

EXHIBIT C



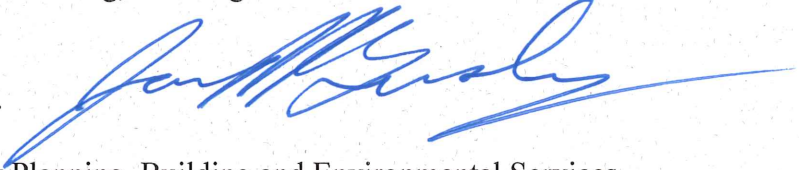
VINEYARD DESIGN
EROSION CONTROL
WATER DEVELOPMENT
DRAINAGE
PERMITTING
GPS/GIS

2800 Jefferson Street
Napa, California 94558
707-253-1806
www.ppiengineering.com

MEMORANDUM

Date: May 16, 2019

To: Daniel Basore, Napa County Planning, Building and Environmental Services

From: James R. Bushey, P.E.
Austin Lemire-Baeten, E.I.T. 

Cc: Brian Bordona, Napa County Planning, Building and Environmental Services

Re: Hess Collection Winery Track I ECP #P18-00445-ECPA
2847 Atlas Peak Road; APN 039-080-042
Revised Hydrologic Analysis

This memo transmits the findings of a revised hydrologic analysis for the above-referenced Track I Erosion Control Plan (ECP). This revised analysis includes approximately 16.0 net acres of proposed new vineyard and 0.9 net acres of existing vineyard that was previously developed utilizing the less-than-1-acre landscape exemption. The pre-project condition for the existing vineyard area was assumed to be the same as the adjacent areas using Google Earth imagery. No changes or redevelopment activities are proposed for the existing vineyard block at this time.

HydroCAD software was used to estimate pre- and post-project runoff from the watershed 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.

Four (4) watersheds were delineated for the hydrologic modeling using American Aerial and Napa County contours. Watersheds 1 through 3 contribute runoff to seasonal swales that are located on the property which eventually converge and exit the property at its southernmost boundary. Watershed 4 encompasses a small area located in the southeast corner of the property. Runoff leaving the proposed project site eventually drains to Milliken Creek (below Milliken Reservoir) and thence to the Napa River. Please see the attached figures for the location of each watershed.

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

- Aiken Loam, 30-50% Slopes (Map Unit Symbol 102)
- Boomer-Forward-Felta Complex, 30-50% Slopes (Map Unit Symbol 110)
- Hambright-Rock Outcrop Complex, 2-30% Slopes (Map Unit Symbol 151)
- Hambright-Rock Outcrop Complex, 30-75% Slopes (Map Unit Symbol 152)

The Boomer-Forward-Felta complex is classified as Hydrologic Soil Group (HSG) B. The Aiken Loam is classified as HSG C. The Hambright-rock outcrop complexes are classified as HSG D. Please see the attached figures for soil type delineations within the vicinity of the watershed.

Land use areas were initially delineated based on Napa County Orthophotos. A site visit was then conducted on July 6, 2018 by Jim Bushey and Matt Bueno of PPI Engineering to ground truth the orthophotos and determine the existing land use conditions. An additional site visit was performed on April 16, 2019 by Matt Bueno and Daniel Basore of the Napa County Engineering Division to confirm pre-project 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. Please see the attached figures for existing and proposed land use delineations.

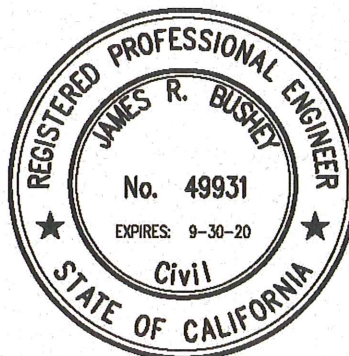
The Time of Concentration (Tc) flow path within the watershed was determined using both American Aerial Mapping and Napa County Contours. The flow path was drafted from the hydrologically most distant point (longest travel time) in the watershed to the watershed outlet per NRCS standards. The Tc did not change from pre- to post-project conditions. The proposed project will not change any of the existing drainage patterns and does not include any surface water conveyance infrastructure. Please see the attached figures for both the pre- and post-project Tc flow paths.

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

Table 1. Individual Watershed Summary

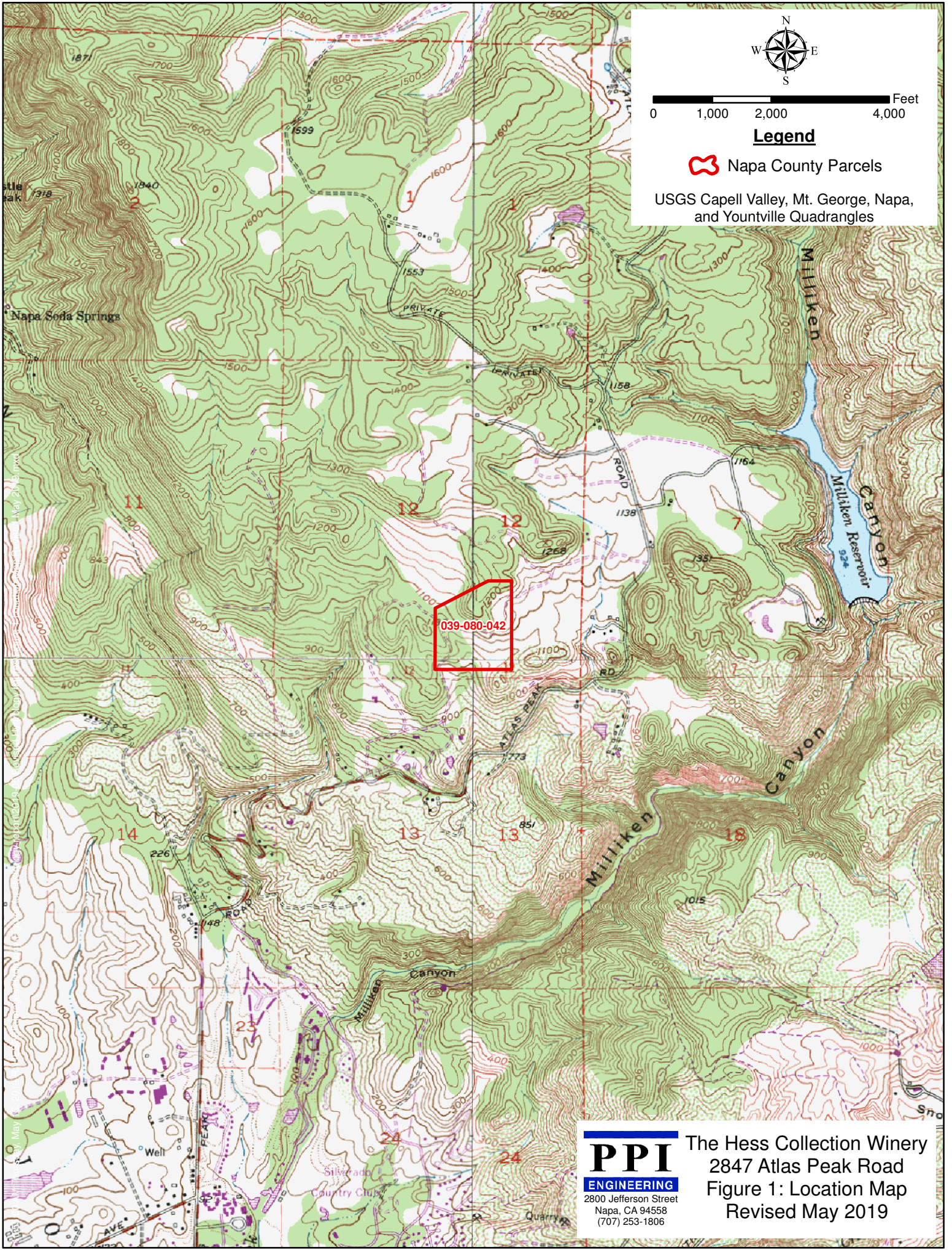
	Runoff (cfs)				Runoff (cfs)		
	Watershed 1				Watershed 2		
	Pre-Project	Post-Project	Increase / Decrease		Pre-Project	Post-Project	Increase / Decrease
2-Year Storm	8.18	7.48	0.70	2-Year Storm	5.52	4.60	0.92
10-Year Storm	22.33	21.26	1.07	10-Year Storm	15.06	13.63	1.43
50-Year Storm	39.05	37.72	1.33	50-Year Storm	26.26	24.48	1.78
100-Year Storm	46.63	45.22	1.41	100-Year Storm	31.36	29.46	1.90
	Runoff (cfs)				Runoff (cfs)		
	Watershed 3				Watershed 4		
	Pre-Project	Post-Project	Increase / Decrease		Pre-Project	Post-Project	Increase / Decrease
2-Year Storm	3.43	3.13	0.30	2-Year Storm	0.55	0.55	0.00
10-Year Storm	9.51	9.05	0.46	10-Year Storm	1.23	1.23	0.00
50-Year Storm	16.77	16.19	0.58	50-Year Storm	1.98	1.98	0.00
100-Year Storm	20.07	19.46	0.61	100-Year Storm	2.32	2.32	0.00

Watersheds 1, 2, and 3 show decreases in runoff from pre- to post-project conditions. This decrease is caused by CN decreases post-project. Watershed 4 shows no net change in runoff from pre- to post-project conditions. This is due to the fact that neither the CN nor the time of concentration (Tc) changed for post-project analysis. 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



0 1,000 2,000 4,000 Feet

Legend

 Napa County Parcels

USGS Capell Valley, Mt. George, Napa,
and Yountville Quadrangles

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The Hess Collection Winery
2847 Atlas Peak Road
Figure 1: Location Map
Revised May 2019



0 100 200 400 Feet

Legend

- Seasonal Wetland, mapped by WRA
- Approximate Property Boundary
- American Aerial 10' Index Contours
- American Aerial 2' Intermediate Contours
- Napa County 25' Index Contours
- Napa County 5' Intermediate Contours

2017 Esri Aerial Photo

10:57:00 AM Thursday, May 16, 2019 R:\HESPER\Images\Hydrology\Figures for Hydrology report\2019-05 Revised Hydrology Figures\Figure 2 Property Boundary and Waters Revised May 2019.mxd

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The Hess Collection Winery
2847 Atlas Peak Road

Figure 2: Property Boundary & Waters
Revised May 2019

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

11:01:13 AM Thursday, May 16, 2019 R:\HESPER\Images\Hydrology\Figures for Hydrology report\2019-05 Revised Hydrology Figures\Figure 3 Watersheds and Proposed Vineyard Block Locations Revised May 2019.mxd

N
W
E
S

0150300600

Feet

Legend

- Proposed Block Boundaries
- Proposed Clearing Limits
- Watershed Boundaries
- American Aerial 10' Index Contours
- American Aerial 2' Intermediate Contours
- Napa County 25' Index Contours
- Napa County 5' Intermediate Contours

2017 Esri Aerial Photo

The map displays a topographic view of a vineyard area with four distinct watersheds outlined in orange. Watershed 1 is in the upper left, Watershed 2 in the upper right, Watershed 3 in the lower left, and Watershed 4 in the lower right. Each watershed contains several proposed vineyard blocks, indicated by red dashed lines and numbered 1 through 5. The map is overlaid with contour lines: pink for 10-foot index contours, green for 2-foot intermediate contours, yellow for 25-foot index contours, and blue for 5-foot intermediate contours. A legend in the top right corner defines the symbols used. A scale bar and north arrow are also present. The background is a 2017 Esri aerial photograph.

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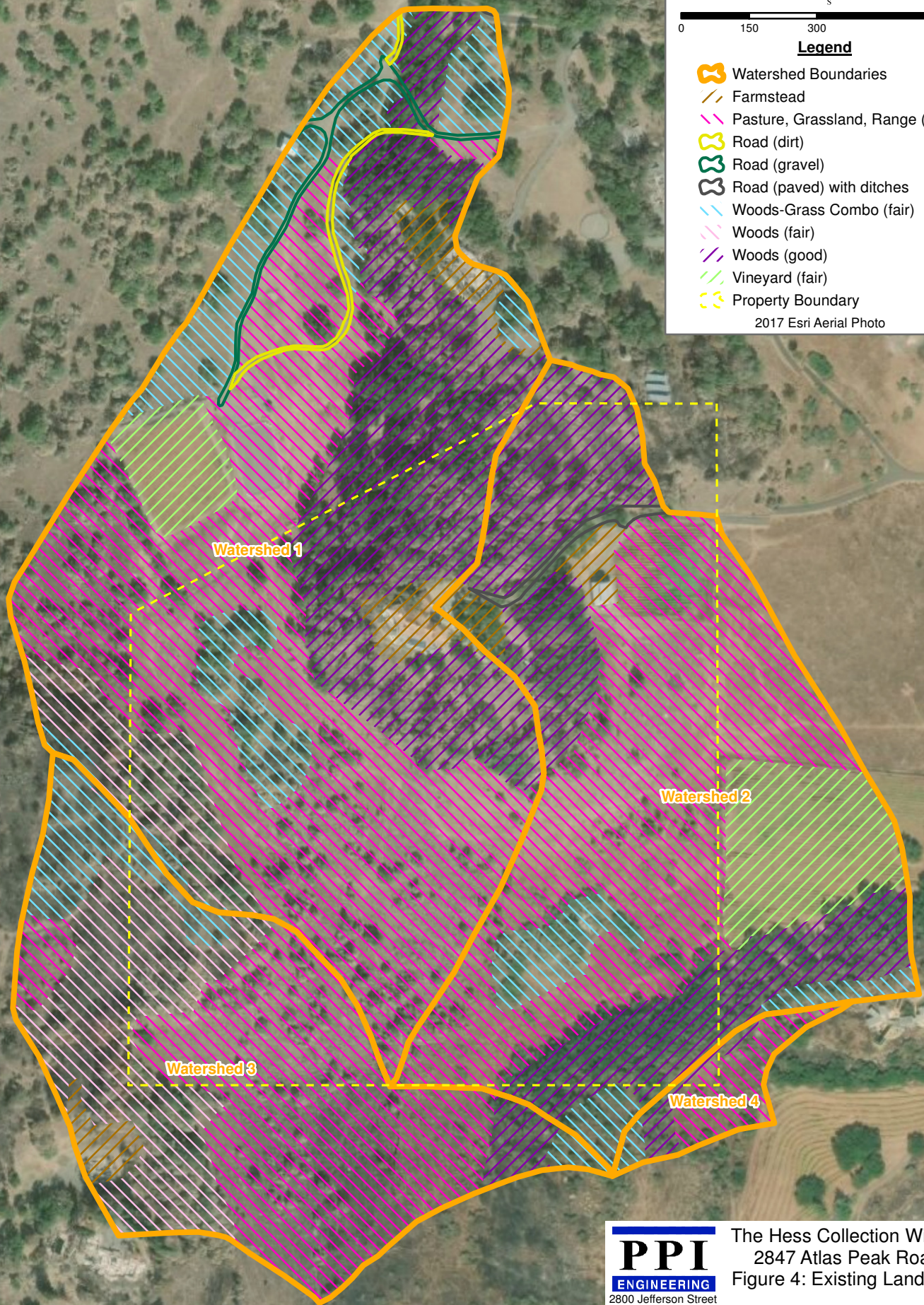
The Hess Collection Winery
2847 Atlas Peak Road

Figure 3: Watersheds and
Proposed Vineyard Block Locations

Revised May 2019

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

11:02:28 AM Thursday, May 16, 2019 R:\HESPER\Images\Hydrology\Figures for Hydrology report\2019-05 Revised Hydrology Figures\Figure 4 Existing Land Use Revised May 2019.mxd



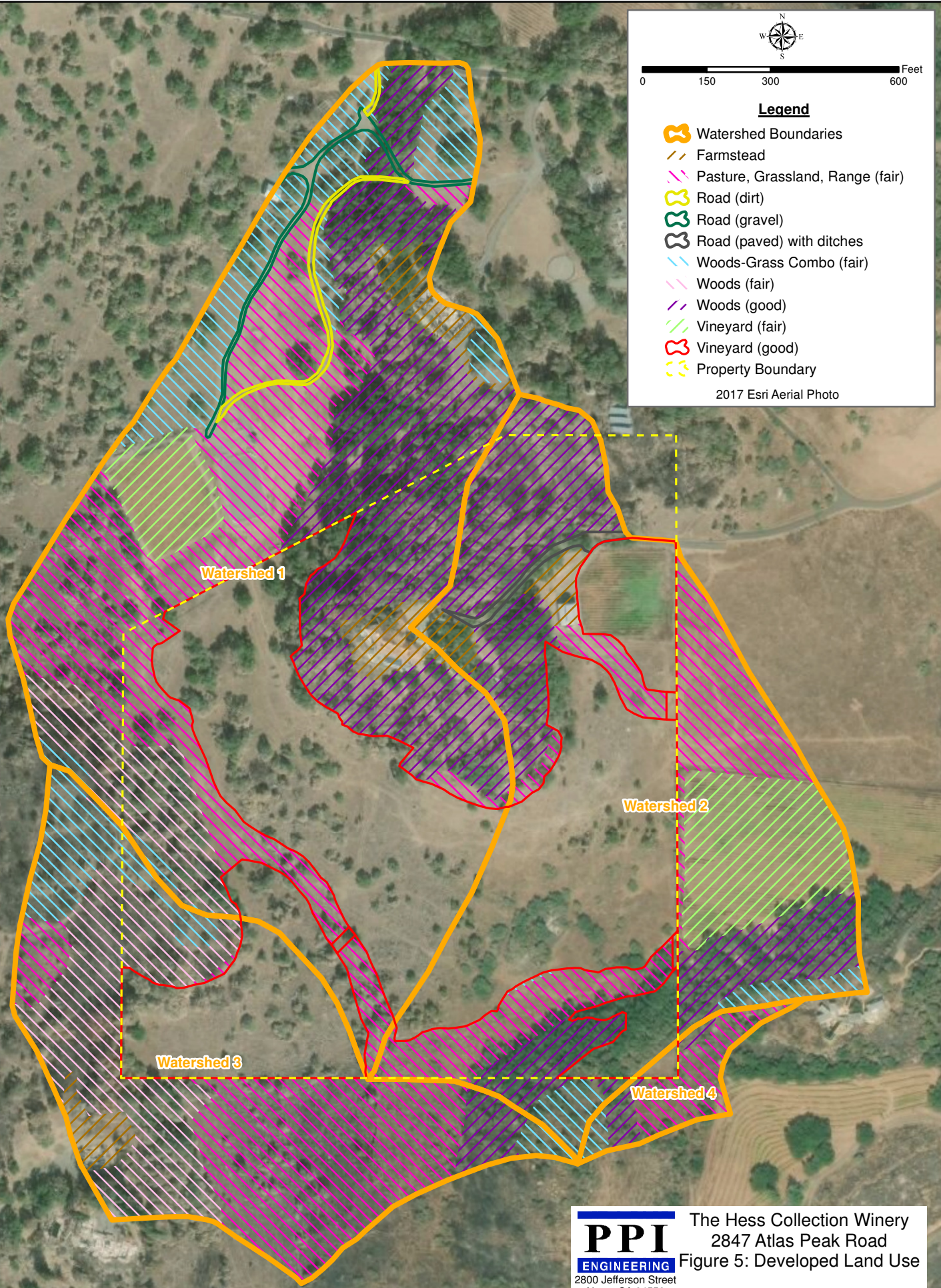
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2847 Atlas Peak Road
Figure 4: Existing Land Use

Revised May 2019

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

11:03:47 AM Thursday, May 16, 2019 R:\HESPER\Images\Hydrology\Figures for Hydrology report\2019-05 Revised Hydrology figures\Figure 5 Developed Land Use Revised May 2019.mxd



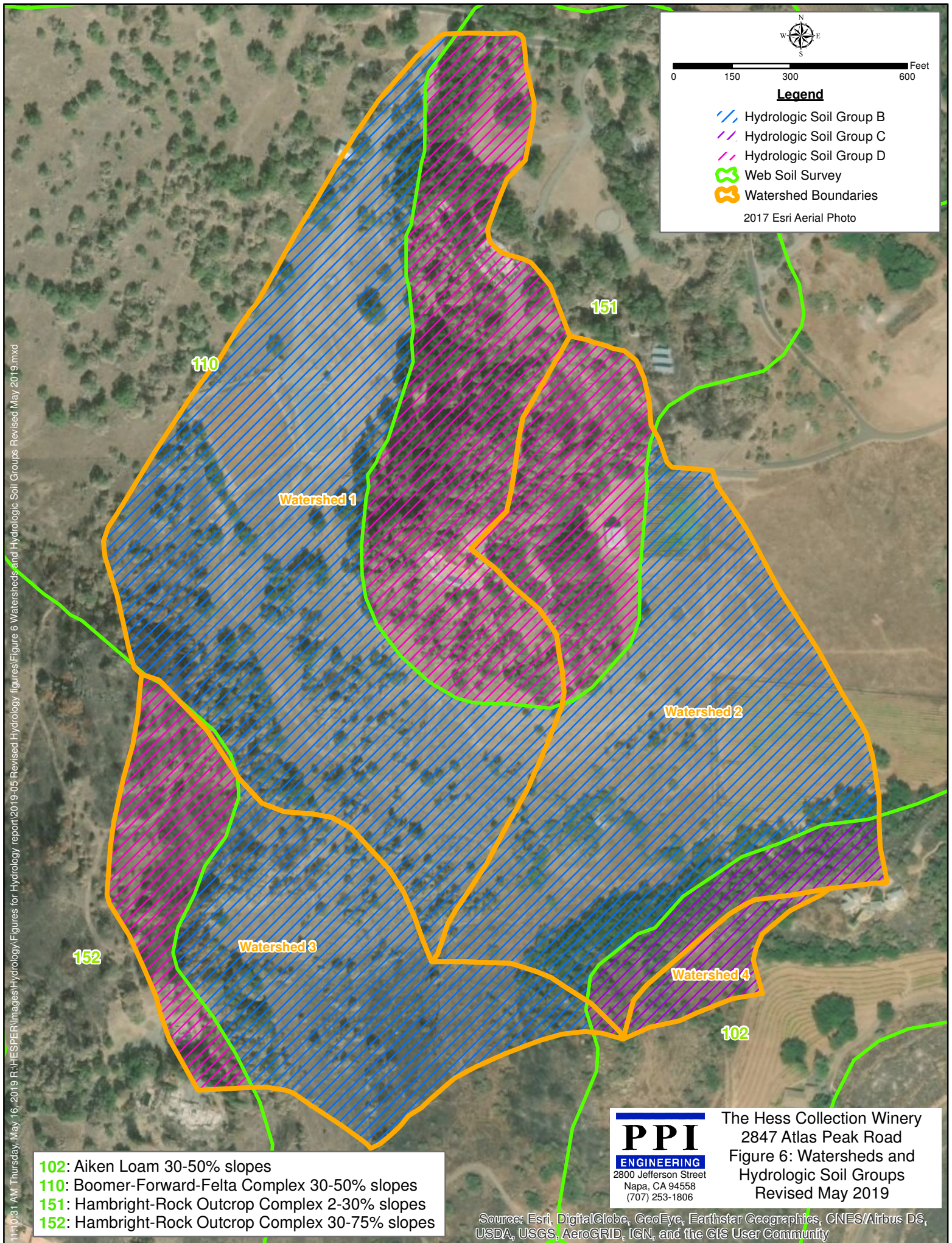
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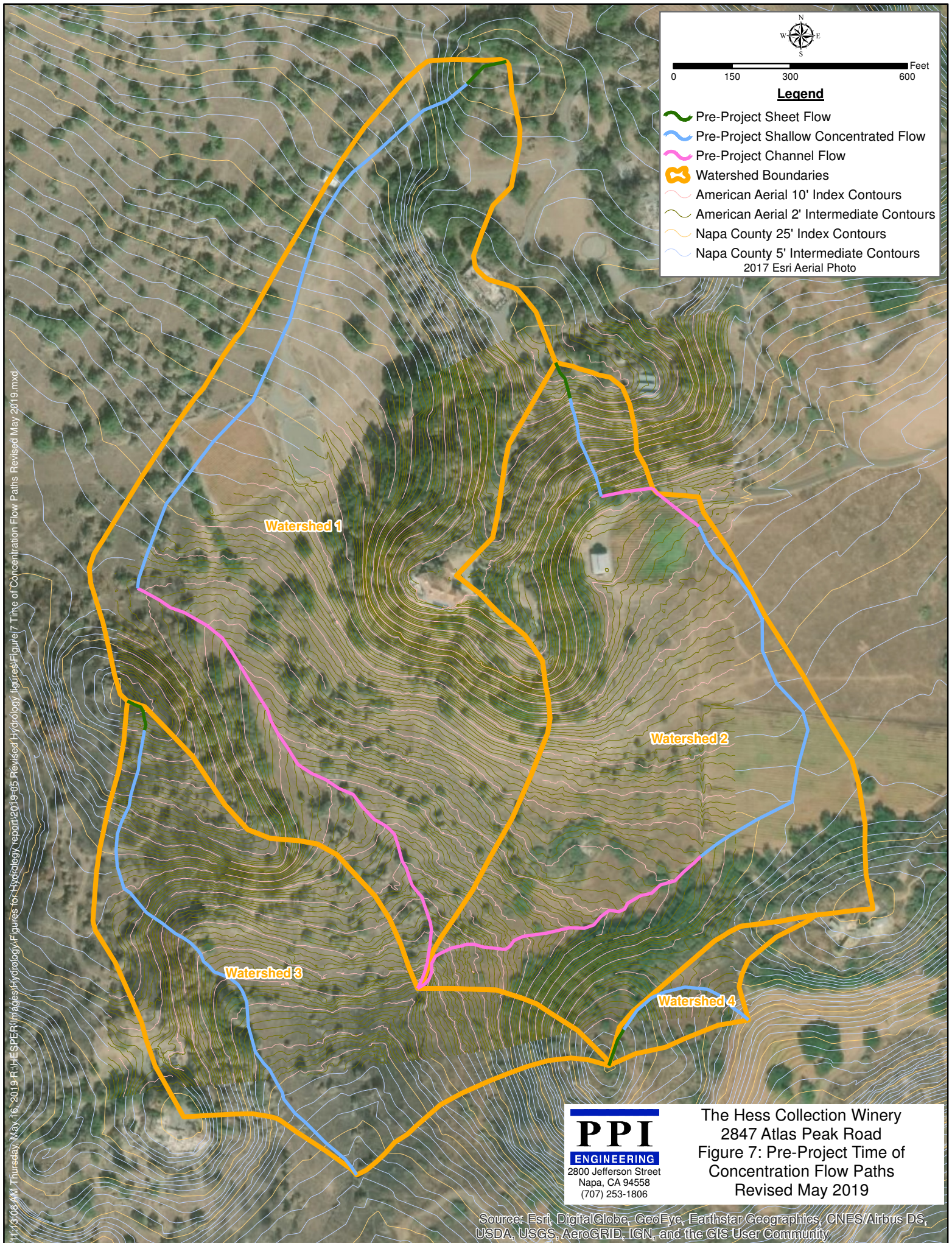
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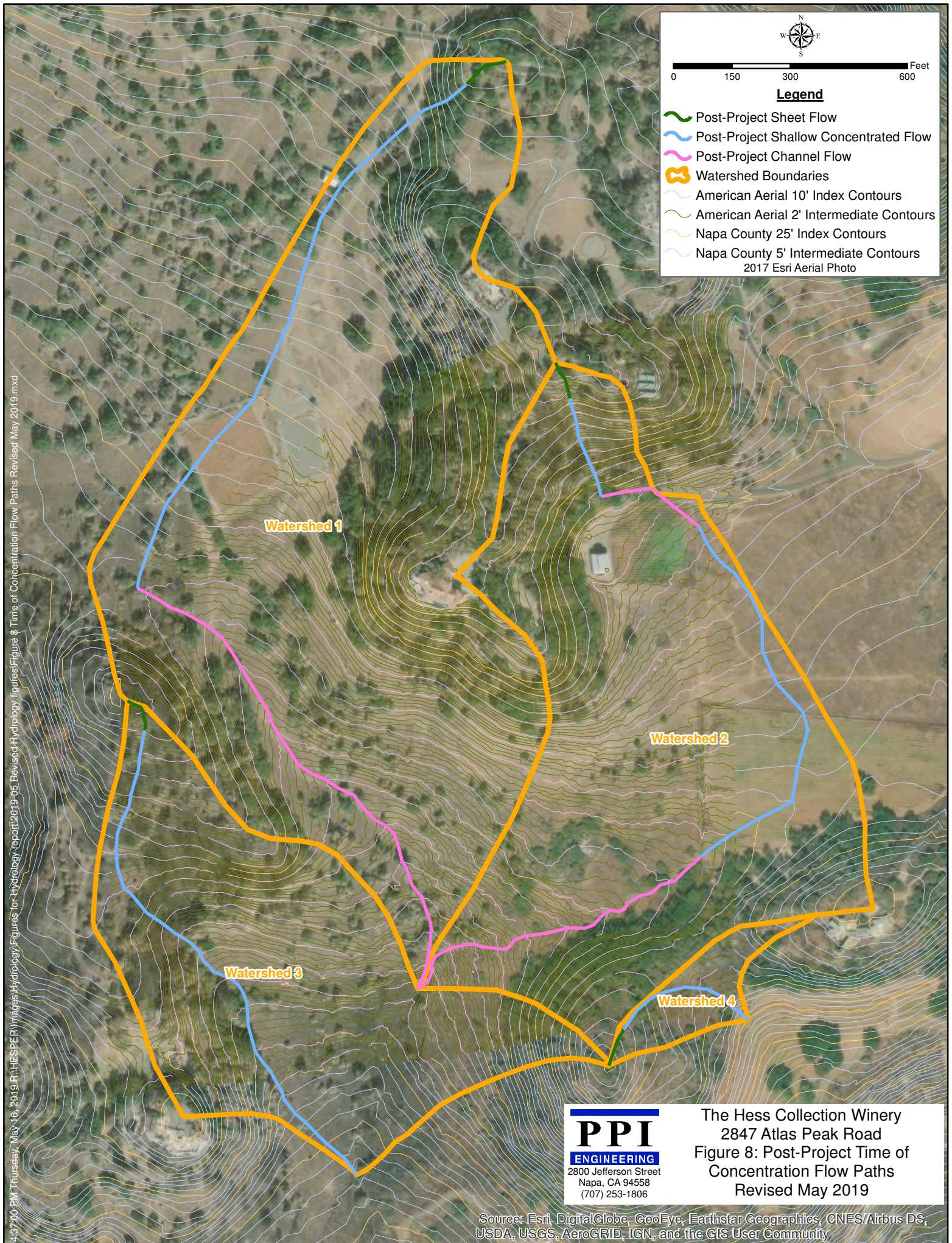
Figure 5: Developed Land Use

Revised May 2019

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

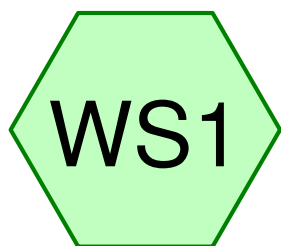






ATTACHMENT B

HYDROCAD ANALYSES



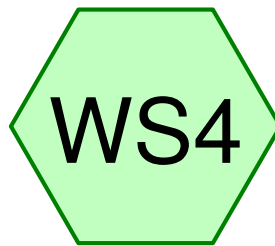
WATERSHED 1



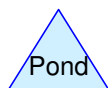
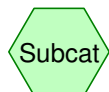
WATERSHED 2



WATERSHED 3



WATERSHED 4



Pre-Project WS1

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PPI Engineering
 Type IA 24-hr 2-Year Rainfall=3.78"
 Printed 5/16/2019

Summary for Subcatchment WS1: WATERSHED 1

Runoff = 8.18 cfs @ 8.12 hrs, Volume= 3.145 af, Depth> 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 2-Year Rainfall=3.78"

Area (ac)	CN	Description
0.183	82	Dirt roads, HSG B
0.034	89	Dirt roads, HSG D
1.352	86	Farmsteads, HSG D
0.213	85	Gravel Roads, HSG B
0.092	91	Gravel Roads, HSG D
15.820	69	Pasture/grassland/range, Fair, HSG B
0.730	84	Pasture/grassland/range, Fair, HSG D
0.007	93	Paved roads w/open ditches, 50% imp, HSG D
1.319	69	Vineyard, Fair, HSG B
2.231	60	Woods, Fair, HSG B
0.021	79	Woods, Fair, HSG D
0.719	55	Woods, Good, HSG B
9.453	77	Woods, Good, HSG D
3.821	65	Woods/grass comb., Fair, HSG B
1.081	82	Woods/grass comb., Fair, HSG D
37.074	71	Weighted Average
37.071		99.99% Pervious Area
0.003		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	56	0.0500	0.11		Sheet Flow, Sheet-1
					Woods: Light underbrush n= 0.400 P2= 3.78"
5.1	1,637	0.1100	5.34		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
3.2	1,365	0.0800	7.02	14.05	Trap/Vee/Rect Channel Flow, Stream
					Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00'
					n= 0.035
16.9	3,058	Total			

Pre-Project WS1

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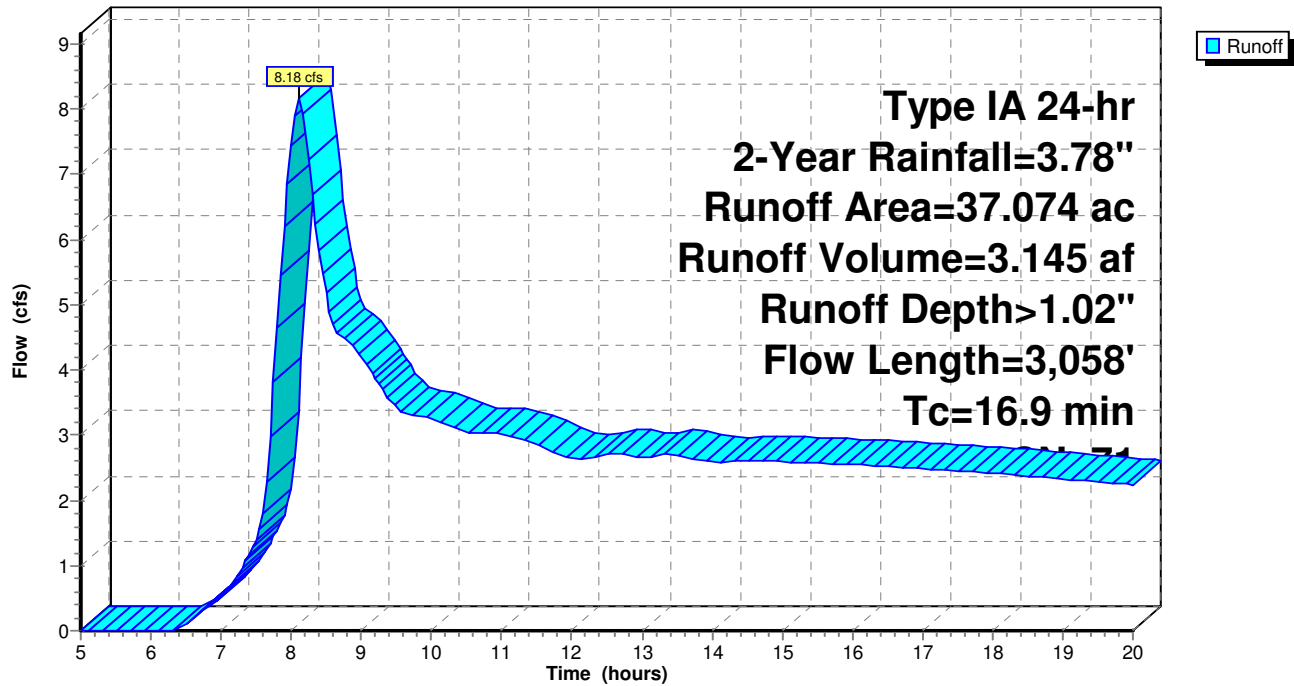
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Type IA 24-hr 2-Year Rainfall=3.78"

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Subcatchment WS1: WATERSHED 1

Hydrograph



Pre-Project WS1

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Type IA 24-hr 10-Year Rainfall=5.82"

Printed 5/16/2019

Summary for Subcatchment WS1: WATERSHED 1

Runoff = 22.33 cfs @ 8.09 hrs, Volume= 7.192 af, Depth> 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=5.82"

Area (ac)	CN	Description
0.183	82	Dirt roads, HSG B
0.034	89	Dirt roads, HSG D
1.352	86	Farmsteads, HSG D
0.213	85	Gravel Roads, HSG B
0.092	91	Gravel Roads, HSG D
15.820	69	Pasture/grassland/range, Fair, HSG B
0.730	84	Pasture/grassland/range, Fair, HSG D
0.007	93	Paved roads w/open ditches, 50% imp, HSG D
1.319	69	Vineyard, Fair, HSG B
2.231	60	Woods, Fair, HSG B
0.021	79	Woods, Fair, HSG D
0.719	55	Woods, Good, HSG B
9.453	77	Woods, Good, HSG D
3.821	65	Woods/grass comb., Fair, HSG B
1.081	82	Woods/grass comb., Fair, HSG D
37.074	71	Weighted Average
37.071		99.99% Pervious Area
0.003		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	56	0.0500	0.11		Sheet Flow, Sheet-1 Woods: Light underbrush n= 0.400 P2= 3.78"
5.1	1,637	0.1100	5.34		Shallow Concentrated Flow, Shallow-1 Unpaved Kv= 16.1 fps
3.2	1,365	0.0800	7.02	14.05	Trap/Vee/Rect Channel Flow, Stream Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
16.9	3,058	Total			

Pre-Project WS1

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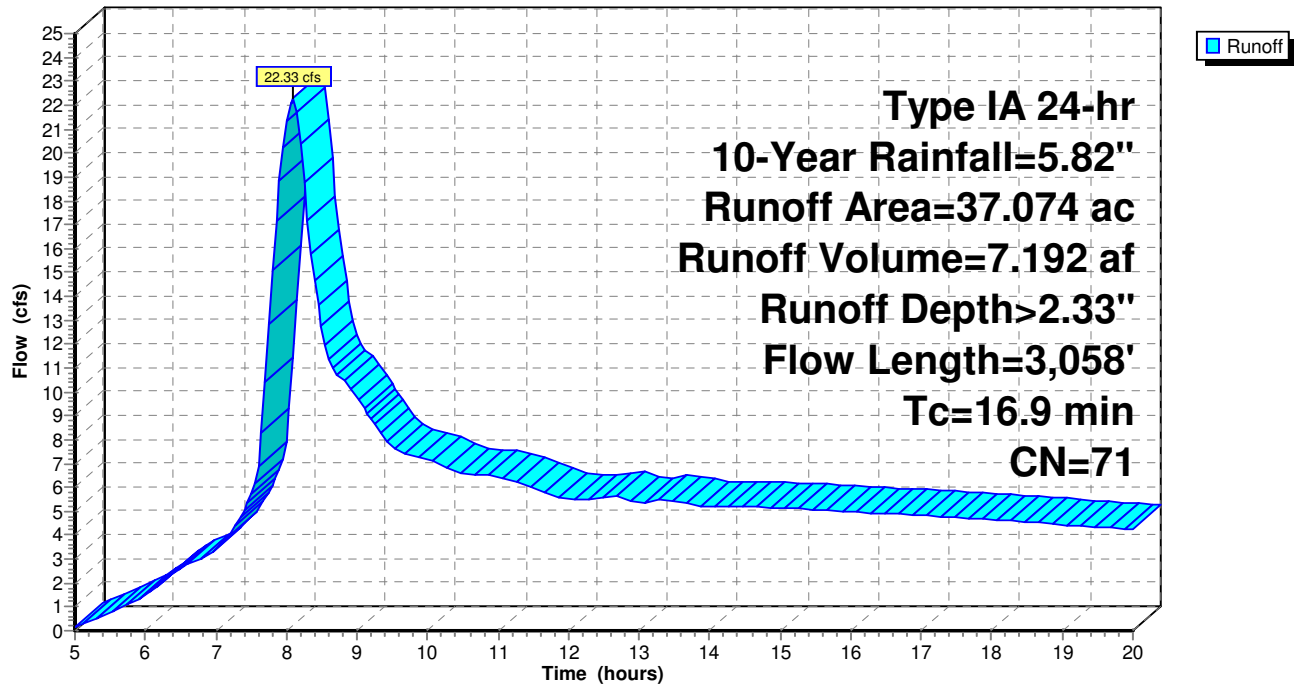
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Type IA 24-hr 10-Year Rainfall=5.82"

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Subcatchment WS1: WATERSHED 1

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Type IA 24-hr 50-Year Rainfall=7.89"

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Summary for Subcatchment WS1: WATERSHED 1

Runoff = 39.05 cfs @ 8.08 hrs, Volume= 11.833 af, Depth> 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 50-Year Rainfall=7.89"

Area (ac)	CN	Description
0.183	82	Dirt roads, HSG B
0.034	89	Dirt roads, HSG D
1.352	86	Farmsteads, HSG D
0.213	85	Gravel Roads, HSG B
0.092	91	Gravel Roads, HSG D
15.820	69	Pasture/grassland/range, Fair, HSG B
0.730	84	Pasture/grassland/range, Fair, HSG D
0.007	93	Paved roads w/open ditches, 50% imp, HSG D
1.319	69	Vineyard, Fair, HSG B
2.231	60	Woods, Fair, HSG B
0.021	79	Woods, Fair, HSG D
0.719	55	Woods, Good, HSG B
9.453	77	Woods, Good, HSG D
3.821	65	Woods/grass comb., Fair, HSG B
1.081	82	Woods/grass comb., Fair, HSG D
37.074	71	Weighted Average
37.071		99.99% Pervious Area
0.003		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	56	0.0500	0.11		Sheet Flow, Sheet-1
					Woods: Light underbrush n= 0.400 P2= 3.78"
5.1	1,637	0.1100	5.34		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
3.2	1,365	0.0800	7.02	14.05	Trap/Vee/Rect Channel Flow, Stream
					Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00'
					n= 0.035
16.9	3,058	Total			

Pre-Project WS1

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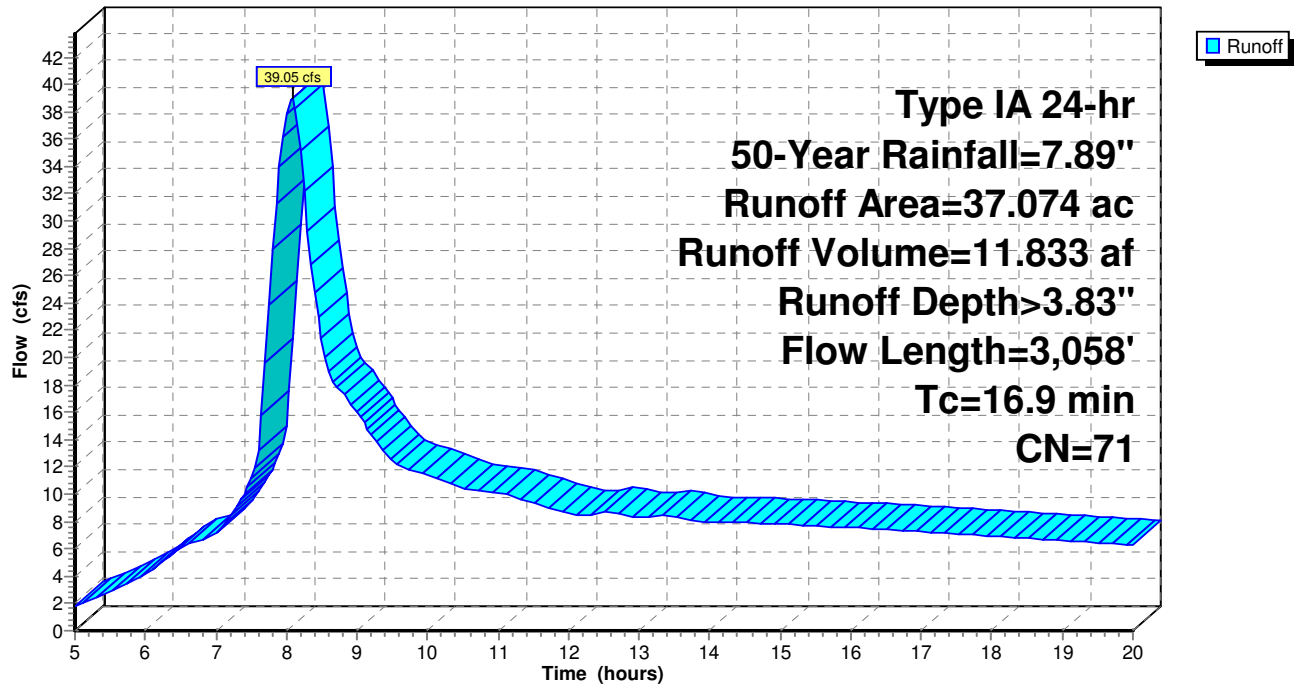
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Type IA 24-hr 50-Year Rainfall=7.89"

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Subcatchment WS1: WATERSHED 1

Hydrograph



Pre-Project WS1

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Type IA 24-hr 100-Year Rainfall=8.78"

Printed 5/16/2019

Summary for Subcatchment WS1: WATERSHED 1

Runoff = 46.63 cfs @ 8.08 hrs, Volume= 13.906 af, Depth> 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
0.183	82	Dirt roads, HSG B
0.034	89	Dirt roads, HSG D
1.352	86	Farmsteads, HSG D
0.213	85	Gravel Roads, HSG B
0.092	91	Gravel Roads, HSG D
15.820	69	Pasture/grassland/range, Fair, HSG B
0.730	84	Pasture/grassland/range, Fair, HSG D
0.007	93	Paved roads w/open ditches, 50% imp, HSG D
1.319	69	Vineyard, Fair, HSG B
2.231	60	Woods, Fair, HSG B
0.021	79	Woods, Fair, HSG D
0.719	55	Woods, Good, HSG B
9.453	77	Woods, Good, HSG D
3.821	65	Woods/grass comb., Fair, HSG B
1.081	82	Woods/grass comb., Fair, HSG D
37.074	71	Weighted Average
37.071		99.99% Pervious Area
0.003		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	56	0.0500	0.11		Sheet Flow, Sheet-1
					Woods: Light underbrush n= 0.400 P2= 3.78"
5.1	1,637	0.1100	5.34		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
3.2	1,365	0.0800	7.02	14.05	Trap/Vee/Rect Channel Flow, Stream
					Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00'
					n= 0.035
16.9	3,058	Total			

Pre-Project WS1

Prepared by Microsoft

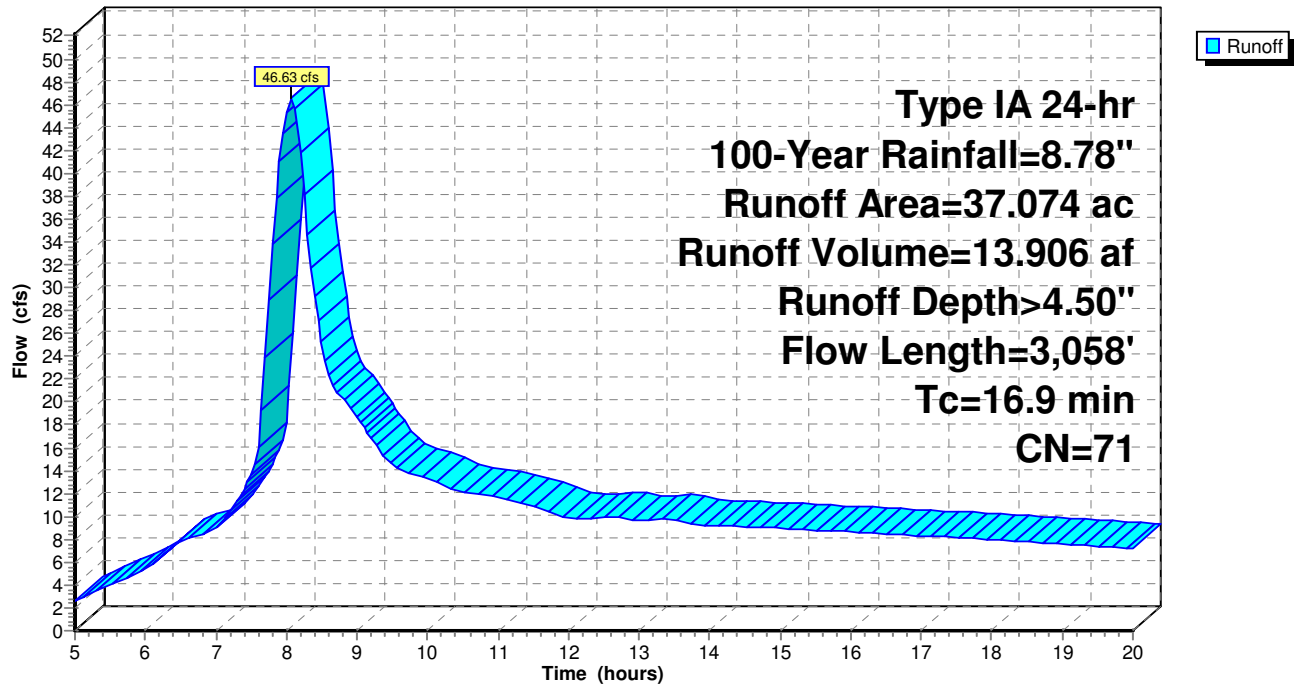
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Type IA 24-hr 100-Year Rainfall=8.78"

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Subcatchment WS1: WATERSHED 1

Hydrograph



Post-Project WS1

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PPI Engineering

Type IA 24-hr 2-Year Rainfall=3.78"

Printed 5/16/2019

Summary for Subcatchment WS1: WATERSHED 1

Runoff = 7.48 cfs @ 8.12 hrs, Volume= 2.977 af, Depth> 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-Year Rainfall=3.78"

Area (ac)	CN	Description
0.183	82	Dirt roads, HSG B
0.034	89	Dirt roads, HSG D
1.352	86	Farmsteads, HSG D
0.213	85	Gravel Roads, HSG B
0.092	91	Gravel Roads, HSG D
8.901	69	Pasture/grassland/range, Fair, HSG B
0.446	84	Pasture/grassland/range, Fair, HSG D
0.007	93	Paved roads w/open ditches, 50% imp, HSG D
1.319	69	Vineyard, Fair, HSG B
8.401	61	Vineyard, Good, HSG B
0.862	81	Vineyard, Good, HSG D
2.192	60	Woods, Fair, HSG B
0.021	79	Woods, Fair, HSG D
0.521	55	Woods, Good, HSG B
8.875	77	Woods, Good, HSG D
2.576	65	Woods/grass comb., Fair, HSG B
1.081	82	Woods/grass comb., Fair, HSG D
37.074	70	Weighted Average
37.071		99.99% Pervious Area
0.003		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	56	0.0500	0.11		Sheet Flow, Sheet-1
					Woods: Light underbrush n= 0.400 P2= 3.78"
5.1	1,637	0.1100	5.34		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
3.2	1,365	0.0800	7.02	14.05	Trap/Vee/Rect Channel Flow, Stream
					Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00'
					n= 0.035
16.9	3,058	Total			

Post-Project WS1

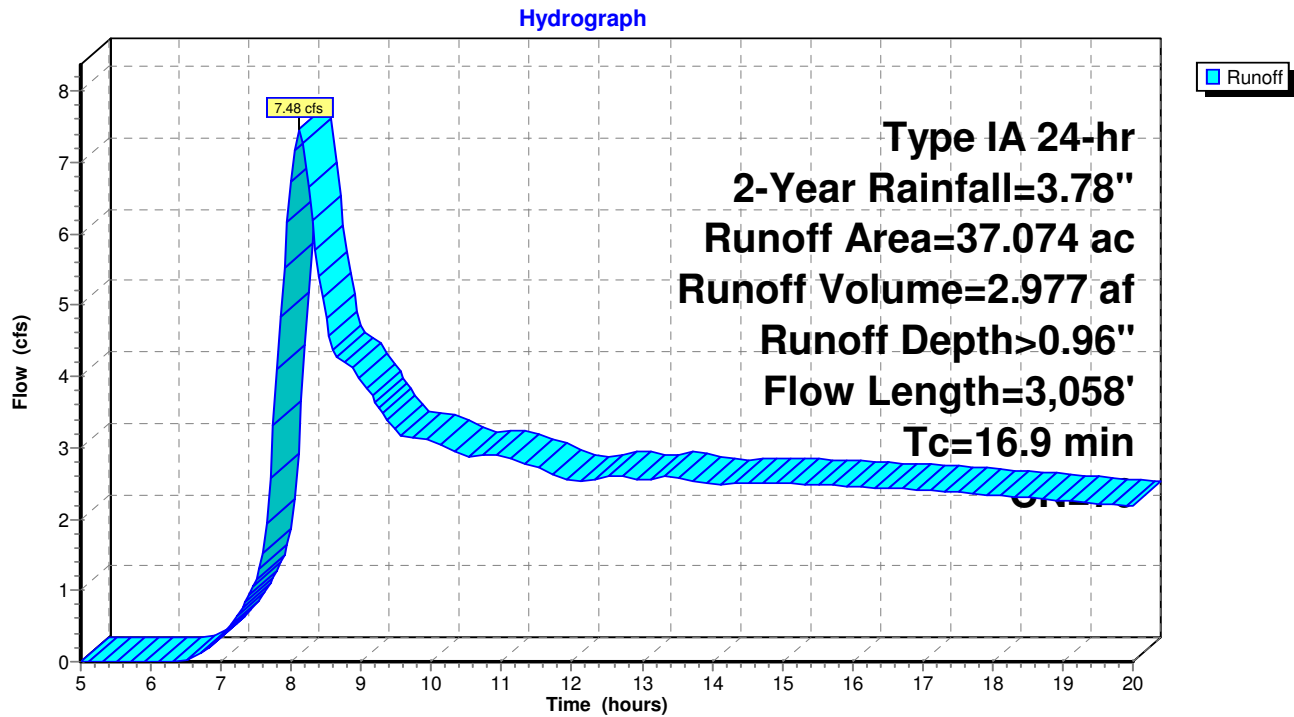
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Type IA 24-hr 2-Year Rainfall=3.78"

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Subcatchment WS1: WATERSHED 1



Post-Project WS1

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Type IA 24-hr 10-Year Rainfall=5.82"

Printed 5/16/2019

Summary for Subcatchment WS1: WATERSHED 1

Runoff = 21.26 cfs @ 8.09 hrs, Volume= 6.933 af, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=5.82"

Area (ac)	CN	Description
0.183	82	Dirt roads, HSG B
0.034	89	Dirt roads, HSG D
1.352	86	Farmsteads, HSG D
0.213	85	Gravel Roads, HSG B
0.092	91	Gravel Roads, HSG D
8.901	69	Pasture/grassland/range, Fair, HSG B
0.446	84	Pasture/grassland/range, Fair, HSG D
0.007	93	Paved roads w/open ditches, 50% imp, HSG D
1.319	69	Vineyard, Fair, HSG B
8.401	61	Vineyard, Good, HSG B
0.862	81	Vineyard, Good, HSG D
2.192	60	Woods, Fair, HSG B
0.021	79	Woods, Fair, HSG D
0.521	55	Woods, Good, HSG B
8.875	77	Woods, Good, HSG D
2.576	65	Woods/grass comb., Fair, HSG B
1.081	82	Woods/grass comb., Fair, HSG D
37.074	70	Weighted Average
37.071		99.99% Pervious Area
0.003		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	56	0.0500	0.11		Sheet Flow, Sheet-1
					Woods: Light underbrush n= 0.400 P2= 3.78"
5.1	1,637	0.1100	5.34		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
3.2	1,365	0.0800	7.02	14.05	Trap/Vee/Rect Channel Flow, Stream
					Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00'
					n= 0.035
16.9	3,058	Total			

Post-Project WS1

Prepared by Microsoft

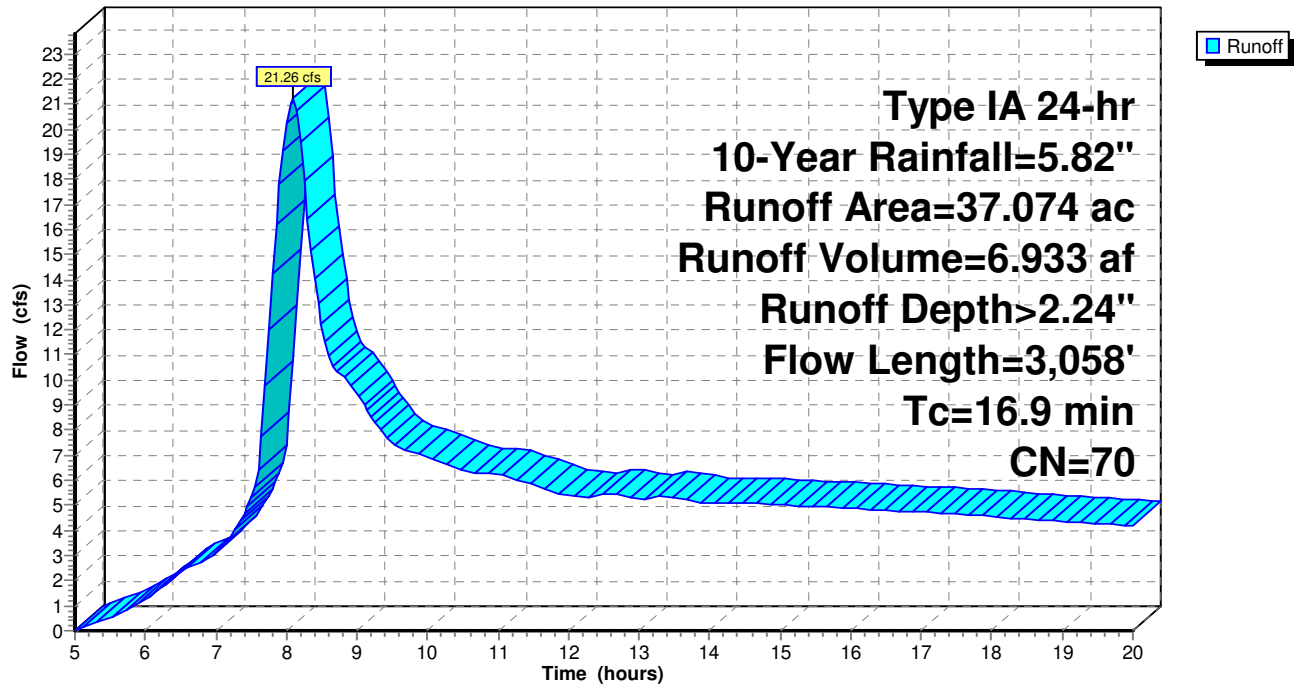
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PPI Engineering
Type IA 24-hr 10-Year Rainfall=5.82"

Printed 5/16/2019

Subcatchment WS1: WATERSHED 1

Hydrograph



Post-Project WS1

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Type IA 24-hr 50-Year Rainfall=7.89"

Printed 5/16/2019

Summary for Subcatchment WS1: WATERSHED 1

Runoff = 37.72 cfs @ 8.08 hrs, Volume= 11.523 af, Depth> 3.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 50-Year Rainfall=7.89"

Area (ac)	CN	Description
0.183	82	Dirt roads, HSG B
0.034	89	Dirt roads, HSG D
1.352	86	Farmsteads, HSG D
0.213	85	Gravel Roads, HSG B
0.092	91	Gravel Roads, HSG D
8.901	69	Pasture/grassland/range, Fair, HSG B
0.446	84	Pasture/grassland/range, Fair, HSG D
0.007	93	Paved roads w/open ditches, 50% imp, HSG D
1.319	69	Vineyard, Fair, HSG B
8.401	61	Vineyard, Good, HSG B
0.862	81	Vineyard, Good, HSG D
2.192	60	Woods, Fair, HSG B
0.021	79	Woods, Fair, HSG D
0.521	55	Woods, Good, HSG B
8.875	77	Woods, Good, HSG D
2.576	65	Woods/grass comb., Fair, HSG B
1.081	82	Woods/grass comb., Fair, HSG D
37.074	70	Weighted Average
37.071		99.99% Pervious Area
0.003		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	56	0.0500	0.11		Sheet Flow, Sheet-1
					Woods: Light underbrush n= 0.400 P2= 3.78"
5.1	1,637	0.1100	5.34		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
3.2	1,365	0.0800	7.02	14.05	Trap/Vee/Rect Channel Flow, Stream
					Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00'
					n= 0.035
16.9	3,058	Total			

Post-Project WS1

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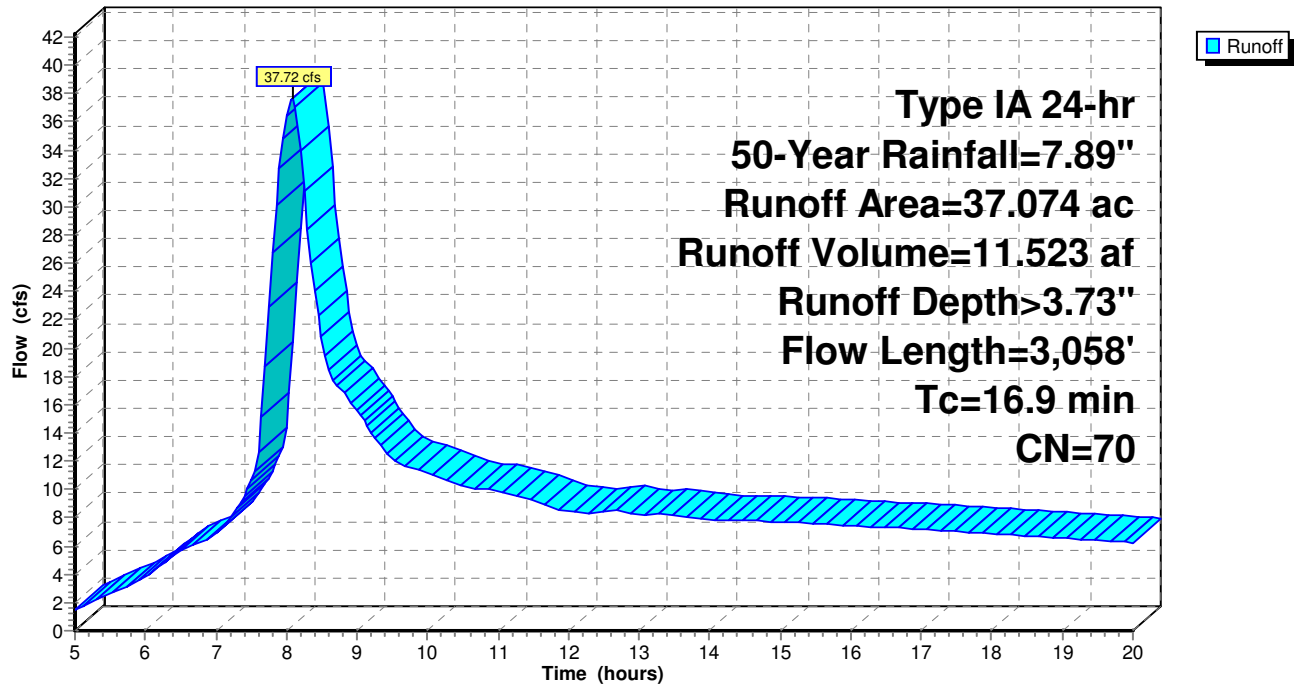
PPI Engineering

Type IA 24-hr 50-Year Rainfall=7.89"

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Subcatchment WS1: WATERSHED 1

Hydrograph



Post-Project WS1

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 Type IA 24-hr 100-Year Rainfall=8.78"
 Printed 5/16/2019

Summary for Subcatchment WS1: WATERSHED 1

Runoff = 45.22 cfs @ 8.08 hrs, Volume= 13.580 af, Depth> 4.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
0.183	82	Dirt roads, HSG B
0.034	89	Dirt roads, HSG D
1.352	86	Farmsteads, HSG D
0.213	85	Gravel Roads, HSG B
0.092	91	Gravel Roads, HSG D
8.901	69	Pasture/grassland/range, Fair, HSG B
0.446	84	Pasture/grassland/range, Fair, HSG D
0.007	93	Paved roads w/open ditches, 50% imp, HSG D
1.319	69	Vineyard, Fair, HSG B
8.401	61	Vineyard, Good, HSG B
0.862	81	Vineyard, Good, HSG D
2.192	60	Woods, Fair, HSG B
0.021	79	Woods, Fair, HSG D
0.521	55	Woods, Good, HSG B
8.875	77	Woods, Good, HSG D
2.576	65	Woods/grass comb., Fair, HSG B
1.081	82	Woods/grass comb., Fair, HSG D
37.074	70	Weighted Average
37.071		99.99% Pervious Area
0.003		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	56	0.0500	0.11		Sheet Flow, Sheet-1
					Woods: Light underbrush n= 0.400 P2= 3.78"
5.1	1,637	0.1100	5.34		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
3.2	1,365	0.0800	7.02	14.05	Trap/Vee/Rect Channel Flow, Stream
					Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00'
					n= 0.035
16.9	3,058	Total			

Post-Project WS1

Prepared by Microsoft

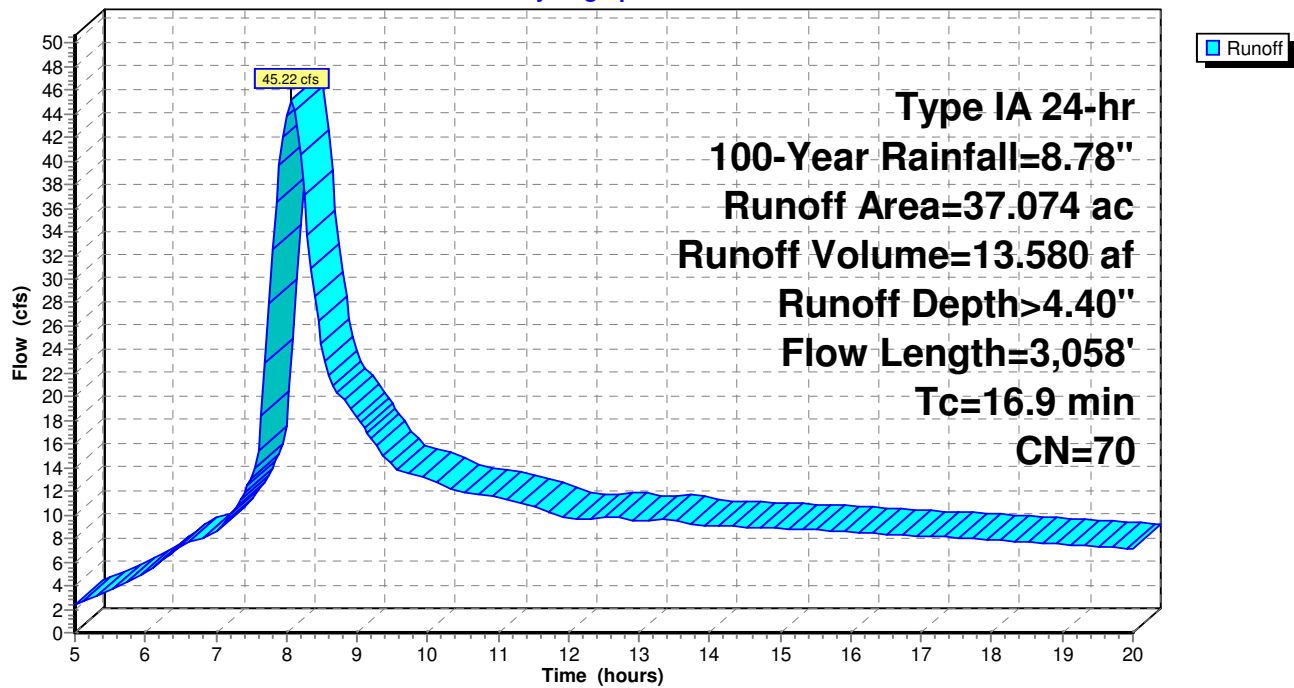
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Type IA 24-hr 100-Year Rainfall=8.78"

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Subcatchment WS1: WATERSHED 1

Hydrograph



Pre-Project WS2

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 Type IA 24-hr 2-Year Rainfall=3.78"
 Printed 5/16/2019

Summary for Subcatchment WS2: WATERSHED 2

Runoff = 5.52 cfs @ 8.10 hrs, Volume= 2.105 af, Depth> 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 2-Year Rainfall=3.78"

Area (ac)	CN	Description
0.718	86	Farmsteads, HSG D
10.752	69	Pasture/grassland/range, Fair, HSG B
0.813	84	Pasture/grassland/range, Fair, HSG D
0.025	89	Paved roads w/open ditches, 50% imp, HSG B
0.181	93	Paved roads w/open ditches, 50% imp, HSG D
2.883	69	Vineyard, Fair, HSG B
1.696	55	Woods, Good, HSG B
1.756	70	Woods, Good, HSG C
4.192	77	Woods, Good, HSG D
0.995	65	Woods/grass comb., Fair, HSG B
0.789	76	Woods/grass comb., Fair, HSG C
24.800	71	Weighted Average
24.697		99.58% Pervious Area
0.103		0.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.1900	0.21		Sheet Flow, Sheet-1 Woods: Light underbrush n= 0.400 P2= 3.78"
0.5	266	0.3300	9.25		Shallow Concentrated Flow, Shallow-1 Unpaved Kv= 16.1 fps
0.4	133	0.0600	6.08	12.16	Trap/Vee/Rect Channel Flow, Roadside Ditch Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
0.3	155	0.1000	7.83	1.54	Pipe Channel, 6" SWCPP 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.015
5.0	1,073	0.0500	3.60		Shallow Concentrated Flow, Shallow-2 Unpaved Kv= 16.1 fps
1.8	873	0.1100	8.23	16.47	Trap/Vee/Rect Channel Flow, Stream Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
16.0	2,600	Total			

Pre-Project WS2

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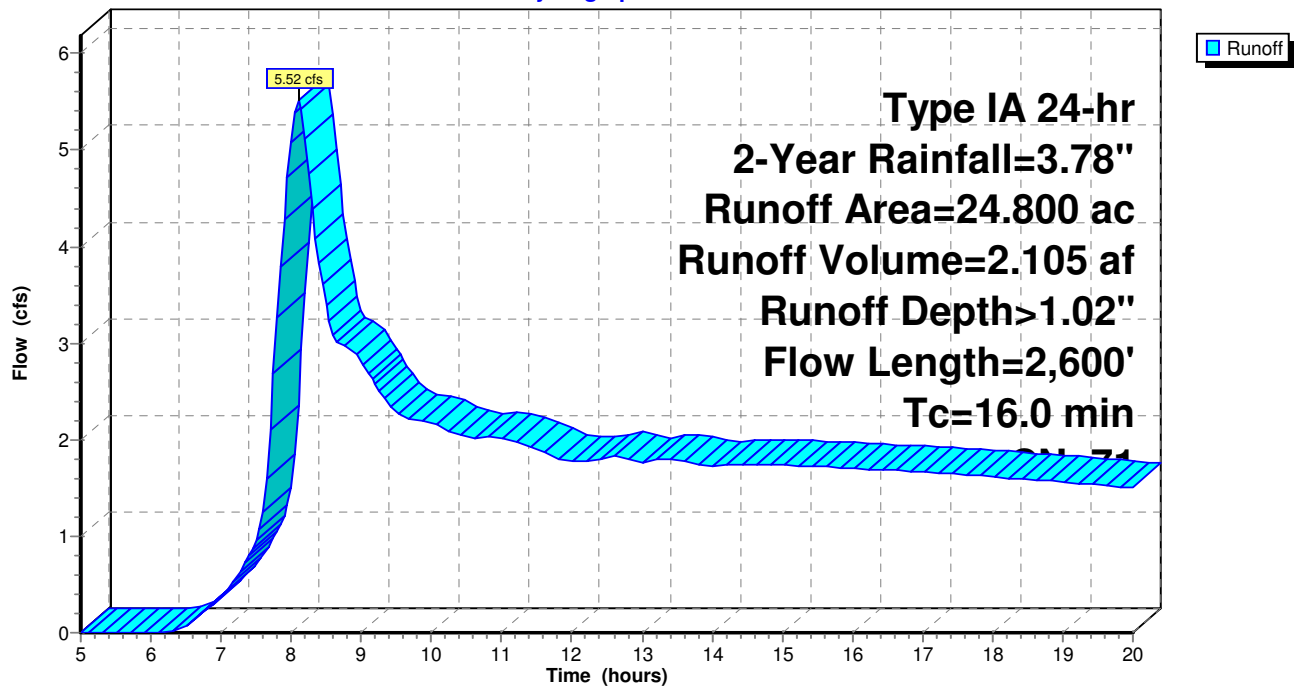
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Type IA 24-hr 2-Year Rainfall=3.78"

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Subcatchment WS2: WATERSHED 2

Hydrograph



Pre-Project WS2

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Type IA 24-hr 10-Year Rainfall=5.82"

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Summary for Subcatchment WS2: WATERSHED 2

Runoff = 15.06 cfs @ 8.08 hrs, Volume= 4.814 af, Depth> 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=5.82"

Area (ac)	CN	Description
0.718	86	Farmsteads, HSG D
10.752	69	Pasture/grassland/range, Fair, HSG B
0.813	84	Pasture/grassland/range, Fair, HSG D
0.025	89	Paved roads w/open ditches, 50% imp, HSG B
0.181	93	Paved roads w/open ditches, 50% imp, HSG D
2.883	69	Vineyard, Fair, HSG B
1.696	55	Woods, Good, HSG B
1.756	70	Woods, Good, HSG C
4.192	77	Woods, Good, HSG D
0.995	65	Woods/grass comb., Fair, HSG B
0.789	76	Woods/grass comb., Fair, HSG C
24.800	71	Weighted Average
24.697		99.58% Pervious Area
0.103		0.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.1900	0.21		Sheet Flow, Sheet-1 Woods: Light underbrush n= 0.400 P2= 3.78"
0.5	266	0.3300	9.25		Shallow Concentrated Flow, Shallow-1 Unpaved Kv= 16.1 fps
0.4	133	0.0600	6.08	12.16	Trap/Vee/Rect Channel Flow, Roadside Ditch Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
0.3	155	0.1000	7.83	1.54	Pipe Channel, 6" SWCPP 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.015
5.0	1,073	0.0500	3.60		Shallow Concentrated Flow, Shallow-2 Unpaved Kv= 16.1 fps
1.8	873	0.1100	8.23	16.47	Trap/Vee/Rect Channel Flow, Stream Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
16.0	2,600	Total			

Pre-Project WS2

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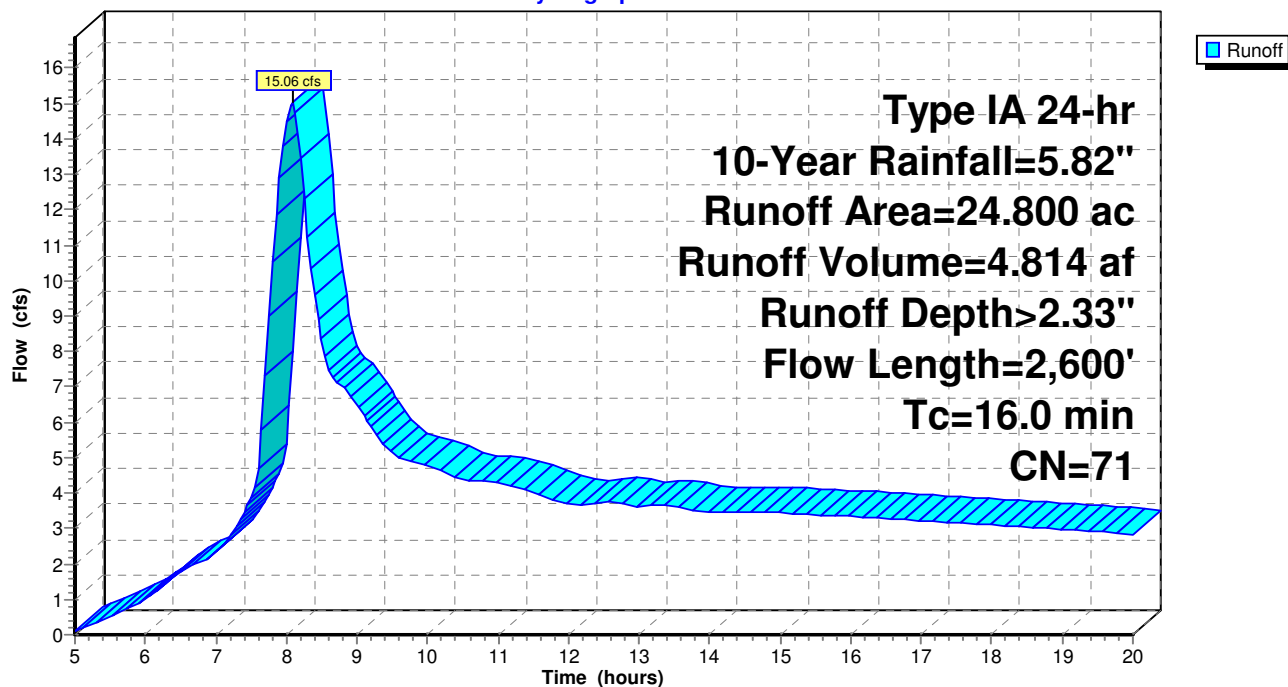
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Type IA 24-hr 10-Year Rainfall=5.82"

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Subcatchment WS2: WATERSHED 2

Hydrograph



Pre-Project WS2

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Type IA 24-hr 50-Year Rainfall=7.89"

Printed 5/16/2019

Summary for Subcatchment WS2: WATERSHED 2

Runoff = 26.26 cfs @ 8.07 hrs, Volume= 7.919 af, Depth> 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 50-Year Rainfall=7.89"

Area (ac)	CN	Description
0.718	86	Farmsteads, HSG D
10.752	69	Pasture/grassland/range, Fair, HSG B
0.813	84	Pasture/grassland/range, Fair, HSG D
0.025	89	Paved roads w/open ditches, 50% imp, HSG B
0.181	93	Paved roads w/open ditches, 50% imp, HSG D
2.883	69	Vineyard, Fair, HSG B
1.696	55	Woods, Good, HSG B
1.756	70	Woods, Good, HSG C
4.192	77	Woods, Good, HSG D
0.995	65	Woods/grass comb., Fair, HSG B
0.789	76	Woods/grass comb., Fair, HSG C
24.800	71	Weighted Average
24.697		99.58% Pervious Area
0.103		0.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.1900	0.21		Sheet Flow, Sheet-1 Woods: Light underbrush n= 0.400 P2= 3.78"
0.5	266	0.3300	9.25		Shallow Concentrated Flow, Shallow-1 Unpaved Kv= 16.1 fps
0.4	133	0.0600	6.08	12.16	Trap/Vee/Rect Channel Flow, Roadside Ditch Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
0.3	155	0.1000	7.83	1.54	Pipe Channel, 6" SWCPP 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.015
5.0	1,073	0.0500	3.60		Shallow Concentrated Flow, Shallow-2 Unpaved Kv= 16.1 fps
1.8	873	0.1100	8.23	16.47	Trap/Vee/Rect Channel Flow, Stream Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
16.0	2,600	Total			

Pre-Project WS2

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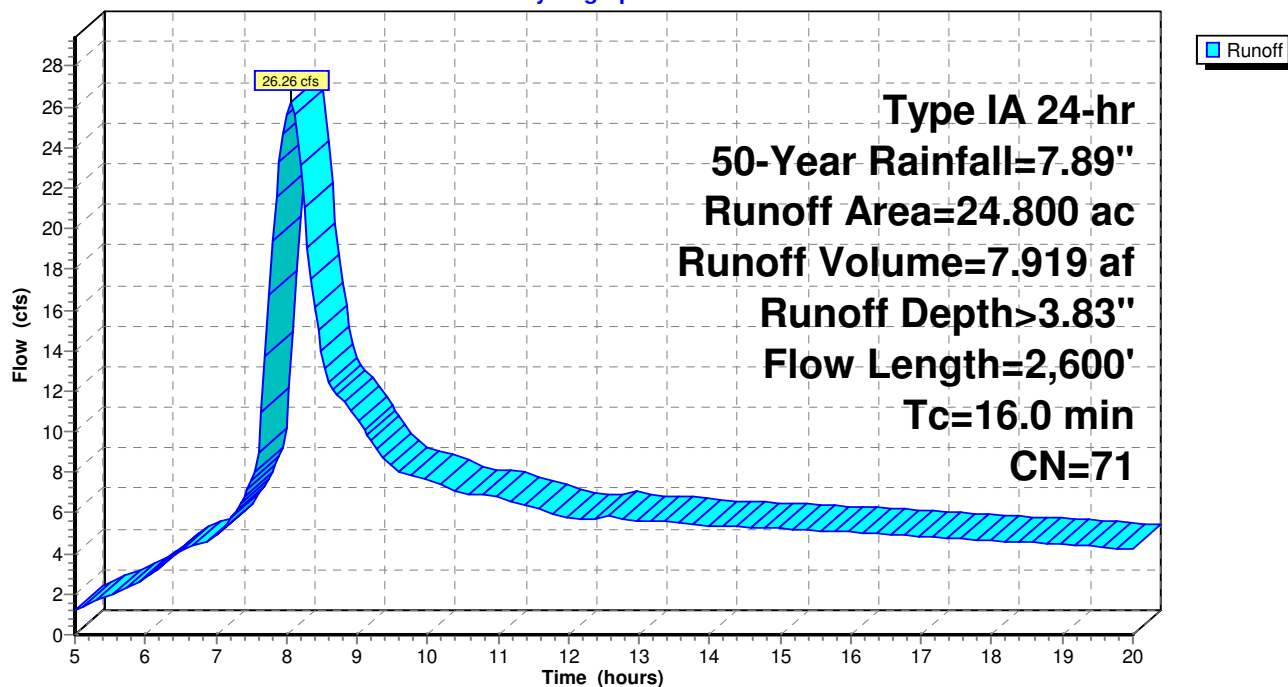
PPI Engineering

Type IA 24-hr 50-Year Rainfall=7.89"

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Subcatchment WS2: WATERSHED 2

Hydrograph



Pre-Project WS2

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 Type IA 24-hr 100-Year Rainfall=8.78"
 Printed 5/16/2019

Summary for Subcatchment WS2: WATERSHED 2

Runoff = 31.36 cfs @ 8.06 hrs, Volume= 9.306 af, Depth> 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
0.718	86	Farmsteads, HSG D
10.752	69	Pasture/grassland/range, Fair, HSG B
0.813	84	Pasture/grassland/range, Fair, HSG D
0.025	89	Paved roads w/open ditches, 50% imp, HSG B
0.181	93	Paved roads w/open ditches, 50% imp, HSG D
2.883	69	Vineyard, Fair, HSG B
1.696	55	Woods, Good, HSG B
1.756	70	Woods, Good, HSG C
4.192	77	Woods, Good, HSG D
0.995	65	Woods/grass comb., Fair, HSG B
0.789	76	Woods/grass comb., Fair, HSG C
24.800	71	Weighted Average
24.697		99.58% Pervious Area
0.103		0.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.1900	0.21		Sheet Flow, Sheet-1 Woods: Light underbrush n= 0.400 P2= 3.78"
0.5	266	0.3300	9.25		Shallow Concentrated Flow, Shallow-1 Unpaved Kv= 16.1 fps
0.4	133	0.0600	6.08	12.16	Trap/Vee/Rect Channel Flow, Roadside Ditch Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
0.3	155	0.1000	7.83	1.54	Pipe Channel, 6" SWCPP 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.015
5.0	1,073	0.0500	3.60		Shallow Concentrated Flow, Shallow-2 Unpaved Kv= 16.1 fps
1.8	873	0.1100	8.23	16.47	Trap/Vee/Rect Channel Flow, Stream Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
16.0	2,600	Total			

Pre-Project WS2

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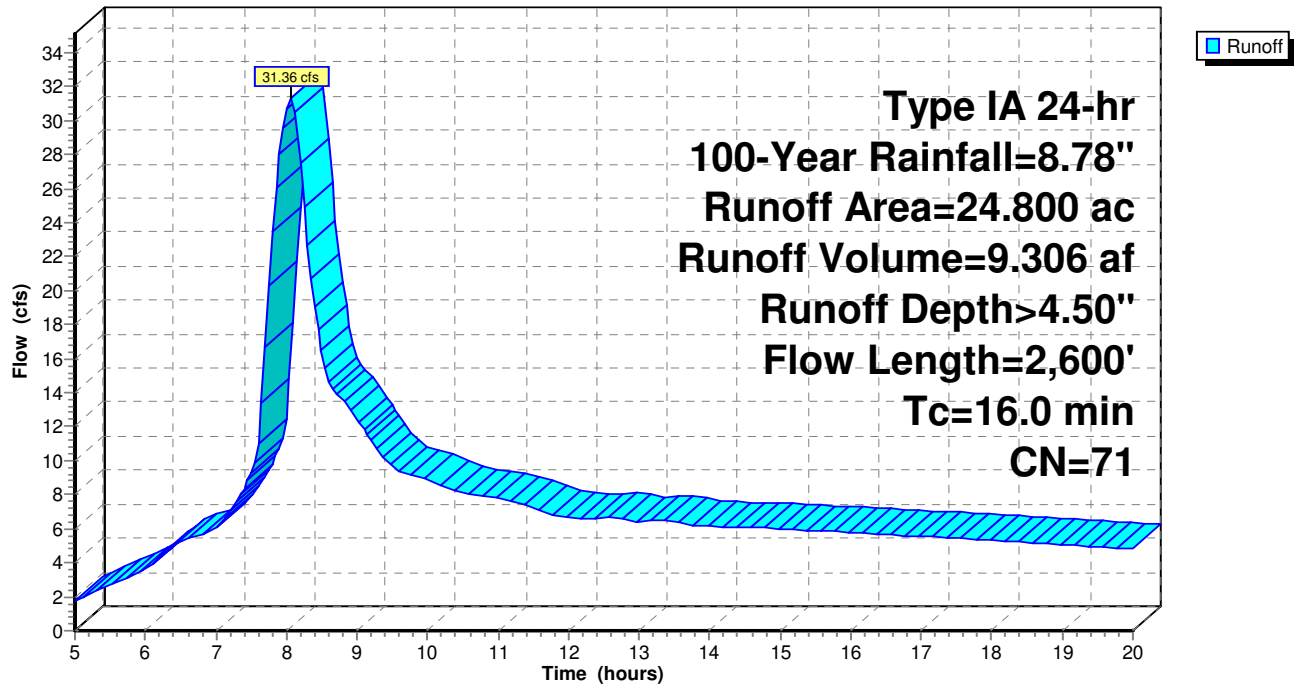
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Type IA 24-hr 100-Year Rainfall=8.78"

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Subcatchment WS2: WATERSHED 2

Hydrograph



Post-Project WS2

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 Type IA 24-hr 2-Year Rainfall=3.78"
 Printed 5/16/2019

Summary for Subcatchment WS2: WATERSHED 2

Runoff = 4.60 cfs @ 8.11 hrs, Volume= 1.884 af, Depth> 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 2-Year Rainfall=3.78"

Area (ac)	CN	Description
0.691	86	Farmsteads, HSG D
4.188	69	Pasture/grassland/range, Fair, HSG B
0.260	84	Pasture/grassland/range, Fair, HSG D
0.026	89	Paved roads w/open ditches, 50% imp, HSG B
0.181	93	Paved roads w/open ditches, 50% imp, HSG D
2.883	69	Vineyard, Fair, HSG B
7.796	61	Vineyard, Good, HSG B
0.605	75	Vineyard, Good, HSG C
0.738	81	Vineyard, Good, HSG D
1.418	55	Woods, Good, HSG B
1.153	70	Woods, Good, HSG C
4.034	77	Woods, Good, HSG D
0.041	65	Woods/grass comb., Fair, HSG B
0.786	76	Woods/grass comb., Fair, HSG C
24.800	69	Weighted Average
24.696		99.58% Pervious Area
0.103		0.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.1900	0.21		Sheet Flow, Sheet-1 Woods: Light underbrush n= 0.400 P2= 3.78"
0.5	266	0.3300	9.25		Shallow Concentrated Flow, Shallow-1 Unpaved Kv= 16.1 fps
0.4	133	0.0600	6.08	12.16	Trap/Vee/Rect Channel Flow, Roadside Ditch Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
0.3	155	0.1000	7.83	1.54	Pipe Channel, 6" SWCPP 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.015
5.0	1,073	0.0500	3.60		Shallow Concentrated Flow, Shallow-2 Unpaved Kv= 16.1 fps
1.8	873	0.1100	8.23	16.47	Trap/Vee/Rect Channel Flow, Stream Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
16.0	2,600	Total			

Post-Project WS2

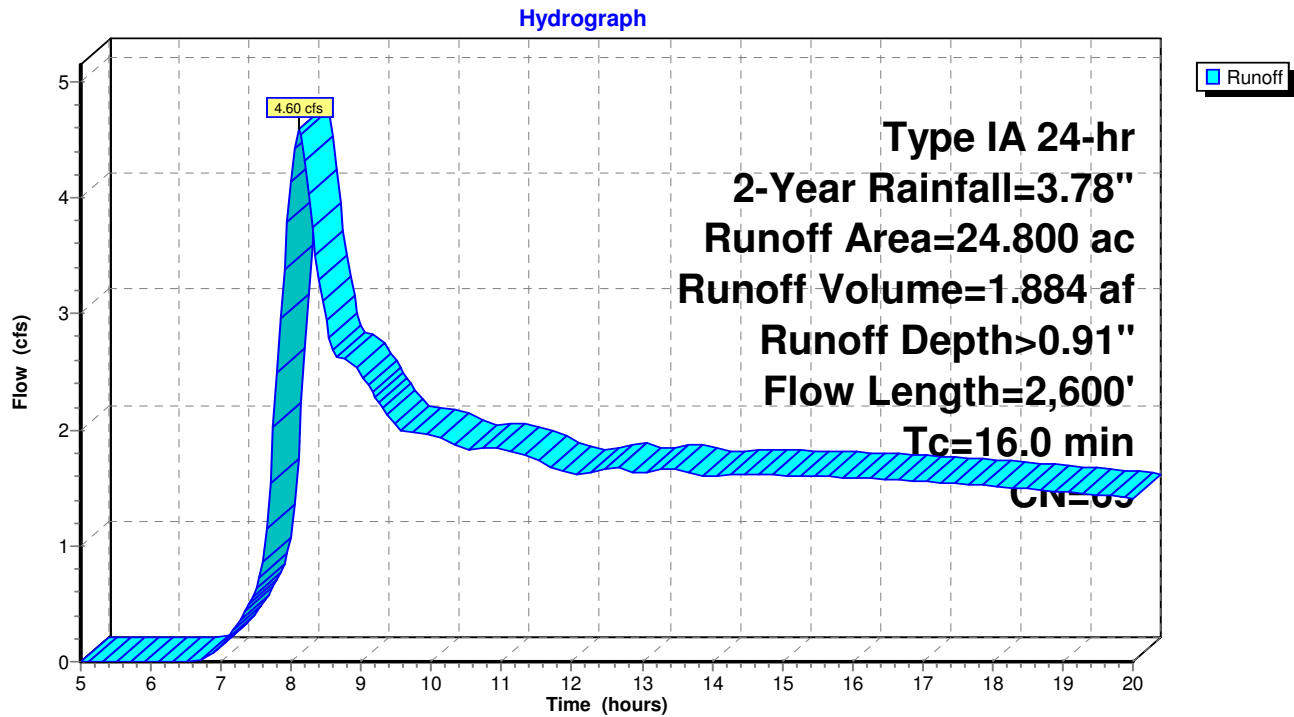
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Type IA 24-hr 2-Year Rainfall=3.78"

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Subcatchment WS2: WATERSHED 2



Post-Project WS2

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Type IA 24-hr 10-Year Rainfall=5.82"

Printed 5/16/2019

Summary for Subcatchment WS2: WATERSHED 2

Runoff = 13.63 cfs @ 8.08 hrs, Volume= 4.469 af, Depth> 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=5.82"

Area (ac)	CN	Description
0.691	86	Farmsteads, HSG D
4.188	69	Pasture/grassland/range, Fair, HSG B
0.260	84	Pasture/grassland/range, Fair, HSG D
0.026	89	Paved roads w/open ditches, 50% imp, HSG B
0.181	93	Paved roads w/open ditches, 50% imp, HSG D
2.883	69	Vineyard, Fair, HSG B
7.796	61	Vineyard, Good, HSG B
0.605	75	Vineyard, Good, HSG C
0.738	81	Vineyard, Good, HSG D
1.418	55	Woods, Good, HSG B
1.153	70	Woods, Good, HSG C
4.034	77	Woods, Good, HSG D
0.041	65	Woods/grass comb., Fair, HSG B
0.786	76	Woods/grass comb., Fair, HSG C
24.800	69	Weighted Average
24.696		99.58% Pervious Area
0.103		0.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.1900	0.21		Sheet Flow, Sheet-1 Woods: Light underbrush n= 0.400 P2= 3.78"
0.5	266	0.3300	9.25		Shallow Concentrated Flow, Shallow-1 Unpaved Kv= 16.1 fps
0.4	133	0.0600	6.08	12.16	Trap/Vee/Rect Channel Flow, Roadside Ditch Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
0.3	155	0.1000	7.83	1.54	Pipe Channel, 6" SWCPP 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.015
5.0	1,073	0.0500	3.60		Shallow Concentrated Flow, Shallow-2 Unpaved Kv= 16.1 fps
1.8	873	0.1100	8.23	16.47	Trap/Vee/Rect Channel Flow, Stream Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
16.0	2,600	Total			

Post-Project WS2

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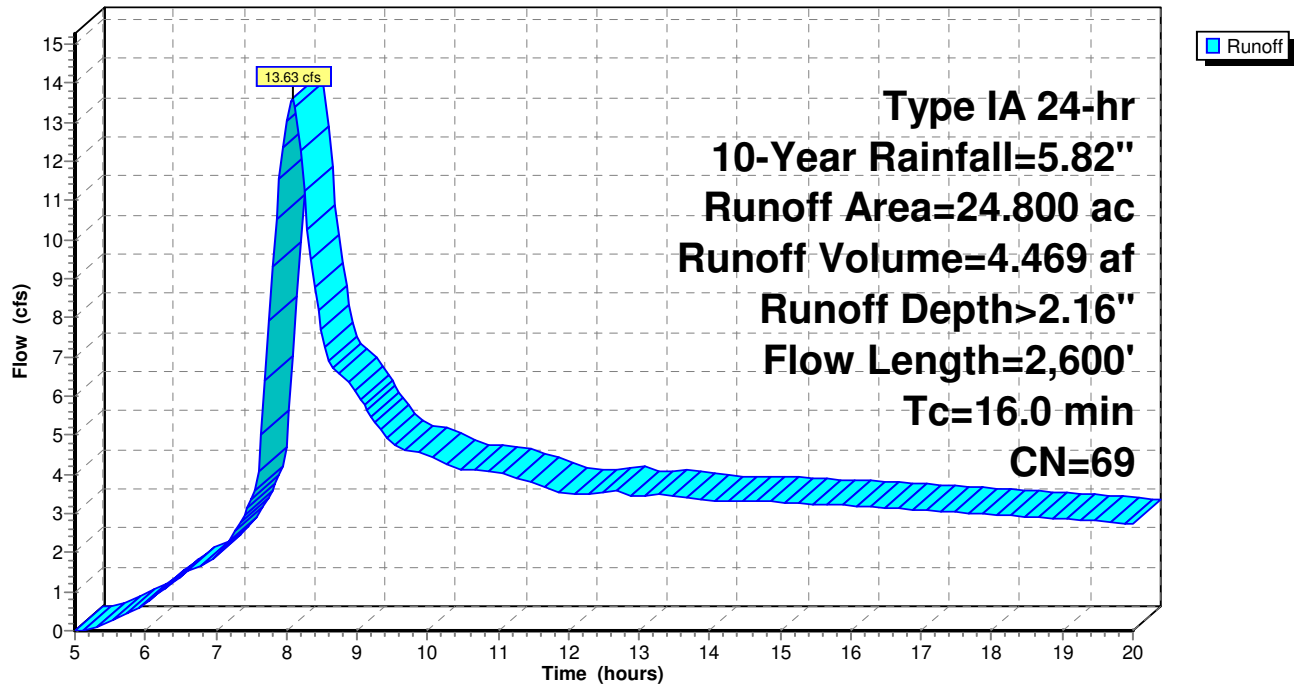
PPI Engineering

Type IA 24-hr 10-Year Rainfall=5.82"

Printed 5/16/2019

Subcatchment WS2: WATERSHED 2

Hydrograph



Post-Project WS2

Prepared by Microsoft

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PPI Engineering

Type IA 24-hr 50-Year Rainfall=7.89"

Printed 5/16/2019

Summary for Subcatchment WS2: WATERSHED 2

Runoff = 24.48 cfs @ 8.07 hrs, Volume= 7.503 af, Depth> 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 50-Year Rainfall=7.89"

Area (ac)	CN	Description
0.691	86	Farmsteads, HSG D
4.188	69	Pasture/grassland/range, Fair, HSG B
0.260	84	Pasture/grassland/range, Fair, HSG D
0.026	89	Paved roads w/open ditches, 50% imp, HSG B
0.181	93	Paved roads w/open ditches, 50% imp, HSG D
2.883	69	Vineyard, Fair, HSG B
7.796	61	Vineyard, Good, HSG B
0.605	75	Vineyard, Good, HSG C
0.738	81	Vineyard, Good, HSG D
1.418	55	Woods, Good, HSG B
1.153	70	Woods, Good, HSG C
4.034	77	Woods, Good, HSG D
0.041	65	Woods/grass comb., Fair, HSG B
0.786	76	Woods/grass comb., Fair, HSG C
24.800	69	Weighted Average
24.696		99.58% Pervious Area
0.103		0.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.1900	0.21		Sheet Flow, Sheet-1 Woods: Light underbrush n= 0.400 P2= 3.78"
0.5	266	0.3300	9.25		Shallow Concentrated Flow, Shallow-1 Unpaved Kv= 16.1 fps
0.4	133	0.0600	6.08	12.16	Trap/Vee/Rect Channel Flow, Roadside Ditch Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
0.3	155	0.1000	7.83	1.54	Pipe Channel, 6" SWCPP 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.015
5.0	1,073	0.0500	3.60		Shallow Concentrated Flow, Shallow-2 Unpaved Kv= 16.1 fps
1.8	873	0.1100	8.23	16.47	Trap/Vee/Rect Channel Flow, Stream Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
16.0	2,600	Total			

Post-Project WS2

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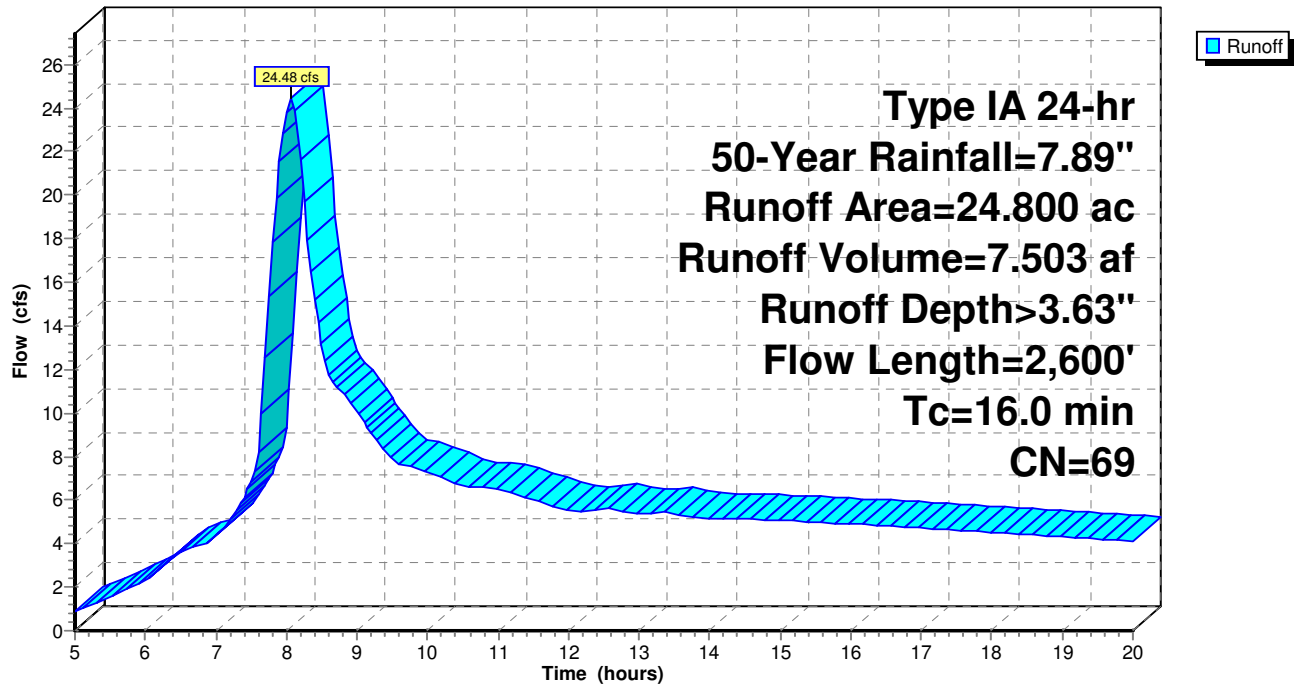
PPI Engineering

Type IA 24-hr 50-Year Rainfall=7.89"

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Subcatchment WS2: WATERSHED 2

Hydrograph



Post-Project WS2

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PPI Engineering
 Type IA 24-hr 100-Year Rainfall=8.78"
 Printed 5/16/2019

Summary for Subcatchment WS2: WATERSHED 2

Runoff = 29.46 cfs @ 8.07 hrs, Volume= 8.868 af, Depth> 4.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
0.691	86	Farmsteads, HSG D
4.188	69	Pasture/grassland/range, Fair, HSG B
0.260	84	Pasture/grassland/range, Fair, HSG D
0.026	89	Paved roads w/open ditches, 50% imp, HSG B
0.181	93	Paved roads w/open ditches, 50% imp, HSG D
2.883	69	Vineyard, Fair, HSG B
7.796	61	Vineyard, Good, HSG B
0.605	75	Vineyard, Good, HSG C
0.738	81	Vineyard, Good, HSG D
1.418	55	Woods, Good, HSG B
1.153	70	Woods, Good, HSG C
4.034	77	Woods, Good, HSG D
0.041	65	Woods/grass comb., Fair, HSG B
0.786	76	Woods/grass comb., Fair, HSG C
24.800	69	Weighted Average
24.696		99.58% Pervious Area
0.103		0.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.1900	0.21		Sheet Flow, Sheet-1 Woods: Light underbrush n= 0.400 P2= 3.78"
0.5	266	0.3300	9.25		Shallow Concentrated Flow, Shallow-1 Unpaved Kv= 16.1 fps
0.4	133	0.0600	6.08	12.16	Trap/Vee/Rect Channel Flow, Roadside Ditch Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
0.3	155	0.1000	7.83	1.54	Pipe Channel, 6" SWCPP 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.015
5.0	1,073	0.0500	3.60		Shallow Concentrated Flow, Shallow-2 Unpaved Kv= 16.1 fps
1.8	873	0.1100	8.23	16.47	Trap/Vee/Rect Channel Flow, Stream Bot.W=0.00' D=1.00' Z= 2.0 '/' Top.W=4.00' n= 0.035
16.0	2,600	Total			

Post-Project WS2

Prepared by Microsoft

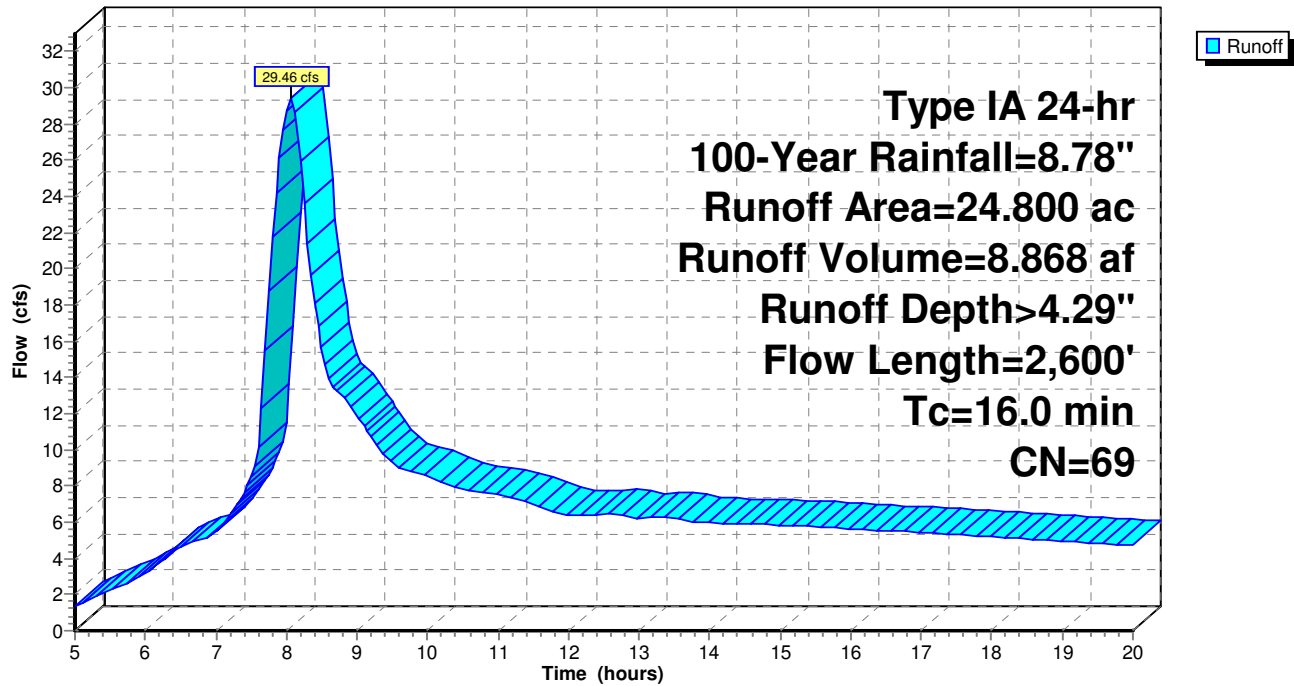
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PPI Engineering
Type IA 24-hr 100-Year Rainfall=8.78"

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Subcatchment WS2: WATERSHED 2

Hydrograph



Pre-Project WS3

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Type IA 24-hr 2-Year Rainfall=3.78"

Printed 5/16/2019

Summary for Subcatchment WS3: WATERSHED 3

Runoff = 3.43 cfs @ 8.04 hrs, Volume= 1.278 af, Depth> 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-Year Rainfall=3.78"

Area (ac)	CN	Description
0.045	74	Farmsteads, HSG B
0.418	86	Farmsteads, HSG D
7.817	69	Pasture/grassland/range, Fair, HSG B
0.492	84	Pasture/grassland/range, Fair, HSG D
2.571	60	Woods, Fair, HSG B
2.248	79	Woods, Fair, HSG D
0.519	55	Woods, Good, HSG B
0.338	65	Woods/grass comb., Fair, HSG B
0.088	76	Woods/grass comb., Fair, HSG C
1.279	82	Woods/grass comb., Fair, HSG D
15.814	70	Weighted Average
15.814		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	100	0.1600	0.29		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
3.9	1,404	0.1400	6.02		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
9.6	1,504	Total			

Pre-Project WS3

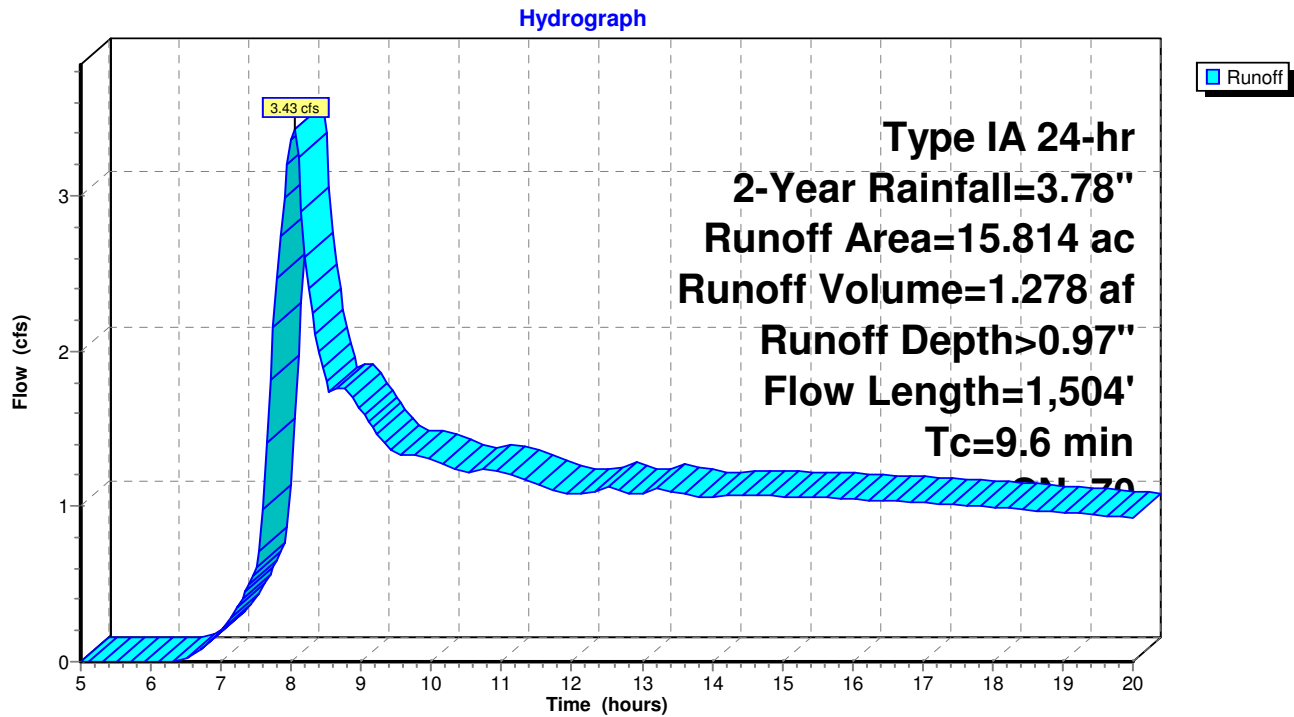
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Type IA 24-hr 2-Year Rainfall=3.78"

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Subcatchment WS3: WATERSHED 3



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Type IA 24-hr 10-Year Rainfall=5.82"

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Summary for Subcatchment WS3: WATERSHED 3

Runoff = 9.51 cfs @ 8.02 hrs, Volume= 2.974 af, Depth> 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=5.82"

Area (ac)	CN	Description
0.045	74	Farmsteads, HSG B
0.418	86	Farmsteads, HSG D
7.817	69	Pasture/grassland/range, Fair, HSG B
0.492	84	Pasture/grassland/range, Fair, HSG D
2.571	60	Woods, Fair, HSG B
2.248	79	Woods, Fair, HSG D
0.519	55	Woods, Good, HSG B
0.338	65	Woods/grass comb., Fair, HSG B
0.088	76	Woods/grass comb., Fair, HSG C
1.279	82	Woods/grass comb., Fair, HSG D
15.814	70	Weighted Average
15.814		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	100	0.1600	0.29		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
3.9	1,404	0.1400	6.02		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
9.6	1,504	Total			

Pre-Project WS3

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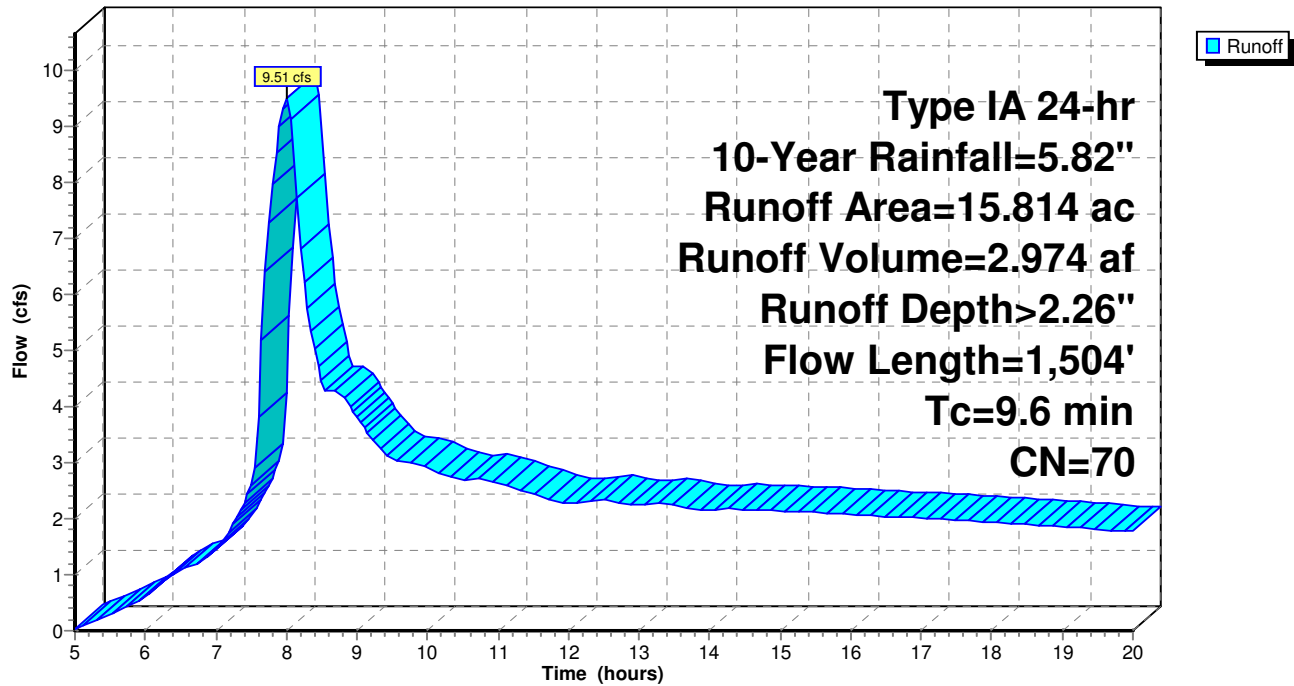
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Type IA 24-hr 10-Year Rainfall=5.82"

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Subcatchment WS3: WATERSHED 3

Hydrograph



Pre-Project WS3

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Type IA 24-hr 50-Year Rainfall=7.89"

Printed 5/16/2019

Summary for Subcatchment WS3: WATERSHED 3

Runoff = 16.77 cfs @ 8.00 hrs, Volume= 4.934 af, Depth> 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 50-Year Rainfall=7.89"

Area (ac)	CN	Description
0.045	74	Farmsteads, HSG B
0.418	86	Farmsteads, HSG D
7.817	69	Pasture/grassland/range, Fair, HSG B
0.492	84	Pasture/grassland/range, Fair, HSG D
2.571	60	Woods, Fair, HSG B
2.248	79	Woods, Fair, HSG D
0.519	55	Woods, Good, HSG B
0.338	65	Woods/grass comb., Fair, HSG B
0.088	76	Woods/grass comb., Fair, HSG C
1.279	82	Woods/grass comb., Fair, HSG D
15.814	70	Weighted Average
15.814		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	100	0.1600	0.29		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
3.9	1,404	0.1400	6.02		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
9.6	1,504	Total			

Pre-Project WS3

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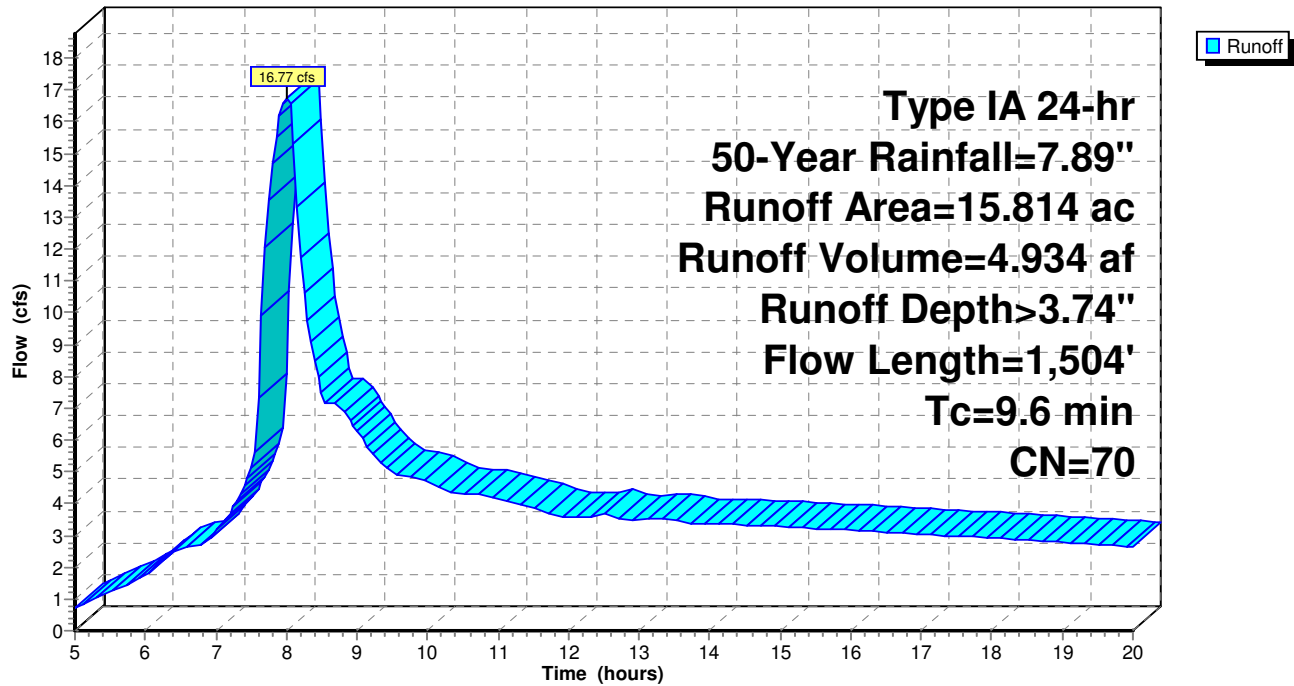
PPI Engineering

Type IA 24-hr 50-Year Rainfall=7.89"

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Subcatchment WS3: WATERSHED 3

Hydrograph



Pre-Project WS3

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Type IA 24-hr 100-Year Rainfall=8.78"

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Summary for Subcatchment WS3: WATERSHED 3

Runoff = 20.07 cfs @ 7.99 hrs, Volume= 5.811 af, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
0.045	74	Farmsteads, HSG B
0.418	86	Farmsteads, HSG D
7.817	69	Pasture/grassland/range, Fair, HSG B
0.492	84	Pasture/grassland/range, Fair, HSG D
2.571	60	Woods, Fair, HSG B
2.248	79	Woods, Fair, HSG D
0.519	55	Woods, Good, HSG B
0.338	65	Woods/grass comb., Fair, HSG B
0.088	76	Woods/grass comb., Fair, HSG C
1.279	82	Woods/grass comb., Fair, HSG D
15.814	70	Weighted Average
15.814		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	100	0.1600	0.29		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
3.9	1,404	0.1400	6.02		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
9.6	1,504	Total			

Pre-Project WS3

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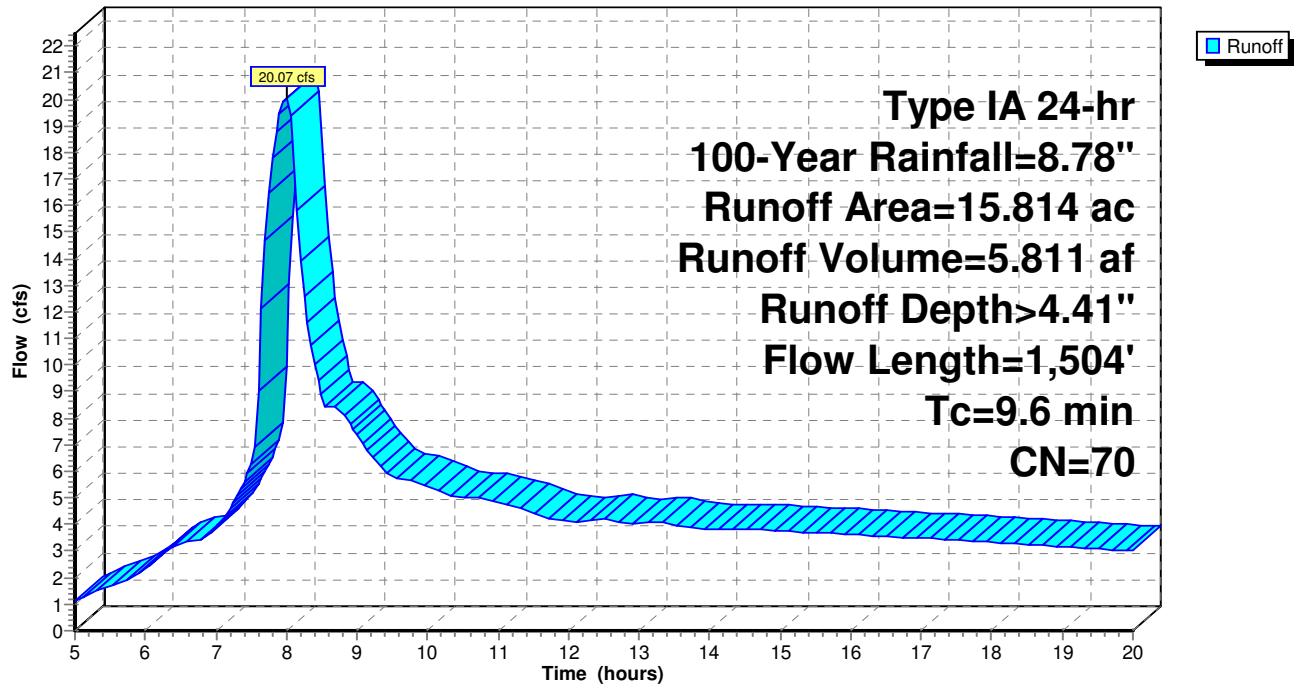
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PPI Engineering
Type IA 24-hr 100-Year Rainfall=8.78"

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Subcatchment WS3: WATERSHED 3

Hydrograph



Post-Project WS3

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PPI Engineering
 Type IA 24-hr 2-Year Rainfall=3.78"
 Printed 5/16/2019

Summary for Subcatchment WS3: WATERSHED 3

Runoff = 3.13 cfs @ 8.04 hrs, Volume= 1.209 af, Depth> 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 2-Year Rainfall=3.78"

Area (ac)	CN	Description
0.045	74	Farmsteads, HSG B
0.418	86	Farmsteads, HSG D
4.994	69	Pasture/grassland/range, Fair, HSG B
0.492	84	Pasture/grassland/range, Fair, HSG D
3.219	61	Vineyard, Good, HSG B
0.001	81	Vineyard, Good, HSG D
2.174	60	Woods, Fair, HSG B
2.247	79	Woods, Fair, HSG D
0.519	55	Woods, Good, HSG B
0.338	65	Woods/grass comb., Fair, HSG B
0.088	76	Woods/grass comb., Fair, HSG C
1.279	82	Woods/grass comb., Fair, HSG D
15.814	69	Weighted Average
15.814		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	100	0.1600	0.29		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
3.9	1,404	0.1400	6.02		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
9.6	1,504	Total			

Post-Project WS3

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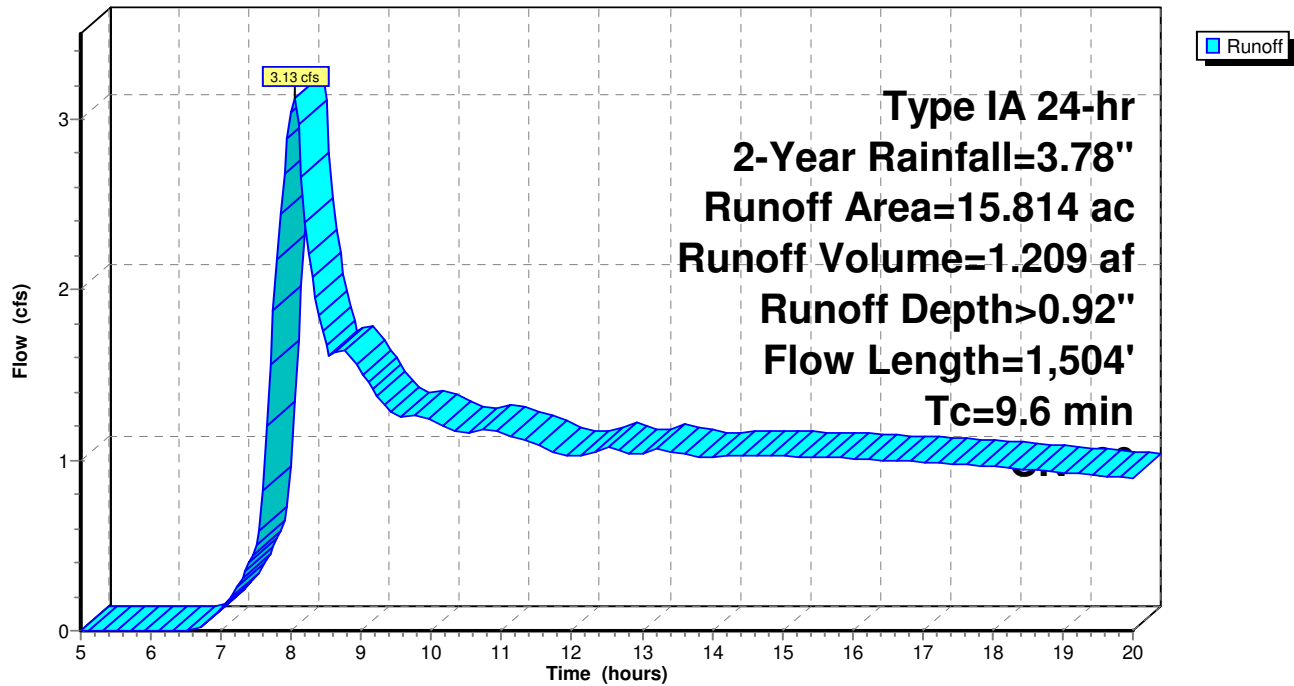
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Type IA 24-hr 2-Year Rainfall=3.78"

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Subcatchment WS3: WATERSHED 3

Hydrograph



Post-Project WS3

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Type IA 24-hr 10-Year Rainfall=5.82"

Printed 5/16/2019

Summary for Subcatchment WS3: WATERSHED 3

Runoff = 9.05 cfs @ 8.02 hrs, Volume= 2.864 af, Depth> 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=5.82"

Area (ac)	CN	Description
0.045	74	Farmsteads, HSG B
0.418	86	Farmsteads, HSG D
4.994	69	Pasture/grassland/range, Fair, HSG B
0.492	84	Pasture/grassland/range, Fair, HSG D
3.219	61	Vineyard, Good, HSG B
0.001	81	Vineyard, Good, HSG D
2.174	60	Woods, Fair, HSG B
2.247	79	Woods, Fair, HSG D
0.519	55	Woods, Good, HSG B
0.338	65	Woods/grass comb., Fair, HSG B
0.088	76	Woods/grass comb., Fair, HSG C
1.279	82	Woods/grass comb., Fair, HSG D
15.814	69	Weighted Average
15.814		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	100	0.1600	0.29		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
3.9	1,404	0.1400	6.02		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
9.6	1,504	Total			

Post-Project WS3

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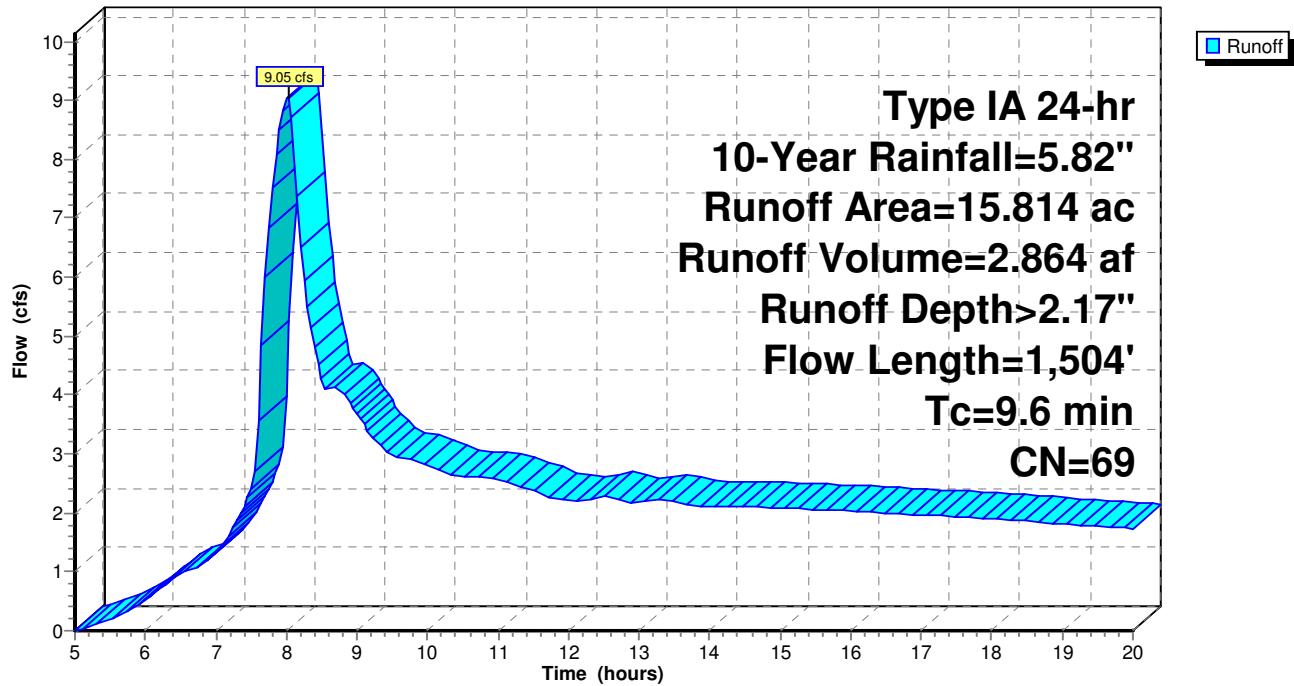
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Type IA 24-hr 10-Year Rainfall=5.82"

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Subcatchment WS3: WATERSHED 3

Hydrograph



Post-Project WS3

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PPI Engineering

Type IA 24-hr 50-Year Rainfall=7.89"

Printed 5/16/2019

Summary for Subcatchment WS3: WATERSHED 3

Runoff = 16.19 cfs @ 8.00 hrs, Volume= 4.801 af, Depth> 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 50-Year Rainfall=7.89"

Area (ac)	CN	Description
0.045	74	Farmsteads, HSG B
0.418	86	Farmsteads, HSG D
4.994	69	Pasture/grassland/range, Fair, HSG B
0.492	84	Pasture/grassland/range, Fair, HSG D
3.219	61	Vineyard, Good, HSG B
0.001	81	Vineyard, Good, HSG D
2.174	60	Woods, Fair, HSG B
2.247	79	Woods, Fair, HSG D
0.519	55	Woods, Good, HSG B
0.338	65	Woods/grass comb., Fair, HSG B
0.088	76	Woods/grass comb., Fair, HSG C
1.279	82	Woods/grass comb., Fair, HSG D
15.814	69	Weighted Average
15.814		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	100	0.1600	0.29		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
3.9	1,404	0.1400	6.02		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
9.6	1,504	Total			

Post-Project WS3

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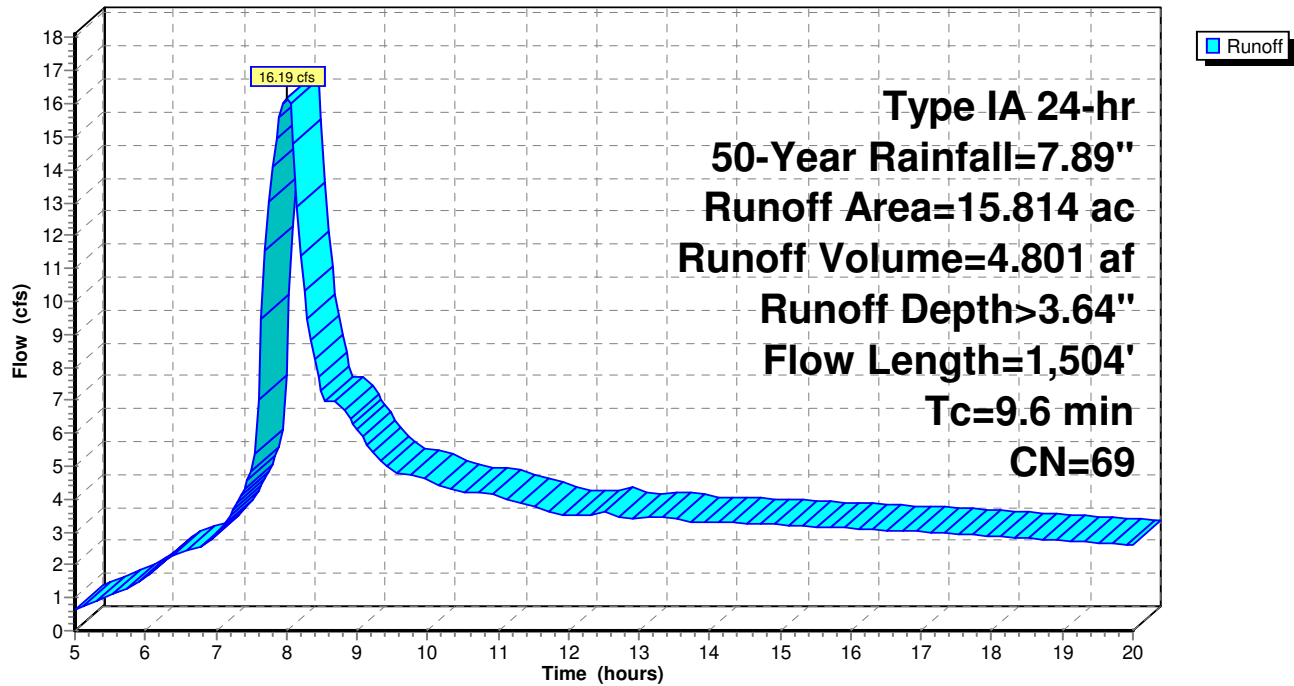
PPI Engineering

Type IA 24-hr 50-Year Rainfall=7.89"

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Subcatchment WS3: WATERSHED 3

Hydrograph



Post-Project WS3

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PPI Engineering
Type IA 24-hr 100-Year Rainfall=8.78"

Printed 5/16/2019

Summary for Subcatchment WS3: WATERSHED 3

Runoff = 19.46 cfs @ 8.00 hrs, Volume= 5.672 af, Depth> 4.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
0.045	74	Farmsteads, HSG B
0.418	86	Farmsteads, HSG D
4.994	69	Pasture/grassland/range, Fair, HSG B
0.492	84	Pasture/grassland/range, Fair, HSG D
3.219	61	Vineyard, Good, HSG B
0.001	81	Vineyard, Good, HSG D
2.174	60	Woods, Fair, HSG B
2.247	79	Woods, Fair, HSG D
0.519	55	Woods, Good, HSG B
0.338	65	Woods/grass comb., Fair, HSG B
0.088	76	Woods/grass comb., Fair, HSG C
1.279	82	Woods/grass comb., Fair, HSG D
15.814	69	Weighted Average
15.814		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	100	0.1600	0.29		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
3.9	1,404	0.1400	6.02		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
9.6	1,504	Total			

Post-Project WS3

Prepared by Microsoft

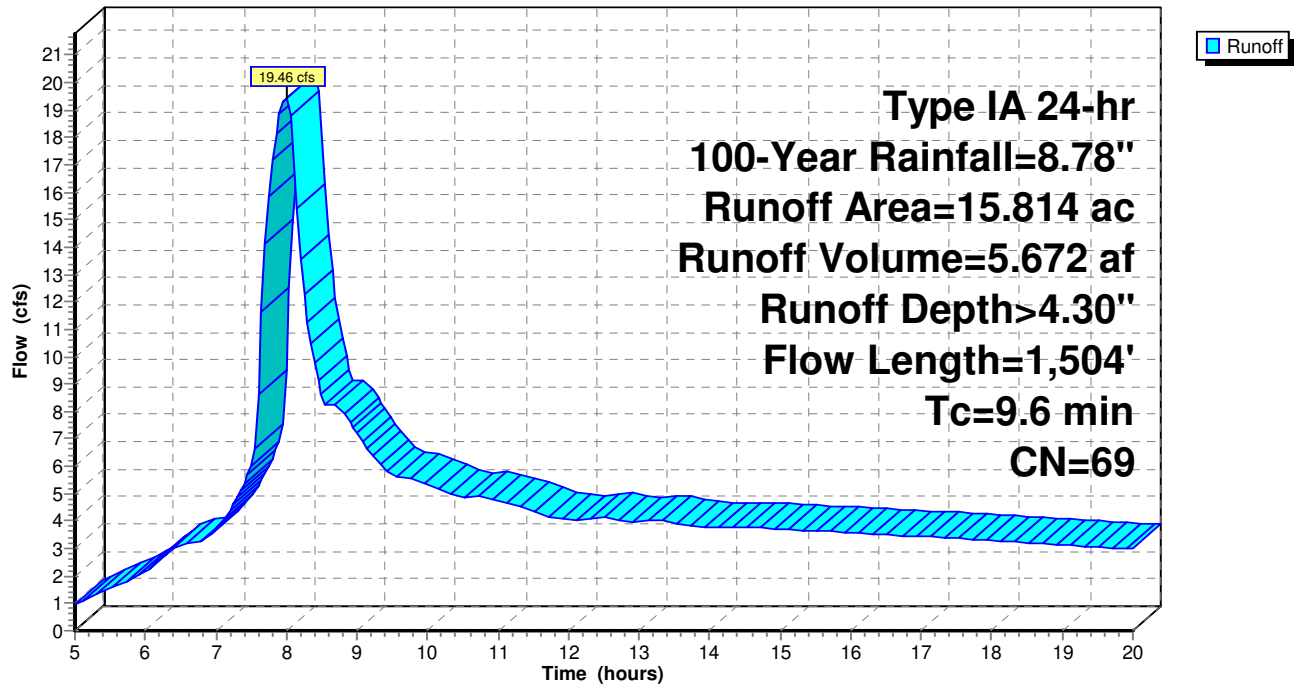
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PPI Engineering
Type IA 24-hr 100-Year Rainfall=8.78"

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Subcatchment WS3: WATERSHED 3

Hydrograph



Pre-Project WS4

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PPI Engineering
Type IA 24-hr 2-Year Rainfall=3.78"

Printed 5/16/2019

Summary for Subcatchment WS4: WATERSHED 4

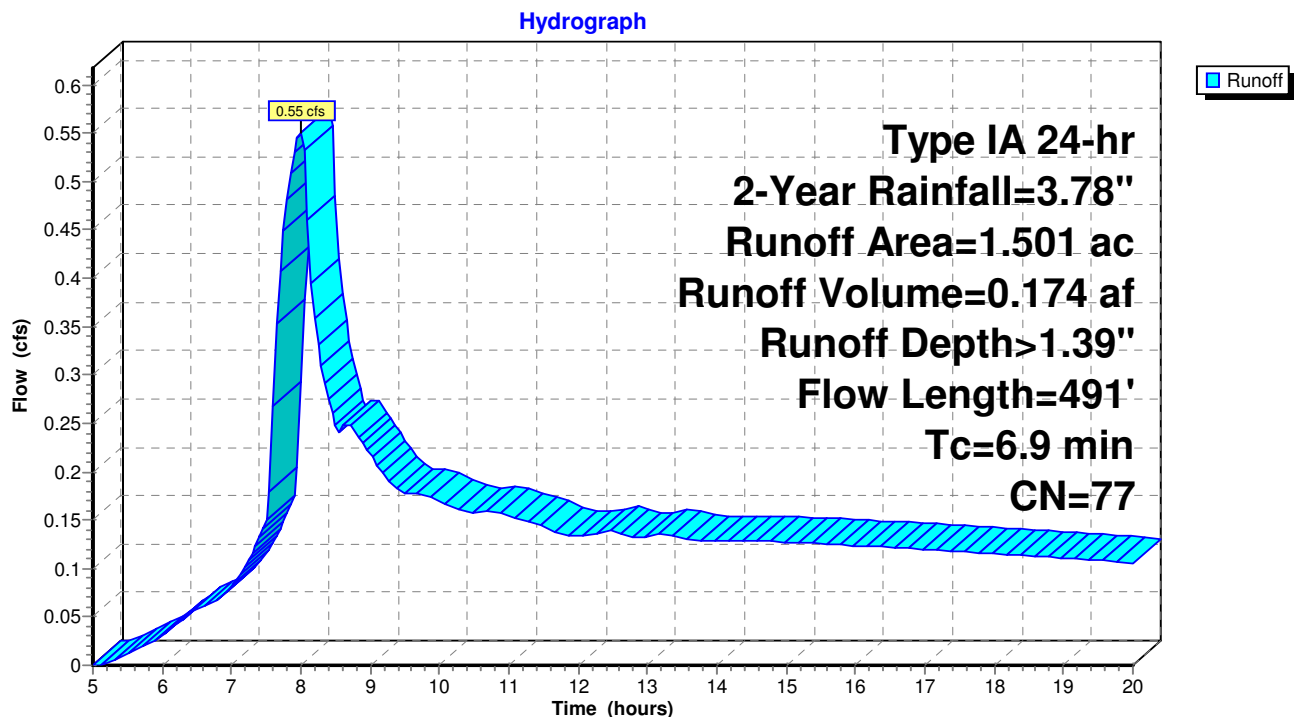
Runoff = 0.55 cfs @ 7.99 hrs, Volume= 0.174 af, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-Year Rainfall=3.78"

Area (ac)	CN	Description
1.007	79	Pasture/grassland/range, Fair, HSG C
0.369	70	Woods, Good, HSG C
0.124	76	Woods/grass comb., Fair, HSG C
1.501	77	Weighted Average
1.501		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	100	0.1500	0.28		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
1.0	391	0.1600	6.44		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
6.9	491	Total			

Subcatchment WS4: WATERSHED 4



Pre-Project WS4

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Type IA 24-hr 10-Year Rainfall=5.82"

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Summary for Subcatchment WS4: WATERSHED 4

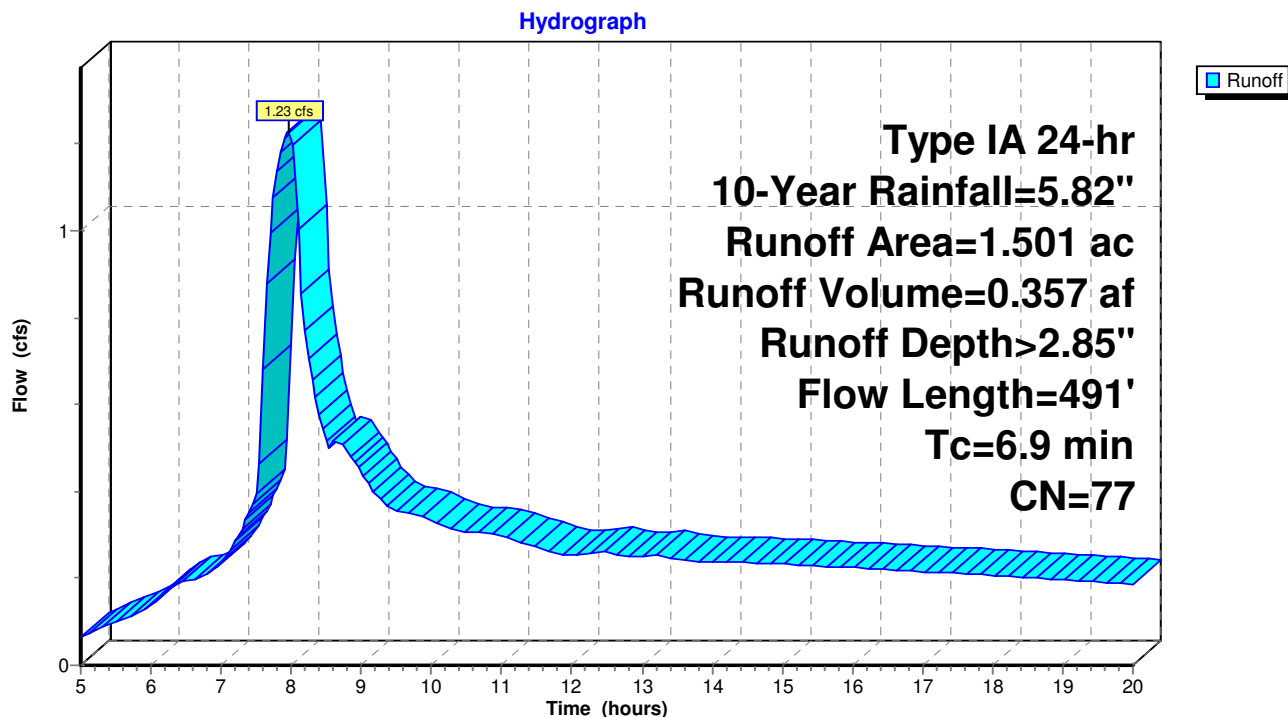
Runoff = 1.23 cfs @ 7.97 hrs, Volume= 0.357 af, Depth> 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=5.82"

Area (ac)	CN	Description
1.007	79	Pasture/grassland/range, Fair, HSG C
0.369	70	Woods, Good, HSG C
0.124	76	Woods/grass comb., Fair, HSG C
1.501	77	Weighted Average
1.501		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	100	0.1500	0.28		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
1.0	391	0.1600	6.44		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
6.9	491	Total			

Subcatchment WS4: WATERSHED 4



Pre-Project WS4

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Type IA 24-hr 50-Year Rainfall=7.89"

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Summary for Subcatchment WS4: WATERSHED 4

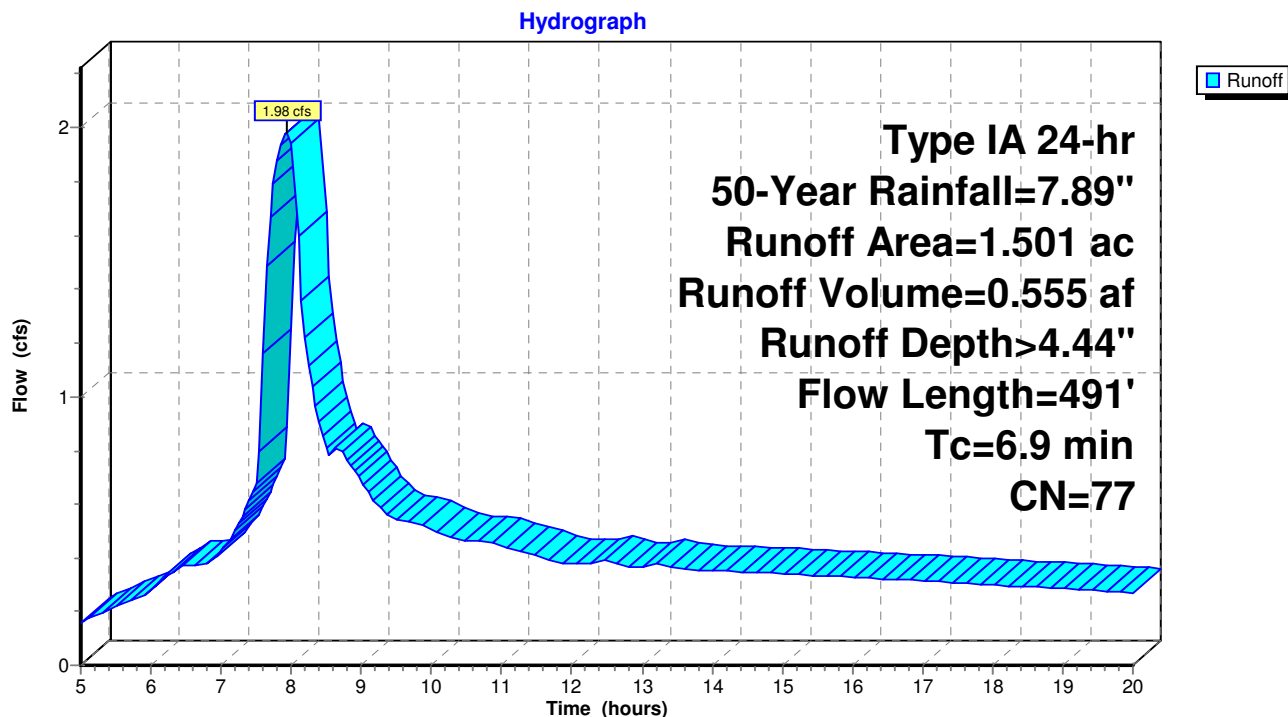
Runoff = 1.98 cfs @ 7.95 hrs, Volume= 0.555 af, Depth> 4.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 50-Year Rainfall=7.89"

Area (ac)	CN	Description
1.007	79	Pasture/grassland/range, Fair, HSG C
0.369	70	Woods, Good, HSG C
0.124	76	Woods/grass comb., Fair, HSG C
1.501	77	Weighted Average
1.501		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	100	0.1500	0.28		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
1.0	391	0.1600	6.44		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
6.9	491	Total			

Subcatchment WS4: WATERSHED 4



Pre-Project WS4

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Type IA 24-hr 100-Year Rainfall=8.78"

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Summary for Subcatchment WS4: WATERSHED 4

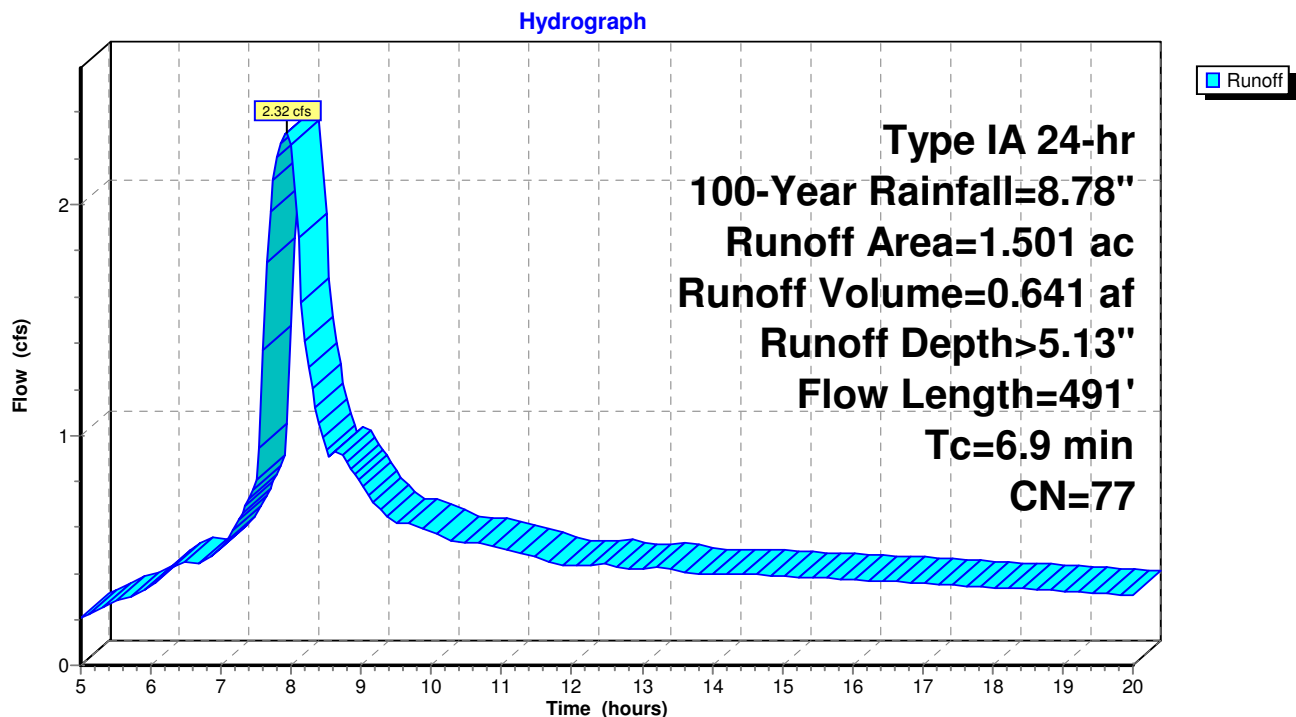
Runoff = 2.32 cfs @ 7.94 hrs, Volume= 0.641 af, Depth> 5.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-Year Rainfall=8.78"

Area (ac)	CN	Description
1.007	79	Pasture/grassland/range, Fair, HSG C
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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	100	0.1500	0.28		Sheet Flow, Sheet-1
					Grass: Dense n= 0.240 P2= 3.78"
1.0	391	0.1600	6.44		Shallow Concentrated Flow, Shallow-1
					Unpaved Kv= 16.1 fps
6.9	491	Total			

Subcatchment WS4: WATERSHED 4



Post-Project WS4

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PPI Engineering
Type IA 24-hr 2-Year Rainfall=3.78"
Printed 5/16/2019

Summary for Subcatchment WS4: WATERSHED 4

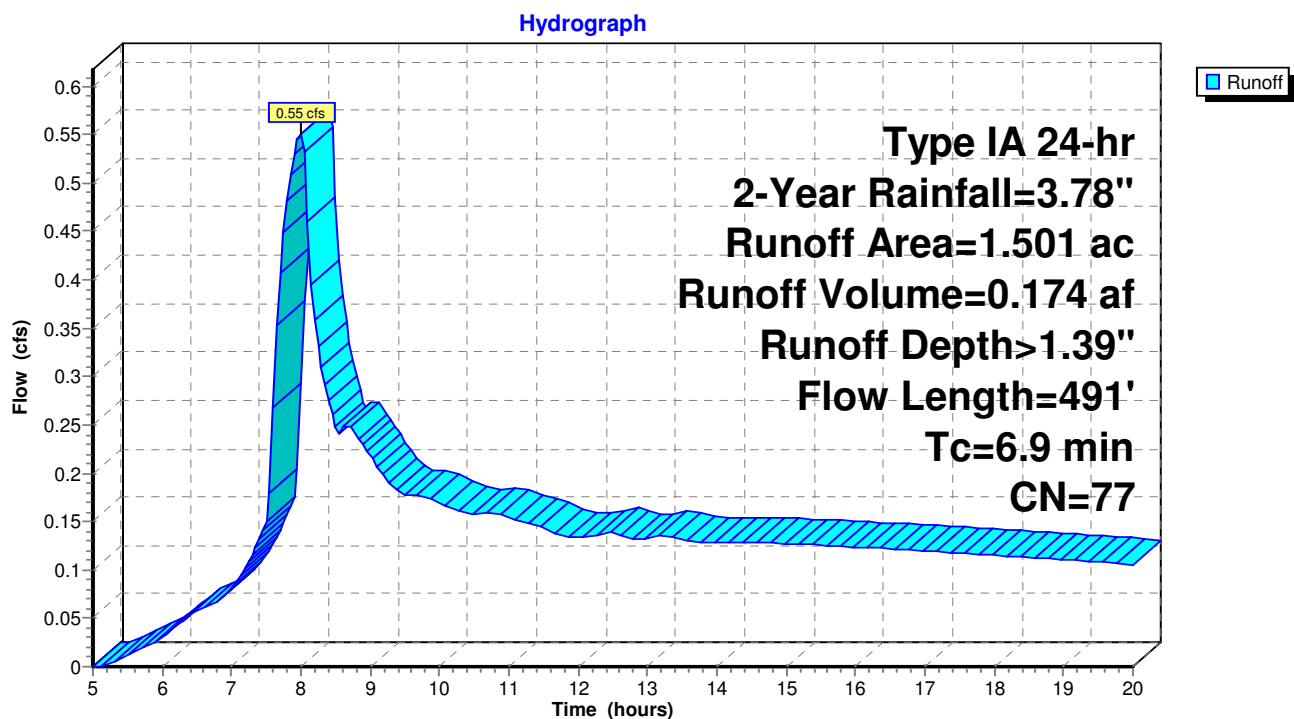
Runoff = 0.55 cfs @ 7.99 hrs, Volume= 0.174 af, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-Year Rainfall=3.78"

Area (ac)	CN	Description
0.953	79	Pasture/grassland/range, Fair, HSG C
0.103	75	Vineyard, Good, HSG C
0.321	70	Woods, Good, HSG C
0.124	76	Woods/grass comb., Fair, HSG C
1.501	77	Weighted Average
1.501		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	100	0.1500	0.28		Sheet Flow, Sheet-1 Grass: Dense n= 0.240 P2= 3.78"
1.0	391	0.1600	6.44		Shallow Concentrated Flow, Shallow-1 Unpaved Kv= 16.1 fps
6.9	491	Total			

Subcatchment WS4: WATERSHED 4



Post-Project WS4

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Type IA 24-hr 10-Year Rainfall=5.82"

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Summary for Subcatchment WS4: WATERSHED 4

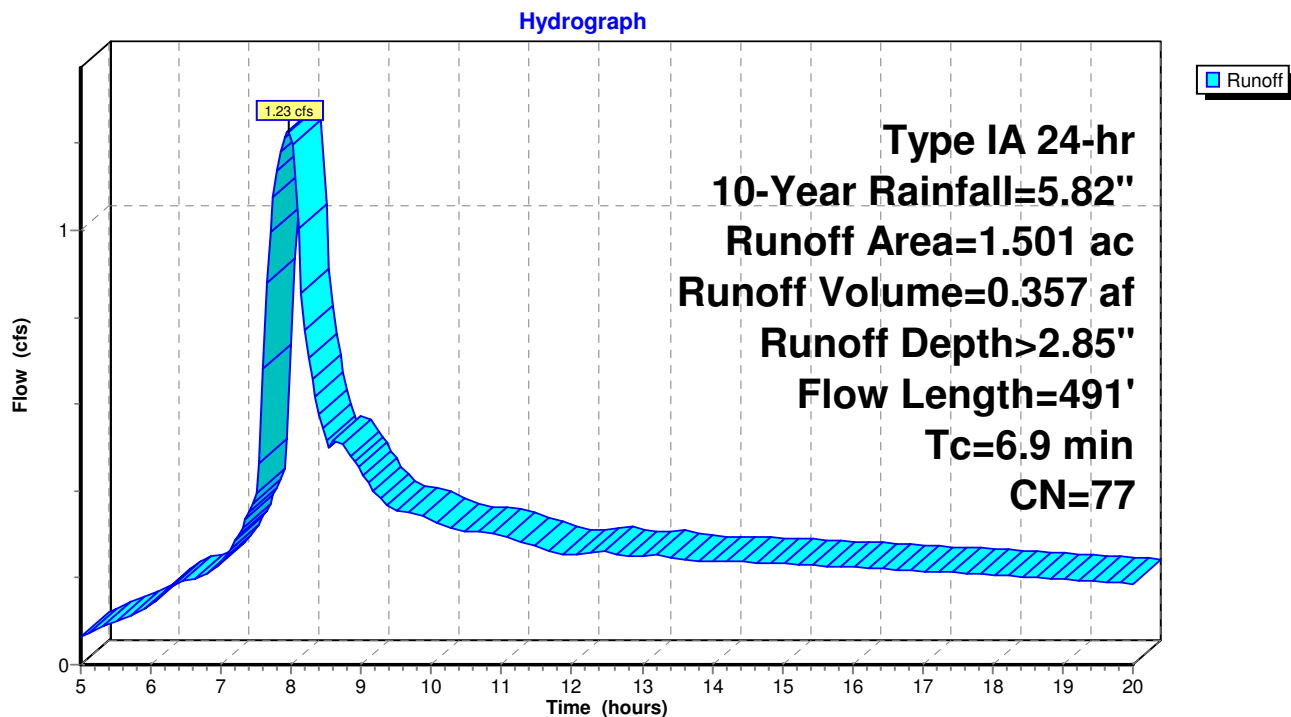
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Subcatchment WS4: WATERSHED 4



Post-Project WS4

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Type IA 24-hr 50-Year Rainfall=7.89"

Printed 5/16/2019

Summary for Subcatchment WS4: WATERSHED 4

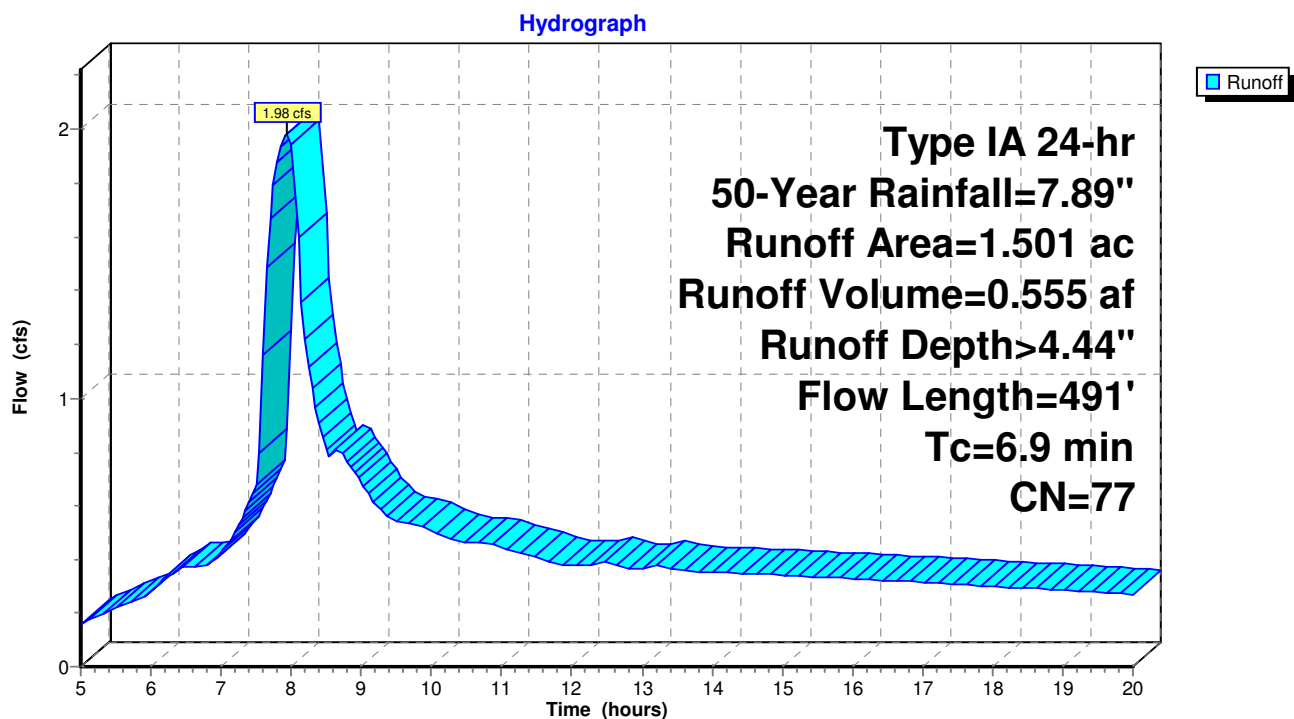
Runoff = 1.98 cfs @ 7.95 hrs, Volume= 0.555 af, Depth> 4.44"

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Subcatchment WS4: WATERSHED 4



Post-Project WS4

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Subcatchment WS4: WATERSHED 4

