

STORMWATER MANAGEMENT REPORT
for
WH02 Solar Project
Swett Road, Windham, Maine
November 20, 2020

Introduction

Walsh Engineering Associates, Inc. (WEA) was retained by TPE ME WH02, LLC (Applicant) for the design and permitting of a solar panel project located on Swett Road in Windham, Maine. The project will be located on 19.9 acres of a 63.2-acre parcel. Proposed development includes the installation of a 5± MW solar panel array, access drive, landscaping, and stormwater amenities.

This Stormwater Management Report assesses both pre-development and post-development peak runoff rates that will be used to manage stormwater. The analysis provided hereon was completed in accordance with the Town of Windham standards.

Methodology

The stormwater runoff analysis has been undertaken utilizing the HydroCAD Stormwater Modeling System software (Version 10.00) developed by the Applied Microcomputer Systems of Chocorua, New Hampshire. The program is based upon the TR-20 computer program and the TR-55 tabular method, both of which are based upon techniques developed by the USDA Soil Conservation Service. The analysis was undertaken for the 2-year frequency (3.10 inches), 10-year frequency (4.60 inches), 25-year frequency (5.80 inches). Twenty-four-hour storms with a Type III distribution were the basis for the analysis.

Pre-Development Conditions

The project is located on the 63± acre parcel identified by Town of Windham's Assessor's Map as Map 6, Lot 60 in the Farm (F) District. The site is primarily undeveloped and wooded with frontage on Swett Road. The site is approximately bisected by a CMP transmission corridor and easement running west to east. Wetlands and streams were recently mapped onsite by Jones Associates, Inc. Two streams, multiple wetlands, and four potential vernal pools (PVPs) were identified onsite. The site generally slopes from west to east towards the unnamed stream on the eastern side of the site. A small portion of the front of the site drains towards Swett Road.

The medium intensity National Cooperative Soil Survey generated by the Natural Resource Conservation Service Web Soil Survey indicates that there are a number of different soil types on site including Nicholville, Lamoine, Elmwood, Hinckley, Lyman-Tunbridge, Lyman-Abram, Paxton, Scantic, Suffield, and Woodbridge. All soils within the development area are classified as either hydrologic soil group (HSG) C or D. The medium intensity soil survey can be found in Appendix D. The hydrologic soil group boundaries are shown on drawings D1.0 – Pre-development Drainage Plan and D2.0 – Post-development Drainage Plan in the attached plan set.

Runoff from the site was analyzed where it leaves the property to the southwest adjacent to Swett Road (AP1) and to the northeast at the unnamed stream (AP2). AP3 analyzes runoff from the subject

property onto the nearest residential property to the south. Flow through AP3, then continues through the abutting property and back onto the subject property, which is taken into account in this analysis. Pre-development HydroCAD calculations can be found in Appendix A and shown on sheet D1.0 – Pre-development Drainage Plan. Pre-development peak flow rates at the analysis points are summarized in Table 1 for the 2, 10, and 25-year storm events.

Post-Development Conditions

Site development includes 19.9 acres of clearing for the solar array and construction of a 20-ft wide gravel access road. The land underneath the solar array will be returned to an undeveloped meadow condition. Stormwater runoff from the southwest developed portion of the site flows southwest to a detention pond (P1) with the aid of a landscaped diversion berm around the edge of the array. Pond P1 outlets into a level-spreader upgradient of a vegetated buffer. The runoff from the undeveloped area and remaining portion of the gravel driveway adjacent to Swett Road is directed under the gravel access road via a culvert to the level-spreader and vegetated buffer. Runoff from the southeasterly developed portion of the site (SC 2.1) is directed around the neighboring property to the south via a landscaped diversion berm and into a level spreader on the east side of the site. The northern section of the developed area (SC 2.2) flows into a detention pond (P2), which outlets to a level spreader. The remaining portion of the site will not be developed.

Post-development HydroCAD calculations can be found in Appendix B and sheets D2.0 – Post Development Drainage Plan can be found in the attached plan set. Post-development peak flow rates at the analysis points are summarized in Table 1 for the 2, 10, and 25-year storm events.

Stormwater Quantity

The Town of Windham requires that the peak flow rate discharging from the site is not increased as a result of the development for the 2, 10, and 25-year storm events.

Table 1 – Comparison of Pre- and Post-Development Runoff Rates
Runoff rates in cubic feet per second (cfs)

Peak Flow Rate Table			
Analysis Point	2-Year Storm	10-Year Storm	25-Year Storm
AP1 Pre-Development	4.5	10.0	14.9
Post-Development	4.1	10.0	14.8
AP2 Pre-Development	29.0	64.6	96.4
Post-Development	25.8	56.1	82.0
AP3 Pre-Development	0.6	1.4	2.1
Post-Development	0.6	1.3	1.9

As shown in Table 1, the post-development peak runoff rate at all analysis points will remain at or below the peak pre-development runoff rate for the 2, 10, and 25-year storm events.

Stormwater Quality

The entire array and surrounding area will be returned to a vegetated meadow condition that is mowed no more than twice per year. Therefore, the array and surrounding area acts as a self-treating stormwater BMP. Runoff from the concrete utility pads and gravel access is road is directed through a stone berm level lip spreader and a vegetated buffer. Therefore, effectively 100% of the developed portion of the site will be treated for stormwater quality with BMPs meeting the Maine DEP standards.

Erosion Control

BMPs such as silt fence and/or filter berms of erosion control mix, mulch, and temporary seeding will be used to prevent erosion and downstream migration of sediment during construction. Permanent erosion control measures include level spreaders, riprap channels, detention ponds, pipe inlet and outlet aprons, permanent revegetation, and compacted gravel surfaces. Erosion and sedimentation control notes and details can be found on Drawings C4.0 through C4.4.

Inspection and Maintenance

The Applicant will be responsible for the maintenance of the stormwater facilities for the project over its lifetime. An Inspection and Maintenance Plan is provided in Appendix F.

Conclusions

The HydroCAD calculations show the peak runoff rates at all analysis points during post-development conditions are estimated to be equal to or less than the peak pre-development runoff rate for each of the 2-year, 10-year, and 25-year storm events. The stormwater management plan provides treatment for 100% of the developed portion of the site with BMPs meeting the Maine DEP Chapter 500 standards. Therefore, no adverse impacts to downgradient waterbodies is anticipated.

Matthew Lambert

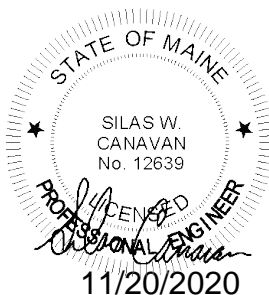


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Silas Canavan, PE



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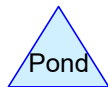
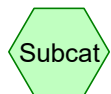
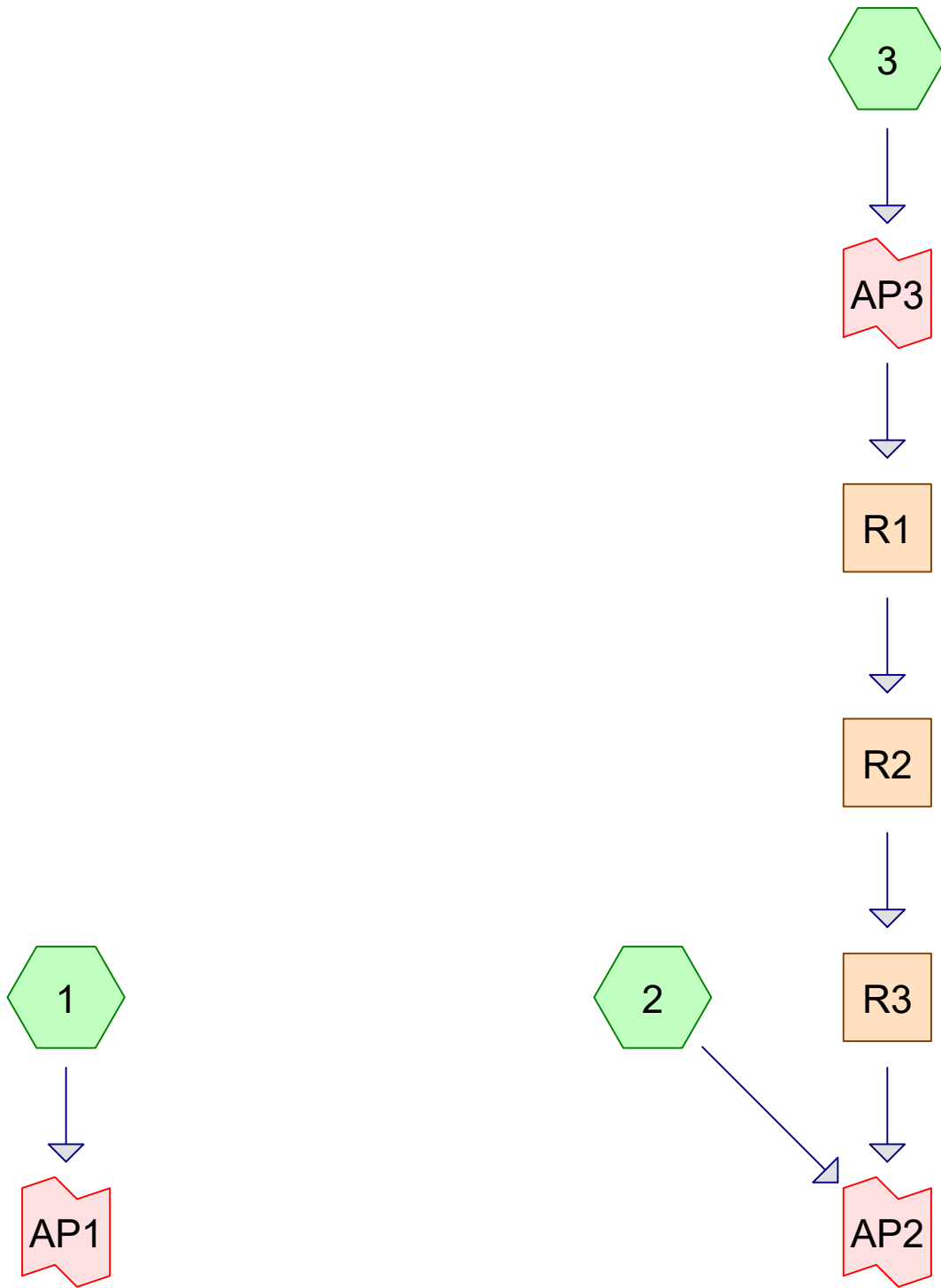
Supporting Data and Calculations

The following material presents calculations and copies of source material used during the analysis for this study.

- Appendix A: Pre-Development HydroCAD Calculations
- Appendix B: Post-Development HydroCAD Calculations
- Appendix C: Stormwater Buffer Calculations
- Appendix D: Web Soil Survey
FEMA FIRMette
- Appendix E: Inspection and Maintenance Plan
- Appendix F: Drainage Plans
 - D1.0: Pre-Development Drainage Plan
 - D2.0: Post-Development Drainage Plan

Appendix A:

Pre-Development HydroCAD Calculations



Pre-Development

Type III 24-hr 2-YR Rainfall=3.10"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: Runoff Area=350,438 sf 0.00% Impervious Runoff Depth=0.97"
Flow Length=760' Tc=35.3 min CN=74 Runoff=4.50 cfs 28,394 cf

Subcatchment 2: Runoff Area=2,178,434 sf 0.00% Impervious Runoff Depth=0.97"
Flow Length=1,134' Tc=32.8 min CN=74 Runoff=28.99 cfs 176,506 cf

Subcatchment 3: Runoff Area=57,203 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=216' Tc=43.6 min CN=73 Runoff=0.62 cfs 4,383 cf

Reach R1: Avg. Flow Depth=0.03' Max Vel=0.98 fps Inflow=0.62 cfs 4,383 cf
n=0.030 L=1,070.0' S=0.0430 '/' Capacity=728.35 cfs Outflow=0.52 cfs 4,383 cf

Reach R2: Avg. Flow Depth=0.11' Max Vel=1.78 fps Inflow=0.52 cfs 4,383 cf
n=0.033 L=955.0' S=0.0322 '/' Capacity=56.71 cfs Outflow=0.50 cfs 4,383 cf

Reach R3: Avg. Flow Depth=0.12' Max Vel=1.55 fps Inflow=0.50 cfs 4,383 cf
n=0.033 L=1,323.0' S=0.0232 '/' Capacity=48.18 cfs Outflow=0.46 cfs 4,383 cf

Link AP1: Inflow=4.50 cfs 28,394 cf
Primary=4.50 cfs 28,394 cf

Link AP2: Inflow=29.02 cfs 180,889 cf
Primary=29.02 cfs 180,889 cf

Link AP3: Inflow=0.62 cfs 4,383 cf
Primary=0.62 cfs 4,383 cf

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Type III 24-hr 2-YR Rainfall=3.10"

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Summary for Subcatchment 1:

Runoff = 4.50 cfs @ 12.54 hrs, Volume= 28,394 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
195,208	77	Woods, Good, HSG D
155,230	70	Woods, Good, HSG C
350,438	74	Weighted Average
350,438		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.3	150	0.1133	0.10		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
2.9	151	0.1192	0.86		Shallow Concentrated Flow, B-C
					Forest w/Heavy Litter Kv= 2.5 fps
6.1	459	0.0196	1.26		Shallow Concentrated Flow, C-D
					Cultivated Straight Rows Kv= 9.0 fps
35.3	760	Total			

Summary for Subcatchment 2:

Runoff = 28.99 cfs @ 12.50 hrs, Volume= 176,506 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
120,795	55	Woods, Good, HSG B
1,518,342	77	Woods, Good, HSG D
539,297	70	Woods, Good, HSG C
2,178,434	74	Weighted Average
2,178,434		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.5	123	0.0569	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	107	0.0467	1.51		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.9	151	0.0331	2.73		Shallow Concentrated Flow, C-D
					Grassed Waterway Kv= 15.0 fps
1.2	753	0.0319	10.64	74.51	Trap/Vee/Rect Channel Flow, D-E
					Bot.W=2.50' D=2.00' Z= 0.5 '/' Top.W=4.50'
					n= 0.025 Earth, clean & winding
32.8	1,134	Total			

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Type III 24-hr 2-YR Rainfall=3.10"

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Summary for Subcatchment 3:

Runoff = 0.62 cfs @ 12.66 hrs, Volume= 4,383 cf, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
31,317	70	Woods, Good, HSG C
25,886	77	Woods, Good, HSG D
57,203	73	Weighted Average
57,203		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
42.8	150	0.0333	0.06		Sheet Flow, AB
					Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	66	0.0833	1.44		Shallow Concentrated Flow, BC
					Woodland Kv= 5.0 fps
43.6	216	Total			

Summary for Reach R1:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 0.92" for 2-YR event
 Inflow = 0.62 cfs @ 12.66 hrs, Volume= 4,383 cf
 Outflow = 0.52 cfs @ 12.88 hrs, Volume= 4,383 cf, Atten= 15%, Lag= 13.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
 Max. Velocity= 0.98 fps, Min. Travel Time= 18.3 min
 Avg. Velocity = 0.76 fps, Avg. Travel Time= 23.4 min

Peak Storage= 574 cf @ 12.88 hrs
 Average Depth at Peak Storage= 0.03'
 Bank-Full Depth= 2.00' Flow Area= 52.0 sf, Capacity= 728.35 cfs

20.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
 Side Slope Z-value= 3.0 ' Top Width= 32.00'
 Length= 1,070.0' Slope= 0.0430 '
 Inlet Invert= 270.00', Outlet Invert= 224.00'



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Type III 24-hr 2-YR Rainfall=3.10"

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Summary for Reach R2:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 0.92" for 2-YR event
Inflow = 0.52 cfs @ 12.88 hrs, Volume= 4,383 cf
Outflow = 0.50 cfs @ 12.99 hrs, Volume= 4,383 cf, Atten= 4%, Lag= 6.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 1.78 fps, Min. Travel Time= 8.9 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 20.3 min

Peak Storage= 270 cf @ 12.99 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 56.71 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 '/' Top Width= 4.50'
Length= 955.0' Slope= 0.0322 '/'
Inlet Invert= 224.50', Outlet Invert= 193.75'



Summary for Reach R3:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 0.92" for 2-YR event
Inflow = 0.50 cfs @ 12.99 hrs, Volume= 4,383 cf
Outflow = 0.46 cfs @ 13.18 hrs, Volume= 4,383 cf, Atten= 9%, Lag= 11.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 1.55 fps, Min. Travel Time= 14.2 min
Avg. Velocity = 0.68 fps, Avg. Travel Time= 32.4 min

Peak Storage= 391 cf @ 13.18 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 48.18 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 '/' Top Width= 4.50'
Length= 1,323.0' Slope= 0.0232 '/'
Inlet Invert= 193.75', Outlet Invert= 163.00'



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Type III 24-hr 2-YR Rainfall=3.10"

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Summary for Link AP1:

Inflow Area = 350,438 sf, 0.00% Impervious, Inflow Depth = 0.97" for 2-YR event
Inflow = 4.50 cfs @ 12.54 hrs, Volume= 28,394 cf
Primary = 4.50 cfs @ 12.54 hrs, Volume= 28,394 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP2:

Inflow Area = 2,235,637 sf, 0.00% Impervious, Inflow Depth = 0.97" for 2-YR event
Inflow = 29.02 cfs @ 12.50 hrs, Volume= 180,889 cf
Primary = 29.02 cfs @ 12.50 hrs, Volume= 180,889 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP3:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 0.92" for 2-YR event
Inflow = 0.62 cfs @ 12.66 hrs, Volume= 4,383 cf
Primary = 0.62 cfs @ 12.66 hrs, Volume= 4,383 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

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Type III 24-hr 10-YR Rainfall=4.60"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: Runoff Area=350,438 sf 0.00% Impervious Runoff Depth=2.05"
Flow Length=760' Tc=35.3 min CN=74 Runoff=10.00 cfs 59,854 cf

Subcatchment 2: Runoff Area=2,178,434 sf 0.00% Impervious Runoff Depth=2.05"
Flow Length=1,134' Tc=32.8 min CN=74 Runoff=64.36 cfs 372,070 cf

Subcatchment 3: Runoff Area=57,203 sf 0.00% Impervious Runoff Depth=1.97"
Flow Length=216' Tc=43.6 min CN=73 Runoff=1.41 cfs 9,398 cf

Reach R1: Avg. Flow Depth=0.05' Max Vel=1.36 fps Inflow=1.41 cfs 9,398 cf
n=0.030 L=1,070.0' S=0.0430 '/' Capacity=728.35 cfs Outflow=1.30 cfs 9,398 cf

Reach R2: Avg. Flow Depth=0.20' Max Vel=2.51 fps Inflow=1.30 cfs 9,398 cf
n=0.033 L=955.0' S=0.0322 '/' Capacity=56.71 cfs Outflow=1.27 cfs 9,398 cf

Reach R3: Avg. Flow Depth=0.21' Max Vel=2.22 fps Inflow=1.27 cfs 9,398 cf
n=0.033 L=1,323.0' S=0.0232 '/' Capacity=48.18 cfs Outflow=1.21 cfs 9,398 cf

Link AP1: Inflow=10.00 cfs 59,854 cf
Primary=10.00 cfs 59,854 cf

Link AP2: Inflow=64.64 cfs 381,467 cf
Primary=64.64 cfs 381,467 cf

Link AP3: Inflow=1.41 cfs 9,398 cf
Primary=1.41 cfs 9,398 cf

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Type III 24-hr 10-YR Rainfall=4.60"

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Summary for Subcatchment 1:

Runoff = 10.00 cfs @ 12.51 hrs, Volume= 59,854 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
195,208	77	Woods, Good, HSG D
155,230	70	Woods, Good, HSG C
350,438	74	Weighted Average
350,438		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.3	150	0.1133	0.10		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
2.9	151	0.1192	0.86		Shallow Concentrated Flow, B-C
					Forest w/Heavy Litter Kv= 2.5 fps
6.1	459	0.0196	1.26		Shallow Concentrated Flow, C-D
					Cultivated Straight Rows Kv= 9.0 fps
35.3	760	Total			

Summary for Subcatchment 2:

Runoff = 64.36 cfs @ 12.47 hrs, Volume= 372,070 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
120,795	55	Woods, Good, HSG B
1,518,342	77	Woods, Good, HSG D
539,297	70	Woods, Good, HSG C
2,178,434	74	Weighted Average
2,178,434		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.5	123	0.0569	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	107	0.0467	1.51		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.9	151	0.0331	2.73		Shallow Concentrated Flow, C-D
					Grassed Waterway Kv= 15.0 fps
1.2	753	0.0319	10.64	74.51	Trap/Vee/Rect Channel Flow, D-E
					Bot.W=2.50' D=2.00' Z= 0.5 '/' Top.W=4.50'
					n= 0.025 Earth, clean & winding
32.8	1,134	Total			

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Type III 24-hr 10-YR Rainfall=4.60"

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Summary for Subcatchment 3:

Runoff = 1.41 cfs @ 12.63 hrs, Volume= 9,398 cf, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
31,317	70	Woods, Good, HSG C
25,886	77	Woods, Good, HSG D
57,203	73	Weighted Average
57,203		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
42.8	150	0.0333	0.06		Sheet Flow, AB
					Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	66	0.0833	1.44		Shallow Concentrated Flow, BC
					Woodland Kv= 5.0 fps
43.6	216	Total			

Summary for Reach R1:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 1.97" for 10-YR event
Inflow = 1.41 cfs @ 12.63 hrs, Volume= 9,398 cf
Outflow = 1.30 cfs @ 12.77 hrs, Volume= 9,398 cf, Atten= 8%, Lag= 8.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2

Max. Velocity= 1.36 fps, Min. Travel Time= 13.1 min

Avg. Velocity = 0.79 fps, Avg. Travel Time= 22.6 min

Peak Storage= 1,018 cf @ 12.77 hrs

Average Depth at Peak Storage= 0.05'

Bank-Full Depth= 2.00' Flow Area= 52.0 sf, Capacity= 728.35 cfs

20.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 3.0 ' Top Width= 32.00'

Length= 1,070.0' Slope= 0.0430 ' / '

Inlet Invert= 270.00', Outlet Invert= 224.00'



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Type III 24-hr 10-YR Rainfall=4.60"

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Summary for Reach R2:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 1.97" for 10-YR event
Inflow = 1.30 cfs @ 12.77 hrs, Volume= 9,398 cf
Outflow = 1.27 cfs @ 12.85 hrs, Volume= 9,398 cf, Atten= 2%, Lag= 4.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 2.51 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 0.95 fps, Avg. Travel Time= 16.8 min

Peak Storage= 484 cf @ 12.85 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 56.71 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 '/' Top Width= 4.50'
Length= 955.0' Slope= 0.0322 '/'
Inlet Invert= 224.50', Outlet Invert= 193.75'



Summary for Reach R3:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 1.97" for 10-YR event
Inflow = 1.27 cfs @ 12.85 hrs, Volume= 9,398 cf
Outflow = 1.21 cfs @ 12.97 hrs, Volume= 9,398 cf, Atten= 5%, Lag= 7.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 2.22 fps, Min. Travel Time= 9.9 min
Avg. Velocity = 0.81 fps, Avg. Travel Time= 27.2 min

Peak Storage= 720 cf @ 12.97 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 48.18 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 '/' Top Width= 4.50'
Length= 1,323.0' Slope= 0.0232 '/'
Inlet Invert= 193.75', Outlet Invert= 163.00'



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Type III 24-hr 10-YR Rainfall=4.60"

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Summary for Link AP1:

Inflow Area = 350,438 sf, 0.00% Impervious, Inflow Depth = 2.05" for 10-YR event
Inflow = 10.00 cfs @ 12.51 hrs, Volume= 59,854 cf
Primary = 10.00 cfs @ 12.51 hrs, Volume= 59,854 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP2:

Inflow Area = 2,235,637 sf, 0.00% Impervious, Inflow Depth = 2.05" for 10-YR event
Inflow = 64.64 cfs @ 12.47 hrs, Volume= 381,467 cf
Primary = 64.64 cfs @ 12.47 hrs, Volume= 381,467 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP3:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 1.97" for 10-YR event
Inflow = 1.41 cfs @ 12.63 hrs, Volume= 9,398 cf
Primary = 1.41 cfs @ 12.63 hrs, Volume= 9,398 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Pre-Development

Type III 24-hr 25-YR Rainfall=5.80"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: Runoff Area=350,438 sf 0.00% Impervious Runoff Depth=3.02"
Flow Length=760' Tc=35.3 min CN=74 Runoff=14.87 cfs 88,118 cf

Subcatchment 2: Runoff Area=2,178,434 sf 0.00% Impervious Runoff Depth=3.02"
Flow Length=1,134' Tc=32.8 min CN=74 Runoff=95.70 cfs 547,771 cf

Subcatchment 3: Runoff Area=57,203 sf 0.00% Impervious Runoff Depth=2.92"
Flow Length=216' Tc=43.6 min CN=73 Runoff=2.11 cfs 13,936 cf

Reach R1: Avg. Flow Depth=0.06' Max Vel=1.60 fps Inflow=2.11 cfs 13,936 cf
n=0.030 L=1,070.0' S=0.0430 '/ Capacity=728.35 cfs Outflow=1.99 cfs 13,936 cf

Reach R2: Avg. Flow Depth=0.25' Max Vel=2.93 fps Inflow=1.99 cfs 13,936 cf
n=0.033 L=955.0' S=0.0322 '/ Capacity=56.71 cfs Outflow=1.96 cfs 13,936 cf

Reach R3: Avg. Flow Depth=0.28' Max Vel=2.60 fps Inflow=1.96 cfs 13,936 cf
n=0.033 L=1,323.0' S=0.0232 '/ Capacity=48.18 cfs Outflow=1.89 cfs 13,936 cf

Link AP1: Inflow=14.87 cfs 88,118 cf
Primary=14.87 cfs 88,118 cf

Link AP2: Inflow=96.35 cfs 561,707 cf
Primary=96.35 cfs 561,707 cf

Link AP3: Inflow=2.11 cfs 13,936 cf
Primary=2.11 cfs 13,936 cf

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Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Subcatchment 1:

Runoff = 14.87 cfs @ 12.50 hrs, Volume= 88,118 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
195,208	77	Woods, Good, HSG D
155,230	70	Woods, Good, HSG C
350,438	74	Weighted Average
350,438		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.3	150	0.1133	0.10		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
2.9	151	0.1192	0.86		Shallow Concentrated Flow, B-C
					Forest w/Heavy Litter Kv= 2.5 fps
6.1	459	0.0196	1.26		Shallow Concentrated Flow, C-D
					Cultivated Straight Rows Kv= 9.0 fps
35.3	760	Total			

Summary for Subcatchment 2:

Runoff = 95.70 cfs @ 12.46 hrs, Volume= 547,771 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
120,795	55	Woods, Good, HSG B
1,518,342	77	Woods, Good, HSG D
539,297	70	Woods, Good, HSG C
2,178,434	74	Weighted Average
2,178,434		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.5	123	0.0569	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	107	0.0467	1.51		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.9	151	0.0331	2.73		Shallow Concentrated Flow, C-D
					Grassed Waterway Kv= 15.0 fps
1.2	753	0.0319	10.64	74.51	Trap/Vee/Rect Channel Flow, D-E
					Bot.W=2.50' D=2.00' Z= 0.5 '/' Top.W=4.50'
					n= 0.025 Earth, clean & winding
32.8	1,134	Total			

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Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Subcatchment 3:

Runoff = 2.11 cfs @ 12.61 hrs, Volume= 13,936 cf, Depth= 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
31,317	70	Woods, Good, HSG C
25,886	77	Woods, Good, HSG D
57,203	73	Weighted Average
57,203		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
42.8	150	0.0333	0.06		Sheet Flow, AB
					Woods: Dense underbrush n= 0.800 P2= 3.10"
0.8	66	0.0833	1.44		Shallow Concentrated Flow, BC
					Woodland Kv= 5.0 fps
43.6	216	Total			

Summary for Reach R1:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 2.92" for 25-YR event
Inflow = 2.11 cfs @ 12.61 hrs, Volume= 13,936 cf
Outflow = 1.99 cfs @ 12.74 hrs, Volume= 13,936 cf, Atten= 6%, Lag= 7.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2

Max. Velocity= 1.60 fps, Min. Travel Time= 11.2 min

Avg. Velocity= 0.81 fps, Avg. Travel Time= 22.0 min

Peak Storage= 1,332 cf @ 12.74 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 2.00' Flow Area= 52.0 sf, Capacity= 728.35 cfs

20.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 3.0 ' Top Width= 32.00'

Length= 1,070.0' Slope= 0.0430 ' / '

Inlet Invert= 270.00', Outlet Invert= 224.00'



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Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Reach R2:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 2.92" for 25-YR event
Inflow = 1.99 cfs @ 12.74 hrs, Volume= 13,936 cf
Outflow = 1.96 cfs @ 12.80 hrs, Volume= 13,936 cf, Atten= 2%, Lag= 3.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 2.93 fps, Min. Travel Time= 5.4 min
Avg. Velocity= 1.04 fps, Avg. Travel Time= 15.3 min

Peak Storage= 639 cf @ 12.80 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 56.71 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 '/' Top Width= 4.50'
Length= 955.0' Slope= 0.0322 '/'
Inlet Invert= 224.50', Outlet Invert= 193.75'



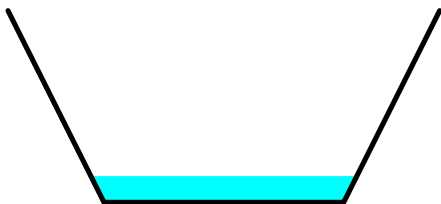
Summary for Reach R3:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 2.92" for 25-YR event
Inflow = 1.96 cfs @ 12.80 hrs, Volume= 13,936 cf
Outflow = 1.89 cfs @ 12.91 hrs, Volume= 13,936 cf, Atten= 4%, Lag= 6.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 2.60 fps, Min. Travel Time= 8.5 min
Avg. Velocity= 0.89 fps, Avg. Travel Time= 24.7 min

Peak Storage= 961 cf @ 12.91 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 48.18 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 '/' Top Width= 4.50'
Length= 1,323.0' Slope= 0.0232 '/'
Inlet Invert= 193.75', Outlet Invert= 163.00'



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Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Link AP1:

Inflow Area = 350,438 sf, 0.00% Impervious, Inflow Depth = 3.02" for 25-YR event
Inflow = 14.87 cfs @ 12.50 hrs, Volume= 88,118 cf
Primary = 14.87 cfs @ 12.50 hrs, Volume= 88,118 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP2:

Inflow Area = 2,235,637 sf, 0.00% Impervious, Inflow Depth = 3.02" for 25-YR event
Inflow = 96.35 cfs @ 12.47 hrs, Volume= 561,707 cf
Primary = 96.35 cfs @ 12.47 hrs, Volume= 561,707 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

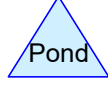
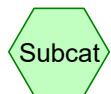
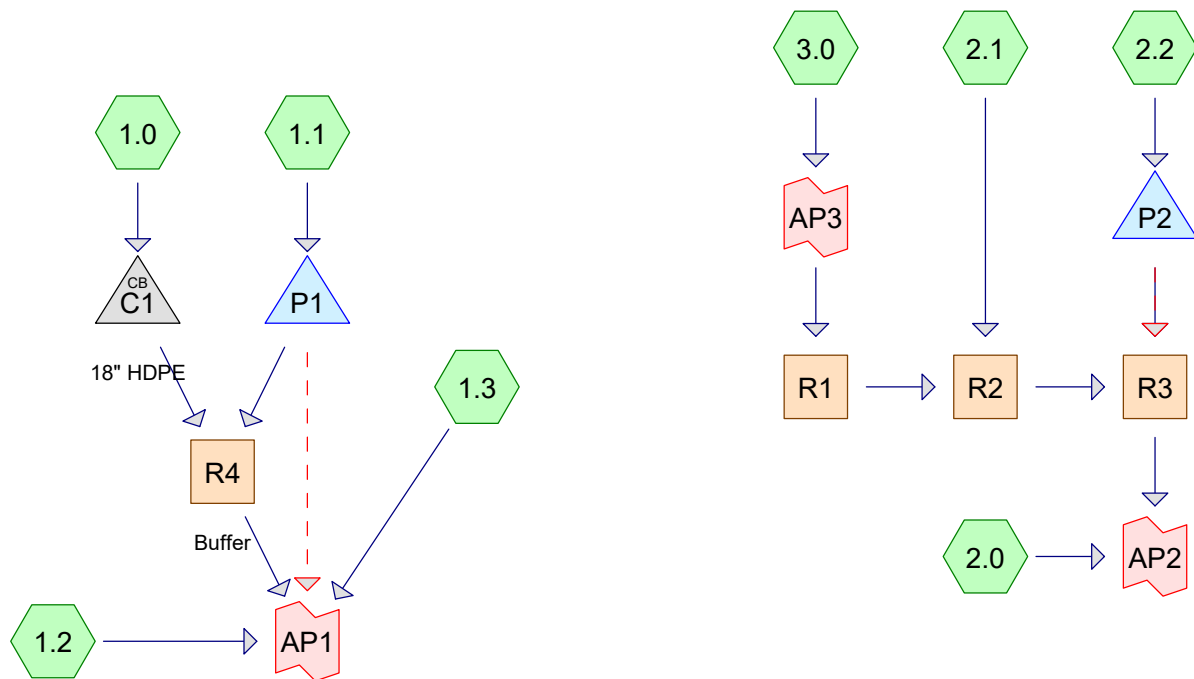
Summary for Link AP3:

Inflow Area = 57,203 sf, 0.00% Impervious, Inflow Depth = 2.92" for 25-YR event
Inflow = 2.11 cfs @ 12.61 hrs, Volume= 13,936 cf
Primary = 2.11 cfs @ 12.61 hrs, Volume= 13,936 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Appendix B:

Post-Development HydroCAD Calculations



Post-Development

Type III 24-hr 2-YR Rainfall=3.10"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Runoff Area=82,206 sf 1.78% Impervious Runoff Depth=1.20"
Flow Length=792' Tc=30.9 min CN=78 Runoff=1.44 cfs 8,225 cf

Subcatchment 1.1: Runoff Area=115,513 sf 3.75% Impervious Runoff Depth=0.97"
Flow Length=543' Tc=12.5 min CN=74 Runoff=2.26 cfs 9,359 cf

Subcatchment 1.2: Runoff Area=9,903 sf 5.98% Impervious Runoff Depth=1.20"
Flow Length=141' Slope=0.0057 ' /' Tc=47.5 min CN=78 Runoff=0.14 cfs 991 cf

Subcatchment 1.3: Runoff Area=148,523 sf 0.00% Impervious Runoff Depth=0.97"
Flow Length=985' Tc=28.2 min CN=74 Runoff=2.12 cfs 12,034 cf

Subcatchment 2.0: Runoff Area=1,504,553 sf 0.00% Impervious Runoff Depth=0.97"
Flow Length=1,134' Tc=32.8 min CN=74 Runoff=20.03 cfs 121,905 cf

Subcatchment 2.1: Runoff Area=98,884 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=515' Tc=26.6 min CN=73 Runoff=1.35 cfs 7,577 cf

Subcatchment 2.2: Runoff Area=590,396 sf 0.00% Impervious Runoff Depth=1.03"
Flow Length=1,247' Tc=33.2 min CN=75 Runoff=8.34 cfs 50,517 cf

Subcatchment 3.0: Runoff Area=36,085 sf 0.00% Impervious Runoff Depth=1.03"
Flow Length=198' Tc=24.9 min CN=75 Runoff=0.58 cfs 3,088 cf

Reach R1: Avg. Flow Depth=0.02' Max Vel=0.90 fps Inflow=0.58 cfs 3,088 cf
n=0.030 L=1,070.0' S=0.0430 ' /' Capacity=728.35 cfs Outflow=0.43 cfs 3,088 cf

Reach R2: Avg. Flow Depth=0.23' Max Vel=2.75 fps Inflow=1.68 cfs 10,664 cf
n=0.033 L=955.0' S=0.0322 ' /' Capacity=56.71 cfs Outflow=1.64 cfs 10,664 cf

Reach R3: Avg. Flow Depth=0.63' Max Vel=4.06 fps Inflow=7.27 cfs 61,182 cf
n=0.033 L=1,323.0' S=0.0232 ' /' Capacity=48.18 cfs Outflow=7.21 cfs 61,182 cf

Reach R4: Buffer Avg. Flow Depth=0.53' Max Vel=0.09 fps Inflow=3.01 cfs 17,572 cf
n=0.800 L=140.0' S=0.0064 ' /' Capacity=8.70 cfs Outflow=2.17 cfs 17,565 cf

Pond C1: 18" HDPE Peak Elev=234.52' Inflow=1.44 cfs 8,225 cf
18.0" Round Culvert n=0.013 L=30.0' S=0.0100 ' /' Outflow=1.44 cfs 8,225 cf

Pond P1: Peak Elev=234.71' Storage=1,502 cf Inflow=2.26 cfs 9,359 cf
Primary=1.61 cfs 9,347 cf Secondary=0.00 cfs 0 cf Outflow=1.61 cfs 9,347 cf

Pond P2: Peak Elev=221.03' Storage=7,660 cf Inflow=8.34 cfs 50,517 cf
Primary=5.92 cfs 50,517 cf Secondary=0.00 cfs 0 cf Outflow=5.92 cfs 50,517 cf

Link AP1: Inflow=4.07 cfs 30,590 cf
Primary=4.07 cfs 30,590 cf

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Type III 24-hr 2-YR Rainfall=3.10"

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Link AP2:

Inflow=25.80 cfs 183,087 cf
Primary=25.80 cfs 183,087 cf

Link AP3:

Inflow=0.58 cfs 3,088 cf
Primary=0.58 cfs 3,088 cf

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Type III 24-hr 2-YR Rainfall=3.10"

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Summary for Subcatchment 1.0:

Runoff = 1.44 cfs @ 12.45 hrs, Volume= 8,225 cf, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
* 1,465	98	Impervious
65,241	77	Woods, Good, HSG D
463	70	Woods, Good, HSG C
15,037	78	Meadow, non-grazed, HSG D
82,206	78	Weighted Average
80,741		98.22% Pervious Area
1,465		1.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.6	150	0.1330	0.10		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
6.3	642	0.0358	1.70		Shallow Concentrated Flow, B-C
					Cultivated Straight Rows Kv= 9.0 fps
30.9	792	Total			

Summary for Subcatchment 1.1:

Runoff = 2.26 cfs @ 12.19 hrs, Volume= 9,359 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
* 76,752	71	Meadow, non-grazed, HSG C
4,336	98	Impervious
25,685	78	Meadow, non-grazed, HSG D
8,740	80	>75% Grass cover, Good, HSG D
115,513	74	Weighted Average
111,177		96.25% Pervious Area
4,336		3.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	134	0.1045	0.24		Sheet Flow, A-B
					Grass: Dense n= 0.240 P2= 3.10"
3.0	409	0.0644	2.28		Shallow Concentrated Flow, B-C
					Cultivated Straight Rows Kv= 9.0 fps
12.5	543	Total			

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Type III 24-hr 2-YR Rainfall=3.10"

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Summary for Subcatchment 1.2:

Runoff = 0.14 cfs @ 12.69 hrs, Volume= 991 cf, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
6,334	77	Woods, Good, HSG D
2,151	78	Meadow, non-grazed, HSG D
724	71	Meadow, non-grazed, HSG C
102	70	Woods, Good, HSG C
* 592	98	Impervious, HSG D
9,903	78	Weighted Average
9,311		94.02% Pervious Area
592		5.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.5	141	0.0057	0.05		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"

Summary for Subcatchment 1.3:

Runoff = 2.12 cfs @ 12.43 hrs, Volume= 12,034 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
64,009	77	Woods, Good, HSG D
13,247	70	Woods, Good, HSG C
69,458	71	Meadow, non-grazed, HSG C
1,809	78	Meadow, non-grazed, HSG D
148,523	74	Weighted Average
148,523		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.4	150	0.0333	0.15		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 3.10"
4.3	422	0.0545	1.63		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
7.5	413	0.0339	0.92		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
28.2	985	Total			

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Type III 24-hr 2-YR Rainfall=3.10"

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Summary for Subcatchment 2.0:

Runoff = 20.03 cfs @ 12.50 hrs, Volume= 121,905 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
1,057,863	77	Woods, Good, HSG D
120,795	55	Woods, Good, HSG B
261,310	70	Woods, Good, HSG C
* 64,160	78	MEADOW D
425	71	Meadow, non-grazed, HSG C
1,504,553	74	Weighted Average
1,504,553		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.5	123	0.0569	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	107	0.0467	1.51		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.9	151	0.0331	2.73		Shallow Concentrated Flow, C-D
					Grassed Waterway Kv= 15.0 fps
1.2	753	0.0319	10.64	74.51	Trap/Vee/Rect Channel Flow, D-E
					Bot.W=2.50' D=2.00' Z= 0.5 ' / Top.W=4.50'
					n= 0.025
32.8	1,134	Total			

Summary for Subcatchment 2.1:

Runoff = 1.35 cfs @ 12.41 hrs, Volume= 7,577 cf, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
24,887	78	Meadow, non-grazed, HSG D
73,997	71	Meadow, non-grazed, HSG C
98,884	73	Weighted Average
98,884		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	150	0.0133	0.11		Sheet Flow, AB
					Grass: Dense n= 0.240 P2= 3.10"
3.0	365	0.0849	2.04		Shallow Concentrated Flow, BC
					Short Grass Pasture Kv= 7.0 fps
26.6	515	Total			

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Type III 24-hr 2-YR Rainfall=3.10"

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Summary for Subcatchment 2.2:

Runoff = 8.34 cfs @ 12.50 hrs, Volume= 50,517 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
305,567	78	Meadow, non-grazed, HSG D
186,507	71	Meadow, non-grazed, HSG C
5,515	80	>75% Grass cover, Good, HSG D
6,879	74	>75% Grass cover, Good, HSG C
19,667	70	Woods, Good, HSG C
66,261	77	Woods, Good, HSG D
590,396	75	Weighted Average
590,396		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	150	0.0200	0.12		Sheet Flow, A-B
					Grass: Dense n= 0.240 P2= 3.10"
4.5	401	0.0449	1.48		Shallow Concentrated Flow, BC
					Short Grass Pasture Kv= 7.0 fps
8.3	662	0.0363	1.33		Shallow Concentrated Flow, CD
					Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0588	1.70		Shallow Concentrated Flow, DE
					Short Grass Pasture Kv= 7.0 fps
33.2	1,247	Total			

Summary for Subcatchment 3.0:

Runoff = 0.58 cfs @ 12.38 hrs, Volume= 3,088 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-YR Rainfall=3.10"

Area (sf)	CN	Description
24,196	77	Woods, Good, HSG D
11,889	70	Woods, Good, HSG C
36,085	75	Weighted Average
36,085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.1	132	0.0303	0.10		Sheet Flow, AB
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.8	66	0.0606	0.62		Shallow Concentrated Flow, BC
					Forest w/Heavy Litter Kv= 2.5 fps
24.9	198	Total			

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Type III 24-hr 2-YR Rainfall=3.10"

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Summary for Reach R1:

Inflow Area = 36,085 sf, 0.00% Impervious, Inflow Depth = 1.03" for 2-YR event
Inflow = 0.58 cfs @ 12.38 hrs, Volume= 3,088 cf
Outflow = 0.43 cfs @ 12.61 hrs, Volume= 3,088 cf, Atten= 26%, Lag= 14.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 0.90 fps, Min. Travel Time= 19.9 min
Avg. Velocity = 0.76 fps, Avg. Travel Time= 23.5 min

Peak Storage= 511 cf @ 12.61 hrs
Average Depth at Peak Storage= 0.02'
Bank-Full Depth= 2.00' Flow Area= 52.0 sf, Capacity= 728.35 cfs

20.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 ' ' Top Width= 32.00'
Length= 1,070.0' Slope= 0.0430 ' '
Inlet Invert= 270.00', Outlet Invert= 224.00'



Summary for Reach R2:

Inflow Area = 134,969 sf, 0.00% Impervious, Inflow Depth = 0.95" for 2-YR event
Inflow = 1.68 cfs @ 12.47 hrs, Volume= 10,664 cf
Outflow = 1.64 cfs @ 12.53 hrs, Volume= 10,664 cf, Atten= 2%, Lag= 4.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 2.75 fps, Min. Travel Time= 5.8 min
Avg. Velocity = 1.03 fps, Avg. Travel Time= 15.5 min

Peak Storage= 570 cf @ 12.53 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 56.71 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 ' ' Top Width= 4.50'
Length= 955.0' Slope= 0.0322 ' '
Inlet Invert= 224.50', Outlet Invert= 193.75'



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Type III 24-hr 2-YR Rainfall=3.10"

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Summary for Reach R3:

Inflow Area = 725,365 sf, 0.00% Impervious, Inflow Depth = 1.01" for 2-YR event
Inflow = 7.27 cfs @ 12.70 hrs, Volume= 61,182 cf
Outflow = 7.21 cfs @ 12.78 hrs, Volume= 61,182 cf, Atten= 1%, Lag= 4.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 4.06 fps, Min. Travel Time= 5.4 min
Avg. Velocity= 1.51 fps, Avg. Travel Time= 14.6 min

Peak Storage= 2,350 cf @ 12.78 hrs
Average Depth at Peak Storage= 0.63'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 48.18 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 '/' Top Width= 4.50'
Length= 1,323.0' Slope= 0.0232 '/'
Inlet Invert= 193.75', Outlet Invert= 163.00'



Summary for Reach R4: Buffer

Inflow Area = 197,719 sf, 2.93% Impervious, Inflow Depth = 1.07" for 2-YR event
Inflow = 3.01 cfs @ 12.41 hrs, Volume= 17,572 cf
Outflow = 2.17 cfs @ 12.68 hrs, Volume= 17,565 cf, Atten= 28%, Lag= 16.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 0.09 fps, Min. Travel Time= 24.7 min
Avg. Velocity= 0.02 fps, Avg. Travel Time= 113.4 min

Peak Storage= 3,212 cf @ 12.68 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.20' Flow Area= 54.7 sf, Capacity= 8.70 cfs

42.00' x 1.20' deep channel, n= 0.800 Sheet flow: Woods+dense brush
Side Slope Z-value= 3.0 '/' Top Width= 49.20'
Length= 140.0' Slope= 0.0064 '/'
Inlet Invert= 233.60', Outlet Invert= 232.70'



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Summary for Pond C1: 18" HDPE

Inflow Area = 82,206 sf, 1.78% Impervious, Inflow Depth = 1.20" for 2-YR event
 Inflow = 1.44 cfs @ 12.45 hrs, Volume= 8,225 cf
 Outflow = 1.44 cfs @ 12.45 hrs, Volume= 8,225 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.44 cfs @ 12.45 hrs, Volume= 8,225 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 234.52' @ 12.45 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	233.90'	18.0" Round Culvert L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 233.90' / 233.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=1.44 cfs @ 12.45 hrs HW=234.51' TW=234.05' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 1.44 cfs @ 2.11 fps)

Summary for Pond P1:

Inflow Area = 115,513 sf, 3.75% Impervious, Inflow Depth = 0.97" for 2-YR event
 Inflow = 2.26 cfs @ 12.19 hrs, Volume= 9,359 cf
 Outflow = 1.61 cfs @ 12.36 hrs, Volume= 9,347 cf, Atten= 29%, Lag= 10.2 min
 Primary = 1.61 cfs @ 12.36 hrs, Volume= 9,347 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 234.71' @ 12.36 hrs Surf.Area= 2,271 sf Storage= 1,502 cf
 Flood Elev= 237.00' Surf.Area= 3,298 sf Storage= 7,876 cf

Plug-Flow detention time= 36.3 min calculated for 9,337 cf (100% of inflow)
 Center-of-Mass det. time= 36.5 min (906.6 - 870.1)

Volume	Invert	Avail.Storage	Storage Description
#1	234.00'	7,876 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
234.00	1,986	0	0
235.00	2,390	2,188	2,188
237.00	3,298	5,688	7,876

Device	Routing	Invert	Outlet Devices
#1	Primary	234.00'	15.0" Round Culvert L= 36.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.00' / 233.60' S= 0.0111 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Secondary	236.00'	25.0' long x 5.0' breadth EMERG-SPILLWAY 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

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Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.61 cfs @ 12.36 hrs HW=234.70' TW=233.96' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 1.61 cfs @ 2.26 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=234.00' TW=0.00' (Dynamic Tailwater)

↑**2=EMERG-SPILLWAY** (Controls 0.00 cfs)

Summary for Pond P2:

Inflow Area = 590,396 sf, 0.00% Impervious, Inflow Depth = 1.03" for 2-YR event
Inflow = 8.34 cfs @ 12.50 hrs, Volume= 50,517 cf
Outflow = 5.92 cfs @ 12.79 hrs, Volume= 50,517 cf, Atten= 29%, Lag= 17.4 min
Primary = 5.92 cfs @ 12.79 hrs, Volume= 50,517 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3

Peak Elev= 221.03' @ 12.79 hrs Surf.Area= 7,098 sf Storage= 7,660 cf

Flood Elev= 226.00' Surf.Area= 14,603 sf Storage= 60,330 cf

Plug-Flow detention time= 17.6 min calculated for 50,465 cf (100% of inflow)

Center-of-Mass det. time= 17.6 min (903.5 - 886.0)

Volume	Invert	Avail.Storage	Storage Description
#1	219.50'	60,330 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
219.50	0	0.0	0	0	0
220.00	5,929	355.0	988	988	10,029
222.00	8,306	440.0	14,168	15,157	15,465
224.00	11,206	524.0	19,440	34,596	21,981
226.00	14,603	608.0	25,734	60,330	29,632

Device	Routing	Invert	Outlet Devices
#1	Secondary	224.10'	10.0' long x 10.0' breadth EMERG SPILLWAY Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Primary	219.50'	18.0" Round Culvert L= 60.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 219.50' / 218.50' S= 0.0167 ' S= 0.0167 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.91 cfs @ 12.79 hrs HW=221.02' TW=194.38' (Dynamic Tailwater)

↑**2=Culvert** (Inlet Controls 5.91 cfs @ 3.35 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=219.50' TW=193.75' (Dynamic Tailwater)

↑**1=EMERG SPILLWAY** (Controls 0.00 cfs)

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Summary for Link AP1:

Inflow Area = 356,145 sf, 1.80% Impervious, Inflow Depth = 1.03" for 2-YR event
Inflow = 4.07 cfs @ 12.56 hrs, Volume= 30,590 cf
Primary = 4.07 cfs @ 12.56 hrs, Volume= 30,590 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP2:

Inflow Area = 2,229,918 sf, 0.00% Impervious, Inflow Depth = 0.99" for 2-YR event
Inflow = 25.80 cfs @ 12.55 hrs, Volume= 183,087 cf
Primary = 25.80 cfs @ 12.55 hrs, Volume= 183,087 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP3:

Inflow Area = 36,085 sf, 0.00% Impervious, Inflow Depth = 1.03" for 2-YR event
Inflow = 0.58 cfs @ 12.38 hrs, Volume= 3,088 cf
Primary = 0.58 cfs @ 12.38 hrs, Volume= 3,088 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

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Type III 24-hr 10-YR Rainfall=4.60"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Runoff Area=82,206 sf 1.78% Impervious Runoff Depth=2.38"
Flow Length=792' Tc=30.9 min CN=78 Runoff=2.92 cfs 16,274 cf

Subcatchment 1.1: Runoff Area=115,513 sf 3.75% Impervious Runoff Depth=2.05"
Flow Length=543' Tc=12.5 min CN=74 Runoff=5.04 cfs 19,729 cf

Subcatchment 1.2: Runoff Area=9,903 sf 5.98% Impervious Runoff Depth=2.38"
Flow Length=141' Slope=0.0057 '/' Tc=47.5 min CN=78 Runoff=0.28 cfs 1,961 cf

Subcatchment 1.3: Runoff Area=148,523 sf 0.00% Impervious Runoff Depth=2.05"
Flow Length=985' Tc=28.2 min CN=74 Runoff=4.70 cfs 25,367 cf

Subcatchment 2.0: Runoff Area=1,504,553 sf 0.00% Impervious Runoff Depth=2.05"
Flow Length=1,134' Tc=32.8 min CN=74 Runoff=44.45 cfs 256,973 cf

Subcatchment 2.1: Runoff Area=98,884 sf 0.00% Impervious Runoff Depth=1.97"
Flow Length=515' Tc=26.6 min CN=73 Runoff=3.07 cfs 16,245 cf

Subcatchment 2.2: Runoff Area=590,396 sf 0.00% Impervious Runoff Depth=2.13"
Flow Length=1,247' Tc=33.2 min CN=75 Runoff=18.08 cfs 104,749 cf

Subcatchment 3.0: Runoff Area=36,085 sf 0.00% Impervious Runoff Depth=2.13"
Flow Length=198' Tc=24.9 min CN=75 Runoff=1.26 cfs 6,402 cf

Reach R1: Avg. Flow Depth=0.04' Max Vel=1.24 fps Inflow=1.26 cfs 6,402 cf
n=0.030 L=1,070.0' S=0.0430 '/' Capacity=728.35 cfs Outflow=1.05 cfs 6,402 cf

Reach R2: Avg. Flow Depth=0.39' Max Vel=3.73 fps Inflow=4.01 cfs 22,647 cf
n=0.033 L=955.0' S=0.0322 '/' Capacity=56.71 cfs Outflow=3.95 cfs 22,647 cf

Reach R3: Avg. Flow Depth=0.92' Max Vel=4.86 fps Inflow=13.26 cfs 127,396 cf
n=0.033 L=1,323.0' S=0.0232 '/' Capacity=48.18 cfs Outflow=13.19 cfs 127,396 cf

Reach R4: Buffer Avg. Flow Depth=0.91' Max Vel=0.13 fps Inflow=6.51 cfs 35,991 cf
n=0.800 L=140.0' S=0.0064 '/' Capacity=8.70 cfs Outflow=5.42 cfs 35,985 cf

Pond C1: 18" HDPE Peak Elev=234.89' Inflow=2.92 cfs 16,274 cf
18.0" Round Culvert n=0.013 L=30.0' S=0.0100 '/' Outflow=2.92 cfs 16,274 cf

Pond P1: Peak Elev=235.25' Storage=2,811 cf Inflow=5.04 cfs 19,729 cf
Primary=3.70 cfs 19,717 cf Secondary=0.00 cfs 0 cf Outflow=3.70 cfs 19,717 cf

Pond P2: Peak Elev=222.65' Storage=20,807 cf Inflow=18.08 cfs 104,749 cf
Primary=10.40 cfs 104,749 cf Secondary=0.00 cfs 0 cf Outflow=10.40 cfs 104,749 cf

Link AP1: Inflow=9.98 cfs 63,313 cf
Primary=9.98 cfs 63,313 cf

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Link AP2:

Inflow=56.11 cfs 384,369 cf
Primary=56.11 cfs 384,369 cf

Link AP3:

Inflow=1.26 cfs 6,402 cf
Primary=1.26 cfs 6,402 cf

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Type III 24-hr 10-YR Rainfall=4.60"

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Summary for Subcatchment 1.0:

Runoff = 2.92 cfs @ 12.44 hrs, Volume= 16,274 cf, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
* 1,465	98	Impervious
65,241	77	Woods, Good, HSG D
463	70	Woods, Good, HSG C
15,037	78	Meadow, non-grazed, HSG D
82,206	78	Weighted Average
80,741		98.22% Pervious Area
1,465		1.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.6	150	0.1330	0.10		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
6.3	642	0.0358	1.70		Shallow Concentrated Flow, B-C
					Cultivated Straight Rows Kv= 9.0 fps
30.9	792	Total			

Summary for Subcatchment 1.1:

Runoff = 5.04 cfs @ 12.18 hrs, Volume= 19,729 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
* 76,752	71	Meadow, non-grazed, HSG C
4,336	98	Impervious
25,685	78	Meadow, non-grazed, HSG D
8,740	80	>75% Grass cover, Good, HSG D
115,513	74	Weighted Average
111,177		96.25% Pervious Area
4,336		3.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	134	0.1045	0.24		Sheet Flow, A-B
					Grass: Dense n= 0.240 P2= 3.10"
3.0	409	0.0644	2.28		Shallow Concentrated Flow, B-C
					Cultivated Straight Rows Kv= 9.0 fps
12.5	543	Total			

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Summary for Subcatchment 1.2:

Runoff = 0.28 cfs @ 12.66 hrs, Volume= 1,961 cf, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
6,334	77	Woods, Good, HSG D
2,151	78	Meadow, non-grazed, HSG D
724	71	Meadow, non-grazed, HSG C
102	70	Woods, Good, HSG C
* 592	98	Impervious, HSG D
9,903	78	Weighted Average
9,311		94.02% Pervious Area
592		5.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.5	141	0.0057	0.05		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"

Summary for Subcatchment 1.3:

Runoff = 4.70 cfs @ 12.41 hrs, Volume= 25,367 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
64,009	77	Woods, Good, HSG D
13,247	70	Woods, Good, HSG C
69,458	71	Meadow, non-grazed, HSG C
1,809	78	Meadow, non-grazed, HSG D
148,523	74	Weighted Average
148,523		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.4	150	0.0333	0.15		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 3.10"
4.3	422	0.0545	1.63		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
7.5	413	0.0339	0.92		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
28.2	985	Total			

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Type III 24-hr 10-YR Rainfall=4.60"

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Summary for Subcatchment 2.0:

Runoff = 44.45 cfs @ 12.47 hrs, Volume= 256,973 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
1,057,863	77	Woods, Good, HSG D
120,795	55	Woods, Good, HSG B
261,310	70	Woods, Good, HSG C
* 64,160	78	MEADOW D
425	71	Meadow, non-grazed, HSG C
1,504,553	74	Weighted Average
1,504,553		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.5	123	0.0569	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	107	0.0467	1.51		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.9	151	0.0331	2.73		Shallow Concentrated Flow, C-D
					Grassed Waterway Kv= 15.0 fps
1.2	753	0.0319	10.64	74.51	Trap/Vee/Rect Channel Flow, D-E
					Bot.W=2.50' D=2.00' Z= 0.5 '/' Top.W=4.50'
					n= 0.025
32.8	1,134	Total			

Summary for Subcatchment 2.1:

Runoff = 3.07 cfs @ 12.39 hrs, Volume= 16,245 cf, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
24,887	78	Meadow, non-grazed, HSG D
73,997	71	Meadow, non-grazed, HSG C
98,884	73	Weighted Average
98,884		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	150	0.0133	0.11		Sheet Flow, AB
					Grass: Dense n= 0.240 P2= 3.10"
3.0	365	0.0849	2.04		Shallow Concentrated Flow, BC
					Short Grass Pasture Kv= 7.0 fps
26.6	515	Total			

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Type III 24-hr 10-YR Rainfall=4.60"

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Summary for Subcatchment 2.2:

Runoff = 18.08 cfs @ 12.47 hrs, Volume= 104,749 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
305,567	78	Meadow, non-grazed, HSG D
186,507	71	Meadow, non-grazed, HSG C
5,515	80	>75% Grass cover, Good, HSG D
6,879	74	>75% Grass cover, Good, HSG C
19,667	70	Woods, Good, HSG C
66,261	77	Woods, Good, HSG D
590,396	75	Weighted Average
590,396		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	150	0.0200	0.12		Sheet Flow, A-B
					Grass: Dense n= 0.240 P2= 3.10"
4.5	401	0.0449	1.48		Shallow Concentrated Flow, BC
					Short Grass Pasture Kv= 7.0 fps
8.3	662	0.0363	1.33		Shallow Concentrated Flow, CD
					Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0588	1.70		Shallow Concentrated Flow, DE
					Short Grass Pasture Kv= 7.0 fps
33.2	1,247	Total			

Summary for Subcatchment 3.0:

Runoff = 1.26 cfs @ 12.36 hrs, Volume= 6,402 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.60"

Area (sf)	CN	Description
24,196	77	Woods, Good, HSG D
11,889	70	Woods, Good, HSG C
36,085	75	Weighted Average
36,085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.1	132	0.0303	0.10		Sheet Flow, AB
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.8	66	0.0606	0.62		Shallow Concentrated Flow, BC
					Forest w/Heavy Litter Kv= 2.5 fps
24.9	198	Total			

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Type III 24-hr 10-YR Rainfall=4.60"

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Summary for Reach R1:

Inflow Area = 36,085 sf, 0.00% Impervious, Inflow Depth = 2.13" for 10-YR event
Inflow = 1.26 cfs @ 12.36 hrs, Volume= 6,402 cf
Outflow = 1.05 cfs @ 12.52 hrs, Volume= 6,402 cf, Atten= 16%, Lag= 9.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 1.24 fps, Min. Travel Time= 14.3 min
Avg. Velocity = 0.77 fps, Avg. Travel Time= 23.0 min

Peak Storage= 902 cf @ 12.52 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 2.00' Flow Area= 52.0 sf, Capacity= 728.35 cfs

20.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 ' ' Top Width= 32.00'
Length= 1,070.0' Slope= 0.0430 ' '
Inlet Invert= 270.00', Outlet Invert= 224.00'



Summary for Reach R2:

Inflow Area = 134,969 sf, 0.00% Impervious, Inflow Depth = 2.01" for 10-YR event
Inflow = 4.01 cfs @ 12.42 hrs, Volume= 22,647 cf
Outflow = 3.95 cfs @ 12.47 hrs, Volume= 22,647 cf, Atten= 2%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 3.73 fps, Min. Travel Time= 4.3 min
Avg. Velocity = 1.25 fps, Avg. Travel Time= 12.8 min

Peak Storage= 1,011 cf @ 12.47 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 56.71 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 ' ' Top Width= 4.50'
Length= 955.0' Slope= 0.0322 ' '
Inlet Invert= 224.50', Outlet Invert= 193.75'



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Type III 24-hr 10-YR Rainfall=4.60"

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Summary for Reach R3:

Inflow Area = 725,365 sf, 0.00% Impervious, Inflow Depth = 2.11" for 10-YR event
Inflow = 13.26 cfs @ 12.65 hrs, Volume= 127,396 cf
Outflow = 13.19 cfs @ 12.72 hrs, Volume= 127,396 cf, Atten= 0%, Lag= 3.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 4.86 fps, Min. Travel Time= 4.5 min
Avg. Velocity = 1.84 fps, Avg. Travel Time= 12.0 min

Peak Storage= 3,589 cf @ 12.72 hrs
Average Depth at Peak Storage= 0.92'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 48.18 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 '/' Top Width= 4.50'
Length= 1,323.0' Slope= 0.0232 '/'
Inlet Invert= 193.75', Outlet Invert= 163.00'



Summary for Reach R4: Buffer

Inflow Area = 197,719 sf, 2.93% Impervious, Inflow Depth = 2.18" for 10-YR event
Inflow = 6.51 cfs @ 12.39 hrs, Volume= 35,991 cf
Outflow = 5.42 cfs @ 12.57 hrs, Volume= 35,985 cf, Atten= 17%, Lag= 10.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 0.13 fps, Min. Travel Time= 17.5 min
Avg. Velocity = 0.02 fps, Avg. Travel Time= 93.4 min

Peak Storage= 5,680 cf @ 12.57 hrs
Average Depth at Peak Storage= 0.91'
Bank-Full Depth= 1.20' Flow Area= 54.7 sf, Capacity= 8.70 cfs

42.00' x 1.20' deep channel, n= 0.800 Sheet flow: Woods+dense brush
Side Slope Z-value= 3.0 '/' Top Width= 49.20'
Length= 140.0' Slope= 0.0064 '/'
Inlet Invert= 233.60', Outlet Invert= 232.70'



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Type III 24-hr 10-YR Rainfall=4.60"

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Summary for Pond C1: 18" HDPE

Inflow Area = 82,206 sf, 1.78% Impervious, Inflow Depth = 2.38" for 10-YR event
Inflow = 2.92 cfs @ 12.44 hrs, Volume= 16,274 cf
Outflow = 2.92 cfs @ 12.44 hrs, Volume= 16,274 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.92 cfs @ 12.44 hrs, Volume= 16,274 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 234.89' @ 12.49 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	233.90'	18.0" Round Culvert L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 233.90' / 233.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=2.91 cfs @ 12.44 hrs HW=234.88' TW=234.45' (Dynamic Tailwater)
↑1=Culvert (Outlet Controls 2.91 cfs @ 3.37 fps)

Summary for Pond P1:

Inflow Area = 115,513 sf, 3.75% Impervious, Inflow Depth = 2.05" for 10-YR event
Inflow = 5.04 cfs @ 12.18 hrs, Volume= 19,729 cf
Outflow = 3.70 cfs @ 12.32 hrs, Volume= 19,717 cf, Atten= 27%, Lag= 8.5 min
Primary = 3.70 cfs @ 12.32 hrs, Volume= 19,717 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 235.25' @ 12.32 hrs Surf.Area= 2,505 sf Storage= 2,811 cf
Flood Elev= 237.00' Surf.Area= 3,298 sf Storage= 7,876 cf

Plug-Flow detention time= 26.1 min calculated for 19,696 cf (100% of inflow)
Center-of-Mass det. time= 26.5 min (874.1 - 847.6)

Volume	Invert	Avail.Storage	Storage Description
#1	234.00'	7,876 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
234.00	1,986	0	0
235.00	2,390	2,188	2,188
237.00	3,298	5,688	7,876

Device	Routing	Invert	Outlet Devices
#1	Primary	234.00'	15.0" Round Culvert L= 36.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.00' / 233.60' S= 0.0111 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Secondary	236.00'	25.0' long x 5.0' breadth EMERG-SPILLWAY 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

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Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=3.69 cfs @ 12.32 hrs HW=235.25' TW=234.32' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 3.69 cfs @ 3.00 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=234.00' TW=0.00' (Dynamic Tailwater)

↑**2=EMERG-SPILLWAY** (Controls 0.00 cfs)

Summary for Pond P2:

Inflow Area = 590,396 sf, 0.00% Impervious, Inflow Depth = 2.13" for 10-YR event
Inflow = 18.08 cfs @ 12.47 hrs, Volume= 104,749 cf
Outflow = 10.40 cfs @ 12.86 hrs, Volume= 104,749 cf, Atten= 42%, Lag= 23.3 min
Primary = 10.40 cfs @ 12.86 hrs, Volume= 104,749 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 222.65' @ 12.86 hrs Surf.Area= 9,195 sf Storage= 20,807 cf
Flood Elev= 226.00' Surf.Area= 14,603 sf Storage= 60,330 cf

Plug-Flow detention time= 23.1 min calculated for 104,640 cf (100% of inflow)
Center-of-Mass det. time= 23.1 min (887.3 - 864.2)

Volume	Invert	Avail.Storage	Storage Description
#1	219.50'	60,330 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
219.50	0	0.0	0	0	0
220.00	5,929	355.0	988	988	10,029
222.00	8,306	440.0	14,168	15,157	15,465
224.00	11,206	524.0	19,440	34,596	21,981
226.00	14,603	608.0	25,734	60,330	29,632

Device	Routing	Invert	Outlet Devices
#1	Secondary	224.10'	10.0' long x 10.0' breadth EMERG SPILLWAY Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Primary	219.50'	18.0" Round Culvert L= 60.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 219.50' / 218.50' S= 0.0167 ' S= 0.0167 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=10.39 cfs @ 12.86 hrs HW=222.64' TW=194.65' (Dynamic Tailwater)

↑**2=Culvert** (Inlet Controls 10.39 cfs @ 5.88 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=219.50' TW=193.75' (Dynamic Tailwater)

↑**1=EMERG SPILLWAY** (Controls 0.00 cfs)

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Summary for Link AP1:

Inflow Area = 356,145 sf, 1.80% Impervious, Inflow Depth = 2.13" for 10-YR event
Inflow = 9.98 cfs @ 12.50 hrs, Volume= 63,313 cf
Primary = 9.98 cfs @ 12.50 hrs, Volume= 63,313 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP2:

Inflow Area = 2,229,918 sf, 0.00% Impervious, Inflow Depth = 2.07" for 10-YR event
Inflow = 56.11 cfs @ 12.50 hrs, Volume= 384,369 cf
Primary = 56.11 cfs @ 12.50 hrs, Volume= 384,369 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP3:

Inflow Area = 36,085 sf, 0.00% Impervious, Inflow Depth = 2.13" for 10-YR event
Inflow = 1.26 cfs @ 12.36 hrs, Volume= 6,402 cf
Primary = 1.26 cfs @ 12.36 hrs, Volume= 6,402 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

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Type III 24-hr 25-YR Rainfall=5.80"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Runoff Area=82,206 sf 1.78% Impervious Runoff Depth=3.40"
Flow Length=792' Tc=30.9 min CN=78 Runoff=4.19 cfs 23,311 cf

Subcatchment 1.1: Runoff Area=115,513 sf 3.75% Impervious Runoff Depth=3.02"
Flow Length=543' Tc=12.5 min CN=74 Runoff=7.49 cfs 29,046 cf

Subcatchment 1.2: Runoff Area=9,903 sf 5.98% Impervious Runoff Depth=3.40"
Flow Length=141' Slope=0.0057 ' / ' Tc=47.5 min CN=78 Runoff=0.41 cfs 2,808 cf

Subcatchment 1.3: Runoff Area=148,523 sf 0.00% Impervious Runoff Depth=3.02"
Flow Length=985' Tc=28.2 min CN=74 Runoff=6.99 cfs 37,346 cf

Subcatchment 2.0: Runoff Area=1,504,553 sf 0.00% Impervious Runoff Depth=3.02"
Flow Length=1,134' Tc=32.8 min CN=74 Runoff=66.10 cfs 378,322 cf

Subcatchment 2.1: Runoff Area=98,884 sf 0.00% Impervious Runoff Depth=2.92"
Flow Length=515' Tc=26.6 min CN=73 Runoff=4.62 cfs 24,090 cf

Subcatchment 2.2: Runoff Area=590,396 sf 0.00% Impervious Runoff Depth=3.11"
Flow Length=1,247' Tc=33.2 min CN=75 Runoff=26.63 cfs 153,126 cf

Subcatchment 3.0: Runoff Area=36,085 sf 0.00% Impervious Runoff Depth=3.11"
Flow Length=198' Tc=24.9 min CN=75 Runoff=1.85 cfs 9,359 cf

Reach R1: Avg. Flow Depth=0.05' Max Vel=1.48 fps Inflow=1.85 cfs 9,359 cf
n=0.030 L=1,070.0' S=0.0430 ' / ' Capacity=728.35 cfs Outflow=1.62 cfs 9,359 cf

Reach R2: Avg. Flow Depth=0.51' Max Vel=4.29 fps Inflow=6.14 cfs 33,449 cf
n=0.033 L=955.0' S=0.0322 ' / ' Capacity=56.71 cfs Outflow=6.06 cfs 33,449 cf

Reach R3: Avg. Flow Depth=1.08' Max Vel=5.25 fps Inflow=17.39 cfs 186,575 cf
n=0.033 L=1,323.0' S=0.0232 ' / ' Capacity=48.18 cfs Outflow=17.31 cfs 186,575 cf

Reach R4: Buffer Avg. Flow Depth=1.14' Max Vel=0.15 fps Inflow=9.13 cfs 52,344 cf
n=0.800 L=140.0' S=0.0064 ' / ' Capacity=8.70 cfs Outflow=8.00 cfs 52,338 cf

Pond C1: 18" HDPE Peak Elev=235.18' Inflow=4.19 cfs 23,311 cf
18.0" Round Culvert n=0.013 L=30.0' S=0.0100 ' / ' Outflow=4.19 cfs 23,311 cf

Pond P1: Peak Elev=235.80' Storage=4,256 cf Inflow=7.49 cfs 29,046 cf
Primary=5.07 cfs 29,033 cf Secondary=0.00 cfs 0 cf Outflow=5.07 cfs 29,033 cf

Pond P2: Peak Elev=224.08' Storage=35,470 cf Inflow=26.63 cfs 153,126 cf
Primary=13.14 cfs 153,126 cf Secondary=0.00 cfs 0 cf Outflow=13.14 cfs 153,126 cf

Link AP1: Inflow=14.81 cfs 92,492 cf
Primary=14.81 cfs 92,492 cf

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Type III 24-hr 25-YR Rainfall=5.80"

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Link AP2:

Inflow=81.97 cfs 564,898 cf
Primary=81.97 cfs 564,898 cf

Link AP3:

Inflow=1.85 cfs 9,359 cf
Primary=1.85 cfs 9,359 cf

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Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Subcatchment 1.0:

Runoff = 4.19 cfs @ 12.43 hrs, Volume= 23,311 cf, Depth= 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
* 1,465	98	Impervious
65,241	77	Woods, Good, HSG D
463	70	Woods, Good, HSG C
15,037	78	Meadow, non-grazed, HSG D
82,206	78	Weighted Average
80,741		98.22% Pervious Area
1,465		1.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.6	150	0.1330	0.10		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
6.3	642	0.0358	1.70		Shallow Concentrated Flow, B-C
					Cultivated Straight Rows Kv= 9.0 fps
30.9	792	Total			

Summary for Subcatchment 1.1:

Runoff = 7.49 cfs @ 12.18 hrs, Volume= 29,046 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
* 76,752	71	Meadow, non-grazed, HSG C
4,336	98	Impervious
25,685	78	Meadow, non-grazed, HSG D
8,740	80	>75% Grass cover, Good, HSG D
115,513	74	Weighted Average
111,177		96.25% Pervious Area
4,336		3.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	134	0.1045	0.24		Sheet Flow, A-B
					Grass: Dense n= 0.240 P2= 3.10"
3.0	409	0.0644	2.28		Shallow Concentrated Flow, B-C
					Cultivated Straight Rows Kv= 9.0 fps
12.5	543	Total			

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Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Subcatchment 1.2:

Runoff = 0.41 cfs @ 12.65 hrs, Volume= 2,808 cf, Depth= 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
6,334	77	Woods, Good, HSG D
2,151	78	Meadow, non-grazed, HSG D
724	71	Meadow, non-grazed, HSG C
102	70	Woods, Good, HSG C
* 592	98	Impervious, HSG D
9,903	78	Weighted Average
9,311		94.02% Pervious Area
592		5.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.5	141	0.0057	0.05		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"

Summary for Subcatchment 1.3:

Runoff = 6.99 cfs @ 12.40 hrs, Volume= 37,346 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
64,009	77	Woods, Good, HSG D
13,247	70	Woods, Good, HSG C
69,458	71	Meadow, non-grazed, HSG C
1,809	78	Meadow, non-grazed, HSG D
148,523	74	Weighted Average
148,523		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.4	150	0.0333	0.15		Sheet Flow, A-B Grass: Dense n= 0.240 P2= 3.10"
4.3	422	0.0545	1.63		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
7.5	413	0.0339	0.92		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
28.2	985	Total			

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Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Subcatchment 2.0:

Runoff = 66.10 cfs @ 12.46 hrs, Volume= 378,322 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
1,057,863	77	Woods, Good, HSG D
120,795	55	Woods, Good, HSG B
261,310	70	Woods, Good, HSG C
* 64,160	78	MEADOW D
425	71	Meadow, non-grazed, HSG C
1,504,553	74	Weighted Average
1,504,553		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.5	123	0.0569	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.10"
1.2	107	0.0467	1.51		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
0.9	151	0.0331	2.73		Shallow Concentrated Flow, C-D
					Grassed Waterway Kv= 15.0 fps
1.2	753	0.0319	10.64	74.51	Trap/Vee/Rect Channel Flow, D-E
					Bot.W=2.50' D=2.00' Z= 0.5 ' /' Top.W=4.50'
					n= 0.025
32.8	1,134	Total			

Summary for Subcatchment 2.1:

Runoff = 4.62 cfs @ 12.38 hrs, Volume= 24,090 cf, Depth= 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
24,887	78	Meadow, non-grazed, HSG D
73,997	71	Meadow, non-grazed, HSG C
98,884	73	Weighted Average
98,884		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	150	0.0133	0.11		Sheet Flow, AB
					Grass: Dense n= 0.240 P2= 3.10"
3.0	365	0.0849	2.04		Shallow Concentrated Flow, BC
					Short Grass Pasture Kv= 7.0 fps
26.6	515	Total			

Post-Development

Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Subcatchment 2.2:

Runoff = 26.63 cfs @ 12.47 hrs, Volume= 153,126 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
305,567	78	Meadow, non-grazed, HSG D
186,507	71	Meadow, non-grazed, HSG C
5,515	80	>75% Grass cover, Good, HSG D
6,879	74	>75% Grass cover, Good, HSG C
19,667	70	Woods, Good, HSG C
66,261	77	Woods, Good, HSG D
590,396	75	Weighted Average
590,396		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	150	0.0200	0.12		Sheet Flow, A-B
					Grass: Dense n= 0.240 P2= 3.10"
4.5	401	0.0449	1.48		Shallow Concentrated Flow, BC
					Short Grass Pasture Kv= 7.0 fps
8.3	662	0.0363	1.33		Shallow Concentrated Flow, CD
					Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0588	1.70		Shallow Concentrated Flow, DE
					Short Grass Pasture Kv= 7.0 fps
33.2	1,247	Total			

Summary for Subcatchment 3.0:

Runoff = 1.85 cfs @ 12.35 hrs, Volume= 9,359 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
24,196	77	Woods, Good, HSG D
11,889	70	Woods, Good, HSG C
36,085	75	Weighted Average
36,085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.1	132	0.0303	0.10		Sheet Flow, AB
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.8	66	0.0606	0.62		Shallow Concentrated Flow, BC
					Forest w/Heavy Litter Kv= 2.5 fps
24.9	198	Total			

Post-Development

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Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Reach R1:

Inflow Area = 36,085 sf, 0.00% Impervious, Inflow Depth = 3.11" for 25-YR event
Inflow = 1.85 cfs @ 12.35 hrs, Volume= 9,359 cf
Outflow = 1.62 cfs @ 12.48 hrs, Volume= 9,359 cf, Atten= 12%, Lag= 8.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 1.48 fps, Min. Travel Time= 12.0 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 22.7 min

Peak Storage= 1,170 cf @ 12.48 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 2.00' Flow Area= 52.0 sf, Capacity= 728.35 cfs

20.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 ' ' Top Width= 32.00'
Length= 1,070.0' Slope= 0.0430 ' '
Inlet Invert= 270.00', Outlet Invert= 224.00'



Summary for Reach R2:

Inflow Area = 134,969 sf, 0.00% Impervious, Inflow Depth = 2.97" for 25-YR event
Inflow = 6.14 cfs @ 12.41 hrs, Volume= 33,449 cf
Outflow = 6.06 cfs @ 12.45 hrs, Volume= 33,449 cf, Atten= 1%, Lag= 2.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 4.29 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 1.38 fps, Avg. Travel Time= 11.5 min

Peak Storage= 1,347 cf @ 12.45 hrs
Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 56.71 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 ' ' Top Width= 4.50'
Length= 955.0' Slope= 0.0322 ' '
Inlet Invert= 224.50', Outlet Invert= 193.75'



Post-Development

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Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Reach R3:

Inflow Area = 725,365 sf, 0.00% Impervious, Inflow Depth = 3.09" for 25-YR event
Inflow = 17.39 cfs @ 12.60 hrs, Volume= 186,575 cf
Outflow = 17.31 cfs @ 12.66 hrs, Volume= 186,575 cf, Atten= 0%, Lag= 3.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 5.25 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 2.04 fps, Avg. Travel Time= 10.8 min

Peak Storage= 4,358 cf @ 12.66 hrs
Average Depth at Peak Storage= 1.08'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 48.18 cfs

2.50' x 2.00' deep channel, n= 0.033 Stream, clean & straight
Side Slope Z-value= 0.5 '/' Top Width= 4.50'
Length= 1,323.0' Slope= 0.0232 '/'
Inlet Invert= 193.75', Outlet Invert= 163.00'



Summary for Reach R4: Buffer

Inflow Area = 197,719 sf, 2.93% Impervious, Inflow Depth = 3.18" for 25-YR event
Inflow = 9.13 cfs @ 12.38 hrs, Volume= 52,344 cf
Outflow = 8.00 cfs @ 12.56 hrs, Volume= 52,338 cf, Atten= 12%, Lag= 10.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 0.15 fps, Min. Travel Time= 15.1 min
Avg. Velocity = 0.03 fps, Avg. Travel Time= 83.6 min

Peak Storage= 7,260 cf @ 12.56 hrs
Average Depth at Peak Storage= 1.14'
Bank-Full Depth= 1.20' Flow Area= 54.7 sf, Capacity= 8.70 cfs

42.00' x 1.20' deep channel, n= 0.800 Sheet flow: Woods+dense brush
Side Slope Z-value= 3.0 '/' Top Width= 49.20'
Length= 140.0' Slope= 0.0064 '/'
Inlet Invert= 233.60', Outlet Invert= 232.70'



Post-Development

Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Pond C1: 18" HDPE

Inflow Area = 82,206 sf, 1.78% Impervious, Inflow Depth = 3.40" for 25-YR event
 Inflow = 4.19 cfs @ 12.43 hrs, Volume= 23,311 cf
 Outflow = 4.19 cfs @ 12.43 hrs, Volume= 23,311 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.19 cfs @ 12.43 hrs, Volume= 23,311 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 235.18' @ 12.48 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	233.90'	18.0" Round Culvert L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 233.90' / 233.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=4.18 cfs @ 12.43 hrs HW=235.16' TW=234.68' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 4.18 cfs @ 2.63 fps)

Summary for Pond P1:

Inflow Area = 115,513 sf, 3.75% Impervious, Inflow Depth = 3.02" for 25-YR event
 Inflow = 7.49 cfs @ 12.18 hrs, Volume= 29,046 cf
 Outflow = 5.07 cfs @ 12.34 hrs, Volume= 29,033 cf, Atten= 32%, Lag= 9.6 min
 Primary = 5.07 cfs @ 12.34 hrs, Volume= 29,033 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 235.80' @ 12.34 hrs Surf.Area= 2,755 sf Storage= 4,256 cf
 Flood Elev= 237.00' Surf.Area= 3,298 sf Storage= 7,876 cf

Plug-Flow detention time= 23.1 min calculated for 29,003 cf (100% of inflow)
 Center-of-Mass det. time= 23.5 min (859.8 - 836.4)

Volume	Invert	Avail.Storage	Storage Description
#1	234.00'	7,876 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
234.00	1,986	0	0
235.00	2,390	2,188	2,188
237.00	3,298	5,688	7,876

Device	Routing	Invert	Outlet Devices
#1	Primary	234.00'	15.0" Round Culvert L= 36.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.00' / 233.60' S= 0.0111 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Secondary	236.00'	25.0' long x 5.0' breadth EMERG-SPILLWAY 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

Post-Development

Type III 24-hr 25-YR Rainfall=5.80"

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Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=5.05 cfs @ 12.34 hrs HW=235.80' TW=234.57' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 5.05 cfs @ 4.12 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=234.00' TW=0.00' (Dynamic Tailwater)

↑**2=EMERG-SPILLWAY** (Controls 0.00 cfs)

Summary for Pond P2:

Inflow Area = 590,396 sf, 0.00% Impervious, Inflow Depth = 3.11" for 25-YR event
Inflow = 26.63 cfs @ 12.47 hrs, Volume= 153,126 cf
Outflow = 13.14 cfs @ 12.92 hrs, Volume= 153,126 cf, Atten= 51%, Lag= 27.2 min
Primary = 13.14 cfs @ 12.92 hrs, Volume= 153,126 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3

Peak Elev= 224.08' @ 12.92 hrs Surf.Area= 11,329 sf Storage= 35,470 cf

Flood Elev= 226.00' Surf.Area= 14,603 sf Storage= 60,330 cf

Plug-Flow detention time= 28.6 min calculated for 152,967 cf (100% of inflow)

Center-of-Mass det. time= 28.6 min (881.8 - 853.2)

Volume	Invert	Avail.Storage	Storage Description
#1	219.50'	60,330 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
219.50	0	0.0	0	0	0
220.00	5,929	355.0	988	988	10,029
222.00	8,306	440.0	14,168	15,157	15,465
224.00	11,206	524.0	19,440	34,596	21,981
226.00	14,603	608.0	25,734	60,330	29,632

Device	Routing	Invert	Outlet Devices
#1	Secondary	224.10'	10.0' long x 10.0' breadth EMERG SPILLWAY Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Primary	219.50'	18.0" Round Culvert L= 60.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 219.50' / 218.50' S= 0.0167 ' S= 0.0167 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=13.14 cfs @ 12.92 hrs HW=224.07' TW=194.79' (Dynamic Tailwater)

↑**2=Culvert** (Inlet Controls 13.14 cfs @ 7.43 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=219.50' TW=193.75' (Dynamic Tailwater)

↑**1=EMERG SPILLWAY** (Controls 0.00 cfs)

Post-Development

Type III 24-hr 25-YR Rainfall=5.80"

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Summary for Link AP1:

Inflow Area = 356,145 sf, 1.80% Impervious, Inflow Depth = 3.12" for 25-YR event
Inflow = 14.81 cfs @ 12.48 hrs, Volume= 92,492 cf
Primary = 14.81 cfs @ 12.48 hrs, Volume= 92,492 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP2:

Inflow Area = 2,229,918 sf, 0.00% Impervious, Inflow Depth = 3.04" for 25-YR event
Inflow = 81.97 cfs @ 12.48 hrs, Volume= 564,898 cf
Primary = 81.97 cfs @ 12.48 hrs, Volume= 564,898 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Summary for Link AP3:

Inflow Area = 36,085 sf, 0.00% Impervious, Inflow Depth = 3.11" for 25-YR event
Inflow = 1.85 cfs @ 12.35 hrs, Volume= 9,359 cf
Primary = 1.85 cfs @ 12.35 hrs, Volume= 9,359 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Appendix C:

Stormwater Buffer and Level Spreader Calculations

Stormwater Buffer B1/Level Spreader L1

Forested Buffer on HSG D soil @ 1% slope:

Area to be Treated:

5,529 SF Impervious

0 SF Landscaped

Stone Berm Width Required = $(5,529 \text{ sf} / 43,560 \text{ sf/acre}) \times (150 \text{ ft/acre}) = 19 \text{ ft}$

Stone Berm Width Provided = **25'** => **OK**

Flow Length required = 150 ft

Buffer Area Required = $150 \text{ ft} \times 19 \text{ ft} = 2,850 \text{ SF}$

Flow Length Provided = 125 ft

Buffer Area Provided = 4,410 sf

Although the buffer length is slightly shorter than standard, the buffer area provided significantly exceeds the buffer area required. As the buffer is very flat and is of pit/mound topography, it is our opinion that the proposed buffer design will provide adequate treatment for the small developed area to be treated.

Level Spreader L2

10-year storm flow rate = 4.6 cfs

Length required = $4 \text{ ft/cfs} \Rightarrow 4 \text{ ft/cfs} \times 3.1 \text{ cfs} = 12.4 \text{ ft}$.

Length provided = **30'** => **OK**

Level Spreader L3

10-year storm flow rate = 10.4 cfs

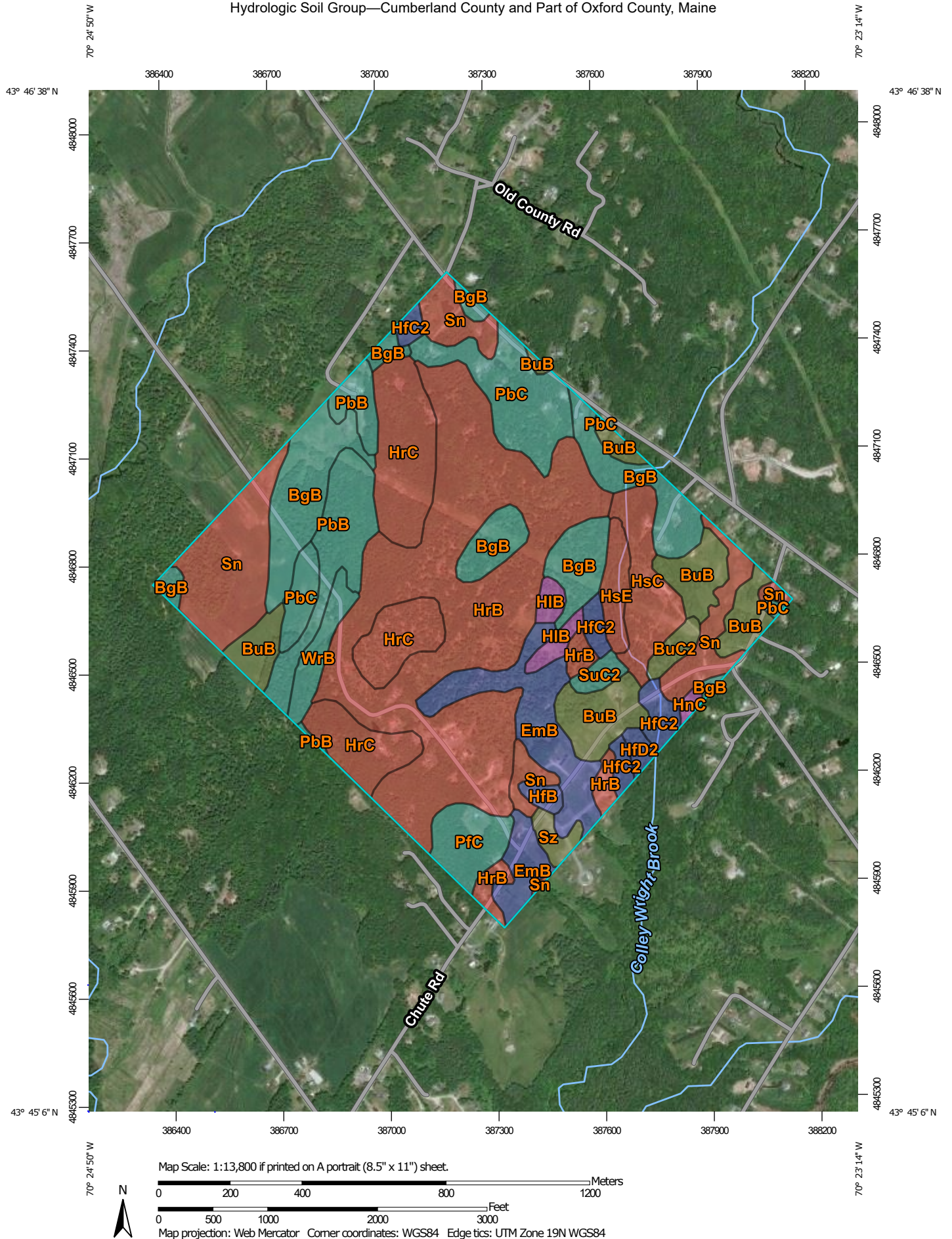
Length required = $4 \text{ ft/cfs} \Rightarrow 4 \text{ ft/cfs} \times 10.4 \text{ cfs} = 41.6 \text{ ft}$.

Length provided = **45'** => **OK**

Appendix D:

**Web Soil Survey
Effective FIRMette**

Hydrologic Soil Group—Cumberland County and Part of Oxford County, Maine



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

9/24/2020
Page 1 of 5

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: Cumberland County and Part of Oxford County, Maine

Survey Area Data: Version 17, Jun 5, 2020

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

Date(s) aerial images were photographed: Jun 7, 2019—Jul 2, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BgB	Nicholville very fine sandy loam, 0 to 8 percent slopes	C	47.8	11.9%
BuB	Lamoine silt loam, 3 to 8 percent slopes	C/D	29.5	7.4%
BuC2	Buxton silt loam, 8 to 15 percent slopes	C/D	3.0	0.7%
EmB	Elmwood fine sandy loam, 0 to 8 percent slopes	B	26.3	6.6%
HfB	Hartland very fine sandy loam, 3 to 8 percent slopes	B	1.9	0.5%
HfC2	Hartland very fine sandy loam, 8 to 15 percent slopes, eroded	B	9.0	2.2%
HfD2	Hartland very fine sandy loam, 15 to 25 percent slopes, eroded	B	1.8	0.5%
HIB	Hinckley loamy sand, 3 to 8 percent slopes	A	4.5	1.1%
HnC	Hinckley-Suffield complex, 8 to 15 percent slopes	A	1.0	0.2%
HrB	Lyman-Tunbridge complex, 0 to 8 percent slopes, rocky	D	110.1	27.4%
HrC	Lyman-Tunbridge complex, 8 to 15 percent slopes, rocky	D	39.3	9.8%
HsC	Lyman-Abram complex, 8 to 15 percent slopes, very rocky	D	13.9	3.4%
HsE	Lyman-Abram complex, 15 to 35 percent slopes, very rocky	D	5.6	1.4%
PbB	Paxton fine sandy loam, 3 to 8 percent slopes	C	21.2	5.3%
PbC	Paxton fine sandy loam, 8 to 15 percent slopes	C	24.3	6.0%
PfC	Paxton very stony fine sandy loam, 8 to 15 percent slopes	C	9.4	2.3%
Sn	Scantic silt loam, 0 to 3 percent slopes	D	41.5	10.3%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
SuC2	Suffield silt loam, 8 to 15 percent slopes, eroded	C	2.5	0.6%
Sz	Swanton fine sandy loam	C/D	2.9	0.7%
WrB	Woodbridge fine sandy loam, 0 to 8 percent slopes	C	6.3	1.6%
Totals for Area of Interest			401.8	100.0%

Description

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

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

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

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

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

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

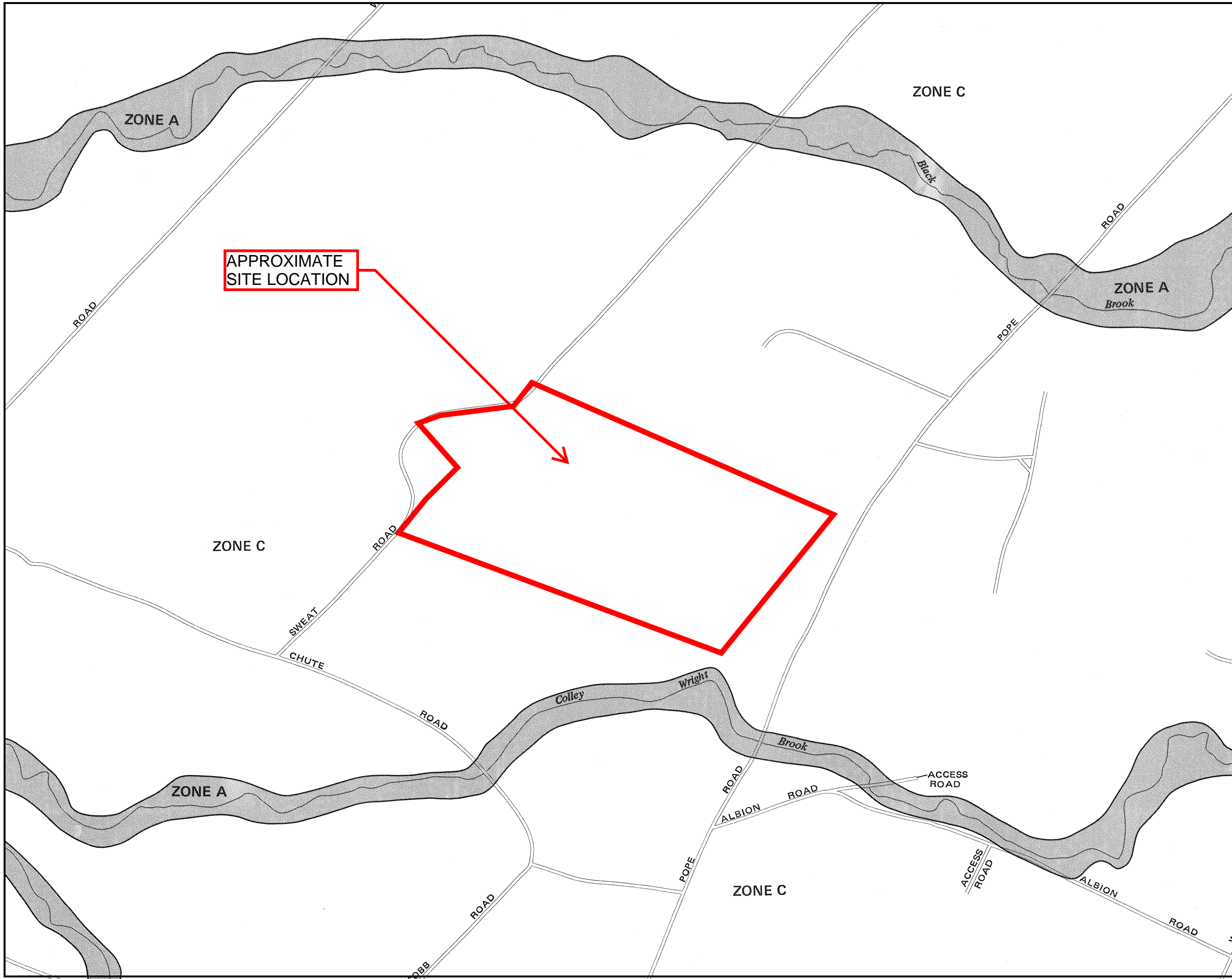
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



APPROXIMATE SCALE

800 0 800 FEET

NATIONAL FLOOD INSURANCE PROGRAM

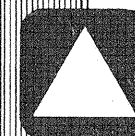
FIRM
FLOOD INSURANCE RATE MAP

TOWN OF
WINDHAM, MAINE
CUMBERLAND COUNTY

PANEL 30 OF 35
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
230189 0030 B

EFFECTIVE DATE:
SEPTEMBER 2, 1981



federal emergency management agency
federal insurance administration

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix E:

Inspection & Maintenance Plan

**POST CONSTRUCTION INSPECTION AND MAINTENANCE PLAN
OF STORMWATER MANAGEMENT FACILITIES
for
TPE WH02 Solar Project
Swett Road, Windham, Maine**

Stormwater Management Facilities include swales, ditches, gravel areas, drain pipe, riprap aprons, level spreaders, and detention ponds. Periodic inspection and maintenance of these site features and devices is necessary to prevent erosion, protect roadways, and remove pollutants from stormwater runoff.

TPE ME WH02, LLC is responsible for the inspections and maintenance of stormwater facilities associates with this project.

RECORD KEEPING:

Inspections shall be conducted by someone with knowledge of erosion and stormwater control, including standards and conditions in the permit. Post construction inspection and corrective action records shall be retained for a minimum of five years after permanent stabilization has been achieved.

SWALES, DITCHES, AND GRAVEL AREAS:

Swales, ditches and gravel areas are easily inspected during a site walk or even a ride-by. Since visual inspection is easy, their condition should be assessed during and/or after significant rainfall events. Any damage or unusual condition such as sedimentation of a ditch, erosion, damaged curb or dying vegetation should be recorded, dated and initialed by the inspector when observed. Even if there is no damage, the inspector should make record of these inspections at least twice annually.

Gravel areas should be visually inspected monthly during the winter. The inspector should pay particular attention for evidence of erosion. The date and initials of the inspector should be recorded on the forms provided as well as a notation of any cleanup effort that was made and repairs to eroded areas.

Open swales and ditches shall be inspected twice per year (in spring and fall) to assure that debris and/or sediments do not reduce the effectiveness of the system. Debris and sediments shall be removed at that time. Any sign of erosion or blockage shall be immediately repaired to assure a vigorous growth of vegetation for the stability of the ditches and slopes proper function. Maintenance shall include, but not be limited to, mowing, trimming and removal of vegetation in the ditches and slopes as required in order to prevent vegetation from blocking or diverting storm flows, replacement of riprap channel lining to prevent scour of the channel invert, removing vegetation and debris from the culverts.

Vegetated ditches should be mowed at least monthly during the growing season. Larger brush or trees must not be allowed to become established in the channel. Any areas where the vegetation fails will be subject to erosion and should be reseeded and mulched immediately.

DRAIN PIPES AND RIPRAP APRONS:

Drain pipes are road culverts and pipes connecting drain manholes. Inspect drain pipes when inspecting other stormwater maintenance facilities. At least annually make a visual inspection of the pipe. During the daylight you should be able to see light through most pipes as they have been laid to a straight line and grade. In some cases (e.g. pipe runs to a drain manhole, or is blocked) you will need a light to inspect pipes.

Remove any obstructions to flow; remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit; and to repair any erosion damage at the pipe inlet and outlet. Sediment should be removed when its level exceeds 20% of the pipe diameter. This may be accomplished by hydraulic flushing or any mechanical means; however, care should be taken to contain the sediment at the pipe outlet, and not flush the sediments into the stormwater filter or wetland areas.

Riprap aprons where stone is displaced should be replaced and chinked to assure stability. With time, additional riprap may be added. Vegetation growing through riprap should be removed on an annual basis.

Record inspections on the forms provided noting condition of pipe and any maintenance procedures implemented.

LEVEL SPREADERS:

Level Spreaders are shallow basins or ditches constructed at the ends of ditches or pipe outlets to disperse or "spread" concentrated flow thinly over a receiving area. Level Spreaders are constructed along the natural contour of the land to create a level "lip" on the outlet side. The integrity of the level lip is critical to the proper performance of this device.

There are three (3) Level Spreaders on the site. Detail for the level spreaders can be found on Detail 1 Sheet C4.2. The individual level spreader locations can be found at the following:

Inspect the Level Spreader at least once each season and following significant rainfall events (1 inch or more of rain in 12 hours). Record inspections on the forms provided noting your observations and any corrective action taken. Any sign of erosion or blockage shall be immediately repaired to assure a vigorous growth of vegetation and stability of stone berms for the stability of the level spreader for proper function. Minor regrading, releaving of the stone "lip," and reseeding of the level lip on an annual basis should be anticipated. Mow level lips at least twice during the growing season. Maintenance may also include removal of sediment buildup especially on the inlet end.

DETENTION POND:

A detention pond is an impoundment designed to temporarily store runoff and release it at a controlled rate. The detention pond for is designed to attenuate peak flows from the site before they reach the outlets.

There are two (2) detention ponds on site, their locations are indicated on sheet C2.1.

Inlets and Outlets of detention ponds should be inspected monthly during wet weather conditions from March to November. The pipe ends should be cleared of debris as necessary and inspected for damage.

Ponds should be inspected annually for erosion, destabilization of side slopes, embankment settling and other signs of structural failure, and loss of storage volume due to sediment accumulation. Corrective action should be taken immediately upon identification of problems.

Embankments should be maintained to preserve their integrity as impoundment structures, including, but not necessarily limited to, vegetative maintenance (mowing, control of woody vegetation), rodent control, erosion control and repair.

Inspections should be documented on forms similar to those provided. The date and initials of the inspector should be recorded as well as a description of conditions and any repair effort.

SEDIMENT DISPOSAL:

Any sediment or debris removed during maintenance of the stormwater system must be disposed of in accordance with the Maine Solid Waste Disposal Rules.

Submitted by:

A handwritten signature in black ink, appearing to read "Silas Canavan".

Silas Canavan, PE
Walsh Engineering Associates, Inc.

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WH02 SOLAR PROJECT WINDHAM, MAINE

INSPECTION / MAINTENANCE LOG

DRAIN PIPES AND RIPRAP APRONS

I: INSPECTED - C: CLEANED - S: SWEEPED - R: REPAIRED

[illegible]

WH02 SOLAR PROJECT WINDHAM, MAINE

INSPECTION / MAINTENANCE LOG

LEVEL SPREADERS

I: INSPECTED - C: CLEANED - R: REPAIRED

[illegible]

WH02 SOLAR PROJECT WINDHAM, MAINE

INSPECTION / MAINTENANCE LOG

DETENTION POND

I: INSPECTED - C: CLEANED - R: REPAIRED

[illegible]

**STORMWATER MANAGEMENT SYSTEM
MAINTENANCE PROGRAM
SUMMARY CHECKLIST**

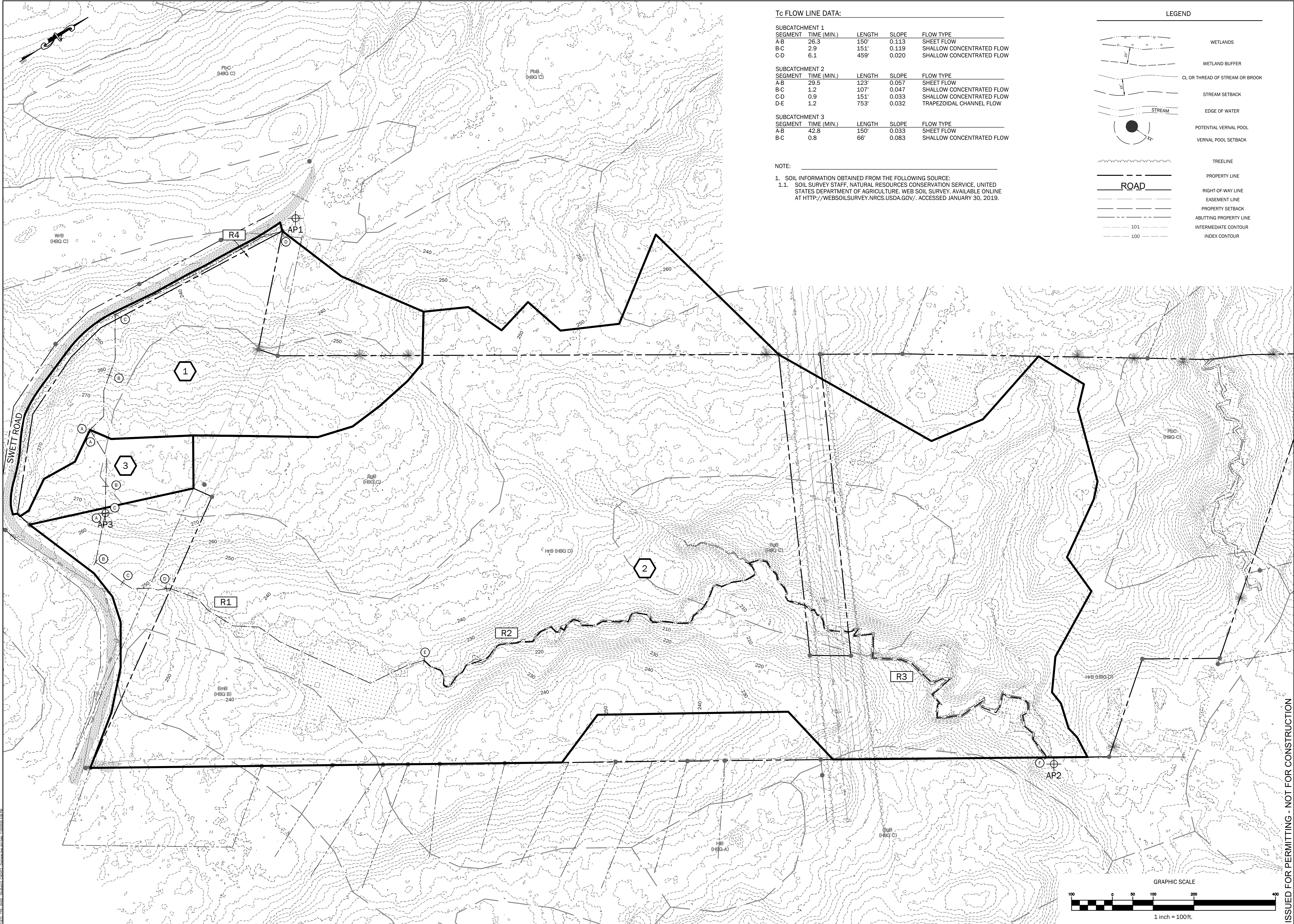
Item	Commentary	Frequency			
		Month	Semi-Annual	Annual	Long-Term
All basin side slopes	Inspect slopes for sloughing, erosion or undesirable tree growth. Mow slopes to control vegetation, repair any structure flaws identified	X Mow Summer		X	
All Pond Sediment Removal	Remove sediment when it occupies 15% of volume.				X 5-Years
Level Spreaders	Review level lip for stability and grass growth, remove sediment and debris		X		
Open Swale, Ditches & Inlet Structures	Inspect for debris accumulation, erosion and excessive vegetation. Mow monthly, remove debris, repair and revegetate any area of erosion	X Mow		X	
Pipelines	Inspect for sediment build-up in pipe. Flush and remove as required.			X	

Appendix F:

Drainage Plans are included in Full Plan Set

D1.0: Pre-Development Drainage Plan

D2.0: Post-Development Drainage Plan



Tc FLOW LINE DATA:

SUBCATCHMENT 1				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	26.3	150'	0.113	SHEET FLOW
B-C	2.9	151'	0.119	SHALLOW CONCENTRATED FLOW
C-D	6.1	459'	0.020	SHALLOW CONCENTRATED FLOW

SUBCATCHMENT 2				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	29.5	123'	0.057	SHEET FLOW
B-C	1.2	107'	0.047	SHALLOW CONCENTRATED FLOW
C-D	0.9	151'	0.033	SHALLOW CONCENTRATED FLOW
D-E	1.2	753'	0.032	TRAPEZOIDAL CHANNEL FLOW

SUBCATCHMENT 3				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	42.8	150'	0.033	SHEET FLOW
B-C	0.8	66'	0.083	SHALLOW CONCENTRATED FLOW

NOTE:

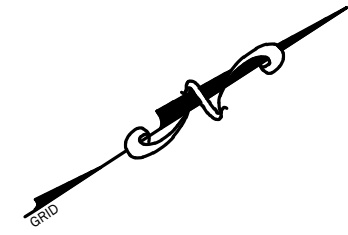
1. SOIL INFORMATION OBTAINED FROM THE FOLLOWING SOURCE:
1.1. SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. WEB SOIL SURVEY, AVAILABLE ONLINE AT [HTTP://WEBSOILSURVEY.NRCS.USDA.GOV/](http://websoilsurvey.nrcs.usda.gov/). ACCESSED JANUARY 30, 2019.

LEGEND

	WETLANDS
	WETLAND BUFFER
	CL OR THREAD OF STREAM OR BROOK
	STREAM SETBACK
	EDGE OF WATER
	POTENTIAL VERNAL POOL
	VERNAL POOL SETBACK
	TREELINE
	PROPERTY LINE
	RIGHT-OF-WAY LINE
	EASEMENT LINE
	PROPERTY SETBACK
	ABUTTING PROPERTY LINE
	INTERMEDIATE CONTOUR
	INDEX CONTOUR



Rev.	Date	Description	Drawn	Check
1	11/18/2020	Issued for DEP Permits	ML	SWC
2	11/23/2020	Issued for Town Permit	ML	SWC



Tc FLOW LINE DATA:

SUBCATCHMENT 1.0				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	24.6	150'	0.133	SHEET FLOW
B-C	6.3	642'	0.036	SHALLOW CONCENTRATED FLOW

SUBCATCHMENT 1.1				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	9.5	134'	0.105	SHEET FLOW
B-C	3.0	409'	0.064	SHALLOW CONCENTRATED FLOW

SUBCATCHMENT 1.2				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	47.5	141'	0.006	SHEET FLOW

Tc FLOW LINE DATA:

SUBCATCHMENT 1.3				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	16.4	150'	0.033	SHEET FLOW
B-C	4.3	422'	0.055	SHALLOW CONCENTRATED FLOW
C-D	7.5	413'	0.034	SHALLOW CONCENTRATED FLOW

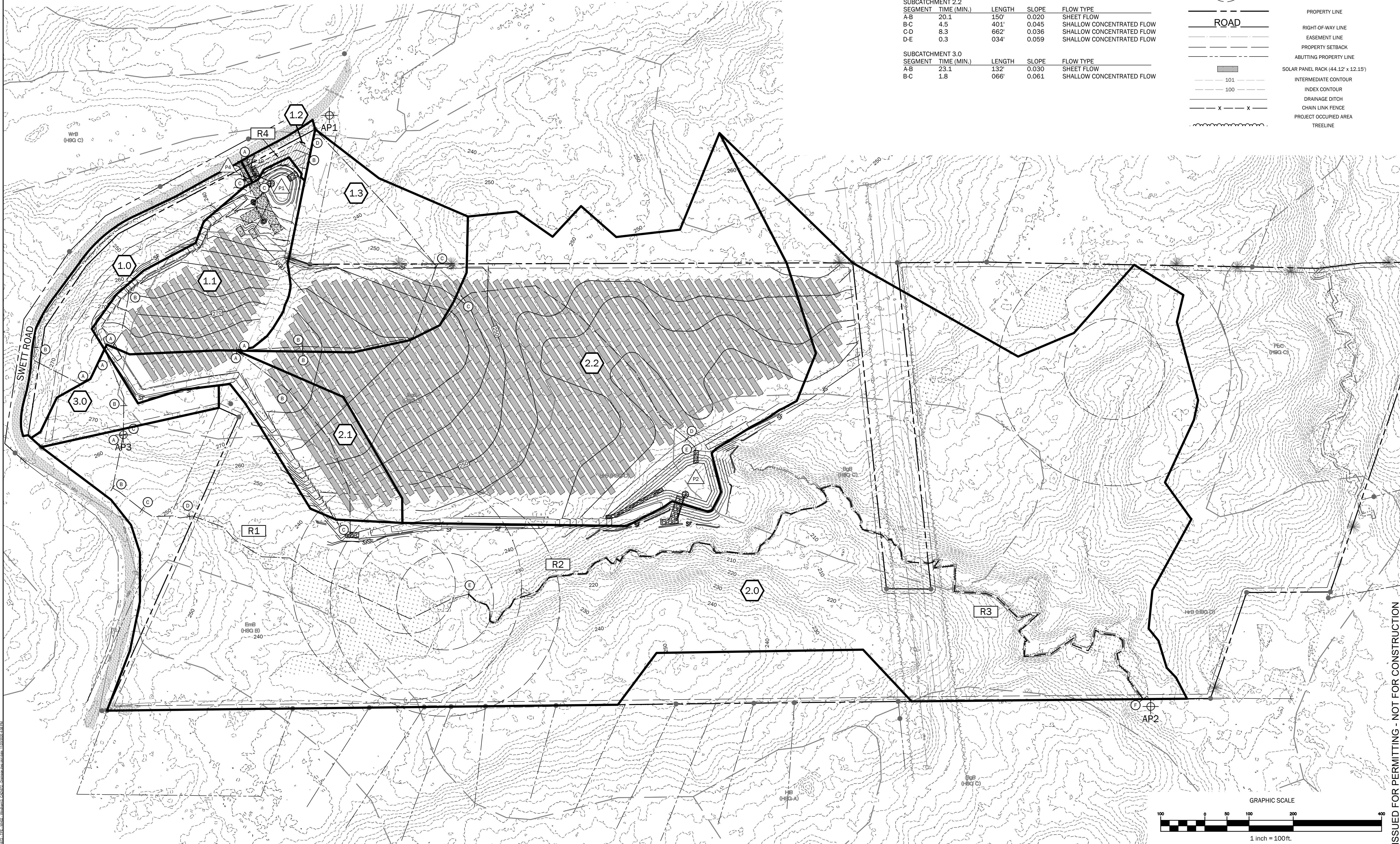
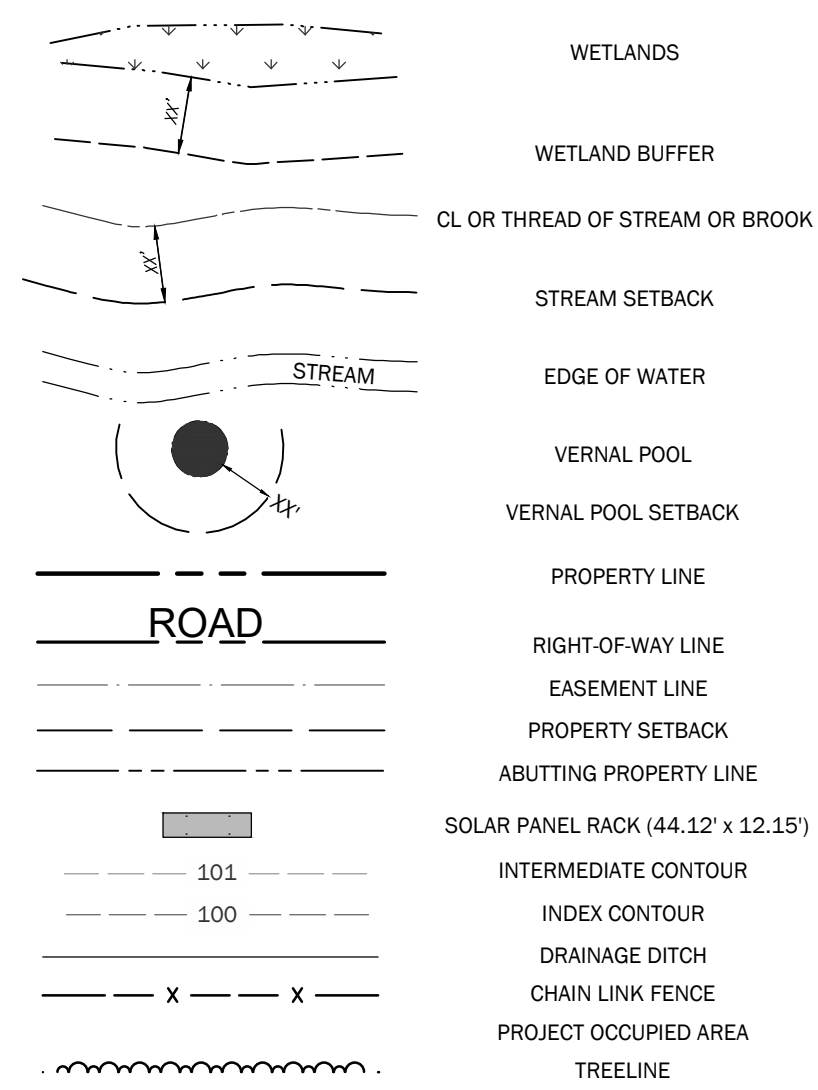
SUBCATCHMENT 2.0				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	29.5	123'	0.037	SHEET FLOW
B-C	1.2	107'	0.047	SHALLOW CONCENTRATED FLOW
C-D	0.9	151'	0.033	SHALLOW CONCENTRATED FLOW
D-E	1.2	753'	0.032	TRAPEZOIDAL CHANNEL FLOW

SUBCATCHMENT 2.1				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	23.6	150'	0.013	SHEET FLOW
B-C	3.0	365'	0.085	SHALLOW CONCENTRATED FLOW

SUBCATCHMENT 2.2				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	20.1	150'	0.020	SHEET FLOW
B-C	4.5	401'	0.045	SHALLOW CONCENTRATED FLOW
C-D	8.3	662'	0.036	SHALLOW CONCENTRATED FLOW
D-E	0.3	034'	0.059	SHALLOW CONCENTRATED FLOW

SUBCATCHMENT 3.0				
SEGMENT	TIME (MIN.)	LENGTH	SLOPE	FLOW TYPE
A-B	23.1	132'	0.030	SHEET FLOW
B-C	1.8	066'	0.061	SHALLOW CONCENTRATED FLOW

LEGEND



WH02 Solar Project

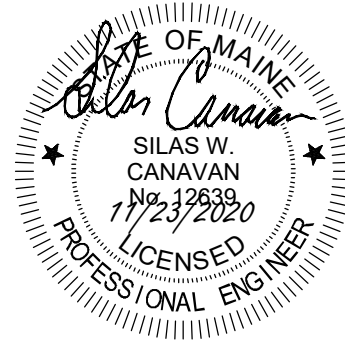
Map 6, Lot 60
Sweet Road
Windham, Maine 04922

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Rev.	Date	Description	Drawn	Check
1	11/18/2020	Issued for DEP Permits	ML	SWC
2	11/23/2020	Issued for Town Permit	ML	SWC

Sheet Title:	
Post-Development Drainage Plan	
Job No.: 672	Sheet No.:
Date: November 2020	Scale: 1" = 100'
Drawn: MTL/TFG	Checked: SWC

D2.0

ISSUED FOR PERMITTING - NOT FOR CONSTRUCTION

