Soil Loss Analysis – Sebastien Marineau-Mes Vineyard

Includes: USLE Calculations
June 2, 2022

The subject site is located at 4000 Silverado Trail, Calistoga, CA, 94515, APN 021-010-077. The property is within the "Calistoga" USGS quadrangle and is positioned on the east side of Napa Valley. Elevations within the proposed vineyard block range from about 300 ft to 400 ft asl. Mapped bedrock units in the area include Tertiary volcanic flow rocks of the unit 3, Sonoma Volcanic Field (Tv, Tv3) [3].

The NRCS web soil survey lists the soil type in the vineyard area as 109, Boomer gravelly loam, volcanic bedrock, 14 to 60 percent slopes, MLRA 15 [1]; see Site Plan – Aerial Map for soil boundaries. The Napa County Soil Survey [4] describes the Boomer series as well-drained soils on uplands derived from weathered mixed igneous rocks. Plant cover is typically Douglas-fir, ponderosa pine, black oak, manzanita, poison oak, and madrone. Run-off is rapid and the hazard of erosion is moderate. The 109 series generally contains the addition of 15%-20% pebbles 2 mm to 5 mm in diameter.

Soil data were obtained from the NRCS web soil survey, which notes that map data may not be valid the map scale for this project (1:1,200 or 1 in = 100 ft). The soils map was created at a scale of 1:24,000 or 1 in = 2,000 ft. Enlarged maps can cause misunderstandings of the accuracy of soil line placement. The NRCS Web Soil Survey lists the following soil properties:

Source	Soil Type	Soils description	K	T	HSG
WebSoil Survey [1]	109	Boomer gravelly loam, volcanic bedrock, 14 to 60 percent slopes, MLRA 15	--	4	C
Napa Soil Survey [4]	109	Boomer-Forward-Felta Complex: Boomer Part	0.32	3	--

Average slope across the vineyard area ranges from 22-40% with an average of 30%.

The energy of precipitation (R) value was determined by getting the Point Precipitation Frequency Estimate for the subject site from the NOAA PFDS site (the 6-hr duration with 2-year recurrence interval with 90% confidence interval). The value of 2.00 was converted to an R value of 75 from Table A-1 [5].

Current groundcover is comprised of primarily undeveloped oak woodland and non-native grasses. The site was heavily impacted by the 2020 Glass Fire that damaged vegetation on the subject parcel.

Existing cover conditions were evaluated in the field on Wednesday, February 16, 2022, with Alexei Belov (Napa County Engineering) as part of a Pre-Application Site Visit. Please refer to Application Section 7: Photos for visual documentation of existing cover crop in each block. Post-cover conditions will establish 75% cover crop throughout.

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An up/down-hill row direction for a P factor of 1 was assumed for soil loss calculations. An up-downhill row direction represents the "worst-case" scenario and any row direction that deviates from up/down-hill and approaches parallel to contours would *improve* (i.e. reduce) soil loss.

Erosion Calculation Results

Soil Loss in tons/acre were computed using the following formula [2]:

$$A = (R) \times (K) \times (LS) \times (C) \times (P) \qquad \text{with } A < T+2$$

Where:

A = Predicted Soil Loss (tons/acre)
R = Rainfall & Runoff Factor (energy of precipitation)
K = Soil Erosiveness (NRCS whole soil, surface layer, dominant condition)
LS = Erosion Energy (function of line length and steepness)
C = Factor for cover crop, surface residue, roughness, and canopy
P = Factor for contouring or cross-slope farming (1.0 if contouring is not applicable)
T = Soil Loss Tolerance

Flow line locations are shown on Site Plan: Topo and ECP Detail.

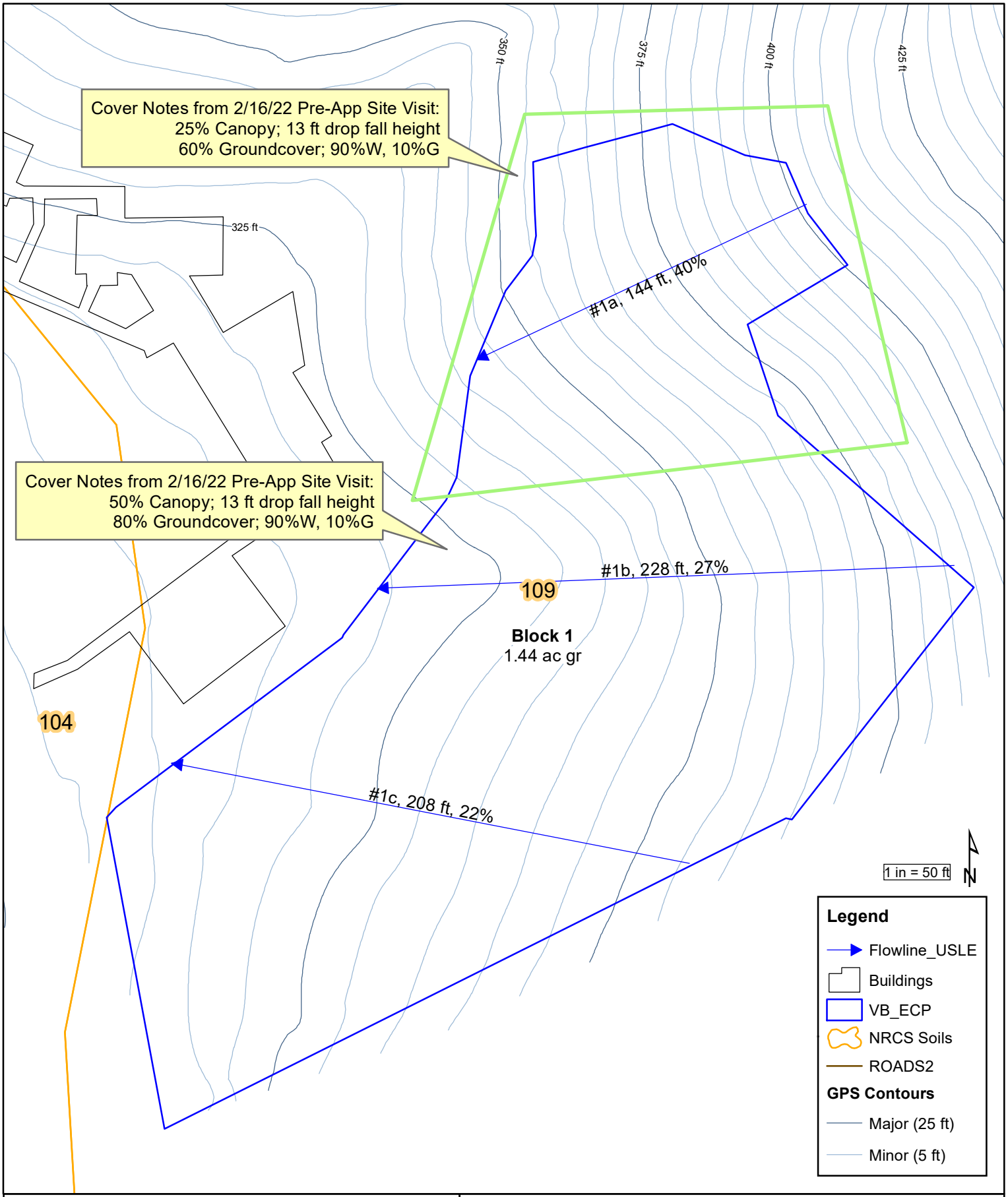
As presented, there will be a significant decrease in soil loss from the site compared to pre-development conditions. Erosion calculations for the Pre- and Post- project site are summarized in TABLE 1.

References

1. *Custom Soil Reource Report for Napa County, California, Sebastien Marineau-Mes*, from USDA NRCS Web Soil Survey, May 2022
2. *Guides for Erosion & Sediment Control*, USDA Soil Conservation Service, Davis, CA, 1991
3. Jennings, C.W., et al., *Geologic map of California*, California Geological Survey, 2010, https://ngmdb.usgs.gov/Prodesc/proddesc_96750.htm
4. Lambert, G., Kashiwagi, J. et al., *Soil Survey of Napa County, California*, USDA in cooperation with UC Agricultural Experiment Station, August 1978
5. *USLE Special Applications for Napa County*, USDA, NRCS, May 2014
6. Wischmeier, W.H., and Smith, D.D. *Predicting rainfall erosion losses – a guide to conservation planning.* USDA, Agriculture Handbook No. 537. 1978

						Cover	C
						60%	0.066
						70%	0.046
						75%	0.034
	Sebastien Marineau-Mes					80%	0.022
	ESTABLISHED VEGETATION					85%	0.016
	A=(R)(K)(LS)(C)(P)					90%	0.011
	Flowline FID	1a	1b	1c			
Var	DESCRIPTION						
R	Rainfall & Runoff Factor	75	75	75			
K	Soil Erosiveness	0.32	0.32	0.32			
	Slope length (ft)	144	228	208			
	Δelevation (ft)						
S	Gradient (%)	40	27	22			
LS^2	Calculated LS (Napa Equ.)	9.928	7.760	5.688			
C	Cover PRE	Table Lookup					
	Drop Fall Height (ft)	13.0	13.0	13.0			
	% Canopy Cover	25%	50%	50%			
	% Ground Cover	80%	60%	60%			
	% W	90%	90%	90%			
	% G	10%	10%	10%			
C	Cover PRE	0.039	0.082	0.082			
C	Cover POST	75%	75%	75%			
C	Cover POST	0.034	0.034	0.034			
P	Cover PRE	1	1	1			
P	Cover POST	1	1	1			
A	Soil loss, tons/acre PRE	9	15	11			
A	Soil loss, tons/acre POST	8	6	5			
	T =	3	3	3			
	T + 2 =	5	5	5			
LS^2	Guides for Erosion & Sediment Control, USDA Soil Conservation Service, Davis, CA 1991						

TABLE 1 Calculation table and results



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Marineau: USLE Map

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Date: 6/2/22 **File:** ...Sebastien_A_USLE.mxd

TABLE 10.—*Factor* **C** *for permanent pasture, range, and idle land*[1]

Vegetative canopy		Cover that contacts the soil surface						
Type and height[2]	Percent cover[3]		Percent ground cover					
		Type[4]	0	20	40	60	80	95+
No appreciable canopy		G	0.45	0.20	0.10	0.042	0.013	0.003
		W	.45	.24	.15	.091	.043	.011
Tall weeds or short brush with average drop fall height of 20 in	25	G	.36	.17	.09	.038	.013	.003
		W	.36	.20	.13	.083	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.076	.039	.011
	75	G	.17	.10	.06	.032	.011	.003
		W	.17	.12	.09	.068	.038	.011
Appreciable brush or bushes, with average drop fall height of 6½ ft	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.087	.042	.011
	50	G	.34	.16	.08	.038	.012	.003
		W	.34	.19	.13	.082	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.078	.040	.011
Trees, but no appreciable low brush. Average drop fall height of 13 ft	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.089	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.087	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.084	.041	.011

[1] The listed **C** values assume that the vegetation and mulch are randomly distributed over the entire area.

[2] Canopy height is measured as the average fall height of water drops falling from the canopy to the ground. Canopy effect is inversely proportional to drop fall height and is negligible if fall height exceeds 33 ft.

[3] Portion of total-area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).

[4] G: cover at surface is grass, grasslike plants, decaying compacted duff, or litter at least 2 in deep.

W: cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface) or undecayed residues or both.

Table 2 C values for non-farmed, natural vegetation [6]

TABLE 9.—*Mulch factors and length limits for construction slopes*[1]

Type of mulch	Mulch Rate	Land Slope	Factor C	Length limit[2]
	Tons per acre	*Percent*		*Feet*
None	0	all	1.0	—
Straw or hay,	1.0	1-5	0.20	200
tied down by	1.0	6-10	.20	100
anchoring and				
tacking	1.5	1-5	.12	300
equipment[3]	1.5	6-10	.12	150
Do.	2.0	1-5	.06	400
	2.0	6-10	.06	200
	2.0	11-15	.07	150
	2.0	16-20	.11	100
	2.0	21-25	.14	75
	2.0	26-33	.17	50
	2.0	34-50	.20	35
Crushed stone,	135	<16	.05	200
¼ to 1½ in	135	16-20	.05	150
	135	21-33	.05	100
	135	34-50	.05	75
Do.	240	<21	.02	300
	240	21-33	.02	200
	240	34-50	.02	150
Wood chips	7	<16	.08	75
	7	16-20	.08	50
Do.	12	<16	.05	150
	12	16-20	.05	100
	12	21-33	.05	75
Do.	25	<16	.02	200
	25	16-20	.02	150
	25	21-33	.02	100
	25	34-50	.02	75

[1] From Meyer and Ports (24). Developed by an interagency workshop group on the basis of field experience and limited research data.

[2] Maximum slope length for which the specified mulch rate is considered effective. When this limit is exceeded, either a higher application rate or mechanical shortening of the effective slope length is required.

[3] When the straw or hay mulch is not anchored to the soil, C values on moderate or steep slopes of soils having K values greater than 0.30 should be taken at double the values given in this table.

Table 3 C values for mulch cover [6]