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ENGINEERING | SITE WORK | LAND SURVEYING

STORMWATER REPORT

Last Revised: 03/24/21

SITE PLAN

ASSESSORS MAP 134 – LOTS 299, 305
& A PORTION OF 314
1265 BARTLETT STREET
NEW BEDFORD, MASSACHUSETTS

PREPARED FOR:

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P.O. Box 91
Rochester, MA 02770

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STORMWATER MANAGEMENT REPORT
AND
HYDROLOGIC ANALYSIS

SECTION 1: Project Summary

The project area associated with the proposed development is located on the west side of Bartlett Street. The site is identified as Assessors Map 134, Lots 299, 305, and a portion of 314, and is located at #1265 Bartlett Street. The total area of the proposed site is approximately 60,168 square feet. The site is located entirely within the Residence A (RA) zoning district.

The site is currently a vacant wooded lot. To the south, the property abuts several small residential lots. To the west, the property abuts Route 140. To the north, the property abuts two large residential lots. The site is not located within an area identified by the Natural Heritage and Endangered Species Program as a Priority Habitat of Rare Species or an Estimated Habitat of Rare Wildlife, however, there are wetlands to the northeast of the locus that extend over a small portion of the northeast corner of the locus. The site is not located within a mapped FEMA Special Flood Hazard Area Zone.

The applicant is seeking permission to construct the roadway, utilities, and subsurface recharge system for a 5 lot subdivision as shown on Definitive Subdivision Plan dated January 5, 2021. The project will tie into municipal water and sewer available in Sheffield Street and Bartlett Street. In order to provide water quality treatment and recharge of stormwater runoff generated by the proposed impervious site coverage, stormwater management practices have been proposed. Proposed structural BMP's include proprietary separators, and a subsurface infiltration BMP.

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SECTION 2: Methodology

Drainage computations were performed using the Natural Resources Conservation Services (NRCS) TR-20 method and HydroCAD® Drainage Calculation Software to determine the change in the existing and post-development runoff rates from each drainage area for the 2-, 10-, and 100-year 24 hour storm events. The limits of the work proposed to complete the project fall within an area subject to protection by the Wetlands Protection Act, therefor, compliance with DEP Stormwater Management Standards is required. Sketches of the existing and proposed watershed areas, HydroCAD® Report, and copies of the calculation sheets are included as appendices to this report.

SECTION 3: Existing Conditions

The soils underlying the proposed development site are identified in the Natural Resources Conservation Service (NRCS) Soil Survey of Bristol County ***(see Exhibit D)***. The site soils are classified as 310A (Woodbridge Fine Sandy Loam [Hydrologic Soils Group "C/D"]), 311B (Wood Bridge Fine Sandy Loam, [HSG "C/D"] and 71A (Ridgebury Fine Sandy Loam, [HSG "D"]).

Soil testing was performed by Farland Corp., under the direction of John Marchand (SE# 2994) to confirm the soil survey and to determine soil suitability for on-site stormwater management purposes (***See Exhibit I***). The locations of these test holes are shown on the Subdivision Plan. Deep test-holes were performed to depths varying from approximately 7 to 9 feet. Soil mottling, indicating depths of seasonal high groundwater, varied throughout the site, with greater depths encountered in the western portion of the site. Sandy loam material was encountered throughout the site, indicating an NRCS Hydrologic Soil Group "B".

SECTION 4: Stormwater Management Overview

Existing Conditions:

Two design points have been analyzed for this project: (1) the limit of the bordering vegetated wetlands in the northeast corner of the site. The design point receives runoff from subcatchment area (S-1). (2) the western boundary of the site. The design point receives runoff from subcatchment area (S-2). There are no existing stormwater attenuation structures on-site designed to capture and detain on-site runoff. Stormwater runoff from the site flows either overland northeasterly toward the wetland or overland westerly.

Proposed Conditions:

Under proposed conditions, the same design points have been analyzed. A total of 3 subcatchment areas contribute runoff to the design points in proposed conditions. (1) the limit of the bordering vegetated wetlands in the northeast corner of the site. The design point receives runoff from subcatchment area (S-1). (2) the western boundary of the site at Route 140. The design point receives runoff from subcatchment areas (S-2) & (S-3).

The proposed infiltration basin and other structural stormwater BMPs have been designed in accordance with the DEP Stormwater Handbook to provide appropriate water quality treatment, groundwater recharge, and peak rate attenuation for all storms, including the 100-year storm event.

SECTION 5: Stormwater Management Standards

Standard 1:

- Under proposed conditions, there will be no new untreated discharges or erosion in wetland areas. The drainage outfalls from the proposed infiltration basin which discharge toward the westerly design point are provided with a rip-rap outlet with level spreader protection (12" max. graded rock size) to help control velocity and erosion at the outlet. Maximum velocity from the Infiltration Basin is 0.80 feet per second from the proposed level spreader.

Channel Slope	Lining [1]	Permissible Velocity (feet/second)
0 - 5%	Tall fescue Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue Redtop Sericea lespedeza Annual lespedeza Small grains	2.5
5 - 10%	Tall fescue Kentucky bluegrass	4
	Grass-legume mixture	3
Greater Than 10%	Tall fescue Kentucky bluegrass	3

Table 2.3.1: Example of Permissible Velocity Table, Modified from Soil and Water Conservation Engineering, 1992, Schwab et al, John Wiley and Sons

Stormwater discharges have been held below erodible velocities. This standard has been met.

Standard 2:

- The design of the stormwater system was designed for the post-development conditions to handle all storms' peak discharges and runoff volume to include the 2, 10, and 100-year storm events. The site drainage system was designed in consideration of the structural standards and techniques of the Best Management Practices (BMP) and Low Impact Development (LID) outlined in the "Stormwater Management Handbook".

  The results of site drainage calculations are presented in the following Table. The results are based upon evaluation of Pre-development conditions and the design of proposed surface drainage systems for the Post-development condition. These results show the Post-Development offsite runoff rates are reduced to less than the Pre-development conditions, thus meeting the BMP guidelines for this site development. This standard has been met.

Table 1 - Comparison of Pre- versus Post-Development Offsite Runoff				
	Pre-Development		Post-Development	
Storm Frequency	Rate (cfs)	Volume (af)	Rate (cfs)	Volume (af)
2-Year Storm				
To Northerly B.V.W.	0.10	0.017	0.08	0.012
To Western Boundary	0.18	0.030	0.14	0.021
10-Year Storm				
To Northerly B.V.W.	0.34	0.044	0.26	0.030
To Western Boundary	0.63	0.078	0.44	0.050
100-Year Storm				
To Northerly B.V.W.	0.87	0.100	0.64	0.066
To Western Boundary	1.64	0.177	1.11	0.175

Standard 3:

- The site is comprised entirely of soils belonging to Hydrologic Soils Groups "B" per on site soil testing and is therefore required to meet the recharge requirements of Standard 3. The proposed infiltration basin has been designed to recharge some of the anticipated stormwater runoff from the new impervious areas. The required Recharge Volume has been calculated using the Static Method and calculations are provided in ***Exhibit F***. Drawdown calculations have also been provided in ***Exhibit G***. Soil test pit data, provided in ***Exhibit I***, indicates that the vertical separation from the bottom of the infiltration basins is greater than 2 feet and less than four feet. Groundwater mounding calculations ***(Exhibit H)*** have been provided demonstrating that the groundwater mounds that forms under the proposed recharge system will not break out above the land or surface of a wetland. This standard has been met.

Standard 4:

- The proposed stormwater management systems for this project have been designed to remove 80% of the average annual post construction load of Total Suspended Solids in accordance with this standard, as shown in calculations provided in ***Exhibit L***. Suitable practices for source control and pollution prevention have been identified in a long-term pollution prevention plan in ***Exhibit M***. Structural BMPs have been designed to capture the required water quality volume (***Exhibit J***) determined in accordance with the Stormwater Handbook. This standard has been met.

Standard 5:

- The use associated with this project is not classified as a Land Use with Higher Potential Pollutant Load (LUHPPL); therefore, this standard does not apply.

Standard 6:

- The site does not discharge within the Zone II or IWPA of a public water supply, nor does it discharge near or to any critical areas. This standard does not apply.

Standard 7:

- The project is not a redevelopment project. This standard does not apply.

Standard 8:

- Where there will be over one acre of disturbance, an EPA Construction General Permit must be obtained, and a Storm Water Pollution Prevention Plan (SWPPP) is required. Construction period sedimentation and erosion controls have been incorporated in the Site Plans as shown on Sheet 4 of 7 (Grading and Utilities). Safeguards have been incorporated into the design to ensure proper operation and maintenance and to prevent negative impacts to the off-site wetland resource areas. Additional erosion controls and pollutant source controls will be provided in the Stormwater Pollution Prevention Plan that will be completed prior to land disturbance. This standard will be met upon submittal of the final SWPPP and Construction General Permit filing.

Standard 9:

- A long-term operation and maintenance plan has been prepared to ensure that stormwater management systems function as designed. ***(Exhibit N)***

Standard 10:

- We are not proposing any illicit discharges as defined in the Stormwater Management Regulations. See attached letter in ***Exhibit O***

EXHIBIT "A"

TOPO! VERSION 2.1.0

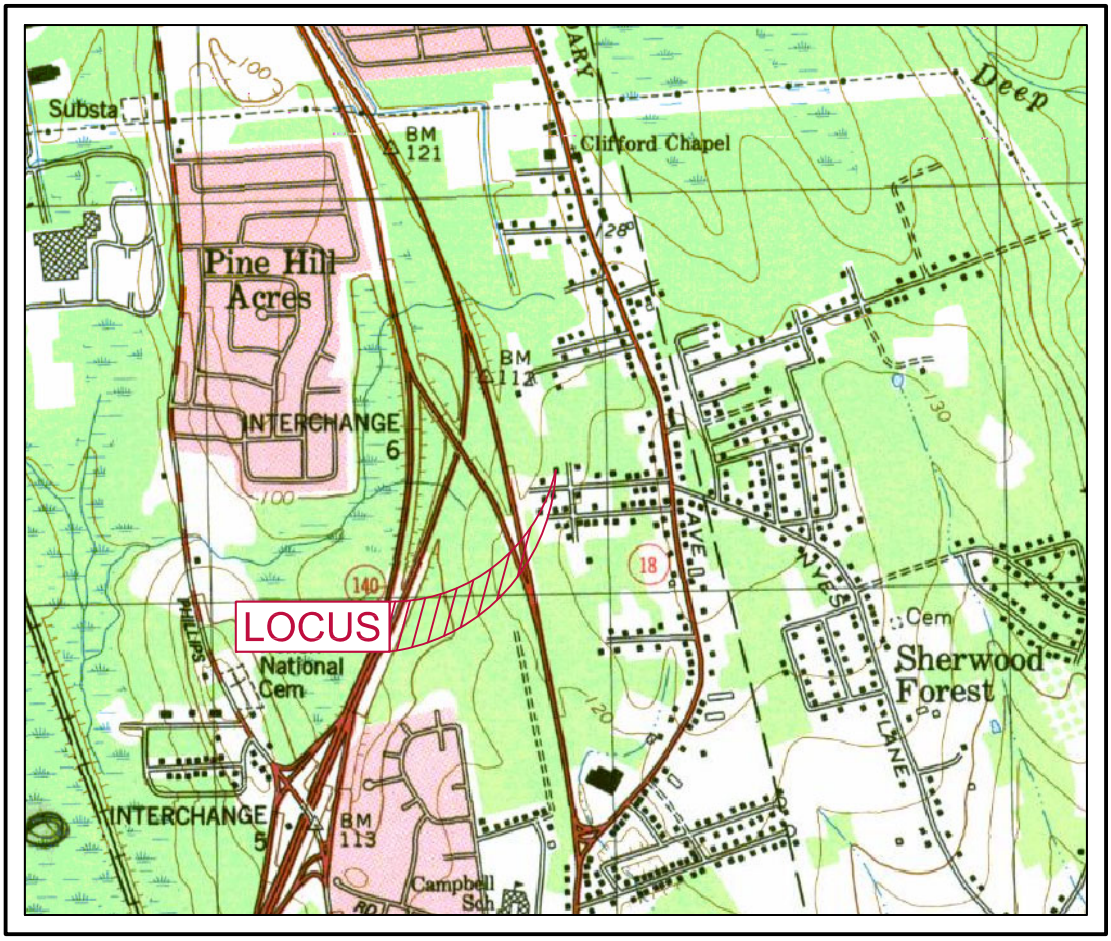

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EXHIBIT "B"

FIRM MAP
PANEL # 25005C0383G
EFFECTIVE DATE: JULY 16, 2014

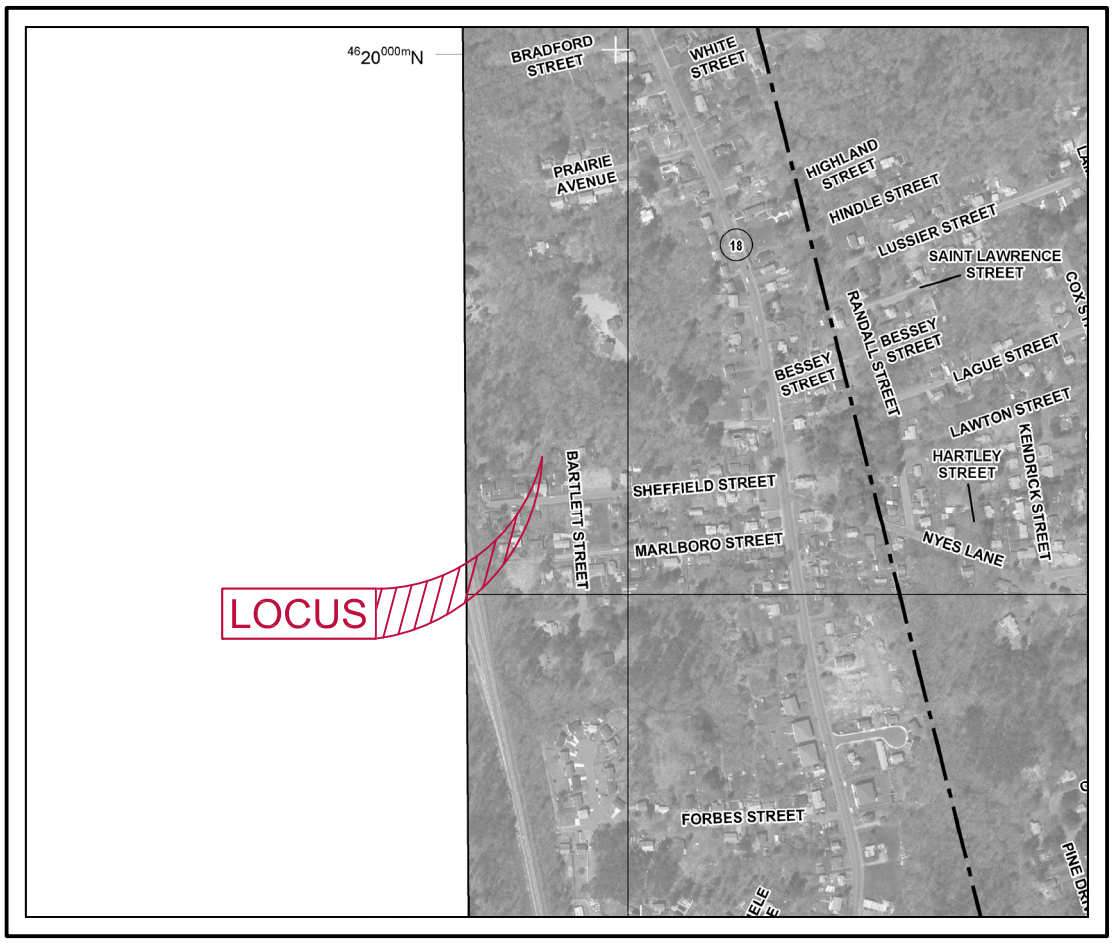

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EXHIBIT "C"

NHESP PRIORITY & ESTIMATED HABITAT MAP 2017

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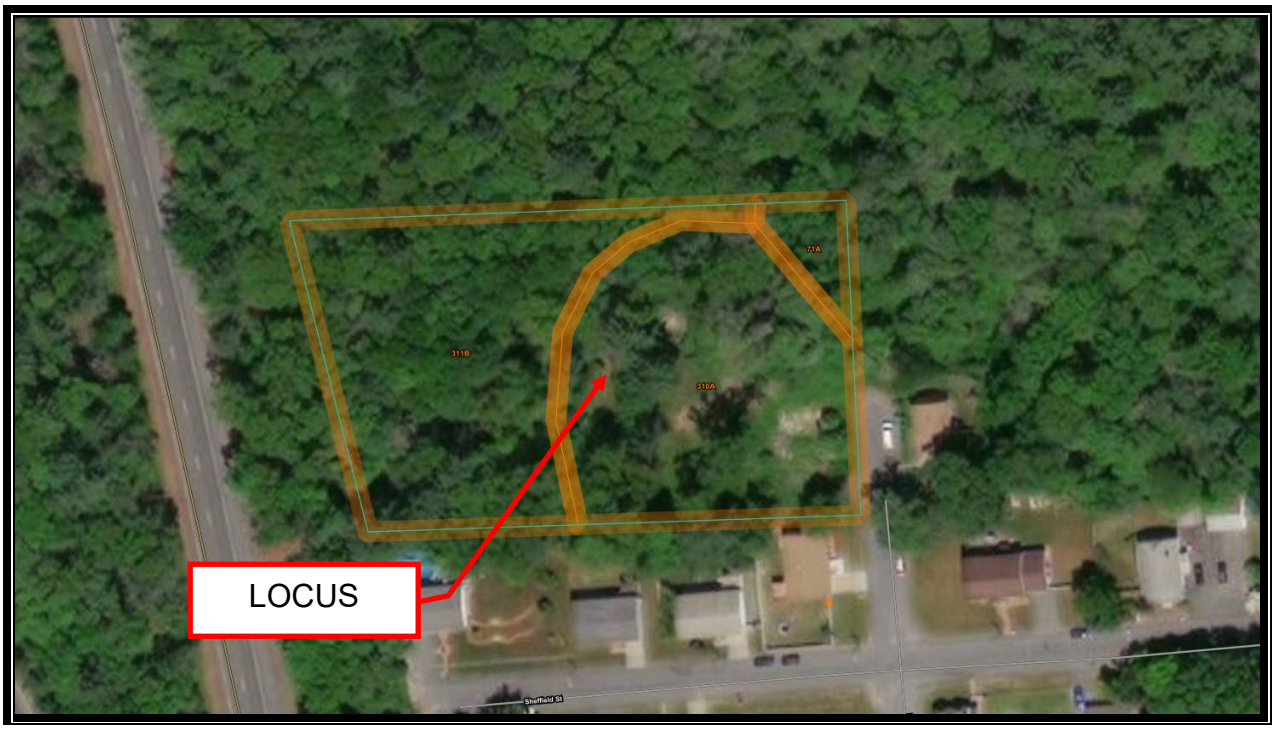
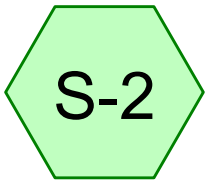
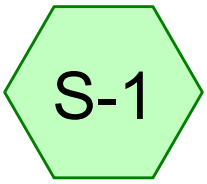
NRCS SOIL MAP



HYDROLOGIC CALCULATIONS (STANDARD #2)



Tributary to West



Tributary to North

Subcat Reach Pond Link

Routing Diagram for 17038PRE
Prepared by Farland Corp.

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S-1: Tributary to North Runoff Area=21,664 sf 0.00% Impervious Runoff Depth=0.41"
Flow Length=229' Tc=21.5 min CN=58 Runoff=0.10 cfs 0.017 af

Subcatchment S-2: Tributary to West Runoff Area=38,345 sf 0.00% Impervious Runoff Depth=0.41"
Flow Length=211' Tc=18.8 min CN=58 Runoff=0.18 cfs 0.030 af

Total Runoff Area = 1.378 ac Runoff Volume = 0.048 af Average Runoff Depth = 0.41"
100.00% Pervious = 1.378 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S-1: Tributary to North

Runoff = 0.10 cfs @ 12.45 hrs, Volume= 0.017 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
21,664	58	Woods/grass comb., Good, HSG B
21,664		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
5.7	179	0.0110	0.52		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.5	229	Total			

Summary for Subcatchment S-2: Tributary to West

Runoff = 0.18 cfs @ 12.42 hrs, Volume= 0.030 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
38,345	58	Woods/grass comb., Good, HSG B
38,345		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
3.0	161	0.0320	0.89		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	211	Total			

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S-1: Tributary to North Runoff Area=21,664 sf 0.00% Impervious Runoff Depth=1.06"
Flow Length=229' Tc=21.5 min CN=58 Runoff=0.34 cfs 0.044 af

Subcatchment S-2: Tributary to West Runoff Area=38,345 sf 0.00% Impervious Runoff Depth=1.06"
Flow Length=211' Tc=18.8 min CN=58 Runoff=0.63 cfs 0.078 af

Total Runoff Area = 1.378 ac Runoff Volume = 0.122 af Average Runoff Depth = 1.06"
100.00% Pervious = 1.378 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S-1: Tributary to North

Runoff = 0.34 cfs @ 12.35 hrs, Volume= 0.044 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
21,664	58	Woods/grass comb., Good, HSG B
21,664		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
5.7	179	0.0110	0.52		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.5	229	Total			

Summary for Subcatchment S-2: Tributary to West

Runoff = 0.63 cfs @ 12.30 hrs, Volume= 0.078 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
38,345	58	Woods/grass comb., Good, HSG B
38,345		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
3.0	161	0.0320	0.89		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	211	Total			

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S-1: Tributary to North Runoff Area=21,664 sf 0.00% Impervious Runoff Depth=2.41"
Flow Length=229' Tc=21.5 min CN=58 Runoff=0.87 cfs 0.100 af

Subcatchment S-2: Tributary to West Runoff Area=38,345 sf 0.00% Impervious Runoff Depth=2.41"
Flow Length=211' Tc=18.8 min CN=58 Runoff=1.64 cfs 0.177 af

Total Runoff Area = 1.378 ac Runoff Volume = 0.277 af Average Runoff Depth = 2.41"
100.00% Pervious = 1.378 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment S-1: Tributary to North

Runoff = 0.87 cfs @ 12.31 hrs, Volume= 0.100 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
21,664	58	Woods/grass comb., Good, HSG B
21,664		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
5.7	179	0.0110	0.52		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.5	229	Total			

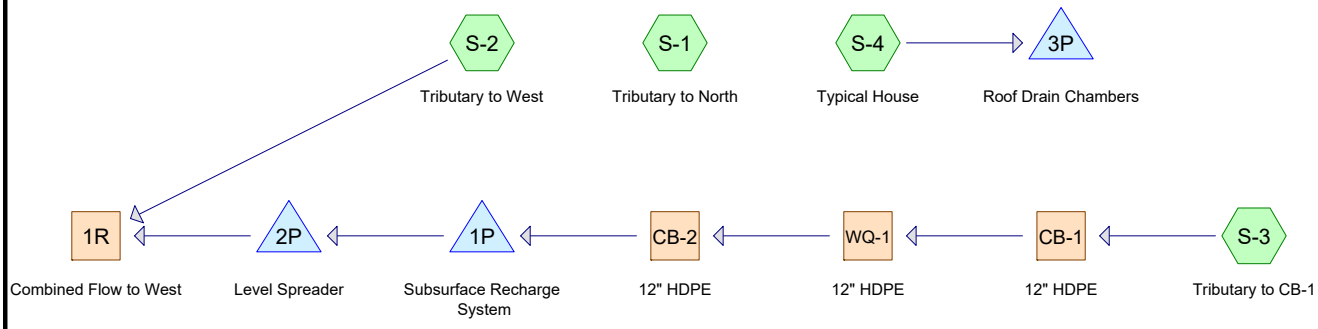
Summary for Subcatchment S-2: Tributary to West

Runoff = 1.64 cfs @ 12.27 hrs, Volume= 0.177 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
38,345	58	Woods/grass comb., Good, HSG B
38,345		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
3.0	161	0.0320	0.89		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	211	Total			



Subcat Reach Pond Link

Routing Diagram for 17038POST
Prepared by Farland Corp.

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S-1: Tributary to North Runoff Area=13,335 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=123' Tc=17.9 min CN=60 Runoff=0.08 cfs 0.012 af

Subcatchment S-2: Tributary to West Runoff Area=22,115 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=100' Tc=17.3 min CN=60 Runoff=0.14 cfs 0.021 af

Subcatchment S-3: Tributary to CB-1 Runoff Area=24,741 sf 45.62% Impervious Runoff Depth=1.42"
Tc=6.0 min CN=78 Runoff=0.93 cfs 0.067 af

Subcatchment S-4: Typical House Runoff Area=936 sf 100.00% Impervious Runoff Depth=3.17"
Tc=6.0 min CN=98 Runoff=0.07 cfs 0.006 af

Reach 1R: Combined Flow to West Inflow=0.14 cfs 0.021 af
Outflow=0.14 cfs 0.021 af

Reach CB-1: 12" HDPE Avg. Flow Depth=0.35' Max Vel=3.82 fps Inflow=0.93 cfs 0.067 af
12.0" Round Pipe n=0.013 L=25.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=0.93 cfs 0.067 af

Reach CB-2: 12" HDPE Avg. Flow Depth=0.33' Max Vel=4.14 fps Inflow=0.93 cfs 0.067 af
12.0" Round Pipe n=0.013 L=8.0' S=0.0125 '/' Capacity=3.98 cfs Outflow=0.93 cfs 0.067 af

Reach WQ-1: 12" HDPE Avg. Flow Depth=0.26' Max Vel=5.62 fps Inflow=0.93 cfs 0.067 af
12.0" Round Pipe n=0.013 L=87.0' S=0.0293 '/' Capacity=6.10 cfs Outflow=0.93 cfs 0.067 af

Pond 1P: Subsurface Recharge System Peak Elev=120.99' Storage=1,693 cf Inflow=0.93 cfs 0.067 af
Discarded=0.03 cfs 0.054 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.054 af

Pond 2P: Level Spreader Peak Elev=123.40' Storage=0.000 af Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 3P: Roof Drain Chambers Peak Elev=100.87' Storage=0.002 af Inflow=0.07 cfs 0.006 af
Outflow=0.00 cfs 0.006 af

Total Runoff Area = 1.403 ac Runoff Volume = 0.106 af Average Runoff Depth = 0.91"
80.00% Pervious = 1.123 ac 20.00% Impervious = 0.281 ac

Summary for Subcatchment S-1: Tributary to North

Runoff = 0.08 cfs @ 12.35 hrs, Volume= 0.012 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.40"

	Area (sf)	CN	Description
	8,936	61	>75% Grass cover, Good, HSG B
*	4,399	58	Woods, Good, HSG B
	13,335	60	Weighted Average
	13,335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
2.1	73	0.0136	0.58		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
17.9	123	Total			

Summary for Subcatchment S-2: Tributary to West

Runoff = 0.14 cfs @ 12.33 hrs, Volume= 0.021 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.40"

	Area (sf)	CN	Description
	16,892	61	>75% Grass cover, Good, HSG B
*	5,223	58	Woods, Good, HSG B
	22,115	60	Weighted Average
	22,115		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
1.5	50	0.0130	0.57		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
17.3	100	Total			

Summary for Subcatchment S-3: Tributary to CB-1

Runoff = 0.93 cfs @ 12.09 hrs, Volume= 0.067 af, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
11,287	98	Paved parking, HSG B
10,419	61	>75% Grass cover, Good, HSG B
3,035	58	Woods/grass comb., Good, HSG B
24,741	78	Weighted Average
13,454		54.38% Pervious Area
11,287		45.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment S-4: Typical House

Runoff = 0.07 cfs @ 12.08 hrs, Volume= 0.006 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.40"

	Area (sf)	CN	Description
*	936	98	Roof
	936		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Reach 1R: Combined Flow to West

Inflow Area = 1.076 ac, 24.09% Impervious, Inflow Depth = 0.23" for 2-yr event
Inflow = 0.14 cfs @ 12.33 hrs, Volume= 0.021 af
Outflow = 0.14 cfs @ 12.33 hrs, Volume= 0.021 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3

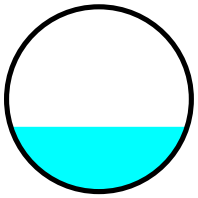
Summary for Reach CB-1: 12" HDPE

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 1.42" for 2-yr event
Inflow = 0.93 cfs @ 12.09 hrs, Volume= 0.067 af
Outflow = 0.93 cfs @ 12.09 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.82 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 0.3 min

Peak Storage= 6 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.56 cfs

12.0" Round Pipe
n= 0.013
Length= 25.0' Slope= 0.0100 '/'
Inlet Invert= 121.50', Outlet Invert= 121.25'



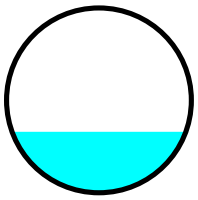
Summary for Reach CB-2: 12" HDPE

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 1.42" for 2-yr event
Inflow = 0.93 cfs @ 12.10 hrs, Volume= 0.067 af
Outflow = 0.93 cfs @ 12.10 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 4.14 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.54 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.98 cfs

12.0" Round Pipe
n= 0.013
Length= 8.0' Slope= 0.0125 '/'
Inlet Invert= 119.70', Outlet Invert= 119.60'



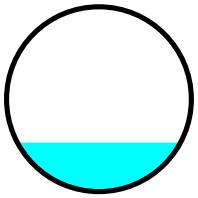
Summary for Reach WQ-1: 12" HDPE

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 1.42" for 2-yr event
Inflow = 0.93 cfs @ 12.09 hrs, Volume= 0.067 af
Outflow = 0.93 cfs @ 12.10 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 5.62 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.08 fps, Avg. Travel Time= 0.7 min

Peak Storage= 14 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.10 cfs

12.0" Round Pipe
n= 0.013
Length= 87.0' Slope= 0.0293 '/'
Inlet Invert= 121.25', Outlet Invert= 118.70'



Summary for Pond 1P: Subsurface Recharge System

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 1.42" for 2-yr event
Inflow = 0.93 cfs @ 12.10 hrs, Volume= 0.067 af
Outflow = 0.03 cfs @ 11.70 hrs, Volume= 0.054 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.70 hrs, Volume= 0.054 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 120.99' @ 16.51 hrs Surf.Area= 1,419 sf Storage= 1,693 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 373.5 min (1,220.2 - 846.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	119.10'	2,119 cf	**16.75'W x 84.70'L x 5.75'H Field A** 8,158 cf Overall - 2,859 cf Embedded = 5,298 cf x 40.0% Voids
#2A	119.85'	2,859 cf	**Cultec R-902HD** x 44 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 44 Chambers in 2 Rows Cap Storage= +2.8 cf x 2 x 2 rows = 11.0 cf
		4,979 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	119.10'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	123.95'	**6.0" Round Culvert X 2.00** L= 11.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 123.95' / 123.50' S= 0.0409 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.03 cfs @ 11.70 hrs HW=119.16' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=119.10' TW=123.40' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Level Spreader

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 123.40' Surf.Area= 0.001 ac Storage= 0.000 af
Peak Elev= 123.40' @ 0.00 hrs Surf.Area= 0.001 ac Storage= 0.000 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	122.50'	0.000 af	**3.00'W x 10.00'L x 1.20'H Prismatoid** 0.001 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	123.50'	**10.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=123.40' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Roof Drain Chambers

Inflow Area = 0.021 ac,100.00% Impervious, Inflow Depth = 3.17" for 2-yr event
Inflow = 0.07 cfs @ 12.08 hrs, Volume= 0.006 af
Outflow = 0.00 cfs @ 11.47 hrs, Volume= 0.006 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.00 cfs @ 11.47 hrs, Volume= 0.006 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.87' @ 13.34 hrs Surf.Area= 0.005 ac Storage= 0.002 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 146.0 min (901.2 - 755.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	0.002 af	**8.00'W x 13.00'L x 2.54'H Field A** 0.006 af Overall - 0.001 af Embedded = 0.005 af x 40.0% Voids
#2A	100.50'	0.001 af	**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
#3B	100.00'	0.002 af	**8.00'W x 13.00'L x 2.54'H Field B** 0.006 af Overall - 0.001 af Embedded = 0.005 af x 40.0% Voids
#4B	100.50'	0.001 af	**Cultec R-150XLHD** x 2 Inside #3 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
		0.006 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 11.47 hrs HW=100.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S-1: Tributary to North Runoff Area=13,335 sf 0.00% Impervious Runoff Depth=1.19"
Flow Length=123' Tc=17.9 min CN=60 Runoff=0.26 cfs 0.030 af

Subcatchment S-2: Tributary to West Runoff Area=22,115 sf 0.00% Impervious Runoff Depth=1.19"
Flow Length=100' Tc=17.3 min CN=60 Runoff=0.44 cfs 0.050 af

Subcatchment S-3: Tributary to CB-1 Runoff Area=24,741 sf 45.62% Impervious Runoff Depth=2.54"
Tc=6.0 min CN=78 Runoff=1.69 cfs 0.120 af

Subcatchment S-4: Typical House Runoff Area=936 sf 100.00% Impervious Runoff Depth=4.56"
Tc=6.0 min CN=98 Runoff=0.10 cfs 0.008 af

Reach 1R: Combined Flow to West Inflow=0.44 cfs 0.050 af
Outflow=0.44 cfs 0.050 af

Reach CB-1: 12" HDPE Avg. Flow Depth=0.49' Max Vel=4.48 fps Inflow=1.69 cfs 0.120 af
12.0" Round Pipe n=0.013 L=25.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=1.69 cfs 0.120 af

Reach CB-2: 12" HDPE Avg. Flow Depth=0.46' Max Vel=4.86 fps Inflow=1.69 cfs 0.120 af
12.0" Round Pipe n=0.013 L=8.0' S=0.0125 '/' Capacity=3.98 cfs Outflow=1.69 cfs 0.120 af

Reach WQ-1: 12" HDPE Avg. Flow Depth=0.36' Max Vel=6.64 fps Inflow=1.69 cfs 0.120 af
12.0" Round Pipe n=0.013 L=87.0' S=0.0293 '/' Capacity=6.10 cfs Outflow=1.69 cfs 0.120 af

Pond 1P: Subsurface Recharge System Peak Elev=122.84' Storage=3,614 cf Inflow=1.69 cfs 0.120 af
Discarded=0.03 cfs 0.057 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.057 af

Pond 2P: Level Spreader Peak Elev=123.40' Storage=0.000 af Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 3P: Roof Drain Chambers Peak Elev=101.33' Storage=0.004 af Inflow=0.10 cfs 0.008 af
Outflow=0.00 cfs 0.008 af

Total Runoff Area = 1.403 ac Runoff Volume = 0.209 af Average Runoff Depth = 1.79"
80.00% Pervious = 1.123 ac 20.00% Impervious = 0.281 ac

Summary for Subcatchment S-1: Tributary to North

Runoff = 0.26 cfs @ 12.28 hrs, Volume= 0.030 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

	Area (sf)	CN	Description
	8,936	61	>75% Grass cover, Good, HSG B
*	4,399	58	Woods, Good, HSG B
	13,335	60	Weighted Average
	13,335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
2.1	73	0.0136	0.58		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
17.9	123	Total			

Summary for Subcatchment S-2: Tributary to West

Runoff = 0.44 cfs @ 12.28 hrs, Volume= 0.050 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

	Area (sf)	CN	Description
	16,892	61	>75% Grass cover, Good, HSG B
*	5,223	58	Woods, Good, HSG B
	22,115	60	Weighted Average
	22,115		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
1.5	50	0.0130	0.57		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
17.3	100	Total			

Summary for Subcatchment S-3: Tributary to CB-1

Runoff = 1.69 cfs @ 12.09 hrs, Volume= 0.120 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
11,287	98	Paved parking, HSG B
10,419	61	>75% Grass cover, Good, HSG B
3,035	58	Woods/grass comb., Good, HSG B
24,741	78	Weighted Average
13,454		54.38% Pervious Area
11,287		45.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment S-4: Typical House

Runoff = 0.10 cfs @ 12.08 hrs, Volume= 0.008 af, Depth= 4.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

	Area (sf)	CN	Description
*	936	98	Roof
	936		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Reach 1R: Combined Flow to West

Inflow Area = 1.076 ac, 24.09% Impervious, Inflow Depth = 0.56" for 10-yr event
Inflow = 0.44 cfs @ 12.28 hrs, Volume= 0.050 af
Outflow = 0.44 cfs @ 12.28 hrs, Volume= 0.050 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3

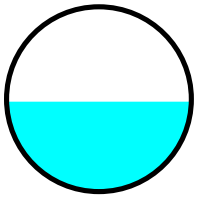
Summary for Reach CB-1: 12" HDPE

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 2.54" for 10-yr event
Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.120 af
Outflow = 1.69 cfs @ 12.09 hrs, Volume= 0.120 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 4.48 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.63 fps, Avg. Travel Time= 0.3 min

Peak Storage= 9 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.56 cfs

12.0" Round Pipe
n= 0.013
Length= 25.0' Slope= 0.0100 '/'
Inlet Invert= 121.50', Outlet Invert= 121.25'



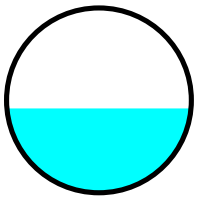
Summary for Reach CB-2: 12" HDPE

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 2.54" for 10-yr event
Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.120 af
Outflow = 1.69 cfs @ 12.09 hrs, Volume= 0.120 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 4.86 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.76 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.98 cfs

12.0" Round Pipe
n= 0.013
Length= 8.0' Slope= 0.0125 '/'
Inlet Invert= 119.70', Outlet Invert= 119.60'



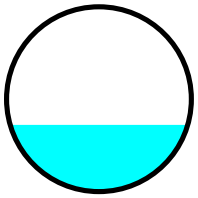
Summary for Reach WQ-1: 12" HDPE

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 2.54" for 10-yr event
Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.120 af
Outflow = 1.69 cfs @ 12.09 hrs, Volume= 0.120 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 6.64 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.37 fps, Avg. Travel Time= 0.6 min

Peak Storage= 22 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.10 cfs

12.0" Round Pipe
n= 0.013
Length= 87.0' Slope= 0.0293 '/'
Inlet Invert= 121.25', Outlet Invert= 118.70'



Summary for Pond 1P: Subsurface Recharge System

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 2.54" for 10-yr event
Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.120 af
Outflow = 0.03 cfs @ 10.99 hrs, Volume= 0.057 af, Atten= 98%, Lag= 0.0 min
Discarded = 0.03 cfs @ 10.99 hrs, Volume= 0.057 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 122.84' @ 18.94 hrs Surf.Area= 1,419 sf Storage= 3,614 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 354.8 min (1,184.4 - 829.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	119.10'	2,119 cf	**16.75'W x 84.70'L x 5.75'H Field A** 8,158 cf Overall - 2,859 cf Embedded = 5,298 cf x 40.0% Voids
#2A	119.85'	2,859 cf	**Cultec R-902HD** x 44 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 44 Chambers in 2 Rows Cap Storage= +2.8 cf x 2 x 2 rows = 11.0 cf
		4,979 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	119.10'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	123.95'	**6.0" Round Culvert X 2.00** L= 11.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 123.95' / 123.50' S= 0.0409 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.03 cfs @ 10.99 hrs HW=119.16' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=119.10' TW=123.40' (Dynamic Tailwater)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Level Spreader

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 0.00" for 10-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 123.40' Surf.Area= 0.001 ac Storage= 0.000 af
Peak Elev= 123.40' @ 0.00 hrs Surf.Area= 0.001 ac Storage= 0.000 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	122.50'	0.000 af	**3.00'W x 10.00'L x 1.20'H Prismatoid** 0.001 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	123.50'	**10.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=123.40' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Roof Drain Chambers

Inflow Area = 0.021 ac,100.00% Impervious, Inflow Depth = 4.56" for 10-yr event
Inflow = 0.10 cfs @ 12.08 hrs, Volume= 0.008 af
Outflow = 0.00 cfs @ 10.78 hrs, Volume= 0.008 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.00 cfs @ 10.78 hrs, Volume= 0.008 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 101.33' @ 14.24 hrs Surf.Area= 0.005 ac Storage= 0.004 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 264.8 min (1,013.5 - 748.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	0.002 af	**8.00'W x 13.00'L x 2.54'H Field A** 0.006 af Overall - 0.001 af Embedded = 0.005 af x 40.0% Voids
#2A	100.50'	0.001 af	**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
#3B	100.00'	0.002 af	**8.00'W x 13.00'L x 2.54'H Field B** 0.006 af Overall - 0.001 af Embedded = 0.005 af x 40.0% Voids
#4B	100.50'	0.001 af	**Cultec R-150XLHD** x 2 Inside #3 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
		0.006 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 10.78 hrs HW=100.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment S-1: Tributary to North Runoff Area=13,335 sf 0.00% Impervious Runoff Depth=2.60"
Flow Length=123' Tc=17.9 min CN=60 Runoff=0.64 cfs 0.066 af

Subcatchment S-2: Tributary to West Runoff Area=22,115 sf 0.00% Impervious Runoff Depth=2.60"
Flow Length=100' Tc=17.3 min CN=60 Runoff=1.07 cfs 0.110 af

Subcatchment S-3: Tributary to CB-1 Runoff Area=24,741 sf 45.62% Impervious Runoff Depth=4.47"
Tc=6.0 min CN=78 Runoff=2.97 cfs 0.212 af

Subcatchment S-4: Typical House Runoff Area=936 sf 100.00% Impervious Runoff Depth=6.76"
Tc=6.0 min CN=98 Runoff=0.15 cfs 0.012 af

Reach 1R: Combined Flow to West Inflow=1.11 cfs 0.175 af
Outflow=1.11 cfs 0.175 af

Reach CB-1: 12" HDPE Avg. Flow Depth=0.70' Max Vel=5.07 fps Inflow=2.97 cfs 0.212 af
12.0" Round Pipe n=0.013 L=25.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=2.96 cfs 0.212 af

Reach CB-2: 12" HDPE Avg. Flow Depth=0.64' Max Vel=5.56 fps Inflow=2.96 cfs 0.212 af
12.0" Round Pipe n=0.013 L=8.0' S=0.0125 '/' Capacity=3.98 cfs Outflow=2.96 cfs 0.212 af

Reach WQ-1: 12" HDPE Avg. Flow Depth=0.49' Max Vel=7.71 fps Inflow=2.96 cfs 0.212 af
12.0" Round Pipe n=0.013 L=87.0' S=0.0293 '/' Capacity=6.10 cfs Outflow=2.96 cfs 0.212 af

Pond 1P: Subsurface Recharge System Peak Elev=124.31' Storage=4,670 cf Inflow=2.96 cfs 0.212 af
Discarded=0.03 cfs 0.061 af Primary=0.48 cfs 0.065 af Outflow=0.51 cfs 0.125 af

Pond 2P: Level Spreader Peak Elev=123.56' Storage=0.000 af Inflow=0.48 cfs 0.065 af
Outflow=0.48 cfs 0.065 af

Pond 3P: Roof Drain Chambers Peak Elev=102.52' Storage=0.006 af Inflow=0.15 cfs 0.012 af
Outflow=0.00 cfs 0.010 af

Total Runoff Area = 1.403 ac Runoff Volume = 0.400 af Average Runoff Depth = 3.42"
80.00% Pervious = 1.123 ac 20.00% Impervious = 0.281 ac

Summary for Subcatchment S-1: Tributary to North

Runoff = 0.64 cfs @ 12.27 hrs, Volume= 0.066 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
	8,936	61	>75% Grass cover, Good, HSG B
*	4,399	58	Woods, Good, HSG B
	13,335	60	Weighted Average
	13,335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
2.1	73	0.0136	0.58		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
17.9	123	Total			

Summary for Subcatchment S-2: Tributary to West

Runoff = 1.07 cfs @ 12.25 hrs, Volume= 0.110 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
	16,892	61	>75% Grass cover, Good, HSG B
*	5,223	58	Woods, Good, HSG B
	22,115	60	Weighted Average
	22,115		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.40"
1.5	50	0.0130	0.57		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
17.3	100	Total			

Summary for Subcatchment S-3: Tributary to CB-1

Runoff = 2.97 cfs @ 12.09 hrs, Volume= 0.212 af, Depth= 4.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
11,287	98	Paved parking, HSG B
10,419	61	>75% Grass cover, Good, HSG B
3,035	58	Woods/grass comb., Good, HSG B
24,741	78	Weighted Average
13,454		54.38% Pervious Area
11,287		45.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment S-4: Typical House

Runoff = 0.15 cfs @ 12.08 hrs, Volume= 0.012 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	936	98	Roof
	936		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Reach 1R: Combined Flow to West

Inflow Area = 1.076 ac, 24.09% Impervious, Inflow Depth = 1.95" for 100-yr event
Inflow = 1.11 cfs @ 12.53 hrs, Volume= 0.175 af
Outflow = 1.11 cfs @ 12.53 hrs, Volume= 0.175 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3

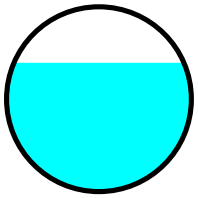
Summary for Reach CB-1: 12" HDPE

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 4.47" for 100-yr event
Inflow = 2.97 cfs @ 12.09 hrs, Volume= 0.212 af
Outflow = 2.96 cfs @ 12.09 hrs, Volume= 0.212 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 5.07 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.84 fps, Avg. Travel Time= 0.2 min

Peak Storage= 15 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.70'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.56 cfs

12.0" Round Pipe
n= 0.013
Length= 25.0' Slope= 0.0100 '/'
Inlet Invert= 121.50', Outlet Invert= 121.25'



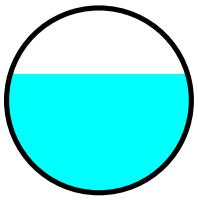
Summary for Reach CB-2: 12" HDPE

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 4.47" for 100-yr event
Inflow = 2.96 cfs @ 12.09 hrs, Volume= 0.212 af
Outflow = 2.96 cfs @ 12.09 hrs, Volume= 0.212 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 5.56 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.99 fps, Avg. Travel Time= 0.1 min

Peak Storage= 4 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.98 cfs

12.0" Round Pipe
n= 0.013
Length= 8.0' Slope= 0.0125 '/'
Inlet Invert= 119.70', Outlet Invert= 119.60'



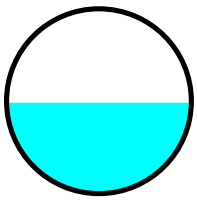
Summary for Reach WQ-1: 12" HDPE

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 4.47" for 100-yr event
Inflow = 2.96 cfs @ 12.09 hrs, Volume= 0.212 af
Outflow = 2.96 cfs @ 12.09 hrs, Volume= 0.212 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 7.71 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.69 fps, Avg. Travel Time= 0.5 min

Peak Storage= 33 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.10 cfs

12.0" Round Pipe
n= 0.013
Length= 87.0' Slope= 0.0293 '/'
Inlet Invert= 121.25', Outlet Invert= 118.70'



Summary for Pond 1P: Subsurface Recharge System

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 4.47" for 100-yr event
Inflow = 2.96 cfs @ 12.09 hrs, Volume= 0.212 af
Outflow = 0.51 cfs @ 12.56 hrs, Volume= 0.125 af, Atten= 83%, Lag= 28.4 min
Discarded = 0.03 cfs @ 9.69 hrs, Volume= 0.061 af
Primary = 0.48 cfs @ 12.56 hrs, Volume= 0.065 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 124.31' @ 12.56 hrs Surf.Area= 1,419 sf Storage= 4,670 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 193.2 min (1,006.5 - 813.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	119.10'	2,119 cf	**16.75'W x 84.70'L x 5.75'H Field A** 8,158 cf Overall - 2,859 cf Embedded = 5,298 cf x 40.0% Voids
#2A	119.85'	2,859 cf	**Cultec R-902HD** x 44 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 44 Chambers in 2 Rows Cap Storage= +2.8 cf x 2 x 2 rows = 11.0 cf
		4,979 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	119.10'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	123.95'	**6.0" Round Culvert X 2.00** L= 11.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 123.95' / 123.50' S= 0.0409 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.03 cfs @ 9.69 hrs HW=119.16' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.48 cfs @ 12.56 hrs HW=124.31' TW=123.56' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 0.48 cfs @ 1.60 fps)

Summary for Pond 2P: Level Spreader

Inflow Area = 0.568 ac, 45.62% Impervious, Inflow Depth = 1.36" for 100-yr event
Inflow = 0.48 cfs @ 12.56 hrs, Volume= 0.065 af
Outflow = 0.48 cfs @ 12.57 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.3 min
Primary = 0.48 cfs @ 12.57 hrs, Volume= 0.065 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 123.40' Surf.Area= 0.001 ac Storage= 0.000 af
Peak Elev= 123.56' @ 12.57 hrs Surf.Area= 0.001 ac Storage= 0.000 af (0.000 af above start)

Plug-Flow detention time= 2.9 min calculated for 0.064 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (880.3 - 880.2)

Volume	Invert	Avail.Storage	Storage Description
#1	122.50'	0.000 af	**3.00'W x 10.00'L x 1.20'H Prismatoid** 0.001 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	123.50'	**10.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)

Primary OutFlow Max=0.48 cfs @ 12.57 hrs HW=123.56' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Vee/Trap Weir** (Weir Controls 0.48 cfs @ 0.80 fps)

Summary for Pond 3P: Roof Drain Chambers

Inflow Area = 0.021 ac,100.00% Impervious, Inflow Depth = 6.76" for 100-yr event
Inflow = 0.15 cfs @ 12.08 hrs, Volume= 0.012 af
Outflow = 0.00 cfs @ 9.57 hrs, Volume= 0.010 af, Atten= 97%, Lag= 0.0 min
Discarded = 0.00 cfs @ 9.57 hrs, Volume= 0.010 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 102.52' @ 15.54 hrs Surf.Area= 0.005 ac Storage= 0.006 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 314.7 min (1,057.7 - 743.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	100.00'	0.002 af	**8.00'W x 13.00'L x 2.54'H Field A** 0.006 af Overall - 0.001 af Embedded = 0.005 af x 40.0% Voids
#2A	100.50'	0.001 af	**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
#3B	100.00'	0.002 af	**8.00'W x 13.00'L x 2.54'H Field B** 0.006 af Overall - 0.001 af Embedded = 0.005 af x 40.0% Voids
#4B	100.50'	0.001 af	**Cultec R-150XLHD** x 2 Inside #3 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
		0.006 af	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 9.57 hrs HW=100.03' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.00 cfs)

RECHARGE CALCULATIONS (STANDARD #3)

STANDARD 3: RECHARGE CALCULATIONS

REQUIRED:

Recharge Volume Required ("A" Soils) = [Impervious Area x (Recharge Depth inches/12)]
= [0 sf x (0.60"/12)]
= 0 cf (Required Volume)

Recharge Volume Required ("B" Soils) = [Impervious Area x (Recharge Depth inches/12)]
= [11,287 sf x (0.35"/12)]
= 330 cf (Required Volume)

Recharge Volume Required ("C" Soils) = [Impervious Area x (Recharge Depth inches/12)]
= [0 sf x (0.25"/12)]
= 0 cf (Required Volume)

Recharge Volume Required ("D" Soils) = [Impervious Area x (Recharge Depth inches/12)]
= [0 sf x (0.10"/12)]
=0 cf (Required Volume)

Total Required Recharge Volume = 330 cf

CAPTURE AREA ADUSTMENT:

Total On-Site Impervious Area		= 0.259 acres
Total On-Site Impervious Area Directed to Infiltration BMP		= 0.259 acres
Adjustment Ratio	(0.259 ac. / 0.259 ac.)	= 1.00
Adjusted Required Recharge Volume	(330 c.f. x 1.00)	= 330 cf
		= 0.0075 acre-feet

STATIC METHOD:

- Assume the entire Required Recharge Volume is discharged into the infiltration device before infiltration begins.

PROVIDED:

Infiltration Basin #1:

- Cumulative Volume below the lowest outlet (Elev.=123.95) = 4,468 c.f.

Total Recharge Volume Provided = 4,468 c.f. (0.103 acre-feet)

DRAWDOWN CALCULATIONS (STANDARD #3)

STANDARD 3: DRAWDOWN CALCULATIONS

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Where:

Rv = Required Storage Volume = (F)(impervious area)

K = Saturated Hydraulic Conductivity

For "Static" and "Simple Dynamic" Methods, use Rawls Rate (see Table 2.3.3).

For "Dynamic Field" Method, use 50% of the in-situ saturated hydraulic conductivity.

INFILTRATION BASIN #1

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)} = 37.07 \text{ hours}$$

Rv =	*4,468*	*C.F.*	*(Recharge Volume Provided)*
K =	*1.02*	*inch/hr.*	
BA =	*1,418*	*S.F.*	*(Max bottom area at outlet elevation)*

TABLE 2.3.3

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

GROUNDWATER MOUNDING CALCULATIONS (STANDARD #3)

Groundwater Mounding Analysis

We are pleased to submit this mounding evaluation report for the proposed Definitive Subdivision Plan at 1265 Bartlett Street in New Bedford, Massachusetts. As required, we have performed model simulations of the mounding effects associated with runoff discharge to groundwater, from the proposed stormwater infiltration basin. The mounding evaluation was generated using the Hantush method of groundwater modeling by using site specific information.

To complete the analysis for this project, a mounding program created to solve the Glover's solution to the Hantush method, by GeoHydroCycle, was utilized. This program uses several site-specific soil parameters and basin configuration parameters to estimate the maximum mound height and extents of mounding which can be anticipated under the infiltration surface area. These include the hydraulic conductivity of the soil, the soil's porosity, the discharge time until stabilization, the initial saturated thickness, the bottom area of the infiltration area and the total loading rate over that area.

In accordance with the Massachusetts Stormwater Handbook, the mounding analysis must demonstrate that the mound which forms under the recharge system from the required recharge volume, which is associated with Standard 3 of the Stormwater Management Regulations, will not breakout above the land or wetland resource area. For the purposes of our calculation, a 100-year 24-hour storm event was modeled.

The following input parameters were used in the mounding calculations:

- Length of application area: The length of the bottom area of the infiltration BMP at the 100-year 24-hour storm elevation.
- Width of application area: The width of the bottom area of the infiltration BMP at the 100-year 24-hour storm elevation.
- Rate of Application: The volume of water infiltrated by the Infiltration BMP during the 100-year 24-hour storm event ("Discarded" volume as denoted on HydroCAD calculations), divided by the bottom area of the Infiltration BMP.
- Aquifer Hydraulic Conductivity: Consistent with the USGS model documentation, hydraulic conductivity is generally applied as 10 times the Rawls rate.
- Initial Saturated Thickness: The saturated thickness value represents the depth of saturated soil between estimated seasonal high groundwater and the highest natural restrictive layer (clay or bedrock). On-site soil logs did not indicate a natural restrictive layer. Well completion reports from the MassDEP Well Driller Program database on nearby properties were utilized to estimate the depth of the natural restrictive layer. A well log at Giselle Avenue indicated a depth to bedrock of 10 feet. The initial saturated thickness was calculated to be the difference between the highest estimated seasonal high groundwater depth (5.0 ft) and the 10 foot refusal depth encountered at Giselle Avenue. An initial saturated thickness of 5 feet was utilized for all calculations.

- Fillable porosity: The porosity value for the sandy loam encountered during on-site soil investigations was estimated at 0.2 as is typically found in New England.

The results of these models are attached.

During the 100-year 24-hour storm event, the maximum mound height under the proposed subsurface recharge system is calculated to be 3.82 feet. The resulting mound elevation is 120.82, which is completely contained within the storage area of the basin and will not breakout above the surrounding natural grade. At approximately 33 feet to the west of the center of the infiltration device, where the existing natural grade is approximately 121.5' +/-, the resulting mound is calculated to be approximately 3.49' (elev.= 120.49). Natural grade then rises up to Route 140 to the west.

MassDEP

Well Completion Report

WELL LOCATION

GPS North:

GPS West:

Assessors Map:

Address: Gisell Avenue

Assessors Lot:

Sub Division:

Permit Number:

City/Town: NEW BEDFORD

Date Issued:

Board Of Health Permit Obtained: NR

Work Performed	Well Type	Drilling Method Overburden	Drilling Method Bedrock
New Well	Domestic		Air Hammer

ADDITIONAL WELL INFORMATION

Developed:

Disinfected: Yes

Total Well Depth: 325.00

Fracture Enhancement:

Well Seal Type:

Depth to Bedrock: 10.00

PERMANENT PUMP (IF AVAILABLE)

Pump Description:

Type:

Nominal Pump Capacity:

Intake Depth:

Horsepower:

Comments:

CASING

From(ft)	To(ft)	Type	Thickness	Diameter
0.00				
0.00	22.00	Steel		6

SCREEN

From(ft)	To(ft)	Type	slotsize	Diameter

WELL SEAL / FILTER PACK / ABANDONMENT MATERIAL

From(ft)	To(ft)	Material Description	Purpose

STATIC WATER LEVEL(ALL WELLS)

Date Measured	Depth Below Ground Surface
12/03/2005	23.00

WELL TEST DATA (ALL SECTIONS MANDATORY FOR PRODUCTION WELLS)

Date	Method	Yield(GPM)	Time Pumped (hrs & min)	Pumping Level (Ft. BGS)	Time To Recoover (Hrs & min)	Recovery
12/02/2005	Constant Rate Pump	7.00	5:10	200	12:50	23

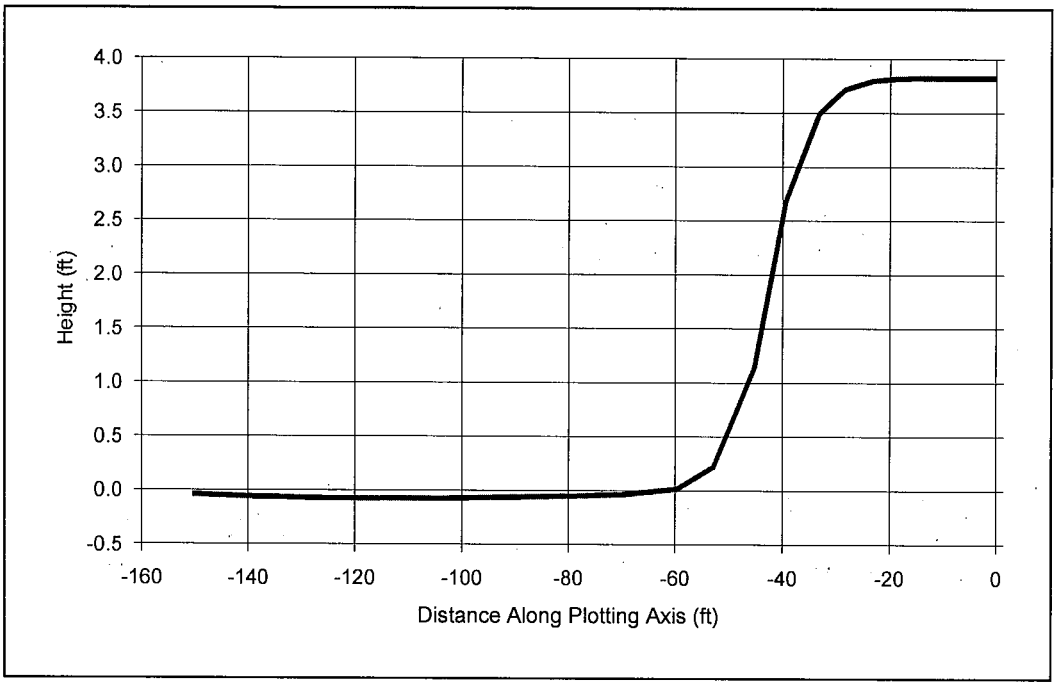
OVER BURDEN

From(ft)	To(ft)	Lithology	Color	Comment	Water Zone	Loss / Add of Fluid	Drill Stem Drop	Drill Rate
0.00	10.00	Gravel						

BEDROCK

From(ft)	To(ft)	Lithology	Comment	Water Zone	Drill Stem Drop	Extra Large	Drill Rate	Rust Stain	Loss / Add Of Fluid	# of Fract Per Ft
10	325	Granite								

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Farland Corp

PROJECT: 1265 Bartlett Street

ANALYST: CG

DATE: .3/24/2021 TIME: 2:29:00 PM

INPUT PARAMETERS

Application rate: 4.72 c.ft/day/sq. ft
Duration of application: 0.208 days
Fillable porosity: 0.2
Hydraulic conductivity: 10 ft/day
Initial saturated thickness: 5 ft
Length of application area: 84.7 ft
Width of application area: 16.75 ft
No constant head boundary used
Plotting axis from Y-Axis: 0 degrees
Edge of recharge area:
positive X: 0 ft
positive Y: 42.3 ft
Total volume applied: 1392.847 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
0	-150	-150	-0.04
0	-126.2	-126	-0.07
0	-102.3	-102	-0.08
0	-78.4	-78	-0.05
0	-59.7	-60	0.02
0	-45.2	-45	1.14
0	-33.3	-33	3.49
0	-23.2	-23	3.8
0	-14.5	-15	3.82
0	-8.7	-9	3.82
0	-4.7	-5	3.82
0	0	0	3.82
0	0	0	3.82
0	0	0	3.82
0	0	0	3.82
0	0	0	3.82
0	0	0	3.82
0	0	0	3.82
0	0	0	3.82
0	0	0	3.82
0	0	0	3.82
0	0	0	3.82
0	0	0	3.82

SOIL LOGS
(STANDARD #3)

FARLAND CORP.

ENGINEERING A BETTER TOMORROW

ENGINEERING | SITE WORK | LAND SURVEYING

LOCATION: 1265 Bartlett Street - New Bedford, MA

PROJECT #: 17-038

DATE: 8/15/18 & 12/6/18

REV:

SOIL LOGS:

	Test Hole #1	Test Hole #2	Test Hole #3
	Elevation=122.0	Elevation=115.5	Elevation=112.5
	0-8" OA HORIZON SANDY LOAM 10YR 3/3	0-7" OA HORIZON SANDY LOAM 10YR 3/3	0-6" OA HORIZON SANDY LOAM 10YR 3/3
	8-22" B HORIZON SANDY LOAM 2.5Y 5/1	7-20" B HORIZON SANDY LOAM 10YR 5/6	6-20" B HORIZON SANDY LOAM 10YR 5/6
	22-108" C HORIZON SANDY LOAM 2.5Y 5/4	20-48" C1 HORIZON SANDY LOAM 2.5Y 5/4	20-48" C1 HORIZON SANDY LOAM 2.5Y 5/4
	REDOX @ 60" ELEV.=117.0	48-96" C2 HORIZON SANDY LOAM 2.5Y 5/3	48-88" C2 HORIZON SANDY LOAM 2.5Y 5/3
		REDOX @ 40" ELEV.=123.2	REDOX @ 28" ELEV.=125.2
Date:	8/15/18	12/6/18	12/6/18
Performed By:	John Marchand	John Marchand	John Marchand
Witness:			

WATER QUALITY VOLUME CALCULATIONS (STANDARD #4)

FARLAND CORP.

ENGINEERING A BETTER TOMORROW

ENGINEERING | SITE WORK | LAND SURVEYING

LOCATION:	1265 Bartlett Street - New Bedford, MA	PROJECT #:	17-038	DATE:	3/5/21
				REV:	3/24/21

STANDARD 4: WATER QUALITY VOLUME:

Note:
Water Quality Volume calculations are based on new impervious areas only. Existing impervious areas have not been included.

Water Quality Treament Volume Formula:

$V_{WQ} = D_{WQ}$ X (1 ft. / 12 in.) X A_{IMP}

Where,

V_{WO} = *Required Water Quality Volume* (in cubic feet)

D_{WQ} = Water Quality Depth: one-inch for discharges within a Zone II or IWPA, to or near another critical area, runoff from a LUHPPL, or exfiltration to soils with infiltration rate greater than 2.4 inches/hour; 1/2 -inch for discharges near or to other areas

A_{IMP} = Impervious Area (in cubic feet)

STORM WATER OUTFALL: Outlet from Subsurface Recharge System

CONTRIBUTING IMPERVIOUS AREA (A_{IMP}) = 11,287 S.F.

V_{WQ}	=	**0.5**	inch	X	1 ft/ 12 in.	X	11,287	s.f.	=	**470**	c.f.

STRUCTURAL BMP TREATMENT:

Subsurface Recharge System (Below lowest outlet invert)

*Refer to Hydrology Calculations	=	4,468	c.f.
TOTAL WATER QUALITY VOLUME PROVIDED IN BMP TREATMENT	=	**4,468**	c.f.

WQV CONVERSION TO FLOW RATE (STATDARD #4)

FARLAND CORP.

ENGINEERING A BETTER TOMORROW

ENGINEERING | SITE WORK | LAND SURVEYING

LOCATION: 1265 Bartlett Street - New Bedford, MA PROJECT #: 17-038 DATE: 3/24/21

WATER QUALITY VOLUME CONVERSION TO FLOW RATE:

Note: The following conversion performed according to methods described in "Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices"

FLOW CONVERSION FOR WATER QUALITY VOLUME FROM CDS-01 OUTLET

$Q_1 = (q_U) \times (V_{WQ}) \times (A_{IMP})$

Where,

q_U = Unit peak discharge, in csm/in (From Figure 4 of conversion guidance document described above, based on 0.1 hour Time of Concentration)

V_{WQ} = Water Quality Depth: one-inch for discharges within a Zone II or IWPA, to or near another critical area, runoff from a LUHPPL, or exfiltration to soils with infiltration rate greater than 2.4 inches/hour; 1/2 -inch for discharges near or to other areas

A_{IMP} = Impervious Area (in squre miles)

Q_1 =	**774**	csm/in	X	**11,287**	s.f.	X	**3.587 e^{-8}**	mi^2 / s.f.	X	**0.5**	inch	=	**0.16** cfs

TSS REMOVAL CALCULATIONS (STANDARD #4)

FARLAND CORP.

ENGINEERING A BETTER TOMORROW

ENGINEERING | SITE WORK | LAND SURVEYING

LOCATION: 1265 Bartlett Street - New Bedford, MA

PROJECT #: 17-038

DATE: 3/5/21

REV: 3/24/21

STANDARD 4: TSS REMOVAL CALCULATIONS:

STORM WATER OUTFALL: OUTLET FROM INFILTRATION BASIN #1

PRETREATMENT (for infiltration BMP in area with rapid infiltration, Zone II or IWPA, discharges to crital areas, and LUHPPL's)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BXC)	E Remaining Load (C-D)
Propriatary Separator (CDS 2015)	44%	1.00	0.44	0.56
		Total TSS Removal=	0.44	

TREATMENT

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BXC)	E Remaining Load (C-D)
Infiltration Basin (with 44% pre-treatment)	80%	1.00	0.80	0.20
		Total TSS Removal=	0.80	

LONG TERM POLLUTION PREVENTION PLAN (STANDARD #4)

FARLAND CORP.

ENGINEERING A BETTER TOMORROW

ENGINEERING | SITE WORK | LAND SURVEYING

Long Term Pollution Prevention Plan

Definitive Subdivision Plan
1265 Bartlett Street
New Bedford, MA 02339

January 5, 2021

Record Owner(s):

Assessor's Map 134 Lot 299 & 305
Amandio & Jose Araujo
224 Nyes Lane
Acushnet, MA 02743

Assessor's Map 134 Portion of Lot 314
Stacy Oliveira
5 Archer's Way
Acushnet, MA 02743

Prepared For:

Amandio & Jose Araujo
P.O. Box 91
Rochester, MA 02770

Prepared By:

Farland Corp.
Project No. 17-038

Long Term Pollution Prevention Plan

This Long Term Pollution Prevention Plan serves to outline good housekeeping practices in order to prevent pollution of the wetland resource areas and surrounding environment. The Long Term Operation & Maintenance Plan shall be taken as part of this document as it is a critical part of this plan and shall be adhered to. Proper operation and maintenance records shall be kept on file at all times.

Snow disposal shall be carried out by the owner. The owner should follow DEP guideline #BWR G2015-01 for all snow removal requirements. For this site, it is anticipated that snow will be plowed from the roadway and piled along the shoulders of the roadway areas. Snow on individual lots is anticipated to be removed by shovel or snow blower by homeowners.

Snow disposal in the following areas are prohibited:

- Dumping snow in the bordering vegetated wetlands is prohibited.
- Dumping of snow on top of storm drain catch basins or in stormwater drainage basin is prohibited. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Illicit discharges to the stormwater management system are prohibited. Illicit discharges are those that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities; firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual residence car washing, flows from riparian habitats and wetlands, de-chlorinated water from swimming pools, water used for street washing, and water used to clean residential buildings without detergents. Measures are provided below to prevent illicit discharges to the stormwater management system.

In the event of oil, gasoline or other hazardous waste spill on-site, the New Bedford Fire Department, DEP and the Conservation Agent shall be notified immediately. For spills of less than ¼ gallon, clean-up with absorbent materials or other appropriate means, unless circumstances dictate that the spill should be treated by a professional emergency response contractor. Spills which exceed the reportable quantities of substances mentioned in 40 CFR 110, 40 CFR 117, or 40 CFG 302 must be immediately reported to the EPA National Response Center (800) 242-8802. Any drainage inlet that may be affected by the spill shall be covered immediately with a spill protector drain cover or similar product, or a spill berm placed around the perimeter of the opening to prevent any contamination into the drainage system. Proper cleanup and disposal of hazardous wastes must follow all applicable local and state regulations and must be carried out by a qualified contractor.

The maintenance of all lawns, gardens and landscaped areas shall be performed by the owner. Good housekeeping practices should include proper storage and minimal use of cleaning products and fertilizers. Homeowners should consult with a professional landscaper for proper maintenance of lawns and landscaped areas.

OPERATION & MAINTENANCE PLAN & LOGS (STANDARD #9)

FARLAND CORP.

ENGINEERING A BETTER TOMORROW

ENGINEERING | SITE WORK | LAND SURVEYING

Long Term Operation and Maintenance Plan

Definitive Subdivision Plan
1265 Bartlett Street
New Bedford, MA 02339

January 5, 2021

Record Owner(s):

Assessor's Map 134 Lot 299 & 305
Amandio & Jose Araujo
224 Nyes Lane
Acushnet, MA 02743

Assessor's Map 134 Portion of Lot 314
Stacy Oliveira
5 Archer's Way
Acushnet, MA 02743

Prepared For:

Amandio & Jose Araujo
P.O. Box 91
Rochester, MA 02770

Prepared By:

Farland Corp.
Project No. 17-038

The Operator, Owner, and Party Responsible for Operation and Maintenance of the Stormwater BMP's will be the City of New Bedford.
The responsible party shall:

a) Maintain an operation and maintenance log for at least three years, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and disposal location);
b) Make this log available to MassDEP and the Conservation Commission upon request during normal business hours; and
c) Allow members and agents of the MassDEP and the Conservation Commission to enter and inspect the premises to evaluate and ensure that the responsible party complies with the Operation and Maintenance Plan requirements for each BMP.

Street Sweeping

It shall be the responsibility of the owner to:

Inspections:

Inspect sediment deposit accumulations on the parking lots quarterly.

Maintenance:

Sweep parking lots at least annually, during March or April before spring rains wash residual sand from winter applications into stormwater systems.

Dispose of the accumulated sediment and hydrocarbons in accordance with local, state, and federal guidelines and regulations.

Stone/ Rip Rap Areas

The rip rap areas are to be inspected and maintained by the owner.

It shall be the responsibility of the owner to:

Inspections:

Inspect the rip rapped areas quarterly.

Maintenance:

Remove accumulated sediment, trash, leaves and debris at least annually. Check for signs of erosion and repair as need. Replace any damaged areas with new rip rap of the same size.

Dispose of the accumulated sediment and hydrocarbons in accordance with local, state, and federal guidelines and regulations.

Drain Manholes

The manholes are to be inspected and maintained by the owner.
It shall be the responsibility of the owner to:

Inspections:

Inspect the manholes quarterly.

Maintenance:

Remove accumulated sediment, trash, leaves and debris when the depth of deposits is greater than or equal to one half the depth from the bottom invert of the lowest pipe in the manhole to the bottom elevation of the manhole.

Dispose of the accumulated sediment and hydrocarbons in accordance with local, state, and federal guidelines and regulations.

CDS® Units

The units are to be inspected and maintained by the owner.

CDS Units are proprietary products and must comply with manufacturer's inspection and maintenance requirements. Refer to the attached CDS Inspection and Maintenance Guide.

In the event of a spill, refer to Long Term Pollution Prevention Plan for necessary procedures to prevent discharge of petroleum product into the infiltration system.

It shall be the responsibility of the owner to:

Inspections:

Inspect the units quarterly.

Prepare inspection reports as part of each inspection and include the following information:

1. Date of inspection
2. Maintenance personnel
3. Location of unit (GPS coordinates if possible)
4. Time since last rainfall
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural Deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, blockages)
8. Presence of oil sheen of depth of oil layer
9. Estimate of depth/ volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/ or maintenance for the units

12. Estimation of time before maintenance is required if not required at time of inspection.

Maintenance:

Cleaning should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method for removing pollutants from the system. The screen should be power washed to ensure it is free of trash and debris.

The CDS® Unit shall be cleaned once the sediment depth reaches 75% of the storage capacity.

If upon inspection, evidence of hydrocarbons is observed, such material shall be immediately removed and disposed of in accordance with local, state, and federal guidelines and regulations.

To remove oil and other hydrocarbons that accumulate, it may be preferable to use adsorbent pads.

Dispose of the accumulated sediment and hydrocarbons in accordance with local, state, and federal guidelines and regulations.

Subsurface Infiltration Chambers

The subsurface infiltration chambers are to be inspected and maintained by the owner. Subsurface infiltration chambers do not rely on standing pool of water, and have been designed to dewater within 72 hours after precipitation. Therefore, mosquito control is not required for the drainage system.

It shall be the responsibility of the owner to:

Inspections:

Inspect subsurface structures at least twice annually.

Maintenance:

If inspection of infiltration system shows that it does not dewater completely within 72 hours of a storm event, the owner shall take immediate steps to restore the function of the system, based on the recommendations of a qualified stormwater professional. Notice shall be provided to the Town of any such corrective action.

Any debris which may clog the system must be removed. Cleaning may be done by vacuum truck. All sediment and hydrocarbons shall be

properly disposed of in accordance with local, state, and federal guidelines and regulations.

Drain Lines

After construction, the drain lines shall be inspected after every major storm for the first few months to ensure proper functions. Presence of accumulated sand and silt would indicate more frequent maintenance of the pre-treatment devices is required. Thereafter, the drain lines shall be inspected at least once per year. Accumulated silt shall be removed by a vactor truck or other method preferred.

Landscaping

Inspections:

- Inspect weekly
- Remove debris and litter as necessary
- Prune and fertilize bi-annually
- Mow lawn as necessary
- Fertilize quarterly

“Definitive Subdivision Plan”
“1265 Bartlett Street”
Operation & Maintenance Log Form

STRUCTURAL SEDIMENT CONTROL BMPS

BMP	DATE INSPECTED	SEDIMENT BUILDUP (YES/NO)	IF SEDIMENT BUILDUP, DATE CLEANED
WQ-1			
DMH-1			
DMH-2			
Subsurface Recharge System			
OTHER:			

Maintenance Notes:

_____
_____
_____

TO BE PERFORMED BY:_____ON OR BEFORE:_____

ILLICIT DISCHARGE STATEMENT (STANDARD #10)

Illicit Discharge Compliance Statement (IDCS)

This Illicit Discharge Compliance Statement is intended to verify that no illicit discharges exist on the site or are proposed. We have included, in the pollution prevention plan, measures to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

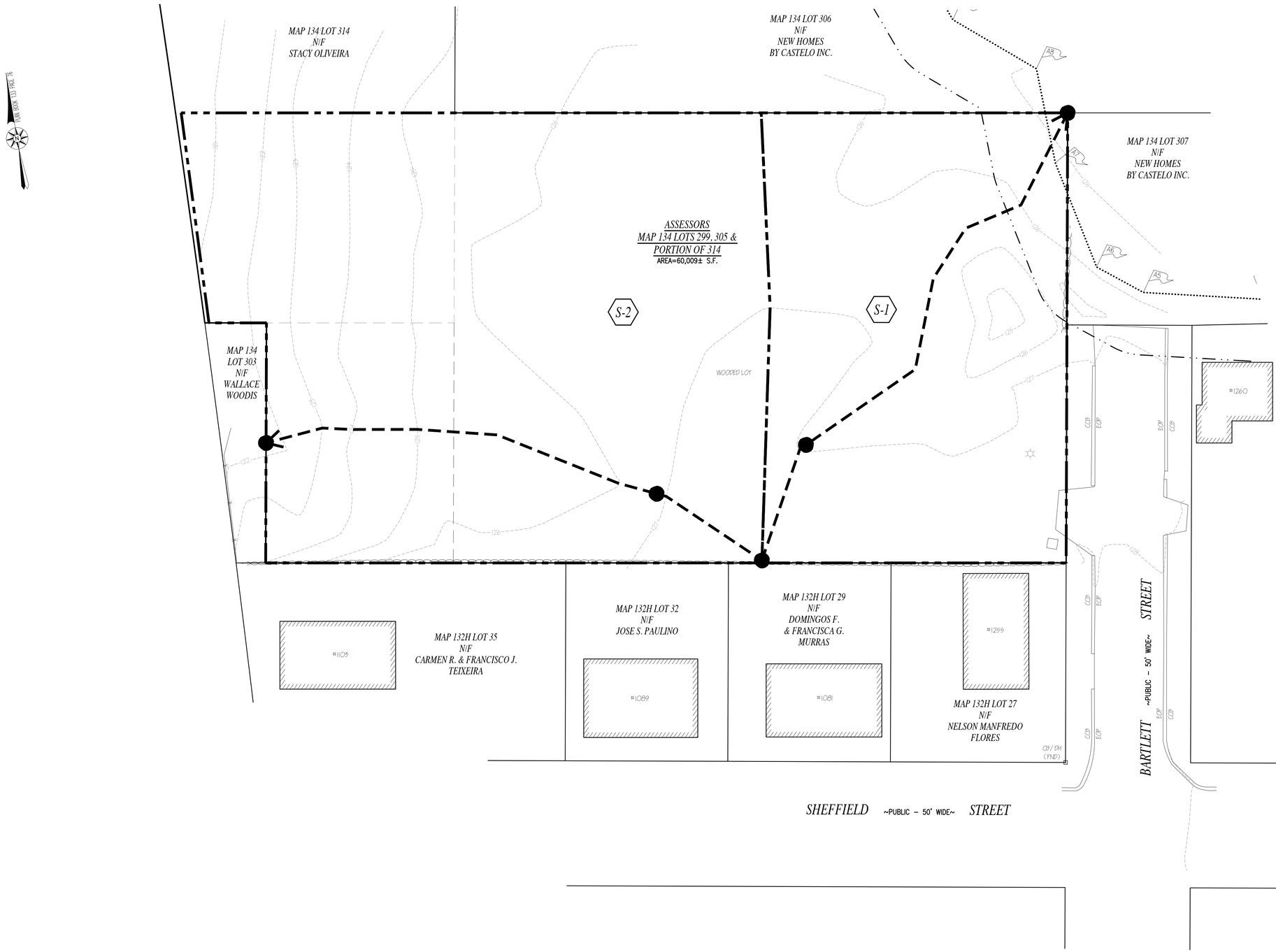
The site plan identifies the location of any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater management systems and the location of any measures taken to prevent the entry of illicit discharges into the stormwater management system.

Farland Corporation, Inc.

3/24/21

Christian A. Farland, P.E., LEED AP
Principal Engineer and President

WATERSHED PLANS



REVISIONS

1	3/5/21	NITSCH COMMENTS

FARLAND CORP.
www.FarlandCorp.com
401 COUNTY STREET
NEW BEDFORD, MA 02740
P.508.717.3479
OFFICES IN:
- TAUNTON
- MARLBOROUGH
- WARWICK, RI

DRAWN BY: NPD
DESIGNED BY: NPD
CHECKED BY: CAF

PRE WATERSHED PLAN

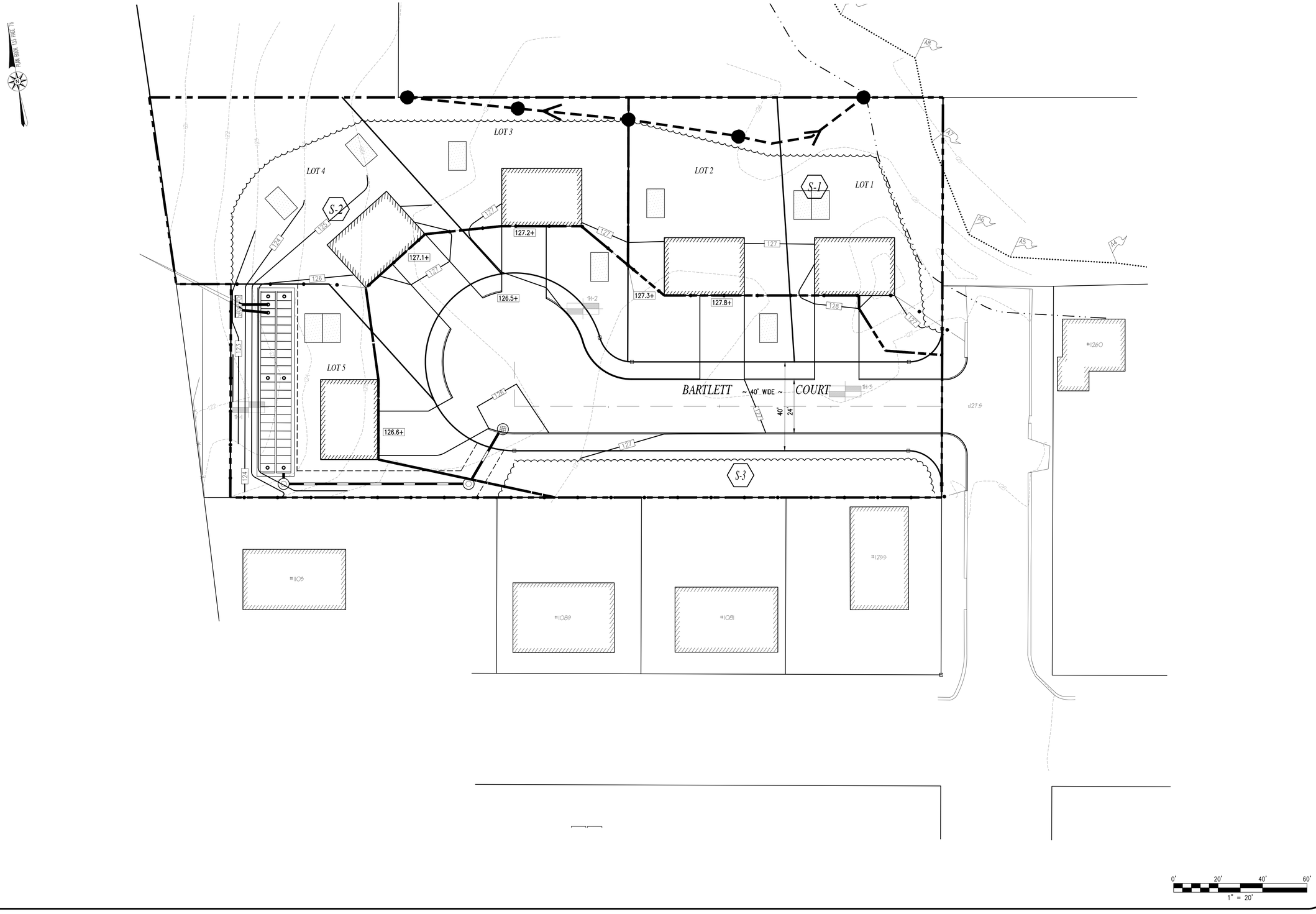
BARTLETT STREET

MAP 134 LOTS 299, 305 AND PORTION OF 314
NEW BEDFORD MASSACHUSETTS

PREPARED FOR: AMANDIO & JOSE ARAUJO
PO BOX 91
ROCHESTER, MA 02770

JANUARY 9, 2020
SCALE: 1"=20'
JOB NO. 17-038
LATEST REVISION: MARCH 5, 2021

SHEET 1 OF 1



0' 20' 40' 60'
1" = 20'

REVISIONS

1	3/5/21	NITSCH COMMENTS

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- MARLBOROUGH
- WARWICK, RI

DRAWN BY: NPD
DESIGNED BY: NPD
CHECKED BY: CAF

POST WATERSHED PLAN

BARTLETT STREET

MAP 134 LOTS 299, 305 AND PORTION OF 314
NEW BEDFORD MASSACHUSETTS

PREPARED FOR: AMANDIO & JOSE ARAUJO
PO BOX 91
ROCHESTER, MA 02770

JANUARY 9, 2020
SCALE: 1"=20'
JOB NO. 17-038
LATEST REVISION:
MARCH 24, 2021

SHEET 1 OF 1