WALSH

ENGINEERING ASSOCIATES, INC.

Stormwater Management Report

for

Proposed New Construction
165 Raymond Hill Road
Raymond, Maine 04071

September 29, 2020

Applicant
Jeffrey S. Buckley
P.O. Box 679
Raymond, Maine 04071

Prepared By
Walsh Engineering Associates, Inc.
1 Karen Drive, Suite 2A
Westbrook, Maine 04092

Introduction

Walsh Engineering Associates, Inc. (WEA) was retained to assist Jeffrey S. Buckley (Applicant) in the review of the stormwater management of 165 Raymond Hill Road. A site plan prepared by WEA titled "Driveway & Site Development Plan" dated September 24, 2020 has been enclosed with this review for reference. The Applicant proposes a 2,700± square foot single family home and 560± foot long, 14-foot-wide gravel driveway. The site currently consists of forest with a cleared meadow.

Methodology

The stormwater runoff analysis has been undertaken utilizing the HydroCAD Stormwater Modeling System software (Version 10) 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-, 10-, and 25-year frequencies (3.0, 4.3, and 5.4 inches, respectively). Twenty-four-hour storms with a Type III distribution were the basis for the analysis.

Pre-Development Conditions

The property is currently forested with a small cleared meadow area. Stormwater runoff from the site flows northwest to the abutting property.

The medium intensity National Cooperative Soil Survey generated by the Natural Resource Conservation Service Web Soil Survey indicates that there are Paxton and Woodbridge soils present. All soils within the development area are classified as hydrologic soil group (HSG) C. The medium intensity soil survey can be found in Appendix B. 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 northwest (AP1). 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 point are summarized in Table 1 for the 2, 10, and 25-year storm events.

Post-Development Conditions

Site development includes the construction of a 2,700± square foot single family home and a 560± foot long, 14-foot-wide gravel driveway. Runoff from the driveway will be captured in a roadside swale and brought to a 100' wide forested buffer. The project will create approximately 8,700± square feet of impervious area and clear 17,400 square feet of forested area.

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, 25, and100-year storm event.

Stormwater Quantity

The Town of Raymond's Stormwater Management Standards require that the peak flow rates discharging from the site are not increased as a result of the development. The development of the site will not cause any change in the curve number of the subcatchment; therefore, post development peak flow rates will remain the same as in the pre-development conditions.

Table 1 – Peak Flow Rates (cfs)			
Analysis Point #1 (AP1)	**2-Year Storm**	**10-Year Storm**	**25-Year Storm**
Pre-Development	4.81	11.07	17.11
Post Development	4.81	11.07	17.11

As shown in Table 1, the post-development peak runoff rate at the analysis point will remain equal to the pre-development runoff rate for the 2, 10, and 25-year storm events.

Stormwater Quality

The Town of Raymond's Stormwater Management Standards as described in Section 9.X "Stormwater Quality and Phosphorus Control" of the Raymond Land Use Ordinance utilize a point system in determining if a development achieves acceptable stormwater quality requirements.

Table 2 – Stormwater Point System	
1) **Point Credits**	**Value**
a) Correcting an Existing Erosion Problem	10
f) 100 ft Wide Wooded Buffer	40
Total	**50**

As shown in Table 2, the development achieves 50 points based on the Stormwater Point System and point schedule outlined in the Raymond Land Use Ordinance. The project intends on improving the existing gravel road's erosion problems for a 10-point credit.

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 compacted gravel surfaces and permanent seeding.

Conclusions

The HydroCAD calculations show that the peak runoff rates at the analysis point under post-development conditions are estimated to be equal to the peak pre-development runoff rates for the 2-, 10-, and 25-year storm events. It is our opinion that the proposed stormwater management plan meets the requirements of the Town of Raymond's regulations.

Respectfully,

Connor Ritter

Connor A. Ritter, EIT
Walsh Engineering Associates, Inc.

William R. Walsh III, PE
Walsh Engineering Associates, Inc.

SUPPORTING DATA AND CALCULATIONS

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

- Appendix A: HydroCAD Report
- Appendix B: Web Soil Survey Map
- Appendix C: Drainage Plans
    - D1.0 – Pre-Development Drainage Plan
    - D2.0 – Post Development Drainage Plan
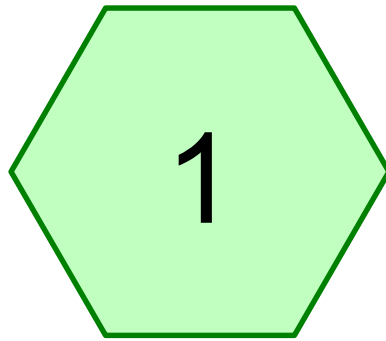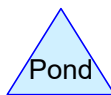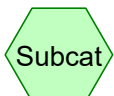
1

Pre-Dev

AP1

Pre-Dev

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
20,800	98	Impervious (1)
30,500	71	Meadow, non-grazed, HSG C (1)
565,900	70	Woods, Good, HSG C (1)

Drainage Analysis

Prepared by Walsh Engineering Associates

HydroCAD® 10.00-25 s/n 02136 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-YR Rainfall=3.00"

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Page 3

Summary for Subcatchment 1: Pre-Dev

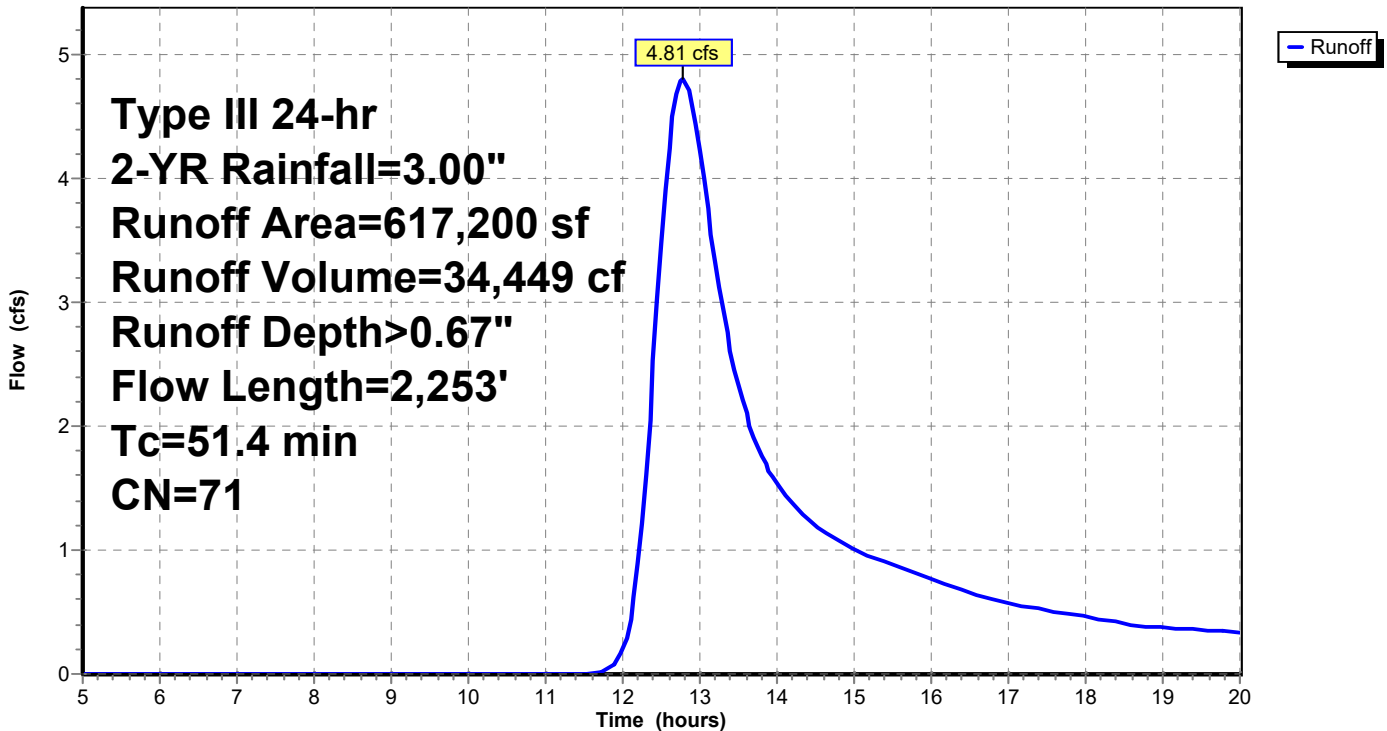Runoff   =   4.81 cfs @ 12.78 hrs, Volume=   34,449 cf, Depth> 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
	565,900	70	Woods, Good, HSG C
	30,500	71	Meadow, non-grazed, HSG C
*	20,800	98	Impervious
	617,200	71	Weighted Average
	596,400		96.63% Pervious Area
	20,800		3.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.4	150	0.0353	0.10		**Sheet Flow, A-B**
					Woods: Light underbrush n= 0.400 P2= 3.00"
27.0	2,103	0.0676	1.30		**Shallow Concentrated Flow, B-C**
					Woodland Kv= 5.0 fps
51.4	2,253	Total			

Subcatchment 1: Pre-Dev

Hydrograph

Type III 24-hr
2-YR Rainfall=3.00"
Runoff Area=617,200 sf
Runoff Volume=34,449 cf
Runoff Depth>0.67"
Flow Length=2,253'
Tc=51.4 min
CN=71

Drainage Analysis
Prepared by Walsh Engineering Associates
HydroCAD® 10.00-25 s/n 02136 © 2019 HydroCAD Software Solutions LLC

Type III 24-hr 2-YR Rainfall=3.00"
Printed 9/28/2020
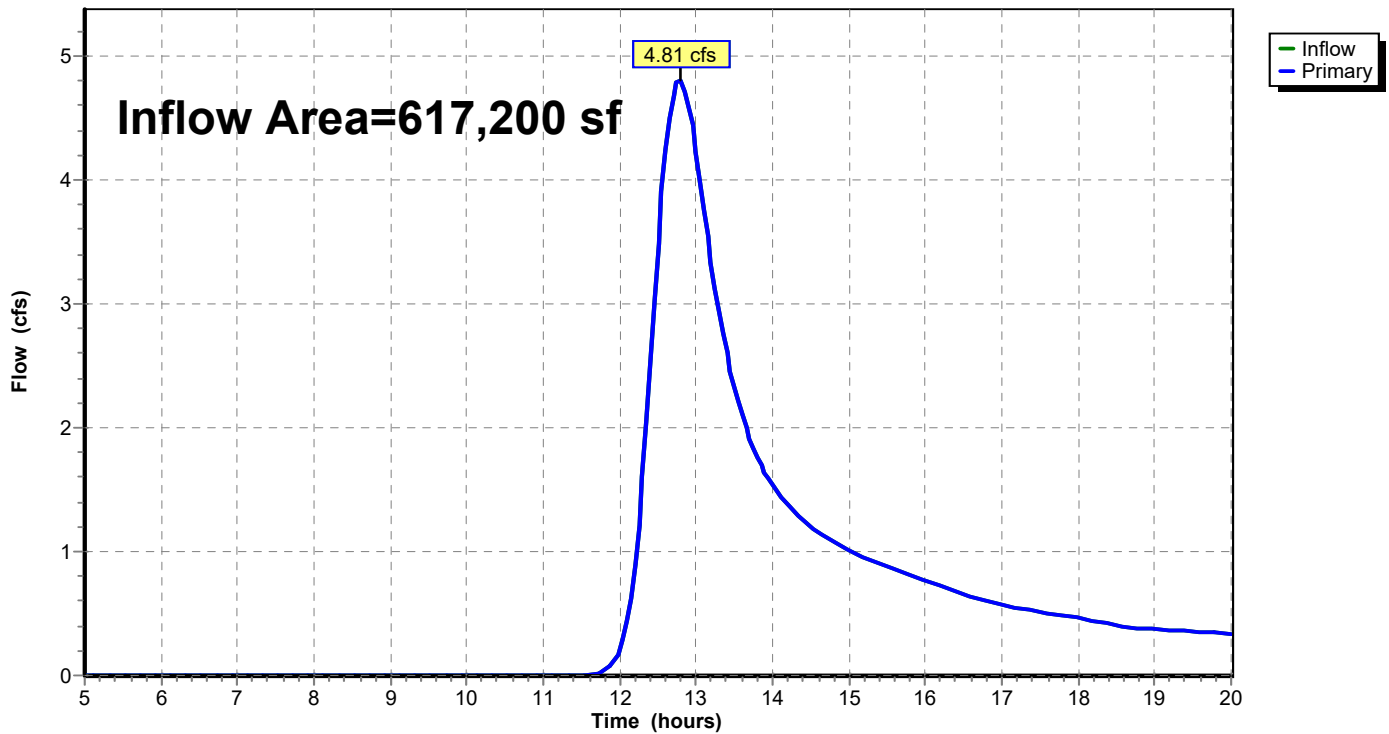Page 4

Summary for Link AP1: Pre-Dev

Inflow Area =   617,200 sf,   3.37% Impervious, Inflow Depth >   0.67"   for 2-YR event
Inflow   =   4.81 cfs @   12.78 hrs, Volume=   34,449 cf
Primary   =   4.81 cfs @   12.78 hrs, Volume=   34,449 cf, Atten= 0%, Lag= 0.0 min

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

Link AP1: Pre-Dev

Hydrograph

Drainage Analysis
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Type III 24-hr 10-YR Rainfall=4.30"
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Page 5

Summary for Subcatchment 1: Pre-Dev

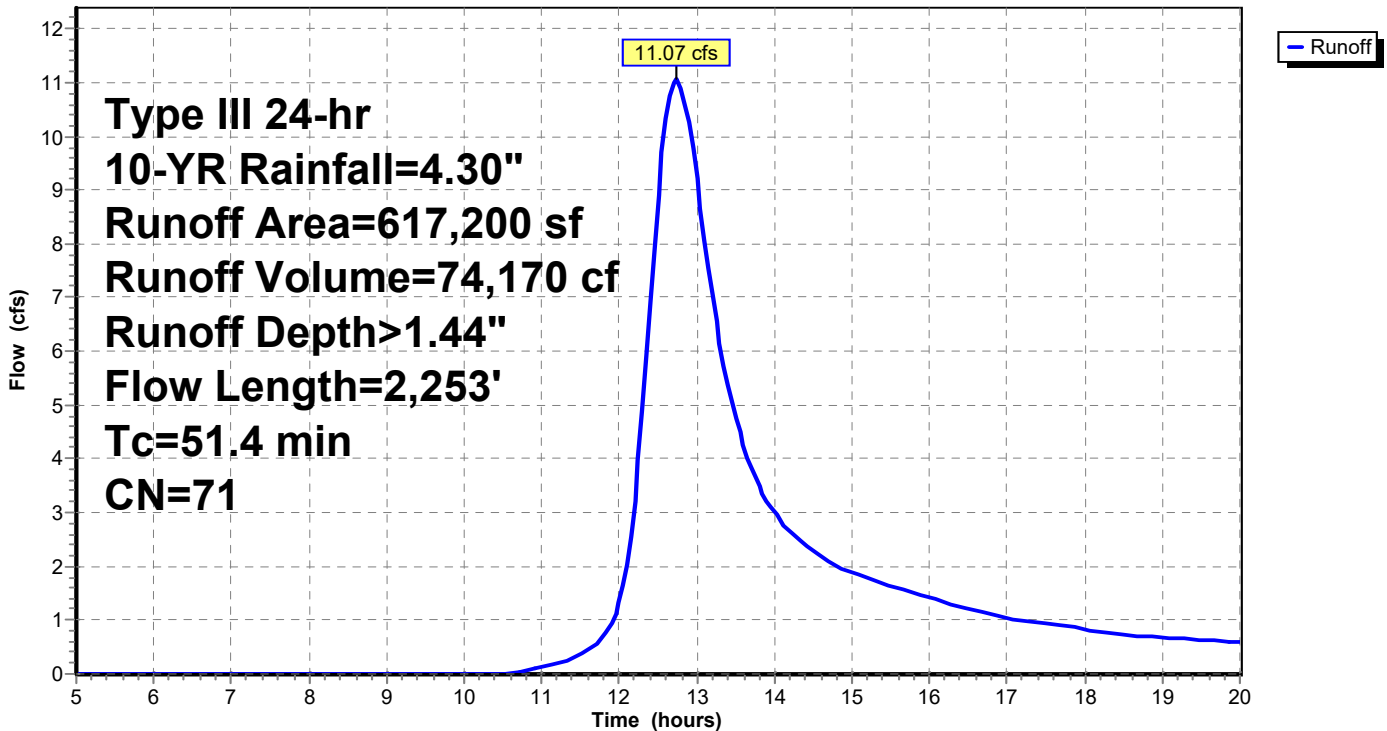Runoff   =   11.07 cfs @ 12.74 hrs, Volume=   74,170 cf, Depth> 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.30"

	Area (sf)	CN	Description
	565,900	70	Woods, Good, HSG C
	30,500	71	Meadow, non-grazed, HSG C
*	20,800	98	Impervious
	617,200	71	Weighted Average
	596,400		96.63% Pervious Area
	20,800		3.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.4	150	0.0353	0.10		**Sheet Flow, A-B**
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27.0	2,103	0.0676	1.30		**Shallow Concentrated Flow, B-C**
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51.4	2,253	Total			

Subcatchment 1: Pre-Dev

Hydrograph

Type III 24-hr
10-YR Rainfall=4.30"
Runoff Area=617,200 sf
Runoff Volume=74,170 cf
Runoff Depth>1.44"
Flow Length=2,253'
Tc=51.4 min
CN=71

Drainage Analysis
Prepared by Walsh Engineering Associates
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Type III 24-hr 10-YR Rainfall=4.30"
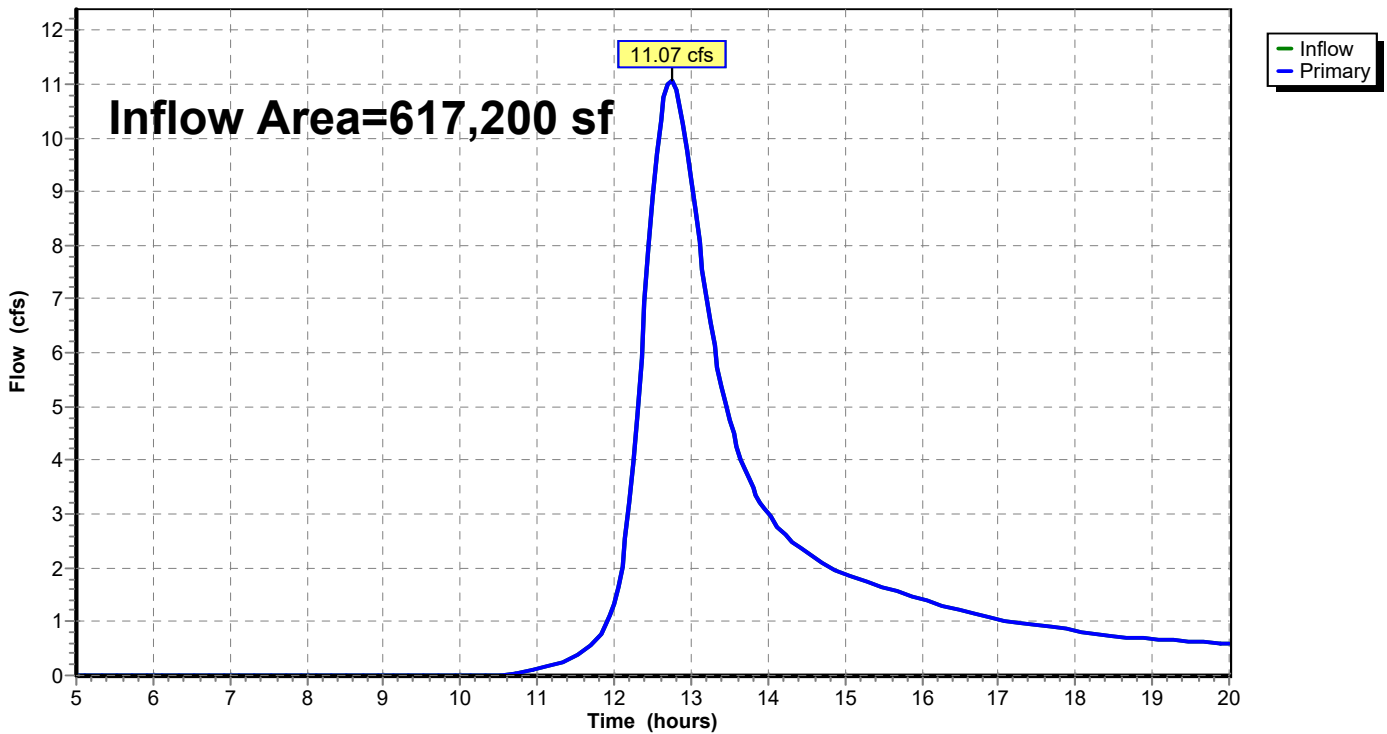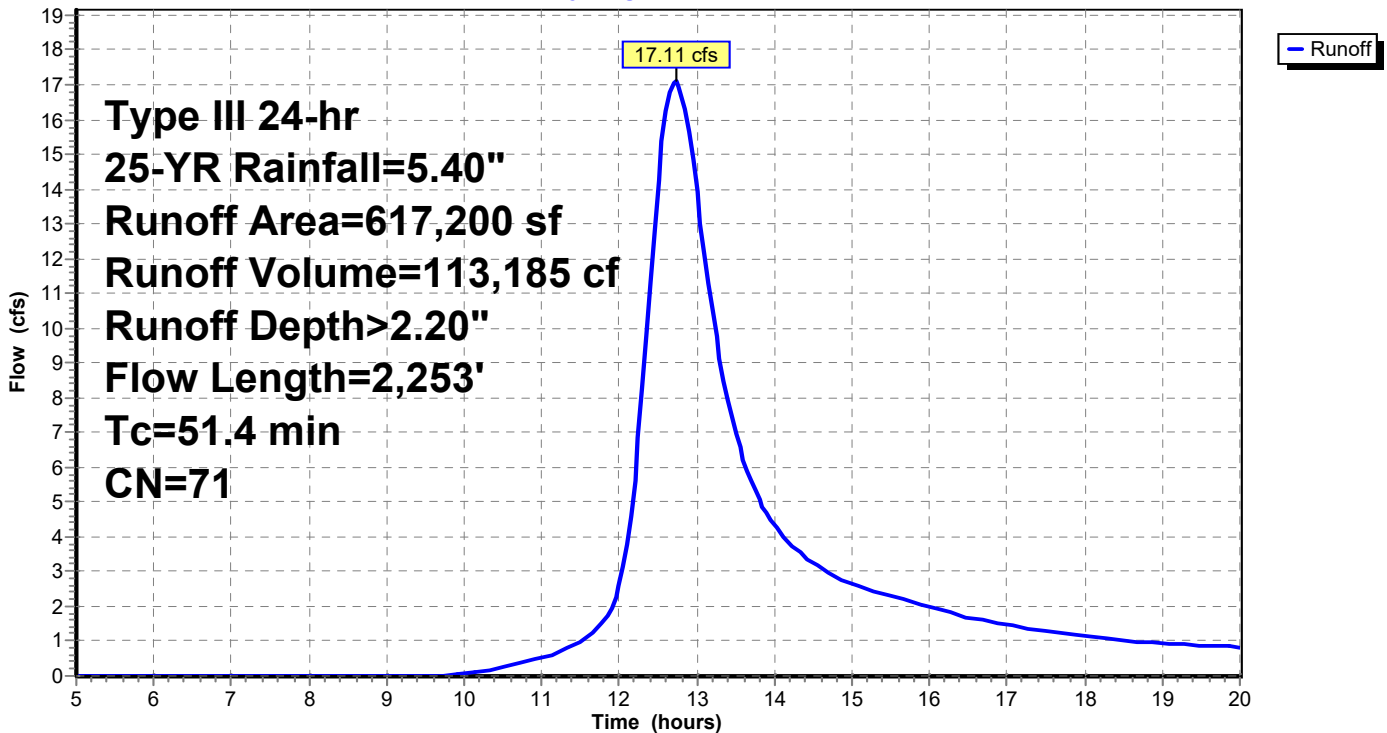Printed 9/28/2020
Page 6

Summary for Link AP1: Pre-Dev

Inflow Area =   617,200 sf,   3.37% Impervious, Inflow Depth >   1.44"   for 10-YR event
Inflow   =   11.07 cfs @   12.74 hrs, Volume=   74,170 cf
Primary   =   11.07 cfs @   12.74 hrs, Volume=   74,170 cf, Atten= 0%, Lag= 0.0 min

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

Link AP1: Pre-Dev

Hydrograph

Drainage Analysis
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Type III 24-hr 25-YR Rainfall=5.40"
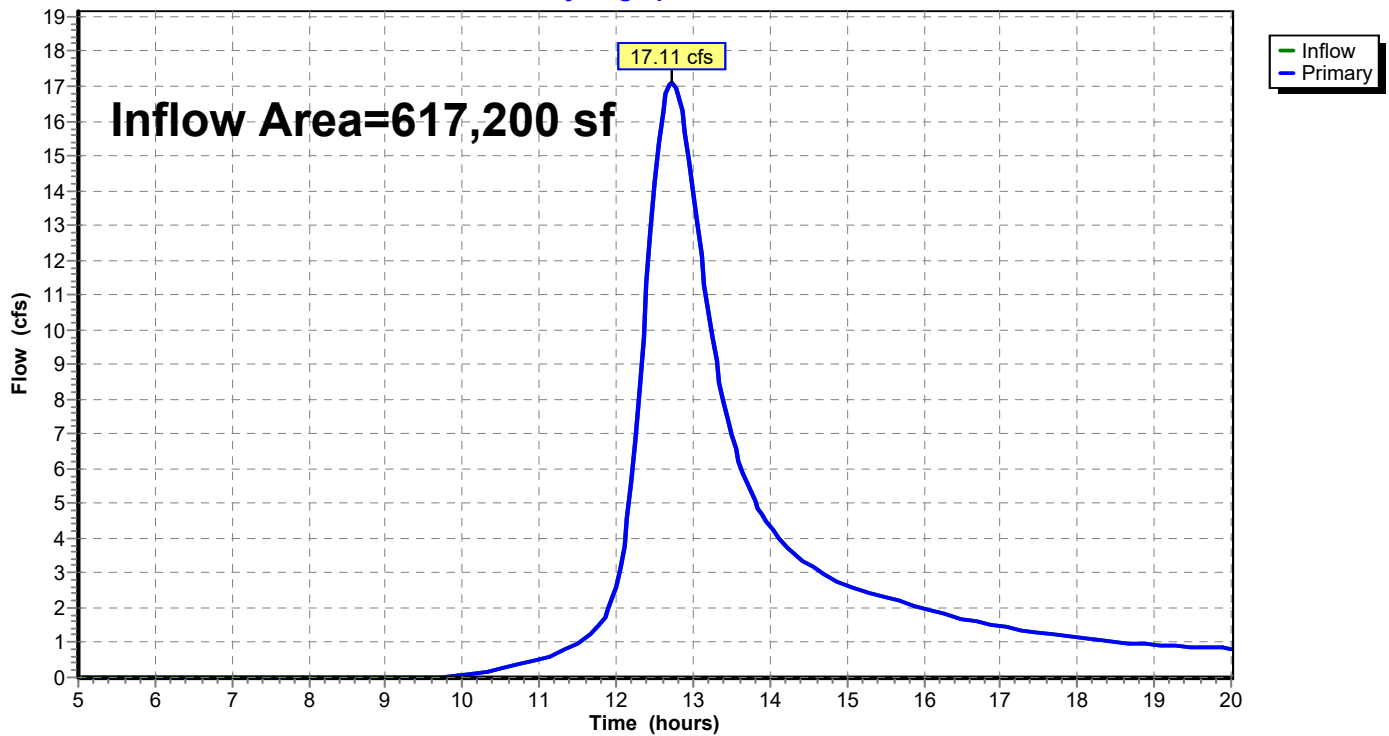Printed 9/28/2020
Page 7

Summary for Subcatchment 1: Pre-Dev

Runoff   =   17.11 cfs @   12.73 hrs, Volume=   113,185 cf, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.40"

	Area (sf)	CN	Description
	565,900	70	Woods, Good, HSG C
	30,500	71	Meadow, non-grazed, HSG C
*	20,800	98	Impervious
	617,200	71	Weighted Average
	596,400		96.63% Pervious Area
	20,800		3.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.4	150	0.0353	0.10		**Sheet Flow, A-B**
					Woods: Light underbrush n= 0.400 P2= 3.00"
27.0	2,103	0.0676	1.30		**Shallow Concentrated Flow, B-C**
					Woodland Kv= 5.0 fps
51.4	2,253	Total			

Subcatchment 1: Pre-Dev

Hydrograph

Type III 24-hr
25-YR Rainfall=5.40"
Runoff Area=617,200 sf
Runoff Volume=113,185 cf
Runoff Depth>2.20"
Flow Length=2,253'
Tc=51.4 min
CN=71

Drainage Analysis
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Type III 24-hr 25-YR Rainfall=5.40"
Printed 9/28/2020
Page 8

Summary for Link AP1: Pre-Dev

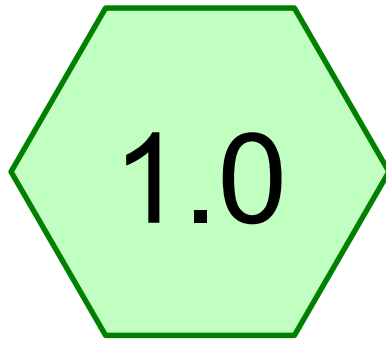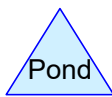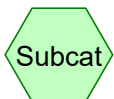Inflow Area =   617,200 sf,   3.37% Impervious, Inflow Depth >   2.20"   for 25-YR event
Inflow   =   17.11 cfs @   12.73 hrs, Volume=   113,185 cf
Primary   =   17.11 cfs @   12.73 hrs, Volume=   113,185 cf, Atten= 0%, Lag= 0.0 min

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

Link AP1: Pre-Dev

Hydrograph

1.0

Post-Dev

AP1.0

Post-Dev

Subcat   Reach   Pond   Link

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
29,500	98	Impervious (1.0)
39,200	71	Meadow, non-grazed, HSG C (1.0)
548,500	70	Woods, Good, HSG C (1.0)

Drainage Analysis
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Type III 24-hr 2-YR Rainfall=3.00"
Printed 9/28/2020
Page 3

Summary for Subcatchment 1.0: Post-Dev

Runoff   =   4.81 cfs @   12.78 hrs, Volume=   34,449 cf, Depth> 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.00"

	Area (sf)	CN	Description
	548,500	70	Woods, Good, HSG C
	39,200	71	Meadow, non-grazed, HSG C
*	29,500	98	Impervious
	617,200	71	Weighted Average
	587,700		95.22% Pervious Area
	29,500		4.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.4	150	0.0353	0.10		**Sheet Flow, A-B**
					Woods: Light underbrush n= 0.400 P2= 3.00"
27.0	2,103	0.0676	1.30		**Shallow Concentrated Flow,**
					Woodland Kv= 5.0 fps
51.4	2,253	Total			

Subcatchment 1.0: Post-Dev

Hydrograph

Type III 24-hr
2-YR Rainfall=3.00"
Runoff Area=617,200 sf
Runoff Volume=34,449 cf
Runoff Depth>0.67"
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Tc=51.4 min
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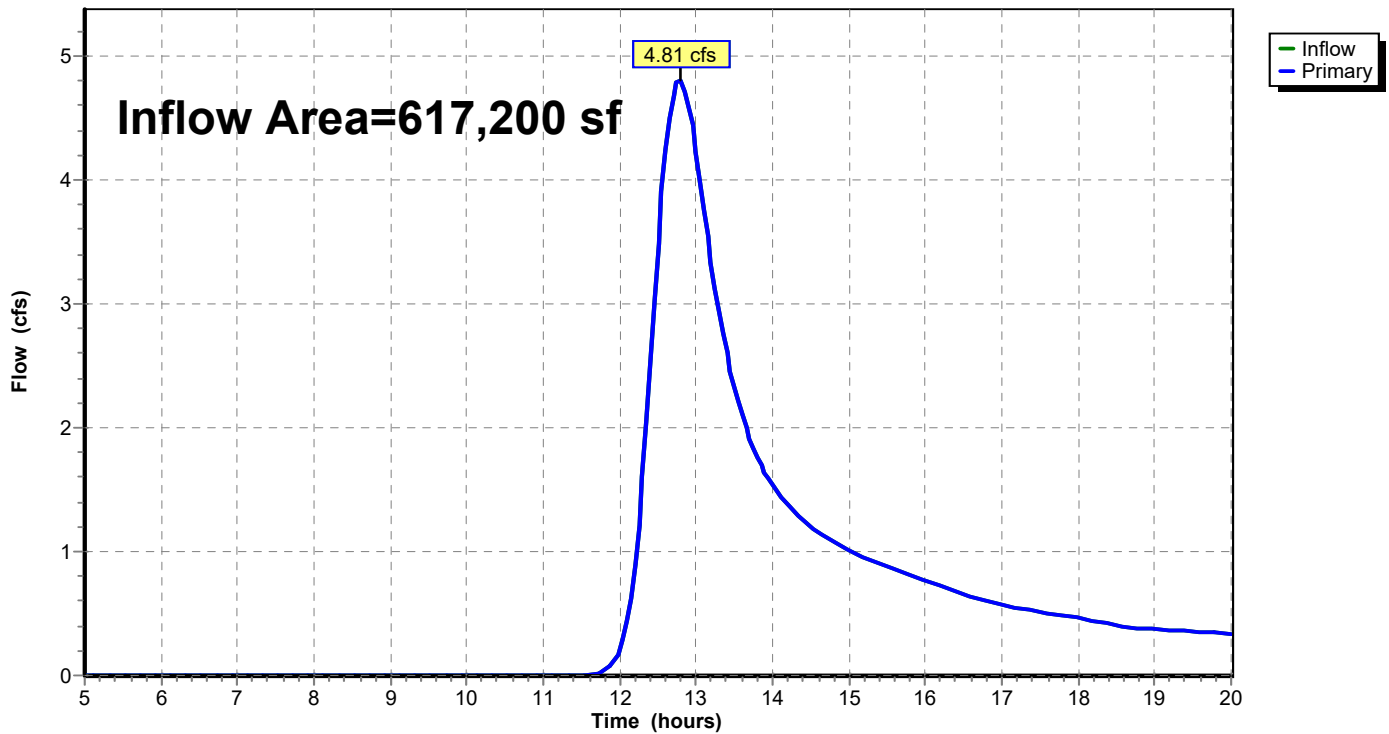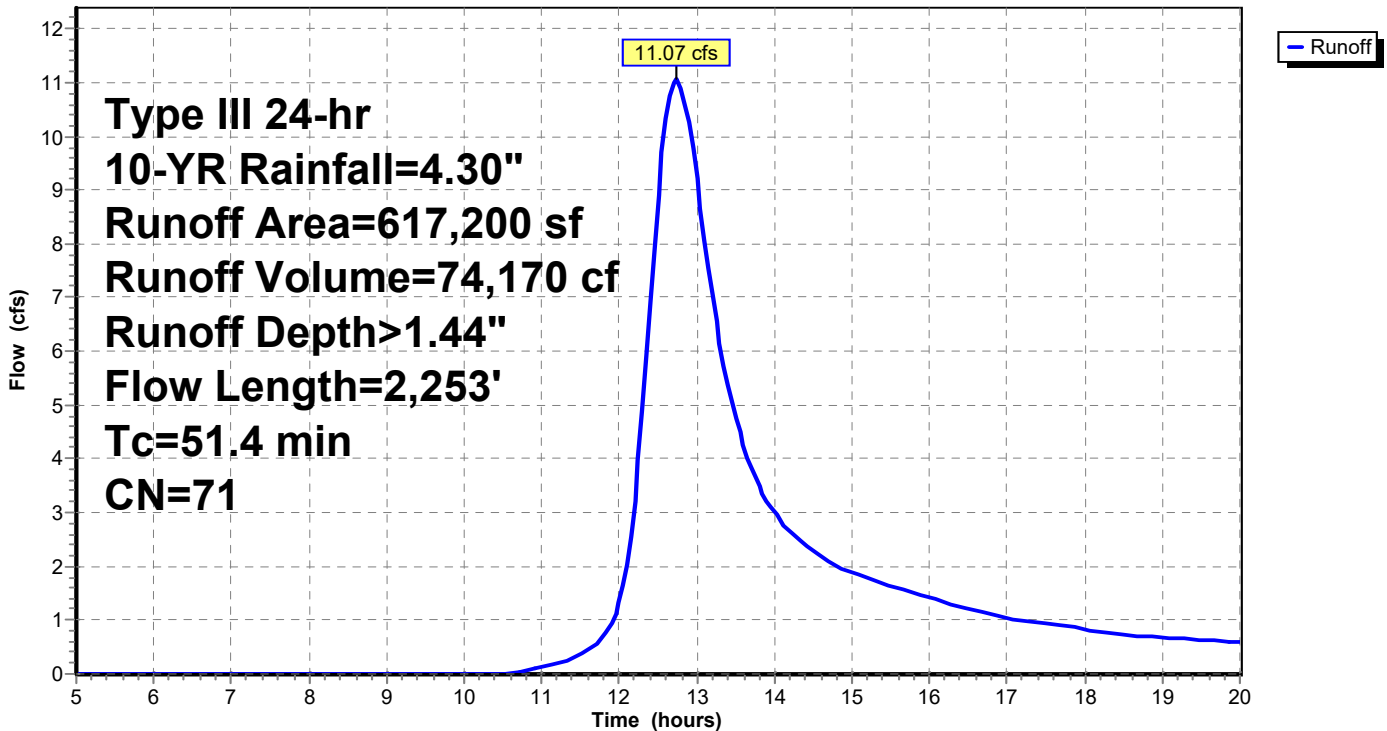Printed 9/28/2020
Page 4

Summary for Link AP1.0: Post-Dev

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Inflow   =   4.81 cfs @   12.78 hrs, Volume=   34,449 cf
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Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link AP1.0: Post-Dev

Hydrograph

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Type III 24-hr 10-YR Rainfall=4.30"
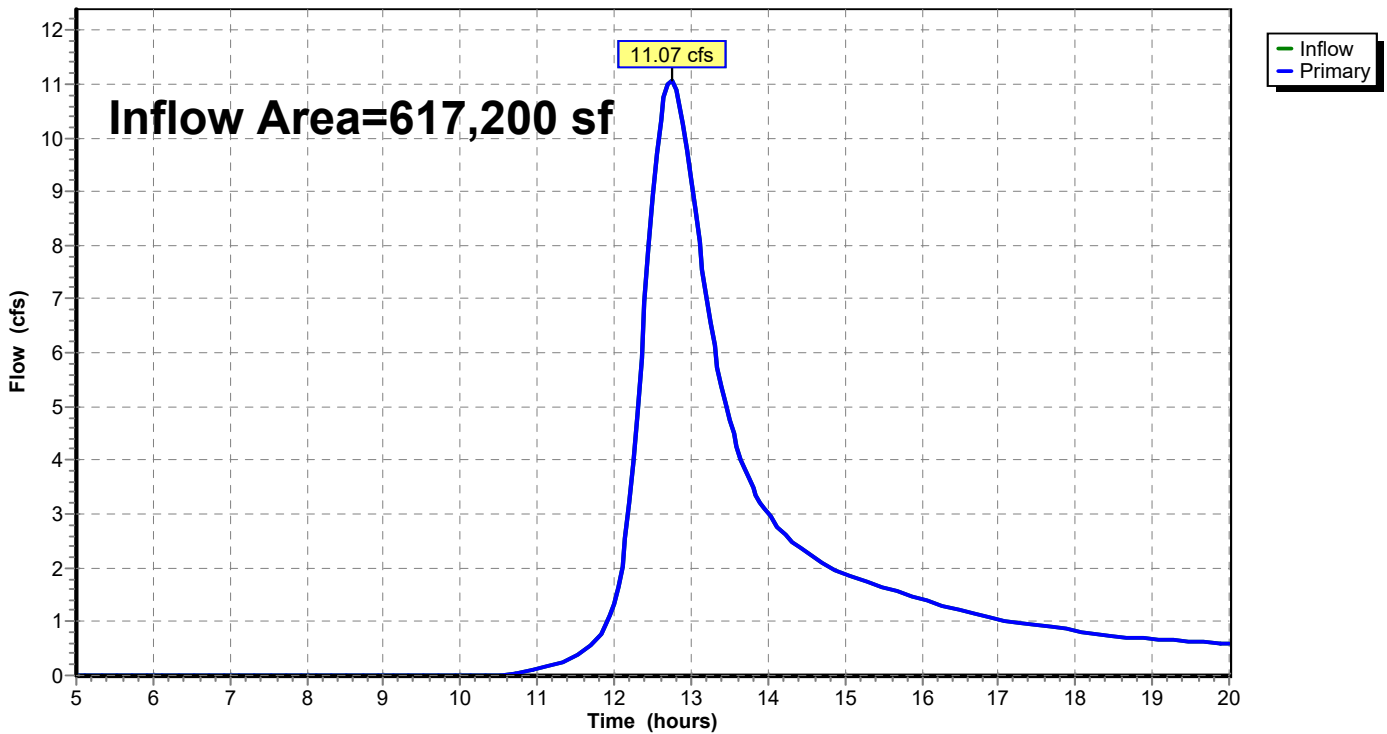Printed 9/28/2020
Page 5

Summary for Subcatchment 1.0: Post-Dev

Runoff   =   11.07 cfs @   12.74 hrs, Volume=   74,170 cf, Depth> 1.44"
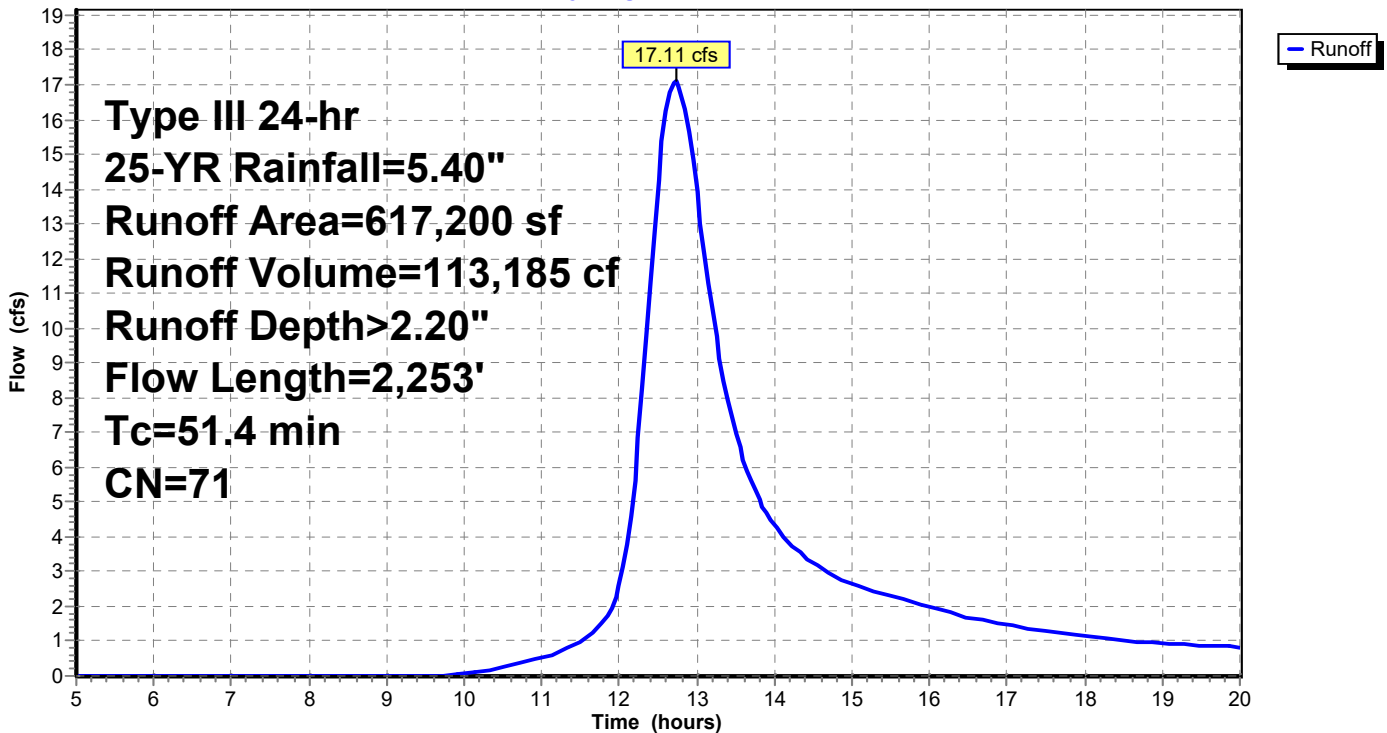
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.30"

	Area (sf)	CN	Description
	548,500	70	Woods, Good, HSG C
	39,200	71	Meadow, non-grazed, HSG C
*	29,500	98	Impervious
	617,200	71	Weighted Average
	587,700		95.22% Pervious Area
	29,500		4.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.4	150	0.0353	0.10		**Sheet Flow, A-B**
					Woods: Light underbrush n= 0.400 P2= 3.00"
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					Woodland Kv= 5.0 fps
51.4	2,253	Total			

Subcatchment 1.0: Post-Dev

Hydrograph

Type III 24-hr
10-YR Rainfall=4.30"
Runoff Area=617,200 sf
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Type III 24-hr 10-YR Rainfall=4.30"
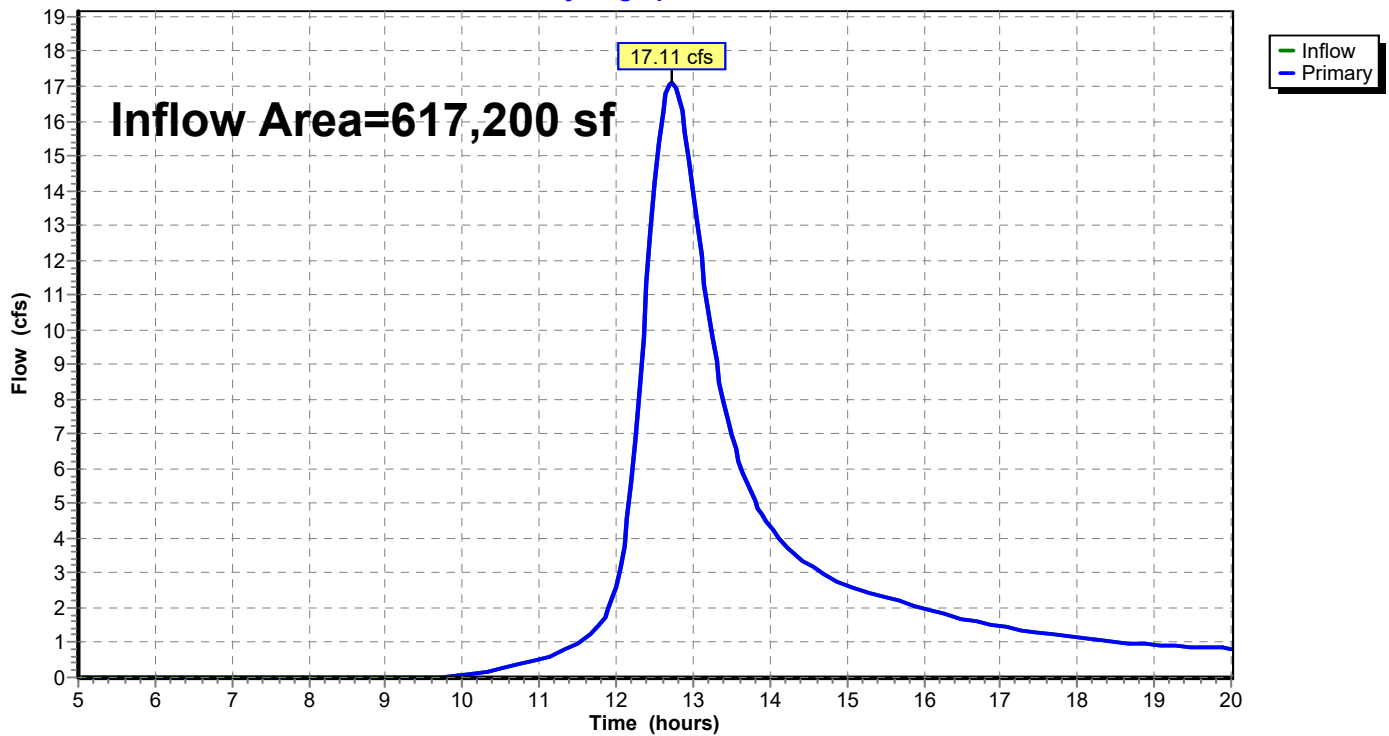Printed 9/28/2020
Page 6

Summary for Link AP1.0: Post-Dev

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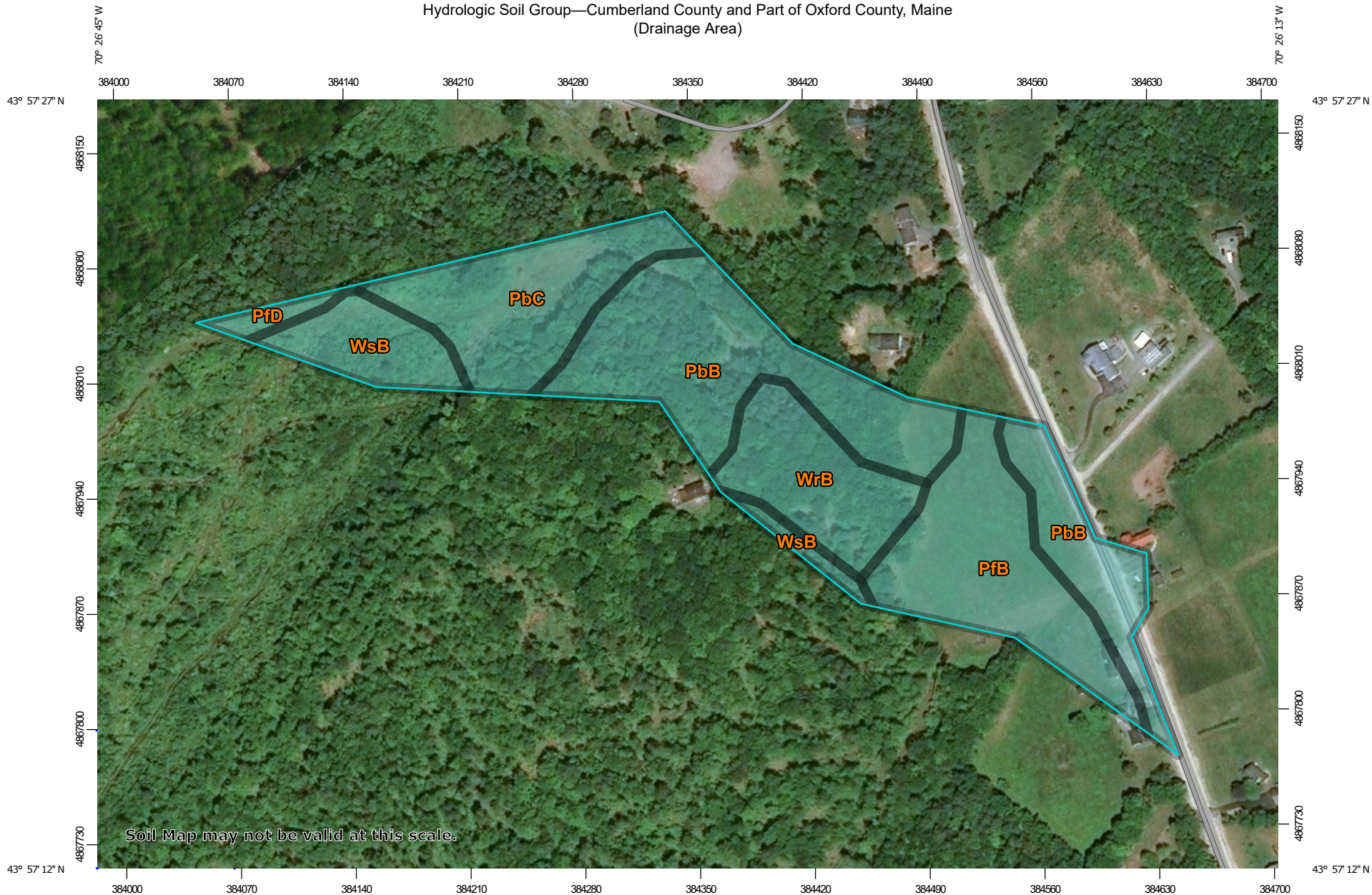Primary   =   11.07 cfs @   12.74 hrs, Volume=   74,170 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
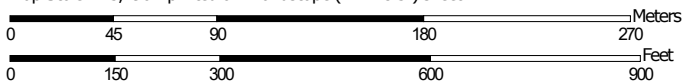
Link AP1.0: Post-Dev

Hydrograph

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Type III 24-hr 25-YR Rainfall=5.40"
Printed 9/28/2020
Page 7

Summary for Subcatchment 1.0: Post-Dev

Runoff   =   17.11 cfs @   12.73 hrs, Volume=   113,185 cf, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.40"

	Area (sf)	CN	Description
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	39,200	71	Meadow, non-grazed, HSG C
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	617,200	71	Weighted Average
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27.0	2,103	0.0676	1.30		**Shallow Concentrated Flow,**
					Woodland Kv= 5.0 fps
51.4	2,253	Total			

Subcatchment 1.0: Post-Dev

Hydrograph

Type III 24-hr
25-YR Rainfall=5.40"
Runoff Area=617,200 sf
Runoff Volume=113,185 cf
Runoff Depth>2.20"
Flow Length=2,253'
Tc=51.4 min
CN=71

17.11 cfs

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Type III 24-hr 25-YR Rainfall=5.40"
Printed 9/28/2020
Page 8

Summary for Link AP1.0: Post-Dev

Inflow Area =   617,200 sf,   4.78% Impervious, Inflow Depth >   2.20"   for 25-YR event
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Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link AP1.0: Post-Dev

Hydrograph

Map Scale: 1:3,290 if printed on A landscape (11" x 8.5") sheet.

N

0	45	90	180	270 Meters

0	150	300	600	900 Feet

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

USDA   **Natural Resources**
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

9/28/2020
Page 1 of 4

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.

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

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

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

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

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

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

Soil Survey Area: 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
PbB	Paxton fine sandy loam, 3 to 8 percent slopes	C	5.1	36.3%
PbC	Paxton fine sandy loam, 8 to 15 percent slopes	C	2.5	17.8%
PfB	Paxton very stony fine sandy loam, 3 to 8 percent slopes	C	3.0	20.9%
PfD	Paxton very stony fine sandy loam, 15 to 25 percent slopes	C	0.3	1.9%
WrB	Woodbridge fine sandy loam, 0 to 8 percent slopes	C	1.9	13.4%
WsB	Woodbridge very stony fine sandy loam, 0 to 8 percent slopes	C	1.4	9.7%
Totals for Area of Interest			**14.2**	**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