

MEMORANDUM

Date: November 11, 2022

To: Patrick Ryan, Napa County Planning, Building, and Environmental Services

From: Matthew S. Bueno, P.E.
Rachel L. Rosasco, E.I.T.

Re: Dry Creek Vineyard Track I ECP
APN 027-070-036
Hydrologic Analysis

This memo transmits the findings of a hydrologic analysis for the above-referenced Track I Erosion Control Plan (ECP). HydroCAD software was used to estimate pre- and post-project runoff from watersheds containing the proposed development areas. The software uses the Natural Resource Conservation Service (NRCS) TR-20 method to calculate runoff. The analysis uses the Type IA 24-hr storm distribution and includes site-specific National Oceanic and Atmospheric Administration (NOAA) point precipitation data for the ranch.

One (1) watershed was delineated for the hydrologic modeling using 2-foot contours from PPI Engineering and 1-foot contours from Sonoma County LIDAR data. Watershed 1 encompasses approximately 2.9 acres and drains into an unnamed swale which eventually flows into Dry Creek. Please see the attached figures for the location of each watershed.

Soils within the watersheds were obtained from the NRCS Web Soil Survey and are classified as the following:

Boomer Loam, Volcanic Bedrock, 2-35% Slopes (Map Unit Symbol 107)
Cohasset Gravelly Loam, 15-30% Slopes (Map Unit Symbol CmE)

Boomer Loam, volcanic bedrock soil (107) is classified as Hydrologic Soil Group (HSG) B. The Cohasset Gravelly Loam (CmE) was modeled using HSG C. Please see the attached figures for soil type delineations within the vicinity of each watershed.

Land use areas were initially delineated based on Napa County orthophotos. A site visit was then conducted on April 26, 2022 by Rachel Rosasco of PPI Engineering to ground truth the orthophotos and determine the existing land use conditions. The land use hydrologic conditions

were classified based on the respective covers as poor (less than 50% cover), fair (50%-75% cover), or good (greater than or equal to 75% cover). The HydroCAD software analyzes the land use data along with the corresponding soil HSGs to determine a weighted Curve Number (CN) for runoff calculations. The grassed areas have been historically managed with grazing. The pre-project condition of the grassed areas that are proposed to be converted to vineyard were classified as Annual Grass in fair condition. The land use classification of Annual Grass is based upon the NRCS Engineering Field Manual Chapter 2, Supplement 1 definition. The post-project condition within the proposed vineyard will be classified as good (based on the proposed cover in the ECP). Please see the attached figures for existing and proposed land use delineations.

The Time of Concentration (Tc) flow path within the watershed was determined using PPI Engineering and Sonoma County contours. The flow path in the watershed was drafted from the hydrologically most distant point (longest travel time) in the watershed to the watershed outlet per NRCS standards. The Tc flow path starts at the top of the watershed and flows through the block before entering the existing infrastructure via the uppermost drop inlet. The flow path continues from the pipe outlet to a natural swale to the watershed outlet point. There was no change to the Tc flow path from pre- to post-project. Please see the attached figures for both the pre- and post-project Tc flow paths for the watershed.

Pre- and post-project runoff calculations from the HydroCAD models for each individual watershed are summarized in Table 1 below. In Table 2 the runoff calculations for the two modeled outlets are summarized. Runoff was calculated for the 2-, 10-, 50- and 100-year storms respectively for each watershed and for the modeled outlets.

Table 1. Individual Watershed Summary

	Runoff (cfs)		
	Watershed 1		
	Pre- Project	Post- Project	Increase/ Decrease
2-Year Storm	1.30	1.09	0.21
10-Year Storm	2.86	2.55	0.31
50-Year Storm	4.58	4.23	0.35
100-Year Storm	5.33	4.96	0.37

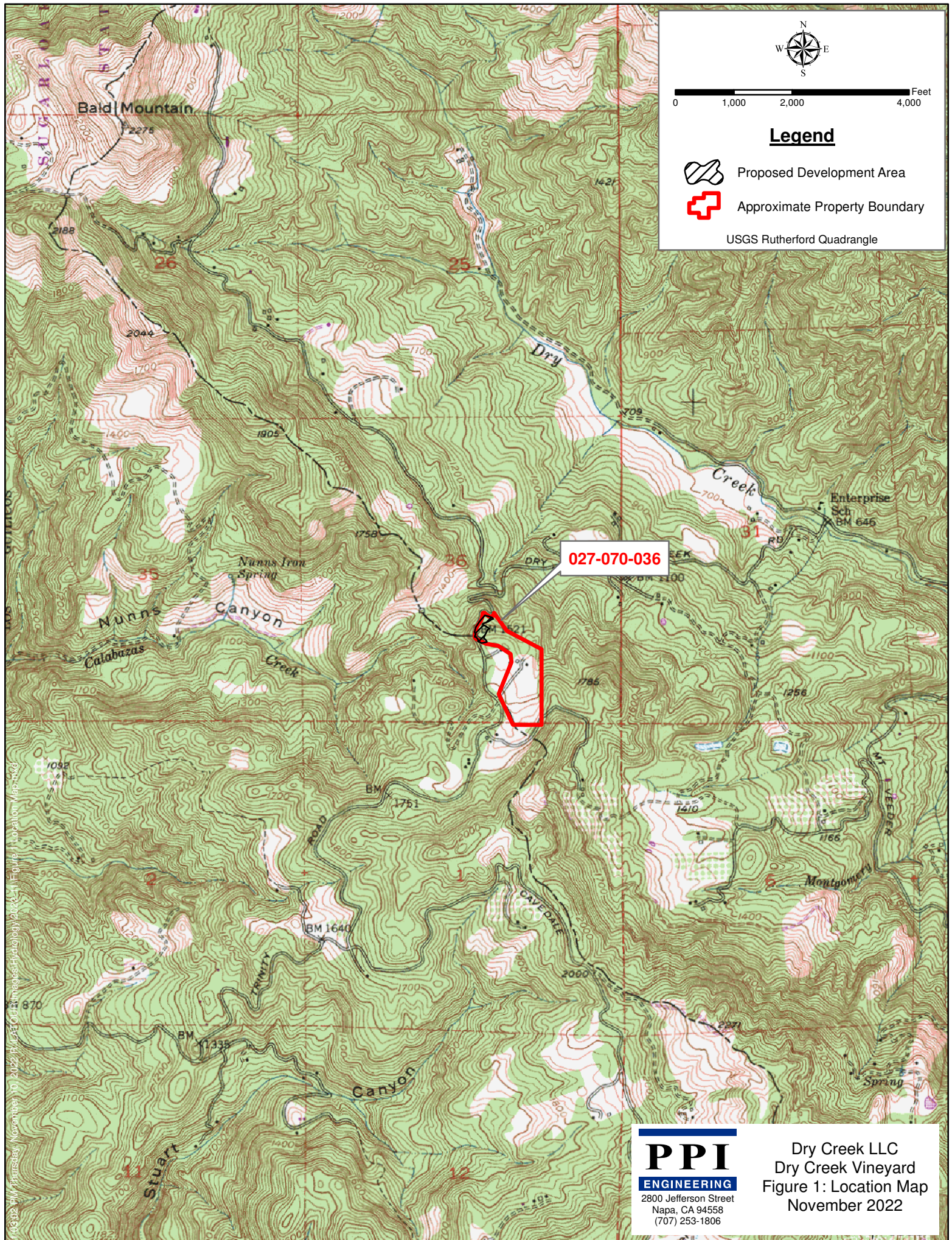
Estimated runoff from Watershed 1 saw a decrease post-project as a result of the decrease in Curve Number from pre- to post-project.

Please see the attached HydroCAD analyses for inputs, details, and summaries of the hydrologic modeling. Based on our analysis, there are no predicted net runoff increases, and no negative hydrologic impacts are expected as a result of this project. The project as proposed is in compliance with Napa County's General Plan policy requiring no-net-increase in runoff.



ATTACHMENT A

SUPPORTING FIGURES





Legend

- Approximate Property Boundary
- PPI Engineering 10' Index Contours
- PPI Engineering 2' Intermediate Contours
- Sonoma County 5' Index Contours

2021 Napa County Aerial Photo

F:\04-48 PM Thursday, November 10, 2022 6:14\TOUR Images Hydrology\2022_11\Figure 2: Property Boundary and Waters.mxd

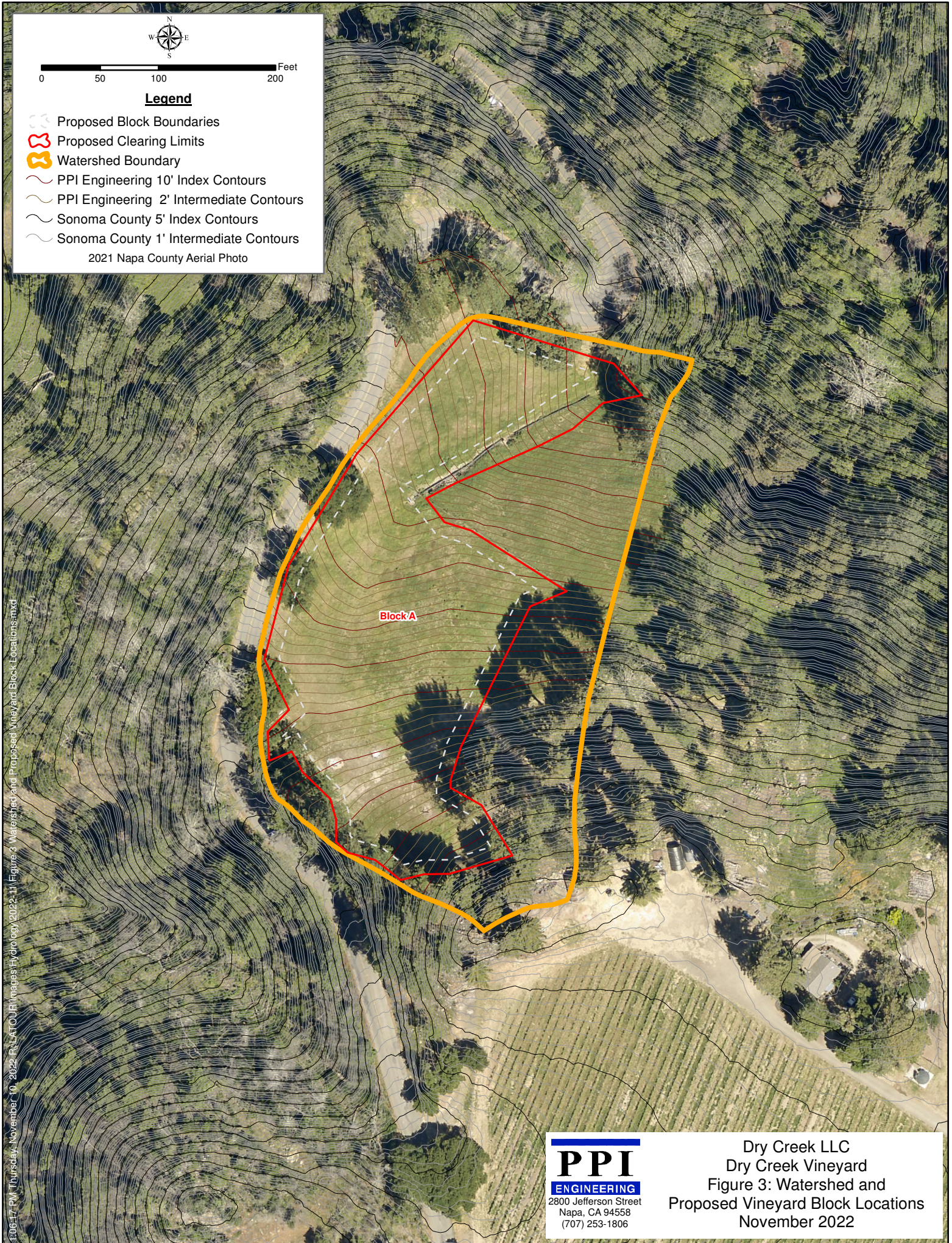
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ENGINEERING
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Napa, CA 94558
(707) 253-1806

Dry Creek LLC
Dry Creek Vineyard
Figure 2: Property Boundary
November 2022



Legend

- Proposed Block Boundaries
 - Proposed Clearing Limits
 - Watershed Boundary
 - PPI Engineering 10' Index Contours
 - PPI Engineering 2' Intermediate Contours
 - Sonoma County 5' Index Contours
 - Sonoma County 1' Intermediate Contours
- 2021 Napa County Aerial Photo



1:06:17 PM Thursday, November 10, 2022 R:\L\TOUR\Images Hydrology 2022-11\Figure 3 Watershed and Proposed Vineyard Block Locations.mxd

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Dry Creek Vineyard
Figure 3: Watershed and
Proposed Vineyard Block Locations
November 2022



0 50 100 200 Feet

Legend

-  Watershed Boundary
-  Annual Grass (fair)
-  Woods (good)
-  Road (dirt)
-  Property Boundary

2021 Napa County Aerial Photo

1:08:12 PM Thursday, November 10, 2022 R:\LATOUR\Images\Hydrology\2022-11\Figure 4 Existing Land Use.mxd

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Dry Creek Vineyard
Figure 4: Existing Land Use
November 2022

0

50

100

200

Feet

Legend

- Watershed Boundary
- Proposed Vineyard (good)
- Annual Grass (fair)
- Woods (good)
- Road (dirt)
- Property Boundary

2021 Napa County Aerial Photo

1:10:40 PM Thursday, November 10, 2022 R:\LATOUR\Images\Hydrology\2022-11\Figure-5 Developed Land Use.mxd

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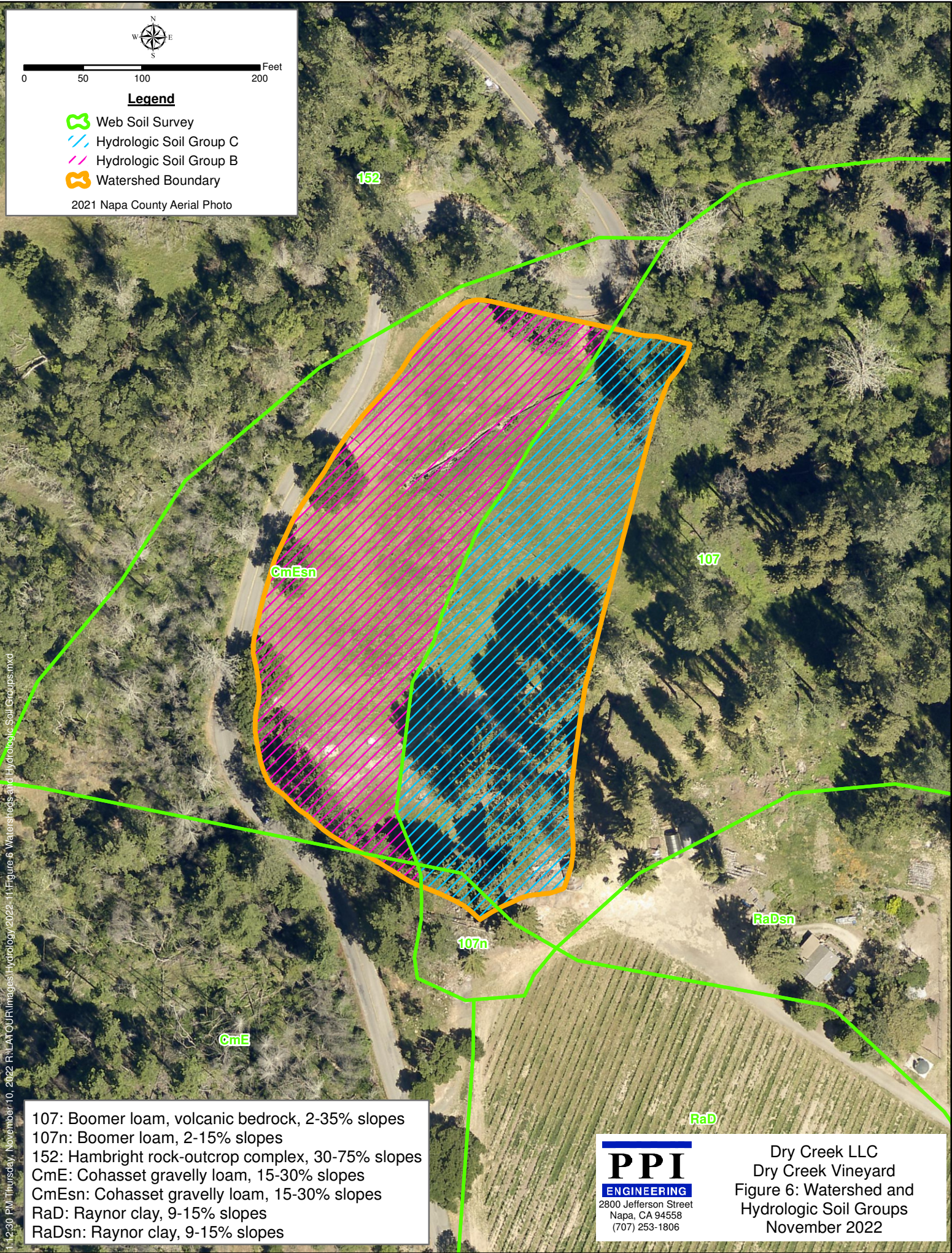
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Dry Creek Vineyard

Figure 5: Developed Land Use

November 2022





0 50 100 200 Feet

Legend

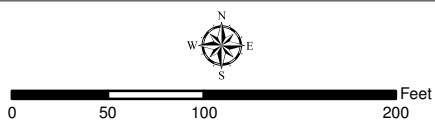
-  Watershed Boundary
-  Pre-Project Sheet Flow
-  Pre-Project Shallow Concentrated Flow
-  Pre-Project Channel Flow
-  PPI Engineering 10' Index Contours
-  PPI Engineering 2' Intermediate Contours
-  Sonoma County 5' Index Contours
-  Sonoma County 1' Intermediate Contours

2021 Napa County Aerial Photo

1:17:51 PM Thursday, November 10, 2022 R:\L\A\TOUR\Images\Hydrology\2022-11\Figure7- Time of Concentration Flow Paths.mxd

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Dry Creek LLC
Dry Creek Vineyard
Figure 7: Pre-Project
Time of Concentration Flow Paths
November 2022



Legend

-  Watershed Boundary
-  Post-Project Sheet Flow
-  Post-Project Shallow Concentrated Flow
-  Post-Project Channel Flow
-  PPI Engineering 10' Index Contours
-  PPI Engineering 2' Intermediate Contours
-  Sonoma County 5' Index Contours
-  Sonoma County 1' Intermediate Contours

2021 Napa County Aerial Photo

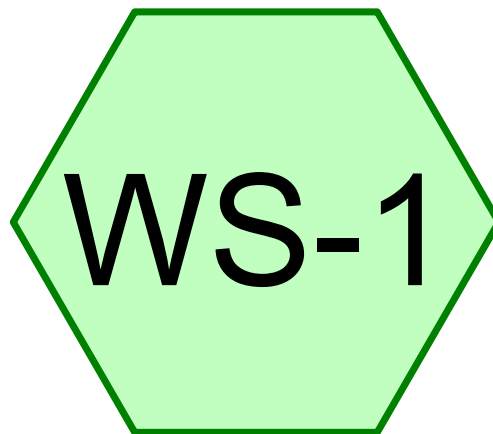
1:10:59 PM Thursday, November 10, 2022 R:\L\A\TOUR\Images\Hydrology\2022\11\Figure 8 Time of Concentration Flow Paths.mxd

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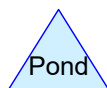
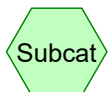
Dry Creek LLC
Dry Creek Vineyard
Figure 8: Post-Project
Time of Concentration Flow Paths
November 2022

ATTACHMENT B

HYDROCAD ANALYSES



Subcat WS-1



Routing Diagram for Pre-Project

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Pre-Project

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Type IA 24-hr 2-yr Rainfall=4.93"

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Page 2

Summary for Subcatchment WS-1: Subcat WS-1

Runoff = 1.30 cfs @ 8.00 hrs, Volume= 0.491 af, Depth= 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr Rainfall=4.93"

Area (ac)	CN	Description
1.167	69	Annual Grass, Fair, HSG B
0.822	79	Annual Grass, Fair, HSG C
0.056	87	Dirt roads, HSG C
0.327	55	Woods, Good, HSG B
0.483	70	Woods, Good, HSG C
2.854	71	Weighted Average
2.854		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	100	0.3000	0.43		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 4.93"
1.4	292	0.2500	3.50		Shallow Concentrated Flow, Shallow - Short Grass Pasture Short Grass Pasture Kv= 7.0 fps
0.1	209	0.2300	37.06	65.49	Pipe Channel, 18" DWCPP 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PPI Dual Walled CPP
0.1	62	0.3400	14.48	28.96	Trap/Vee/Rect Channel Flow, Stream (std ditch) Bot.W=0.00' D=1.00' Z= 2.0 ' Top.W=4.00' n= 0.035
5.5	663	Total			

Pre-Project

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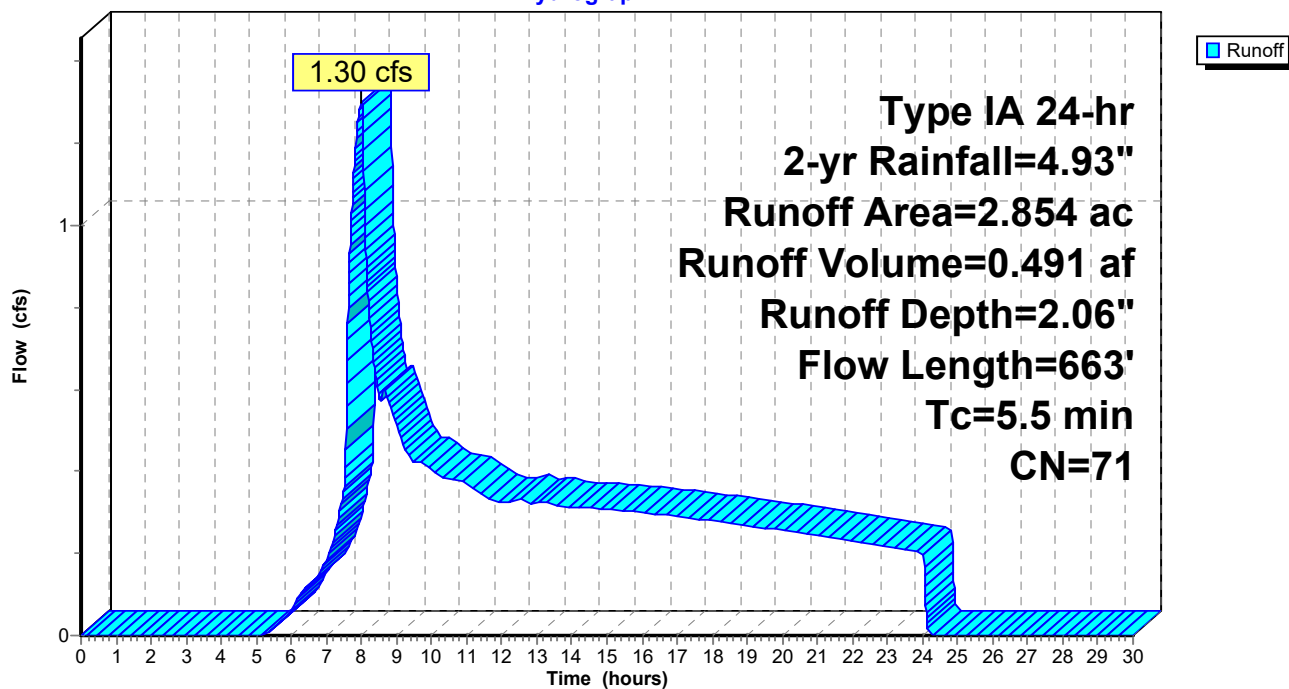
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Page 3

Subcatchment WS-1: Subcat WS-1

Hydrograph



Pre-Project

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Type IA 24-hr 10-yr Rainfall=7.43"

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Page 4

Summary for Subcatchment WS-1: Subcat WS-1

Runoff = 2.86 cfs @ 7.95 hrs, Volume= 0.972 af, Depth= 4.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr Rainfall=7.43"

Area (ac)	CN	Description
1.167	69	Annual Grass, Fair, HSG B
0.822	79	Annual Grass, Fair, HSG C
0.056	87	Dirt roads, HSG C
0.327	55	Woods, Good, HSG B
0.483	70	Woods, Good, HSG C
2.854	71	Weighted Average
2.854		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	100	0.3000	0.43		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 4.93"
1.4	292	0.2500	3.50		Shallow Concentrated Flow, Shallow - Short Grass Pasture Short Grass Pasture Kv= 7.0 fps
0.1	209	0.2300	37.06	65.49	Pipe Channel, 18" DWCPP 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PPI Dual Walled CPP
0.1	62	0.3400	14.48	28.96	Trap/Vee/Rect Channel Flow, Stream (std ditch) Bot.W=0.00' D=1.00' Z= 2.0 ' Top.W=4.00' n= 0.035
5.5	663	Total			

Pre-Project

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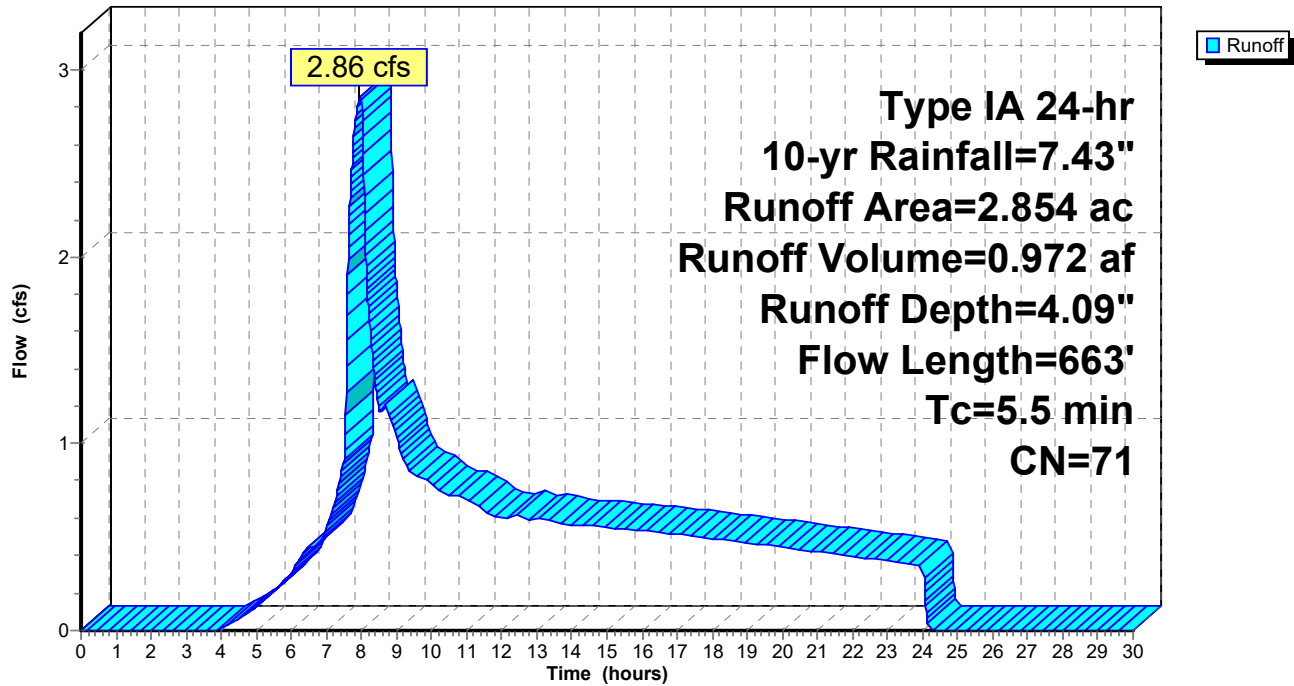
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Page 5

Subcatchment WS-1: Subcat WS-1

Hydrograph



Pre-Project

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Type IA 24-hr 50-yr Rainfall=9.95"

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Summary for Subcatchment WS-1: Subcat WS-1

Runoff = 4.58 cfs @ 7.93 hrs, Volume= 1.501 af, Depth= 6.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50-yr Rainfall=9.95"

Area (ac)	CN	Description
1.167	69	Annual Grass, Fair, HSG B
0.822	79	Annual Grass, Fair, HSG C
0.056	87	Dirt roads, HSG C
0.327	55	Woods, Good, HSG B
0.483	70	Woods, Good, HSG C
2.854	71	Weighted Average
2.854		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	100	0.3000	0.43		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 4.93"
1.4	292	0.2500	3.50		Shallow Concentrated Flow, Shallow - Short Grass Pasture Short Grass Pasture Kv= 7.0 fps
0.1	209	0.2300	37.06	65.49	Pipe Channel, 18" DWCPP 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PPI Dual Walled CPP
0.1	62	0.3400	14.48	28.96	Trap/Vee/Rect Channel Flow, Stream (std ditch) Bot.W=0.00' D=1.00' Z= 2.0 ' Top.W=4.00' n= 0.035
5.5	663	Total			

Pre-Project

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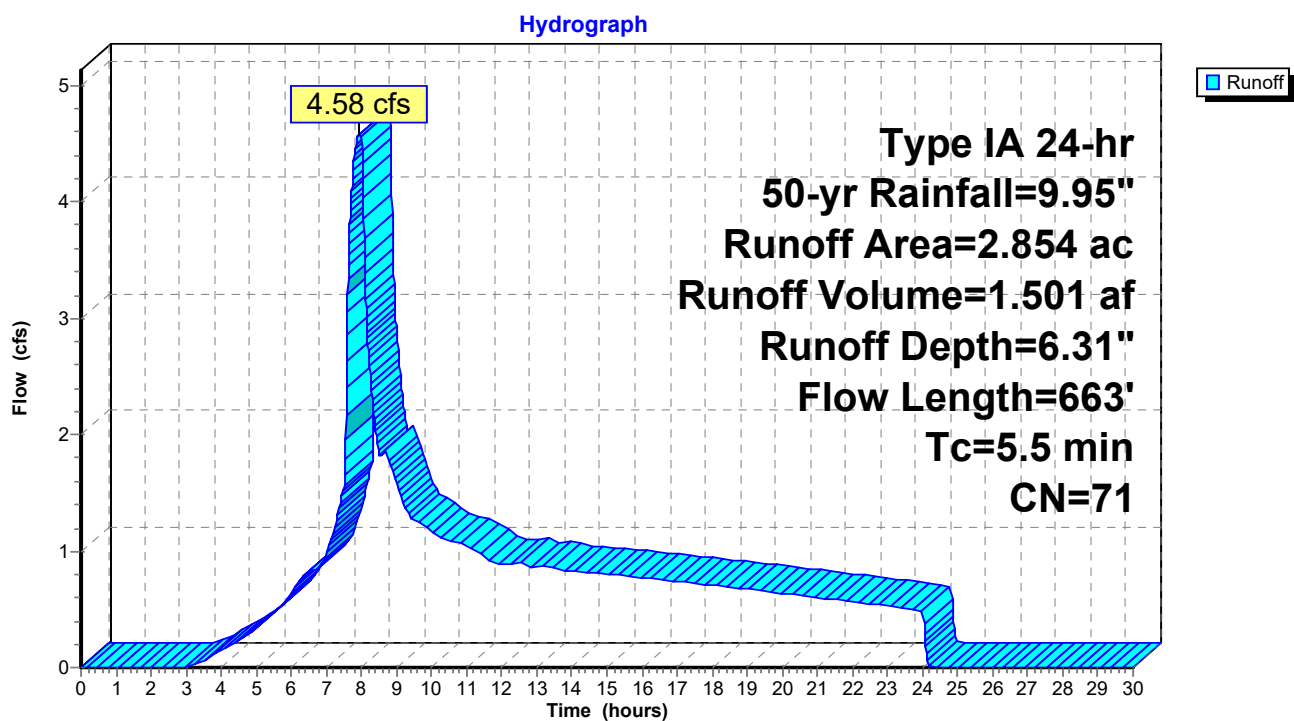
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Type IA 24-hr 50-yr Rainfall=9.95"

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Page 7

Subcatchment WS-1: Subcat WS-1



Pre-Project

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Type IA 24-hr 100-yr Rainfall=11.00"

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Page 8

Summary for Subcatchment WS-1: Subcat WS-1

Runoff = 5.33 cfs @ 7.93 hrs, Volume= 1.729 af, Depth= 7.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr Rainfall=11.00"

Area (ac)	CN	Description
1.167	69	Annual Grass, Fair, HSG B
0.822	79	Annual Grass, Fair, HSG C
0.056	87	Dirt roads, HSG C
0.327	55	Woods, Good, HSG B
0.483	70	Woods, Good, HSG C
2.854	71	Weighted Average
2.854		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	100	0.3000	0.43		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 4.93"
1.4	292	0.2500	3.50		Shallow Concentrated Flow, Shallow - Short Grass Pasture Short Grass Pasture Kv= 7.0 fps
0.1	209	0.2300	37.06	65.49	Pipe Channel, 18" DWCPP 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PPI Dual Walled CPP
0.1	62	0.3400	14.48	28.96	Trap/Vee/Rect Channel Flow, Stream (std ditch) Bot.W=0.00' D=1.00' Z= 2.0 ' Top.W=4.00' n= 0.035
5.5	663	Total			

Pre-Project

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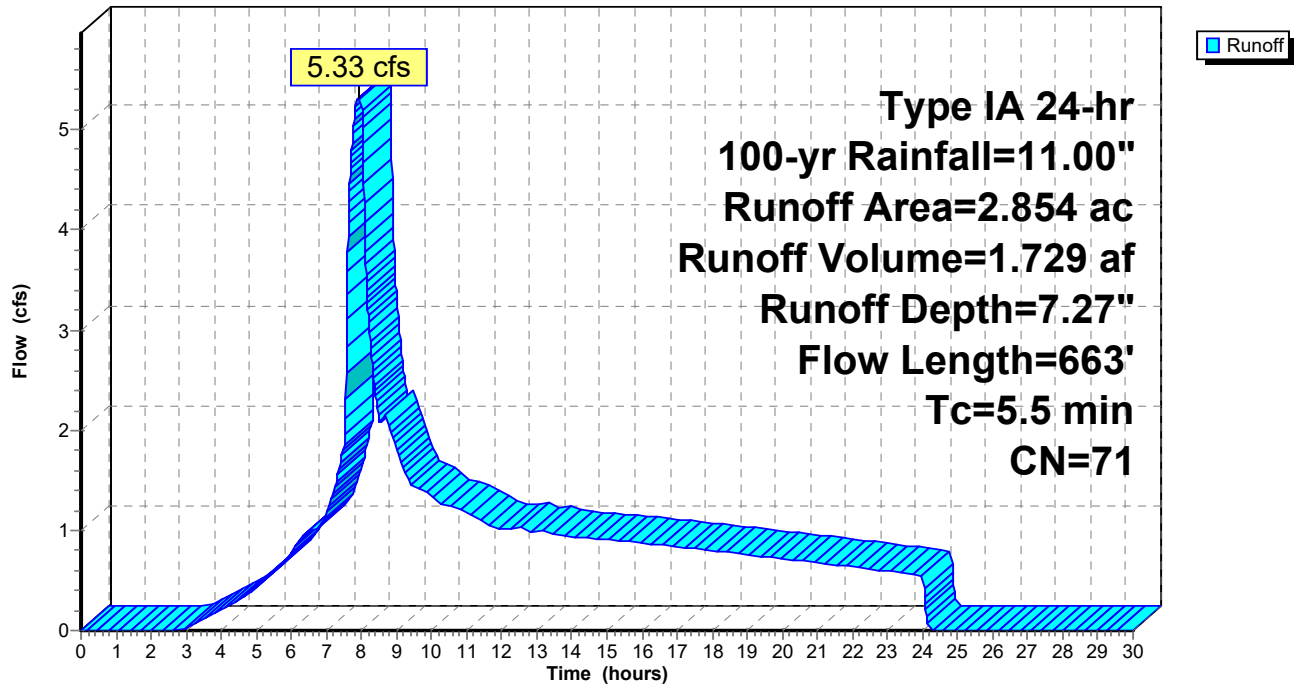
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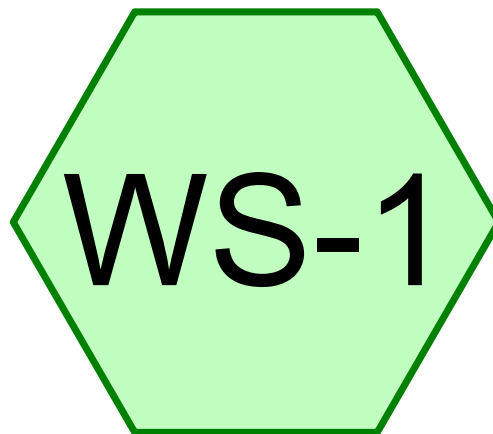
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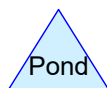
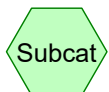
Subcatchment WS-1: Subcat WS-1

Hydrograph





Subcat WS-1



Post-Project

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Type IA 24-hr 2-yr Rainfall=4.93"

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Page 11

Summary for Subcatchment WS-1: Subcat WS-1

Runoff = 1.09 cfs @ 8.01 hrs, Volume= 0.435 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr Rainfall=4.93"

Area (ac)	CN	Description
0.126	69	Annual Grass, Fair, HSG B
0.458	79	Annual Grass, Fair, HSG C
0.054	87	Dirt roads, HSG C
1.253	61	Vineyard, Good, HSG B
0.409	75	Vineyard, Good, HSG C
0.115	55	Woods, Good, HSG B
0.439	70	Woods, Good, HSG C
2.854	68	Weighted Average
2.854		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	100	0.3000	0.43		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 4.93"
1.4	292	0.2500	3.50		Shallow Concentrated Flow, Shallow - Short Grass Pasture Short Grass Pasture Kv= 7.0 fps
0.1	209	0.2300	37.06	65.49	Pipe Channel, 18" DWCPP 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PPI Dual Walled CPP
0.1	62	0.3400	14.48	28.96	Trap/Vee/Rect Channel Flow, Stream (std ditch) Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
5.5	663	Total			

Post-Project

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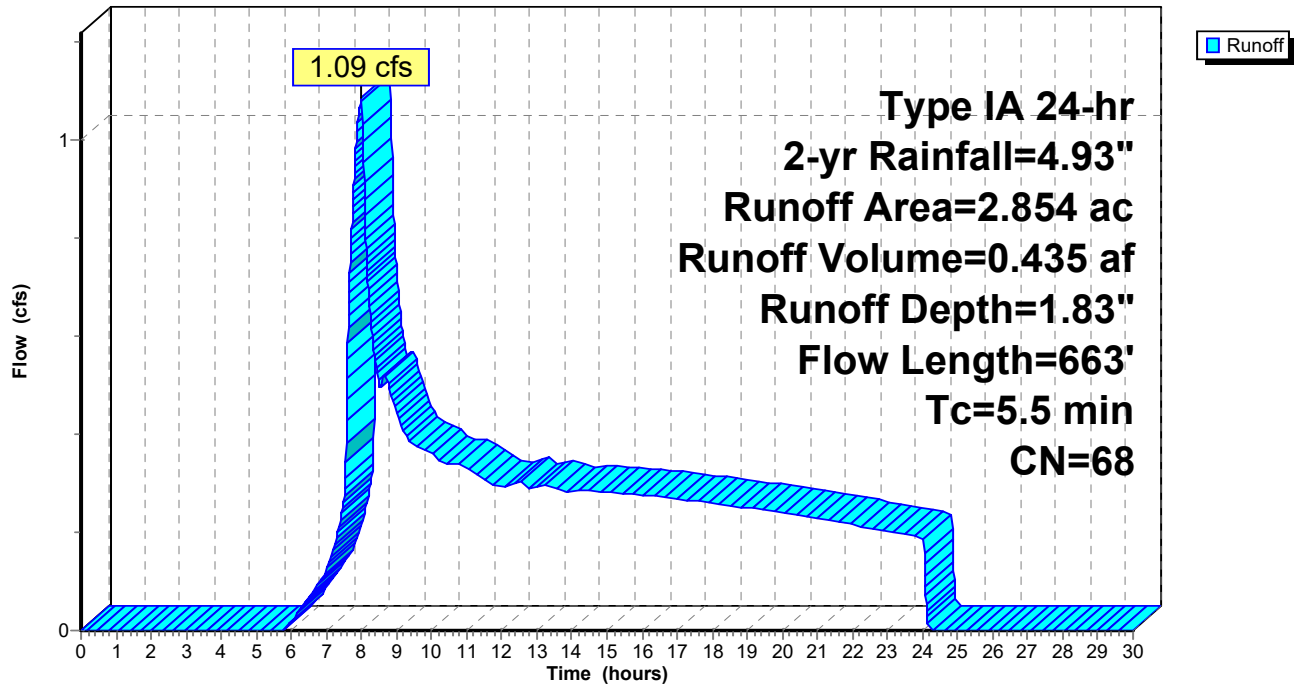
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Subcatchment WS-1: Subcat WS-1

Hydrograph



Post-Project

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Type IA 24-hr 10-yr Rainfall=7.43"

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Summary for Subcatchment WS-1: Subcat WS-1

Runoff = 2.55 cfs @ 7.97 hrs, Volume= 0.895 af, Depth= 3.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr Rainfall=7.43"

Area (ac)	CN	Description
0.126	69	Annual Grass, Fair, HSG B
0.458	79	Annual Grass, Fair, HSG C
0.054	87	Dirt roads, HSG C
1.253	61	Vineyard, Good, HSG B
0.409	75	Vineyard, Good, HSG C
0.115	55	Woods, Good, HSG B
0.439	70	Woods, Good, HSG C
2.854	68	Weighted Average
2.854		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	100	0.3000	0.43		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 4.93"
1.4	292	0.2500	3.50		Shallow Concentrated Flow, Shallow - Short Grass Pasture Short Grass Pasture Kv= 7.0 fps
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0.1	62	0.3400	14.48	28.96	Trap/Vee/Rect Channel Flow, Stream (std ditch) Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
5.5	663	Total			

Post-Project

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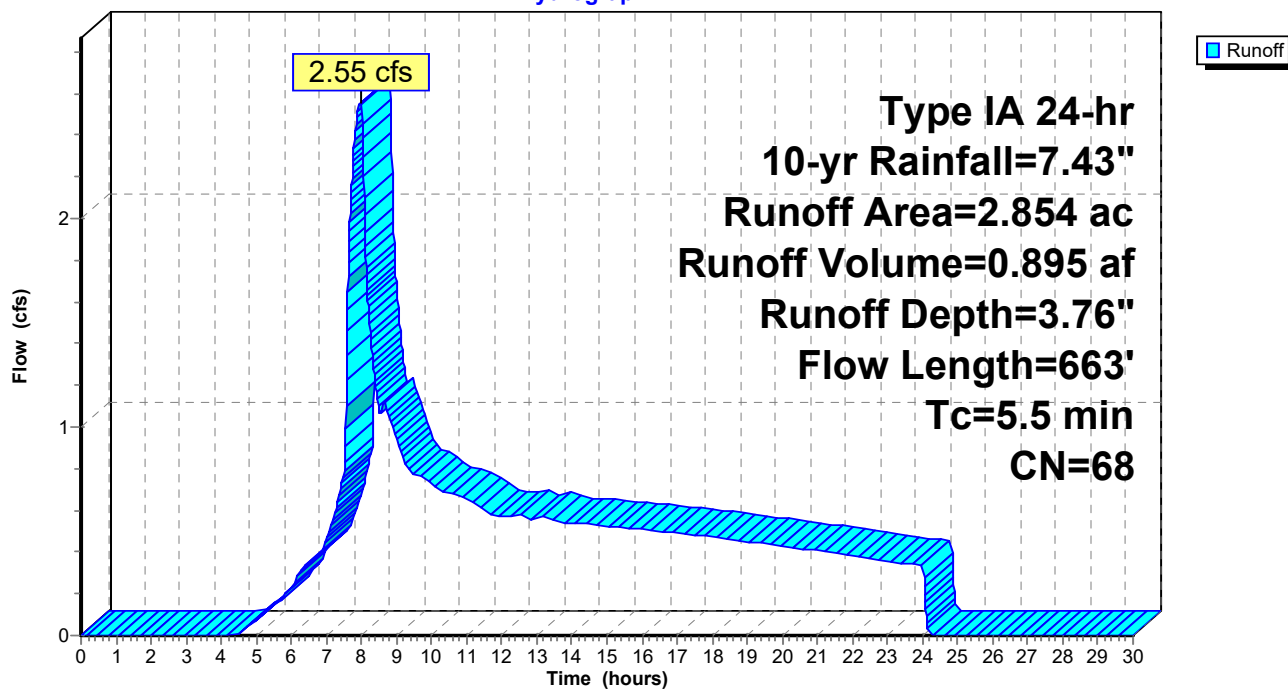
Type IA 24-hr 10-yr Rainfall=7.43"

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Subcatchment WS-1: Subcat WS-1

Hydrograph



Post-Project

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Type IA 24-hr 50-yr Rainfall=9.95"

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Summary for Subcatchment WS-1: Subcat WS-1

Runoff = 4.23 cfs @ 7.94 hrs, Volume= 1.408 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50-yr Rainfall=9.95"

Area (ac)	CN	Description
0.126	69	Annual Grass, Fair, HSG B
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5.5	663	Total			

Post-Project

Prepared by PPI Engineering

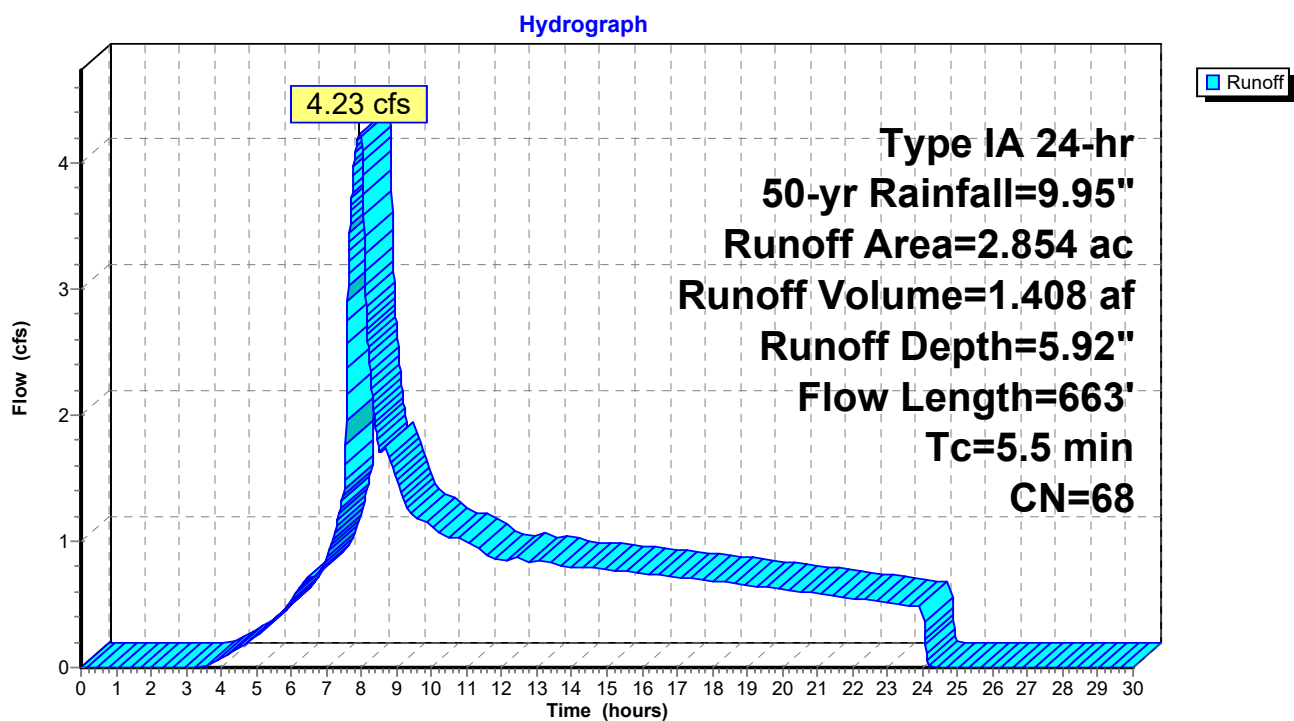
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Type IA 24-hr 50-yr Rainfall=9.95"

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Subcatchment WS-1: Subcat WS-1



Post-Project

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Type IA 24-hr 100-yr Rainfall=11.00"

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Summary for Subcatchment WS-1: Subcat WS-1

Runoff = 4.96 cfs @ 7.94 hrs, Volume= 1.630 af, Depth= 6.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr Rainfall=11.00"

Area (ac)	CN	Description
0.126	69	Annual Grass, Fair, HSG B
0.458	79	Annual Grass, Fair, HSG C
0.054	87	Dirt roads, HSG C
1.253	61	Vineyard, Good, HSG B
0.409	75	Vineyard, Good, HSG C
0.115	55	Woods, Good, HSG B
0.439	70	Woods, Good, HSG C
2.854	68	Weighted Average
2.854		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	100	0.3000	0.43		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 4.93"
1.4	292	0.2500	3.50		Shallow Concentrated Flow, Shallow - Short Grass Pasture Short Grass Pasture Kv= 7.0 fps
0.1	209	0.2300	37.06	65.49	Pipe Channel, 18" DWCPP 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PPI Dual Walled CPP
0.1	62	0.3400	14.48	28.96	Trap/Vee/Rect Channel Flow, Stream (std ditch) Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
5.5	663	Total			

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Subcatchment WS-1: Subcat WS-1

Hydrograph

