MEMORANDUM

February 18, 2020

To: Taylor Berkley Boydstun
Berkley Wines
Sent via email (taylor@tberkleywines.com)

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

Job No. 706-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
New Vineyard Development
Teachworth Winery
County APNs 020-400-018 & 020-400-019
4451 St Helena Highway
Vicinity Calistoga, 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 Teachworth Winery property in Napa County (County), California. This document was prepared for the property owner to provide hydrogeologic analyses that are in conformance with County Tier 1 requirements, as described in the County WAA Guidelines (WAA, 2015).

The Teachworth Winery property (referred to herein as the subject property) is comprised of two parcels with a combined area of 76.8 acres and is located at 4451 St Helena Highway, in Calistoga, California. Figure 1, "Location Map," shows the approximate parcel boundaries of the subject property in question, superimposed on a topographic base map of the area. The property boundaries shown on Figure 1 were adapted from parcel boundary data provided by Terra Firma Surveys Inc. (TFI) of St. Helena, California, and reflect a recent lot line adjustment between the two parcels. Also shown on Figure 1 are the locations of the four existing onsite water wells (Well Nos. 1 through 4), and the locations of nearby but offsite wells owned by others. Figure 2, "Aerial Photo Map," shows the same property boundaries and well locations that are illustrated on Figure 1, but the base map for Figure 2 is an aerial photograph of the area; this aerial photograph was obtained via the ArcGIS Pro software package. Note that the locations of the wells shown on Figures 1 and 2 are approximate only, due to registration (alignment) issues with the imagery. Further, the locations of the nearby offsite wells owned by others shown on those two figures are

MEMORANDUM

not all inclusive; that is, additional wells owned by others on nearby properties may also exist at locations unknown to RCS.

As reported by the winery manager, Mr. Taylor Boydstun, the 76.8-acre subject property is currently developed with 1 acre of existing vineyards, 0.5 acres of landscaping, residences, and a winery which has an existing permitted production of 5,000 gallons of wine per year. Domestic and/or irrigation water demands for the existing residences, vineyard, landscaping and winery at the subject property have historically been met by pumping groundwater from the existing onsite Well Nos. 1 through 4. Currently, Well Nos. 2 and 3 are used to meet the water demands for the vineyard, the landscaping, and the primary and secondary residences located on Assessor's Parcel Number (APN) 020-400-018. This is because Well No. 1 was taken out of service due to issues with dissolved iron in its pumped groundwater. Well No. 4 is used to meet the water demands for the residence on APN 020-400-019 only.

RCS understands the proposed project is to develop 4.5 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 Nos. 2 and 3.

As part of the permit submittal for the proposed new vineyard project, a Water Availability Analysis (WAA) is required by the County. The purpose of this Memorandum is to comply with the 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 Well Nos. 2 and 3 (the project wells), 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 5, 2019, the following key items were noted and/or observed (refer to Figures 1 and 2):

a. The Teachworth property is comprised of two parcels having County APNs of 020-400-018 and 020-400-019. These parcels are referred to herein as the "subject property." The total assessed area of the subject property, per the assessor's records, is 76.8 acres.

b. The subject property is located in the hills on the western side of Napa Valley, and due south of the intersection of Dunaweal Lane and the St Helena Highway. Topographically, the property is comprised by four ridges, three of which slope toward the northwest corner of the property, whereas the fourth hillside slopes toward the northeast. The primary residence is located on a relatively flat ridge formed by this latter hillside. Based on the topographic contours, surface water runoff from direct rainfall would drain in a generally northward direction across the property (see Figure 1)

c. An ephemeral, unnamed drainage was observed on the subject property; it traverses from the south-southeast to the north-northwest within the central portion of APN 020-400-019. This drainage was observed to be flowing during our site visit in June 2019. This drainage is reportedly not perennial; instead, it is an ephemeral drainage and would contain surface water runoff only during or immediately after a rainfall event.

(Note, the CDEC St. Helena -4SW rain gage shows a rainfall of approximately 5 inches between May 15 and May 21, 2019.)

d. Developments on the subject property currently consist of a winery, two primary residences, a secondary residence, approximately 0.5 acres of existing landscaping, and approximately 1.0 acres of existing vineyards.

e. Offsite areas surrounding the subject property consist of residences, vineyard areas, and abundant undeveloped native vegetation, as seen on Figure 2.

f. As shown on Figures 1 and 2, the existing onsite water wells are located in the northern and central portions of the subject property, as follows: Well No. 1 is located adjacent to the primary residence on APN 020-400-018; Well No. 2 is located adjacent to the existing vineyard on APN 020-400-018; Well No. 3 lies adjacent to the existing winery on APN 020-400-019; and Well No. 4 is located adjacent to the primary residence that lies on the parcel with APN 020-400-019. Currently, Well Nos. 2 and 3 are used to fill two water tanks (referred to herein as the “upper tank” and “lower tank”) on APN 020-400-018, and are used to meet the demands of the following: the primary and secondary residences on APN 020-400-018; the winery; and the existing vineyards and landscaping. Well No. 4 supplies water only to the primary residence on APN 020-400-019. According to the winery manager, Well No. 1 has not been pumped for approximately 15 years due to high dissolved iron issues in its pumped groundwater.

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 obvious locations and/or existence of nearby but offsite wells owned by others.

   RCS geologists contacted the 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 within a 500-foot radius of Well Nos. 2 and 3. The offsite wells that were readily observed during our field visit (see Figures 1 and 2) are possibly not the only ones that exist in these areas; additional privately-owned wells may also exist.

Key Construction and Testing Data for Existing Onsite Wells

A DWR Well Completion Report is available for each of the existing onsite wells and are represented by Log No. 445163 (Well No. 1), Log No. 700057 (Well No. 2), Log No. 819555 (Well No. 3), and Log No. 737012 (Well No. 4); copies of these driller’s logs are appended to this Memorandum. Table 1, “Summary of Well Construction and Pumping Data,” provides a tabulation of key well construction data, driller-estimated airlift flow rates, and the very limited pumping data that are available for the onsite wells.

DRAFT
MEMORANDUM

Well Construction Data

Key data listed on the available driller's logs and/or identified for each well during our site visit are as follows:

Well No. 1:

a. This well was drilled and constructed in March through May 1996 by Larry Herman Drilling (LHD) of Lower Lake, 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 790 feet (ft) below ground surface (bgs).

c. The borehole was cased with steel well casing having a nominal diameter of 6 inches; the total casing depth of the well is reported to be 640 ft bgs.

d. Casing perforations have a slot opening width of 0.125 inches and were placed continuously between 480 and 620 ft bgs.

e. The gravel pack material listed on the driller's log for Well No. 1 is reported to be 5/16-inch pea gravel; this gravel was placed between the depths of 22 and 640 ft bgs.

f. Well No. 1 is reportedly constructed with a sanitary seal consisting of cement from ground surface to 22 ft bgs.

Well No. 2:

a) This well was drilled and constructed in November 1998 by A&K Drilling (A&K) of Petaluma, California, using the direct air rotary method.

b) The pilot hole was reported to have been drilled to a depth of 530 ft bgs.

c) The borehole was cased with polyvinyl chloride (PVC) well casing having a nominal diameter of 5 inches; the total casing depth is reported to be 530 ft bgs.

d) Casing perforations are factory-cut slots, with a slot opening width of 0.032 inches (32-slot); perforations were placed continuously between 330 and 530 ft bgs.

e) The gravel pack material listed on the driller's log is reported to be "gravel," and was placed between the depths of 50 and 530 ft bgs.

f) The sanitary seal, consisting of "grout", was set from ground surface to 50 ft bgs.

Well No. 3:

a. This well was drilled and constructed in December 2000 by A&K; the method of drilling Well No. 3 was not listed on the driller's log.

b. The pilot hole was reported to have been drilled to a depth of 495 bgs.

c. The borehole was cased with PVC well casing having a nominal diameter of 5 inches; the total casing depth of the well is reported to be 435 ft bgs.

d. Casing perforations for the well are factory-cut slots, with a slot opening width of 0.032 inches (32-slot). Perforations in this well were placed continuously between 235 and 435 ft bgs.

e. The gravel pack material listed on the driller's log for Well No. 3 is reported to be "gravel," and this material was placed from 20 to 435 ft bgs.

f. The sanitary seal, consisting of cement, was set from ground surface to 20 ft bgs.

Well No. 4:

a. This well was drilled and constructed in August and September 2001 by D. Bess Pump & Well (D. Bess) of Napa, California, using direct mud rotary method.

b. The pilot hole was reported to have been drilled to a depth of 484 bgs.

c. The borehole was cased with PVC well casing having a nominal diameter of 5 inches; the total casing depth of the well is reported to be 470 ft bgs.

d. Casing perforations for the well are factory-cut slots, with a slot opening width of 0.032 inches (32-slot). Perforations were placed continuously between 310 and 465 ft bgs.

e. The gravel pack material listed on the driller's log is reported to be 3/8-inch pea gravel and was placed from 23 to 465 ft bgs.

f. Well No. 4 is reportedly constructed with a cement sanitary seal that was set from ground surface to 23 ft bgs.

Summary of Initial "Test" Data for Onsite Wells

The driller's logs for the four onsite wells provided the depth to the original post-construction static water level (SWL) and the original airlift flow rate in each well (see Table 1), as follows:

Well No. 1:

- The initial SWL, following completion of well construction, was at a depth of 300 ft bgs in May 1996.
- The reported maximum airlift flow rate during initial post-construction airlifting operation in the well was estimated by the driller to be 20 gallons per minute (gpm) during 4 hours of intermittent airlifting. 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.

Well No. 2:

- The initial SWL, following completion of well construction, was reported to be 290 ft bgs in 1998.
- The reported maximum airlift flow rate during initial post-construction airlifting operations was estimated by the driller to be 18 gpm during 5 hours of intermittent airlifting.

Well No. 3:

- The initial SWL, following completion of well construction, was reported to be 200 ft bgs in 2000.
- The reported maximum airlift flow rate during initial post-construction airlifting operations was estimated by the driller to be 30 gpm during 6 hours of intermittent airlifting.

Well No. 4:

- The initial SWL, following completion of well construction, was reported to be 370 ft bgs in 2001.
- The reported maximum airlift flow rate during initial post-construction airlifting operations was estimated by the driller to be 60 gpm during 2.5 hours of intermittent airlifting.

It should be noted that short-term water level drawdowns for each well cannot be determined because airlift operations do not allow a "pumping level" to be measured. Water level drawdown represents the vertical distance, in feet, between the static (non-pumping) water level and the pumping water level created in a specific well while pumping at any rate. Thus, the original specific capacity[1] value for each well following its construction cannot be calculated for any of the onsite wells.

To our knowledge, no historical, long-term pumping test data are available for the existing onsite wells. Anderson Pump & Well (Anderson) of Petaluma, California is the pumping contractor for the existing onsite wells, and Anderson provided RCS with information regarding the design rates of the permanent pumps installed in the onsite wells. Anderson reported the design rate (in gpm) and depth setting (in feet) for the pumps at the time of pump installation in each of the onsite wells as follows: 10 gpm for Well No. 1 (depth setting unknown); 10 gpm for Well No. 2 at a depth of 275 ft; 25 gpm Well No. 3 at a depth of 260 ft bgs; and 25 gpm for Well No. 4 at depth of 420 ft. Note, that these rates are not necessarily considered to be current operational pumping rates for these wells; current, measured operational pumping rates for the onsite wells are unknown.

Well Data from Site Visit

As discussed above, a site visit to the subject property was performed by an RCS geologist on June 5, 2019. The following information for Well Nos. 1 through 4 was collected from that site visit:

- Well No. 1 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 311.83 ft below reference point (brp) was measured by the RCS geologist while the pump was shut off. This SWL is roughly 11 ft shallower than the 300-foot SWL depth reported by LHD at the May 1996 date of construction of this well.
- Well No. 2 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 284.9 ft brp was measured by the RCS geologist while the pump was shut off. This SWL is roughly 5 ft shallower than

[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.

the 290-foot SWL depth reported by A&K at the date of well construction in November 1998.

- Well No. 3 was observed to be equipped with a permanent pump, but the well was not being pumped at the time of our visit. A SWL could not be measured in the well due to an obstruction in the well casing at a depth of approximately 60 ft brp.
- Well No. 4 was observed to be equipped with a permanent pump, but the well was not being pumped at the time of our visit. A SWL could not be measured in the well as the access port at the wellhead could not be opened to allow access for the manual electric tape sounder device.
- During our June 2019 site visit, no totalizer flow dial devices (to measure flow rates and flow volumes) were observed near the wellhead for any of the four onsite wells. However, it was reported by the winery manager that new totalizers were installed in the piping near the upper and lower water tanks in early-October 2019. The upper and lower water tanks currently only store groundwater pumped from Wells 2 and 3. There is no flowmeter installed at Well 4. The winery manager has been collecting totalizer readings on a monthly basis since the meters were installed in October 2019. Thus, the available totalizer data are very short-term.

Local Geologic Conditions

Figure 3, "Geology Map," illustrates the types, lateral extents, and boundaries between the various earth materials mapped at ground surface in the region by others. Specifically, Figure 3 has been adapted from the results of regional geologic field mapping of the Calistoga Quadrangle, as published by the California Geological Survey (CGS, 2003). As shown on Figure 3, the key earth materials mapped at ground surface in the area include the following:

a. Artificial dam fill: This consists of material used for the construction of earth dams, rock-fill dams, and/or embankments to impound water (map symbol, adf). This material does not exist on the subject property.

b. Alluvial-type deposits: These deposits are Quaternary in age and consist of the following: alluvial fan and/or undivided alluvium, terrace, stream or basin materials, including landslide and older fluvial and lacustrine deposits (map symbols Qha, Qhf, Qf, Qls, and Qtg on Figure 3). These deposits are generally unconsolidated, and consist of layers and lenses of gravel, sand, silt, and clay and are shown to exist outside of the boundaries of the subject property, with the exception of landslide deposits (see yellow color on Figure 3). This landslide mass exists within the central portion of the subject property.[2]

c. 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: tuff and tuff breccia (map symbol, Tstp); and rhyolite flow rocks and domes (map symbol, Tsrc). As shown on Figure 3, rhyolite flows are exposed in the topographically elevated portions of the property because they are hard and tend to resist weathering.

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

d. Great Valley Sequence. The geologically older (Cretaceous-aged) Great Valley Sequence rocks (not shown on Figure 3) are not exposed on the subject property but are known to occur at ground surface further to the northeast and southwest 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.

Review of the driller's descriptions listed on the available driller's logs for the four onsite wells reveals that drilling of all four wells encountered typical rocks of the Sonoma Volcanics beneath the property. Typical driller-terminology for the drill cuttings on these logs included: "white consolidated volcanics;" "yellow volcanic ash;" "gray and black volcanic ash;" "red volcanics;" "white consolidated volcanics," and "soft ash." Therefore, based on the available subsurface geologic data, the Sonoma Volcanics are interpreted by RCS to extend to depths of at least 790 ft bgs beneath the property (at least in the vicinity of Well No. 1).

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 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.

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:

- Whether the hard fractured volcanic flow rocks are the preponderant volcanic material beneath the property.
- The possible occurrence and thickness of the ash flow tuffs beneath the property.
- The number, frequency, size and degree of openness of the fractures/joints in the hard volcanic rocks.
- The degree of interconnection of the various fracture/joint systems in the subsurface and to ground surface.

- The extent to which the open fractures may have been possibly in-filled over time by chemical 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.

As stated above, the principal rock types expected in the subsurface beneath a portion of the property are a combination of hard, volcanic flow rock, and tuff breccias that may be fractured to varying degrees, along with interbedded layers of softer and more deeply weathered ash flow tuff. From our long-term experience with the Sonoma Volcanics, based on numerous other water well construction projects in the County, pumping capacities in individual wells constructed into the Sonoma volcanics have ranged widely, from rates as low as a few gpm (if abundant soft and fine-grained ash-flow tuff is present), to rates as high as 200 gpm or more (if particularly abundant, hard, and well-fractured flow rocks are present).

Potentially Nonwater-Bearing Rocks

This category is represented by 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 are considered to underlie the volcanic rocks that exist beneath the subject property to depths of at least 790 ft bgs, depending on the location.

In essence, these geologically older and 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

Four faults[3], as mapped by others, have been mapped east and south of the subject property as shown by the dashed black lines labeled as "unnamed faults" on Figure 3 (CGS, 2013). 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 rocks of the Sonoma Volcanics. If abundant fractures were to occur, they would tend to increase the amount of open area in the rock 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 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, Well Nos. 2 and 3 are considered to be the "project wells," and they will represent the only onsite wells that will be used to meet water demands of the proposed

[3] Note that it is neither the purpose of 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

new vineyard development project. These two wells are also currently used to meet the water demands for: the existing primary and secondary residences (on APN 020-400-018); landscaping; and the winery. Well No. 1 is currently out of service, and Well No. 4 is used to meet the water demands only for the residence on APN 020-400-019.

Existing Water Demands

Due to the lack of long-term historical totalizer data, the average annual water use for the property is relatively unknown. Totalizer data for the new devices installed near the onsite water tanks only date to early-October 2019. Thus, existing and proposed (future) onsite water demands for the property were estimated by RCS[4] and corroborated by the winery manager, as discussed below. Table 2, "Groundwater Use Estimates," is intended to categorize the specific water demands of the existing developments and for the proposed project; these estimated annual groundwater demands are discussed below.

Those estimated groundwater demands for the subject property are as follows:

a. Existing residential demand = 2.00 acre-feet per year (AF/yr.)
   - This is based on two primary residences (at a unit use of 0.75 AF/yr/house) and one secondary residence (at a unit use of 0.50 AF/yr/house).
   - This estimate is considered to be conservative because only the secondary residence is occupied on a full-time basis, according to the winery manager; the two primary residences are only occupied on a part-time basis.

b. Existing winery demand = 0.13 AF/yr.
   - This is based on the existing permitted winery production capacity of 5,000 gallons per year, based on a unit use of 2.65 AF/yr per 100,000 gallons of wine (includes process water, domestic and winery landscaping).

c. Existing vineyard irrigation demand = 0.50 AF/yr.
   - This is for irrigation water used on the reported 1.0 acres of existing vineyards (based on a unit use of 0.50 AF/year per acre vine, AF/yr/ac).

d. Existing landscape irrigation demand = 2.73 AF/yr.
   - This estimate is based on the reported irrigated landscaped area of 0.5 acres and a reported water use of approximately 0.44 AF for the month of November 2019. This value was derived by the winery manager from the water tank totalizer readings and is considered by the winery manager to be representative of monthly landscape irrigation demands. This monthly irrigation demand of 0.44 AF is approximately equal to 0.015 AF/day (0.44 AF/30 days). Assuming a typical landscape irrigation season of 26 weeks (or 182 days), as reported by the winery manager, the annual water demand for landscape irrigation is approximately 2.73 AF/yr (or 0.015 AF/day x 182 days/year).

e. Total estimated existing water demand = a + b + c + d = 5.36 AF/yr.

[4] Water demand estimates presented herein were based on those values presented for specified land uses listed in Appendix B of the County's WAA Guidance Document (WAA 2015), unless otherwise noted.

Proposed (Future) Groundwater Demands

Subject property water demands (including both the current use and proposed vineyard use increases) are proposed to be met by pumping groundwater from the project wells (Well Nos. 2 and 3). Water demands for the residence on APN 020-400-019 will continue to be met by pumping groundwater from Well No. 4 only.

These total proposed groundwater demands for the subject property are as follows:

a. Proposed residential demand = 2.00 AF/yr (same as existing).
b. Proposed winery demand = 0.13 AF/yr (same as existing)
c. Proposed landscaping irrigation demand = 2.73 AF/yr (same as existing).
d. Proposed vineyard irrigation demand = 2.75 AF/yr.
    - This total includes the existing irrigated vineyard area of 1 acre and the proposed new irrigated vineyard area of 4.5 acres.
e. Total proposed annual groundwater demand = a + b + c + d = 7.61 AF/yr.

Proposed Pumping Rates

To determine an appropriate estimated pumping rate necessary in the future from Well Nos. 2 and 3 combined, the timing of water demands throughout the year must be considered. Groundwater will be required:

a. Year-round (365 days/year) for the winery water demands (0.13 AF/yr) and residential demands on APN 020-400-018 (1.25 AF/yr)
b. During the 20-week irrigation season for vineyards (2.75 AF/yr)
c. During the 26-week irrigation season for landscaping (2.73 AF/yr)

Based on these assumptions, Well Nos. 2 and 3 would need to pump at a total combined rate of about 18 gpm. This pumping rate is needed only during the times of the year when the annual pumping for winery and residential use occurs simultaneously with the 20-week vineyard irrigation season and the 26-week landscaping irrigation season. This pumping rate assumes that Well Nos. 2 and 3 would be pumped at a 50% operational basis, that is, 12 hours/day, 7 days/week during the time of year when all onsite demands coincide.

Original airlift rates for Well Nos. 2 and 3, reported by others, were a combined total of approximately 48 gpm (18 gpm and 30 gpm, respectively, in 1998 and 2000, for these two wells). As previously mentioned, 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. Therefore, the total combined operational pumping rate of Well Nos. 2 and 3 could be 24 gpm at this time, but there are no "hard" pumping rate data for these wells.

DRAFT
MEMORANDUM

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 "Petrified Forest" rain gage, which is located roughly 4 miles west-northwest 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 2018-19. The average annual rainfall for WY 2000-01 through WY 2018-19 at this gage is calculated to be 39.6 inches (3.3 ft). This rain gage is located at a slightly higher elevation than the subject property, and therefore, the average annual rainfall at the subject property could be considered to be slightly lower than that experienced at this known gage location.

The nearest rain gage to the subject property with a relatively long data record is the gage located in Calistoga. The data for this gage is available from the Western Regional Climate Center (WRCC) website (WRCC 2019). For this rain gage, the period of record is listed as the year 1906 through September 2019. Note that several months and/or years of rainfall data are missing for this rain gage, as follows: between 1906 and 1909, between 1914 and 1931, between 1934 and 1943, and between 2017 and 2018. For the period of available record, the average annual rainfall at this Calistoga gage is 36.4 inches (3.0 feet). 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 3.6 miles northwest of the subject property, thus making it 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 40 inches (3.3 ft).

An additional, but older, 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 within the boundaries of the 45-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 45 inches (3.8 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 40 inches (3.3 ft), as derived from the PRISM data set. The 40-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 subject 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 governmental 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 the County in the report titled "Updated Napa County Hydrogeologic Conceptual Model" (LSCE&MBK, 2013) prepared for the County. Watershed boundaries within the 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 4, "Watershed Boundaries," was prepared for this project using those watershed boundaries for which data are available. As shown on Figure 4, the subject property is located within the watershed referred to by MBK as "Napa River Watershed at St Helena." As shown on Table 8-9 on page 97 of the referenced report (LSCE&MBK, 2013), 14% of the average annual rainfall that occurs within this watershed was estimated to be able to deep percolate as groundwater recharge. Note that, as shown on Table 8-9 of LSCE & MBK (2013), calculations for the "Napa River Watershed at St Helena" include the Napa River Watershed at Calistoga.

As stated above, the total surface area of the subject property is 76.8 ac. Assuming 40 inches (3.3 ft) of rainfall occurs 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 253.4 AF/yr (76.8 ac x 3.3 ft). Assuming 14% of that average annual rainfall volume would be able to deep percolate to the groundwater in the volcanic rocks that lie beneath the subject property over the long term, then the average annual groundwater recharge at the subject property would be approximately 35.5 AF/yr (253.4 AF/yr x 14%). This estimated annual recharge volume is greater than the total estimated average annual groundwater demand for the subject property of 7.61 AF/yr.

DRAFT
MEMORANDUM

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 estimated volume of groundwater to be extracted for use at the subject property 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 = 76.8 acres

b) Depth to the bottom of the perforations in Well No. 3 = 435 ft; Well No. 3 was selected for a conservative analysis instead of using the other project well (Well No. 2), since Well No. 2's perforations extend to a depth of 530 ft. Based on this depth in Well No. 3, and on the data listed on the driller's logs for this well and the other onsite wells, rocks of the Sonoma Volcanics clearly extend to a greater depth than the total depth of Well No. 3. Thus, it is highly likely that the saturated zone beneath the property could extend deeper than is estimated using the data for only Well No. 3.

c) To present a conservative calculation of groundwater in storage, we will also assume that the current minimum saturated thickness of the aquifer(s) beneath the subject property is about 235 ft vertical feet. This value is calculated using Well No. 3 data by subtracting the A&K-measured SWL of approximately 200 ft bgs in this well (in December 2000) from the reported depth to bottom of the perforations in the well (435 ft). Based on the water level data presented herein, the December 2000 SWL is the deepest available SWL measured for this well, and thus it 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 continue 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 December 2000) is calculated as:

   S = property area (subpart a, above) times saturated thickness (subpart c, above) times average specific yield (subpart d, above) = 76.8 ac x 235 ft x 2% = 361 AF

In contrast, the proposed average annual groundwater use for the property is estimated to be 7.61 AF/yr. Hence, the estimated groundwater demand for the entire property represents only about 2% of the groundwater conservatively estimated to currently be in storage in the volcanic rocks beneath the subject property, based on the conservative water level data for December

2000. 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 are not expected to cause a net deficit in the volume of groundwater within the volcanic rock aquifer system beneath the subject property so as to impact nearby wells on offsite properties to a point that they would not be able to provide sufficient groundwater for the existing permitted land uses on those offsite properties.

Effect of Ground Slope Angle on Recharge Potential

Any estimate of the percentage of rainfall that becomes available for deep percolation that relies on estimates of rainfall, evapotranspiration, and surface water outflow for an entire watershed, such as those estimates provided by LSCE&MBK 2013, inherently includes the effects of ground surface slope angle in the estimate. However, to provide a more complete consideration of the potential effects of ground slope angle on groundwater recharge specifically at the subject property, analysis of those effects is provided below.

Many basic geologic references assume that recharge potential is reduced on steeper slopes, as steeper slopes can increase surface water runoff rates, and therefore less time is available for rainfall to deep percolate. Page 56 of LSCE&MBK (2013), asserts that deep percolation recharge from rainfall is "significantly reduced" for land areas with slopes angles greater than 30 degrees. On page 11 of LSCE&MBK (2013), an assessment of slope angles (inclinations) greater than 30 degrees is also mentioned, and this was attributed to a prior LSCE report, namely "LSCE 2011" therein; that document is likely to be the reference listed as "2011a" on page 134 of LSCE&MBK 2013. In that referenced document (LSCE, 2011), the statement is made on page 29 that "areas in which the slope of the land surface exceeds 30 degrees, beyond which recharge potential is significantly reduced." No other references or data are presented in any of the above-referenced documents to quantify the qualitative description of "significantly reduced". Because the various factors that affect groundwater recharge are likely interrelated (Yeh 2009), assigning a value to define the amount that recharge is diminished is extremely difficult. No references were reviewed by RCS that quantify the possible reduction of deep percolation that might occur as a function of slope angle/percentage.

Estimates of the deep percolation of rainfall for the entire "Napa River Watershed at St Helena" watershed were based on water balance calculations by others that included rainfall throughout the entire watershed. As discussed above, those watershed-scale calculations inherently include all slopes within the watershed, including slopes greater than 30 degrees. Therefore, to evaluate the site-specific recharge potential of the property and to also include assumptions about the varying recharge potential based on slope, then the deep percolation percentage used for slopes less than 30 degrees within the entire watershed would have to be increased to offset the decrease in the percentage for slopes greater than 30 degrees.

Table 4, "Estimated Recharge Based on Deep Percolation Assumptions for Slope Angle," shows a range of values for different assumptions for the amount of deep percolation that might occur on slopes greater than 30 degrees in the Sonoma Volcanics at the subject property. To create Table 4, deep percolation values were first calculated for the entire Napa River Watershed at St Helena. That is, the deep percolation percentage for the slopes within the watershed that are less than 30 degrees were increased to offset the diminished deep percolation percentage for the slopes greater than 30 degrees. A range of values were calculated assuming a range of "diminishment factors" of 25%, 50%, 75%, and 100%. Once the deep percolation percentages for slopes less than and greater than 30 degrees were calculated for the entire watershed, then those same resultant percentages shown on Table 4 were applied to the subject property; recall that the entire property is underlain by rocks of the Sonoma Volcanics.

As shown above, a recharge estimate of 35.5 AF/yr. is calculated for the subject property assuming a conservative value of 14% for the deep percolation of rainfall that would occur on all 76.8 acres of the subject property that are underlain by rocks of the Sonoma Volcanics. Approximately 9 acres of the subject property consist of slopes greater than 30 degrees. Hence, if the assumption is made that the deep percolation that occurs on the 9 acres of the subject property with slopes greater than 30 degrees is diminished by a factor of 100%, then the average annual recharge that is estimated to occur at the subject property would be 34.5 AFY; see Table 4 herein. This calculated recharge volume is still greater than the estimated total onsite future (proposed) groundwater demand of 7.61 AF/yr.

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 2020), declared an end to the drought in Northern California in 2017, which included Napa County. As of February 4, 2020, the area of Napa County in which the subject property lies, is currently mapped as "Abnormally Dry" on the NDMC website (NDMC 2019)

Table 5, "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 two rain gages discussed below and shown on Table 5; that drought period rainfall amount is also expressed on Table 5 as a percentage of the total rainfall that occurred. As shown on Table 5, 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 Calistoga rain gage and reported by the WRCC had the lowest total rainfall at 41% (drought period average was 15.8 inches), compared to the long-term average (36.4 inches), and that specific drought lasted two years. The WY 1986-87 to WY 1991-92 drought period lasted for six years, but rainfall during this drought was 89% of the average annual rainfall at the WRCC rain gage. It is important to note that the drought year percentage listed on Table 5 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 this gage 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 81% of the long-term average.

Hence, for the purposes of this analysis, a "prolonged" drought period rainfall is conservatively considered to be 41% of the average annual rainfall that occurred in the region (using the rainfall data from the WRCC Calistoga 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 5. This six-year period is a quite conservative estimate, because the 41%-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 approximately 45.7 AF is estimated to be required for the subject property (7.61 AF/yr times 6 years). Assuming groundwater recharge is reduced to 41% 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 34.5 AF/yr. Taking 41% of this annual volume yields a drought period recharge volume of 14.1 AF/yr.
- Assuming a drought period duration of 6 continuous years, then a total of 84.6 AF (14.1 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 41% of the average annual rainfall might occur, a conservative estimate of the total drought-period recharge at the subject property (84.6 AF) would exceed the estimate of the total onsite groundwater demand (45.7 AF) that may occur over the same six-year period.

Key Conclusions and Recommendations

1. The existing property is comprised of two parcels, and is currently developed with 1 acre of vineyards, 0.5 acres of landscaping, two primary residences, one secondary residence, and a winery.
2. The proposed project consists of developing an additional 4.5 acres of vines bringing the total future onsite planted vineyard area to 5.5 acres.
3. Current groundwater demands for the existing vineyard and landscaping, the winery, and the primary and secondary residences are estimated to be approximately 5.36 AF/yr.
4. Future average annual groundwater demands for the subject property, including the proposed vineyard project (which adds 4.5 acres of new vines) are estimated to be approximately 7.61 AF/yr.
5. Existing (and future) water demands for the proposed project will be met by pumping groundwater from Well Nos. 2 and 3. Water demands for the residence on APN 020-400-019 will continue to be meet by pumping groundwater from Well No. 4 only.
6. To meet the estimated groundwater demands for the project each year, Well Nos. 2 and 3 would need to pump at a combined rate of about 18 gpm to meet the water demands during the time of year when the assumed 20-week vineyard irrigation season and the 26-week landscape irrigation season coincide with the annual year-round demands for the residences and winery.
7. Groundwater recharge at the subject property on an average annual basis is estimated to be 34.5 AF/yr.; this value is based on conservative estimates of the average annual rainfall at the property (40 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. This estimate also considers the 9 acres of land which have a slope greater than 30 degrees; no recharge is assumed to occur on those 9 acres.
8. Conservative estimates of recharge that may occur during a theoretical "prolonged drought" (as defined herein) show that, over a theoretical six-year period of continuous drought in which only 41% of the average annual rainfall might occur, a total of 84.6 AF of rainfall recharge is estimated to occur strictly within the boundaries of the subject property. This theoretical drought period recharge estimate of 84.6 AF is more than the estimated groundwater of the proposed project of 45.7 AF for the same continuous six-year period.
9. In the future, RCS recommends that a groundwater monitoring program be implemented for the onsite wells. This would include the regular monitoring of static and pumping water levels via the use of water level pressure transducers, continued monitoring of the instantaneous flow rates and cumulative pumped volumes from Well Nos. 2 and 3 via the existing flowmeter totalizer devices. 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 Well Nos. 2 and 3 can be addressed in a timely manner.

DRAFT
MEMORANDUM

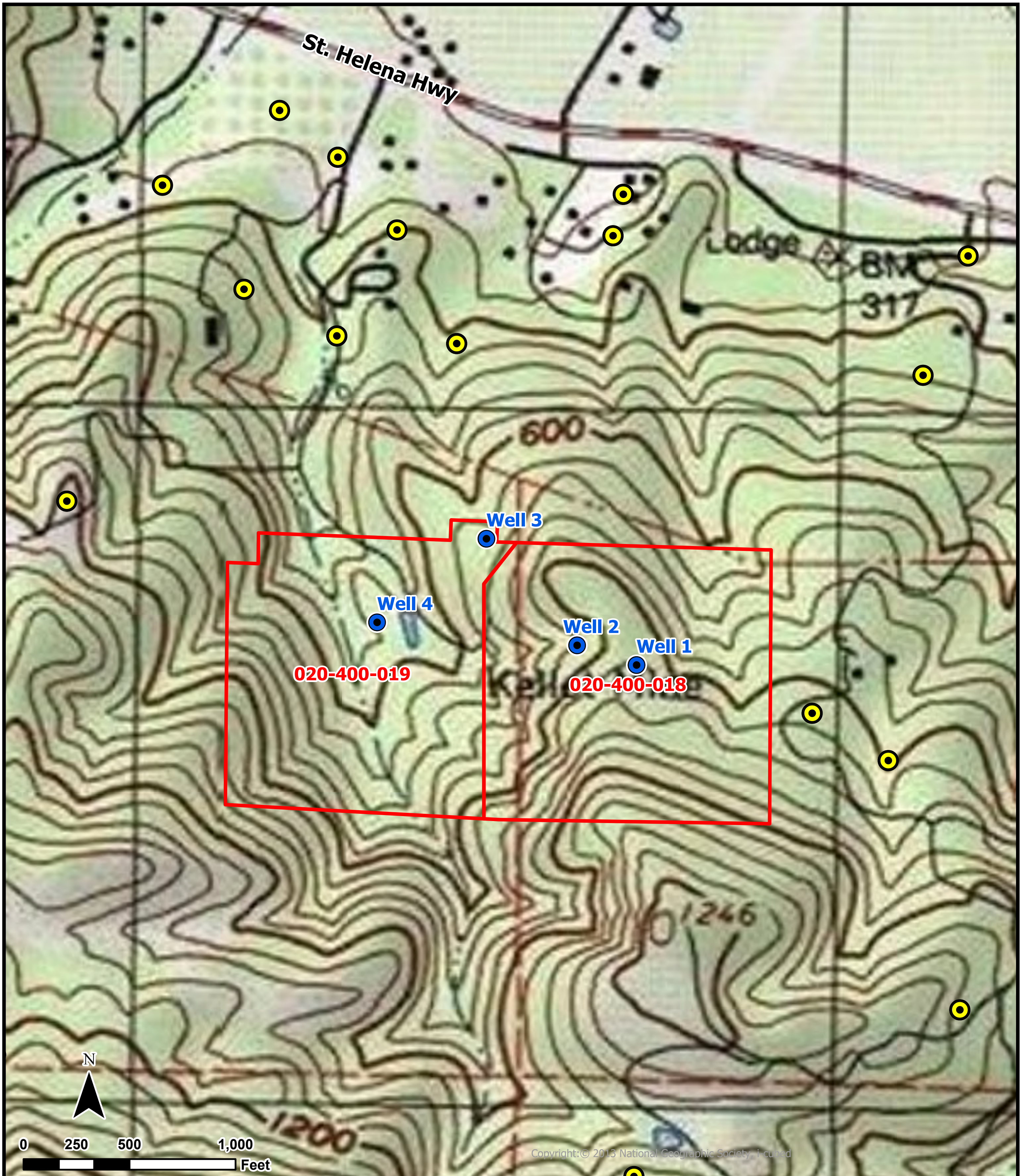
References

- **(CGS 2013)** Delattre, M.P., et al., 2013. Geologic Map of the Calistoga 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

- California Department of Water Resources, Well Completion Report Map Application Database, 2019;

  https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37
- Napa County GIS database, 2019; https://gis.napa.ca.gov
- Napa One Rain, 2019; https://napa.onerain.com
- (NDMC 2019) National Drought Mitigation Center website, 2019; http://drought.unl.edu
- Quaternary Fault and Fold Database of the United States, USGS, 2019; https://earthquake.usgs.gov/hazards/qfaults
- PRISM Climate Group, Oregon State University, 2015; https://prism.oregonstate.edu
- Western Regional Climate Center, 2019; https://www.wrcc.dri.edu



LEGEND

Property Boundary (showing County APNs)

Teachworth Well Location

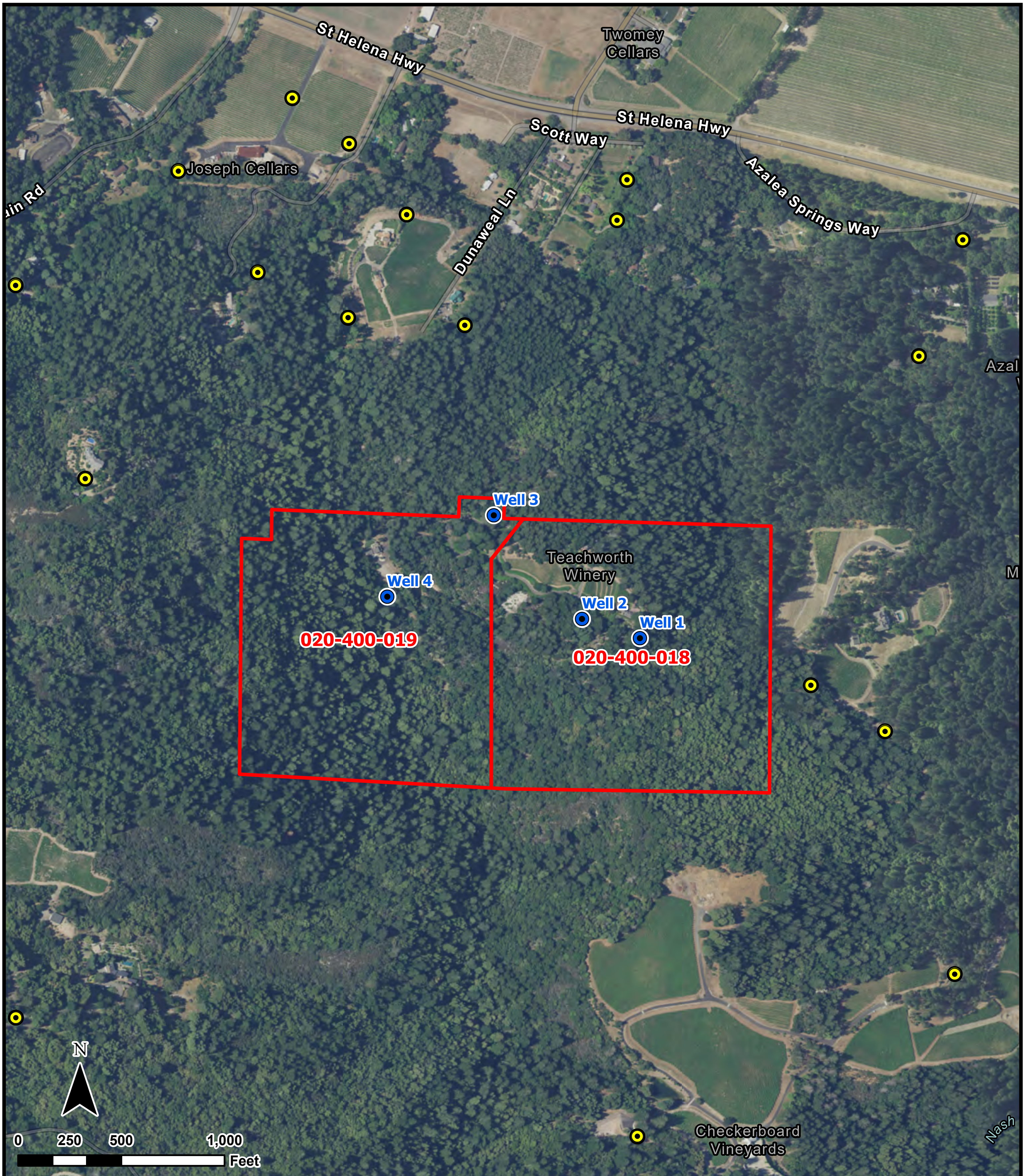
Offsite Well Location (Approx.)

RCS

FIGURE 1
WELL LOCATION MAP

RCS Job No. 706-NPA01

February 2020



LEGEND

Property Boundary (showing County APNs)

Teachworth Well Location

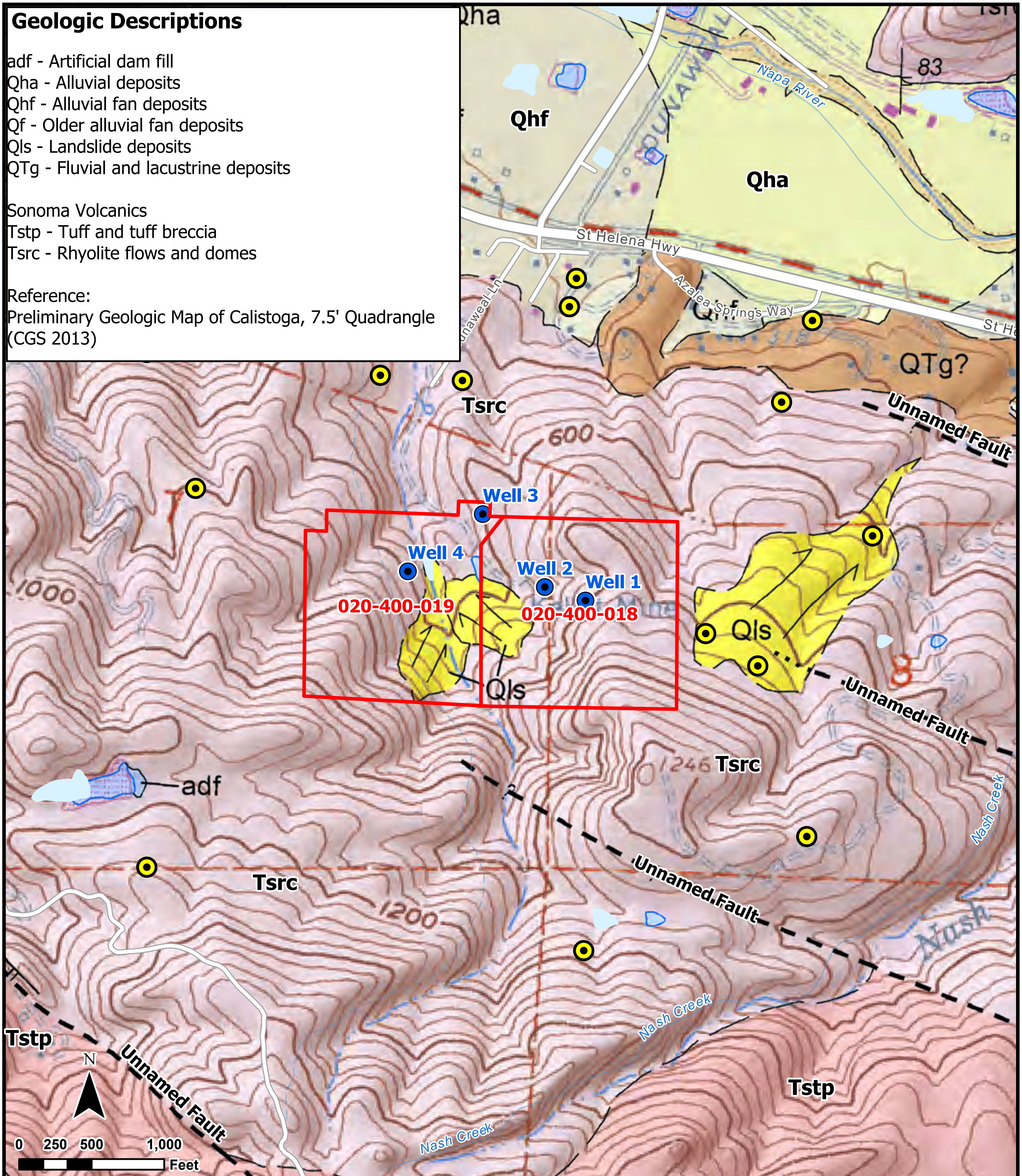
Offsite Well Location (Approx.)

RCS

FIGURE 2
AERIAL PHOTO MAP

RCS Job No. 706-NPA01

February 2020



LEGEND

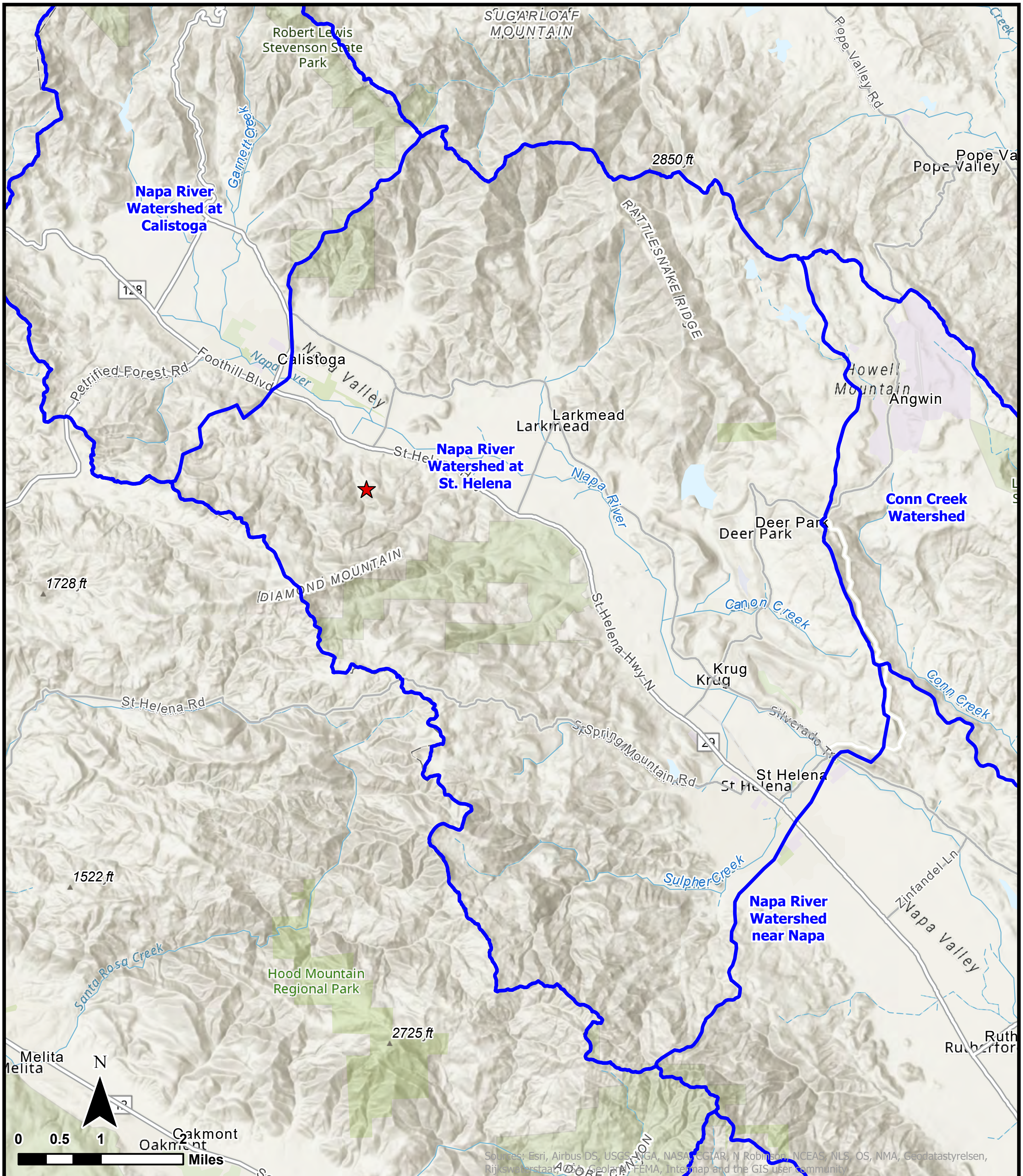
- Property Boundary (showing County APNs)
- Teachworth Well Location
- Offsite Well Location (Approx.)

RCS

FIGURE 3
GEOLOGY MAP

RCS Job No. 706-NPA01

February 2020



LEGEND

★ Subject Property

Watershed Boundary

RCS

FIGURE 4
WATERSHED MAP

RCS Job No. 706-NPA01

February 2020

Table 1
Summary of Well Construction and Pumping Data
Teachworth Winery

WELL CONSTRUCTION DETAILS

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
Well No. 1	445163	March 1996	Air Rotary	790	640	Steel	6	8.75	0-22 (cement)	480-620	ND 0.125	22-640 5/16" Pea Gravel
Well No. 2	700057	November 1998	Air Rotary	530	530	PVC	5	8	0-50 (grout)	330-530	Factory-Cut 0.032	50-530 Gravel
Well No. 3	819555	December 2000	ND	495	435	PVC	5	8	0-20 (cement)	235-435	Factory-Cut 0.032	20-435 Gravel
Well No. 4	737012	August 2001	Mud Rotary	484	470	PVC	5	8.75	0-23 (cement)	310-465	Factory-Cut 0.032	23-465 3/8" Pea Gravel

POST-CONSTRUCITON YIELD DATA

Reported Well Designation	Date & Type of "Test" Data	Duration of "Test" (hrs)	Estimated Flow Rate (gpm)	Static Water Level (ft)	Pumping Water Level (ft)	Estimated Specific Capaity (gpm/ft ddn)
Well No. 1	1996 Airlift	4	20	300	ND	--
Well No. 2	1998 Airlift	5	18	290	ND	--
Well No. 3	2000 Airlift	6	30	200	ND	--
Well No. 4	2001 Airlift	2.5	60	60	ND	--

Notes: in = inches
ft = feet
hrs = hours
gpm = gallons per minute
gpm/ft ddn = gallons per minute per foot of water level drawdown
ND = no data available
During airlifting, a pumping water level cannot be monitored, and therefore the original specific capacity of the well cannot be calculated.

DRAFT

Table 2
Groundwater Use Estimates
Teachworth Winery

Groundwater Use	Estimated Groundwater Use (acre-feet/year)[1]		Water Source
	Existing	Future	
Residential Groundwater Use			
APN 020-400-018			
Existing Primary Residence	0.75	0.75	Wells 2 and 3
Existing Secondary Residence	0.50	0.50	
APN 020-400-019			
Existing Primary Residence	0.75	0.75	Well 4
Winery Groundwater Use			
Existing Winery	0.13	0.13	Wells 2 and 3
Irrigation Groundwater Use			
Vineyard - Existing 1.0 acres	0.50	0.50	Wells 2 and 3
Vineyard - Proposed 4.5 acres (new)	---	2.25	
Landscaping - Existing 1 acre[2]	2.73	2.73	Wells 2 and 3
Total Combined Groundwater Use (Residential + Winery + Irrigation)	**5.36**	**7.61**	

Notes:

[1]Estimates based on Napa County Water Availability Analysis Guidance Document (WAA 2015)

[2]Estimates based on the reported total landscape irrigation demand for the month of November 2019 of approximately 0.44 AF (30 days); the reported irrigation season is 26 weeks (182 days).

1 acre-foot = 325,851 gallons

DRAFT

Table 3
Comparison of Rainfall Data Sources
Teachworth Winery

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	Elevation Relative to Subject Property(1)
Napa One Rain Petrified Forest	WY 2000-01 through WY 2018-19	39.6 (3.3)	1,090	4.0	Higher
WRCC Calistoga	January 1906 through September 2019(2)	36.4 (3.0)	400	3.6	Lower
PRISM	1981 to 2010	40 (3.3)	---	---	---
Napa County Isohyetal Map	1900 to 1960	45.0 (3.8)	---	---	---

Notes:

1. The subject property is located at elevations between ±480 and ±1,000 ft asl
2. Several months and/or years of rainfall data missing between 1906 and 1909, 1914 and 1931, between 1934 and 1943, and between 2017 and 2018.

DRAFT

Table 4
Estimated Recharge Based on Deep Percolation Assumptions for Slope Angle
Teachworth Winery

Region	Area	Average Rainfall [1]	Rainfall Volume	Reduced Recharge Assumption based on Slope Angle									
				Deep Percolation/Not Slope Dependent		Deep Percolation on >30° Slope Diminished by 25%		Deep Percolation on >30° Slope Diminished by 50%		Deep Percolation on >30° Slope Diminished by 75%		Deep Percolation on >30° Slope Diminished by 100%	
				Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume
	(acres)	(ft)	(AF)	(%)	(AF)	(%)	(AF)	(%)	(AF)	(%)	(AF)	(%)	(AF)
Entire Napa River Watershed at St. Helena													
<30° Slope	46,254	3.5	161,889	14.00%	22,664.46	14.35%	23,238.99	14.71%	23,813.51	15.06%	24,388.04	15.42%	24,962.56
>30° Slope	4,690	3.5	16,415	14.00%	2,298.10	10.50%	1,723.58	7.00%	1,149.05	3.50%	574.53	0.00%	-
TOTAL =	50,944			TOTAL =	24,962.56	TOTAL =	24,962.56	TOTAL =	24,962.56	TOTAL =	24,962.56	TOTAL =	24,962.56
Teachworth Wines Property													
<30° Slope	67.8	3.3	223.7	14.00%	31.32	14.35%	32.12	14.71%	32.91	15.06%	33.71	15.42%	34.50
>30° Slope	9.0	3.3	29.7	14.00%	4.16	10.50%	3.12	7.00%	2.08	3.50%	1.04	0.00%	-
TOTAL =	76.8			TOTAL =	35.5	TOTAL =	35.2	TOTAL =	35.0	TOTAL =	34.7	TOTAL =	34.5

Note: The "Napa River Watershed at St. Helena" values are used to calculate the change in deep percolation percentage of <30° slopes based on the deep percolation volume of 22,503 AF calculated using the assumptions shown. Deep percolation percentage values determined for the entire watershed are then used for site specific calculations.

[1] Average Rainfall for "Napa River Watershed at St. Helena" per PRISM Dataset (1980-2010); average rainfall for "Teachworth Wines" per PRISM Dataset (1980-2010)

DRAFT

Table 5
Drought Period Rainfall as Percentage of Average
Teachworth Winery

Statewide Drought Period as Defined by DWR (DWR 2005)	Drought Duration (years)	Average Rainfall by Raingage					
		Calistoga Raingage WRCC Period of Record - 1906 through 2019			Petrified Forest Napa OneRain Period of Record - WY 2000-01 to WY 2018-19		
		[A] Total Gage Average (in)	[B] Drought Period Ave. (in)	[B÷A] Drought Period Rainfall as % of Average	[A] Total Gage Average (in)	[B] Drought Period Ave. (in)	[B/A] Drought Period Rainfall as % of Average
WY 1928-29 to WY 1933-34	6	36.4	16.6	46%	ND	ND	ND
WY 1975-76 to WY 1976-77	2	36.4	15.1	41%	ND	ND	ND
WY 1986-87 to WY 1991-92	6	36.4	26.1	72%	ND	ND	ND
WY 2006-07 to WY 2008-09	3	36.4	26.5	73%	39.6	29.2	74%
WY 2011-12 to WY 2015-16	5	36.4	26.1	72%	39.6	32.1	81%

ND = No rainfall data for corresponding drought period.

* Raingage data do not extend through entire drought period and/or are missing rainfall data within drought period.

DRAFT

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

QUADRUPLICATE
For Local Requirements

Page ____ of ____

Owner's Well No. ____

Date Work Began 3-29-96, Ended 5-6-96

Local Permit Agency Napa Health Dept.

Permit No. 5842 (Rec. #) Permit Date 4-29-96

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 445163

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

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

DEPTH TO FIRST WATER 500 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	400	Brown Volcanic Tuffs
400	600	Gray Volcanic Tuffs
600	685	Gray Volcanic Tuffs / w/ Gray ash
685	700	Hard Black Volcanics
700	790	Gray / Black Volcanic Ash

TEACHWORTH WELL 1

TOTAL DEPTH OF BORING 790 (Feet)

TOTAL DEPTH OF COMPLETED WELL 640 (Feet)

WELL OWNER

Name Walter Teachworth

Mailing Address 1562 Chabus

St. Helena Ca 94574

CITY STATE ZIP

WELL LOCATION

Address 4421 N. St. Helena Hwy.

City Calistoga

County Napa

APN Book 20 Page 400 Parcel 18

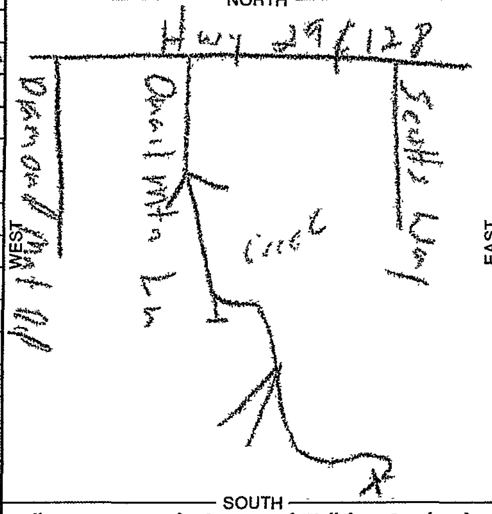
Township ____ Range ____ Section ____

Latitude ____ NORTH Longitude ____ WEST

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

LOCATION SKETCH

NORTH



WEST EAST

SOUTH

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

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

____ Deepen

____ Other (Specify)

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

PLANNED USE(S) (✓)

____ MONITORING

WATER SUPPLY

X Domestic

____ Public

____ Irrigation

____ Industrial

____ "TEST WELL"

____ CATHODIC PROTECTION

____ OTHER (Specify)

DRILLING METHOD air rotary FLUID ____

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 300 (Ft.) & DATE MEASURED ____

ESTIMATED YIELD* 20 (GPM) & TEST TYPE air lift

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

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

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	22	11"								
22	640	8 3/4								
640	790	6 1/4								
0	480	8	X				steel	6 1/4	.156	
480	620			X			"		.188	1/8
620	640									

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	22	X			
22	640				3/16 Pea
640	790				open

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 Larry Herman Drilling

(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

13011 Hwy 29 Lower Lake Ca 95457

ADDRESS CITY STATE ZIP

Signed Larry Herman 5-6-96 465071

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

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page ____ of ____

Owner's Well No. ____

Date Work Began 11-2-98, Ended 11-24-98

Local Permit Agency NAPA COUNTY

Permit No. 96-10417 Permit Date 10-27-98

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 700057

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

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

DRILLING METHOD AIR FLUID ____

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	80	YELLOW VOLCANIC ASH
80	290	WHITE ASH SEVERAL SMALL COLORED LAYERS
290	310	HARD ASH GRAY
310	365	CAVING FRACTURED LAYER
		*NOTE: GROUTED WITH NEAT CEMENT FROM 365-290 AND RE-DRILLED
365	450	RED VOLCANICS
450	530	HARD YELLOW ASH

TEACHWORTH WELL 2

RECEIVED
FEB - 8 1999
DEPT. OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 530 (Feet)

TOTAL DEPTH OF COMPLETED WELL 530 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

CITY [redacted] STATE ZIP [redacted]

WELL LOCATION

Address 4451 N. ST. HELENA HWY.

City CALISTOGA

County NAPA

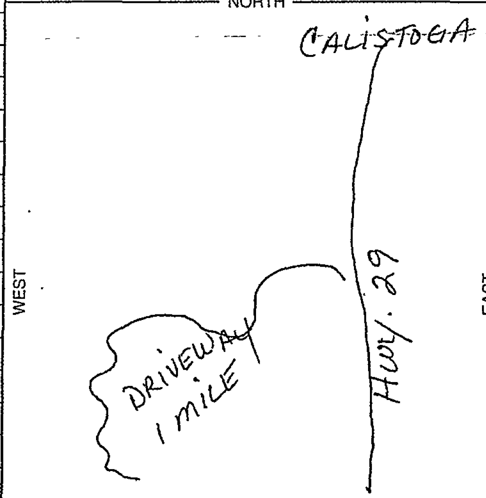
APN Book 20 Page 400 Parcel 18

Township ____ Range ____ Section ____

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

LOCATION SKETCH

NORTH



WEST EAST

SOUTH

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

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
____ Deepen
____ Other (Specify)

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

PLANNED USES (✓)

WATER SUPPLY
X Domestic ____ Public
____ Irrigation ____ Industrial

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

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 310 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 290 (Ft.) & DATE MEASURED ____

ESTIMATED YIELD * 18+ (GPM) & TEST TYPE AIR

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

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

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	330	8	X				PVC	5	200	
330	530	8		X			PVC	5	200	.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	50		X		GROUT
50	530			X	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 A & K DRILLING (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS P.O. Box 750143 CITY Petaluma, STATE CA ZIP 94975

Signed David Anderson WELL DRILLER/AUTHORIZED REPRESENTATIVE

2-5-99 DATE SIGNED

720534 C-57 LICENSE NUMBER

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

QUADRUPLICATE
For Local Requirements

Page ____ of ____

Owner's Well No. ____

Date Work Began 12-1-00, Ended 12-7-00

Local Permit Agency NAPA COUNTY

Permit No. 96-11286 Permit Date 8-27-99

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 819555

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

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

DRILLING METHOD ____ FLUID ____

DEPTH FROM SURFACE Ft	to Ft	DESCRIPTION *Describe material, grain size, color, etc.*
0	1	DECOMPOSED VEGITATION
1	280	WHITE CONSOLIDATED VOLCANIC
280	360	STAINED WHITE CONSOLIDATED VOLCANIC
360	495	WHITE CONSOLIDATED VOLCANIC

TEACHWORTH WELL 3

RECEIVED

JAN 26 2001

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 495 (Feet)

TOTAL DEPTH OF COMPLETED WELL 435 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

CITY [redacted] STATE [redacted] ZIP

WELL LOCATION

Address 4451 ST. HELENA HWY.,

City CALISTOGA

County NAPA

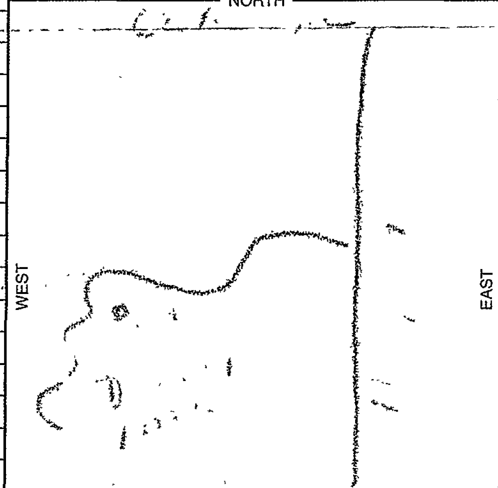
APN Book 20 Page 400 Parcel 18

Township ____ Range ____ Section ____

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

LOCATION SKETCH

NORTH



SOUTH

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

ACTIVITY (✓)

X NEW WELL

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

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

PLANNED USES (✓)

WATER SUPPLY
- X Domestic ____ Public
- X Irrigation ____ Industrial

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

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 240 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 200 (Ft.) & DATE MEASURED ____

ESTIMATED YIELD * 30 (GPM) & TEST TYPE AIR LIFT

TEST LENGTH 6 (Hrs.) TOTAL DRAWDOWN ____ (Ft.)

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

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	235	8	X				PVC	5	200	
235	435	8		X			PVC	5	200	.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	435				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 A & K DRILLING, INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

P.O. BOX 750143 PETALUMA CA 94975
ADDRESS CITY STATE ZIP

Signed ____ 1-24-01 720534
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. # 1

Date Work Began 8-30-01, Ended 9-10-01

Local Permit Agency Co of Napa Environmental Mangt.

Permit No. 96-11903 Permit Date 8-31-01

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 737012

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

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

DRILLING METHOD Rotory FLUID Bentonite

DEPTH FROM SURFACE Ft. to Ft.		DESCRIPTION *Describe material, grain size, color, etc.*
0	36	Clay Volcanic Ash
36	366	Hard Volcanic Ash light brown in Color Sand & Ash Mix
366	395	Soft Ash Slight Saturation Water Approx 5 GPM Per 30'
395	465	Water bearing Ash & Rock Mix

TEACHWORTH WELL 4

RECEIVED
NOV 14 2001
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

TOTAL DEPTH OF BORING 484 (Feet)

TOTAL DEPTH OF COMPLETED WELL 470 (Feet)

WELL OWNER

Name [redacted]

Mailing Address [redacted]

CITY STATE ZIP

WELL LOCATION

Address 4473 St Helena Hy

City Calistoga

County Napa

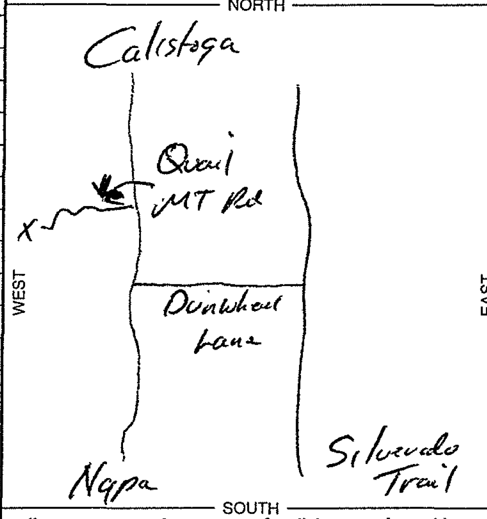
APN Book 20 Page 400 Parcel 19

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 (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

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

PLANNED USES (✓)

WATER SUPPLY
✓ Domestic ___ Public
___ Irrigation ___ Industrial

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

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 370 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 60' (Ft.) & DATE MEASURED 9-01

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

TEST LENGTH 2 1/2 (Hrs.) TOTAL DRAWDOWN NA (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	11 1/2	X				PVC F480	5	200	
25	310	8 3/4	X				PVC F480	5	200	
310	465			X			PVC F480	5	200	032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	23	✓			
23	465			✓	3/8 Peabreal

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 D. Bess Pump & Well (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 1115 Mt. George Ave. CITY Napa, STATE CA ZIP 94558

Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED 9-12-01 C-57 LICENSE NUMBER 487027

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