EXHIBIT D

DRAFT
MEMORANDUM

February 8, 2019

To: Mr. Tim Persson
2847 Atlas Peak Road
Napa, CA 94558
Sent via email (tpersson@hesscollection.com)

Cc: Ms. Annalee Sanborn & Mr. Jim Bushey
PPI Engineering, Inc. (PPI)
Sent via email: (asanborn@ppiengineering.com)
(jbushey@ppiengineering.com)

Job No. 678-NPA01

From: Geza Demeter, Anthony Hicke, and Richard C. Slade
Richard C. Slade & Associates LLC (RCS)

Re: Results of Napa County Tier 1 Water Availability Analysis
Hess Persson New Vineyard Development
2847 Atlas Peak Road, County APN 039-080-042
Napa County, California

Introduction

This Memorandum presents the key findings and conclusions, along with our preliminary recommendations, regarding the Water Availability Analysis (WAA) prepared by RCS for the proposed new vineyard development at the Hess Persson property in Napa County (County), California. This document was prepared by RCS to provide conformance with Napa County Tier 1 requirements, as described in the Napa County WAA Guidelines (WAA, 2015). The Hess Persson property is comprised by 40.1 acres and is located at 2847 Atlas Peak Road, east of Oak Knoll in Napa County (County).

Figure 1, "Location Map," shows the boundaries of the subject property superimposed on the USGS topographic map for the Napa, Yountville, Capell Valley and Mount George quadrangles. Property boundaries shown on Figure 1 were adapted from the County Assessor's parcel data; County parcel data are freely available on the Napa County GIS website. Also shown on Figure 1 is the location of the existing onsite water well (known herein as "Onsite Well"), and the locations of nearby but offsite wells owned by others. Figure 2, "Aerial Photograph Map," shows the same property boundaries and well locations that are illustrated on Figure 1, but the basemap for Figure 2 is an aerial photograph of the area; this aerial photograph was obtained from the USGS EarthExplorer website (the date of the imagery is June 3, 2016). Note that the locations shown are approximate only, due to registration (alignment) issues with the imagery.

As reported by the project engineer, PPI Engineering, Inc. (PPI) of Napa, California, the 40.1-acre subject property is currently developed with 0.9 acres of existing vineyards and one residence. Irrigation water demands for the existing vineyards and residence at the subject property have historically been, and continue to be met by pumping groundwater from the existing onsite well.

RCS understands the proposed project is to develop approximately 16.0 acres of new vineyards. For this project, the future water demands for the existing and proposed new vineyards are proposed to be met using groundwater pumped from the existing onsite well.

As part of the permit submittal for the proposed new winery project, a Water Availability Analysis (WAA) is required by the County. The purpose of this Memorandum is to comply with Napa County's WAA guidelines for a "Tier 1" WAA (i.e., a Groundwater Recharge Estimate); those guidelines were promulgated by the County in May 2015. Because there are no known offsite wells located with 500 ft of the onsite well (the project well), County requirements for a "Tier 2" WAA analysis (i.e., a Well Interference Evaluation) have been "presumptively met" per the WAA Guidelines.

Site Conditions

From our data review work and from our field reconnaissance visit to the subject property on June 27, 2018, the following key items were noted and/or observed (refer to Figures 1 and 2):

a. The Hess Persson property is comprised of a single parcel having a Napa County Assessor's Parcel Number (APN) of 039-080-024. This parcel is referred to herein as the "subject property." The total assessed area of the subject property, per the assessor's records, is 40.1 acres.

b. Topographically, the subject property is located in the hills on the eastern side of Napa Valley, and west of Atlas Peak Road. The property contains ridges in the northeastern and northwestern portions, and two small topographic swales; one on the west and one on the southeastern corner of the site.

c. There were no actively flowing drainages and/or creeks observed by the RCS geologist on the subject property; thus, onsite drainage is strictly ephemeral, and flows only occur during and directly after rainfall events. Based on the topographic contours, the property drains towards Atlas Peak Road to the south (see Figure 1). An offsite ephemeral blue-line creek, located east of the property, and which drains towards Atlas Peak Road, was observed to be dry.

d. Developments on the subject property currently consist of one residence (with minor landscaping and a pool) and approximately 0.9 acres of existing vineyards located in the northeastern portion of the property.

e. Offsite areas surrounding the subject property consist primarily of residences, but a few small vineyard areas were observed on nearby offsite properties. Naturally vegetated and/or wooded hillsides (i.e., undeveloped areas) were also observed farther offsite to the north and northwest.

f. As shown on Figures 1 and 2, the existing water well is located in the northeastern portion of the property near the existing residence and vineyards. Reportedly, this well supplies all water needed for domestic supply to the primary residence and for irrigation supply to the existing vineyards.

DRAFT
MEMORANDUM

g. During the site visit, an RCS geologist also traveled along onsite roads and offsite public roads in the area surrounding the subject property in attempt to identify the possible locations and/or existence of nearby but offsite wells owned by others. In addition, because of our work on neighboring properties owned by others, locations of offsite wells had been mapped in the past, and are included on Figures 1 and 2 where known.

   RCS geologists also contacted Napa County Planning, Building, and Environmental Service (PBES) in an attempt to acquire "Well Completion Reports" (also known as "driller's logs") that might exist for wells located on those neighboring but offsite properties. In addition, RCS geologists also used the California Department of Water Resources (DWR) online Well Completion Report website to download driller's logs for wells within the immediate vicinity of the subject property. As a result of those inquiries, a few driller's logs were obtained for wells historically drilled in the area.

   Figures 1 and 2 show the approximate locations of known, reported, and/or inferred nearby offsite wells surrounding the subject property, as determined from the field reconnaissance and well log research. None of these mapped offsite wells are known to or appear to lie to within 500 of the Onsite Well.

Key Construction and Testing Data for Existing Onsite Wells

A DWR Well Completion Report is available for the existing Onsite Well and it is represented by Log No. 823010; a copy of which is appended to this Memorandum. Table 1, "Summary of Well Construction and Pumping Data," provides a tabulation of key well construction data, groundwater airlifting data, and pumping data that are available for the Onsite Well.

Well Construction Data

Key data listed on the available driller's log for the Onsite Well and/or identified during our site visit include:

a. This well was drilled and constructed in April 1999 by Huckfeldt Well Drilling (Huckfeldt) of Napa, California, using the direct air rotary method.

b. The pilot hole (the borehole drilled before the well casing was placed downwell) was reported to have been drilled to a depth of 520 feet below ground surface (bgs).

c. The borehole was cased with PVC well casing having a nominal diameter of 6 inches; the total casing depth of the Onsite Well is reported to be 518 ft bgs.

d. Casing perforations for the Onsite Well are factory-cut slots having a slot opening width of 0.032 inches (32-slot). Perforations in this well were placed between the following depth intervals: 278 ft to 298 ft bgs; and 418 ft to 518 ft bgs.

e. The gravel pack material listed on the driller's log for the Onsite Well is reported to be "pea gravel."

f. The Onsite Well is reportedly constructed with a sanitary seal consisting of concrete from 0 to 20 ft bgs, then bentonite from 20 to 22 ft bgs; thus the sanitary seal was set to a depth of 22 ft bgs.

MEMORANDUM

Summary of Initial "Test" Data for the Onsite Well

The driller's log for the Onsite Well provided the original post-construction static water level, and the original airlift test rate (as shown on Table 1). These data include:

- The initial static water level (SWL), following completion of well construction was reported to be 330 ft bgs on April 9, 1999.
- The reported maximum airlift flow rate during initial post-construction airlifting operation in the Onsite Well was estimated by the driller to be 90 gallons per minute (gpm). As a rule of thumb, RCS Geologists estimate that normal operational pumping rates for a new well equipped with a permanent pump are typically on the order of only about one-half or less of the airlifting rate reported on a driller's log.
- A "water level drawdown" value was not and could not be provided on the driller's log, because water level drawdown cannot be measured during airlifting operations; thus, the original post-construction specific capacity[1] value for the Onsite Well cannot be calculated from the data on the available driller's log.

Pumping Test Data for the Onsite Well

On October 30, 2012, a 4-hour constant rate pumping test of the Onsite Well was performed by Doshier-Gregson Pump & Well Service (Doshier-Gregson) of American Canyon, California. The 4-hour pumping test was performed at a constant rate of 44 gpm. However, no water level data (static and/or pumping levels) were provided on the available pumping test report sheet. Information provided in the Doshier-Gregson report revealed that the permanent pump was set to a depth of approximately 400 ft bgs.

On February 23, 2017, a 4-hour pumping test was performed at the Onsite Well by Ray's Well Testing Service (RWTS) of Sebastopol, California. Figure 3, "Water Levels During February 2017 Pumping Test by RWTS," illustrates the water level changes in the Onsite Well during this 4-hour pumping test period. Key data available from the constant rate pumping test by RWTS include:

- A SWL of 336.8 ft below the wellhead reference point (brp) was recorded by the pumper before the test began.
- Based on the reported pumping rates by the pumper, the well was initially pumped at a rate of 41.6 gpm, but the pumping rate was increased to 54.3 gpm within the first 30 minutes of pumping; there were no further pumping rate adjustments reported by the pumper during the remainder of the 4-hour pumping test period.
- A maximum pumping water level (PWL) of 340.1 ft brp was reported by the pumper at the end of the continuous 4-hour pumping period; this represents a maximum water level drawdown of 3.3 ft at the end of the test (the permanent pump is reportedly set to a depth of approximately 440 ft bgs). As shown on Figure 3, water levels appeared to be relatively stable during the pumping test. It was reported that in the last 3 hours of the pumping test, the PWL in the well did not decline.

[1] Specific capacity, in gallons per minute per foot of water level drawdown (gpm/ft ddn), represents the ratio of the pumping rate in a well (in gpm) divided by the amount of water level drawdown (in ft ddn) created in the well while pumping at that rate.

- No water level recovery measurements were reported by RWTS for this February 2017 pumping test.
- Based on the pumping rate of 54.3 gpm, the short-term specific capacity of the Onsite Well is calculated to have been 16.4 gpm/ft ddn at the time of testing.
- As seen on Figure 3, static and pumping water levels reported in this well have been below the 278-foot depth to the top of its uppermost perforations. Hence, cascading water conditions have occurred and will continue to occur in this well in the future.

Well Data from Site Visit

As discussed above, a site visit to the subject property was performed by an RCS geologist on June 27, 2018. The following information for the Onsite Well was gleaned from that site visit:

- The Onsite Well was observed to be equipped with a permanent pump, but the well was not being pumped at the time of our visit. A SWL of 343.9 ft brp was measured by the RCS geologist while the pump was shut off. This SWL is roughly 7 ft deeper than the 337-foot SWL depth reported by RWTS in February 2017, and 14 ft deeper than the 330-foot SWL depth reported on the driller's log for the Onsite Well, immediately after it had been constructed in April 1999.
- No totalizer flow dial device (to measure flow rates and flow volumes) was observed near the wellhead.

Figure 3 provides all available water level measurement data for the Onsite Well. In general, the water levels are stable, exhibiting a slight decline over time. The temporal frequency of measurement is not sufficient to determine whether or not the slight decline is due to seasonal water level variation or correlates with regional rainfall patterns. Also, the water level differences observed in these wells between their respective original, post-construction static water levels and more recent static water levels measured could partially be the result of differences in the types and accuracy of the various manual water level measurement devices (i.e., tape sounders, airlines, etc.) used by the drilling contractors, pumpers, and RCS geologists.

Local Geologic Conditions

Figure 4, "Geologic Map," illustrates the types, lateral extents, and boundaries between the various earth materials mapped at ground surface in the region by others. Specifically, Figure 4 has been adapted from the results of regional geologic field mapping of the Mt. George (2004), Napa (2004), Yountville (2005), and Capell Valley (2006) quadrangles, as published by the California Geological Survey (CGS). Because Figure 4 represents a collaboration of different sources of geologic mapping, the nomenclature, colors, and the mapped contacts between the different earth materials are different from map to map. Regardless, as shown on Figure 4, the key earth materials mapped at ground surface in the area from include the following:

a. Sonoma Volcanics. The Sonoma Volcanics are comprised by a highly variable sequence of chemically and lithologically diverse volcanic rocks. These rock types include the following: rhyolite ash flow and tuff (map symbol Tsvr and Tsvrt); dacite lava flows (map symbol Tsvdg); andesite lava flows (map symbol Tsvaa); and mafic flows, breccias, and tuff (map symbol Tsvm). As shown on Figure 4, the rhyolite ash flows and tuff deposits are exposed in the topographically elevated portion of the property, whereas the harder dacitic and andesitic lava flows are exposed in the central and topographically lower portions of the property.

Review of the driller's descriptions listed on the available driller's log for the Onsite Well reveals that drilling of this well encountered typical rocks of the Sonoma Volcanics at the well site. Typical driller-terminology for the drill cuttings on this log included: "gray volcanics;" "mixed volcanics;" "black volcanics;" "gray and red volcanics;" and "hard black volcanics." Therefore, based on the available subsurface geologic data, the Sonoma Volcanics are interpreted by RCS to extend to depths of at least 520 ft bgs beneath the property (at least in the vicinity of the Onsite Well).

b. <u>Great Valley Sequence.</u> The geologically older (Cretaceous-aged) Great Valley Sequence rocks (not shown on Figure 4) are not exposed on the subject property, but are known to occur at ground surface further to the east of the subject property. These rocks consist mainly of well consolidated to cemented rocks, thickly bedded mudstone, siltstone, and shale, with minor amounts of thinly bedded sandstone. These rocks are also known to underlie all younger geologic materials (including the Sonoma Volcanics) that occur in the region, and are considered to be the bedrock of the area.

Again, based solely on the RCS geologist's interpretation of the driller's descriptions of the drill cuttings listed on the available driller's log for the Onsite Well, these bedrock materials are interpreted to exist beneath the property at depths greater than the 520-foot deep drilled borehole depth of the Onsite Well.

Local Hydrogeologic Conditions

The earth materials described above can generally be separated into two basic categories, based on their relative ability to store and transmit groundwater to wells. These two basic categories include:

Potentially Water-Bearing Materials

The principal water-bearing materials beneath the subject property and its environs are represented by the hard, fractured volcanic flow rocks and flow breccias of the Sonoma Volcanics. The occurrence and movement of groundwater in these rocks tend to be controlled primarily by the secondary porosity within the rock mass, that is, by the fractures and joints that have been created in these harder volcanic flow-type rocks over time by various volcanic and tectonic processes. Specifically, these fractures and joints have been created as a result of the cooling of these originally molten flow rocks and flow breccias deposits following their deposition, and also from mountain building or tectonic processes (faulting and folding) that have occurred over time in the region after the rocks were erupted and hardened. Some groundwater can also occur in zones of deep weathering between the periods of volcanic events that yielded the various flow rocks, and also with the pore spaces created by the grain-to-grain interaction in the volcanic tuff and ash, if those rock types exist beneath the harder, flow-type rocks.

The amount of groundwater available at a particular drill site for a well constructed into the Sonoma Volcanics beneath the subject property would depend on such factors as:

- the number, frequency, size and degree of openness of the fractures/joints in the subsurface
- the degree of interconnection of the various fracture/joint systems in the subsurface
- the extent to which the open fractures may have been possibly in-filled over time by chemicals precipitates/deposits and/or weathering products (clay, etc.)
- the amount of recharge from local rainfall that becomes available for deep percolation to the fracture systems
- to a lesser extent, the size of the pore-spaces formed by the grain-to-grain interactions of volcanic ash particles, if those rock types existed beneath the subject property.

As stated above, the principal rock type expected in the subsurface beneath a portion of the property is a combination of hard, volcanic flow rock, and ash flow tuff and breccias that may be fractured to varying degrees. Descriptions of drill cuttings by the well driller that are recorded on the available driller's log for Onsite Well are consistent with the typical descriptions of the various rocks known in the Sonoma Volcanics. From our long-term experience with the fractured flow rocks within the Sonoma Volcanics, based on numerous other water well construction projects in Napa County, pumping capacities in individual wells have ranged widely, from rates as low as 5 to 10 gpm, to rates as high as 200 gpm, or more.

Potentially Nonwater-Bearing Rocks

This category includes the geologically older and fine-grained sedimentary rocks of the Great Valley Sequence; as stated above, these materials do not occur at ground surface on the property. Instead, these potentially nonwater-bearing rocks would underlie the volcanic rocks that exist beneath the subject property at depths greater than 520 ft bgs, depending on the location, as interpreted by RCS from the driller's descriptions listed on the available driller's log for the Onsite Well.

In essence, these diverse rocks are well-cemented and well-lithified, and have an overall low permeability. Occasionally, localized conditions can allow for small quantities of groundwater to exist in these rocks wherever they may be sufficiently fractured and/or are relatively more coarse-grained. However, even in areas with potentially favorable conditions, well yields are often only a few gpm in these rocks, and the water quality can be marginal to poor in terms of total dissolved solids concentrations, and other dissolved constituents.

Geologic Structure

A single fault[2], as mapped by others, has been interpreted to exist south of the subject property as shown by the dark-colored, solid and/or short dashed line on Figure 4 (CGS 2006), and the solid green line labeled Soda Creek Fault (USGS 2000). The possible impacts of this fault on groundwater availability in the region are unknown due to an absence of requisite data. Faults can serve to increase the number and frequency of fracturing in the Sonoma Volcanics rocks. If such fractures were to occur, they would tend to increase the amount of open area in the rock fractures which, in turn, could increase the ability of the local earth materials to store groundwater. Faults can also act as barriers to groundwater flow; it is unknown if these mapped

[2] Note that it is neither the purpose nor within our Scope of Hydrogeologic Services for this project to assess the potential seismicity or activity of any faults that may occur in the region

faults impact groundwater flow, as water level data necessary to make such a determination are not available.

Project Water Demands

For the purposes of this WAA, the Onsite Well is the only existing well on the subject property and is considered to be the "project well," as it will represent the only well that will be used to meet water demands of the proposed new vineyard development project. All existing onsite water demands currently supplied by groundwater will continue to use groundwater pumped from the Onsite Well.

Existing and proposed (future) onsite water demands for the property have been estimated by RCS[3], as discussed below. Table 2, "Groundwater Use Estimates," is intended to categorize the specific water demands of the project and other onsite uses. As shown on Table 2, the estimated annual groundwater demands for the project are discussed below.

Existing Water Demands

Water demands for the existing vineyards and onsite residence are currently met by pumping groundwater from the Onsite Well. Because there are no historic flowmeter totalizer data for the Onsite Well, the actual historic onsite use is unknown in terms of instantaneous flow rates and the total volume pumped each season. Therefore, the existing annual onsite water demands have been estimated to be as follows:

a. Existing residential demand = 0.80 acre-feet per year (AF/yr)
    - This includes 0.75 AF/yr for the residence and 0.05 AF/yr for the pool
b. Existing vineyard irrigation demand = 0.45 AF/yr
    - This demand includes irrigation water used for existing 0.9 acres of vineyards, assuming 0.5 AF of groundwater per acre of vines (AF/ac).
c. Total estimated existing water demand = a + b = 1.25 AF/yr

Hence, the estimated total existing annual water demand is 1.25 AF/yr, and this volume is currently met by pumping groundwater from the Onsite Well.

Future Water Demands

In the future, water demands for the property will be met by pumping groundwater from the Onsite Well (the project well). As discussed above, the new vineyard project, the onsite residence, and existing vineyard, are included in the total future project water demand.

Thus, the total future annual onsite groundwater demand for the property will be as follows:

a. Residential groundwater demand = 0.80 AF/yr (same as existing)
b. Vineyard irrigation groundwater demand = 8.45 AF/yr
    - This demand includes irrigation water for the 16.9 total acres of future onsite vines (0.9 acres of existing vines, plus 16.0 acres of proposed new vines)

---

[3] These water demand estimates were based on those values presented for specified land uses provided in Appendix B of the County's WAA Guidance Document (WAA 2015).

DRAFT
MEMORANDUM

c. Total proposed future groundwater demand for the Hess Persson property:

= a + b = 9.25 AF/yr

Proposed Pumping Rates

To determine an appropriate estimated combined pumping rate necessary from the Onsite Well, to meet the estimated future groundwater demand for the property, it will be conservatively assumed that the future vineyard irrigation water demands (8.45 AF/yr) will be required only during a 16-week irrigation season each year[4]. In addition, it is assumed that all residential water demands (residence, minor landscaping, and pool) will be required year-round (365 days/year). Based on those assumptions, the Onsite Well would need to pump at a rate of about 35 gpm. This pumping rate assumes that the Onsite Well would be pumped at a 50% operational basis, that is, 12 hours/day, 7 days/week during the assumed 16-week irrigation season each year. Pumping rates for the Onsite Well, reported by others, have ranged from 44 gpm (in October 2012) to 54 gpm (in February 2017). Additionally, water level data from the 4-hour pumping test performed by RWTS in February 2017 revealed that pumping water levels were stable (water levels did not decline in the final 3 hours of testing) and only 3.3 ft of water level drawdown occurred while pumping at a rate of 54 gpm. Thus, it appears the Onsite Well is more than capable of meeting the instantaneous pumping rate of 35 gpm required for the vineyard project and existing uses.

Rainfall

Long-term rainfall data are essential for estimating the average annual recharge that may occur at the subject property. Average annual rainfall totals that occur specifically at the subject property are not directly known, because no onsite rain gage exists. Rainfall data exist for the nearby “Milliken Reservoir” rain gage, which is located roughly 1 mile east of the subject property. Data for this rain gage are available from the Napa One Rain website, which is maintained by Napa County. Data from the Napa One Rain website for this gage are available beginning in water year (WY) 2000-01 (October 2000 - September 2001) through WY 2017-18. The average annual rainfall for WY 2000-01 through WY 2017-18 at this gage is calculated to be 23.5 inches (1.96 ft). This rain gage is located at a slightly lower elevation then the subject property, and therefore, the average annual rainfall at the subject property could be considered to be slightly higher than that experienced at this known gage location. It must be noted that there appears to be several months of missing data for this gage between March 28 and August 28, 2013. Thus, rainfall totals for WY 2012-13 are likely higher than what is shown for that water year. Additionally, because the data record is limited and included several years of drought rainfall, RCS does not consider these data to be representative of the long-term average annual rainfall in the area.

A second Napa One Rain gage named “Mt. George” exists roughly 3 miles southeast of the subject property. Rainfall data for the Mt. George gage on the Napa One Rain website are available for WY 2000-01 through WY 2017-18. The average rainfall for that period of water years at this Mt. George gage is calculated to be 24.9 inches (2.08 ft). Because this gage is located at a slightly higher elevation than the subject property, the average rainfall at the subject

[4] In reality, the vineyard irrigation season could last for a period of 20 weeks or longer. Therefore, assuming all onsite vineyard irrigation demands would occur during a 16-week irrigation season is a conservative estimate, because the groundwater volume for the project would need to be extracted in a shorter period of time.

DRAFT
MEMORANDUM

property could be considered to be slightly lower than that experienced at this known gage location. However, similar to the Milliken Reservoir gage, the Mt. George gage data record is limited and includes several years of drought year rainfall, it may not be representative of the long-term average annual rainfall in the area.

The nearest rain gage to the subject property with a relatively long data record is the gage located at the Napa State Hospital. The data for this gage is available from the Western Regional Climate Center (WRCC) website (WRCC 2018). For that rain gage, the period of record is listed as the year 1893 through October 2018. Note that prior to 1919, approximately 5 years of rainfall data are missing from the data set. For the available period of record, the average annual rainfall at this Napa State Hospital gage is 24.7 inches (2.06 ft), as reported on the WRCC website. This rainfall gage, however, is located at a lower elevation than the subject property, and therefore, the rainfall at the subject property would tend to be somewhat higher than that experienced at this known gage location. Also, this rain gage is located roughly 7 miles south of the subject property, thus making it even less likely that these data are representative of the long-term average rainfall at the subject property.

To help corroborate the average annual rainfall data derived from the Napa One Rain and/or WRCC gages, RCS reviewed the precipitation data published by the PRISM Climate Group at Oregon State University. This data set, which is freely available from the PRISM website contains "spatially gridded average annual precipitation at 800m (800-meter) grid cell resolution." The date range for this dataset includes the climatological period between 1981 and 2010. These gridded data provide an average annual rainfall distributed across the subject property. Using this data set, RCS determined that the average rainfall for the subject property for the stated date range may be approximately 32.7 inches (2.73 ft).

An additional rainfall data source, an isohyetal map (a map showing contours of equal average annual rainfall) was prepared by the County for all of Napa County, and is freely available for download from the online Napa County GIS database (a copy of this map is not provided herein). As described in the metadata for the file (also available via the County GIS database), the isohyets are based on a 60-year data period beginning in 1900 and ending in 1960. As stated in the metadata for the file, the contour interval for the map is reported to be "variable due to the degree of variation of annual precipitation with horizontal distance", and therefore the resolution of the data for individual parcels is difficult to discern. The subject property is situated near the boundaries of the 35-inch average and 27.5-inch average annual rainfall contour on this County map. Based on our interpretation of the actual isohyetal contour map (not provided herein), the long-term average annual rainfall at the subject property may be on the order of 34 inches (2.83 ft), using these rainfall data.

Table 3, "Comparison of Rainfall Data Sources," provides a comparison of the data collected from the different rainfall sources discussed above. Based on those rainfall data sources and as summarized on Table 3, RCS will consider the long-term average annual rainfall at the subject property to be 32.7 inches (2.73 ft), as derived from the PRISM data set. The 32.7-inch per year estimate is based on the data source with a relatively long period of record (29 years) and is more site-specific, when compared to the other rainfall data sources listed in Table 3 that: exist at different elevations; and/or are located at a significant distance from the subject property; and/or have a shorter period of available data.

Estimate of Groundwater Recharge

Groundwater recharge on a long-term average annual basis at the Hess Persson property can be estimated as a percentage of average rainfall that falls on the subject property and becomes available to deep percolate into the aquifer system(s) beneath the site over the long-term. The actual percentage of rain that deep percolates can be variable based on numerous conditions, such as: the slope of the land; the soil type that exists at the property; the evapotranspiration that occurs on the property; the intensity and duration of the rainfall; etc. Therefore, RCS has considered various analyses of deep percolation into the rocks of the Sonoma Volcanics, as relied upon by other consultants and by certain government agencies for projects in the Napa Valley.

Recharge volumes estimated in this Memorandum are based on the long-term average annual rainfall values determined for the subject property using the available data presented above. Note that a calculation of average annual rainfall for any long-term period always includes periods of below-average rainfall and above-average rainfall that occurred during the period over which the average was calculated. Therefore, the following recharge calculations also include consideration of drought year conditions.

Updated Napa County Hydrogeologic Conceptual Model (LSCE&MBK 2013)

Estimates of groundwater recharge as a percentage of rainfall are presented for a number of watersheds (but not all watersheds) in Napa County in the report titled "Updated Napa County Hydrogeologic Conceptual Model" (LSCE&MBK, 2013) prepared for Napa County. Watershed boundaries within Napa County are shown on Figures 8-3 and 8-4 in that report. At the request of RCS, those watershed boundaries were provided to RCS by MBK Engineers (MBK). Figure 5, "Watershed Boundaries," was prepared for this project using those watershed boundaries for which data are available. As shown on Figure 5, the subject property is located within the watershed referred to by MBK as "Milliken Creek." As shown on Table 8-9 on page 97 of the referenced report (LSCE&MBK, 2013), 8% of the average annual rainfall that occurs within this watershed was estimated to be able to deep percolate as groundwater recharge. Further, as shown on the data table for the Milliken Creek watershed superimposed on Figure 8-13, for the stated period of 1976 through 1983, the average annual precipitation was 3.14 ft, and the average annual recharge during that period was 0.31 ft (LSCE&MBK 2013). These estimates equate to a deep percolation percentage of 10% for the Milliken Creek watershed.

Groundwater recharge estimates that have been regularly used by others for the Sonoma Volcanics throughout Napa County in different watersheds range from a conservative estimate of 7% to perhaps 17% or higher. RCS has previously assigned conservative deep percolation estimates of 9% to 10% for the Sonoma Volcanics prior to the LSCE&MBK 2013 study. These estimates were based, in part, on the RCS review of USGS Water Resources Investigation Reports WRI 77-82 and WRI 03-4229 (USGS 1977 and USGS 2003, respectively) and from our previous experience in preparing numerous hydrogeologic assessments throughout Napa and Sonoma counties for properties underlain by the Sonoma Volcanics. One groundwater study prepared by others as part of the Napa Pipe Project Environmental Impact Report estimated that 10.5% of rainfall recharge occurred within the Sonoma Volcanics (BHFS 2011). A recent water availability analysis was prepared by RCS for a project on a property proximal to the Hess Persson property that used a conservative groundwater recharge estimate of 9%.

Therefore, to present a conservative estimate of groundwater recharge, a value of 9% may also be an appropriate assumption for the percentage of rainfall that can deep percolate to recharge the groundwater beneath the Hess Persson property. As stated above, the total surface area of the subject property is 40.1 acres. Assuming a volume of 32.7 inches (2.73 ft) of rainfall falls on the subject property on a long-term average annual basis, then the total volume of rainfall that would fall each year directly on the property over the long term would be approximately 109.5 AF (40.1 acres x 2.73 ft). Assuming 9% of the average annual rainfall would be able to deep percolate to the groundwater beneath the subject property, then the average annual groundwater recharge at the subject property would be approximately 9.86 AF/yr. This estimated average annual recharge volume (i.e., 9.86 AF/yr) is greater than the estimated total onsite future (proposed) groundwater demand of 9.25 AF/yr.

Estimate of Groundwater in Storage

To help evaluate possible impacts to the local volcanic rock aquifer systems that might occur as a result of pumping for the proposed project, the volume of groundwater extracted for the project can be compared to an estimate of the current volume of groundwater in storage strictly beneath the subject property. To estimate the amount of groundwater currently in storage beneath the subject property, the following parameters are needed:

a) Approximate surface area of subject property = 40.1 acres

b) Depth to base of perforations in Onsite Well = 518 ft bgs; this is the only known well that exists on the property, therefore only data from this well can be used to estimate of the thickness of currently saturated rocks within the Sonoma Volcanics that might exist beneath the property.

c) To present a conservative calculation of groundwater in storage, we will also assume that the current saturated thickness of the aquifer(s) beneath the subject property is about 175 ft vertical feet. This value is calculated using the Onsite Well data by subtracting the RCS-measured SWL of about 342 ft bgs (or 344 ft brp) in this well (on June 27, 2018) from the reported depth to bottom of the perforations in the well at 518 ft bgs. Based on the water level data presented herein, the June 2018 SWL is the deepest available SWL measured for this well, and thus is used here to provide a more conservative calculation of the minimum volume of groundwater currently in storage beneath the property.

d) Approximate average specific yield of the Sonoma Volcanics = 2%. The specific yield is essentially the ratio of the volume of water that drains from the saturated portion of the geologic materials (due to gravity) to the total volume of rocks. Specific yield of the Sonoma Volcanics can vary greatly depending on a number of factors, including the degree and interconnection of the pore spaces and/or fracture zones within the rocks. A conservative estimate by Kunkel and Upson for the specific yield of the Sonoma Volcanics ranges from 3% to 5% (USGS 1960). For other nearby properties for which RCS has performed similar analyses, an even more conservative estimate for specific yield of 2% has been used. Hence, to present a conservative analysis, we will assume a specific yield of 2% for the Sonoma Volcanics rocks that underlie the subject property, but the actual value, in reality, could be higher.

e) Thus, a conservative estimate of the groundwater currently in storage (S), beneath the subject property (as of June 2018) is calculated as:

S = property area (subpart a, above) times saturated thickness (subpart c, above) times average specific yield (subpart d, above) = (40.1 acres)(175 ft)(2%) = 140.4 AF

In contrast, the proposed average annual groundwater use for the property is estimated to be 9.25 AF/yr. Hence, the estimated groundwater demand for the entire property represents only about 7% of the groundwater conservatively estimated to currently be in storage in the volcanic rocks beneath the subject property based on water level data for June 2018. Furthermore, this percentage does not include annual groundwater recharge that will occur from rainfall into the onsite aquifers. Based on the foregoing, the estimated groundwater demands of the proposed project and the entire subject property should are not expected to cause a net deficit in the volume of groundwater within the aquifers beneath the property so as to impact nearby wells to a point that they would not support permitted land uses.

Possible Effects of "Prolonged Drought"

California has experienced a number of periods of extended drought throughout its history. Here, drought is defined as a meteorological drought, that is, a period in which the total annual precipitation is less than the long-term average annual precipitation (DWR 2015). For similar projects in the County, Napa County PBES has asked RCS to consider what the effects on groundwater availability at a particular property might be if a period of "prolonged drought" were to occur in the region, assuming the project were to operate in the future as described herein. Recharge volumes estimated in this document are based on the long-term average rainfall value determined for the subject property using available data. Recall that a calculation of average annual rainfall for any long-term period always includes periods of below-average rainfall and above-average rainfall that occurred during the period over which the average was calculated. Therefore, it is our opinion that the preceding calculations do inherently include consideration of drought year conditions.

However, to help understand what potential conditions might exist in the local volcanic rocks beneath the property during a "prolonged drought period", a "prolonged drought" must be defined. As discussed by DWR, "there is no universal definition of when a drought begins or ends, nor is there a state statutory process for defining or declaring drought" (DWR 2015). California's most significant historical statewide droughts were defined by DWR as occurring during the following periods (DWR 2015):

- WY 1928-29 through WY1933-34 – six years
- WY 1975-76 through WY 1976-77 – two years
- WY 1986-87 through WY 1991-92 – six years
- WY 2006-07 through WY 2008-09 – three years
- Recent drought – WY 2011-12 through WY 2015-16[5] – five years

[5] The DWR 2015 drought document was published in February 2015, and lists the recent significant drought through the 2013-14 water year only; the drought continued throughout the State into WY 2015-16. Due to rains in WY 2016-17, various sources, including the National Drought Mitigation Center website (NDMC 2018), declared an end to the drought in Northern California in 2017, which included Napa County. As of November 27, 2018, the area of Napa County in which the subject property lies, is currently mapped as "moderate drought."

Table 4, "Drought Period Rainfall as Percentage of Average," shows the average amount of rainfall that occurred during each drought period for which rainfall data exist at the three rain gages discussed above and shown on Table 4; that drought period rainfall amount is also expressed on Table 4 as a percentage of the total rainfall that occurred. As shown on Table 4, determining the amount of rain that might fall during a "prolonged drought" is variable, and depends on the period of record for the specific rain gage. Clearly, the WY 1975-76 to WY 1976-77 drought period recorded by the Napa State Hospital rain gage and reported by the WRCC had the lowest total rainfall at 48% (drought period average was 11.8 inches), compared to the long-term average (24.7 inches), and that specific drought lasted two years. The WY 1928-29 to WY 1933-34 drought period lasted for six years, but rainfall during this drought was 70% of the average annual rainfall at the WRCC rain gage. It is important to note that the drought year percentage listed on Table 4 is completely dependent on the period of record for each individual gage. An example of this is the Napa One Rain gage data; because the period of record for these two gages is short, and includes many drought years, then the last available drought year period (WY 2011-12 to WY 2015-16) rainfall percentage is shown to be between 67% and 82% of the long-term average.

Hence, for the purposes of this analysis, a "prolonged" drought period rainfall is conservatively considered to be 48% of the average annual rainfall that occurred in the region (using the rainfall data from the WRCC Napa State Hospital rain gage). Further, to again be conservative, a "prolonged drought period" is estimated to last 6 years, which is the longest drought period on record according to DWR (DWR 2015); see Table 4. This six-year period is a conservative estimate, because the 48%-average figure corresponds with a two-year drought period, not a six-year drought period.

To meet six years of proposed groundwater demand for the proposed project, a total onsite groundwater extraction of 55.5 AF is estimated to be required for the subject property (9.25 AF/yr times 6 years). Assuming groundwater recharge is reduced to 48% of the average annual recharge during such a theoretical "prolonged drought period", then the resulting total of groundwater recharge that might occur during the six-year drought period for the subject property is calculated as follows:

- As shown herein under the heading "Estimate of Groundwater Recharge," a conservative estimate of the average annual groundwater recharge on the subject property is estimated to be 9.86 AF/yr. Taking 48% of this annual volume yields a drought period recharge volume of 4.73 AF/yr.
- Assuming a drought period duration of 6 continuous years, then a total of 28.38 AF (4.73 AF/yr times 6 years) of water would be available to recharge the volcanic rocks beneath the property by virtue of deep percolation of the direct rainfall that occurs solely within the boundaries of the subject property.

Therefore, assuming a theoretical six-year drought period during which only 48% of the average annual rainfall might occur, a conservative estimate of the total drought-period recharge at the subject property (28.38 AF) would be less than the estimate of the total onsite groundwater demand (55.5 AF) that may occur over the same six-year period. With those estimated water demands, there would theoretically be a total recharge "deficit" of 27.12 AF that might occur (calculated by subtracting the 28.38 AF of groundwater recharge over the entire six years from 55.5 AF of total onsite groundwater extractions over the entire 6-year period). Water to meet this theoretical deficit would be (and is) available during drought periods from the approximately 140.4 AF of groundwater conservatively estimated to be in storage (as of June 2018) beneath the subject property. Hence, the theoretical six-year long drought period groundwater "recharge deficit" of 27.12 AF would represent about 19% of that volume of groundwater in storage. Temporarily removing an average of 4.52 AF of groundwater from storage every year (27.12 AF of "deficit" over the entire 6-year period) may cause water levels to decrease slightly beneath the subject property, but removal of such a relatively small percentage of groundwater from storage over an entire 6-year period of time is not expected to significantly impact groundwater levels beneath the property. Recharge that occurs during periods of average rainfall would then recharge the aquifers. Again, this drought analysis is quite conservative, and assumes very extreme drought (48% of average rainfall occurring every year for six consecutive years).

Groundwater Quality

Samples of groundwater were collected by Doshier-Gregson following their October 2012 testing of the Onsite Well and submitted to two separate laboratories to be analyzed for specific analytes. Results of this sampling revealed that total coliform and fecal coliform (E.coli), which were analyzed by Caltest Laboratory of Napa, California, were both absent in the sample. Additionally, BC Laboratories, of Fresno, California, analyzed the samples for total recoverable arsenic and total recoverable lead and found both constituents were not detected in the samples submitted to the laboratory. No other groundwater quality data are available for the Onsite Well.

Key Conclusions and Recommendations

1. The existing property is currently developed with 0.9 acres of vineyards and one residence (with associated minor landscaping) and a pool.
2. The proposed project consists of developing an additional 16 acres of vines bringing the total proposed onsite planted vineyard area to 16.9 acres.
3. Current groundwater demands for the existing property are estimated to be approximately 1.25 AF/yr. This demand includes 0.80 AF/yr for the existing residence (and pool) and 0.45 AF/yr for vineyard irrigation.
4. The future average annual groundwater demand for the proposed project (including the existing residence, pool, existing 0.9 acres of vines, and 16 acres of new vines) is estimated to be approximately 9.25 AF/yr.
5. All existing (and future) water demands for the proposed project will be met by pumping groundwater from the Onsite Well.
6. To meet the estimated peak pumping rate for the project each year, the Onsite Well would need to pump at a rate of about 35 gpm to meet the irrigation demands during the assumed 4-month irrigation season pumping 12 hours per day, every day.
7. Based on the results of the separate constant rate pumping tests of the Onsite Well in October 2012 and February 2017, the Onsite Well appears to be more than capable of pumping at rates needed to meet the future groundwater demands of the project (35 gpm is the peak pumping rate needed each irrigation season). Data generated from the pumping test performed in February 2017 suggest the pumping capacity of the Onsite Well is on the order of 54 gpm. Additionally, pumping water

DRAFT
MEMORANDUM

levels appeared to be stable during the February 2017 pumping test by others; the maximum water level drawdown during that test was only 3.3 ft.

8. Groundwater recharge at the subject property on an average annual basis is estimated to be 9.86 AF/yr; this value is based on conservative estimates of the average annual rainfall at the property (32.7 inches per year) and conservative estimates of average rainfall that could be available to deep percolate into the fractures and jointed rocks of the Sonoma Volcanics that underlie the subject property.

9. Conservative estimates of recharge that may occur during a "prolonged drought" (as defined herein) show that, over a theoretical six-year period of continuous drought in which only 48% of the average annual rainfall might occur, a total of 28.23 AF of rainfall recharge is estimated to occur strictly within the boundaries of the subject property. This theoretical drought period recharge estimate of 28.23 AF is less than the estimated groundwater of the proposed project of 55.5 AF for the same continuous six-year period. In this scenario, about 19% of groundwater currently estimated to be in storage beneath the subject property would be utilized over that entire six-year period of continuous drought. Rainfall recharge during years of average and above-average rainfall would then replenish groundwater in storage that is used to meet the groundwater demand of the entire property during a theoretical 6-year drought.

10. In the future, RCS recommends monitoring on a regular basis of static and pumping water levels, and also of the instantaneous flow rates and cumulative pumped volumes from the Onsite Well via the use of a water level pressure transducer and the proper installation of a dual-reading flow meter near the wellhead (that records both flow rate and totalizing values, respectively). RCS also recommends that a new water level transducer be purchased and installed in the Onsite Well to permit the automatic, frequent, and accurate recording of water levels in this well. By continuing to observe the trends in groundwater levels and future well production rates/volumes over time by qualified professionals, potential declines in water levels and well production in the Onsite Well can be addressed in a timely manner.

DRAFT
MEMORANDUM

References

- **(CGS 2004)** Clahan, Wagner, et al., 2004. Geologic Map of the Napa 7.5' Quadrangle, Napa County, California: A Digital Database, California Geologic Survey.
- **(CGS 2004)** Bezore, Sowers, et al., 2004. Geologic Map of the Mt. George 7.5' Quadrangle, Napa and Solano Counties, California: A Digital Database, California Geologic Survey.
- **(CGS 2005)** Bezore, Clahan, et al., 2005. Geologic Map of the Yountville 7.5' Quadrangle, Napa County, California: A Digital Database, California Geologic Survey.
- **(CGS 2006)** Delattre, Sowers, et al., 2006. Geologic Map of the Capell Valley 7.5' Quadrangle, Napa County, California: A Digital Database, California Geologic Survey
- **(DWR 2015)** Jones, Jeanine, et al., February 2015. California's Most Significant Droughts: Comparing Historical and Recent Conditions, California Department of Water Resources
- **(LSCE&MBK 2013)** Luhdorff & Scalmanini Consulting Engineers and MBK Engineers, January 2013. Updated Hydrogeologic Conceptualization and Characterization of Conditions, Prepared for Napa County.
- **(WAA 2015)** Napa County Board of Supervisors, Adopted May 12, 2015. Water Availability Analysis (WAA) – Guidance Document.

Websites

- Napa County GIS database, 2018; https://gis.napa.ca.gov
- Earth Explorer, USGS, 2018; https://earthexplorer.usgs.gov
- Quaternary Fault and Fold Database of the United States, USGS, 2018; https://earthquake.usgs.gov/hazards/qfaults
- Napa One Rain, 2018; https://napa.onerain.com
- Western Regional Climate Center, 2018; https://www.wrcc.dri.edu
- PRISM Climate Group, Oregon State University, 2015; https://prism.oregonstate.edu
- (NDMC 2018) National Drought Mitigation Center website, 2018; http://drought.unl.edu

Figure 1
Location Map

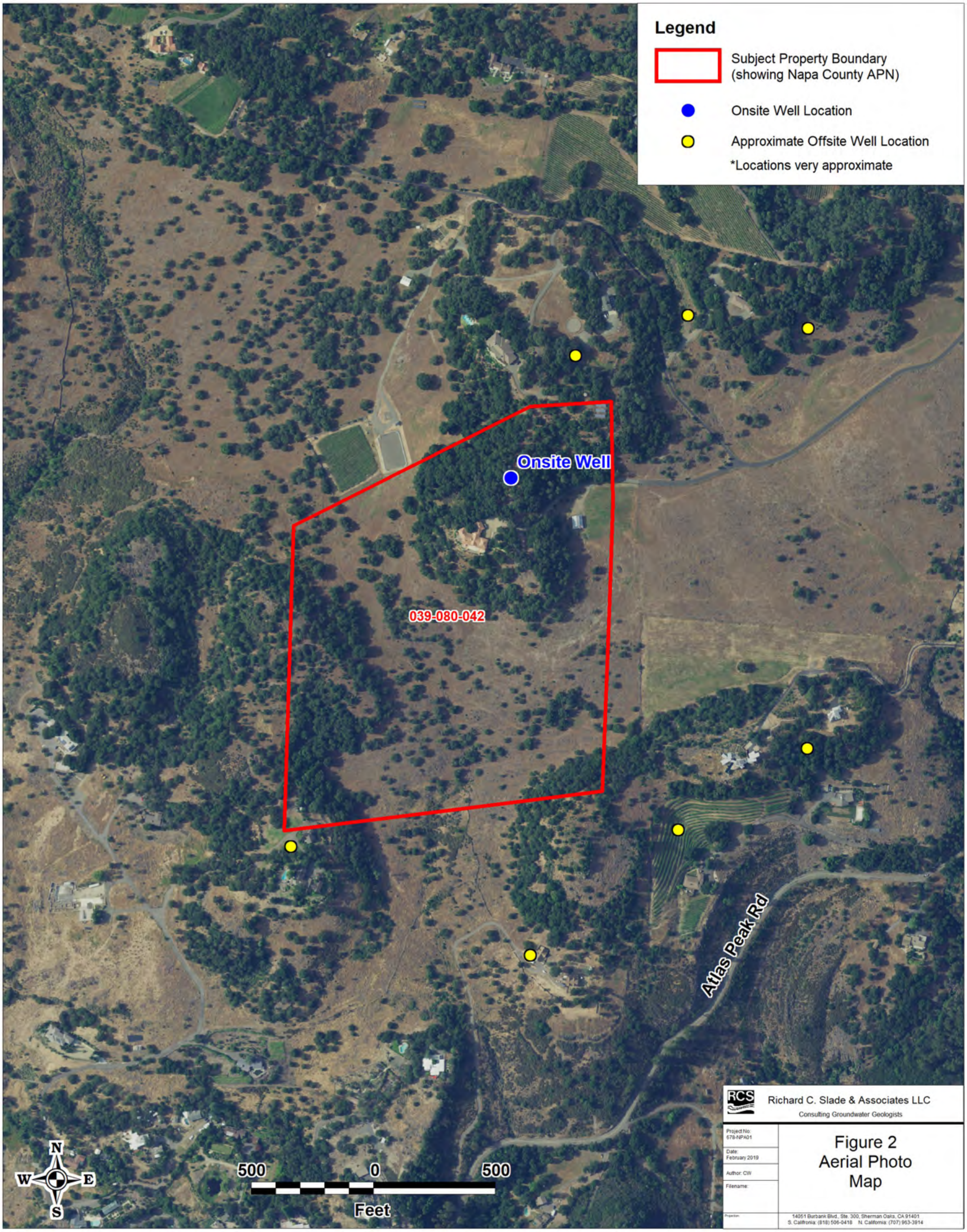
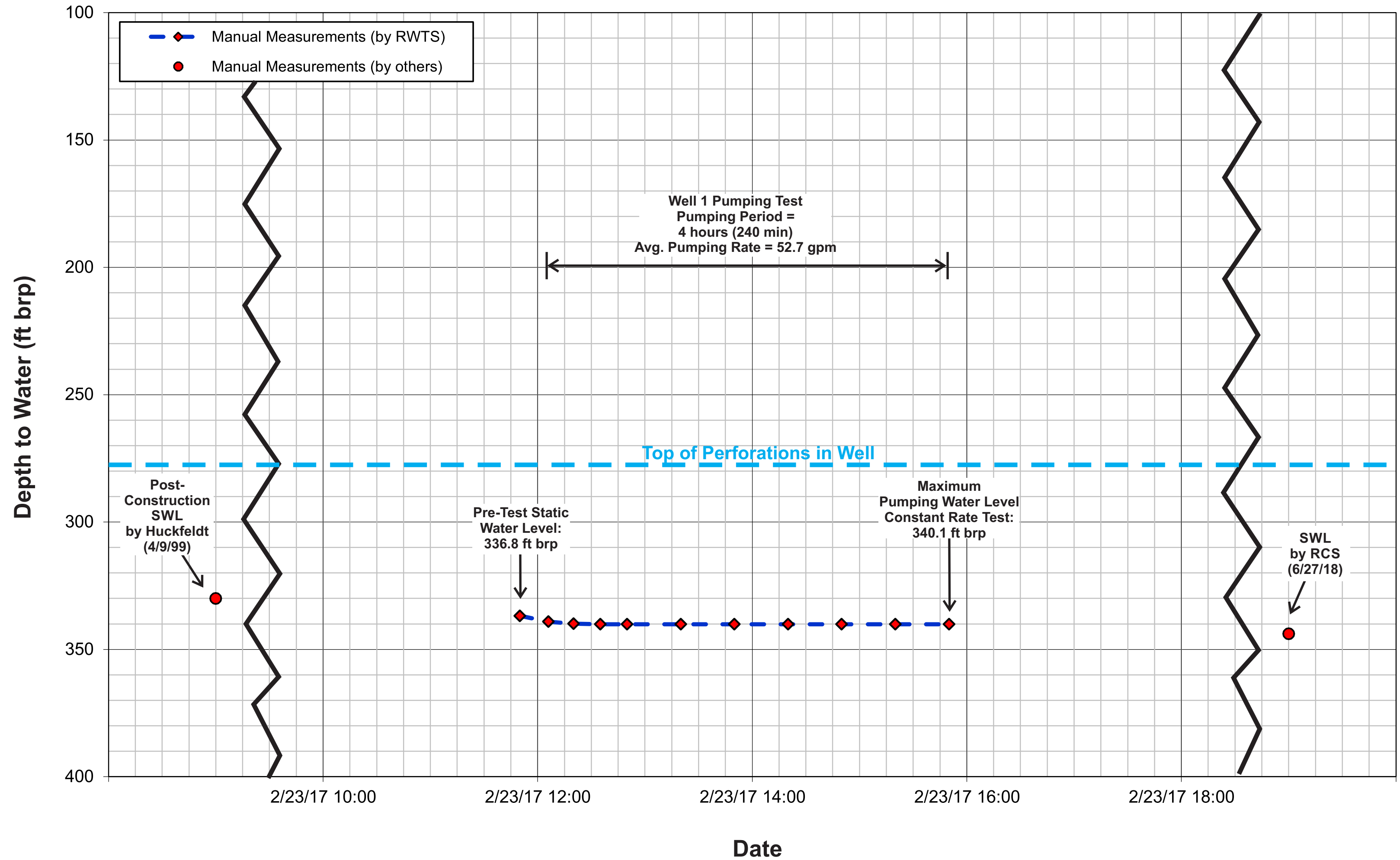


Figure 2
Aerial Photo
Map

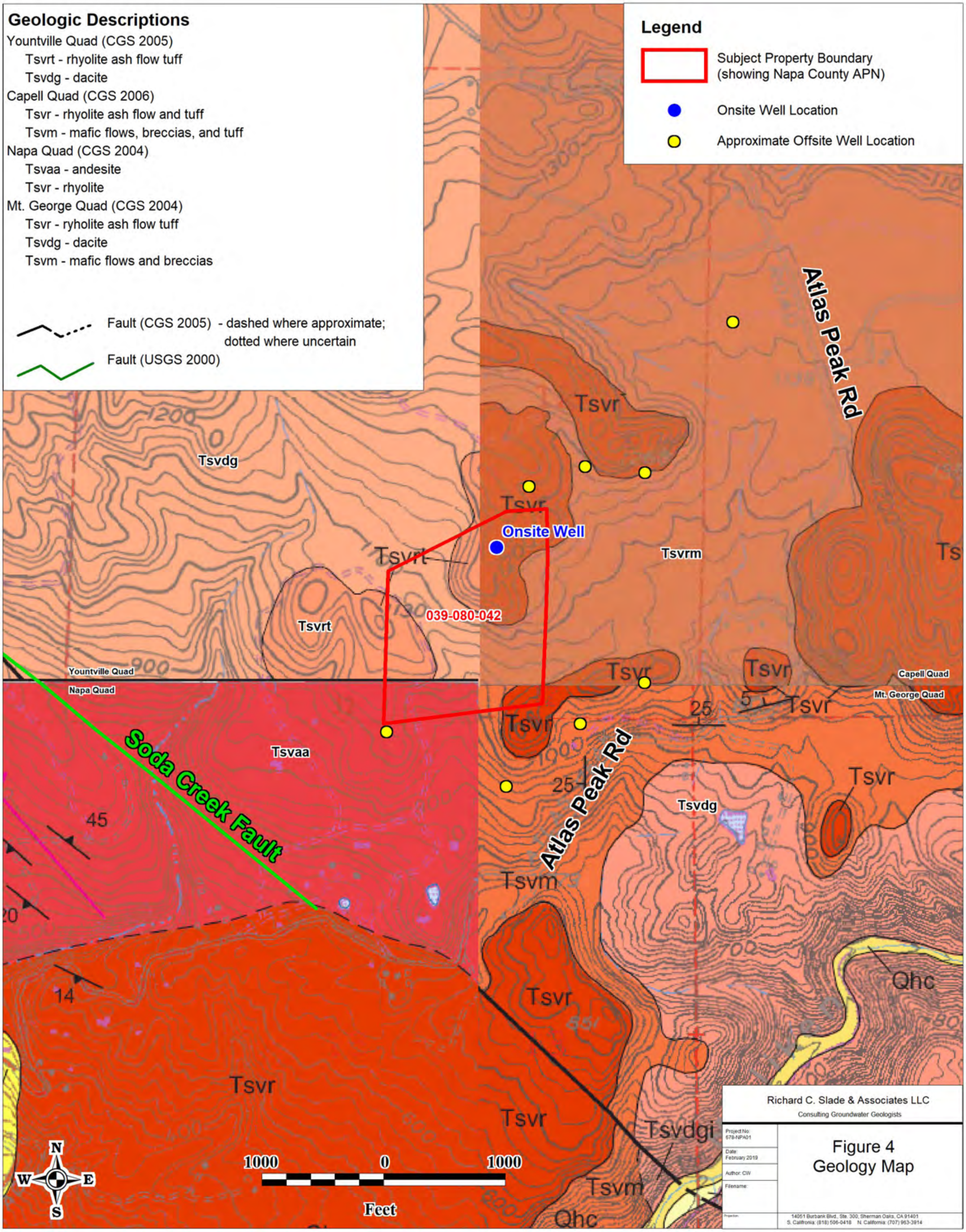


RCS

RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS
14051 Burbank Boulevard, Ste. 300
Sherman Oaks, CA 91401
Southern California (818) 506-0418
Northern California (707) 963-3914
www.rcslade.com

FIGURE 3
WATER LEVELS DURING FEBRUARY 2017 PUMPING TEST BY OTHERS
ONSITE WELL
HESS PERSSON

Job No. 678-NPA01 **February 2019**



Geologic Descriptions
Yountville Quad (CGS 2005)
Tsvrt - rhyolite ash flow tuff
Tsvdg - dacite
Capell Quad (CGS 2006)
Tsvr - rhyolite ash flow and tuff
Tsvm - mafic flows, breccias, and tuff
Napa Quad (CGS 2004)
Tsvaa - andesite
Tsvr - rhyolite
Mt. George Quad (CGS 2004)
Tsvr - ryholite ash flow tuff
Tsvdg - dacite
Tsvm - mafic flows and breccias
Fault (CGS 2005) - dashed where approximate; dotted where uncertain
Fault (USGS 2000)
Legend
Subject Property Boundary (showing Napa County APN)
Onsite Well Location
Approximate Offsite Well Location
Atlas Peak Rd
Tsvr
Tsvdg
Onsite Well
Tsvrm
Tsvrt
039-080-042
Yountville Quad
Napa Quad
Capell Quad
Mt. George Quad
Soda Creek Fault
Tsvaa
Tsvm
Qhc
Tsvdgi
1000
0
1000
Feet
N
S
W
E
Richard C. Slade & Associates LLC
Consulting Groundwater Geologists
Project No: 678-NPA01
Date: February 2019
Author: CW
Filename:
Figure 4
Geology Map
14051 Burbank Blvd., Ste. 300, Sherman Oaks, CA 91401
S. California: (818) 506-0418 N. California: (707) 963-3914

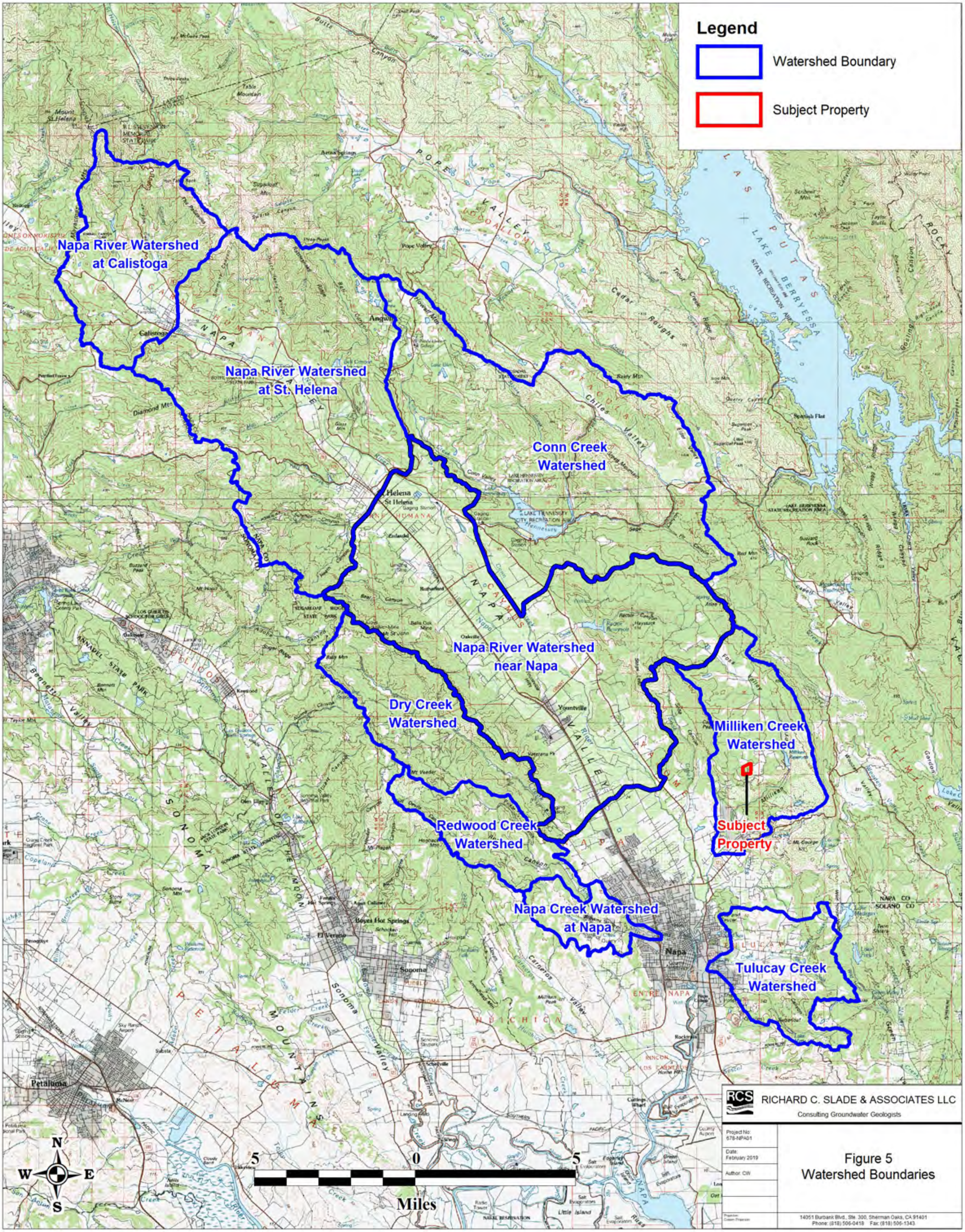


Figure 5
Watershed Boundaries

Table 1
Summary of Well Construction and Pumping Data
Hess Persson Property

Reported Well Designation	DWR Well Log No.	Date Drilled	Method of Drilling	Pilot Hole Depth (ft bgs)	Casing Depth (ft bgs)	Casing Type	Casing Diameter (in)	Borehole Diameter (in)	Sanitary Seal Depth (ft bgs)	Perforation Intervals (ft bgs)	Type and Size (in) of Perforations	Gravel Pack Interval (ft) and Size	Current Status of Well	Post-Construction Yield Data					
														Date & Type of Yield Data	Duration of "Test" (hrs)	Estimated Flow Rate (gpm)	Static Water Level (ft)	Pumping Water Level (ft)	Estimated Specific Capacity (gpm/ft ddn)
Onsite Well	823010	April 1999	Direct Air Rotary	520	518	PVC	6	9	0-20 (concrete) 20-22 (bentonite)	278-298 418-518	Factory-cut 0.032"	22-518 Pea Gravel	Active	4/9/99 Airlift	2	90	330	ND	ND
														10/30/12 Pump	4	44	ND	ND	ND
														2/23/17 Pump	4	54	336.8	340.1	16.4

Notes: ft bgs = feet below ground surface
SWL = static water level
brp = below reference point, generally top of well head
ND = no data available
Approximate pump depth setting = ±440 ft bgs (per records produced by Doshier-Gregson).

Table 2
Groundwater Use Estimates
Hess Persson

Groundwater Use	Estimated Groundwater Use (acre-feet/year)[1]	
	Existing	Future
Residential Groundwater Use		
Existing Residence[2]	0.75	0.75
Existing Pool	0.05	0.05
Total Residential Groundwater Use	**0.80**	**0.80**
Irrigation Groundwater Use		
Vineyard - Existing 0.9 acres	0.45	0.45
Vineyard - Proposed 16.0 acres	---	7.95
Total Irrigation Groundwater Use	**0.45**	**8.45**
Total Combined Groundwater Use (Irrigation + Residential)	**1.25**	**9.25**

Notes:
[1]Estimates based on Napa County Water Availability Analysis Guidance Document (WAA 2015)
[2]The existing residential water demand also includes irrigation water for minor landscaping.

1 acre-foot = 325,851 gallons

Table 3
Comparison of Rainfall Data Sources
Hess Persson Property

Rain Gage and/or Data Source	Years of Available Rainfall Record	Average Annual Rainfall in Inches (ft)	Elevation of Rain Gage (ft asl)	Distance of Rain Gage from Subject Property (mi)	Elevation Relative to Subject Property(1)
Napa One Rain Milliken Reservoir	WY 2000-01 through WY 2017-18(2) (18 years)	23.5 (1.96)	830	1.0	Lower
Napa One Rain Mt. George	WY 2000-01 through WY 2017-18(3) (18 years)	24.9 (2.08)	1,420	3.3	Higher
WRCC Napa State Hospital	January 1983 through September 2018(4) (35 years)	24.7 (2.06)	60	7.0	Lower
PRISM Climate Group	1981 to 2010 (29 years)	32.7 (2.73)	Site Specific - Countywide Coverage	---	---
Napa County Isohyetal Map	1900 to 1960 (60 years)	34.0 (2.83)	---	---	---

Notes:

1. The subject property is located at an elevation between ±970 and ±1,240 ft asl
2. There is missing data from March 28 to August 28, 2013.
3. There is missing data from August 9 to September 31, 2018.
4. Several months and/or years of rainfall data missing between 1897 and 1902, and between 1915 and 1916.

Table 4
Drought Period Rainfall as Percentage of Average

Statewide Drought Period as Defined by DWR (DWR 2005)	Drought Duration (years)	Average Rainfall by Raingage								
		Napa Hospital Raingage, WRCC Period of Record - 1893 through 2018			Milliken Reservoir, Napa One Rain Period of Record - WY 2000-01 through WY 2017-18			Mt. George, Napa One Rain Period of Record - WY 2000-01 through WY 2017-18		
		[A] Total Gage Average (in)	[B] Drought Period Ave. (in)	[B÷A] Drought Period Rainfall as % of Average	[C] Total Gage Average (in)	[D] Drought Period Ave. (in)	[D÷E] Drought Period Rainfall as % of Average	[E] Total Gage Average (in)	[F] Drought Period Ave. (in)	[F÷E] Drought Period Rainfall as % of Average
WY 1928-29 to WY 1933-34	6	24.7	17.3	70%	ND	ND	ND	ND	ND	ND
WY 1975-76 to WY 1976-77	2	24.7	11.8	48%	ND	ND	ND	ND	ND	ND
WY 1986-87 to WY 1991-92	6	24.7	18.5	75%	ND	ND	ND	ND	ND	ND
WY 2006-07 to WY 2008-09	3	24.7	18.8	76%	23.5	17.9	76%	24.9	18.9	76%
WY 2011-12 to WY 2015-16	5	24.7	21.0	85%	23.5	15.8	67%	24.9	20.3	82%

ND = No rainfall data avaialble for the corresponding drought period.

Table 5
Summary of Limited Groundwater Quality Data
Hess Persson

Constituent Analyzed	Units	Maximum Contaminant Level	Onsite Well
		Date of Samples:	**10/30/2012**
General Physical Constituents			
Specific Conductance	µmhos/cm	900; 1,600; 2,200[(1)]	NA
pH	units	6.5 to 8.5	NA
Turbidity	NTU	5	NA
Sodium Absorption Ratio (SAR)	units	None	NA
General Mineral Constituents			
Total Dissolved Solids	mg/L	500; 1,000; 1,500[(1)]	NA
Total Hardness		None	NA
Alkalinity (Total) as $CaCO_3$		None	NA
Bicarbonate		None	NA
Calcium		None	NA
Magnesium		None	NA
Sodium		None	NA
Sulfate		250, 500, 600[(1)]	NA
Chloride		250, 500, 600[(1)]	NA
Fluoride		2	NA
Silica (as SiO_2)		None	NA
Nitrate (as N)		45	NA
Nitrite (as N)		1	NA
Detected Inorganic Constituents (Trace Elements)			
Arsenic	µg/L	10	<2.0
Barium		1000	NA
Iron		300	NA
Lead		15	<1.0
Manganese		50	NA
Zinc		5000	NA

Notes:

(1) The three listed numbers represent the recommended, upper and short-term State Maximum Contaminant Levels for the constituent.

µmhos/cm = micromhos per centimeter; NTU = nephelometric turbidity unit; mg/L = milligrams per liter; µg/L = micrograms per liter

ND = constituent not detected or below reporting detection limit

Constituents that exceed State MCLs for water used for domestic purposes at listed in **BOLD**.

APPENDIX
CALIFORNIA
DEPARTMENT OF WATER RESOURCES
WELL COMPLETION REPORTS (DRILLER'S LOGS)

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No.

Date Work Began 4-1-99, Ended 4-9-99

Local Permit Agency Napa County Environmental Mgmt.

Permit No. 96-10972 Permit Date 3-8-99

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 823010

DWR USE ONLY — DO NOT FILL IN

06N03W07

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

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

DRILLING METHOD rotary air FLUID

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	40	brown clay
40	75	gray volcanics
75	120	soft volcanic ash
120	270	gray & black volcanics
270	320	mixed volcanics
320	350	black volcanics
350	440	gray & red volcanics
440	520	hard black volcanics

TOTAL DEPTH OF BORING 520 (Feet)

TOTAL DEPTH OF COMPLETED WELL 518 (Feet)

WELL OWNER

N

M

Ci

WELL LOCATION

Address same

City

County Napa

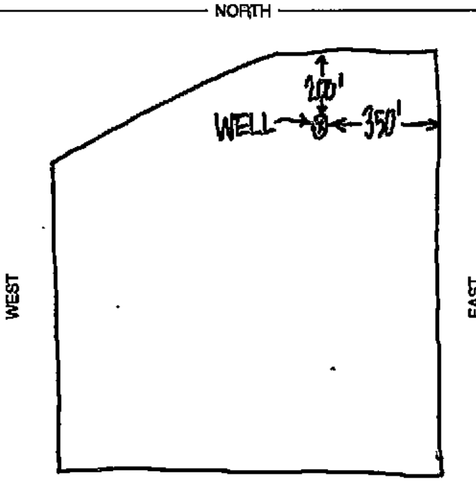
APN Book 39 Page 080 Parcel 42

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)

X 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 200 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 330 (Ft.) & DATE MEASURED 4-9-99

ESTIMATED YIELD * 90 (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	25	12½								
25	520	9								
0	278		X				PVC-F480	6"	SDR-21	
278	298			X			PVC-F480	6"	SDR-21	.032
298	418		X				PVC-F480	6"	SDR-21	
418	518			X			PVC-F480	6"	SDR-21	.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			concrete
20	22		X		chips
22	518			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 Napa CA 94558
ADDRESS CITY STATE ZIP

Signed [signature] 4-12-99 439-746
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