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Water Availability Analysis

Vine Cliff Winery Alteration Use Permit and Minor Modification
P25-00161-UP & P24-00191-MM
Planning Commission Hearing – June 18, 2025

Water Availability Analysis

Vine Cliff Winery, Napa County APN 032-030-027

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(Applicant)

Vine Cliff Winery
7400 Silverado Trail
Napa, California

Prepared by:

OEI

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September 18, 2024

Contents

Introduction

Vine Cliff Winery is seeking permits from the County of Napa to renovate winery facilities at 7400 Silverado Trail (APN 032-030-027) which is located about 2.8 miles east of Oakville in the hills east of the Napa Valley floor. The subject parcel lies outside of the boundaries of the Napa Valley Groundwater Sub-basin. This Water Availability Analysis (WAA) is an update to the prior approved WAA for the parcel prepared by OEI in December 2017. The update includes a new well search in the project area and vicinity and revisions to the Tier 1 analysis to conform with updated County of Napa Groundwater guidance from Department of Planning, Building, & Environmental Services. No change in water use is expected.

The WAA includes the following elements: estimates of existing and proposed water uses on the project parcel and within the project recharge area, compilation of drillers' logs from the area and characterization of local hydrogeologic conditions, and execution of Tier 1 and Tier 2 screening criteria including estimates of groundwater recharge relative to proposed uses (Tier 1) and the potential for well interference at neighboring wells (Tier 2). No wells are within 500 ft of the project wells; per County guidance, no additional well interference analysis is required. The project well does not lie within 1,500 ft of any County-designated significant stream; hence no additional analysis of potential surface water-groundwater interaction is required (Tier 3).

Limitations

Groundwater systems of Napa County and the Coast Range are typically complex, and available data rarely allows for more than general assessment of groundwater conditions and delineation of aquifers. Hydrogeologic interpretations are based on the drillers' reports made available to us through the California Department of Water Resources, available geologic maps and hydrogeologic studies and professional judgment. This analysis is based on available data and relies significantly on interpretation of data from disparate sources of disparate quality.

Given the significant depths to water in wells near the project parcel (160 to 626-ft), the relationship between groundwater recharge generated on the project parcel and groundwater availability at the project wells is uncertain. It is likely that water flowing to the project wells is supplied by groundwater inflows from surrounding areas as well as from recharge occurring on the overlying landscape comprised by the subject parcel. Analysis of the age and sources of the deeper groundwater occurring beneath the project parcel is beyond the scope of this study.

The water balance approach used to estimate groundwater recharge for this study simulates potential recharge from infiltration of precipitation and does not include verifiable estimates of the capacity of the project aquifer materials to accept recharge. Where bedrock of low permeability and/or fractured bedrock underlies the subject parcel and study area, a significant proportion of the potential recharge may exit the project area as shallow subsurface flow rather than percolating and recharging the local aquifer. Quantifying the proportion of the potential recharge that percolates to underlying bedrock aquifers is beyond the scope of this analysis; we have attempted to characterize aquifer hydraulic parameters from available data. Data describing subsurface conditions of soil and bedrock, local aquifer hydraulic characteristics, and local processes and pathways of groundwater percolation are rarely available and difficult to obtains in the absence of focused and well-funded hydrogeologic investigations.

Hydrogeologic Conditions

The tier 1 WAA focuses on estimating groundwater recharge for comparison to groundwater use. Groundwater recharge in hillside areas of Napa County results primarily from infiltration of precipitation distributed across the land surface. To accomplish Tier 1 objectives in a manner consistent with hydrogeologic principles and water balance techniques used to estimate groundwater recharge, we define an area of landscape encompassing the project parcel that represents the likely source of infiltration recharge of the aquifer utilized by the project wells. The so-defined project recharge area is also used to estimate existing groundwater use on surrounding parcels so that a more comprehensive assessment of groundwater availability can be performed to assess project groundwater use in the context of the regional project aquifer. The recharge area thus also represents the project groundwater impact area and is sometimes referred to as the project recharge /impact area.

The project parcel is located in the foothills east of the Napa Valley in the northwest portion of a relatively large (~32 square miles) block of andesitic and basaltic lava flows of the Tertiary-aged Sonoma Volcanics. These volcanic rocks comprise much of the mountains east of the Napa Valley from the northern portion of the Milliken-Sarco-Tullocay (MST) basin north to Lake Hennessey (Figure 1). At the east edge of Napa Valley within the lowest-lying portions of the project parcel and immediately west of the parcel, alluvial fan deposits (map units Qf and Qhf) overlie the Sonoma Volcanics, mapped locally to be andesite and basalt flows (map unit Tsa, Figure 1). A project recharge area was developed for this project and is bounded by ridgelines delineating groundwater flow on the east north and south sides and the geologic contact with the alluvium of the Napa Valley floor to the west. This project recharge area is approximately 306.6 acres in size Geologic cross sections in the vicinity of the project parcel indicate that the Tsa unit extends to the west beneath portions of the alluvium of the Napa Valley and that wells in the area completed to depths as high as 600-ft do not fully penetrate the Tsa unit (see geologic Sections B and C, LSCE, 2013).

The Tsa unit is part of the lower member of the Sonoma Volcanics which was described by Weaver (1949) as comprised of individual lava flows displaying great variability in thickness and texture over short distances. Given this heterogeneity it can be expected that hydrogeologic conditions exhibit similar spatial variability and yields from wells completed anywhere in the Tsa unit, ranging from minimal yield to several hundred gpm (LSCE, 2013).

Driller's logs (Well Completion Reports) for wells around the project parcel were obtained from the California Department of Water Resources and from County files. A subset of these logs was compiled and georeferenced based on parcel and location sketch information available for some wells (Figure 1). The project parcel has two wells. The upper well (Well 1) is in the central-east portion of the parcel and was completed in 1996 to a depth of 385-ft. The lower well (Well 2) is in the south-east portion of the parcel and was completed in 1996 to a depth of 280-ft (Table 1 & Figure 1). Static water level was not reported in well 1 but was reported at 150 feet bgs in well 2 at the time of construction.

Alluvial fan deposits in the southwest corner of the subject parcel are expected to be highly permeable relative to the underlying volcanic bedrock that comprises the project aquifer. Groundwater recharge processes are likely to be enhanced by the alluvial fan deposits because water may more readily percolate into and saturate the fan deposits and establish a perched water table overlying the bedrock aquifer that could provide for more effective percolation to the bedrock. This phenomena affects only a small portion of the parcel but could have a disproportionate effect on overall recharge occurring on the subject parcel.

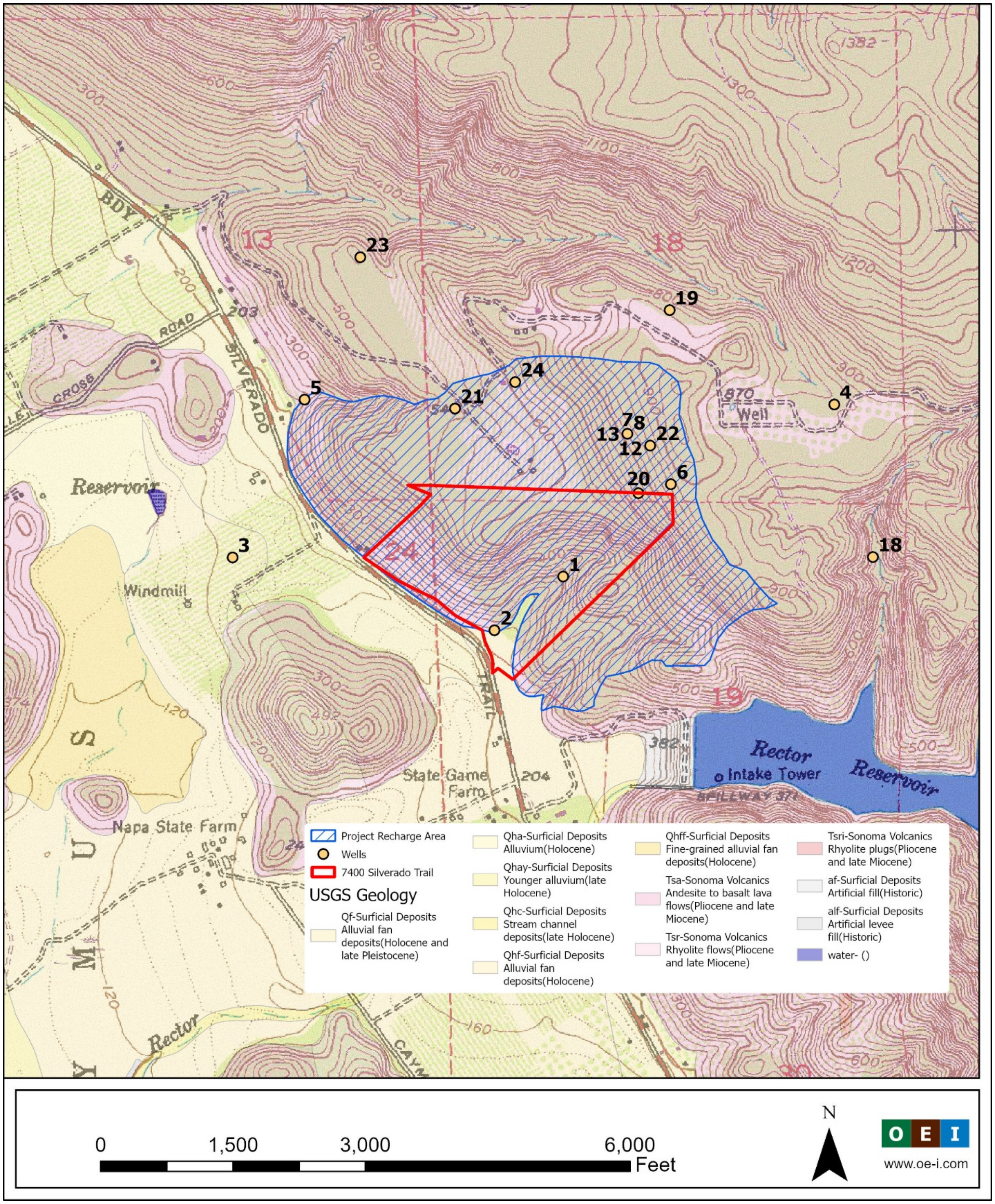

Figure 1: Surficial geology and locations of wells in the vicinity of the project parcel (Graymer et al., 2007). Units are as follows:

Table 1: Well completion details for the upper well (Well 1), lower well (Well 2), and wells on nearby parcels. Wells indicated by * were not included in the 2016 analysis but have been included from improved records and well search in 2024.

Well No.	1	2	3*	4*	5*	6	7*	8*	9*	10*	11*	12*
Year Completed	1996	1986	1977	1995	1998	2007	2004	2004	2004	2004	2004	2004
Depth	385	283	240	800	600	690	300	300	300	300	300	300
Static Water Level	-	150	15	182	350	480	-	-	-	-	-	-
Estimated Yield	120	200	220	30	20	90	-	-	-	-	-	-
Top of Screened Interval	200	183	40	60	80	360	-	-	-	-	-	-
Bottom of Screened Interval	300	283	240	80	600	690	-	-	-	-	-	-
Geologic Unit	Tsa	Tsa	Qhf	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa
WCR No.	547492	119629	103154	547445	324026	1073642	802399	802400	802401	802402	802403	802404

Well No.	13*	14*	15*	16*	17*	18	19*	20	21*	22*	23*	24
Year Completed	2004	2004	2004	2004	2004	1999	1999	1978	1998	1998	1992	2000
Depth	300	300	300	300	300	1125	753	350	595	810	637	590
Static Water Level	-	-	-	-	-	271	393	220	275	375	400	260
Estimated Yield	-	-	-	-	-	300	150	20	60	100	60	60
Top of Screened Interval	-	-	-	-	-	385	433	150	245	440	397	130
Bottom of Screened Interval	-	-	-	-	-	585	753	350	545	810	637	590
Geologic Unit	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa	Tsa
WCR No.	802405	802406	802407	802408	802409	e0177367	778357	-	528419	528473	482234	710238

Water Demand

Existing groundwater uses within the project recharge area (described below in the Groundwater Recharge Analysis section) consist of Residential Use for eight residences, Winery Use for the 48,000 gallon per year Vine Cliff Winery, and Irrigation Use for 121 acres of vineyard of which 26 acres are on the project parcel.

The existing Residential Use is estimated to total 7.15 ac-ft/yr. The existing Winery Use (Vine Cliff Winery) is estimated to total 2.41 ac-ft/yr, and the existing Irrigation Use is estimated to total 60.57 ac-ft/yr for a Total Existing Use of 70.11 ac-ft/yr. Approximately 17.06 ac-ft/yr or 24% of the existing use is associated with the project parcel with the remainder associated with neighboring parcels (Tables 2-4). These values vary slightly from water use estimates associated with the 2017 WAA due to updated water use calculations and changes in land use on surrounding parcels. The proposed project actions include the addition of a commercial kitchen. However, water use on the project parcel will not change as a result of this as precious water demand estimates assume water demand based on the annual number of attendees at catered events which will not change between existing and proposed conditions as a result of this project. No change in water use is expected as part of this project. Water for the project parcel is supplied by wells 1 and 2 (Table 1 and Figures 1 & 3)

Table 2: Existing and proposed annual groundwater uses (ac-ft/yr) within the project recharge area.

	Existing Condition (acre-ft/yr)	Proposed Condition (acre-ft/yr)
Project Parcel	**17.06**	**17.06**
Residential Use	1.80	1.80
Irrigation Use	12.84	12.84
Winery Use	2.03	2.03
Employee/Guest Use	0.39	0.39
Neighboring Parcels	**53.05**	**53.05**
Residential Use	5.35	5.35
Irrigation Use	47.70	47.70
Total	**70.11**	**70.11**

Table 3: Existing and proposed water use on the project parcel. Note that landscaping water use was reported as a flat rate rather than a per-acre rate.

	# of Units	Use per Unit	Annual Water Use (AF/yr)
Residential Use			**1.80**
Residences, Oversized	1 Residence	1.00 AF/Residence	1.00
Residences, Secondary	2 Residences	0.35 AF/Residence	0.70
Pools	1 Pool	0.10 AF/Pool	0.10
Agricultural Use			**12.84**
Vineyard	25.67 Acres	0.50 AF/acre/yr	12.84
Winery Use			**2.03**
Process Water	48000 Gallons	2.15 AF/100,000 gal.	1.03
Domestic & Landscaping	- Gallons	0.50 AF/100,000 gal.	1.00
Guest & Employee Use			**0.39**
Tasting Room Visitations	14600 Guests	3 gal./Guest	0.13
Events w/ On-Site Catering	2100 Guests	15 gal./Guest	0.10
Full-Time Employees	12 Employees	15 gal./shift @ 250 shifts/yr	0.14
Part-Time Employees	4 Employees	15 gal./shift @ 125 shifts/yr	0.02
Total			**17.06**

Table 4: Existing and proposed groundwater use on neighboring parcels within the groundwater recharge area.

	# of Units	Use per Unit	Annual Water Use (AF/yr)
Residential Use			**5.35**
Residences, Oversized	1 Residence	1.00 AF/Residence	1.00
Residences, Primary	4 Residences	0.75 AF/Residence	3.00
Pools	3 Pools	0.10 AF/Pool	0.30
Other Landscaping, Addtl.	21000 sq. ft.	0.05 AF/1,000 sq. ft.	1.05
Agricultural Use			**47.70**
Vineyard	95.4 Acres	0.50 AF/acre/yr	47.70
Total			**53.05**

Groundwater Recharge Analysis

Groundwater recharge within the project recharge area was estimated using a Soil Water Balance (SWB) of Napa County developed by OEI. This model implements the U.S. Geologic Survey's SWB modeling software and produces a spatially distributed estimate of annual recharge. This model operates on a daily timestep and uses daily values for precipitation and evapotranspiration along with soil hydrologic parameters and vegetation cover. The model calculates runoff based on the Natural Resources Conservation Service (NRCS) curve number approach and Actual Evapotranspiration (AET) and recharge based on a modified Thornthwaite-Mather soil-water-balance approach (Westenbroek et al., 2010). Details of this model and the hydrologic data and simulated water budget outputs are provided in Appendix B.

Groundwater recharge for this project area was previously simulated for Water Year 2010 which was selected because annual precipitation in that year was nearest to the 30-year average for the period 1981-2010. OEI's SWB modeling also estimated recharge for Water Year 2014 to represent drought year conditions. In late-November 2022, the County of Napa instituted a new policy prescribing that for purposes of estimating groundwater recharge, the mean annual precipitation to be used is that mean for Water Years 2012-2021 derived from the newest PRISM data. County of Napa has provided gridded GIS data of the mean precipitation for this period for use by WAA practitioners.

OEI's use of the SWB model is believed to provide more accurate estimates of potential groundwater recharge because it is a physically based distributed model that incorporates information characterizing the water balance in the soil column. Calculation of evapotranspiration using local climate data along with soil moisture storage and precipitation is believed to provide a more accurate representation of local conditions; evapotranspiration is the largest component of the water balance. Unfortunately, the SWB model structure does not allow for a groundwater recharge calculation based on a mathematical average because the model is driven by daily climate data. Consequently, OEI has adapted the SWB model estimates for the prior "average year" (WY 2010) and the "drought year" (WY 2014) to provide an estimate for the average annual rainfall for the period 2012-2021 developed by County of Napa.

OEI has utilized SWB models for WY 2010 and WY 2014 for dozens of project sites in the County of Napa. We have observed that potential recharge for WY 2010 is consistently much greater than for WY 2014 across a wide variety of terrain, vegetation, soils and climate. This is most easily characterized by the percentage of annual precipitation available for recharge that we calculate for each project site. Our approach for adapting the SWB model outputs to estimate groundwater recharge for the specified annual average precipitation is to assume that the percentage of annual rainfall available for groundwater recharge is a linear function of annual rainfall and interpolating between the recharge percentage for WY 2010 and WY 2014. The water balance data from the SWB model years is tabulated in Table 5.

Results

Updated WAA guidance from the County of Napa requires the use of the updated 2012-2021 average precipitation dataset provided by County of Napa and produced by PRISM Climate Group at Oregon State University. This dataset provides spatially distributed 10-year average precipitation data at the location of this project. The 10-year average precipitation at the site is approximately 27.7 inches. We assume that a linear relationship exists between precipitation and runoff and use the simulated 2010 and 2014 SWB data to predict average recharge based on the 10-year average precipitation data. This method results in an average recharge estimate of 6.2 inches of 22.5% of average precipitation, slightly less than the 2010 normal year prediction.

Table 5: Summary of water balance results from the SWB model.

	2010 Normal Year		2014 Dry Year		2012 -2021 Avg.	
	inches	% of precip	inches	% of precip	inches	% of precip
Precipitation	29.4	-	15.1	-	27.7	-
AET		-		-	-	-
Runoff		-		-	-	-
Δ Soil Moisture		-		-	-	-
Recharge	6.8	23.1%	2.1	13.8%	6.2	22.5%

Groundwater Storage

Groundwater storage is estimated as the product of the aquifer surface area (assumed to be equivalent to the project recharge area), the depth of the saturated zone of the aquifer intersected by wells, and the porosity of the fractured bedrock. The surface area is about 306.6 acres. The depth of the saturated zone was defined as the average difference between the static water level and the bottom of the screened interval in the two project wells (Wells 1 and 2in Table 1 & Figure 1). The estimated depth of the saturated zone is therefore about 100-ft. Note that the depth of the aquifer is defined by well depth, and that the saturated zone of the aquifer probably extends to substantially greater depths. The potential aquifer storage capacity is therefore likely to be underestimated.

The porosity of the fractured bedrock is expected to lie between <1 and 10% (Freeze and Cherry, 1979; Weight and Sonderegger, 2000). Given the relatively low specific capacities (for fractured bedrock) of wells (Table 1) in the project aquifer, we assume a low-end (conservative) porosity of 1%. The estimated groundwater storage in the bedrock aquifer is calculated as 306.6 ac-ft.

Comparison of Water Demand and Groundwater Recharge/Storage

The total proposed water use for the project recharge area is estimated to be 70.1 ac-ft/yr. This represents 44% of the estimated 10-year average annual recharge of 159.4 ac-ft/yr (Table 6). This comparison indicates that the project aquifer has a modest surplus of water in terms of annual use compared to annual recharge, and that the aquifer storage is more than six times the annual recharge. When the comparison is restricted to the footprint of the project parcel, the total proposed water use is a smaller percentage (33%) of the mean annual groundwater recharge (Table 6).

Table 6: Comparison of total annual Water Use and groundwater recharge.

Domain	Total Proposed Demand (ac-ft/yr)	Dry Water Year (2014)		
		Recharge (ac-ft/yr)	Recharge Surplus (ac-ft/yr)	Demand as % of Recharge
Project Recharge Area	70.1	159.4	89.3	44%
Project Parcel	17.1	51.8	34.7	33%

The significant volume of groundwater in storage is expected to moderate the impacts of climatic variations on aquifer conditions. The effects of dry years and wet years are likely balanced out over the period of years or decades required for water to move through the aquifer, such that short-term reductions in groundwater storage associated with periods of reduced groundwater recharge during dry years would be compensated by increases in storage during wetter years.

The use of the 2012-2021 average precipitation as required by County of Napa guidelines implicitly acknowledges this aspect of groundwater resources.

There is no new water use associated with this project at Vine Cliff Winery; the water use estimates in this report incorporate land use changes since about 2016. This updated WAA estimated an increase of 0.45 ac-ft/yr of residential use and 4.04 ac-ft/yr of vineyard irrigation. This WAA concluded that an additional 8.1 acres of vineyard were planted in project recharge area. This updated WAA also incorporated groundwater recharge estimates based on the County-wide SWB model developed by OEI (Appendix B). This iteration of the SWB model predicted a higher rate of groundwater recharge than the limited SWB model developed for OEI's prior WAA. The prior WAA estimated that groundwater use on the project parcel was 52% of mean annual recharge as compared to 33% in the updated WAA (Table 6).

Well Interference Analysis

The closest neighboring well to the two existing wells on the project parcel appears to be located about 1,275 feet northeast of well 1lk on the adjacent parcel to the north (Well 20 in Table 1 & Figure 1). Based on the WAA guidance document, a Tier 2 well interference analysis is not required given that non-project wells are located greater than 500-feet from the project wells.

Summary

Application of the Soil Water Balance (SWB) model and updated 10-year average precipitation data to estimate water available for aquifer recharge in the project area revealed that average recharge is ~6.2 inches/yr or 159.4 ac-ft/yr. No new water use is associated with this project. On the project parcel, groundwater demand is equivalent to 33% of the estimated annual recharge in an average water year; in other words, groundwater recharge is almost double groundwater use on the parcel. The total Water Use for the project recharge area is estimated to be 70.1 ac-ft/yr which represents 44% of the mean annual recharge indicating that the project is unlikely to result in significant declines in groundwater elevations or depletion of groundwater resources over time.

The closest neighboring well to the project wells is located more than 500 feet from the project wells, hence it is presumed that significant well interference is unlikely to occur per County guidance. There are no County-designated significant streams within 1,500 ft of the project parcel.

References

Freeze, R., and Cherry, J., 1979. Groundwater. Prentice-Hall, New Jersey, 604 pgs.

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Weaver, C.E., 1949. Geology of the Coast Ranges immediately north of the San Francisco Bay Region, California, California Department of Natural Resources, Division of Mines, Bulletin 149.

Weight, W., and Sonderegger, J., 2000. Manual of Applied Field Hydrogeology. McGraw-Hill, 608 pgs.

Westenbroek, S.M., Kelson, V.A., Dripps, W.R., Hunt R.J., and Bradbury, K.R., 2010. SWB - A Modified Thornthwaite-Mather Soil-Water-Balance Code for Estimating Groundwater Recharge, U.S. Geological Survey Techniques and Methods 6-A31, 60 pgs.

APPENDIX A

WELL COMPLETION REPORTS

QUADRUPLICATE
For Local Requirements

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 547492

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
RECEIVED OCT 21 1996 ENVIRONMENTAL MANAGEMENT

Page 1 of 1
Owner's Well No. ____
Date Work Began 9-19-96, Ended 10-2-96
Local Permit Agency Napa Co. Dept. of Environmental Mgmt
Permit No. 42920 Permit Date 8-27-96

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER ____ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain size, color, etc.)		
0	43	Brown rock		
43	65	Soft brown rock		
65	88	Soft brown shale		
88	155	Black and grey rock		
155	192	Red rock		
192	200	Hard black rock		
200	280	Hard grey rock		
280	385	Hard black rock		
		Continued from below		
		blank	screen	slot size
300	320	x		
320	340		x	.030
340	360	x		
360	388		x	.030
380	385	x		

TOTAL DEPTH OF BORING 385 (Feet)
TOTAL DEPTH OF COMPLETED WELL 385 (Feet)

WELL OWNER

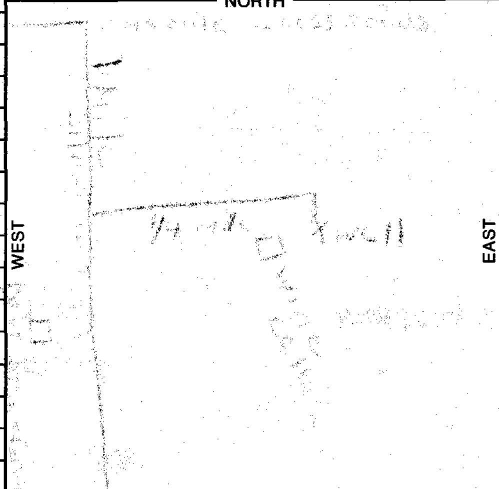
Name [redacted]
Mailing Address [redacted]
CITY STATE ZIP

WELL LOCATION

Address 7400 Silverado Trail
City Napa
County Napa
APN Book 32 Page 030 Parcel 27
or Township ____ Range ____ Section ____
or Latitude ____ DEG. MIN. SEC. NORTH Longitude ____ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH



WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
___ Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary-Air FLUID Foam

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ____ (Ft.) & DATE MEASURED 10-2-96
ESTIMATED YIELD* 120 (GPM) & TEST TYPE Airlift
TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN Complete
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	200	13½	x				F-480	8"	cl 200	
200	220			x						.030
220	240		x							
240	260			x						.030
260	280		x							
280	300			x						.030

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	55	x			
55	57		x		
57	385			x	Pea gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ____

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Doshier-Gregson Inc
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

5365 Napa-Vallejo Hwy American Canyon, Ca 94589
ADDRESS CITY STATE ZIP

Signed ____ WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED 258826 C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
Use to comply with local requirements

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 119629

Notice of Intent No. ____
Local Permit No. or Date ____

State Well No. ____
Other Well No. ____

(1) OWNER:
Name [redacted]
Address [redacted]
City [redacted] Zip [redacted]

(2) LOCATION OF WELL (See instructions):
County Napa Owner's Well Number 32-030-27
Well address if different from above Silv. Tr. below Rector dam
Township ____ Range ____ Section ____
Distance from cities, roads, railroads, fences, etc. ____

WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic [X]
Irrigation [ ]
Industrial [ ]
Test Well [ ]
Stock [X]
Municipal [ ]
Other [ ]

(5) EQUIPMENT:
Rotary [ ] Reverse [ ]
Cable [ ] Air [X]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:
Yes [X] No [ ] Size 13 3/4"
Diameter of bore 13 3/4"
Packed from 20 to 283 ft.

(7) CASING INSTALLED:
Steel [ ] Plastic [X] Concrete [ ]

(8) PERFORATIONS:
Type of perforation or size of screen machine

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	183	8	200	183	283	.040

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 20 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ____ ft.
Method of sealing grout

(10) WATER LEVELS:
Depth of first water, if known 110 ft.
Standing level after well completion 150 ft.

(11) WELL TESTS:
Was well test made? Yes [X] No [ ] If yes, by whom? driller
Type of test Pump [ ] Bailer [ ] Air lift [X]
Depth to water at start of test 150 ft. At end of test complete ft.
Discharge 200 gal/min after 1 hours Water temperature ____
Chemical analysis made? Yes [ ] No [X] If yes, by whom? ____
Was electric log made? Yes [ ] No [X] If yes, attach copy to this report

(12) WELL LOG:
Total depth 283 ft. Depth of completed well 283 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	3	topsoil & boulders
3	25	grey rock
25	50	brown & grey rock
50	100	grey & lt. brown rock
100	125	dk. grey & green rock, hard fractured
125	150	grey green rock stringers red rock
"	"	hard fractured
150	200	dk & lt grey & green rock hard frac
200	283	dk. grey green & red rock brown
		rock stringers black hard fractured

DO NOT IDENTIFY
NOT FOR PUBLIC USE
WATER CODE SEC. 13752

Work started 7/14 1986 Completed 7/23 1986

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED ____ (Well Driller)

NAME Doshier and Gregson Drilling, Inc.
(Person, firm, or corporation) (Typed or printed)
Address 5365 Napa-Vallejo Highway
City Vallejo Zip 94589
License No. 294001 Date of this report 7/23/86

EL RETIRO VINEYARD
(ANTONION GOMEZ)

QUADRUPLICATE
Use to comply with local requirements

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

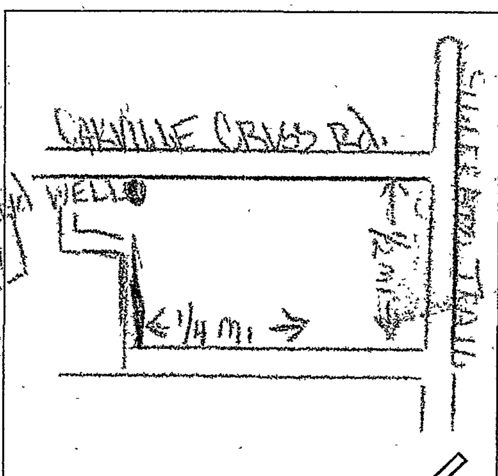
No. 103154

Notice of Intent No. ____
Local Permit No. or Date [redacted]

State Well No. ____
Other Well No. ____

(1) OWNER: Name [redacted]
Address [redacted]
City [redacted] Zip [redacted]

(2) LOCATION OF WELL (See instructions):
County Napa Owner's Well Number 31-070-09
Well address if different from above Same
Township ____ Range ____ Section ____
Distance from cities, roads, railroads, fences, etc. ____



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic [ ]
Irrigation [X]
Industrial [ ]
Test Well [ ]
Stock [ ]
Municipal [ ]
Other [ ]

(5) EQUIPMENT:
Rotary [X] Reverse [ ]
Cable [ ] Air [ ]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:
Yes [X] No [ ] Size 3/4"
Diameter of bore 12¼
Packed from ____ to 20 ft.

(7) CASING INSTALLED:
Steel [X] Plastic [ ] Concrete [ ]

(8) PERFORATIONS: Machine
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	240'	8"	188	40'	240'	
				on top		

(9) WELL SEAL:
Was surface sanitary seal provided? Yes [X] No [ ] If yes, to depth 20 ft.
Were strata sealed against pollution? Yes [ ] No [X] Interval ____ ft.
Method of sealing Grout

(10) WATER LEVELS:
Depth of first water, if known 43' ft.
Standing level after well completion 15' ft.

(11) WELL TESTS:
Was well test made? Yes [X] No [ ] If yes, by whom? Drillers
Type of test Pump [ ] Bailer [X] Air lift [ ]
Depth to water at start of test 43' ft. At end of test 10 ft
Discharge 220gpm+ gal/min after ____ hours Water temperature ____
Chemical analysis made? Yes [ ] No [X] If yes, by whom? ____
Was electric log made? Yes [ ] No [XX] If yes, attach copy to this report

(12) WELL LOG: Total depth 240 ft. Depth of completed well 240 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	2	soil & boulders
2	17	cemented gravel
17	21	blue clay
21	25	blue clay, gravel imb.
25	34	brittle hard brown rock
34	43	brown tuffa, multi colored hard rock strs
43	47	multi colored fractured rock
47	67	black & green fractured rock
67	74	granular brown fractured rock
74	78	red,green&black fractured £rock
78	79	black&brown fractured rock
79	94	hard black large fractured rock
94	101	hard black red&green lge.frac. rock
101	110	hard black&brown lge.frac.rock
110	113	hard grn.&black lge.frac.rock
113	118	hard grn.&brn.rock sm.fractures
118	131	semi hard granular grn.grey& black rock (Lost Water)
131	133	hard black rock very lge.frac.
133	137	hard blk rock,sm.fractures
137	141	semi hard blk&grn rock frac.
141	146	hard blk rock,sm.fract.
	145	large fract.
146	148	hard blk rock no fractures
148	149	hard blk very lge.frac.rock
149	154	semi hard blk,red&green rock
154	159	semi hard blk&grey frac.rock
159	161	blk volcanic foam-rock
161	167	semi hard blk fractured rock
167	171	hard blk fractured rock
171	186	blk.volcanic foam rock
186	194	hard blk rock fractured
194	208	black granular rock
208	213	hard black rock fractured
213	224	black & red granular rock
224	240	hard grey & red rock,soft grey strs

Work started 12-7 1977 Completed 12-19 1977

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED J D Doshier
(Well Driller)

NAME Doshier-Gregson Drilling,Inc.
(Person, firm or corporation) (Typed or printed)
Address 5365 Napa-Vallejo Hwy
City Vallejo,Ca Zip 94590
License No. 294001 Date of this report 12/20/77

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Environmental

Cover Sheet

APN	032-030-052-000
Permit #	
Program	WELL
DocType	WL
Street #	
Street Name	SILVERADO TRL
Year	

QUADRUPLICATE
For Local Requirements
Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 547445

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE | LONGITUDE
APN/TRS/OTHER

Owner's Well No.
Date Work Began 6-19-95 Ended 7-21-95
Local Permit Agency Napa Co. Dept. of Environmental Mgmt
Permit No. 39478 Permit Date 6-19-95

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER 370 (Ft.) BELOW SURFACE

RECEIVED AUG 0 3 1995 DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	2	Topsoil
2	20	Brown Rock Soft
20	40	Gray & brown med.
40	70	Gray Rock Hard
70	100	Gray & brown rock hard
100	145	Lt. red & gray rock med.
145	160	Gray & red rock med.
160	205	Black & gray rock med.
205	235	Black,gray, rock,stringers red fract.
235	265	Gray rock med
265	295	Gray & red rock fract. med
295	310	red, gray & brown rock
310	355	Red, black & brown rock, soft
355	370	Broen, red & black rock, fract.
370	400	Black, brown & red rock
400	455	Gray & brown rock, med.
455	500	Gray rock, hard
500	530	Gray & Black rock, med.
530	560	Brown, black & red rock, med.
560	590	Black,& brown rock, med.
590	605	Black, brown & red
605	635	Black & red rock, med.
635	665	Black & green rock, med.
665	700	Dk gray & black rock, med.
700	735	Black, red & brown rock, med.
735	755	REd, black & brown rock, fract.
755	775	Black rock, fract. med.
775	805	Black & gray rock, fract. med.

TOTAL DEPTH OF BORING 805 (Feet)
TOTAL DEPTH OF COMPLETED WELL 800 (Feet)

WELL OWNER

Name [redacted]
Mailing Address [redacted]
[redacted]
CITY STATE ZIP

WELL LOCATION

Address 7781 Silverado Trail
City Napa
County Napa
APN Book 32 Page 030 Parcel ~~07~~ 52
or Township ___ Range ___ Section ___
or Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

#5497

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Mud & Air rotary FLUID Water-Bentonite

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 182 (Ft.) & DATE MEASURED 7-26-95
ESTIMATED YIELD* 30 (GPM) & TEST TYPE Pump
TEST LENGTH 8 (Hrs.) TOTAL DRAWDOWN complete (Ft.)
** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	60	13½	X				i-c-1	8	F-480	
60	80			X			i-c-1	8	F-480	.032
80	800	Perf.	& solid				staggered			
2	1	14"			X					

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
800	22			X	Pea Gravel
22	21		X		
21	1	X			

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Doshier-Gregson, Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

5365 Napa-Vallejo Hwy Vallejo, Ca 94590
ADDRESS CITY STATE ZIP

Signed [signature] 08-01-95 258826
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
Use to comply with local requirements

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in
No. 095283

Notice of Intent No. _____
Local Permit No. or Date _____

State Well No. _____
Other Well No. _____

(1) OWNER: Name [redacted]
Address [redacted]
City [redacted] Zip [redacted]

(2) LOCATION OF WELL (See instructions):
County Napa Owner's Well Number 32-030-07
Well address if different from above Silverado Trail
Township Napa Range _____ Section _____
Distance from cities, roads, railroads, fences, etc. _____

WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☒
Irrigation XX ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) EQUIPMENT:
Rotary ☐ Reverse ☐
Cable ☐ Air XX
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☐ No ☐ Size _____
Diameter of bore _____
Packed from _____ to _____ ft.

(7) CASING INSTALLED:
Steel XX Plastic ☐ Concrete ☐

(8) PERFORATIONS:
Type of perforation or size of screen Machine

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	500	6"	188	400	500	¼x3"

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval _____ ft.
Method of sealing Grout

(10) WATER LEVELS:
Depth of first water, if known 415 ft.
Standing level after well completion 300 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? driller
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test 300 ft. At end of test _____ ft
Discharge 60 gal/min after _____ hours Water temperature _____
Chemical analysis made? Yes ☐ No ☒ If yes, by whom? _____
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 500 ft. Depth of completed well 500 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	150	Red clay & soft red rock
150	175	Gray rock - hard fract.
175	200	Gray, red & green rock,med.hard
200	225	Yellow,bl.& br. rock, fract.
225	250	Green & Gray rock, soft
250	275	Black & brown rock - sfot
275	325	Brown, ~~xxxxx~~ rock, med. hard
325	350	Brown, green & black rock -soft
350	400	Green, yellow & bl.rock - soft
400	500	Red ~~xn~~,black, yellow & green rock - hard fract.

Work started 11-5 1980 Completed ~~xxxxxxx~~ 12-1 1980

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED [signature]
(Well Driller)
NAME Doshier-Gregson Drilling, Inc.
(Person, firm, or corporation) (Typed or printed)
Address 5365 Napa-Vallejo Hwy.
City Vallejo Zip 94590
License No. 294001 Date of this report 12/4/80

 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL File with DWR   LOCAL

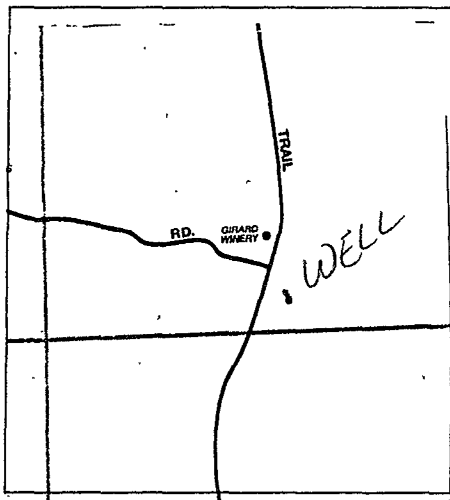
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

√ [initials] 1/6/99
Do not fill in
No. 324026

Notice of Intent No. ______
Local Permit No. or Date ______
State Well No. ______
Other Well No. ______

(1) OWNER: Name Stonebridge Cellars, Inc.
Address [redacted]
City St. Helena ZIP 94574

(2) LOCATION OF WELL (See instructions) A.P.#031-050-069
County Napa Owner's Well Number ______
Well address if different from above 6730 Silverado Trail
Township ______ Range ______ Section ______
Distance from cities, roads, railroads, fences, etc. ______



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☒
Industrial ☐
Test Well ☐
Municipal ☐
Other ☐
(Describe)

(5) EQUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☒ No ☐ Size pea
Diameter of bore 8 3/4"
Packed from 27 to 600 ft.

(7) CASING INSTALLED:
Steel ☐ Plastic ☒ Concrete ☐

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	600	6	F480	80	600	factory

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 27 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ______ ft.
Method of sealing concrete

(10) WATER LEVELS:
Depth of first water, if known ______ ft.
Standing level after well completion 350 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? driller
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test 350 ft. At end of test 550 ft.
Discharge 20 gal/min after 6 hours Water temperature ______
Chemical analysis made? Yes ☐ No ☒ If yes, by whom? ______
Was electric log made Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 600 ft. Completed depth 600 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	55	Boulders & Brown Soil
55	70	Red Rock Soft
70	90	Dark Gray Rock Hard
90	110	Dark Gray & Black Rock Hard Stringers Red
110	130	White Light Gray Rock Stringers Red Clay Soft
130	150	Brown Red Gray & Black Rock
150	170	White Red Black & Brown Rock Soft
170	190	White&Brown Rock Stringers Light Gray Clay
190	230	White Brown & Black Rock Soft
230	250	Reddish Brown Clay Stringers Black&White Rock
250	270	Gray Clay
270	290	Red Rock Soft
290	430	Dark Gray Black Rock Stringers Green Red Hard Fract
430	600	Dark Gray Black Rock Stringers Green Rock Hard Fract

Work started 09/16 1998 Completed 10/16/ 1998

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Signed [signature] (Well Driller)
NAME McLean & Williams, Inc. (Person, firm, or corporation) (Typed or printed)
Address 878 El Centro Ave.
City Napa ZIP 94558
License No. 396352 Date of this report 11/20/98

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DWR 188 (REV. 12-86) 86 96355

QUADRUPLICATE
For Local Requirements

Page ___ of ___
Owner's Well No. ______

Date Work Began 2/06/2008, Ended 2/27/2008
Local Permit Agency Napa County
Permit No. W07-00951 Permit Date 12/28/2007

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 1073642

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Air

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	6	Brown Clay & Brown Ash
6	57	Hard Purple Rock, Some Brown Clay
57	125	Hard Purple Rock
125	160	Brown & Red Clay
160	240	Brown Clay & Hard Gray Rock
240	330	Hard Black & Gray Rock
330	360	Red Ash & Hard Gray Rock
360	400	Hard Fractured Gray Rock
400	560	Hard Black & Gray Rock
560	610	Med. Hard Black Ash
610	630	Med Hard Black & Yellow Ash
630	690	Med. Hard Black & Gray Ash

TOTAL DEPTH OF BORING 690 (Feet)
TOTAL DEPTH OF COMPLETED WELL 690 (Feet)

RECEIVED
APR 15 2008
DEPT. OF ENVIRONMENTAL MANAGEMENT

WELL OWNER

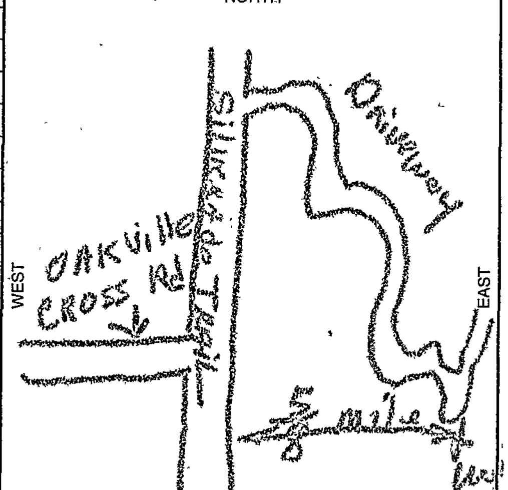
Name [redacted]
Mailing Address [redacted]
CITY [redacted]

WELL LOCATION

Address 7770 Silverado Trail
City Oakville
County Napa
APN Book 032 Page 030 Parcel 054-000
Township ___ Range ___ Section ___
Lat ___ N DEG. MIN. SEC. Long ___ W DEG. MIN. SEC.

LOCATION SKETCH

NORTH



SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
✓ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 510 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 480 (Ft.) & DATE MEASURED 2-27-08
ESTIMATED YIELD * 90 (GPM) & TEST TYPE Air lift
TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN NA (Ft.)
* May not be representative of a well's long-term yield.
GPM at day of test

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	53	14	✓				Plastic	8	F480	
53	360	12 1/4	✓				"	"	"	
360	690	12 1/4		✓			"	8	"	.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	52	✓			
52	690				Pea Gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Pulliam Well Exploration
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

5110 Highway 128 Napa CA 94558
ADDRESS CITY STATE ZIP

Signed [signature] C-57 LICENSED WATER WELL CONTRACTOR
DATE SIGNED 3-5-08 C-57 LICENSE NUMBER 222 506

DWR 188 REV. 05-03 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page 1 of 11

Owner's Well No. HE-1

Date Work Began 8-31-04, Ended 9-17-04

Local Permit Agency NAPA COUNTY

Permit No. E04-0364 Permit Date 8-26-04

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 802399

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ______ FLUID ______

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	100	RED CLAY SOFT W/COBBLES
100	160	MUDSTONE W/GRAVEL
160	240	MUDSTONE-HARD BLACK ROCK
240	300	HARD BLACK ROCK

RECEIVED
NOV - 7 2005
DEPT. OF
ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 300 (Feet)

TOTAL DEPTH OF COMPLETED WELL 300 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

[redacted]

CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL

City NAPA

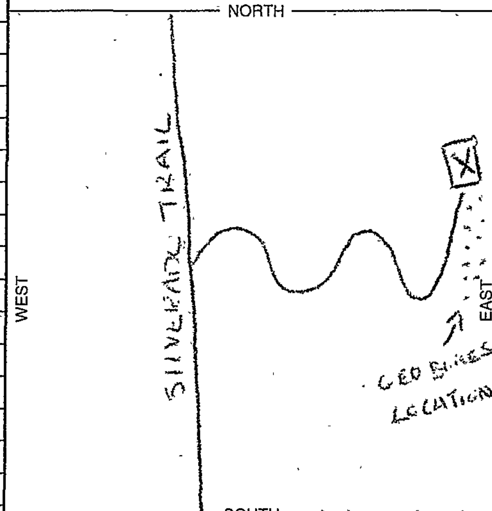
County NAPA

APN Book 032 Page 030 Parcel 054-000

Township ___ Range ___ Section ___

Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

___ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ✓
HEAT EXCHANGE ✓
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				POLYETHYLENE	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELLS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

PO BOX 141 ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed [signature] 11/4/05 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page 2 of 11

Owner's Well No. HE-2

Date Work Began 8-31-04, Ended 9-17-04

Local Permit Agency NAPA COUNTY

Permit No. EC4-03641 Permit Date 8-26-04

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 802400

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ___ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ______ FLUID ______

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	100	RED CLAY SOFT W/COBBLES
100	160	MUDSTONE W/GRAVEL
160	240	MUDSTONE-HARD BLACK ROCK
240	300	HARD BLACK ROCK

RECEIVED

NOV - 7 2005

DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 300 (Feet)

TOTAL DEPTH OF COMPLETED WELL 300 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL

City NAPA

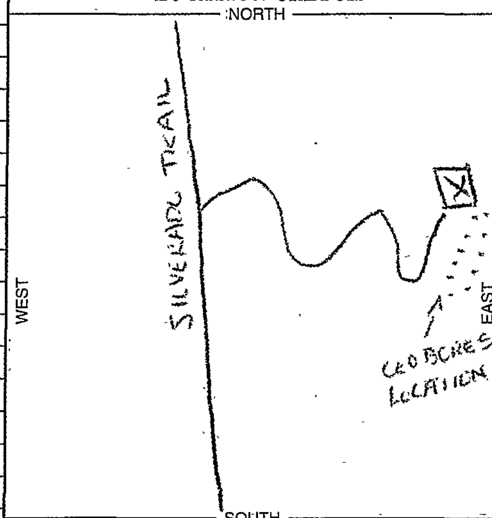
County NAPA

APN Book 032 Page 030 Parcel 054-000

Township ___ Range ___ Section ___

Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

___ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ✓
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ______ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ______ (Ft.) & DATE MEASURED ______

ESTIMATED YIELD * ______ (GPM) & TEST TYPE ______

TEST LENGTH ______ (Hrs.) TOTAL DRAWDOWN ______ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				POLYETHYLENE	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ______

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELLS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

PO BOX 141 ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed ______ 11/4/05 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page 3 of 11
Owner's Well No. HE-3
Date Work Began 8-31-04, Ended 9-17-04
Local Permit Agency NAPA COUNTY
Permit No. E04-0364 Permit Date 8-26-04

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 802401

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ______ FLUID ______

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	100	REDCLAY SOFT W/COBBLES
100	160	MUDSTONE W/GRAVEL
160	240	MUDSTONE - HARDBLACK ROCK
240	300	HARD BLACK ROCK

RECEIVED
NOV - 7 2005
DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING ______ (Feet)
TOTAL DEPTH OF COMPLETED WELL ______ (Feet)

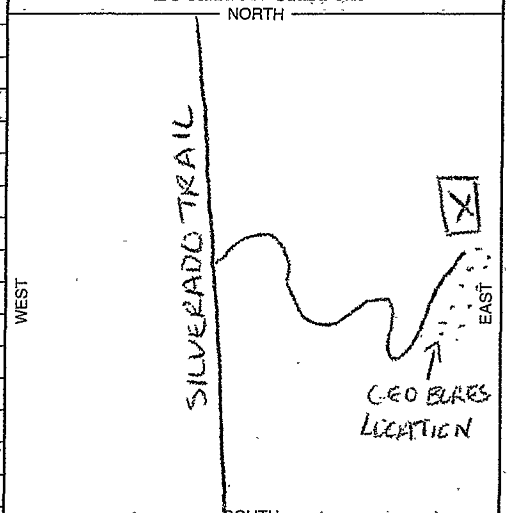
WELL OWNER

Name [redacted]
Mailing Address [redacted]
CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL
City NAPA
County NAPA
APN Book 032 Page 030 Parcel 054-000
Township ____ Range ____ Section ____
Latitude ____ NORTH DEG. MIN. SEC. Longitude ____ WEST DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ✓
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ______ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ______ (Ft.) & DATE MEASURED ______
ESTIMATED YIELD * ______ (GPM) & TEST TYPE ______
TEST LENGTH ______ (Hrs.) TOTAL DRAWDOWN ______ (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				POLYETHYLENE	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ______
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELLS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

PO BOX 141 ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed [signature] 11/4/05 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page 4 of 11
Owner's Well No. HE-4
Date Work Began 8-31-04, Ended 9-17-04
Local Permit Agency NAPA COUNTY
Permit No. E04-03164 Permit Date 8-26-04

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 802402

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ___ FLUID ___

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	100	RED CLAY SOFT W/ COBBLES
100	160	MUDSTONE W/GRAVEL
160	240	MUDSTONE - HARD BLACK ROCK
240	300	HARD BLACK ROCK

RECEIVED
NOV - 7 2005
DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 300 (Feet)
TOTAL DEPTH OF COMPLETED WELL 300 (Feet)

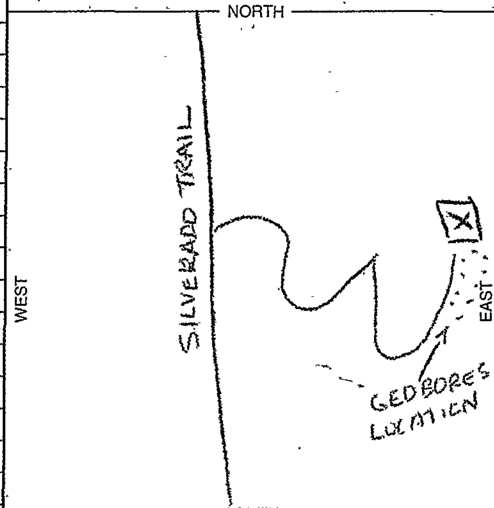
WELL OWNER

Name [redacted]
Mailing Address [redacted]
CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL
City NAPA
County NAPA
APN Book 032 Page 030 Parcel 054-000
Township ___ Range ___ Section ___
Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ✓
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				POLYETHYLENE	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELLS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

PO BOX 141 ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed [signature] 11/4/04 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements
Page 5 of 11
Owner's Well No. HE-5
Date Work Began 8-31-04, Ended 9-17-04
Local Permit Agency NAPA COUNTY
Permit No. E04-0364 Permit Date 8-26-04

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 802403

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ___ FLUID ___

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	100	REDCLAY SOFT W/ COBBLES
100	160	MUD STONE W/GRAVEL
160	240	MUD STONE -HARDBLACK ROCK
240	300	HARD BLACK ROCK

RECEIVED
NOV - 7 2005
DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING ______ (Feet)
TOTAL DEPTH OF COMPLETED WELL ______ (Feet)

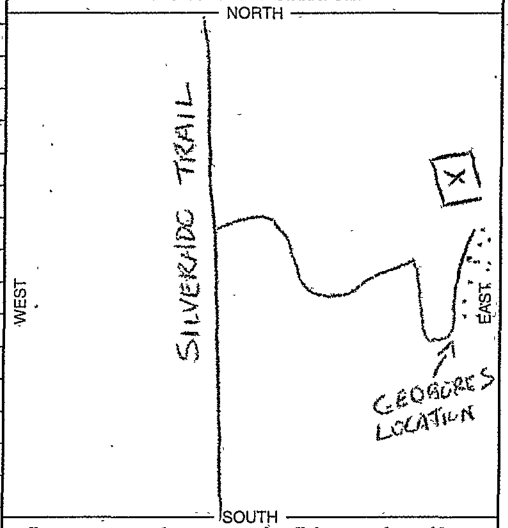
WELL OWNER

Name [redacted]
Mailing Address [redacted]
CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL
City NAPA
County NAPA
APN Book 032 Page 030 Parcel 054-000
Township ___ Range ___ Section ___
Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ✓
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ______ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ______ (Ft.) & DATE MEASURED ______
ESTIMATED YIELD * ______ (GPM) & TEST TYPE ______
TEST LENGTH ______ (Hrs.) TOTAL DRAWDOWN ______ (Ft.)
* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				Polyethylene	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELLS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

P.O. BOX 141 ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed [signature] 11/4/05 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page 6 of 11

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 802404

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

Owner's Well No. HE-6

Date Work Began 8-31-04, Ended 9-17-04

Local Permit Agency NAPA COUNTY

Permit No. E04-0364 Permit Date 8-26-04

GEOLOGIC LOG

ORIENTATION (✓) ___ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ___ FLUID ___

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	100	RED CLAY SOFT W/ COBBLES
100	160	MUD STONE W/ GRAVEL
160	240	MUDSTONE - HARD BLACK ROCK
240	300	HARD BLACK ROCK

TOTAL DEPTH OF BORING 300 (Feet)

TOTAL DEPTH OF COMPLETED WELL 300 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

[redacted]
CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL

City NAPA

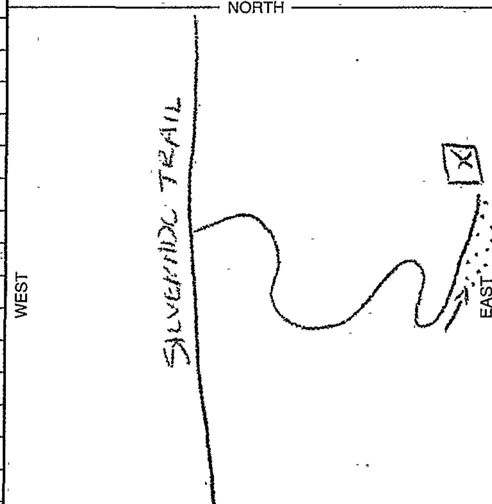
County NAPA

APN Book 032 Page 030 Parcel 054-000

Township ___ Range ___ Section ___

Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

___ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ✓
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				Polyethylene	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELLS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

P.O. BOX 141 ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed ___ 11/4/05 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page 7 **of** 11
Owner's Well No. HE-7
Date Work Began 8-31-04, Ended 9-17-04

Local Permit Agency NAPA COUNTY
Permit No. E04-0364 Permit Date 8-26-04

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 802405

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ______ FLUID ______

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	100	RED CLAY SOFT W/COBBLES
100	160	MUDSTONE W/GRAVEL
160	240	MUDSTONE - HARD BLACK ROCK
240	300	HARD BLACK ROCK

RECEIVED
NOV - 7 2005
DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 300 (Feet)
TOTAL DEPTH OF COMPLETED WELL 300 (Feet)

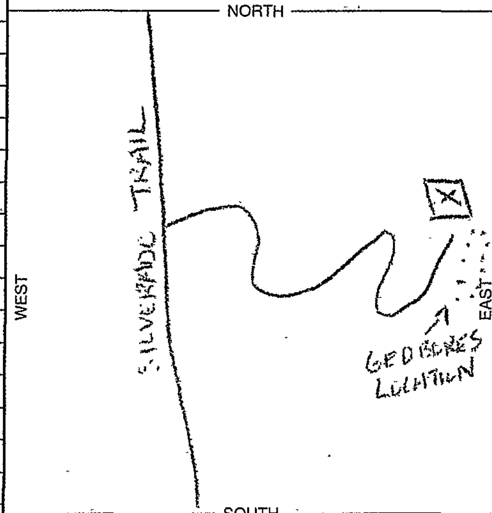
WELL OWNER

Name [redacted]
Mailing Address [redacted]
CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL
City NAPA
County NAPA
APN Book 032 Page 030 Parcel 054-000
Township ___ Range ___ Section ___
Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

___ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ✓
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				Polyethylene	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ______

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELLS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

PO BOX 141, ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed [signature] 11/4/05 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page 8 of 11

Owner's Well No. HE-B

Date Work Began 8-31-04, Ended 9-17-04

Local Permit Agency NAPA COUNTY

Permit No. E04-0364 Permit Date 8-26-04

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 802406

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ___ FLUID ___

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	100	RED CLAY SOFT W/COBBLES
100	160	MUDSTONE W/GRAVEL
160	240	MUDSTONE - HARD BLACK ROCK
240	300	HARD BLACK ROCK

RECEIVED

NOV - 7 2005

DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 300 (Feet)

TOTAL DEPTH OF COMPLETED WELL 300 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL

City NAPA

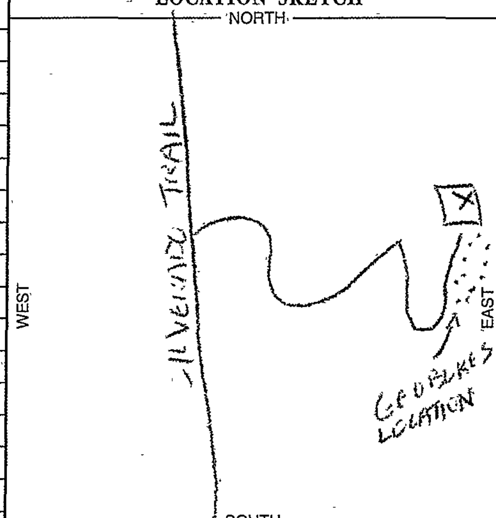
County NAPA

APN Book 032 Page 030 Parcel 054-000

Township ___ Range ___ Section ___

Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY

___ Domestic ___ Public

___ Irrigation ___ Industrial

MONITORING ___

TEST WELL ___

CATHODIC PROTECTION ___

HEAT EXCHANGE ✓

DIRECT PUSH ___

INJECTION ___

VAPOR EXTRACTION ___

SPARGING ___

REMEDIATION ___

OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				Polyethylene	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELLS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

P.O. BOX 141 ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed [signature] 11/4/05 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page 9 of 11

Owner's Well No. HE-9

Date Work Began 8-31-04, Ended 9-17-04

Local Permit Agency NAPA COUNTY

Permit No. E04-0364 Permit Date 8-26-04

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 802407

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ___ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ___ FLUID ___

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	100	RED CLAY SOFT W/COBBLES
100	160	MUD STONE W/GRAVEL
160	240	MUDSTONE - HARD BLACK ROCK
240	300	HARD BLACK ROCK

RECEIVED

NOV - 7 2005

DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 300 (Feet)

TOTAL DEPTH OF COMPLETED WELL 300 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL

City NAPA

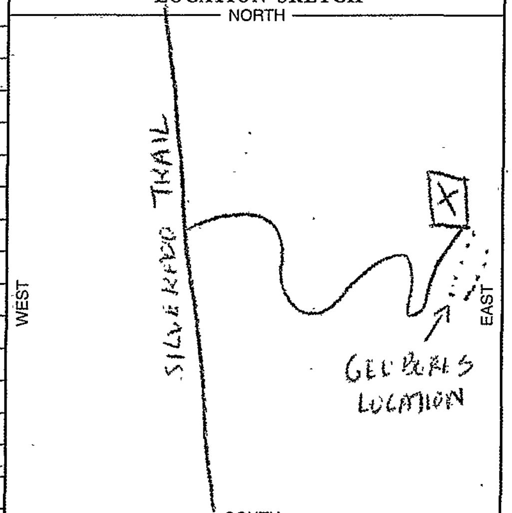
County NAPA

APN Book 032 Page 030 Parcel 054-000

Township ___ Range ___ Section ___

Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

___ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ✓
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				Polyethylene	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELLS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

P.O. BOX 141 ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed ___ 11/4/05 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Owner's Well No. HE-10

Date Work Began 8-31-04, Ended 9-17-04

Local Permit Agency NAPA COUNTY

Permit No. E-04-0364 Permit Date 8-26-04

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 802408

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ___ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ___ FLUID ___

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	100	RED CLAY SLFT W/ COBBLES
100	160	MUD STONE W/ GRAVEL
160	240	MUD STONE - HARD BLACK ROCK
240	300	HARD BLACK ROCK

RECEIVED
NOV - 7 2005
DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 300 (Feet)

TOTAL DEPTH OF COMPLETED WELL 300 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL

City NAPA

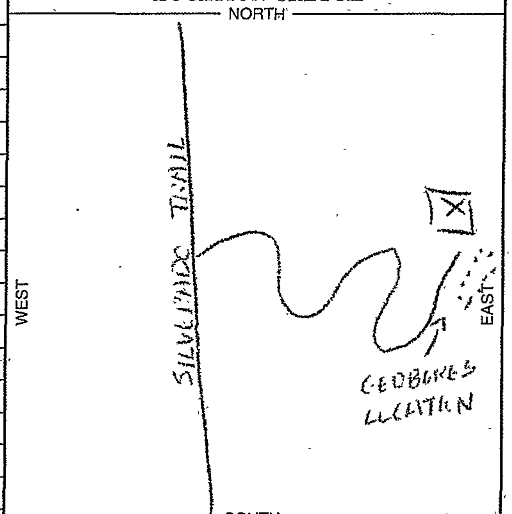
County NAPA

APN Book 032 Page 030 Parcel 054-000

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ✓
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE: BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				POLYETHYLENE	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELLS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

PO BOX 141 ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed [signature] 11/4/05 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 802409

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

Owner's Well No. HE-11
Date Work Began 8-31-04, Ended 9-17-04
Local Permit Agency NAPA COUNTY
Permit No. E04-0364 Permit Date 8-26-04

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ___ FLUID ___

DEPTH FROM SURFACE Ft. to	Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	100	REDCLAY SOFT W/COBBLES
100	160	MUDSTONE W/GRAVEL
160	240	MUDSTONE - HARD BLACK ROCK
240	300	HARD BLACK ROCK

RECEIVED
NOV - 7 2005
DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 300 (Feet)
TOTAL DEPTH OF COMPLETED WELL 300 (Feet)

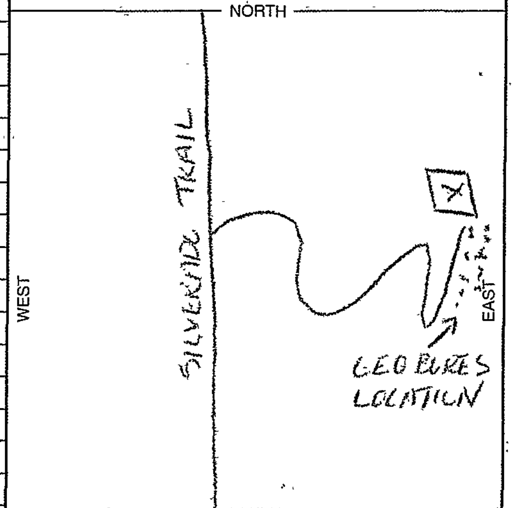
WELL OWNER

Name [redacted]
Mailing Address [redacted]
CITY STATE ZIP

WELL LOCATION

Address 7770 SILVERADO TRAIL
City NAPA
County NAPA
APN Book 032 Page 030 Parcel 054-000
Township ___ Range ___ Section ___
Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

___ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ✓
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to	Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	300	6"	✓				Polyethylene	1"	SDR-11	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to	Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0'	300'		✓		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME WDC EXPLORATION & WELL
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

PO BOX 141 ZAMORA CA 95698
ADDRESS CITY STATE ZIP

Signed [signature] 11/4/05 283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. e0177367

Owner's Well No. 1-2013

Date Work Began 5/29/2013, Ended 7/3/2013

Local Permit Agency Napa County Environmental Mgmt

Permit No. 96-11125 Permit Date 6/23/1999

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./ STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ROTARY FLUID AIR

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain, size, color, etc.
0	10	BOULDERS
10	80	HARD BLACK VOLCANICS
80	160	RED, BLACK VOLCANICS
160	260	TAN, GRAY VOLCANICS
260	355	GRAY VOLCANICS
355	420	GRAY, TAN VOLCANICS
420	460	BLACK, RED VOLCANICS
460	645	BLACK VOLCANIC ROCK
645	680	BROWN, RED VOLCANICS
680	790	GRAY, TAN VOLCANICS
790	820	RED VOLCANICS
820	870	BLACK VOLCANICS
870	880	RED VOLCANICS
880	900	GRAY, TAN VOLCANICS
900	950	GRAY, RED, TAN VOLCANICS
950	970	RED VOLCANICS
970	985	BLACK, GREEN VOLCANICS
985	1000	RED VOLCANICS
1000	1020	BLACK VOLCANICS
1020	1035	GRAY VOLCANICS
1035	1045	RED, BLACK VOLCANICS
1045	1080	BLACK VOLCANICS
1080	1140	GRAY, GREEN, RED VOLCANICS
		CONTINUED CASING LAYOUT
605	685	SCREEN STEEL 8" .060 SLOT
685	725	BLANK STEEL 8"
725	865	SCREEN STEEL 8" .060 SLOT
865	925	BLANK STEEL 8"
925	1105	SCREEN STEEL 8" .060 SLOT
1105	1125	BLANK STEEL 8"

TOTAL DEPTH OF BORING 1140 (Feet)

TOTAL DEPTH OF COMPLETED WELL 1125 (Feet)

RECEIVED SEP 4 2013 DEPT. OF ENVIRONMENTAL MANAGEMENT

WELL OWNER

Name Oakville Ranch Vineyards

Mailing Address 1832 Baker Street

San Francisco CA 94115

CITY STATE ZIP

WELL LOCATION

Address 7781 Silverado Trail

City Napa CA

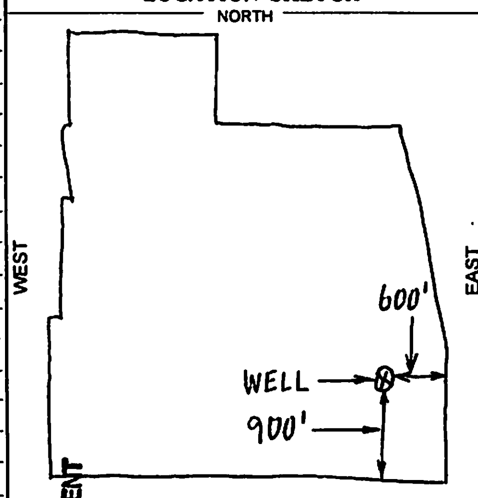
County Napa

APN Book 032 Page 030 Parcel 052

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
- ___ Deepen
- ___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
- ___ Domestic ___ Public
- ✓ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 280 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 271 (Ft.) & DATE MEASURED 7/3/2013

ESTIMATED YIELD * 300 (GPM) & TEST TYPE AIR LIFT

TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN N/A (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	1140	15								
0	385		✓				STEEL	8	.250	
385	465			✓			STEEL	8	.250	.060
465	505		✓				STEEL	8	.250	
505	585			✓			STEEL	8	.250	.060
585	605		✓				STEEL	8	.250	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	54	✓			10 SK SAND
54	1125			✓	#6 SAND

ATTACHMENTS (✓)

- ___ Geologic Log
- ___ Well Construction Diagram
- ___ Geophysical Log(s)
- ___ Soil/Water Chemical Analysis
- ___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME HUCKFELDT WELL DRILLING, INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2110 Penny Lane, Napa, CA 94559
ADDRESS CITY STATE ZIP

Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE

07/24/13 DATE SIGNED

439-746 C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page 1 of 1

Owner's Well No.

Date Work Began 7-31-01, Ended 8-13-01

Local Permit Agency Napa County Environmental Mgmt.

Permit No. 96-11123 Permit Date 6-23-99

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 778357

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD rotary FLUID

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	12	fractured boulders
12	60	black volcanic rock
60	120	red volcanics
120	280	black volcanics
280	380	red & whitewvolcanic ash
380	420	yellow ash
420	500	black volcanics
500	520	red volcanics
520	580	red & black volcanics
580	760	black volcanics
	250	5 GPM
	460	30 GPM
	690	150 GPM

TOTAL DEPTH OF BORING 760 (Feet)

TOTAL DEPTH OF COMPLETED WELL 753 (Feet)

WELL OWNER

Name Oakville Ranch Vineyards

Mailing Address 7781 Silverado Trail

Napa (CITY) CA (STATE) 94558 (ZIP)

WELL LOCATION

Address same

City

County Napa

APN Book 32 Page 030 Parcel 52

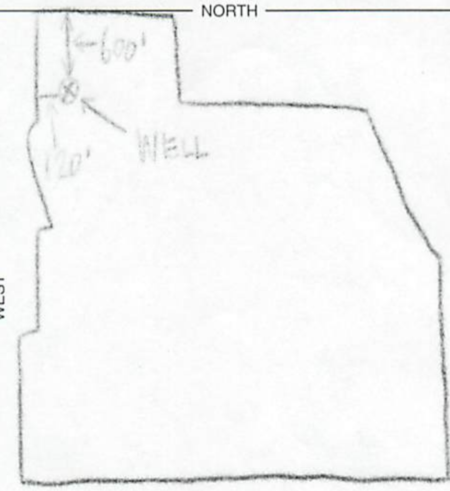
Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH

WEST



EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
X Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 250 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 393 (Ft.) & DATE MEASURED 8-13-01

ESTIMATED YIELD * 150 (GPM) & TEST TYPE air lift

TEST LENGTH 3 (Hrs.) TOTAL DRAWDOWN N/A (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	25	13								
25	760	12								
0	433		X				steel	$8\frac{1}{4}$	.188	
433	633			X			steel	$8\frac{1}{4}$	.188	.090
633	653		X				steel	$8\frac{1}{4}$	.188	
653	753			X			steel	$8\frac{1}{4}$	.188	.090

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	22	X			concrete
22	753			X	pea gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME HUCKFELDT WELL DRILLING
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2110 Penny Lane (ADDRESS) Napa (CITY) CA (STATE) 94559 (ZIP)

Signed [signature] (WELL DRILLER/AUTHORIZED REPRESENTATIVE) 8-20-01 (DATE SIGNED) 439-746 (C-57 LICENSE NUMBER)

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page ___ of ___

Owner's Well No. ___

Date Work Began 3-11-99 Ended 3-22-99

Local Permit Agency Napa County

Permit No. 70041 Permit Date 11-23-98

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 528419

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO. No APN 9/1/99

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER 290 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	18	brown clay
18	140	gray rock with brown ash
140	170	red ash
170	310	gray rock with gray boulders
310	380	hard purple rock
380	465	soft red ash
465	530	brown red ash
530	580	black ash
580	610	brown clay

TOTAL DEPTH OF BORING 610 (Feet)

TOTAL DEPTH OF COMPLETED WELL 595 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

CITY STATE ZIP

WELL LOCATION

Address 7770 Silverado Tr

City Napa

County Napa

APN Book ___ Page ___ Parcel 32-030-46

or Township ___ Range ___ Section ___

or Latitude ___ NORTH Longitude ___ WEST

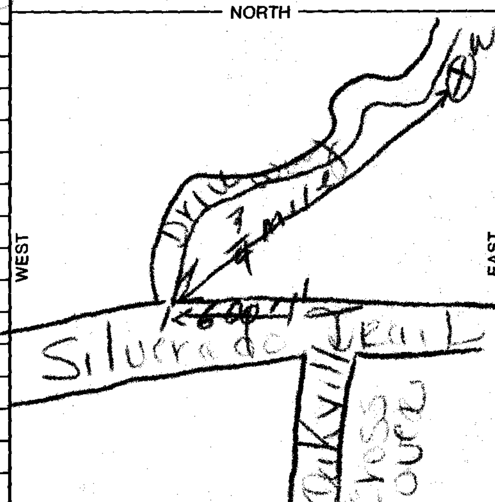
DEG. MIN. SEC. DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST

EAST



SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USE(S) (✓)

___ MONITORING

WATER SUPPLY
___ Domestic
___ Public
✓ Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Mud Rotary FLUID mud

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 275 (Ft.) & DATE MEASURED 3-22-99

ESTIMATED YIELD* 60 (GPM) & TEST TYPE Air Lift

TEST LENGTH 5 (Hrs.) TOTAL DRAWDOWN 300 (Ft.)

** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	245	10	✓				Plastic	6	200	
245	595			✓			"	"	"	Factory

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	31	✓			
31	595				Pea Gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Pulliam Drilling
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2877 Piedmont Ave Napa Ca 94558
ADDRESS CITY STATE ZIP

Signed [signature] 4-5-99 248617
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page ____ of ____

Owner's Well No. ______

Date Work Began 1-4-98, Ended 3-17-98

Local Permit Agency Napa County

Permit No. 4561 Permit Date 1-5-98

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 528473

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER 410 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain size, color, etc.)
0	60	hard gray rock
60	110	brown ash
110	125	hard gray rock
125	170	brown ash
170	230	hard gray rock
230	400	gray red & black ash
400	410	brown ash
410	555	red & black ash & gray rock
555	620	hard gray rock
620	645	brown ash
645	770	red & black ash
770	810	brown & red ash

RECEIVED

NOV 17 1998

DEPT OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 810 (Feet)

TOTAL DEPTH OF COMPLETED WELL 810 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

CITY STATE ZIP

WELL LOCATION

Address 7770 [illegible]

City [illegible]

County [illegible]

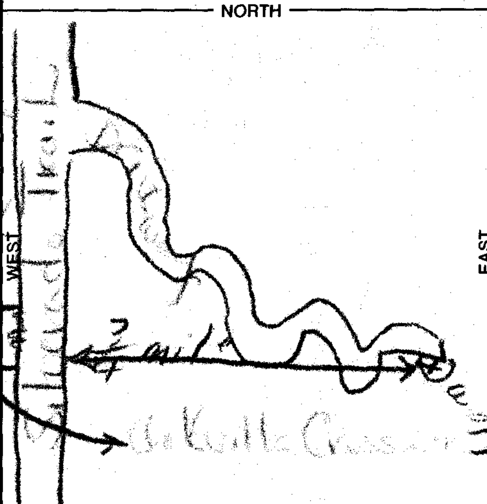
APN Book ____ Page ____ Parcel [redacted]

Township ____ Range ____ Section ____

Latitude ____ NORTH DEG. MIN. SEC. Longitude ____ WEST DEG. MIN. SEC.

LOCATION SKETCH

NORTH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)

___ MONITORING

WATER SUPPLY
___ Domestic
___ Public
✓ Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Air FLUID Air

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 375' (Ft.) & DATE MEASURED 3-17-98

ESTIMATED YIELD* 100 (GPM) & TEST TYPE Air lift

TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 375 (Ft.)

** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	440	10	✓				Plastic	8	200	
440	810	"		✓			"	"		Factory 1/32

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	25	✓			
25	810				Pea Gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Pulliam Well Drilling
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2577 Piedmont Napa Ca 94558
ADDRESS CITY STATE ZIP

Signed Tom Pulliam 3-31-98 248677
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

QUADRUPLICATE
For Local Requirements

Page 1 of 1

Owner's Well No. #4388

Date Work Began 11/23/92, Ended 1/11/93

Local Permit Agency Napa County Env. Dept. of Health

Permit No. 32121 Permit Date 11/19/92

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 482234

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER 400 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	26	Brown & red clay
26	40	Brown sand stone
40	70	Dk. gray & brown rock med. hard
70	145	Brown, gray, black & red rock, hard fracture
145	160	Dk. gray rock, hard fracture
160	220	Brown, gray rock stringers, red hard fracture
220	250	Lt. green, brown & gray rock hard fracture
250	265	Gray, brown & red rock hard
265	310	Red rock, medium hard
310	340	Red & brown rock hard
340	370	Black, gray & red rock hard fracture
370	400	Black, red, green & brown rock hard
400	490	Green, red & black rock med. fractu
490	520	Black, red, green & stringers brown rock hard fracture
520	600	White, red, black, gray & green rock hard
600	630	Green, black rock stringer dk. gray, fracture
630	640	Dk. gray rock hard

RECEIVED
JAN 13 1993
DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 640 (Feet)

TOTAL DEPTH OF COMPLETED WELL 637 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

CITY STATE ZIP

WELL LOCATION

Address 7776 Silverado Trail

City Oakville

County Napa

APN Book 32 Page 030 Parcel 06

or Township ___ Range ___ Section ___

or Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)

___ MONITORING

WATER SUPPLY

___ Domestic

___ Public

X Irrigation

___ Industrial

___ "TEST WELL"

___ CATHODIC PROTECTION

___ OTHER (Specify)

DRILLING METHOD Mud & air rotary FLUID Water, bentonite foam

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 400 (Ft.) & DATE MEASURED ___

ESTIMATED YIELD* 60 (GPM) & TEST TYPE AIR

TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN complete (Ft.)

* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	397	15"	X				1-C-2	8	F-480	032
397	637			X						
1	3				X					

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	22	X			
22	25		X		
25	637			X	Pea gravel

ATTACHMENTS (✓)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Doshier & Gregson, Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

5365 Napa Vallejo Hwy Vallejo CA. 94589
ADDRESS CITY STATE ZIP

Signed ___ WELL DRILLER/AUTHORIZED REPRESENTATIVE ___ DATE SIGNED 258826 C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page ___ of ___

Owner's Well No. ___

Date Work Began 10-30-00, Ended 11-6-00

Local Permit Agency Napa County

Permit No. 96-11657 Permit Date 9-14-00

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 710238

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD rotary FLUID Air

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	20	brown clay & rock
20	135	grayash, black rock
135	150	red volcanic rock
150	315	grayash & black rock
315	365	red volcanic rock
365	570	brownash, streaks of broken up black rock
570	590	grayash & black rock

Oakville Cross Rd

TOTAL DEPTH OF BORING 595 (Feet)

TOTAL DEPTH OF COMPLETED WELL 590 (Feet)

WELL OWNER

Name Charles Saunders

Mailing Address 7777 Silverado Tr.

Napa Ca. 94558

CITY STATE ZIP

WELL LOCATION

Address Same

City Same

County Napa

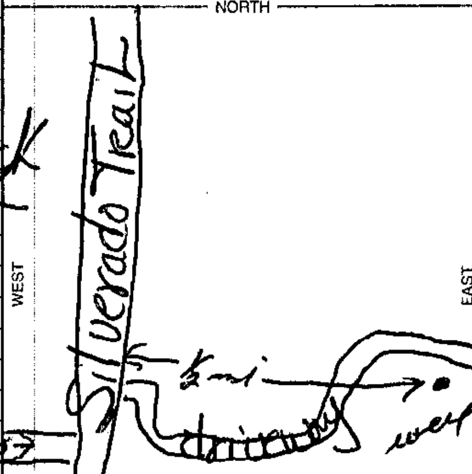
APN Book ___ Page ___ Parcel 032-030-040

Township ___ Range ___ Section ___

Latitude ___ NORTH Longitude ___ WEST
DEG. MIN. SEC. DEG. MIN. SEC.

LOCATION SKETCH

NORTH



WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

PLANNED USES (✓)

WATER SUPPLY
X Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 140 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 260 (Ft.) & DATE MEASURED 11-3-00

ESTIMATED YIELD * 60 (GPM) & TEST TYPE Air Lift

TEST LENGTH 3 (Hrs.) TOTAL DRAWDOWN 580 (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE: BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	23	10 5/8	X				PLASTIC	5"	200	
23	130	8"	X				"	"	"	
130	590	8"	FACT				PREF "	"	"	5/32

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	23	X			
23	590	PEA GRAVEL			

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Pulliam Well Drilling
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

2877 Piedmont Av Napa Ca. 94558
ADDRESS CITY STATE ZIP

Signed [signature] 12-2-00 248677
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

APPENDIX B

NAPA COUNTY GROUNDWATER RECHARGE ANALYSIS

Napa County Groundwater Recharge Analysis

Introduction

Developing accurate estimates of the spatial and temporal distribution of groundwater recharge is a key component of sustainable groundwater management. Efforts to quantify recharge are inherently difficult owing to the wide variability of factors controlling hydrologic processes, the wide range of available tools/methods for estimating recharge, and the difficulty in assessing the accuracy of estimates because direct measurement of recharge rates is, for the most part, infeasible (Healy 2010, Seiler and Gat 2007).

Numerical modeling is a common approach for developing recharge estimates. Soil-water-balance modeling is one category of numerical models particularly well-suited for estimating recharge across large areas with modest data requirements. This study describes an application of the U.S. Geological Survey's (USGS) Soil Water Balance Model (SWB) (Westenbroek et al. 2010) to develop spatial and temporal distributions of groundwater recharge across Napa County. This model operates on a daily timestep and calculates surface runoff based on the Natural Resources Conservation Service (NRCS) curve number method and potential evapotranspiration based on the Hargreaves-Samani methods (Hargreaves and Samani 1985). Actual evapotranspiration (AET) and recharge are calculated using a modified Thornthwaite-Mather soil-water-balance approach (Westenbroek et al. 2010).

It is important to note that the SWB model focuses on surface and soil-zone processes and does not simulate the groundwater system or track groundwater storage over time. The model also does not simulate surface water/groundwater interaction or baseflow; thus, the runoff estimates represent only the surface runoff component of streamflow resulting from rainstorms and the recharge estimates represent only the infiltration recharge component (also referred to as diffuse recharge) of total recharge (stream-channel recharge is not simulated).

This modeling work and summary report has been prepared by O'Connor Environmental, Inc., for it's private use in relation to Water Availability Analyses (WAA) prepared on behalf of private clients for projects using groundwater in "hillside" areas of Napa County as required by Napa Planning, Building & Environmental Services. The modeling to-date is complete in its current form but remains subject to revision; it is considered a working draft with information suitable for use to support WAA projects. Parties interested in obtaining more information regarding the modeling or who may wish to offer comments should contact O'Connor Environmental, Inc.

Model Development

The model was developed using a 30-meter (98.4 ft) resolution rectangular grid. Water budget calculations were made on a daily time step. Key spatial inputs included a flow direction map developed from the USGS 1 arc-second resolution Digital Elevation Model (DEM), a land cover map derived from the U.S. Forest Service (USFS) CALVEG dataset that was supplemented by a database of agricultural areas maintained by the County of Napa (Figure 1), a distribution of Hydrologic Soil Groups (A through D classification from lowest to highest runoff potential; Figure 2), and a distribution of Available Water Capacity (AWC) developed from the NRCS Soil Survey Geographic Database (SSURGO) (Figure 3).

A series of model parameters were assigned for each land cover type/soil group combination including an infiltration rate, a curve number, dormant and growing season interception storage values, and a rooting depth (Table 1).

Infiltration rates for hydrologic soil groups A through D were applied based on Cronshey et al. (1986) (Table 2) along with default soil-moisture-retention relationships based on Thornthwaite and Mather (1957) (Figure 4). Curve numbers were assigned based on standard NRCS methods. Interception storage values and rooting depths were assigned based on literature values and from previous modeling experience including a SWB model covering Sonoma County and calibrated using runoff volumes from several stream gages (OEI 2017).

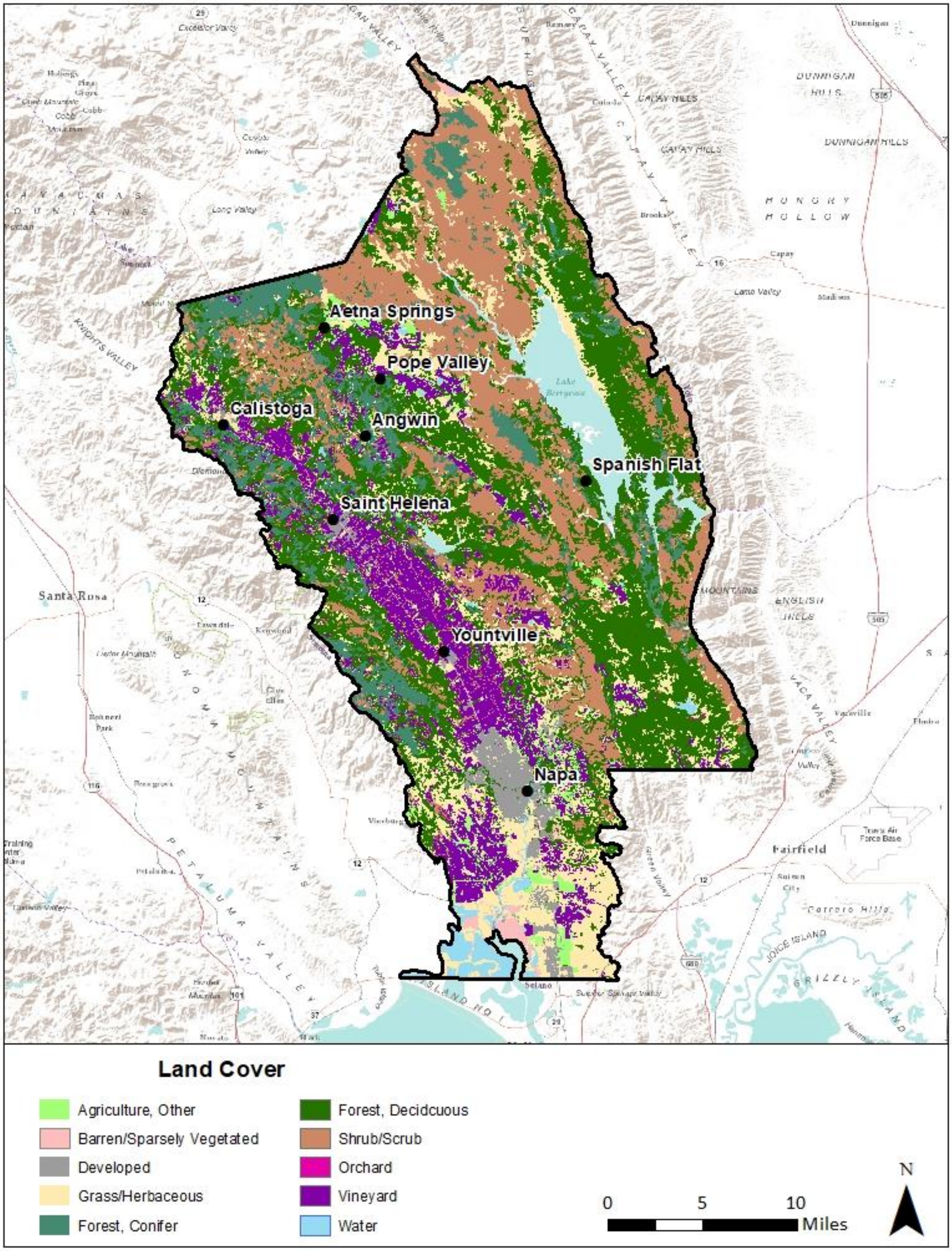


Figure 1: Land cover distribution used in the Napa County SWB model.

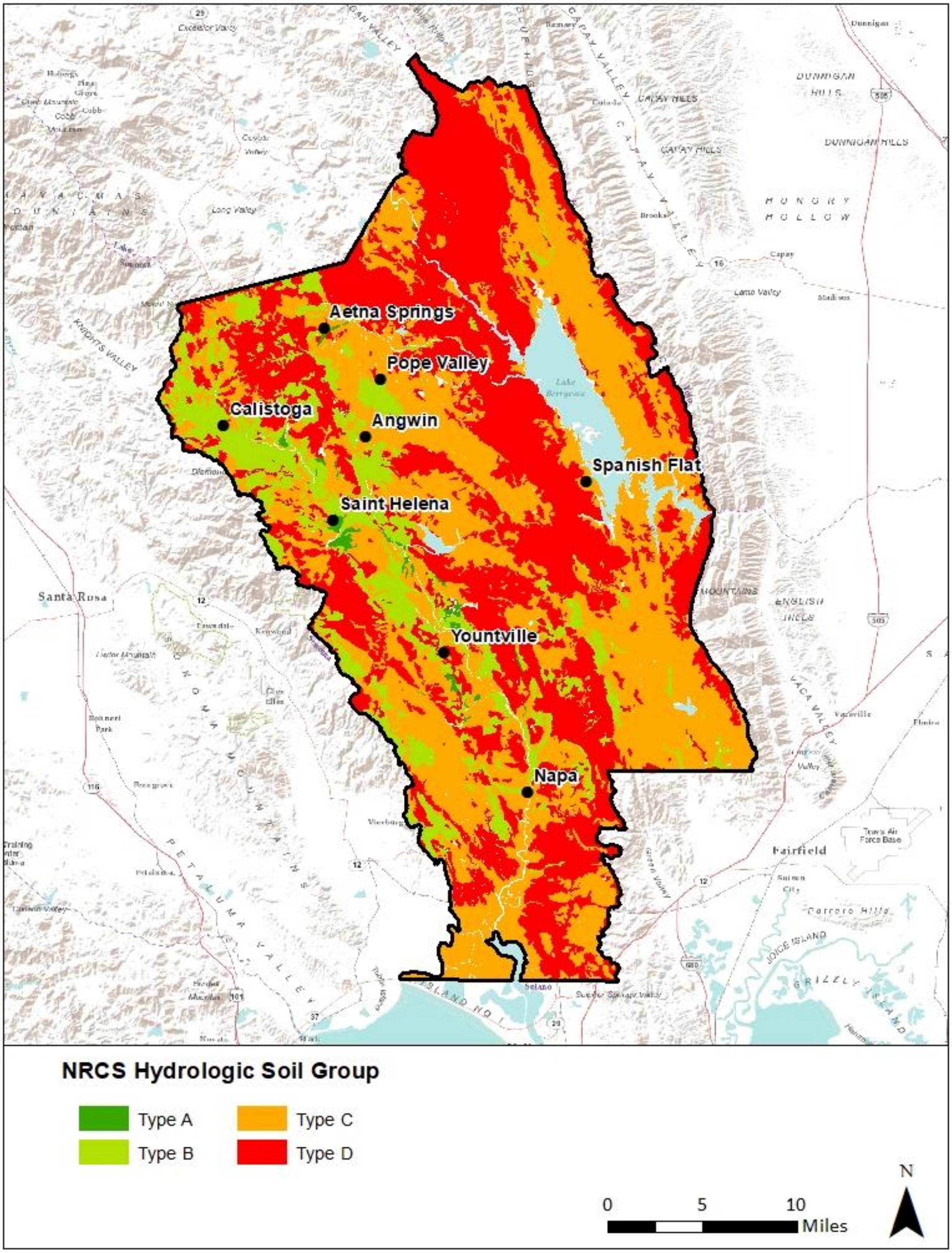


Figure 2: Hydrologic soil group distribution used in the Napa County SWB model.

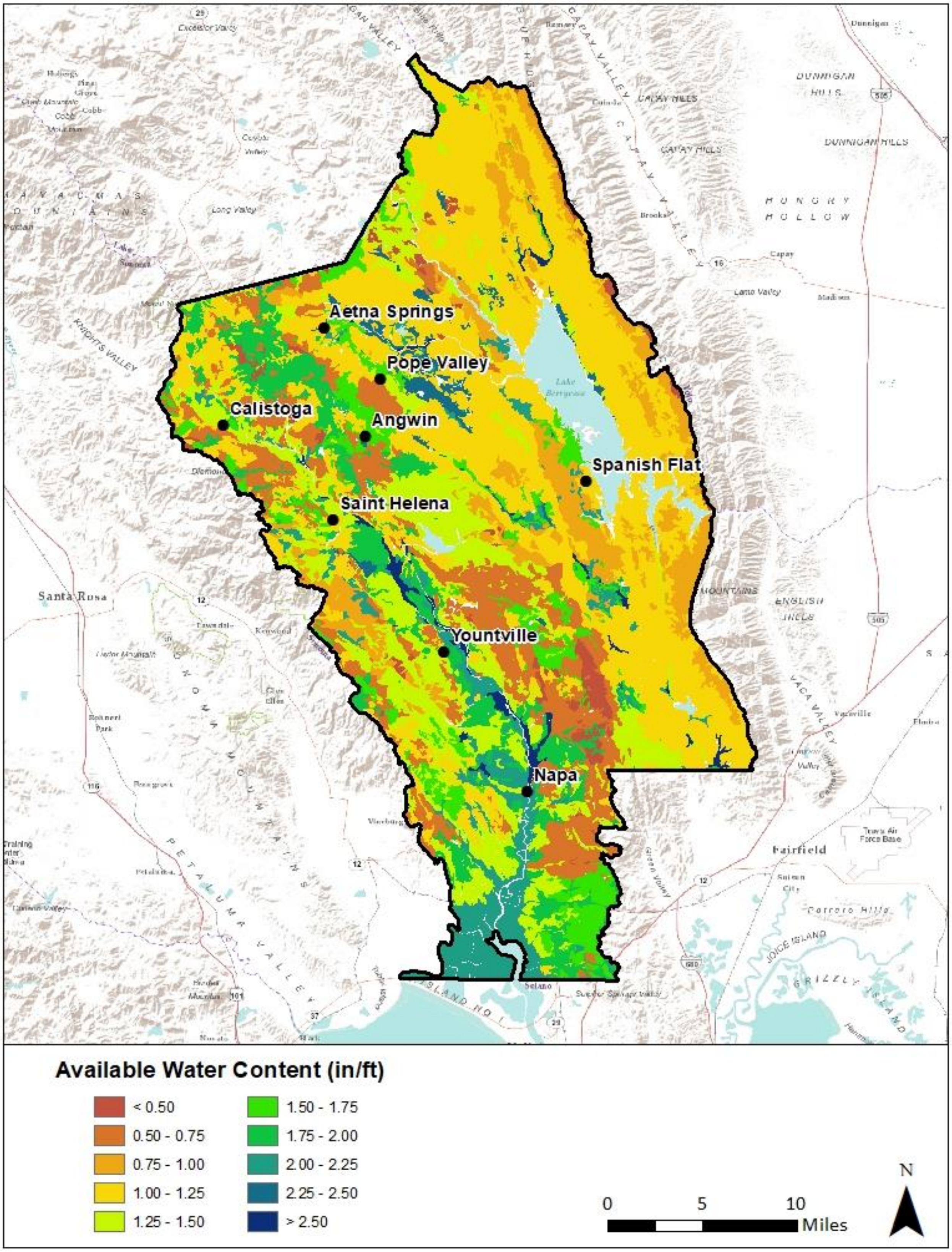


Figure 3: Available water capacity distribution used in the Napa County SWB model.

Table 1: Soil and land cover properties used in the Napa County SWB model.

Land Cover	Interception Storage Values ()		Curve Number by NRCS Soil Type ()				Rooting Depth by NRCS Soil Type (ft)			
	Growing Season	Dormant Season	Type A	Type B	Type C	Type D	Type A	Type B	Type C	Type D
Agriculture, Other	0.080	0.040	38	61	75	81	2.0	1.9	1.8	1.7
Barren	0.000	0.000	77	86	91	94	0.0	0.0	0.0	0.0
Developed	0.005	0.002	61	75	83	87	2.3	2.1	2.0	1.8
Grassland/Herbaceous	0.005	0.004	30	58	71	78	1.3	1.1	1.0	1.0
Forest, Coniferous	0.050	0.050	30	55	70	77	5.9	5.1	4.9	4.7
Forest, Deciduous	0.050	0.020	30	55	70	77	5.9	5.1	4.9	4.7
Shrub/Scrub	0.080	0.015	30	48	65	73	3.2	2.8	2.7	2.6
Orchard	0.050	0.015	38	61	75	81	3.2	2.8	2.7	2.6
Vineyard	0.080	0.015	38	61	75	81	2.2	2.1	2.0	1.9
Water	0.000	0.000	100	100	100	100	0.0	0.0	0.0	0.0

Table 2: Infiltration rates for NRCS hydrologic soil groups (Cronshey et al. 1986).

Soil Group	Infiltration Rate (in/hr)
A	> 0.3
B	0.15 - 0.3
C	0.05 - 0.15
D	<0.05

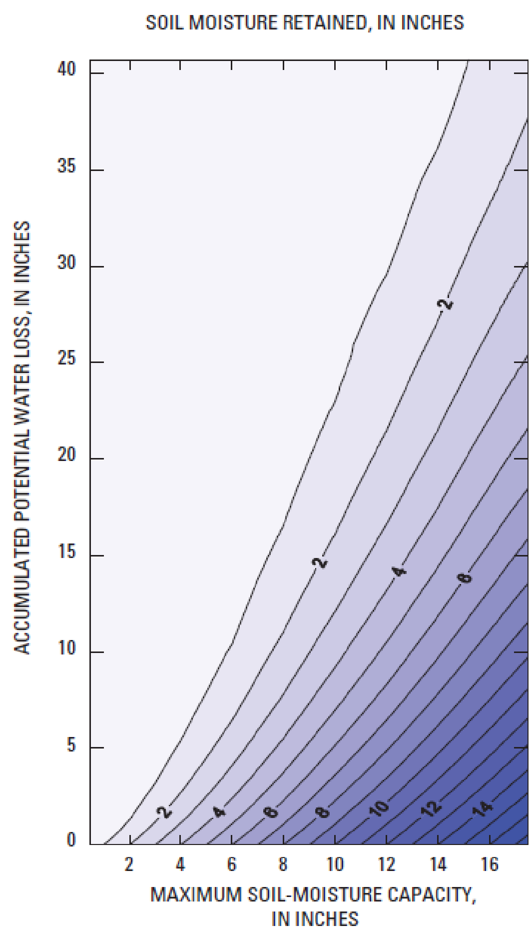


Figure 4: Soil-moisture-retention table (Thornthwaite and Mather 1957).

The SWB model utilizes daily precipitation and mean daily temperature data derived from climate stations. To account for the spatial variability of these parameters, daily precipitation and mean daily temperature were input as gridded (spatially-distributed) time-series. The gridded precipitation time-series was created using data from 15 weather stations in Napa County, and the gridded mean temperature time-series was created using data from 8 stations (Table 3). These stations were selected based on completeness of the records and to provide station data representative of the range of climates experienced in the county. Data was obtained from the California Data Exchange Center (CDEC), the National Climatic Data Center (NCDC), and from Napa One Rain.

To create the gridded time-series, the model domain was divided into discrete areas represented by individual weather stations (Figures 5 and 6). This delineation was based on climate variations described by existing gridded mean annual (1981-2010) precipitation and temperature data (PRISM 2010) and local knowledge of climatic variations across the county.

For the precipitation time-series, each area representing a weather station was subdivided into four to twenty-three zones based on 1-inch average annual precipitation contours. Within each zone the raw station data was multiplied by a unique scaling factor. This scaling factor was calculated as the ratio of average annual precipitation within a zone to average annual precipitation at the representative rain gage. In certain locations, typically near the boundary of areas represented by gages located on the valley bottom and at higher elevations, this scaling was unable to smoothly resolve differences in annual and event precipitation totals. To more accurately estimate precipitation near these boundaries, precipitation records from the two gages in question were averaged using weights calculated proportionally to the difference between PRISM mean annual precipitation at a rain gage and within a selected zone. The resulting gridded time-series is comprised of 220 individual time-series based on the scaled station data from 15 stations.

The assignment of temperature stations was based on the understanding that the spatial variability of temperatures across Napa County is relatively homogenous, with elevation being the primary variable. Temperature records were classified either as Mountain, Valley Bottom, or East County and applied within areas the PRISM datasets described as being similar. To smooth the transition from Mountain zones to Valley Bottom and East County zones, Hillside zones were created where the temperature records of the two nearest gages were averaged.

Missing and suspect data was encountered in the raw precipitation and temperature data from the weather stations used by the model. Values that were significantly outside the typical range, and where similar observations were not found at nearby stations, were removed from the datasets. These and missing values were filled using scaled data from other nearby stations. Precipitation data used for gap filling was scaled using the ratio of the 1981 to 2010 mean annual precipitation (PRISM 2010) between the two stations. Temperature data was scaled using the ratio of the 1981 to 2010 mean monthly minimum and maximum temperatures (PRISM 2010) between the two stations.

The current analysis focuses on Water Year 2010 (October 1, 2009 – September 30, 2010) and Water Year 2014 (October 1, 2013 – September 30, 2014). These years were selected because they represent periods with data available from most weather stations in the county and where most stations reported annual precipitation totals close to the long-term average (WY 2010) and significantly below the long term average (WY 2014). Based on a comparison between station data and PRISM average precipitation depths during Water Year 2010, rainfall averaged 101% of long-term average conditions and ranged from 78% at Lake Hennessey to 111% at the Napa County Airport. In Water Year 2014, rainfall averaged 55% of long-term average conditions and ranged from 41% at Lake Hennessey to 73% at the Napa State Hospital (Table 3).

Table 3: Weather stations used in the Napa County SWB model. See Figures 7- 9 for associated timeseries.

Station	Data Used	1981 - 2010 Mean Annual Precip (in)	WY 2010		WY 2014	
			Precip (in)	% Avg	Precip (in)	% Avg
Angwin[1]	Precip & Temp	42.54	44.64	105%	25.04	59%
Atlas Peak[1]	Precip & Temp	41.76	39.04	93%	20.08	48%
Berryessa[1]	Precip & Temp	28.97	28.16	97%	13.97	48%
Calistoga[2]	Precip	39.41	41.75	106%	18.18	46%
Knoxville Creek[1]	Temp Only	-	-	-	-	-
Lake Hennessey[3]	Precip Only	34.09	26.52	78%	13.92	41%
Mt. George[3]	Precip Only	31.15	29.64	95%	18.24	59%
Mt. Veeder[3]	Precip Only	44.81	46.44	104%	28.6	64%
Napa County Airport[2]	Precip & Temp	21.14	23.56	111%	9.87	47%
Napa River at Yountville Cross Rd[3]	Precip Only	31.86	32.72	103%	14.93	47%
Napa State Hospital[2]	Precip & Temp	26.81	28.85	108%	19.66	73%
Petrified Forest[3]	Precip Only	42.39	46.6	110%	22.84	54%
Redwood Creek At Mt. Veeder Road[3]	Precip Only	34.71	37.36	108%	23.48	68%
Saint Helena[2]	Precip & Temp	37.43	39.11	104%	19.11	51%
Saint Helena 4WSW[1]	Precip & Temp	45.44	47.88	105%	28.88	64%
Sugarloaf Peak[3]	Precip Only	32.20	26.16	81%	17.12	53%

1 – Data accessed from California Data Exchange Center (CDEC)
2 – Data accessed from National Climate Data Center (NCDC)
3 – Data access from Napa One Rain

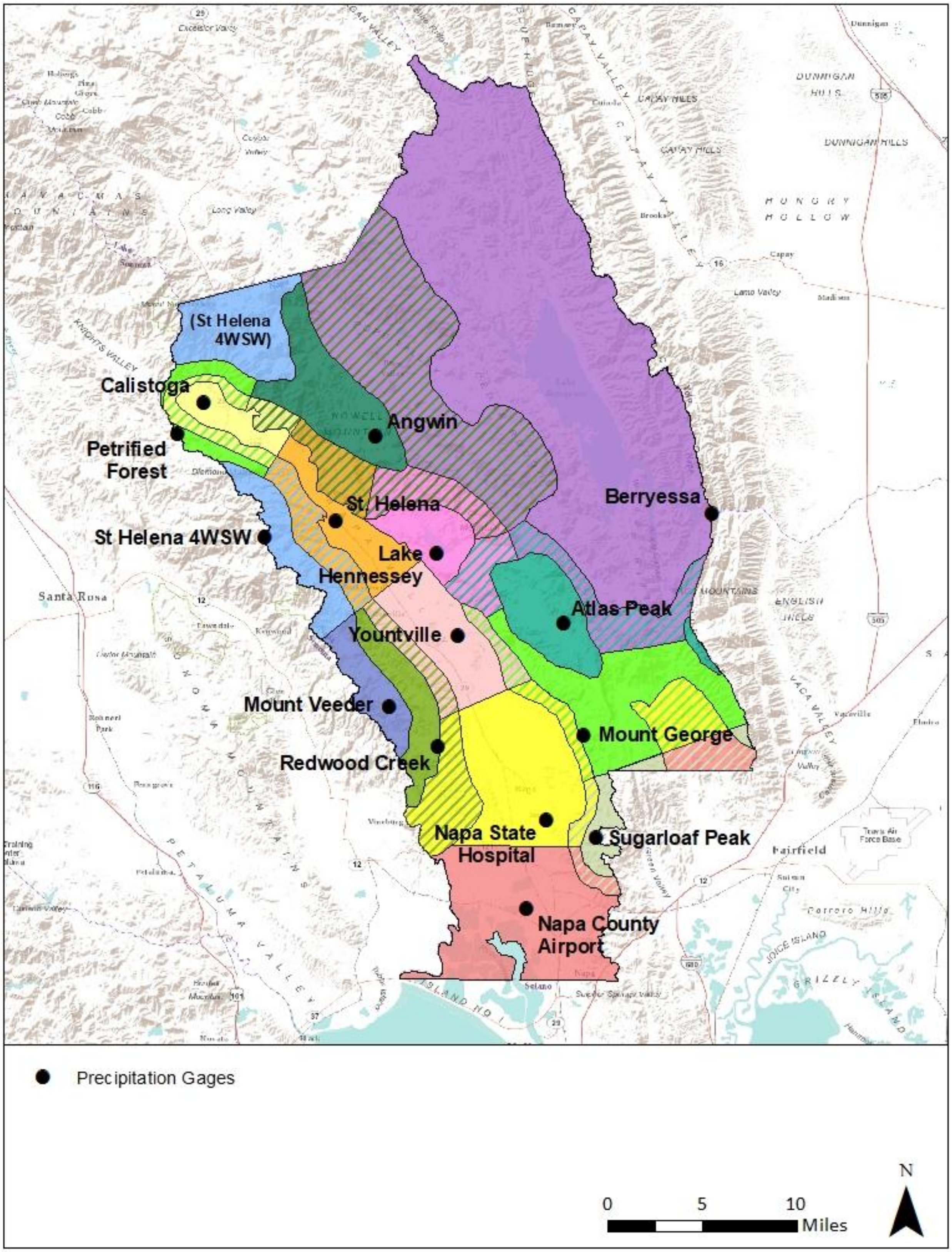


Figure 5: Precipitation zones used in the Napa County SWB model. Hatching indicates areas where two precipitation records were averaged across a zone.

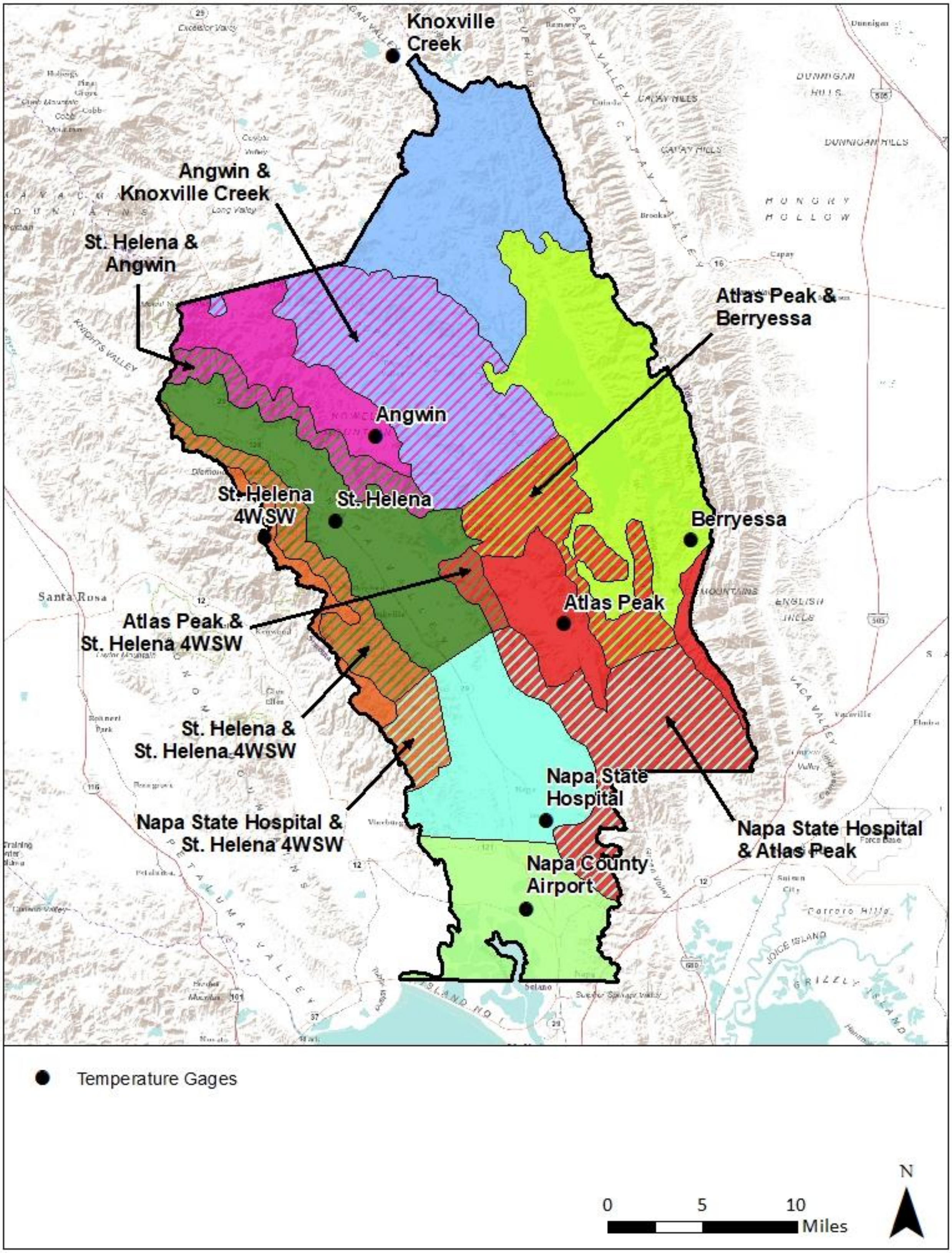


Figure 6: Temperature zones used in the Napa County SWB model. Hatching indicates areas where two temperature records were averaged across a zone.

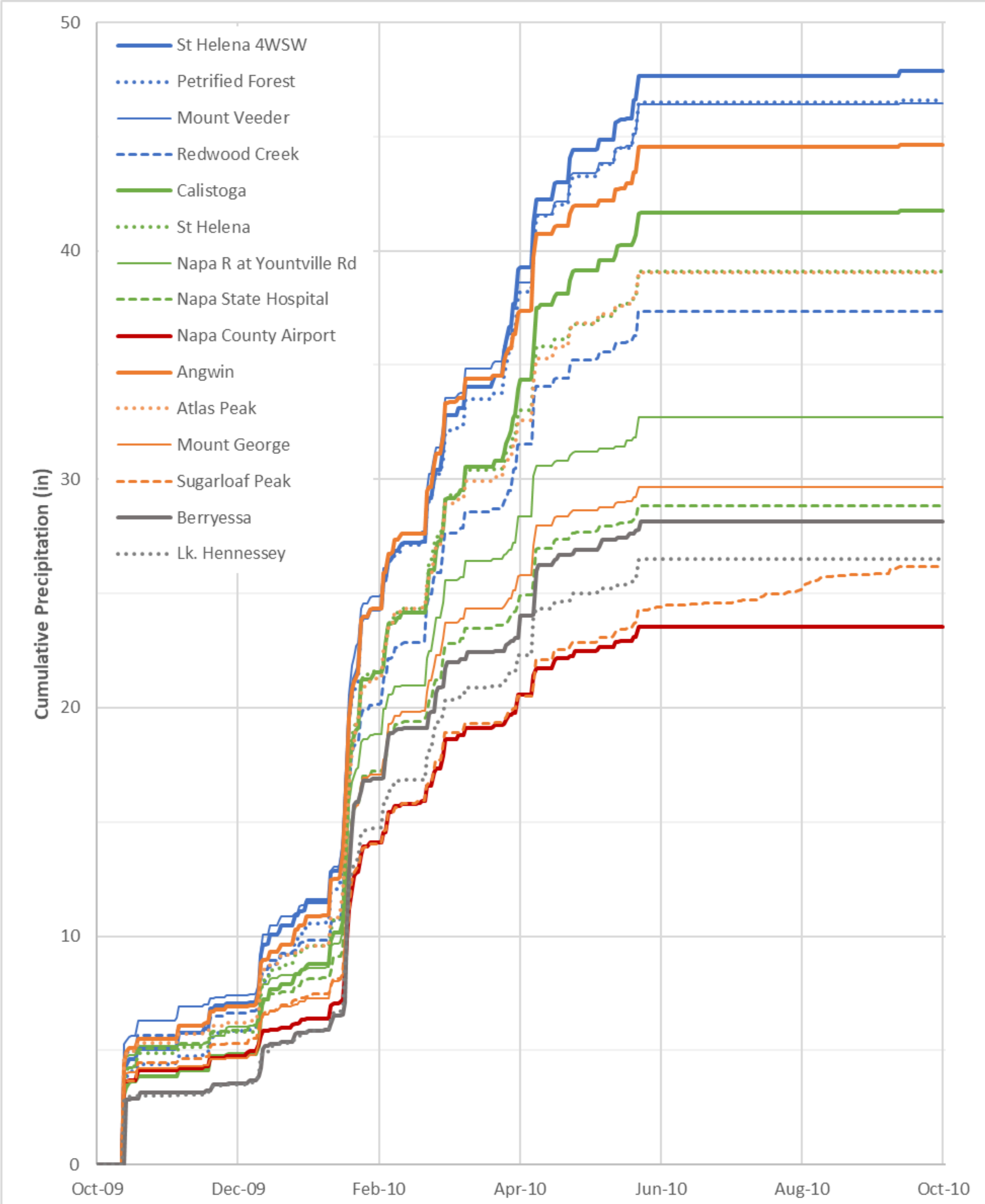


Figure 7a: Daily precipitation data used in the Napa County SWB model for WY 2010.

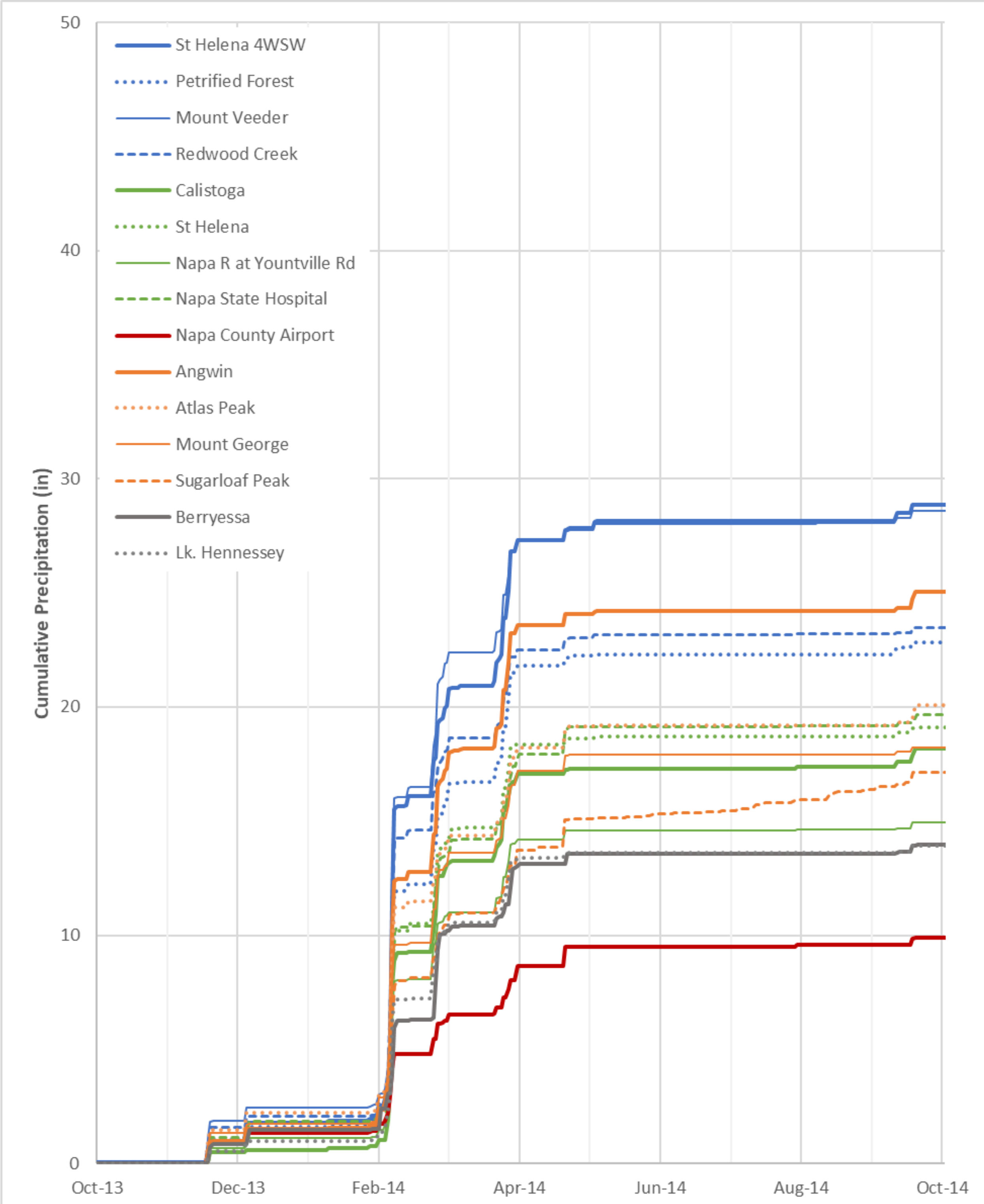


Figure 7b: Daily precipitation data used in the Napa County SWB model for WY 2014.

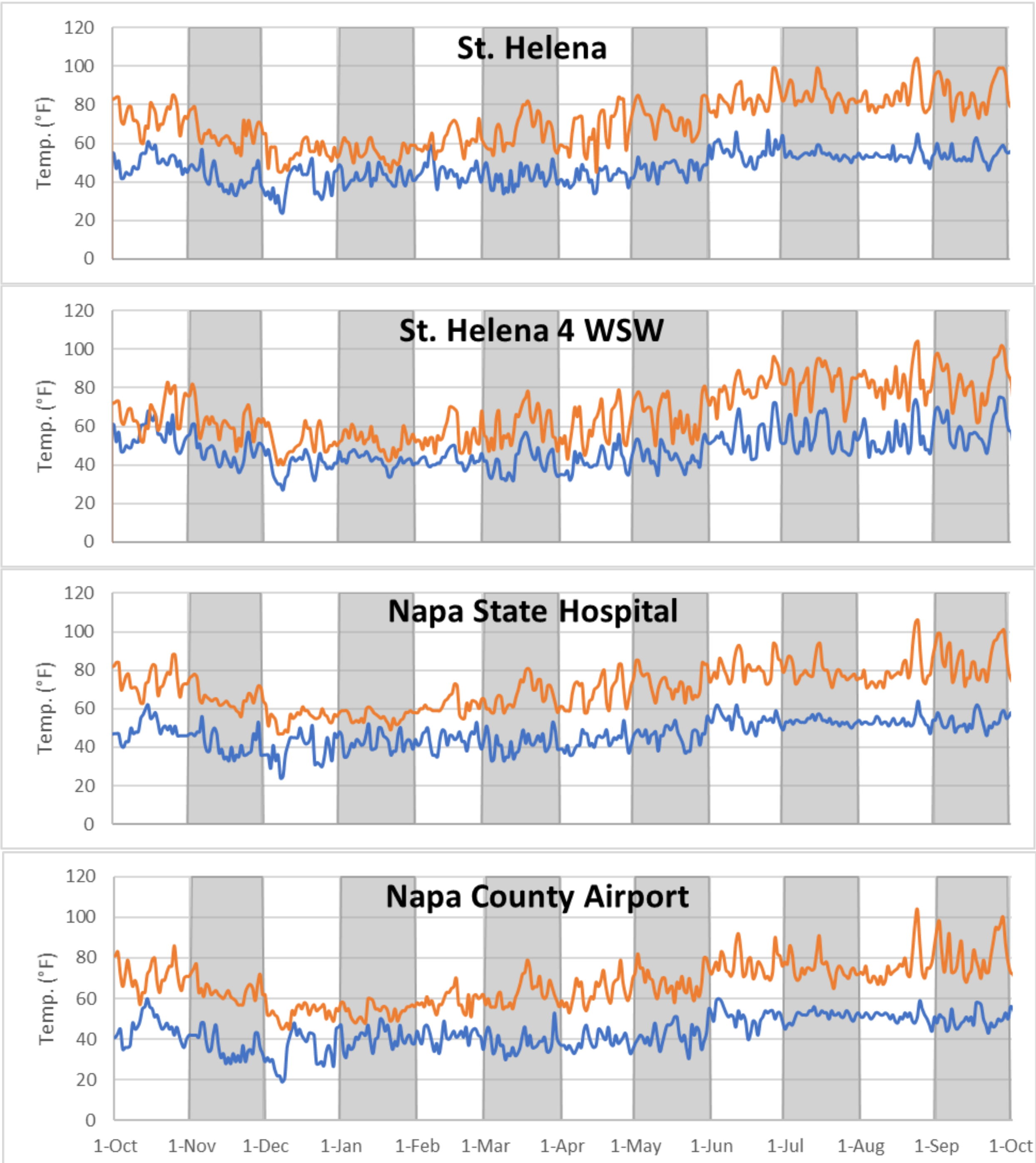


Figure 8: Daily minimum and maximum temperature data used in the Sonoma County SWB model for WY 2010.

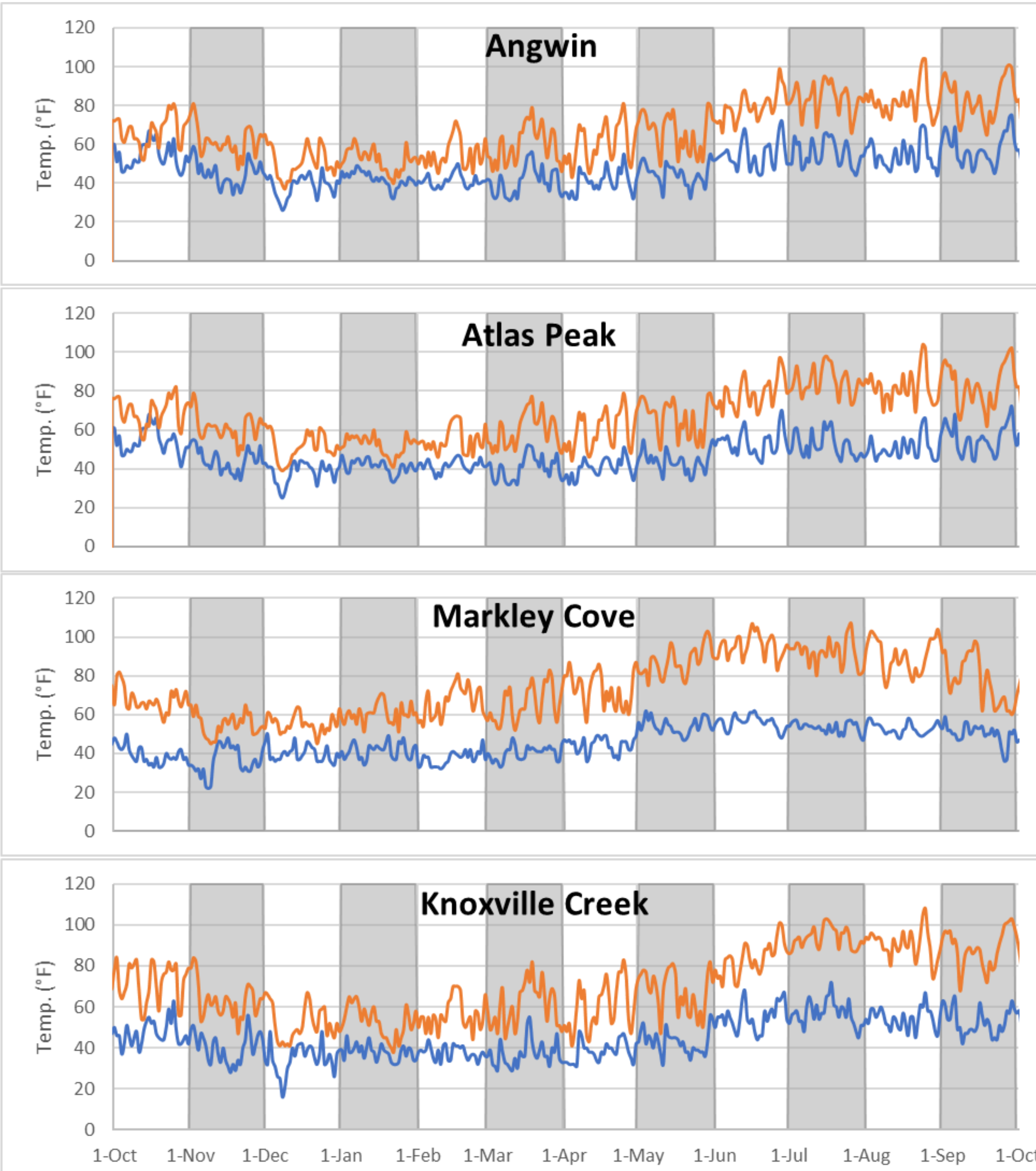


Figure 8 – cont.

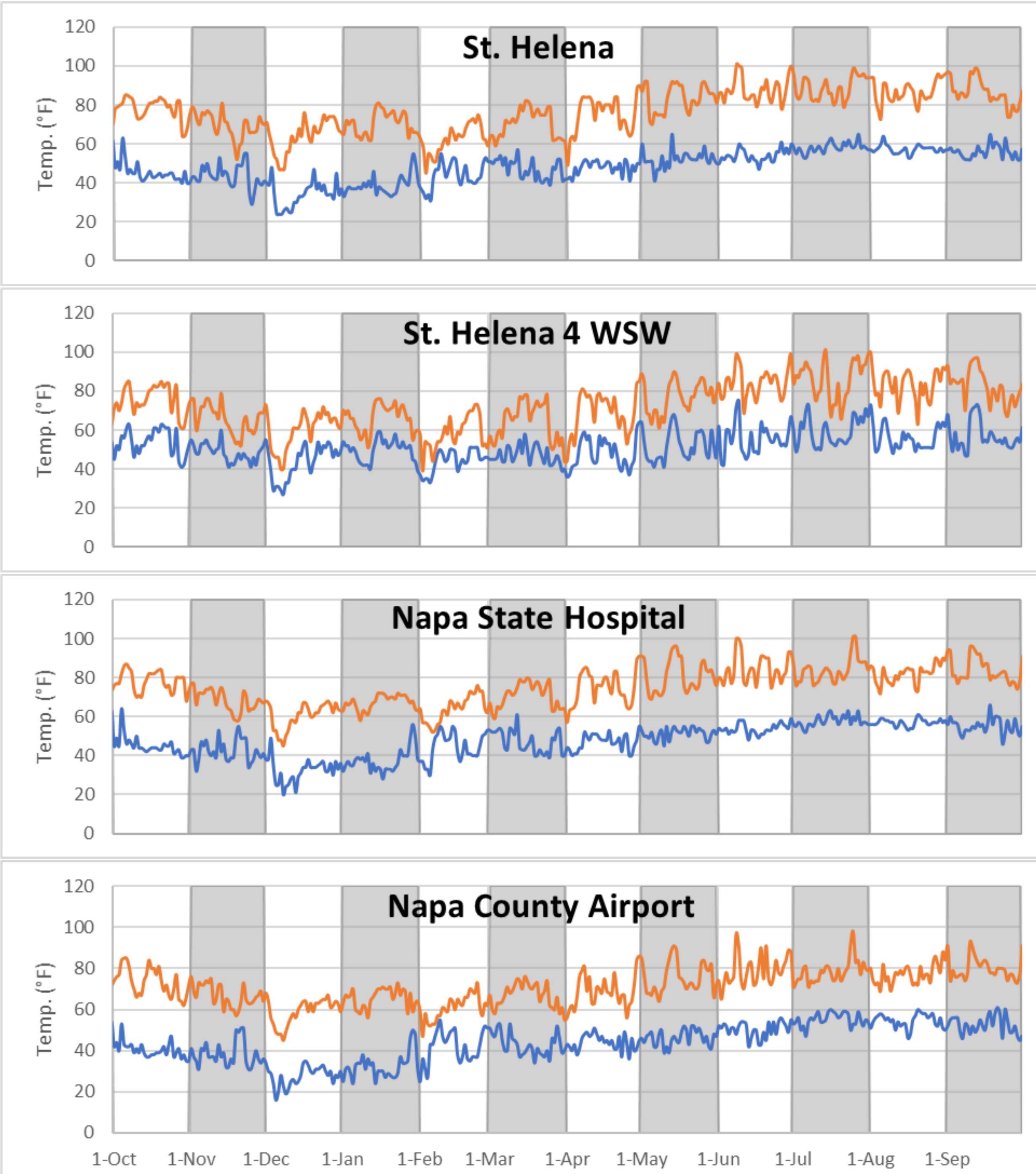


Figure 9: Daily minimum and maximum temperature data used in the Sonoma County SWB model for WY 2010.

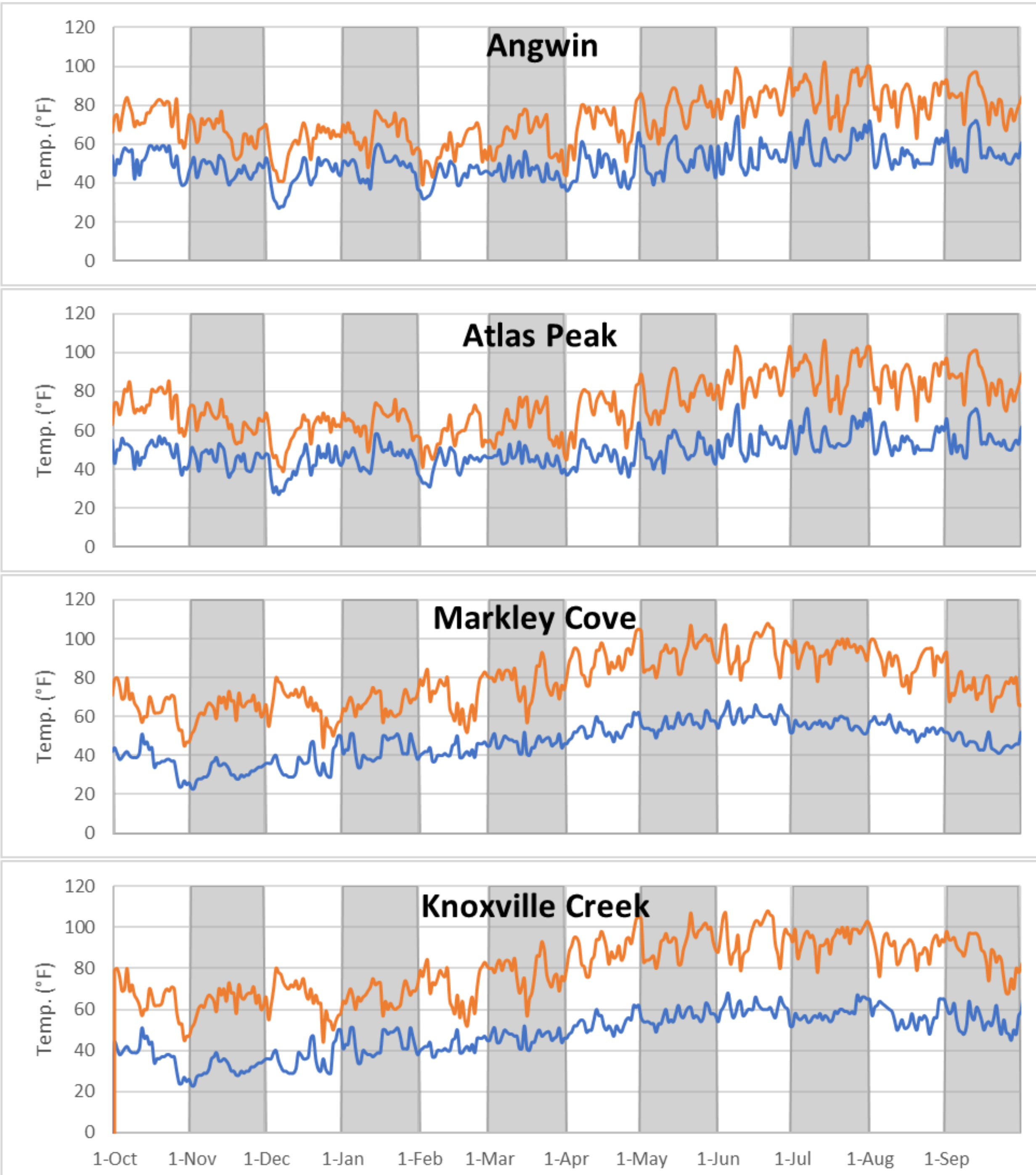


Figure 9 – cont.

Model Calibration

Available data are insufficient to calibrate the Water Year 2010 and 2014 SWB simulations; however, the land cover and soil properties used in the model were obtained from a previously prepared and calibrated SWB model of Sonoma County (OEI 2017). The Sonoma County model was calibrated against total monthly runoff volumes derived using baseflow separation of streamflow data for five watersheds within Sonoma County. Gages were selected because they represented relatively small watersheds (1.2 – 14.3 mi^2) without significant urbanization, diversions, groundwater abstraction, reservoir impoundments, or large alluvial bodies where significant exchanges between surface water and groundwater may be expected. These attributes are desirable because the hydrographs can more readily be separated into surface runoff and baseflow components and the surface runoff pattern is more directly comparable to the SWB simulated surface runoff which does not account for water use, reservoir operations, or surface water/groundwater exchange.

SWB utilizes a simplified routing scheme whereby surface runoff is routed to downslope cells or out of the model domain on the same day in which it originates as rainfall, thus it is not capable of accurately estimating streamflow over short time periods. The use of the total monthly surface runoff volumes provided a means of calibrating the Sonoma County SWB model to measured surface runoff data within the limitations of the model's approach to simulating surface runoff.

The SWB model of Sonoma County reproduced seasonal variations in surface runoff in all five calibration watersheds. Monthly Mean Errors (ME) ranged from -0.2 to 0.4 inches with a mean value of 0.1 inches. Annual surface runoff totals ranged from an under-prediction of approximately 10% at Franchini Creek to an over-prediction of approximately 19% at Buckeye Creek, with a mean over-prediction of approximately 6% across the five watersheds. These results indicate that the SWB model was able to reproduce monthly surface runoff volumes with a reasonable degree of accuracy and that the model tends to over-predict surface runoff somewhat, suggesting that the model may generate a low-range estimate of recharge.

Although the climate in Napa County is slightly drier than in Sonoma County, the vegetation, soils, and geology are similar and parameters calibrated using data from Sonoma County should be applicable to Napa County. Calibration of the Napa County SWB model was not performed due to a lack of publicly-available contemporary discharge records in suitable watersheds. Contemporary discharge records exist for USGS gaging stations located along the Napa River near St. Helena and Napa, but the watersheds above these gages are large and contain significant groundwater abstraction, reservoir impoundments, and alluvial bodies. USGS gages on smaller watersheds in Napa County have been inactive since 1983 or earlier. Discharge records exist through Napa One Rain for several streams gaged by the Napa County Resource Conservation District (RCD) but the RCD has cautioned against use of these discharge records for calibration purposes due to incomplete rating curve development.

Estimates of groundwater recharge are also available from an earlier model prepared by Luhdorff and Scalmanini Engineers and MBK Engineers (LSCE 2013). This report provided estimates of average annual recharge as a percentage of average annual precipitation for nine watersheds in Napa County. Averaged across the same nine watersheds, the SWB model predicts significantly higher rates of recharge than the model prepared by LSCE, which predicts slightly lower AET but significantly more runoff (Table 4). Differences in methodology between these two models complicate direct comparisons. The LSCE model calculated infiltration into the soil as the difference between monthly precipitation and discharge volumes within each watershed. Discharge volumes were calculated from USGS stream gages and included both direct runoff and baseflow from groundwater. <u>Inclusion of baseflow with direct runoff in these calculations may inappropriately reduce the estimated volume of water infiltrated into the soil and available for recharge</u>.

Table 4: Comparison of results from SWB model and Luhdorff and Scalmanini model.

USGS Gage	HUC	Mean Precip, 2010 (in)	Mean AET, 2010 (% Precip)		Mean Runoff, 2010 (% Precip)		Mean Recharge, 2010 (% Precip)	
			SWB	LSCE	SWB	LSCE	SWB	LSCE
Conn Ck nr Oakville	11456500	34.8	59%	53%	21%	25%	21%	21%
Dry Ck nr Napa	11457000	41.5	56%	50%	18%	43%	25%	6%
Milliken Ck nr Napa	11458100	32.3	52%	41%	20%	51%	28%	8%
Napa Ck at Napa	11458300	36.6	61%	43%	16%	46%	23%	11%
Napa R nr Napa	11458000	39.5	56%	48%	20%	35%	24%	17%
Napa R nr St Helena	11456000	47.9	46%	45%	23%	42%	30%	14%
Redwood Ck nr Napa	11458200	39.6	53%	49%	26%	40%	22%	10%
Tulucay Ck nr Napa	11458300	27.0	64%	49%	16%	47%	20%	5%

Model Results

The principal elements of the annual water budget simulated with the Napa County SWB model for Water Years 2010 and 2014 are presented in map form in Figures 10 - 19 and in tabular form for 27 major watershed areas in Napa County (Tables 5 - 8). The watersheds are based on USGS HUC-12 watersheds and are named for the stream which comprises the largest proportion of the area; in many cases the areas consist of multiple tributary streams (Figure 20).

In Water Year 2010 (representing "average" hydrologic conditions) precipitation varied from 21.8 inches in the Ledgewood Creek watershed to 53.3 inches in the Saint Helena Creek watershed (Figure 10, Table 5). Actual evapotranspiration (AET) ranged from 13.4 inches in the Jackson Creek watershed to 25.2 inches in the Saint Helena Creek watershed (Figure 11). Surface runoff ranged from 3.4 inches in the Ledgewood Creek watershed to 13.5 inches in the Saint Helena Creek watershed (Figure 12). Recharge ranged from 3.3 inches in the Ledgewood Creek watershed to 14.4 inches in the Saint Helena watershed. (Figure 13). Small decreases in soil moisture storage (up to 1.8 inches) occurred in most watersheds, with changes in most watersheds being less than an inch (Figure 14). Note that the San Pablo Bay estuaries have been excluded from these comparisons.

Expressed as a percentage of the annual precipitation, AET ranged from 77% in the Ledgewood Creek watershed to 45% in the Jackson Creek watershed (Table 6). Surface runoff ranged from 15% of precipitation in the Ledgewood Creek watershed to 42% in the Jackson Creek watershed. Recharge ranged from 10% of the precipitation in the Jackson Creek watershed to 27% in the Saint Helena watershed.

In Water Year 2014 (representing “dry” hydrologic conditions during the second year of an extreme three-year drought) precipitation varied from 10.1 inches in the American Canyon Creek watershed to 32.2 inches in the Saint Helena Creek watershed (Figure 15, Table 7). Actual evapotranspiration (AET) ranged from 10.3 inches in the Jackson Creek watershed to 17.8 inches in the Saint Helena Creek watershed (Figure 16). Surface runoff ranged from 0.7 inches in the American Canyon Creek watershed to 13.2 inches in the Saint Helena Creek watershed (Figure 17). Recharge ranged from 0.6 inches in the Wragg Canyon watershed to 4.1 inches in the Saint Helena watershed. (Figure 18). Large decreases in soil moisture storage of between 2.3 and 4.3 inches were also simulated (Figure 19).

Expressed as a percentage of the annual precipitation, AET ranged from 55% in the Saint Helena Creek watershed to 121% in the Jackson Creek watershed (Table 8). These very large AET rates caused significant decreases in soil moisture. Decreases in soil moisture ranged from 9% of precipitation in the Saint Helena watershed to 36% in the American Canyon Creek watershed. Surface runoff ranged from 7% of precipitation in the American Canyon Creek watershed to 41% in the Saint Helena Watershed. Recharge ranged from 18% in the Milliken Creek Watershed to 5% in the Jackson Creek and Wragg Canyon watersheds.

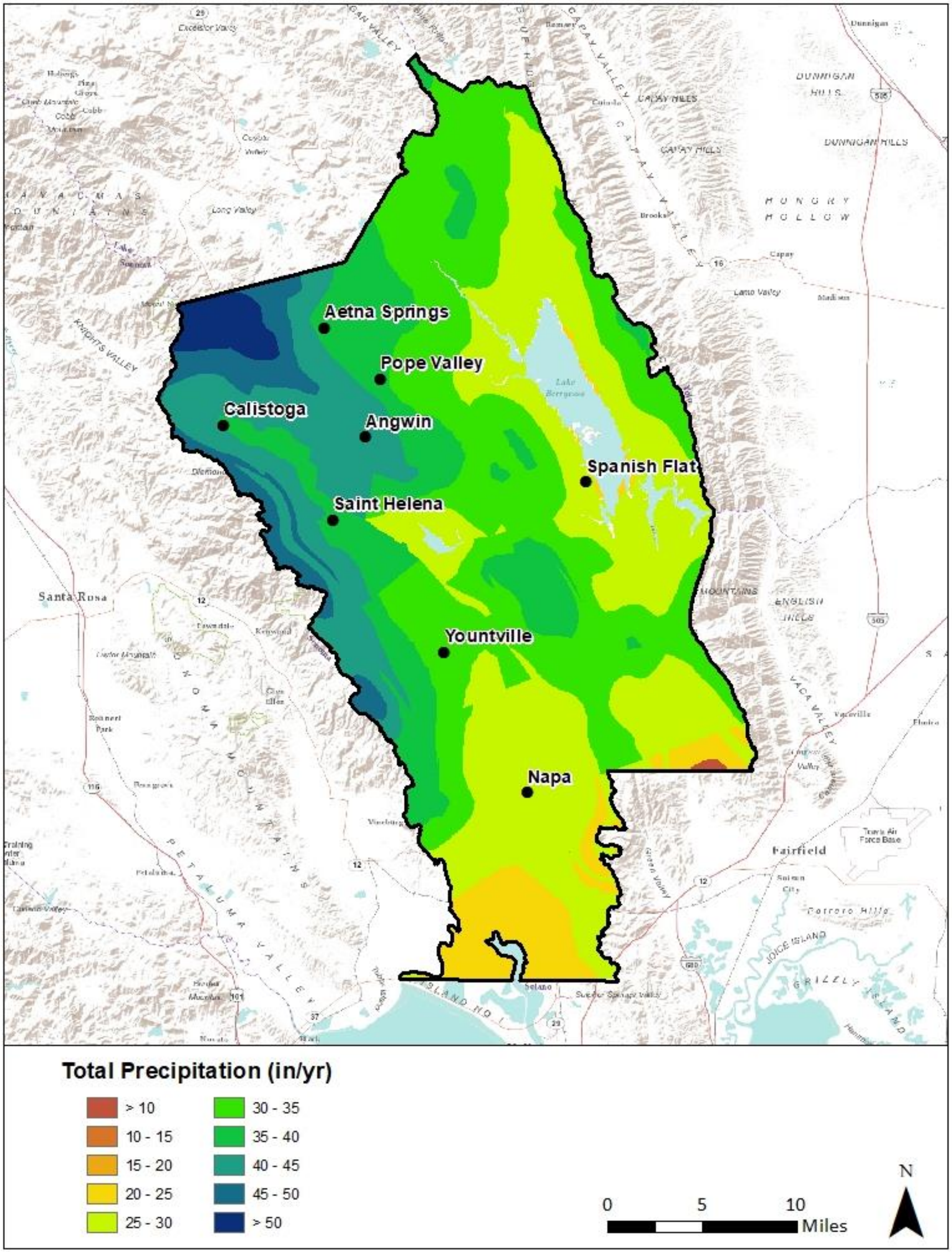


Figure 10: Water Year 2010 precipitation simulated with the Napa County SWB model.

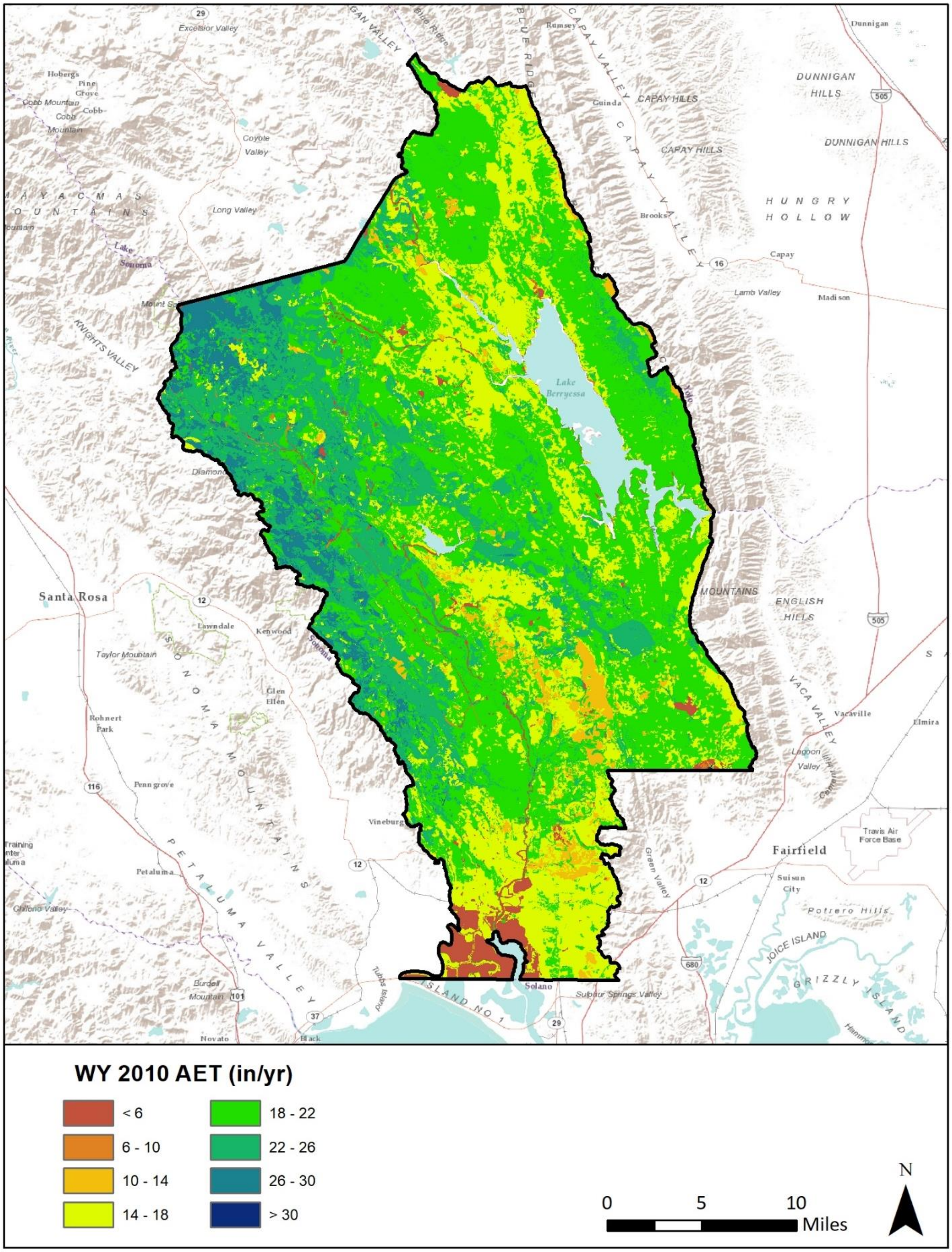


Figure 11: Water Year 2010 AET simulated with the Napa County SWB model.

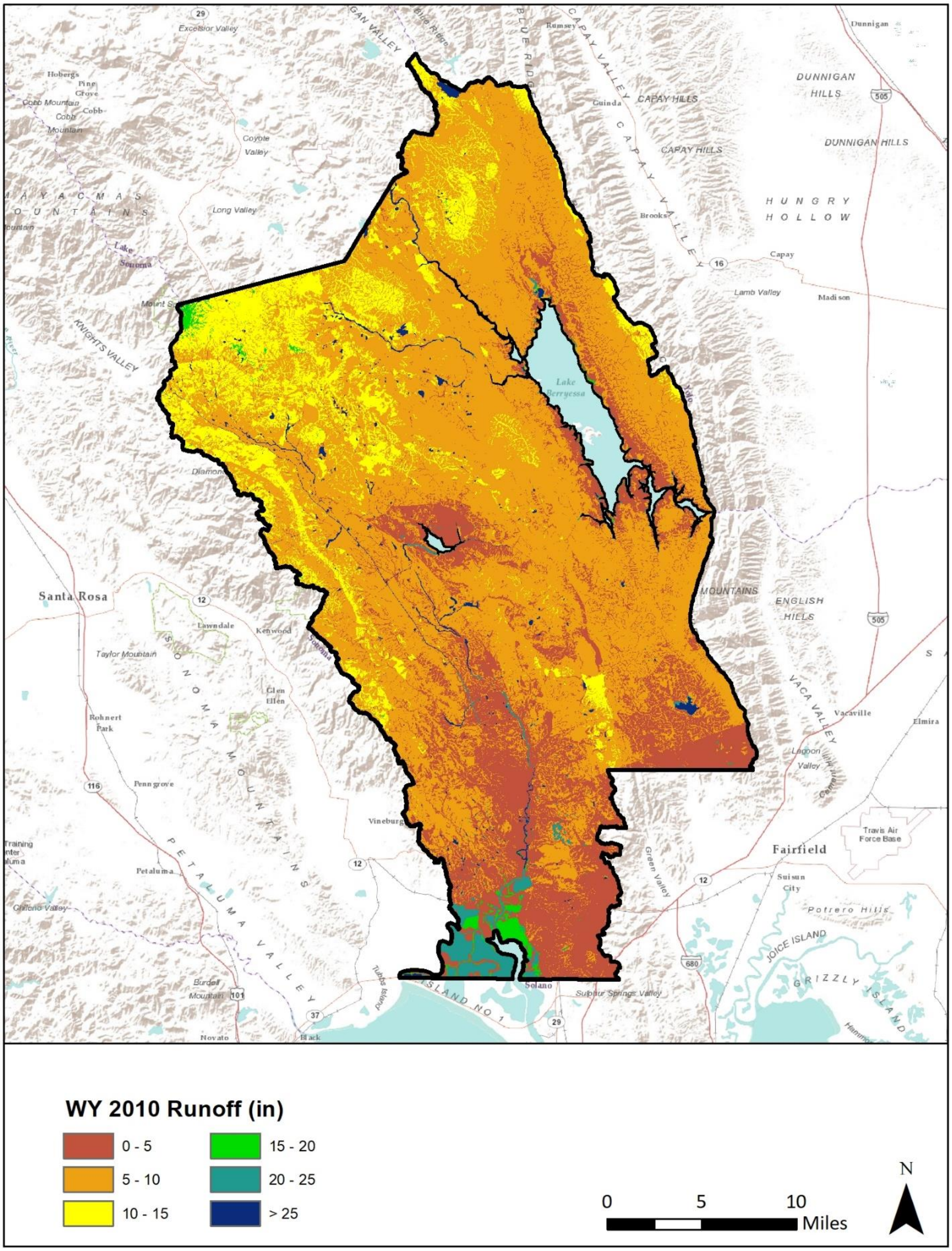


Figure 12: Water Year 2010 runoff simulated with the Napa County SWB model.

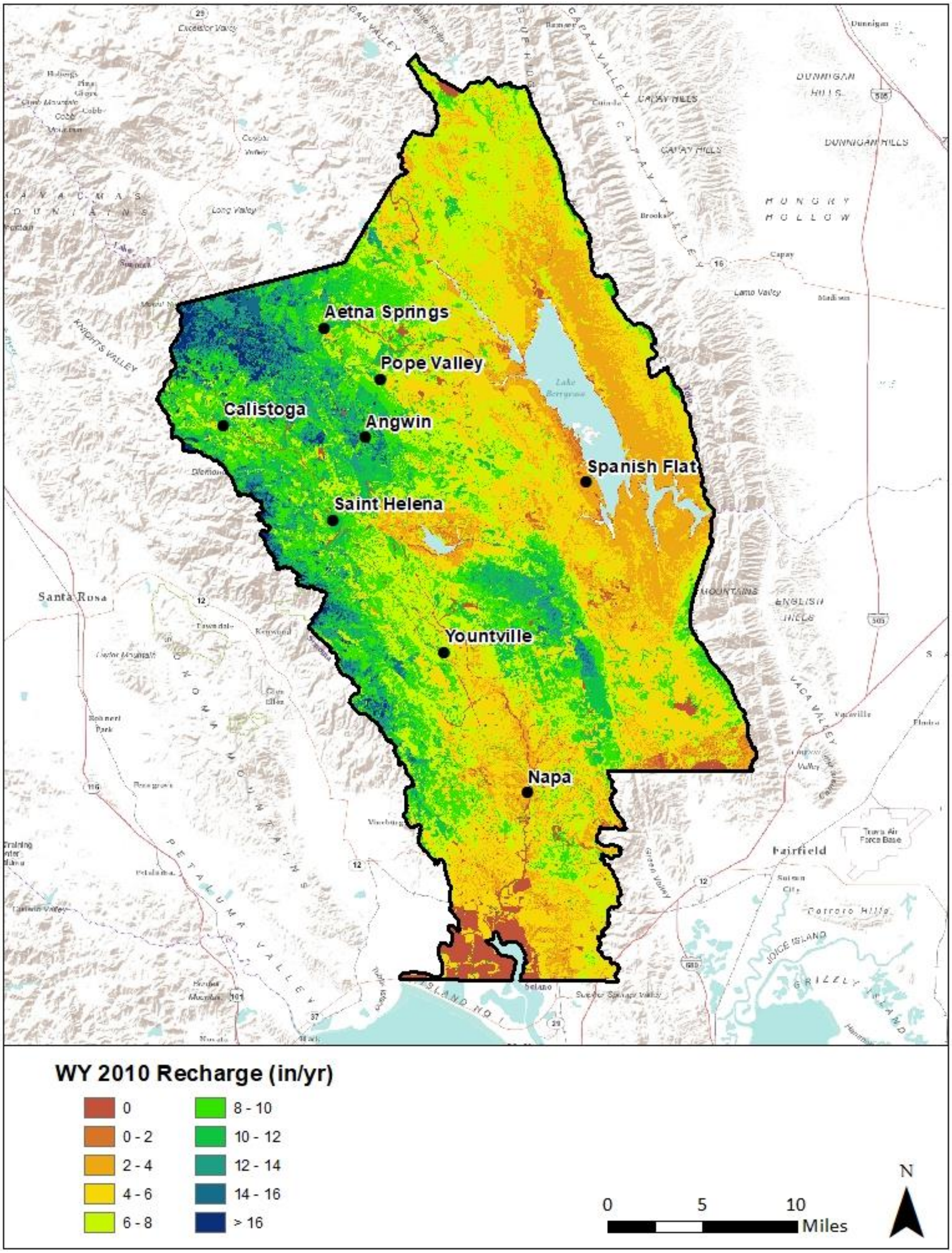


Figure 13: Water Year 2010 recharge simulated with the Napa County SWB model.

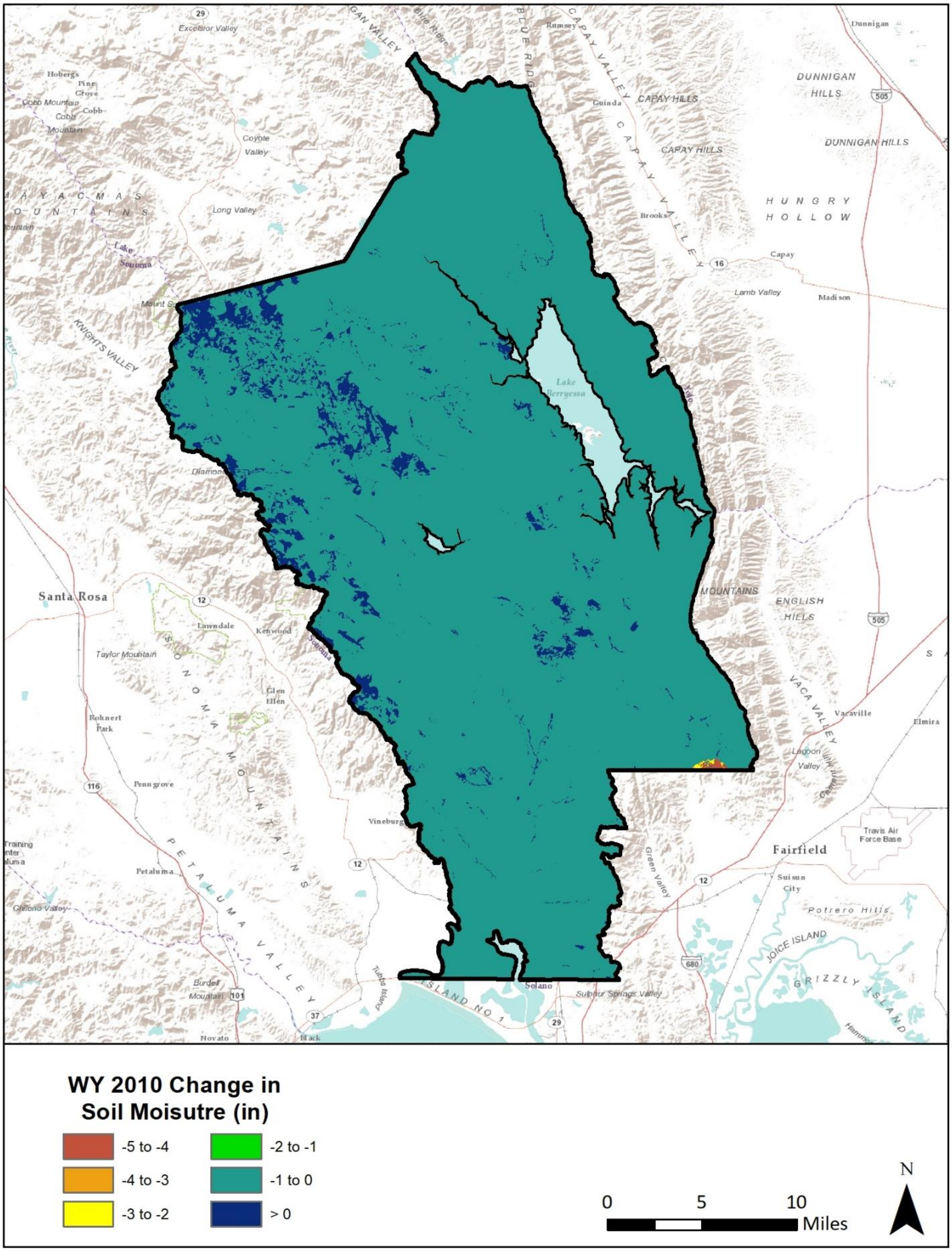


Figure 14: Water Year 2010 change in soil moisture content simulated with the Napa County SWB model.

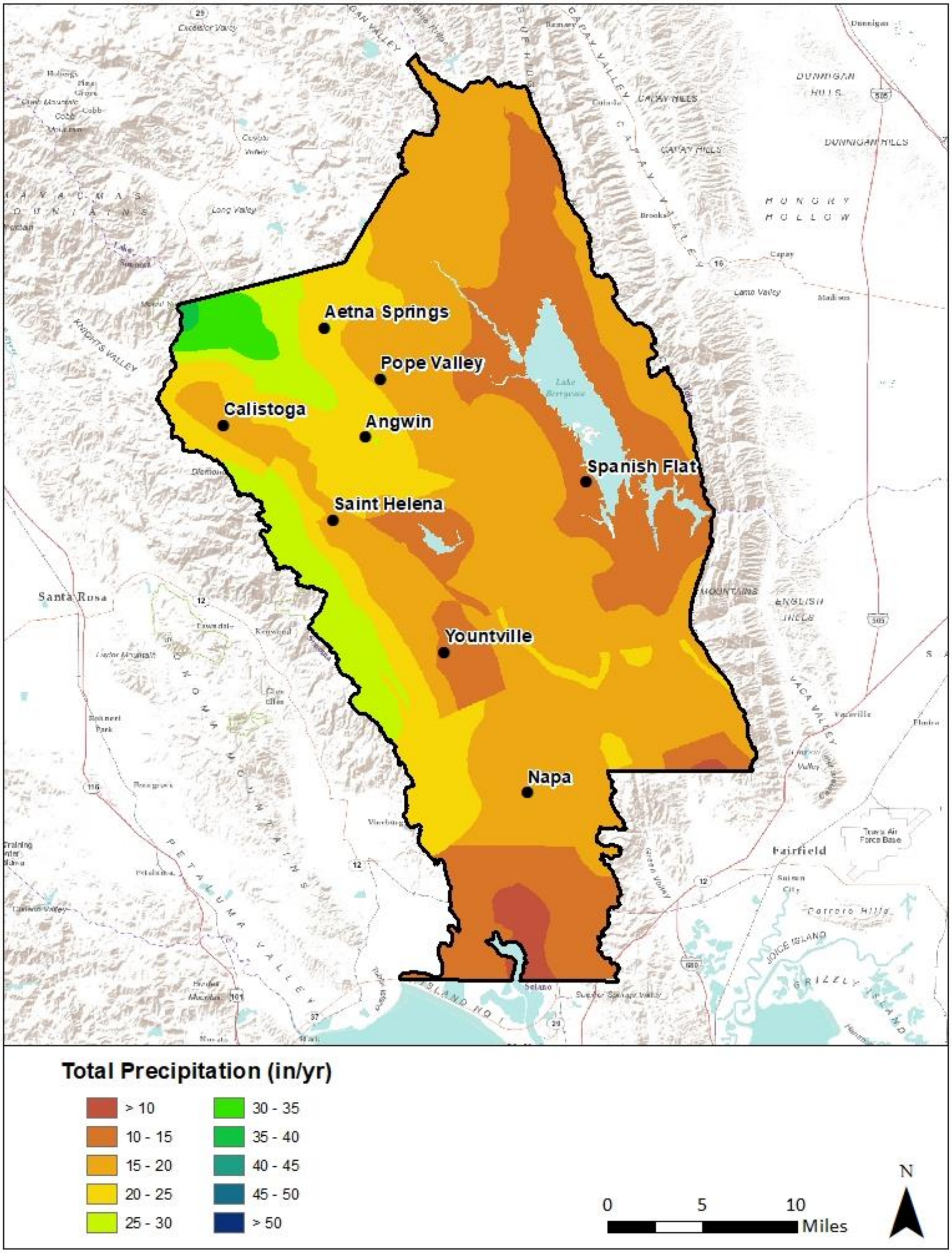


Figure 15: Water Year 2014 precipitation simulated with the Napa County SWB model.

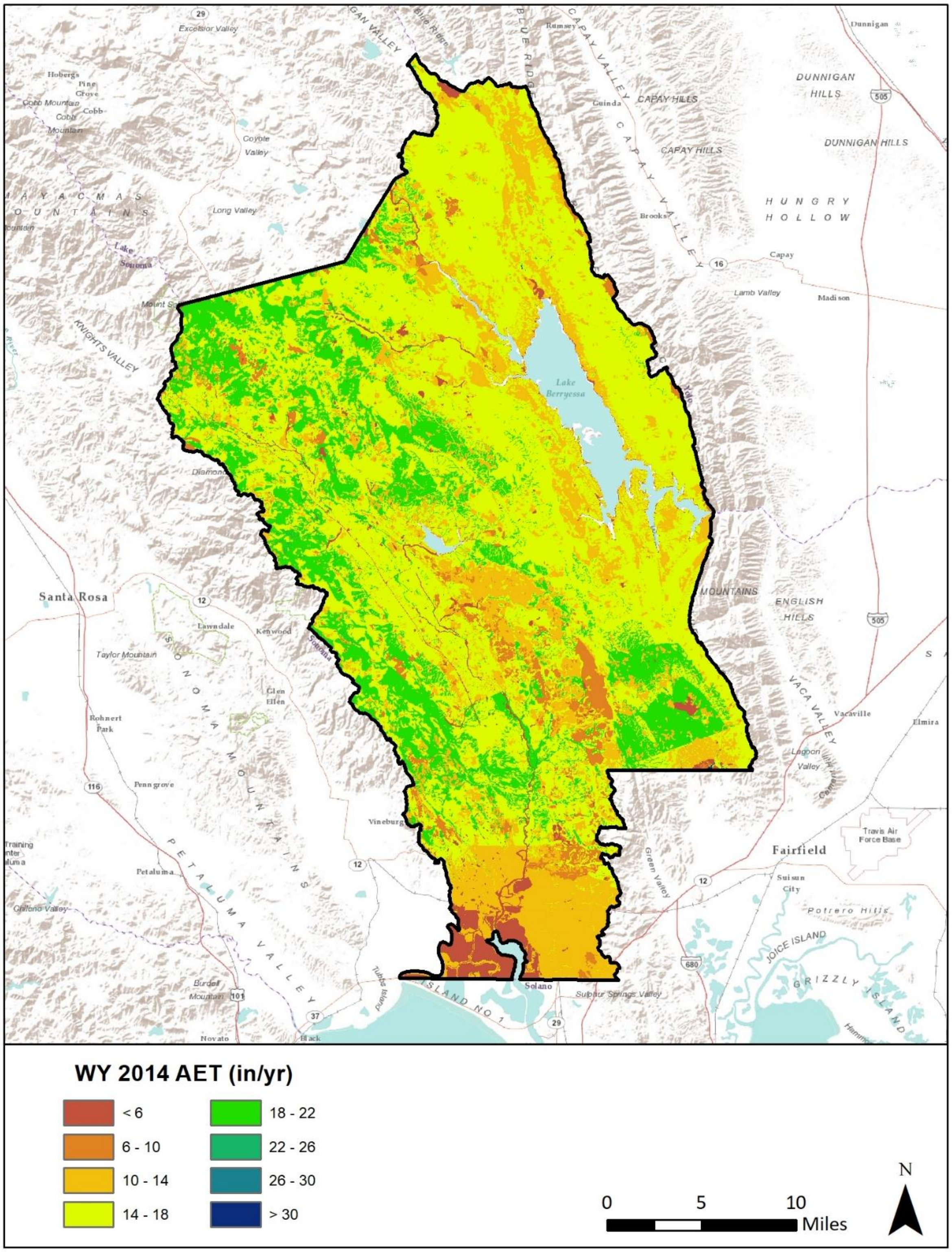


Figure 16: Water Year 2014 AET simulated with the Napa County SWB model.

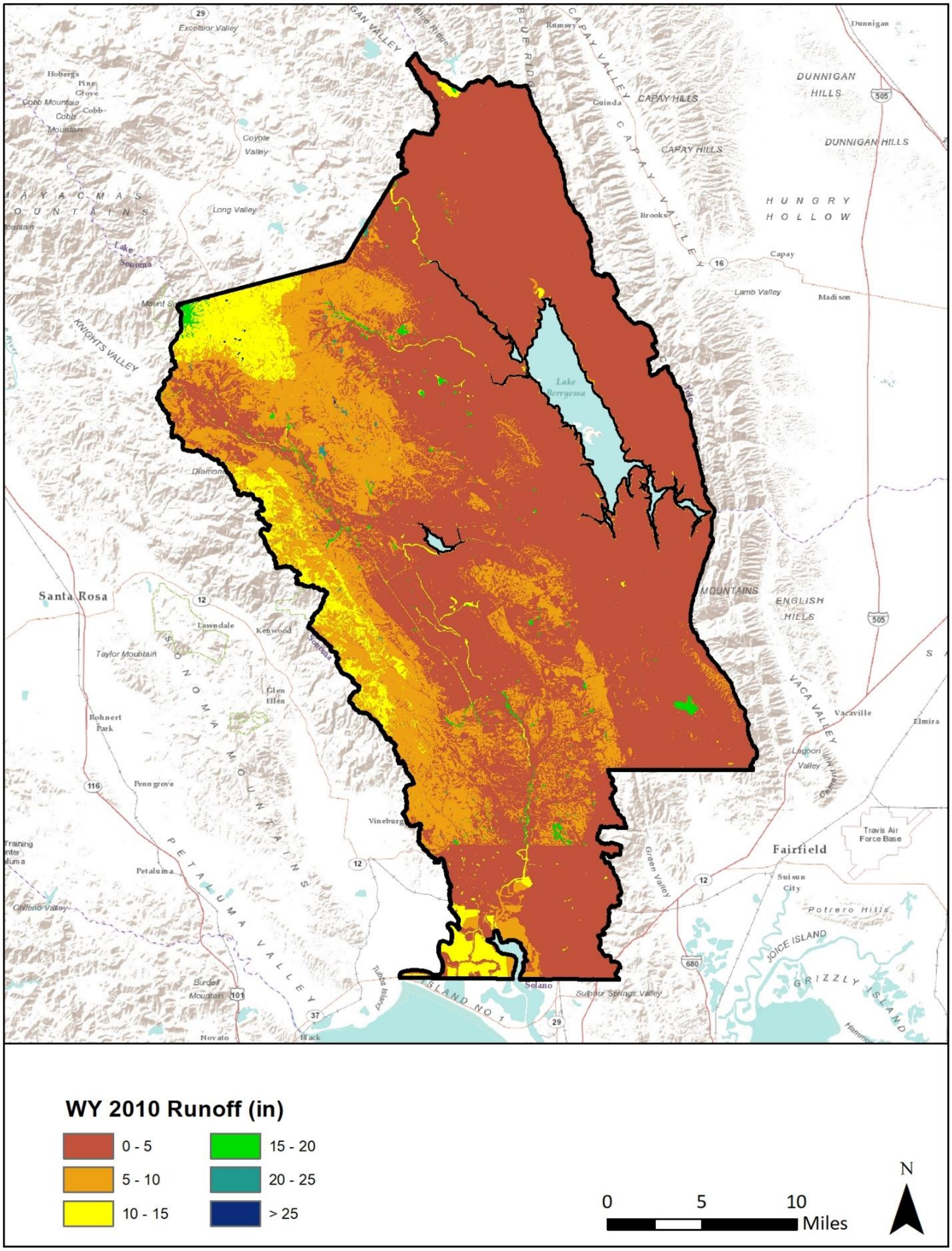


Figure 17: Water Year 2014 recharge simulated with the Napa County SWB model.

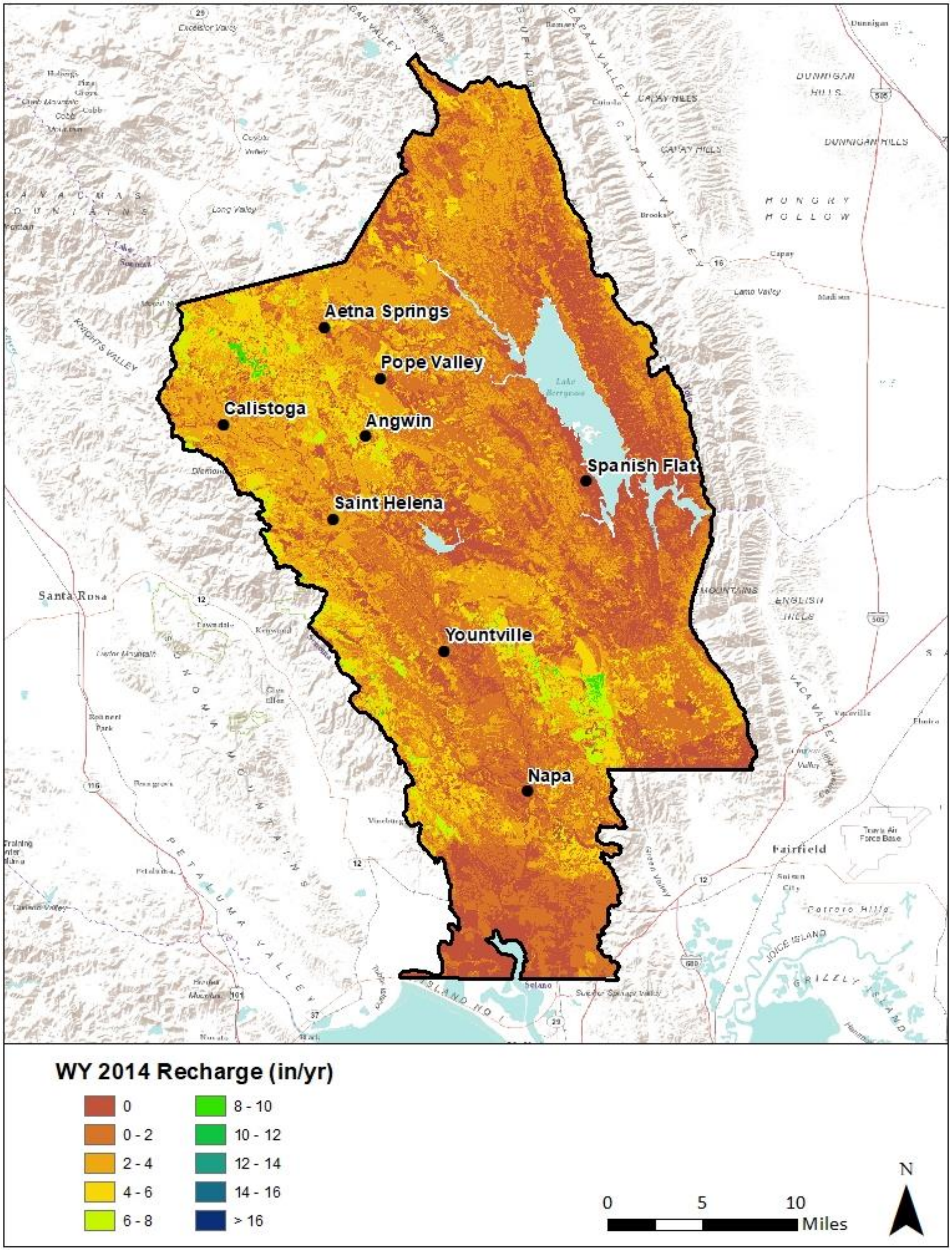


Figure 18: Water Year 2014 recharge simulated with the Napa County SWB model.

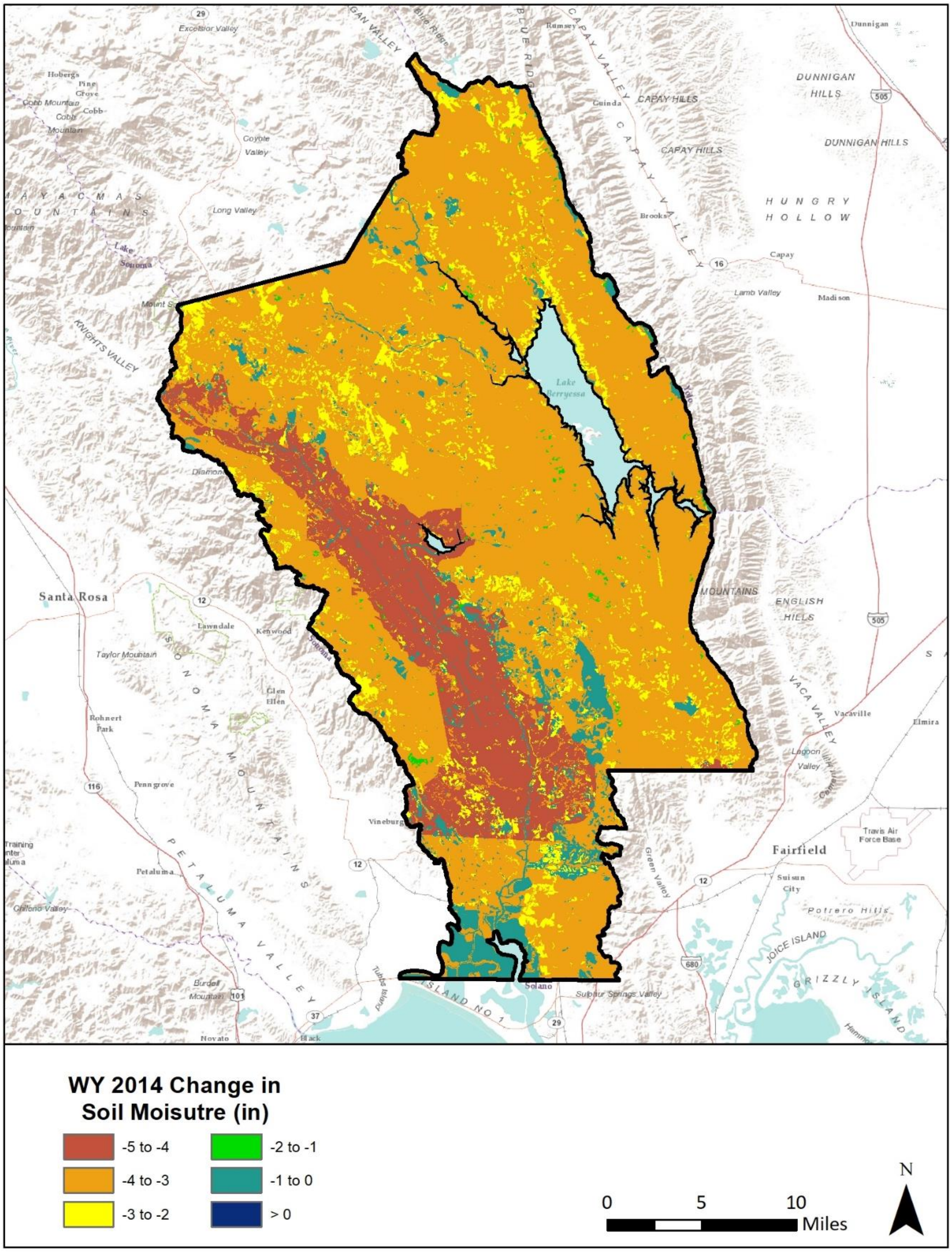


Figure 19: Water Year 2014 change in soil moisture content simulated with the Napa County SWB model.

Table 5: Simulated precipitation and recharge values averaged across HUC-12 watersheds in Napa County for Water Year 2010 expressed as depths. See Figure 20 for watershed locations.

Name	Drainage Area (mi^2)	Precipitation (in)	AET (in)	Surface Runoff (in)	Recharge (in)	Soil Moisture Change (in)
American Canyon Creek	10.8	24.1	16.3	3.7	4.7	-0.6
Bucksnort Creek	1.9	47.9	24.5	12.1	11.1	0.1
Butts Creek-Putah Creek	49.9	33.0	17.4	9.7	6.2	-0.7
Capell Creek	43.0	31.1	19.1	7.4	5.0	-0.6
Carneros Creek	29.7	28.0	18.6	5.2	5.5	-0.6
Chiles Creek	32.0	34.6	21.1	7.1	6.8	-0.5
Dry Creek	28.8	37.0	22.2	7.2	8.4	-0.5
Hunting Creek	12.0	33.7	19.0	9.7	5.7	-0.8
Jackson Creek-Putah Creek	54.5	29.9	13.4	12.6	3.0	-0.5
Lake Curry-Suisun Creek	16.4	30.7	18.9	6.5	5.9	-0.6
Lake Hennessey-Conn Creek	20.0	35.1	19.6	8.5	7.3	-0.4
Ledgewood Creek	6.4	21.8	16.9	3.4	3.3	-1.8
Lower Eticuera Creek	44.0	30.0	17.7	8.1	4.7	-0.7
Lower Napa River	45.0	31.7	19.9	5.6	6.7	-0.6
Lower Pope Creek	31.8	33.9	18.0	9.7	6.5	-0.6
Maxwell Creek	35.1	34.7	19.6	8.7	6.9	-0.6
Middle Napa River	60.3	39.9	22.8	8.5	9.2	-0.5
Milliken Creek	29.7	30.9	16.9	6.6	7.9	-0.6
Rector Creek-Conn Creek	22.3	32.8	18.0	7.1	8.2	-0.7
Saint Helena Creek	7.7	53.3	25.2	13.5	14.4	0.1
San Pablo Bay Estuaries	19.5	23.9	8.1	13.8	2.3	-0.3
Tulucay Creek	34.2	26.1	16.7	4.6	5.4	-0.7
Upper Eticuera Creek	25.6	31.2	17.2	8.6	6.1	-0.8
Upper Napa River	44.6	44.7	23.6	10.6	10.8	-0.4
Upper Pope Creek	21.7	44.5	22.7	10.5	11.5	-0.3
Wooden Valley & Suisun Creeks	23.3	29.0	19.0	5.1	5.5	-0.6
Wragg Canyon-Putah Creek	34.2	28.3	16.3	8.6	3.3	-0.6

Table 6: Simulated precipitation and recharge values averaged across HUC-12 watersheds in Napa County for Water Year 2010 expressed as a percentage of precipitation. See Figure 20 for watershed locations.

Name	Drainage Area (mi^2)	Precipitation (in)	AET (%)	Surface Runoff (%)	Recharge (%)	Soil Moisture Change (%)
American Canyon Creek	10.8	24.1	67%	15%	19%	-3%
Bucksnort Creek	1.9	47.9	51%	25%	23%	0%
Butts Creek-Putah Creek	49.9	33.0	53%	29%	19%	-2%
Capell Creek	43.0	31.2	61%	24%	16%	-2%
Carneros Creek	29.7	29.7	66%	19%	20%	-2%
Chiles Creek	32.0	34.6	61%	21%	20%	-1%
Dry Creek	28.8	37.8	60%	20%	23%	-1%
Hunting Creek	12.0	33.7	56%	29%	17%	-2%
Jackson Creek-Putah Creek	54.5	29.7	45%	42%	10%	-2%
Lake Curry-Suisun Creek	16.4	30.7	61%	21%	19%	-2%
Lake Hennessey-Conn Creek	20.0	36.0	56%	24%	21%	-1%
Ledgewood Creek	6.4	21.8	77%	15%	15%	-8%
Lower Eticuera Creek	44.0	30.0	59%	27%	16%	-2%
Lower Napa River	45.0	31.7	63%	18%	21%	-2%
Lower Pope Creek	31.8	33.9	53%	29%	19%	-2%
Maxwell Creek	35.1	34.7	56%	25%	20%	-2%
Middle Napa River	60.3	40.4	57%	21%	23%	-1%
Milliken Creek	29.7	30.9	55%	21%	26%	-2%
Rector Creek-Conn Creek	22.3	32.8	55%	22%	25%	-2%
Saint Helena Creek	7.7	53.3	47%	25%	27%	0%
San Pablo Bay Estuaries	19.5	23.9	34%	58%	10%	-1%
Tulucay Creek	34.2	26.1	64%	18%	21%	-3%
Upper Eticuera Creek	25.6	31.2	55%	28%	19%	-3%
Upper Napa River	44.6	44.7	53%	24%	24%	-1%
Upper Pope Creek	21.7	44.5	51%	23%	26%	-1%
Wooden Valley & Suisun Creeks	23.3	29.0	65%	18%	19%	-2%
Wragg Canyon-Putah Creek	34.2	28.3	58%	31%	12%	-2%

Table 7: Simulated precipitation and recharge values averaged across HUC-12 watersheds in Napa County for Water Year 2014 expressed as depths. See Figure 20 for watershed locations.

Name	Drainage Area (mi^2)	Precipitation (in)	AET (in)	Surface Runoff (in)	Recharge (in)	Soil Moisture Change (in)
American Canyon Creek	10.8	10.1	12.3	0.7	0.7	-3.6
Bucksnort Creek	1.9	28.8	17.6	11.5	2.6	-3.0
Butts Creek-Putah Creek	49.9	16.9	14.2	3.9	1.9	-3.2
Capell Creek	43.0	15.8	14.8	3.1	1.1	-3.1
Carneros Creek	29.7	15.0	14.7	4.6	2.0	-3.7
Chiles Creek	32.0	18.3	16.5	3.7	1.5	-3.3
Dry Creek	28.8	21.5	16.5	6.8	2.5	-3.7
Hunting Creek	12.0	16.7	15.4	3.1	1.6	-3.4
Jackson Creek-Putah Creek	54.5	14.9	10.3	6.1	0.7	-2.3
Lake Curry-Suisun Creek	16.4	18.4	16.1	3.7	1.9	-3.4
Lake Hennessey-Conn Creek	20.0	19.1	14.8	5.7	2.2	-3.2
Ledgewood Creek	6.4	12.2	13.9	1.7	0.8	-4.3
Lower Eticuera Creek	44.0	14.9	14.0	2.6	1.3	-3.1
Lower Napa River	45.0	19.4	15.9	5.0	2.2	-3.6
Lower Pope Creek	31.8	17.8	14.5	4.5	2.0	-3.2
Maxwell Creek	35.1	18.3	15.9	3.8	2.0	-3.3
Middle Napa River	60.3	21.3	16.5	6.6	2.5	-3.7
Milliken Creek	29.7	18.7	13.7	4.5	3.4	-2.9
Rector Creek-Conn Creek	22.3	16.5	13.6	4.0	2.3	-3.4
Saint Helena Creek	7.7	32.2	17.8	13.2	4.1	-3.0
San Pablo Bay Estuaries	19.5	10.4	6.0	5.6	0.5	-1.6
Tulucay Creek	34.2	14.6	13.5	2.6	1.7	-3.3
Upper Eticuera Creek	25.6	15.5	14.1	2.5	2.1	-3.2
Upper Napa River	44.6	22.9	16.2	6.9	3.3	-3.5
Upper Pope Creek	21.7	25.6	16.8	8.5	3.5	-3.2
Wooden Valley & Suisun Creeks	23.3	17.9	16.4	3.1	2.0	-3.5
Wragg Canyon-Putah Creek	34.2	14.1	12.6	3.6	0.6	-2.8

Table 8: Simulated precipitation and recharge values averaged across HUC-12 watersheds in Napa County for Water Year 2014 expressed as a percentage of precipitation. See Figure 20 for watershed locations.

Name	Drainage Area (mi^2)	Precipitation (in)	AET (%)	Surface Runoff (%)	Recharge (%)	Soil Moisture Change (%)
American Canyon Creek	10.8	10.1	121%	7%	7%	-36%
Bucksnort Creek	1.9	28.8	61%	40%	9%	-10%
Butts Creek-Putah Creek	49.9	16.8	84%	23%	11%	-19%
Capell Creek	43.0	15.8	94%	20%	7%	-20%
Carneros Creek	29.7	17.6	98%	30%	13%	-25%
Chiles Creek	32.0	18.4	90%	20%	8%	-18%
Dry Creek	28.8	22.1	77%	32%	12%	-17%
Hunting Creek	12.0	16.7	92%	18%	10%	-20%
Jackson Creek-Putah Creek	54.5	14.7	69%	41%	5%	-16%
Lake Curry-Suisun Creek	16.4	18.4	88%	20%	10%	-19%
Lake Hennessey-Conn Creek	20.0	19.6	78%	30%	12%	-17%
Ledgewood Creek	6.4	12.2	114%	14%	7%	-35%
Lower Eticuera Creek	44.0	14.9	94%	18%	9%	-21%
Lower Napa River	45.0	19.4	82%	26%	11%	-19%
Lower Pope Creek	31.8	17.8	81%	25%	11%	-18%
Maxwell Creek	35.1	18.3	87%	21%	11%	-18%
Middle Napa River	60.3	21.8	77%	31%	12%	-18%
Milliken Creek	29.7	18.7	74%	24%	18%	-16%
Rector Creek-Conn Creek	22.3	16.5	83%	24%	14%	-21%
Saint Helena Creek	7.7	32.2	55%	41%	13%	-9%
San Pablo Bay Estuaries	19.5	10.4	58%	53%	4%	-16%
Tulucay Creek	34.2	14.6	93%	18%	12%	-23%
Upper Eticuera Creek	25.6	15.5	91%	16%	14%	-21%
Upper Napa River	44.6	22.9	71%	30%	14%	-15%
Upper Pope Creek	21.7	25.6	66%	33%	14%	-12%
Wooden Valley & Suisun Creeks	23.3	17.9	91%	17%	11%	-20%
Wragg Canyon-Putah Creek	34.2	14.1	90%	26%	5%	-20%

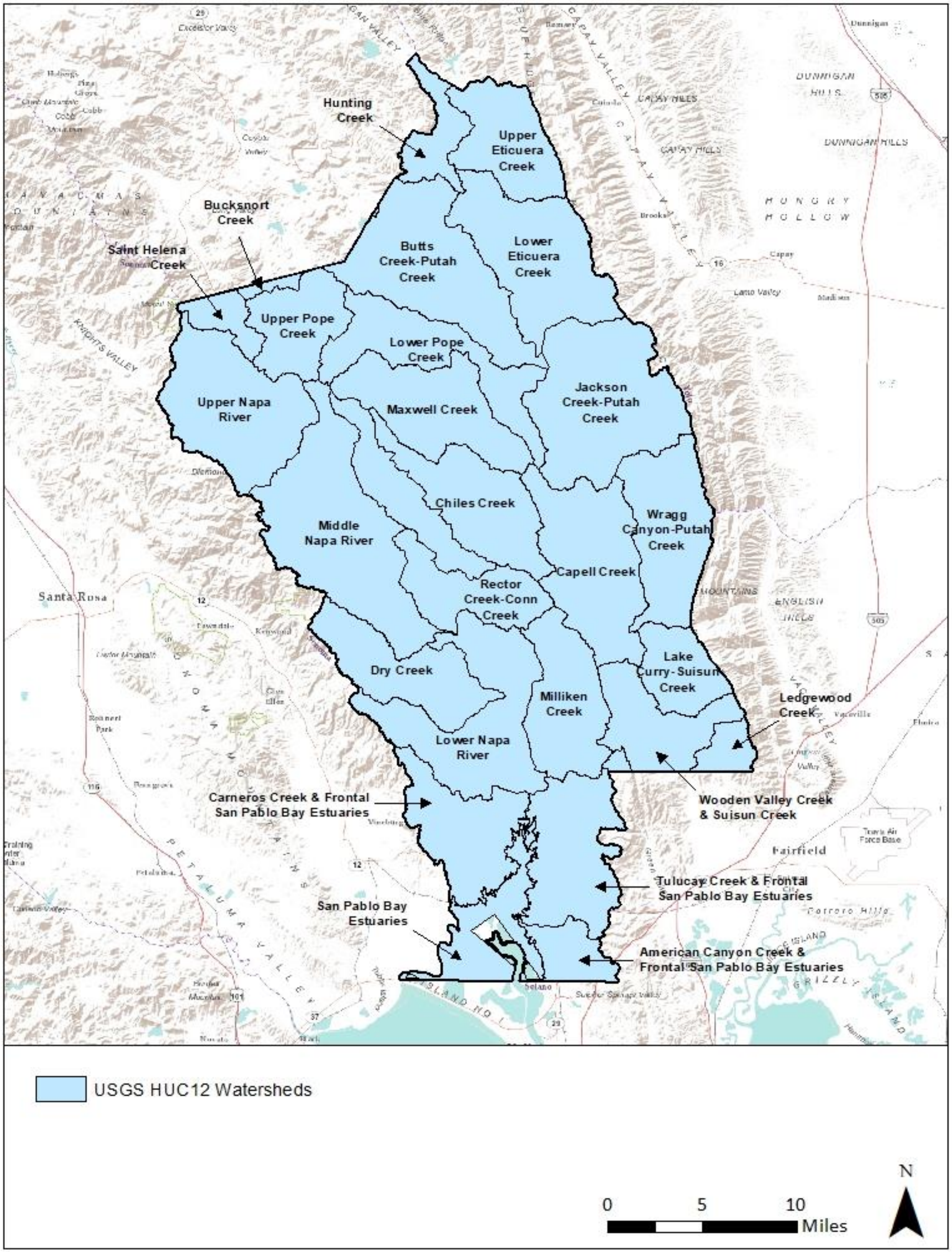


Figure 20: Major watersheds areas used to summarize water budget information in Tables 5 - 8.

Discussion and Conclusion

Numerous previous modeling studies have estimated water budget components in several larger watershed areas in Sonoma and Napa Counties including the Santa Rosa Plain, the Green Valley and Dutch Bill Creek watersheds, and the Sonoma Valley (Farrar et. al., 2006; Kobor and O'Connor, 2016; Woolfenden and Hevesi, 2014). Comparisons to these water budgets are useful for evaluating the SWB results, but one would not expect precise agreement owing to significant variations in climate, land cover, soil types, underlying hydrogeologic conditions, and different spatial scales of modeling studies. These regional analyses estimate that average annual recharge varies from 7% to 19% of the annual precipitation. The equivalent county-wide value from this study is slightly higher at 20%.

Water budgets for the Napa River and selected sub-basins were also estimated in a previous study by Luhdorff and Scalmanini Engineers and MBK Engineers (LSCE 2013). The LSCE study estimated that, as a percentage of annual precipitation, AET comprised slightly less, runoff significantly more, and recharge substantially less of the typical annual water budget. LSCE (2013) calculated infiltration of precipitation based on the difference between total monthly streamflow at selected gaging stations and total monthly precipitation for the gages' drainage area. Streamflow volumes include both direct runoff (overland flow and interflow) and baseflow from groundwater. Inclusion of baseflow with direct runoff in these calculations may inappropriately reduce the estimated volume of water infiltrated into the soil and available for recharge; the LSCE approach therefore tends to underestimate groundwater recharge. Additionally, many of the gauging stations used for the analysis are located in reaches that may be significantly influenced by upstream reservoir releases, surface water diversions, groundwater abstraction, and/or surface water groundwater exchanges, further complicating the interpretation of the LSCE (2013) runoff rates and the interrelated calculations of AET and recharge rates. In contrast, the SWB model presented here is based on calibrated parameter values developed for a similar model in Sonoma County which was calibrated to gauges specifically selected to minimize the effects of reservoir releases, water use, or significant surface water/groundwater interaction, and after separating and removing the baseflow component of streamflow.

The recharge estimates presented here arguably represent the best available county-wide estimates produced at a fine spatial resolution using a consistent and objective data-driven approach. This analysis focused on two Water Years, 2010 and 2014, which represent average and drought conditions respectively. Input parameters were determined based on literature values and values calibrated through prior modeling experience in Sonoma County.

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