

DRAINAGE REPORT

**201 Elm Street & 6 Monroe Street
(Map 66 - Lot 61 & Map 55 - Lot 24)
Amesbury, Massachusetts 01913**



344 North Main Street | Andover • MA 01810
(978) 416-0920 | www.civildci.com



APPLICANT:

**Rivers Edge Development, LLC
201 Elm Street
Amesbury, MA 01913**

SUBMITTED TO:

**City of Amesbury
39 S Hunt Road
Amesbury, MA 01913**

ISSUED:

April 22, 2025

CDCI FILE #: 25-10704

DRAINAGE REPORT

Drainage Narrative

TAB 1

Figures

TAB 2

Figure 1 – Orthophoto
Figure 2 – USGS Map
Figure 3 – FEMA Flood Map
Figure 4 – NRCS Soils Map
Figure 5 – NHESP Map

Existing Conditions

TAB 3

2-Yr Storm Event Summary
10-Yr Storm Event Summary
25-Yr Storm Event Summary
100-Yr Storm Event Summary

Proposed Conditions

TAB 4

2-Yr Storm Event Summary
10-Yr Storm Event Summary
25-Yr Storm Event Summary
100-Yr Storm Event Summary

Supplemental Information

TAB 5

Stormwater Calculations
Test Pit Logs
Long Term Operations and Maintenance Program
Existing Watershed Plan
Proposed Watershed Plan

DRAINAGE REPORT

201 Elm Street and 6 Monroe Street
Amesbury, Massachusetts

TAB 1

DRAINAGE REPORT

201 Elm Street and 6 Monroe Street
Amesbury, Massachusetts

PROJECT DESCRIPTION

The applicant proposes redeveloping two parcels located at 201 Elm Street and 6 Monroe Street (Map 66/ Lot 61 & Map 55/ Lot 24) in Amesbury, MA. The project includes a subdivision of the combined parcels into three residential lots and the following improvements:

- Renovation and minor addition to the existing historic house at 201 Elm Street, originally constructed in 1731.
- Construction of a new two-family dwelling with associated driveway access and utilities.
- Construction of a single-family dwelling with associated driveway access and utilities.

SITE DESCRIPTION

The total combined lot area is approximately 0.84-AC and is located within the R-8 Zoning District. The site currently contains a historic house surrounded primarily by wooded areas. No wetland resource areas are located on or near the site.

The site slopes from a high of approximately 132-FT at the northwest side of the lot to a low of approximately 98-FT near the intersection of Elm Street and Monroe Street.

According to the Natural Resource Conservation Service Soil Survey, on-site soils consist of Merrimac Fine Sandy Loam (245B) and Paxton Fine Sandy Loam (307E). Test pits were conducted by this office in February 2025 to determine soil texture and estimated seasonal high groundwater elevations. Test pit logs are provided under Tab 5 of this report.

REGULATORY STORMWATER MANAGEMENT COMPLIANCE

City of Amesbury Zoning Ordinance

Under Site Plan Review, Section XI.C.8.e.1, of the City of Amesbury Zoning Ordinance, post-development peak rates of surface runoff must not exceed pre-development rates. The project has been designed to comply with this standard for the 2-, 10-, 25-, and 100-year storm events.

Per Section XI.C.8.p of the City of Amesbury Zoning Ordinance, the design and construction of stormwater management must comply with Section 7 (Design Standards) of the Amesbury Subdivision Rules and Regulations.

City of Amesbury Subdivision Rules and Regulations

Under Section 7.10 (Drainage), the design of the stormwater management systems shall comply with the 2016 MS4 regulations and the 2008 Massachusetts Stormwater Handbook. Under the 2016 MS4, the project is below the 1-AC disturbance threshold, and as such, is not subject to the MS4 stormwater design criteria (see Exhibit 1).

Additionally, according to MassDEP Stormwater Regulations, the project is exempt from the Stormwater Management Standards as it involves the construction of:

- A single-family dwelling
- A two-family dwelling (structure with fewer than four units) (see Exhibit 2)

However, the proposed drainage system has been designed to comply with the Redevelopment Standards outlined in Section 7.10.B.4 of the Amesbury Subdivision Rules and Regulations. See stormwater calculations under Tab 5 of this report.

DRAINAGE REPORT

201 Elm Street and 6 Monroe Street
Amesbury, Massachusetts

DRAINAGE ANALYSIS

The proposed development was analyzed as a single subcatchment, consisting both on-site and as well as off-site runoff flowing through the project site. The entire subwatershed eventually discharges into the City's closed drainage system located in Elm Street and Monroe Street.

To mitigate peak flows, each dwelling incorporates roof drywells to infiltrate stormwater runoff. As demonstrated in the table below, the impact of the proposed improvements results in no increase in peak discharge for all major storm events, with minor reductions in peak flows for the larger storms.

Design Point 1

Peak Flow:

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	100-YR (6.5-IN)
Pre-Development	1.8-CFS	3.6-CFS	4.9-CFS	6.9-CFS
Post-Development	1.8-CFS	3.6-CFS	4.8-CFS	6.6-CFS

METHODOLOGY

Drainage calculations were performed using the computer program HydroCAD by HydroCAD Software Solutions, LLC based upon Technical Release 20 (TR-20), developed by the NRCS. Drainage calculations were prepared for the 2-YR, 10-YR, 25-YR, and 100-YR Type III 24-hour storm events. Rainfall data corresponds with National Weather Service Technical Paper 40 (TP-40) used in Technical Release 55 (TR-55). Curve numbers were generated using the information provided in TR-55 and the SCS Soils Survey.

new development is defined as any construction activities or land alteration resulting in total earth disturbances equal to or greater than 1 acre (or activities that are part of a larger common plan of development disturbing greater than 1 acre) on an area that has not previously been developed to include impervious cover.

redevelopment is defined as any construction, land alteration, or improvement of impervious surfaces resulting in total earth disturbances equal to or greater than 1 acre (or activities that are part of a larger common plan of development disturbing greater than 1 acre) that does not meet the definition of new development (see above).

- a. Permittees shall develop, implement, and enforce a program to address post-construction stormwater runoff from all new development and redevelopment sites that disturb one or more acres and discharge into the permittees MS4 at a minimum. Permittees authorized under the MS4-2003 permit shall continue to implement and enforce their program and modify as necessary to meet the requirements of this part.
 - i. The permittee's new development/ redevelopment program shall include sites less than one acre if the site is part of a larger common plan of development or redevelopment which disturbs one or more acre.
 - ii. The permittee shall develop or modify, as appropriate, an ordinance or other regulatory mechanism within two (2) years of the effective date of the permit to contain provisions that are at least as stringent as the following:
 1. Low Impact Development (LID) site planning and design strategies must be used to the maximum extent feasible.
 2. The design of treatment and infiltration practices should follow the guidance in Volume 2 of the Massachusetts Stormwater Handbook, as amended, or other federally or State approved¹⁰ BMP design guidance.
 3. Stormwater management systems on new development sites shall be designed to:
 - a) Not allow new stormwater conveyances to discharge untreated stormwater in accordance with Massachusetts Stormwater Handbook Standard 1;
 - b) Control peak runoff rates in accordance with Massachusetts Stormwater Handbook Standard 2¹¹;
 - c) Recharge groundwater in accordance with Massachusetts Stormwater Handbook Standard 3¹²;
 - d) Eliminate or reduce the discharge of pollutants from land uses with higher pollutant loads as defined in the Massachusetts Stormwater Handbook in accordance with Massachusetts Stormwater Handbook Standard 5;
 - e) Protect Zone II or Interim Wellhead Protection Areas of public water supplies in accordance with Massachusetts Stormwater Handbook Standard 6¹³;

¹⁰ State approved includes any state in the United States, including, but not limited to, approved guidance by the Commonwealth of Massachusetts

¹¹ Requirement necessary for Section 401 water quality certification by Massachusetts

¹² Requirement necessary for Section 401 water quality certification by Massachusetts

¹³ Requirement necessary for Section 401 water quality certification by Massachusetts

5. For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

6. Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A “storm water discharge” as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

7. A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

8. A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

9. A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

10. All illicit discharges to the stormwater management system are prohibited.

Applicability

Except as expressly provided herein, stormwater runoff from all industrial, commercial, institutional, office, residential and transportation projects including site preparation, construction and redevelopment, and all point source stormwater discharges from said projects shall be managed according to the Stormwater Management Standards.

The Stormwater Management Standards shall not apply to:

(1) A single-family house;

(2) Housing development and redevelopment projects comprised of detached single-family dwellings on four or fewer lots provided that there are no stormwater discharges that may potentially affect a critical area;

- (3) Multi-family housing development and redevelopment projects with four or fewer units, including condominiums, cooperatives, apartment buildings and townhouses, provided that there are no stormwater discharges that may potentially affect a critical area; and
- (4) Emergency repairs to roads or their drainage systems.

The Stormwater Management Standards shall apply to the maximum extent practicable to the following:

- (1) Housing development and redevelopment projects comprised of detached single-family dwellings on four or fewer lots that have a stormwater discharge that may potentially affect a critical area;
- (2) Multi-family housing development and redevelopment projects, with four or fewer units, including condominiums, cooperatives, apartment buildings, and townhouses, that have a stormwater discharge that may potentially affect a critical area;
- (3) Housing development and redevelopment projects comprised of detached single-family dwellings on five to nine lots, provided there is no stormwater discharge that may potentially affect a critical area;
- (4) Multi-family housing development and redevelopment projects with five to nine units, including condominiums, cooperatives, apartment buildings, and townhouses, provided there is no stormwater discharge that may potentially affect a critical area;
- (5) Marinas and boat yards, provided that the hull maintenance, painting and service areas are protected from exposure to rain, snow, snow melt, and stormwater runoff; and
- (6) Footpaths, bikepaths and other paths for pedestrian and/or nonmotorized vehicle access.

Critical areas include Outstanding Resource Waters as designated in 314 CMR 4.00, Special Resource Waters as designated in 314 CMR 4.00, recharge areas for public water supplies as defined in 310 CMR 22.02 (Zone Is, Zone IIs and Interim Wellhead Protection Areas for groundwater sources and Zone As for surface water sources), bathing beaches as defined in 105 CMR 445.000, cold-water fisheries as defined in 310 CMR 10.04 and 314 CMR 9.02, and shellfish growing areas as defined in 310 CMR 10.04 and 314 CMR 9.02.

For phased projects, the determination of whether the Stormwater Management Standards apply is made on the entire project as a whole including all phases. When proposing a development or redevelopment project subject to the Stormwater Management Standards, proponents shall consider environmentally sensitive site design that incorporates low impact development techniques in addition to stormwater best management practices.

Project proponents seeking to demonstrate compliance with some or all of the Stormwater Management Standards to the maximum extent practicable shall demonstrate that:

- (1) They have made all reasonable efforts to meet each of the Standards;
- (2) They have made a complete evaluation of possible stormwater management measures, including environmentally sensitive site design, low impact development techniques that minimize land disturbance and impervious surfaces, structural stormwater best management practices, pollution prevention, erosion and sedimentation control, and proper operation and maintenance of stormwater best management practices; and
- (3) If full compliance with the Standards cannot be achieved, they are implementing the highest practicable level of stormwater management.

The Stormwater Management Standards (Standards 4, 5, 6, 8, and 9) require project proponents to develop a construction-period erosion, sedimentation, and pollution prevention plan and long-term pollution prevention and operation and maintenance plans. The level of detail in these plans should reflect the complexity of the project and the nature and extent of the impacts that may arise both during and after construction. For small residential projects that are subject to jurisdiction under the Wetlands Protection Act and that are required to meet the Stormwater Management Standards only to the maximum extent practicable, the issuing authority has broad discretion to tailor this requirement to the specific stormwater

DRAINAGE REPORT

201 Elm Street and 6 Monroe Street
Amesbury, Massachusetts

TAB 2



344 North Main Street | Andover • MA 01810
(978) 416-0920 | www.civildci.com

PROJECT:

201 ELM STREET

AMESBURY, MA 01913

PREPARED FOR:

**RIVERS EDGE
DEVELOPMENT LLC**

**88 ELM STREET
AMESBURY, MA 01913**

**FIGURE 1:
ORTHO**

PREPARED BY: TJS
SCALE: 1"=250'
CDCI FILE #: 25-10704
DATE: FEBRUARY 14, 2025



344 North Main Street | Andover • MA 01810
(978) 416-0920 | www.civildci.com

PROJECT:

201 ELM STREET

AMESBURY, MA 01913

PREPARED FOR:

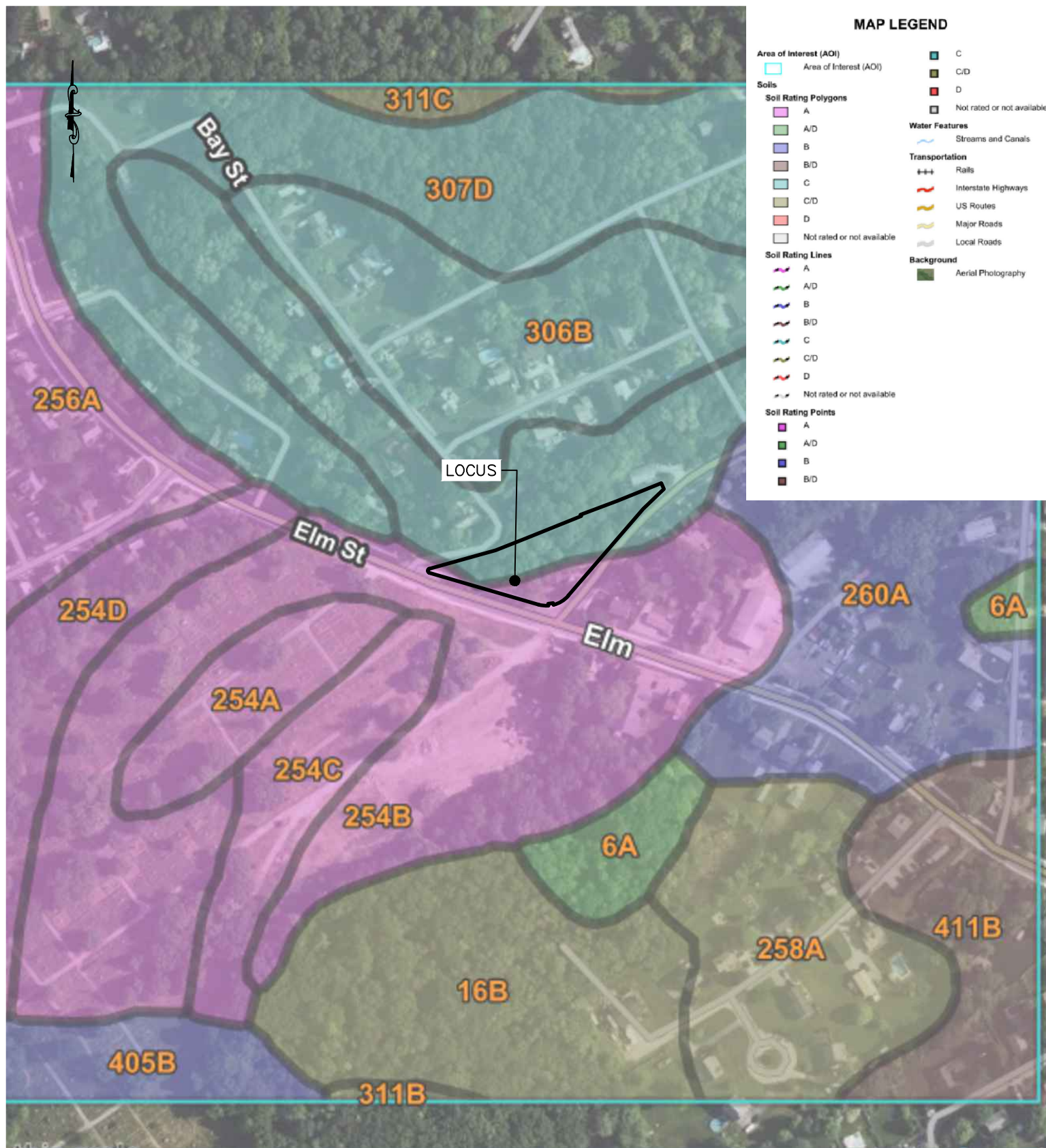
**RIVERS EDGE
DEVELOPMENT LLC**

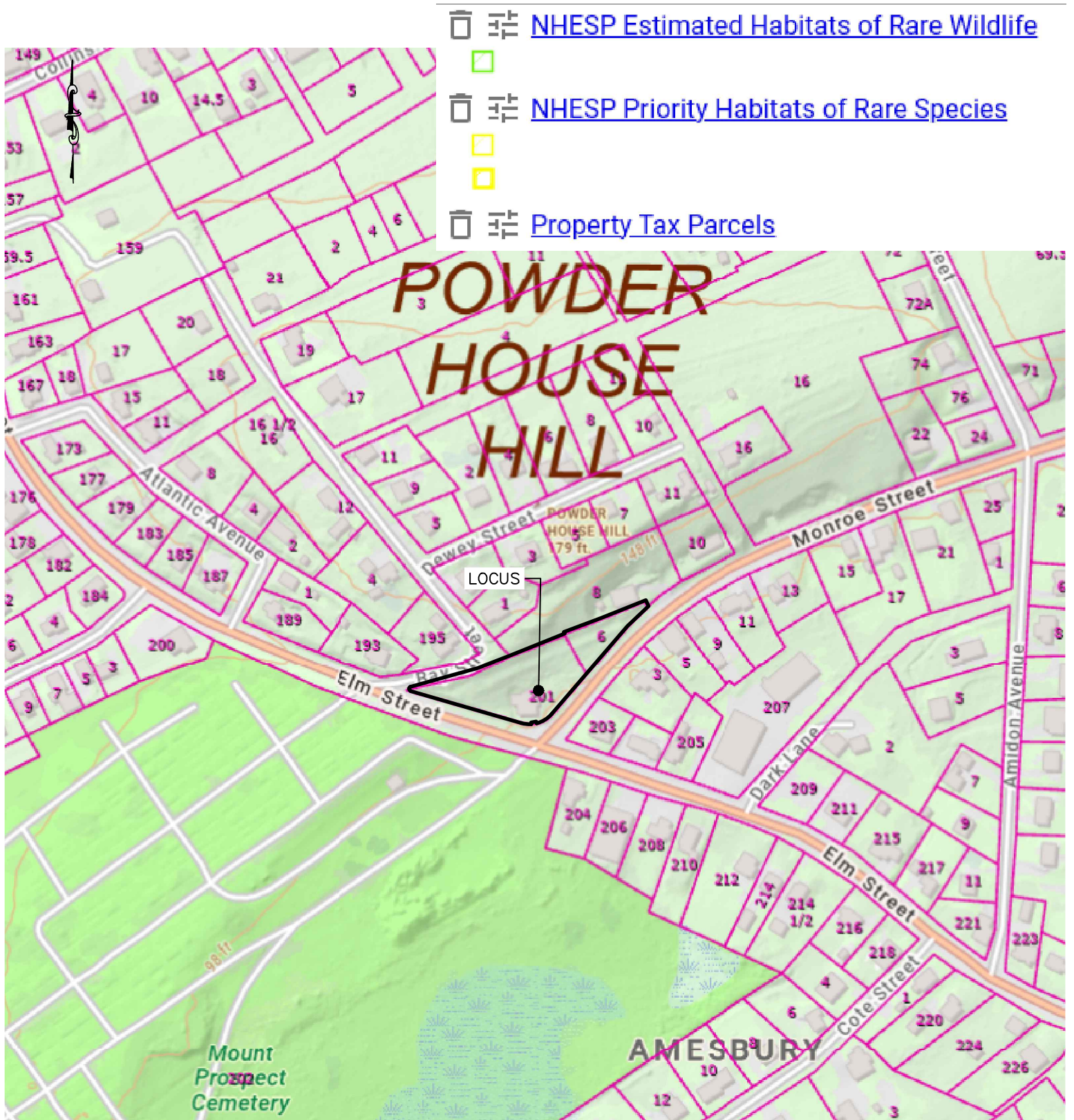
**88 ELM STREET
AMESBURY, MA 01913**

**FIGURE 2:
USGS**

**PREPARED BY: TJS
SCALE: 1"=500'
CDCI FILE #: 25-10704
DATE: FEBRUARY 14, 2025**



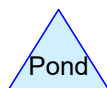
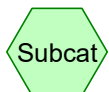
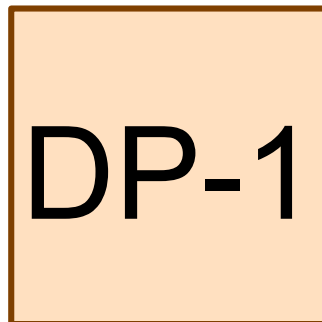
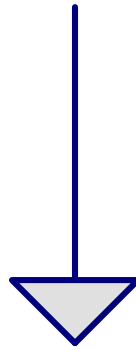
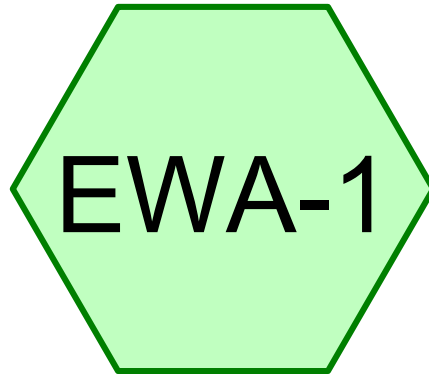




DRAINAGE REPORT

201 Elm Street and 6 Monroe Street
Amesbury, Massachusetts

TAB 3



Pre-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Printed 4/22/2025

Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC	P2 (inches)
1	2-Year	Type III 24-hr		Default	24.00	1	3.20	2	3.20
2	10-Year	Type III 24-hr		Default	24.00	1	4.50	2	3.20
3	25-Year	Type III 24-hr		Default	24.00	1	5.30	2	3.20
4	100-Year	Type III 24-hr		Default	24.00	1	6.50	2	3.20

Pre-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Printed 4/22/2025

Page 3

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.14	49	50-75% Grass cover, Fair, HSG A (EWA-1)
0.09	79	50-75% Grass cover, Fair, HSG C (EWA-1)
0.31	74	>75% Grass cover, Good, HSG C (EWA-1)
0.01	96	Gravel surface, HSG A (EWA-1)
0.01	98	Paved parking, HSG A (EWA-1)
0.11	98	Paved parking, HSG C (EWA-1)
0.06	98	Roofs, HSG C (EWA-1)
0.04	98	Unconnected roofs, HSG A (EWA-1)
0.02	30	Woods, Good, HSG A (EWA-1)
0.94	70	Woods, Good, HSG C (EWA-1)
1.73	73	TOTAL AREA

Pre-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Printed 4/22/2025

Page 4

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.22	HSG A	EWA-1
0.00	HSG B	
1.51	HSG C	EWA-1
0.00	HSG D	
0.00	Other	
1.73		TOTAL AREA

Pre-Development 4-16-25*Type III 24-hr 2-Year Rainfall=3.20", P2=3.20"*

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 6

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEWA-1:

Runoff Area=1.73 ac 12.72% Impervious Runoff Depth=0.93"

Tc=6.0 min UI Adjusted CN=72 Runoff=1.7 cfs 0.13 af

Reach DP-1:

Inflow=1.7 cfs 0.13 af

Outflow=1.7 cfs 0.13 af

Total Runoff Area = 1.73 ac Runoff Volume = 0.13 af Average Runoff Depth = 0.93"
87.28% Pervious = 1.51 ac 12.72% Impervious = 0.22 ac

Pre-Development 4-16-25

Type III 24-hr 2-Year Rainfall=3.20", P2=3.20"

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 7

Summary for Subcatchment EWA-1:

Runoff = 1.7 cfs @ 12.10 hrs, Volume= 0.13 af, Depth= 0.93"
 Routed to Reach DP-1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.20", P2=3.20"

Area (ac)	CN	Adj	Description
* 0.01	98		Paved parking, HSG A
0.04	98		Unconnected roofs, HSG A
0.01	96		Gravel surface, HSG A
0.02	30		Woods, Good, HSG A
0.14	49		50-75% Grass cover, Fair, HSG A
0.09	79		50-75% Grass cover, Fair, HSG C
0.31	74		>75% Grass cover, Good, HSG C
0.94	70		Woods, Good, HSG C
0.06	98		Roofs, HSG C
0.11	98		Paved parking, HSG C
1.73	73	72	Weighted Average, UI Adjusted
1.51			87.28% Pervious Area
0.22			12.72% Impervious Area
0.04			18.18% Unconnected

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

Summary for Reach DP-1:

Inflow Area = 1.73 ac, 12.72% Impervious, Inflow Depth = 0.93" for 2-Year event
 Inflow = 1.7 cfs @ 12.10 hrs, Volume= 0.13 af
 Outflow = 1.7 cfs @ 12.10 hrs, Volume= 0.13 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pre-Development 4-16-25*Type III 24-hr 10-Year Rainfall=4.50", P2=3.20"*

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 8

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEWA-1:

Runoff Area=1.73 ac 12.72% Impervious Runoff Depth=1.82"

Tc=6.0 min UI Adjusted CN=72 Runoff=3.6 cfs 0.26 af

Reach DP-1:

Inflow=3.6 cfs 0.26 af

Outflow=3.6 cfs 0.26 af

Total Runoff Area = 1.73 ac Runoff Volume = 0.26 af Average Runoff Depth = 1.82"
87.28% Pervious = 1.51 ac 12.72% Impervious = 0.22 ac

Pre-Development 4-16-25

Type III 24-hr 10-Year Rainfall=4.50", P2=3.20"

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 9

Summary for Subcatchment EWA-1:

Runoff = 3.6 cfs @ 12.09 hrs, Volume= 0.26 af, Depth= 1.82"
 Routed to Reach DP-1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.50", P2=3.20"

Area (ac)	CN	Adj	Description
* 0.01	98		Paved parking, HSG A
0.04	98		Unconnected roofs, HSG A
0.01	96		Gravel surface, HSG A
0.02	30		Woods, Good, HSG A
0.14	49		50-75% Grass cover, Fair, HSG A
0.09	79		50-75% Grass cover, Fair, HSG C
0.31	74		>75% Grass cover, Good, HSG C
0.94	70		Woods, Good, HSG C
0.06	98		Roofs, HSG C
0.11	98		Paved parking, HSG C
1.73	73	72	Weighted Average, UI Adjusted
1.51			87.28% Pervious Area
0.22			12.72% Impervious Area
0.04			18.18% Unconnected

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

Summary for Reach DP-1:

Inflow Area = 1.73 ac, 12.72% Impervious, Inflow Depth = 1.82" for 10-Year event
 Inflow = 3.6 cfs @ 12.09 hrs, Volume= 0.26 af
 Outflow = 3.6 cfs @ 12.09 hrs, Volume= 0.26 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pre-Development 4-16-25*Type III 24-hr 25-Year Rainfall=5.30", P2=3.20"*

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 10

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEWA-1:

Runoff Area=1.73 ac 12.72% Impervious Runoff Depth=2.43"

Tc=6.0 min UI Adjusted CN=72 Runoff=4.9 cfs 0.35 af

Reach DP-1:

Inflow=4.9 cfs 0.35 af

Outflow=4.9 cfs 0.35 af

Total Runoff Area = 1.73 ac Runoff Volume = 0.35 af Average Runoff Depth = 2.43"
87.28% Pervious = 1.51 ac 12.72% Impervious = 0.22 ac

Pre-Development 4-16-25

Type III 24-hr 25-Year Rainfall=5.30", P2=3.20"

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 11

Summary for Subcatchment EWA-1:

Runoff = 4.9 cfs @ 12.09 hrs, Volume= 0.35 af, Depth= 2.43"
 Routed to Reach DP-1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=5.30", P2=3.20"

Area (ac)	CN	Adj	Description
* 0.01	98		Paved parking, HSG A
0.04	98		Unconnected roofs, HSG A
0.01	96		Gravel surface, HSG A
0.02	30		Woods, Good, HSG A
0.14	49		50-75% Grass cover, Fair, HSG A
0.09	79		50-75% Grass cover, Fair, HSG C
0.31	74		>75% Grass cover, Good, HSG C
0.94	70		Woods, Good, HSG C
0.06	98		Roofs, HSG C
0.11	98		Paved parking, HSG C
1.73	73	72	Weighted Average, UI Adjusted
1.51			87.28% Pervious Area
0.22			12.72% Impervious Area
0.04			18.18% Unconnected

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

Summary for Reach DP-1:

Inflow Area = 1.73 ac, 12.72% Impervious, Inflow Depth = 2.43" for 25-Year event
 Inflow = 4.9 cfs @ 12.09 hrs, Volume= 0.35 af
 Outflow = 4.9 cfs @ 12.09 hrs, Volume= 0.35 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pre-Development 4-16-25*Type III 24-hr 100-Year Rainfall=6.50", P2=3.20"*

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 12

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEWA-1:

Runoff Area=1.73 ac 12.72% Impervious Runoff Depth=3.41"

Tc=6.0 min UI Adjusted CN=72 Runoff=6.9 cfs 0.49 af

Reach DP-1:

Inflow=6.9 cfs 0.49 af

Outflow=6.9 cfs 0.49 af

Total Runoff Area = 1.73 ac Runoff Volume = 0.49 af Average Runoff Depth = 3.41"
87.28% Pervious = 1.51 ac 12.72% Impervious = 0.22 ac

Pre-Development 4-16-25

Type III 24-hr 100-Year Rainfall=6.50", P2=3.20"

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 13

Summary for Subcatchment EWA-1:

Runoff = 6.9 cfs @ 12.09 hrs, Volume= 0.49 af, Depth= 3.41"
 Routed to Reach DP-1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=6.50", P2=3.20"

Area (ac)	CN	Adj	Description
* 0.01	98		Paved parking, HSG A
0.04	98		Unconnected roofs, HSG A
0.01	96		Gravel surface, HSG A
0.02	30		Woods, Good, HSG A
0.14	49		50-75% Grass cover, Fair, HSG A
0.09	79		50-75% Grass cover, Fair, HSG C
0.31	74		>75% Grass cover, Good, HSG C
0.94	70		Woods, Good, HSG C
0.06	98		Roofs, HSG C
0.11	98		Paved parking, HSG C
1.73	73	72	Weighted Average, UI Adjusted
1.51			87.28% Pervious Area
0.22			12.72% Impervious Area
0.04			18.18% Unconnected

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

Summary for Reach DP-1:

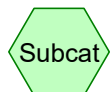
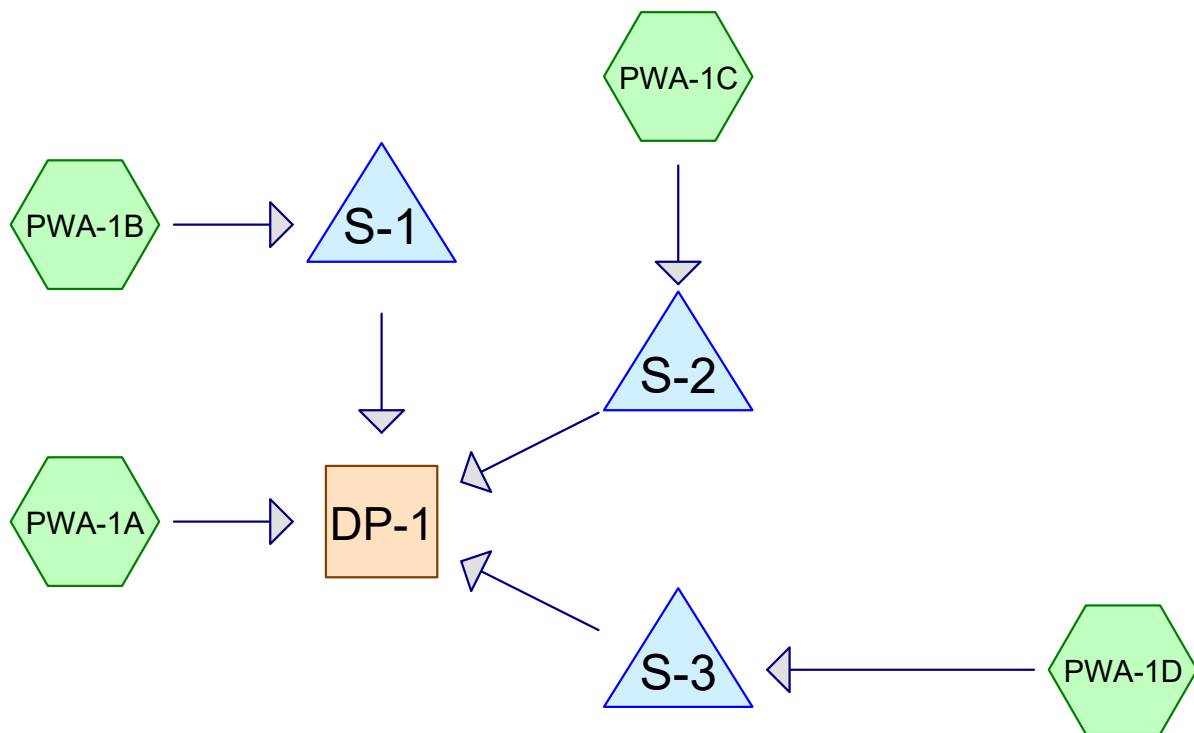
Inflow Area = 1.73 ac, 12.72% Impervious, Inflow Depth = 3.41" for 100-Year event
 Inflow = 6.9 cfs @ 12.09 hrs, Volume= 0.49 af
 Outflow = 6.9 cfs @ 12.09 hrs, Volume= 0.49 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

DRAINAGE REPORT

201 Elm Street and 6 Monroe Street
Amesbury, Massachusetts

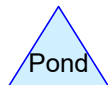
TAB 4



Subcat



Reach



Pond



Link

Routing Diagram for Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc, Printed 4/22/2025
HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Printed 4/22/2025

Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.20	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.50	2
3	25-Year	Type III 24-hr		Default	24.00	1	5.30	2
4	100-Year	Type III 24-hr		Default	24.00	1	6.50	2

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Printed 4/22/2025

Page 3

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.04	49	50-75% Grass cover, Fair, HSG A (PWA-1A)
0.04	79	50-75% Grass cover, Fair, HSG C (PWA-1A)
0.08	39	>75% Grass cover, Good, HSG A (PWA-1A)
0.54	74	>75% Grass cover, Good, HSG C (PWA-1A)
0.05	98	Paved parking, HSG A (PWA-1A)
0.18	98	Paved parking, HSG C (PWA-1A)
0.05	98	Roofs, HSG A (PWA-1B)
0.09	98	Roofs, HSG C (PWA-1C, PWA-1D)
0.06	98	Unconnected roofs, HSG C (PWA-1A)
0.60	70	Woods, Good, HSG C (PWA-1A)
1.73	76	TOTAL AREA

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Printed 4/22/2025

Page 4

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.22	HSG A	PWA-1A, PWA-1B
0.00	HSG B	
1.51	HSG C	PWA-1A, PWA-1C, PWA-1D
0.00	HSG D	
0.00	Other	
1.73		TOTAL AREA

Post-Development 4-16-25*Type III 24-hr 2-Year Rainfall=3.20"*

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 5

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPWA-1A: Runoff Area=1.59 ac 18.24% Impervious Runoff Depth=1.04"
Tc=6.0 min UI Adjusted CN=74 Runoff=1.8 cfs 0.14 af

SubcatchmentPWA-1B: Runoff Area=0.05 ac 100.00% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.01 af

SubcatchmentPWA-1C: Runoff Area=0.05 ac 100.00% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.01 af

SubcatchmentPWA-1D: Runoff Area=0.04 ac 100.00% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Reach DP-1: To ROW Inflow=1.8 cfs 0.14 af
Outflow=1.8 cfs 0.14 af

Pond S-1: S-1 Peak Elev=97.88' Storage=158 cf Inflow=0.2 cfs 0.01 af
Discarded=0.0 cfs 0.01 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.01 af

Pond S-2: S-2 Peak Elev=96.31' Storage=70 cf Inflow=0.2 cfs 0.01 af
Outflow=0.1 cfs 0.01 af

Pond S-3: S-3 Peak Elev=101.59' Storage=83 cf Inflow=0.1 cfs 0.01 af
Discarded=0.0 cfs 0.01 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.01 af

Total Runoff Area = 1.73 ac Runoff Volume = 0.17 af Average Runoff Depth = 1.19"
75.14% Pervious = 1.30 ac 24.86% Impervious = 0.43 ac

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.20"

Printed 4/22/2025

Page 6

Summary for Subcatchment PWA-1A:

Runoff = 1.8 cfs @ 12.10 hrs, Volume= 0.14 af, Depth= 1.04"
 Routed to Reach DP-1 : To ROW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Adj	Description
0.05	98		Paved parking, HSG A
0.04	98		Paved parking, HSG C
0.08	39		>75% Grass cover, Good, HSG A
0.04	49		50-75% Grass cover, Fair, HSG A
0.03	98		Paved parking, HSG C
0.54	74		>75% Grass cover, Good, HSG C
0.04	79		50-75% Grass cover, Fair, HSG C
0.11	98		Paved parking, HSG C
0.06	98		Unconnected roofs, HSG C
0.60	70		Woods, Good, HSG C
1.59	75	74	Weighted Average, UI Adjusted
1.30			81.76% Pervious Area
0.29			18.24% Impervious Area
0.06			20.69% Unconnected

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

Summary for Subcatchment PWA-1B:

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 2.97"
 Routed to Pond S-1 : S-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
0.05	98	Roofs, HSG A
0.05		100.00% Impervious Area

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

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.20"

Printed 4/22/2025

Page 7

Summary for Subcatchment PWA-1C:

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 2.97"
 Routed to Pond S-2 : S-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
0.05	98	Roofs, HSG C
0.05		100.00% Impervious Area

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

Summary for Subcatchment PWA-1D:

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 2.97"
 Routed to Pond S-3 : S-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.20"

Area (ac)	CN	Description
0.04	98	Roofs, HSG C
0.04		100.00% Impervious Area

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

Summary for Reach DP-1: To ROW

Inflow Area = 1.73 ac, 24.86% Impervious, Inflow Depth = 0.95" for 2-Year event
 Inflow = 1.8 cfs @ 12.10 hrs, Volume= 0.14 af
 Outflow = 1.8 cfs @ 12.10 hrs, Volume= 0.14 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond S-1: S-1

Inflow Area = 0.05 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2-Year event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.01 af
 Outflow = 0.0 cfs @ 12.58 hrs, Volume= 0.01 af, Atten= 85%, Lag= 29.8 min
 Discarded = 0.0 cfs @ 12.58 hrs, Volume= 0.01 af
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af
 Routed to Reach DP-1 : To ROW

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Post-Development 4-16-25

Type III 24-hr 2-Year Rainfall=3.20"

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 8

Peak Elev= 97.88' @ 12.58 hrs Surf.Area= 338 sf Storage= 158 cf

Plug-Flow detention time= 43.6 min calculated for 0.01 af (100% of inflow)

Center-of-Mass det. time= 43.6 min (800.0 - 756.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	97.00'	225 cf	13.00'W x 26.00'L x 2.04'H Field A 690 cf Overall - 128 cf Embedded = 562 cf x 40.0% Voids
#2A	97.50'	128 cf	Cultec C-100HD x 9 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 3 rows
		353 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	97.00'	2.400 in/hr Exfiltration over Wetted area
#2	Primary	99.00'	12.0" x 12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.58 hrs HW=97.88' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.0 cfs)**Primary OutFlow** Max=0.0 cfs @ 0.00 hrs HW=97.00' (Free Discharge)↑**2=Orifice/Grate** (Controls 0.0 cfs)**Summary for Pond S-2: S-2**

Inflow Area = 0.05 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2-Year event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.01 af
 Outflow = 0.1 cfs @ 12.32 hrs, Volume= 0.01 af, Atten= 62%, Lag= 14.2 min
 Discarded = 0.1 cfs @ 12.32 hrs, Volume= 0.01 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Peak Elev= 96.31' @ 12.32 hrs Surf.Area= 257 sf Storage= 70 cf

Plug-Flow detention time= 5.4 min calculated for 0.01 af (100% of inflow)

Center-of-Mass det. time= 5.4 min (761.8 - 756.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.70'	175 cf	9.50'W x 27.00'L x 2.04'H Field A 524 cf Overall - 86 cf Embedded = 438 cf x 40.0% Voids
#2A	96.20'	86 cf	Cultec C-100HD x 6 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
		261 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Post-Development 4-16-25

Type III 24-hr 2-Year Rainfall=3.20"

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 9

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.70'	8.270 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.1 cfs @ 12.32 hrs HW=96.31' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.1 cfs)**Summary for Pond S-3: S-3**

Inflow Area = 0.04 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2-Year event
 Inflow = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af
 Outflow = 0.0 cfs @ 12.41 hrs, Volume= 0.01 af, Atten= 70%, Lag= 19.1 min
 Discarded = 0.0 cfs @ 12.41 hrs, Volume= 0.01 af
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af
 Routed to Reach DP-1 : To ROW

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Peak Elev= 101.59' @ 12.41 hrs Surf.Area= 126 sf Storage= 83 cf

Plug-Flow detention time= 12.1 min calculated for 0.01 af (100% of inflow)

Center-of-Mass det. time= 12.1 min (768.5 - 756.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.20'	155 cf	9.00'W x 14.00'L x 3.54'H Field A 446 cf Overall - 58 cf Embedded = 388 cf x 40.0% Voids
#2A	101.20'	58 cf	Cultec R-150XLHD x 2 Inside #1 Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 2 rows
		213 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.20'	8.270 in/hr Exfiltration over Wetted area
#2	Primary	103.70'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.41 hrs HW=101.59' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.0 cfs)**Primary OutFlow** Max=0.0 cfs @ 0.00 hrs HW=100.20' (Free Discharge)↑**2=Orifice/Grate** (Controls 0.0 cfs)

Post-Development 4-16-25*Type III 24-hr 10-Year Rainfall=4.50"*

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 10

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPWA-1A: Runoff Area=1.59 ac 18.24% Impervious Runoff Depth=1.97"
Tc=6.0 min UI Adjusted CN=74 Runoff=3.6 cfs 0.26 af

SubcatchmentPWA-1B: Runoff Area=0.05 ac 100.00% Impervious Runoff Depth=4.26"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.02 af

SubcatchmentPWA-1C: Runoff Area=0.05 ac 100.00% Impervious Runoff Depth=4.26"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.02 af

SubcatchmentPWA-1D: Runoff Area=0.04 ac 100.00% Impervious Runoff Depth=4.26"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.01 af

Reach DP-1: To ROW Inflow=3.6 cfs 0.26 af
Outflow=3.6 cfs 0.26 af

Pond S-1: S-1 Peak Elev=98.34' Storage=256 cf Inflow=0.2 cfs 0.02 af
Discarded=0.0 cfs 0.02 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.02 af

Pond S-2: S-2 Peak Elev=96.72' Storage=139 cf Inflow=0.2 cfs 0.02 af
Outflow=0.1 cfs 0.02 af

Pond S-3: S-3 Peak Elev=102.38' Storage=142 cf Inflow=0.2 cfs 0.01 af
Discarded=0.0 cfs 0.01 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.01 af

Total Runoff Area = 1.73 ac Runoff Volume = 0.31 af Average Runoff Depth = 2.16"
75.14% Pervious = 1.30 ac 24.86% Impervious = 0.43 ac

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

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

Printed 4/22/2025

Page 11

Summary for Subcatchment PWA-1A:

Runoff = 3.6 cfs @ 12.10 hrs, Volume= 0.26 af, Depth= 1.97"
 Routed to Reach DP-1 : To ROW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Adj	Description
0.05	98		Paved parking, HSG A
0.04	98		Paved parking, HSG C
0.08	39		>75% Grass cover, Good, HSG A
0.04	49		50-75% Grass cover, Fair, HSG A
0.03	98		Paved parking, HSG C
0.54	74		>75% Grass cover, Good, HSG C
0.04	79		50-75% Grass cover, Fair, HSG C
0.11	98		Paved parking, HSG C
0.06	98		Unconnected roofs, HSG C
0.60	70		Woods, Good, HSG C
1.59	75	74	Weighted Average, UI Adjusted
1.30			81.76% Pervious Area
0.29			18.24% Impervious Area
0.06			20.69% Unconnected

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

Summary for Subcatchment PWA-1B:

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af, Depth= 4.26"
 Routed to Pond S-1 : S-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.05	98	Roofs, HSG A
0.05		100.00% Impervious Area

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

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

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

Printed 4/22/2025

Page 12

Summary for Subcatchment PWA-1C:

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af, Depth= 4.26"
 Routed to Pond S-2 : S-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.05	98	Roofs, HSG C
0.05		100.00% Impervious Area

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

Summary for Subcatchment PWA-1D:

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 4.26"
 Routed to Pond S-3 : S-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.04	98	Roofs, HSG C
0.04		100.00% Impervious Area

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

Summary for Reach DP-1: To ROW

Inflow Area = 1.73 ac, 24.86% Impervious, Inflow Depth = 1.81" for 10-Year event
 Inflow = 3.6 cfs @ 12.10 hrs, Volume= 0.26 af
 Outflow = 3.6 cfs @ 12.10 hrs, Volume= 0.26 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond S-1: S-1

Inflow Area = 0.05 ac, 100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af
 Outflow = 0.0 cfs @ 12.71 hrs, Volume= 0.02 af, Atten= 89%, Lag= 37.6 min
 Discarded = 0.0 cfs @ 12.71 hrs, Volume= 0.02 af
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af
 Routed to Reach DP-1 : To ROW

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Post-Development 4-16-25

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

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 13

Peak Elev= 98.34' @ 12.71 hrs Surf.Area= 338 sf Storage= 256 cf

Plug-Flow detention time= 73.1 min calculated for 0.02 af (100% of inflow)

Center-of-Mass det. time= 73.0 min (822.8 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	97.00'	225 cf	13.00'W x 26.00'L x 2.04'H Field A 690 cf Overall - 128 cf Embedded = 562 cf x 40.0% Voids
#2A	97.50'	128 cf	Cultec C-100HD x 9 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 3 rows
		353 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	97.00'	2.400 in/hr Exfiltration over Wetted area
#2	Primary	99.00'	12.0" x 12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.71 hrs HW=98.34' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.0 cfs)**Primary OutFlow** Max=0.0 cfs @ 0.00 hrs HW=97.00' (Free Discharge)↑**2=Orifice/Grate** (Controls 0.0 cfs)**Summary for Pond S-2: S-2**

Inflow Area = 0.05 ac, 100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af
 Outflow = 0.1 cfs @ 12.41 hrs, Volume= 0.02 af, Atten= 70%, Lag= 19.4 min
 Discarded = 0.1 cfs @ 12.41 hrs, Volume= 0.02 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Peak Elev= 96.72' @ 12.41 hrs Surf.Area= 257 sf Storage= 139 cf

Plug-Flow detention time= 10.7 min calculated for 0.02 af (100% of inflow)

Center-of-Mass det. time= 10.7 min (760.5 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.70'	175 cf	9.50'W x 27.00'L x 2.04'H Field A 524 cf Overall - 86 cf Embedded = 438 cf x 40.0% Voids
#2A	96.20'	86 cf	Cultec C-100HD x 6 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
		261 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Post-Development 4-16-25

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

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 14

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.70'	8.270 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.1 cfs @ 12.41 hrs HW=96.72' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.1 cfs)**Summary for Pond S-3: S-3**

Inflow Area = 0.04 ac, 100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.01 af
 Outflow = 0.0 cfs @ 12.46 hrs, Volume= 0.01 af, Atten= 75%, Lag= 22.2 min
 Discarded = 0.0 cfs @ 12.46 hrs, Volume= 0.01 af
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af
 Routed to Reach DP-1 : To ROW

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 102.38' @ 12.46 hrs Surf.Area= 126 sf Storage= 142 cf

Plug-Flow detention time= 19.2 min calculated for 0.01 af (100% of inflow)
 Center-of-Mass det. time= 19.2 min (769.0 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.20'	155 cf	9.00'W x 14.00'L x 3.54'H Field A 446 cf Overall - 58 cf Embedded = 388 cf x 40.0% Voids
#2A	101.20'	58 cf	Cultec R-150XLHD x 2 Inside #1 Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 2 rows
		213 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.20'	8.270 in/hr Exfiltration over Wetted area
#2	Primary	103.70'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.46 hrs HW=102.38' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.0 cfs)**Primary OutFlow** Max=0.0 cfs @ 0.00 hrs HW=100.20' (Free Discharge)↑**2=Orifice/Grate** (Controls 0.0 cfs)

Post-Development 4-16-25*Type III 24-hr 25-Year Rainfall=5.30"*

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 15

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPWA-1A: Runoff Area=1.59 ac 18.24% Impervious Runoff Depth=2.61"
Tc=6.0 min UI Adjusted CN=74 Runoff=4.8 cfs 0.35 af

SubcatchmentPWA-1B: Runoff Area=0.05 ac 100.00% Impervious Runoff Depth=5.06"
Tc=6.0 min CN=98 Runoff=0.3 cfs 0.02 af

SubcatchmentPWA-1C: Runoff Area=0.05 ac 100.00% Impervious Runoff Depth=5.06"
Tc=6.0 min CN=98 Runoff=0.3 cfs 0.02 af

SubcatchmentPWA-1D: Runoff Area=0.04 ac 100.00% Impervious Runoff Depth=5.06"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.02 af

Reach DP-1: To ROW Inflow=4.8 cfs 0.35 af
Outflow=4.8 cfs 0.35 af

Pond S-1: S-1 Peak Elev=98.79' Storage=320 cf Inflow=0.3 cfs 0.02 af
Discarded=0.0 cfs 0.02 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.02 af

Pond S-2: S-2 Peak Elev=97.03' Storage=185 cf Inflow=0.3 cfs 0.02 af
Outflow=0.1 cfs 0.02 af

Pond S-3: S-3 Peak Elev=103.05' Storage=178 cf Inflow=0.2 cfs 0.02 af
Discarded=0.0 cfs 0.02 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.02 af

Total Runoff Area = 1.73 ac Runoff Volume = 0.40 af Average Runoff Depth = 2.80"
75.14% Pervious = 1.30 ac 24.86% Impervious = 0.43 ac

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Type III 24-hr 25-Year Rainfall=5.30"

Printed 4/22/2025

Page 16

Summary for Subcatchment PWA-1A:

Runoff = 4.8 cfs @ 12.09 hrs, Volume= 0.35 af, Depth= 2.61"
 Routed to Reach DP-1 : To ROW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Adj	Description
0.05	98		Paved parking, HSG A
0.04	98		Paved parking, HSG C
0.08	39		>75% Grass cover, Good, HSG A
0.04	49		50-75% Grass cover, Fair, HSG A
0.03	98		Paved parking, HSG C
0.54	74		>75% Grass cover, Good, HSG C
0.04	79		50-75% Grass cover, Fair, HSG C
0.11	98		Paved parking, HSG C
0.06	98		Unconnected roofs, HSG C
0.60	70		Woods, Good, HSG C
1.59	75	74	Weighted Average, UI Adjusted
1.30			81.76% Pervious Area
0.29			18.24% Impervious Area
0.06			20.69% Unconnected

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

Summary for Subcatchment PWA-1B:

Runoff = 0.3 cfs @ 12.09 hrs, Volume= 0.02 af, Depth= 5.06"
 Routed to Pond S-1 : S-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.05	98	Roofs, HSG A
0.05		100.00% Impervious Area

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

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Type III 24-hr 25-Year Rainfall=5.30"

Printed 4/22/2025

Page 17

Summary for Subcatchment PWA-1C:

Runoff = 0.3 cfs @ 12.09 hrs, Volume= 0.02 af, Depth= 5.06"
 Routed to Pond S-2 : S-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.05	98	Roofs, HSG C
0.05		100.00% Impervious Area

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

Summary for Subcatchment PWA-1D:

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af, Depth= 5.06"
 Routed to Pond S-3 : S-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.04	98	Roofs, HSG C
0.04		100.00% Impervious Area

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

Summary for Reach DP-1: To ROW

Inflow Area = 1.73 ac, 24.86% Impervious, Inflow Depth = 2.39" for 25-Year event
 Inflow = 4.8 cfs @ 12.09 hrs, Volume= 0.35 af
 Outflow = 4.8 cfs @ 12.09 hrs, Volume= 0.35 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond S-1: S-1

Inflow Area = 0.05 ac, 100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
 Inflow = 0.3 cfs @ 12.09 hrs, Volume= 0.02 af
 Outflow = 0.0 cfs @ 12.80 hrs, Volume= 0.02 af, Atten= 90%, Lag= 43.1 min
 Discarded = 0.0 cfs @ 12.80 hrs, Volume= 0.02 af
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af
 Routed to Reach DP-1 : To ROW

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Post-Development 4-16-25

Type III 24-hr 25-Year Rainfall=5.30"

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 18

Peak Elev= 98.79' @ 12.80 hrs Surf.Area= 338 sf Storage= 320 cf

Plug-Flow detention time= 90.4 min calculated for 0.02 af (100% of inflow)

Center-of-Mass det. time= 90.3 min (837.4 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	97.00'	225 cf	13.00'W x 26.00'L x 2.04'H Field A 690 cf Overall - 128 cf Embedded = 562 cf x 40.0% Voids
#2A	97.50'	128 cf	Cultec C-100HD x 9 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 3 rows
		353 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	97.00'	2.400 in/hr Exfiltration over Wetted area
#2	Primary	99.00'	12.0" x 12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.80 hrs HW=98.79' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.0 cfs)**Primary OutFlow** Max=0.0 cfs @ 0.00 hrs HW=97.00' (Free Discharge)↑**2=Orifice/Grate** (Controls 0.0 cfs)**Summary for Pond S-2: S-2**

Inflow Area = 0.05 ac, 100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
 Inflow = 0.3 cfs @ 12.09 hrs, Volume= 0.02 af
 Outflow = 0.1 cfs @ 12.44 hrs, Volume= 0.02 af, Atten= 73%, Lag= 21.2 min
 Discarded = 0.1 cfs @ 12.44 hrs, Volume= 0.02 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Peak Elev= 97.03' @ 12.44 hrs Surf.Area= 257 sf Storage= 185 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 14.0 min (761.1 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.70'	175 cf	9.50'W x 27.00'L x 2.04'H Field A 524 cf Overall - 86 cf Embedded = 438 cf x 40.0% Voids
#2A	96.20'	86 cf	Cultec C-100HD x 6 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
		261 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Post-Development 4-16-25

Type III 24-hr 25-Year Rainfall=5.30"

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 19

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.70'	8.270 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.1 cfs @ 12.44 hrs HW=97.03' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.1 cfs)**Summary for Pond S-3: S-3**

Inflow Area = 0.04 ac, 100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af
 Outflow = 0.0 cfs @ 12.47 hrs, Volume= 0.02 af, Atten= 76%, Lag= 22.8 min
 Discarded = 0.0 cfs @ 12.47 hrs, Volume= 0.02 af
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af
 Routed to Reach DP-1 : To ROW

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 103.05' @ 12.47 hrs Surf.Area= 126 sf Storage= 178 cf

Plug-Flow detention time= 22.9 min calculated for 0.02 af (100% of inflow)
 Center-of-Mass det. time= 22.8 min (769.9 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.20'	155 cf	9.00'W x 14.00'L x 3.54'H Field A 446 cf Overall - 58 cf Embedded = 388 cf x 40.0% Voids
#2A	101.20'	58 cf	Cultec R-150XLHD x 2 Inside #1 Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 2 rows
		213 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.20'	8.270 in/hr Exfiltration over Wetted area
#2	Primary	103.70'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.47 hrs HW=103.04' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.0 cfs)**Primary OutFlow** Max=0.0 cfs @ 0.00 hrs HW=100.20' (Free Discharge)↑**2=Orifice/Grate** (Controls 0.0 cfs)

Post-Development 4-16-25*Type III 24-hr 100-Year Rainfall=6.50"*

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 20

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPWA-1A: Runoff Area=1.59 ac 18.24% Impervious Runoff Depth=3.61"
Tc=6.0 min UI Adjusted CN=74 Runoff=6.6 cfs 0.48 af

SubcatchmentPWA-1B: Runoff Area=0.05 ac 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=0.3 cfs 0.03 af

SubcatchmentPWA-1C: Runoff Area=0.05 ac 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=0.3 cfs 0.03 af

SubcatchmentPWA-1D: Runoff Area=0.04 ac 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=0.2 cfs 0.02 af

Reach DP-1: To ROW Inflow=6.6 cfs 0.48 af
Outflow=6.6 cfs 0.48 af

Pond S-1: S-1 Peak Elev=99.04' Storage=352 cf Inflow=0.3 cfs 0.03 af
Discarded=0.0 cfs 0.02 af Primary=0.1 cfs 0.00 af Outflow=0.1 cfs 0.03 af

Pond S-2: S-2 Peak Elev=97.68' Storage=254 cf Inflow=0.3 cfs 0.03 af
Outflow=0.1 cfs 0.03 af

Pond S-3: S-3 Peak Elev=103.74' Storage=213 cf Inflow=0.2 cfs 0.02 af
Discarded=0.1 cfs 0.02 af Primary=0.1 cfs 0.00 af Outflow=0.1 cfs 0.02 af

Total Runoff Area = 1.73 ac Runoff Volume = 0.55 af Average Runoff Depth = 3.82"
75.14% Pervious = 1.30 ac 24.86% Impervious = 0.43 ac

Post-Development 4-16-25

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

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 21

Summary for Subcatchment PWA-1A:

Runoff = 6.6 cfs @ 12.09 hrs, Volume= 0.48 af, Depth= 3.61"
 Routed to Reach DP-1 : To ROW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Adj	Description
0.05	98		Paved parking, HSG A
0.04	98		Paved parking, HSG C
0.08	39		>75% Grass cover, Good, HSG A
0.04	49		50-75% Grass cover, Fair, HSG A
0.03	98		Paved parking, HSG C
0.54	74		>75% Grass cover, Good, HSG C
0.04	79		50-75% Grass cover, Fair, HSG C
0.11	98		Paved parking, HSG C
0.06	98		Unconnected roofs, HSG C
0.60	70		Woods, Good, HSG C
1.59	75	74	Weighted Average, UI Adjusted
1.30			81.76% Pervious Area
0.29			18.24% Impervious Area
0.06			20.69% Unconnected

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

Summary for Subcatchment PWA-1B:

Runoff = 0.3 cfs @ 12.09 hrs, Volume= 0.03 af, Depth= 6.26"
 Routed to Pond S-1 : S-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.05	98	Roofs, HSG A
0.05		100.00% Impervious Area

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

Post-Development 4-16-25

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

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 22

Summary for Subcatchment PWA-1C:

Runoff = 0.3 cfs @ 12.09 hrs, Volume= 0.03 af, Depth= 6.26"
 Routed to Pond S-2 : S-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.05	98	Roofs, HSG C
0.05		100.00% Impervious Area

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

Summary for Subcatchment PWA-1D:

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af, Depth= 6.26"
 Routed to Pond S-3 : S-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.04	98	Roofs, HSG C
0.04		100.00% Impervious Area

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

Summary for Reach DP-1: To ROW

Inflow Area = 1.73 ac, 24.86% Impervious, Inflow Depth = 3.33" for 100-Year event
 Inflow = 6.6 cfs @ 12.09 hrs, Volume= 0.48 af
 Outflow = 6.6 cfs @ 12.09 hrs, Volume= 0.48 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Pond S-1: S-1

Inflow Area = 0.05 ac, 100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
 Inflow = 0.3 cfs @ 12.09 hrs, Volume= 0.03 af
 Outflow = 0.1 cfs @ 12.34 hrs, Volume= 0.03 af, Atten= 61%, Lag= 15.5 min
 Discarded = 0.0 cfs @ 12.34 hrs, Volume= 0.02 af
 Primary = 0.1 cfs @ 12.34 hrs, Volume= 0.00 af
 Routed to Reach DP-1 : To ROW

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Post-Development 4-16-25

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

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 23

Peak Elev= 99.04' @ 12.34 hrs Surf.Area= 338 sf Storage= 352 cf

Plug-Flow detention time= 92.5 min calculated for 0.03 af (100% of inflow)

Center-of-Mass det. time= 92.4 min (836.4 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	97.00'	225 cf	13.00'W x 26.00'L x 2.04'H Field A 690 cf Overall - 128 cf Embedded = 562 cf x 40.0% Voids
#2A	97.50'	128 cf	Cultec C-100HD x 9 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 3 rows
		353 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	97.00'	2.400 in/hr Exfiltration over Wetted area
#2	Primary	99.00'	12.0" x 12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 12.34 hrs HW=99.04' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.0 cfs)**Primary OutFlow** Max=0.1 cfs @ 12.34 hrs HW=99.04' (Free Discharge)↑**2=Orifice/Grate** (Weir Controls 0.1 cfs @ 0.62 fps)**Summary for Pond S-2: S-2**

Inflow Area = 0.05 ac, 100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
 Inflow = 0.3 cfs @ 12.09 hrs, Volume= 0.03 af
 Outflow = 0.1 cfs @ 12.46 hrs, Volume= 0.03 af, Atten= 75%, Lag= 22.5 min
 Discarded = 0.1 cfs @ 12.46 hrs, Volume= 0.03 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Peak Elev= 97.68' @ 12.46 hrs Surf.Area= 257 sf Storage= 254 cf

Plug-Flow detention time= 18.6 min calculated for 0.03 af (100% of inflow)

Center-of-Mass det. time= 18.6 min (762.6 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.70'	175 cf	9.50'W x 27.00'L x 2.04'H Field A 524 cf Overall - 86 cf Embedded = 438 cf x 40.0% Voids
#2A	96.20'	86 cf	Cultec C-100HD x 6 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
		261 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Post-Development 4-16-25

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

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 24

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.70'	8.270 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.1 cfs @ 12.46 hrs HW=97.68' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.1 cfs)**Summary for Pond S-3: S-3**

Inflow Area = 0.04 ac, 100.00% Impervious, Inflow Depth = 6.26" for 100-Year event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af
 Outflow = 0.1 cfs @ 12.30 hrs, Volume= 0.02 af, Atten= 46%, Lag= 13.0 min
 Discarded = 0.1 cfs @ 12.31 hrs, Volume= 0.02 af
 Primary = 0.1 cfs @ 12.30 hrs, Volume= 0.00 af
 Routed to Reach DP-1 : To ROW

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 103.74' @ 12.31 hrs Surf.Area= 126 sf Storage= 213 cf

Plug-Flow detention time= 25.1 min calculated for 0.02 af (100% of inflow)
 Center-of-Mass det. time= 25.1 min (769.0 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.20'	155 cf	9.00'W x 14.00'L x 3.54'H Field A 446 cf Overall - 58 cf Embedded = 388 cf x 40.0% Voids
#2A	101.20'	58 cf	Cultec R-150XLHD x 2 Inside #1 Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 2 rows
		213 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.20'	8.270 in/hr Exfiltration over Wetted area
#2	Primary	103.70'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.1 cfs @ 12.31 hrs HW=103.73' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.1 cfs)**Primary OutFlow** Max=0.1 cfs @ 12.30 hrs HW=103.74' (Free Discharge)↑**2=Orifice/Grate** (Weir Controls 0.1 cfs @ 0.62 fps)

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

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

Printed 4/22/2025

Page 1

Stage-Area-Storage for Pond S-1: S-1

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
97.00	338	0	98.04	419	194
97.02	340	3	98.06	421	198
97.04	341	5	98.08	422	203
97.06	343	8	98.10	424	207
97.08	344	11	98.12	425	211
97.10	346	14	98.14	427	216
97.12	347	16	98.16	428	220
97.14	349	19	98.18	430	224
97.16	350	22	98.20	432	228
97.18	352	24	98.22	433	232
97.20	354	27	98.24	435	236
97.22	355	30	98.26	436	240
97.24	357	32	98.28	438	244
97.26	358	35	98.30	439	248
97.28	360	38	98.32	441	252
97.30	361	41	98.34	443	255
97.32	363	43	98.36	444	259
97.34	365	46	98.38	446	262
97.36	366	49	98.40	447	265
97.38	368	51	98.42	449	268
97.40	369	54	98.44	450	271
97.42	371	57	98.46	452	274
97.44	372	59	98.48	453	277
97.46	374	62	98.50	455	280
97.48	375	65	98.52	457	283
97.50	377	68	98.54	458	285
97.52	379	73	98.56	460	288
97.54	380	77	98.58	461	291
97.56	382	82	98.60	463	293
97.58	383	87	98.62	464	296
97.60	385	92	98.64	466	299
97.62	386	97	98.66	467	301
97.64	388	101	98.68	469	304
97.66	389	106	98.70	471	307
97.68	391	111	98.72	472	310
97.70	393	116	98.74	474	312
97.72	394	120	98.76	475	315
97.74	396	125	98.78	477	318
97.76	397	130	98.80	478	320
97.78	399	135	98.82	480	323
97.80	400	139	98.84	482	326
97.82	402	144	98.86	483	329
97.84	404	149	98.88	485	331
97.86	405	153	98.90	486	334
97.88	407	158	98.92	488	337
97.90	408	162	98.94	489	339
97.92	410	167	98.96	491	342
97.94	411	172	98.98	492	345
97.96	413	176	99.00	494	347
97.98	414	181	99.02	496	350
98.00	416	185	99.04	497	353
98.02	418	190			

Post-Development 4-16-25

Prepared by Civil Design Consultants, Inc

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

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

Printed 4/22/2025

Page 2

Stage-Area-Storage for Pond S-2: S-2

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
95.70	257	0	96.74	332	142
95.72	258	2	96.76	334	145
95.74	259	4	96.78	335	149
95.76	261	6	96.80	337	152
95.78	262	8	96.82	338	155
95.80	264	10	96.84	340	158
95.82	265	12	96.86	341	161
95.84	267	14	96.88	343	164
95.86	268	16	96.90	344	167
95.88	270	18	96.92	346	170
95.90	271	21	96.94	347	173
95.92	273	23	96.96	348	176
95.94	274	25	96.98	350	179
95.96	275	27	97.00	351	181
95.98	277	29	97.02	353	184
96.00	278	31	97.04	354	187
96.02	280	33	97.06	356	189
96.04	281	35	97.08	357	192
96.06	283	37	97.10	359	194
96.08	284	39	97.12	360	197
96.10	286	41	97.14	362	199
96.12	287	43	97.16	363	201
96.14	289	45	97.18	365	203
96.16	290	47	97.20	366	205
96.18	292	49	97.22	367	207
96.20	293	51	97.24	369	209
96.22	294	55	97.26	370	211
96.24	296	58	97.28	372	213
96.26	297	62	97.30	373	216
96.28	299	65	97.32	375	218
96.30	300	69	97.34	376	220
96.32	302	72	97.36	378	222
96.34	303	76	97.38	379	224
96.36	305	79	97.40	381	226
96.38	306	82	97.42	382	228
96.40	308	86	97.44	384	230
96.42	309	89	97.46	385	232
96.44	311	93	97.48	386	234
96.46	312	96	97.50	388	236
96.48	313	99	97.52	389	238
96.50	315	103	97.54	391	240
96.52	316	106	97.56	392	242
96.54	318	110	97.58	394	244
96.56	319	113	97.60	395	246
96.58	321	116	97.62	397	248
96.60	322	120	97.64	398	250
96.62	324	123	97.66	400	252
96.64	325	126	97.68	401	255
96.66	327	129	97.70	403	257
96.68	328	133	97.72	404	259
96.70	330	136	97.74	405	261
96.72	331	139			

Post-Development 4-16-25*Type III 24-hr 100-Year Rainfall=6.50"*

Prepared by Civil Design Consultants, Inc

Printed 4/22/2025

HydroCAD® 10.20-5c s/n 06435 © 2023 HydroCAD Software Solutions LLC

Page 3

Stage-Area-Storage for Pond S-3: S-3

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
100.20	126	0	102.80	246	166
100.25	128	3	102.85	248	169
100.30	131	5	102.90	250	171
100.35	133	8	102.95	253	174
100.40	135	10	103.00	255	176
100.45	138	13	103.05	257	179
100.50	140	15	103.10	259	181
100.55	142	18	103.15	262	184
100.60	144	20	103.20	264	186
100.65	147	23	103.25	266	189
100.70	149	25	103.30	269	191
100.75	151	28	103.35	271	194
100.80	154	30	103.40	273	196
100.85	156	33	103.45	276	199
100.90	158	35	103.50	278	201
100.95	161	38	103.55	280	204
101.00	163	40	103.60	282	206
101.05	165	43	103.65	285	209
101.10	167	45	103.70	287	211
101.15	170	48			
101.20	172	50			
101.25	174	55			
101.30	177	59			
101.35	179	63			
101.40	181	67			
101.45	184	71			
101.50	186	75			
101.55	188	79			
101.60	190	83			
101.65	193	87			
101.70	195	91			
101.75	197	95			
101.80	200	99			
101.85	202	103			
101.90	204	107			
101.95	207	111			
102.00	209	115			
102.05	211	118			
102.10	213	122			
102.15	216	126			
102.20	218	129			
102.25	220	133			
102.30	223	137			
102.35	225	140			
102.40	227	143			
102.45	230	147			
102.50	232	150			
102.55	234	153			
102.60	236	156			
102.65	239	158			
102.70	241	161			
102.75	243	163			

DRAINAGE REPORT

201 Elm Street and 6 Monroe Street
Amesbury, Massachusetts

TAB 5

Project: 201 Elm Street
Location: Amesbury, MA
Client: River's Edge Development, LLC

Project Number: 25-10704
Prepared By: MAC
Date: April 18, 2025

CITY OF AMESBURY ZONING ORDINANCE

Section XI.C.8.e.1: Stormwater Runoff

	2-Year	10-Year	25-Year	100-Year
Design Point 1	(3.2-IN)	(4.5-IN)	(5.3-IN)	(6.5-IN)
Pre-Development Conditions:	1.8	3.6	4.9	6.9
Post Development Conditions:	1.8	3.6	4.8	6.6

Conclusion: The Stormwater Management System conforms to the City of Amesbury Zoning Ordinance.

CITY OF AMESBURY SUBDIVISION RULES AND REGULATIONS

Redevelopment Requirements (7.10.B.4)

ii)

Retain volume of runoff equivalent to, or greater than, 0.80-inch multiplied by the total post-construction impervious surface area on the site

Existing Total Impervious Area:	0.23 AC
Proposed Total Impervious Area:	0.43 AC
<u>Net Increase:</u>	0.20 AC

Required Recharge Volume: $0.20\text{-AC} \times 43,560\text{-SF} \times (0.80\text{-IN} / 12\text{-IN/FT}) = \mathbf{581\text{-CF}}$

Total Recharge Provided:

S-1:	353 CF
S-2:	261 CF
S-3:	213 CF

Total Required Recharge Volume:	581 CF
Total Provided Recharge Volume	827 CF

MSC

(CONT) #24-10619

#4
0-6 10YR 3/2 LOAM GRAN. F.R.A.
6-18 10YR 5/8 SANDY LOAM " "
18-92 10YR 6/6 SAND " "
SHUT @ 86" ROOTS @ 42" NO WATER OBS.
NO REFUSAL

#1
0-10 10YR 3/2 LOAM GRAN. F.R.A.
10-30 7.5YR 5/8 SANDY LOAM " "
30-90 10YR 5/6 LOAMY SAND " "
SHUT @ 78" ROOTS @ 40" NO WATER OBS.
NO REFUSAL

MSC

2-7-25 CDCI #24-10619
201 Elm St Amesbury, MA.
TEST PITS

#2
0-8 10YR 5/8 SANDY LOAM GRAN. F.R.A.
8-22 10YR 5/6 LOAMY SAND " "
22-78 10YR 6/6 SAND " "
78-96 10YR 6/4 SAND " "

SHUT @ 72" OBS. WATER @ 92" ROOTS @ 60"
NO REFUSAL

#3
0-6 10YR 3/2 LOAM " "
6-12 10YR 5/8 SANDY LOAM " "
12-24 10YR 5/6 LOAMY SAND " "
24-96 10YR 6/6 SAND " "

SHUT @ 84" ROOTS @ 58" NO WATER
NO REFUSAL

LONG TERM OPERATIONS AND MAINTENANCE PROGRAM

April 18, 2025

This Long-Term Operations and Maintenance Program Plan has been prepared in accordance with the Stormwater Management Policy issued by the Department of Environmental Protection (DEP) for the proposed development located at 201 Elm Street and 6 Monroe Street in Amesbury, MA. Upon a period beginning twelve months after the completion of the driveway, all structural BMP's shall be inspected twice annually, once in April and once in November. The inspection shall be performed as indicated below:

Subsurface Infiltration System/Infiltration Trench/Underdrain

Infiltration systems are prone to clogging and failure, so it is imperative to develop and implement aggressive maintenance plans and schedules. Inspections and preventive maintenance must be performed at least twice a year. Drainage pipes, including those associated with the subsurface infiltration systems, shall be inspected and cleaned of sediment at least every five (5) years, or in accordance to manufacture's specifications, or as required to maintain adequate functionality of the stormwater conveyance system. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations. The subsurface infiltration systems shall be inspected twice annually, once in April and once in November. Any and all debris and/or sediments shall be removed from the units and be disposed of at an approved offsite location in accordance with all applicable local, state, and federal regulations.

See attached Cultec Operations and Maintenance Guidelines.

Owner / Responsible Party (During Construction):

River's Edge Development, LLC
ethan.petersohn1@gmail.com
88 Elm Street
Salisbury, MA 01952

Owner / Responsible Party (After Construction):

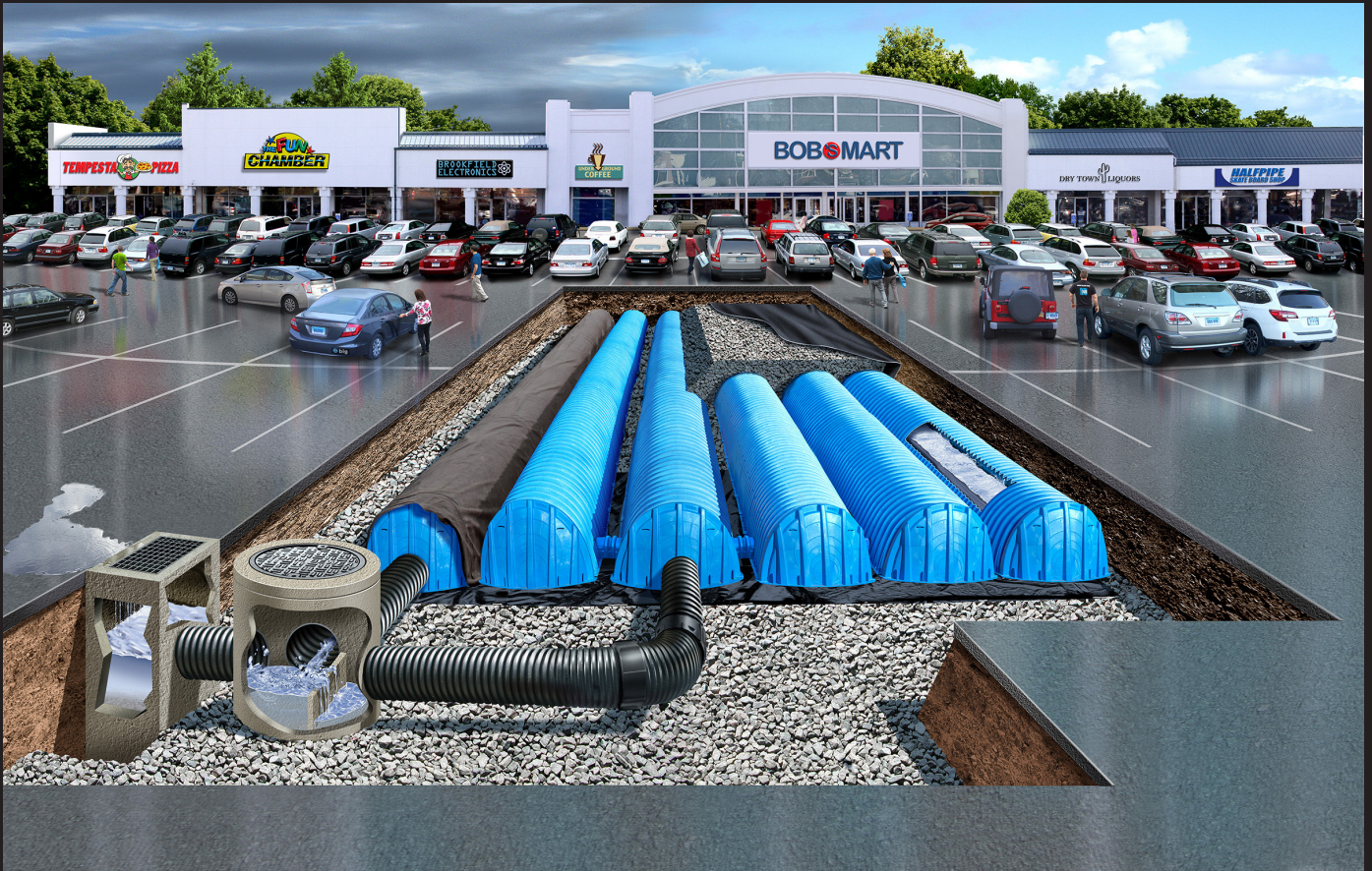
The individual owners of each unit and owner of the single-family dwellings shall be responsible for the continued long-term O&M pertaining to their respective lots.

Estimated Operations and Maintenance Budget:

It is anticipated that the stormwater management system will require an annual budget of \$500 to maintain.

CONTACTOR® & RECHARGER®

STORMWATER MANAGEMENT SOLUTIONS



OPERATION & MAINTENANCE GUIDELINES FOR CULTEC STORMWATER MANAGEMENT SYSTEMS



STORMWATER MANAGEMENT SOLUTIONS



OPERATIONS AND MAINTENANCE GUIDELINES

Published by

CULTEC

P.O. Box 280
878 Federal Road
Brookfield, Connecticut 06804 USA
www.cultec.com

Copyright Notice

© 2023 CULTEC All rights reserved. Printed in the USA.

This document and any accompanying CULTEC products are copyrighted by CULTEC. Any reproduction and/or distribution without prior written consent from CULTEC is strictly prohibited.

Disclaimers:

The drawings, photographs and illustrations shown in this document are for illustrative purposes only and are not necessarily to scale.

Actual designs may vary.

CULTEC reserves the right to make design and/or specification changes at any time without notice at CULTEC's sole discretion.

CULTEC, the CULTEC logo, RECHARGER, CONTACTOR, HVLV, PAC, STORMFILTER, STORMGENIE and The Chamber with The Stripe are registered trademarks of CULTEC.

Chamber of Choice, HD, 100, 125, 150, 150XL, 180, 280, 330, 330XL, 360, V8, 902, Field Drain Panel, C-1, C-2, C-3, C-4, EZ-24, Landscape Series are trademarks of CULTEC. © Copyright on all drawings, illustrations, photos, charts - CULTEC. All rights reserved.

Protected by one or more of the following patents owned by Cultec:

U.S. Patents 6,129,482; 6,322,288; 6,854,925; 7,226,241; 7,806,627; 8,366,346; 8,425,148; U.S. Designs D613,819; D638,095; D668,318; Canadian Patent 2,450,565; 2,591,255; Canadian Designs 129144; 135983; 159073; 160977; and/or other U.S. or Foreign Patent(s) or Patent(s) Pending.

Contact Information:

For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at CT-CustomerService@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail CT-Tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

Doc ID: CLT057 11-23
November 2023

*These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.
Actual designs may vary.*

This manual contains guidelines recommended by CULTEC and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

- A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to determine if any sediment has accumulated in the inlet row.
- B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.
 1. **Manhole Access**

This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. StormFilter Access

Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

- C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

- A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.
- B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.
- C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.
- D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. Minor Maintenance

The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. Major Maintenance

The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

	Frequency	Action
Inlets and Outlets	Every 3 years	Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	- Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. - Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	- Clean stormwater management chambers and feed connectors of any debris. - Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. - Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	- Clean stormwater management chambers and feed connectors of any debris. - Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. - Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. - Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. - Attain the appropriate approvals as required. - Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1 st year	Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC at 1-800-428-5832.

BMP OPERATION & MAINTENANCE LOG

Project Name: _____

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

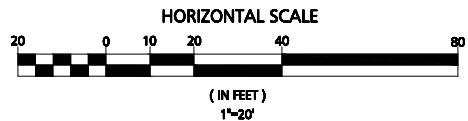
[illegible]

G:\Projects\25-10704\201 Elm Street - Amesbury, MA\Drawings\Map\25-10704 EWP.dwg, Apr 16, 2025, 2:17pm C:\CADD\ANNO.DWG

LEGEND	
PROPERTY LINE	_____
ABUTTERS PROPERTY LINE	_____
EXISTING EDGE OF PAVEMENT	-----
EXISTING CONTOUR	-----
EXISTING WATERSHED BOUNDARY	=====
EXISTING TC	-----
HYDROLOGIC SOILS GROUP A	////
HYDROLOGIC SOILS GROUP B	////
HYDROLOGIC SOILS GROUP C	////
HYDROLOGIC SOILS GROUP D	////

SOILS SUMMARY:	
SYMBOL	DESCRIPTION
306B	PAXTON FINE SANDY LOAM
307E	PAXTON FINE SANDY LOAM
254B	MERRIMAC FINE SANDY LOAM

HSG
C
C
A



DATE	DESCRIPTION
REVISIONS	
OWNER / APPLICANT:	
RIVERS EDGE DEVELOPMENT LLC	
88 ELM STREET	
AMESBURY, MA 01913	
PROJECT:	
201 ELM STREET	
AMESBURY, MA 01913	
DATE ISSUED:	APRIL 16, 2025
PROJECT #:	25-10704
PREPARED BY:	MAC

ISSUED FOR REVIEW
APR 16, 2025

PROFESSIONAL ENGINEER FOR
CIVIL DESIGN CONSULTANTS, INC.

CIVIL DESIGN
CONSULTANTS, INC.

344 North Main Street | Andover, MA 01810
(978) 466-0920 | www.civilddc.com

DRAWING TITLE:
EXISTING WATERSHED PLAN

DRAWING #:

EWP



LEGEND	
PROPERTY LINE	
PROPOSED BUILDING	
PROPOSED CONTOUR	1.48
PROPOSED SPOT GRADE	X 1.00
PROPOSED SPOT GRADE (TW/BW)	X TW: 159.57 BW: 155.67
PROPOSED DRAIN	
PROPOSED CATCH BASIN	
PROPOSED DRAIN MANHOLE	
PROPOSED RETAINING WALL	
PROPOSED WATERSHED BOUNDARY	
PROPOSED TC	
PROPOSED IMPERVIOUS SURFACE	
HYDROLOGIC SOILS GROUP A	
HYDROLOGIC SOILS GROUP B	
HYDROLOGIC SOILS GROUP C	
HYDROLOGIC SOILS GROUP D	

SOILS SUMMARY:	
SYMBOL	DESCRIPTION
307E	PAXTON FINE SANDY LOAM
254B	MERRIMAC FINE SANDY LOAM

HSG
C
A

DATE	DESCRIPTION
REVISIONS	

OWNER / APPLICANT:
RIVER'S EDGE DEVELOPMENT, LLC
88 ELM STREET
SALISBURY, MA 01952

PROJECT:
201 ELM STREET & 6 MONROE STREET
AMESBURY, MA 01913

DATE ISSUED:	MARCH 5, 2025
PROJECT #:	25-10704
PREPARED BY:	MAC

ISSUED FOR REVIEW
DATE: 3/5/25

PROFESSIONAL ENGINEER FOR CIVIL DESIGN
CONSULTANTS, INC.

CIVIL DESIGN
CONSULTANTS, INC.
244 North Main Street | Andover, MA 01810
(978) 468-0920 | www.civildesign.com

DRAWING TITLE:
PROPOSED WATERSHED PLAN

DRAWING #:

PWP

