

Hydrologic Analysis
Harcross Winery/Enan Vineyard
Proposed New Vineyard Development
6204 Dry Creek Road
Napa, CA 94559
APN 027-530-006
June 7, 2023



The following analysis evaluates a proposed, approximately 3-acre vineyard development on an approximately 51-acre parcel, located in Napa County, northwest of Napa, California, to determine the proposal's potential to increase runoff from the site. The analysis was prepared by David Steiner, CPESC, CPSWQ, at the request of and in consultation with Mike Muelrath of Applied Civil Engineering. Drainage on the site is to the north to Dry Creek, thence east and north to the Napa River and south to San Francisco Bay. In addition to the current agricultural proposal, development of the site includes an approved residence—currently under construction—and a soon-to-be-proposed, small winery. The potential hydrologic impacts of these two “structural” developments are addressed by way of standard measures required by the County of Napa, rather than via USDA TR-55 modeling, which would normally be applied to vineyard developments. The ag and structural elements of the proposed site development are intimately intertwined, but neither method of addressing hydrology is suitable for analysis of the two, together. Moreover, the very small acreage of this proposal, relative to that of any drainage of which it may be a part, would likely lead to masking or buffering potential hydrologic impacts, as predicted by the TR-55 model. For these reasons, this analysis and its conclusion are based solely on a comparison of the pre- and post-project Runoff Curve Numbers of the proposed vineyard development area.

Pre-project Curve Number: A site visit on May 17, 2023, and examination of aerial photographic images on the Napa County website, show the entire area to be annual grassland. The upper areas were cleared and winterized (to 70% vegetative cover) as part of the approved residential development. Growth on the lower areas was estimated to provide approximately 60% vegetative cover. In any event conditions on the proposed vineyard areas are accurately characterized as “annual grass in fair condition”, i.e., from 50-75% cover. As the entire area (per USDA soil mapping and the Web Soil Survey) is in Hydrologic Soil Group “C”, the appropriate pre-project Curve Number is 79. (See accompanying copies of the relevant Web Soil Survey page, and the USDA Curve Number table consulted for this designation¹).

The **post-project Runoff Curve Number** is based on the specifications of the proposed vineyard's Erosion Control Plan, which calls for non-tilled cover crop management, with 80% vegetative cover. The minimal vineyard avenues will be under the same management as the

¹ *Engineering Field Handbook, Part 650, Chapter 2, Supplement 1, USDA/NRCS, Oct 2008.*

vineyard blocks, with supplementary applications of straw mulch and seed as winterization measures, as needed. These specifications will upgrade the vineyard/annual grass to “good” hydrologic condition, to which the CN table assigns a Curve Number of 75. (See accompanying pdf printouts of the pre-and post-project WinTR-55 Curve Number pages.)

Conclusion: Assuming maintenance of the ECP’s specifications, the proposed vineyard will result in no increase in runoff from the site.

DAS

Enan
Pre-project, CN only
County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Main	Annual grass	(fair)	3	79
Total Area / Weighted Curve Number			3	79
			=	==

DAS

Enan
Post-project, CN only
County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Main	Vineyard (annual grass)	(good) C	3	75
Total Area / Weighted Curve Number			3 =	75 ==

Area of Interest (AOI)

Soil Map

Soil Data Explorer

Download Soils Data

Shopping Cart (Free)

View Soil Information By Use: All Uses

Printable Version

Add to Shopping Cart

Intro to Soils

Suitabilities and Limitations for Use

Soil Properties and Qualities

Ecological Sites

Soil Reports

Search

Properties and Qualities Ratings

Open All

Close All

Soil Chemical Properties

Soil Erosion Factors

Soil Health Properties

Soil Physical Properties

Available Water Capacity

Available Water Storage

Available Water Supply, 0 to 100 cm

Available Water Supply, 0 to 150 cm

Available Water Supply, 0 to 25 cm

Available Water Supply, 0 to 50 cm

Bulk Density, One-Third Bar

Linear Extensibility

Liquid Limit

Organic Matter

Percent Clay

Percent Sand

Percent Silt

Plasticity Index

Saturated Hydraulic Conductivity (Ksat)

Saturated Hydraulic Conductivity (Ksat), Standard Classes

Surface Texture

Water Content, 15 Bar

Water Content, One-Third Bar

Soil Qualities and Features

AASHTO Group Classification (Surface)

AASHTO Group Index

Depth to a Selected Soil Restrictive Layer

Depth to Any Soil Restrictive Layer

Depth to Bedrock

Drainage Class

Frost Action

Frost-Free Days

Hydrologic Soil Group

View Description

View Rating

View Options

Map

Table

Description of Rating

Rating Options

Detailed Description

Advanced Options

Aggregation Method

Dominant Condition

Component Percent Cutoff

Tie-break Rule

Lower

Map — Hydrologic Soil Group

Scale

(not to scale)

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

You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Map surveys that comprise your AOI were mapped at 1:24,000. The design of map units and the level of on that map scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of map not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Tables — Hydrologic Soil Group — Summary By Map Unit

Summary by Map Unit — Napa County, California (CA055)

Summary by Map Unit — Napa County, California (CA055)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
136	Felton gravelly loam, 30 to 50 percent slopes	C	29.4	81.7%
178	Sobrante loam, 5 to 30 percent slopes	C	6.6	18.3%
Totals for Area of Interest			36.1	100.0%

Description — Hydrologic Soil Group

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

https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

1/2

Land Use	Cover	Hydrologic 1/ Condition	Hydrologic Soil Group			
	Treatment or Practice		A	B	C	D
Orchards, deciduous		(See accompanying land-use description)				
Orchards, Evergreen		Poor	55	72	81	86
		Fair	42	64	76	82
		Good	33	58	72	79
Vineyards		(See accompanying land-use description)				
NON-CULTIVATED AGRICULTURAL LAND (Grassland, Woodland, Brushland)						
Annual grass		Poor	65	78	86	89
		Fair	49	69	79	84
		Good	38	61	75	81
Broadleaf chaparral		Poor	53	70	80	85
		Fair	40	63	75	81
		Good	31	57	71	78
Meadow		Poor	63	77	84	90
		Fair	58	70	78	84
		Good	30	58	72	78
Narrowleaf chaparral		Poor	70	82	88	90
		Fair	55	72	81	86
Open brush		Poor	61	76	84	88
		Fair	46	66	77	83
		Good	41	63	75	81

Close-seeded legumes or rotation meadow, contour - Close-seeded legumes or rotation meadow planted on the contour or in straight rows on land with 2 percent slopes or less.

Irrigated pasture - Irrigated land that is planted to perennial grasses and legumes for production of forage and which is cultivated only to establish or renew the stand of plants. For hydrologic purposes, dryland pasture is considered as annual grass.

Orchards, Deciduous - Land planted to such deciduous trees as apples, apricots, pears, walnuts, and almonds. Soil protection during the rainy season is dependent on ground cover. This ground cover may be annual grass or perennial grass cover crops with or without legumes, occasionally legumes alone.

Use curve numbers that apply to the land use or the kind and condition of cover during storm periods; for example, Annual grass curve numbers for annual grass or grass-legume cover. Where orchards are kept bare by disking or the use of herbicides, use Fallow curve numbers.

Because of management practices, ground cover in orchards is seldom continuous. Only orchards untilled with more than 75 percent of the ground surface continuously protected by cover are in Good Hydrologic Condition, others are Fair or Poor.

Orchards, Evergreen - Land planted to evergreen trees which include citrus, avocado, and Christmas tree plantations. Soil protection is dependent on ground cover or litter. This ground cover may be annual grass or perennial grass cover crops with or without legumes alone; or the ground protection may be litter where tree canopy is sufficiently dense to produce an effective amount of fallen leaves.

Because of management practices, ground cover in orchards is seldom continuous. Only untilled orchards with more than 75 percent of the ground surface continuously protected by litter or plant cover are in Good Hydrologic Condition, others are Fair or Poor.

Vineyards - Land planted to grapes. Soil protection during the rainy season is dependent on ground cover. This ground cover may be annual grass or perennial grass cover crops with or without legumes, occasionally legumes alone.

Use curve numbers that apply to the land use or the kind and condition of cover during the storm periods; for example, Annual grass curve numbers for annual grass or grass legume cover. Where vineyards are kept bare by disking or the use of herbicides, use Fallow curve numbers.

Addendum:
Hydrologic Analysis
Harcross Winery/Enan Vineyard
Proposed New Vineyard Development
6204 Dry Creek Road
Napa, CA 94559
APN 027-530-006
January 10, 2024



In response to the memorandum to Don Barella (Planning) from Alexei Belov (Engineering) we have prepared the following addendum to the Hydrologic Analysis submitted on June 7, 2023. This addendum consists primarily of a complete WinTR-55 run--within the proposed, 2.3-acre Block A.

The pre- and post-project runoff curve numbers (CN) of Block A are as submitted in June for the complete project: Pre-project CN 79 , HSG C, Annual grass, fair condition; Post-project CN 75, HSG C, Vineyard (annual grass), good condition.

The pre- and post-project Time of Concentration (Tc) flowpaths were selected in order to both maximize hydrologic remoteness within Block A, and to provide common points of origin and outlet, to the extent possible. Beginning at a point near the upper end of the block, both flowpaths outlet in the inboard drainage ditch along the lower perimeter access road. The post-project flowpath is intercepted by the upper (of two) mid-slope diversions; this structure directs flows to the storm drain that outlets at the bottom of the proposed vineyard.

Results of the WinTR-55 runs are as follows:

- 2-year, 24-hour storm: Pre-project peak flow = 1.09 cfs
Post-project = .95 cfs
- 10-year, 24-hour storm: Pre-project peak flow = 1.97 cfs
Post-project = 1.81 cfs
- 50-year, 24-hour storm: Pre-project peak flow = 2.87 cfs
Post-project = 2.52 cfs
- 100-year, 24-hour storm: Pre-project peak flow = 3.26 cfs
Post-project = 3.09 cfs

These results bear out the conclusion of the original analysis submitted, that **the post-project peak flow will be reduced**, primarily as the result of the increased level of cover, as demonstrated in the runoff curve number comparison. To the specific point raised by Engineering staff, runoff is slowed in the flatter slopes of the diversion, compensating for acceleration within the storm drain. This phenomenon is a little hard to pick up, as on this small site the application uses its "default minimum" Time of Concentration (.1 hour) to make its calculations. However, detailed examination of the Tc components reveals that the post-project Tc is actually .02 hours more than the pre-project Tc (.59 hour vs .57 hour).

DAS

Enan-Harcross, Block A
Pre-project
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow 2-Yr (cfs) (hr)	and Peak Time (hr) 10-Yr (cfs) (hr)	by Rainfall Return Period 50-Yr (cfs) (hr)	100-Yr (cfs) (hr)
------------------------------------	------------------------------------	--	---	-------------------------

SUBAREAS

Main	1.09	1.97	2.87	3.26
	12.12	12.11	12.12	12.11

REACHES

OUTLET	1.09	1.97	2.87	3.26
--------	------	------	------	------

DAS

Enan-Harcross, Block A
Pre-project
Napa County, California

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
4.85	6.23	7.32	8.76	9.82	10.9	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type CA-1
Dimensionless Unit Hydrograph: <standard>

DAS

Enan-Harcross, Block A
Pre-project
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)

Main							
SHEET	100	0.2400	0.150				0.049
SHALLOW	80	0.1130	0.050				0.004
SHALLOW	102	0.1860	0.050				0.004
Time of Concentration							0.1
							=====

DAS

Enan-Harcross, Block A
Pre-project
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Main	Open space; grass cover 50% to 75% (fair)	C	2.3	79
	Total Area / Weighted Curve Number		2.3 ===	79 ==

DAS

Enan-Harcross, Block A
Pre-project
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Main	Annual grass	(fair)	2.3	79
Total Area / Weighted Curve Number			2.3	79
			===	==

DAS

Enan-Harcross, Block A
Post-project
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow 2-Yr (cfs) (hr)	and Peak Time (hr) 10-Yr (cfs) (hr)	by Rainfall Return Period 50-Yr (cfs) (hr)	100-Yr (cfs) (hr)
------------------------------------	------------------------------------	--	---	-------------------------

SUBAREAS

Main	0.95 12.12	1.81 12.12	2.52 12.12	3.09 12.11
------	---------------	---------------	---------------	---------------

REACHES

OUTLET	0.95	1.81	2.52	3.09
--------	------	------	------	------

DAS

Enan-Harcross, Block A
Post-project
Napa County, California

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
4.85	6.23	7.32	8.76	9.32	10.9	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type CA-1
Dimensionless Unit Hydrograph: <standard>

DAS

Enan-Harcross, Block A
Post-project
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)

Main							
SHEET	100	0.2400	0.150				0.049
SHALLOW	55	0.1090	0.050				0.003
SHALLOW	74	0.0540	0.050				0.005
CHANNEL	120					17.500	0.002
Time of Concentration							0.1
							=====

DAS

Enan-Harcross, Block A
Post-project
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)

Main							
SHEET	100	0.2400	0.150				0.049
SHALLOW	55	0.1090	0.050				0.003
SHALLOW	74	0.0540	0.050				0.005
CHANNEL	120	MANUAL ENTRY (IN PIPE)				17.500	0.002
Time of Concentration							0.1
							=====

DAS

Enan-Harcross, Block A
Post-project
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Main	User defined urban (Click button or	C	2.3	75
	Total Area / Weighted Curve Number		2.3 ===	75 ==

DAS

Enan-Harcross, Block A
Post-project
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Main	Vineyard (annual grass)	(good) C	2.3	75
Total Area / Weighted Curve Number			2.3 ===	75 ==

[Home](#)[Site Map](#)[Organization](#)[Search](#)[NWS](#) [All NOAA](#) [Go](#)**General Information**[Homepage](#)
[Progress Reports](#)
[FAQ](#)
[Glossary](#)**Precipitation Frequency**[Data Server](#)
[GIS Grids](#)
[Maps](#)
[Time Series](#)
[Temporals](#)
[Documents](#)**Probable Maximum Precipitation**[Documents](#)**Miscellaneous**[Publications](#)
[Storm Analysis](#)
[Record Precipitation](#)**Contact Us**[Inquiries](#)**NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA****Data description****Data type:** Precipitation depth **Units:** English **Time series type:** Partial duration**Select location****1) Manually:****a) By location** (decimal degrees, use "-" for S and W): Latitude: Longitude: **b) By station (list of CA stations):** Select station **c) By address** **2) Use map:****POINT PRECIPITATION FREQUENCY (PF) ESTIMATES**WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2[PF tabular](#)[PF graphical](#)[Supplementary information](#)[Print page](#)

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.148 (0.132-0.168)	0.186 (0.165-0.211)	0.234 (0.207-0.266)	0.272 (0.238-0.313)	0.322 (0.272-0.386)	0.360 (0.297-0.442)	0.398 (0.319-0.502)	0.436 (0.338-0.568)	0.486 (0.360-0.664)	0.524 (0.373-0.744)
10-min	0.213 (0.189-0.241)	0.266 (0.237-0.303)	0.335 (0.297-0.382)	0.390 (0.342-0.448)	0.462 (0.390-0.553)	0.516 (0.426-0.633)	0.571 (0.457-0.719)	0.625 (0.485-0.814)	0.697 (0.516-0.952)	0.751 (0.535-1.07)
15-min	0.257 (0.229-0.292)	0.322 (0.286-0.366)	0.405 (0.359-0.462)	0.471 (0.413-0.542)	0.559 (0.472-0.669)	0.625 (0.515-0.766)	0.690 (0.553-0.870)	0.756 (0.586-0.984)	0.843 (0.624-1.15)	0.909 (0.647-1.29)
30-min	0.378 (0.336-0.429)	0.473 (0.420-0.538)	0.595 (0.527-0.678)	0.692 (0.607-0.797)	0.821 (0.693-0.982)	0.918 (0.756-1.13)	1.01 (0.812-1.28)	1.11 (0.862-1.45)	1.24 (0.916-1.69)	1.34 (0.950-1.90)
60-min	0.578 (0.515-0.657)	0.724 (0.644-0.824)	0.911 (0.807-1.04)	1.06 (0.930-1.22)	1.26 (1.06-1.51)	1.41 (1.16-1.72)	1.55 (1.24-1.96)	1.70 (1.32-2.22)	1.90 (1.40-2.59)	2.05 (1.46-2.90)
2-hr	0.922 (0.821-1.05)	1.16 (1.03-1.32)	1.45 (1.29-1.66)	1.69 (1.48-1.94)	1.99 (1.68-2.38)	2.22 (1.83-2.72)	2.44 (1.96-3.08)	2.66 (2.07-3.47)	2.95 (2.18-4.03)	3.17 (2.25-4.50)
3-hr	1.21 (1.08-1.37)	1.52 (1.35-1.72)	1.90 (1.68-2.17)	2.20 (1.93-2.54)	2.60 (2.19-3.11)	2.89 (2.38-3.54)	3.18 (2.55-4.01)	3.46 (2.69-4.51)	3.63 (2.83-5.23)	4.11 (2.92-5.83)

PF Map: Contiguous US

6-hr	1.88 (1.67-2.13)	2.36 (2.09-2.68)	2.96 (2.62-3.37)	3.43 (3.01-3.95)	4.04 (3.41-4.83)	4.49 (3.70-5.50)	4.93 (3.95-6.22)	5.37 (4.16-6.99)	5.93 (4.39-8.10)	6.35 (4.52-9.02)
12-hr	2.71 (2.41-3.08)	3.45 (3.07-3.93)	4.39 (3.89-5.00)	5.12 (4.49-5.90)	6.08 (5.13-7.28)	6.79 (5.60-8.32)	7.49 (6.00-9.44)	8.18 (6.35-10.7)	9.09 (6.73-12.4)	9.76 (6.95-13.9)
24-hr	3.76 (3.38-4.27)	4.85 (4.36-5.51)	6.23 (5.59-7.09)	7.32 (6.52-8.39)	8.76 (7.58-10.3)	9.82 (8.36-11.8)	10.9 (9.07-13.3)	11.9 (9.72-14.9)	13.3 (10.5-17.2)	14.3 (11.0-19.1)
2-day	4.87 (4.38-5.53)	6.26 (5.62-7.11)	8.02 (7.19-9.13)	9.40 (8.37-10.8)	11.2 (9.71-13.2)	12.6 (10.7-15.0)	13.9 (11.6-17.0)	15.2 (12.4-19.0)	16.9 (13.3-21.9)	18.2 (13.9-24.3)
3-day	5.58 (5.01-6.33)	7.14 (6.42-8.12)	9.12 (8.17-10.4)	10.7 (9.50-12.2)	12.7 (11.0-15.0)	14.2 (12.1-17.0)	15.7 (13.1-19.2)	17.1 (14.0-21.4)	19.0 (15.0-24.7)	20.5 (15.6-27.3)
4-day	6.24 (5.61-7.08)	7.98 (7.17-9.07)	10.2 (9.13-11.6)	11.9 (10.6-13.6)	14.2 (12.3-16.7)	15.8 (13.5-18.9)	17.4 (14.5-21.3)	19.0 (15.5-23.8)	21.1 (16.6-27.4)	22.7 (17.3-30.3)
7-day	7.70 (6.92-8.74)	9.87 (8.86-11.2)	12.6 (11.3-14.3)	14.7 (13.1-16.8)	17.4 (15.1-20.5)	19.5 (16.6-23.3)	21.4 (17.9-26.2)	23.4 (19.0-29.3)	25.9 (20.4-33.5)	27.7 (21.2-37.0)
10-day	8.78 (7.89-9.96)	11.3 (10.1-12.8)	14.4 (12.9-16.3)	16.8 (14.9-19.2)	19.9 (17.2-23.4)	22.1 (18.8-26.5)	24.3 (20.3-29.7)	26.5 (21.6-33.2)	29.3 (23.0-37.9)	31.3 (23.9-41.8)
20-day	11.3 (10.2-12.8)	14.6 (13.1-16.5)	18.6 (16.6-21.1)	21.6 (19.2-24.8)	25.5 (22.1-30.0)	28.2 (24.0-33.8)	30.9 (25.8-37.8)	33.5 (27.3-41.9)	36.7 (28.9-47.6)	39.1 (29.9-52.1)
30-day	13.6 (12.2-15.5)	17.5 (15.7-19.9)	22.3 (19.9-25.3)	25.8 (23.0-29.6)	30.3 (26.3-35.7)	33.5 (28.5-40.1)	36.5 (30.4-44.6)	39.4 (32.1-49.3)	43.0 (33.8-55.7)	45.6 (34.8-60.8)
45-day	16.5 (14.8-18.7)	21.1 (19.0-24.0)	26.6 (23.9-30.3)	30.7 (27.4-35.2)	35.8 (31.0-42.2)	39.4 (33.5-47.2)	42.7 (35.7-52.3)	45.9 (37.4-57.5)	49.8 (39.2-64.6)	52.6 (40.2-70.2)
60-day	19.7 (17.7-22.3)	25.0 (22.4-28.4)	31.3 (28.0-35.6)	35.9 (32.0-41.2)	41.6 (36.0-49.0)	45.6 (38.8-54.6)	49.2 (41.1-60.2)	52.7 (42.9-66.0)	56.9 (44.8-73.8)	59.9 (45.8-79.9)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: [Precipitation frequency estimates](#)

Main Link Categories:
[Home](#) | [OWP](#)

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Water Prediction (OWP)
1325 East West Highway
Silver Spring, MD 20910
Page Author: [HDSC webmaster](#)
Page last modified: April 21, 2017

[Map Disclaimer](#)
[Disclaimer](#)
[Credits](#)
[Glossary](#)

[Privacy Policy](#)
[About](#)
[Career Opportunity](#)

USDA

United States Department of Agriculture

Natural Resources Conservation Service

Contact Us

Subscribe

Archived Soil Surveys

Soil Survey Status

Glossary

Preferences

Link

Logout

Help

Area of Interest (AOI)

Soil Map

Soil Data Explorer

Download Soils Data

Shopping Cart (Free)

View Soil Information By Use: All Uses

Printable Version

Add to Shopping Cart

Intro to Soils

Suitabilities and Limitations for Use

Soil Properties and Qualities

Ecological Sites

Soil Reports

Search

Properties and Qualities Ratings

Open All

Close All

Soil Chemical Properties

Soil Erosion Factors

Soil Health Properties

Soil Physical Properties

Available Water Capacity

Available Water Storage

Available Water Supply, 0 to 100 cm

Available Water Supply, 0 to 150 cm

Available Water Supply, 0 to 25 cm

Available Water Supply, 0 to 50 cm

Bulk Density, One-Third Bar

Linear Extensibility

Liquid Limit

Organic Matter

Percent Clay

Percent Sand

Percent Silt

Plasticity Index

Saturated Hydraulic Conductivity (Ksat)

Saturated Hydraulic Conductivity (Ksat), Standard Classes

Surface Texture

Water Content, 15 Bar

Water Content, One-Third Bar

Soil Qualities and Features

AASHTO Group Classification (Surface)

AASHTO Group Index

Depth to a Selected Soil Restrictive Layer

Depth to Any Soil Restrictive Layer

Depth to Bedrock

Drainage Class

Frost Action

Frost-Free Days

Hydrologic Soil Group

View Description

View Rating

View Options

Map

Table

Description of Rating

Rating Options

Detailed Description

Advanced Options

Aggregation Method

Dominant Condition

Component Percent Cutoff

Tie-break Rule

Lower

Map — Hydrologic Soil Group

Scale (not to scale)

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

You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Map surveys that comprise your AOI were mapped at 1:24,000. The design of map units and the level of detail on that map scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of map units. Map units not shown at this scale could have been shown at a more detailed scale.

Tables — Hydrologic Soil Group — Summary By Map Unit

Summary by Map Unit — Napa County, California (CA055)

Summary by Map Unit — Napa County, California (CA055)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
136	Felton gravelly loam, 30 to 50 percent slopes	C	29.4	81.7%
178	Sobranite loam, 5 to 30 percent slopes	C	6.6	18.3%
Totals for Area of Interest			36.1	100.0%

Description — Hydrologic Soil Group

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

https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

1/2

Land Use	Cover	Hydrologic 1/ Condition	Hydrologic Soil Group			
	Treatment or Practice		A	B	C	D
Orchards, deciduous		(See accompanying land-use description)				
Orchards, Evergreen		Poor	55	72	81	86
		Fair	42	64	76	82
		Good	33	58	72	79
Vineyards		(See accompanying land-use description)				
NON-CULTIVATED AGRICULTURAL LAND (Grassland, Woodland, Brushland)						
Annual grass		Poor	65	78	86	89
		Fair	49	69	79	84
		Good	38	61	75	81
Broadleaf chaparral		Poor	53	70	80	85
		Fair	40	63	75	81
		Good	31	57	71	78
Meadow		Poor	63	77	84	90
		Fair	58	70	78	84
		Good	30	58	72	78
Narrowleaf chaparral		Poor	70	82	88	90
		Fair	55	72	81	86
Open brush		Poor	61	76	84	88
		Fair	46	66	77	83
		Good	41	63	75	81

Close-seeded legumes or rotation meadow, contour - Close-seeded legumes or rotation meadow planted on the contour or in straight rows on land with 2 percent slopes or less.

Irrigated pasture - Irrigated land that is planted to perennial grasses and legumes for production of forage and which is cultivated only to establish or renew the stand of plants. For hydrologic purposes, dryland pasture is considered as annual grass.

Orchards, Deciduous - Land planted to such deciduous trees as apples, apricots, pears, walnuts, and almonds. Soil protection during the rainy season is dependent on ground cover. This ground cover may be annual grass or perennial grass cover crops with or without legumes, occasionally legumes alone.

Use curve numbers that apply to the land use or the kind and condition of cover during storm periods; for example, Annual grass curve numbers for annual grass or grass-legume cover. Where orchards are kept bare by disking or the use of herbicides, use Fallow curve numbers.

Because of management practices, ground cover in orchards is seldom continuous. Only orchards untilled with more than 75 percent of the ground surface continuously protected by cover are in Good Hydrologic Condition, others are Fair or Poor.

Orchards, Evergreen - Land planted to evergreen trees which include citrus, avocado, and Christmas tree plantations. Soil protection is dependent on ground cover or litter. This ground cover may be annual grass or perennial grass cover crops with or without legumes alone; or the ground protection may be litter where tree canopy is sufficiently dense to produce an effective amount of fallen leaves.

Because of management practices, ground cover in orchards is seldom continuous. Only untilled orchards with more than 75 percent of the ground surface continuously protected by litter or plant cover are in Good Hydrologic Condition, others are Fair or Poor.

Vineyards - Land planted to grapes. Soil protection during the rainy season is dependent on ground cover. This ground cover may be annual grass or perennial grass cover crops with or without legumes, occasionally legumes alone.

Use curve numbers that apply to the land use or the kind and condition of cover during the storm periods; for example, Annual grass curve numbers for annual grass or grass legume cover. Where vineyards are kept bare by disking or the use of herbicides, use Fallow curve numbers.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Enan-Harcross Vineyard

Proposed storm drain

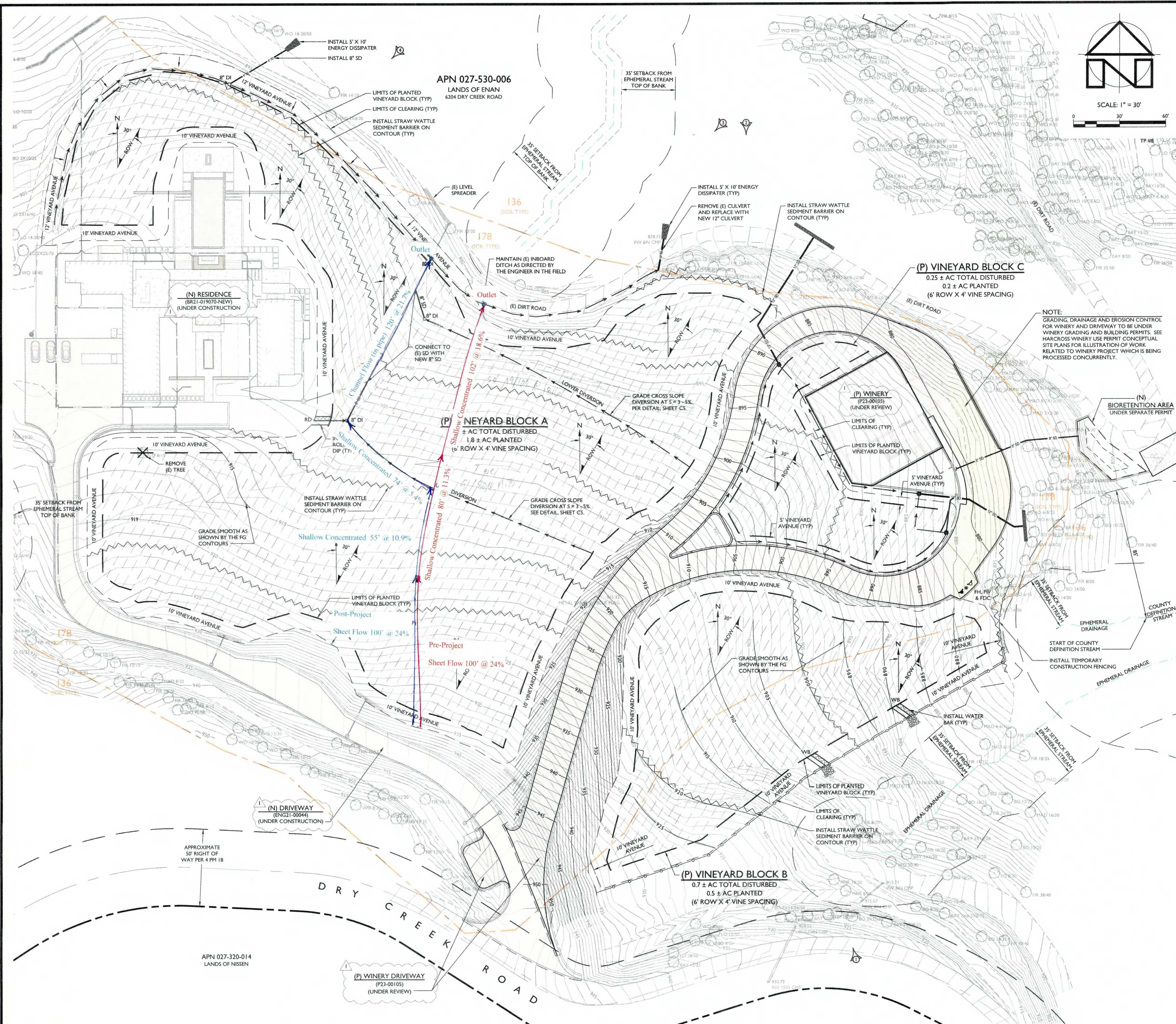
Inputs			Results		
Pipe diameter, d_0	8	in ▼	Flow depth, y	0.3333	ft ▼
Manning roughness, n	0.012		Flow area, a	0.1745	ft ² ▼
Pressure slope (possibly 2 equal to pipe slope), S_0	21.7	% rise/run ▼	Pipe area, a_0	0.3491	ft ² ▼
Relative flow depth, y/d_0	0.5	fraction ▼	Relative area, a/a_0	0.5000	fraction ▼
			Wetted perimeter, P_w	1.0472	ft ▼
			Hydraulic radius, R_h	0.1667	ft ▼
			Top width, T	0.6667	ft ▼
			Velocity, v	17.4691	ft/sec ▼
			Velocity head, h_v	4.7429	ft H ₂ O ▼
			Froude number, F	6.09	
			Average shear stress (tractive force), τ	2.2579	psf ▼
			Flow, Q (See notes)	3.0488	cfs ▼
			Full flow, Q_0	6.0977	cfs ▼
			Ratio to full flow, Q/Q_0	0.5000	fraction ▼



Notes:

This is the flow and depth inside an *infinitely long* pipe.

Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or [see my 2-minute tutorial](#) for standard culvert headwater calculations using HY-8.



EROSION CONTROL PLAN

SOIL TYPE LEGEND:

136 FELTON GRAVELLY LOAM, 30 TO 50 PERCENT SLOPES
178 SOBRANTE LOAM, 5 TO 30 PERCENT SLOPES

SOIL TYPE BOUNDARIES SHOWN ON THIS MAP ARE BASED ON THE NAPA COUNTY
GEOGRAPHIC INFORMATION SYSTEM DATA AND SHOULD BE CONSIDERED
APPROXIMATE.

LEGEND:

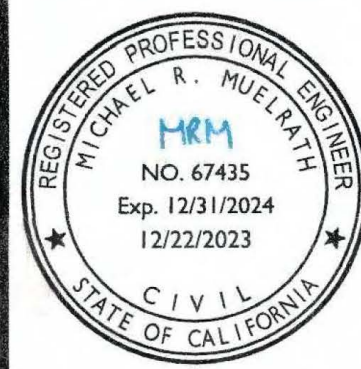
	APPROXIMATE PROPERTY LINE (SUBJECT PARCEL)
	APPROXIMATE PROPERTY LINE (ADJACENT PARCEL)
	VINEYARD CLEARING LIMITS / VINEYARD AVENUE
	LIMIT OF VINEYARD BLOCK
	VINE ROW & ROW DIRECTION
	BLUE LINE STREAM
	EPHEMERAL STREAM
	COUNTY DEFINITION STREAM
	SOIL TYPE BOUNDARY
	STRAW WATTLE SEDIMENT BARRIER
	TEMPORARY CONSTRUCTION FENCE
	DRAIN INLET
	ROLLING DIP
	WATERBAR
	ROCK ENERGY DISSIPATOR
	PHOTO LOCATION AND DIRECTION

NOTES:

1. ALL CLEARING LIMITS SHALL BE MARKED BY THE ENGINEER OR SURVEYOR PRIOR TO CONSTRUCTION AND TEMPORARY CONSTRUCTION FENCING (ORANGE FENCING OR EQUIVALENT) SHALL BE INSTALLED ALONG THE CLEARING LIMITS PRIOR TO ANY LAND PREPARATION ACTIVITIES. THE TEMPORARY CONSTRUCTION FENCING SHALL BE ADJUSTED AROUND THE CANOPY OF ANY TREES THAT ARE TO REMAIN OUTSIDE OF THE CLEARING LIMITS WITH CANOPY THAT OVERHANGS INTO THE CLEARING LIMITS TO KEEP LAND PREPARATION ACTIVITIES OUTSIDE OF THE TREE CANOPY AREA.
2. ALL STREAM SETBACKS SHALL BE VERIFIED BY THE ENGINEER PRIOR TO CONSTRUCTION.
3. TRACK WALK ENTIRE DISTURBED AREA. SEE SURFACE ROUGHENING DETAILS SHEET C5.
4. ALL TEMPORARY STAGING, STOCKPILE AND PARKING AREAS SHALL BE WITHIN THE PROPOSED DEVELOPMENT AREAS. NO STAGING, STOCKPILING, PARKING OR OTHER LAND DISTURBANCE SHALL OCCUR OUTSIDE OF THE PROPOSED DEVELOPMENT AREAS.
5. ALL EROSION CONTROL MATERIALS SHALL BE FREE OF PLASTIC MONOFILAMENT SUCH THAT SMALL WILDLIFE WILL NOT BECOME ENTANGLED.

SITE PHOTOGRAPH NOTES:

REPRESENTS APPROXIMATE LOCATION AND DIRECTION OF ISOMETRIC VIEW
OBTAINED FROM GOOGLE EARTH IMAGERY DATED MAY 16, 2023. SEE
PHOTOGRAPHIC DOCUMENTATION OF EXISTING SITE CONDITIONS FOR THE
HARCROSS WINERY VINEYARD DEVELOPMENT EROSION CONTROL PLAN FOR
PHOTOGRAPHS AND DESCRIPTIONS.



DRAWN BY:
PowerCAD LLC

CHECKED BY: MRM

DATE: DECEMBER 22, 2023

REVISIONS:
11/10/2023
PERMIT SUBMITTA

12/22/2023
REVISION #1

JOB NUMBER: 19-140

FILE:
19-140 ECP-HW-PLAN DWG

ORIGINAL SIZE:
24" X 36"

SHEET NUMBER:

C4

OF