	<Collection: 0 items>

GIS-IDs

GIS-ID

<Geometry>			
Scaled Area	0.017 acres	Area (User Defined)	0.040 acres
Use Scaled Area?	False		

Geometry

X (ft)	Y (ft)
-92.52	-63.58
-108.54	-50.83
-125.62	-62.12
-120.16	-81.85
-99.71	-82.76

Active Topology	
Is Active?	True

Catchment	
Outflow Element	O-2

Inflow (Wet) Collection

Rainfall	
Use Local Rainfall?	False

Runoff			
Runoff Method	Unit Hydrograph	Drying Time	7.0 days
Percent Impervious	0.0 %	Unit Hydrograph Method	SCS Unit Hydrograph
Area Defined By	Single Area	Tc Input Type	Composite Tc
Loss Method	SCS CN	Time of Concentration (Composite)	0.083 hours
SCS CN	69.000	SCS Unit Hydrograph Method	Default Curvilinear
SCS CN (Composite)	69.000		

Tc Data Collection

TR-55 Sheet Flow			
Hydraulic Length	62.0 ft	Slope	0.019 ft/ft

Drainage Area 2

TR-55 Sheet Flow			
Manning's n	0.011	2 Year 24 Hour Depth	3.4 in

Results (Extended Catchment)			
Precipitation (Cumulative)	4.1 in	Precipitation (Incremental)	0.5 in

Results (Flow)			
Flow (Total Out)	0.16 cfs	Local Inflow?	False
Flow (Total Surface Runoff)	0.16 cfs	Flow (Local from Inflow Collection)	0.00 cfs

Results (Maximum Values)			
Precipitation (Total)	(N/A) in	Evaporation (Total)	(N/A) in
Runon (Total)	(N/A) in	Flow (Maximum)	0.16 cfs
Infiltration (Total)	(N/A) in	Time (Maximum Flow)	12.126 hours
Runoff Coefficient (Calculated)	(N/A) %		

SWMM Results			
Depth (Snow)	(N/A) ft	Intensity (Rainfall)	(N/A) in/h
Flow (Groundwater)	(N/A) cfs	Loss Rate	(N/A) in/h
Elevation (Groundwater)	(N/A) ft	Evaporation Rate	(N/A) in/h

Results			
Area (Unified)	0.040 acres	Volume (Total Runoff)	583.0 ft³

Calculation Messages

Time (hours)	Message

Post-Development
O-2 100-year Storm Event

<General>			
ID	96	Hyperlinks	<Collection: 0 items>
Label	O-2	Station	0+00 ft
Notes			

GIS-IDs

GIS-ID

<Geometry>			
X	-78.28 ft	Y	24.02 ft

Active Topology	
Is Active?	True

Boundary Condition			
Boundary Condition Type	Free Outfall	Tidal Gate?	False
Route to Catchment	<None>		

Infiltration/Inflow & Seepage	
Apply SWMM RTK Unit Hydrograph Set?	False

Inflow (Wet) Collection

Physical			
Update Ground Elevation from Terrain Model?	True	Elevation (Rim)	75.09 ft
Elevation (Ground)	75.09 ft	Elevation (Invert)	75.09 ft
Set Rim to Ground Elevation?	True		

Water Quality	
Apply Treatment?	False

Pollutograph Collection

Pollutograph

Results (Flow)			
Flow (Total Out)	0.16 cfs	Flow (Local from Inflow Collection)	0.00 cfs
Local Inflow?	False	Volume (Total Outflow)	224.4 ft³

Results (Misc)	
Depth (Structure)	0.00 ft

Results

O-2

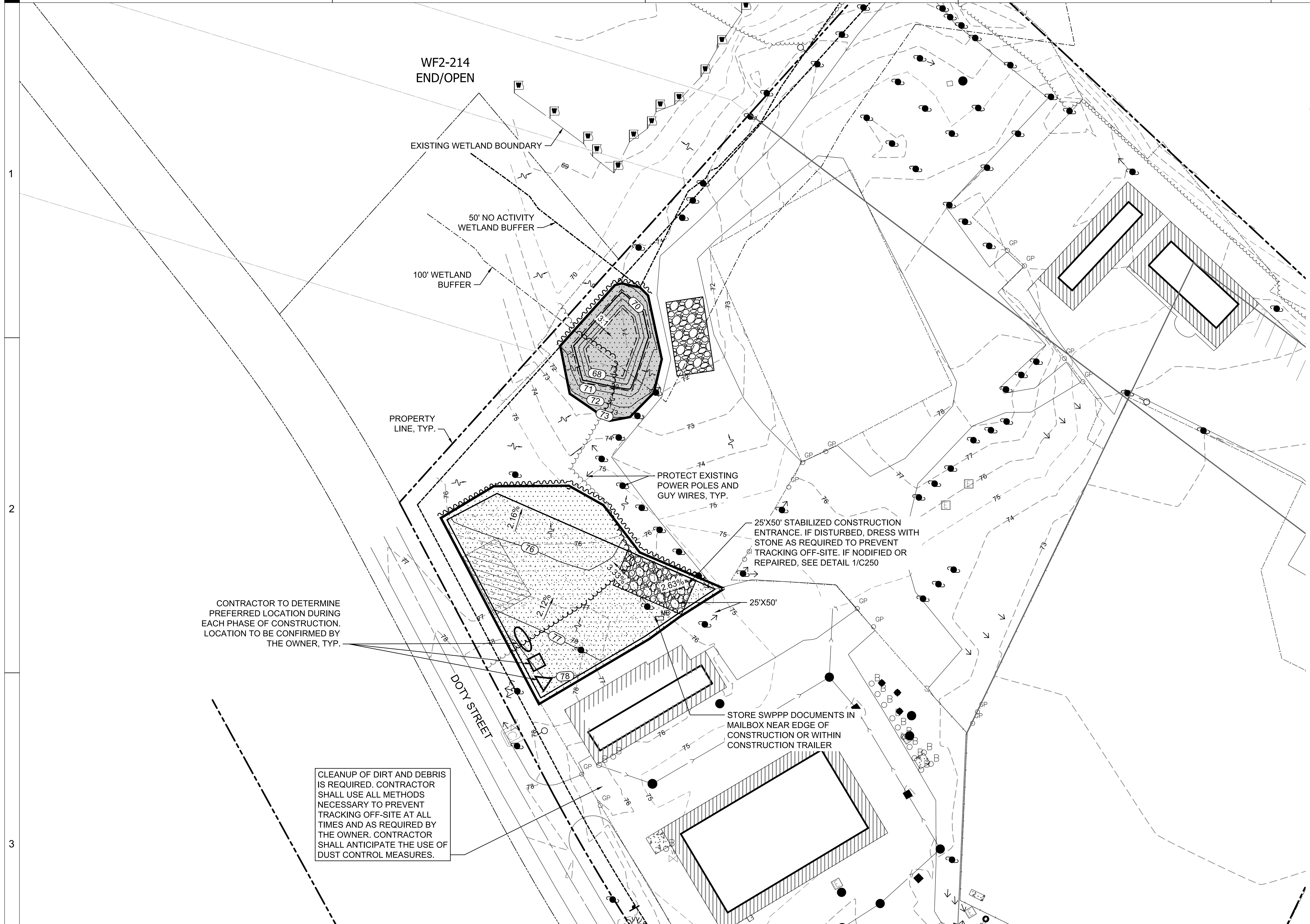
Results			
Depth (Average)	0.00 ft	Depth (Node)	0.00 ft
Time to Local Inflow (Maximum)	12.127 hours	Hydraulic Grade	75.09 ft
Local Inflow (Total Volume)	582.9 ft³	Time to Maximum Hydraulic Grade	0.000 hours
Time to Maximum Depth	0.000 hours	Hydraulic Grade (Maximum)	75.09 ft
Local Inflow (Maximum)	0.16 cfs	Time to Maximum Inflow	12.127 hours
Depth (Maximum)	0.00 ft	Flow (Total In Maximum)	0.16 cfs

Calculation Messages

Time (hours)	Message

APPENDIX H

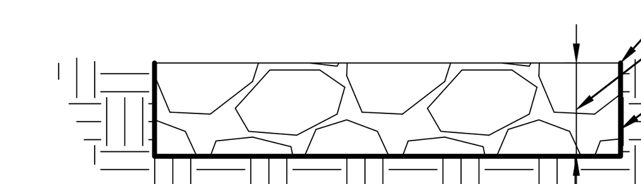
EROSION & SEDIMENT CONTROL PLAN



LEGEND

- PROJECT SITE/DISTURBED AREA
- SILT FENCE
- FINISHED GRADE
- DIRECTION OF DRAINAGE
- TEMPORARY ROLLED EROSION CONTROL PRODUCT

THE EROSION AND SEDIMENT CONTROLS IDENTIFIED ON THIS DRAWING ARE TO BE INSTALLED AS CONSTRUCTION ACTIVITIES ALLOW. ALL TEMPORARY CONTROLS TO REMAIN UNTIL THE SITE HAS BEEN STABILIZED AND APPROVED BY THE OWNER'S REPRESENTATIVE.



1 STABILIZED CONSTRUCTION ENTRANCE/ CONTRACTOR STAGING AND LAYDOWN AREA (AS REQUIRED)
NOT TO SCALE

EROSION AND SEDIMENT CONTROL NOTES

1. EROSION/ SEDIMENTATION CONTROL MEASURES SHOULD BE INSTALLED BEFORE EARTH DISTURBING ACTIVITIES BEGIN AND ARE REQUIRED REGARDLESS OF THE TIME OF YEAR. THIS PLAN AND ITS ASSOCIATED REQUIREMENTS FOR THE PERMIT MUST BE IMPLEMENTED DURING WINTER MONTHS AS WELL. ADDITIONAL INSTALLATION/REMOVAL OF STABILIZATION CONTROLS ASSOCIATED WITH SEEDING OUTSIDE THE SEEDING WINDOW ARE INCIDENTAL TO THE PROJECT.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTROL EROSION/SEDIMENT ON THE SITE AT ALL TIMES. THE CONTROL MEASURES IDENTIFIED ON THE PLAN ARE A MINIMUM. THE CONTRACTOR SHALL PROVIDE ADDITIONAL EROSION/SEDIMENT CONTROL MEASURES AS NECESSARY AND BY CONSTRUCTION PHASE, TO FULFILL THIS REQUIREMENT.
3. CONTRACTOR IS REQUIRED TO MAINTAIN SWPPP DOCUMENTATION.
4. EXCEPT AS PRECLUDED BY SNOW COVER, THE CONTRACTOR IS REQUIRED TO USE STABILIZATION CONTROLS ON ALL DISTURBED AREAS OF THE SITE REGARDLESS OF THE TIME PERIOD BEFORE THEY WILL BE DISTURBED AGAIN. IN THE EVENT THAT CONSTRUCTION ACTIVITY WITHIN A DISTURBED AREA WILL NOT OCCUR FOR A PERIOD OF 14 OR MORE CALENDAR DAYS, THE CONTRACTOR IS REQUIRED TO INSTALL STABILIZATION MEASURES IMMEDIATELY AFTER CONSTRUCTION ACTIVITY CEASED IN THAT AREA.
5. THE CONTRACTOR SHALL USE CONTROL MEASURES AS REQUIRED TO KEEP SOILS FROM LEAVING THE SITE.
6. CONTRACTOR SHALL IMPLEMENT SITE SPECIFIC BEST MANAGEMENT PRACTICES (BMPS) AS SHOWN AND REQUIRED BY THE SWPPP. ADDITIONAL BEST MANAGEMENT PRACTICES SHALL BE IMPLEMENTED BY THE CONTRACTOR AS DICTATED BY SITE CONDITIONS OR THE PROJECT GOVERNING AUTHORITIES AT NO ADDITIONAL COST TO THE OWNER THROUGHOUT ALL PHASES OF CONSTRUCTION.
7. IF AFTER REPEATED FAILURE ON THE PART OF THE CONTRACTOR TO PROPERLY CONTROL SOIL EROSION, SEDIMENT AND/OR POLLUTION FROM THE PROJECT SITE, THE GOVERNING AUTHORITIES RESERVE THE RIGHT TO EFFECT NECESSARY CORRECTIVE MEASURES AND CHARGE ANY COSTS TO THE CONTRACTOR.
8. ALL BMPS AND CONTROLS SHALL CONFORM TO THE APPLICABLE FEDERAL, STATE, OR LOCAL REQUIREMENTS, STANDARDS, AND SPECIFICATIONS OR MANUAL OF PRACTICE.
9. ALL BMPS AND CONTROLS INSTALLED ON GREEN INFRASTRUCTURE SHALL REMAIN UNTIL STABILIZATION IS APPROVED BY THE OWNER'S REPRESENTATIVE.
10. IN THE EVENT THAT SOILS LEAVE THE SITE, CLEANUP OF ALL SURROUNDING ROADS, DRIVES, AND PARKING LOTS SHALL BE PERFORMED ON A DAILY BASIS AT A MINIMUM AND UPON REQUEST BY OWNER'S REPRESENTATIVE AT NO ADDITIONAL COST. PAVEMENT IS TO BE SCRAPED OF DEBRIS AND MUD AND BROOMED CLEAN. MUD TRACKS ARE TO BE REMOVED AS THEY ARE CREATED.
11. IF DURING CONSTRUCTION OPERATIONS ANY LOOSE MATERIALS ARE DEPOSITED IN THE FLOW LINE OF GUTTERS, DRAINAGE STRUCTURES, OR DITCHES SUCH THAT THE NATURAL FLOW LINE OF WATER IS OBSTRUCTED, THIS LOOSE MATERIAL SHALL BE REMOVED.
12. ALL SEDIMENT SHALL BE PREVENTED FROM ENTERING ANY EXISTING STORM DRAINAGE SYSTEMS BY THE USE OF INLET PROTECTION OR OTHER APPROVED FUNCTIONAL METHODS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING SEDIMENT RESULTING FROM CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS PROJECT.
13. CONSTRUCTION ACCESS POINTS TO THE SITE SHALL BE PROTECTED IN SUCH A WAY AS TO PREVENT TRACKING OF MUD OR SOIL ONTO PUBLIC THOROUGHFARES. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY BY THE CONTRACTOR.
14. MAINTAIN SILT FENCING AT ALL TIMES IN AN UPRIGHT POSITION. CLEAN SILT FROM FENCING/FILTER SOCKS ON A REGULAR BASIS AS PER THE STANDARD SPECIFICATIONS. SILT FENCES MUST BE CLEANED OUT WHEN THEY ARE 50% FULL. FILTER SOCKS MUST BE CLEANED OUT WHEN THEY ARE 33% FULL.
15. CONTRACTOR TO LOCATE/RELOCATE FILTER SOCKS AS NECESSARY THROUGHOUT THE PROJECT TO CONTROL EROSION/SEDIMENT.
16. REMOVE ALL TEMPORARY EROSION/SEDIMENTATION CONTROLS NOT CALLED OUT TO REMAIN AFTER SITE HAS BEEN STABILIZED AND APPROVED BY THE OWNER'S REPRESENTATIVE.
17. CONTRACTOR TO USE EXTREME CAUTION WHILE INSTALLING SILT FENCE OR OTHER EROSION CONTROL DEVICES SO AS NOT TO DAMAGE UNDERGROUND UTILITIES.
18. WHERE WATER IS PUMPED FROM EXCAVATIONS ON SITE, PROVISIONS SHALL BE MADE TO REMOVE SEDIMENT FROM THE WATER BEFORE IT IS RELEASED INTO THE STORM SEWER SYSTEM. METHODS INCLUDE: DEWATERING BAGS, ADDING FLOCCULANTS TO SILTY WATER AND PLACING A FILTER FABRIC BARRIER AROUND THE PUMP INLET. THE COMBINATION OF THESE METHODS HELPS TO REMOVE SEDIMENT FROM THE WATER. THE MOST COMMON METHOD INCLUDES PLACING CHITOSAN GEOTEXTILE TREATMENT BAGS WITHIN THE DEWATERING BAG AND INSTALLING AN ADDITIONAL INTAKE PROTECTION BAG AT THE NEAREST DOWNSTREAM INTAKE.
19. WHERE WATER IS RELEASED FROM A DEWATERING SYSTEM, PRECAUTIONS SHALL BE TAKEN TO ENSURE THAT EROSION GULLIES DO NOT FORM. ONE METHOD IS TO PIPE THE WATER DIRECTLY INTO A STORM SEWER STRUCTURE. WATER MUST BE FILTERED THROUGH AN APPROPRIATE FILTER DEVICE BEFORE DISCHARGING.
20. CONCRETE SLURRY AND DUST FROM SAWCUTTING ACTIVITIES IS PROHIBITED FROM ENTERING THE STORM SEWER SYSTEM. ALL STORM INTAKES LOCATED NEAR SAWCUTTING ACTIVITIES ARE REQUIRED TO BE PROTECTED. SAWCUT SLURRY AND DUST MUST BE CONTAINED, CLEANED UP, AND DISPOSED OF OFF-SITE. A TEMPORARY 8" FILTER SOCK IS REQUIRED.
21. SANITARY WASTE DISPOSAL: ALL LOCATIONS OF PORTABLE RESTROOM FACILITIES MUST BE IDENTIFIED ON THE PLAN. IN THE EVENT THAT PORTABLE RESTROOM FACILITIES ARE USED ON-SITE, THE CONTRACTOR IS REQUIRED TO INSTALL AN 8" FILTER SOCK AROUND THE FACILITY TO MINIMIZE THE RADIUS OF THE AFFECTED ZONE IN THE EVENT OF A SPILL. WASTES SHALL BE COLLECTED AND DISPOSED OF IN COMPLETE COMPLIANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS. PORTABLE RESTROOM FACILITIES MUST NOT BE LOCATED NEAR DRAINAGE WAYS. RELOCATE AS REQUIRED FOR CONSTRUCTION.
22. IDENTIFICATION OF ALLOWABLE NON-STORMWATER DISCHARGES: DURING CONSTRUCTION THE NON-STORMWATER DISCHARGES, WHICH INCLUDE WATER FLUSHED FROM WATER LINES, PAVEMENT WASHING (WHERE NO SPILLS OR LEAKS HAVE OCCURRED, UNLESS THE SPILLED MATERIAL HAS BEEN CLEANED UP), VEHICLE WASHING, AND GROUNDWATER (DEWATERING), SHOULD BE DIRECTED AS MUCH AS POSSIBLE TOWARDS VEGETATED AREAS AND AWAY FROM DRAINAGE WAYS. REFER TO THE OKLAHOMA DEQ NPDES GENERAL PERMIT NO. 2 FOR ALLOWABLE NON-STORMWATER DISCHARGES.
23. POLLUTION AND SPILL PREVENTION PLANNING: POTENTIALLY HAZARDOUS MATERIALS ON THE CONSTRUCTION SITE INCLUDE FUEL, LUBRICANTS, CURING COMPOUNDS, FERTILIZERS, GREASE AND CLEANING SOLVENTS. THE CONTRACTOR STAGING AREA FOR PORTABLE RESTROOM FACILITIES, TEMPORARY FUEL TANKS, WASTE CONTAINERS AND OTHER HAZARDOUS CHEMICALS MUST BE PROTECTED BY AN 8" FILTER SOCK AT ALL TIMES. ALL REASONABLE PRECAUTIONS WILL BE TAKEN TO PREVENT SPILLS. ANY SPILLED MATERIAL WILL IMMEDIATELY BE DIRECTED AWAY FROM STORMWATER INTAKES, DETENTION BASINS, OR DRAINAGE WAYS. SPILLED MATERIALS WILL BE CLEANED AND, IF NECESSARY, SOIL REMEDIATION PRACTICES WILL BE USED. A RECORD OF SPILLS WILL BE MAINTAINED BY THE PRIME CONTRACTOR. RELOCATE AS REQUIRED FOR CONSTRUCTION.
24. CONCRETE, PAINT AND GROUT WASHOUT AREA: THE WASHOUT AREA SHOULD BE AN APPROVED CONCRETE WASHOUT CONTAINER, COLLECTION BAG, OR WASHOUT BOX. IF USING FILTER SOCKS, STACK TWO (2) TALL AND LINE WITH AN IMPERMEABLE PLASTIC LINER. CONTRACTOR TO HAUL OFF ALL WASTE MATERIAL. ALL LOCATIONS OF CONCRETE, PAINT AND GROUT WASHOUT AREAS MUST BE PROVIDED BY THE CONTRACTOR AND IDENTIFIED ON THE PLAN.THE CONTRACTOR IS REQUIRED TO INSTALL A SIGN THAT DESIGNATES THE WASHOUT AREA. RELOCATE AS REQUIRED FOR CONSTRUCTION.
25. SPILL KIT: A SPILL KIT IS REQUIRED TO BE ON-SITE AND LOCATION NOTED ON THE STORMWATER POLLUTION PREVENTION PLAN. THE SPILL KIT SHOULD BE DESIGNED TO DEAL WITH ANY HAZARDOUS MATERIALS ON-SITE.THE SPILL KIT SHALL BE A SEALED STORAGE SHED LOCATED NEAR THE CONSTRUCTION TRAILER OR FUELING AREA. THE SPILL KIT SHALL CONTAIN, BUT NOT BE LIMITED TO THE FOLLOWING ITEMS: A GARBAGE CAN, GLOVES, SAFETY GOGGLES, BROOM AND DUST PAN AND OIL ABSORBENT CLAY CHIPS OR PADS. THE SPILL KIT SHALL BE RESTOCKED AS SUPPLIES ARE USED. THE CONTRACTOR SHALL INSTALL A SIGN THAT DESIGNATES THE SPILL KIT. RELOCATE AS REQUIRED FOR CONSTRUCTION.
26. DUST CONTROL: THE CONTRACTOR SHALL IMPLEMENT DUST CONTROL MEASURES WHERE DUST IS GENERATED. FREQUENT WATERING OF THE SITE, SPRINKLED, VEGETATIVE COVER, MULCH, WINDBREAKS, TILLAGE, STONE AND SPRAY-ON CHEMICAL SOIL TREATMENTS (PALLIATIVES) ARE POSSIBLE DUST CONTROL MEASURES. IF THE DUST CONTROL IS NOT ACCEPTABLE IT SHALL BE CHANGED AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
27. STOCKPILED MATERIALS: CONTRACTOR TO IDENTIFY ALL LOCATIONS OF STOCKPILED MATERIALS ON THE STORMWATER POLLUTION PREVENTION PLAN. CONTRACTOR SHALL PROVIDE ALL EROSION/SEDIMENTATION CONTROLS AS REQUIRED TO CONTAIN MATERIALS ON-SITE. AT A MINIMUM, THE CONTRACTOR IS REQUIRED TO PROVIDE SILT FENCE/FILTER SOCKS AROUND STOCKPILED SOILS BEFORE STOCKPILE IS RE-SPREAD. IF STOCKPILE SOILS WILL REMAIN INACTIVE FOR 14 DAYS OR MORE, THE CONTRACTOR TO SHALL COVER OR PROVIDE TEMPORARY STABILIZATION CONTROLS.
28. SEQUENCE OF MAJOR ACTIVITIES: INCORPORATE ALL TEMPORARY STABILIZING AND PERMANENT EROSION/SEDIMENT CONTROL FEATURES AT THE EARLIEST TIME PRACTICABLE. THE CONTRACTOR SHALL AMEND THE SWPPP WHENEVER THERE IS A CHANGE IN DESIGN, CONSTRUCTION, OPERATION OR MAINTENANCE OF A STORMWATER BMP.

SHIVEHATTERY
ARCHITECTURE + ENGINEERING
440 North Wells Street, Suite 320 | Chicago, Illinois 60654
312.324.5500 | www.shive-hattery.com
Iowa | Illinois | Indiana | Nebraska

JEFF RATH, PE 61591 12/03/2021

EVERSOURCE WAREHAM PARKING LOT

EVERSOURCE ENERGY
DOTY STREET, WAREHAM, MA 02576

PRELIMINARY - NOT FOR CONSTRUCTION

DRAWN: EAW
APPROVED: JMR
ISSUED FOR: PERMIT
DATE: 12/03/2021
PROJECT NO. 7211970
FIELD BOOK: ---
CLIENT NO: ---

EROSION & SEDIMENT CONTROL PLAN

C250

P:\Projects\CH7211970\Deliverables\Drawings\1_Civil\Erosion Control Plan.dwg
Printed: 12/2/2021 3:12:53 PM

APPENDIX I

OPERATION AND MAINTENANCE PLAN

Long-term Pollution Prevention & Operation and Maintenance Plan

Eversource Wareham – Gravel Parking Lot
Wareham, MA | November 30, 2021

Prepared For:
Eversource Energy
Doty Street
Wareham, MA 02576

Shive-Hattery Project Number: 7211970

SHIVEHATTERY
ARCHITECTURE + ENGINEERING

440 North Wells Street | Suite 320 | Chicago, Illinois 60654

312.324.5500 | fax 319.364.4251 | shive-hattery.com

1. Stormwater Management System Owners and Party Responsible for Operation and Maintenance

- Eversource Energy is the stormwater management system owner.
- Eversource Energy is the party responsible for operation and maintenance.

2. Good housekeeping practices

- Routinely remove trash and debris from the gravel parking lot and landscaped areas.
- Sweep or vacuum the gravel parking lot up to four times per year.
- General inspections shall be conducted after storm events greater than or equal to the 1-year. 24-hour storm event.

3. Requirements for Routine Inspections and Maintenance of Stormwater BMPs

a. Infiltration Basin

- Routinely remove trash and debris from the basin, at least once a month or more often if necessary.
- Inspect the basin monthly, as well as after every major storm to ensure the basin is draining within 72 hours.
- Inspect the basin semi-annually for settling, cracking erosion, leakage, tree growth on the embankments, and the condition of the vegetative cover.
- Mow the basin at least semi-annually to prevent woody growth, stimulate grass growth, and enhance nutrient removal. Do not mow when the ground is wet to avoid compaction of the bottom soils.
- Inspect the basin semi-annually for sediment accumulation in the basin bottom. Remove accumulated sediment as necessary if it is negatively affecting the basin capacity and infiltration capability. When the soil is thoroughly dry, remove the top cracked layer of sediment, and till and re-seed the remaining soil.

4. Spill prevention and response plans

- All reasonable precautions will be taken to prevent spills
- If there is a spill event, the spilled material will be immediately directed away from stormwater intakes, infiltration basins, or drainage ways. The facility manager will be immediately notified to evaluate the spill and coordinate the necessary clean up. If necessary, soil remediation practices will be used.

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

- Routinely remove trash and debris from landscaped and vegetated areas.
- Inspect landscaped areas and vegetative areas monthly to check health and density of plants.
- Re-plant bare areas as necessary.
- Apply erosion control measures if soil is exposed or erosion channels are forming.

6. Requirements for storage and use of fertilizers, herbicides, and pesticides

- No pesticides are to be used unless a single spot treatment is required for a specific control application.
- Fertilizer usage should be avoided. If it is deemed necessary, slow-release fertilizer should be used. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary.

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

- The owner (Eversource Energy) shall be responsible for training and/or hiring the appropriate personnel to implement the Long-Term Pollution Prevention Plan.

8. List of Emergency Contacts for implementing Long-Term Pollution Prevention Plan

- The applicant (Eversource Energy) shall implement the Long-Term Pollution Prevention Plan and will create a list of emergency contacts.

9. Operation and Maintenance Log Form

- Refer to attached Operation and Maintenance Log Form.

SHIVEHATTERY
ARCHITECTURE + ENGINEERING

OPERATION AND MAINTENANCE LOG FORM

Inspection Date	Inspector Name	BMP Inspected	Comments	Recommendation	Follow-up Inspection Required? (Yes/No)