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Water Availability Analysis

Kenefick Winery Use Permit P16-00021-UP
Planning Commission Hearing March 6, 2019

DELTA CONSULTING & ENGINEERING
OF ST. HELENA

WATER AVAILABILITY ANALYSIS

FOR THE

KENEFICK RANCH WINERY USE PERMIT

PROJECT LOCATED AT

2200 PICKETT ROAD
CALISTOGA, CA 94515

COUNTY: NAPA
APN: 020-340-007

INITIAL SUBMITTAL: DECEMBER 18, 2015
REVISION #1 (NO CHANGES): JANUARY 10, 2017

PREPARED FOR REVIEW BY:

NAPA COUNTY PLANNING, BUILDING, AND ENVIRONMENTAL SERVICES
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I. BACKGROUND

This water availability analysis is prepared for the Kenefick Ranch Winery Use Permit Application in accordance with the *Water Availability Analysis (WAA)* Guidance Document provided by the Napa County Planning, Building, and Environmental Services Department.

Based on the WAA, all projects fall within three Tiers of screening when determining the level of analysis required by the County of Napa. See Table 1 from the WAA below:

Table 1: Project Screening Criteria Applicability

Tier	Criteria Type	Napa Valley Floor	MST	All Other Areas
1	Water Use	Yes	Yes	Yes
2	Well Interference	No[1]	No[1]	Yes
3	Groundwater/Surface Water Interaction	No[1]	No[1]	No[1]

1. Further analysis may be required under CEQA if substantial evidence, in the record, indicates a potentially significant impact may occur from the project.

The subject parcel and proposed winery development is located south east of the City of Calistoga at the edge of the valley floor against the Mayacamas Mountains. The parcel is split zoned between the Agricultural Preserve (AP) and Agriculture Watershed (AW) Zoning Districts, with the majority of the parcel zoned AP. Please see the Vicinity Map and Slope Analysis and Soil Type Map in the Appendix for the project location and zoning information, respectively. This project is subject to the analysis required in both Tier 1 and Tier 2. Tier 3 is not expected to be required according to Table 1 above.

II. TIER 1 ANALYSIS

Tier 1 of the WAA requests the applicant estimate the existing and proposed water usage for the entire parcel, and then compare the total estimated parcel water usage to the applicable water use criteria. As noted in Table 2A of the WAA (referenced below), the water use criteria is subject to the parcel location.

Table 2A: Water Use Criteria

Project parcel location	Water Use Criteria (acre-feet per acre per year)
Napa Valley Floor	1.0
MST Groundwater Deficient Area	0.3 or no net increase, whichever is less[1]
All Other Areas	Parcel Specific[2]

1. Does not apply to the Ministerial Exemption as outlined in the Groundwater Conservation Ordinance

2. Water use criteria for project shall be considered in relation to the average annual recharge available to project property, as calculated by the applicant or their consultant.

Due to the portion of the subject parcel within the AW zoning district, it has been classified as 'All Other Areas' with respect to the Tier 1 Parcel Location. Therefore, the WAA requires the applicant to estimate the average annual groundwater recharge potential on the parcel. This analysis will identify the existing and proposed water uses on the parcel, estimate the total annual water usage, and then estimate the potential average annual recharge volume on the parcel.

A. Existing Water Usage

The existing water uses for the property consist of a residence, farm worker housing, a vineyard management office, and vineyards. There is one well on the parcel that is used to supply the residence, farm worker housing, and vineyard office. The parcel's vineyards are irrigated with surface water from several existing reservoirs on the Kenefick Ranch parcels. The reservoirs are filled by surface water runoff collected during rain events.

Residential Use

The residential developments on the parcel consist of a two (2) bedroom residence, a two (2) bedroom farm worker house, and a two (2) bedroom farm worker trailer. According to the owner of the property, the residence is not permanently occupied and is used approximately 180 nights a year. The landscaping is minimal.

In order to estimate the water use of the existing residences, this analysis will use Napa County Environmental Health Division's *Regulations for Design, Construction, and Installation of Alternative Sewage Treatment Systems*. These regulations specify the demand effluent for a residence as 150 gallons per day per bedroom. The landscaping and garden water use has been estimated by the owner of the property at 1,000 gallons per month. See the table below for the estimate of annual water use for the residential development.

Use Type	Use Size	Days used	Annual Use (gallons)
Main Residence	2 bedrooms x 150 g/d	180	54,000
Farmworker House	2 bedrooms x 150 g/d	365	109,500
Farmworker Trailer	2 bedrooms x 150 g/d	365	109,500
Landscaping	1,000 gallons / month		12,000
		Total:	285,000

The estimated water usage for existing residential development is 285,000 gallons per year or 0.875 acre-feet per year.

Office Use

A modular office building is installed on the parcel and allows one employee to assist with vineyard operations. The office employee's water use is estimated using Napa County Environmental Health Division's *Regulations for Design, Construction, and Installation of Alternative Sewage Treatment Systems*.

Use Type	Use Size	Days used	Annual Use (gallons)
Office	1 employee x 20 g/d	250	5,000
		Total:	5,000

The estimated water usage for existing residential development is 5,000 gallons per year or 0.015 acre-feet per year.

Vineyard Use

The existing vineyards are irrigated with surface water stored in several reservoirs on the Kenefick Ranch parcels. No groundwater will be used to irrigate the vineyards on the winery parcel.

B. Proposed Water Usage

The marketing plan for Kenefick Ranch Winery proposes a 20,000 Gallon per Year (GPY) wine production capacity, four (4) employees, and a maximum twelve (12) daily visitors. Appendix B of the WAA includes guidelines for estimating the quantity of water required for specific land uses. The table below uses the values from the WAA Appendix B to estimate the annual water use for the proposed winery development. Annual water use values are conservatively estimated by assuming the maximum employees and visitors will occupy the site 365 days per year.

Use Type	Total Use	Water Use Values	Annual Use
Wine Production	20,000 Gallons	0.0215 acre-feet / 1,000 Gallons of Wine	0.43 acre-feet (140,000 Gallons)
Employees	4	15 Gallons / Shift	21,900 Gallons
Visitors	12	3 Gallons / Visitor	13,140 Gallons
		Total:	175,040 Gallons

The estimated water usage for the proposed winery development is 175,040 gallons per year or 0.54 acre-feet per year.

C. Aquifer Recharge Analysis

A number of factors influence the potential aquifer recharge rates. These factors include, but are not limited to, local precipitation, soil permeability, and the land gradient. This analysis will review each of these factors in determining the site-specific aquifer recharge potential.

Local Precipitation

Precipitation infiltration is the most substantial factor contributing to on-site aquifer recharge. The Western Regional Climate Center (WRCC) has compiled average rainfall data in the City of Calistoga from 1948 to 2010 for each month. Based on this information, the average annual precipitation in Calistoga is 37.86 inches per year (3.15 feet per year). As the property contains approximately 44.28 acres of land, the total estimated rainfall on the property is calculated to be 139.7 acre-feet per year, which amounts to approximately 45.5 million gallons of water.

While the quantity of rainfall derived on the subject property is able to be identified by using precipitation records and basic volume calculations, the actual quantity of precipitation that infiltrates into the ground and recharges the groundwater is only a small percentage of this water. How much of the rainfall that can potentially infiltrate in order to recharge the aquifer is based on the property's soil types and their respective permeability.

Soil Permeability

Information on soil types and formations and soil permeability is publically available via the Web Soil Survey (websoilsurvey.sc.egov.usda.gov). This website is produced by the National Cooperative Soil Survey and is operated by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS).

The Web Soil Survey is used to determine what soil types are found on the subject property and each soil's respective permeability. The Web Soil Survey provides the Saturated Hydraulic Conductivity (Ksat) for each soil formation in micrometers per second. Due to the complex nature of soil types and soil combinations that produce each unique soil formation, a weighted average of the minimum permeability of all soil layers found in a formation is used. Please see the Appendix for applicable sections of the Web Soil Survey Report prepared for this parcel and the Slope Analysis and Soil Type Map which identifies the soil formations located on this property.

Per the Web Soil Survey, the following soil formations and their respective permeability are found on the subject property:

Soil Number	Soil Name	Permeability (mm/sec)	Permeability (cm/hr)	Area (acres)
124	Cortina Very Gravelly Loam, 0%-5% slopes	80.2105	28.88	19.47
152	Hambright Rock-Outcrop Complex, 30%-75% slopes	0	0	13.13
170	Pleasanton Loam, 0%-2% slopes	3.75	1.35	11.68
			Total Area:	44.28

Land Gradient

In conjunction with the soil permeability, the gradient (or slopes) of the property also is a significant factor in determining the aquifer recharge capacity. Lands with steeper slopes increase the velocity of storm water runoff, creating a higher percentage of surface storm water runoff and a smaller percentage of storm water infiltration Inversely, flatter slopes allow for a slower surface storm water runoff rate and a higher infiltration potential. For this analysis, the slopes were classified into three categories: less than 15% slope, 15-25% slope, and greater than 25% slope.

The subject property's topographic information was determined using elevation data taken from the publicly available contour data (at 5-foot intervals) of the Napa River Watershed Area prepared by Towill, Inc. in May, 2003, and available from the Napa County GIS Data Catalog (https://gis.napa.ca.gov/). Please see the Slope Analysis and Soil Type Map in the Appendix.

Recharge Potential

The final recharge potential for a parcel is based on the combination of the soil permeability and the land gradient. The *City of Rohnert Park City-Wide Water Supply Assessment* (dated January, 2005, and available from the City of Rohnert Park (https://www.ci.rohnert-park.ca.us/)), provides methodology to determine categories of Recharge Potential. Based on this report, there are four categories of recharge potential: Very Low, Low, Moderate and High and are defined as follows:

- Very Low – permeability <0.5 cm/hr and slope >15%
- Low – permeability <0.5 cm/hr and slope <15%, permeability 0.5 – 1.5 cm/hr and slope >25%

- Moderate - permeability 0.5 – 1.5 cm/hr and slope <15%, permeability 1.5 – 5.0 cm/hr and slope >15%, permeability >5 cm/hr and slope >25%
- High - permeability 1.5 - 5 cm/hr and slope <15%, permeability >5 cm/hr and slope 15-25%

See the table below of a summary of the recharge potential acreage on the parcel. Areas with very low/low recharge potential are shown in gray and areas with moderate/high recharge potential are shown in green.

Soil Number	Soil Name	Permeability (cm/hr)	Area (acres)	Area (acres) Slope < 15%	Area (acres) Slope 15-25%	Area (acres) Slope > 25%
124	Cortina Very Gravelly Loam, 0%-5% slopes	28.88	19.47	19.47		
152	Hambright Rock-Outcrop Complex, 30%-75% slopes	0	13.13			13.13
170	Pleasanton Loam, 0%-2% slopes	1.35	11.68	11.68		
		Total Area:	44.28	31.15		13.13

As shown above, 13.13 acres (30%) of the parcel is classified as having very low or low recharge potential, and is not used in this analysis of groundwater recharge. The remaining 31.15 acres (70%) of the parcel is classified as having moderate or high recharge potential.

Based on the methodology followed in the *Water Availability Analysis* (prepared for the Woolls Ranch Winery by Luhdorff & Scalmanini and dated May, 2014), we conservatively assume that a 10% groundwater recharge takes place in areas with moderate or high recharge potential and that no groundwater recharge takes place in areas with very low or low recharge potential. The average annual groundwater recharge volume is calculated by applying the average rainfall of 37.86 inches to the areas delineated as having moderate or high recharge potential. See the table below for a summary of the average annual recharge volume.

Recharge Potential	Total Area (acres)	Recharge Rate	Average Annual Rainfall (inches)	Average Recharge Volume (ac-ft)	Average Recharge Volume (gal)
Very Low/Low	13.13	0%	37.86	0	0
Moderate/High	31.15	10%	37.86	9.83	3,202,410

Based on this analysis, we conclude that this parcel should experience an average annual groundwater recharge of **9.83 acre-feet**, or **0.22 acre-feet / acre / year**.

D. Water Use and Recharge Summary

The total estimated water use for the parcel, both existing and proposed, is 1.43 acre-feet and is summarized in the table below.

Use	Annual Gallons	Annual Acre-feet
Existing Residential	285,000	0.875
Existing Office	5,000	0.015
Proposed Winery	175,040	0.540
Total:	465,040	1.43

The total estimated annual ground water recharge of 9.83 acre-feet far exceeds the estimated water use of 1.43 acre-feet and therefore meets the Tier 1 Water Criterion.

III. TIER 2 ANALYSIS

As required by the WAA, projects within the AW zoning must perform a well interference check to determine if any wells or springs are located within 500 feet of the groundwater source used for the project. Research on the neighboring parcels located several wells, but none within a 500 foot radius of the project well. A Well Interference Map, located in the Appendix, has been prepared to show the neighboring wells within the general vicinity of the project well.

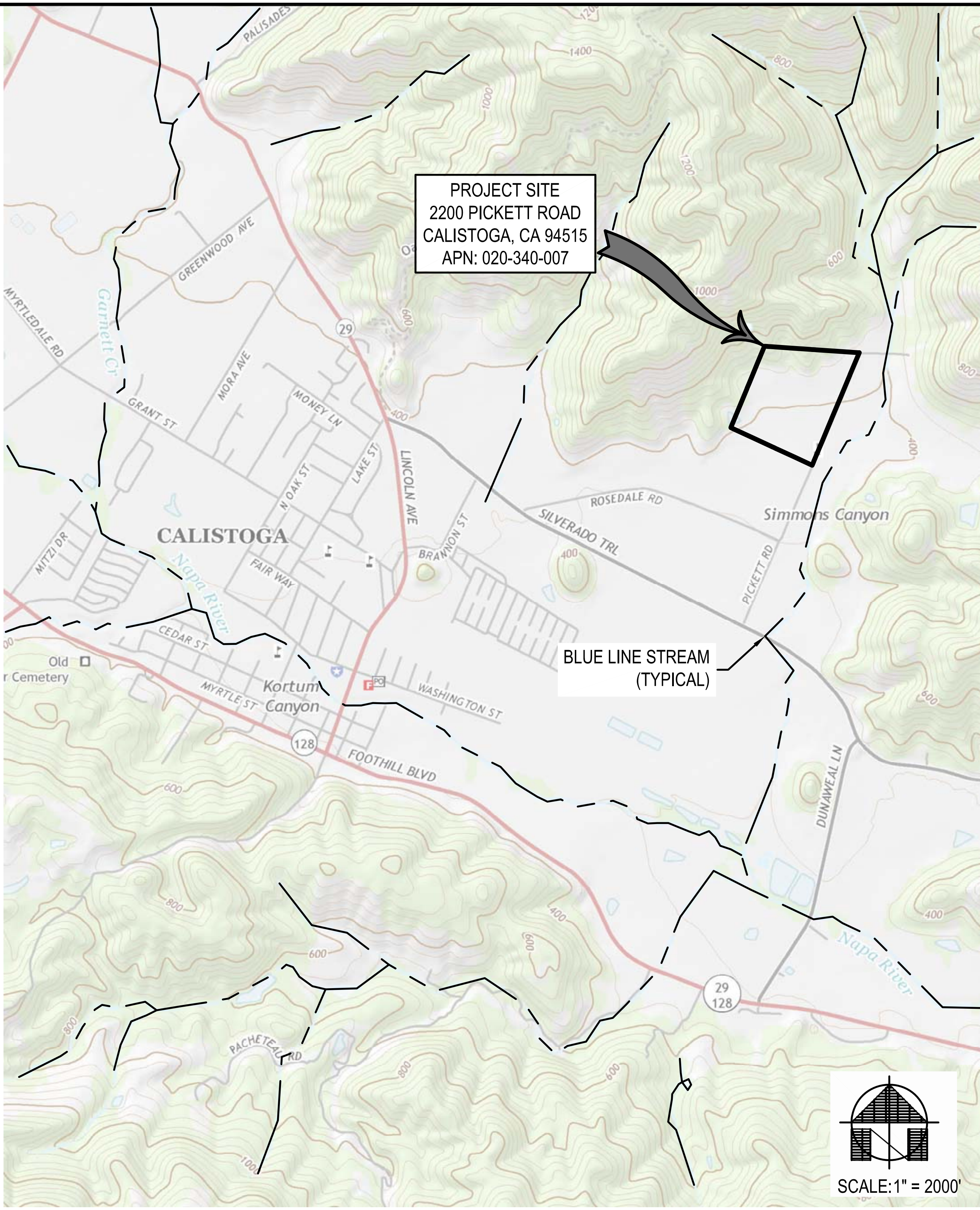
Since there are no wells or springs located within 500 feet of the parcel's well, the Tier 2 Well Interference Criterion is met.

IV. REPORT CONCLUSION

Based on the analysis completed in this report, the proposed vineyard development meets both Tier 1 and Tier 2 Criterions and is therefore in compliance of the WAA.

V. APPENDIX

Vicinity Map
Slope Analysis and Soil Type Map
Well Interference Map
Web Soil Survey



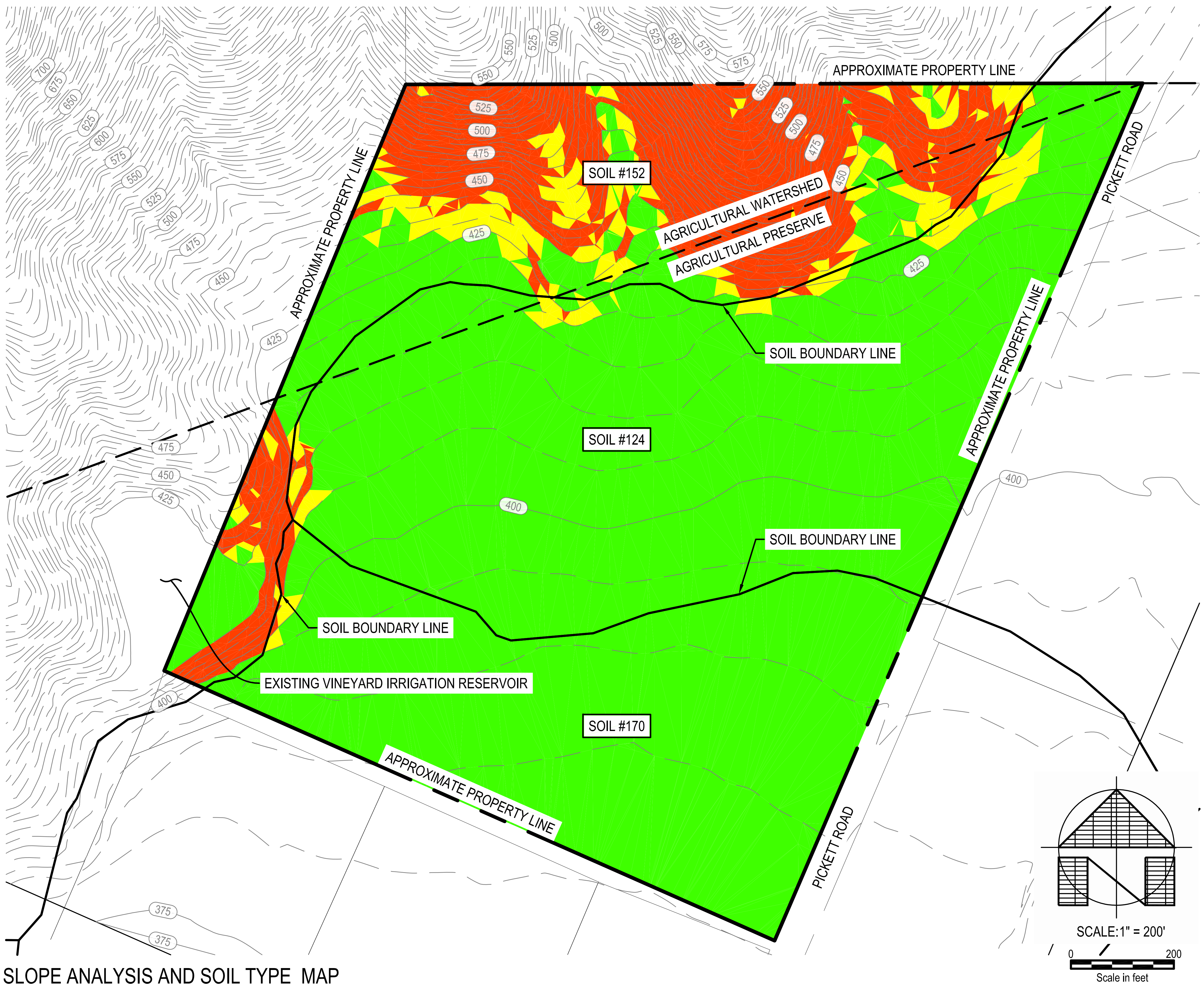
MAP FROM USGS 7.5 MIN SERIES MAP NAME: CALISTOGA

0 2000'
Scale in feet

VICINITY MAP

WATER AVAILABILITY ANALYSIS

DELTA CONSULTING & ENGINEERING OF ST. HELENA 1104 ADAMS STREET, SUITE 203 - ST. HELENA, CALIFORNIA 94574 707-963-8456 + 707-963-8528 FAX			SHEET 1 OF 3
DATE:	12/18/15	JOB # K-140	
SCALE:	1"=2000'	APN: 020-340-007	



SLOPE ANALYSIS AND SOIL TYPE MAP

SLOPE ANALYSIS TABLE

NUMBER	SLOPE (MINIMUM)	SLOPE (MAXIMUM)	COLOR
1	0.00%	15.00%	
2	15.00%	25.00%	
3	25.00%	1609.71%	

DATA SOURCE: NAPA COUNTY GIS
DESCRIPTION: 2002 DTM & IMAGERY
NAME: I-3

SOIL TYPE TABLE

SOIL #	SOIL NAME	PERMEABILITY (CM/HR)	AREA (ACRES)
124	CORTINA VERY GRAVELLY LOAM	28.88	19.47
152	HAMBRIGHT ROCK OUTCROP	0.00	13.13
170	PLEASANTON LOAM	1.35	11.68

DATA SOURCE: USDA / NRCS
DESCRIPTION: CUSTOM SOIL RESOURCE REPORT
NAME: KENEFICK WINERY

SLOPE ANALYSIS & SOIL TYPE MAP
WATER AVAILABILITY ANALYSIS
CALISTOGA
CALIFORNIA

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OF ST. HELENA
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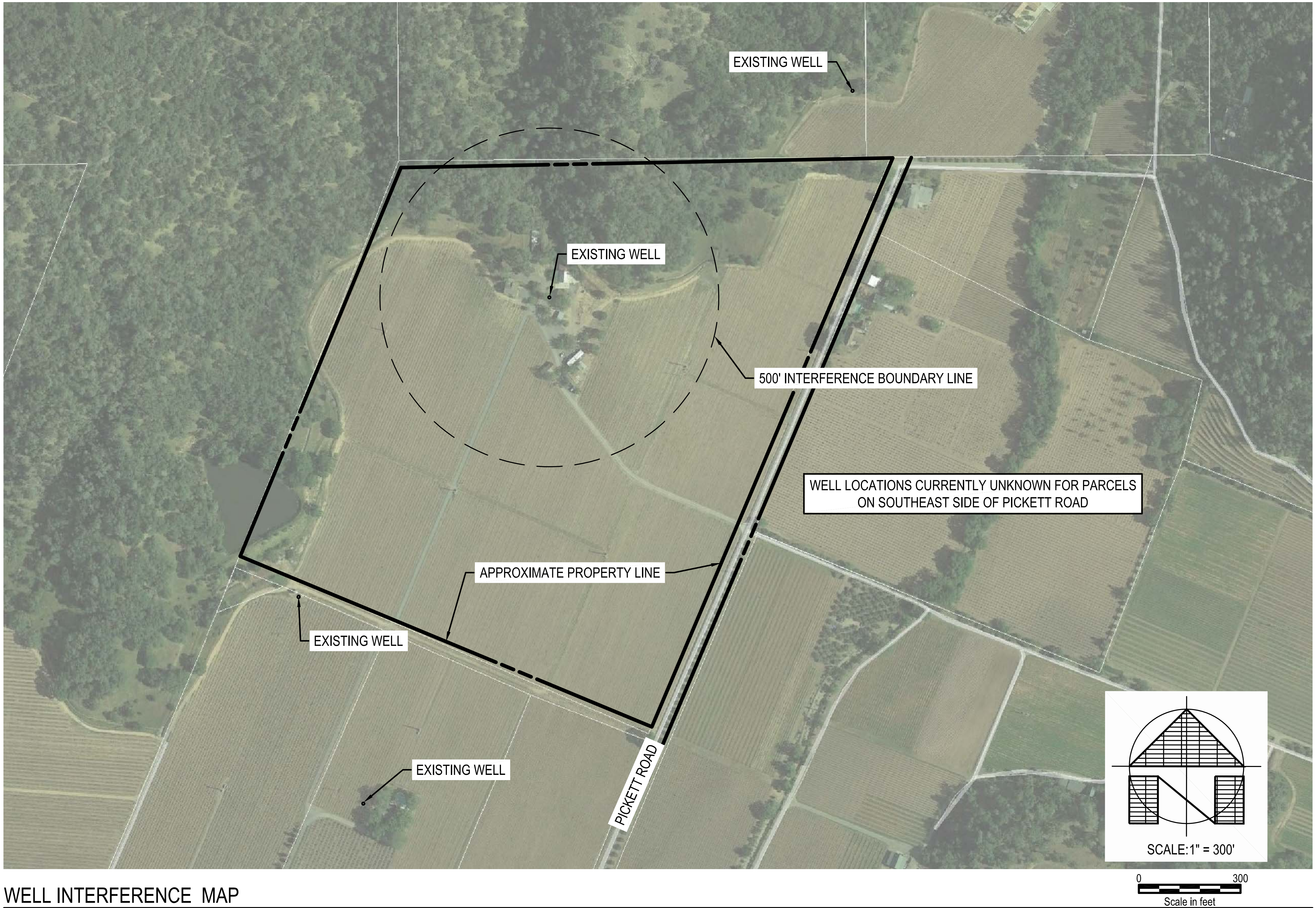

WELL INTERFERENCE MAP

WELL LOCATIONS SHOWN ARE APPROXIMATE AND BASED ON VISITS TO THE SITE AND SURROUNDING PARCELS

AERIAL IMAGE, DATED APRIL 20, 2013, OBTAINED FROM GOOGLE EARTH PRO

WELL INTERFERENCE MAP
WATER AVAILABILITY ANALYSIS
CALISTOGA CALIFORNIA

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United States Department of Agriculture

NRCS

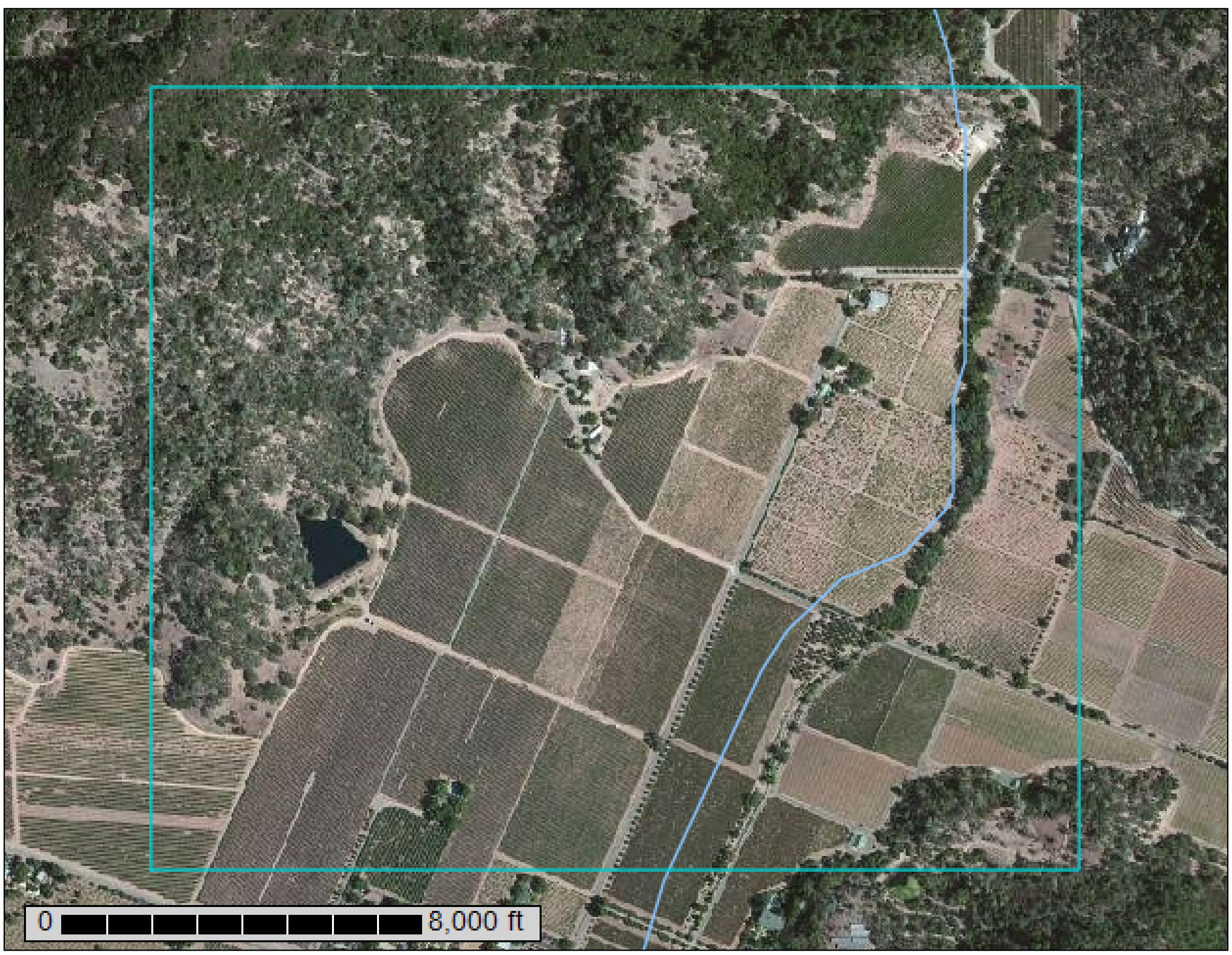
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Napa County, California

Kenefick Winery



September 14, 2015

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

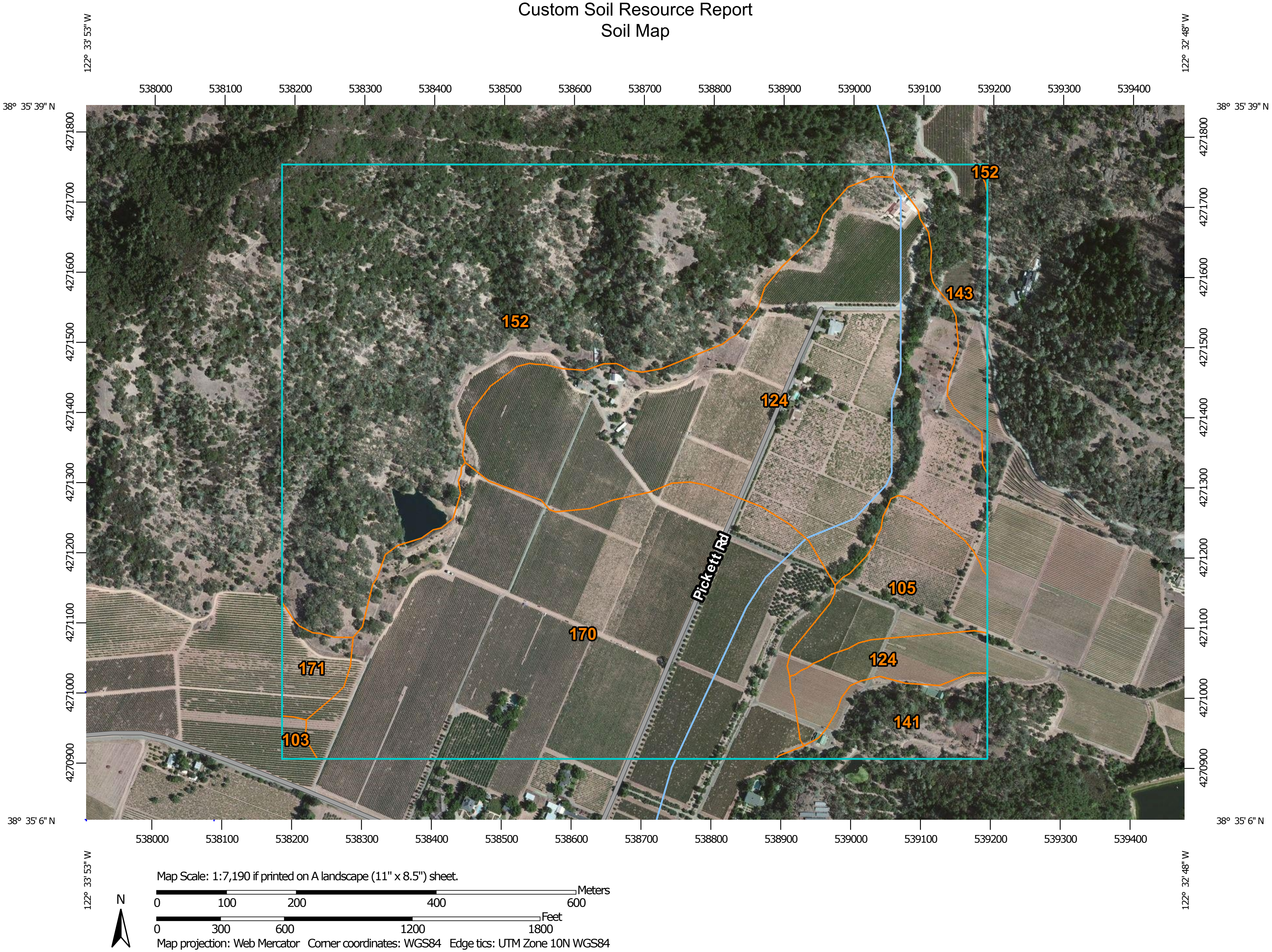
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


122° 33' 53" W
122° 32' 48" W
538000
538100
538200
538300
538400
538500
538600
538700
538800
538900
539000
539100
539200
539300
539400
38° 35' 39" N
38° 35' 6" N
4271800
4271700
4271600
4271500
4271400
4271300
4271200
4271100
4271000
4270900
152
143
124
105
170
171
103
141
Pickett Rd
Map Scale: 1:7,190 if printed on A landscape (11" x 8.5") sheet.
Meters
0
100
200
400
600
Feet
0
300
600
1200
1800
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Napa County, California
Survey Area Data: Version 7, Sep 25, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 14, 2011—Aug 15, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Napa County, California (CA055)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
103	Bale loam, 0 to 2 percent slopes	0.6	0.3%
105	Bale clay loam, 2 to 5 percent slopes	8.9	4.2%
124	Cortina very gravelly loam, 0 to 5 percent slopes	56.4	26.6%
141	Forward-Kidd complex, 50 to 75 percent slopes	6.4	3.0%
143	Guenoc-Rock outcrop complex, 5 to 30 percent slopes	6.7	3.2%
152	Hambright rock-Outcrop complex, 30 to 75 percent slopes	72.2	34.0%
170	Pleasanton loam, 0 to 2 percent slopes	58.4	27.5%
171	Pleasanton loam, 2 to 5 percent slopes	2.7	1.3%
Totals for Area of Interest		**212.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Napa County, California

103—Bale loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hdk3
Elevation: 20 to 400 feet
Mean annual precipitation: 25 to 35 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 220 to 270 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Bale and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bale

Setting

Landform: Flood plains, alluvial fans
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from rhyolite and/or alluvium derived from igneous rock

Typical profile

H1 - 0 to 24 inches: loam
H2 - 24 to 60 inches: stratified gravelly sandy loam to loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: Rare
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B

Minor Components

Clear lake

Percent of map unit: 3 percent
Landform: Alluvial fans

105—Bale clay loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: hdk5
Elevation: 20 to 400 feet
Mean annual precipitation: 25 to 35 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 220 to 270 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Bale and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bale

Setting

Landform: Flood plains, terraces
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from rhyolite and/or alluvium derived from igneous rock

Typical profile

H1 - 0 to 24 inches: clay loam
H2 - 24 to 60 inches: stratified gravelly sandy loam to loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: Rare
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B

124—Cortina very gravelly loam, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: hdks
Elevation: 30 to 2,400 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 230 to 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cortina and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cortina

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 11 inches: very gravelly loam
H2 - 11 to 60 inches: stratified very gravelly loamy sand to very gravelly sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A

Minor Components

Riverwash

Percent of map unit: 5 percent
Landform: Drainageways

141—Forward-Kidd complex, 50 to 75 percent slopes

Map Unit Setting

National map unit symbol: hdlb
Elevation: 400 to 4,500 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 54 to 55 degrees F
Frost-free period: 200 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Forward and similar soils: 60 percent
Kidd and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Forward

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from rhyolite

Typical profile

H1 - 0 to 4 inches: gravelly loam
H2 - 4 to 35 inches: loam, gravelly loam
H2 - 4 to 35 inches: weathered bedrock
H3 - 35 to 59 inches:

Properties and qualities

Slope: 50 to 75 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B

Description of Kidd

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Residuum weathered from rhyolite

Typical profile

H1 - 0 to 14 inches: loam
H2 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 50 to 75 percent
Depth to restrictive feature: 14 to 18 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D

143—Guenoc-Rock outcrop complex, 5 to 30 percent slopes

Map Unit Setting

National map unit symbol: hdld
Elevation: 400 to 3,000 feet
Mean annual precipitation: 25 to 35 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Guenoc and similar soils: 60 percent
Rock outcrop: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Guenoc

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from basic igneous rock

Typical profile

H1 - 0 to 12 inches: loam
H2 - 12 to 30 inches: clay loam
H3 - 30 to 40 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 30 percent
Depth to restrictive feature: 25 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: LOAMY UPLAND (R015XD126CA)

Description of Rock Outcrop

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Free face
Down-slope shape: Linear
Across-slope shape: Linear

Properties and qualities

Slope: 5 to 30 percent
Depth to restrictive feature: About 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8

152—Hambright rock-Outcrop complex, 30 to 75 percent slopes

Map Unit Setting

National map unit symbol: hdlp
Elevation: 200 to 3,000 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Hambright and similar soils: 50 percent
Rock outcrop: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hambright

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from basic volcanic rock

Typical profile

H1 - 0 to 12 inches: very stony loam
H2 - 12 to 22 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 75 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 1.1 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: VERY SHALLOW ROCKY (R015XD127CA)

Description of Rock Outcrop

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Free face
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Residuum weathered from igneous, metamorphic and sedimentary rock

Properties and qualities

Slope: 30 to 75 percent
Depth to restrictive feature: About 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8

170—Pleasanton loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hdm8
Elevation: 2,400 feet
Mean annual precipitation: 25 to 35 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Pleasanton and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pleasanton

Setting

Landform: Alluvial fans, flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 11 inches: loam
H2 - 11 to 66 inches: loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C

171—Pleasanton loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: hdm9
Elevation: 2,400 feet
Mean annual precipitation: 25 to 35 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Pleasanton and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pleasanton

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 11 inches: loam
H2 - 11 to 66 inches: loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Saturated Hydraulic Conductivity (Ksat), Standard Classes (Kenefick Winery)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

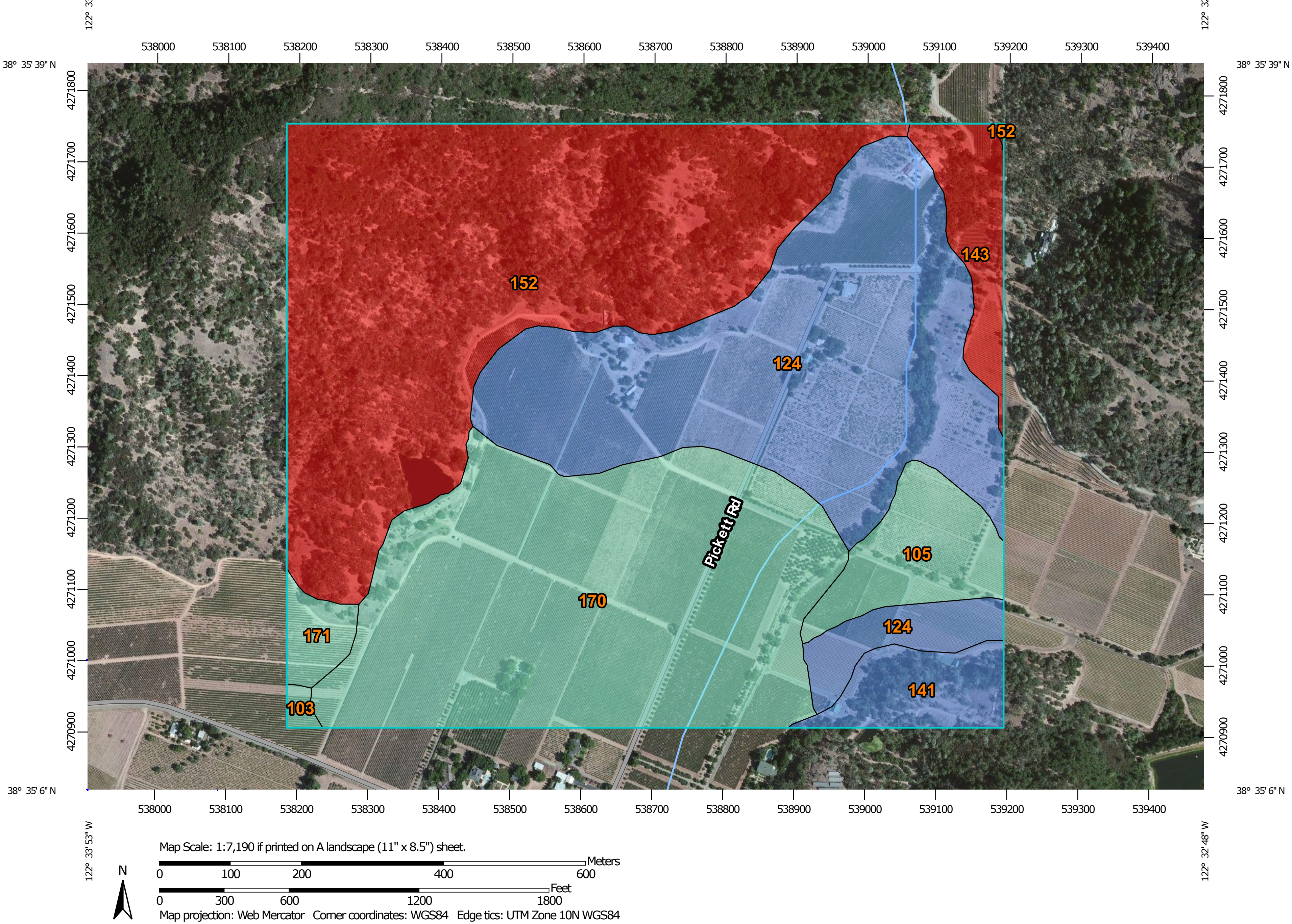
Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

Custom Soil Resource Report
Map—Saturated Hydraulic Conductivity (Ksat), Standard Classes (Kenefick Winery)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Lines

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Points

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Napa County, California
Survey Area Data: Version 7, Sep 25, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 14, 2011—Aug 15, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Saturated Hydraulic Conductivity (Ksat), Standard Classes (Kenefick Winery)

Saturated Hydraulic Conductivity (Ksat), Standard Classes— Summary by Map Unit — Napa County, California (CA055)				
Map unit symbol	**Map unit name**	**Rating (micrometers per second)**	**Acres in AOI**	**Percent of AOI**
103	Bale loam, 0 to 2 percent slopes	9.0000	0.6	0.3%
105	Bale clay loam, 2 to 5 percent slopes	9.0000	8.9	4.2%
124	Cortina very gravelly loam, 0 to 5 percent slopes	28.0000	56.4	26.6%
141	Forward-Kidd complex, 50 to 75 percent slopes	28.0000	6.4	3.0%
143	Guenoc-Rock outcrop complex, 5 to 30 percent slopes	0.0000	6.7	3.2%
152	Hambright rock-Outcrop complex, 30 to 75 percent slopes	0.0000	72.2	34.0%
170	Pleasanton loam, 0 to 2 percent slopes	9.0000	58.4	27.5%
171	Pleasanton loam, 2 to 5 percent slopes	9.0000	2.7	1.3%
Totals for Area of Interest			**212.3**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat), Standard Classes (Kenefick Winery)

Units of Measure: micrometers per second

Aggregation Method: Minimum or Maximum

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Minimum or Maximum" returns either the lowest or highest attribute value among all components of the map unit, depending on the corresponding "tie-break" rule. In this case, the "tie-break" rule indicates whether the lowest or highest value among all components should be returned. For this aggregation method, percent composition ties cannot occur. The result may correspond to a map unit component of very minor extent. This aggregation method is appropriate for either numeric attributes or attributes with a ranked or logically ordered domain.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Slowest

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Interpret Nulls as Zero: No

This option indicates if a null value for a component should be converted to zero before aggregation occurs. This will be done only if a map unit has at least one component where this value is not null.

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

For an attribute of a soil horizon, a depth qualification must be specified. In most cases it is probably most appropriate to specify a fixed depth range, either in centimeters or inches. The Bottom Depth must be greater than the Top Depth, and the Top Depth can be greater than zero. The choice of "inches" or "centimeters" only applies to the depth of soil to be evaluated. It has no influence on the units of measure the data are presented in.

When "Surface Layer" is specified as the depth qualifier, only the surface layer or horizon is considered when deriving a value for a component, but keep in mind that the thickness of the surface layer varies from component to component.

When "All Layers" is specified as the depth qualifier, all layers recorded for a component are considered when deriving the value for that component.

Whenever more than one layer or horizon is considered when deriving a value for a component, and the attribute being aggregated is a numeric attribute, a weighted average value is returned, where the weighting factor is the layer or horizon thickness.

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Physical Soil Properties (Kenefick Winery)

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the

Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Physical Soil Properties–Napa County, California														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
103—Bale loam, 0 to 2 percent slopes														
Bale	0-24	-41-	-37-	16-22- 27	1.40-1.45-1.50	4.00-9.00-14.00	0.13-0.15-0.16	0.0- 1.5- 2.9	1.0- 2.0-3.0	.24	.24	5	6	48
	24-60	-67-	-20-	10-13- 16	1.40-1.45-1.50	4.00-9.00-14.00	0.08-0.10-0.11	0.0- 1.5- 2.9	0.5- 0.8-1.0	.17	.24			
Clear lake	—	—	—	—	—	—	—	—	—					
105—Bale clay loam, 2 to 5 percent slopes														
Bale	0-24	-35-	-34-	27-31- 35	1.30-1.38-1.45	4.00-9.00-14.00	0.14-0.15-0.16	3.0- 4.5- 5.9	1.0- 2.0-3.0	.20	.20	5	6	48
	24-60	-67-	-15-	10-18- 26	1.40-1.45-1.50	4.00-9.00-14.00	0.08-0.10-0.11	0.0- 1.5- 2.9	0.5- 0.8-1.0	.15	.20			
124—Cortina very gravelly loam, 0 to 5 percent slopes														
Cortina	0-11	-44-	-41-	5-15- 25	1.45-1.50-1.55	14.00-28.00-42.00	0.09-0.11-0.13	0.0- 1.5- 2.9	0.5- 0.8-1.0	.15	.37	2	7	38
	11-60	-79-	-17-	0- 5- 10	1.55-1.60-1.65	42.00-92.00-141.00	0.06-0.08-0.09	0.0- 1.5- 2.9	0.1- 0.3-0.5	.05	.24			
Riverwash	—	—	—	—	—	—	—	—	—					

Physical Soil Properties–Napa County, California															
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
141—Forward-Kidd complex, 50 to 75 percent slopes														
Forward	0-4	-43-	-43-	10-14- 18	0.85-0.88-0.90	14.00-28.00-42.00	0.06-0.09-0.12	0.0- 1.5- 2.9	2.0- 3.0-4.0	.17	.37	3	6	48
	4-35	-43-	-43-	10-14- 18	0.85-0.88-0.90	14.00-28.00-42.00	0.09-0.13-0.16	0.0- 1.5- 2.9	0.0- 0.0-0.0	.32	.55			
	35-59	—	—	—	—	0.00-0.21-0.42	-0.00-0.00	—	—					
Kidd	0-14	-43-	-43-	10-14- 18	0.85-0.90-0.95	14.00-28.00-42.00	0.10-0.15-0.19	0.0- 1.5- 2.9	1.0- 2.0-3.0	.28	.49	2	6	48
	14-18	—	—	—	—	0.07-70.00-141.00	—	—	—					
143—Guenoc-Rock outcrop complex, 5 to 30 percent slopes														
Guenoc	0-12	-39-	-37-	20-24- 27	1.40-1.45-1.50	4.00-9.00-14.00	0.16-0.17-0.18	0.0- 1.5- 2.9	0.5- 1.3-2.0	.37	.37	2	6	48
	12-30	-22-	-39-	35-39- 45	1.40-1.48-1.55	1.40-2.70-4.00	0.14-0.15-0.16	3.0- 4.5- 5.9	0.5- 0.8-1.0	.10	.28			
	30-40	—	—	—	—	0.07-70.00-141.00	-0.00-0.00	—	—					
Rock outcrop	0-10	—	—	—	—	0.00-0.00-0.00	—	—	—					

Physical Soil Properties–Napa County, California														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
152—Hambright rock-Outcrop complex, 30 to 75 percent slopes														
Hambright	0-12	-39-	-37-	20-24- 27	1.40-1.45-1.50	4.00-9.00-14.00	0.08-0.09-0.10	1.2- 1.9- 2.7	2.0- 5.0-8.0	.10	.28	1	8	0
	12-22	—	—	—	—	0.07-70.00-141.00	-0.00-0.00	—	—					
Rock outcrop	0-10	—	—	—	—	0.00-0.00-0.00	—	—	—					
170—Pleasanton loam, 0 to 2 percent slopes														
Pleasanton	0-11	-43-	-39-	12-19- 25	1.40-1.45-1.50	4.00-9.00-14.00	0.13-0.14-0.15	0.0- 1.5- 2.9	1.0- 1.5-2.0	.24	.37	5	6	48
	11-66	-35-	-40-	25-25- 35	1.40-1.48-1.55	1.40-2.70-4.00	0.13-0.14-0.15	3.0- 4.5- 5.9	0.5- 0.8-1.0	.24	.37			
171—Pleasanton loam, 2 to 5 percent slopes														
Pleasanton	0-11	-43-	-39-	12-19- 25	1.40-1.45-1.50	4.00-9.00-14.00	0.13-0.14-0.15	0.0- 1.5- 2.9	1.0- 1.5-2.0	.24	.37	5	6	48
	11-66	-35-	-40-	25-25- 35	1.40-1.48-1.55	1.40-2.70-4.00	0.13-0.14-0.15	3.0- 4.5- 5.9	0.5- 0.8-1.0	.24	.37			

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