# EDEN ESTATES

Bancroft Road
Andover, Massachusetts

# PROJECT REPORT

on
Drainage & Sedimentation Control
&
Project Stormwater Report

Prepared For:

**EDEN LANE, LLC**
42 School Street
Andover, MA 01810


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Date: May 26, 2024
Revised:

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# Eden Estates

Andover, Massachusetts

## I. Table of Contents

# II. Project Narrative

## *i. Introduction*

Eden Estates is a proposed three (3) lot single-family residential subdivision, on a local road, located on the south side of Bancroft Road in Andover, Massachusetts. The subject property consists of approximately 3.9± acres and is mainly grassed areas with wooded areas along portions of the perimeter of the site. The topography slopes from a high point near the easterly most corner property to a low point at the northwesterly most corner of the site. The elevations range from a high of 308 to a low of 284, a general vertical elevation difference of approximately twenty-four (24) feet.

The soils within the project consist of the Woodbridge series. This series is classified as being within the SCS-Hydrological Soils Group (HSG) C/D; ranked third/fourth on a scale of four (A, B, C, D) in terms of infiltration capacity.

These calculations determine Pre-Development and Post-Development peak flow rates (Q) and runoff volumes using the SCS-TR20 Runoff Method with HydroCAD. Proposed mitigation of the increase in runoff is being obtained primarily through the proposed detention facility within the property. The results for each drainage area, which experiences an increase in impervious area and therefore an apparent increase in peak runoff, will be tabulated. The objective is to mitigate the storm drainage flows such that there will be no increase in the peak rate of runoff or volume of runoff at any point along the parcel's boundary. The calculations will be performed for the 2, 10, 25 and 100-year storm events.

Applicable regulations of the Town of Andover and the State of Massachusetts are incorporated herein.

*ii. Summary & Results*

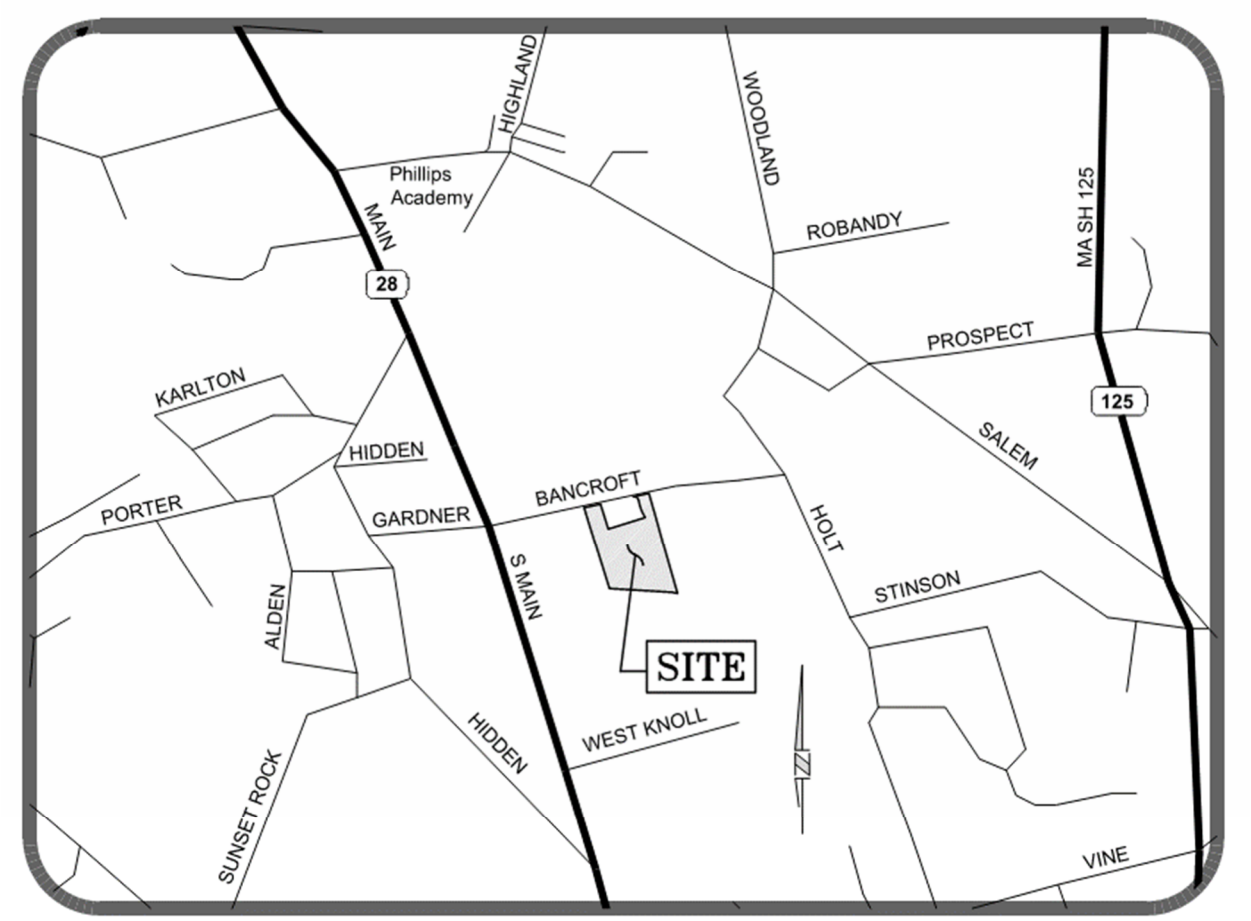
As indicated in the Introduction, the objective is to mitigate the storm drainage flows such that there will be no increase in the peak rate of runoff or volume of runoff at any point at the parcel's boundary. The following table summarizes the pre-development vs. the post-development peak runoff flow rates for the 2, 10, 25 and 100-year storm event. As indicated, due to the detention mitigation facility located within the project, the peak rates and volumes of runoff from the site are not increased under any design storm conditions, therefore, no downstream properties should be adversely affected by this project.

**Pre-Development vs. Post-Development Drainage Summary Tables**

| Design Storm | Peak Flow Rate | | | Runoff Volume | | |
|---|---|---|---|---|---|---|
| | Pre-Dev. (cfs) | Post-Dev. (cfs) | Δ (cfs) | Pre-Dev. (ac.-ft.) | Post-Dev. (ac.-ft.) | Δ (ac.-ft.) |
| 2 | 3.0 | 1.9 | (1.1) | 0.337 | 0.315 | (0.022) |
| 10 | 7.0 | 5.6 | (1.4) | 0.760 | 0.749 | (0.011) |
| 25 | 10.4 | 8.3 | (2.1) | 1.140 | 1.135 | (0.005) |
| 100 | 17.9 | 12.5 | (5.4) | 1.999 | 1.999 | 0.000 |

These Storm Drainage calculations were prepared in accordance with the applicable Town of Andover Regulations and the Massachusetts DEP Stormwater Handbook. Drainage structures and pipes were designed according to generally accepted engineering principles and in accordance with the stated regulations.

## III. Locus Map, USGS Map & FIRMette Map




*LOCUS MAP*

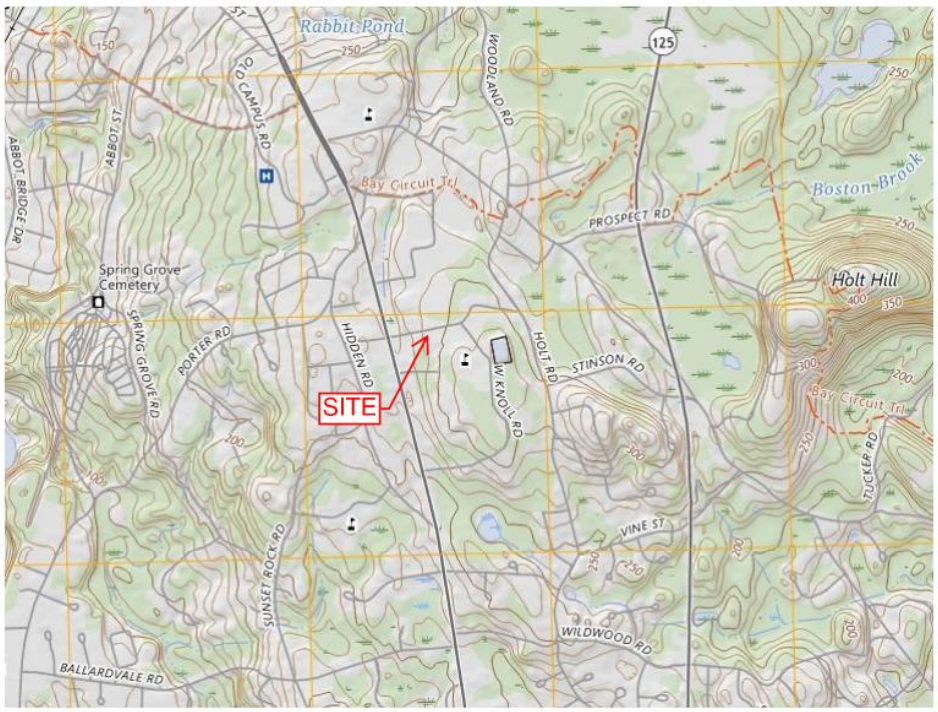
*SCALE: 1" = 800'*

USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
OnDemand Topo

7.5-MINUTE TOPO QUADRANGLE
Custom Extent
7.5-MINUTE TOPO




SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR SMOOTHNESS = Medium


**Produced by the United States Geological Survey**
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 19T

Data is provided by The National Map (TNM), is the best available at the time of map generation, and includes data content from supporting themes of Elevation, Hydrography, Geographic Names, Boundaries, Transportation, Structures, Land Cover, and Orthoimagery. Refer to associated Federal Geographic Data Committee (FGDC) Metadata for additional source data information.

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands. Temporal changes may have occurred since these data were collected and some data may no longer represent actual surface conditions.

Learn About The National Map: https://nationalmap.gov

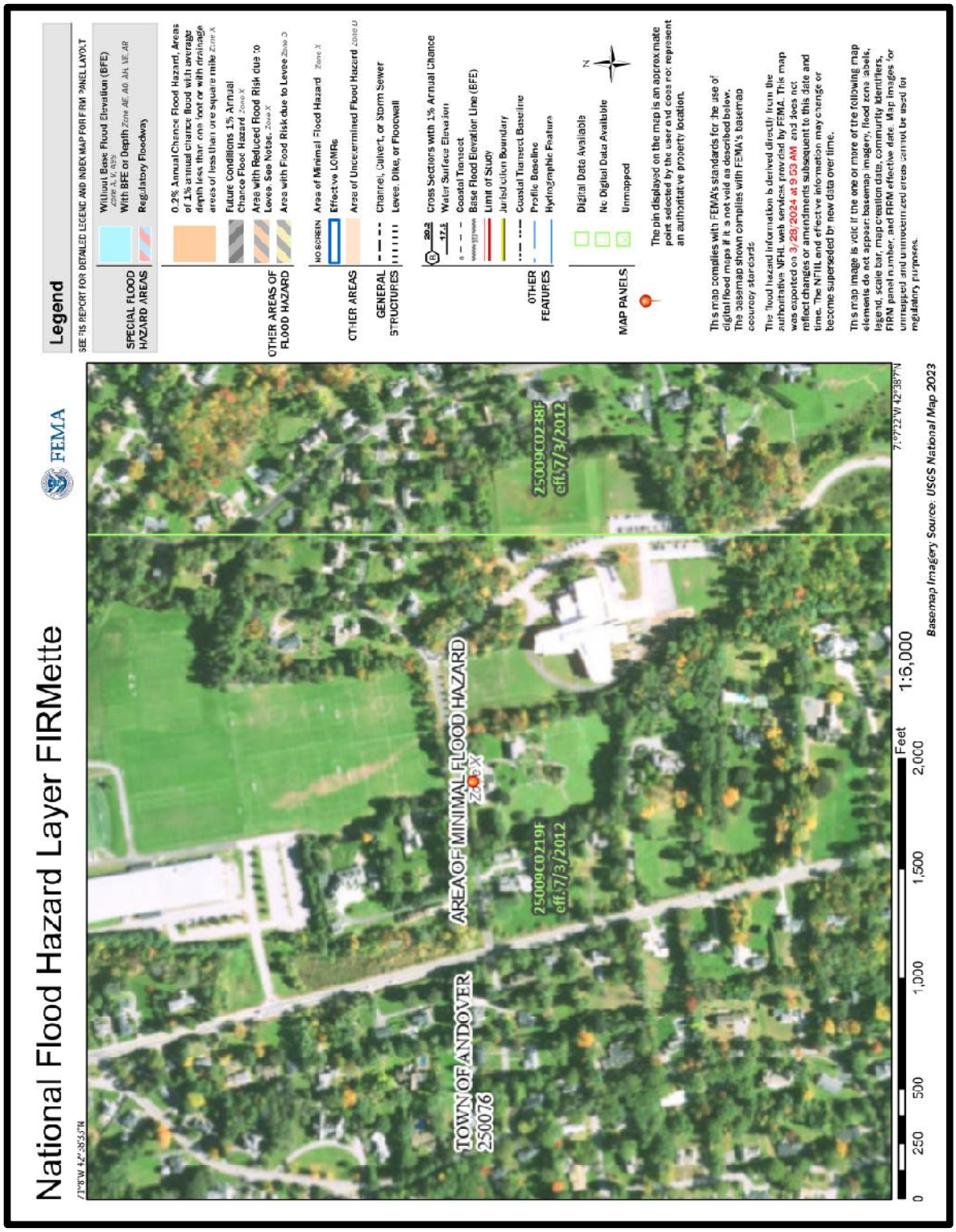
ROAD CLASSIFICATION

| | |
|---|---|
| Expressway | Local Connector |
| Secondary Hwy | Local Road |
| Ramp | 4WD |

Interstate Route  US Route  State Route

# Eden Estates

Andover, Massachusetts



# IV. Storm Drain Calculations

## *i. Description of Drainage System*

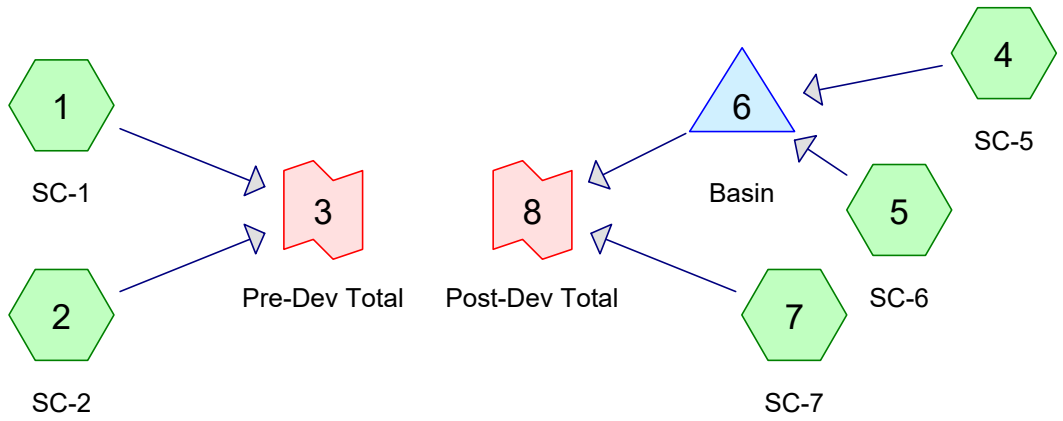
The proposed drainage system is a combination closed and open system. Decreases in peak flow rates and volumes of runoff will be obtained primarily through use of the proposed detention facility. Catch basins will be constructed to collect the runoff and transport it to the closed drainage system and discharge to the detention basin. The basin will serve to detain and store the runoff while discharging a flow rate equal to or less than the calculated pre-development peak flow rate. The difference will be stored in the basin.

Pre- and Post-Development Drainage Area Maps accompany these calculations. The following table summarizes the pre vs. post development drainage areas for the entire site.

| Drainage Area | Pre-Dev. (s.f) | Post-Dev. (s.f) |
|---|---|---|
| | | |
| SC-1 | 40,745 | |
| SC-2 | 158,106 | |
| | | |
| SC-4 | | 32,361 |
| SC-5 | | 150,743 |
| SC-7 | | 15,747 |
| **Total** | **198,851** | **198,851** |

*ii. Runoff and Mitigation Design Calculations*

*25-Year Design Storm Event – Detail*




Subcat Reach Pond Link

**Routing Diagram for 42215 Original 2024-05-26**
Prepared by DK Engineering LLC, Printed 5/26/2024

## Summary for Subcatchment 1: SC-1

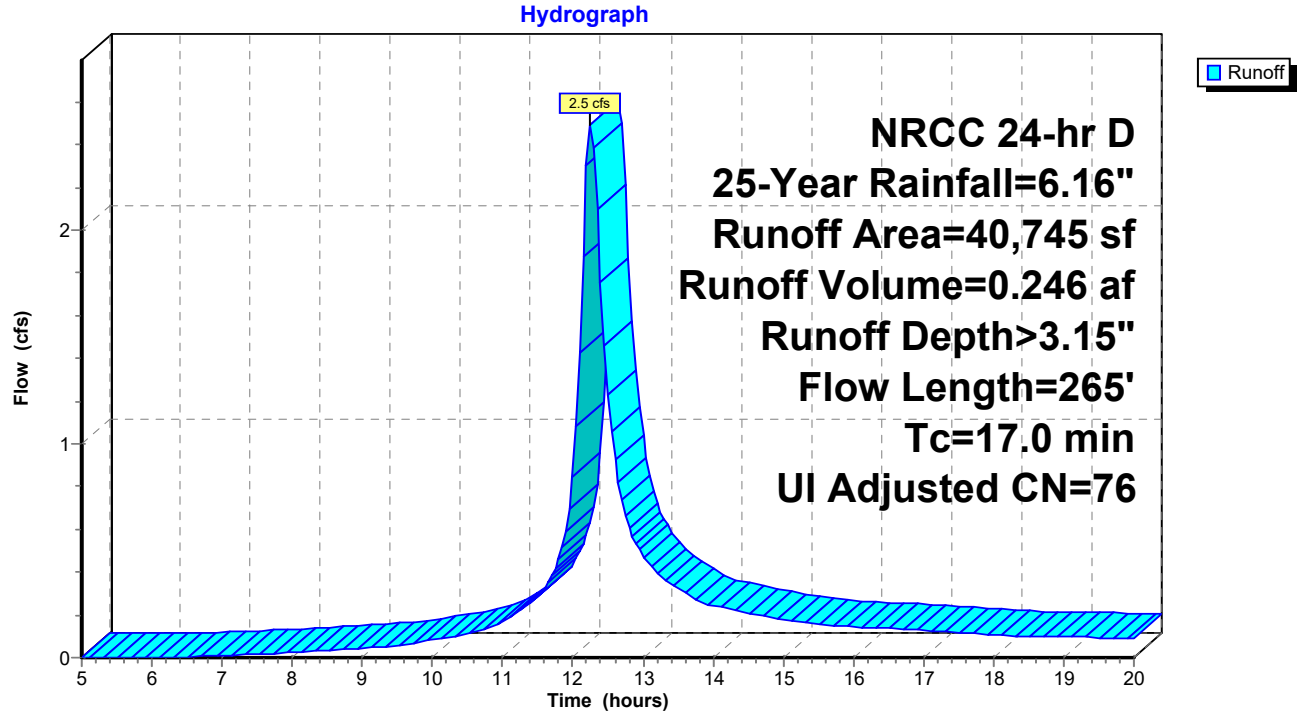
Runoff = 2.5 cfs @ 12.26 hrs, Volume= 0.246 af, Depth> 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.16"

| Area (sf) | CN | Adj | Description |
|---|---|---|---|
| 4,506 | 98 | | Unconnected pavement, HSG C |
| 5,117 | 98 | | Unconnected roofs, HSG C |
| 17,044 | 73 | | Woods, Fair, HSG C |
| 14,078 | 74 | | >75% Grass cover, Good, HSG C |
| 40,745 | 79 | 76 | Weighted Average, UI Adjusted |
| 31,122 | | | 76.38% Pervious Area |
| 9,623 | | | 23.62% Impervious Area |
| 9,623 | | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.5 | 50 | 0.0200 | 0.07 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10" |
| 4.5 | 215 | 0.0250 | 0.79 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 17.0 | 265 | Total | | | |

## Subcatchment 1: SC-1



## Summary for Subcatchment 2: SC-2

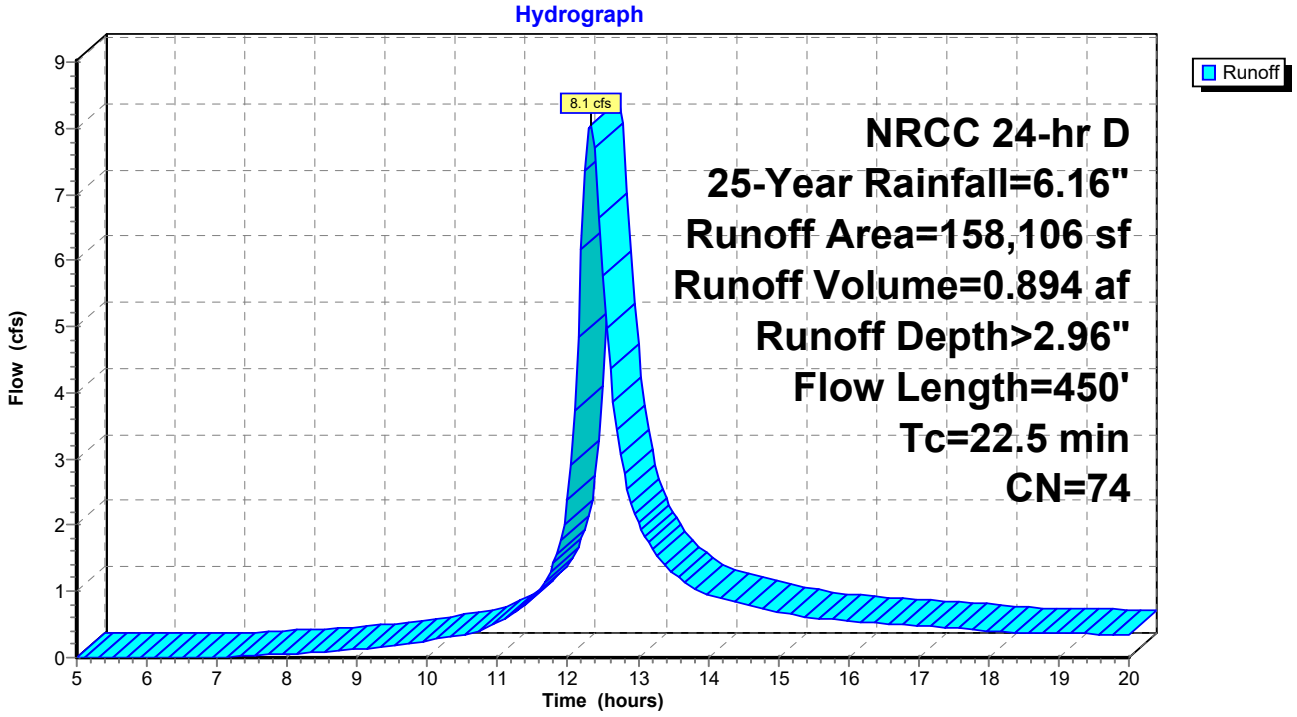
Runoff = 8.1 cfs @ 12.32 hrs, Volume= 0.894 af, Depth> 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.16"

| Area (sf) | CN | Description |
|---|---|---|
| 1,432 | 98 | Unconnected pavement, HSG C |
| 966 | 98 | Unconnected roofs, HSG C |
| 109,752 | 74 | >75% Grass cover, Good, HSG C |
| 45,956 | 73 | Woods, Fair, HSG C |
| 158,106 | 74 | Weighted Average |
| 155,708 | | 98.48% Pervious Area |
| 2,398 | | 1.52% Impervious Area |
| 2,398 | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 16.5 | 50 | 0.0100 | 0.05 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10" |
| 6.0 | 400 | 0.0500 | 1.12 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 22.5 | 450 | Total | | | |

## Subcatchment 2: SC-2

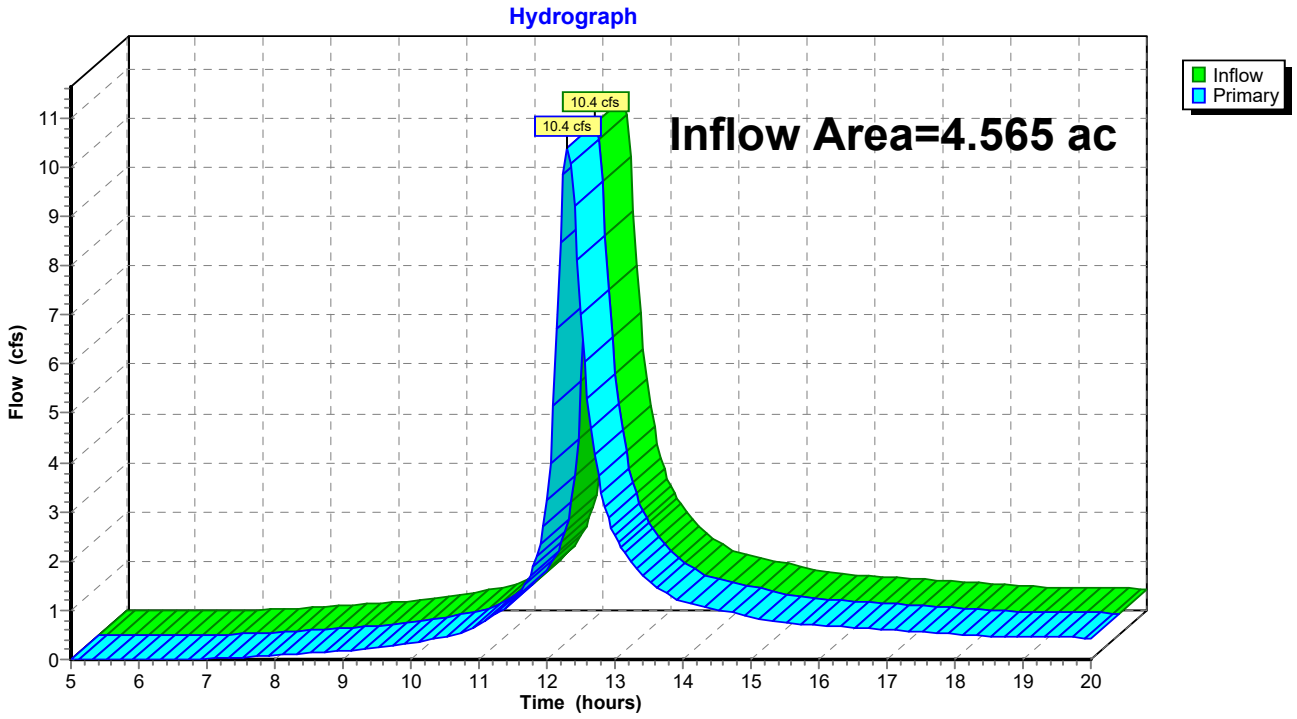


## Summary for Link 3: Pre-Dev Total

Inflow Area = 4.565 ac, 6.05% Impervious, Inflow Depth > 3.00" for 25-Year event
Inflow = 10.4 cfs @ 12.31 hrs, Volume= 1.140 af
Primary = 10.4 cfs @ 12.31 hrs, Volume= 1.140 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Link 3: Pre-Dev Total



## Summary for Subcatchment 4: SC-5

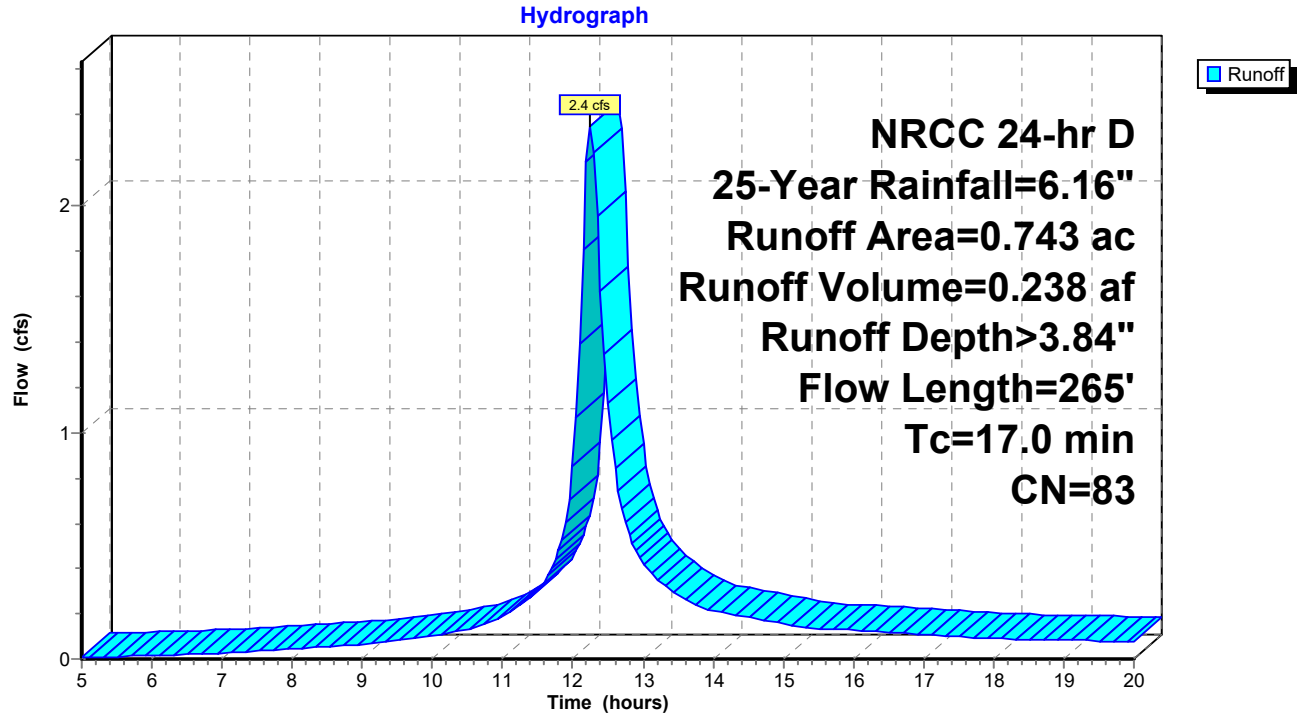
Runoff = 2.4 cfs @ 12.25 hrs, Volume= 0.238 af, Depth> 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.16"

| Area (ac) | CN | Description |
|---|---|---|
| 0.251 | 98 | Paved parking, HSG C |
| 0.024 | 98 | Unconnected pavement, HSG C |
| 0.012 | 98 | Unconnected roofs, HSG C |
| 0.336 | 74 | >75% Grass cover, Good, HSG C |
| 0.120 | 73 | Woods, Fair, HSG C |
| 0.743 | 83 | Weighted Average |
| 0.456 | | 61.37% Pervious Area |
| 0.287 | | 38.63% Impervious Area |
| 0.036 | | 12.54% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.5 | 50 | 0.0200 | 0.07 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10" |
| 4.5 | 215 | 0.0250 | 0.79 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 17.0 | 265 | Total | | | |

## Subcatchment 4: SC-5



## Summary for Subcatchment 5: SC-6

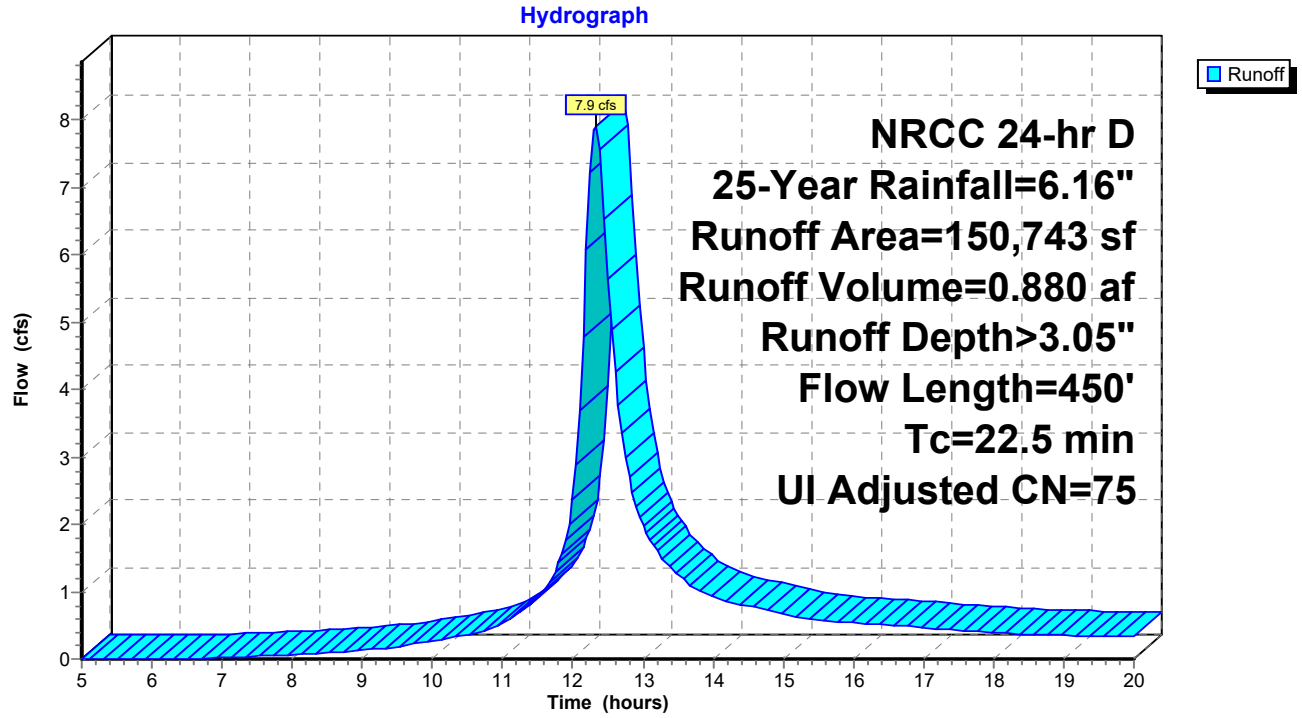
Runoff = 7.9 cfs @ 12.32 hrs, Volume= 0.880 af, Depth> 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.16"

| Area (sf) | CN | Adj | Description |
|---|---|---|---|
| 2,642 | 98 | | Unconnected pavement, HSG C |
| 3,767 | 98 | | Unconnected pavement, HSG C |
| 12,049 | 98 | | Unconnected roofs, HSG C |
| 105,931 | 74 | | >75% Grass cover, Good, HSG C |
| 26,354 | 73 | | Woods, Fair, HSG C |
| 150,743 | 77 | 75 | Weighted Average, UI Adjusted |
| 132,285 | | | 87.76% Pervious Area |
| 18,458 | | | 12.24% Impervious Area |
| 18,458 | | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 16.5 | 50 | 0.0100 | 0.05 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10" |
| 6.0 | 400 | 0.0500 | 1.12 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 22.5 | 450 | Total | | | |

## Subcatchment 5: SC-6



## Summary for Pond 6: Basin

Inflow Area = 4.204 ac, 16.91% Impervious, Inflow Depth > 3.19" for 25-Year event
Inflow = 10.1 cfs @ 12.31 hrs, Volume= 1.118 af
Outflow = 7.9 cfs @ 12.45 hrs, Volume= 1.054 af, Atten= 22%, Lag= 8.8 min
Discarded = 0.0 cfs @ 12.45 hrs, Volume= 0.017 af
Primary = 7.9 cfs @ 12.45 hrs, Volume= 1.037 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 288.07' @ 12.45 hrs Surf.Area= 5,238 sf Storage= 8,504 cf

Plug-Flow detention time= 46.2 min calculated for 1.050 af (94% of inflow)
Center-of-Mass det. time= 25.5 min ( 827.6 - 802.1 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 286.00' | 20,825 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

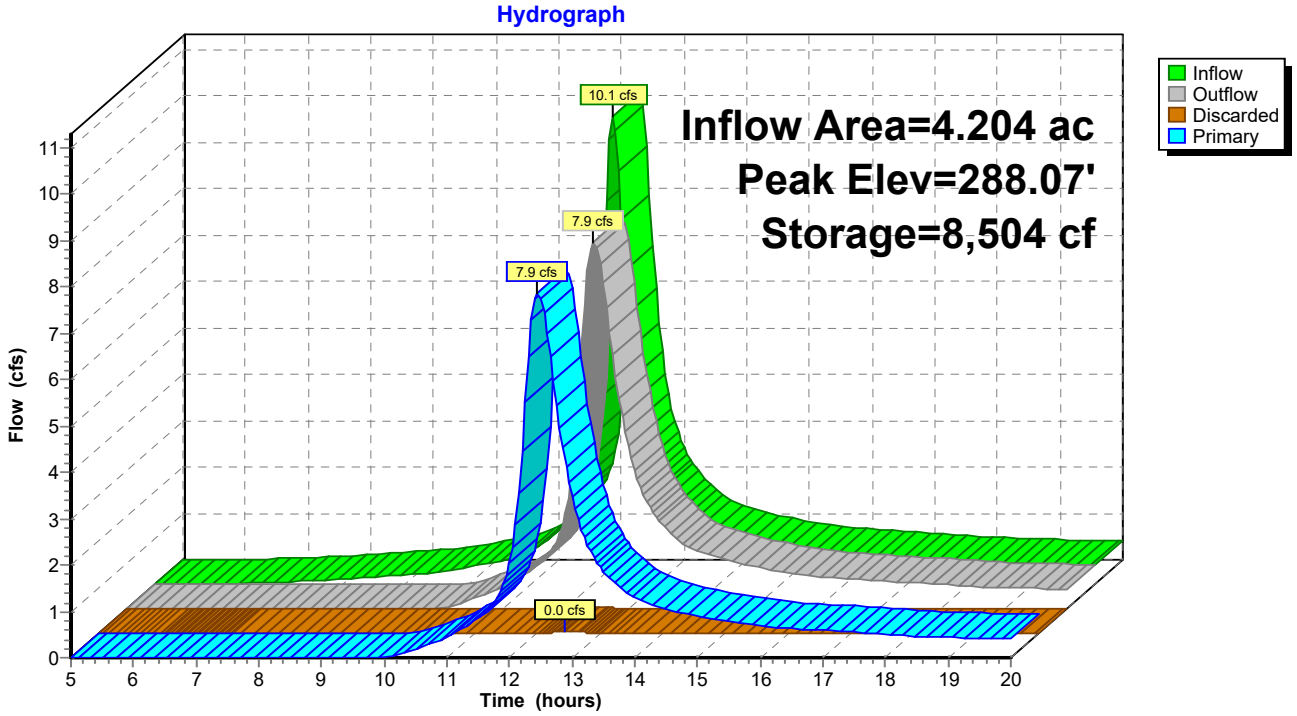
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 286.00 | 2,975 | 0 | 0 |
| 288.00 | 5,150 | 8,125 | 8,125 |
| 290.00 | 7,550 | 12,700 | 20,825 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 286.00' | **0.170 in/hr Exfiltration over Surface area** |
| #2 | Primary | 286.50' | **12.0" Vert. Orifice/Grate** C= 0.600 |
| #3 | Primary | 287.00' | **15.0" Vert. Orifice/Grate** C= 0.600 |

**Discarded OutFlow** Max=0.0 cfs @ 12.45 hrs HW=288.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

**Primary OutFlow** Max=7.9 cfs @ 12.45 hrs HW=288.07' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 3.9 cfs @ 4.99 fps)
└**3=Orifice/Grate** (Orifice Controls 4.0 cfs @ 3.53 fps)

## Pond 6: Basin


Hydrograph
Inflow Area=4.204 ac
Peak Elev=288.07'
Storage=8,504 cf
10.1 cfs
7.9 cfs
7.9 cfs
0.0 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
7
8
9
10
11
5
6
7
8
9
10
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14
15
16
17
18
19
20

## Summary for Subcatchment 7: SC-7

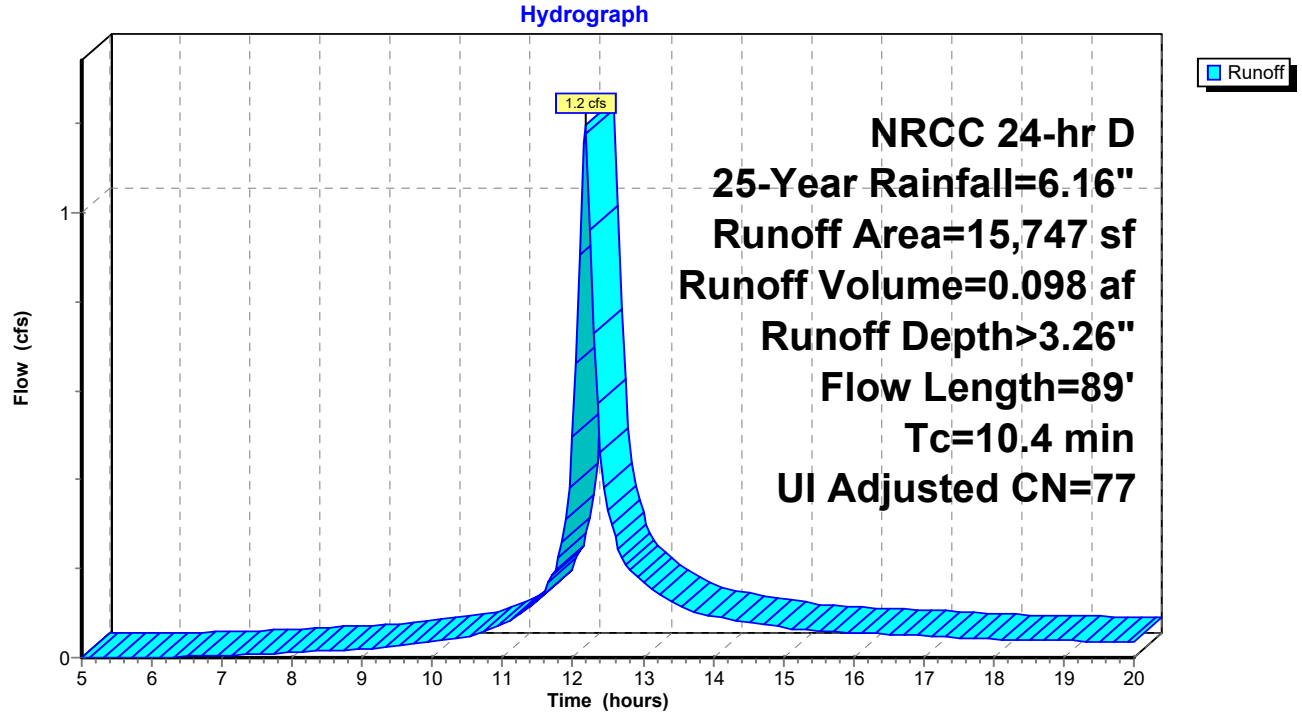
Runoff = 1.2 cfs @ 12.18 hrs, Volume= 0.098 af, Depth> 3.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.16"

| Area (sf) | CN | Adj | Description |
|---|---|---|---|
| 3,412 | 98 | | Unconnected pavement, HSG C |
| 1,065 | 98 | | Unconnected roofs, HSG C |
| 8,684 | 74 | | >75% Grass cover, Good, HSG C |
| 2,586 | 73 | | Woods, Fair, HSG C |
| 15,747 | 81 | 77 | Weighted Average, UI Adjusted |
| 11,270 | | | 71.57% Pervious Area |
| 4,477 | | | 28.43% Impervious Area |
| 4,477 | | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.1 | 38 | 0.0200 | 0.06 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10" |
| 0.3 | 51 | 0.0300 | 2.79 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 10.4 | 89 | Total | | | |

## Subcatchment 7: SC-7

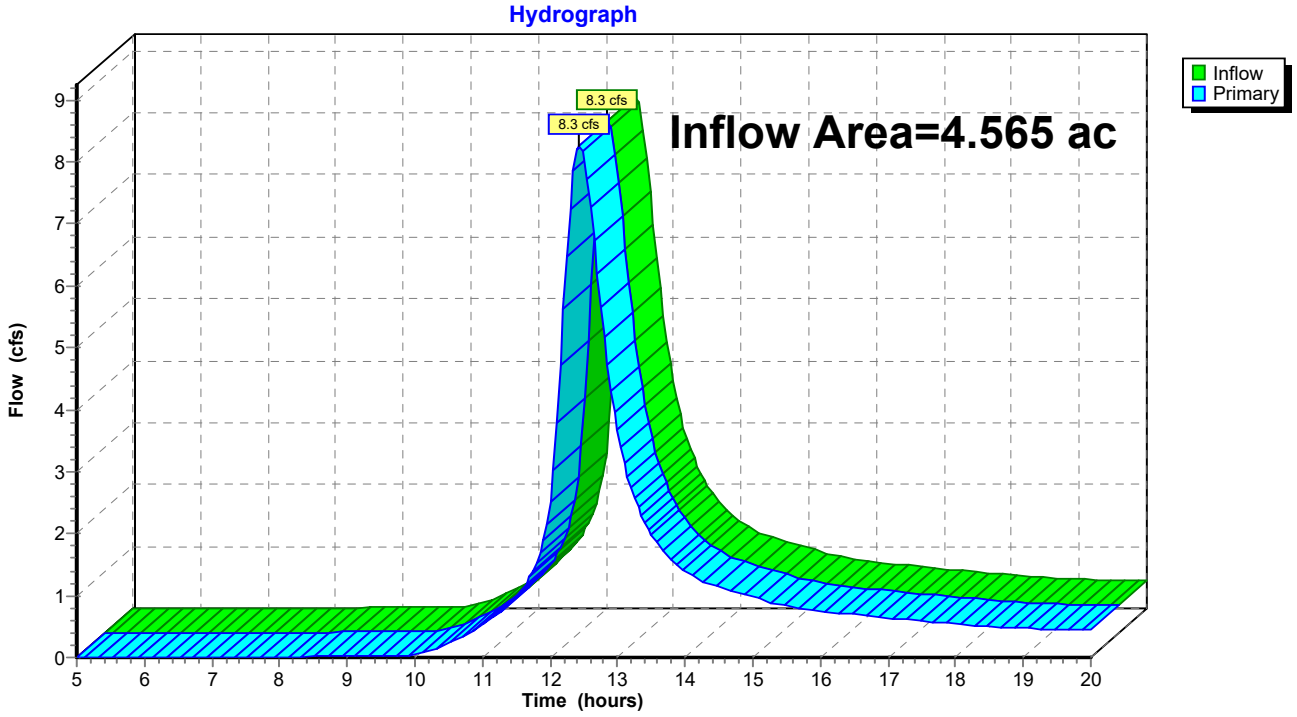


## Summary for Link 8: Post-Dev Total

Inflow Area = 4.565 ac, 17.82% Impervious, Inflow Depth > 2.98" for 25-Year event
Inflow = 8.3 cfs @ 12.44 hrs, Volume= 1.135 af
Primary = 8.3 cfs @ 12.44 hrs, Volume= 1.135 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Link 8: Post-Dev Total



## Summary for Subcatchment 9: From SC-5

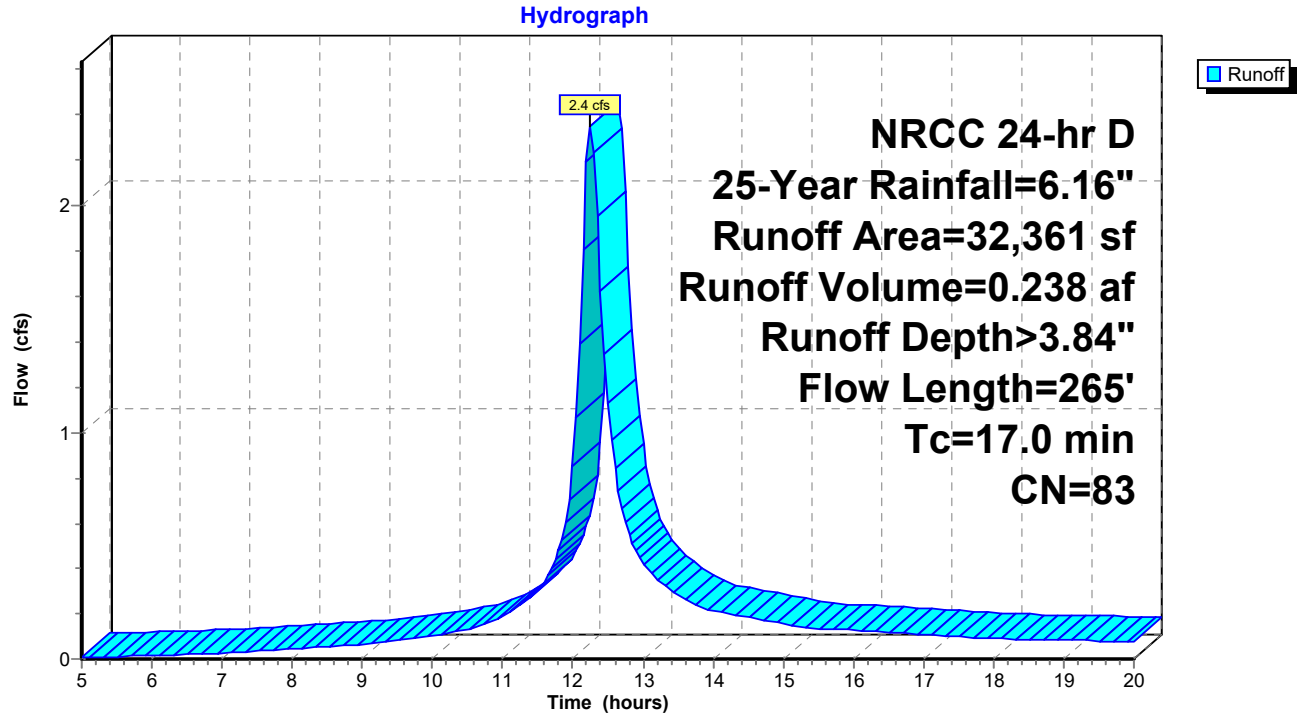
Runoff = 2.4 cfs @ 12.25 hrs, Volume= 0.238 af, Depth> 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.16"

| Area (sf) | CN | Description |
|---|---|---|
| 10,920 | 98 | Paved parking, HSG C |
| 1,060 | 98 | Unconnected pavement, HSG C |
| 501 | 98 | Unconnected roofs, HSG C |
| 14,637 | 74 | >75% Grass cover, Good, HSG C |
| 5,243 | 73 | Woods, Fair, HSG C |
| 32,361 | 83 | Weighted Average |
| 19,880 | | 61.43% Pervious Area |
| 12,481 | | 38.57% Impervious Area |
| 1,561 | | 12.51% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.5 | 50 | 0.0200 | 0.07 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10" |
| 4.5 | 215 | 0.0250 | 0.79 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 17.0 | 265 | Total | | | |

## Subcatchment 9: From SC-5



## Summary for Reach 10R: Water Treatment Swale

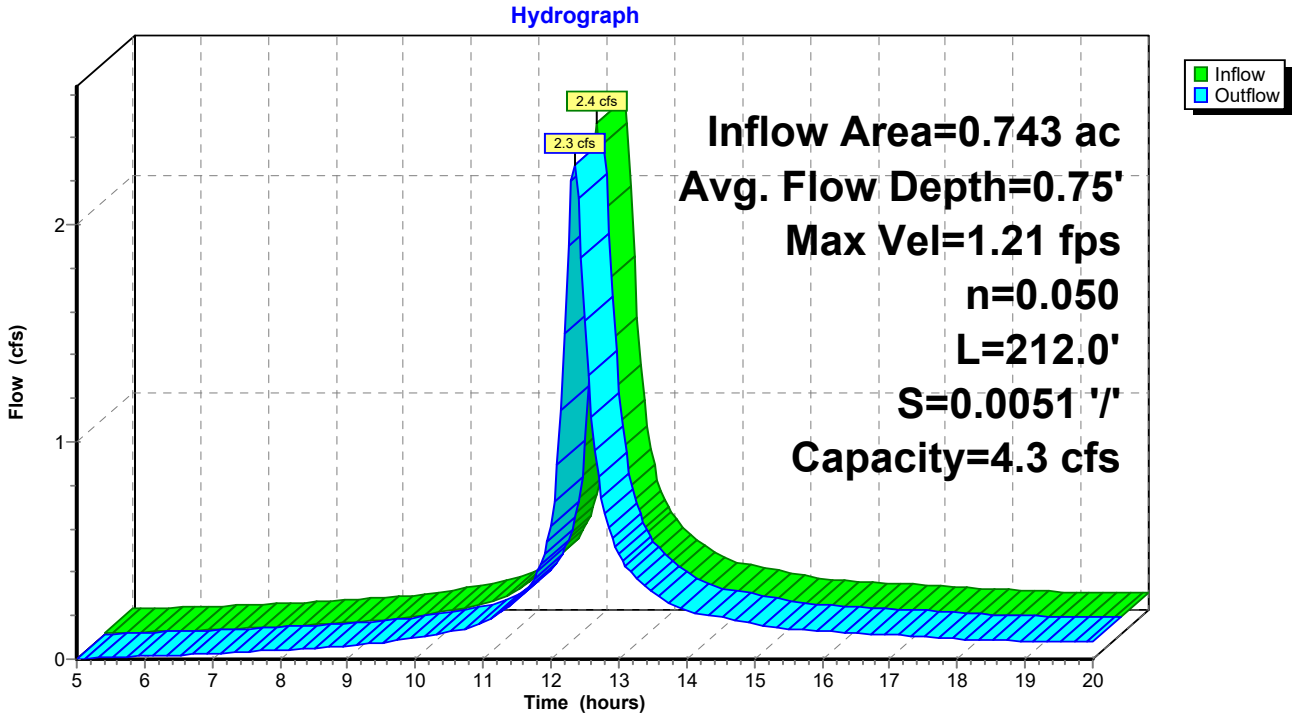
Inflow Area = 0.743 ac, 38.57% Impervious, Inflow Depth > 3.84" for 25-Year event
Inflow = 2.4 cfs @ 12.25 hrs, Volume= 0.238 af
Outflow = 2.3 cfs @ 12.34 hrs, Volume= 0.237 af, Atten= 3%, Lag= 5.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.21 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 0.53 fps, Avg. Travel Time= 6.7 min

Peak Storage= 397 cf @ 12.29 hrs
Average Depth at Peak Storage= 0.75'
Bank-Full Depth= 1.00' Flow Area= 3.0 sf, Capacity= 4.3 cfs

1.00' x 1.00' deep channel, n= 0.050 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 212.0' Slope= 0.0051 '/'
Inlet Invert= 290.00', Outlet Invert= 288.91'

## Reach 10R: Water Treatment Swale



## Summary for Pond 11P: Basin

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 286.00' | 20,458 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

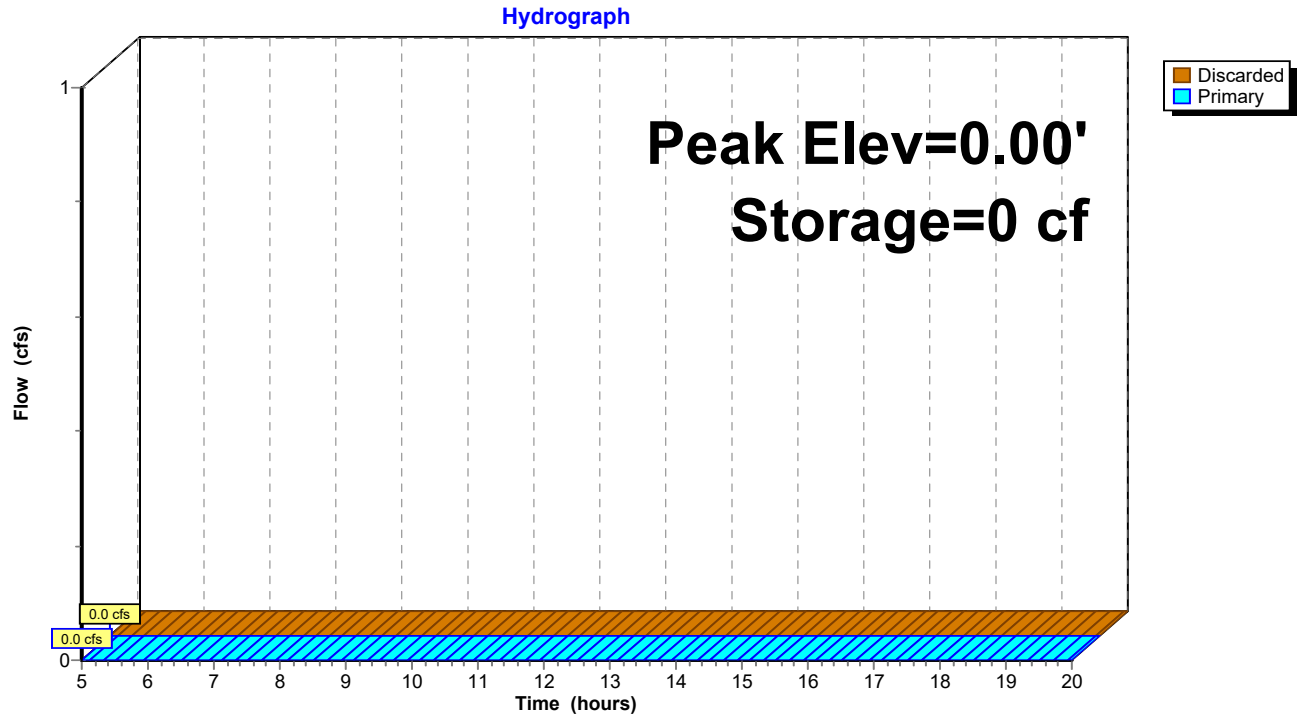
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 286.00 | 2,910 | 0 | 0 |
| 286.50 | 3,450 | 1,590 | 1,590 |
| 288.00 | 5,060 | 6,383 | 7,973 |
| 290.00 | 7,425 | 12,485 | 20,458 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 286.00' | **0.170 in/hr Exfiltration over Surface area** |
| #2 | Primary | 286.50' | **12.0" Vert. Orifice/Grate** C= 0.600 |
| #3 | Primary | 287.00' | **15.0" Vert. Orifice/Grate** C= 0.600 |

**Discarded OutFlow** Max=0.0 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
└**1=Exfiltration** ( Controls 0.0 cfs)

**Primary OutFlow** Max=0.0 cfs @ 5.00 hrs HW=0.00' (Free Discharge)
├**2=Orifice/Grate** ( Controls 0.0 cfs)
└**3=Orifice/Grate** ( Controls 0.0 cfs)

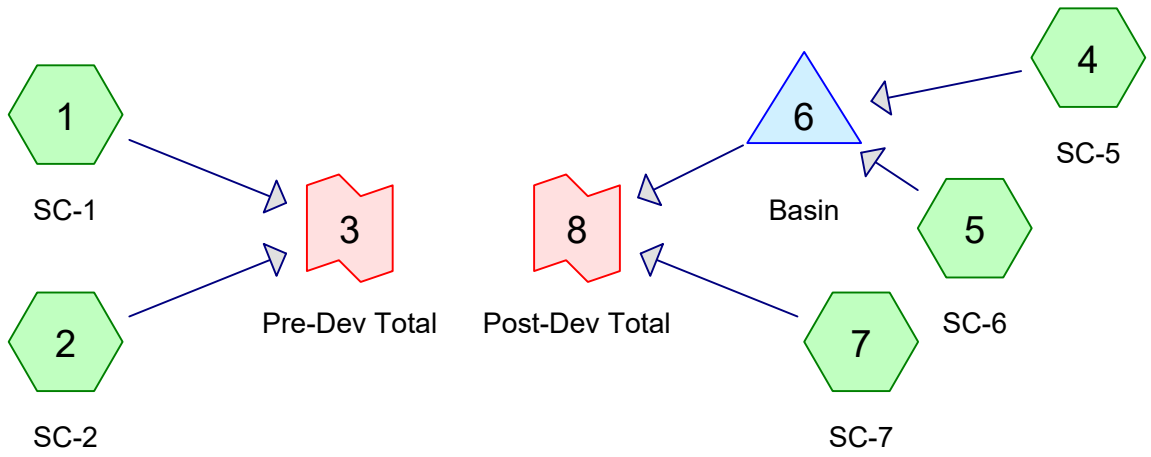
### Pond 11P: Basin



*iii. Runoff and Mitigation Design Summary Calculations*

*2, 10, 25 & 100-Year Design Storm Events Summary Calculations*

*See Following Pages*




Subcat Reach Pond Link

**Routing Diagram for 42215 Original 2024-05-26**
Prepared by DK Engineering LLC, Printed 5/26/2024

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1: SC-1** Runoff Area=40,745 sf 23.62% Impervious Runoff Depth>0.97"
Flow Length=265' Tc=17.0 min UI Adjusted CN=76 Runoff=0.8 cfs 0.076 af

**Subcatchment2: SC-2** Runoff Area=158,106 sf 1.52% Impervious Runoff Depth>0.86"
Flow Length=450' Tc=22.5 min CN=74 Runoff=2.3 cfs 0.261 af

**Link 3: Pre-Dev Total** Inflow=3.0 cfs 0.337 af
Primary=3.0 cfs 0.337 af

**Subcatchment4: SC-5** Runoff Area=0.743 ac 38.63% Impervious Runoff Depth>1.39"
Flow Length=265' Tc=17.0 min CN=83 Runoff=0.9 cfs 0.086 af

**Subcatchment5: SC-6** Runoff Area=150,743 sf 12.24% Impervious Runoff Depth>0.91"
Flow Length=450' Tc=22.5 min UI Adjusted CN=75 Runoff=2.3 cfs 0.264 af

**Pond 6: Basin** Peak Elev=287.19' Storage=4,318 cf Inflow=3.1 cfs 0.350 af
Discarded=0.0 cfs 0.012 af Primary=1.8 cfs 0.284 af Outflow=1.8 cfs 0.297 af

**Subcatchment7: SC-7** Runoff Area=15,747 sf 28.43% Impervious Runoff Depth>1.03"
Flow Length=89' Tc=10.4 min UI Adjusted CN=77 Runoff=0.4 cfs 0.031 af

**Link 8: Post-Dev Total** Inflow=1.9 cfs 0.315 af
Primary=1.9 cfs 0.315 af

**Total Runoff Area = 9.130 ac Runoff Volume = 0.718 af Average Runoff Depth = 0.94"**
**88.07% Pervious = 8.041 ac 11.93% Impervious = 1.089 ac**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1: SC-1** Runoff Area=40,745 sf 23.62% Impervious Runoff Depth>2.13"
Flow Length=265' Tc=17.0 min UI Adjusted CN=76 Runoff=1.7 cfs 0.166 af

**Subcatchment2: SC-2** Runoff Area=158,106 sf 1.52% Impervious Runoff Depth>1.96"
Flow Length=450' Tc=22.5 min CN=74 Runoff=5.4 cfs 0.594 af

**Link 3: Pre-Dev Total** Inflow=7.0 cfs 0.760 af
Primary=7.0 cfs 0.760 af

**Subcatchment4: SC-5** Runoff Area=0.743 ac 38.63% Impervious Runoff Depth>2.72"
Flow Length=265' Tc=17.0 min CN=83 Runoff=1.7 cfs 0.169 af

**Subcatchment5: SC-6** Runoff Area=150,743 sf 12.24% Impervious Runoff Depth>2.04"
Flow Length=450' Tc=22.5 min UI Adjusted CN=75 Runoff=5.3 cfs 0.589 af

**Pond 6: Basin** Peak Elev=287.72' Storage=6,733 cf Inflow=6.9 cfs 0.758 af
Discarded=0.0 cfs 0.015 af Primary=5.3 cfs 0.683 af Outflow=5.4 cfs 0.698 af

**Subcatchment7: SC-7** Runoff Area=15,747 sf 28.43% Impervious Runoff Depth>2.22"
Flow Length=89' Tc=10.4 min UI Adjusted CN=77 Runoff=0.8 cfs 0.067 af

**Link 8: Post-Dev Total** Inflow=5.6 cfs 0.749 af
Primary=5.6 cfs 0.749 af

**Total Runoff Area = 9.130 ac Runoff Volume = 1.585 af Average Runoff Depth = 2.08"**
**88.07% Pervious = 8.041 ac 11.93% Impervious = 1.089 ac**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1: SC-1** Runoff Area=40,745 sf 23.62% Impervious Runoff Depth>3.15"
Flow Length=265' Tc=17.0 min UI Adjusted CN=76 Runoff=2.5 cfs 0.246 af

**Subcatchment2: SC-2** Runoff Area=158,106 sf 1.52% Impervious Runoff Depth>2.96"
Flow Length=450' Tc=22.5 min CN=74 Runoff=8.1 cfs 0.894 af

**Link 3: Pre-Dev Total** Inflow=10.4 cfs 1.140 af
Primary=10.4 cfs 1.140 af

**Subcatchment4: SC-5** Runoff Area=0.743 ac 38.63% Impervious Runoff Depth>3.84"
Flow Length=265' Tc=17.0 min CN=83 Runoff=2.4 cfs 0.238 af

**Subcatchment5: SC-6** Runoff Area=150,743 sf 12.24% Impervious Runoff Depth>3.05"
Flow Length=450' Tc=22.5 min UI Adjusted CN=75 Runoff=7.9 cfs 0.880 af

**Pond 6: Basin** Peak Elev=288.07' Storage=8,504 cf Inflow=10.1 cfs 1.118 af
Discarded=0.0 cfs 0.017 af Primary=7.9 cfs 1.037 af Outflow=7.9 cfs 1.054 af

**Subcatchment7: SC-7** Runoff Area=15,747 sf 28.43% Impervious Runoff Depth>3.26"
Flow Length=89' Tc=10.4 min UI Adjusted CN=77 Runoff=1.2 cfs 0.098 af

**Link 8: Post-Dev Total** Inflow=8.3 cfs 1.135 af
Primary=8.3 cfs 1.135 af

**Total Runoff Area = 9.130 ac Runoff Volume = 2.356 af Average Runoff Depth = 3.10"**
**88.07% Pervious = 8.041 ac 11.93% Impervious = 1.089 ac**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1: SC-1** Runoff Area=40,745 sf 23.62% Impervious Runoff Depth>5.45"
Flow Length=265' Tc=17.0 min UI Adjusted CN=76 Runoff=4.2 cfs 0.425 af

**Subcatchment2: SC-2** Runoff Area=158,106 sf 1.52% Impervious Runoff Depth>5.20"
Flow Length=450' Tc=22.5 min CN=74 Runoff=13.9 cfs 1.574 af

**Link 3: Pre-Dev Total** Inflow=17.9 cfs 1.999 af
Primary=17.9 cfs 1.999 af

**Subcatchment4: SC-5** Runoff Area=0.743 ac 38.63% Impervious Runoff Depth>6.25"
Flow Length=265' Tc=17.0 min CN=83 Runoff=3.7 cfs 0.387 af

**Subcatchment5: SC-6** Runoff Area=150,743 sf 12.24% Impervious Runoff Depth>5.32"
Flow Length=450' Tc=22.5 min UI Adjusted CN=75 Runoff=13.6 cfs 1.535 af

**Pond 6: Basin** Peak Elev=288.90' Storage=13,273 cf Inflow=17.0 cfs 1.922 af
Discarded=0.0 cfs 0.019 af Primary=11.9 cfs 1.831 af Outflow=11.9 cfs 1.850 af

**Subcatchment7: SC-7** Runoff Area=15,747 sf 28.43% Impervious Runoff Depth>5.58"
Flow Length=89' Tc=10.4 min UI Adjusted CN=77 Runoff=2.0 cfs 0.168 af

**Link 8: Post-Dev Total** Inflow=12.5 cfs 1.999 af
Primary=12.5 cfs 1.999 af

**Total Runoff Area = 9.130 ac Runoff Volume = 4.090 af Average Runoff Depth = 5.38"**
**88.07% Pervious = 8.041 ac 11.93% Impervious = 1.089 ac**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment1: SC-1** Runoff Area=40,745 sf 23.62% Impervious Runoff Depth>0.03"
Flow Length=265' Tc=17.0 min UI Adjusted CN=76 Runoff=0.0 cfs 0.002 af

**Subcatchment2: SC-2** Runoff Area=158,106 sf 1.52% Impervious Runoff Depth>0.01"
Flow Length=450' Tc=22.5 min CN=74 Runoff=0.0 cfs 0.004 af

**Link 3: Pre-Dev Total** Inflow=0.0 cfs 0.006 af
Primary=0.0 cfs 0.006 af

**Subcatchment4: SC-5** Runoff Area=0.743 ac 38.63% Impervious Runoff Depth>0.11"
Flow Length=265' Tc=17.0 min CN=83 Runoff=0.0 cfs 0.007 af

**Subcatchment5: SC-6** Runoff Area=150,743 sf 12.24% Impervious Runoff Depth>0.02"
Flow Length=450' Tc=22.5 min UI Adjusted CN=75 Runoff=0.0 cfs 0.006 af

**Pond 6: Basin** Peak Elev=286.07' Storage=216 cf Inflow=0.0 cfs 0.012 af
Discarded=0.0 cfs 0.007 af Primary=0.0 cfs 0.000 af Outflow=0.0 cfs 0.007 af

**Subcatchment7: SC-7** Runoff Area=15,747 sf 28.43% Impervious Runoff Depth>0.03"
Flow Length=89' Tc=10.4 min UI Adjusted CN=77 Runoff=0.0 cfs 0.001 af

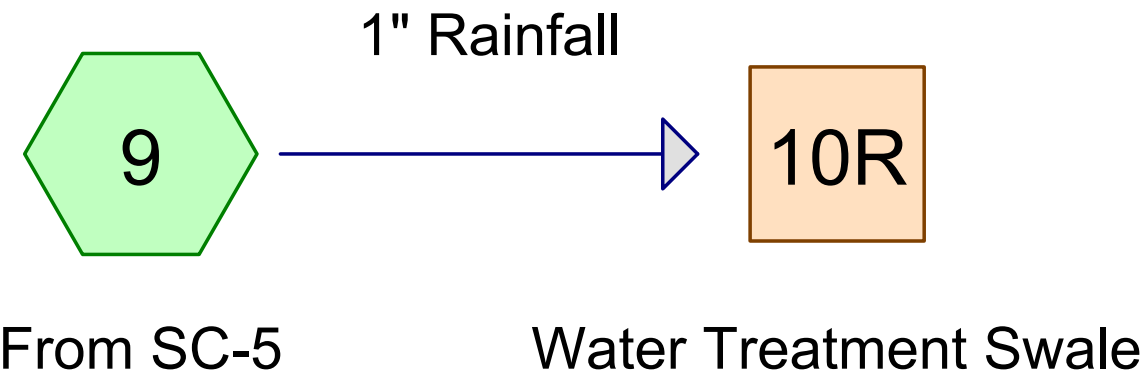
**Link 8: Post-Dev Total** Inflow=0.0 cfs 0.001 af
Primary=0.0 cfs 0.001 af

**Total Runoff Area = 9.130 ac Runoff Volume = 0.019 af Average Runoff Depth = 0.03"**
**88.07% Pervious = 8.041 ac 11.93% Impervious = 1.089 ac**

*iv. Water Treatment Swale Design*

*1" Rainfall Design*

*See Following Pages*




Subcat Reach Pond Link

**Routing Diagram for 42215 Original 2024-05-26**
Prepared by DK Engineering LLC, Printed 5/26/2024

## Summary for Subcatchment 9: From SC-5

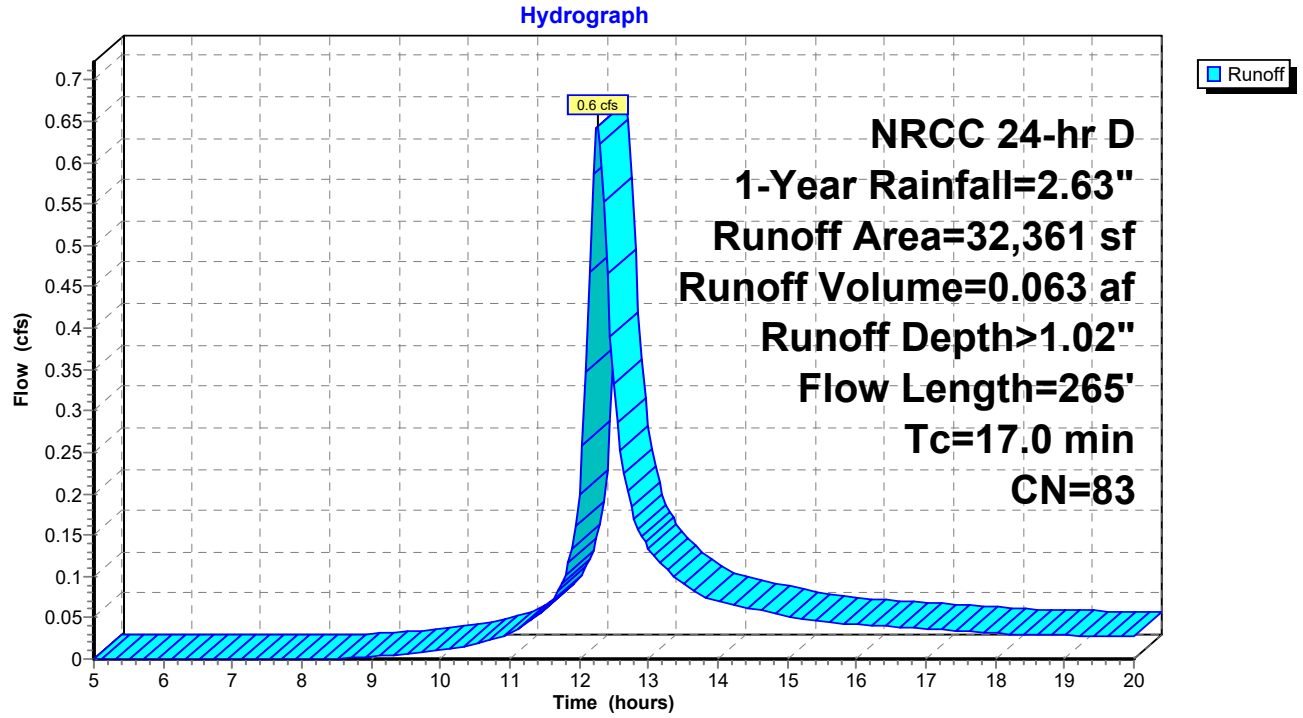
Runoff = 0.6 cfs @ 12.26 hrs, Volume= 0.063 af, Depth> 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-Year Rainfall=2.63"

| Area (sf) | CN | Description |
|---|---|---|
| 10,920 | 98 | Paved parking, HSG C |
| 1,060 | 98 | Unconnected pavement, HSG C |
| 501 | 98 | Unconnected roofs, HSG C |
| 14,637 | 74 | >75% Grass cover, Good, HSG C |
| 5,243 | 73 | Woods, Fair, HSG C |
| 32,361 | 83 | Weighted Average |
| 19,880 | | 61.43% Pervious Area |
| 12,481 | | 38.57% Impervious Area |
| 1,561 | | 12.51% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.5 | 50 | 0.0200 | 0.07 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10" |
| 4.5 | 215 | 0.0250 | 0.79 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 17.0 | 265 | Total | | | |

## Subcatchment 9: From SC-5



## Summary for Reach 10R: Water Treatment Swale

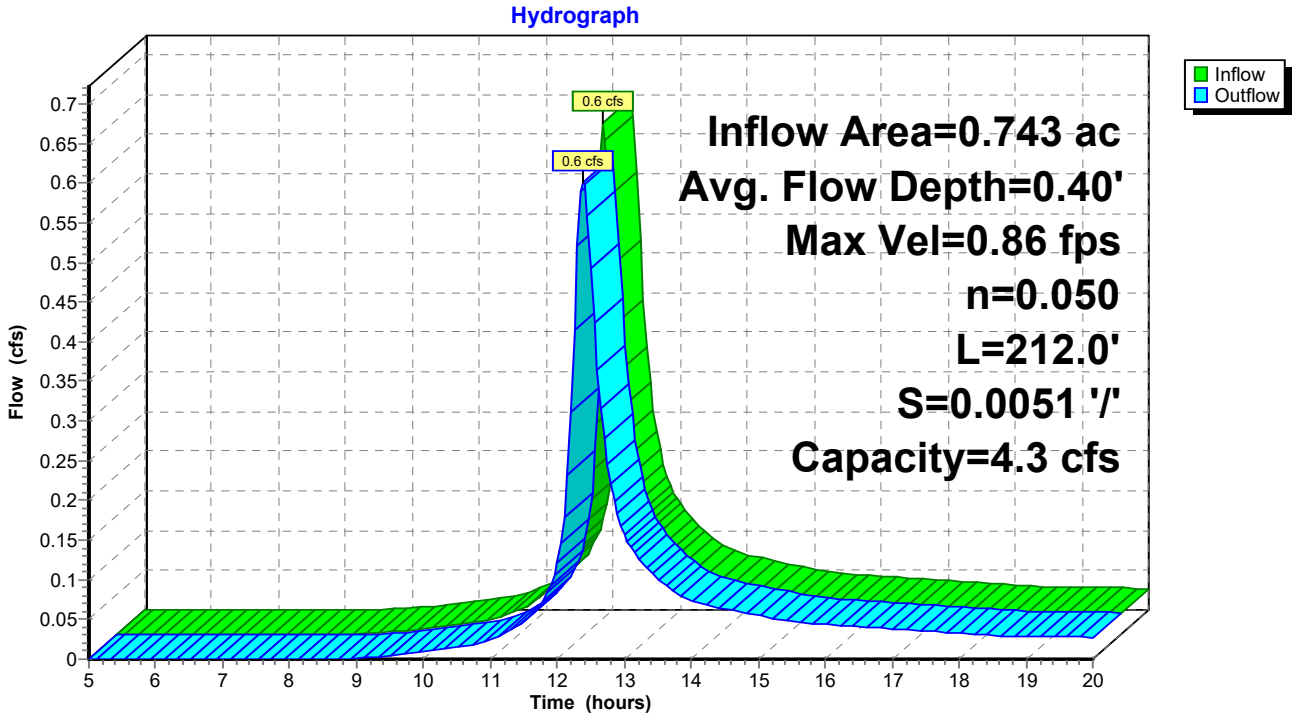
Inflow Area = 0.743 ac, 38.57% Impervious, Inflow Depth > 1.02" for 1-Year event
Inflow = 0.6 cfs @ 12.26 hrs, Volume= 0.063 af
Outflow = 0.6 cfs @ 12.38 hrs, Volume= 0.062 af, Atten= 7%, Lag= 7.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.86 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 0.38 fps, Avg. Travel Time= 9.3 min

Peak Storage= 150 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00' Flow Area= 3.0 sf, Capacity= 4.3 cfs

1.00' x 1.00' deep channel, n= 0.050 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 212.0' Slope= 0.0051 '/'
Inlet Invert= 290.00', Outlet Invert= 288.91'

## Reach 10R: Water Treatment Swale



## V. Hydraulic Analysis ~ (100-Year Design Storm)

*See Following Pages*

# FL-DOT Report



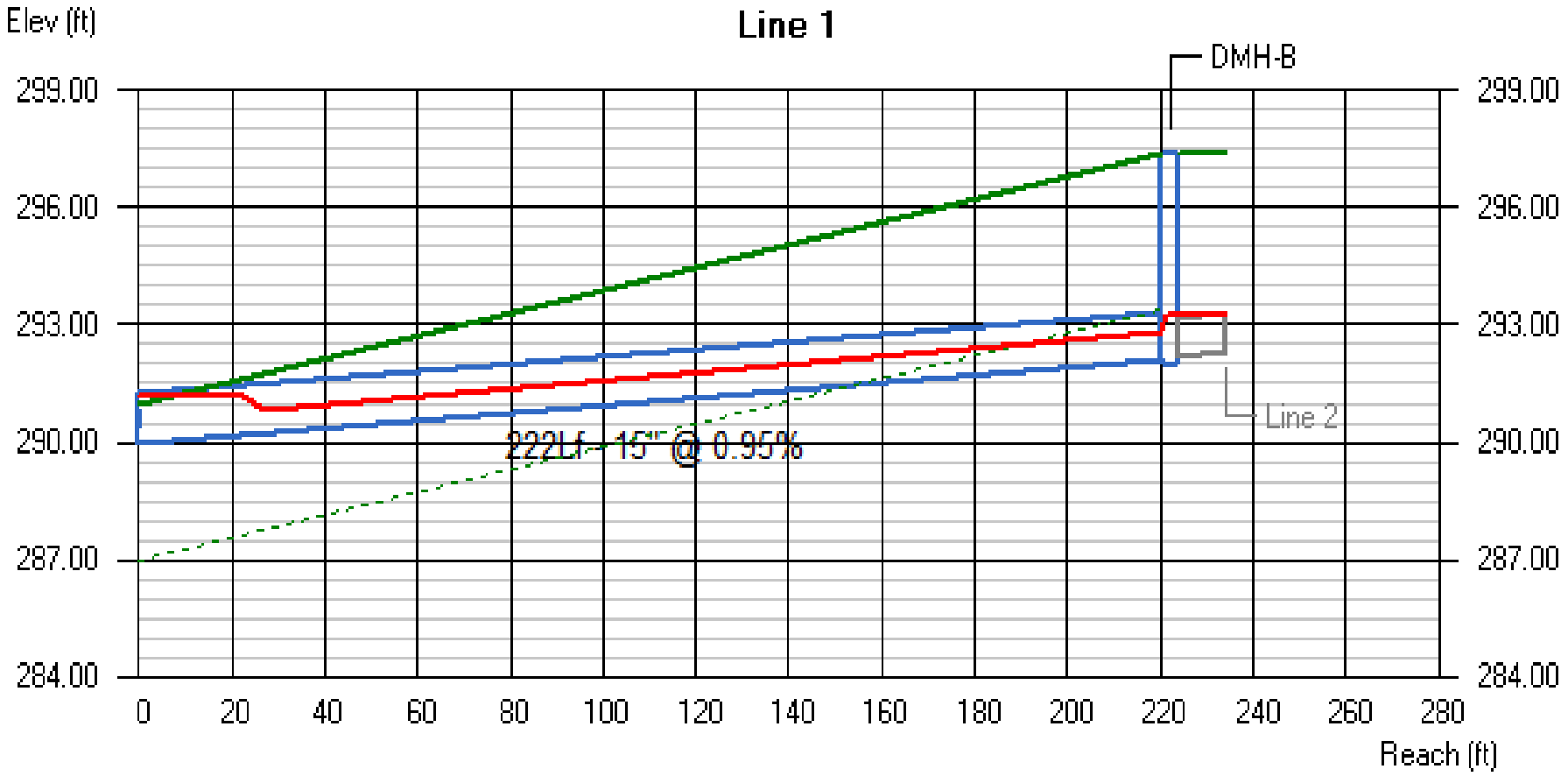
| Line No | To Line | Type of struc | n - value | Len | Drainage Area | | | Time of conc | Time of flow in sect | Inten (I) | Total CA | Add Q | Inlet elev | Elev of HGL | | | Rise | HGL | Actual | | Date: 05-26-2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | C1 = 0.2<br>C2 = 0.5<br>C3 = 0.9 | | | | | | | Total flow | | Elev of Crown | | | Span | Pipe | Full Flow | | Frequency: 100 yrs |
| | | | | | | | | | | | | | | Elev of Invert | | | | | | | Proj: 42215 ~ Pipes.stm |
| | | | | | Increment (ac) | Sub-total (ac) | Sum CA | | | | | Q | | Up | Down | Fall | Size | Slope | Vel | Cap | |
| | | | | (ft) | | | | (min) | (min) | (in/hr) | | (cfs) | (ft) | (ft) | (ft) | (ft) | (in) | (%) | (ft/s) | (cfs) | Line description |
| 1 | End | MH | 0.010 | 222 | 0.00 | 0.12 | 0.02 | 17.33 | 1.07 | 6.90 | 0.45 | 0.00 | 297.40 | 292.81 | 291.21 | 1.60 | 15 | 0.72 | 3.46 | 3.12 | |
| | | | | | 0.00 | 0.34 | 0.17 | | | | | 3.12 | | 293.35 | 291.25 | | 15 | 0.95 | 6.65 | 8.16 | |
| | | | | | 0.00 | 0.29 | 0.26 | | | | | | | 292.10 | 290.00 | 2.10 | Cir | | | | |
| 2 | 1 | MH | 0.010 | 55 | 0.00 | 0.12 | 0.02 | 17.13 | 0.20 | 6.93 | 0.45 | 0.00 | 297.40 | 293.50 | 293.22 | 0.28 | 12 | 0.51 | 4.47 | 3.13 | |
| | | | | | 0.00 | 0.34 | 0.17 | | | | | 3.13 | | 293.75 | 293.20 | | 12 | 1.00 | 5.90 | 4.64 | |
| | | | | | 0.00 | 0.29 | 0.26 | | | | | | | 292.75 | 292.20 | 0.55 | Cir | | | | |
| 3 | 2 | Grate | 0.010 | 14 | 0.00 | 0.00 | 0.00 | 17.00 | 0.11 | 6.96 | 0.24 | 0.00 | 297.13 | 294.13 | 294.12 | 0.02 | 12 | 0.13 | 2.10 | 1.65 | |
| | | | | | 0.25 | 0.25 | 0.12 | | | | | 1.65 | | 294.00 | 293.85 | | 12 | 1.06 | 6.08 | 4.77 | |
| | | | | | 0.13 | 0.13 | 0.11 | | | | | | | 293.00 | 292.85 | 0.15 | Cir | | | | |
| 4 | 2 | Grate | 0.010 | 15 | 0.12 | 0.12 | 0.02 | 17.00 | 0.13 | 6.96 | 0.21 | 0.00 | 297.13 | 294.13 | 294.12 | 0.02 | 12 | 0.10 | 1.90 | 1.49 | |
| | | | | | 0.09 | 0.09 | 0.04 | | | | | 1.49 | | 294.00 | 293.85 | | 12 | 1.03 | 5.97 | 4.69 | |
| | | | | | 0.16 | 0.16 | 0.14 | | | | | | | 293.00 | 292.85 | 0.15 | Cir | | | | |

NOTES: Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82 (in/hr)

**42215 ~ SD**

# Line Profile (Line 1)



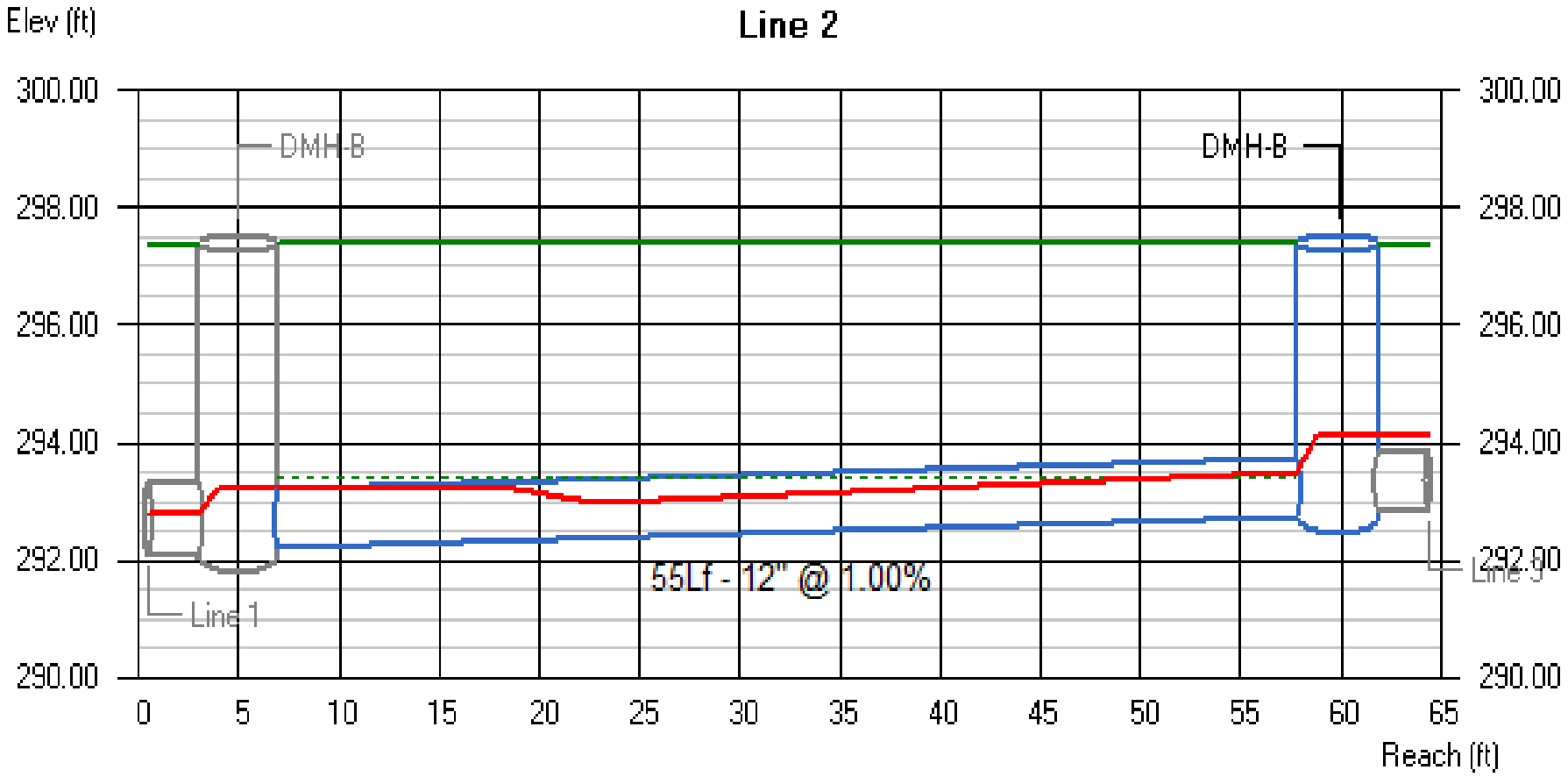



| Line # | Q | Invert Elevation | | Depth of Flow | | | Hydraulic Grade Line | | | Velocity | | Cover | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (cfs) | Dn (ft) | Up (ft) | Dn (ft) | Up (ft) | Hw (ft) | Dn (ft) | Up (ft) | Jnct (ft) | Dn (ft/s) | Up (ft/s) | Dn (ft) | Up (ft) |
| 1 | 3.12 | 290.00 | 292.10 | 1.21 | 0.71 | 1.12 | 291.21 | 292.81 j | 293.22 i | 2.56 | 4.36 | -0.25 | 4.05 |

**42215 ~ SD** | No. Lines: 4 | Run Date: 05-26-2024

# Line Profile (Line 2)



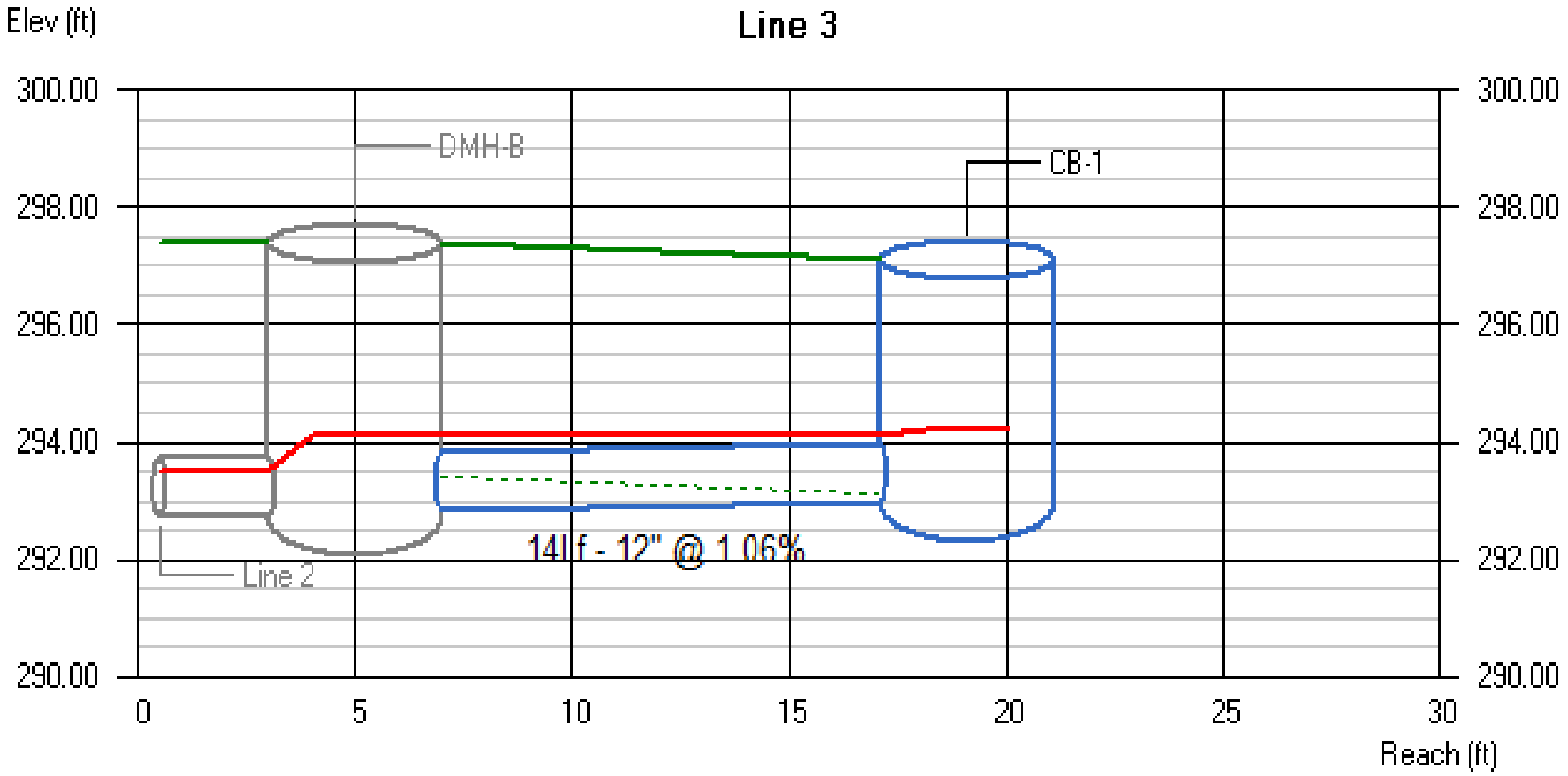



| Line # | Q | Invert Elevation | | Depth of Flow | | | Hydraulic Grade Line | | | Velocity | | Cover | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (cfs) | Dn (ft) | Up (ft) | Dn (ft) | Up (ft) | Hw (ft) | Dn (ft) | Up (ft) | Jnct (ft) | Dn (ft/s) | Up (ft/s) | Dn (ft) | Up (ft) |
| 2 | 3.13 | 292.20 | 292.75 | 1.00 | 0.75 | 1.37 | 293.22 | 293.50 j | 294.12 i | 3.99 | 4.95 | 4.20 | 3.65 |

**42215 ~ SD** | No. Lines: 4 | Run Date: 05-26-2024

# Line Profile (Line 3)



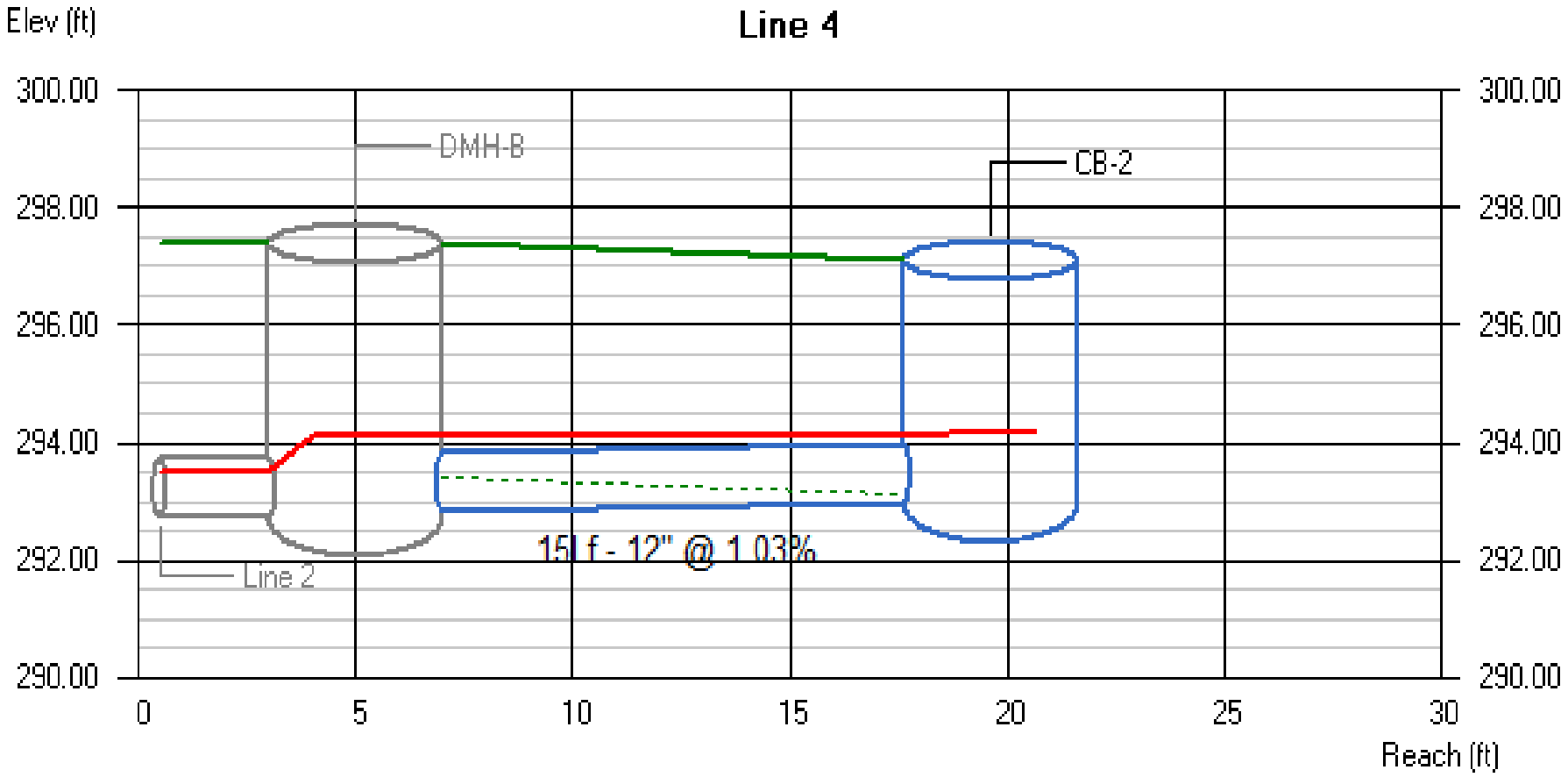



| Line # | Q | Invert Elevation | | Depth of Flow | | | Hydraulic Grade Line | | | Velocity | | Cover | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (cfs) | Dn (ft) | Up (ft) | Dn (ft) | Up (ft) | Hw (ft) | Dn (ft) | Up (ft) | Jnct (ft) | Dn (ft/s) | Up (ft/s) | Dn (ft) | Up (ft) |
| 3 | 1.65 | 292.85 | 293.00 | 1.00 | 1.00 | 1.20 | 294.12 | 294.13 | 294.20 | 2.10 | 2.10 | 3.55 | 3.13 |

**42215 ~ SD** | No. Lines: 4 | Run Date: 05-26-2024

# Line Profile (Line 4)






| Line # | Q | Invert Elevation | | Depth of Flow | | | Hydraulic Grade Line | | | Velocity | | Cover | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (cfs) | Dn (ft) | Up (ft) | Dn (ft) | Up (ft) | Hw (ft) | Dn (ft) | Up (ft) | Jnct (ft) | Dn (ft/s) | Up (ft/s) | Dn (ft) | Up (ft) |
| 4 | 1.49 | 292.85 | 293.00 | 1.00 | 1.00 | 1.19 | 294.12 | 294.13 | 294.19 | 1.90 | 1.90 | 3.55 | 3.13 |

**42215 ~ SD** | No. Lines: 4 | Run Date: 05-26-2024

# VI. Erosion And Sedimentation Control Maintenance Plan

## *i. Soil Erosion & Sediment Control Narrative*

In general, the erosion control methodology to be employed on the site involves the installation of straw wattles (Compost Filter Soxx) as shown on the plans to protect abutting properties. These devices will remain in place until the earth disturbing activity is stabilized with loam and seed and grass is growing. Loam and seeding, are permanent methods of site stabilization while the straw wattles placement is considered temporary erosion control methods. If a significant amount of soil is tracked onto the roadway from the lot construction, then, at the direction of the Town Inspector, street sweeping will be performed.

The disturbed portions of the entire site will be hydroseeded if construction including loaming and seeding has not been completed prior to October 1st of a season. This will provide approximately three (3) or four (4) weeks growing season for the grass, which will serve to stabilize the site to accommodate spring runoff periods. No other methods to stabilize the site for winter construction are necessary.

During construction, and upon completion of construction, the project will require some maintenance of erosion control devices. During construction, straw wattles must be checked every couple of weeks and after rainstorms, repaired and replaced as necessary due to sediment buildup behind it or on the device. After large storm events, the cleaning of sediment may be necessary. If storm events occur after the slopes and other areas, which are stabilized, have been planted but prior to seed germination, then replanting and re-grading of those areas might be necessary. This work will be performed by the developer on an as-needed basis, during the construction phase.

The plan set contains the erosion control layout, while the storm drainage calculations attached hereto describe the soils which are present on the site, as well as the methodology for handling storm water flow on the property.

*ii. Operation and Maintenance Procedures*

Compost Filter Sock

Installation

1. Perimeter control used for control of sediment in storm runoff shall meet Filtrexx Soxx Mesh Material and Filtrexx Certified FilterMedia specifications or equal.
2. Perimeter control will be placed at locations indicated on plans and in a manner as directed by the Engineer or Manufacturer.
3. Perimeter control should be installed parallel to the base of the slope or other disturbed area.
4. Effective Soxx height in the field for 12" diameter Soxx should be = 9.5" high.
5. Stakes should be installed through the middle of the perimeter control on 10 ft centers, using nominal 2 in by 2 in by 3 ft wooden stakes.
6. Staking depth for sand and silt loam soils shall be 12 in.
7. Loose compost may be backfilled along the upslope side of the perimeter control, filling the seam between the soil surface and the device, improving filtration and sediment retention.

Inspection & maintenance

Routine inspection should be conducted within 24 hours of a runoff event or as designated by the regulating authority. Perimeter control should be regularly inspected to make sure they maintain their shape and are producing adequate hydraulic flow-through. If ponding becomes excessive, additional perimeter control may be required to reduce effective slope length or sediment removal may be necessary. Perimeter control shall be inspected until area above has been permanently stabilized and construction activity has ceased.

1. The contractor shall maintain the perimeter control in a functional condition at all times and it shall be routinely inspected.
2. If the perimeter control has been damaged, it shall be repaired, or replaced if beyond repair.
3. The contractor shall remove sediment at the base of the upslope side of the perimeter control when accumulation has reached 1/2 of the effective height of the Soxx, or as directed by the Engineer. Alternatively, a new perimeter control can be placed on top of and slightly behind the original one creating more sediment storage capacity without soil disturbance.

4. Perimeter control shall be maintained until disturbed area above the device has been permanently stabilized and construction activity has ceased.
5. The FilterMedia will be dispersed on site once disturbed area has been permanently stabilized, construction activity has ceased, or as determined by the engineer.
6. For long-term sediment and pollution control applications, perimeter control can be seeded at the time of installation to create a vegetative filtering system for prolonged and increased filtration of sediment (contained vegetative filter strip). The appropriate seed mix shall be determined by the engineer.

## Stabilized Construction Entrance - Developing Areas

### Definition

A stabilized pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk, or parking area shall be provided.

### Purpose

The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights-of-way or streets.

### Conditions Where Practice Applies

A stabilized construction entrance shall be used at all points of construction ingress and egress.

### Design Criteria

1. Aggregate Size - Use 2-inch stone or reclaimed or recycled concrete equivalent.
2. Thickness - Not less than 6 inches.
3. Width - 10-foot minimum but not less than the full width of points where ingress or egress occurs.
4. Length - As required, but not less than 50 feet (except on a single residence lot where a 30-foot minimum would apply).
5. Filter cloth - To be placed over the entire area to be covered with aggregate. Filter cloth will not be required on a single-family residence lot.
6. Piping of surface water under entrance shall be provided as required. If piping is impossible, a mountable berm with 5:1 slopes will be permitted.

Maintenance

The entrance shall be maintained in a condition which will prevent tracking of sediment onto public rights-of-way or streets. This may require periodic topdressing with additional aggregate. All sediment spilled, dropped, or washed onto public rights-of-way must be removed immediately.

When necessary, wheels must be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment trapping device. All sediment shall be prevented from entering storm drains, ditches, or watercourses.

Criteria for Filter Cloth

The filter cloth shall be a woven or non-woven fabric consisting only of continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew, rot resistant, and conform to the properties of the following table:

| Roads | Haul Roads Test Fabric Properties 3/ | Light Duty 1-/ Grade Subgrade | Heavy Duty 2-/ Rough Graded | Method |
|---|---|---|---|---|
| Grab Tensile Strength (lbs.) | 200 | 220 | | ASTM D1682 |
| Elongation at Failure (%) | 50 | 60 | | ASTM D1682 |
| Mullen Burst Strength (lbs.) | 190 | 430 | | ASTM D3786 |
| Puncture Strength (lbs.) | 40 | 125 | | ASTM D751 modified |
| Equivalent Opening Size | 40-80 | 40-80 | | US Std Sieve CW-02215 |
| Aggregate Depth (in.) | 6 | 10 | | -- |

1-/ Light Duty Road: Sites that have been graded to subgrade and where most travel would be single axle vehicles and an occasional multi-axle truck. Trevira Spunbond 1115, Mirafi 100X, Typar 3401, or equivalent.

2-/ Heavy Duty Road: Sites with only rough grading, and where most travel would be multi-axle vehicles. Trevira Spunbond 1135, Mirafi 600X, or equivalent.

3-/ Fabrics not meeting these specifications may be used only when design procedure and supporting documentation are supplied to determine aggregate depth and fabric strength.

# VII. Appendix – Norse Environmental Services ~ Soil Logs

*See Following Pages*

# Soil Suitability Assessment

Site: 9 Bancroft Street
City/Town: Andover, MA
Soil Evaluator/Soil Scientist: Maureen Herald – Norse Environmental Services, Inc.

## A. Facility Information

1. Owner Information:
   Greg Alexandris

   Street Address:
   9 Bancroft Street

   Town:

| Andover | MA | 01810 |
|---|---|---|
| City/Town | State | Zip Code |

## B. Site Information

1. (Check one) New Construction ☐ Upgrade ☐ Repair ☐

2. Published Soil Survey available? Yes ☒ No ☐ If yes: Web Soil Survey (Year Published) 1"=1410 (Publication Scale) 310 (Soil Map Unit)

   Woodbridge (Soil Name) None (Soil limitations)

3. Surficial Geological Report available? Yes ☐ No ☒ If yes: _____ (Year Published) _____ (Publication Scale) _____ (Map Unit)

   _____ (Geologic Material) _____ (Landform)

4. Flood Rate Insurance Map:

   Above the 500-year flood boundary? Yes ☒ No ☐ Within the 100-year flood boundary? Yes ☐ No ☒

   Within the 500-year flood boundary? Yes ☐ No ☒ Within a Velocity Zone? Yes ☐ No ☒

5. Wetland Area: National Wetland Inventory Map _____ (Map Unit) _____ (Name)

   Wetlands Conservancy Program Map _____ (Map Unit) _____ (Name)

6. Current Water Resource Conditions (USGS) Aug/2022 (Month/Year) Range: Above Normal ☐ Normal ☐ Below Normal ☒

7. Other references reviewed: _____

# Soil Suitability Assessment

Site: 9 Bancroft Street
City/Town: Andover, MA
Soil Evaluator/Soil Scientist: Maureen Herald – Norse Environmental Services, Inc.

## C. On-Site Review

**Deep Observation Hole Number:** DH 1 – DH 4 | 12/12/22 (Date) | 10:00 a.m. (Time) | Cloudy - 33F (Weather)

1. Location

   Ground Elevation at Surface of Hole: See Plan

   Location (Identify on Plan): See Plan

2. Land Use: Residential site – farm field (e.g. woodland, agricultural field, vacant lot, etc.) | None (Surface Stones) | Varies (Slope (%))

   Grasses (Vegetation) | Drumloidal (Landform) | Back Slope (Position on landscape (attach sheet))

3. Distances from: Open Water Body >10 ft. feet | Drainage Way >100 ft. feet | Possible Wet Area >100 ft feet

   Property Line >10 ft. feet | Drinking Water Well _____ feet | Other _____

4. Parent Material: Glacial Till | Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☒ No ☐ - Varies throughout the Deep Holes – See next page

   If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

   Estimated Depth to High Groundwater: _____ inches | _____ elevation

# Soil Suitability Assessment

Site: 9 Bancroft Street
City/Town: Andover, MA
Soil Evaluator/Soil Scientist: Maureen Herald – Norse Environmental Services, Inc.

Deep Observation Hole Number: DH-1

| Depth (In.) | Soil Horizon/ Layer | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features (mottles) | | | Soil Texture (USDA) | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Depth | Color | Percent | | Gravel | Cobbles & Stones | | | |
| 0-14” | Ap | 10YR 2/2 | | | | FSL | | | Granular | Friable | |
| 14-33” | Bw | 10YR 5/6 | | | | FSL | | | Weak Blocky | Friable | |
| 33-48” | C | 2.5Y 5/3 | 43” | 7.5YR 5/6 | 20% | SL | | | Massive | Friable | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes: ESHWT 43” / No Observed Water

# Soil Suitability Assessment

Site: 9 Bancroft Street
City/Town: Andover, MA
Soil Evaluator/Soil Scientist: Maureen Herald – Norse Environmental Services, Inc.

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Deep Observation Hole Number: DH-2

| Depth (In.) | Soil Horizon/ Layer | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features (mottles) | | | Soil Texture (USDA) | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Depth | Color | Percent | | Gravel | Cobbles & Stones | | | |
| 0-14” | Ap | 10YR 2/2 | | | | FSL | | | Granular | Friable | |
| 14-28” | Bw | 10YR 5/6 | | | | FSL | | | Weak Blocky | Friable | |
| 28-51” | C | 2.5Y 5/3 | 32” | 7.5YR 5/6 | 20% | SL | | | Massive | Friable | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes: ESHWT 32” / No Observed Water .

# Soil Suitability Assessment

Site: 9 Bancroft Street
City/Town: Andover, MA
Soil Evaluator/Soil Scientist: Maureen Herald – Norse Environmental Services, Inc.

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Deep Observation Hole Number: DH-3

| Depth (In.) | Soil Horizon/ Layer | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features (mottles) | | | Soil Texture (USDA) | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Depth | Color | Percent | | Gravel | Cobbles & Stones | | | |
| 0-14” | Ap | 10YR 2/2 | | | | FSL | | | Granular | Friable | |
| 14-25” | Bw | 10YR 5/6 | | | | FSL | | | Weak Blocky | Friable | |
| 25-55” | C | 2.5Y 5/3 | 43” | 7.5YR 5/6 | 15% | SL | | | Massive | Friable | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes: ESHWT 43”/ No Observed Water

# Soil Suitability Assessment

Site: 9 Bancroft Street
City/Town: Andover, MA
Soil Evaluator/Soil Scientist: Maureen Herald – Norse Environmental Services, Inc.

Deep Observation Hole Number: DH-4

| Depth (In.) | Soil Horizon/ Layer | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features (mottles) | | | Soil Texture (USDA) | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Depth | Color | Percent | | Gravel | Cobbles & Stones | | | |
| 0-9” | Ap | 10YR 2/2 | | | | FSL | | | Granular | Friable | |
| 9-24” | Bw | 10YR 5/6 | | | | FSL | | | Weak Blocky | Friable | |
| 24-51” | C | 2.5Y 5/4 | 43” | 7.5YR 6/6 | 20% | SL | | | Massive | Friable | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes: ESHWT 43” / No Observed Water .

## D. Certification

I certify that I have passed the soil evaluator examination* approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience described in 310 CMR 15.017.

| | |
|---|---|
| Signature of Soil Evaluator | Date |
| Maureen Herald | SE13578 |
| Typed or Printed Name of Soil Evaluator | Soil Evaluator Number |

## E. Test Pit Locations

See Plan

## VIII. Appendix – NRCS Soils Information

*See Following Pages*

Hydrologic Soil Group—Essex County, Massachusetts, Northern Part
(42215 ~ 9 Bancroft Rd, Andover, MA)


Map Scale: 1:1,190 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

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

## MAP LEGEND

**Area of Interest (AOI)**

- Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

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

**Soil Rating Lines**

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

**Soil Rating Points**

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

**Water Features**

- Streams and Canals

**Transportation**

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

**Background**

- Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 18, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

# Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 310A | Woodbridge fine sandy loam, 0 to 3 percent slopes | C/D | 1.8 | 38.1% |
| 310B | Woodbridge fine sandy loam, 3 to 8 percent slopes | C/D | 2.8 | 59.4% |
| 310C | Woodbridge fine sandy loam, 8 to 15 percent slopes | C/D | 0.1 | 2.5% |
| **Totals for Area of Interest** | | | **4.7** | **100.0%** |

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

# Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Some minor components, however, have properties and behavior characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

# Report—Map Unit Description

# Essex County, Massachusetts, Northern Part

## 310A—Woodbridge fine sandy loam, 0 to 3 percent slopes

**Map Unit Setting**

*National map unit symbol:* 2w686
*Elevation:* 0 to 1,420 feet

*Mean annual precipitation:* 36 to 71 inches
*Mean annual air temperature:* 39 to 55 degrees F
*Frost-free period:* 140 to 240 days
*Farmland classification:* All areas are prime farmland

**Map Unit Composition**

*Woodbridge and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Woodbridge**

**Setting**

*Landform:* Ground moraines, hills, drumlins
*Landform position (two-dimensional):* Summit, footslope
*Landform position (three-dimensional):* Crest
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

**Typical profile**

*Ap - 0 to 7 inches:* fine sandy loam
*Bw1 - 7 to 18 inches:* fine sandy loam
*Bw2 - 18 to 30 inches:* fine sandy loam
*Cd - 30 to 65 inches:* gravelly fine sandy loam

**Properties and qualities**

*Slope:* 0 to 3 percent
*Depth to restrictive feature:* 20 to 39 inches to densic material
*Drainage class:* Moderately well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.14 in/hr)
*Depth to water table:* About 18 to 30 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 4.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2w
*Hydrologic Soil Group:* C/D
*Ecological site:* F144AY037MA - Moist Dense Till Uplands
*Hydric soil rating:* No

**Minor Components**

**Paxton**

*Percent of map unit:* 7 percent
*Landform:* Ground moraines, hills, drumlins
*Landform position (two-dimensional):* Summit, shoulder

*Landform position (three-dimensional):* Crest
*Down-slope shape:* Convex, linear
*Across-slope shape:* Convex
*Hydric soil rating:* No

**Ridgebury**

*Percent of map unit:* 6 percent
*Landform:* Depressions, ground moraines, drainageways, drumlins, hills
*Landform position (two-dimensional):* Footslope, toeslope
*Landform position (three-dimensional):* Head slope, base slope
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Hydric soil rating:* Yes

**Whitman, extremely stony**

*Percent of map unit:* 1 percent
*Landform:* Drainageways, depressions
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Hydric soil rating:* Yes

**Sutton**

*Percent of map unit:* 1 percent
*Landform:* Ground moraines, hills
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Base slope
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Hydric soil rating:* No

## 310B—Woodbridge fine sandy loam, 3 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* 2t2ql
*Elevation:* 0 to 1,470 feet
*Mean annual precipitation:* 36 to 71 inches
*Mean annual air temperature:* 39 to 55 degrees F
*Frost-free period:* 140 to 240 days
*Farmland classification:* All areas are prime farmland

### Map Unit Composition

*Woodbridge, fine sandy loam, and similar soils:* 82 percent
*Minor components:* 18 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Woodbridge, Fine Sandy Loam

#### Setting

*Landform:* Ground moraines, drumlins, hills
*Landform position (two-dimensional):* Summit, backslope, footslope
*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Parent material:* Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

**Typical profile**

*Ap - 0 to 7 inches:* fine sandy loam
*Bw1 - 7 to 18 inches:* fine sandy loam
*Bw2 - 18 to 30 inches:* fine sandy loam
*Cd - 30 to 65 inches:* gravelly fine sandy loam

**Properties and qualities**

*Slope:* 3 to 8 percent
*Depth to restrictive feature:* 20 to 39 inches to densic material
*Drainage class:* Moderately well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.14 in/hr)
*Depth to water table:* About 18 to 30 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 3.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2w
*Hydrologic Soil Group:* C/D
*Ecological site:* F144AY037MA - Moist Dense Till Uplands
*Hydric soil rating:* No

## Minor Components

**Paxton**

*Percent of map unit:* 10 percent
*Landform:* Drumlins, ground moraines, hills
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Nose slope, side slope, crest
*Down-slope shape:* Convex, linear
*Across-slope shape:* Convex
*Hydric soil rating:* No

**Ridgebury**

*Percent of map unit:* 8 percent
*Landform:* Depressions, ground moraines, hills, drainageways
*Landform position (two-dimensional):* Toeslope, backslope, footslope
*Landform position (three-dimensional):* Base slope, head slope, dip
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Hydric soil rating:* Yes

## 310C—Woodbridge fine sandy loam, 8 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* 2w689
*Elevation:* 0 to 1,370 feet
*Mean annual precipitation:* 36 to 71 inches
*Mean annual air temperature:* 39 to 55 degrees F
*Frost-free period:* 140 to 240 days
*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

*Woodbridge and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Woodbridge

#### Setting

*Landform:* Ground moraines, hills, drumlins
*Landform position (two-dimensional):* Backslope, footslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

#### Typical profile

*Ap - 0 to 7 inches:* fine sandy loam
*Bw1 - 7 to 18 inches:* fine sandy loam
*Bw2 - 18 to 30 inches:* fine sandy loam
*Cd - 30 to 65 inches:* gravelly fine sandy loam

#### Properties and qualities

*Slope:* 8 to 15 percent
*Depth to restrictive feature:* 20 to 39 inches to densic material
*Drainage class:* Moderately well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.14 in/hr)
*Depth to water table:* About 18 to 30 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 4.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* C/D
*Ecological site:* F144AY037MA - Moist Dense Till Uplands
*Hydric soil rating:* No

**Minor Components**

**Paxton**

*Percent of map unit:* 10 percent
*Landform:* Ground moraines, hills, drumlins
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex, linear
*Across-slope shape:* Convex
*Hydric soil rating:* No

**Ridgebury**

*Percent of map unit:* 4 percent
*Landform:* Depressions, ground moraines, hills, drainageways, drumlins
*Landform position (two-dimensional):* Footslope, toeslope
*Landform position (three-dimensional):* Head slope, base slope
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Hydric soil rating:* Yes

**Sutton**

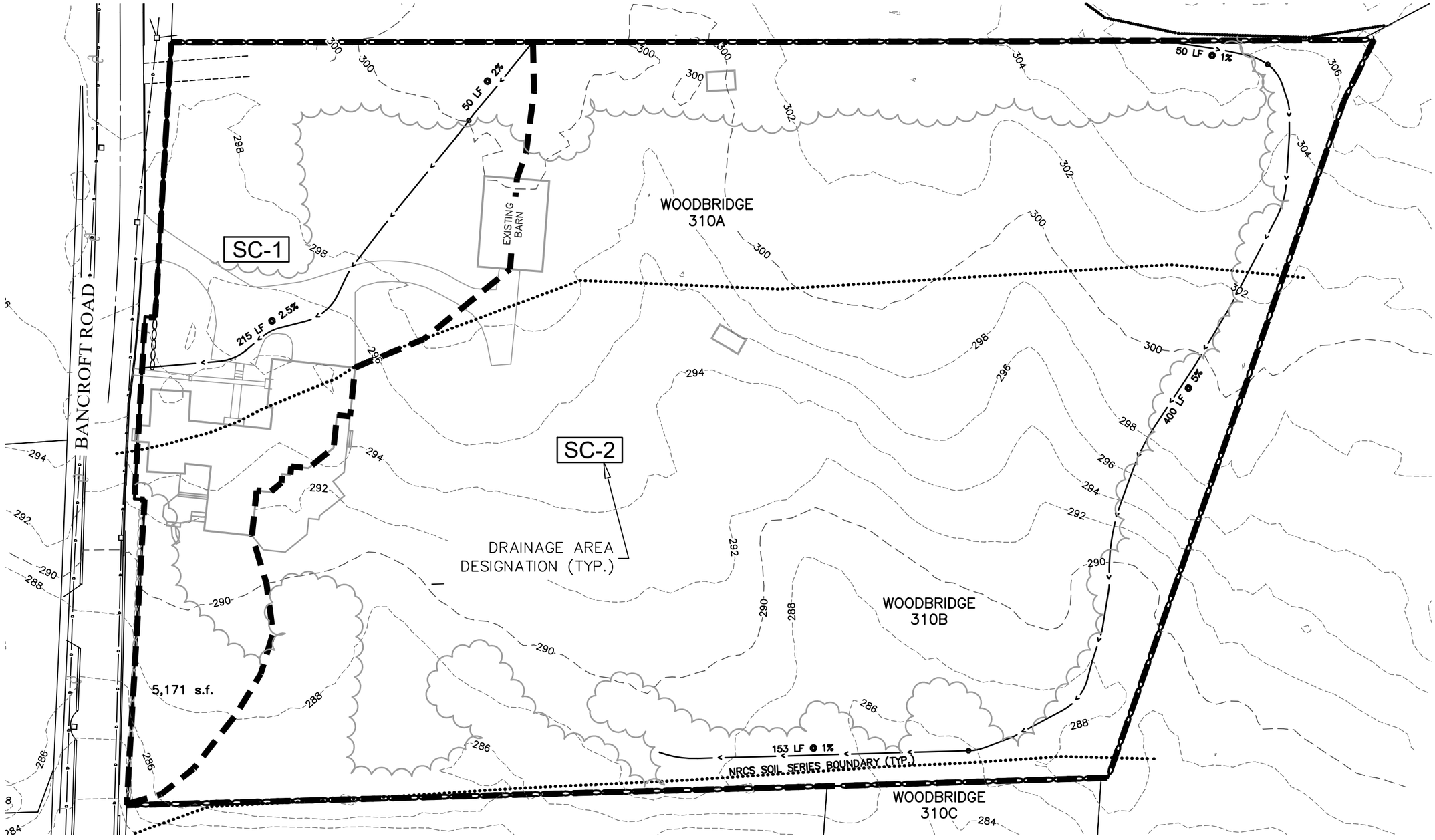
*Percent of map unit:* 1 percent
*Landform:* Ground moraines, hills
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Base slope
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 18, Sep 9, 2022

# IX. Appendix – Drainage Area Maps

*See Following Pages*




## SOILS LEGEND

| Series | HSG |
|---|---|
| (310A) Woodbridge fine sandy loam, 0 to 3% slopes | C/D |
| (310B) Woodbridge fine sandy loam, 3 to 8% slopes | C/D |
| (310C) Woodbridge fine sandy loam, 8 to 15% slopes | C/D |

# EDEN LANE


DK Engineering LLC
59 Granite Lane, Chester, NH 03036
Tel. Number:: (603) 505-5226
E-mail Address: dan@dke.llc


Assessor's Map & Lot: Map 59 & Lot 30

| Project No.: | Drawing Scale: |
|---|---|
| 42215 | 1" = 50' |
| Plan Date: 05/26/24 | Revised Date: |

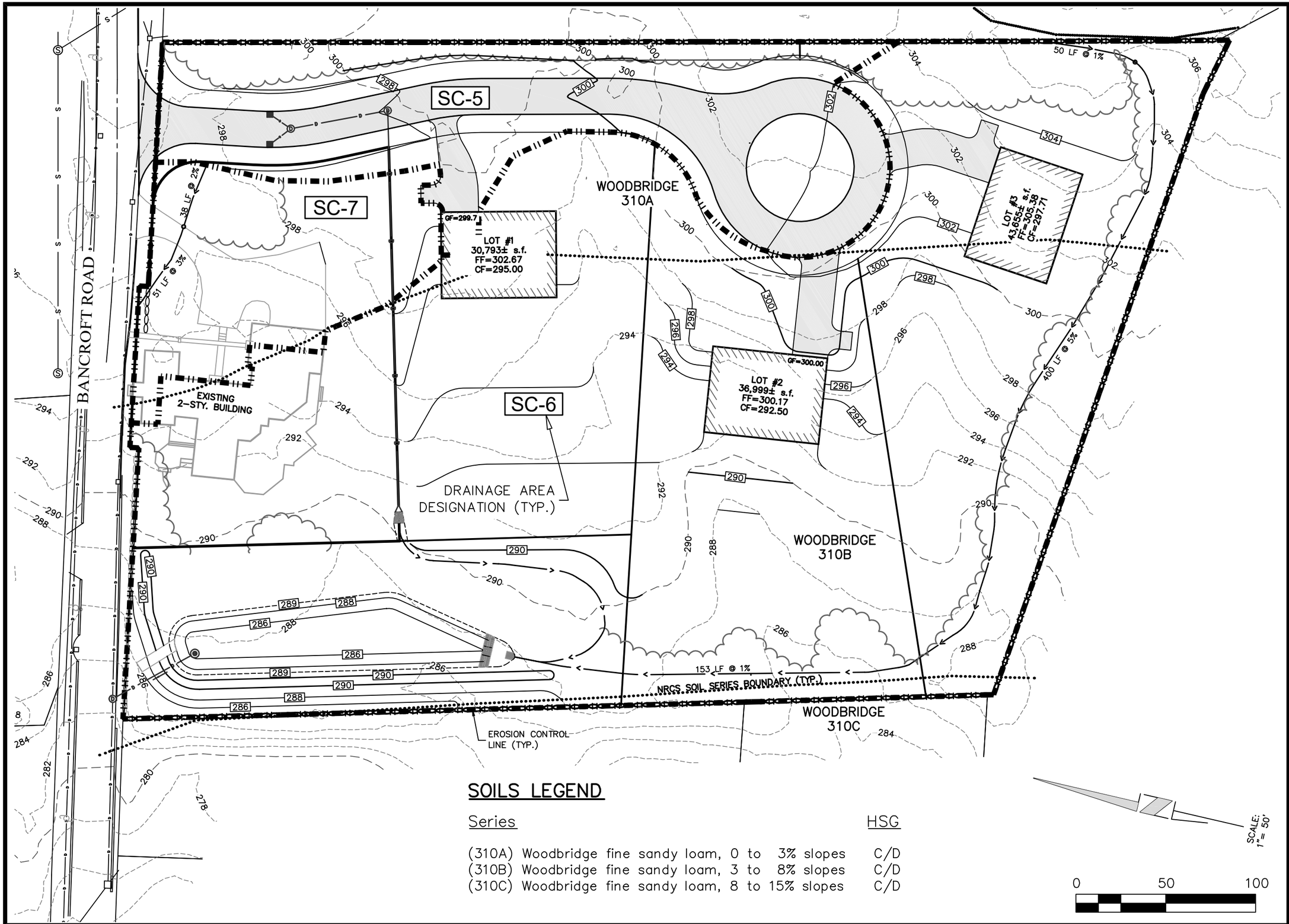
Sheet Title: PRE-DEV. DRAINAGE AREA MAP

Sheet No.: 1

No. of Shts.: 2

Drawing name: D:_dk data\Projects\42215 ~ADC - 9 Bancroft St - Andover_dwg\42215 ~ Subd Plan 2024-05-26.dwg

Plotted on May 25, 2024 - 3:56pm




## SOILS LEGEND

| Series | | | HSG |
|---|---|---|---|
| (310A) | Woodbridge fine sandy loam, | 0 to 3% slopes | C/D |
| (310B) | Woodbridge fine sandy loam, | 3 to 8% slopes | C/D |
| (310C) | Woodbridge fine sandy loam, | 8 to 15% slopes | C/D |

SCALE: 1" = 50'

0 50 100

# EDEN LANE


DK Engineering LLC
59 Granite Lane, Chester, NH 03036
Tel. Number:: (603) 505-5226
E-mail Address: dan@dke.llc


| | |
|---|---|
| Assessor's Map & Lot: Map 59 & Lot 30 | |
| Project No.: 42215 | Drawing Scale: 1" = 50' |
| Plan Date: 05/26/24 | Revised Date: |

Sheet Title: POST-DEV. DRAINAGE AREA MAP

Sheet No.: 2

No. of Shts.: 2

Drawing name: D:_dk data\Projects\42215 ~ADC - 9 Bancroft St - Andover_dwg\42215 ~ Subd Plan 2024-05-26.dwg

Plotted on May 25, 2024 - 3:58pm

# X. Project Stormwater Report

*See Following Pages*

# EDEN ESTATES

JN: 42215

# PROJECT STORMWATER REPORT

Applicant:

EDEN LANE, LLC
42 School Street
Andover, MA 01810

Date: 05/26/2024
Revised:

Prepared by:

Daniel Koravos, P.E.

05/26/24
Date

DK Engineering LLC
Address: 59 Granite Lane, Chester, NH 03036
Tel. (603) 505-5226 • E-mail dan@dke.llc

# TABLE OF CONTENTS

## *I. Checklist for Stormwater Report*

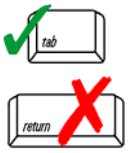
*See the following pages for the "Checklist for Stormwater Report"*

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

# Checklist for Stormwater Report

## A. Introduction

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




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

The Stormwater Report must include:

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

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

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

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

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

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

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

# Checklist for Stormwater Report

## B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

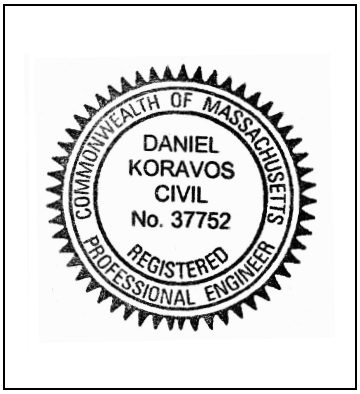
*Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

## Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature




05 / 26 / 24

Signature and Date

## Checklist

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

☑ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

# Checklist for Stormwater Report

## Checklist (continued)

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

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

**Standard 1: No New Untreated Discharges**

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

# Checklist for Stormwater Report

## Checklist (continued)

**Standard 2: Peak Rate Attenuation**

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

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

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

**Standard 3: Recharge**

☑ Soil Analysis provided.

☑ Required Recharge Volume calculation provided.

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

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

☑ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

☑ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

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

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

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

# Checklist for Stormwater Report

## Checklist (continued)

**Standard 3: Recharge** (continued)

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

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

**Standard 4: Water Quality**

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

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

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

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

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

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

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

# Checklist for Stormwater Report

## Checklist (continued)

**Standard 4: Water Quality** (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

**Standard 6: Critical Areas**

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

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

# Checklist for Stormwater Report

## Checklist (continued)

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

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

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

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

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

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

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

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

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

# Checklist for Stormwater Report

## Checklist (continued)

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

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

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

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

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

**Standard 9: Operation and Maintenance Plan**

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

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

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

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

**Standard 10: Prohibition of Illicit Discharges**

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

☑ An Illicit Discharge Compliance Statement is attached;

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

## *II. Introduction*

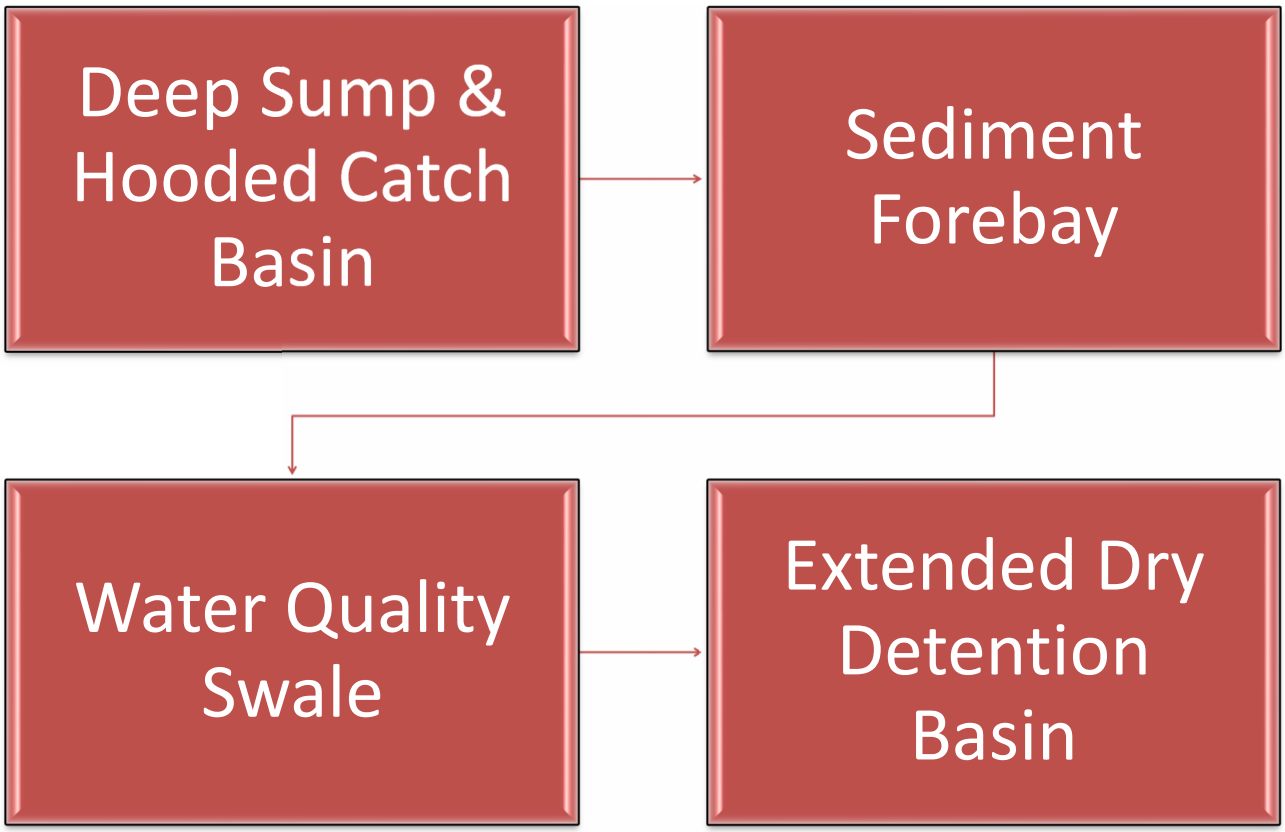
Eden Estates is a proposed three (3) lot single-family residential subdivision on a local road. The proposed development involves subdividing one (1) lot into three (3) lots, two (2) parcels and a local road (Eden Lane). The property is located at 9 Bancroft Road between South Main Street (Rt. 28) and Holt Road in Andover, Massachusetts. The subject land consists of approximately 3.9± acres. The existing vegetation mainly consists of grass areas with a tree line area along the perimeter of the property. Topography generally slopes from the easterly boundary of the property to the northwest corner of the site along Bancroft Road.

The soils within the project as mapped by the Natural Resource Conservation Service (NRCS) are mainly Woodbridge series (fine sandy loam). The Woodbridge series is classified as being within the NRCS-Hydrological Soils Group C/D; ranked third and fourth on a scale of four (A, B, C, D) in terms of infiltration capacity. For a more detailed description of this soil see the "Project Report on Drainage & Sedimentation Control".

The proposed stormwater management system for the project includes the installation of deep sump catch basins that will collect all of the roadway runoff and direct the flow to the closed drainage system. The catch basins are the start of the two BMP Treatment Trains as presented and described on the following pages.

The primary low impact development element of the project is the utilization of the Local Road regulations. As compared to the Minor Road regulations, there is a reduction in the required pavement width of six (6) feet and the five (5) foot sidewalk is not required. This allows for a pavement area reduction of approximately 35%.

# BMP Treatment Train



## *III. Standard 1: No New Untreated Discharge*

The proposed BMP Train consists of the drainage area catch basins CB-1 and CB-2. The runoff flows to the proposed catch basins in roadways. These catch basins are constructed with a deep sump and hood. The runoff is then transported to a forebay that discharges to the water quality swale. The water quality transports the runoff to an extended dry detention basin.

## *IV. Standard 2: Peak Rate Attenuation*

*See the "Project Report on Drainage & Sedimentation Control" dated May 26, 2024 with latest revisions*

## *V. Standard 3: Recharge*

### Required Recharge Volume

$R_v$ = F * A = (0.25/12) ft. * 30,940 s.f. = **645 c.f.**

F = Target Depth Factor ("C" Soils = 0.25-inch)
A = Impervious Area

### Provided Recharge Volume

Basin 6
Bottom of the basin elevation = 286.00
Bottom area of the basin = 2,910 s.f.
Lowest pond outlet elevation = 286.50
Surface area at elevation 286.50 = 3,450 s.f.

**Recharge Volume Provided = 1,590 c.f. > 645 c.f. Required**

### Drawdown Time Calculation

Basin

$Time_{Drawdown} = R_v \div (K * Area)$ = **2.6 hours**
K = 1.02 in./hr. = 0.085 ft./hr.
$R_v$ = 645 c.f.
Area = 2,910 s.f.

### Pretreatment

Total Area of the Roadway Pavement = 0.29 acs.

Annual Sediment Volume
= 0.29 acs. * 750 lbs./acre-storm ÷ 90 lbs./c.f. * 10 storms/year
**=24 c.f./year**

Volume of Catch Basin Sumps
Area * Depth = $2^2 * \pi * 4$ ft. = 50 c.f.
Two (2) Catch Basins Provide **100 c.f. of Storage**

## Drawdown Time

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

### BASIN

| | | | |
|---|---|---|---|
| T | = | 19.3 | Drawdown Time (hours) |
| Rv | = | 645 | Recharge Volume (cubic feet) |
| K | = | 1.02 | Saturated Hydraulic Conductivity (inches per hour) |
| A | = | 2,910 | Bottom Area (square feet) |

$Time_{drawdown}$ = 645 / (1.02/12 * 2,910) = 2.6 hours

# *VI. Standard 4: Water Quality*

## Water Quailty Treatment Volume

$V_{WQ} = (D_{WQ}/12 \text{ inches/foot}) * (A_{IMP} * 43{,}560 \text{ square feet/acre})$

$V_{WQ}$ = Required Water Quality Volume (in cubic feet)
$D_{WQ}$ = Water Quality Depth = ½ inch
$A_{IMP}$ = Impervious Area (in acres)

$V_{WQ} = (0.5/12 \text{ inches/foot}) * (0.71 * 43{,}560 \text{ square feet/acre})$

$V_{WQ}$ = 1,290 c.f.

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

*Version 1, Automated: Mar. 4, 2008*

Location: 9 Bancroft Rd., Andover, MA

## TSS Removal Calculation Worksheet

| B<br>BMP[1] | C<br>TSS Removal Rate[1] | D<br>Starting TSS Load* | E<br>Amount Removed (C*D) | F<br>Remaining Load (D-E) |
|---|---|---|---|---|
| Deep Sump and Hooded Catch Basin | 0.25 | 1.00 | 0.25 | 0.75 |
| Sediment Forebay | 0.25 | 0.75 | 0.19 | 0.56 |
| Water Quality Swale - Dry | 0.70 | 0.56 | 0.39 | 0.17 |
| Extended Dry Detention Basin | 0.50 | 0.17 | 0.08 | 0.08 |
| | 0.00 | 0.08 | 0.00 | 0.08 |

**Total TSS Removal =** 92%

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

Project: Eden Estates
Prepared By: Dan Koravos
Date: 4/15/2024

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

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

## *VII. Standard 5: Land Uses with Higher Potential Loads*

*Not Applicable*

## *VIII. Standard 6: Critical Areas*

*Not Applicable*

## *IX. Standard 7: Redevelopments*

*Not Applicable*

## *X. Standard 8: Construction Period Pollution Prevention & Erosion and Sedimentation Control*

### Sequence of Major Activities

#### The order of activities will be as follows:

1. Install the erosion control line to protect surrounding areas
2. Install the construction stabilization entrance
3. Clear and grub for roadway and detention basin
4. Construction of the detention basin
5. Stockpile loam in designated areas
6. Grade for roadway
7. Install utilities including water, electric and storm drain
8. Place base course of pavement
9. Construct buildings
10. Complete grading and install permanent seeding and plantings
11. Complete final paving
12. Remove accumulated sediment from the basin and clean drainage system
13. When all construction activity is complete and the site is stabilized, remove haybales and reseed any areas disturbed by their removal

### Controls - Erosion and Sediment Controls

#### Stabilization practices

Permanent stabilization – Disturbed portions of the site where construction activities have permanently ceased shall be hydroseeded within three weeks of completion and the roadway has been paved with a base course.

Sediment Basin – The proposed detention basin will be constructed so that it can be used as a sedimentation basin during construction. The basin will be formed by excavating the basin area as indicated on the construction plans. Once the outlet riser is constructed, compost filter socks will be placed around the outlet, which will create ponding in the basin. This will allow sediment to settle prior to reaching the outlet riser. This basin will drain through a corrugated metal riser and outlet pipe to a riprap outlet apron. Once construction activities are nearly complete, the accumulated sediment will be removed from the basin.

Storm Water Management - Storm water drainage will be provided by storm sewer and catch basins for the developed areas. The areas which are not developed will be graded as shown on the Grading Plan and have permanent seeding or plantings. When construction is complete, the majority of the developed portions of the site will

drain to a detention basin. During construction the detention basin will act as a sedimentation basin. When upslope areas are stabilized, the accumulated sediment will be removed from the detention basin, and the areas on the sides of the basin will be planted with vegetation. It is expected that the drainage system will result in over 90 percent removal of total suspended solids from the site's storm water runoff. The pond has been designed by a professional engineer to keep peak flow rates from the two, ten, twenty-five and one hundred year/ 24 hour storms at their pre-development rates. Discharge from the basin will be directed to an existing closed drainage system in Bancroft Road.

## Other Controls - Waste Disposal

### Waste Materials

All waste materials will be collected and stored in a metal dumpster. The dumpster will meet all local and state solid waste management regulations. All trash and construction debris from the site will be deposited in the dumpster. The dumpster will be emptied as necessary, and the trash will be hauled to the local dump. No construction waste materials will be buried onsite. All personnel will be instructed regarding the correct procedure for waste disposal. Mr. Greg Alexandris, the individual who manages the day-to-day site operations, will be responsible for seeing that these procedures are followed.

### Hazardous Waste

All hazardous waste materials, if any, will be disposed of in the manner specified by local or state regulations or by the manufacturer. Site personnel will be instructed in these practices and Mr. Greg Alexandris, the individual who manages day-to-day site operations, will be responsible for seeing that these practices are followed.

### Sanitary Waste

All sanitary waste will be collected from the portable units as required by local regulations.

### Offsite Vehicle Tracking

A stabilized construction entrance has been provided to help reduce vehicle tracking of sediments. The paved street adjacent to the site entrance will be swept as necessary to remove any excess mud, dirt or rock tracked from the site.

## Timing of Controls/Measures

As indicated in the Sequence of Major Activities, installation of the erosion control line and stabilized construction entrance will be constructed prior to clearing or grading of any other portions of the site. The detention basin and all disturbed areas associated with the construction of the roadway will be hydroseeded within three weeks of completion. The individual lots will be constructed at different times and seeded as soon as the site work for the lot is completed.

## Compliance with Federal, State and Local Regulations

The storm water pollution prevention plan reflects the requirements for storm water management and erosion and sediment control, as established. To ensure compliance, this plan was prepared in accordance with the requirements of the town of Andover, Massachusetts, and the Massachusetts Department of Environmental Protection.

## Maintenance/Inspection Procedures

### Erosion and Sediment Control Inspection and Maintenance Practices

These are the inspection and maintenance practices that will be used to maintain erosion and sediment controls:

- All control measures will be inspected at least once each week and following any storm event of 0.5 inches or greater.
- All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of it being reported.
- Built up sediment will be removed from compost filter socks when it has reached one half the height of the barrier.
- Compost filter socks will be inspected for depth of sediment and tears, to see if the fabric is securely attached and to see that the stakes are firmly in the ground.
- The sediment basin will be inspected for depth of sediment and built up sediment will be removed when it reaches 10 percent of the design capacity or at the end of the job.
- Temporary and permanent seeding and planting will be inspected for bare spots, washouts, and healthy growth.
- A maintenance inspection report will be made after each inspection.
- Mr. Greg Alexandris, site superintendent, will select individuals who will be responsible for inspections, maintenance, and repair activities, and filling out the inspection and maintenance report.

- Personnel selected for inspection and maintenance responsibilities will receive training as required. They will be trained in all the inspection and maintenance practices necessary for keeping the erosion and sediment controls used onsite in good working order.

## Non-Storm Water Discharges

It is expected that the following non-storm water discharges will occur from the site during the construction period:

- Water from water line flashings
- Pavement wash waters (where no spills or leaks of toxic or hazardous materials have occurred)
- All non-storm water discharges will be directed to the sediment basin prior to discharge.

## Inventory for pollution prevention plan

The materials or substances listed below are expected to be present onsite during construction:

| | |
|---|---|
| Concrete | Petroleum based products |
| Detergents | Cleaning solvents |
| Paints (enamel & latex) | Wood |
| Tar | Masonry block |
| Fertilizers | Roofing shingles |

## Spill Prevention

Material Management Practices

The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff.

## Good Housekeeping

The following good housekeeping practices will be followed onsite during the construction project:

- An effort will be made to store only enough product required to do the job
- All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure
- Products will be kept in their original containers with the original manufacturer's label

- Substances will not be mixed with one another unless recommended by the manufacturer
- Whenever possible, all of a product will be used up before disposing of the container
- Manufacturer recommendations for proper use and disposal will be followed
- The site superintendent will inspect daily to ensure proper use and disposal of materials onsite

### Hazardous Products

These practices are used to reduce the risks associated with hazardous materials

- Original labels and material safety data will be retained; they contain important product information
- If surplus product must be disposed of, manufacturer's or local and state recommended methods for proper disposal will be followed

## Product Specific Practices

### Petroleum Products

All onsite vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers, which are clearly labeled. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations.

### Fertilizers

Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

### Paints

All containers will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewer system but will be properly disposed of according to manufacturer's instructions or state and local regulations.

## Spill Control Practices

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the materials storage area onsite. Equipment and materials will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well-ventilated area and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- Spills of toxic or hazardous materials will be reported to the appropriate State or local government agency, regardless of the size.
- The spill prevention plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.
- Mr. Greg Alexandris, the site superintendent responsible for the day-to-day site operations, will be the spill prevention and cleanup coordinator. He will designate at least two (2) other site personnel who will receive spill prevention and cleanup training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the material storage area and in the office trailer onsite.

## Erosion and Sedimentation Control Specifications

### Compost Filter Soxx (or equal)

Installation

1. Perimeter control used for control of sediment in storm runoff shall meet filtrexx soxx mesh material and filtrexx certified filter media specifications.
2. Perimeter control will be placed at locations indicated on plans and in a manner as directed by the engineer or manufacturer.
3. Perimeter control should be installed parallel to the base of the slope or other disturbed area.
4. Effective soxx height in the field for 12" diameter soxx should be = 9.5" high.
5. Stakes should be installed through the middle of the perimeter control at 10 ft. on center using nominal 2 in by 2 in by 3 ft wooden stakes.
6. Staking depth for sand and silt loam soils shall be 12 in.
7. Loose compost may be backfilled along the upslope side of the perimeter control, filling the seam between the soil surface and the device, improving filtration and sediment retention.

Inspection & maintenance

Routine inspection should be conducted within 24 hrs. of a runoff event or as designated by the regulating authority. Perimeter control should be regularly inspected to make sure they maintain their shape and are producing adequate hydraulic flow-through. If ponding becomes excessive, additional perimeter control may be required to reduce effective slope length or sediment removal may be necessary. Perimeter control shall be inspected until areas above have been permanently stabilized and construction activity has ceased.

1. The contractor shall maintain the perimeter control in a functional condition at all times and it shall be routinely inspected.
2. If the perimeter control has been damaged, it shall be repaired, or replaced if beyond repair.
3. The contractor shall remove sediment at the base of the upslope side of the perimeter control when accumulation has reached 1/2 of the effective height of the soxx, or as directed by the engineer. Alternatively, a new perimeter control can be placed on top of and slightly behind the original one creating more sediment storage capacity without soil disturbance.
4. Perimeter control shall be maintained until disturbed area above the device has been permanently stabilized and construction activity has ceased.
5. The filter media will be dispersed on site once disturbed area has been permanently stabilized, construction activity has ceased, or as determined by the engineer.
6. For long-term sediment and pollution control applications, perimeter control can be seeded at the time of installation to create a vegetative filtering system for prolonged and increased filtration of sediment (contained vegetative filter strip). The appropriate seed mix shall be determined by the engineer.

## Stabilized Construction Entrance - Developing Areas

Definition

A stabilized pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk, or parking area shall be provided.

Purpose

The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights-of-way or streets.

Conditions Where Practice Applies

A stabilized construction entrance shall be used at all points of construction ingress and egress.

Design Criteria

1. Aggregate Size - Use 2-inch stone or reclaimed or recycled concrete equivalent.
2. Thickness - Not less than 6 inches.
3. Width - 10-foot minimum but not less than the full width of points where ingress or egress occurs.
4. Length - As required, but not less than 50 feet (except on a single residence lot where a 30-foot minimum would apply).
5. Filter cloth - To be placed over the entire area to be covered with aggregate. Filter cloth will not be required on a single-family residence lot.
6. Piping of surface water under entrance shall be provided as required. If piping is impossible, a mountable berm with 5:1 slopes will be permitted.

Maintenance

The entrance shall be maintained in a condition which will prevent tracking of sediment onto public rights-of-way or streets. This may require periodic topdressing with additional aggregate. All sediment spilled, dropped, or washed onto public rights-of-way must be removed immediately.

When necessary, wheels must be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment trapping device. All sediment shall be prevented from entering storm drains, ditches, or watercourses.

Criteria for Filter Cloth

The filter cloth shall be a woven or non-woven fabric consisting only of continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew, rot resistant, and conform to the properties of the following table:

| Roads | Haul Roads Test Fabric Properties 3/ | Light Duty 1-/ Heavy Duty 2-/ Grade Subgrade Rough Graded | Method |
|---|---|---|---|
| Grab Tensile Strength (lbs.) | 200 | 220 | ASTM D1682 |
| Elongation at Failure (%) | 50 | 60 | ASTM D1682 |
| Mullen Burst Strength (lbs.) | 190 | 430 | ASTM D3786 |
| Puncture Strength (lbs.) | 40 | 125 | ASTM D751 modified |
| Equivalent Opening Size | 40-80 | 40-80 | US Std Sieve CW-02215 |
| Aggregate Depth (in.) | 6 | 10 | -- |

1-/ Light Duty Road: Sites that have been graded to subgrade and where most travel would be single axle vehicles and an occasional multi-axle truck. Trevira Spunbond 1115, Mirafi 100X, Typar 3401, or equivalent.

2-/ Heavy Duty Road: Sites with only rough grading, and where most travel would be multi-axle vehicles. Trevira Spunbond 1135, Mirafi 600X, or equivalent.

3-/ Fabrics not meeting these specifications may be used only when design procedure and supporting documentation are supplied to determine aggregate depth and fabric strength.

## *XI. Standard 9: Operation and Maintenance Plan*

### Erosion and Sedimentation Control Maintenance Plan

In general, the erosion control methodology to be employed on the site involves the installation of Compost Filter Soxx (or equal) in any area in which land disturbing activities could result in sediment spilling onto abutting property. The Filter Soxx will remain in place until the earth disturbing activity is stabilized with loam and seed and grass is growing, and/or houses are constructed, and roadway paved. Paving, loaming, and seeding, are permanent methods of site stabilization while the Compost Filter Soxx placement is considered temporary erosion control methods. Compost Filter Soxx are also specified to be placed around each of the catch basins, which will be constructed in the road, to prevent sediment travel into the storm drainage system. The storm drain catch basins are specified with 4' sumps to maximize the sediment trapping capability of the system. The protective Compost Filter Soxx are considered temporary measures to be employed during construction and not necessary after the roadway pavement is put in place. If a significant amount of soil is tracked onto the roadway from the on lot construction, then, at the direction of the Town Agent and/or Inspector, Compost Filter Soxx can be reinstalled adjacent to the catch basins.

The detention basin has the effect of collecting and holding runoff from the street drainage system, and allowing it to be treated and controlled, before being infiltrated into the ground or discharged. The pond will be loamed and seeded. Overland outlets from the ponds will be loamed and seeded or riprap, depending upon the pond location and slope.

The disturbed portions of the entire site will be hydroseeded if construction including loaming and seeding has not been completed prior to October 1st of a season. This will provide approximately three (3) or four (4) weeks growing season for the grass, which will serve to stabilize the site to accommodate spring runoff periods. No other methods to stabilize the site for winter construction are necessary.

During construction, and upon completion of construction, the project will require some maintenance of erosion control devices. During construction, Compost Filter Soxx must be checked every couple of weeks and after rainstorms, repaired and replaced as necessary due to sediment buildup behind it or on the device. After large storm events, the detention pond might require cleaning of sediment to restore them to the pre-event condition. If storm events occur after the side slopes and other areas, which are stabilized, have been planted but prior to seed germination, then replanting and re-grading of those areas might be necessary. This work will be performed by the developer on an as-needed basis, during the construction phase. After the subdivision is constructed, cleaning of catch basin sumps, drainage swale

and sediment ponds/sumps are probably the only item of maintenance, which will be necessary, other than to restore any grass areas, which are disturbed through normal use of roadways. The property owner will perform this work

The plan set contains the erosion and sedimentation control layout, while the storm drainage calculations attached hereto describe the soils which are present on the site, as well as the methodology for handling storm water flow on the property.

## Operation and Maintenance Procedures

### Detention Basins

Detention basin shall be inspected at least once per year to ensure that the basin is operating as intended. Inspections conducted at intervals during and after the storm will help to determine if the basin is meeting the expected detention times. The outlet structure shall be inspected for evidence of clogging or outflow release velocities that are greater than design flow. Potential problems that shall be checked include subsidence, erosion, cracking, or tree growth on the embankment; damage to the emergency spillway; sediment accumulation around the outlet; inadequacy of the inlet/outlet channel erosion control measures; changes in the condition of the pilot channel; and erosion within the basin and banks. Any necessary repairs shall be made immediately. During inspections, changes to the detention basin or the contributing watershed shall be noted, as these may affect basin performance.

The upper-stage, side slopes, embankment, and emergency spillway shall be mowed at least twice per year. Trash and debris shall also be removed at this time.

Sediment shall be removed from the basin as necessary, and at least once every ten (10) years. Providing an on-site sediment disposal area will reduce the overall sediment removal costs.

### Maintenance Criteria

- Detention basin shall be inspected at least once per year to ensure that the basin is operating as intended. Inspections shall be conducted during wet weather to determine if the basin is meeting the targeted detention times.

- At least twice during the growing season the upper-stage, side slopes, embankment, and emergency spillway shall be mowed, and accumulated trash and debris removed.

- Remove sediment from the extended dry detention basin as necessary, but at least once every ten (10) years.

## Deep Sump Catch Basins

The actual removal of sediments and associated pollutants and trash occurs only when inlets or sumps are cleaned out; therefore, regular maintenance is required. Most studies have linked the failure of inlets to the lack of regular maintenance. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. In addition, frequent cleaning also results in more volume available for future storms and enhances the overall performance. Ideally, in areas of high sediment loading, inlets shall be inspected, and cleaned, after every major storm event. At a minimum, water quality inlets and deep sumps shall be cleaned four times per year and inspected monthly. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations.

### Maintenance Criteria

- Inlets shall be cleaned a minimum of four (4) times per year and inspected monthly.
- All sediments and hydrocarbons shall be properly handled and disposed of, in accordance with local, state, and federal guidelines and regulations.

## Sediment Forebays

The actual removal of sediments and associated pollutants occurs only when sediment traps and forebays are cleaned; therefore, regular maintenance is required. Frequently the removal of accumulated sediments will make it less likely that sediments will be re-suspended. At a minimum, sediment traps shall be cleaned four (4) times per year and inspected monthly.

### Maintenance Criteria

- Traps shall be cleaned four (4) times per year and inspected monthly.
- All sediments and hydrocarbons shall be handled properly and disposed in accordance with local, state, and federal guidelines and regulations.

## Water Quality Swales

A maintenance and inspection schedule shall be incorporated into the design to ensure the effectiveness of water quality swales. Swales shall be inspected on a semi-annual basis; additional inspections shall be scheduled during the first few months to make sure that the vegetation in the swales becomes adequately established. The water quality swales shall be inspected for slope integrity, soil

moisture, vegetative health, soil stability, soil compaction, soil erosion, ponding, and sedimentation.

Regular maintenance tasks include mowing, fertilizing, liming, watering, pruning, and weed and pest control. Swales shall be mowed at least once per year. The grass must not be cut shorter than four (4) inches because the effectiveness of the vegetation in reducing flow velocity and pollutant removal may be reduced.

Sediment and debris shall be removed manually, at least once per year, and periodic reseeding may be required to maintain the dense growth of vegetation. Care shall be taken to protect water quality swales from snow removal and disposal practices and off street parking. Since swales may be located on private residential property, it is important for developers to clearly outline the maintenance requirements to property purchasers.

### Maintenance Criteria

- Maintenance is required for the proper operation of water quality swales. Plans for water quality swales shall identify owners, parties responsible for maintenance, and an inspection and maintenance schedule.

- Water quality swales shall be inspected at least semi-annually, and maintenance and repairs made as necessary. Additional inspections shall be scheduled during the first few months to make sure the vegetation becomes adequately established. Repairs and reseeding shall be done as required.

- Swales shall be mowed at least once per year. Grass clippings shall be removed. The grass must not be cut too often or shorter than four (4) inches, in order to maintain the effectiveness of the swale.

- Sediment and debris shall be removed manually, at least once per year, before the vegetation is adversely impacted.

- Care shall be taken to protect water quality swales from snow removal and disposal practices and off street parking.

## Grass Channels

Grassed Channels (formerly known as Biofilter swales) are treatment systems with a longer hydraulic residence time than drainage channels. The removal mechanisms are sedimentation and gravity separation, rather than filtration. To receive TSS credit, a sediment forebay or equivalent must be provided for pretreatment.

### Maintenance

*Mowing*: Set the mower blades no lower than three (3) to four (4) inches above the ground. Mow on an as-needed basis during the growing season so that the grass height does not exceed six (6) inches.

*Inspection*: Inspect semi-annually the first year, and at least once a year thereafter. Inspect the grass for growth and the side slopes for signs of erosion and formation of rills and gullies. Plant an alternative grass species if the original grass cover is not successfully established.

*Trash/Debris Removal*: Remove accumulated trash and debris prior to mowing.

*Sediment Removal*: Check on a yearly basis and clean as needed. Use hand methods (i.e., a person with a shovel) when cleaning to minimize disturbance to vegetation and underlying soils. Sediment build-up in the grass channel reduces its capacity to treat and convey the water quality event, 2-year, and 10-year 24-hour storm.

## *XII. Standard 10: Prohibition of Illicit Discharges*

Recording of this instrument constitutes an agreement by the Owner and Operator of the facility that no stormwater discharges other than those outlined on this plan are allowed for this site.

## *XIII. Inspection Forms*

*See the following pages for Sample Project Inspection Forms*

**Inspection Form**

To be completed every 7 days and within 24 hours of a rainfall event of 0.5 inches or

Inspector: Date:

Inspector's Qualifications:

Days since last rainfall: Amount of last rainfall: Inches

**Stabilization Measures:**

more

| Area Disturbed | Date Since Last Disturbance | Date of Next Disturbance | Stabilized (Yes/No) | Stabilized With | Condition |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Stabilization required:

_____
_____
_____
_____
_____

On or before: _____

To be performed by: _____

**Maintenance Report Form**

Detention/Sediment Basins:

| Depth of sediment basin | Condition of basin side slopes | Any evidence of overtopping of the embankment | Condition of outfall from sediment basin |
|---|---|---|---|
| | | | |

Maintenance required for sediment basin:

_____
_____

On or before:

_____
_____

To be performed by:

_____
_____

Stabilization to avoid off-site sedimentation:

| Does sediment get transported to the road? | Is the gravel clean, or does it contain sediment? | Does all traffic use stabilized areas to leave the site? | Do the construction vehicles exit through a wash-down area prior to leaving the site, if necessary? |
|---|---|---|---|
| | | | |

Maintenance required for stabilized construction:

_____
_____
_____

On or before: _____

To be performed by: _____

**Erosion Control Barrier Inspection and Maintenance Report Form**

Perimeter Structural Controls: Date:

Silt Fence and/or Straw Bales

| Barrier Location | Has silt reached 1/3 of fence height? | Is the fence properly secured? | Is there evidence of washout or overtopping? |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

Maintenance required for silt fence and straw bales:

_____
_____
_____
_____
_____
_____

On or before: _____

To be performed by: _____