

# JONES & BEACH ENGINEERS INC.

## DRAINAGE ANALYSIS

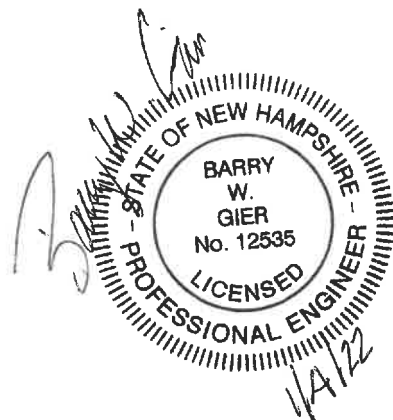
## EROSION AND SEDIMENT CONTROL PLAN

### MEADOWBROOK VILLAGE

Tax Map 270 Lot 2 & 3, Tax Map 273 Lot 49  
44 Meadowbrook Drive  
Barrington, NH 03825

### Prepared for:

21 Boylston Street, LLC  
18 Brush Hill Road  
Merrimac, MA 01860



### Prepared by:

Jones & Beach Engineers, Inc.  
85 Portsmouth Avenue  
P.O. Box 219  
Stratham, NH 03885  
(603) 772-4746  
August 19, 2021  
Revised December 23, 2021  
JBE Project No. 20747

## 1. EXECUTIVE SUMMARY

The purpose of this project is to construct an open space subdivision containing 11-lots on Town of Barrington Tax Map 270 Lot 2 & 3 and Tax Map 273 Lot 49. The proposed subdivision will contain 9.75 acres of developed space and 47.79 acres of open space with associated parking, drainage, and utilities. Two models were compiled, one for the area in its existing (pre-development) condition, and a second for its proposed (post-development) condition. The analysis was conducted using the USDA SCS TR-20 method within the HydroCAD Stormwater Modeling System environment. A summary of the existing and proposed conditions peak rates of runoff is as follows:

EXECUTIVE SUMMARY TABLE								
Analysis Point	2 Year		10 Year		25 Year		50 Year	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Analysis Point #1	6.99	4.63	18.17	13.99	28.36	23.56	38.36	32.99
Analysis Point #2	6.17	4.27	13.26	8.80	19.32	12.61	25.06	16.18

The drainage design intent for this site is to maintain the post-development peak flow to the pre-development peak flow conditions to the extent practicable and to effectively treat stormwater from the development of this project. This has been accomplished through the use of a vegetated treatment swale and detention basin to maintain the peak discharge and treat stormwater.

In addition, the potential for increased erosion and sedimentation is handled by way of riprap inlet and outlet protection aprons. The use of Best Management Practices per the NHDES Stormwater Manual have been applied to the design of this drainage system and will be observed during all stages of construction. Existing wetlands and abutting property owners will suffer minimal impact resultant from this development.

## TABLE OF CONTENTS

1. Executive Summary
2. Drainage Analysis
  - 2.1. Introduction
  - 2.2. Methodology
  - 2.3. Existing Conditions Analysis
  - 2.4. Proposed Conditions Analysis
  - 2.5. Conclusion
  - 2.6. Drainage Calculations – Pre-Development Conditions Analysis
    - 2.6.1. 2-Year – 24 Hour Summary Analysis
    - 2.6.2. 10-Year – 24 Hour Complete Analysis
    - 2.6.3. 25-Year – 24 Hour Summary Analysis
    - 2.6.4. 50-Year – 24 Hour Summary Analysis
  - 2.7. Drainage Calculations – Proposed-Development Conditions Analysis
    - 2.7.1. 2-Year – 24 Hour Summary Analysis
    - 2.7.2. 10-Year – 24 Hour Complete Analysis
    - 2.7.3. 25-Year - 24 Hour Summary Analysis
    - 2.7.4. 50-Year – 24 Hour Summary Analysis
3. Extreme Precipitation Table
4. Rip-Rap Calculations
5. Site Specific Soils Report
6. USGS Map
7. Web Soil Survey Map
8. Aerial Photography of Site
9. Representative Photographs of Site
10. Stormwater Operations and Maintenance Manual
11. Plans
  - 11.1. Pre-Development Drainage Plans
  - 11.2. Post-Development Drainage Plans

## **2. DRAINAGE ANALYSIS**

### **2.1 INTRODUCTION**

The purpose of this project is to construct an open space subdivision containing 11-lots on Town of Barrington Tax Map 270 Lot 2 & 3 and Tax Map 273 Lot 49. The proposed subdivision will contain lots with houses, associated parking, drainage, and utilities. Each lot will be serviced by a private well and septic system.

### **2.2 METHODOLOGY**

The existing and proposed watersheds were modeled utilizing HydroCad stormwater software, version 9.10. The watersheds were analyzed utilizing the SCS TR-20 methodology for hydrograph development and the TR-55 methodology for Time of Concentration (Tc) determination. The Dynamic-Storage-Indicating method for reach and pond routing was utilized. Type III, 24-hour hydrographs were developed for the 2-year, 10-year, 25-year, 50-year, and 100-year storm events, corresponding to rainfall events of 3.08", 4.66", 5.91", 7.06" and 8.46" respectively.

Existing topography and site features were obtained through aerial topography and on-ground topography completed by Jones & Beach Engineers. Existing soil conditions were derived from information obtained from the NRCS Web Soil Survey.

### **2.3 EXISTING CONDITIONS ANALYSIS**

The study area consists of the subject property and upstream contributing area. The study area contains 22.73 acres including offsite contributing areas. The existing site features a single home accessed by a gravel driveway. The site is significantly forested with the exception of the existing house and gravel driveway. The existing site features a high point located in the central portion of the study area. The site drains away in all directions from this high point resulting in the Analysis Points as defined below.

The majority of the soils for this site are described as Hydrological Soils "D". Along the northeastern property line, there is a small portion described as Hydrological Soils "A". There is a section described as Hydrological Soils "D" soil along the western side of the study area abutting the wetland boundary. To the southern side of the study area, there is a section described as Hydrological Soils "C" abutting the wetland boundary and it continues to the area of Candlestick Lane

Two Analysis Points (AP's) were defined for this project. Analysis Points are described as below:

Analysis Point #1 is defined as the wetland boundary along the western edge of the developed area. All stormwater on the western side of the high point flows overland and drains to this point. Analysis Point #2 is defined as the wetland boundary to the eastern side of the developed area. All stormwater on the eastern side of the high point flows overland and drains to this point.

## 2.4 PROPOSED CONDITIONS ANALYSIS

The proposed site includes the construction of an 11-lot subdivision with houses, access drives, parking, drainage, and utilities.

The addition of the proposed impervious paved areas and buildings causes an increase in the curve number ( $C_n$ ) and a decrease in the time of concentration ( $T_c$ ), the net result being a potential increase in peak rates of runoff from the site. To mitigate the potential increase in the peak rate of runoff and to effectively treat the subsequent stormwater runoff, the following Best Management Practices (BMP's) have been employed at the Analysis Points as follows:

In post construction condition, the site is divided into 4 watersheds that drain to two Analysis Points.

The proposed road that enters on the eastern side of the property and runs to the existing high point of the developed area divides the stormwater. Stormwater to the northeast that breaks at the high point along the proposed house locations flows overland to the northern side of the proposed road to a drainage ditch that runs alongside the road. The ditch terminates at the low point at station 1+75. A 24" corrugated plastic culvert (P2) conveys stormwater to the Vegetated Treatment Swale. Stormwater to the south of the proposed road that breaks at the high point along the proposed house locations drains to a ditch that runs along the road to the Vegetated Treatment Swale. The Vegetated Treatment Swale discharges treated stormwater to the proposed Detention Basin #1 which provides peak stormwater mitigation. Discharge from the basin then enters the existing wetland at Analysis Point #1.

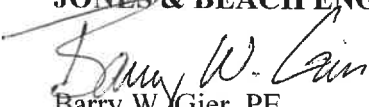
Stormwater to the west that breaks at the high point along the proposed house locations that is not collected by the drainage swale flows overland to the existing wetland at "AP-1".

Stormwater to the north that breaks at the high point along the proposed house locations that is not collected by the drainage swale flows overland to the existing wetland at "AP-2".

## 2.5 CONCLUSION

This proposed site development will have minimal adverse effect on abutting infrastructures or properties by way of stormwater runoff or siltation if properly constructed in accordance with this Drainage Analysis and approved project plan set. The post-construction peak rates of runoff for the site will be lower than the existing conditions for all analyzed storm events. Appropriate steps will be taken to control erosion and sedimentation; these will be accomplished through the construction of a drainage system consisting of site grading, detention ponds, and riprap outlet protection aprons. The use of Best Management Practices developed by the State of New Hampshire have been utilized in the design of this system and their application will be enforced with regular inspections throughout the construction process.

Respectfully Submitted,  
**JONES & BEACH ENGINEERS, INC.**

  
Barry W. Gier, PE  
Vice-President

## 2.6 DRAINAGE CALCULATIONS

### PRE-DEVELOPMENT CONDITIONS ANALYSIS

- 2.6.1 2-Year 24-Hour Summary Analysis
- 2.6.2 10-Year 24-Hour Complete Analysis
- 2.6.3 25-Year 24-Hour Summary Analysis
- 2.6.4 50-Year 24-Hour Summary Analysis



EX-WS-1



EX-WS-2



Analysis Point #1 Analysis Point #2



## 20747-EXIST-DRAINAGE

Prepared by Jones & Beach Engineers

HydroCAD® 10.10-4a s/n 10589 © 2020 HydroCAD Software Solutions LLC

Printed 8/9/2021

Page 2

### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.282	80	>75% Grass cover, Good, HSG D (1S, 2S)
0.006	96	Gravel surface, HSG B (1S)
0.236	96	Gravel surface, HSG D (1S, 2S)
0.104	98	Paved parking, HSG C (1S)
0.011	83	Paved roads w/open ditches, 50% imp, HSG A (2S)
0.331	93	Paved roads w/open ditches, 50% imp, HSG D (1S, 2S)
0.077	30	Woods, Good, HSG A (2S)
3.447	55	Woods, Good, HSG B (1S)
4.814	70	Woods, Good, HSG C (1S)
13.426	77	Woods, Good, HSG D (1S, 2S)
<b>22.734</b>	<b>73</b>	<b>TOTAL AREA</b>



## 20747-EXIST-DRAINAGE

Prepared by Jones & Beach Engineers

HydroCAD® 10.10-4a s/n 10589 © 2020 HydroCAD Software Solutions LLC

Printed 8/9/2021

Page 3

### Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.088	HSG A	2S
3.453	HSG B	1S
4.918	HSG C	1S
14.275	HSG D	1S, 2S
0.000	Other	
<b>22.734</b>		<b>TOTAL AREA</b>

**20747-EXIST-DRAINAGE**

Type III 24-hr 2-YR Rainfall=3.08"

Prepared by Jones & Beach Engineers

Printed 8/9/2021

HydroCAD® 10.10-4a s/n 10589 © 2020 HydroCAD Software Solutions LLC

Page 4

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 1S: EX-WS-1**

Runoff Area=649,560 sf 1.41% Impervious Runoff Depth>0.68"  
Flow Length=716' Tc=26.3 min CN=70 Runoff=6.99 cfs 0.841 af

**Subcatchment 2S: EX-WS-2**

Runoff Area=340,718 sf 0.82% Impervious Runoff Depth>1.02"  
Flow Length=646' Tc=24.3 min CN=77 Runoff=6.17 cfs 0.668 af

**Link AP-1: Analysis Point #1**

Inflow=6.99 cfs 0.841 af  
Primary=6.99 cfs 0.841 af

**Link AP-2: Analysis Point #2**

Inflow=6.17 cfs 0.668 af  
Primary=6.17 cfs 0.668 af

**Total Runoff Area = 22.734 ac Runoff Volume = 1.509 af Average Runoff Depth = 0.80"**  
**98.79% Pervious = 22.459 ac 1.21% Impervious = 0.274 ac**

**20747-EXIST-DRAINAGE**

Type III 24-hr 10-YR Rainfall=4.66"

Prepared by Jones & Beach Engineers

Printed 8/9/2021

HydroCAD® 10.10-4a s/n 10589 © 2020 HydroCAD Software Solutions LLC

Page 1

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 1S: EX-WS-1**

Runoff Area=649,560 sf 1.41% Impervious Runoff Depth>1.63"  
Flow Length=716' Tc=26.3 min CN=70 Runoff=18.17 cfs 2.024 af

**Subcatchment 2S: EX-WS-2**

Runoff Area=340,718 sf 0.82% Impervious Runoff Depth>2.16"  
Flow Length=646' Tc=24.3 min CN=77 Runoff=13.26 cfs 1.408 af

**Link AP-1: Analysis Point #1**

Inflow=18.17 cfs 2.024 af  
Primary=18.17 cfs 2.024 af

**Link AP-2: Analysis Point #2**

Inflow=13.26 cfs 1.408 af  
Primary=13.26 cfs 1.408 af

**Total Runoff Area = 22.734 ac Runoff Volume = 3.432 af Average Runoff Depth = 1.81"**  
**98.79% Pervious = 22.459 ac 1.21% Impervious = 0.274 ac**

**20747-EXIST-DRAINAGE**

Prepared by Jones &amp; Beach Engineers

HydroCAD® 10.10-4a s/n 10589 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-YR Rainfall=4.66"

Printed 8/9/2021

Page 2

**Summary for Subcatchment 1S: EX-WS-1**

Runoff = 18.17 cfs @ 12.39 hrs, Volume= 2.024 af, Depth&gt; 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.66"

Area (sf)	CN	Description
271	96	Gravel surface, HSG B
150,142	55	Woods, Good, HSG B
4,510	98	Paved parking, HSG C
209,710	70	Woods, Good, HSG C
9,322	93	Paved roads w/open ditches, 50% imp, HSG D
9,872	80	>75% Grass cover, Good, HSG D
262,862	77	Woods, Good, HSG D
2,871	96	Gravel surface, HSG D
649,560	70	Weighted Average
640,389		98.59% Pervious Area
9,171		1.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	32	0.0625	0.10		<b>Sheet Flow, WOODS</b> Woods: Light underbrush n= 0.400 P2= 3.20"
0.3	34	0.0625	1.75		<b>Sheet Flow, ROAD</b> Smooth surfaces n= 0.011 P2= 3.20"
7.2	32	0.0312	0.07		<b>Sheet Flow, WOODS</b> Woods: Light underbrush n= 0.400 P2= 3.20"
2.7	225	0.0755	1.37		<b>Shallow Concentrated Flow, WOODS</b> Woodland Kv= 5.0 fps
10.6	393	0.0152	0.62		<b>Shallow Concentrated Flow, WOODS</b> Woodland Kv= 5.0 fps
26.3	716	Total			

**Summary for Subcatchment 2S: EX-WS-2**

Runoff = 13.26 cfs @ 12.34 hrs, Volume= 1.408 af, Depth&gt; 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.66"

Area (sf)	CN	Description
3,354	30	Woods, Good, HSG A
468	83	Paved roads w/open ditches, 50% imp, HSG A
5,088	93	Paved roads w/open ditches, 50% imp, HSG D
2,396	80	>75% Grass cover, Good, HSG D
321,987	77	Woods, Good, HSG D
7,425	96	Gravel surface, HSG D
340,718	77	Weighted Average
337,940		99.18% Pervious Area
2,778		0.82% Impervious Area

**20747-EXIST-DRAINAGE**

Type III 24-hr 10-YR Rainfall=4.66"

Prepared by Jones &amp; Beach Engineers

Printed 8/9/2021

HydroCAD® 10.10-4a s/n 10589 © 2020 HydroCAD Software Solutions LLC

Page 3

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	64	0.0150	0.10		<b>Sheet Flow, GRASS</b> Grass: Dense n= 0.240 P2= 3.20"
0.6	35	0.0150	0.99		<b>Sheet Flow, GRAVEL</b> Smooth surfaces n= 0.011 P2= 3.20"
3.9	128	0.0117	0.54		<b>Shallow Concentrated Flow, WOODS</b> Woodland Kv= 5.0 fps
5.3	319	0.0407	1.01		<b>Shallow Concentrated Flow, WOODS</b> Woodland Kv= 5.0 fps
3.3	100	0.0100	0.50		<b>Shallow Concentrated Flow, WOODS</b> Woodland Kv= 5.0 fps
24.3	646	Total			

**Summary for Link AP-1: Analysis Point #1**

Inflow Area = 14.912 ac, 1.41% Impervious, Inflow Depth > 1.63" for 10-YR event  
 Inflow = 18.17 cfs @ 12.39 hrs, Volume= 2.024 af  
 Primary = 18.17 cfs @ 12.39 hrs, Volume= 2.024 af, Atten= 0%, Lag= 0.0 min

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

**Summary for Link AP-2: Analysis Point #2**

Inflow Area = 7.822 ac, 0.82% Impervious, Inflow Depth > 2.16" for 10-YR event  
 Inflow = 13.26 cfs @ 12.34 hrs, Volume= 1.408 af  
 Primary = 13.26 cfs @ 12.34 hrs, Volume= 1.408 af, Atten= 0%, Lag= 0.0 min

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

**20747-EXIST-DRAINAGE**

Type III 24-hr 25-YR Rainfall=5.91"

Prepared by Jones & Beach Engineers

Printed 8/9/2021

HydroCAD® 10.10-4a s/n 10589 © 2020 HydroCAD Software Solutions LLC

Page 5

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 1S: EX-WS-1**

Runoff Area=649,560 sf 1.41% Impervious Runoff Depth>2.51"  
Flow Length=716' Tc=26.3 min CN=70 Runoff=28.36 cfs 3.121 af

**Subcatchment 2S: EX-WS-2**

Runoff Area=340,718 sf 0.82% Impervious Runoff Depth>3.16"  
Flow Length=646' Tc=24.3 min CN=77 Runoff=19.32 cfs 2.058 af

**Link AP-1: Analysis Point #1**

Inflow=28.36 cfs 3.121 af  
Primary=28.36 cfs 3.121 af

**Link AP-2: Analysis Point #2**

Inflow=19.32 cfs 2.058 af  
Primary=19.32 cfs 2.058 af

**Total Runoff Area = 22.734 ac Runoff Volume = 5.178 af Average Runoff Depth = 2.73"**  
**98.79% Pervious = 22.459 ac 1.21% Impervious = 0.274 ac**

## 20747-EXIST-DRAINAGE

Type III 24-hr 50-YR Rainfall=7.06"

Prepared by Jones & Beach Engineers

Printed 8/9/2021

HydroCAD® 10.10-4a s/n 10589 © 2020 HydroCAD Software Solutions LLC

Page 6

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

### Subcatchment 1S: EX-WS-1

Runoff Area=649,560 sf 1.41% Impervious Runoff Depth>3.39"  
Flow Length=716' Tc=26.3 min CN=70 Runoff=38.36 cfs 4.209 af

### Subcatchment 2S: EX-WS-2

Runoff Area=340,718 sf 0.82% Impervious Runoff Depth>4.12"  
Flow Length=646' Tc=24.3 min CN=77 Runoff=25.06 cfs 2.684 af

### Link AP-1: Analysis Point #1

Inflow=38.36 cfs 4.209 af  
Primary=38.36 cfs 4.209 af

### Link AP-2: Analysis Point #2

Inflow=25.06 cfs 2.684 af  
Primary=25.06 cfs 2.684 af

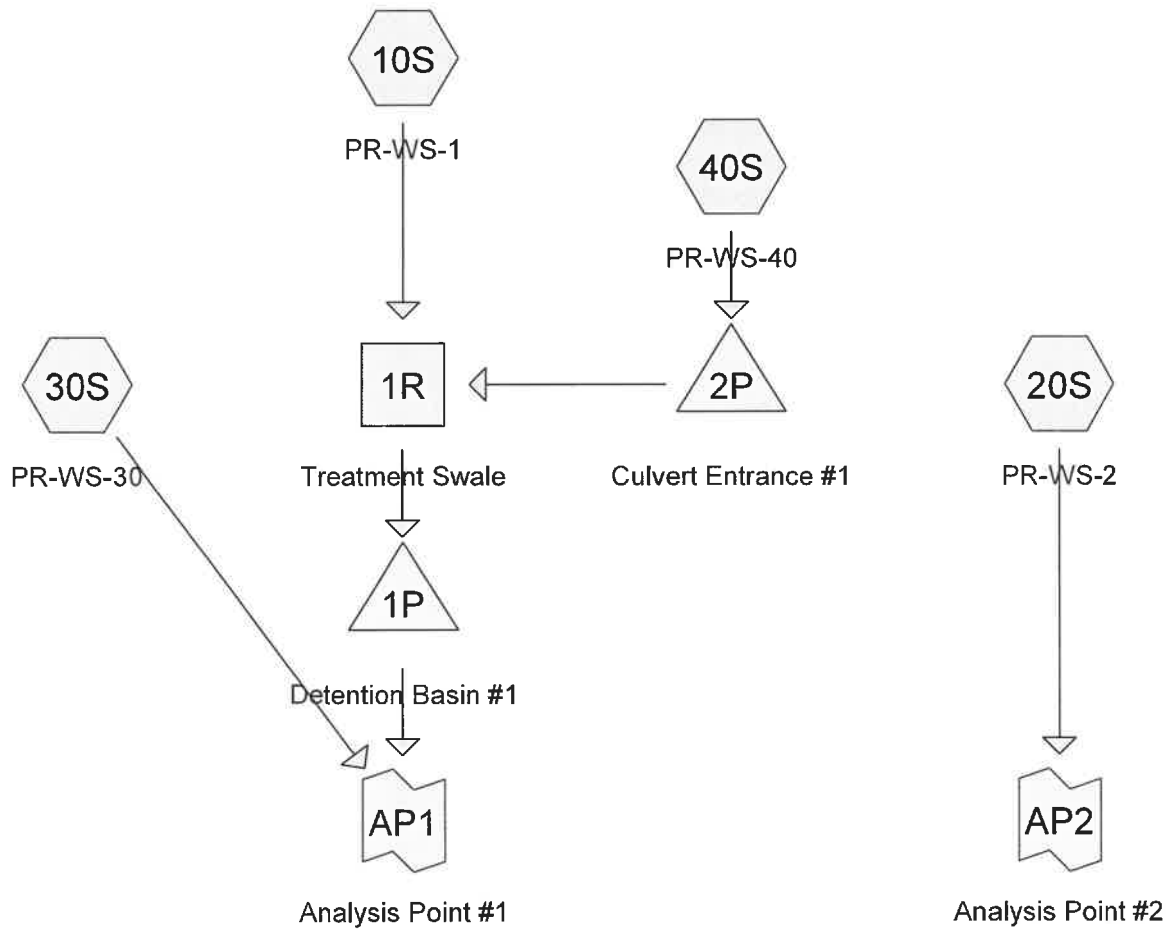
**Total Runoff Area = 22.734 ac Runoff Volume = 6.894 af Average Runoff Depth = 3.64"**  
**98.79% Pervious = 22.459 ac 1.21% Impervious = 0.274 ac**

## 2.7 APPENDIX II

### POST-DEVELOPMENT CONDITIONS ANALYSIS

- 2.7.1 2-Year 24-Hour Summary Analysis
- 2.7.2 10-Year 24-Hour Complete Analysis
- 2.7.3 25-Year 24-Hour Summary Analysis
- 2.7.4 50-Year 24-Hour Summary Analysis





**20747-PROP-DRAINAGE**

Prepared by {enter your company name here}

Printed 1/4/2022

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

Page 2

**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.003	39	>75% Grass cover, Good, HSG A (20S)
1.719	61	>75% Grass cover, Good, HSG B (10S, 30S, 40S)
1.004	74	>75% Grass cover, Good, HSG C (10S, 30S)
5.992	80	>75% Grass cover, Good, HSG D (10S, 20S, 30S, 40S)
0.011	83	Paved roads w/open ditches, 50% imp, HSG A (20S)
0.402	89	Paved roads w/open ditches, 50% imp, HSG B (10S, 30S, 40S)
0.099	92	Paved roads w/open ditches, 50% imp, HSG C (30S)
1.244	93	Paved roads w/open ditches, 50% imp, HSG D (10S, 20S, 30S, 40S)
0.073	30	Woods, Good, HSG A (20S)
1.332	55	Woods, Good, HSG B (30S)
3.814	70	Woods, Good, HSG C (10S, 30S)
7.040	77	Woods, Good, HSG D (10S, 20S, 30S)
<b>22.734</b>	<b>75</b>	<b>TOTAL AREA</b>

**20747-PROP-DRAINAGE**

Prepared by {enter your company name here}

Printed 1/4/2022

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

Page 3

**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.088	HSG A	20S
3.453	HSG B	10S, 30S, 40S
4.918	HSG C	10S, 30S
14.275	HSG D	10S, 20S, 30S, 40S
0.000	Other	
<b>22.734</b>		<b>TOTAL AREA</b>

**20747-PROP-DRAINAGE**

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

POST-DEVELOPMENT  
Type III 24-hr 2 YR Rainfall=3.08"

Printed 1/4/2022

Page 4

Time span=5.00-20.00 hrs, dt=0.02 hrs, 751 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 10S: PR-WS-1** Runoff Area=282,039 sf 5.12% Impervious Runoff Depth>1.08"  
Flow Length=613' Tc=23.2 min CN=78 Runoff=5.53 cfs 0.584 af

**Subcatchment 20S: PR-WS-2** Runoff Area=209,570 sf 2.67% Impervious Runoff Depth>1.14"  
Flow Length=631' Tc=24.3 min CN=79 Runoff=4.27 cfs 0.457 af

**Subcatchment 30S: PR-WS-30** Runoff Area=420,502 sf 1.96% Impervious Runoff Depth>0.68"  
Flow Length=468' Tc=26.3 min CN=70 Runoff=4.54 cfs 0.544 af

**Subcatchment 40S: PR-WS-40** Runoff Area=78,167 sf 12.76% Impervious Runoff Depth>1.20"  
Flow Length=557' Tc=16.6 min CN=80 Runoff=1.97 cfs 0.180 af

**Reach 1R: Treatment Swale** Avg. Flow Depth=0.68' Max Vel=0.50 fps Inflow=7.47 cfs 0.751 af  
n=0.150 L=380.0' S=0.0050 '/ Capacity=41.03 cfs Outflow=6.16 cfs 0.731 af

**Pond 1P: Detention Basin #1** Peak Elev=176.60' Storage=10,765 cf Inflow=6.16 cfs 0.731 af  
Outflow=2.68 cfs 0.650 af

**Pond 2P: Culvert Entrance #1** Peak Elev=179.48' Storage=760 cf Inflow=1.97 cfs 0.180 af  
18.0" Round Culvert n=0.012 L=52.0' S=0.0050 '/ Outflow=2.15 cfs 0.167 af

**Link AP1: Analysis Point #1** Inflow=4.63 cfs 1.194 af  
Primary=4.63 cfs 1.194 af

**Link AP2: Analysis Point #2** Inflow=4.27 cfs 0.457 af  
Primary=4.27 cfs 0.457 af

**Total Runoff Area = 22.734 ac Runoff Volume = 1.764 af Average Runoff Depth = 0.93"**  
**96.14% Pervious = 21.855 ac 3.86% Impervious = 0.878 ac**

**20747-PROP-DRAINAGE**

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

POST-DEVELOPMENT

Type III 24-hr 10 YR Rainfall=4.66"

Printed 1/4/2022

Page 1

Time span=5.00-20.00 hrs, dt=0.02 hrs, 751 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 10S: PR-WS-1**                      Runoff Area=282,039 sf   5.12% Impervious   Runoff Depth>2.24"  
Flow Length=613'   Tc=23.2 min   CN=78   Runoff=11.63 cfs   1.210 af

**Subcatchment 20S: PR-WS-2**                      Runoff Area=209,570 sf   2.67% Impervious   Runoff Depth>2.32"  
Flow Length=631'   Tc=24.3 min   CN=79   Runoff=8.80 cfs   0.932 af

**Subcatchment 30S: PR-WS-30**                      Runoff Area=420,502 sf   1.96% Impervious   Runoff Depth>1.63"  
Flow Length=468'   Tc=26.3 min   CN=70   Runoff=11.78 cfs   1.310 af

**Subcatchment 40S: PR-WS-40**                      Runoff Area=78,167 sf   12.76% Impervious   Runoff Depth>2.41"  
Flow Length=557'   Tc=16.6 min   CN=80   Runoff=3.98 cfs   0.361 af

**Reach 1R: Treatment Swale**                      Avg. Flow Depth=1.08'   Max Vel=0.66 fps   Inflow=15.32 cfs   1.557 af  
n=0.150   L=380.0'   S=0.0050 '/'   Capacity=41.03 cfs   Outflow=13.63 cfs   1.530 af

**Pond 1P: Detention Basin #1**                      Peak Elev=177.06'   Storage=20,429 cf   Inflow=13.63 cfs   1.530 af  
Outflow=7.77 cfs   1.426 af

**Pond 2P: Culvert Entrance #1**                      Peak Elev=179.83'   Storage=760 cf   Inflow=3.98 cfs   0.361 af  
18.0" Round Culvert   n=0.012   L=52.0'   S=0.0050 '/'   Outflow=4.06 cfs   0.347 af

**Link AP1: Analysis Point #1**                      Inflow=13.99 cfs   2.735 af  
Primary=13.99 cfs   2.735 af

**Link AP2: Analysis Point #2**                      Inflow=8.80 cfs   0.932 af  
Primary=8.80 cfs   0.932 af

**Total Runoff Area = 22.734 ac   Runoff Volume = 3.812 af   Average Runoff Depth = 2.01"**  
**96.14% Pervious = 21.855 ac   3.86% Impervious = 0.878 ac**

**20747-PROP-DRAINAGE**

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

POST-DEVELOPMENT

Type III 24-hr 10 YR Rainfall=4.66"

Printed 1/4/2022

Page 2

**Summary for Subcatchment 10S: PR-WS-1**

Runoff = 11.63 cfs @ 12.33 hrs, Volume= 1.210 af, Depth&gt; 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10 YR Rainfall=4.66"

Area (sf)	CN	Description
6,116	89	Paved roads w/open ditches, 50% imp, HSG B
22,484	61	>75% Grass cover, Good, HSG B
38,780	74	>75% Grass cover, Good, HSG C
13,220	70	Woods, Good, HSG C
22,781	93	Paved roads w/open ditches, 50% imp, HSG D
100,513	80	>75% Grass cover, Good, HSG D
78,145	77	Woods, Good, HSG D
282,039	78	Weighted Average
267,591		94.88% Pervious Area
14,449		5.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	100	0.0150	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.08"
1.9	130	0.0500	1.12		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.2	37	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
4.0	266	0.0500	1.12		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.8	80	0.0125	1.68		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
23.2	613	Total			

**Summary for Subcatchment 20S: PR-WS-2**

Runoff = 8.80 cfs @ 12.34 hrs, Volume= 0.932 af, Depth&gt; 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10 YR Rainfall=4.66"

Area (sf)	CN	Description
495	83	Paved roads w/open ditches, 50% imp, HSG A
147	39	>75% Grass cover, Good, HSG A
3,180	30	Woods, Good, HSG A
10,687	93	Paved roads w/open ditches, 50% imp, HSG D
98,727	80	>75% Grass cover, Good, HSG D
96,334	77	Woods, Good, HSG D
209,570	79	Weighted Average
203,979		97.33% Pervious Area
5,591		2.67% Impervious Area

**20747-PROP-DRAINAGE**

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

POST-DEVELOPMENT

Type III 24-hr 10 YR Rainfall=4.66"

Printed 1/4/2022

Page 3

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	100	0.0260	0.13		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.08"
11.2	531	0.0250	0.79		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
24.3	631	Total			

**Summary for Subcatchment 30S: PR-WS-30**

Runoff = 11.78 cfs @ 12.38 hrs, Volume= 1.310 af, Depth&gt; 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10 YR Rainfall=4.66"

Area (sf)	CN	Description
7,064	89	Paved roads w/open ditches, 50% imp, HSG B
40,622	61	>75% Grass cover, Good, HSG B
58,024	55	Woods, Good, HSG B
4,327	92	Paved roads w/open ditches, 50% imp, HSG C
4,967	74	>75% Grass cover, Good, HSG C
152,928	70	Woods, Good, HSG C
5,108	93	Paved roads w/open ditches, 50% imp, HSG D
15,298	80	>75% Grass cover, Good, HSG D
132,164	77	Woods, Good, HSG D
420,502	70	Weighted Average
412,253		98.04% Pervious Area
8,250		1.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.2	100	0.0100	0.09		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.08"
7.1	368	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
26.3	468	Total			

**Summary for Subcatchment 40S: PR-WS-40**

Runoff = 3.98 cfs @ 12.23 hrs, Volume= 0.361 af, Depth&gt; 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10 YR Rainfall=4.66"

**20747-PROP-DRAINAGE**

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

POST-DEVELOPMENT  
Type III 24-hr 10 YR Rainfall=4.66"

Printed 1/4/2022

Page 4

Area (sf)	CN	Description
4,335	89	Paved roads w/open ditches, 50% imp, HSG B
11,761	61	>75% Grass cover, Good, HSG B
15,617	93	Paved roads w/open ditches, 50% imp, HSG D
46,454	80	>75% Grass cover, Good, HSG D
78,167	80	Weighted Average
68,191		87.24% Pervious Area
9,976		12.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	100	0.0200	0.11		<b>Sheet Flow,</b>
					Grass: Dense n= 0.240 P2= 3.08"
2.1	457	0.0600	3.67		<b>Shallow Concentrated Flow,</b>
					Grassed Waterway Kv= 15.0 fps
16.6	557	Total			

**Summary for Reach 1R: Treatment Swale**

[79] Warning: Submerged Pond 2P Primary device # 1 INLET by 0.18'

Inflow Area = 8.269 ac, 6.78% Impervious, Inflow Depth > 2.26" for 10 YR event  
 Inflow = 15.32 cfs @ 12.30 hrs, Volume= 1.557 af  
 Outflow = 13.63 cfs @ 12.57 hrs, Volume= 1.530 af, Atten= 11%, Lag= 16.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.02 hrs  
 Max. Velocity= 0.66 fps, Min. Travel Time= 9.6 min  
 Avg. Velocity = 0.25 fps, Avg. Travel Time= 25.5 min

Peak Storage= 7,882 cf @ 12.41 hrs  
 Average Depth at Peak Storage= 1.08', Surface Width= 22.47'  
 Bank-Full Depth= 2.00' Flow Area= 44.0 sf, Capacity= 41.03 cfs

16.00' x 2.00' deep channel, n= 0.150  
 Side Slope Z-value= 3.0 '/' Top Width= 28.00'  
 Length= 380.0' Slope= 0.0050 '/'  
 Inlet Invert= 177.80', Outlet Invert= 175.90'





**20747-PROP-DRAINAGE**

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

POST-DEVELOPMENT  
Type III 24-hr 10 YR Rainfall=4.66"

Printed 1/4/2022

Page 5

**Summary for Pond 1P: Detention Basin #1**

[62] Hint: Exceeded Reach 1R OUTLET depth by 0.61' @ 13.22 hrs

Inflow Area = 8.269 ac, 6.78% Impervious, Inflow Depth > 2.22" for 10 YR event  
 Inflow = 13.63 cfs @ 12.57 hrs, Volume= 1.530 af  
 Outflow = 7.77 cfs @ 12.95 hrs, Volume= 1.426 af, Atten= 43%, Lag= 22.3 min  
 Primary = 7.77 cfs @ 12.95 hrs, Volume= 1.426 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.02 hrs  
 Peak Elev= 177.06' @ 12.95 hrs Surf.Area= 22,945 sf Storage= 20,429 cf

Plug-Flow detention time= 64.5 min calculated for 1.424 af (93% of inflow)  
 Center-of-Mass det. time= 42.8 min ( 870.3 - 827.5 )

Volume #1	Invert	Avail.Storage	Storage Description			
	176.00'	45,792 cf	<b>Custom Stage Data (Irregular) Listed below (Recalc)</b>			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
176.00	16,002	694.0	0	0	16,002	
177.00	22,509	1,376.9	19,163	19,163	128,547	
178.00	30,973	1,331.8	26,629	45,792	138,362	

Device	Routing	Invert	Outlet Devices															
#1	Primary	177.50'	<b>4.0' long x 2.0' breadth EMERGENCY OVERFLOW</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32															
#2	Device 4	177.50'	<b>4.0' long TOP OF WEIR PLATE</b> 2 End Contraction(s)															
#3	Device 4	176.00'	<b>36.0" W x 15.0" H Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads															
#4	Primary	176.00'	<b>36.0" Round P-201</b> L= 84.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 176.00' / 174.50' S= 0.0179 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 7.07 sf															

**Primary OutFlow** Max=7.77 cfs @ 12.95 hrs HW=177.06' (Free Discharge)

- 1=EMERGENCY OVERFLOW ( Controls 0.00 cfs)
- 4=P-201 (Inlet Controls 7.77 cfs @ 3.50 fps)
- 2=TOP OF WEIR PLATE ( Controls 0.00 cfs)
- 3=Orifice/Grate (Passes 7.77 cfs of 10.44 cfs potential flow)

## 20747-PROP-DRAINAGE

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

POST-DEVELOPMENT

Type III 24-hr 10 YR Rainfall=4.66"

Printed 1/4/2022

Page 6

### Summary for Pond 2P: Culvert Entrance #1

[93] Warning: Storage range exceeded by 0.83'

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=51)

Inflow Area = 1.794 ac, 12.76% Impervious, Inflow Depth > 2.41" for 10 YR event  
Inflow = 3.98 cfs @ 12.23 hrs, Volume= 0.361 af  
Outflow = 4.06 cfs @ 12.22 hrs, Volume= 0.347 af, Atten= 0%, Lag= 0.0 min  
Primary = 4.06 cfs @ 12.22 hrs, Volume= 0.347 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.02 hrs  
Peak Elev= 179.83' @ 12.22 hrs Surf.Area= 1,201 sf Storage= 760 cf

Plug-Flow detention time= 24.8 min calculated for 0.347 af (96% of inflow)

Center-of-Mass det. time= 10.9 min ( 808.7 - 797.8 )

Volume	Invert	Avail.Storage	Storage Description		
#1	177.50'	760 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.50	50	80.0	0	0	50
178.00	278	155.0	74	74	1,454
179.00	1,201	373.0	686	760	10,617

Device	Routing	Invert	Outlet Devices
#1	Primary	178.70'	<b>18.0" Round Culvert</b> L= 52.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 178.70' / 178.44' S= 0.0050 ' S= 0.0050 ' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

**Primary OutFlow** Max=4.05 cfs @ 12.22 hrs HW=179.83' (Free Discharge)

↑1=Culvert (Barrel Controls 4.05 cfs @ 3.95 fps)

### Summary for Link AP1: Analysis Point #1

Inflow Area = 17.923 ac, 4.19% Impervious, Inflow Depth > 1.83" for 10 YR event  
Inflow = 13.99 cfs @ 12.58 hrs, Volume= 2.735 af  
Primary = 13.99 cfs @ 12.58 hrs, Volume= 2.735 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.02 hrs

### Summary for Link AP2: Analysis Point #2

Inflow Area = 4.811 ac, 2.67% Impervious, Inflow Depth > 2.32" for 10 YR event  
Inflow = 8.80 cfs @ 12.34 hrs, Volume= 0.932 af  
Primary = 8.80 cfs @ 12.34 hrs, Volume= 0.932 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.02 hrs

**20747-PROP-DRAINAGE**

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

POST-DEVELOPMENT

Type III 24-hr 25 YR Rainfall=5.91"

Printed 1/4/2022

Page 5

Time span=5.00-20.00 hrs, dt=0.02 hrs, 751 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 10S: PR-WS-1**                      Runoff Area=282,039 sf   5.12% Impervious   Runoff Depth>3.25"  
Flow Length=613'   Tc=23.2 min   CN=78   Runoff=16.80 cfs   1.755 af

**Subcatchment 20S: PR-WS-2**                      Runoff Area=209,570 sf   2.67% Impervious   Runoff Depth>3.35"  
Flow Length=631'   Tc=24.3 min   CN=79   Runoff=12.61 cfs   1.342 af

**Subcatchment 30S: PR-WS-30**                      Runoff Area=420,502 sf   1.96% Impervious   Runoff Depth>2.51"  
Flow Length=468'   Tc=26.3 min   CN=70   Runoff=18.39 cfs   2.020 af

**Subcatchment 40S: PR-WS-40**                      Runoff Area=78,167 sf   12.76% Impervious   Runoff Depth>3.46"  
Flow Length=557'   Tc=16.6 min   CN=80   Runoff=5.65 cfs   0.517 af

**Reach 1R: Treatment Swale**                      Avg. Flow Depth=1.34'   Max Vel=0.74 fps   Inflow=21.93 cfs   2.257 af  
n=0.150   L=380.0'   S=0.0050 '/'   Capacity=41.03 cfs   Outflow=19.99 cfs   2.225 af

**Pond 1P: Detention Basin #1**                      Peak Elev=177.36'   Storage=27,730 cf   Inflow=19.99 cfs   2.225 af  
Outflow=12.34 cfs   2.105 af

**Pond 2P: Culvert Entrance #1**                      Peak Elev=180.10'   Storage=760 cf   Inflow=5.65 cfs   0.517 af  
18.0" Round Culvert   n=0.012   L=52.0'   S=0.0050 '/'   Outflow=5.64 cfs   0.502 af

**Link AP1: Analysis Point #1**                      Inflow=23.56 cfs   4.125 af  
Primary=23.56 cfs   4.125 af

**Link AP2: Analysis Point #2**                      Inflow=12.61 cfs   1.342 af  
Primary=12.61 cfs   1.342 af

**Total Runoff Area = 22.734 ac   Runoff Volume = 5.634 af   Average Runoff Depth = 2.97"**  
**96.14% Pervious = 21.855 ac   3.86% Impervious = 0.878 ac**

**20747-PROP-DRAINAGE**

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 10589 © 2020 HydroCAD Software Solutions LLC

POST-DEVELOPMENT

Type III 24-hr 50 YR Rainfall=7.06"

Printed 1/4/2022

Page 6

Time span=5.00-20.00 hrs, dt=0.02 hrs, 751 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 10S: PR-WS-1** Runoff Area=282,039 sf 5.12% Impervious Runoff Depth>4.22"  
Flow Length=613' Tc=23.2 min CN=78 Runoff=21.69 cfs 2.280 af

**Subcatchment 20S: PR-WS-2** Runoff Area=209,570 sf 2.67% Impervious Runoff Depth>4.33"  
Flow Length=631' Tc=24.3 min CN=79 Runoff=16.18 cfs 1.736 af

**Subcatchment 30S: PR-WS-30** Runoff Area=420,502 sf 1.96% Impervious Runoff Depth>3.39"  
Flow Length=468' Tc=26.3 min CN=70 Runoff=24.88 cfs 2.724 af

**Subcatchment 40S: PR-WS-40** Runoff Area=78,167 sf 12.76% Impervious Runoff Depth>4.45"  
Flow Length=557' Tc=16.6 min CN=80 Runoff=7.22 cfs 0.665 af

**Reach 1R: Treatment Swale** Avg. Flow Depth=1.55' Max Vel=0.81 fps Inflow=28.24 cfs 2.930 af  
n=0.150 L=380.0' S=0.0050 ' Capacity=41.03 cfs Outflow=26.00 cfs 2.894 af

**Pond 1P: Detention Basin #1** Peak Elev=177.60' Storage=34,108 cf Inflow=26.00 cfs 2.894 af  
Outflow=16.83 cfs 2.761 af

**Pond 2P: Culvert Entrance #1** Peak Elev=180.38' Storage=760 cf Inflow=7.22 cfs 0.665 af  
18.0" Round Culvert n=0.012 L=52.0' S=0.0050 ' Outflow=7.21 cfs 0.650 af

**Link AP1: Analysis Point #1** Inflow=32.99 cfs 5.485 af  
Primary=32.99 cfs 5.485 af

**Link AP2: Analysis Point #2** Inflow=16.18 cfs 1.736 af  
Primary=16.18 cfs 1.736 af

**Total Runoff Area = 22.734 ac Runoff Volume = 7.405 af Average Runoff Depth = 3.91"**  
**96.14% Pervious = 21.855 ac 3.86% Impervious = 0.878 ac**

# Extreme Precipitation Tables

## Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.022 degrees West
Latitude	43.148 degrees North
Elevation	0 feet
Date/Time	Thu, 24 Jun 2021 10:28:05 -0400

### Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
<b>1yr</b>	0.26	0.40	0.50	0.65	0.81	1.03	<b>1yr</b>	0.70	0.98	1.20	1.54	1.98	2.57	2.80	<b>1yr</b>	2.28	2.69	3.10	3.82	4.39	<b>1yr</b>
<b>2yr</b>	0.32	0.49	0.61	0.80	1.01	1.28	<b>2yr</b>	0.87	1.16	1.49	1.89	2.41	3.08	3.42	<b>2yr</b>	2.73	3.29	3.79	4.51	5.14	<b>2yr</b>
<b>5yr</b>	0.37	0.57	0.72	0.96	1.23	1.58	<b>5yr</b>	1.06	1.44	1.85	2.37	3.03	3.90	4.38	<b>5yr</b>	3.45	4.21	4.82	5.70	6.45	<b>5yr</b>
<b>10yr</b>	0.40	0.63	0.80	1.09	1.42	1.85	<b>10yr</b>	1.23	1.69	2.17	2.81	3.62	4.66	5.28	<b>10yr</b>	4.13	5.08	5.79	6.81	7.67	<b>10yr</b>
<b>25yr</b>	0.47	0.74	0.94	1.30	1.73	2.28	<b>25yr</b>	1.49	2.09	2.70	3.51	4.56	5.91	6.77	<b>25yr</b>	5.23	6.51	7.38	8.62	9.65	<b>25yr</b>
<b>50yr</b>	0.52	0.83	1.07	1.49	2.01	2.68	<b>50yr</b>	1.74	2.46	3.19	4.17	5.44	7.06	8.18	<b>50yr</b>	6.25	7.87	8.87	10.31	11.49	<b>50yr</b>
<b>100yr</b>	0.59	0.95	1.22	1.72	2.34	3.14	<b>100yr</b>	2.02	2.90	3.76	4.95	6.48	8.46	9.88	<b>100yr</b>	7.48	9.50	10.66	12.34	13.68	<b>100yr</b>
<b>200yr</b>	0.65	1.06	1.37	1.97	2.73	3.70	<b>200yr</b>	2.35	3.41	4.45	5.89	7.74	10.12	11.94	<b>200yr</b>	8.96	11.48	12.82	14.77	16.29	<b>200yr</b>
<b>500yr</b>	0.77	1.26	1.64	2.39	3.34	4.58	<b>500yr</b>	2.88	4.24	5.54	7.39	9.77	12.85	15.34	<b>500yr</b>	11.37	14.75	16.36	18.75	20.55	<b>500yr</b>

### Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
<b>1yr</b>	0.24	0.36	0.44	0.60	0.73	0.90	<b>1yr</b>	0.63	0.88	0.93	1.26	1.54	1.98	2.49	<b>1yr</b>	1.75	2.40	2.89	3.36	3.94	<b>1yr</b>
<b>2yr</b>	0.31	0.49	0.60	0.81	1.00	1.18	<b>2yr</b>	0.86	1.15	1.36	1.82	2.34	2.99	3.31	<b>2yr</b>	2.65	3.18	3.66	4.39	5.01	<b>2yr</b>
<b>5yr</b>	0.35	0.54	0.67	0.92	1.16	1.40	<b>5yr</b>	1.01	1.37	1.61	2.14	2.77	3.59	3.99	<b>5yr</b>	3.17	3.83	4.42	5.35	5.95	<b>5yr</b>
<b>10yr</b>	0.38	0.59	0.73	1.02	1.32	1.60	<b>10yr</b>	1.14	1.56	1.81	2.44	3.12	4.09	4.58	<b>10yr</b>	3.62	4.41	5.09	6.21	6.76	<b>10yr</b>
<b>25yr</b>	0.44	0.67	0.83	1.19	1.56	1.91	<b>25yr</b>	1.35	1.86	2.12	2.84	3.66	4.85	5.49	<b>25yr</b>	4.29	5.28	6.13	7.55	8.42	<b>25yr</b>
<b>50yr</b>	0.49	0.74	0.92	1.32	1.78	2.18	<b>50yr</b>	1.54	2.13	2.37	3.20	4.12	5.51	6.27	<b>50yr</b>	4.88	6.03	7.06	8.75	9.69	<b>50yr</b>
<b>100yr</b>	0.54	0.82	1.03	1.49	2.04	2.50	<b>100yr</b>	1.76	2.45	2.66	3.59	4.62	6.25	7.15	<b>100yr</b>	5.53	6.88	8.14	10.15	11.13	<b>100yr</b>
<b>200yr</b>	0.61	0.91	1.15	1.67	2.33	2.86	<b>200yr</b>	2.01	2.79	2.97	4.03	5.19	7.07	8.98	<b>200yr</b>	6.26	8.63	9.39	11.77	12.80	<b>200yr</b>
<b>500yr</b>	0.71	1.05	1.36	1.97	2.80	3.44	<b>500yr</b>	2.42	3.36	3.47	4.69	6.08	8.29	10.90	<b>500yr</b>	7.34	10.48	11.36	14.34	15.35	<b>500yr</b>

### Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
<b>1yr</b>	0.28	0.43	0.53	0.71	0.88	1.08	<b>1yr</b>	0.76	1.05	1.23	1.72	2.19	2.79	3.08	<b>1yr</b>	2.47	2.96	3.38	4.10	4.77	<b>1yr</b>
<b>2yr</b>	0.33	0.50	0.62	0.84	1.04	1.24	<b>2yr</b>	0.90	1.22	1.47	1.94	2.48	3.21	3.56	<b>2yr</b>	2.85	3.42	3.94	4.65	5.30	<b>2yr</b>
<b>5yr</b>	0.39	0.61	0.75	1.03	1.31	1.58	<b>5yr</b>	1.13	1.54	1.84	2.46	3.15	4.22	4.78	<b>5yr</b>	3.74	4.60	5.25	6.06	6.95	<b>5yr</b>
<b>10yr</b>	0.46	0.71	0.87	1.22	1.58	1.91	<b>10yr</b>	1.36	1.87	2.22	2.99	3.78	5.23	6.00	<b>10yr</b>	4.63	5.77	6.54	7.43	8.54	<b>10yr</b>
<b>25yr</b>	0.56	0.85	1.06	1.51	1.99	2.47	<b>25yr</b>	1.72	2.41	2.85	3.87	4.84	6.96	8.13	<b>25yr</b>	6.16	7.82	8.73	9.76	10.82	<b>25yr</b>
<b>50yr</b>	0.65	0.99	1.23	1.77	2.38	2.98	<b>50yr</b>	2.05	2.91	3.46	4.71	5.84	8.64	10.25	<b>50yr</b>	7.65	9.86	10.90	11.98	13.22	<b>50yr</b>
<b>100yr</b>	0.76	1.14	1.43	2.07	2.84	3.60	<b>100yr</b>	2.45	3.52	4.19	5.73	7.06	10.73	12.92	<b>100yr</b>	9.50	12.42	13.58	14.73	16.16	<b>100yr</b>
<b>200yr</b>	0.88	1.32	1.68	2.43	3.39	4.37	<b>200yr</b>	2.92	4.27	5.09	6.99	8.53	13.37	15.17	<b>200yr</b>	11.84	14.58	16.92	18.09	19.79	<b>200yr</b>
<b>500yr</b>	1.08	1.61	2.07	3.00	4.27	5.61	<b>500yr</b>	3.68	5.49	6.56	9.10	10.96	17.93	20.36	<b>500yr</b>	15.87	19.57	22.64	23.80	25.89	<b>500yr</b>



Project Name: MEADOWBROOK VILLAGE JBE #: 20747  
Town/City: BARRINGTON, NH Date: 6/30/2021

### Rip Rap Outlet Protection Calculation

#### Outlet Designation:

Pipe Size (Do): 18 in. = 1.5 ft  
Q10 (cfs): 25.48 cfs  
Tailwater Elevation (TW): 0.25 (FT) if TW = 0, assume 3"/0.25'

#### Apron Length (La):

TW < Do YES  $La = 1.8Q/Do^{1.5} + 7Do$   
La = 35.47 ft

TW > Do No  $La = 3.0Q/Do^{1.5} + 7Do$   
La =

#### Apron Width (W<sub>2</sub>):

TW < Do  $W_2 = 3Do + La$   
W<sub>2</sub> = 39.97 ft.

TW > Do  $W_2 = 3Do + .4La$   
W<sub>2</sub> = ft.

#### Rip-Rap Diameter (D<sub>50</sub>):

D<sub>50</sub>:  $D_{50} = 0.02Q^{1.3}/TW*Do$   
D<sub>50</sub> = 3.59 ft. 43.08 in.  
Use 3" minimum D<sub>50</sub> ==> D50 = 43.08 in.

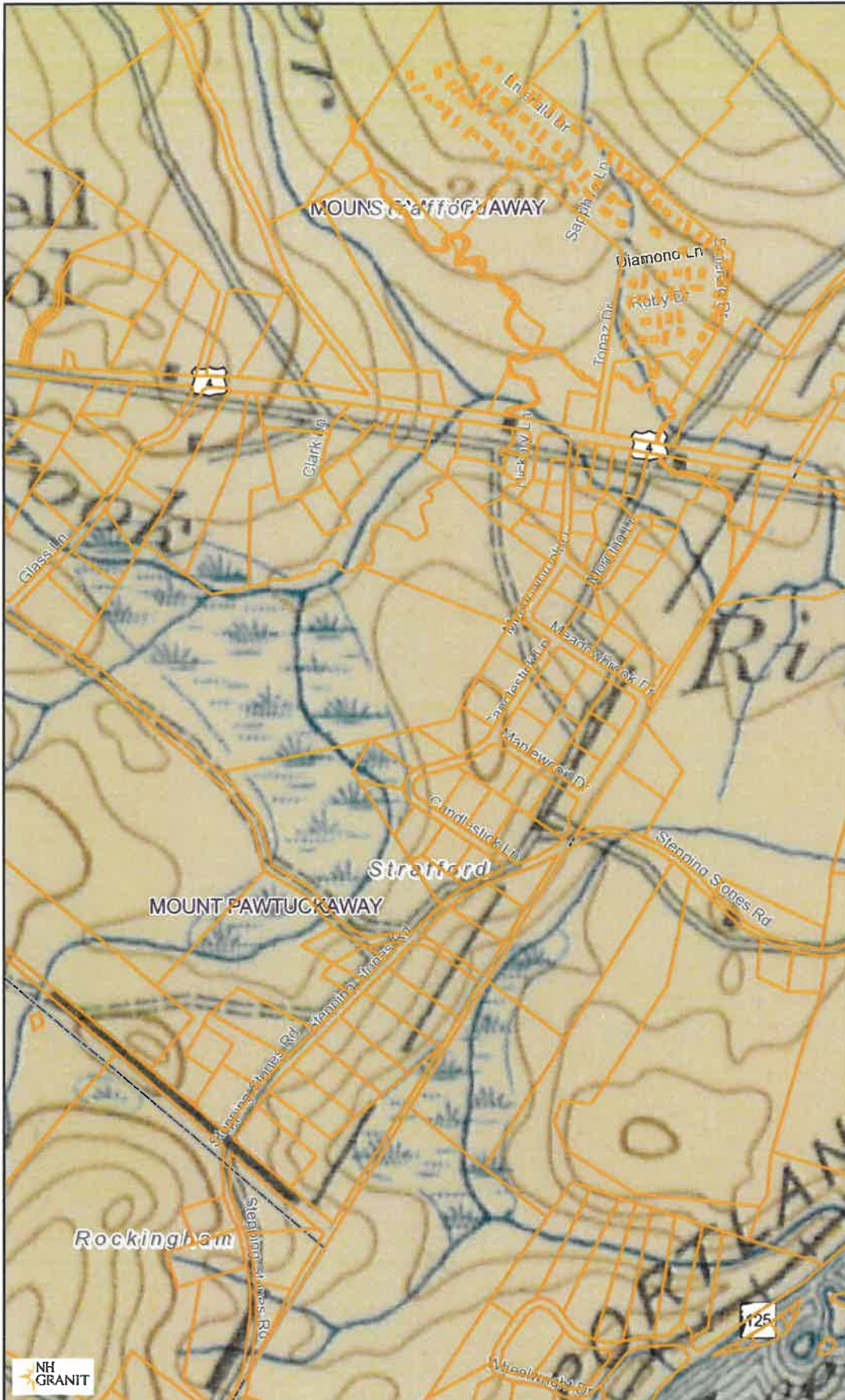
#### Rip-Rap Thickness (T):

$T = 2.5*D_{50}$   
T = 107.691 in.

#### Apron Width (W<sub>1</sub>):

$W_1 = 3*Do$   
W<sub>1</sub> = 4.5 ft.

# USGS MAP



## Legend

- Parcels
  - Parcel Polygons
  - Attributes for Additional Lines
- 15-minute
- State
- County
- City/Town 1919

## Map Scale

1: 10,000



© NH GRANIT, [www.granit.unh.edu](http://www.granit.unh.edu)

Map Generated: 7/6/2021

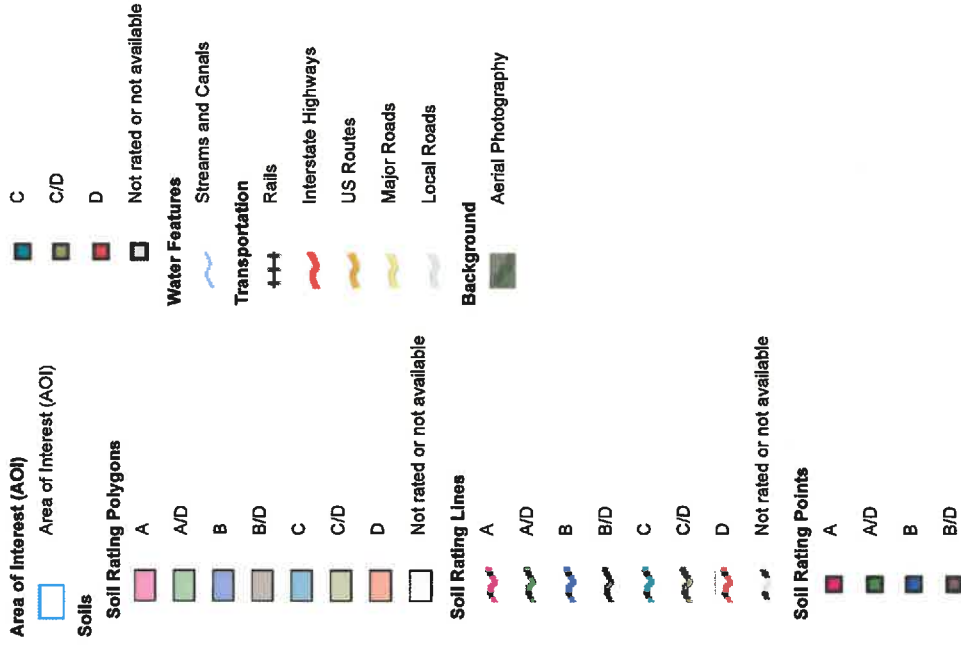
## Notes







## MAP LEGEND



## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Strafford County, New Hampshire  
 Survey Area Data: Version 20, May 29, 2020

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

Date(s) aerial images were photographed: Aug 28, 2015—May 15, 2017

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
AdB	Acton very stony fine sandy loam, 0 to 8 percent slopes	A/D	11.1	4.4%
Be	Biddeford silty clay loam	C/D	1.9	0.7%
CfB	Charlton fine sandy loam, 3 to 8 percent slopes	B	3.6	1.4%
CsB	Charlton fine sandy loam, 3 to 8 percent slopes, very stony	B	25.0	9.9%
CsC	Charlton fine sandy loam, 8 to 15 percent slopes, very stony	B	8.7	3.4%
DeA	Deerfield loamy fine sand, 0 to 3 percent slopes	A	2.0	0.8%
Fa	Fresh water marsh		29.3	11.6%
GIB	Gloucester fine sandy loam, 3 to 8 percent slopes	A	6.3	2.5%
GIC	Gloucester fine sandy loam, 8 to 15 percent slopes	A	5.4	2.1%
GsB	Gloucester very stony fine sandy loam, 3 to 8 percent slopes	A	31.0	12.3%
GsC	Gloucester very stony fine sandy loam, 8 to 15 percent slopes	A	11.7	4.7%
HaB	Hinckley loamy sand, 3 to 8 percent slopes	A	19.4	7.7%
LeB	Leicester very stony fine sandy loam, 3 to 8 percent slopes	A/D	3.8	1.5%
LrA	Leicester-Ridgebury fine sandy loams, 0 to 3 percent slopes, very stony	B/D	0.9	0.4%
Ml	Mixed alluvial land, wet		8.1	3.2%
PbB	Paxton fine sandy loam, 3 to 8 percent slopes	C	1.3	0.5%
PdB	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	C	19.4	7.7%
Sb	Saugatuck loamy sand	B/D	1.0	0.4%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
ScA	Scantic silt loam, 0 to 3 percent slopes	C/D	1.2	0.5%
SuB	Sutton fine sandy loam, 0 to 8 percent slopes, very stony	B/D	13.6	5.4%
Wa	Whitman fine sandy loam, 0 to 3 percent slopes, very stony	D	28.1	11.2%
WdA	Windsor loamy sand, 0 to 3 percent slopes	A	10.5	4.2%
WdB	Windsor loamy sand, 3 to 8 percent slopes	A	8.5	3.4%
<b>Totals for Area of Interest</b>			<b>251.6</b>	<b>100.0%</b>

## 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*





LOOKING WEST FROM MEADOWBROOK ROAD



LOOKING EAST FROM EXISTING GRAVEL DRIVEWAY



EXISTING STREAM ON NORTHERN EDGE OF PROPERTY



WOODED AREA (TYPICAL)

# JONES & BEACH ENGINEERS INC.

85 Portsmouth Avenue, PO Box 219, Stratham, NH 03885  
603.772.4746 - JonesandBeach.com

## **STORMWATER MANAGEMENT OPERATION AND MAINTENANCE MANUAL**

**Prepared for:**

**MEADOWBROOK VILLAGE  
Tax Map 270 Lot 2 & 3, Tax Map 273 Lot 49  
44 Meadowbrook Drive  
Barrington, NH 03825**

**7/6/2021  
Rev. 1/4/22  
JBE Project No. 20747**



# Inspection and Maintenance of Facilities and Property

## A. Maintenance of Common Facilities or Property

1. The future owners and assigns are responsible to perform the maintenance obligations or hire a Professional Engineer to review the site on an annual basis for maintenance and certification of the stormwater system. The Association shall keep receipts and records of all maintenance companies hired throughout the year to submit along with the following form. The annual report and certification shall be submitted with three copies to the Town Planner by December 31<sup>st</sup> of each year.

## B. General Inspection and Maintenance Requirements

1. Permanent stormwater and sediment and erosion control facilities to be maintained on the site include, but are not limited to, the following:
  - a. Culverts
  - b. Swales
  - c. Vegetation and landscaping
  - d. Roadways
  - e. Riprap inlet and outlet protection aprons
  - f. Detention Basin
  - g. Invasive Species
2. Maintenance of permanent measures shall follow the following schedule:
  - a. Normal winter roadway maintenance including plowing and snow removal.
  - b. Road sweeping at the end of every winter, preferably at the start of the spring rain season.
  - c. **Inspection** of culvert inlets and outlets at least **once per month** during the rainy season (March to November). Any debris is to be removed and disposed of properly.
  - d. **Annual inspection** of the site for erosion, destabilization, settling, and sloughing. Any needed repairs are to be conducted immediately.
  - e. **Annual inspection** of site's vegetation and landscaping. Any areas that are bare shall be reseeded and mulched with hay or, if the case is extreme, loamed and seeded or sodded to ensure adequate vegetative cover. Landscape specimens shall be replaced in kind, if they are found to be dead or dying.

- f. Rock riprap should be **inspected annually** and after every major storm event in order to ensure that it has not been displaced, undermined, or otherwise damaged. Displaced rock should be replaced, or additional rock added in order to maintain the structure(s) in their undamaged state. Woody vegetation should not be allowed to become established in riprap areas, and/or any debris removed from the void spaces between the rocks. If the riprap is adjacent to a stream or other waterbody, the water should be kept clear of obstructions, debris, and sediment deposits.
- g. **Detention Basin:** Detention Basin should be inspected twice annually and after every rainfall event of 2.5" or greater within a 24-hour period at a minimum. The basin areas designed to collect and detain stormwater will need only minimal maintenance.

The bottom, interior, and exterior side slopes and crest of the earthen berm shall be mowed at least once per year. Vegetation shall be maintained in a healthy condition. Woody vegetation shall be removed from embankments.

Embankments shall be inspected annually for settlement, erosion, seepage, animal burrow, woody vegetation and other conditions that could degrade the embankment and reduce its stability for impounding water. Immediate corrective action should be implemented if any such conditions are found.

Inspect inlet and outlet pies, outlet structures, and rip-rap outlet/erosion control once per year. Correct any deficiencies immediately.

Trash and debris shall be removed from the basin and any inlet or outlet whenever observed.

Accumulated sediment should be removed when depth exceeds 3".

- h. **Invasive Species:** Inspection for invasive species growing in stormwater management practices shall occur bi-annually or more frequently during other routine inspections. If invasive species are encountered they should be removed entirely and disposed of in a proper manner. If required, a contractor with the proper qualifications should be hired to remove invasive species.

See attached sample forms as a guideline.

Any inquiries in regards to the design, function, and/or maintenance of any one of the above mentioned facilities or tasks shall be directed to the project engineer:

Jones & Beach Engineers, Inc.  
85 Portsmouth Avenue  
P.O. Box 219  
Stratham, NH 03885

T#: (603) 772-4746  
F#: (603) 772-0227

**Commitment to maintenance requirements**

I agree to complete and/or observe all of the required maintenance practices and their respective schedules as outlined above.

---

Signature

---

Print Name

---

Title

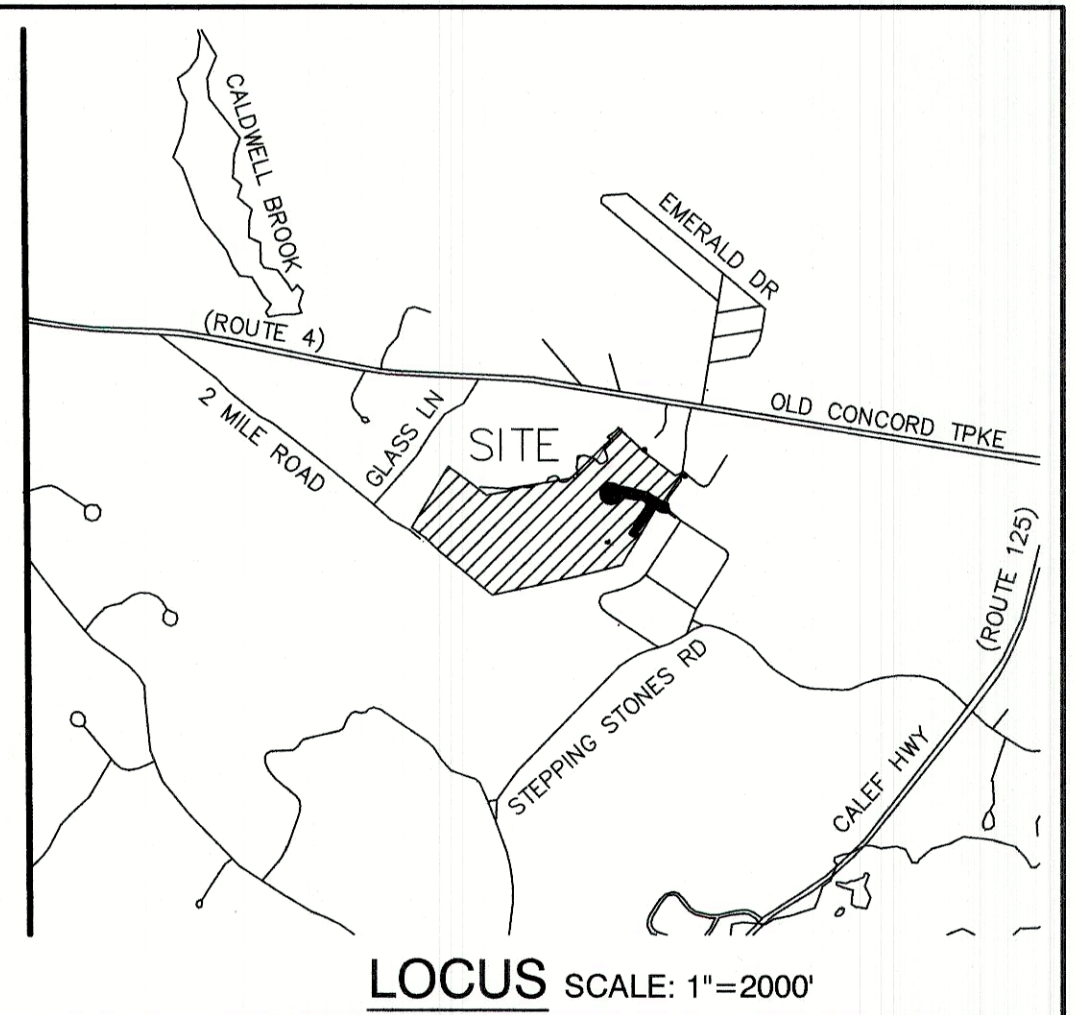
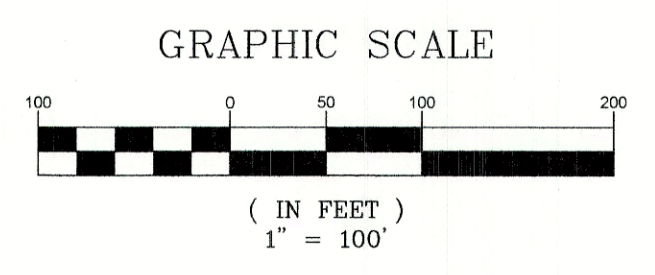
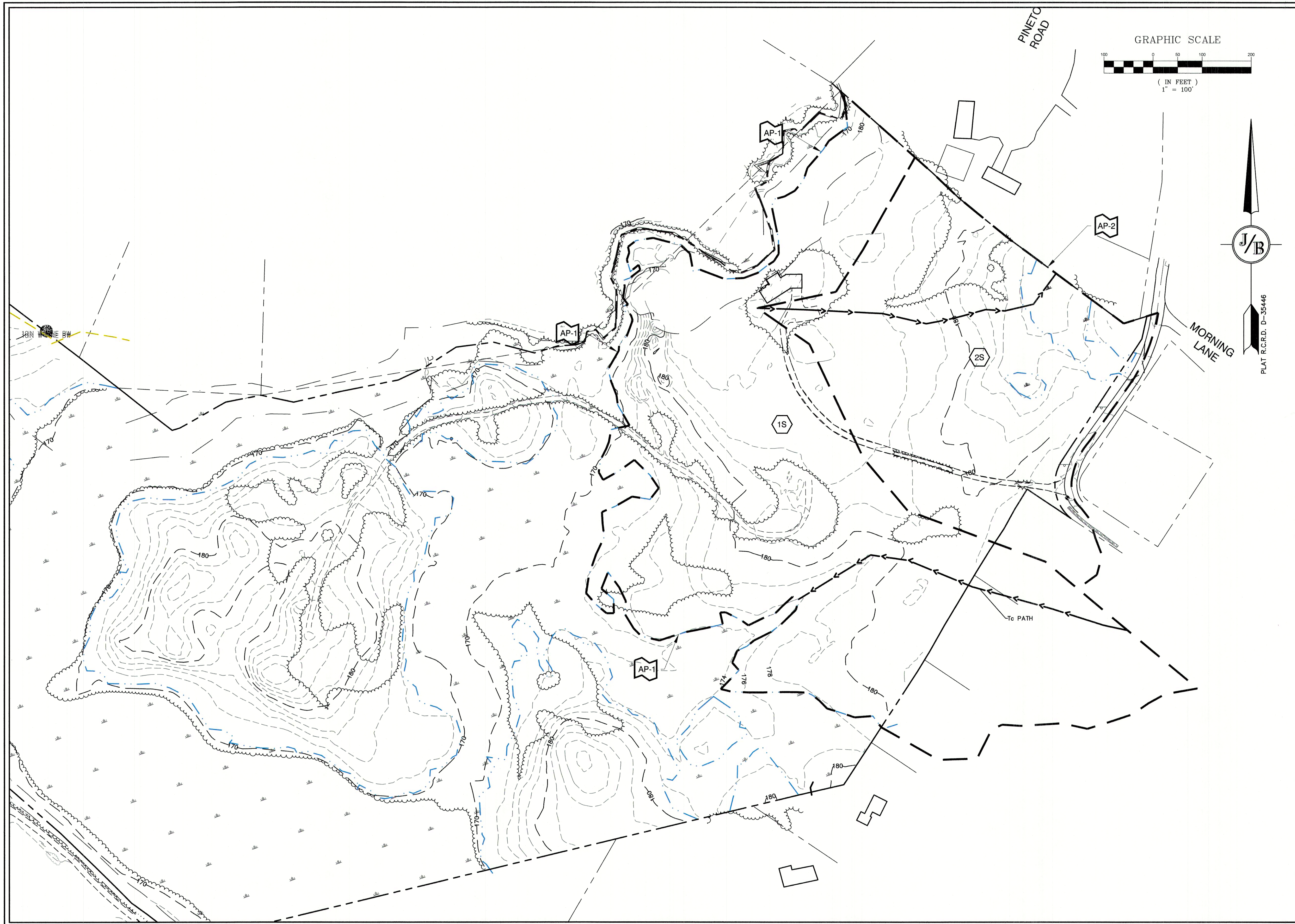
---

Date

## Annual Operations and Maintenance Report

The future owners and assigns are responsible to perform the maintenance obligations or hire a Professional Engineer to review the site on an annual basis for maintenance and certification of the stormwater system. The Association shall keep receipts and records of all maintenance companies hired throughout the year to submit along with the following form. The annual report and certification shall be submitted with three copies to the Town Planner by December 31<sup>st</sup> of each year.

<b>Construction Activity</b>	<b>Date of Inspection</b>	<b>Who Inspected</b>	<b>Findings of Inspector</b>
Culverts			
Swales			
Vegetation and landscaping			
Roadways			
Detention Basin			



**LEGEND**

SUBCATCHMENT BOUNDARY	
SUBCATCHMENT	
REACH	
POND	
TC PATH	
WETLANDS	
SOILS	
FLOW ARROW	

PROJECT PARCEL  
TOWN OF BARRINGTON  
TAX MAP 270, LOT 2 & 3  
TAX MAP 273, LOT 49

APPLICANT/OWNER  
ANTHONY L. & JANIS SERRA  
44 MEADOWBROOK DR  
BARRINGTON, NH 03825  
BK 1236, PG 653

TOTAL LOT AREA  
2,529,529 SQ. FT.  
58.07 ACRES

Design: BWG | Draft: DFP | Date: 8/9/21  
Checked: BWG Scale: AS-NOTED | Project No.: 20747  
Drawing Name: 20747-WATERSHED.dwg  
THIS PLAN SHALL NOT BE MODIFIED WITHOUT WRITTEN PERMISSION FROM JONES & BEACH ENGINEERS, INC. (JBE). ANY ALTERATIONS, AUTHORIZED OR OTHERWISE, SHALL BE AT THE USER'S SOLE RISK AND WITHOUT LIABILITY TO JBE.

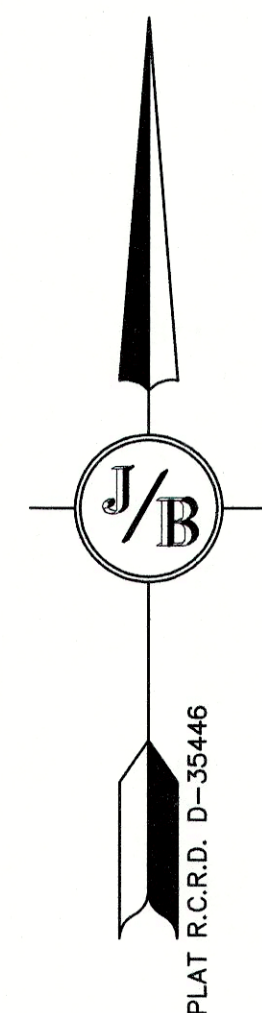
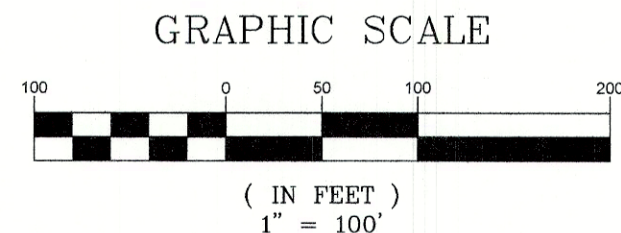
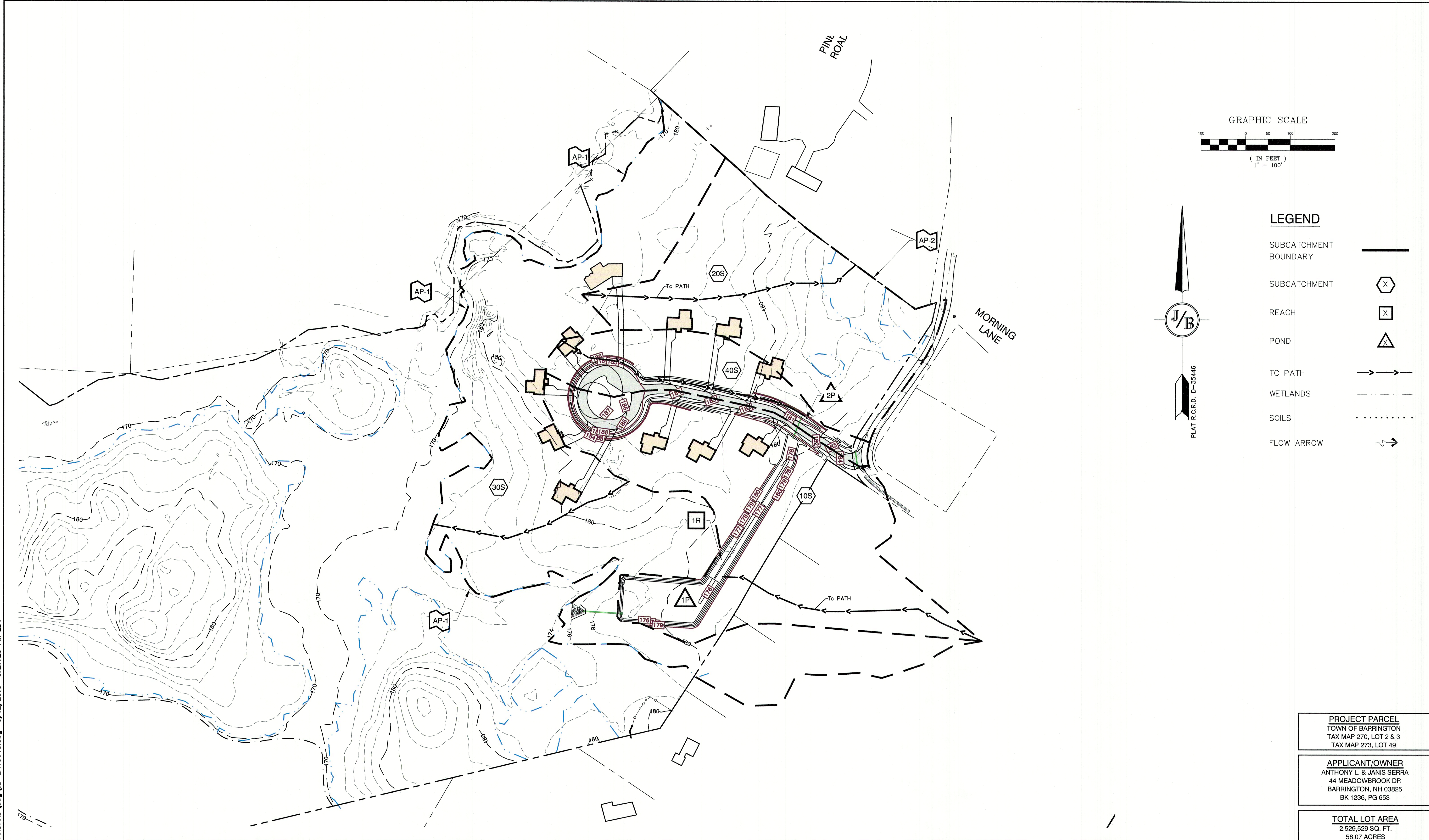
REV.	DATE	REVISION	BY
1	01/04/22	REVISED PER TOWN COMMENTS	BWG
0	08/09/21	ISSUED FOR REVIEW	BWG

Designed and Produced in NH  
**J/B Jones & Beach Engineers, Inc.**  
Civil Engineering Services  
85 Portsmouth Ave. PO Box 219 Stratham, NH 03885  
603-772-4746 FAX: 603-772-0227  
E-MAIL: JBE@JONESANDBEACH.COM

Plan Name: **EXISTING WATERSHED PLAN**  
Project: TAX MAP 270 LOTS 2 & 3 AND TAX MAP 273 LOT 49 MEADOWBROOK DRIVE, BARRINGTON, NH  
Owner of Record: ANTHONY L. & JANIS SERRA 44 MEADOWBROOK DR, BARRINGTON, NH

DRAWING No.  
**W1**  
SHEET 1 OF 2  
JBE PROJECT NO. 20747

F:\CADD\MASTER STANDARD\dwg\LB-LAYOUTS.dwg 3/12/2015 3:27:29 PM EDT



**LEGEND**

- SUBCATCHMENT BOUNDARY
- SUBCATCHMENT X
- REACH X
- POND X
- TC PATH
- WETLANDS
- SOILS
- FLOW ARROW

<b>PROJECT PARCEL</b> TOWN OF BARRINGTON TAX MAP 270, LOT 2 & 3 TAX MAP 273, LOT 49
<b>APPLICANT/OWNER</b> ANTHONY L. & JANIS SERRA 44 MEADOWBROOK DR BARRINGTON, NH 03825 BK 1236, PG 653
<b>TOTAL LOT AREA</b> 2,529,529 SQ. FT. 58.07 ACRES

Design: BWG	Draft: DFP	Date: 8/9/21
Checked: BWG	Scale: AS-NOTED	Project No.: 20747
Drawing Name: 20747-WATERSHED.dwg		
THIS PLAN SHALL NOT BE MODIFIED WITHOUT WRITTEN		
ANY ALTERATIONS, AUTHORIZED OR OTHERWISE, SHALL BE AT THE USER'S SOLE RISK AND WITHOUT LIABILITY TO JBE.		

REV.	DATE	REVISION	BY
1	01/04/22	REVISED PER TOWN COMMENTS	BWG
0	08/09/21	ISSUED FOR REVIEW	BWG

Designed and Produced in NH

**J/B Jones & Beach Engineers, Inc.**

85 Portsmouth Ave. PO Box 219 Stratham, NH 03885

Civil Engineering Services 603-772-4746 FAX: 603-772-0227 E-MAIL: JBE@JONESANDBEACH.COM

Plan Name:	<b>PROPOSED WATERSHED PLAN</b>
Project:	<b>TAX MAP 270 LOTS 2 &amp; 3 AND TAX MAP 273 LOT 49 MEADOWBROOK DRIVE, BARRINGTON, NH</b>
Owner of Record:	ANTHONY L. & JANIS SERRA 44 MEADOWBROOK DR, BARRINGTON, NH

DRAWING No.

**W2**

SHEET 2 OF 2  
JBE PROJECT NO. 20747