STORMWATER MANAGEMENT NARRATIVE

for

CC Railroad Street Newmarket LLC
3 Railroad Street, Newmarket NH
Site Plan

Project Description

The subject property is located at 3 Railroad Street and is comprised of two parcels being merged, Tax Map U3, Lot 138A, and Tax Map U4, Lot 16. The subject property is accessed from Railroad Street and is bordered by S. Main Steet to the north, the railroad to the east, and mixed use residential and commercial to the south and west. Lot 138A is 0.18 acres and Lot 16 is 0.94 acres, resulting in a total project area of 1.12 acres. The subject property contains one existing historical brick building, one office building, historical railroad tracks, gravel area, and native vegetation. The property is serviced by municipal water, sewer and there is a closed drainage system within the Railroad St., but this lot does not drain to that system. Overhead utilities are also currently provided to the site from Railroad Street. The subject property has a gentle downgradient slope from west to east and contains steeper slopes on the northern portion up to South Main Street.

Existing Site Conditions

In the construction area, slopes range from 1% to more than 5%, with most slopes in the construction area around less than 3%. The subject parcel, a combination of two lots is bound to the west by Railroad Street, to the north by South Main Street and to the east by the railroad tracks.

The soil types in the proposed disturbance area (per NRCS Web Soil Survey) are 699-Urban land. According to NRCS Web Soil Survey, there is no designated soil group assigned to 699-Urban land. The site is mostly grass and woods, with the exception of the existing buildings and adjacent gravel access and parking areas.

Subsequent testing of the soil has revealed infiltration rates of 3.78 and 7.5 inches per hour in the locations of test pits 1 and 3, respectively. Based off the results of the test pit analysis, TP 1 soils indicate soil group C soils, TP 2 soils indicate soil group D soils, and TP 3 indicates soil group B soils. Conservatively, stormwater modeling and analysis models the soils throughout the Site as soil group D soils. Test pit data is attached to this report in the appendix and test pit locations are shown on the drainage plans contained in this report.

Currently the subject parcel contains roughly 18,400 square feet of impervious cover between roofs, gravel surface and pavement.

Since the development includes a portion of the adjacent parcel, the site area is modeled using two subcatchments for the existing drainage analysis:

Proposed Site Conditions

In the proposed conditions, the size and shape of the subcatchment areas are altered due to the placement of new site features. Four subcatchment areas have been identified in the post development condition to allow for sizing of stormwater features. The two study points remain the same.

A drywell system consists of a stone reservoir around a perforated concrete basin. The drywell system provides a level of detention along with treatment for the area that is collected, infiltrating a majority of the stormwater that is directed there. At the larger storm events, runoff is designed to overflow out of the drywell and into the closed drainage system that connects to the underground infiltration system.

An underground infiltration system consists of a stone reservoir embedded with perforated pipe. This system collects the majority of the new driveway and parking area and half of the new roof, equaling just more than 24,000 square feet of impervious surfaces. The underground system provides a level of detention along with treatment for the area that is collected, infiltrating a majority of the stormwater that is directed there.

Overall, the increase in impervious cover on the site from pre-development to post-Development is 12,850 square feet. The treatment system proposed provides treatment and detention for nearly double this increase.

Study Methodology

Runoff and routing calculations have been performed for the watershed areas affected by the proposed development. Times of concentration and runoff curve number calculations have been determined using the method described in the Natural Resource Conservation Service (NRCS) Technical Release 55, (TR-55). Time of concentration calculations have been amended where the values given by the TR-55 method is less than five minutes. In these cases a standard minimum value of five minutes has been used to keep this parameter within the acceptable working range of the model. Each Tc path and corresponding length and slope is identified in the pre and post development drainage area plan. The TR-20 based HydroCAD (version 10.0) modeling software has been utilized to perform the complex runoff and routing calculations.

Calculation Results

Preface

Existing-development and post-development calculations have been calculated for the 2-, 10-, 25-, and 50-year storm frequency in accordance with Town of Newmarket's Development Regulations. The SCS TR-20 method was used with a Type III 24-hour storm. The Time of Concentration (Tc) is calculated using the Lag Method. Two Study Points (**SP-1 AND SP-2**) were used for comparison of post-development runoff values with those from existing conditions.

Results

Peak Rate (cfs)

	2 Yr.	***10 Yr.***	***25 Yr.***	***50 Yr.***	***100 Yr.***
SP-1					
Existing	1.49	2.63	3.55	4.39	5.41
Proposed	**0.52**	**0.93**	**1.27**	**1.57**	**4.46**
SP-2					
Existing	1.16	2.16	2.98	3.74	4.66
Proposed	**0.97**	**1.81**	**2.50**	**3.13**	**3.90**

Volume (cf)

	2 Yr.	***10 Yr.***	***25 Yr.***	***50 Yr.***	***100 Yr.***
SP-1					
Existing	5,720	10,255	14,008	17,528	21,854
Proposed	**1,788**	**3,250**	**4,650**	**6,918**	**10,278**
SP-2					
Existing	5,673	10,593	14,728	18,634	23,456
Proposed	**4,747**	**8,863**	**12,323**	**15,591**	**19,625**

Summary

There is a reduction in peak flow and volume of stormwater runoff at both analysis points for all the design storm events. This is due to the underground infiltration system.

Per Appendix B of the New Hampshire Stormwater Manual infiltration BMP's remove 90% TSS, 60% total nitrogen and 60% total phosphorous.

This will help reduce the runoff generated from the site, increase the groundwater recharge, and further protect the water quality of the downstream areas.

Earthwork and grading for site preparation and proposed stormwater features will be required to complete the improvements. Stormwater runoff from most of the post-development impervious areas, including roofs, sidewalks, and paved parking areas will be directed via sheet flow to catch basins with the use of curbing and site grading. From there, stormwater is collected and routed to a new underground infiltration basin system, designed to infiltrate to groundwater. Test pit and infiltration rate analysis (included in this report) in the location of the underground infiltration system indicates the soils in the location of test pit #3 are well-suited to infiltrate stormwater runoff. Based on the HydroCAD analysis and design produced for this report, the proposed underground infiltration system provides no stormwater runoff outflow from the device in the 2- and

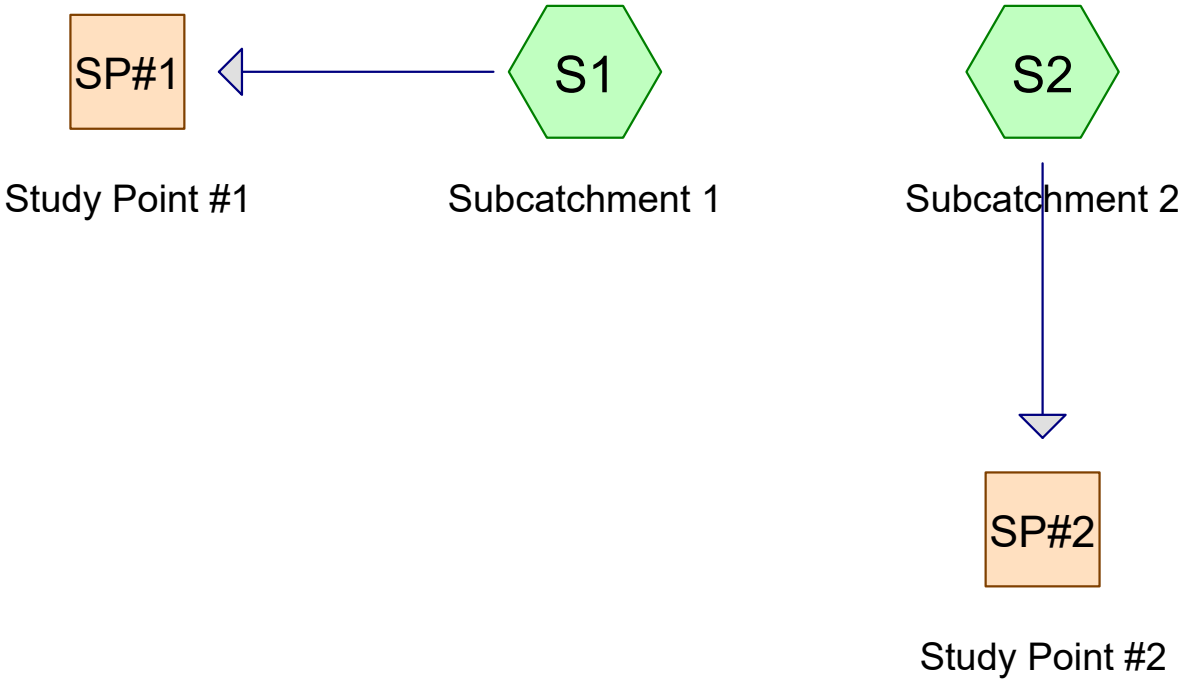
10-year storm events. The 25-, 50-year, and 100-year storm events will produce outflows from the secondary culvert outlet in the system of 0.10, 0.73, and 3.22 cfs, respectively. Ultimately, the underground infiltration system provides a significant decrease to stormwater runoff to Moonlight Brook in all design storm events.

A grass swale also collects stormwater along the northwestern property area and directs stormwater to a proposed drywell. The drywell is designed to infiltrate a portion of the stormwater runoff collected, any overflow from the drywell will travel via sheet flow and collection to the new underground infiltration system.

A portion of new building roof area in proposed sub-catchment S20 is collected via roof drains and outlets near the northern section of the railroad corridor along the property line, in a low area of the corridor. The pre-development areas contributing to this discharge point location includes approximately 0.95 acres, of which 0.25 acres is impervious building or parking areas. Post-development analysis of the areas contributing to this discharge point is approximately 0.79 acres, of which 0.20 acres is impervious building or parking areas. The resulting runoff peak rate and volumes decrease in pre- to post-development analysis for all storm events evaluated. This discharge point is evaluated in HydroCAD as SP#2.

In addition to collecting and treating nearly double the amount of impervious cover than the increase on site, all of the disturbed areas will be loamed and seeded along with new landscaping which will help retain stormwater on the non-impervious areas of the site.

PRE-DEVELOPMENT MODEL OUTPUT



Subcat Reach Pond Link

Routing Diagram for 02 230750_PRE_03
Prepared by Horizons Engineering, Printed 2/22/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Year	Type III 24-hr		Default	24.00	1	3.16	2
2	10 Year	Type III 24-hr		Default	24.00	1	4.79	2
3	25 Year	Type III 24-hr		Default	24.00	1	6.09	2
4	50 Year	Type III 24-hr		Default	24.00	1	7.29	2
5	100 Year	Type III 24-hr		Default	24.00	1	8.75	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
29,539	80	>75% Grass cover, Good, HSG D (S1, S2)
5,852	96	Gravel surface, HSG D (S1)
14,870	98	Paved parking, HSG D (S1, S2)
6,563	98	Roofs, HSG D (S1, S2)
20,980	77	Woods, Good, HSG D (S1, S2)
77,804	**85**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
77,804	HSG D	S1, S2
0	Other	
77,804		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	0	0	29,539	0	29,539	>75% Grass cover, Good	
0	0	0	5,852	0	5,852	Gravel surface	
0	0	0	14,870	0	14,870	Paved parking	
0	0	0	6,563	0	6,563	Roofs	
0	0	0	20,980	0	20,980	Woods, Good	
0	**0**	**0**	**77,804**	**0**	**77,804**	**TOTAL AREA**	

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: Subcatchment1 Runoff Area=36,517 sf 28.52% Impervious Runoff Depth=1.88"
Flow Length=408' Tc=12.5 min CN=87 Runoff=1.49 cfs 5,720 cf

SubcatchmentS2: Subcatchment2 Runoff Area=41,287 sf 26.69% Impervious Runoff Depth=1.65"
Flow Length=497' Slope=0.0100 '/' Tc=23.0 min CN=84 Runoff=1.16 cfs 5,673 cf

Reach SP#1: Study Point #1 Inflow=1.49 cfs 5,720 cf
Outflow=1.49 cfs 5,720 cf

Reach SP#2: Study Point #2 Inflow=1.16 cfs 5,673 cf
Outflow=1.16 cfs 5,673 cf

Total Runoff Area = 77,804 sf Runoff Volume = 11,393 cf Average Runoff Depth = 1.76"
72.45% Pervious = 56,371 sf 27.55% Impervious = 21,433 sf

Summary for Subcatchment S1: Subcatchment 1

Runoff = 1.49 cfs @ 12.17 hrs, Volume= 5,720 cf, Depth= 1.88"
Routed to Reach SP#1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.16"

Area (sf)	CN	Description
5,903	98	Paved parking, HSG D
4,512	98	Roofs, HSG D
8,824	80	>75% Grass cover, Good, HSG D
11,426	77	Woods, Good, HSG D
5,852	96	Gravel surface, HSG D
36,517	87	Weighted Average
26,102		71.48% Pervious Area
10,415		28.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0300	0.19		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
1.6	194	0.0100	2.03		**Shallow Concentrated Flow, Segment 2** Paved Kv= 20.3 fps
1.3	53	0.0100	0.70		**Shallow Concentrated Flow, Segment 3** Short Grass Pasture Kv= 7.0 fps
0.9	61	0.0500	1.12		**Shallow Concentrated Flow, Segment 5** Woodland Kv= 5.0 fps
12.5	408	Total			

Summary for Subcatchment S2: Subcatchment 2

Runoff = 1.16 cfs @ 12.32 hrs, Volume= 5,673 cf, Depth= 1.65"
Routed to Reach SP#2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.16"

Area (sf)	CN	Description
8,967	98	Paved parking, HSG D
2,051	98	Roofs, HSG D
20,715	80	>75% Grass cover, Good, HSG D
9,554	77	Woods, Good, HSG D
41,287	84	Weighted Average
30,269		73.31% Pervious Area
11,018		26.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0100	0.12		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
9.5	397	0.0100	0.70		**Shallow Concentrated Flow, Segment 2** Short Grass Pasture Kv= 7.0 fps
23.0	497	Total			

Summary for Reach SP#1: Study Point #1

Inflow Area = 36,517 sf, 28.52% Impervious, Inflow Depth = 1.88" for 2 Year event
Inflow = 1.49 cfs @ 12.17 hrs, Volume= 5,720 cf
Outflow = 1.49 cfs @ 12.17 hrs, Volume= 5,720 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Reach SP#2: Study Point #2

Inflow Area = 41,287 sf, 26.69% Impervious, Inflow Depth = 1.65" for 2 Year event
Inflow = 1.16 cfs @ 12.32 hrs, Volume= 5,673 cf
Outflow = 1.16 cfs @ 12.32 hrs, Volume= 5,673 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 300R

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: Subcatchment1 Runoff Area=36,517 sf 28.52% Impervious Runoff Depth=3.37"
Flow Length=408' Tc=12.5 min CN=87 Runoff=2.63 cfs 10,255 cf

SubcatchmentS2: Subcatchment2 Runoff Area=41,287 sf 26.69% Impervious Runoff Depth=3.08"
Flow Length=497' Slope=0.0100 '/' Tc=23.0 min CN=84 Runoff=2.16 cfs 10,593 cf

Reach SP#1: Study Point #1 Inflow=2.63 cfs 10,255 cf
Outflow=2.63 cfs 10,255 cf

Reach SP#2: Study Point #2 Inflow=2.16 cfs 10,593 cf
Outflow=2.16 cfs 10,593 cf

Total Runoff Area = 77,804 sf Runoff Volume = 20,848 cf Average Runoff Depth = 3.22"
72.45% Pervious = 56,371 sf 27.55% Impervious = 21,433 sf

Summary for Subcatchment S1: Subcatchment 1

Runoff = 2.63 cfs @ 12.17 hrs, Volume= 10,255 cf, Depth= 3.37"
Routed to Reach SP#1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.79"

Area (sf)	CN	Description
5,903	98	Paved parking, HSG D
4,512	98	Roofs, HSG D
8,824	80	>75% Grass cover, Good, HSG D
11,426	77	Woods, Good, HSG D
5,852	96	Gravel surface, HSG D
36,517	87	Weighted Average
26,102		71.48% Pervious Area
10,415		28.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0300	0.19		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
1.6	194	0.0100	2.03		**Shallow Concentrated Flow, Segment 2** Paved Kv= 20.3 fps
1.3	53	0.0100	0.70		**Shallow Concentrated Flow, Segment 3** Short Grass Pasture Kv= 7.0 fps
0.9	61	0.0500	1.12		**Shallow Concentrated Flow, Segment 5** Woodland Kv= 5.0 fps
12.5	408	Total			

Summary for Subcatchment S2: Subcatchment 2

Runoff = 2.16 cfs @ 12.31 hrs, Volume= 10,593 cf, Depth= 3.08"
Routed to Reach SP#2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.79"

Area (sf)	CN	Description
8,967	98	Paved parking, HSG D
2,051	98	Roofs, HSG D
20,715	80	>75% Grass cover, Good, HSG D
9,554	77	Woods, Good, HSG D
41,287	84	Weighted Average
30,269		73.31% Pervious Area
11,018		26.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0100	0.12		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
9.5	397	0.0100	0.70		**Shallow Concentrated Flow, Segment 2** Short Grass Pasture Kv= 7.0 fps
23.0	497	Total			

Summary for Reach SP#1: Study Point #1

Inflow Area = 36,517 sf, 28.52% Impervious, Inflow Depth = 3.37" for 10 Year event
Inflow = 2.63 cfs @ 12.17 hrs, Volume= 10,255 cf
Outflow = 2.63 cfs @ 12.17 hrs, Volume= 10,255 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Reach SP#2: Study Point #2

Inflow Area = 41,287 sf, 26.69% Impervious, Inflow Depth = 3.08" for 10 Year event
Inflow = 2.16 cfs @ 12.31 hrs, Volume= 10,593 cf
Outflow = 2.16 cfs @ 12.31 hrs, Volume= 10,593 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 300R

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: Subcatchment1 Runoff Area=36,517 sf 28.52% Impervious Runoff Depth=4.60"
Flow Length=408' Tc=12.5 min CN=87 Runoff=3.55 cfs 14,008 cf

SubcatchmentS2: Subcatchment2 Runoff Area=41,287 sf 26.69% Impervious Runoff Depth=4.28"
Flow Length=497' Slope=0.0100 '/' Tc=23.0 min CN=84 Runoff=2.98 cfs 14,728 cf

Reach SP#1: Study Point #1 Inflow=3.55 cfs 14,008 cf
Outflow=3.55 cfs 14,008 cf

Reach SP#2: Study Point #2 Inflow=2.98 cfs 14,728 cf
Outflow=2.98 cfs 14,728 cf

Total Runoff Area = 77,804 sf Runoff Volume = 28,737 cf Average Runoff Depth = 4.43"
72.45% Pervious = 56,371 sf 27.55% Impervious = 21,433 sf

Summary for Subcatchment S1: Subcatchment 1

Runoff = 3.55 cfs @ 12.17 hrs, Volume= 14,008 cf, Depth= 4.60"
Routed to Reach SP#1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.09"

Area (sf)	CN	Description
5,903	98	Paved parking, HSG D
4,512	98	Roofs, HSG D
8,824	80	>75% Grass cover, Good, HSG D
11,426	77	Woods, Good, HSG D
5,852	96	Gravel surface, HSG D
36,517	87	Weighted Average
26,102		71.48% Pervious Area
10,415		28.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0300	0.19		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
1.6	194	0.0100	2.03		**Shallow Concentrated Flow, Segment 2** Paved Kv= 20.3 fps
1.3	53	0.0100	0.70		**Shallow Concentrated Flow, Segment 3** Short Grass Pasture Kv= 7.0 fps
0.9	61	0.0500	1.12		**Shallow Concentrated Flow, Segment 5** Woodland Kv= 5.0 fps
12.5	408	Total			

Summary for Subcatchment S2: Subcatchment 2

Runoff = 2.98 cfs @ 12.31 hrs, Volume= 14,728 cf, Depth= 4.28"
Routed to Reach SP#2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.09"

Area (sf)	CN	Description
8,967	98	Paved parking, HSG D
2,051	98	Roofs, HSG D
20,715	80	>75% Grass cover, Good, HSG D
9,554	77	Woods, Good, HSG D
41,287	84	Weighted Average
30,269		73.31% Pervious Area
11,018		26.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0100	0.12		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
9.5	397	0.0100	0.70		**Shallow Concentrated Flow, Segment 2** Short Grass Pasture Kv= 7.0 fps
23.0	497	Total			

Summary for Reach SP#1: Study Point #1

Inflow Area = 36,517 sf, 28.52% Impervious, Inflow Depth = 4.60" for 25 Year event
Inflow = 3.55 cfs @ 12.17 hrs, Volume= 14,008 cf
Outflow = 3.55 cfs @ 12.17 hrs, Volume= 14,008 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Reach SP#2: Study Point #2

Inflow Area = 41,287 sf, 26.69% Impervious, Inflow Depth = 4.28" for 25 Year event
Inflow = 2.98 cfs @ 12.31 hrs, Volume= 14,728 cf
Outflow = 2.98 cfs @ 12.31 hrs, Volume= 14,728 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 300R

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: Subcatchment1 Runoff Area=36,517 sf 28.52% Impervious Runoff Depth=5.76"
Flow Length=408' Tc=12.5 min CN=87 Runoff=4.39 cfs 17,528 cf

SubcatchmentS2: Subcatchment2 Runoff Area=41,287 sf 26.69% Impervious Runoff Depth=5.42"
Flow Length=497' Slope=0.0100 '/' Tc=23.0 min CN=84 Runoff=3.74 cfs 18,634 cf

Reach SP#1: Study Point #1 Inflow=4.39 cfs 17,528 cf
Outflow=4.39 cfs 17,528 cf

Reach SP#2: Study Point #2 Inflow=3.74 cfs 18,634 cf
Outflow=3.74 cfs 18,634 cf

Total Runoff Area = 77,804 sf Runoff Volume = 36,162 cf Average Runoff Depth = 5.58"
72.45% Pervious = 56,371 sf 27.55% Impervious = 21,433 sf

Summary for Subcatchment S1: Subcatchment 1

Runoff = 4.39 cfs @ 12.17 hrs, Volume= 17,528 cf, Depth= 5.76"
Routed to Reach SP#1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 Year Rainfall=7.29"

Area (sf)	CN	Description
5,903	98	Paved parking, HSG D
4,512	98	Roofs, HSG D
8,824	80	>75% Grass cover, Good, HSG D
11,426	77	Woods, Good, HSG D
5,852	96	Gravel surface, HSG D
36,517	87	Weighted Average
26,102		71.48% Pervious Area
10,415		28.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0300	0.19		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
1.6	194	0.0100	2.03		**Shallow Concentrated Flow, Segment 2** Paved Kv= 20.3 fps
1.3	53	0.0100	0.70		**Shallow Concentrated Flow, Segment 3** Short Grass Pasture Kv= 7.0 fps
0.9	61	0.0500	1.12		**Shallow Concentrated Flow, Segment 5** Woodland Kv= 5.0 fps
12.5	408	Total			

Summary for Subcatchment S2: Subcatchment 2

Runoff = 3.74 cfs @ 12.31 hrs, Volume= 18,634 cf, Depth= 5.42"
Routed to Reach SP#2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 Year Rainfall=7.29"

Area (sf)	CN	Description
8,967	98	Paved parking, HSG D
2,051	98	Roofs, HSG D
20,715	80	>75% Grass cover, Good, HSG D
9,554	77	Woods, Good, HSG D
41,287	84	Weighted Average
30,269		73.31% Pervious Area
11,018		26.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0100	0.12		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
9.5	397	0.0100	0.70		**Shallow Concentrated Flow, Segment 2** Short Grass Pasture Kv= 7.0 fps
23.0	497	Total			

Summary for Reach SP#1: Study Point #1

Inflow Area = 36,517 sf, 28.52% Impervious, Inflow Depth = 5.76" for 50 Year event
Inflow = 4.39 cfs @ 12.17 hrs, Volume= 17,528 cf
Outflow = 4.39 cfs @ 12.17 hrs, Volume= 17,528 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Reach SP#2: Study Point #2

Inflow Area = 41,287 sf, 26.69% Impervious, Inflow Depth = 5.42" for 50 Year event
Inflow = 3.74 cfs @ 12.31 hrs, Volume= 18,634 cf
Outflow = 3.74 cfs @ 12.31 hrs, Volume= 18,634 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 300R

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: Subcatchment1 Runoff Area=36,517 sf 28.52% Impervious Runoff Depth=7.18"
Flow Length=408' Tc=12.5 min CN=87 Runoff=5.41 cfs 21,854 cf

SubcatchmentS2: Subcatchment2 Runoff Area=41,287 sf 26.69% Impervious Runoff Depth=6.82"
Flow Length=497' Slope=0.0100 '/' Tc=23.0 min CN=84 Runoff=4.66 cfs 23,456 cf

Reach SP#1: Study Point #1 Inflow=5.41 cfs 21,854 cf
Outflow=5.41 cfs 21,854 cf

Reach SP#2: Study Point #2 Inflow=4.66 cfs 23,456 cf
Outflow=4.66 cfs 23,456 cf

Total Runoff Area = 77,804 sf Runoff Volume = 45,310 cf Average Runoff Depth = 6.99"
72.45% Pervious = 56,371 sf 27.55% Impervious = 21,433 sf

Summary for Subcatchment S1: Subcatchment 1

Runoff = 5.41 cfs @ 12.17 hrs, Volume= 21,854 cf, Depth= 7.18"
Routed to Reach SP#1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.75"

Area (sf)	CN	Description
5,903	98	Paved parking, HSG D
4,512	98	Roofs, HSG D
8,824	80	>75% Grass cover, Good, HSG D
11,426	77	Woods, Good, HSG D
5,852	96	Gravel surface, HSG D
36,517	87	Weighted Average
26,102		71.48% Pervious Area
10,415		28.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0300	0.19		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
1.6	194	0.0100	2.03		**Shallow Concentrated Flow, Segment 2** Paved Kv= 20.3 fps
1.3	53	0.0100	0.70		**Shallow Concentrated Flow, Segment 3** Short Grass Pasture Kv= 7.0 fps
0.9	61	0.0500	1.12		**Shallow Concentrated Flow, Segment 5** Woodland Kv= 5.0 fps
12.5	408	Total			

Summary for Subcatchment S2: Subcatchment 2

Runoff = 4.66 cfs @ 12.31 hrs, Volume= 23,456 cf, Depth= 6.82"
Routed to Reach SP#2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.75"

Area (sf)	CN	Description
8,967	98	Paved parking, HSG D
2,051	98	Roofs, HSG D
20,715	80	>75% Grass cover, Good, HSG D
9,554	77	Woods, Good, HSG D
41,287	84	Weighted Average
30,269		73.31% Pervious Area
11,018		26.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0100	0.12		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
9.5	397	0.0100	0.70		**Shallow Concentrated Flow, Segment 2** Short Grass Pasture Kv= 7.0 fps
23.0	497	Total			

Summary for Reach SP#1: Study Point #1

Inflow Area = 36,517 sf, 28.52% Impervious, Inflow Depth = 7.18" for 100 Year event
Inflow = 5.41 cfs @ 12.17 hrs, Volume= 21,854 cf
Outflow = 5.41 cfs @ 12.17 hrs, Volume= 21,854 cf, Atten= 0%, Lag= 0.0 min

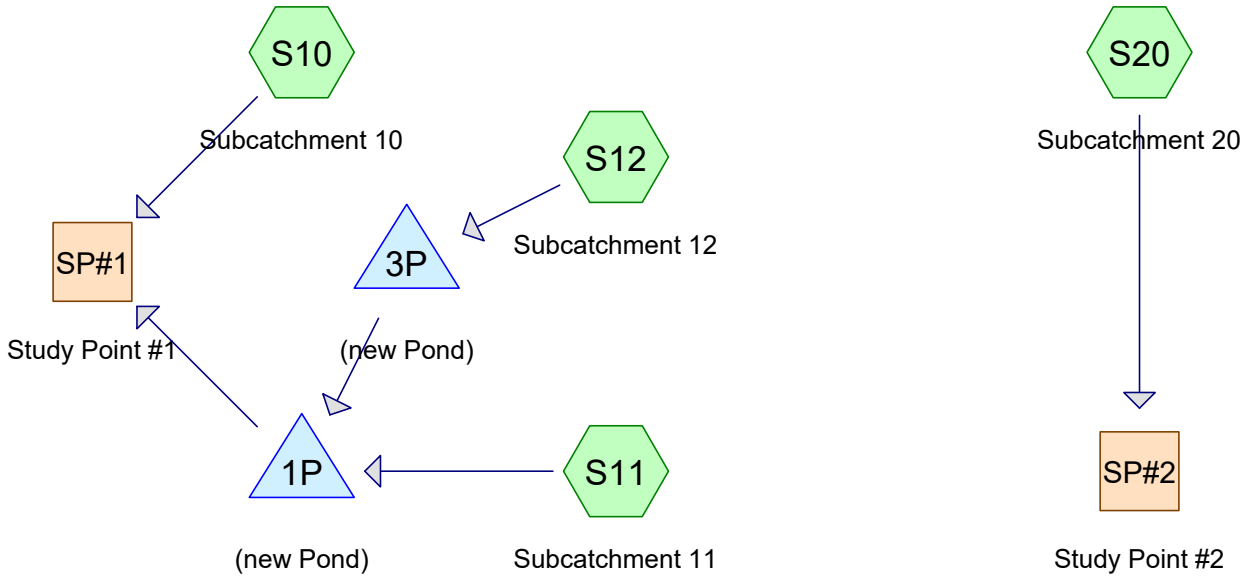
Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Reach SP#2: Study Point #2

Inflow Area = 41,287 sf, 26.69% Impervious, Inflow Depth = 6.82" for 100 Year event
Inflow = 4.66 cfs @ 12.31 hrs, Volume= 23,456 cf
Outflow = 4.66 cfs @ 12.31 hrs, Volume= 23,456 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 300R

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

POST-DEVELOPMENT MODEL OUTPUT



Subcat Reach Pond Link

Routing Diagram for 03 230750_POST_04
Prepared by Horizons Engineering, Printed 2/22/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Year	Type III 24-hr		Default	24.00	1	3.16	2
2	10 Year	Type III 24-hr		Default	24.00	1	4.79	2
3	25 Year	Type III 24-hr		Default	24.00	1	6.09	2
4	50 Year	Type III 24-hr		Default	24.00	1	7.29	2
5	100 Year	Type III 24-hr		Default	24.00	1	8.75	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
33,872	80	>75% Grass cover, Good, HSG D (S10, S12, S20)
28,839	98	Paved parking, HSG D (S10, S11, S12, S20)
10,947	98	Roofs, HSG D (S11, S20)
4,174	77	Woods, Good, HSG D (S10, S20)
77,832	**89**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
77,832	HSG D	S10, S11, S12, S20
0	Other	
77,832		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	0	0	33,872	0	33,872	>75% Grass cover, Good	
0	0	0	28,839	0	28,839	Paved parking	
0	0	0	10,947	0	10,947	Roofs	
0	0	0	4,174	0	4,174	Woods, Good	
0	**0**	**0**	**77,832**	**0**	**77,832**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	1P	35.60	33.00	50.0	0.0520	0.012	0.0	12.0	0.0	

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS10: Subcatchment10 Runoff Area=11,920 sf 32.01% Impervious Runoff Depth=1.80"
Flow Length=100' Slope=0.0300 '/' Tc=8.7 min CN=86 Runoff=0.52 cfs 1,788 cf

SubcatchmentS11: Subcatchment11 Runoff Area=24,036 sf 100.00% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=98 Runoff=1.65 cfs 5,864 cf

SubcatchmentS12: Subcatchment12 Runoff Area=7,332 sf 44.33% Impervious Runoff Depth=1.96"
Tc=6.0 min CN=88 Runoff=0.38 cfs 1,198 cf

SubcatchmentS20: Subcatchment20 Runoff Area=34,544 sf 25.14% Impervious Runoff Depth=1.65"
Flow Length=497' Slope=0.0100 '/' Tc=23.0 min CN=84 Runoff=0.97 cfs 4,747 cf

Reach SP#1: Study Point #1 Inflow=0.52 cfs 1,788 cf
Outflow=0.52 cfs 1,788 cf

Reach SP#2: Study Point #2 Inflow=0.97 cfs 4,747 cf
Outflow=0.97 cfs 4,747 cf

Pond 1P: (new Pond) Peak Elev=34.29' Storage=1,418 cf Inflow=1.65 cfs 5,864 cf
Discarded=0.32 cfs 5,864 cf Primary=0.00 cfs 0 cf Outflow=0.32 cfs 5,864 cf

Pond 3P: (new Pond) Peak Elev=41.51' Storage=424 cf Inflow=0.38 cfs 1,198 cf
Discarded=0.07 cfs 1,198 cf Primary=0.00 cfs 0 cf Outflow=0.07 cfs 1,198 cf

Total Runoff Area = 77,832 sf Runoff Volume = 13,597 cf Average Runoff Depth = 2.10"
48.88% Pervious = 38,046 sf 51.12% Impervious = 39,786 sf

Summary for Subcatchment S10: Subcatchment 10

Runoff = 0.52 cfs @ 12.12 hrs, Volume= 1,788 cf, Depth= 1.80"
Routed to Reach SP#1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.16"

Area (sf)	CN	Description
3,815	98	Paved parking, HSG D
0	98	Roofs, HSG D
7,205	80	>75% Grass cover, Good, HSG D
900	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
11,920	86	Weighted Average
8,105		67.99% Pervious Area
3,815		32.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0300	0.19		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"

Summary for Subcatchment S11: Subcatchment 11

Runoff = 1.65 cfs @ 12.09 hrs, Volume= 5,864 cf, Depth= 2.93"
Routed to Pond 1P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.16"

Area (sf)	CN	Description
18,163	98	Paved parking, HSG D
5,873	98	Roofs, HSG D
0	80	>75% Grass cover, Good, HSG D
0	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
24,036	98	Weighted Average
24,036		100.00% Impervious Area

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

Summary for Subcatchment S12: Subcatchment 12

Runoff = 0.38 cfs @ 12.09 hrs, Volume= 1,198 cf, Depth= 1.96"
Routed to Pond 3P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.16"

Area (sf)	CN	Description
3,250	98	Paved parking, HSG D
0	98	Roofs, HSG D
4,082	80	>75% Grass cover, Good, HSG D
0	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
7,332	88	Weighted Average
4,082		55.67% Pervious Area
3,250		44.33% Impervious Area

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

Summary for Subcatchment S20: Subcatchment 20

Runoff = 0.97 cfs @ 12.32 hrs, Volume= 4,747 cf, Depth= 1.65"
Routed to Reach SP#2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.16"

Area (sf)	CN	Description
3,611	98	Paved parking, HSG D
5,074	98	Roofs, HSG D
22,585	80	>75% Grass cover, Good, HSG D
3,274	77	Woods, Good, HSG D
34,544	84	Weighted Average
25,859		74.86% Pervious Area
8,685		25.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0100	0.12		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
9.5	397	0.0100	0.70		**Shallow Concentrated Flow, Segment 2** Short Grass Pasture Kv= 7.0 fps
23.0	497	Total			

Summary for Reach SP#1: Study Point #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43,288 sf, 71.85% Impervious, Inflow Depth = 0.50" for 2 Year event
Inflow = 0.52 cfs @ 12.12 hrs, Volume= 1,788 cf
Outflow = 0.52 cfs @ 12.12 hrs, Volume= 1,788 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Reach SP#2: Study Point #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 34,544 sf, 25.14% Impervious, Inflow Depth = 1.65" for 2 Year event
Inflow = 0.97 cfs @ 12.32 hrs, Volume= 4,747 cf
Outflow = 0.97 cfs @ 12.32 hrs, Volume= 4,747 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 300R

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: (new Pond)

Inflow Area = 31,368 sf, 86.99% Impervious, Inflow Depth = 2.24" for 2 Year event
Inflow = 1.65 cfs @ 12.09 hrs, Volume= 5,864 cf
Outflow = 0.32 cfs @ 11.75 hrs, Volume= 5,864 cf, Atten= 80%, Lag= 0.0 min
Discarded = 0.32 cfs @ 11.75 hrs, Volume= 5,864 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach SP#1 : Study Point #1

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 34.29' @ 12.52 hrs Surf.Area= 4,000 sf Storage= 1,418 cf

Plug-Flow detention time= 23.5 min calculated for 5,854 cf (100% of inflow)
Center-of-Mass det. time= 23.5 min (780.2 - 756.7)

Volume	Invert	Avail.Storage	Storage Description
#1	33.40'	4,480 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 11,200 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.40	4,000	0	0
36.20	4,000	11,200	11,200

Device	Routing	Invert	Outlet Devices
#1	Primary	35.60'	**12.0" Round Culvert** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 35.60' / 33.00' S= 0.0520 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Discarded	33.40'	**3.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.32 cfs @ 11.75 hrs HW=33.44' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=33.40' (Free Discharge)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Pond 3P: (new Pond)

Inflow Area = 7,332 sf, 44.33% Impervious, Inflow Depth = 1.96" for 2 Year event
Inflow = 0.38 cfs @ 12.09 hrs, Volume= 1,198 cf
Outflow = 0.07 cfs @ 12.54 hrs, Volume= 1,198 cf, Atten= 80%, Lag= 27.1 min
Discarded = 0.07 cfs @ 12.54 hrs, Volume= 1,198 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 1P : (new Pond)

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 41.51' @ 12.54 hrs Surf.Area= 914 sf Storage= 424 cf

Plug-Flow detention time= 77.3 min calculated for 1,196 cf (100% of inflow)
Center-of-Mass det. time= 77.2 min (892.7 - 815.6)

Volume	Invert	Avail.Storage	Storage Description
#1	39.00'	161 cf	**Dry well (Prismatic)** Listed below (Recalc) 402 cf Overall x 40.0% Voids
#2	41.00'	1,399 cf	**Open water storage (Irregular)** Listed below (Recalc)
		1,560 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.00	201	0	0
41.00	201	402	402

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
41.00	346	146.0	0	0	346
42.00	1,196	110.0	728	728	1,090
42.51	1,438	118.0	671	1,399	1,247

Device	Routing	Invert	Outlet Devices
#1	Discarded	39.00'	**3.500 in/hr Exfiltration over Surface area**
#2	Primary	42.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** 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 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.07 cfs @ 12.54 hrs HW=41.51' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=39.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS10: Subcatchment10 Runoff Area=11,920 sf 32.01% Impervious Runoff Depth=3.27"
Flow Length=100' Slope=0.0300 '/' Tc=8.7 min CN=86 Runoff=0.93 cfs 3,250 cf

SubcatchmentS11: Subcatchment11 Runoff Area=24,036 sf 100.00% Impervious Runoff Depth=4.55"
Tc=6.0 min CN=98 Runoff=2.52 cfs 9,121 cf

SubcatchmentS12: Subcatchment12 Runoff Area=7,332 sf 44.33% Impervious Runoff Depth=3.47"
Tc=6.0 min CN=88 Runoff=0.66 cfs 2,120 cf

SubcatchmentS20: Subcatchment20 Runoff Area=34,544 sf 25.14% Impervious Runoff Depth=3.08"
Flow Length=497' Slope=0.0100 '/' Tc=23.0 min CN=84 Runoff=1.81 cfs 8,863 cf

Reach SP#1: Study Point #1 Inflow=0.93 cfs 3,250 cf
Outflow=0.93 cfs 3,250 cf

Reach SP#2: Study Point #2 Inflow=1.81 cfs 8,863 cf
Outflow=1.81 cfs 8,863 cf

Pond 1P: (new Pond) Peak Elev=35.10' Storage=2,721 cf Inflow=2.52 cfs 9,121 cf
Discarded=0.32 cfs 9,121 cf Primary=0.00 cfs 0 cf Outflow=0.32 cfs 9,121 cf

Pond 3P: (new Pond) Peak Elev=41.95' Storage=836 cf Inflow=0.66 cfs 2,120 cf
Discarded=0.11 cfs 2,120 cf Primary=0.00 cfs 0 cf Outflow=0.11 cfs 2,120 cf

Total Runoff Area = 77,832 sf Runoff Volume = 23,354 cf Average Runoff Depth = 3.60"
48.88% Pervious = 38,046 sf 51.12% Impervious = 39,786 sf

Summary for Subcatchment S10: Subcatchment 10

Runoff = 0.93 cfs @ 12.12 hrs, Volume= 3,250 cf, Depth= 3.27"
Routed to Reach SP#1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.79"

Area (sf)	CN	Description
3,815	98	Paved parking, HSG D
0	98	Roofs, HSG D
7,205	80	>75% Grass cover, Good, HSG D
900	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
11,920	86	Weighted Average
8,105		67.99% Pervious Area
3,815		32.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0300	0.19		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"

Summary for Subcatchment S11: Subcatchment 11

Runoff = 2.52 cfs @ 12.09 hrs, Volume= 9,121 cf, Depth= 4.55"
Routed to Pond 1P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.79"

Area (sf)	CN	Description
18,163	98	Paved parking, HSG D
5,873	98	Roofs, HSG D
0	80	>75% Grass cover, Good, HSG D
0	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
24,036	98	Weighted Average
24,036		100.00% Impervious Area

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

Summary for Subcatchment S12: Subcatchment 12

Runoff = 0.66 cfs @ 12.09 hrs, Volume= 2,120 cf, Depth= 3.47"
Routed to Pond 3P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.79"

Area (sf)	CN	Description
3,250	98	Paved parking, HSG D
0	98	Roofs, HSG D
4,082	80	>75% Grass cover, Good, HSG D
0	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
7,332	88	Weighted Average
4,082		55.67% Pervious Area
3,250		44.33% Impervious Area

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

Summary for Subcatchment S20: Subcatchment 20

Runoff = 1.81 cfs @ 12.31 hrs, Volume= 8,863 cf, Depth= 3.08"
Routed to Reach SP#2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.79"

Area (sf)	CN	Description
3,611	98	Paved parking, HSG D
5,074	98	Roofs, HSG D
22,585	80	>75% Grass cover, Good, HSG D
3,274	77	Woods, Good, HSG D
34,544	84	Weighted Average
25,859		74.86% Pervious Area
8,685		25.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0100	0.12		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
9.5	397	0.0100	0.70		**Shallow Concentrated Flow, Segment 2** Short Grass Pasture Kv= 7.0 fps
23.0	497	Total			

Summary for Reach SP#1: Study Point #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43,288 sf, 71.85% Impervious, Inflow Depth = 0.90" for 10 Year event
Inflow = 0.93 cfs @ 12.12 hrs, Volume= 3,250 cf
Outflow = 0.93 cfs @ 12.12 hrs, Volume= 3,250 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Reach SP#2: Study Point #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 34,544 sf, 25.14% Impervious, Inflow Depth = 3.08" for 10 Year event
Inflow = 1.81 cfs @ 12.31 hrs, Volume= 8,863 cf
Outflow = 1.81 cfs @ 12.31 hrs, Volume= 8,863 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 300R

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: (new Pond)

Inflow Area = 31,368 sf, 86.99% Impervious, Inflow Depth = 3.49" for 10 Year event
Inflow = 2.52 cfs @ 12.09 hrs, Volume= 9,121 cf
Outflow = 0.32 cfs @ 11.65 hrs, Volume= 9,121 cf, Atten= 87%, Lag= 0.0 min
Discarded = 0.32 cfs @ 11.65 hrs, Volume= 9,121 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach SP#1 : Study Point #1

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 35.10' @ 12.63 hrs Surf.Area= 4,000 sf Storage= 2,721 cf

Plug-Flow detention time= 51.3 min calculated for 9,104 cf (100% of inflow)
Center-of-Mass det. time= 51.2 min (799.9 - 748.7)

Volume	Invert	Avail.Storage	Storage Description
#1	33.40'	4,480 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 11,200 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.40	4,000	0	0
36.20	4,000	11,200	11,200

Device	Routing	Invert	Outlet Devices
#1	Primary	35.60'	**12.0" Round Culvert** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 35.60' / 33.00' S= 0.0520 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Discarded	33.40'	**3.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.32 cfs @ 11.65 hrs HW=33.44' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=33.40' (Free Discharge)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Pond 3P: (new Pond)

Inflow Area = 7,332 sf, 44.33% Impervious, Inflow Depth = 3.47" for 10 Year event
Inflow = 0.66 cfs @ 12.09 hrs, Volume= 2,120 cf
Outflow = 0.11 cfs @ 12.57 hrs, Volume= 2,120 cf, Atten= 83%, Lag= 28.8 min
Discarded = 0.11 cfs @ 12.57 hrs, Volume= 2,120 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 1P : (new Pond)

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 41.95' @ 12.57 hrs Surf.Area= 1,347 sf Storage= 836 cf

Plug-Flow detention time= 95.1 min calculated for 2,116 cf (100% of inflow)
Center-of-Mass det. time= 95.0 min (894.4 - 799.4)

Volume	Invert	Avail.Storage	Storage Description
#1	39.00'	161 cf	**Dry well (Prismatic)** Listed below (Recalc) 402 cf Overall x 40.0% Voids
#2	41.00'	1,399 cf	**Open water storage (Irregular)** Listed below (Recalc)
		1,560 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.00	201	0	0
41.00	201	402	402

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
41.00	346	146.0	0	0	346
42.00	1,196	110.0	728	728	1,090
42.51	1,438	118.0	671	1,399	1,247

Device	Routing	Invert	Outlet Devices
#1	Discarded	39.00'	**3.500 in/hr Exfiltration over Surface area**
#2	Primary	42.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** 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 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.11 cfs @ 12.57 hrs HW=41.95' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=39.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS10: Subcatchment10 Runoff Area=11,920 sf 32.01% Impervious Runoff Depth=4.50"
Flow Length=100' Slope=0.0300 '/' Tc=8.7 min CN=86 Runoff=1.27 cfs 4,465 cf

SubcatchmentS11: Subcatchment11 Runoff Area=24,036 sf 100.00% Impervious Runoff Depth=5.85"
Tc=6.0 min CN=98 Runoff=3.22 cfs 11,721 cf

SubcatchmentS12: Subcatchment12 Runoff Area=7,332 sf 44.33% Impervious Runoff Depth=4.71"
Tc=6.0 min CN=88 Runoff=0.88 cfs 2,879 cf

SubcatchmentS20: Subcatchment20 Runoff Area=34,544 sf 25.14% Impervious Runoff Depth=4.28"
Flow Length=497' Slope=0.0100 '/' Tc=23.0 min CN=84 Runoff=2.50 cfs 12,323 cf

Reach SP#1: Study Point #1 Inflow=1.27 cfs 4,650 cf
Outflow=1.27 cfs 4,650 cf

Reach SP#2: Study Point #2 Inflow=2.50 cfs 12,323 cf
Outflow=2.50 cfs 12,323 cf

Pond 1P: (new Pond) Peak Elev=35.76' Storage=3,769 cf Inflow=3.22 cfs 11,721 cf
Discarded=0.32 cfs 11,536 cf Primary=0.11 cfs 185 cf Outflow=0.43 cfs 11,721 cf

Pond 3P: (new Pond) Peak Elev=42.24' Storage=1,191 cf Inflow=0.88 cfs 2,879 cf
Discarded=0.12 cfs 2,879 cf Primary=0.00 cfs 0 cf Outflow=0.12 cfs 2,879 cf

Total Runoff Area = 77,832 sf Runoff Volume = 31,389 cf Average Runoff Depth = 4.84"
48.88% Pervious = 38,046 sf 51.12% Impervious = 39,786 sf

Summary for Subcatchment S10: Subcatchment 10

Runoff = 1.27 cfs @ 12.12 hrs, Volume= 4,465 cf, Depth= 4.50"
Routed to Reach SP#1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.09"

Area (sf)	CN	Description
3,815	98	Paved parking, HSG D
0	98	Roofs, HSG D
7,205	80	>75% Grass cover, Good, HSG D
900	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
11,920	86	Weighted Average
8,105		67.99% Pervious Area
3,815		32.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0300	0.19		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"

Summary for Subcatchment S11: Subcatchment 11

Runoff = 3.22 cfs @ 12.09 hrs, Volume= 11,721 cf, Depth= 5.85"
Routed to Pond 1P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.09"

Area (sf)	CN	Description
18,163	98	Paved parking, HSG D
5,873	98	Roofs, HSG D
0	80	>75% Grass cover, Good, HSG D
0	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
24,036	98	Weighted Average
24,036		100.00% Impervious Area

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

Summary for Subcatchment S12: Subcatchment 12

Runoff = 0.88 cfs @ 12.09 hrs, Volume= 2,879 cf, Depth= 4.71"
Routed to Pond 3P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.09"

Area (sf)	CN	Description
3,250	98	Paved parking, HSG D
0	98	Roofs, HSG D
4,082	80	>75% Grass cover, Good, HSG D
0	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
7,332	88	Weighted Average
4,082		55.67% Pervious Area
3,250		44.33% Impervious Area

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

Summary for Subcatchment S20: Subcatchment 20

Runoff = 2.50 cfs @ 12.31 hrs, Volume= 12,323 cf, Depth= 4.28"
Routed to Reach SP#2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Rainfall=6.09"

Area (sf)	CN	Description
3,611	98	Paved parking, HSG D
5,074	98	Roofs, HSG D
22,585	80	>75% Grass cover, Good, HSG D
3,274	77	Woods, Good, HSG D
34,544	84	Weighted Average
25,859		74.86% Pervious Area
8,685		25.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0100	0.12		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
9.5	397	0.0100	0.70		**Shallow Concentrated Flow, Segment 2** Short Grass Pasture Kv= 7.0 fps
23.0	497	Total			

Summary for Reach SP#1: Study Point #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43,288 sf, 71.85% Impervious, Inflow Depth = 1.29" for 25 Year event
Inflow = 1.27 cfs @ 12.12 hrs, Volume= 4,650 cf
Outflow = 1.27 cfs @ 12.12 hrs, Volume= 4,650 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Reach SP#2: Study Point #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 34,544 sf, 25.14% Impervious, Inflow Depth = 4.28" for 25 Year event
Inflow = 2.50 cfs @ 12.31 hrs, Volume= 12,323 cf
Outflow = 2.50 cfs @ 12.31 hrs, Volume= 12,323 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 300R

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: (new Pond)

Inflow Area = 31,368 sf, 86.99% Impervious, Inflow Depth = 4.48" for 25 Year event
Inflow = 3.22 cfs @ 12.09 hrs, Volume= 11,721 cf
Outflow = 0.43 cfs @ 12.62 hrs, Volume= 11,721 cf, Atten= 87%, Lag= 31.9 min
Discarded = 0.32 cfs @ 11.40 hrs, Volume= 11,536 cf
Primary = 0.11 cfs @ 12.62 hrs, Volume= 185 cf
Routed to Reach SP#1 : Study Point #1

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 35.76' @ 12.62 hrs Surf.Area= 4,000 sf Storage= 3,769 cf

Plug-Flow detention time= 73.5 min calculated for 11,700 cf (100% of inflow)
Center-of-Mass det. time= 73.4 min (818.3 - 744.9)

Volume	Invert	Avail.Storage	Storage Description
#1	33.40'	4,480 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 11,200 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.40	4,000	0	0
36.20	4,000	11,200	11,200

Device	Routing	Invert	Outlet Devices
#1	Primary	35.60'	**12.0" Round Culvert** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 35.60' / 33.00' S= 0.0520 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Discarded	33.40'	**3.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.32 cfs @ 11.40 hrs HW=33.43' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=0.10 cfs @ 12.62 hrs HW=35.75' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.10 cfs @ 1.34 fps)

Summary for Pond 3P: (new Pond)

Inflow Area = 7,332 sf, 44.33% Impervious, Inflow Depth = 4.71" for 25 Year event
Inflow = 0.88 cfs @ 12.09 hrs, Volume= 2,879 cf
Outflow = 0.12 cfs @ 12.62 hrs, Volume= 2,879 cf, Atten= 86%, Lag= 31.8 min
Discarded = 0.12 cfs @ 12.62 hrs, Volume= 2,879 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 1P : (new Pond)

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 42.24' @ 12.62 hrs Surf.Area= 1,509 sf Storage= 1,191 cf

Plug-Flow detention time= 112.1 min calculated for 2,874 cf (100% of inflow)
Center-of-Mass det. time= 112.0 min (903.0 - 791.0)

Volume	Invert	Avail.Storage	Storage Description
#1	39.00'	161 cf	**Dry well (Prismatic)** Listed below (Recalc) 402 cf Overall x 40.0% Voids
#2	41.00'	1,399 cf	**Open water storage (Irregular)** Listed below (Recalc)
		1,560 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.00	201	0	0
41.00	201	402	402

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
41.00	346	146.0	0	0	346
42.00	1,196	110.0	728	728	1,090
42.51	1,438	118.0	671	1,399	1,247

Device	Routing	Invert	Outlet Devices
#1	Discarded	39.00'	**3.500 in/hr Exfiltration over Surface area**
#2	Primary	42.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** 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 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.12 cfs @ 12.62 hrs HW=42.24' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=39.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS10: Subcatchment10 Runoff Area=11,920 sf 32.01% Impervious Runoff Depth=5.64"
Flow Length=100' Slope=0.0300 '/' Tc=8.7 min CN=86 Runoff=1.57 cfs 5,607 cf

SubcatchmentS11: Subcatchment11 Runoff Area=24,036 sf 100.00% Impervious Runoff Depth=7.05"
Tc=6.0 min CN=98 Runoff=3.85 cfs 14,123 cf

SubcatchmentS12: Subcatchment12 Runoff Area=7,332 sf 44.33% Impervious Runoff Depth=5.88"
Tc=6.0 min CN=88 Runoff=1.08 cfs 3,590 cf

SubcatchmentS20: Subcatchment20 Runoff Area=34,544 sf 25.14% Impervious Runoff Depth=5.42"
Flow Length=497' Slope=0.0100 '/' Tc=23.0 min CN=84 Runoff=3.13 cfs 15,591 cf

Reach SP#1: Study Point #1 Inflow=1.57 cfs 6,918 cf
Outflow=1.57 cfs 6,918 cf

Reach SP#2: Study Point #2 Inflow=3.13 cfs 15,591 cf
Outflow=3.13 cfs 15,591 cf

Pond 1P: (new Pond) Peak Elev=36.04' Storage=4,216 cf Inflow=3.85 cfs 14,123 cf
Discarded=0.32 cfs 12,812 cf Primary=0.74 cfs 1,311 cf Outflow=1.06 cfs 14,123 cf

Pond 3P: (new Pond) Peak Elev=42.49' Storage=1,532 cf Inflow=1.08 cfs 3,590 cf
Discarded=0.13 cfs 3,590 cf Primary=0.00 cfs 0 cf Outflow=0.13 cfs 3,590 cf

Total Runoff Area = 77,832 sf Runoff Volume = 38,910 cf Average Runoff Depth = 6.00"
48.88% Pervious = 38,046 sf 51.12% Impervious = 39,786 sf

Summary for Subcatchment S10: Subcatchment 10

Runoff = 1.57 cfs @ 12.12 hrs, Volume= 5,607 cf, Depth= 5.64"
Routed to Reach SP#1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 Year Rainfall=7.29"

Area (sf)	CN	Description
3,815	98	Paved parking, HSG D
0	98	Roofs, HSG D
7,205	80	>75% Grass cover, Good, HSG D
900	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
11,920	86	Weighted Average
8,105		67.99% Pervious Area
3,815		32.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0300	0.19		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"

Summary for Subcatchment S11: Subcatchment 11

Runoff = 3.85 cfs @ 12.09 hrs, Volume= 14,123 cf, Depth= 7.05"
Routed to Pond 1P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 Year Rainfall=7.29"

Area (sf)	CN	Description
18,163	98	Paved parking, HSG D
5,873	98	Roofs, HSG D
0	80	>75% Grass cover, Good, HSG D
0	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
24,036	98	Weighted Average
24,036		100.00% Impervious Area

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

Summary for Subcatchment S12: Subcatchment 12

Runoff = 1.08 cfs @ 12.09 hrs, Volume= 3,590 cf, Depth= 5.88"
Routed to Pond 3P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 Year Rainfall=7.29"

Area (sf)	CN	Description
3,250	98	Paved parking, HSG D
0	98	Roofs, HSG D
4,082	80	>75% Grass cover, Good, HSG D
0	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
7,332	88	Weighted Average
4,082		55.67% Pervious Area
3,250		44.33% Impervious Area

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

Summary for Subcatchment S20: Subcatchment 20

Runoff = 3.13 cfs @ 12.31 hrs, Volume= 15,591 cf, Depth= 5.42"
Routed to Reach SP#2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 Year Rainfall=7.29"

Area (sf)	CN	Description
3,611	98	Paved parking, HSG D
5,074	98	Roofs, HSG D
22,585	80	>75% Grass cover, Good, HSG D
3,274	77	Woods, Good, HSG D
34,544	84	Weighted Average
25,859		74.86% Pervious Area
8,685		25.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0100	0.12		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
9.5	397	0.0100	0.70		**Shallow Concentrated Flow, Segment 2** Short Grass Pasture Kv= 7.0 fps
23.0	497	Total			

Summary for Reach SP#1: Study Point #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43,288 sf, 71.85% Impervious, Inflow Depth = 1.92" for 50 Year event
Inflow = 1.57 cfs @ 12.12 hrs, Volume= 6,918 cf
Outflow = 1.57 cfs @ 12.12 hrs, Volume= 6,918 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Reach SP#2: Study Point #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 34,544 sf, 25.14% Impervious, Inflow Depth = 5.42" for 50 Year event
Inflow = 3.13 cfs @ 12.31 hrs, Volume= 15,591 cf
Outflow = 3.13 cfs @ 12.31 hrs, Volume= 15,591 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 300R

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: (new Pond)

Inflow Area = 31,368 sf, 86.99% Impervious, Inflow Depth = 5.40" for 50 Year event
Inflow = 3.85 cfs @ 12.09 hrs, Volume= 14,123 cf
Outflow = 1.06 cfs @ 12.43 hrs, Volume= 14,123 cf, Atten= 72%, Lag= 20.8 min
Discarded = 0.32 cfs @ 11.25 hrs, Volume= 12,812 cf
Primary = 0.74 cfs @ 12.43 hrs, Volume= 1,311 cf
Routed to Reach SP#1 : Study Point #1

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 36.04' @ 12.43 hrs Surf.Area= 4,000 sf Storage= 4,216 cf

Plug-Flow detention time= 70.7 min calculated for 14,097 cf (100% of inflow)
Center-of-Mass det. time= 70.6 min (813.0 - 742.4)

Volume	Invert	Avail.Storage	Storage Description
#1	33.40'	4,480 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 11,200 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.40	4,000	0	0
36.20	4,000	11,200	11,200

Device	Routing	Invert	Outlet Devices
#1	Primary	35.60'	**12.0" Round Culvert** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 35.60' / 33.00' S= 0.0520 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Discarded	33.40'	**3.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.32 cfs @ 11.25 hrs HW=33.43' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=0.73 cfs @ 12.43 hrs HW=36.03' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.73 cfs @ 2.24 fps)

Summary for Pond 3P: (new Pond)

Inflow Area = 7,332 sf, 44.33% Impervious, Inflow Depth = 5.88" for 50 Year event
Inflow = 1.08 cfs @ 12.09 hrs, Volume= 3,590 cf
Outflow = 0.13 cfs @ 12.69 hrs, Volume= 3,590 cf, Atten= 88%, Lag= 36.0 min
Discarded = 0.13 cfs @ 12.69 hrs, Volume= 3,590 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Pond 1P : (new Pond)

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 42.49' @ 12.69 hrs Surf.Area= 1,629 sf Storage= 1,532 cf

Plug-Flow detention time= 128.2 min calculated for 3,584 cf (100% of inflow)
Center-of-Mass det. time= 128.1 min (913.2 - 785.0)

Volume	Invert	Avail.Storage	Storage Description
#1	39.00'	161 cf	**Dry well (Prismatic)** Listed below (Recalc) 402 cf Overall x 40.0% Voids
#2	41.00'	1,399 cf	**Open water storage (Irregular)** Listed below (Recalc)
		1,560 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.00	201	0	0
41.00	201	402	402

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
41.00	346	146.0	0	0	346
42.00	1,196	110.0	728	728	1,090
42.51	1,438	118.0	671	1,399	1,247

Device	Routing	Invert	Outlet Devices
#1	Discarded	39.00'	**3.500 in/hr Exfiltration over Surface area**
#2	Primary	42.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** 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 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.13 cfs @ 12.69 hrs HW=42.49' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=39.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS10: Subcatchment10 Runoff Area=11,920 sf 32.01% Impervious Runoff Depth=7.06"
Flow Length=100' Slope=0.0300 '/' Tc=8.7 min CN=86 Runoff=1.95 cfs 7,013 cf

SubcatchmentS11: Subcatchment11 Runoff Area=24,036 sf 100.00% Impervious Runoff Depth=8.51"
Tc=6.0 min CN=98 Runoff=4.63 cfs 17,045 cf

SubcatchmentS12: Subcatchment12 Runoff Area=7,332 sf 44.33% Impervious Runoff Depth=7.30"
Tc=6.0 min CN=88 Runoff=1.33 cfs 4,462 cf

SubcatchmentS20: Subcatchment20 Runoff Area=34,544 sf 25.14% Impervious Runoff Depth=6.82"
Flow Length=497' Slope=0.0100 '/' Tc=23.0 min CN=84 Runoff=3.90 cfs 19,625 cf

Reach SP#1: Study Point #1 Inflow=4.32 cfs 10,277 cf
Outflow=4.32 cfs 10,277 cf

Reach SP#2: Study Point #2 Inflow=3.90 cfs 19,625 cf
Outflow=3.90 cfs 19,625 cf

Pond 1P: (new Pond) Peak Elev=36.77' Storage=4,480 cf Inflow=4.63 cfs 17,482 cf
Discarded=0.32 cfs 14,217 cf Primary=3.10 cfs 3,264 cf Outflow=3.43 cfs 17,482 cf

Pond 3P: (new Pond) Peak Elev=42.57' Storage=1,560 cf Inflow=1.33 cfs 4,462 cf
Discarded=0.13 cfs 4,025 cf Primary=0.92 cfs 437 cf Outflow=1.05 cfs 4,462 cf

Total Runoff Area = 77,832 sf Runoff Volume = 48,145 cf Average Runoff Depth = 7.42"
48.88% Pervious = 38,046 sf 51.12% Impervious = 39,786 sf

Summary for Subcatchment S10: Subcatchment 10

Runoff = 1.95 cfs @ 12.12 hrs, Volume= 7,013 cf, Depth= 7.06"
Routed to Reach SP#1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.75"

Area (sf)	CN	Description
3,815	98	Paved parking, HSG D
0	98	Roofs, HSG D
7,205	80	>75% Grass cover, Good, HSG D
900	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
11,920	86	Weighted Average
8,105		67.99% Pervious Area
3,815		32.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0300	0.19		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"

Summary for Subcatchment S11: Subcatchment 11

Runoff = 4.63 cfs @ 12.09 hrs, Volume= 17,045 cf, Depth= 8.51"
Routed to Pond 1P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.75"

Area (sf)	CN	Description
18,163	98	Paved parking, HSG D
5,873	98	Roofs, HSG D
0	80	>75% Grass cover, Good, HSG D
0	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
24,036	98	Weighted Average
24,036		100.00% Impervious Area

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

Summary for Subcatchment S12: Subcatchment 12

Runoff = 1.33 cfs @ 12.09 hrs, Volume= 4,462 cf, Depth= 7.30"
Routed to Pond 3P : (new Pond)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.75"

Area (sf)	CN	Description
3,250	98	Paved parking, HSG D
0	98	Roofs, HSG D
4,082	80	>75% Grass cover, Good, HSG D
0	77	Woods, Good, HSG D
0	96	Gravel surface, HSG D
7,332	88	Weighted Average
4,082		55.67% Pervious Area
3,250		44.33% Impervious Area

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

Summary for Subcatchment S20: Subcatchment 20

Runoff = 3.90 cfs @ 12.31 hrs, Volume= 19,625 cf, Depth= 6.82"
Routed to Reach SP#2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=8.75"

Area (sf)	CN	Description
3,611	98	Paved parking, HSG D
5,074	98	Roofs, HSG D
22,585	80	>75% Grass cover, Good, HSG D
3,274	77	Woods, Good, HSG D
34,544	84	Weighted Average
25,859		74.86% Pervious Area
8,685		25.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0100	0.12		**Sheet Flow, Segment 1** Grass: Short n= 0.150 P2= 2.93"
9.5	397	0.0100	0.70		**Shallow Concentrated Flow, Segment 2** Short Grass Pasture Kv= 7.0 fps
23.0	497	Total			

Summary for Reach SP#1: Study Point #1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43,288 sf, 71.85% Impervious, Inflow Depth = 2.85" for 100 Year event
Inflow = 4.32 cfs @ 12.25 hrs, Volume= 10,277 cf
Outflow = 4.32 cfs @ 12.25 hrs, Volume= 10,277 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Reach SP#2: Study Point #2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 34,544 sf, 25.14% Impervious, Inflow Depth = 6.82" for 100 Year event
Inflow = 3.90 cfs @ 12.31 hrs, Volume= 19,625 cf
Outflow = 3.90 cfs @ 12.31 hrs, Volume= 19,625 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 300R

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: (new Pond)

[93] Warning: Storage range exceeded by 0.57'

Inflow Area = 31,368 sf, 86.99% Impervious, Inflow Depth = 6.69" for 100 Year event
Inflow = 4.63 cfs @ 12.09 hrs, Volume= 17,482 cf
Outflow = 3.43 cfs @ 12.25 hrs, Volume= 17,482 cf, Atten= 26%, Lag= 9.9 min
Discarded = 0.32 cfs @ 10.90 hrs, Volume= 14,217 cf
Primary = 3.10 cfs @ 12.25 hrs, Volume= 3,264 cf
Routed to Reach SP#1 : Study Point #1

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 36.77' @ 12.25 hrs Surf.Area= 4,000 sf Storage= 4,480 cf

Plug-Flow detention time= 65.2 min calculated for 17,450 cf (100% of inflow)
Center-of-Mass det. time= 65.1 min (805.3 - 740.2)

Volume	Invert	Avail.Storage	Storage Description
#1	33.40'	4,480 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 11,200 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.40	4,000	0	0
36.20	4,000	11,200	11,200

Device	Routing	Invert	Outlet Devices
#1	Primary	35.60'	**12.0" Round Culvert** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 35.60' / 33.00' S= 0.0520 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Discarded	33.40'	**3.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.32 cfs @ 10.90 hrs HW=33.43' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=3.08 cfs @ 12.25 hrs HW=36.76' (Free Discharge)
↑**1=Culvert** (Inlet Controls 3.08 cfs @ 3.92 fps)

Summary for Pond 3P: (new Pond)

[93] Warning: Storage range exceeded by 0.06'
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

Inflow Area = 7,332 sf, 44.33% Impervious, Inflow Depth = 7.30" for 100 Year event
Inflow = 1.33 cfs @ 12.09 hrs, Volume= 4,462 cf
Outflow = 1.05 cfs @ 12.25 hrs, Volume= 4,462 cf, Atten= 21%, Lag= 9.8 min
Discarded = 0.13 cfs @ 12.25 hrs, Volume= 4,025 cf
Primary = 0.92 cfs @ 12.25 hrs, Volume= 437 cf
Routed to Pond 1P : (new Pond)

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 42.57' @ 12.25 hrs Surf.Area= 1,639 sf Storage= 1,560 cf

Plug-Flow detention time= 118.2 min calculated for 4,454 cf (100% of inflow)
Center-of-Mass det. time= 118.2 min (897.6 - 779.3)

Volume	Invert	Avail.Storage	Storage Description
#1	39.00'	161 cf	**Dry well (Prismatic)** Listed below (Recalc) 402 cf Overall x 40.0% Voids
#2	41.00'	1,399 cf	**Open water storage (Irregular)** Listed below (Recalc)
		1,560 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.00	201	0	0
41.00	201	402	402

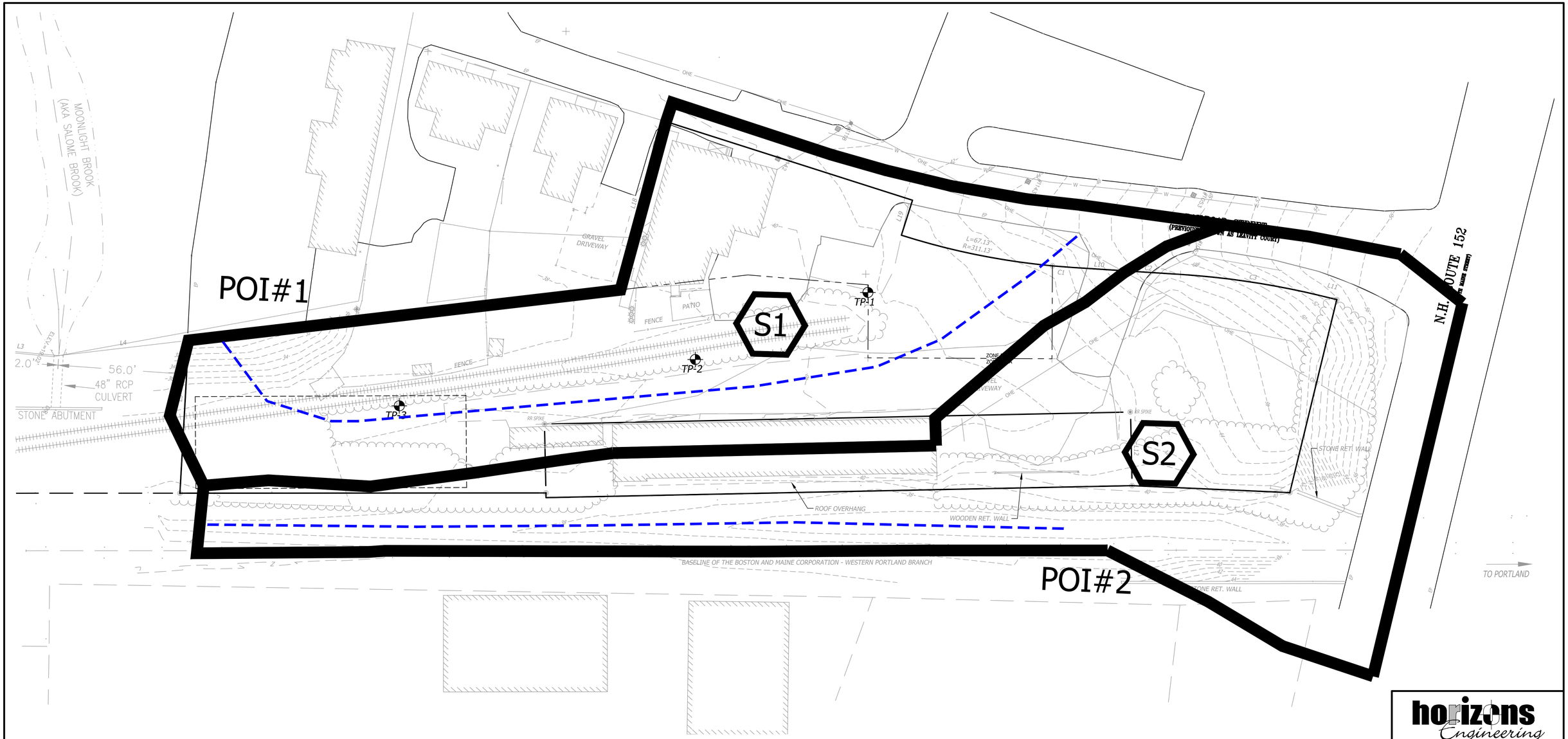
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
41.00	346	146.0	0	0	346
42.00	1,196	110.0	728	728	1,090
42.51	1,438	118.0	671	1,399	1,247

Device	Routing	Invert	Outlet Devices
#1	Discarded	39.00'	**3.500 in/hr Exfiltration over Surface area**
#2	Primary	42.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** 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 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.13 cfs @ 12.25 hrs HW=42.57' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.89 cfs @ 12.25 hrs HW=42.57' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.89 cfs @ 0.63 fps)

STORMWATER MANAGEMENT PLANS



LEGEND

- S1 — SUBCATCHMENT ID
- SUBCATCHMENT BOUNDARY
- TIME OF CONCENTRATION (TC)

FOR REVIEW
NOT FOR CONSTRUCTION

DATE OF PRINT
FEBRUARY 22 2024
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CONDOR CAPITAL

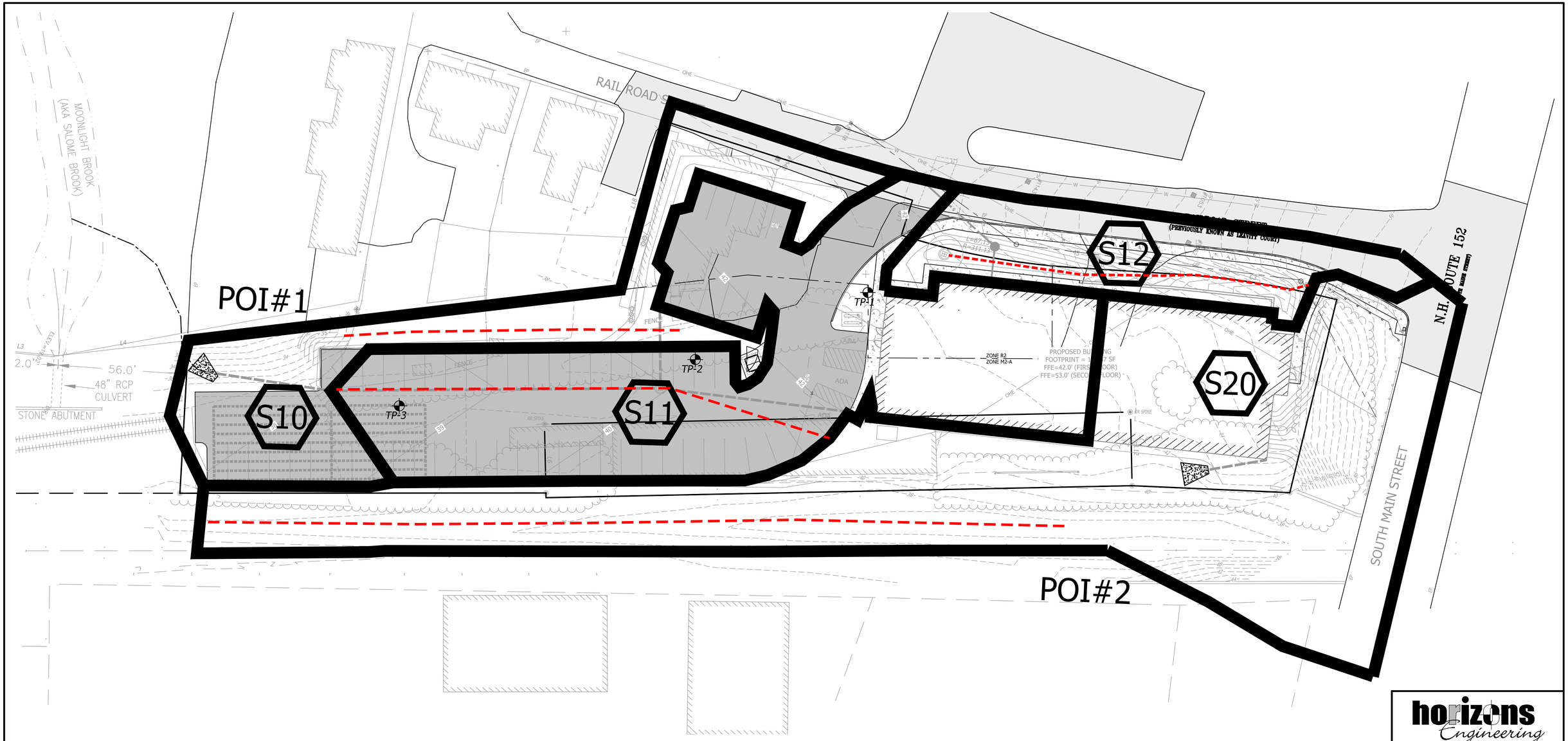
3 RAIL ROAD STREET
NEWMARKET, NH 03857

PRE-DEVELOPMENT
DRAINAGE PLAN

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: 10.17.23	PROJECT #: 230750
ENGIN'D BY: TAL	DRAWN BY: TAL
CHECK'D BY: MJS	ARCHIVE #: H-___

D101



LEGEND

S10 — SUBCATCHMENT ID

SUBCATCHMENT BOUNDARY

TIME OF CONCENTRATION (TC)

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DATE OF PRINT
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NEWMARKET, NH 03857

POST-DEVELOPMENT
DRAINAGE PLAN

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: 10.17.23	PROJECT #: 230750
ENGIN'D BY: TAL	DRAWN BY: TAL
CHECK'D BY: MJS	ARCHIVE #: H-___

D102

SOILS REPORTS

3641A White Mountain Highway, North Conway, NH 03860 • Ph 603-447-2254 • Fax 603-444-1343 • www.horizonsengineering.com

TEST PITS - 10/16/2023
Job #: 230750 – CC Capital – Newmarket, NH
Observer: Elias Buzzell

Test Pit Report:
Test pits completed on 10/16/23. Site conditions were a mix of moderate rain and sun throughout the day. Test pits located on the site of a defunct train station, significant human transported material found throughout the test pits. A layer of coal dust and coal fragments was identified in every pit. Parent material on site appears to be dense clays which limit opportunities for infiltration. Infiltration tests were successful on test pit numbers 1 & 3, test pit 2 did not successfully infiltrate. Compacted gravel layer restricts infiltration on pit 3 and will need to be removed or bypassed to manage stormwater from the proposed parking structure.

Test Pit #1

0-6"	10YR 3/3	Dark Brown, Fine Sandy Loam, Granular, Loose, Clear Smooth Boundary, 20% Gravel
6-18"	10YR 5/6	Yellowish Brown, Fine Sandy Loam, Granular, Very Friable, Abrupt Wavy Boundary, 20% Gravel
18-30"	10YR 3/1	Very Dark Gray, Coal Fragments & Coal Dust, Blocky, Friable, Firm in Place, Clear Wavy Boundary, 20% Gravel, Red Mottles
30-43"	2.5YR 4/2	Dark Grayish Brown, Clay, Massive, Firm, Firm in Place, Gradual Smooth Boundary, Red Mottles
43-54"	5Y 3/1	Very Dark Gray, Clay, Massive, Friable, Firm in Place, Red Mottles

ESHWT: 22"
ROOTS: 21"
OBSERVED H20: N/O
RESTRICTIVE LAYER: 29”
TERMINATION: 54"
REFUSAL: N/O

Note:

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Test Pit #2

0-4"	10YR 2/1	Black, Fine Sandy Loam, Granular, Friable, Abrupt Smooth Boundary, 70% Gravel
4-7"	10YR 4/3	Olive Brown, Fine Sandy Loam, Massive, Friable Firm in Place, Abrupt Smooth Boundary, 70% Gravel, Red Mottles
7-12"	10YR 2/1	Black, Coal Fragments & Coal Dust, Massive, Friable, Firm in Place, Clear Smooth Boundary, 50% Gravel, Red Mottles
12-47"	5YR 4/2	Olive Gray, Clay, Massive, Firm Firm in Place, Red Mottles

ESHWT: 5" – Perched Water Table, Surface nearly impermeable.
ROOTS: 3"
OBSERVED H20: N/O
RESTRICTIVE LAYER: 12”
TERMINATION: 47"
REFUSAL: N/O

Note:
Impermeable surface to Clay layer.

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Test Pit #3

0-7"	10YR 3/1	Very Dark Gray, Sand & Gravel, Massive, Friable, Firm in Place, Abrupt Smooth Boundary, 70% Gravel
7-11"	10YR 2/1	Black, Fine Sandy Loam, Massive, Friable, Firm in Place, Abrupt Wavy Boundary, 50% Gravel
11-16"	10YR 3/4	Dark Yellowish Brown, Fine Sandy Loam, Massive, Friable, Firm in Place, Abrupt Wavy Boundary, 50% Gravel
16-26"	10YR 2/1	Black, Fine Sandy Loam & Coal Dust, Blocky, Friable, Firm in Place, Clear Wavy Boundary, 10% Gravel
26-35"	5Y 4/2	Olive Gray, Fine Sandy Loam, Single Grain, Very Friable, Gradual Smooth Boundary
35-65"	2.5Y 4/3	Olive Brown, Fine Sand, Single Grain, Loose,

ESHWT: N/O to Depth, Perched Water Table @ 15”
ROOTS: 4”
OBSERVED H20: N/O
RESTRICTIVE LAYER: N/O
TERMINATION: 65”
REFUSAL: N/O

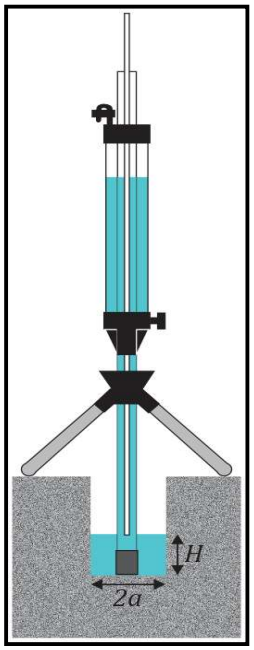
Note:
No original ground located, pit is 100% human transported material.

HEI Project Name:	**CC Capital - Newmarket**
HEI Project Number:	**230750**
Test Location:	**Test Pit 1**
Test Date:	**10/16/2023**
Performed by:	**Elias Buzzell**

Guleph Permeameter Single Head Test Results

Depth of Practice:	**14"**	
Reservoir Cross-sectional area in cm^2		
(enter "35.22" for Combined and "2.16" for Inner reservoir):	**35.22**	
Enter water Head Height ("H" in cm):	**5**	
Enter the Borehole Radius ("a" in cm):	**3**	*Standard (3)*
Soil Texture Category	**3**	

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc



Res Type	35.22
H	5
a	3
H/a	1.666667
a*	0.12
C0.01	0.809485
C0.04	0.842059
C0.12	0.803154
C0.36	0.803154
C	0.803154
R	2.500
Q	1.4675
pi	3.1415

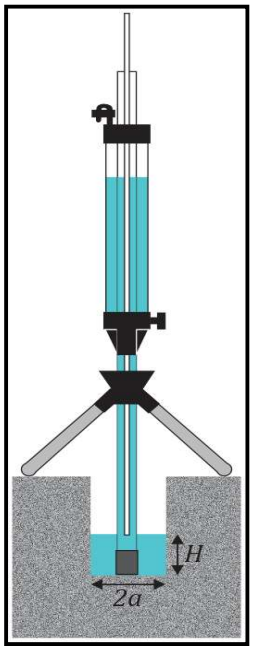
RATE OF CHANGE:	**2.5000**	
α^*=	**0.12**	***cm^{-1}***
C =	**0.803154257**	
Q =	**1.4675**	
K_{fs} =	**0.0027**	***cm/sec***
	0.1601	***cm/min***
	0.0000	***m/sec***
	0.0631	***inch/min***
	3.7830	***inch/hr***
Φ_m =	**0.0222**	***cm^2/min***

HEI Project Name:	**CC Capital - Newmarket**
HEI Project Number:	**230750**
Test Location:	**Test Pit 3**
Test Date:	**10/16/2023**
Performed by:	**Elias Buzzell**

Guleph Permeameter Single Head Test Results

Depth of Practice:	**46"**	
Reservoir Cross-sectional area in cm^2		
(enter "35.22" for Combined and "2.16" for Inner reservoir):	**35.22**	
Enter water Head Height ("H" in cm):	**5**	
Enter the Borehole Radius ("a" in cm):	**3**	*Standard (3)*
Soil Texture Category	**4**	

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc



	3.0000
Res Type	35.22
H	5
a	3
H/a	1.666667
a*	0.36
C0.01	0.809485
C0.04	0.842059
C0.12	0.803154
C0.36	0.803154
C	0.803154
R	3.000
Q	1.761
pi	3.1415

α*=	**0.36**	***cm^{-1}***
C =	**0.803154257**	
Q =	**1.761**	
K_{fs} =	**0.0053**	***cm/sec***
	0.3178	***cm/min***
	0.0001	***m/sec***
	0.1251	***inch/min***
	7.5065	***inch/hr***
Φ_m =	**0.0147**	***cm^2/min***

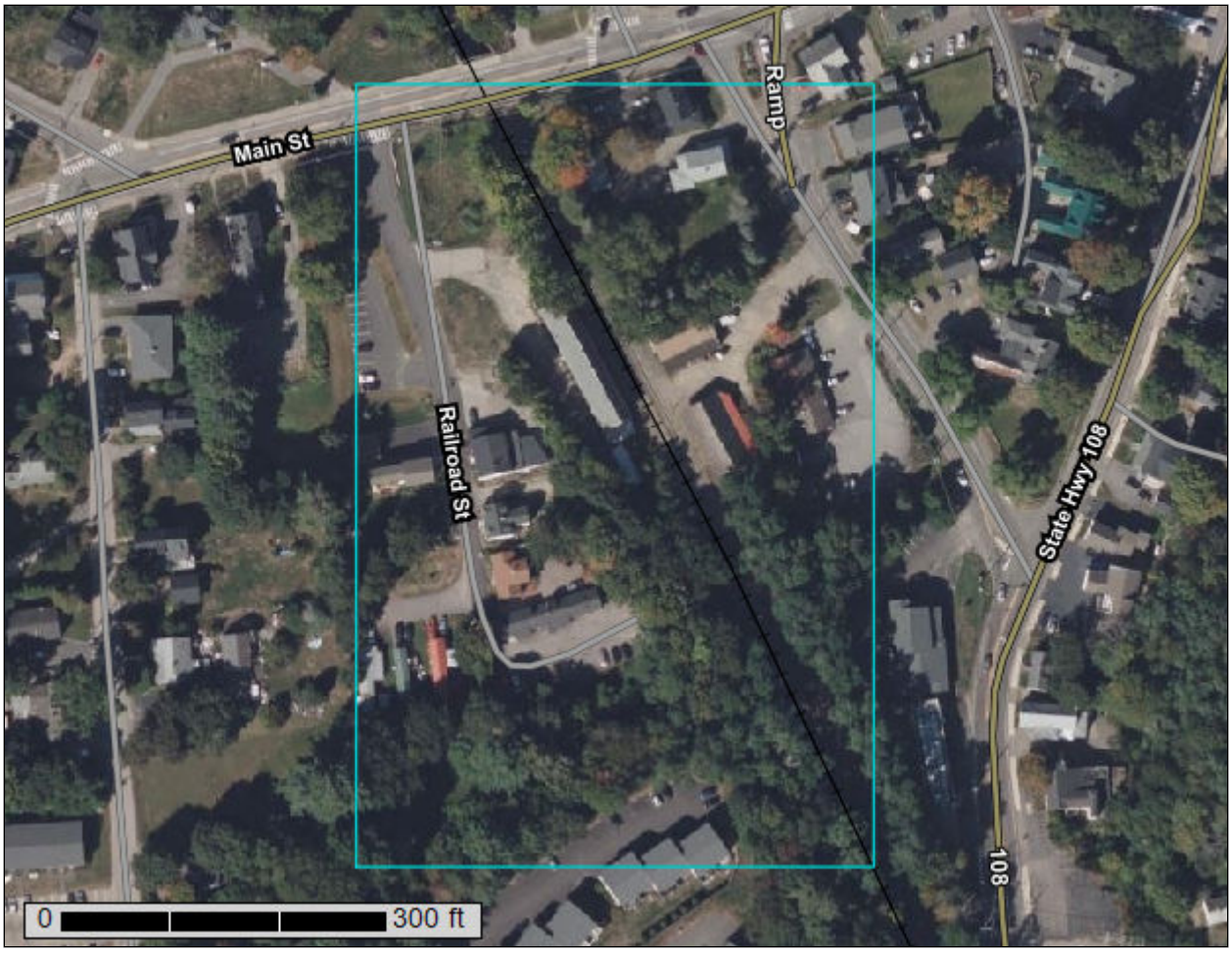
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Rockingham County, New Hampshire



October 20, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,280 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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1:24,000.

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: Rockingham County, New Hampshire
Survey Area Data: Version 26, Aug 22, 2023

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

Date(s) aerial images were photographed: Jun 19, 2020—Sep 20, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
140C	Chatfield-Hollis-Canton complex, 8 to 15 percent slopes, rocky	0.6	7.4%
305	Lim-Pootatuck complex	0.2	2.3%
699	Urban land	5.1	64.4%
799	Urban land-Canton complex, 3 to 15 percent slopes	2.0	25.9%
Totals for Area of Interest		**7.9**	**100.0%**

Map Unit Descriptions

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, 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 and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils 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. Other minor components, however, have properties and behavioral 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*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one 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.

Rockingham County, New Hampshire

140C—Chatfield-Hollis-Canton complex, 8 to 15 percent slopes, rocky

Map Unit Setting

National map unit symbol: 2w82s
Elevation: 0 to 980 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Chatfield, very stony, and similar soils: 35 percent
Canton, very stony, and similar soils: 25 percent
Hollis, very stony, and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chatfield, Very Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 2 inches: fine sandy loam
Bw - 2 to 30 inches: gravelly fine sandy loam
2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 41 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 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 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Description of Hollis, Very Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 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: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Canton, Very Stony

Setting

Landform: Ridges, hills, moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 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 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Newfields, very stony

Percent of map unit: 5 percent
Landform: Hills, ground moraines, moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Freetown

Percent of map unit: 5 percent
Landform: Swamps, kettles, bogs, depressions, marshes
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro, very stony

Percent of map unit: 3 percent
Landform: Outwash deltas, drainageways, outwash terraces, depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave, linear
Hydric soil rating: Yes

Rock outcrop

Percent of map unit: 2 percent
Landform: Hills, ridges
Hydric soil rating: Unranked

305—Lim-Pootatuck complex

Map Unit Setting

National map unit symbol: 9cmx
Elevation: 0 to 740 feet
Mean annual precipitation: 46 to 49 inches
Mean annual air temperature: 48 degrees F
Frost-free period: 155 to 160 days
Farmland classification: Farmland of local importance

Map Unit Composition

Lim and similar soils: 45 percent
Pootatuck and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lim

Setting

Landform: Flood plains
Parent material: Alluvium

Typical profile

H1 - 0 to 8 inches: very fine sandy loam
H2 - 8 to 38 inches: very fine sandy loam
H3 - 38 to 44 inches: fine sandy loam
H4 - 44 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: NoneFrequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Ecological site: F144AY015NY - Wet Silty Low Floodplain
Hydric soil rating: Yes

Description of Pootatuck

Setting

Parent material: Sandy and/or coarse-loamy alluvium derived from granite, gneiss or schist

Typical profile

H1 - 0 to 4 inches: very fine sandy loam
H2 - 4 to 26 inches: very fine sandy loam
H3 - 26 to 60 inches: loamy fine sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: NoneFrequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: F144AY015NY - Wet Silty Low Floodplain
Hydric soil rating: No

Minor Components

Not named wet

Percent of map unit: 15 percent
Landform: Flood plains
Hydric soil rating: Yes

699—Urban land

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Minor Components

Not named

Percent of map unit: 15 percent
Hydric soil rating: No

799—Urban land-Canton complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9cq0
Elevation: 0 to 1,000 feet
Mean annual precipitation: 42 to 46 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 55 percent
Canton and similar soils: 20 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Parent material: Till

Typical profile

H1 - 0 to 5 inches: gravelly fine sandy loam
H2 - 5 to 21 inches: gravelly fine sandy loam
H3 - 21 to 60 inches: loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Udorthents

Percent of map unit: 5 percent
Hydric soil rating: No

Boxford and eldridge

Percent of map unit: 4 percent

Hydric soil rating: No

Squamscott and scitico

Percent of map unit: 4 percent
Landform: Marine terraces
Hydric soil rating: Yes

Scituate and newfields

Percent of map unit: 4 percent
Hydric soil rating: No

Chatfield

Percent of map unit: 4 percent
Hydric soil rating: No

Walpole

Percent of map unit: 4 percent
Landform: Depressions
Hydric soil rating: Yes

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EXTREME PRECIPITATION TABLE

Extreme Precipitation Tables

Northeast Regional Climate Center

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

Metadata for Point

Smoothing	Yes
State	New Hampshire
Location	New Hampshire, United States
Latitude	43.076 degrees North
Longitude	70.94 degrees West
Elevation	10 feet
Date/Time	Tue Feb 13 2024 09:27:52 GMT-0500 (Eastern Standard Time)

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.40	0.50	0.65	0.82	1.04	**1yr**	0.70	0.98	1.21	1.56	2.01	2.63	2.85	**1yr**	2.33	2.74	3.15	3.87	4.46	**1yr**
2yr	0.32	0.49	0.61	0.81	1.02	1.29	**2yr**	0.88	1.17	1.50	1.92	2.45	3.16	3.49	**2yr**	2.79	3.36	3.86	4.59	5.23	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.59	**5yr**	1.06	1.45	1.86	2.40	3.09	4.00	4.49	**5yr**	3.54	4.31	4.93	5.83	6.60	**5yr**
10yr	0.41	0.64	0.81	1.10	1.43	1.86	**10yr**	1.23	1.70	2.19	2.85	3.69	4.79	5.42	**10yr**	4.24	5.21	5.93	6.99	7.87	**10yr**
25yr	0.47	0.74	0.95	1.31	1.74	2.29	**25yr**	1.50	2.10	2.72	3.56	4.66	6.09	6.97	**25yr**	5.39	6.70	7.58	8.88	9.94	**25yr**
50yr	0.52	0.84	1.07	1.50	2.02	2.69	**50yr**	1.74	2.48	3.21	4.24	5.57	7.29	8.43	**50yr**	6.46	8.11	9.13	10.66	11.87	**50yr**
100yr	0.59	0.95	1.22	1.73	2.35	3.16	**100yr**	2.03	2.91	3.79	5.03	6.64	8.75	10.20	**100yr**	7.74	9.81	10.99	12.79	14.18	**100yr**
200yr	0.65	1.06	1.38	1.98	2.73	3.72	**200yr**	2.36	3.43	4.49	5.99	7.94	10.49	12.35	**200yr**	9.28	11.87	13.24	15.36	16.94	**200yr**
500yr	0.77	1.26	1.65	2.39	3.35	4.61	**500yr**	2.89	4.26	5.59	7.52	10.04	13.34	15.90	**500yr**	11.81	15.29	16.94	19.57	21.46	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.24	0.37	0.45	0.60	0.74	0.90	**1yr**	0.64	0.88	0.92	1.26	1.56	2.07	2.52	**1yr**	1.83	2.42	2.90	3.29	3.96	**1yr**
2yr	0.32	0.49	0.60	0.81	1.00	1.18	**2yr**	0.86	1.16	1.37	1.83	2.35	3.04	3.42	**2yr**	2.69	3.29	3.77	4.49	5.04	**2yr**
5yr	0.35	0.54	0.67	0.92	1.17	1.40	**5yr**	1.01	1.37	1.62	2.14	2.77	3.75	4.18	**5yr**	3.32	4.02	4.62	5.48	6.20	**5yr**
10yr	0.39	0.59	0.74	1.03	1.33	1.61	**10yr**	1.15	1.57	1.82	2.44	3.12	4.33	4.87	**10yr**	3.83	4.68	5.38	6.36	7.15	**10yr**
25yr	0.44	0.67	0.84	1.19	1.57	1.92	**25yr**	1.36	1.88	2.11	2.83	3.64	4.90	5.94	**25yr**	4.34	5.72	6.58	7.73	8.64	**25yr**
50yr	0.49	0.74	0.92	1.33	1.79	2.20	**50yr**	1.54	2.15	2.36	3.19	4.09	5.58	6.90	**50yr**	4.94	6.63	7.66	8.96	9.97	**50yr**
100yr	0.55	0.83	1.03	1.49	2.05	2.52	**100yr**	1.77	2.47	2.64	3.57	4.57	6.34	8.00	**100yr**	5.61	7.69	8.92	10.37	11.46	**100yr**
200yr	0.61	0.92	1.16	1.68	2.34	2.88	**200yr**	2.02	2.82	2.94	3.99	5.11	7.19	9.29	**200yr**	6.36	8.93	10.40	12.00	13.20	**200yr**
500yr	0.71	1.06	1.36	1.98	2.82	3.47	**500yr**	2.43	3.40	3.41	4.62	5.95	8.46	11.29	**500yr**	7.49	10.86	12.73	14.53	15.86	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.88	1.08	**1yr**	0.76	1.06	1.25	1.74	2.20	2.88	3.03	**1yr**	2.55	2.91	3.45	4.21	4.87	**1yr**
2yr	0.33	0.51	0.63	0.85	1.04	1.25	**2yr**	0.90	1.22	1.48	1.95	2.50	3.31	3.58	**2yr**	2.93	3.45	3.96	4.73	5.48	**2yr**
5yr	0.39	0.61	0.75	1.03	1.32	1.59	**5yr**	1.14	1.55	1.86	2.49	3.18	4.26	4.79	**5yr**	3.77	4.60	5.25	6.20	6.98	**5yr**
10yr	0.46	0.71	0.88	1.23	1.58	1.93	**10yr**	1.37	1.89	2.24	3.04	3.83	5.27	5.97	**10yr**	4.66	5.74	6.53	7.64	8.53	**10yr**
25yr	0.56	0.85	1.06	1.52	2.00	2.49	**25yr**	1.72	2.44	2.88	3.95	4.91	7.30	8.01	**25yr**	6.46	7.70	8.67	10.11	11.17	**25yr**
50yr	0.65	0.99	1.23	1.77	2.39	3.02	**50yr**	2.06	2.95	3.50	4.81	5.95	9.09	10.01	**50yr**	8.05	9.63	10.78	12.50	13.70	**50yr**
100yr	0.76	1.15	1.44	2.08	2.85	3.65	**100yr**	2.46	3.57	4.25	5.89	7.22	11.31	12.52	**100yr**	10.01	12.04	13.38	15.47	16.81	**100yr**
200yr	0.88	1.33	1.68	2.43	3.39	4.43	**200yr**	2.93	4.33	5.17	7.20	8.74	14.12	15.69	**200yr**	12.50	15.09	16.63	19.14	20.66	**200yr**
500yr	1.08	1.61	2.07	3.01	4.28	5.70	**500yr**	3.69	5.57	6.68	9.42	11.28	18.97	21.13	**500yr**	16.79	20.31	22.16	25.42	27.17	**500yr**

Powered by ACIS Northeast Regional Climate Center

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INSPECTION AND MAINTAINANCE MANUAL

February 2024

CC RAILROAD STREET NEWMARKET LLC
SITE PLAN
RAIL ROAD SRTEET
Newmarket, New Hampshire
February, 2024

Horizons Engineering, Inc.

MAINE • NEW HAMPSHIRE • VERMONT

INSPECTION AND MAINTENANCE MANUAL

FOR

CC RAILROAD STREET NEWMARKET LLC
RAIL ROAD STREET
NEWMARKET, NEW HAMPSHIRE

FEBRUARY 2024

Project No. 230750

Horizons Engineering, Inc.

MAINE ● NEW HAMPSHIRE ● VERMONT

INSPECTION AND MAINTENANCE MANUAL
FOR
CC RAILROAD STREET NEWMARKET LLC
RAIL ROAD STREET
NEWMARKET, NEW HAMPSHIRE

February 2024

Introduction

This document is intended to provide a unified procedure for the party responsible for inspecting and maintaining the stormwater management device(s) that are located within the proposed development (see project plans for the device locations).

Responsible Parties

The ultimate responsibility for complying with this plan rests with the owners of the Property.

Owner / Inspector's Name: CC Railroad Street Newmarket LLC

Prior to transfer of ownership to another entity the existing owner shall notify DES in writing of such transfer.

Parties assigned to complete inspection and maintenance tasks are presented in the following table:

DEVICE	TASK	PARTY RESPONSIBLE
Structural Stormwater Devices		
Stormwater Devices	Inspection	OWNER
	Maintenance	OWNER
	Reporting	OWNER
Catch Basins	Inspection	OWNER
	Maintenance	OWNER
	Reporting	OWNER
Culverts and Ditch	Inspection	OWNER
	Maintenance	OWNER
	Reporting	OWNER

Frequency of Activities

The best time to assess/inspect drainage feature performance is during rain. To the extent practicable inspections shall be timed to coincide with moderate storms that do not have the potential for severe (thunderstorms, etc) precipitation. The frequency of inspection and maintenance will vary by intensity of use and based upon observed maintenance frequency; however, the following shall serve as the minimum inspection frequency:

- Catch basins, drain manholes and culverts: Spring and fall
- If the stormwater ponds do not drain within 72 hours following a rainfall event, then a qualified professional shall assess the condition of the pond to determine measures required to restore infiltration function, including but not limited to removal of accumulated sediments or reconstruction of the pond bottom.
- Periodic mowing of embankments
- Removal of woody vegetation from fill embankments
- Removal of debris from outlet structures
- Removal of accumulated sediment
- Inspection and repair of inlet and outlet structures, and appurtenances
- Trash and debris shall be removed at each inspection.

Records

A record of annual inspection and maintenance activities shall be recorded on the Inspection and Maintenance Log presented below. Photographs shall be included for each stormwater management practice.

____
Year

Stormwater BMP
Inspection and Maintenance Log

FOR

CC RAILROAD STREET NEWMARKET LLC
RAILROAD STREET
NEWMARKET, NH

DEVICE/ LOCATION	INSPECTION		FOLLOW UP ACTIVITY	
	Date	Insp. Name	Date	Action Taken

BMP Location
In the parking lot/driveway

Culvert/Drain Lines
Inspection Form

CC RAILROAD STREET NEWMARKET LLC
RAILROAD STREET
NEWMARKET, NH

Date of today's inspection__/__/__ Inspector Name_____
Date of last inspection (of this BMP) __/__/__

Recent Weather history

Storm date(s)	Storm duration	Rainfall amount	Did runoff occur?

Today's Weather_____

FEATURE	IS THERE:	CIRCLE ONE		SUGGESTED ACTION
Banks				
	Sediment build up?	Y	N	Clean out sediment from culverts/drain lines
	Trash/debris blocking inlet/outlet?	Y	N	Remove debris/trash from pipe

BMP Location
In the parking lot/driveway

Catch Basins
Inspection Form

CC RAILROAD STREET NEWMARKET LLC
RAILROAD STREET
NEWMARKET, NH

Date of today's inspection__/__/__ Inspector Name_____
Date of last inspection (of this BMP) __/__/__

Recent Weather history

Storm date(s)	Storm duration	Rainfall amount	Did runoff occur?

Today's Weather_____

FEATURE	IS THERE:	CIRCLE ONE		SUGGESTED ACTION
Banks				
	Sediment build up?	Y	N	Clean out sediment from basin
	Trash/debris in grate?	Y	N	Remove debris/trash from grate
	Debris on water surface?	Y	N	Skim water surface to remove debris/trash

BMP Location
Drywell @ project entrance Infiltration system @ end of driveway

Infiltration Systems Inspection Form

CC RAILROAD STREET NEWMARKET LLC
RAILROAD STREET
NEWMARKET, NH

Date of today's inspection__/__/__ Inspector Name_____
Date of last inspection (of this BMP) __/__/__

Recent Weather history

Storm date(s)	Storm duration	Rainfall amount	Did runoff occur?

Today's Weather_____

FEATURE	IS THERE:	CIRCLE ONE		SUGGESTED ACTION
Outlet from structure				
	Turbid Discharge?	Y	N	Follow turbidity upgradient to source and stabilize. Check for internal erosion or piping of soils along outlet culvert.
	Scour?	Y	N	Replace/repair stone at outlet apron. If needed add geotextile overlain by stone to reconstruct scour apron
	Clogged overflow pipe outlet	Y	N	Remove clog and debris in pipe

_____
Year

Deicing Log

FOR

CC RAILROAD STREET NEWMARKET LLC
RAILROAD STREET
NEWMARKET, NH

DATE	CHEMICAL APPLIED	CHEMICAL AMOUNT / APPLICATION RATE

ST- STORMTECH INFILTRATION CHAMBERS
(*To include stormtech isolator rows*)

Photo Credit: Stormtech

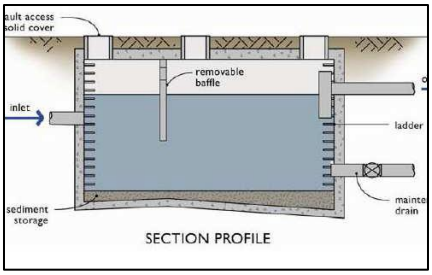
Inspection Frequency:
Isolator Rows shall be inspected immediately after completion of the site construction and cleaned out if necessary. The typical inspection schedule after construction for the Isolator Rows is a minimum of twice a year (spring & fall) - maintain features as described below.

Inspection of the Isolator Row shall involve a visual check using either the inspection ports or the access manholes

Maintenance Requirements:

- If upon visual inspection of the Isolator Row, it is found that sediment has accumulated to an average depth exceeding 3 inches throughout the length of the Isolator Row, cleanout is required.
- Cleanout of the accumulated material in the Isolator Row should be accomplished by vacuum pumping.
- Cleanout should be performed during dry weather and care should be taken to avoid tearing the fabric in the Isolator Rows.
- A site maintenance log will be kept. This log will record the dates when maintenance tasks were completed, the person who completed the task, and any observations of malfunctions in components of the stormwater management system. Call 1-888-892-2694 to speak with a Technical representative or visit www.stormtech.com.

WQ- WATER QUALITY INLETS



Inspection Frequency:
Inspect 2 times per year (spring and fall-after leaf drop) unless otherwise described- maintain features as described below

Maintenance Requirements:

- Remove floating debris in each chamber.
- If an oily sheen or hydrocarbons are present on the water surface contact your supervisor
    - Skimming/absorbants should be used to remove to the material and disposed of in accordance with state and federal regulations.
- Remove accumulated sediment in chambers if sediment has accumulated to ½ sump depth.
    - If sediment has accumulated to pipe invert out, check discharge end of pipe for sediment accumulations and remove sediment from pipe
    - Note such conditions and increase inspection frequency if it is determined that the loads of sediment to the basin are consistently high
    - Address source of sediment if possible.
- Do not dispose of cleanings in wetland areas or within 40 feet of wetland areas- refer to Appendix b; pages B-2 and B-4 in NH DES guidance document http://des.nh.gov/organization/divisions/water/stormwater/documents/nh_idde_sop.pdf to determine where catchbasin cleanings and street sweepings may be disposed of.

CB – CATCH BASINS
(*To include trench drains, drain manholes, double catch basins, and drop inlets*)

Inspection Frequency:
Inspect (2) times per year (spring and fall (after leaf drop)) unless otherwise described – maintain as described below;

Maintenance Requirements:

- Remove debris from inlets grates.
- If an oily sheen or hydrocarbons are present on the water surface contact your supervisor
    - Skimming/absorbents should be used to remove to the material and disposed of in accordance with state and federal regulations.
- Remove accumulated sediment in sump if sediment has accumulated to ½ sump depth or is within 1 foot below invert out of basin.
    - If sediment has accumulated to pipe invert out, check discharge end of pipe for sediment accumulations and remove sediment from pipe.
    - Note such conditions and increase inspection frequency if it is determined that the loads of sediment to the basin are consistently high.
    - Address source of sediment if possible.
- For drop inlets with no sump sediments will typically only accumulate if there is an obstruction in the downstream culvert and/or culvert outlet. Therefore where sediments are present in structure:
    - Inspect culvert and culvert outlet and remove debris and sediments.
- Do not dispose of catch basin cleanings in wetland areas or within 40 feet of wetland areas- refer to Appendix b; pages B-2 and B-4 in NH DES guidance document http://des.nh.gov/organization/divisions/water/stormwater/documents/nh_idde_sop.pdf to determine where catch basin cleanings and street sweepings may be disposed of.

DRY WELL

Inspection Frequency:
Inspect all areas listed below 2 times per year (spring and fall-after leaf drop) unless otherwise described- maintain features as described below.

Once per year the system must be checked to determine that it does not retain standing water for more than 72 hours. Refer to Drawdown Protocols contained in this Plan.

Maintenance Requirements:

- Inspection of infiltration components (floor of structure) at least twice annually, and following any rainfall event exceeding 2.5 inches in a 24-hour period, with maintenance or rehabilitation conducted as warranted by such inspection.
- Removal of debris from contributing gutters.
- Removal of accumulated sediment from concrete chamber.
- Check structure after spring thaw and after leaf drop and remove debris and sediment accumulations that could restrict outflow.
- If an infiltration system does not drain within 72-hours following a rainfall event, then a qualified professional should assess the condition of the facility to determine measures required to restore infiltration function, including but not limiting to removal of accumulated sediments or reconstruction of the infiltration feature.

GS-GRASS SWALES
(*Includes grass ditches, grass Pre-Treatment Swales, and grass Treatment Swales*)

Inspection Frequency:
Inspect once per year unless otherwise described.
Grassed channels should be inspected for sediment accumulation, vegetation loss, and presence of invasive species. Maintain features as described below.

Maintenance Requirements:

- Repairs, including vegetation replacement, should be made based on inspection.
    - Grass Treatment Swales require a relatively flat swale floor (both laterally (side to side), and longitudinally (along their length)) to spread water across the swale floor and slow flows down to enable sediments to settle in the swale. This may create areas of standing water and associated dead spots in the grass.
        - Reseed such areas by scratching in seed and applying mulch matting for areas that exceed 4 ft. in diameter.
        - If reseeding does not work or water is seen ponding for more than 48 hours turf aeration of the swale floor may rejuvenate it.
            - Re-seed and rake out plugs created by aeration activities.
- Remove sediment and debris annually, or more frequently as warranted by inspection.
    - Leaves should be raked from swales to avoid smothering grass.
- Mow vegetated channels at least once a year to control establishment of woody vegetation.
    - It is recommended to cut grass no shorter than 4 inches.
    - Rake/collect grass clippings from swales.

RR- RIP RAP OUTLET APRONS
(To include Rip Rap Channels/Swales)

Inspection Frequency:
Inspect once per year unless otherwise indicated or if apron is inlet to a stormwater Detention/treatment Pond or Bioretention Area (if so, see DP and BR, respectively). Maintain features as described below.

Maintenance Requirements:

- Remove debris accumulations if they redirect flow off of the apron or otherwise restrict flow or cause any backflow into the culvert outlet.
- Repair and replace gaps in stone coverage with stone of similar or larger size stone.
    - Refer to design plans for apron dimensions, stone size and any required geotextile underlayment.
    - Be careful not to extend apron into jurisdictional wetland areas or local wetland buffers.
- Ensure that any flared end sections are level to help spread water out onto apron. Re-level if needed.
- Ensure concrete or masonry headwalls are not undermined or have evidence of piping/voids; evidence that flow has bypassed culvert. If voids are found:
    - Check again during storms to determine what has caused voids and contact an engineer if water is flowing around/bypassing culvert.

CONTROL OF INVASIVE PLANTS

During maintenance activities, check for the presence of invasive plants and remove in a safe manner as described on the following pages. They should be controlled as described on the following pages.

Background:

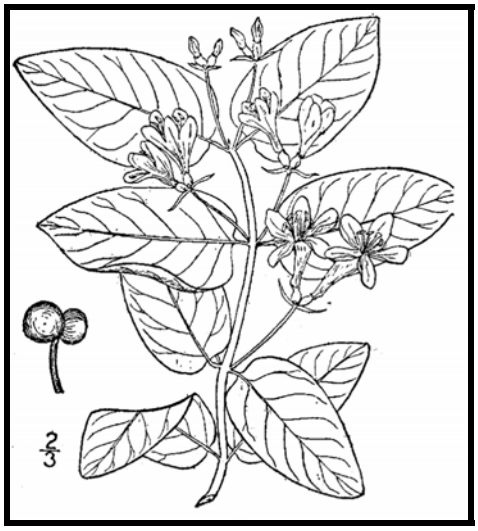
Invasive plants are introduced, alien, or non-native plants, which have been moved by people from their native habitat to a new area. Some exotic plants are imported for human use such as landscaping, erosion control, or food crops. They also can arrive as "hitchhikers" among shipments of other plants, seeds, packing materials, or fresh produce. Some exotic plants become invasive and cause harm by:

- becoming weedy and overgrown;
- killing established shade trees;
- obstructing pipes and drainage systems;
- forming dense beds in water;
- lowering water levels in lakes, streams, and wetlands;
- destroying natural communities;
- promoting erosion on stream banks and hillsides; and
- resisting control except by hazardous chemical.

UNIVERSITY of NEW HAMPSHIRE COOPERATIVE EXTENSION

Methods for Disposing Non-Native Invasive Plants

Prepared by the Invasives Species Outreach Group, volunteers interested in helping people control invasive plants. Assistance provided by the Piscataquog Land Conservancy and the NH Invasives Species Committee. Edited by Karen Bennett, Extension Forestry Professor and Specialist.



Tatarian honeysuckle
Lonicera tatarica
USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions*. Vol. 3: 282.

Non-native invasive plants crowd out natives in natural and managed landscapes. They cost taxpayers billions of dollars each year from lost agricultural and forest crops, decreased biodiversity, impacts to natural resources and the environment, and the cost to control and eradicate them.

Invasive plants grow well even in less than desirable conditions such as sandy soils along roadsides, shaded wooded areas, and in wetlands. In ideal conditions, they grow and spread even faster. There are many ways to remove these non-native invasives, but once removed, care is needed to dispose the removed plant material so the plants don't grow where disposed.

Knowing how a particular plant reproduces indicates its method of spread and helps determine the appropriate disposal method. Most are spread by seed and are dispersed by wind, water, animals, or people. Some reproduce by vegetative means from pieces of stems or roots forming new plants. Others spread through both seed and vegetative means.

Because movement and disposal of viable plant parts is restricted (see NH Regulations), viable invasive parts can't be brought to most transfer stations in the state. Check with your transfer station to see if there is an approved, designated area for invasives disposal. This fact sheet gives recommendations for rendering plant parts non-viable.

Control of invasives is beyond the scope of this fact sheet. For information about control visit www.nhinvasives.org or contact your UNH Cooperative Extension office.

New Hampshire Regulations

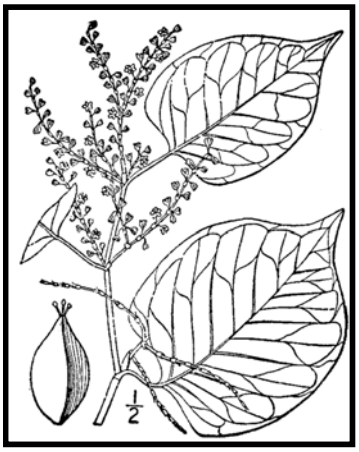
Prohibited invasive species shall only be disposed of in a manner that renders them nonliving and nonviable. (Agr. 3802.04)

No person shall collect, transport, import, export, move, buy, sell, distribute, propagate or transplant any living and viable portion of any plant species, which includes all of their cultivars and varieties, listed in Table 3800.1 of the New Hampshire prohibited invasive species list. (Agr 3802.01)

How and When to Dispose of Invasives?

To prevent seed from spreading remove invasive plants before seeds are set (produced). Some plants continue to grow, flower and set seed even after pulling or cutting. Seeds can remain viable in the ground for many years. If the plant has flowers or seeds, place the flowers and seeds in a heavy plastic bag "head first" at the weeding site and transport to the disposal site. The following are general descriptions of disposal methods. See the chart for recommendations by species.

Burning: Large woody branches and trunks can be used as firewood or burned in piles. For outside burning, a written fire permit from the local forest fire warden is required unless the ground is covered in snow. Brush larger than 5 inches in diameter can't be burned. Invasive plants with easily airborne seeds like black swallow-wort with mature seed pods (indicated by their brown color) shouldn't be burned as the seeds may disperse by the hot air created by the fire.



Japanese knotweed
Polygonum cuspidatum
USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions*. Vol. 1: 676.

Bagging (solarization): Use this technique with softer-tissue plants. Use heavy black or clear plastic bags (contractor grade), making sure that no parts of the plants poke through. Allow the bags to sit in the sun for several weeks and on dark pavement for the best effect.

Tarping and Drying: Pile material on a sheet of plastic and cover with a tarp, fastening the tarp to the ground and monitoring it for escapes. Let the material dry for several weeks, or until it is clearly nonviable.

Chipping: Use this method for woody plants that don't reproduce vegetatively.

Burying: This is risky, but can be done with watchful diligence. Lay thick plastic in a deep pit before placing the cut up plant material in the hole. Place the material away from the edge of the plastic before covering it with more heavy plastic. Eliminate as much air as possible and toss in soil to weight down the material in the pit. Note that the top of the buried material should be at least three feet underground. Japanese knotweed should be at least 5 feet underground!

Drowning: Fill a large barrel with water and place soft-tissue plants in the water. Check after a few weeks and look for rotted plant material (roots, stems, leaves, flowers). Well-rotted plant material may be composted. A word of caution- seeds may still be viable after using this method. Do this before seeds are set. This method isn't used often. Be prepared for an awful stink!

Composting: Invasive plants can take root in compost. Don't compost any invasives unless you know there is no viable (living) plant material left. Use one of the above techniques (bagging, tarping, drying, chipping, or drowning) to render the plants nonviable before composting. Closely examine the plant before composting and avoid composting seeds.

Be diligent looking for seedlings for *years* in areas where removal and disposal took place.

Suggested Disposal Methods for Non-Native Invasive Plants

This table provides information concerning the disposal of removed invasive plant material. If the infestation is treated with herbicide and left in place, these guidelines don't apply. Don't bring invasives to a local transfer station, unless there is a designated area for their disposal, or they have been rendered non-viable. This listing includes wetland and upland plants from the New Hampshire Prohibited Invasive Species List. The disposal of aquatic plants isn't addressed.

<table>
<tr><th>Woody Plants</th><th>Method of Reproducing</th><th>Methods of Disposal</th></tr>
<tr><td rowspan="2">Norway maple
(Acer platanoides)
European barberry
(Berberis vulgaris)
Japanese barberry
(Berberis thunbergii)
autumn olive
(Elaeagnus umbellata)
burning bush
(Euonymus alatus)
Morrow's honeysuckle
(Lonicera morrowii)
Tatarian honeysuckle
(Lonicera tatarica)
showy bush honeysuckle
(Lonicera x bella)
common buckthorn
(Rhamnus cathartica)
glossy buckthorn
(Frangula alnus)</td><td rowspan="2">Fruit and Seeds
  </td><td>Prior to fruit/seed ripening
Seedlings and small plants
▪ Pull or cut and leave on site with roots exposed. No special care needed.
Larger plants
▪ Use as firewood.
▪ Make a brush pile.
▪ Chip.
▪ Burn.</td></tr>
<tr><td>After fruit/seed is ripe
Don't remove from site.
▪ Burn.
▪ Make a covered brush pile.
▪ Chip once all fruit has dropped from branches.
▪ Leave resulting chips on site and monitor.</td></tr>
<tr><td rowspan="2">oriental bittersweet
(Celastrus orbiculatus)
multiflora rose
(Rosa multiflora)</td><td rowspan="2">Fruits, Seeds, Plant Fragments
  </td><td>Prior to fruit/seed ripening
Seedlings and small plants
▪ Pull or cut and leave on site with roots exposed. No special care needed.
Larger plants
▪ Make a brush pile.
▪ Burn.</td></tr>
<tr><td>After fruit/seed is ripe
Don't remove from site.
▪ Burn.
▪ Make a covered brush pile.
▪ Chip – only after material has fully dried (1 year) and all fruit has dropped from branches. Leave resulting chips on site and monitor.</td></tr>
</table>

Non-Woody Plants	Method of Reproducing	Methods of Disposal
garlic mustard *(Alliaria petiolata)* spotted knapweed *(Centaurea maculosa)* ▪ Sap of related knapweed can cause skin irritation and tumors. Wear gloves when handling. black swallow-wort *(Cynanchum nigrum)* ▪ May cause skin rash. Wear gloves and long sleeves when handling. pale swallow-wort *(Cynanchum rossicum)* giant hogweed *(Heracleum mantegazzianum)* ▪ Can cause major skin rash. Wear gloves and long sleeves when handling. dame's rocket *(Hesperis matronalis)* perennial pepperweed *(Lepidium latifolium)* purple loosestrife *(Lythrum salicaria)* Japanese stilt grass *(Microstegium vimineum)* mile-a-minute weed *(Polygonum perfoliatum)*	**Fruits and Seeds** 	**Prior to flowering** Depends on scale of infestation Small infestation ▪ Pull or cut plant and leave on site with roots exposed. Large infestation ▪ Pull or cut plant and pile. (You can pile onto or cover with plastic sheeting). ▪ Monitor. Remove any re-sprouting material. **During and following flowering** Do nothing until the following year or remove flowering heads and bag and let rot. Small infestation ▪ Pull or cut plant and leave on site with roots exposed. Large infestation ▪ Pull or cut plant and pile remaining material. (You can pile onto plastic or cover with plastic sheeting). ▪ Monitor. Remove any re-sprouting material.
common reed (*Phragmites australis*) Japanese knotweed *(Polygonum cuspidatum)* Bohemian knotweed *(Polygonum x bohemicum)*	**Fruits, Seeds, Plant Fragments** Primary means of spread in these species is by plant parts. Although all care should be given to preventing the dispersal of seed during control activities, the presence of seed doesn't materially influence disposal activities.	**Small infestation** ▪ Bag all plant material and let rot. ▪ Never pile and use resulting material as compost. ▪ Burn. **Large infestation** ▪ Remove material to unsuitable habitat (dry, hot and sunny or dry and shaded location) and scatter or pile. ▪ Monitor and remove any sprouting material. ▪ Pile, let dry, and burn.

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