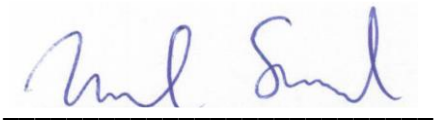
January 27, 2023

MEMORANDUM

To: Carneros Vintners Winery
4200 Stage Gulch Road
Sonoma, CA 95476

From: 
Michael Sherwood California PG #8839 (Exp. 6/30/2023)
Geologist, O'Connor Environmental, Inc.

Subject: ADDENDUM TO GROUNDWATER REPORT 4200 STAGE GULCH ROAD, SONOMA
APN 142-051-031 PLP02-0085

Introduction

This memorandum supplements and updates the Groundwater Report completed for the Carneros Vintners Winery in March of 2019 [1]. Carneros Vintners Winery is applying for a Use Permit Modification to increase production at their winery facility from 250,000 cases (PLP02-0085) to 2,500,000 cases along with the elimination of public tasting, tours and events. In the 2019 groundwater report (attached) we evaluated potential effects of the proposed project to the local hydrogeologic system by generating estimates of existing and proposed water use within the project recharge area, compilation of well completion reports (drillers' logs) from the area and characterization of local hydrogeologic conditions, estimates of annual groundwater recharge relative to existing and proposed groundwater use, and the potential for well interference between the project well and neighboring wells and streams.

Our principal conclusion from the 2019 analysis is unchanged, and is as follows:

Application of the Soil Water Balance (SWB) model to the project recharge area revealed that average water year recharge was approximately 4.9 inches/yr or 345.6 acre-ft/yr. The total proposed water use for the project aquifer recharge area is estimated to be 223.3 acre-ft/yr. This represents 65% of the estimated mean annual recharge within the project impact area, suggesting that the project is unlikely to result in causing a gross imbalance between recharge and groundwater utilization.

Since the submittal of our 2019 report, there have been additional years of low rainfall and critical regional drought conditions in Water Years 2020 and 2021, and several significant updates to Sonoma County Groundwater planning and policy have occurred including the publication of the Sonoma Valley

[1] 2019, O'Connor Environmental Inc.. Groundwater Report APN 142-051-031, PLP02-0085, 4200 Stage Gulch Road, Sonoma.Prepared per Sonoma County Policy and Procendure 8-1-14. Prepared for Carneros Vintners Winery for Sonoma County. March, 7, 2019.

Groundwater Sustainability Plan (GSP) in 2021[2]. After reviewing the Sonoma Valley GSP we have also reviewed our characterization of the project aquifer and conclusions regarding project impacts to groundwater. The following memorandum summarizes our findings and puts them into context with the Sonoma Valley Groundwater subbasin, the current understanding of groundwater conditions reported in the GSP and water use in the project area.

Project Aquifer

Previous Characterization

As shown in Figure 1 the project parcel and project water supply well (Well 3) is located 1,300 feet southwest of the boundary of the Sonoma Valley Groundwater Basin (SVGB). The project site and well are located within the contributing watershed area of the SVGB (see Figure 3-1 in the GSP). The project water supply well is screened between 255 feet and 695 feet below ground surface (bgs) in rocks of the Sonoma Volcanics (Figure 1). The main project aquifer is understood to consist of volcanic rocks of the Sonoma Volcanics and a shallow depth of static water of 20 feet bgs indicates the project aquifer is confined. Well 3 accesses a highly productive portion the Sonoma Volcanics with a maximum yield of 500 gpm reported at the time of completion and a working pumping rate of 250 gpm. Two faults denoted to be approximately located are mapped between Well 3 and the western edge of the groundwater basin.

Additional Information

The GSP reports that wells in this region of the Sonoma Valley groundwater subbasin access groundwater from two main aquifers. Wells screened from 100 to 220 feet bgs access a "Shallow Aquifer System". In the western portion of the basin, this aquifer material is characterized as sand, silt, clay, and gravel deposits from streams, floodplains, and alluvial fans. Below depths of approximately 400 feet bgs, wells are believed to access a "Deep Aquifer System". This system includes sand, gravel, and clay sequences interspersed with more consolidated sedimentary layers of the Glen Ellen, Huichica, and Petaluma formations. In some regions, especially near the foot of the Sonoma Mountains, the deep aquifer system also includes units of the Sonoma Volcanics. Yields from wells connected to the deep aquifer system are typically much lower than in the shallow aquifer system. The deep and shallow aquifer systems in the Sonoma Valley subbasin are separated by aquitards composed of clay or volcanics, in the western margin of the subbasin where the project parcel lies the aquitard is relatively thin (Sonoma Water, 2021, 3-37).

Groundwater recharge processes supplying the deep aquifer are not well known. These processes are presumed to include mainly leakage from the upper shallow aquifer system, followed by groundwater inflows along the margin of the valley, which is also known as mountain-front recharge. The influence of faults on hydrogeology of the SVGB are generally discussed in the GSP. The GSP does not indicate if and how faulting along the western margin of the basin, mainly associated with the Rodgers Creek Fault Zone, impacts groundwater flow. The role that fault zones play in groundwater flow into and out of the subbasin is acknowledged as one of the areas that require further study.

Updated Interpretation

Based upon the characterization of the SVGB aquifer system it appears that the project well could intersect the western edge of the deeper aquifer system extending beyond the SVGB boundary. Due to its location on the valley margin at the base of Sonoma Mountain, Well 3 could also influence

[2]. https://sonomavalleygroundwater.org/gsp/

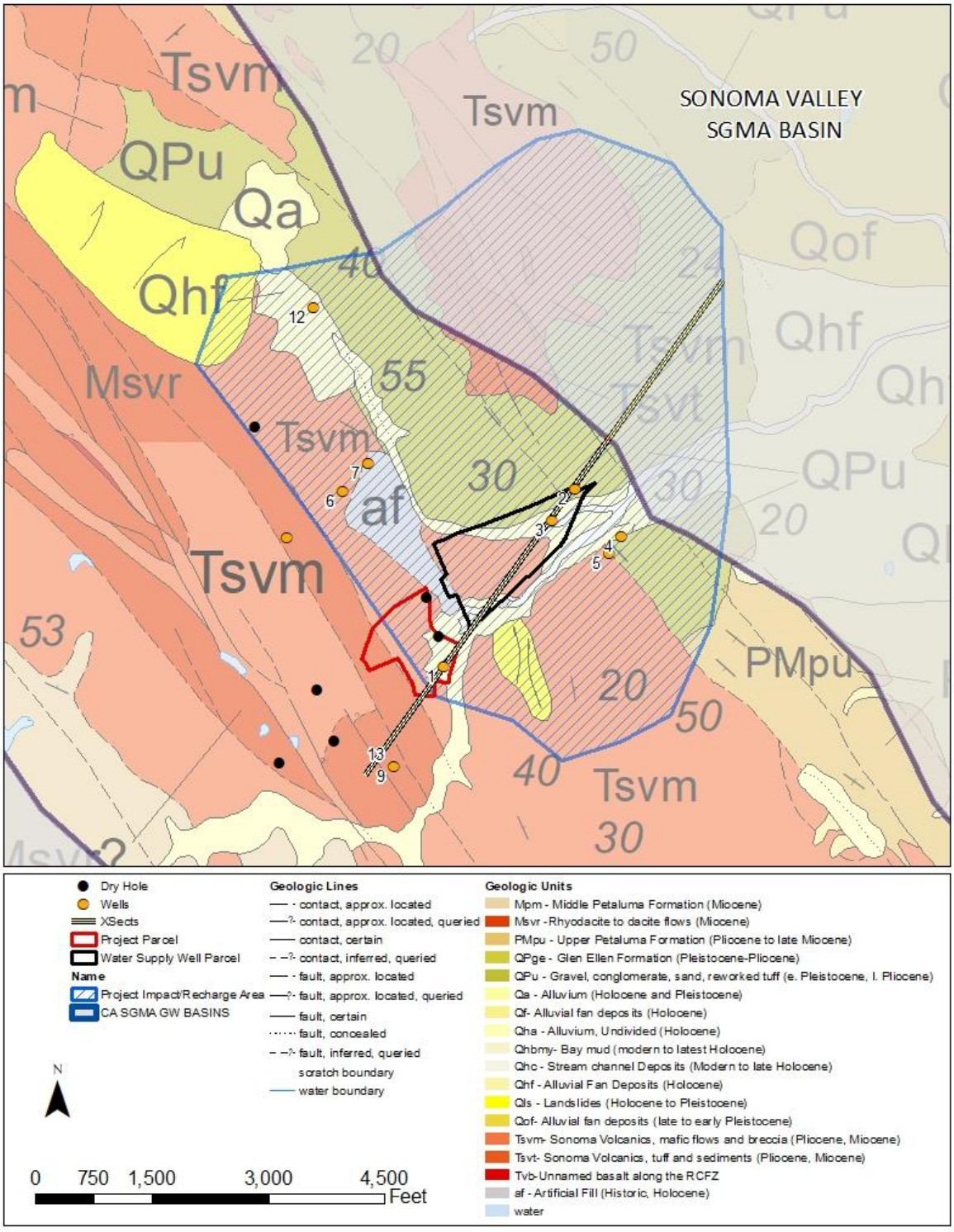


Figure 1: Surficial geology and locations of Sonoma Valley Groundwater Basin boundary and wells in the vicinity of the project parcel. Project water supply well is Well 3. Surficial geology based on data from the Geologic Map of the Napa and Bodega Bay 30' x 60' Quadrangle, California (Wagner and Gutierrez, 2017).

groundwater moving towards the basin as mountain-front recharge. Although a connection to the deeper aquifer system is certainly possible, the Sonoma Volcanics consist of fractured bedrock and other volcanic deposits with highly variable aquifer properties and the degree to which groundwater accessed by the project well could be connected to the deep aquifer system described in the SVGB is unknown.

The potentiometric groundwater elevation in Well 3 is 235 ft above the elevation of the well screens nearest the ground surface indicative of a high pressure head in a confined aquifer; the groundwater elevation in Well 3 is greater than 100 ft amsl. This characteristic of the project well and aquifer appears distinctive in comparison to groundwater elevations in monitoring wells in the deep aquifer (Figure 2) that are near sea level (~ 0 ft amsl), and can be interpreted to suggest that the project aquifer may not be continuous with the western portion of the deep aquifer of the SVGB.

Groundwater Conditions

The GSP reports on groundwater conditions throughout the SVGB. Along the western edge of the subbasin deep groundwater is understood to flow on a gradient to the east towards the center of the basin indicating that the project well is located in an upgradient position compared to the basin. Groundwater elevation monitoring data for wells constructed in the deeper aquifer are reported to show declines in both the long- and short-term in the GSP (Sonoma Water 2021, Figure 3-13). The monitoring well nearest the project site is SON0083, approximately 2.7 miles to the north of Well 3. Data for this well and others in the area show a decline in groundwater surface elevations over the last two decades (Figure 2). Although this well is relatively distant from the project site this data does show that in some deeper wells, including SON0083 water level recovery has not been coupled to precipitation trends as higher periods of rainfall (blue striped time periods in groundwater hydrographs in Figure 2) have not yet resulted in proportional recovery. This trend of declining groundwater levels is not restricted only to this portion of the basin. Moderate to significant declines in groundwater have been documented in other areas of the basin including an area southeast of Sonoma and southwest of El Verano where persistent groundwater pumping depressions have been identified.

These trends in groundwater elevation, together with uncertainty regarding the relationship between the project aquifer and the deep aquifer of the SVGB, indicate that there is some potential for concern regarding groundwater use in the project aquifer. An existing permit condition for the project requiring installation of a monitoring well addresses this potential concern by providing a data stream that Permit Sonoma can use to assess conditions and potential effects of the project well on aquifers in the SVGB.

Change in Use

A review of Google Earth aerial imagery was performed to identify any possible new significant water use within the project impact area for the years since our report was completed. Imagery was available for July 2019 through June 2022. No evidence of significant new land and water use was observed.

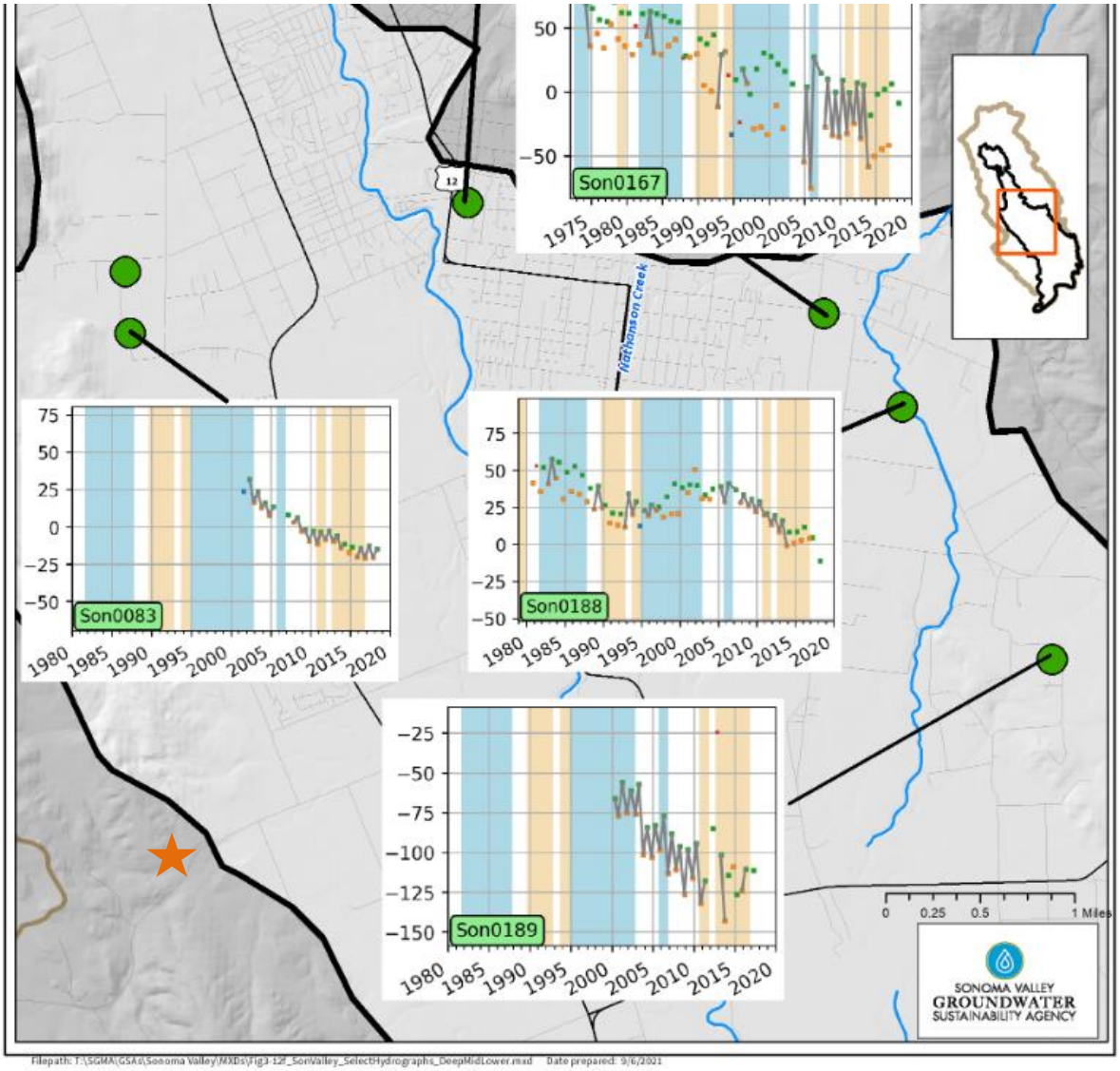


Figure 3-12f. Select Hydrographs - Deep Aquifer Wells (> 200 feet bls)

Figure 2. Reproduction of Figure 3-12f from The Sonoma Valley GSP. Orange star shows the approximate location of the project well.

Conclusion

A review of the recently completed GSP for the SVGB was performed to further characterize the project aquifer and review additional information related to groundwater conditions. The conceptual model of the project aquifer was expanded somewhat and we have identified potential connectivity between the project aquifer and the deep aquifer system of the SVGB as a potential future concern. The spatial separation between the project well and areas of concentrated groundwater use, intervening mapped faults, and highly variable aquifer material create significant uncertainty regarding the degree and potential significance of connectivity to SVGB aquifers.

Groundwater recharge within the project recharge area was estimated using a Soil Water Balance (SWB) model for Water Year 2010 which was selected as precipitation was close to the 30-year average for much of Sonoma County. Groundwater use in the project recharge area, which has not changed since 2019, is equivalent to 65% of the estimated mean annual groundwater recharge of 345.6 acre-ft/yr, indicating a reasonable balance between groundwater use and available groundwater.

Declining groundwater level trends have been identified in monitoring wells accessing the deep aquifer in the SVGB. The existing permit condition to install a monitoring well is believed to be an appropriate means to evaluate potential future effects of the project on aquifers in the SVGB.

References

Sonoma Water, 2021. Groundwater Sustainability Plan Sonoma Valley Groundwater Subbasin. Sonoma Valley Groundwater Sustainability Agency

Attachment

Groundwater Report

APN 142-051-031, PLP02-0085

4200 Stage Gulch Road, Sonoma

OEI 2019

Groundwater Report

APN 142-051-031, PLP02-0085

4200 Stage Gulch Road, Sonoma

Prepared per Sonoma County Policy & Procedure 8-1-14

Prepared for:

Carneros Vintners Winery
4200 Stage Gulch Road
Sonoma, CA 95476

Prepared by:

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March 7, 2019

Contents

Introduction

Carneros Vintners Winery is applying for a Use Permit Modification to increase production at their winery facility from 250,000 cases (PLP02-0085) to 2,500,000 cases along with the elimination of public tasting, tours and events. The winery is located at 4200 Stage Gulch Road (Sonoma County APN 142-051-031) approximately 3.6 miles southwest of the City of Sonoma (Figure 1). Water for the winery is supplied by a well located on a neighboring parcel approximately 2,000 feet to the east. The western portion of the project parcel is in the Class 3 groundwater area defined by Sonoma County to be an area with "marginal groundwater". The eastern portion of the project parcel and the main water supply well parcel are located in the Class 1 groundwater area defined as a "major groundwater basin" (Figure 1).

This hydrogeologic report was prepared as required by Sonoma County Permit and Resource Management Division (PRMD) pursuant to General Plan Policy WR-2e, Procedure and Policy 8-1-14, and section 10d of Exhibit A-2 of County Ordinance No. 6189 regarding water availability in Zone 3 and 4 areas where groundwater is believed to be of limited supply. This report only evaluates potential impacts of the proposed project to the hydrogeologic system. All other plans and documents related to permitting the project are being prepared by other professionals.

This hydrogeologic report includes the following elements: estimates of existing and proposed water use within the project recharge area, compilation of well completion reports (drillers' logs) from the area and characterization of local hydrogeologic conditions, estimates of annual groundwater recharge relative to existing and proposed groundwater use, and the potential for well interference between the project well and neighboring wells and streams.

Limitations

Groundwater systems of Sonoma 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, discussion with others knowledgeable about site conditions, and professional judgment. This analysis is based on limited available data and relies significantly on interpretation of data from disparate sources of disparate quality.

Given the confined aquifer conditions found within the project water supply well and neighboring well and apparently significant depths to water in the project water supply well (300 plus feet), the relationship between groundwater recharge generated within the project vicinity and groundwater availability at the project well is not expected to be tightly coupled. Substantial uncertainty exists regarding the source area for groundwater flowing to the project wells.

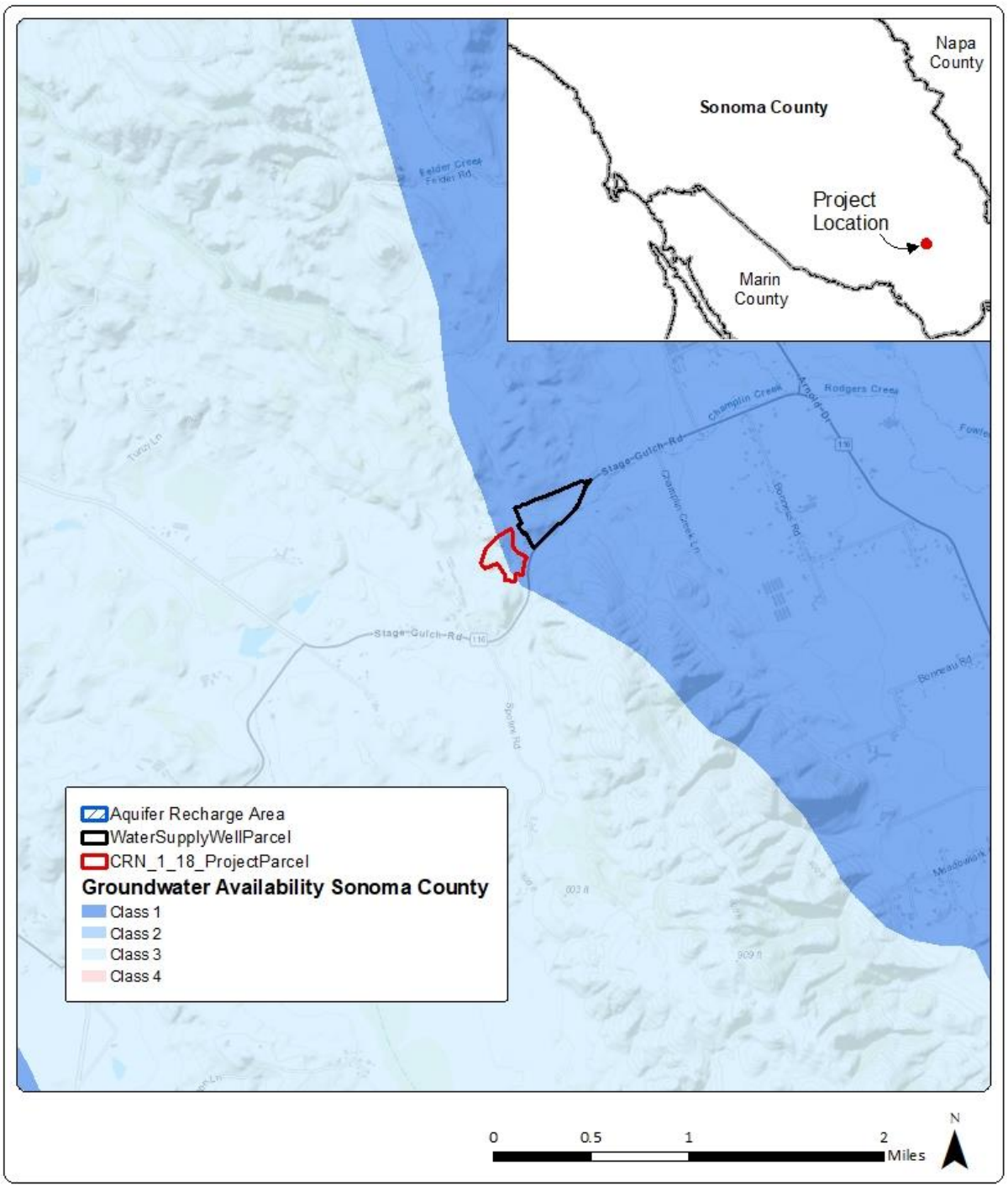


Figure 1: Project location map.

Hydrogeologic Conditions

Overview

The project parcel is located on a topographic divide between the Petaluma and Sonoma Valleys near the southern-most extent of Sonoma Mountain. The site is in the Champlin Creek watershed along the southeastern limits of the Rodgers Creek Fault Zone (Figures 1 and 2). Recent geologic mapping by Wagner and Gutierrez (2017), shows Quaternary alluvium (map unit Qha) is mapped on the project parcel along the eastern edge near the valley bottom where Champlin Creek flows through the parcel. This unit fills the valley bottom with a shallow layer of alluvium including poorly sorted sand, gravel, silt, and clay, and follows Champlin Creek as it cuts through the divide draining east towards the Sonoma Valley.

The bedrock geology mapped within the project parcel is part of the Sonoma Volcanics Formation and includes mafic flows and breccia on (map unit Tsvm) in fault contact with the Miocene-aged Rhyodacite to dacite flows (map unit Msvr) in the western lobe of the parcel. The Msvr unit located on the project parcel is a relatively small 0.1 square mile sliver bound by two approximately located fault contacts to the east and west and lies between two blocks of the Tsvm. The mafic flows and breccia underlie the alluvium on the project parcel. The Tsvm unit is associated with an approximately 5 square mile block mapped to the south and is most likely connected to the Tsvm outcropping to the north.

The main winery water supply well (Well 3) is located on APN 142-051-029 to the east (Figures 1 and 2). Most of this parcel is mapped as the Sonoma Volcanics mafic flows and breccias (map unit Tsvm). Quaternary alluvium (Qha) and Quaternary channel deposits fill the valley bottoms of the two reaches of Champlin Creek running along the north central portion and the southern corner of the project parcel. Along the northern edge of the parcel tuffaceous, gravelly sediments, presumably originating from the Sonoma Volcanics are mapped as Plio-Pleistocene sediments including gravel, conglomerate, sands and reworked tuff (map unit QPu). These sediments are up to 200 ft in thickness as noted in some local well completion reports. The mafic flows and breccia of the Sonoma Volcanics (map unit Tsvm) are mapped on the remainder of the parcel and are presumed to be a part of the larger unit mapped nearby underlying the shallow sedimentary units nearby.

In general, wells drilled in the Sonoma Volcanics tend to be low-yielding. Typical yields range from 16 to 50 gallons per minute (gpm) with reported yields as high as several hundred gpm (LSCE 2013). Unwelded sections of tuff are considered to be good water producers (DWR 1982). Bedrock units such as the Andesite to Basalt Lava Flows (map unit Tsa) typically have low primary porosity and are not water yielding except where fractured (DWR 1982).

In the project vicinity the Sonoma Volcanics are significantly sheared by faults associated with the Rodgers Creek Fault Zone. The Rodgers Creek Fault is active and trends northwest to southeast extending from the southern end of the Healdsburg Fault down into San Pablo Bay. This fault zone has numerous mapped traces associated with it causing complex local structures

and geologic relationships. Faults can be either barriers or conduits for groundwater flow. Based on the number of documented dry holes and abandoned wells in the project area, the faulting in this area appears to have had a significant impact on groundwater resources likely due to the restricted groundwater flow to and across areas within the RCFZ.

Well Data

Well Completion Reports for several wells within the vicinity of the project parcel were obtained through the California Department of Water Resources (DWR) Well Completion Report Map Application. Well Completion Reports for the wells on the project parcel and neighboring parcels including the water supply well parcel were provided by the project applicant along with details for other local wells described in a Geology and Groundwater Potential report prepared by Eugene Boudreau (Boudreau, 2009). A subset of all logs obtained was compiled (Appendix A) and georeferenced based on parcel and location sketch information (Figure 2). Two wells serve the project parcel: Well 1 is on the project parcel and Well 3 is on a neighboring parcel to the east.

Well 1 is a productive well near the southeastern edge of the project parcel. Two other dry holes are also located on the project parcel according to Boudreau (2009). Well 1 was completed to a depth of 710 feet in 2003. At the time of completion, the well had an estimated yield of 15 gpm and had a static water level of 20 ft (Table 1). The Geologic Log from the Well Completion Report indicates that the upper 260 feet of the well is completed in strata of gray clay. At depths below 260 feet, the well intersects “Reddish Brown Rock” consistent with the underlying Sonoma Volcanics (Tsvm). This well is screened from 510 to 710 feet wholly within the rocks of the Sonoma Volcanics. Since development Well 1’s production has diminished significantly since it was drilled (as reported by the applicant), and the winery has relied on water from the water supply well parcel to the east. For approximately 10 years the project parcel winery has obtained water from Well 2 on APN 142-051-029. In the summer of 2018 Carneros Vintners Winery switched to using water from Well 3. Currently Well 1 only serves the residence located on the project parcel.

Well 2 was developed under the oversight of Jim Verhey, who owns the rights to drill on the parcel, and is located near the northeastern property line on APN 142-051-029 and as previously mentioned served as the main water source for the Carneros Vintners Winery up until the summer of 2018. Well 2 was drilled in 2004 to an initial depth of 900 ft and completed to depth of 860 ft. The geologic log reports 40 ft of clay and clay embedded with gravel of the Alluvium (Qal) followed by 200 ft of green and brown sand & gravel with clays (presumably part of the QPu unit). The remaining 660 ft of the boring intersected mostly red and black volcanic rock with some green ash interlayered. The well was constructed with three screened intervals of casing from 230 to 390 ft, 410 to 590 ft and 610 to 840 ft with each screened interval separated by 20 ft of blank casing. Water was first encountered at 100 ft but following development (which was reported to be difficult due to the large amount of water flowing into the well) the static water level was reported to be 0 ft (at the surface) with an estimated yield of 500 gpm. The artesian nature of the well indicates that the water entering the well is under pressure and is therefore

emerging from a confined aquifer system. Since development, the production has been reported to be greater than initially reported, up to 800 gpm. Presently this well serves as an irrigation water source for several nearby vineyards.

Well 3 is located on APN 142-051-029 about 2,350 feet to the east of Well 1 and was also developed by Jim Verhey. According to an agreement with Mr. Verhey, beginning in 2018 rights to use water from Well 3 belong solely to the Carneros Vintners Winery and the Soils Plus rock quarry located on the adjacent parcel to the north of the project parcel (APN 142-051-041). Well 3 was drilled in 2016 to a total depth of 740 feet and completed to 715 feet. The geologic log reports 17 feet of brown and green clay with sand and gravel of the Quaternary alluvium (Qal) before penetrating over 700 feet of various types and colors of volcanic rock and ash of the Msvr unit of the Sonoma Volcanics. The reported static water level after development was 20 feet with an estimated yield of 500 gallons per minute. A permanent pumping rate of 250 gpm was selected for Well 3 following a step drawdown pumping test performed in June 2016 where the well was pumped at rates of 200, 350 and 500 gpm for three hours each. Appendix B is a memorandum authored by Richard Slade summarizing the pumping test results and well development details. During development of the well the borehole was subjected to electric log surveying by West Coast Well Logging Services (Attachment C) to further characterize the aquifer. Results of the electric log survey show four distinct zones of water bearing material starting at 300 ft and extending to the base of the well at 750 ft. It was understood based on experience with Well 2 that the lowest zone of water was under the most pressure; consequently, according to Jim Verhey, Well 3 was screened only down to 695 ft approximately 20 ft above the fourth zone of water specifically to avoid intersecting this zone (Verhey, 2019). The well is screened between 255 and 695 ft with 20 ft of blank casing between 475 and 495 ft. The depth of static water (20 ft) is significantly higher (235 ft) than the top of the screened interval indicating that the project aquifer is confined and similar to Well 2.

Well Completion Reports for five dry holes and ten other completed wells could be accurately georeferenced in the vicinity of the project parcel and project water supply parcel (Well 2, 4 – 13, Figure 2). Depths of the completed wells are typically greater than 500 ft. Well 6 is only 138 feet deep and is the outlier of this group of wells. The deepest is Well 2 which was completed to 860 feet; the average well depth is 620 feet. Yield appears to be correlated with proximity to the Rodgers Creek Fault Zone (RCFZ). A number of documented dry holes (black dots in Figure 2) are located in the area nearest the RCFZ in addition to several wells (Wells 1, 6, 7, 8 and 13) reported to have had decreased production or gone dry since development (Boudreau, 2009). Estimated yields reported at the time of development for these wells ranged between 15 and 200 gpm with an average of 65 gpm; however, the wells with the highest estimated production of 100 and 200 gpm (Well 13 and 8 respectively) have both been abandoned. The numerous dry holes and trend of declining and abandoned wells in this area suggest that faulting associated with the RCFZ has a significant impact on groundwater availability. This is likely because the faults are acting as barriers to groundwater flow. Geologic logs for the majority of these wells report layers of clay and volcanic ash and rock consistent with the mapped geology of the area.

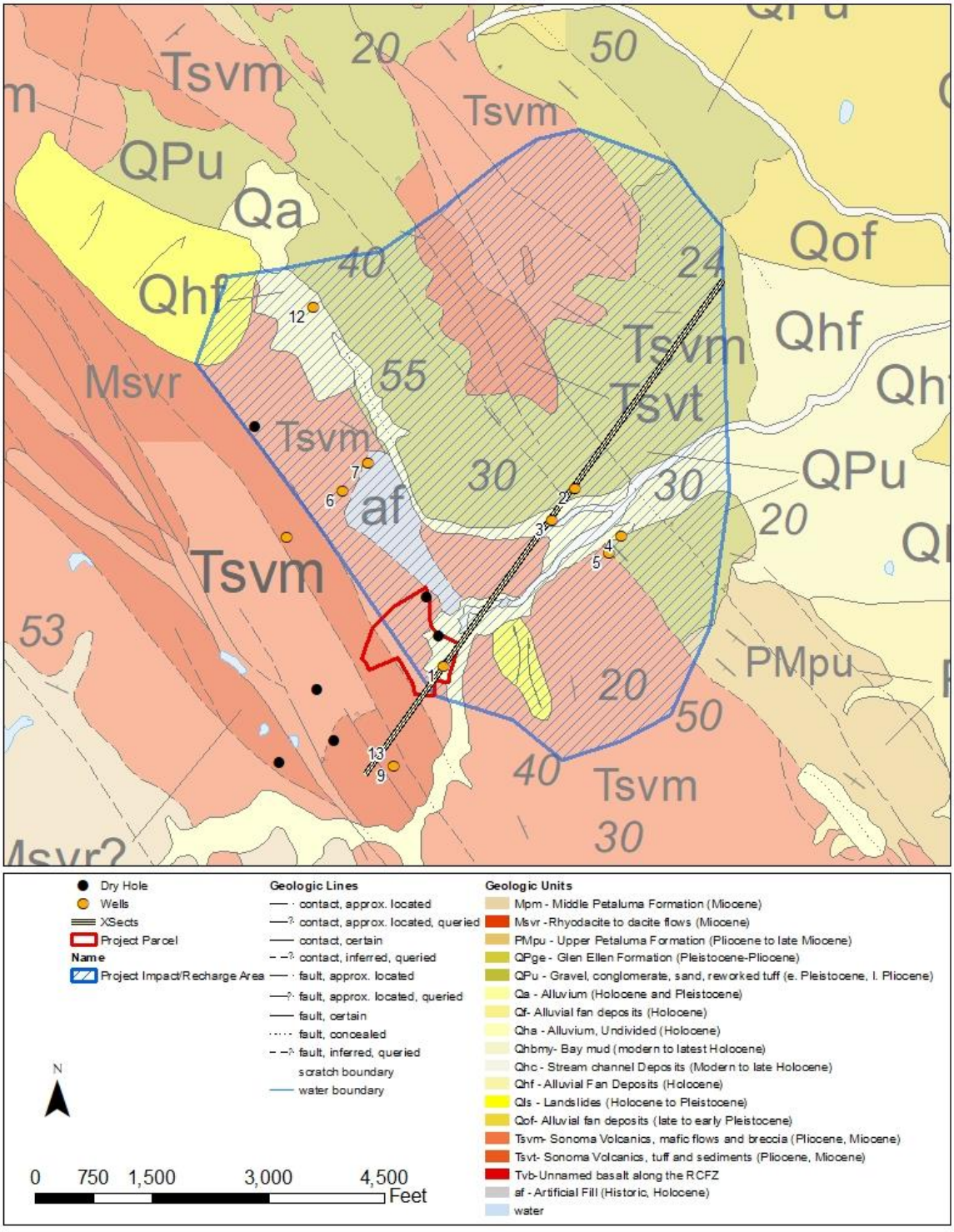


Figure 2: Surficial geology and locations of wells in the vicinity of the project parcel. Surficial geology based on data from the Geologic Map of the Napa and Bodega Bay 30' x 60' Quadrangle, California (Wagner and Gutierrez, 2017).

Wells further east of the RCFZ and closer to the project water supply well parcel (Wells 2-5) including the project water supply well are far more productive with estimated yields ranging from 300 to 500 gpm with an average of 450 gpm. These wells are all completed in the Tsvm of the Sonoma Volcanics with screened intervals extending deeper than 600 ft. All wells exhibit characteristics of a confined aquifer with two of the four reporting artesian conditions and two reporting static water levels much higher than the upper limit of screening.

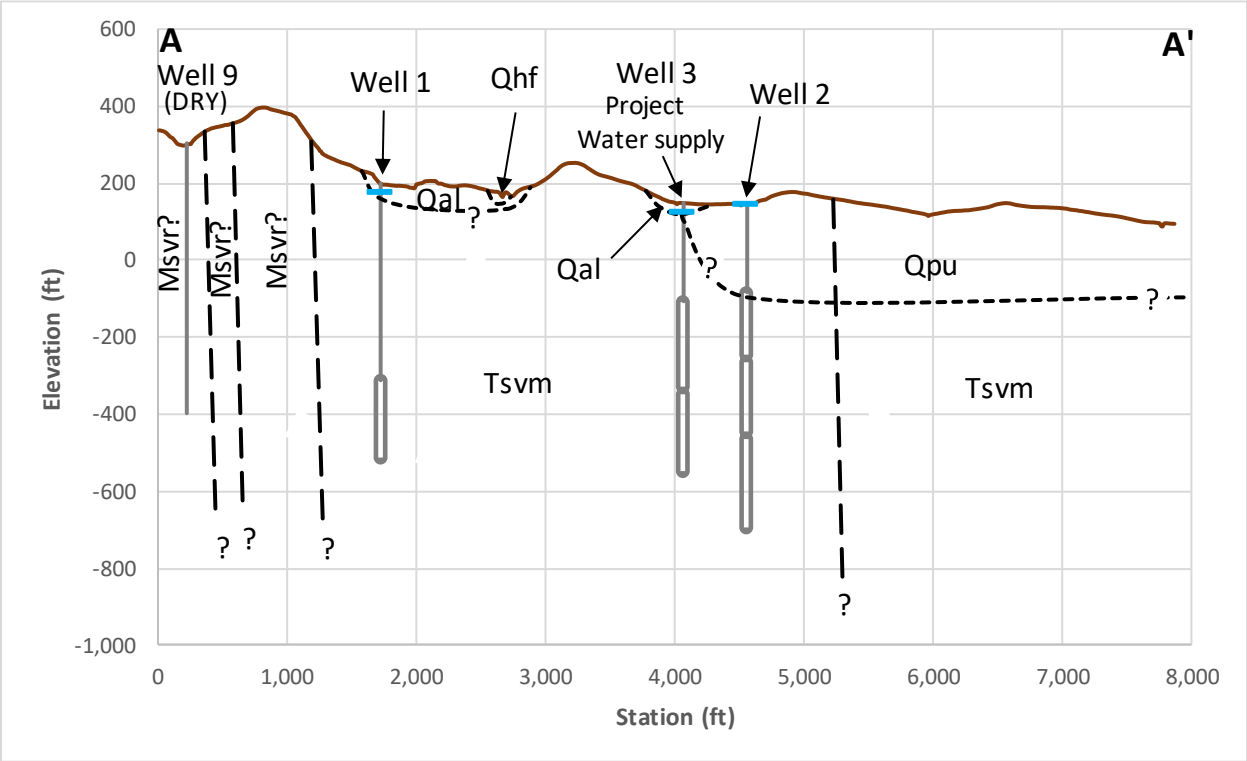
Table 1: Well completion details for wells on and near the project parcel

Well ID	1	2	3	4	5	6	7
Year Completed	2003	2004	2016	2005	2018	NA	2003
Depth (ft)	710	860	715	661	700	138	550
Estimated Yield (gpm)	15	500	500	300	500	15	18
Static Water Level (ft)	20	0	20	0	50	NA	275
Top of Screen (ft)	510	230	255	71	160	NA	210
Bottom of Screen (ft)	710	840	695	641	700	NA	520
Geologic Map Unit	Qha/Tsvm	Qpu/Tsvm	Qha/Tsvm	Qha/Tsvt	Tsvm	Tsvm	Tsvm

Well ID	8	9	10	11	12	13
Year Completed	NA	NA	1996	1998	1999	1999
Depth (ft)	510	770	520	712	700	780
Estimated Yield (gpm)	30	DRY	12	375	40	100
Static Water Level (ft)	80	NA	NA	76	28	100
Top of Screen (ft)	NA	NA	200	65	80	240
Bottom of Screen (ft)	NA	NA	520	430	400	780
Geologic Map Unit	Msvr	Msvr	Mtvr	Qhf	Qhf	Qhf

Geologic Cross-Section

A geologic cross-section oriented southwest to northeast through the project recharge area is shown in Figure 3 (see Figure 2 for location). The cross-section intersects several faults dividing members of the Sonoma Volcanics (Msvr and Tsvm) and crosses two branches of Champlin Creek. The block the project well is completed in is at least 900 feet thick and likely contains a confining layer or layers resulting in artesian or near artesian conditions in Wells 2 and 3. Due to the nature of the QPu unit its thickness is likely to be highly variable but for the purposes of this interpretation we are taking the thickness from the Geologic log for Well 2 which indicates the presence of the sand and clays associated with the unit to a depth of 240 ft. Information regarding the subsurface alignment and depth of faulting in the area is scarce and although a slight dip to the east is indicated in the cross-section faults may intersect or have a much different configuration than what is shown.



Faults:

? — — — **Fault, Approximately Located (queried were uncertain)**

Contact, Approximately Located (queried were uncertain)

Well

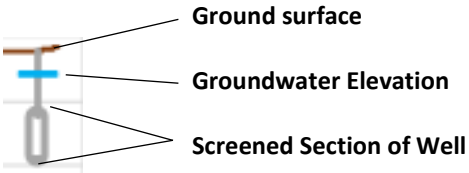


Figure 3: Hydrogeologic cross section A - A' through the vicinity of the project parcel (see Figure 2 for location).

Project Aquifer

The project impact area and estimated project recharge area is conceptualized as nearby portions of the block of the Sonoma Volcanics Formation that the project water supply well (Well 3) is completed in. Typically we are able to estimate the extent of the project aquifer however, due to the complex nature of the local geology including faulting associated with the RCFZ and confined conditions in the project well and surrounding wells, the project aquifer itself is difficult, if not impossible, to accurately delineate. In place of defining the aquifer extent we have defined a project impact area conceptualized as the potential project recharge area. The recharge area is bounded to the west by a fault contact between the Tsvm and Msvr units of the Sonoma

Volcanics while the remaining northern, southern and eastern boundaries follow surface drainage divides.

The estimated recharge area is approximately 846 acres. Although a small portion of the project recharge area is covered by a surficial layer of the gravel, conglomerate, sand and reworked tuff (map unit QPu), alluvium (Qal) and channel deposits (Qch), these do not extend to the depths the project well is screened within and so the aquifer materials are assumed to consist wholly of the rocks of the Sonoma Volcanics, mainly the Tsvm and Tsvt units. Because static water levels at the project water supply well (Well 3) are elevated above the screened interval and artesian conditions are reported at the nearby Well 2, the project aquifer is interpreted to be confined.

Groundwater Storage Volume

An estimate of the total available groundwater storage within the aquifer recharge area can be obtained as the product of the recharge area (impact area) in units of acres, the saturated aquifer thickness in units of feet, and the aquifer specific yield. This method may not be valid for confined aquifers, but it can be used for general interpretative and comparative purposes. The saturated aquifer thickness is typically estimated as the difference between the depth at which water was first encountered and the bottom of the screened interval of the project well however this information was not available and therefore the total screened interval of the well has been used instead.

The project well is screened from 255 to a depth of 695 feet yielding an estimated saturated aquifer thickness of 440 feet. This provides a minimum estimate of the saturated thickness; the Sonoma Volcanics Formation may extend to much greater depths beneath the project recharge area.

The porosity of fractured bedrock such as the Tsvm and Tsvt units of the Sonoma Volcanics is expected to lie between <1 and 10% (Freeze and Cherry, 1979; Weight and Sonderegger, 2000). To be conservative, we have used low-end estimates of specific yield of 1% for the project aquifer. This results in an estimate of the available groundwater storage of 3,722 acre-ft (846 acres x 440 feet x 0.01).

Water Demand

Within the project recharge area, water demand was estimated for both existing and proposed conditions. Water uses on the project parcel were determined using site details provided by the project applicants and from available satellite imagery. Water use rates on the project parcel were estimated using data provided by the project applicants and from wastewater data provided by Steve Martin and Associates. Water uses on other parcels in the project recharge area were determined from interviews with neighbors and available satellite imagery and water use was estimated using rates obtained from the Napa County Water Availability Analysis Guidance Document (2015).

Existing Condition

In the current condition, the project parcel contains a single primary residence, the winery facility, and four small blocks (totaling to 0.45 acres) of olive trees. Although Well 1 supplies some water to the parcel, it is unreliable and so water from Well 3 is used as the main source. Portions of vineyard shown on the west and south edges of the parcel are not managed by the project applicant; irrigation water for these is obtained from winery process wastewater stored in an on-site, off-stream reservoir and Well 2.

Well 3 supplies water to the Carneros Vintners Winery parcel (APN 142-051-031) and the Soils Plus quarry parcel (APN 142-051-041). Currently the Carneros Vintners Winery produces 250,000 cases of wine annually. According to Steve Martin and Associates (SMA) process wastewater estimates (which are assumed to be equivalent to production demand) for full production of wine requires two gallons of water per gallon of wine which results in a water demand of 1,200,000 gallons or 3.68 acre-ft (Table 4, Appendix C). The SMA report states the winery septic system is currently sized to serve 20 full-time workers and a daily maximum of five office visitors; these uses are included in the totals listed in Table 5. The current use permit lists that the winery will host tastings and events; however, the winery has not exercised their right to host any tastings or events.

The project well (Well 3) and Well 2 are on the project water supply well parcel (APN 142-051-029). Irrigation of approximately 15.8 acres of vineyard is the only water use on this parcel. Well 2 supplies all water to these vines along with an additional 85.4 acres on parcels located to the west and northwest outside of the project recharge/impact area. All vineyard areas irrigated with water from Well 2 are shown as beige polygons in Figure 4. An estimate of water demand for the irrigation of these vines was provided by the owner of the project water supply well parcel. On average for the years 2013 and 2014 the vines required 0.4 acre-ft per acre of vineyard. Applying this rate to the 101.2 acres of vines results in an estimated demand of 40.5 acre-ft annually (Table 6).

An additional 394.1 acres of vineyards (shown as light purple polygons in Figure 4) are located on seven parcels within the project recharge/impact area. Although wells were not located for every parcel, it is assumed that these vineyards are irrigated with groundwater. Assuming that the irrigation demand is similar to that of the vines located on the project water supply well parcel (0.4 acre-ft/acre), an annual irrigation demand of 157.7 acre-ft is estimated for the remaining 394.1 acres (Table 6).

Industrial use within the project impact area includes the Soils Plus quarry and the Sonoma County refuse transfer station. Water use is not expected to be large at the County transfer station; as such we defer to Boudreau (2009) who states an assumed demand for the dump of 1 acre-foot. We also will assume the dump has 10 full time employees. Soils Plus uses a significant amount of water, mostly for dust control. According to the foreman at Soils Plus, water use for dust control occurs mostly during the summer months. The two main water uses are by a water truck that sprays roads and other areas with loose sediment and the dust control system for the

large rock crushing plant. The water truck holds 4,000 gallons and makes a maximum of five runs a day five days a week over the six months of the spring and summer dry season. The rock crushing plant uses a maximum of 12,000 gallons a day and runs three days a week over the six months of the spring and summer dry season. The quarry also has a maximum of nine employees working five days a week. Table 7 summarizes industrial use within the project impact area. Table 5 summarizes employee use within the project impact area.

To the south of the project site, parcel APN 142-052-022 contains a single main residence and a dairy. The total head of cattle was estimated based on available pasture located on the parcel. A rule of thumb stated by the USDA assumes a cow-calf pair requires approximately 2 acres of pasture. The parcel contains about 80 acres of herbaceous landcover according to the Sonoma County Ag and Open Space District finescale vegetation map (SCAOSD Veg map, 2015) a count of 40 milch cattle was assumed. Water use per milch cow was estimated from rates given in the Small user water report estimator (DWR, 2019) which states a daily use per cow of 30 gallons and a washout use rate of 35 gallons per day per dairy cow totaling to 65 gallons per day per cow (Table 8). A total of two full time employees are assumed to work at the dairy.

One additional primary residence was identified on parcel APN 142-052-017 just east of the dairy parcel.

Based on these uses, existing water demand within the project recharge area is estimated at 219.6 acre-ft/yr (Table 2). Of this, the majority (199.9 acre-ft/yr) comes from irrigation of vineyards on neighboring parcels. Winery, industrial, residential, livestock/dairy and employee use make up the remainder (Tables 3 – 8). Of the total use, the project parcel uses approximately 6.3 acre-ft/yr or 62% of the total.

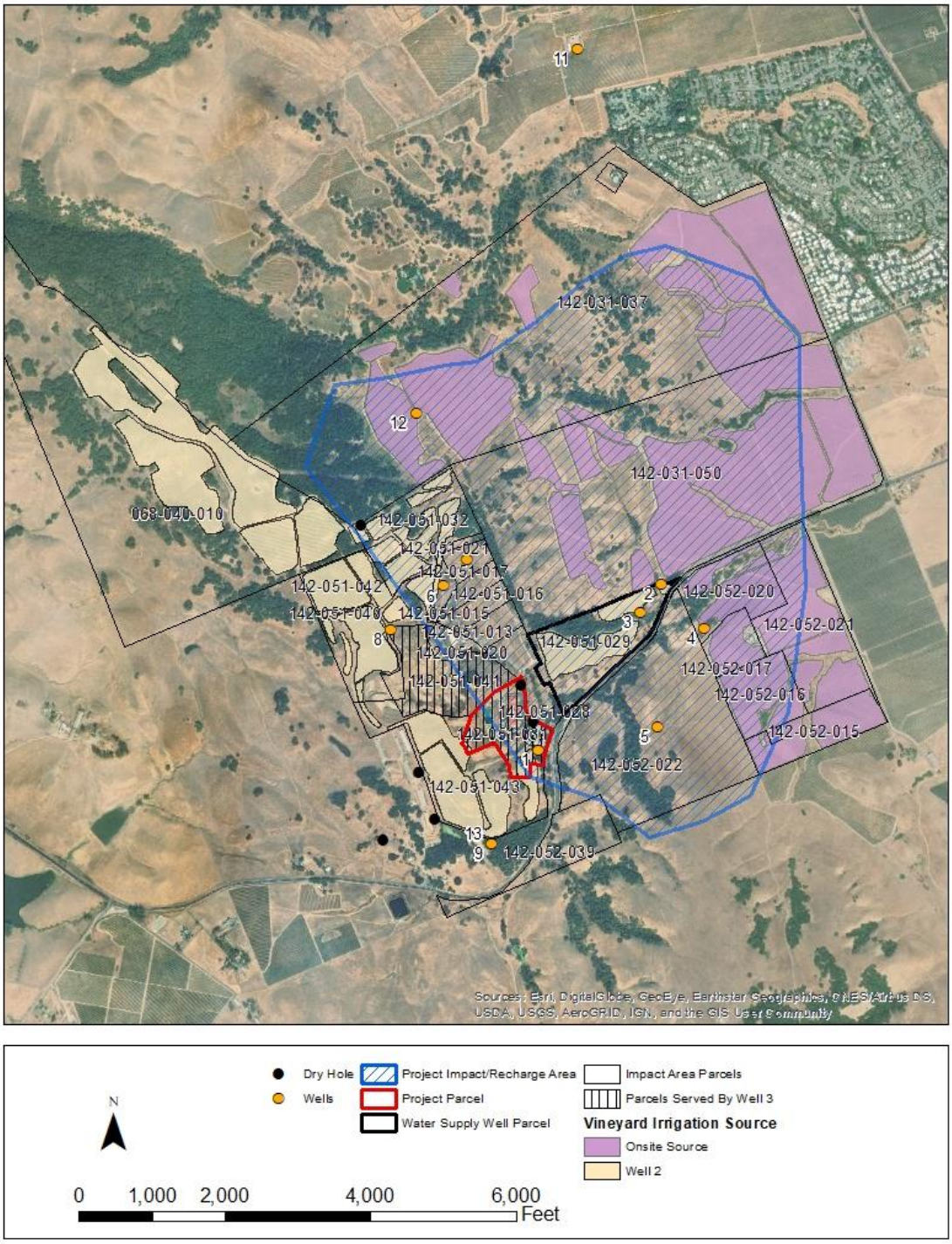


Figure 4: Satellite imagery of land uses within the project recharge area.

Table 2: Estimated existing, proposed and full buildout water demand for the project recharge area.

	Residential Use (acre-ft/yr)	Irrigation Use (acre-ft/yr)	Industrial Use (acre-ft/yr)	Livestock Use (acre-ft/yr)	Winery Use (acre-ft/yr)	Employee Use (acre-ft/yr)	Total Use (acre-ft/yr)
Existing Use	1.5	199.9	11.0	2.9	3.7	0.4	**219.5**
Proposed Use	1.5	199.9	11.0	2.9	19.2	0.4	**235.0**
Full Buildout Use	14.9	289.1	11.0	2.9	19.2	0.4	**337.5**

Table 3: Estimated existing and proposed residential water use within the project recharge area.

Use Category	# of Units	Use per Unit (ac-ft/yr)	Annual Water Use (ac-ft/yr)
Main Residence	3	0.50	1.50
TOTAL			**1.50**

Table 4 Estimated existing winery water use within the project recharge area.

Use Category	Count Cases	Count (gallons of wine)	PW estimate (gallons/yr)	PW estimate (acre-ft/yr)
Full Production	250,000	600,000	1,200,000	3.68
TOTAL				**3.7**

Table 5: Estimated existing and proposed employee use within the project recharge area.

Work Category	Count	Days per Year	Use per Person (gal/day)	Annual Water Use (ac-ft/yr)
Full-time Employee	41	260	15	0.49
Max Daily Office Visitors	5	260	15	0.060
TOTAL				**0.55**

Table 6: Estimated existing irrigation use within the project recharge area.

Use Category	Number of Acres	Use per Acre (ac-ft/yr)	Annual Water Use (ac-ft/yr)
Vineyard Irrigation (Well 2)	101.2	0.40	40.48
Orchard Irrigation (Well 3)	0.45	4.00	1.80
Vineyard Irrigation all other sites	394.13	0.40	157.65
TOTAL			**199.9**

Table 7: Estimated existing and proposed industrial water use within the project recharge area.

Use Category	Annual Water Use (ac-ft/yr)
Sonoma County Dump	1.00
Quarry	10.0
TOTAL	**11.0**

Table 8: Estimated existing and proposed stock water use within the project recharge area.

Use Category	Estimated Head Count*	Use per Head** (gal/day)	Annual Water Use (ac-ft/yr)
Dairy Cattle	40	65	2.9
TOTAL			**2.9**

*Assuming 40 head of milch cattle ~2 acres pasture per cow calf pair

**65 gallons per day is 30/ milch cow plus 35 washout

From: Small user water report estimator, CA DWR

Proposed Condition

In the proposed condition, the Carneros Vintner's Winery water use will increase significantly from the current annual total of 250,000 cases to 2,500,000 cases. The number of employees (20) and office visitors (five max daily) will remain the same. Table 9 summarizes the five distinct use categories and the estimated water use for each use category. Water use rates are taken from the SMA process wastewater report (Appendix C) which presents the process wastewater for each use. The increased winery production will have an estimated annual use of 19.2 acre-ft (Table 9); this is an increase of 15.5 acre-ft from the current 3.7 acre-ft total.

No other changes in demand are expected as a result of the proposed project. The project does propose the reuse of process wastewater to irrigate 30 acres of vineyard on the property adjacent to the project parcel. This reuse of the wastewater will offset the estimated irrigation demand in the project impact area by 12 acre-ft/yr reducing the irrigation water demand to 188.1 acre-ft/yr (Table 10).

Total water demand in the project recharge area is estimated to increase by 3.7 acre-ft/yr. This increase, all associated with the increased winery production, has been significantly offset from 15.5 acre-ft/yr to only 3.7 acre-ft/yr by the reuse of the process wastewater. In the proposed condition, the project parcel, will use 21.8 acre-ft/yr. This is equivalent to 6% of total use within the project recharge area.

Table 9: Estimated proposed winery water use within the project recharge area.

Use Category	Count Cases	Count (gallons of wine)	PW estimate (gallons/yr)	PW estimate (acre-ft/yr)
Full Production	55,000	132,000	264,000	0.81
Crush and Bulk Haul Offsite	289,000	693,600	693,600	2.13
Crush, Ferment Bulk haul offsite	1,056,000	2,534,400	3,801,600	11.67
Lees Wine	300,000	720,000	1,260,000	3.87
Bottling	800,000	-	240,000	0.74
TOTAL				**19.2**

Table 10: Estimated proposed irrigation water use within the project recharge area.

Use Category	Number of Acres	Use per Acre (ac-ft/yr)	Annual Water Use (ac-ft/yr)
Vineyard Irrigation	495.78	0.40	198.31
Orchard Irrigation	0.45	4.00	1.80
Process Wastewater used as irrigation	30	0.4	12.00
TOTAL			**188.1**

Full Build-Out Condition

The full build-out condition reflects the full development of parcels consistent with their current zoning. Uses in the full build-out condition were estimated using the following assumptions:

- All parcels will have primary dwellings and half will have secondary dwellings
- For parcels with existing vineyards, orchards, or other established agricultural uses, 50% of open land was considered to be developed. Open land was considered to be areas classified as non-riparian shrubs or as herbaceous by Vegetation and Habitat Map Key accompanying the Sonoma County Fine Scale Vegetation Map (SCAOSD, 2015). Limitations on maximum slope, riparian setbacks, and feasibility were not considered (except as noted below).
- Parcels without vineyard, orchard, or other established agricultural uses were not considered to have agriculture in the future
- Subdivisions and other discretionary projects were not considered

Additionally, the future build-out was only analyzed for parcels where development or wells would be within the project recharge area. If only a small portion of a parcel was included within the project recharge area or if all portions of a parcel within the project recharge area have prohibitively steep slopes, potential development on a parcel was not included.

Of the 24 parcels which would use water from the project recharge area, three have existing primary residences (the project parcel has one); 19 would be added to reach a full build-out total of 22. Two of the 24 parcels were not given main residences because they were associated with the Soils Plus quarry at APN 142-051-041 and the County transfer station at APN 142-051-020. Assuming that half of the 22 parcels will have secondary residences in the full build-out condition yields a total of 11 secondary residences in the full build-out condition.

The parcels within the project recharge area with existing vineyard (including those irrigated with water from Well 2) contain a total of 445 acres of land designated as herbaceous in addition to the vineyard areas. Applying the assumption that half of this area would be developed into additional vineyard would add 222.5 acres of vines for a full buildout total of 718.8 acres of vines which would require an annual total of 287.5 acre-ft of irrigation. Including the demand of the

existing 0.45 acres of orchard (1.8 acre-ft) and applying the offset for the 30 acres irrigated by process wastewater (12 acre-ft) brings the total full buildout irrigation demand to 277.3 acre-ft.

Based on these developments, water use in the full-build out condition is estimated to be as high as 325.7 acre-ft/yr (Table 2.) This increase comes from additional residences, and an increase in vineyard acreage (Tables 12 and 13).

Table 12: Estimated full build-out residential water use within the project recharge area.

Use Category	# of Units	Use per Unit (ac-ft/yr)	Annual Water Use (ac-ft/yr)
Main Residence	22	0.50	11.00
Secondary Residences	11	0.35	3.85
TOTAL			**14.85**

Table 13: Estimated full build-out irrigation water use within the project recharge area.

Use Category	Number of Acres	Use per Acre (ac-ft/yr)	Annual Water Use (ac-ft/yr)
Vineyard Irrigation	718.8	0.40	287.5
Orchard Irrigation Well 2	0.45	4.00	1.80
Process Wastewater used as irrigation	30	0.4	12.0
TOTAL			**277.3**

Groundwater Recharge Analysis

Groundwater recharge within the project recharge area was estimated using a Soil Water Balance (SWB) model developed for Sonoma County and portions of Marin County. The SWB model was developed by the U.S. Geological Survey (Westenbroek at al., 2010) and produces a spatially distributed estimate of annual recharge. This model operates on a daily timestep and 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 are included in Appendix D.

Groundwater recharge was simulated for Water Year 2010 which was selected as precipitation was close to the 30-year average for much of Sonoma County. During the simulated water year, precipitation averaged 26.4 inches across the project recharge area and actual evapotranspiration (AET) averaged 18.7 inches. Groundwater recharge varied across the project recharge area from 0 to 18.1 inches with a spatially averaged recharge of 4.9 inches (Table 14).

Groundwater recharge estimates can also be expressed as a total volume by multiplying the calculated recharge by the project aquifer impact/recharge area of 846.5 acres. This calculation yields an estimated mean annual recharge of 345.6 acre-ft/yr.

Water budget estimates are available for several larger watershed areas nearby including the Santa Rosa Plain, the Green Valley Creek watershed, and the Sonoma Valley. Comparisons to these water budgets are useful for determining the overall reasonableness of the results although one would not expect precise agreement owing to significant variations in climate, land cover, soil types, and underlying hydrogeologic conditions. These regional analyses estimated that mean annual recharge was equivalent to between 7% and 28% of mean annual precipitation (Farrar et. al., 2006; Flint and Flint 2014, Kobor and O'Connor, 2016; Woolfenden and Hevesi, 2014). The simulated water year 2010 groundwater recharge for the project recharge area represents approximately 19% (Table 14) of the precipitation, within the range of these regional estimates.

Table 14: Summary of water balance results from the SWB model for Water Year 2010.

	2010 Normal Year	
	inches	% of precip
Precipitation	26.4	-
AET	18.7	71%
Runoff	2.8	11%
Recharge	4.9	19%

Comparison of Water Demand and Groundwater Recharge

The total proposed groundwater use for the project recharge area is estimated to be 223.3 acre-ft/yr, 21.8 acre-ft/yr of which is for the project parcel. Groundwater use in the project recharge area is equivalent to 65% of the estimated mean annual groundwater recharge of 345.6 acre-ft/yr, indicating that there is a surplus of groundwater resources (Table 15). Given the magnitude of the surpluses, the proposed project is unlikely to result in significant reductions in groundwater levels or depletion of groundwater resources over time.

Table 15: Comparison of estimated water use and mean annual recharge within the project recharge area

		Average Water Year (2010)		
Scenario	Total Proposed Demand (ac-ft/yr)	Recharge (ac-ft/yr)	Recharge Surplus (ac-ft/yr)	Demand as % of Recharge
Proposed	223.3	345.6	122.3	65%
Full Buildout	325.8	345.6	19.8	94%

Potential Impacts to Streams and Neighboring Wells

The project well (Well 3) is in the valley adjacent to Champlin Creek. The creek is located approximately 75 feet to the south and less than 1 ft lower in elevation. The project well is screened from 255 ft to 475 ft and from 495 ft to 695 ft these intervals are located at a significant depth such that given the substantial vertical separation and confined nature of the aquifer, increased pumping from the project well is unlikely to have negative impacts on this stream.

The nearest neighboring well (Well 2) is located approximately 500 feet northeast of the project well and screened from 230 ft to 390 ft, 410 ft to 590 ft and from 610 ft to 840 ft. Although these elevations do overlap with a large portion of the screened intervals of the project well, it has been reported that the lowest section of the aquifer intersected by Well 2 which is not intersected by the Project well (Well 3) has the greatest production and is the primary layer causing the artesian conditions at the well. Due to the pressurized nature of this groundwater development of the well was difficult for the driller. This highly productive layer was identified in the e-log survey of the project well beginning at a depth of 700 ft and to avoid development difficulties, the lowest water-bearing stratum was left unscreened. This configuration is likely to reduce potential well interference between Wells 2 and 3.

The next nearest wells located with certainty are Wells 4 and 5 which are located approximately 915 ft and 840 ft respectively to the southeast and of the project well. Given the substantial horizontal separation, increased pumping from the project well is unlikely to have significant negative impacts at these locations.

Summary

Application of the Soil Water Balance (SWB) model to the project recharge area revealed that average water year recharge was approximately 4.9 inches/yr or 345.6 acre-ft/yr. The total proposed water use for the project aquifer recharge area is estimated to be 223.3 acre-ft/yr. This represents 65% of the estimated mean annual recharge within the project impact area, suggesting that the project is unlikely to result in cause a gross imbalance between recharge and groundwater utilization.

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APPENDIX A

WELL COMPLETION REPORTS

APPENDIX B

WELL 3 E-LOG SURVEY RESULTS

APPENDIX C

STEVE MARTIN AND ASSOCIATES PROCESS WASTEWATER SUMMARY

APPENDIX D

SONOMA COUNTY GROUNDWATER RECHARGE ANALYSIS